Land Rover Frelander 2
Repair Manual & Wirig Diagrams 2006-2010

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Important Safety Instructions

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual carrying out the work.

Anyone who departs from the instructions provided in this manual must first establish that personal safety or vehicle integrity is not compromised by the choice of method, tools or components.

Warnings, Cautions and Notes in This Manual

WARNING: Warnings are used to indicate that failure to follow a procedure correctly may result in personal injury.

CAUTION: Cautions are used to indicate that failure to follow a procedure correctly may result in damage to the vehicle or equipment being used.

• NOTE: Notes are used to provide additional essential information required to carry out a complete and satisfactory repair.

Generic warnings or cautions are in their relevant description and operation procedure within section 100-00. If the generic warnings or cautions are required for a procedure, there will be a referral to the appropriate description and operation procedure.

If a warning, caution or note only applies to one step, it is placed at the beginning of the specific step.

Trustmark Authoring Standards (TAS) Removal and Installation Procedures

• NOTE: TAS style procedures can be identified by steps that have no accompanying step text and the magenta color of the electrical connectors and fasteners such as nuts, bolts, clamps or clips.

A TAS removal and installation procedure uses a sequence of color illustrations to indicate the order to be followed when removing/disassembling or installing/assembling a component.

Many of the TAS procedures will have the installation information within the removal steps. These procedures will have the following note at the beginning of the procedure:

• NOTE: Removal steps in this procedure may contain installation details.

Items such as O-ring seals, gaskets, seals, self-locking nuts and bolts are to be discarded and new components installed unless otherwise stated within the procedure. Coated nuts or bolts are to be reused, unless damaged or otherwise stated within the procedure.

Specification procedures will contain all technical data that are not part of a repair procedure.

TAS Graphics

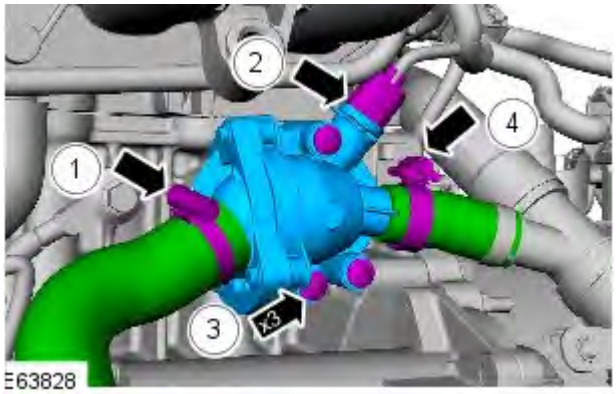
Colors used in the graphic are as follows:

- Blue - Indicates the target item, item to be removed/installed or disassembled/assembled
- Green and Brown - Indicates a secondary item that needs to be detached, removed/installed or disassembled/assembled prior to the target item
- Magenta - Indicates electrical connectors and fasteners such as nuts, bolts, clamps or clips
- Pale Blue - is for the special tool(s) and general equipment.

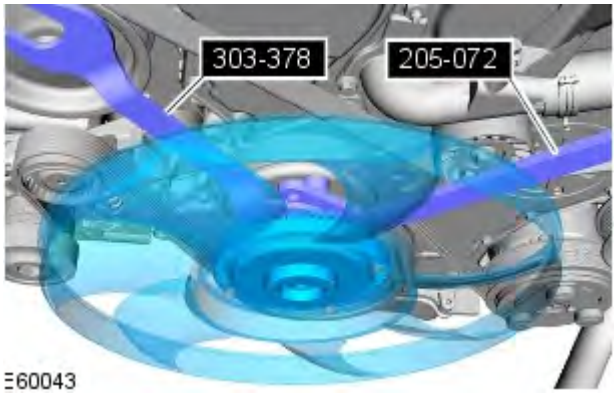
There may be multiple steps assigned to one illustration.

Numbered pointers are used to indicate the number of electrical connectors and fasteners such as nuts, bolts, clamps or clips.

Items in the illustration can be transparent or use cutouts to show hidden detail(s).



E63828



E60043

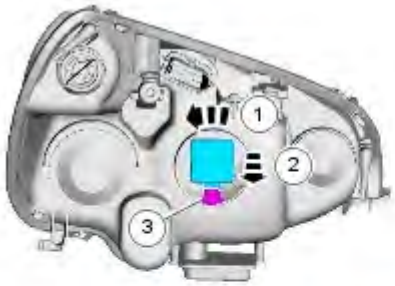
TAS Symbols

Symbols are used inside the graphics and in the text area to enhance the information display. The following paragraphs describe the various types and categories of symbols.

Prohibition symbols advise on prohibited actions to either avoid damage or health and safety related risks.

E85026

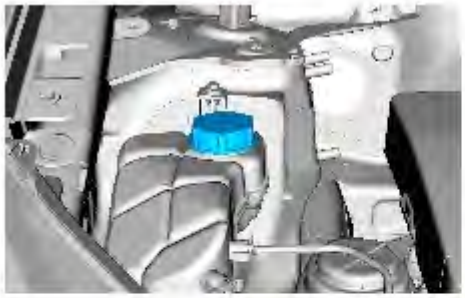
Health and Safety symbols recommend the use of particular protection equipment to avoid or at least reduce the risk or severity of possible injuries.



2.

E85027

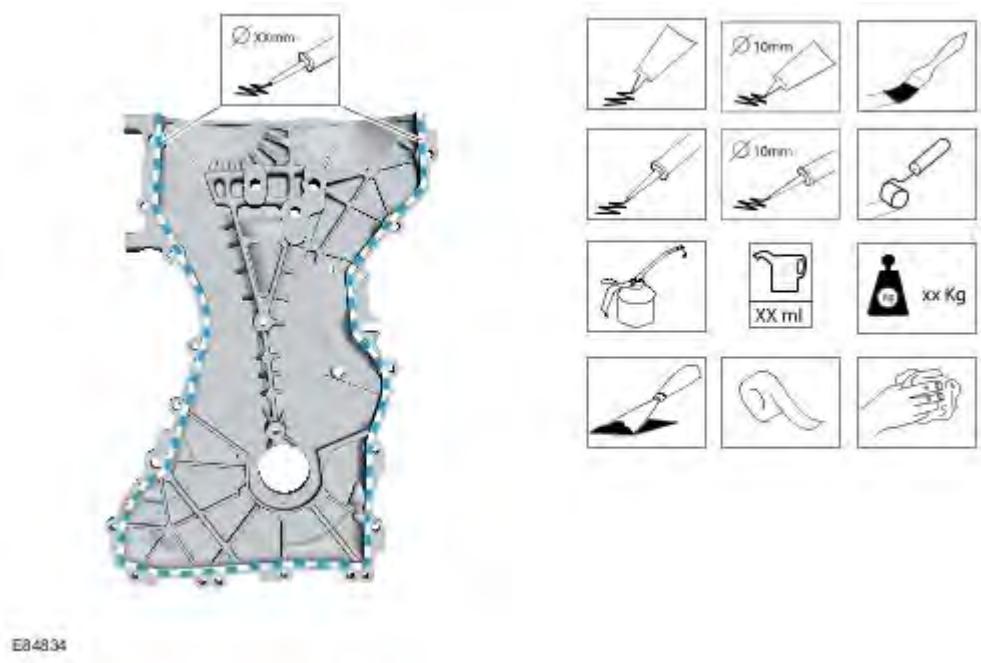
Warning symbols are used to indicate potential risks resulting from a certain component or area.



3.

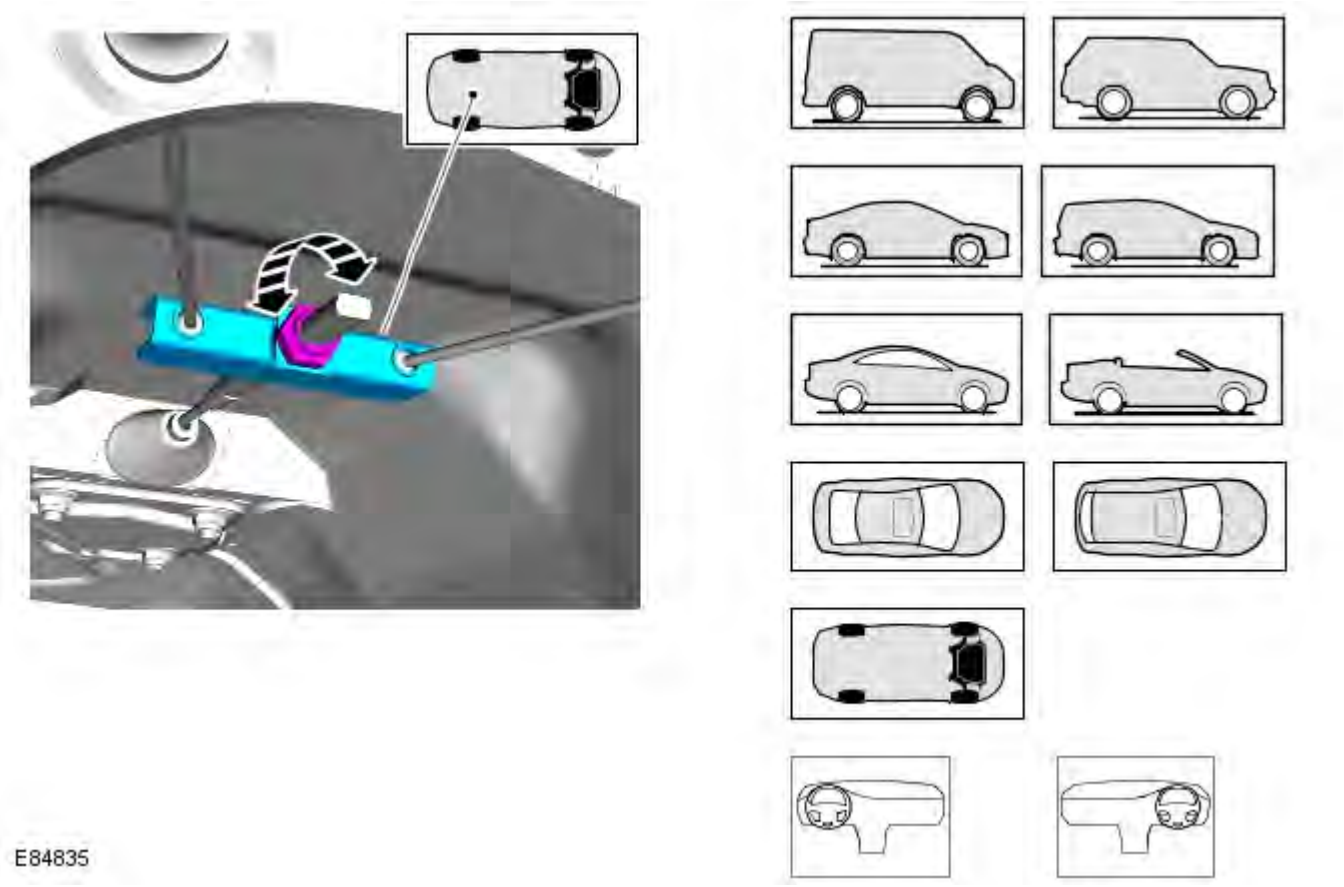
E85028

Instruction symbols are used to apply sealer, lubricant, weight, tape or cleaning detergent to a component.



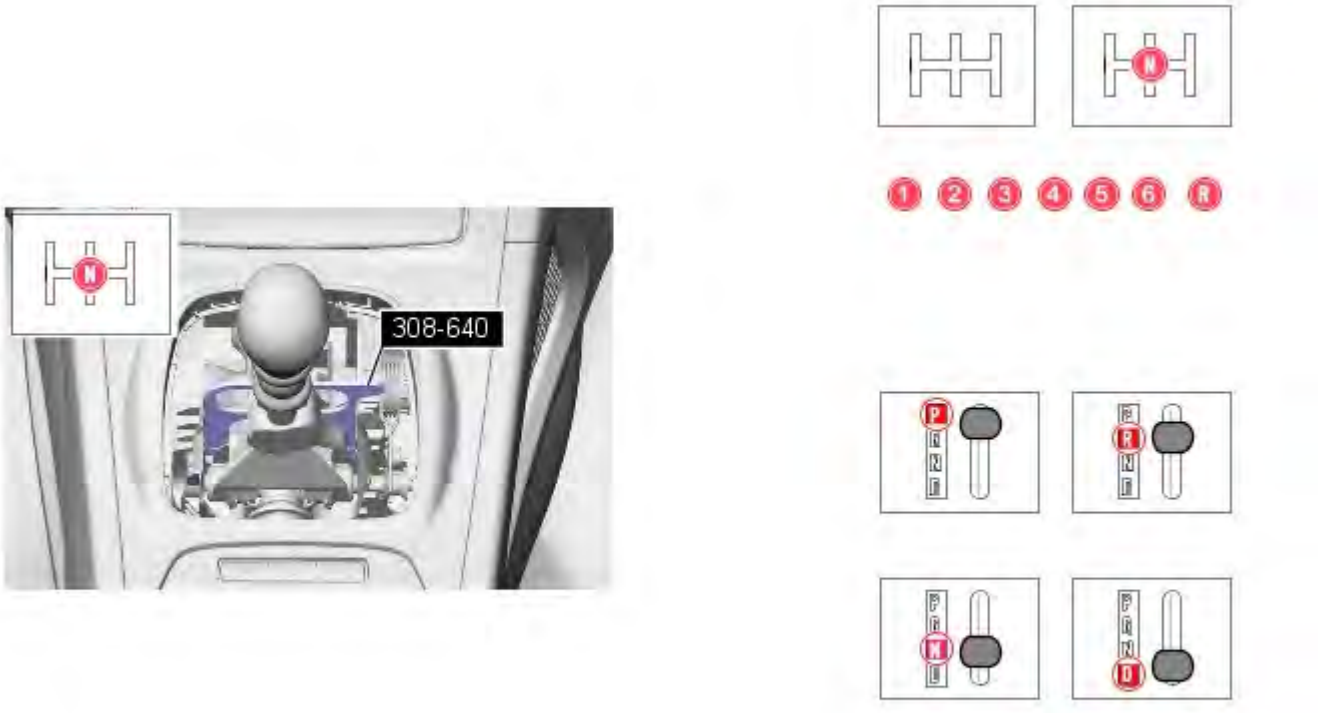
E84834

Location symbols are used to show the location of a component or system within the vehicle.



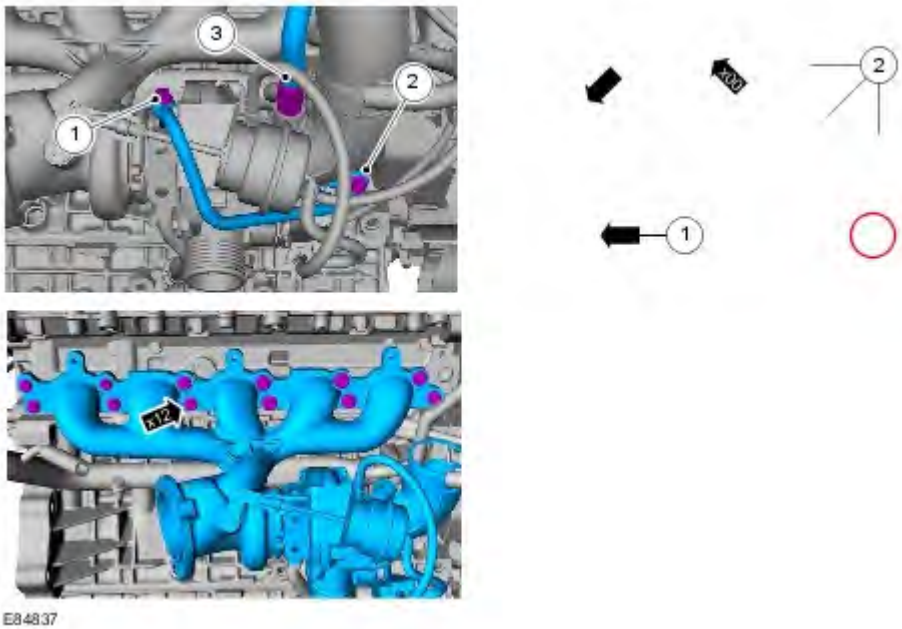
E84835

Gearshift lever or selector lever position symbols are used to show which gearshift lever or selector lever position is to be set.



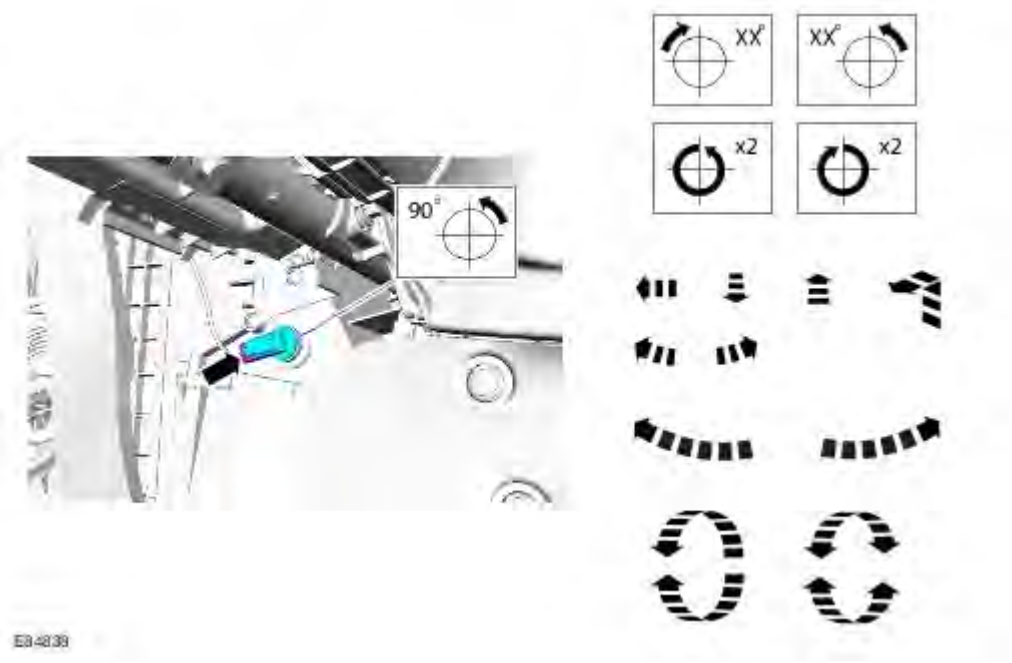
E84836

Pointer symbols are used to draw the attention to components and give special instructions such as a required sequence or number of components. The number of components is reflected by the value inside the luty arrow. A sequence number is located inside the circle. Numbers inside circles are also used to allocate special information such as tightening torques or chemicals to a particular component.

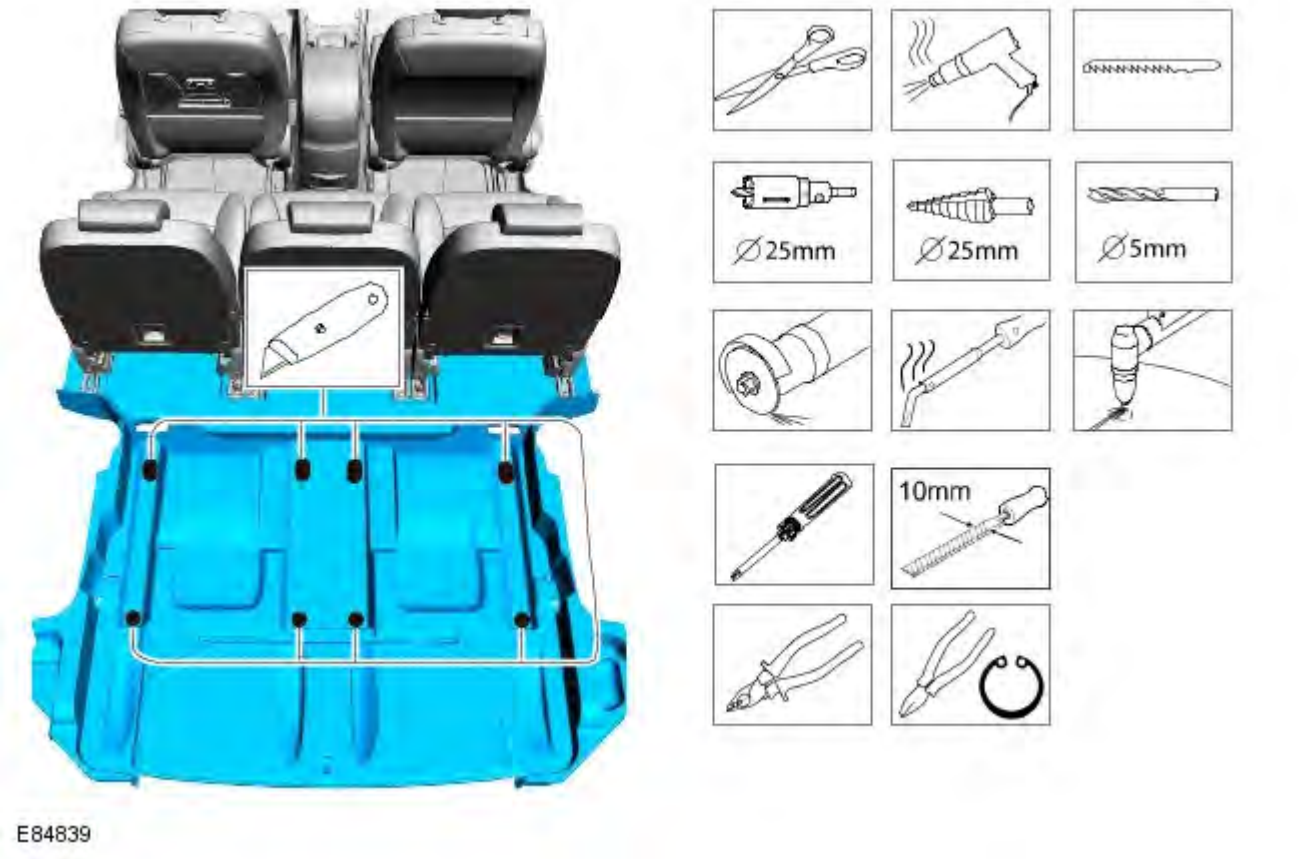


E84837

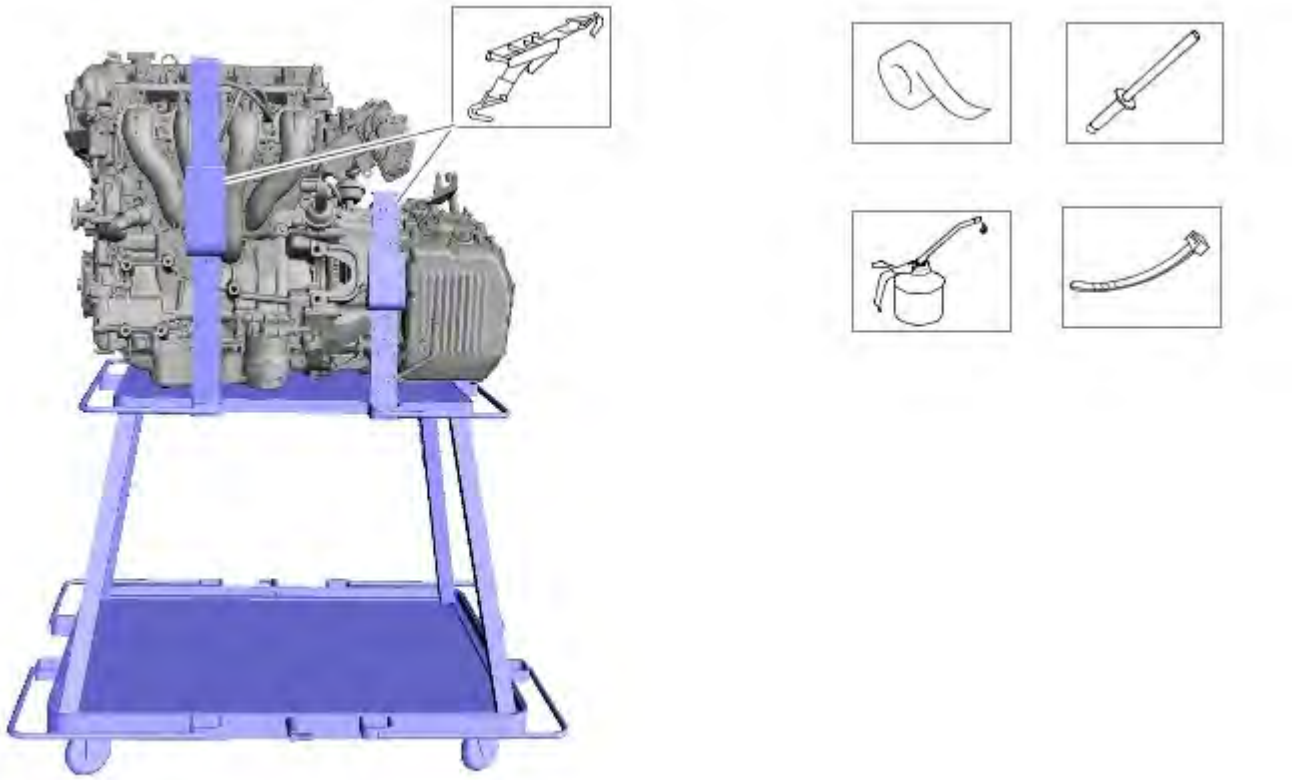
Movement arrows are used to show three dimensional or rotational movements. These movements can include specific values inside the symbol if required.



Standard tool symbols recommend the use of certain standard tools. These tools can include dimension values if required.

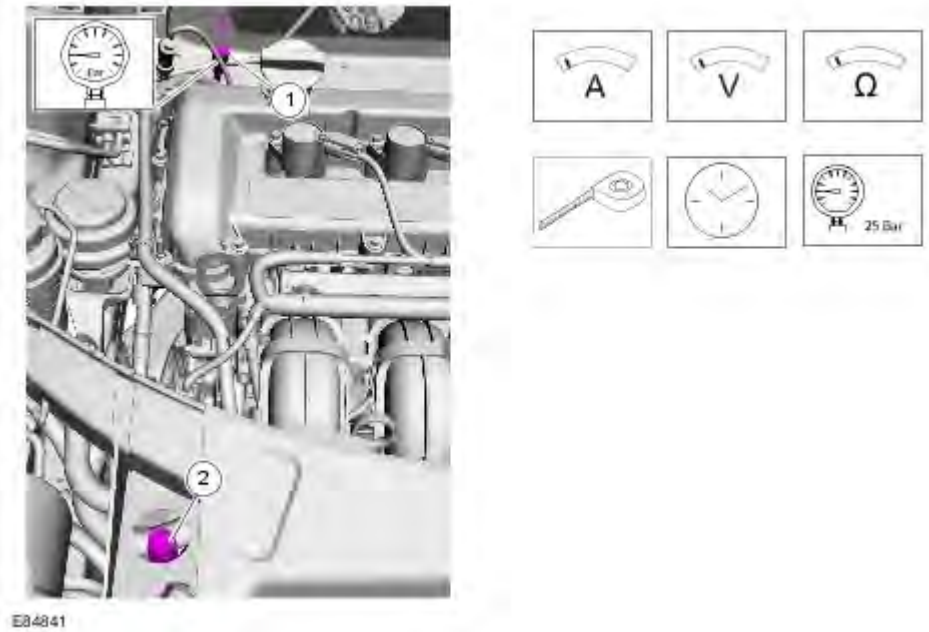


The following graphic illustrates a set of symbols that are used to provide detailed information on where to apply a material.



E84840

Measurement symbols provide detailed information on where to carry out a specific measurement. These symbols can include specific values if required.



E84841

Special Tools and Torque Figure(s)

Special tools will be shown with the tool number in the illustration. The special tool number(s), general equipment, material(s) and torque figure(s) used for the procedure step will be shown in the text column.

Published: 11-May-2011

General Information - Important Safety Instructions

Description and Operation

Safety Notice

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all motor vehicles, as well as the safety of the person doing the work. This manual provides general directions for accomplishing service and repair work with tested effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the person doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in the manual must first establish that neither personal safety or vehicle integrity is compromised from choices of methods, tools or parts.

Published: 11-May-2011

General Information - How To Use This Manual

Description and Operation

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How To Use This Manual

This manual covers all aspects necessary in order to service the vehicle effectively.

The manual is structured into five main sections, General Information, Chassis, Powertrain, Electrical and Body and Paint with each section dealing with a specific part of a vehicle system.

Each of the five main sections contain sub-sections dealing with items which form a part of that specific system.

Pages at the start of the manual list all sections available. Each section has a contents list detailing, where applicable, Specifications, Description and Operation, Diagnosis and Testing, General Procedures and Repair Procedures.

Where components need to be removed or disassembled in sequence, each operation in the sequence will be identified numerically and also graphically in an accompanying illustration.

All left-hand and right-hand references to the vehicle are taken from a position sitting in the driver seat looking forward.

All left-hand and right-hand references to the engine are taken from a position at the flywheel looking towards the front camshaft pulley.

Inspection and Verification

Visual Inspection Charts, Symptom Charts and other information charts (such as diagnostic routines) or supplement test procedures with technical specifications will navigate the user to a specific test procedure.

Symptom Chart

The symptom chart indicates symptoms, sources and actions to address a condition.

Pinpoint Tests

For electrical systems, pinpoint test steps are used to identify the source of a concern in a logical, step-by-step manner. Pinpoint tests have two columns: CONDITIONS and DETAILS/RESULTS/ACTIONS.

The CONDITIONS column is used exclusively for graphics and icons (with or without captions) and the DETAILS/RESULTS /ACTIONS column provides direction to another test step or specific corrective actions.

The boxed numbers indicate the order in which the described action is to be carried out.

Component Tests

A component test is used when a component is tested in multiple pinpoint tests, or if a procedure is too complicated to be formatted within a single page of the pinpoint test.

Graphics

Test graphics show the measurement or test to be carried out in a test step.

A representative tester graphic is used for voltmeters and ohmmeters.

If multiple measurements are made in a single graphic, the test leads are drawn with a solid line until the test lead splits to indicate the multiple measurements, at which point dashed lines are used.

Breakout box type testers are represented by a double circle test pin. Test pins are labelled with the pin number.

• NOTE: Dimensions quoted are to design engineering specifications with service limits quoted, where applicable.

Workshop Manual Organization

The five main sections, together with the areas which they cover are given below:

- **Section 1** - General Information.
- **Section 2** - Chassis.
- **Section 3** - Powertrain.
- **Section 4** - Electrical.
- **Section 5** - Body and Paint.

Sub-section numbers appear after the initial section number, for example, **Section 412-01** covers Climate Control, which is part of the electrical section.

In the number given above, the first digit of the number **'4'** indicates the section **i.e. Electrical**.

The second and third digits **'12'** of the number indicate the vehicle system **i.e. Climate Control**.

The last two digits of the number **'01'** indicate the part of the system covered by the sub-section **i.e. Air Conditioning (A/C) Compressor**.

Published: 11-May-2011

General Information - General Service Information

Description and Operation

Introduction

This manual has been written in a format that is designed to meet the needs of Land Rover technicians worldwide and to assist them in the efficient repair and maintenance of Land Rover vehicles.

This manual provides descriptions and methods for accomplishing adjustment, service and repair work using tested and effective procedures. Following these procedures will help ensure product reliability.

Special Tools

The Special Tool(s) Table provided at the beginning of each procedure lists the special tool(s) required to carry out repair operations within that specific procedure. Wherever possible, illustrations are provided which will assist technicians in identifying the special tool(s) required and also showing such tool(s) in use.

Special tools may be obtained from the manufacturer, SPX Tools, the addresses of their branches will be found in the Special Tools Glossary.
For additional information, refer to: Special Tool Glossary (100-00 General Information, Description and Operation).

Important Safety Instructions

Appropriate service methods and correct repair procedures are essential for the safe and reliable operation of all motor vehicles as well as ensuring the personal safety of the individual carrying out the work.

This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Any person who departs from the instructions provided in this manual must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts.

Individuals who undertake their own repairs should have some skill or training and limit repairs to components which could not affect the safety of the vehicle or its passengers. Any repairs required to safety critical items such as steering, brakes, suspension or supplemental restraint system should be carried out by a Land Rover Dealer. Repairs to such items should NEVER be attempted by untrained individuals.

Warnings, Cautions and Notes which appear in this manual

As you read through this manual, you will come across Warnings, Cautions and Notes. A Warning, Caution or Note is placed at the beginning of a series of steps. If the warning, caution or note only applies to one step, it is placed at the beginning of the specific step after the step number.

Warnings, Cautions and Notes have the following meanings:

Warning: Procedures which must be followed to avoid the possibility of personal injury.

Caution: Calls attention to procedures which must be followed to avoid damage to components.

Note: Gives helpful information.

References

References to the Left Hand (LH) or Right Hand (RH) side given in this manual are made when viewing the vehicle or unit from the rear.

Fault Diagnostic Equipment

The vehicle is equipped with a number of electronic control systems to provide optimum performance of the vehicle's systems.

Land Rover approved diagnostic equipment is available and must be used where specified. The use of this equipment will assist with the fault diagnostic abilities of the Dealer workshop. In particular, the equipment can be used to interrogate the electronic systems for diagnosis of faults which may become evident during the life of the vehicle.

This manual is produced as a reference source to supplement Land Rover approved diagnostic equipment.

Features of the equipment include:

a. Fully upgradeable support for the technician

b. Structured diagnostics to accommodate all skill levels

c. Direct print-out of screen information and test results

Testing the vehicle

Operations covered in this manual do not include reference to testing the vehicle after repair. It is essential that work is inspected and tested after completion and if necessary, a road test of the vehicle is carried out, particularly where safety related items are concerned.

Repairs and Replacement Parts

Land Rover parts are manufactured to the same exacting standards as the original factory fitted components. For this reason, it is essential that only genuine Land Rover parts are used during maintenance or repair.

Attention is particularly drawn to the following points concerning repairs and the fitting of replacement parts and accessories.

Safety features and corrosion prevention treatments embodied in the vehicle may be impaired if other than Land Rover recommended parts are fitted. In certain territories, legislation prohibits the fitting of parts not to manufacturer's specification. Torque wrench setting figures, where given, must be adhered to and locking devices, where specified must be used. If the efficiency of a locking device is impaired during removal it must be replaced.

Owners purchasing accessories whilst travelling abroad must ensure that the accessory and its fitted location on the vehicle conform to legal requirements.

The terms of the vehicle warranty may be invalidated by the fitting of parts other than those recommended by Land Rover.

• NOTE: The fitting of non-approved Land Rover parts and accessories or the carrying out of non-approved alterations or conversions may be dangerous. Any of the foregoing could affect the safety of the vehicle and occupants; also, the terms and conditions of the vehicle warranty may also be invalidated .

All Land Rover recommended parts have the full backing of the vehicle warranty.

Land Rover Dealers are obliged to supply only Land Rover recommended parts.

Specifications

Land Rover are constantly seeking to improve the specification, design and production of their vehicles and alterations take place accordingly. Whilst every effort is made to ensure the accuracy of this Manual, it should not be regarded as an infallible guide to current specifications of any particular vehicle.

This Manual does not constitute an offer for sale of any particular vehicle. Land Rover dealers are not agents of Land Rover and have no authority to bind the manufacturer by any expressed or implied undertaking or representation.

Published: 11-May-2011

General Information - Standard Workshop Practices

Description and Operation

Vehicle in Workshop

When working on a vehicle in the workshop always make sure that:

- Where practicable, the parking brake is applied and the wheels are securely chocked to prevent the vehicle moving forwards or backwards.
- Whenever possible, the ignition key is removed before any work is carried out on the vehicle.
- If the engine is to be run, there is adequate ventilation, or an extraction hose is used to remove exhaust fumes.
- There is adequate room to raise the vehicle and remove the wheels, if necessary.
- Fender covers are always installed if any work is to be carried out in the engine compartment.
- Where practicable, the battery is disconnected if working on the engine, underneath the vehicle, or if the vehicle is raised.

• CAUTIONS:

Prior to disconnecting the battery, refer to the Electrical Section of this manual - Battery disconnection/connection. For additional information, refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

When electric arc welding on a vehicle, always disconnect the generator wiring to prevent the possibility of a surge of current causing damage to the internal components of the generator.

- If using welding equipment on the vehicle, a suitable fire extinguisher is readily available.

Battery - General

• CAUTIONS:

Prior to carrying out any procedures which involve disconnecting/ or connecting the battery, refer to the Electrical Section of this manual - Battery disconnection/connection.
For additional information, refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

A discharged battery condition may have been caused by an electrical short circuit. If this condition exists there will be an apparently live circuit on the vehicle even when all normal circuits are switched off. This can cause arcing when the jumper cables are connected.

While it is not recommended that the vehicle is jump started, it is recognized that this may occasionally be the only practical way to mobilize a vehicle. Prior to attempting a jump start, reference must be made to the Electrical Section of this manual - Jump Starting.

Following jump starting of a disabled vehicle, the discharged battery must be checked for serviceability and recharged off the vehicle as soon as possible to avoid permanent damage.

Do not rely on the generator to restore a discharged battery. For a generator to recharge a battery, it would take in excess of eight hours continuous driving with no additional loads placed on the battery.

- Always make sure that the jumper cables are adequate for the task.
- Always make sure that the slave battery is of the same voltage as the vehicle battery. The batteries must be connected in parallel.
- Always make sure that switchable electric circuits are switched off before connecting jumper cables. This reduces the risk of arcing occurring when the final connection is made.

Towing the Vehicle

WARNING: When towing is necessary, reference must be made to the Jacking, Lifting and Towing Section of this Manual.

When the vehicle is being towed dock the remote control and switch on the ignition. (steering lock released and warning lights illuminated). Only then will the steering, turn signal lamps, horn and stop lamps be operational. Failure to follow these instructions may result in personal injury. It must be noted that with the engine not running, the power steering and brake booster will be inoperative therefore, greater effort will be needed to steer the vehicle and apply the brakes.

General Installation Instructions

Component removal

Whenever possible, clean components and the surrounding area before removal.

- Blank off openings exposed by component removal.
- Following disconnection, seal fuel, oil or hydraulic lines immediately using suitable blanking plugs or caps.
- Seal open ends of exposed oilways using suitable tapered hardwood plugs or conspicuous plastic plugs.
- Immediately a component is removed, place it in a suitable container; use a separate container for each component and its associated parts.

- Clean bench and provide marking materials, labels and containers before disassembling components.

Disassembling

Observe scrupulous cleanliness when disassembling components, particularly when brake, fuel, air suspension or hydraulic system parts are disassembled. A particle of dirt or cloth fragment could cause a serious malfunction if trapped in these systems.

- Blow out all tapped holes, crevices, oilways and fluid passages with dry, compressed air.

WARNING: Suitable eye protection must be worn.

- Use suitable marker ink to identify mating parts, do not use a scriber or centre punch as they could initiate cracks or distortion.
- Wire or tape mating parts together where necessary to prevent accidental interchange.
- Suitably identify parts which are to be renewed and to those parts requiring further inspection. Keep these parts separate.
- To make sure that the correct replacement part has been obtained, do not discard a part due for renewal until after comparing it with the new part.

Cleaning Components

Always use cleaning agents which are suitable for the work being undertaken and the components being cleaned. NEVER use gasoline (petrol) as a cleaning agent (degreaser). Always make sure that the component being cleaned is compatible with the cleaning agent.

Always follow the manufacturer's instructions regarding the use of cleaning agents and make sure that the environment in which the work is being undertaken is suitable. See Health and Safety Precautions for further information regarding cleaning.

General Inspection of Components

All components should be inspected for wear or damage before reassembling.

- Always make sure that component to be inspected is clean and free from oil or grease.
- When a component is to be checked dimensionally against design specified values, use the appropriate measuring equipment i.e. micrometers, verniers, surface plates, dial test indicators (DTI).
- Always make sure that all measuring equipment is correctly calibrated before use.
- Reject a component which is not within specified values/limits or if it appears to be damaged.
- A component may be reinstalled if dimensions obtained during checking are at the maximum tolerance limit and it is in an undamaged condition.
- Bearing journal clearances should be checked where necessary using Plastigauge.

Joints and Joint Faces

All gaskets should be installed dry unless stated otherwise. Always apply the specified lubricant to O-rings and install O-rings using the fingers only.

Use gasket removal spray and/or plastic scrapers to remove traces of old gasket.

CAUTION: DO NOT use metal scrapers or emery cloth as these may damage the sealing surfaces.

Many joints use sealants instead of gaskets as the sealing medium. Where this is the case, the sealant together with its part number will be found listed in the relevant repair operation and also in the sealants table.

CAUTION: Always remove all traces of the old sealant prior to reassembly. Use plastic scrapers, specified solvents where available or dry, lint free cloth. DO NOT use metal scrapers or emery cloth as these may damage the sealing surfaces. Make sure that sealing surfaces are free from oil or grease as sealants will not adhere properly to contaminated surfaces.

Do not allow sealant to enter tapped holes or oilways.

Locking Devices

Always replace locking devices with one of the same design and of the correct size.

Tab washers

Always release locking tabs before loosening fixings, do not reuse tab washers.

Locknuts

Always use a backing spanner when loosening and tightening locknuts, brake and fuel pipe unions.

Roll pins

Always install new roll pins of the correct size.

Circlips

Always install new circlips ensuring that they are of the correct size for the groove.

Woodruff keys

Woodruff keys may be reused provided there is no indication of wear or distortion.

Remove any burrs from edges of keyways using a fine file.

Split pins

Never attempt to straighten and reuse a split pin, always make sure that replacement pins are of the correct size for the hole in which they are to be installed.

Screw Threads

- Damaged nuts, bolts and screws must always be discarded. Attempting to recut or repair damaged threads with a tap or die impairs the strength and fit of the threads and is not recommended.

• NOTE: During certain repair operations, it may be necessary to remove traces of thread locking agents using a tap. Where this is necessary, the instruction to do so will appear in the relevant operation and it is essential that a tap of the correct size and thread is used.

- Some bolts are coated with a thread locking agent and unless stated otherwise, they must not be reused. New bolts having the same part number as the original must always be installed. When nuts or bolts are to be discarded, the repair operation and relevant torque chart will include an instruction to that effect. Do not use proprietary thread locking agents as they may not meet the specification required. See also Encapsulated ('Patched') Bolts and Screws.
- Always make sure that replacement nuts and bolts are at least equal in strength to those that they are replacing. Castellated nuts must not be loosened to accept a split pin except in recommended cases when this forms part of an adjustment.
- Do not allow oil or grease to enter blind holes, the hydraulic action resulting from tightening the bolt or stud can split the housing and also give a false torque reading.
- Always tighten a nut, bolt or screw to the specified torque figure, damaged or corroded threads can give a false torque reading.
- Nut and bolt loosening and tightening sequences, where given, must ALWAYS be followed. Distortion of components or faulty sealing of joints will result if the sequences are not followed. Where an instruction is given to tighten in stages, these stages must be adhered to; do not attempt to combine stages particularly where certain stages involve tightening by degrees.
- To check or re-tighten a fixing to a specified torque, first loosen a quarter of a turn, then retighten to the specified torque figure.
- Unless instructed otherwise, do not lubricate bolt or nut threads prior to installing.

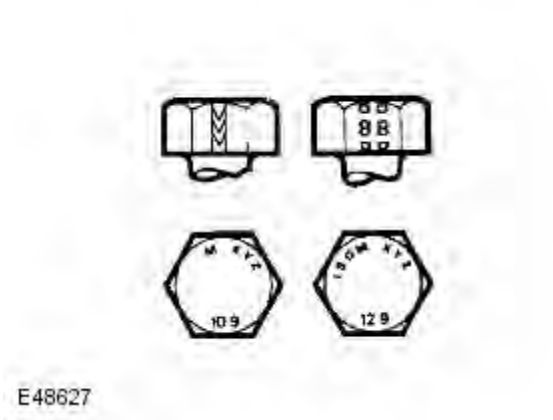
Where it is stated that bolts and screws may be reused, the following procedures must be carried out:

- Check that threads are undamaged.
- Remove all traces of locking agent from the threads.

CAUTION: DO NOT use a wire brush; take care that threads are not damaged.

- Make sure that threads are clean and free from oil or grease.
- Apply the specified locking agent to the bolt threads.

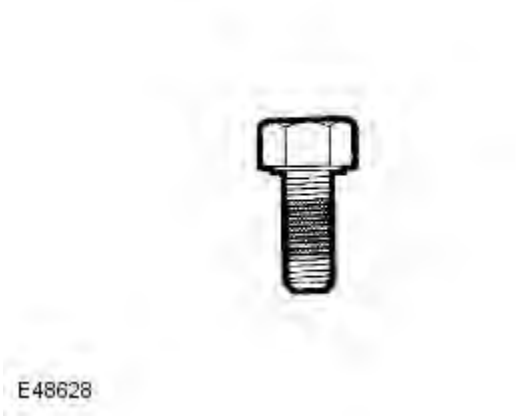
Bolt and Nut Identification



An ISO metric bolt or screw made of steel and larger than 6 mm in diameter can be identified by either of the symbols ISO M or M embossed or indented on top of the bolt head.

In addition to marks identifying the manufacturer, the top of the bolt head is also marked with symbols indicating the strength grade e.g. 8.8, 10.9, 12.9, 14.9. Alternatively, some bolts and screws have the M and strength grade symbol stamped on the flats of the hexagon.

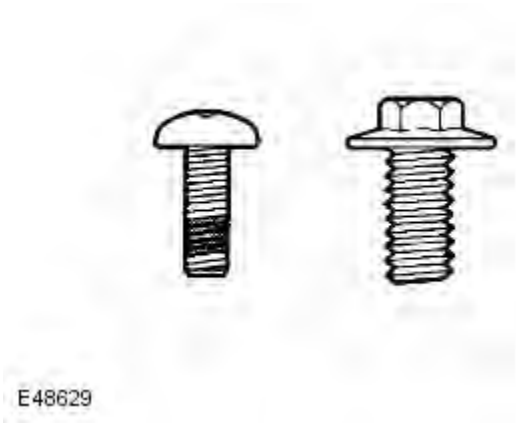
Encapsulated ('Patched') bolts and screws



E48628

Encapsulated ('patched') bolts and screws have a thread locking agent applied to the threads during manufacture. Most thread locking agents are colored, the band of color extending for 360 degrees around the thread. Some locking agents however, are neutral in color and may not be so easily identified apart from a slightly darker area of thread where the locking agent has been applied. The locking agent is released and activated by the tightening process and is then chemically cured to provide the locking action.

Self-locking bolts and screws



E48629

Unless stated in a specific repair procedure, self-locking bolts and screws i.e. nylon patched or trilobular thread can be reused provided that resistance is felt when the locking portion enters the female thread.

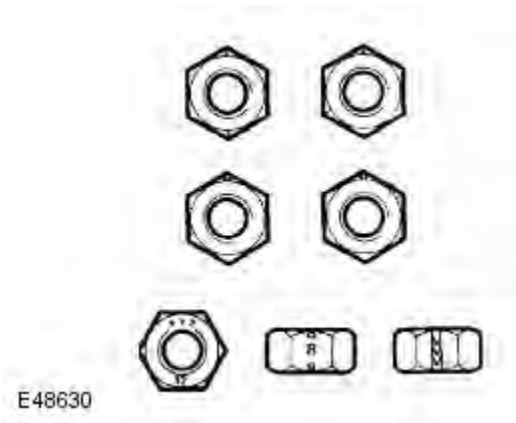
Nylon patched bolts and screws have a locking agent either applied to, or inserted in the threaded portion. They are identified by the presence of a colored section of thread extending approximately 180 degrees around the thread or by a colored plug inserted into the bolt.

Trilobular bolts have a special thread form which creates a slight interference with the thread of the hole or nut into which it is screwed.

CAUTION: Do Not reuse self-locking fasteners in critical locations e.g. drive plates/flywheel or engine bearings. Do not install non self-locking fasteners where a self-locking fastener is specified.

Trilobular bolts should not be used as a substitute for patched bolts.

Nut identification



E48630

A nut with an ISO metric thread is marked on one face or one of the hexagonal flats with the strength grade symbol 8, 12, 14. Some nuts with the strength grade 4, 5 or 6 are also marked and some have the metric symbol M on the hexagonal flat opposite the strength grade marking.

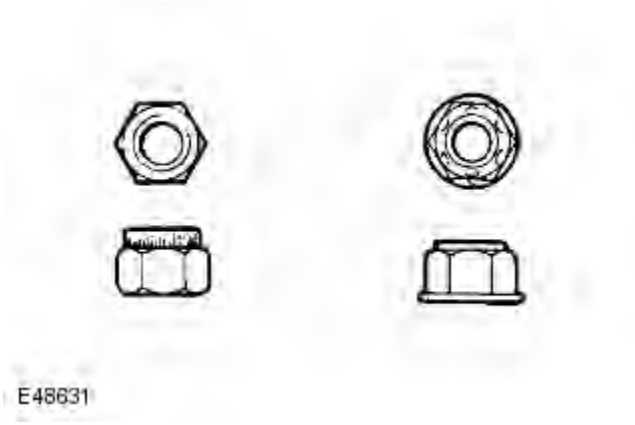
A clock face system is sometimes used as an alternative method of indicating the strength grade. The external chamfers or a face of the nut is marked in a position relative to the appropriate hour mark on a clock face to indicate the strength grade.

A dot is used to locate the 12 o'clock position and a dash to indicate the strength grade. If the grade is above 12, two dots identify the 12 o'clock position.

When tightening a slotted or castellated nut, never loosen it to insert a split pin except where specified as part of an adjustment procedure. If difficulty is experienced in correctly positioning the slot, alternative washers or nuts should be selected.

Where a nut is tightened to adjust or maintain bearing pre-load, the tightening procedure must be adhered to.

Self-locking nuts



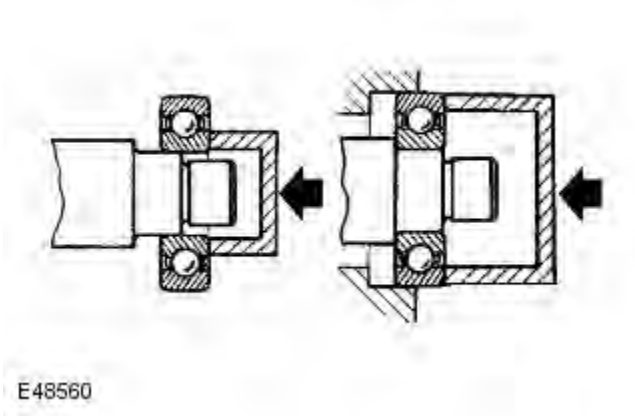
Unless stated otherwise, self-locking nuts once removed must be discarded and new nuts of the same type and strength grade installed.

Ball and Roller Bearings

When removing and installing bearings, make sure that the following practices are observed to make sure component serviceability:

CAUTION: Service tools have been developed for removing the majority of bearings; these must always be used where specified.

- Remove all traces from bearing under inspection by cleaning with a suitable degreasant; maintain absolute cleanliness throughout operations.
- Conduct a visual inspection for markings on rolling elements, raceways, outer surfaces of outer or inner surfaces of inner rings. Reject any bearings found to be marked since marking in these areas indicates onset of wear.
- Hold inner race of bearing between finger and thumb of one hand and rotate outer race to check that it revolves absolutely smoothly. Repeat holding outer race and rotating inner race. DO NOT spin the bearing.
- Rotate outer ring gently using a reciprocating movement whilst holding inner ring; feel for any check or obstruction to rotation. Reject bearing if movement is not absolutely smooth.
- Check bearing for blueing or signs of overheating.
- Lubricate bearing with the specified lubricant.
- Inspect bearing surface of shaft and bearing housing for discoloration or other markings which indicate overheating of bearing or movement between bearing and seating.
- Before installing bearing, make sure that shaft and bearing housing are clean and free from burrs.
- If one bearing of a pair shows signs of wear, overheating etc., it is advisable to replace bearings as a pair unless it is suspected that one bearing may have been faulty when installed, was installed incorrectly or the fault arose due to oil seal failure.
- Never reinstall a bearing unless it is in a fully serviceable condition.



- When installing a bearing to a shaft, only apply force to the inner ring of the bearing. When installing a bearing into a housing, only apply force to the outer ring of the bearing.

CAUTION: Service tools have been developed for installing the majority of bearings; these must always be used where specified.

- In the case of grease lubricated bearings, fill the space between the bearing and outer seal with the recommended grade of grease before installing the seal.

CAUTION: When a waxed oil seal (installed dry) type of oil seal is to be installed, take great care that grease does not contaminate the running surface of the seal.

- Always make suitable reference marks between the components of separable bearings e.g. taper roller bearings when disassembling to make sure correct location of components when assembling. Never install new rollers in an outer ring, always install a new bearing assembly.

Brake Pads and Linings

Always install the correct grade and specification of brake pads and linings. When replacing these items, always replace as complete axle sets.

Brake Hydraulics

Always observe the following recommendations when working on the braking system:

WARNING: Do not intermix brake fluid of different specifications.

- Always use two spanners when loosening or tightening brake pipes or hose connections.
- Make sure that hoses run in a natural curve and are not kinked or twisted.
- Install brake pipes and hoses securely in their retaining clips and make sure that they cannot contact a potential chafing point.
- Containers used for brake fluid must be kept absolutely clean.
- Do not store brake fluid in unsealed containers, the fluid will absorb water which will lower the boiling point of the fluid.
- Do not allow brake fluid to be contaminated with other fluids such as mineral oil and do not put brake fluid in a container which has previously been used for storing other fluids.
- Do not reuse brake fluid which has been bled from the system.
- Always use brake fluid or a suitable brake cleaning fluid to clean hydraulic components.
- Unless stated otherwise, use only clean brake fluid to lubricate hydraulic seals and components.
- Always install blanking plugs to hoses, pipes or components immediately after disconnection.
- Check thread compatibility of original equipment with replacement components.
- Observe absolute cleanliness when working with hydraulic components.

Pipes and Hoses

When removing or installing flexible hydraulic pipes and hoses, make sure that the following procedures are observed to make sure component serviceability:

- Prior to removal, clean area around hose or pipe end which is to be disconnected.
- Obtain appropriate blanking plugs or caps before disconnecting hose or pipe end fittings in order that connections can be plugged immediately following disconnection.
- Always install blanking plugs or caps to pipes and unions immediately following disconnection.
- Clean hose or pipe and blow through with an air line.

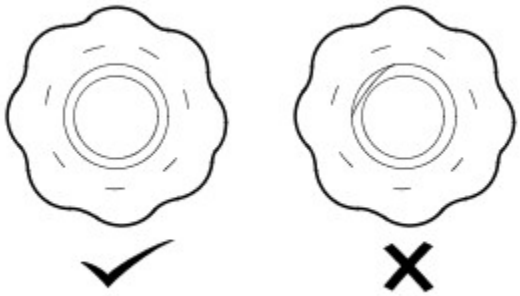
WARNING: Suitable eye protection must be worn.

- Check hoses externally for cracks, separation of plies, security of end fittings and external damage; replace faulty hoses.
- Check pipes for signs of corrosion and chafing, replace as necessary.

CAUTION: If pipes are found to be chafed, rectify clips, mounting points etc., to prevent further problems in service.

- When installing hoses, make sure that no unnecessary bends are introduced and that hoses are not kinked, twisted or positioned close to potential chafing points.
- When installing pipes, make sure that pipes are positioned and clipped clear of potential chafing points.
- Always replace sealing washers installed to banjo bolts, sealing plugs etc.
- Always use a backing spanner when tightening unions and do not overtighten union nuts or banjo bolts.
- After any work on hydraulic systems, always check for fluid leaks whilst a second operator applies working pressure to the brake pedal or operates the system that has been worked on.

Fuel system hoses

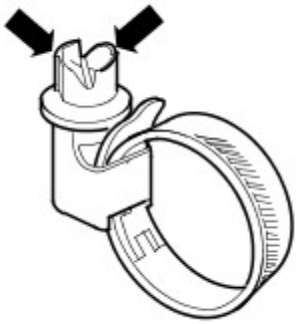


E48632

All fuel hoses are made up of two laminations, an armoured rubber outer sleeve and an inner viton core. Whenever a hose is removed, make sure that the inner bore is inspected to check that the viton lining has not become separated from the outer sleeve.

WARNING: Never attempt to repair fuel hoses or rectify leaking 'quick-fit' connectors the fuel hose and connectors must be replaced as an assembly.

Fuel system hose clips



E48636

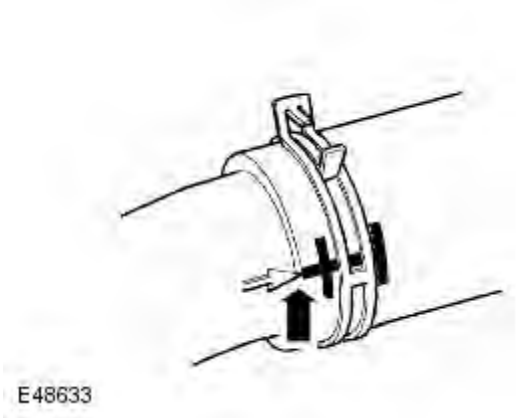
Certain fuel system hose clips are of the 'break-off head' type where a slot in the screw head shears off when the clip is tightened to a specific torque. These clips may be removed using a screwdriver and must be replaced with new clips on reassembly. Clips must be tightened until the portion of the slot shears off. Do not attempt to tighten clips by any other method, do not install any other type of clip.

Cooling system hoses

CAUTION: The following precautions must be observed to make sure that the integrity of the cooling system hoses and their connection to the system is maintained.

Hose orientation and connection

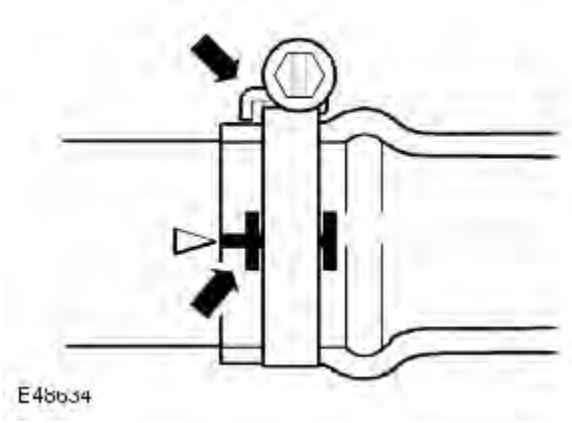
Correct orientation of cooling system hoses is important to make sure that hoses do not become fatigued or damaged through contact with adjacent components.



E48633

Where orientation marks are provided on the hose and corresponding component, the marks must be aligned when the hose is installed. Hoses must be installed fully on to their connection points, usually a moulded form on a pipe provides a positive indicator.

Hose clips



Markings are usually provided on the hose to indicate the correct clip position. If no markings are provided, position the clip directly behind the retaining lip at the end of the stub pipe. Worm drive clips should be orientated with the crimped side of the drive housing facing towards the end of the hose or the hose may become pinched between the clip and the stub pipe retaining lip. Unless otherwise stated, worm drive clips should be tightened to 3 Nm (2 lb-ft). Make sure that hose clips do not foul adjacent components.

E48635

Oetiker clips may be removed by bending the tag (arrowed) and releasing the free end of the clip. Clips must not be reused. When installing new clips, make sure clip is positioned on hose before tightening and make sure that when clip is tightened, the tag is located in the longitudinal slot in the free end of the clip (arrowed in illustration).

Heat protection

Always make sure that heatshields and protective sheathing are in good condition; replace if damage is evident. Particular care must be taken when routing hoses close to hot engine components such as the exhaust manifolds and exhaust gas recirculation (EGR) pipes. Hoses will relax and deflect slightly when hot, make sure this movement is taken into account when routing and securing hoses.

Electrical Precautions

General

The following guidelines are intended to make sure the safety of the operator whilst preventing damage to the electrical and electronic components of this vehicle.

Equipment

Prior to commencing any test procedure on the vehicle, make sure that the relevant test equipment is working correctly and that any harness or connectors are in good condition. It is particularly important to check the condition of all plugs and leads of mains operated equipment.

Polarity

Never reverse connect the vehicle battery and always make sure the correct polarity when connecting test equipment.

High voltage circuits

Whenever disconnecting live ht circuits, always use insulated pliers and never allow the open end of the ht lead to contact other components, particularly ECU's.

Vehicles installed with Bi-Xenon headlamp bulbs

WARNING: The following precautions must be observed as failure to comply may result in exposure to ultra-violet rays, severe electric shock, burns or risk of an explosion.

- Safety goggles and gloves must be worn.
- Make sure that headlamps are switched off before removing bulbs.

- Do not touch the glass portion of the bulb.
- On no account should headlamps be switched on with the bulb removed from the headlamp.
- Bulb testing may only be carried out with the bulb installed in the headlamp.
- Bulbs must be disposed of in accordance with the local authority bye-laws.

Connectors and harnesses

The engine compartment of a vehicle is a particularly hostile environment for electrical components and connectors. Always observe the following:

- Make sure electrically related items are dry and oil free before disconnecting/connecting test equipment.
- Make sure that disconnected multiplugs and sensors are protected from any possible oil, coolant or other liquid contamination. Any such contamination could impair performance or lead to component failure.
- Never force connectors apart or pull on the wiring harness.
- Always make sure locking tabs are disengaged before disconnecting multiplugs etc. and make sure that correct orientation is achieved before connection.
- Make sure that any protection covers, insulation etc. are replaced if disturbed.

Having confirmed that a component is faulty, carry out the following:

- Switch off the ignition and disconnect the battery.
- Remove the component and support the disconnected harness.
- When replacing electrical components, keep oily hands away from electrical connections and make sure that locking tabs on connectors are fully engaged.

Battery Disconnection/Connection

Always refer to the Electrical Section of this manual - Battery Connection/Disconnection prior to attempting to connect or disconnect the battery.
For additional information, refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

Fuel Handling Precautions

The following information lists basic precautions which must be observed if fuel is to be handled safely. It also outlines other areas of risk which must not be ignored. As this information is issued for basic guidance only, consult your local Fire Department where any doubt as to personal and environmental safety exists - See also Health and Safety Precautions.

General precautions

Always have the correct type of fire extinguisher containing Foam, CO2, Gas or powder accessible when handling or draining fuel or dismantling fuel systems. Fire extinguishers must also be located in areas where fuel is stored.

Make sure that suitable warning signs are exhibited.

Keep all sources of ignition well away from areas where fuel is being handled.

Make sure that any leadlamps are flameproof and kept clear of spillage.

• WARNINGS:

Do not disassemble or reassemble fuel system components whilst vehicle is over a pit.

No one should be permitted to repair components associated with fuel without first having specialist training.

Always disconnect the vehicle battery before carrying out disassembly, reassembly or draining work on a fuel system.

Fuel tank and system draining

Draining must be carried out in accordance with the procedures given in the relevant Fuel System section of this manual.

• WARNINGS:

Never drain fuel or work on a fuel system while the vehicle is over a pit. Extraction or draining of fuel must be carried out in a well ventilated area.

Always attach fuel vapor warning labels to fuel tanks immediately after draining.

Containers used for storing fuel must be clearly marked with the contents and placed in a safe storage area which meets the requirements of the local authority.

CAUTION: Some fuel lines are now installed with 'quick release' connectors. If a connector is damaged, no attempt must be made to repair the connector, a new fuel line and connector(s) assembly must be installed.

Always release pipe clips fully before attempting to disconnect fuel pipes.

Fuel tank repairs

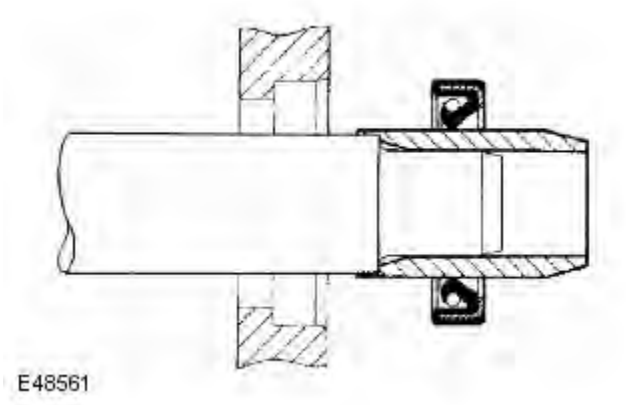
CAUTION: No attempt should be made to repair a plastic fuel tank. If the structure of the tank is damaged, a new

tank must be installed.

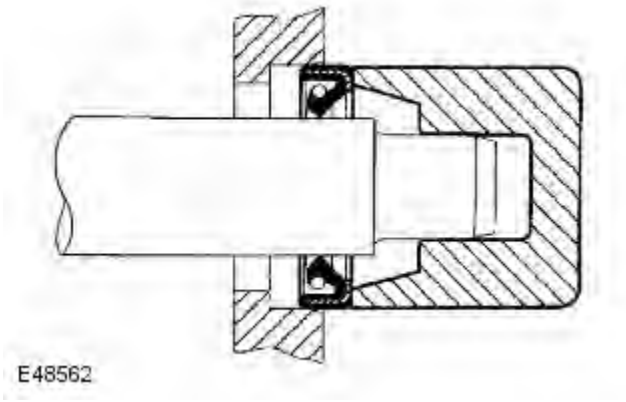
Oil seals

Never use a seal which has been improperly stored or handled.

- Take great care when removing old seals that the sealing surfaces and seal housing are not damaged.
- Carefully examine seal before installing to make sure that it is clean and undamaged.
- Make sure that the surface on which the seal is to run and also the seal housing is clean and free from burrs or scratches. Renew the component if the sealing surface cannot be restored.
- Special tools and protection sleeves are provided for installing the majority of seals and must be used when specified.
- Many seals are now coated with a protective wax and DO NOT need to be lubricated prior to installing. Always check the relevant repair procedure which will state if a seal must be installed dry. Never touch these seals with oily hands as the oil will contaminate the protective coating and affect the sealing properties of the seal; also, make sure that installing tools and protection sleeves are free from oil and grease. Seals which must be lubricated prior to installing should have the recommended lubricant applied to the areas specified in the repair procedure.
- Make sure that a seal is installed the correct way round. For example, the lip of the seal must face towards the lubricant which it is sealing.
- When installing an oil seal, make sure that it is positioned square to shaft and housing. Where the seal is to be installed to a housing prior to installing over a shaft, take care not to allow the weight of an unsupported shaft to rest on the seal.



- Always use the recommended special tool and protection sleeve to install an oil seal. If no tool is specified, use a suitable mandrel approximately 0.4 mm (0.015 in) smaller than the outside diameter of the seal. Use adhesive tape on the shaft to protect the sealing lip of the seal.



- Press or drift the seal in to the depth of its housing if the housing is shouldered or flush with the face of the housing where no shoulder is provided. Make sure that the seal is not tilted in the housing when it is installed.

Supplementary Restraint System (SRS) Precautions

WARNING: Do not install rear facing child seats in the front passenger seat.

The SRS contains components which are potentially hazardous to service personnel if not handled correctly. The following guidelines and precautions are intended to alert personnel to potential sources of danger and emphasise the importance of ensuring the integrity of the SRS components installed to the vehicle.

WARNING: The following precautions MUST be adhered to when working on the SRS system:

- **The correct procedures must always be used when working on SRS components.**
- **Persons working on the SRS system must be fully trained and have been issued with the safety guidelines.**
- **The airbag modules contain extremely flammable and hazardous compounds. Contact with water, acids or heavy metals may produce harmful or explosive results. Do not dismantle, incinerate or bring into contact with electricity before the unit has been deployed.**
- **Always replace a seat belt assembly that has withstood the strain of a severe vehicle impact or if the webbing**

shows signs of fraying.
- **Always disconnect the vehicle battery before carrying out any electric welding on a vehicle installed with an SRS system.**

CAUTION: Do not expose airbag modules or seat belt pre-tensioners to temperatures exceeding 85° C (185° F).

It should be noted that these precautions are not restricted to operations performed when servicing the SRS system. The same care should be exercised when working on ancillary systems and components located in the vicinity of SRS components; these include but are not limited to:

- Steering wheel airbag, rotary coupler.
- Passenger front airbag.
- Side curtain airbag modules - front and rear.
- Seat belt pre-tensioners.
- SRS harnesses, link leads and connectors.
- Side (thorax) air bags.

Making the system safe

Before working on or in the vicinity of SRS components, make sure the system is rendered safe by performing the following operations:

- Remove the remote control.
- Disconnect battery, earth lead first.
- Wait 2 minutes for the SRS power circuit to discharge before commencing work.

• NOTE: The SRS uses energy reserve capacitors to keep the system active in the event of electrical supply failure under crash conditions. It is necessary to allow the capacitors sufficient time to discharge (2 minutes) in order to avoid the risk of accidental deployment.

Installation

In order to make sure system integrity, it is essential that the SRS system is regularly checked and maintained so that it is ready for effective operation in the event of a collision. Carefully inspect SRS components before installation. Do not install a part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.

WARNING: The integrity of the SRS systems is critical for safety reasons. Make sure the following precautions are always adhered to:

- **Do not install accessories or other objects to trim panels which cover airbags.**
- **Never install used SRS components from another vehicle or attempt to repair an SRS component.**
- **When repairing an SRS system, only use genuine new parts.**
- **Never apply electrical power to an SRS component unless instructed to do so as part of an approved test procedure.**
- **Special fixings are necessary for installing an airbag module – do not use other fixings.**
- **Always use new fixings when replacing an SRS component and make sure that all fixings are tightened to the correct torque.**

• CAUTIONS:

Take care not to trap airbag modules when installing interior trim components.

Make sure SRS components are not contaminated by oil or grease.

• NOTE: Following seat belt pre-tensioner deployment, the seat belts can still be used as conventional seat belts but will need to be replaced as soon as possible to make sure full SRS protection. Do not use the seat belts if the retraction mechanism is not working correctly.

• NOTE: If the SRS components are to be replaced, the part number/bar code of the new unit must be recorded.

SRS component testing precautions

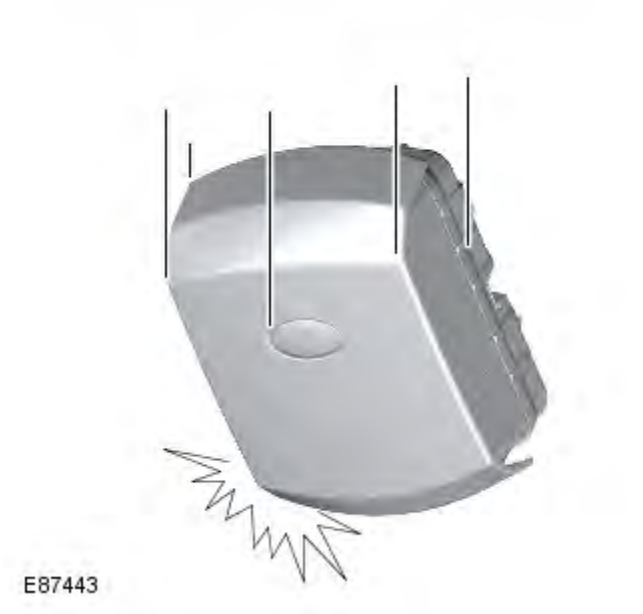
The SRS components are triggered using relatively low operating currents, always adhere to the following :

WARNING: Never use a multimeter or other general purpose equipment on SRS components. Use only Land Rover approved diagnostic equipment to diagnose system faults.

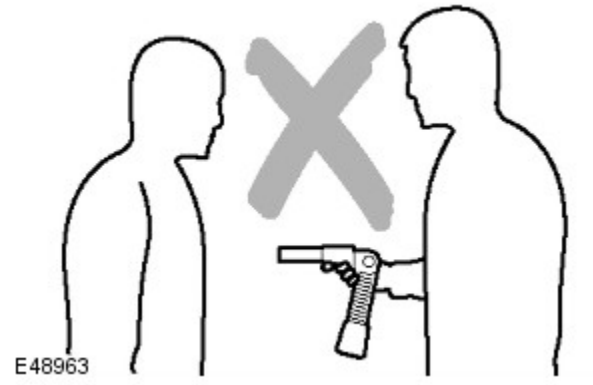
WARNING: Do not use electrical test equipment on the SRS harness while it is connected to any of the SRS components, it may cause accidental deployment and injury.

Handling and storage

Always observe the following precautions when handling SRS components:



- Never drop an SRS component. The airbag diagnostic control unit is a particularly shock sensitive device and must be handled with extreme care. Airbag modules and seat belt pre-tensioners could deploy if subjected to a strong shock.
- Never wrap your arms around an airbag module. If a module has to be carried, hold it by the cover with the cover uppermost and the base away from your body.
- Never transport airbag modules or seat belt pre-tensioners in the passenger compartment of a vehicle. Always transport airbag modules or seat belt pretensioners in their original packaging in the luggage compartment of the vehicle.
- Never attach anything to an airbag cover or any trim component covering an airbag module. Do not allow anything to rest on top of an airbag module.
- Always keep components cool, dry and free from contamination.
- Never apply grease or cleaning solvents to seat belt pre-tensioner units, component failure could result.
- Always store an airbag module with the deployment side uppermost. If it is stored deployment side down, accidental deployment will propel the airbag module with sufficient force to cause serious injury.
- Keep new airbag modules in their original packaging until just prior to installing. Place the old module in the empty packaging for carriage.



• WARNINGS:

When handling a side curtain airbag module, hold by the gas generator housing, DO NOT hold by the airbag. Do not wrap the thumb around the gas generator while holding. Do not drape airbag over shoulder or around neck. For seat buckle type pre-tensioners, hold by the piston tube, with the open end of the piston tube pointing towards the ground and the buckle facing away from your body. Do not cover the end of the piston tube. DO NOT hold buckle type pre-tensioners by the bracket assembly or cable. Never point the piston tube towards your body or other people.

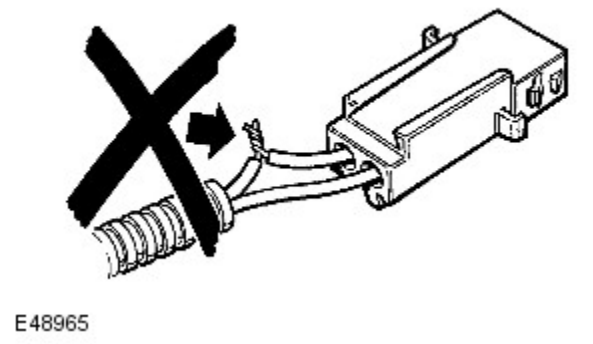
Airbag modules and seat belt pre-tensioners are classed as explosive devices. For overnight and longer term storage, they must be stored in a secure steel cabinet which has been approved as suitable for the purpose and has been registered with the local authority.

Store airbag modules or seat belt pre-tensioners in a designated storage area. If there is no designated storage area available, store in the locked luggage compartment of the vehicle and inform the workshop supervisor.

CAUTION: Improper handling or storage can internally damage the airbag module making it inoperative. If you suspect the airbag module has been damaged, install a new module and refer to the deployment/disposal procedures for disposal of the damaged module.

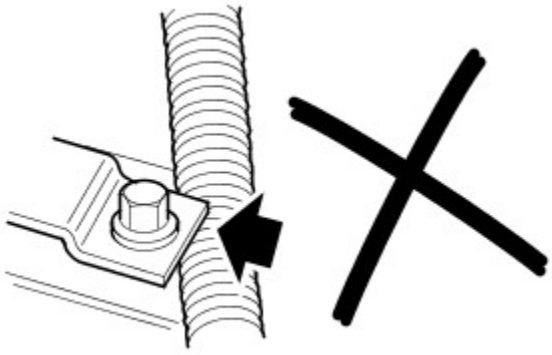
SRS harness and connectors

Always observe the following precautions with regards to SRS system electrical wiring:



- Never attempt to modify, splice or repair SRS wiring.
- Never install electrical equipment such as a mobile telephone, two-way radio or in-car entertainment system in such a way that it could generate electrical interference in the airbag harness. Seek specialist advice when installing such equipment.

• NOTE: SRS wiring can be identified by a special yellow outer sleeve protecting the wires (black with yellow stripe protective coverings are sometimes used).



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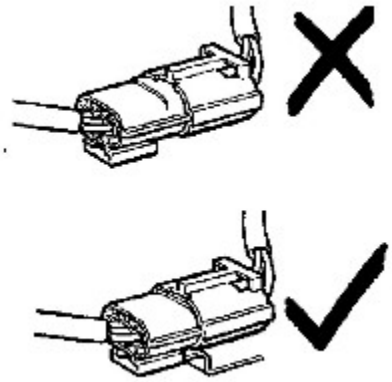
WARNING: Always make sure SRS wiring is routed correctly. Be careful to avoid trapping or pinching the SRS wiring.



E48966

WARNING: Do not leave the connectors hanging loose or allow SRS components to hang from their harnesses. Look for possible chafing points.

Side impact crash sensor inspection

After any degree of side body damage, inspect the side impact crash sensors. Replace a crash sensor if there is any sign of damage.

CAUTION: Take extra care when painting or carrying out bodywork repairs in the vicinity of the crash sensors. Avoid direct exposure of the crash sensors or link harnesses to heat guns, welding or spraying equipment. Take care not to damage sensor or harness when reinstalling components.

Clock spring

CAUTION: Always follow the procedure for installing and checking the clock spring as instructed in the SRS repairs section. Comply with all safety and installation procedures to make sure the system functions correctly. Observe the following precautions:

- Do not unlock and rotate the clock spring when it is removed from the vehicle.
- Do not turn the road wheels when the clock spring is removed from the vehicle.
- Always make sure the clock spring is removed and installed in its central position and with the front road wheels in the straight ahead position - refer to SRS repair section for the correct removal and installation procedure.
- If a new clock spring is being installed, make sure the locking tab holding the coupler's rotational position is not broken; units with a broken locking tab must not be used.

Airbag and pre-tensioner deployment

WARNING: During deployment parts of the airbag module become hot enough to burn you. Wait 30 minutes after deployment before touching the airbag module.

Deployment procedures and precautions as detailed in this manual should be strictly adhered to. Only personnel who have undergone the appropriate training should undertake deployment of airbag and pre-tensioner modules. The following precautions must be complied with:

- Only use deployment equipment approved for the intended purpose.
- Deployment of airbag / pre-tensioner modules must be performed in a well ventilated area which has been designated for the purpose.
- Make sure airbag / pre-tensioner modules are not damaged or ruptured before attempting to deploy.
- Where local legislation exists, notify the relevant authorities of intention to deploy airbag and pretensioner units.
- When deploying airbag pre-tensioner units, make sure that all personnel are at least 15 metres (45 feet) away from the deployment zone.

- Make sure deployment tool is connected correctly, in compliance with the instructions detailed in the SRS section of this manual. In particular, make sure deployment tool is NOT connected to battery supply before connecting to airbag module connector.
- When deploying seat belt pre-tensioners, make sure pre-tensioner unit is secured correctly to the seat.
- When removing deployed airbag modules and pre-tensioner units, wear protective clothing. Use gloves and seal deployed units in a plastic bag.
- Following deployment of any component of the SRS system within the vehicle, all SRS components must be replaced. DO NOT reuse or salvage any parts of the SRS system.
- Do not lean over an airbag module when connecting deployment equipment.

If a vehicle is to be scrapped, undeployed airbag modules and pre-tensioner units must be manually deployed. In this case airbags can be deployed in the vehicle. Before deployment, make sure the airbag module is secure within its correct mounting position. Deployment of the driver's airbag in the vehicle may damage the steering wheel; if the vehicle is not being scrapped, deploy the module outside of the vehicle.

SRS Component Replacement Policy

• CAUTIONS:

The restraints control module (RCM) must be replaced after every time any SRS component has been deployed.

The SRS side impact sensor must be replaced if there are any signs of physical damage or if the RCM is registering a fault.

The following information details the policy for replacement of SRS components as a result of a vehicle accident.

Impacts which do not deploy the airbags or pre-tensioners

Check for structural damage in the area of the impact paying particular attention to bumper armatures, longitudinals and bracketry.

Impacts which deploy the airbags or pre-tensioners

The replacement and inspection policy is dependent on the type and severity of the crash condition. The following guidelines are the minimum that should be exercised as a result of the deployment of specific SRS components.

Check for structural damage in the area of impact paying particular attention to bumper armatures, longitudinals and bracketry.

Front Airbag Deployment - Driver and Passenger

CAUTION: If the front airbags are deployed, the following components must be replaced:

- Driver airbag module
- Steering wheel
- Passenger airbag module
- Instrument panel
- Fly leads (where applicable) connecting front airbag modules to SRS harness
- All seat belt buckle pre-tensioner
- All occupied seats at the time of the crash should have their seat belts replaced
- Any seat belt with a deployed retractor pretensioner should be replaced.
- Rotary coupler
- Any front impact sensors that have been physically damaged or if a fault is being registered
- RCM

Additionally, the following items must be inspected for damage and replaced as necessary:

- Front passenger's seat belt retractor and webbing, tongue latching function, 'D' loop and body anchorage point
- Rear seat belt buckles, webbing, buckle covers, body anchorage points and tongue latching function
- Front seat frames and head restraints
- Steering column - if adjustment is lost or if there are signs of collapse
- Seat belt height adjusters
- Rear seat belts

Side Air Bags

CAUTION: If the side (thorax) air bags are deployed, the following components must be replaced on the side of the vehicle on which the deployment occurred:

- Side (thorax) airbag
- Any side impact sensors that have been physically damaged or if a fault is being registered
- RCM

Additionally, the following items must be inspected for damage and replaced as necessary:

- Front seat belts, retractors and webbing, tongue latching function, 'D' loop and body anchorage points
- Rear seat belt buckles, webbing, buckle covers, tongue latching function, and body anchorage points
- Front seat frame and head restraints
- Door trim casing
- Seat belt height adjusters

- Rear seat belts

Side Curtain Airbag Modules

CAUTION: If the head airbag modules are deployed, the following components must be replaced on the side of the vehicle on which the deployment occurred:

- Side curtain airbag modules
- Headliner and all pillar trims
- Link lead between airbag gas generator and RCM harness
- Airbag retaining clips
- Front seat belt buckle pre-tensioners
- Any side impact sensors that have been physically damaged or if a fault is being registered
- RCM

Additionally, the following items must be inspected for damage and replaced as necessary:

- Component mounting brackets
- Front seat belts, retractors and webbing, tongue latching function, 'D' loop and body anchorage points
- Rear seat belt buckles, webbing, buckle covers, tongue latching function, and body anchorage points
- Adjacent trim components
- Seat belt height adjusters

Rear impacts

CAUTION: If the seat belt pre-tensioners are deployed during a rear impact, the following components must be replaced:

- Seat belt pre-tensioners
- Front and rear seat belt retractors used during the impact
- RCM

Additionally, the following items must be inspected for damage and replaced as necessary:

- Seat belt height adjusters
- Front seat belts, retractors and webbing, tongue latching function, 'D' loop and body anchorage points
- Rear seat belt buckles, webbing, buckle covers, tongue latching function, and body anchorage points

Air Conditioning System Precautions

The air conditioning system contains fluids and components which could be potentially hazardous to the service engineer or the environment if not serviced and handled correctly. The following guidelines are intended to alert the service engineer to potential sources of danger and emphasise the importance of ensuring the integrity of the Air Conditioning operating conditions and components installed to the vehicle.

Where necessary, additional specific precautions are detailed in the relevant sections of this Manual and also in the Health and Safety Section. These precautions must be referred to prior to commencing repair operations.

The refrigerant used in the air conditioning system is HFC-134a (Hydrofluorocarbon) R134a.

• WARNINGS:

Servicing must only be carried out by personnel familiar with both the vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

R134a is a hazardous liquid and when handled incorrectly can cause serious injury. Suitable protective clothing, consisting of face protection, heat proof gloves, rubber boots and rubber apron or waterproof overalls, must be worn when carrying out operations on the air conditioning system.

Remedial actions

WARNING: Due to its low evaporating temperature, R134a must be handled with care. R134a splashed on any part of the body will cause immediate freezing of that area. Also, refrigerant cylinders and replenishment trolleys when discharging will freeze skin to them if contact is made.

If an accident involving R134a should occur, conduct the following remedial actions:

- If liquid R134a enters the eye, do not rub it. Gently run large quantities of eye wash over affected eye to raise the temperature. If an eye wash is not available, cool, clean water may be used to flush the eye. After rinsing, cover the eye with a clean pad and seek immediate medical attention.
- If liquid R134a is splashed onto the skin, run large quantities of water over the affected area to raise the temperature. Implement the same action if the skin comes in contact with discharging cylinders. Wrap the contaminated body parts in blankets (or similar materials) and seek immediate medical attention.
- If the debilitating effects of inhalation of R134a vapour are suspected, seek fresh air. If the affected person is unconscious, move them away from the contaminated area to fresh air and apply artificial respiration and/or oxygen and seek immediate medical attention.

Service precautions

Observe the following precautions when handling components used in the air conditioning system:

- Air conditioning units must not be lifted by their hoses, pipes or capillary lines.
- Hoses and lines must not be subjected to any twist or stress; the efficiency of the system will be impaired by kinks or restrictions. Make sure that hoses are correctly positioned before tightening couplings, and make sure that all clips and supports are utilised.
- Flexible hoses should not be positioned closer than 100 mm (4.0 in) to the exhaust manifold unless protected by heat shielding.
- Completed assemblies must be checked for refrigeration lines touching metal panels. Any direct contact of components and panels may transmit noise and so must be eliminated.
- The appropriate torque wrench must be used when tightening refrigerant connections to the stipulated value. An additional spanner must be used to hold the union to prevent twisting of the pipe when tightening connections.
- Before connecting any hose or pipe, make sure that refrigerant oil is applied to the seat of the new O-rings, **BUT NOT** to the threads of the connection.
- All protective plugs or caps must remain in place in the component until immediately prior to connection.
- Make sure components are at room temperature before uncapping/unplugging, to prevent condensation of moisture from the air that enters it.
- When disconnecting, immediately plug or cap all air conditioning pipes to prevent ingress of dirt and moisture into the system.
- Components must not remain uncapped/unplugged, if a system has been left uncapped/unplugged for 20 minutes or longer, a new receiver/drier must be installed.
- The receiver/drier contains desiccant which absorbs moisture. It must be positively sealed at all times. A receiver/drier that has been left uncapped for longer than 20 minutes must not be used; install a new unit.
- The receiver/drier should be the last component connected to the system to make sure optimum dehydration and maximum moisture protection of the system.
- Whenever a component of the refrigeration system is replaced, it will also be necessary to install a new receiver/drier unit.
- Use alcohol and a clean lint-free cloth to clean dirty connections.
- Make sure that all new parts installed are marked for use with R134a.
- When a major repair has been completed, a leak test should be conducted; refer to the Repairs Section of this manual for the correct procedure.

Refrigerant oil

CAUTION: Refrigerant oil easily absorbs water and must not be stored for long periods. Do not pour unused refrigerant oil back into the container. Always use an approved refrigerant oil.

When replacing components in the air conditioning system, drain the refrigerant oil from the component being replaced into a graduated container. On assembly, add the quantity of refrigerant oil drained to the new component - See Air Conditioning Compressor Replacement in this Section.

Compressor

A new compressor is sealed and pressurised with Nitrogen gas. When installing a new compressor, slowly release the sealing cap; gas pressure should be heard to vent as the seal is broken.

CAUTION: A new compressor should always be sealed and could be pressurised with nitrogen gas. To avoid possible oil loss, release the sealing cap(s) slowly. Do not remove the cap(s) until immediately prior to connecting the air conditioning pipes to the compressor.

Rapid refrigerant discharge

If the air conditioning system is involved in accident damage and the system is punctured, the refrigerant will discharge rapidly. The rapid discharge of refrigerant will also result in the loss of most of the oil from the system. The compressor must be removed and all the remaining oil in the compressor drained and refilled as instructed in the air conditioning section of this manual.

Precautions for refrigerant recovery, recycling and recharging

When the air conditioning system is recharged, any existing refrigerant is first recovered from the system and recycled. The system is then charged with the required weight of refrigerant and volume of refrigerant oil.

WARNING: Refrigerant must always be recycled before reuse to make sure that the purity of the refrigerant is high enough for safe use in the air conditioning system. Recycling should always be carried out with equipment which is design certified by Underwriter Laboratory Inc. for compliance with SAE J1991. Other equipment may not recycle refrigerant to the required level of purity.

• CAUTIONS:

A R134a Refrigerant Recovery Recycling Recharging Station must not be used with any other type of refrigerant. Refrigerant R134a from domestic and commercial sources must not be used in motor vehicle air conditioning systems.

The system must be evacuated immediately before recharging commences. Delay between evacuation and recharging is not permitted.

Air Conditioning Compressor Replacement

A new compressor is supplied filled with a full charge (X cm^3) of refrigerant oil.

A calculated quantity of oil must be drained from the new compressor before installing. To calculate the quantity of oil to be drained:

- Remove the drain plug from the old compressor.

- Invert the compressor and gravity drain the oil into a calibrated measuring cylinder. Rotate the compressor clutch to make sure the compressor is completely drained.
- Note the quantity of oil drained (Y cm^3).
- Calculate the quantity of oil to be drained from the new compressor using the following formula:**X cm^3 — (Y cm^3 + 20 cm^3) = Q cm^3**
- Remove the drain plug from the new compressor and drain Q cm3 of oil. install and tighten the compressor drain plug.

Vehicle Weights

Item	kg	lb
Maximum Gross Vehicle Weight (GVW) - All models (1)	2505	5511
Approximate unladen weight (2):		
3.2 Petrol	1825	4015
2.2 Diesel	1820	4004
Maximum weight of unbraked trailer:		
On-road	750	1650
Off-road	750	1650
Maximum towable weight (mass) - Trailers with overrun brakes:		
On-road	2000	4400
Off-road	2000	4400
Gross train weight - Trailers with overrun brakes (3):		
On-road	4505	9911
Off-road	4505	9911
Nose weight:		
On-road	150	330
Off-road	150	330
Maximum front axle load - All models (4)	1310	2882
Maximum rear axle load - All models (4)	1360	2992
Maximum roof rack load - All models (5)	75	165

(1) The maximum permissible weight of the vehicle including passengers and load.

(2) This figure includes the toolkit, all fluids to the correct levels and spare wheel but excludes the driver and passengers.

(3) The maximum permissible weight of the vehicle and braked trailer and their respective loads.

(4) The front and rear maximum loads cannot be reached simultaneously as this will exceed the GVW limit. When calculating rear axle loading, remember that the trailer nose weight, the load in the vehicle's luggage area, weight on the roof rack, and the weight of rear seat passengers must all be added together.

(5) This figure includes the weight of the roofrack.

Vehicle Dimensions

Item	mm	in
Length - excluding license plate plinth - All models	4500	177.2
Width - All models:		
Mirrors extended	2180	85.83
Mirrors folded	2005	78.95
Maximum height - including roof rails - All models	1820	71.65
Wheelbase - All models	2660	104.7
Track:		
Front with 16" wheels	1611	63.43
Front with 17"/18"/19" wheels	1601	63.03
Rear with 16" wheels	1624	63.94
Rear with 17"/18"19" wheels	1614	63.54
Vehicle ride height (1):		
Front	490.7±12	19.32±0.47
Rear	504.6±12	19.87±0.47
Underbody running clearance to exhaust - Minimum - Kerb weight	229	9.0
Front axle to underbody clearance	216	8.5
Rear axle to differential casing clearance	267	10.5
Suspension travel from kerb - ROW (unladen):	227	8.9
Front (bump/rebound)	105/80	4.13/3.15
Rear (bump/rebound)	130/90	5.12/3.54
Total articulation	335	13.2
Suspension travel from kerb - NAS (unladen):		
Front (bump/rebound)	102/76	4/3
Rear (bump/rebound)	127/89	5/3.5
Total articulation	330	13.2
Wading depth	500	19.7
Departure angle - Towbar NOT installed	34°	
Departure angle - Fixed height towbar - NOT NAS vehicles	19°	
Departure angle - Detachable towbar installed - NOT NAS vehicle	18°	
Departure angle - Towbar installed - NAS vehicles	19°	
Approach angle	31°	
Breakover angle	157°	
Maximum gradient for continuous operation	30°	
Maximum gradient for drive through operation (2)	45°	

(1) Ride height is measured vertically from wheel center to underside of wheelarch. All figures are with vehicle at 'Showroom' height - full fluids, full tank of fuel, no occupants/luggage, tires inflated to normal pressures.

(2) 5 seconds maximum duration.

Published: 11-May-2011

General Information - Health and Safety Precautions

Description and Operation

Introduction

Modern vehicles contain many materials and liquids which if not handled with care can be hazardous to both personal health and the environment. Also, many of the procedures associated with vehicle maintenance and repair involve physical hazards or other risks to health.

This subsection lists some of these hazardous operations and the materials and equipment associated with them. Precautions necessary to avoid these hazards are identified.

The list is not exhaustive and all operations and procedures and the handling of materials, should be carried out with health and safety in mind.

Before using any product the Materials Safety Data Sheet supplied by the manufacturer or supplier should be consulted.

WARNING: Many liquids and other substances used in motor vehicles are poisonous and should under no circumstances be consumed and should, as far as possible, be kept from contact with the skin. These liquids and substances include acid, anti-freeze, brake fluid, fuel, windscreen washer additives, lubricants, refrigerants and various adhesives.

Acids and Alkalis

For example - alkalis such as caustic soda used in cleaning materials; acids such as sulphuric acid used in batteries.

Both alkalis and acids are irritant and corrosive to the skin, eyes, nose and throat. They cause burns and can destroy ordinary protective clothing.

Avoid splashes to the skin, eyes and clothing. Wear suitable protective impervious apron, gloves and goggles. Do not breath mists.

Make sure access to eye wash bottles, shower and soap are readily available for splashing accidents.

Display Eye Hazard sign.

Air Bags

Highly flammable, explosive – observe No Smoking policy.

Used within the vehicle as safety restraints.

The inflator contains a high-energy propellant which, when ignited, produces a VERY HOT GAS (2500°C).

The gas inflator (generator) used in air bags is Sodium Azide. This material is hermetically sealed in each air bag module and is completely consumed during deployment. No attempt should be made to open an air bag inflator as this will lead to the risk of exposure to Sodium Azide. If a gas generator is ruptured, full protective clothing should be worn when dealing with the spillage.

After normal deployment, gloves and safety goggles should be worn during the handling process.

Deployed air bags should be disposed of in a plastic bag in accordance with local regulations at an approved chemical waste site.

Following any direct contact with Sodium Azide:

- Wash affected areas thoroughly with water.
- **SEEK IMMEDIATE MEDICAL ASSISTANCE.**

Air Bags - Do's

- Do store modules in an upright position.
- Do keep modules dry.
- Do carry modules with the cover side pointing away from the body.
- Do place modules with their cover side upwards.
- Do carefully inspect modules for damage.
- Do stand to one side when connecting modules.
- Do make sure all test equipment is properly calibrated and maintained.
- Do wash hands after handling deployed air bags.

Air Bags - Do Not

- Do Not store highly flammable material together with modules or gas generators.
- Do Not store gas generators at temperatures exceeding 80°C.
- Do Not store modules upside down.
- Do Not attempt to open a gas generator housing.
- Do Not expose gas generators to open flame or sources of heat.
- Do Not place anything on top of a module cover.
- Do Not use damaged modules.
- Do Not touch a fired module or gas generator for at least 10 minutes after firing.
- Do Not use any electrical probes on the wiring circuit.

Air Suspension

Whenever work is being undertaken on the air suspension system, suitable eye protection must be worn.

Air Conditioning Refrigerant

Highly flammable, combustible – observe No Smoking policy.

Skin contact may result in frostbite.

Instructions given by the manufacturer must be followed. Avoid naked lights, wear suitable protective gloves and goggles.

If refrigerant comes into contact with the skin or eyes, rinse the affected areas with water immediately. Eyes should also be rinsed with an appropriate irrigation solution such as a solution of 9% Sodium Chloride and Purified Water. **DO NOT RUB THE EYES AND SEEK IMMEDIATE MEDICAL ATTENTION.**

Air Conditioning Refrigerant

Do Not

- Do Not expose refrigerant bottles to sunlight or heat.
- Do Not expose refrigerant bottles to frost.
- Do Not drop refrigerant bottles.
- Do Not vent refrigerant to atmosphere under any circumstance.
- Do Not mix refrigerants.

Adhesives and Sealants

Many adhesives and sealants are highly flammable – OBSERVE NO SMOKING POLICY. These items, should be stored in flameproof cabinets in No Smoking areas. Cleanliness and tidiness in use should be observed, for example disposable paper covering benches. All adhesives and sealants should be dispensed from applicators where possible; containers, including secondary containers, should be labelled appropriately.

Anaerobic, Cyanoacrylate (super-glues) and other Acrylic Adhesives

Many are irritant, sensitizing or harmful to the skin and respiratory tract. Some are eye irritants.

Skin and eye contact should be avoided and the manufacturer's instructions followed.

Cyanoacrylate adhesives (super-glues) MUST NOT contact the skin or eyes. If skin or eye tissue is bonded, cover with a clean moist pad and **SEEK IMMEDIATE MEDICAL ATTENTION.** Do not attempt to pull skin tissue apart. Use in well ventilated areas as vapors can cause irritation to the nose and eyes.

For two-pack systems see Resin-based and Isocyanate Adhesives/Sealers.

Solvent-based Adhesives/Sealers - See Solvents

Follow manufacturers instructions.

Water-based Adhesives/Sealers

Those based on polymer emulsions and rubber/latex may contain small amounts of volatile, toxic and harmful chemicals. Skin and eye contact should be avoided and adequate ventilation provided during use.

Hot Melt Adhesives

In the solid state, they are safe. In the molten state they may cause burns and health hazards may arise from the inhalation of toxic fumes.

Use appropriate protective clothing and a thermostatically controlled heater with a thermal cut-out and adequate extraction.

Resin-based Adhesives/Sealers, for example Epoxide and Formaldehyde Resin-based

Mixing should be carried out in well ventilated areas as harmful or toxic volatile chemicals may be released.

Skin contact with uncured resins and hardeners can result in irritation, dermatitis, and absorption of toxic or harmful chemicals through the skin. Splashes can damage the eyes.

Provide adequate ventilation and avoid skin and eye contact.

Isocyanate (Polyurethane) Adhesives/Sealers

See also Resin-based Adhesives

Individuals suffering from asthma or respiratory allergies should not work with or near these materials as sensitivity reactions can occur.

Over exposure is irritating to the eyes and respiratory system. Excessive concentrations may produce effects on the nervous system including drowsiness. In extreme cases, loss of consciousness may result. Long term exposure to vapour concentrations may result in adverse health effects.

Prolonged contact with the skin may lead to skin irritation and in some cases, dermatitis.

Splashes entering the eye will cause discomfort and possible damage.

Any spraying should preferably be carried out in ventilated booths which incorporate facilities for removing vapors and spray droplets from the breathing zone.

Wear appropriate gloves, eye and respiratory protection.

Antifreeze

May be flammable when undiluted.

Vapors may be given off from coolant antifreeze when heated. Avoid breathing these vapors.

Antifreeze may be absorbed through the skin in toxic or harmful quantities. Antifreeze, if swallowed, can be fatal; **SEEK IMMEDIATE MEDICAL ATTENTION.**

Battery Acids

See also Alkalis and Acids.

Gases released during battery charging are explosive. Always remove the battery from the vehicle prior to charging. Never use naked flames or allow sparks near charging or recently charged batteries. NEVER add acid to a battery, the chemical reaction produced will be violent and explosive. In cases of eye contact, wash affected area with copious amounts of water and **SEEK IMMEDIATE MEDICAL ATTENTION.**

Make sure there is adequate ventilation during battery charging, observe NO SMOKING POLICY.

Brake Pads and Linings

Always fit the correct grade and specification of brake pads and linings. When renewing pads and linings, always replace as complete axle sets.

Brake and Clutch Fluid

Splashes to the skin and eyes are irritating and in the long term can be damaging, avoid prolonged skin contact. In cases of eye contact, wash affected area with copious amounts of water and SEEK IMMEDIATE MEDICAL ATTENTION.

Chemical Materials

All chemical materials should always be used with caution and stored and handled with care. They may be toxic, harmful, corrosive, irritant or highly flammable and give rise to hazardous fumes and dusts.

The effects of excessive exposure to chemicals may be immediate or delayed; briefly experienced or permanent; cumulative; superficial; life threatening; or may reduce life expectancy.

Chemical Materials - Do's

- Do carefully read and observe hazard and precaution warnings given on material containers (labels) and in any accompanying leaflets, posters or other instructions. Material health and safety data sheets can be obtained from manufacturers.
- Do remove chemical materials from the skin and clothing as soon as practicable after soiling. Change heavily soiled clothing and have it cleaned.
- Do organise work practices and protective clothing to avoid soiling of the skin and eyes.
- Do avoid breathing vapors, aerosols, dusts or fumes; inadequate container labelling; fire and explosion hazards.
- Do wash before job breaks, before eating, smoking, drinking or using toilet facilities when handling chemical materials.
- Do keep work areas clean, uncluttered and free of spills.
- Do store chemical materials according to national and local regulations.
- Do keep chemical materials out of the reach of children.

Chemical Materials - Do Not

- Do Not mix chemical materials except under the manufacturers instructions; some chemicals can form other toxic or harmful chemicals, give off toxic or harmful fumes or become explosive when mixed together.
- Do Not spray chemical materials, particularly those based on solvents, in confined spaces, for example when people are inside a vehicle.
- Do Not apply heat or flame to chemical materials except under the manufacturers instructions. Some are highly flammable and some may release toxic or harmful fumes.
- Do Not leave containers open. Fumes given off can build up to toxic, harmful or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas such as pits.
- Do Not transfer chemical materials to unlabelled containers.
- Do Not clean hands or clothing with chemicals. Chemicals, particularly solvents and fuels, will dry skin and may cause irritation leading to dermatitis or be absorbed through the skin in toxic or harmful quantities.
- Do Not use emptied containers for other materials except when they have been cleaned under supervised conditions.
- Do Not sniff or smell chemical materials, even brief exposure to high concentrations of fumes can be toxic or harmful.

Corrosion Protection Materials

Some corrosion protection materials are highly flammable – observe NO SMOKING POLICY.

These materials are varied and the manufacturers instructions must always be followed. The materials may contain solvents, resins or petroleum products. Skin and eye contact should be avoided. They should only be sprayed in conditions of adequate ventilation and not in confined spaces.

Dust

Dust or powder produced during repair operations may be irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials or those arising from dry abrasion operations. Wear respiratory protection if ventilation is inadequate.

Fine dusts of combustible material can present an explosion hazard. Avoid explosive limits and sources of ignition.

Electrical Equipment

Electric shock can result from the use of faulty electrical equipment or from the misuse of equipment in good condition.

Make sure that electrical equipment is maintained in good condition and frequently tested. Faulty equipment should be labelled and preferably removed from the work station.

Make sure that flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked or otherwise damaged. If using cable reel extension equipment, ALWAYS ensure that the cable is fully unwound from the reel.

Make sure that electrical equipment and flexes do not come into contact with water.

Make sure that electrical equipment is protected by the correct rated fuse.

Never misuse electrical equipment and never use equipment which is in any way faulty. The results could be fatal.

Make sure that the cables of mobile electrical equipment cannot get trapped and damaged, such as in a vehicle hoist.

Make sure that the designated electrical workers are trained in basic First Aid.

In cases of electrocution:

- Switch off the power supply before approaching the victim.
- If this is not possible, **DO NOT TOUCH THE VICTIM** but push or drag the person from the source of electricity using dry, non-conductive material.
- Commence resuscitation if trained to do so.
- **SEEK IMMEDIATE MEDICAL ATTENTION.**

Exhaust Fumes

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, lead and aromatic hydrocarbons. Engines should be run only under conditions of adequate exhaust extraction or general ventilation and not in confined spaces.

Gasoline (Petrol) engine

There may not be adequate warning of odour or of irritation before toxic or harmful effects arise. These may be immediate or delayed.

Gas Oil (Diesel engine)

Soot, discomfort and irritation usually give adequate warning of hazardous fume concentrations.

Fibre Insulation

The fibrous nature of surfaces and cut edges can cause skin irritation. This is usually a physical and not a chemical effect.

Precautions should be taken to avoid excessive skin contact through careful organization of work practices and the use of gloves.

Fire

Many of the materials found on or associated with the repair of vehicles are highly flammable. Some give off toxic or harmful fumes if burnt; others such as fluoroelastomers when burnt or damaged by excessive heat can break down and produce highly corrosive hydrofluoric acid - See Fluoroelastomers.

Should any material be in a burnt or overheated condition, handle with extreme caution and wear protective clothing when handling such items. Dispose of such material in accordance with local regulations.

Decontaminate and dispose of protective clothing immediately after use.

Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Make sure, before using electrical or welding equipment, that there is no fire hazard present.

Have a suitable fire extinguisher available when using welding or heating equipment.

First Aid

Apart from meeting any legal requirements it is desirable for someone in the workshop to be trained in First Aid procedures.

Splashes in the eye should be flushed carefully with clean water for at least ten minutes.

Soiled skin should be washed with soap and water.

In case of cold burns, from alternative fuels, place affected area in cool to cold water.

Individuals affected by inhalation of gases and fumes should be removed to fresh air immediately. If effects persist, consult a doctor.

If liquids are swallowed inadvertently, consult a doctor giving him the information on the container or label. Do not induce vomiting unless this action is indicated on the label.

Fluoroelastomers (Synthetic Rubber)

Many 'O' rings, seals, hoses, flexible pipes and other similar which appear to be manufactured from natural rubber are, in fact, made of synthetic materials called Fluoroelastomers.

Under normal operating conditions, these materials are safe and do not constitute a health hazard. However, if the materials are damaged by burning or exposure to excessive heat, they can break down and produce highly corrosive hydrofluoric acid.

WARNING: Contact with hydrofluoric acid can cause serious burns on contact with the skin. If skin contact does occur, carry out the following steps immediately:

Remove any contaminated clothing.

SEEK IMMEDIATE MEDICAL ATTENTION

Irrigate affected area of skin with copious amounts of cold water or limewater for 15 to 60 minutes.

Foams - Polyurethane

Used in sound and noise insulation. Cured foams used in seat and trim cushioning.

Unreacted components are irritating and may be harmful to the skin and eyes. Wear gloves and goggles.

Individuals with chronic respiratory diseases, asthma, bronchial medical problems, or histories of allergic diseases should not work in or near uncured materials.

The components, vapors or spray mists can cause direct irritation, sensitivity reactions and may be toxic or harmful.

Vapors and spray mists must not be inhaled. These materials must be applied with adequate ventilation and respiratory protection. Do not remove the respirator immediately after spraying, wait until the vapour/mists have cleared.

Burning of the uncured components and the cured foams can generate toxic and harmful fumes. Smoking, naked flames or the use of electrical equipment during foaming operations and until vapors/mists have cleared should not be allowed. Any heat cutting of cured foams or partially cured foams should be carried out in areas having suitable fume extraction equipment.

Fuels

Avoid skin contact with fuel where possible. Should contact occur, wash the affected skin with soap and water.

Gasoline (Petrol)

Highly flammable - OBSERVE NO SMOKING POLICY.

Swallowing gasoline (petrol) can result in mouth and throat irritation and absorption from the stomach can result in drowsiness and unconsciousness. Small amounts can be fatal to children. Inhalation into the lungs, through vomiting, is a very serious hazard.

Gasoline (petrol) dries the skin and can cause irritation and prolonged or repeated contact may cause dermatitis; if it is allowed to enter the eyes, it will cause severe smarting. Wash affected area with copious amounts of water and **SEEK IMMEDIATE MEDICAL ATTENTION.**

Gasoline (petrol) may contain appreciable quantities of benzene, which is toxic upon inhalation and the concentration of vapors must be kept very low. High concentrations will cause eye, nose and throat irritation, nausea, headache, depression and symptoms of drunkenness. Very high concentrations will result in rapid loss of consciousness.

Make sure there is adequate ventilation when handling and using gasoline (petrol). Great care must be taken to avoid the serious consequences of inhalation in the event of vapour build up arising from spillages in confined spaces.

Special precautions apply to cleaning and maintenance operations on gasoline (petrol) storage tanks.

Gasoline (petrol) should not be used as a cleaning agent. It must not be siphoned by mouth.

Gas-oil (Diesel Fuel)

Combustible.

Prolonged skin contact with high boiling point gas oils (diesel fuel) may cause serious skin disorders including skin cancer.

Inhalation into the lungs will cause internal bleeding **- SEEK IMMEDIATE MEDICAL ATTENTION.**

If swallowed, DO NOT induce vomiting - SEEK IMMEDIATE MEDICAL ATTENTION.

Kerosene (Paraffin)

Used also as heating fuel, solvent and cleaning agent.

Flammable - OBSERVE NO SMOKING POLICY.

Irritation of the mouth and throat may result from swallowing. The main hazard from swallowing arises if liquid aspiration into the lungs occurs.

Liquid contact dries the skin and can cause irritation or dermatitis. Splashes in the eye may be slightly irritating.

In normal circumstances the low volatility does not give rise to harmful vapors. Exposure to mists and vapors from kerosene at elevated temperature should be avoided (mists may arise in dewaxing). Avoid skin and eye contact and make sure there is adequate ventilation.

If swallowed, DO NOT induce vomiting - SEEK IMMEDIATE MEDICAL ATTENTION.

Gas Cylinders

Gases such as oxygen, acetylene, argon and propane are normally stored in cylinders at pressures of up to 138 bar (13800 kPa) (2000 lbf/in²) and great care should be taken in handling these cylinders to avoid mechanical damage to them or to the valve gear attached. The contents of each cylinder should be clearly identified by appropriate markings.

Cylinders should be stored in well ventilated enclosures, and protected from ice and snow or direct sunlight. Fuel gases, for example acetylene and propane should not be stored in close proximity to oxygen cylinders.

Care should be exercised to prevent leaks from gas cylinders and lines and also to avoid sources of ignition.

Only trained personnel should undertake work involving gas cylinders.

General Workshop Tools and Equipment

It is essential that all tools and equipment are maintained in good condition and the correct safety equipment is used where required.

Never use tools or equipment for any purpose other than that for which they were designed. Never overload equipment such as hoists, jacks, axle and chassis stands or lifting slings. Damage caused by overloading is not always immediately apparent and may result in a fatal failure the next time that the equipment is used.

Do not use damaged or defective tools or equipment, particularly high speed equipment such as grinding wheels. A damaged grinding wheel can disintegrate without warning and cause serious injury.

Wear suitable eye protection when using grinding, chiselling or sand blasting equipment.

Wear a suitable breathing mask when using abrasive blasting equipment or using spraying equipment.

Make sure there is adequate ventilation to control dusts, mists and fumes.

High Pressure Air, Lubrication and Oil Test Equipment

Always keep high pressure equipment in good condition, and regularly maintained, particularly at joints and unions.

Never direct a high pressure nozzle, for example diesel injector, at the skin as the fluid may penetrate to the underlying tissue and cause serious injury.

Jacking

Always refer to the Jacking and Lifting section of this manual prior to raising the vehicle off the ground.

When vehicle is to be raised by means of a jack, ensure that it is standing on level ground, that parking brake is applied and wheels are chocked. ALWAYS use the recommended jacking points and ensure that vehicle jack has sufficient load capacity for the weight of the vehicle.

WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Ensure that hoists have sufficient load capacity for the weight of the vehicle.

Legal Aspects

There are many laws and regulations relating to health and safety in the use and disposal of materials and equipment in a workshop.

For a safe working environment and to avoid environmental pollution, workshops should be familiar, in detail, with the many health and safety laws and regulations within their country, published by both national and local authorities.

Lubricants and Greases

Avoid all prolonged and repeated contact with mineral oils. All lubricants and greases may be irritating to the eyes and skin.

Used Engine Oil

Prolonged and repeated contact with engine oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

Do not employ used engine oils as lubricants or for any application where appreciable skin contact is likely to occur.

Health Protection Precautions

- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Do not put oily rags into pockets.
- Avoid contaminating clothes, particularly underpants, with oil.
- Heavily soiled clothing and oil-impregnated footwear should not be worn. Overalls must be cleaned regularly.
- First Aid treatment should be obtained immediately for open cuts and wounds.
- Use barrier creams, applying them before each work period, to help the removal of oil from the skin.
- Wash with soap and water to make sure all oil is removed (skin cleansers and nail brushes will help). Preparations containing lanoline replace the natural skin oils which have been removed.
- Do not use gasoline (petrol), kerosene (paraffin), diesel fuel (gas oil), thinners or solvents for cleaning skin.
- If skin disorders develop, obtain medical advice without delay.
- Where practicable, degrease components prior to handling.
- Where there is a risk of eye contact, eye protection should be worn, for example chemical goggles or face shields; in addition an eye wash facility should be provided.

Environmental Precautions

This section provides general information which can help to reduce the environmental impacts from the activities carried out in workshops.

Emissions to air

Many of the activities that are carried out in workshops emit gases and fumes which can contribute to global warming, depletion of the ozone layer and/or the formation of photochemical smog at ground level. By considering how the workshop activities are carried out, these gases and fumes can be minimised, thus reducing the impact on the environment.

Exhaust fumes

Running car engines is an essential part of workshop activities and exhaust fumes need to be ventilated to atmosphere. However, the amount of time engines are running and the position of the vehicle should be carefully considered at all times, to reduce the release of poisonous gases and minimise the inconvenience to people living nearby.

Solvents

Some of the cleaning agents used are solvent based and will evaporate rapidly to atmosphere if used carelessly, or if containers are left unsealed. All containers must be firmly closed when not required and solvent should be used sparingly. Wherever possible, solvents having a low toxicity and flammability should be selected. Always follow the instructions supplied by the solvent manufacturer. Similarly, many paints are solvent based and the spray should be used in such a way as to reduce emissions to a minimum.

Refrigerant

It is illegal to release any refrigerant into the atmosphere. Discharge and replacement of these materials from air conditioning units should only be carried out using the appropriate equipment.

Discharges to water

Most workshops will have two systems for discharging waste water - storm drains and foul drains. Storm drains should only receive clean water i.e. rainwater. Foul drains will accept many of the normal waste water i.e. washing water, detergents and domestic type waste BUT NOT oil, petrol, solvent, acids, hydraulic fluid, antifreeze and similar fluids. If in doubt, always consult the local authority or water company.

Spillages

Every precaution must be taken to prevent spillage of oil, fuel, solvents etc., reaching the drains. All handling of such materials must take place well away from drains and preferably in an area with a suitable containing wall to prevent discharge into drains or watercourses. If a spillage occurs, it must be soaked up immediately using a spill kit where provided.

Checklist

Spillage prevention:

- Store liquids in a secure area.
- Make sure that taps on liquid containers are secure and cannot be accidentally turned on.
- Protect bulk storage tanks from vandalism by locking the valves.
- Transfer liquids from one container to another in an area away from open drains.
- Ensure lids are replaced securely on containers.
- Have spill kits available near to points of storage and liquid handling areas.

Spill Kits

Special materials are available to absorb a number of different substances. They can be in granular form, ready to use and are supplied in suitable containers. Disposal of used spill absorbing material is dealt with in Waste management.

Land contamination

Oils, fuels and solvents etc. can contaminate any soil with which they come into contact. Such materials MUST never be disposed of by pouring on to soil and every precaution must be taken to avoid spillage reaching soil. Waste materials

stored on open ground could either leak or have contaminating substances washed off them that would contaminate the land. Always store these materials in suitable skips or similarly robust containers.

Legal compliance

Some sites may have a discharge consent for effluent discharge to the foul drain for a car wash etc. It is essential to know the types of effluent which are allowed to be discharged into the drain and to check the results of any monitoring carried out by the Water Company.

Where paint spraying operations are carried out it may be necessary to apply to the Local Authority for an air emissions licence to operate the plant. If such a licence is necessary, additional precautions will be necessary to comply with the requirements and the results of any air quality monitoring must be checked regularly.

Checklist

Always adhere to the following:

- Know what legal consents and licences apply to the operations.
- Check that the emissions and discharges comply with legal requirements.

Waste Management

Pollution can be reduced by careful handling, storage and disposal of all waste materials that occur on sites. Legislation makes it illegal to dispose of waste materials other than to licensed waste carriers and disposal sites.

This means that it is necessary to not only know what the waste materials are but also to have the necessary documentation and licences.

Handling and storage of waste

Ensure that waste materials are not poured down the drain or on to soil and are stored in such a way that they do not escape on to land or soil.

All waste must be segregated into individual types e.g. oils, metals, batteries, scrap components etc. This will prevent any reaction between different materials and assist in disposal.

Disposal of waste

Dispose of waste in accordance with the following guidelines:

- **Fuel, hydraulic fluid, anti-freeze and oil:** Keep separate and dispose of to specialist contractors.
- **Refrigerant:** Collect in specialist equipment and reuse.
- **Detergents:** Safe to pour down the foul drain if diluted.
- **Paint, thinners:** Keep separate and dispose of to specialist contractor.
- **Components:** Return to supplier for refurbishment or disassemble and reuse any suitable parts. Dispose of remainder in ordinary waste.
- **Small parts:** Reuse any suitable parts, dispose of the remainder in ordinary waste.
- **Metals:** Can be sold if separate from general waste.
- **Tyres:** Keep separate and dispose of to specialist contractor. DO NOT attempt to dispose of tyres by burning.
- **Components/materials containing asbestos:** Keep separate and dispose of to specialist contractor.
- **Oil and fuel wastes (e.g. rags, used spill kit material):** Keep separate and dispose of to specialist contractors.
- **Air filters:** Keep separate and dispose of to specialist contractors.
- **Rubber/plastics:** Dispose of in ordinary waste.
- **Hoses:** Dispose of in ordinary waste.
- **Batteries:** Keep separate and dispose of to specialist contractors.
- **Air bags - DANGER EXPLOSIVES:** Keep separate and dispose of to specialist contractors.
- **Electrical components:** Return to supplier for refurbishment or disassemble and reuse any suitable components. Dispose of remainder in ordinary waste.
- **Catalytic converters:** May be sold if kept separate from general waste.
- **Packaging:** Compact/recycle as much as possible and dispose of in ordinary waste.
- **Office/paper waste:** Recycle paper and toner and ink cartridges, dispose of remainder in ordinary waste.

Noise

Car alarm testing, panel beating, running engines, using air tools etc. are operations which invariably produce a large amount of noise. The location of such activities and also the time of day must be carefully considered having regard to the proximity of houses schools etc.

Some operations may produce high noise levels which could, in time, damage hearing. In these cases, suitable ear protection must be worn.

Solder

Solders are mixtures of metals such that the melting point of the mixture is below that of the constituent metals (normally lead and tin). Solder application does not normally give rise to toxic lead fumes, provided a gas/air flame is used. Oxy-acetylene flames should not be used, as they are much hotter and will cause lead fumes to be produced.

Some fumes may be produced by the application of any flame to surfaces coated with grease, and inhalation of these should be avoided.

Removal of excess solder should be undertaken with care, to make sure that fine lead dust is not produced, which can give toxic effects if inhaled. Respiratory protection may be necessary.

Solder spillage and filings should be collected and removed promptly to prevent general air contamination by lead.

High standards of personal hygiene are necessary in order to avoid ingestion of lead or inhalation of solder dust from clothing.

Solvents

For example acetone, white spirit, toluene, xylene, trichloroethane.

Used in cleaning and dewaxing materials, paints, plastics, resins and thinners.

Some may be highly flammable or flammable.

Skin contact will degrease the skin and may result in irritation and dermatitis following repeated or prolonged contact. Some can be absorbed through the skin in toxic or harmful quantities.

Splashes in the eye may cause severe irritation and could lead to loss of vision.

Brief exposure of high concentrations of vapors or mists will cause eye and throat irritation, drowsiness, dizziness, headaches and, in the worst circumstances, unconsciousness.

Repeated or prolonged exposure to excessive but lower concentrations of vapors or mists, for which there might not be adequate warning indications, can cause more serious toxic or harmful effects.

Aspiration into the lungs, for example through vomiting, is the most serious consequence of swallowing.

Avoid splashes to the skin, eyes and clothing. Wear protective gloves, goggles and clothing if necessary.

Make sure there is good ventilation when in use, avoid breathing fumes, vapors and spray mists and keep containers tightly sealed. Do not use in confined spaces.

When spraying materials containing solvents, for example paints, adhesives, and metal coatings, use extraction ventilation or personal respiratory protection in the absence of adequate general ventilation.

Do not apply heat or flame except under specific and detailed manufacturers instructions.

Suspended Loads

CAUTION: Never improvise lifting tackle.

There is always a danger when loads are lifted or suspended. Never work under an unsupported, suspended or raised load, for example a suspended engine.

Always make sure that lifting equipment such as jacks, hoists, axle stands and slings are adequate and suitable for the job, in good condition and regularly maintained.

Viton

In common with many other manufacturers vehicles, some components installed to Land Rover vehicles have seals, 'O' rings or gaskets which contain a material known as 'Viton'.

Viton is a fluoroelastomer, that is a synthetic rubber type which contains Fluorine. Although Viton is the most well known fluoroelastomer, there are others, including Fluorel and Tecmoflon.

When used under design conditions fluoroelastomers are perfectly safe. If, however, they are exposed to temperatures in excess of 400°C, the material will not burn, but will decompose, and one of the products formed is hydrofluoric acid.

This acid is extremely corrosive and may be absorbed directly, through contact, into the general body system. **WHERE CASES OF SKIN CONTACT OCCUR, SEEK IMMEDIATE MEDICAL HELP.**

O-rings, seals or gaskets which have been exposed to very high temperatures will appear charred or as a black sticky substance.

DO NOT, under any circumstances touch them or the attached components.

Enquiries should be made to determine whether Viton or any other fluoroelastomer has been used in the affected O-ring, seal or gasket. If they are of natural rubber or nitrile there is no hazard. If in doubt, be cautious as the material may be Viton or any fluoroelastomer.

If Viton or any other fluoroelastomers have been used, the affected area should be decontaminated before the

commencement of work.

Disposable heavy duty plastic gloves should be worn at all times, and the affected area washed down using wire wool and a limewater (calcium hydroxide) solution to neutralise the acid before disposing of the decomposed Viton residue and final cleaning of the area. After use, the plastic gloves should be discarded carefully and safely.

Welding

Welding processes include Resistance Welding (Spot Welding), Arc Welding and Gas Welding.

Resistance Welding

This process may cause particles of molten metal to be emitted at a high velocity, and the eyes and skin must be protected.

Arc Welding

This process emits a high level of ultra-violet radiation which may cause arc-eye and skin burns to the operator and to other persons nearby. Gas-shielded welding processes are particularly hazardous in this respect. Personal protection must be worn, and screens used to shield other people.

CONTACT LENS WEARERS ARE ADVISED TO REVERT TO ORDINARY SPECTACLES WHEN ARC WELDING as the arc spectrum is believed to emit microwaves which dry out the fluid between the lens and the eye. This may result in blindness when the lens is removed from the eye.

Metal spatter will also occur, and appropriate eye and skin protection is necessary.

The heat of the welding arc will produce fumes and gases from the metals being welded, the rods and from any applied coatings or contamination on the surfaces being worked on. These gases and fumes may be toxic and inhalation of these should be avoided. The use of extraction ventilation to remove the fumes from the working area may be necessary particularly in cases where the general ventilation is poor, or where considerable welding work is anticipated. In extreme cases or confined spaces where adequate ventilation cannot be provided, air-fed respirators may be necessary.

CAUTION: Some of the components installed to the vehicle e.g. the interior cross beam and underbonnet cross member are manufactured from magnesium alloy. On no account should any welding operations be attempted on these components.

Gas Welding (and Cutting)

Oxy-acetylene torches may be used for welding and cutting, and special care must be taken to prevent leakage of these gases, with consequent risk of fire and explosion.

The process will produce metal spatter and eye and skin protection is necessary.

The flame is bright, and eye protection should be used, but the ultra-violet emission is much less than that from arc welding, and lighter filters may be used.

The process itself produces few toxic fumes, but such fumes and gases may be produced from coatings on the work, particularly during cutting away of damaged body parts, and inhalation of the fumes should be avoided.

In brazing, toxic fumes may be produced from the metals in the brazing rod, and a severe hazard may arise if brazing rods containing cadmium are used. In this event particular care must be taken to avoid inhalation of fumes and expert advice may be required.

SPECIAL PRECAUTIONS MUST BE TAKEN BEFORE ANY WELDING OR CUTTING TAKES PLACE ON VESSELS WHICH HAVE CONTAINED COMBUSTIBLE MATERIALS, FOR EXAMPLE BOILING OR STEAMING OUT OF FUEL TANKS.

Warning Symbols on Vehicles

Decals showing warning symbols will be found on various vehicle components.

These decals must not be removed. The warnings are for the attention of owners/operators and persons carrying out service or repair operations on the vehicle.

Published: 11-May-2011

General Information - Solvents, Sealants and Adhesives

Description and Operation

Solvents

WARNING: Always handle all solvents, sealers and adhesives with extreme care. Some contain chemicals or give off fumes which can be dangerous to health. Always follow the manufacturers instructions. If in doubt about any substance, particularly a solvent, DO NOT use it.

CAUTION: If in doubt about the suitability of any proprietary solvent or sealer for a particular application, contact the manufacturer of the product for information.

The Health and Safety Precautions subsection refers to some commonly used chemicals and materials, hazards associated with their use, and safety measures to be taken. Some of these chemicals may be included as an ingredient in a sealer or adhesive.

Sealers

Certain procedures in this manual involve the use of sealants during installation of components. Where a sealant is required, the application, together with the Land Rover part number is given in the General Specification at the start of each section and an instruction that a sealant must be used appears in the relevant repair procedure.

It is essential that the sealant(s) specified for a particular procedure are used, DO NOT use any other sealant.

Always remove traces of old sealant using a plastic scraper or suitable solvent, never use emery cloth or metal scrapers.

Adhesives

Whenever a procedure involves the use of an adhesive, the adhesive specified must be used and the manufacturer's instructions regarding application together with any health and safety precautions must be followed.

Published: 11-May-2011

General Information - Road/Roller Testing

Description and Operation

Road or rolling road testing may be carried out for various reasons and a procedure detailing pre-test checks, through engine starting and stopping, pre-driving checks, on-test checks to final checks on completion of the test are given.

Unless complete vehicle performance is being checked, the full road test procedure need not be carried out. Instead, those items particularly relevant to the system(s) being checked can be extracted.

Pre-Test Checks

WARNING: If the brake system hydraulic fluid level is low, pedal travel is excessive or a hydraulic leak is found, do not attempt to road test the vehicle until the reason for the low fluid level, excessive pedal travel or hydraulic leak is found and rectified.

It is suggested that pre-test and functional tests of those systems/circuits which affect the safe and legal operations of the vehicle, such as brakes, lights and steering, should always be carried out before the road or rolling road test.

- Engine oil level
- Engine coolant level
- Tires, for correct pressure, compatible types and tread patterns, and wear within limits.
- There is sufficient fuel in the tank to complete the test.
- Check all around the engine, transmission and under the vehicle for oil, coolant, hydraulic and fuel leaks. Make a note of any apparent leaks and wipe off the surrounding areas to make it easier to identify the extent of the leak on completion of the test.

Starting the Engine

• NOTE: On initial drive away from cold and within the first 1.5 km (1 mile), do not depress accelerator pedal beyond half travel until the vehicle has attained a minimum speed of 25 km/h (15 miles/h). Never operate at high engine speed or with the accelerator pedal at full travel whilst the engine is cold.

With the ignition off, check:

- The parking brake is applied.
- **Automatic transmission:** The selector lever is in 'P' - PARK.
- **Manual transmission:** The gear lever is in NEUTRAL.
- All instrument gauges read zero.

With the ignition on, check:

- Ignition controlled warning lights come on.
- Engine temperature gauge registers a reading compatible with the engine temperature.
- Fuel gauge registers a reading appropriate to the fuel level in the tank.
- The operation of the parking brake warning light and fluid level warning indicator light.

On Road Test Check:

CAUTION: At commencement of road testing, check the brake operation while still travelling at low speed before continuing with the test. If the brakes pull to one side, or appear to be otherwise faulty, do not continue with the road test until the fault has been found and rectified.

- The parking brake releases completely.
- Gear changing is smooth, and there are no abnormal noises or vibrations from the transmission.
- The engine power output is satisfactory, acceleration is smooth and accelerator pedal operation is not stiff or heavy, and engine speed returns to idle correctly.
- There is no excessive or abnormally colored smoke from the engine under normal driving, heavy load or overrun conditions.
- Steering operation is smooth, accurate, not excessively heavy or with excessive free play or vibration. Does not pull to one side and self centres smoothly after cornering.
- All instruments register the correct readings and operate correctly.
- Switches and controls operate smoothly and positively, warning or indicator lights operate correctly and the direction indicator control self cancels when the steering is returned to the straight ahead position.
- Heating and ventilation systems work correctly and effectively.
- Brakes operate efficiently.

Brake Testing

Avoid brake testing on busy roads where it can cause inconvenience or danger to other road users.

CAUTION: Brake testing which includes heavy brake applications should not be carried out with new brake pads/discs until the components have bedded-in. New brake friction components will not reach full efficiency until the bedding-in process is complete. Note that when new parking brake shoes or rear brake discs have been installed, it is essential that the 'bedding-in' procedure is carried out.
For additional information, refer to: Parking Brake Shoes Bedding-In (206-05 Parking Brake and Actuation, General Procedures).

Test the brakes at several speeds within the normal operating range using both light and heavy pedal pressure. Note any tendency to snatch, pull or drag, and any undue delay in application or release.

Allow the vehicle to coast and note any tendency to pull to one side, or evidence that the brakes are binding.

After stopping the vehicle (not immediately after a period of heavy braking), carefully check the brake temperature. A disc which feels appreciably hotter than the others, could indicate that the pads on that disc are binding.

After completion of the test, check for:

- Oil, coolant, hydraulic, air and fuel leaks.
- Abnormal temperature of any moving components or assemblies, e.g. wheel hubs, transmission etc., which might indicate over tightness or lack of lubrication.

Rolling Road Testing

Four-Wheel Rolling Road

CAUTION: When utilising a four-wheel rolling road for testing, ensure all relevant health and safety requirements are adhered to.

Provided that front and rear rollers are rotating at identical speeds and that normal workshop safety standards are applied, there is no speed restriction during testing except any that may apply to the tires.

Ensure that the parking brake is released prior to engaging roller driving mechanism.

Two-Wheel Rolling Road

CAUTION: On no account should an attempt be made to carry out any form of testing on a two-wheel rolling road.

Published: 11-May-2011

General Information - Special Tool Glossary

Description and Operation

Service Tools

Special service tools have been developed to facilitate removal, dismantling and assembly of mechanical components in a cost effective and time efficient manner. The use of such special tools also helps prevent the potential for damage to components.

Some operations described in this manual cannot be carried out properly without the aid of the relevant service tools.

All orders and enquiries from the United Kingdom and European countries except Germany, Austria, Switzerland and Spain and countries not in the following list should be sent direct to:

SPX UK Ltd.,

Genoa House,

Everdon Park,

Daventry,

Northants,

NN11 5YJ

England

Tel: 0044 (0) 1327 303467/303455

Fax: 0044 (0) 1327 706632

e-mail: spxsalesuk@servicesolutions.spx.com

Overseas orders for the following countries should be placed with the local distributor.

Germany, Austria and Switzerland

SPX Europe GMBH,

Porschestrasse 4,

63512 Hainburg,

Germany

Tel: 0049 61829590

Fax: 0049 6182959299

Spain

SPX Iberica SA,

C/Francisco Aritio,

158 nave 72 (Nudo Oeste),

19004 Guadalajara,

Spain

Tel: 0034 949208381

Fax: 0034 949208327

North America

SPX Corporation

665, Eisenhower Drive,

Owatonna,

MN 55060,

USA

Tel: 0018 772979110

Fax: 0018 005787375

Australia

SPX Australia,

28, Clayton Road,

Notting Hill,

Victoria 3168,

Australia

Tel: 0061 00395446222

Fax: 0061 00395445222

e-mail: sales@spx.com.au

Japan and East Asia

Jatek Ltd.,

5 - 53, Minawacho 2-chome,

Kohoku-ku,

Yokohama,

Kanagawa 223-0051,

Japan

Tel: 0081 455627700

Fax: 0081 455627800

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Audio Amplifier Module (AAM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the audio amplifier system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Audio Amplifier Module (AAM)

DTC	Description	Possible Cause	Action
B1A01-11	Speaker #1	• Front Left Tweeter Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Front Left Tweeter Speaker circuit for short to ground
B1A01-12	Speaker #1	• Front Left Tweeter Speaker circuit - short to power	Refer to electrical circuit diagrams and check Front Left Tweeter Speaker circuit for short to power
B1A01-13	Speaker #1	• Front Left Tweeter Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Front Left Tweeter Speaker circuit for open circuit
B1A01-1A	Speaker #1	• Front Left Tweeter Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Front left tweeter speaker connection for crossload
B1A01-49	Speaker #1	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1A02-11	Speaker #2	• Front Right Tweeter Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Front Right Tweeter Speaker circuit for short to ground
B1A02-12	Speaker #2	• Front Right Tweeter Speaker circuit - short to power	Refer to electrical circuit diagrams and check Front Right Tweeter Speaker circuit for short to power
B1A02-13	Speaker #2	• Front Right Tweeter Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Front Right Tweeter Speaker circuit for open circuit
B1A02-1A	Speaker #2	• Front Right Tweeter Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Front right tweeter speaker connection for crossload
B1A02-49	Speaker #2	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1A03-11	Speaker #3	• Front Left Woofer Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Front Left Woofer Speaker circuit for short to ground
B1A03-12	Speaker #3	• Front Left Woofer Speaker circuit - short to power	Refer to electrical circuit diagrams and check Front Left Woofer Speaker circuit for short to power

DTC	Description	Possible Cause	Action
B1A03-13	Speaker #3	• Front Left Woofer Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Front Left Woofer Speaker circuit for open circuit
B1A03-1A	Speaker #3	• Front Left Woofer Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Front left woofer speaker connection for crossload
B1A03-49	Speaker #3	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1A04-11	Speaker #4	• Front Right Woofer Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Front Right Woofer Speaker circuit for short to ground
B1A04-12	Speaker #4	• Front Right Woofer Speaker circuit - short to power	Refer to electrical circuit diagrams and check Front Right Woofer Speaker circuit for short to power
B1A04-13	Speaker #4	• Front Right Woofer Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Front Right Woofer Speaker circuit for open circuit
B1A04-1A	Speaker #4	• Front Right Woofer Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Front right woofer speaker connection for crossload
B1A04-49	Speaker #4	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1A05-11	Speaker #5	• Rear Left Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Rear Left Speaker circuit for short to ground
B1A05-12	Speaker #5	• Rear Left Speaker circuit - short to power	Refer to electrical circuit diagrams and check Rear Left Speaker circuit for short to power
B1A05-13	Speaker #5	• Rear Left Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Rear Left Speaker circuit for open circuit
B1A05-1A	Speaker #5	• Rear Left Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Rear left speaker connection for crossload
B1A05-49	Speaker #5	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1A06-11	Speaker #6	• Rear Right Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Rear Right Speaker circuit for short to ground
B1A06-12	Speaker #6	• Rear Right Speaker circuit - short to power	Refer to electrical circuit diagrams and check Rear Right Speaker circuit for short to power
B1A06-13	Speaker #6	• Rear Right Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Rear Right Speaker circuit for open circuit
B1A06-1A	Speaker #6	• Rear Right Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Rear right speaker connection for crossload
B1A06-49	Speaker #6	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1A07-11	Speaker #7	• Rear Left Surround Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Rear Left Surround Speaker circuit for short to ground
B1A07-12	Speaker #7	• Rear Left Surround Speaker circuit - short to power	Refer to electrical circuit diagrams and check Rear Left Surround Speaker circuit for short to power
B1A07-13	Speaker #7	• Rear Left Surround Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Rear Left Surround Speaker circuit for open circuit
B1A07-1A	Speaker #7	• Rear Left Surround Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Rear left surround speaker connection for crossload

DTC	Description	Possible Cause	Action
B1A07-49	Speaker #7	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1A08-11	Speaker #8	• Rear Right Surround Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Rear Right Surround Speaker circuit for short to ground
B1A08-12	Speaker #8	• Rear Right Surround Speaker circuit - short to power	Refer to electrical circuit diagrams and check Rear Right Surround Speaker circuit for short to power
B1A08-13	Speaker #8	• Rear Right Surround Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Rear Right Surround Speaker circuit for open circuit
B1A08-1A	Speaker #8	• Rear Right Surround Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Rear right surround speaker connection for crossload
B1A08-49	Speaker #8	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1A09-11	Speaker #9	• Center Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Center Speaker circuit for short to ground
B1A09-12	Speaker #9	• Center Speaker circuit - short to power	Refer to electrical circuit diagrams and check Center Speaker circuit for short to power
B1A09-13	Speaker #9	• Center Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Center Speaker circuit for open circuit
B1A09-1A	Speaker #9	• Center Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Center speaker connection for crossload
B1A09-49	Speaker #9	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1A10-11	Speaker #10	• Left Subwoofer Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Left Subwoofer Speaker circuit for short to ground
B1A10-12	Speaker #10	• Left Subwoofer Speaker circuit - short to power	Refer to electrical circuit diagrams and check Left Subwoofer Speaker circuit for short to power
B1A10-13	Speaker #10	• Left Subwoofer Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Left Subwoofer Speaker circuit for open circuit
B1A10-1A	Speaker #10	• Left Subwoofer Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Left subwoofer speaker connection for crossload
B1A10-49	Speaker #10	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1A11-11	Speaker #11	• Right Subwoofer Speaker circuit - short to ground	Refer to electrical circuit diagrams and check Right Subwoofer Speaker circuit for short to ground
B1A11-12	Speaker #11	• Right Subwoofer Speaker circuit - short to power	Refer to electrical circuit diagrams and check Right Subwoofer Speaker circuit for short to power
B1A11-13	Speaker #11	• Right Subwoofer Speaker circuit - open circuit	Refer to electrical circuit diagrams and check Right Subwoofer Speaker circuit for open circuit
B1A11-1A	Speaker #11	• Right Subwoofer Speaker circuit - resistance below threshold	Refer to electrical circuit diagrams and check Right subwoofer speaker connection for crossload
B1A11-49	Speaker #11	• Internal electronic failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
B1D84-11	Headphone panel 1	• Headphone panel 1 left or right signal circuit - short to ground	Refer to electrical circuit diagrams and check headphone panel 1 left or right signal circuit for short to ground
B1D84-13	Headphone panel 1	• Headphone panel 1 left or right signal circuit - open circuit	Refer to electrical circuit diagrams and check headphone panel 1 left or right signal circuit for open circuit

DTC	Description	Possible Cause	Action
B1D84-23	Headphone panel 1	• Headphone panel 1 control line circuit - signal stuck low	Refer to electrical circuit diagrams and check headphone panel 1 control line for short to ground. Check for stuck switch/button
B1D85-11	Headphone panel 2	• Headphone panel 2 left or right signal circuit - short to ground	Refer to electrical circuit diagrams and check headphone panel 2 left or right signal circuit for short to ground
B1D85-13	Headphone panel 2	• Headphone panel 2 left or right signal circuit - open circuit	Refer to electrical circuit diagrams and check headphone panel 2 left or right signal circuit for open circuit
B1D85-23	Headphone panel 2	• Headphone panel 2 control line circuit - signal stuck low	Refer to electrical circuit diagrams and check headphone panel 2 control line for short to ground. Check for stuck switch/button
B1D86-11	Headphone panel 3	• Headphone panel 3 left or right signal circuit - short to ground	Only 2 headphone panels available on this vehicle. If this DTC is logged, check/amend Car Configuration File to reflect 2 panels only using the manufacturer approved diagnostic system
B1D86-13	Headphone panel 3	• Headphone panel 3 left or right signal circuit - open circuit	Only 2 headphone panels available on this vehicle. If this DTC is logged, check/amend Car Configuration File to reflect 2 panels only using the manufacturer approved diagnostic system
B1D86-23	Headphone panel 3	• Headphone panel 3 control line circuit - signal stuck low	Only 2 headphone panels available on this vehicle. If this DTC is logged, check/amend Car Configuration File to reflect 2 panels only using the manufacturer approved diagnostic system
B1D87-11	Headphone panel 4	• Headphone panel 4 left or right signal circuit - short to ground	Only 2 headphone panels available on this vehicle. If this DTC is logged, check/amend Car Configuration File to reflect 2 panels only using the manufacturer approved diagnostic system
B1D87-13	Headphone panel 4	• Headphone panel 4 left or right signal circuit - open circuit	Only 2 headphone panels available on this vehicle. If this DTC is logged, check/amend Car Configuration File to reflect 2 panels only using the manufacturer approved diagnostic system
B1D87-23	Headphone panel 4	• Headphone panel 4 control line circuit - signal stuck low	Only 2 headphone panels available on this vehicle. If this DTC is logged, check/amend Car Configuration File to reflect 2 panels only using the manufacturer approved diagnostic system
U3000-05	Control module - system programming failures	• Software incompatibility • The version of the Local Configuration file does not match that expected	Re-configure the audio amplifier as an existing control module, using the manufacturer approved diagnostic system
U3000-42	Control module - general memory failure	• General memory failure	Re-configure the audio amplifier as an existing control module, using the manufacturer approved diagnostic system. Clear DTC, cycle ignition and read DTCs. If DTC returns, suspect audio amplifier module and install a new module. Refer to the new module/component installation note at the top of the DTC Index
U3000-44	Control module - data memory failure	• Data memory failure	Re-configure the audio amplifier as an existing control module, using the manufacturer approved diagnostic system. Clear DTC, cycle ignition and read DTCs. If DTC returns, suspect audio amplifier module and install a new module. Refer to the new module/component installation note at the top of the DTC Index
U3000-55	Control Module	• Incorrect car configuration data received	Check/up-date Car Configuration File using manufacturer approved diagnostic system
U3000-87	Control Module	• Missing message	Check CJB for DTCs and refer to DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). Check information and entertainment module for Car Configuration File and MOST network DTCs and refer to relevant DTC Index. Carry out MOST/CAN network tests using the manufacturer approved diagnostic system
U3003-16	Battery Voltage	• Circuit voltage below threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U3003-17	Battery Voltage	• Circuit voltage above threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Anti-Lock Braking System (ABS)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the anti lock breaking system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).

DTC	Description	Possible Cause	Action
B10DF-46	Master cylinder isolation valve - calibration / parameter memory failure	• Valve not calibrated - Internal ABS module failure	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0001-01	Master Cylinder Isolation Valve 1 - electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0002-01	Master Cylinder Isolation Valve 2 - electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0003-01	Low Pressure Feed Valve 1 - electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0004-01	Low Pressure Feed Valve 2 - electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0010-01	Left Front Inlet Control - General electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0011-01	Left Front Outlet Control - General electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0014-01	Right Front Inlet Control - General electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0015-01	Right Front Outlet Control - General electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0018-01	Left Rear Inlet Control - General electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
C0019-01	Left Rear Outlet Control - General electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C001C-01	Right Rear Inlet Control - General electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C001D-01	Right Rear Outlet Control - General electrical failure	• Internal ABS module fault	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0020-01	ABS Pump Motor Control - General electrical failure	• Power supply to pump motor - short circuit • Power supply to pump motor - incorrect voltage • Pump ground circuit fault • Mechanical pump fault	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new ABS module. Refer to the new module/component installation note at the top of the DTC Index
C0020-1C	ABS Pump Motor Control - Circuit voltage out of range	• Power supply to pump motor - short circuit, high resistance • Pump ground circuit fault • Internal ABS module fault	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new ABS module. Refer to the new module/component installation note at the top of the DTC Index
C0020-71	ABS pump motor control - actuator stuck	• Power supply to pump motor - short circuit, high resistance • Mechanical pump fault	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new ABS module. Refer to the new module/component installation note at the top of the DTC Index
C0030-07	Left Front Tone Wheel - Mechanical Failure	• Bearing encoder damaged	• Install a new left front wheel bearing. For additional information, refer to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).
C0031-01	Left Front Wheel Speed Sensor - General electrical failure	• Wheel speed sensor circuit - short to ground, short to power, open circuit • Wheel speed sensor failure	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new wheel speed sensor as required. For additional information, refer to: Front Wheel Speed Sensor (206-09A Anti-Lock Control, Removal and Installation).
C0031-07	Left Front Wheel Speed Sensor - Mechanical Failure	• Wheel speed sensor faulty/incorrectly installed	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Check sensor for correct installation. Install a new wheel speed sensor as required. For additional information, refer to: Front Wheel Speed Sensor (206-09A Anti-Lock Control, Removal and Installation).
C0033-07	Right Front Tone Wheel - Mechanical Failure	• Bearing encoder damaged	• Install a new right front wheel bearing. For additional information, refer to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).
C0034-01	Right Front Wheel Speed Sensor - General electrical failure	• Wheel speed sensor circuit - short to ground, short to power, open circuit • Wheel speed sensor failure	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new wheel speed sensor as required. For additional information, refer to: Front Wheel Speed Sensor (206-09A Anti-Lock Control, Removal and Installation).
C0034-07	Right Front Wheel Speed Sensor - Mechanical Failure	• Wheel speed sensor faulty/incorrectly installed	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check sensor for correct installation. Clear DTC and retest if DTC returns. Install a new wheel speed sensor as required. For additional information, refer to: Front Wheel Speed Sensor (206-09A Anti-Lock Control,

DTC	Description	Possible Cause	Action
			Removal and Installation).
C0036-07	Left Rear Tone Wheel - Mechanical Failure	• Bearing encoder damaged	• Install a new left rear wheel bearing. For additional information, refer to: Rear Wheel Bearing (204-02 Rear Suspension, Removal and Installation).
C0037-01	Left Rear Wheel Speed Sensor - General electrical failure	• Wheel speed sensor circuit - short to ground, short to power, open circuit • Wheel speed sensor failure	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new wheel speed sensor as required. For additional information, refer to: Rear Wheel Speed Sensor (206-09A Anti-Lock Control, Removal and Installation).
C0037-07	Left Rear Wheel Speed Sensor - Mechanical Failure	• Wheel speed sensor faulty/incorrectly installed	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Check sensor for correct installation. Install a new wheel speed sensor as required. For additional information, refer to: Rear Wheel Speed Sensor (206-09A Anti-Lock Control, Removal and Installation).
C003907	Right Rear Tone Wheel - Mechanical Failure	• Bearing encoder damaged	• Install a new right rear wheel bearing. For additional information, refer to: Rear Wheel Bearing (204-02 Rear Suspension, Removal and Installation).
C003A-01	Left Rear Wheel Speed Sensor - General electrical failure	• Wheel speed sensor circuit - short to ground, short to power, open circuit • Wheel speed sensor failure	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new wheel speed sensor as required. For additional information, refer to: Rear Wheel Speed Sensor (206-09A Anti-Lock Control, Removal and Installation).
C003A-07	Right Rear Wheel Speed Sensor - Mechanical Failure	• Wheel speed sensor faulty/incorrectly installed	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check sensor for correct installation. Clear DTC and retest if DTC returns. Install a new wheel speed sensor as required. For additional information, refer to: Rear Wheel Speed Sensor (206-09A Anti-Lock Control, Removal and Installation).
C0040-64	Brake Pedal Switch "A" - Signal plausibility failure	• Brake pedal switch circuit - short to ground, short to power, open circuit • Brake pedal switch failure	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new brake switch as required. For additional information, refer to: Speed Control Deactivator Switch (310-03A Speed Control - I6 3.2L Petrol, Removal and Installation).
C0044-01	TMC Pressure Sensor - General electrical failure	• NOTE: The sensor is internal to the control module • Sensor failure	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0044-28	TMC Pressure Sensor - Signal Offset	• NOTE: The sensor is internal to the control module • Sensor failure	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0044-64	TMC Pressure Sensor - Signal plausibility	• NOTE: The sensor is internal to the control module • Sensor failure	• Clear DTC and retest if DTC returns. Install a new ABS module, refer to the new module/component installation note at the top of the DTC Index
C0051-28	Steering wheel rotation sensor - Off-set monitoring	• Sensor loose/incorrectly installed • Vehicle track incorrectly adjusted	• Check the sensor and encoder wheel for correct installation/alignment. Check the steering and suspension for damage/wear which could affect the track, rectify as necessary
C0061-01	Lateral Acceleration Sensor - General Electrical Failure	• Sensor circuit - short to ground, short to power, open circuit • Internal sensor failure	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new sensor • Using the manufacturer approved diagnostic

DTC	Description	Possible Cause	Action
			system, carry out the lateral accelerometer calibration routine For additional information, refer to: Accelerometer (206-09C Anti-Lock Control - Stability Assist, Removal and Installation).
C0061-28	Lateral Acceleration Sensor - Signal bias level out of range/zero adjustment failure	• Sensor incorrectly calibrated	• Clear DTC and retest if DTC returns • Using the manufacturer approved diagnostic system, carry out the lateral accelerometer calibration routine For additional information, refer to: Accelerometer (206-09C Anti-Lock Control - Stability Assist, Removal and Installation).
C0061-64	Lateral Acceleration Sensor - Signal plausibility failure	• Lateral acceleration sensor internal failure	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new sensor • Using the manufacturer approved diagnostic system, carry out the lateral accelerometer calibration routine For additional information, refer to: Accelerometer (206-09C Anti-Lock Control - Stability Assist, Removal and Installation).
C0062-01	Longitudinal Acceleration Sensor - General electrical failure	• Sensor circuit - short to ground, short to power, open circuit • Internal sensor failure	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new sensor • Using the manufacturer approved diagnostic system, carry out the longitudinal accelerometer calibration routine For additional information, refer to: Accelerometer (206-09C Anti-Lock Control - Stability Assist, Removal and Installation).
C0062-28	Longitudinal Acceleration Sensor - Signal bias level out of range/zero adjustment failure	• Sensor incorrectly calibrated	• Clear DTC and retest if DTC returns • Using the manufacturer approved diagnostic system, carry out the longitudinal accelerometer calibration routine For additional information, refer to: Accelerometer (206-09C Anti-Lock Control - Stability Assist, Removal and Installation).
C0062-64	Longitudinal Acceleration Sensor - Signal plausibility failure	• Longitudinal Acceleration sensor internal failure	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new sensor • Using the manufacturer approved diagnostic system, carry out the longitudinal accelerometer calibration routine For additional information, refer to: Accelerometer (206-09C Anti-Lock Control - Stability Assist, Removal and Installation).
C0063-01	Yaw Rate Sensor - General electrical failure	• Yaw rate sensor circuit - short to ground, power, open circuit • Yaw rate sensor internal failure	• Refer to electrical circuit diagrams and check Yaw rate sensor circuit for short to ground, power, open circuit. Clear DTC and retest if DTC returns. Install a new sensor • Using the manufacturer approved diagnostic system, carry out the yaw rate sensor calibration routine For additional information, refer to: Accelerometer (206-09C Anti-Lock Control - Stability Assist, Removal and Installation).
C0063-28	Yaw Rate Sensor - Signal bias level out of range/zero adjustment failure	• Sensor incorrectly calibrated	• Clear DTC and retest if DTC returns. • Using the manufacturer approved diagnostic system, carry out the yaw rate sensor calibration routine For additional information, refer to: Accelerometer (206-09C Anti-Lock Control - Stability Assist, Removal and Installation).
C0063-64	Yaw Rate Sensor - Signal plausibility failure	• Yaw rate sensor internal failure	• Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and retest if DTC returns. Install a new sensor • Using the manufacturer approved diagnostic system, carry out the yaw rate sensor calibration routine For additional information, refer to: Accelerometer (206-09C Anti-Lock Control - Stability Assist, Removal and Installation).

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Audio Front Control Module (ACM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the audio front control system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Audio Front Control Module (ACM)

DTC	Description	Possible Cause	Action
B1134-11	Phone input	• Phone input circuit - short to ground	Refer to electrical circuit diagrams and check phone input circuit for short to ground
B1134-12	Phone input	• Phone input circuit - short to power	Refer to electrical circuit diagrams and check phone input circuit for short to power
B1134-13	Phone input	• Phone input circuit - open circuit	Refer to electrical circuit diagrams and check phone input circuit for open circuit
B1A01-11	Speaker #1	• Left front speaker circuit - short to ground	Refer to electrical circuit diagrams and check left front speaker circuit for short to ground
B1A01-12	Speaker #1	• Left front speaker circuit - short to power	Refer to electrical circuit diagrams and check left front speaker circuit for short to power
B1A01-1A	Speaker #1	• Left front speaker circuit - resistance below threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A01-1B	Speaker #1	• Left front speaker circuit - resistance above threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A01-1C	Speaker #1	• Left front speaker circuit - voltage out of range	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A02-11	Speaker #2	• Right front speaker circuit - short to ground	Refer to electrical circuit diagrams and check right front speaker circuit for short to ground
B1A02-12	Speaker #2	• Right front speaker circuit - short to power	Refer to electrical circuit diagrams and check right front speaker circuit for short to power
B1A02-1A	Speaker #2	• Right front speaker circuit - resistance below threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A02-1B	Speaker #2	• Right front speaker circuit - resistance above threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A02-1C	Speaker #2	• Right front speaker circuit - voltage out of range	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A03-11	Speaker #3	• Left rear speaker circuit - short to ground	Refer to electrical circuit diagrams and check left rear speaker circuit for short to ground
B1A03-12	Speaker #3	• Left rear speaker circuit - short to power	Refer to electrical circuit diagrams and check left rear speaker circuit for short to power
B1A03-1A	Speaker #3	• Left rear speaker circuit - resistance below threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A03-1B	Speaker #3	• Left rear speaker circuit - resistance above threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
B1A03-1C	Speaker #3	• Left rear speaker circuit - voltage out of range	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A04-11	Speaker #4	• Right rear speaker circuit - short to ground	Refer to electrical circuit diagrams and check right rear speaker circuit for short to ground
B1A04-12	Speaker #4	• Right rear speaker circuit - short to power	Refer to electrical circuit diagrams and check right rear speaker circuit for short to power
B1A04-1A	Speaker #4	• Right rear speaker circuit - resistance below threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A04-1B	Speaker #4	• Right rear speaker circuit - resistance above threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A04-1C	Speaker #4	• Right front speaker circuit - voltage out of range	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A56-13	Antenna	• Antenna circuit - open circuit	Refer to electrical circuit diagrams and check antenna circuit for open circuit
B1B69-11	Antenna 12 volt supply circuit	• Antenna 12 volt supply circuit - short to ground	Refer to electrical circuit diagrams and check antenna 12 volt supply circuit for short to ground
B1B69-15	Antenna 12 volt supply circuit	• Antenna 12 volt supply circuit - short to power, open circuit	Refer to electrical circuit diagrams and check antenna 12 volt supply circuit for short to power, open circuit
B1D19-16	Compact disc unit	• Circuit voltage below threshold	Install a new integrated audio module, refer to the new module/component installation note at the top of the DTC Index. For additional information, refer to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation).
B1D19-77	Compact disc unit	• Commanded position not reachable	Install a new integrated audio module, refer to the new module/component installation note at the top of the DTC Index. For additional information, refer to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation).
B1D19-93	Compact disc unit	• No operation	Install a new integrated audio module, refer to the new module/component installation note at the top of the DTC Index. For additional information, refer to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation).
B1D78-11	Auxiliary input	• Auxiliary input circuit - short to ground	Refer to electrical circuit diagrams and check auxiliary input circuit for short to ground
B1D78-12	Auxiliary input	• Auxiliary input circuit - short to power	Refer to electrical circuit diagrams and check auxiliary input circuit for short to power
B1D78-13	Auxiliary input	• Auxiliary input circuit - open circuit	Refer to electrical circuit diagrams and check auxiliary input circuit for open circuit
B1D79-11	Microphone input	• Microphone input circuit - short to ground	Refer to electrical circuit diagrams and check microphone input circuit for short to ground
B1D79-12	Microphone input	• Microphone input circuit - short to power	Refer to electrical circuit diagrams and check microphone input circuit for short to power
B1D79-13	Microphone input	• Microphone input circuit - open circuit	Refer to electrical circuit diagrams and check microphone input circuit for open circuit
U3000-49	Control module	• Internal electronic failure	Install a new control module, refer to the new module/component installation note at the top of the DTC Index. For additional information, refer to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation).
U3000-55	Control module	• Incorrect car configuration data received	Check/up-date Car Configuration File using manufacturer approved diagnostic system
U3000-87	Control module	• Missing message	Check CJB for DTCs and refer to DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). Check information and entertainment module for Car Configuration File and MOST network DTCs and refer to relevant DTC Index. Carry out MOST/CAN network tests using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
U3000-98	Control module	• Component or system over temperature	Check for additional DTCs and refer to relevant DTC Index, check/monitor system for re-occurrence
U3003-62	Battery voltage	• Mis-match in voltage, of 2 volts or more, between integrated control module and CJB	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Auxiliary Heater Control Module (AHCM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the fuel fired booster heater contol system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Description and Operation).

• NOTE: Where an 'on demand self-test' is referred to, this can be accessed via the 'DTC Monitor' tab on the manufacturers approved diagnostic system.

DTC	Description	Possible Causes	Action
B1D22-11	Coolant Temperature Sensor - circuit short to ground	• Fuel fired booster heater coolant temperature sensor internal fault	• Check and install a new fuel fired booster heater **coolant temperature sensor** • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D22-15	Coolant Temperature Sensor - circuit short to battery or open	• Fuel fired booster heater coolant temperature sensor internal fault	• Check and install a new fuel fired booster heater **coolant temperature sensor** • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D23-13	Overheat Sensor - circuit open	• Fuel fired booster heater coolant temperature sensor internal fault	• Check and install a new fuel fired booster heater **coolant temperature sensor** • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D24-11	Glow Plug - circuit short to ground	• Fuel fired booster heater glow plug internal fault	• Carry out circuit checks, inspect the glow plug cables and connector. Repair the circuit or check and install a new fuel fired booster heater **glow plug** as required For additional information, refer to: Fuel Fired Booster Heater Glow Plug And Burner Assembly (412-02B Auxiliary Climate Control, Removal and Installation). • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation

DTC	Description	Possible Causes	Action
B1D24-15	Glow Plug - circuit short to battery or open	• Fuel fired booster heater glow plug internal fault	• Carry out circuit checks, inspect the glow plug cables and connector. Repair the circuit or check and install a new fuel fired booster heater **glow plug** as required For additional information, refer to: Fuel Fired Booster Heater Glow Plug And Burner Assembly (412-02B Auxiliary Climate Control, Removal and Installation). • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D25-11	Heater Fuel Pump - circuit short to ground	• Heater fuel pump circuit short to ground • Heater fuel pump failure	• Refer to the electrical circuit diagrams and check the fuel fired booster heater fuel pump and circuit for short to ground • Repair the circuit or check and install a new fuel fired booster heater **fuel pump** as required For additional information, refer to: Fuel Fired Booster Heater Fuel Pump (412-02B Auxiliary Climate Control, Removal and Installation). • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D25-15	Heater Fuel Pump - circuit short to battery or open	• Heater fuel pump circuit short to power, open circuit • Heater fuel pump failure	• Refer to the electrical circuit diagrams and check the fuel fired booster heater fuel pump and circuit for short to power, open circuit • Repair the circuit or check and install a new fuel fired booster heater **fuel pump** as required For additional information, refer to: Fuel Fired Booster Heater Fuel Pump (412-02B Auxiliary Climate Control, Removal and Installation). • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D26-11	Combustion Air Blower - circuit short to ground	• Fuel fired booster heater module failure	• Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • If the diagnostic trouble code reoccurs check and install a new fuel fired booster heater module as required For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation). • Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
B1D26-15	Combustion Air Blower - circuit short to battery or open	• Fuel fired booster heater module failure	• Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • If the diagnostic trouble code reoccurs check and install a new fuel fired booster heater module as required For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation). • Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
B1D26-92	Combustion Air Blower - performance or incorrect operation	• Fuel fired booster heater module failure	• Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test)

DTC	Description	Possible Causes	Action
			• Check for reoccurrence of the diagnostic trouble code • If the diagnostic trouble code reoccurs check and install a new fuel fired booster heater module as required For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation). • Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
B1D26-93	Combustion Air Blower - no operation	• Fuel fired booster heater module failure	• Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for reoccurrence of the diagnostic trouble code • If the diagnostic trouble code reoccurs check and install a new fuel fired booster heater module as required For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation). • Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
B1D27-11	Heater Coolant Pump - circuit short to ground	• Heater coolant pump circuit short to ground • Heater coolant pump failure	• Refer to the electrical circuit diagrams and check the fuel fired booster heater water pump and circuit for short to ground • Repair the circuit or check and install a new fuel fired booster heater **water pump** as required For additional information, refer to: Fuel Fired Booster Heater Coolant Pump (412-02B Auxiliary Climate Control, Removal and Installation). • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D27-15	Heater Coolant Pump - circuit short to battery or open	• Heater coolant pump circuit short to power, open circuit • Heater coolant pump failure	• Refer to the electrical circuit diagrams and check the fuel fired booster heater water pump and circuit for short to power, open circuit • Repair the circuit or check and install a new fuel fired booster heater **water pump** as required For additional information, refer to: Fuel Fired Booster Heater Coolant Pump (412-02B Auxiliary Climate Control, Removal and Installation). • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D28-11	Fuel Pre-heater - circuit short to ground	• NOTE: The pre heat is performed by the ignition glow plug • Fuel fired booster heater glow plug internal fault	• Carry out circuit checks, inspect the glow plug cables and connector • Check and install a new fuel fired booster heater **glow plug** as required For additional information, refer to: Fuel Fired Booster Heater Glow Plug And Burner Assembly (412-02B Auxiliary Climate Control, Removal and Installation). • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation

DTC	Description	Possible Causes	Action
B1D28-15	Fuel Pre-heater - circuit short to battery or open	• NOTE: The pre heat is performed by the ignition glow plug • Fuel fired booster heater glow plug internal fault	• Carry out circuit checks, inspect the glow plug cables and connector • Check and install a new fuel fired booster heater **glow plug** as required For additional information, refer to: Fuel Fired Booster Heater Glow Plug And Burner Assembly (412-02B Auxiliary Climate Control, Removal and Installation). • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D29-93	No Start, Even After Restart Attempt - no operation	• No fuel present at fuel fired booster heater module • Exhaust system blocked • Air intake blocked	• Check vehicle fuel level • Check fuel lines to fuel fired booster heater module for blockage, kinking or damage • Check exhaust system and air intake for blockage, kinking or damage • Check fuel for aeration and correct fuel delivery • Check vehicle is not parked on an incline when parking heater is operated • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D30-93	No Start In Test Mode - no operation	• No fuel present at fuel fired booster heater module • Exhaust system blocked • Air intake blocked	• Check vehicle fuel level • Check fuel lines to fuel fired booster heater module for blockage, kinking or damage • Check exhaust system and air intake for blockage, kinking or damage • Check fuel for aeration and correct fuel delivery • Check vehicle is not parked on an incline when parking heater is operated • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D31-94	Flame Detected Prior to Normal Operation - unexpected operation	• NOTE: The glow plug and flame sensor are a combined unit • Glow plug circuit fault	• Check exhaust system and air intake for blockage, kinking or damage • Carry out circuit checks, inspect the glow plug cables and connector. Repair the circuit or check and install a new fuel fired booster heater **glow plug** as required For additional information, refer to: Fuel Fired Booster Heater Glow Plug And Burner Assembly (412-02B Auxiliary Climate Control, Removal and Installation). • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D32-92	Multiple Flame Interruption During Heating Cycle - performance or incorrect operation	• No fuel present at fuel fired booster heater module • Exhaust system blocked • Air intake blocked	• Check vehicle fuel level • Check fuel lines to Fuel fired booster heater module for blockage, kinking or damage • Check exhaust system and air intake for blockage, kinking or damage • Check fuel for aeration and correct fuel delivery • Check vehicle is not parked on an incline when parking heater is operated • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation

DTC	Description	Possible Causes	Action
B1D33-92	Flame Interruption During Normal Operation - performance or incorrect operation	• No fuel present at fuel fired booster heater module • Exhaust system blocked • Air intake blocked	• Check vehicle fuel level • Check fuel lines to fuel fired booster heater module for blockage, kinking or damage • Check exhaust system and air intake for blockage, kinking or damage • Check fuel for aeration and correct fuel delivery • Check vehicle is not parked on an incline when parking heater is operated • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D34-68	Heater In Lock Out Mode - event information	• Fuel fired booster heater system fault	• NOTE: For information only, rectify other stored fuel fired booster heater diagnostic trouble codes prior to this diagnostic trouble code • Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for stored diagnostic trouble codes • Check for correct operation
B1D63-11	External Control Relay - circuit short to ground	• Fuel fired booster heater module failure	• Check and install a new fuel fired booster heater module as required For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation). • Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
B1D63-15	External Control Relay - circuit short to battery or open	• Fuel fired booster heater module failure	• Check and install a new fuel fired booster heater module as required For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation). • Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U0010-00	Medium Speed CAN Communication Bus - no sub type information	• Medium speed CAN communication bus off	• Using the manufacturer approved diagnostic system, complete a CAN network integrity test
U0028-08	Vehicle Communication Bus A - Bus Signal / Message Failures	• Medium speed CAN communication bus off • Fuel fired booster heater module failure	• Using the manufacturer approved diagnostic system, complete a CAN network integrity test
U0300-00	Internal Control Module Software Incompatibility - no sub type information	• Fuel fired booster heater module not configured or incorrectly configured	• Re-configure the fuel fired booster heater module using the manufacturer approved diagnostic system (Module programming/Configure existing module/Auxiliary heater control module)
U1A37-87	Crash Status Telegram Bus Signal / Message Failures Missing message	• Crash signal received over CAN network	• NOTE: Event information - the restraints control module has recorded a crash event • Using the manufacturer approved diagnostic system, check other modules for related diagnostic trouble codes
U2101-00	Control Module Configuration Incompatible - no sub type information	• Fuel fired booster heater module not configured or incorrectly configured • Central junction box not configured correctly	• Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for reoccurrence of the diagnostic trouble code • If the diagnostic trouble code returns • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required • Re-configure the Fuel fired booster heater module using the manufacturer approved diagnostic system

DTC	Description	Possible Causes	Action
			• Check for stored diagnostic trouble codes • Check for correct operation
U3000-16	Control Module - circuit voltage below threshold	• Fuel fired booster heater module power circuit fault • Battery/charging system fault	• Check other modules for related diagnostic trouble codes • If other modules contain low voltage related diagnostic trouble codes, suspect a common cause (battery/charging system fault) • If not, refer to the electrical circuit diagrams and check the power and ground circuits to the fuel fired booster heater module • Check for stored diagnostic trouble codes • Check for correct operation
U3000-17	Control Module - circuit voltage above threshold	• Charging system fault • Fuel fired booster heater module failure	• Check other modules for related diagnostic trouble codes • If other modules contain high voltage related diagnostic trouble codes, suspect a common cause (battery/charging system fault) • If not, refer to the electrical circuit diagrams and check the power and ground circuits to the fuel fired booster heater module • Check for stored diagnostic trouble codes • Check for correct operation
U3000-43	Control Module - special memory failure	• Fuel fired booster heater module failure	• Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for reoccurrence of the diagnostic trouble code • If the diagnostic trouble code returns • Install a new fuel fired booster heater module as required For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation). • Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U3000-49	Control Module - internal electronic failure	• Fuel fired booster heater module failure	• Using the manufacturer approved diagnostic system, record then clear any stored diagnostic trouble codes then conduct the fuel fired booster heater **operation test** (Setup and configuration/auxiliary heater/operation test) • Check for reoccurrence of the diagnostic trouble code • If the diagnostic trouble code returns • Install a new fuel fired booster heater module as required For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation). • Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U3003-62	Battery Voltage - signal compare failure	• There is a difference of more than 2 volts between the power supply to the fuel fired booster heater and the battery voltage value broadcast via the CAN bus	• Check other modules for related diagnostic trouble codes • If other modules contain voltage related diagnostic trouble codes, suspect a common cause (battery/charging system fault) • If not, refer to the electrical circuit diagrams and check the power and ground circuits to the fuel fired booster heater module

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Terrain Response Control Module (ATCM)

Description and Operation

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
● * Tire condition, pressures, etc ● Driveline, Engine, Transmission, Suspension, components (correct installation, damage, etc)	● Fuses ● Harnesses/Connectors ● Terrain response module ● Engine Control Module (ECM) ● Transmission Control Module (TCM) ● Anti-Lock Brake System control module ● Active On-demand control module ● Dynamic suspension control module * Controller area network (CAN) circuits

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module/transmission is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/transmission.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the Terrain Response system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Ride and Handling Optimization (204-06 Ride and Handling Optimization, Description and Operation).

Terrain Response Control Module

DTC	Description	Possible Cause	Action
C1A00-46	Control Module - calibration / parameter memory failure	● The Terrain Response Control Module has indicated a calibration / parameter memory failure for embedded systems using FLASH memory. This is equivalent to EEPROM in RAM/ROM/EEPROM embedded systems ● Corruption in the non-volatile memory storage system (EEPROM) in the Terrain Response Control Module	Rectify this DTC before attempting to rectify others. Record all DTCs logged and clear them. With ignition on select a terrain response special program, turn off the ignition, then turn back on the ignition and verify the selected special program is still active. If the selected terrain response special program is not still active and has returned to the general program, confirm if DTC has returned. Repeat procedure again once more. If DTC is still present install a new terrain response rotary control and control module. Refer to the warranty policy and procedures manual if a module is suspect

DTC	Description	Possible Cause	Action
C1A01-96	LED Circuit - component internal failure	• Terrain response rotary control and control module - LED short circuit to ground • Terrain response rotary control and control module - LED open circuit	• NOTE: If the system is in 'failsafe default mode due to another issue no LEDs will illuminate. This fault does not cause the system to go to 'failsafe default'. Refer to the Description and Operation section of workshop manual. Check terrain response system, special program LEDs. One or more of the LEDs is suspected of not illuminating as appropriate. With the engine running move the terrain response rotary control through all five programs and confirm the appropriate special program LED does not illuminate when the terrain response rotary control is in that position. Suspect the terrain response rotary control and control module, check and install a new terrain response rotary control and control module as required, refer to the new module/component installation note at the top of the DTC Index.
C1A02-94	Rotary Encoder Stuck In Intermediate Position - unexpected operation	• The terrain response rotary control is held in an intermediate position (between the special programs) for more than 60 seconds • Foreign object preventing correct operation of terrain response rotary control • Mechanical damage to the terrain response rotary control	• NOTE: Suspect driver error do not replace the terrain response rotary control at this time Check for foreign object preventing correct operation of terrain response rotary control. Start the vehicle engine, rotate the terrain response rotary control until it has located a genuine detent, wait 60 seconds. Stop the vehicle engine, clear the DTC and retest
U0073-88	Control Module Communication Bus "A" Off - bus off	• Bus off. The Terrain Response Control Module has detected the data bus is not available • CAN bus open circuit • CAN bus short circuit to ground • CAN bus short circuit to power • Failure of another control module on the CAN bus	Refer to electrical circuit diagrams, check CAN circuit for open circuit, short to ground, short to power, repair/renew as necessary. Using the manufacturer approved diagnostic system, carry out network integrity test. Check the system is operating correctly and the DTC does not return.
U0100-87	Lost Communication With ECM/PCM "A" - missing message	• The Terrain Response Control Module has not received one or more expected messages from the Engine Control Module • High speed CAN circuit communications failure • Open circuit Engine Control Module, powerfeed • Open circuit Engine Control Module, ground supply • Engine Control Module disconnected from the high speed CAN communication bus • Open circuit Engine Control Module high speed CAN low circuit • Open circuit Engine Control Module high speed CAN high circuit • Engine Control Module not configured • Engine Control Module failure	Using the manufacturer approved diagnostic system, check the Engine Control Module for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, carry out network integrity test. Using the manufacturer approved diagnostic system, re-configure the Engine Control Module. Refer to electrical circuit diagrams, check power feed and ground supplies, to Engine Control Module for open circuit. Check for open circuit Engine Control Module high speed CAN low circuit. Check for open circuit Engine Control Module high speed CAN high circuit, repair as necessary
U0101-87	Lost Communication with TCM - missing message	• The Terrain Response Control Module has not received one or more expected messages from the Transmission Control Module • High speed CAN circuit communications failure • Open circuit Transmission Control Module, powerfeed • Open circuit	Using the manufacturer approved diagnostic system, check the Transmission Control Module for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, carry out network integrity test. Using the manufacturer approved diagnostic system, re-configure the Transmission Control Module. Refer to electrical circuit diagrams, check power feed and ground supplies, to Transmission Control Module for open circuit. Check for open circuit Transmission Control Module high speed CAN low circuit. Check for open circuit Transmission Control Module high speed CAN high circuit, repair as necessary

DTC	Description	Possible Cause	Action
		Transmission Control Module, ground supply • Transmission Control Module disconnected from the high speed CAN communication bus • Open circuit Transmission Control Module high speed CAN low circuit • Open circuit Transmission Control Module high speed CAN high circuit • Transmission Control Module not configured • Transmission Control Module failure	
U0121-87	Lost Communication With Anti-Lock Brake System (ABS) Control Module - missing message	• The Terrain Response Control Module has not received one or more expected messages from the Anti-Lock Brake System Control Module • High speed CAN circuit communications failure • Open circuit Anti-Lock Brake System Control Module, powerfeed • Open circuit Anti-Lock Brake System Control Module, ground supply • Anti-Lock Brake System Control Module disconnected from the high speed CAN communication bus • Open circuit Anti-Lock Brake System Control Module high speed CAN low circuit • Open circuit Anti-Lock Brake System Control Module high speed CAN high circuit • Anti-Lock Brake System Control Module not configured • Anti-Lock Brake System Control Module failure	Using the manufacturer approved diagnostic system, check the Anti-Lock Brake System Control Module for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, carry out network integrity test. Using the manufacturer approved diagnostic system, re-configure the Anti-Lock Brake System Control Module. Refer to electrical circuit diagrams, check power feed and ground supplies, to Anti-Lock Brake System Control Module for open circuit. Check for open circuit Anti-Lock Brake System Control Module high speed CAN low circuit. Check for open circuit Anti-Lock Brake System Control Module high speed CAN high circuit, repair as necessary. Suspect the Anti-Lock Brake System Control Module, check and install a new Anti-Lock Brake System Control Module as required, refer to the new module/component installation note at the top of the DTC Index. Check the system is operating correctly and the DTC does not return.
U0136-87	Lost Communication With Differential Control Module - Rear - missing message	• The Terrain Response Control Module has not received one or more expected messages from the Rear Differential Control Module • High speed CAN circuit communications failure • Open circuit Rear Differential Control Module, powerfeed • Open circuit Rear Differential Control Module, ground supply • Rear Differential Control Module disconnected from the high speed CAN communication bus • Open circuit Rear Differential Control Module high speed CAN low circuit • Open circuit Rear Differential Control Module high speed CAN high circuit • Rear Differential Control Module not configured • Rear Differential Control Module failure	Using the manufacturer approved diagnostic system, check the Rear Differential Control Module for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, carry out network integrity test. Using the manufacturer approved diagnostic system, re-configure the Rear Differential Control Module. Refer to electrical circuit diagrams, check power feed and ground supplies, to Rear Differential Control Module for open circuit. Check for open circuit Rear Differential Control Module high speed CAN low circuit. Check for open circuit Rear Differential Control Module high speed CAN high circuit, repair as necessary. Suspect the Rear Differential Control Module, check and install a new Rear Differential Control Module as required, refer to the new module/component installation note at the top of the DTC Index. Check the system is operating correctly and the DTC does not return.

DTC	Description	Possible Cause	Action
U0140-87	Lost Communication With Body Control Module - missing message	• The Terrain Response Control Module has not received one or more expected messages from the Body Control Module • High speed CAN circuit communications failure • Open circuit Body Control Module, powerfeed • Open circuit Body Control Module, ground supply • Body Control Module disconnected from the high speed CAN communication bus • Open circuit Body Control Module high speed CAN low circuit • Open circuit Body Control Module high speed CAN high circuit • Body Control Module not configured • Body Control Module failure	Using the manufacturer approved diagnostic system, check the Body Control Module for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, carry out network integrity test. Using the manufacturer approved diagnostic system, re-configure the Body Control Module. Refer to electrical circuit diagrams, check power feed and ground supplies, to Body Control Module for open circuit. Check for open circuit Body Control Module high speed CAN low circuit. Check for open circuit Body Control Module high speed CAN high circuit, repair as necessary. Suspect the Body Control Module, check and install a new Body Control Module as required, refer to the new module/component installation note at the top of the DTC Index. Check the system is operating correctly and the DTC does not return.
U0300-55	Internal Control Module Software Incompatibility - not configured	• The Terrain Response Control Module has failed to recognise a matching master configuration ID from the CAN data bus master • Terrain Response Control Module has incorrect CAN configuration • CAN bus master not correctly configured • Message containing configuration ID not received due to CAN bus issue • Message containing configuration ID not transmitted by CAN bus master	Using the manufacturer approved diagnostic system, check the CAN configuration in the Terrain Response Control Module, check correct software versions installed and update as necessary. If similar DTCs from other modules suspect CAN bus or CAN bus master ECU, check CAN bus operation, check the CAN configuration in the CAN bus master module, check correct software versions installed and update as necessary. Check the system is operating correctly and the DTC does not return.
U0401-94	Invalid Data Received From ECM/PCM - unexpected operation	• The Terrain Response Control Module has detected that the Engine Control Module component had operated in a way or at a time that it had not been commanded to operate • The engine management system, Engine Control Module is unable to support normal terrain response functionality, the terrain response system will go into default condition • Engine management system fault • Engine Control Module failure	Using the manufacturer approved diagnostic system, check the Engine Control Module for DTCs and refer to the relevant DTC index, rectify as required. Check the system is operating correctly and the DTC does not return
U0402-94	Invalid Data Received From Transmission Control Module - unexpected operation	• The Terrain Response Control Module has detected that the Transmission Control Module component had operated in a way or at a time that it had not been commanded to operate • The transmission system, Transmission Control Module is unable to support normal	Using the manufacturer approved diagnostic system, check the Transmission Control Module for DTCs and refer to the relevant DTC index, rectify as required. Check the system is operating correctly and the DTC does not return

DTC	Description	Possible Cause	Action
		terrain response functionality, the terrain response system will go into default condition • Transmission system fault • Transmission Control Module failure	
U0415-94	Invalid Data Received From Anti-Lock Brake System Control Module - unexpected operation	• The Terrain Response Control Module has detected that the Anti-Lock Brake System control module component had operated in a way or at a time that it had not been commanded to operate • The Anti-Lock Brake System , Anti-Lock Brake System control module is unable to support normal terrain response functionality, the terrain response system will go into default condition • Anti-Lock Brake System fault • Anti-Lock Brake System control module failure	Using the manufacturer approved diagnostic system, check the Anti-Lock Brake System control module for DTCs and refer to the relevant DTC index, rectify as required. Check the system is operating correctly and the DTC does not return. Suspect the Anti-Lock Brake System control module, check and install a new Anti-Lock Brake System control module as required, refer to the new module/component installation note at the top of the DTC Index.
U0437-94	Invalid Data Received From Differential Control Module-Rear - unexpected operation	• The Terrain Response Control Module has detected that the Rear Differential Control Module component had operated in a way or at a time that it had not been commanded to operate • The Rear Differential system, Rear Differential Control Module is unable to support normal terrain response functionality, the terrain response system will go into default condition • Rear Differential system fault • Rear Differential Control Module failure	Using the manufacturer approved diagnostic system, check the Rear Differential Module for DTCs and refer to the relevant DTC index, rectify as required. Check the system is operating correctly and the DTC does not return. Suspect the Rear Differential Module, check and install a new Rear Differential Module as required, refer to the new module/component installation note at the top of the DTC Index.
U2012-4A	Car Configuration Parameter(s) - incorrect component installed	• The Terrain Response Control Module has detected a mismatch between the hardware connected and the hardware expected • Vehicle not correctly configured • Incorrect components installed for vehicle configuration	Using the manufacturer approved diagnostic system, check the vehicle configuration file, rectify as necessary. Check correct components for vehicle configuration are installed, rectify as necessary. Check the system is operating correctly and the DTC does not return.

Published: 06-Jul-2011

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Body Control Module (BCM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For additional information, refer to: Communications Network (418-00 Module Communications Network, Description and Operation).

Body control module (BCM)

DTC	Description	Possible Cause	Action
B100A-11	Fuel Pump Authorisation - circuit short to ground	• Fuel pump authorisation circuit - short to ground	Refer to electrical circuit diagrams and check fuel pump authorisation circuit for short to ground
B100A-15	Fuel Pump Authorisation - circuit short to power or open	• Fuel pump authorisation circuit - short to power, open circuit	Refer to electrical circuit diagrams and check fuel pump authorisation circuit for short to power, open circuit
B1024-08	Transponder - Bus signal/Message Failures	• Transponder - Bus signal/message failures	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B1024-51	Start Control Unit - not programmed	• Start control unit - not configured	Re-configure the start control unit using the manufacturer approved diagnostic system
B1024-81	Start Control unit - invalid serial data received	• Invalid serial data received	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B1024-87	Start control unit - missing message	• Missing message	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B1024-96	Start control unit - component internal failure	• Internal failure	Install a new start control unit, refer to new module/component installation note at the top of the DTC Index
B1025-81	Transponder - invalid serial data	• Invalid serial data received	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B1026-08	Steering Column Lock - Bus Signal/Message Failures	• Steering column lock - Bus signal/message failures	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B1026-51	Steering Column Lock - not programmed	• Steering column lock - not configured	Re-configure the steering column lock using the manufacturer approved diagnostic system
B1026-52	Steering Column Lock - not activated	• Request to enable the steering column lock supply not approved	Check LIN circuit between steering column lock and CJB
B1026-71	Steering Column Lock - actuator stuck	• Should be set if the SCL is unable to reach locked and OK position	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B1026-82	Steering Column Lock	• Steering column lock incorrectly programmed	Install a new steering column lock
B1026-92	Steering Column Lock - performance or incorrect operation	• Micro switch/sensor fault	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B1026-94	Steering Column Lock - unexpected operation	• Status messages are received from the SCL when SCL should be turned off	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B1026-96	Steering Column Lock - component internal failure	• Internal failure	Install a new steering column lock, refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
B1029-21	Accelerator Pedal Sensor signal amplitude < minimum	• Accelerator pedal sensor signal <3% of supply(5V)	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B1029-22	Accelerator Pedal Sensor signal amplitude > maximum	• Accelerator pedal sensor signal >=97% of supply(5V)	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B108A-23	Start button - signal stuck low	• SW1 and SW2 constantly active	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B108B-23	Start Button Circuit "A" - signal stuck low	• SW1 constantly active for long time while button press detected at SW2	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B108B-24	Start button circuit "A" - signal stuck high	• SW1 never active while button press detected at SW2	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B108C-23	Start button circuit "B" - signal stuck low	• SW2 constantly active for long time while button press detected at SW1	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B108C-24	Start button circuit "B" - signal stuck high	• SW2 never active while button press detected at SW1	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B108D-24	Start button circuit "C" signal stuck high	• SW3 never active while button press detected at SW1	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B1095-12	Wiper On/Off Relay - circuit short to power	• Wiper On/Off relay circuit - short to power	Refer to electrical circuit diagrams and check wiper On/Off relay circuit for short to power
B1095-14	Wiper On/Off Relay - circuit short to ground or open	• Wiper On/Off relay circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check wiper On/Off relay circuit for short to ground, open circuit
B1096-12	Wiper High/Low Relay - circuit short to power	• Wiper High/Low relay circuit - short to power	Refer to electrical circuit diagrams and check wiper High/Low relay circuit for short to power
B1096-14	Wiper High/Low Relay - circuit short to ground or open	• Wiper High/Low relay circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check wiper High/Low relay circuit for short to ground, open circuit
B1097-12	Heated Windshield Relay - circuit short to power	• Heated windshield relay circuit - short to power	Refer to electrical circuit diagrams and check heated windshield relay circuit for short to power
B1097-14	Heated Windshield Relay - circuit short to ground or open	• Heated windshield relay circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check heated windshield relay circuit for short to ground, open circuit
B109B-11	License Plate Light - circuit short to ground	• License plate lamp circuit - short to ground	Refer to electrical circuit diagrams and check license plate lamp circuit for short to ground
B109B-13	License Plate Light - open circuit	• License plate lamp circuit - open circuit	Refer to electrical circuit diagrams and check license plate lamp circuit for open circuit
B10A2-02	Crash Input - general signal failure	• Incorrect signal received	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B10A2-11	Crash Input - circuit short to ground	• Crash input circuit - short to ground	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B10A2-15	Crash signal - circuit short to power or open	• Crash signal circuit - short to power, open circuit	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B10A2-68	Crash signal - event information	• Crash signal - event information	Check RCM for DTCs and refer to the relevant DTC Index
B10A5-12	Alarm Siren - circuit short to power	• Alarm siren circuit - short to power	Refer to electrical circuit diagrams and check alarm siren circuit for short to power
B10A5-14	Alarm Siren - circuit short to ground or open	• Alarm siren circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check alarm siren circuit for short to ground, open circuit
B10AC-86	Cruise Control Switch - Signal invalid	• Signal invalid	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B10AC-87	Cruise Control Switch - Missing message	• Missing message	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B10AC-95	Cruise Control Switch - Wrong assembly	• Mis-match between Car Configuration File and vehicle	Check/up-date Car Configuration File using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
B10AD-04	Rain Sensor - System Internal Failure	• Internal sensor failure	Install a new rain sensor, refer to new module/component installation note at the top of the DTC Index
B10AD-09	Rain Sensor - Component Failures	• Rain sensor incorrectly installed • Rain sensor internal failure	Check for correct installation of rain sensor. Install a new sensor as required, refer to new module/component installation note at the top of the DTC Index
B10BE-11	Solar Sensor - circuit short to ground	• Sunload sensor circuit - short to ground	Refer to electrical circuit diagrams and check sunload sensor for short to ground
B10BE-13	Solar Sensor - open circuit	• Sunload sensor circuit - open circuit	Refer to electrical circuit diagrams and check sunload sensor for open circuit
B10C0-12	Fuel Pump Power Supply - circuit short to power	• Fuel pump power supply circuit - short to power	Refer to electrical circuit diagrams and check fuel pump power supply circuit for short to power
B10C0-14	Fuel Pump Power Supply - circuit short to ground or open	• Fuel pump power supply circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check fuel pump power supply circuit for short to ground, open circuit
B10D7-94	PATS Key - unexpected operation	• No response from transponder in key	Replace key
B10E5-11	PCM wake-up signal - circuit short to ground	• Engine Control Module (ECM) wake-up signal circuit - short to ground	Refer to electrical circuit diagrams and check ECM wake-up signal circuit for short to ground
B10E5-15	PCM wake-up signal - circuit short to power or open	• Engine Control Module (ECM) wake-up signal circuit - short to power, open circuit	Refer to electrical circuit diagrams and check ECM wake-up signal circuit for short to power, open circuit
B10E7-12	Ignition On Relay - circuit short to power	• EJB ignition On relay control circuit - short to power	Refer to electrical circuit diagrams and check EJB ignition relay control circuit for short to power
B10E7-14	Ignition On Relay - circuit short to ground or open	• EJB ignition On relay control circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check EJB ignition relay control circuit for short to ground, open circuit
B10EA-12	Positive temperature coefficient heater - circuit short to power	• Positive temperature coefficient heater circuit - short to power	Refer to electrical circuit diagrams and check positive temperature coefficient heater circuit for short to power
B10EA-14	Positive temperature coefficient heater - circuit short to ground or open	• Positive temperature coefficient heater circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check positive temperature coefficient heater circuit for short to ground, open circuit
B10EB-77	Driver door double locking motor - commanded position not reachable	• Incorrect feedback from DDM	Check for Lost Communications DTCs and carry out associated pinpoint test using manufacturer approved diagnostic system. If no lost communication DTC, check double locking mechanism for mechanical failure
B10EC-77	Passenger door double locking motor - commanded position not reachable	• Incorrect feedback from PDM	Check for Lost Communications DTCs and carry out associated pinpoint test using manufacturer approved diagnostic system. If no lost communication DTC, check double locking mechanism for mechanical failure
B10ED-77	Rear door driver side double locking motor - commanded position not reachable	• Incorrect feedback from rear door driver side	Check DDM for Lost Communications DTCs and carry out associated pinpoint test using manufacturer approved diagnostic system. If no lost communication DTC, Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system, check double locking mechanism for mechanical failure
B10EE-77	Rear door passenger side double locking motor - commanded position not reachable	• Incorrect feedback from rear door passenger side	Check PDM for Lost Communications DTCs and carry out associated pinpoint test using manufacturer approved diagnostic system. If no lost communication DTC, Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system, check double locking mechanism for mechanical failure
B10EF-12	Sunroof Speed Output - circuit short to power	• Sunroof speed output circuit - short to power	Refer to electrical circuit diagrams and check sunroof speed output circuit for short to power
B10EF-14	Sunroof Speed Output - circuit short to ground or open	• Sunroof speed output circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check sunroof speed output circuit for short to ground, open circuit
B10F2-12	Sunroof control - circuit short to power	• Sunroof control circuit - short to power	Refer to electrical circuit diagrams and check sunroof control circuit for short to power

DTC	Description	Possible Cause	Action
B10F2-14	Sunroof control - circuit short to ground or open	• Sunroof control circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check sunroof control circuit for short to ground, open circuit
B10F3-11	Left front position light - circuit short to ground	• Left front position light circuit - short to ground	Refer to electrical circuit diagrams and check left front position light circuit for short to ground
B10F4-11	Right front position light - circuit short to ground	• Right front position light circuit - short to ground	Refer to electrical circuit diagrams and check right front position light circuit for short to ground
B10F5-11	Left rear position light - circuit short to ground	• Left rear position light circuit - short to ground	Refer to electrical circuit diagrams and check left rear position light circuit for short to ground
B10F5-12	Left Rear Position light – short circuit to power	• Left rear position light circuit - short to power	Refer to electrical circuit diagrams and check left rear position light circuit for short to power
B10F6-11	Right rear position light - circuit short to ground	• Right rear position light circuit - short to ground	Refer to electrical circuit diagrams and check right rear position light circuit for short to ground
B10F6-12	Right rear position light - short circuit to power	• Right rear position light circuit - short to power	Refer to electrical circuit diagrams and check right rear position light circuit for short to power
B1101-12	Comfort relay - circuit short to power	• Comfort relay control circuit - short to power	Refer to electrical circuit diagrams and check comfort relay control circuit for short to power
B1101-14	Comfort relay - circuit short to ground or open	• Comfort relay control circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check comfort relay control circuit for short to ground, open circuit
B1108-77	Driver door central locking motor - commanded position not reachable	• Incorrect feedback from DDM	Check for Lost Communications DTCs and carry out associated pinpoint test using manufacturer approved diagnostic system. If no lost communication DTC, check central locking mechanism for mechanical failure
B1109-77	Passenger door central locking motor - commanded position not reachable	• Incorrect feedback from PDM	Check for Lost Communications DTCs and carry out associated pinpoint test using manufacturer approved diagnostic system. If no lost communication DTC, check central locking mechanism for mechanical failure
B110A-77	Rear door driver side central locking motor - commanded position not reachable	• Incorrect feedback from rear door driver side	Check DDM for Lost Communications DTCs and carry out associated pinpoint test using manufacturer approved diagnostic system. If no lost communication DTC, Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system, check central locking mechanism for mechanical failure
B110B-77	Rear door passenger side central locking motor - commanded position not reachable	• Incorrect feedback from rear door passenger side	Check PDM for Lost Communications DTCs and carry out associated pinpoint test using manufacturer approved diagnostic system. If no lost communication DTC, Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system, check central locking mechanism for mechanical failure
B1115-11	High Mounted Stoplamp control - circuit short to ground	• High mounted stoplamp control circuit - short to ground	Refer to electrical circuit diagrams and check high mounted stoplamp control circuit for short to ground
B1115-13	High Mounted Stoplamp control - circuit open	• High mounted stoplamp control circuit - open circuit	Refer to electrical circuit diagrams and check high mounted stoplamp control circuit for open circuit
B112A-12	Ignition On Relay B - circuit short to power	• RJB ignition On relay circuit - short to power	Refer to electrical circuit diagrams and check RJB ignition On relay circuit for short to power
B112A-14	Ignition On Relay B - circuit short to ground or open	• RJB ignition On relay circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check RJB ignition On relay circuit for short to ground, open circuit
B112B-07	Steering Wheel Module - Mechanical Failures	• Any position or button on wiper stalk active for more than 60 seconds (180 seconds for speed control buttons) • Switch internal failure	Check for stuck wiper or speed control buttons. Install a new switch as required, refer to new module/component installation note at the top of the DTC Index
B112B-88	Steering Wheel Module - Bus off	• Lost communications with steering wheel module	Carry out diagnostic strategy associated with this DTC using manufacturer approved diagnostic system
B112C-88	Interior Motion Sensor - Bus off	• Lost communications with interior motion sensor	Carry out diagnostic strategy associated with this DTC using manufacturer approved diagnostic system
B1130-07	Light switch module - Mechanical Failures	• Any buttons on the Light Switch Module active for more than 60 seconds or Exterior Light Switch in illegal combination	Check for stuck light switch buttons. Install a new light switch as required, refer to new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
		• Switch internal failure	
B1130-88	Light Switch Module - Bus off	• Lost communications with lighting switch module	Carry out diagnostic strategy associated with this DTC using manufacturer approved diagnostic system
B1131-88	Wiper Motor Module - Bus off	• Lost communications with wiper motor module	Carry out diagnostic strategy associated with this DTC using manufacturer approved diagnostic system
B113C-11	Hazard switch illumination - circuit short to ground	• Hazard switch illumination circuit - short to ground	Refer to electrical circuit diagrams and check hazard switch illumination circuit for short to ground
B113C-15	Hazard switch illumination - circuit short to power or open	• Hazard switch illumination circuit - short to power, open circuit	Refer to electrical circuit diagrams and check hazard switch illumination circuit for short to power, open circuit
B113D-12	Sunroof Global Open/Close Control - circuit short to power	• Roof opening panel global open/close control circuit - short to power	Refer to electrical circuit diagrams and check roof opening panel global open/close control circuit for short to power
B113D-14	Sunroof Global Open/Close Control - circuit short to ground or open	• Roof opening panel global open/close control circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check roof opening panel global open/close control circuit for short to ground, open circuit
B1182-51	Tire Pressure Monitoring System (TPMS) - Not Programmed	• TPMS module in Transport/Factory mode	Enter TPMS module into customer mode using manufacturer approved diagnostic system
B11BC-11	Extended accessory relay - circuit short to ground	• Extended accessory relay circuit - short to ground	Refer to electrical circuit diagrams and check extended accessory relay circuit for short to ground
B11BC-15	Extended accessory relay - circuit short to power or open	• Extended accessory relay circuit - short to power, open circuit	Refer to electrical circuit diagrams and check extended accessory relay circuit for short to power, open circuit
B1A79-11	Rear Fog Lamp - circuit short to ground	• Rear fog lamp supply circuit - short to ground	Refer to electrical circuit diagrams and check rear fog lamp supply circuit for short to ground
B1A79-13	Rear Fog Lamp - circuit open	• Rear fog lamp supply circuit - open circuit	Refer to electrical circuit diagrams and check rear fog lamp supply circuit for open circuit
B1A84-41	Car Configuration Data - general checksum failure	• Checksum error	Configure the CJB as a 'NEW' module using the manufacturer approved diagnostic system
B1A99-04	Power On Reset-System Internal failure	• The DTC will be set if the reset counter reaches the maximum value (currently 5)	Install a new CJB, refer to the new module/component installation note at the top of the DTC Index
B1C96-11	Alarm LED Circuit - circuit short to ground	• Alarm LED circuit - short to ground	Refer to electrical circuit diagrams and check alarm LED circuit for short to ground
B1C96-15	Alarm LED Circuit - circuit short to power or open	• Alarm LED circuit - short to power, open circuit	Refer to electrical circuit diagrams and check alarm LED circuit for short to power, open circuit
B1D00-11	Left-hand Low Beam Circuit - circuit short to ground	• Left-hand low beam circuit - short to ground	Refer to electrical circuit diagrams and check left-hand low beam circuit for short to ground
B1D00-13	Left-hand Low Beam Circuit - circuit open	• Left-hand low beam circuit - open circuit	Refer to electrical circuit diagrams and check left-hand low beam circuit for open circuit
B1D01-11	Right-hand Low Beam Circuit - circuit short to ground	• Right-hand low beam circuit - short to ground	Refer to electrical circuit diagrams and check right-hand low beam circuit for short to ground
B1D01-13	Right-hand Low Beam Circuit - circuit open	• Right-hand low beam circuit - open circuit	Refer to electrical circuit diagrams and check right-hand low beam circuit for open circuit
B1D06-11	Left Turn Indicator - circuit short to ground	• Left turn indicator circuit - short to ground	Refer to electrical circuit diagrams and check left turn indicator circuit for short to ground
B1D06-13	Left Turn Indicator - circuit open	• Left turn indicator circuit - open circuit	Refer to electrical circuit diagrams and check left turn indicator circuit for open circuit
B1D07-11	Right Turn Indicator - circuit short to ground	• Right turn indicator circuit - short to ground	Refer to electrical circuit diagrams and check right turn indicator circuit for short to ground
B1D07-13	Right Turn Indicator - circuit open	• Right turn indicator circuit - open circuit	Refer to electrical circuit diagrams and check right turn indicator circuit for open circuit
B1D17-00	Battery Backed Sounder - General Failure Information	• Internal inclination sensor fault	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
B1D17-88	Battery Backed Sounder - bus off	• Lost communications with battery backed sounder	Carry out the network test associated with this DTC using the manufacturer approved diagnostic system
B1D17-96	Battery Backed Sounder - component internal failure	• Battery backed sounder - internal failure	Install a new battery backed sounder, refer to new module/component installation note at the top of the DTC Index
B1D18-96	Volumetric Sensor Circuit - component internal failure	• Interior motion sensor - internal failure	Install a new interior motion sensor, refer to new module/component installation note at the top of the DTC Index
B1D21-62	Remote Control Switch - Signal compare failure	• A request from a programmed remote key was received and the rolling counter was incorrect	Re-synchronise the remote key by using the key to start the vehicle
B1C55-12	Horn Relay Coil Circuit - circuit short to power	• Horn relay control circuit - short to power	Refer to electrical circuit diagrams and check horn relay control circuit for short to power
B1C55-14	Horn Relay Coil Circuit- circuit short to ground or open	• Horn relay control circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check horn relay control circuit for short to ground, open circuit
B1C82-12	Headlamp Washer Relay Coil Circuit - circuit short to power	• Headlamp washer relay control circuit - short to power	Refer to electrical circuit diagrams and check headlamp washer relay control circuit for short to power
B1C82-14	Headlamp Washer Relay Coil Circuit - circuit short to ground or open	• Headlamp washer relay control circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check headlamp washer relay control circuit for short to ground, open circuit
B1C84-12	Heated Rear Window Relay Output Circuit - circuit short to power	• Heated rear window relay control circuit - short to power	Refer to electrical circuit diagrams and check heated rear window relay control circuit for short to power
B1C84-14	Heated Rear Window Relay Output Circuit - circuit short to ground or open	• Heated rear window relay control circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check heated rear window relay control circuit for short to ground, open circuit
B1C90-12	Auxiliary Driving Lamps Relay Coil Circuit - circuit short to power	• Auxiliary driving lamps relay control circuit - short to power	Refer to electrical circuit diagrams and check auxiliary driving lamps relay control circuit for short to power
B1C90-14	Auxiliary Driving Lamps Relay Coil Circuit - circuit short to ground or open	• Auxiliary driving lamps relay control circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check auxiliary driving lamps relay control circuit for short to ground, open circuit
B1D13-12	Interior Lights #1 Circuit - circuit short to power	• Instrument panel interior lights circuit - short to power	Refer to electrical circuit diagrams and check instrument panel interior lights circuit for short to power
B1D13-14	Interior Lights #1 Circuit - circuit short to ground or open	• Instrument panel interior lights circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check instrument panel interior lights circuit for short to ground, open circuit
B1D1A-12	Interior Lights Circuit 'C' - circuit short to power	• Roof console interior lights circuit - short to power	Refer to electrical circuit diagrams and check roof panel interior lights circuit for short to power
B1D1A-14	Interior Lights Circuit 'C' - circuit short to ground or open	• Roof console interior lights circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check roof panel interior lights circuit for short to ground, open circuit
B1D35-24	Hazard Switch - Signal stuck high	• Hazard switch is active more than 60 seconds	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C0023-11	Stop Lamp Control - circuit short to ground	• Stop lamp control circuit - short to ground	Refer to electrical circuit diagrams and check stop lamp control circuit for short to ground
C0023-13	Stop Lamp Control - circuit open	• Stop lamp control circuit - open circuit	Refer to electrical circuit diagrams and check stop lamp control circuit for open circuit
C1108-11	Pedal Sensor(s) Supply Voltage - circuit short to ground	• Pedal sensor(s) supply voltage circuit - short to ground	Refer to electrical circuit diagrams and check pedal sensor(s) supply voltage circuit for short to ground
C1108-15	Pedal Sensor(s) Supply Voltage - circuit short to power or open	• Pedal sensor(s) supply voltage circuit - short to power, open circuit	Refer to electrical circuit diagrams and check pedal sensor(s) supply voltage circuit for short to power, open circuit
C1A41-21	Clutch Pedal Sensor - signal amplitude < minimum	• signal<3% of supply(5V)	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
C1A41-22	Clutch Pedal Sensor - signal amplitude > maximum	• signal>=97% of supply(5V)	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A56-16	Front Left Wheel Module - circuit voltage below threshold (low battery)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A56-86	Front Left Wheel Module - signal invalid (out of range)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A56-93	Front Left Wheel Module - no operation (lost sensor)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A57-11	Left Front Initiator - short to ground	• Left front initiator circuit - short to ground	Refer to electrical circuit diagrams and check left front initiator circuit for short to ground
C1A57-12	Left Front Initiator - short to power	• Left front initiator circuit - short to power	Refer to electrical circuit diagrams and check left front initiator circuit for short to power
C1A57-13	Left Front Initiator - open circuit	• Left front initiator circuit - open circuit	Refer to electrical circuit diagrams and check left front initiator circuit for open circuit
C1A58-16	Front Right Wheel Module - circuit voltage below threshold (low battery)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A58-86	Front Right Wheel Module - signal invalid (out of range)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A58-93	Front Right Wheel Module - no operation (lost sensor)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A59-11	Right Front Initiator - short to ground	• Right front initiator circuit - short to ground	Refer to electrical circuit diagrams and check right front initiator circuit for short to ground
C1A59-12	Right Front Initiator - short to power	• Right front initiator circuit - short to power	Refer to electrical circuit diagrams and check right front initiator circuit for short to power
C1A59-13	Right Front Initiator - open circuit	• Right front initiator circuit - open circuit	Refer to electrical circuit diagrams and check right front initiator circuit for open circuit
C1A60-16	Rear Left Wheel Module - circuit voltage below threshold (low battery)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A60-86	Rear Left Wheel Module - signal invalid (out of range)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A60-93	Rear Left Wheel Module - no operation (lost sensor)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A61-11	Left Rear Initiator - short to ground	• Left rear initiator circuit - short to ground	Refer to electrical circuit diagrams and check left rear initiator circuit for short to ground
C1A61-12	Left Rear Initiator - short to power	• Left rear initiator circuit - short to power	Refer to electrical circuit diagrams and check left rear initiator circuit for short to power
C1A61-13	Left Rear Initiator - open circuit	• Left rear initiator circuit - open circuit	Refer to electrical circuit diagrams and check left rear initiator circuit for open circuit
C1A62-16	Rear Right Wheel Module - circuit voltage below threshold (low battery)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A62-86	Rear Right Wheel Module - signal invalid (out of range)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A62-93	Rear Right Wheel Module - no operation (lost sensor)	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A63-11	Right Rear Initiator - short to ground	• Right rear initiator circuit - short to ground	Refer to electrical circuit diagrams and check right rear initiator circuit for short to ground
C1A63-12	Right Rear Initiator - short to battery	• Right rear initiator circuit - short to power	Refer to electrical circuit diagrams and check right rear initiator circuit for short to power

DTC	Description	Possible Cause	Action
C1A63-13	Right Rear Initiator - open circuit	• Right rear initiator circuit - open circuit	Refer to electrical circuit diagrams and check right rear initiator circuit for open circuit
C1B14-12	Sensor supply #1 - circuit short to power	• Sensor supply #1 circuit - short to power	Refer to electrical circuit diagrams and check sensor supply #1 circuit for short to power
C1D18-00	Localisation failed	• Tire pressure monitor localisation failed	Check for additional related DTCs and refer to this DTC Index
C1D21-05	Wheel module - general signal failure	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1D22-49	Steering Wheel Switch Right Module - Internal failure	• Steering wheel switch right module - internal failure	Install a new wash/wipe switch, refer to new module/component installation note at the top of the DTC Index
C2003-07	Steering Wheel Switch Left Module - Mechanical Failures	• Steering wheel switch left module - mechanical failure	Install a new indicator switch, refer to new module/component installation note at the top of the DTC Index
C2003-49	Steering Wheel Switch Left Module - Internal failure	• Steering wheel switch left module - internal failure	Install a new indicator switch, refer to new module/component installation note at the top of the DTC Index
C2004-12	Headlamp washer relay B - circuit short to power	• Headlamp washer relay B circuit - short to power	Refer to electrical circuit diagrams and check headlamp washer relay B circuit for short to power
C2004-14	Headlamp washer relay B - circuit short to ground or open	• Headlamp washer relay B circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check headlamp washer relay B circuit for short to ground, open circuit
P0460-15	Fuel Level Sensor A - short to battery or open circuit	• Fuel tank unit circuit A short to power, open circuit	• NOTE: Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Refer to the electrical circuit diagrams and check the circuit between the central junction box and the fuel tank unit circuit (F/P sensor) for short to power, open circuit. Using the manufacturer approved diagnostic system check and install latest relevant level of software to the central junction box and the instrument panel cluster. If the level of software is correct carry out a battery reset
P0462-00	Fuel Level Sensor A - no subtype information	• Fuel tank unit circuit A short to ground or high resistance	• NOTE: Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Refer to the electrical circuit diagrams and check the circuit between the central junction box and the fuel tank unit circuit (F/P sensor) for short to ground. Using the manufacturer approved diagnostic system check and install latest relevant level of software to the central junction box and the instrument panel cluster. If the level of software is correct carry out a battery reset
P0604-00	Internal Control Module Random Access Memory (RAM) Error	• RAM Checksum not correct	Install a new CJB, refer to the new module/component installation note at the top of the DTC Index
P0605-00	Internal Control Module Read Only Memory (ROM) Error	• ROM Checksum not correct	Install a new CJB, refer to the new module/component installation note at the top of the DTC Index
P062F-00	Internal Control Module Read Only Memory (ROM) Error	• EEP read back value does not match written value	Install a new CJB, refer to the new module/component installation note at the top of the DTC Index
P0801-11	Reverse inhibit control circuit - circuit short to ground	• Reverse inhibit control circuit - short to ground	Refer to electrical circuit diagrams and check reverse inhibit control circuit for short to ground
P1346-13	Fuel Level Sensor B - open circuit	• Fuel tank unit circuit B short to power, open circuit	• NOTE: Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Refer to the electrical circuit diagrams and check the circuit between the central junction box and the fuel tank unit circuit (Fuel eject sensor) for short to power, open circuit. Using the manufacturer approved diagnostic system check and install latest relevant level of software to the central junction box and the instrument panel cluster. If the level of software is correct carry out a battery reset
P1348-00	Fuel Level Sensor B - no subtype information	• Fuel tank unit circuit B short to ground	• NOTE: Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Refer to the electrical circuit diagrams and check the circuit between the central junction box and the fuel

DTC	Description	Possible Cause	Action
			tank unit circuit (Fuel eject sensor) for short to ground. Using the manufacturer approved diagnostic system check and install latest relevant level of software to the central junction box and the instrument panel cluster. If the level of software is correct carry out a battery reset
P1674-00	Control Module Software Corrupted	• A software assertion failed within the module	Load the latest relevant level of software using the manufacturer approved diagnostic system
U0001-00	High Speed CAN Communication Bus	• Bus Off	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0010-00	Medium Speed CAN Communication Bus	• Bus Off	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0100-00	Lost Communication With ECM/PCM 'A'	• Lost communication with ECM	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0101-00	Lost Communication with TCM	• Lost communication with TCM	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0104-00	Lost Communication With Speed Control Module	• Lost communication with speed control module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0126-00	Lost Communication With Steering Angle Sensor Module	• Lost communication with steering angle sensor	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0129-00	Lost Communication With Brake System Control Module	• Lost communication with ABS module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0135-00	Lost Communication With Differential Control Module - Front	• Lost communication with differential control module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module	• Lost communication with instrument cluster	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0156-00	Lost Communication With Information Center "A"	• Lost communication with information center	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0159-00	Lost Communication With Parking Assist Control Module "A"	• Lost communication with parking aid module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0164-00	Lost Communication With HVAC Control Module	• Lost communication with climate control module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0166-00	Lost Communication With Auxiliary Heater Control Module	• Lost communication with auxiliary heater control module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0181-00	Lost Communication With Headlamp Levelling Control Module	• Lost communication with headlamp Levelling control module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0199-00	Lost Communication With "Door Control Module A"	• Lost communication with Driver Door Module (DDM)	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0200-00	Lost Communication With "Door Control Module B"	• Lost communication with Passenger Door Module (PDM)	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0208-00	Lost Communication With "Seat Control Module A"	• Lost communication with Passenger Seat Module (PSM)	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0214-00	Lost Communication With Remote Function Actuation	• Lost communication with Remote Keyless Entry module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0231-00	Lost Communication With Rain Sensing Module	• Lost communication with rain sensing module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0236-00	Lost Communication With Column Lock Module	• Lost communication with steering column lock module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0252-00	Lost Communication With Lighting Control Module - Rear 'B'	• Lost communication with trailer module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U0301-00	Software Incompatibility with ECM/PCM	• ECM disconnected • Incorrect ECM installed	Check electrical connections to ECM. Check correct ECM is installed

DTC	Description	Possible Cause	Action
U0401-00	Invalid Data Received From ECM/PCM	• Invalid data received from ECM	Check ECM for DTCs and refer to DTC Index
U0405-00	Invalid Data Received From Cruise Control Module	• Invalid data received from speed control module	Check speed control module for DTCs and refer to DTC Index
U0515-00	Invalid data received from remote function actuation	• Invalid data received from keyless entry module	Check keyless entry module for DTCs and refer to DTC Index. Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
U2005-62	Vehicle Speed - Signal compare failure	• Vehicle Speed - Signal compare failure	Check ABS for DTCs and refer to DTC Index
U2010-11	Switch Illumination - circuit short to ground	• Switch illumination circuit - short to ground	Refer to electrical circuit diagrams and check switch illumination circuit for short to ground
U2010-15	Switch Illumination - circuit short to power or open	• Switch illumination circuit - short to power, open circuit	Refer to electrical circuit diagrams and check switch illumination circuit for short to power, open circuit
U2017-41	Control Module Software #2 - general checksum failure	• Signal configuration checksum not correct	Install latest relevant level of software using the manufacturer approved diagnostic system
U2018-41	Control Module Software #3 - general checksum failure	• Local configuration checksum not correct	Install latest relevant level of software using the manufacturer approved diagnostic system
U2101-00	Control Module Configuration Incompatible	• Each function reports if a car configuration parameter has a value that is unknown	Check and reload Car Configuration File
U3000-51	Control Module - not programmed	• Car config or Local config or Signal config is not loaded	Install latest relevant level of software using the manufacturer approved diagnostic system
U3003-16	Battery Voltage	• Circuit voltage below threshold	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
U3003-17	Battery Voltage	• Circuit voltage above threshold	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Cellular Telephone Control Module (Bluetooth Telephone Module) (BPM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the cellular phone system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Cellular Phone (415-01 Information and Entertainment System, Description and Operation).

Bluetooth Module

DTC	Description	Possible Cause	Action
B1A5613	Bluetooth antenna	Bluetooth antenna circuit - open circuit	Refer to electrical circuit diagrams and check bluetooth antenna circuit for open circuit
B1D7984	Microphone input	Signal amplitude below minimum	Carry out MOST system checks using manufacturer approved diagnostic system
U1A0088	Private Bus circuit	BT chipset communications failure	Install a new bluetooth module. For additional information, refer to: Bluetooth Module (415-01 Information and Entertainment System, Removal and Installation).
U210000	Control module	Initial configuration incomplete	Re-configure the CJB using the manufacturer approved diagnostic system. If DTC remains carry out CAN Network integrity tests using the manufacturer approved diagnostic system
U210100	Control module	Configuration incompatible	Check/up-date Car Configuration File using manufacturer approved diagnostic system
U300044	Control module	Data memory failure	Install a new bluetooth module. For additional information, refer to: Bluetooth Module (415-01 Information and Entertainment System, Removal and Installation).
U300045	Control module	Program memory failure	Install a new bluetooth module. For additional information, refer to: Bluetooth Module (415-01 Information and Entertainment System, Removal and Installation).
U300055	Control module	Incorrect Car Configuration File data received	Check/up-date Car Configuration File using manufacturer approved diagnostic system
U300087	Control module	Missing message	Check CJB for DTCs and refer to DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). Check information and entertainment module for Car Configuration File and MOST network DTCs and refer to relevant DTC Index. Carry out MOST/CAN network tests using the manufacturer approved diagnostic system
U300098	Control module	Over temperature	Check for additional DTCs and refer to DTC Index. Check/monitor system for re-occurrence
U300362	Battery voltage	Mis-match in battery voltage, of 2 volts or more, between bluetooth module and CJB	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Published: 28-Apr-2011

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Digital Audio Broadcast Module (DABM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the digital audio broadcast system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Digital Audio Broadcast Module (DAB)

DTC	Description	Possible Cause	Action
B11A4-11	L-Band antenna	DAB L-Band antenna circuit - short to ground	Refer to electrical circuit diagrams and check DAB L-Band antenna circuit for short to ground
B11A4-13	L-Band antenna	DAB L-Band antenna circuit - open circuit	Refer to electrical circuit diagrams and check DAB L-Band antenna circuit for open circuit
B11A5-11	Band 3 antenna	DAB Band 3 antenna circuit - short to ground	Refer to electrical circuit diagrams and check DAB Band 3 antenna circuit for short to ground
B11A5-13	Band 3 antenna	DAB Band 3 antenna circuit - open circuit	Refer to electrical circuit diagrams and check DAB Band 3 antenna circuit for open circuit
U3000-04	Control module	System internal failure	Install a new digital audio broadcast module. For additional information, refer to: Satellite Radio Tuner (415-01 Information and Entertainment System, Removal and Installation).
U3000-4A	Control module	Incorrect component installed	Install a new digital audio broadcast module or Re-configure the digital audio broadcast module using the manufacturer approved diagnostic system
U3000-55	Control module	Incorrect Car Configuration File data received	Check/up-date Car Configuration File using manufacturer approved diagnostic system
U3000-87	Control module	Missing message	Check CJB for DTCs and refer to DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). Check information and entertainment module for Car Configuration File and MOST network DTCs and refer to relevant DTC Index. Carry out MOST/CAN network tests using the manufacturer approved diagnostic system
U3000-98	Control module	Component or system over temperature	Check for additional DTCs and refer to relevant DTC Index. Check/monitor system for re-occurrence
U3003-62	Battery voltage	Mis-match in battery voltage, of 2 volts or more, between digital broadcast module and CJB	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Driver/Passenger Door Module (DDM/PDM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the driver passenger door system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Handles, Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Driver/passenger door module

B108F-23	Cabin Lock/Unlock Switch	• Signal stuck low	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B10ED-11	Rear door driver side double locking motor	• Circuit short to ground	Refer to the electrical circuit diagrams and check rear door driver side double locking motor control circuit for short to ground
B10ED-15	Rear door driver side double locking motor	• Circuit short to power or open	Refer to the electrical circuit diagrams and check rear door driver side double locking motor control circuit for short to power, open circuit
B10EE-11	Rear door passenger side double locking motor	• Circuit short to ground	Refer to the electrical circuit diagrams and check rear door passenger side double locking motor control circuit for short to ground
B10EE-15	Rear door passenger side double locking motor	• Circuit short to power or open	Refer to the electrical circuit diagrams and check rear door passenger side double locking motor control circuit for short to power, open circuit
B110A-11	Rear door driver side central locking motor	• Circuit short to ground	Refer to electrical circuit diagrams and check rear door driver side central locking motor control circuit for short to ground
B110A-15	Rear door driver side central locking motor	• Circuit short to power or open	Refer to electrical circuit diagrams and check rear door driver side central locking motor control circuit for short to power, open circuit
B110B-11	Rear door passenger side central locking motor	• Circuit short to ground	Refer to electrical circuit diagrams and check rear door passenger side central locking motor control circuit for short to ground
B110B-15	Rear door passenger side central locking motor	• Circuit short to power or open	Refer to electrical circuit diagrams and check rear door passenger side central locking motor control circuit for short to power, open circuit
B117C-07	Rear Power Window up	• Mechanical Failure	Check for mechanical failure of rear window mechanism
B117C-72	Rear Power Window up	• Actuator Stuck Open	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117C-73	Rear Power Window up	• Actuator Stuck Closed	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117C-92	Rear Power Window up	• Performance or incorrect operation	Refer to electrical circuit diagrams and check power and ground supplies to rear door module
B117D-72	Rear Power Window down	• Actuator Stuck Open	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117D-73	Rear Power Window down	• Actuator Stuck Closed	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index

B117E-07	Front Power Window up	• Mechanical failure	Check for mechanical failure of front window mechanism
B117E-72	Front Power Window up	• Actuator stuck open	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117E-73	Front Power Window up	• Actuator stuck closed	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F-72	Front Power Window down	• Actuator stuck open	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F-73	Front Power Window down	• Actuator stuck closed	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B11D1-83	LIN Bus Circuit "C"	• Value of signal protection calculation incorrect	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack, refer to new module/component installation note at the top of the DTC Index
B11D1-86	LIN Bus Circuit "C"	• Signal Invalid	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack, refer to new module/component installation note at the top of the DTC Index
B11D1-87	LIN Bus Circuit "C"	• Missing Message	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack, refer to new module/component installation note at the top of the DTC Index
B11F6-11	Driver Folding Mirror Motor	• Short To Ground	Refer to electrical circuit diagrams and check driver folding mirror motor for short to ground
B11F6-15	Driver Folding Mirror Motor	• Short to power or open	Refer to electrical circuit diagrams and check driver folding mirror motor for short to power, open circuit
B11F7-11	Passenger Folding Mirror Motor	• Short To Ground	Refer to electrical circuit diagrams and check passenger folding mirror motor for short to ground
B11F7-15	Passenger Folding Mirror Motor	• Short to power or open	Refer to electrical circuit diagrams and check passenger folding mirror motor for short to power, open circuit
B1A98-83	LIN Bus Circuit #1	• Value of signal protection calculation incorrect	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test LIN circuit between driver side rear door module and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack, refer to new module/component installation note at the top of the DTC Index
B1A98-86	LIN Bus Circuit #1	• Signal Invalid	Refer to the electrical circuit diagrams and test LIN circuit between driver side rear door module and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack, refer to new module/component installation note at the top of the DTC Index
B1A98-87	LIN Bus Circuit #1	• Missing Message	Refer to the electrical circuit diagrams and test LIN circuit between driver side rear door module and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack, refer to new module/component installation note at the top of the DTC Index
B1C39-29	Key Lock Switch	• Signal invalid	Carry out the associated pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1B15-11	Sensor Supply #2	• Short to ground	Refer to the electrical circuit diagrams and test rear window sensor supply circuit for short to ground
C1B15-15	Sensor Supply #2	• Short to power or open circuit	Refer to the electrical circuit diagrams and test rear window sensor supply circuit for short to power or open circuit
U2004-24	Auxiliary Switch Pack	• Signal stuck high	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Driver/Passenger door module (DDM/PDM)

DTC	Description	Possible Cause	Action
B109C-15	Front Courtesy Light	• Short to power or open circuit	Refer to the electrical circuit diagrams and test front courtesy light circuit for short to power or open circuit
B109D-11	Front Courtesy Light	• Short to ground	Refer to the electrical circuit diagrams and test front courtesy light circuit for short ground
B10EB-11	Driver door double locking motor	• Short to ground	Refer to the electrical circuit diagrams and test driver door double locking motor circuit for short ground
B10EB-15	Driver door double locking motor	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver door double locking motor circuit for short to power or open circuit
B10EC-11	Passenger door double locking motor	• Short to ground	Refer to the electrical circuit diagrams and test passenger door double locking motor circuit for short ground
B10EC-15	Passenger door double locking motor	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger door double locking motor circuit for short to power or open circuit

DTC	Description	Possible Cause	Action
B1108-11	Driver door central locking motor	• Short to ground	Refer to the electrical circuit diagrams and test driver door central locking motor circuit for short ground
B1108-15	Driver door central locking motor	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver door central locking motor circuit for short to power or open circuit
B1109-11	Passenger door central locking motor	• Short to ground	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1109-15	Passenger door central locking motor	• Short to power or open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1163-11	Left Mirror Heater Output short to ground	• Short to ground	Refer to the electrical circuit diagrams and test left mirror heater output circuit for short to ground
B1163-15	Left Mirror Heater Output short to power	• Short to power or open circuit	Refer to the electrical circuit diagrams and test left mirror heater output circuit for short to power or open circuit
B1164-11	Right Mirror Heater Output short to ground	• Short to ground	Refer to the electrical circuit diagrams and test right mirror heater output circuit for short to ground
B1164-15	Right Mirror Heater Output short to power	• Short to power or open circuit	Refer to the electrical circuit diagrams and test right mirror heater output circuit for short to power or open circuit
B1165-11	Left Front Puddle Lamp Output short to ground	• Short to ground	Refer to the electrical circuit diagrams and test left front puddle lamp output circuit for short to ground
B1165-15	Left Front Puddle Lamp Output open load or short to power	• Short to power or open circuit	Refer to the electrical circuit diagrams and test left front puddle lamp output circuit for short to power or open circuit
B1166-11	Right Front Puddle Lamp Output short to ground	• Short to ground	Refer to the electrical circuit diagrams and test right front puddle lamp output circuit for short to ground
B1166-15	Right Front Puddle Lamp Output open load or short to battery	• Short to power or open circuit	Refer to the electrical circuit diagrams and test right front puddle lamp output circuit for short to power or open circuit
B117E-72	Front Power Window up	• Actuator stuck open	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117E-73	Front Power Window up	• Actuator stuck closed	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F-72	Front Power Window down	• Actuator stuck open	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F-73	Front Power Window down	• Actuator stuck closed	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B1189-29	Front Window Position Sensor	• Signal invalid	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B118A-29	Rear Window Position Sensor	• Signal invalid	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A94-11	Driver Mirror	• Short to ground	Refer to the electrical circuit diagrams and test driver mirror fold motor circuit for short to ground
B1A94-15	Driver Mirror	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver mirror fold motor circuit for short to power or open circuit
B1A95-11	Passenger Mirror	• Short to ground	Refer to the electrical circuit diagrams and test passenger mirror fold motor circuit for short to ground
B1A95-15	Passenger Mirror	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger mirror fold motor circuit for short to power or open circuit
B1A98-83	LIN Bus Circuit #1	• Value of signal protection calculation incorrect	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack, refer to new module/component installation note at the top of the DTC Index
B1A98-86	LIN Bus Circuit #1	• Signal Invalid	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack, refer to new module/component installation note at the top of the DTC Index
B1A98-87	LIN Bus Circuit #1	• Missing Message	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack, refer to new module/component installation note at the top of the DTC Index
B1C09-11	Driver Left/Right Mirror Motor Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver left/right mirror motor circuit for short to ground

DTC	Description	Possible Cause	Action
B1C09-15	Driver Left/Right Mirror Motor Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver left/right mirror motor circuit for short to power or open circuit
B1C10-11	Driver Up/Down Mirror Motor Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver up/down mirror motor circuit for short to ground
B1C10-15	Driver Up/Down Mirror Motor Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver up/down mirror motor circuit for short to power or open circuit
B1C11-11	Passenger Left/Right Mirror Motor Circuit	• Short to ground	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C11-15	Passenger Left/Right Mirror Motor Circuit	• Short to power or open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C12-11	Passenger Up/Down Mirror Motor Circuit	• Short to ground	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C12-15	Passenger Up/Down Mirror Motor Circuit	• Short to power or open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C13-11	Driver Up/Down Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to ground
B1C13-15	Driver Up/Down Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to power or open circuit
B1C14-11	Driver Left/Right Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to ground
B1C14-15	Driver Left/Right Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to power or open circuit
B1C15-11	Passenger Up/Down Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to ground
B1C15-15	Passenger Up/Down Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to power or open circuit
B1C16-11	Passenger Left/Right Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to ground
B1C16-15	Passenger Left/Right Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to power or open circuit
C1B14-11	Sensor Supply #1	• Short to ground	Refer to the electrical circuit diagrams and test window sensor supply circuit for short to ground
C1B14-15	Sensor Supply #1	• Short to power or open circuit	Refer to the electrical circuit diagrams and test window sensor supply circuit for short to power or open circuit
U0010-00	Medium speed CAN communication Bus	• Medium speed CAN communication Bus	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0140-00	Lost communication with CJB	• Logged when subscribed CAN message missing from CJB	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0208-00	Lost communication With Driver Seat Module (DSM)	• Missing message	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0300-00	Internal control module software incompatibility	• Invalid configuration message is received	Re-configure the CJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the DDM/PDM, refer to the new module installation note at the top of the DTC Index
U2002-24	Switch	• Signal stuck high	Clear DTC and re-test. If DTC remains, install a new passenger side window switch
U2010-11	Switch illumination	• Circuit short to ground	Carry out CAN network tests using the manufacturer approved diagnostic system
U2010-12	Switch illumination	• Circuit short to battery	Carry out CAN network tests using the manufacturer approved diagnostic system
U2012-08	Car Configuration Parameter(s)	• Bus signal/message failures	Cycle the ignition status and re-test. If DTC remains, re-configure the RJB using the manufacturer approved diagnostic system
U2013-24	Switch Pack	• Signal stuck high	Clear DTC and re-test. If DTC remains, install a new driver side window switch pack, refer to new module/component installation note at the top of the DTC Index
U2014-44	Control module hardware	• Data Memory Failure	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
U2100-00	Initial configuration not complete	• No sub type information	Re-configure the DDM/PDM using the manufacturer approved diagnostic system
U3000-49	Control module	• Internal electronic failure	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
U3002-55	Vehicle Identification Number (VIN)	• Not configured	Re-configure the relevant module as new using the manufacturer approved diagnostic system and re-test. If DTC remains install a new module, refer to the new module installation note at the top of the DTC Index
U3002-81	Vehicle Identification Number (VIN)	• Vehicle/component mis-match. Corrupt VIN data being transmitted, module previously installed to other vehicle	Install original module, check for DTCs and refer to relevant DTC Index
U3003-62	Battery voltage	• Mis-match of battery voltage, of 2 volts or lower, between DDM/PDM and CJB	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Driver Seat Module (DSM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the driver seat system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Seats (501-10 Seating, Description and Operation).

Driver seat module (DSM).

DTC	Description	Possible Cause	Action
B1060-11	Seat Headrest Motor Output - Circuit short to ground	• Seat headrest motor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check seat headrest motor circuit for short circuit to ground
B1060-15	Seat Headrest Motor Output - Circuit short to battery or open	• Seat headrest motor circuit short circuit to power, open circuit	• Refer to the electrical circuit diagrams and check seat headrest motor circuit for short circuit to power, open circuit
B1064-31	Seat Headrest Motor Sensor - No signal	• Seat headrest motor sensor circuit open circuit, high resistance • Seat headrest motor sensor internal failure	• Refer to the electrical circuit diagrams and check seat headrest motor sensor circuit for open circuit, high resistance • Check and install new seat headrest motor sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
B106D-24	Headrest Up Switch - Signal stuck high	• Seat headrest up switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check seat headrest up switch circuit for short circuit to power
B106E-24	Headrest Down Switch - Signal stuck high	• Seat headrest down switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check seat headrest down switch circuit for short circuit to power
B1087-83	Lin Bus "A" - Value of signal protection calculation incorrect	• Seat and memory switch pack internal failure	• Check and install new seat and memory switch pack as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
B1087-86	Lin Bus "A" - Signal invalid	• Seat and memory switch pack internal failure	• Check and install new seat and memory switch pack as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
B1087-87	Lin Bus "A" - Missing message	• Seat and memory switch pack circuit open circuit • Seat and memory switch pack internal failure	• Refer to the electrical circuit diagrams and check seat and memory switch pack circuit for communication fault • Check and install new seat and memory switch pack as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component

DTC	Description	Possible Cause	Action
B1B86-11	Seat Height Motor Relay - Circuit short to ground	• Seat height motor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check seat height motor circuit for short circuit to ground
B1B86-15	Seat Height Motor Relay - Circuit short to battery or open	• Seat height motor circuit short circuit to power, open circuit	• Refer to the electrical circuit diagrams and check seat height motor circuit for short circuit to power, open circuit
B1B87-31	Seat Height Motor Speed/Position Sensor - No signal	• Seat height motor speed/position sensor circuit open circuit, high resistance • Seat height motor speed/position sensor internal failure	• Refer to the electrical circuit diagrams and check seat height motor speed/position sensor circuit for open circuit, high resistance • Check and install new seat height motor speed/position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
B1B88-11	Seat Slide Motor Relay - Circuit short to ground	• Seat slide motor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check seat slide motor circuit for short circuit to ground
B1B88-15	Seat Slide Motor Relay - Circuit short to battery or open	• Seat slide motor circuit short circuit to power, open circuit	• Refer to the electrical circuit diagrams and check seat slide motor circuit for short circuit to power, open circuit
B1B89-31	Seat Slide Motor Speed/Position Sensor - No signal	• Seat slide motor speed/position sensor circuit open circuit, high resistance • Seat slide motor speed/position sensor internal failure	• Refer to the electrical circuit diagrams and check seat slide motor speed/position sensor circuit for open circuit, high resistance • Check and install new seat slide motor speed/position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
B1B90-11	Seat Tilt Motor Relay - Circuit short to ground	• Seat tilt motor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check seat tilt motor circuit for short circuit to ground
B1B90-15	Seat Tilt Motor Relay - Circuit short to battery or open	• Seat tilt motor circuit short circuit to power, open circuit	• Refer to the electrical circuit diagrams and check seat tilt motor circuit for short circuit to power, open circuit
B1B91-31	Seat Tilt Motor Speed/Position Sensor - No signal	• Seat tilt motor speed/position sensor circuit open circuit, high resistance • Seat tilt motor speed/position sensor internal failure	• Refer to the electrical circuit diagrams and check seat tilt motor speed/position sensor circuit for open circuit, high resistance • Check and install new seat tilt motor speed/position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
B1B92-11	Seat Recline Motor Relay - Circuit short to ground	• Seat recline motor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check seat recline motor circuit for short circuit to ground
B1B92-15	Seat Recline Motor Relay - Circuit short to battery or open	• Seat recline motor circuit short circuit to power, open circuit	• Refer to the electrical circuit diagrams and check seat recline motor circuit for short circuit to power, open circuit
B1B93-31	Seat Recline Motor Speed/Position Sensor - No signal	• Seat recline motor speed/position sensor circuit open circuit, high resistance • Seat recline motor speed/position sensor internal failure	• Refer to the electrical circuit diagrams and check seat recline motor speed/position sensor circuit for open circuit, high resistance • Check and install new seat recline motor speed/position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
B1B94-24	Seat Height Up Switch - Signal stuck high	• Seat height up switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check seat height up switch circuit short circuit to power
B1B95-24	Seat Height Down Switch - Signal stuck high	• Seat height down switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check seat height down switch circuit short circuit to power
B1B96-24	Seat Slide Forward Switch - Signal stuck high	• Seat slide forward switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check seat slide forward switch circuit short circuit to power

DTC	Description	Possible Cause	Action
B1B97-24	Seat Slide Backward Switch - Signal stuck high	• Seat slide backward switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check seat slide backward switch circuit short circuit to power
B1B98-24	Seat Tilt Up Switch - Signal stuck high	• Seat tilt up switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check seat tilt up switch circuit short circuit to power
B1B99-24	Seat Tilt Down Switch - Signal stuck high	• Seat tilt down switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check seat tilt down switch circuit short circuit to power
B1C00-24	Seat Recline Up Switch - Signal stuck high	• Seat recline up switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check seat recline up switch circuit short circuit to power
B1C01-24	Seat Recline Down Switch - Signal stuck high	• Seat recline down switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check seat recline down switch circuit short circuit to power
B1C02-24	Memory Store Switch - Signal stuck high	• Memory store switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check memory store switch circuit short circuit to power
B1C03-24	Memory #1 Switch - Signal stuck high	• Memory #1 switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check memory #1 switch circuit short circuit to power
B1C04-24	Memory #2 Switch - Signal stuck high	• Memory #2 switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check memory #2 switch circuit short circuit to power
B1C05-24	Memory #3 Switch - Signal stuck high	• Memory #3 switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check memory #3 switch circuit short circuit to power
U0010-88	Medium Speed CAN Communication Bus - Bus off	• Medium speed CAN bus circuit fault	• Refer to the electrical circuit diagrams and check the power and ground connections to the module • Using the manufacturer approved diagnostic system, complete a CAN network integrity test • Refer to the electrical circuit diagrams and check the CAN network
U0140-00	Lost Communication With Body Control Module - No sub type information	• Lost communication with body control module	• Refer to the electrical circuit diagrams and check the power and ground connections to the module • Using the manufacturer approved diagnostic system, complete a CAN network integrity test • Refer to the electrical circuit diagrams and check the CAN network between the seat control module and body control module
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - No sub type information	• Lost communication with instrument panel control module	• Refer to the electrical circuit diagrams and check the power and ground connections to the module • Using the manufacturer approved diagnostic system, complete a CAN network integrity test • Refer to the electrical circuit diagrams and check the CAN network between seat control module and instrument panel cluster control module
U0199-00	Lost Communication With "Door Control Module A" - No sub type information	• Lost communication with door control module	• Refer to the electrical circuit diagrams and check the power and ground connections to the module • Using the manufacturer approved diagnostic system, complete a CAN network integrity test • Refer to the electrical circuit diagrams and check the CAN network between seat control module and door control module
U0300-00	Internal Control Module Software Incompatibility - No sub type information	• Seat control module is not configured correctly	• Using the manufacturer approved diagnostic system check and install latest relevant level of software to the seat control module. Clear the diagnostic trouble code and re-test
U1A14-49	CAN Initialisation Failure - Internal electronic failure	• Seat control module internal failure	• Using the manufacturer approved diagnostic system check and install latest relevant level of software to the seat control module. Clear the diagnostic trouble code and re-test • If fault persists, check and install a new seat control module. Refer to the warranty policy and procedures manual, or determine if any

DTC	Description	Possible Cause	Action
			prior approval programme is in operation, prior to the installation of a new module/ component
U1A4C-00	Build / End of Line mode Active - No sub type information	• Error/mismatch in car configuration file	• Using the manufacturer approved diagnostic system check and up-date the car configuration file as required. Clear the DTC and re-test • Check and install a new seat control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
U3000-49	Control Module - Internal electronic failure	• Seat control module internal failure	• Check and install a new seat control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
U3001-46	Control Module Improper Shutdown - Calibration / parameter memory failure	• Event information • Seat control module whilst in manufacturing mode the power has been disconnected	• DTC for information only. Clear the DTC and retest. If the problem persists, renew the module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
U3002-81	Vehicle Identification Number - Invalid serial data received	• Error/mismatch in car configuration file • The seat control module has previously been installed to another vehicle	• Using the manufacturer approved diagnostic system check and up-date the car configuration file as required. Clear the DTC and re-test • Check and install the original, or a new seat control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
U3003-16	Battery Voltage – Circuit voltage below threshold	• Seat control module supply voltage below threshold	• Check vehicle battery and charging system, repair as required. Refer to the relevant section in the workshop manual. Refer to the electrical circuit diagrams and check the power and ground supply circuits to the seat control module. Clear the DTC and re-test
U3003-17	Battery Voltage – Circuit voltage above threshold	• Seat control module supply voltage above threshold	• Check vehicle battery and charging system, repair as required. Refer to the relevant section in the workshop manual. Refer to the electrical circuit diagrams and check the power and ground supply circuits to the seat control module. Clear the DTC and re-test

General Information - Diagnostic Trouble Code (DTC) IndexTD4 2.2L Diesel, DTC: Engine Control Module (ECM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For additional information on the description and operation of the system: For additional information, refer to: Engine (303-01B Engine - TD4 2.2L Diesel, Description and Operation).

Powertrain control module diesel (PCMD)

DTC	Description	Possible Cause	Action
B10A2-68	Crash Input - Event information	• Air bag event detected	• Using the manufacturer approved diagnostic system, check restraints control module, for related DTCs and refer to the relevant DTC index
P0016-00	Crankshaft Position - Camshaft Position Correlation - Bank 1 Sensor A - No sub type information	• Engine timing incorrect • Timing chain installed incorrectly • The relative positions of the crankshaft position sensor and cam timing plate teeth are not correct	• Check engine timing • Check camshaft sensor timing plate is installed correctly • Check valve timing • Check timing chain installed correctly
P0030-12	HO2S Heater Control Circuit (Bank 1, Sensor 1) - Circuit short to battery	• NOTE: - Circuit O_T_SHT1 - • Front heated oxygen sensor heater control circuit short circuit to power • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check front heated oxygen sensor heater control circuit for short circuit to power • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0030-13	HO2S Heater Control Circuit (Bank 1, Sensor 1) - Circuit open	• NOTE: - Circuit O_T_SHT1 - • Front heated oxygen sensor heater control circuit high resistance, open circuit • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check the front heated oxygen sensor heater control circuit for high resistance, open circuit • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0031-11	HO2S Heater Control Circuit Low (Bank 1, Sensor 1) - Circuit short to ground	• NOTE: - Circuit O_T_SHT1 - • Front heated oxygen sensor heater control circuit short circuit to ground • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check front heated oxygen sensor heater control circuit for short circuit to ground • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0031-16	HO2S Heater Control Circuit Low (Bank 1, Sensor 1) - Circuit voltage below threshold	• NOTE: - Circuit O_T_SHT1 - • Front heated oxygen sensor heater control circuit short circuit to ground • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check front heated oxygen sensor heater control circuit for short circuit to ground • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the

DTC	Description	Possible Cause	Action
			installation of a new module/component
P0032-12	HO2S Heater Control Circuit High (Bank 1, Sensor 1) - Circuit short to battery	• NOTE: - Circuit O_T_SHT1 - ● Front heated oxygen sensor heater control circuit short circuit to power ● Front heated oxygen sensor failure	● Refer to the electrical circuit diagrams and check front heated oxygen sensor heater control circuit for short circuit to power ● Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0045-13	Turbo charger/Supercharger Boost Control A Circuit / Open - Circuit open	• NOTE: - Circuit O_T_BPANEG - ● Variable geometry turbocharger actuator vane circuit open circuit	● Refer to the electrical circuit diagrams and check variable geometry turbocharger actuator vane circuit for open circuit ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0045-18	Turbo charger/Supercharger Boost Control A Circuit / Open - Circuit current below threshold	● Power stage temperature dependant current limitation	● Refer to the electrical circuit diagrams and check connections are secure and wiring integrity ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0045-19	Turbo charger/Supercharger Boost Control A Circuit / Open - Circuit current above threshold	• NOTE: - Circuit O_T_BPAPOS - ● Actuator-vane variable geometry turbocharger - Power stage output 1 (positive) short circuit to power ● Turbo charger actuator power stage output 1 circuit over current	• NOTE: This DTC may be logged due to battery voltage. Check the body control module, information and entertainment module and navigation system module for related DTC's. If DTC's are logged suspect generator or battery supply voltage fault. Check and repair as required prior to diagnosing this DTC ● Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine ● Refer to the electrical circuit diagrams and check the actuator vane variable geometry turbocharger circuit - O_T_BPAPOS - For short circuit to power
P0046-19	Turbo charger/Supercharger Boost Control A Circuit Range/Performance - Circuit current above threshold	● Power stage excess temperature ● Variable geometry turbocharger actuator vane circuit, short circuit to ground, short circuit to power ● Variable geometry turbocharger actuator vane failure	● Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane circuit, for short circuit to ground, short circuit to power ● Check and install a new variable geometry turbocharger actuator vane as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0047-11	Turbo charger/Supercharger Boost Control A Circuit Low - Circuit short to ground	• NOTE: - Circuit O_T_BPAPOS - ● Variable geometry turbocharger actuator vane circuit short circuit to ground	● Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane circuit, for short circuit to ground ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0047-14	Turbo charger/Supercharger Boost Control A Circuit Low - Circuit short to ground or open	• NOTE: - Circuit O_T_BPANEG - ● Variable geometry turbocharger actuator vane circuit short circuit to ground, open circuit	● Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane circuit, for short circuit to ground, open circuit ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0047-18	Turbo charger/Supercharger Boost Control A Circuit Low - Circuit current below threshold	● Power stage current limitation	● Refer to the electrical circuit diagrams and check connections are secure and wiring integrity ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
P0048-00	Turbo charger/Supercharger Boost Control A Circuit High - No sub type information	• Actuator power stage error	• Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0048-12	Turbo charger/Supercharger Boost Control A Circuit High - Circuit short to battery	• NOTE: - Circuit O_T_BPAPOS - • Variable geometry turbocharger actuator vane circuit short circuit to power	• Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane circuit, for short circuit to power • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0048-15	Turbo charger/Supercharger Boost Control A Circuit High - Circuit short to battery or open	• NOTE: - Circuit O_T_BPANEG - • Variable geometry turbocharger actuator vane circuit short circuit to power, open circuit	• Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane circuit, for short circuit to power, open circuit • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0053-16	HO2S Heater Resistance (Bank 1, Sensor 1) - Circuit voltage below threshold	• Front heated oxygen sensor heater control circuit short circuit to ground • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check front heated oxygen sensor heater control circuit for short circuit to ground • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0053-17	HO2S Heater Resistance (Bank 1, Sensor 1) - Circuit voltage above threshold	• Front heated oxygen sensor heater control circuit short circuit to power • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check front heated oxygen sensor heater control circuit for short circuit to power • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0053-1A	HO2S Heater Resistance (Bank 1, Sensor 1) - Circuit resistance below threshold	• Front heated oxygen sensor heater control circuit short circuit to ground • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check front heated oxygen sensor heater control circuit for short circuit to ground • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0053-1B	HO2S Heater Resistance (Bank 1, Sensor 1) - Circuit resistance above threshold	• Front heated oxygen sensor heater control circuit short circuit to power • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check front heated oxygen sensor heater control circuit for short circuit to power • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0069-00	MAP - Barometric Pressure Correlation - No sub type information	• Manifold absolute pressure/boost pressure sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Manifold absolute pressure/boost pressure sensor internal fault • Barometric pressure sensor failure (internal engine control module fault)	• Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine • Refer to the electrical circuit diagrams and check the boost pressure sensor circuit - I_A_BPS - For short circuit to ground, short circuit to power, open circuit, high resistance

DTC	Description	Possible Cause	Action
P0072-00	Ambient Air Temperature Sensor Circuit Low - No sub type information	• NOTE: - I_A_IATS - ● Ambient air temperature sensor circuit short circuit to ground, open circuit	● Refer to the electrical circuit diagrams and check ambient air temperature sensor circuit - I_A_IATS - For short circuit to ground, open circuit ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0073-00	Ambient Air Temperature Sensor Circuit High - No sub type information	• NOTE: - I_A_IATS - ● Ambient air temperature sensor circuit short circuit to power ● Ambient air temperature sensor fault	● Refer to the electrical circuit diagrams and check ambient air temperature sensor circuit - I_A_IATS - For short circuit to power
P0087-00	Fuel Rail/System Pressure - Too Low - No sub type information	• NOTE: - Circuit I_A_RALPS - ● Fuel rail pressure sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance ● Fuel starvation ● Fuel lines leaking ● Fuel lines restricted ● Blocked air filter	● Refer to the electrical circuit diagrams and check the fuel rail pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance ● Check the fuel lines for any signs of leakage, replace as required ● Check the fuel lines for any signs of damage, crimping or restrictions, replace as required ● Check for blocked air filter, replace as required
P0087-21	Fuel Rail/System Pressure - Too Low - Signal amplitude < minimum	• NOTE: - Circuit I_A_RALPS - ● Fuel rail pressure sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance ● Fuel starvation ● Fuel lines leaking ● Fuel lines restricted ● Blocked air filter	● Refer to the electrical circuit diagrams and check the fuel rail pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance ● Check the fuel lines for any signs of leakage, replace as required ● Check the fuel lines for any signs of damage, crimping or restrictions, replace as required ● Check for blocked air filter, replace as required
P0087-22	Fuel Rail/System Pressure - Too Low - Signal amplitude > maximum	• NOTE: - Circuit I_A_RALPS - ● Fuel rail pressure sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance ● Fuel starvation ● Fuel lines leaking ● Fuel lines restricted ● Blocked air filter	● Refer to the electrical circuit diagrams and check the fuel rail pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance ● Check the fuel lines for any signs of leakage, replace as required ● Check the fuel lines for any signs of damage, crimping or restrictions, replace as required ● Check for blocked air filter, replace as required
P0087-23	Fuel Rail/System Pressure - Too Low - Signal stuck low	• NOTE: - Circuit I_A_RALPS - ● Fuel rail pressure sensor circuit short circuit to ground ● Fuel starvation ● Fuel lines leaking ● Fuel lines restricted ● Blocked air filter	● Refer to the electrical circuit diagrams and check the fuel rail pressure sensor circuit for short circuit to ground ● Check the fuel lines for any signs of leakage, replace as required ● Check the fuel lines for any signs of damage, crimping or restrictions, replace as required ● Check for blocked air filter, replace as required
P0088-00	Fuel Rail/System Pressure - Too High - No sub type information	• NOTE: - Circuit I_A_RALPS - ● Fuel rail pressure sensor circuit short circuit to power ● Fuel starvation ● Fuel lines leaking ● Fuel lines restricted ● Blocked air filter	● Refer to the electrical circuit diagrams and check the fuel rail pressure sensor circuit for short circuit to power ● Check the fuel lines for any signs of leakage, replace as required ● Check the fuel lines for any signs of damage, crimping or restrictions, replace as required ● Check for blocked air filter, replace as required
P0088-21	Fuel Rail/System Pressure - Too High - Signal amplitude < minimum	• NOTE: - Circuit I_A_RALPS - ● Fuel lines restricted ● Pressure control valve circuit short circuit to power ● Pressure control valve	● Using the manufacturer approved diagnostic system, check engine control module, for related DTCs and refer to the relevant DTC index ● Check the fuel lines for any signs of damage, crimping or restrictions, replace as required

DTC	Description	Possible Cause	Action
		stuck closed	
P0088-22	Fuel Rail/System Pressure - Too High	• NOTE: - Circuit I_A_RALPS - ● Leaking fuel system ● Volume control valve circuit short circuit to ground, open circuit ● Volume control valve stuck open	● Check for fuel leaks ● Refer to the electrical circuit diagrams and check volume control valve circuit for short circuit to ground, open circuit ● Check and install a new high pressure fuel pump as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0088-24	Fuel Rail/System Pressure - Too High - Signal stuck high	● Leaking fuel system ● Pressure control valve stuck ● Pressure control valve circuit short circuit to ground, short circuit to power, open circuit	● Check for fuel leaks ● Refer to the electrical circuit diagrams and check pressure control valve circuit for short circuit to ground, short circuit to power, open circuit ● Check and install new pressure control valve as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0088-27	Fuel Rail/System Pressure - Too High - Signal rate of change above threshold	● Leak in high pressure section ● Injector nozzle stuck open/worn ● Worn high pressure pump, filter blocked ● Leaking pressure control valve ● Low pressure section pressure low (leak in system, pump output low)	● Check for fuel leaks in high and low pressure systems ● Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC index
P0089-62	Fuel Pressure Regulator Performance - Signal compare failure	● Fuel low pressure delivery system ● Fuel pressure control valve exceeded tolerance threshold	● Check fuel low pressure delivery system ● Check and install a new fuel pressure control valve as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0089-64	Fuel Pressure Regulator Performance - Signal plausibility failure	● Fuel low pressure delivery system ● Fuel pressure control valve exceeded tolerance threshold	● Check fuel low pressure delivery system ● Check and install a new fuel pressure control valve as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0097-00	Intake Air Temperature Sensor 2 Circuit Low - No sub type information	• NOTE: - Circuit I_A_IATS - ● Intake air temperature sensor short circuit to ground	● Refer to the electrical circuit diagrams and check intake air temperature sensor for short circuit to ground ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0098-00	Intake Air Temperature Sensor 2 Circuit High - No sub type information	• NOTE: - Circuit I_A_IATS - ● Intake air temperature sensor short circuit to power	● Refer to the electrical circuit diagrams and check intake air temperature sensor for short circuit to power ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009B-00	Fuel Pressure Relief Control Circuit/Open - No sub type information	• NOTE: - Circuit O_T_PCV - ● Pressure control valve control circuit open circuit	● Refer to the electrical circuit diagrams and check pressure control valve circuit for open circuit ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009C-00	Fuel Pressure Relief Control Circuit Low - No sub type information	• NOTE: - Circuit O_T_PCV - ● Pressure control valve control circuit short circuit to ground	● Refer to the electrical circuit diagrams and check pressure control valve circuit for short circuit to ground ● Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
P009D-00	Fuel Pressure Relief Control Circuit High - No sub type information	• NOTE: - Circuit O_T_PCV - • Pressure control valve control circuit short circuit to power	• Refer to the electrical circuit diagrams and check pressure control valve circuit for short circuit to power • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009E-00	Fuel Pressure Relief Control Performance/Stuck Off - No sub type information	• NOTE: - Circuit O_T_PCV - • Pressure control valve power stage excess temperature • Pressure control valve control circuit short circuit to ground, short circuit to power, open circuit, high resistance	• Refer to the electrical circuit diagrams and check pressure control valve circuit for short circuit to ground, short circuit to power, open circuit, high resistance
P00AF-75	Turbo charger/Supercharger Boost Control A Module Performance - Emergency position not reachable	• NOTE: - Circuit I_F_BPA - • Variable geometry turbocharger actuator vane circuit short circuit to ground, short circuit to power, open circuit, high resistance • Variable geometry turbocharger actuator vane failure	• Refer to the electrical circuit diagrams and check variable geometry turbocharger actuator vane circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check and install new variable geometry turbocharger actuator vane as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0100-00	Mass or Volume Air Flow A Circuit - No sub type information	• Mass air flow sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance • Mass air flow sensor internal failure	• Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine • Refer to the electrical circuit diagrams and check mass air flow sensor circuit - I_F_AMS2 - For short circuit to ground, short circuit to power, open circuit, high resistance
P0102-21	Mass or Volume Air Flow A Circuit Low - Signal amplitude < minimum	• Air flow pulse width modulated raw signal above upper limit	• Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0102-26	Mass or Volume Air Flow A Circuit Low - Signal rate of change below threshold	• Air flow pulse width modulated corrected signal above upper limit	• Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0103-22	Mass or Volume Air Flow A Circuit High - Signal amplitude > maximum	• Mass air flow / inlet air temperature sensor short circuit to power • Mass air flow / inlet air temperature sensor internal failure	• Using the manufacturer approved diagnostic system perform the **(Turbo, exhaust gas recirculation and air path dynamic test)** routine • Refer to the electrical circuit diagrams and check mass air flow / inlet air temperature sensor circuit - I_F_AMS2 - For short circuit to power
P0103-27	Mass or Volume Air Flow A Circuit High - Signal rate of change above threshold	• Air flow pulse width modulated corrected signal above upper limit	• Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0112-00	Intake Air Temperature Sensor 1 Circuit Low - No sub type information	• NOTE: - Circuit I_R_IATS3 - • Mass air flow intake air temperature sensor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check the mass air flow intake air temperature sensor circuit for short circuit to ground • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P0113-00	Intake Air Temperature Sensor 1 Circuit High - No sub type information	• NOTE: - Circuit I_R_IATS3 - • Mass air flow intake air temperature sensor circuit short circuit to power	• Refer to the electrical circuit diagrams and check the mass air flow intake air temperature sensor circuit for short circuit to power

General Information - Diagnostic Trouble Code (DTC) IndexI6 3.2L Petrol, DTC: Engine Control Module (ECM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If diagnostic trouble codes are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the Electronic engine control system, refer to the relevant Description and Operation section in the workshop manual.For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).

Powertrain control module petrol (PCMP) SI6 petrol engine

DTC	Description	Possible Cause	Action
B1024-00	Start control unit - No sub type information	• Starter relay signal circuit: short circuit to ground • Starter relay signal circuit: short circuit to power • Starter relay signal circuit: open circuit • Starter relay fault	• Check the starter relay and circuits. Refer to the electrical guides. Install a new relay as necessary
B1024-82	Start control unit - Alive/sequence counter incorrect/not updated	• Controller area network (CAN) circuit: open circuit • CAN circuit: short circuit to ground • CAN circuit: short circuit to power	• Check the CAN circuit. Refer to the electrical guides. Rectify as necessary
B1024-86	Start control unit - Signal invalid	• Controller area network (CAN) circuit: open circuit • CAN circuit: short circuit to ground • CAN circuit: short circuit to power	• Check the CAN circuit. Refer to the electrical guides. Rectify as necessary
B10A2-68	Crash input - Event information	• Event information • The control module has registered that the vehicle has been in a collision	• Clear the DTC. Check/rectify any damage resulting from the collision
P0011-00	Intake (A) camshaft position timing - Over-advanced (bank 1) - No sub type information	• Poor engine oil quality/condition • Variable valve timing (VVT) solenoid/circuit fault • VVT unit fault	• Check for related DTC's. Check the engine oil quality/condition. Check the VVT solenoid and circuits. Refer to the electrical guides. Install a new VVT unit as required
P0012-00	Intake (A) camshaft position timing - Over-retarded (bank 1) - No sub type information	• Poor engine oil quality/condition • Low engine oil pressure • Variable valve timing (VVT) solenoid/circuit fault • VVT unit fault	• Check for related DTC's. Check the engine oil quality/condition. Check the engine oil pressure. Check the VVT solenoid and circuits. Refer to the electrical guides. Install a new VVT unit as required
P0012-68	Intake (A) camshaft position timing - Over-retarded (bank 1) - Event information	• Poor engine oil quality/condition • Low engine oil pressure • Variable valve timing (VVT) unit fault - camshaft reset valve	• Check the engine oil quality/condition. Check the engine oil pressure. Check the VVT unit. Install a new VVT unit as required
P0016-00	Crankshaft position - Camshaft position correlation - Bank 1 sensor A - No sub type information	• Poor engine oil quality • Camshaft inlet sensor incorrectly installed • Crankshaft position sensor incorrectly installed	• Check the engine oil quality/condition • Refer to the relevant sections of the workshop manual and check the camshaft inlet sensor for correct installation, check the crankshaft position sensor for correct

DTC	Description	Possible Cause	Action
		• Camshaft inlet sensor, short circuit to ground, short circuit to power, open circuit, high resistance • Camshaft inlet sensor air-gap to target rotor greater than specification • Excessive run out on target rotor • Loose variable valve timing actuator chain drive or tensioners • Damaged, worn timing chain	installation • Refer to electrical circuit diagrams and check the camshaft inlet sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the relevant sections of the workshop manual and check the camshaft inlet sensor for correct air-gap to target rotor spacing, check target run out is to specification, check variable valve timing actuator chain drive or tensioners are operating to specification
P0018-00	Crankshaft position - Camshaft position correlation - Bank 2 sensor A - No sub type information	• Poor engine oil quality/condition • Incorrectly adjusted camshafts • Damaged (worn) timing chain • Variable valve timing (VVT) solenoid/circuit fault • VVT unit fault	• Check the engine oil quality/condition. Check the camshaft timing and chain. Rectify as necessary. Check the VVT solenoid and circuits. Refer to the electrical guides Install a new VVT unit as required
P001A-00	Intake (A) cam profile control circuit/open (bank 1) - No sub type information	• Camshaft profile control circuit: open circuit • Camshaft profile control circuit: short circuit to ground • Camshaft profile actuator fault	• Check the camshaft profile actuator and circuits. Refer to the electrical guides. Rectify as necessary
P001B-00	Intake (A) cam profile control circuit low (bank 1) - No sub type information	• Camshaft profile control circuit: open circuit • Camshaft profile control circuit: short circuit to ground • Camshaft profile actuator fault	• Check the camshaft profile actuator and circuits. Refer to the electrical guides. Rectify as necessary
P001C-00	Intake (A) camshaft profile control circuit high (bank 1) - No sub type information	• Camshaft profile control circuit: short circuit to power • Camshaft profile actuator fault	• Check the camshaft profile actuator and circuits. Refer to the electrical guides. Rectify as necessary
P001D-00	Intake (A) cam profile control circuit/open (bank 2) - No sub type information	• Camshaft profile control circuit: open circuit • Camshaft profile control circuit: short circuit to ground • Camshaft profile actuator fault	• Check the camshaft profile actuator and circuits. Refer to the electrical guides. Rectify as necessary
P001E-00	Intake (A) camshaft profile control circuit low (bank 2) - No sub type information	• Camshaft profile control circuit: open circuit • Camshaft profile control circuit: short circuit to ground • Camshaft profile actuator fault	• Check the camshaft profile actuator and circuits. Refer to the electrical guides. Rectify as necessary
P001F-00	Intake (A) camshaft profile control circuit high (bank 2) - No sub type information	• Camshaft profile control circuit: short circuit to power • Camshaft profile actuator fault	• Check the camshaft profile actuator and circuits. Refer to the electrical guides. Rectify as necessary
P0021-00	Intake (A) camshaft position timing over advanced (bank 2) - No sub type information	• Poor engine oil quality/condition • Variable valve timing (VVT) solenoid/circuit fault • VVT unit fault	• Check for related DTC's. Check the engine oil quality/condition. Check the VVT solenoid and circuits. Refer to the electrical guides. Install a new VVT unit as required
P0022-00	Intake (A) camshaft position timing over retarded (bank 2) - No sub type information	• Poor engine oil quality/condition • Low engine oil pressure • Variable valve timing (VVT) solenoid/circuit fault • VVT unit fault	• Check for related DTC's. Check the engine oil quality/condition. Check the engine oil pressure. Check the VVT solenoid and circuits. Refer to the electrical guides. Install a new VVT unit as required
P0031-00	HO2S Heater control circuit low (bank 1, sensor 1) - No sub type information	• HO2S heater control circuit: short circuit to ground • HO2S heater control circuit: open circuit • HO2S fault	• Check the HO2S and circuits. Refer to the electrical guides. Install a new sensor as required

Published: 28-Apr-2011

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Front Controls Display Interface Module (FCDIM) - Front Integrated Control Panel

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the front display interface system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Front Control Display Interface Module (FCDIM) (high level display front)

DTC	Description	Possible Cause	Action
U1A01-15	Communications link	Navigation module to High Level Display Front communications link circuit - short to power, open circuit	Refer to electrical circuit diagrams and check Navigation Module to High Level Display Front communications link circuit for short to power, open circuit
U1A4B-48	Control module microprocessor 'B'	Supervision software failure	Install a new HLDF. For additional information, refer to: Video Display (415-01 Information and Entertainment System, Removal and Installation).
U3000-48	Control module	Supervision software failure	Install a new HLDF. For additional information, refer to: Video Display (415-01 Information and Entertainment System, Removal and Installation).
U3000-4B	Control module	Over temperature	Check for additional DTCs and refer to DTC Index. Check/monitor system for re-occurrence
U3000-55	Control module	Incorrect Car Configuration File data received	Check/up-date Car Configuration File using manufacturer approved diagnostic system
U3000-87	Control module	Missing message	Check CJB for DTCs and refer to DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). Check information and entertainment module for Car Configuration File and MOST network DTCs and refer to relevant DTC Index. Carry out MOST/CAN network tests using the manufacturer approved diagnostic system
U3000-98	Control module	Component or system over temperature	Check for additional DTCs and refer to DTC Index. Check/monitor system for re-occurrence
U3003-16	Battery voltage	Circuit voltage below threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U3003-17	Battery voltage	Circuit voltage above threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Headlamp Control Module (HCM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For additional information, refer to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Adaptive Front Lighting System (AFS) Control Module

DTC	Description	Possible Cause	Action
B1041-04	Leveling Control - System Internal Failures	• Module internal failure	Suspect Adaptive Front Lighting System (AFS) Control Module internal fault. Replace as required, refer to the new module/component installation note at the top of the DTC Index
B1041-54	Leveling Control - Missing Calibration	• NOTE: This DTC will normally be logged when a new module has been installed. • Leveling sensor calibration routine not carried out	• NOTE: Sensor calibration routine must be carried out with the vehicle unladen. Calibrate the Headlamp Leveling sensors using the manufacturer approved diagnostic system, carry the out routine 'Headlamp Control Module System Calibration' from the 'Module programming and configuration - Setup and Configuration - Lighting'
B1087-83	LIN Bus "A" - Value of signal protection calculation incorrect	• LIN Bus circuit fault • No communication on the LIN Bus • LIN bus EMC interference	• NOTE: This circuit uses shielded cable Refer to the electrical circuit diagrams and check the LIN Bus circuit for harness damage
B1087-86	LIN Bus "A" - Signal Invalid	• LIN Bus circuit fault • No communication on the LIN Bus • LIN bus EMC interference	• NOTE: This circuit uses shielded cable Refer to the electrical circuit diagrams and check the LIN Bus circuit for harness damage
B1087-88	LIN Bus "A" - Bus Off	• LIN Bus circuit fault • No communication on the LIN Bus	• NOTE: This circuit uses shielded cable Refer to the electrical circuit diagrams and check the LIN Bus circuit for harness damage
B10AE-11	Headlamp Leveling Motor - Circuit short to ground	• Headlamp Leveling Motor control circuit short to ground	Refer to the electrical circuit diagrams and check Headlamp Leveling Motor control circuit for short to ground
B10AE-12	Headlamp Leveling Motor - Circuit short to battery	• Headlamp Leveling Motor control circuit short to power	Refer to the electrical circuit diagrams and check Headlamp Leveling Motor control circuit for short to power
B10AE-64	Headlamp Leveling Motor - Signal plausibility failure	• Signal plausibility failure (voltage out of range)	Refer to the electrical circuit diagrams and check Headlamp Leveling Motor circuits for failure. Disconnect one headlamp connector, clear DTC and re-test. If DTC cleared, suspect Adaptive Front Lighting System (AFS) Control Module or circuits to the disconnected side of the failure. If DTC remains, reconnect first headlamp and disconnect second, clear DTC and re-test. If DTC cleared, suspect Adaptive Front Lighting System (AFS) Control Module or circuits to the disconnected side of the failure. If DTC remains, suspect common circuits of the failure. Refer to the electrical circuit diagrams and check as required
B1A59-11	Sensor 5 Volt Supply - Circuit short to ground	• Headlamp Leveling Sensor 5 volt supply circuit short to ground	Refer to electrical circuit diagrams and check Headlamp Leveling Sensor 5 volt supply circuit for short to ground
B1A59-12	Sensor 5 Volt Supply - General Electrical Failure	• Headlamp Leveling Sensor 5 volt supply circuit short to power	Refer to electrical circuit diagrams and check Headlamp Leveling Sensor 5 volt supply circuit for short to power

DTC	Description	Possible Cause	Action
B1D64-01	Left Headlamp Swivelling Motor - General Electrical Failure	• Internal Headlamp Motor Fault • Internal Headlamp Circuit Fault	Using the manufacturer approved diagnostic system perform an On Demand Self Test, look for any errors in movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). Refer to the electrical circuit diagrams and check for circuit fault between the Adaptive Front Lighting System (AFS) Control Module and the Headlamp Swivelling Motor. If no mechanical or circuit faults are evident, suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B1D64-87	Left Headlamp Swivelling Motor - Missing message	• Missing message	Using the manufacturer approved diagnostic system perform an On Demand Self Test, look for any errors in movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). Refer to the electrical circuit diagrams and check for circuit fault between the Adaptive Front Lighting System (AFS) Control Module and the Headlamp Swivelling Motor. If no mechanical or circuit faults are evident, suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B1D65-01	Right Headlamp Swivelling Motor - General electrical failure	• Internal Headlamp Motor Fault • Internal Headlamp Circuit Fault	Using the manufacturer approved diagnostic system perform an On Demand Self Test, look for any errors in movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). Refer to the electrical circuit diagrams and check for circuit fault between the Adaptive Front Lighting System (AFS) Control Module and the Headlamp Swivelling Motor. If no mechanical or circuit faults are evident, suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B1D65-87	Right Headlamp Swivelling Motor - Missing message	• Missing message	Using the manufacturer approved diagnostic system perform an On Demand Self Test, look for any errors in movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). Refer to the electrical circuit diagrams and check for circuit fault between the Adaptive Front Lighting System (AFS) Control Module and the Headlamp Swivelling Motor. If no mechanical or circuit faults are evident, suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B1D68-00	Left Headlamp Swivelling Feedback Sensor - No sub type information	• Internal Headlamp Sensor Fault • Internal Headlamp Circuit Fault	Using the manufacturer approved diagnostic system perform an On Demand Self Test, look for any errors in movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). Refer to the electrical circuit diagrams and check for circuit fault between the Adaptive Front Lighting System (AFS) Control Module and the Headlamp Swivelling Feedback Sensor. If no mechanical or circuit faults are evident, suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B1D69-00	Right Headlamp Swivelling Feedback Sensor - No sub type information	• Internal Headlamp Sensor Fault • Internal Headlamp Circuit Fault	Using the manufacturer approved diagnostic system perform an On Demand Self Test, look for any errors in movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). Refer to the electrical circuit diagrams and check for circuit fault between the Adaptive Front Lighting System (AFS) Control Module and the Headlamp Swivelling Feedback Sensor. If no mechanical or circuit faults are evident, suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
C1A03-12	Left Front Height Sensor - Circuit short to battery	• Left Front Height Sensor circuit short to power	Refer to the electrical circuit diagrams, and check Left Front Height Sensor circuit for short to power
C1A03-14	Left Front Height Sensor - Circuit short to ground or open	• Left Front Height Sensor circuit short to ground or open circuit	Refer to the electrical circuit diagrams, and check Left Front Height Sensor circuit for short to ground or open circuit
C1A05-12	Left Rear Height Sensor - Circuit short to battery	• Left Rear Height Sensor circuit short to power	Refer to the electrical circuit diagrams, and check Left Rear Height Sensor circuit for short to power
C1A05-14	Left Rear Height Sensor - Circuit short to ground or open	• Left Rear Height Sensor circuit short to ground or open circuit	Refer to the electrical circuit diagrams, and check Left Rear Height Sensor circuit for short to ground or open circuit
U0001-88	High Speed CAN Communication Bus - Bus off	• CAN Bus Off • CAN Bus Circuit fault	Check other modules for related DTCs. Carry out the CAN Network Integrity test using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
U0101-00	Lost communication with TCM - No sub type information	• Lost communication with the Transmission Control Module • CAN network fault	Check the Transmission Control Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Transmission Control Module
U0121-00	Lost communication with Anti-lock Brake System (ABS) Control Module - No sub type information	• Lost communication with the Anti-lock Brake System Module • CAN network fault	Check the Anti-lock Brake System Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Anti-lock Brake System Module
U0126-00	Lost communication with Steering Angle Sensor Module - No sub type information	• Lost communication with the Steering Angle Sensor Module • CAN network fault	Check the Steering Angle Sensor Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Steering Angle Sensor Module
U0140-00	Lost communication with Body Control Module - No sub type information	• Lost communication with the Central Junction Box • CAN network fault	Check the Central Junction Box for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Central Junction Box
U0300-00	Internal Control Module Software Incompatibility - No sub type information	• Car Configuration File (CCF) information incompatible to the Adaptive Front Lighting System (AFS) Control Module	• NOTE: The Car Configuration File (CCF) parameters required are (Vehicle type)(Headlamp type)(Gearbox type) and (Dayrunning light) Re-configure the Car Configuration File (CCF) as required using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the Adaptive Front Lighting System (AFS) Control Module, refer to the new module installation note at the top of the DTC Index
U0402-00	Invalid Data Received From Transmission Control Module - No sub type information	• Invalid Data Received from the Transmission Control Module • Transmission component fault	Check the Transmission Control Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Transmission Control Module
U0415-00	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - No sub type information	• Invalid data received from Anti-lock Brake System Module • Anti-lock Brake System Module component fault	Check the Anti-lock Brake System Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Anti-lock Brake System Module
U0422-00	Invalid data from Body Control Module - No sub type information	• Invalid signal from the Central Junction Box • Central Junction Box fault	Check the Central Junction Box for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Central Junction Box
U0428-00	Invalid Data Received From Steering Angle Sensor Module - No sub type information	• Invalid Data Received from the Steering Angle Sensor Module • Steering Angle Sensor Module fault	Check the Steering Angle Sensor Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Steering Angle Sensor
U2100-00	Initial Configuration Not Complete - No sub type information	• Car Configuration File (CCF) information not received completely	• NOTE: The Car Configuration File (CCF) parameters required are (Vehicle type)(Headlamp type)(Gearbox type) and (Dayrunning light) Re-configure the Car Configuration File (CCF) as required using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the Adaptive Front Lighting System (AFS) Control Module, refer to the new module installation note at the top of the DTC Index
U2101-00	Control Module Configuration Incompatible - No sub type information	• Car Configuration File (CCF) information incompatible to Adaptive Front Lighting System (AFS) Control Module	Check the correct Adaptive Front Lighting System (AFS) Control Module is installed to vehicle specification. Refit original or replace the module as required. Refer to the new module/component installation note at the top of the DTC Index
U3003-16	Battery Voltage - Circuit voltage below threshold	• The power supply to the Module has been below 9 Volts for more than 1000 milliseconds	Suspect Battery or Charging fault. Check the battery condition and state of charge. Check the vehicle charging system. Refer to the relevant workshop manual section. Clear the DTC, cycle ignition state to off then on, if DTC returns refer to the electrical circuit diagrams and check power and ground circuit to the Adaptive Front Lighting System (AFS) Control Module

DTC	Description	Possible Cause	Action
U3003-17	Battery Voltage - Circuit voltage above threshold	• The power supply to the Module has been above 16 Volts for more than 1000 milliseconds	Suspect Charging fault. Check the battery condition and state of charge. Check the vehicle charging system. Refer to the relevant workshop manual section
U3003-62	Battery Voltage - Signal compare failure	• Difference in battery voltage, of 2 volts or more, between the central broadcast voltage (via CAN Bus) and Adaptive Front Lighting System (AFS) Control Module	Check other modules for related stored DTCs. Refer to the electrical circuit diagrams and check power and ground voltages at the Adaptive Front Lighting System (AFS) Control Module

Published: 06-Jul-2011

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Heating Ventilation and Air Conditioning Control Module (HVAC)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTC's are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For additional information, refer to: Climate Control System (412-00 Climate Control System - General Information, Diagnosis and Testing).

Heating ventilation and air conditioning control module (HVAC)

DTC	Description	Possible Cause	Action
B102E-09	Air quality sensor general failure information - Component failures	• Internal sensor fault	Install a new air quality sensor
B102E-11	Air quality sensor general electrical failures - Circuit short to ground	• Air quality sensor circuit - short to ground • Incorrect climate control module installed	Refer to the electrical circuit diagrams and check air quality sensor circuit for short to ground. Install a new climate control module as required, refer to new module/component installation note at the top of the DTC Index
B102E-12	Air quality sensor general electrical failures - Circuit short to battery	• Air quality sensor circuit - short to power • Air quality sensor - Open circuit	Refer to the electrical circuit diagrams and check air quality sensor circuit for short to power. Install a new air quality sensor as required
B1030-09	Left front seat heater general failure information - Component failures	• Seat heater module internal failure	Install a new seat heater module, refer to the new module/component installation note at the top of the DTC Index
B1030-4B	Left front seat heater system internal failures - Over temperature	• Seat heater module internal failure • Sensor incorrect/no feedback	Clear DTC and re-test. If DTC remains install a new seat heater module, refer to the new module/component installation note at the top of the DTC Index. Install a new front seat heater mat
B1030-87	Left front seat heater bus signal/message failures - Missing message	• LIN bus circuit or seat heater module power supply circuit fault	Refer to the electrical circuit diagrams and check the front left seat heater module LIN Bus circuit, power and ground supply circuits for short circuit to ground, short circuit to power, open circuit, high resistance
B1032-09	Right front seat heater general failure information - Component failures	• Seat heater module internal failure	Install a new seat heater module, refer to the new module/component installation note at the top of the DTC Index
B1032-4B	Right front seat heater system internal failures - Over temperature	• Seat heater module internal failure • Sensor incorrect/no feedback	Clear DTC and re-test. If DTC remains install a new seat heater module, refer to the new module/component installation note at the top of the DTC Index. Install a new front seat heater mat
B1032-87	Right front seat heater bus signal/message failures - Missing message	• LIN Bus circuit or seat heater module power supply circuit fault	Refer to the electrical circuit diagrams and check the front right seat heater module LIN Bus circuit, power and ground supply circuits for short circuit to ground, short circuit to power, open circuit, high resistance
B1034-01	Left front seat heater element general failure information - General electrical failure	• Element damaged, open circuit	Refer to the electrical circuit diagrams and check the left front seat heater element circuit for open circuit
B1035-01	Left rear seat heater element general failure information - General electrical failure	• Element damaged, open circuit	This DTC will only log in validation mode. No help text required
B1036-01	Right front seat heater element general failure information - General electrical failure	• Element damaged, open circuit	Refer to the electrical circuit diagrams and check front right seat heater element circuit for open circuit

DTC	Description	Possible Cause	Action
B1038-01	Left front seat heater sensor general failure information - General electrical failure	• Sensor damaged, open circuit	Refer to the electrical circuit diagrams and check front left seat heater sensor circuit for open circuit
B103A-01	Right front seat heater sensor general failure information - General electrical failure	• Sensor damaged, open circuit	Refer to the electrical circuit diagrams and check front right seat heater sensor circuit for open circuit
B105A-11	Cabin temperature sensor fan general electrical failures - Circuit short to ground	• In-vehicle temperature sensor circuit - short to ground	Refer to the electrical circuit diagrams and check In-vehicle temperature sensor circuit for short to ground
B105A-15	Cabin temperature sensor fan general electrical failures - Circuit short to battery or open	• In-vehicle temperature sensor circuit - short to power or open circuit	Refer to the electrical circuit diagrams and check In-vehicle temperature sensor for short to power or open circuit
B105A-71	Cabin temperature sensor fan general electrical failures - Actuator stuck	• Fan jammed or broken	Remove obstruction from fan. Install new sensor as required
B1081-09	Left temperature damper motor general failure information - Component failures	• Internal failure	Install a new actuator as required
B1081-77	Left temperature damper motor mechanical failures - Commanded position not reachable	• Obstruction in flap movement • Range greater than expected default	Clear obstruction from flap. Using manufacturer approved diagnostic system check relevant datalogger signals to read motor range and compare defaults. Execute LIN calibration run using manufacturer approved diagnostic system
B1081-87	Left temperature damper motor bus signal/message failures - Missing message	• LIN Bus fault • Actuator fault	Refer to the electrical circuit diagrams and check the left air temperature door motor LIN Bus circuit, power and ground supply circuits for short circuit to ground, short circuit to power, open circuit, high resistance. Install a new actuator as required
B1082-09	Right temperature damper motor general failure information - Component failures	• Internal failure	Install a new actuator as required
B1082-77	Right temperature damper motor mechanical failures - Commanded position not reachable	• Obstruction in flap movement • Range greater than expected default	Clear obstruction from flap. Using manufacturer approved diagnostic system check relevant datalogger signals to read motor range and compare defaults. Execute LIN calibration run using manufacturer approved diagnostic system
B1082-87	Right temperature damper motor bus signal/message failures - Missing message	• LIN Bus fault • Actuator fault	Refer to the electrical circuit diagrams and check the right air temperature door motor LIN Bus circuit, power and ground supply circuits for short circuit to ground, short circuit to power, open circuit, high resistance
B1083-09	Recirculation damper motor general failure Information - Component failures	• Internal failure	Install new actuator as required
B1083-77	Recirculation damper motor mechanical failures - Commanded position not reachable	• Obstruction in flap movement • Range greater than expected default	Clear obstruction from flap. Using manufacturer approved diagnostic system check relevant datalogger signals to read motor range and compare defaults. Execute LIN calibration run using manufacturer approved diagnostic system
B1083-87	Recirculation damper motor bus signal/message failures - Missing message	• LIN Bus fault • Actuator fault	Refer to the electrical circuit diagrams and check the air intake door motor LIN Bus circuit, power and ground supply circuits for short circuit to ground, short circuit to power, open circuit, high resistance
B1085-09	Defroster damper motor general failure - Information component failures	• Internal failure	Install new actuator as required
B1085-77	Defroster damper motor mechanical failures - Commanded position not reachable	• Obstruction in flap movement • Range greater than expected default	Clear obstruction from flap. Clear the DTC and retest. If the problem persists, remove the defrost vent/register blend door actuator and check the blend flap operation
B1085-87	Defroster damper motor bus signal/message failures - Missing message	• LIN Bus fault • Actuator fault	Refer to the electrical circuit diagrams and check the screen air distribution door motor LIN Bus circuit, power and ground supply circuits for short circuit to ground, short circuit to power, open circuit, high resistance
B1086-09	Air distribution damper motor general failure - Information component failures	• Internal failure	Install a new actuator as required

DTC	Description	Possible Cause	Action
B1086-77	Air distribution damper motor mechanical failures - Commanded position not reachable	• Obstruction in flap movement • Range greater than expected default	Clear obstruction from flap. Clear the DTC and retest. If the problem persists, remove the defrost vent/register blend door actuator and check the blend flap operation
B1086-87	Air distribution damper motor bus signal/message failures - Missing message	• LIN Bus fault • Actuator fault	Refer to the electrical circuit diagrams and check the face/feet air distribution door motor LIN Bus circuit, power and ground supply circuits for short circuit to ground, short circuit to power, open circuit, high resistance
B1087-4A	LIN bus A system internal failures - Incorrect component installed	• Incorrect module installed • Incorrect car configuration data being transmitted	Ensure correct module is installed. Check and correct car configuration file using manufacturer approved diagnostic system
B1087-54	LIN bus A system programming failures - Missing calibration	• LIN systems calibration routine failed	Run LIN systems calibration routine and clear DTC using manufacturer approved diagnostic system
B1087-83	LIN bus A bus signal/message failures - Value of signal protection calculation incorrect	• Possible fault with one or more LIN nodes	Clear DTC and monitor for re-occurrence
B1087-86	LIN bus A bus signal/message failures - Signal invalid	• Incorrect stepper motor/s installed	Run LIN Arbitration routine using manufacturer approved diagnostic system. Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1087-88	LIN bus A bus signal/message failures - Bus off	• LIN Bus A circuit - short to ground, power	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1088-4A	LIN bus B system internal failures - Incorrect component installed	• Incorrect module installed • Incorrect car configuration data being transmitted by central junction box	Ensure correct module is installed. Check and correct car configuration file using manufacturer approved diagnostic system
B1088-83	LIN bus B bus signal/message failures - Value of signal protection calculation incorrect	• Possible fault with one or more LIN Nodes	Clear DTC and monitor for re-occurrence
B1088-86	LIN bus B bus signal/message failures - Signal invalid	• Incorrect stepper motor/s installed	Run LIN Arbitration routine using manufacturer approved diagnostic system. Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1088-88	LIN bus B bus signal/message failures - Bus off	• LIN Bus B circuit - short to ground, power	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10B9-11	Blower control general electrical failures - Circuit short to ground	• Blower Control circuit - short to ground	Refer to electrical circuit diagrams and check Blower Control circuit for short to ground
B10B9-12	Blower control general electrical failures - Circuit short to battery	• Blower Control circuit - short to power	Refer to electrical circuit diagrams and check Blower Control circuit for short to power
B10B9-13	Blower control general electrical failures - Circuit open	• Blower control circuit - open circuit	This DTC will only log in validation mode. No help text required
B1A61-11	Cabin temperature sensor general electrical failures - Circuit short to ground	• In-vehicle temperature sensor circuit - short to ground	Refer to electrical circuit diagrams and check In-vehicle temperature sensor circuit for short to ground
B1A61-15	Cabin temperature sensor general electrical failures - Circuit short to battery or open	• In-vehicle temperature sensor circuit - short to power or open circuit	Refer to electrical circuit diagrams and check In-vehicle temperature sensor circuit for short to power or open circuit
B1A69-09	Humidity sensor general failure information - Component failures	• Internal sensor failure	Install a new rear view mirror/humidity sensor
B1A69-87	Humidity sensor bus signal/message failures - Missing message	• Senor disconnected, open circuit	Refer to the electrical circuit diagrams and check humidity sensor circuit for short circuit to ground, short circuit to power, open circuit
B1B71-11	Evaporator temperature sensor general electrical failures - Circuit short to ground	• Evaporator temperature sensor circuit - short to ground	Refer to electrical circuit diagrams and check Evaporator temperature sensor circuit for short to ground
B1B71-15	Evaporator temperature sensor general electrical failures - Circuit short to battery or open	• Evaporator temperature sensor circuit - short to power or open circuit	Refer to electrical circuit diagrams and check Evaporator temperature sensor circuit for short to power or open circuit
U0010-00	Medium speed CAN communication bus - No sub type information	• Medium speed CAN bus off	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0140-00	Lost communication with central electronic module general failure information - No sub type information	• Missing message	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
U0156-00	Lost communication with infotainment control module general failure information - No sub type information	• Missing message	Carry out CAN network integrity tests using the manufacturer approved diagnostic system
U0300-00	Internal control module software incompatibility general failure information - No sub type information	• Invalid configuration message is received	Re-configure the central junction box using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the climate control module, refer to the new module/component installation note at the top of the DTC Index
U2002-23	Switch general signal failures - Signal stuck low	• Switch stuck	Check finisher around module for correct installation
U2101-00	Control module configuration incompatible general failure information - No sub type information	• Incorrect car configuration data being transmitted by central junction box	Check and correct car configuration file using manufacturer approved diagnostic system
U3000-41	Control module system internal failures - General checksum error	• Internal micro controller error • Checksum error	Install a new climate control module, refer to new module/component installation note at top of DTC Index
U3003-62	Battery voltage algorithm based failures - Signal compare failure	• Mis-match in battery voltage, of 2 volts or more, between climate control module and central junction box	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Infotainment Control Module (ICM) - High Line

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the infotainment control system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Infotainment Control Module (High Line) (ICM)

DTC	Description	Possible Cause	Action
B101C-11	Seek up switch	• Seek up switch circuit - short to ground	Refer to electrical circuit diagrams and check seek up switch circuit for short to ground
B101D-11	Seek down switch	• Seek down switch circuit - short to ground	Refer to electrical circuit diagrams and check seek down switch circuit for short to ground
B101F-11	Eject switch	• Eject switch circuit - short to ground	Refer to electrical circuit diagrams and check eject switch circuit for short to ground
B1022-11	Audio On/Off switch	• Audio On/Off switch circuit - short to ground	Refer to electrical circuit diagrams and check audio on/off switch circuit for short to ground
B104A-11	Button 1	• Button 1 circuit - short to ground	Refer to electrical circuit diagrams and check Button 1 circuit for short to ground
B104B-11	Button 2	• Button 2 circuit - short to ground	Refer to electrical circuit diagrams and check Button 2 circuit for short to ground
B104C-11	Button 3	• Button 3 circuit - short to ground	Refer to electrical circuit diagrams and check Button 3 circuit for short to ground
B104D-11	Button 4	• Button 4 circuit - short to ground	Refer to electrical circuit diagrams and check Button 4 circuit for short to ground
B104E-11	Button 5	• Button 5 circuit - short to ground	Refer to electrical circuit diagrams and check Button 5 circuit for short to ground
B11A6-11	FM button	• FM button circuit - short to ground	Refer to electrical circuit diagrams and check FM button circuit for short to ground
B11A7-11	AM button	• AM button circuit - short to ground	Refer to electrical circuit diagrams and check AM button circuit for short to ground
B11A8-11	CD button	• CD button circuit - short to ground	Refer to electrical circuit diagrams and check CD button circuit for short to ground
B11A911	Tone button	• Tone button circuit - short to ground	Refer to electrical circuit diagrams and check tone button circuit for short to ground
B11AA-11	Skip up button	• Skip up button circuit - short to ground	Refer to electrical circuit diagrams and check skip up button circuit for short to ground
B11AB-11	Skip down button	• Skip down button circuit - short to ground	Refer to electrical circuit diagrams and check skip down button circuit for short to ground
B11AC-11	Enter button	• Enter button circuit - short to ground	Refer to electrical circuit diagrams and check enter button circuit for short to ground
B11AD-11	Exit button	• Exit button circuit - short to ground	Refer to electrical circuit diagrams and check exit button circuit for short to ground

DTC	Description	Possible Cause	Action
B11AE-11	Menu button	• Menu button circuit - short to ground	Refer to electrical circuit diagrams and check menu button circuit for short to ground
B11AF-11	Phone button	• Phone button circuit - short to ground	Refer to electrical circuit diagrams and check phone button circuit for short to ground
B11B0-11	Scan button	• Scan button circuit - short to ground	Refer to electrical circuit diagrams and check scan button circuit for short to ground
B11B1-11	Auto button	• Auto button circuit - short to ground	Refer to electrical circuit diagrams and check auto button circuit for short to ground
B11B3-11	Button 6	• Button 6 circuit - short to ground	Refer to electrical circuit diagrams and check button 6 circuit for short to ground
B11B4-11	Button 7	• Button 7 circuit - short to ground	Refer to electrical circuit diagrams and check button 7 circuit for short to ground
B11B5-11	Button 8	• Button 8 circuit - short to ground	Refer to electrical circuit diagrams and check button 8 circuit for short to ground
B11B6-11	Button 9	• Button 9 circuit - short to ground	Refer to electrical circuit diagrams and check button 9 circuit for short to ground
B1A59-49	Sensor 5 volt supply	• Internal electronic failure	Install a new information and entertainment module, refer to the new module/component installation note at the top of the DTC Index
B1D21-15	Remote control switch	• Remote control switch circuit - short to power, open circuit	Refer to electrical circuit diagrams and check remote control switch circuit for short to power, open circuit
U0010-00	Medium speed CAN communication Bus	• Bus Off	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0127-00	Lost communications with tire pressure monitor system module	• Lost communications	Carry out CAN Network integrity tests using manufacturer approved diagnostic system. Check CJB for DTCs and refer to relevant DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0140-00	Lost communications with CJB	• Lost communications	Carry out CAN Network integrity tests using manufacturer approved diagnostic system. Check CJB for DTCs and refer to relevant DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0142-00	Lost communication with body control module 'B'	• Lost communications	Carry out CAN Network integrity tests using manufacturer approved diagnostic system. Check CJB for DTCs and refer to relevant DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0155-00	Lost communication with instrument cluster	• Lost communications	Carry out CAN Network integrity tests using manufacturer approved diagnostic system. Check instrument cluster for DTCs and refer to relevant DTC Index. For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing).
U0159-00	Lost communications with park assist control module 'A'	• Lost communications	Carry out CAN Network integrity tests using manufacturer approved diagnostic system. Check parking aid module for DTCs and refer to relevant DTC Index. For additional information, refer to: Parking Aid (413-13 Parking Aid, Diagnosis and Testing).
U0164-00	Lost communication with climate control module	• Lost communications	Carry out CAN Network integrity tests using manufacturer approved diagnostic system. Check climate control module for DTCs and refer to relevant DTC Index. For additional information, refer to: Climate Control System (412-00 Climate Control System - General Information, Diagnosis and Testing).
U0184-00	Lost communication with radio	• Lost communications	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0186-00	Lost communications with audio amplifier 'A'	• Lost communications	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
U0193-00	Lost communications with digital audio control module 'A'	• Lost communications	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0197-00	Lost communications with telephone control module	• Lost communications	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0199-00	Lost communications with DDM	• Lost communications	Carry out MOST Network integrity tests using manufacturer approved diagnostic system. Check DDM for DTCs and refer to relevant DTC Index below
U0200-00	Lost communications with PDM	• Lost communications	Carry out MOST Network integrity tests using manufacturer approved diagnostic system. Check PDM for DTCs and refer to relevant DTC Index below
U0214-00	Lost communications with remote function actuation	• Lost communications	Carry out CAN Network integrity tests using manufacturer approved diagnostic system. Check remote keyless entry module for DTCs and refer to relevant DTC Index below
U0245-00	Lost communications with entertainment control module - front	• Lost communications	Carry out MOST Network integrity tests GO to Pinpoint Test ??. . Check for additional DTCs and refer to relevant DTC Index
U0256-00	Lost communications with front controls interface module	• Lost communications	Carry out MOST Network integrity tests GO to Pinpoint Test ??. . Check for additional DTCs and refer to relevant DTC Index
U0257-00	Lost communications with front controls/display interface module	• Lost communications	Carry out MOST Network integrity tests GO to Pinpoint Test ??. . Check for additional DTCs and refer to relevant DTC Index
U0300-00	Internal control module software incompatibility	• Incorrect software	Check software level is correct to hardware level
U0300-51	Internal control module software incompatibility	• Not programmed	Download the correct level of software using the manufacturer approved diagnostic system
U3000-55	Control module	• Incorrect car configuration data received	Check/up-date Car Configuration File using manufacturer approved diagnostic system
U3000-87	Control module	• Missing message	Check CJB for DTCs and refer to DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). Check information and entertainment module for Car Configuration File and MOST network DTCs and refer to relevant DTC Index. Carry out MOST/CAN network tests using the manufacturer approved diagnostic system
U3002-81	Vehicle Identification Number	• Incorrect VIN stored and locked (module previously installed to other vehicle)	Ensure correct component is installed to vehicle
U3003-62	Battery voltage	• Mis-match in battery voltage, of 2 volts or more, between information and entertainment control module and CJB	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Infotainment Control Module (ICM) - Low Line

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the infontainment control system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Infotainment control module (low line) (ICM)

DTC	Description	Possible Cause	Action
B1A00-16	Control module	• Supply voltage low	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A01-01	Speaker #1	• Left front speaker circuit - short circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A01-13	Speaker #1	• Left front speaker circuit - open circuit	Refer to the electrical circuit diagrams and check left front speaker circuit for open circuit
B1A02-01	Speaker #2	• Right front speaker circuit - short circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A02-13	Speaker #2	• Right front speaker circuit - open circuit	Refer to electrical circuit diagrams and check right front speaker circuit for open circuit
B1A03-01	Speaker #3	• Left rear speaker circuit - short circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A03-13	Speaker #3	• Left rear speaker circuit - open circuit	Refer to electrical circuit diagrams and check left rear speaker circuit for open circuit
B1A04-01	Speaker #4	• Right rear speaker circuit - short circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A04-13	Speaker #4	• Right rear speaker circuit - open circuit	Refer to electrical circuit diagrams and check right rear speaker circuit for open circuit
B1A56-14	Antenna	• Antenna circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check antenna circuit for short ground, open circuit
B1D19-96	Compact disc unit	• Component internal failure	Install a new compact disc unit, refer to the new module/component installation note at the top of the DTC Index. For additional information, refer to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation).
B1D19-98	Compact disc unit	• Compact disc unit over temperature	Check for additional DTCs and refer to DTC Index, check/monitor system for re-occurrence
B1D20-91	Head unit	• Head unit below temperature	Check for additional DTCs and refer to DTC Index, check/monitor system for re-occurrence
B1D20-98	Head unit	• Head unit over temperature	Check for DTCs and refer to DTC Index, check/monitor system for re-occurrence
B1D21-11	Remote control switch	• Remote control switch circuit - short to ground	Refer to electrical circuit diagrams and check remote control switch circuit for short to ground

DTC	Description	Possible Cause	Action
B1D21-13	Remote control switch	• Remote control switch circuit - open circuit	Refer to electrical circuit diagrams and check remote control switch circuit for open circuit
U0010-87	Medium speed CAN communications Bus	• Missing message	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0010-88	Medium Speed CAN Communication Bus	• Bus Off	Carry out CAN network integrity tests using the manufacturer approved diagnostic system
U0073-88	Control module communication Bus 'A' off	• Bus Off	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0300-55	Internal control module software incompatibility	• Incorrect Car Configuration File • Incorrect component installed	Check/amend Car Configuration File using manufacturer approved diagnostic system. Install correct component
U1A03-87	Car Configuration Parameter	• Missing message	Check/amend the Car Configuration File using the manufacturer approved diagnostic system. Carry out CAN network integrity tests using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Instrument Cluster (IPC)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the instrument cluster system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

Instrument cluster control module (IPC)

DTC	Description	Possible Cause	Action
B1184-62	Steering Column Lock Output	• Signal compare failure	Check steering lock power from CJB. Check CJB for DTCs and refer to relevant DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
B1A14-96	RCM Warning Lamp	• Light Emitting Diode (LED) failure	Install a new instrument cluster. For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation). Refer to the new module/component installation note at the top of the DTC Index
B1A84-41	Car Configuration Data	• Flash download checksum error	Install latest available level of software using the manufacturer approved diagnostic system
B1A84-81	Car Configuration Data	• Invalid Car Configuration data received	Check/amend Car Configuration File using manufacturer approved diagnostic system
C2002-62	Odometer Tampered	• DTC set when one or more stored odometer value does not match	Clear DTC, cycle ignition and re-test
U0010-87	Medium Speed CAN Communication Bus	• Multiple loss of CAN data to other systems	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0010-88	Medium Speed CAN Communication Bus	• Break in connection to bus	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0140-08	Lost Communication With Body Control Module	• No messages received from CJB for greater than timeout period	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0208-08	Lost Communication With "Seat Control Module A"	• No messages received from DSM for greater than timeout period	Check DSM for DTCs and refer to relevant DTC Index. For additional information, refer to: Seats (501-10 Seating, Diagnosis and Testing). Carry out CAN Network integrity tests using the manufacturer approved diagnostic system
U0300-62	Internal Control Module Software Incompatibility	• Configuration data received is different from the stored data	Check correct instrument cluster is installed
U3000-46	Control Module	• EEPROM write error	Check power and ground circuits to the instrument cluster, clear DTC and re-test. If DTC remains, install a new instrument cluster. For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation). Refer to the new module/component installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
U3000-48	Control Module	• Internal application software error detected	Check power and ground circuits to the instrument cluster, clear DTC and re-test. If DTC remains, install a new instrument cluster. For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation). Refer to the new module/component installation note at the top of the DTC Index
U3000-4B	Control Module	• Internal over temperature	Check for additional DTCs and refer to DTC Index, clear DTC and re-test/monitor condition for re-occurrence
U3003-17	Battery Voltage	• Circuit voltage above threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Published: 28-Apr-2011

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Navigation Control Module (NAV)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the navigation system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Navigation System (415-01 Information and Entertainment System, Description and Operation).

Navigation Control Module (NCV)

DTC	Description	Possible Cause	Action
B1A89-11	Satellite antenna	GPS antenna circuit - short to ground	Refer to electrical circuit diagrams and check GPS antenna circuit for short to ground
B1A89-13	Satellite antenna	GPS antenna circuit - open circuit	Refer to electrical circuit diagrams and check GPS antenna circuit for open circuit
B1A89-1B	GPS module	GPS receiver error	Install a new multimedia module. For additional information, refer to: Navigation System Digital Versatile Disc (DVD) Unit (415-01 Information and Entertainment System, Removal and Installation).
B1D55-14	Antenna #2 circuit	TMC/VICS antenna circuit - open circuit	• NOTE: Ignore this DTC on vehicles with an E*, D* or C* suffix module part number If a fault is identified with the TMC system, refer to electrical circuit diagrams and check TMC/VICS antenna circuit for open circuit
B1D56-14	Antenna #3 circuit	VICS beacon antenna circuit - open circuit	Refer to electrical circuit diagrams and check VICS beacon antenna circuit for open circuit
U2005-31	Control module	Missing vehicle speed message	Check information and entertainment module for MOST network error DTCs and refer to relevant DTC Index. Carry out MOST network tests using manufacturer approved diagnostic system
U3000-49	Control module	Internal failure	Install a new multimedia module. For additional information, refer to: Navigation System Digital Versatile Disc (DVD) Unit (415-01 Information and Entertainment System, Removal and Installation).
U3000-55	Control module	Incorrect Car Configuration File data received	Check/up-date Car Configuration File using manufacturer approved diagnostic system
U3000-87	Control module	Missing message	Check CJB for DTCs and refer to DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). Check information and entertainment module for Car Configuration File and MOST network DTCs and refer to relevant DTC Index. Carry out MOST/CAN network tests using the manufacturer approved diagnostic system
U3000-98	Control module	Component or system over temperature	Check for additional DTCs and refer to relevant DTC Index. Check/monitor system for re-occurrence
U3003-16	Battery voltage	Circuit voltage below threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U3003-17	Battery voltage	Circuit voltage above threshold	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Published: 21-Oct-2011

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Occupant Classification System (OCS)

Description and Operation

CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the occupant classification system, refer to the relevant Description and Operation section in the workshop manual. For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).

Occupant Classification System (OCS)

DTC	Description	Possible Cause	Action
B1193-53	Crash Event Storage Full and Locked - deactivated	• Crash event occurred	• Clear diagnostic trouble code and re-test
B1A54-01	Occupant Belt Tension Sensor - General Electrical Failure	• General electrical failure	• Clear diagnostic trouble code and re-test. If the problem persists, check and install a new safety belt tension sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
B1A54-02	Occupant Belt Tension Sensor - General signal failure	• General signal failure	• Refer to the electrical circuit diagrams and check safety belt tension and mat pressure sensor circuits for short to each other
B1A54-11	Occupant Belt Tension Sensor - circuit short to ground	• Safety belt tension sensor voltage reference or signal circuit - short to ground	• Refer to the electrical circuit diagrams and check safety belt tension sensor voltage reference and signal circuits for short to ground
B1A54-12	Occupant Belt Tension Sensor - circuit short to battery	• Safety belt tension sensor voltage reference or signal circuit - short to power	• Refer to the electrical circuit diagrams and check safety belt tension sensor voltage reference and signal circuits for short to power
B1A54-13	Occupant Belt Tension Sensor - circuit open	• Safety belt tension sensor voltage reference or signal circuit - open circuit	• Refer to the electrical circuit diagrams and check safety belt tension sensor voltage reference and signal circuits for open circuit
B1A62-02	Pressure Sensor - General signal failure	• General signal failure	• Refer to the electrical circuit diagrams and check safety belt tension and mat pressure sensor circuits for short to each other
B1A62-11	Pressure Sensor - circuit short to ground	• Mat pressure sensor voltage reference or signal circuits - short to ground	• Refer to the electrical circuit diagrams and check mat pressure sensor voltage reference and signal circuits for short to ground
B1A62-12	Pressure Sensor - circuit short to battery	• Mat pressure sensor voltage reference, ground or signal circuits - short to power	• Refer to the electrical circuit diagrams and check mat pressure sensor voltage reference, ground and signal circuits for short to power

DTC	Description	Possible Cause	Action
B1A62-13	Pressure Sensor - circuit open	• Mat pressure sensor voltage reference or signal circuit - open circuit	• Refer to the electrical circuit diagrams and check mat pressure sensor voltage reference and signal circuits for open circuit
B1A62-7B	Pressure Sensor - low fluid level	• Low fluid level - bladder damaged	• Check and install new bladder as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U0001-88	High Speed CAN Communication Bus - Bus off	• Bus off	• Refer to the electrical circuit diagrams and check CAN network for short, open circuit. Carry out the CAN network integrity test using the manufacturer approved diagnostic system
U0151-00	Lost Communication With Restraints Control Module - no sub type information	• Restraints control module missing message	• Refer to the electrical circuit diagrams and check power and ground supplies to restraints control module. Carry out CAN network integrity test using the manufacturer approved diagnostic system
U0300-00	Internal Control Module Software Incompatibility - no sub type information	• Master car configuration file ID does not correspond	• Check correct occupancy seat module is installed for vehicle specification. Check auxiliary junction box for related diagnostic trouble codes and refer to relevant diagnostic trouble code index
U2016-51	Control Module Main Software - not programmed	• Main software not programmed	• Check and install a new occupancy seat module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U201A-51	Control Module Main Calibration Data - not programmed	• Main calibration data not programmed	• Check and install a new occupancy seat module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U3000-04	Control Module - System Internal Failures	• Occupancy seat module internal electronic failure	• Check and install a new occupancy seat module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U3000-54	Control Module - missing calibration	• This diagnostic trouble code is set if a 'calibrate occupancy seat module empty seat offset' routine is requested and fails due to one of the pre-conditions to execute the routine	• Check the following criteria have all been achieved: Ignition status set to RUN/START. Verify seat is always empty after power-up before re-zero is requested. The occupancy seat module has gone through the seat assembly plant calibration. No collision event received from the restraints control module during the current ignition cycle. No faults present in the current ignition cycle. The trigger message for calibrate empty seat offset has been received from the diagnostic tool. Occupancy seat module has enough time to begin classification. Temperature is between 6C (42F) and 36C (97F)
U3003-16	Battery Voltage - circuit voltage below threshold	• Circuit voltage below threshold	• Check battery is in fully charged and serviceable condition. Check integrity of charging system
U3003-17	Battery Voltage - circuit voltage above threshold	• Circuit voltage above threshold	• Check battery is in fully charged and serviceable condition. Check integrity of charging system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Rear Differential Control Module (RDCM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the rear differential system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Rear Drive Axle and Differential (205-02 Rear Drive Axle/Differential, Description and Operation).

DTC	Description	Possible Cause	Action
P0560-17	System Voltage - circuit voltage above threshold	• Differential Electronic Module (DEM) supply circuit voltage above threshold	• Check vehicle battery and charging system, repair as required. Refer to the relevant section in the workshop manual. Refer to the electrical circuit diagrams and check the power and ground supply circuits to the Differential Electronic Module (DEM). Clear the DTC and re-test.
P0602-54	Powertrain Control Module Programming Error - missing calibration	• Differential Electronic Module (DEM) programming error • Differential Electronic Module (DEM) internal failure	• Using the manufacturer approved diagnostic system check and install latest level of software to the Differential Electronic Module (DEM). Clear the DTC and re-test. • Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0607-49	Control Module Performance - internal electronic failure	• Differential Electronic Module (DEM) internal failure	• Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0666-11	PCM / ECM / TCM Internal Temperature Sensor Circuit - circuit short to ground	• Differential Electronic Module (DEM) internal failure	• Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0666-15	PCM / ECM / TCM Internal Temperature Sensor Circuit - circuit short to battery or open	• Differential Electronic Module (DEM) internal failure	• Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0667-27	PCM / ECM / TCM Internal Temperature Sensor Range/Performance - signal rate of change above threshold - signal rate of change above threshold	• Differential Electronic Module (DEM) internal failure	• Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0748-14	Pressure Control Solenoid A Electrical - circuit short to ground or open	• Differential Electronic Module (DEM) internal failure	• Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to

DTC	Description	Possible Cause	Action
			the installation of a new module/component.
P0748-1D	Pressure Control Solenoid A Electrical - circuit current out of range	• Differential Electronic Module (DEM) internal failure	• Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0932-11	Hydraulic Pressure Sensor Circuit - circuit short to ground	• Internal oil pressure sensor connector fault • Internal oil pressure sensor failure • Differential Electronic Module (DEM) internal failure	• Remove the Differential Electronic Module (DEM) and check the internal oil pressure sensor connection. Repair as required. • Check and install a new internal oil pressure sensor as required. • Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0932-15	Hydraulic Pressure Sensor Circuit - circuit short to battery or open	• Internal oil pressure sensor connector fault • Internal oil pressure sensor failure • Differential Electronic Module (DEM) internal failure	• Remove the Differential Electronic Module (DEM) and check the internal oil pressure sensor connection. Repair as required. • Check and install a new internal oil pressure sensor as required. • Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0937-11	Hydraulic Oil Temperature Sensor Circuit - circuit short to ground	• Internal oil temperature sensor connector fault • Internal oil temperature sensor failure • Differential Electronic Module (DEM) internal failure	• Remove the Differential Electronic Module (DEM) and check the internal oil temperature sensor connection. Repair as required. • Check and install a new internal oil temperature sensor as required. • Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0937-15	Hydraulic Oil Temperature Sensor Circuit - circuit short to battery or open	• Internal oil temperature sensor connector fault • Internal oil temperature sensor failure • Differential Electronic Module (DEM) internal failure	• Remove the Differential Electronic Module (DEM) and check the internal oil temperature sensor connection. Repair as required. • Check and install a new internal oil temperature sensor as required. • Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0938-27	Hydraulic Oil Temperature Sensor Range/Performance-signal rate of change above threshold	• Internal oil temperature sensor connector fault • Internal oil temperature sensor failure • Differential Electronic Module (DEM) internal failure	• Remove the Differential Electronic Module (DEM) and check the internal oil temperature sensor connection. Repair as required. • Check and install a new internal oil temperature sensor as required. • Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P0961-62	Pressure Control Solenoid A Control Circuit Range/Performance - signal compare failure	• Differential Electronic Module (DEM) internal failure • Differential coupling assembly failure	• Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. • Clear the DTC and re-test. Check and install a new differential coupling assembly as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

DTC	Description	Possible Cause	Action
P1889-12	Oil Pressure Pump Performance -circuit short to battery	• Oil pressure feeder pump circuit short to power • Oil pressure feeder pump internal failure • Differential Electronic Module (DEM) internal failure	• Refer to the electrical circuit diagrams and check oil pressure feeder pump circuit for short to power. • Clear the DTC and re-test. Check and install a new oil pressure feeder pump as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. • Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P1889-14	Oil Pressure Pump Performance- circuit short to ground or open	• Oil pressure feeder pump circuit short to ground, open circuit • Oil pressure feeder pump internal failure • Differential Electronic Module (DEM) internal failure	• Refer to the electrical circuit diagrams and check oil pressure feeder pump circuit for short to ground, open circuit. • Clear the DTC and re-test. Check and install a new oil pressure feeder pump as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. • Clear the DTC and re-test. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P1889-49	Oil Pressure Pump Performance - internal electronic failure	• Oil pressure feeder pump internal failure	• Clear the DTC and re-test. Check and install a new oil pressure feeder pump as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P1889-74	Oil Pressure Pump Performance - actuator slipping	• Oil pressure feeder pump harness short to ground, short to power, open circuit • Oil pressure feeder pump internal failure • Differential coupling assembly failure	• Refer to the electrical circuit diagrams and check oil pressure feeder pump harness for short to ground, short to power, open circuit. • Clear the DTC and re-test. Check and install a new oil pressure feeder pump as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. • Clear the DTC and re-test. Check and install a new differential coupling assembly as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
P188A-68	Differential Oil Temperature Too High/Too Low - event information	• Differential oil temperature too high • Internal oil temperature sensor connector fault • Internal oil temperature sensor connector fault • Differential Electronic Module (DEM) internal failure • Differential coupling assembly failure	• Allow differential coupling assembly to cool. Consider the ambient temperature. Clear the DTC and re-test. • Remove the Differential Electronic Module (DEM) and check the internal oil temperature sensor connection. Repair as required. • Check and install a new internal oil temperature sensor as required. • Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. • Clear the DTC and re-test. Check and install a new differential coupling assembly as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
U0001-00	High Speed CAN Communication Bus - no sub type information	• High speed CAN communication bus short to ground, short to power, open circuit	• Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check the CAN network for short to ground, short to power, open circuit.

DTC	Description	Possible Cause	Action
U0100-00	Lost Communication With ECM/PCM "A" - no sub type information	• Lost communication with Engine Control Module (ECM)	• Refer to the electrical circuit diagrams and check the power and ground circuits to the Engine Control Module (ECM). Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check the CAN network between the All Terrain Control Module (ATCM) and Differential Electronic Module (DEM).
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - no sub type information	• Lost communication with Anti-Lock Brake System (ABS) module	• Refer to the electrical circuit diagrams and check the power and ground circuits to the Anti-Lock Brake System (ABS) module. Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check the CAN network between the All Terrain Control Module (ATCM) and Differential Electronic Module (DEM).
U0138-00	Lost Communication with All Terrain Control Module - no sub type information	• Lost communication with All Terrain Control Module (ATCM)	• Refer to the electrical circuit diagrams and check the power and ground circuits to the All Terrain Control Module (ATCM). Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check the CAN network between the All Terrain Control Module (ATCM) and Differential Electronic Module (DEM).
U0140-00	Lost Communication With Body Control Module - no sub type information	• Lost communication with Central Junction Box (CJB)	• Refer to the electrical circuit diagrams and check the power and ground circuits to the Central Junction Box (CJB). Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Central Junction Box (CJB) and Differential Electronic Module (DEM).
U0300-00	Internal Control Module Software Incompatibility - no sub type information	• High speed CAN communication bus circuit problem • Invalid configuration message is received	• Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check the CAN network to the Differential Electronic Module (DEM). • Refer to the electrical circuit diagrams and check the power and ground circuits to the module. Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Central Junction Box (CJB) and Differential Electronic Module (DEM). Clear the DTC and re-test.
U0300-4A	Internal Control Module Software Incompatibility - incorrect component installed	• Differential Electronic Module (DEM) missing calibration, corrupt software • Incorrect Differential Electronic Module (DEM) installed to vehicle	• Using the manufacturer approved diagnostic system check and install latest relevant level of software to the Differential Electronic Module (DEM). Clear the DTC and re-test. • Check and ensure the correct Differential Electronic Module (DEM) is installed. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
U0401-68	Invalid Data Received From ECM/PCM - event information	• Invalid data received	• Check Engine Control Module (ECM) for related DTCs and refer to the relevant DTC Index. Clear the DTC and re-test.
U0415-00	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - no sub type information	• Invalid data received from Anti-Lock Braking System (ABS) module	• Check Anti Lock Braking System (ABS) module for related DTCs and refer to the relevant DTC Index. Clear the DTC and re-test.
U0418-68	Invalid Data Received From Brake System Control Module - event information	• Invalid data received from Anti-Lock Braking System (ABS) module	• Check Anti Lock Braking System (ABS) module for related DTCs and refer to the relevant DTC Index. Clear the DTC and re-test.

DTC	Description	Possible Cause	Action
U2101-00	Control Module Configuration Incompatible - no sub type information	• Car Configuration File (CCF) data parameter incorrect	• Using the manufacturer approved diagnostic system check and up-date the Car Configuration File (CCF) as required. Clear the DTC and re-test.
U3002-81	Vehicle Identification Number- invalid serial data received	• Incorrect Differential Electronic Module (DEM) installed to vehicle	• Check and ensure the correct Differential Electronic Module (DEM) is installed. Check and install a new Differential Electronic Module (DEM) as required. Refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.
U3003-62	Battery Voltage - signal compare failure	• Mis-match in battery voltage, between the Central Junction Box (CJB) and Differential Electronic Module (DEM), of 2 volts or more	• Refer to the electrical circuit diagrams and check the power and ground circuits to the Differential Electronic Module (DEM). Refer to the electrical circuit diagrams and check the power and ground circuits to the Central Junction Box (CJB).

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Parking Aid Module (PAM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the parking assist control system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Parking Aid (413-13 Parking Aid, Description and Operation).

Parking assist control module (PAM)

DTC	Description	Possible Cause	Action
B1B36-01	Front right outer sensor	• Front right outer sensor signal circuit - short to ground, open circuit • Front right outer sensor power supply circuit - open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B36-12	Front right outer sensor	• Front right outer sensor signal circuit - short to power	Refer to electrical circuit diagrams and check front right outer sensor signal circuit for short to power
B1B36-96	Front right outer sensor	• Front right outer sensor ground circuit - open circuit • Front right outer sensor internal failure	Refer to electrical circuit diagrams and check front right outer sensor ground circuit for open circuit. Install new sensor as necessary. For additional information, refer to: Front Outer Parking Aid Sensor (413-13 Parking Aid, Removal and Installation).
B1B38-01	Front right inner sensor	• Front right inner sensor signal circuit - short to ground, open circuit • Front right inner sensor power supply circuit - open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B38-12	Front right inner sensor	• Front right inner sensor signal circuit - short to power	Refer to electrical circuit diagrams and check front right inner sensor signal circuit for short to power
B1B38-96	Front right inner sensor	• Front right inner sensor ground circuit - open circuit • Front right inner sensor internal failure	Refer to electrical circuit diagrams and check front right inner sensor ground circuit for open circuit. Install new sensor as necessary. For additional information, refer to: Front Inner Parking Aid Sensor (413-13 Parking Aid, Removal and Installation).
B1B40-01	Front left outer sensor	• Front left outer sensor signal circuit - short to ground, open circuit • Front left outer sensor power supply circuit - open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B40-12	Front left outer sensor	• Front left outer sensor signal circuit - short to power	Refer to electrical circuit diagrams and check front left outer sensor signal circuit for short to power
B1B40-96	Front left outer sensor	• Front left outer sensor ground circuit - open circuit • Front left outer sensor internal failure	Refer to electrical circuit diagrams and check front left outer sensor ground circuit for open circuit. Install new sensor as necessary. For additional information, refer to: Front Outer Parking Aid Sensor (413-13 Parking Aid, Removal and Installation).

DTC	Description	Possible Cause	Action
B1B42-01	Front left inner sensor	• Front left inner sensor signal circuit - short to ground, open circuit • Front left inner sensor power supply circuit - open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B42-12	Front left inner sensor	• Front left inner sensor signal circuit - short to power	Refer to electrical circuit diagrams and check front left inner sensor signal circuit for short to power
B1B42-96	Front left inner sensor	• Front left inner sensor ground circuit - open circuit • Front left inner sensor internal failure	Refer to electrical circuit diagrams and check front left inner sensor ground circuit for open circuit. Install new sensor as necessary. For additional information, refer to: Front Inner Parking Aid Sensor (413-13 Parking Aid, Removal and Installation).
B1B44-01	Rear right outer sensor	• Rear right outer sensor signal circuit - short to ground, open circuit • Rear right outer sensor power supply circuit - open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B44-12	Rear right outer sensor	• Rear right outer sensor signal circuit - short to power	Refer to electrical circuit diagrams and check rear right outer sensor signal circuit for short to power
B1B44-96	Rear right outer sensor	• Rear right outer sensor ground circuit - open circuit • Rear right outer sensor internal failure	Refer to electrical circuit diagrams and check rear right outer sensor ground circuit for open circuit. Install new sensor as necessary. For additional information, refer to: Rear Outer Parking Aid Sensor (413-13 Parking Aid, Removal and Installation).
B1B46-01	Rear right inner sensor	• Rear right inner sensor signal circuit - short to ground, open circuit • Rear right inner sensor power supply circuit - open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B46-12	Rear right inner sensor	• Rear right inner sensor signal circuit - short to power	Refer to electrical circuit diagrams and check rear right inner sensor signal circuit for short to power
B1B46-96	Rear right inner sensor	• Rear right inner sensor ground circuit - open circuit • Rear right inner sensor internal failure	Refer to electrical circuit diagrams and check rear right inner sensor ground circuit for open circuit. Install new sensor as necessary. For additional information, refer to: Rear Inner Parking Aid Sensor (413-13 Parking Aid, Removal and Installation).
B1B48-01	Rear left outer sensor	• Rear left outer sensor signal circuit - short to ground, open circuit • Rear left outer sensor power supply circuit - open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B48-12	Rear left outer sensor	• Rear left outer sensor signal circuit - short to power	Refer to electrical circuit diagrams and check rear left outer sensor signal circuit for short to power
B1B48-96	Rear left outer sensor	• Rear left outer sensor ground circuit - open circuit • Rear left outer sensor internal failure	Refer to electrical circuit diagrams and check rear left outer sensor ground circuit for open circuit. Install new sensor as necessary. For additional information, refer to: Rear Outer Parking Aid Sensor (413-13 Parking Aid, Removal and Installation).
B1B50-01	Rear left inner sensor	• Rear left inner sensor signal circuit - short to ground, open circuit • Rear left inner sensor power supply circuit - open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B50-12	Rear left inner sensor	• Rear left inner sensor signal circuit - short to power	Refer to electrical circuit diagrams and check rear left inner sensor signal circuit for short to power
B1B50-96	Rear left inner sensor	• Rear left inner sensor ground circuit - open circuit • Rear left inner sensor internal failure	Refer to electrical circuit diagrams and check rear left inner sensor ground circuit for open circuit. Install new sensor as necessary. For additional information, refer to: Rear Inner Parking Aid Sensor (413-13 Parking Aid, Removal and Installation).

DTC	Description	Possible Cause	Action
B1B54-11	Parking aid status LED	• Parking aid status LED - short to ground (detected if driven only)	Refer to the electrical circuit diagrams and test status LED circuit for short to ground
B1B54-12	Parking aid status LED	• Parking aid status LED - short to power (detected if not driven only)	Refer to the electrical circuit diagrams and test status LED circuit for short to power
B1B57-11	Front sensors power supply circuit	• Front sensors power supply circuit - short to ground	Refer to the electrical circuit diagrams and test front sensor power supply circuit for short to ground
B1B58-11	Rear sensors power supply circuit	• Rear sensors power supply circuit - short to ground	Refer to the electrical circuit diagrams and test rear sensor power supply circuit for short to ground
B1C30-73	Disable switch	• Disable switch stuck closed • Disable switch circuit - short circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0010-00	Medium speed CAN communication Bus	• Medium speed CAN communication Bus	Carry out the associated pinpoint test using the manufacturer approved diagnostic system
U0073-00	Control module communication Bus "A" Off	• Control module communication Bus "A" Off	Carry out the associated pinpoint test using the manufacturer approved diagnostic system
U0140-00	Lost communication with CJB	• Logged when subscribed CAN message missing from CJB	Carry out the associated pinpoint test using the manufacturer approved diagnostic system
U0252-00	Lost communication with trailer module	• Logged when subscribed message missing from trailer module	Check trailer module for DTCs and refer to DTC Index
U0300-00	Internal control module software incompatibility	• CJB car configuration data is not compatible with the parking aid module	Re-configure the CJB using the manufacturer approved diagnostic system. Clear DTCs and re-test. If DTC still logged, install a new parking aid module. Refer to the new module installation note at the top of the DTC Index
U0422-00	Invalid data received from CJB	• Logged when subscribed CAN message invalid from CJB	Check CJB for DTCs and refer to DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U2100-00	Initial configuration not complete	• No configuration has been previously set	Re-configure CJB using manufacturer approved diagnostic tool, clear DTC and re-test. If DTC remains check CAN network. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U2101-00	Control module configuration incompatible	• Data sent from CJB is invalid	Re-configure CJB using manufacturer approved diagnostic tool, clear DTC and re-test. If DTC remains check Check CJB for DTCs and refer to DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U3000-49	Control module	• Internal control module failure	Install a new parking aid control module, refer to the new module installation note at the top of the DTC Index
U3003-16	Battery voltage	• Circuit voltage below threshold	Carry out the associated pinpoint test using the manufacturer approved diagnostic system
U3003-17	Battery voltage	• Circuit voltage above threshold	Carry out the associated pinpoint test using the manufacturer approved diagnostic system
U3003-62	Battery voltage	• Mis-match in battery voltage, of 2 volts or more, between parking aid module and CJB	Carry out the associated pinpoint test using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Restraints Control Module (RCM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the restraints control system, refer to the relevant Description and Operation section in the workshop manual. For additional information, refer to: (501-20B Supplemental Restraint System)

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (Description and Operation),
Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (Description and Operation).

Restraints Control Module (RCM)

DTC	Description	Possible Cause	Action
B0001-11	Driver Frontal Stage 1 Deployment Control - Circuit short to ground	• Driver's airbag ignitor stage 1 circuit short circuit to ground	• Refer to electrical circuit diagrams and check driver's airbag ignitor (stage 1) circuit for short circuit to ground
B0001-12	Driver Frontal Stage 1 Deployment Control - Circuit short to battery	• Driver's airbag ignitor stage 1 circuit short circuit to power	• Refer to electrical circuit diagrams and check driver's airbag ignitor (stage 1) circuit for short circuit to power
B0001-13	Driver Frontal Stage 1 Deployment Control - Circuit open	• Driver's airbag ignitor stage 1 circuit open circuit	• Refer to electrical circuit diagrams and check driver's airbag ignitor (stage 1) circuit for open circuit
B0001-19	Driver Frontal Stage 1 Deployment Control - Circuit current above threshold	• Driver's airbag ignitor stage 1 circuit current above threshold	• Refer to electrical circuit diagrams and check driver's airbag ignitor (stage 1) circuit for swapped pins or cross coupling between two firing lines
B0001-1A	Driver Frontal Stage 1 Deployment Control - Circuit resistance below threshold	• Driver's airbag ignitor stage 1 circuit resistance below threshold	• Refer to electrical circuit diagrams and check driver's airbag ignitor (stage 1) circuit for short circuit between both lines to ignitor
B0001-95	Driver Frontal Stage 1 Deployment Control - Incorrect assembly	• Driver's airbag ignitor (stage 1) incorrect assembly	• Check driver's airbag ignitor (stage 1) installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0002-11	Driver Frontal Stage 2 Deployment Control - Circuit short to ground	• Driver's airbag ignitor (stage 2) circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's airbag ignitor (stage 2) circuit for short circuit to ground
B0002-12	Driver Frontal Stage 2 Deployment Control - Circuit short to battery	• Driver's airbag ignitor (stage 2) circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's airbag ignitor (stage 2) circuit for short circuit to power
B0002-13	Driver Frontal Stage 2 Deployment Control - Circuit open	• Driver's airbag ignitor stage 2 circuit open circuit	• Refer to electrical circuit diagrams and check driver's airbag ignitor (stage 2) circuit for open circuit
B0002-19	Driver Frontal Stage 2 Deployment Control - Circuit current above threshold	• Driver's airbag ignitor stage 2 circuit current above threshold	• Refer to electrical circuit diagrams and check driver's airbag ignitor (stage 2) circuit for swapped pins or cross coupling between two firing lines
B0002-1A	Driver Frontal Stage 2 Deployment Control - Circuit resistance below threshold	• Driver's airbag ignitor stage 2 circuit resistance below threshold	• Refer to electrical circuit diagrams and check driver's airbag ignitor (stage 2) circuit for short circuit between both lines to ignitor

DTC	Description	Possible Cause	Action
B0002-95	Driver Frontal Stage 2 Deployment Control - Incorrect assembly	• Driver's airbag ignitor (stage 2) incorrect assembly	• Check driver’s airbag ignitor (stage 2) installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0004-11	Driver Knee Bolster Deployment Control - Circuit short to ground	• Driver's knee bolster ignitor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's knee bolster ignitor circuit for short circuit to ground
B0004-12	Driver Knee Bolster Deployment Control - Circuit short to battery	• Driver's knee bolster ignitor circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's knee bolster ignitor circuit for short circuit to power
B0004-13	Driver Knee Bolster Deployment Control - Circuit open	• Driver's knee bolster ignitor circuit open circuit	• Refer to the electrical circuit diagrams and check driver's knee bolster ignitor circuit for open circuit
B0004-19	Driver Knee Bolster Deployment Control - Circuit current above threshold	• Driver's knee bolster ignitor circuit current above threshold	• Refer to electrical circuit diagrams and check driver’s knee bolster ignitor circuit for swapped pins or cross coupling between two firing lines
B0004-1A	Driver Knee Bolster Deployment Control - Circuit resistance below threshold	• Driver's knee bolster ignitor circuit resistance below threshold	• Refer to electrical circuit diagrams and check driver's knee bolster ignitor circuit for short circuit between both lines to ignitor
B0004-95	Driver Knee Bolster Deployment Control - Incorrect assembly	• Driver’s knee bolster ignitor incorrect assembly	• Check driver’s knee bolster ignitor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0005-11	Collapsible Steering Column Deployment Control - Circuit short to ground	• Collapsible steering column circuit short circuit to ground	• Refer to the electrical circuit diagrams and check collapsible steering column circuit for short circuit to ground
B0005-12	Collapsible Steering Column Deployment Control - Circuit short to battery	• Collapsible steering column circuit short circuit to power	• Refer to the electrical circuit diagrams and check collapsible steering column circuit for short circuit to power
B0005-13	Collapsible Steering Column Deployment Control - Circuit open	• Collapsible steering column circuit open circuit	• Refer to the electrical circuit diagrams and check collapsible steering column circuit for open circuit
B0005-19	Collapsible Steering Column Deployment Control - Circuit current above threshold	• Collapsible steering column circuit current above threshold	• Refer to electrical circuit diagrams and check collapsible steering column circuit for swapped pins or cross coupling between two firing lines
B0005-1A	Collapsible Steering Column Deployment Control - Circuit resistance below threshold	• Collapsible steering column circuit resistance below threshold	• Refer to electrical circuit diagrams and check collapsible steering column circuit for short circuit between both lines to deployable device
B0005-95	Collapsible Steering Column Deployment Control - Incorrect assembly	• Collapsible steering column incorrect assembly	• Check collapsible steering column installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0010-11	Passenger Frontal Stage 1 Deployment Control - Circuit short to ground	• Front passenger's airbag ignitor (stage 1) circuit short circuit to ground	• Refer to the electrical circuit diagrams and check front passenger's airbag ignitor (stage 1) circuit for short circuit to ground
B0010-12	Passenger Frontal Stage 1 Deployment Control - Circuit short to battery	• Front passenger's airbag ignitor (stage 1) circuit short circuit to power	• Refer to the electrical circuit diagrams and check front passenger's airbag ignitor (stage 1) circuit for short circuit to power
B0010-13	Passenger Frontal Stage 1 Deployment Control - Circuit open	• Front passenger's airbag ignitor (stage 1) circuit open circuit	• Refer to the electrical circuit diagrams and check front passenger's airbag ignitor (stage 1) circuit for open circuit
B0010-19	Passenger Frontal Stage 1 Deployment Control - Circuit current above threshold	• Front passenger's airbag ignitor (stage 1) circuit current above threshold	• Refer to electrical circuit diagrams and check front passenger’s airbag ignitor (stage 1) circuit for swapped pins or cross coupling between two firing lines
B0010-1A	Passenger Frontal Stage 1 Deployment Control - Circuit resistance below threshold	• Front passenger's airbag ignitor (stage 1) circuit resistance below threshold	• Refer to electrical circuit diagrams and check front passenger's airbag ignitor (stage 1) circuit for short circuit between both lines to ignitor

DTC	Description	Possible Cause	Action
B0010-95	Passenger Frontal Stage 1 Deployment Control - Incorrect assembly	• Front passenger's airbag ignitor (stage 1) incorrect assembly	• Check front passenger’s airbag ignitor (stage 1) installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0011-11	Passenger Frontal Stage 2 Deployment Control - Circuit short to ground	• Front passenger's airbag ignitor (stage 2) circuit short circuit to ground	• Refer to the electrical circuit diagrams and check front passenger's airbag ignitor (stage 2) circuit for short circuit to ground
B0011-12	Passenger Frontal Stage 2 Deployment Control - Circuit short to battery	• Front passenger's airbag ignitor (stage 2) circuit short circuit to power	• Refer to the electrical circuit diagrams and check front passenger's airbag ignitor (stage 2) circuit for short circuit to power
B0011-13	Passenger Frontal Stage 2 Deployment Control - Circuit open	• Front passenger's airbag ignitor (stage 2) circuit open circuit	• Refer to the electrical circuit diagrams and check front passenger's airbag ignitor (stage 2) circuit for open circuit
B0011-19	Passenger Frontal Stage 2 Deployment Control - Circuit current above threshold	• Front passenger's airbag ignitor (stage 2) circuit current above threshold	• Refer to electrical circuit diagrams and check front passenger’s airbag ignitor (stage 2) circuit for swapped pins or cross coupling between two firing lines
B0011-1A	Passenger Frontal Stage 2 Deployment Control - Circuit resistance below threshold	• Front passenger's airbag ignitor (stage 2) circuit resistance below threshold	• Refer to electrical circuit diagrams and check front passenger's airbag ignitor (stage 2) circuit for short circuit between both lines to ignitor
B0011-95	Passenger Frontal Stage 2 Deployment Control - Incorrect assembly	• Front passenger's airbag ignitor (stage 2) incorrect assembly	• Check front passenger’s airbag ignitor (stage 2) installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0050-11	Driver Seatbelt Sensor - Circuit short to ground	• Driver's seatbelt switch circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's seatbelt switch circuit for short circuit to ground
B0050-12	Driver Seatbelt Sensor - Circuit short to battery	• Driver's seatbelt switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's seatbelt switch circuit for short circuit to power
B0050-13	Driver Seatbelt Sensor - Circuit open	• Driver's seatbelt switch circuit open circuit	• Refer to the electrical circuit diagrams and check driver's seatbelt switch circuit for open circuit
B0050-19	Driver Seatbelt Sensor - Circuit current above threshold	• Driver's seatbelt switch circuit current above threshold	• Refer to electrical circuit diagrams and check driver’s seatbelt switch circuit for swapped pins or cross coupling between two firing lines
B0050-1E	Driver Seatbelt Sensor - Circuit resistance out of range	• Driver's seatbelt switch circuit resistance out of range	• Refer to the electrical circuit diagrams and check driver's seatbelt sensor for resistance out of range
B0050-95	Driver Seatbelt Sensor - Incorrect assembly	• Driver's seatbelt sensor incorrect assembly	• Check front driver’s seatbelt sensor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0052-11	Passenger Seatbelt Sensor - Circuit short to ground	• Passenger's seatbelt switch circuit short circuit to ground	• Refer to the electrical circuit diagrams and check passenger's seatbelt switch circuit for short circuit to ground
B0052-12	Passenger Seatbelt Sensor - Circuit short to battery	• Passenger's seatbelt switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's seatbelt switch circuit for short circuit to power
B0052-13	Passenger Seatbelt Sensor - Circuit open	• Passenger's seatbelt switch circuit open circuit	• Refer to the electrical circuit diagrams and check passenger's seatbelt switch circuit for open circuit
B0052-19	Passenger Seatbelt Sensor - Circuit current above threshold	• Passenger's seatbelt switch circuit current above threshold	• Refer to electrical circuit diagrams and check passenger’s seatbelt switch circuit for swapped pins or cross coupling between two firing lines
B0052-1E	Passenger Seatbelt Sensor - Circuit resistance out of range	• Passenger's seatbelt switch circuit resistance out of range	• Refer to the electrical circuit diagrams and check passenger's seatbelt sensor for resistance out of range

DTC	Description	Possible Cause	Action
B0052-95	Passenger Seatbelt Sensor - Incorrect assembly	• Passenger's seatbelt sensor incorrect assembly	• Check front passenger’s seatbelt sensor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0070-11	Driver Seatbelt Pretensioner Deployment Control - Circuit short to ground	• Driver's seatbelt pretensioner ignitor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's seatbelt pretensioner ignitor circuit for short circuit to ground
B0070-12	Driver Seatbelt Pretensioner Deployment Control - Circuit short to battery	• Driver's seatbelt pretensioner ignitor circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's seatbelt pretensioner ignitor circuit for short circuit to power
B0070-13	Driver Seatbelt Pretensioner Deployment Control - Circuit open	• Driver's seatbelt pretensioner ignitor circuit open circuit	• Refer to the electrical circuit diagrams and check driver's seatbelt pretensioner ignitor circuit for open circuit
B0070-19	Driver Seatbelt Pretensioner Deployment Control - Circuit current above threshold	• Driver's seatbelt pretensioner ignitor circuit current above threshold	• Refer to electrical circuit diagrams and check driver’s seatbelt pretensioner ignitor circuit for swapped pins or cross coupling between two firing lines
B0070-1A	Driver Seatbelt Pretensioner Deployment Control - Circuit resistance below threshold	• Driver's seatbelt pretensioner ignitor circuit resistance below threshold	• Refer to electrical circuit diagrams and check driver's seatbelt pretensioner ignitor circuit for short circuit between both lines to ignitor
B0070-95	Driver Seatbelt Pretensioner Deployment Control - Incorrect assembly	• Driver’s seatbelt pretensioner ignitor incorrect assembly	• Check front driver’s seatbelt pretensioner ignitor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0072-11	Passenger Seatbelt Pretensioner Deployment Control - Circuit short to ground	• Passenger's seatbelt pretensioner ignitor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check passenger's seatbelt pretensioner ignitor circuit for short circuit to ground
B0072-12	Passenger Seatbelt Pretensioner Deployment Control - Circuit short to battery	• Passenger's seatbelt pretensioner ignitor circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's seatbelt pretensioner ignitor circuit for short circuit to power
B0072-13	Passenger Seatbelt Pretensioner Deployment Control - Circuit open	• Passenger's seatbelt pretensioner ignitor circuit open circuit	• Refer to the electrical circuit diagrams and check passenger's seatbelt pretensioner ignitor circuit for open circuit
B0072-19	Passenger Seatbelt Pretensioner Deployment Control - Circuit current above threshold	• Passenger's seatbelt pretensioner ignitor circuit current above threshold	• Refer to electrical circuit diagrams and check passenger’s seatbelt pretensioner ignitor circuit for swapped pins or cross coupling between two firing lines
B0072-1A	Passenger Seatbelt Pretensioner Deployment Control - Circuit resistance below threshold	• Passenger's seatbelt pretensioner ignitor circuit resistance below threshold	• Refer to electrical circuit diagrams and check passenger's seatbelt pretensioner ignitor circuit for short circuit between both lines to ignitor
B0072-95	Passenger Seatbelt Pretensioner Deployment Control - Incorrect assembly	• Passenger’s seatbelt pretensioner ignitor incorrect assembly	• Check front passenger’s seatbelt pretensioner ignitor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0080-11	Driver Seatbelt Load Limiter Deployment Control - Circuit short to ground	• Driver's safety belt retractor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's safety belt retractor circuit for short circuit to ground
B0080-12	Driver Seatbelt Load Limiter Deployment Control - Circuit short to battery	• Driver's safety belt retractor circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's safety belt retractor circuit for short circuit to power
B0080-13	Driver Seatbelt Load Limiter Deployment Control - Circuit open	• Driver's safety belt retractor circuit open circuit	• Refer to the electrical circuit diagrams and check driver's safety belt retractor circuit for open circuit
B0080-19	Driver Seatbelt Load Limiter Deployment Control - Circuit current above threshold	• Driver's safety belt retractor circuit current above threshold	• Refer to electrical circuit diagrams and check driver’s safety belt retractor circuit for swapped pins or cross coupling between two firing lines

DTC	Description	Possible Cause	Action
B0080-1A	Driver Seatbelt Load Limiter Deployment Control - Circuit resistance below threshold	• Driver's safety belt retractor circuit resistance below threshold	• Refer to electrical circuit diagrams and check driver's safety belt retractor circuit for short circuit between both lines to ignitor
B0080-95	Driver Seatbelt Load Limiter Deployment Control - Incorrect assembly	• Driver’s safety belt retractor incorrect assembly	• Check driver’s safety belt retractor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B0082-11	Passenger Seatbelt Load Limiter Deployment Control - Circuit short to ground	• Passenger's safety belt retractor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check passenger's safety belt retractor circuit for short circuit to ground
B0082-12	Passenger Seatbelt Load Limiter Deployment Control - Circuit short to battery	• Passenger's safety belt retractor circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's safety belt retractor circuit for short circuit to power
B0082-13	Passenger Seatbelt Load Limiter Deployment Control - Circuit open	• Passenger's safety belt retractor circuit open circuit	• Refer to the electrical circuit diagrams and check passenger's safety belt retractor circuit for open circuit
B0082-19	Passenger Seatbelt Load Limiter Deployment Control - Circuit current above threshold	• Passenger's safety belt retractor circuit current above threshold	• Refer to electrical circuit diagrams and check passenger’s safety belt retractor circuit for swapped pins or cross coupling between two firing lines
B0082-1A	Passenger Seatbelt Load Limiter Deployment Control - Circuit resistance below threshold	• Passenger's safety belt retractor circuit resistance below threshold	• Refer to electrical circuit diagrams and check passenger's safety belt retractor circuit for short circuit between both lines to ignitor
B0082-95	Passenger Seatbelt Load Limiter Deployment Control - Incorrect assembly	• Passenger’s safety belt retractor incorrect assembly	• Check passenger’s safety belt retractor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B00B5-11	Driver Seat Track Position Restraints Sensor - Circuit short to ground	• Driver's seat position sensor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's seat position sensor circuit for short circuit to ground
B00B5-12	Driver Seat Track Position Restraints Sensor - Circuit short to battery	• Driver's seat position sensor circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's seat position sensor circuit for short circuit to power
B00B5-13	Driver Seat Track Position Restraints Sensor - Circuit open	• Driver's seat position sensor circuit open circuit	• Refer to the electrical circuit diagrams and check driver's seat position sensor circuit for open circuit
B00B5-19	Driver Seat Track Position Restraints Sensor - Circuit current above threshold	• Driver's seat position sensor circuit current above threshold	• Refer to electrical circuit diagrams and check driver’s seat position sensor circuit for swapped pins or cross coupling between two firing lines
B00B5-1E	Driver Seat Track Position Restraints Sensor - Circuit resistance out of range	• Driver's seat position sensor circuit resistance out of range	• Refer to the electrical circuit diagrams and check driver's seat position sensor for resistance out of range
B00B5-95	Driver Seat Track Position Restraints Sensor - Incorrect assembly	• Driver’s seat position sensor incorrect assembly	• Check driver’s seat position sensor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B00D2-68	Restraint System Malfunction Indicator 1 - Event information	• Restraint system events information	• Refer to electrical circuit diagrams and check for instrument cluster internal fault • Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component
B00D2-95	Restraint System Malfunction Indicator 1 - Incorrect assembly	• Restraint system incorrect assembly	• Using the manufacturer approved diagnostic system check and install latest relevant level of software to the restraints control module • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required

DTC	Description	Possible Cause	Action
B00D5-12	Restraint System Passenger Disable Indicator - Circuit short to battery	• Passenger's airbag disable lamp circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's airbag disable lamp circuit for short circuit to power
B00D5-14	Restraint System Passenger Disable Indicator - Circuit short to ground or open	• Passenger's airbag disable lamp circuit short circuit to ground, open circuit, high resistance	• Refer to the electrical circuit diagrams and check passenger's airbag disable lamp circuit for short circuit to ground, open circuit, high resistance
B00D5-95	Restraint System Passenger Disable Indicator - Incorrect assembly	• Passenger’s airbag disable lamp incorrect assembly	• Check passenger’s airbag disable lamp installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B00DF-24	Passenger Restraints Disable Switch - Signal stuck high	• Passenger's restraints disable switch stuck or internal failure	• Refer to the electrical circuit diagrams and check passenger's restraints disable switch
B00DF-55	Passenger Restraints Disable Switch - Not configured	• Passenger's restraints disable switch not configured	• Refer to the electrical circuit diagrams and check passenger's restraints disable switch
B00DF-64	Passenger Restraints Disable Switch - Signal plausibility failure	• Passenger's restraints disable switch configuration error	• Refer to the electrical circuit diagrams and check passenger's restraints disable switch
B10FD-11	Drivers Side Peripheral Acceleration Sensor - Circuit short to ground	• Driver's front side impact sensor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's front side impact sensor circuit for short circuit to ground
B10FD-12	Drivers Side Peripheral Acceleration Sensor - Circuit short to battery	• Driver's front side impact sensor circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's front side impact sensor circuit for short circuit to power
B10FD-19	Drivers Side Peripheral Acceleration Sensor - Circuit current above threshold	• Driver's front side impact sensor circuit current above threshold	• Refer to electrical circuit diagrams and check driver’s front side impact sensor circuit for swapped pins or cross coupling between two firing lines
B10FD-4A	Drivers Side Peripheral Acceleration Sensor - Incorrect component installed	• Driver's front side impact sensor incorrect component installed	• Restraints control module detected a miss-match between the hardware fitted and what is expected • Check correct driver’s front side impact sensor installed
B10FD-87	Drivers Side Peripheral Acceleration Sensor - Missing message	• Driver's front side impact sensor circuit open circuit • Driver's front side impact sensor internal fault	• Refer to electrical circuit diagrams and check driver's front side impact sensor circuit for communication fault
B10FD-95	Drivers Side Peripheral Acceleration Sensor - Incorrect assembly	• Driver’s front side impact sensor incorrect assembly	• Check driver’s front side impact sensor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B10FD-96	Drivers Side Peripheral Acceleration Sensor - Component internal failure	• Driver's front side impact sensor internal fault	• Refer to electrical circuit diagrams and check driver's front side impact sensor
B10FE-11	Passenger Side Peripheral Acceleration Sensor - Circuit short to ground	• Passenger's front side impact sensor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check passenger's front side impact sensor circuit for short circuit to ground
B10FE-12	Passenger Side Peripheral Acceleration Sensor - Circuit short to battery	• Passenger's front side impact sensor circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's front side impact sensor circuit for short circuit to power
B10FE-19	Passenger Side Peripheral Acceleration Sensor - Circuit current above threshold	• Passenger's front side impact sensor circuit current above threshold	• Refer to electrical circuit diagrams and check passenger’s front side impact sensor circuit for swapped pins or cross coupling between two firing lines
B10FE-4A	Passenger Side Peripheral Acceleration Sensor - Incorrect component installed	• Passenger's front side impact sensor incorrect component installed	• Restraints control module detected a miss-match between the hardware fitted and what is expected • Check correct passenger’s front side impact sensor installed
B10FE-87	Passenger Side Peripheral Acceleration Sensor - Missing message	• Passenger's front side impact sensor circuit open circuit • Passenger's front side impact sensor internal	• Refer to electrical circuit diagrams and check passenger's front side impact sensor circuit for communication fault

DTC	Description	Possible Cause	Action
		fault	
B10FE-95	Passenger Side Peripheral Acceleration Sensor - Incorrect assembly	• Passenger’s front side impact sensor incorrect assembly	• Check passenger’s front side impact sensor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B10FE-96	Passenger Side Peripheral Acceleration Sensor - Component internal failure	• Passenger's front side impact sensor internal fault	• Refer to electrical circuit diagrams and check passenger's front side impact sensor
B1126-11	Drivers Side-Side Airbag Deployment Control - Circuit short to ground	• Driver's side air bag circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's side air bag circuit for short circuit to ground
B1126-12	Drivers Side-Side Airbag Deployment Control - Circuit short to battery	• Driver's side air bag circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's side air bag circuit for short circuit to power
B1126-13	Drivers Side-Side Airbag Deployment Control - Circuit open	• Driver's side air bag circuit open circuit	• Refer to the electrical circuit diagrams and check driver's side air bag circuit for open circuit
B1126-19	Drivers Side-Side Airbag Deployment Control - Circuit current above threshold	• Driver's side air bag circuit current above threshold	• Refer to electrical circuit diagrams and check driver’s side air bag circuit for swapped pins or cross coupling between two firing lines
B1126-1A	Drivers Side-Side Airbag Deployment Control - Circuit resistance below threshold	• Driver's side air bag circuit resistance below threshold	• Refer to electrical circuit diagrams and driver’s side air bag circuit for short circuit between both lines to air bag
B1126-95	Drivers Side-Side Airbag Deployment Control - Incorrect assembly	• Driver’s side air bag incorrect assembly	• Check driver’s side air bag installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B1127-11	Passengers Side-Side Airbag Deployment Control - Circuit short to ground	• Passenger's side air bag circuit short circuit to ground	• Refer to the electrical circuit diagrams and check passenger's side air bag circuit for short circuit to ground
B1127-12	Passengers Side-Side Airbag Deployment Control - Circuit short to battery	• Passenger's side air bag circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's side air bag circuit for short circuit to power
B1127-13	Passengers Side-Side Airbag Deployment Control - Circuit open	• Passenger's side air bag circuit open circuit	• Refer to the electrical circuit diagrams and check passenger's side air bag circuit for open circuit
B1127-19	Passengers Side-Side Airbag Deployment Control - Circuit current above threshold	• Passenger's side air bag circuit current above threshold	• Refer to electrical circuit diagrams and check passenger’s side air bag circuit for swapped pins or cross coupling between two firing lines
B1127-1A	Passengers Side-Side Airbag Deployment Control - Circuit resistance below threshold	• Passenger's side air bag circuit resistance below threshold	• Refer to electrical circuit diagrams and passenger's side air bag circuit for short circuit between both lines to side air bag
B1127-95	Passengers Side-Side Airbag Deployment Control - Incorrect assembly	• Passenger’s side air bag incorrect assembly	• Check passenger’s side air bag installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B1128-11	Drivers Side-Side Inflatable Curtain Deployment Control - Circuit short to ground	• Driver's side curtain air bag circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's side curtain air bag circuit for short circuit to ground
B1128-12	Drivers Side-Side Inflatable Curtain Deployment Control - Circuit short to battery	• Driver's side curtain air bag circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's side curtain air bag circuit for short circuit to power
B1128-13	Drivers Side-Side Inflatable Curtain Deployment Control - Circuit open	• Driver's side curtain air bag circuit open circuit	• Refer to the electrical circuit diagrams and check driver's side curtain air bag circuit for open circuit
B1128-19	Drivers Side-Side Inflatable Curtain Deployment Control - Circuit current above threshold	• Driver's side curtain air bag circuit current above threshold	• Refer to electrical circuit diagrams and driver’s side curtain air bag circuit for swapped pins or cross coupling between two firing lines

DTC	Description	Possible Cause	Action
B1128-1A	Drivers Side-Side Inflatable Curtain Deployment Control - Circuit resistance below threshold	• Driver's side curtain air bag circuit resistance below threshold	• Refer to electrical circuit diagrams and driver's side curtain air bag circuit for short circuit between both lines to side curtain air bag
B1128-95	Drivers Side-Side Inflatable Curtain Deployment Control - Incorrect assembly	• Driver’s side curtain air bag incorrect assembly	• Check driver’s side curtain air bag installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B1129-11	Passengers Side-Side Inflatable Curtain Deployment Control - Circuit short to ground	• Passenger's side curtain air bag circuit short circuit to ground	• Refer to the electrical circuit diagrams and check passenger's side curtain air bag circuit for short circuit to ground
B1129-12	Passengers Side-Side Inflatable Curtain Deployment Control - Circuit short to battery	• Passenger's side curtain air bag circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's side curtain air bag circuit for short circuit to power
B1129-13	Passengers Side-Side Inflatable Curtain Deployment Control - Circuit open	• Passenger's side curtain air bag circuit open circuit	• Refer to the electrical circuit diagrams and check passenger's side curtain air bag circuit for open circuit
B1129-19	Passengers Side-Side Inflatable Curtain Deployment Control - Circuit current above threshold	• Passenger's side curtain air bag circuit current above threshold	• Refer to electrical circuit diagrams and check passenger’s side curtain air bag circuit for swapped pins or cross coupling between two firing lines
B1129-1A	Passengers Side-Side Inflatable Curtain Deployment Control - Circuit resistance below threshold	• Passenger's side curtain air bag circuit resistance below threshold	• Refer to electrical circuit diagrams and passenger's side curtain air bag circuit for short circuit between both lines to side curtain air bag
B1129-95	Passengers Side-Side Inflatable Curtain Deployment Control - Incorrect assembly	• Passenger’s side curtain air bag incorrect assembly	• Check passenger’s side curtain air bag installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B1193-68	Crash Event Storage Full and Locked - Event information	• Restraints control module crash event storage area full and locked	• Read out the event data recorder and then refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module
B1194-11	Driver Side Frontal Acceleration Sensor - Circuit short to ground	• Driver's side front impact sensor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's side front impact sensor circuit for short circuit to ground
B1194-12	Driver Side Frontal Acceleration Sensor - Circuit short to battery	• Driver's side front impact sensor circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's side front impact sensor circuit for short circuit to power
B1194-19	Driver Side Frontal Acceleration Sensor - Circuit current above threshold	• Driver's side front impact sensor circuit current above threshold	• Refer to electrical circuit diagrams and driver’s side front impact sensor circuit for swapped pins or cross coupling between two firing lines
B1194-4A	Driver Side Frontal Acceleration Sensor - Incorrect component installed	• Driver's side front impact sensor incorrect component installed	• Restraints control module detected a miss-match between the hardware fitted and what is expected • Check correct driver’s side front impact sensor installed
B1194-87	Driver Side Frontal Acceleration Sensor - Missing message	• Driver's side front impact sensor circuit open circuit • Driver's side front impact sensor internal fault	• Refer to electrical circuit diagrams and driver's side front impact sensor for communication fault
B1194-95	Driver Side Frontal Acceleration Sensor - Incorrect assembly	• Driver’s side front impact sensor incorrect assembly	• Check driver’s side front impact sensor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B1194-96	Driver Side Frontal Acceleration Sensor - Component internal failure	• Driver's side front impact sensor internal fault	• Refer to electrical circuit diagrams and check driver's side front impact sensor
B1195-11	Passenger Side Frontal Acceleration Sensor - Circuit short to ground	• Passenger's side front impact sensor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check passenger's side front impact sensor circuit for short circuit to ground

DTC	Description	Possible Cause	Action
B1195-12	Passenger Side Frontal Acceleration Sensor - Circuit short to battery	• Passenger's side front impact sensor circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's side front impact sensor circuit for short circuit to power
B1195-19	Passenger Side Frontal Acceleration Sensor - Circuit current above threshold	• Passenger's side front impact sensor circuit current above threshold	• Refer to electrical circuit diagrams and passenger's side front impact sensor circuit for swapped pins or cross coupling between two firing lines
B1195-4A	Passenger Side Frontal Acceleration Sensor - Incorrect component installed	• Passenger's side front impact sensor incorrect component installed	• Restraints control module detected a miss-match between the hardware fitted and what is expected • Check correct passenger's side front impact sensor installed
B1195-87	Passenger Side Frontal Acceleration Sensor - Missing message	• Passenger's side front impact sensor circuit open circuit • Passenger's side front impact sensor internal fault	• Refer to electrical circuit diagrams and passenger's side front impact sensor for communication fault
B1195-95	Passenger Side Frontal Acceleration Sensor - Incorrect assembly	• Passenger's side front impact sensor incorrect assembly	• Check passenger's side front impact sensor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B1195-96	Passenger Side Frontal Acceleration Sensor - Component internal failure	• Passenger's side front impact sensor internal fault	• Refer to electrical circuit diagrams and check passenger's side front impact sensor
B1196-11	Driver Side Second Row Peripheral Acceleration Sensor - Circuit short to ground	• Driver's side rear side impact sensor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check driver's side rear side impact sensor circuit for short circuit to ground
B1196-12	Driver Side Second Row Peripheral Acceleration Sensor - Circuit short to battery	• Driver's side rear side impact sensor circuit short circuit to power	• Refer to the electrical circuit diagrams and check driver's side rear side impact sensor circuit for short circuit to power
B1196-19	Driver Side Second Row Peripheral Acceleration Sensor - Circuit current above threshold	• Driver's side rear side impact sensor circuit current above threshold	• Refer to electrical circuit diagrams and check driver's side rear side impact sensor circuit for swapped pins or cross coupling between two firing lines
B1196-4A	Driver Side Second Row Peripheral Acceleration Sensor - Incorrect component installed	• Driver's side rear side impact sensor incorrect component installed	• Restraints control module detected a miss-match between the hardware fitted and what is expected • Check correct driver's side rear side impact sensor installed
B1196-87	Driver Side Second Row Peripheral Acceleration Sensor - Missing message	• Driver's side rear side impact sensor circuit open circuit • Driver's side rear side impact sensor internal fault	• Refer to electrical circuit diagrams and check driver's side rear side impact sensor for communication fault
B1196-95	Driver Side Second Row Peripheral Acceleration Sensor - Incorrect assembly	• Driver's side rear side impact sensor incorrect assembly	• Check driver's side rear side impact sensor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B1196-96	Driver Side Second Row Peripheral Acceleration Sensor - Component internal failure	• Driver's side rear side impact sensor internal fault	• Refer to electrical circuit diagrams and check driver's side rear side impact sensor
B1197-11	Passenger Side Second Row Peripheral Acceleration Sensor - Circuit short to ground	• Passenger's side rear side impact sensor circuit short circuit to ground	• Refer to the electrical circuit diagrams and check passenger's side rear side impact sensor circuit for short circuit to ground
B1197-12	Passenger Side Second Row Peripheral Acceleration Sensor - Circuit short to battery	• Passenger's side rear side impact sensor circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's side rear side impact sensor circuit for short circuit to power
B1197-19	Passenger Side Second Row Peripheral Acceleration Sensor - Circuit current above threshold	• Passenger's side rear side impact sensor circuit current above threshold	• Refer to electrical circuit diagrams and check passenger's side rear side impact sensor circuit for swapped pins or cross coupling between two firing lines

DTC	Description	Possible Cause	Action
B1197-4A	Passenger Side Second Row Peripheral Acceleration Sensor - Incorrect component installed	• Passenger's side rear side impact sensor incorrect component installed	• Restraints control module detected a miss-match between the hardware fitted and what is expected • Check correct passenger’s side rear side impact sensor installed
B1197-87	Passenger Side Second Row Peripheral acceleration Sensor - Missing message	• Passenger's side rear side impact sensor circuit open circuit • Passenger's side rear side impact sensor internal fault	• Refer to electrical circuit diagrams and check passenger's side rear side impact sensor for communication fault
B1197-95	Passenger Side Second Row Peripheral Acceleration Sensor - Incorrect assembly	• Passenger’s side rear side impact sensor incorrect assembly	• Check passenger’s side rear side impact sensor installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B1197-96	Passenger Side Second Row Peripheral Acceleration Sensor - Component internal failure	• Passenger's side rear side impact sensor internal fault	• Refer to electrical circuit diagrams and check passenger's side rear side impact sensor
B1A55-11	Crash Record Output - Circuit short to ground	• Event signal circuit short circuit to ground	• Refer to the electrical circuit diagrams and check event signal circuit for short circuit to ground
B1A55-12	Crash Record Output - Circuit short to battery	• Event signal circuit short circuit to power	• Refer to the electrical circuit diagrams and check event signal circuit for short circuit to power
B1D74-11	Passenger Airbag Cutoff Enable Switch - Circuit short to ground	• Passenger's air bag deactivation switch circuit short circuit to ground	• Refer to the electrical circuit diagrams and check passenger's air bag deactivation switch circuit for short circuit to ground
B1D74-12	Passenger Airbag Cutoff Enable Switch - Circuit short to battery	• Passenger's air bag deactivation switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's air bag deactivation switch circuit for short circuit to power
B1D74-13	Passenger Airbag Cutoff Enable Switch - Circuit open	• Passenger's air bag deactivation switch circuit open circuit	• Refer to the electrical circuit diagrams and check passenger's air bag deactivation switch circuit for open circuit
B1D74-19	Passenger Airbag Cutoff Enable Switch - Circuit current above threshold	• Passenger's air bag deactivation switch circuit current above threshold	• Refer to electrical circuit diagrams and check passenger’s air bag deactivation switch circuit for swapped pins or cross coupling between two firing lines
B1D74-1E	Passenger Airbag Cutoff Enable Switch - Circuit resistance out of range	• Passenger's air bag deactivation switch circuit resistance out of range	• Refer to the electrical circuit diagrams and check passenger's air bag deactivation switch for resistance out of range
B1D74-95	Passenger Airbag Cutoff Enable Switch - Incorrect assembly	• Passenger’s air bag deactivation switch incorrect assembly	• Check passenger’s air bag deactivation switch installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
B1D75-11	Passenger Airbag Cutoff Disable Switch - Circuit short to ground	• Passenger's air bag deactivation switch circuit short circuit to ground	• Refer to the electrical circuit diagrams and check passenger's air bag deactivation switch circuit for short circuit to ground
B1D75-12	Passenger Airbag Cutoff Disable Switch - Circuit short to battery	• Passenger's air bag deactivation switch circuit short circuit to power	• Refer to the electrical circuit diagrams and check passenger's air bag deactivation switch circuit for short circuit to power
B1D75-13	Passenger Airbag Cutoff Disable Switch - Circuit open	• Passenger's air bag deactivation switch circuit open circuit	• Refer to the electrical circuit diagrams and check passenger's air bag deactivation switch circuit for open circuit
B1D75-19	Passenger Airbag Cutoff Disable Switch - Circuit current above threshold	• Passenger's air bag deactivation switch circuit current above threshold	• Refer to electrical circuit diagrams and check passenger’s air bag deactivation switch circuit for swapped pins or cross coupling between two firing lines

DTC	Description	Possible Cause	Action
B1D75-1E	Passenger Airbag Cutoff Disable Switch - Circuit resistance out of range	• Passenger's air bag deactivation switch circuit resistance out of range	• Refer to the electrical circuit diagrams and check passenger's air bag deactivation switch for resistance out of range
B1D75-95	Passenger Airbag Cutoff Disable Switch - Incorrect assembly	• Passenger’s air bag deactivation switch incorrect assembly	• Check passenger’s air bag deactivation switch installed correctly • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
U0001-88	High Speed CAN Communication Bus - Bus off	• High speed CAN bus circuit fault	• Refer to the electrical circuit diagrams and check the power and ground connections to the module • Using the manufacturer approved diagnostic system, complete a CAN network integrity test • Refer to the electrical circuit diagrams and check the CAN network
U0140-00	Lost Communication With Body Control Module - No sub type information	• Lost communication with body control module	• Refer to the electrical circuit diagrams and check the power and ground connections to the module • Using the manufacturer approved diagnostic system, complete a CAN network integrity test • Refer to the electrical circuit diagrams and check the CAN network between the restraints control module and body control module
U0154-00	Lost Communication With Restraints Occupant Classification System Module - No sub type information	• Lost communication with restraints occupant classification system module	• Refer to the electrical circuit diagrams and check the power and ground connections to the module • Using the manufacturer approved diagnostic system, complete a CAN network integrity test • Refer to the electrical circuit diagrams and check the CAN network between the restraints control module and restraints occupant classification system module
U0300-00	Internal Control Module Software Incompatibility - No sub type information	• Restraints control module is not configured correctly	• Using the manufacturer approved diagnostic system check and install latest relevant level of software to the restraints control module
U0455-64	Invalid Data Received From Restraints Occupant Classification System Module - Signal plausibility failure	• Restraints occupant classification system module configuration error	• Using the manufacturer approved diagnostic system check and install latest relevant level of software to the restraints occupant classification module
U0455-92	Invalid Data Received From Restraints Occupant Classification System Module - Performance or incorrect operation	• Restraints occupant classification system module internal failure	• Refer to the electrical circuit diagrams and check for restraints occupant classification system module internal fault and check for stored DTCs
U0455-94	Invalid Data Received From Restraints Occupant Classification System Module - Unexpected operation	• Restraints occupant classification system module unexpected operation	• Using the manufacturer approved diagnostic system check and install latest relevant level of software to the restraints occupant classification module
U2100-00	Initial Configuration Not Complete - No sub type information	• Restraints control module is not configured correctly	• Using the manufacturer approved diagnostic system check and install latest relevant level of software to the restraints occupant classification module
U2101-00	Control Module Configuration Incompatible - No sub type information	• Restraints control module is not configured correctly	• Using the manufacturer approved diagnostic system check and install latest relevant level of software to the restraints control module • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required. Clear the DTC and re-test
U3000-49	Control Module - Internal electronic failure	• Restraints control module internal electronic failure	• Restraints control module internal fault • Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/ component

DTC	Description	Possible Cause	Action
U3003-62	Battery Voltage - Signal compare failure	• Restraints control module measured voltage is 2.5v lower than battery voltage	• Refer to the electrical circuit diagrams and check input voltage to the restraints control module compared to battery voltage
U3006-17	Control Module Input Power 'A' - Circuit voltage above threshold	• Restraints control module circuit supply voltage above threshold	• Refer to the electrical circuit diagrams and check for high input voltage to the restraints control module
U3006-68	Control Module Input Power 'A' - Event information	• Restraints control module circuit supply voltage below threshold	• Refer to the electrical circuit diagrams and check for low input voltage to the restraints control module
U3008-13	Control Module Ground 'A' - Circuit open	• Restraints control module ground supply open circuit	• Refer to the electrical circuit diagrams and check the ground supply for open circuit to the restraints control module

Published: 27-Apr-2011

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Steering Angle Sensor Module (SASM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the anti lock control stability system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).

Steering Angle Sensor Module

DTC	Description	Possible Cause	Action
U0001-00	High Speed CAN Communication Bus General Failure Information No sub type information	• Bus Off	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
U0140-00	Lost Communication With Central electronic module General Failure Information No sub type information	• Lost communication with CJB	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
U0300-00	Internal Control Module Software Incompatibility General Failure Information No sub type information	• CAN Bus fault • Loss of power to module • Incorrect component installed • Module internal failure	Carry out CAN network and power feed tests using manufacturer approved diagnostic system. Check correct steering wheel rotation sensor is installed. Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3000-04	Control Module General Failure Information System Internal Failures	• CAN Bus fault • Loss of power to module • Incorrect component installed • Module internal failure	Carry out CAN network and power feed tests using manufacturer approved diagnostic system. Check correct steering wheel rotation sensor is installed. Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3000-14	Control Module General Electrical Failures Circuit short to ground or open	• Loss of power to module • Module internal failure	Carry out power feed tests using manufacturer approved diagnostic system. Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3000-1D	Control Module General Electrical Failures Circuit current out of range	• Loss of power to module • Module internal failure	Carry out power feed tests using manufacturer approved diagnostic system. Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3000-44	Control Module System Internal Failures Data memory failure	• Module internal failure	Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3000-48	Control Module System Internal Failures Supervision software failure	• Module internal failure	Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3000-49	Control Module System Internal Failures Internal electronic failure	• Loss of power to module • Module internal failure	Carry out power feed tests using manufacturer approved diagnostic system. Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3000-61	Control Module Algorithm Based Failures Signal calculation failure	• Steering wheel rotation sensor mis-aligned • Module internal failure	Check for correct installation of sensor. Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.

DTC	Description	Possible Cause	Action
U3000-62	Control Module Algorithm Based Failures Signal compare failure	• Steering wheel rotation sensor mis-aligned • Module internal failure	Check for correct installation of sensor. Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3000-64	Control Module Algorithm Based Failures Signal plausibility failure	• Steering wheel rotation sensor mis-aligned • Module internal failure	Check for correct installation of sensor. Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3000-81	Control Module Bus Signal / Message Failures Invalid serial data received	• Loss of power to module • CAN Bus fault • Module internal failure	Carry out CAN network and power feed tests using manufacturer approved diagnostic system. Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3000-87	Control Module Bus Signal / Message Failures Missing message	• Loss of power to module • CAN Bus fault • Missing module	Carry out CAN network and power feed tests using manufacturer approved diagnostic system. Check for missing modules on CAN network
U3000-92	Control Module Component Failures Performance or incorrect operation	• Steering wheel rotation sensor mis-aligned • Module internal failure	Check for correct installation of sensor. Install a new steering wheel rotation sensor as required, refer to new module/component installation note at the top of the DTC Index.
U3003-62	Battery Voltage Algorithm Based Failures Signal compare failure	• Mis-match in battery voltage, of 2 volts or more, between CJB and steering wheel rotation sensor module	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system

Published: 28-Apr-2011

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Satellite Digital Audio Radio System Module (SARM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the satellite radio system, refer to the relevant Description and Operation section in the workshop manual.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Satellite Radio Module (SRM)

DTC	Description	Possible Cause	Action
B1A89-11	Satellite antenna	SDARS antenna circuit - short to ground	Refer to electrical circuit diagrams and check SDARS antenna circuit for short to ground
B1A89-12	Satellite antenna	SDARS antenna circuit - short to power	Refer to electrical circuit diagrams and check SDARS antenna circuit for short to power
B1A89-13	Satellite antenna	SDARS antenna circuit - open circuit	Refer to electrical circuit diagrams and check SDARS antenna circuit for open circuit
U3000-04	Control module	System internal failure	Install a new satellite radio module. For additional information, refer to: Satellite Radio Tuner (415-01 Information and Entertainment System, Removal and Installation).
U3000-4A	Control module	Incorrect component installed	Install a new satellite radio module. For additional information, refer to: Satellite Radio Tuner (415-01 Information and Entertainment System, Removal and Installation). or Re-configure the satellite radio module using the manufacturer approved diagnostic system
U3000-55	Control module	Incorrect Car Configuration File data received	Check/up-date Car Configuration File using manufacturer approved diagnostic system
U3000-87	Control module	Missing message	Check CJB for DTCs and refer to DTC Index. For additional information, refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). Check information and entertainment module for Car Configuration File and MOST network DTCs and refer to relevant DTC Index. Carry out MOST/CAN network tests using the manufacturer approved diagnostic system
U3000-98	Control module	Component or system over temperature	Check for additional DTCs and refer to relevant DTC Index. Check/monitor system for re-occurrence
U3003-62	Battery voltage	Mis-match in battery voltage, of 2 volts or more, between satellite radio module and CJB	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Transmission Control Module (TCM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the transmission control system, refer to the relevant Description and Operation section in the workshop manual. For additional information, refer to: Transmission Description (307-01 Automatic Transmission/Transaxle, Description and Operation).

Transmission control module (TCM)

DTC	Description	Possible Cause	Action
P0218-68	Transmission fluid overtemperature condition	• Transmission fluid level low • Transmission fluid cooler/hoses are obstructed/damaged/blocked. • Mechanical fault in the transmission	Check the transmission fluid level and condition. Check the transmission fluid cooler /hoses for signs of obstruction/damage /blockage. Rectify as necessary. Refer to the warranty policy and procedures manual if the transmission is suspect.
P0500-00	Vehicle speed sensor A (output shaft speed sensor)	• Vehicle speed sensor A circuit: short circuit to ground • Vehicle speed sensor A circuit: open circuit • Vehicle speed sensor A fault	Check the vehicle speed sensor A and circuits. Refer to the electrical guides. Rectify as necessary.
P056-100	System voltage unstable	• Battery fault • Charging system fault	Check the battery and charging systems. Refer to the electrical guides. Rectify as necessary.
P0562-00	System voltage low	• Battery fault • Charging system fault	
P0601-00	Internal control module memory checksum error	• Internal transmission control module (TCM) fault	Reconfigure the module using the approved diagnostic system.
P0603-00	Internal control module keep alive memory (KAM) error	• Internal transmission control module (TCM) fault	Refer to the warranty policy and procedures manual if the TCM is suspect.
P0604-00	Internal control module random access memory (RAM) error	• Internal transmission control module (TCM) fault	
P0605-00	Internal control module read only memory (ROM) error	• Internal transmission control module (TCM) fault	
P0614-00	Engine control module (ECM)/transmission control module (TCM) incompatible	• Incorrect software in TCM	Reconfigure the module using the approved diagnostic system.
P062F-00	Internal control module electrically erasable programmable read only memory (EEPROM) error	• Internal transmission control module (TCM) fault	Refer to the warranty policy and procedures manual if the TCM is suspect.
P0705-00	Transmission range sensor A circuit (PRNDL input)	• Incorrect adjustment of the gear selector lever cable • Incorrect adjustment of the gear position sensor • Internal transmission control module (TCM) fault	Check the adjustment of the gear selector lever cable and sensor. For additional information, refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission/Transaxle External Controls, General Procedures). Refer to the warranty policy and procedures manual if the TCM is suspect.
P0706-00	Transmission range sensor A circuit range/performance	• Incorrect adjustment of the gear selector lever cable • Incorrect adjustment of the gear position sensor • Internal transmission control	Check the adjustment of the gear selector lever cable. For additional information, refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission/Transaxle External Controls,

DTC	Description	Possible Cause	Action
		module (TCM) fault	General Procedures).
P0709-00	Transmission range sensor A circuit intermittent	• Incorrect adjustment of the gear selector lever cable • Incorrect adjustment of the gear position sensor • Internal transmission control module (TCM) fault	Calibrate the gear position sensor using the approved diagnostic system. Refer to the warranty policy and procedures manual if the TCM is suspect.
P0711-00	Transmission fluid temperature sensor A circuit range/performance	• Transmission fluid temperature sensor circuit: high resistance in terminals • Transmission fluid temperature sensor fault	Check the transmission fluid temperature sensor and circuits. Refer to the electrical guides. Rectify as necessary.
P0712-00	Transmission fluid temperature sensor A circuit low	• Transmission fluid temperature sensor circuit: short circuit to ground • Transmission fluid temperature sensor circuit: open circuit	
P0713-00	Transmission fluid temperature sensor A circuit high	• Transmission fluid temperature sensor circuit: short circuit to power	
P0715-00	Turbine/Input shaft speed (ISS) sensor A circuit	• Transmission ISS circuit: short circuit to power	Check the transmission ISS sensor and circuits. Refer to the electrical guides. Install a new ISS sensor as necessary. For additional information, refer to: (307-01 Automatic Transmission/Transaxle) Input Shaft Speed (ISS) Sensor - I6 3.2L Petrol (Removal and Installation), Input Shaft Speed (ISS) Sensor - TD4 2.2L Diesel (Removal and Installation).
P0716-00	Turbine/Input shaft speed (ISS) sensor A circuit range/performance	• Transmission ISS sensor circuit: high resistance in terminals • Transmission ISS sensor fault	
P0718-00	Turbine/input shaft speed (ISS) sensor A circuit intermittent	• Transmission ISS sensor circuit: intermittent high resistance in terminals • Transmission ISS sensor fault	
P0720-00	Output shaft speed (OSS) sensor circuit (vehicle speed sensor A circuit)	• OSS sensor circuit: short circuit to power	Check the transmission OSS sensor and circuits. Refer to the electrical guides. Rectify as necessary.
P0721-00	Output shaft speed (OSS) sensor circuit (vehicle speed sensor A circuit) range/performance	• The wheel radius does not agree with the wheel radius programmed in the car configuration file • OSS sensor not installed correctly • OSS sensor circuit: high resistance in terminals • OSS sensor fault	Check that the correct wheels and tires are installed. Check the transmission OSS sensor for correct installation. Check the OSS sensor and circuits. Refer to the electrical guides. Rectify as necessary.
P0722-00	Output shaft speed (OSS) sensor circuit (vehicle speed sensor A circuit) no signal	• OSS sensor circuit: high resistance in terminals • OSS sensor circuit: open circuit • OSS sensor circuit: short circuit to ground • OSS sensor fault • Internal transmission control module (TCM) fault	Check the transmission OSS sensor and circuits. Refer to the electrical guides. Rectify as necessary. Refer to the warranty policy and procedures manual if the TCM is suspect.
P0723-00	Output shaft speed (OSS) sensor circuit (vehicle speed sensor A circuit) intermittent	• OSS sensor not installed correctly • OSS sensor circuit: intermittent high resistance in terminals • OSS sensor fault • Internal transmission control module (TCM) fault	Check the transmission OSS sensor for correct installation. Check the OSS sensor and circuits. Refer to the electrical guides. Rectify as necessary. Refer to the warranty policy and procedures manual if the TCM is suspect.
P0725-00	Engine speed input circuit	• Controller area network (CAN) circuit: open circuit • CAN circuit: short circuit to ground • CAN module fault	Carry out a complete vehicle read for CAN related DTCs. Rectify as necessary.
P0729-00	Gear 6 incorrect ratio	• Contact resistance in the terminals • Solenoid regulating incorrectly • Mechanical fault in transmission - transmission components worn and	Carry out a complete read for related engine torque DTCs. Check transmission fluid level and condition. Refer to the warranty policy and procedures manual if the transmission is suspect.

DTC	Description	Possible Cause	Action
		causing slip or system pressure too low	
P0730-00	Incorrect gear ratio	• Internal malfunction of the transmission	Refer to the warranty policy and procedures manual if the transmission is suspect.
P0730-95	Incorrect gear ratio - incorrect assembly	• Incorrect final gear installed	Check transmission units part numbers. Refer to the warranty policy and procedures manual if the transmission is suspect.
P0731-00	Gear 1 incorrect ratio	• Contact resistance in the terminals • Solenoid regulating incorrectly • Mechanical fault in transmission - transmission components worn and causing slip or system pressure too low	Carry out a complete read for related engine torque DTCs. Check transmission fluid level and condition. Refer to the warranty policy and procedures manual if the transmission is suspect.
P0732-00	Gear 2 incorrect ratio	• Contact resistance in the terminals • Solenoid regulating incorrectly • Mechanical fault in transmission - transmission components worn and causing slip or system pressure too low	
P0733-00	Gear 3 incorrect ratio	• Contact resistance in the terminals • Solenoid regulating incorrectly • Mechanical fault in transmission - transmission components worn and causing slip or system pressure too low	
P0734-00	Gear 4 incorrect ratio	• Contact resistance in the terminals • Solenoid regulating incorrectly • Mechanical fault in transmission - transmission components worn and causing slip or system pressure too low	
P0735-00	Gear 5 incorrect ratio	• Contact resistance in the terminals • Solenoid regulating incorrectly • Mechanical fault in transmission - transmission components worn and causing slip or system pressure too low	
P0736-00	Reverse gear incorrect ratio	• Internal malfunction in the transmission control system • Mechanical fault in transmission. Transmission components worn and causing slip or system pressure too low • Fluid level low/condition poor	
P073D-00	Unable to engage neutral	• Contact resistance in the terminals • Solenoids stuck in the on/off position. • Mechanical fault in the transmission	Check transmission fluid level and condition. Refer to the warranty policy and procedures manual if the transmission is suspect.
P073E-64	Unable to engage reverse	• Contact resistance in the terminals • Solenoids stuck in the on/off position. • Mechanical fault in the transmission	

DTC	Description	Possible Cause	Action
P073F-00	Unable to engage gear 1	• Contact resistance in the terminals • Solenoids stuck in the on/off position. • Mechanical fault in the transmission	
P0741-00	Torque converter clutch solenoid circuit performance/stuck off	• Contact resistance in the terminals • Torque converter clutch lock up control solenoid (SLU) circuit: short circuit to ground • Torque converter clutch lock up control solenoid (SLU) circuit: short circuit to power • Torque converter clutch lock up control solenoid (SLU) circuit: open circuit • Torque converter clutch lock up solenoid (SLU) stuck in off position • Internal transmission control module (TCM) fault	Refer to the warranty policy and procedures manual if the transmission or the TCM is suspect.
P0742-00	Torque converter clutch solenoid circuit stuck on	• Contact resistance in the terminals • Torque converter clutch lock up control solenoid (SLU) circuit: short circuit to ground • Torque converter clutch lock up control solenoid (SLU) circuit: short circuit to power • Torque converter clutch lock up control solenoid (SLU) circuit: open circuit • Torque converter clutch lock up solenoid (SLU) stuck in on position • Internal transmission control module (TCM) fault	
P0744-68	Torque converter clutch solenoid circuit intermittent	• Engine stalled • Mechanical fault in engine	Carry out a complete read for related engine DTCs. Rectify as necessary.
P074A-00	Unable to engage gear 2	• Contact resistance in the terminals • Solenoids stuck in the on/off position • Mechanical fault in the transmission	Check transmission fluid level and condition. Refer to the warranty policy and procedures manual if the transmission is suspect.
P074B-00	Unable to engage gear 3	• Contact resistance in the terminals • Solenoids stuck in the on/off position • Mechanical fault in the transmission	
P074C-00	Unable to engage gear 4	• Contact resistance in the terminals • Solenoids stuck in the on/off position • Mechanical fault in the transmission	
P074D-00	Unable to engage gear 5	• Contact resistance in the terminals • Solenoids stuck in the on/off position • Mechanical fault in the transmission	
P074E-00	Unable to engage gear 6	• Contact resistance in the terminals • Solenoids stuck in the on/off position • Mechanical fault in the transmission	
P0777-00	Pressure control solenoid B stuck on	• Shift solenoid No. 2 stuck in the on position	Refer to the warranty policy and procedures manual if the transmission is suspect.

DTC	Description	Possible Cause	Action
P0814-42	Transmission range display circuit - general memory failure	• Internal transmission control module (TCM) fault • Internal gear selector module (GSM) fault	Refer to the warranty policy and procedures manual if a module is suspect.
P0814-49	Transmission range display circuit - internal electronic failure	• Internal transmission control module (TCM) fault • Internal gear selector module (GSM) fault	
P081711	Starter disable circuit open	• Start lock output control circuit: short circuit to ground • Start lock output control circuit: open circuit	Check the starter disable circuits. Refer to the electrical guides. Rectify as necessary.
P0817-12	Starter disable circuit open	• Start lock output control circuit: short circuit to power	
P081C-49	Park input circuit - internal electronic failure	• Internal transmission control module (TCM) fault • Internal gear selector module (GSM) fault	Refer to the warranty policy and procedures manual if a module is suspect.
P0826-01	Up and down switch circuit	• Internal transmission control module (TCM) fault • Internal gear selector module (GSM) fault	Refer to the warranty policy and procedures manual if a module is suspect.
P085A-00	Gear shift module B communication circuit	• Local interconnect network (LIN) circuit fault between the gear selector module (GSM) and transmission control module (TCM)	Check the local interconnect network (LIN) circuits. Refer to the electrical guides. Rectify as necessary.
P0860-11	Gear shift module A communication circuit	• Local interconnect network (LIN) circuit fault between the gear selector module (GSM) and transmission control module (TCM)	Check the local interconnect network (LIN) circuits. Refer to the electrical guides. Rectify as necessary.
P0860-12	Gear shift module A communication circuit	• Local interconnect network (LIN) circuit fault between the gear selector module (GSM) and transmission control module (TCM)	
P0860-13	Gear shift module A communication circuit	• Local interconnect network (LIN) circuit fault between the gear selector module (GSM) and transmission control module (TCM)	
P0860-87	Gear shift module A communication circuit - missing message	• Local interconnect network (LIN) circuit fault between the gear selector module (GSM) and transmission control module (TCM)	
P088513	Transmission control module (TCM) power relay control circuit open	• TCM power relay control circuit: open circuit • TCM power relay fault	Check the TCM relay and circuits. Refer to the electrical guides. Rectify as necessary.
P0886-11	Transmission control module (TCM) power relay control circuit low	• TCM power relay control circuit: short circuit to ground • TCM power relay fault	
P0894-68	Transmission component slipping	• Transmission fluid level low • Mechanical fault in the transmission	Carry out a complete read for related DTCs. Rectify as necessary. Check the transmission fluid level and condition. Rectify as necessary. Refer to the warranty policy and procedures manual if the transmission is suspect.
P0895-00	Shift time too short	• Internal transmission control fault (TCM) • Hydraulic fault in the transmission	Refer to the warranty policy and procedures manual if the transmission or a module is suspect.
P0896-00	Shift time too long	• Internal transmission control fault (TCM) • Hydraulic fault in the transmission	

DTC	Description	Possible Cause	Action
P0897-09	Transmission fluid deteriorated	• Transmission fluid no longer serviceable	Drain and refill the transmission with fresh fluid. For additional information, refer to: (307-01 Automatic Transmission/Transaxle) Transmission Fluid Drain and Refill - I6 3.2L Petrol (General Procedures), Transmission Fluid Drain and Refill - TD4 2.2L Diesel (General Procedures).
P0928-13	Gear shift lock solenoid circuit open	• Gear shift lock solenoid circuit: open circuit • Gear shift lock solenoid fault	Check the gear shift lock solenoid and circuits. Refer to the electrical guides. Rectify as necessary.
P0930-11	Gear shift lock solenoid circuit low	• Gear shift lock solenoid circuit: short circuit to ground • Gear shift lock solenoid fault	
P0931-12	Gear shift lock solenoid circuit high	• Gear shift lock solenoid circuit: short circuit to power • Gear shift lock solenoid fault	
P0960-00	Pressure control solenoid A control circuit open	• Line pressure control solenoid (SLT) circuit: short circuit to ground • Line pressure control solenoid (SLT) circuit: open circuit • Line pressure control solenoid (SLT) fault	Refer to the warranty policy and procedures manual if the transmission is suspect.
P0961-00	Pressure control solenoid A control circuit range/performance	• Line pressure control solenoid (SLT) circuit: short circuit to ground • Line pressure control solenoid (SLT) circuit: open circuit • Line pressure control solenoid (SLT) circuit: short circuit to power • Line pressure control solenoid (SLT) fault	
P0963-00	Pressure control solenoid A control circuit high	• Line pressure control solenoid (SLT) circuit: short circuit to power • Line pressure control solenoid (SLT) fault	
P0964-00	Pressure control solenoid B control circuit open	• Torque converter clutch lock up control solenoid (SLU)circuit: short circuit to ground • Torque converter clutch lock up control solenoid (SLU) circuit: open circuit • Torque converter clutch lock up control solenoid (SLU) fault	Refer to the warranty policy and procedures manual if the transmission is suspect.
P0965-00	Pressure control solenoid B control circuit range/performance	• Torque converter clutch lock up control solenoid (SLU)circuit: short circuit to ground • Torque converter clutch lock up control solenoid (SLU) circuit: open circuit • Torque converter clutch lock up control solenoid (SLU) circuit: short circuit to power • Torque converter clutch lock up control solenoid (SLU) fault	
P0967-00	Pressure control solenoid B control circuit high	• Torque converter clutch lock up control solenoid (SLU) circuit: short circuit to power • Torque converter clutch lock up control solenoid (SLU) fault	
P0969-00	Pressure control solenoid C control circuit range/performance	• C2 Pressure control solenoid (SLC2) circuit: short circuit to ground • C2 Pressure control solenoid (SLC2) circuit: open circuit • C2 Pressure control solenoid	Refer to the warranty policy and procedures manual if the transmission is suspect.

DTC	Description	Possible Cause	Action
		(SLC2) circuit: short circuit to power • C2 Pressure control solenoid (SLC2) fault	
P0970-00	Pressure control solenoid C control circuit low	• C2 Pressure control solenoid (SLC2) circuit: short circuit to ground • C2 Pressure control solenoid (SLC2) circuit: open circuit • C2 Pressure control solenoid (SLC2) fault	
P0971-00	Pressure control solenoid C control circuit high	• C2 Pressure control solenoid (SLC2) circuit: short circuit to power • C2 Pressure control solenoid (SLC2) fault	
P0973-00	Shift solenoid A control circuit low	• Shift solenoid No. 1 circuit: short circuit to ground • Shift solenoid No. 1 circuit: open circuit • Shift solenoid No. 1 fault	Refer to the warranty policy and procedures manual if the transmission is suspect.
P0974-00	Shift solenoid A control circuit high	• Shift solenoid No. 1 circuit: short circuit to power • Shift solenoid No. 1 fault	
P0976-00	Shift solenoid B control circuit low	• Shift solenoid No. 2 circuit: short circuit to ground • Shift solenoid No. 2 circuit: open circuit • Shift solenoid No. 2 fault	Refer to the warranty policy and procedures manual if the transmission is suspect.
P0977-00	Shift solenoid B control circuit high	• Shift solenoid No. 2 circuit: short circuit to power • Shift solenoid No. 2 fault	
P1783-68	Transmission overtemperature condition	• Transmission fluid level low • Transmission fluid cooler/hoses are obstructed/damaged/blocked. • Mechanical fault in the transmission • The transmission has been exposed to high load and high ambient temperature.	Check the transmission fluid level and condition. Check the transmission fluid cooler /hoses for signs of obstruction/damage /blockage. Rectify as necessary. Refer to the warranty policy and procedures manual if the transmission is suspect.
P1799-00	Controller area network (CAN) transmission control module (TCM)/anti-lock brake system (ABS) circuit malfunction	• CAN circuit fault (between ABS module (brake control module(BCM)) and TCM • ABS (BCM) module fault	Check the CAN circuits. Refer to the electrical guides. Rectify as necessary. Refer to the warranty policy and procedures manual if the ABS module (BCM) is suspect.
P2158-00	Vehicle Speed Sensor B (input shaft speed sensor (ISS))	• ISS sensor circuit: short circuit to ground • ISS sensor circuit: short circuit to power • ISS sensor circuit: open circuit • ISS sensor fault	Check the ISS sensor and circuits. Refer to the electrical guides. Install a new ISS sensor as necessary. For additional information, refer to: Input Shaft Speed (ISS) Sensor - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, Removal and Installation) / Input Shaft Speed (ISS) Sensor - TD4 2.2L Diesel (307-01 Automatic Transmission/Transaxle, Removal and Installation).
P2719-00	Pressure control solenoid D control circuit range/performance	• Pressure control solenoid (SLC3) circuit: short circuit to ground • Pressure control solenoid (SLC3) circuit: open circuit • Pressure control solenoid (SLC3) circuit: short circuit to power • Pressure control solenoid (SLC3) fault	Refer to the warranty policy and procedures manual if the transmission is suspect.
P2720-00	Pressure control solenoid D control circuit low	• Pressure control solenoid (SLC3) circuit: short circuit to ground • Pressure control solenoid (SLC3) circuit: open circuit • Pressure control solenoid (SLC3) fault	

DTC	Description	Possible Cause	Action
P2721-00	Pressure control solenoid D control circuit high	• Pressure control solenoid (SLC3) circuit: short circuit to power • Pressure control solenoid (SLC3) fault	
P2728-00	Pressure control solenoid E control circuit range/performance	• Pressure control solenoid (SLB1) circuit: short circuit to ground • Pressure control solenoid (SLB1) circuit: open circuit • Pressure control solenoid (SLB1) circuit: short circuit to power • Pressure control solenoid (SLB1) fault	Refer to the warranty policy and procedures manual if the transmission is suspect.
P2729-00	Pressure control solenoid E control circuit low	• Pressure control solenoid (SLB1) circuit: short circuit to ground • Pressure control solenoid (SLB1) circuit: open circuit • Pressure control solenoid (SLB1) fault	
P2730-00	Pressure control solenoid E control circuit high	• Pressure control solenoid (SLB1) circuit: short circuit to power • Pressure control solenoid (SLB1) fault	
P2733-00	Pressure control solenoid F stuck on	• SLC1 solenoid has jammed • Mechanical faults in transmission	Refer to the warranty policy and procedures manual if the transmission is suspect.
P2737-00	Pressure control solenoid F control circuit range/performance	• Pressure control solenoid (SLC1) circuit: short circuit to ground • Pressure control solenoid (SLC1) circuit: open circuit • Pressure control solenoid (SLC1) circuit: short circuit to power • Pressure control solenoid (SLC1) fault	
P2738-00	Pressure control solenoid F control circuit low	• Pressure control solenoid (SLC1) circuit: short circuit to ground • Pressure control solenoid (SLC1) circuit: open circuit • Pressure control solenoid (SLC1) fault	
P2739-00	Pressure control solenoid F control circuit high	• Pressure control solenoid (SLC1) circuit: short circuit to power • Pressure control solenoid (SLC1) fault	
P2783-68	Torque converter temperature too high	• Transmission fluid level low • Transmission fluid cooler/hoses are obstructed/damaged/blocked. • Mechanical fault in the transmission • The transmission has been exposed to extreme load and high ambient temperature	Check the transmission fluid level and condition. Check the transmission fluid cooler /hoses for signs of obstruction/damage /blockage. Rectify as necessary. Refer to the warranty policy and procedures manual if the transmission is suspect.
P2787-68	Clutch temperature too high	• Transmission fluid level low • Transmission fluid cooler/hoses are obstructed/damaged/blocked. • Mechanical fault in the transmission • The transmission has been exposed to extreme load and high ambient temperature	Check the transmission fluid level and condition. Check the transmission fluid cooler /hoses for signs of obstruction/damage /blockage. Rectify as necessary. Refer to the warranty policy and procedures manual if the transmission is suspect.

DTC	Description	Possible Cause	Action
P2800-00	Transmission range sensor B circuit (PRNDL input)	• Incorrect adjustment of the gear selector lever cable • Internal transmission control module (TCM) fault	Check that the gear selector lever cable is correctly adjusted. For additional information, refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission/Transaxle External Controls, General Procedures). Refer to the warranty policy and procedures manual if the TCM is suspect
P2801-00	Transmission range sensor B circuit range/performance	• Incorrect adjustment of the gear selector lever cable • Internal transmission control module (TCM) fault	
P2805-00	Transmission range sensor A/B correlation	• Incorrect adjustment of the gear selector lever cable • Internal transmission control module (TCM) fault	
U0001-00	High speed controller area network (CAN) communication bus	• CAN circuit: open circuit • CAN circuit: short circuit to each other • CAN circuit: short circuit to power • CAN control module failure	Carry out a complete vehicle read for DTCs indicating a CAN or module fault. Rectify as necessary. Refer to the warranty policy and procedures manual if a module is suspect.
U0100-00	Lost communication with ECM "A"	• CAN circuit: open circuit • CAN circuit: short circuit to each other • CAN circuit: short circuit to power • CAN control module failure	Carry out a complete vehicle read for DTCs indicating a CAN or module fault. Rectify as necessary. Refer to the warranty policy and procedures manual if a module is suspect.
U0121-00	Controller area network (CAN) transmission control module (TCM)/anti-lock brake system (ABS) circuit malfunction no communication	• CAN circuit: open circuit • CAN circuit: short circuit to each other • CAN circuit: short circuit to power • CAN control module failure	Carry out a complete vehicle read for DTCs indicating a CAN or module fault. Rectify as necessary. Refer to the warranty policy and procedures manual if a module is suspect.
U0300-00	Internal control module software incompatibility	• Incorrect controller area network (CAN) configuration ID - incorrect hardware/software level	Check that the modules are correct for the vehicle and that the correct level of software is installed. Reconfigure the CAN system using the approved diagnostic system.
U0401-00	Invalid data received from engine control module (ECM)	• Incorrect signal from the ECM	Carry out a complete vehicle read for DTCs indicating a controller area network (CAN) or ECM fault. Rectify as necessary. Refer to the warranty policy and procedures manual if the ECM is suspect.
U0415-00	Invalid data received from the anti-lock brake system (ABS) control module	• The engine control module (ECM) has the wrong code for the immobilizer • The ABS module (brake control module (BCM)) has the wrong code for the immobilizer • Transmission control module (TCM) fault	Reprogramme the modules as necessary. Refer to the warranty policy and procedures manual if a module is suspect.
U2100-00	Initial configuration not complete	• Controller area network (CAN) circuit fault • Initial central configuration has never been sent	Check for other controller area network (CAN) DTCs or apparently unrelated customer complaints. Carry out a complete vehicle DTC read. Check the CAN circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs and test for normal operation. Check correct central car configuration software is installed. Reprogramme the module as necessary.
U2101-00	Control module configuration incompatible	• Central car configuration parameter missing or corrupted	Check correct central car configuration software is installed. Reprogramme the module as necessary.
U2023-00	Engine torque signal	• Controller area network (CAN) circuit (between engine control module (ECM) and transmission control module (TCM)): open circuit • CAN circuit (between ECM and TCM): short circuit • CAN module fault	Carry out a complete read for related DTCs. Rectify as necessary. Check the CAN circuits. Refer to the electrical guides. Rectify as necessary.
U2105-11	Switch pack signal "A"	• Shift lock solenoid circuit fault: short circuit to ground • Gear selector module (GSM) fault	Check the GSM and circuits. Refer to the electrical guides. Rectify as necessary. Refer to the warranty policy and procedures manual if the GSM is suspect.

DTC	Description	Possible Cause	Action
U2105-12	Switch pack signal "A"	• Shift lock solenoid circuit fault: short circuit to power • Gear selector module (GSM) fault	
U3003-62	Battery voltage	• Mis-match in voltage between battery and the transmission control module (TCM) - difference greater than 2 volts	Check the power supply circuit to the TCM. Refer to the electrical guides. Rectify as necessary.

General Information - Diagnostic Trouble Code (DTC) IndexDTC: Trailer Module (TRM)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the trailer module system, refer to the relevant Description and Operation section in the workshop manual. For additional information, refer to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Trailer module (TRM)

DTC	Description	Possible Cause	Action
C111A-11	Right Stop Lamp General Electrical Failures Circuit short to ground	• Right stop lamp circuit - short to ground	Refer to electrical circuit diagrams and check right stop lamp circuit for short to ground
C111A-12	Right Stop Lamp General Electrical Failures Circuit short to battery	• Right stop lamp circuit - short to power	Refer to electrical circuit diagrams and check right stop lamp circuit for short to power
C111B-11	Left Stop Lamp General Electrical Failures Circuit short to ground	• Left stop lamp circuit - short to ground	Refer to electrical circuit diagrams and check left stop lamp circuit for short to ground
C111B-12	Left Stop Lamp General Electrical Failures Circuit short to battery	• Left stop lamp circuit - short to power	Refer to electrical circuit diagrams and check left stop lamp circuit for short to power
C1120-11	Reversing lamp General Electrical Failures Circuit short to ground	• Reverse lamp circuit - short to ground	Refer to electrical circuit diagrams and check reverse lamp circuit for short to ground
C1120-12	Reversing lamp General Electrical Failures Circuit short to battery	• Reverse lamp circuit - short to power	Refer to electrical circuit diagrams and check reverse lamp circuit for short to power
C1126-11	Position Lamps General Electrical Failures Circuit short to ground	• Position lamp circuit - short to ground	Refer to electrical circuit diagrams and check position lamp circuit for short to ground
C1126-12	Position Lamps General Electrical Failures Circuit short to battery	• Position lamp circuit - short to power	Refer to electrical circuit diagrams and check position lamp circuit for short to power
B1102-62	Trailer stop lamp Algorithm Based Failures Signal compare failure	• Input signal stop lamp from wire is inconsistent with CAN message	Check CJB for additional related DTCs and refer to relevant DTC Index. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
B1A79-11	Rear Fog Lamp Circuit General Electrical Failures Circuit short to ground	• Rear fog lamp circuit - short to ground	Refer to electrical circuit diagrams and check rear fog lamp circuit for short to ground
B1A79-12	Rear Fog Lamp Circuit General Electrical Failures Circuit short to battery	• Rear fog lamp circuit - short to power	Refer to electrical circuit diagrams and check rear fog lamp circuit for short to power
B1D06-11	Left Turn Indicator General Electrical Failures Circuit short to ground	• Left turn indicator lamp circuit - short to ground	Refer to electrical circuit diagrams and check left turn indicator lamp circuit for short to ground
B1D06-12	Left Turn Indicator General Electrical Failures Circuit short to battery	• Left turn indicator lamp circuit - short to power	Refer to electrical circuit diagrams and check left turn indicator lamp circuit for short to power
B1D07-11	Right Turn Indicator General Electrical Failures Circuit short to ground	• Right turn indicator lamp circuit - short to ground	Refer to electrical circuit diagrams and check right turn indicator lamp circuit for short to ground
B1D07-12	Right Turn Indicator General Electrical Failures Circuit short to battery	• Right turn indicator lamp circuit - short to power	Refer to electrical circuit diagrams and check right turn indicator lamp circuit for short to power

DTC	Description	Possible Cause	Action
U0010-88	Medium Speed CAN Communication Bus Signal / Message Failures Bus off	• Bus Off	Carry out CAN network integrity tests using the manufacturer approved diagnostic system
U0140-87	Lost Communication With Central electronic module Bus Signal / Message Failures Missing message	• Missing message	Check CJB for DTCs and refer to the relevant DTC Index.
U0300-00	Internal Control Module Software Incompatibility General Failure Information No sub type information	• Invalid configuration message is received	Re-configure the CJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the trailer module, refer to the new module installation note at the top of the DTC Index
U0422-68	Invalid Data Received From Central electronic module Algorithm Based Failures	• Event information	Check for additional related DTCs and refer to the relevant DTC Index
U1A03-81	Car Config Parameter Bus Signal / Message Failures	• Invalid serial data received	Check/amend Car Configuration File (CCF) as required using the manufacturer approved diagnostic system. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
U2100-51	Control Module Not Configured System Programming Failures	• Not programmed	Install latest available level of software using the manufacturer approved diagnostic system. Check/amend Car Configuration File (CCF) as required using the manufacturer approved diagnostic system
U3000-42	Control Module System Internal Failures General memory failure	• RAM or EEPROM memory test failed	Install a new module, refer to the new module/component installation note at the top of the DTC Index
U3000-51	Control Module System Programming Failures	• Not programmed	Install latest available level of software using the manufacturer approved diagnostic system. Check/amend Car Configuration File (CCF) as required using the manufacturer approved diagnostic system
U3003-62	Battery Voltage Algorithm Based Failures Signal compare failure	• Difference in battery voltage, of 2 volts more, between trailer module and CJB	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

General Information - Diagnostic Trouble Code (DTC) IndexDTC: High Definition Radio Module (HDR)

Description and Operation

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Description And Operation

For a detailed description of the cellular phone system, refer to the relevant Description and Operation section in the workshop manual. For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Digital Audio Control Module C (DACMC)

DTC	Description	Possible Cause	Action
B1A56-02	Antenna - general signal failure	• Antenna general signal failure	Refer to the electrical guides and check the IBOC radio module circuit and the antenna for short to power, open circuit, high resistance. Clear the diagnostic trouble code and retest. If the diagnostic trouble code persists, check and install a new IBOC radio module, as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module
B1A56-11	Antenna - circuit short to ground	• IBOC radio module or antenna circuit short to ground	Refer to the electrical guides and check the IBOC radio module circuit and the antenna for short circuit to ground
B1A56-12	Antenna - circuit short to battery	• IBOC radio module or antenna circuit short to power	Refer to the electrical guides and check the IBOC radio module circuit and the antenna for short circuit to power
B1A56-13	Antenna - circuit open	• IBOC radio module or antenna circuit open circuit	Refer to the electrical guides and check the IBOC radio module circuit and the antenna for open circuit
U200D-14	Control Module Output Power A - circuit short to ground or open	• IBOC radio module power supply circuit short to ground or open circuit	Refer to the electrical guides and check the IBOC radio module diversity power circuit for short to ground, open circuit
U3000-04	Control Module - system internal failures	• IBOC radio module internal failure	Renew the IBOC radio module
U3000-4A	Control Module - incorrect component installed	• IBOC radio module internal incorrect component installed - The module has been installed to a vehicle not configured to accept it	Using the manufacturer approved diagnostic system select the vehicle configuration main menu, select configure existing modules menu and program the module
U3000-55	Control Module - not configured	• IBOC radio module not configured correctly	Using the manufacturer approved diagnostic system select the vehicle configuration main menu, select configure existing modules menu and program the module
U3000-87	Control Module - missing message	• Missing message	Using the manufacturer approved diagnostic system select the vehicle configuration main menu, select configure existing modules menu and program the module
U3000-98	Control Module - component or system over temperature	• IBOC radio module component or system over temperature	Consider moving the IBOC radio module to prevent unit overheating. Cool the vehicle interior down by ensuring it is in the shade and have the A/C on cool. When cool, clear the diagnostic trouble code and retest
U3003-62	Battery Voltage - signal compare failure	• Mismatch in battery voltage of 2 volts or more for longer than 1 minute, between the measured battery voltage at the IBOC radio module and the battery voltage signal sent from the rear junction box	Refer to the electrical guides and check that power supply voltage at IBOC radio module and rear junction box is not different by more than 2 volts. Rectify as required

Authoring Template

Published: 29-Nov-2011

Identification Codes - Identification Codes

Description and Operation

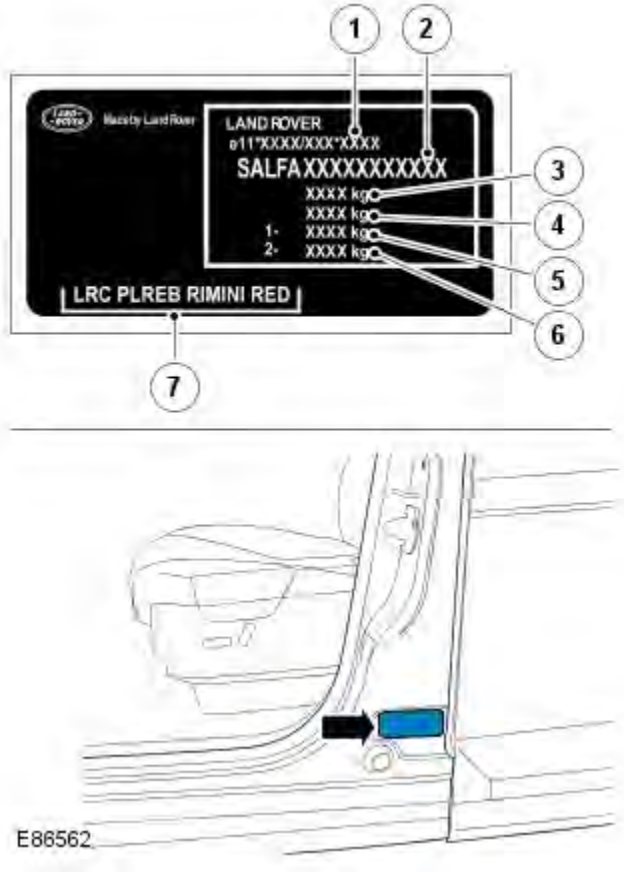
VIN Number

VIN and identification label locations:

- **1.** The VIN is stamped on a plate that is visible through the lowest part of the left side of the windshield.
- **2.UK, Europe and ROW** The VIN label is located at the bottom of the left-hand front door 'B' Pillar.
- **3.UK, Europe and ROW** The Tire Data/Specification label is attached to the right-hand B-pillar.
- **4.China** Market specific VIN label at bottom of right-hand 'B' Pillar (RH side for China)
- **5.USA and Canada** Vin included on market specific tyre label including certification compliance statement on driver's side 'B' Pillar below door striker.
- **6.** The VIN is stamped in the body just forward of the spare wheel well.

Windscreen VIN

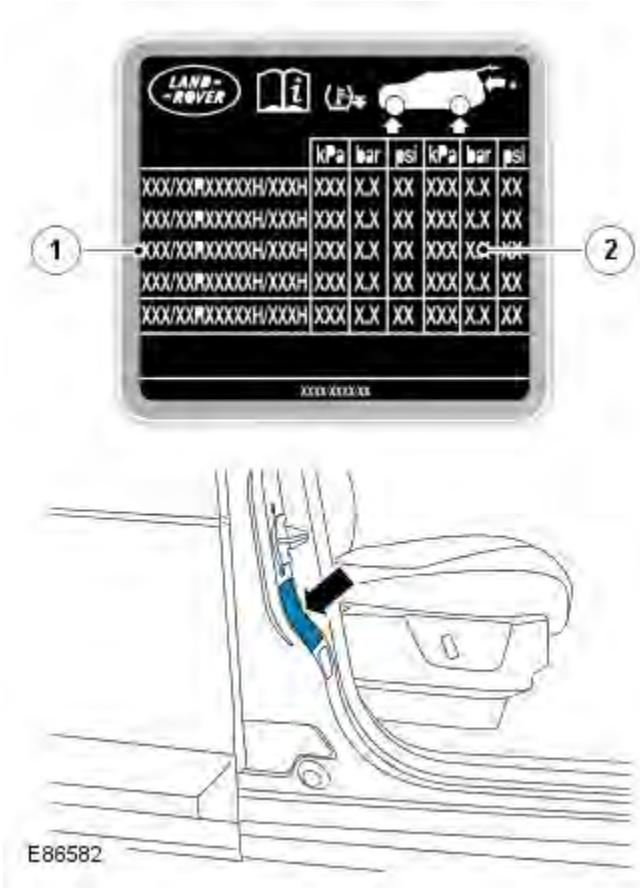
VIN label - UK, Europe and ROW



Item	Part Number	Description
1	-	Type/Approval Number - If shown
2	-	VIN Number
3	-	Gross Vehicle Weight
4	-	Gross Trailer Weight
5	-	Front Axle Weight
6	-	Rear Axle Weight

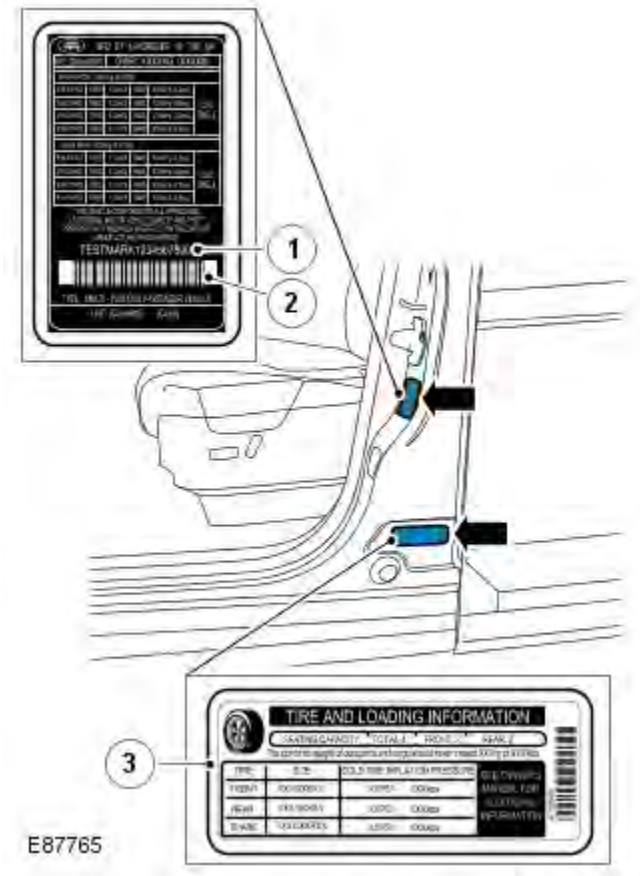
7	-	Colour Code Group

Tire Data Label



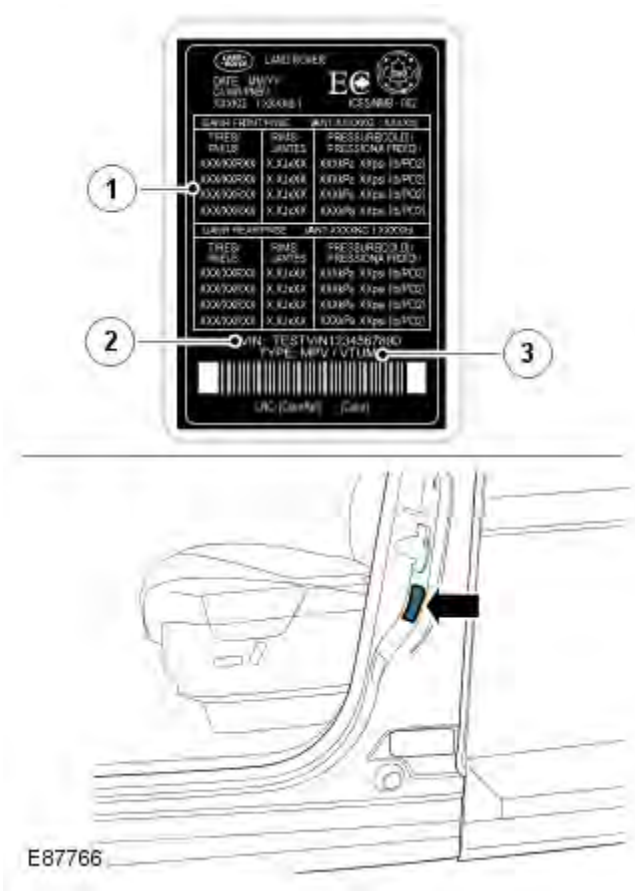
Item	Part Number	Description
1	-	Tire Size
2	-	Tire Pressures

VIN/Certification/Tire data label - NAS only



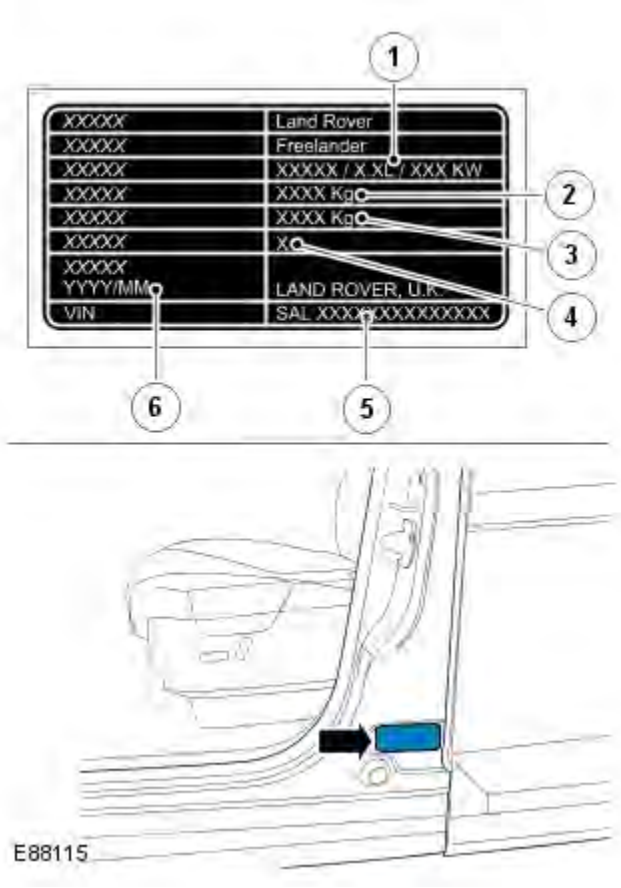
Item	Part Number	Description
1	-	Vehicle VIN Number
2	-	Bar Code Identification
3	-	Tire Pressures

VIN/Tire pressure label - Canada only



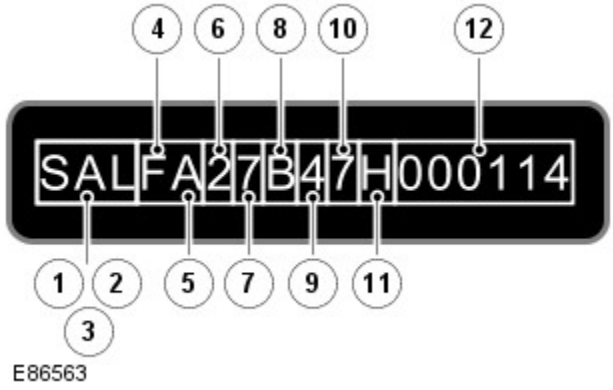
Item	Part Number	Description
1	-	Tire Pressures
2	-	Vehicle VIN Number
3	-	Vehicle Type

VIN label - China



Item	Part Number	Description
1	-	Engine Type / Capacity / Power
2	-	Gross Vehicle Weight
3	-	Gross Train Weight
4	-	Occupancy
5	-	Vehicle VIN Number
6	-	Build Date

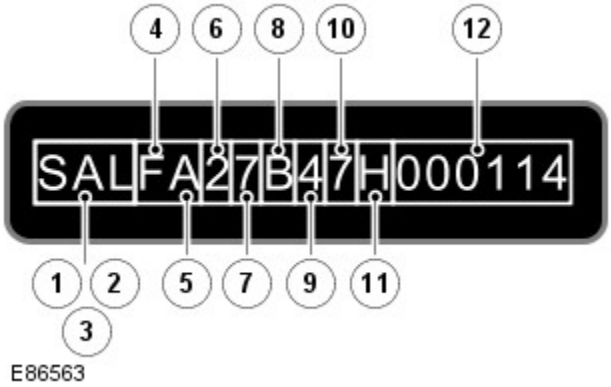
VIN number - UK, EU and ROW (vehicles built up to 2010MY)



VIN Position	Character	Identifies
1 - 3 - World identifier	SAL	Land Rover (UK)
4 - Vehicle type	F	Freelander 2
5 - Class	A	Standard
6 - Body Type	2	4 Door
6 - Body Type	4	Commercial
7 - Transmission and Steering	3	RHD, Automatic transmission
7 - Transmission and Steering	4	LHD, Automatic transmission
7 - Transmission and Steering	7	RHD, Manual transmission
7 - Transmission and Steering	8	LHD, Manual transmission
8 - Engine	A	3.2L Petrol
8 - Engine	B	2.2L Diesel
8 - Engine	C	2.2L Diesel with cDPF
9- Check Digit	4	Derived by calculation: 0-9 or X
10 - Model year	7	2007
10 - Model year	8	2008

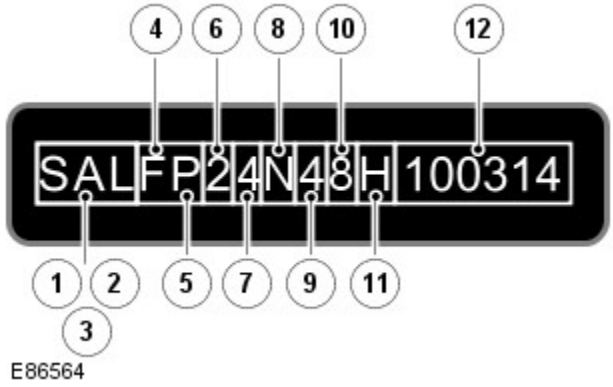
VIN Position	Character	Identifies
10 - Model year	9	2009
11 - Plant	H	Halewood
12 - 17 - Serial number	000114	Unique six digit serial number

VIN number - UK, EU and ROW (vehicles built from 2010MY)



VIN Position	Character	Identifies
1 - 3 - World identifier	SAL	Land Rover (UK)
4 - Vehicle type	F	Freelander 2
5 - Class	A	Standard - 4WD
5 - Class	B	Standard - 2WD (diesel manual **only**) - 2011MY onwards
6 - Body Type	2	4 Door
7 - Transmission and Steering	A	RHD, Automatic transmission
7 - Transmission and Steering	B	LHD, Automatic transmission
7 - Transmission and Steering	C	RHD, Manual transmission
7 - Transmission and Steering	D	LHD, Manual transmission
8 - Engine	A	3.2L Petrol
8 - Engine	B	2.2L Diesel (low power)
8 - Engine	C	2.2L Diesel with cDPF (low power)
8 - Engine	D	2.2L Diesel (high power) - 2011MY onwards
8 - Engine	E	2.2L Diesel with cDPF (high power) - 2011MY onwards
8 - Engine	G	2.0L Petrol- 2012 MY onwards
9- Check Digit	4	Derived by calculation: 0-9 or X
10 - Model year	A	2010
10 - Model year	B	2011
10 - Model year	C	2012
11 - Plant	H	Halewood
11 - Plant	L	Pune (India) - 2011MY onwards
12 - 17 - Serial number	000114	Unique six digit serial number

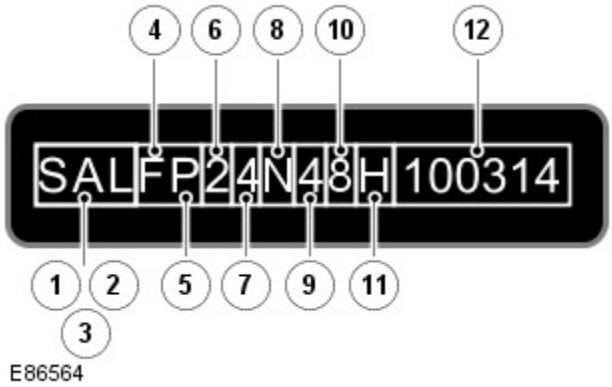
VIN number - NAS and Canada (vehicles built up to 2010MY)



VIN Position	Character	Identifies
1 - 3 - World identifier	SAL	Land Rover (UK)
4 - Model range	F	LR2
5 - Class	P	NAS SE
5 - Class	R	NAS HSE
5 - Class	S	NAS SE+Technology pack
5 - Class	T	NAS HSE+Technology pack
6 - Body Type	2	4 Door
7 - Transmission and Steering	4	LHD, Automatic transmission
8 - Engine	N	3.2L Petrol, ULEV 2 NAS

VIN Position	Character	Identifies
9 - Check digit	4	Derived by calculation: 0-9 or X
10 - Model year	8	2008
10 - Model year	9	2009
11 - Plant	H	Halewood
12 -17 - Serial number	100314	Unique six digit serial number

VIN number - NAS and Canada (vehicles built from 2010MY)



VIN Position	Character	Identifies
1 - 3 - World identifier	SAL	Land Rover (UK)
4 - Model range	F	LR2
5 - Class	P	NAS SE
5 - Class	R	NAS HSE
5 - Class	S	NAS SE+Lux pack
5 - Class	T	NAS HSE+Lux pack
6 - Body Type	2	4 Door
7 - Transmission and Steering	B	LHD, Automatic transmission
8 - Engine	N	3.2L Petrol, ULEV 2 NAS
9 - Check digit	4	Derived by calculation: 0-9 or X
10 - Model year	A	2010
10 - Model year	B	2011
10 - Model year	C	2012
11 - Plant	H	Halewood
12 -17 - Serial number	100314	Unique six digit serial number

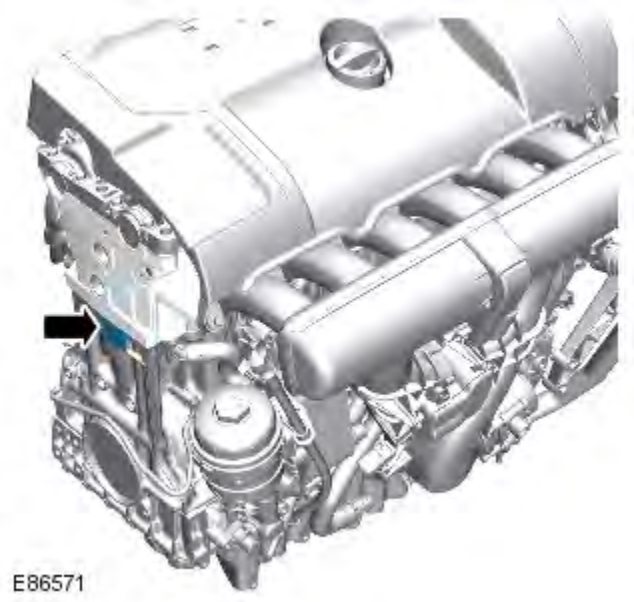
2.0 Liter Petrol Engine Serial Number

The 2.0 Liter Petrol Engine Serial Number is stamped on the RH side of the cylinder block.

2.2 Liter Diesel Engine Serial Number

The 2.2 Liter Diesel Engine Serial Number is stamped on the RH side of the cylinder block.

3.2 Liter Petrol Engine Serial Number



The 3.2 Liter Petrol Engine Serial Number is etched into the LH side of the engine block.

Automatic Transmission Serial Number

The Automatic Transmission Serial Number is stamped on the LH side of the transmission casing.

Manual Transmission Serial Number

The Manual Transmission Serial Number is stamped on the transmission casing.

Rear Differential Serial Number

The Rear Differential Serial Number is stamped on the side of the differential casing.

Power transfer unit

The number is stamped on the underside of the casing.

Published: 24-Jun-2011

Jacking and Lifting - Jacking

Description and Operation

General

WARNING: The following instructions must be adhered to before raising the vehicle off the ground:

- Position vehicle on a solid, level surface.
- Apply the parking brake.
- Select 'P' - PARK on automatic transmission selector.
- Select 'N' - Neutral on manual transmission.

WARNING: If the drive shaft(s) are to be disconnected, it will be necessary to raise all four wheels off the ground in order that the shaft(s) can be rotated. DO NOT use the customer jack and ensure that the vehicle is adequately supported on axle stands. With the vehicle raised, it will be necessary to release the park brake and select Neutral - 'N' in the main transmission to enable the drive shaft(s) to be rotated.

• CAUTIONS:

To avoid damage to the underbody components of the vehicle, the following instructions must be adhered to:

Do not position jacks or axle stands under the following components:

- Body structure other than any approved jacking or lifting points
- Rear subframe
- Bumpers
- Fuel lines
- Fuel tank
- Brake lines
- Front or rear suspension arms
- Steering linkage
- Rear differential unit
- Transmission
- Engine oil pan - See note below

• NOTE: For certain repair operations, it may be necessary to support the engine under the oil pan. In this case, a block of hardwood or a rubber pad must be positioned on the jack lifting pad to protect the oil pan.

Hydraulic jack

• WARNINGS:

Before commencing work on underside of vehicle, ensure that axle stands are correctly positioned and vehicle is securely supported.

Always chock the rear wheels when jacking the front of the vehicle.

A hydraulic jack with a minimum lifting capacity of 1500 kg, (3,300 lbs) must be used.

Raising and Supporting the Vehicle

To assist in raising the vehicle, use the customer jacking points on the sill or on the trolley jack position at the rear of the front subframe as indicated in the following illustrations.

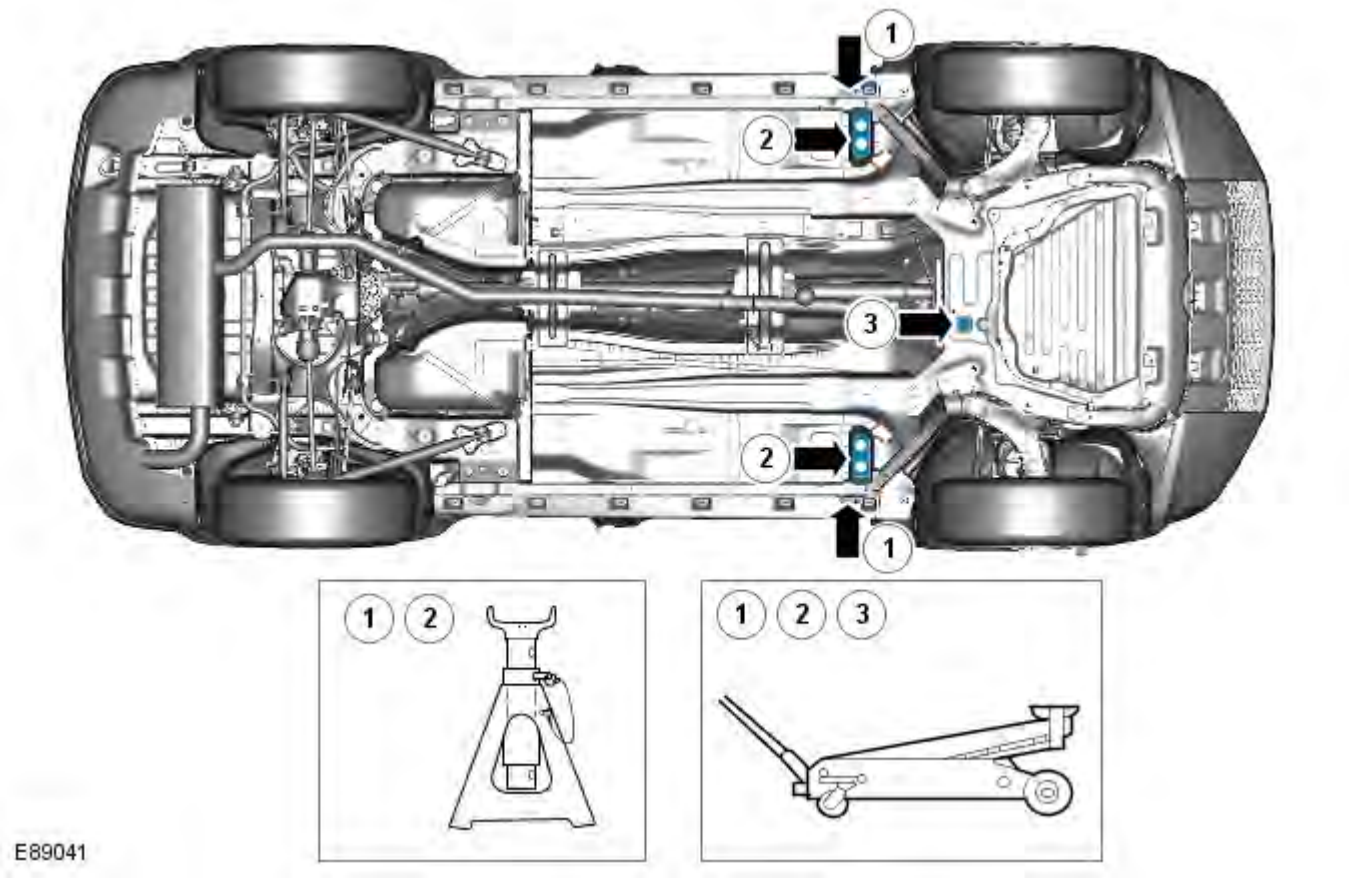
Raising the front of the vehicle

WARNING: Always chock the rear wheels when jacking the front of the vehicle.

Apply the parking brake.

Select 'P' - Park on automatic transmission selector.

Select 'N' - Neutral on manual transmission.



Position lifting pad of jack beneath the jacking point located on the rear of the front subframe, position 3.

With vehicle at desired height, carefully lower jack until vehicle rests on axle stand(s), position 1 or 2.

WARNING: Before commencing work on underside of vehicle, ensure that axle stands are correctly positioned and vehicle is securely supported.

CAUTION: Position suitable material between axle stands and the sill to prevent damage.

Reverse procedure when removing vehicle from stands.

Raising the rear of the vehicle

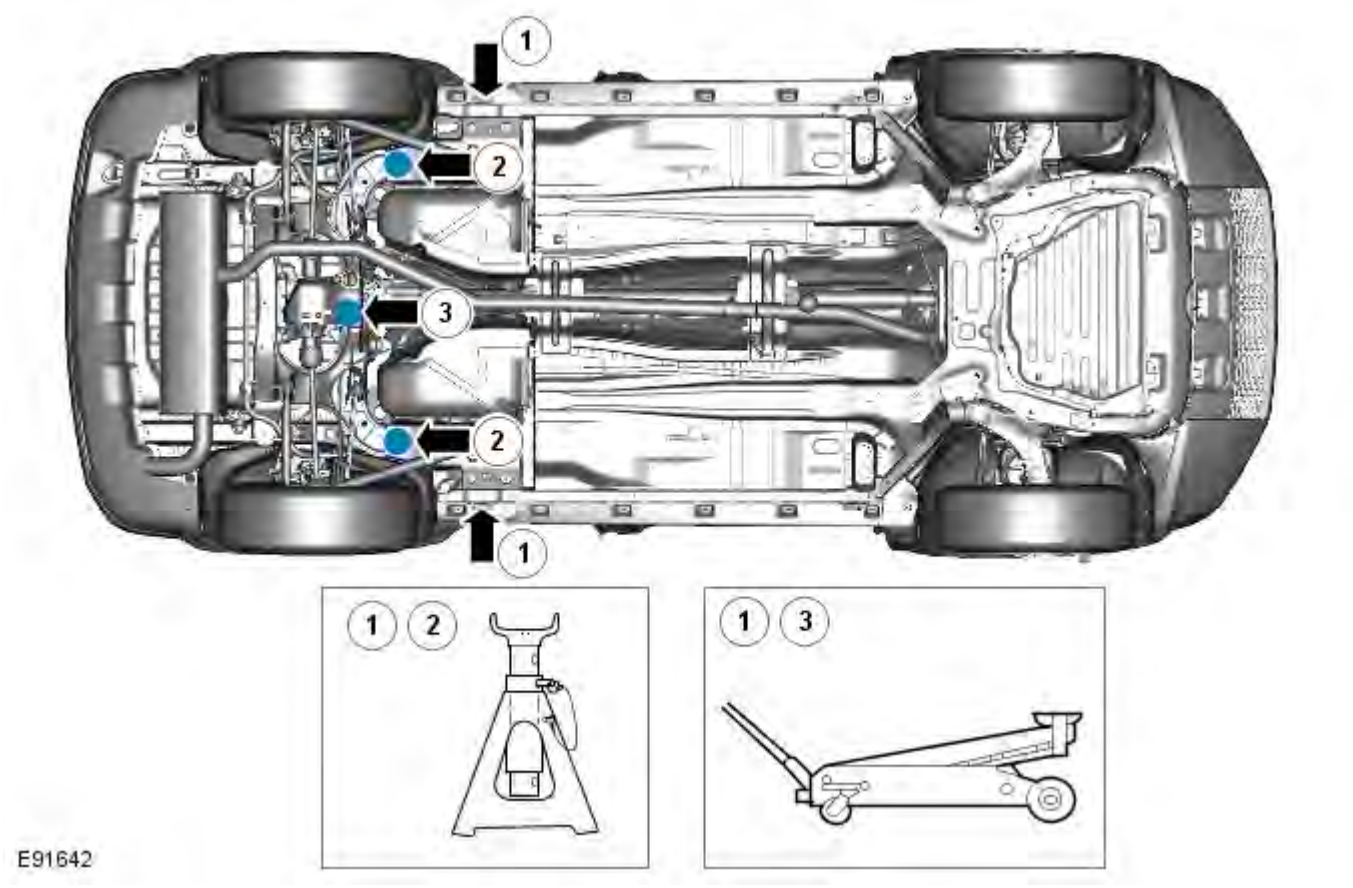
All vehicles

WARNING: Always chock the front wheels when jacking the rear of the vehicle.

Apply the parking brake.

Select 'P' - Park on automatic transmission selector.

Select 'N' - Neutral on manual transmission.



Vehicles with four-wheel drive

On vehicles with four-wheel drive, position lifting pad of jack beneath the rear jacking point located on the rear differential support bracket, position 3.

With vehicle at desired height, position axle stand(s) as illustration and carefully lower jack until vehicle rests on axle stand(s), position 1 or 2.

Vehicles with two-wheel drive

CAUTION: With no central jacking point at the rear it is not possible to raise both sides of the vehicle at once.

On vehicles with two-wheel drive, position lifting pad of jack beneath the rear jacking point located on the body, position 1.

With vehicle at desired height, position axle stand(s) as illustration and carefully lower jack until vehicle rests on axle stand(s), position 2.

All vehicles

WARNING: Before commencing work on underside of vehicle, ensure that axle stands are correctly positioned and vehicle is securely supported.

CAUTION: Position suitable material between axle stands and body to prevent damage.

Reverse procedure when removing vehicle from stands.

Published: 11-May-2011

Jacking and Lifting - Lifting

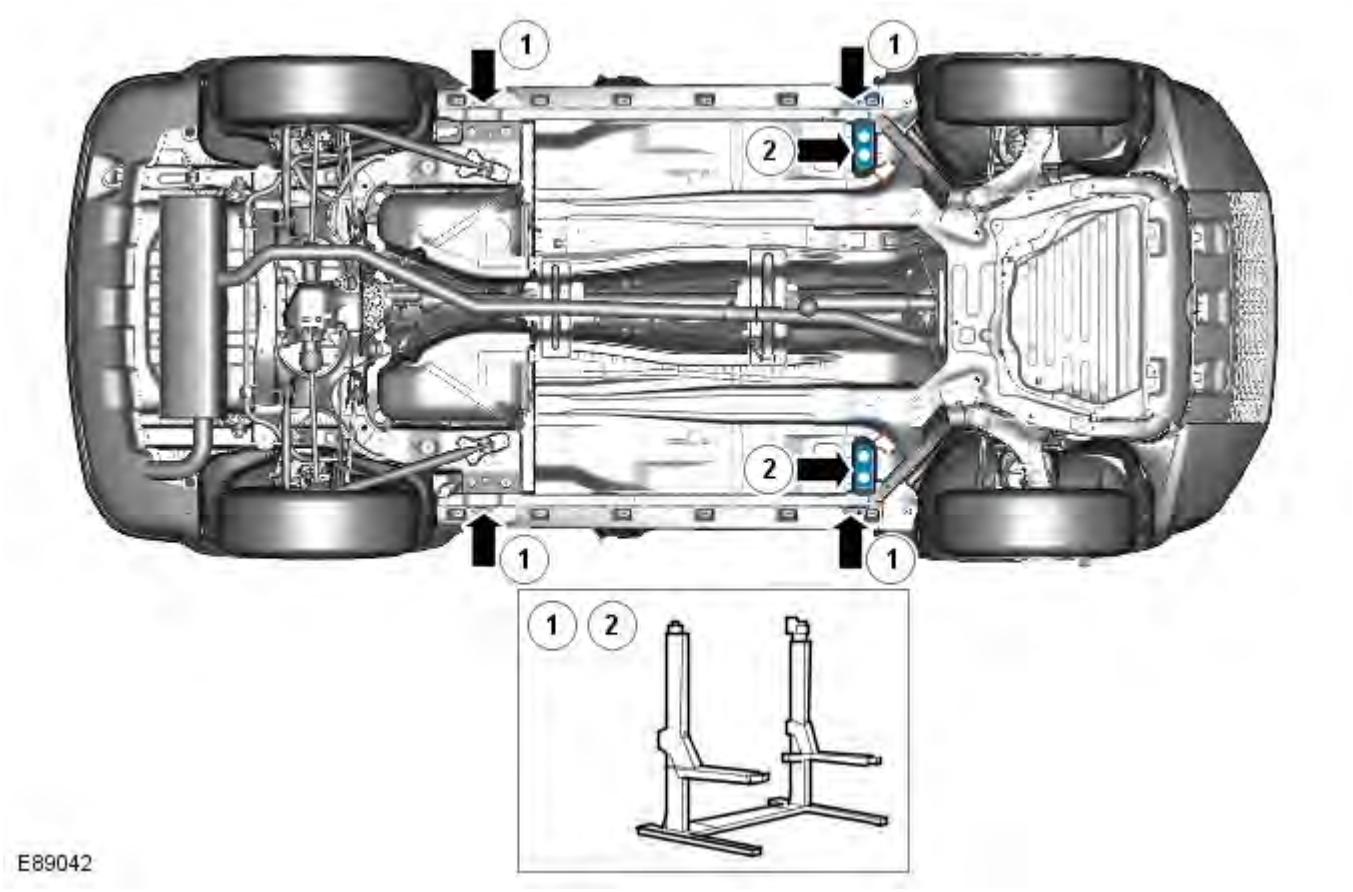
Description and Operation

Two-Post Lift

WARNING: Make sure that the vehicle is stable before commencing work.

CAUTION: If the drive shaft(s) are to be removed, release the parking brake and select NEUTRAL 'N' in the transmission in order that the shaft(s) can be rotated when the vehicle is raised to the desired height.

1. Position the vehicle with the centre of the lift pillars aligned approximately with the front of the driver/passenger seat cushions.



Item	Part Number	Description
1	-	Two post lift locations - Customer jacking points
2	-	Optional, Two-post front lift locations - Body mounting used in vehicle production

2. Extend the lifting arms and position the pad of each lifting arm beneath the approved points.

3. Raise the vehicle until the wheels are just clear of the ground and check that the pads of each lifting arm are still correctly positioned.

4. Raise the vehicle to the desired height.

5. Ensure the vehicle is correctly supported with the lifting pads in full contact with the approved points.

Vehicle on wheels - Four-Post Ramp

- WARNINGS:

If the drive shaft(s) are to be disconnected, it will be necessary to raise all four wheels off the ramp in order that the shaft(s) can be rotated. Refer to the 'Wheel Free Lift - Four-Post Ramp' section below for lifting instructions then release the parking brake and select NEUTRAL in the transmission.

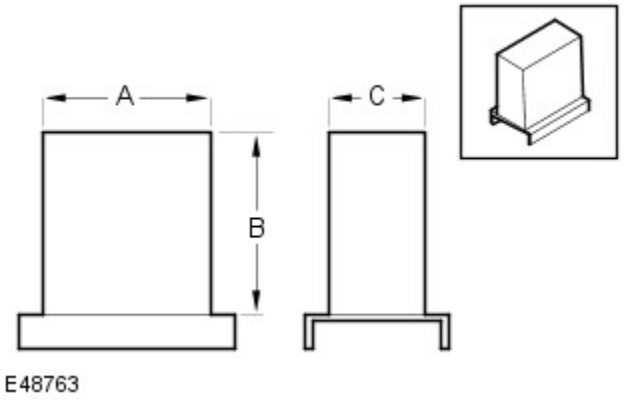
Do not push the vehicle backwards and forwards along the ramp in order to gain access to the drive shaft fixings.

Position the vehicle on the ramp with the front and rear wheels equidistant from the ends of the ramp. Chock the wheels, select NEUTRAL in the transmission and where practical, apply the parking brake.

Wheel-Free Lift - Four-Post Ramp

• NOTE: To enable the vehicle to be supported correctly on the wheel-free longitudinals, it will be necessary to produce 2 off each of the support blocks to the dimensions given in the accompanying illustrations. The supporting part of each block must be manufactured from suitable hardwood or metal and the 'U' shaped base of each block must be manufactured from metal. Note that it is essential to ensure that the 'U' shaped base of each block is wide enough to fit over the wheel free longitudinals.

Front support block dimensions



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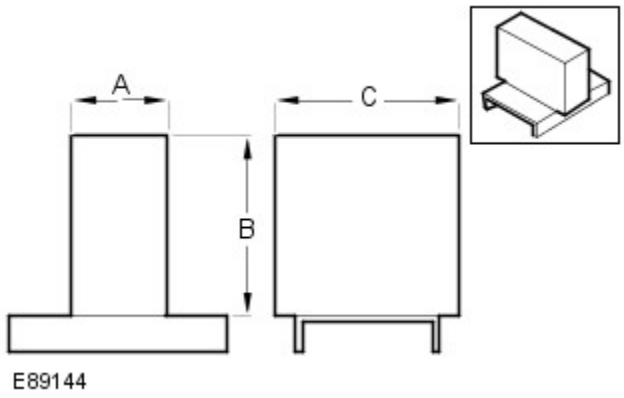
Item	Part Number	Description
A	-	130 mm (5.118 in)
B	-	160 mm (6.299 in)
C	-	90 mm (3.543 in)

Rear support block dimensions



E89144

Item	Part Number	Description
A	-	50 mm (1.1968 in)
B	-	190 (7.480 in)
C	-	110 (4.330 in)

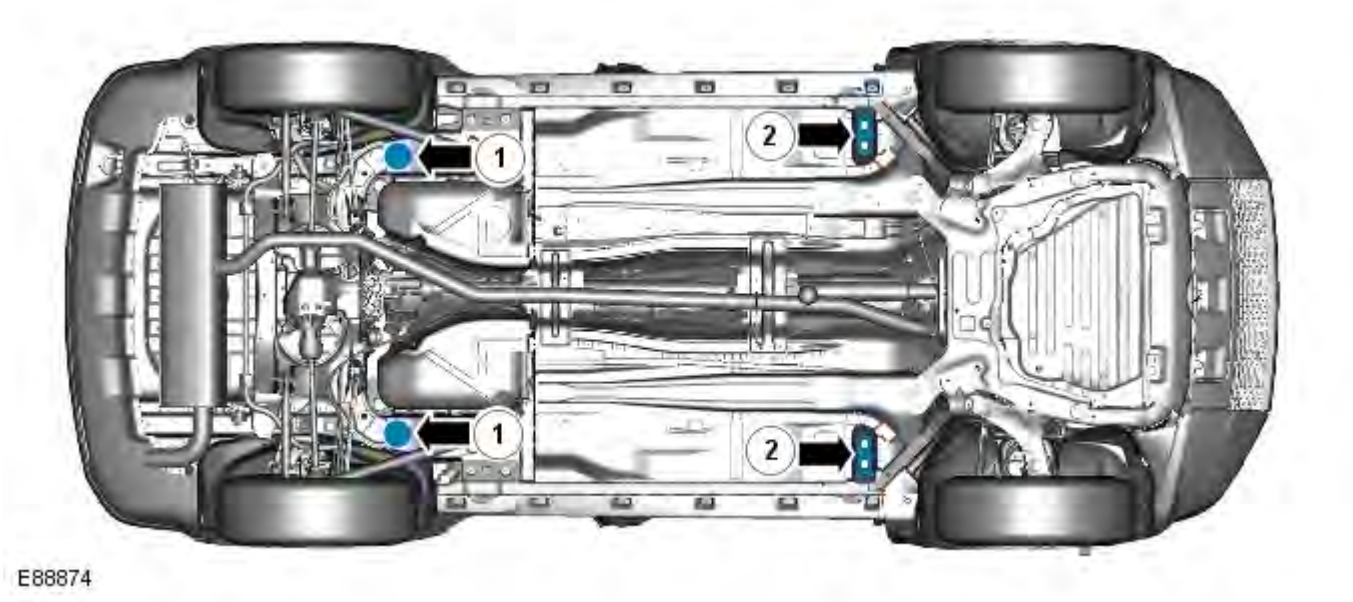
Raising and Supporting the Vehicle

1. Position vehicle on ramp.

2. Apply parking brake.

3. Raise ramp to required height

4. Align the wheel-free longitudinals and position the support blocks beneath the positions shown



Engage wheel-free and lower ramp until weight of vehicle rests on support blocks and road wheels are just clear of ramp.

Ensure that vehicle is correctly supported on all four support blocks, that blocks are still correctly positioned and are in full contact with the body mounting points.

WARNING: Make sure that the vehicle is stable before commencing work

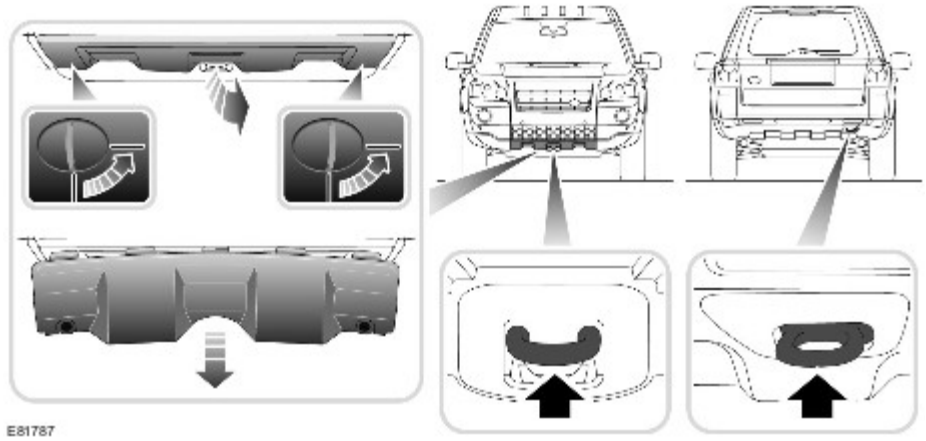
Published: 11-May-2011

Jacking and Lifting - Vehicle Recovery

Description and Operation

Towing Points

CAUTION: The single towing points at the front and rear of the vehicle are designed for vehicle recovery purposes only and must NOT be used to tow a trailer or caravan.



The front towing eye is accessible after releasing the 2 toggle fasteners securing the towing eye access panel and removing the panel.

CAUTION: Ensure that during towing, the towing attachment does not contact the bumper.

The rear towing eye is accessible after releasing the 2 toggle fasteners securing the towing eye access panel and removing the panel.

CAUTION: This towing eye should only be used for towing another vehicle or for recovery purposes.

Towing the vehicle on four wheels

• WARNINGS:

Ensure that the remote control remains docked whilst the vehicle is being towed. Removing the remote control will engage the steering lock, which will prevent the vehicle from steering correctly.

If the engine cannot be run whilst the vehicle is being towed, there will be no power assistance for the steering or brakes. This will result in greater effort being required to steer or slow the vehicle, and greatly increased stopping distances.

• CAUTIONS:

The vehicle should only be towed with four wheels on the ground. Towing with two wheels on the ground will result in serious damage to the transmission.

The vehicle should only be towed for a maximum of 80 km (50 miles), at a maximum speed of 80 km/h (50 mph). Towing for a greater distance, or at a higher speed may result in serious damage to the transmission.

• NOTE: The recommended recovery method is to raise all four wheels.

Towing procedure

1. The vehicle should be parked on firm level ground, with the park brake on, and the gear selector in P if an automatic gearbox is fitted.

2. Secure the towing attachment from the recovery vehicle to the front towing eye.

CAUTION: Leaving the ignition switched on for extended periods will cause the battery to drain.

3. Dock the remote control, and switch on the ignition.

4. Apply the foot brake, and select neutral.

5. With the footbrake still applied, release the park brake.

6. The vehicle can now be towed a maximum of 80 km (50 miles) at a maximum speed of 80 km/h (50 mph).

7. Upon arrival at the destination, ensure wherever possible that the vehicle is parked on firm level ground.

8. Apply the park brake, and place the selector lever into the P position.

9. Switch off the ignition, and remove the remote control.

WARNING: Use extreme caution when detaching towing equipment. Vehicle movement is possible which can result in serious injuries.

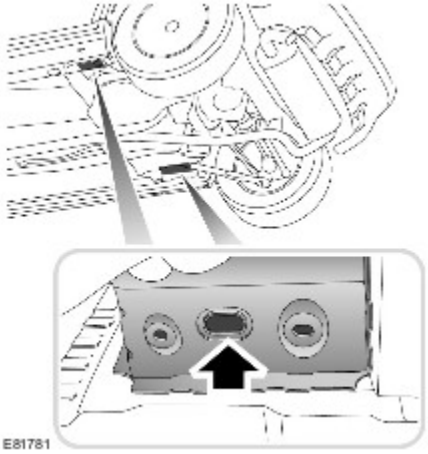
10. Remove the towing attachment from the towing eye.

Lashing Points

- WARNINGS:

Use the lashing points at the front and rear of the vehicle, DO NOT secure lashing hooks or restraints to any other part of the vehicle.

The front and rear lashing points must only be used for securing the vehicle during transportation.



The grahics show the front and rear lashing points.

Transporting by trailer

CAUTION: Use the lashing points at the front and rear of the vehicle, DO NOT secure lashing hooks or restraints to any other part of the vehicle.

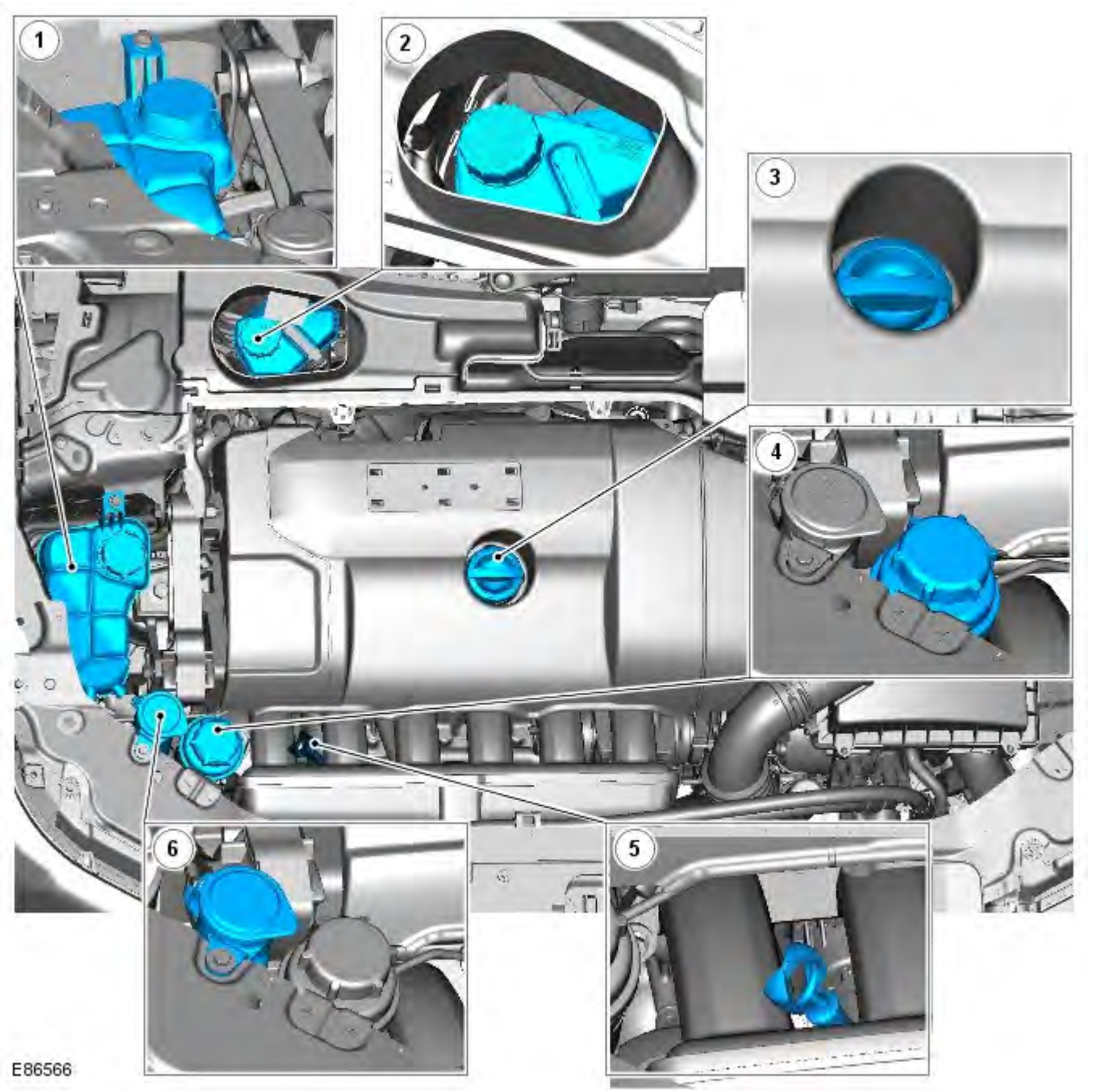
Position the vehicle, apply the parking brake and select 'N' - Neutral. The recommended method for recovery/transportation of the vehicle, is on a transporter or trailer designed for that purpose.

Published: 11-May-2011

Maintenance Schedules - Maintenance Schedules - Gasoline Engines

Description and Operation

Under Bonnet View



Item	Part Number	Description
1	-	Coolant expansion tank
2	-	Brake fluid reservoir (LH drive illustrated - RH drive on opposite side)
3	-	Engine oil filler cap
4	-	Power steering reservoir
5	-	Engine oil level indicator
6	-	Windscreen washer fluid reservoir

Maintenance Operations

CAUTION: Note that the 'A' and 'B' Service Intervals listed on the 'Maintenance Check Sheet' for vehicles operating under arduous conditions, vary from those specified for vehicles operating under normal conditions. Reference must therefore, always be made to the 'Arduous Conditions section for vehicles operating under these conditions.

Unless stated otherwise, the following operations must be carried out at every service interval.

Battery

- Check condition of battery.
- Check/top up battery electrolyte level.

Front Seats

Front seat frame fixings - Every 2 years or 30,000 miles (48,000 km)

- Carefully remove the trim panels covering the seat frame fixing Torx screws.
- Check that the front seat frame fixing Torx screws are secure and that the seat frames show no signs of movement.
- Install the trim panels on completion.

Rear Seats

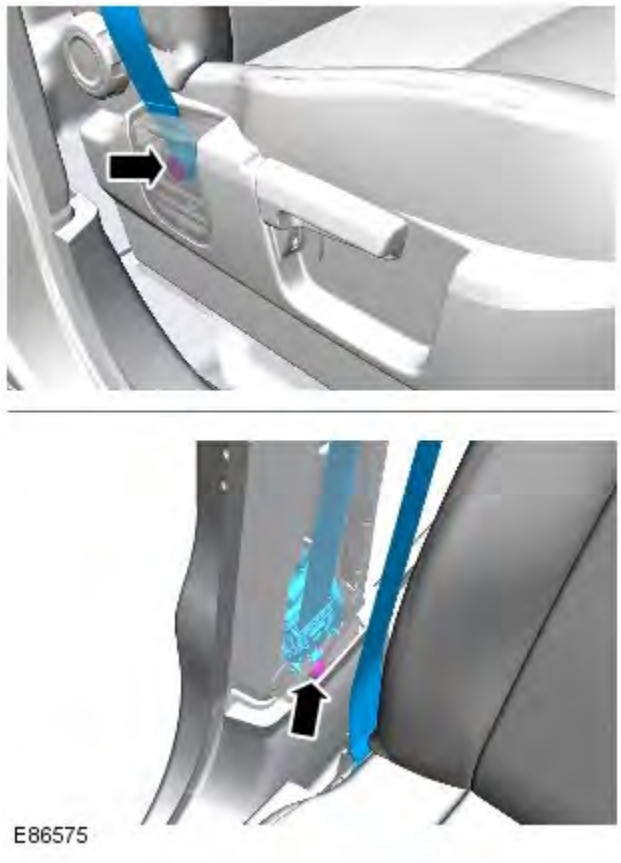
Rear seat frame fixings - Every 2 years or 30,000 miles (48,000 km)

- Check that the seat frame fixings are secure and that the seat frames show no signs of movement.

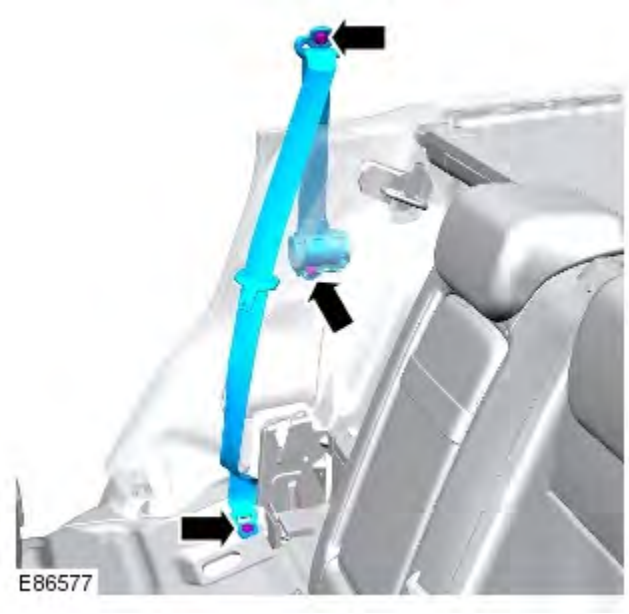
Safety Belts

Safety belts - Every 2 years or 30,000 miles (48,000 km)

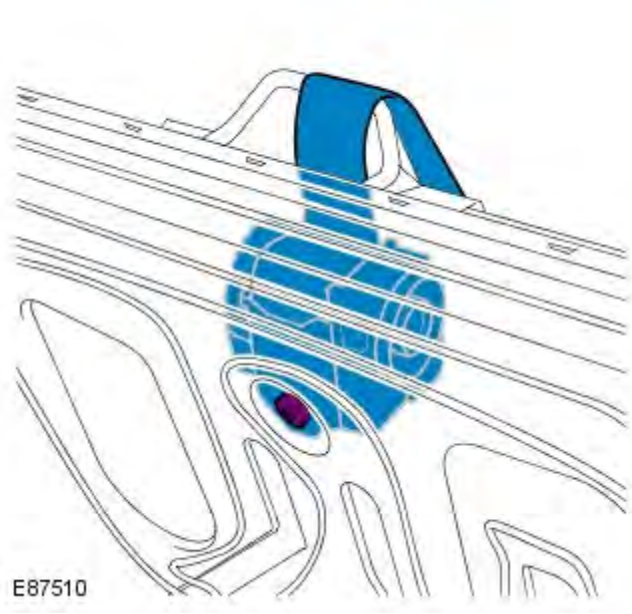
Front Seat Belt Mountings



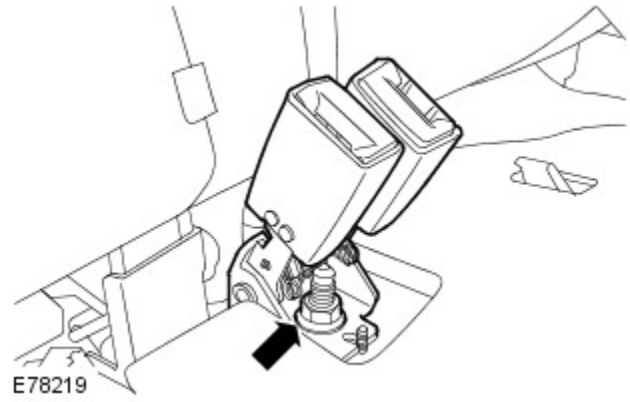
Rear Seat Belt Mountings



Reel Mounting - Center Rear Seat Belt



Buckle Mounting - Center Rear seat Belt

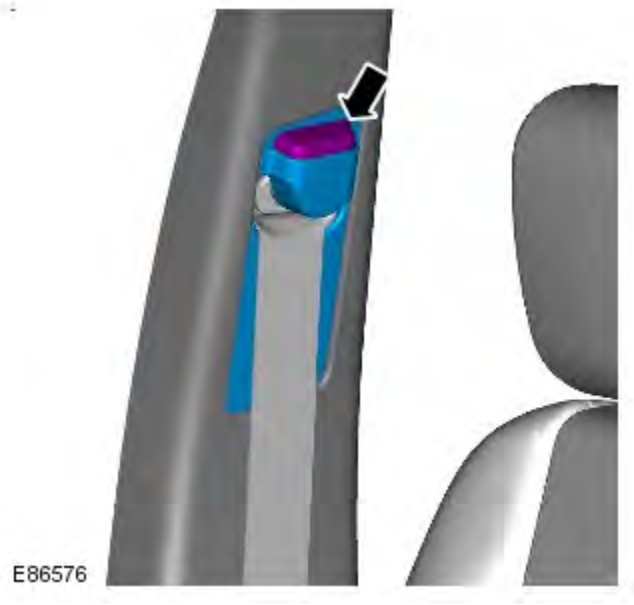


1. Fully extend each safety belt and check that it returns unassisted; repeat for all belts.

2. Check entire length of safety belt webbing for signs of fraying or damage: repeat for all belts.

3. Connect each safety belt to the correct buckle, check safety belt buckle and tongue are secure; check that buckle releases tongue correctly.

4. Check all safety belt and buckle mountings and fixings for security.



5. Check front safety belt height adjusters for correct operation.

Lamps, Horns and Warning Indicators

- Check side, head, fog, reversing and tail lamps for correct operation.
- Check operation of headlamp automatic levelling system - if installed.
- Check turn signals and hazard warning lamps for correct operation.
- Check brake (stop) lamps for correct operation.
- Check all exterior lamp lenses for clarity and condition; pay particular attention to headlamp and fog lamp lenses for stone chips or damage.
- Check horn for loud, clear sound.
- Switch on headlamps and check that side/headlamp reminder warning sounds when door is opened.
- Check operation of interior courtesy lamps.
- Check operation of all instrument pack warning and indicator lamps.

Washers and Wipers

- Check all wiper blades for condition and signs of splits or damage.
- Check security of wiper arms.
- Operate front and rear screen washers, check that jets are clear and correctly aimed.
- Operate front and rear wipers at all speeds and check for smooth, smear free operation.

Pollen Filter

- Replace pollen filter.
  For additional information, refer to: Pollen Filter (412-01 Climate Control, Removal and Installation).

Corrosion/Cosmetic Inspection

- Carry out the annual corrosion/cosmetic inspection using the Annual Corrosion Inspection Sheet.

Wheels and Tires

- Check that tires comply with manufacturer's specification.
  For additional information, refer to: Specifications (204-04 Wheels and Tires, Specifications).
- Check/adjust tire pressures including spare.
  For additional information, refer to: Specifications (204-04 Wheels and Tires, Specifications).
- **Vehicle fitted with Uni-directional tires:** Mark the wheel to stud relationship of each road wheel and note location

of each road wheel to its respective hub.
- Loosen road wheel nuts. Raise vehicle to a wheel free condition.
  For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
- Remove the road wheels.
- Visually check tires for condition, lumps or bulges. Check tread depth across the width of the tire and around the circumference; ensure that remaining tread depth does not contravene local legislative requirements.

• NOTE: Do not install wheels at this stage.

Braking System

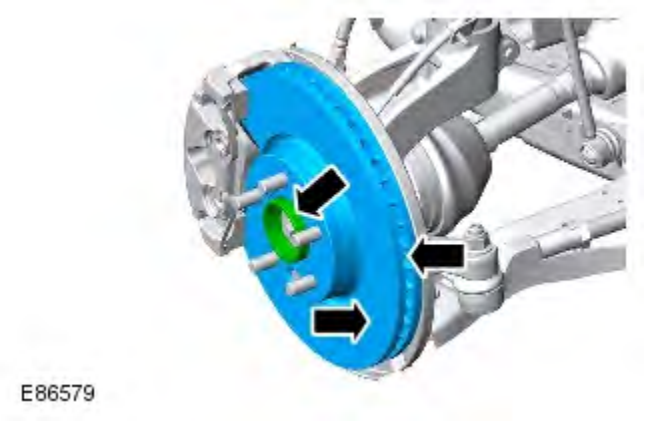
CAUTION: For vehicles operating under arduous conditions see relevant section.

1. Inspect front brake pads for wear.
For additional information, refer to: Specifications (206-03 Front Disc Brake, Specifications).

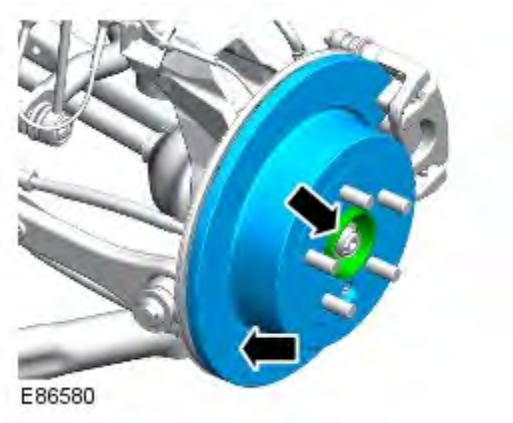
2. Inspect rear brake pads for wear.
For additional information, refer to: Specifications (206-04 Rear Disc Brake, Specifications).

3. Check brake calipers for signs of fluid leaks.

Front brakes



Rear brakes



4. Check brake discs for condition.

5. Check all brake booster and brake system pipes and hoses for condition, chafing and leaks.

6. Clean road wheel hub spigots and apply grease, Land Rover Part Number RYL 105020 to the wheel mating surface of each spigot.

7. Every 3 years: Replace brake fluid. For additional information, refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).

8. Every 6 years: Replace all flexible brake hoses.

9. Vehicles fitted with Uni-directional tires: Install road wheels on their respective hubs ensuring that stud to wheel relationship is maintained.

10. Vehicles fitted with NON Uni-directional tires: Install wheels on the opposite side of the vehicle but ensure that they are on the same axle as they were originally installed.

11. Install road wheel nuts and tighten to 133 Nm (98 lb-ft).

Parking brake

With the vehicle stationary, apply the parking brake and check for correct operation.

For additional information, refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

Door Locks and Hinges

1. Check operation of all door locks, bonnet lock and fuel filler flap.

2. Lubricate all door check straps, bonnet catch and fuel filler flap catch.

Cooling System

CAUTION: **Anti-freeze concentration must be maintained at 50%.**

1. Check specific gravity of coolant using a hydrometer.

• NOTE: A suitable hydrometer is available from the Equipment Programme under Part Number 511 3302 001 00.

2. Top-up cooling system if necessary.
For additional information, refer to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications).

Cooling system - Check/Top-up

WARNING: **Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank whilst the system is hot.**

• CAUTIONS:

Engine coolant will damage the paint finished surfaces. If coolant is spilled, immediately remove the coolant and wash the area with water.

Always top-up with a 50% mixture of anti-freeze and water.

- Check the level of coolant in the expansion tank. With the engine cold, the coolant level must be to the **UPPER LEVEL** indicator mark above the **COLD FILL RANGE** text on the side of the expansion tank. Ignore any coolant which may be visible in the top section of the tank.
- If topping-up is required, remove expansion tank filler cap and top-up coolant level to the **UPPER LEVEL** indicator mark.
  For additional information, refer to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications).
- Install expansion tank filler cap, tighten cap until ratchet is heard to 'click'.

Coolant - Replace

Every 10 years: Replace the coolant.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

Ignition System

Every 75,000 miles (120,000 km). Replace spark plugs.
For additional information, refer to: Specifications (303-07B Glow Plug System, Specifications).

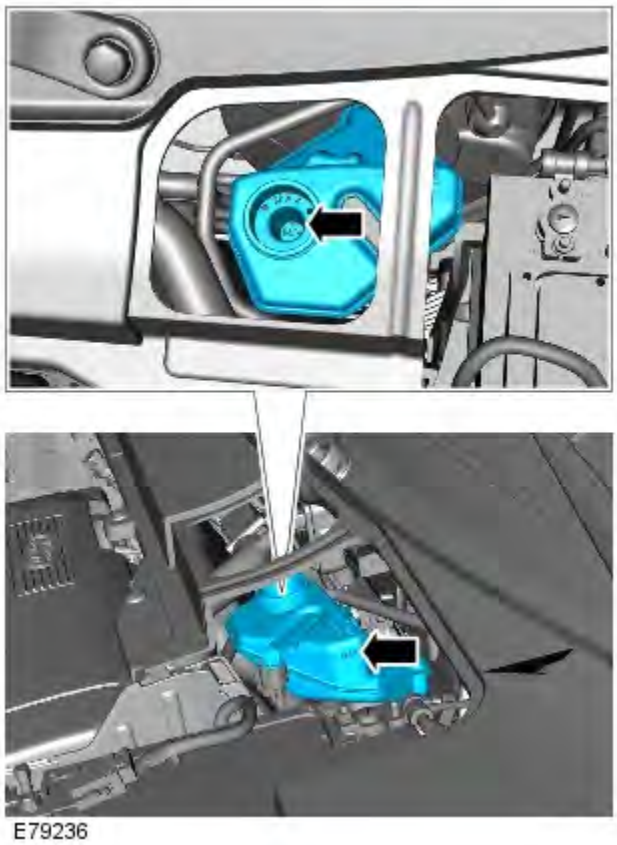
Accessory Drive Belt

CAUTION: For vehicles operating under arduous conditions see relevant section.

- Check the condition of the accessory drive belt.
- Remove all traces of mud and dirt from the drive belt and pulleys.
- Check the drive belt for signs of splitting and wear.
- **Every 105,000 miles (168,000 km) - Petrol models: Replace the accessory drive belt.** For additional information, refer to: Accessory Drive Belt (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

Fluid levels

Brake Fluid Reservoir



- Remove the brake fluid reservoir cover.
- Check the fluid level in the brake fluid reservoir, the level must be to the **MAX** mark on the reservoir; top-up if necessary.
- Clean the area around the reservoir filler cap, remove cap.
- If necessary, top-up using the recommended fluid to the **MAX** mark on the reservoir.
  For additional information, refer to: Specifications (206-00 Brake System - General Information, Specifications).
- Install the reservoir filler cap.
- Install the brake fluid reservoir cover.

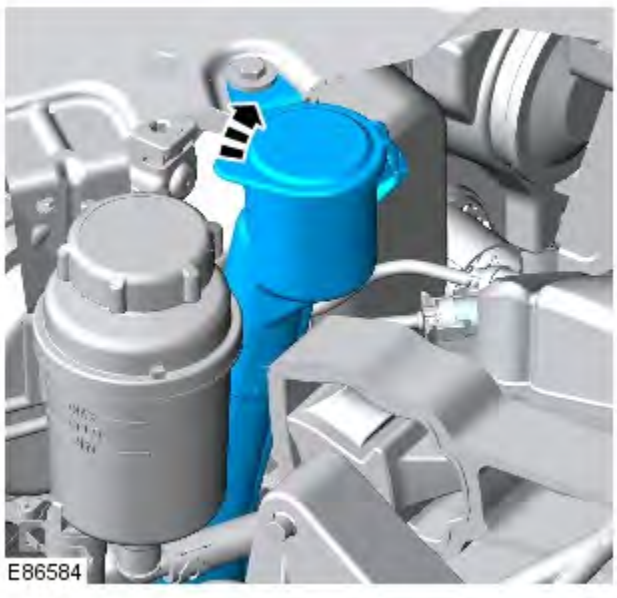
Power Steering Fluid Reservoir

CAUTION: **To prevent over filling, check/top-up the system with the engine switched off and the system cold. Ensure that the steering wheel is in the straight ahead position, do not turn the steering wheel prior to checking the fluid level.**

- Check that the fluid level is to the mid-way mark between the **MAX** and **MIN** marks on the fluid reservoir, top-up if necessary.
- Clean the area around the reservoir filler cap, remove cap.
- CAUTION: **Do not fill reservoir above the MAX mark.**

  If necessary, top-up using the recommended fluid to the mid-way mark on the reservoir.
  For additional information, refer to: Specifications (211-02 Power Steering, Specifications).
- Install the reservoir filler cap.

Windshield Washer Reservoir



- Remove the windshield washer reservoir filler cap.
- Top-up the reservoir using a mixture of an approved windshield washer fluid and water until the level is to the bottom of the gauze filter in the reservoir filler neck.
- Install the reservoir filler cap.

Engine Oil and Filter

CAUTION: For vehicles operating under arduous conditions see relevant section.

Every 6 months or 7,500 miles (12,000 km): NAS and Gulf markets Renew engine oil and filter.
For additional information, refer to: Specifications (303-01A Engine - I6 3.2L Petrol, Specifications).

Air Filtering

CAUTION: For vehicles operating under arduous conditions see relevant section.

1. Every 2 years or 30,000 miles (48,000 km): Replace the air cleaner element.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

Automatic Transmission

Every 10 years or 150,000 miles (240,000 km): Renew automatic transmission fluid.
For additional information, refer to: Specifications (307-01 Automatic Transmission/Transaxle, Specifications).

Manual Transmission

Every 10 years or 150,000 miles (240,000 km): Renew manual transmission fluid.
For additional information, refer to: Specifications (308-00 Manual Transmission/Transaxle and Clutch - General Information, Specifications).

Power Transfer Unit

Every 10 years or 150,000 miles (240,000 km): Renew power transfer unit oil.
For additional information, refer to: Specifications (205-03, Specifications).

Differential Assembly - Rear

Every 10 years or 150,000 miles (240,000 km): Renew rear differential oil.
For additional information, refer to: Specifications (205-02 Rear Drive Axle/Differential, Specifications).

Suspension and Body Mountings

1. Check for free play in all suspension and body mounting rubbers.

2. Check condition of suspension rubber boots and gaiters.

Fuel System

- Check fuel system pipes, hoses and unions for chafing, leaks and corrosion.

Electrical Harnesses

- Check all electrical harnesses for chafing.

Oil/Fluid Leaks

- Check for oil/fluid leaks.

Power Steering

- Check power steering rod ball joint fixings, gaiters and condition of ball joints and dust covers.
- Check power steering pipes, hoses and unions for chafing, leaks and corrosion.

Exhaust System

- Check exhaust system for leaks, security and damage.

Fault Lamp(s)

- If fault lamp(s) are illuminated, test the associated system using T4 and report findings.

Road Test

- Carry out road test of vehicle.
  For additional information, refer to: Road/Roller Testing (100-00 General Information, Description and Operation).

General

- Endorse Service Record.
- Report any unusual features of vehicle condition and any additional work required.

Vehicles Operating Under Arduous Conditions

Service intervals for vehicles operating under arduous conditions are detailed below.

Braking system

CAUTION: **When vehicles are operating under arduous conditions, the following service items must be carried out every 3 months or 3,750 miles (6,000 km).**

- Inspect front brake pads for wear.
- Inspect rear pads for wear.
- Check brake calipers for signs of fluid leaks.
- Check brake discs for condition.
- Check all brake booster and brake system pipes and hoses for condition, chafing and leaks.
- Clean road wheel hub spigots and apply grease, Land Rover Part Number RYL 105020 to the wheel mating surface of each spigot.

Brake Fluid Replacement

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 2 Years or 30,000 miles (48,000 km).**

- Replace brake fluid.

Road Wheel Speed Sensors

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 3 months or 3,750 miles (6,000 km).**

- Inspect the road wheel speed sensor harnesses for damage.

Engine Oil and Filter

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 3 months or 3,750 miles (6,000 km).**

- Renew engine oil and filter.

Air Filtering

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 12 months or 15,000 miles (24,000 km).**

- Replace the air filter element.
  For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

Accessory Drive Belt

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 5 years or 75,000 miles (120,000 km).**

- Replace the accessory drive belt.
  For additional information, refer to: Accessory Drive Belt (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

Radiator and Cooling Fan

CAUTION: **When vehicles are operating under arduous conditions, the following item must be carried out.**

- Visually check radiator for external obstructions, check cooling fan blades for damage.

Continuous Use In Severe Off-Road Conditions

CAUTION: **After 50 miles (80 km) continuous use in severe off-road conditions i.e. wading, deep mud and abrasive grit/slurry, the following items must be cleaned and inspected.**

- The parking brake.
- The accessory drive belt .

Vehicles used in dusty or field conditions or deep wading:

- More frequent attention to the air cleaner will be required.

Additional Items That May Require Attention

1. Every 6 years: It is recommended that all brake fluid hydraulic seals are replaced.

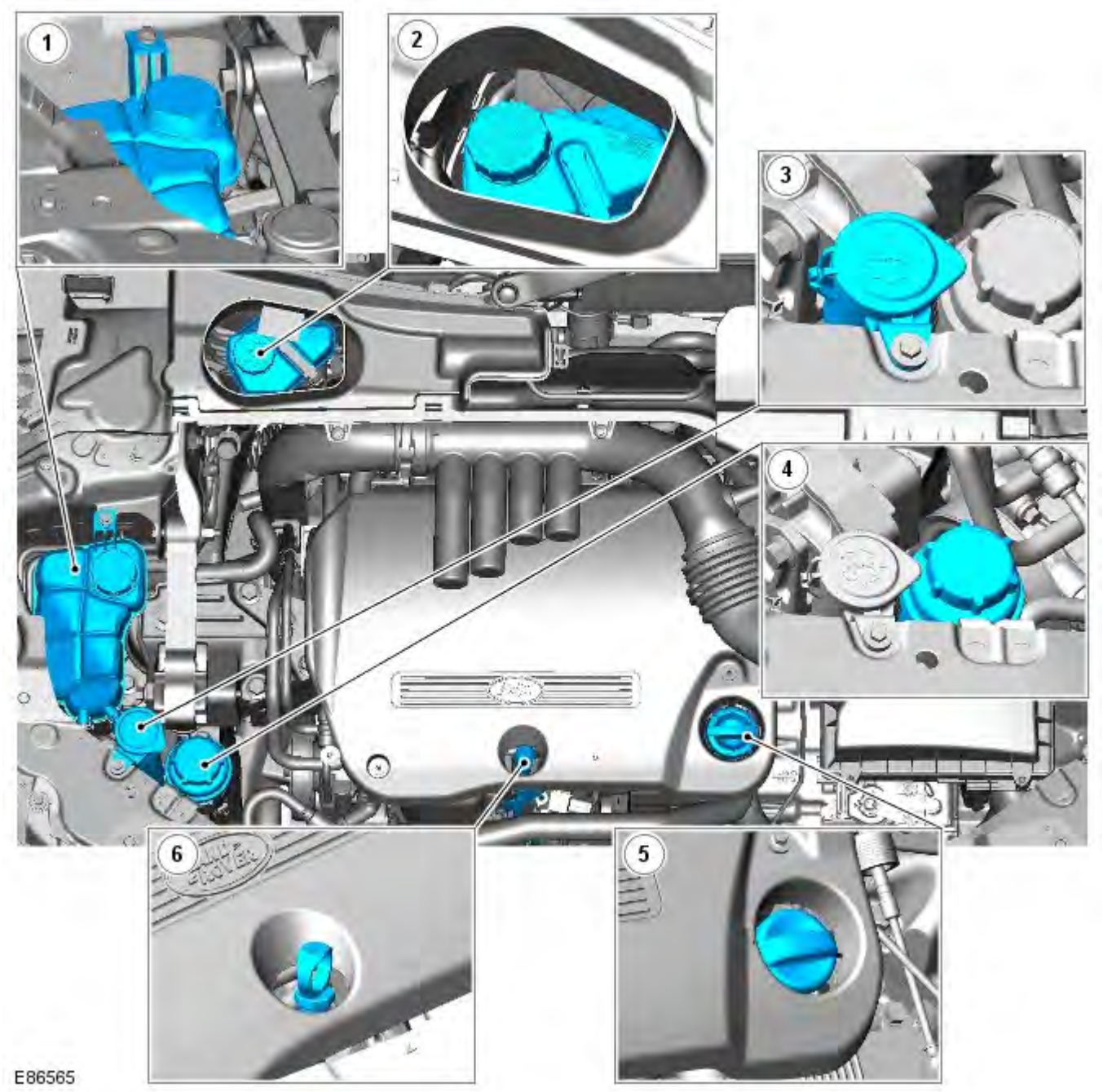
• NOTE: This is in addition to the maintenance requirement that flexible brake hoses MUST be replaced at this service interval.

Published: 11-May-2011

Maintenance Schedules - Maintenance Schedules - Diesel Engines

Description and Operation

Under Bonnet View



Item	Part Number	Description
1	-	Coolant expansion tank
2	-	Brake fluid reservoir (RH drive illustrated - LH drive on opposite side)
3	-	Windshield washer reservoir
4	-	Power steering fluid reservoir
5	-	Engine oil filler cap
6	-	Engine oil level indicator

Maintenance Operations

CAUTION: Note that the A and B Services listed on the Maintenance Check Sheet, applicable to vehicles operating under arduous conditions, vary both in period and mileage (kilometres) to the intervals specified for those vehicles operating under normal conditions. Reference must therefore, always be made to the 'Arduous Conditions section' for vehicles operating under these conditions.

Unless stated otherwise, the following operations must be carried out at every service interval.

Battery

- Check condition of battery.
- Check/top up battery electrolyte level.

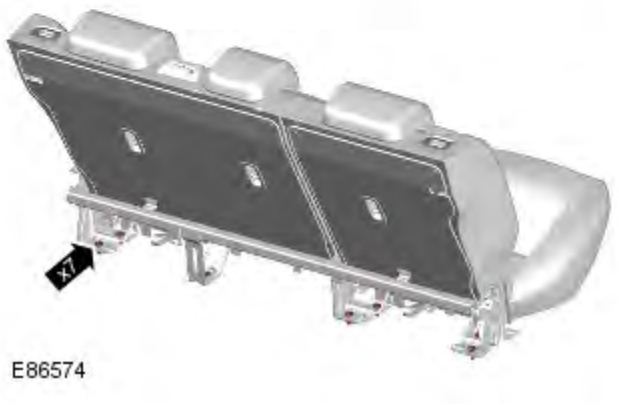
Front seats

Front seat frame fixings - Every 2 years or 30,000 miles (48,000 km)

- Carefully remove the trim panels covering the seat frame fixing Torx screws.
- Check that the front seat frame fixing Torx screws are secure and that the seat frames show no signs of movement.
- Install the trim panels on completion.

Rear Seats

Rear seat frame fixings - Every 2 years or 30,000 miles (48,000 km)

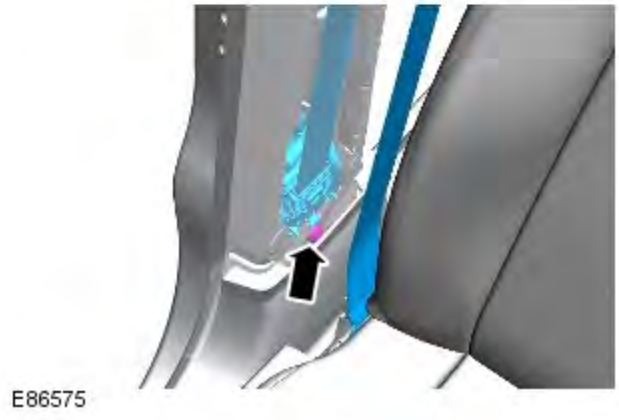


- Check that the seat frame fixings are secure and that the seat frames show no signs of movement.

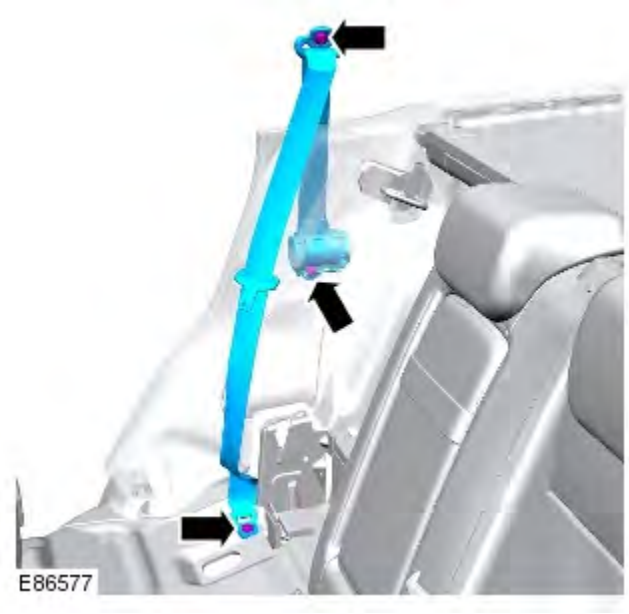
Safety Belts

Safety belts - Every 2 years or 30,000 miles (48,000 km)

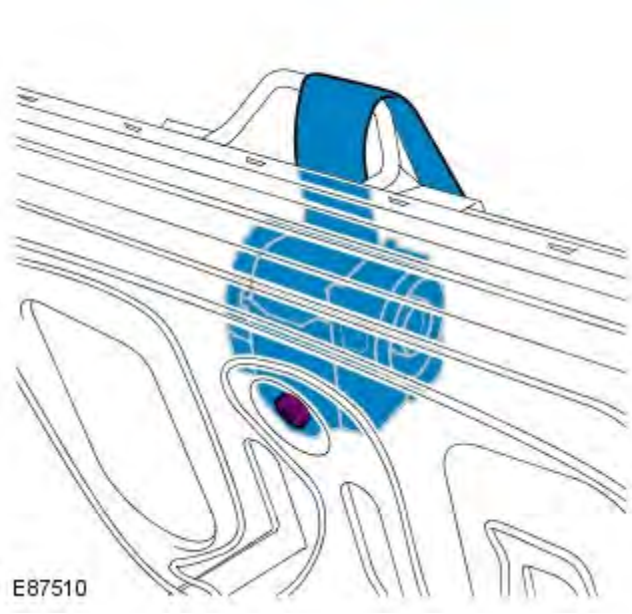
Front Seat Belt Mountings



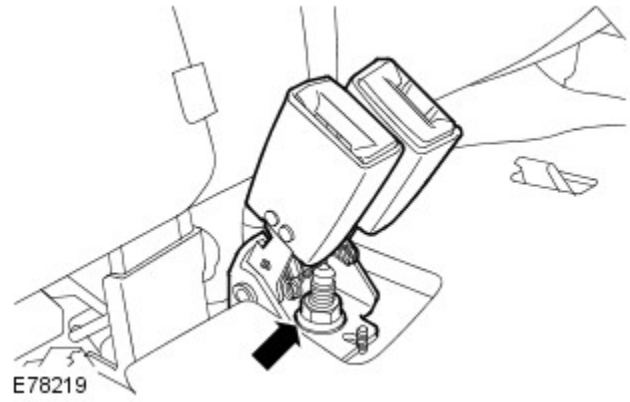
Rear Seat Belt Mountings



Reel Mounting - Center Rear Seat Belt



Buckle Mounting - Center Rear seat Belt

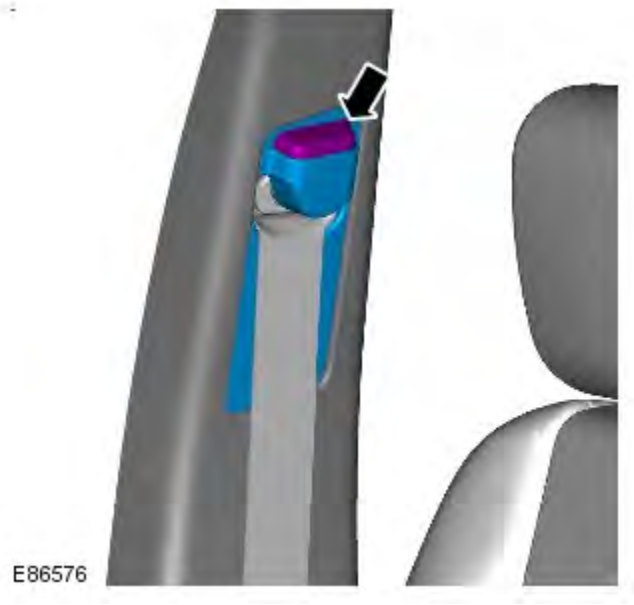


1. Fully extend each safety belt and check that it returns unassisted; repeat for all belts.

2. Check entire length of safety belt webbing for signs of fraying or damage: repeat for all belts.

3. Connect each safety belt to the correct buckle, check safety belt buckle and tongue are secure; check that buckle releases tongue correctly.

4. Check all safety belt and buckle mountings and fixings for security.



5. Check front safety belt height adjusters for correct operation.

Lamps, Horns and Warning Indicators

- Check side, head, fog, reversing and tail lamps for correct operation.
- Check operation of headlamp automatic levelling system - if installed.
- Check turn signals and hazard warning lamps for correct operation.
- Check brake (stop) lamps for correct operation.
- Check all exterior lamp lenses for clarity and condition; pay particular attention to headlamp and fog lamp lenses for stone chips or damage.
- Check horn for loud, clear sound.
- Switch on headlamps and check that side/headlamp reminder warning sounds when door is opened.
- Check operation of interior courtesy lamps.
- Check operation of all instrument pack warning and indicator lamps.

Washers and Wipers

- Check all wiper blades for condition and signs of splits or damage.
- Check security of wiper arms.
- Operate front and rear screen washers, check that jets are clear and correctly aimed.
- Operate front and rear wipers at all speeds and check for smooth, smear free operation.

Pollen Filter

- Replace pollen filter.
  For additional information, refer to: Pollen Filter (412-01 Climate Control, Removal and Installation).

Corrosion/Cosmetic Inspection

- Carry out the annual corrosion/cosmetic inspection using the Annual Corrosion Inspection Sheet.

Wheels and Tires

- Check that tires comply with manufacturer's specification.
  For additional information, refer to: Specifications (204-04 Wheels and Tires, Specifications).
- Check/adjust tire pressures including spare.
  For additional information, refer to: Specifications (204-04 Wheels and Tires, Specifications).
- **Vehicle fitted with Uni-directional tires:** Mark the wheel to stud relationship of each road wheel and note location

of each road wheel to its respective hub.
- Loosen road wheel nuts. Raise vehicle to a wheel free condition.
For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
- Remove the road wheels.
- Visually check tires for condition, lumps or bulges. Check tread depth across the width of the tire and around the circumference; ensure that remaining tread depth does not contravene local legislative requirements.

• NOTE: Do not install wheels at this stage.

Braking System

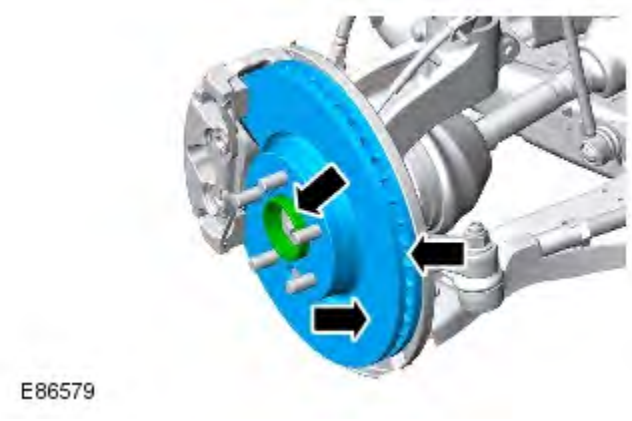
CAUTION: For vehicles operating under arduous conditions see relevant section.

1. Inspect front brake pads for wear.
For additional information, refer to: Specifications (206-03 Front Disc Brake, Specifications).

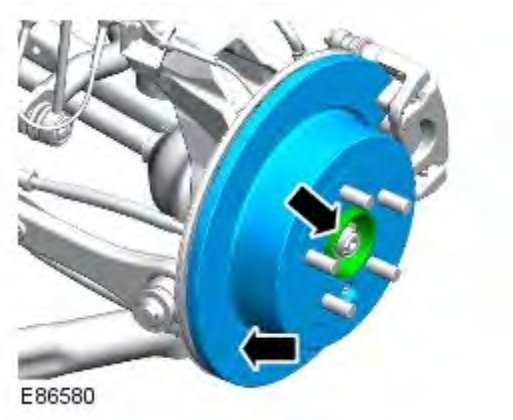
2. Inspect rear brake pads for wear.
For additional information, refer to: Specifications (206-04 Rear Disc Brake, Specifications).

3. Check brake calipers for signs of fluid leaks.

Front brakes



Rear brakes



4. Check brake discs for condition.

5. Check all brake booster and brake system pipes and hoses for condition, chafing and leaks.

6. Clean road wheel hub spigots and apply grease, Land Rover Part Number RYL 105020 to the wheel mating surface of each spigot.

7. Every 3 years: Replace brake fluid. For additional information, refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).

8. Every 6 years: Replace all flexible brake hoses.

9. Vehicles fitted with Uni-directional tires: Install road wheels on their respective hubs ensuring that stud to wheel relationship is maintained.

10. Vehicles fitted with NON Uni-directional tires: Install wheels on the opposite side of the vehicle but ensure that they are on the same axle as they were originally installed.

11. Install road wheel nuts and tighten to 133 Nm (98 lb-ft).

Parking brake

With the vehicle stationary, apply the parking brake and check for correct operation.

For additional information, refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

Door Locks and Hinges

1. Check operation of all door locks, bonnet lock and fuel filler flap.

2. Lubricate all door check straps, bonnet catch and fuel filler flap catch.

Cooling System

CAUTION: **Anti-freeze concentration must be maintained at 50%.**

1. Check specific gravity of coolant using a hydrometer.

• NOTE: A suitable hydrometer is available from the Equipment Programme under Part Number 511 3302 001 00.

2. Top-up cooling system if necessary.
For additional information, refer to: Specifications (303-03B Engine Cooling - TD4 2.2L Diesel, Specifications).

Cooling system - Check/Top-up

WARNING: **Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank whilst the system is hot.**

• CAUTIONS:

Engine coolant will damage the paint finished surfaces. If coolant is spilled, immediately remove the coolant and wash the area with water.

Always top-up with a 50% mixture of anti-freeze and water.

- Check the level of coolant in the expansion tank. With the engine cold, the coolant level must be to the **UPPER LEVEL** indicator mark above the **COLD FILL RANGE** text on the side of the expansion tank. Ignore any coolant which may be visible in the top section of the tank.
- If topping-up is required, remove expansion tank filler cap and top-up coolant level to the **UPPER LEVEL** indicator mark.
  For additional information, refer to: Specifications (303-03B Engine Cooling - TD4 2.2L Diesel, Specifications).
- Install expansion tank filler cap, tighten cap until ratchet is heard to 'click'.

Coolant - Replace

Every 10 years: Replace the coolant.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

Accessory Drive Belt

CAUTION: For vehicles operating under arduous conditions see relevant section.

- Check the condition of the accessory drive belt.
- Remove all traces of mud and dirt from the drive belt and pulleys.
- Check the drive belt for signs of splitting and wear.
- **Every 150,000 miles (240,000 km): Replace the accessory drive belt.** For additional information, refer to: Accessory Drive Belt (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

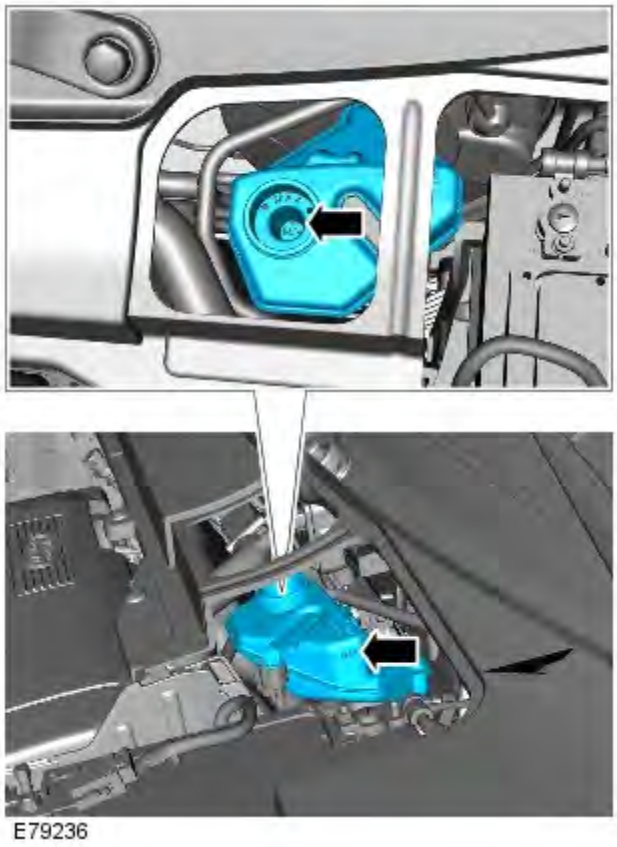
Camshaft Timing Belt, Tensioner and Pulley

CAUTION: For vehicles operating under arduous conditions see relevant section.

1. Every 10 years or 150,000 miles (240,000 km): Replace the camshaft timing belt, tensioner and pulley.
For additional information, refer to: Timing Belt (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

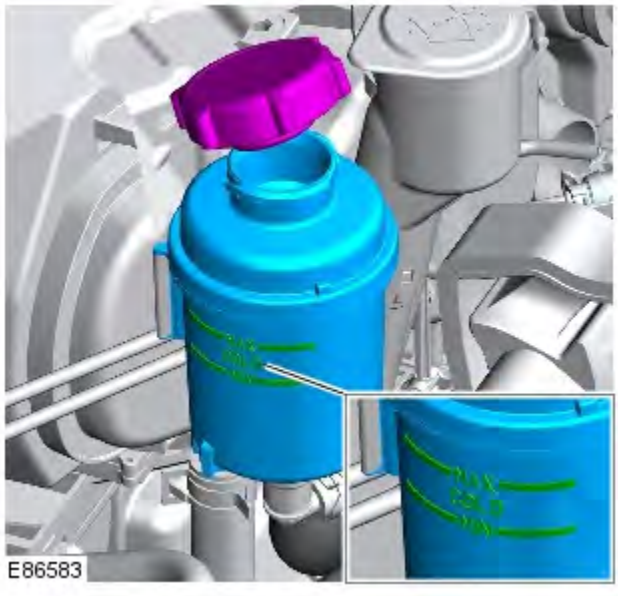
Fluid levels

Brake Fluid Reservoir



- Remove the brake fluid reservoir cover.
- Check the fluid level in the brake fluid reservoir, the level must be to the **MAX** mark on the reservoir; top-up if necessary.
- Clean the area around the reservoir filler cap, remove cap.
- If necessary, top-up using the recommended fluid to the **MAX** mark on the reservoir.
  For additional information, refer to: Specifications (206-00 Brake System - General Information, Specifications).
- Install the reservoir filler cap.
- Install the brake fluid reservoir cover.

Power Steering Fluid Reservoir



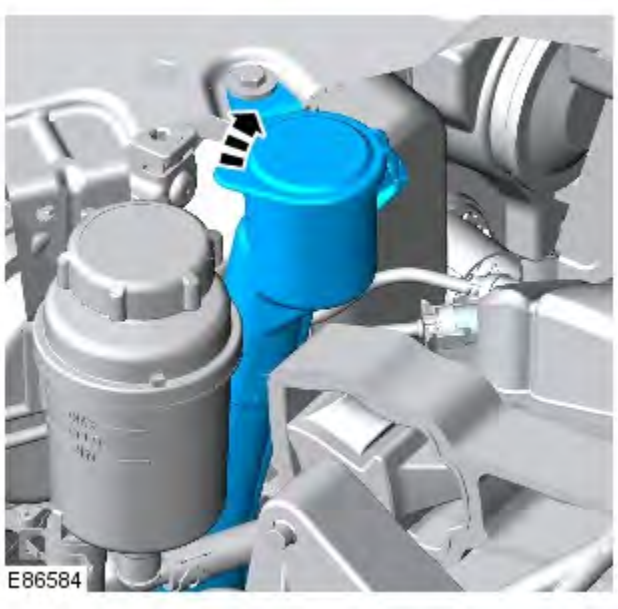
CAUTION: **To prevent over filling, check/top-up the system with the engine switched off and the system cold.**

Ensure that the steering wheel is in the straight ahead position, do not turn the steering wheel prior to checking the fluid level.

- Check that the fluid level is to the mid-way mark between the **MAX** and **MIN** marks on the fluid reservoir, top-up if necessary.
- Clean the area around the reservoir filler cap, remove cap.
- CAUTION: **Do not fill reservoir above the MAX mark.**

  If necessary, top-up using the recommended fluid to the mid-way mark on the reservoir.
  For additional information, refer to: Specifications (211-02 Power Steering, Specifications).
- Install the reservoir filler cap.

Windshield Washer Reservoir



- Remove the windshield washer reservoir filler cap.
- Top-up the reservoir using a mixture of an approved windshield washer fluid and water until the level is to the bottom of the gauze filter in the reservoir filler neck.
- Install the reservoir filler cap.

Engine Oil and Filter

• CAUTIONS:

For vehicles operating under arduous conditions see relevant section.

Vehicles operating on high sulphur content fuel - above 0.7%, the oil and filter change period MUST NOT exceed 3 months or 3,750 miles (6,000 km).

Vehicles operating on moderate sulphur content fuel - 0.3 to 0.7%, the oil and filter change period MUST NOT exceed 6 months or 7,500 miles (12,000 km).

- Renew engine oil and filter.
  For additional information, refer to: Oil Filter Element (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

Air Filtering

CAUTION: For vehicles operating under arduous conditions see relevant section.

1. Every 2 years or 30,000 miles (48,000 km): Replace the air cleaner element.
For additional information, refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

Fuel Filter

1. Every year or 15,000 miles (24,000 km): Drain water from the fuel filter.

1. Every 2 years or 30,000 miles (48,000 km): Replace fuel filter element.
For additional information, refer to: Fuel Filter (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

Automatic Transmission

Every 10 years or 150,000 miles (240,000 km): Renew automatic transmission fluid.

For additional information, refer to: Specifications (307-01 Automatic Transmission/Transaxle, Specifications).

Manual Transmission

Every 10 years or 150,000 miles (240,000 km): Renew manual transmission fluid.
For additional information, refer to: Specifications (308-00 Manual Transmission/Transaxle and Clutch - General Information, Specifications).

Power Transfer Unit

Every 10 years or 150,000 miles (240,000 km): Renew power transfer unit oil. For additional information, refer to: (308-07B Transfer Case)

Power Transfer Unit - TD4 2.2L Diesel, Vehicles With: M66 6-Speed Manual Transmission AWD (Removal and Installation),
Power Transfer Unit - TD4 2.2L Diesel, Vehicles With: M66 6-Speed Manual Transmission AWD (Removal and Installation).

Differential Assembly - Rear

Every 10 years or 150,000 miles (240,000 km): Renew rear differential oil.
For additional information, refer to: Specifications (205-02 Rear Drive Axle/Differential, Specifications).

Suspension and Body Mountings

- Check for free play in all suspension and body mounting rubbers.
- Check condition of suspension rubber boots and gaiters.

Fuel System

- Check fuel system pipes, hoses and unions for chafing, leaks and corrosion.

Electrical Harnesses

- Check all electrical harnesses for chafing.

Oil/Fluid Leaks

- Check for oil/fluid leaks.

Power Steering

- Check power steering rod ball joint fixings, gaiters and condition of ball joints and dust covers.
- Check power steering pipes, hoses and unions for chafing, leaks and corrosion.

Exhaust System

- Check exhaust system for leaks, security and damage.

Clutch

1. Check clutch pipes and unions for chafing, leaks and corrosion.

Fault Lamp(s)

- If fault lamp(s) are illuminated, test the associated system using Land Rover approved diagnostic equipment and report findings.

Road Test

- Carry out road test of vehicle.
  For additional information, refer to: Road/Roller Testing (100-00 General Information, Description and Operation).

General

- Endorse Service Record.
- Report any unusual features of vehicle condition and any additional work required.

Vehicles Operating Under Arduous Conditions

Recommended service intervals for vehicles operating under arduous conditions are detailed below.

Braking System

CAUTION: **When vehicles are operating under arduous conditions, the following service items must be carried out every 3 months or 3,750 miles (6,000 km).**

- Inspect front brake pads for wear.

- Inspect rear pads for wear.
- Check brake calipers for signs of fluid leaks.
- Check brake discs for condition.
- Check all brake booster and brake system pipes and hoses for condition, chafing and leaks.
- Clean road wheel hub spigots and apply grease, Land Rover Part Number RYL 105020 to the wheel mating surface of each spigot.

Brake Fluid Replacement

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 2 Years or 30,000 miles (48,000 km).**

- Replace brake fluid.

Road Wheel Speed Sensors

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 3 months or 3,750 miles (6,000 km).**

- Inspect the road wheel speed sensor harnesses for damage.

Engine Oil and Filter

• CAUTIONS:

When vehicles are operating under arduous conditions, the following service item must be carried out every 3 months or 3,750 miles (6,000 km).

Vehicles operating on high sulphur content fuel - above 0.7%, the oil and filter change period MUST NOT exceed 3 months or 3,750 miles (6,000 km).

Vehicles operating on moderate sulphur content fuel - 0.3 to 0.7%, the oil and filter change period MUST NOT exceed 6 months or 7,500 miles (12,000 km).

- Renew engine oil and filter.

Air Filtering

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 12 months or 15,000 miles (24,000 km).**

- Replace the air filter element.
  For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

Accessory Drive Belt

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 5 years or 75,000 miles (120,000 km).**

- Replace the accessory drive belt. For additional information, refer to: Accessory Drive Belt (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

Camshaft Timing Belt, Tensioner and Pulley

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 4 years or 60,000 miles (96,000 km).**

- Replace the camshaft timing belt, tensioner and pulley.
  For additional information, refer to: Timing Belt (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

Radiator/Charge Air Cooler and Cooling Fan

CAUTION: **When vehicles are operating under arduous conditions, the following items must be carried out.**

- Visually check the radiator/charge air cooler for external obstructions, check cooling fan blades for damage.
- Remove any debris from the charge air cooler using a low pressure hose.

Continuous Use In Severe Off-Road Conditions

CAUTION: **After 50 miles (80 km) continuous use in severe off-road conditions i.e. wading, deep mud and abrasive grit/slurry, the following items must be cleaned and inspected.**

- The parking brake.
- The accessory drive belt.

Vehicles used in dusty or field conditions or deep wading:

- More frequent attention to the air cleaner will be required.

Fuel Filter

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 3 months or 3,750 miles (6,000 km).**

- Drain water from the fuel filter.

Poor Fuel Quality

CAUTION: **When vehicles are operating under arduous conditions, the following service item must be carried out every 3 months or 3,750 miles (6,000 km).**

- Where vehicles are used in these areas, the fuel filter may require draining at more frequent intervals.

Additional Items That May Require Attention

1. Every 6 years: It is recommended that all brake fluid hydraulic seals are replaced.

• NOTE: This is in addition to the maintenance requirement that flexible brake hoses MUST be replaced at this service interval.

Published: 08-Dec-2011

Suspension System - General Information -

Coil Spring Suspension

Item	Specification
Front	Front: - Conventional coil spring with a twin tube damper and a high stress stabilizer bar
Rear	Rear: - Conventional coil spring with a twin tube damper and a high stress stabilizer bar

Wheel Alignment Specification (All Markets) - Front

• NOTE: All figures are with vehicle at 'Showroom' ride height - full fluids, full tank of fuel, no occupants/luggage, tires inflated to normal pressures

Item		Left-hand		Right-hand		Total/Balance	
Camber		**Nominal**	**Tolerance**	**Nominal**	**Tolerance**	**Nominal**	**Tolerance**
	Decimal degrees	-0.50°	± 0.75°	-0.50°	± 0.75°	0°	± 0.75°
	Degrees/minutes	-30'	± 45'	-30'	± 45'	0'	± 45'
		Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
	Decimal degrees	-1.25°	0.25°	-1.25°	0.25°	-0.75°	0.75°
	Degrees/minutes	-1°.15'	15'	-1°.15'	15'	-45'	45'
Castor		**Nominal**	**Tolerance**	**Nominal**	**Tolerance**	**Nominal**	**Tolerance**
	Decimal degrees	3.25°	± 0.75°	3.25°	±0.75°	0°	± 0.75°
	Degrees/minutes	3°15'	± 45'	3°15'	± 45'	0'	± 45'
		Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
	Decimal degrees	2.50°	4°	2.50°	4°	-0.75°	0.75°
	Degrees/minutes	2°30'	4°	2°30'	4°	-45'	45'
Toe		**Nominal**	**Tolerance**	**Nominal**	**Tolerance**	**Nominal**	**Tolerance**
	Decimal degrees	0.10°	±0.10°	0.10°	±0.10°	0.20°	± 0.20°
	Degrees/minutes	6'	±6'	6'	±6'	12'	± 12'
		Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
	Decimal degrees	0°	0.20°	0°	0.20°	0°	0.40°
	Degrees/minutes	0'	12'	0'	12'	0'	24'

Wheel Alignment Specification (All Markets) - Rear

• NOTE: All figures are with vehicle at 'Showroom' ride height - full fluids, full tank of fuel, no occupants/luggage, tires inflated to normal pressures

Item		Left-hand		Right-hand		Total/Balance		Thrust Angle	
Camber		**Nominal**	**Tolerance**	**Nominal**	**Tolerance**				
	Decimal degrees	-1.95°	± 0.75°	-1.95°	± 0.75°				
	Degrees/minutes	-1°57'	± 45'	-1°57'	± 45'				
		Minimum	**Maximum**	**Minimum**	**Maximum**				
	Decimal degrees	-2.70°	-1.20°	-2.70°	-1.20°				
	Degrees/minutes	-2°42'	-1°12'	-2°42'	-1°12'				
Toe		**Nominal**	**Tolerance**	**Nominal**	**Tolerance**	**Nominal**	**Tolerance**	**Nominal**	**Tolerance**
	Decimal degrees	0.17°	± 0.14°	0.17°	± 0.14°	0.33°	± 0.20°	0°	± 0.14°
	Degrees/minutes	10'	± 8'	10'	± 8'	20'	± 12'	0'	± 8'
		Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
	Decimal degrees	0.03°	0.31°	0.03°	0.31°	0.13°	0.53°	-0.14°	0.14°
	Degrees/minutes	2'	18'	2'	18'	8'	32'	-8'	8'

Vehicle Ride Height

• NOTE: All figures are with vehicle at 'Kerbside' (curbside) ride height - full fluids, full tank of fuel, no occupants/luggage, tires inflated to normal pressures

• NOTE: Ride height is measured vertically from wheel center to underside of wheel arch

Description	mm	inch
Front	490.7 ± 12	19.32 ± 0.47
Rear	504.6 ± 12	19.87 ± 0.47

Published: 11-May-2011

Suspension System - General Information - Suspension System

Diagnosis and Testing

Principles of Operation

For a detailed description of the suspension system, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Front Suspension (204-01 Front Suspension, Description and Operation),
Rear Suspension (204-02 Rear Suspension, Description and Operation),
Ride and Handling Optimization (204-06 Ride and Handling Optimization, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage.

Visual Inspection

Mechanical
• Damaged tires • Wheel bearing(s) • Loose or damaged front or rear suspension components • Loose, damaged or missing suspension fastener(s) • Incorrect spring(s) installed • Damaged or sagging spring(s) • Damaged or leaking shock absorber(s) • Damaged or leaking strut(s) • Worn or damaged suspension bushing(s) • Loose, worn or damaged steering system components • Damaged axle components

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Cause	Action
Crabbing	• Incorrect rear thrust angle • Front or rear suspension components • Drive axle damaged	CHECK the rear toe adjustment. REFER to: Specifications (204-00 Suspension System - General Information, Specifications) / Four-Wheel Alignment (204-00 Suspension System - General Information, General Procedures). INSPECT the front and rear suspension systems. REPAIR or INSTALL new suspension components as necessary. INSTALL a new rear drive axle/differential as necessary
Drift/Pull	• Unequal tire pressure • Incorrect wheel alignment • Tires • Unevenly loaded or overloaded vehicle • Damaged steering components • Brake drag	CHECK and ADJUST the tire pressures. INSPECT the tire for excessive wear. REFER to: Specifications (204-04 Wheels and Tires, Specifications). CHECK and ADJUST the wheel alignment. REFER to: Four-Wheel Alignment (204-00 Suspension System - General Information, General Procedures). CHECK and ADJUST the tire pressures. INSPECT the tire for excessive wear. REFER to: Specifications (204-04 Wheels and Tires, Specifications). NOTIFY the customer of incorrect vehicle loading. CHECK the steering system. REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing). CHECK the brakes. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
Front Bottoming or Riding Low	• Coil springs	CHECK the ride height. INSTALL new springs as necessary. REFER to: Spring (204-01 Front Suspension, Removal and Installation) / Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation).
Incorrect Tire Wear	• Incorrect tire pressure (rapid center rib or inner and outer edge wear) • Excessive front or rear toe (rapid inner or outer edge wear) • Excessive negative or positive camber (rapid inner or outer edge wear) • Tires out of balance (tires cupped or dished)	CHECK and ADJUST the tire pressure. INSPECT the tire for excessive wear. REFER to: Specifications (204-04 Wheels and Tires, Specifications). CHECK and ADJUST the wheel alignment. REFER to: Four-Wheel Alignment (204-00 Suspension System - General Information, General Procedures). BALANCE the wheels/tires

Suspension System - General Information - Four-Wheel Alignment

General Procedures

1. Check the geometry specifications.

   Refer to: Specifications (204-00 Suspension System - General Information, Specifications).

2. Check the tie rod ends, suspension joints, wheel bearings and wheels and tires for damage, wear and free play.

3. Check and adjust tire pressures.

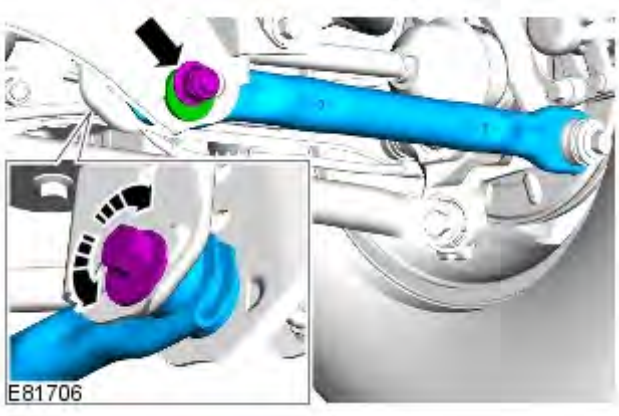
4. Position the vehicle on a calibrated, level, vehicle lift.

5. Release the vehicle parking brake.

6. Using only four wheel alignment equipment approved by Land Rover, check and adjust the wheel alignment.

7. **7.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

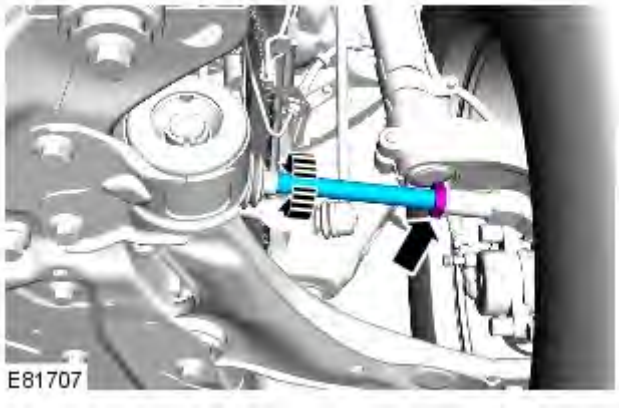


8. Adjust the rear toe.

   Torque: 175 Nm

9. Repeat the rear toe measurement.

10. Align the steering to straight ahead.



11. Adjust the front toe.

    Torque: 55 Nm

12. Check, and if necessary, repeat the wheel alignment procedure until the correct values are obtained.

13. Using the Land Rover approved diagnostic system, calibrate the steering angle sensor.

Published: 11-May-2011

Front Suspension -

Coil Spring Suspension

Item	Specification
Front	Conventional coil spring with a twin tube damper and a high stress stabilizer bar

Road Spring Identification

Part Number	Specification	Isolator
LR 001131	Green/Yellow/Orange.	LR 001145

Torque Specifications

Description	Nm	lb-ft
Damper locknut*	80	59
Front subframe crossbrace:		
M10*	45	33
M16*	140 + 240°	103 + 240°
Front subframe to body bolts*	140 + 240°	103 + 240°
Front ride height sensor	10	7
Halfshaft to hub bolt*	45 + 80°	33 + 80°
Lower control arm front bolt	140 + 45°	104 + 45°
Lower control arm rear nut and bolt	175	129
Lower control arm taper ball joint locknut*	100	74
Spring and damper assembly top mounting nuts	30	22
Stabilizer bar clamp bolts	175	129
Stabilizer bar link nuts*	60	44
Wheel knuckle to damper clamp bolt	110	81

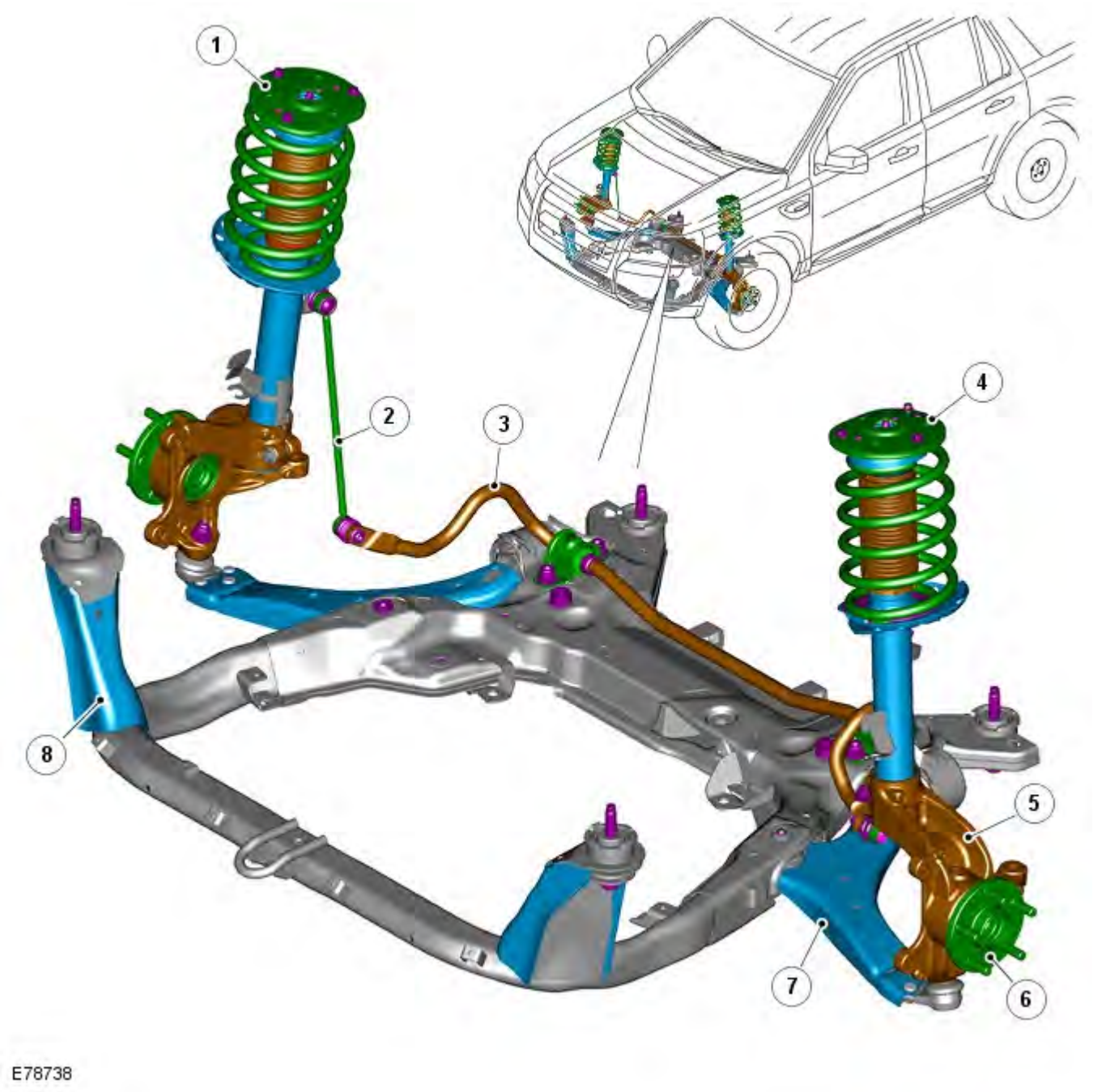
*** New nuts/bolts must be fitted**

Published: 11-May-2011

Front Suspension - Front Suspension

Description and Operation

COMPONENT LOCATION



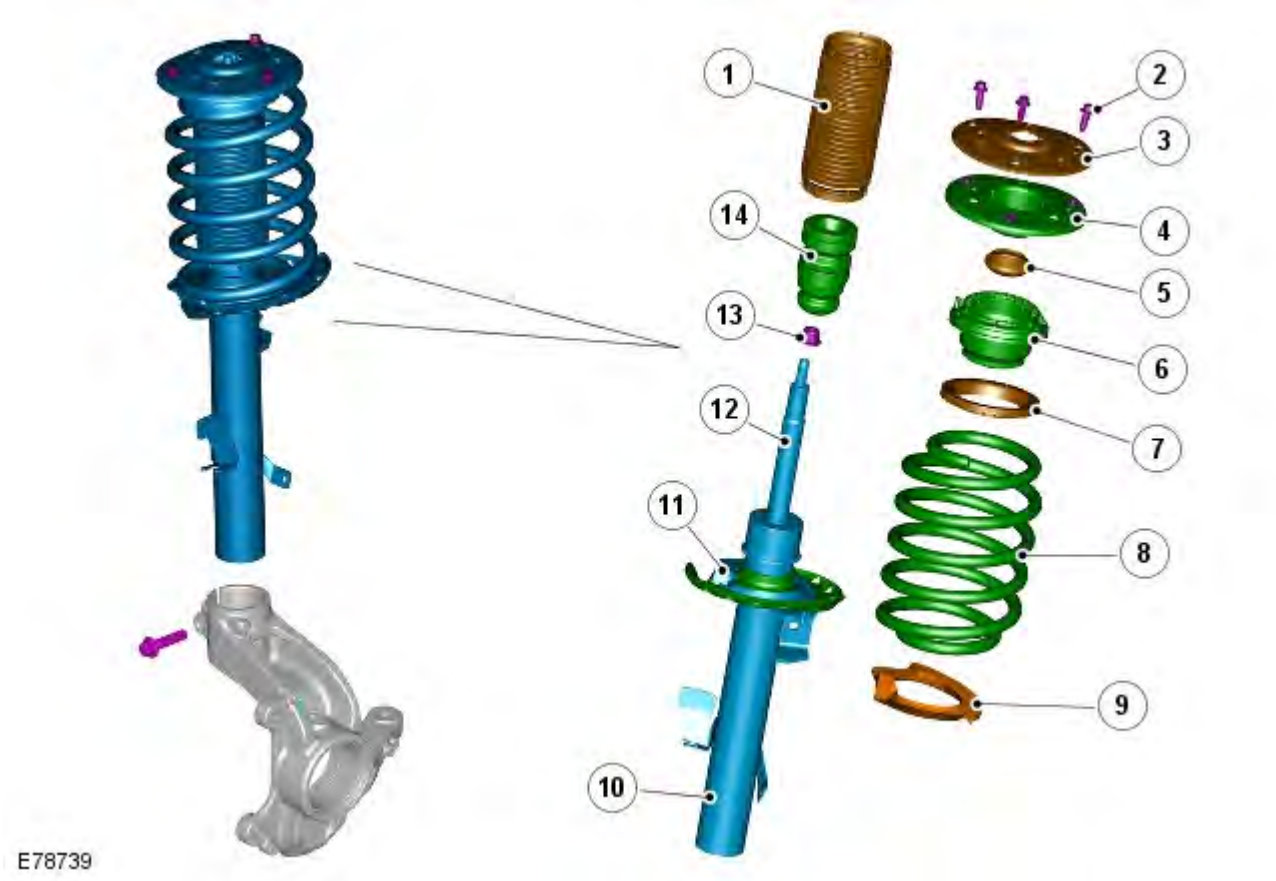
Item	Part Number	Description
1	-	Right Hand (RH) spring and damper assembly
2	-	Stabilizer bar link
3	-	Stabilizer bar
4	-	Left Hand (LH) spring and damper assembly
5	-	Wheel knuckle
6	-	Hub and bearing assembly
7	-	Lower control arm
8	-	Subframe

OVERVIEW

The front suspension features long travel McPherson struts to optimize on and off road performance.

The suspension components are mounted on a subframe. The subframe is mounted on 4 bushes which have differing compression rates to absorb lateral and longitudinal loading. This provides a rigid platform for front suspension cornering loads, frontal impact absorption and also provides a towing point for off-road recovery.

SPRING AND DAMPER



Item	Part Number	Description
1	-	Boot
2	-	Bolts - Top mount (3 off)
3	-	Upper top mount plate
4	-	Lower top mount plate
5	-	Bump washer
6	-	Top mount bearing
7	-	Spring isolator
8	-	Spring
9	-	Spring Isolator
10	-	Damper body
11	-	Spring seat
12	-	Damper piston rod
13	-	Locknut
14	-	Spring aid

The spring and damper assembly is a twin tube design with the conventional coil spring located on a welded spring seat on the damper tube. The lower end of the damper body locates in the wheel knuckle which is clamped with a bolt.

The damper functions by restricting the flow of hydraulic fluid through internal galleries within the damper. The damper rod moves axially within the damper, its movement limited by the flow of fluid through the galleries, providing damping of undulations in the terrain. The damper rod is sealed at its exit point from the damper body to maintain the fluid within the unit and to prevent the ingress of dirt and moisture. The seal also incorporates a wiper to keep the rod clean.

The damper rod is located through a central hole in the top mount assembly. The rod is threaded at its outer end. A self-locking nut secures the top mount to the damper rod. A spring aid is fitted to the damper rod to prevent the top mount contacting the top of the damper during full suspension compression and also assists the suspension tune. A boot is fitted between the damper body and the top mount and protects the damper piston rod from damage.

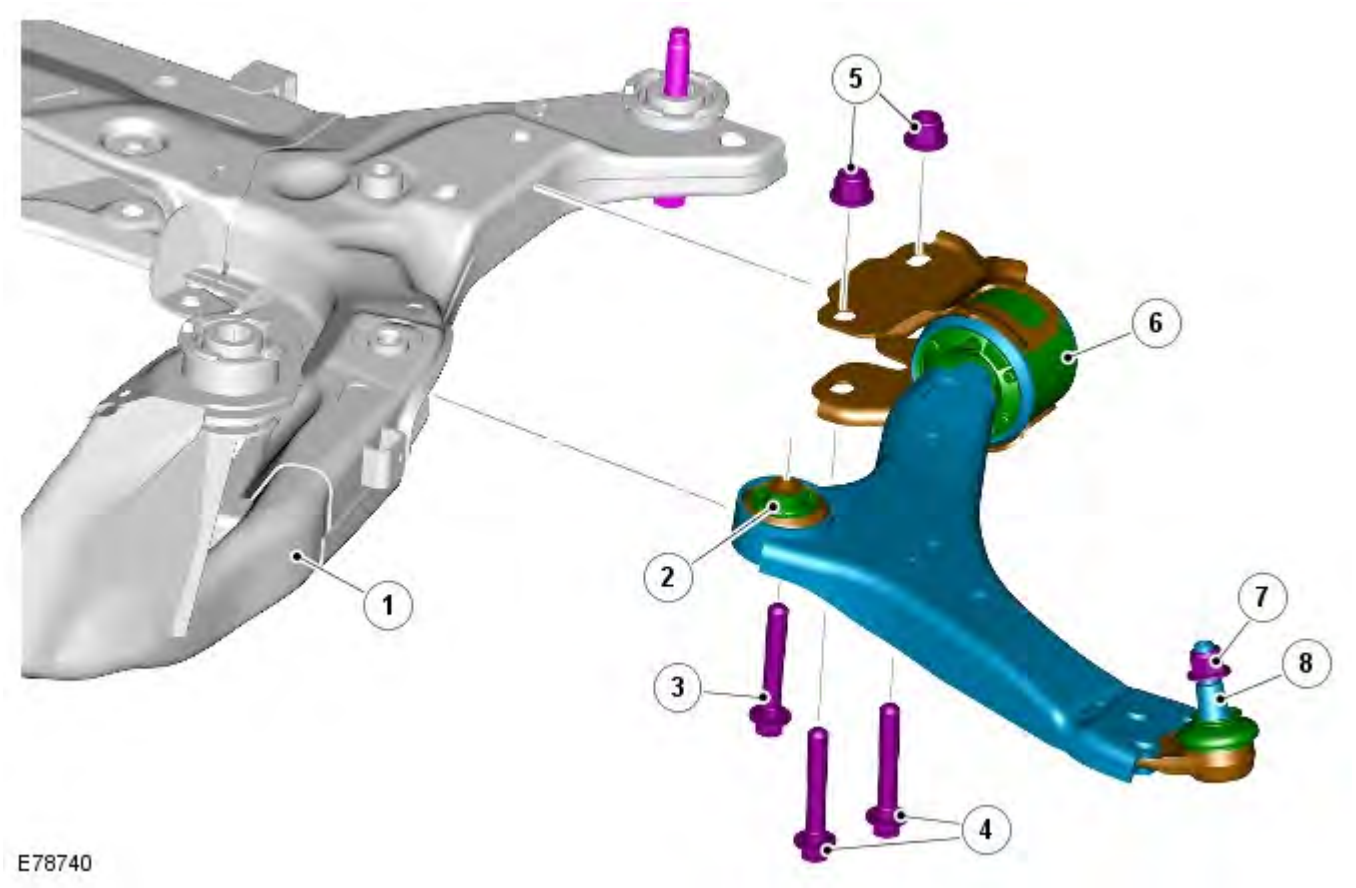
The coil spring fitted differs with vehicle specification. Each spring is colour coded to identify its rating and fitment requirements.

The coil spring is located in a spring seat which is an integral part of the damper body and contains a spring isolator. The design of the spring seat prevents the spring rotating. The spring has a linear rate compression and is inclined to counter cornering forces. The opposite end of the coil spring is also located in a spring isolator which is fitted in the top mount assembly. Both spring isolators are made from rubber and prevent any noise produced during damper and spring compression/extension from being transmitted to the vehicle body.

The top mount is fitted with a top mount bearing which is located between the 2 top mount plates and the damper rod. A self locking nut secures the damper rod to the top mount. The top mount bearing reduces steering resistance by preventing the spring from 'winding' up when the steering in turned. The top mount attaches to a strengthened turret on the chassis with 3 integral studs and self-locking nuts.

Two brackets are welded to the damper body. One bracket provides for the attachment of the stabilizer link. The second bracket provides for the attachment of the brake hose and wheel speed sensor cable. This bracket also positively locates the damper into the wheel knuckle and its location is critical to controlling the vehicle trim height.

LOWER CONTROL ARM



Item	Part Number	Description
1	-	Subframe
2	-	Ball bush
3	-	Bolt - front attachment
4	-	Bolt - rear attachment (2 off)
5	-	Nut - rear attachment (2 off)
6	-	Hydrabush
7	-	Locknut
8	-	Taper ball joint

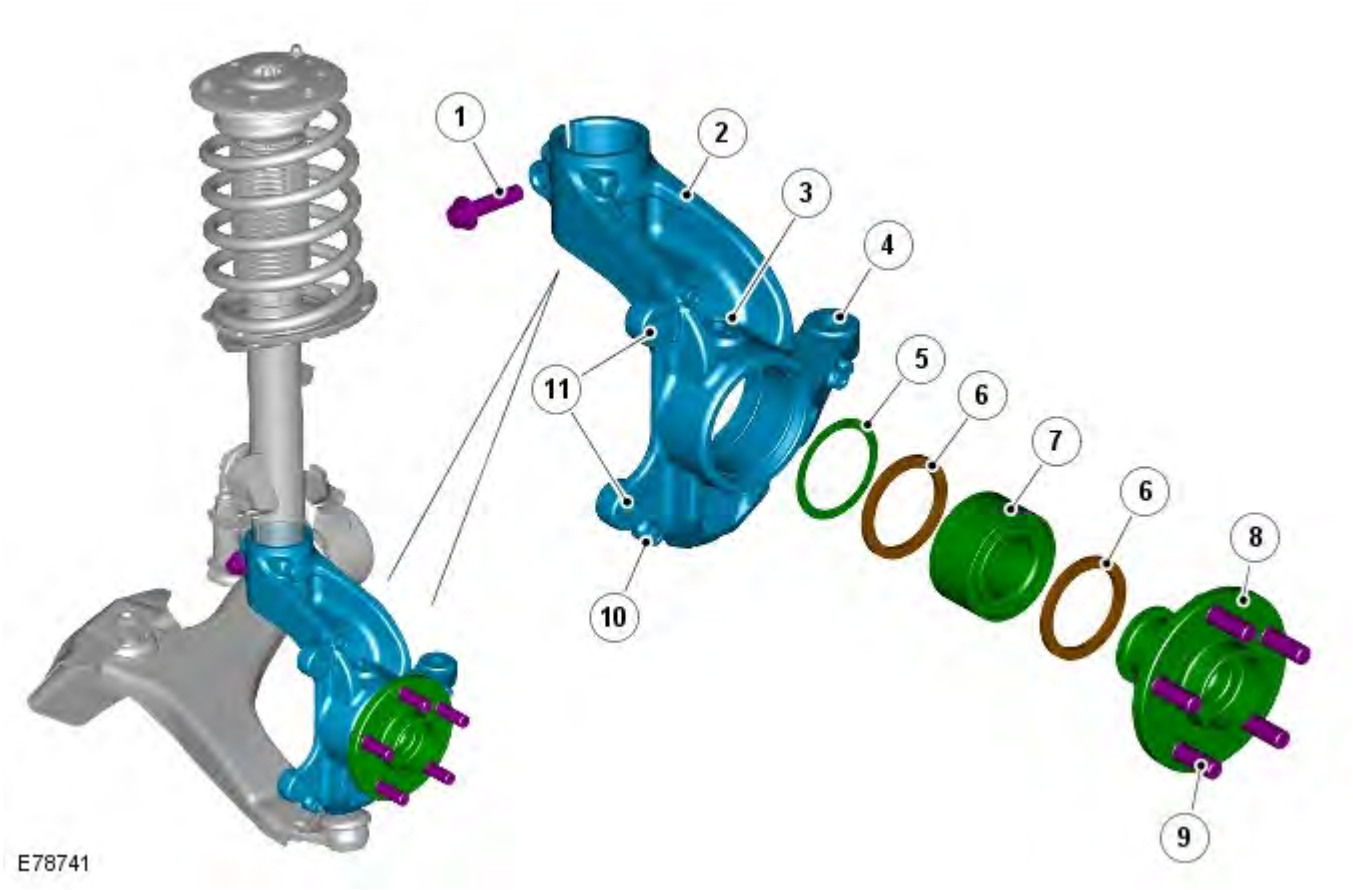
The lower control arm assembly comprises the control arm, a rubber bush, a hydrabush and a ball joint.

The control arm is a pressed steel fabrication. The outer end is fitted with a non-serviceable taper ball joint which mates with the wheel knuckle.

The 2 inner attachments locate in the subframe. The forward attachment is a non-serviceable rubber bush which is pressed into the control arm. This joint locates in a slot in the subframe and is secured with a bolt which is screwed into a threaded boss on the subframe.

The rearward attachment is a hydrabush which is located on a spigot on the control arm. The hydrabush has 2 welded brackets which provides for its attachment to the subframe with 2 bolts and nuts. The hydrabush contains hydraulic fluid and valves which allow controlled displacement of the bush to improve bump and handling characteristics and also reduce road noise transmission. The bush becomes progressively stiffer as the forces on it increase, such as severe braking.

WHEEL KNUCKLE AND HUB ASSEMBLY



Item	Part Number	Description
1	-	Clamp bolt
2	-	Wheel knuckle
3	-	Anti-lock Brake System (ABS) wheel speed sensor mounting
4	-	Steering tie-rod attachment
5	-	ABS wheel speed sensor pulse ring
6	-	Seal
7	-	Wheel bearing
8	-	Hub
9	-	Wheel stud
10	-	Disc shield attachment
11	-	Brake caliper attachment

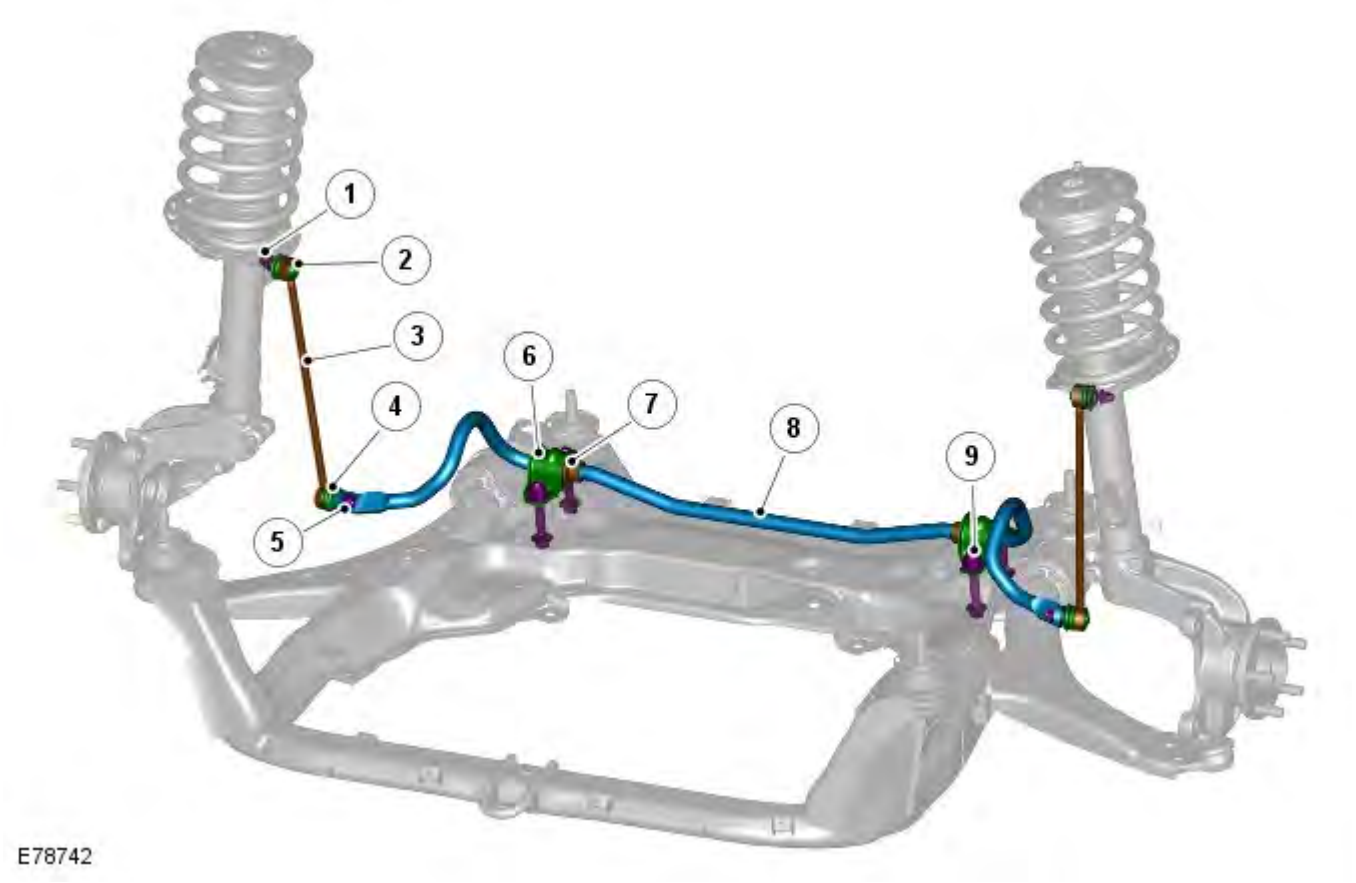
The cast steel wheel knuckle provides the attachment for the lower control arm, spring and damper assembly, wheel hub and bearing assembly and the steering tie-rod.

The extended lower boss on the knuckle provides for the attachment of the steering gear tie-rod ball joint. The ball joint is a taper fitting and is secured with a locknut. The tie-rod allows for the adjustment of the front wheel toe angle.

The upper section of the wheel knuckle has a location hole for the damper body. The damper body slides into the hole and locates against an abutment. The rear face of the hole is split and allows the damper body to be secured in the wheel knuckle with a clamp bolt.

Mounting locations are provided for the brake caliper and the brake disc shield. A hole in the top face of the wheel knuckle provides the location for the ABS wheel speed sensor which is secured with a bolt.

STABILIZER BAR



Item	Part Number	Description
1	-	Locknut (hidden)
2	-	Ball joint
3	-	Link
4	-	Ball joint
5	-	Locknut
6	-	Clamp
7	-	Bush
8	-	Stabilizer bar
9	-	Bolt (2 off)

The stabilizer bar is attached to the rear of the subframe with bushes and mounting brackets. The pressed steel brackets locate over the bushes and are attached to the cross member with bolts screwed into threaded locations in the subframe. The stabilizer bar has 'anti-shuffle' collars pressed in position on the inside edges of the bushes. The collars prevent sideways movement of the stabilizer bar.

The stabilizer bar is manufactured from 20.5 mm diameter, manganese steel bar. Each end of the stabilizer bar curves forwards to attach to a ball joint on a stabilizer link. Each stabilizer link is secured to a bracket on the damper body with a locknut. The links, which are not handed, allow the stabilizer bar to move with the wheel travel providing maximum effectiveness.

The stabilizer bar bushes are the compression type which grip the bar under compression by the mounting brackets. When fitting replacement bushes, it is important to ensure the bushes are correctly orientated to the bar. Failure to correctly align the bushes will result in excessive pre-load (wind-up) in the bushes when the suspension is at its nominal ride height.

Published: 11-May-2011

Front Suspension - Front Suspension

Diagnosis and Testing

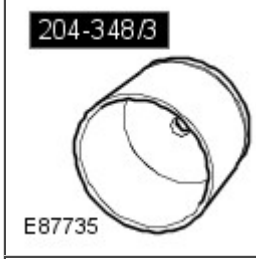
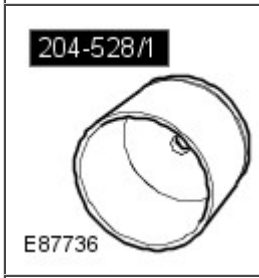
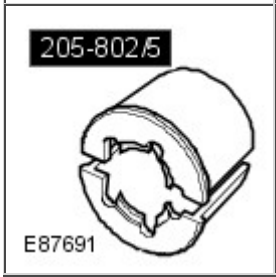
For additional information.
REFER to: Suspension System (204-00 Suspension System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Front Suspension - Front Wheel Bearing

Removal and Installation

Special Tool(s)

	204-348/3 Remover/Installer, Wheel Hub/Wheel Bearing
	204-348-01 Adapter for 204-348
	204-528/1 Remover/Installer, Bushing
	204-536/2 Remover/Installer, Bushing
	205-802/5 Remover, Wheel Hub/Bearing

Removal

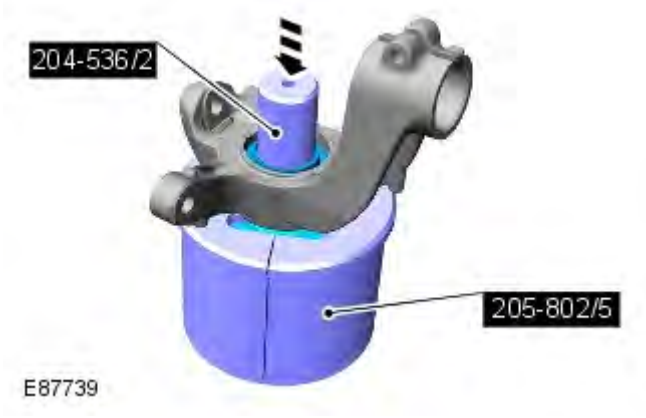
- NOTE: The wheel bearing is supplied as part of the drive flange assembly.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the wheel knuckle.

   Refer to: Wheel Knuckle (204-01 Front Suspension, Removal and Installation).

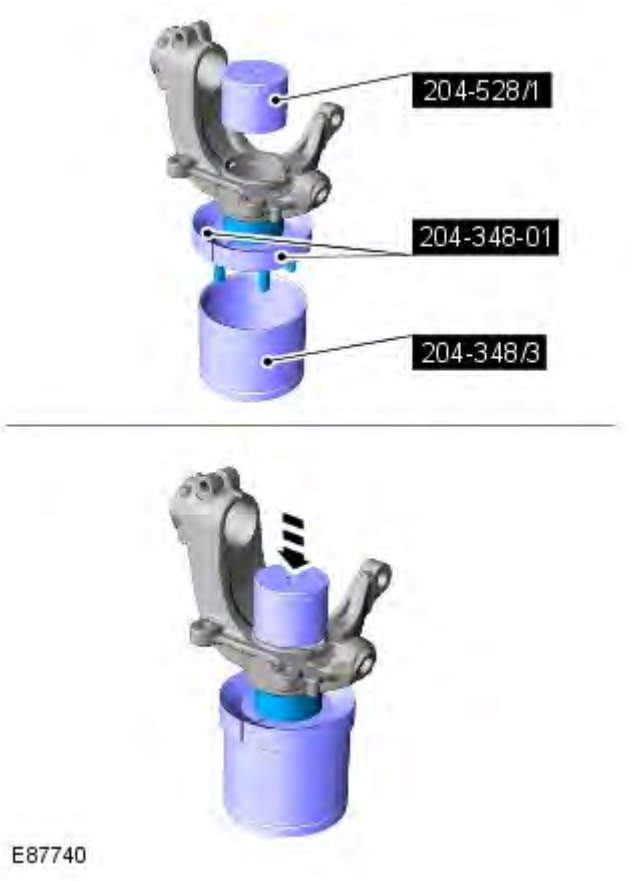


3.
- Position the wheel knuckle assembly in a press and support on special tool.

  Special Tool(s): 205-802/5
- Using the special tool, press the drive flange assembly out of the wheel knuckle.

  Special Tool(s): 204-536/2

Installation



1. **1.** CAUTION: Make sure that a new drive flange assembly is installed.
   - Position the new drive flange assembly in the special tools.

     Special Tool(s): 204-348/3, 204-348-01
   - Using the special tool, press the drive flange assembly into the wheel knuckle.

     Special Tool(s): 204-528/1

2. Install the wheel knuckle.

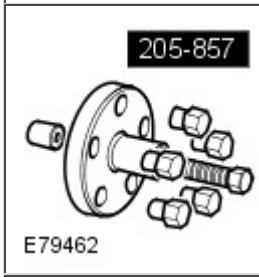
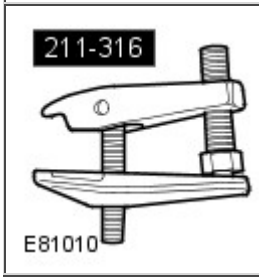
   Refer to: Wheel Knuckle (204-01 Front Suspension, Removal and Installation).

Published: 11-May-2011

Front Suspension - Lower Arm

Removal and Installation

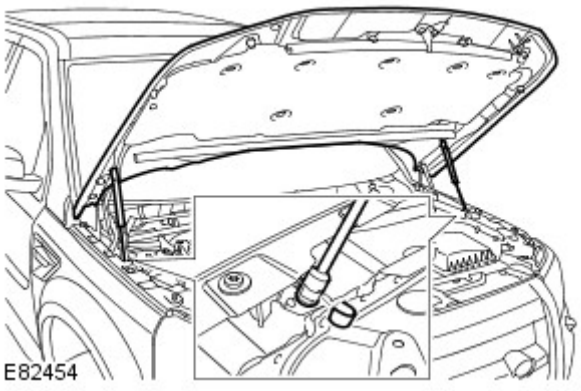
Special Tool(s)

	204-619 G-Clamp
	205-857 Remover, Halfshaft
	211-316 Separator, Ball Joint

Removal

1. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



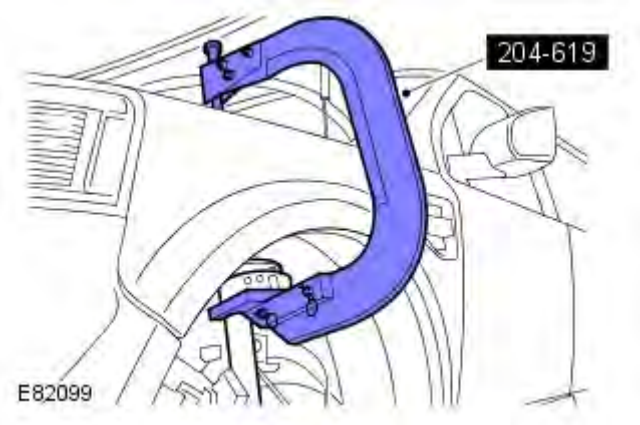
2. Release the hood support struts and secure the hood in an upright position.

3. **3.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

4. Remove the wheel and tire.

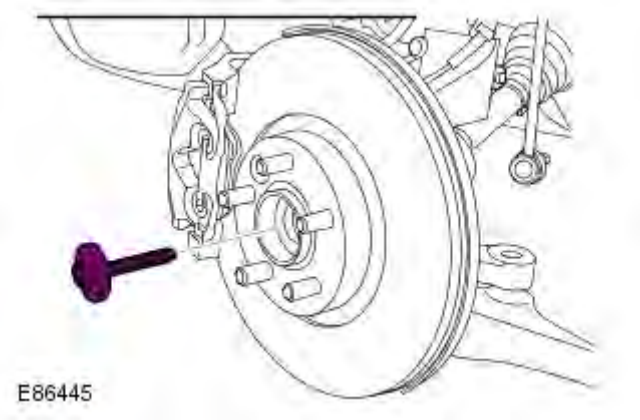
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



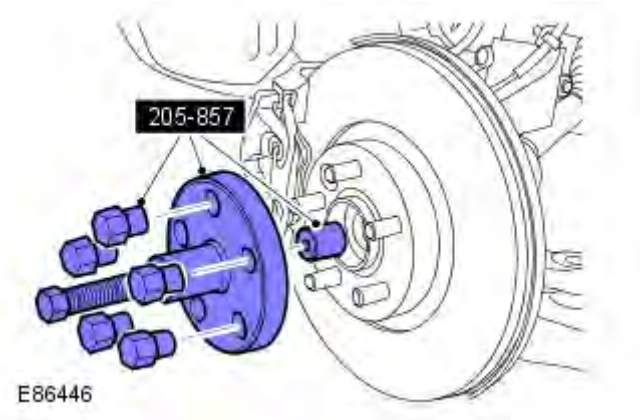
5. **5.** NOTE: This step requires the aid of another technician.

   Compress the spring and damper assembly.

   Special Tool(s): 204-619

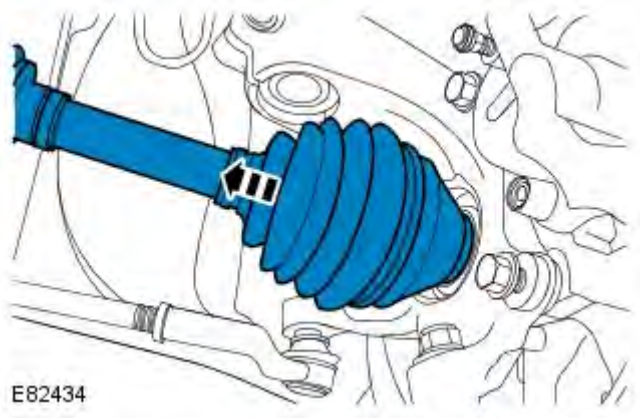


6. Remove and discard the front halfshaft bolt.



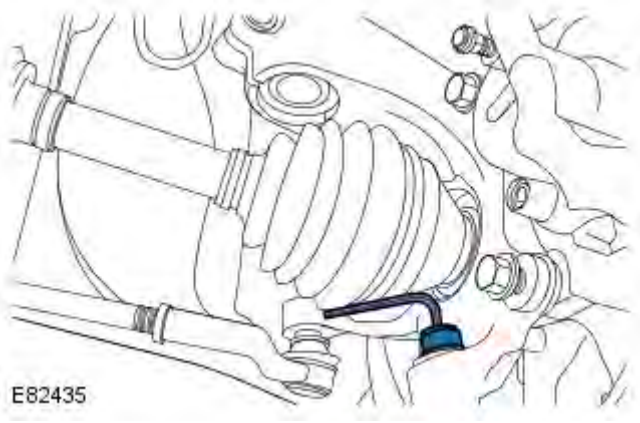
7. Partially release the front halfshaft from the wheel knuckle.

   Special Tool(s): 205-857



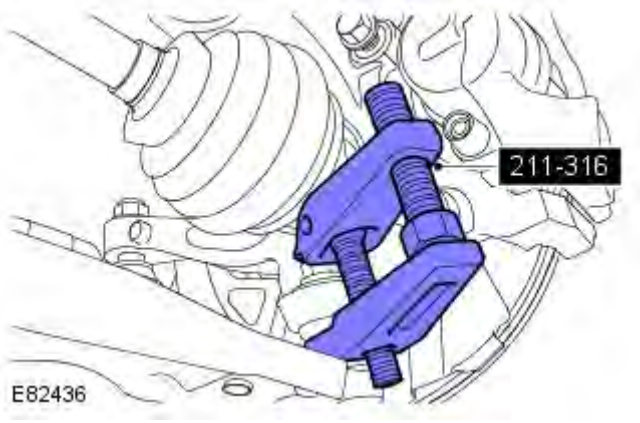
8. **8.** CAUTION: Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

   Partially release the front halfshaft from the wheel knuckle.

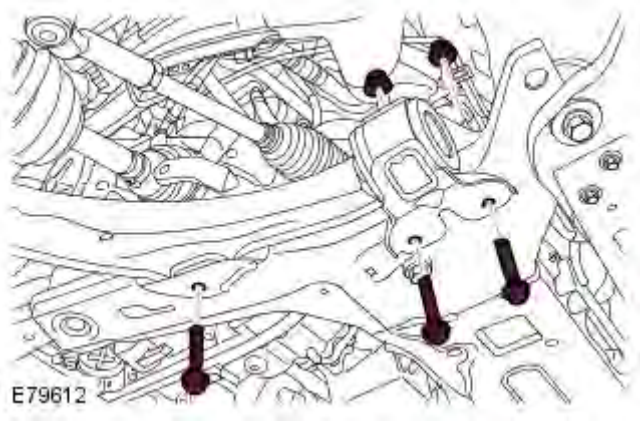


9. **9.** WARNING: Make sure that a new lower arm ball joint nut is installed.

   CAUTION: Make sure that the ball joint ball does not rotate.

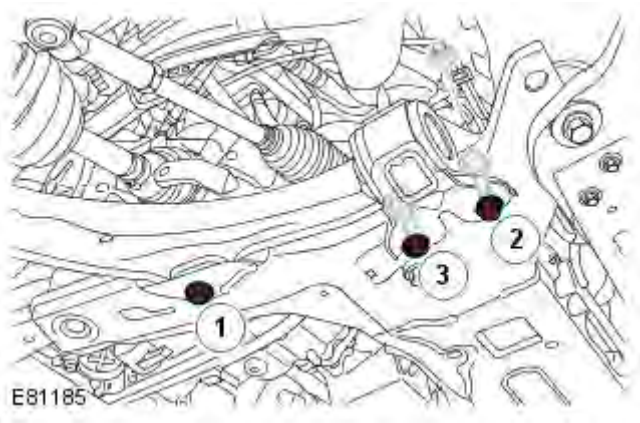


10. *Special Tool(s):* 211-316



11. Remove and discard the lower arm bolts.

Installation

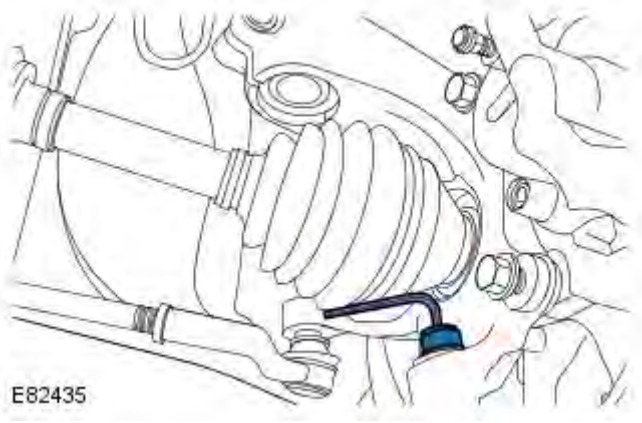


1. **1.** NOTE: Make sure that new nuts and bolts are installed.
   - Install the lower suspension arm.
   - Tighten bolt 1.

     Torque:
     Stage 1:140 Nm
     Stage 2:45°
   - Tighten bolt 2 to

     Torque: 175 Nm
   - Tighten bolt 3 to

     Torque: 175 Nm



2. **2.** WARNING: Make sure that a new lower arm ball joint nut is installed.

   CAUTION: Make sure that the ball joint ball does not rotate.

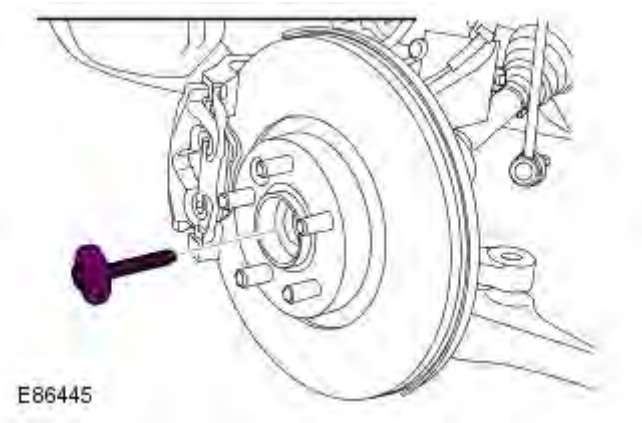
   Torque: 100 Nm

3. **3.** CAUTION: Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

   Fully insert the front halfshaft into the wheel knuckle.

4. **4.** NOTE: This step requires the aid of another technician.

   Release the tension from the spring and damper assembly and remove the special tool.



5. **5.** CAUTIONS:

   Make sure that a new bolt is installed.

   Make sure that the brake hose is not twisted and is correctly located.

   Install a new front halfshaft bolt.

   Torque:
   Stage 1:45 Nm
   Stage 2:80°

6. Install the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

7. Lower the hood and secure the support struts with the clips.

8. Install the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

Published: 11-May-2011

Front Suspension - Front Stabilizer Bar

Removal and Installation

Removal

CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

- NOTE: Only use clean water as a lubricant for the bushing, if required.
- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the front wheels and tires.

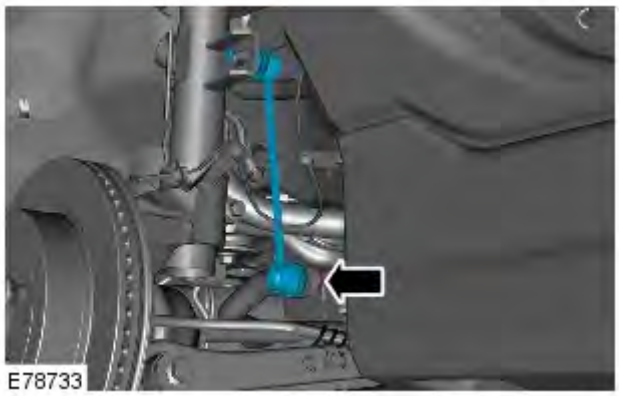
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the driveshaft.

   Refer to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

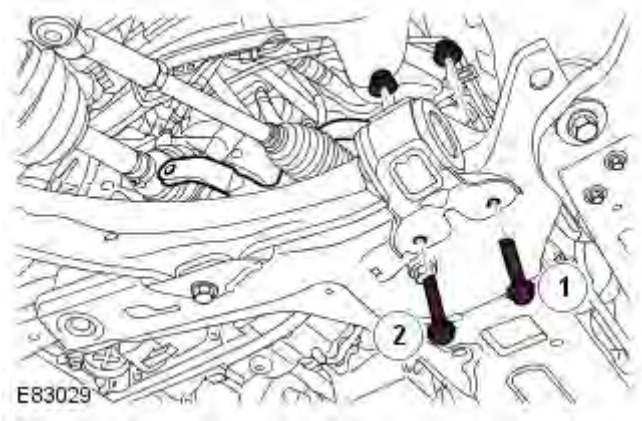
4. Remove the catalytic converters.

   Refer to: Catalytic Converter (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).



5. **5.** CAUTION: Make sure that the ball joint ball does not rotate.
   - Disconnect both stabilizer bar links.

     Torque: 60 Nm
   - Discard the nuts.



6. **6.** WARNING: Make sure that new nuts are installed.
   - Tighten in the sequence shown.

     Torque: 175 Nm
   - Repeat the above procedure for the other side.

7. **7.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the stabilizer bar bushings.

Installation

1. **1.** CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

   To install, reverse the removal procedure.

Published: 11-May-2011

Front Suspension - Front Stabilizer Bar Bushing

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

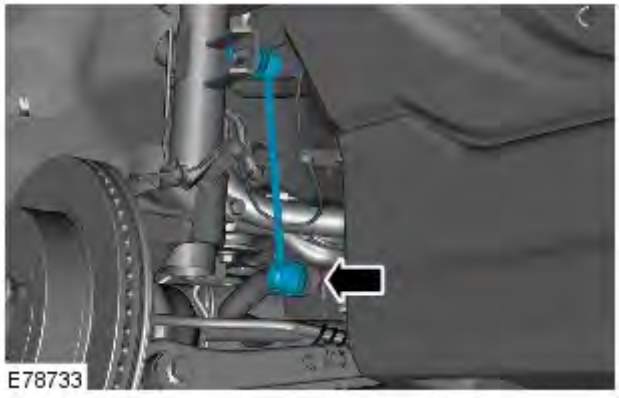
   Raise and support the vehicle.

2. Remove the front wheels and tires.

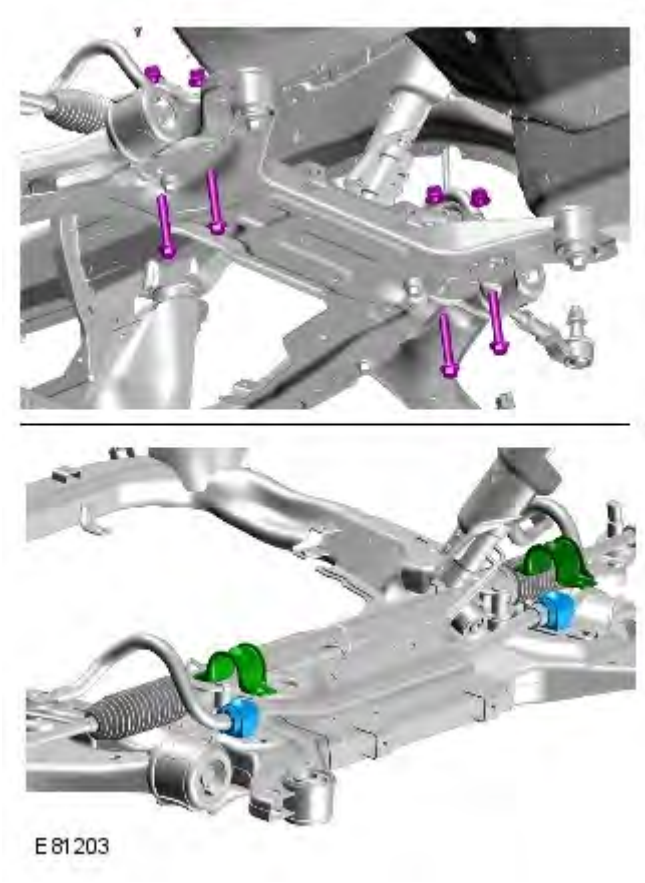
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



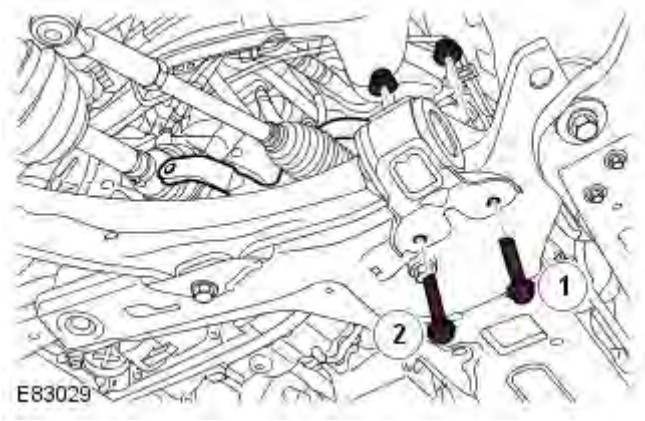
4. **4.** CAUTION: Make sure that the ball joint ball does not rotate.
   - Disconnect both front stabilizer bar links from the stabilizer bar.
   - Discard the nuts.



5. **5.** WARNING: Make sure that new nuts are installed.

   Remove the stabilizer bar bushing.

Installation



1. **1.** WARNING: Make sure that new nuts are installed.

   Install the stabilizer bar bushings.

   Torque: 175 Nm

2. **2.** WARNING: Make sure that new nuts are installed.

   CAUTION: Make sure that the ball joint ball does not rotate.

   Install the stabilizer link bar.

   Torque: 60 Nm

3. Install the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

4. Install the wheels and tires.

Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Front Suspension - Front Stabilizer Bar Link

Removal and Installation

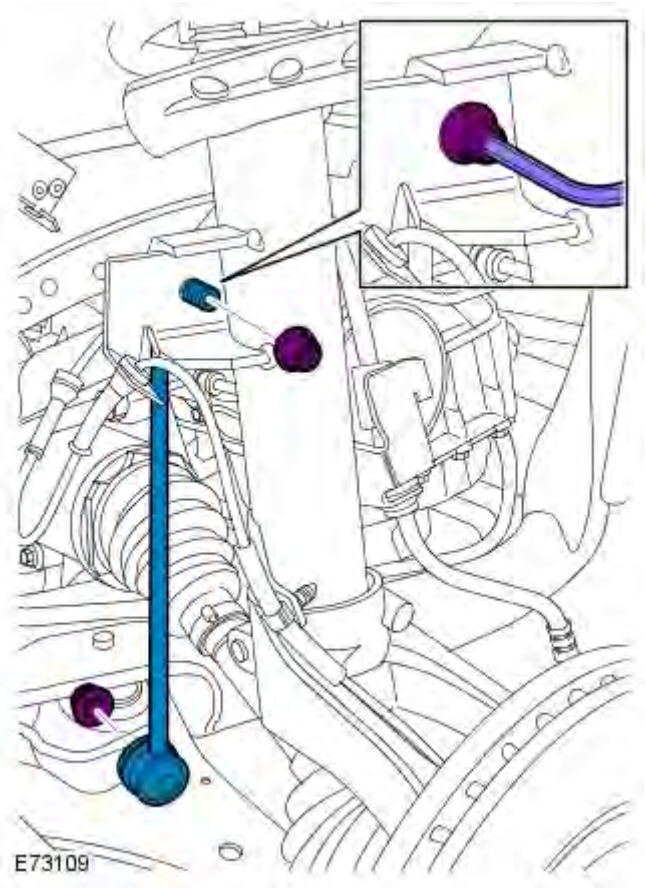
Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



3. **3.** WARNING: Make sure that new nuts are installed.

   CAUTION: Use an Allen key to prevent the ball joint rotating whilst removing the nut.

   Torque: 60 Nm

Installation

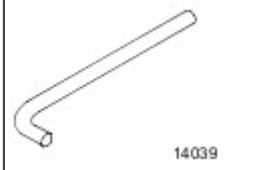
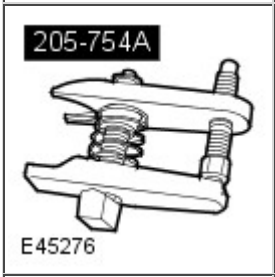
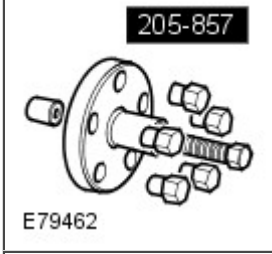
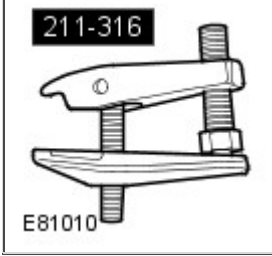
1. To install, reverse the removal procedure.

Published: 11-May-2011

Front Suspension - Wheel Knuckle

Removal and Installation

Special Tool(s)

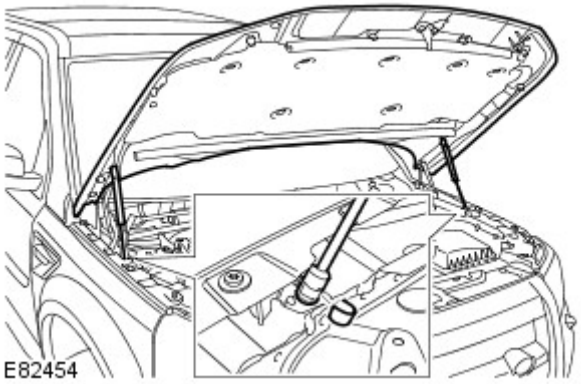
	204-159 Lever, Wheel Knuckle
	204-619 G-Clamp
	205-754A Splitter, Ball Joints
	205-857 Remover, Halfshaft
	211-316 Separator, Ball Joint

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



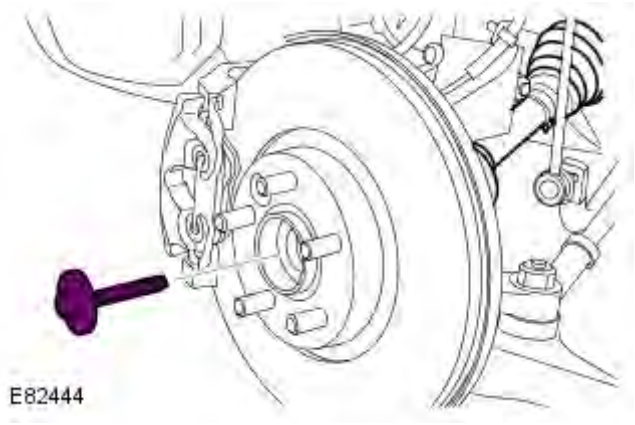
2. Release the hood support struts and secure the hood in an upright position.

3. **3.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

4. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

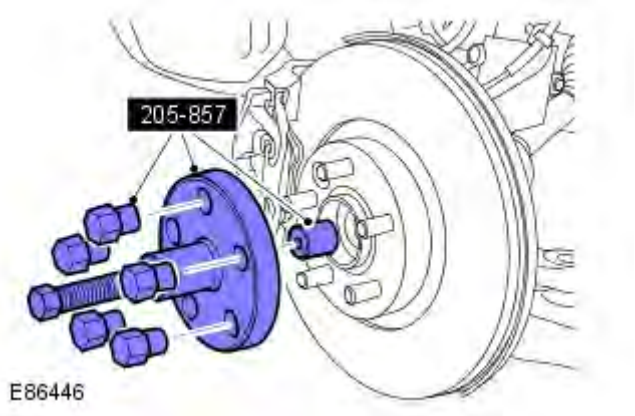


5. **5.** CAUTIONS:

   Discard the bolt.

   Do not use air tools to install the bolt. Failure to follow this instruction may result in damage to the component.

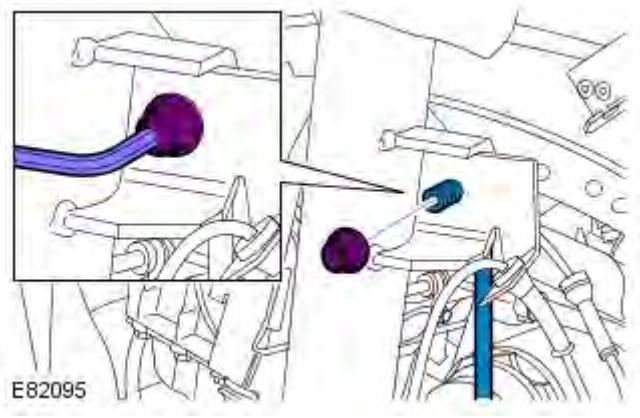
   Torque:
   Stage 1:45 Nm
   Stage 2:60°



6. **6.** CAUTION: Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

   Partially release the front halfshaft from the wheel knuckle.

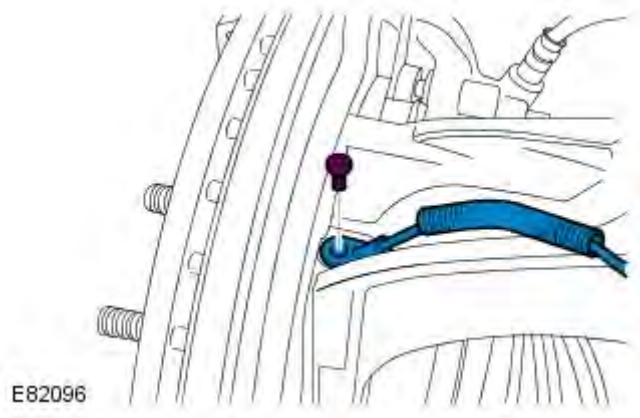
   Special Tool(s): 205-857



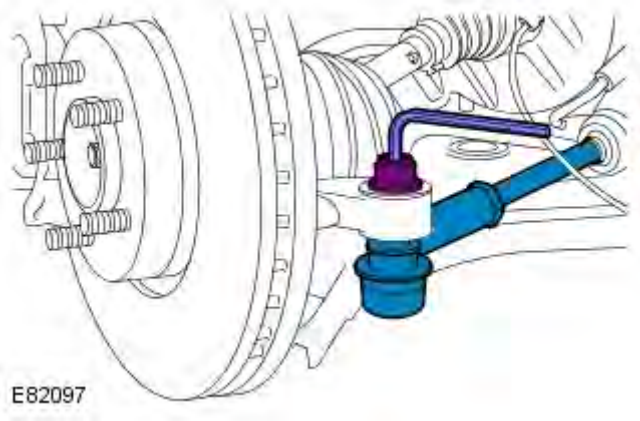
7. **7.** WARNING: Make sure that a new nut is installed.

   CAUTION: Make sure that the ball joint ball does not rotate.

   Torque: 60 Nm



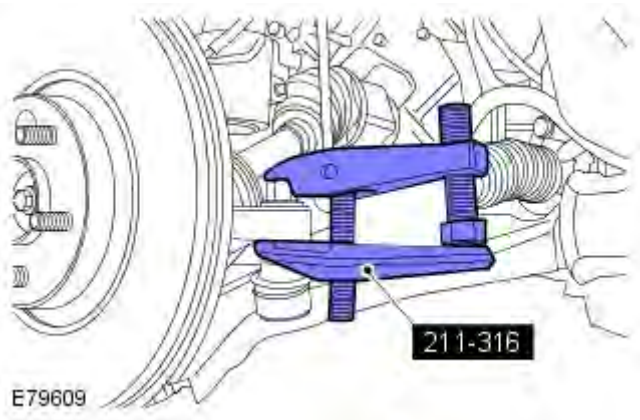
8. *Torque:* 5 Nm



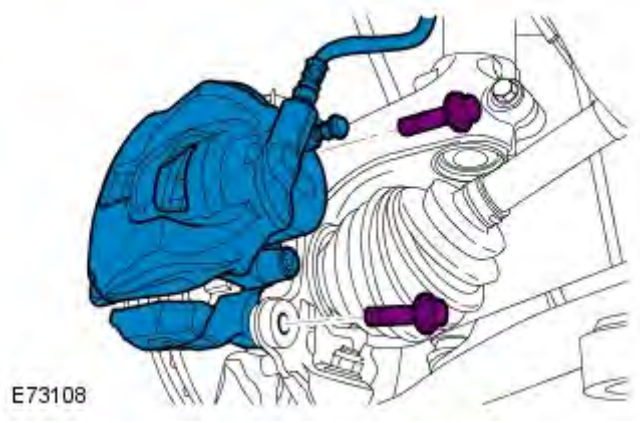
9. **9.** WARNING: Make sure that a new tie-rod end nut is installed.

   CAUTION: Make sure that the ball joint ball does not rotate.

   Torque: 80 Nm

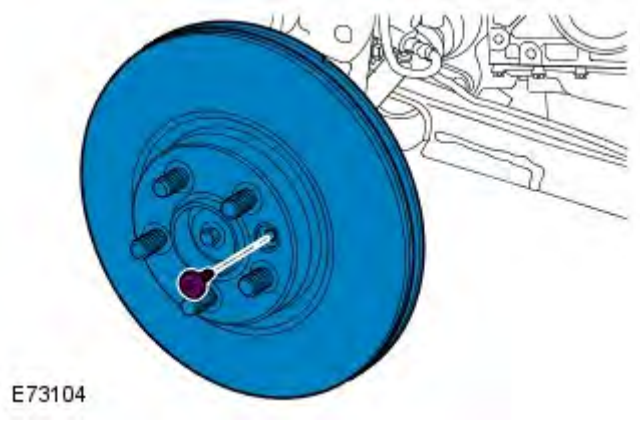


10. *Special Tool(s):* 211-316

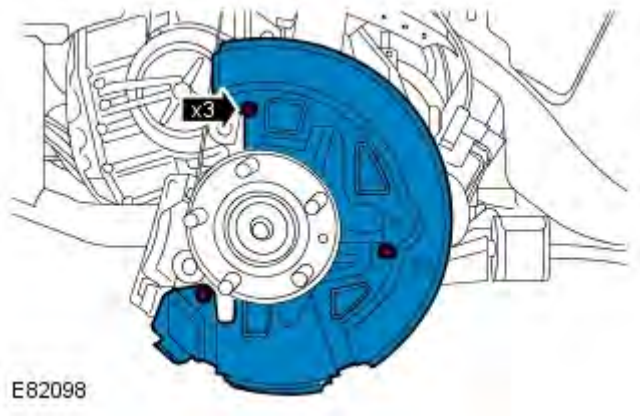


11. **11.** CAUTION: Make sure that no load is placed on the brake hose.

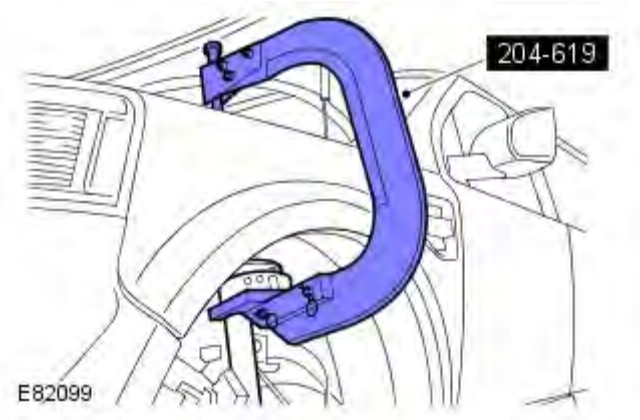
    Torque: 200 Nm



12. *Torque:* 35 Nm

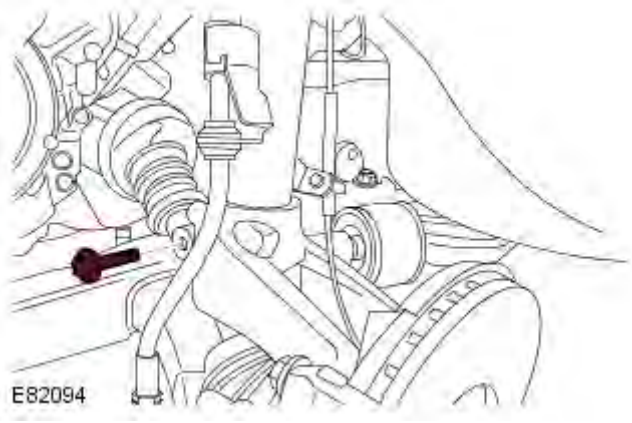


13. *Torque:* 10 Nm

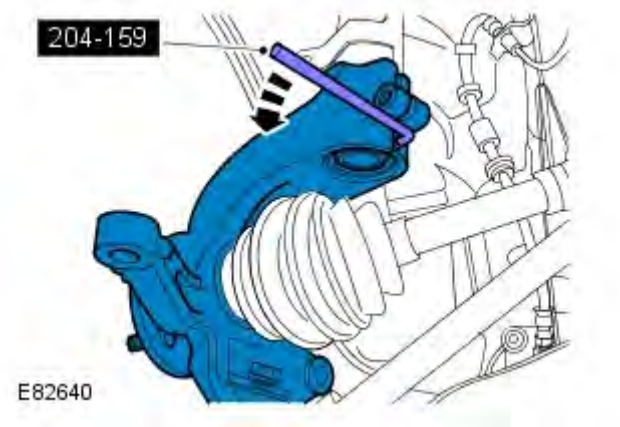


14. **14.** NOTE: This step requires the aid of another technician.

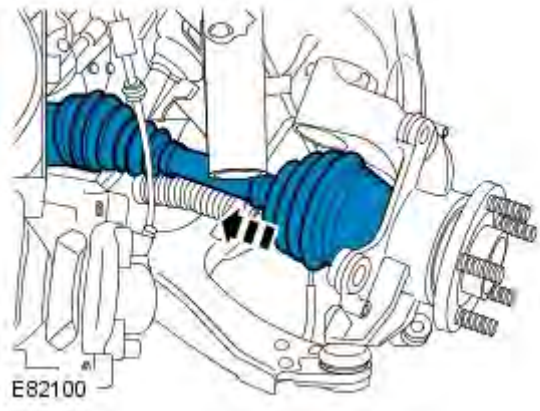
    Special Tool(s): 204-619



15. *Torque:* 110 Nm



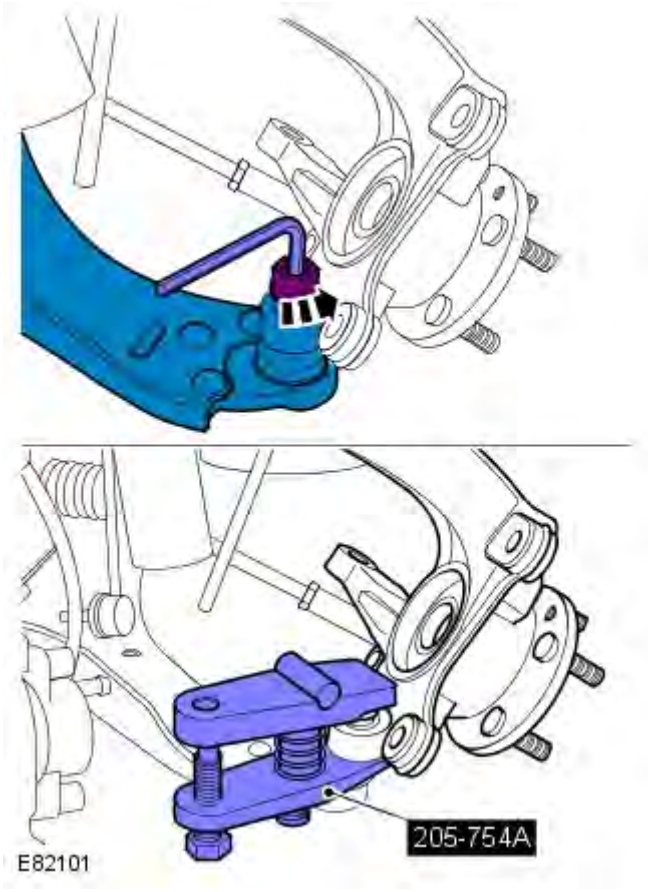
16. *Special Tool(s):* 204-159



17. **17.** CAUTIONS:

⚠ Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

⚠ Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.



18. **18.** WARNING: Make sure that a new lower arm ball joint nut is installed.

    CAUTION: Make sure that the ball joint ball does not rotate.

    Special Tool(s): 205-754A
    Torque: 100 Nm

Installation

1. **1.** CAUTIONS:

   Make sure that the brake hose is not twisted and is correctly located.

   Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

   Install the halfshaft bolt finger tight.

   • NOTE: Make sure that all the component mating faces are clean.

   To install, reverse the removal procedure.

Published: 11-May-2011

Front Suspension - Front Shock Absorber

Removal and Installation

Removal

- WARNINGS:

Ensure the spring compressor Safe Working Load (SWL) meets or exceeds the spring rating quoted in the Specifcations section.

Always follow the spring compressor manufacturer's instructions.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the road wheel.

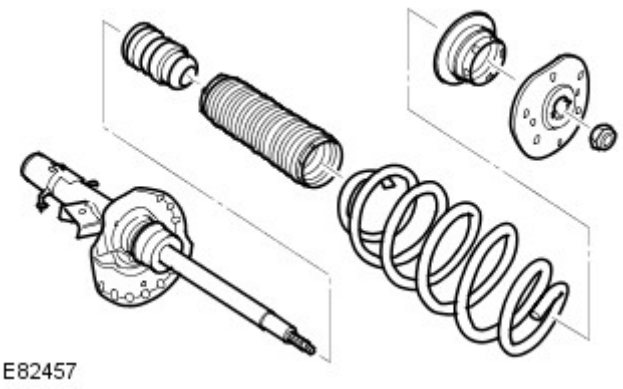
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the spring and damper assembly.

   Refer to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation).

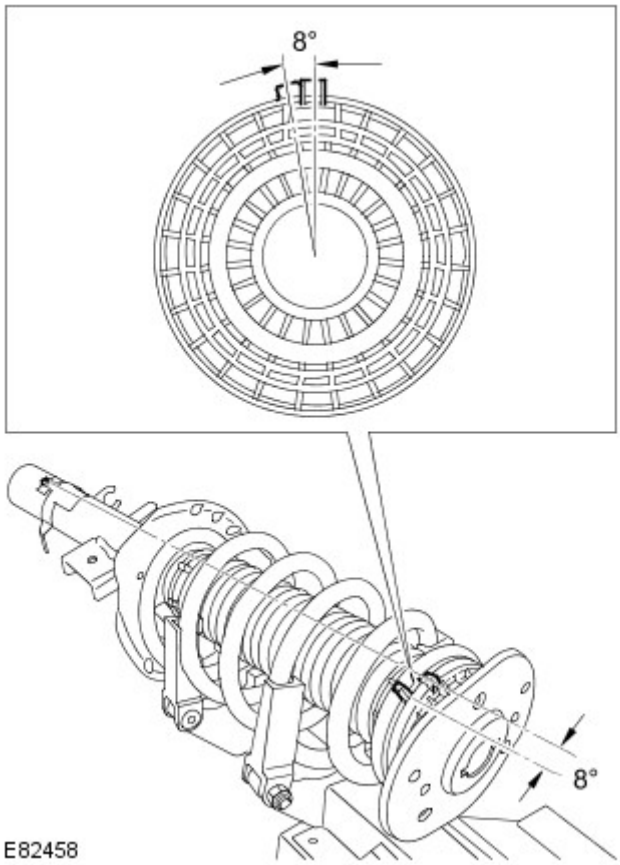
4. Install the spring compressor in a vise.

5. Install the shock absorber and spring assembly in the spring compressor.



6. **6.** WARNING: Make sure that a new nut is installed.

Installation



1. **1.** WARNINGS:

   Make sure that a new nut is installed.

   It is imperative that the timing marks are aligned as shown in illustration.

   Torque: 80 Nm

2. Release the tension from the spring and damper assembly and remove from the special tool.

3. Remove the spring compressor from a vise.

4. Install the spring and damper assembly.

   Refer to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation).

5. Install the road wheel.

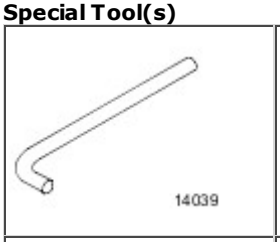
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Front Suspension - Shock Absorber and Spring Assembly

Removal and Installation

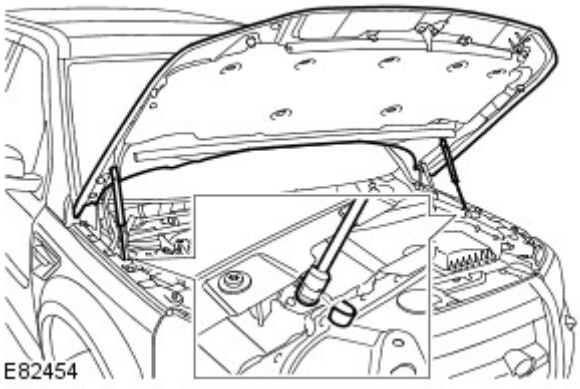
Special Tool(s)

	204-159 Lever, Wheel Knuckle
	204-619 G-Clamp

Removal

1. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



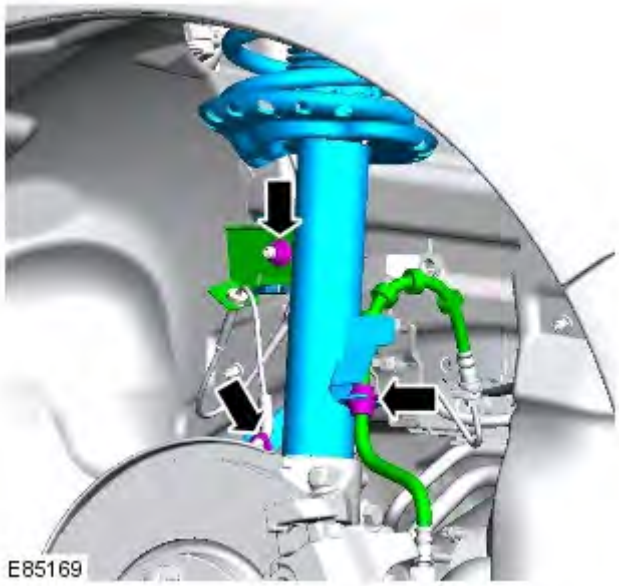
2. Release the hood support struts and secure the hood in an upright position.

3. **3.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

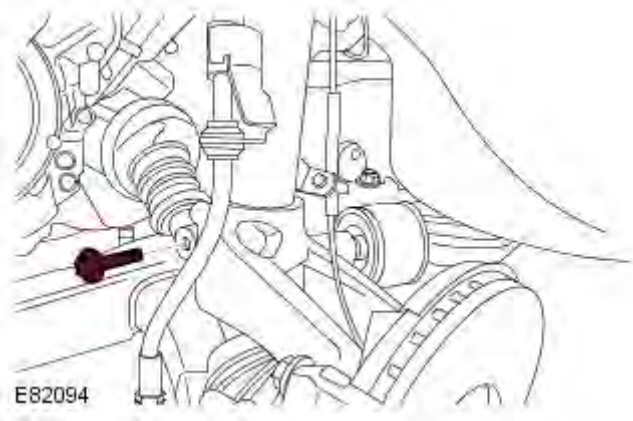
4. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

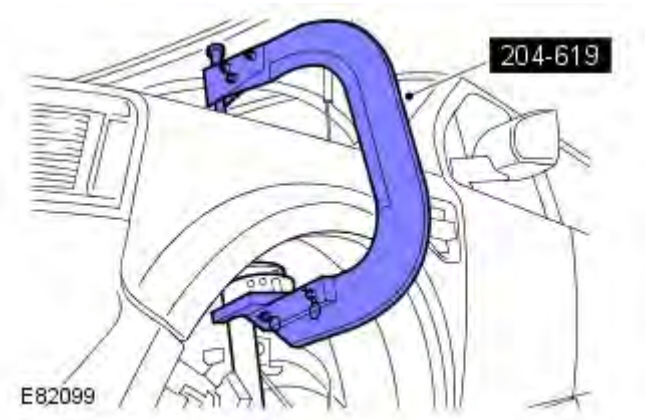


5. **5.** WARNING: Make sure that a new nut is installed.

   Torque: 60 Nm



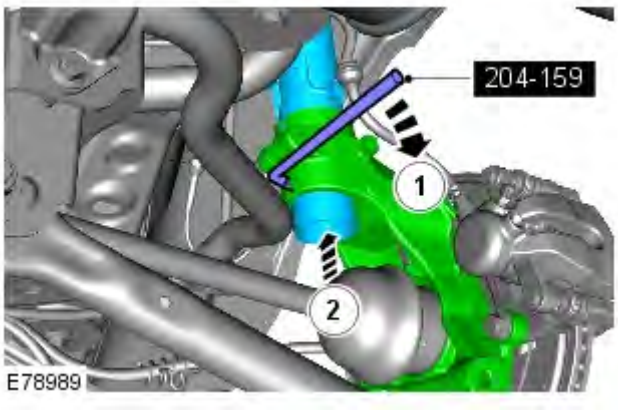
6. *Torque:* 110 Nm



7. **7.** NOTE: This step requires the aid of another technician.

   Compress the spring and damper assembly.

   Special Tool(s): 204-619

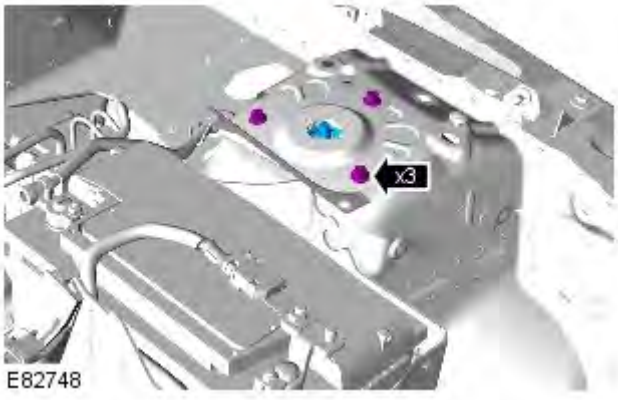


8. Release the damper from the knuckle assembly.

   Special Tool(s): 204-159

9. **9.** NOTE: This step requires the aid of another technician.

   Release the tension from the spring and damper assembly and remove the tool.



10. Remove the spring and damper assembly.

    Torque: 30 Nm

Installation

1. **1.** CAUTIONS:

   Make sure that the brake hose is not twisted and is correctly located.

   Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

   • NOTE: Make sure that the component is clean, free of foreign material and lubricant.

   To install, reverse the removal procedure.

Published: 11-May-2011

Front Suspension - Spring

Removal and Installation

Removal

- WARNINGS:

Ensure the spring compressor Safe Working Load (SWL) meets or exceeds the spring rating quoted in the Specifcations section.

Always follow the spring compressor manufacturer's instructions.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the road wheel.

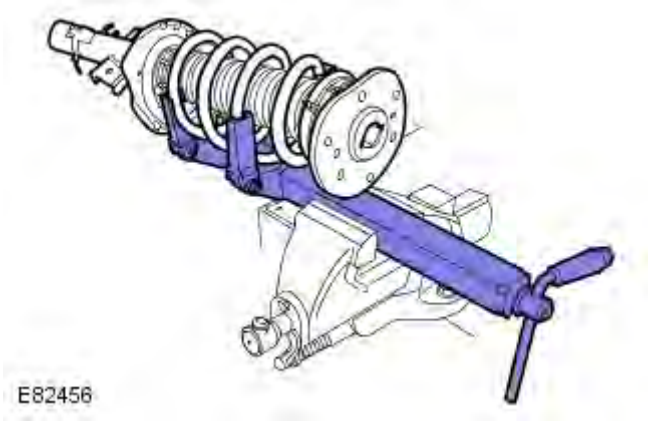
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the spring and damper assembly.

   Refer to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation).

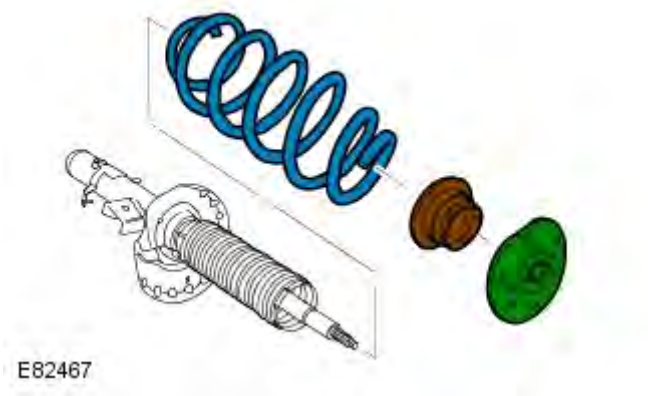
4. Install the spring compressor in a vise.

5. Install the shock absorber and spring assembly in the spring compressor.



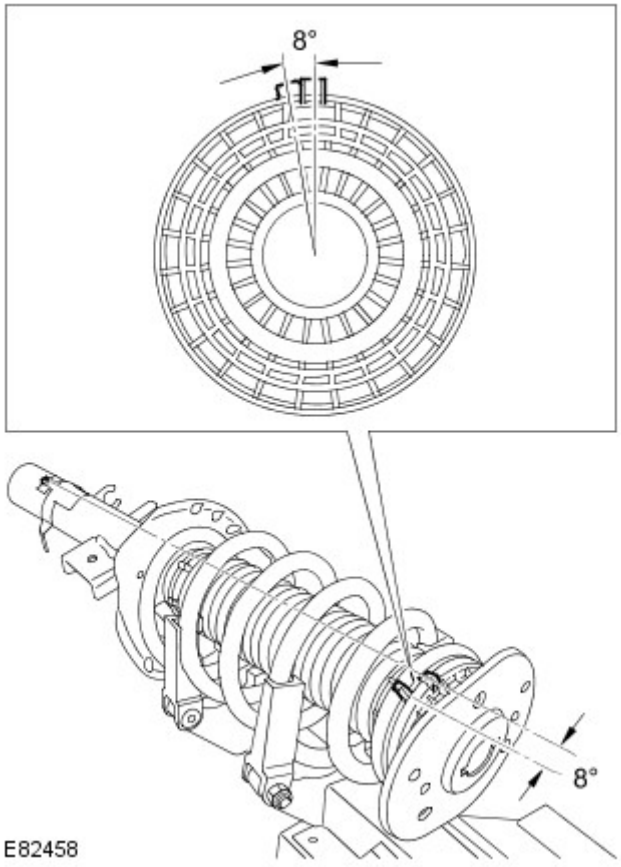
6. **6.** WARNING: Make sure that a new nut is installed.

7. Remove old spring from the spring compressor.



Installation

1. Install the new spring to the compressor and compress sufficiently.



2. **2.** WARNINGS:

   Make sure that a new nut is installed.

   It is imperative that the timing marks are aligned as shown in illustration.

   Torque: 80 Nm

3. Release the tension from the spring and damper assembly and remove from the special tool.

4. Remove the spring compressor from a vise.

5. Install the spring and damper assembly.

   Refer to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation).

6. Install the road wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Rear Suspension -

Coil Spring Suspension

Item	Specification
Rear	Conventional coil spring with a twin tube damper and a high stress stabilizer bar

Road Spring Color Coding - Rear

Part Number	Spring Color	Isolator
RKB 500210	Grey	LR 003092 (9mm)
RKB 500210	Grey/White	LR 005304 (15mm)
RKB 500220	Brown	LRL 003092 (9mm)
RKB 500220	Brown/White	LR 005304 (15mm)

- NOTE: The grey or brown springs have a 9 mm thick isolator
- NOTE: The grey/white or brown/white springs have a 15 mm thick isolator

To maintain correct trim height make sure the spring colour and appropriate isolator is matched

Torque Specifications

Description	Nm	lb-ft
Damper locknut	80	59
Front lower arm transverse links nuts & bolts	175	129
Rear ride height sensor	10	7
Rear lower arm nuts & bolts	175	129
Spring and damper assembly top mounting nuts	32	24
Stabilizer bar bushing clamp bolts*	60	44
Stabilizer link nuts*	60	44
Trailing arm nuts and bolts	270	199
Trailing arm bracket to body bolts*	110	81
Wheel knuckle to damper clamp bolt	110	81

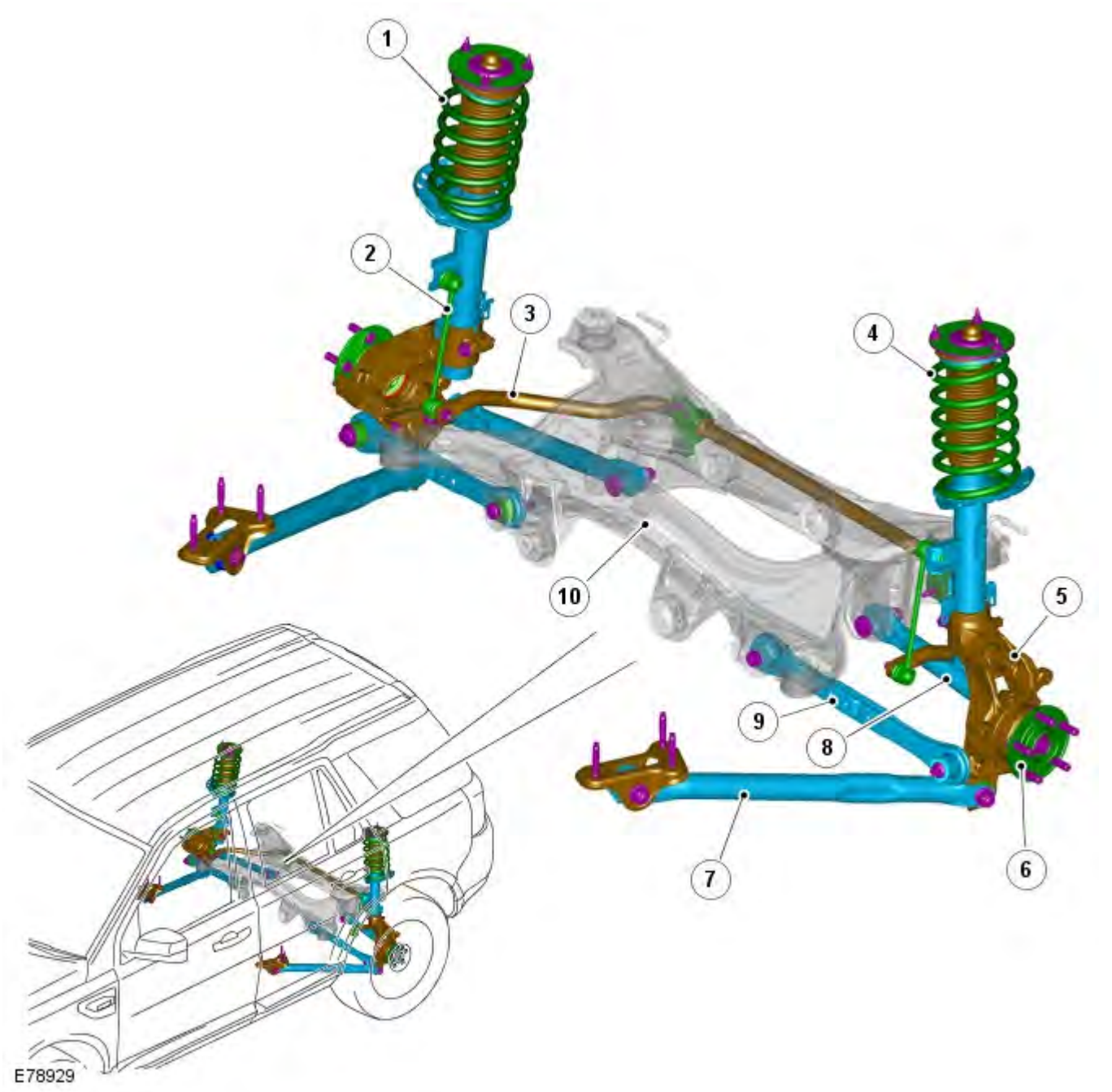
*** New nuts/bolts must be fitted**

Published: 11-May-2011

Rear Suspension - Rear Suspension

Description and Operation

COMPONENT LOCATION



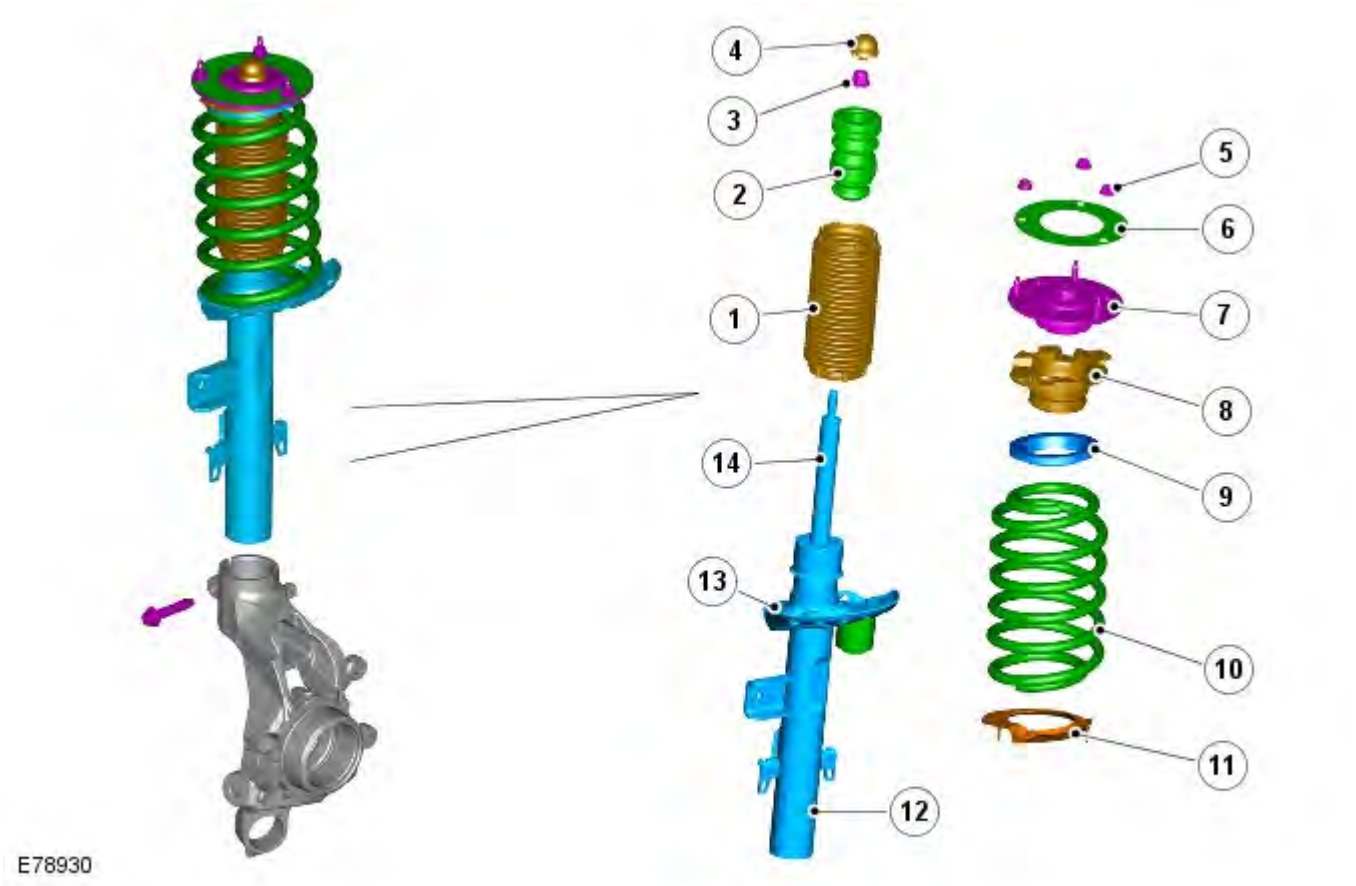
Item	Part Number	Description
1	-	Right Hand (RH) spring and damper assembly
2	-	Stabilizer link
3	-	Stabilizer bar
4	-	Left Hand (LH) spring and damper assembly
5	-	Wheel knuckle
6	-	Hub
7	-	Longitudinal link
8	-	Rear transverse link
9	-	Front transverse link
10	-	Subframe

OVERVIEW

The rear suspension features long travel McPherson struts to optimize on and off road performance.

The suspension components are mounted on a subframe which provides a rigid platform attached to the underside of the vehicle body. The subframe is mounted to the body on 4 bushes which have differing compression rates to absorb lateral and longitudinal loading from cornering and braking.

SPRING AND DAMPER



Item	Part Number	Description
1	-	Boot
2	-	Spring aid
3	-	Locknut
4	-	Cap
5	-	Locknut (3 off)
6	-	Gasket
7	-	Top mount assembly
8	-	Spacer
9	-	Spring isolator
10	-	Spring
11	-	Spring isolator
12	-	Damper body
13	-	Spring seat
14	-	Damper piston rod

The spring and damper assembly is a twin tube design with the conventional coil spring located on a welded spring seat on the damper tube. The lower end of the damper body locates in the wheel knuckle which is clamped with a bolt.

The damper functions by restricting the flow of hydraulic fluid through internal galleries within the damper. The damper rod moves axially within the damper, its movement limited by the flow of fluid through the galleries, providing damping of undulations in the terrain. The damper rod is sealed at its exit point from the damper body to maintain the fluid within the unit and to prevent the ingress of dirt and moisture. The seal also incorporates a wiper to keep the rod clean.

The damper rod is located through a central hole in the top mount assembly. The rod is threaded at its outer end. A self-locking nut secures the top mount to the damper rod. A spring aid is fitted to the damper rod to prevent the top mount contacting the top of the damper during full suspension compression and also assists the suspension tune. A boot is fitted between the damper body and the top mount and protects the damper piston rod from damage.

The coil spring fitted differs with vehicle specification. Each spring is colour coded to identify its rating and fitment requirements.

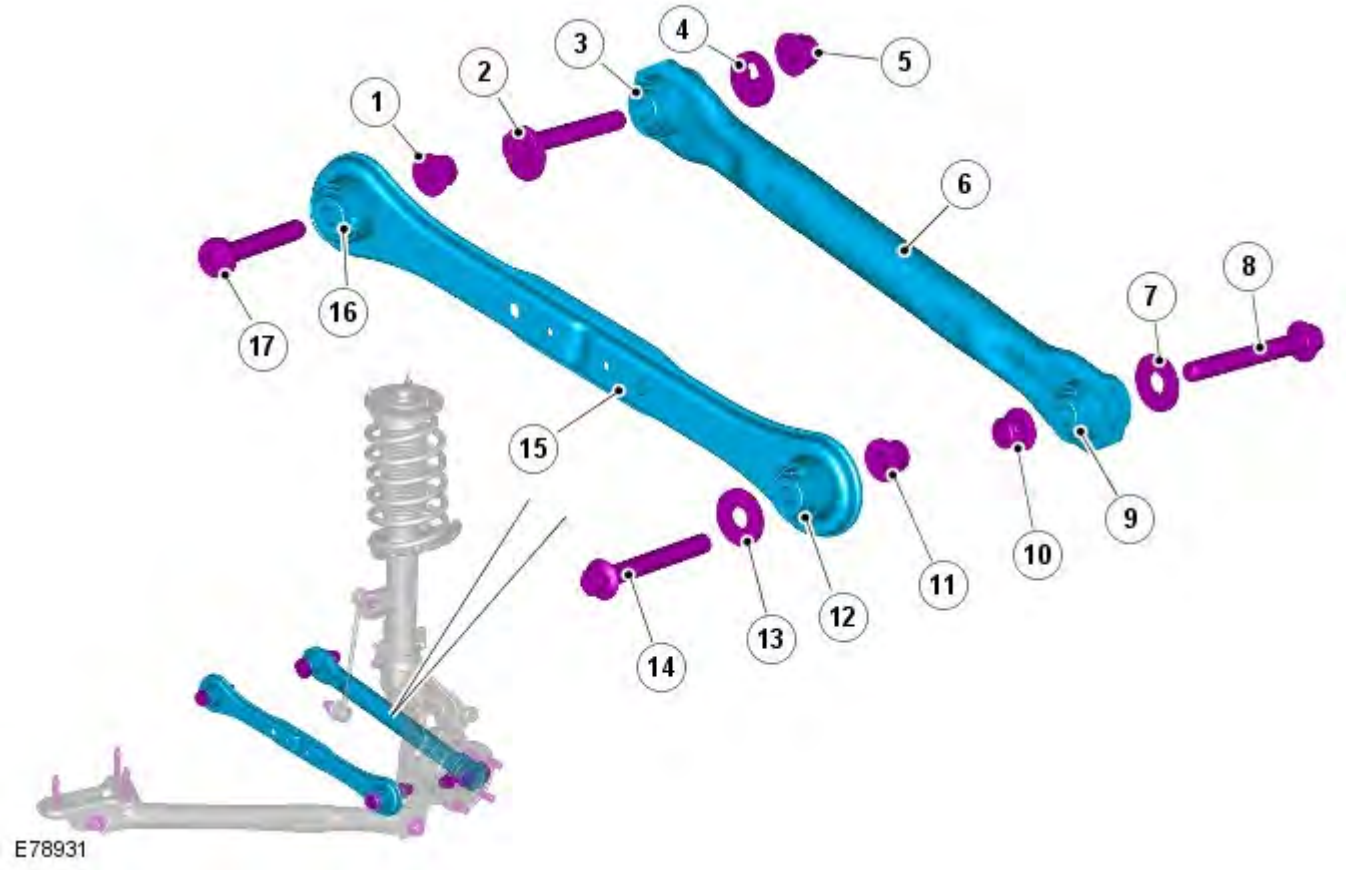
The coil spring is located in a spring seat which is an integral part of the damper body and contains a spring isolator. The design of the spring seat prevents the spring rotating. The spring has a linear rate compression and is inclined to counter cornering forces. The opposite end of the coil spring is also located in a spring isolator which is fitted in the top mount assembly. Both spring isolators are made from rubber and prevent any noise produced during damper and spring compression/extension from being transmitted to the vehicle body. A mass damper is attached to the damper spring seat to absorb vibration and prevent noise intrusion into the vehicle interior.

The top mount is fitted with a gasket to prevent the ingress of moisture between the top mount and the turret mounting.

The top mount attaches to a strengthened turret on the chassis with 3 integral studs and self-locking nuts.

Two brackets are welded to the damper body. One bracket provides for the attachment of the stabilizer link. The second bracket provides for the attachment of the brake hose and wheel speed sensor cable. This bracket also positively locates the damper into the wheel knuckle and its location is critical to controlling the vehicle trim height.

TRANSVERSE LINKS



Item	Part Number	Description
1	-	Locknut
2	-	Eccentric bolt
3	-	Bush - inner
4	-	Eccentric cam washer
5	-	Locknut
6	-	Rear transverse link
7	-	Washer
8	-	Bolt
9	-	Bush - outer
10	-	Locknut
11	-	Locknut
12	-	Bush - outer
13	-	Washer
14	-	Bolt
15	-	Front transverse link
16	-	Bush - inner
17	-	Bolt

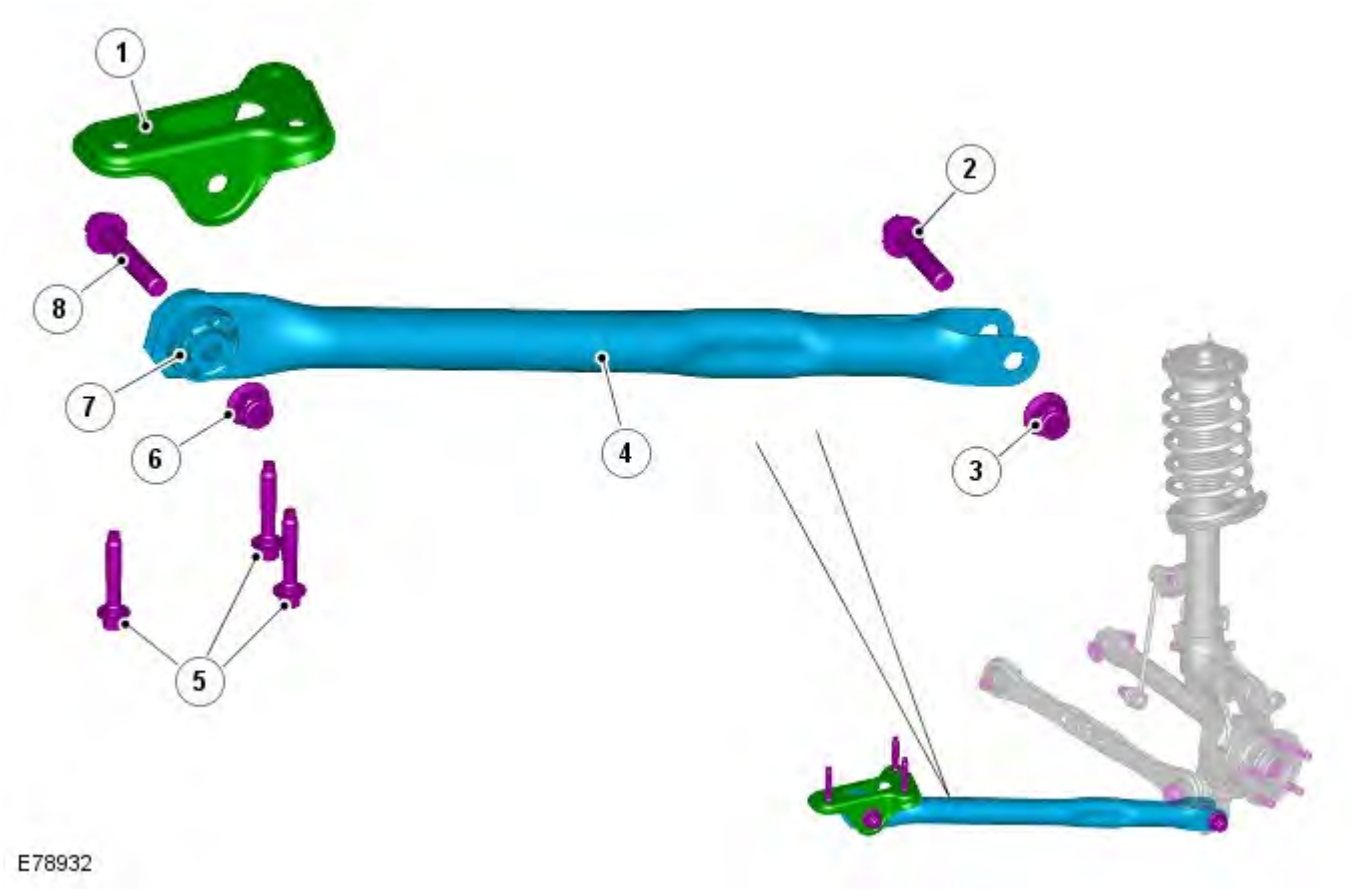
Lateral wheel location is provided by 2 transverse links which are located between the subframe and the wheel knuckle. The links are long to give excellent camber control. Each link is fitted with dynamic bushes to control the rear camber in a progressive manner as cornering loads increase which gives a limited amount of passive rear wheel steering. The 2 transverse links are different in their design. The front link is a steel pressing. The rear link is fabricated from squeezed and cropped tube. The links are designed to withstand vehicle jacking loads.

The front transverse link is fitted with bushes which compress under cornering forces to provide a controlled amount of rear wheel toe-in, in addition to the camber control. The front link has a deform point in a central position along its length. This allows the link to be deformed in the event of a severe lateral rear wheel impact, for example striking a kerb. In the event of a severe lateral impact, the link will permanently deform, absorbing the impact and protecting the subframe from damage. The amount of deformation creates excessive toe-in which is immediately noticeable to the driver.

The rear transverse link is mounted to the subframe using an eccentric bolt and washer which allows for adjustment of the wheel toe angle.

Both transverse links are attached to the subframe with bolts and locknuts. The outer ends of each link locate in mounting holes integral with the wheel knuckle and are secured with bolts and locknuts.

LONGITUDINAL LINK



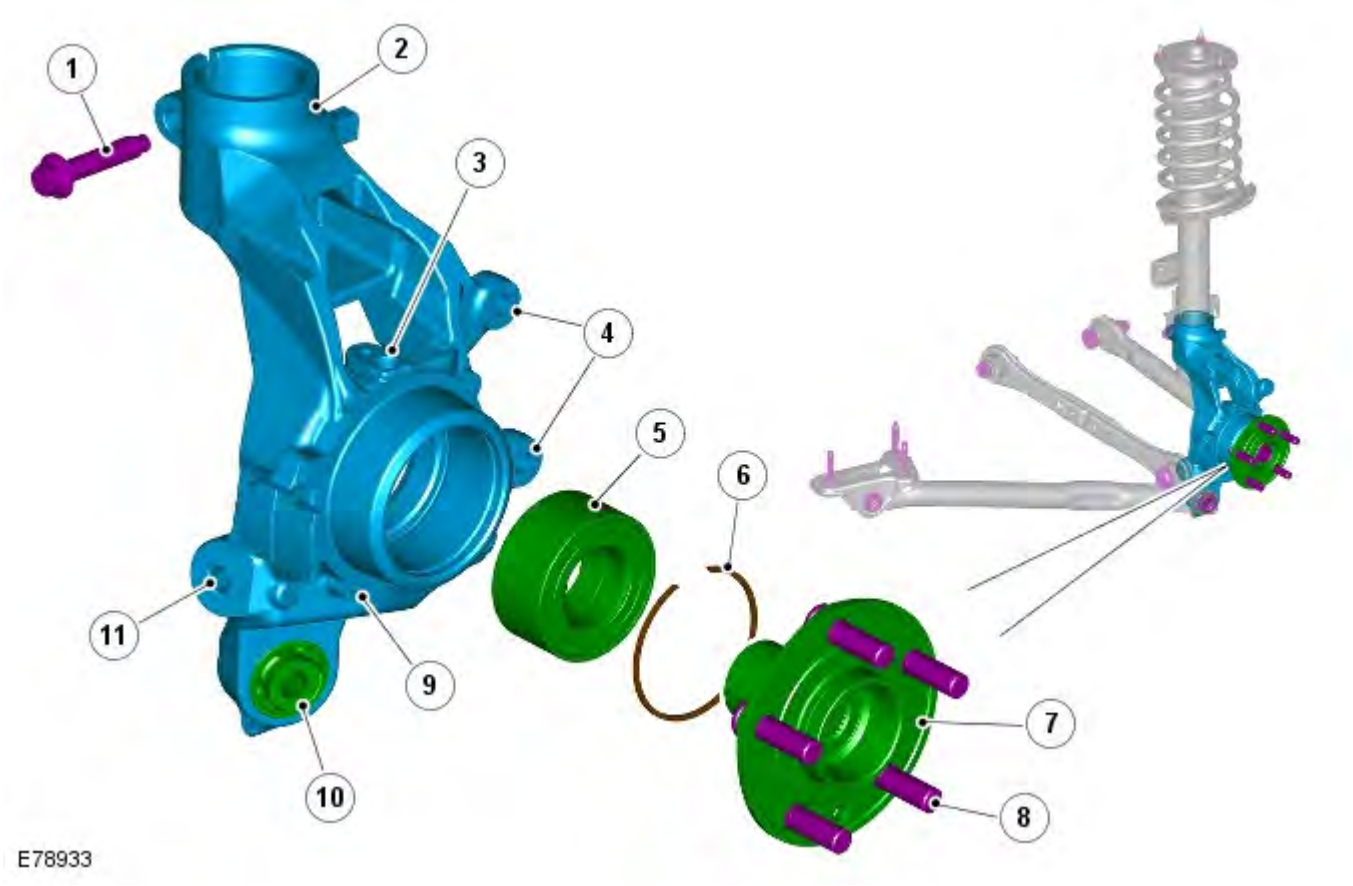
Item	Part Number	Description
1	-	Body mounting bracket
2	-	Bolt
3	-	Locknut
4	-	Longitudinal link
5	-	Bolts
6	-	Locknut
7	-	Bush
8	-	Bolt

The longitudinal links are fabricated from squeezed and cropped tube and are located between the wheel knuckle and the vehicle body. The links control the rear suspension in reaction to braking and traction forces.

The rear mounting is forked and locates on either side of a bush pressed into the wheel knuckle. The link is secured with a bolt and locknut which passes through the bush.

The front mounting of the link locates in a bracket which is bolted to the underside of the vehicle sill. The link is fitted with a bush which locates in the bracket and is secured with a bolt and locknut.

WHEEL KNUCKLE AND HUB



Item	Part Number	Description
1	-	Clamp bolt
2	-	Wheel knuckle
3	-	Anti-lock Brake system (ABS) wheel speed sensor
4	-	Brake caliper attachment
5	-	Bearing
6	-	Circlip
7	-	Hub
8	-	Studs
9	-	Disc shield attachment
10	-	Bush - Longitudinal link
11	-	Front transverse link attachment

The cast steel wheel knuckle provides the attachment for the transverse links, longitudinal link, spring and damper assembly and the wheel hub and bearing assembly.

An extended lower boss on the knuckle is fitted with a pressed bush and provides for the attachment of the longitudinal link. The link is secured to the knuckle with a bolt and locknut which passes through both the link and the bush.

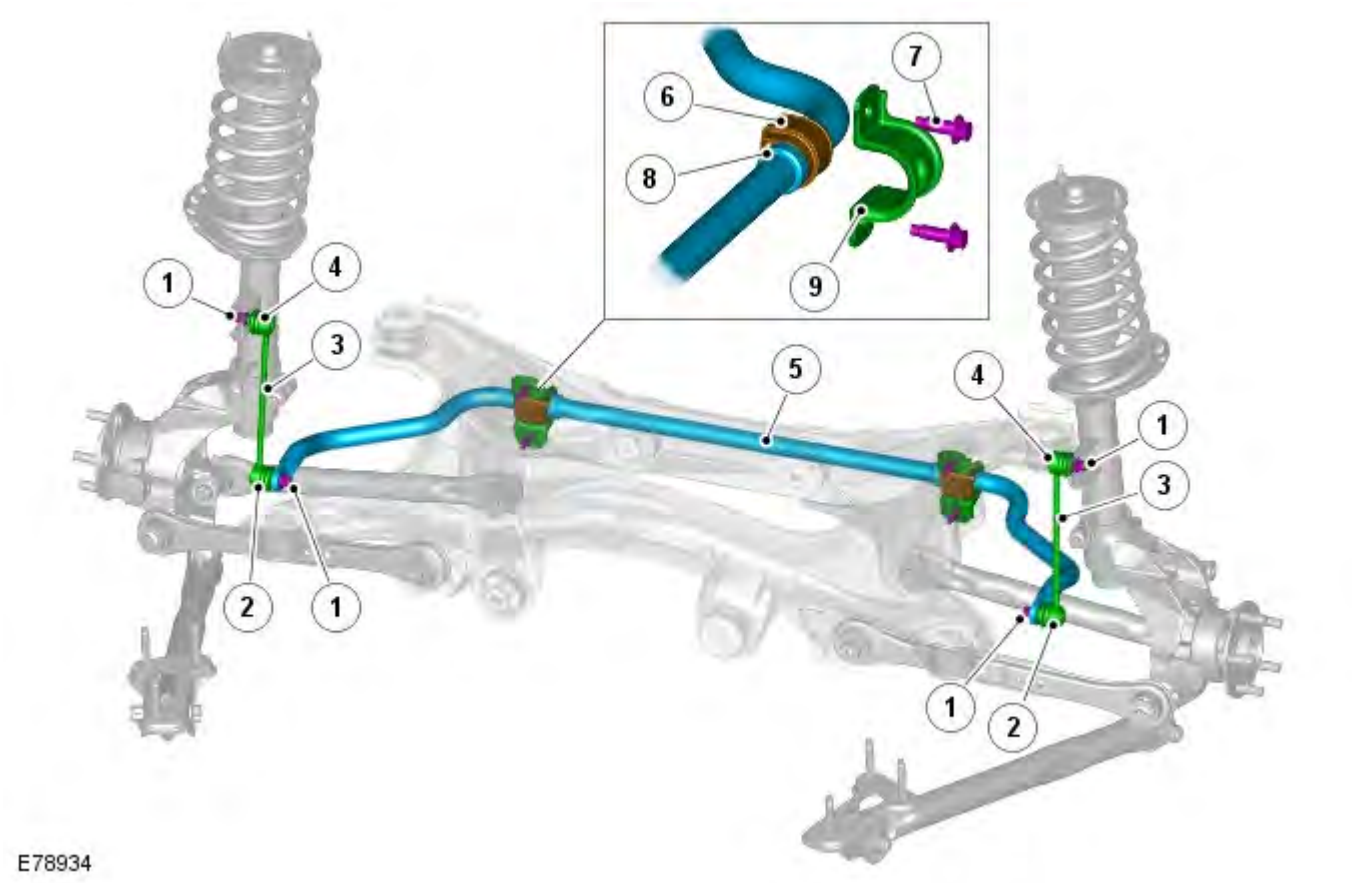
Two further bosses on the inside face of the wheel knuckle allow for the attachment of the front and rear transverse links which are each secured with a bolt and locknut.

The upper section of the wheel knuckle has a location hole for the damper body. The damper body slides into the hole and locates against an abutment on the damper body. The rear face of the hole is split and allows the damper body to be secured in the wheel knuckle with a clamp bolt.

Mounting locations are provided for the brake caliper and the brake disc shield. A hole in the top face of the wheel knuckle provides the location for the ABS wheel speed sensor which is secured with a bolt.

The wheel hub assembly includes the wheel bearing and ABS sensor pulse ring. The hub assembly is a non-serviceable component and requires replacement as a complete assembly.

STABILIZER BAR



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Item	Part Number	Description
1	-	Locknut
2	-	Ball joint
3	-	Link
4	-	Ball joint
5	-	Stabilizer bar
6	-	Bush
7	-	Bolt
8	-	Collar
9	-	Clamp

The stabilizer bar is attached to the rear of the subframe with bushes and mounting brackets. The pressed steel brackets locate over the bushes and are attached to the cross member with bolts screwed into threaded locations in the subframe. The stabilizer bar has 'anti-shuffle' collars pressed in position on the inside edges of the bushes. The collars prevent sideways movement of the stabilizer bar.

The stabilizer bar is manufactured from 22 mm diameter, manganese steel bar. Each end of the stabilizer bar curves forwards to attach to a ball joint on a stabilizer link. Each stabilizer link is secured to a bracket on the damper body with a locknut. The links, which are not handed, allow the stabilizer bar to move with the wheel travel providing maximum effectiveness. The stabilizer bar bushes are of the compression type which grip the bar under compression by the clamps.

The stabilizer bar bushes are the compression type which grip the bar under compression by the mounting brackets. When fitting replacement bushes to the bar it is important to ensure the bushes are correctly orientated to the bar. Failure to correctly align the bushes will result in excessive pre-load (wind-up) in the bushes when the suspension is at its nominal ride height.

Published: 11-May-2011

Rear Suspension - Rear Suspension

Diagnosis and Testing

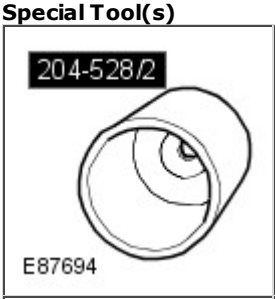
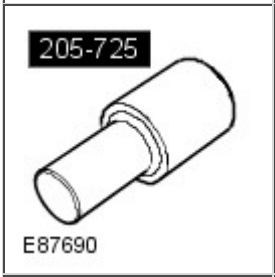
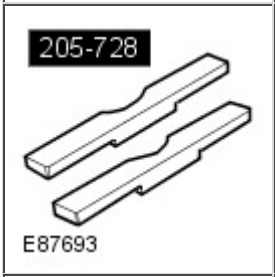
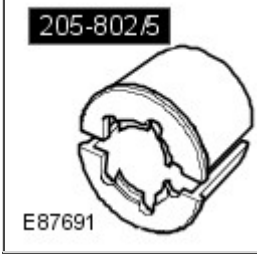
For additional information.
REFER to: Suspension System (204-00 Suspension System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Rear Suspension - Rear Wheel Bearing

Removal and Installation

Special Tool(s)

	204-528/2 Remover/Installer, Bushing
	205-725 Remover/Installer, Wheel Hub
	205-726 Remover/Installer, Wheel Hub Bearing
	205-728 Remover/Installer, Wheel Hub
	205-802/5 Remover, Wheel Hub/Bearing

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the wheel and tire.

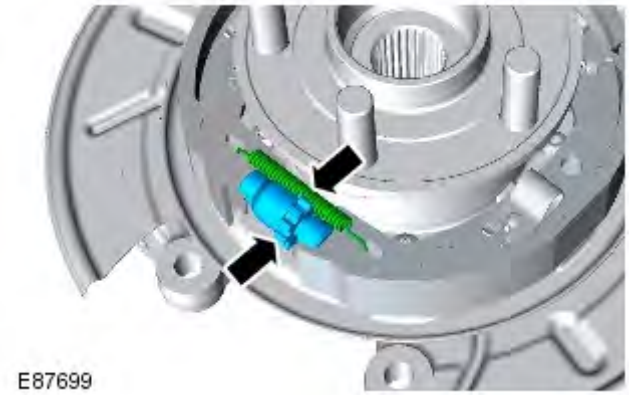
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the wheel knuckle.

   Refer to: Wheel Knuckle (204-02 Rear Suspension, Removal and

Installation).

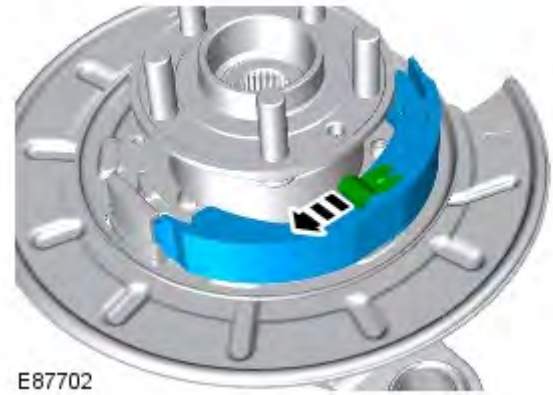
4.

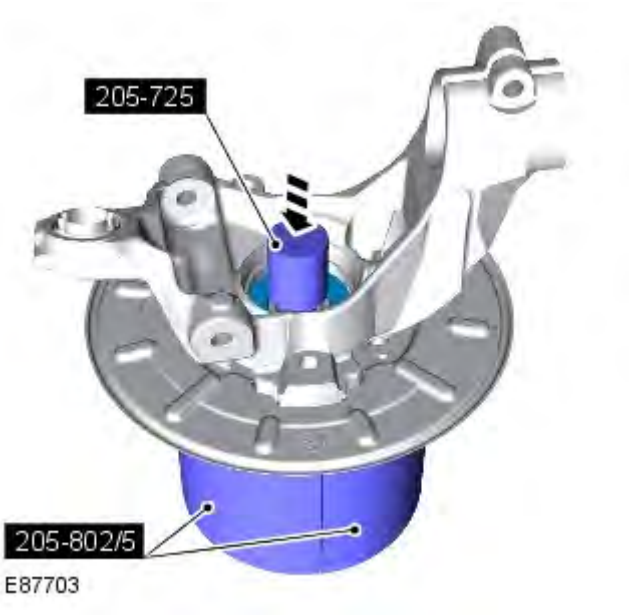


5.

6.

7.



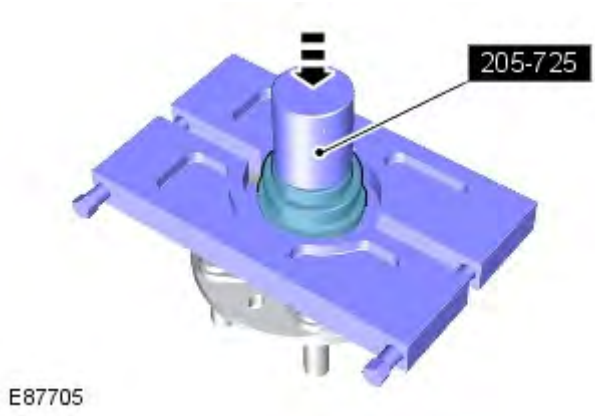


8. **8.** NOTE: Bearing damage is unavoidable during this operation.
   - Position the wheel knuckle assembly in a press and support on special tool.

     Special Tool(s): 205-802/5
   - Press the drive flange out of the wheel knuckle assembly using special tool.

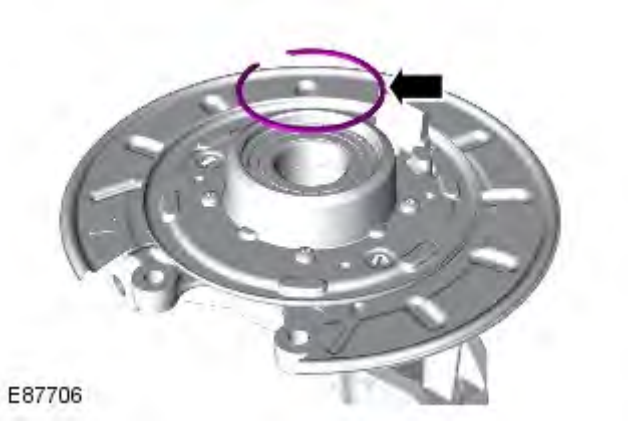
     Special Tool(s): 205-725

9. **9.** NOTE: The inner bearing track will remain on the drive flange.

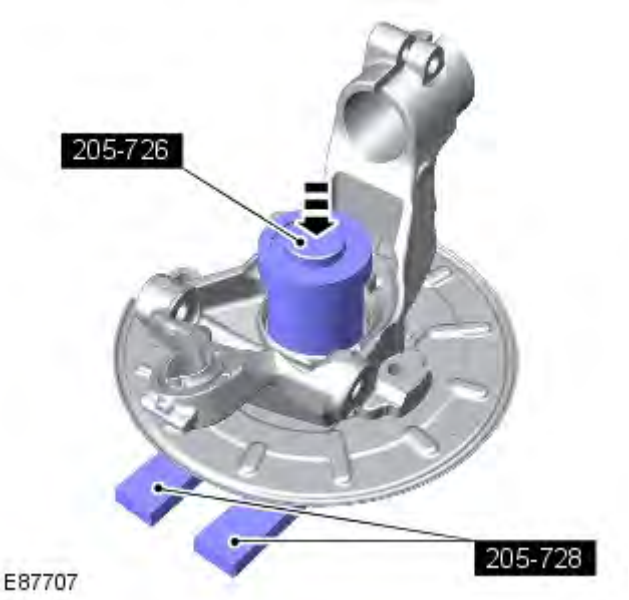


10.
   - Clamp both halves of a suitable bearing separator around the inner bearing track and position the drive flange in a press.
   - Using the special tool, press the drive flange from the inner bearing track.

     Special Tool(s): 205-725



11. Remove the circlip from the wheel knuckle assembly.

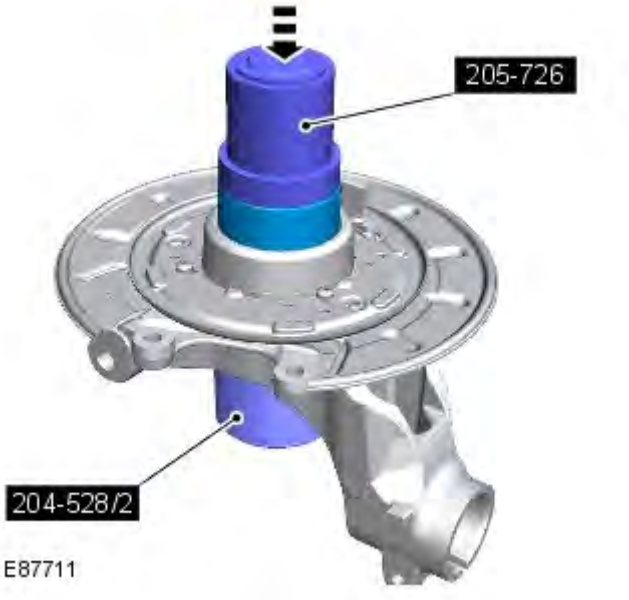


12.
- Position the wheel knuckle assembly in a press and support on special tools.

  Special Tool(s): 205-728
- Press the wheel bearing out of the wheel knuckle assembly using special tool.

  Special Tool(s): 205-726

Installation

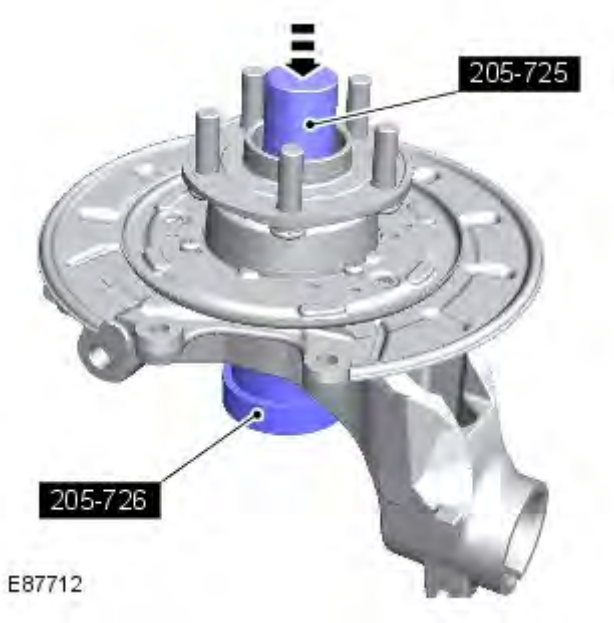


1. **1.** CAUTION: One side of the bearing is magnetic. The magnetic side is identifiable by the application of a matt black finish. The magnetic side must face towards the inboard side of the vehicle. Before fitting the bearing, make sure the magnetic face is clean. The bearing must be handled with extreme care.
   - Position the wheel knuckle assembly in a press and support on special tool.

     Special Tool(s): 204-528/2
   - Press the new wheel bearing into the wheel knuckle assembly using special tool.

     Special Tool(s): 205-726

2. Install the circlip to the wheel knuckle assembly.



3.
- Position the wheel knuckle assembly in a press and support on special tool.

  Special Tool(s): 205-726
- Press the drive flange into the wheel knuckle assembly using special tool.

  Special Tool(s): 205-725

4. **4.** WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

   Clean the backing plate and apply grease to the brake shoe contacts.

5. Clean the adjuster and set it to its minimum extension.

6.
   - Install the secondary brake shoe.
   - Install the hold-down spring and retaining pin.

7. **7.** WARNING: Make sure the return spring and the adjuster spring are correctly installed to the primary shoe.

   CAUTION: Make sure the brake shoe spring is not over stretched.
   - Install the spreader plate and the spring.
   - Install the primary brake shoe.
   - Install the return spring.
   - Install the hold-down spring and retaining pin.

8. **8.** CAUTION: Make sure the brake shoe spring is not over stretched.

   Install the brake shoe adjuster.

9. Install the wheel knuckle.

   Refer to: Wheel Knuckle (204-02 Rear Suspension, Removal and Installation).

10. Adjust the parking brake.

    Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

11. Install the wheel and tire.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and

Published: 11-May-2011

Rear Suspension - Front Lower Arm

Removal and Installation

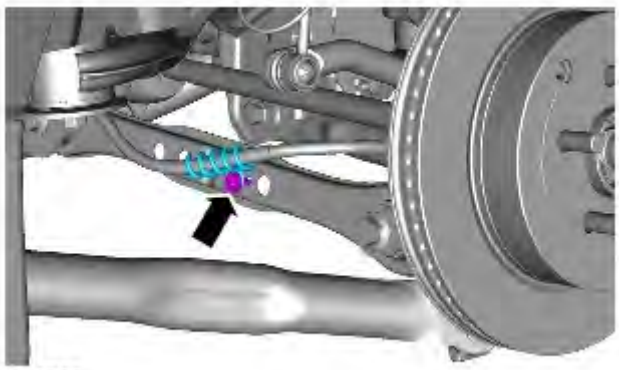
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

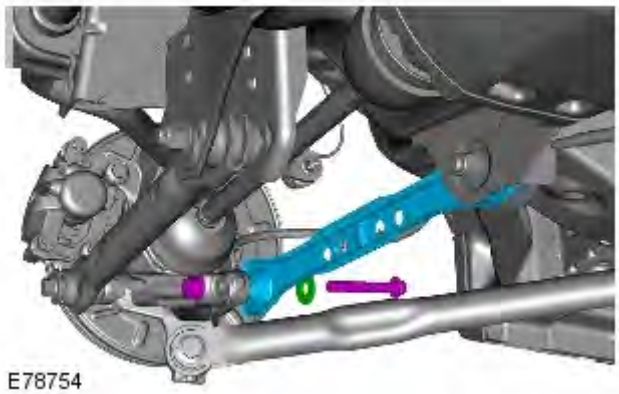
   Raise and support the vehicle.

2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).


E78753

3.
   - Discard the bolt.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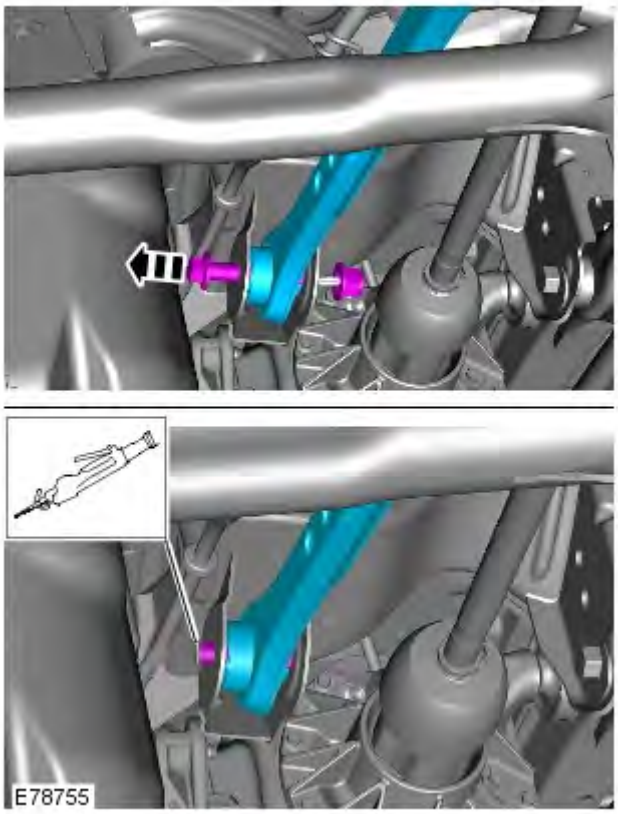
4.

5.
   - Partially release the bolt for access. Cut off the bolt head and withdraw in the opposite direction.
   - On installation, reverse the orientation of the new bolt.
   - Make sure the captive nut and protective shield from the service kit is installed.

6.



Installation

1. Install the front lower arm.

2. **2.** CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

   Install the nuts, bolts and washers, do not tighten at this stage.

3. **3.** CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

   Support weight of vehicle on a jack at the rear hub.

4. Tighten the nuts and bolts.

   Torque: 175 Nm

5. **5.** WARNING: Make sure that a new bolt is installed.

   Install the parking brake cable retaining bolt.

   Torque: 10 Nm

6. Install the rear wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

7. Check and if necessary, adjust the rear wheel alignment

Published: 11-May-2011

Rear Suspension - Rear Lower Arm

Removal and Installation

Removal

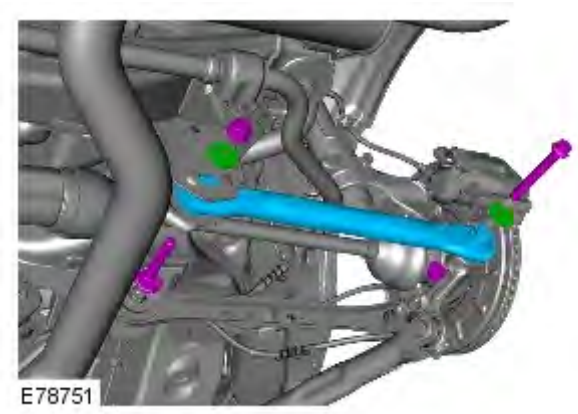
• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



3.
   - During installation, do not tighten the nuts and bolts until the 4 wheel alignment procedure has been carried out.
   - *Torque:* 175 Nm

Installation

1. To install, reverse the removal procedure.

2. Carry out the wheel alignment procedure.

Published: 11-May-2011

Rear Suspension - Trailing Arm

Removal and Installation

Removal

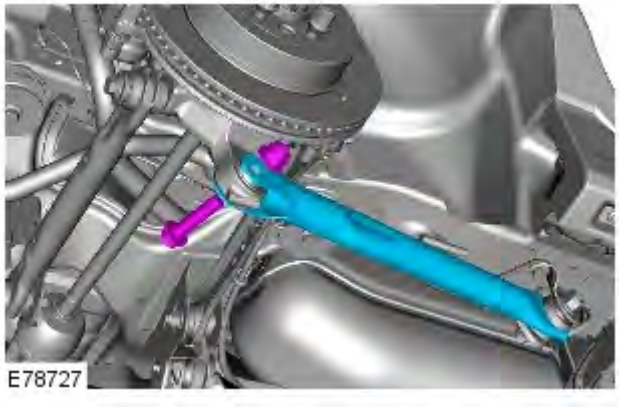
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

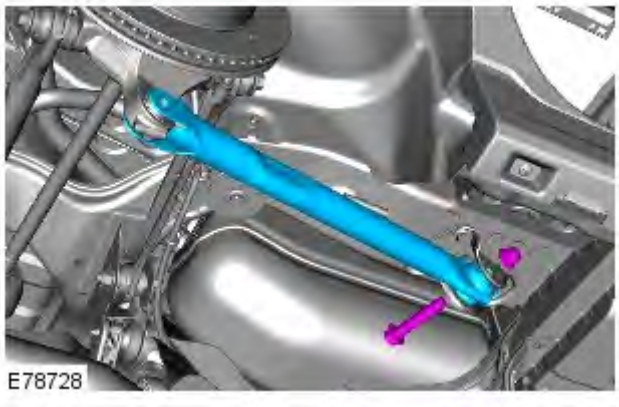
2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3.



4.



Installation

1. Install the trailing link.

2. Fit nuts, bolts and washers securing the trailing link to the body and hub, but do not tighten at this stage.

3. **3.** CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

   Support weight of vehicle on a jack at the rear hub.

4. Tighten the nuts and bolts.

   Torque: 270 Nm

5. Install the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

6. Check and if necessary, adjust the rear wheel alignment

Published: 11-May-2011

Rear Suspension - Rear Stabilizer Bar

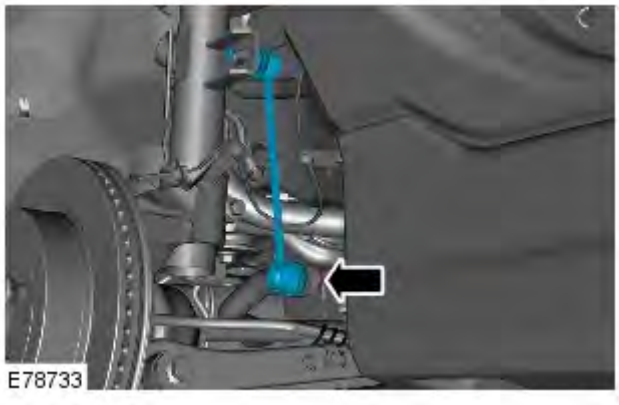
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.



2. **2.** CAUTIONS:

   Make sure that the ball joint ball does not rotate.

   Discard the nuts.

   Disconnect both rear stabilizer bar links from the stabilizer bar.

   Torque: 60 Nm

3. Remove the stabilizer bar bushings.

   Refer to: Rear Stabilizer Bar Bushing (204-02 Rear Suspension, Removal and Installation).

4. **4.** CAUTION: Note the fitted position of the component prior to removal.

   Remove the stabilizer bar.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

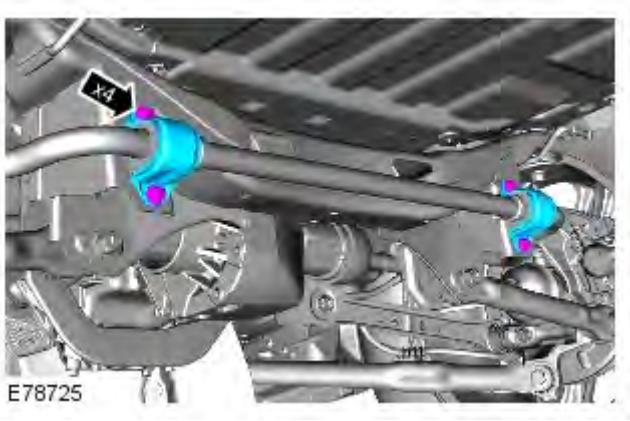
Rear Suspension - Rear Stabilizer Bar Bushing

Removal and Installation

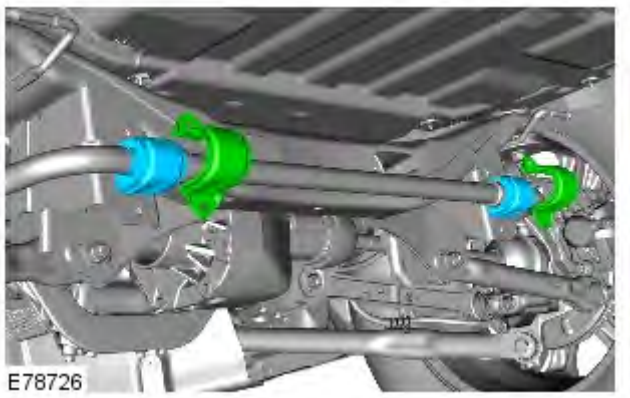
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.



2. **2.** CAUTION: Discard the bolts.
   - NOTE: Muffler has been removed for clarity.



3.

Installation

1. **1.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

   Install the stabilizer bar bushings.

2. **2.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

   Install the stabilizer bar clamps.

3. **3.** CAUTION: Make sure that new bolts are installed.

   Install the bolts, but do not tighten fully at this stage.

4. **4.** CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

   Tighten the stabilizer bar clamp bolts.

Published: 11-May-2011

Rear Suspension - Rear Stabilizer Bar Link

Removal and Installation

Removal

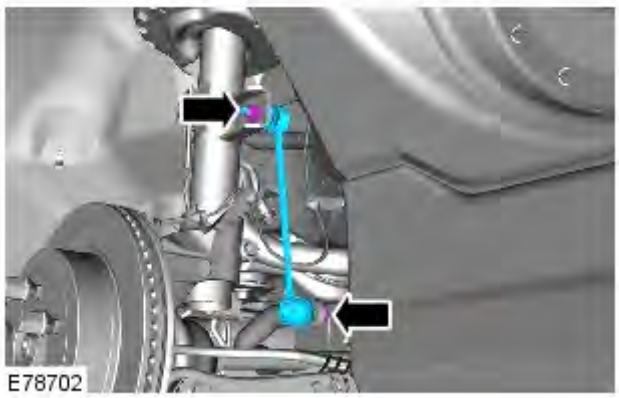
- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



3. **3.** CAUTIONS:

   Make sure that the ball joint ball does not rotate.

   Discard the nuts.

   Torque: 60 Nm

Installation

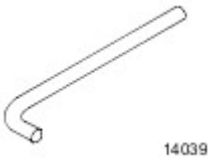
1. To install, reverse the removal procedure.

Published: 18-May-2011

Rear Suspension - Wheel Knuckle

Removal and Installation

Special Tool(s)

 14039	204-159 Lever, Wheel Knuckle
204-528/2 E87694	204-528/2 Remover/Installer, Bushing
204-620-01 E82678	204-620-01 Installer, Wheel Knuckle Bushing
204-620-02 E82677	204-620-02 Remover/Installer, Wheel Knuckle Bushing
204-620-03 E82676	204-620-03 Remover, Wheel Knuckle Bushing
205-725 E87690	205-725 Remover/Installer, Wheel Hub
205-726 E87692	205-726 Remover/Installer, Wheel Hub Bearing

	205-728 Remover/Installer, Wheel Hub
	205-802/5 Remover, Wheel Hub/Bearing
	205-857 Remover, Halfshaft
	LR-121 Hydraulic Cylinder 10t

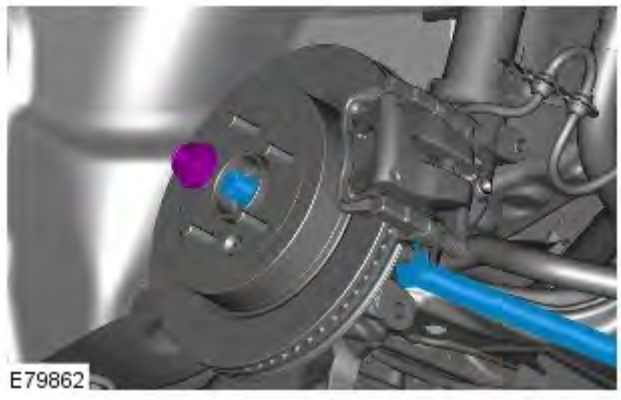
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

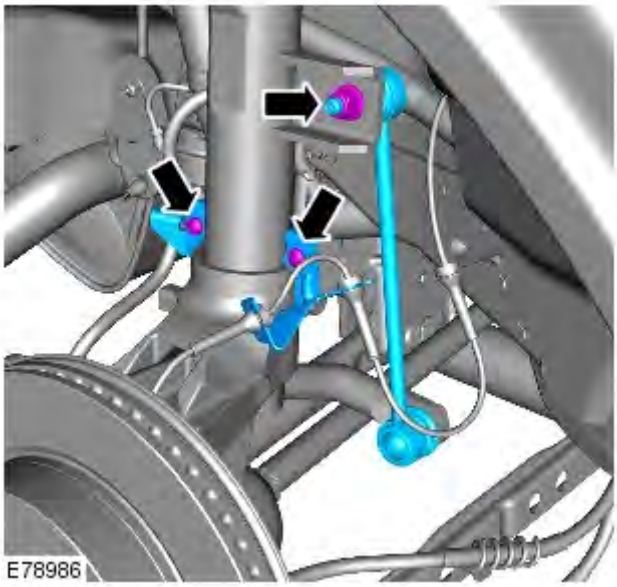
2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

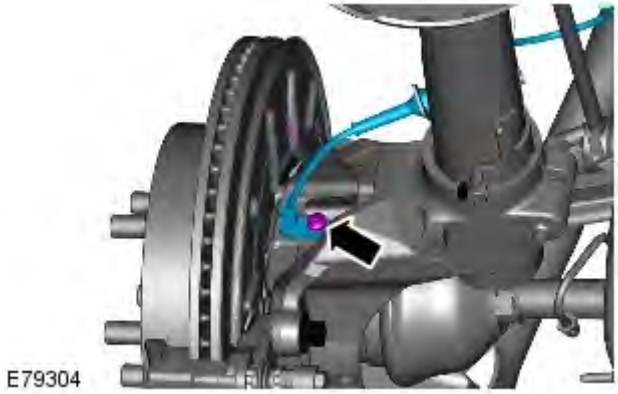


3. **3.** CAUTION: Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

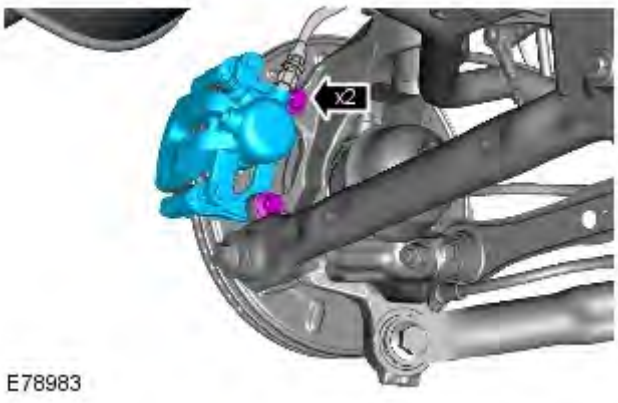
   Remove and discard the rear halfshaft nut.



4. **4.** CAUTION: Discard the nut.
   - NOTE: RH illustration shown, LH is similar.



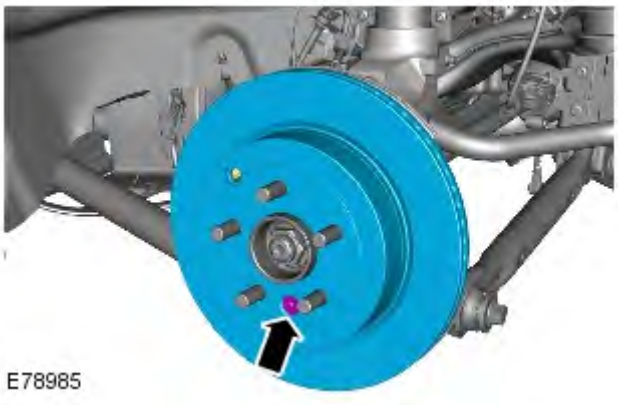
5. Release the wheel speed sensor from the wheel knuckle.



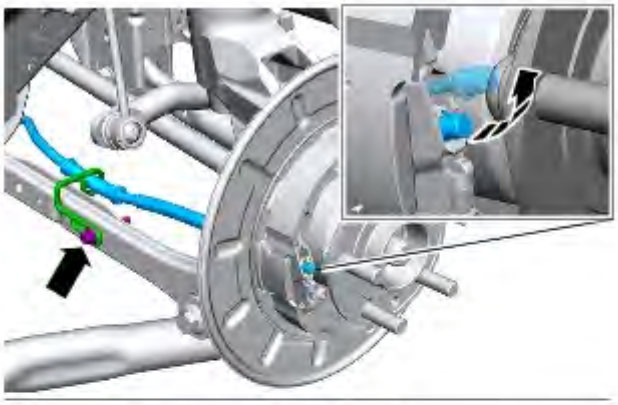
6. **6.** CAUTION: Make sure that no load is placed on the brake hose.
   - Tie the brake caliper and brake caliper anchor plate assembly aside.

7.

- Release the park brake shoe adjustment.

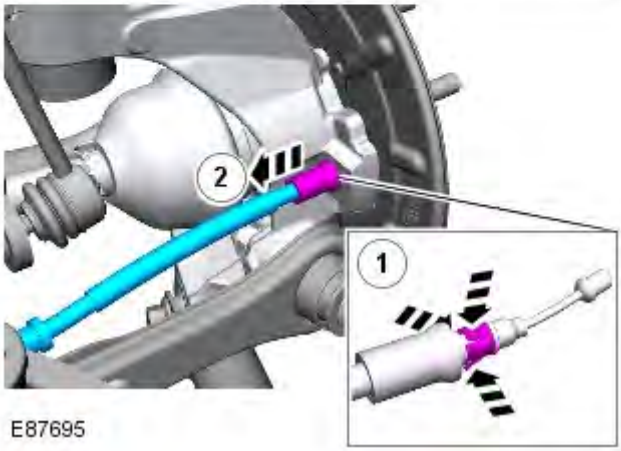


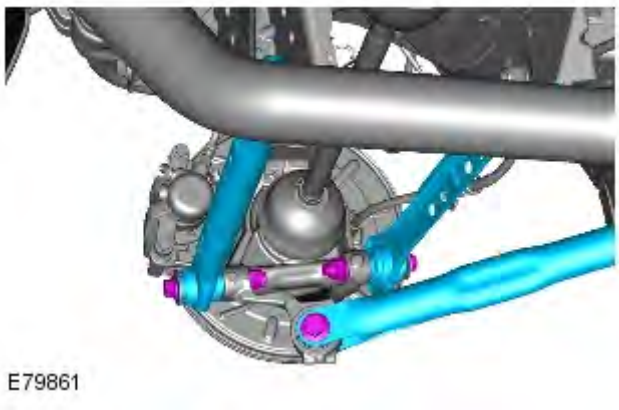
8. Remove the brake disc.



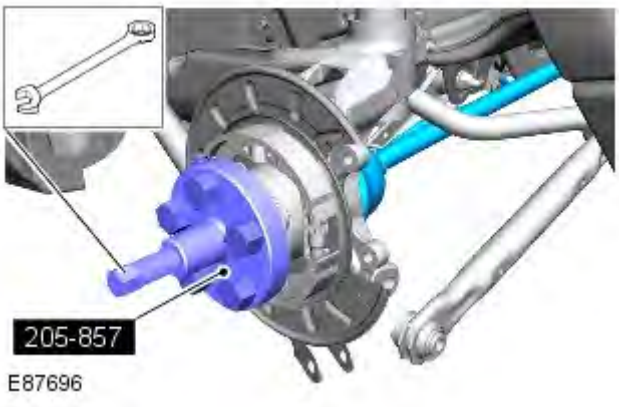
9.

- Release the parking brake cable from the wheel knuckle.
- Collect the clip.




E79861

10.



E87696

11. **11.** CAUTIONS:

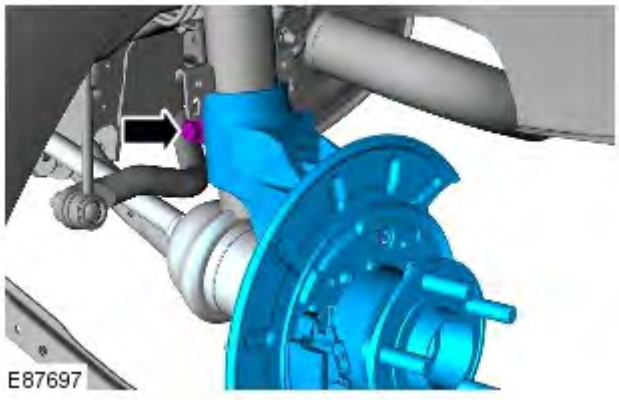
⚠ Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

⚠ Do not store or install halfshafts with joints at maximum articulation or damage may occur to the joint.

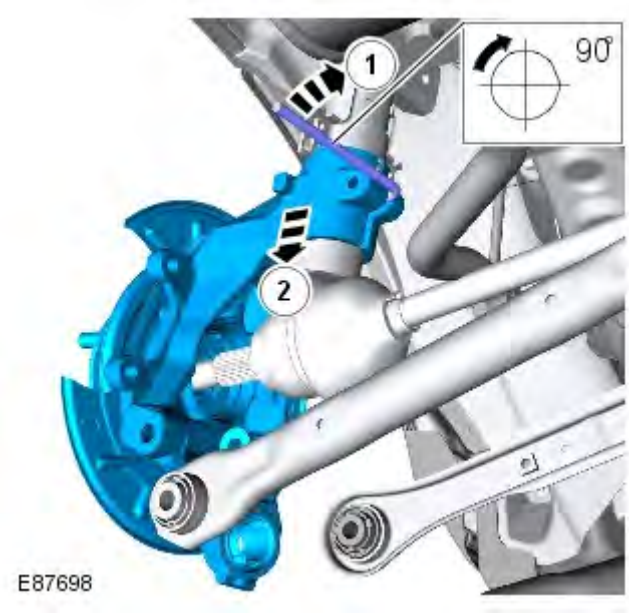
⚠ Angularly Adjusted Roller (AAR) joints, used at the inboard end of some halfshafts have no internal retaining mechanism and can separate.

- Release the rear halfshaft.

Special Tool(s): 205-857
- Tie the rear halfshaft aside.

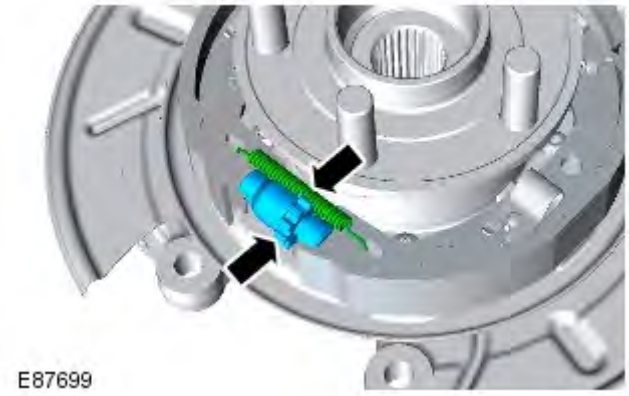

E87697

12. Remove and discard the wheel knuckle clamping bolt.



13. With assistance, remove the wheel knuckle assembly.

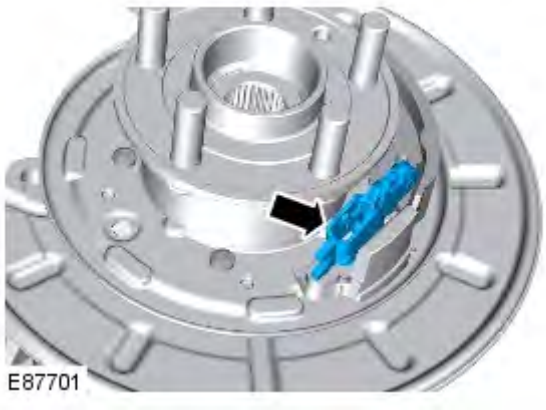
    Special Tool(s): 204-159



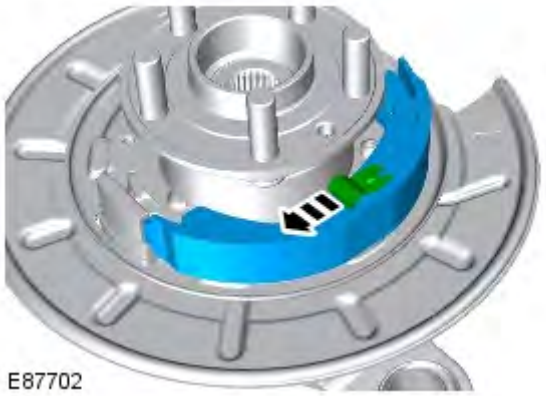
14. **14.** NOTE: Do not disassemble further if the component is removed for access only.

15.

16.



17.

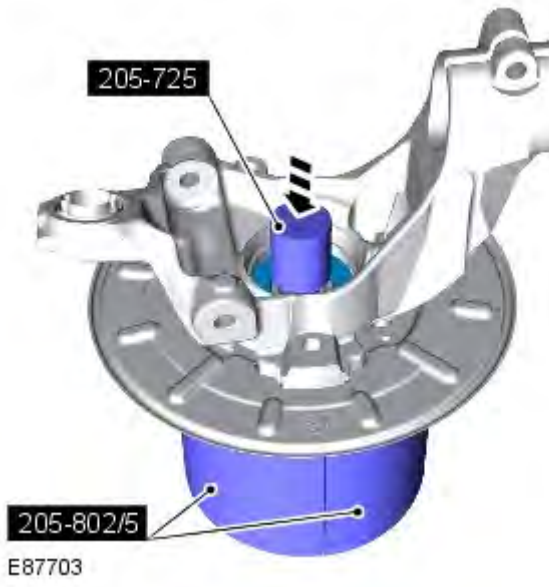


18. **18.** NOTE: Bearing damage is unavoidable during this operation.

- Position the wheel knuckle assembly in a press and support on special tool.

  Special Tool(s): 205-802/5
- Press the drive flange out of the wheel knuckle assembly using special tool.

  Special Tool(s): 205-725



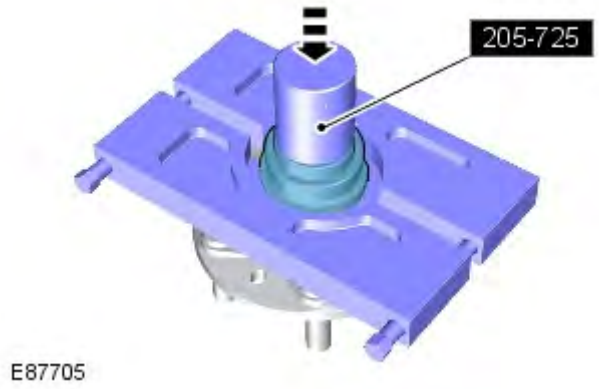
19. **19.** NOTE: The inner bearing track will remain on the drive flange.

E87704

20.

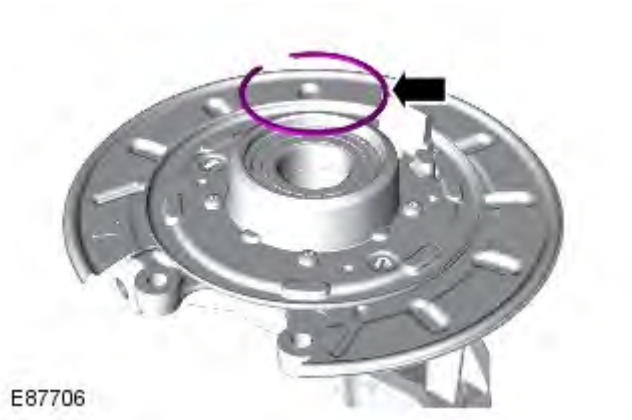
- Clamp both halves of a suitable bearing separator around the inner bearing track and position the drive flange in a press.
- Using the special tool, press the drive flange from the inner bearing track.

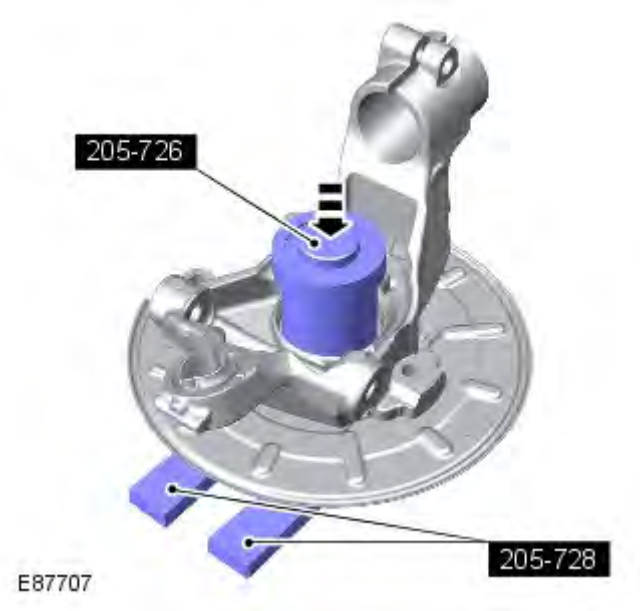
Special Tool(s): 205-725



E87705

21. Remove the circlip from the wheel knuckle assembly.


E87706



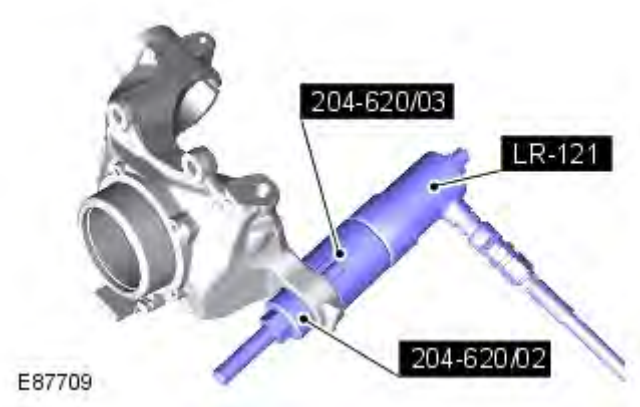
22.

- Position the wheel knuckle assembly in a press and support on special tools.

  Special Tool(s): 205-728
- Press the wheel bearing out of the wheel knuckle assembly using special tool.

  Special Tool(s): 205-726

23. Remove the brake backing plate.

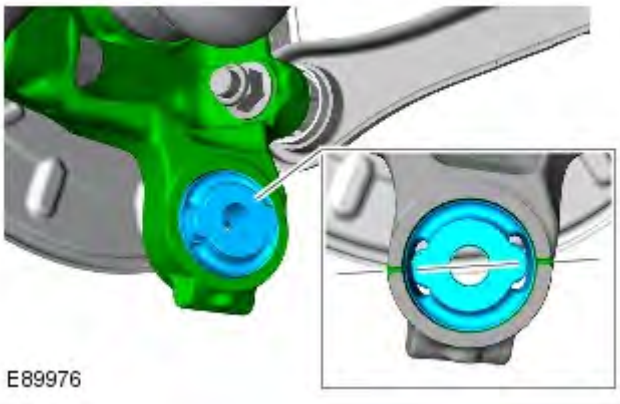


24. **24.** CAUTION: Mark the components to aid installation.

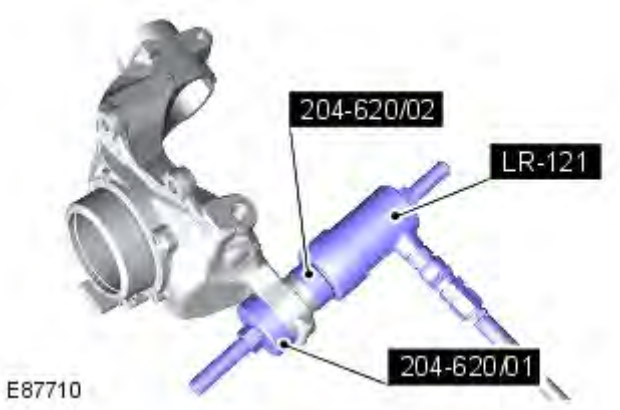
    Remove the wheel knuckle bushing.

    Special Tool(s): LR-121, 204-620-02, 204-620-03

Installation



1. **1.** CAUTION: Make sure that the installation marks are aligned.

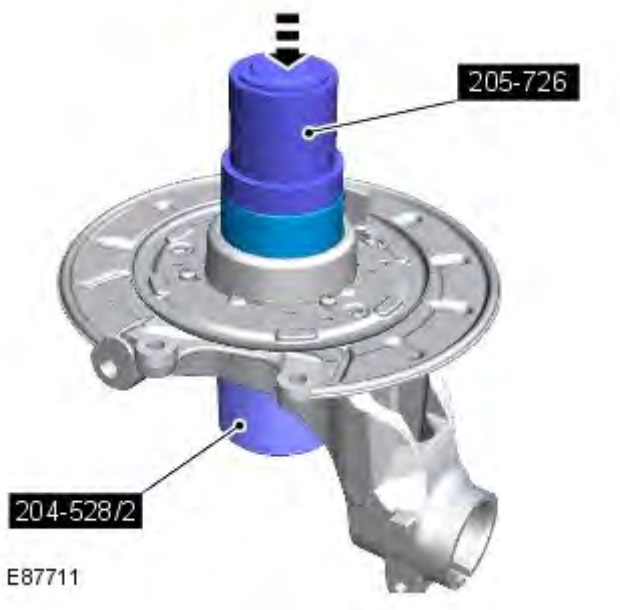


2. **2.** CAUTION: Make sure the correct special tool is used to install the bushings to the correct depth.

   Install the wheel knuckle bushing.

   Special Tool(s): LR-121, 204-620-01, 204-620-02

3. Install the brake backing plate.



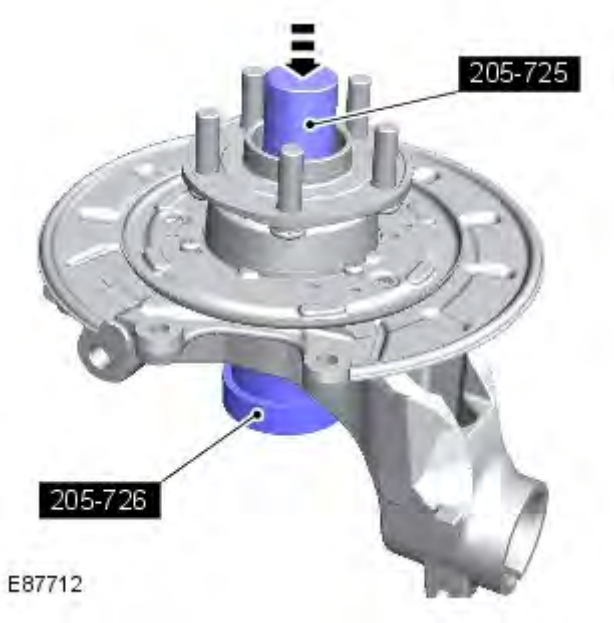
4. **4.** CAUTION: One side of the bearing is magnetic. The magnetic side is identifiable by the application of a matt black finish. The magnetic side must face towards the inboard side of the vehicle. Before fitting the bearing, make sure the magnetic face is clean. The bearing must be handled with extreme care.

   - Position the wheel knuckle assembly in a press and support on special tool.

     Special Tool(s): 204-528/2
   - Press the new wheel bearing into the wheel knuckle assembly using special tool.

     Special Tool(s): 205-726

5. Install the circlip to the wheel knuckle assembly.



6.
- Position the wheel knuckle assembly in a press and support on special tool.

  Special Tool(s): 205-726
- Press the drive flange into the wheel knuckle assembly using special tool.

  Special Tool(s): 205-725

7. **7.** WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

   Clean the backing plate and apply grease to the brake shoe contacts.

8. Clean the adjuster and set it to its minimum extension.

9.
   - Install the secondary brake shoe.
   - Install the hold-down spring and retaining pin.

10. **10.** WARNING: Make sure the return spring and the adjuster spring are correctly installed to the primary shoe.

    CAUTION: Make sure the brake shoe spring is not over stretched.

    - Install the spreader plate and the spring.
    - Install the primary brake shoe.
    - Install the return spring.
    - Install the hold-down spring and retaining pin.

11. **11.** CAUTION: Make sure the brake shoe spring is not over stretched.

    Install the brake shoe adjuster.

12. With assistance, install the wheel knuckle assembly.

    Special Tool(s): 204-159

13. Install a new wheel knuckle clamping bolt.

    Torque: 110 Nm

14. Install the rear halfshaft to the drive flange.

15. **15.** CAUTION: Only tighten the nut finger tight at this stage.

Install a new rear halfshaft nut, do not fully tighten at this stage.

16. **16.** CAUTION: Only tighten the nuts and bolts finger tight at this stage.

    Connect both lower arms to the hub assembly, do not fully tighten at this stage.

17. **17.** CAUTION: Only tighten the nut and bolt finger-tight at this stage.

    Connect the trailing arm to the hub assembly, do not fully tighten at this stage.

18. **18.** CAUTION: Make sure that the clip is correctly located.

    - Connect the parking brake cable.
    - Secure the parking brake cable.

19. **19.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

    Install the brake disc.

    Torque: 35 Nm

20. **20.** CAUTIONS:

    Make sure that the mating faces are clean and free of foreign material.

    Make sure that the brake hose is not twisted and is correctly located.

    Secure the brake caliper and anchor plate to the wheel knuckle.

    Torque: 110 Nm

21. Install the rear wheel speed sensor to the wheel knuckle.

    Torque: 5 Nm

22. Install the brake line and wheel speed sensor brackets.

    Torque: 10 Nm

23. **23.** WARNING: Make sure that a new nut is installed.

    Secure the stabilizer bar link.

    Torque: 60 Nm

24. Support the weight of the vehicle using a jack under the rear hub.

25. **25.** CAUTIONS:

    Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

    Do not use air tools to install the nut. Failure to follow this

instruction may result in damage to the component.

- Tighten both lower arm nuts and bolts.

  Torque: 175 Nm
- Tighten the trailing arm nut and bolt.

  Torque: 270 Nm
- Tighten the rear halfshaft nut.

  Torque:
  Stage 1:330 Nm
  Stage 2:30°
- Stake the hub nut.

26. Adjust the parking brake.

    Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

27. Install the wheel and tire.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Rear Suspension - Rear Shock Absorber

Removal and Installation

Removal

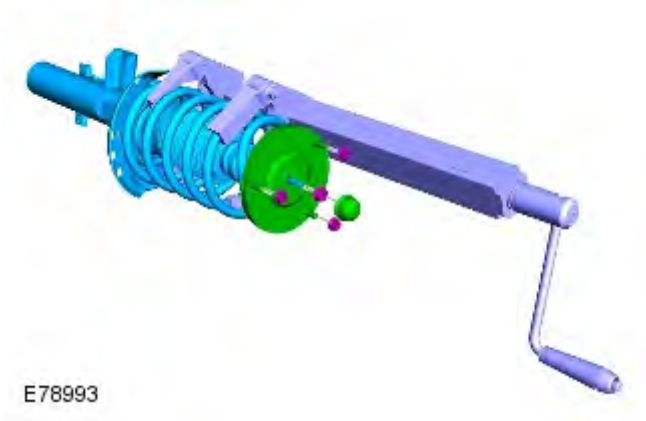
• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the shock absorber and spring assembly.

   Refer to: Shock Absorber and Spring Assembly (204-02 Rear Suspension, Removal and Installation).



3. **3.** WARNINGS:

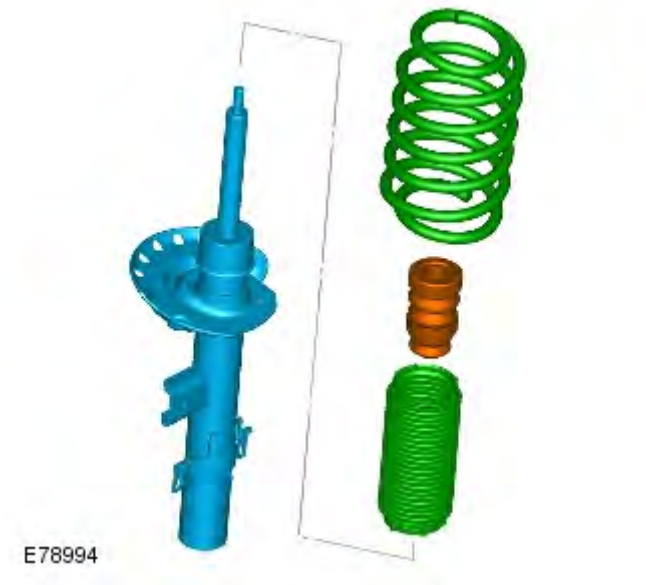
   Always follow the spring compressor manufacturer's instructions.

   Take extra care when handling the compressed spring.

   • NOTE: Make sure that this component is installed to the noted removal position.

   Remove the spring.

4. Remove the shock absorber damper rod components.



Installation

1. Install the shock absorber shaft dust shield, spring aid and gaiter.

2. **2.** WARNING: Take extra care when handling the compressed spring.

   • CAUTIONS:

Make sure that these components are installed to the noted removal position.

Make sure that the mating faces are clean and free of foreign material.

Install the spring.

3. Install the spring inclination spacer and top mount, install the nut but do not fully tighten at this stage.

4. Carefully release the spring tension.

5. Tighten the nut.

   Torque: 80 Nm

6. Install the cap.

7. Install the shock absorber and spring assembly.

   Refer to: Shock Absorber and Spring Assembly (204-02 Rear Suspension, Removal and Installation).

Published: 11-May-2011

Rear Suspension - Shock Absorber and Spring Assembly

Removal and Installation

Removal

1. Remove the rear quarter trim panel.

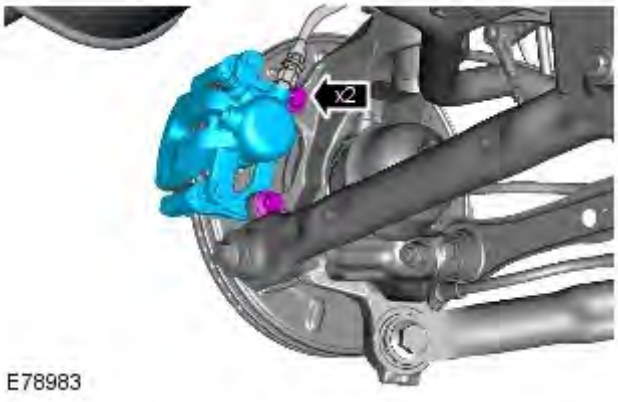
   Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

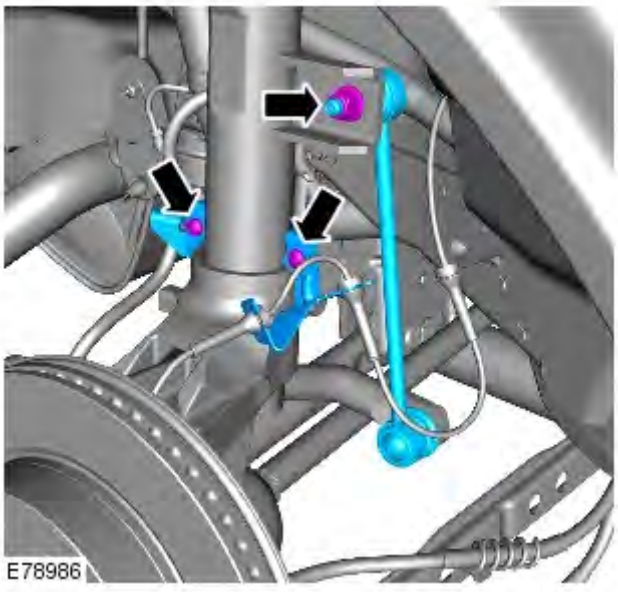
   Raise and support the vehicle.

3. Remove the wheel and tire.

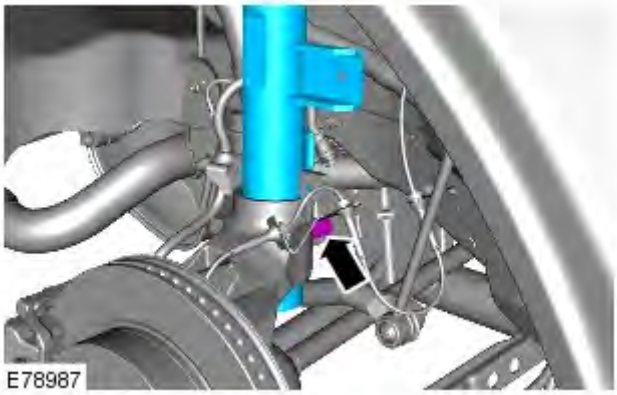
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



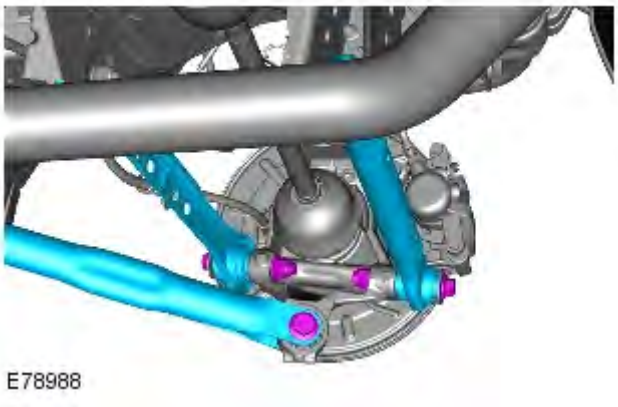
4. **4.** CAUTION: Make sure that no load is placed on the brake hose.



5. **5.** CAUTION: Discard the nut.



6. Remove and discard the bolt from the rear wheel knuckle.



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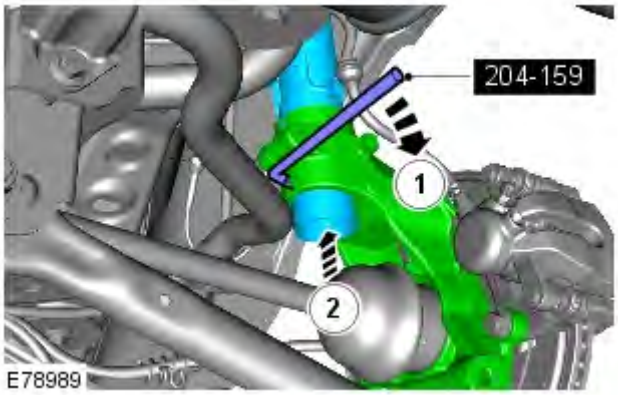

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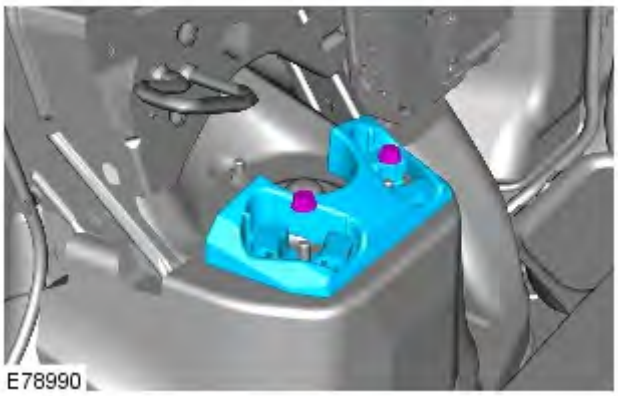
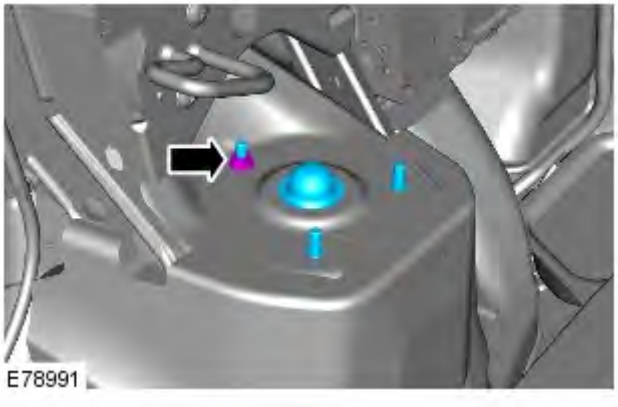


9. **9.** CAUTION: Make sure that no components catch.



10.

Installation

1. **1.** CAUTION: Make sure that new bolts are installed.

   Install the shock absorber to the hub assembly.

   Torque: 110 Nm

2. Install the shock absorber and spring assembly.

   Torque: 32 Nm

3. **3.** CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

   Install the lower suspension arms.

4. Install the brake line and wheel speed sensor brackets.

   Torque: 10 Nm

5. **5.** WARNING: Make sure that a new nut is installed.

   Secure the stabilizer bar link.

   Torque: 60 Nm

6. **6.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that the brake hose is not twisted and is correctly located.

   Secure the brake caliper and anchor plate to the wheel knuckle.

   Torque: 110 Nm

7. **7.** CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

   Support weight of vehicle on a jack at the rear hub.

8. Tighten the trailing arm nut and bolt.

Torque: 270 Nm

9. Tighten the front and rear lower arm nuts and bolts.

   Torque: 175 Nm

10. Install the wheel and tire.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

11. Install the rear quarter trim panel.

    Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Rear Suspension - Wheel Knuckle Rear Bushing

Removal and Installation

Special Tool(s)

204-620-01 E82678	204-620-01 Installer, Wheel Knuckle Bushing
204-620-02 E82677	204-620-02 Remover/Installer, Wheel Knuckle Bushing
204-620-03 E82676	204-620-03 Remover, Wheel Knuckle Bushing
LR-121 E87232	LR-121 Hydraulic Cylinder 10t

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

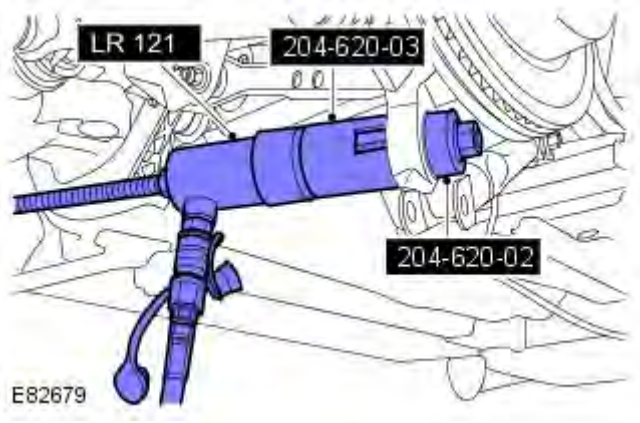
   Raise and support the vehicle.

2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the trailing arm.

   Refer to: Trailing Arm (204-02 Rear Suspension, Removal and Installation).

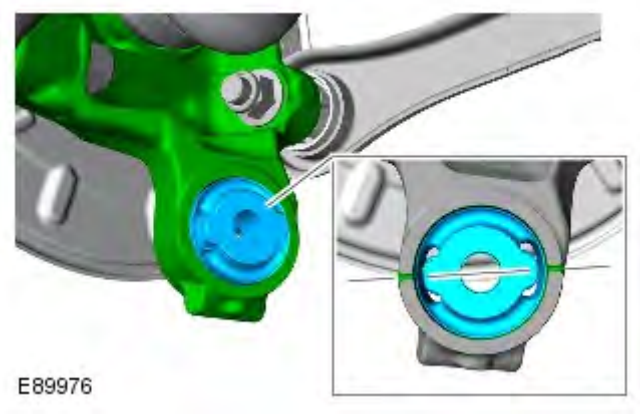


4. **4.** CAUTION: Mark the components to aid installation.

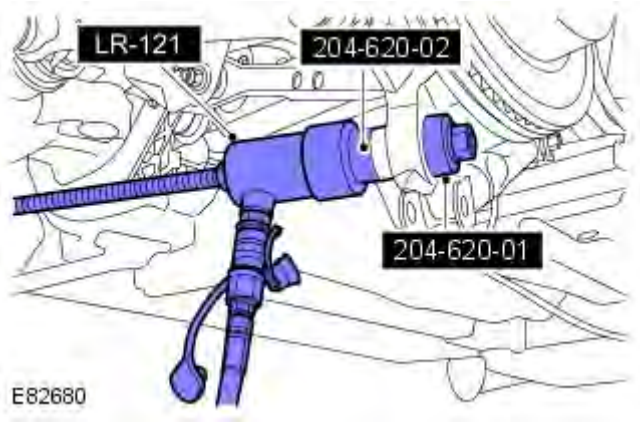
   Remove the bushing.

   Special Tool(s): LR-121, 204-620-02, 204-620-03

Installation



1. **1.** CAUTION: Make sure that the installation marks are aligned.



2. **2.** CAUTION: Make sure the correct special tool is used to install the bushings to the correct depth.

   Install the bushing.

   Special Tool(s): LR-121, 204-620-01, 204-620-02

3. Install the trailing arm.

   Refer to: Trailing Arm (204-02 Rear Suspension, Removal and Installation).

4. Install the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Wheels and Tires -

Wheel Type

• CAUTIONS:

CAUTION: With reduced size spare wheel fitted, do not exceed 50 mph (80 km/h) and replace with standard size wheel at earliest opportunity.

CAUTION: Do not use power tools when operating the spare wheel winch, raise and lower winch manually using hand tools only.

Item	Specification
Alloy	6.5J x 16
Alloy	7.5J x 17
Alloy	8.0J x 18
Steel	7.0 J X 17
Alloy wheel (Accessory)	8.5J x 19
Steel wheel (Spacesaver)	4.0J x 17

Tire Sizes - Standard Fit

CAUTION: CAUTION: Inner tubes must not be fitted with any of these tires.

Wheel Size	Tire Size	Load index & Speed Rating
6.5J x 16	215/75 R16	103H or 107H
7.5J x 17	235/65 R17	104V or 108V
7.0J X 17	235/65 R17	103H
8.0J x 18	235/60 R18	103V OR 107V
4.0J x 17	135/90 R17	

Tire Sizes - Accessory Fit

CAUTION: CAUTION: Inner tubes must not be fitted with any of these tires.

Wheel Size	Tire size	Speed Rating
8.0J x 19	235/55 R19	105V

Tire Pressures

Loading condition	bar	lb/in²
All conditions - Vehicle loaded to maximum vehicle gross weight:		
Front	2.2	32
Rear	2.2	32
Spacesaver spare wheel	2.2	32
Standard size spare wheel	2.2	32
19" Accessory wheel	2.4	35

Recommended Lubricant

Item	Land Rover Part No.
Wheel hub spigot	RYL 105020

Torque Specifications

Description	Nm	lb-ft
Road wheel nuts*	133	98
Tire low pressure sensor	8	6

*** Road wheel nuts must be tightened by diagonal selection**

Published: 11-May-2011

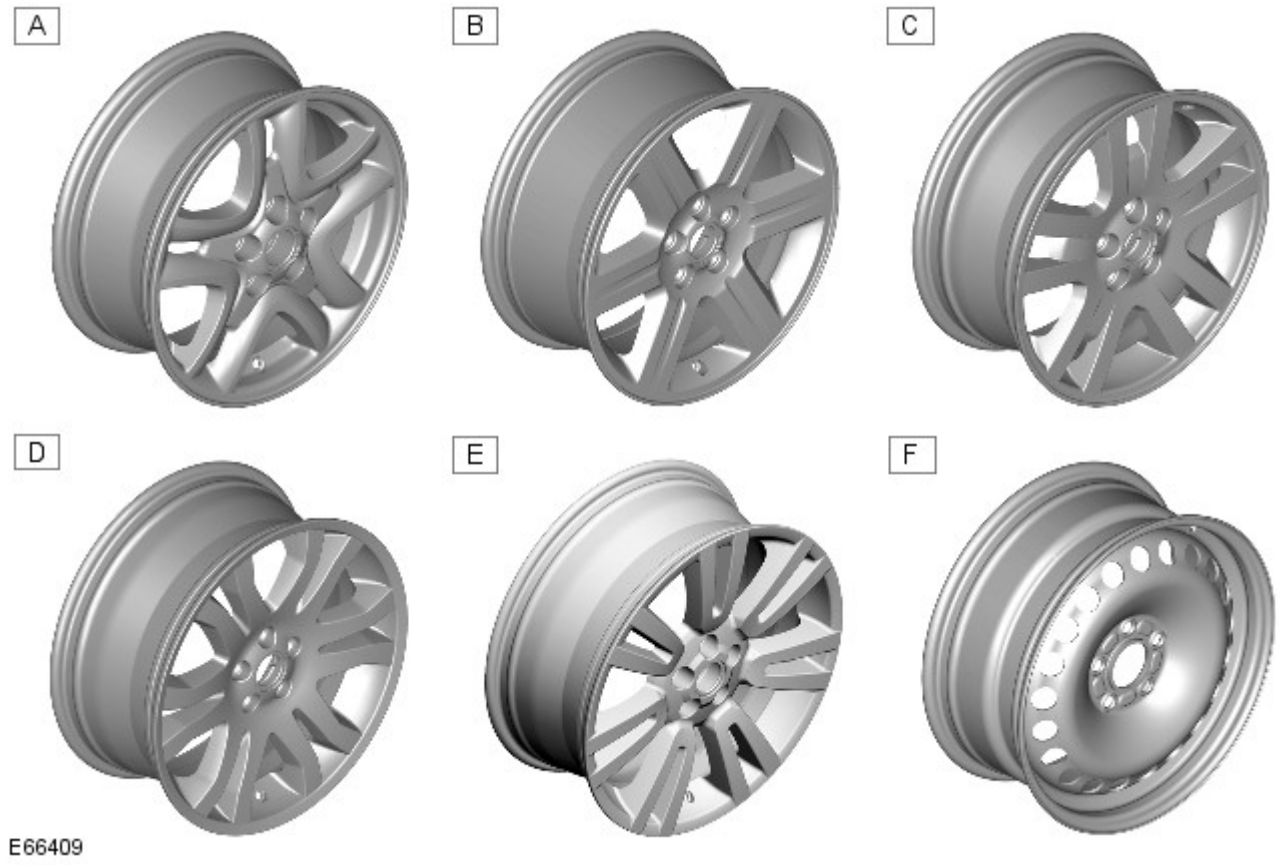
Wheels and Tires - Wheels and Tires

Description and Operation

OVERVIEW

A number of alloy and steel wheel and tire size combinations are available. A Tire Pressure Monitoring System (TPMS) is also available. The system monitors the pressure in each tire and informs the driver if the pressure falls below predetermined thresholds.

WHEELS



Item	Part Number	Description
A	-	6.5J X 16
B	-	7.5J X 17 - Style 1
C	-	7.5J X 17 - Style 2
D	-	8.0J X 18
E	-	8JX 19 (From 2009MY)
F	-	7J X 17 - Steel

The spare wheel fitted is a full size 7J X 17 steel wheel and uses a 225/65 R17 tire.

On vehicles from 2009MY a 8J X 19 alloy wheel is available and uses a 235/55 R19 tire. A 10 spoke chrome shadow 8J X 19 alloy wheel fitted with a 235/55R19 tire is also available as an optional fitment.

TIRES

Tires are available in a number of sizes and tread patterns dependent on vehicle usage. Tire sizes are as follows:

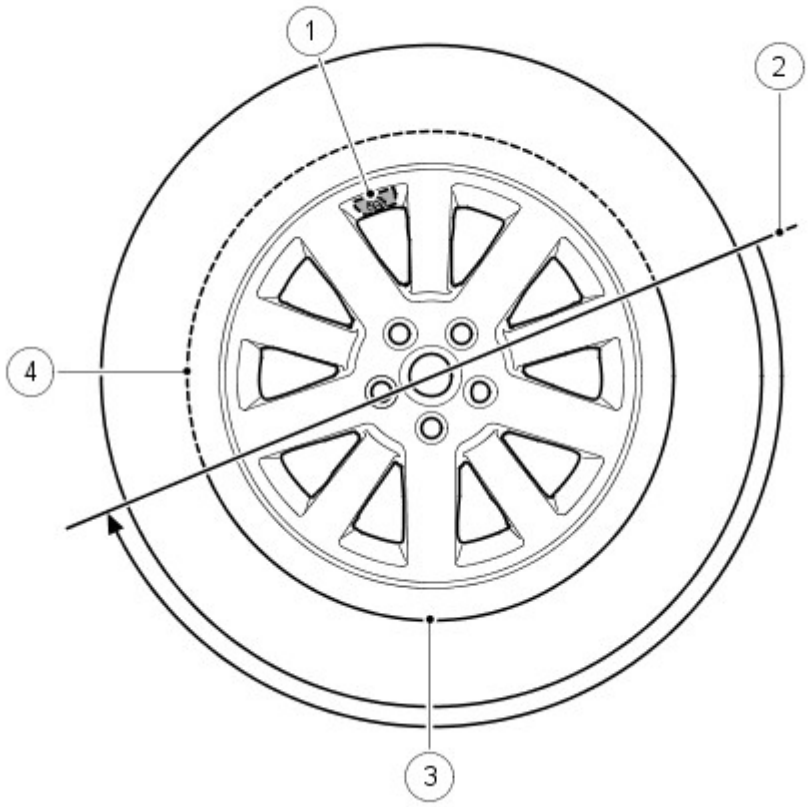
- 215/75R16
- 225/65 R17
- 235/65R17
- 235/60R18
- 235/55R19.

WARNING: Tires should be inflated to the recommended pressures (as given in the Owners Handbook) only when the tires are cold (ambient temperature). If the tires have been subjected to use or exposed to direct sunlight, move the vehicle into a shaded position and allow the tires to cool before checking/adjusting the pressures.

Tire Changing

On vehicles fitted the TPMS, care must be taken when removing and refitting tires to ensure that the tire pressure sensor is not damaged.

Vehicles fitted with TPMS can be visually identified by an external metal locknut and valve of the tire pressure sensor on the road wheels. Vehicles without TPMS will have rubber tire valve.



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Item	Part Number	Description
1	-	Tire valve and pressure sensor
2	-	Tire fitting/removal tool initial start position
3	-	High tire and bead tension area
4	-	Low tire and bead tension area

When removing the tire, the bead breaker must not be used within 90 degrees of the tire valve in each direction on each side of the tire.

When using the tire removal machine, the fitting arm start position must be positioned as shown in the tire changing illustration for each side of the tire. The wheel can then be rotated through 180 degrees in a counter-clockwise direction. This will relieve tension from the tire bead allowing the remaining 180 degrees of the tire to be manually pulled from the rim.

When refitting the tire, position the fitting arm as shown. Rotate the tire and take care that the bead on the low tension side of the tire does not damage the sensor.

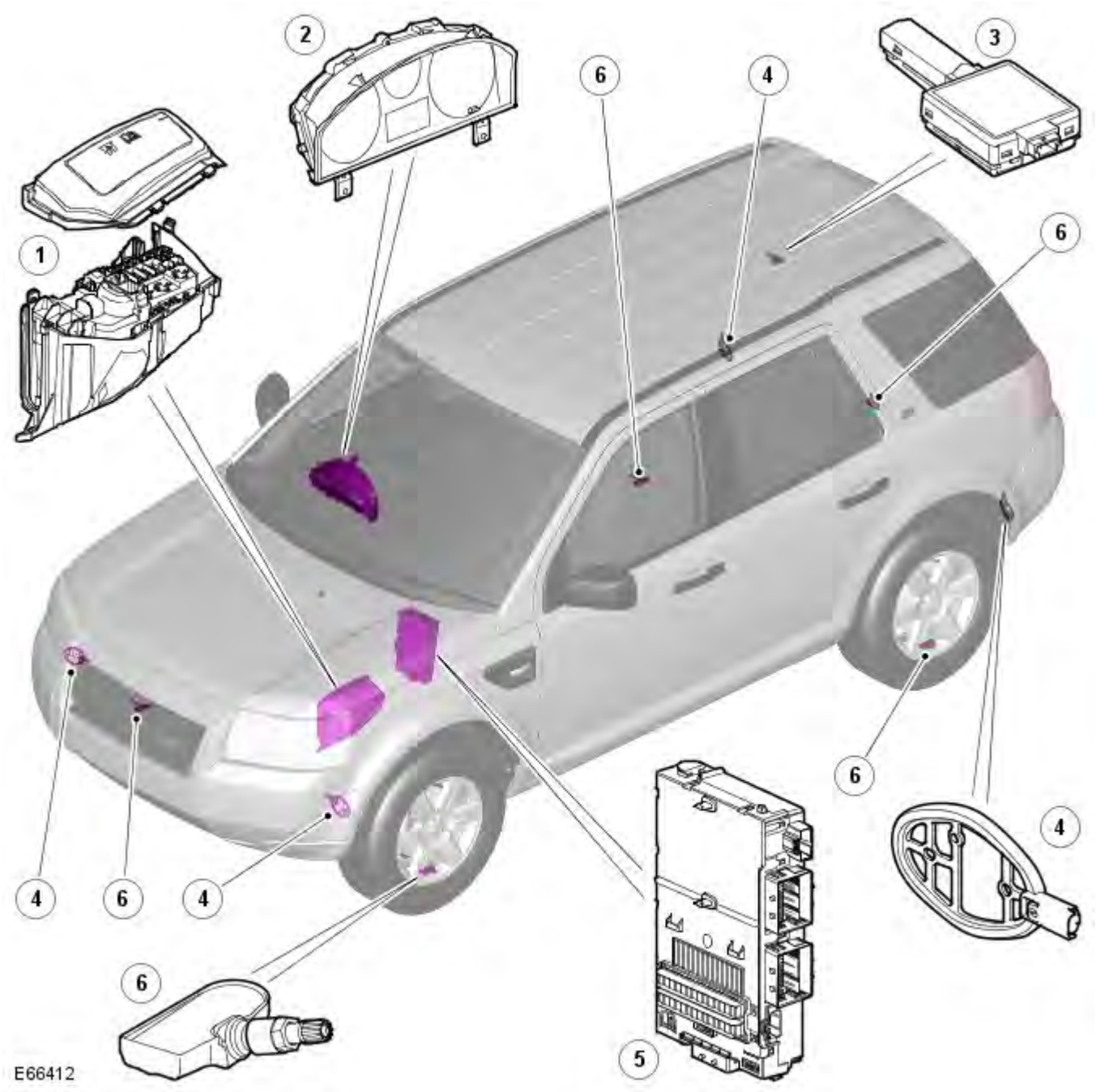
TREAD Act - NAS Only

Vehicles supplied to the North American markets must comply with the legislation of the Transport Recall Enhancement, Accountability and Documentation (TREAD) act. Part of the requirement of the TREAD act is for the vehicle to display a label, positioned on the driver's side 'B' pillar, which defines the recommended tire inflation pressure, load limits and maximum load of passengers and luggage weight the vehicle can safely carry. This label will be specific to each individual vehicle and will be installed on the production line.

This label must not be removed from the vehicle. The label information will only define the specification of the vehicle as it came off the production line. It will not include dealer or owner fitted accessory wheels and tires of differing size from the original fitment.

If the label is damaged or removed for body repair, it must be replaced with a new label specific to that vehicle. A new label is requested from Land Rover parts and will be printed specifically for the supplied VIN of the vehicle.

TIRE PRESSURE MONITORING SYSTEM (TPMS)



Item	Part Number	Description
1	-	Battery junction box
2	-	Instrument cluster
3	-	RF receiver
4	-	Initiator
5	-	Central Junction Box (CJB)
6	-	Tire pressure sensor

The TPMS is a driver assistance system which assists the driver to maintain the tire pressures at the optimum level. The TPMS is a standard fitment on North American Specification (NAS) vehicles and an optional fitment in other markets. The TPMS system has the following benefits:

- Improve fuel consumption
- Maintain ride and handling characteristics
- Reduce the risk of rapid tire deflation - which may be caused by under inflated tires
- Comply with legislation requirements in relevant markets.

CAUTION: The TPMS is not intended as a replacement for regular tire pressure and tire condition checks and should be considered as additional to good tire maintenance practices.

The TPMS measures the pressure in each of the tires on the vehicle (including the spare, if required) and issues warnings to the driver if any of the pressures deviate from defined tolerances.

• NOTE: During a 'blow-out' a very rapid reduction in pressure is experienced. The system is not intended to warn the driver of a 'blow-out', since it is not possible to give the driver sufficient warning that such an event is occurring, due to its short duration. The design of the TPMS is to assist the driver in keeping the tires at the correct pressure, which will tend to reduce the likelihood of a tire 'blow-out' occurring.

The controlling software for the TPMS is located within the CJB. The software detects the following:

- the tire pressure is below the recommended low pressure value - under inflated tire
- the position of the tire on the vehicle.

The system comprises a Radio Frequency (RF) receiver, 4 initiators and 4 tire pressure sensors (5 if the spare wheel has a sensor fitted).

The 4 initiators are hard wired to the CJB. The initiators transmit 125 KHz Low Frequency (LF) signals to the tire pressure sensors which respond by modifying the mode status within the RF transmission. The 315 or 433 MHZ RF signals are detected by the RF receiver which is located at the rear of the vehicle, behind the headlining. The RF receiver is connected to the CJB on the Local Interconnect Network (LIN) bus. The received RF signals from the tire pressure sensors are passed to the CJB on the LIN bus and contain identification, pressure, temperature and acceleration information for each wheel and tire.

The TPMS software communicates with the instrument cluster via the medium speed Controller Area Network (CAN) bus to provide the driver with appropriate warnings. The TPMS software also indicates status or failure of the TPMS or components.

Tire Location and Identification

The TPMS can identify the position of the wheels on the vehicle and assign a received tire pressure sensor identification to a specific position on the vehicle, for example FL (front left), FR (front right), RL (rear left) and RR (rear right). This feature is required because of the different pressure targets and threshold between the front and rear tires.

The wheel location is performed automatically by the TPMS software using an 'auto-location' function. This function is fully automatic and requires no input from the driver. The TPMS software automatically re-learns the position of the wheels on the vehicle if the tire pressure sensors are replaced or the wheel positions on the vehicle are changed.

The TPMS software can automatically detect, under all operating conditions, the following:

- one or more new tire pressure sensors have been fitted
- one or more tire pressure sensors have stopped transmitting
- TPMS software can reject identifications from tire pressure sensors which do not belong to the vehicle
- the spare wheel and one of the 'running' wheels on the vehicle have changed positions.

If a new tire pressure sensor is fitted on any 'running' wheel, the software can learn the new sensor identification automatically when the vehicle is driven for more than 15 minutes at a speed of more than 20 km/h (12.5 mph).

• NOTE: The spare wheel is not fitted with a tire pressure sensor.

TPMS Operation

Each time the vehicle is driven the TPMS software activates each initiator in turn to transmit a LF 125 KHz signal to each tire pressure sensor. The LF signal is received by the tire pressure sensor which responds by transmitting a 315 or 433 MHZ (depending on market) signal which is received by the RF receiver. The signal contains coded data which corresponds to sensor identification, air pressure, air temperature and acceleration data. This is then passed to the CJB on the ISO 9141 K Line.

If the vehicle has been parked for more than 15 minutes and then driven at a speed of more than 12.5 mph (20 km/h), the initiators each fire an LF signal in turn for 18 seconds in the following order:

- Front LH
- Front RH
- Rear RH
- Rear LH.

Each tire pressure sensor responds in turn which allows the TPMS software to establish the sensor positions at the start of the drive cycle. This process is repeated up to three times but less if the sensor positions are already known. The process is known as 'Auto Location' and takes 2 to 4 minutes to complete.

During this period the tire pressure sensors transmit at regular intervals, once every 5 seconds (once every 15 seconds on NAS vehicles). For the remainder of the drive cycle the tire pressure sensors transmit once every 60 seconds or more often if a change of tire pressure is sensed until the vehicle stops and the TPMS returns to the parking mode.

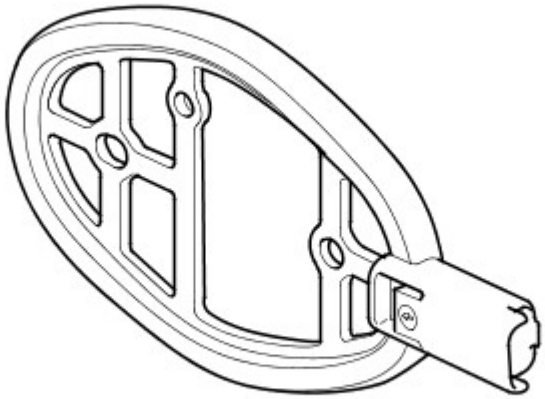
Once the wheel positions have been established, the initiators stop transmitting the LF signal and do not transmit again until the vehicle has been parked for more than 15 minutes.

The warning appears in the instrument cluster message centre when the inflation pressure has fallen to 25% of the nominal pressure. The displayed message will also include the position(s) of the affected wheel(s).

The TPMS enters 'Parking Mode' after the vehicle speed has been less than 20 km/h (12.5 mph) for 15 minutes. In parking mode the tire pressure sensors transmit a coded RF signal once every 13 hours. If the tire pressure decreases by more than 0.06 bar (1 lbf/in^2), the sensor will transmit more often if pressure in the tire is being lost.

The spare wheel tire pressure sensor also transmits a signal once every 13 hours in the same manner as the 'running wheels' when in parking mode. If the tire pressure decreases by more than 0.06 bar (1 lbf/in^2), the sensor will transmit more often if pressure in the tire is being lost.

Initiators



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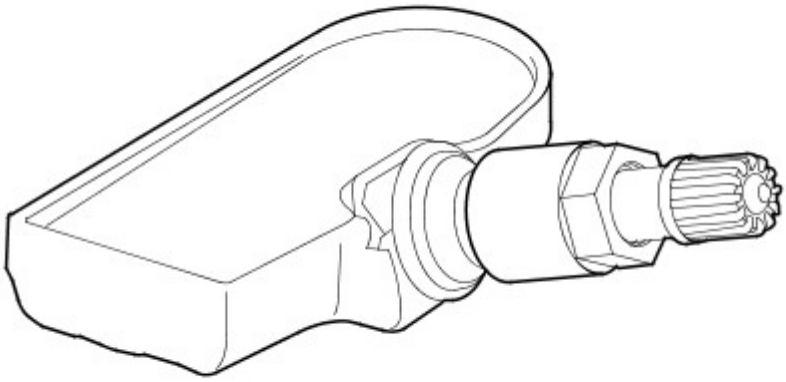
Four initiators are fitted to the vehicle. The front initiators are located near the front of the front wheel arches, behind the fender splash shields. The rear initiators are located at the rear of the rear wheel arches, behind the fender splash shields. Each initiator has a connector which connects to the vehicle body harness.

The initiator is a passive, LF transmitter. The initiators transmit their signals which are received by the tire pressure sensors, prompting them to modify their mode status.

The TPMS energises each initiator in turn using LF drivers. The corresponding tire pressure sensor detects the LF signal and responds by modifying the mode status within the RF transmission.

Tire Pressure Sensor



E45553

The TPMS uses active tire pressure sensors which are located on each wheel, inside the tire cavity. The sensor incorporates the tire valve and is secured in the wheel by a nut on the outside of the wheel. The sensor contains a Printed Circuit Board (PCB) which houses a Positive Temperature Co-efficient (PTC) sensor, a Piezo pressure sensor. a radio receiver and transmitter and a lithium battery.

The tire pressure sensors use the PTC sensor and the Piezo sensor to periodically measure the pressure and temperature of the air inside the tire. The data is transmitted by RF data signals at either 315 MHz or 433 MHz dependant on market requirements.

The RF transmission from the sensor contains a unique identification code in its transmission data. This allows the TPMS to identify the wheel on the vehicle. If the sensor is replaced on a 'running' wheel, the new sensor identification will be learnt when the vehicle is driven at speed of more than 20 km/h (12.5 mph) for 15 minutes.

If a new sensor is fitted to the spare wheel, the identification for that sensor can be programmed into the TPMS using IDS. The code is provided on a label with the complete tire, wheel and sensor assembly when new and is also printed on the casing of each sensor. Alternatively, the spare wheel may also be programmed to the TPMS by using it as a 'running' wheel for 15 minutes at a speed of more than 20 km/h (12.5 mph), then replacing it to the spare wheel location.

The tire pressure sensor can also detect when the wheel is rotating. In order to preserve battery power, the sensor uses different transmission rates when the wheel is stationary or moving. The wheel speed required to change from stationary to moving transmission rates is very low to allow for the requirement for slow off-road driving.

The care points detailed in 'Tire Changing' earlier in this section must be followed to avoid damage to the sensor. If a new sensor is fitted, a new nut, seal and washer must also be fitted and the sensor nut tightened to the correct torque as given in the Service Repair Manual.

Instrument Cluster Indications

Item	Part Number	Description
1	-	Low tire pressure warning indicator
2	-	Message centre

The warning indications to the driver are common on all vehicles fitted with TPMS. The driver is alerted to system warnings by a low tire pressure warning indicator in the instrument cluster and an applicable text message in the message centre.

The TPMS software within the CJB passes system status information to the instrument cluster on the medium speed CAN bus. The instrument cluster then converts this data into illumination of the warning indicator and display of an appropriate message.

When the ignition is switched on, the warning indicator is illuminated for 3 seconds for a bulb check.

• NOTE: If the vehicle is not fitted with the TPMS, the warning indicator will not illuminate.

The instrument cluster checks, within the 3 second bulb check period, for a CAN bus message from the TPMS. During this time the TPMS performs internal tests and CAN bus initialisation. The warning indicator will be extinguished if the TPMS software does not issue a fault message or tire pressure warning message.

If a TPMS fault warning message is detected by the instrument cluster at ignition on, the warning indicator will flash for 75 seconds after the 3 second bulb check period and then remain permanently illuminated.

If a tire pressure warning message is detected by the instrument cluster at ignition on, the warning indicator will extinguish briefly after the 3 second bulb check period, before re-illuminating to indicate a tire pressure warning.

The following table shows the warning indicator functionality for given events:

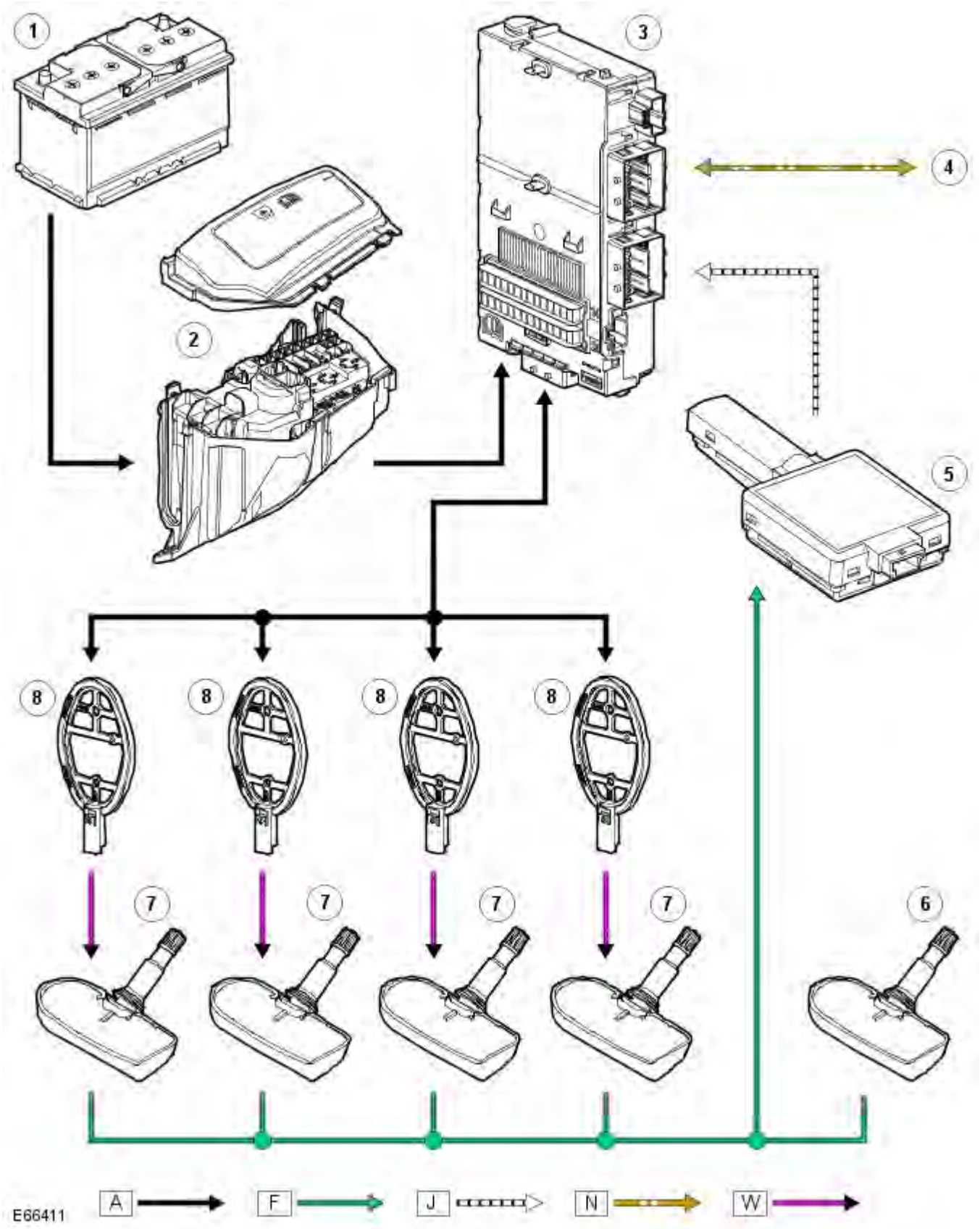
Event	Instrument Cluster Indications
Low pressure warning limit reached in high speed mode	Warning indicator illuminated. 'TYRE PRESSURES LOW FOR SPEED' message displayed.
Low pressure warning limit reached in one wheel in low speed mode	Warning indicator illuminated. 'CHECK ALL TYRE PRESSURES XX LOW' message displayed.
Low pressure warning limit reached in more than one wheel in low speed mode	Warning indicator illuminated. 'CHECK ALL TYRE PRESSURES' message displayed.
Warning limit reached in any 'running' wheel and no location specified by TPMS	Warning indicator illuminated. 'CHECK ALL TYRE PRESSURES' message displayed.
Warning limit reached in spare wheel (if fitted)	Warning indicator illuminated for 20 seconds and again at subsequent ignition cycles. 'CHECK SPARE TYRE PRESSURE' message displayed.
TPMS fault	Warning indicator flashing for 75 seconds and then remains permanently illuminated. 'TYRE PRESSURE MONITORING SYSTEM FAULT' message displayed.

Event	Instrument Cluster Indications
No transmission from a specific tire pressure sensor or Specific tyre pressure sensor fault	Warning indicator flashing for 75 seconds and then remains permanently illuminated. 'XX TYRE PRESSURE NOT MONITORED' message displayed for 20 seconds.
No transmission from more than one tyre pressure sensor or More than one tyre pressure sensor fault	Amber warning indicator flashing for 75 seconds and then remains permanently illuminated. 'TYRE PRESSURE MONITORING SYSTEM FAULT' message displayed for 20 seconds.
CAN signals missing	Warning indicator flashing for 75 seconds and then remains permanently illuminated. 'TYRE PRESSURE MONITORING SYSTEM FAULT' message is displayed for 20 seconds.

• NOTE: 'XX' is the tire position on the vehicle, for example Front Left, Front Right, Rear Left or Rear Right.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **F** = RF transmission; **J** = ISO 9141 K Line; **N** = CAN bus Medium speed; **W** = LF transmission



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box (BJB)
3	-	CJB
4	-	Medium speed CAN Bus to other vehicle systems
5	-	RF remote receiver
6	-	Spare wheel tire pressure sensor
7	-	Tire pressure sensor (4 off)
8	-	Initiator (4 off)

Published: 11-May-2011

Wheels and Tires - Wheels and Tires

Diagnosis and Testing

Principles of Operation

For a detailed description of the wheels and tires and Tire Pressure Monitoring System (TPMS), refer to the relevant Description and Operation section in the workshop manual.
REFER to: Wheels and Tires (204-04 Wheels and Tires, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for, obvious signs of damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Tire pressures • Tire/Wheel damage • Tire low pressure sensor installation/damage • Front initiator installation/damage • Rear initiator installation/damage	• Fuses • Central Junction Box (CJB) • Electrical connectors/harnesses • RF receiver (TPMS receiver)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

• NOTE: Tire Pressure Monitor System DTCs will be logged in the Central Junction Box (CJB).

DTC	Description	Possible Cause	Action
B118251	Tire Pressure Monitoring System (TPMS) - Not Programmed	• TPMS module in Transport/Factory mode	Enter TPMS module into customer mode using manufacturer approved diagnostic system
C1A5616	Front Left Wheel Module - circuit voltage below threshold (low battery)	• Siemens internal algorithm	Install a new module as required
C1A5686	Front Left Wheel Module - signal invalid (out of range)	• Siemens internal algorithm	Install a new module as required
C1A5693	Front Left Wheel Module - no operation (lost sensor)	• Siemens internal algorithm	Install a new module as required
C1A5711	Left Front Initiator - short to ground	• Left front initiator circuit - short to ground	Refer to electrical circuit diagrams and check left front initiator circuit for short to ground
C1A5712	Left Front Initiator - short to power	• Left front initiator circuit - short to power	Refer to electrical circuit diagrams and check left front initiator circuit for short to power
C1A5713	Left Front Initiator - open circuit	• Left front initiator circuit - open circuit	Refer to electrical circuit diagrams and check left front initiator circuit for open circuit
C1A5816	Front Right Wheel Module - circuit voltage below threshold (low battery)	• Siemens internal algorithm	Install a new module as required
C1A5886	Front Right Wheel Module - signal invalid (out of range)	• Siemens internal algorithm	Install a new module as required

DTC	Description	Possible Cause	Action
C1A5893	Front Right Wheel Module - no operation (lost sensor)	• Siemens internal algorithm	Install a new module as required
C1A5911	Right Front Initiator - short to ground	• Right front initiator circuit - short to ground	Refer to electrical circuit diagrams and check right front initiator circuit for short to ground
C1A5912	Right Front Initiator - short to power	• Right front initiator circuit - short to power	Refer to electrical circuit diagrams and check right front initiator circuit for short to power
C1A5913	Right Front Initiator - open circuit	• Right front initiator circuit - open circuit	Refer to electrical circuit diagrams and check right front initiator circuit for open circuit
C1A6016	Rear Left Wheel Module - circuit voltage below threshold (low battery)	• Siemens internal algorithm	Install a new module as required
C1A6086	Rear Left Wheel Module - signal invalid (out of range)	• Siemens internal algorithm	Install a new module as required
C1A6093	Rear Left Wheel Module - no operation (lost sensor)	• Siemens internal algorithm	Install a new module as required
C1A6111	Left Rear Initiator - short to ground	• Left rear initiator circuit - short to ground	Refer to electrical circuit diagrams and check left rear initiator circuit for short to ground
C1A6112	Left Rear Initiator - short to power	• Left rear initiator circuit - short to power	Refer to electrical circuit diagrams and check left rear initiator circuit for short to power
C1A6113	Left Rear Initiator - open circuit	• Left rear initiator circuit - open circuit	Refer to electrical circuit diagrams and check left rear initiator circuit for open circuit
C1A6216	Rear Right Wheel Module - circuit voltage below threshold (low battery)	• Siemens internal algorithm	Install a new module as required
C1A6286	Rear Right Wheel Module - signal invalid (out of range)	• Siemens internal algorithm	Install a new module as required
C1A6293	Rear Right Wheel Module - no operation (lost sensor)	• Siemens internal algorithm	Install a new module as required
C1A6311	Right Rear Initiator - short to ground	• Right rear initiator circuit - short to ground	Refer to electrical circuit diagrams and check right rear initiator circuit for short to ground
C1A6312	Right Rear Initiator - short to battery	• Right rear initiator circuit - short to power	Refer to electrical circuit diagrams and check right rear initiator circuit for short to power
C1A6313	Right Rear Initiator - open circuit	• Right rear initiator circuit - open circuit	Refer to electrical circuit diagrams and check right rear initiator circuit for open circuit
C1B1412	Sensor supply #1 - circuit short to power	• Sensor supply #1 circuit - short to power	Refer to electrical circuit diagrams and check sensor supply #1 circuit for short to power
C1D1800	Localisation failed	• Tire pressure monitor localisation failed	Check for additional related DTCs and refer to this DTC Index
C1D2105	Wheel module - general signal failure	• Siemens internal algorithm	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
U015500	Lost Communication With Instrument Panel Cluster (IPC) Control Module	• Lost communication with instrument cluster	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U016400	Lost Communication With HVAC Control Module	• Lost communication with climate control module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system

Published: 11-May-2011

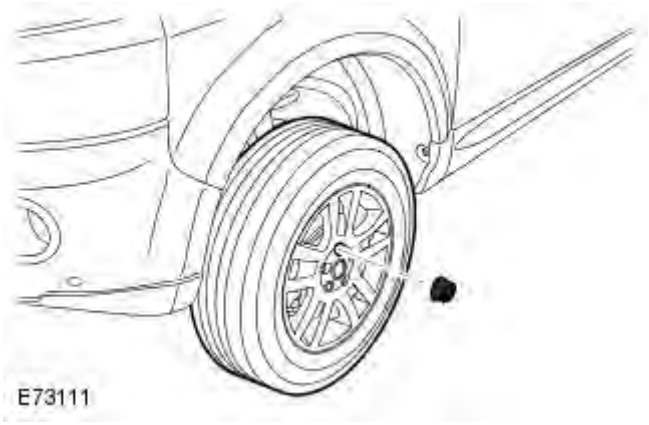
Wheels and Tires - Wheel and Tire

Removal and Installation

Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.



2.
   - Torque: 133 Nm (98 lb.ft).

Installation

1. **1.** CAUTION: Apply a small amount of grease to the hub and wheel mating surfaces before installation. Make sure the grease does not come into contact with the vehicles braking components and the wheel stud threads. Failure to follow these instructions may result in personal injury.

   To install, reverse the removal procedure.

Published: 11-May-2011

Wheels and Tires - Tire Low Pressure Sensor

Removal and Installation

Removal

WARNING: The valve seal and steel washer must be replaced each time a tire is changed to avoid seal failure. The seal and washer must be replaced if the sensor is removed. Removal of the sensor retaining nut must be regarded as sensor removal. The valve cap must always be in place except when inflating, releasing or checking pressure.

• NOTE: If the sensor is replaced on a 'running' wheel, the new sensor identification will be learnt when the vehicle is first driven. If a new sensor is installed to the spare wheel, the identification for that sensor must be programmed into the tire pressure monitoring system (TPMS) module using Land Rover approved diagnostic equipment. The identification code is provided on a label with the complete assembly and is also printed on the casing of each sensor.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

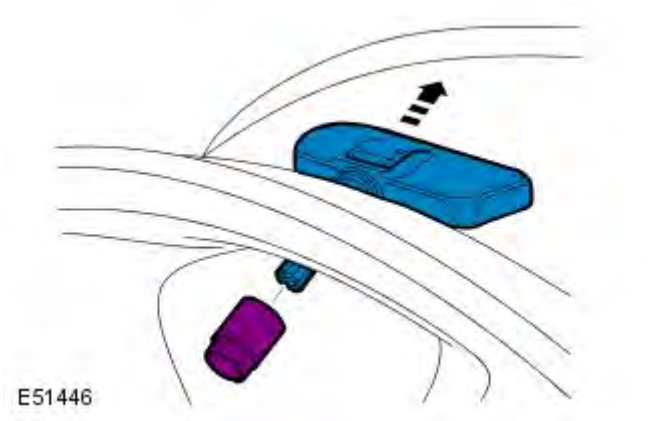
   Raise and support the vehicle.

2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. **3.** CAUTION: To avoid damage to the tire low pressure sensor, release the tire bead from the rim, 180 degrees from the valve.

   Remove the tire from the wheel.



4.
   - Remove and discard the nut.
   - Release and withdraw the sensor along the valve axis.

5. Remove and discard the seal and washer.

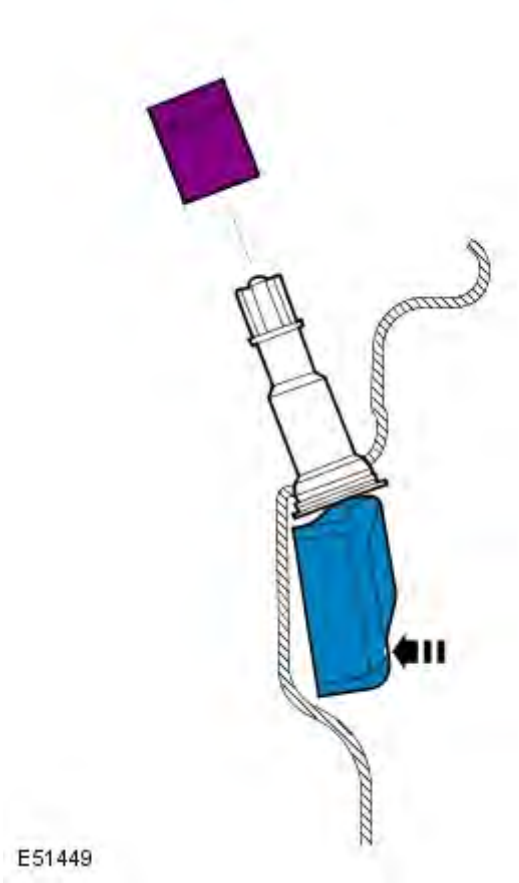
Installation

1. **1.** CAUTIONS:

Make sure that the component is clean, free of foreign material and lubricant.

Do not use compressed air to clean the sensor.

Install a new washer and seal, making sure the valve remains pressed fully onto its seat.



2. **2.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.
   - Install the tire low pressure sensor.
   - Install and hand tighten the nut whilst keeping the sensor in place.
   - Tighten the nut.

     Torque: 8 Nm

3. Install the tire and balance the wheel.

4. Install the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Wheels and Tires - Tire Pressure Monitoring System (TPMS) Receiver

Removal and Installation

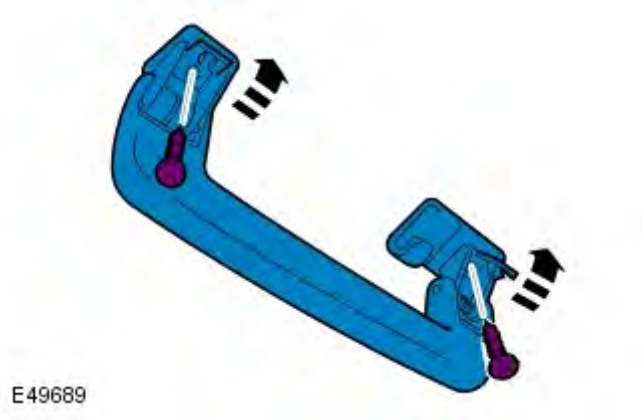
Removal

1. Remove both D-pillar upper trim panels.

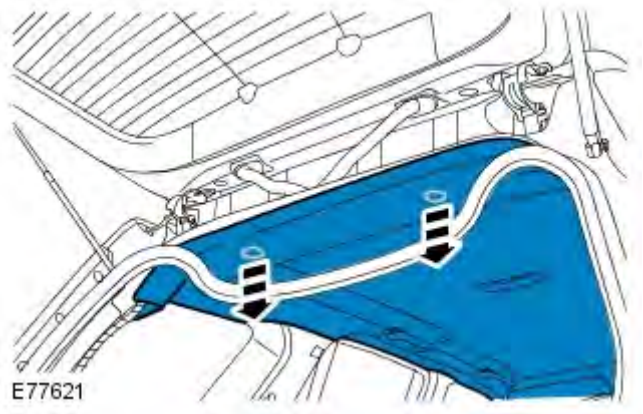
   Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove both C-pillar trim panels.

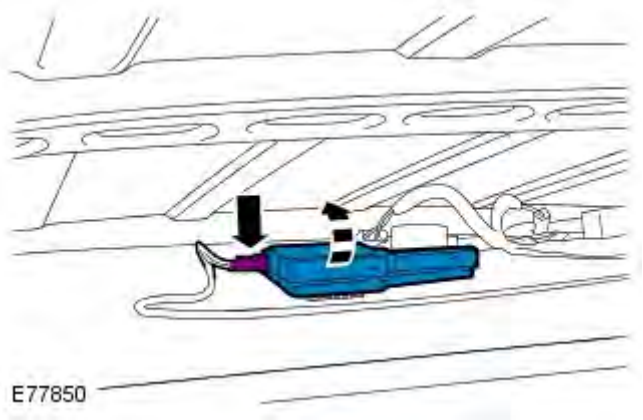
   Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. Remove both rear passenger assist handles.



4. Release the rear of the headliner.



5. Remove the tire pressure monitoring system receiver.

Installation

1. To install, reverse the removal procedure.

2. If a new component is to be installed, configure using IDS.

Published: 11-May-2011

Wheels and Tires - Tire Pressure Monitoring System (TPMS) Front Antenna

Removal and Installation

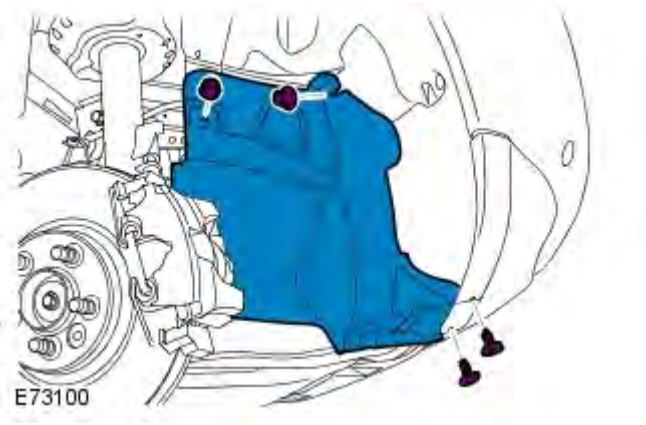
Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

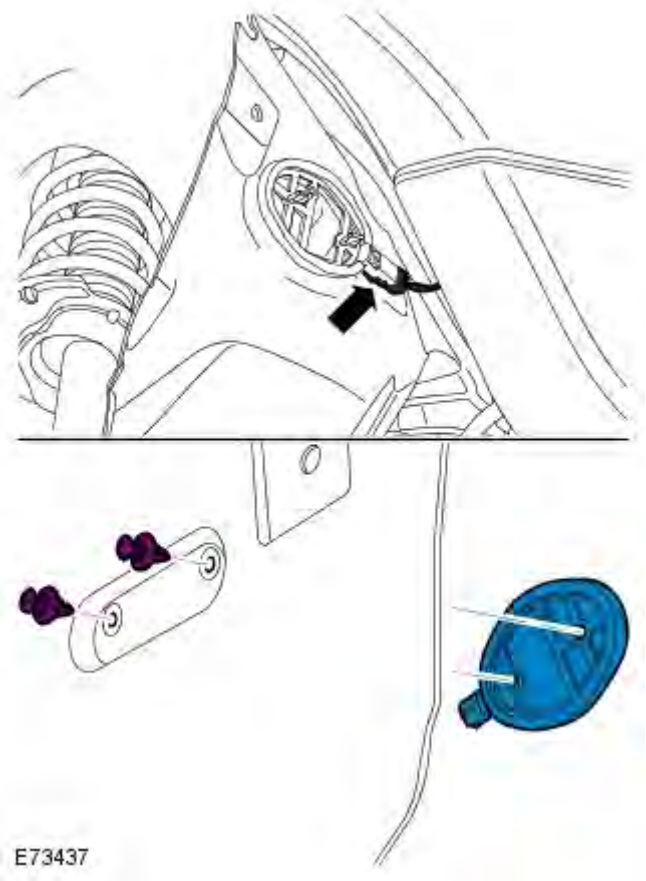
2. Remove the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



3. Remove the fender splash shield extension panel.

4. Release the front of the fender splash shield.



5. Remove the tire pressure antenna.

Installation

1. To install, reverse the removal procedure.
2. Initiate a new tire pressure antenna using WDS.

Published: 11-May-2011

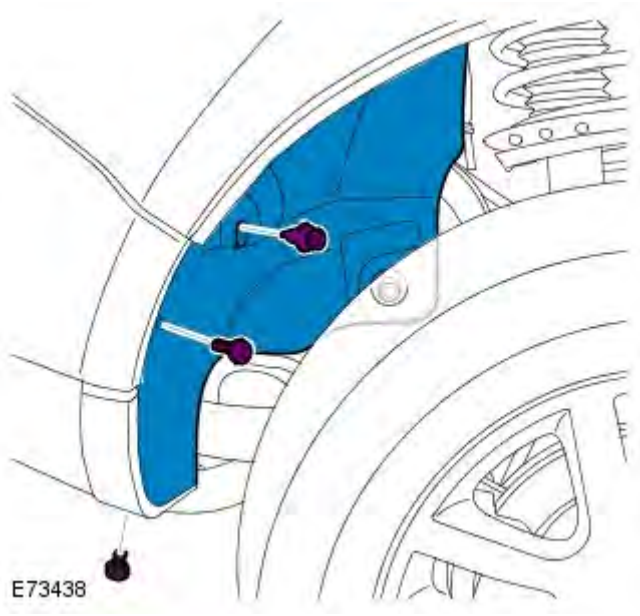
Wheels and Tires - Tire Pressure Monitoring System (TPMS) Rear Antenna

Removal and Installation

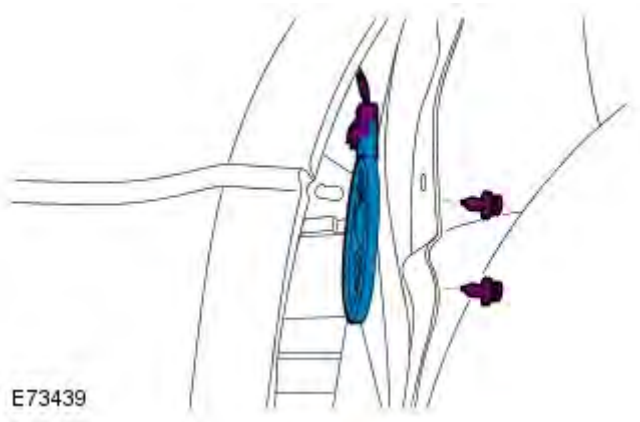
Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.



2. Release the fender splash shield.



3. Remove the tire pressure antenna.

Installation

1. To install, reverse the removal procedure.
2. Initiate a new tire pressure antenna using WDS.

Published: 11-May-2011

Vehicle Dynamic Suspension - Rear Suspension Height Sensor

Removal and Installation

Removal

- NOTE: This sensor is only fitted to vehicles with Xenon headlamps and is installed on the LH side of the vehicle.
- NOTE: Removal steps in this procedure may contain installation details.

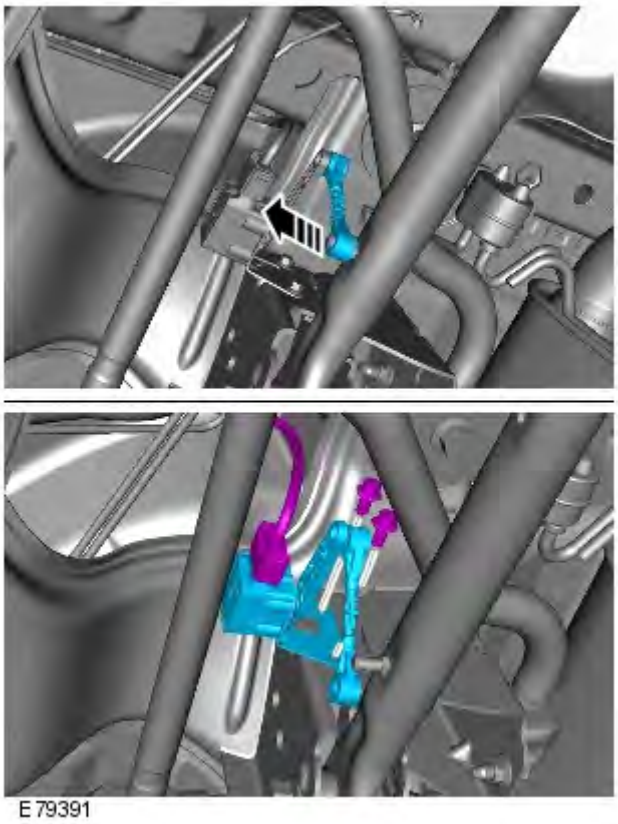
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

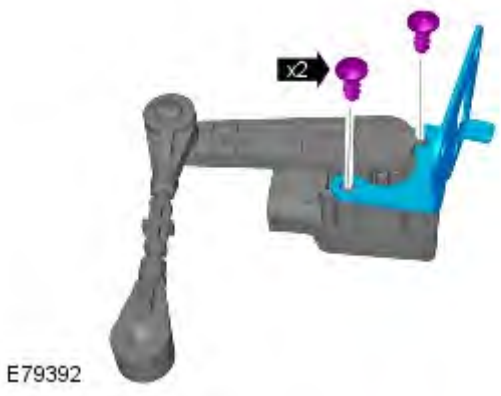
2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. *Torque:* 10 Nm



4.



Installation

1. To install, reverse the removal procedure.

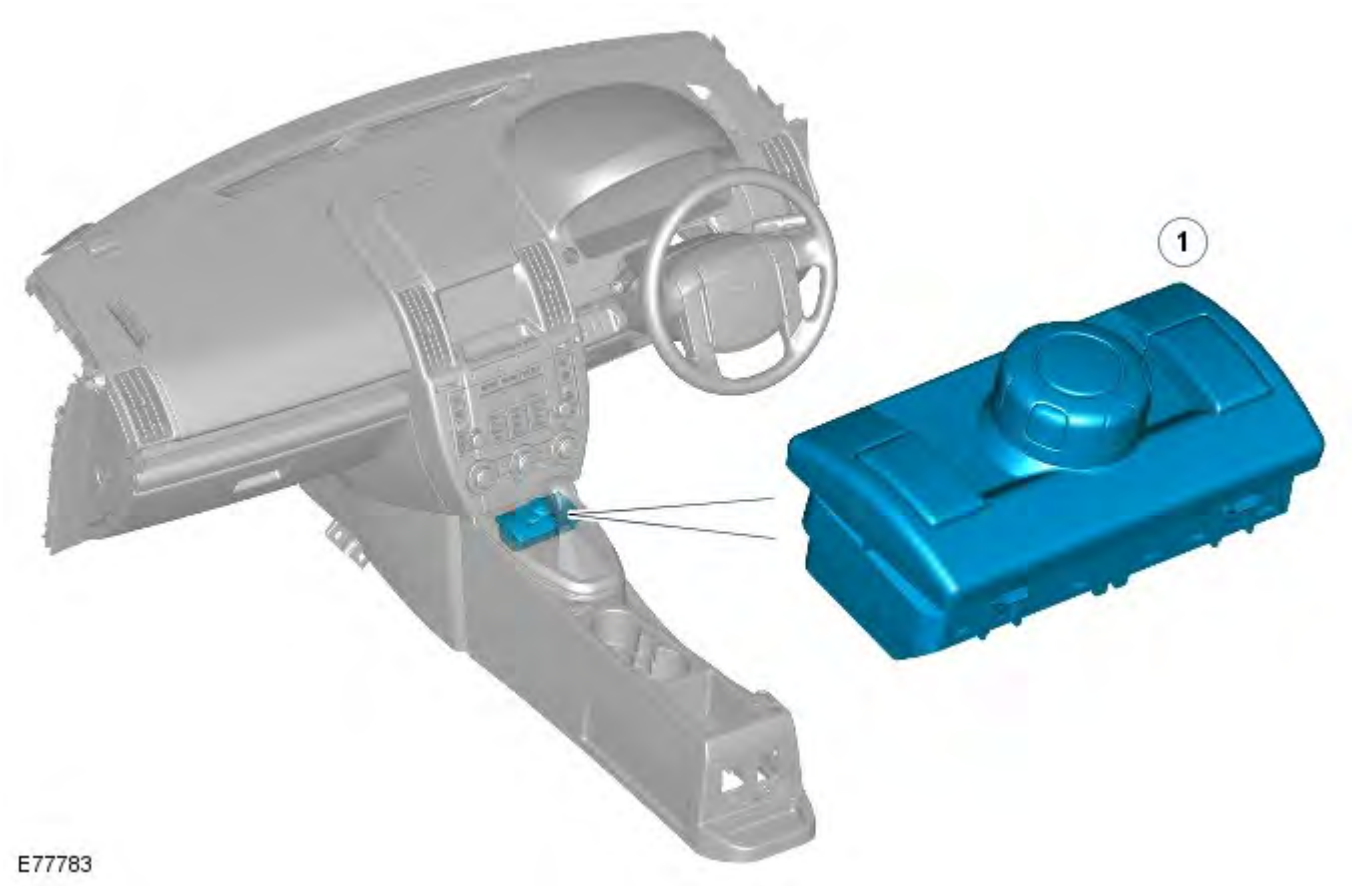
2. Using Land Rover approved diagnostic equipment, calibrate the sensor.

Published: 11-May-2011

Ride and Handling Optimization - Ride and Handling Optimization

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Terrain Response rotary control

OVERVIEW

The Terrain Response™ system allows the driver to select a program which aims to provide the optimum settings for traction and performance for the prevailing terrain conditions. The system cannot be switched off. 'Special Programs off' is the default program and covers all general driving conditions. Three specific terrain programs are selectable to cover all terrain surfaces.

The system is controlled by a rotary control located on the center console, forward of the transmission selector lever. The rotary control allows the selection of one of the following 4 programs:

- Special programs off
- Grass/Gravel/Snow
- Mud/Ruts
- Sand.

The rotary control can be rotated through 360 degrees or more in either direction and selects each program in turn. When Terrain Response is fitted to a vehicle, a hi-line instrument cluster will also be fitted which will display the selected program in the message center.

The Terrain Response system uses a combination of a number of vehicle sub-systems to achieve the required vehicle characteristics for the terrain selected. The following sub-systems are used in the Terrain Response system:

- Engine management system
- Automatic transmission (if fitted)
- Active on-demand coupling
- Brake system (ABS/DSC/ETC/HDC functions).

The rotary control switch pack also contains the Terrain Response control module. The control module detects the selection made on the rotary control and transmits a signal on the high speed Controller Area Network (CAN) bus which is received by each of the sub-system control modules. Each of the affected control modules contain software which applies the correct operating parameters to their controlled system for the Terrain Response program selection made. They also provide feedback for the selected program so that the Terrain Response control module can check that all systems have changed to the correct operating parameters.

Information is displayed in the instrument cluster message center which informs the driver of improvements which can be made to the vehicle operating parameters to optimize the vehicle for the prevailing conditions.

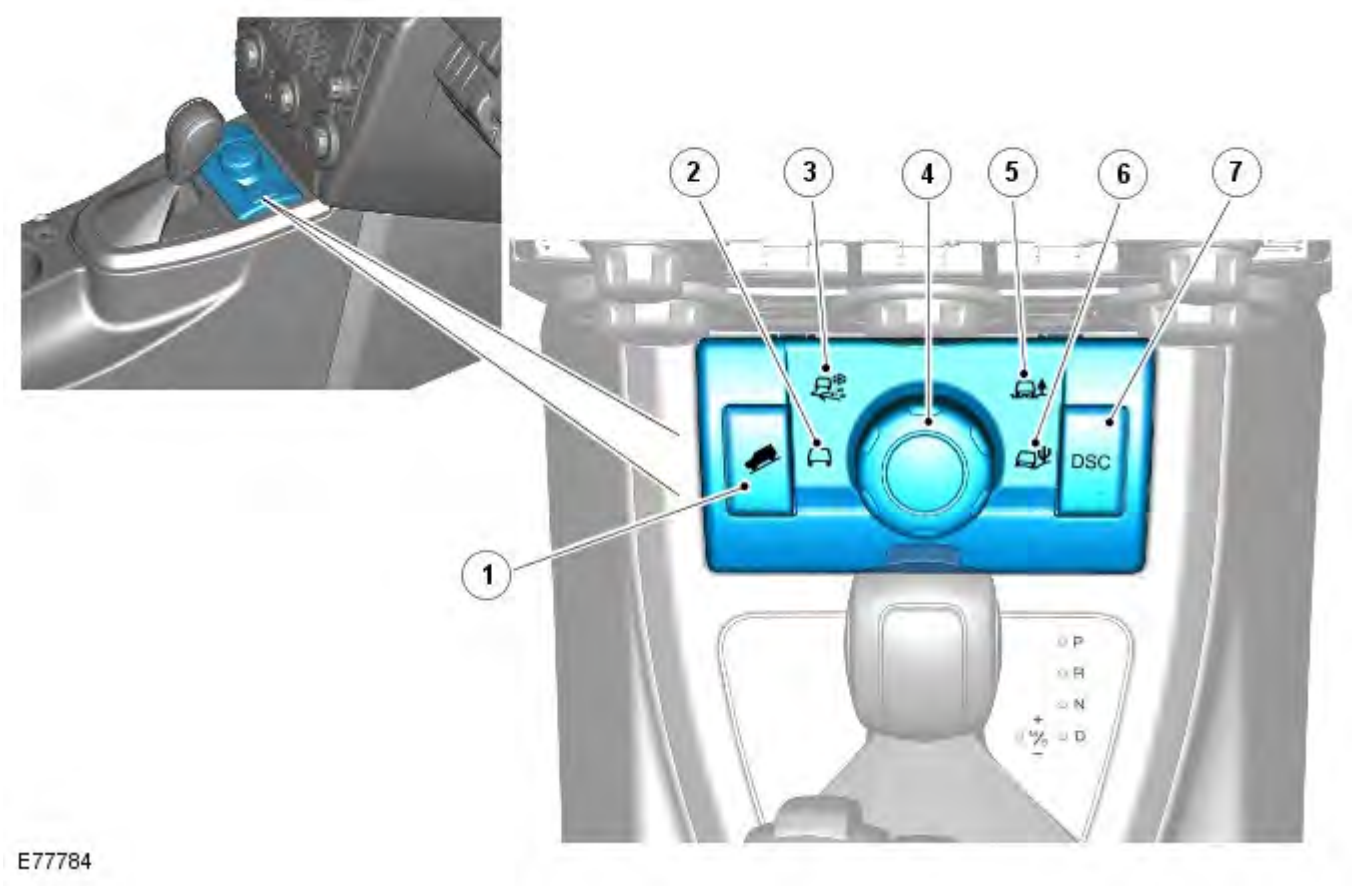
Inexperienced off-road drivers may benefit from the automatic assistance of the Terrain Response system and the driver information. Experienced off-road drivers can select the specific programs for extreme conditions to access control over the vehicle systems (for example; accelerator pedal maps, transmission shift maps, traction settings) which are not accessible on vehicles without Terrain Response.

Stop/Start Vehicles - From 2010 MY

Activation of the Terrain Response special programs will deactivate the Stop/Start system.

However, if Terrain Response is activated when the engine is shutdown in a Stop/Start cycle the engine will automatically restart. If during this event the Stop/Start system cannot detect the driver's occupancy, for example either the driver's safety belt or door is unlatched, the engine will not restart. The Stop/Start system will request the driver to depress the clutch to restart the engine. The driver will be informed of this by 'RESTART REQUIRED PRESS CLUTCH' being displayed in the message center.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

TERRAIN RESPONSE ROTARY CONTROL AND MODULE



Item	Part Number	Description
1	-	Hill Descent Control (HDC) switch
2	-	Special programs off
3	-	Grass/Gravel/Snow program
4	-	Rotary control
5	-	Mud/ruts program
6	-	Sand program
7	-	Dynamic Stability Control (DSC) switch

Each program is denoted by a symbol which represents the terrain encountered. The rotary control will only select the last program in its direction of rotation. Further rotation of the control in either direction, once the last program has been selected, will have no effect, for example; once 'Sand' has been selected, further rotation in a clockwise direction will retain 'Sand'.

The control module and rotary control is connected via a harness connector which also contains the wiring for the HDC and DSC switches and the illumination circuits. The control module and rotary control uses 4 of these wires for 12V battery supply (ignition - only when the ignition is on) a ground and high speed CAN bus (positive and negative).

PRINCIPLES OF OPERATION

The following vehicle sub-system control modules are used for the Terrain Response system:

- Engine management - Engine Control Module (ECM)
- Transmission control - Transmission Control Module (TCM) (automatic transmission only)
- Active on-demand coupling control module
- Brake system - Anti-lock Brake System (ABS)/Dynamic Stability Control (DSC)/Electronic Traction Control (ETC)/ Hill Descent Control (HDC) - ABS module

Each sub-system operates in different ways in relation to the selected Terrain Response program to achieve the optimum traction, stability and ease of control for the terrain encountered.

Engine Management System (EMS)

The EMS can change the accelerator pedal maps to change the amount of torque per percentage of pedal travel.

Each terrain program uses a combination of operating parameters for each sub-system. Changing between terrain programs initiates a different set of operating characteristics which will be noticeable to the driver, for example; if the accelerator pedal is held in a constant position and the terrain program is changed from Grass/Gravel/Snow to Sand, the driver will notice the torque and engine speed increase. If the terrain program is changed from Sand to Grass/Gravel/Snow, the driver will notice a reduction in torque and engine speed.

• NOTE: The change in torque and engine speed can take approximately 30 seconds and care must be taken not to confuse the Terrain Response system operation with an EMS fault.

Transmission Control (Automatic transmission only)

The transmission control module changes the shift maps for the Terrain Response program selected. This changes the shift points providing early or late upshifts and downshifts.

For example, in the Grass/Gravel/Snow program, the transmission will perform early upshifts and very late downshifts to ensure the transmission is in the highest gear possible. The hill detection function of the Transmission Control module (TCM) will lock the torque converter and hold whichever gear is selected to the engine speed (RPM) limit if necessary when descending a steep incline. This provides maximum engine braking before the driver needs to apply the brakes.

Sport mode is only available when the general program is selected. Sport mode is disabled in all Terrain Response special programs. 'CommandShift™' is available in any program.

Active On-Demand Coupling Control

The active on-demand coupling control module has 2 operating strategies; pre-emptive and reactive.

The pre-emptive strategy anticipates and predicts the locking torque value required to minimize slip and maximize stability. Each Terrain Response program has a different threshold and input criteria for the pre-emptive strategy. For example, a higher locking torque would be applied on slippery surfaces.

The reactive strategy varies the amount of locking torque in response to the actual slip level and the dynamic behavior of the vehicle. Each Terrain Response program has a different threshold and input for the reactive strategy. The reactive strategy improves vehicle traction and composure by eliminating any wheel spin which has occurred after the pre-emptive strategy was applied. The locking response applied is applicable to the terrain program selected. For example, very sensitive on slippery surfaces to provide maximum traction and minimize surface damage.

The locking torque calculations use various signals from other sub-systems, for example, engine torque, accelerator pedal position, selected gear, steering angle, vehicle speed, lateral acceleration, yaw behavior.

The DSC function of the ABS system can override the active on-demand coupling control and reduce any applied locking torque during DSC action.

ABS System Control

The ABS module controls several functions and adjusts the operating parameters of these functions to optimize the selected Terrain Response program.

Traction Control

Traction control uses different slip/acceleration thresholds to improve traction and vehicle composure. For example, the system sensitivity is increased on slippery surfaces such as wet grass or snow to reduce wheel spin. If wheel spin was allowed in these circumstances, loss of traction may result from surface damage (wet grass) or the car being unable to move (snow) due to wheel spin.

Dynamic Stability Control

If DSC is switched off (with the DSC switch adjacent to the Terrain Response rotary control) when using a Terrain Response special program, if the special program is subsequently changed for a different program, DSC is automatically switched back on.

The DSC uses different threshold values for the selected program to automatically reduce DSC intervention, removing the requirement for the driver to disable the DSC system in order to reduce engine intervention which is sometimes induced in extreme off-road conditions. In extreme sand conditions, there may be an additional benefit of disabling the DSC function using the DSC switch in addition to selecting the sand program.

In the Mud/Ruts program the DSC system is calibrated to tolerate a higher 'yaw' threshold. This allows a greater differential between the actual and desired wheel turning behavior before DSC intervenes. This allows the DSC system to ignore the effect of ruts 'jarring' the car or adjusting the front wheel steering angle.

The Terrain Response system can alter the balance between engine and brake intervention. For example, when the sand program is selected, the DSC system reduces its reliance on engine intervention and increases the use of brake intervention to maintain the vehicles momentum and prevent it from becoming bogged down if wheel slip is detected.

Hill Descent Control

HDC is automatically switched on or off and target speeds are adjusted in response to the Terrain Response program selected. The responsiveness of the HDC function is also increased where required.

Automatic operation of HDC aims to assist the driver by switching the system on or off when it is of most benefit. HDC is only automatically switched on when the mud/ruts program is selected. HDC is not automatically selected in other

programs.

Incorrect Program Usage

Selection of an inappropriate program is discouraged in the following ways:

- The active program icon is continually displayed in the instrument cluster message center
- The Terrain Response control module 'locks' out certain functions in some programs, for example:
  - cruise control is only available with the special programs off or grass/gravel/snow program
  - transmission 'Sport' mode is deactivated in all special programs.
- When the ignition has been in the off mode, continually for more than 6 hours, the Terrain Response system defaults to the special programs off.

Selection of an inappropriate program for the terrain conditions will not endanger the driver or cause damage to the vehicle. Continued use of an inappropriate program may reduce the life of some components. The driver may notice reduced vehicle response, with the engine and transmission being less responsive than in special programs off. Also, in some programs, HDC will remain on, signified by illumination of the HDC indicator in the instrument cluster. The driver may also notice torque 'wind-up' in the active on-demand coupling causing a braking effect when the vehicle is manoeuvred in some special programs.

Driver Information

The high-line instrument cluster fitted to all vehicles with Terrain Response, contains a message center which displays vehicle information to the driver. The message center contains the Terrain Response program icons which display the currently selected program. If no symbol is displayed, no special program is selected and the system is in 'Special programs off'.

Any required changes to the sub-systems are also passed to the driver in the form of indicator illumination in the instrument cluster or appropriate messages in the message center, 'HDC OFF' for example.

In certain operating conditions, the Terrain Response system also displays advice or warning messages to ensure the driver is using the vehicle to its full potential, for example, steering angle is displayed in the message center to avoid driving in deep ruts with steering lock applied.

DIAGNOSTICS

The Terrain Response control module stores information on detected Terrain Response faults and CAN errors which can be interrogated using IDS. The Terrain Response sub-systems and the instrument cluster also store information relating to CAN errors from the Terrain Response control module.

The control module also stores the miles traveled and time elapsed for the individual programs which can also be retrieved using IDS. This information aids diagnosis of the Terrain Response system and also provides an indication of Terrain Response system abuse by the driver which can lead to premature component failure.

This information can also be used to check customer concerns, for example, high fuel consumption which may be due to continued use of a certain program.

Terrain Response System Fault Diagnosis

Terrain Response relies on the correct functionality of the 4 sub-systems. If one of the sub-systems develops a fault, the Terrain Response system will not function, even though the fault is **NOT** in the Terrain Response system.

The Terrain Response control module and rotary control should only be investigated if there are no apparent faults in any of the sub-systems. If a fault in a sub-system is subsequently corrected, the Terrain Response system will function normally after an ignition mode 1 and 2 (on and off) cycle.

Terrain Response Sub-System Faults

When a fault occurs in a sub-system, the driver is alerted by the illumination of a warning indicator and/or an appropriate message for that sub-system in the instrument cluster message center. There will be no warning of a Terrain Response system fault.

When a sub-system fault is present and the driver attempts to select a different Terrain Response program using the rotary control or at the next ignition mode 2 (on) cycle, a message 'SYSTEM FAULT SPECIAL PROGRAMS NOT AVAILABLE' will appear in the message center. This implies that the Terrain Response system has a fault, but **only because a sub-system fault is preventing its operation**. This message will be displayed for 5 seconds per ignition mode 2 cycle, but is repeated if a further selection is made by the driver using the Terrain Response rotary control or at the next ignition mode 2 (on) cycle.

• NOTE: The message 'SYSTEM FAULT SPECIAL PROGRAMS NOT AVAILABLE' can also be generated by a fault in the Terrain Response rotary control or control module. Refer to the following information for details of rotary control or control module faults.

It is not possible for the Terrain Response control module to cause any fault behavior (warning indicator illumination or message generation) in any of the 4 sub-systems. Illumination of a sub-system warning indicator and/or a sub-system related message will **NEVER** be associated with a Terrain Response control module or Terrain Response system fault.

The sub-system control modules can detect a fault with the CAN signal from the Terrain Response control module. If a fault in the Terrain Response system is detected, the sub-system control modules will operate in the 'Special programs off' setting. The sub-system control modules will record a fault code for a failure of the Terrain Response CAN signal. These faults can be retrieved using IDS and will provide useful information to indicate investigation of the Terrain Response control module or the CAN network.

Terrain Response Rotary Control or Control Module Fault

If a fault occurs in the Terrain Response rotary control, all rotary control icon amber Light Emitting Diodes (LED's) will be turned off and rotation of the rotary control is ignored. The instrument cluster message center will display a message 'SYSTEM FAULT SPECIAL PROGRAMS NOT AVAILABLE' when the fault occurs, if the fault is present and the driver attempts to select a special program (if the control module is able to do this) or at the next ignition mode 2 (on) cycle.

The Terrain Response rotary control and the control module are an integral unit. If a fault occurs in either component, the whole unit will require replacement. **ENSURE THAT THE FAULT IS WITH THE TERRAIN RESPONSE CONTROL MODULE AND NOT IN A SUB-SYSTEM MODULE BEFORE REPLACING THE MODULE.**

If a CAN fault exists and prevents Terrain Response system operation, all of the Terrain Response rotary control icon LED's will be illuminated and rotation of the rotary control is ignored.

If the instrument cluster does not receive a Terrain Response system CAN message from the Terrain Response control module, the message 'SYSTEM FAULT SPECIAL PROGRAMS NOT AVAILABLE' will be displayed when the fault occurs and will be repeated at every ignition mode 2 (on) cycle.

User Error

The following incorrect usage of the system may be misinterpreted as a system fault:

- Engine not running - Program changes and driver advisory messages are only available with the engine running
- Special program change attempted with DSC or ABS active (this includes ABS cycling which is operational when HDC is being used on slippery or loose surfaces)
- Special program change attempted with overheat condition present on the active on-demand coupling.

Published: 11-May-2011

Ride and Handling Optimization - Ride and Handling Optimization

Diagnosis and Testing

Principles of Operation

For a detailed description of the Terrain Response system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Ride and Handling Optimization (204-06 Ride and Handling Optimization, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• * Tire condition, pressures, etc • Driveline, Engine, Transmission, Suspension, components (correct installation, damage, etc)	• Fuses • Harnesses/Connectors • Terrain response module • Engine Control Module (ECM) • Transmission Control Module (TCM) • Anti-Lock Brake System control module • Active On-demand control module • Dynamic suspension control module * Controller area network (CAN) circuits

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module/transmission is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/transmission.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Terrain Response Control Module (ATCM) (100-00 General Information, Description and Operation).

Published: 11-May-2011

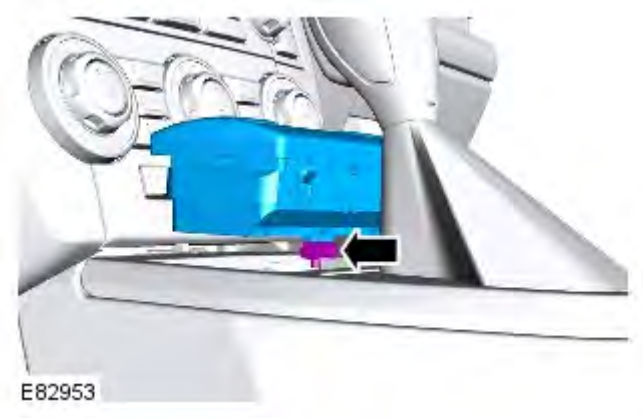
Ride and Handling Optimization - Ride and Handling Optimization Switch

Removal and Installation

Removal

1.

2.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Driveline System - General Information - Driveline System

Diagnosis and Testing

Principles of Operation

For a detailed description of the driveline systems, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Driveshaft (205-01 Driveshaft, Description and Operation),
Universal Joints (205-01 Driveshaft, Description and Operation),
Rear Drive Axle and Differential (205-02 Rear Drive Axle/Differential, Description and Operation),
Front Drive Axle and Differential (205-03 Front Drive Axle/Differential, Description and Operation),
Front Drive Halfshafts (205-04 Front Drive Halfshafts, Description and Operation),
Rear Drive Halfshafts (205-05 Rear Drive Halfshafts, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• NOTE: Certain driveline symptoms are also common to the engine, transmission, wheel bearings, tires, and other parts of the vehicle. For this reason, ensure that the cause of the trouble is in the driveline before adjusting, repairing, or installing any new components.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for system integrity and obvious signs damage.
3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

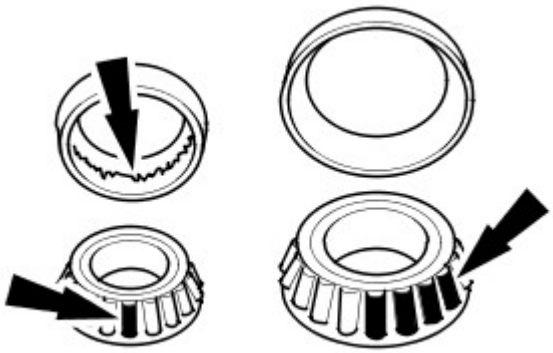
Identify the Condition

Gear Howl and Whine

Howling or whining of the ring gear and pinion is due to an incorrect gear pattern, gear damage or incorrect bearing preload.

Bearing Whine

Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by worn/damaged pinion bearings, which are operating at driveshaft speed. Bearing noise occurs at all driving speeds. This distinguishes it from gear whine which is speed dependent.



ELE0012864

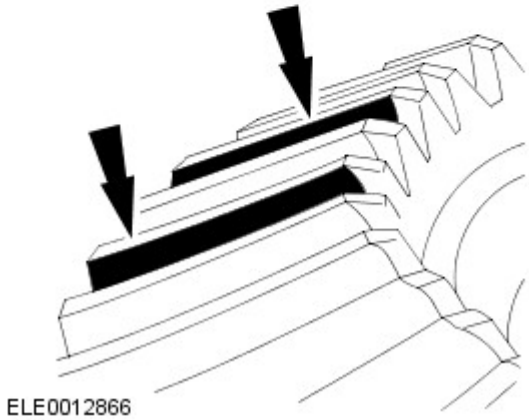
As noted, pinion bearings make a high-pitched, whistling noise, usually at all speeds. If however there is only one pinion bearing that is worn/damaged, the noise may vary in different driving phases.

A wheel bearing noise can be mistaken for a pinion bearing noise.

Chuckle

Chuckle that occurs on the coast driving phase is usually caused by excessive clearance between the differential gear hub and the differential case bore.

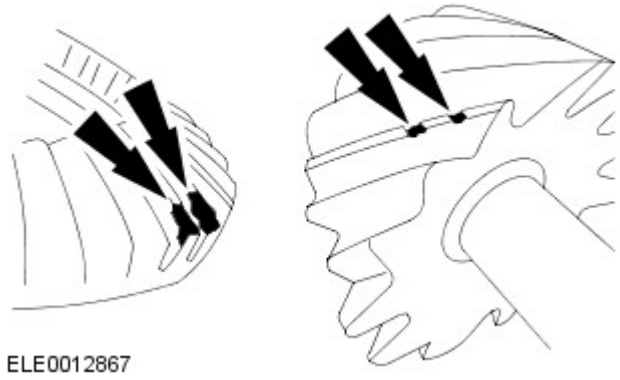
Damage to a gear tooth on the coast side can cause a noise identical to a chuckle. A very small tooth nick or ridge on the edge of a tooth can cause the noise.



ELE0012866

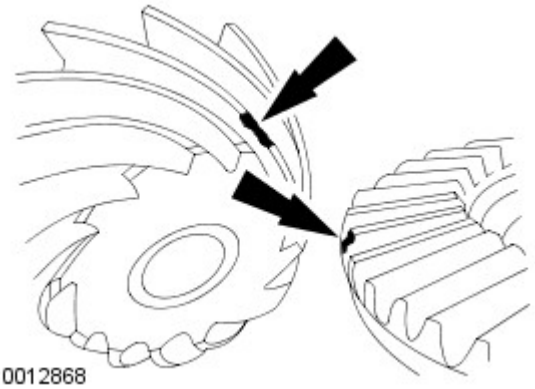
Knock

Knock, which can occur on all driving phases, has several causes including damaged teeth or gearset.



ELE0012867

A gear tooth damaged on the drive side is a common cause of the knock.



ELE0012868

Clunk

Clunk is a metallic noise heard when the automatic transmission is engaged in REVERSE or DRIVE. The noise may also occur when the throttle is applied or released. Clunk is caused by transmission calibration, backlash in the driveline or loose suspension components and is felt or heard in the vicinity of the rear drive axle.

Bearing Rumble

Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a worn/damaged wheel bearing. The lower pitch is because the wheel bearing turns at only about one-third of the driveshaft speed. Wheel bearing noise also may be high-pitched, similar to gear noise, but will be evident in all four driving modes.

Symptom Chart

Symptom	Possible Cause	Action
Noise is at constant tone over a narrow vehicle speed range. Usually heard on light drive and coast conditions	• Rear drive axle	• For additional information. GO to Pinpoint Test A.
Noise is the same on drive or coast	• Road noise • Worn or damaged driveshaft joint • Driveshaft center bearing • Wheel bearing	• Normal condition (road noise) • Check and install new components a required. REFER to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation), Rear Wheel Bearing (204-02 Rear Suspension, Removal and Installation), Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).
Noise is produced with the vehicle stationary and when driving	• Engine • Transmission	• For additional information. REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing), Diagnostics (307-01 Automatic Transmission/Transaxle, Diagnosis and Testing).
Loud clunk in the driveline when shifting from reverse to forward	• Transmission calibration • Transmission Mount • Transmission • Suspension components • Backlash in the driveline • Engine idle speed set too high • Engine mount	• Using the manufacturer approved diagnostic system, re-configure the Transmission Control Module (TCM) with the latest available calibration • Inspect and install new transmission mounts as required • For transmission diagnostics. REFER to: Diagnostics (307-01 Automatic Transmission/Transaxle, Diagnosis and Testing). • Inspect and install new suspension components as required • Inspect and install new driveline components as required • Check and adjust the idle speed as required • Inspect and install new engine mounts as required
Clicking, popping, or grinding noises	• Inadequate or contaminated lubrication in the front/rear drive halfshaft constant velocity (CV) joint • Another component contacting the front/rear drive halfshaft • Wheel bearings, brakes or suspension components	• Inspect, clean and lubricate with new grease as required • Ensure all other components are clear from front/rear drive halfshaft • Inspect and install new components as required
Vibration at highway speeds	• Out of balance wheel(s) or tire(s) • Driveshaft misaligned/out of balance • Driveshaft center bearing touching body mounting point	• Balance and install new wheel(s) and tire(s) as required. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation). • Check driveshaft alignment. Check driveshaft balance using manufacturer approved diagnostic system • Check driveshaft alignment
Shudder, Vibration During Acceleration	• Powertrain/driveline misalignment • High constant velocity (CV) joint operating angles caused by incorrect ride height	• Check for powertrain/driveline misalignment and rectify as required. Install new components as required • Check the ride height and verify the correct spring rate. Install new components as required
Lubricant Leak	• Rear drive axle breather • Damaged seal • Rear drive axle filler plug • Rear drive axle cover/active on-demand coupling joint	• Check oil level and correct as necessary • Install new driveshaft/pinion seal as required. REFER to: Active On-Demand Coupling Drive Pinion Seal (205-02 Rear Drive Axle/Differential, Removal and Installation). • Check and install new filler plug as required • Re-seal leaking joints as required

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Rear Differential Control Module (RDCM) (100-00 General Information, Description and Operation).

Pinpoint Tests

PINPOINT TEST A : EXCESSIVE DRIVELINE NOISE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK NOISE FROM VEHICLE ON ROAD TEST	
	1 Road test vehicle to determine load and speed conditions when noise occurs.
	2 Assess the noise with different gears selected.
	Does the noise occur in different gears at the same vehicle speed? **Yes** INSTALL a new rear drive axle/differential assembly. REFER to: Differential Case (205-02 Rear Drive Axle/Differential, Removal and Installation). RE-TEST the system for normal operation. **No** REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing) / Diagnostics (307-01 Automatic Transmission/Transaxle, Diagnosis and Testing).

Published: 11-May-2011

Driveshaft -

General Specification

Item	Specification
Type	Three piece driveshaft, incorporating centre bearings, CV joints, a swaged front section, and long plunge double offset joint at the rear of the front section
Fixed constant velocity joint	Front
Plunging constant velocity joint	Rear
Long plunge double offset joint	Rear of front section

Torque Specifications

Description	Nm	lb-ft
CV joint support bracket bolts to floor	25	18
Driveshaft to power transfer unit Torx bolts*	40	30
Driveshaft to rear differential pinion flange Torx bolts*	40	30
CV joint support bracket bolts to to CV joint	24	18

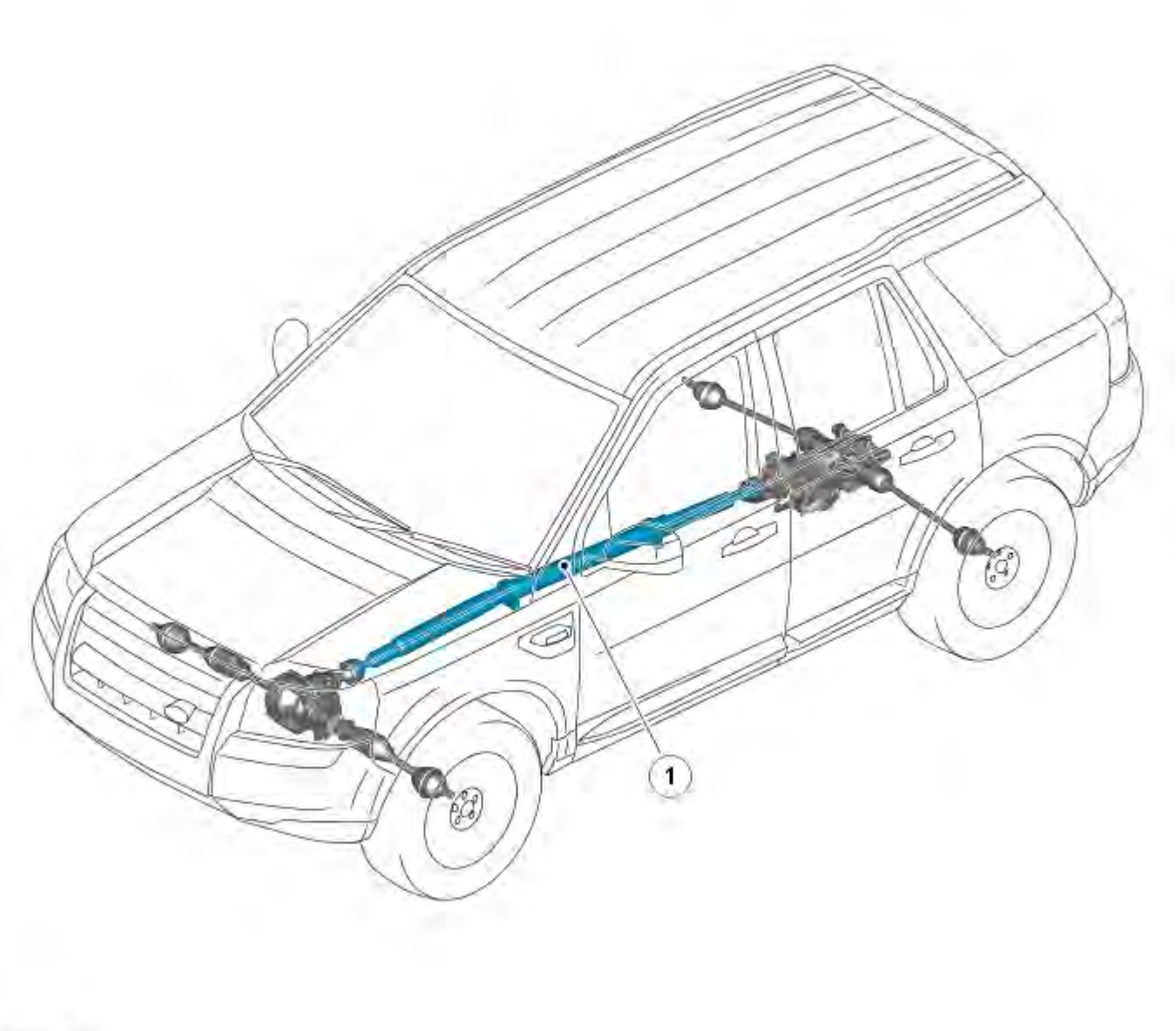
*** New nuts/bolts must be fitted**

Published: 11-May-2011

Driveshaft - Driveshaft

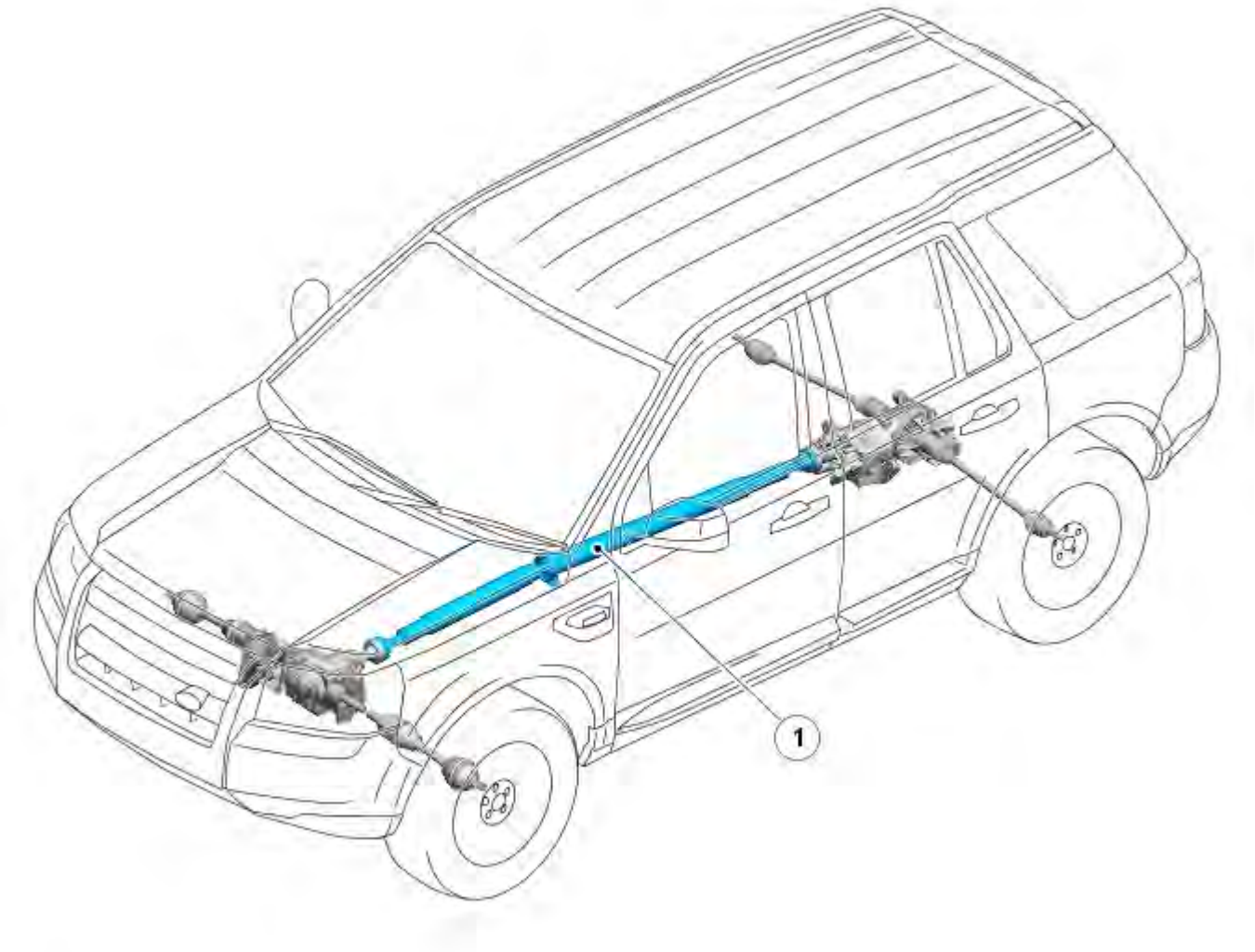
Description and Operation

COMPONENT LOCATION - TD4 MANUAL AND SI6 (UP TO VIN 180237) AND TD4 AUTO.



Item	Part Number	Description
1	-	Driveshaft

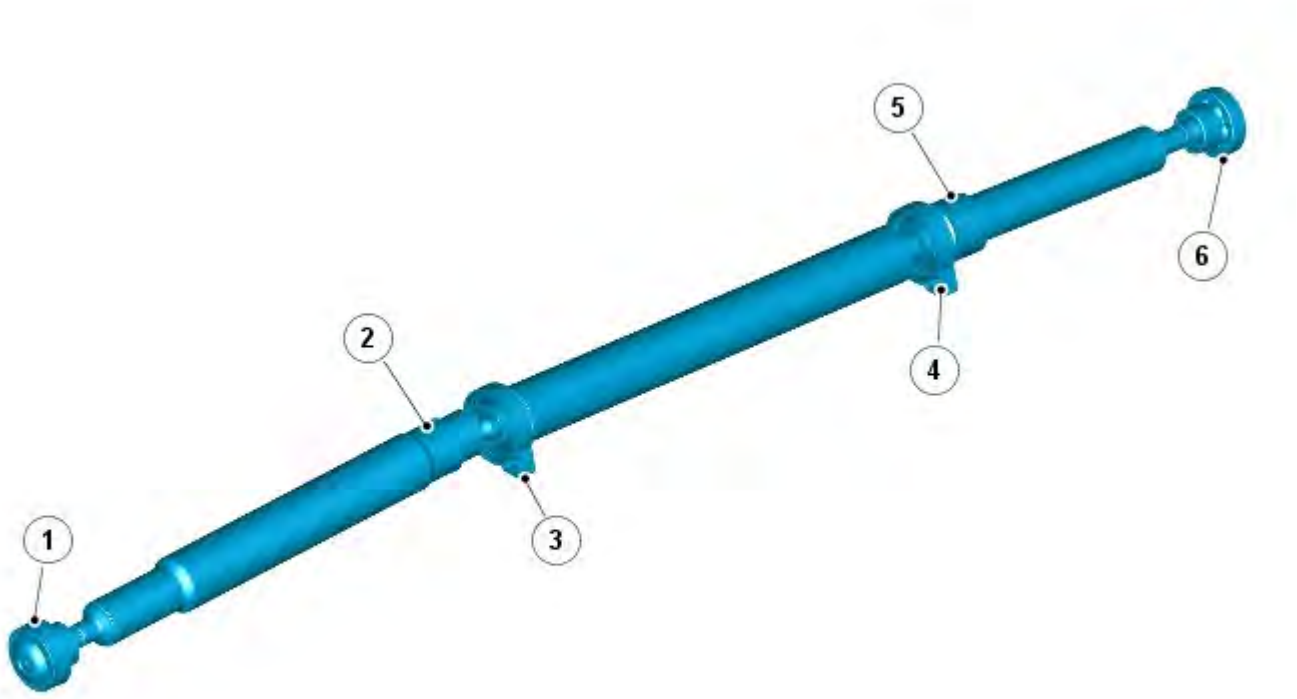
COMPONENT LOCATION - TD4 MANUAL AND SI6 (FROM VIN 180238)



E130046

Item	Part Number	Description
1	-	Driveshaft

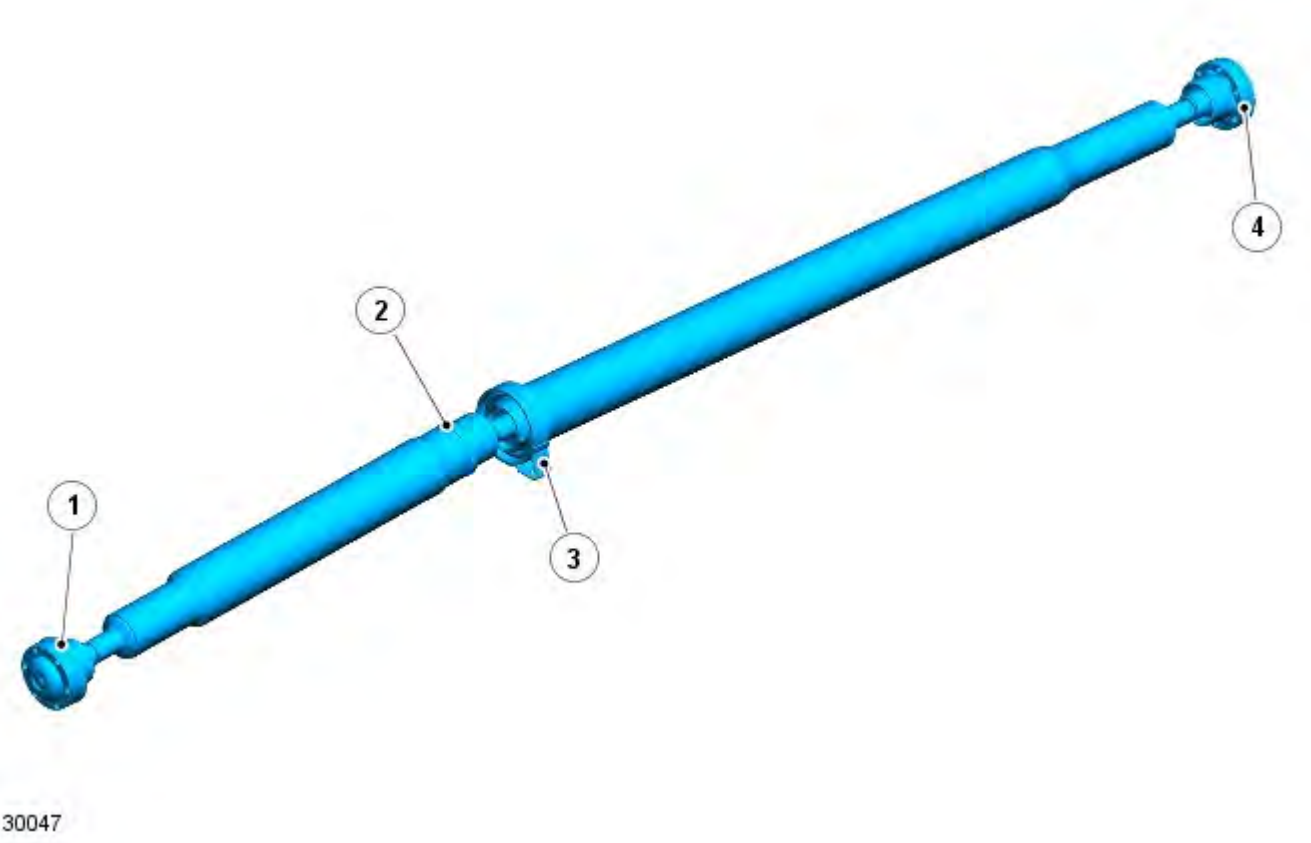
OVERVIEW - TD4 MANUAL AND SI6 (UP TO VIN 180237) AND TD4 AUTO.



E80144

Item	Part Number	Description
1	-	Fixed constant velocity joint
2	-	Long plunge double-offset joint
3	-	Center bearing
4	-	Center bearing
5	-	Universal joint
6	-	Plunging constant velocity joint

OVERVIEW - TD4 MANUAL AND SI6 (FROM VIN 180238)



E130047

Item	Part Number	Description
1	-	Fixed constant velocity joint
2	-	Long plunge double-offset joint
3	-	Center bearing
4	-	Plunging constant velocity joint

Manufactured from high-strength thin-walled tubular steel to minimize weight, the driveshaft incorporates crash energy management features, designed to collapse progressively and predictably in the event of a severe frontal impact. These features include:

- swaged construction of the front section which allows the section to collapse, and a
- sophisticated long-plunge double-offset joint at the rear of the front section, which absorbs the energy of the impact.

The driveshaft is supported by either 1 or 2 high stiffness, center bearings manufactured from pressed steel with riveted aluminum heatshield assemblies.

Published: 11-May-2011

Driveshaft - Universal Joints

Description and Operation

For additional information, refer to: Driveshaft (205-01 Driveshaft, Description and Operation).

Published: 11-May-2011

Driveshaft - Driveshaft

Diagnosis and Testing

For additional information.
REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Driveshaft - DriveshaftVehicles Without: Diesel Particulate Filter (DPF)

Removal and Installation

Removal

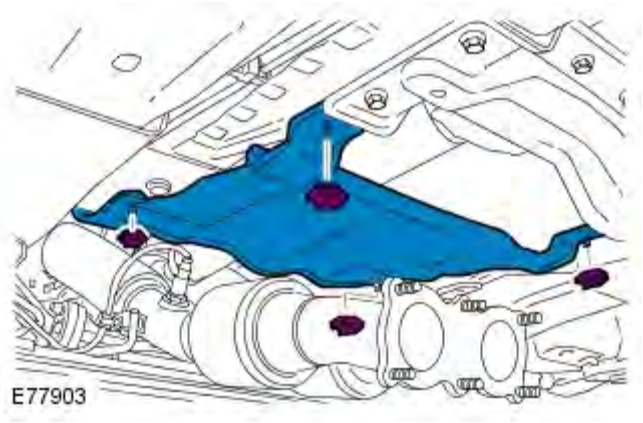
- NOTE: If a new drive shaft is to be installed, remove the seal protector from the front sliding joint.
- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.
   - NOTE: All vehicles.

   Raise and support the vehicle.

2. Remove the exhaust system.

   Refer to: Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).



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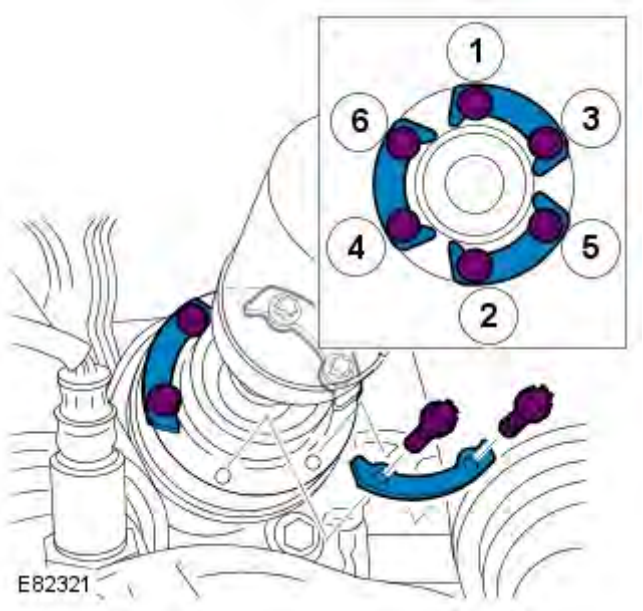
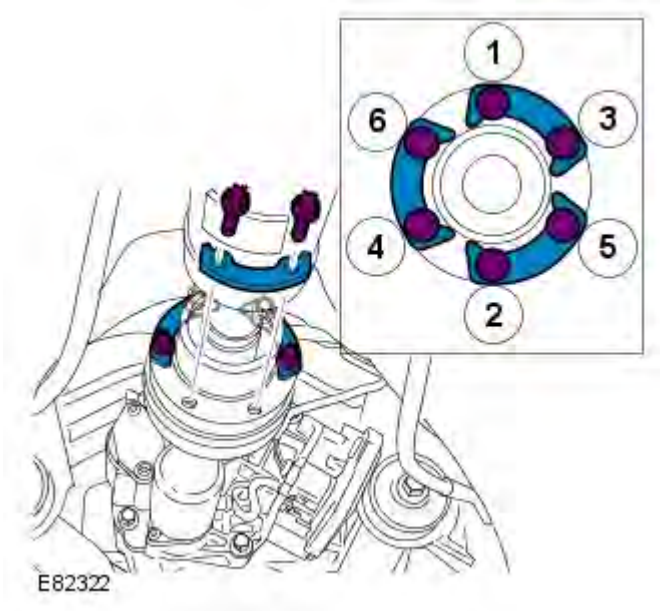


4. **4.** WARNING: Do not lever the driveshaft joints to release from the power transfer unit or the rear differential flanges.
   - CAUTIONS:

   Make sure that the driveshaft is supported with suitable retaining straps.

   Make sure that new bolts are installed.

   Torque: 40 Nm



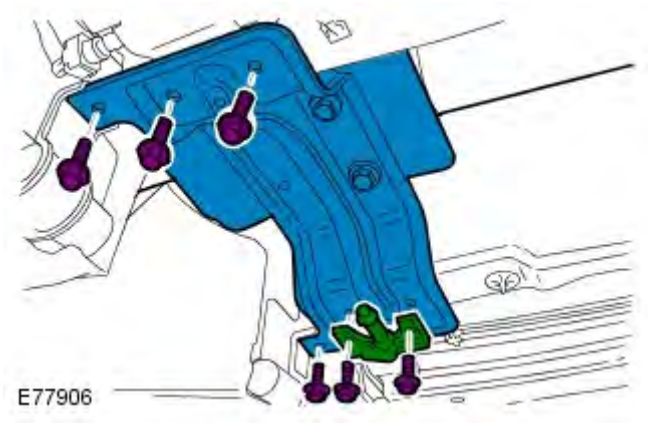
5. **5.** WARNING: Do not lever the driveshaft joints to release from the power transfer unit or the rear differential flanges.

   • CAUTIONS:

   Make sure that the driveshaft is supported with suitable retaining straps.

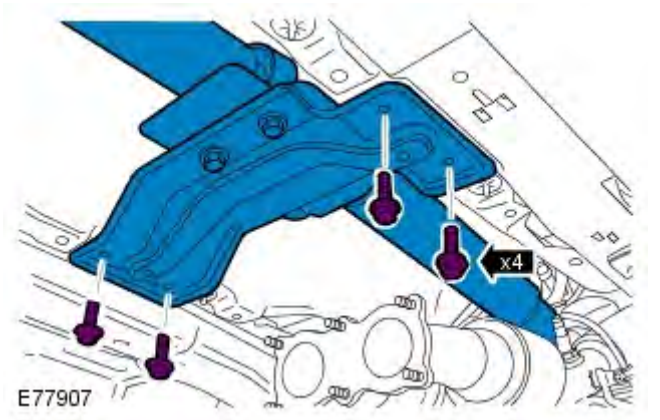
   Make sure that new bolts are installed.

   Torque: 40 Nm



6. **6.** NOTE: All vehicles built up to VIN 180237, and all TD4 Automatics built from VIN 180238

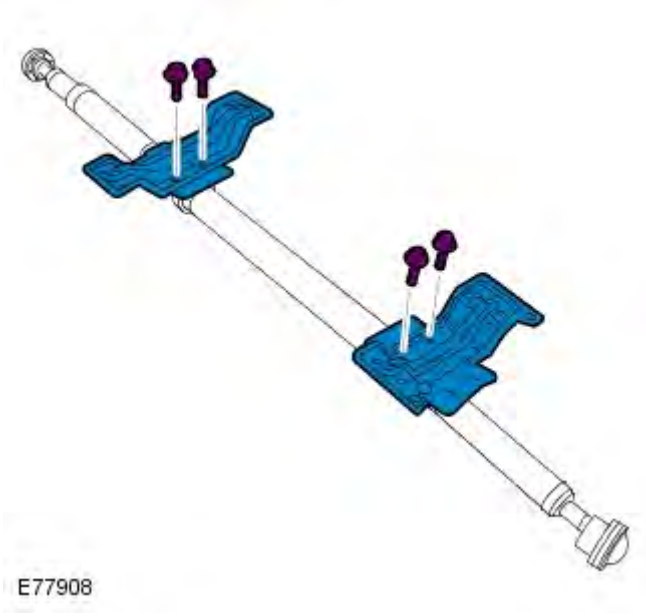
   - *Torque:* 25 Nm



7. **7.** NOTE: All vehicles.

   • NOTE: This step requires the aid of another technician.

   - *Torque:* 25 Nm



8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

   • NOTE: All vehicles built up to VIN 180237, and all TD4 Automatics built from VIN 180238

   - *Torque:* 25 Nm

9. **9.** NOTE: TD4 Manual, and all Si6 built from VIN 180238

   - *Torque:* 25 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Driveshaft - DriveshaftVehicles With: Diesel Particulate Filter (DPF)

Removal and Installation

Removal

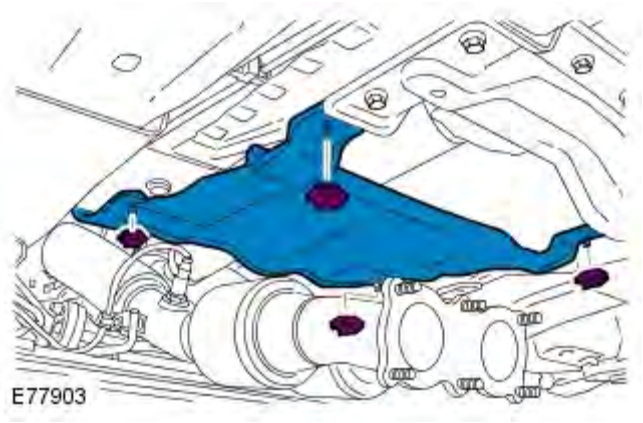
- NOTE: If a new drive shaft is to be installed, remove the seal protector from the front sliding joint.
- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.
   - NOTE: All vehicles.

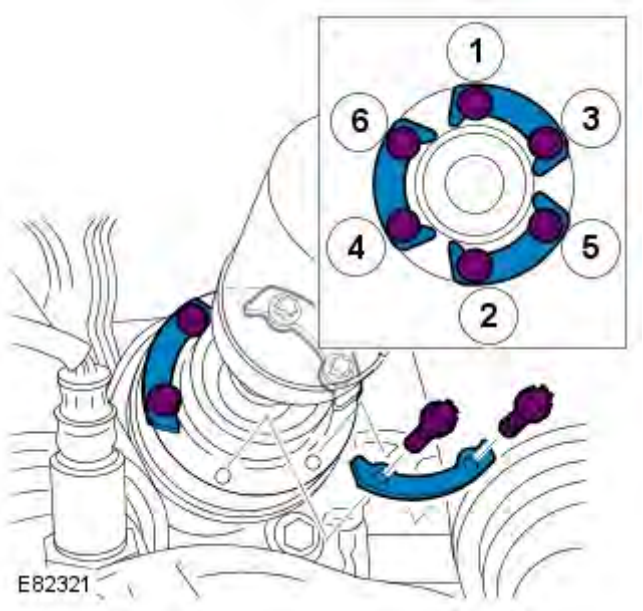
   Raise and support the vehicle.

2. Remove the Diesel Particulate Filter (DPF).

   Refer to: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).



3.

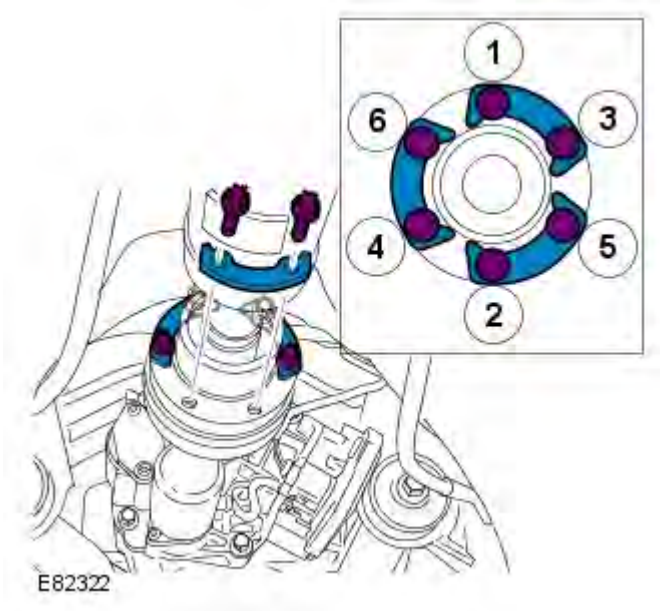


4. **4.** WARNING: Do not lever the driveshaft joints to release from the power transfer unit or the rear differential flanges.
   - CAUTIONS:

   Make sure that the driveshaft is supported with suitable retaining straps.

   Make sure that new bolts are installed.

   Torque: 40 Nm



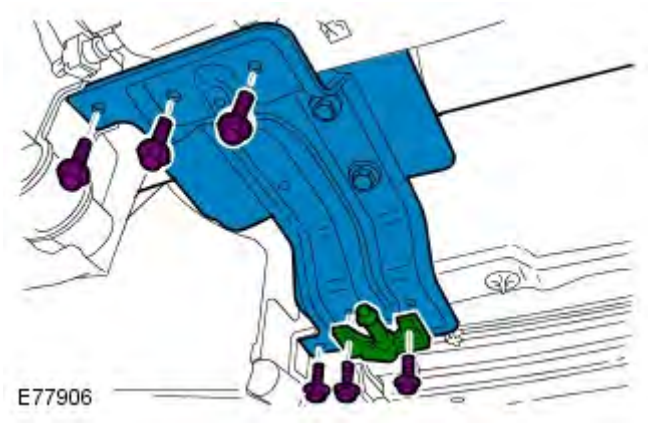
5. **5.** WARNING: Do not lever the driveshaft joints to release from the power transfer unit or the rear differential flanges.

   • CAUTIONS:

   Make sure that the driveshaft is supported with suitable retaining straps.

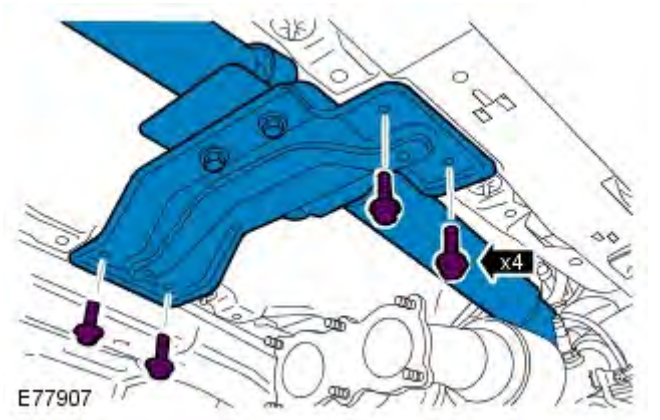
   Make sure that new bolts are installed.

   Torque: 40 Nm



6. **6.** NOTE: All vehicles built up to VIN 180237, and all TD4 Automatics built from VIN 180238

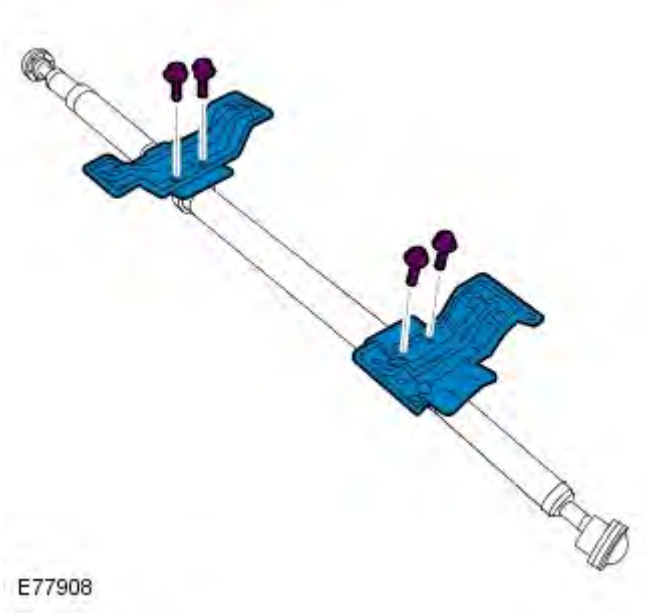
   - *Torque:* 25 Nm



7. **7.** NOTE: All vehicles.

   • NOTE: This step requires the aid of another technician.

   - *Torque:* 25 Nm



8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

   • NOTE: All vehicles built up to VIN 180237, and all TD4 Automatics built from VIN 180238

   - *Torque:* 25 Nm

9. **9.** NOTE: TD4 Manual built from VIN 180238

   - *Torque:* 25 Nm

Installation

1. To install, reverse the removal procedure.

Published: 23-Sep-2011

Rear Drive Axle/Differential -

Lubrication

Description	Lubricant	Capacity (liters/pints/US quarts)
Haldex controlled coupling	Statoil SL01-301. Land Rover Part No LR003136	0.65/1.1/0.69
Rear drive axle/differential	Castrol Axle EPX 80W-90. Land Rover Part No LR003156	0.7/1.2/0.74

General Specification

Item	Specification
Differential type	Low offset hypoid spiral bevel design
Ratio	2.58:1
Electronic torque managed (ETM) range	Up to 1500 Nm (1106 lbf.ft)

Torque Specifications

Description	Nm	lb-ft
Active on-demand coupling module	6	4
Active on-demand coupling to differential	24	18
Active on-demand oil pump	6	4
Driveshaft to the rear flange*	40	30
Rear differential front bush retaining bolts*	175	129
Rear differential insulator to the rear differential	25	18
Rear differential rear bush retaining bolts*	110	81
Rear differential support bracket	25	18
Rear drive axle/differential pinion flange nut*	130	96
Rear drive axle/differential fluid drain plug	35	26
Rear drive axle/differential fluid filler plug	35	26

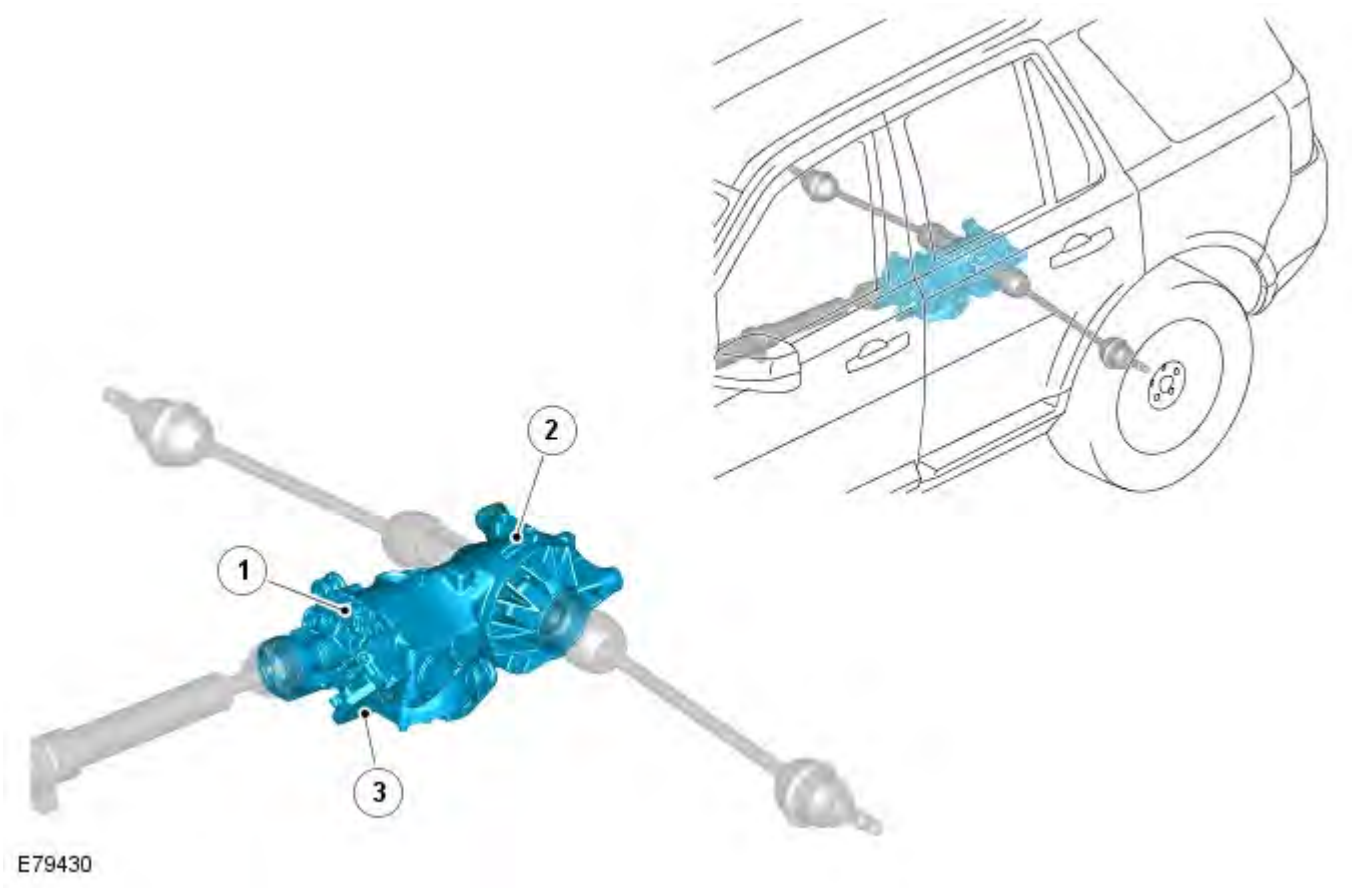
*** New nuts/bolts must be fitted**

Published: 11-May-2011

Rear Drive Axle/Differential - Rear Drive Axle and Differential

Description and Operation

COMPONENT LOCATION



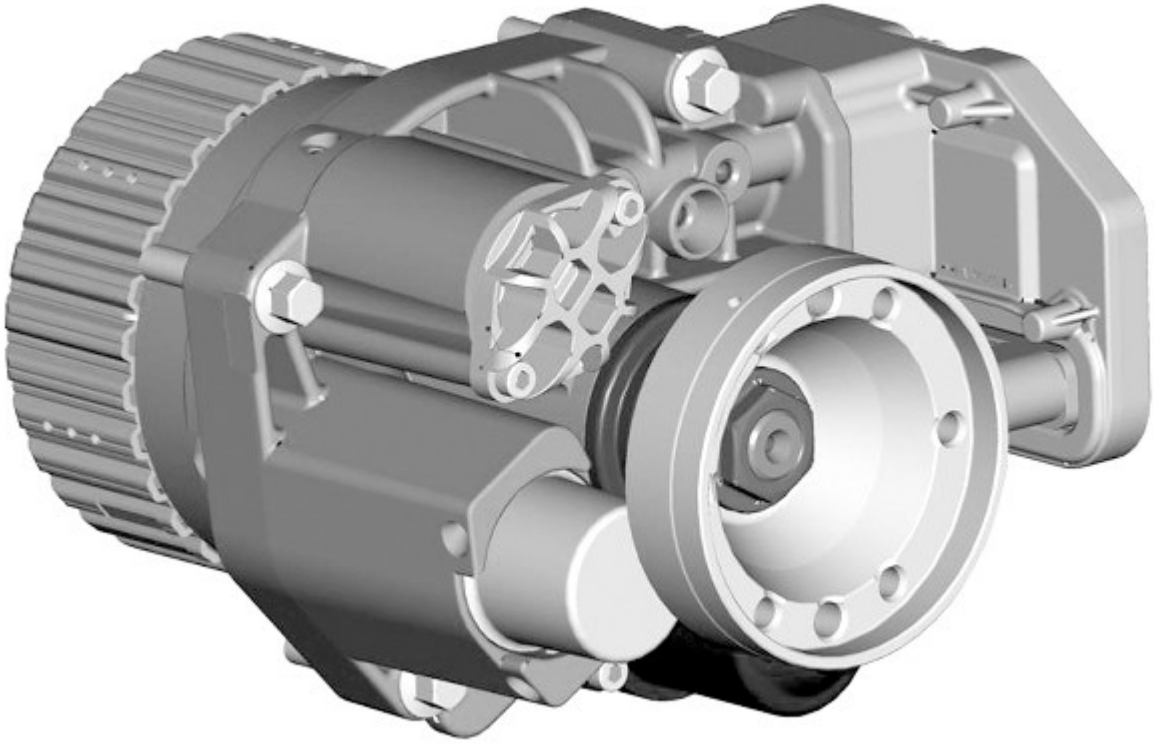
Item	Part Number	Description
1	-	Active on-demand coupling
2	-	Differential
3	-	Active on-demand coupling module

OVERVIEW

The differential operates in conjunction with the active on-demand coupling to provide drive to the rear axle.

Vehicles from 2009MY

Generation 4 Active On-Demand Coupling from 2009MY



E103421

Vehicles from 2009MY are fitted with a modified design of the active on-demand coupling, known as the generation 4 unit. The new active on-demand coupling has design improvement changes over the previous generation 3 coupling which give the following advantages:

- Reduced base torque at high differential speed
- Torque activation independent of differential speed
- Accurate torque limiter
- Energy stored in accumulator
- Lower max current consumption
- Faster response.

DIFFERENTIAL

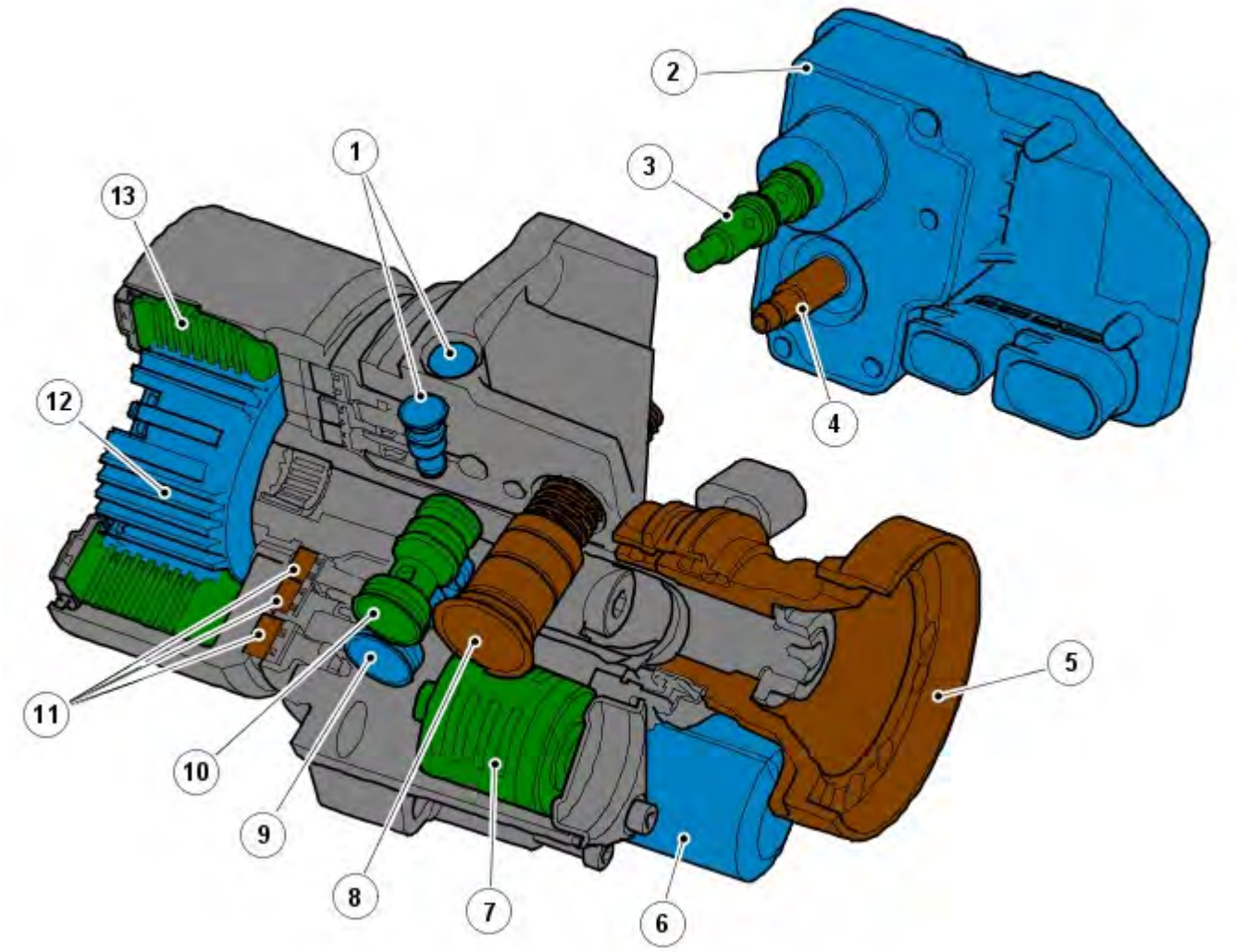
The differential unit is a low-offset-hypoid spiral-bevel design, based on a 167mm crown wheel geared to deliver a ratio of 2.58:1. The design of the differential gears and the 4 mountings that control the torque reaction of the unit within the rear subframe, provide a differential unit of excellent efficiency and refinement.

The torque delivered to the differential is controlled by the active on-demand coupling, mounted into the void at the front of the differential's cast-aluminum casing, which also provides the oil reservoir for the coupling.

ACTIVE ON-DEMAND COUPLING

Active On-demand Coupling

• NOTE: Generation 3 coupling shown.



E79431

Item	Part Number	Description
1	-	Check valves - exhaust side
2	-	Active on-demand coupling module
3	-	Control valve / axial solenoid
4	-	Oil pressure and temperature sensor
5	-	Input shaft
6	-	Electric hydraulic pump
7	-	Oil filter
8	-	Accumulator
9	-	Check valve - intake side
10	-	Combined check and by-pass valve
11	-	Ring shaped annular piston
12	-	Inner connection hub with splines for outer hub.
13	-	Inner and outer wet clutch plates

The active on-demand coupling provides the benefits of a permanent 4x4 system with the efficiency and economical benefits of a part-time system. Located between the differential and driveshaft, the coupling is a self-contained unit combining mechanical, hydraulic and electronic functions to distribute drive between the front and rear axles with transparent automatic control.

The active on-demand coupling provides the following functions:

- Electronic management of torque transfer.
- Rapid engagement in response to traction demands.
- Rapid disengagement to ensure its operation cannot corrupt wheel speed signals and compromise stability control system operation; this is especially important on very low friction surfaces.
- Pre-engagement from rest to minimize the risk of wheel-spin.
- No opposing forces when maneuvring or parking the vehicle.

- Not sensitive to brake testing on a chassis dynamometer.

Generation 4 Active On-Demand Coupling - Vehicles from 2009MY

- The generation 4 coupling does not have the differential speed driven pump used on the previous generation 3 coupling, but is fitted with a bigger capacity electrically operated axial pump and a high pressure accumulator.
- The proportional throttle valve and pressure sensor on the generation 3 coupling is replaced with a proportional pressure reducing valve.
- The torque limiter pressure reducing valve on the generation 3 coupling is replaced by an electronic control valve and controlling software.

The generation 4 active on-demand coupling gives the following improvements over the previous generation 3 coupling:

- Reduced base torque at high differential speeds
- Torque activation is now independent of differential speed
- Accurate torque limiter control
- Energy stored in high pressure accumulator giving a low maximum current consumption of the electric pump and faster response.

Control Module - Generation 3 and 4 Couplings

The control module, attached to the casing of the active on-demand coupling, forms a single unit with the control valve/axial solenoid. By analyzing information from other vehicle modules and sensors the control module regulates the axial solenoid to control the hydraulic fluid pressure supplied to the clutch plates. Some of the modules and sensors the control module communicates with are listed below:

- Hardwired:
  - Control valve / axial solenoid
  - Electric hydraulic pump
  - Oil pressure and temperature sensor
- High speed CAN (controller area network):
  - Engine control module
  - Anti-lock brake system / traction control module
  - Traction response switch
  - Yaw rate sensor
  - Steering wheel rotation sensor

The axial solenoid constantly adjusts the control valve output using a Pulse Width Modulation (PWM) signal. The fluid pressure delivered to the clutch plates determines the amount of torque that is delivered to the rear axle.

The active on-demand coupling has integrated oil pressure and temperature sensors to enable the control module to accurately manage the torque transfer under all environmental and operating conditions. Using these signals the control module will use strategies to protect the coupling from overheating; in extreme cases to protect the coupling from damage the coupling will disengage if the temperature of the hydraulic fluid exceeds 105°C. The coupling will return to normal functionality when the temperature falls below 101°C.

The control module has an integrated diagnostics system, which constantly monitors the active on-demand coupling system as well as its input and output signals. If the control module detects a fault a Diagnostic Trouble Code (DTC) is stored. The DTC is accessed using the Land Rover approved diagnostic system.

Electric Hydraulic Pump

When negotiating very low friction surfaces such as wet grass, snow or ice; initial wheel-spin can cut into the surface and reduce grip. With a re-active on-demand coupling, almost 60 degrees of wheel rotation would occur before torque could be transmitted through the coupling.

On Generation 3 couplings, to counteract this Land Rover developed a unique high-pressure pre-charge facility which energizes the hydraulic circuit as soon as the engine is started. Essentially an electrically operated hydraulic pump was designed to maintain a potential of 500 Nm (369 lb ft) of torque pressure within the coupling. (This pre-charge torque capacity has been increased to 1500Nm (1106 lb ft) for the Generation 4 coupling.)

Vehicles fitted with Terrain Response also add further benefits by varying the level of pre-charge to deliver optimum traction over a range of different terrain surfaces. The level of pre-charge is varied depending on the particular terrain response mode, for example:

- Terrain response in 'Special Programs Off' mode as common with vehicles without terrain response, the coupling is programmed to transmit 500 Nm 369 lb ft of torque on Generation 3 couplings and 1500 Nm (1106 lb ft) of torque on Generation 4 couplings to the rear axle when the vehicle moves from rest in a straight line. This strategy minimizes traction loss from a standing-start regardless of the terrain. When the vehicle accelerates the pressure in the coupling is decreased to improve fuel economy.
- The ability to sense the steering angle allows the coupling to be programmed to provide no torque transfer through the coupling. This prevents the coupling locking when the vehicle is maneuvring at low speeds and acute steering angles.
- In 'Grass / Gravel / Snow' mode the coupling is programmed to maintain its pre-charge state until much higher speeds are obtained. The same applies even if the vehicle is traveling at low speeds and acute steering angles, as traction takes precedence over coupling lock-up on low-friction surfaces.

For additional information, refer to: Ride and Handling Optimization (204-06 Ride and Handling Optimization, Description and Operation).

Mechanical Hydraulic Pump - Generation 3 Couplings - Vehicles up to 2009MY

The driveshaft is attached to the coupling's front clutch plate assembly (input), with the rear clutch plate assembly connected to the differential pinion (output). A swash-plate with 6 hydraulic rollers is also attached to the differential pinion. When there is no speed difference between the coupling's input and output, the rollers do not function.

However, when the front and rear axles start to rotate at different speeds, the swash-plate rotates relative to the rollers which generates the hydraulic pressure. This pressure is used to force the opposing clutch plates together, increasing the transmission of torque to the rear axle. As the difference in axle speed increases the hydraulic pressure pushes the clutch plates further together to increase the torque to the rear axle.

A control valve/axial solenoid controls the amount of pressure applied to the clutch plates, and hence the amount of torque transmitted to the rear wheels. Close manufacturing tolerances and exceptionally low component wear ensure torque control remains accurate throughout the vehicle's life.

Mechanical Hydraulic Pump - Generation 4 Couplings - Vehicles from 2009MY

The Generation 4 coupling does not use the swash plate to mechanically raise hydraulic pressure; instead, a new hydraulic pump is used to generate hydraulic pressure and force the clutch plates together. The removal of the swash plate allows a larger overall clutch plate surface area, which in turn reduces the hydraulic pressure requirement. The pressure required to achieve 1500Nm (1106 lb ft) has been reduced from 100 Bar for Generation 3 couplings to 40 Bar for Generation 4 couplings.

The positioning of the Generation 4 coupling's input and output remains the same as the Generation 3 coupling, as described above.

By-pass Valve

On very low friction surfaces, driveline drag torque can occur, for example:

- reverse torque from engine braking, or
- forced movement of the driveshaft by the front wheels.

This can influence rear wheel speed, making it impossible to determine the true friction capability of the rear wheels, by distorting the wheel speed signal. To prevent this, the active on-demand coupling is designed to open immediately in response to a stability control event. This is achieved by a by-pass valve instantly reducing system pressure to nominal.

To balance the 4 bar base pressure (see below for details), the Generation 3 coupling uses a large Belleville spring to force the clutch plates clear of each other to prevent torque transmission through the coupling. Even at 0°C, torque transmission is reduced from 300 Nm to Zero within 10 ms. The Generation 4 coupling however, does not require a Bellville spring to separate the plates as the coupling does not have a significant base pressure pushing the plates together.

Accumulator

The further the clutch plates have to move in order to contact each other, the longer it takes to displace the hydraulic fluid necessary to build pressure and transmit torque. To counter this, the Generation 3 coupling incorporates an accumulator. This retains a nominal 4 bar pressure within the hydraulic circuit. Although this is not enough pressure to cause significant torque transmission through the coupling, it forces the plates very close together so that very little fluid displacement is required to achieve full engagement and maximum torque transfer. Full torque transmission can be achieved in 150 ms.

On Generation 4 couplings, the 150ms activation time is achieved through the use of a Bellville spring that acts to push the plates together (without causing significant torque transmission through the coupling). As the pump is not continuously used to create this base pressure (as it was with Generation 3 coupling), improvements in fuel economy have been achieved.

Wet Clutch Pack

The clutch pack is made up of 7 pairs of plates; the inner discs are produced from hardened steel with the outer discs manufactured from steel with a sintered face. The clutch plates operate in transmission fluid.

Torque transmission across the clutch pack is limited to 1500 Nm (1106 lb ft). This ensures the lower gears retain an element of front-wheel-drive for traction stability. Within the higher gears the coupling is theoretically capable of transmitting all the drive to the rear axle; although conditions would have to be extreme for this to occur.

PRINCIPLES OF OPERATION

Generation 3 Couplings - up to 2009MY

An internal electronically-controlled pump provides hydraulic pre-charge pressure within the coupling. The pre-charge pressure supplies the required operating pressure to the clutch plates to eliminate initial wheel-spin as the vehicle accelerates from standstill.

In conjunction with the pre-charge pressure a mechanical hydraulic pump operates within the clutch plates to supply the coupling's main hydraulic operating pressure. The mechanical pump is functioned by the 'input' and 'output' of the coupling:

- input - driveshaft connection from the front axle,
- output - differential connection to the rear axle.

Any speed difference between the front and rear axles will start the operation of the mechanical hydraulic pump. The amount of hydraulic pressure applied to the clutch pack by the pump determines the gap between the clutch plates. For example, the greater the hydraulic pressure, the smaller the gap between the plates and subsequently the greater the torque transmitted through the coupling from the front axle to the rear axle.

This main hydraulic pressure is designed to transmit the torque for traction demands of off-road driving, and to provide lock-up as required.

Generation 4 Couplings - from 2009MY

The Generation 4 coupling still uses an electrically-controlled pump to provide hydraulic pre-charge to eliminate wheel-spin from standstill; however, the same pump is also used to provide the coupling's main hydraulic operating pressure.

The principles of transmitting torque through the clutch plates remains the same, as described above for the Generation 3 coupling.

Published: 11-May-2011

Rear Drive Axle/Differential - Rear Drive Axle and Differential

Diagnosis and Testing

For additional information.
REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).

Published: 11-May-2011

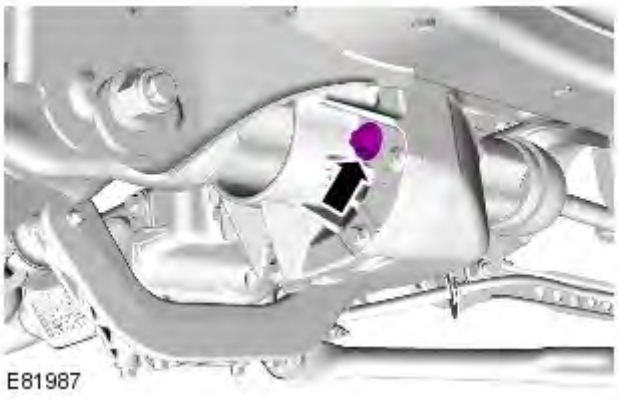
Rear Drive Axle/Differential - Differential Draining and Filling

General Procedures

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   CAUTION: Make sure the vehicle is on a flat level surface.

   Raise and support the vehicle.



2. No provision is made to fully drain the rear differential. During repair procedures, fluid will be lost. A container should be positioned to collect any spillage.

3. Make sure the vehicle is level. Remove the rear differential filler plug and discard the sealing washer.

4. Fill the rear differential, until a thin thread of fluid runs from the filler hole.

   Refer to: Specifications (205-02 Rear Drive Axle/Differential, Specifications).

5. Using a new washer, install the drain plug.

   Torque: 35 Nm

6. Lower the vehicle.

Published: 11-May-2011

Rear Drive Axle/Differential - Active On-Demand Coupling Filling

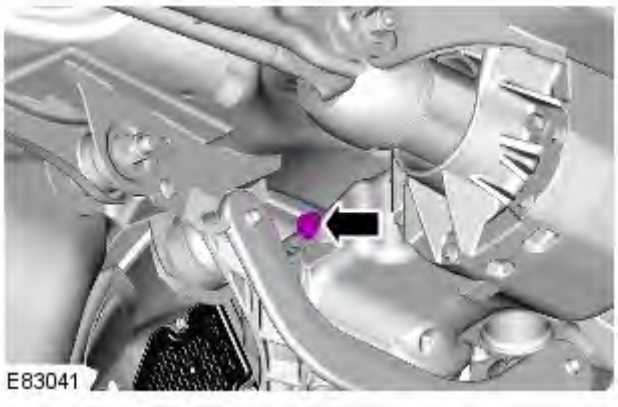
General Procedures

• NOTE: If installing a new active on-demand coupling, fill with 650 ml of fluid. It is not possible to completely drain the active on-demand coupling fluid during service. The procedure below MUST be followed for both filling and topping up.

1. **1.** CAUTION: Make sure the vehicle is on a flat level surface.

   Raise and support the vehicle.

2. No provision is made to fully drain the active on-demand coupling. During repair procedures, fluid will be lost. A container should be positioned to collect any spillage.



3. **3.** CAUTION: This is a filler plug only and must not be used as a fluid level indicator.

   Make sure the vehicle is level. Remove the filler plug and discard the sealing washer.

4. Fill the active on-demand coupling, until a thin thread of fluid runs from the filler hole.

   Refer to: Specifications (205-02 Rear Drive Axle/Differential, Specifications).

5. Install the active on-demand fluid filler plug.

6. Turn the ignition on for 5 minutes.

7. Turn the ignition off and remove the remote handset.

8. Fill the active on-demand coupling, until a thin thread of fluid runs from the filler hole.

9. **9.** CAUTION: This is a filler plug only and must not be used as a fluid level indicator.

   Using a syringe, remove exactly 70 ml of fluid.

10. **10.** CAUTION: Replace the washer.

    Install and tighten the filler plug.

    Torque: 35 Nm

Published: 11-May-2011

Rear Drive Axle/Differential - Active On-Demand Coupling

Removal and Installation

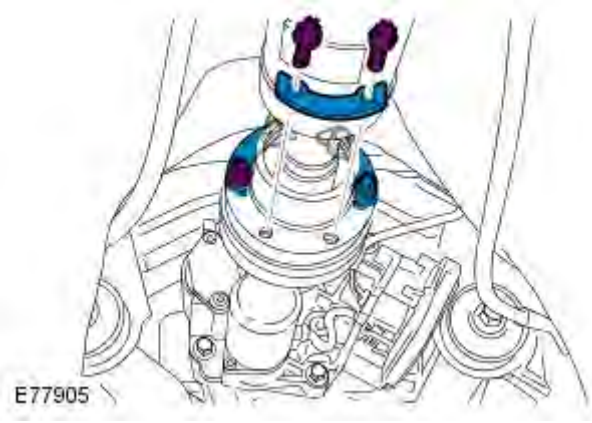
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise the vehicle on a lift.

2. Remove the exhaust system.

   Refer to: Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).



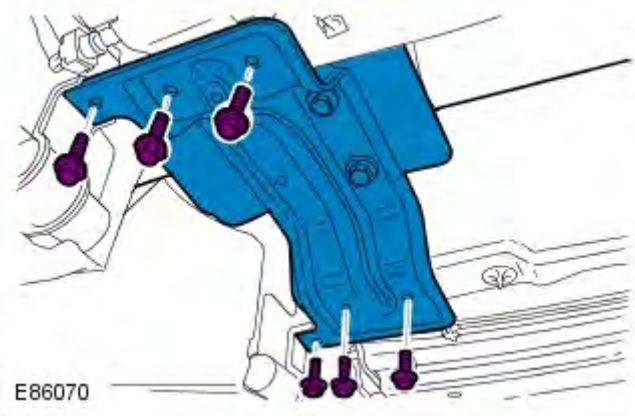
3. **3.** WARNING: Do not lever the driveshaft joints to release from the power transfer unit or the rear differential flanges.

   • CAUTIONS:

   Mark the components to aid installation.

   Make sure that the driveshaft is supported with suitable retaining straps.

   - Discard the bolts.



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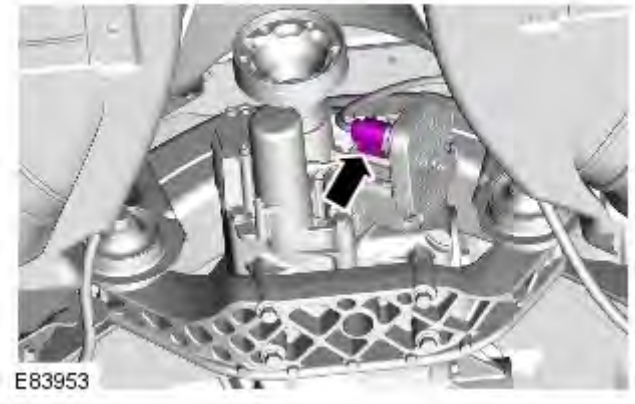

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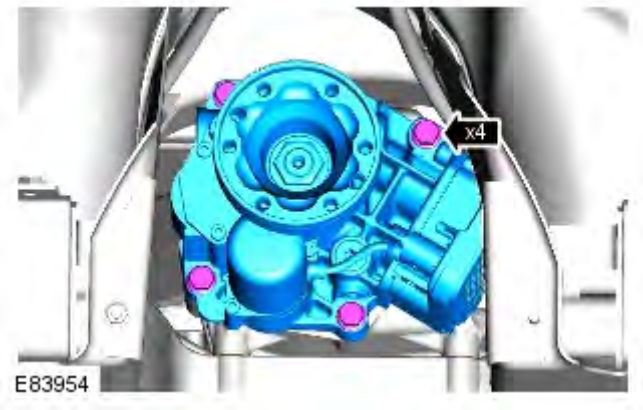


6.
- Position a container to collect the oil spillage.
- Discard the O-ring seal.

Installation

1. Lubricate and install a new O-ring seal.

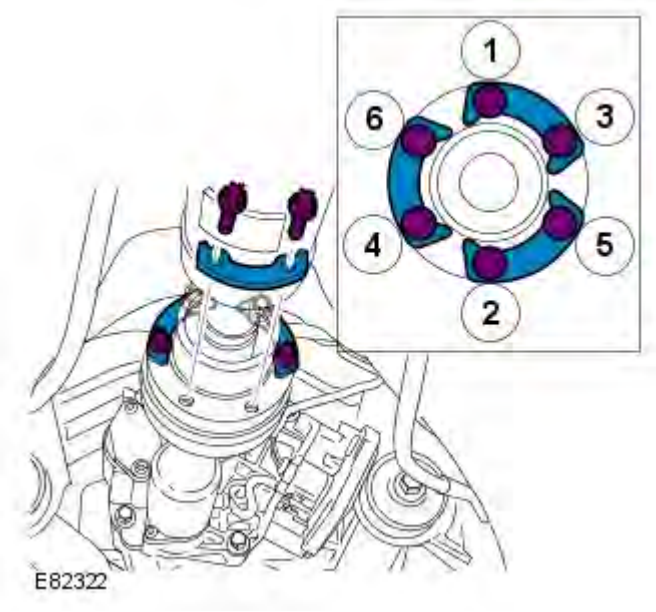
   Refer to: Specifications (205-02 Rear Drive Axle/Differential, Specifications).

2. **2.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

   Install the active on-demand coupling.

   Torque: 24 Nm

3. Connect the electrical connector.



4. **4.** CAUTION: Make sure that new bolts are installed.

   • NOTE: Make sure that the component is installed to the position noted on removal.

   Install the driveshaft to the active on-demand coupling.

   Torque: 40 Nm

5. Install the driveshaft rear support bracket.

   Torque: 35 Nm

6. Check and top-up the active on-demand coupling fluid level.

   Refer to: Active On-Demand Coupling Filling (205-02 Rear Drive Axle/Differential, General Procedures).

7. Install the exhaust system.

   Refer to: Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

Published: 11-May-2011

Rear Drive Axle/Differential - Active On-Demand Coupling Module

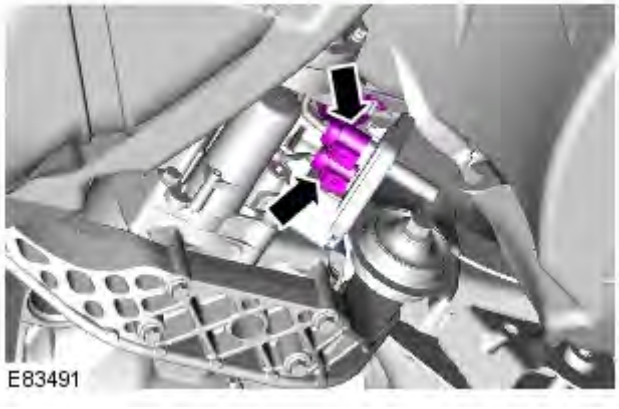
Removal and Installation

Removal

- NOTE: If installing a new active on-demand coupling module the sensor and throttle valve must also be installed.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise the vehicle on a lift.



2. Disconnect the electrical connectors.

3. **3.** CAUTION: Make sure that the area around the component is clean and free of foreign material.
   - Position a container to collect the fluid spillage.
   - Remove and discard the gasket.

4.

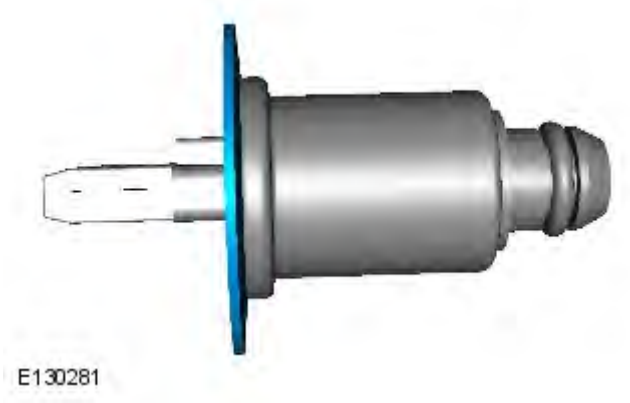
- Using a suitable tool, remove the throttle valve.

5.

- Using a suitable tool, remove the active on demand coupling sensor.

Installation

1. Install the new gasket.


E130281

2. Install the cupped washer to the sensor with the convex side against the sensor.

E130280

3. **3.** CAUTIONS:

   The throttle valve and sensor must be installed to the active on-demand coupling module before the assembly is installed to the active on-demand coupling. Failure to follow this instruction may result in damage to the vehicle.

   Make sure the component is aligned as shown.

   Install the sensor and washer assembly.

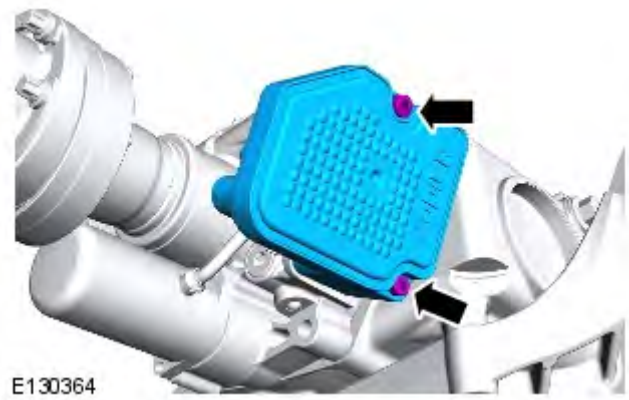
4. Install the new throttle valve.

E130283

5. **5.** NOTE: Lubricate the O-ring seal.

   Install the active on-demand coupling module.

   Torque: 6 Nm


E130364

6. Connect the electrical connectors.

Published: 11-May-2011

Rear Drive Axle/Differential - Active On-Demand Coupling Oil Pump

Removal and Installation

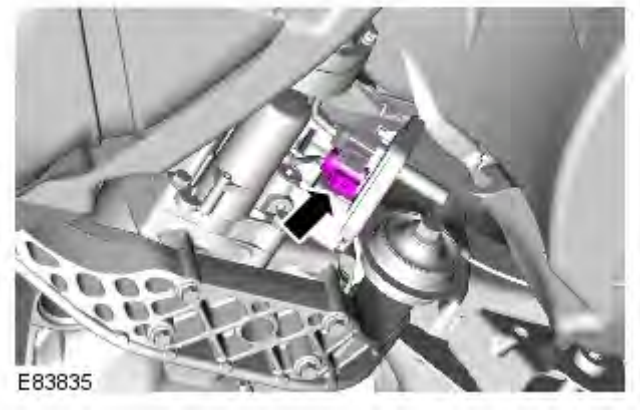
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise the vehicle on the lift.

2. Remove the drive pinion flange.

   Refer to: Drive Pinion Flange (205-02 Rear Drive Axle/Differential, Removal and Installation).



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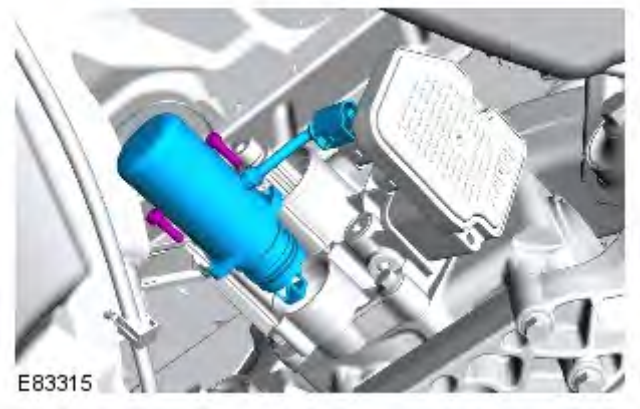


4. **4.** CAUTIONS:

   Be prepared to collect escaping oil.

   Make sure that the area around the component is clean and free of foreign material.

   - Discard the O-ring seals.

Installation

1. **1.** CAUTION: Only use the specified material to lubricate the seals.

   Lubricate the O-ring seals.

   Refer to: Specifications (205-02 Rear Drive Axle/Differential, Specifications).

2. Install the new O-ring seals.

3. **3.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

   Install the oil pump.

Torque: 6 Nm

4. Connect the electrical connector.

5. Install the drive flange.

   Refer to: Drive Pinion Flange (205-02 Rear Drive Axle/Differential, Removal and Installation).

6. Check and top-up the active on-demand coupling fluid level.

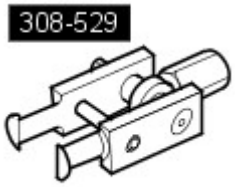
   Refer to: Active On-Demand Coupling Filling (205-02 Rear Drive Axle/Differential, General Procedures).

Published: 11-May-2011

Rear Drive Axle/Differential - Active On-Demand Coupling Drive Pinion Seal

Removal and Installation

Special Tool(s)

E54135	100-012 Slide Hammer
E85136	205-862-1 Installer, Active On-demand Pinion Seal
 E85137	308-529 Remover, Seals

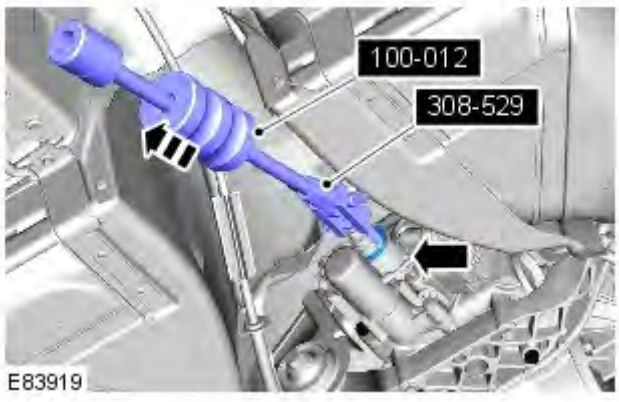
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise the vehicle on the lift.

2. Remove the differential drive flange.

   Refer to: Drive Pinion Flange (205-02 Rear Drive Axle/Differential, Removal and Installation).



E83919

3. Carefully remove and discard the pinion oil seal.

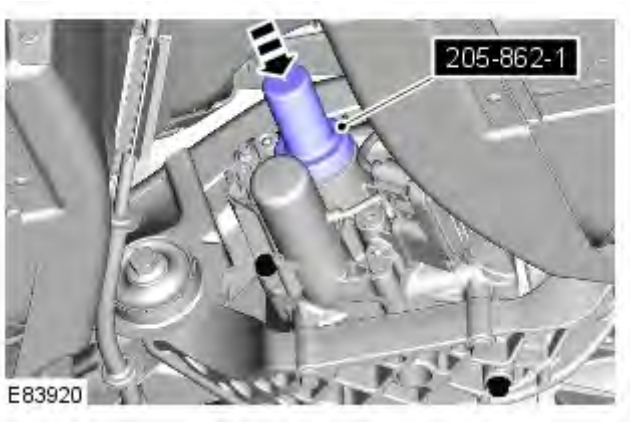
   Special Tool(s): 308-529, 100-012

Installation

1. **1.** CAUTION: Only use the specified material to lubricate the seals.

Lubricate the oil seal.

Refer to: Specifications (205-02 Rear Drive Axle/Differential, Specifications).



2.
- Using the special tool, install a new oil seal.

  Special Tool(s): 205-862-1
- Tap in the seal until the head of the drift is against the active on-demand coupling housing.

3. Install the differential drive flange.

   Refer to: Drive Pinion Flange (205-02 Rear Drive Axle/Differential, Removal and Installation).

4. Install the exhaust system.

   Refer to: Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

Published: 11-May-2011

Rear Drive Axle/Differential - Differential Case

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

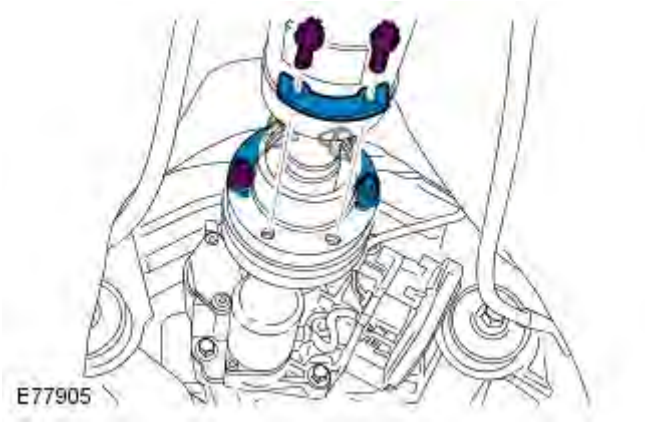
   Raise and support the vehicle.

2. Remove the LH rear wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. With assistance, remove the rear muffler.

   Refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).



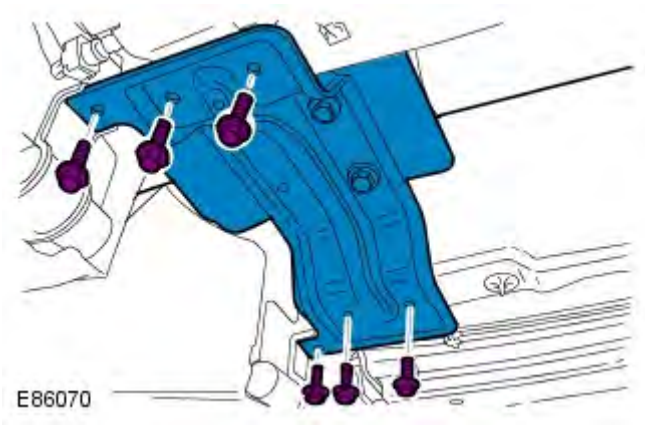
4. **4.** WARNING: Do not lever the driveshaft joints to release from the power transfer unit or the rear differential flanges.

   • CAUTIONS:

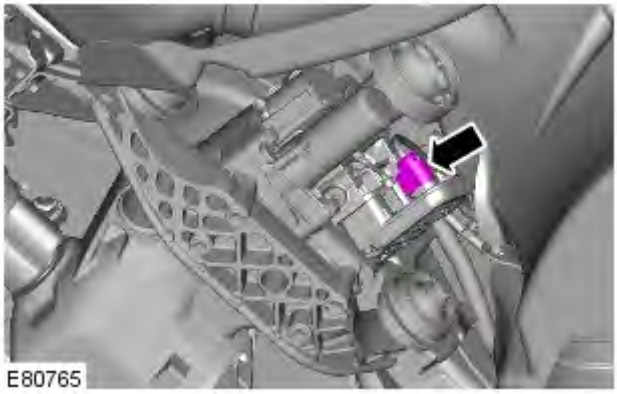
   Mark the components to aid installation.

   Make sure that the driveshaft is supported with suitable retaining straps.

   - Discard the bolts.



5.

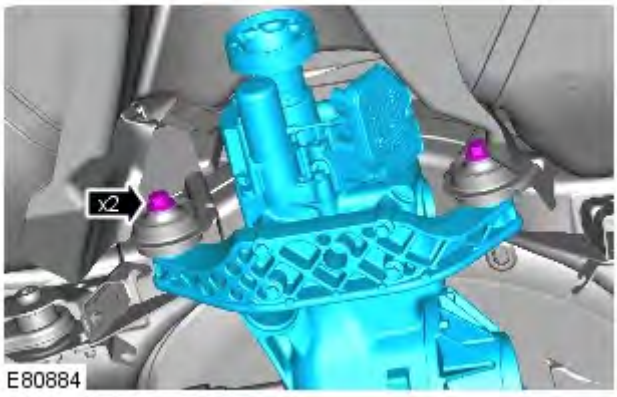


6.

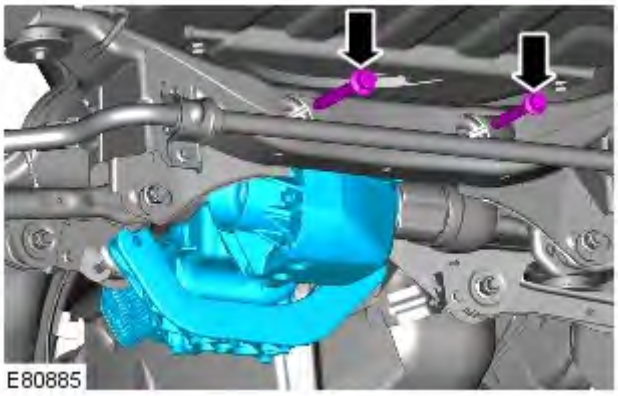
7. Remove the LH rear halfshaft.

   Refer to: Rear Halfshaft LH (205-05 Rear Drive Halfshafts, Removal and Installation).

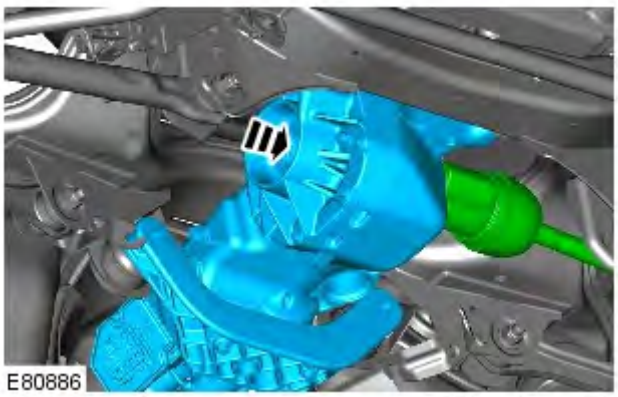
8. Using a transmission jack, support the differential case.



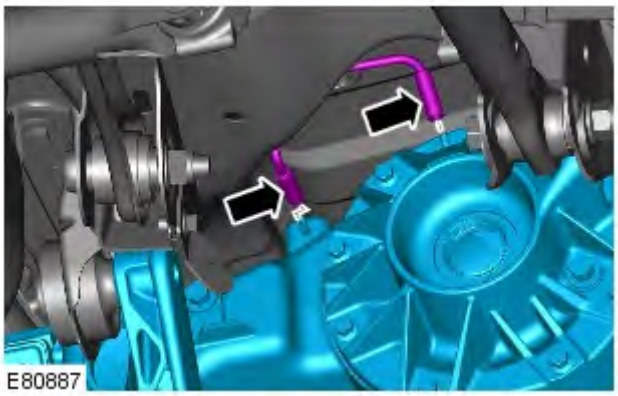
9. **9.** CAUTION: Mark the components to aid installation.
   - Discard the bolts.



10. **10.** CAUTION: Mark the components to aid installation.
    - Discard the bolts.



11. Carefully release the RH inboard halfshaft joint from the differential and tie aside.

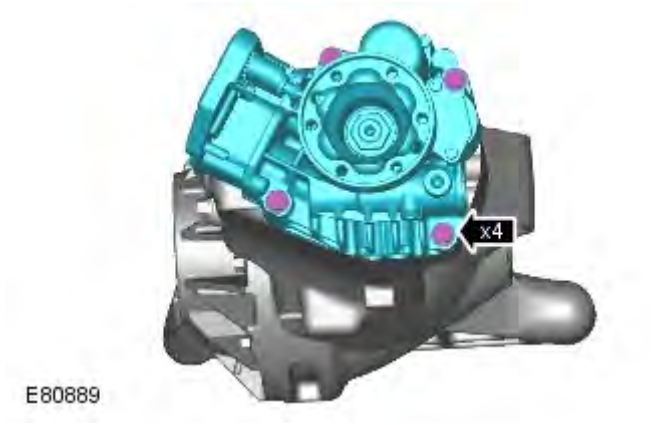


12.

13. Carefully lower and remove the differential case.

14. **14.** NOTE: Do not disassemble further if the component is removed for access only.

15.



Installation

1. **1.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

   Install a new O-ring seal to the active on-demand coupling.

2. **2.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Make sure that new bolts are installed.

   Align the active on-demand coupling to the differential and tighten the bolts.

   Torque: 24 Nm

3. Install the rear differential support bracket.

   Torque: 35 Nm

4. Using a transmission jack, carefully raise the assembly.

5. Connect the differential breather lines.

6. Secure the RH inner halfshaft joint to the differential.

7. **7.** CAUTIONS:

   Make sure that the installation marks are aligned.

   Make sure that new bolts are installed.

   Install the rear differential front bush retaining bolts.

   Torque: 175 Nm

8. **8.** CAUTIONS:

   Make sure that the installation marks are aligned.

   Make sure that new bolts are installed.

Install the rear differential rear bush retaining bolts.

Torque: 110 Nm

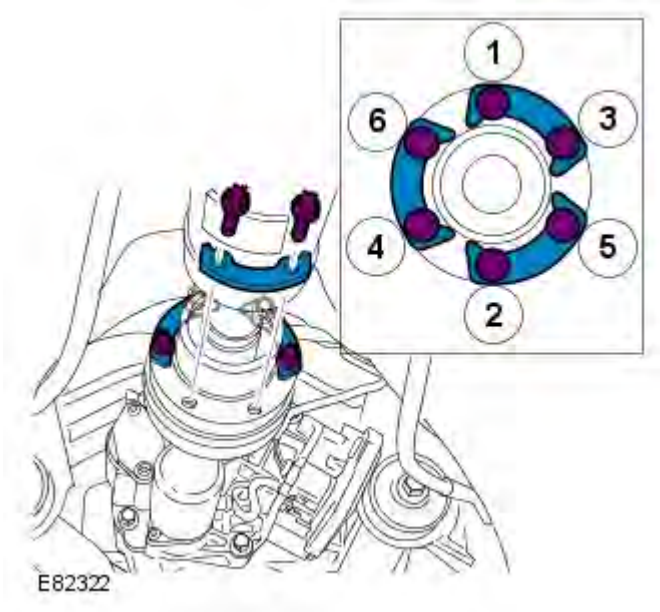
9. Install the LH halfshaft.

   Refer to: Rear Halfshaft LH (205-05 Rear Drive Halfshafts, Removal and Installation).

10. Connect the Active On-demand Coupling module electrical connector.

11. Install the driveshaft rear support bracket.

    Torque: 35 Nm



12. **12.** CAUTION: Make sure that new bolts are installed.

    Connect the driveshaft to the rear flange.

    Torque: 40 Nm

13. Install the rear muffler.

    Refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).

14. Install the LH rear wheel and tire.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

15. Check and top-up the active on-demand coupling fluid level.

    Refer to: Active On-Demand Coupling Filling (205-02 Rear Drive Axle/Differential, General Procedures).

16. Fill the differential case with fluid.

    Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

Published: 11-May-2011

Rear Drive Axle/Differential - Differential Support Insulator

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

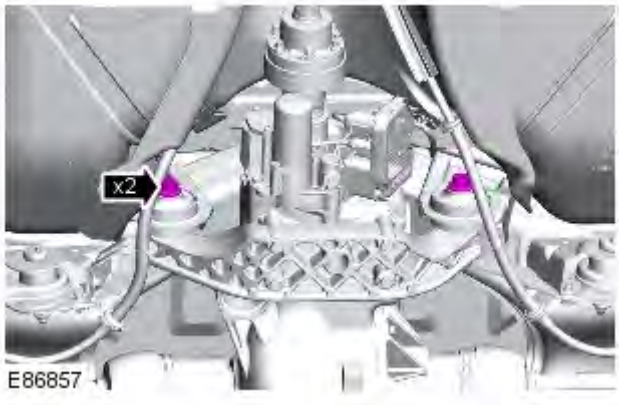
   Raise and support the vehicle.

2. Remove the exhaust system.

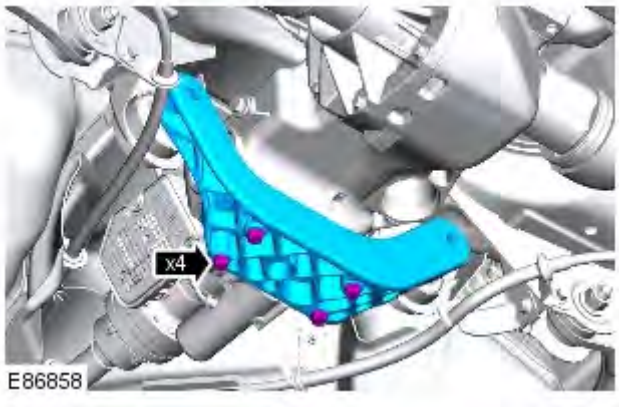
   Refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).

3. **3.** WARNING: Make sure to support the vehicle with axle stands.

   Support the rear differential using a transmission jack.



4. **4.** CAUTION: Mark the components to aid installation.
   - Discard the bolts.



5.

Installation

1. Install the rear differential insulator to the rear differential.

   Torque: 35 Nm

2. **2.** CAUTIONS:

   Make sure that new bolts are installed.

Make sure that the installation marks are aligned.

Install the rear differential front bush retaining bolts.

Torque: 175 Nm

3. Install the exhaust system.

   Refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).

Published: 11-May-2011

Rear Drive Axle/Differential - Differential Front Bushing

Removal and Installation

Special Tool(s)

	205-860-01 Remover, Differential Bushing
	205-860-02 Remover, Differential Bushing
	205-860-03 Installer, Differential Bushing
	205-860-04 Installer, Differential Bushing
	205-860-09 Installer, Differential Bushing
	205-860-10 Spacer, Differential Bushing
	LR-121 Hydraulic Cylinder 10t

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

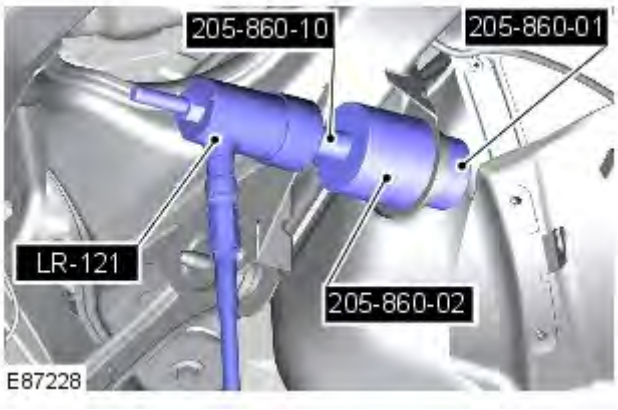
   Raise and support the vehicle.

2. Remove both rear wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the rear differential.

   Refer to: Differential Case (205-02 Rear Drive Axle/Differential, Removal and Installation).



4. **4.** CAUTIONS:

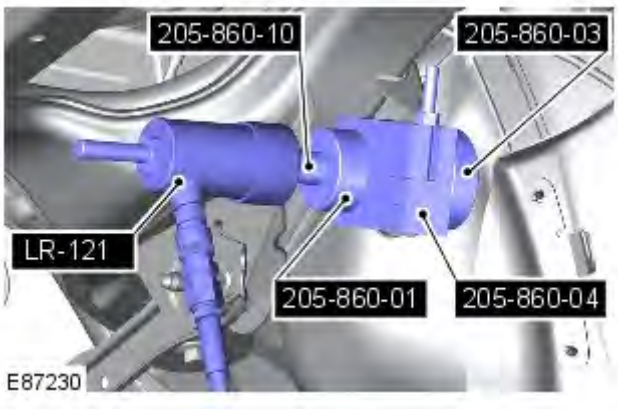
   Mark the components to aid installation.

   Note the fitted position of the component prior to removal.

   Using the special tools, remove the bushing.

   Special Tool(s): 205-860-01, 205-860-02, 205-860-10, LR-121

Installation



1. Us[illegible]e special tool, compress the bushing.
2. **2.** CAUTION: Make sure the correct special tool is used to install the bushing to the correct depth.

   Special Tool(s): 205-860-10, 205-860-01, 205-860-04, LR-121

   • NOTE: Make sure that these components are installed to the noted removal position.

   Using the special tool, install the bushing.

   Special Tool(s): 205-860-10, 205-860-01, 205-860-04, 205-860-03, LR-121

3. Install the rear differential.

   Refer to: Differential Case (205-02 Rear Drive Axle/Differential, Removal and Installation).

4. Install the rear wheels and tires.

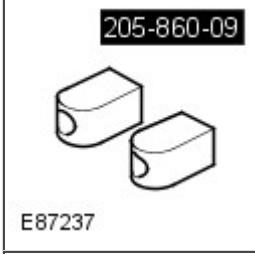
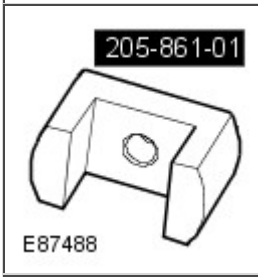
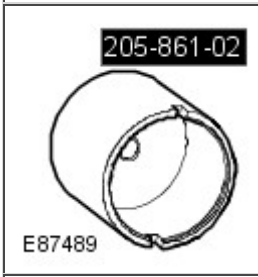
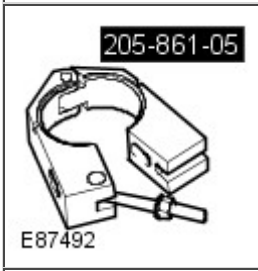
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Rear Drive Axle/Differential - Differential Rear Bushing

Removal and Installation

Special Tool(s)

	205-860-09 Installer, Differential Bushing
	205-861-01 Remover, Differential Bushing
	205-861-02 Remover/Installer, Differential Bushing
	205-861-03 Installer, Differential Bushing
	205-861-04 Installer, Differential Bushing
	205-861-05 Installer, Differential Bushing
	LR-121 Hydraulic Cylinder 10t

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

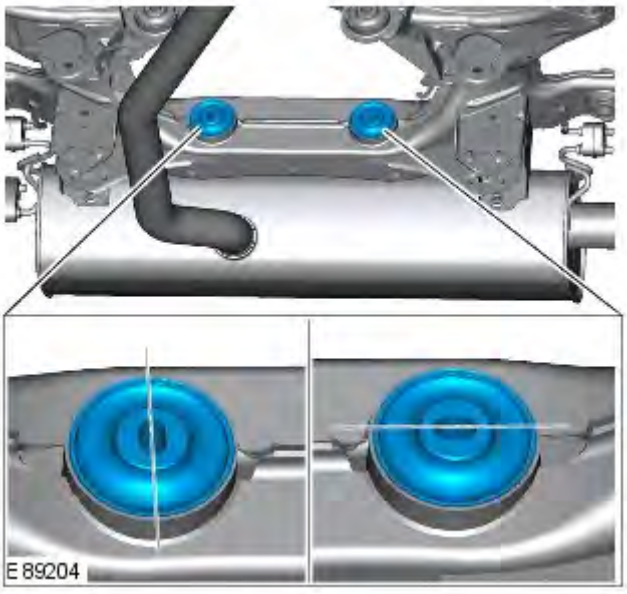
   Raise and support the vehicle.

2. Remove both rear wheels and tires.

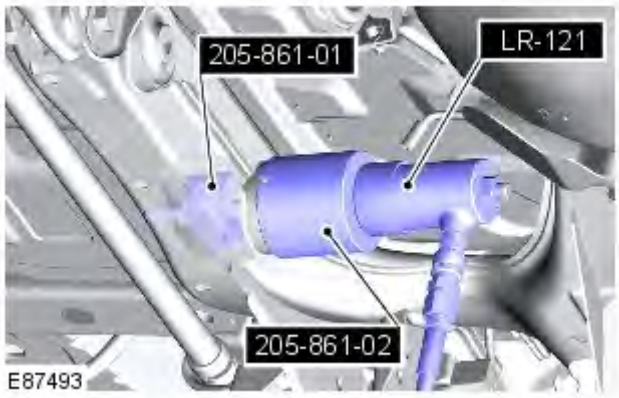
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the rear differential.

   Refer to: Differential Case (205-02 Rear Drive Axle/Differential, Removal and Installation).



4. Take note of the fitted position of the rear bushings. The RH bushing slot is positioned vertically and the LH bushing slot is positioned horizontally.

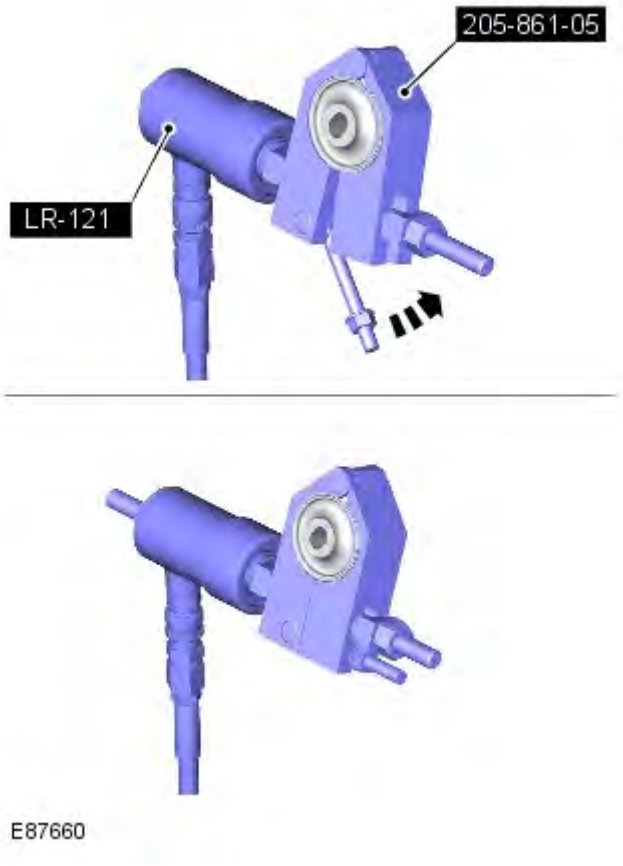


5. **5.** CAUTION: Note the fitted position of the component prior to removal.

   Using the special tool, remove the bushing.

   Special Tool(s): 205-861-01, 205-861-02, LR-121

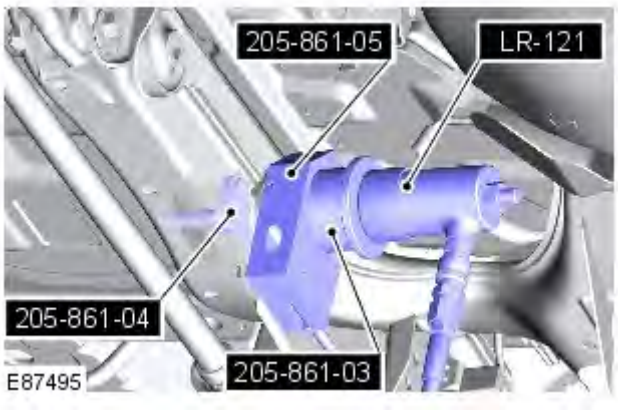
Installation



1. **1.** CAUTION: Only use the specified special tool.

   Using the special tool, compress the bushing.

   Special Tool(s): 205-860-09, 205-861-05, LR-121



2. **2.** CAUTION: Make sure the correct special tool is used to install the bushings to the correct depth.

   • NOTE: Make sure that these components are installed to the noted removal position.

   Using the special tool, install the bushing, making sure the slot on the RH bushing is positioned vertically and the slot on the LH bushing is positioned horizontally.

   Special Tool(s): LR-121, 205-861-04, 205-861-03, 205-861-05

3. Install the rear differential.

   Refer to: Differential Case (205-02 Rear Drive Axle/Differential, Removal and Installation).

4. Install the rear wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Rear Drive Axle/Differential - Drive Pinion Flange

Removal and Installation

Special Tool(s)

	205-053 Retainer, Drive Flange

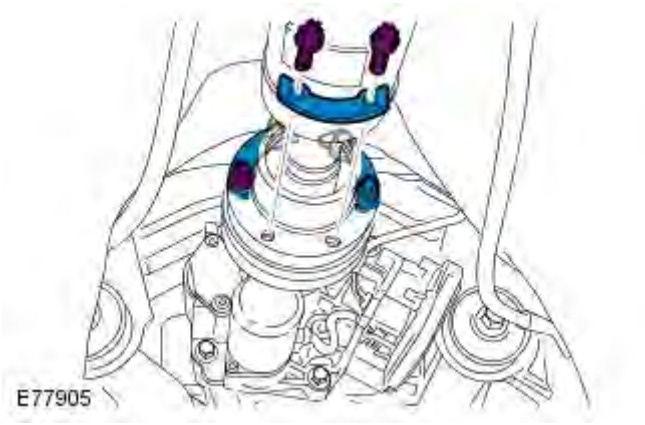
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the exhaust system.

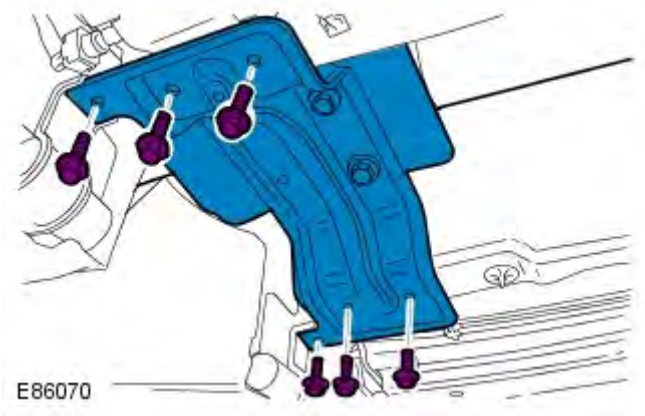
   Refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).



3. **3.** WARNING: Do not lever the driveshaft joints to release from the power transfer unit or the rear differential flanges.

   CAUTION: Mark the components to aid installation.

   - Discard the bolts.



4. **4.** CAUTION: Make sure that the driveshaft is supported with suitable retaining straps.

5.
- Position a container to collect the oil spillage.
- Using the special tool, remove the drive flange.

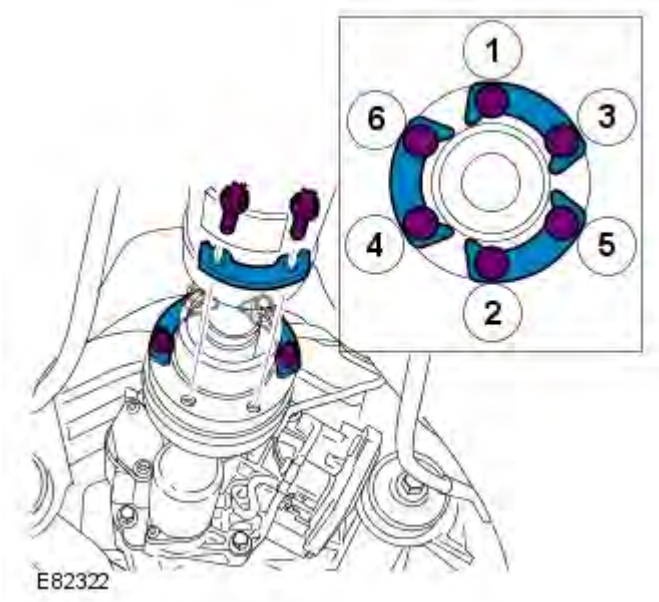
Special Tool(s): 205-053
- Discard the nut.

Installation

1. **1.** WARNING: Make sure that a new nut is installed.

   Using the special tool, install the drive flange.

   Special Tool(s): 205-053
   Torque: 130 Nm



2. **2.** CAUTION: Make sure that new bolts are installed.

   • NOTE: Make sure that these components are installed to the noted removal position.

   Install the driveshaft to the active on-demand coupling.

   Torque: 40 Nm

3. Install the driveshaft rear support bracket.

   Torque: 35 Nm

4. Check and top-up the active on-demand coupling fluid level.

   Refer to: Active On-Demand Coupling Filling (205-02 Rear Drive Axle/Differential, General Procedures).

5. Install the exhaust system.

Refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).

Published: 11-May-2011

Rear Drive Axle/Differential - Drive Pinion Front Bearing

Removal and Installation

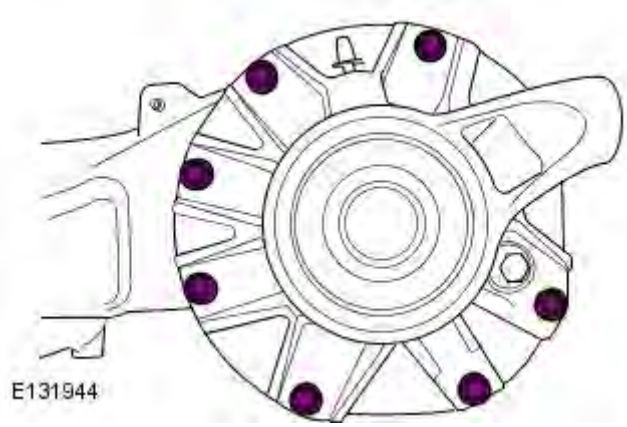
Removal

1. Raise and support the vehicle.
2. Drain the differential fluid.

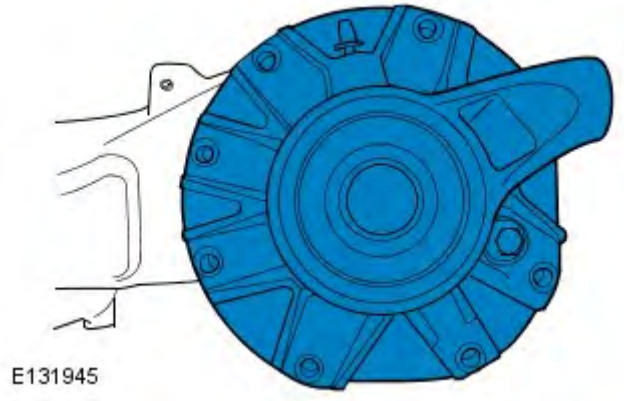
   Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

3. Remove the rear differential.

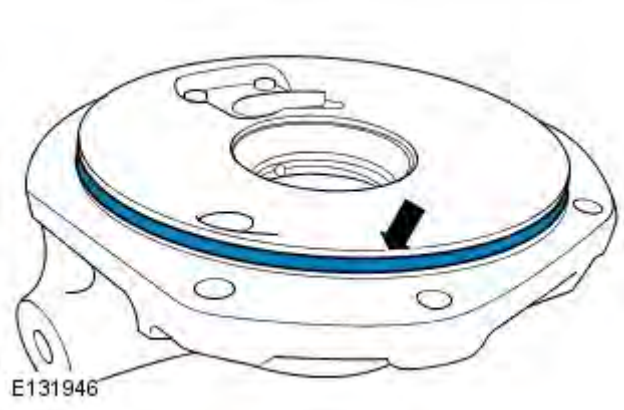
   Refer to: Differential Case (205-02 Rear Drive Axle/Differential, Removal and Installation).



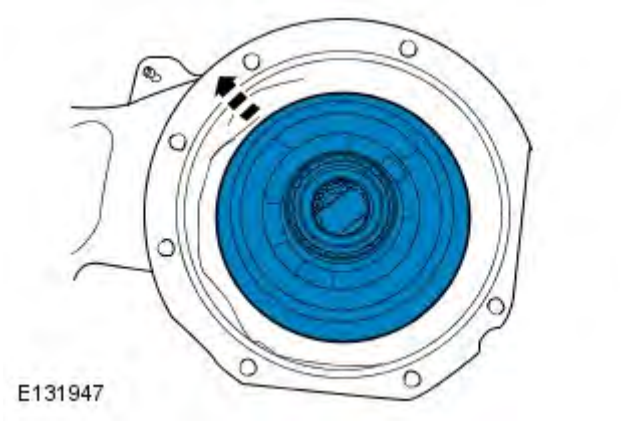
4. Remove the differential casing bolts.



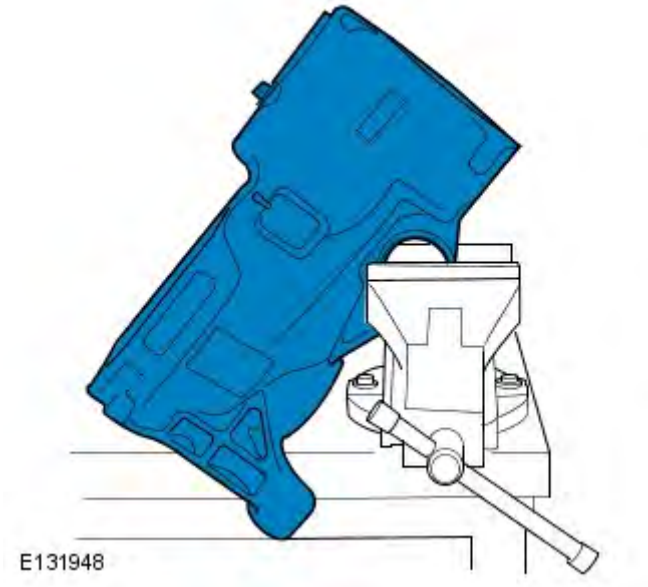
5. Remove the differential case.



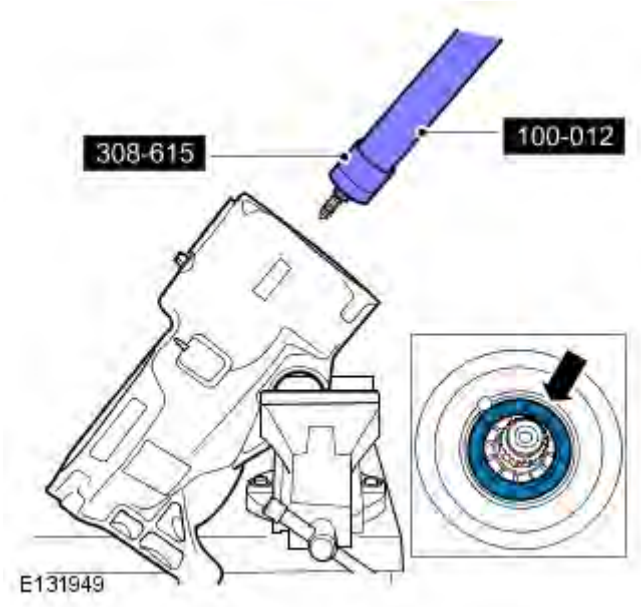
6. Remove and discard the differential case seal.



7. Remove the crown wheel assembly.

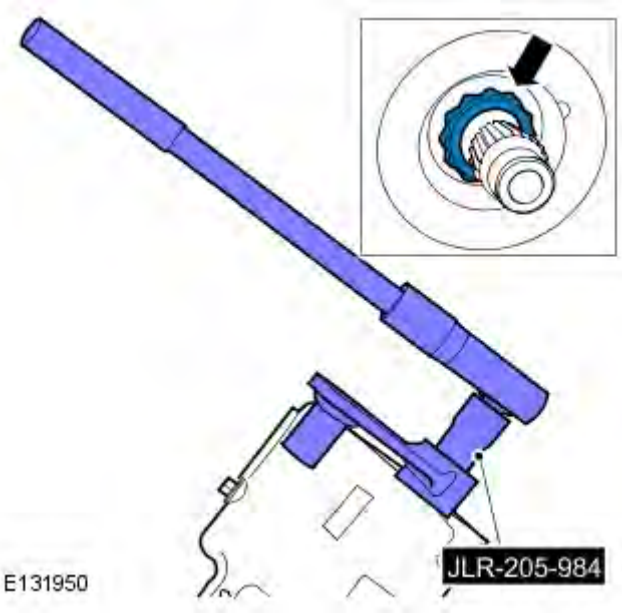


8. Position the differential assembly in a suitable vice as shown.



9. **9.** CAUTION: Make sure the pinion seal recess is not damaged as the seal is removed.

   Using the special tool remove the pinion shaft oil seal.

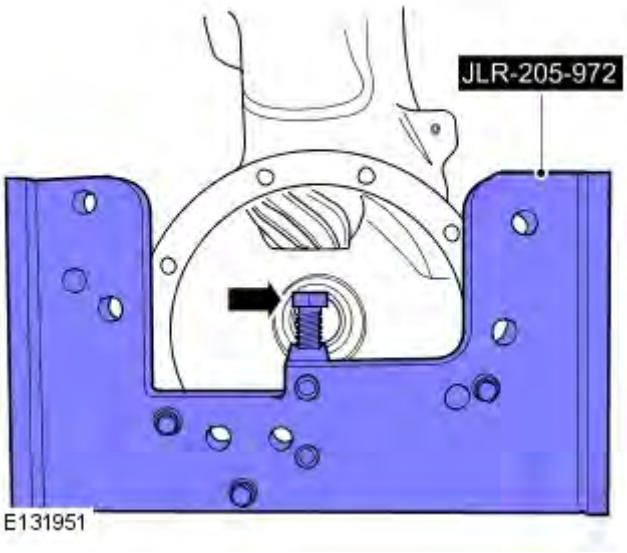


10. **10.** WARNING: High torque application.

CAUTION: Do not use air tools or heat to remove the nut (as this could contaminate the head bearing). Failure to follow this instruction may result in damage to the component.

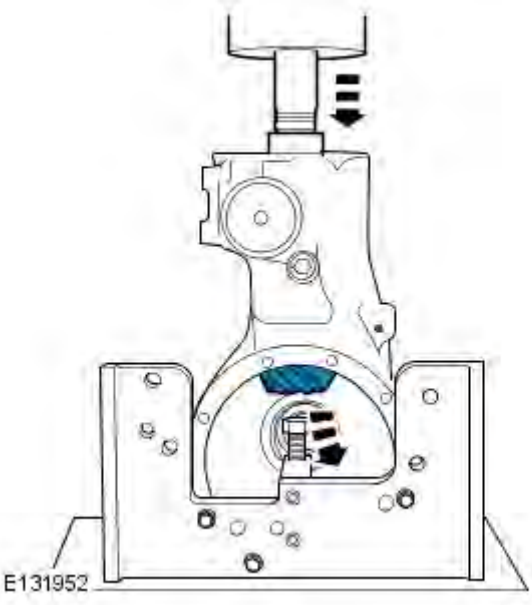
• NOTE: The special tool should be turned clockwise to remove the pinion shaft nut.

Using the special tools remove the pinion shaft nut.



11.

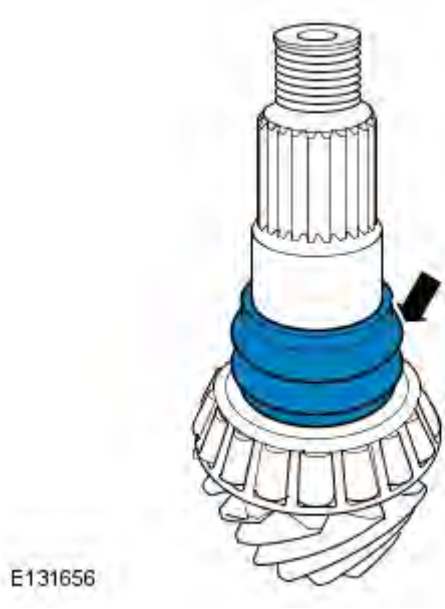
- Secure the differential casing to the special tool.
- Position the support bolt to its lowest setting.



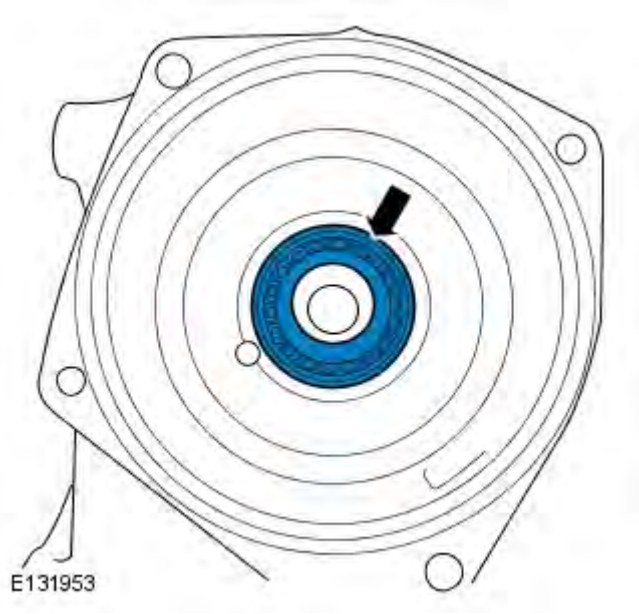
12. **12.** CAUTION: Twisting or damage to the casing may occur if the base plates to support the jig on the press are not used.

Using a suitable press remove the differential pinion shaft.

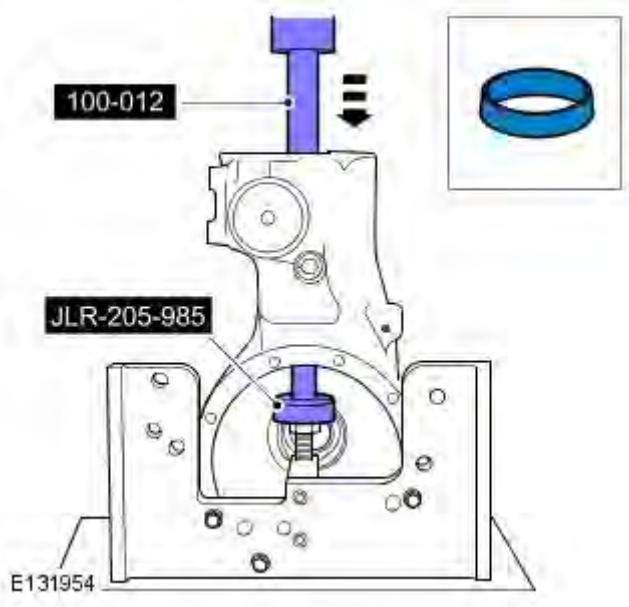
13. Remove and discard the pinion shaft collapsible spacer.



14. Remove the tail bearing inner race.



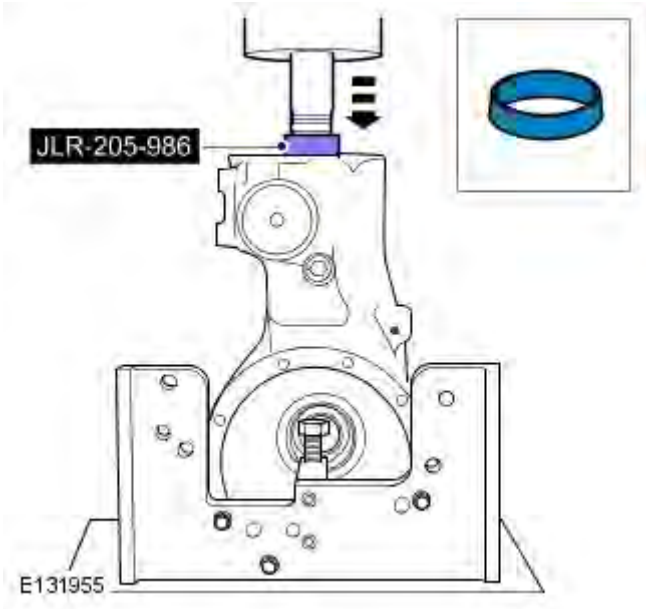
15. Using the special tools remove the pinion shaft tail bearing outer race.



16. **16.** CAUTION: It is essential that absolute cleanliness is observed when working on the rear differential. Always cover any open orifices using lint free non-flocking material to prevent the ingress of foreign matter. Failure to follow this instruction may result damage to the components.

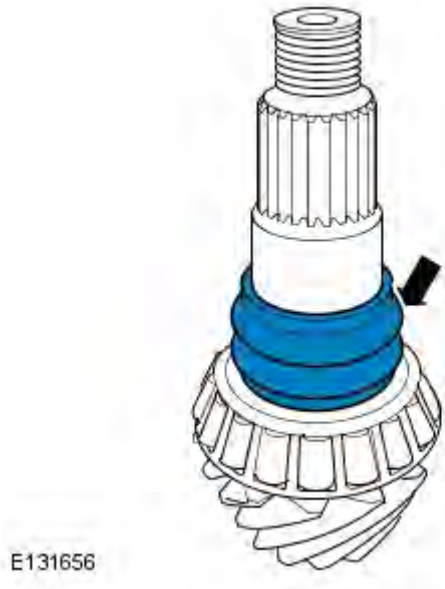
    - Remove the differential from the supporting tool.
    - Thoroughly clean the pinion shaft paying particular attention to the thread.
    - Using a suitable cleaning fluid thoroughly clean the differential casings.

Installation

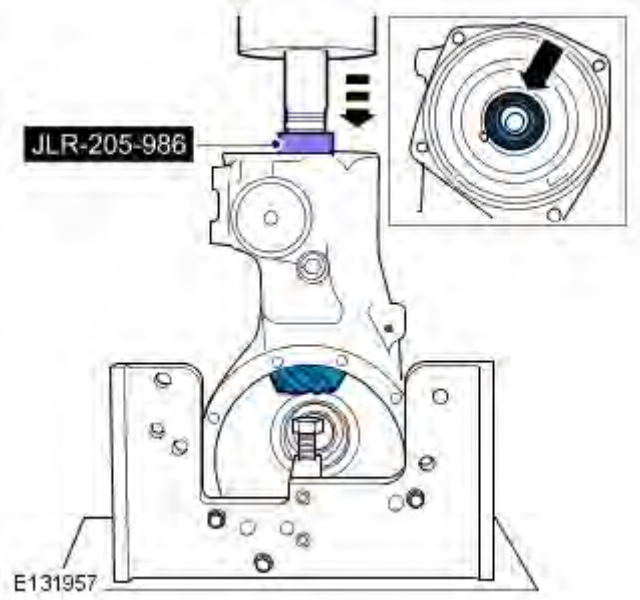


1. **1.** CAUTION: Do not clean or lubricate the new pinion shaft tail bearing, as it is supplied coated with a low friction oil. Failure to follow this instruction will require the pinion shaft tail bearing to be replaced before the differential can be successfully assembled.

    - Secure the differential casing to the special tool.
    - Using a suitable press and the special tool install the pinion shaft tail bearing outer race.

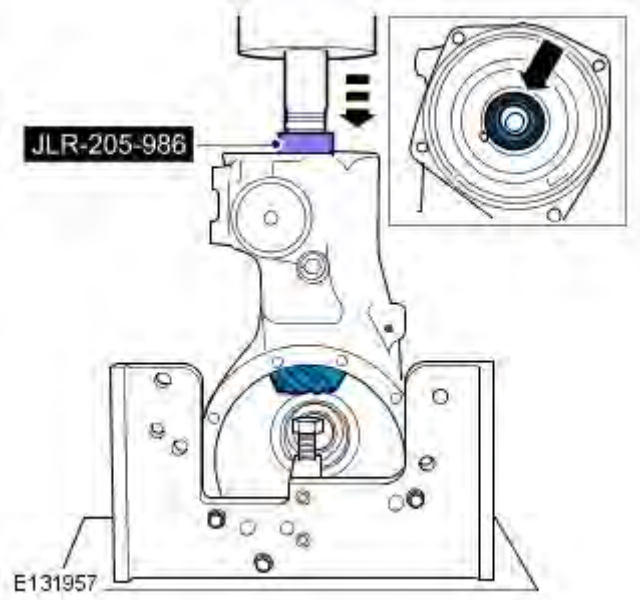


2. Install the new pinion shaft spacer.



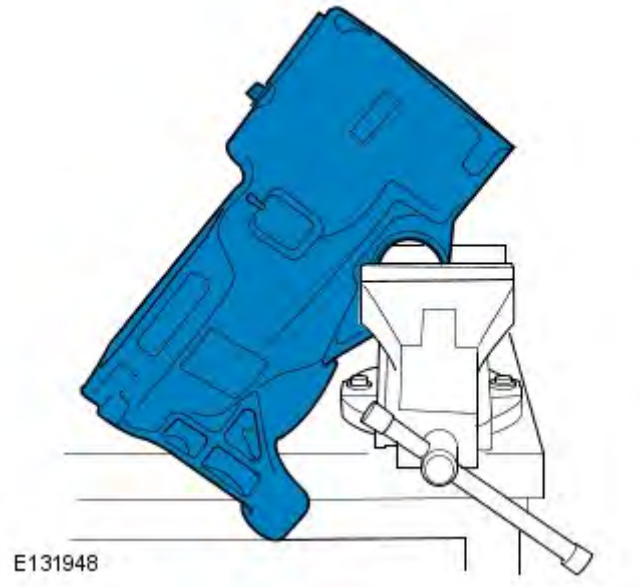
3.

- Install the pinion shaft to the differential case.
- Lubricate the pinion head bearing with differential oil.
- Position the support bolt to its highest setting.



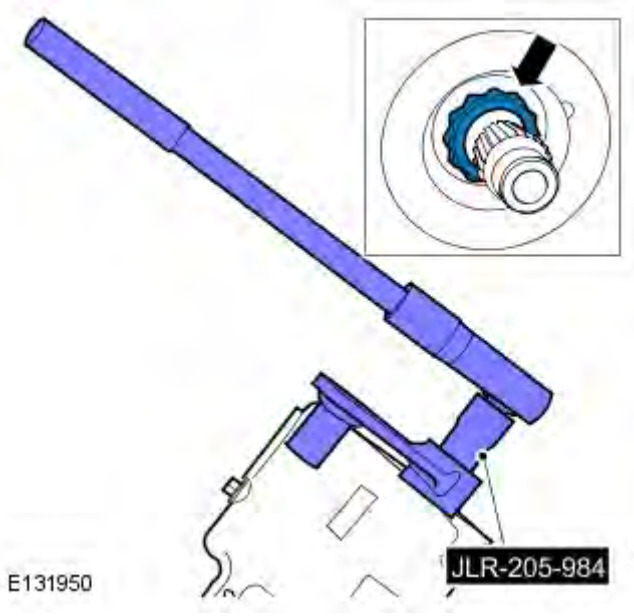
4. **4.** CAUTION: Do not clean or lubricate the new pinion shaft tail bearing, as it is supplied coated with a low friction oil. Failure to follow this instruction will require the pinion shaft tail bearing to be replaced before the differential can be successfully assembled.

   Using a suitable press and the special tool install the pinion shaft tail bearing inner race.



5.

- Position the differential assembly in a suitable vice as shown.
- Remove the differential from the supporting tool.



6. **6.** WARNING: High torque application.

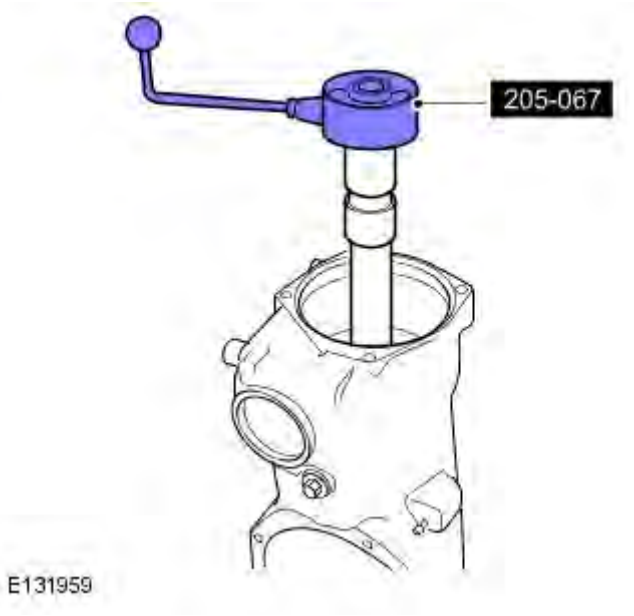
   • CAUTIONS:

   The special tool should be turned counter clockwise to install the pinion shaft nut.

   Do not use air tools to install the nut. Failure to follow this instruction may result in damage to the component.

   • NOTE: 250 Nm (184 lb.ft) is the minimum torque requirement to begin collapsing the pinion shaft spacer.

   - Using the special tools install the new pinion nut.
   - Tighten to 250 Nm (184 ib. ft).



7. **7.** CAUTIONS:

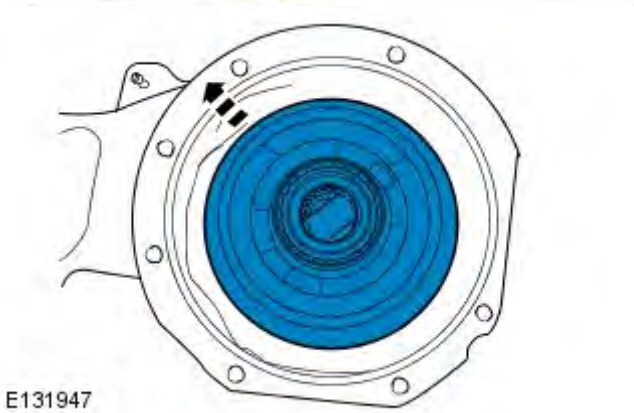
   Make sure the specified torque to rotate the pinion shaft is not exceeded. If excess preload is applied to the joint the pinion shaft should be removed and a new collapsible spacer, pinion shaft tail bearing, pinion shaft tail bearing cup and pinion nut must be installed.

   The special tool should be rotated at 60 rpm (1x revolution per second) to produce a consistent reading.

   The pinion shaft should be rotated through two full revolutions by hand before the torque measurement is performed.

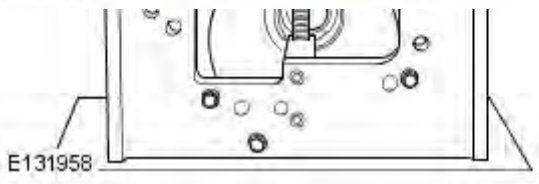
   - Using the special tool, check the torque required to rotate the pinion shaft. The specified torque is 1.1 Nm +/- 0.2 Nm
   - If the specified torque to rotate the pinion shaft is not reached, using the special tools, tighten the pinion flange nut in one degree increments and check the rotational torque after each until the specified torque of 1.1 Nm +/-0.2 Nm is achieved.

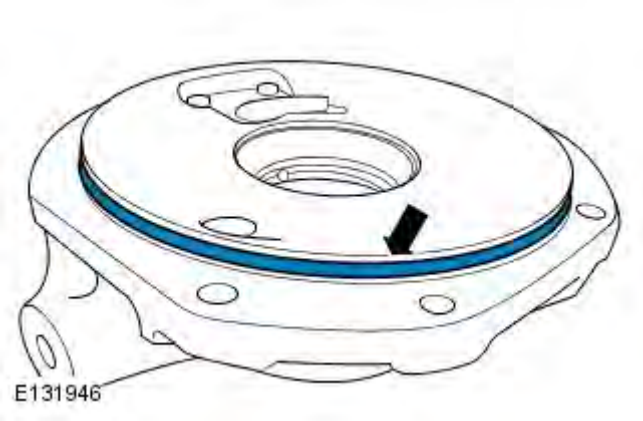
9. Install the crown wheel assembly.



8. **8.** CAUTION: Do not lubricate the pinion oil seal.

   Using a suitable press, the special tool and adapter install the pinion bearing oil seal.



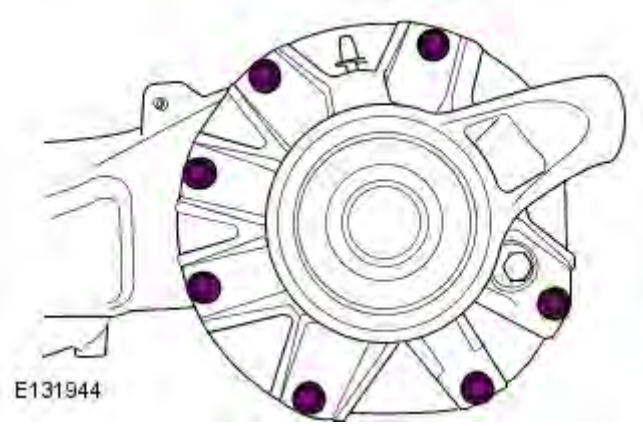


10. **10.** CAUTIONS:

    Make sure the mating faces are clean, failure to follow this instruction may result in damage to the differential.

    Make sure the new seal is not twisted when fitting, failure to follow this instruction may result in damage to the differential.

    - Install the differential case seal.
    - Apply a thin amount of clean differential oil to the new differential casing seal.



11.
    - Install the differential casing bolts.
    - Tighten the 7 bolts to 29 Nm.

12. Install the rear differential.

    Refer to: Differential Case (205-02 Rear Drive Axle/Differential, Removal and Installation).

13. Fill the differential case with fluid.

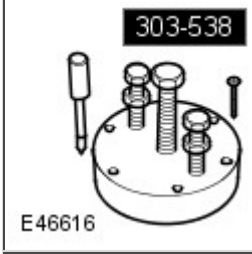
    Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

Published: 11-May-2011

Rear Drive Axle/Differential - Drive Pinion Seal

Removal and Installation

Special Tool(s)

	100-012 Slide Hammer
	205-865 Installer, Differential Pinion Seal
	303-538 Remover/Installer, Crankshaft Oil Seal
	308-615 Remover, Seals

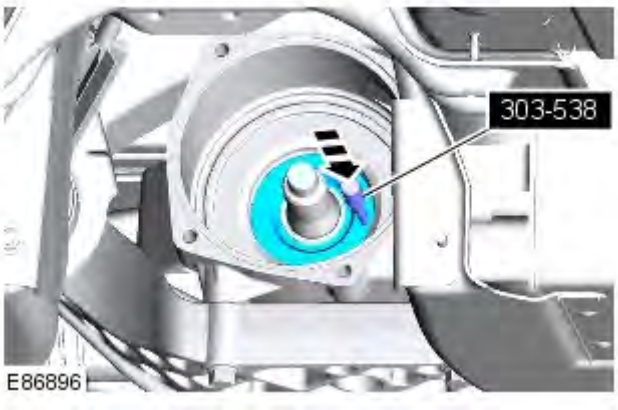
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the active on-demand coupling.

   Refer to: Active On-Demand Coupling (205-02 Rear Drive Axle/Differential, Removal and Installation).



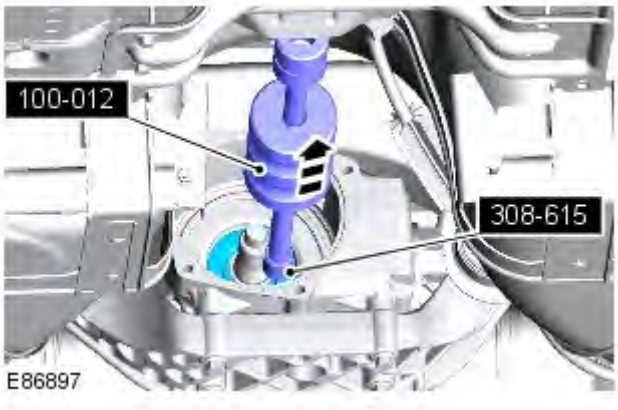
3. **3.** CAUTIONS:

   Take extra care not to damage the edges of the component.

   Take extra care not to damage the mating faces.

   Using the special tool, punch a hole in the oil seals outer edge.

   Special Tool(s): 303-538



4. **4.** CAUTIONS:

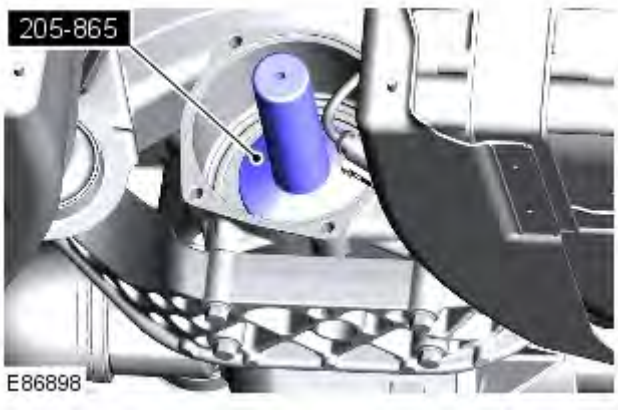
   Take extra care not to damage the mating faces.

   Be prepared to collect escaping oil.

   Using the special tools and a self tapping screw, remove the oil seal.

   Special Tool(s): 308-615, 100-012

Installation



1. **1.** CAUTIONS:

   Take extra care not to damage the seal.

   Make sure that the area around the component is clean and free of foreign material.

   Using the special tool, install the new drive pinion seal.

   Special Tool(s): 205-865

2. Install the active on-demand coupling.

   Refer to: Active On-Demand Coupling (205-02 Rear Drive Axle/Differential, Removal and Installation).

3. Check and top-up the differential case.

   Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

Published: 11-May-2011

Rear Drive Axle/Differential - Rear Halfshaft Seal

Removal and Installation

Special Tool(s)

	205-863 Installer, Halfshaft Seal

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the halfshaft.

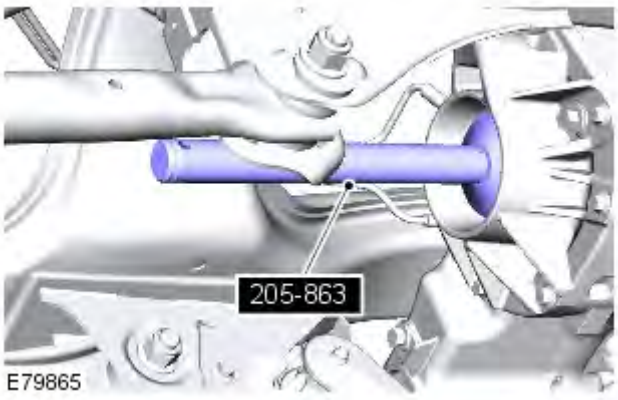
   Refer to: Rear Halfshaft LH (205-05 Rear Drive Halfshafts, Removal and Installation).

4. **4.** CAUTIONS:

   Take extra care not to damage the mating faces.

   Take extra care not to damage the edges of the component.

Installation



1. **1.** CAUTIONS:

   Make sure that the seal is correctly located.

   Take extra care not to damage the seal.

   Using the special tool, install a new rear halfshaft oil seal.

   Special Tool(s): 205-863

2. Install the halfshaft.

   Refer to: Rear Halfshaft LH (205-05 Rear Drive Halfshafts, Removal and Installation).

3. Install the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Front Drive Axle/Differential - Front Drive Axle and Differential

Description and Operation

For additional information, refer to: Transmission Description (307-01 Automatic Transmission/Transaxle, Description and Operation).

For additional information, refer to: Manual Transmission and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Description and Operation).

Published: 11-May-2011

Front Drive Axle/Differential - Front Drive Axle

Diagnosis and Testing

For additional information.
REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Front Drive Halfshafts -

General Specification

Item	Specification
Type	Fully floating, solid shafts with inner and outer constant velocity joints

Recommended Lubricant

Item	Specification
Front drive halfshaft (auto only)	Weicon anti-seize grease
Outboard joint	Use grease supplied with replacement boot kit
Inboard joint	Use grease supplied with replacement boot kit

Torque Specifications

Description	Nm	lb-ft
Extension shaft bearing anchorage to block bolts - 3.2L Petrol	48	35
Extension shaft bearing anchorage to transmission bolts - 3.2L Petrol	25	18
Extension shaft bearing anchorage to block bolts- 2.2L Diesel	65	48
Extension shaft bearing anchorage to transmission bolts - 2.2L Diesel	25	18
Front halfshaft to hub bolt*	45 + 80°	33 + 80°
Heat shield to bearing anchorage	10	7

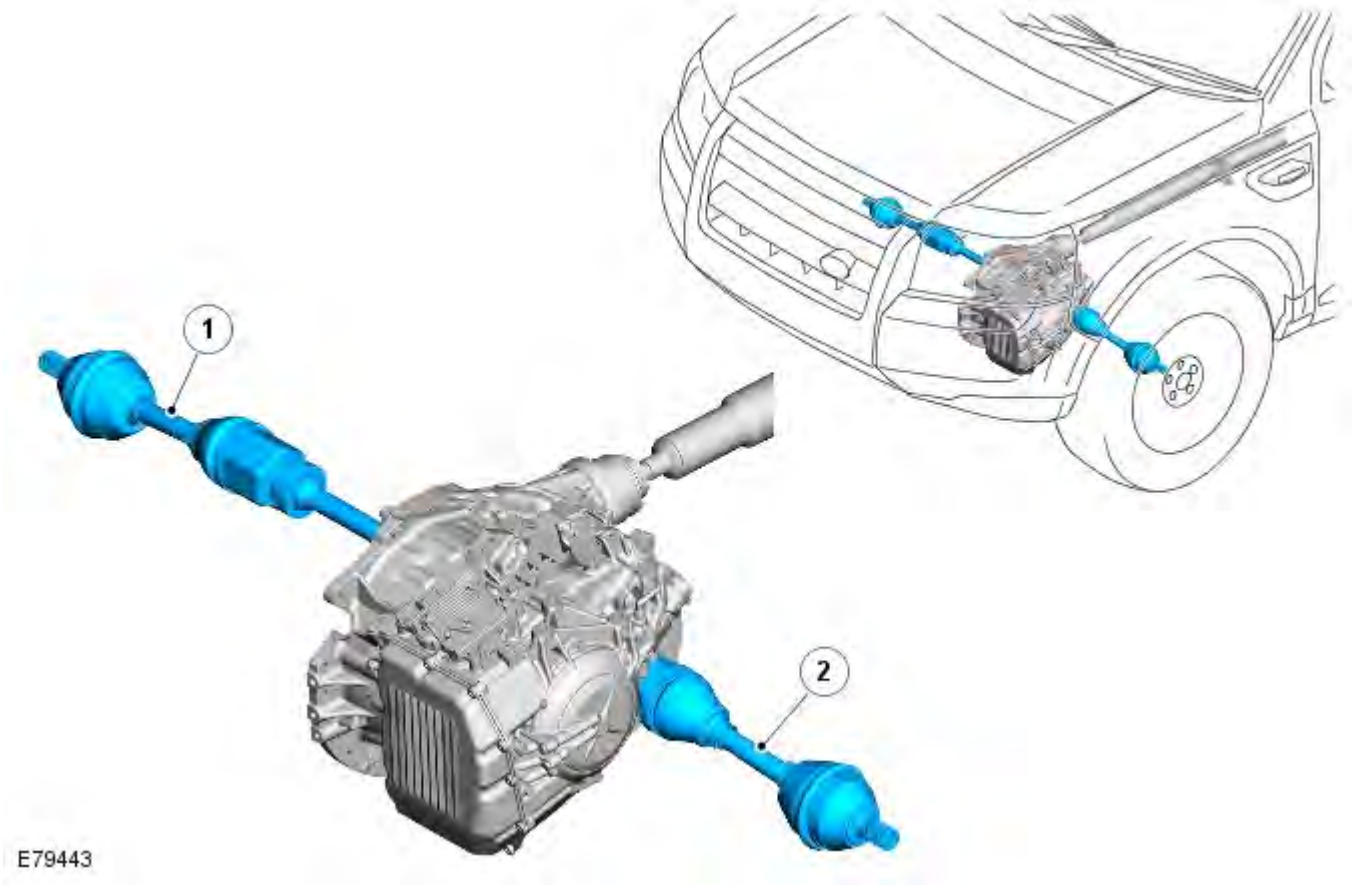
*** New nuts/bolts must be fitted**

Published: 11-May-2011

Front Drive Halfshafts - Front Drive Halfshafts

Description and Operation

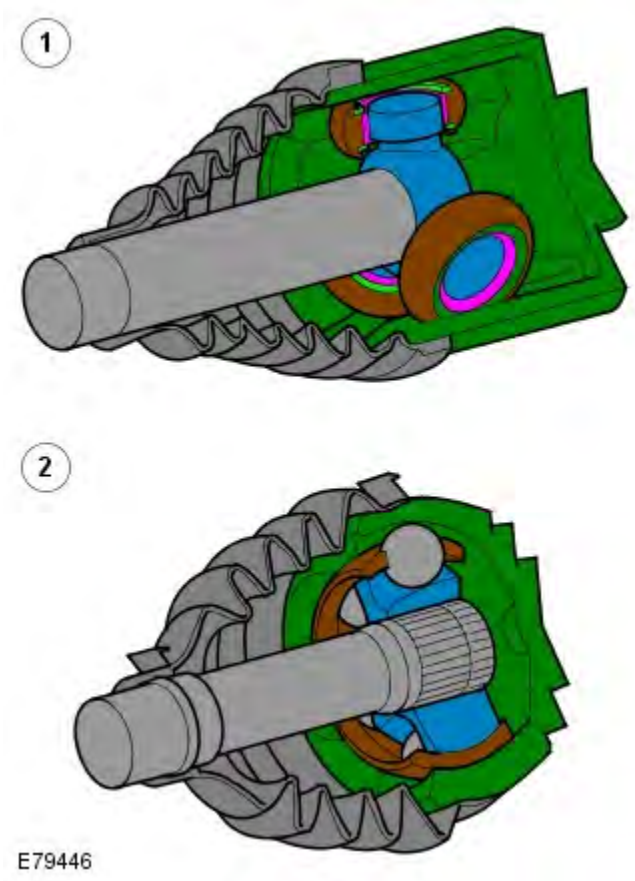
COMPONENT LOCATION



Item	Part Number	Description
1	-	Halfshaft - RH (right-hand)
2	-	Halfshaft - LH (left-hand)

OVERVIEW

Constant Velocity Joints



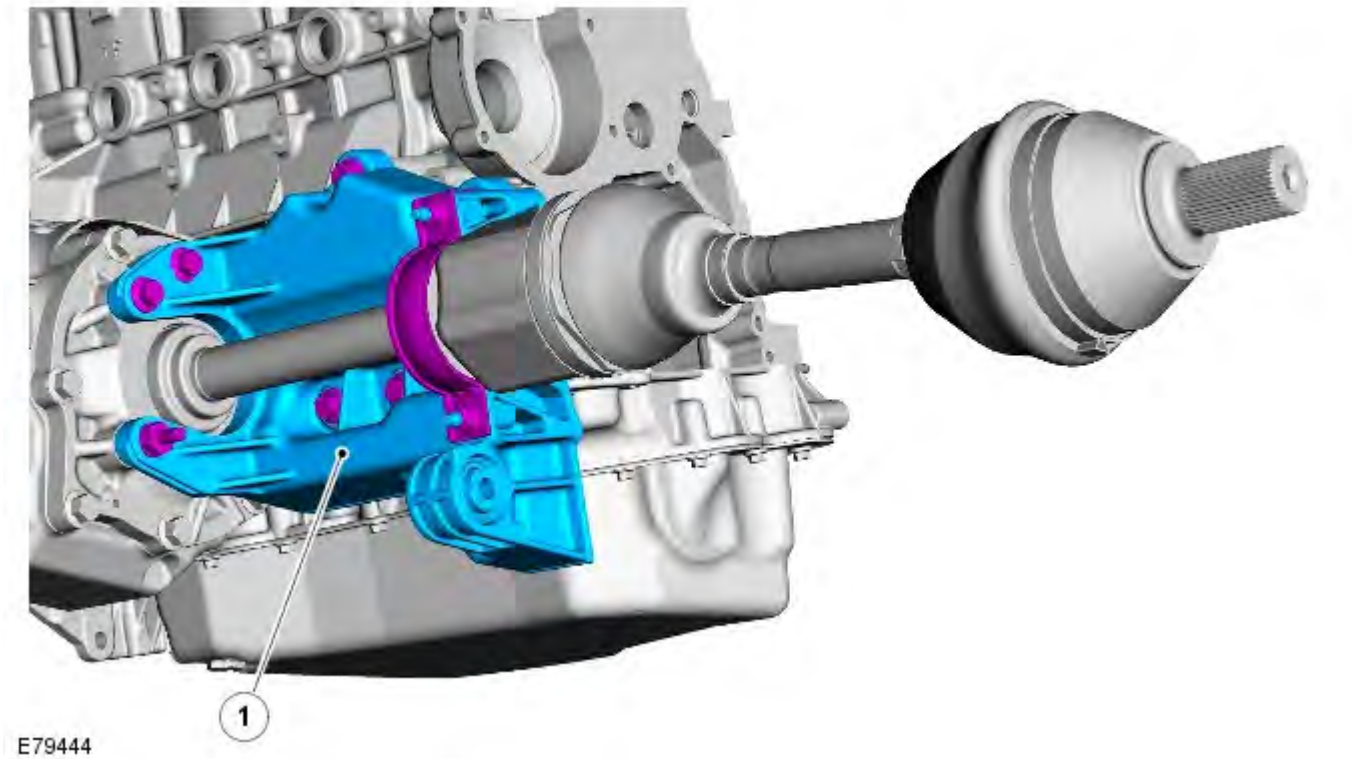
Item	Part Number	Description
A	-	Inner constant velocity joint
B	-	Outer constant velocity joint

Each halfshaft comprises a solid steel shaft with inner and outer constant velocity joints. The inner joint is the 'tripode' type with spherical bushing to reduce sliding resistance; the shaft and inner joint are one assembly.

The outer joint is the 'ball and socket' type, with a splined connection between the joint and the shaft. The joints are packed with grease and protected by gaiters.

The halfshafts are of equal length to eliminate stiffness-related torque-steer.

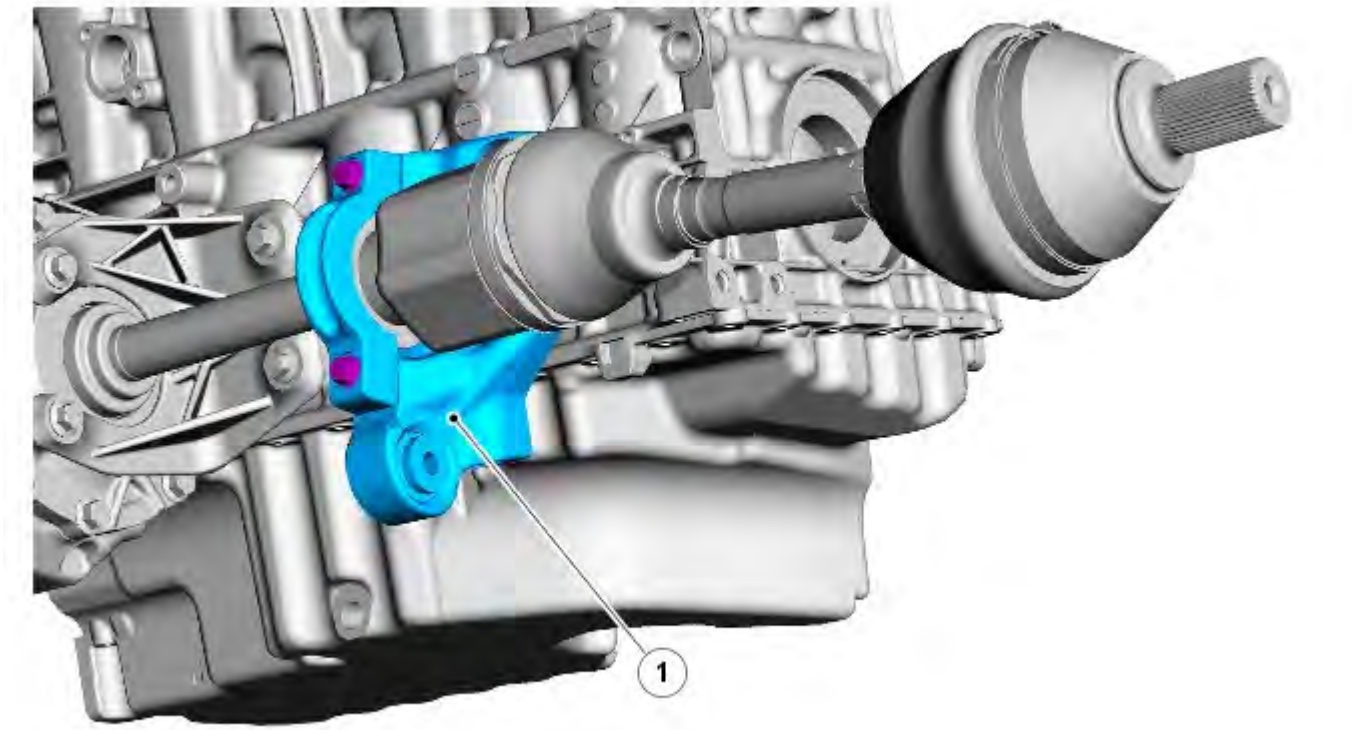
Bearing Anchorage - Diesel Derivative



E79444

Item	Part Number	Description
1	-	Bearing anchorage - diesel derivative

Bearing Anchorage - Petrol Derivative



E79445

Item	Part Number	Description
1	-	Bearing anchorage - petrol derivative

An extension shaft attached to the right-hand halfshaft is supported by a bearing anchorage arrangement. The bearing anchorage on the diesel and petrol derivatives are of different construction, each designed to support the specific engine torque loadings.

Published: 11-May-2011

Front Drive Halfshafts - Front Drive Halfshafts

Diagnosis and Testing

For additional information.
REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).

Published: 13-May-2011

Front Drive Halfshafts - Front Halfshaft LH

Removal and Installation

Special Tool(s)

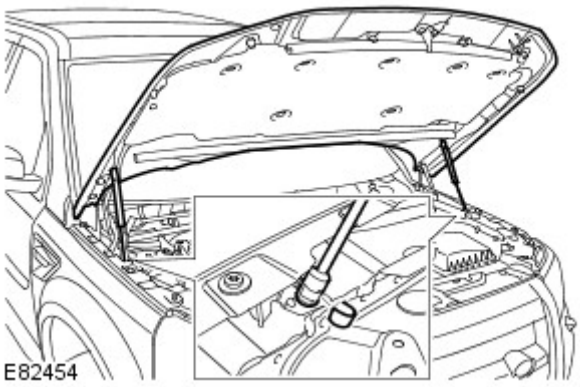
	204-619 G-Clamp
	205-754A Splitter, Ball Joints
	205-857 Remover, Halfshaft

Removal

- NOTE: The seal protector is not a special tool but is available from the parts catalogue.

1. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



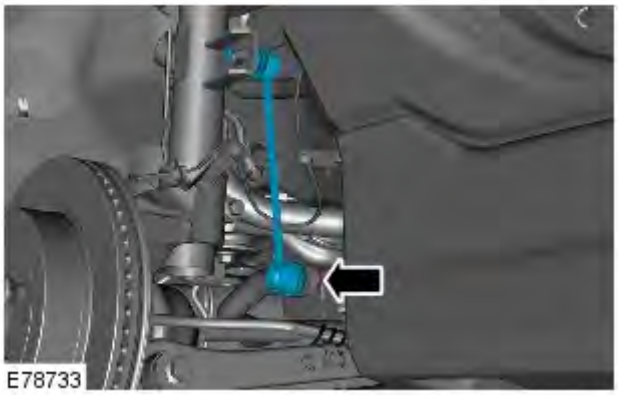
2. Release the hood support struts and secure the hood in an upright position.

3. **3.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

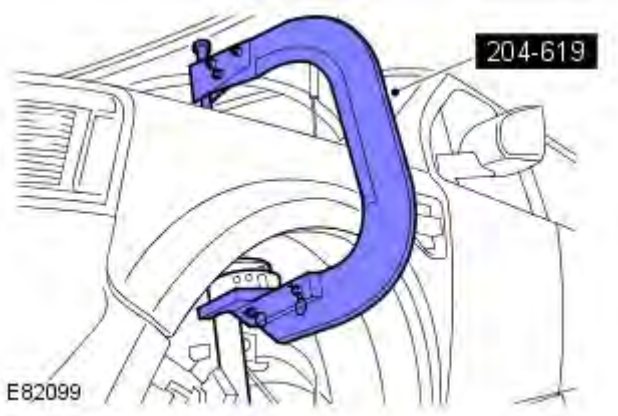
4. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



5. **5.** WARNING: Make sure that a new nut is installed.

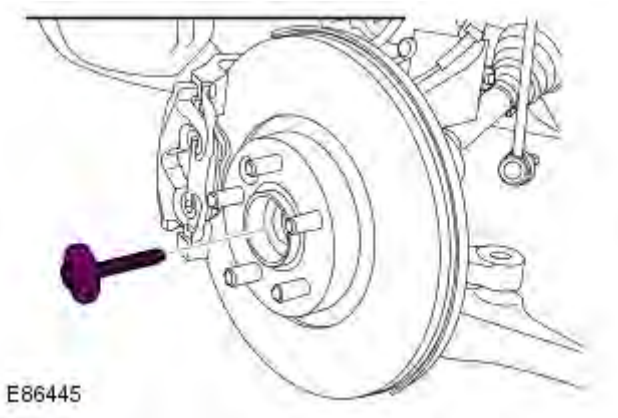
   Torque: 60 Nm



6. **6.** NOTE: This step requires the aid of another technician.

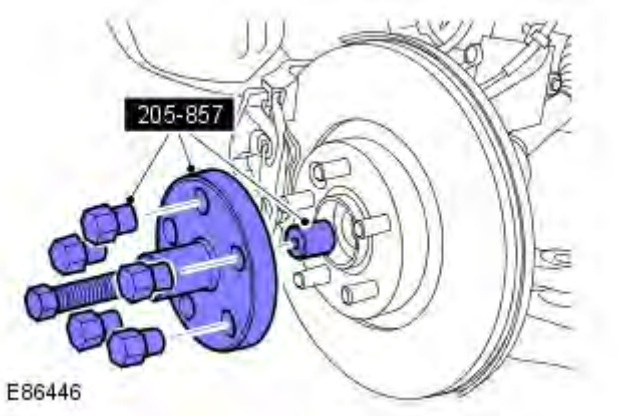
   Compress the spring and damper assembly.

   Special Tool(s): 204-619



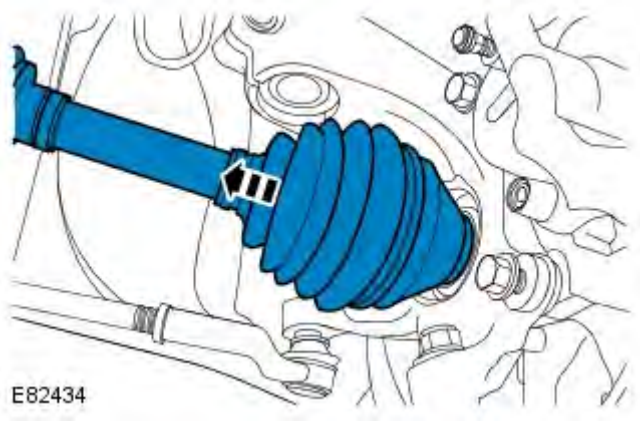
7. **7.** WARNING: Make sure that a new bolt is installed.

   Torque:
   Stage 1:45 Nm
   Stage 2:60°



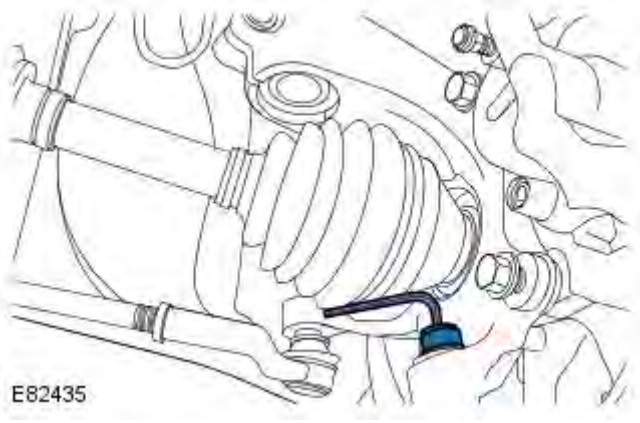
8. Partially release the halfshaft from the wheel knuckle.

   Special Tool(s): 205-857



9. **9.** CAUTION: Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

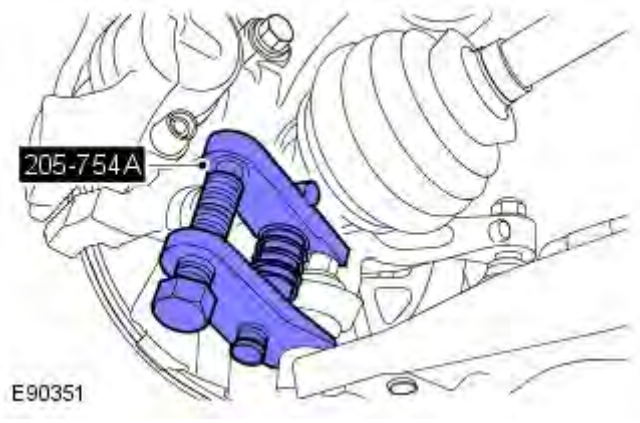
   Partially release the halfshaft from the wheel knuckle.



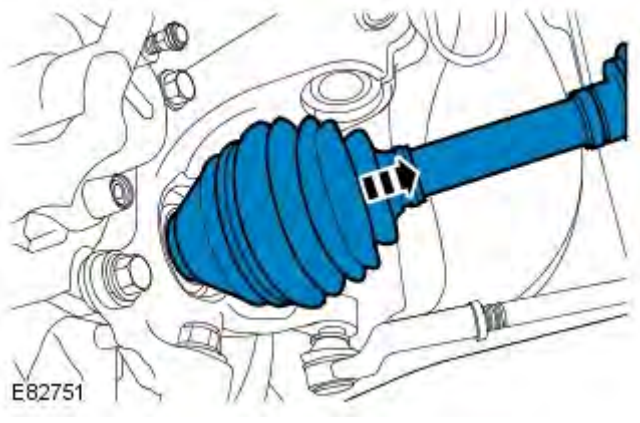
10. **10.** WARNING: Make sure that a new lower arm ball joint nut is installed.

    CAUTION: Make sure that the ball joint ball does not rotate.

    Torque: 100 Nm

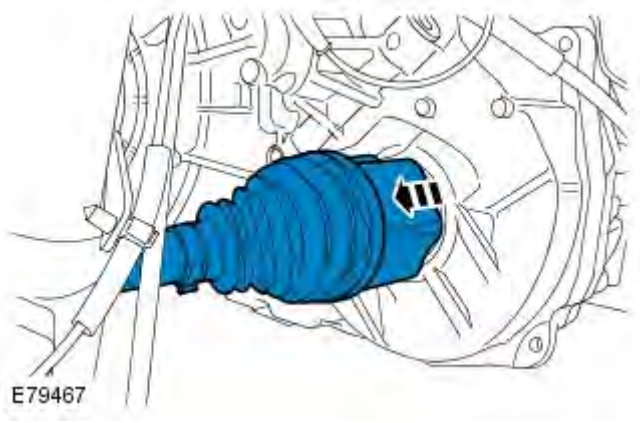


11. *Special Tool(s):* 205-754A



12. **12.** CAUTION: Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

    Remove the halfshaft from the wheel knuckle.

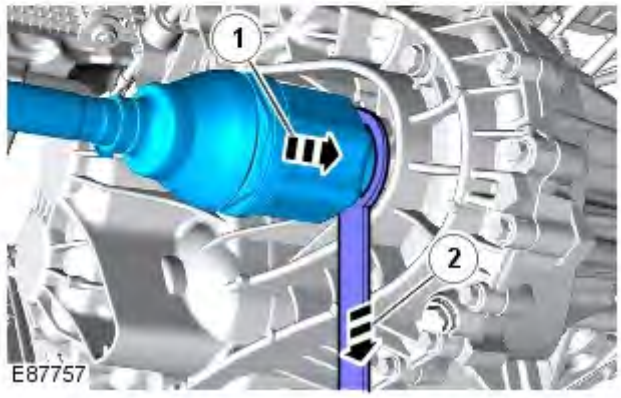


13. **13.** WARNING: Manual transmission: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

Installation

1. **1.** NOTE: Do not fully engage the halfshaft until the oil seal protector has been removed.

   To prevent oil seal damage use the protector when installing the shaft into the transmission. It is not a special tool but is available from the Parts Catalogue.



2. **2.** CAUTIONS:

   Install the halfshaft nut finger tight.

   Do not use air tools to install the nut. Failure to follow this instruction may result in damage to the component.

   To install, reverse the removal procedure.

3. Manual transmission vehicles only: Check and top-up the transmission fluid level.

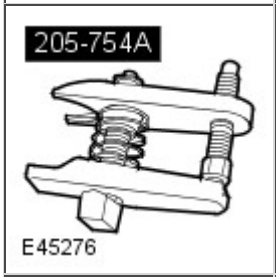
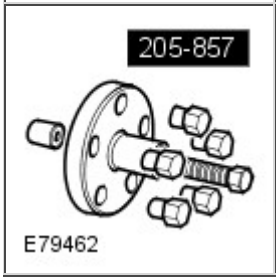
   Refer to: Transmission Fluid Level Check (308-03 Manual Transmission/Transaxle, General Procedures).

Published: 18-May-2011

Front Drive Halfshafts - Front Halfshaft RH

Removal and Installation

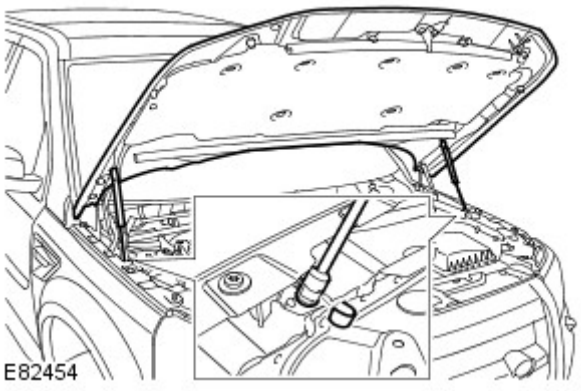
Special Tool(s)

	204-619 G-Clamp
	205-754A Splitter, Ball Joints
	205-857 Remover, Halfshaft

Removal

1. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



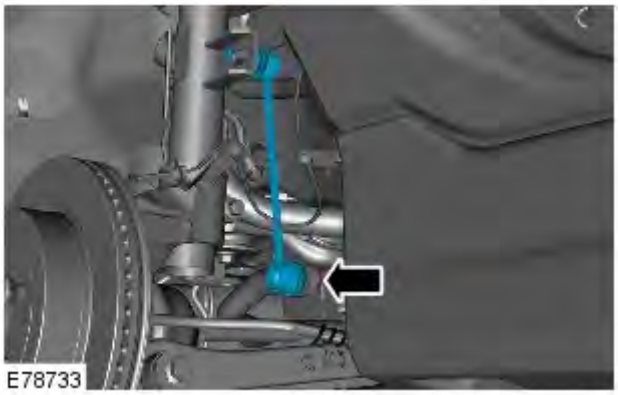
2. Release the hood support struts and secure the hood in an upright position.

3. **3.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

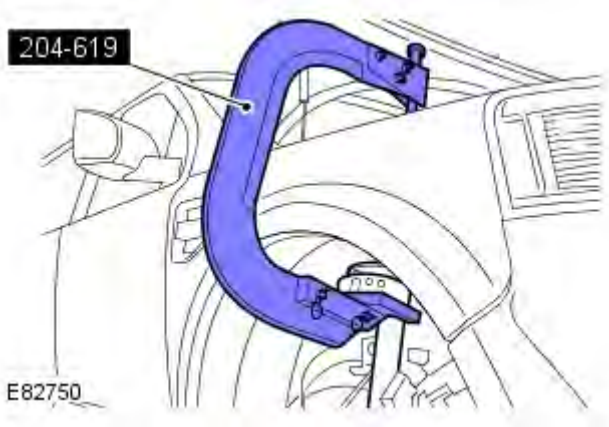
4. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



5. **5.** WARNING: Make sure that a new nut is installed.

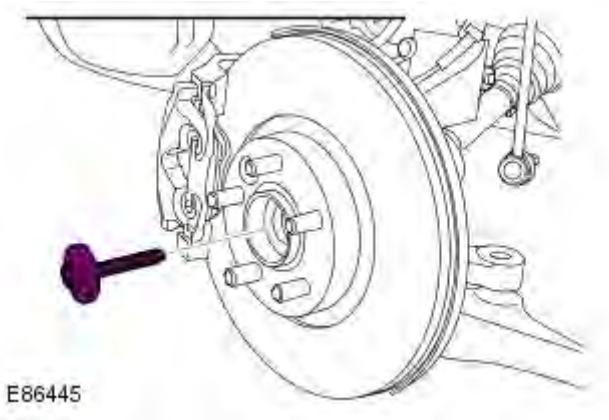
   Torque: 60 Nm



6. **6.** NOTE: This step requires the aid of another technician.

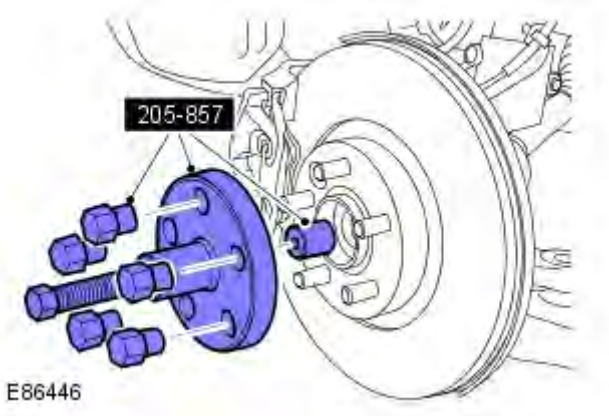
   Compress the spring and damper assembly.

   Special Tool(s): 204-619



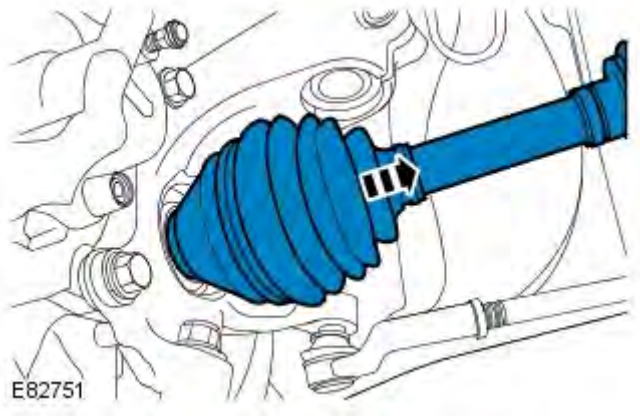
7. **7.** WARNING: Make sure that a new bolt is installed.

   Torque:
   Stage 1:45 Nm
   Stage 2:60°



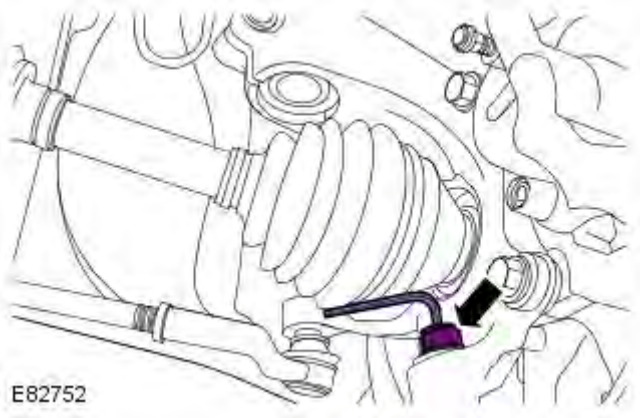
8. Partially release the halfshaft from the wheel knuckle.

   Special Tool(s): 205-857



9. **9.** CAUTION: Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

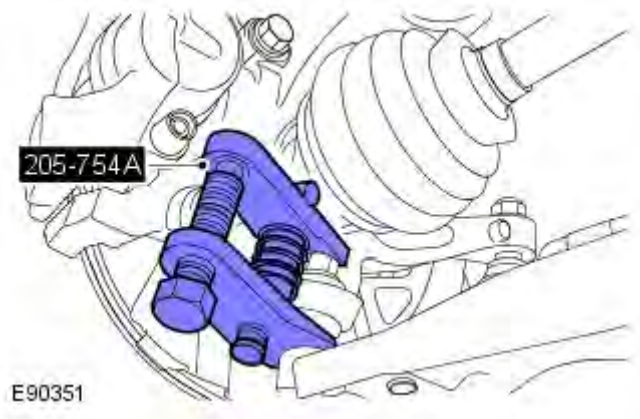
   Partially release the halfshaft from the wheel knuckle.



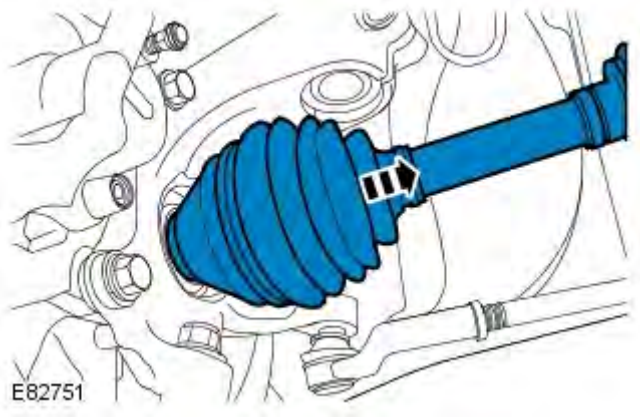
10. **10.** WARNING: Make sure that a new lower arm ball joint nut is installed.

    CAUTION: Make sure that the ball joint ball does not rotate.

    Torque: 100 Nm

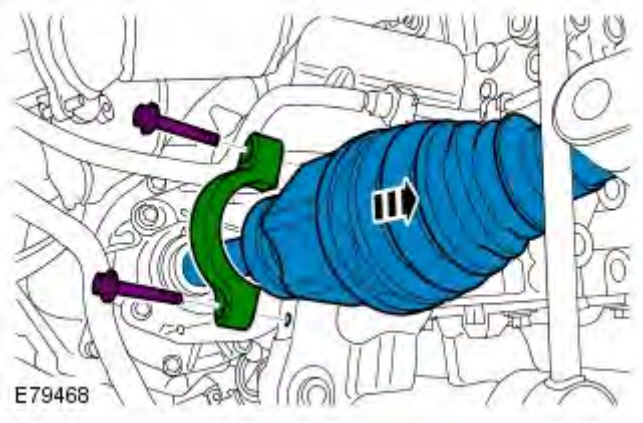


11. *Special Tool(s):* 205-754A



12. **12.** CAUTION: Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

    Remove the halfshaft from the wheel knuckle.



13. **13.** WARNING: Manual transmission: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

    • NOTE: Petrol illustration shown, diesel uses studs and nuts. The torque figure is the same for all models.

    Torque: 25 Nm

Installation

1. **1.** CAUTIONS:

   Install the halfshaft nut finger tight.

   Do not use air tools to install the nut. Failure to follow this instruction may result in damage to the component.

   To install, reverse the removal procedure.

2. Manual transmission vehicles only: Check and top-up the transmission fluid level.

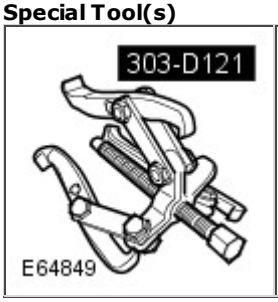
   Refer to: Transmission Fluid Level Check (308-03 Manual Transmission/Transaxle, General Procedures).

Published: 11-May-2011

Front Drive Halfshafts - Inner Constant Velocity (CV) Joint Boot

Removal and Installation

Special Tool(s)

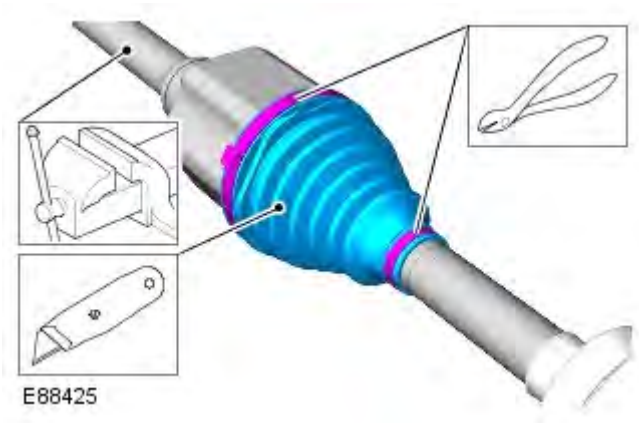
	303-D121 Puller, General Purpose

Removal

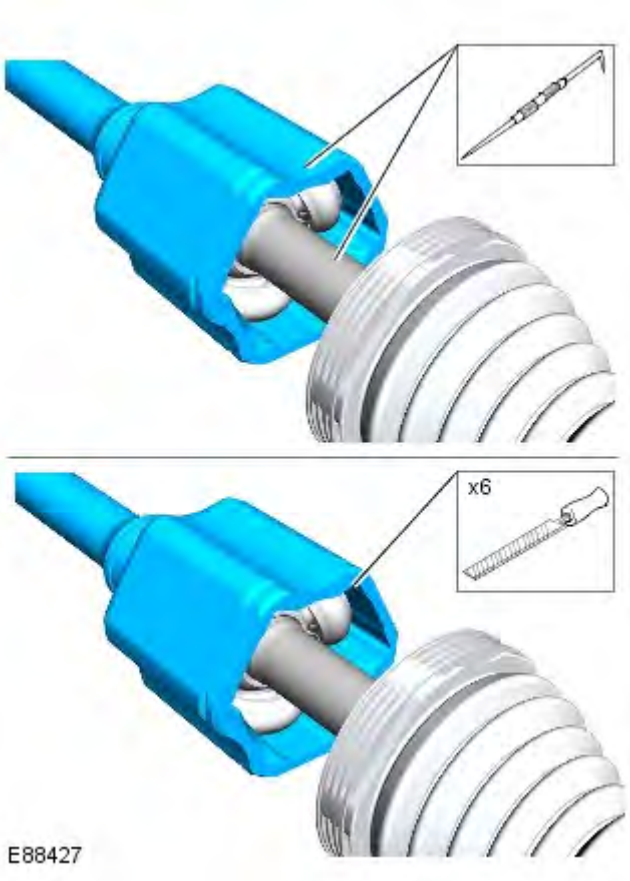
- NOTE: RH inner constant velocity joint boot shown, LH is similar.

1. Remove the halfshaft.

   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).



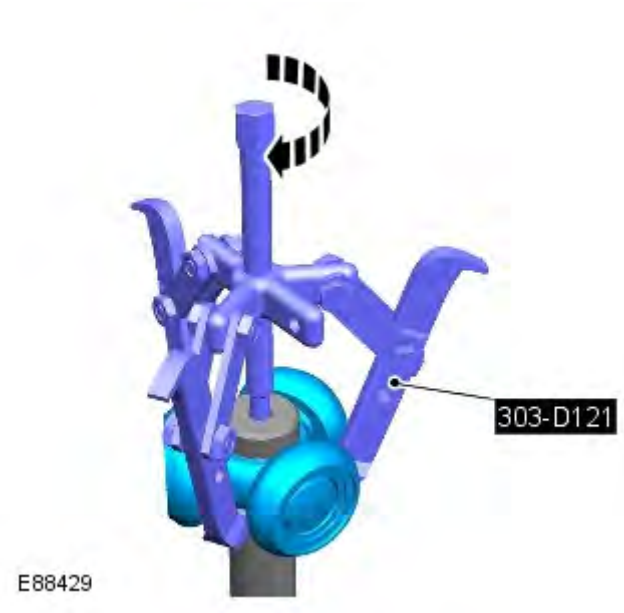
2. **2.** NOTE: Discard the retaining clips.



3. **3.** CAUTION: Make sure that filings and swarf do not enter the component.

4. **4.** NOTE: Discard the retaining clip.

5. *Special Tool(s):* 303-D121



Installation

1. **1.** CAUTION: Extreme cleanliness must be exercised when handling these components.

   Clean and inspect the components for deterioration.

2. Install the inner CV boot onto the halfshaft.

3. **3.** NOTE: Install a new retaining clip.

   Install the inner CV joint inner onto the halfshaft.

4. **4.** CAUTION: Make sure that these components are installed to the noted removal position.

   Install the inner CV joint outer onto the halfshaft.

5. Pack the inner CV joint with the grease supplied.

6. **6.** NOTE: Install new retaining clips.

   Secure the inner CV joint boot to the inner CV joint.

7. Install the halfshaft.

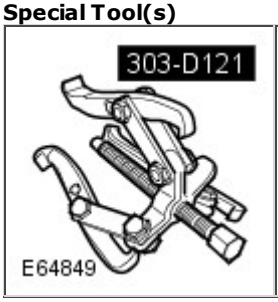
   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).

Published: 11-May-2011

Front Drive Halfshafts - Outer Constant Velocity (CV) Joint Boot

Removal and Installation

Special Tool(s)

	303-D121 Puller, General Purpose

Removal

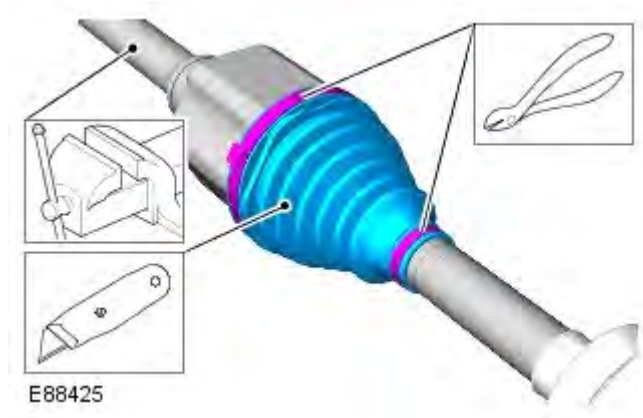
• NOTE: The outer constant velocity joint must not be removed from the shaft. The inner joint and boot have to be removed to allow the outer joint boot to be replaced. The inner and outer boots are supplied together as a kit.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

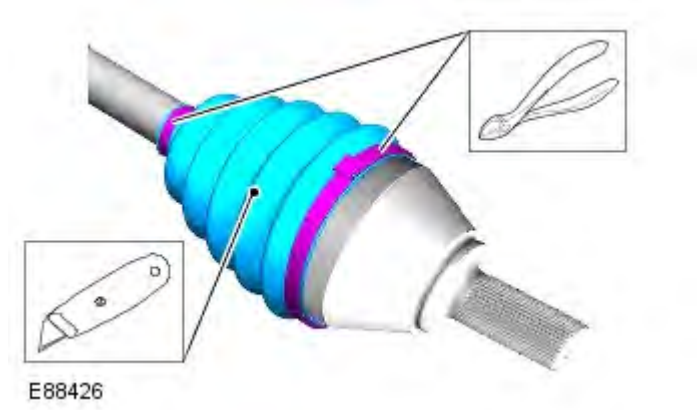
   Raise and support the vehicle.

2. Remove the halfshaft.

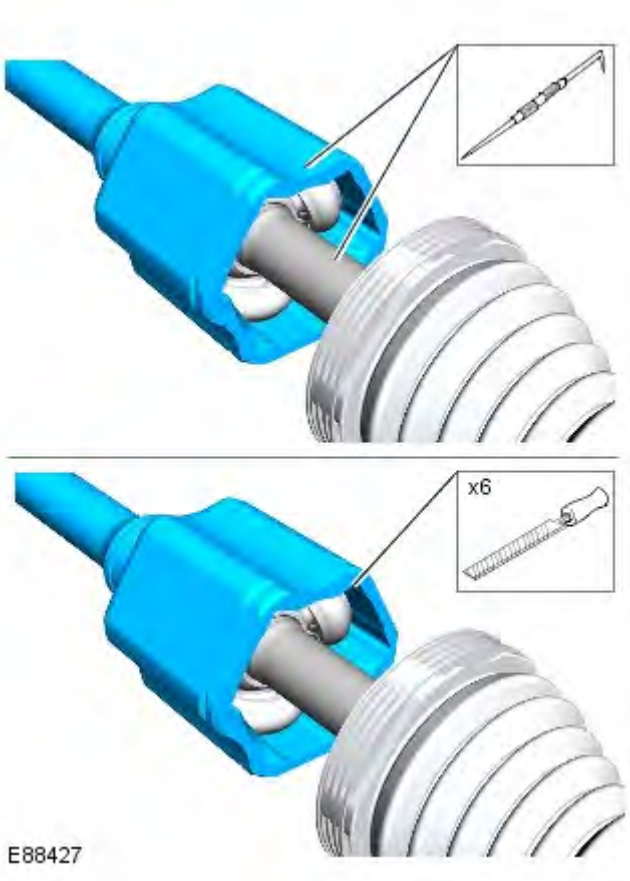
   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).



3. **3.** NOTE: Discard the retaining clips.



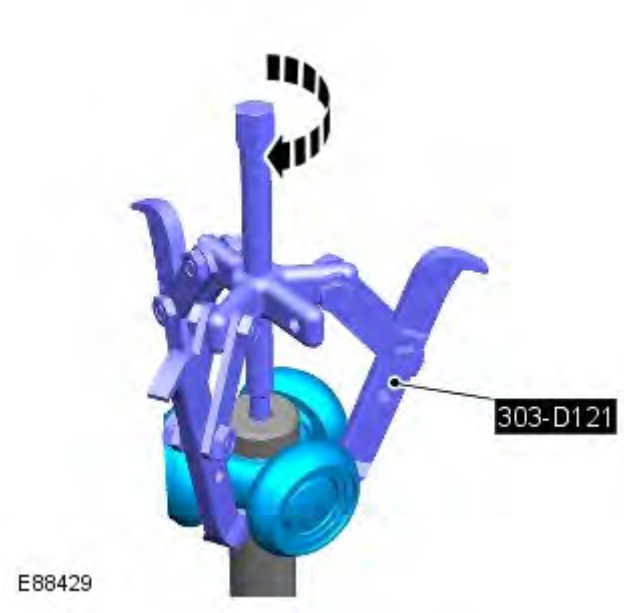
4. **4.** NOTE: Discard the retaining clips.



5. **5.** CAUTION: Make sure that filings and swarf do not enter the component.

6. **6.** NOTE: Discard the retaining clip.

7. *Special Tool(s):* 303-D121



Installation

1. **1.** CAUTION: Extreme cleanliness must be exercised when handling these components.

   Clean and inspect the components for deterioration.

2. Install the inner and outer CV boots onto the halfshaft.

3. **3.** NOTE: Install a new retaining clip.

   Install the inner CV joint inner onto the halfshaft.

4. **4.** CAUTION: Make sure that these components are installed to the noted removal position.

   Install the inner CV joint outer onto the halfshaft.

5. Pack the inner CV joint with the grease supplied.

6. Pack the outer CV joint with the grease supplied.

7. **7.** NOTE: Install new retaining clips.

   Secure the inner CV joint boot to the inner CV joint.

8. **8.** NOTE: Install new retaining clips.

   Secure the outer CV joint boot to the outer CV joint.

9. Install the RH halfshaft.

   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).

Published: 11-May-2011

Rear Drive Halfshafts -

General Specification

Item	Specification
Type	Fully floating, solid shafts with inner and outer constant velocity joints

Recommended Lubricant

Item	Specification
Inboard joint	Use grease supplied with replacement boot kit
Outboard joint	Use grease supplied with replacement boot kit

Torque Specifications

Description	Nm	lb-ft
Halfshaft nut*+	395	291

*** New nuts/bolts must be fitted**

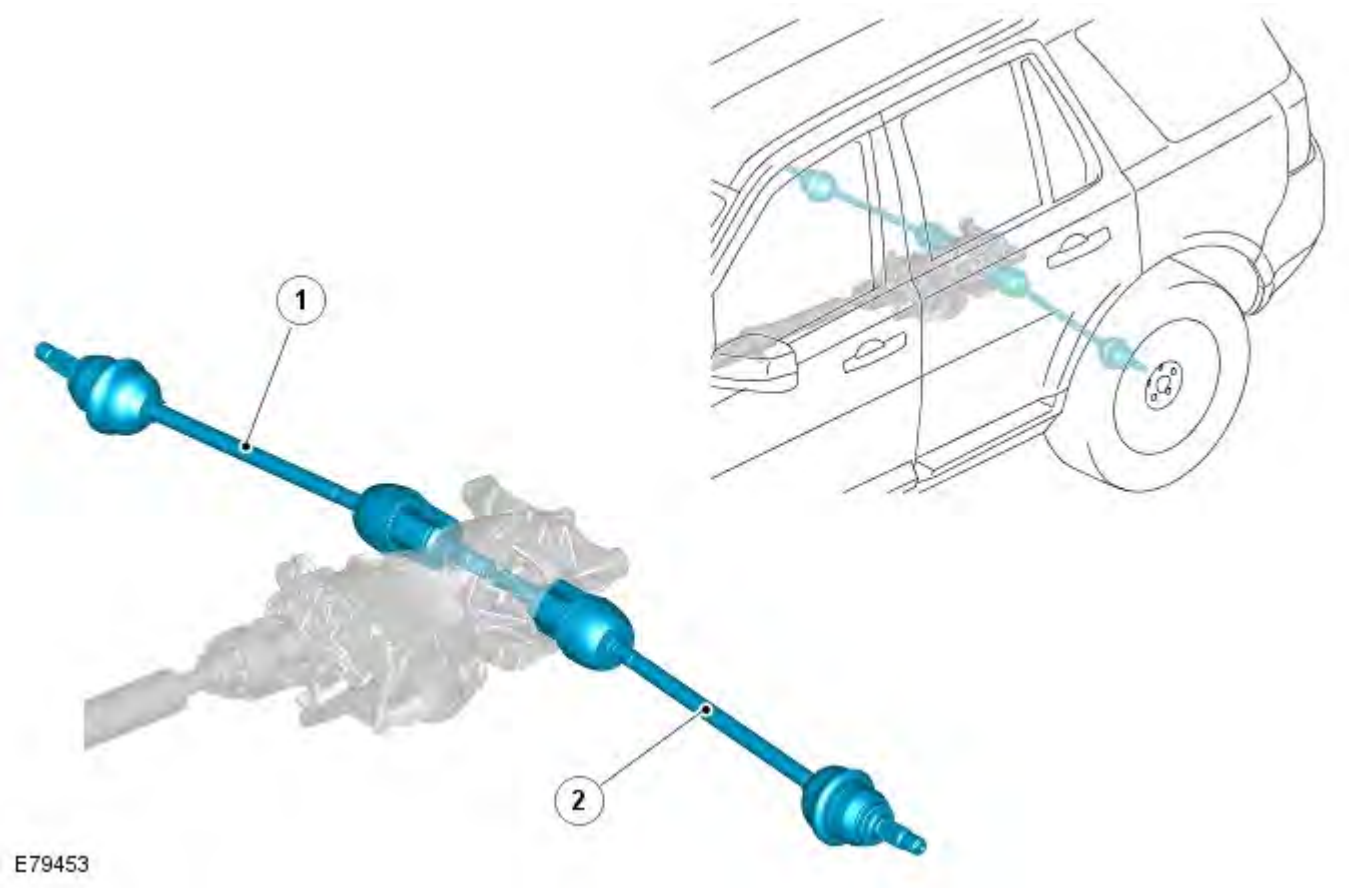
+ Stake nut on completion

Published: 11-May-2011

Rear Drive Halfshafts - Rear Drive Halfshafts

Description and Operation

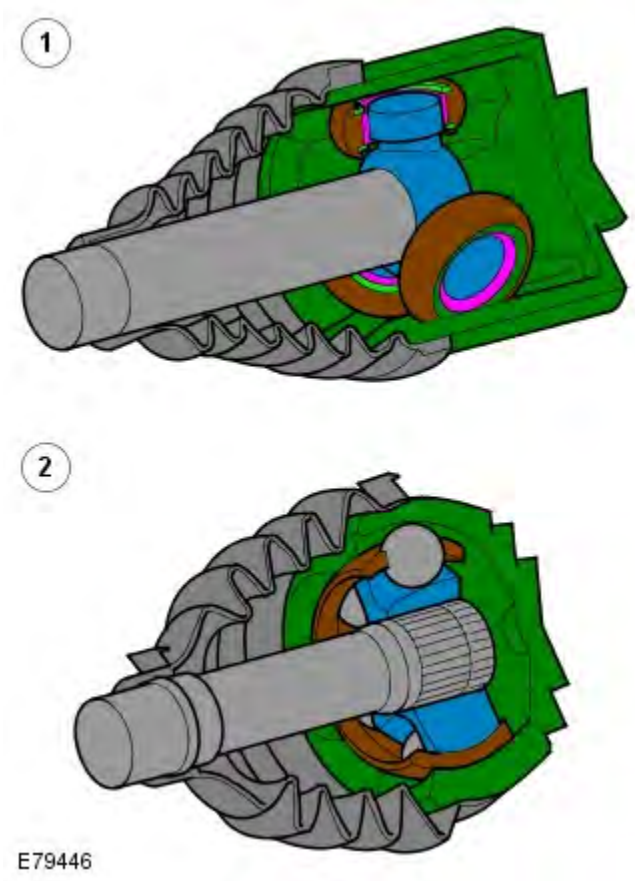
COMPONENT LOCATION



Item	Part Number	Description
1	-	Halfshaft - RH (right-hand)
2	-	Halfshaft - LH (left-hand)

OVERVIEW

Constant Velocity Joints



Item	Part Number	Description
A	-	Inner constant velocity joint
B	-	Outer constant velocity joint

Each halfshaft comprises a solid steel shaft with inner and outer constant velocity joints.

The inner joint is the 'tripode' type with spherical bushing to reduce sliding resistance; the shaft and inner joint are one assembly.

The outer joint is the 'ball and socket' type, with a splined connection between the joint and the shaft. The joints are packed with grease and protected by gaiters.

The halfshafts are of equal length to eliminate stiffness-related torque-steer.

Published: 11-May-2011

Rear Drive Halfshafts - Rear Drive Halfshafts

Diagnosis and Testing

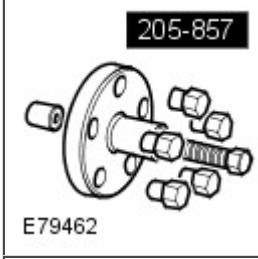
For additional information.
REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).

Published: 18-May-2011

Rear Drive Halfshafts - Rear Halfshaft LH

Removal and Installation

Special Tool(s)

	205-857 Remover, Halfshaft
	205-858 Remover, Halfshaft Inboard Joint
	205-928 Remover, Half Shaft Inboard Joint

Removal

• CAUTIONS:

Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

Do not store or install halfshafts with joints at maximum articulation or damage may occur to the joint.

Angularly Adjusted Roller (AAR) joints, used at the inboard end of some halfshafts have no internal retaining mechanism and can separate.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

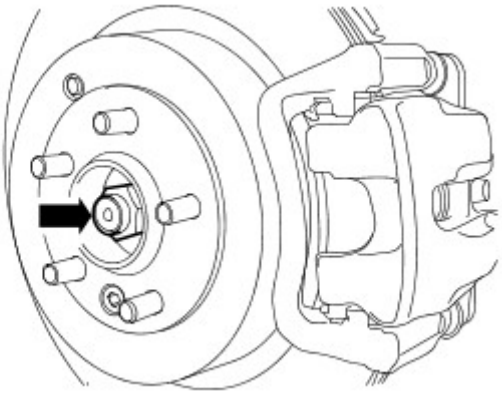
   Raise and support the vehicle.

2. Drain the differential lubricant.

   Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

3. Remove the wheel and tire.

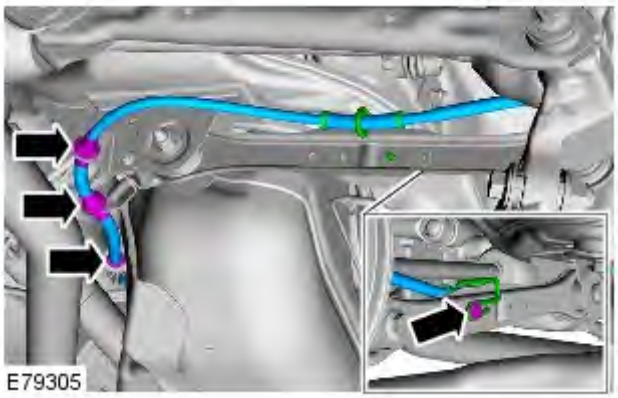
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).


E46796

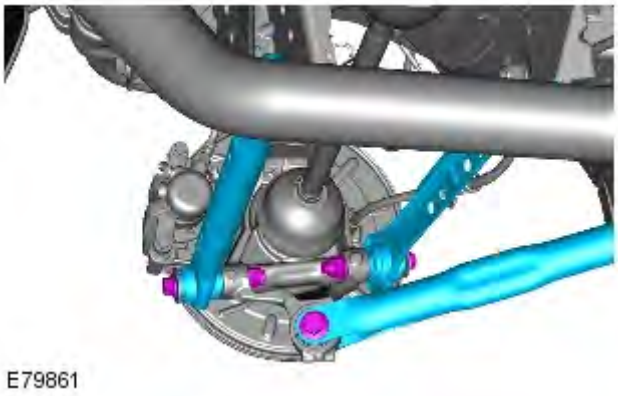
4. Loosen the rear halfshaft nut.

5. Remove the stabilizer bar link.

   Refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).


E79305

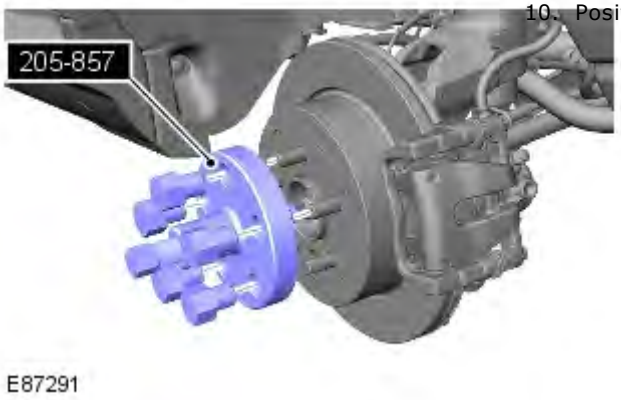
6. **6.** NOTE: RH illustration shown, LH is similar.


E79861

7.

8. Re and discard the rear halfshaft nut.

10. Position a container to collect the oil spillage.

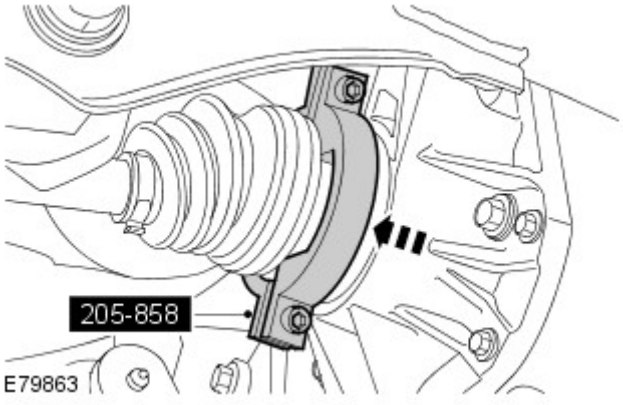


E87291

9. **9.** CAUTION: Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

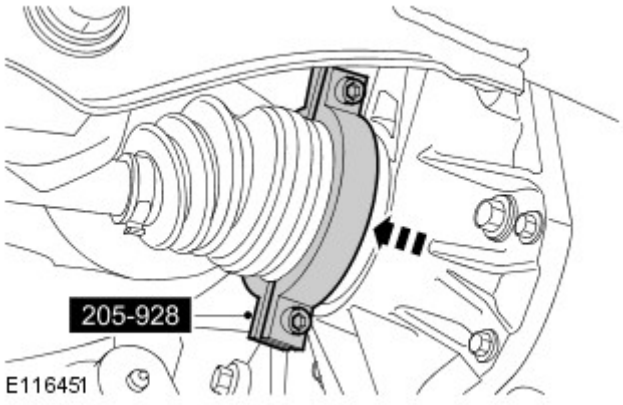
   Release the rear halfshaft.

   Special Tool(s): 205-857



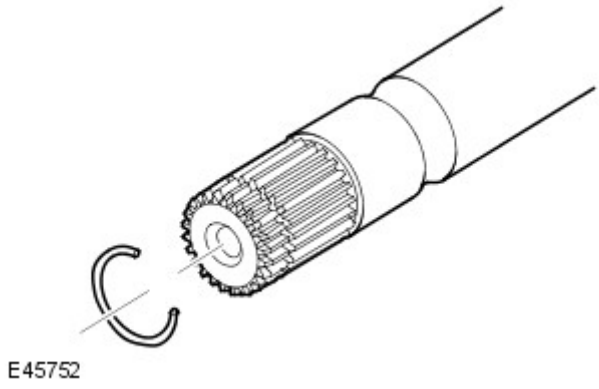
11. Install the special tool, to the rear halfshaft inboard joint casing.

    Special Tool(s): 205-858



12. Install the special tool, to the rear halfshaft inboard joint casing.

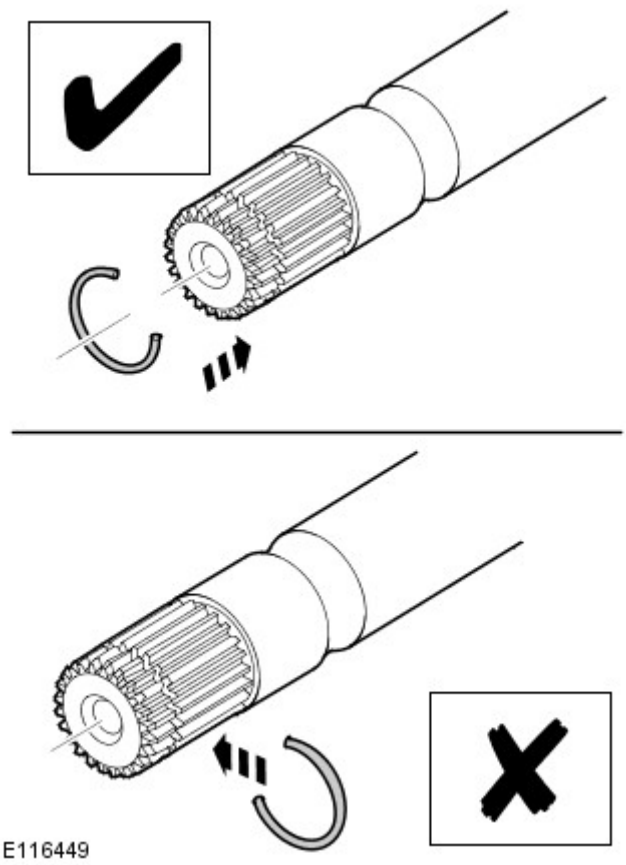
    Special Tool(s): 205-928



13. With assistance, remove the rear halfshaft.

Installation

1. Clean the components.

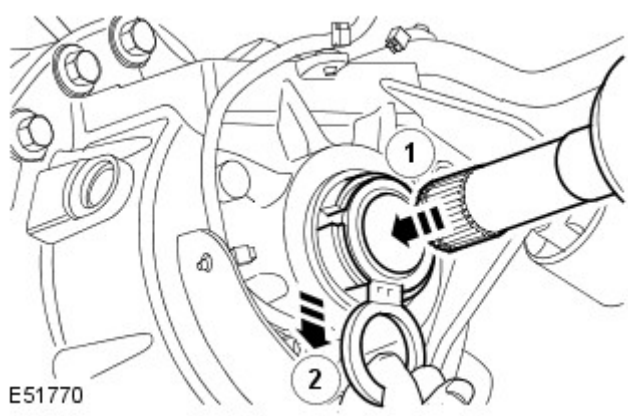


2. **2.** CAUTIONS:

   Take extra care not to damage the seal.

   Make sure that the snap ring is installed from the end of the halfshaft. Failure to follow this instruction may result in damage to the vehicle.

   Install a new snap ring to the rear halfshaft and with assistance, connect the inner CV joint to the differential.



3. **3.** NOTE: The oil seal protector is designed to break into two pieces.

   Remove and discard the rear halfshaft oil seal protector.

4. With assistance, install the rear halfshaft to the hub.

5. **5.** CAUTION: Only tighten the nut finger tight at this stage.

   Install a new rear halfshaft nut, do not fully tighten at this stage.

6. **6.** CAUTION: Only tighten the nuts and bolts finger tight at this stage.

   Connect both lower arms to the hub assembly, do not fully tighten at this stage.

7. **7.** CAUTION: Only tighten the nut and bolt finger-tight at this stage.

   Connect the trailing arm to the hub assembly, do not fully tighten at this stage.

8. Secure the parking brake cable.

9. Support the weight of the vehicle using a jack under the rear hub.

10. **10.** CAUTIONS:

    Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

    Do not use air tools to install the nut. Failure to follow this instruction may result in damage to the component.

    - Tighten both lower arm nuts and bolts.

      Torque: 175 Nm
    - Tighten the trailing arm nut and bolt.

      Torque: 270 Nm
    - Tighten the rear halfshaft nut.

      Torque:
      Stage 1:330 Nm
      Stage 2:30°
    - Stake the hub nut.

11. Install the stabilizer bar link.

    Refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).

12. Install the wheel and tire.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

13. **13.** CAUTION: Do not fill the differential with lubricant up to the filler plug. The filler plug is only used to fill the differential with lubricant, and not to act as a level indicator.

    Fill the differential with the correct amount of lubricant.

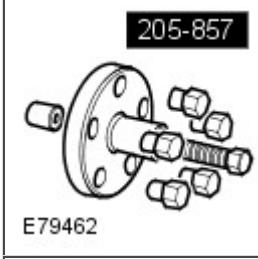
    Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

Published: 18-May-2011

Rear Drive Halfshafts - Rear Halfshaft RH

Removal and Installation

Special Tool(s)

	205-857 Remover, Halfshaft
	205-858 Remover, Halfshaft Inboard Joint
	205-928 Remover, Half Shaft Inboard Joint

Removal

• CAUTIONS:

Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

Do not store or install halfshafts with joints at maximum articulation or damage may occur to the joint.

Angularly Adjusted Roller (AAR) joints, used at the inboard end of some halfshafts have no internal retaining mechanism and can separate.

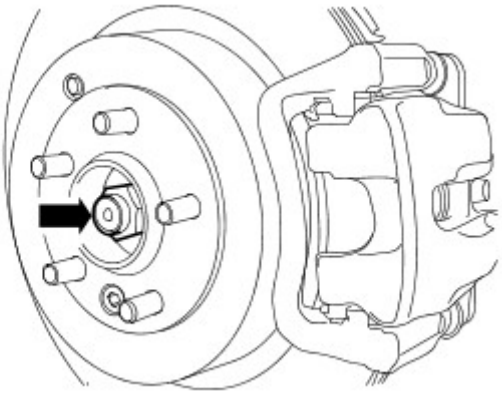
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Drain the differential lubricant.

3. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

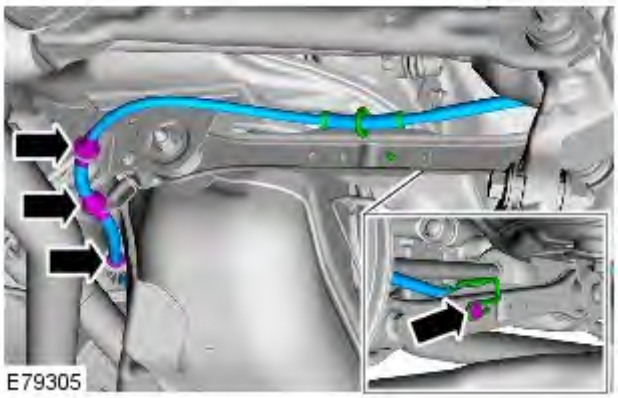

E46796

4. **4.** NOTE: LH illustration shown, RH is similar.

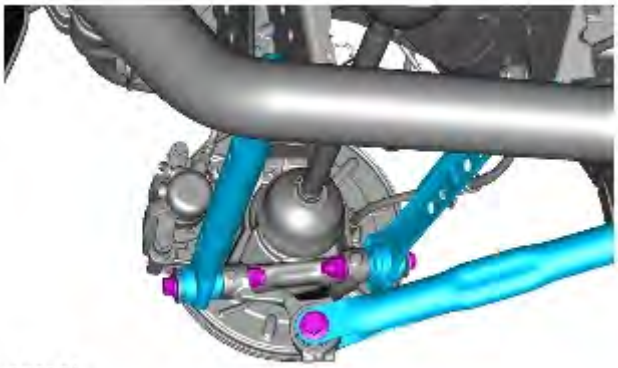
   Loosen the rear halfshaft nut.

5. Remove the stabilizer bar link.

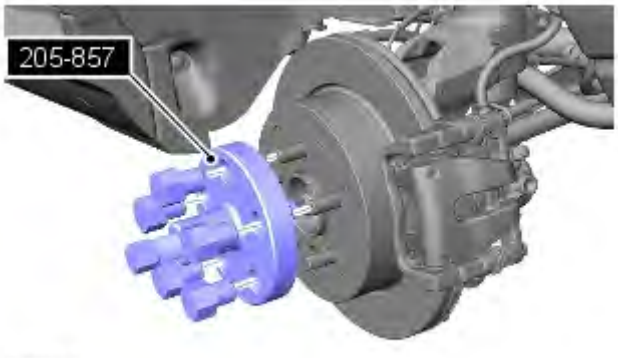
   Refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).


E79305

6.


E79861

7. **7.** NOTE: LH illustration shown, RH is similar.



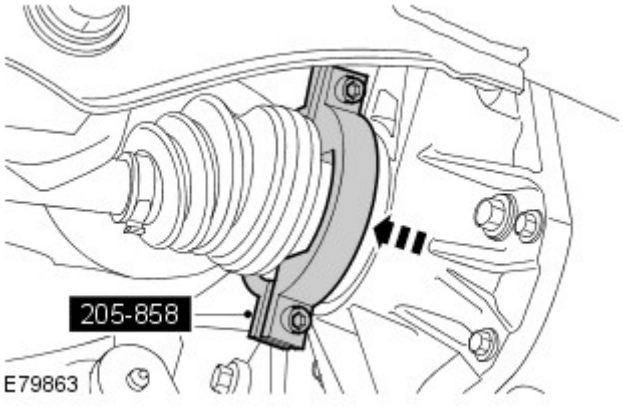
E87291

8. Re and discard the rear halfshaft nut.
9. **9.** CAUTION: Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

   • NOTE: LH illustration shown, RH is similar.

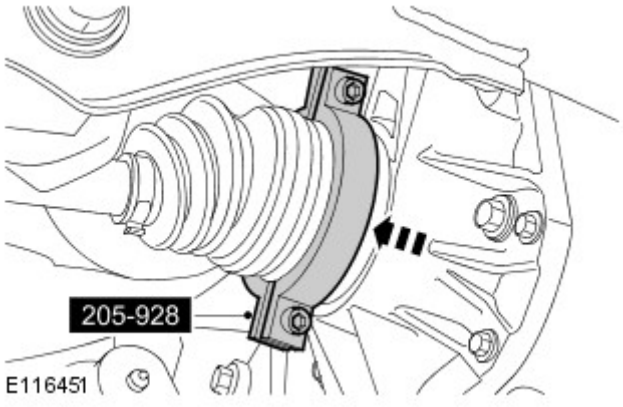
   Release the rear halfshaft.

   Special Tool(s): 205-857



10. Install the special tool, to the rear halfshaft inboard joint casing.

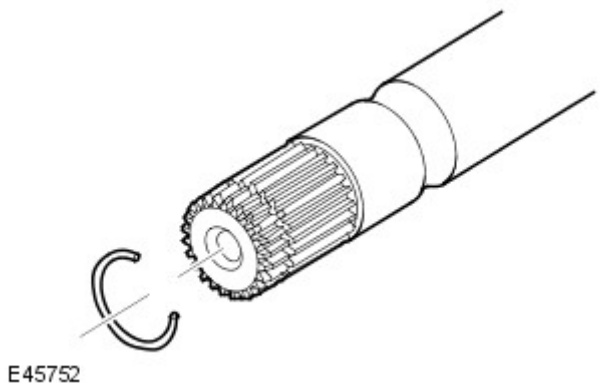
    Special Tool(s): 205-858



11. Install the special tool, to the rear halfshaft inboard joint casing.

    Special Tool(s): 205-928

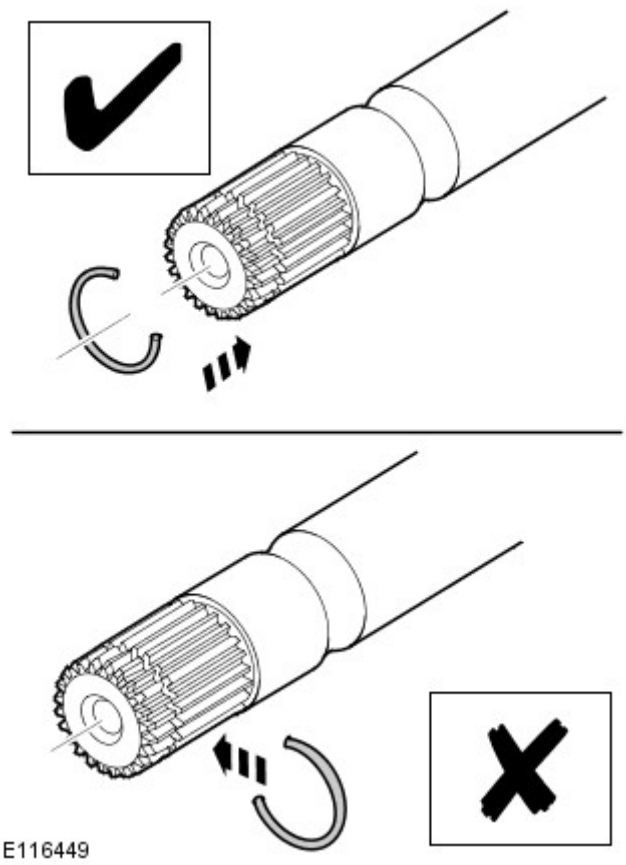
12. Position a container to collect the oil spillage.



13. With assistance, remove the rear halfshaft.

Installation

1. Clean the components.

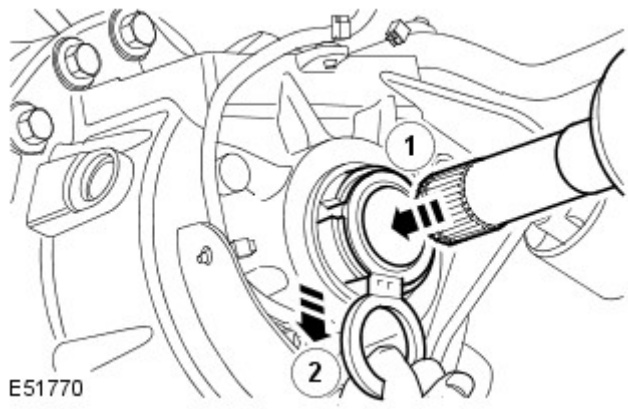


2. **2.** CAUTIONS:

   Take extra care not to damage the seal.

   Make sure that the snap ring is installed from the end of the halfshaft. Failure to follow this instruction may result in damage to the vehicle.

   Install a new snap ring to the rear halfshaft and with assistance, connect the inner CV joint to the differential.



3. **3.** NOTE: The oil seal protector is designed to break into two pieces.

   Remove and discard the rear halfshaft oil seal protector.

4. With assistance, install the rear halfshaft to the hub.

5. **5.** CAUTION: Only tighten the nut finger tight at this stage.

   Install a new rear halfshaft nut, do not fully tighten at this stage.

6. **6.** CAUTION: Only tighten the nuts and bolts finger tight at this stage.

   Connect both lower arms to the hub assembly, do not fully tighten at this stage.

7. **7.** CAUTION: Only tighten the nut and bolt finger-tight at this stage.

   Connect the trailing arm to the hub assembly, do not fully tighten at this stage.

8. Secure the parking brake cable.

9. Support the weight of the vehicle using a jack under the rear hub.

10. **10.** CAUTIONS:

    Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

    Do not use air tools to install the nut. Failure to follow this instruction may result in damage to the component.

    - Tighten both lower arm nuts and bolts.

      Torque: 175 Nm
    - Tighten the trailing arm nut and bolt.

      Torque: 270 Nm
    - Tighten the rear halfshaft nut.

      Torque:
      Stage 1:330 Nm
      Stage 2:30°
    - Stake the hub nut.

11. Install the stabilizer bar link.

    Refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).

12. Install the wheel and tire.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

13. **13.** CAUTION: Do not fill the differential with lubricant up to the filler plug. The filler plug is only used to fill the differential with lubricant, and not to act as a level indicator.

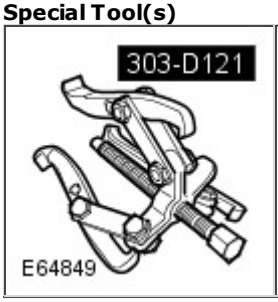
    Fill the differential with the correct amount of lubricant.

Published: 11-May-2011

Rear Drive Halfshafts - Inner Constant Velocity (CV) Joint Boot

Removal and Installation

Special Tool(s)

	303-D121 Puller, General Purpose

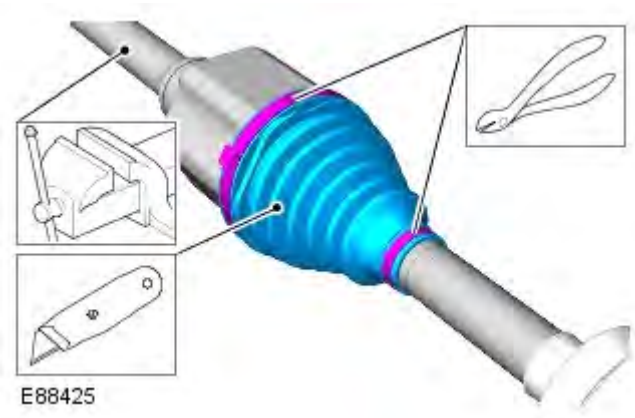
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

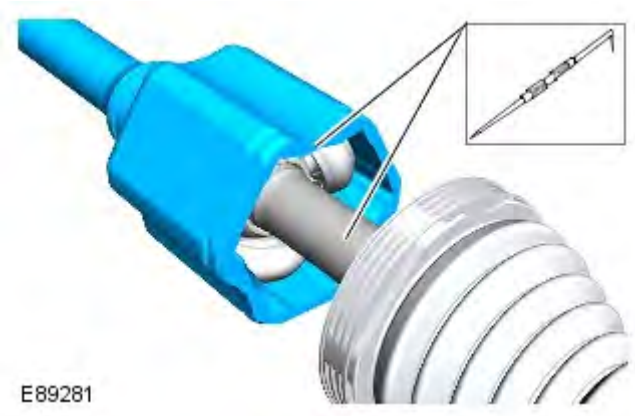
   Raise and support the vehicle.

2. Remove the halfshaft.

   Refer to: Rear Halfshaft LH (205-05 Rear Drive Halfshafts, Removal and Installation).



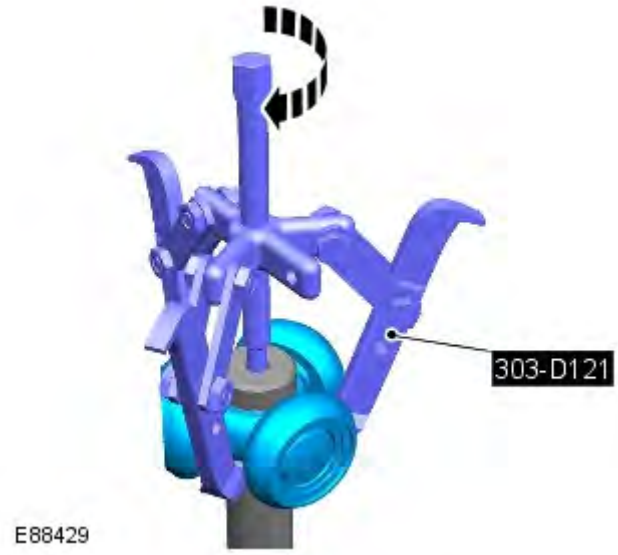
3. **3.** NOTE: Discard the retaining clips.



4.

5. **5.** NOTE: Discard the retaining clip.

6. *Special Tool(s):* 303-D121



Installation

1. **1.** CAUTION: Extreme cleanliness must be exercised when handling these components.

   Clean and inspect the components for deterioration.

2. Install the inner CV boot onto the halfshaft.

3. **3.** NOTE: Install a new retaining clip.

   Install the inner CV joint inner onto the halfshaft.

4. **4.** CAUTION: Make sure that these components are installed to the noted removal position.

   Install the inner CV joint outer onto the halfshaft.

5. Pack the inner CV joint with the grease supplied.

6. **6.** NOTE: Install new retaining clips.

   Secure the inner CV joint boot to the inner CV joint.

7. Install the halfshaft.

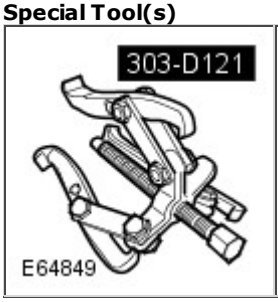
Refer to: Rear Halfshaft LH (205-05 Rear Drive Halfshafts, Removal and Installation).

Published: 11-May-2011

Rear Drive Halfshafts - Outer Constant Velocity (CV) Joint Boot

Removal and Installation

Special Tool(s)

	303-D121 Puller, General Purpose

Removal

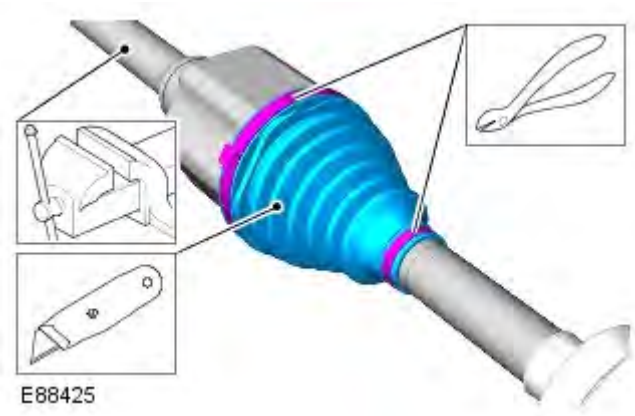
• NOTE: The outer Constant Velocity joint must not be removed from the shaft. The inner joint and gaiter have to be removed to facilitate gaiter replacement of the outer C. V. gaiter. The inner and outer gaiters are supplied together as a kit.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

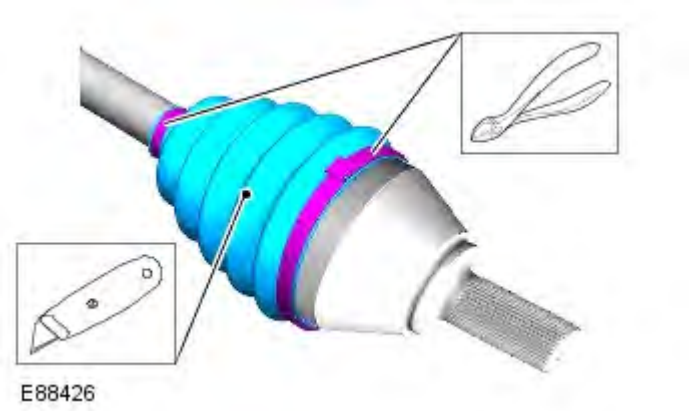
   Raise and support the vehicle.

2. Remove the halfshaft.

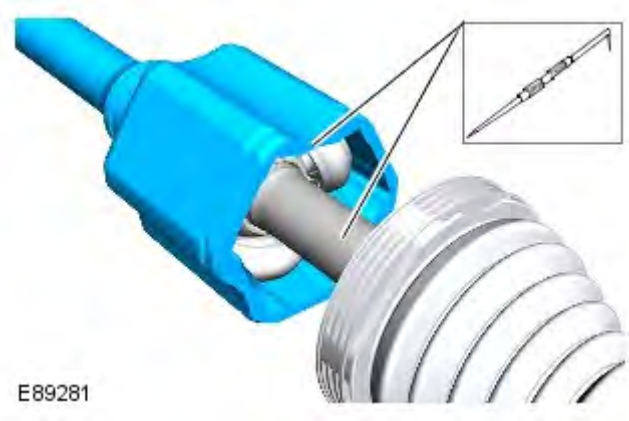
   Refer to: Rear Halfshaft LH (205-05 Rear Drive Halfshafts, Removal and Installation).



3. **3.** NOTE: Discard the retaining clips.



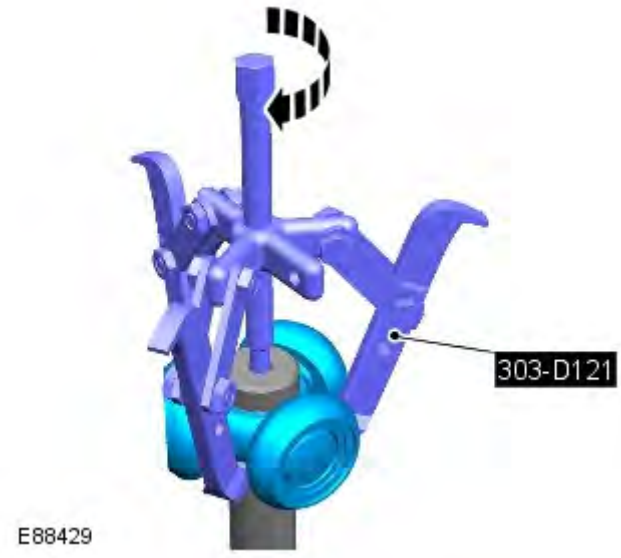
4. **4.** NOTE: Discard the retaining clips.



5.

6. **6.** NOTE: Discard the retaining clip.

7. *Special Tool(s):* 303-D121



Installation

1. **1.** CAUTION: Extreme cleanliness must be exercised when handling these components.

   Clean and inspect the components for deterioration.

2. Install the inner and outer CV boots onto the halfshaft.

3. **3.** NOTE: Install a new retaining clip.

4. **4.** CAUTION: Make sure that these components are installed to
   Install the inner CV joint inner onto the halfshaft.

the noted removal position.

Install the inner CV joint outer onto the halfshaft.

5. Pack the inner CV joint with the grease supplied.

6. Pack the outer CV joint with the grease supplied.

7. **7.** NOTE: Install new retaining clips.

   Secure the inner CV joint boot to the inner CV joint.

8. **8.** NOTE: Install new retaining clips.

   Secure the outer CV joint boot to the outer CV joint.

9. Install the halfshaft.

   Refer to: Rear Halfshaft LH (205-05 Rear Drive Halfshafts, Removal and Installation).

Published: 11-May-2011

Brake System - General Information -

Brake Hydraulic Fluid

CAUTION: * If the fluid shown is not available, use a low viscosity DOT 4 brake fluid meeting ISO 4925 Class 6 and Land Rover LRES22BF03 requirements.

Item	Specification
Recommended hydraulic fluid*	SHELL DONAX YB DOT4 ESL FLUID

General Specification

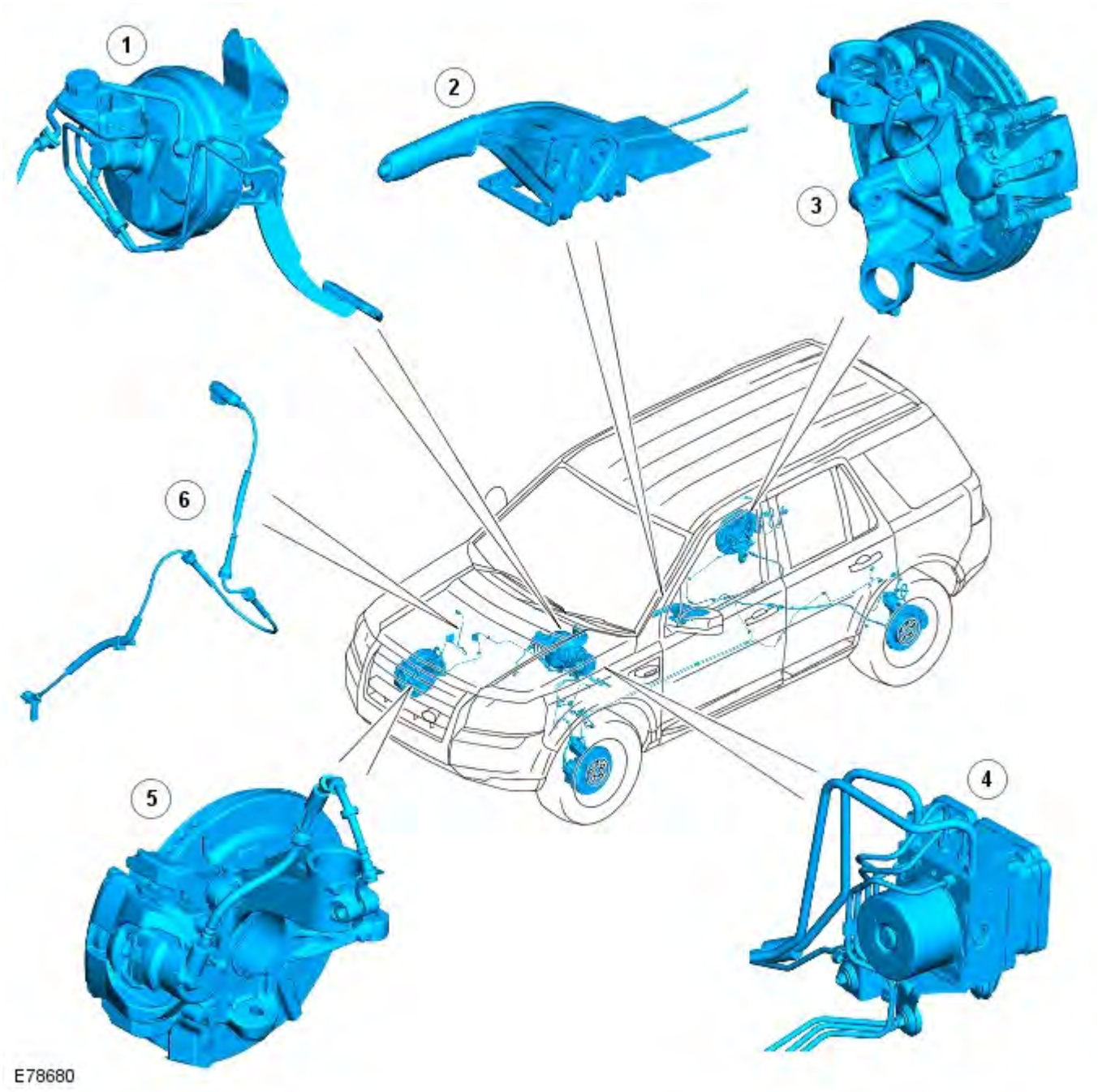
Item	Specification
Front and rear calipers	Single piston sliding calipers
Operation	Hydraulic, self adjusting
Front disc	Ventilated
Rear disc:	
3.2 Petrol	Ventilated
2.2 Diesel	Solid
Parking brake type	Manually applied cable operated system
Master cylinder and booster:	
Make	Continental Teves
Master cylinder type	Tandem design with independent (primary and secondary) hydraulic circuits
Booster type	Compact design with tandem diaphragms 203.20 mm (8.00 in) and 228.60 mm (9.00 in) in diameter

Published: 11-May-2011

Brake System - General Information - Brake System

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Brake pedal, booster and master cylinder assembly
2	-	Parking brake lever
3	-	Rear disc brake and parking brake assembly
4	-	Anti-lock Brake System (ABS) module and Hydraulic Control Unit (HCU)
5	-	Front disc brake assembly
6	-	ABS speed sensor cable

INTRODUCTION

Vehicle braking is achieved with a vacuum assisted, hydraulic circuit connected via an integrated ABS module and HCU, to the front and rear disc brake calipers. For increased safety, the hydraulic system is designed as a diagonally split dual circuit. This provides a primary and secondary braking circuit connected between the master cylinder and each front and opposing rear wheel.

The braking system provides anti-lock control to aid the driver, and to make sure the vehicle remains in control during all driving conditions and manouevres. The sophisticated ABS functionality also integrates with other vehicle software controlled systems, to provide stability assistance and control when driving off-road.

The parking brake is a manually applied cable system that operates brake shoes, housed within the inner diameter of each rear brake disc.

FRONT AND REAR DISC BRAKES

The 3.2L i6 vehicle is installed with ventilated front and rear brake discs. The 2.2L TD4 vehicle is installed with ventilated front and solid rear brake discs. Both the i6 and TD4 vehicles feature single piston, sliding calipers on all brake discs. For additional information, refer to:

Front Disc Brake (206-03 Front Disc Brake, Description and Operation),
Rear Disc Brake (206-04 Rear Disc Brake, Description and Operation).

PARKING BRAKE

The parking brake is a manually applied, cable operated system. The RH and LH rear brake discs form the parking brake drums, and provide the location for the parking brake shoes and components.
For additional information, refer to: Parking Brake (206-05 Parking Brake and Actuation, Description and Operation).

HYDRAULIC BRAKE ACTUATION

Hydraulic brake actuation consists of the brake pedal, master cylinder, HCU, and the connecting hydraulic pipes and hoses.

The tandem brake master cylinder with reservoir is attached to, and operated by the brake booster. The brake master cylinder is a tandem design that supplies pressure to 2 independent (primary and secondary) hydraulic circuits.
For additional information, refer to: Hydraulic Brake Actuation (206-06 Hydraulic Brake Actuation, Description and Operation).

BRAKE BOOSTER

The brake booster is vacuum operated and provides power assistance to the brake hydraulic system. The booster is of tandem design that incorporates 2 separate diaphragms. On both the gasoline and diesel models, the vacuum required for booster operation is produced by an engine driven, vacuum pump.
For additional information, refer to: Brake Booster (206-07 Power Brake Actuation, Description and Operation).

ANTI-LOCK CONTROL

The anti-lock control system features a Continental Teves Mk25E1 ABS module with integral 4 channel HCU. The ABS module and HCU provide brake system monitoring, and active brake functions to control the vehicle stability and traction. The ABS module also provides specific functions to assist the vehicle during off-road driving.

The anti-lock control system provides the following functions:

- Anti-lock Brake System (ABS)
- Corner Brake Control (CBC)
- Dynamic Stability Control (DSC)
- Electronic Brake Force Distribution (EBD)
- Electronic Traction Control (ETC)
- Emergency Brake Assist (EBA)
- Engine Drag-Torque Control (EDC)
- Hill Descent Control (HDC) with gradient release control
- Roll Stability Control (RSC)
- Terrain Response™ system integration.

For additional information, refer to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).

Published: 11-May-2011

Brake System - General Information - Brake System

Diagnosis and Testing

Principle of Operation

For a detailed description of the brake system, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Brake System (206-00 Brake System - General Information, Description and Operation),
Front Disc Brake (206-03 Front Disc Brake, Description and Operation),
Rear Disc Brake (206-04 Rear Disc Brake, Description and Operation),
Parking Brake (206-05 Parking Brake and Actuation, Description and Operation),
Hydraulic Brake Actuation (206-06 Hydraulic Brake Actuation, Description and Operation),
Brake Booster (206-07 Power Brake Actuation, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Brake master cylinder • Brake caliper piston(s) • Brake discs • Wheel bearings • Brake pads • Power brake booster • Vacuum pump • Brake pedal linkage • Brake booster vacuum hose • Tires	• Damaged or corroded wiring harness • Brake master cylinder fluid level switch

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the concern and refer to the Symptom Chart.

Road Test

Carry out a road test to compare actual vehicle braking performance with the performance standards expected by the driver. The ability of the test driver to make valid comparisons and detect performance deficiencies will depend on experience.

The driver should have a thorough knowledge of brake system operation and accepted general performance guidelines to make good comparisons and detect performance concerns.

An experienced brake technician will always establish a route that will be used for all brake diagnosis road tests. The roads selected will be reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Crowned roads should be avoided because of the large amount of weight shifted to the low set of wheels on this type of road. Once the route is established and consistently used, the road surface variable can be eliminated from the test results.

Before a road test, obtain a complete description of the customer concerns or suspected condition. From the description, the technician's experience will allow the technician to match possible causes with symptoms. Certain components will be tagged as possible suspects while others will be eliminated by the evidence. More importantly, the customer description can reveal unsafe conditions which should be checked or corrected before the road test. The description will also help form the basic approach to the road test by narrowing the concern to specific components, vehicle speed or conditions.

Begin the road test with a general brake performance check. Keeping the description of the concern in mind, test the brakes at different vehicle speeds using both light and heavy pedal pressure.

If the concern becomes evident during this check, verify it fits the description given before the road test. If the concern is not evident, attempt to duplicate the condition using the information from the description.

If a concern exists, refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Cause	Action
Brakes noisy	• Brake pads • Brake discs	GO to Pinpoint Test A.
Vibration when brakes are applied	• Wheels/tires out of balance • Wheel hub nuts loose • Brake caliper mounting bolts loose • Brake pads • Foreign material/scratches/corrosion on brake disc contact surfaces • Excessive brake disc thickness	GO to Pinpoint Test B.

Symptom	Possible Cause	Action
	variation • Excessive brake disc runout • Wheel bearing wear or failure • Suspension bushing wear or failure • Steering bushing wear or failure	
The brakes pull or drift	• Tire pressures/wear • Brake calipers • Brake pads • Brake discs • Wheel alignment adjustment • Wheel bearing • Suspension bushings and ball joints	GO to Pinpoint Test C.
The pedal feels spongy	• Air in brake system • Leak in hydraulic system • Brake booster/master cylinder failure • Brake pads	GO to Pinpoint Test D.
The pedal goes down fast	• Air in brake system • Leak in hydraulic system • Brake booster/master cylinder • Brake pads	GO to Pinpoint Test E.
The pedal goes down slowly	• Air in brake system • Brake booster/master cylinder	GO to Pinpoint Test F.
Excessive brake pedal effort	• Brake pads • Brake booster	GO to Pinpoint Test G.
Brake lockup during light brake pedal force	• Brake pads • Brake calipers	GO to Pinpoint Test H.
Brakes drag	• Parking brake control applied/malfunction • Seized parking brake cables • Seized caliper slide pins • Seized brake caliper • Brake booster • Pedal gear	GO to Pinpoint Test I.
Excessive/Erratic brake pedal travel	• Hydraulic system • Brake pads • Brake discs • Hub and bearing assembly	GO to Pinpoint Test J.
The red brake warning indicator is always on	• Fluid level • Brake fluid level sensor • Parking brake control • Electrical circuit	Fill the system to specification. Check for leaks. Install a new brake master cylinder fluid reservoir as required. REFER to: Brake Master Cylinder (206-06 Hydraulic Brake Actuation, Removal and Installation). Check parking brake operation/electrical circuits. REFER to: Parking Brake (206-05 Parking Brake and Actuation, Diagnosis and Testing).
Slow or incomplete brake pedal return	• Brake pedal binding • Brake booster/master cylinder	GO to Pinpoint Test K.

Pinpoint Tests

PINPOINT TEST A : BRAKES NOISY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: INSPECT BRAKE PADS	
	1 Inspect the condition of the front and rear brake pads. Check for damage to any anti-squeal shims.
	Are the brake pads OK? **Yes** GO to A2. **No** CLEAN or INSTALL new brake pads as required. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation) / Brake Pads (206-04 Rear Disc Brake, Removal and Installation). Test the system for normal operation.
A2: INSPECT BRAKE DISCS	
	1 Inspect the brake discs for excessive corrosion, wear or disc thickness variation.
	Does excessive corrosion, wear or disc thickness variation exist? **Yes** INSTALL new brake discs and brake pads as required. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation) / Brake Disc (206-03 Front Disc Brake, Removal and Installation) /

	Brake Pads (206-04 Rear Disc Brake, Removal and Installation) / Brake Disc (206-04 Rear Disc Brake, Removal and Installation). TEST the system for normal operation. **No** Vehicle is OK.

PINPOINT TEST B : VIBRATION WHEN BRAKES ARE APPLIED	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: ROAD TEST VEHICLE	
	1 Road test the vehicle between 40-80 km/h (25-50 mph) without applying brakes.
	Is the vibration present? **Yes** TEST for noise vibration and harshness (wheel/tire balance, worn/damaged suspension bushings/components, etc.). REPEAT road test if necessary. **No** GO to B2.
B2: CHECK FOR BRAKE VIBRATION	
	1 Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal.
	Is a vibration present? **Yes** CHECK the brake caliper mounting bolts and wheel hub nuts and TIGHTEN as necessary. CHECK the balance of all road wheels and tires and REPAIR as necessary. CHECK the brake discs for excessive wear, runout, thickness variation or cracks. INSTALL new brake discs and brake pads as required. GO to B3. **No** Vehicle is OK.
B3: IS VIBRATION STILL PRESENT UNDER BRAKE APPLICATION?	
	1 Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal.
	Is a vibration present? **Yes** CHECK for wear or failure of steering gear bushings. CHECK for wear or failure of steering gear ball joints. CHECK for wear or failure of front wheel bearings, suspension bushings and ball joints. CHECK for wear or failure of rear wheel bearings, suspension bushings and ball joints. REFER to relevant section in workshop manual and INSTALL new components as required. **No** Vehicle is OK.

PINPOINT TEST C : THE BRAKES PULL OR DRIFT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: ROAD TEST VEHICLE	
	1 Road test the vehicle and apply the brake pedal.
	Does the vehicle pull or drift? **Yes** GO to C2. **No** Vehicle is OK.
C2: INSPECT TIRE CONDITION/PRESSURE	
	1 Check for excessive tire wear or incorrect pressures.
	Are the tires at the correct pressure and in good condition? **Yes** GO to C3. **No** ADJUST the tire pressures or INSTALL new tires if excessively worn. TEST the system for normal operation.
C3: CHECK CALIPERS	
	1 Check the disc brake caliper pistons and pins for binding, leaking or sticking.
	Do the disc brake caliper pistons and pins bind, leak or stick? **Yes** RECTIFY sticking pins and INSTALL new brake calipers as required. REFER to: Brake Caliper (206-03 Front Disc Brake, Removal and Installation) / Brake Caliper (206-04 Rear Disc Brake, Removal and Installation). TEST the system for normal operation. **No** GO to C4.
C4: INSPECT BRAKE DISCS	
	1 Check the brake discs for excessive damage, thickness variation or runout.
	Does excessive damage or runout exist? **Yes** INSTALL new brake discs and brake pads as required. TEST the system for normal operation. **No** GO to C5.
C5: INSPECT THE FRONT HUB AND WHEEL BEARING ASSEMBLY	
	1 Check the front hub and wheel bearing assembly.

	Are the wheel bearings OK? **Yes** GO to C6. **No** INSTALL new wheel bearings as required. REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation). TEST the system for normal operation.
C6: CHECK SUSPENSION BUSHINGS AND BALL JOINTS	
	1 Check all suspension bushings and ball joints.
	Are the suspension bushings and ball joints OK? **Yes** Check and adjust steering geometry REFER to: Four-Wheel Alignment (204-00 Suspension System - General Information, General Procedures). **No** INSTALL new suspension bushings and ball joints as required. REFER to the relevant section in the workshop manual.

PINPOINT TEST D : THE PEDAL FEELS SPONGY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK FOR SPONGY PEDAL (ENGINE OFF)	
	1 Check for a firm brake pedal.
	Is the brake pedal effort and brake pedal travel normal? **Yes** Vehicle is OK. **No** GO to D2.
D2: CHECK BRAKE PEDAL RESERVE (ENGINE OFF)	
	1 Pump the brake pedal 10 times and hold on the final application.
	Does the brake pedal feel firm on final application? **Yes** GO to D3. **No** BLEED the brake system. REFER to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures) / Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).
D3: CHECK BRAKE PEDAL RESERVE (ENGINE ON)	
	1 Apply Parking Brake and ensure transmission is in park/neutral.
	2 Start engine and allow to idle.
	3 Apply the brake pedal lightly three or four times.
	4 Wait 15 seconds for the vacuum to recover.
	5 Push down on the brake pedal until it stops moving downward or an increased resistance to the brake pedal travel occurs.
	6 Hold the brake pedal in the applied position while increasing the engine speed to 2000 rpm.
	7 Release the accelerator pedal.
	Does the brake pedal move downward as the engine speed returns to idle? **Yes** GO to D4. **No** CHECK the vacuum to brake booster.
D4: CHECK BRAKE FLUID LEVEL	
	1 Check the brake master cylinder reservoir fluid level.
	Is the fluid level OK? **Yes** BLEED the brake system. REFER to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures) / Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. **No** CHECK for leaking brake system and RECTIFY as necessary. ADD fluid and BLEED the brake system. REFER to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures) / Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. REPEAT road test if required.

PINPOINT TEST E : THE PEDAL GOES DOWN FAST	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: ROAD TEST VEHICLE	
	1 Road test the vehicle and apply the brake pedal.
	Is the brake pedal effort and brake pedal travel normal? **Yes** Vehicle is OK. **No** GO to E2.
E2: PRESSURIZE SYSTEM AND CHECK BRAKE PEDAL TRAVEL	

	1 With the vehicle stationary pump the brake pedal rapidly (five times).
	Does the brake pedal travel build up and then hold? **Yes** BLEED the brake system. REFER to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures) / Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. **No** GO to E3.
E3: CHECK FOR BRAKE SYSTEM LEAKS	
	1 Check for external brake system leaks. For additional information, refer to brake master cylinder component test in this section.
	Are leaks found? **Yes** REPAIR as necessary, ADD fluid and BLEED brake system. REFER to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures) / Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. **No** System is OK.

PINPOINT TEST F : THE PEDAL GOES DOWN SLOWLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK FOR BRAKE SYSTEM LEAKS	
	1 Check for external brake system leaks. For additional information, refer to brake master cylinder component test in this section.
	Are there any external brake system leaks? **Yes** REPAIR as necessary. ADD fluid and BLEED the brake system. REFER to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures) / Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. **No** Check for brake master cylinder internal leaks, refer to brake master cylinder component test in this section, and repair as necessary.

PINPOINT TEST G : EXCESSIVE BRAKE PEDAL EFFORT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK BRAKE PADS	
	1 Check the brake pads for wear, contamination, correct installation, damage and type.
	Are any concerns found? **Yes** INSTALL brake pads correctly or INSTALL new brake pads as required. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation) / Brake Pads (206-04 Rear Disc Brake, Removal and Installation). TEST the system for normal operation. REPEAT road test. **No** GO to G2.
G2: CHECK VACUUM	
	1 Disconnect the vacuum hose from the brake booster.
	2 Connect a vacuum/pressure tester to the vacuum hose.
	3 Run the engine at normal operating temperature.
	4 Record the vacuum reading.
	Is the reading 90 kPa (26.5 in-Hg) or greater **Yes** GO to G3. **No** LOCATE and REPAIR the source of low vacuum. TEST the system for normal operation.
G3: INSPECT SYSTEM	
	1 Switch the engine off.
	2 Reconnect the vacuum hose.
	3 Inspect the brake booster, rubber grommet, and all vacuum plumbing for cracks, holes, damaged connections, or missing clamps.
	4 Pump the brake pedal several times to exhaust the vacuum. Push down on the brake pedal and hold.
	Does the brake pedal move down when the engine is started? **Yes** Vacuum system is OK. **No** GO to G4.
G4: CHECK POWER BRAKE BOOSTER VALVE	
	1 Check the brake booster valve. For additional information, refer to Brake Booster component test in this section.

	Is the power brake booster valve OK? **Yes** CHECK the brake booster. For additional information, refer to Brake Booster component test in this section. INSTALL a new brake booster as required. REFER to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation). TEST the system for normal operation. **No** INSTALL a new brake booster valve. TEST the system for normal operation.

PINPOINT TEST H : BRAKE LOCKUP DURING LIGHT BRAKE PEDAL FORCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: TEST BRAKE LOCKUP	
	1 Road test the vehicle and apply the brake pedal lightly.
	Do the brakes lockup? **Yes** GO to H2. **No** Vehicle is OK.
H2: INSPECT BRAKE PADS	
	1 Inspect brake pads for contamination, correct installation, damage and type.
	Are any concerns found? **Yes** INSTALL the brake pads correctly or INSTALL new brake pads as required. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation) / Brake Pads (206-04 Rear Disc Brake, Removal and Installation). TEST the system for correct operation. **No** GO to H3.
H3: INSPECT BRAKE CALIPERS	
	1 Inspect brake calipers for binding, leaking or sticking.
	Are any concerns found? **Yes** INSTALL the brake calipers correctly or INSTALL new brake calipers as required. REFER to: Brake Caliper (206-03 Front Disc Brake, Removal and Installation) / Brake Caliper (206-04 Rear Disc Brake, Removal and Installation). TEST the system for normal operation. **No** Vehicle is OK.

PINPOINT TEST I : BRAKES DRAG	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: ROAD TEST VEHICLE	
	1 Road test the vehicle and apply the brakes.
	Are the brakes functioning correctly? **Yes** Vehicle is OK. **No** GO to I2.
I2: CHECK BRAKE CALIPERS AND PARKING BRAKE CABLES	
	1 Check the front and rear caliper pistons and pins for binding, leaking or sticking and parking brake cables for sticking/binding.
	Do the disc brake caliper pistons and pins bind, leak or stick, or the parking brake cables stick/bind? **Yes** REPAIR or INSTALL new components as required. Test the system for normal operation. Road test vehicle if necessary. **No** GO to I3.
I3: CHECK BRAKE BOOSTER	
	1 Check the brake booster connecting rod alignment and travel.
	Is the connecting rod OK? **Yes** Vehicle is OK. **No** INSTALL a new brake booster. REFER to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST J : EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: TEST ON ROUGH ROAD	
	1 Road test the vehicle on rough road conditions.
	2 Apply the brakes slowly.
	Is the brake pedal effort and brake pedal travel normal? **Yes** Vehicle is OK. **No** GO to J2.
J2: CHECK BRAKE FLUID LEVEL	

	1 Check the brake master cylinder reservoir fluid level.
	Is the fluid level OK? **Yes** GO to J3. **No** CHECK brake master cylinder reservoir sealing points. For additional information, refer to Brake master cylinder component test in this section. ADD brake fluid and BLEED the brake system. REFER to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures) / Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. REPEAT road test if necessary.
J3: CHECK BRAKE PEDAL RESERVE	
	1 Run engine at idle speed.
	2 Apply the brake pedal lightly three or four times.
	3 Wait 15 seconds for the vacuum to replenish.
	4 Push down on the brake pedal until it stops moving downward or an increased resistance to the brake pedal travel occurs.
	5 Hold the brake pedal in the applied position while increasing the engine speed to 2000 rpm.
	6 Release the accelerator pedal.
	Does the brake pedal move downward as the engine speed returns to idle? **Yes** GO to J4. **No** CHECK the vacuum to the brake booster.
J4: CHECK THE FRONT WHEEL BEARING ASSEMBLY	
	1 Check the front wheel bearing assembly.
	Are the front wheel bearings loose? **Yes** INSTALL a new front wheel bearing if damaged. REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation). TEST the system for normal operation. **No** CHECK the front brake discs for thickness variances.

PINPOINT TEST K : SLOW OR INCOMPLETE BRAKE PEDAL RETURN	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK FOR BRAKE PEDAL RETURN	
	1 Run the engine at idle while making several brake applications.
	2 Pull the brake pedal rearward with approximately 44.5 N (10lb) force.
	3 Release the brake pedal and measure the distance to the toe board.
	4 Make a hard brake application.
	5 Release the brake pedal and measure the brake pedal to toe board distance. The brake pedal should return to its original position.
	Does the brake pedal return to its original position? **Yes** Vehicle is OK. **No** GO to K2.
K2: CHECK FOR BRAKE PEDAL BINDING	
	1 Disconnect the brake booster from the brake pedal. Check the brake pedal to ensure free operation.
	Is the brake pedal operating freely? **Yes** INSTALL a new brake booster. REFER to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation). TEST the system for normal operation. **No** REPAIR or INSTALL new brake pedal. TEST the system for normal operation.

Component Tests

Brake Booster

1. **1.** Check all hoses and connections. All unused vacuum connectors should be capped. Hoses and their connections should be correctly secured and in good condition with no holes and no collapsed areas. Inspect the valve on the brake booster for damage.
2. **2.** Check the hydraulic brake system for leaks or low fluid.
3. **3.** With the automatic transmission in PARK, stop the engine and apply the parking brake. Pump the brake pedal several times to exhaust all vacuum in the system. With the engine switched off and all vacuum in the system exhausted, apply the brake pedal and hold it down. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the vacuum booster system is not functioning.
4. **4.** Remove the vacuum hose from the brake booster. Manifold vacuum should be available at the brake booster end of the hose with the engine at idle speed and the automatic transmission in PARK. Make sure that all unused vacuum outlets are correctly capped, hose connectors are correctly secured and vacuum hoses are in good condition. When it is established that manifold vacuum is available to the brake booster, connect the vacuum hose to the brake booster and repeat Step 3. If no downward movement of the brake pedal is felt, install a new

brake booster.

5. **5.** Operate the engine for a minimum of 10 seconds at a fast idle. Stop the engine and allow the vehicle to stand for 10 minutes. Then, apply the brake pedal with approximately 89 N (20lb) of force. The pedal feel (brake application) should be the same as that noted with the engine running. If the brake pedal feels hard (no power assist), install a new valve and then repeat the test. If the brake pedal still feels hard, install a new brake booster. If the brake pedal movement feels spongy, bleed the brake system.
   REFER to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures) / Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

Brake Master Cylinder

Usually, the first and strongest indicator of anything wrong in the brake system is a feeling through the brake pedal. In diagnosing the condition of the brake master cylinder, check pedal feel as evidence of a brake concern. Check for brake warning lamp illumination and the brake fluid level in the brake master cylinder reservoir.

Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of repair.

- Modern brake systems are designed to produce a pedal effort that is not as hard as in the past. Complaints of light pedal efforts should be compared to the pedal efforts of another vehicle of the same model and year.
- The fluid level will fall with brake pad wear.

Abnormal Conditions

Changes in the brake pedal feel or brake pedal travel are indicators that something could be wrong in the brake system. The diagnostic procedure and techniques use brake pedal feel, warning indicator illumination and low brake fluid level as indicators to diagnosing brake system concerns. The following conditions are considered abnormal and indicate that the brake master cylinder is in need of repair:

• NOTE: Prior to carrying out any diagnosis, ensure the brake system warning indicator is functional.

- Brake pedal goes down fast. This could be caused by an external or internal leak.
- Brake pedal goes down slowly. This could be caused by an internal or external leak.
- Brake pedal is low or feels spongy. This condition may be caused by no fluid in the brake master cylinder, reservoir cap vent holes clogged or air in the hydraulic system.
- Brake pedal effort is excessive. This may be caused by a bind or obstruction in the pedal/linkage, a faulty non-return valve, booster or insufficient booster vacuum.
- Rear brakes lock up during light pedal force. This may be caused by damaged brake pads, a partially applied parking brake, a damaged ABS sensor or bearing failure.
- Brake pedal effort erratic. This condition could be caused by the brake booster or incorrectly installed brake pads.
- Brake warning indicator is on. This may be caused by low fluid level or float assembly damaged.

Non Pressure Leaks

Any reduced fluid volume in the brake master cylinder reservoir may be caused by two types of none pressure external leaks.

Type 1: An external leak may occur at the brake master cylinder reservoir cap because of incorrect positioning of the gasket and cap. Reposition cap and gasket.

Type 2: An external leak may occur at the brake master cylinder reservoir mounting seals. Repair such a leak by installing new seals and make sure that the brake master cylinder reservoir retaining bolt is correctly installed.

Published: 11-May-2011

Brake System - General Information - Brake System Bleeding

General Procedures

WARNING: If any components upstream of the Hydraulic Control Unit (HCU), including the HCU itself are replaced, the brake system must be bled using Land Rover approved diagnostic equipment. This will ensure that all air is expelled from the new component(s).

• NOTE: The following procedure covers bleeding the brake system if components down stream of the HCU have been replaced. Where only the primary or secondary brake circuits have been disturbed in isolation, it should only be necessary to bleed that circuit. Partial bleeding of the hydraulic system is only permissible if a brake tube or hose has been disconnected with only minimal loss of fluid.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

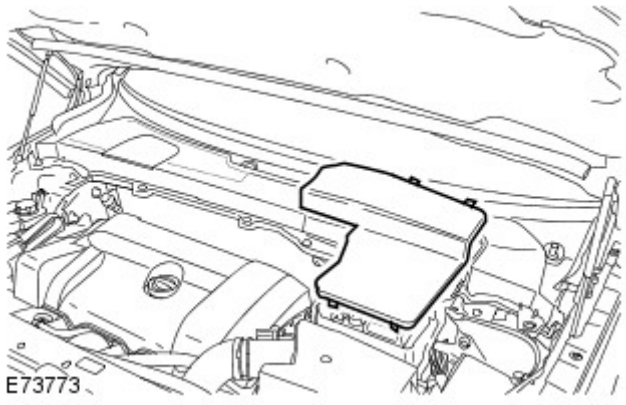
   Raise and support the vehicle.

2. Check that the brake fluid lines are secure and that there are no signs of a brake fluid leak. If a brake fluid leak is detected, investigate and rectify the cause of the leak before bleeding the brakes.

   Refer to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).

3. Pump the brake pedal until the brake vacuum assistance is exhausted.

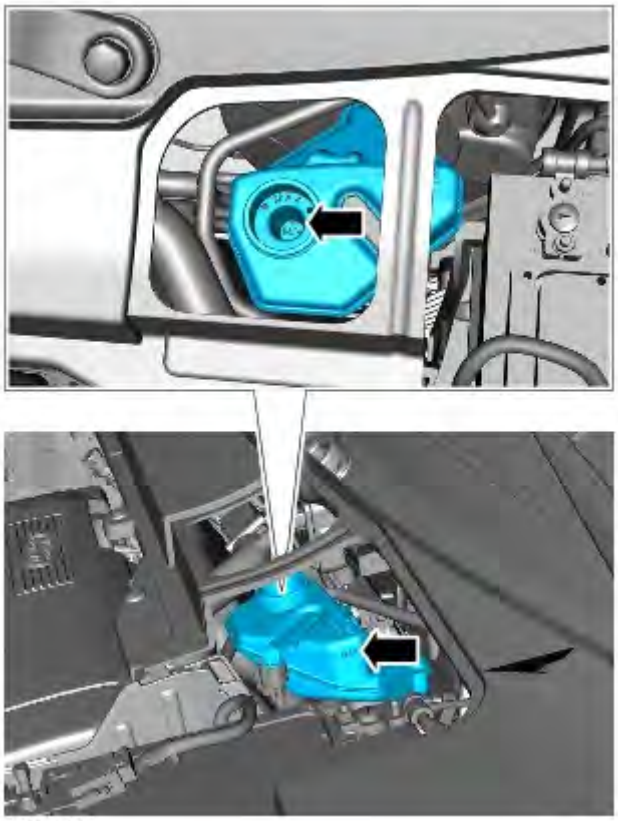
4.



5. **5.** WARNING: Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.

   CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

   Remove the brake fluid reservoir cap.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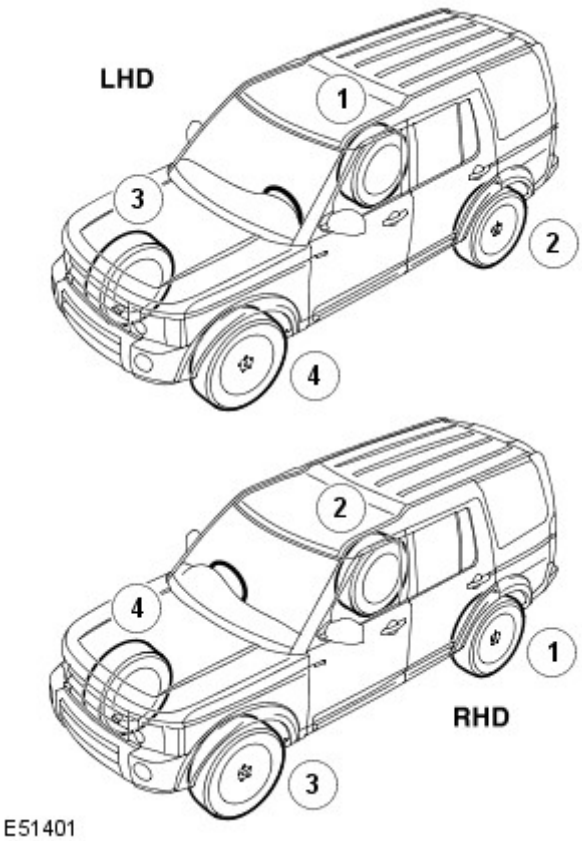
6. Fill the brake fluid reservoir to the MAX mark.

7. Install the bleed tube to the brake caliper bleed screw and immerse the free end of the bleed tube in a bleed jar containing a small quantity of approved brake fluid.

8.
   - Starting at the brake caliper furthest away from the brake master cylinder, loosen the bleed screw by one-half to three-quarters of a turn.



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9. **9.** CAUTION: The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.

   With assistance, depress the brake pedal steadily through its full stroke and allow it to return to the rest position. Repeat the procedure until brake fluid, clean and air-free flows into the bleed jar.

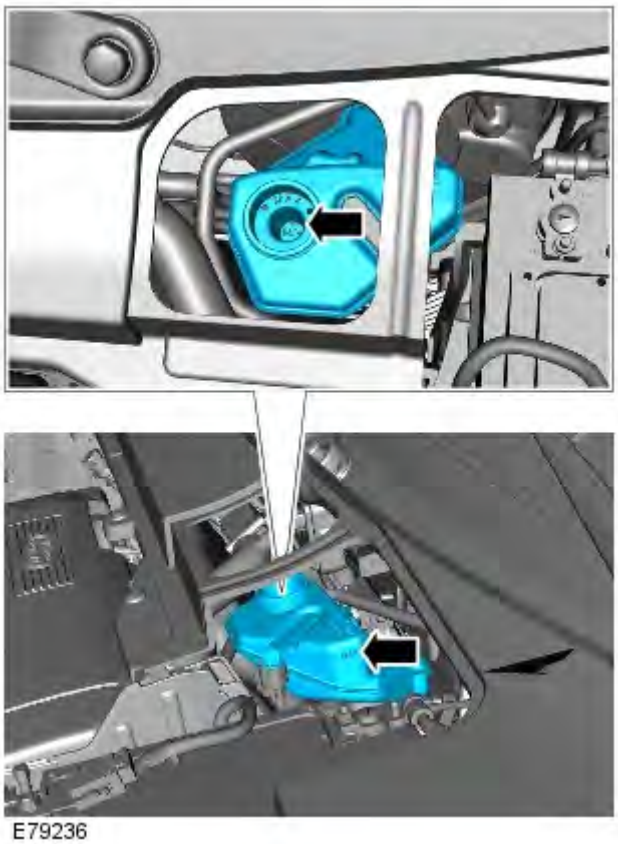
10. When brake fluid, clean and air-free flows into the bleed jar, depress and hold the brake pedal down.

11. **11.** CAUTION: Make sure the bleed screw cap is installed after bleeding. This will prevent corrosion to the bleed screw.

    With the brake pedal fully depressed, tighten the bleed screw.

    Torque: 10 Nm

12. Fill the brake fluid reservoir to the MAX mark.



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13. **13.** WARNING: Braking efficiency may be seriously impaired if an incorrect bleed sequence is used.

    Repeat the brake bleeding procedure for each brake caliper, following the above sequence.

14. Fill the brake fluid reservoir to the MAX mark.

15. Apply the brakes and check for leaks.

16. Install the brake fluid reservoir cap.

17. Install the fluid reservoir access panel.

Published: 11-May-2011

Front Disc Brake -

General Specification

Item	Specification
Front disc	Ventilated
Front disc diameter:	
3.2 Petrol	316 mm (12.4 in)
2.2 Diesel	300 mm (11.8 in)
Front disc thickness new (All engines)	28 mm (1.10 in)
Service limit (All engines)	26 mm (1.024 in)
Maximum disc run-out - disc installed	0.080 mm (0.003 in)
Pad minimum thickness	2 mm (0.078 in)
Piston diameter	60 mm (2.362 in)

Torque Specifications

Description	Nm	lb-ft
Brake caliper bleed screw	8	6
Brake caliper mounting plate to wheel knuckle bolts*	200	148
Brake caliper guide pin bolts	28	21
Brake disc dust shield bolts	10	7
Brake disc Torx screw	35	26
Brake flexi hose union to caliper	32	24
Brake hose retaining bracket to damper bolt	22	16

*** New nuts/bolts must be fitted**

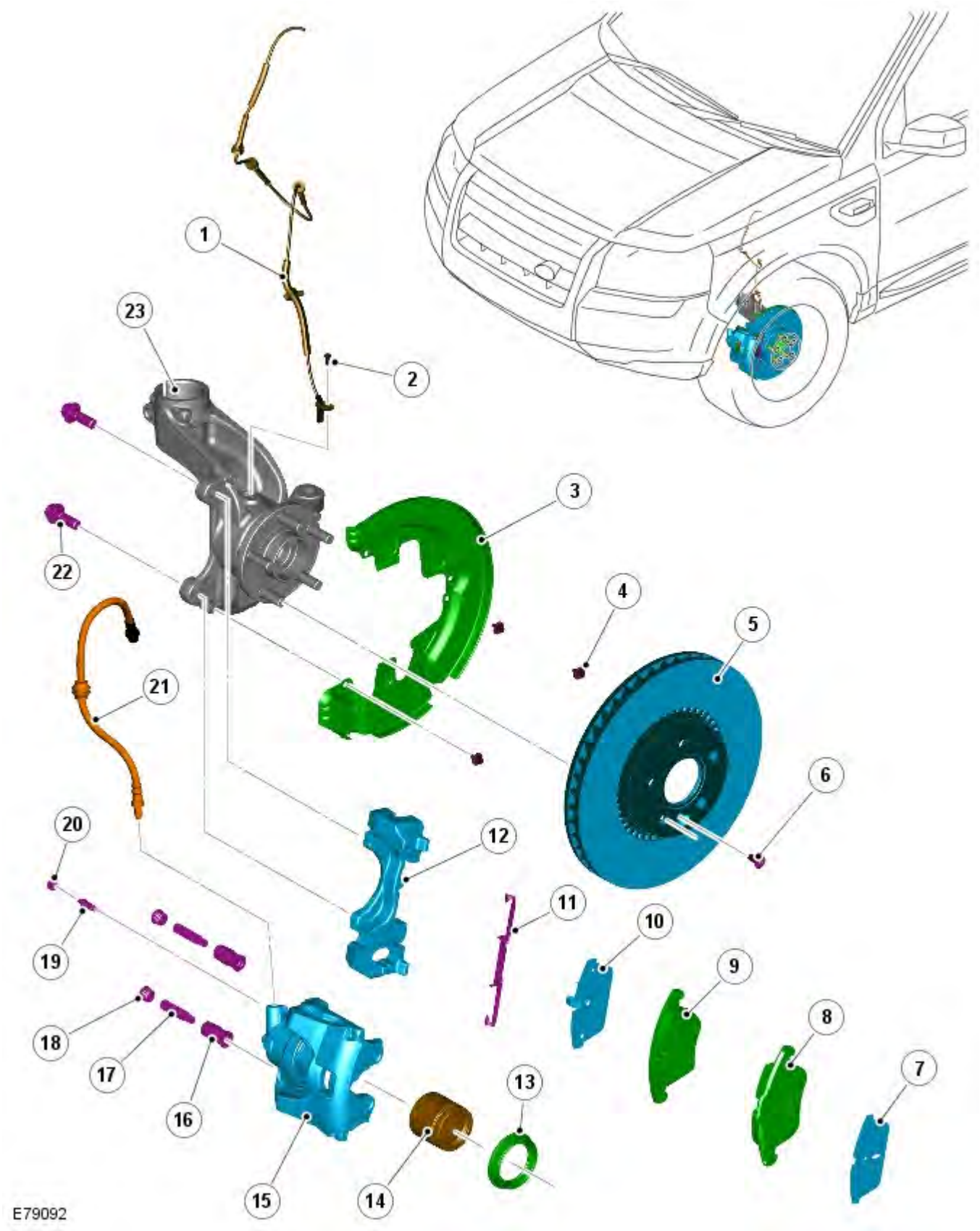
Published: 11-May-2011

Front Disc Brake - Front Disc Brake

Description and Operation

COMPONENT LOCATION

- NOTE: i6 gasoline front disc brake shown; TD4 diesel front disc brake similar.



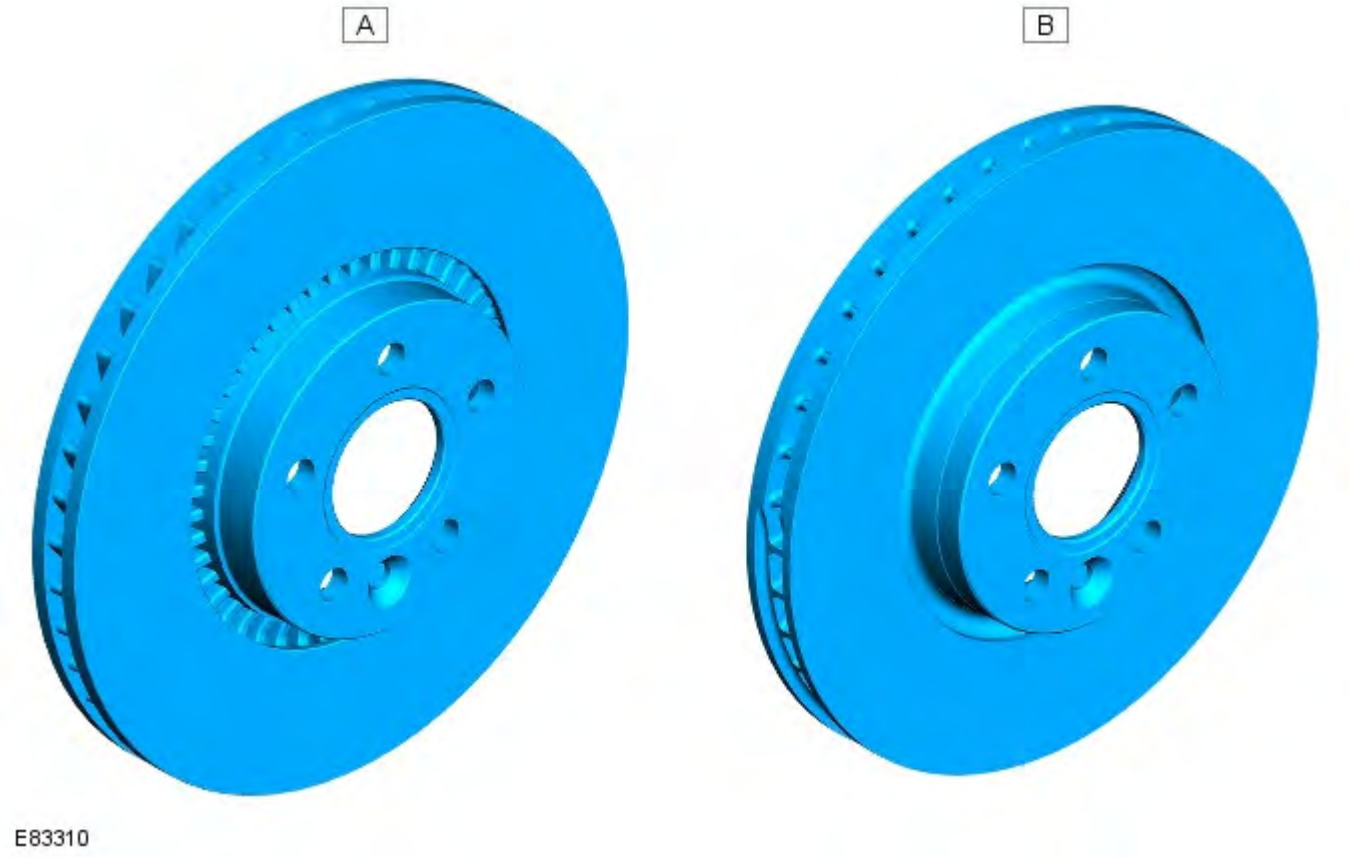
Item	Part Number	Description
1	-	Anti-lock Brake System (ABS) sensor cable
2	-	ABS sensor retaining screw

3	-	Dust shield
4	-	Dust shield retaining screw (3 off)
5	-	Brake disc
6	-	Brake disc retaining screw
7	-	Outer anti-squeal shim
8	-	Outer brake pad
9	-	Inner brake pad
10	-	Inner anti-squeal shim
11	-	Caliper housing spring
12	-	Fixed carrier
13	-	Caliper piston seal
14	-	Caliper piston
15	-	Sliding caliper
16	-	Bushed bolt rubber boot (2 off)
17	-	Bushed bolt (2 off)
18	-	Bushed bolt dust cap (2 off)
19	-	Caliper bleed screw
20	-	Bleed screw cap
21	-	Flexible hose
22	-	Fixed carrier retaining bolt (2 off)
23	-	Front Left-Hand (LH) wheel knuckle

OVERVIEW

The front brake assembly features a ventilated brake disc and cast-iron sliding caliper with single acting piston.

BRAKE DISC



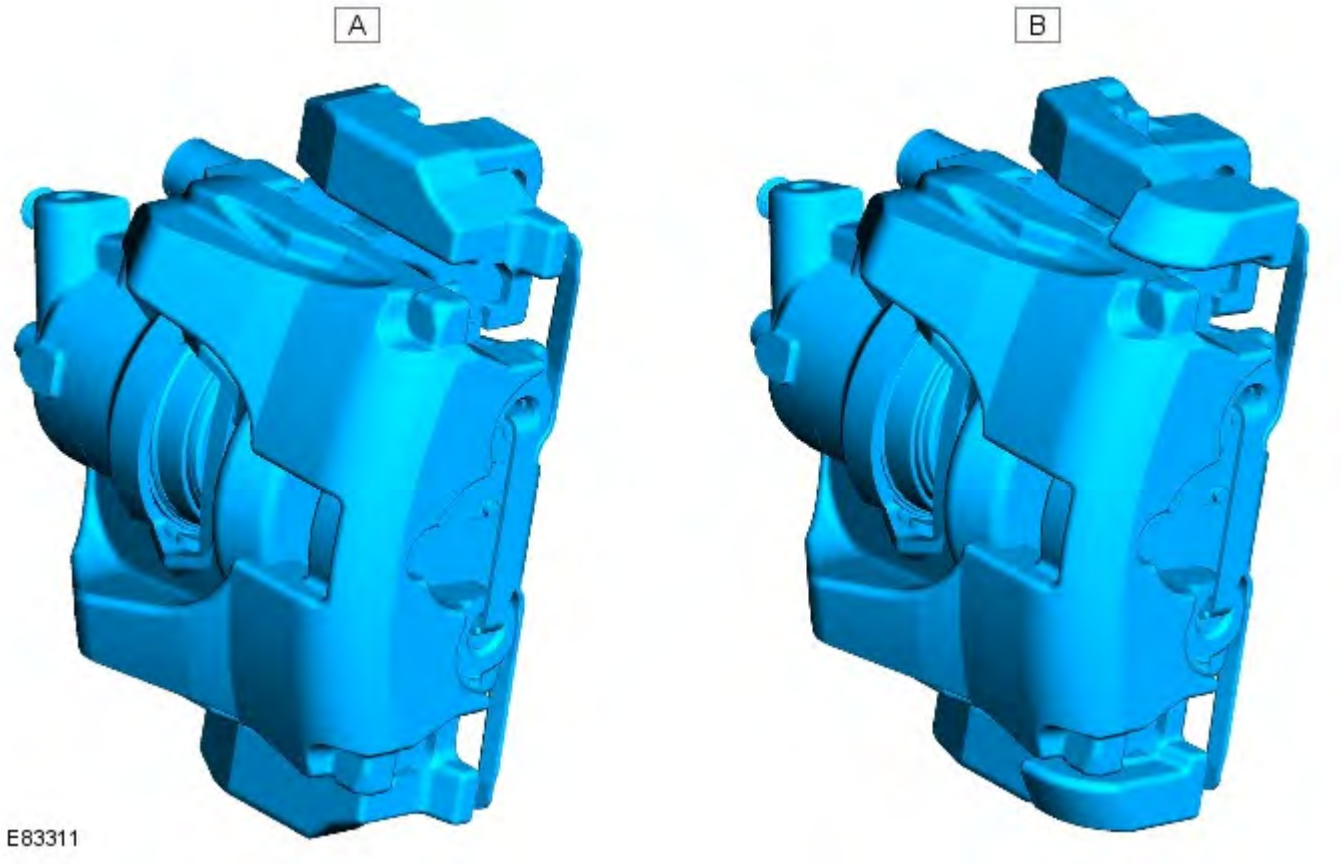
Item	Part Number	Description
A	-	Front brake disc - i6 gasoline vehicle
B	-	Front brake disc - TD4 diesel vehicle

The brake disc installed to the 3.2 liter i6 gasoline vehicle is 316 x 28 mm (12.44 x 1.10 in) diameter. The brake disc installed to the 2.2 liter TD4 diesel vehicle is 300 x 28 mm (11.81 x 1.10 in) diameter. The brake disc is secured to the wheel knuckle hub with a single screw and is also retained by the 5 wheel securing nuts.

Both types of front brake disc are manufactured with ventilation channels, allowing the disc to achieve high levels of thermal stability even during severe braking.

The disc is cooled as the forward motion of the vehicle draws air through the ventilation channels, and across the surfaces of the disc.

CALIPER ASSEMBLY



Item	Part Number	Description
A	-	Front brake caliper - i6 gasoline vehicle
B	-	Front brake caliper - TD4 diesel vehicle

The caliper assembly comprises a fixed carrier and sliding caliper. The fixed carrier is mounted to straddle the brake disc and is attached to the wheel knuckle with 2 bolts. The fixed carrier provides the location for 2 brake pads that are mounted on either side of the brake disc, and is formed with guide channels that allow the brake pads to slide toward the disc surface.

• NOTE: The 2 fixed carrier retaining bolts are pre-applied with a thread locking adhesive and must not be re-used during maintenance. New fixed carrier retaining bolts must be used and the original bolts discarded.

The sliding caliper is mounted over the fixed carrier and retains the 2 brake pads within the caliper assembly. The sliding caliper is secured to the fixed carrier with 2 bushed bolts, and is formed with a hydraulic chamber containing a 60 mm (2.36 in) diameter piston and annular seal.

The sliding caliper is connected via a flexible hose to the brake system hydraulic circuit, and also incorporates a bleed screw for maintenance purposes.

The 2 bushed bolts are machined with a smooth surface and are protected from dirt and moisture ingress with a collapsible rubber boot. The bushed bolts allow the sliding caliper limited lateral movement along the fixed carrier.

A housing spring is located on the outer side of the brake disc, and is connected with formed hooks between the fixed carrier and sliding caliper. During operation of the brake, the spring is tensioned as the sliding caliper moves toward the brake disc. The spring assists to move the sliding caliper away from the brake disc as the brake is released.

An anti-squeal shim is installed on the outside edge of each brake pad and reduces Noise, Vibration and Harshness (NVH) from the brake components during operation.

The brake pads are not installed with pad wear sensors.

BRAKE DUST SHIELD

A formed brake dust shield is located between the wheel knuckle and brake disc, and is secured to the knuckle with 3 screws.

The brake dust shield is handed to the relevant side of the vehicle and protects the brake components from cross axle stone throws. The brake dust shield also prevents debris and brake dust from spreading to other parts of the vehicle.

PRINCIPLES OF OPERATION

Brake Application

As the brake pedal is applied, initial hydraulic pressure is felt in the sliding caliper chamber causing the piston to extend toward the brake disc. The moving piston contacts the inner brake pad, forcing the pad along the fixed carrier guide channels and into contact with the inner side of the brake disc.

As the piston extends from the caliper chamber, it passes through an internal annular seal located within the caliper

chamber. The movement of the piston distorts the shape of the seal and consequently, the seal applies pressure on the piston outer surface.

The sliding caliper now reacts and commences to slide along the 2 bushed bolts, in the opposite direction to the extending piston. The sliding caliper contacts the outer brake pad, forcing the pad along the fixed carrier guide channels and into contact with the outer side of the brake disc. The housing spring that is attached between the fixed carrier and sliding caliper is tensioned as the sliding caliper moves toward the brake disc.

With both brake pads now in full contact with the brake disc and hydraulic pressure acting on the piston, no further movement of the piston and sliding caliper is possible. The force created by the piston and caliper acting against the brake pads increases rapidly, trapping the brake disc and slowing the vehicle.

Brake Release

As the brake pedal is released, hydraulic pressure in the caliper chamber collapses and force is no longer applied to the brake pads. The brake pads are moved slightly outwards by the action of the rotating brake disc, and the caliper internal annular seal returns to the normal shape. As the seal moves it grips on the piston outer surface and withdraws the piston into the chamber, sufficiently to provide the necessary pad to disc clearance.

This action prevents the piston from holding the inner brake pad against the disc, and also enables the piston to protrude further from the caliper chamber to compensate for brake pad wear.

With no pressure being applied to the hydraulic system, the housing spring tension is also relieved and the spring returns to the normal position. As the housing spring moves, the attached sliding caliper is moved away from the outer side of the disc to provide the necessary clearance between the outer brake pad and the brake disc.

Published: 11-May-2011

Front Disc Brake - Front Disc Brake

Diagnosis and Testing

For additional information.
REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Front Disc Brake - Brake Pads

Removal and Installation

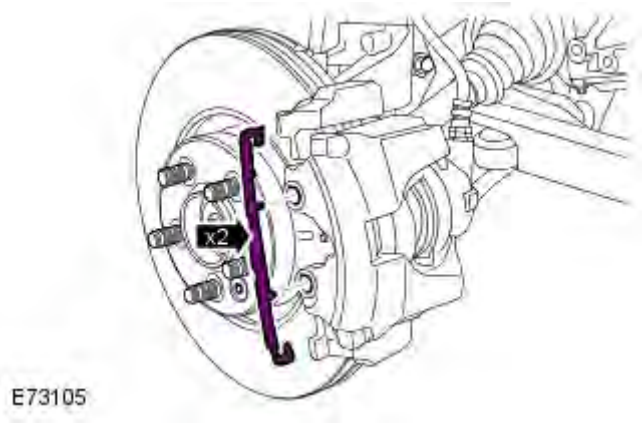
Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

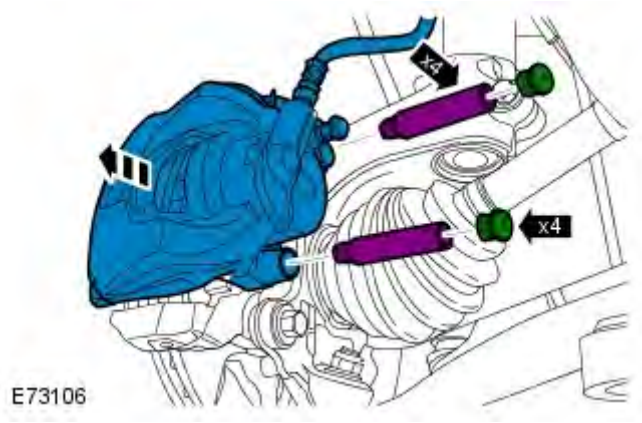
   Raise and support the vehicle.

2. Remove the front wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



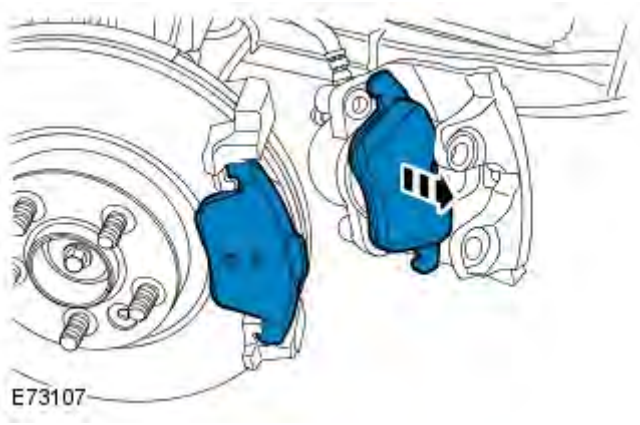
3. Remove the brake pad spring clip.



4. Remove the 2 caliper guide pins.

5. **5.** CAUTION: Make sure that no load is placed on the brake hose.

   Release the brake caliper.



6. Remove the brake pads.

7. Repeat the above procedure for the other side.

Installation

1. **1.** WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

   CAUTION: Make sure that the mating faces are clean and free of foreign material and that no grease is applied to the brake pad guides.

   Clean the brake caliper housing and anchor plate using brake cleaning fluid.

2. Inspect the caliper piston and slide pin seals for damage.

3. Position a bleed jar containing a small quantity of approved brake fluid. Connect the bleed tube to the bleed screw and loosen the screw.

4. Press the piston into the caliper housing and tighten the bleed screw.

   Torque: 8 Nm

5. Disconnect the bleed tube and remove the jar.

6. Install the brake pads.

7. Install the brake caliper.

8. **8.** CAUTION: Make sure that the brake hose is not twisted and is correctly located.

   Install the guide pins and tighten.

   Torque: 28 Nm

9. Install the brake pad spring clip.

10. Repeat the above procedure for the other side.

11. Install the front wheels and tires.

Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

12. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.

Published: 11-May-2011

Front Disc Brake - Brake Disc

Removal and Installation

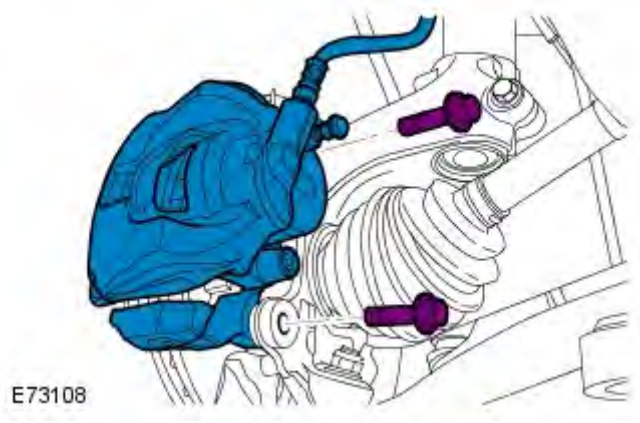
Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

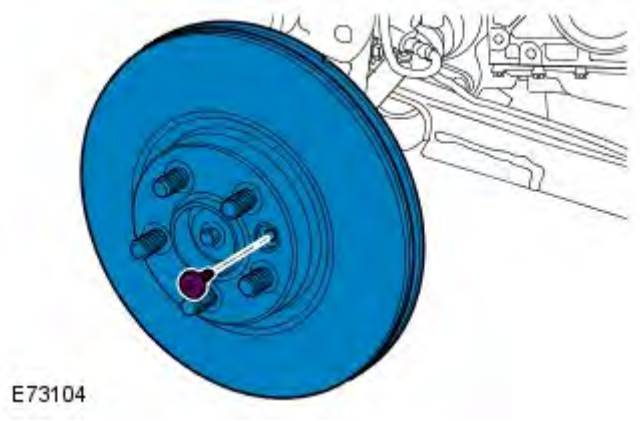
2. Remove the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



3. **3.** CAUTION: Make sure that no load is placed on the brake hose.

   Release the brake caliper and tie aside.



4. Remove the brake disc.

Installation

1. Make sure the brake disc and hub mating surfaces are clean.

2. Install the brake disc and tighten the Torx screw.

   Torque: 35 Nm

3. **3.** WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

   Clean the brake caliper housing and anchor plate using brake cleaning fluid.

4. **4.** CAUTION: Make sure that the brake hose is not twisted and is correctly located.

   Install the brake caliper and tighten the new bolts.

   Torque: 200 Nm

5. Install the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

6. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.

Published: 11-May-2011

Front Disc Brake - Brake Caliper Anchor Plate

Removal and Installation

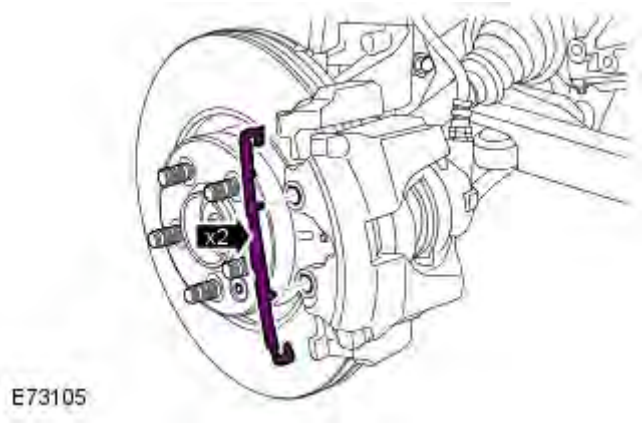
Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the front wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



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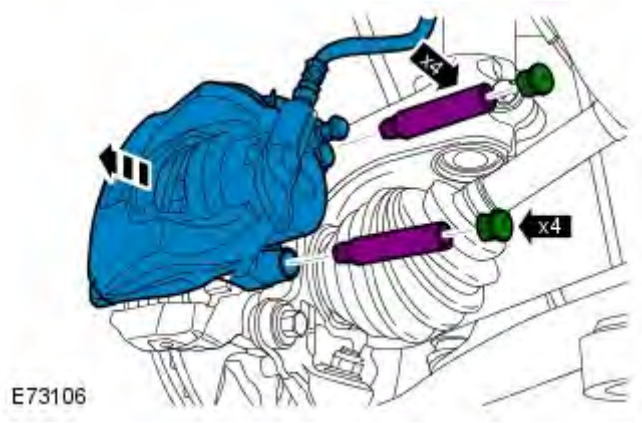
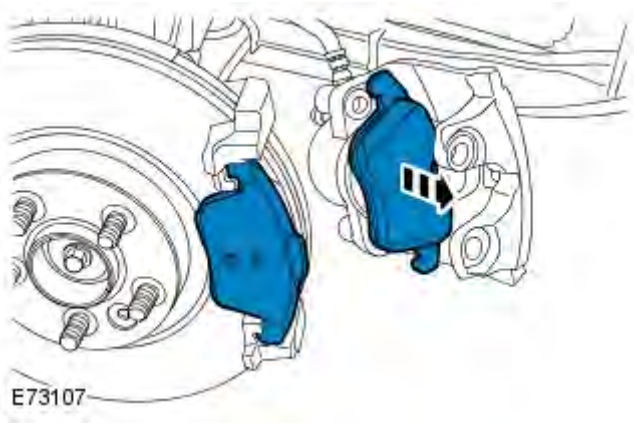


4. *Torque:* 28 Nm

5. **5.** CAUTION: Do not allow the brake caliper to hang on the brake hose.

   Release the brake caliper.



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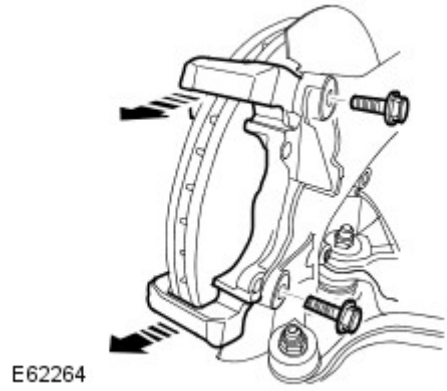


7. **7.** CAUTION: Make sure that new bolts are installed.

   Torque: 200 Nm

Installation

1. **1.** CAUTION: Make sure that the brake hose is not twisted and is correctly located.

   To install, reverse the removal procedure.

Published: 11-May-2011

Rear Disc Brake -

General Specification

Item	Specification
Rear disc:	
3.2 Petrol engine	Ventilated
2.2 Diesel engine	Solid
Rear disc diameter:	
Ventilated	302 mm (11.9 in)
Solid	302 mm (11.9 in)
Rear disc thickness new:	
Ventilated	20 mm (0.79 in)
Solid	12 mm (0.47 in)
Service limit:	
Ventilated	18 mm
Solid	10 mm
Pad minimum thickness	2 mm
Maximum disc run out - Disc installed	0.080 mm

Torque Specifications

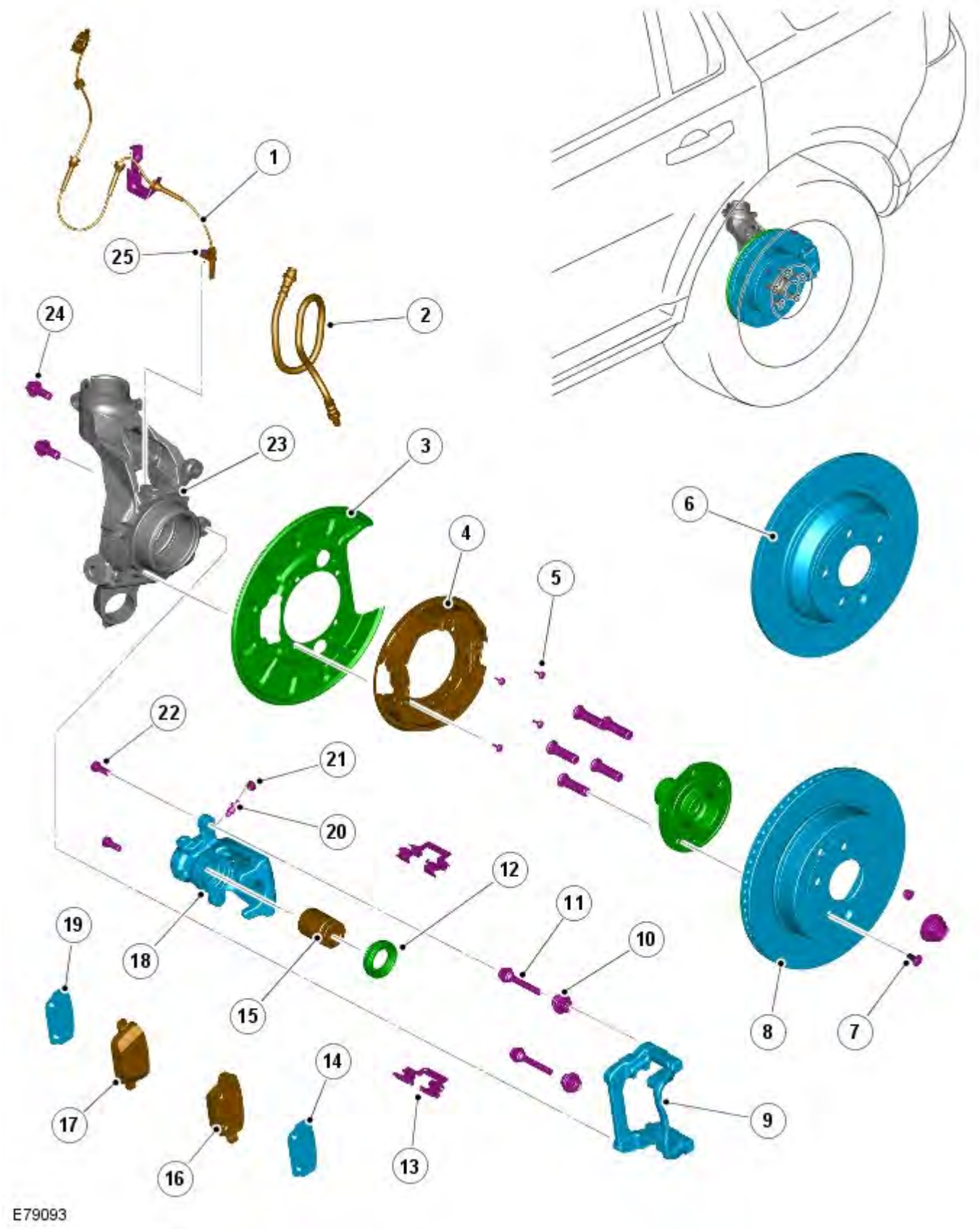
Description	Nm	lb-ft
Brake caliper bleed screw	10	7
Brake caliper fixed carrier to wheel knuckle bolts*	110	81
Brake caliper guide pin bolts	30	22
Brake disc dust shield bolts	13	10
Brake disc Torx screw	35	26
Brake flexi hose unions to caliper	15	11
Brake hose retaining bracket to wheel knuckle bolt	22	16

*** New nuts/bolts must be installed**

Rear Disc Brake - Rear Disc Brake

Description and Operation

COMPONENT LOCATION



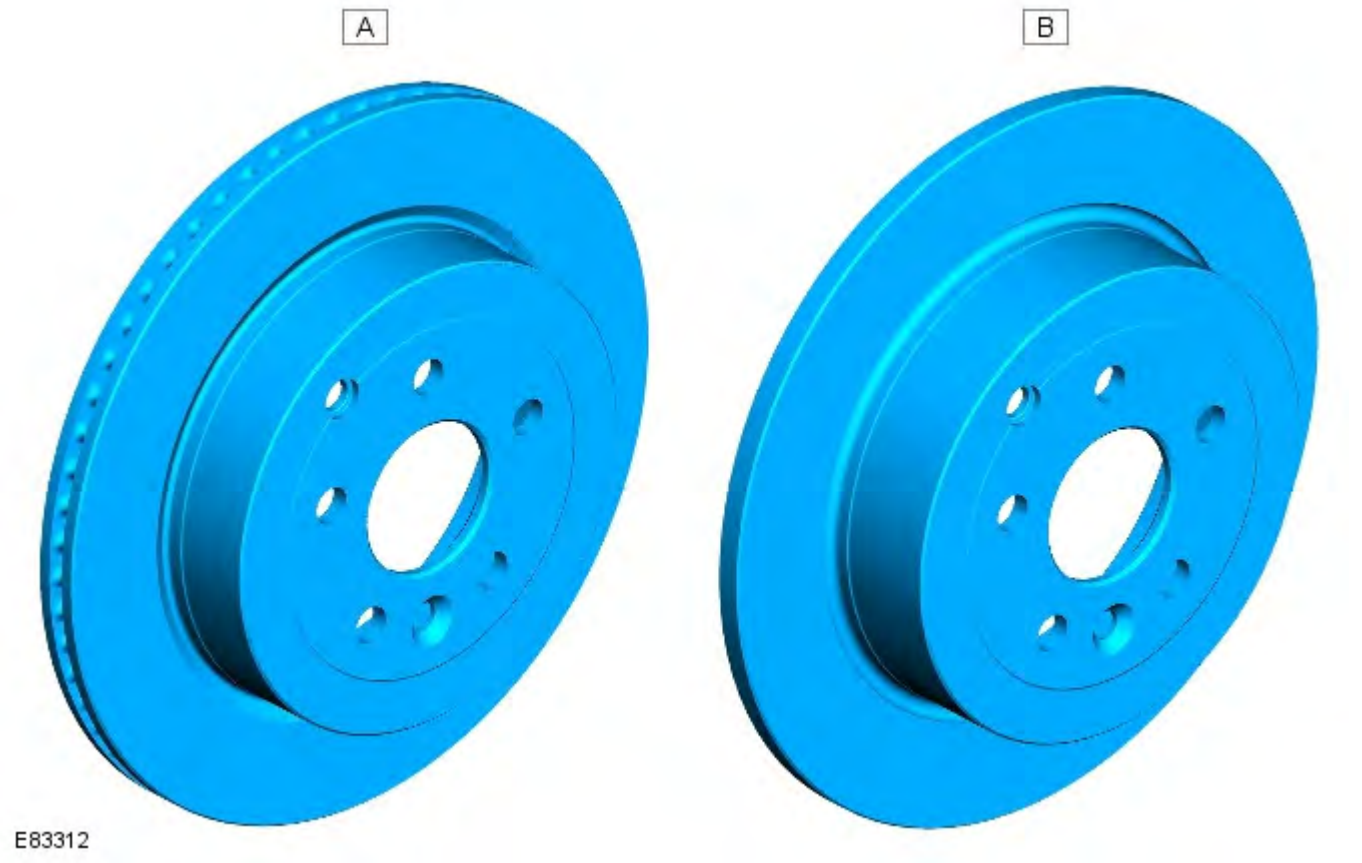
Item	Part Number	Description
1	-	Anti-lock Brake System (ABS) sensor cable
2	-	Flexible hose
3	-	Dust shield
4	-	Parking brake assembly

5	-	Dust shield retaining screw (4 off)
6	-	Brake disc – solid (TD4 diesel vehicle)
7	-	Brake disc retaining screw
8	-	Brake disc – ventilated (i6 gasoline vehicle)
9	-	Fixed carrier
10	-	Bushed bolt rubber boot (2 off)
11	-	Bushed bolt
12	-	Caliper piston seal
13	-	Brake pad retaining spring (2 off)
14	-	Outer anti-squeal shim
15	-	Caliper piston
16	-	Outer brake pad
17	-	Inner brake pad
18	-	Sliding caliper
19	-	Inner anti-squeal shim
20	-	Caliper bleed screw
21	-	Bleed screw cap
22	-	Bushed bolt retaining screw (2 off)
23	-	Rear Left-Hand (LH) wheel knuckle
24	-	Fixed carrier retaining bolt (2 off)
25	-	Anti-lock Brake System (ABS) sensor retaining screw

OVERVIEW

The rear brake assembly features either a conventional ventilated or a solid type brake disc, and cast-iron sliding caliper with single acting piston.

BRAKE DISC



Item	Part Number	Description
A	-	Rear brake disc - i6 gasoline vehicle
B	-	Rear brake disc - TD4 diesel vehicle

The ventilated type brake disc is 302 x 20 mm (11.89 x 0.79 in) in diameter and installed to the 3.2 liter i6 gasoline vehicle. The solid type brake disc is 302 x 12 mm (11.89 x 0.47 in) in diameter and installed to the 2.2 liter TD4 diesel vehicle. The brake disc is secured to the wheel knuckle hub with a single screw and is also retained by the 5 wheel securing nuts.

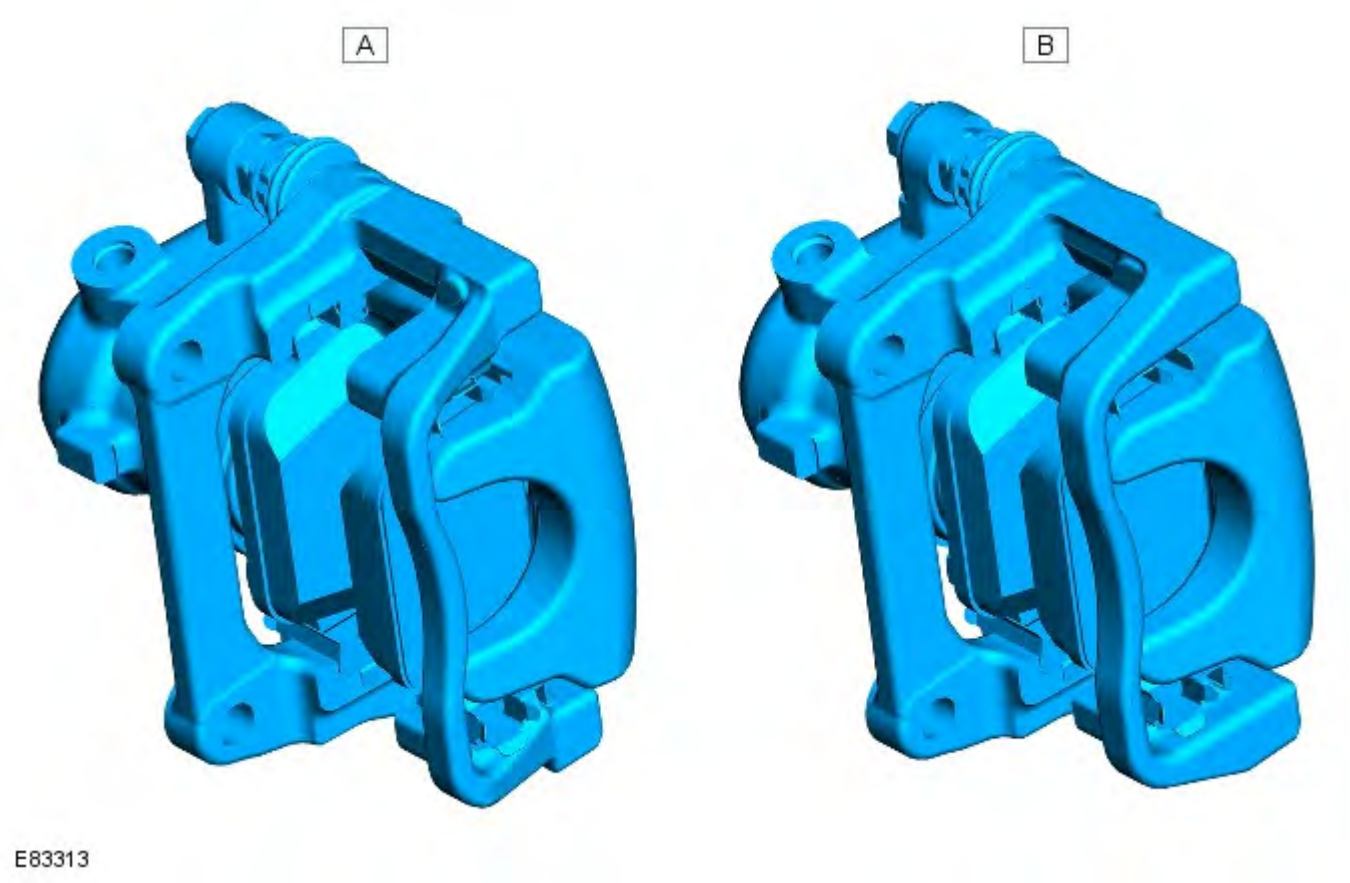
Both sizes of rear brake disc are sufficiently cooled to achieve high levels of thermal stability, even during severe braking.

The solid type brake disc is cooled as the vehicles forward motion directs air over the disc surfaces. The conventional ventilated disc is cooled by the forward motion of the vehicle drawing air through radial slots formed on the disc outer rim. The air cools the disc from the inside edge to the disc center, before venting out through slots formed around the disc central bell.

The brake disc also forms the location for the parking brake components. The brake disc internal diameter is 185 mm (7.28 in) and is machined with a smooth surface to form the brake drum. An integral backplate and brake dust shield is mounted to the rear of the brake disc. The backplate encloses the brake disc and also provides the mounting location for the 2 parking brake shoes and operating components.

An aperture is formed in the dust shield and backplate that allows the parking brake cable to protrude through to the inner side of the brake disc, and connect to the parking brake expander unit. A hole machined in the brake disc outer hub provides access to the parking brake manual adjuster.
For additional information, refer to: Parking Brake (206-05 Parking Brake and Actuation, Description and Operation).

CALIPER ASSEMBLY



Item	Part Number	Description
A	-	Rear brake caliper - i6 gasoline vehicle
B	-	Rear brake caliper - TD4 diesel vehicle

The caliper assembly comprises a fixed carrier and sliding caliper. The fixed carrier is mounted to straddle the brake disc and is attached to the wheel knuckle with 2 bolts. The fixed carrier provides the location for 2 brake pads that are mounted on either side of the brake disc, and is formed with guide channels that allow the brake pads to slide toward the disc surface.

• NOTE: The 2 fixed carrier retaining bolts are pre-applied with a thread locking adhesive and must not be re-used during maintenance. New fixed carrier retaining bolts must be used and the original bolts discarded.

The sliding caliper is mounted over the fixed carrier and retains the 2 brake pads within the caliper assembly. The sliding caliper is secured to the fixed carrier with 2 bushed bolts, and is formed with a hydraulic chamber containing a piston and annular seal.

The sliding caliper is connected via a flexible hose to the brake system hydraulic circuit, and also incorporates a bleed screw for maintenance purposes.

The 2 bushed bolts are machined with a smooth surface and are protected from dirt and moisture ingress with a collapsible rubber boot. The bushed bolts allow the sliding caliper limited lateral movement along the fixed carrier.

An anti-squeal shim is installed on the outside edge of each brake pad and reduces Noise, Vibration and Harshness (NVH) from the brake components during operation.

An upper and lower brake pad retaining spring are mounted between the fixed carrier and sliding caliper. The retaining springs are held in position by the 2 bushed bolts, and maintain pressure on the brake pads to prevent radial movement of the pads away from the brake disc.

The brake pads are not installed with pad wear sensors.

BRAKE DUST SHIELD

A formed brake dust shield and integral parking brake backplate is located between the wheel knuckle and brake disc, and is secured to the knuckle with 4 screws.

The brake dust shield is handed to the relevant side of the vehicle and protects the brake components from cross axle stone throws. The brake dust shield also prevents debris and brake dust from spreading to other parts of the vehicle.

PRINCIPLES OF OPERATION

Brake Application

As the brake pedal is applied, initial hydraulic pressure is felt in the sliding caliper chamber causing the piston to extend toward the brake disc. The moving piston contacts the inner brake pad, forcing the pad along the fixed carrier guide channels and into contact with the inner side of the brake disc.

As the piston extends from the caliper chamber, it passes through an internal annular seal located within the caliper chamber. The movement of the piston distorts the shape of the seal and consequently, the seal applies pressure on the piston outer surface.

The sliding caliper now reacts and commences to slide along the 2 bushed bolts, in the opposite direction to the extending piston. The sliding caliper contacts the outer brake pad, forcing the pad along the fixed carrier guide channels and into contact with the outer side of the brake disc.

With both brake pads now in full contact with the brake disc and hydraulic pressure acting on the piston, no further movement of the piston and sliding caliper is possible. The force created by the piston and caliper acting against the brake pads increases rapidly, trapping the brake disc and slowing the vehicle.

Brake Release

As the brake pedal is released, hydraulic pressure in the caliper chamber collapses and force is no longer applied to the brake pads. The brake pads are moved slightly outwards by the action of the rotating brake disc, and the caliper internal annular seal returns to the normal shape. As the seal moves it grips on the piston outer surface and withdraws the piston into the chamber, sufficiently to provide the necessary pad to disc clearance.

This action prevents the piston from holding the inner brake pad against the disc, and also enables the piston to protrude further from the caliper chamber to compensate for brake pad wear.

Published: 11-May-2011

Rear Disc Brake - Rear Disc Brake

Diagnosis and Testing

For additional information.
REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Rear Disc Brake - Brake Pads

Removal and Installation

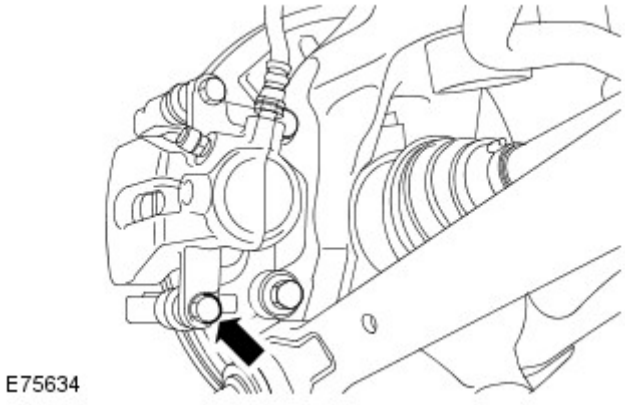
Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

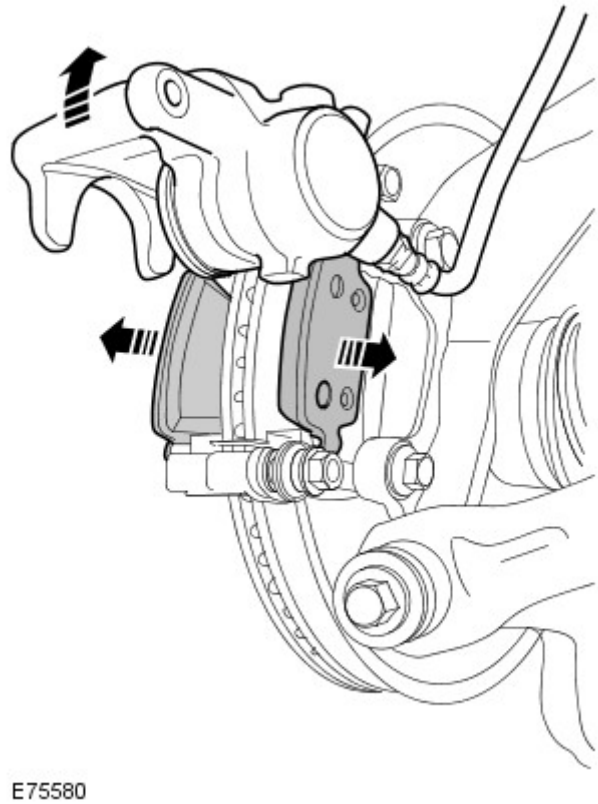
2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).


E75634

3. Remove the brake caliper lower bolt.

4. Remove the brake pads.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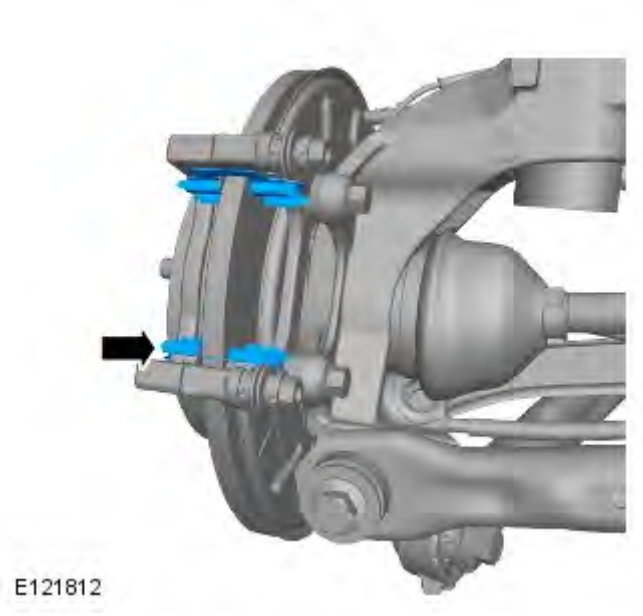
5. Remove the brake pad clips.

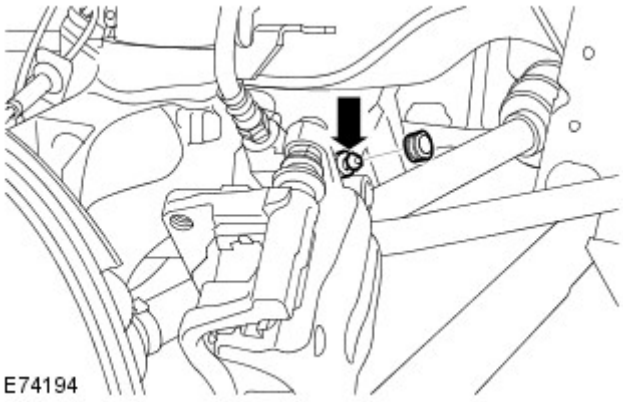


Installation

1. **1.** WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

   Clean the brake caliper housing and anchor plate using brake cleaning fluid.

2. Inspect the caliper piston and slide pin seals for damage.



3. Position a bleed jar containing a small quantity of approved brake fluid. Connect the bleed tube to the bleed screw and loosen the screw.

4. Press the piston into the caliper housing and tighten the bleed screw.

   Torque: 10 Nm

5. Disconnect the bleed tube and remove the jar.

6. **6.** CAUTIONS:

   If new brake pads are installed, a new gold coloured brake pad clip must be fitted in the lower position. The clip with one hole must be fitted to petrol vehicles. The clip with two holes must be fitted to diesel vehicles. Failure to follow this instruction may result in damage to the vehicle.

   If new brake pads are installed, a new black coloured brake

pad clip must be fitted in the upper position. Failure to follow this instruction may result in damage to the vehicle.

Install the brake pad clips.

7. Install the brake pads.

8. Secure the brake caliper.

   Torque: 35 Nm

9. Repeat the above procedure for the other side.

10. Install the wheels and tires.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

11. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.

Published: 11-May-2011

Rear Disc Brake - Brake Disc

Removal and Installation

Removal

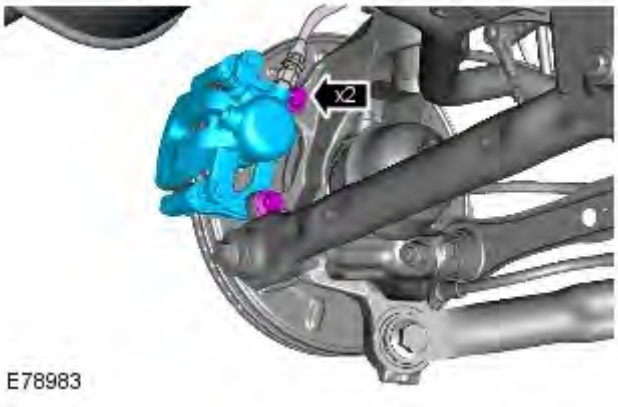
• NOTE: If the parking brake shoes or the brake discs have been removed for access to other components then DO NOT carry out the bedding in procedure.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

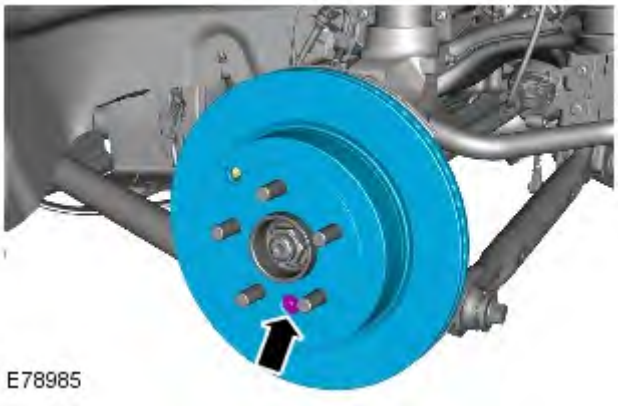
2. Remove the wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



3. **3.** CAUTION: Make sure that no load is placed on the brake hose.
   - Tie the brake caliper and anchor aside.

4.
   - Release the park brake shoe adjustment.



5.

6. Repeat the above procedure for the other side.

Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Install the brake disc.

   Torque: 35 Nm

2. **2.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that the brake hose is not twisted and is correctly located.

   Secure the brake caliper and anchor plate to the wheel knuckle.

   Torque: 110 Nm

3. Repeat the above procedure for the other side.

4. Adjust the parking brake.

   Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

5. Install the wheels and tires.

6. If necessary, carry out the parking brake shoe bedding-in procedure.

   Refer to: Parking Brake Shoes Bedding-In (206-05 Parking Brake and Actuation, General Procedures).

Published: 11-May-2011

Rear Disc Brake - Brake Caliper

Removal and Installation

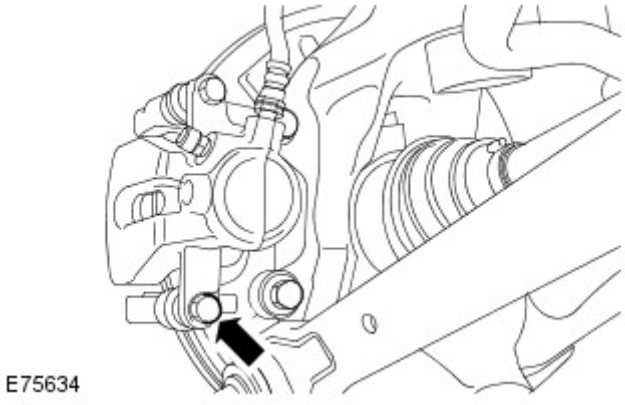
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).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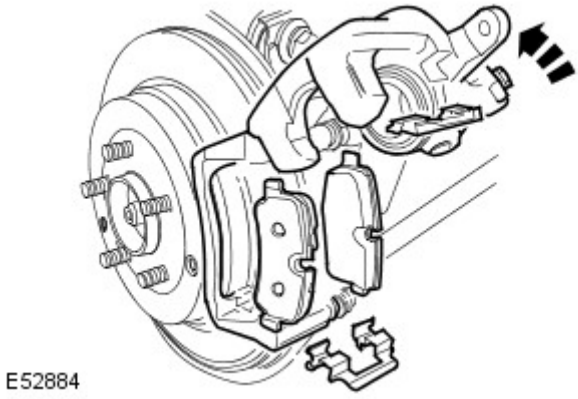
3. **3.** CAUTION: Make sure that new bolts are installed.

   • NOTE: Use an additional wrench to prevent the component from rotating.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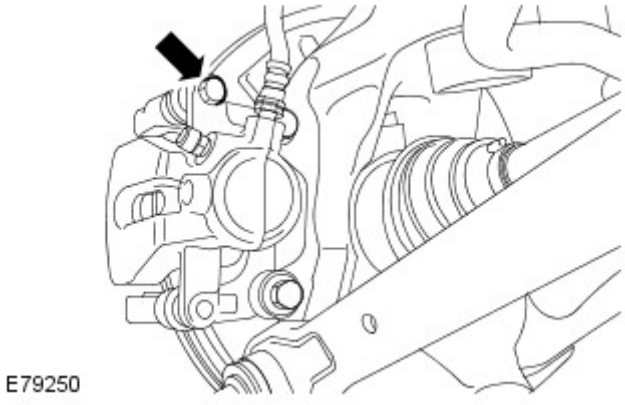
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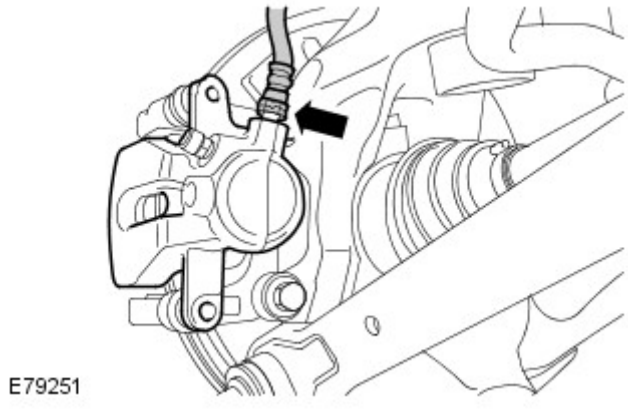
5. **5.** CAUTION: Make sure that new bolts are installed.

   • NOTE: Use an additional wrench to prevent the component from rotating.



6. **6.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.

7. Remove the brake caliper housing.

Installation

1. **1.** WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

   Clean the brake caliper housing and anchor plate using brake cleaning fluid.

2. Install the brake caliper.

3. Connect the brake tube to the brake caliper.

   Torque: 30 Nm

4. Install the brake caliper upper bolt.

   Torque: 30 Nm

5.
   - Install the two clips.
   - Install the brake pads.

6. **6.** CAUTION: Make sure that the brake hose is not twisted and is correctly located.

   Install the brake caliper lower bolt.

   Torque: 30 Nm

7. Install the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

8. Bleed the brake system.

   Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).

Published: 11-May-2011

Rear Disc Brake - Brake Caliper Anchor Plate

Removal and Installation

Removal

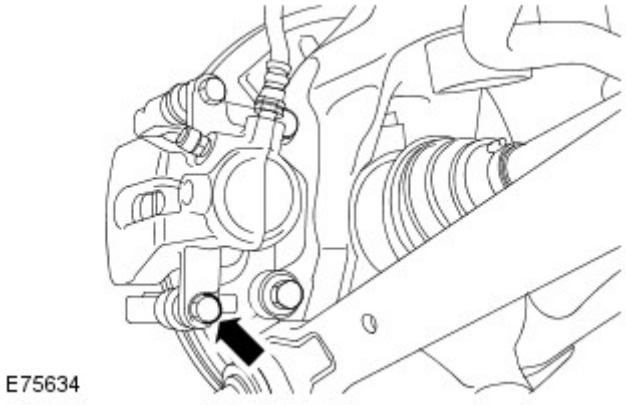
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3.



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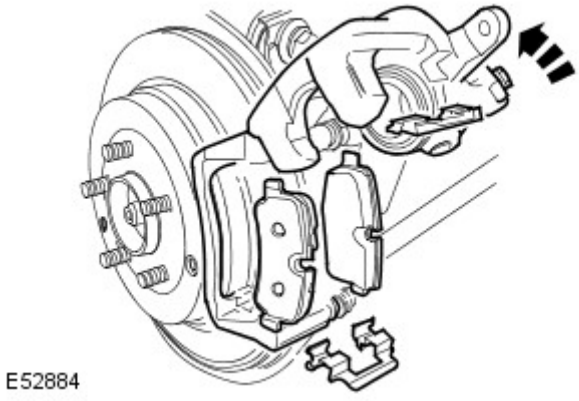

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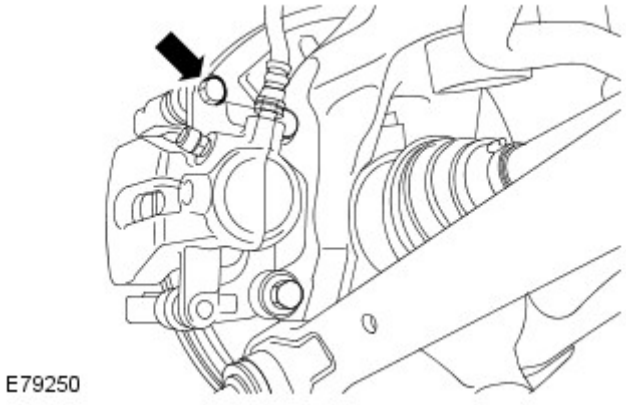
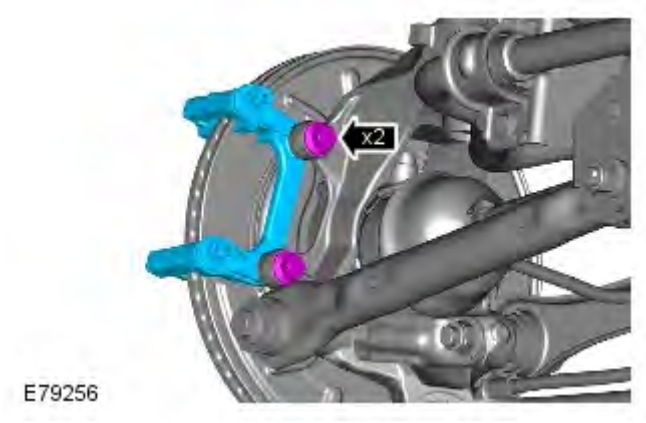


6. **6.** CAUTION: Do not allow the brake caliper to hang on the

brake hose.

Tie the brake caliper housing aside.

7.



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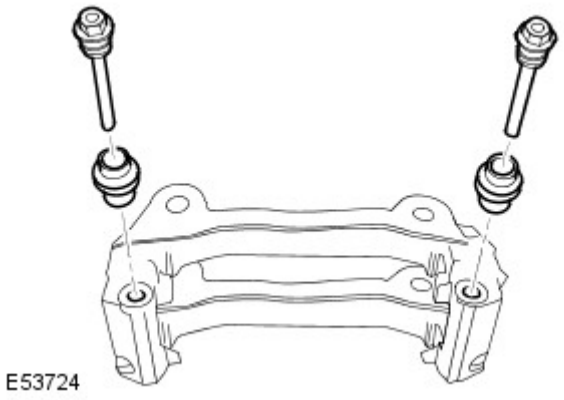


Installation

1. **1.** WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

   Clean the brake caliper housing and anchor plate using brake cleaning fluid.

2. Clean and lubricate the guide pins.

3. Install the guide pins.

4. **4.** CAUTION: Make sure that new bolts are installed.

   Install the brake caliper anchor plate.

   Torque: 110 Nm

5. **5.** CAUTION: Make sure that new bolts are installed.

   Install the brake caliper housing and install the top bolt.

   Torque: 35 Nm

6. Install the clips and brake pads.

7. **7.** CAUTIONS:

Make sure that new bolts are installed.

Make sure that the brake hose is not twisted and is correctly located.

Align the brake caliper to the anchor plate.

Torque: 30 Nm

8. Install the wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Parking Brake and Actuation -

General Specification

Item	Specification
Make	TRW
Type	Drum machined in centre of the brake disc
Operation	Manually applied cable operated system.
Parking brake drum internal diameter	185 mm (7.28 in)
Minimum brake lining material thickness	1 mm (0.039 in)

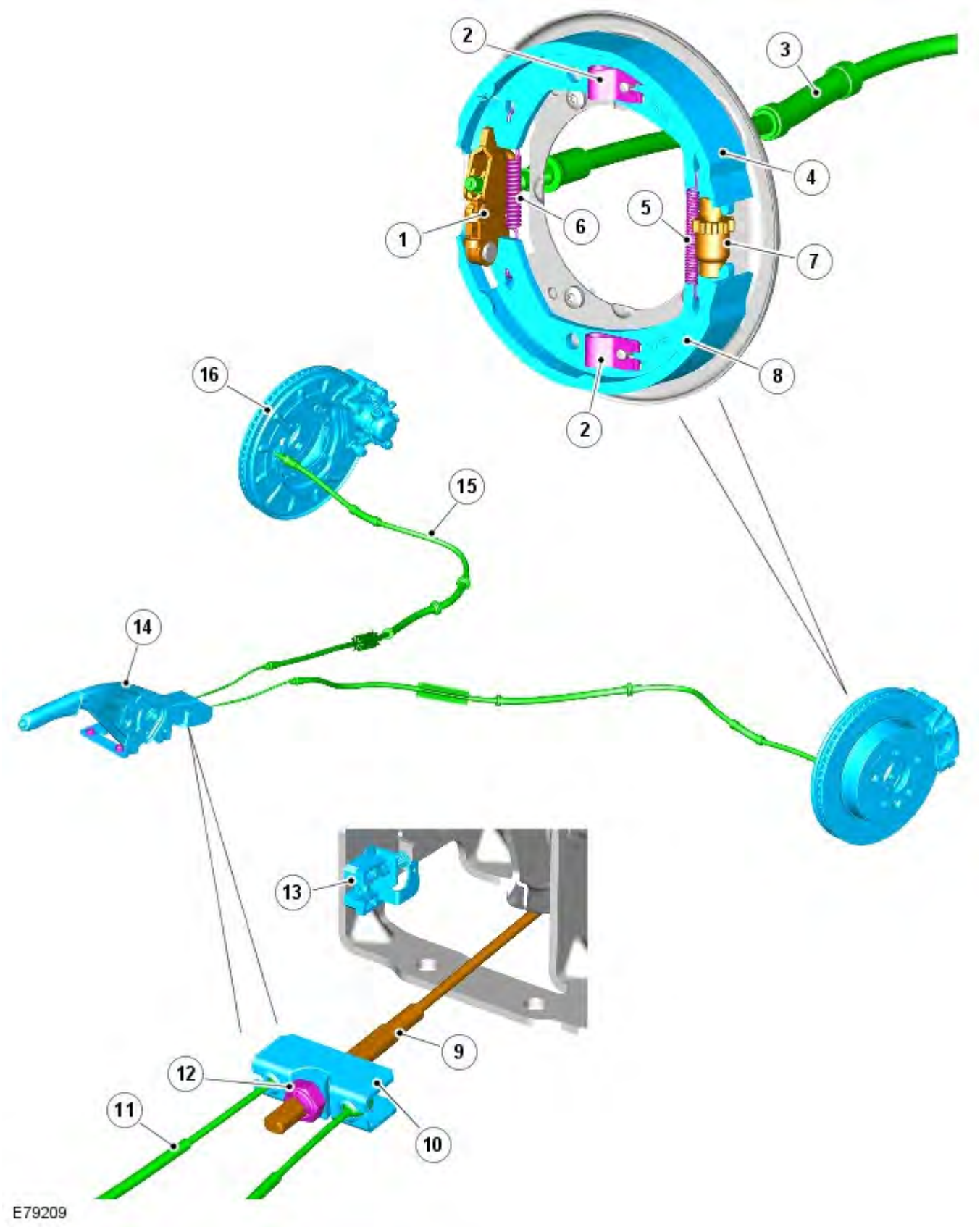
Torque Specifications

Description	Nm	lb-ft
LH/RH parking brake cable bolts	10	7
Parking brake actuator mounting bracket bolts	25	18
Parking brake warning indicator switch Torx screw	2	1

Parking Brake and Actuation - Parking Brake

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Parking brake expander unit
2	-	Brake shoe retaining clip (2 off)
3	-	Parking brake outer cable sleeve
4	-	Upper (trailing) brake shoe

5	-	Brake shoe retaining spring
6	-	Brake shoe return spring
7	-	Brake shoe mechanical adjuster
8	-	Lower (leading) brake shoe
9	-	Parking brake lever cable
10	-	Parking brake cable equalizer
11	-	Parking brake inner cable
12	-	Equalizer fastener
13	-	Parking brake microswitch
14	-	Parking brake lever assembly
15	-	Parking brake outer cable
16	-	Brake dust shield

OVERVIEW

The parking brake is a manually actuated system that operates brake shoes located in the rear brake discs. The inside center of the rear brake disc is manufactured to form the brake drum.

BRAKE SHOE ASSEMBLY

The brake shoes are mounted horizontally on an integral brake dust shield and backplate, and form an upper trailing and lower leading brake shoe type system. Retaining pins pass through holes in the dust shield and corresponding holes in each brake shoe bracket. Each pin is secured to the brake shoe with a retaining clip. The retaining pins allow movement of the brake shoe toward the drum surface during parking brake operation, but prevent sideways movement of the brake shoe away from the dust shield.

An expander unit and manual adjuster are located along the horizontal axis of the dust shield. The expander unit is positioned at the front of the dust shield and forms the location for the leading and trailing ends of the brake shoe brackets. The manual adjuster is mounted at the rear of the dust shield and forms the location and fulcrum point for the opposite ends of the brake shoe brackets.

The manual adjuster provides the means to adjust the brake shoe lining to drum clearance for maintenance purposes. Access to the manual adjuster knurled wheel is through a formed hole in the front of the brake disc. Adjustment is required if the brake shoes or discs are renewed. A bedding-in procedure must also be performed to make sure the drum brakes operate satisfactorily.
For additional information, refer to: Parking Brake Shoes Bedding-In (206-05 Parking Brake and Actuation, General Procedures).

The corresponding ends of both the upper and lower brake shoe brackets are maintained in contact with the expander unit and manual adjuster by 2 return springs. The return springs are located between the ends of each upper and lower brake shoe and attach to holes formed in the brake shoe brackets. The return springs pull the brake shoes away from the drum when the parking brake is released.

PARKING BRAKE LEVER

The parking brake lever is located in the floor console between the driver and passenger seats, and comprises a toothed quadrant, pawl and press-button release mechanism. A single cable with a formed threaded rod-end connects the quadrant to the equalizer unit, and is secured with either a locknut or a locking washer and nut.

The threaded rod allows adjustments to the parking brake cable tension and parking brake lever travel to be performed for maintenance purposes.
For additional information, refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

The parking brake cable is routed from the parking brake lever equalizer, and along the chassis to the rear parking brake expander unit. The parking brake cable protrudes through the brake dust shield, and is formed with a nipple that connects to the expander unit. The opposite ends of each Left-Hand (LH) and Right-Hand (RH) parking brake cable are formed with a nipple that connect to the equalizer unit. The equalizer unit makes sure the LH and RH parking brake assemblies operate simultaneously when the parking brake is applied.

A microswitch is located on the base of the parking brake lever. The microswitch operates the parking brake warning indicator lamp located in the instrument cluster, when the parking brake is applied.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

PRINCIPLES OF OPERATION

As the parking brake lever is applied, the toothed quadrant rotates and pulls on the threaded rod and cable equalizer. The equalizer pulls the 2 parking brake cables and operates the 2 expander units simultaneously. Movement of the expander unit causes the upper and lower brake shoes to pivot against the manual adjuster fulcrum, and the brake shoes contact the brake drum against the tension of the 2 return springs.

As the parking brake lever quadrant rotates, the teeth on the pawl engage with corresponding teeth on the quadrant. In the applied position, the pawl teeth are held under spring tension against the quadrant teeth to prevent the lever from disengaging.

With the parking brake applied and the ignition in power mode 6 (ignition), the microswitch connects a ground to the instrument cluster and illuminates the parking brake warning indicator lamp.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

When the parking brake lever press-button is pressed and the lever moved to release the parking brake, the pawl teeth are raised clear from the quadrant teeth. As the parking brake lever is lowered, the parking brake cable closes the expander unit and the brake shoes are immediately moved away from the brake drum by the 2 return springs.

As the parking brake lever reaches the fully released position, the microswitch is opened to disconnect the circuit to the instrument cluster. With the parking brake released, the parking brake warning indicator lamp is extinguished.

Published: 11-May-2011

Parking Brake and Actuation - Parking Brake

Diagnosis and Testing

Principle of Operation

For a detailed description of the parking brake, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Parking Brake (206-05 Parking Brake and Actuation, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern by operating the system to duplicate the condition.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Parking brake control • Cable and conduit • Equalizer	• Parking brake control warning circuit

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Cause	Action
The parking brake will not engage	• Parking brake control • Cable and conduit	Go to Pinpoint Test A
The parking brake will not release	• Cable and conduit • Parking brake control	Go to Pinpoint Test B

Pinpoint Tests

PINPOINT TEST A : THE PARKING BRAKE WILL NOT ENGAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FOR INCORRECTLY ADJUSTED REAR PARKING BRAKE CABLE	
	1 Carry out parking brake cable adjustment procedure. REFER to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).
	Does the parking brake now engage correctly? **Yes** Vehicle OK. **No** GO to A2.
A2: CHECK FOR WORN PARKING BRAKE SHOES	
	1 Inspect the rear parking brake shoes for excessive wear.
	Are parking brake shoes OK? **Yes** GO to A3. **No** INSTALL new parking brake shoes. REFER to: Parking Brake Shoes (206-05 Parking Brake and Actuation, Removal and Installation). Test the system for normal operation.
A3: CHECK FOR DAMAGED PARKING BRAKE CABLES	
	1 Inspect the parking brake components, cables and conduit for damage, rust or fraying.
	Are the parking brake components, cables and conduits OK? **Yes** CHECK for other causes such as loose parking brake control or system components. **No** REPAIR or INSTALL new components, cables and conduit as necessary. REFER to: Parking Brake Front Cable (206-05 Parking Brake and Actuation, Removal and Installation) / Parking Brake Rear Cables (206-05 Parking Brake and Actuation, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST B : THE PARKING BRAKE WILL NOT RELEASE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK PARKING BRAKE CONTROL	
• NOTE: Ensure correct adjustment of parking brake shoes prior to test.	
	1 Raise and support the vehicle with the parking brake fully applied. REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).

	2 Release the parking brake by pulling upwards on the control lever and pushing the release button.
	Did the parking brake control release? **Yes** CHECK for other causes such as conventional brake system components, REPAIR or INSTALL new components as necessary. **No** GO to B2.
B2: CHECK PARKING BRAKE CABLES	
	1 Loosen the parking brake cable tension. • Rotate the wheels by hand.
	Did the rear wheels rotate OK? **Yes** CHECK and INSTALL a new parking brake control as required. REFER to: Parking Brake Control (206-05 Parking Brake and Actuation, Removal and Installation). TEST the system for normal operation. **No** GO to B3.
B3: CHECK REAR PARKING BRAKE CABLES	
	1 Disconnect the parking brake rear cable from the vehicle and check for binding/sticking.
	Did the parking brake rear cable show signs of binding/sticking? **Yes** INSTALL a new rear parking brake cable. REFER to: Parking Brake Rear Cables (206-05 Parking Brake and Actuation, Removal and Installation). TEST the system for normal operation. **No** Check for parking brake component or rear brake caliper failures.

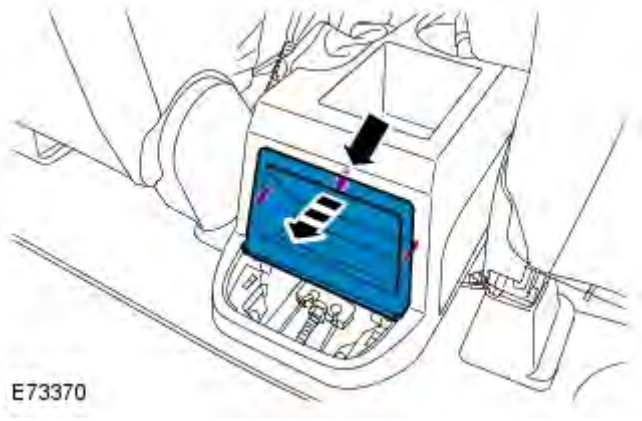
Parking Brake and Actuation - Parking Brake Cable Adjustment

General Procedures

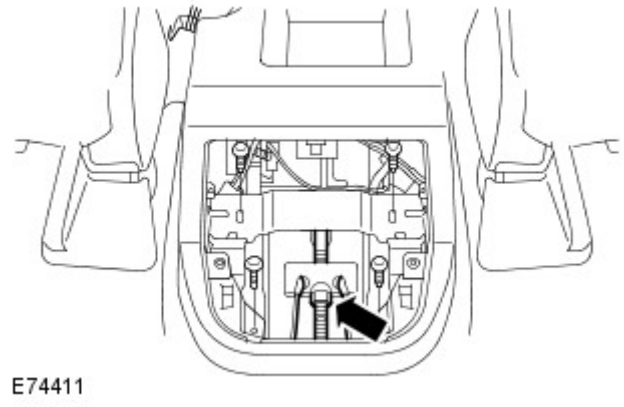
1. Apply the parking brake lever one click at a time and count the number of clicks required to apply the brakes firmly. The brakes should be firmly applied between 3 and 9 clicks.

2.

3.



4. With the parking brake lever fully lowered, release the parking brake cable adjustment.

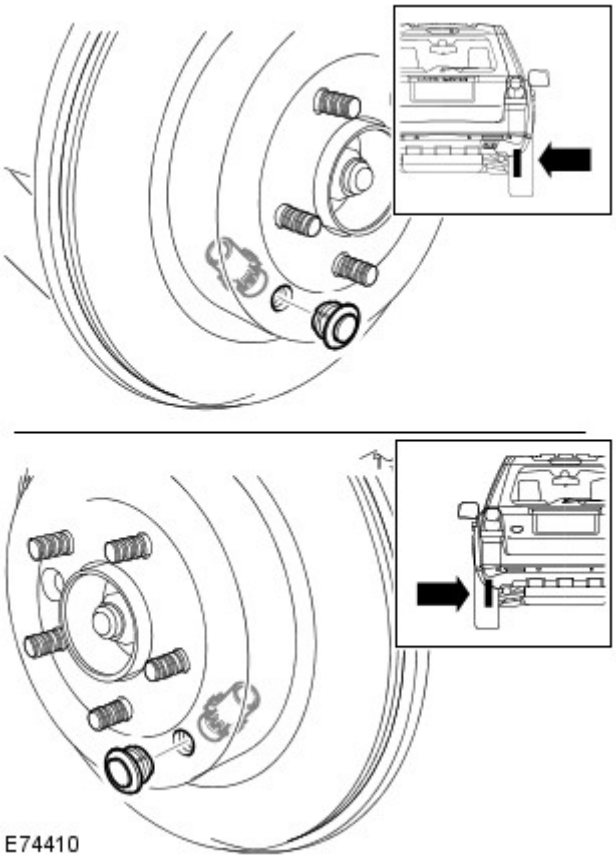


5. **5.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

6. Remove the rear wheels and tires

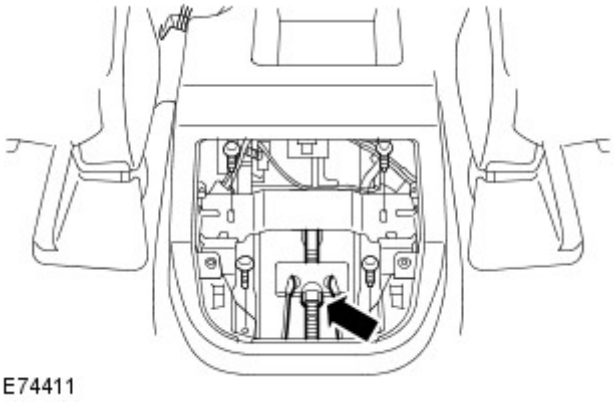
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



7. **7.** NOTE: Apply the parking brake control lever several times to centralize the brake shoes.

   Rotate the parking brake adjuster until the disc cannot be turned, then back the adjuster off 8 clicks.

8. Repeat the above procedure for the other side.



9. Adjust the parking brake front cable to give a parking brake lever travel of between 3 and 9 clicks, to firmly apply the brakes.

10. Install the coin tray and stowage compartment.

11. Install the rear wheels and tires.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

12. If necessary, carry out the parking brake shoe bedding-in procedure.

    Refer to: Parking Brake Shoes Bedding-In (206-05 Parking Brake and Actuation, General Procedures).

Published: 11-May-2011

Parking Brake and Actuation - Parking Brake Shoes Bedding-In

General Procedures

• NOTE: This procedure must be carried out if, new parking brake shoes are fitted, new rear brake discs are fitted or if the vehicle has been mud wading (not water) for more than 50 miles.

1. Carry out the parking brake shoe bedding-in procedure.

2. Adjust the parking brake.

   Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

3.
   - Carry out the parking brake shoe bedding-in procedure.
   - On a dynamometer: Apply the parking brake lever for approximately 40 seconds, a braking force reading of 800 Nm must be obtained.

4. **4.** WARNING: Where possible, all road tests should be on well surfaced and dry roads. Always comply with speed limits and local traffic regulations.

   - Carry out the parking brake shoe bedding-in procedure.
   - On a road test: At approximately 24 mph (40 km/h), apply the parking brake lever until a braking force can be felt. Apply the parking brake lever by one further notch and drive on for 400 metres (440 yards).

5. Re-adjust the parking brake.

Published: 11-May-2011

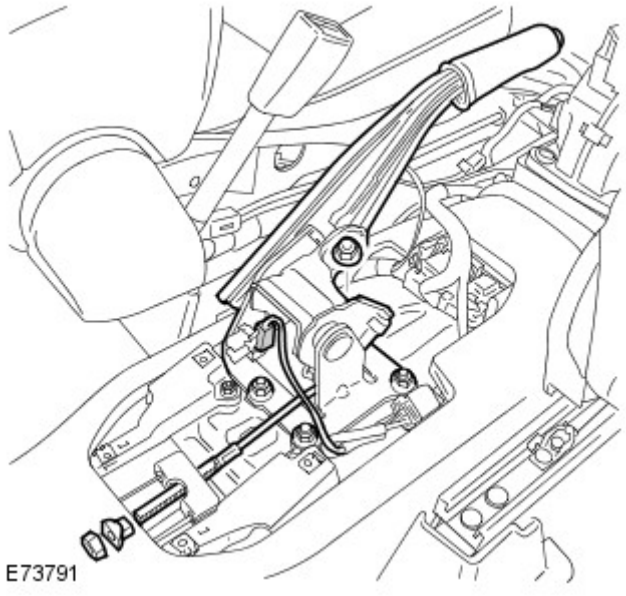
Parking Brake and Actuation - Parking Brake Control

Removal and Installation

Removal

1. Remove the floor console.

   Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).



2.
   - *Torque:* 25 Nm

Installation

1. To install, reverse the removal procedure.

2. Adjust the parking brake.

   Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

Published: 11-May-2011

Parking Brake and Actuation - Parking Brake Warning Indicator Switch

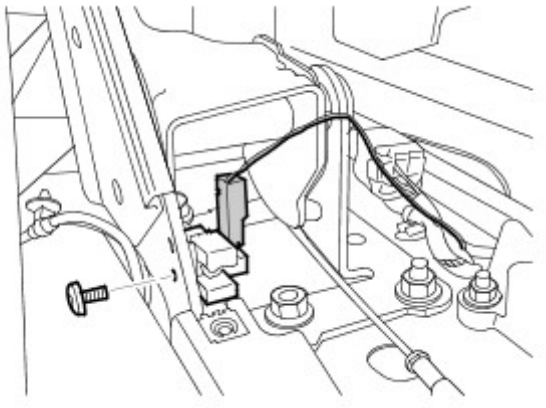
Removal and Installation

Removal

1. Remove the floor console.

   Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

2. Release the vehicle parking brake.



3. Remove the parking brake switch.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Parking Brake and Actuation - Parking Brake Front Cable

Removal and Installation

Removal

- NOTE: The parking brake front cable is part of the parking brake control.

1. Remove the parking brake control.

   Refer to: Parking Brake Control (206-05 Parking Brake and Actuation, Removal and Installation).

Installation

1. Install the parking brake control.

   Refer to: Parking Brake Control (206-05 Parking Brake and Actuation, Removal and Installation).

Published: 11-May-2011

Parking Brake and Actuation - Parking Brake Rear Cables

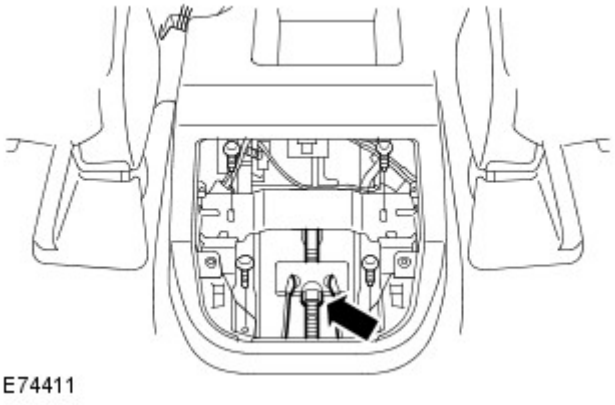
Removal and Installation

Removal

1. Remove the coin tray.

2. Remove the stowage compartment.

3. Remove the adjusting nut and disconnect the front parking brake cable.



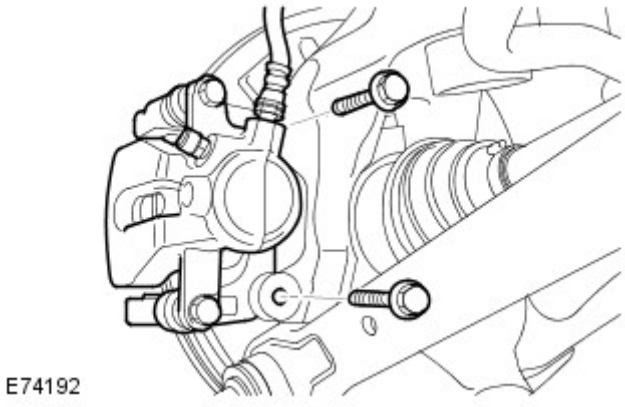
4. Release the rear parking brake cables and remove the compensator.

5. **5.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

6. Remove both rear wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).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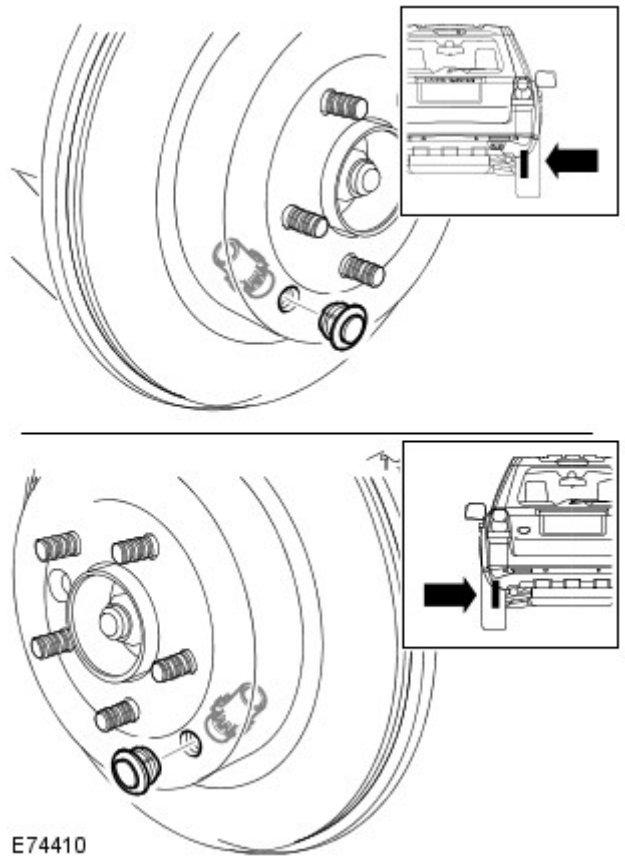
7. Tie the rear brake caliper aside.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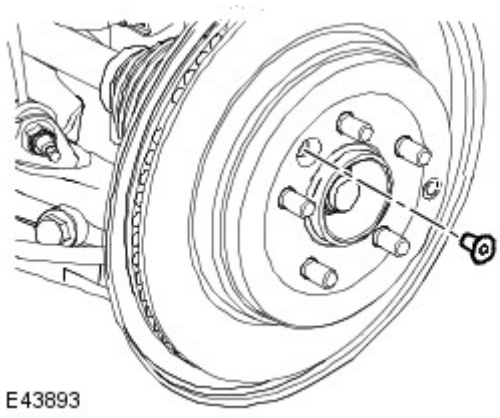
8. Back-off the parking brake adjuster.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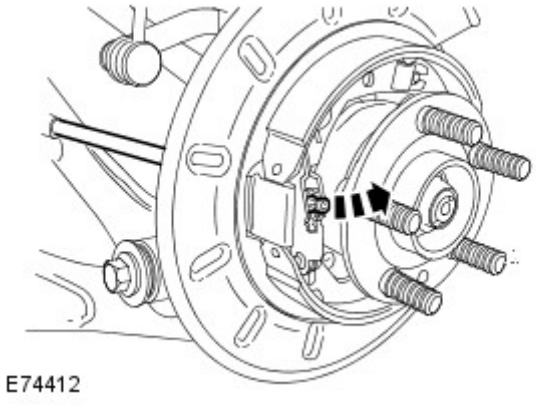
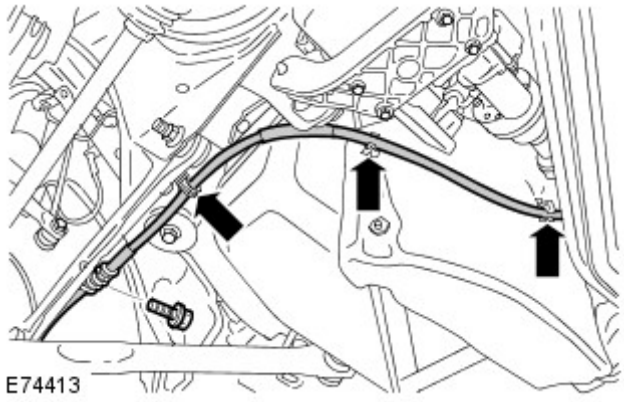
9. Remove the brake disc.


E74412

10. Release the cable support bracket, clip and cable-tie.

11. Release the parking brake cable from the body.


E74413

12. Disconnect and remove the cable.

13. Repeat the above procedure for the other side.

Installation

1. Install the parking brake cable to the hub and connect the nipple.
2. Install the parking brake cable to the body.
3. Connect the cable support bracket, clip and cable tie.
4.
   - Install the brake disc.
   - *Torque:* 35 Nm
5.
   - Install the brake caliper.
   - *Torque:* 110 Nm
6. Repeat the above procedure for the other side.
7. Install the compensator to the rear parking brake cables.
8. Connect the front parking brake cable and install the adjusting nut.
9. Adjust the parking brake.

   Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).
10. Install the coin tray and stowage compartment.
11. Install both wheels and tires.

Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Parking Brake and Actuation - Parking Brake Shoes

Removal and Installation

Removal

• NOTE: If the parking brake shoes or the brake discs have been removed for access to other components then DO NOT carry out the bedding in procedure.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the wheels and tires.

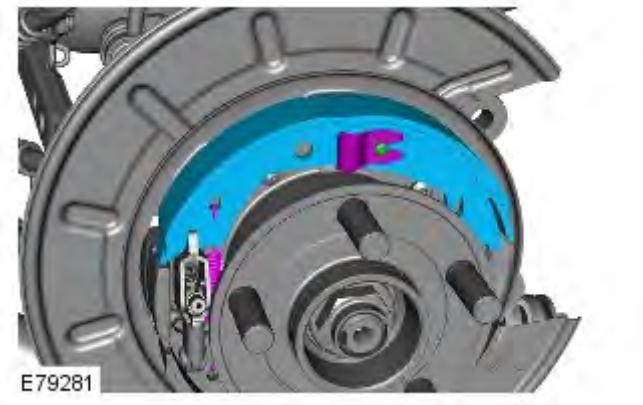
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove both rear brake discs.

   Refer to: Brake Disc (206-04 Rear Disc Brake, Removal and Installation).

4.

5.



6.

7.

8. Repeat the above procedure for the other side.

Installation

1. **1.** WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

   Clean the backing plate and apply grease to the brake shoe contacts.

2. Clean the adjuster and set it to its minimum extension.

3. **3.** CAUTION: Make sure the brake shoe spring is not over stretched.

   - Install the secondary brake shoe.
   - Connect the parking brake cable.
   - Connect the parking brake cable retaining spring to the brake shoe lever, making sure the spring is not twisted.
   - Install the hold-down spring and retaining pin.

4. **4.** WARNING: Make sure the return spring and the adjuster spring are correctly installed to the primary shoe.

   CAUTION: Make sure the brake shoe spring is not over stretched.

   - Install the primary brake shoe.
   - Install the spreader plate and the spring.
   - Install the return spring.
   - Install the hold-down spring and retaining pin.

5. **5.** CAUTION: Make sure the brake shoe spring is not over stretched.

   Install the brake shoe adjuster.

6. Repeat the above procedure for the other side.

7. Install both rear brake discs.

   Refer to: Brake Disc (206-04 Rear Disc Brake, Removal and Installation).

8. Install the wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

9. If necessary, carry out the parking brake shoe bedding-in procedure.

   Refer to: Parking Brake Shoes Bedding-In (206-05 Parking Brake and Actuation, General Procedures).

Published: 11-May-2011

Hydraulic Brake Actuation -

General Specification

Item	Specification
Master cylinder bore diameter:	
Primary	27 mm
Secondary	27 mm
Stroke	36 mm

Torque Specifications

Description	Nm	lb-ft
Brake booster to brake pedal bracket nuts	22	16
Brake master cylinder nuts	26	19
Brake pedal bracket nuts	25	18
Brake pipe unions	15	11
Fluid reservoir to master cylinder	6	4

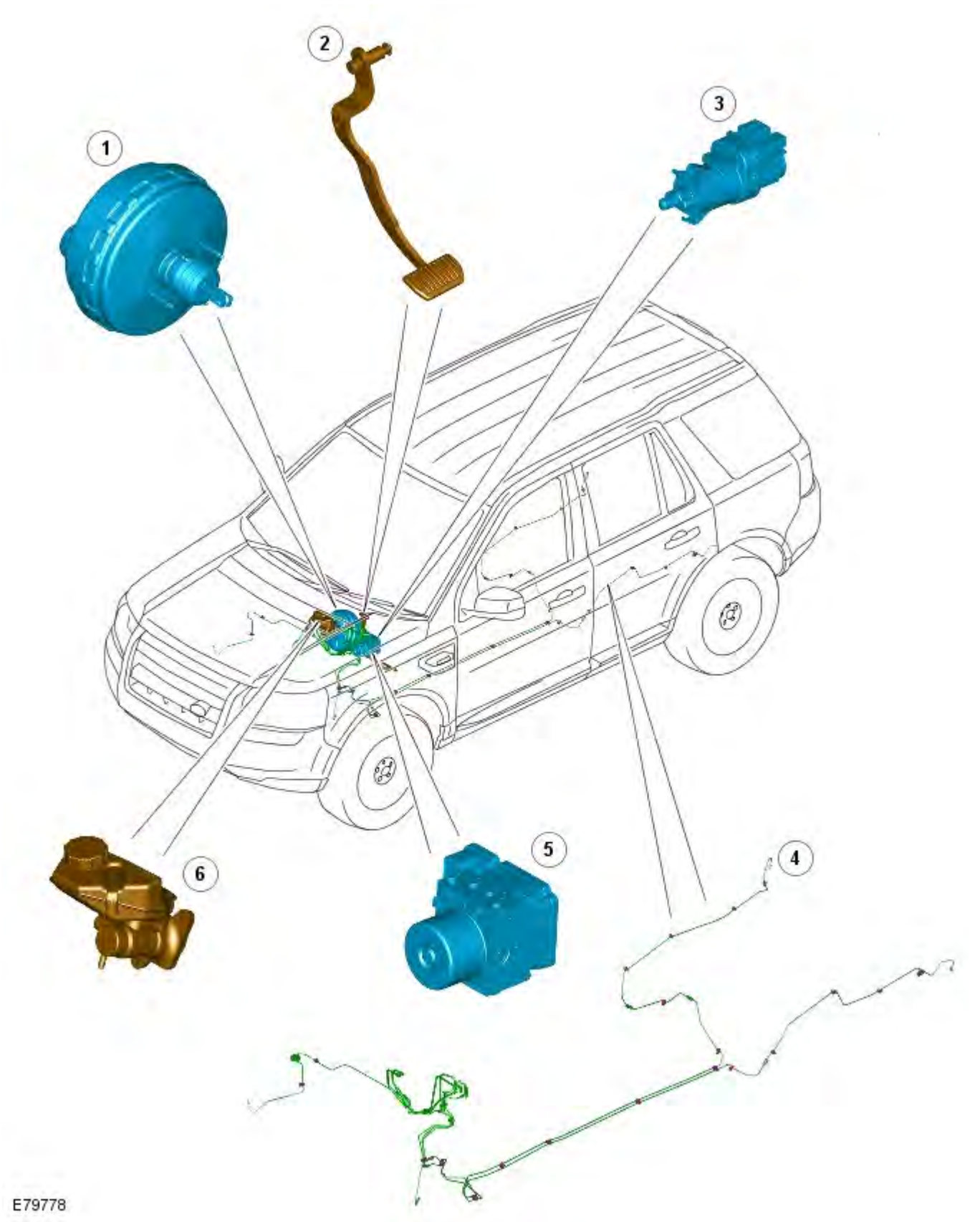
Published: 11-May-2011

Hydraulic Brake Actuation - Hydraulic Brake Actuation

Description and Operation

COMPONENT LOCATION

- NOTE: Left-Hand Drive (LHD) shown; Right-Hand Drive (RHD) similar.



Item	Part Number	Description
1	-	Brake booster
2	-	Brake pedal

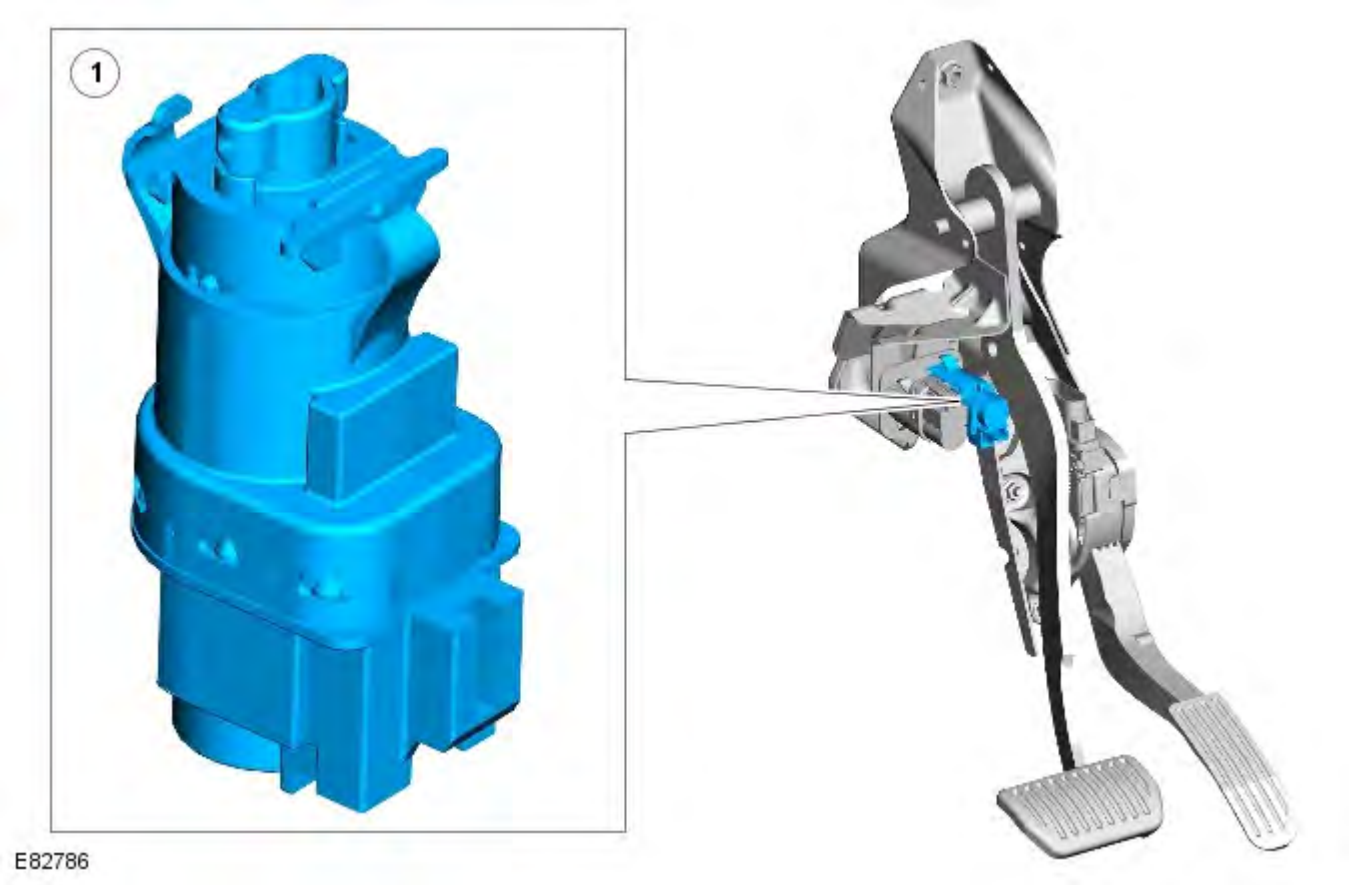
3	-	Stoplamp switch
4	-	Hydraulic pipes
5	-	Integrated Hydraulic Control Unit (HCU) and Anti-lock Brake System (ABS) module
6	-	Brake master cylinder and fluid reservoir

OVERVIEW

The hydraulic brake system is a diagonally split dual circuit system and consists of the brake pedal, brake master cylinder, HCU and the hydraulic pipes and hoses. The system also features a non-active brake booster.
For additional information, refer to: Brake Booster (206-07 Power Brake Actuation, Description and Operation).

The preformed rigid brake pipes distribute pressure from the master cylinder to the 4 brake calipers, via the integrated HCU and ABS module. Flexible hoses connect the rigid brake pipes to the front and rear calipers.

BRAKE PEDAL



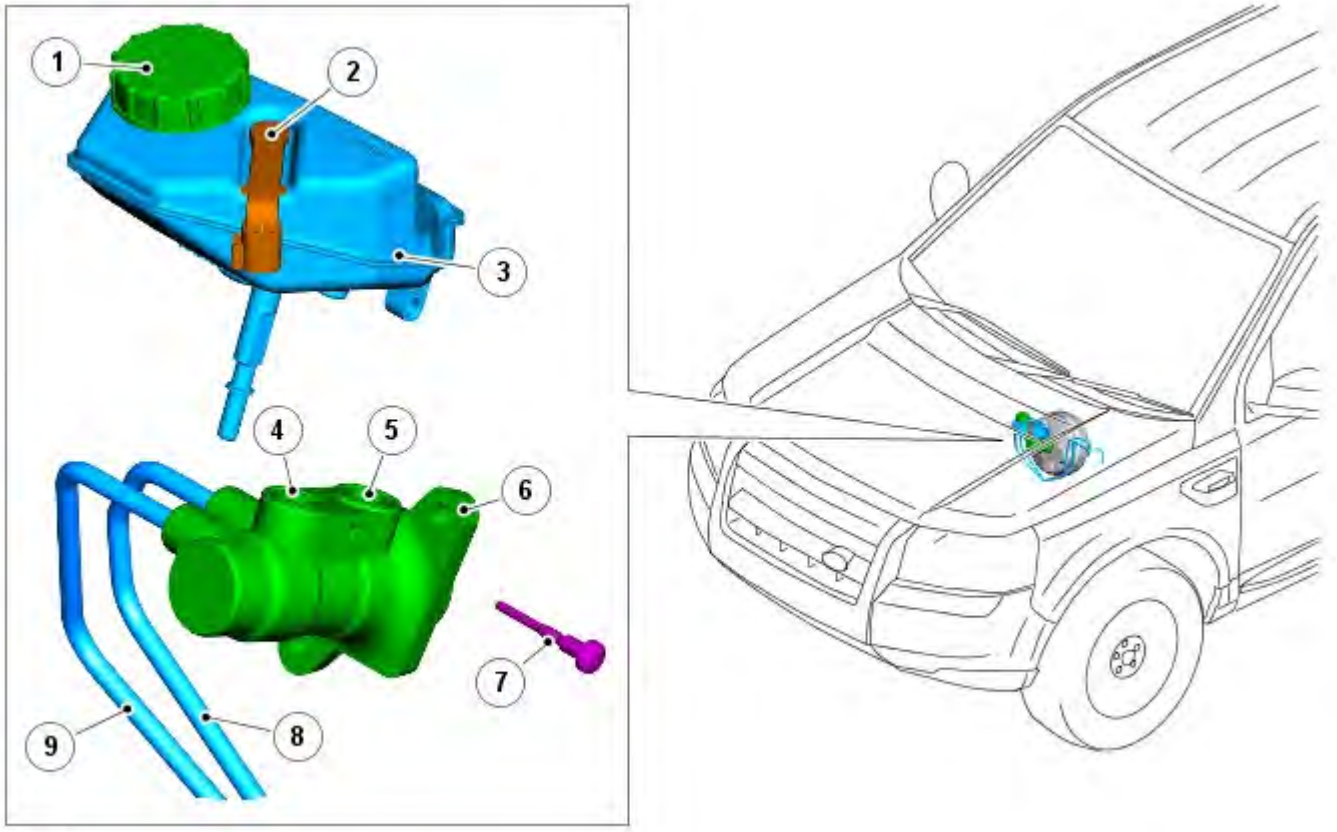
Item	Part Number	Description
1	-	Stoplamp switch

The brake pedal is mounted in a bracket that is attached to the rear side of the engine bulkhead. The pedal assembly is different for LHD and RHD vehicles, and is connected to the brake booster push rod with a clevis pin.

The stoplamp switch is mounted on the brake pedal bracket and will illuminate the vehicle stoplamps when the brake pedal is pressed. The stoplamp switch is also used as an input to the speed control system, and will cancel the current speed setting when the brake pedal is pressed. For additional information, refer to:

Speed Control - 3.2L (310-03 Speed Control - 3.2L, Description and Operation),
Speed Control - 2.2L Diesel (310-03 Speed Control - 2.2L Diesel, Description and Operation).

BRAKE MASTER CYLINDER AND FLUID RESERVOIR



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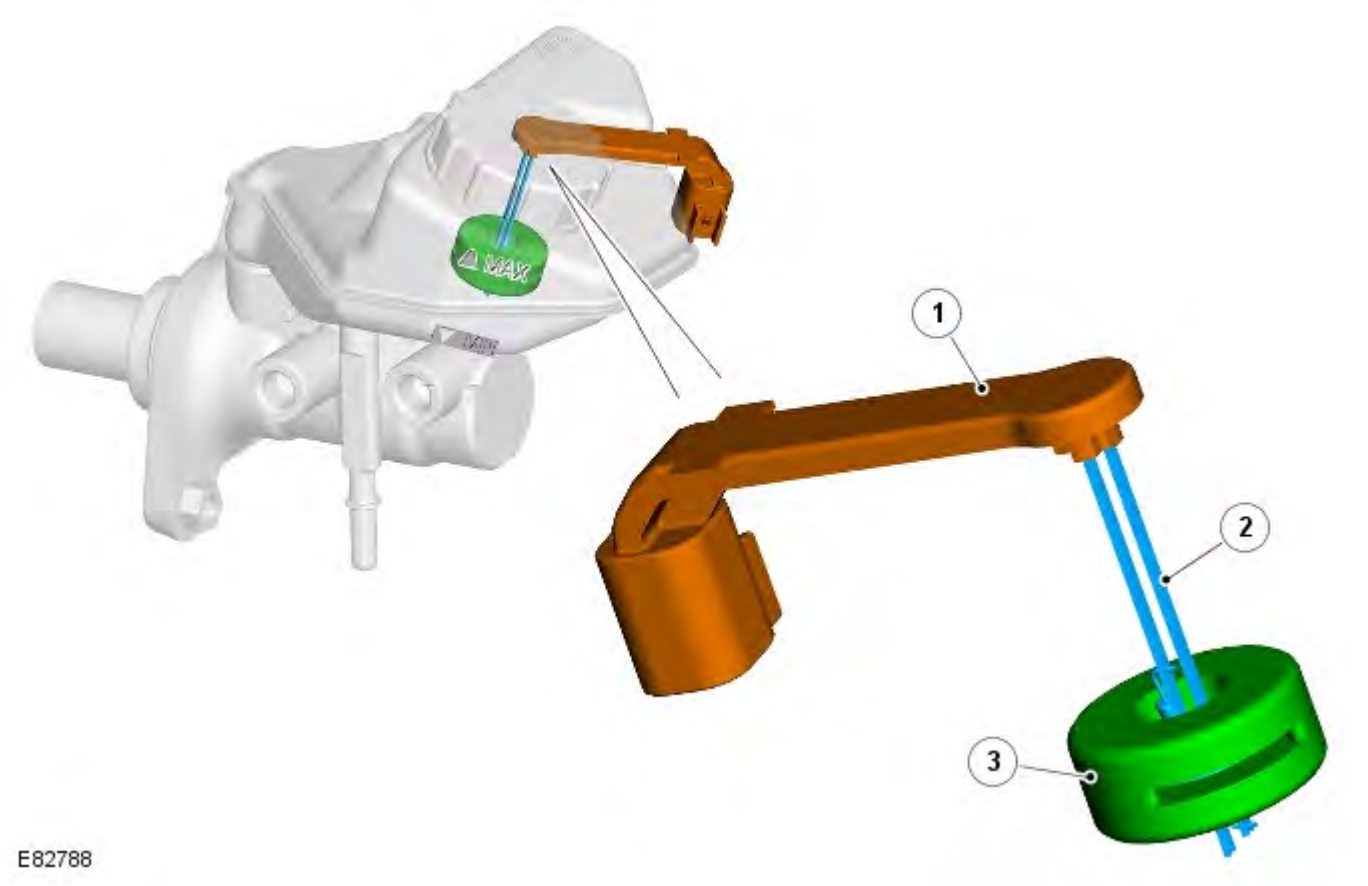
Item	Part Number	Description
1	-	Brake fluid reservoir cap
2	-	Brake fluid level switch
3	-	Brake fluid reservoir
4	-	Secondary circuit inlet port
5	-	Primary circuit inlet port
6	-	Brake master cylinder
7	-	Screw
8	-	Primary circuit outlet port
9	-	Secondary circuit outlet port

The brake master cylinder is attached to the front of the brake booster, on the driver's side of the engine compartment. The brake master cylinder is a tandem design that supplies pressure to 2 independent (primary and secondary) hydraulic circuits. Each circuit is connected between the calipers of diagonally opposing front and rear wheels to provide a fail safe brake system.

A reservoir is mounted on top of the master cylinder and retains sufficient volume of hydraulic fluid to allow for normal system use, and to compensate for the replenishment of the system as the brake linings wear. The reservoir is internally divided to provide an independent supply of fluid to each brake circuit, and prevents a single fluid leak from disabling both primary and secondary brake circuits. If a failure occurs in one brake hydraulic circuit the remaining circuit will still operate effectively, although brake pedal travel and vehicle braking distances will increase.

On vehicles with manual transmission, the brake fluid reservoir also supplies hydraulic fluid for operation of the clutch assembly.

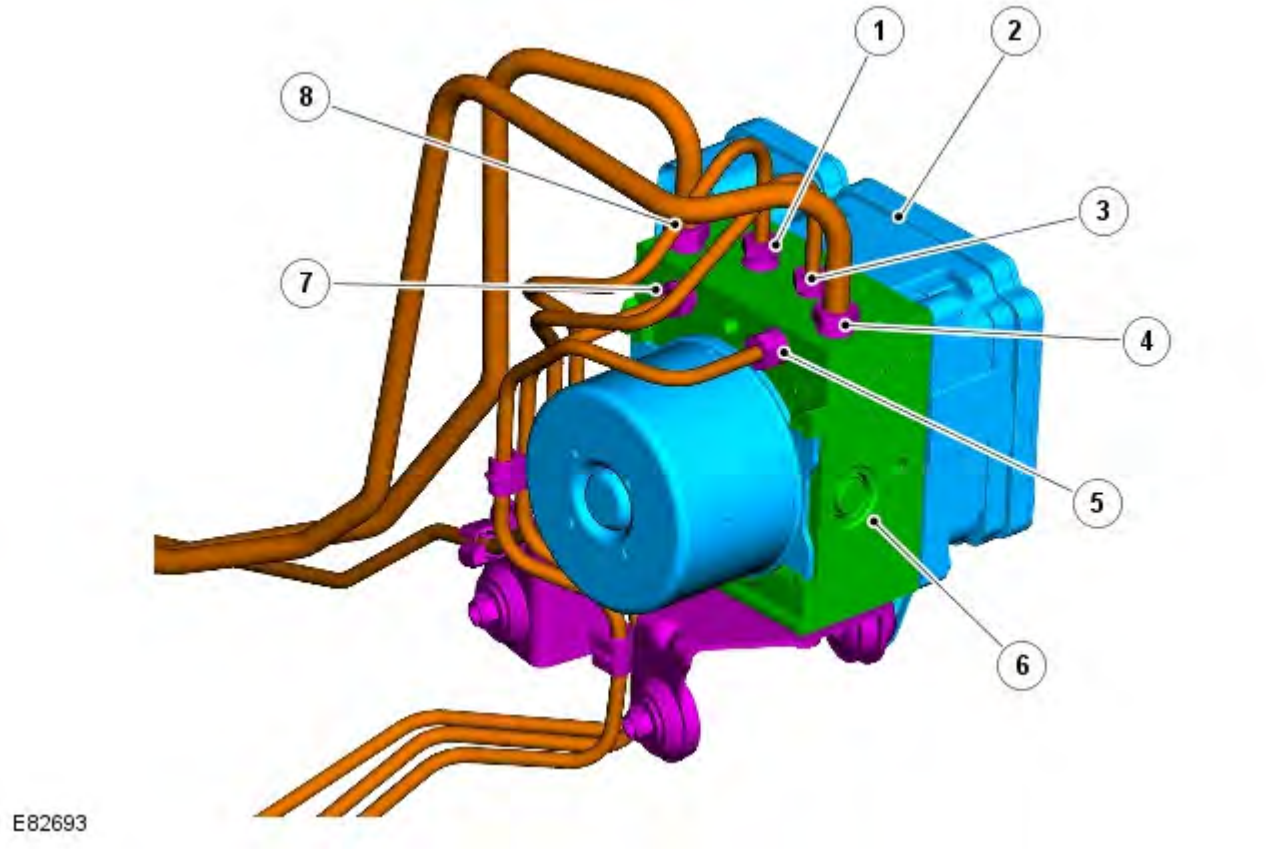
Brake Fluid Level Switch



Item	Part Number	Description
1	-	Contact carrier
2	-	Contact
3	-	Float

The reservoir incorporates a brake fluid level switch that is hardwired to the Central Junction Box (CJB). When the reservoir fluid falls to a predetermined low level, the switch contacts close and provide a signal feed back to the CJB. The CJB then broadcasts a message on the medium speed Controller Area Network (CAN) bus to the instrument cluster that in turn illuminates the brake fluid warning indicator lamp.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

HYDRAULIC CONTROL UNIT



Item	Part Number	Description
1	-	Brake pipe to LH front caliper
2	-	ABS module
3	-	Brake pipe to RH front caliper
4	-	Master cylinder primary circuit connection
5	-	Brake pipe to LH rear caliper
6	-	HCU
7	-	Brake pipe to RH rear caliper
8	-	Master cylinder secondary circuit connection

The HCU is located on the rear LH side of the engine compartment and is an integral component with the ABS module. The HCU is a 4 channel unit that modulates the supply of hydraulic pressure to the brakes under the control of the ABS module.

The primary and secondary outlet ports of the master cylinder are connected via 8 mm (0.315 in) diameter brake pipes to the primary and secondary circuits of the HCU. The primary circuit in the HCU provides 2 separate outlet ports to the RH front and LH rear brakes. The secondary circuit in the HCU provides 2 separate outlet ports to the LH front and RH rear brakes.

The HCU incorporates 3 brake operating modes as follows:

- Normal braking/ Electronic Brake Force Distribution (EBD)
- ABS braking
- Active braking.

As the HCU and ABS module is a fully integrated unit, the description and operation details for the HCU and ABS functionality, including the 3 braking modes, are detailed in the Anti-Lock Control - Stability Assist section of the manual. For additional information, refer to: Anti-Lock Control - Stability Assist (206-09 Anti-Lock Control - Stability Assist, Description and Operation).

Servicing Information

The ABS module and HCU form a single component and must not be separated. The ABS module and HCU assembly is supplied in a pre-filled state. After installation, the hydraulic brake system only requires a conventional bleed of the system; there is no requirement to pressure bleed the system.

• NOTE: The ABS module and HCU is a fragile component and must be discarded if dropped or damaged.

PRINCIPLES OF OPERATION

As the brake pedal is pressed, the front push rod in the brake booster pushes the master cylinder primary piston along the bore of the housing. This produces pressure in the primary pressure chamber and in conjunction with the primary spring, overcomes the secondary spring and simultaneously moves the secondary piston along the bore.

The initial movement of the pistons away from the piston stops closes the primary and secondary center valves located inside the master cylinder. Further movement of the pistons then pressurizes the fluid in the primary and secondary chambers and the brake circuits. The fluid in the chambers behind the pistons is unaffected by the movement of the

pistons and will flow unrestricted through the inlet ports, between the chambers and the reservoir.

Pressurized fluid enters the HCU that is mounted on the front of the ABS module. The HCU then modulates the supply of pressurized fluid to the brakes under control of the ABS module.
For additional information, refer to: Anti-Lock Control - Stability Assist (206-09 Anti-Lock Control - Stability Assist, Description and Operation).

Published: 11-May-2011

Hydraulic Brake Actuation - Hydraulic Brake Actuation

Diagnosis and Testing

For additional information.
REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Hydraulic Brake Actuation - Brake Pedal and Bracket

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

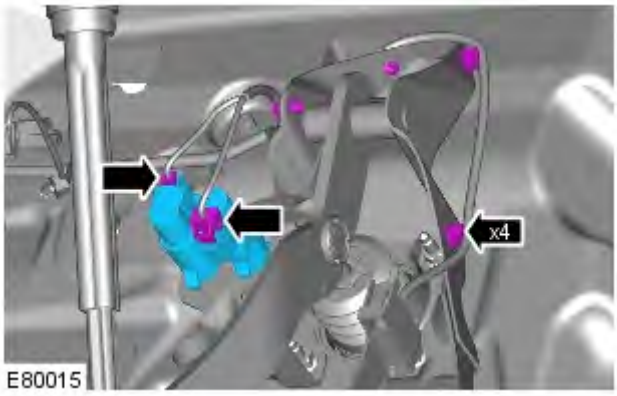
   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20, General Procedures).

2. Remove the driver lower air bag module.

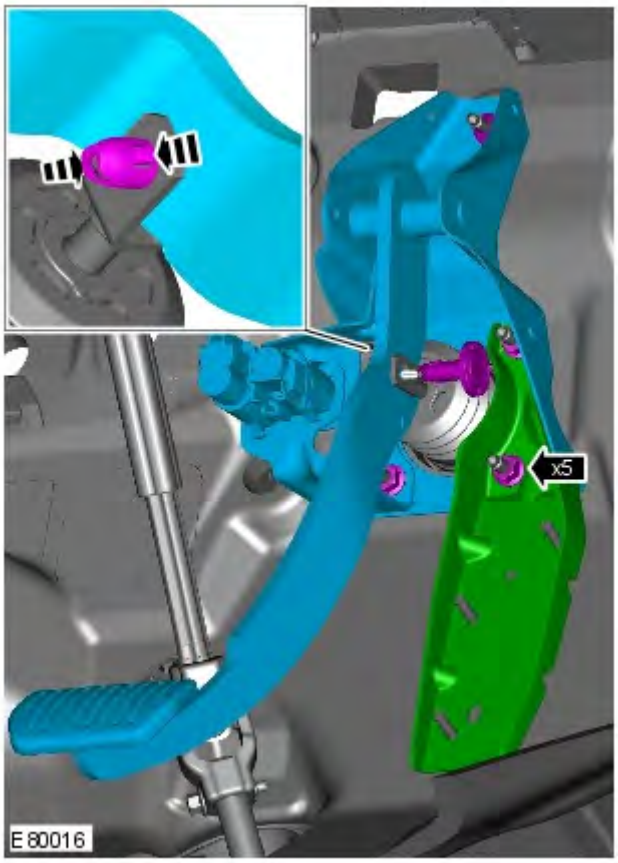
   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

3. Remove the throttle pedal assembly.

   Refer to: Speed Control Actuator (310-03B Speed Control - TD4 2.2L Diesel, Removal and Installation).



4.



5. Remove the brake pedal assembly.

   Torque: 25 Nm

6. **6.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the stoplamp switch.

7. Remove the speed control deactivation switch.

Installation

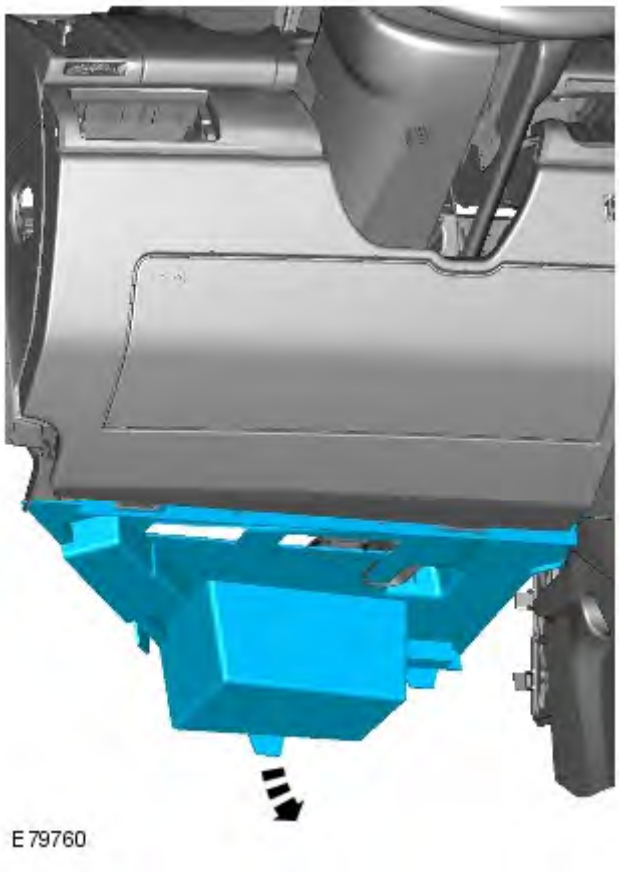
1. To install, reverse the removal procedure.

Published: 11-May-2011

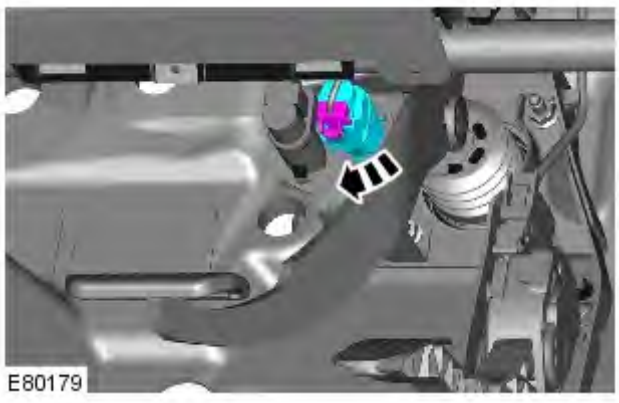
Hydraulic Brake Actuation - Brake Pedal Control Switch

Removal and Installation

Removal



1. Remove the closing panel.



2. Remove the stoplamp switch.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Hydraulic Brake Actuation - Brake Master Cylinder

Removal and Installation

Removal

• CAUTIONS:

Extreme cleanliness must be exercised when handling these components.

If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

• NOTE: Removal steps in this procedure may contain installation details.

All vehicles

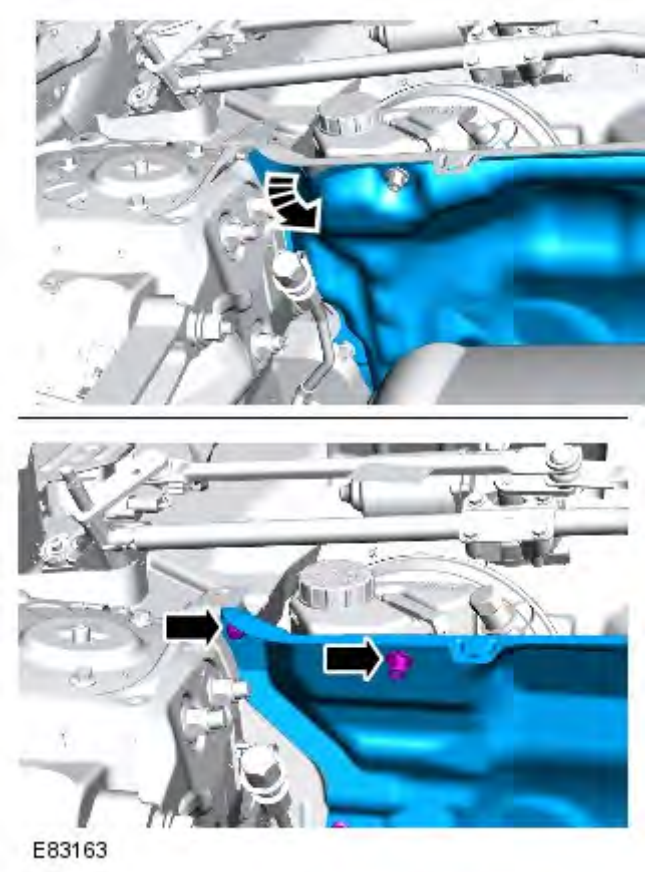
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the brake fluid reservoir.

   Refer to: Brake Fluid Reservoir (206-06 Hydraulic Brake Actuation, Removal and Installation).

Right-hand drive vehicles



3. **3.** NOTE: Torque applies to bolt only.

   Torque: 10 Nm

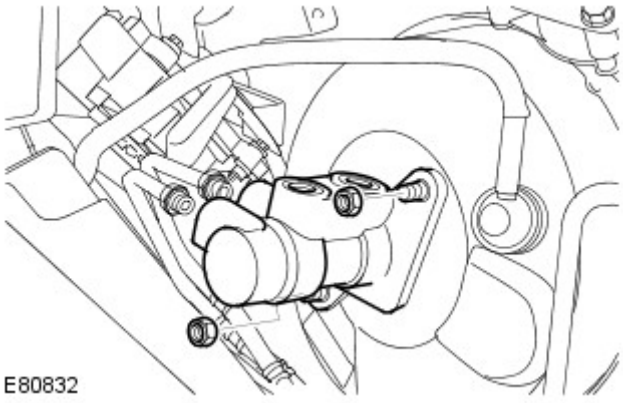
All vehicles

4. **4.** CAUTIONS:

   Be prepared to collect escaping fluids.

   Make sure that all openings are sealed.

   Torque: 15 Nm



5. **5.** CAUTIONS:

   Be prepared to collect escaping fluids.

   The seal is to be reused unless damaged.

   Torque: 26 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Hydraulic Brake Actuation - Brake Fluid Reservoir

Removal and Installation

Removal

• CAUTIONS:

Extreme cleanliness must be exercised when handling these components.

If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

• NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

Left-hand drive vehicles

2. Remove the battery.

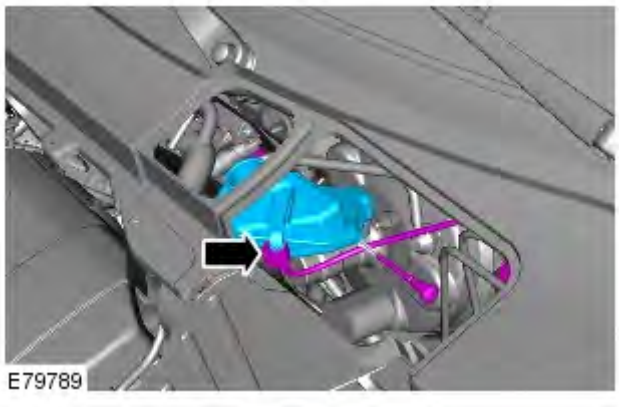
   Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

Right-hand drive vehicles

3. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

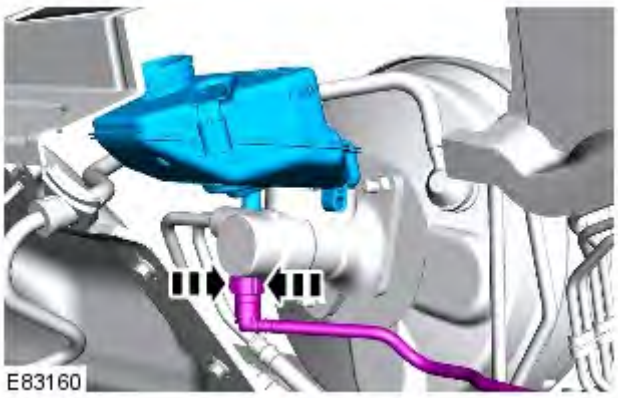
All vehicles



4. **4.** CAUTION: Be prepared to collect escaping fluids.

   Torque: 6 Nm

Vehicles with manual transmission

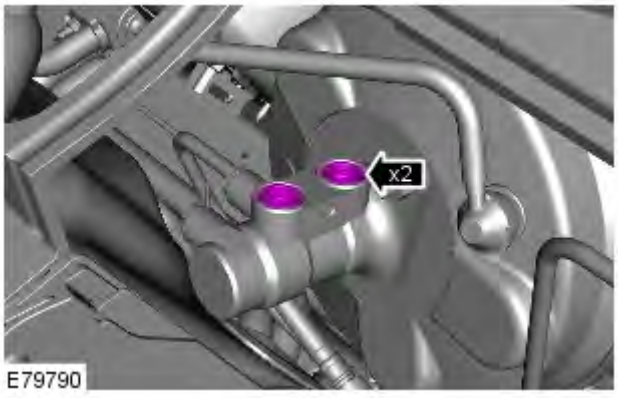


5. **5.** CAUTIONS:

   Be prepared to collect escaping fluids.

   Make sure that all openings are sealed.

All vehicles



6. **6.** CAUTION: Make sure that all openings are sealed.

Installation

All vehicles

1. To install, reverse the removal procedure.

2. Bleed the brake system.

   Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).

Vehicles with manual transmission

3. Bleed the clutch system.

   Refer to: Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

Published: 11-May-2011

Power Brake Actuation -

General Specification

Item	Specification
Brake booster type	Twin chamber 203.20 mm and 228.60 mm (8.00 in and 9.00 in)
Boost ratio	8:1
Brake vacuum pump make	Bosch

Torque Specifications

Description	Nm	lb-ft
Brake booster to brake pedal bracket nuts	22	16
Brake master cylinder nuts	26	19
Brake vacuum pump bolts:		
3.2L Petrol	17	13
2.2L Diesel	9	7

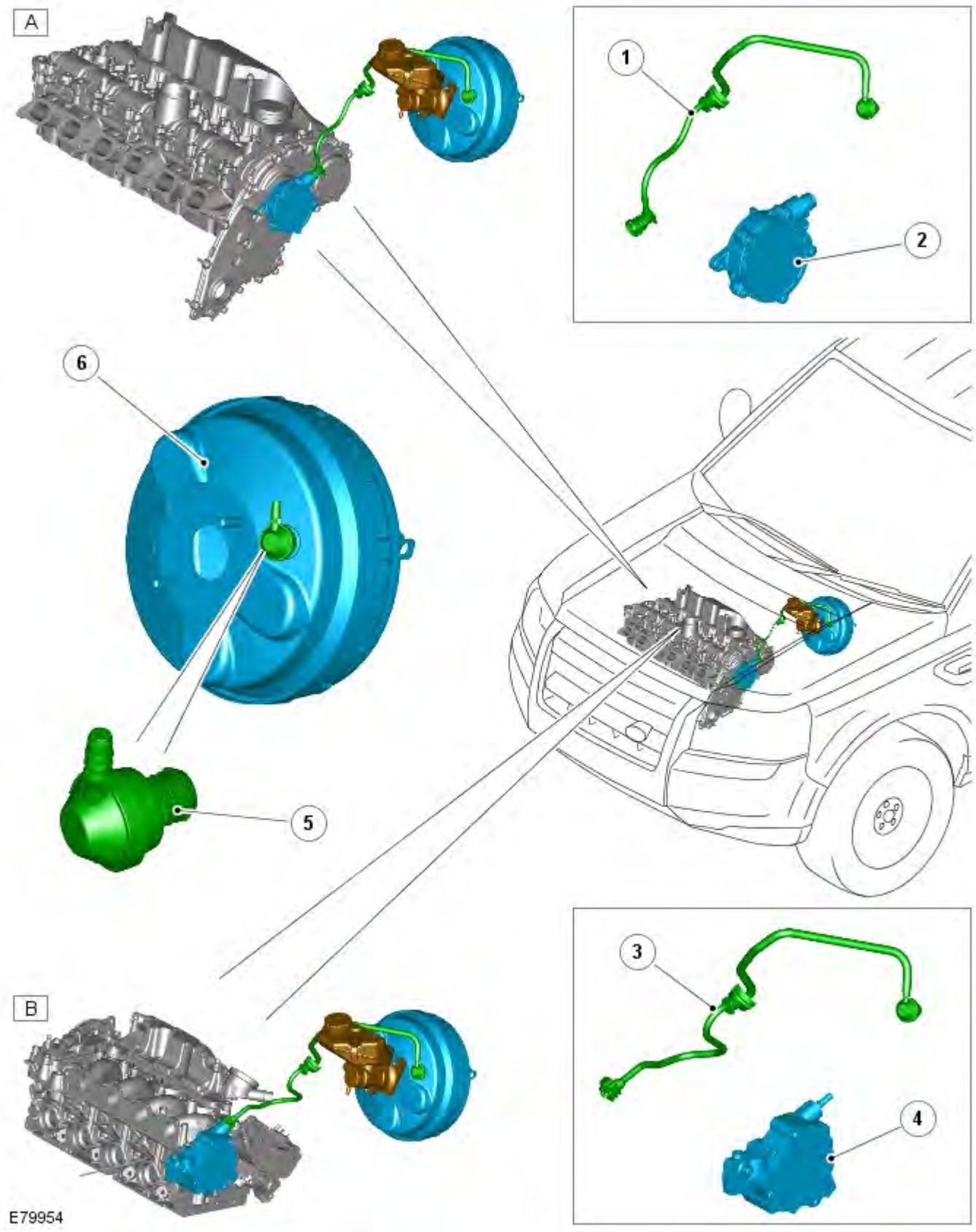
Published: 11-May-2011

Power Brake Actuation - Brake Booster

Description and Operation

COMPONENT LOCATION

- NOTE: Left-Hand Drive (LHD) shown; Right-Hand Drive (RHD) similar.



Item	Part Number	Description
A	-	Power brake component location - i6 engine
B	-	Power brake component location - TD4 engine

1	-	Vacuum pipe - i6 engine
2	-	Vacuum pump - i6 engine
3	-	Vacuum pipe - TD4 engine (up to 2010 MY)
4	-	Vacuum pump - TD4 engine
5	-	Check valve
6	-	Brake booster

OVERVIEW

Power assistance for the braking system is provided by a vacuum operated, non-active brake booster.

The brake booster is a compact unit that occupies less space than a conventional brake booster, improving the vehicles crash performance characteristics. The unit is installed with tandem diaphragms that are 203.20 mm (8.00 in) and 228.60 mm (9.00 in) in diameter and operate as a single unit.

The unit is located on the driver's side of the engine compartment, and is sealed to the bulkhead with a gasket and secured with 4 studs and locking nuts. The brake booster actuating push rod is attached to the brake pedal with a clevis pin. The booster output rod locates in the primary piston of the brake master cylinder.
For additional information, refer to: Hydraulic Brake Actuation (206-06 Hydraulic Brake Actuation, Description and Operation).

VACUUM COMPONENTS

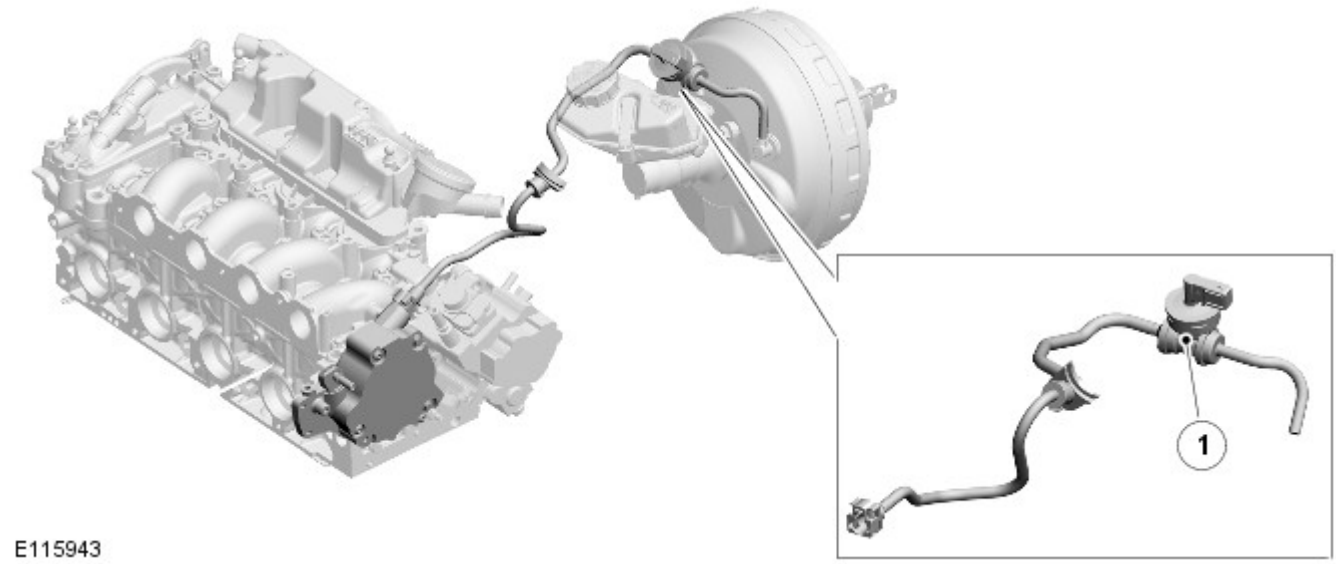
For both the i6 gasoline and TD4 diesel engines, the vacuum required for brake booster operation is created by a vacuum pump mounted at the rear of the cylinder head. The vacuum pump is driven by the intake camshaft.

A rigid plastic pipe connects the vacuum pump to a check valve installed on the front chamber of the brake booster. The pipe length and routing is different for LHD and RHD models.

The check valve maintains the vacuum necessary for brake booster operation and prevents air from entering the front chamber.

Stop/Start Vehicles - From 2010 MY

Stop/Start Vehicle Components



Item	Part Number	Description
1	-	Brake vacuum sensor

Brake vacuum sensor

A brake vacuum sensor is introduced on Stop/Start vehicles to monitor vacuum reserves in the brake servo. The vacuum sensor is mounted in the vacuum pipe and hardwired to the ECM.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

Published: 11-May-2011

Power Brake Actuation - Power Brake System

Diagnosis and Testing

For additional information.
REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Power Brake Actuation - Brake Booster

Removal and Installation

Removal

- CAUTIONS:

Extreme cleanliness must be exercised when handling these components.

If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

All vehicles

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the windshield wiper motor and linkage.

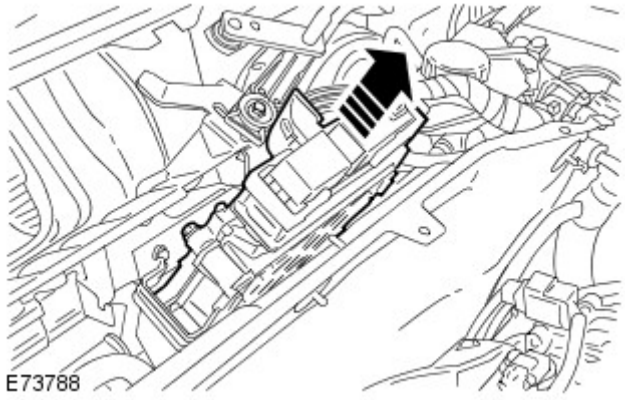
   Refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

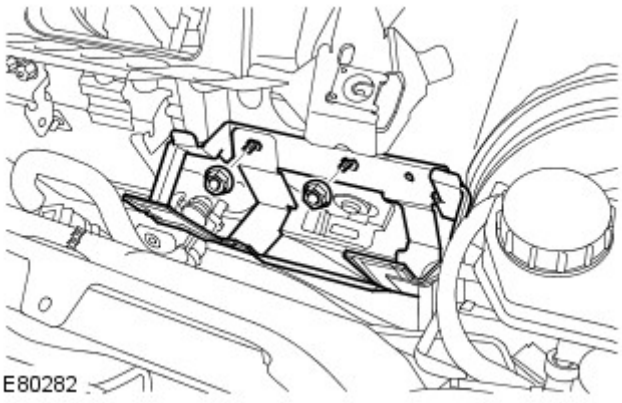
4. Remove the driver lower air bag module.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

Left-hand drive vehicles

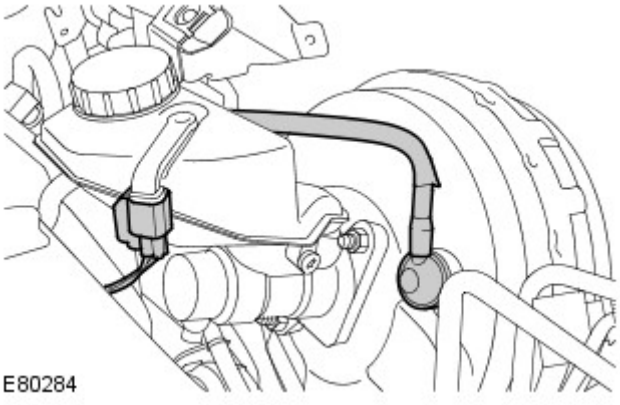
5.





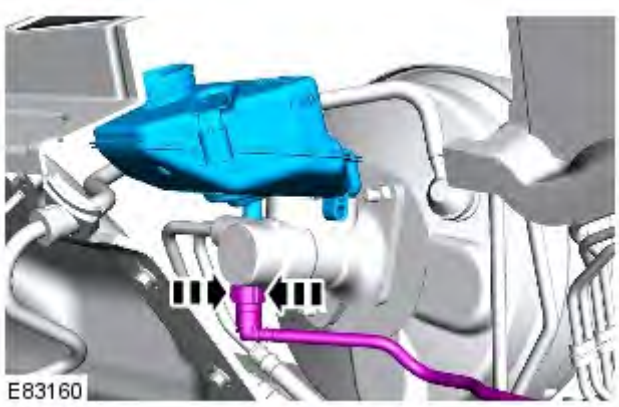
6.

All vehicles



7. **7.** CAUTION: Make sure that all openings are sealed.

Vehicles with manual transmission

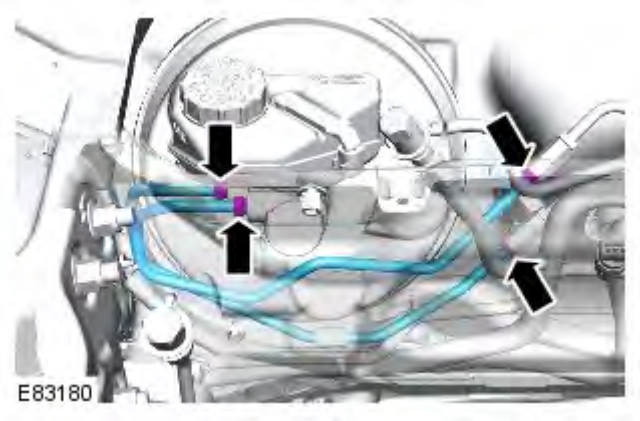


8. **8.** CAUTIONS:

Be prepared to collect escaping fluids.

Make sure that all openings are sealed.

Right-hand drive vehicles

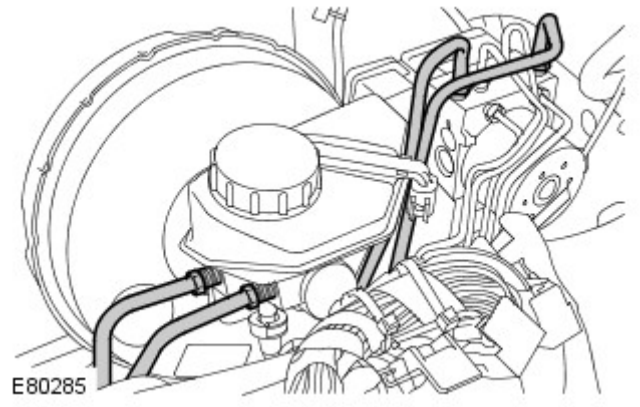


9. **9.** CAUTIONS:

   Be prepared to collect escaping fluids.

   Make sure that all openings are sealed.

Left-hand drive vehicles

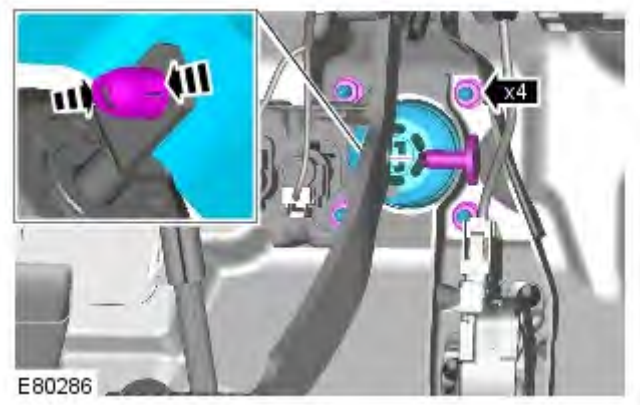


10. **10.** CAUTIONS:

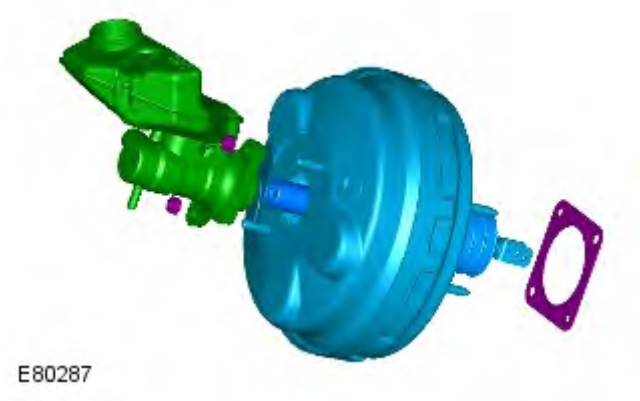
    Be prepared to collect escaping fluids.

    Make sure that all openings are sealed.

All vehicles



11. **11.** CAUTION: The seal is to be reused unless damaged.



12. **12.** CAUTION: The seal is to be reused unless damaged.

Installation

All vehicles

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Install the brake master cylinder.

   Torque: 26 Nm

2. **2.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Install the brake booster.

   Torque: 22 Nm

3. **3.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Install the brake fluid tubes.

   Torque: 15 Nm

Vehicles with manual transmission

4. **4.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Connect the clutch fluid line.

All vehicles

5. Connect the brake booster vacuum line.

6. Connect the low brake fluid warning indicator switch electrical connector.

Left-hand drive vehicles

7. Install the ECM bracket.

   Torque: 10 Nm

8. Install the ECM.

All vehicles

9. Install the driver lower air bag module.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

10. Install the windshield wiper motor and linkage.

    Refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

11. Connect the battery ground cable.

Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

12. Bleed the brake system.

    Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).

Vehicles with manual transmission

13. Bleed the clutch system.

    Refer to: Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

Published: 11-May-2011

Power Brake Actuation - Brake Vacuum PumpI6 3.2L Petrol

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

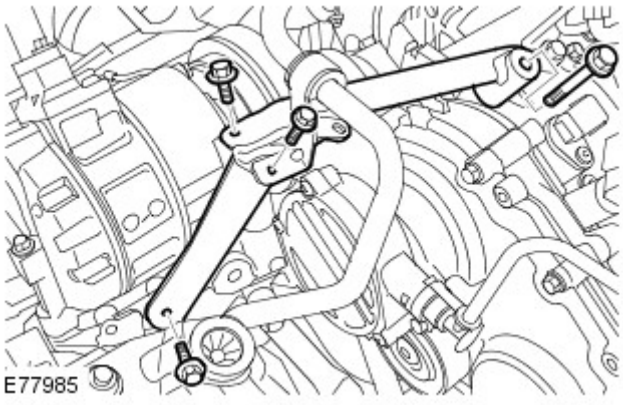
   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

4. Remove the air cleaner assembly.

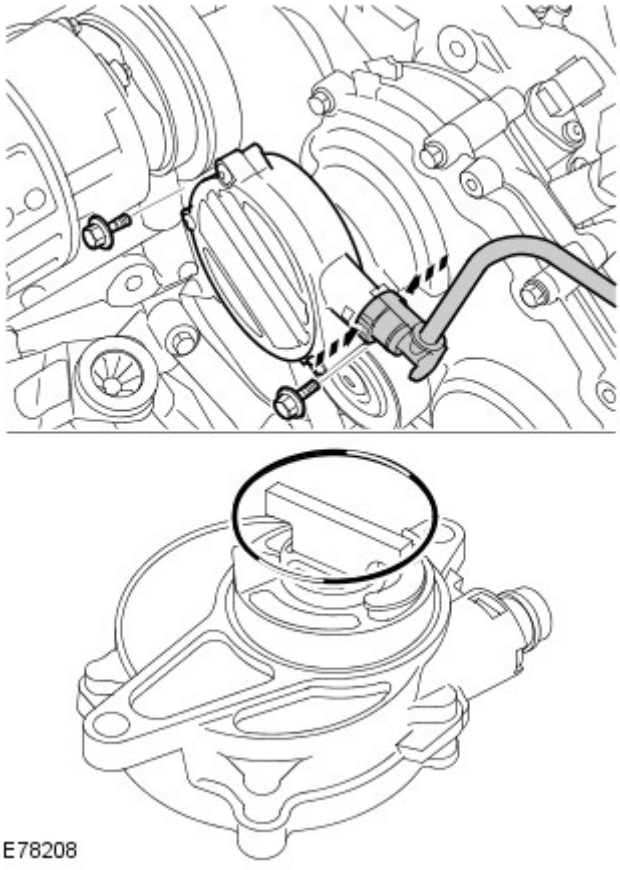
   Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).



5. Remove the A/C compressor, upper support bracket.

   Torque:
   M10 45 Nm
   M8 25 Nm
   M6 10 Nm

6. Disconnect the brake booster vacuum line from the brake vacuum pump.



7. **7.** NOTE: Make sure that this component is installed to the noted removal position.

   Remove the brake vacuum pump.

   Torque: 17 Nm

Installation

1. **1.** NOTE: Make sure that the component is clean, free of foreign material and lubricant.

   To install, reverse the removal procedure.

Published: 11-May-2011

Power Brake Actuation - Brake Vacuum PumpTD4 2.2L Diesel

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

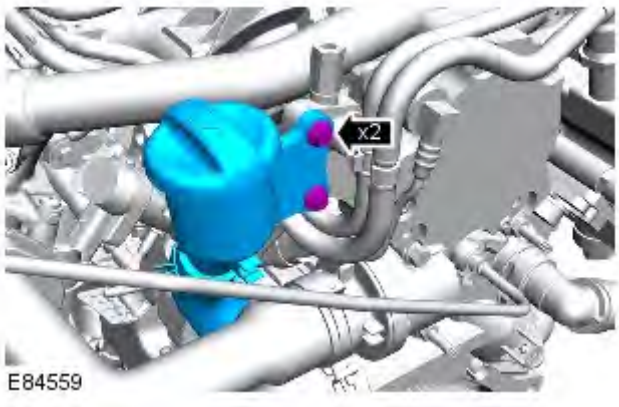
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

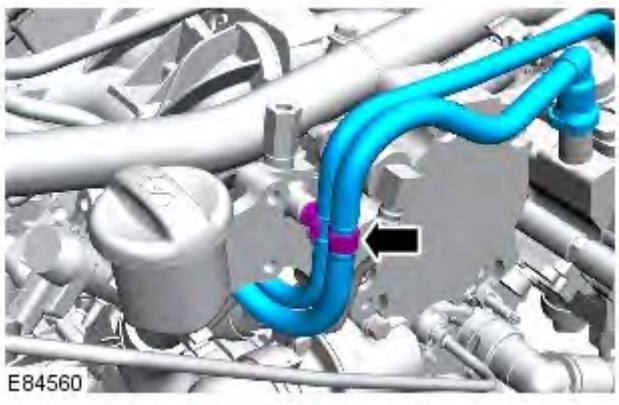
   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).



4. *Torque:* 9 Nm



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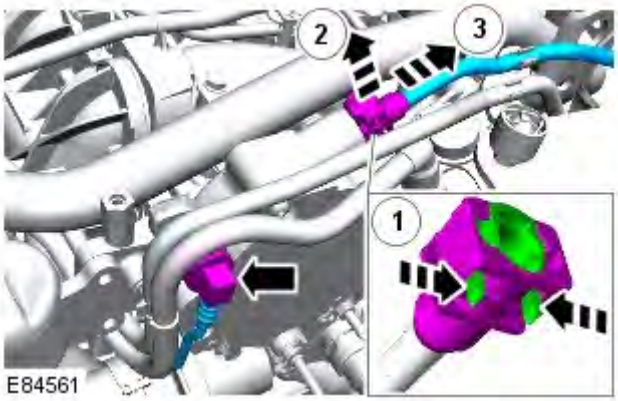
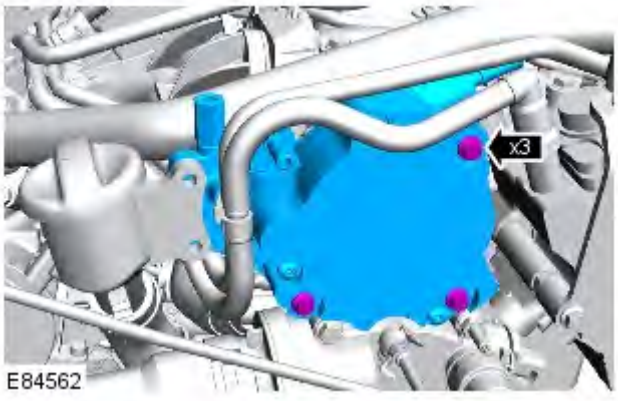
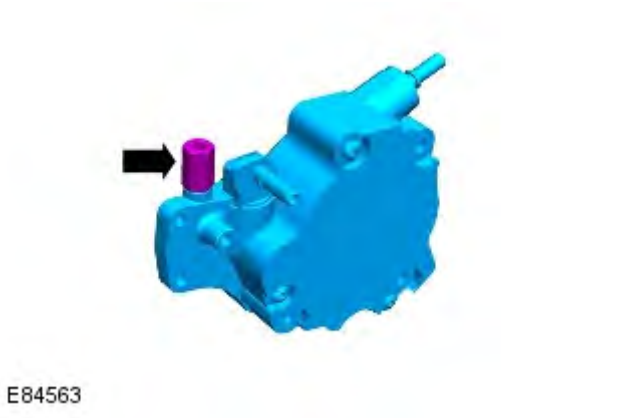


6. **6.** CAUTION: Make sure that all openings are sealed.



7. **7.** CAUTION: The seals are to be reused unless damaged.

   Torque: 9 Nm



8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

   Torque: 9 Nm

Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   To install, reverse the removal procedure.

Published: 11-May-2011

Anti-Lock Control -

General Specification

Item	Specification
System make / type	Continental Teves - MK23E1
Wheel speed sensors:	
Make	Continental Teves
Yaw rate sensor:	
Make / type	Continental Teves - RSC03
Location	Center console in front of gear shift

Torque Specifications

Description	Nm	lb-ft
ABS module to mounting bracket nuts	10	7
Accelerometer bolts	6	5
Brake fluid tube unions	15	11
Front road wheel speed sensor to wheel knuckle bolt	5	4
Rear road wheel speed sensor to wheel knuckle bolt	5	4

Published: 11-May-2011

Anti-Lock Control - Anti-Lock Control

Description and Operation

OVERVIEW

The anti-lock control section is incorporated within the anti-lock control - stability assist section of the workshop manual. For additional information, refer to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).

Published: 11-May-2011

Anti-Lock Control - Anti-Lock Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the Anti-lock Braking System (ABS), refer to the relevant Description and Operation section in the workshop manual. REFER to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• NOTE: Prior to any testing or inspection, the vehicle should be check for any relevant warning lamps being illuminated. If a warning lamp is illuminated, check for DTCs and refer to the relevant DTC Index, if no warning lamp is illuminated, continue with diagnostic procedures below.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

Visual Inspection

Mechanical	Electrical
○ Brake fluid level ○ Vacuum system ○ Wheel speed sensor installation ○ Wheel speed sensor air gap ○ Steering wheel rotation sensor ○ Accelerometer/sensor cluster installation ○ Incorrect wheel or tire size	○ Warning light operation ○ Fuses ○ Wheel speed sensors ○ Connectors/Pins ○ Harnesses ○ Steering wheel rotation sensor ○ Accelerometer/sensor cluster ○ Hydraulic Control Unit (HCU)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, check the anti-lock braking system and steering rotation sensor modules for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Anti-Lock Braking System (ABS) (100-00 General Information, Description and Operation).

Pinpoint Tests

PINPOINT TEST A : BRAKE VACUUM ASSIST FUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE BRAKE PEDAL TRAVEL WITH THE ENGINE OFF	
	1 Set ignition switch to OFF.
	2 Pump the brake pedal six times and hold firm pressure on the pedal.
	Did the pedal travel decrease and the pedal go hard as it was pumped? **Yes** GO to A2. **No** CHECK the vacuum circuit to the brake booster. Start the engine and idle for three minutes, switch ignition OFF then repeat the test. If the pedal travel does not decrease, suspect the brake booster.
A2: CHECK THE BRAKE PEDAL TRAVEL WITH THE ENGINE RUNNING	

	1 With firm pressure still held on the brake pedal, start the engine.
	Did the pedal travel increase as the engine started? **Yes** The vacuum function of the brake booster is operating normally. Check for DTCs indicating a fault elsewhere in the system. **No** CHECK the vacuum circuit to the brake booster.

Published: 11-May-2011

Anti-Lock Control - Anti-Lock Brake System (ABS) Module

Removal and Installation

Removal

- CAUTIONS:

Extreme cleanliness must be exercised when handling these components.

If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

All vehicles

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

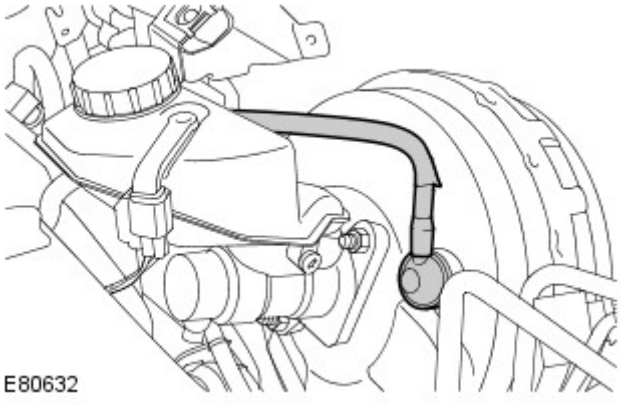
Right-hand drive vehicles

4. Remove the plenum chamber panel.

Left-hand drive vehicles

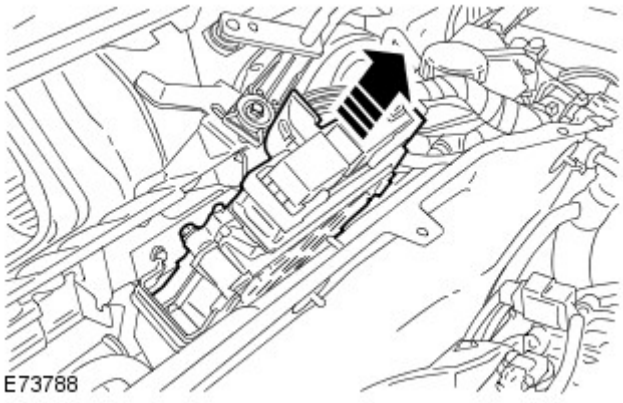
5. Remove the windshield wiper motor and linkage.

   Refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).



6. **6.** CAUTION: Make sure that all openings are sealed.

All vehicles



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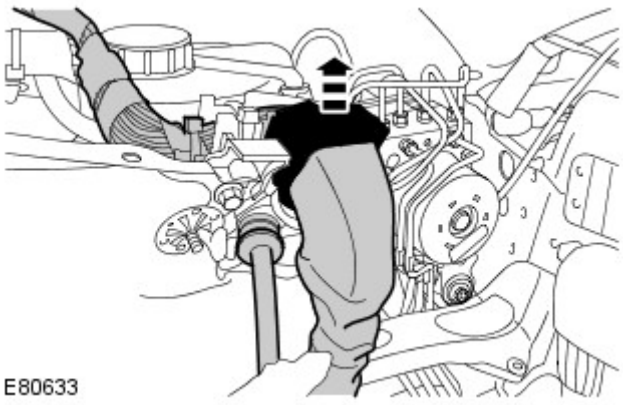

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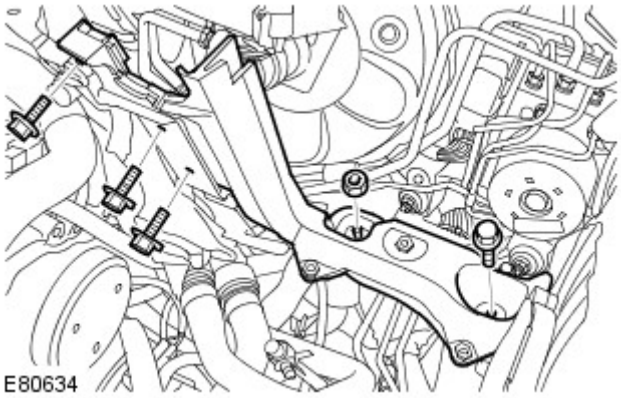
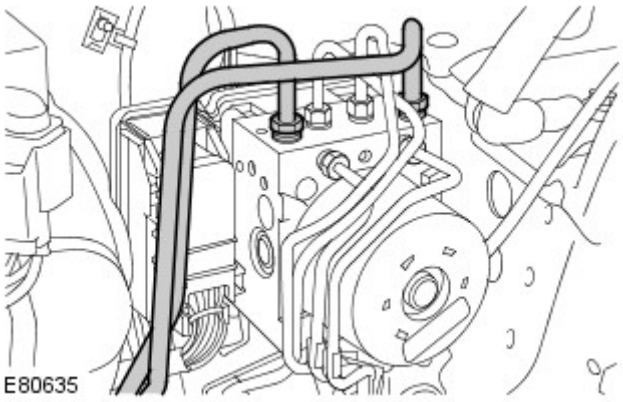


9.

Left-hand drive vehicles

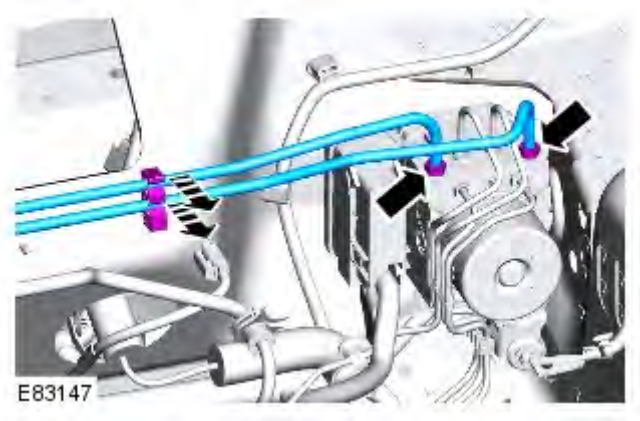


10. **10.** CAUTIONS:

⚠ Be prepared to collect escaping fluids.

⚠ Make sure that all openings are sealed.

Right-hand drive vehicles

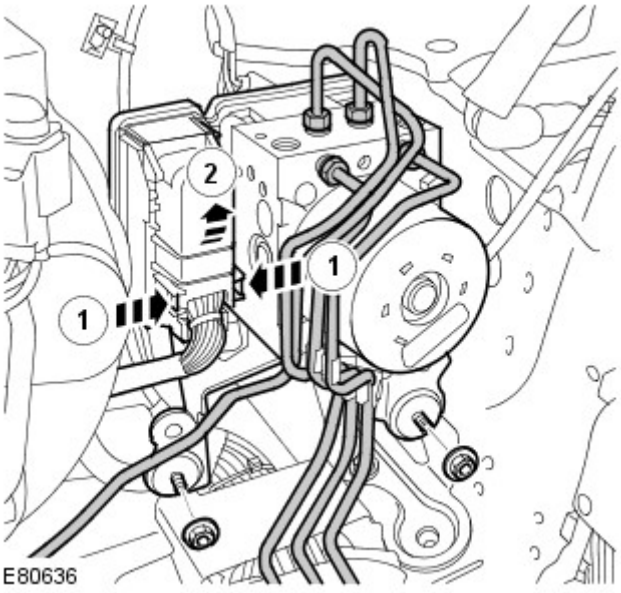


11. **11.** CAUTIONS:

⚠ Be prepared to collect escaping fluids.

⚠ Make sure that all openings are sealed.

All vehicles



12. **12.** CAUTIONS:

⚠ Be prepared to collect escaping fluids.

⚠ Make sure that all openings are sealed.

Installation

All vehicles

1. Install the ABS module.

   Torque: 10 Nm

2. Install the brake fluid tubes.

   Torque: 15 Nm

3. Install the battery tray support.

   Torque:
   M6 10 Nm
   M8 25 Nm

Left-hand drive vehicles

4. Connect the brake booster vacuum line.

All vehicles

5. Install the ECM.
6. Reclaim the vacuum line and harness.

Left-hand drive vehicles

7. Install the windshield wiper motor and linkage.

   Refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

Right-hand drive vehicles

8. Install the plenum chamber panel.

All vehicles

9. Install the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

10. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

11. Bleed the brake system.

    Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).

12. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Anti-Lock Control - Front Wheel Speed Sensor

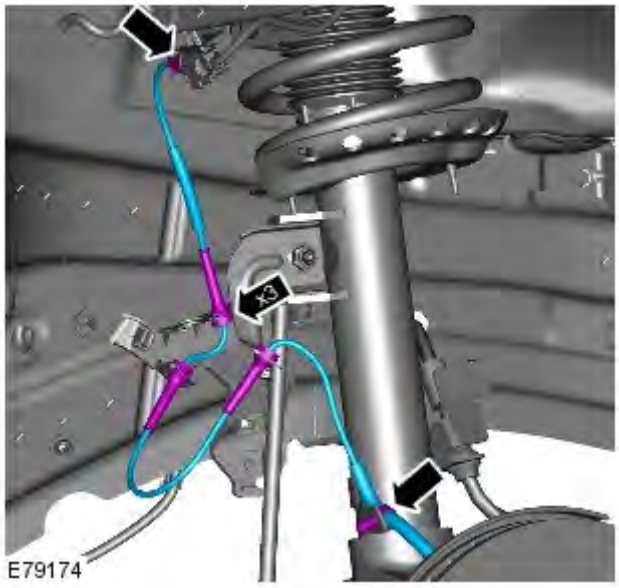
Removal and Installation

Removal

1. Raise and support the vehicle.
2. Remove the front wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
3. Release the fender splash shield.

   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
4.



5. *Torque:* 5 Nm

Installation

1. To install, reverse the removal procedure.
2. If a new component is to be installed, configure using IDS.

Published: 11-May-2011

Anti-Lock Control - Rear Wheel Speed Sensor

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

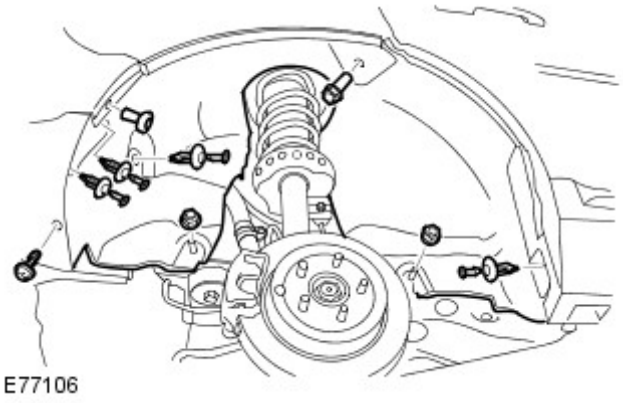
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the rear wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3.



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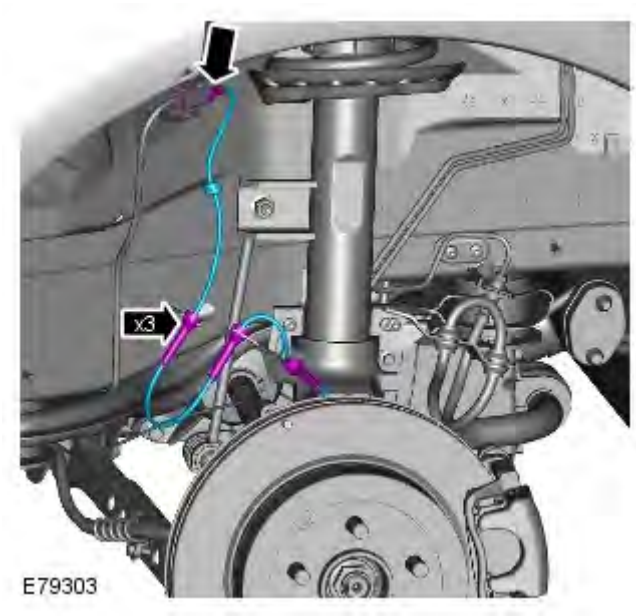
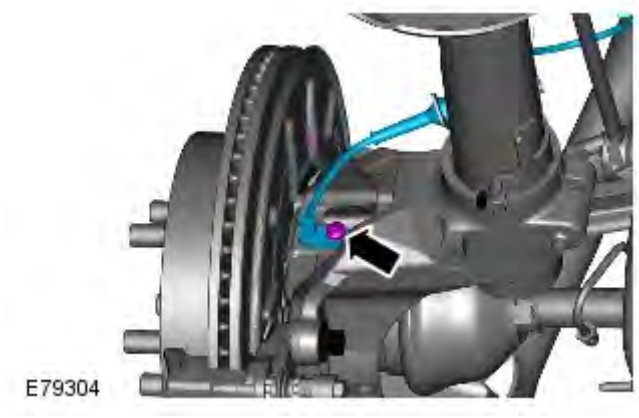




5. *Torque:* 5 Nm

Installation

1. To install, reverse the removal procedure.

2. If a new component is to be installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Anti-Lock Control - Traction Control - Anti-Lock Control - Traction Control

Description and Operation

OVERVIEW

The anti-lock control - traction control section is incorporated within the anti-lock control - stability assist section of the workshop manual.
For additional information, refer to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).

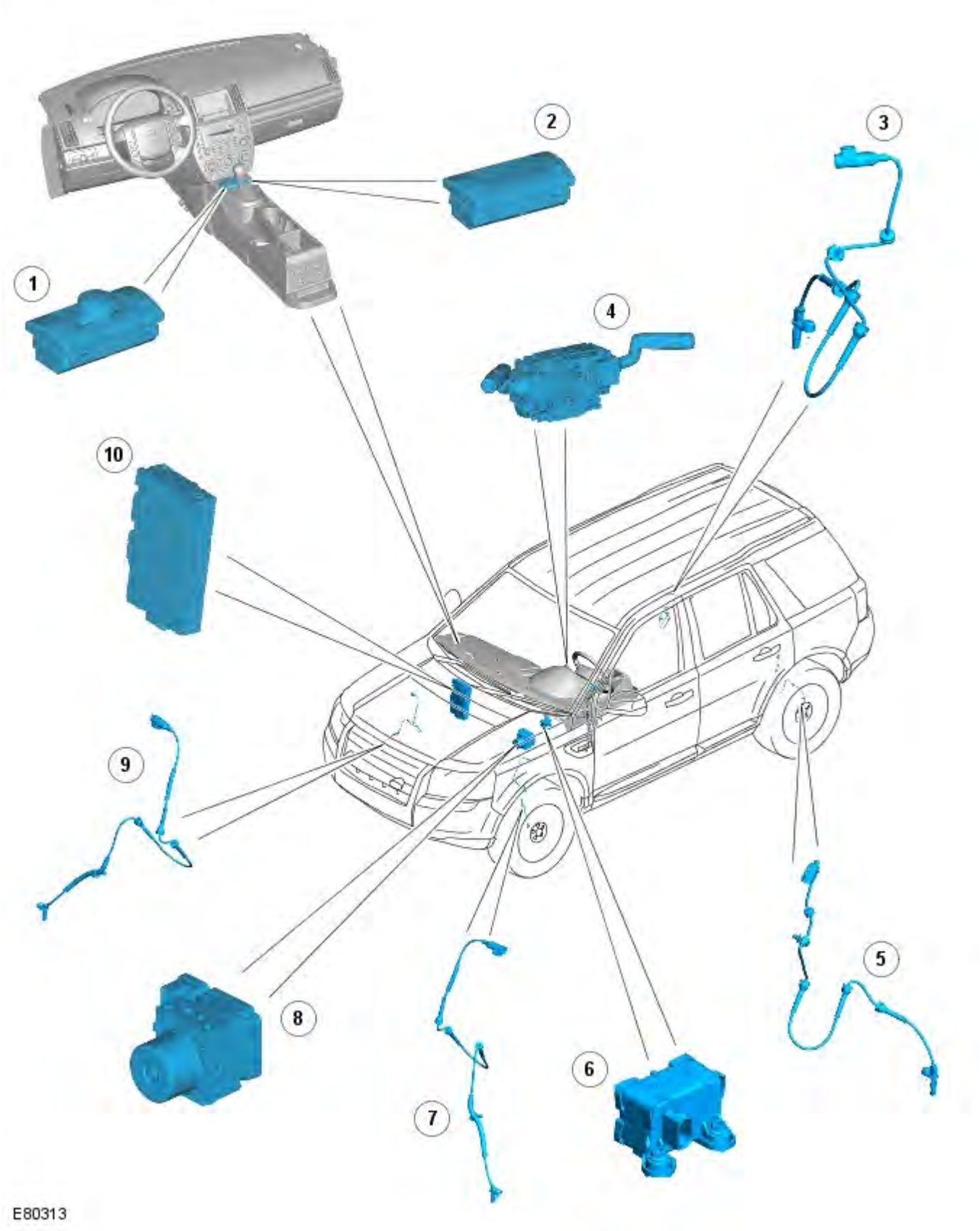
Published: 11-May-2011

Anti-Lock Control - Stability Assist - Anti-Lock Control - Stability Assist

Description and Operation

COMPONENT LOCATION

- NOTE: Left-Hand Drive (LHD) shown; Right-Hand Drive (RHD) similar.



Item	Part Number	Description
1	-	Hill Descent Control (HDC) and Dynamic Stability Control (DSC) switches (with Terrain Response™)
2	-	HDC and DSC switches (without Terrain Response™)

3	-	Right-Hand (RH) rear wheel speed sensor
4	-	Steering wheel module (including steering angle sensor)
5	-	Left-Hand (LH) rear wheel speed sensor
6	-	Sensor cluster
7	-	LH front wheel speed sensor
8	-	Integrated Anti-lock Brake System (ABS) module and Hydraulic Control Unit (HCU)
9	-	RH front wheel speed sensor
10	-	Central Junction Box (CJB)

OVERVIEW

The vehicle ABS and stability control system features a Continental Teves Mk25E1 module, with an integral 4-channel HCU. The integrated ABS module and HCU is located on the rear LH side of the engine compartment, and is installed in the brake hydraulic circuit between the brake master cylinder and the 4 brake calipers.

The ABS module is connected to the high speed Controller Area Network (CAN) bus, and actively interacts with other vehicle system control modules and associated sensors to receive and transmit current vehicle operating information.

When required, the ABS module will actively intervene and operate the HCU during braking or vehicle maneuvers to correct the vehicle attitude, stability, traction or speed. During severe incidents of vehicle correction, the ABS module will also request the Engine Control Module (ECM) to reduce engine power in order to further stabilize and correct the vehicle.

To provide full system functionality, the ABS and DSC systems comprise the following components:

- DSC switch
- HDC switch
- 4 wheel speed sensors
- Sensor cluster
- Steering angle sensor
- Instrument cluster indicator lamps
- Integrated ABS module and HCU.

The ABS system also provides brake functions that are designed to assist the vehicle or aid the driver. The following functions are detailed in the section 'Principles of Operation':

- Anti-lock Brake System (ABS)
- Corner Brake Control (CBC)
- Dynamic Stability Control (DSC)
- Electronic Brake Force Distribution (EBD)
- Electronic Traction Control (ETC)
- Emergency Brake Assist (EBA)
- Engine Drag-Torque Control (EDC)
- HDC (with gradient release control)
- Roll Stability Control (RSC)
- Terrain Response™ system integration.

All the brake functions listed, apart from HDC, are automatically active when the ignition is in power mode 6 (ignition) and the engine is running.

DYNAMIC STABILITY CONTROL SWITCH

The DSC switch allows the DSC function to be selected off. The DSC switch is non-latching and is installed in the floor console, forward of the gear selector lever. Pressing the DSC switch connects an ignition power feed to the ABS module. With the first press of the DSC switch, the ABS module disables the DSC functions. When the DSC switch is pressed again, the ABS module re-enables the DSC functions. The DSC switch must be pressed for a minimum of 0.3 second for the ABS module to react. The DSC function is re-enabled at the beginning of each ignition cycle.

To confirm that the DSC function is selected off, the amber colored DSC warning indicator lamp located in the instrument cluster, is continuously illuminated. On vehicles installed with a high-line instrument cluster, a message is also displayed in the message center to confirm that DSC is selected off.

For additional information, refer to:

Instrument Cluster (413-01 Instrument Cluster, Description and Operation),
Information and Message Center (413-08 Information and Message Center, Description and Operation).

When the DSC function is selected on, the DSC warning indicator lamp is extinguished.

Although Land Rover recommend that DSC is selected on for all normal driving conditions, it may be beneficial to de-select DSC in order to maximize traction under the following conditions:

- To rock the vehicle out of a hollow or a soft surface.
- When driving on loose surfaces or with snow chains installed.
- When driving in deep sand, snow or mud.
- When driving on tracks with deep longitudinal ruts.

Even when DSC is deselected, driving maneuvers with extreme yaw or lateral acceleration may trigger RSC activity to assist the vehicle stability.

To prevent mis-use of, or in the event of a broken DSC switch, a Diagnostic Trouble Code (DTC) is stored in the ABS module memory if the input from the DSC switch is held high for more than 1 minute.

HILL DESCENT CONTROL SWITCH

The HDC switch controls the selection of the HDC function.

The HDC switch is non-latching and is installed in the floor console, forward of the gear selector lever. Momentarily pressing and releasing the HDC switch connects an ignition power feed to the ABS module. With the first press and release of the HDC switch, the ABS module enables operation of the HDC function. When the HDC switch is pressed and released again, the ABS module disables operation of the HDC function.

To prevent mis-use of, or in the event of a broken HDC switch, if the switch is pressed for more than 10 seconds no change of state occurs. A DTC is stored in the ABS module memory if the input from the HDC switch is held high for more than 1 minute.

HDC Activating Stoplamps

Operation of the vehicle stoplamps during HDC is controlled by the CJB. The ABS module monitors the brake system hydraulic pressure and requests the CJB, via the high speed CAN bus, to energize the stoplamps during active braking.

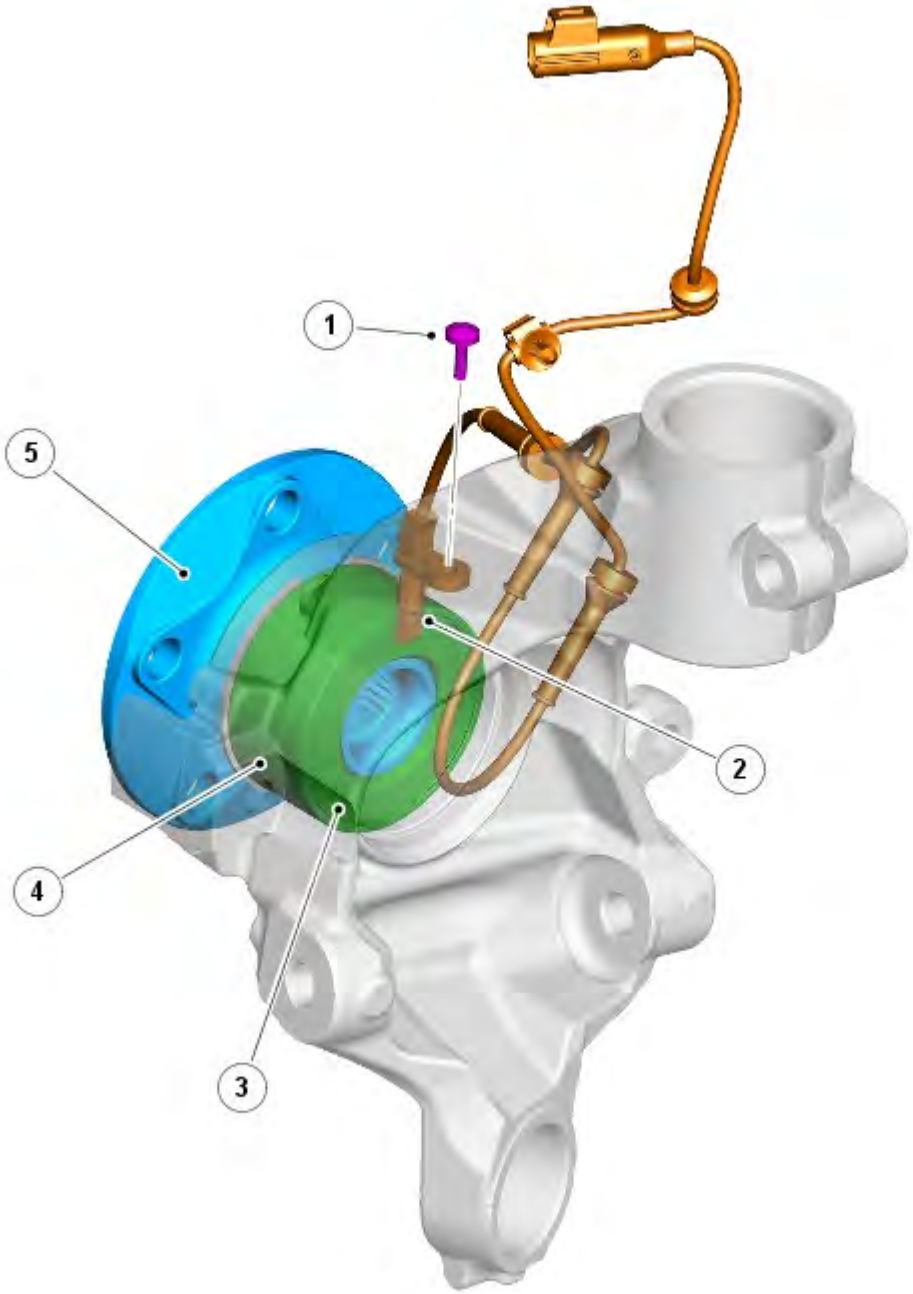
A pressure threshold and time filter prevents the stoplamps from flickering while HDC is braking.

Stop/Start Vehicles - From 2010 MY

Activation of Hill Descent Control will deactivate the Stop/Start system. However, if Hill Descent Control is activated when the engine is shutdown in a Stop/Start cycle the engine will automatically restart. If during this event the Stop/Start system cannot detect the driver's occupancy, for example either the driver's safety belt or door is unlatched, the engine will not restart. The Stop/Start system will request the driver to depress the clutch to restart the engine. The driver will be informed of this by 'RESTART REQUIRED PRESS CLUTCH' being displayed in the message center.

The driver must respond to this request within a limited time period, or otherwise a conventional engine restart using the ignition switch will be required.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

WHEEL SPEED SENSORS



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Item	Part Number	Description
1	-	Retaining screw
2	-	Wheel speed sensor
3	-	Bearing seal and magnetic encoder ring
4	-	Wheel bearing
5	-	Wheel hub

An active wheel speed sensor is installed in each wheel knuckle, and provides the ABS module with a rotational speed signal from each road wheel. The head of each wheel speed sensor is positioned close to a magnetic encoder incorporated into the seal of the wheel bearing. Each front axle bearing encoder contains 44 north and south poles; each rear axle bearing encoder contains 48 pole pairs. A fly lead connects each sensor to the vehicle harness.

The wheel speed sensor is supplied with a power supply and a signal connection from the ABS module. When the ignition switch is in power mode 6 (ignition), the ABS module supplies power to the wheel speed sensors and monitors the return signals. Rotation of the wheels induces current fluctuations in the speed sensor return signals. The ABS module subsequently converts the return signals into individual wheel speeds, and the overall vehicle speed.

The ABS module outputs the individual wheel speeds, and vehicle speed on the high speed CAN bus for use by other systems. The quality of the vehicle speed signal is also broadcast on the high speed CAN bus. If all wheel speed signals are available to calculate vehicle speed from, the quality of the vehicle speed signal is set to 'data calculated within specified accuracy'. If one or more wheel speed sensors are inoperative, the quality of the vehicle speed signal is set to 'accuracy outside specification'.

The ABS module monitors the wheel speed sensor circuits for faults. If a fault is detected the ABS module stores a related DTC in memory and illuminates the appropriate warning indicator lamps, depending on the system functions affected (DSC/ETC, ABS, EBA/EBD, HDC). A warning chime is also sounded to alert the driver to the fault condition.

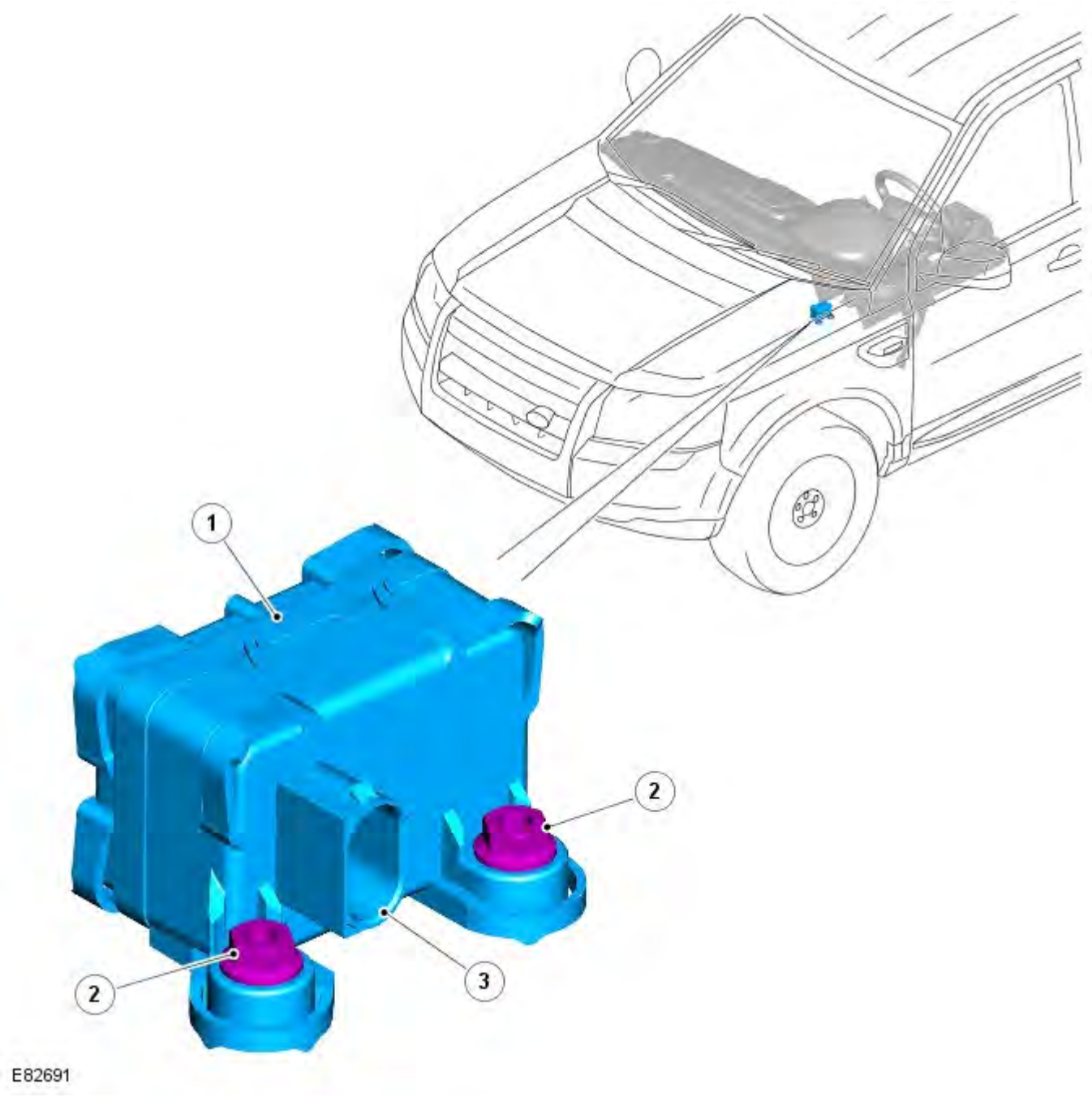
For vehicles installed with a high-line instrument cluster, a message is displayed in the message center, only if the fault affects the HDC function.

For additional information, refer to:

Instrument Cluster (413-01 Instrument Cluster, Description and Operation),
Information and Message Center (413-08 Information and Message Center, Description and Operation).

As the wheel speed sensors are active devices, a return signal is available when the road wheels are not rotating. This enables the ABS module to check the condition of the speed sensors while the vehicle is stationary.

SENSOR CLUSTER



Item	Part Number	Description
1	-	Sensor cluster
2	-	Retaining stud and nut (2 off)
3	-	Electrical connector

The sensor cluster is installed beneath the center console and is secured to the transmission tunnel with 2 studs and nuts. The sensor cluster is a compact unit that provides the ABS module with inputs of yaw rate, roll rate, longitudinal and lateral acceleration. The ABS module broadcasts the input values on the high speed CAN bus for use by other systems.

When the ignition is in power mode 6 (ignition), the sensor cluster receives an ignition power feed from the ABS module. The sensor cluster is also connected to the ABS module via a private CAN bus.

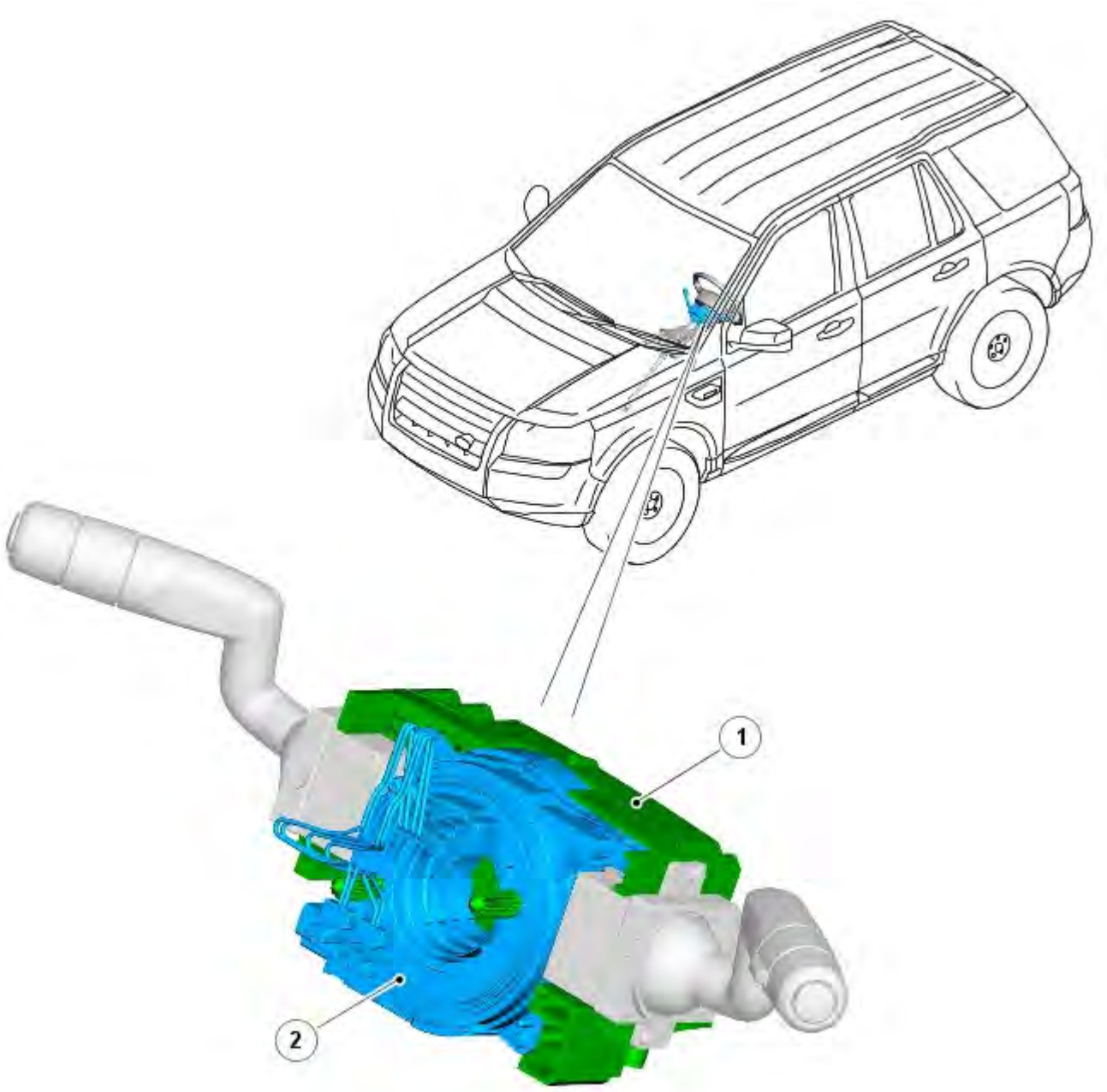
The sensor cluster is diagnosed by the ABS module. If a sensor fault is detected the ABS module stores a related DTC in memory and illuminates the appropriate warning indicator lamps, depending on the system functions affected (DSC/ETC, ABS, EBA/EBD, HDC). A warning chime is also sounded to alert the driver to the fault condition.

For vehicles installed with a high-line instrument cluster, a message is displayed in the message center, only if the fault affects the HDC function.

For additional information, refer to:

Instrument Cluster (413-01 Instrument Cluster, Description and Operation),
Information and Message Center (413-08 Information and Message Center, Description and Operation).

STEERING WHEEL MODULE



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Item	Part Number	Description
1	-	Steering wheel module
2	-	Clockspring and steering angle sensor

The steering wheel module contains the steering angle sensor, clockspring and steering column multifunction switches to form an integral component. The steering angle sensor is connected directly to the clockspring.

The steering wheel module is mounted to the upper steering column with 2 screws, and receives an electrical supply from the main harness via a 4-pin connector located on the side of the unit. The module provides the location and electrical connection for the 2 multifunction switches.

Input signals from the steering angle sensor are received and processed by the steering wheel module to calculate the steering wheel angle, and steering wheel angle speed. The information is transmitted on the high speed CAN bus for use by the ABS module.

Steering Angle Sensor

The steering angle sensor is connected to the steering wheel with 2 dowels. The steering angle sensor monitors steering wheel rotation, and provides information of the steering wheel angle and rate of speed of steering wheel movements.

A code wheel and 16 optical digital sensors are installed inside the steering wheel angle sensor. Rotation of the code

wheel is read by the optical-digital sensors to produce steering wheel rotational speed signals. The steering angle sensor is able to measure a rotation range of +/- 720 degrees, although the steering mechanism will only allow the steering wheel to rotate a maximum of +/-540 degrees.

Signals from the steering angle sensor are transmitted on the vehicle high speed CAN bus, and received and processed by other systems such as DSC. The transmitted information includes details of steering wheel angle and steering wheel rotational speed, along with signal integrity information.

If a fault occurs within the steering angle sensor, a DTC will be set and stored in the steering angle sensor memory. The steering angle sensor fault is also stored in the ABS module memory that illuminates the appropriate warning indicator lamps, depending on the system functions affected (DSC/ETC, ABS, EBA/EBD, HDC). A warning chime is also sounded to alert the driver to the fault condition.

For vehicles installed with a high-line instrument cluster, a message is displayed in the message center, only if the fault affects the HDC function.

For additional information, refer to:

> Instrument Cluster (413-01 Instrument Cluster, Description and Operation),
> Information and Message Center (413-08 Information and Message Center, Description and Operation).

The steering angle sensor and ABS module are able to be interrogated using the Land Rover approved diagnostic equipment.

Clockspring

The clockspring is a rotary coupling that provides the electrical connection between the fixed steering wheel module, and the steering wheel mounted controls and Supplemental Restraint System (SRS) driver's airbag.

A colored indicator is provided within the clockspring and is visible through a transparent perspex cover when the steering wheel is removed, and the steering angle sensor is aligned to the central position. The indicator makes sure the steering angle sensor and steering system are correctly aligned following repairs to the steering mechanism.

Service Information

Before separating the steering components from the connecting steering column, the clockspring must be aligned to the center position (indicator visible) and the wheels pointing straight ahead. The clockspring is retained in the central position with a locking screw.

INSTRUMENT CLUSTER INDICATOR LAMPS

Item	Part Number	Description
1	-	Brake warning indicator lamp – all except North American Specification (NAS)
2	-	ABS warning indicator lamp
3	-	Brake warning indicator lamp - NAS vehicles
4	-	HDC warning indicator lamp (low line instrument cluster)
5	-	DSC warning indicator lamp
6	-	HDC information indicator lamp

The instrument cluster contains 2 types of indicator lamps to display the operating status of the selected anti-lock control - stability assist functions. The indicator lamps provide a visual notification of either a system warning or information indication to the driver. There are 4 indicator lamps on vehicles with a high-line instrument cluster; 5 indicator lamps on vehicles with a low-line instrument cluster.

The following anti-lock control - stability assist indicator lamps are installed in the instrument cluster:

- ABS warning indicator lamp
- Brake warning indicator lamp
- DSC warning indicator lamp
- HDC warning indicator lamp
- HDC information indicator lamp.

For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

ANTI-LOCK BRAKE SYSTEM MODULE

The ABS module controls the brake functions by operating the HCU to modulate hydraulic pressure to the individual wheel brakes.

The ABS module is attached to the HCU and forms an integral component. A 47-pin connector provides the electrical interface between the ABS module and the vehicle wiring. The ABS module may be interrogated using the Land Rover approved diagnostic equipment.

HYDRAULIC CONTROL UNIT

The HCU is a 4 channel unit that modulates the supply of hydraulic pressure to the brakes, under the control of the ABS module.

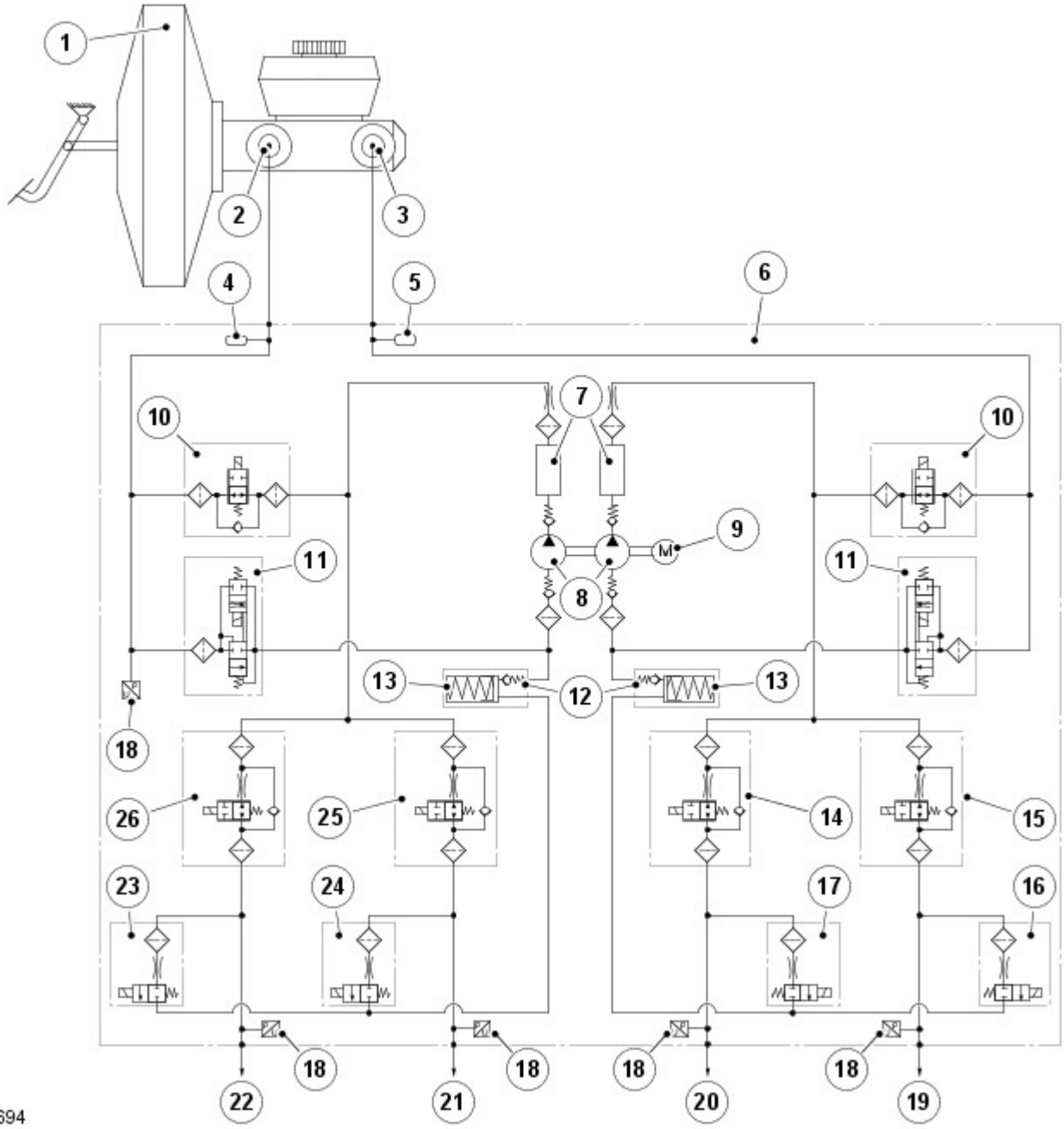
The master cylinder primary and secondary circuit outlets are connected to the HCU primary and secondary circuits.
For additional information, refer to: Hydraulic Brake Actuation (206-06 Hydraulic Brake Actuation, Description and Operation).
Each of the HCU circuits contains the following components to control the supply of hydraulic pressure to the brakes:

- A normally open, solenoid-operated pilot valve, to enable active braking.
- A normally closed, solenoid-operated priming valve, to connect the brake fluid reservoir to the dual circuit hydraulic pump during active braking.
- A hydraulic pump, to generate hydraulic pressure for active braking and return brake fluid to the reservoir.
- Normally open, solenoid-operated inlet valves and normally closed, solenoid-operated outlet valves, to modulate the hydraulic pressure in the individual brakes.
- An accumulator and a relief valve, to allow the fast release of pressure from the brakes.
- Filters, to protect the internal components from contamination.

The primary circuit also incorporates a pressure sensor to provide the ABS module with a hydraulic pressure signal.

Contact pins on the HCU mate with contacts on the ABS module to provide the electrical connections from the ABS module to the dual circuit hydraulic pump motor, and the pressure sensor. The solenoids that operate the valves are installed within the ABS module.

HCU Schematic Diagram



Item	Part Number	Description
1	-	Brake booster
2	-	Primary hydraulic circuit
3	-	Secondary hydraulic circuit
4	-	Pulsation damper
5	-	Pulsation damper
6	-	HCU
7	-	Damping chamber
8	-	Dual circuit hydraulic pump
9	-	D.C. motor
10	-	Solenoid-operated pilot valve (2 off)
11	-	Solenoid-operated priming valve (2 off)
12	-	Check valve
13	-	Low-pressure accumulator (2 off)
14	-	Solenoid-operated inlet valve (RH rear brake)
15	-	Solenoid-operated inlet valve (LH front brake)
16	-	Solenoid-operated outlet valve (LH front brake)
17	-	Solenoid-operated outlet valve (RH rear brake)
18	-	Pressure sensor (5 off)
19	-	LH front brake (secondary circuit)
20	-	RH rear brake (secondary circuit)
21	-	LH rear brake (primary circuit)
22	-	RH front brake (primary circuit)
23	-	Solenoid-operated outlet valve (RH front brake)
24	-	Solenoid-operated outlet valve (LH rear brake)

25	-	Solenoid-operated inlet valve (LH rear brake)
26	-	Solenoid-operated inlet valve (RH front brake)

The HCU features 3 operating modes:

- Normal braking/ EBD
- ABS braking
- Active braking.

Normal Braking/EBD Mode

Initially, all of the solenoid-operated valves are de-energized. Operating the brake pedal produces a corresponding increase or decrease of pressure in the brakes, through the open pilot valves and inlet valves. If the ABS module determines that EBD is necessary, it energizes the inlet valves for both the rear brakes, to isolate the brakes from any further increase in hydraulic pressure.

• NOTE: Only the rear brakes are controlled by the EBD function.

ABS Braking Mode

If the ABS module determines that ABS braking is necessary, it energizes the inlet and outlet valves of the related brake and starts the hydraulic return pump. The inlet valve closes to isolate the brake from pressurized fluid; the outlet valve opens to release pressure from the brake into the accumulator, and the return pump circuit. The reduced hydraulic pressure allows the wheel to accelerate. The ABS module then operates the inlet and outlet valves to modulate the pressure in the brake to apply the maximum braking effort without locking the wheel. Control of the valves for each wheel takes place individually.

Active Braking Mode

The active braking mode is used to generate and control hydraulic pressure to the brakes for functions other than Normal and ABS braking, for example RSC, DSC, EBA, ETC, HDC.

For active braking, the ABS module energizes the pilot valves and priming valves, starts the return pump and energizes all of the inlet valves. Brake fluid, drawn from the reservoir through the master cylinder and priming valve, is pressurized by the return pump and supplied to the inlet valves. The ABS module then operates the inlet valves and outlet valves, as required, to modulate the pressure in the individual brakes. Some noise may be generated during active braking.

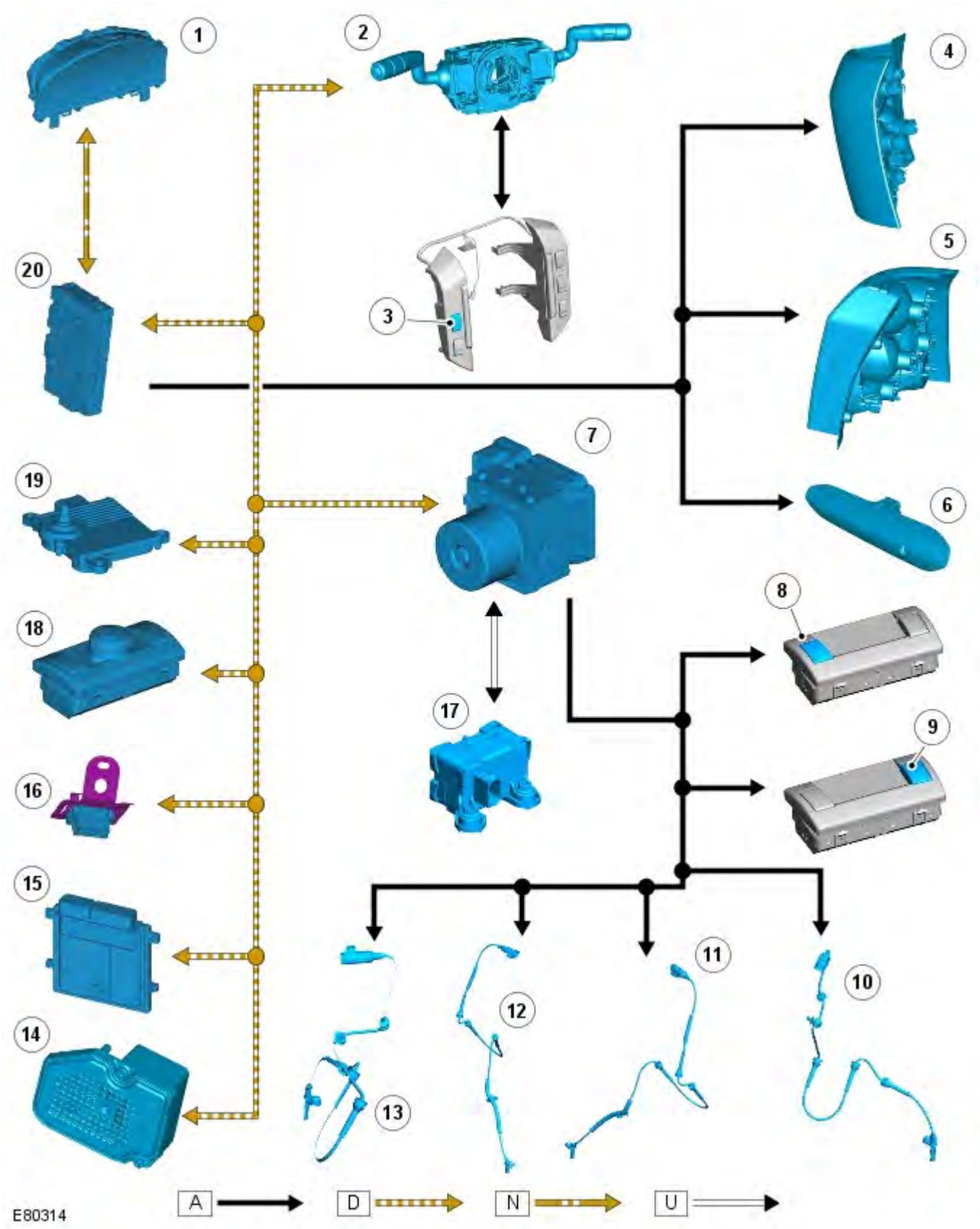
Service Information

The ABS module comprises an HCU and an Electronic Control Unit (ECU) that must not be separated. The ABS module and HCU assembly is supplied as a single component and arrives in a pre-filled state.

• NOTE: The ABS module, HCU and the sensor cluster are fragile components and must be discarded if dropped or damaged.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High Speed CAN bus; **N** = Medium Speed CAN bus; **U** = Private CAN bus



Item	Part Number	Description
1	-	Instrument cluster
2	-	Steering wheel module (steering angle sensor)
3	-	Speed control `+' and '-` switches
4	-	RH stoplamp
5	-	LH stoplamp
6	-	High mounted stoplamp
7	-	ABS module
8	-	HDC switch
9	-	DSC switch
10	-	LH rear wheel speed sensor
11	-	RH front wheel speed sensor

12	-	LH front wheel speed sensor
13	-	RH rear wheel speed sensor
14	-	Active On-Demand Coupling module
15	-	ECM
16	-	Diagnostic socket
17	-	Sensor cluster
18	-	Terrain Response™ control module
19	-	Transmission Control Module (TCM) - automatic transmission models only
20	-	CJB

PRINCIPLES OF OPERATION

Anti-Lock Brake System

ABS controls the speed of all road wheels to ensure optimum wheel slip when braking at the adhesion limit. The wheels are prevented from locking to retain effective steering control of the vehicle.

The front brake pressures are modulated separately for each wheel. The rear brake pressures are modulated by select low. Select low applies the same pressure to both rear brakes, with the pressure level being determined by the wheel on the lower friction surface. This maintains rear stability on split friction surfaces.

Corner Brake Control

CBC influences the brake pressures, below and within ABS thresholds, to counteract the yawing moment produced when braking in a corner. CBC produces a correction torque by limiting the brake pressure on one side of the vehicle.

Dynamic Stability Control

DSC uses brakes and powertrain torque control to assist in maintaining the lateral stability of the vehicle. While the ignition is energized the DSC function is permanently enabled, unless selected off using the DSC switch. Even if DSC is deselected, driving maneuvers with extreme yaw or lateral acceleration may trigger RSC activity to assist the vehicle stability.

DSC enhances driving safety in abrupt maneuvers and in under-steer or over-steer situations that may occur in a bend. The ABS module monitors the yaw rate and lateral acceleration of the vehicle, steering input, and then selectively applies individual brakes and signals for powertrain torque adjustments to reduce under-steer or over-steer.

In general:

- In an under-steer situation; the inner wheels are braked to counteract the yaw movement towards the outer edge of the bend.
- In an over-steer situation; the outer wheels are braked to prevent the rear end of the vehicle from pushing towards the outer edge of the bend.

The ABS module monitors the tracking stability of the vehicle using inputs from the wheel speed sensors, the steering angle sensor, and the yaw rate and lateral acceleration sensor. The tracking stability is compared with stored target data. Whenever the tracking stability deviates from the target data, the ABS module intervenes by applying the appropriate brakes.

The following interactions occur in an intervention situation:

- High speed CAN signal to the ECM, to reduce engine torque.
- High speed CAN signal to the Active On-demand Coupling module, to open the locking torque of the center coupling.
- Application of braking to the appropriate corner of the vehicle.

Electronic Brake Force Distribution

EBD limits the brake pressure applied to the rear wheels. When the brakes are applied, the weight of the vehicle transfers forwards, reducing the ability of the rear wheels to transfer braking effort to the road surface. This may cause the rear wheels to slip and make the vehicle unstable.

EBD uses the anti-lock braking hardware to automatically optimize the pressure of the rear brakes, below the point where ABS is normally invoked.

• NOTE: Only the rear brakes are controlled by the EBD function.

Electronic Traction Control

ETC attempts to optimize forward traction by reducing engine torque, or by applying the brake of a spinning wheel until traction is regained.

ETC is activated if an individual wheel speed is above that of the vehicle reference speed (positive slip) and the brake pedal is not pressed. The brake is applied to the spinning wheel, allowing the excess torque to be transmitted to the non-spinning wheels through the drive line. If necessary, the ABS module also sends a high speed CAN bus message to the ECM to request a reduction in engine torque.

When the DSC function is selected off using the DSC switch, the engine torque reduction feature is disabled.

Emergency Brake Assist

EBA assists the driver in emergency braking situations by automatically maximizing the applied braking effort. There are two situations when the ABS module will invoke EBA:

- When the brake pedal is rapidly pressed.
- When the brake pedal is pressed hard enough to bring the front brakes into ABS operation.

When the brake pedal is rapidly pressed, the ABS module increases the hydraulic pressure to all of the brakes until the threshold for ABS operation is reached. This action applies the maximum braking effort for the available traction. The ABS module monitors for the sudden application of the brakes, using inputs from the brake pedal switch and from the pressure sensor within the HCU. With the brake pedal pressed, if the rate of increase of hydraulic pressure exceeds the predetermined limit, the ABS module invokes emergency braking.

When the brake pedal is pressed hard enough to bring the front brakes into ABS operation, the ABS module increases the hydraulic pressure to the rear brakes up to the ABS threshold.

EBA operation continues until the driver releases the brake pedal, sufficiently for the hydraulic pressure in the HCU to drop below a threshold value stored in the ABS module.

Engine Drag-Torque Control

EDC prevents wheel slip caused by any of the following:

- A sudden decrease in engine torque when the accelerator is suddenly released.
- The sudden engagement of the clutch after a downshift on manual transmission vehicles.
- A downshift using the CommandShift function on automatic transmission vehicles.

When the ABS module detects the onset of wheel slip without the brakes being applied, the ABS module signals the ECM via the high speed CAN bus to request a momentary increase in engine torque.

Hill Descent Control

HDC uses engine braking and brake intervention to control the vehicle speed and acceleration during low speed off-road descents, and in low grip on-road conditions. Generally, equal pressure is applied to all 4 brakes, but pressure to individual brakes may be modified by the ABS and DSC functions to retain the vehicles stability. Selection of the HDC function is controlled by the HDC switch located on the floor console. HDC operates at vehicle speeds up to 50 km/h (31 mph).

WARNING: Incorrect use of the HDC function may compromise the stability of the vehicle, resulting in a dangerous and uncontrolled hill descent. Pressing the clutch pedal and/or driving with the transmission in 'Neutral' while HDC is active, will prevent engine braking from assisting the vehicle. The brakes will overheat and induce the HDC fade out strategy. In this condition there will be no control over the vehicle during a descent.

• NOTE: With the HDC function selected, HDC is operative even when the clutch pedal is pressed or the transmission is in the 'Neutral' position. It is not recommended to drive the vehicle further than is absolutely necessary with HDC selected, and the clutch pedal pressed/ or the transmission in 'Neutral'.

On manual transmission vehicles, HDC may be used in first and reverse gears only. Once the vehicle is moving, the clutch pedal is to be fully released. The vehicle is not recommended to be driven with HDC active and the transmission in 'Neutral'.

On automatic transmission vehicles, HDC may be used in 'D' drive, 'R' reverse and CommandShift '1' only. When in 'D', the TCM will automatically select the most appropriate gear. The vehicle is not recommended to be driven with HDC active and the transmission in 'Neutral'.

HDC is able to be selected at speeds up to 80 km/h (50 mph), but will only be enabled at speeds below 50 km/h (31 mph).

When HDC is selected:

- At speeds up to 50 km/h (31 mph), the HDC information indicator lamp is permanently illuminated if a valid gear is selected.
- At speeds between 50 to 80 km/h (31 to 50 mph), the HDC information indicator lamp flashes and on vehicles with the high line instrument cluster, a message advising that the speed is too high is displayed in the message center. If the HDC switch is pressed while the vehicle speed is greater than 80 km/h (50 mph), the HDC information indicator lamp will not illuminate and HDC will not be selected.
- If the speed reaches 80 km/h (50 mph) or more, a warning chime is sounded, the HDC function is switched off, the information indicator lamp is extinguished and, on vehicles with the high line instrument cluster, a message advising that HDC has been switched off is displayed in the message center.

For additional information, refer to:

Instrument Cluster (413-01 Instrument Cluster, Description and Operation),
Information and Message Center (413-08 Information and Message Center, Description and Operation).

When HDC is enabled, the ABS module calculates a target speed and compares this with the actual vehicle speed. The ABS module then operates the HCU in the active braking mode as required, to achieve and maintain the target speed. Operation of the vehicle stoplamps during HDC is controlled by the CJB.

Applying the foot brake during active braking may result in a pulse being felt through the brake pedal.

The target speed varies between minimum and maximum values for each gear and transmission range, depending on driver inputs through the foot pedals. If the foot pedals are not operated, the ABS module adopts a default target speed:

HDC Target Speeds

Target Speed	Automatic Transmission Gear		Manual Transmission Gear	
	1st and Drive	Reverse	1st	Reverse
Default	10 km/h (6 mph)	3.5 km/h (2.2 mph)	10 km/h (6 mph)	8 km/h (5 mph)
Minimum	6 km/h (3.7 mph)	3.5 km/h (2.2 mph)	7.5 km/h (4.7 mph)	8 km/h (5 mph)
Maximum	20 km/h (12.4 mph)	3.5 km/h (2.2 mph)	20 km/h (12.4 mph)	8 km/h (5 mph)

The target speed is varied between the minimum and maximum values using the accelerator pedal, or by pressing the

speed control '+' and '-' buttons (dependant on vehicle specification). The HDC Target speed will also vary depending on the Terrain Response™ mode selected.

During changes of target speed, the ABS module limits vehicle deceleration and acceleration to -0.5 meters per second squared (m/s^2) (-1.64 feet per second squared (ft/s^2)); and +0.5 m/s^2 (+1.64 ft/s^2) respectively.

To provide a safe transition from active braking to brakes off, the ABS module invokes a fade out strategy that gradually releases the braking effort during active braking. The fade out strategy occurs if any of the following conditions is detected during active braking:

- HDC is selected off using the HDC switch.
- Failure of a component used by HDC, but not critical to fade out function.
- Accelerator pedal pressed when transmission is in neutral.
- Brakes overheat.

If fade out is invoked because of HDC de-selection or component failure, the HDC function is cancelled by the ABS module. If fade out is invoked because the accelerator pedal is pressed with the transmission in neutral, or because of brake overheat, the HDC function remains in standby and resumes operation when the accelerator pedal is released or the brakes have cooled.

The fade out strategy increases the target speed at a constant acceleration rate of 0.5 m/s^2 (1.64 ft/s^2), until the maximum target speed is reached, or until no active braking is required for 0.5 second. If the accelerator pedal is positioned within the range that influences target speed, the acceleration rate is increased to 1.0 m/s^2 (3.3 ft/s^2).

When fade out is invoked because of component failure, a warning chime is sounded and the HDC information indicator lamp is extinguished. The HDC warning indicator lamp is then illuminated (on low-line instrument cluster), or a message advising of the fault is displayed in the message center (on high-line instrument cluster).

For additional information, refer to:

Instrument Cluster (413-01 Instrument Cluster, Description and Operation),
Information and Message Center (413-08 Information and Message Center, Description and Operation).

When fade out is invoked because of brake overheat, on vehicles with the high-line instrument cluster, a message advising that HDC is temporarily unavailable is displayed. On vehicles with the low-line instrument cluster, the HDC warning indicator lamp flashes. At the end of fade out, the HDC information indicator flashes. The flashing warning and information indicator lamps, and/or displayed message continue while HDC remains selected, until the brakes have cooled.

For additional information, refer to:

Instrument Cluster (413-01 Instrument Cluster, Description and Operation),
Information and Message Center (413-08 Information and Message Center, Description and Operation).

To monitor for brake overheat, the ABS module monitors the amount of braking activity and, from this, estimates the temperature of each brake. If the estimated temperature of any brake exceeds a preset limit, the ABS module invokes the fade out strategy. After the fade out cycle, the HDC function is re-enabled when the ABS module estimates that all of the brake temperatures are at less than 64% of the preset temperature limit.

Roll Stability Control

The RSC function uses the brakes and the engine to attempt to restore vehicle stability, if the vehicle is forced into a harsh maneuver that risks it tipping over.

The ABS module monitors driver inputs and vehicle behavior using various powertrain signals and the inputs from the wheel speed sensors, the steering angle sensor, the roll rate sensor, yaw rate and lateral acceleration sensors. These inputs are compared with modeled behavior and, if the vehicle behavior reaches a given risk level, the ABS module cuts the engine power, or brakes one or more wheels sufficiently to allow the vehicle to regain stability and help the driver remain in control.

While the ignition is energized, RSC is permanently enabled even if the DSC function is selected off.

Terrain Response™ System Integration

The Terrain Response™ function integrates the ABS and other vehicle system control modules to assist the vehicle when driving off-road or during difficult surface conditions. Terrain Response is activated when the rotary control switch is set to a Terrain Response special program.

When a Terrain Response special program is activated, the ABS module along with other vehicle system control modules will operate in accordance with programmed software maps. The software maps allow the ABS system to function with a threshold that will assist the selected Terrain Response special program.
For additional information, refer to: Ride and Handling Optimization (204-06 Ride and Handling Optimization, Description and Operation).

Published: 11-May-2011

Anti-Lock Control - Stability Assist - Anti-Lock Control - Stability Assist

Diagnosis and Testing

Principles of Operation

For a detailed description of the Anti-lock Control - Stability Assist system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Steering wheel rotation sensor installation/fixings	• Fuses • Wheel speed sensors • Connectors/Pins • Harnesses • Steering wheel rotation sensor

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Steering Angle Sensor Module (SASM) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Anti-Lock Control - Stability Assist - Accelerometer

Removal and Installation

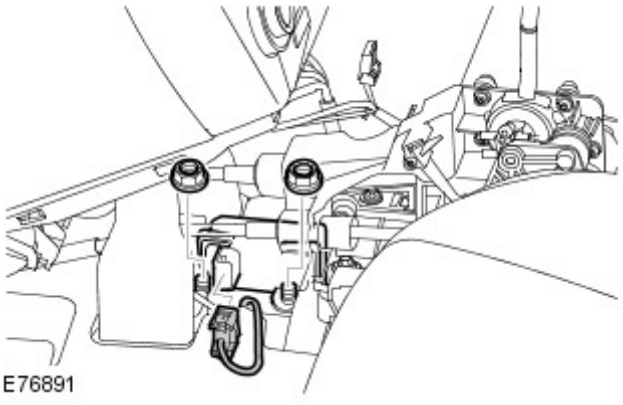
Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the floor console.

   Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).



3. *Torque:* 6 Nm

Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Steering System - General Information -

General Specification

Item	Specification
Make / type	Hydraulic power assisted steering rack and pinion
Number of turns - lock to lock	2.58
Piston diameter	44 mm (1.73 in)
Rack bar diameter	28 mm (1.10 in)
Steering ratio	15.3°
Steering rack travel	144 mm (5.70 in)
Turning circle NAS	11.7 m (38.5ft)
Turning circle ROW	11.4 m (37.4ft)

Published: 11-May-2011

Steering System - General Information - Steering System

Diagnosis and Testing

Principle of Operation

For a detailed description of the steering system, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Steering System (211-00 Steering System - General Information, Diagnosis and Testing),
Power Steering (211-02 Power Steering, Description and Operation),
Steering Linkage (211-03 Steering Linkage, Description and Operation),
Steering Column (211-04 Steering Column, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern by operating the system.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

Visual Inspection

Mechanical
• Check the tires for correct pressure, size and tread pattern • Check for wheel rim and tire damage • Check road wheel security • Check the power steering fluid level and the hydraulic circuit for fluid leaks • Check the power steering pump drive belt condition and tension • Check the power steering pump for security, wear, damage and excessive noise • Check the steering gear assembly for damage, wear and security • Check the hydraulic pipes and cooler lines for damage and correct routing • Check the steering joints for damage, excessive play, wear and security • Check the steering column and joints for damage, excessive play, wear and security

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

• NOTE: If a component is suspect and the vehicle remains under the manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new component.

Symptom	Possible Cause	Action
Steering wanders	• Excessive free play in the steering system • Steering geometry incorrectly aligned	Check for excessive movement or play in the steering system with the engine running. Check for play at several different steering positions. Carry out steering geometry and alignment checks. REFER to: Four-Wheel Alignment (204-00 Suspension System - General Information, General Procedures).
Steering pulls to the left or right	• Steering/suspension components damaged, bent, loose • Steering geometry incorrectly aligned	Check steering and suspension components for damage/correct installation. Carry out steering geometry and alignment checks. REFER to: Four-Wheel Alignment (204-00 Suspension System - General Information, General Procedures).
Steering feels notchy when turning from lock to lock Steering feels tight and does not self-center	• Steering or suspension swivel joints seized • Steering tie rod end joints or track rod inner joints seized • Steering column or universal joints seized • Steering gear internal components misaligned, worn or damaged	Disconnect the steering gear from the suspension. Check for freedom of movement in the suspension. Disconnect the steering column from the steering gear. Check the steering column and universal joints for freedom of movement. Check the steering gear for freedom of movement. Rectify as necessary.
Power steering hydraulics noisy operation	• Power steering fluid level low or contaminated • Power steering fluid aerated • Power steering hoses twisted or restricted	Check and top-up the power steering fluid level if required. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures). Check for contaminated fluid. Check for air ingress into the system. Check the power steering hoses for twisting or restrictions. Rectify as necessary.
Power steering pump noisy	• Power steering fluid level low or contaminated • Pump internal components worn or damaged	Check and top-up the power steering fluid level if required. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures). Check for contaminated fluid. Check for excessive pump noise. Install a new pump as required. Refer to the new component installation note at the top of the Symptom Chart

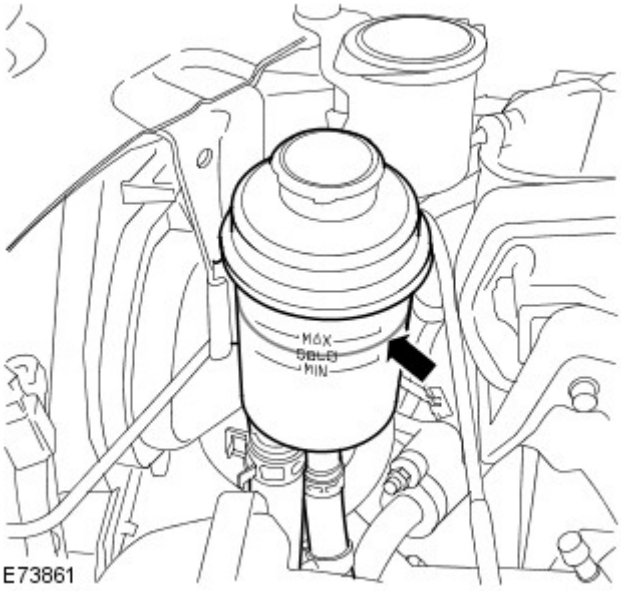
Symptom	Possible Cause	Action
Power steering gear noisy	• Power steering fluid level low or contaminated • Steering gear internal components worn or damaged	Check and top-up the power steering fluid level if required. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures). Check for contaminated fluid. Check for excessive steering gear noise. Install a new steering gear as required. Refer to the new component installation note at the top of the Symptom Chart
Steering column noisy	• Steering column fouling or universal joints dry	Check the steering column and universal joints. Rectify as necessary
Power steering feels heavier than normal through its operating range	• Lack of power assistance	Check the power steering pump pressure

Published: 11-May-2011

Steering System - General Information - Power Steering System Bleeding

General Procedures

1. Clean power steering fluid reservoir around the filler cap and fluid indicator.
2. Check the power steering fluid, if aerated, wait until fluid is free from bubbles then top-up reservoir to UPPER level mark with recommended fluid.



3. **3.** CAUTION: Fluid must always be present in the reservoir during bleeding.

   Remove the filler cap and fill to the MAX level mark.
4. Install the filler cap.
5. Start the engine and allow to run for 10 seconds, stop the engine.
6. Check the power steering fluid, if aerated, wait until fluid is free from bubbles then top-up reservoir to UPPER level mark with recommended fluid.
7. Start the engine and turn steering fully lock to lock, stop the engine.
8. Check and top-up power steering fluid level.
9. Start and run the engine for 2 minutes, turn the steering fully lock to lock.
10. Check and top-up power steering fluid level.

Published: 11-May-2011

Steering System - General Information - Power Steering System Flushing

General Procedures

• NOTE: If heavy steering or contamination within the power steering system is found, it is necessary to carry out the system flush procedure as detailed below. If any components have been replaced in the power steering system the procedure below must be carried out in full.

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Remove the power steering fluid reservoir cap.

2. Using a suitable syringe, remove the power steering fluid from the power steering fluid reservoir.

3. CAUTION: Be prepared to collect escaping fluids.

• NOTE: Note the orientation of the clip.

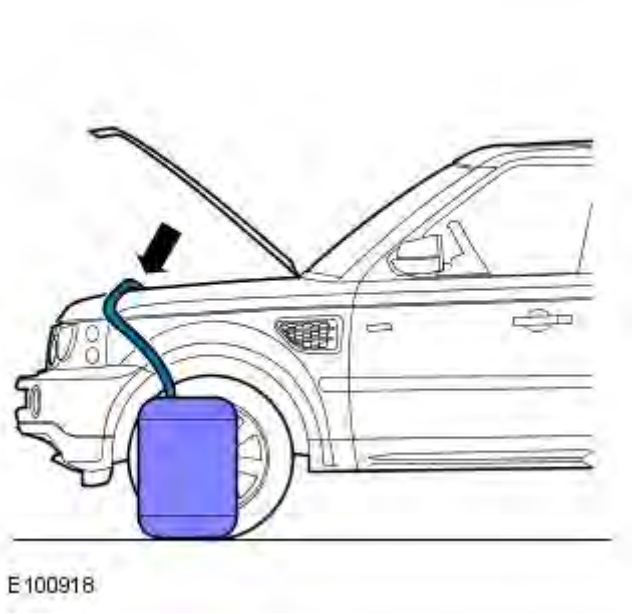
Detach the power steering fluid reservoir.

- Detach but do not remove the power steering fluid reservoir.
- Release the power steering fluid return hose from the power steering fluid reservoir.
- If a quick release coupling is fitted to the power steering return hose, release the power steering fluid return hose from the coupling by removing the clip.

4. CAUTION: Be prepared to collect escaping fluids.

• NOTE: Make sure that all openings are sealed. Use new blanking caps.

Using a suitable blanking cap, cap the power steering reservoir return pipe.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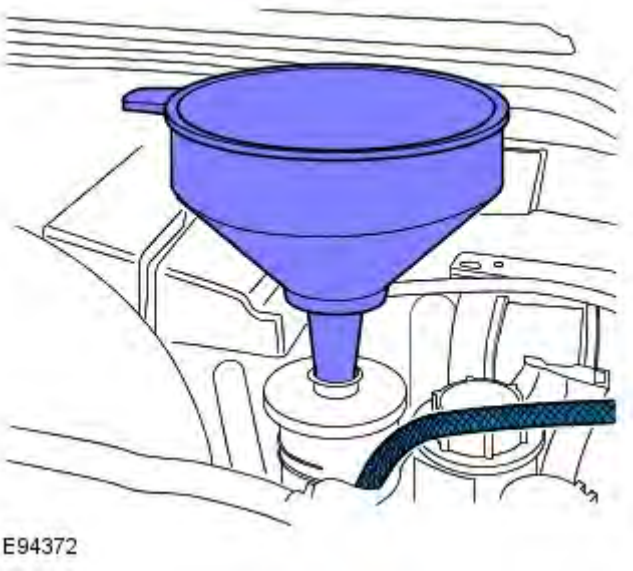
5. CAUTION: Be prepared to collect escaping fluids.

• NOTE: Make sure the extended pipe is not kinked or twisted and is correctly secured with hose clips.

Attach a suitable pipe to the power steering return hose to allow the fluid to drain.


E94372

6. NOTE: The suitable funnel should have the a capacity of 4 litres and O-ring seal

• NOTE: The suitable funnel must be tightly sealed to the power steering fluid reservoir to avoid fluid leakage.

Install a suitable funnel onto the power steering fluid reservoir.

7. WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

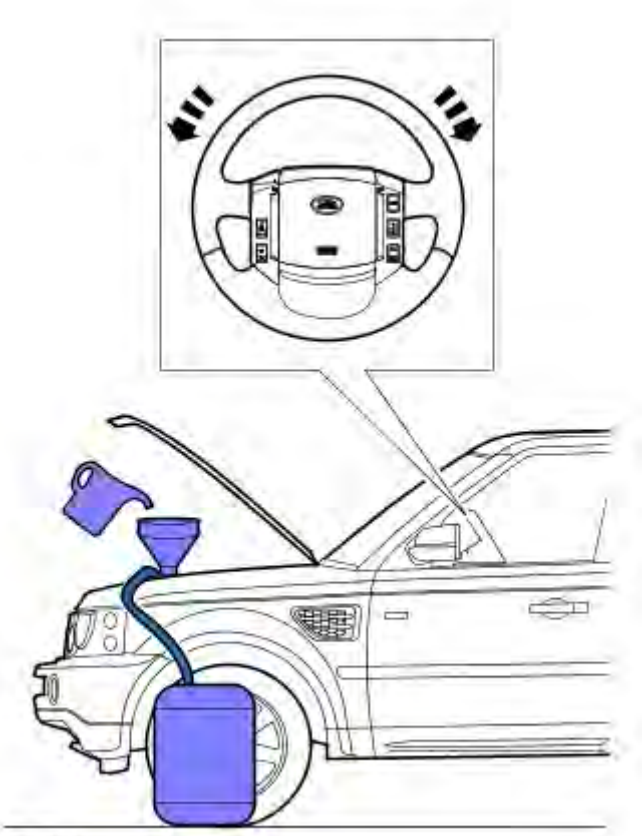
Raise and support the vehicle with the wheels just clear of the ground.

8. CAUTIONS:

Steps 8 and 9 must be carried out within 2 - 3 seconds of each other. Failure to follow this instruction may result in damage to the power steering system.

Be prepared to collect escaping fluids.

Using the suitable funnel, top up the power steering system with the specified fluid. Make sure the fluid level is maintained at two thirds full in the funnel.


E94373

9. CAUTIONS:

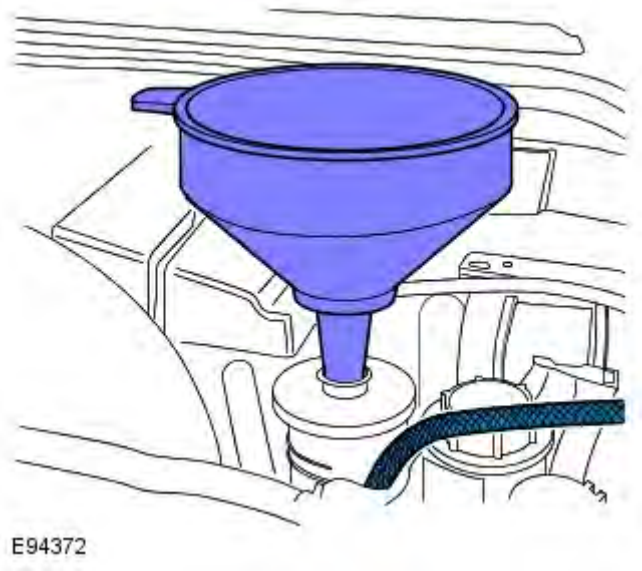
Be prepared to collect escaping fluids.

Do not allow the power steering fluid level in the power steering fluid reservoir to fall below the minimum power steering fluid level. Failure to follow this instruction may result in damage to the power steering system.

Make sure the engine is switched off as soon as the full 4 litres of power steering fluid has entered the power steering fluid reservoir.

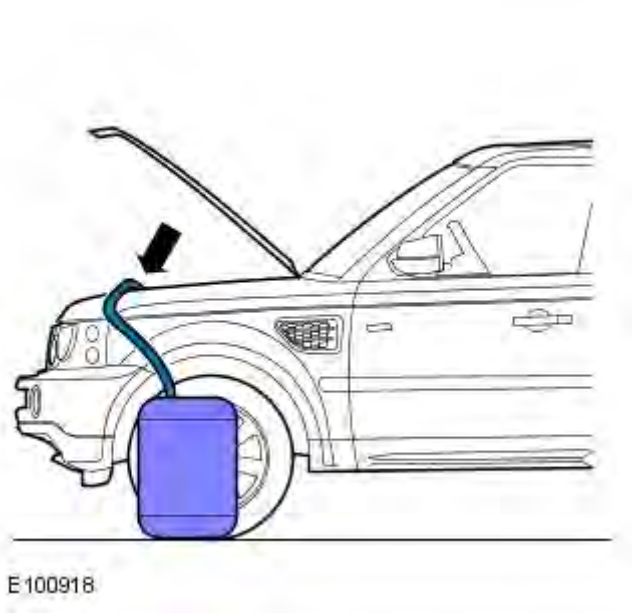
Flush the power steering system.

- Start the engine
- With assistance turn the steering slowly lock to lock 3 times at approximately 1 revolution every 5 seconds.
- Continue to flush the power steering system until 4 litres of power steering fluid has been added to the power steering reservoir. This should take approximately 30 seconds.


E94372

10. CAUTION: Be prepared to collect escaping fluids.

Remove the suitable funnel.


E100918

11. CAUTION: Be prepared to collect escaping fluids.

Remove the suitable pipe to the power steering return hose.

12. CAUTION: Be prepared to collect escaping fluids.

- NOTE: Note the orientation of the clip.

If a quick release coupling is fitted to the power steering return hose, connect the power steering fluid return hose to the coupling by installing the clip.

13. Install a new power steering fluid reservoir.
For additional information, refer to: Power Steering Fluid Reservoir (211-02 Power Steering, Removal and Installation).

Published: 05-Dec-2011

Power Steering -

Lubricants, Fluids, Sealers and Adhesives

Item	specification	Capacity
Recommended fluid	Pentozin CHF202	Fill to maximum mark on reservoir

General Specification

Item	Specification
PAS pump - 2.2 Diesel	Hitachi variable displacement pump (VDP)
PAS pump - 3.2 Petrol	ZF Conventional (fixed displacement) pump with oil cooler
PAS pump - 2.0 Petrol	ZF Conventional (fixed displacement) pump with oil cooler
PAS cooler - 3.2 Petrol	Integral part of hoses
Steering gear	Welded steel tube design for conventional gear (Visteon)
System operating pressure:	
3.2 Petrol	125 Bar ± 5 (1813 ± 73 psi)
2.2 Diesel	115 Bar ± 4 (1667 ± 58 psi)
2.0 Petrol	115 Bar ± 4 (1667 ± 58 psi)
Idle residual pressure	4 bar ± 1 (58 ± 15 psi)
Fluid flow	Constant
Maximum flow	8.8 Liters per minute ± 0.5 l/min

Torque Specifications

Description	Nm	lb-ft
High-pressure line to power steering pump - 2.2 Diesel	20	15
High-pressure line to power steering pump - 3.2 Petrol	25	18
High-pressure line to power steering pump - 2.0 Petrol	27	20
Power steering fluid cooler	10	7
Power steering fluid line bolts	27	20
Power steering fluid pressure lines	25	18
Power steering gear to cross member nuts	105	77
Power steering pump bolts - All engines	24	18

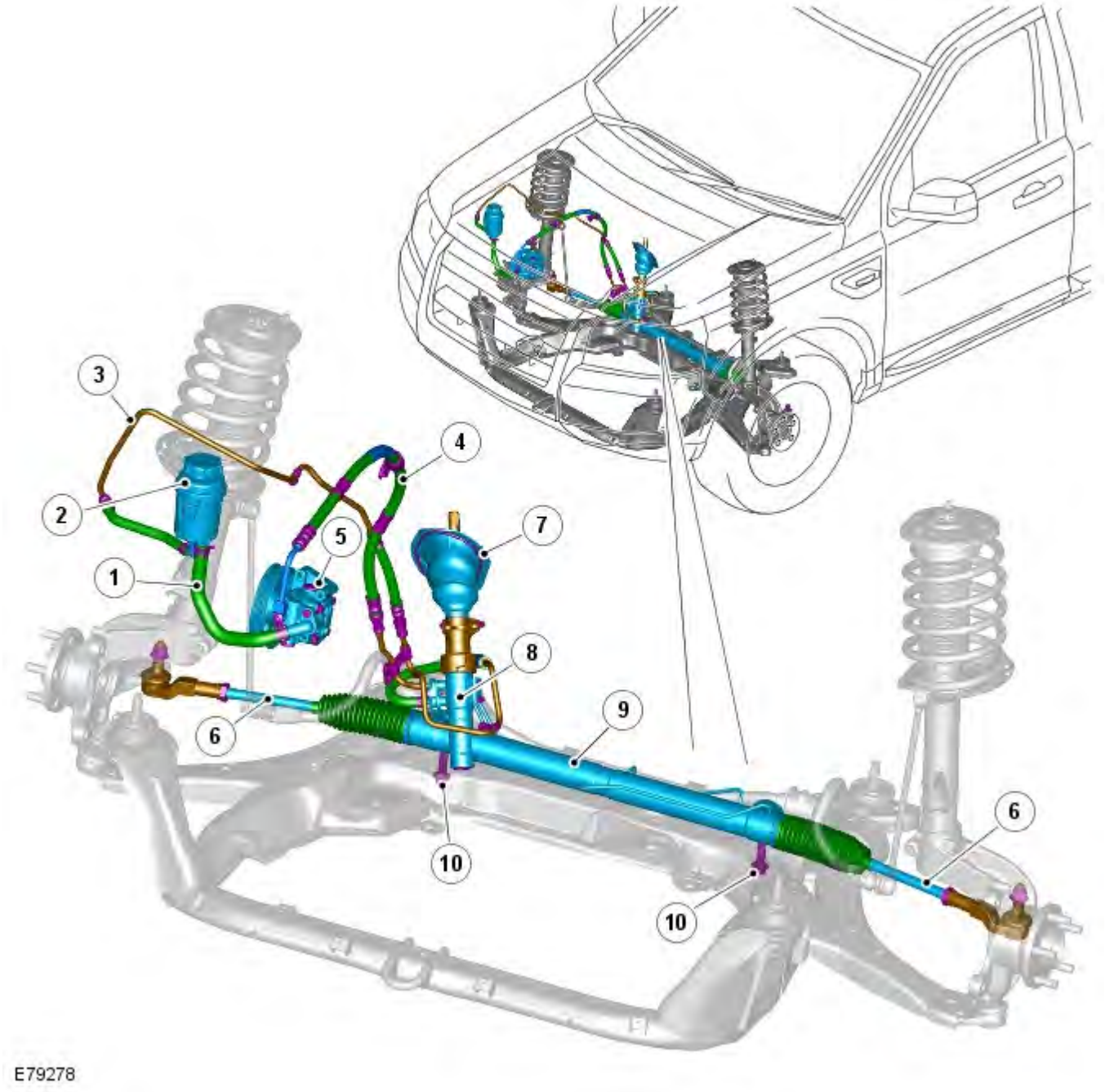
Published: 11-May-2011

Power Steering - Power Steering

Description and Operation

COMPONENT LOCATION - TD4 DIESEL

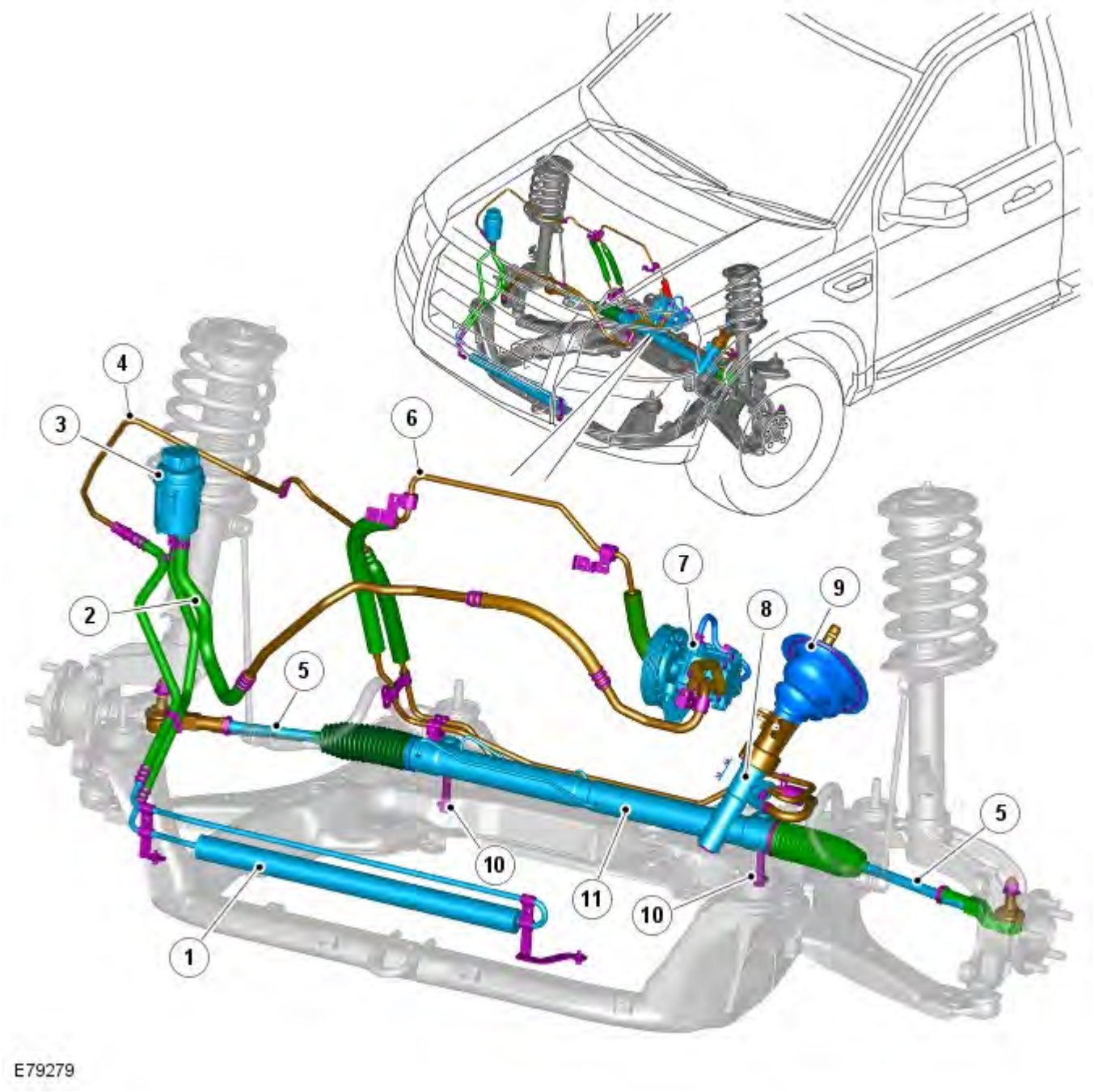
- NOTE: Right Hand (RH) drive shown, Left Hand (LH) drive similar



Item	Part Number	Description
1	-	Suction hose - reservoir to pump
2	-	Reservoir
3	-	Fluid return pipe - steering gear to reservoir
4	-	High pressure feed pipe - pump to steering gear
5	-	Power steering pump
6	-	Tie-rod
7	-	Bulkhead seal and gasket
8	-	Valve unit
9	-	Steering gear
10	-	Bolt

COMPONENT LOCATION - i6 PETROL

- NOTE: LH drive shown, RH drive similar



Item	Part Number	Description
1	-	Fluid cooler
2	-	Suction hose - reservoir to pump
3	-	Reservoir
4	-	Fluid return pipe - steering gear to cooler
5	-	Tie-rod
6	-	High pressure feed pipe - pump to steering gear
7	-	Power steering pump
8	-	Valve unit
9	-	Bulkhead seal and gasket
10	-	Bolt
11	-	Steering gear

OVERVIEW

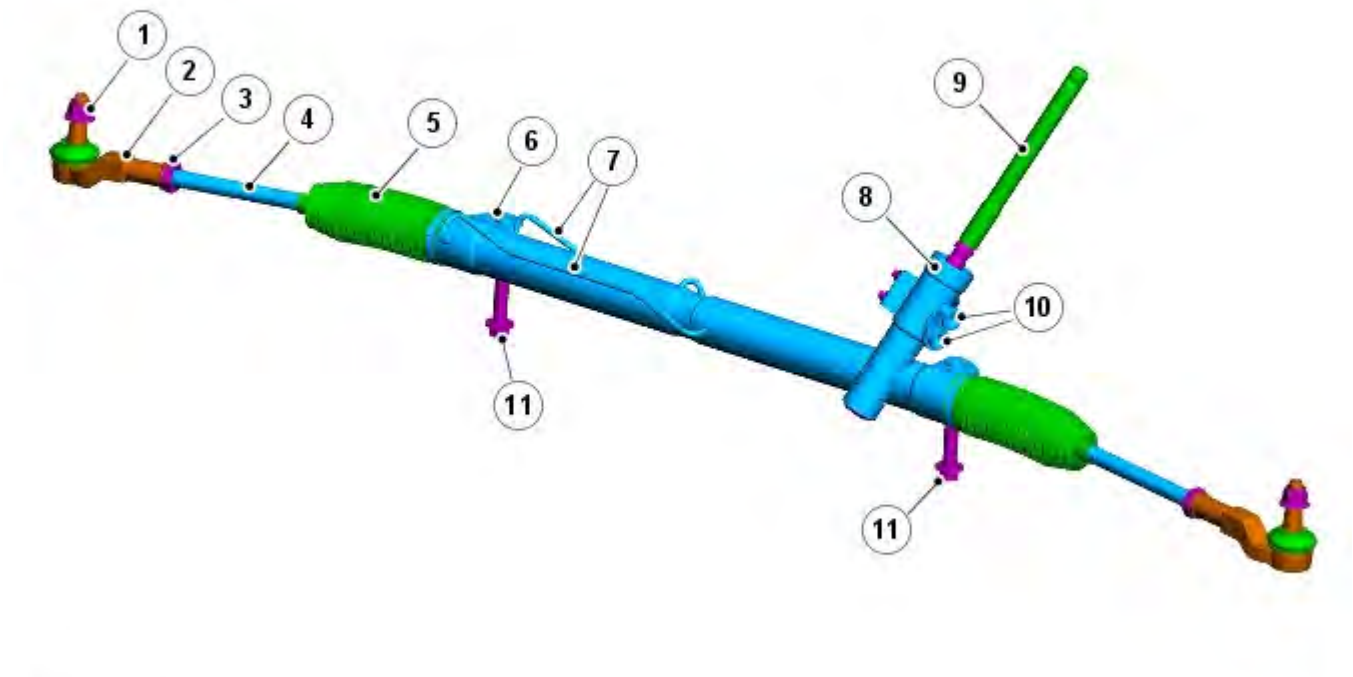
The power steering system comprises a hydraulic steering gear, a power steering pump, reservoir and a fluid cooler on petrol engine derivatives.

The steering gear is a conventional end take-off, rack and pinion power assisted unit, mounted on the rear of the subframe.

Different power steering pumps are used on the TD4 diesel engine and the i6 petrol engine. A variable displacement vane pump is used on the diesel engine to give improved engine economy. A fixed displacement vane pump is used on the petrol engine to provide refinement and responsiveness. Both pumps have high flow rates which enhance the steering performance.

Petrol engine vehicles are fitted with a fluid cooler to cool the power steering fluid from the fixed displacement pump.

STEERING GEAR



E83411

Item	Part Number	Description
1	-	Locknut
2	-	Tie-rod end
3	-	Locknut
4	-	Tie-rod
5	-	Steering gear boot
6	-	Steering gear casing attachment lugs
7	-	Pressure/return pipes
8	-	Valve unit housing
9	-	Input shaft
10	-	Pressure/return connection to/from pump
11	-	Attachment bolts

The steering gear, manufactured by Visteon, is located at the rear, top face, of the front subframe. It is solidly bolted to the subframe with two bolts. The bolts are passed through from the underside of the subframe, to improve service access, and are screwed into threaded bosses on the steering gear body.

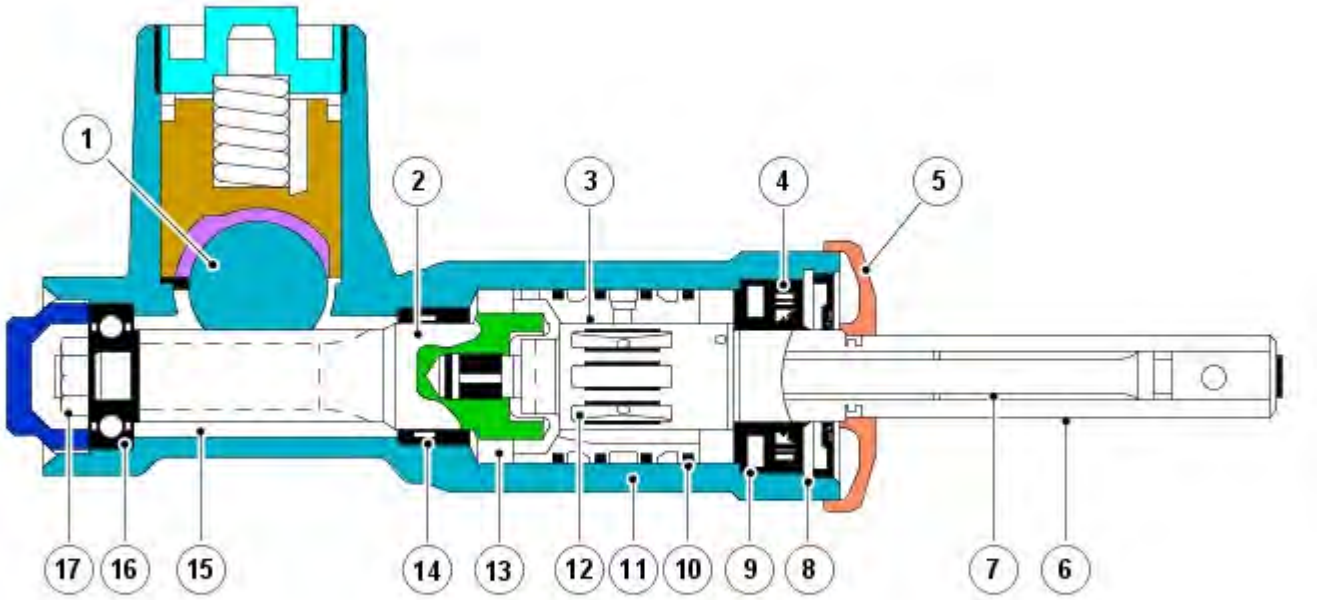
The steering gear is a conventional end take-off, rack and pinion power assisted unit with lock to lock requiring 2.6 turns of the steering wheel. This gives a steering ratio (ratio of steering wheel angle to road wheel angle) of 16.7:1 which provides very quick and responsive reaction to driver inputs. The steering gear features large diameter tie-rods which optimize feedback and feel to the driver.

The steering gear comprises a steel, welded and machined, one piece housing which contains a mechanical steering rack, a valve unit and an integrated hydraulic power unit. The steering gear uses a rack with an integrated piston which is guided on plain bearings within the rack housing. The pinion, which is attached to the valve unit, runs in bearings and meshes with the rack teeth. The rack is pressed against the pinion by a spring loaded yoke which ensures that the teeth mesh without any play. The pinion is connected to the valve unit via a torsion bar. The rotary motion of the steering wheel is converted into linear movement of the rack by the pinion and is initiated by the valve unit. This movement is transferred into movement of the road wheels by adjustable tie-rods.

The piston of the hydraulic power unit is located at one end of the gear housing. Each side of the piston is connected to fluid pressure or fluid return via external metal pipes which are connected to the valve unit. Each end of the gear has a threaded hole which provides for the fitment of the tie-rod. The external ends of the steering gear are sealed with boots which prevent the ingress of dirt and moisture and allow for vertical movement of the tie-rods with the suspension in addition to linear movement when the steering wheel is turned. The boots are serviceable items and are retained on the gear housing and the tie-rod with ties.

Valve Unit

- NOTE: Typical valve unit shown



E46943

Item	Part Number	Description
1	-	Rack
2	-	Pinion shaft
3	-	Outer sleeve
4	-	Oil sleeve
5	-	Dirt seal
6	-	Input shaft
7	-	Torsion bar
8	-	Circlip
9	-	Oil seal
10	-	PTFE ring
11	-	Steering gear housing
12	-	Slots
13	-	Pin - pinion shaft to outer sleeve
14	-	Oil seal
15	-	Pinion shaft teeth
16	-	Bearing
17	-	Pinion shaft nut

The valve unit is an integral part of the steering gear. The principle function of the valve unit is to provide power assistance (i.e. when parking) to optimize the effort required to turn the steering wheel. The pinion housing of the valve is an integral part of the main steering gear assembly.

The pinion housing has four machined ports which provide connections for pressure feed of the power steering pump, return fluid to the reservoir and pressure feeds to each side of the cylinder piston. A non-return valve and seal is fitted in the pressure feed port from the power steering pump. The valve unit comprises an outer sleeve, an input shaft, a torsion bar and a pinion shaft.

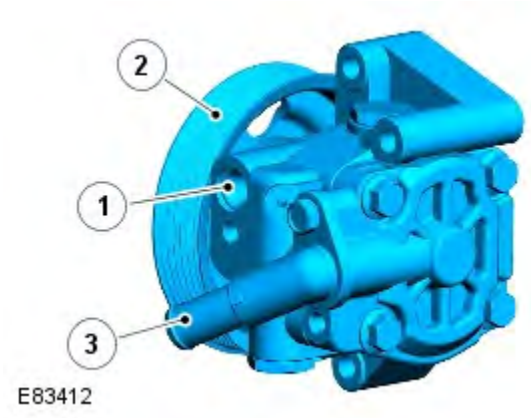
The valve unit is co-axial with the pinion shaft which is connected to the steering column via the input shaft. The valve unit components are located in the steering gear pinion housing which is sealed with a cap. The outer sleeve is located in the main bore of the pinion housing. Three annular grooves are machined on its outer diameter. PTFE rings are located between the grooves and seal against the bore of the pinion housing. Holes are drilled radially in each annular groove through the wall of the sleeve. The bore of the outer sleeve is machined to accept the input shaft. Six equally spaced slots are machined in the bore of the sleeve.

The ends of the slots are closed and do not continue to the end of the outer sleeve. The radial holes in the outer sleeve are drilled into each slot. The input shaft has two machined flats at its outer end which allow for the attachment of the steering column intermediate shaft yoke. The flats ensure that the intermediate shaft is fitted in the correct position to maintain the optimum phase angle. The inner end of the input shaft forms a dog-tooth which mates with a slot in the pinion shaft. The fit of the dog-tooth in the slot allows a small amount of relative rotation between the input shaft and the pinion shaft before the dog-tooth contacts the wall of the slot. This ensures that, if the power assistance fails, the steering can be operated manually without over stressing the torsion bar.

The central portion of the input shaft has equally spaced longitudinal slots machined in its circumference. The slots are arranged alternately around the input shaft. The torsion bar is fitted inside the input shaft and is an interference fit in the pinion shaft. The torsion bar is connected to the input shaft by a drive pin. The torsion bar is machined to a smaller

diameter in its central section. The smaller diameter allows the torsion bar to twist in response to torque applied from the steering wheel in relation to the grip of the tyres on the road surface. The pinion shaft has machined teeth on its central diameter which mate with teeth on the steering gear rack. A slot, machined in the upper end of the pinion shaft mates with the dog-tooth on the input shaft. The pinion shaft locates in the pinion housing and rotates on ball and roller bearings.

POWER STEERING PUMP - TD4



Item	Part Number	Description
1	-	Pressure output port (to steering gear valve unit)
2	-	Pulley
3	-	Suction port (from reservoir)

The pump is a variable displacement, vane type pump which supplies the required hydraulic pressure to the steering gear valve unit. The pump is located at the front of the engine and is driven by the Front Engine Auxiliary Drive (FEAD) Poly Vee belt which is directly driven from the crankshaft. The output from the pump increases proportionally with the load applied to the steering valve unit. A self-adjusting tensioner is fitted to maintain the correct tension on the belt.

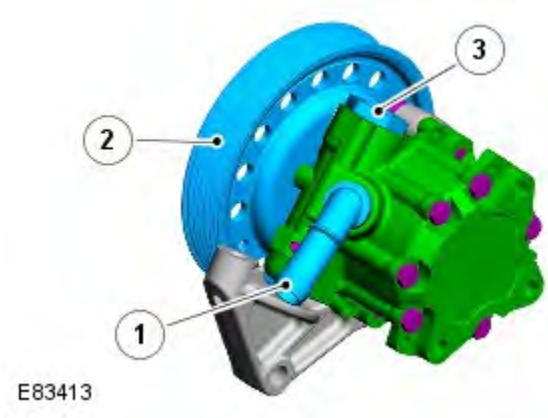
The pump consists of a cartridge set which consists of 11 vanes and a rotor. These are mounted on the input shaft and are surrounded by a variable displacement cam ring. The vanes rotate within the cam ring and are driven by the shaft. As the vanes rotate, the cam ring causes the space between the vanes to increase. This causes a depression between the vanes and fluid is drawn from the reservoir via the suction hose into the space between the vanes. As the shaft rotates, the inlet port is closed to the vanes which have drawn in fluid, trapping the fluid between the vanes. The cam ring causes the space between the vanes to reduce and consequentially compresses and pressurizes the hydraulic fluid trapped between them. Further rotation of the shaft moves the vanes to the outlet port. As the vanes pass the port plate, the pressurized fluid passes from the pump outlet port into the pressure hose to the steering gear.

The cam ring can move within the valve body. By moving the cam ring it is possible to vary the eccentricity of the shaft and the vanes in relation to the cam ring. As the eccentricity is decreased, the volume of hydraulic fluid trapped between the vanes decreases, maintaining a constant fluid output. This reduces the power and torque required to turn the pump and therefore improves engine economy. The pump has an internal regulating valve which controls the eccentricity of the cam ring and therefore varies the flow rate according to demand.

At low engine speeds, the internal displacement of the variable displacement pump is at its maximum to generate the controlled fluid output. As the pump speed increases with engine speed, the increased flow inside the pump generates a back pressure within the pump. This back pressure causes an internal regulating valve to move the the cam ring and reduce the internal displacement of the pump to maintian the constant fluid flow from the pump.

A regulating, pressure relief valve within the pump limits the maximum pressure supplied to the steering gear to 115 bar (1667 lbf in^2) ± 4 bar (58 lbf in^2) and also limits the maximum flow to 8.8 l/min (1.93 gal/min) ± 0.5 l/min (0.1 gal/min) at 10 bar (145 bf in^2). The pump has a displacement of 9.6 cc/rev (0.58in^3/rev).

POWER STEERING PUMP - i6



Item	Part Number	Description
1	-	Suction port (from reservoir)
2	-	Pulley

3	-	Pressure output port (to steering gear valve unit)

The pump is a fixed displacement, vane type pump which supplies hydraulic pressure to the steering gear valve unit. The pump is located at the rear of the engine and is driven by the Rear Engine Auxiliary Drive (READ) Poly Vee belt which is indirectly driven from the camshafts. The pump supplies a constant flow rate, therefore the output is independent of pump/engine speed. A self-adjusting tensioner is fitted to maintain the correct tension on the belt.

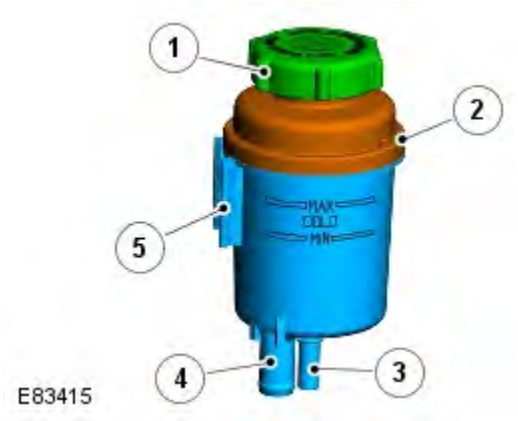
The pump contains a number of vanes which rotate within a cam ring and are driven by the input shaft. As the vanes rotate, the cam ring causes the space between the vanes to increase. This causes a depression between the vanes and fluid is drawn from the reservoir via the suction hose into the space between the vanes. As the shaft rotates, the inlet port is closed to the vanes which have drawn in fluid, trapping the fluid between the vanes. The cam ring causes the space between the vanes to reduce and consequentially compresses and pressurizes the hydraulic fluid trapped between them. Further rotation of the shaft moves the vanes to the outlet port. As the vanes pass the port plate the pressurized fluid passes from the pump outlet port into the pressure hose to the steering gear.

The pressurized fluid is subject to control by a flow control and pressure relief valve. The flow control valve maintains a constant flow of fluid supplied to the steering gear irrespective of engine speed variations. The pressure relief valve limits the maximum pressure on the output side of the pump. A metering orifice is included in the discharge port of the pump.

If the pressure in the orifice reaches a predetermined level, a spring loaded ball in the centre of the flow control valve is lifted from its seat and allows pressurized fluid to recirculate within the pump. The pressure relief valve will operate if the discharge from the pump is restricted, for example, steering held on full lock. If the output from the pump is blocked, all output is recirculated through the pump. In this condition, as no fresh fluid is drawn into the pump from the reservoir, the fluid temperature inside the pump will increase rapidly. Consequentially, periods of operation of the steering gear on full lock should be kept to a minimum to prevent overheating of the pump and the fluid within it.

The pump has an internal pressure relief valve which also incorporates a flow control valve. The pressure relief valve limits the maximum pressure supplied to the steering gear to 125 bar (1812 lbf in^2) ± 4 bar (58 lbf in^2). The flow control valve limits the maximum flow to 8.8 l/min (1.93 gal/min) ± 0.5 l/min (0.1 gal/min) at 10 bar (145 bf in^2) The pump has a displacement of 11 cc/rev (0.67 in^3/rev).

RESERVOIR



Item	Part Number	Description
1	-	Cap
2	-	Body
3	-	Return connection (DW12 - from steering gear) (i6 - from fluid cooler)
4	-	Suction connection (to power steering pump)
5	-	Bracket attachment mouldings

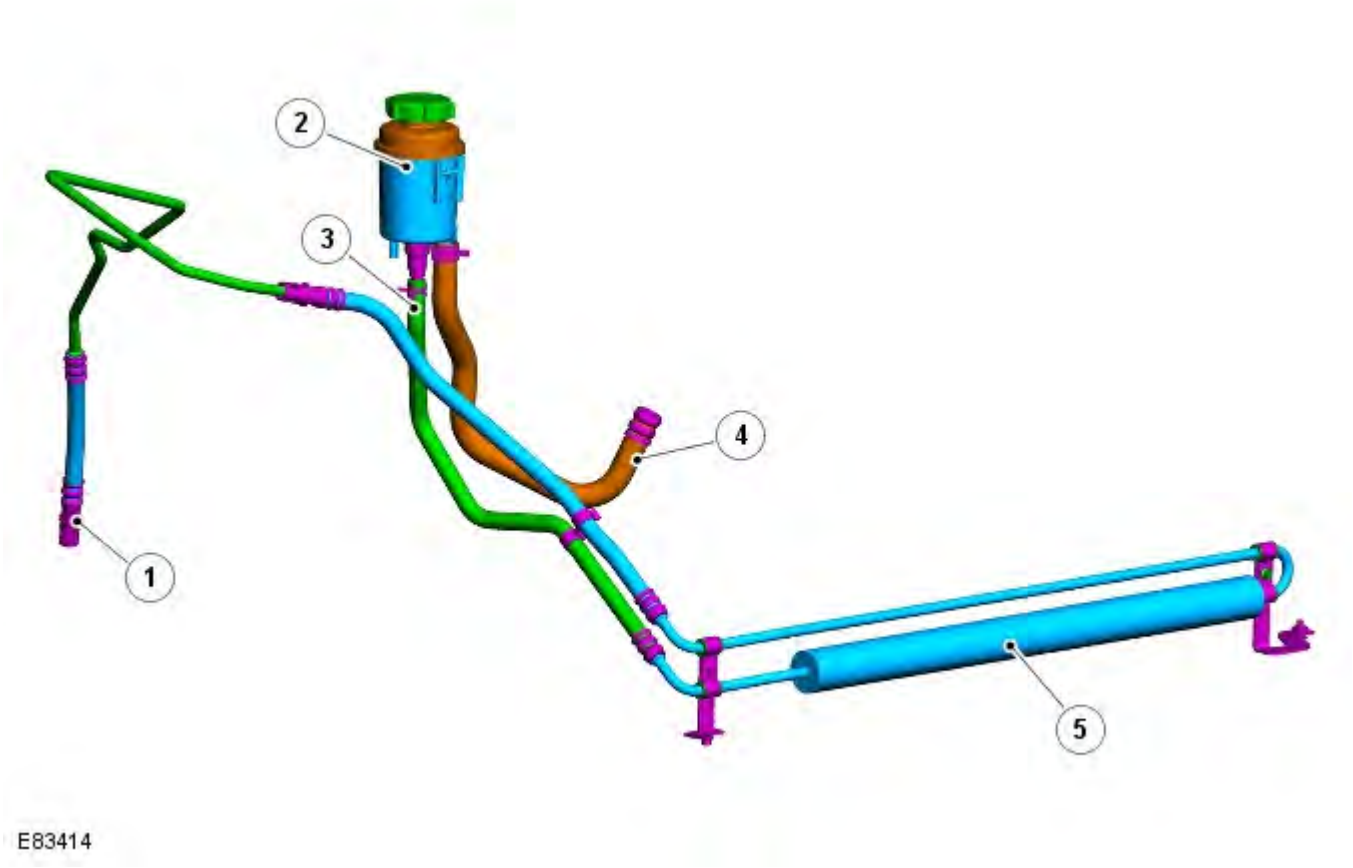
The fluid reservoir is located on a bracket in the RH side of the engine compartment, behind the headlamp assembly. The reservoir comprises a body, cap and filter. The purpose of the reservoir is to contain a surplus of the hydraulic fluid in the system to allow for expansion and contraction of the fluid due to temperature variations.

The fluid level ensures that the supply connection on the bottom of the reservoir is covered with fluid at all operating vehicle attitudes. Any air which is present in the system is exhausted from the system in the reservoir.

The body is a plastic moulding with two ports at the bottom which provide for the connection of the suction supply and return hoses. Moulded markings on the side of the reservoir denote the upper and lower fluid levels. A non-serviceable, 100 micron nylon mesh filter is fitted in the body. The filter removes particulate matter from the fluid before it is drawn into the pump supply connection. Maximum and minimum fluid levels are moulded into the body and assist checking fluid levels when the hydraulic fluid is cold.

The cap is rotated counterclockwise to release from the body. The cap is fitted with an O-ring to prevent fluid leakage and incorporates a breather hole to allow for changes in fluid level during operation and prevent vacuum or pressurization of the reservoir.

FLUID COOLER (i6 ONLY)



E83414

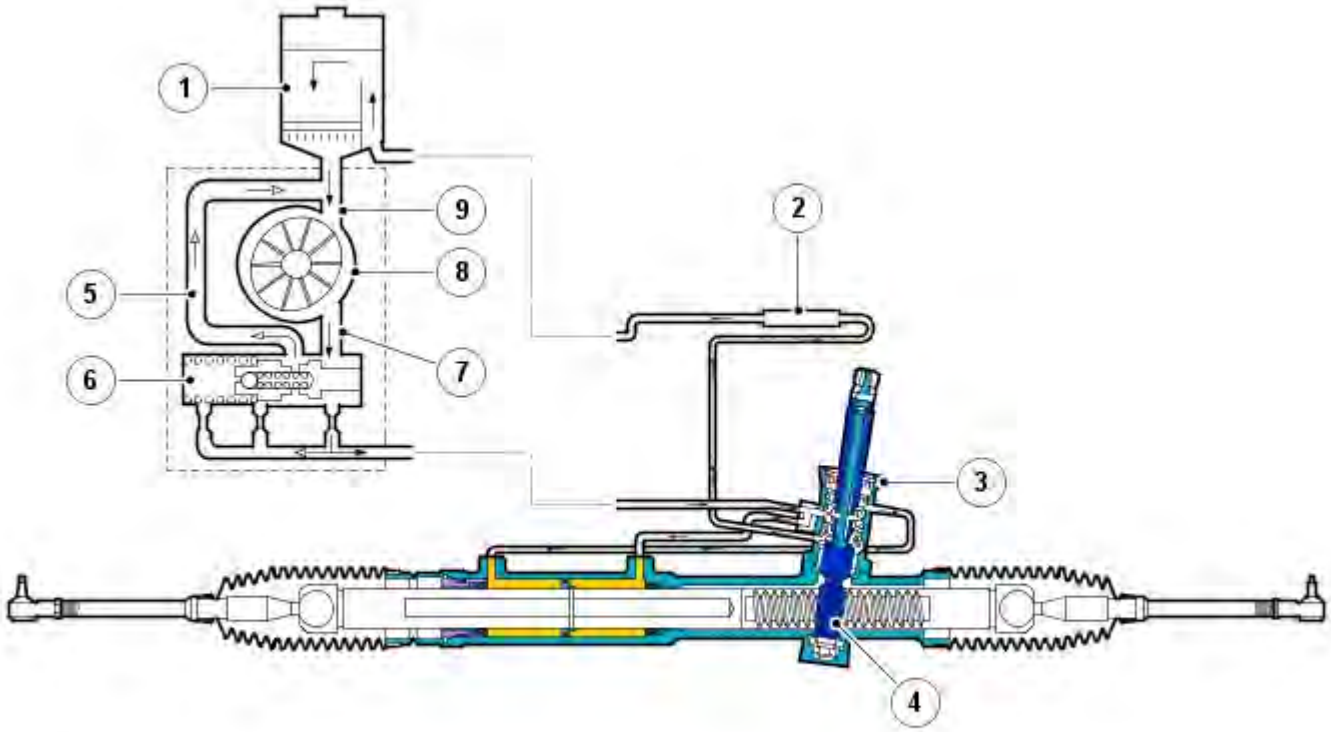
Item	Part Number	Description
1	-	Fluid return (from steering gear)
2	-	Reservoir
3	-	Fluid return (from fluid cooler)
4	-	Suction hose (to power steering pump)
5	-	Fluid cooler

The fluid cooler is located in the return line from the steering gear to the reservoir. The cooler comprises flexible hoses which connect between the reservoir and the return pipe from the steering gear. The cooler is an integral part of the hoses and cannot be replaced as a separate component.

The cooler is a fabricated aluminum tube, through which the power steering fluid passes and is located in front of the engine cooling radiator and the Air Conditioning (A/C) condenser. The outer diameter of the cooler tube has aluminum loops attached to it which dissipate heat. Cool air entering the front of the vehicle passes over the cooler and flows through the loops. The loops act as heat exchangers, conducting heat from the fluid as it passes through the tube.

PRINCIPLES OF OPERATION

Fixed Displacement Pump Schematic - Typical



E46944

Item	Part Number	Description
1	-	Reservoir
2	-	Fluid cooler
3	-	Valve unit
4	-	Steering rack and pinion
5	-	Flow control/pressure relief - return
6	-	Flow control/pressure relief valve
7	-	Output port
8	-	Power steering pump
9	-	Low pressure suction line

When the engine is started the power steering pump draws fluid from the reservoir into the low pressure suction line. The fluid passes through the pump and emerges as pressurized fluid at the outlet port. The high pressure hose passes the pressurized fluid to the steering gear valve unit.

If no steering effort is applied, there is minimal restriction within the system and the supply pressure from the pump is low. Minimal pressure is applied, via the valve unit, to each side of the piston in the hydraulic cylinder and the full flow from the power steering pump returns to the reservoir via the fluid cooler.

When steering effort is applied in either direction, the return flow of fluid to the reservoir is restricted by the valve unit, causing the supply pressure from the pump to increase. The pressurized fluid is directed by the valve unit to the applicable side of the piston in the hydraulic cylinder, providing the power assistance required to reduce the steering effort. Fluid displaced from the low pressure side of the cylinder is returned via the valve unit and fluid cooler to the reservoir. The fluid cooler reduces the fluid temperature improving fluid performance and also prolongs the life of hoses and seals in the system.

Published: 11-May-2011

Power Steering - Power Steering

Diagnosis and Testing

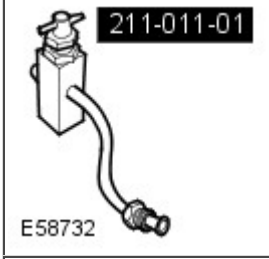
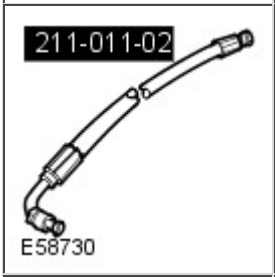
For additional information.
REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Power Steering - Power Steering Pressure TestTD4 2.2L Diesel

General Procedures

Special Tool(s)

	211-011-01 Valve Block, Power Steering Pressure Test
	211-011-02 Hose, Power Steering Pressure Test
	211-011-12 Adapter, Power Steering Pressure Test
	211-287 Hose and Gauge, Power Steering Pressure Test

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

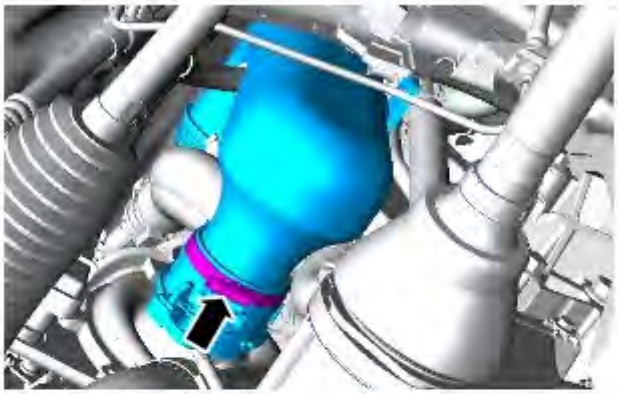
2. Remove the engine cover.

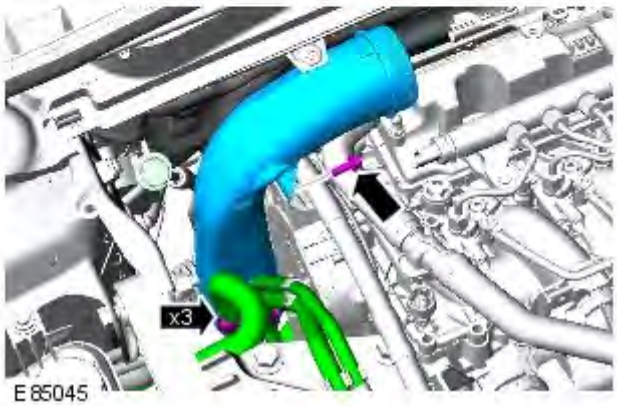
   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. **3.** WARNING: Make sure to support the vehicle with axle stands.

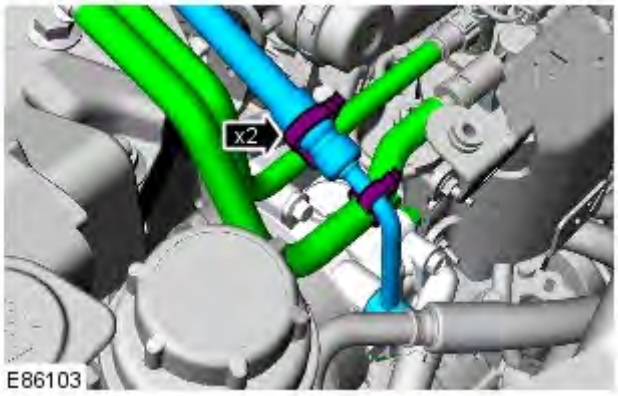
   Raise and support the vehicle.

4.

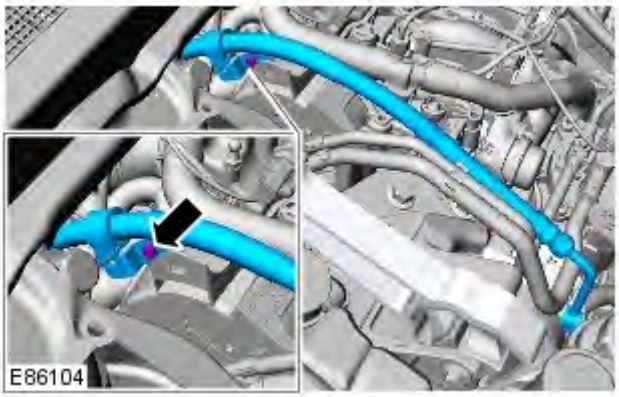




5. Remove and discard the 2 cable ties.

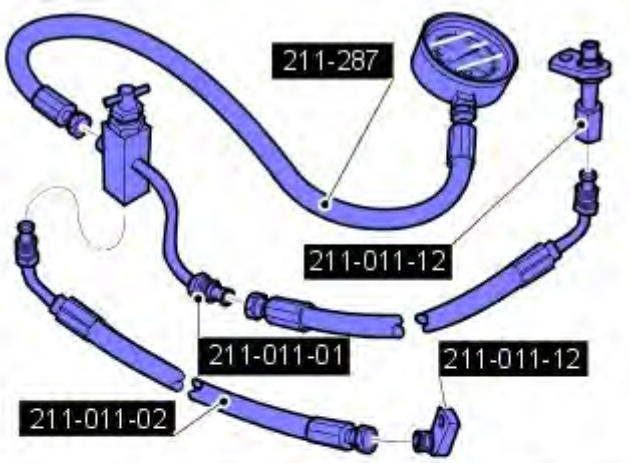


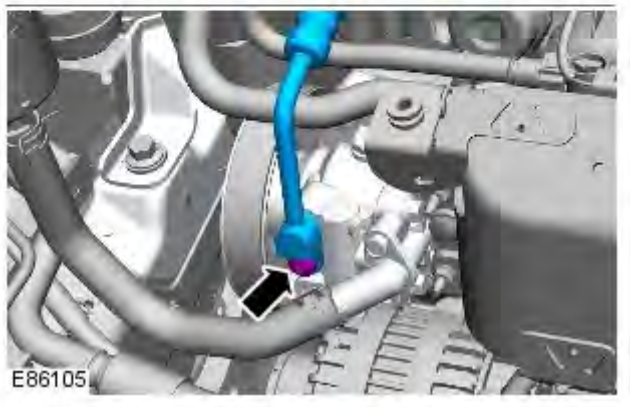
6.



8. Position an absorbent cloth to collect fluid spillage.
7. **7.** CAUTION: Discard fluid siphoned from the power steering system.

   Siphon the fluid from the power steering reservoir.





9. **9.** CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

   • NOTE: Some fluid spillage is inevitable during this operation.

   • NOTE: Care must be taken to avoid contamination of the accessory drive belt.

   Disconnect the power steering high-pressure pipe union.

10.
   - Install the O-ring seal.
   - Install the special tools.

     Special Tool(s): 211-011-12, 211-011-02, 211-011-02, 211-011-01, 211-287
   - Tie the pressure gauge aside under the hood.

11. **11.** CAUTION: Only use new fluid from a sealed container.

    Refill and bleed the power steering.

    Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

12. Connect the battery ground cable.

13. **13.** NOTE: Make sure the steering components and test equipment are free from leaks.

    • NOTE: Maintain the maximum fluid level during the test.

    • NOTE: Make sure the steering is in the straight ahead position.

    - With the test valve open start the engine.
    - Turn the steering fully lock to lock, stop the engine.
    - Top-up the power steering fluid reservoir.

14. For power steering pressures, refer to the steering specification section.

    Refer to: Specifications (211-02 Power Steering, Specifications).

15. **15.** CAUTION: Do not hold steering at full lock for longer than

10 seconds.

- With the engine at idle, slowly turn the steering wheel and hold on full lock.
- Record the pressure reading.

16.
- Repeat the above procedure for the other side.
- Record the pressure reading.

17. With the engine at idle, release the steering wheel. The pressure should be, at or below, the pressure specified.

18. Pressure outside this tolerance, indicates a fault.

19. **19.** CAUTION: Pump damage will occur if the test valve is closed for longer periods.

    To determine if the fault is in the steering pump or the steering rack, close the test valve for a maximum of 5 seconds.

20. If the pressures recorded fall outside the given values, replace the power steering pump.

21. If the maximum pump pressure is correct, then suspect the power steering rack.

22. **22.** CAUTION: Discard fluid siphoned from the power steering system.

    On completion of the test stop the engine, disconnect the battery ground cable and siphon the fluid from the power steering reservoir.

23. Disassemble the test equipment.

24.
- Clean the component mating faces.
- Install a new O-ring seal.
- Connect the high-pressure line to the power steering pump.
- *Torque:* 22 Nm

25. Secure the power steering high pressure pipe support bracket.

26. Secure the fuel lines to the power steering high pressure pipe with new cable ties.

27. Install the turbocharger intake tube.

28. Install the engine cover.

    Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

29. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

30. **30.** CAUTION: Only use new fluid from a sealed container.

    Refill and bleed the power steering.

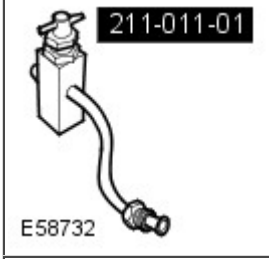
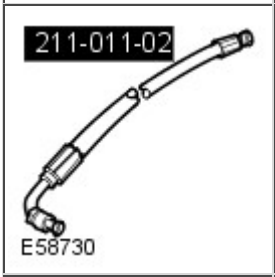
Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Published: 11-May-2011

Power Steering - Power Steering Pressure TestI6 3.2L Petrol

General Procedures

Special Tool(s)

	211-011-01 Valve Block, Power Steering Pressure Test
	211-011-02 Hose, Power Steering Pressure Test
	211-011-11 Hose, Power Steering Pressure Test
	211-287 Hose and Gauge, Power Steering Pressure Test
	211-313 Adapter, Power Steering Pressure Test
	211-325 Adapter, Power Steering Pressure Test

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

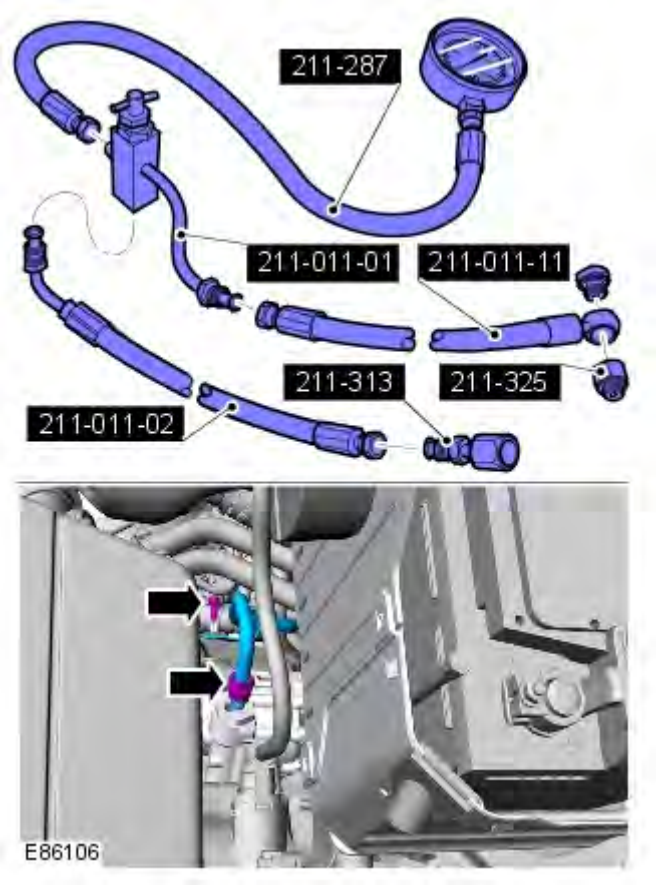
2. Remove the air cleaner housing.

Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

3. **3.** CAUTION: Discard fluid siphoned from the power steering system.

   Siphon the fluid from the power steering reservoir.

4. Position an absorbent cloth to collect fluid spillage.



5. **5.** CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

   • NOTE: Some fluid spillage is inevitable during this operation.

   • NOTE: Care must be taken to avoid contamination of the accessory drive belt.

   Disconnect the power steering high-pressure pipe union.

6.
   - Install the O-ring seal.
   - Install the special tools.

     Special Tool(s): 211-313, 211-011-02, 211-011-11, 211-011-01, 211-287, 211-325
   - Tie the pressure gauge aside under the hood.

7. **7.** CAUTION: Only use new fluid from a sealed container.

   Refill and bleed the power steering.

   Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

8. Connect the battery ground cable.

9. **9.** NOTE: Make sure the steering components and test equipment are free from leaks.

   • NOTE: Maintain the maximum fluid level during the test.

   • NOTE: Make sure the steering is in the straight ahead position.

   - With the test valve open start the engine.

- Turn the steering fully lock-to-lock, stop the engine.
- Top-up the power steering fluid reservoir.

10. For power steering pressures, refer to the steering specification section.

    Refer to: Specifications (211-02 Power Steering, Specifications).

11. **11.** CAUTION: Do not hold steering at full lock for longer than 10 seconds.

    - With the engine at idle, slowly turn the steering wheel and hold on full lock.
    - Record the pressure reading.

12.
    - Repeat the above procedure for the other side.
    - Record the pressure reading.

13. With the engine at idle, release the steering wheel. The pressure should be, at or below, the pressure specified.

14. Pressure outside this tolerance, indicates a fault.

15. **15.** CAUTION: Pump damage will occur if the test valve is closed for longer periods.

    To determine if the fault is in the steering pump or the steering rack, close the test valve for a maximum of 5 seconds.

16. If the pressures recorded fall outside the given values, replace the power steering pump.

17. If the maximum pump pressure is correct, then suspect the power steering rack.

18. **18.** CAUTION: Discard fluid siphoned from the power steering system.

    On completion of the test stop the engine, disconnect the battery ground cable and siphon the fluid from the power steering reservoir.

19. Disassemble the test equipment.

20.
    - Clean the component mating faces.
    - Install a new O-ring seal.
    - Connect the high-pressure pipe union to the power steering pump.
    - *Torque:* 25 Nm

21. Install the air cleaner housing.

    Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

22. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

23. **23.** CAUTION: Only use new fluid from a sealed container.

    Refill and bleed the power steering.

    Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Published: 11-May-2011

Power Steering - Power Steering PumpI6 3.2L Petrol

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

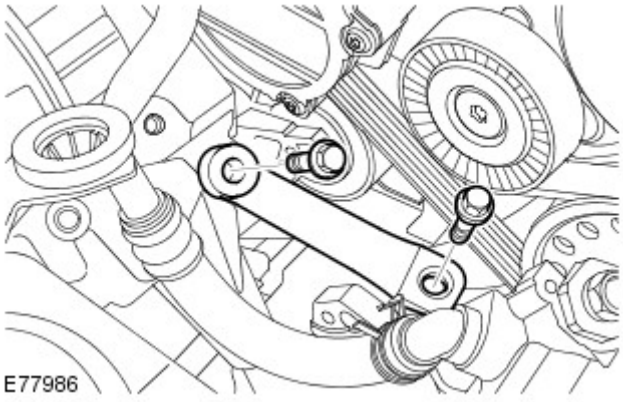
3. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

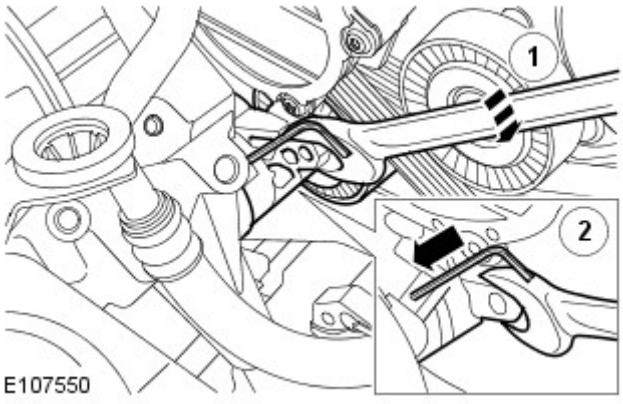
4. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

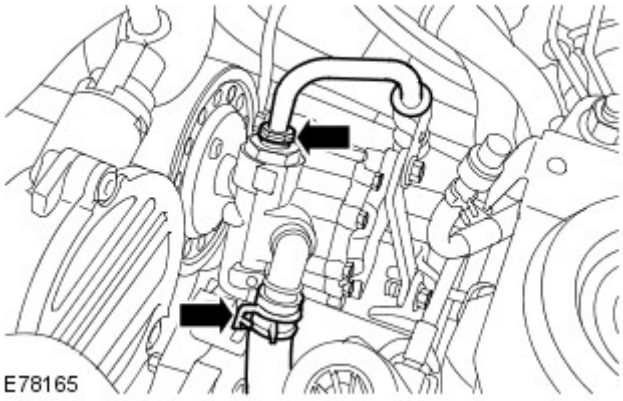
5. Siphon the fluid from the power steering reservoir.



6. Remove the A/C compressor, lower support bracket.



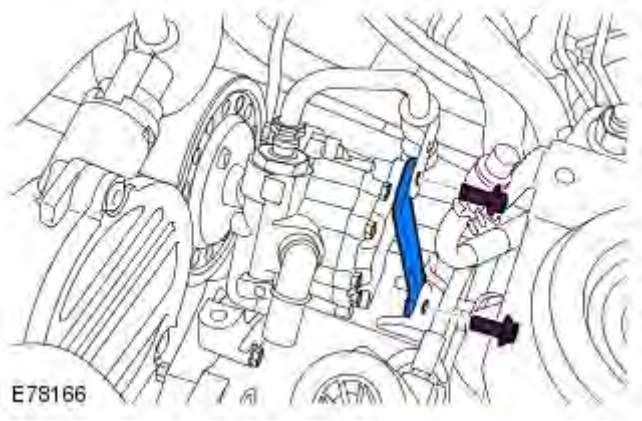
7. Using suitable tools, release the accessory drive belt tension.



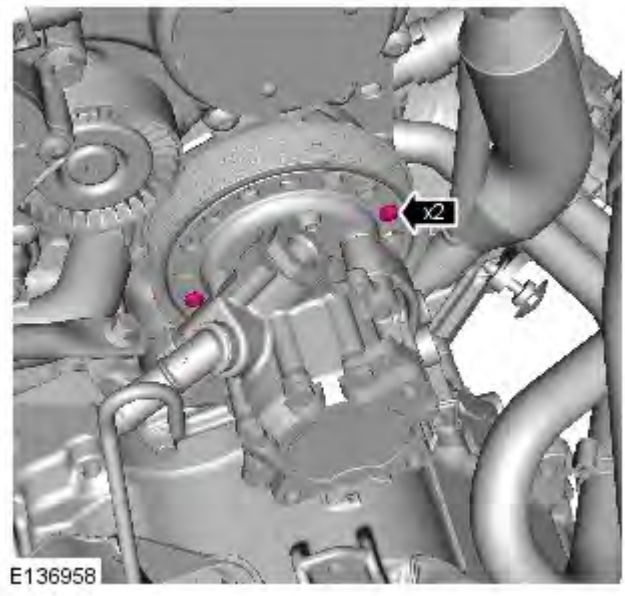
8. **8.** CAUTION: Be prepared to collect escaping fluids.

   • NOTE: Make sure that all openings are sealed.

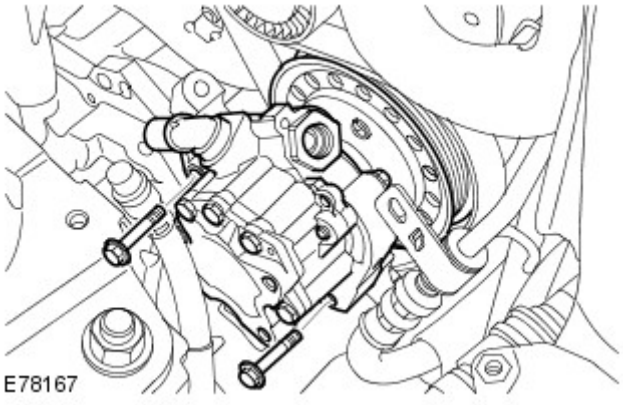
   Disconnect the power steering fluid lines.



9. Release the power steering pump support bracket.



10. Remove the coolant pump drive retaining screws.



11. **11.** NOTE: Note the orientation of the coolant pump drive for installation.

    Remove the power steering pump.

Installation

1. **1.** CAUTION: Make sure that the coolant pump drive is located to the retaining spring.

   • NOTE: Make sure that the coolant pump drive is installed to the noted position in the power steering pump pulley.

   Install the power steering pump.

   Torque: 25 Nm

2. Install the coolant pump drive retaining screws.

   Torque: 10 Nm

3. **3.** CAUTIONS:

   Extreme cleanliness must be exercised when handling these components.

   A new O-ring seal is to be installed.

   Connect the power steering fluid lines.

   Torque: 27 Nm

4. Install the accessory drive belt.

5. Install the A/C compressor, lower support bracket.

   Torque: 25 Nm

6. Install the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

7. Install the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

8. Install the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

9. Fill and bleed the power steering system.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, General Procedures).

10. Connect the battery ground cable and install the cover.

Published: 11-May-2011

Power Steering - Power Steering PumpTD4 2.2L Diesel

Removal and Installation

Removal

CAUTION: Always plug any open connections to prevent contamination.

1. Remove the engine cover.

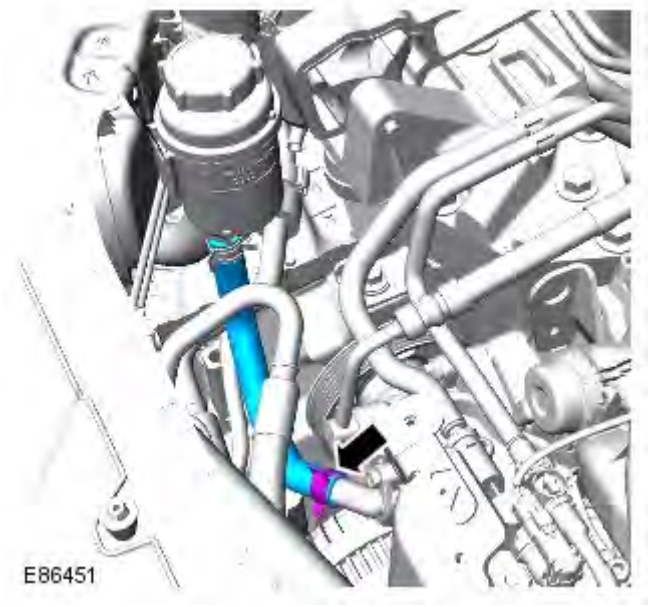
   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

3. **3.** WARNING: Power steering fluid is extremely flammable. Make sure that power steering fluid is not spilt over the engine and that the power steering fluid reservoir cap is sealed.

   Siphon the fluid from the power steering reservoir.



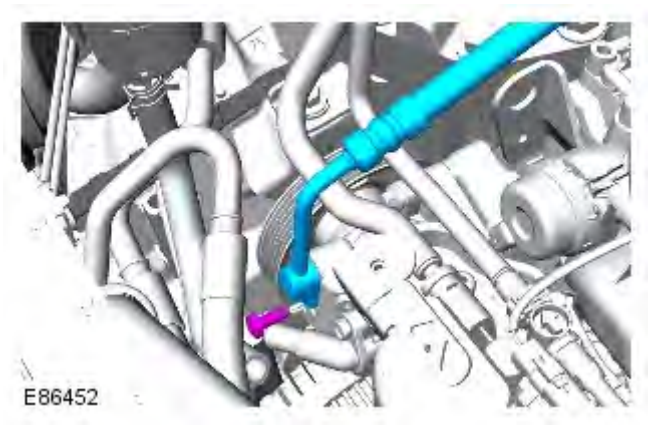
4. **4.** CAUTIONS:

   Be prepared to collect escaping oil.

   Make sure that the area around the component is clean and free of foreign material.

   Always plug any open connections to prevent contamination.

   - Position a container to collect the oil spillage.

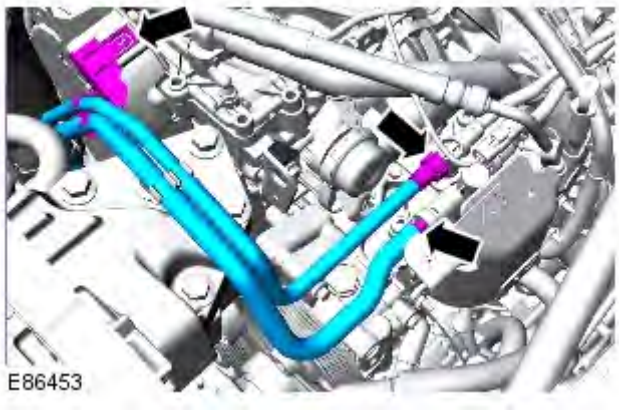


5. **5.** CAUTIONS:

   Be prepared to collect escaping oil.

   Make sure that the area around the component is clean and free of foreign material.

   Always plug any open connections to prevent contamination.

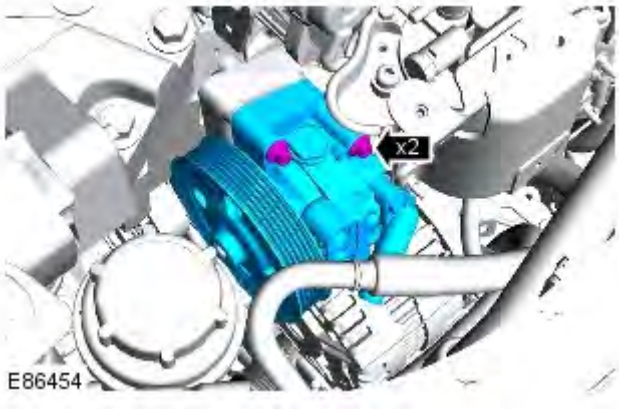


6. **6.** CAUTIONS:

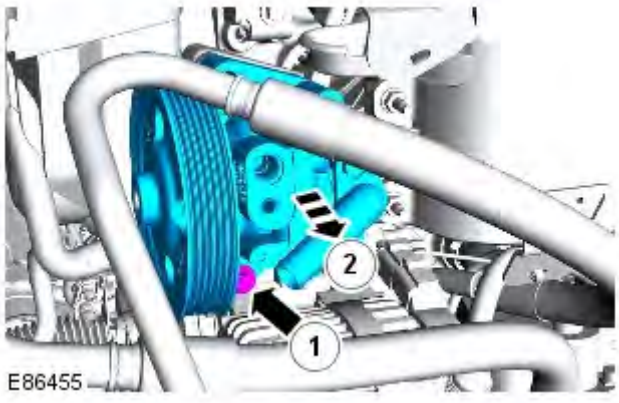
   Be prepared to collect escaping fuel.

   Make sure that the area around the component is clean and free of foreign material.

   Always plug any open connections to prevent contamination.



7.



8.

Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Install the power steering pump.

   Torque: 24 Nm

2. Connect the fuel lines.

3. Connect the high-pressure power steering line to the power steering pump.

   Torque: 20 Nm

4. Connect the power steering reservoir to power steering pump hose.
5. Install the accessory drive belt.

Refer to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

6. Install the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. Fill and bleed the power steering system.

   Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Published: 11-May-2011

Power Steering - Steering Gear

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

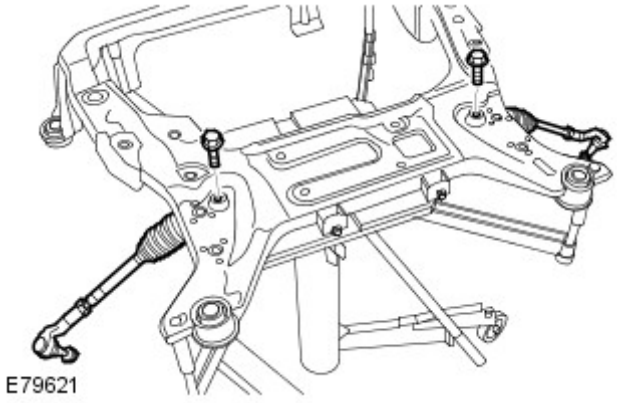
2. Remove the front road wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the front subframe assembly.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

4. Remove the steering gear.



Installation

1. Install the steering gear.

   Torque: 105 Nm

2. Install the front subframe.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

3. Install the wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

4. Refill and bleed the power steering.

   Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

5. Using only four wheel alignment equipment approved by Land Rover, check and adjust the wheel alignment.

Published: 11-May-2011

Power Steering - Power Steering Fluid Cooler

Removal and Installation

Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the front wheels and tires.

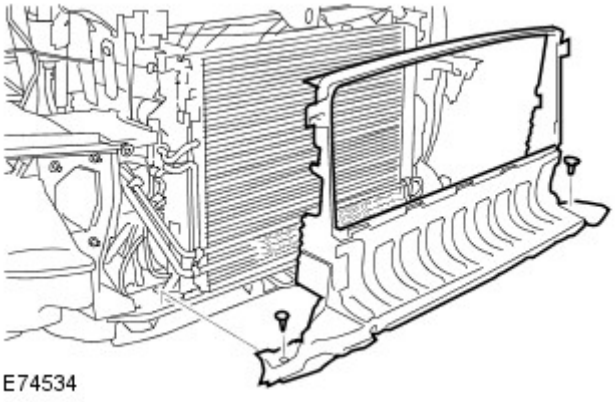
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the front bumper.

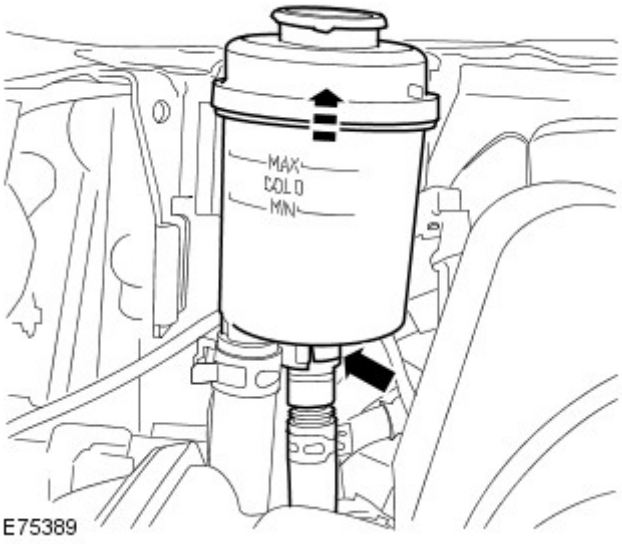
   Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

4. Remove the RH headlamp assembly.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

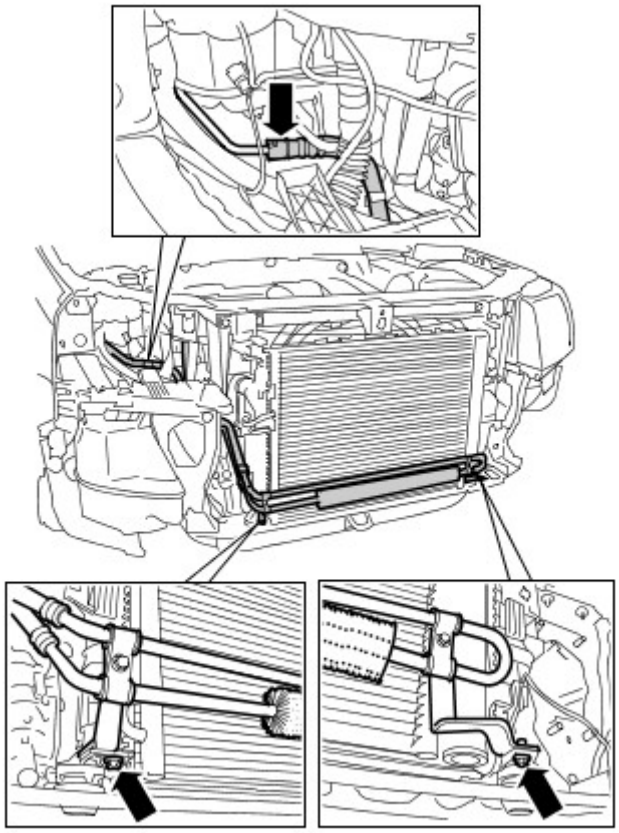


5.



6.

- Release the power steering fluid reservoir.
- Disconnect the quick release connector.


E74536

7.
- *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

2. Check and top-up power steering fluid level.

   Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

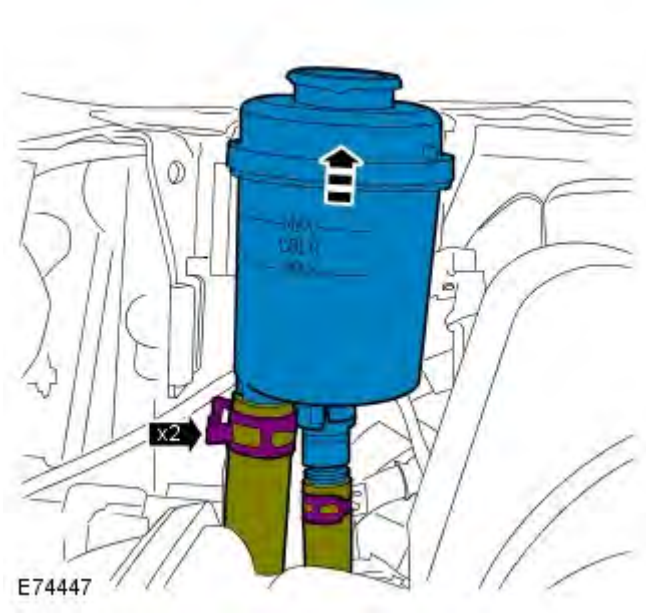
Published: 11-May-2011

Power Steering - Power Steering Fluid Reservoir

Removal and Installation

Removal

1. Remove the power steering fluid reservoir cap.
2. Using a suitable syringe, remove the power steering fluid from the power steering fluid reservoir.



3. **3.** CAUTIONS:

   Be prepared to collect escaping fluids.

   Make sure that all openings are sealed. Use new blanking caps.

   Remove the power steering fluid reservoir.

Installation

1. To install, reverse the removal procedure.
2. Fill and bleed the power steering system.

   Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Published: 11-May-2011

Steering Linkage -

Torque Specifications

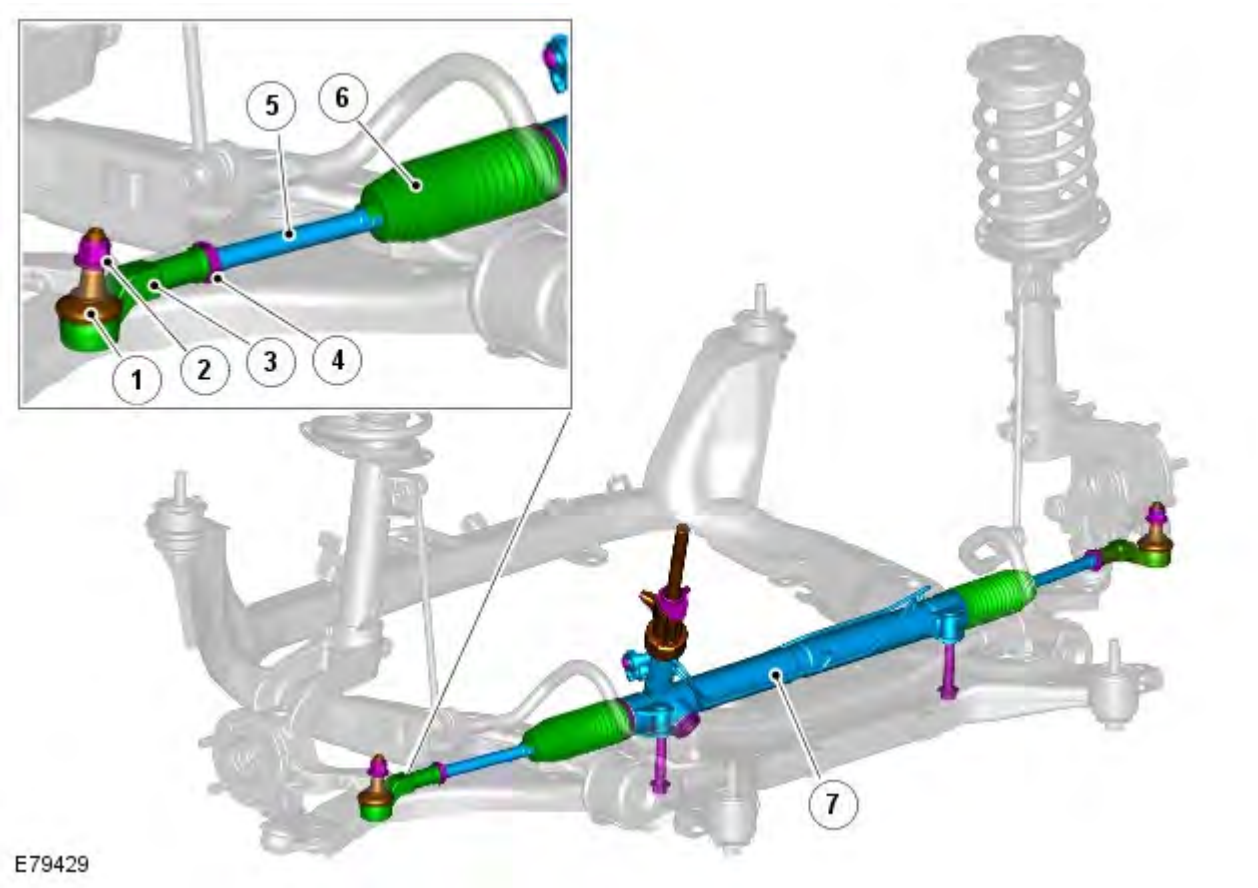
Description	Nm	lb-ft
Tie-rod end nut	70	52
Tie-rod locking nut	55	41

Published: 11-May-2011

Steering Linkage - Steering Linkage

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Ball joint
2	-	Locknut
3	-	Tie rod end
4	-	Locknut
5	-	Tie rod
6	-	Steering gear boot
7	-	Steering gear

OVERVIEW

The outer ends of the tie rods are threaded to allow the fitment of the tie rod ends. The tie rod ends are screwed onto the tie rods and locked with locknuts to prevent inadvertent movement. The thread on the tie rod allows the position of the tie rod end to be adjusted in order to set the correct toe angle for each front wheel. The tie rod has a ball fitting which is screwed into the end of the steering gear. A boot is fitted to the steering gear to protect the ball fitting from dirt and moisture.

The tie rod end comprises a forged housing with a threaded bore for attachment to the tie rod. The tie rod end incorporates a non-serviceable tapered ball joint which locates in a tapered hole in the front wheel knuckle and is secured with a self-locking nut. The ball joint has an internal hexagonal drive which enables the joint to be held stationary when the self-locking nut is tightened.

Published: 11-May-2011

Steering Linkage - Steering Linkage

Diagnosis and Testing

For additional information.
REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Steering Linkage - Tie Rod End

Removal and Installation

Special Tool(s)

	205-754 Splitter, Ball Joints

Removal

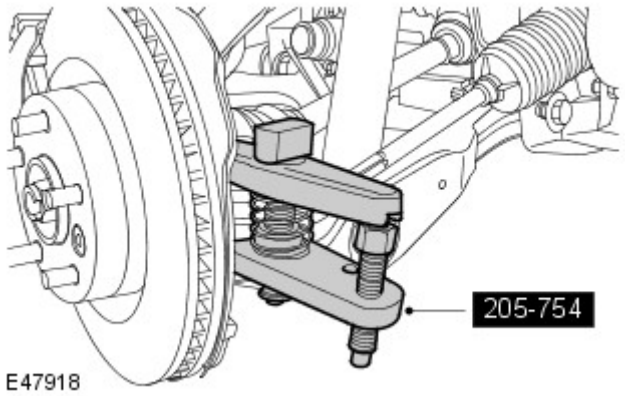
1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

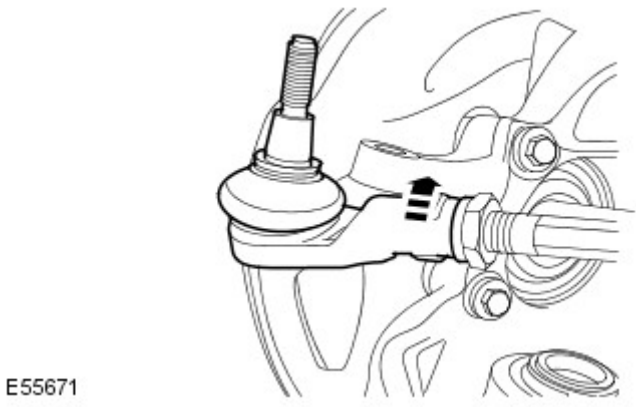
3. Loosen the tie-rod end lock nut.



4. **4.** CAUTION: Make sure that the ball joint ball does not rotate.

   Release the tie-rod end ball joint from the wheel knuckle.

   Special Tool(s): 205-754



5. **5.** CAUTION: Note the number of turns when removing the tie rod end to aid installation.

   Remove the tie-rod end.

Installation

1. **1.** CAUTION: Make sure that the tie rod end is installed with

the same number of turns as when removed.

Install the tie-rod end.

2. **2.** WARNING: Make sure that a new tie-rod end nut is installed.

   • CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that the ball joint ball does not rotate.

   Connect the tie-rod end ball joint.

   Torque: 70 Nm

3. **3.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Tighten the tie-rod locking nut.

   Torque: 55 Nm

4. Install the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

5. Using only four wheel alignment equipment approved by Land Rover, check and adjust the wheel alignment.

Published: 11-May-2011

Steering Linkage - Steering Gear Boot

Removal and Installation

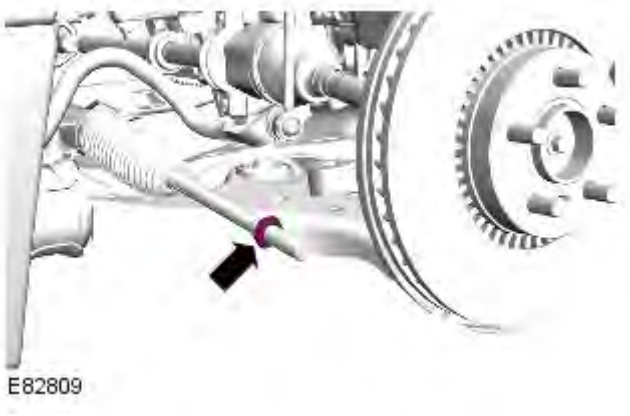
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

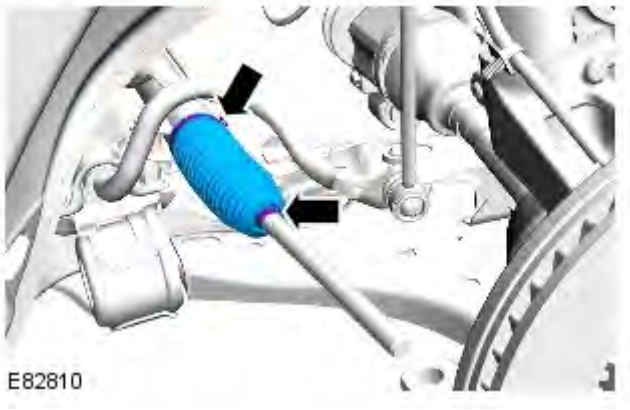
   Raise and support the vehicle.

2. Remove the tie rod end.

   Refer to: Tie Rod End (211-03 Steering Linkage, Removal and Installation).



3. **3.** NOTE: Note the fitted position.



4.

Installation

1. **1.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that the boot is correctly located.

   To install, reverse the removal procedure.

Published: 11-May-2011

Steering Column -

General Specification

Item	Specification
Upper column	Manual column with tilt and reach adjustment

Torque Specifications

Description	Nm	lb-ft
Heatshield lower bolts (2) to steel pinion tower	3.2	2.3
Heatshield upper bolt (1) to plastic seal	2.4	1.77
Steering column bolts	25	18
Steering wheel bolt	48	35
Universal joint to steering gear bolt*	25	18

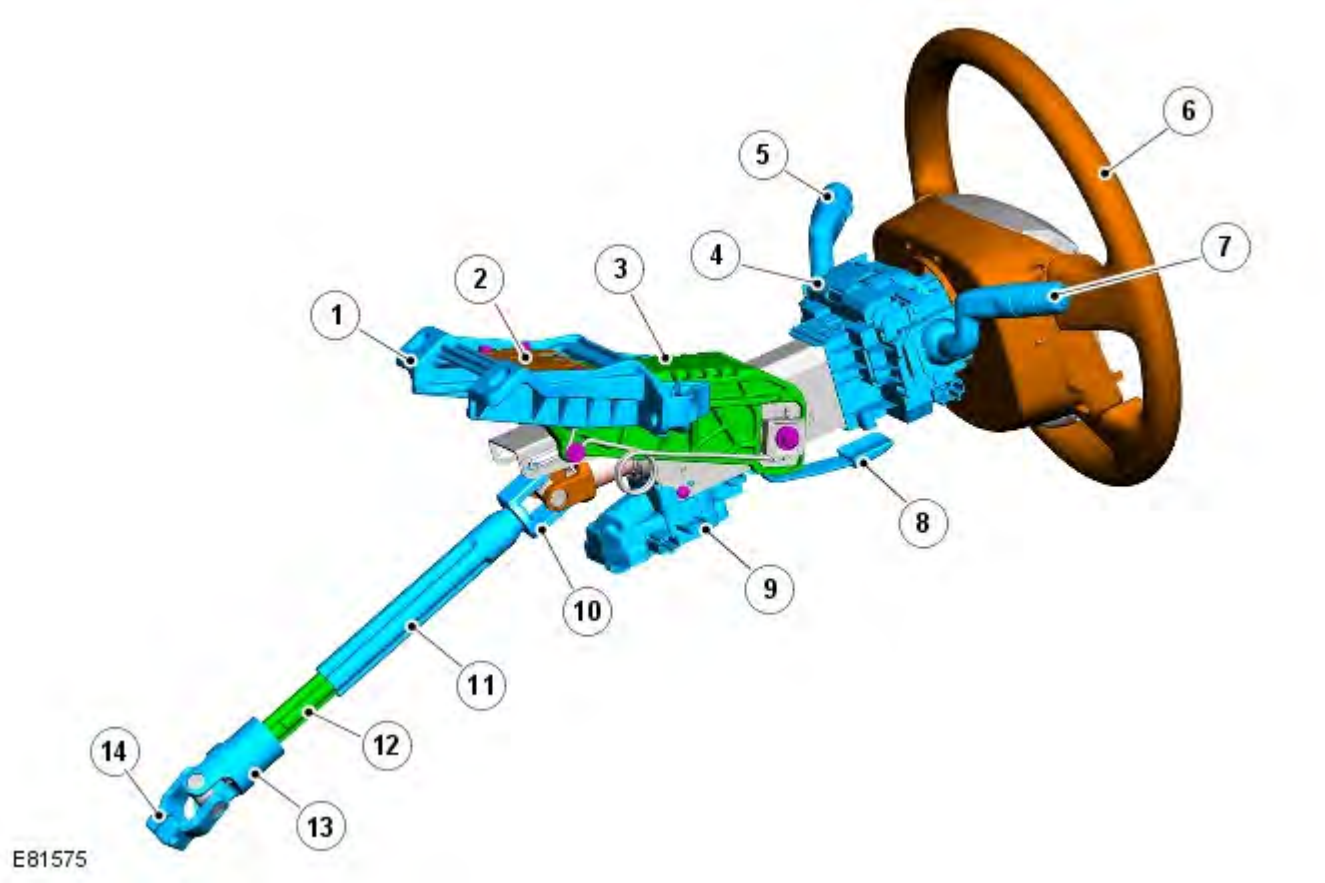
*** New nuts/bolts must be fitted**

Published: 11-May-2011

Steering Column - Steering Column

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Outer bracket
2	-	Energy management plate
3	-	Inner bracket
4	-	Clockspring, steering wheel angle sensor and steering wheel module
5	-	Right Hand (RH) multifunction switch
6	-	Steering wheel
7	-	Left Hand (LH) multifunction switch
8	-	Steering column adjustment lever
9	-	Electric steering column lock
10	-	Upper yoke
11	-	Outer tube
12	-	Inner tube
13	-	Lower yoke
14	-	Clamp bolt

• NOTE: On North American Specification (NAS) vehicles, a running change was introduced during 2008 Model Year (MY) to disable the electric steering column lock. Under the change, the internal electronics (printed circuit board (PCB), motor, etc.) of the lock have been removed and the lock has been disabled in the car configuration file. The change is incorporated on VIN (vehicle identification number) 082896, 085531, 085622, 085685, 085832, 085891, 085942, 085987, 086049, 086081, 086123, 086178, 086276, 086287, 086309, 086363, 086383, 086389, 086398, 086403 and 091770 onwards.

• NOTE: Items 10, 11, 12 and 13 are components of the intermediate shaft.

OVERVIEW

The steering column is bolted to a magnesium steering column frame which is an integral part of the cross-car beam located behind the instrument panel. The cross car beam is manufactured from a combination of steel tension members and ultra-lightweight diecast magnesium carriers. The beam not only forms an armature around which the fascia is constructed, but is also an integral part of the vehicle's crash structure.

Steering wheel position can be moved by adjusting the column upper for reach or rake, whilst soft-stops are used to minimize adjustment noise in fore-aft movements. The adjustable upper column is designed to manage crash energy in the horizontal plane.

The intermediate shaft can collapse telescopically to prevent uncontrolled steering wheel displacement during an impact.

The column lintermediate shaft is produced from steel tube for good rigidity. This is bonded to a stiff thin-walled

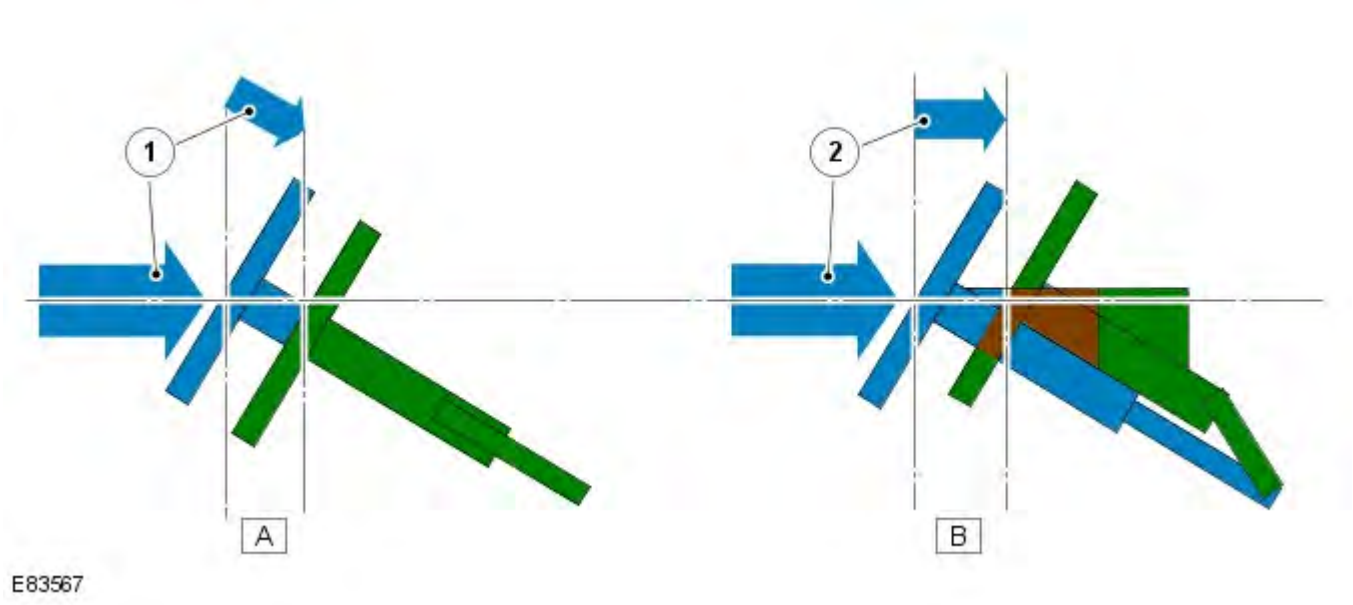
elastomer to isolate road noise.

IMPACT PROTECTION

In a serious impact, the steering column is designed to manage two simultaneous events; the intermediate shaft must isolate the steering wheel from any movement of the steering rack (if the angle of the steering wheel changes it will affect the way in which the airbag deploys towards the driver).

In addition, to prevent excessive force causing injury as the driver strikes the airbag, the whole upper-column assembly is designed to progressively move forwards as the driver contacts the airbag. This motion helps to safely and progressively decelerate the driver. The steering column has a 'Horizontal Load Limiting' system which differs from conventional designs that rely on movement along the column axis.

Horizontal Load Limiting System



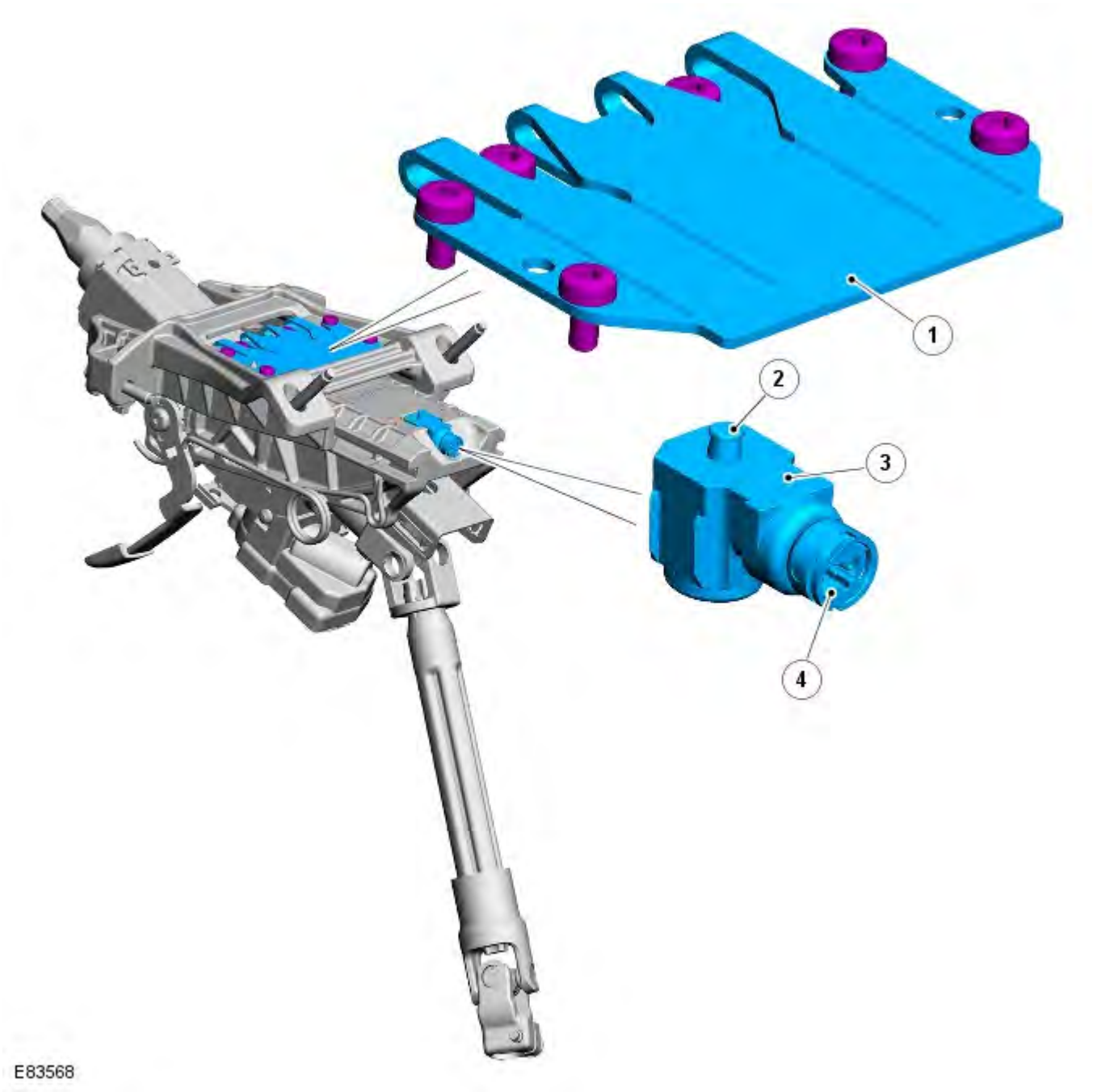
Item	Part Number	Description
A	-	Conventional steering column design
B	-	Horizontal load limiting system
1	-	Mismatch between direction of force and motion
2	-	Motion aligned to force

The Horizontal Load Limiting System provides a progressive and stable load limiting characteristic as shown in 'B' in the illustration. Loads applied to the column cause the column to move horizontally with the driver. This movement is controlled by an energy management plate. The plate has leaves which peel back in a controlled manner, absorbing energy and allowing the column to move with the driver.

The plate is bolted to the steering column outer bracket attached to cross-car beam and the inner bracke

Pyrotechnic Additional Load Device - North American Specification (NAS) Only

• NOTE: Steering column shown deployed for clarity



Item	Part Number	Description
1	-	Energy management plate
2	-	Pin
3	-	Pyrotechnic device
4	-	Electrical connector

On NAS market vehicles, an additional pyrotechnic device is fitted to provide increased energy absorption to allow for a driver not wearing a seat belt. If the driver is wearing a seatbelt and a crash situation occurs, the device is not activated.

The pyrotechnic device is located below the energy management plate. When the system detects that the driver's seat belt is not buckled, and a crash situation occurs which activates the airbags, the device fires, which retracts the pin engaged in a hole in the central leaf in the energy management plate. This provides the required increase in energy absorption to allow for the additional loading caused by the unrestrained driver.

Published: 11-May-2011

Steering Column - Steering Column

Diagnosis and Testing

For additional information.
REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Steering Column - Steering Wheel
Removal and Installation

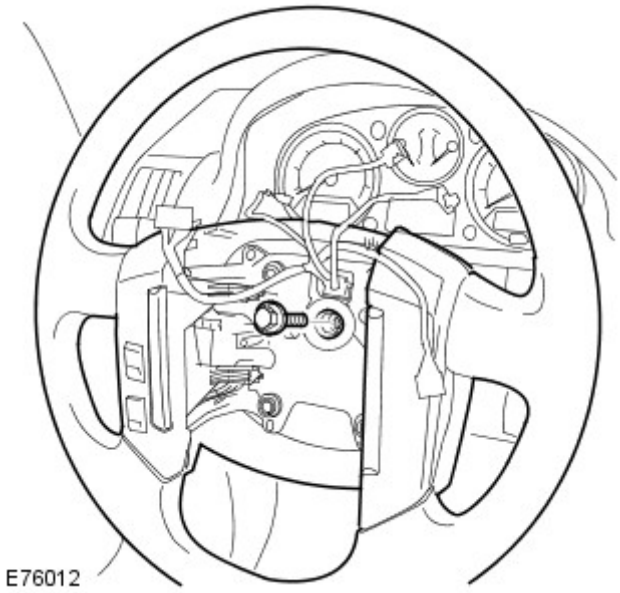
Removal

1. Make the SRS system safe.

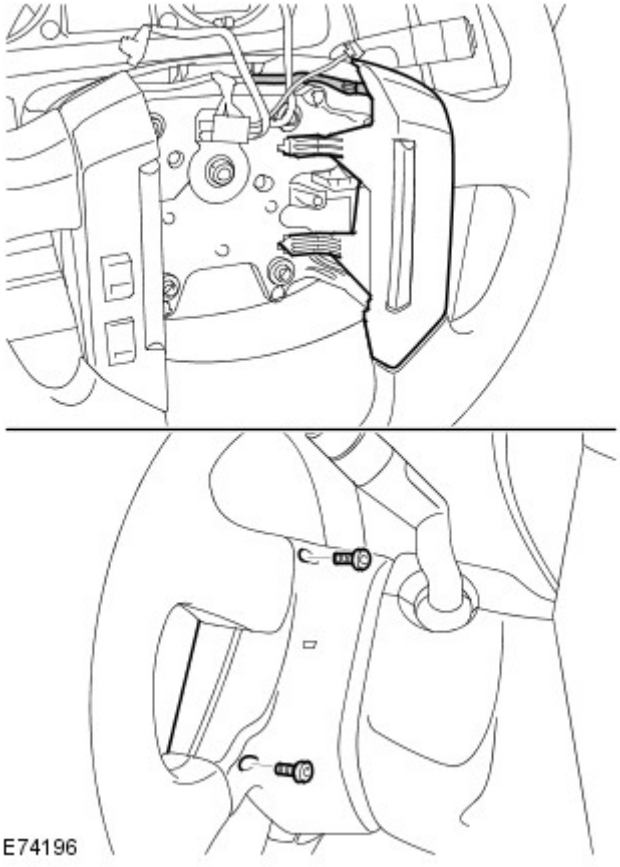
   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20, General Procedures).

2. Remove the driver air bag module.

   Refer to: Driver Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



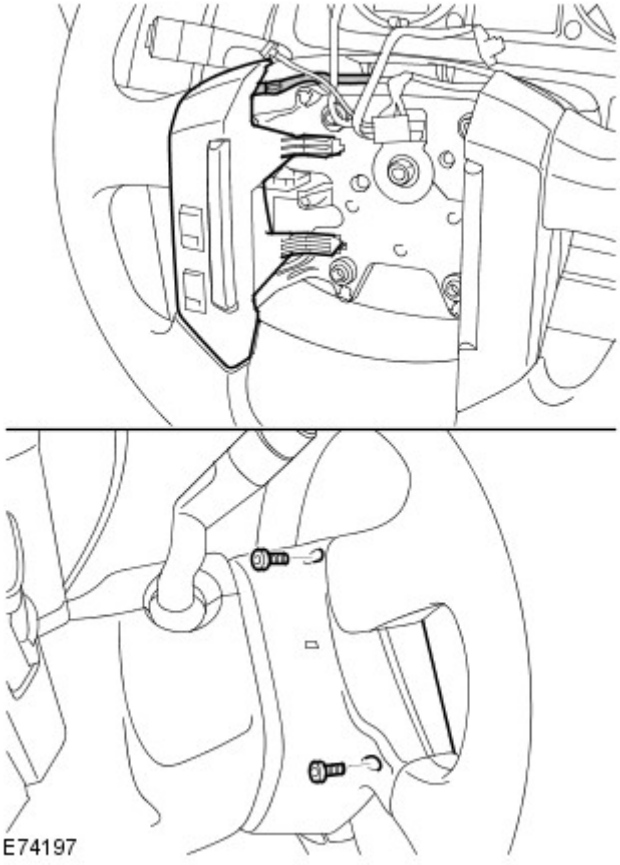
3.
   - *Torque:* 48 Nm



4. **4.** CAUTION: Protect the surrounding trim to avoid damage.

   • NOTE: Do not disassemble further if the component is removed for access only.

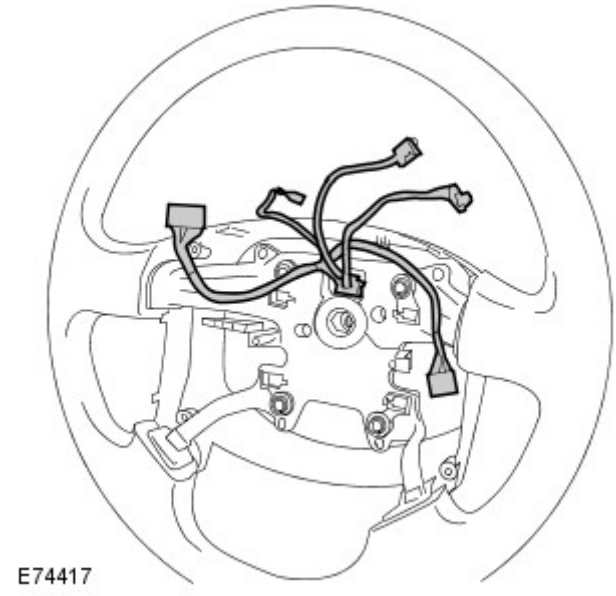
   - Remove the 2 Torx screws.
   - Disconnect the electrical connector.



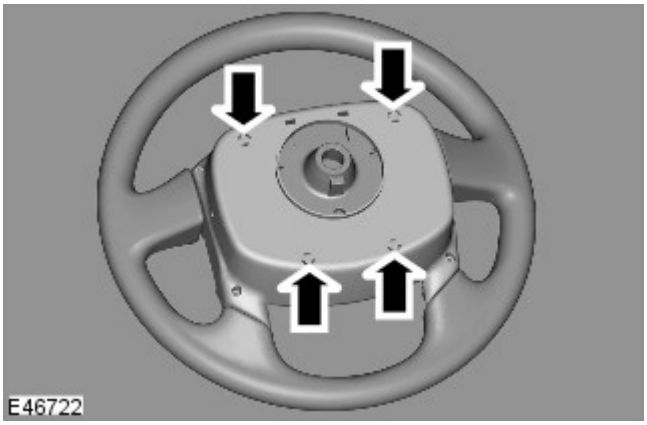
5. **5.** CAUTION: Protect the surrounding trim to avoid damage.

   - Remove the 2 Torx screws.
   - Disconnect the electrical connector.

6. Remove the steering wheel control switch harness.



7.



Installation

1. Install the steering wheel cover.
2. Install the wiring harness
3. Install the cruise speed control switch.
4. Install the horn switch.
5. Install the steering wheel.
6. Install the driver air bag module.

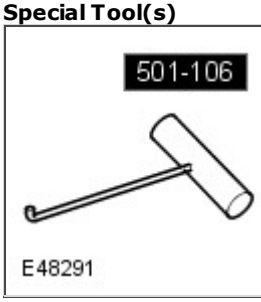
   Refer to: Driver Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

Published: 11-May-2011

Steering Column - Steering Column

Removal and Installation

Special Tool(s)

	501-106 Remover, Driver Air Bag

Removal

1. Make the SRS system safe.

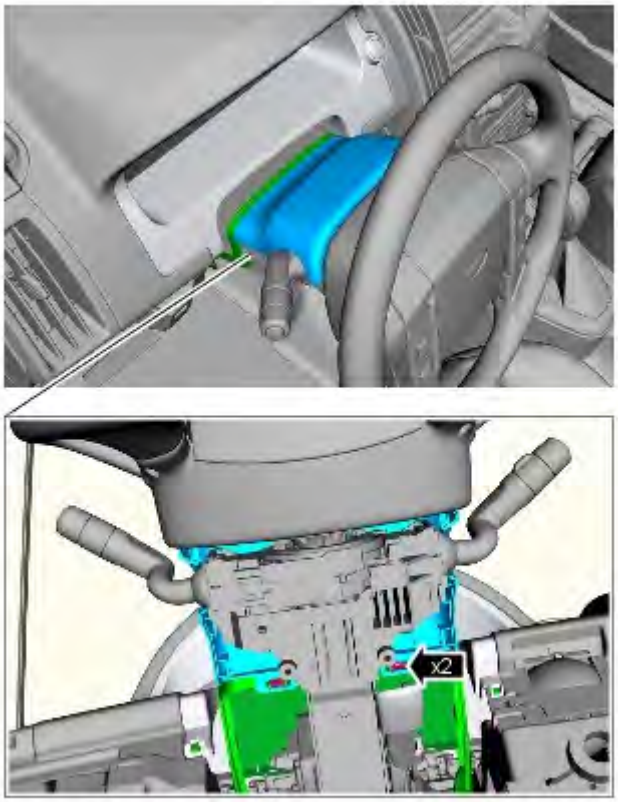
   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

2. Remove the driver lower air bag.

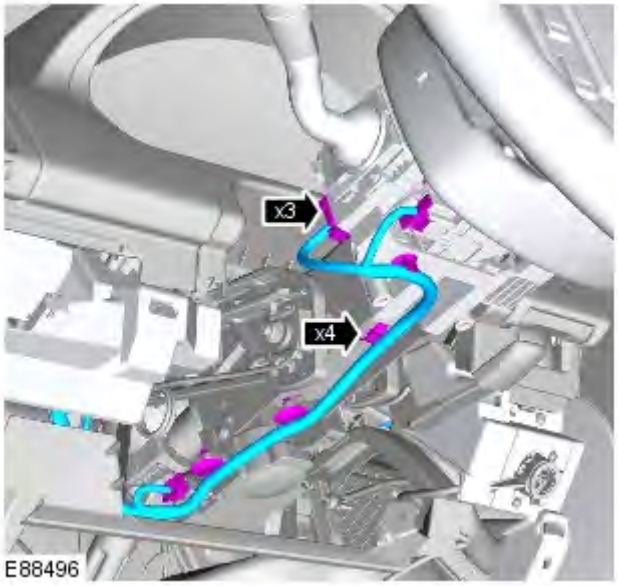
   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

3. Remove the steering column lower cowl.

4. Remove the steering column upper cowl.



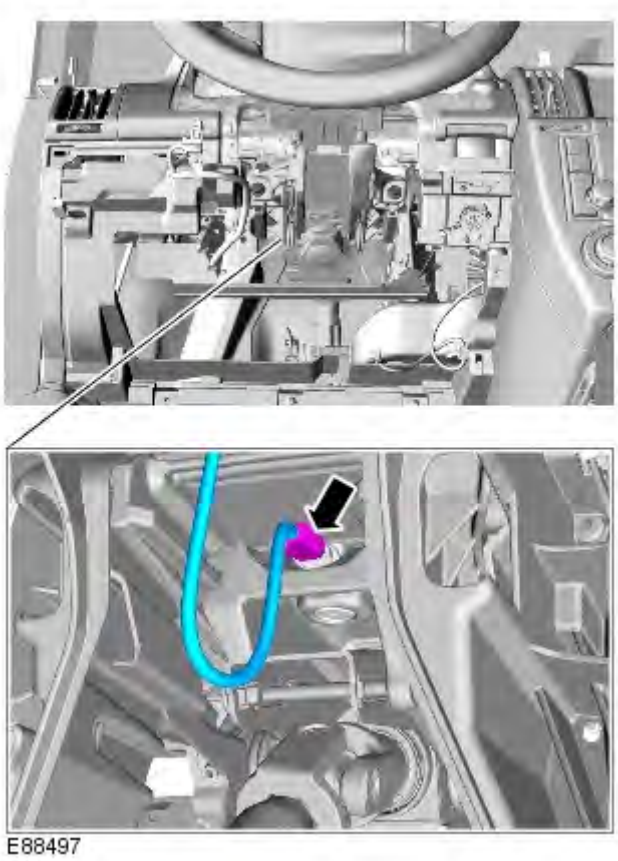
E86851



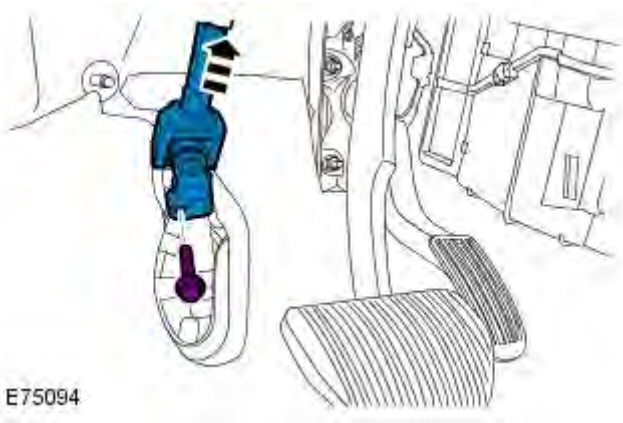
E88496

5. **5.** CAUTION: Take extra care not to damage the clips.

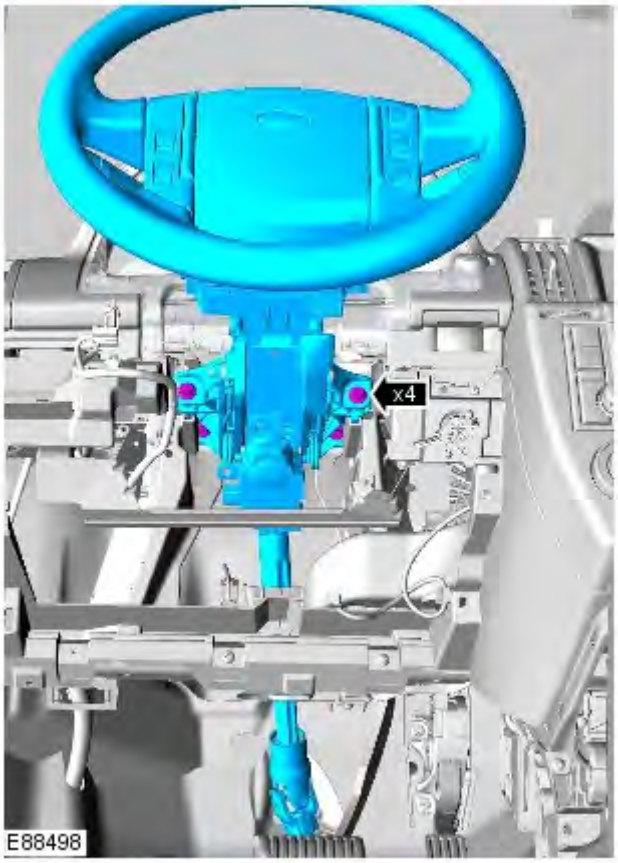
   Release the steering column wiring harness.


E88497

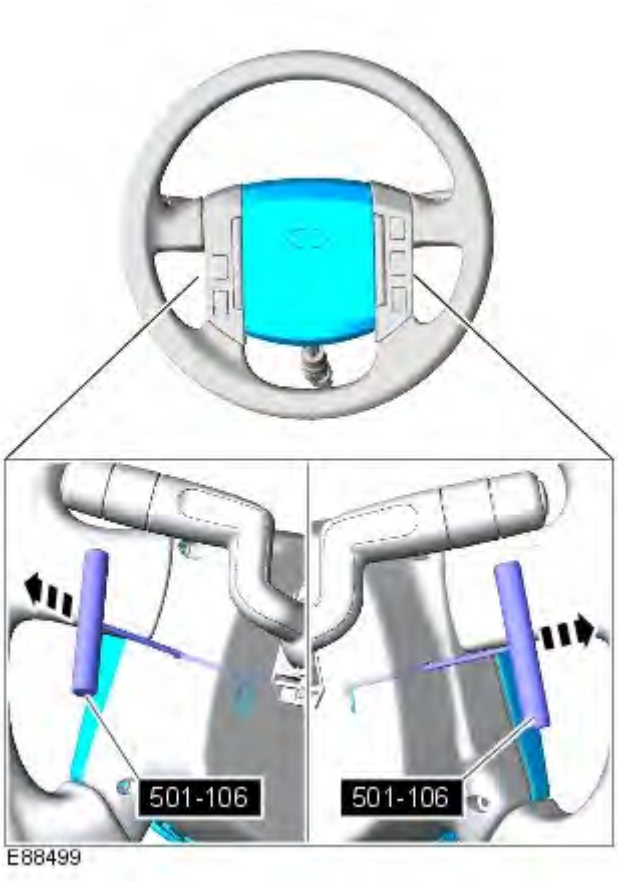
6. If installed, disconnect the SRS ride-down electrical connector concealed at the rear of the steering column.


E75094

7. Remove the steering column universal joint clamp bolt and release the shaft.

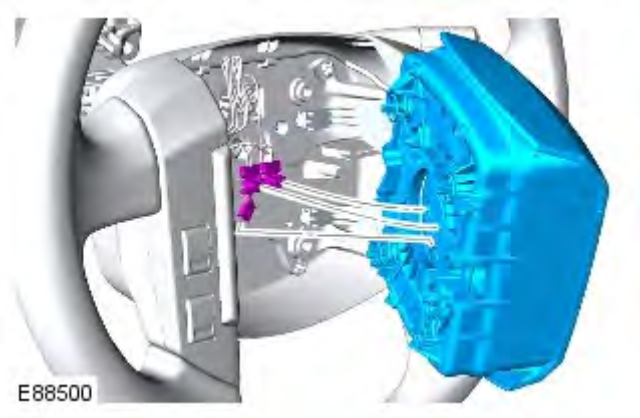


8. Remove the steering column assembly.

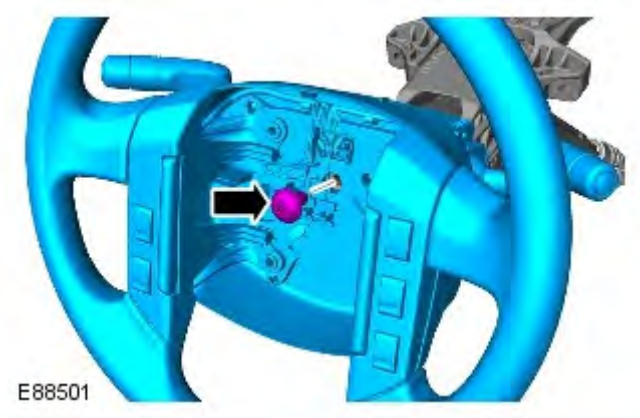


9. **9.** NOTE: Do not disassemble further if the component is removed for access only.
   - Using the special tool, remove the driver air bag module.

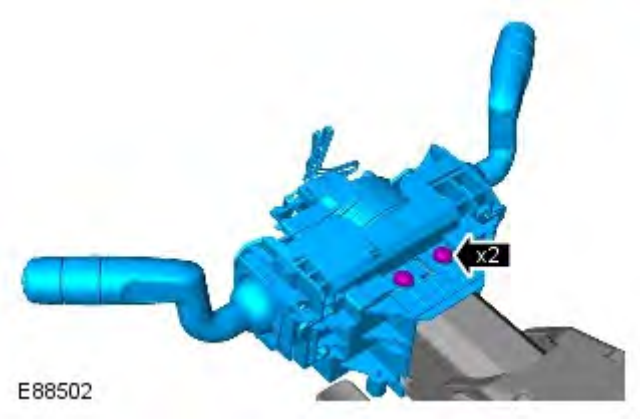
     Special Tool(s): 501-106
   - Carefully release the 2 clips.



10. **10.** WARNING: Do not probe supplemental restraint system (SRS) electrical connectors.
    - Disconnect the 3 electrical connectors.



11. Remove the steering wheel.



12. **12.** CAUTION: Make sure that the clockspring rotor does not rotate.

    Remove the clockspring.

Installation

1. Install the steering column and tighten the bolts.

   Torque: 25 Nm

2. **2.** WARNING: Make sure that a new bolt is installed.

   Connect the steering shaft universal joint and tighten the bolt.

   Torque: 25 Nm

3. Install the clockspring.

4. Install the steering wheel.

5. **5.** WARNINGS:

   Torque: 40 Nm

The SRS electrical connectors are unique. DO NOT force, or attempt to connect electrical connectors to the wrong sockets.

Driver air bag module installation can be confirmed by hearing 2 audible clicks, 1 for each spring. The module edges should also be flush with the steering wheel.

Install the driver air bag module.

6. If installed, connect the SRS ride-down electrical connector concealed at the rear of the steering column.

7. Secure the wiring harness to the steering column.

8. Connect the steering column electrical connectors.

9. Install the steering column upper cowl.

10. Install the steering column lower cowl.

11. Install the driver lower air bag module.

    Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

12. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

13. If a new steering column has been installed, configure the steering column lock using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Steering Column Switches -

Torque Specifications

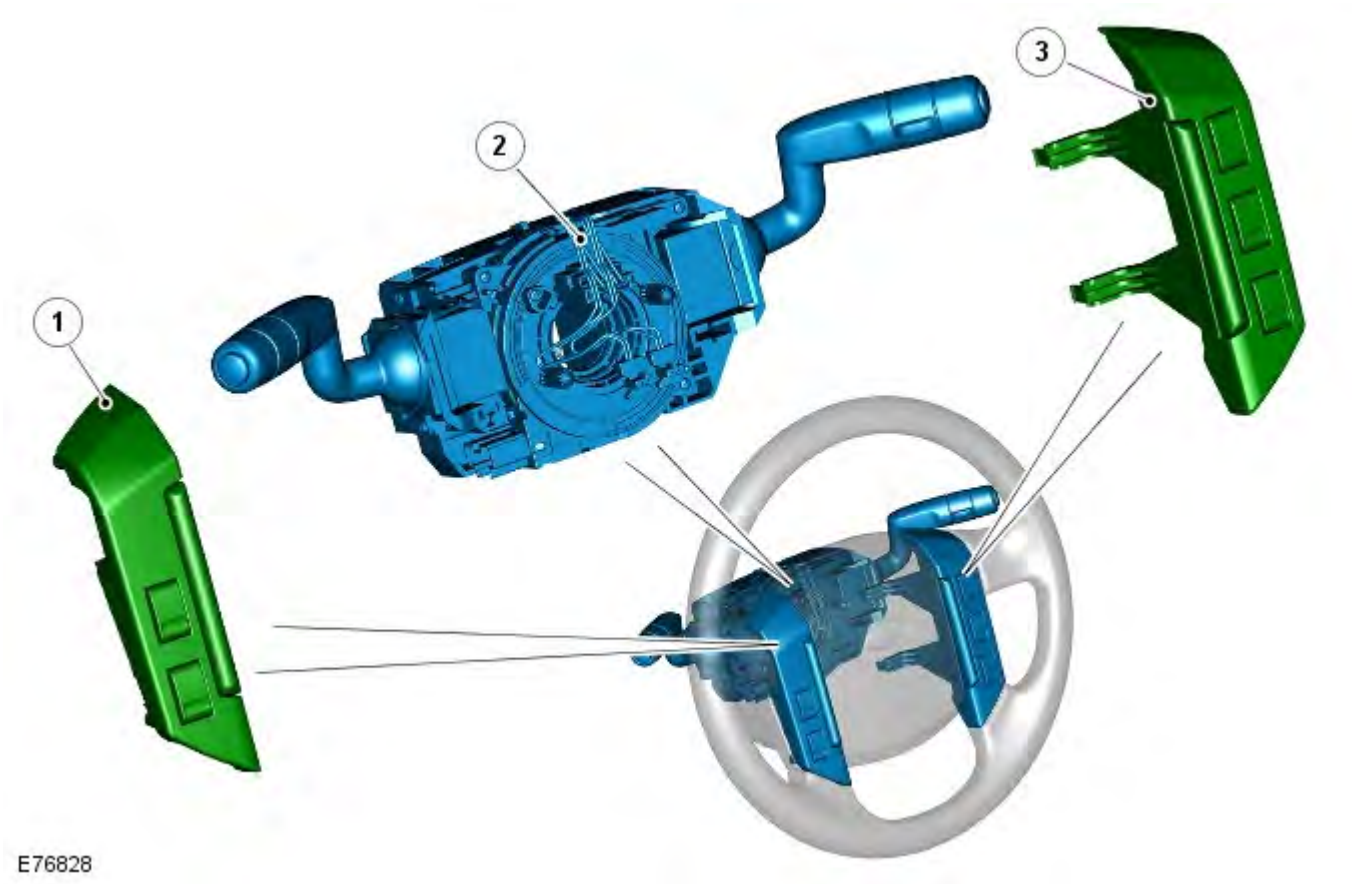
Description	Nm	lb-ft
Steering column switch Torx screws	1.5	1.0

Published: 11-May-2011

Steering Column Switches - Steering Column Switches

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Speed control switches
2	-	Steering column case containing the multifunction switches and clockspring
3	-	Audio control switches

OVERVIEW

The windshield wiper switch is located in the right-hand-side of the case and retained with 2 screws. The switch is connected to the main harness via a connector at the back of the switch. The switch controls the following functions:

- Windshield wiper intermittent slow and fast speed
- Windshield wiper flick wipe
- Windshield wash/wipe
- Rear wash/wipe
- Intermittent delay selection.

The turn signal indicator switch is located in the left-hand-side of the case and retained with 2 screws. The switch is connected to the main harness via a connector on the back of the switch. The switch controls the following functions:

- Left / right turn signal operation
- High / low beam operation
- Headlamp flash
- Trip computer function selection (if fitted).

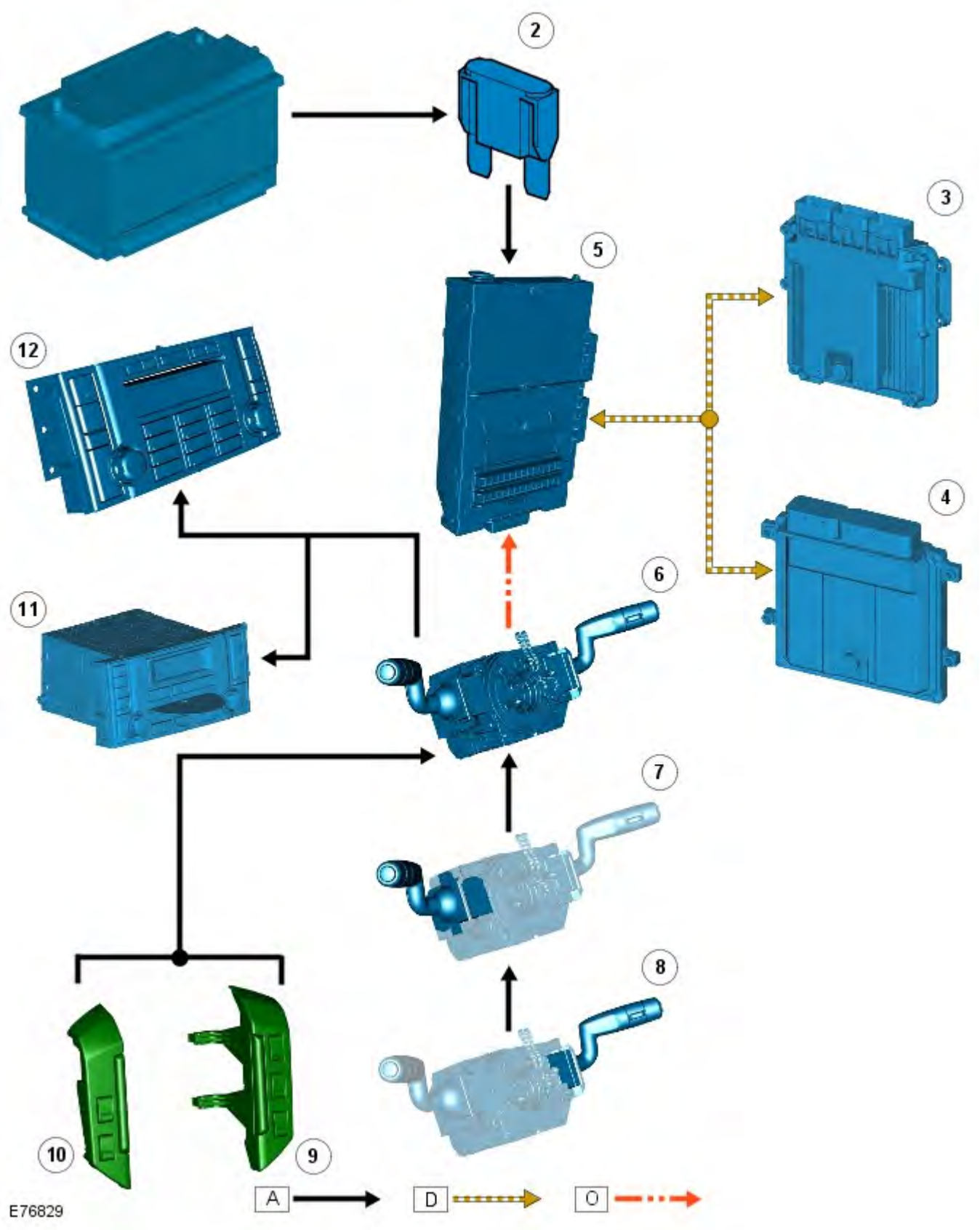
The trip button allows the driver to cycle though an option menu and also reset trip cycle mileage calculations. The trip computer information is displayed in the instrument cluster message center (high line instrument cluster only).

Steering wheel mounted switches on the right-hand-side of the driver's airbag, control the audio and telephone functions. Switches on the left-hand-side of the driver's airbag control the speed control functions.

The clockspring is located in the front of the case and retained with four screws. The clockspring engages in slots in the steering wheel boss and turns with the rotation of the steering wheel. The clockspring incorporates a tang which cancels the turn signal indicators when the steering wheel is rotated.
For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High speed CAN bus, **O** = LIN bus

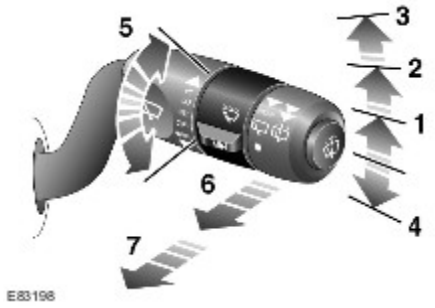


Item	Part Number	Description
1	-	Battery
2	-	Mega fuse 18
3	-	Engine control module (ECM) (Diesel)
4	-	Engine control module (ECM) (petrol)
5	-	Central junction box (CJB)
6	-	Clockspring
7	-	Steering column LH multifunction switch
8	-	Steering column RH multifunction switch
9	-	RH audio control switches
10	-	LH speed control switches

11	-	Integrated audio module
12	-	Integrated control module

PRINCIPLES OF OPERATION

Windshield Wiper Switch



Item	Part Number	Description
1	-	Intermittent wipe/rain sensor
2	-	Low speed wipe
3	-	High speed wipe
4	-	Single wipe - pull down and release
5	-	Intermittent wipe delay or rain sensor sensitivity
6	-	Intermittent operation of the rear wiper
7	-	Operates the rear washer and wiper

The windshield wiper functions are operated by moving the switch up or down. Flick wipe is selected by pushing the switch down. The switch is non-latching in this position and wiper operation is stopped when the switch is released and it returns to the off position. The flick wipe switch contact is connected on a single wire to the Central junction box (CJB) and ground. This is the same connection to the CJB as the fast speed wipe. When the switch is operated the circuit is completed between the CJB and ground. The CJB detects the completed circuit and operates the wipers for as long as the switch contact is made.

Intermittent is selected by pushing the wiper switch up, to the detent position; the wipers operate at the delay period selected on the rotary switch on the wiper stalk. The wipers remain in the intermittent mode until the wiper switch is moved to the off or slow/fast speed positions. The intermittent switch contact is connected between the CJB and ground. When the switch is moved to the intermittent position the circuit is completed. The CJB detects the completed circuit and operates the wipers in the intermittent delay selected for as long as the switch contact is made.

The intermittent delay period is selected using a rotary control on the wiper switch stalk. The rotary control allows the driver to select six delay periods to suit the prevailing weather conditions. The rotary control is connected on three wires to the CJB and a single wire to ground. The six positions each use a different combination of the three wires. The CJB detects, via the three wires, which selection has been made and operates the wipers with the appropriate delay.

Slow speed operation is selected by pushing the wiper switch up, to the second detent position. The wipers operate at slow speed until the wiper switch is moved to the off, intermittent or fast speed positions. The slow speed switch contact is connected between the CJB and ground. When the switch is moved to the slow speed position the circuit is completed. The CJB detects the completed circuit and operates the wipers at slow speed for as long as the switch contact is made.

Fast speed operation is selected by pushing the wiper switch up, to the third detent position. The wipers operate at fast speed until the wiper switch is moved to the off, intermittent or slow speed positions. The fast speed switch contact is connected between the CJB and ground. When the switch is moved to the fast speed position the circuit is completed. The CJB detects the completed circuit and operates the wipers at fast speed for as long as the switch contact is made.

The windshield washer function button is located on the end of the switch stalk. When the button is pressed a circuit is completed between the CJB and ground. The CJB detects the completed circuit and operates the windshield washer for as long as the button is depressed.

Rear Wash/Wipe Switch

The rear wash/wipe functions are operated by moving the switch rearwards. Rear wipe is selected by moving the wiper switch rearwards to the first detent position. The rear wiper switch is connected between the CJB and ground. When the switch is moved to the rear wiper position the circuit is completed. The CJB detects the completed circuit and operates the rear wiper for as long as the switch contact is made.

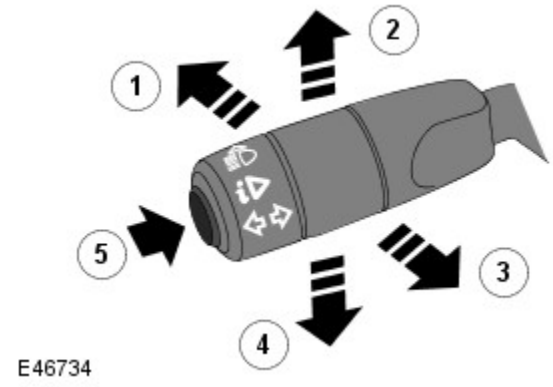
The rear washer is selected by moving the wiper switch rearwards to the second, non-latching position. When the switch is moved to this position a circuit is completed between the CJB and ground. The CJB detects the completed circuit and operates the rear washer for as long as the switch contact is made.

For additional information, refer to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

Turn Signal Indicator and Headlamp Switch

The turn signal indicator switch assembly is located in the left hand side of the case and is retained in the case with two screws. The switch is connected to the main harness via a connector on the back of the switch. The switch controls the following functions:

- Left / right turn signal operation
- High / low beam operation
- Headlamp flash
- Computer function selection (if fitted).



Item	Part Number	Description
1	-	High beam
2	-	Right hand indicator
3	-	Headlamp flash
4	-	Left hand indicator
5	-	Computer function button

Turn Signal Indicator

The turn signal indicators are operated by pushing the switch up for right hand indicators and down for left hand indicators. The switch has a detent position which locks the switch in the selected position until it is moved to the central off position. The switch also has a 'lane change' function which allows the switch to be operated, without moving through the detent, for use when changing lane on highways or when overtaking. When released from the 'lane change' position, the switch is automatically returned to the central off position. The left and right hand turn signal indicator switch positions are connected on separate wires to the Central Junction Box (CJB) and the switch. When a switch position selection is made, a circuit is completed from the CJB to ground, via the selected switch position. The CJB detects the completed circuit and operates the selected turn signal indicator until the switch is moved to the central off position. The turn signal indicators can be cancelled either manually by the driver or automatically when the steering wheel is rotated to the straight ahead position.

High/Low Beam and Headlamp Flash

High beam is operated by pushing the switch forwards. The switch is latched in this position and the high beam is active until the switch is manually pulled rearwards. The headlamp flash function is operated by pulling the switch rearwards. The switch contacts complete a circuit and the headlamps are activated for as long as the switch is operated. The switch is non-latching in this position and the headlamp flash is switched off when the switch is released and it returns to its off position. The high beam and headlamp flash positions are connected on separate wires to the CJB and ground. When a switch selection is made, a circuit is completed from the CJB to ground via the switch contacts.

For additional information, refer to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

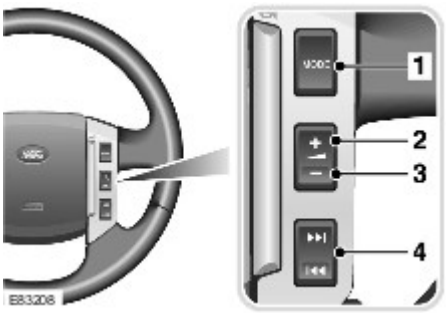
Computer Function Button

The computer function button is located on the end of the switch stalk. The button is a momentary switch and allows the driver to select the following information in the instrument cluster message center:

- Trip distance
- Distance on fuel remaining in the fuel tank
- Fuel tank remaining quantity
- Average fuel consumption
- Vehicle life fuel consumption
- Average speed
- Instantaneous fuel consumption.

The button is connected to the instrument cluster and ground. When the button is pressed the circuit is completed and the instrument cluster displays the next trip computer information. Repeated presses of the button selects each display in the message center in turn.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

Audio Control Switches



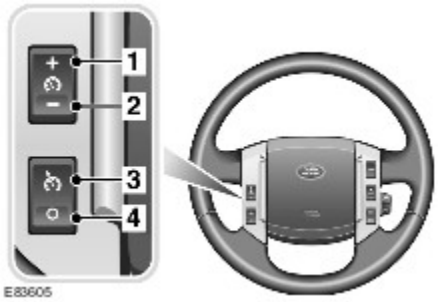
Item	Part Number	Description

1	-	Press to switch between radio, CD, or AUX
2	-	Press to increase volume
3	-	Press to decrease volume
4	-	Press and release to scroll through preset radio stations or CD tracks. Press to search up or down for the next or previous radio station/CD track

The audio control switches are resistive ladder switches. These switches connect to the Infotainment Control Module (ICM) or Integrated Audio Module (IAM) (dependant upon the level of audio fitted to the vehicle) via the clockspring.

For additional information, refer to: Audio System (415-01, Description and Operation).

Speed Control Switches



Item	Part Number	Description
1	-	Set target speed, or increase speed
2	-	Set target speed, or decrease speed
3	-	Resume set speed
4	-	Cancels speed control operation without erasing memorized speed

The speed control switches are resistive ladder type. The signals from the resistive ladder are fed to the steering column module (located in the clockspring) which then outputs the signals as a local interconnect network (LIN) bus signal to the central junction box (CJB). The CJB transmits speed control signals on the high speed controller area network (CAN) bus to the engine control module (ECM).

For additional information, refer to: Speed Control (310-03A Speed Control - I6 3.2L Petrol, Description and Operation).

For additional information, refer to: Speed Control - 2.2L Diesel (310-03, Description and Operation).

Published: 11-May-2011

Steering Column Switches - Steering Column Switches

Diagnosis and Testing

Principles of Operation

For a detailed description of the steering column switches, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Steering Column Switches (211-05 Steering Column Switches, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for system integrity and obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Switches	• Fuse(s) • Electrical connector(s) • Wiring Harness

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check Central Junction Box (CJB) for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B109512	Wiper On/Off Relay - circuit short to power	• Wiper On/Off relay circuit - short to power	Refer to electrical circuit diagrams and check wiper On/Off relay circuit for short to power
B109514	Wiper On/Off Relay - circuit short to ground or open	• Wiper On/Off relay circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check wiper On/Off relay circuit for short to ground, open circuit
B109612	Wiper High/Low Relay - circuit short to power	• Wiper High/Low relay circuit - short to power	Refer to electrical circuit diagrams and check wiper High/Low relay circuit for short to power
B109614	Wiper High/Low Relay - circuit short to ground or open	• Wiper High/Low relay circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check wiper High/Low relay circuit for short to ground, open circuit
B10AC86	Cruise Control Switch - Signal invalid	• Signal invalid	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B10AC87	Cruise Control Switch - Missing message	• Missing message	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B10AC95	Cruise Control Switch - Wrong assembly	• Mis-match between Car Configuration File and vehicle	Check/up-date Car Configuration File using the manufacturer approved diagnostic system
B112B07	Steering Wheel Module - Mechanical Failures	• Any position or button on wiper stalk active for more than 60 seconds (180 seconds for speed control buttons) • Switch internal failure	Check for stuck wiper or speed control buttons. Install a new switch as required. REFER to: Steering Column Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).

DTC	Description	Possible Cause	Action
B112B88	Steering Wheel Module - Bus off	• Lost communications with steering wheel module	Carry out diagnostic strategy associated with this DTC using manufacturer approved diagnostic system
C1D2249	Steering Wheel Switch Right Module - Internal failure	• Steering wheel switch right module - internal failure	Install a new wash/wipe switch. REFER to: Steering Column Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
C200307	Steering Wheel Switch Left Module - Mechanical Failures	• Steering wheel switch left module - mechanical failure	Install a new indicator switch. REFER to: Steering Column Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
C200349	Steering Wheel Switch Left Module - Internal failure	• Steering wheel switch left module - internal failure	Install a new indicator switch. REFER to: Steering Column Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
U012600	Lost Communication With Steering Angle Sensor Module	• Lost communication with steering angle sensor	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system

Published: 11-May-2011

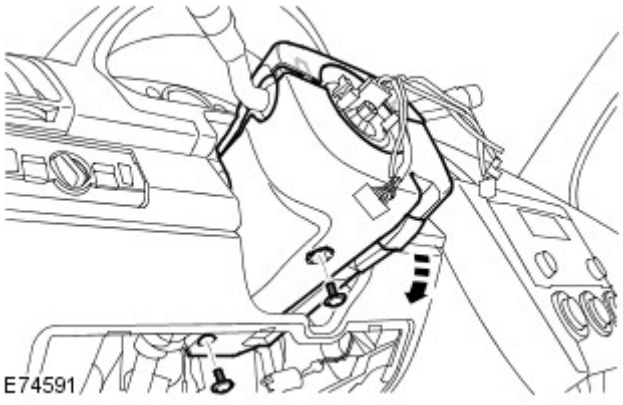
Steering Column Switches - Steering Column Multifunction Switch

Removal and Installation

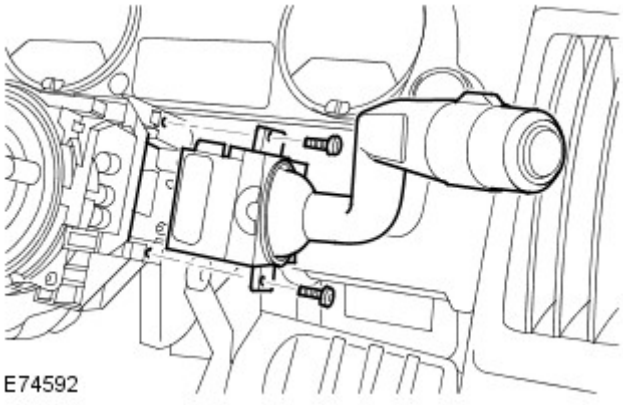
Removal

• NOTE: Removal of the windshield wiper switch assembly is identical to this procedure.

1. Release the steering column adjustment lever.
2. Remove the steering column upper cowl.
3. Remove the steering column lower cowl.



4. Remove the steering column multifunction switch.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Steering Column Switches - Ignition Switch

Removal and Installation

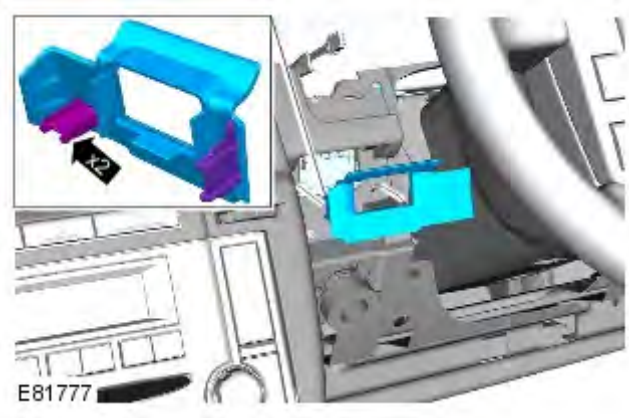
Removal

1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

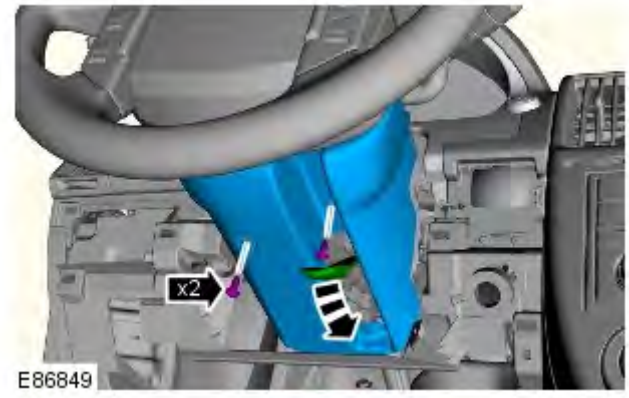
2. Remove the driver lower air bag module.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



3. **3.** NOTE: RHD illustration shown, LHD is similar.

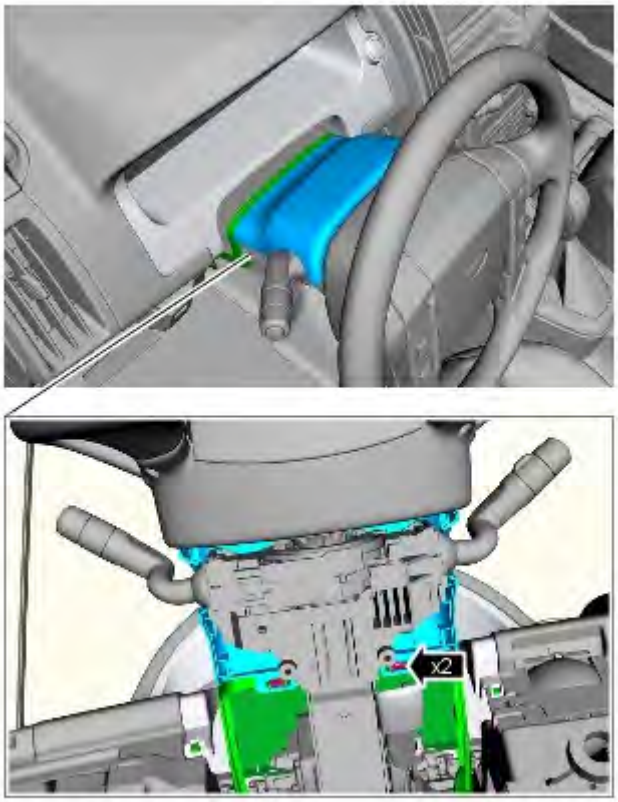
   Remove the keyless start control module trim cover.



4. Remove the steering column lower cowl.

5. Adjust the steering column to its lowest position.

6.



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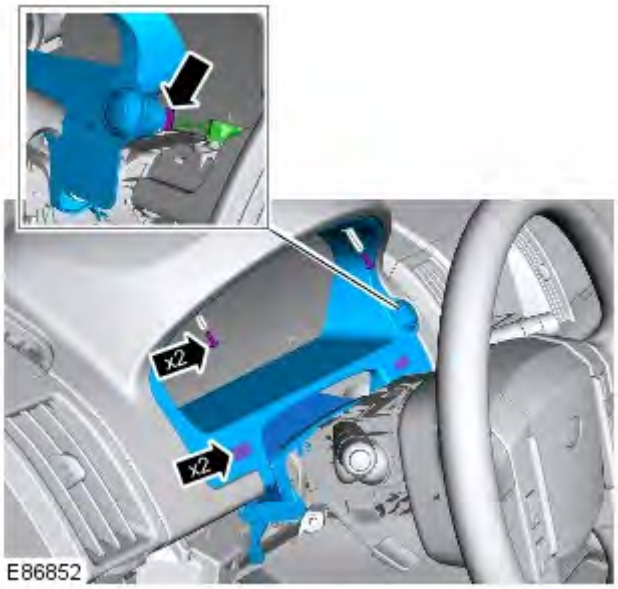
7. **7.** NOTE: Take extra care when releasing the clips.

   Remove the instrument cluster surround.



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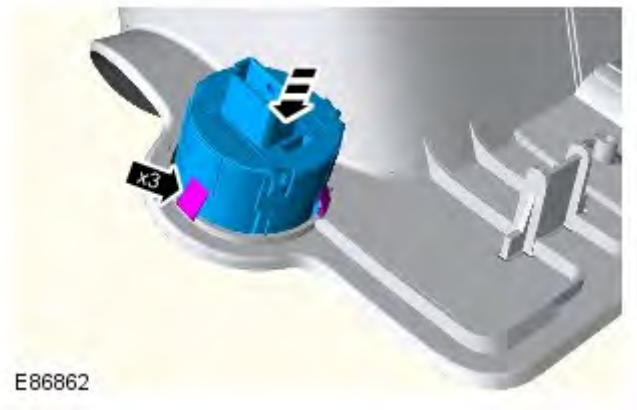


8. Remove the ignition switch.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Steering Column Switches - Steering Column Lock Module

Removal and Installation

Removal

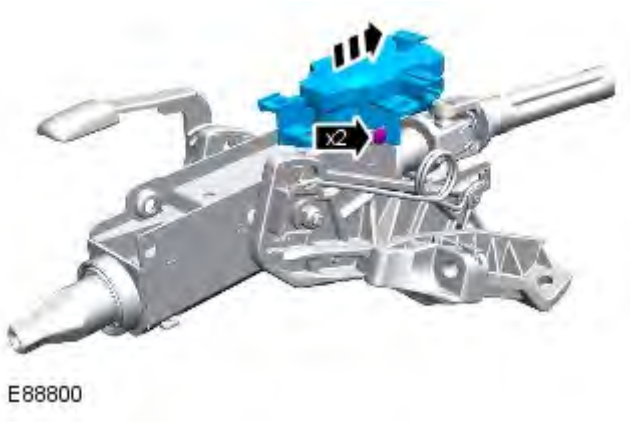
- NOTE: On vehicles built from VIN 091770 the steering column lock module may be a non-functional component.
- NOTE: The steering column lock module is retained with 2 X 6mm patch locked, tamper proof bolts.
- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the steering column.

   Refer to: Steering Column (211-04 Steering Column, Removal and Installation).



3. **3.** NOTE: Using a suitable stud extraction tool, remove the tamper proof bolts .

Installation

1. **1.** CAUTION: Tighten the new tamper proof bolts until the hexagon head shears.

   To install, reverse the removal procedure.

2. Using the Land Rover approved diagnostic system, calibrate a new module.

Published: 11-May-2011

Engine System - General Information - Engine

Diagnosis and Testing

For additional information. REFER to:

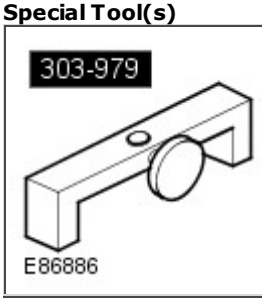
Engine (303-01A Engine - I6 3.2L Petrol, Diagnosis and Testing),
Engine (303-01B Engine - TD4 2.2L Diesel, Diagnosis and Testing).

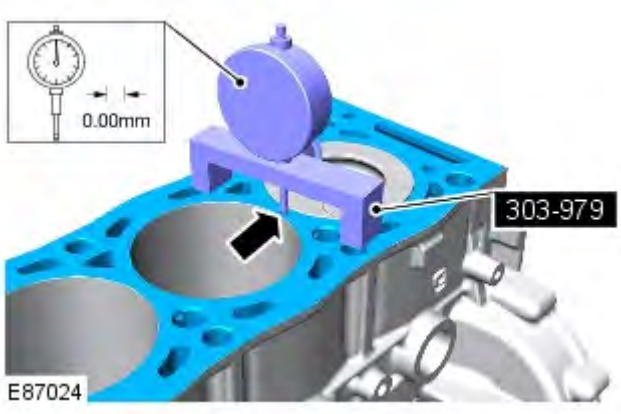
Published: 11-May-2011

Engine System - General Information - Cylinder Head Gasket SelectionTD4 2.2L Diesel

General Procedures

Special Tool(s)

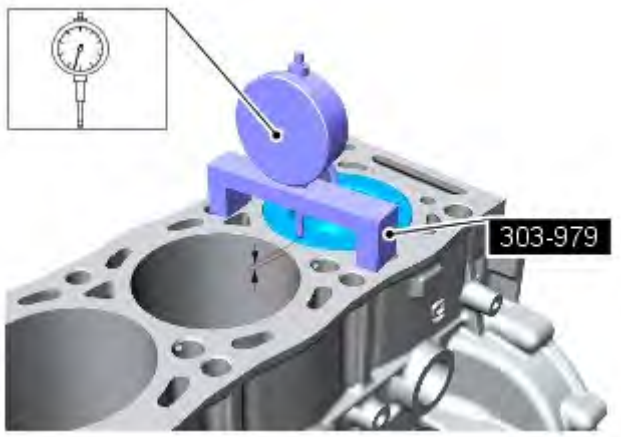
	303-979 Measuring Bridge, Piston Protusion



1. **1.** CAUTION: Make sure that the surface is clean and free of foreign material.

   Zero the gauge on the cylinder block machined face.

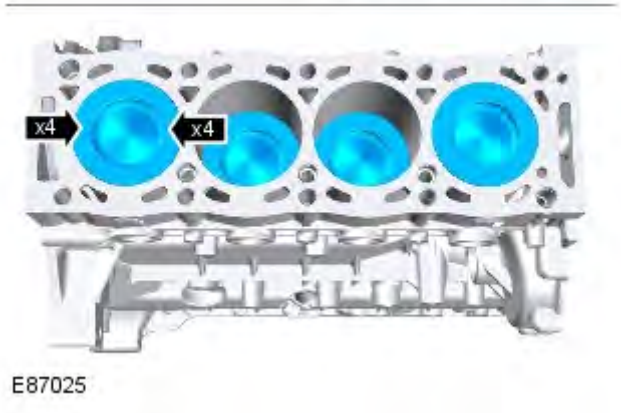
   Special Tool(s): 303-979

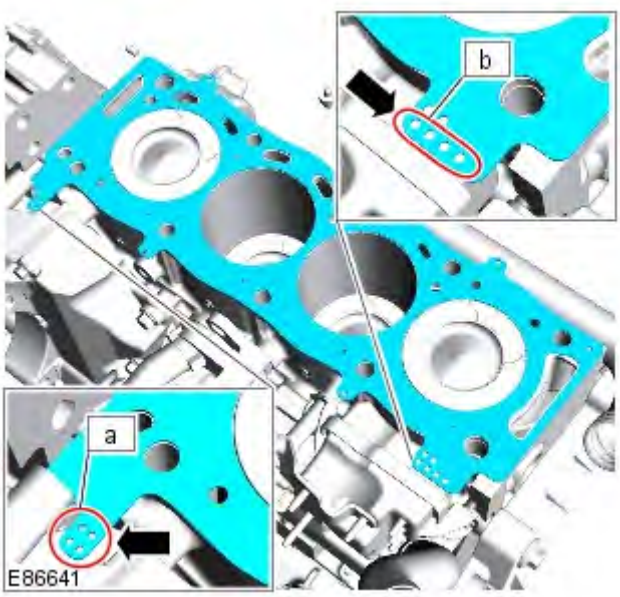


2. **2.** CAUTION: Make sure that the surface is clean and free of foreign material.

   • NOTE: Note the dial gauge readings.

   Take 2 measurements on each piston crown.





3. **3.** CAUTION: The gasket thickness is identified by the number of holes (1 to 4) at either of the locations shown.

   Use the highest piston protrusion measurment, to select the correct thickness cylinder head gasket.

   Refer to: Specifications (303-01B Engine - TD4 2.2L Diesel, Specifications).

Published: 02-Jun-2011

Engine System - General Information - Leakage Test Using Smoke Test Equipment

General Procedures

CAUTION: The compressed air line supply pressure must be between 3.5 and 12 bar (50 and 175 psi) for the smoke test equipment to function correctly. Do not exceed this pressure. Failure to follow this instruction may result in damage to the smoke test equipment.

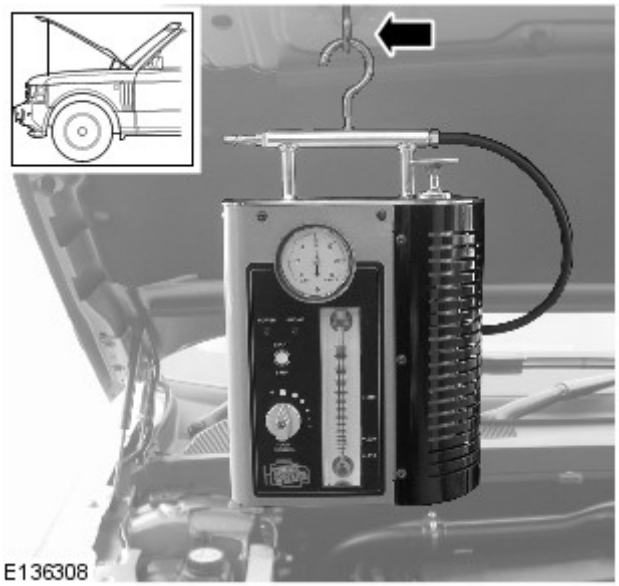
• NOTE: The vehicle battery must be in good condition and fully charged before carrying out this procedure.

• NOTE: On vehicles with 3.0L TDV6, it will be necessary to insert smoke at both air cleaner outlet pipes independently if the right hand turbocharger and associated hoses are to be tested.

• NOTE: In some cases it may be necessary to remove undertrays, trim or engine covers to obtain access to all potential leak locations.

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

• NOTE: For further information regarding operation of the test equipment refer to the manufacturers operators manual supplied with the kit.



1. WARNING: Use an additional support to prevent the hood from falling if the smoke test equipment is secured to the hood. Failure to follow this instruction may result in personal injury.

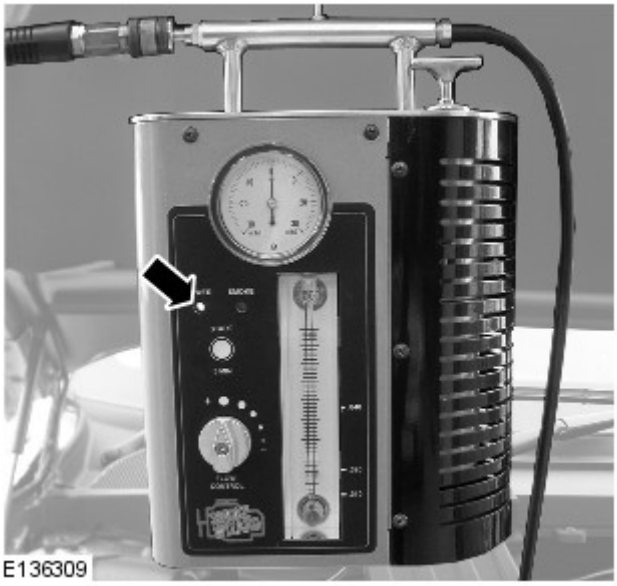
Install the smoke test equipment to a suitable location under the hood.

2. Connect a suitable compressed air line to the smoke test equipment.

3. Connect the smoke test equipment positive power cable to the battery positive terminal.

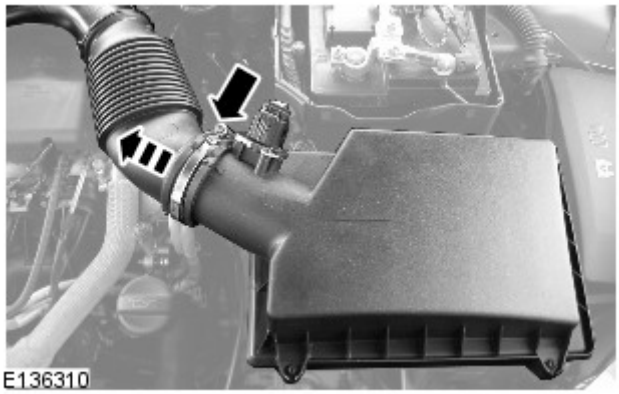
4. WARNING: Do not connect the smoke test equipment negative cable to the battery negative terminal.

Connect the smoke test equipment negative cable to a suitable body ground point.



5. NOTE: A flashing green light indicates low battery voltage. In this case, place the battery on charge and make sure that the battery is fully charged before using the smoke test equipment.

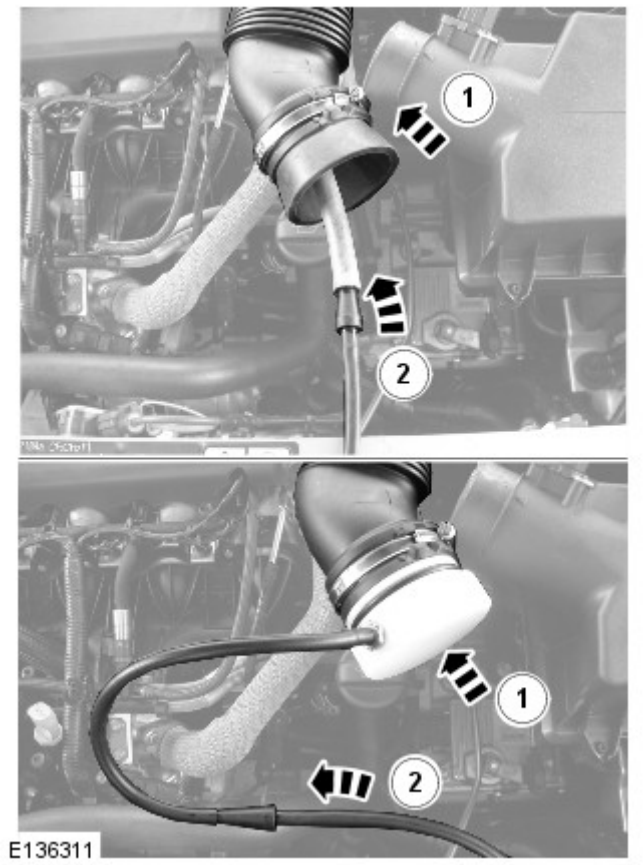
Observe the power indicator lamp on the smoke test equipment. Make sure that a continuous green light is displayed.



6. NOTE: In some cases it may be necessary to remove the air cleaner(s) to allow access to the air cleaner outlet pipes.

• NOTE: In some cases it will be necessary to cap one of the air cleaner outlet pipes. Use the blanking caps supplied in the kit to cap the open orifice.

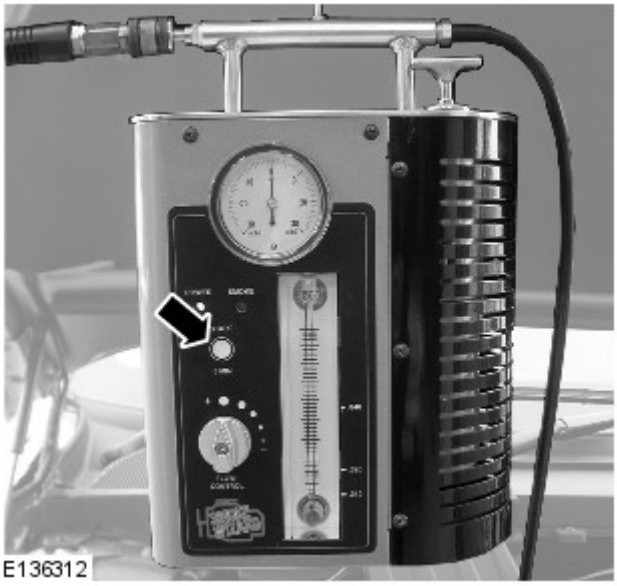
Disconnect the air cleaner outlet pipe(s).



7. NOTE: Make sure the smoke test equipment adapter is a good fit to the air cleaner outlet pipe. This must be an air tight seal.

Connect the smoke test equipment supply hose to the air cleaner outlet pipe.

1. Install the appropriate adapter to the air cleaner outlet pipe.
2. Connect the smoke test equipment supply hose to the adapter link hose.



8. NOTE: The flow control valve must be in the fully open position.

• NOTE: Smoke is produced for 5 minutes. The smoke test equipment will automatically switch off after this period of time.

Switch the smoke test equipment on.

9. Remove the oil filler cap, and observe until a constant flow of smoke is visible leaving the oil filler orifice. Install the oil filler cap.

10. NOTE: The longer smoke is allowed to exit from a leak, the more fluorescent dye will be deposited at a leak location.

Using the torch supplied in the kit set to white light, look for escaping smoke. Alternatively, use the ultraviolet light to look for fluorescent dye deposits at the source of a leak.

Engine - I6 3.2L Petrol -

Lubricants, Fluids, Sealers and Adhesives

Description	Land Rover Part No.
Cam cover to cylinder head joint	LR006801 (Loctite 510)
Bedplate to oil sump	STC50550
Block to bedplate	STC50550
Engine oil - NAS, Middle East and North Africa Models	5W/30 - ACEA A1 + ILSAC GF-3 or ILSAC GF-3*
Engine oil - ROW Models	0W/30 - ACEA A5/B5

The recommended oil change interval for ILSAC GF-3 is 5000 miles.

Capacities

Item	Capacity (liters/pints/US quarts)
Dry fill including filter	9.3/16.4/9.8
Service fill - includes filter	7.7/13.6/8.1
Amount of oil required to bring the level from the lower to the upper mark on the dipstick	0.8/1.4/0.9

General Specification

Item	Specification
Type	3.2 liter, inline 6 naturally aspirated petrol engine, twin overhead camshafts, 4 valves per cylinder
Cylinder arrangement	Inline 6
Cylinder numbering	1-6 from front of engine
Bore - nominal	84.0 mm (3.307 in)
Stroke	96.0 mm (3.779 in)
Capacity	3192 cm³ (195.8 in³)
Firing order	1 - 5 - 3 - 6 - 2 - 4
Compression ratio	10.8:1
Direction of rotation	Clockwise from front of engine
Maximum power	171 kW (230 hp) @ 6300rpm
Maximum torque	317 Nm (234 lb-ft) @ 3200rpm
Engine oil pressure*:	
At 800 rev/min	1.03 bar/103 kPa/15 lb/in²
At 4000 rev/min	3.45 bar/345 kPa/50 lb/in²
Oil pump	
Oil pump to crankshaft clearance	0.087mm ±0.022 mm (0.00343 in ± 0.000866 in)
Maximum permissible cylinder head warp:	
Over head length	0.05 mm (0.00196 in)
Over head width	0.03 mm (0.00118 in)
Cylinder head height	149.4 mm ± 0.15 mm (5.882 in ± 0.0059 in)
Maximum permissible amount to be removed during skimming	0.3 mm (0.0118 in)
Main bearing journals:	
Number	7
Diameter standard	65 mm + 0.004 - 0.015 mm (2.55 in + 0.000157 - 0.000590 in)
Maximum diameter variation	0.006 mm (0.000236 in)
Big end journals:	
Diameter standard	50 mm + 0.004 - 0.015 mm (1.96 in + 0.000157 - 0.000590 in)
Maximum diameter variation	0.01 mm (0.000393 in)
Camshaft:	
Number of bearings	7 per camshaft
Tappets+:	
Inlet	Hydraulic
Exhaust+	Graded
Valves:	
Valve clearance - Exhaust	0.45mm ±0.05 mm (0.0177 in ± 0.00196 in)
Length - inlet valve	106.19 mm ± 0.07 mm (4.18 in ± 0.0275 in)
Length - exhaust valve	129.96 mm ± 0.07 mm (5.12 in ± 0.0275 in)
Seat angle	45° ± 0.01°
Head diameter - inlet valve	33 mm ± 0.15 mm (1.29 in ± 0.0590 in)
Head diameter - exhaust valve	28 mm ± 0.15 mm (1.10 in ± 0.0590 in)
Stem diameter - inlet valve	5.97 mm + 0 -.015 mm (0.235 in + 0 -000590 in)
Stem diameter - exhaust valve	5.962 mm +0 -0.007 mm (0.234 in +0 -0.000275 in)
Stem to guide clearance - inlet valve	50-70 µm
Stem to guide clearance - exhaust valve	50-70 µm
Valve springs:	
Type	Conical
Length (free)	45 mm (1.77 in)

*** Prior to checking the engine oil pressure, a road test of 6 miles (10 kilometres) must be carried out. Do not attempt to attain normal engine operating temperature by allowing the engine to idle.**

+ There are 50 different thicknesses of graded tappet available ranging from 2.950mm to 3.685 mm (0.116 in to 0.145 in) rising in increments of 0.015 mm (0.0005 in).

Torque Specifications

Description	Nm	lb-ft
Camshaft bearing housing to cylinder head bolts	A	A
Camshaft drive sprocket bolts		
Exhaust	75 + 90°	55 + 90°
Inlet	110	81
Cylinder head bolts	A	A
Cylinder head wiring harness mounting bolts	6	5
Dipstick tube bolt	10	7
Engine insulator lower bolts	110	81
Engine insulator lower heatshield Torx screw	10	7
Engine insulator upper bolts	110	81
Engine mount bracket LH:		
M8*	25	18
M12*	80	59
Engine mount LH bolts	175	129
Engine mount RH bolts	80	59
Engine mount bracket RH bolt:		
M10*	45	33
M12*	80	59
Flywheel flexplate bolts	45 + 50°	33 + 50°
Exhaust manifold bolts	A	A
Intake manifold bolts	16	12
Lifting bracket bolts	48	35
Lower inlet manifold bolts	10	7
Lubricant drain plug	38	28
Oil cooler assembly to block retaining bolts	10	7
Oil cooler hose bolts	10	7
Oil filter	25	18
Oil level sensor bolt	8	6
Oil pan bolts:		
M7	17	13
M10	45	33
Oil pump adjuster bolt	17	13
Oil pump lock adjuster sleeve bolt	8	6
Oil strainer pick-up assembly bolt	17	13
Oil squirt jet	6	5
Throttle body to block support bolt	10	7
Throttle body screws*	8	6
Timing chain tensioner bolt	10	7
Timing cover bolts	A	A
VVT solenoid	10	7
VVT unit retaining bolt	A	A

*** New nuts/bolts must be fitted**

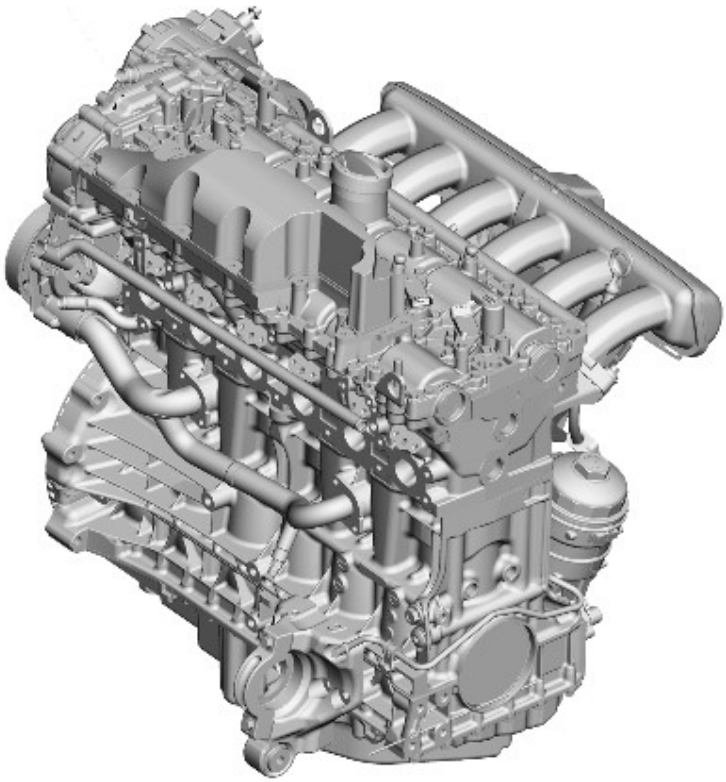
A = refer to procedure for correct torque sequence

Published: 11-May-2011

Engine - I6 3.2L Petrol - Engine

Description and Operation

EXTERNAL VIEW



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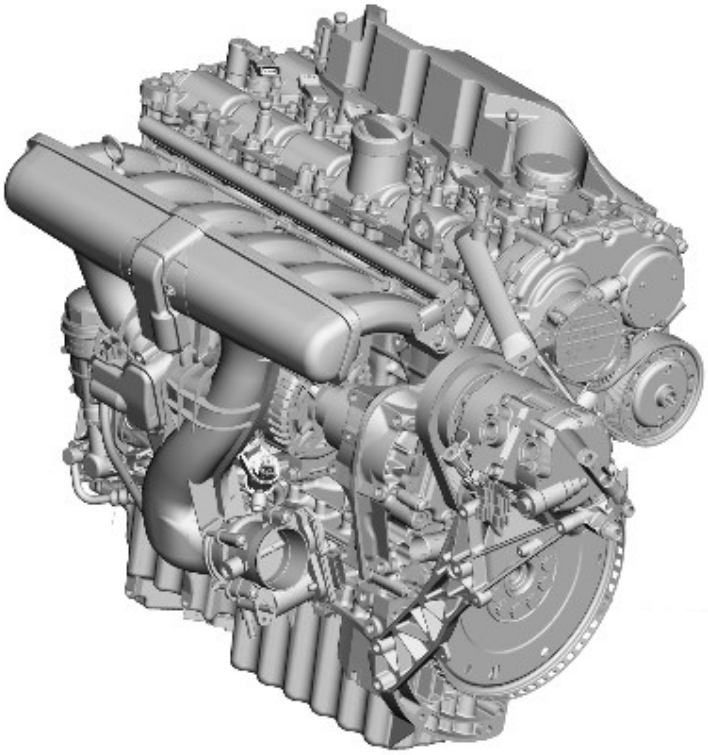


E79456

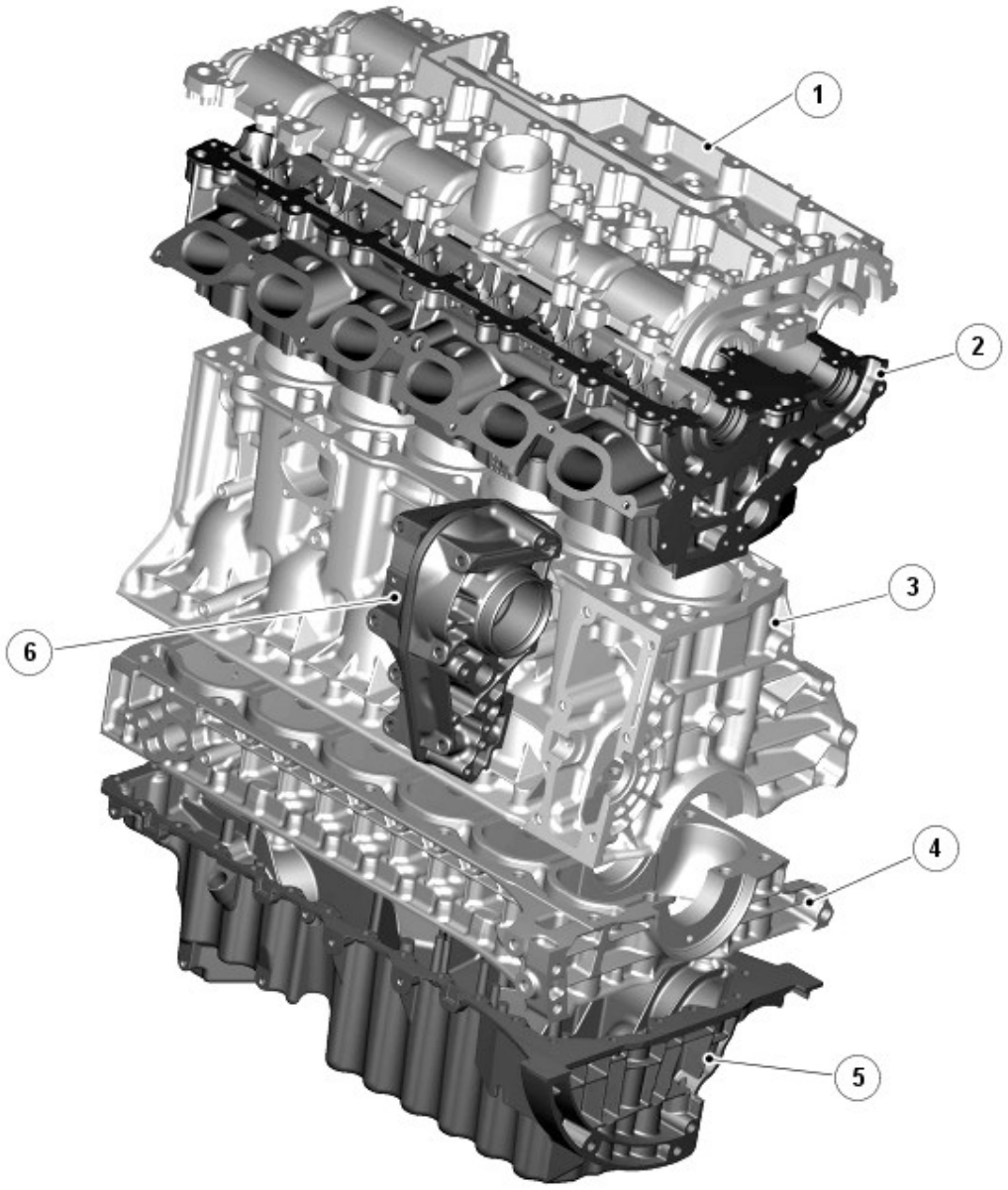
OVERVIEW

The Si6 petrol engine is a 3.2 litre, inline 6-cylinder, naturally aspirated unit, with 4 valves per cylinder, operated by 2 overhead camshafts. The engine emissions comply with EURO 4 (European Union emission regulations) and Ultra Low Emissions Vehicle (ULEV) II legislative requirements and employs catalytic converters, electronic engine management control and pressure controlled crankcase ventilation to limit the emission of pollutants. The cooling system is a low volume, high velocity system. The Engine

Control Module (ECM) controls the fuel injection system and the ignition system.

The cylinder block is of aluminum alloy construction with cast iron liners and a pressed aluminum bedplate section bolted to the bottom of the block to improve lower structure rigidity. The single-piece oil sump is also of a pressed aluminum construction. The cylinder head and the camshaft bearing housing are manufactured from cast aluminum. The exhaust manifolds are of a fabricated stainless steel twin skin design incorporating catalytic converters and a moulded plastic acoustic cover is fitted over the upper engine to reduce engine-generated noise.

Engine Structure



E89592

Item	Part Number	Description
1	-	Camshaft bearing housing
2	-	Cylinder head
3	-	Cylinder block
4	-	Bedplate section
5	-	Oil pan
6	-	Gear housing

Technical features

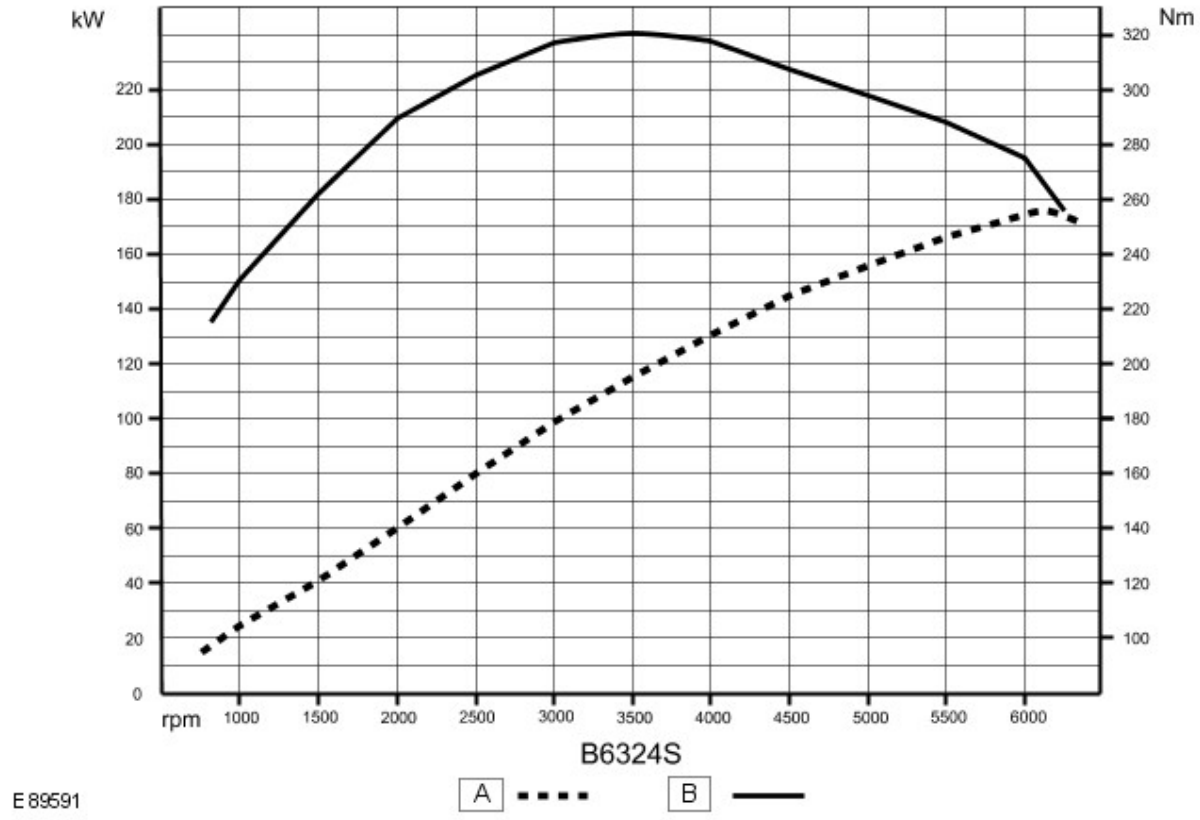
The engines technical features include:

- A 6-cylinder, inline configuration, liquid cooled, aluminium cylinder block with cast iron liners
- Pistons are cast from a light alloy metal, with 2 compression rings and a 3-piece oil control ring
- Aluminum cylinder head, incorporating 2 camshafts
- Four valves per cylinder
- Variable lift height hydraulic valve tappets (intake only)
- Variable Camshaft Timing (VCT) (intake only)
- Crankshaft vibration damper to give the crankshaft a smoother operation
- A single gear driven camshaft timing chain drives both camshafts
- An aluminum bedplate section between the oil pan and cylinder block
- A forged steel crankshaft with induction hardened bearing surfaces
- Forged steel connecting rods

- A Rear End Ancillary Drive (READ) system
- Two fabricated stainless steel twin skin exhaust manifolds
- A 3-position Variable Intake System (VIS)
- An advanced Engine Management System (EMS) incorporating electronic throttle control
- Four catalytic converters

Technical data

DESCRIPTION	TYPE
Configuration	Inline 6-cylinder
Output	171 kW at 6200 rpm
Torque	320 Nm at 3200 rpm
Displacement	3192 cm³
Stroke/bore	96.0 mm/84.0 mm
Compression ratio	10.8:1
Firing order	1-5-3-6-2-4
Approximate weight	180 kg (including intake pipe, exhaust manifold, alternator and oil)



Item	Part Number	Description
A	-	Torque (Nm)
B	-	Power (kW)

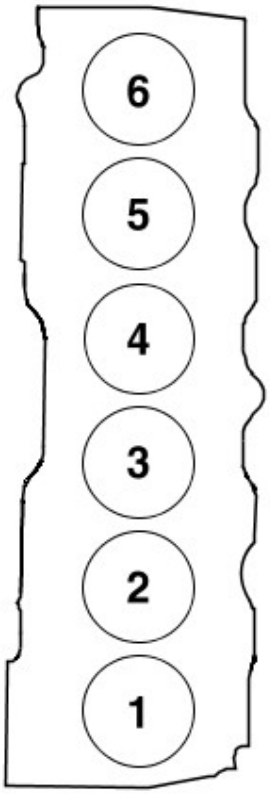
CYLINDER BLOCK COMPONENTS

The main cylinder block components are:

- Cylinder block
- Connecting rods and pistons
- Piston cooling jets
- Generator
- Gear housing
- Thermostat housing
- Crankshaft Position (CKP) sensor
- Knock sensors
- Coolant pump
- Coolant inlet pipe

Cylinder Numbering

The cylinders are numbered as shown below, with cylinder 1 at the front of the engine.



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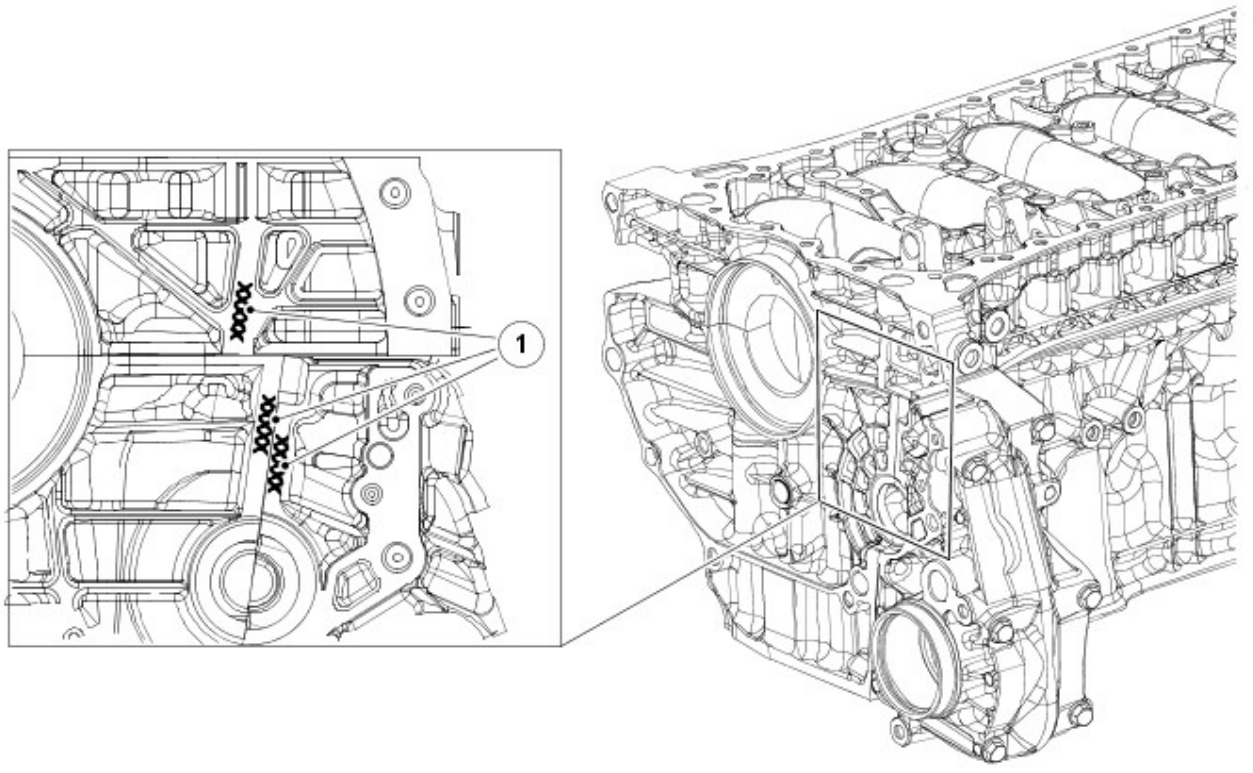
Cylinder Block

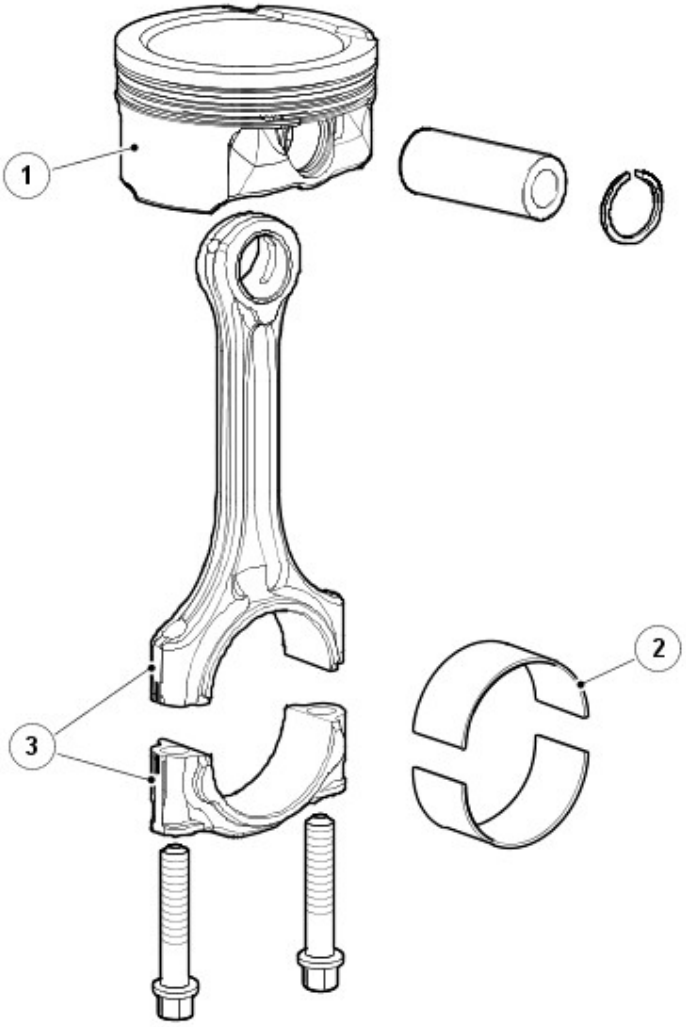


E86979

Item	Part Number	Description
1	-	Identification markings

The cylinders and crankcase are contained in the cylinder block, which is of a cast aluminum construction. The cylinder sleeves are made of cast iron and cast in bores. The cylinder block is of a pen coolant mantle design, which allows coolant to flow freely around the upper section of the cylinders.

Connecting rods and Pistons



E86986

Item	Part Number	Description
1	-	Piston
2	-	Connecting rod bearings
3	-	Connecting rod and cap assembly

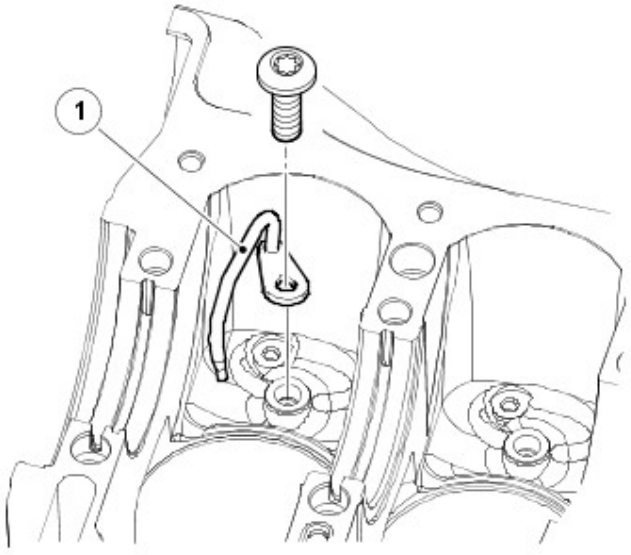
The connecting rods are 'L' profile forged with a trapezium shaped (a shape with 4 sides with 2 of its sides parallel) small end. The big end has a fracture split bearing cap, which gives a stable joint because the bearing cap and connecting rod are secured in the actual fracture surface. Aluminium bearings are used for both the lower and upper bearing half.

The pistons are cast from a light-alloy metal consisting of aluminium and silicon. The piston skirt is graphite coated at the front and rear to ensure low friction between the piston and cylinder, particularly during cold starting and during short periods of extreme load. The piston is 'weight optimised', which means, for example, that the piston pin is comparatively short and that the piston is missing material from the sides.

Each piston has 3 piston rings:

- An upper compression ring of nitrated steel
- A second ring of alloyed cast iron, which functions as both a compression ring and an oil scraper ring
- A 3-part oil ring made of nitrated steel

Piston Cooling Jets

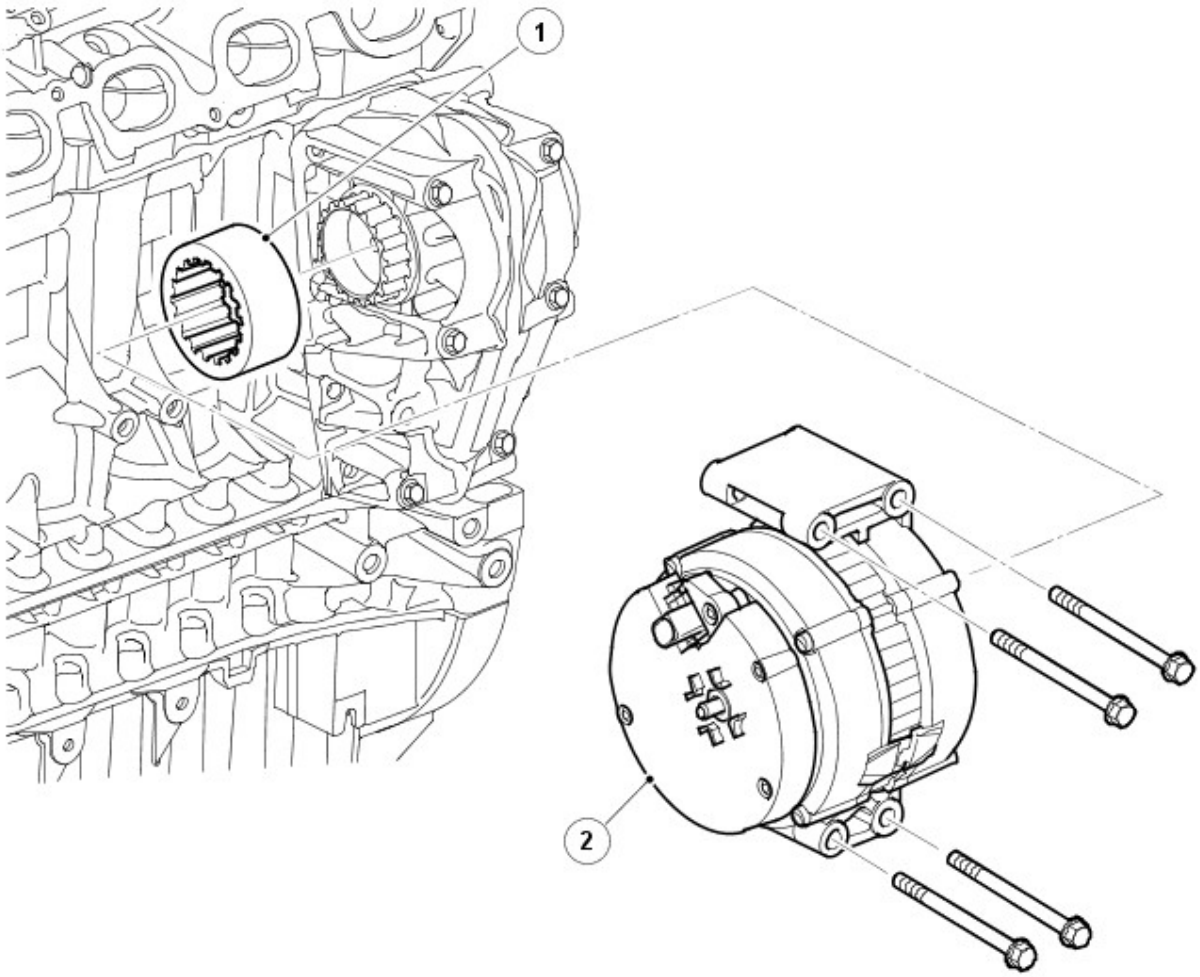


E86987

Item	Part Number	Description
1	-	Piston cooling jet (6 off)

Jets located in the cylinder block spray oil on to the inside of the piston to provide piston and piston pin lubrication and cooling. The oil is distributed through the cylinder block, via the main oil gallery and channels bored in the block.

Generator

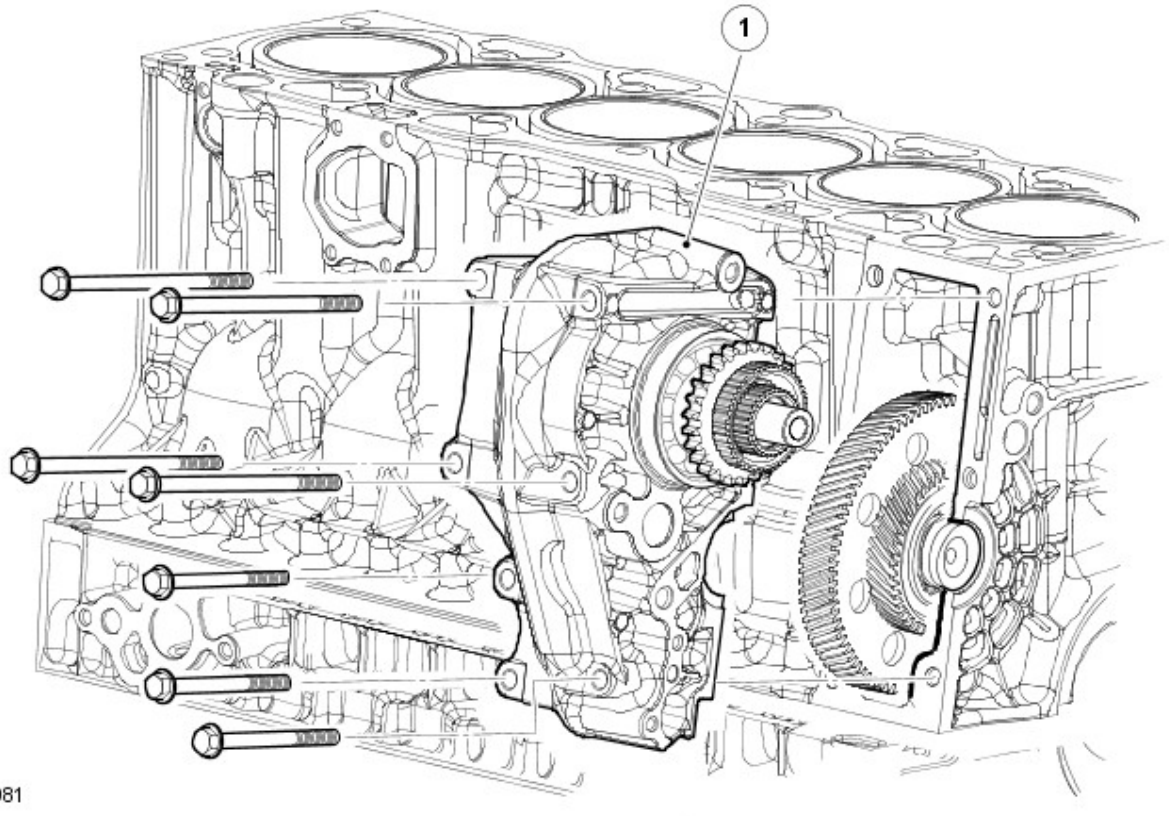


E87044

Item	Part Number	Description
1	-	Rubber sleeve
2	-	Generator

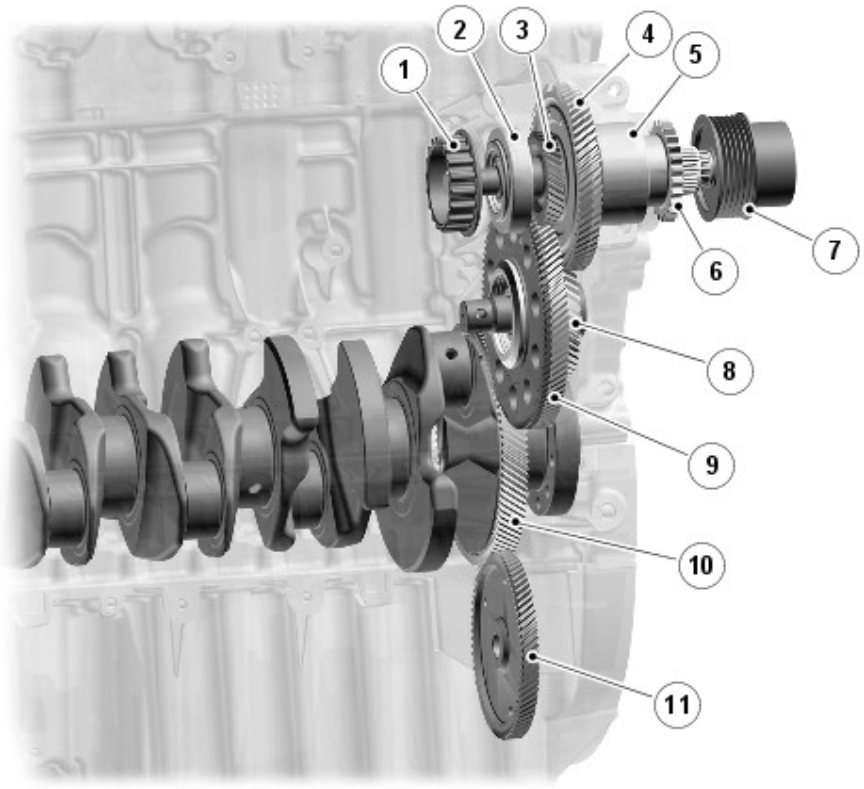
The generator is located at the rear of the intake side of the cylinder block. The generator is driven by the crankshaft gearwheel via the auxiliary unit shaft gearwheel and the auxiliary unit inner shaft gear wheel (see gear housing section for more information).

Gear Housing Components



E86981

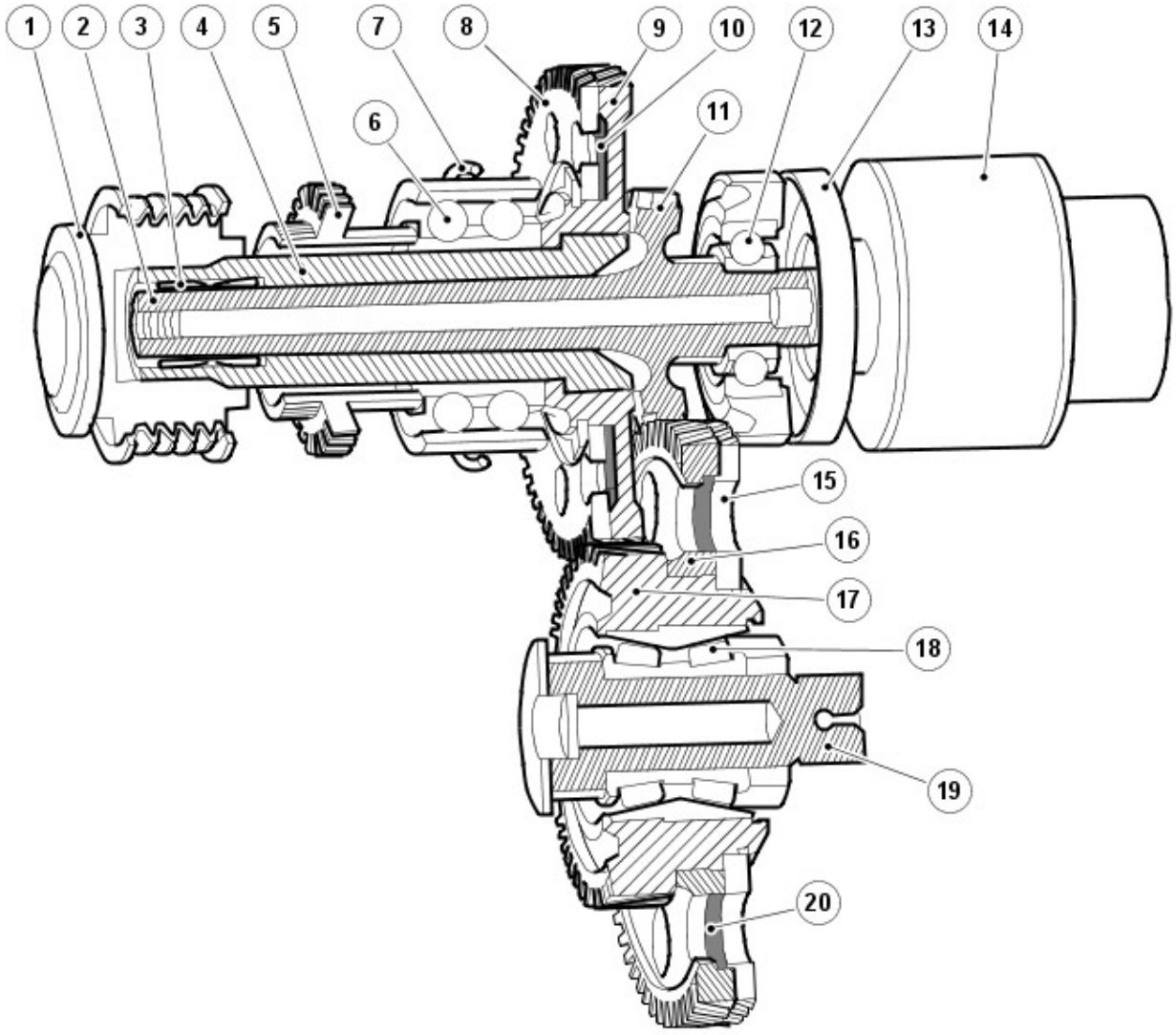
Item	Part Number	Description
1	-	Gear housing assembly



E89597

Item	Part Number	Description
1	-	Generator connection sleeve
2	-	Front bearing
3	-	Auxiliary unit inner shaft gear wheel
4	-	Camshaft drive outer shaft gear wheel
5	-	Rear bearing
6	-	Camshaft chain gear wheel
7	-	Pulley
8	-	Camshaft drive shaft gear wheel
9	-	Auxiliary unit shaft drive gear wheel
10	-	Crankshaft gear wheel

11	-	Oil pump gear wheel
12	-	Intermediate shaft



E89598

Item	Part Number	Description
1	-	Pulley
2	-	Auxiliary unit shaft
3	-	Needle bearing
4	-	Cam driving shaft
5	-	Gear, camshaft chain
6	-	Seal
7	-	Double row bearing
8	-	"Narrow" gear wheel (Scissor gear) intermediate shaft
9	-	"Wide" gear wheel, cam driving shaft
10	-	Spring © spring)
11	-	Gear wheel, auxiliary unit shaft
12	-	Single row bearing with bearing housing
13	-	Seal
14	-	Sleeve connection, alternator
15	-	"Narrow" gear wheel (Scissor gear) intermediate shaft, drives the auxiliary unit shaft
16	-	"Wide" gear wheel intermediate shaft, drives the auxiliary unit shaft
17	-	Small gear wheel intermediate shaft, drives the cam driving shaft
18	-	Double row conical bearing
19	-	Intermediate shaft
20	-	Spring © spring)

The gear housing functions as an external cover for the following sub-sections:

- Intermediate shaft
- Camshaft drive outer shaft
- Auxiliary unit inner shaft

Intermediate Shaft

The intermediate shaft is used to locate the camshaft drive shaft gear wheel in the cylinder block. The shaft is journaled with a double conical roller bearing. The auxiliary unit shaft drive gear wheel is in 2 pieces, with the narrow half being spring tensioned in the opposite direction to the wide half. This feature reduces noise because gear play is eliminated. Only the wide half drives the auxiliary unit's gear wheel. The camshaft chain gear wheel is of the conventional design.

The shaft is sealed against the exhaust side (i.e. the rear side of the cylinder block) by a sealing washer. To remove or install the washer, the flywheel/flexplate must be removed.

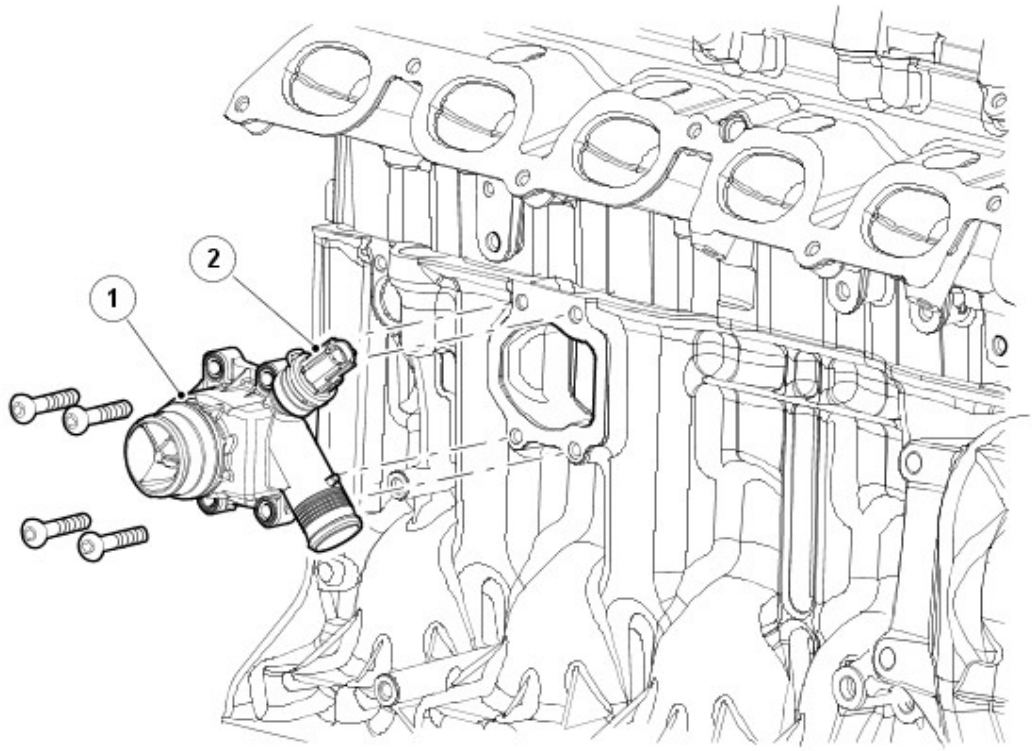
Camshaft Drive Outer Shaft

The camshaft drive outer shaft is journaled at the front end of the shaft with a double row bearing in the gear housing. Needle bearings are used at the rear end (pulley side) against the auxiliary unit shaft. The camshaft drive outer shaft gear wheel is in 2 pieces, a wide and a narrow half to reduce noise. The camshaft chain gear wheel is also located on the shaft and is used to drive the camshafts chain.

Auxiliary Unit Inner Shaft

The auxiliary unit inner shaft is journaled at the front end of the shaft (generator side) in the gear housing with a single row bearing. Needle bearings are used at the rear end (pulley side) against the camshaft drive shaft. There is a pulley at the rear end of the shaft that drives the Air Conditioning (AC) compressor and the power steering pump, via a polyvee belt. The shaft also drives the generator at the front end, via a sleeve connector.

Thermostat Housing



E87015

Item	Part Number	Description
1	-	Thermostat housing
2	-	Coolant temperature sensor

The thermostat housing is located towards the front of the intake side of the engine cylinder block. The housing contains a wax type thermostat and a coolant temperature sensor.

Coolant flows in at the coolant pump and passes through a number of channels before it collects and then flows out to the thermostat housing. If the thermostat housing is closed, the coolant passes via the by-pass channel directly to the coolant pump to then circulate through the cylinder block again
For additional information, refer to: Engine Cooling (303-03A Engine Cooling - I6 3.2L Petrol, Description and Operation).
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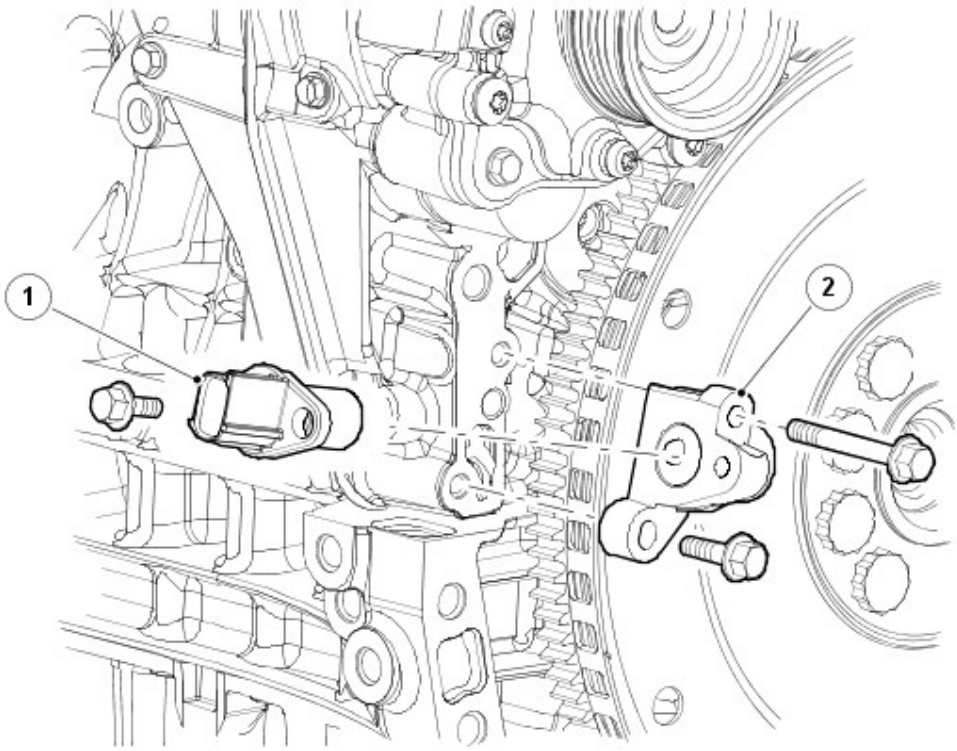
Crankshaft Position Sensor



E87039

Item	Part Number	Description
1	-	CKP sensor
2	-	Sensor bracket

The Crankshaft Position (CKP) sensor is located at the rear of the intake side of the cylinder block. The sensor provides an input of engine crankshaft speed and position. The sensor works on the principle of the Hall effect and scans a trigger wheel (magnetic disc) on the flywheel
For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).
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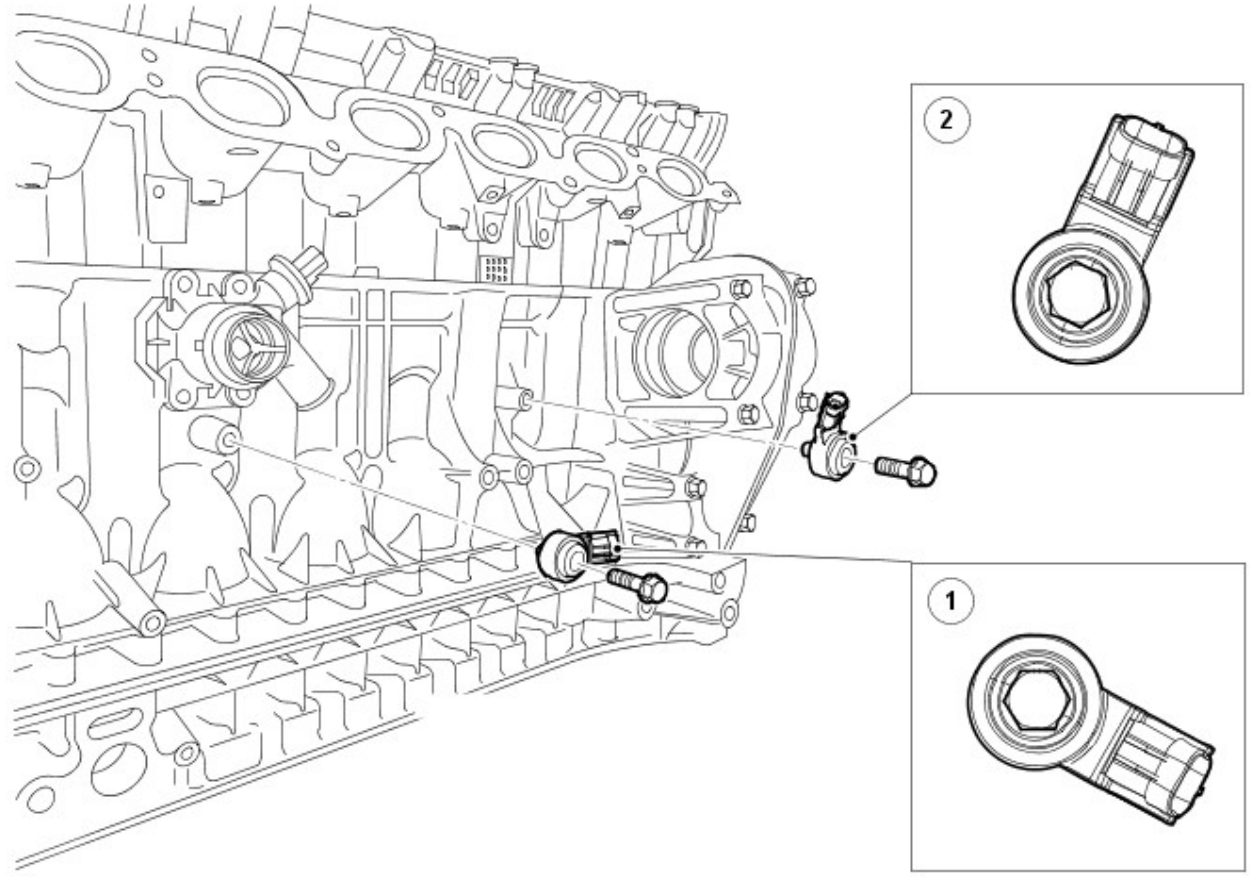
Knock Sensors



Item	Part Number	Description
1	-	Front knock sensor
2	-	Rear knock sensor

The knock sensors are located at the front and rear intake side of the cylinder block. They are piezo-electric sensors that provide inputs to detect and locate detonation during combustion
For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).
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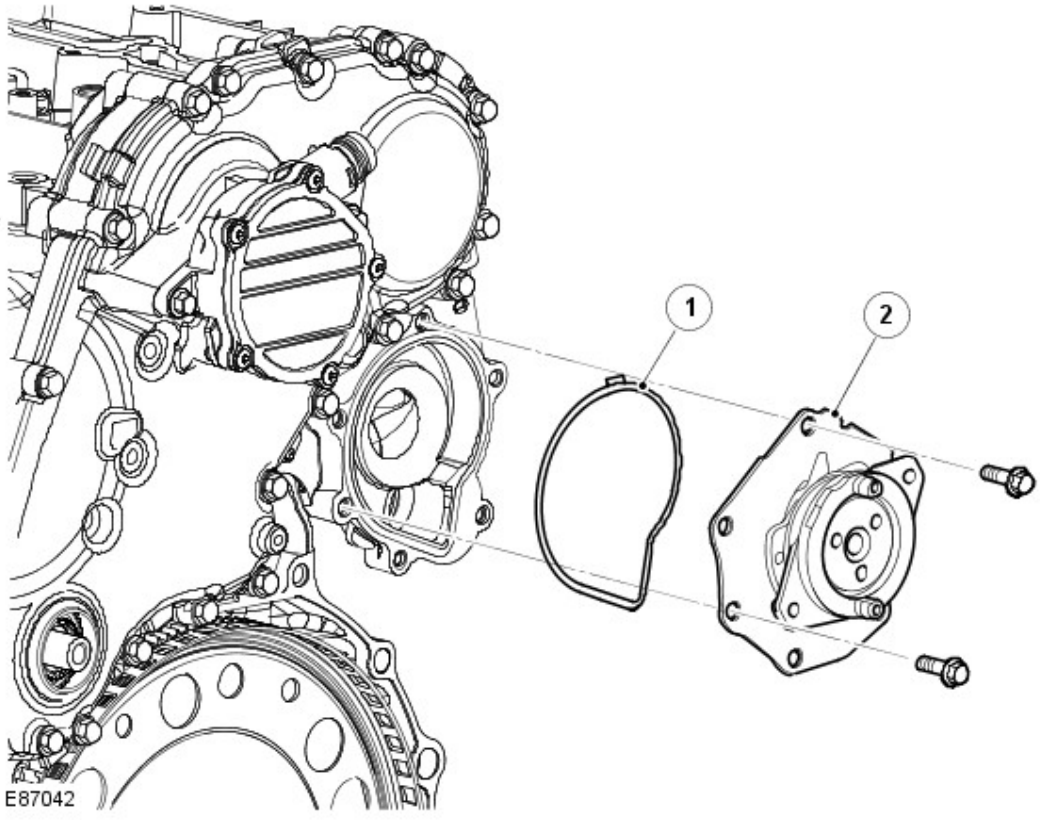
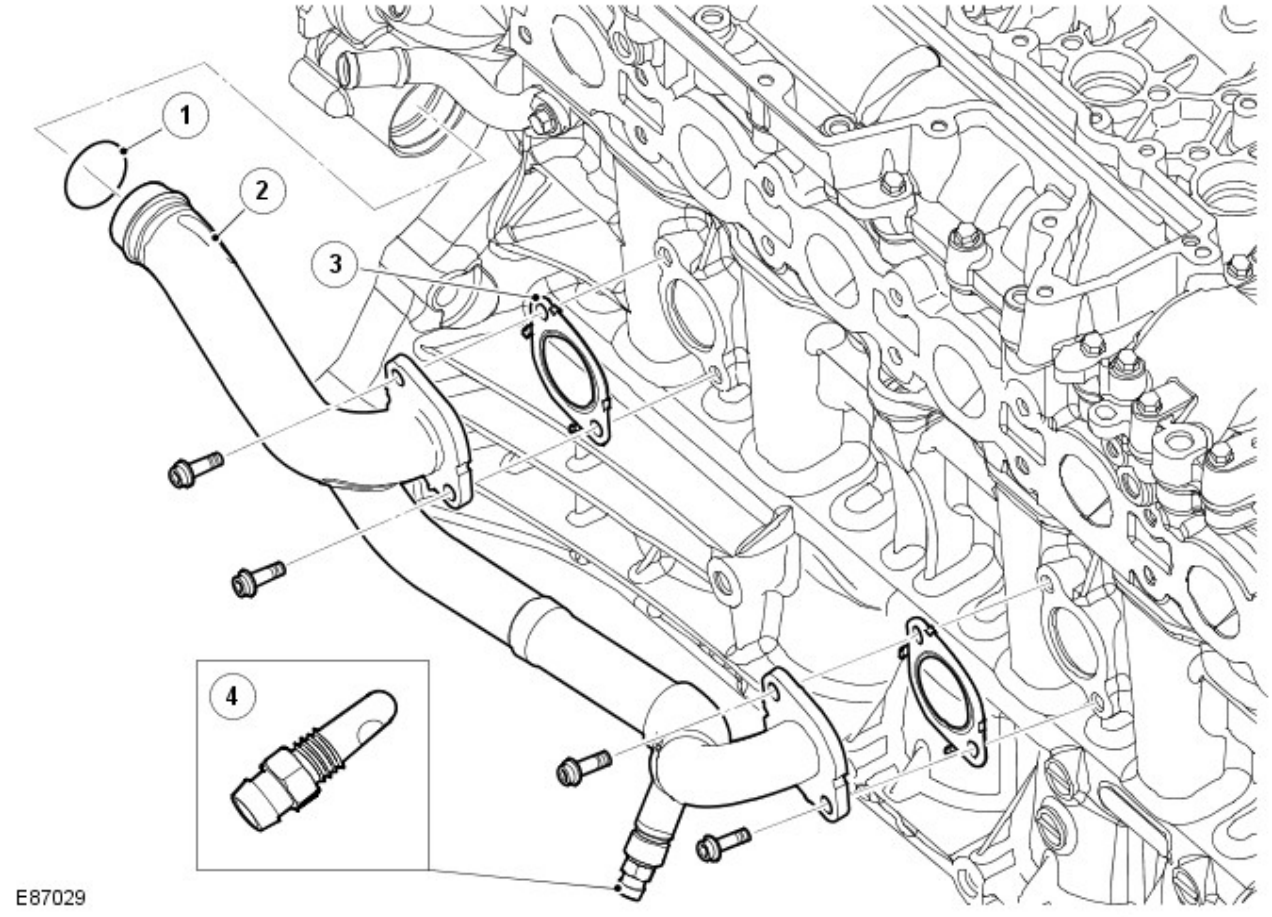
Coolant Pump



Item	Part Number	Description
1	-	Seal
2	-	Coolant pump

The coolant pump is installed on the RH side of the cylinder block rear face and is secured and sealed via 6 bolts and an 'O' ring. The coolant pump and power steering pump are both driven by a single pulley via a poly-vee belt. A keyed shaft at the front of the pulley drives the power steering pump, while a driver mechanism attached to the rear of the pulley drives the coolant pump.

Coolant Inlet Pipe



Item	Part Number	Description
1	-	O ring
2	-	Coolant inlet pipe
3	-	Gasket (2 off)
4	-	Drain nipple

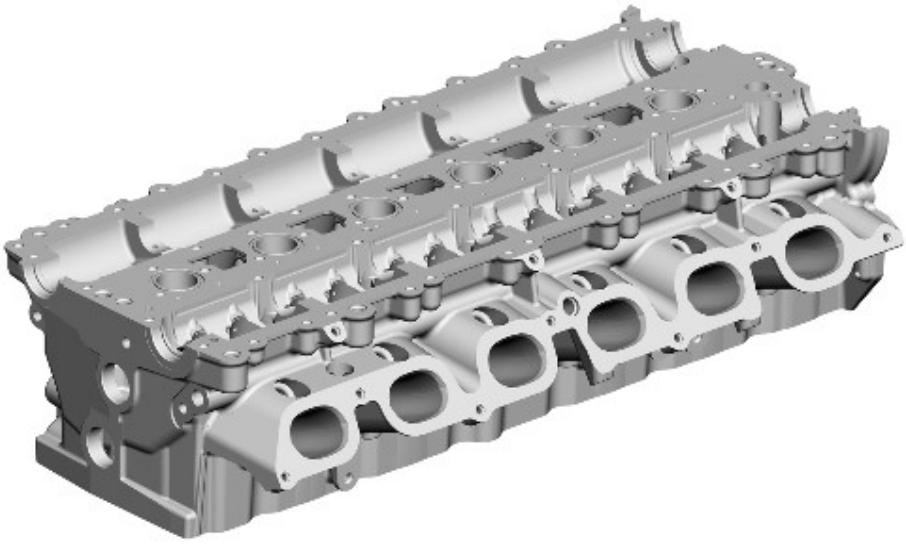
The coolant inlet pipe is located on the exhaust side of the engine. The coolant is routed from the coolant pump into 2 connections on the engine block via the coolant inlet pipe and leaves the engine block at the rear end, via the thermostat housing.

CYLINDER HEAD COMPONENTS

The main cylinder head components are:

- Cylinder head
- Cylinder head gasket
- Oil separator
- Camshaft housing
- Camshafts
- Intake and exhaust valve assemblies
- Variable Camshaft Timing (VCT) solenoid and Camshaft Position (CMP) sensors
- Spark plugs
- Coils
- Fuel rail and injectors
- Vacuum pump
- Intake manifold
- Exhaust manifold

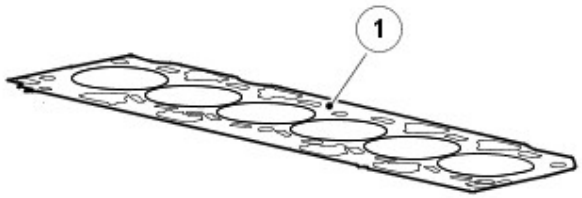
Cylinder Head



E90912

The chill cast cylinder head is of the cross-flow type, manufactured from a light-alloy metal. Deep-seated bolts, to reduce distortion, secure the cylinder head to the cylinder block. Two hollow locating dowels align the cylinder head with the cylinder block. The 2 camshafts are supported by 7 bearing caps each, directly in the cylinder head and camshaft cover.

Cylinder Head Gasket

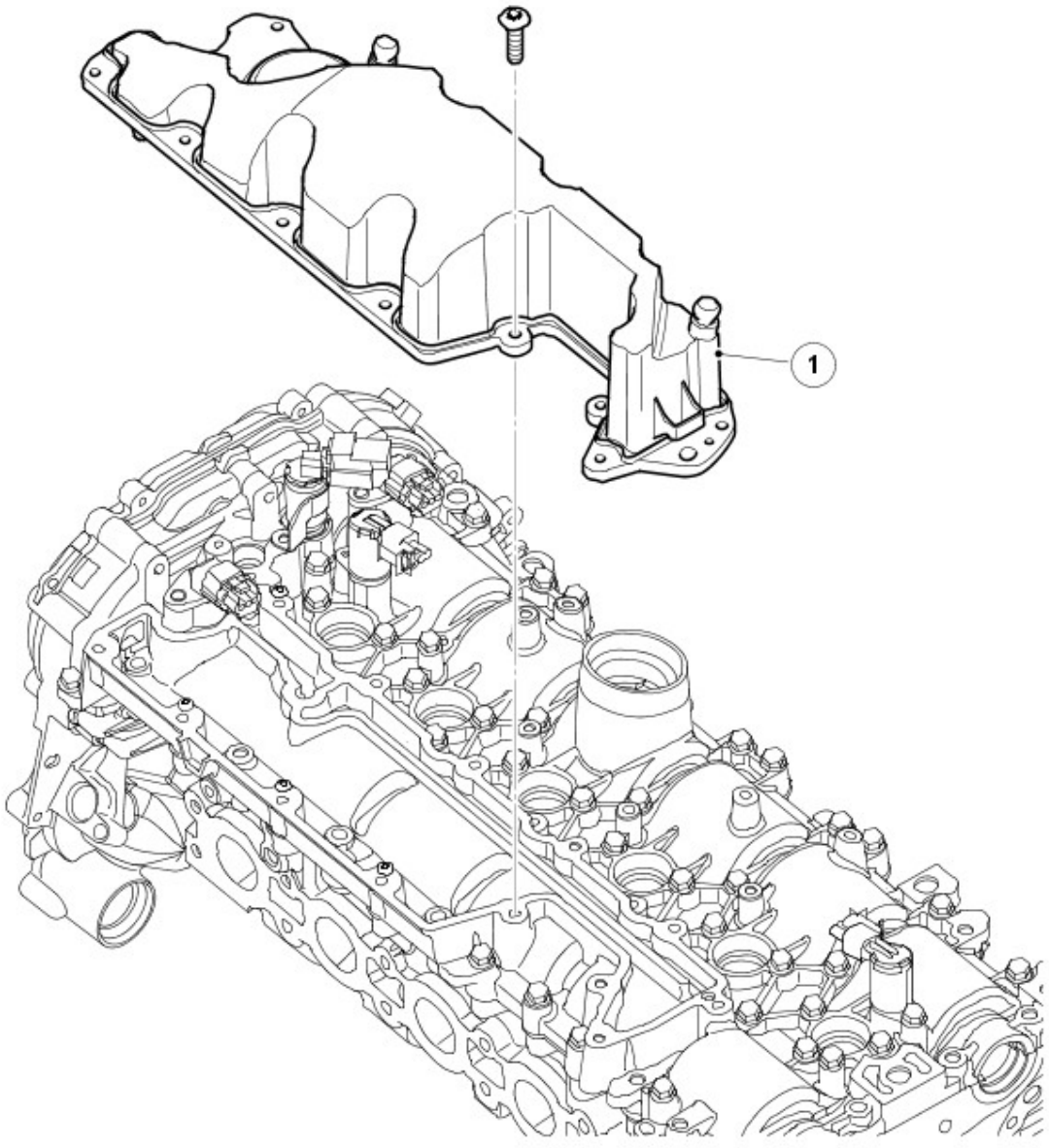


E89572

Item	Part Number	Description
1	-	Cylinder head gasket

The seal between the cylinder head and cylinder block is a conventional cylinder head gasket. The head gasket is made of steel and has multiple layers. For service, there is only 1 size of gasket available.

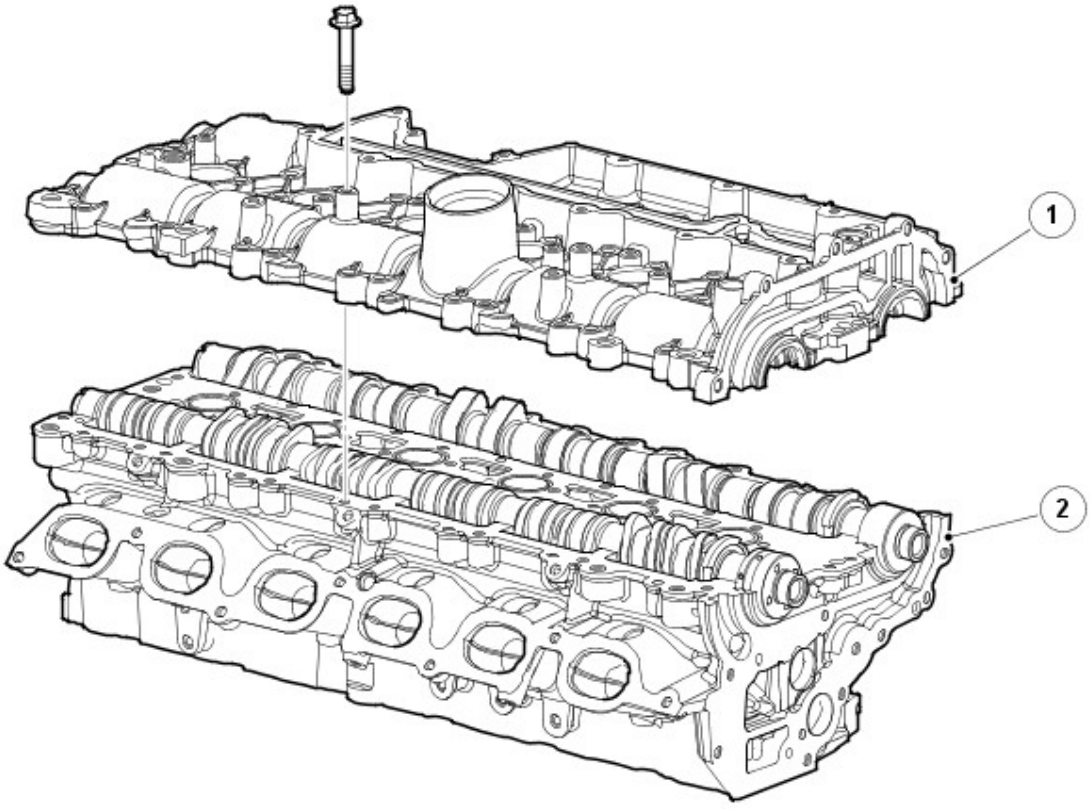
Oil Separation Housing



Item	Part Number	Description
1	-	Oil separation housing

Crankcase gases are routed from the crankcase, engine block and cylinder head to the oil separation housing located on the camshaft cover. From the oil separation housing, the crankcase gases are routed via a pressure regulator, located at the rear edge of the housing, to the cylinder head and the intake ports for the intake valves.
For additional information, refer to: Evaporative Emissions (303-13 Evaporative Emissions, Description and Operation).

Camshaft Housing



E87026

Item	Part Number	Description
1	-	Camshaft housing
2	-	Cylinder head

The chill cast camshaft housing is manufactured from a light-alloy metal and acts as a combined valve cover and camshaft bearing cap. The housing has cast oil ducts on it's underside, which ensure good oil supply to the camshafts and the valve lifters. The oil separation housing is located on the camshaft cover
For additional information, refer to: Engine Emission Control - 3.2L (303-08 Engine Emission Control - 3.2L NA - I6, Description and Operation).
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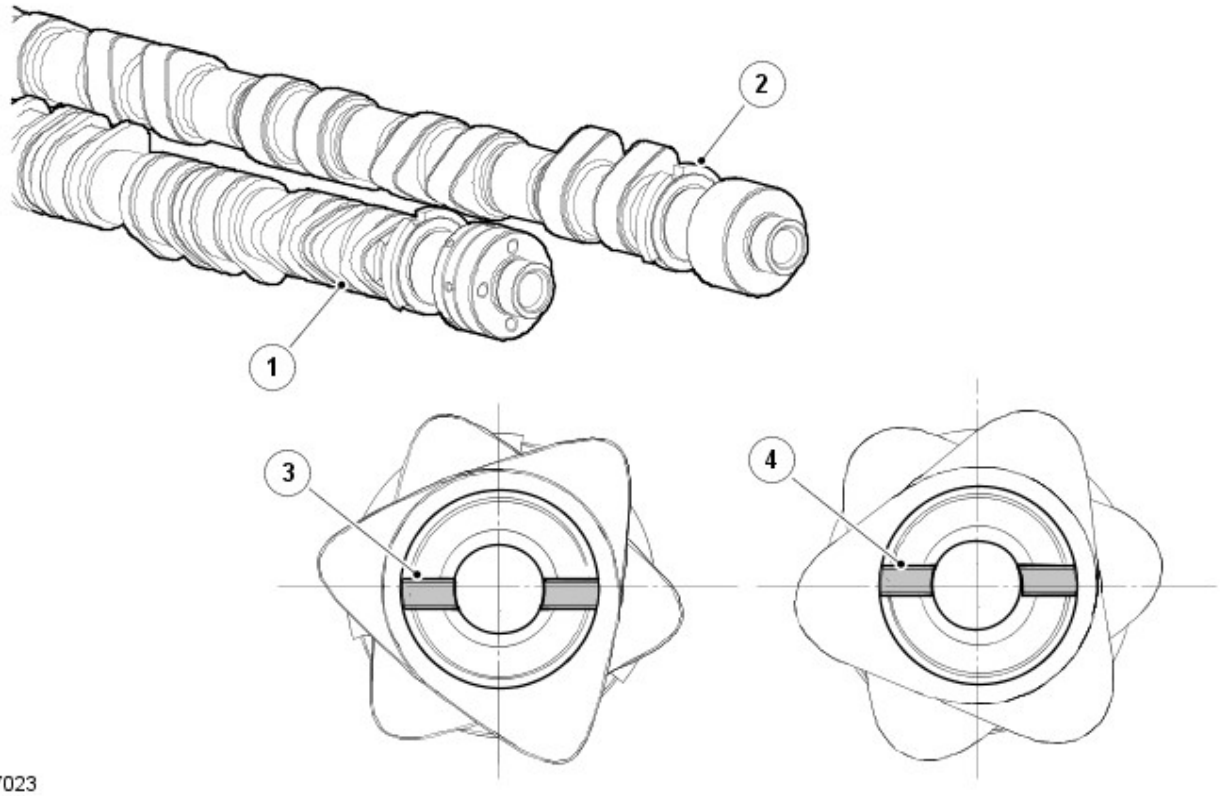
Camshafts



E87023

Item	Part Number	Description
1	-	Intake camshaft

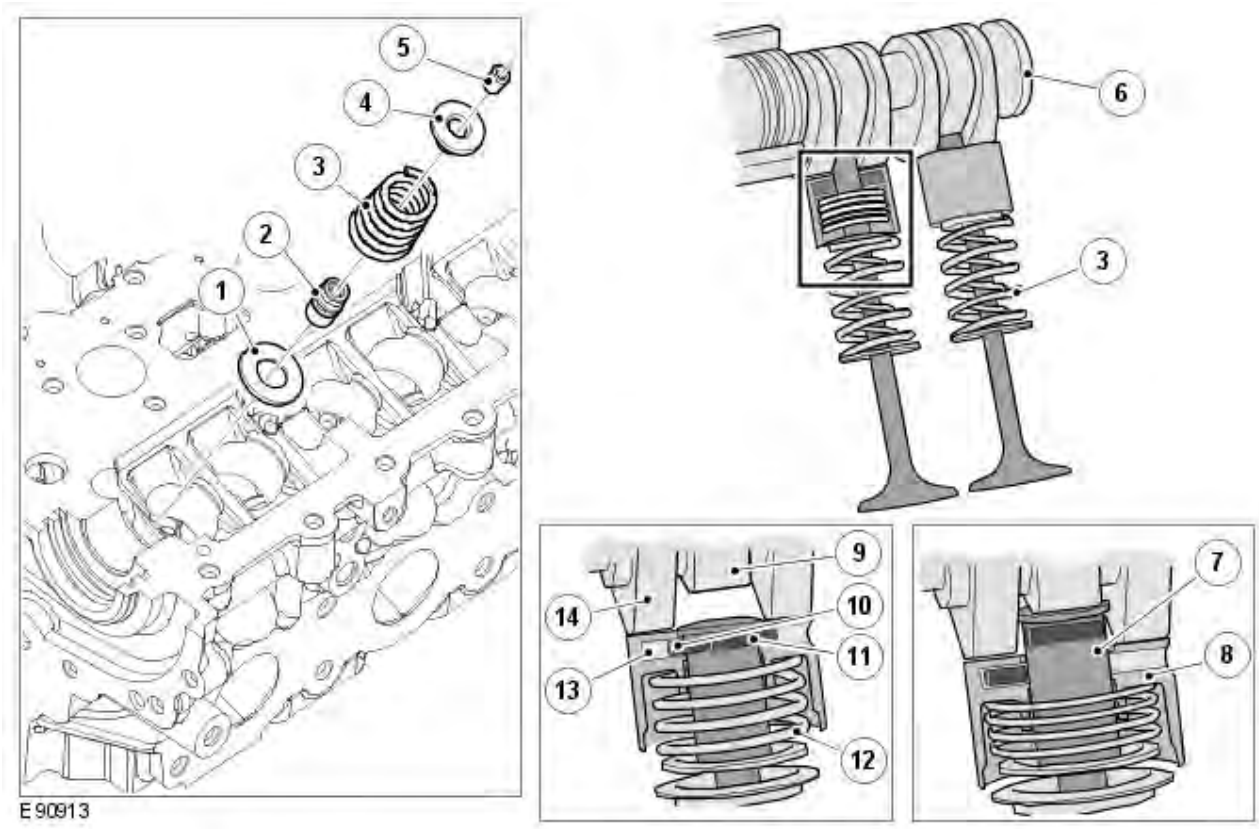
2	-	Exhaust camshaft
3	-	Exhaust camshaft slot below centre line
4	-	Inlet camshaft slot above centre line

The camshafts are of a hollow steel tube construction, drilled to save weight. Each camshaft is retained in the cylinder head by the camshaft housing. The intake camshaft is equipped with a VCT unit and also drives the vacuum pump.

The intake camshaft has cam lobes with different profiles. One for a small lifting height of 3.6 mm, and 1 for larger lifting height of 10.0 mm. The transition between the lifting heights is controlled via the Camshaft Profile Switching (CPS) function.

The exhaust camshaft is conventional, i.e. only has a lifting height of 10.0 mm.

Intake and Exhaust Valve Assemblies

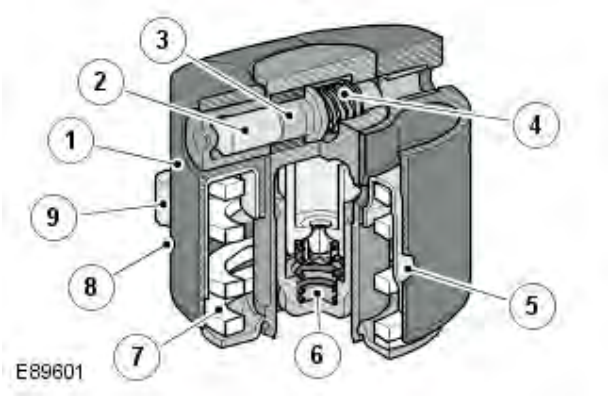


Item	Part Number	Description
1	-	Valve spring seat (24 off)
2	-	Valve stem seal (24 off)
3	-	Valve spring (12 off intake, 12 off exhaust)
4	-	Valve spring retainer (24 off)
5	-	Valve spring collets (48 off)
6	-	Intake camshaft
7	-	Hydraulic tappet, inner
8	-	Tappet, outer
9	-	Cam lobe, central (smaller lifting height)
10	-	Locking pin, outer
11	-	Locking pin, inner
12	-	Return spring, outer tappet
13	-	Oil inlet
14	-	Cam lobes, outer (greater lifting height)

The cylinder head incorporates 2 overhead camshafts operating 4 valves per cylinder via hydraulic tappets for the intake camshaft and mechanical tappets for the exhaust camshaft.

Camshaft Profile Switching

CPS is a system where the intake valves, at engine speeds up to approximately 3000 rpm, have a small lifting height of 3.6 mm, and at speeds above approximately 3000 rpm, have a greater lifting height of 10.0 mm. CPS, in combination with the VCT function makes it possible to control the cylinders' incoming air quantity in such a way that the Electronic Throttle Actuator (ETA) can be fully open. A fully open ETA, during operation, reduces the pump losses considerably compared with when the amount of intake air is controlled by the ETA itself. Reduced pump losses, in turn, cause a reduction in fuel consumption.



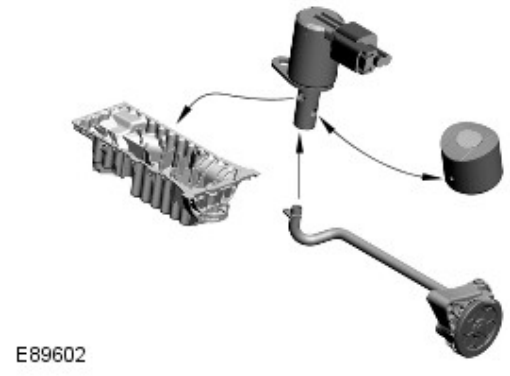
Item	Part Number	Description
1	-	Outer tappet
2	-	Locking pin, outer
3	-	Inner tappet
4	-	Locking pin with spring, inner
5	-	Oil inlet, hydraulic valve adjustment
6	-	Hydraulic valve adjustment unit
7	-	Return spring, outer tappet
8	-	Lug
9	-	Oil inlet, CPS function

The electrical hydraulic valves are seat valves.

The valves have 3 inputs/outputs:

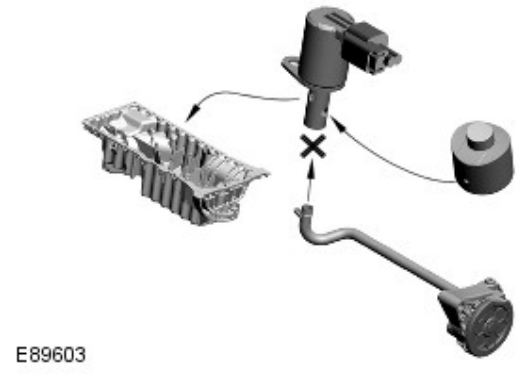
- Inlet, oil supply
- To/from tappet
- To return, i.e. oil pan

A solenoid is affected via an electro-magnet, which affects a valve that can assume 2 positions.



When the solenoid is not activated, the valve is only affected by the oil pressure on the intake side. The valve closes for intake but opens between the tappet and return.

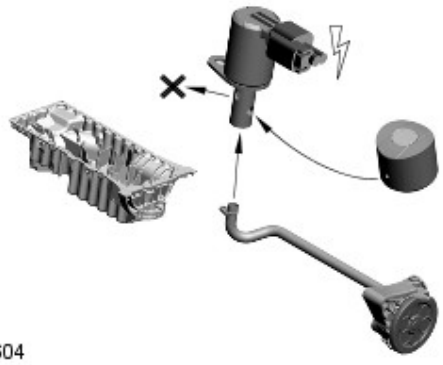
The oil pressure is low at the tappet's outer locking pin and the valves lift a small amount.



When the solenoid is activated, the valve is affected from above by an electro-magnet that overpowers the force of the oil pressure.

The valve shifts position and closes between the tappet and return but opens the connections between intake and tappet.

The oil pressure is high at the tappet's outer locking pin that is lifted and affects the inner locking pin. Outer and inner tappet connect and the valves lift a greater amount.

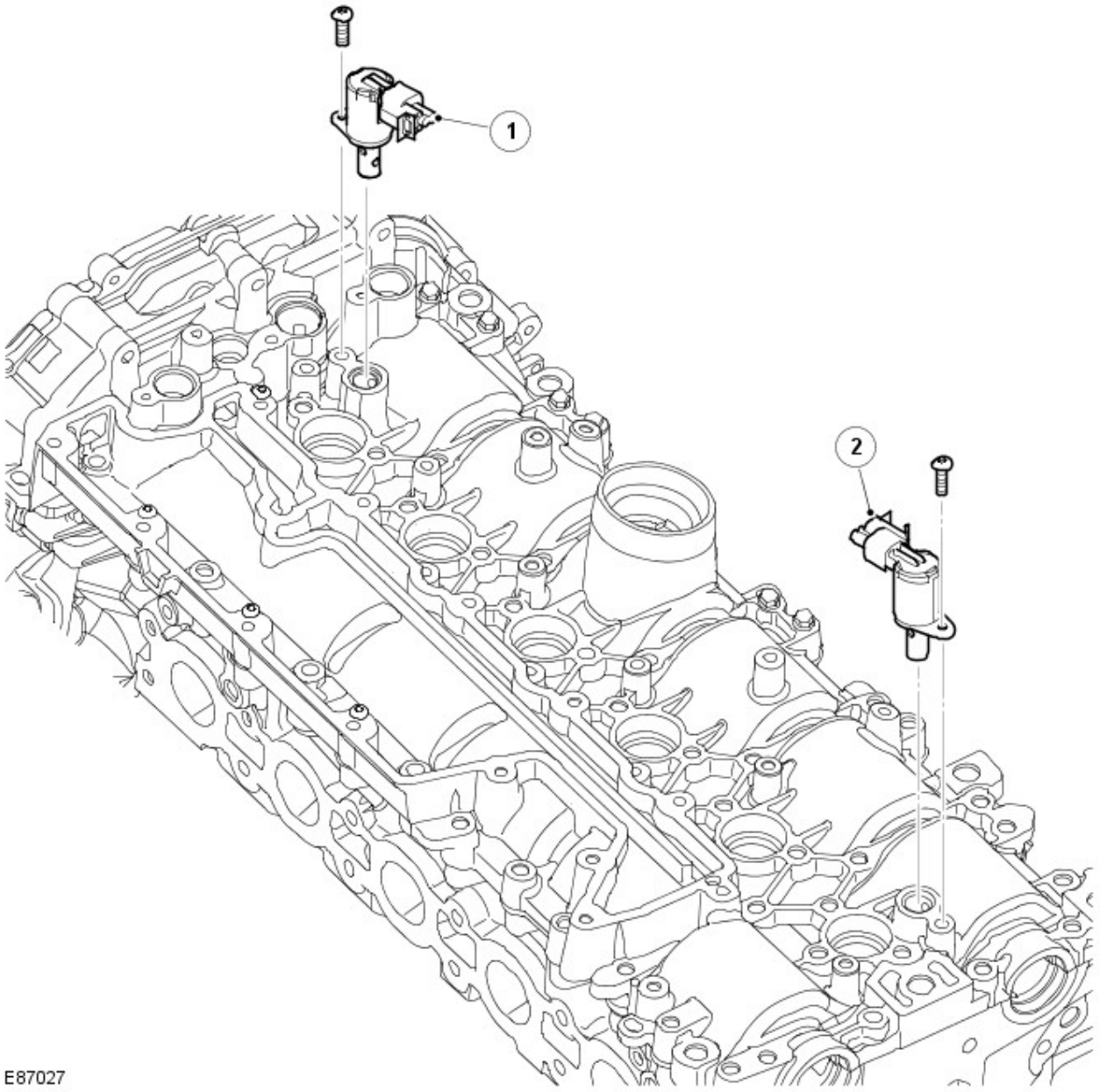


E89604

The intake camshaft is equipped with 3 lobes for each valve. One centrally located with a small lifting height of 3.6 mm, and 2 outer lobes with greater (same) lifting heights of 10.0 mm.

At small lifting heights, only the centrally located lobe works on the valve, which occurs via the inner tappet. The outer lobes work on the outer tappet that follows the movement of the lobes. The return spring is compressed and ensures that the tappet is always in contact with the camshaft. When the centrally located tappet and the outer tappet are not joined, the outer tappet moves without affecting the valve. Thus the lifting height is small. At high lifting height, the inner tappet and the outer tappet are joined via the 2 lock pins.

The position of the lock pins is controlled hydraulically by 2 electro-hydraulic CPS solenoid valves. These valves are located in the camshaft housing.



E87027

Item	Part Number	Description
1	-	CPS solenoid valve - cylinders 3, 5 and 6
2	-	CPS solenoid valve - cylinders 1, 2 and 4

One solenoid controls the valves for cylinders 1, 2 and 4 whilst the other controls the valves for cylinders 3, 5 and 6. The solenoids therefore control 6 valves each (when the engine has 2 intake valves and 2 exhaust valves per cylinder).

The position of the solenoids valves, on or off, are controlled by the ECM
For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).
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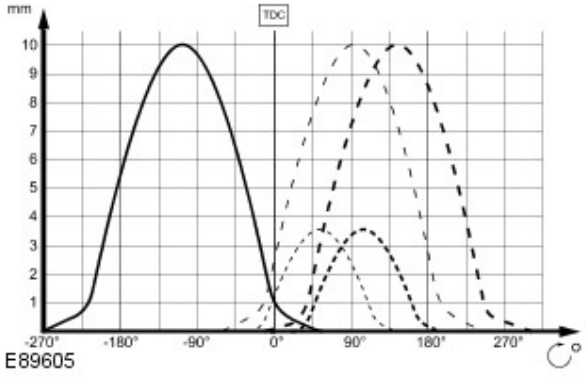
The inner tappet works like a hydraulic tappet, which compensates for any wear. The valve clearance is therefore '0'.

The exhaust camshaft is conventional and has a lifting height of 10.0 mm. The tappets are mechanical (i.e. have valve clearance).

Camshaft Data



Intake

- Opening angle, 3.6, mm lifting height:
  - Crankshaft degrees - 152°
  - Crankshaft degrees - 76°
- Opening angle, 10.0 mm lifting height:
  - Crankshaft degrees - 240°
  - Crankshaft degrees - 120°

Exhaust

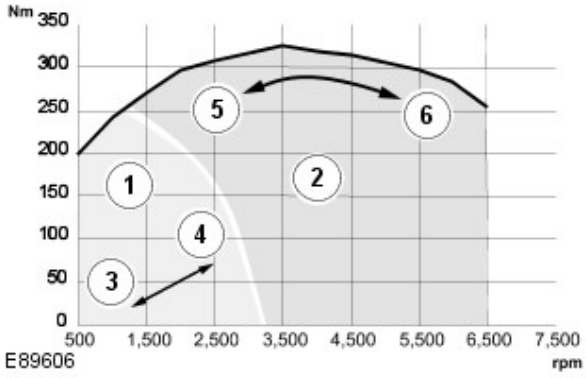
- Opening angle, 10.0 mm lifting height:
  - Crankshaft degrees - 240°
  - Crankshaft degrees - 120°

The intake camshaft has a VCT unit.

Lifting height	Opens	Closes
Intake 3.6 mm	32 BTDC to 28 ATDC	120 ATDC to 180 ATDC (or 60 BBDC to 0 BBDC)
Intake 10.0 mm	37 BTDC to 23 ATDC	203 ATDC to 263 ATDC (or 23 ABDC to 83 ABDC)
Exhaust, 10.0 mm	228 BTDC (or 48 BBDC)	12 ATDC

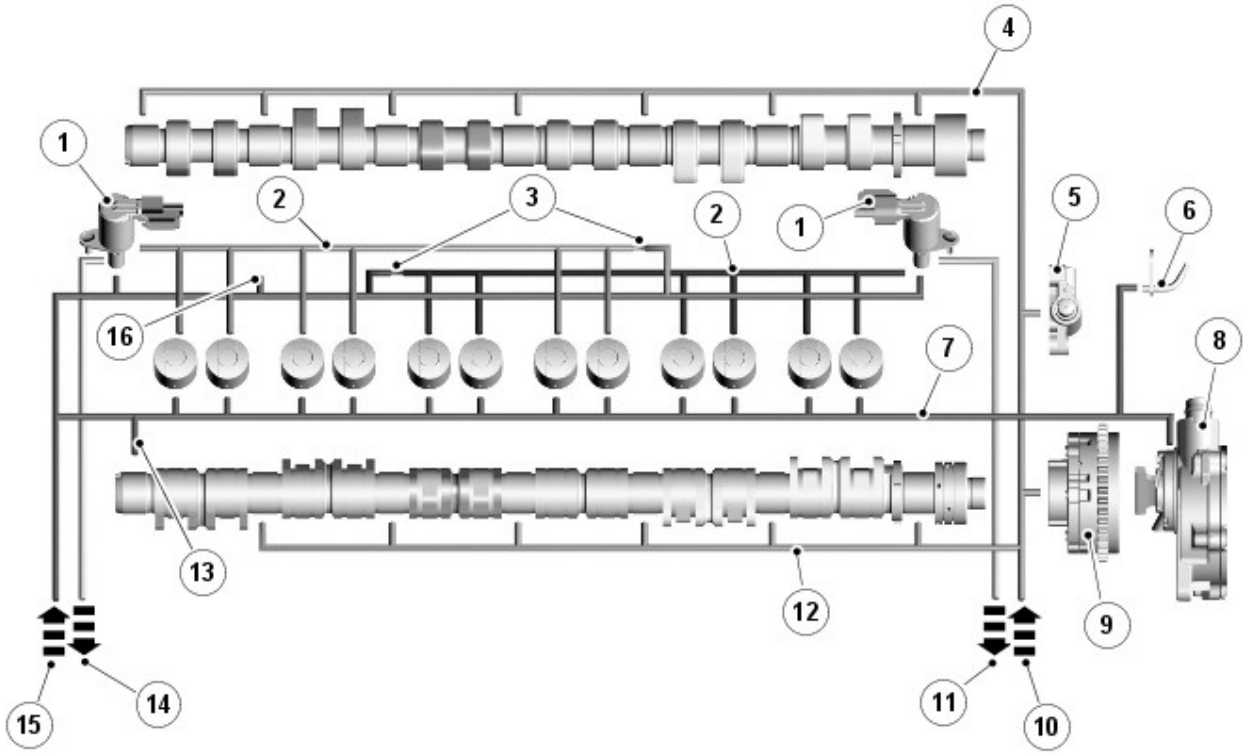
- BTDC = Before Top Dead Centre
- ABDC = After Bottom Dead Centre
- BBDC = Before Bottom Dead Centre
- ATDC = After Top Dead Centre

Camshaft Position in Relation to Load and RPM



Item	Part Number	Description
1	-	Range for lifting height 3.6 mm
2	-	Range for lifting height 10.0 mm
3	-	Small lifting height, 'early' camshaft
4	-	Small lifting height, 'late' camshaft
5	-	Large lifting height, 'early' camshaft
6	-	Large lifting height, 'late' camshaft

By closing the intake valves early at low load and low engine speed, reduced fuel consumption is achieved.



E89607

Item	Part Number	Description
1	-	CPS solenoid valve (x 2)
2	-	Oil circuit, tappet CPS function
3	-	Calibrated passage (choke)
4	-	To bearing, exhaust camshaft
5	-	Tensioner, camshaft chain
6	-	Nozzle, camshaft chain lubrication
7	-	Oil circuit, hydraulic adjusting valve clearance
8	-	Vacuum pump
9	-	VCT unit
10	-	Oil inlet, rear
11	-	Return
12	-	To bearing, intake camshaft
13	-	To front bearing, intake camshaft
14	-	Return
15	-	Oil inlet, front
16	-	Bleeding

The oil inlet, located on the front edge of the cylinder, supplies oil to the following:

- The hydraulic tappets
- The vacuum pump
- The nozzle for cam chain lubrication
- The intake camshaft's front bearing
- The electro-hydraulic CPS solenoid valves, front and rear
- The tappets with CPS function

There is a bleed valve (16) in the duct for the rear electro-hydraulic solenoid valves.

The duct is also equipped with 2 calibrated passages (3) to each tappet circuit (2) (i.e. the circuits after the CPS solenoid valves). A continuous flow through the circuit ensures the necessary stable pressure differences that are necessary for a stable transfer between the small and large tappet (or vice versa).

• NOTE: In the event of a small lifting height, the tappet circuit, in principle, has no pressure when the CPS valves are open, which produces a return flow to the oil pan.

A filter is located in each passage.

The oil inlet, located on the rear edge of the cylinder, supplies oil to the following:

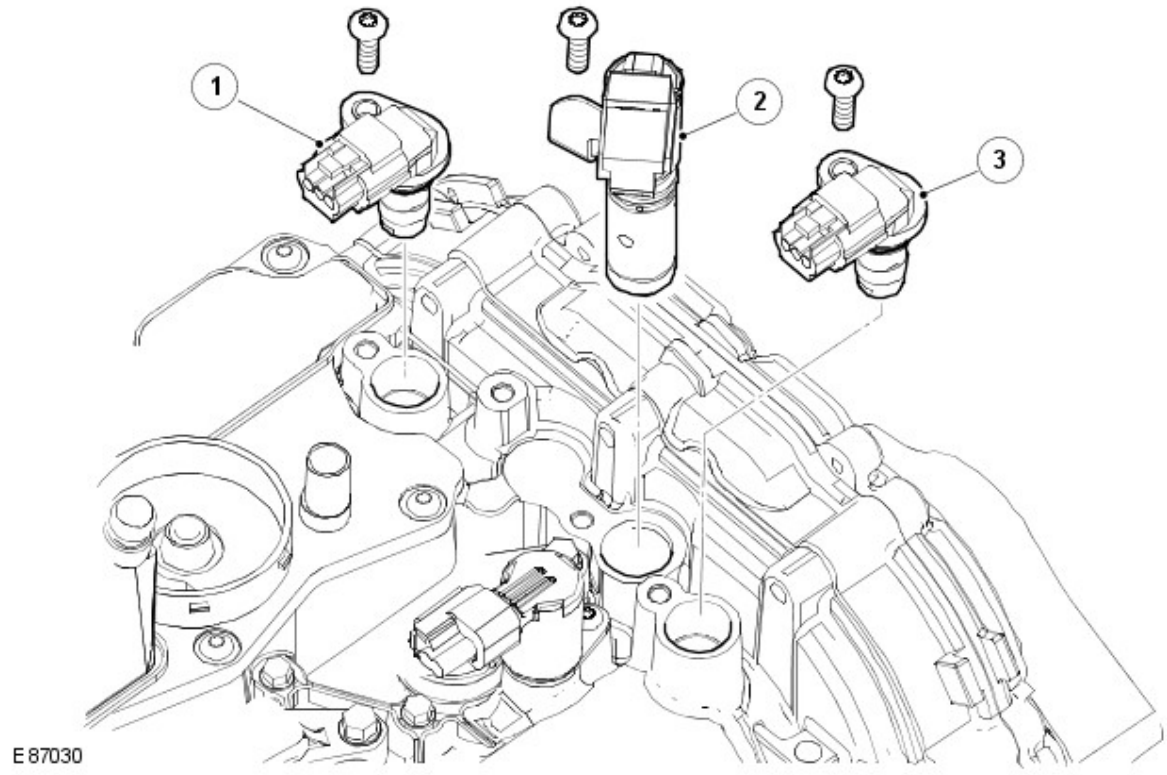
- The camshaft chain's hydraulic tensioner
- The intake camshaft VCT unit
- The intake camshaft's bearings
- The exhaust camshaft's bearings

To switch from low lift to high lift and vice versa as smoothly as possible, the transfer is only permitted when certain conditions are completed. These are:

- That the oil temperature is above +40°C (104°F). Calculated internally in the ECM, from, amongst other things, the coolant temperature
- Occasionally the volumetric efficiency is the same for low and high lift, which means that the air requirement is within a range where it can be managed initially by VCT control. This is to achieve as soft a transfer as possible.
- It is possible to adjust ignition timing to prevent torque peaks during CPS control

For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).

Variable Camshaft Timing Solenoid and Camshaft Position Sensors



Item	Part Number	Description
1	-	CMP Sensor - exhaust camshaft
2	-	VCT solenoid
3	-	CMP Sensor - intake camshaft

The profile, or position and shape of the camshaft lobes are optimized for a certain engine rpm, but this normally limits low-end torque or high-end power. At high engine speeds, an engine requires large amounts of air. However, the intake valves may close before all the air has been given a chance to flow in. On the other hand, if the camshaft keeps the valves open for longer periods of time, problems start to occur at the lower engine speeds. This will cause unburnt fuel to exit the engine since the valves are still open.

To overcome this, VCT changes the valve timing by either advancing or retarding the camshafts to allow for optimum engine performance, reduced emissions, and increased fuel efficiency. This is achieved via an electronically controlled hydraulic solenoid valve located in the camshaft housing at the rear of the engine, behind the rear CPS solenoid. The ECM transmits a signal to the solenoid, which directs engine oil into the VCT unit. A valve spool in the VCT unit regulates the flow of oil.
For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).
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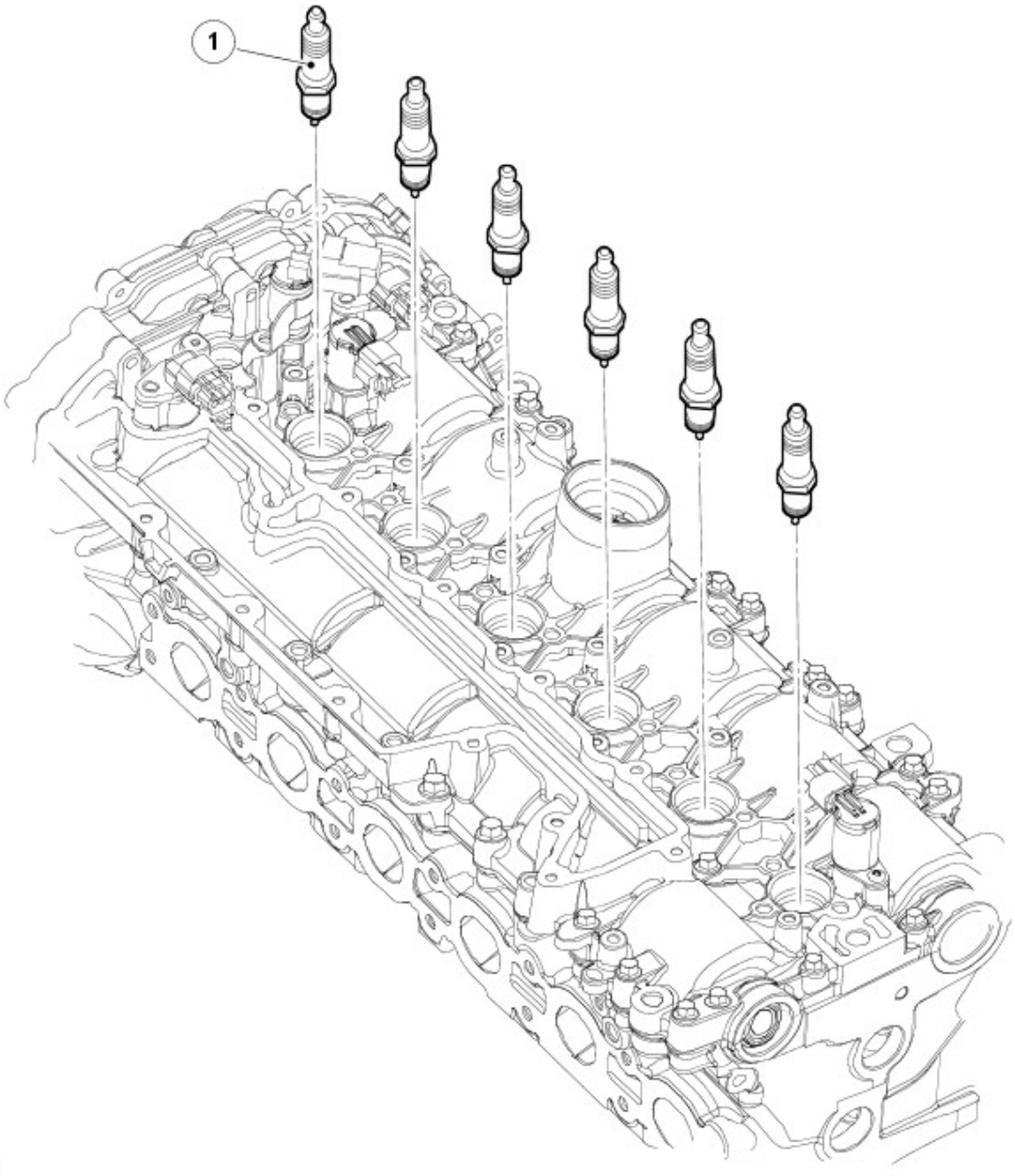
There are 2 CMP sensors located in the camshaft housing. The CMP sensors monitor the position of the camshafts to establish ignition timing order, fuel injection triggering and for accurate VCT camshaft advance-retard timing feedback.

The CMP sensor is a Hall-effect sensor, which switches a battery fed supply on and off. The supply is switched when the teeth of the reluctor pass by the tip of the sensor. The 4 teeth are of differing shapes, so the ECM can determine the exact position of the camshaft at any time.
For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).

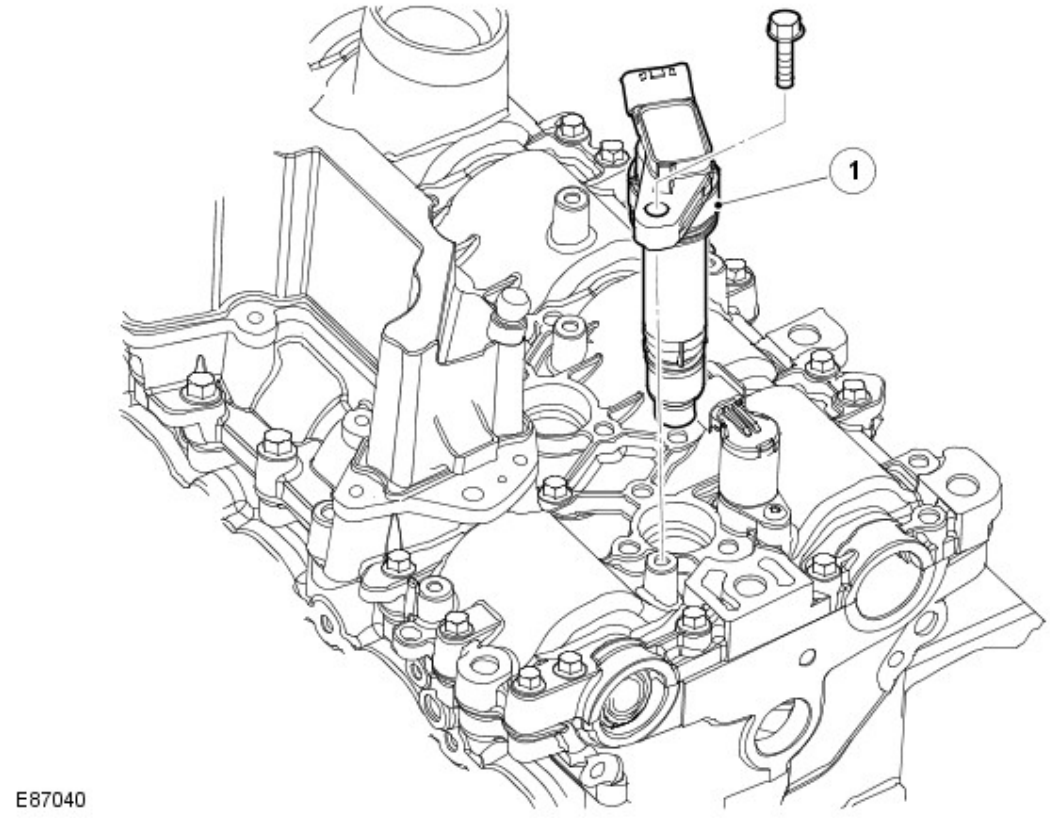
Spark Plugs



Item	Part Number	Description
1	-	Spark plug (6 of)

The spark plugs screw into the cylinder head through the camshaft housing and are controlled by the ECM via individual coils.

Ignition Coils



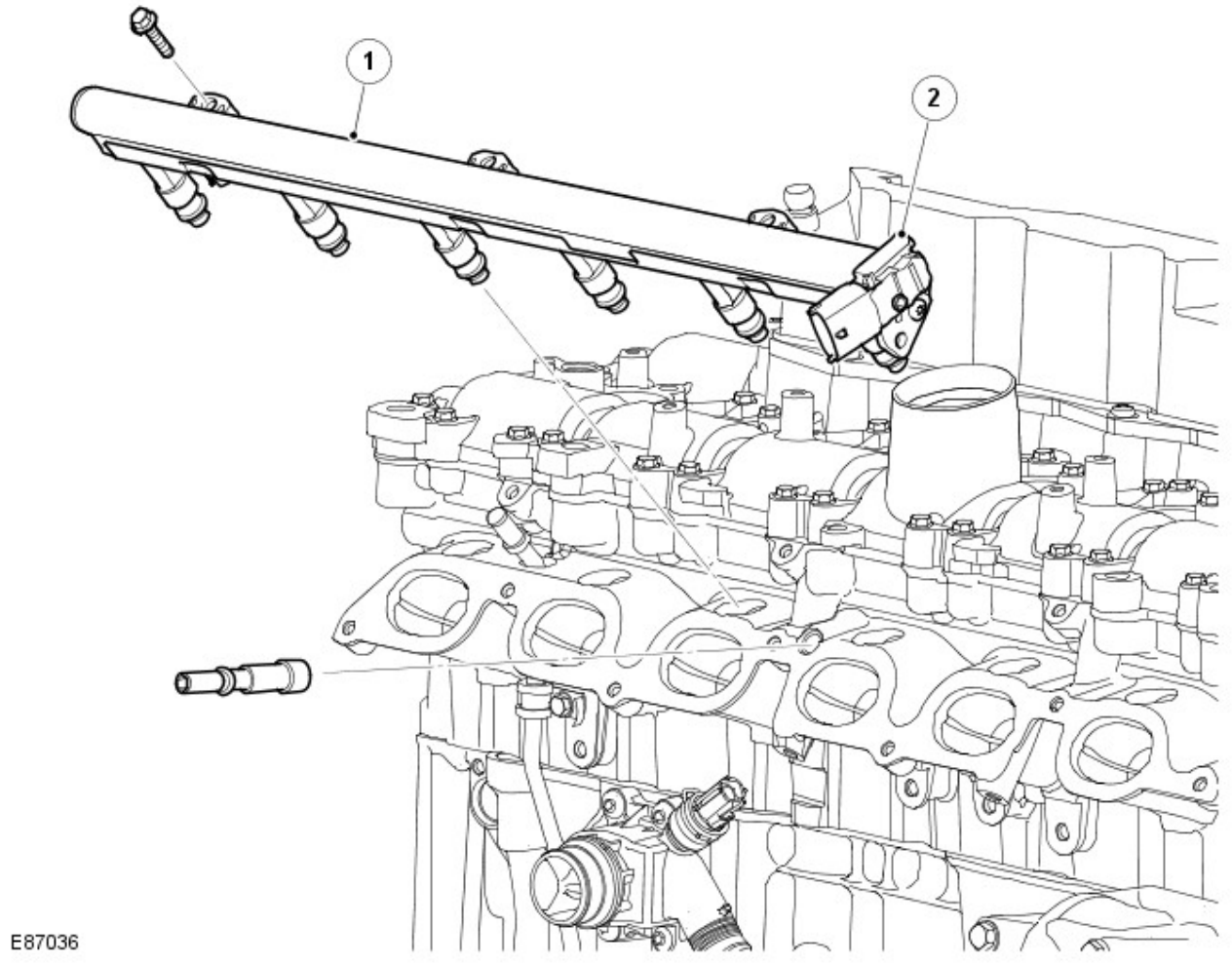
Item	Part Number	Description
1	-	Ignition coil (6 off)

The ECM uses a separate ignition coil for each spark plug. The ignition coils are of the plug top design, which attach to the top of the spark plug. The coils are secured to the camshaft housing with a bolt.

The coil has a rubber seal, which seals the coil in the spark plug hole in the cylinder head, preventing the ingress of moisture and debris around the spark plug. These coils eliminate the requirement for HT leads, which in turn improves the ignition system reliability.

Each coil has a 3-pin female connector, which provide for a battery voltage ignition feed, an earth for the secondary winding and a primary winding negative (switch) terminal. The switch terminal of each coil is connected to a separate pin on the ECM to allow independent switching.
For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).

Fuel Rail and Injectors



Item	Part Number	Description
1	-	Fuel rail
2	-	Fuel rail pressure and temperature sensor
3	-	Fuel pressure pipe

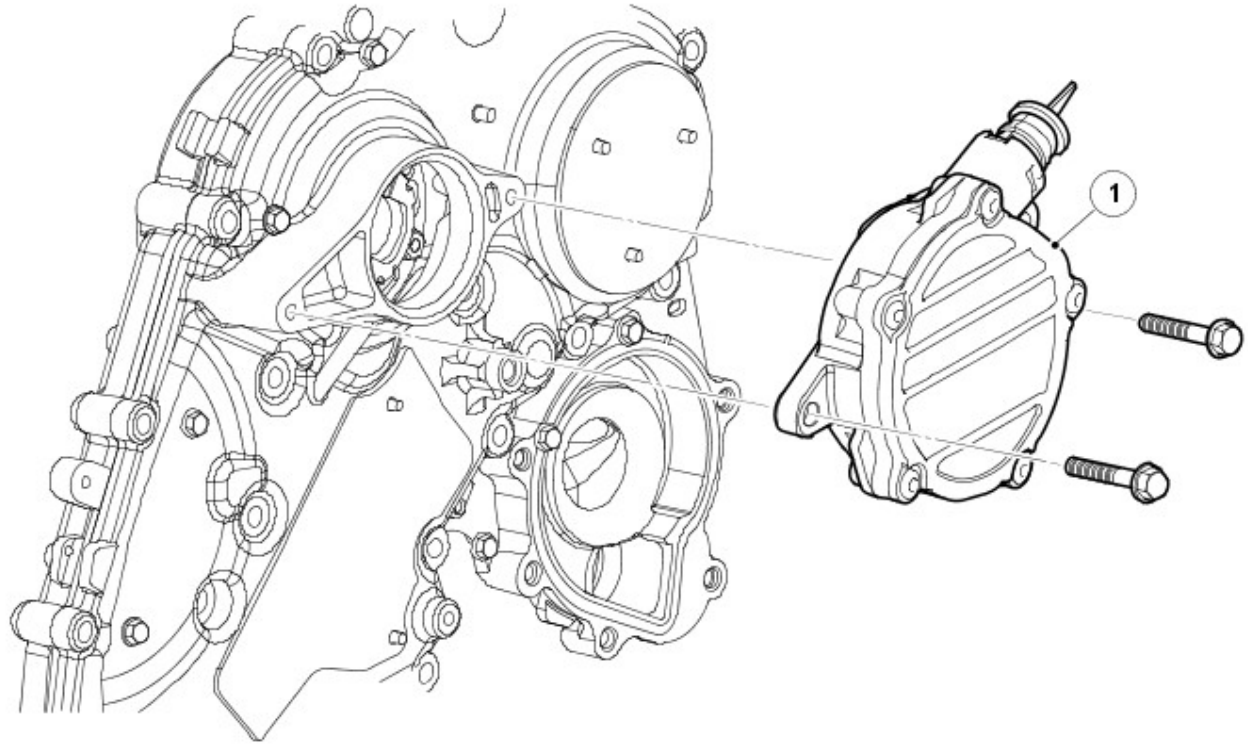
The fuel rail maintains a fuel pressure of 3.8 bar (55 psi) above manifold depression under normal operating conditions, though this is programmed to rise to 4.2 bar (61 psi) in response to either:

- Cold start conditions, to improve fuel vaporization
- Cold fuel conditions, as the colder the fuel the higher viscosity

The fuel rail is attached to the intake side of the cylinder head with 3 bolts. Six fuel injectors are installed in the cylinder head and connected to the fuel rail. 'O' ring seals are used to seal the injectors in both the fuel rail and cylinder head. A connection for the fuel pressure pipe is located between injectors 1 and 2.

There is a fuel rail pressure and temperature sensor located at the end of the fuel rail, next to injector number 6. The pressure sensor continuously monitors the fuel pressure in the fuel rail, this value is used by the ECM to calculate the injector pulse-width required to deliver the correct mass of fuel per injection. The temperature sensor measures the temperature of the fuel in the fuel rail. This input is then used to deliver the correct quantity of fuel to the engine.
For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).

Vacuum Pump



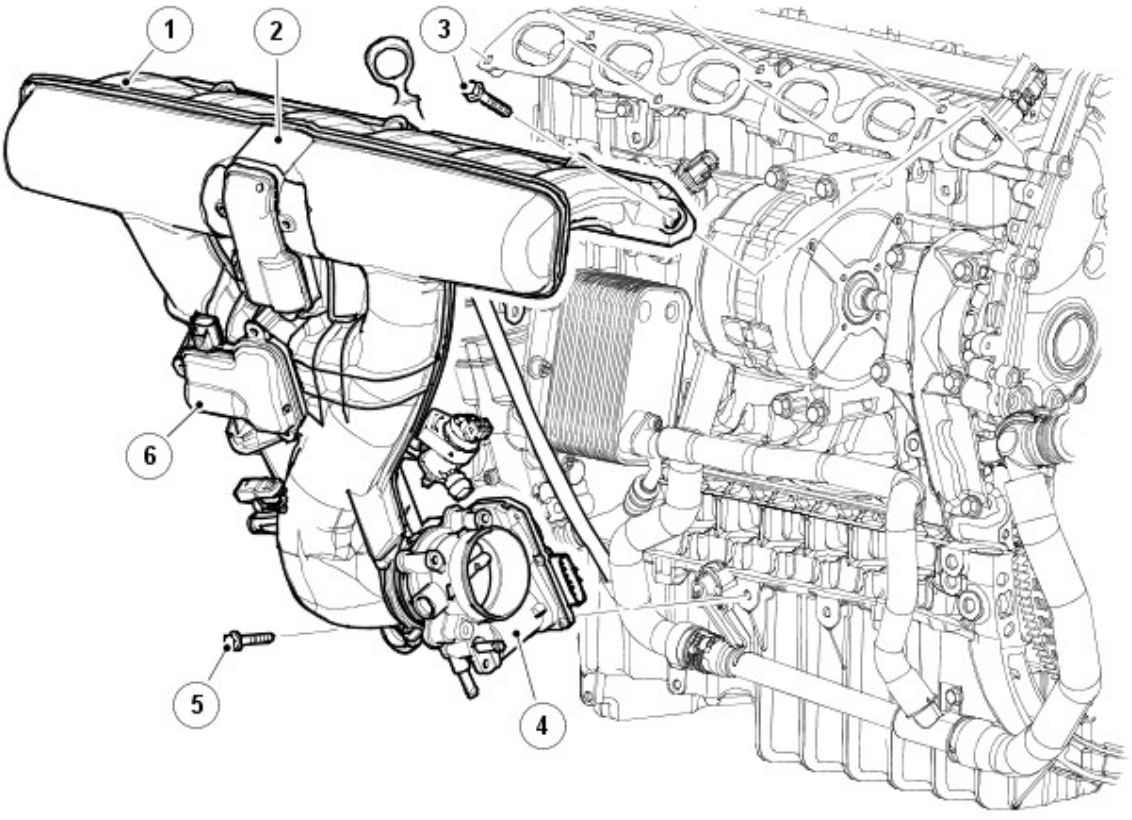
E87033

Item	Part Number	Description
1	-	Vacuum pump

The intake camshaft is equipped with the VCT unit. The intake camshaft also drives the vacuum pump.

• NOTE: When installing the vacuum pump make sure the slot in the VCT unit and the vacuum pump coupling are in the vertical position to aid installation. The vertical position is marked on the vacuum pump housing by 2 raised lines.

Intake Manifold



E90915

Item	Part Number	Description
1	-	Intake manifold
2	-	Variable plenum valve
3	-	Bolt (7 of)
4	-	Throttle body and module

5	-	Bolt (2 of)
6	-	Variable tract valve

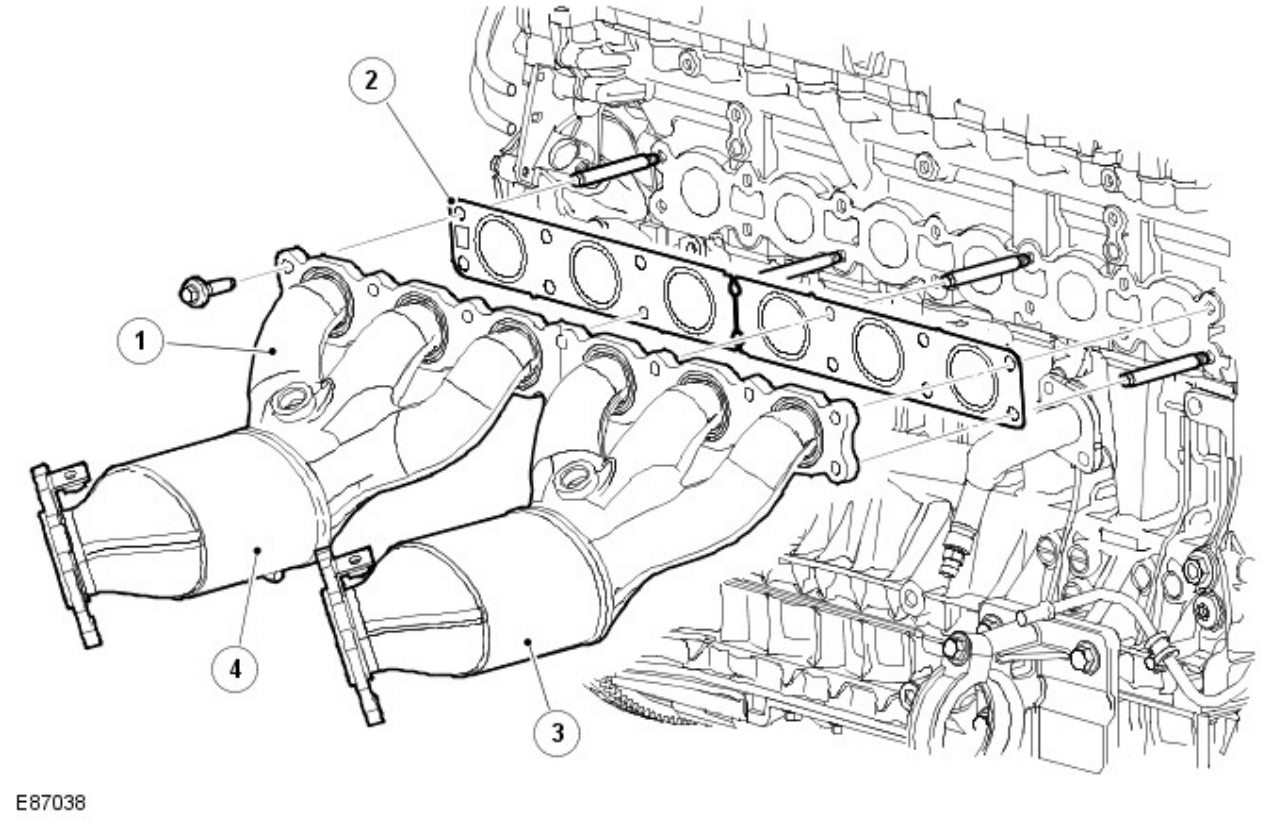
The intake manifold attaches to the cylinder head with 6 bolts and the oil pan with 2 bolts.

The manifold is capable of varying both intake tract length and plenum volume by means of 2 separate valves.

At low engine speeds, long intake tracts are utilized to provide optimum engine torque. Shorter tracts are used at medium speeds, again, to optimize engine torque for the existing engine speed range.

At higher engine speeds the benefits of optimizing the tract lengths are outweighed by the necessity of maintaining an appropriate supply of air to meet the engines requirements. Therefore, the plenum valve is opened to create a single, large plenum volume to provide the maximum quantity of air to charge the engines cylinders.
For additional information, refer to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Description and Operation).

Exhaust Manifold



E87038

Item	Part Number	Description
1	-	Exhaust manifold assembly
2	-	Gasket
3	-	Exhaust manifold - cylinders 1 to 3
4	-	Exhaust manifold - cylinders 4 to 6

The exhaust manifold comprises 2 separate manifold assemblies. One manifold is used for cylinders 1 to 3 and the second manifold is used for cylinders 4 to 6. The manifolds are sealed to the cylinder head with a gasket and secured with 14 bolts.

Each manifold comprises 3 fabricated branches, which merge into an integral catalytic converter. A threaded boss is positioned where the 3 branches merge and provides for the fitment of a pre-catalyst Heated Oxygen Sensor (HO2S). The catalytic converter outlets have offset flanges which mate with corresponding flanges on the front section exhaust system.

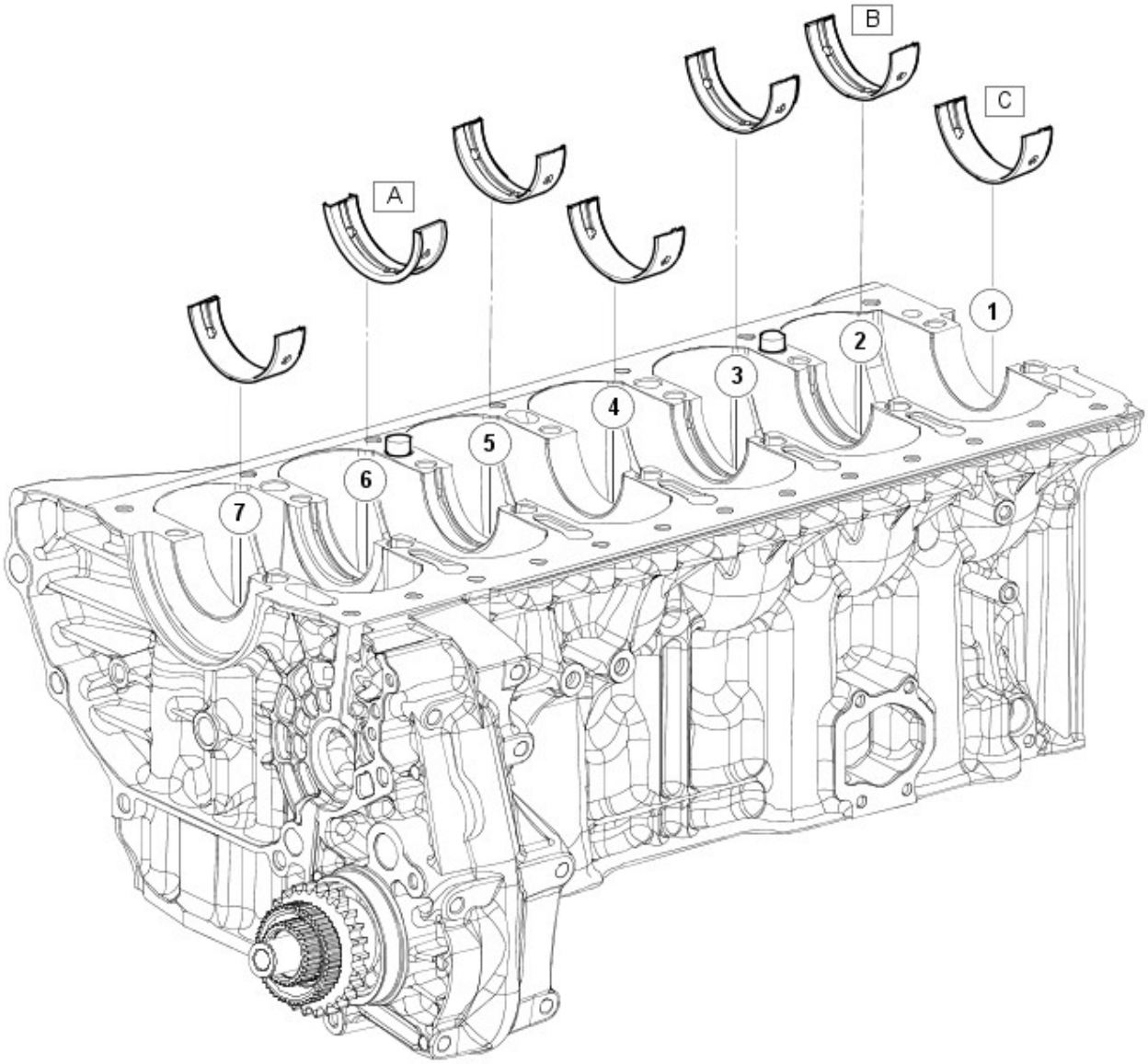
A bracket on each outlet flange allows for the attachment of an exhaust manifold heat shield.

CRANKSHAFT, BEDPLATE AND OIL PAN COMPONENTS

The crankshaft and oil pan components are:

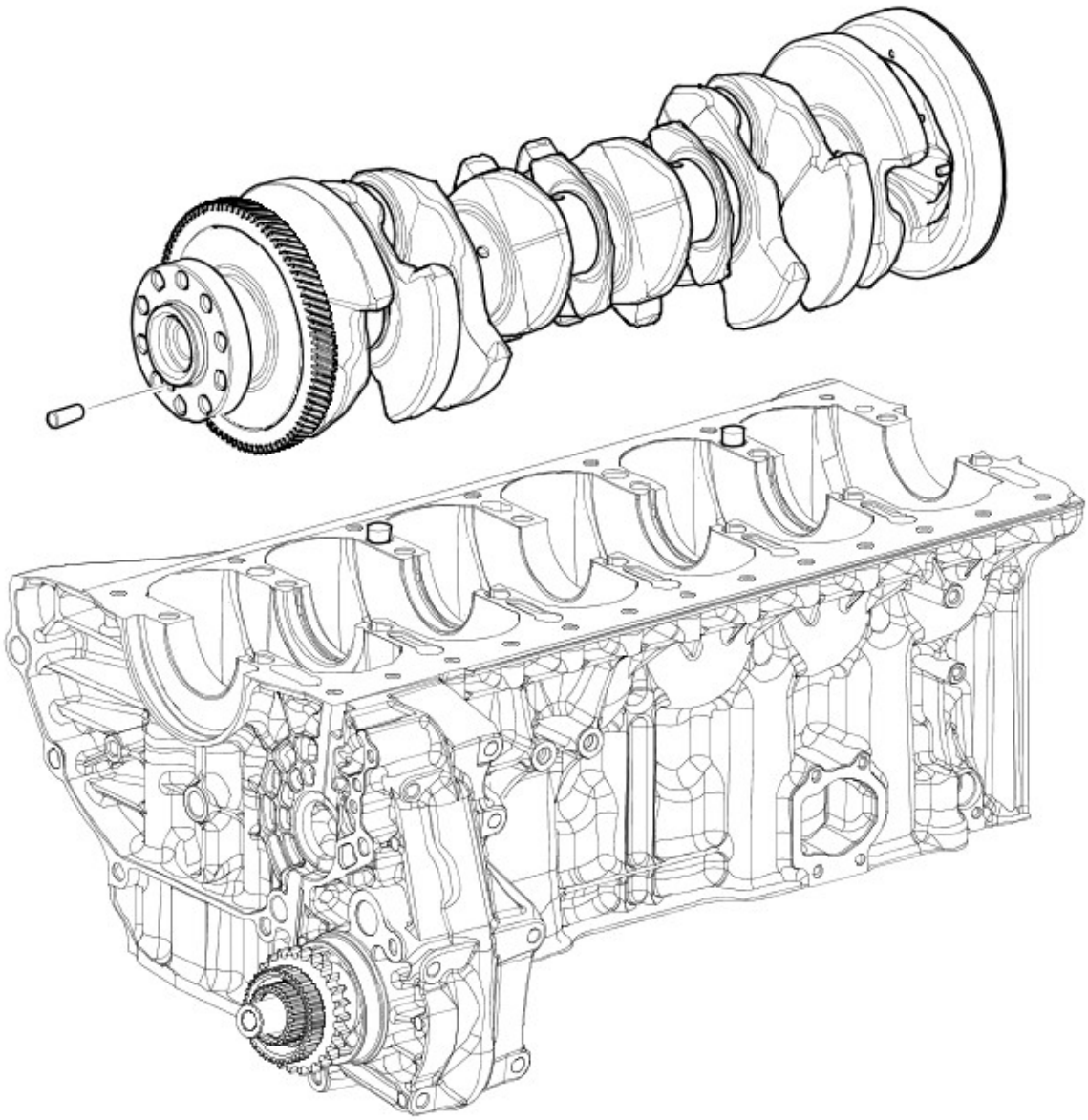
- Crankshaft and main bearings
- Crankshaft vibration damper and cooling valve
- Bedplate
- Oil filter and cooler assembly
- Oil pump assembly
- Oil pick-up
- Oil pan
- Oil level gage
- Starter motor

Crankshaft and Main Bearings



E86982

Item	Part Number	Description
A	-	Thrust bearing - position 6
B	-	Grooved main bearing - positions 2, 3 and 5
C	-	Main bearing - positions 1, 4 and 7



E86984

The crankshaft is made of forged steel and has induction hardened bearing surfaces. There are 2 types of aluminium main bearing:

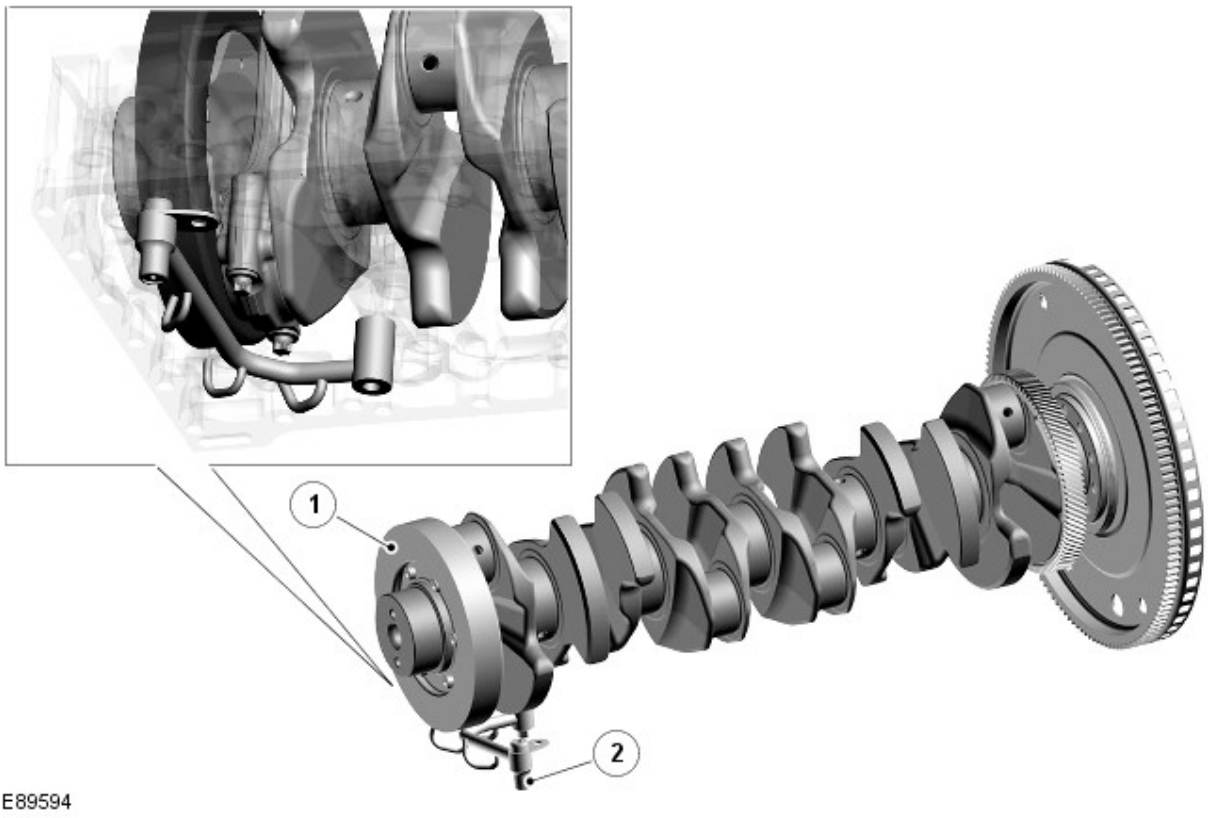
- With complete oil ducts for upper main bearings 2, 3, 5 and 6
- With short oil ducts for all lower and 1, 4 and 7 upper main bearings

Due to missing counter-weights for cylinders 1 and 6 and selected counter-balancing of the entire crankshaft, main bearings 1, 4 and 7 are exposed to greater loads than the others. To reduce the load on the bearings, bearing shells with short oil ducts are used. In addition, these main bearings have their own oil circuit where the oil is not distributed on to the connecting rod bearings. The 6th main bearing also works as a thrust bearing.

A gear wheel is crimped to the rear edge of the crankshaft. The gear wheel drives the oil pump and the Rear End Ancillary Drive (READ) timing gear.

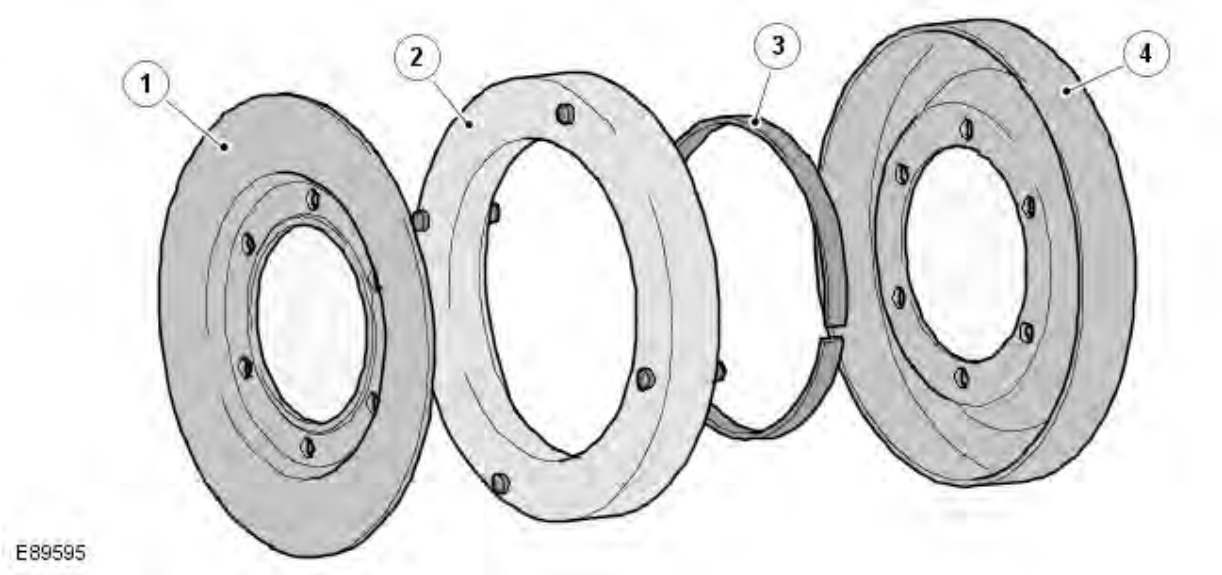
The crankshaft has a viscous vibration damper located directly in front of the connecting rod pin for cylinder 1, i.e. located in the actual cylinder block.

Crankshaft Vibration Damper and Cooling Valve



Item	Part Number	Description
1	-	Crankshaft vibration damper
2	-	Crankshaft vibration damper cooling valve

One of the remedies for obtaining a compact engine unit is to place the crankshaft vibration damper inside the engine block. The damper has been positioned at the front of the crankshaft between the end and the connecting rod pin for the crankshaft for cylinder 1.

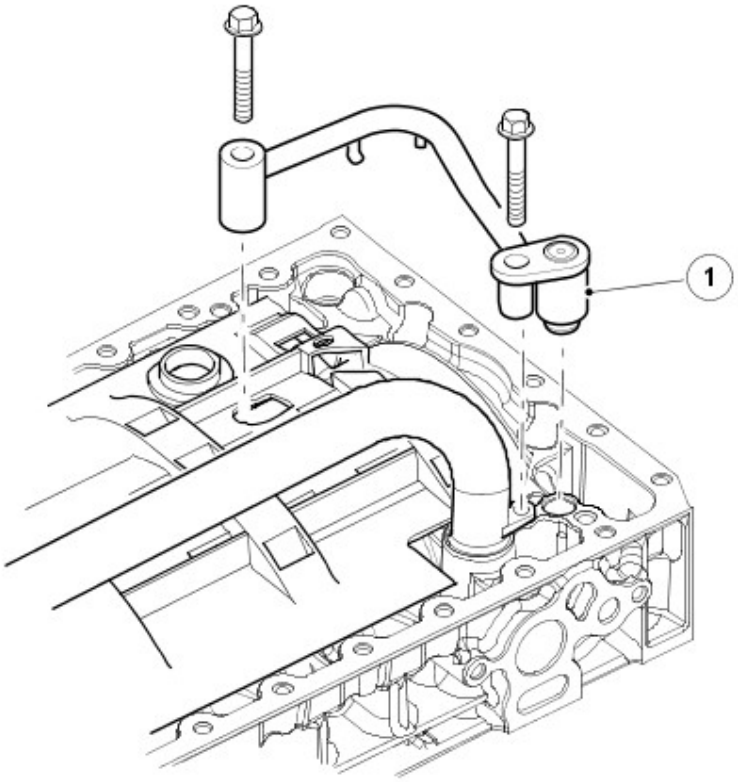


Item	Part Number	Description
1	-	Front housing
2	-	Solid steel ring
3	-	Plastic bearing
4	-	Rear housing

The damper consists of a solid steel ring, placed in an enclosed housing filled with silicon fluid. The ring is radially journaled through a plastic bearing. There are buttons on the front and rear side surfaces, 4 on each side. These buttons are axially journaled.

The task of the damper is to even out fast unwanted increases and reductions in speed (i.e. crankshaft oscillations) and to give the crankshaft a smoother operation.

When the rotation speed of the crankshaft increases or reduces quickly, the change in speed of the steel ring is delayed due to the high viscosity of the silicon fluid. The function of the damper is based on the braking effect of the silicon fluid and the steel ring's own inertia. When the ring moves in the silicon fluid in the damper housing, a large amount of heat is generated that must be routed away.



E87018

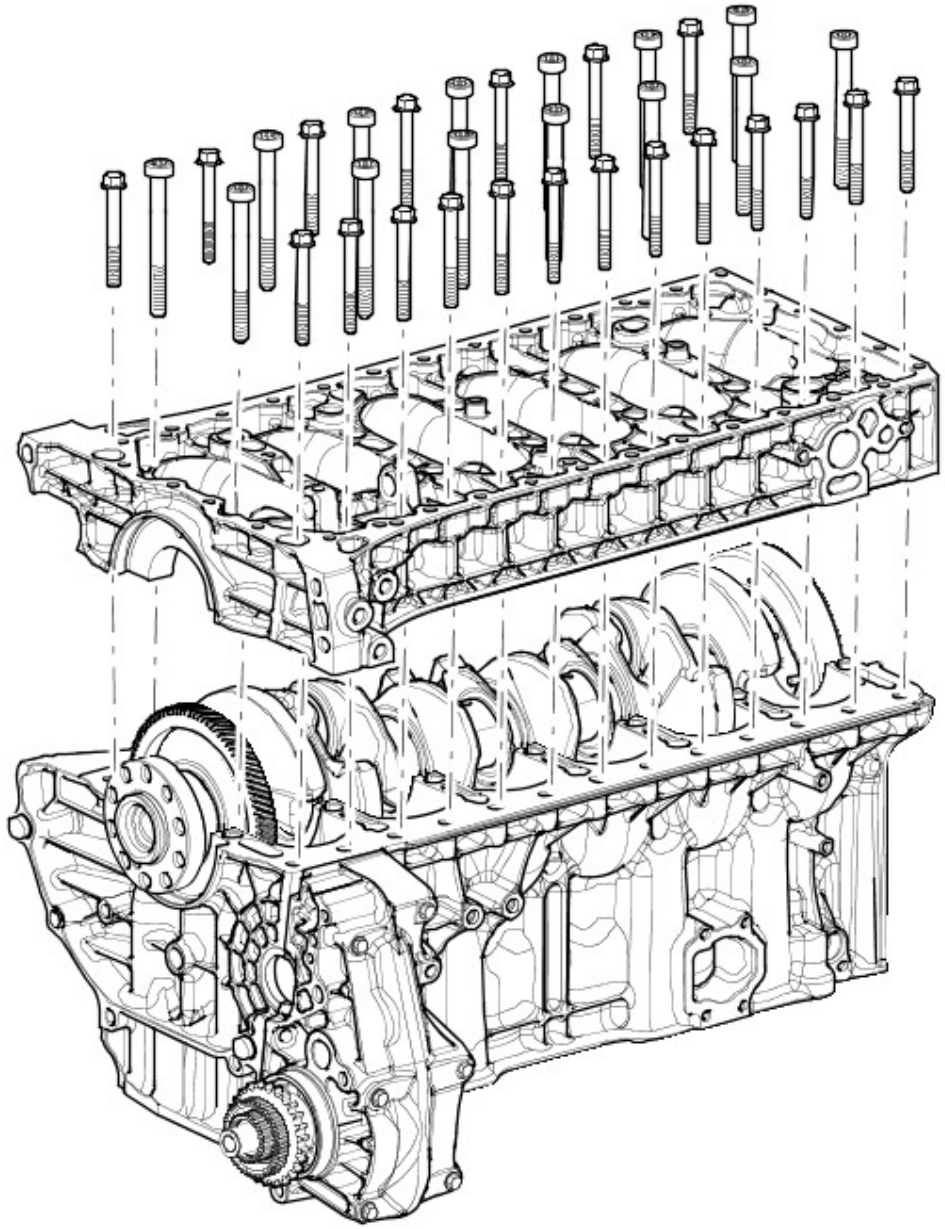
Item	Part Number	Description
1	-	Valve

Because the damper is located in an environment where the normal operating temperature can reach approximately 140°C (284°F), coupled with the fact that the damper also generates its own heat, it is necessary for it to be oil cooled. A separate oil circuit routes oil from the engine's oil cooler to a valve in the engine block, which opens at approximately 2 bar. The oil then flows to 3 jets, located on the crankshaft vibration damper cooling pipe, which then directs the oil to the lower section of the damper.

The oil flows through the jets at approximately 12 liters per minute.

At high temperatures, oil cooling reduces the damper temperature by approximately 7°C (45°F).

Bedplate

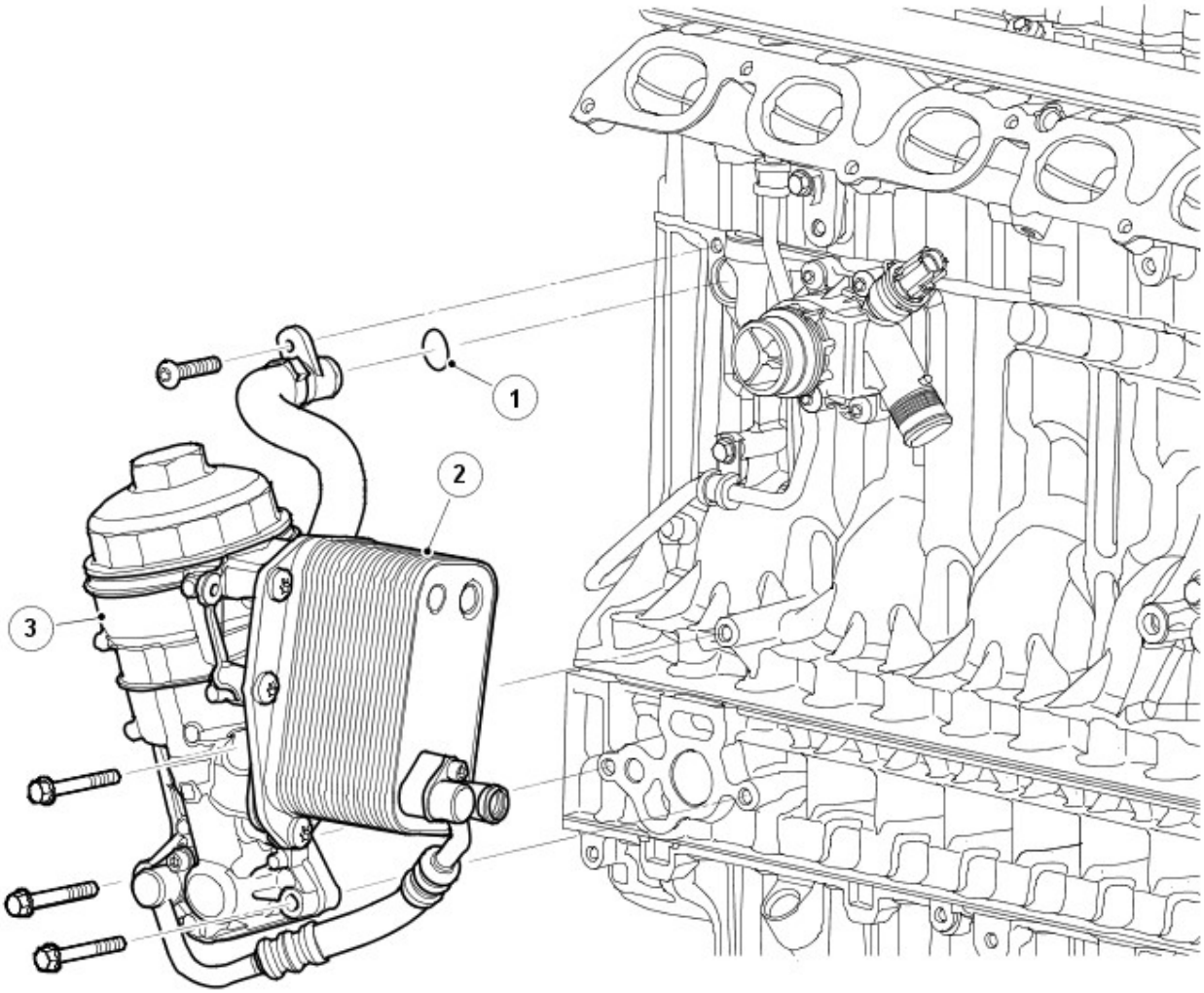


E86988

The bedplate is of an aluminium alloy structure bolted to the bottom of the cylinder block to further improve rigidity and to retain the crankshaft. The 7 cast iron crankshaft bearing caps are cast in the boreholes.

A windage tray attached to the underside of the bedplate isolates the oil pan from the disturbed air produced by the rotation of the crankshaft, to prevent oil aeration and improve oil drainage.

Oil Filter and Cooler Assembly

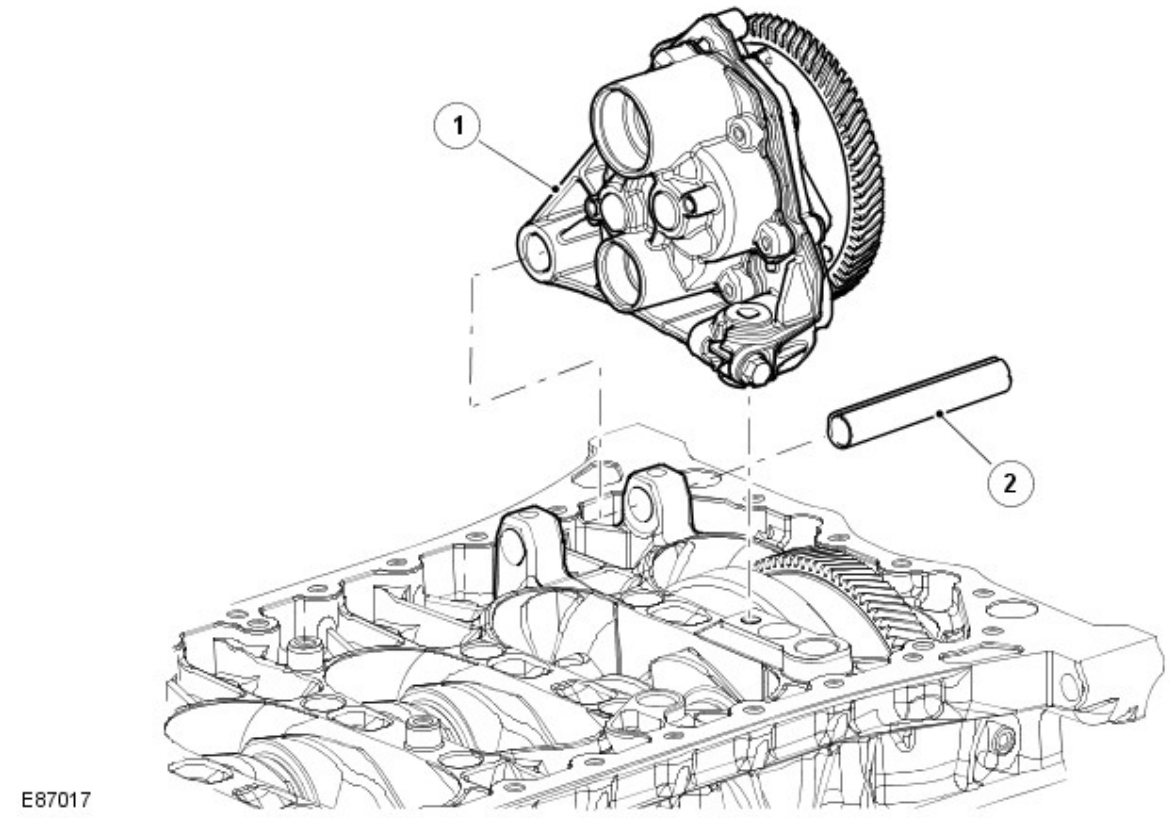


E87034

Item	Part Number	Description
1	-	O-ring
2	-	Oil cooler
3	-	Oil filter housing

The oil filter and cooler assembly is located at the front of the LH side of the cylinder block. The oil filter housing contains a separate single oil filter element. The oil filter supplies clean oil to the oil cooler, which is connected to the coolant system, and is further distributed to the various engine systems (For more information refer to the lubrication section).

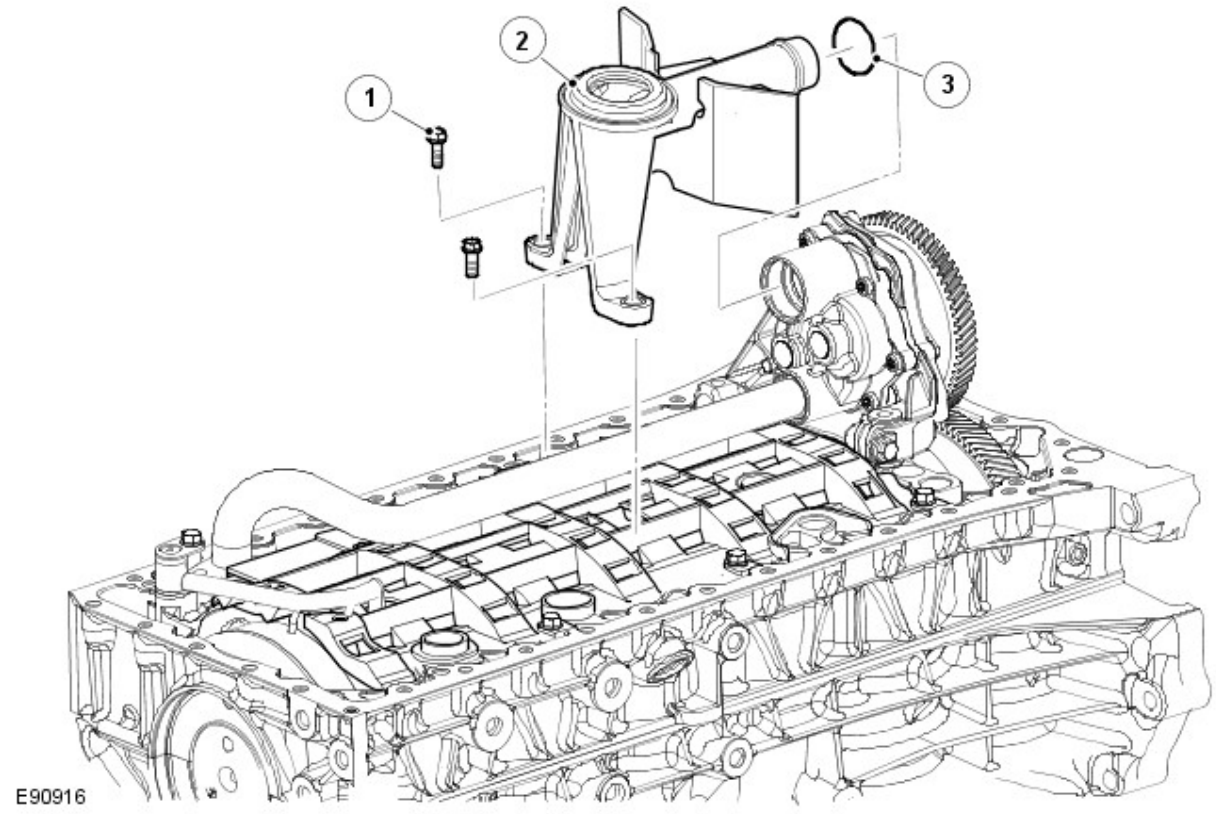
Oil Pump Assembly



Item	Part Number	Description
1	-	Oil pump assembly
2	-	Pivot pin

The oil pump is attached to bottom of the bedplate via a pivot pin and a bolt. The pump is an external gear wheel pump with integrated pressure control valve (for more information refer to the lubrication section).

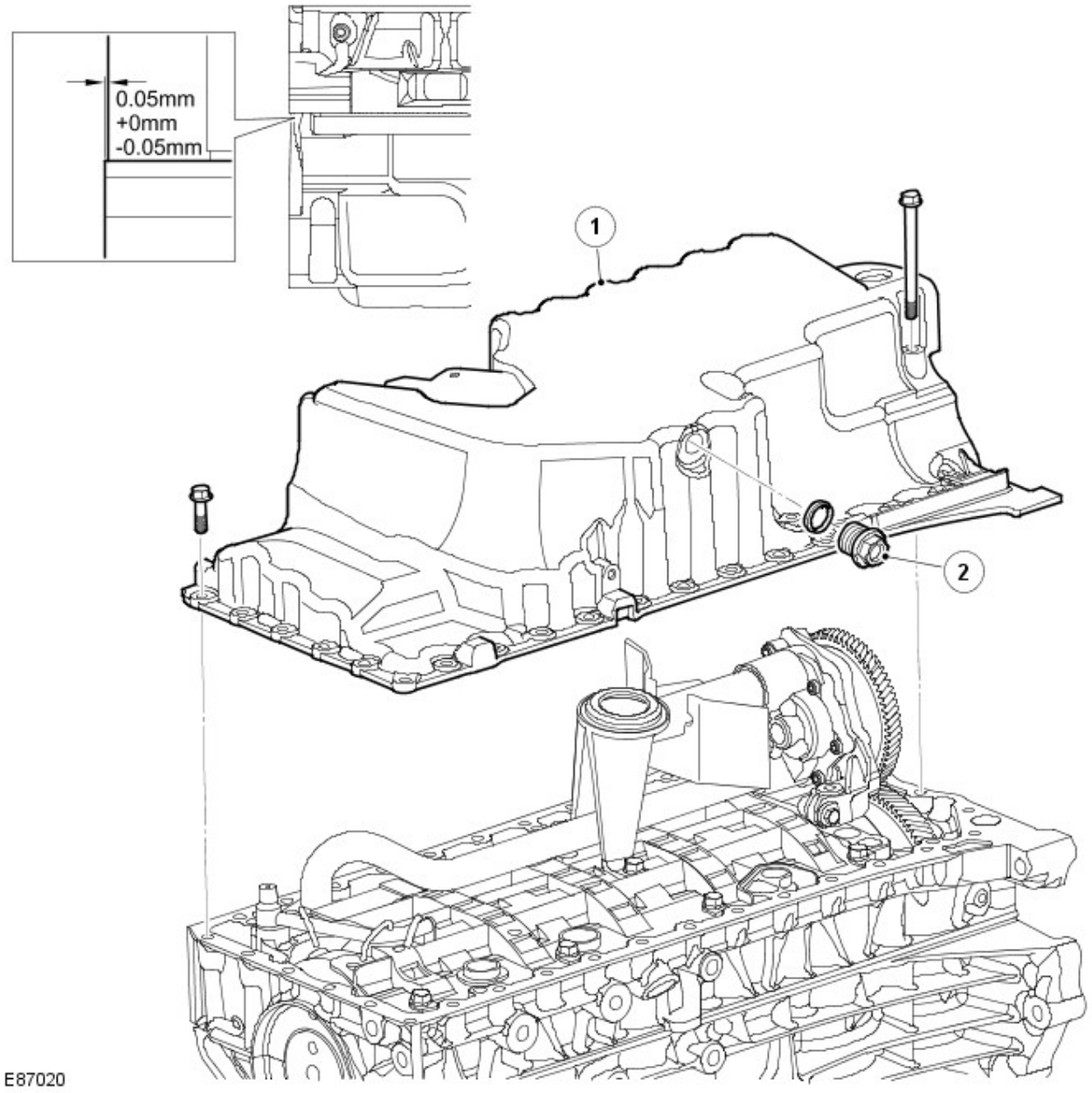
Oil Pick-up



Item	Part Number	Description
1	-	Bolt (2 of)
2	-	Oil pick-up
3	-	O-ring seal

The fabricated steel oil pick-up is immersed in the oil reservoir to provide a supply to the oil pump during all normal vehicle attitudes. A mesh screen in the intake prevents debris from entering the oil system.

Oil Pan

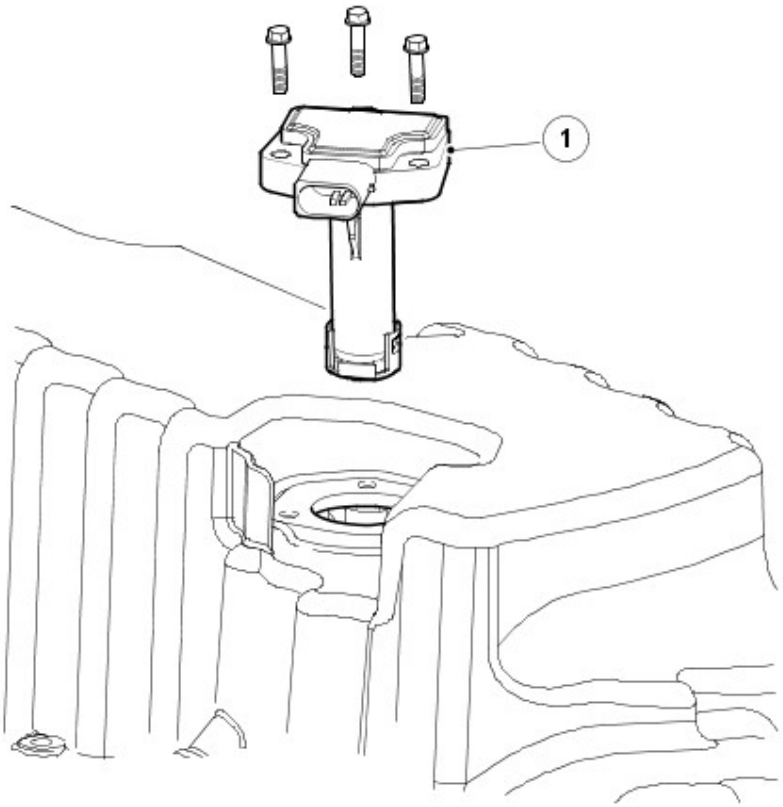


Item	Part Number	Description
1	-	Oil pan
2	-	Oil drain plug

The aluminium alloy structural oil pan is bolted to the bedplate.

• NOTE: The oil pan should always be fitted proud of the bedplate by 0.05mm (+0mm -0.05mm).

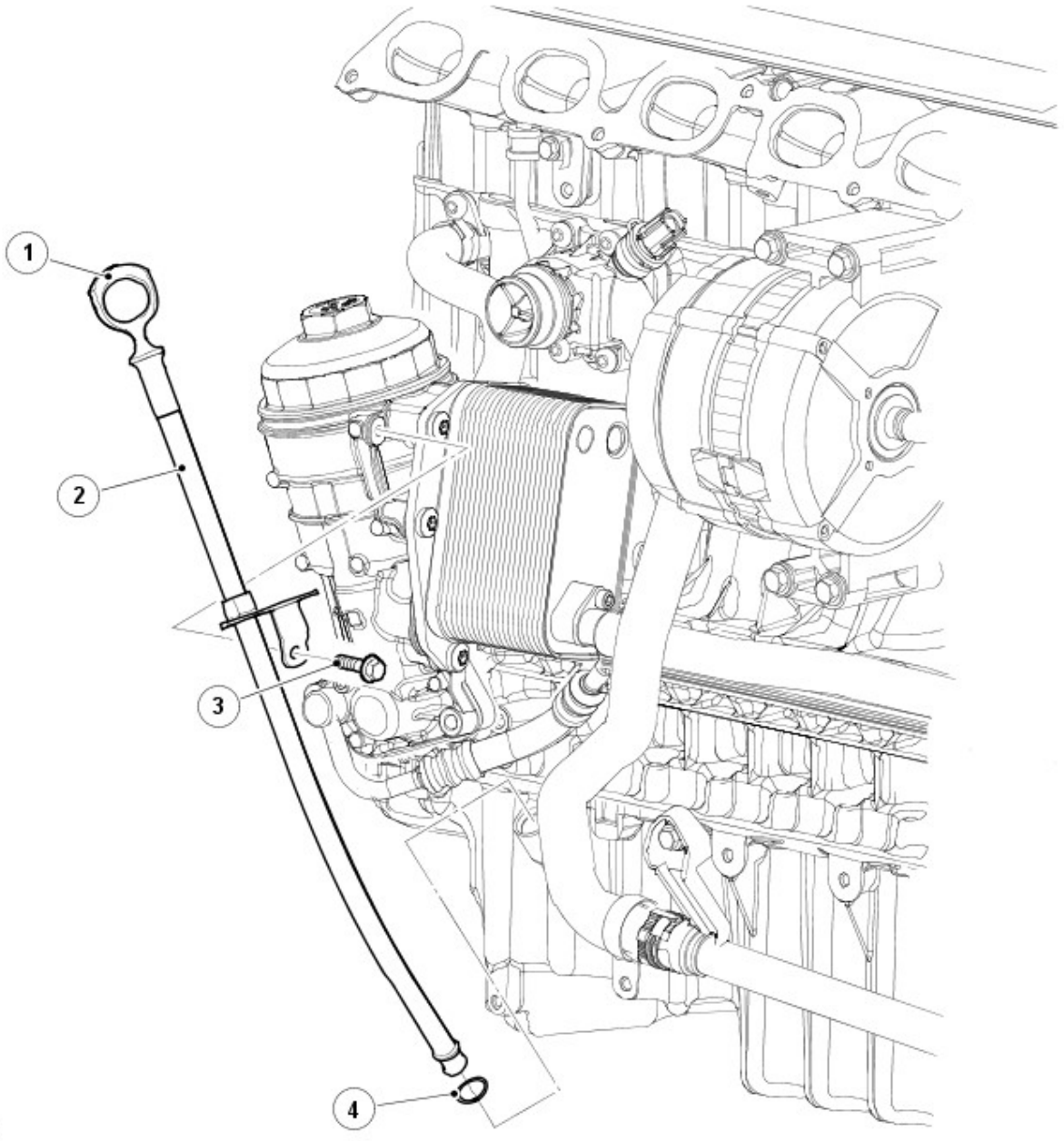
A combined oil level/temperature sensor is attached to the underside of the oil pan via 3 bolts. The tip of the sensor locates through an aperture and is sealed with an O-ring.



Item	Part Number	Description
1	-	Oil level/temperature sensor

The engine oil drain plug is located on the exhaust side of the engine, towards the bottom of the oil pan.

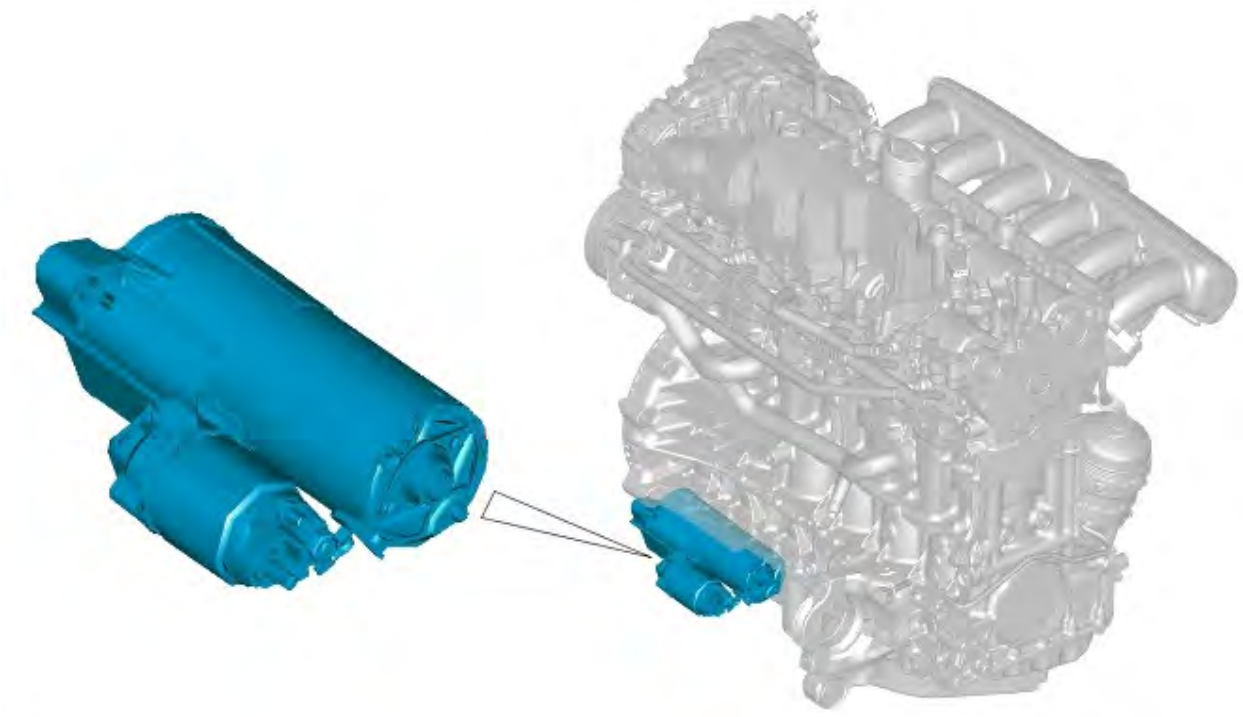
Oil Level Gage



Item	Part Number	Description
1	-	Oil level gage
2	-	Oil level gage tube
3	-	Bolt
4	-	O-ring seal

The oil level gauge locates along the intake side of the engine and is supported in a tube installed in the oil pan. A bolt securely attaches the tube to the engine oil cooler via a bracket. Two holes in the end of the gauge indicate the minimum and maximum oil levels. The difference between the dipstick markings, minimum and maximum, corresponds to 0.8 litres.

Starter Motor



E79497

The starter motor is located in a recess at the rear of the exhaust side of the oil pan. The motor, rated at 1.4 kW, uses permanent magnets instead of field windings to provide a low-weight starter motor; with the use of planetary gears to deliver a good torque to weight ratio
For additional information, refer to: Starting System (303-06A Starting System - I6 3.2L Petrol, Description and Operation).
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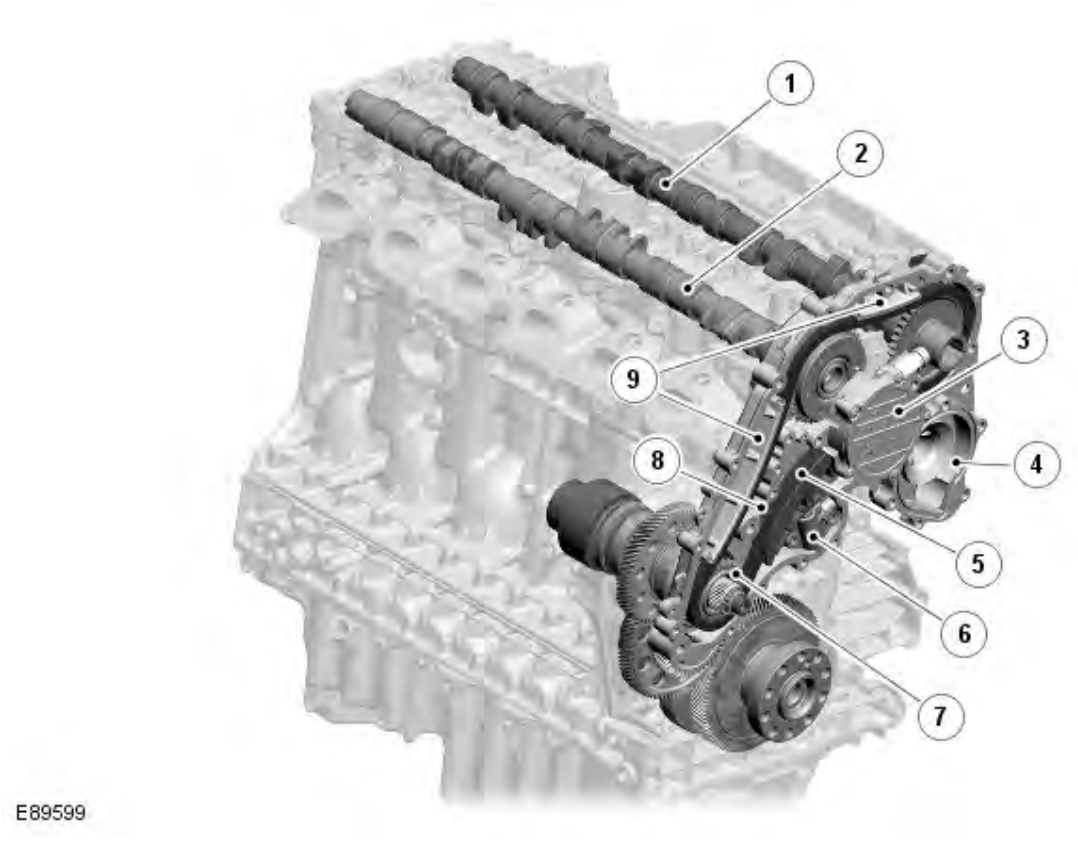
CAMSHAFT TIMING COMPONENTS

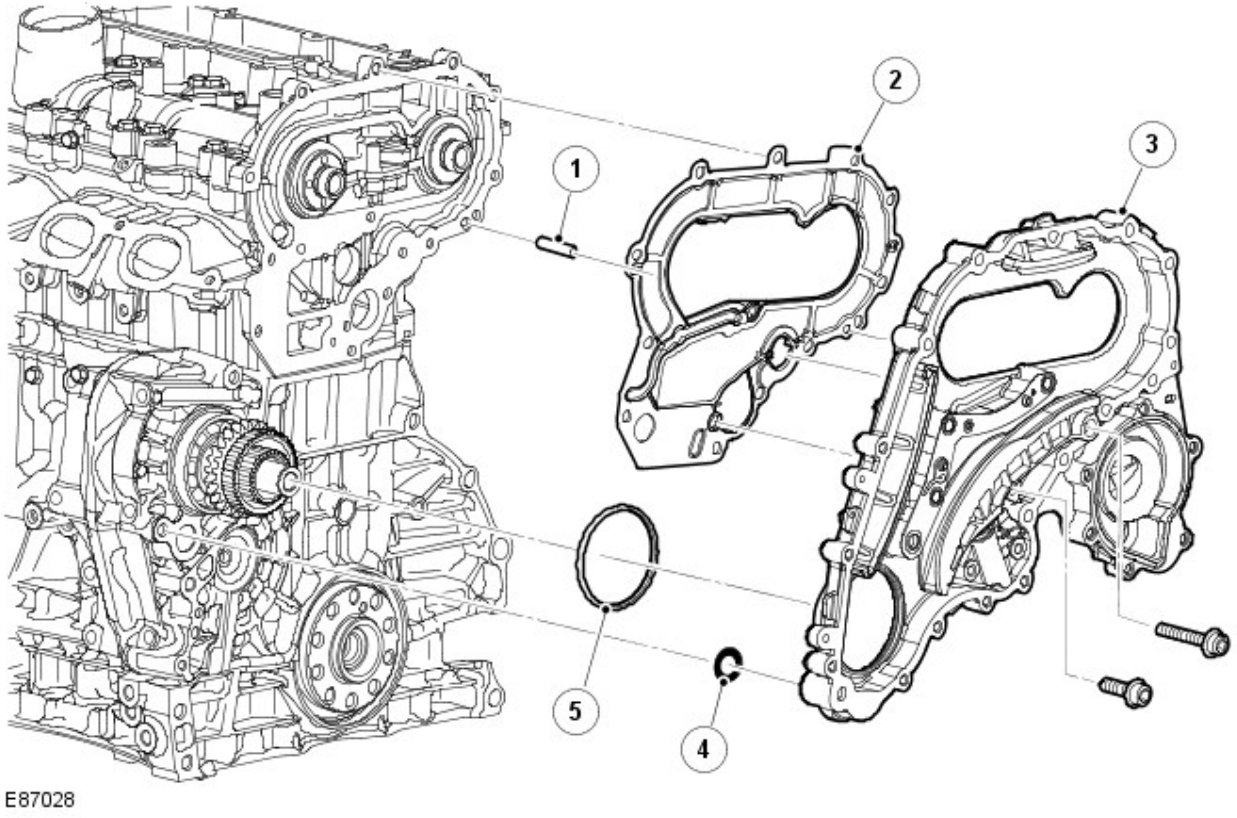


E89599

Item	Part Number	Description
1	-	Exhaust camshaft
2	-	Intake camshaft
3	-	Vacuum pump
4	-	Cooling pump housing
5	-	Chain guide

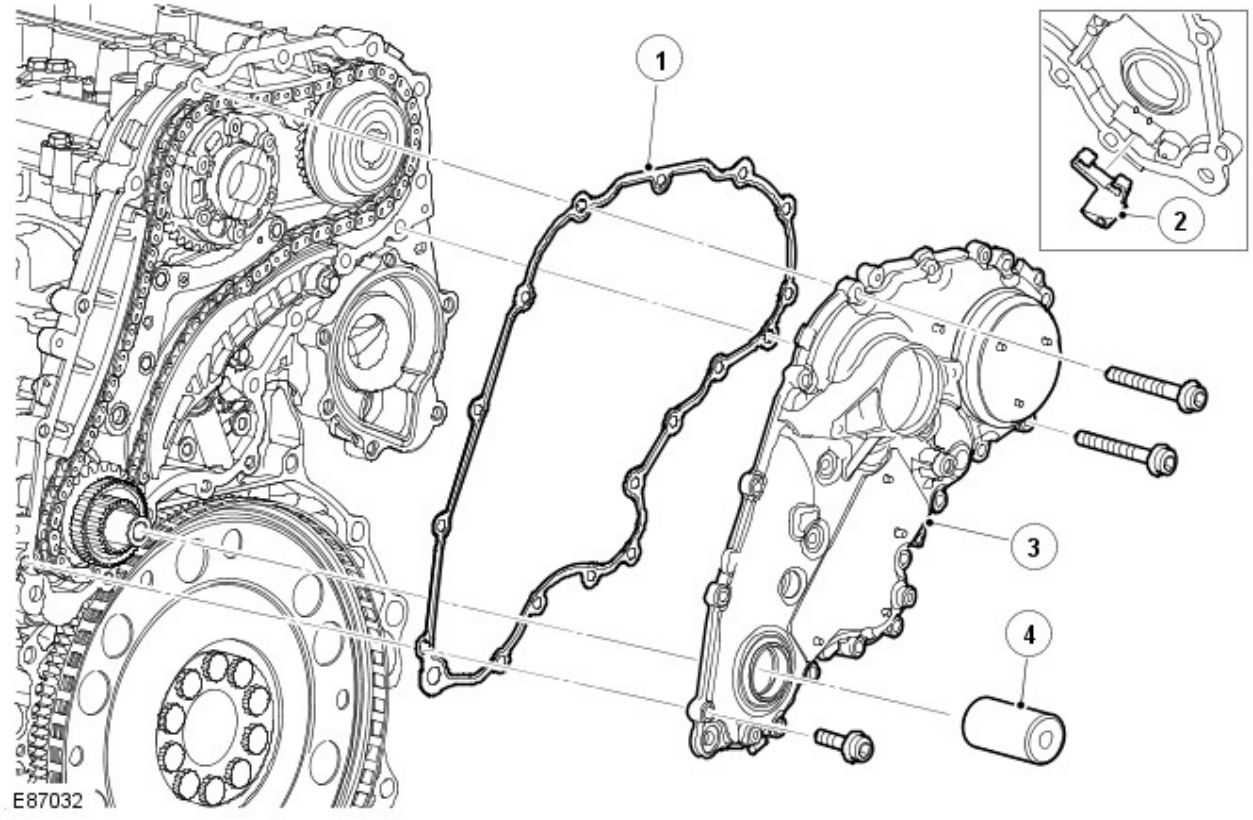
6	-	Hydraulic chain tensioner
7	-	Camshaft chain gear
8	-	Camshaft chain lubrication nozzle
9	-	Chain guide

The timing chain for the camshafts is located in a housing at the rear of the engine.



E87028

Item	Part Number	Description
1	-	Dowel (used to align gasket and timing case)
2	-	Gasket
3	-	Front timing case
4	-	Seal
5	-	O-ring



E87032

Item	Part Number	Description

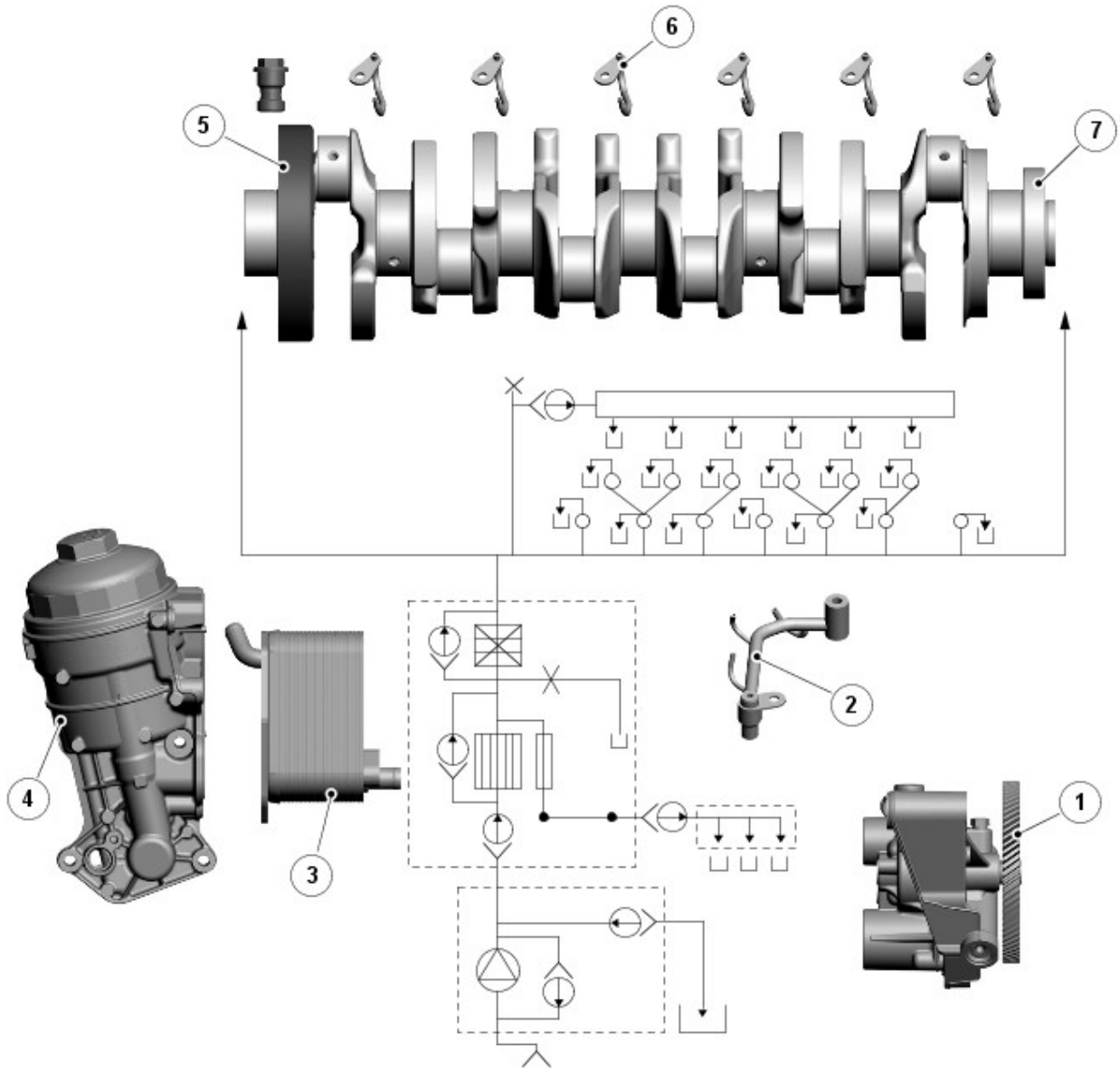
1	-	Gasket
2	-	Oil scraper
3	-	Rear timing case
4	-	Centering tool

The timing chain is driven by the camshaft chain gear via the crankshaft. The chain drives both the intake and exhaust camshafts. The chain is continually tensioned by a hydraulic chain tensioner and is lubricated by oil via a separate nozzle. The tensioner has an inhibitor that prevents the chain from slackening in the event of reversed loading.

The intake camshaft is equipped with a VCT unit and also drives the vacuum pump.

The return oil from the camshafts housing is routed to the gear housing and lubricates the timing gear's bearings and gear wheel.

LUBRICATION SYSTEM



E89647

The lubrication system components and functions are:

- Oil pick-up
- Oil pump
- Oil filter and cooler assembly
- Intake valve (piston cooling)
- Cylinder head oil supply
- Gear housing

Oil Pick-up

The oil pick-up contains a strainer, which separates large contaminants and prevents them from reaching the oil pump.

Oil Pump

The oil pump is an external gear wheel pump with integrated pressure control valve. The valve opens at approximately 4.5 bar and controls the system pressure.

The pump is driven by the crankshaft and is 1.3 times faster than the crankshaft.

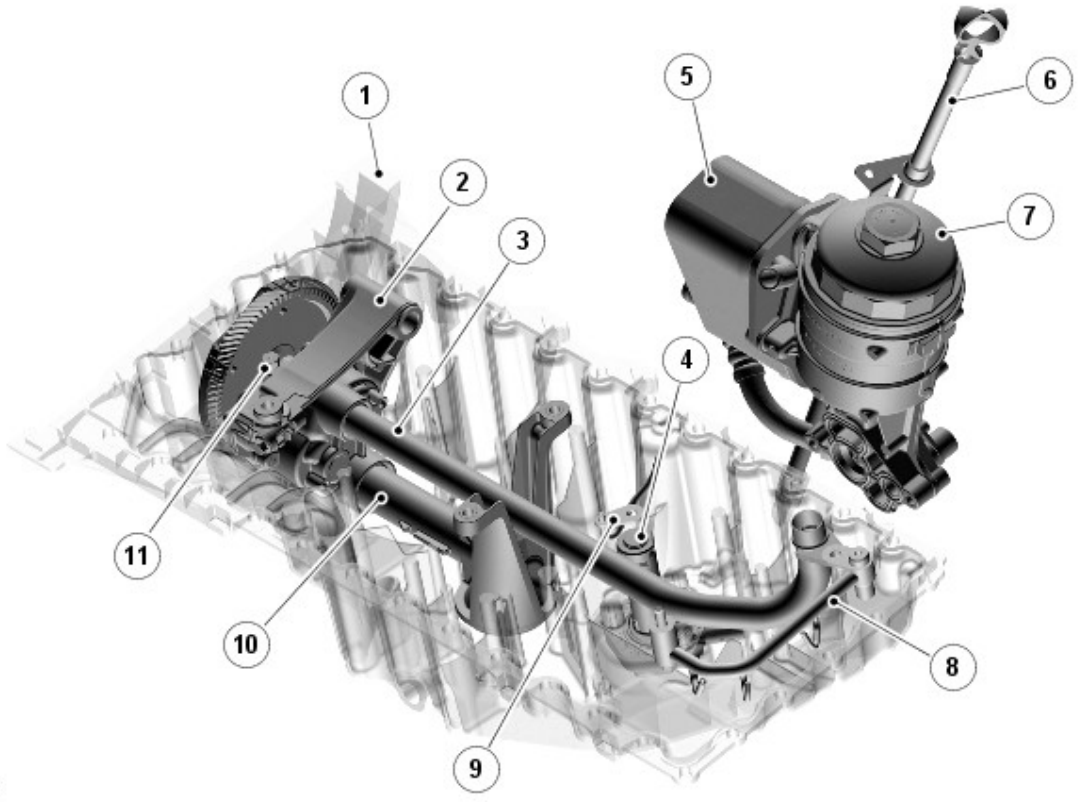
To ensure that the air is released from the oil system, a valve is located in the oil pump on the pressure side. During the build-up of pressure, air is routed out into the crankcase. This continues until the valve closes at approximately 0.2 bar.

Oil Filter and Cooler Assembly

The majority of oil is routed to the oil filter, which is a separate single filter element located in the housing. The over-flow valve for the blocked filter is in the cover. The valve opens at approximately 2 bar.

There is a valve at the bottom of the housing. The task of the valve is to drain the housing of oil when the oil filter is removed. When the oil filter is installed, the valve is closed. A spring loaded ring at the bottom of the filter housing is affected by the actual filter. The ring is, in turn, mechanically connected to the valve.

When the filter is removed, the spring lifts the ring, which, in turn, opens the valve whereupon the oil drains to the oil pan.



E89648

Item	Part Number	Description
1	-	Oil pan
2	-	Oil pump
3	-	Oil pressure pipe
4	-	Oil level/temperature sensor
5	-	Oil cooler
6	-	Oil level gage
7	-	Oil filter cover
8	-	Vibration damper pipe with jets
9	-	Piston cooling jet (6 off)
10	-	Supply line with strainer
11	-	Bleed valve

The oil passes a non-return valve before it reaches the oil cooler/filter housing. The non-return valve ensures that the oil filter housing is not drained of oil when the engine is switched off. The valve opens at approximately 0.2 bar.

The oil first passes the oil cooler, a plate oil cooler. The chamber for oil and coolant is split alternately between the plates. There are 20 plates used in total. The first 16 plates are used for oil, which is routed through the engine's normal lubrication circuit, i.e. the oil is routed to the oil filter.

The 4 last plates are used to provide a proportion of the oil with extra cooling before it is routed onwards to cool the vibration damper. The circuit is calibrated to achieve correct flow.

There is a by-pass valve parallel to the oil cooler. The valve ensures an oil flow to the oil filter even if the oil cooler is blocked. The valve opens at approximately 2 bar.

Intake Valve (Piston Cooling)

The oil is also routed to the duct for oil cooling, which is parallel to the ducts for main bearings and connecting rod bearings.

The oil first passes a valve that opens/closes at approximately 2.0 bar. Thereafter, the oil is routed to the jets for piston cooling:

- If the valve has too high an opening pressure, this means that the oil flow to the pistons reduces, which can cause engine damage
- If the valve has too low an opening pressure, this produces an increased flow to piston cooling. It can, in certain situations (before the relief valve is opened) result in the engine's oil pressure being too low causing engine damage

The jets direct the oil towards the underneath of the pistons. Each cylinder has its own jet.

Cylinder Head Oil Supply

Oil is routed from the cylinder block through a front and rear duct to the cylinder head. The duct at the front edge supplies 2 circuits in the cylinder head with oil:

1. Circuit for the hydraulic tappets, vacuum pump and cam chain lubrication

A longitudinal duct on the intake side supplies the following components with oil:

- The hydraulic tappets
- The vacuum pump
- The nozzle for cam chain lubrication

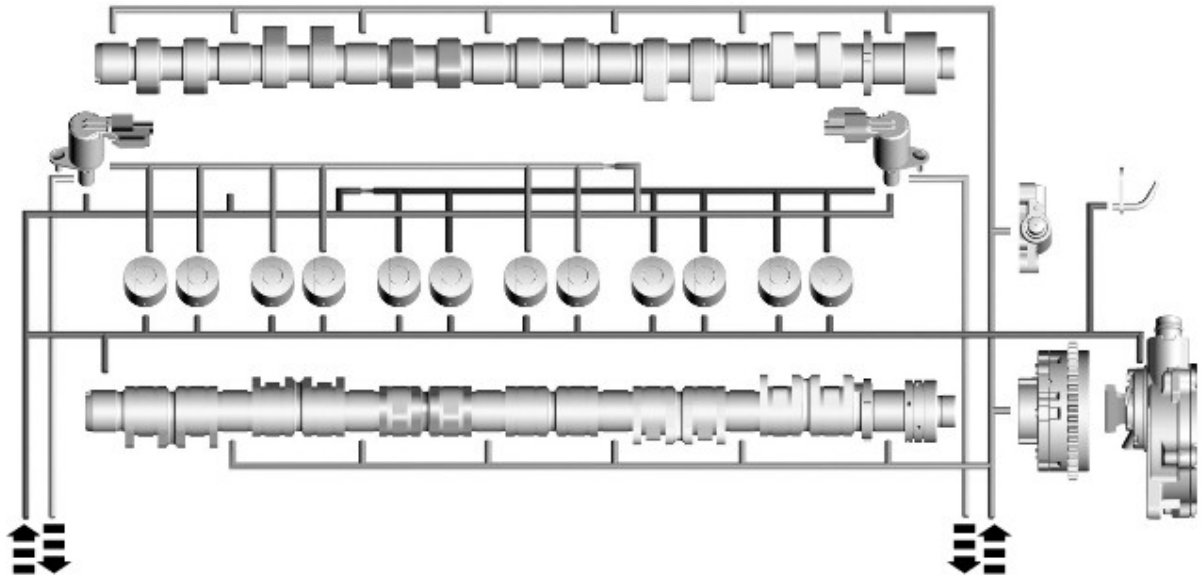
2. Circuit for the intake camshaft's front bearing, the CPS valves and the tappets with CPS function

A duct supplies the intake camshaft's front bearing and both the CPS valves.

The front CPS valve controls the oil flow to the tappets for cylinders 1, 2 and 4 and the rear CPS valve controls the oil flow to the tappets for cylinders 3, 5 and 6.

When the CPS valve solenoids are activated, the valves open (i.e. shift from low to high valve lifting height) and the tappets are supplied with oil under pressure.

The longitudinal duct that supplies the rear CPS valve is equipped with a bleed hole. This is to ensure that no air reaches the CPS valves or the tappets.



E89649

The duct is also equipped with 2 calibrated passages to each tappet circuit (i.e. the circuits after the CPS valves). A continuous flow through the circuit ensures the necessary stable pressure differences required for a stable transfer between the small and large tappet (or vice versa).

• NOTE: In the event of a small lifting height, the tappet circuit, in principle, has no pressure when the CPS valves are open, which produces a return flow to the oil pan.

A filter is located in each passage.

The duct at the rear edge supplies the following components/functions with oil:

- The camshaft chain's hydraulic tensioner
- The VCT valve and the VCT unit for the intake camshaft
- The camshaft bearings for the intake camshaft (6, i.e. all except the front)
- The camshaft bearings for the exhaust camshaft (all 7)

Gear Housing

The drained oil from the camshaft chain housing is supplied to bearings and meshings, i.e. the oil is not pressurized. The oil is routed through the bottom of the gear housing via the rear bearing, onwards into the housing where the meshings and front bearing are spray lubricated.

The internal needle bearings between the shafts are also supplied by the oil on its way out from the camshaft chain housing. The oil reaches the bearings through the opening between the shafts.

Even the intermediate shaft bearings are lubricated by the oil that is sprayed around the housing.

Published: 11-May-2011

Engine - I6 3.2L Petrol - Engine

Diagnosis and Testing

Principles of Operation

For a detailed description of the engine system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Engine (303-01A Engine - I6 3.2L Petrol, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Coolant leaks • Oil leaks • Leaks in the fuel system • Visibly damaged or worn parts • Loose or missing fixings	• Fuses • Loose or corroded electrical connectors • Harnesses • Sensors

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

• NOTE: If an engine is suspect, when the vehicle remains under the Manufacturers warranty refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new engine.

• NOTE: Due to the possibility of loose carbon, that has become trapped between the valve face and seat, effecting the pressure readings, when carrying out a compression test and some cylinders are found to have low pressures, install the spark plugs, road test the vehicle and re-test the suspect cylinders. If the correct pressures are restored, no further action is required.

Symptom	Action
All engine related issues	• Check ECM for Diagnostic Trouble Codes (DTCs) and refer to DTC Index. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
Difficult to start hot and cold	• Carry out general engine checks: - Compression test. Refer to component tests in this section. - Valve clearances. REFER to: Valve Clearance Check (303-01A Engine - I6 3.2L Petrol, General Procedures). - Spark plug condition and color
Poor idle	• Ensure the air intake system is free from leaks • Carry out general engine checks: - Compression test. Refer to component tests in this section. - Valve clearances. REFER to: Valve Clearance Check (303-01A Engine - I6 3.2L Petrol, General Procedures). - Spark plug condition and color • Check for collapsed catalytic converter/blocked exhaust system • Check long and short term fuel trim datalogger signals - Readings up to 10%: may be considered as acceptable if the readings are equal bank to bank - Positive readings of between 10-20%: check for air leaks in air intake system - Negative readings of between 10-20%: check for over fuelling e.g. leaking injectors, high fuel pressure - Readings above 20%: check for DTCs and refer to DTC Index. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • Carry out a vacuum gauge check. Refer to component tests in this section.
Insufficient power/Insufficient compression	• Ensure the air intake system is free from leaks • Carry out general engine checks: - Compression test. Refer to component tests in this section. - Valve clearances. REFER to: Valve Clearance Check (303-01A Engine - I6 3.2L Petrol, General Procedures). - Spark plug condition and color • Check for collapsed catalytic converter/blocked exhaust system • Check long and short term fuel trim datalogger signals - Readings up to 10%: may be considered as acceptable if the readings are equal bank to bank

Symptom	Action
	- Positive readings of between 10-20%: check for air leaks in air intake system - Negative readings of between 10-20%: check for over fuelling e.g. leaking injectors, high fuel pressure - Readings above 20%: check for DTCs and refer to DTC Index. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). ● Carry out a vacuum gauge check. Refer to component tests in this section.
Oil consumption	● Carry out oil leak check followed by an oil consumption test. Refer to the component tests in this section ● If oil consumption is excessive: ● Check the integrity of the engine breather system ● Carry out general engine checks: - Compression test. Refer to component tests in this section. - Valve clearances. REFER to: Valve Clearance Check (303-01A Engine - I6 3.2L Petrol, General Procedures). - Spark plug condition and color
Noise	● Refer to the Special Service Messages on the Electronic Product Quality Report (EPQR) system for sound files. If the symptom does NOT compare to any of the sound files, contact Dealer Technical Support (DTS).

Component Tests

Engine Oil Leaks

• NOTE: Before installing new gaskets or oil seals, make sure that the fault is clearly established.

If the oil leak cannot be identified clearly by a visual inspection, carry out an Ultraviolet test:

Fluorescent Oil Additive Method

1. **1.** Clean the engine with a suitable cleaning fluid (brake cleaner).
2. **2.** Drain the engine oil and refill with recommended oil, premixed with Diesel Engine Oil Dye or equivalent. Use a minimum 14.8 ml (0.5 ounce) to a maximum 29.6 ml (1 ounce) of fluorescent additive to all engines. If oil is not premixed, fluorescent additive must first be added to the crankcase.
3. **3.** Run engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using a 12 Volt Master UV Diagnostic Inspection Kit or equivalent. A clear bright yellow or orange area will identify leak. For extremely small leaks, several hours may be required for the leak to appear.
4. **4.** As necessary, pressurize the main oil gallery system to locate leaks due to incorrectly sealed, loose or cocked plugs. If the flywheel bolts leak oil, look for sealer on the threads.
5. **5.** Repair all leaks as necessary.

Compression Test

General Remarks

• NOTE: Removing fuses and disconnecting electrical components may cause the Engine Control Module (ECM) to log Diagnostic Trouble Codes (DTCs). After the measurements have been carried out, DTCs should be cleared from memory by connecting to the Manufacturer Approved Diagnostic System.

• NOTE: Only check the compression pressure with the valves set to the prescribed clearance (if this can be adjusted).

The compression pressure should be checked with the engine at operating temperature.

Check the Compression Pressure

WARNING: Move gear selector lever to 'P' position. Failure to follow this instruction may result in personal injury.

1. **1.** Remove the fuel pump relay.
2. **2.** Start the engine - the engine will start, run for a few seconds then stop.
3. **3.** Remove the spark plugs.
4. **4.** Install the compression tester.
5. **5.** Install an auxiliary starter switch in the starting circuit. With the ignition switch OFF, using the auxiliary starter switch, crank the engine a minimum of five compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.
6. **6.** Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.
7. **7.** Install the removed components in reverse order, observing the specified tightening torques.
8. **8.** Clear all DTCs from the ECM.

Interpretation of the Results

• NOTE: Due to the possibility of loose carbon that has become trapped between the valve face and seat effecting the pressure readings, when carrying out a compression test and cylinders are found to have low pressures, install the spark plugs, road test the vehicle and re-test the suspect cylinders. If the correct pressures are restored, no further action is required.

The indicated compression pressures are considered within specification if the lowest reading cylinder is within 75% of the highest reading.

If the cylinder pressures are found to be low, carry out a leakdown test to determine the location of the fault (if any leakback can be heard through the engine breather system suspect the piston rings, if any leakback can be heard through the inlet system suspect the inlet valve or seat, if any leakback can be heard through the exhaust manifold suspect the exhaust valve or seat. If the measurements for two cylinders next to each other are both too low then it is very likely that the cylinder head gasket between them is burnt through. This can also be recognized by traces of engine oil in the coolant and/or coolant in the engine oil).

Oil Consumption Test

The amount of oil an engine uses will vary with the way the vehicle is driven in addition to normal engine-to-engine variation. This is especially true during the first 16,100 km (10,000 miles) when a new engine is being broken in or until certain internal components become conditioned. Vehicles used in heavy-duty operation may use more oil. The following are examples of heavy-duty operation:

- Trailer towing applications
- Severe loading applications
- Sustained high speed operation

Engines need oil to lubricate the following internal components:

- Cylinder block cylinder walls
- Pistons and piston rings
- Intake and exhaust valve stems
- Intake and exhaust valve guides
- All internal engine components

When the pistons move downward, a thin film of oil is left on the cylinder walls. As the vehicle is operated, some oil is also drawn into the combustion chambers past the intake and exhaust valve stem seals and burned.

The following are examples of conditions that can affect oil consumption rates:

- Engine size
- Operator driving habits
- Ambient temperatures
- Quality and viscosity of oil
- Engine is being run in an overfilled condition (check the oil level at least five minutes after a hot shutdown with the vehicle parked on a level surface. The oil level should not be above the top of the cross-hatched area and the letter "F" in FULL).

Operation under varying conditions can frequently be misleading. A vehicle that has been run for several thousand miles on short trips or in below-freezing ambient temperatures may have consumed a "normal" amount of oil. However, when checking the engine oil level, it may measure up to the full mark on the oil level indicator due to dilution (condensation and fuel) in the engine crankcase. The vehicle then might be driven at high speeds on the highway where the condensation and fuel boil off. The next time the engine oil is checked it may appear that a liter of oil was used in about 160 km (100 miles). Oil consumption rate is about one liter per 2,400 km (1,500 miles).

Make sure the selected engine oil meets manufacturer specification and the recommended API performance category "SG" and SAE viscosity grade as shown in the vehicle Owner's Guide. It is also important that the engine oil is changed at the intervals specified for the typical operating conditions.

The following diagnostic procedure is used to determine the source of excessive oil consumption.

• NOTE: Oil use is normally greater during the first 16,100 km (10,000 miles) of service. As mileage increases, oil use decreases. High speed driving, towing, high ambient temperature and other factors may result in greater oil use.

1. **1.** Define excessive consumption, such as the number of miles driven per liter of oil used. Also determine customers driving habits, such as sustained high speed operation, towing, extended idle and other considerations.
2. **2.** Verify that the engine has no external oil leaks as described under Engine Oil Leaks in this section.
3. **3.** Carry out an oil consumption test:
    - Run the engine to normal operating temperature. Switch engine OFF and allow oil to drain back for at least five minutes .
    - With vehicle parked on level surface, check the engine oil level.
    - If required, add engine oil to set level exactly to the FULL mark.
    - Record the vehicle mileage.
    - Instruct the customer to return for a level check after driving the vehicle as usual for 1,610 km (1000 miles).
    - Check the oil level under the same conditions and at the same location as the initial check.

• NOTE: If the oil consumption rate is unacceptable go to Step 4.

4. **4.** Check the Positive Crankcase Ventilation (PCV) system. Make sure the system is not plugged.
5. **5.** Check for plugged oil drain-back holes in the cylinder head and cylinder block.
6. **6.** Carry out a cylinder compression test. Refer to the Compression Test procedure in this section. This can help

determine the source of oil consumption such as valves, piston rings or other areas.

7. **7.** Check valve guides for excessive guide clearance. Install new valve stem seals after verifying valve guide clearance.
8. **8.** Worn or damaged internal engine components can cause excessive oil consumption. Small deposits of oil on the tips of the spark plugs can be a clue to internal oil consumption.

Intake Manifold Vacuum Test

Bring the engine to normal operating temperature. Connect a vacuum gauge or equivalent to the intake manifold. Run the engine at the specified idle speed.

The vacuum gauge should read between 51-74 kPa (15-22 in-Hg) depending upon the engine condition and the altitude at which the test is performed. Subtract 4.0193 kPa (1 in-Hg) from the specified reading for every 304.8 m (1,000 feet) of elevation above sea level.

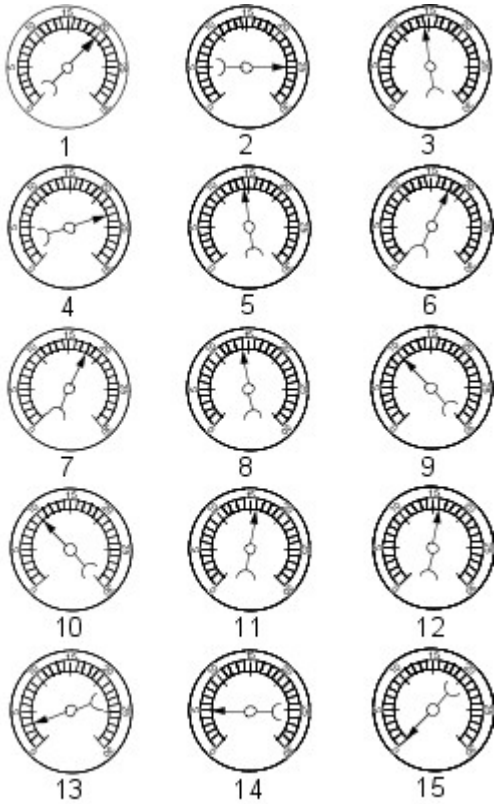
The reading should be steady. As necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust damper until needle moves easily without excessive flutter.

Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas. Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.

The following are potential gauge readings. Some are normal; others should be investigated further.



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1. **1.** NORMAL READING: Needle between 51-74 kPa (15-22 in-Hg) and holding steady.
2. **2.** NORMAL READING DURING RAPID ACCELERATION: When the engine is rapidly accelerated, the needle will drop to a low (not to zero) reading. When the throttle is suddenly released, the needle will snap back up to a higher than normal figure.
3. **3.** NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP: The needle will register as low as 51 kPa (15 in-Hg) but will be relatively steady. Some oscillation is normal.
4. **4.** WORN RINGS OR DILUTED OIL: When the engine is accelerated, the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).
5. **5.** STICKING VALVES: When the needle remains steady at a normal vacuum but occasionally flicks (sharp, fast movement) down and back about 13 kPa (4 in-Hg), one or more valves may be sticking.
6. **6.** BURNED OR BENT VALVES: A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or damaged valves. Insufficient hydraulic valve tappet or hydraulic lash adjuster clearance will also cause this reaction.
7. **7.** POOR VALVE SEATING: A small but regular downscale flicking can mean one or more valves are not seating

correctly.

8. **8.** WORN VALVE GUIDES: When the needle oscillates over about a 13 kPa (4 in-Hg) range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.
9. **9.** WEAK VALVE SPRINGS: When the needle oscillation becomes more violent as engine RPM is increased, weak valve springs are indicated. The reading at idle could be relatively steady.
10. **10.** LATE VALVE TIMING: A steady but low reading could be caused by late valve timing.
11. **11.** IGNITION TIMING RETARDED: Retarded ignition timing will produce a steady but somewhat low reading.
12. **12.** INSUFFICIENT SPARK PLUG GAP: When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.
13. **13.** INTAKE LEAK: A low, steady reading can be caused by an intake manifold or throttle body gasket leak.
14. **14.** BLOWN HEAD GASKET: A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head to cylinder block surface.
15. **15.** RESTRICTED EXHAUST SYSTEM: When the engine is first started and is idled, the reading may be normal, but as the engine RPM is increased, the back pressure caused by a clogged muffler, kinked tail pipe or other concerns will cause the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.

When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory such as the power brake booster, the unit will not function correctly. Always repair vacuum leaks.

Published: 11-May-2011

Engine - I6 3.2L Petrol - Engine Oil Draining and Filling

General Procedures

• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

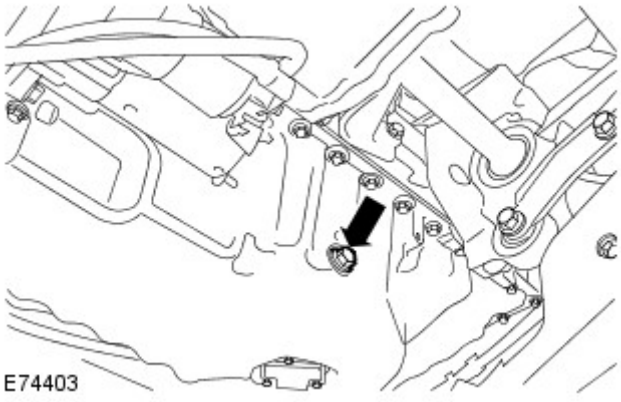
   Raise and support the vehicle.

2. Remove the oil filter.

   Refer to: Oil Filter Element (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

3. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



4. **4.** WARNING: Avoid skin contact with the specified material.

   • CAUTIONS:

   Hot fluid.

   Be prepared to collect escaping fluids.

   - *Torque:* 38 Nm
   - Remove and discard the sealing washer.

5. **5.** CAUTIONS:

   Make sure that the component is clean, free of foreign material and lubricant.

   Make sure that new sealing washers are installed.

   To install, reverse the removal procedure.

6. Check and top-up the engine oil.

Published: 11-May-2011

Engine - I6 3.2L Petrol - Valve Clearance Adjustment

General Procedures

Special Tool(s)

	303-1235 Holder, Camshaft

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

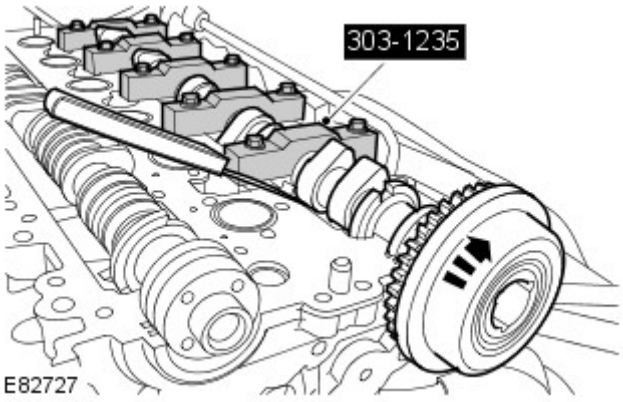
2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the camshafts.

   Refer to: Camshafts (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

4. Replace the valve shims, with the smallest shim available.



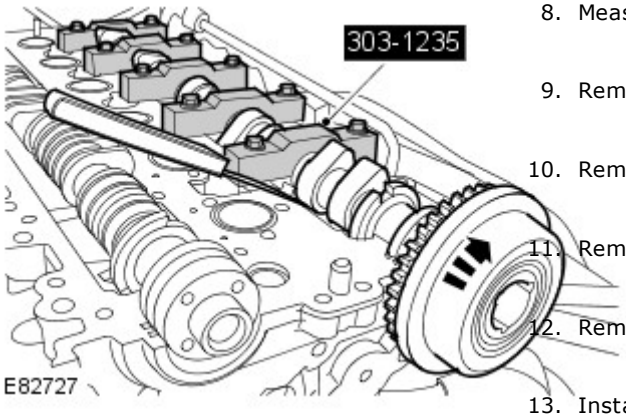
5. Using the special tools, position and secure the exhaust camshaft.

   Special Tool(s): 303-1235

6. Using the original bolt, install the camshaft sprocket and lightley tighten.

7. Using a feeler gauge, measure the clearance between the camshaft and the valve shim.

8. Measure and record the tappet clearances.



9. Remove the camshaft sprocket.

10. Remove the special tool.

11. Remove the exhaust camshaft.

12. Remove the valve tappets, replace with selected tappets.

13. Install the camshafts.

Refer to: Camshafts (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

14. Connect the battery ground cable and install the cover.

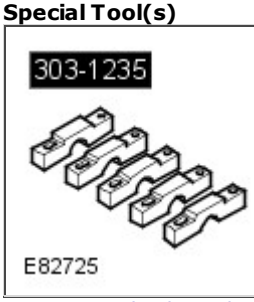
    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Valve Clearance Check

General Procedures

Special Tool(s)

	303-1235 Holder, Camshaft

• NOTE: Only the exhaust cam shaft has adjustable tappets.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

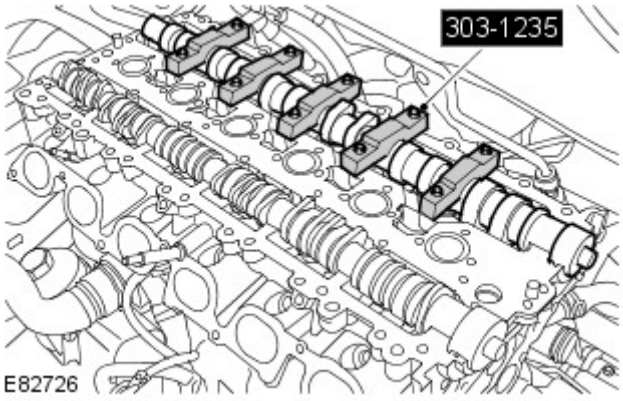
   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the camshaft bearing housing.

   Refer to: Valve Cover (303-01A Engine - I6 3.2L Petrol, Removal and Installation).



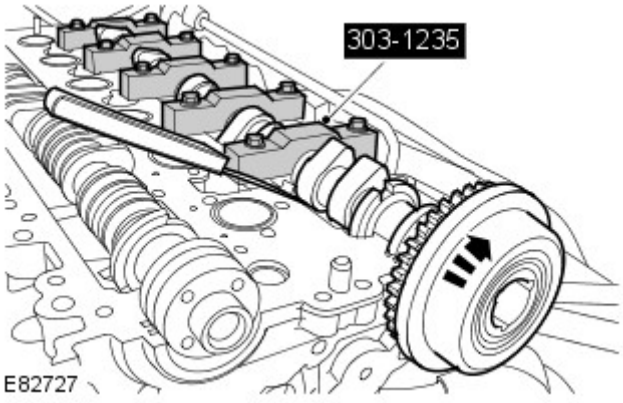
4. Using the special tools, position and secure the exhaust camshaft.

   Special Tool(s): 303-1235

5. Using the original bolt, install the camshaft sprocket and lightley tighten.

6. For valve clearance data, refer to specifications.

   Refer to: Specifications (303-01A Engine - I6 3.2L Petrol, Specifications).



7. Using a feeler gauge, measure the clearance between the camshaft and the valve shim.

8. Remove the camshaft sprocket.

9. Remove the special tools.

10. Install the camshaft bearing housing.

    Refer to: Valve Cover (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

11. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Hydraulic Lash Adjuster Priming

General Procedures

• NOTE: Hydraulic lash adjusters are fitted to the intake camshaft only.

1. Check the engine oil level.
2. If lash adjuster noise occurs when the engine is started, allow the engine to warm at idle for 1 minute (at -20 degrees celsius allow the engine to warm for 5 minutes).
3. Run the engine at 3500 RPM for 1 minute.
4. Allow the engine to idle for 30 seconds.
5. If the valve train noise is still present, repeat the above up to a maximum of 6 times.

Published: 11-May-2011

Engine - I6 3.2L Petrol - Intake Manifold

Removal and Installation

Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the air cleaner assembly.

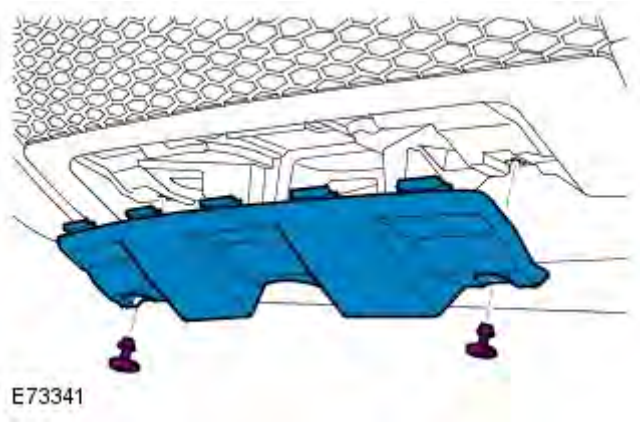
   Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

4. **4.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

5. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



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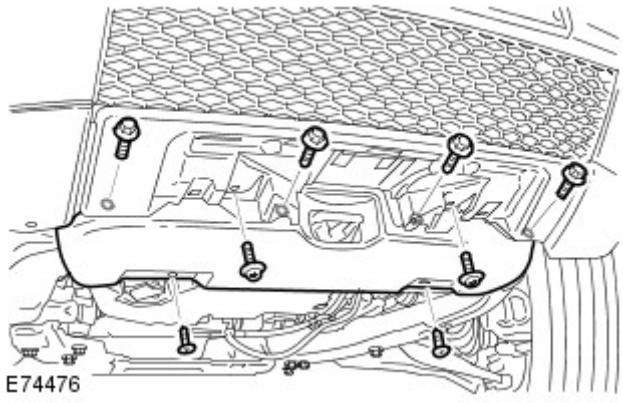

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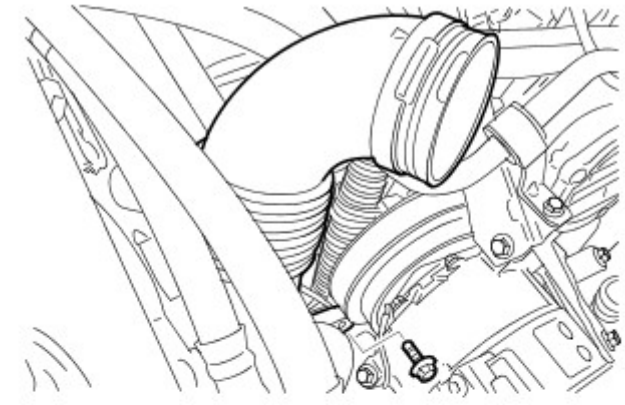
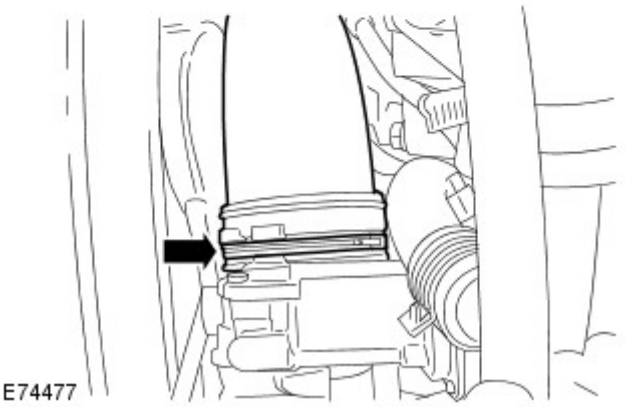
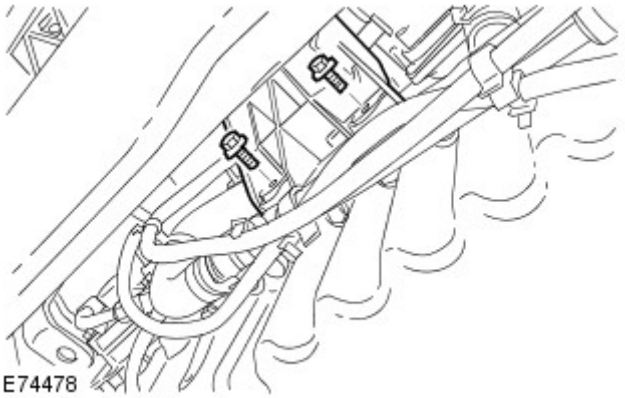
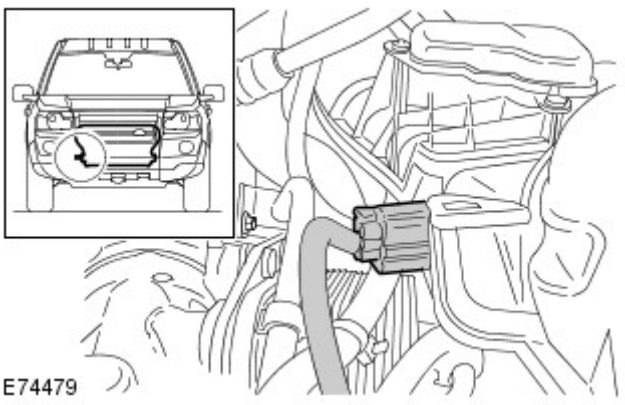


8. Remove the air cleaner outlet pipe.

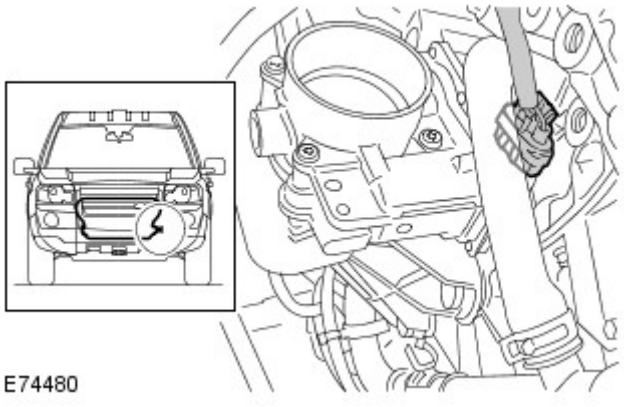




9. Remove the 2 lower intake manifold bolts.

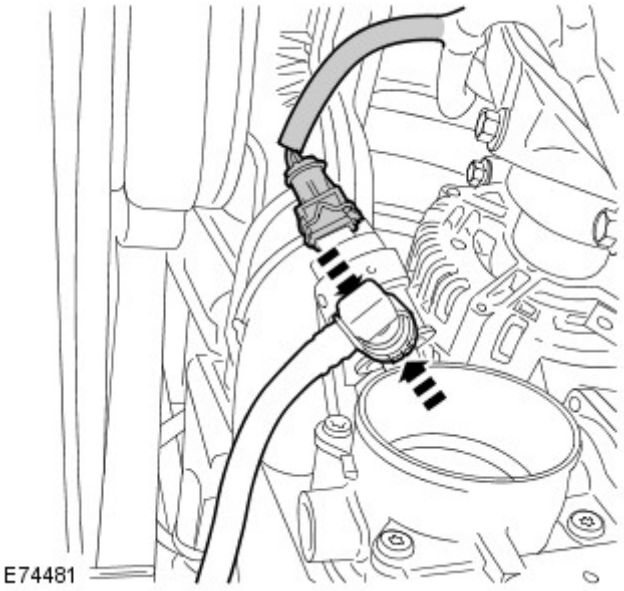


10. Disconnect the MAP sensor electrical connector.



11. Disconnect the throttle body electrical connector.

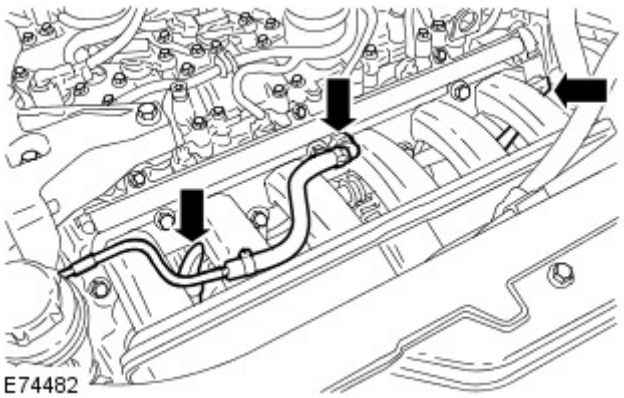
12. Disconnect the fuel purge line.



13. Disconnect the purge control valve (PCV) electrical connector.

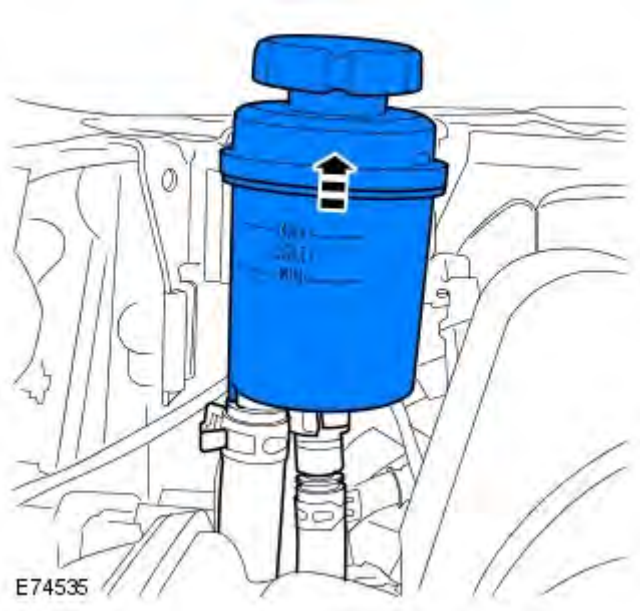
14. Disconnect the fuel rail pressure (FRP) sensor electrical connector.

15. Remove the dipstick.

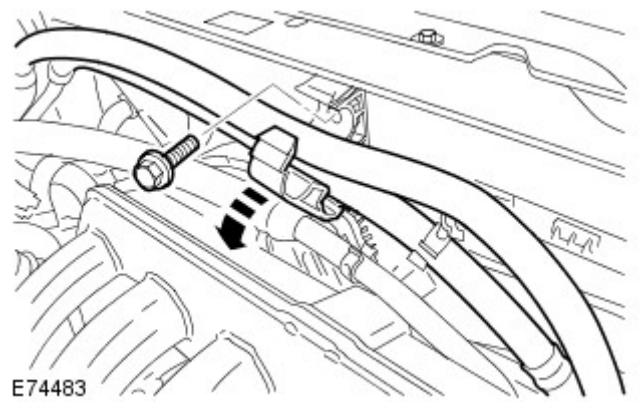


16. **16.** CAUTION: Be prepared to collect escaping fluids.

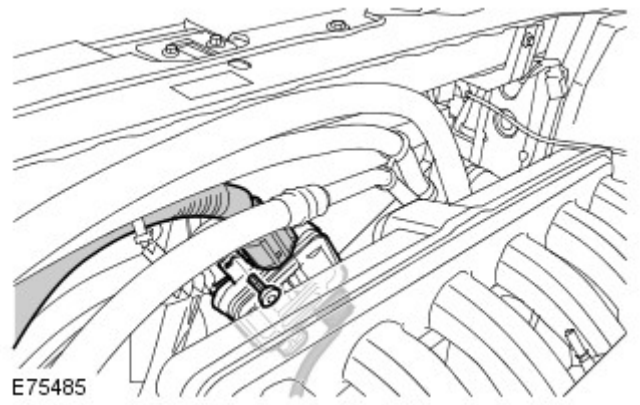
    Disconnect the coolant bleed hose.



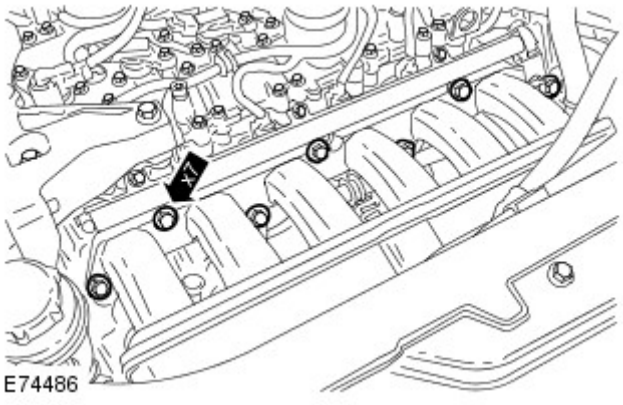
17. Release the PAS fluid reservoir from the bracket and tie aside.



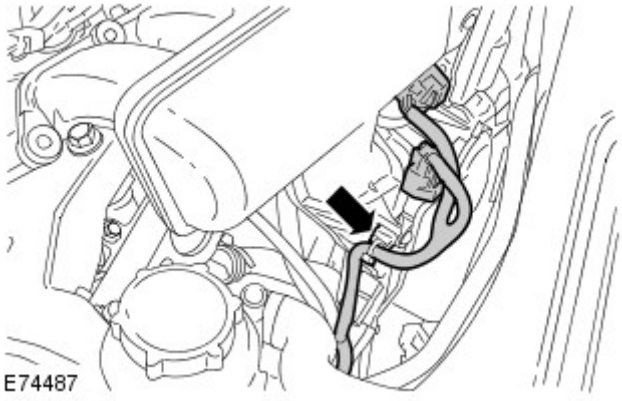
18. Remove the A/C line support bracket.



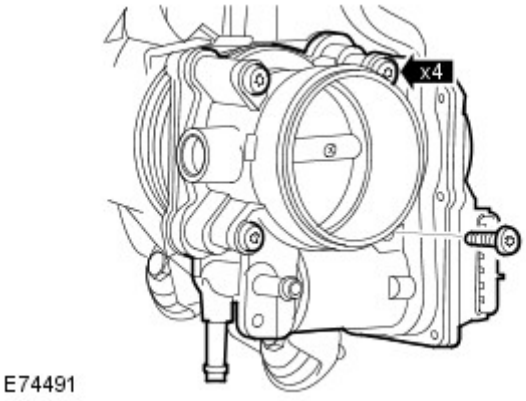
19. Remove the cooling fan module.



20. Remove the intake manifold.



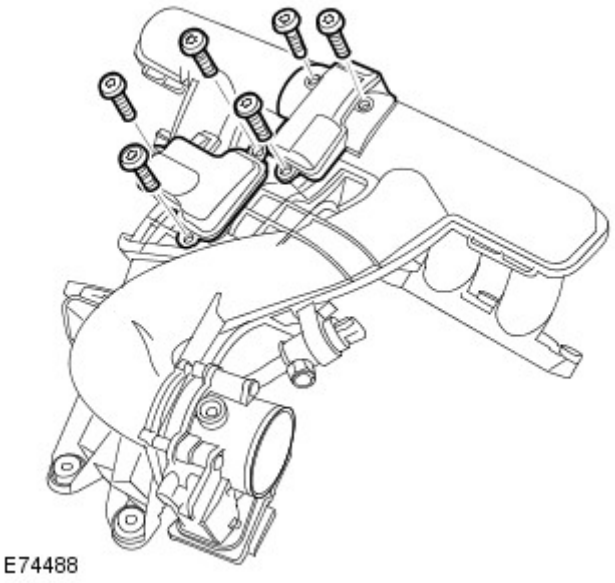
21. Disconnect the 2 intake manifold module connectors.



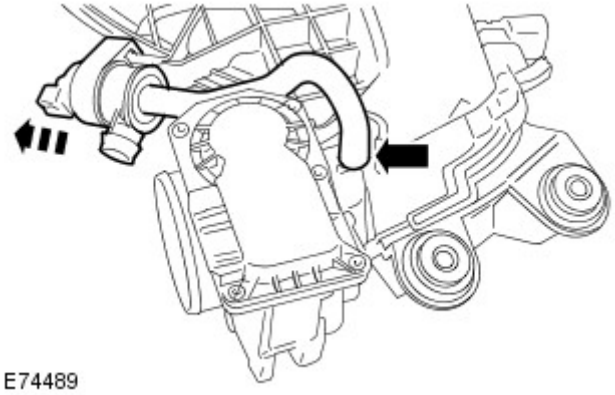
22. **22.** NOTE: Do not disassemble further if the component is removed for access only.

    Remove the throttle body.

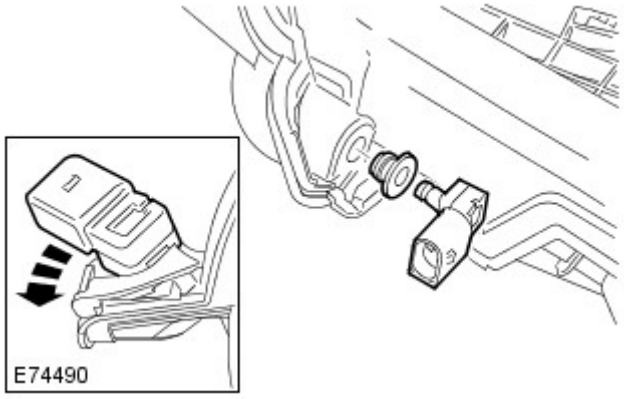
23. Remove the 2 intake manifold modules.


E74488

24. Remove the purge valve assembly.


E74489

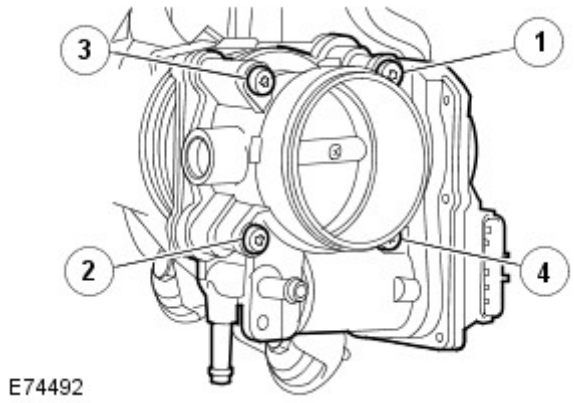
25. Remove the manifold absolute pressure (MAP) sensor.


E74490

26. Remove and discard the intake manifold gaskets.

Installation

1. Clean the component mating faces.
2. Install the gaskets.
3. Install the intake manifold modules.
4. Install the MAP sensor.
5. Install the purge valve assembly.



6. Install the throttle body and tighten the screws in the sequence shown.

   Torque: 8 Nm

7. Install the inlet manifold and tighten the bolts.

   Torque: 16 Nm

8. Install the cooling fan module.
9. Connect the coolant bleed hose.
10. Install the PAS fluid reservoir in the bracket.
11. Install the dipstick.
12. Connect and secure the electrical connectors.
13. Install the A/C line support bracket and tighten the bolt.

Torque: 10 Nm

14. Connect the purge line.

15. Install the lower intake manifold bolts.

    Torque: 10 Nm

16. Install the air cleaner outlet pipe.

17. Install the engine undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

18. Install the front undershield.

19. Install the front towing eye cover.

20. Install the air cleaner assembly.

    Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

21. Install the engine cover.

    Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

22. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

23. Check and top-up the coolant.

Published: 11-May-2011

Engine - I6 3.2L Petrol - Variable Valve Timing (VVT) Unit

Removal and Installation

Removal

CAUTION: Extreme cleanliness must be exercised when handling these components.

- NOTE: This procedure is the same as the timing chain and gears procedure.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the variable valve timing (VVT) unit.

   Refer to: Timing Chain (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

Installation

1. Install the VVT unit.

   Refer to: Timing Chain (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

2. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Valve Cover

Removal and Installation

Special Tool(s)

	303-1285 Roller, Sealant

Removal

- NOTE: The cylinder head and valve cover are machined as a pair, and cannot be serviced separately.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the timing component housing.

   Refer to: Timing Components Housing (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

4. Remove the crankcase vent oil separator.

   Refer to: Crankcase Vent Oil Separator (303-08A Engine Emission Control - I6 3.2L Petrol, Removal and Installation).

5. Remove the engine RH mount.

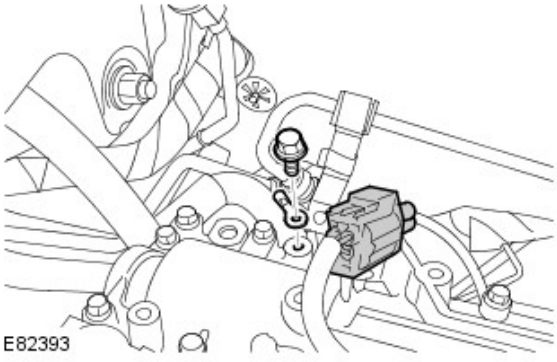
   Refer to: Engine Mount RH (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

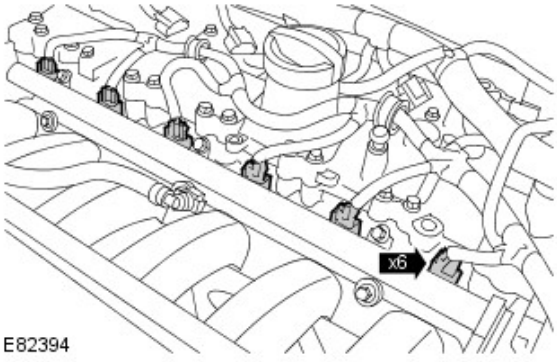
6. Remove the 6 ignition coil-on-plugs.

   Refer to: Ignition Coil-On-Plug (303-07A Engine Ignition, Removal and Installation).

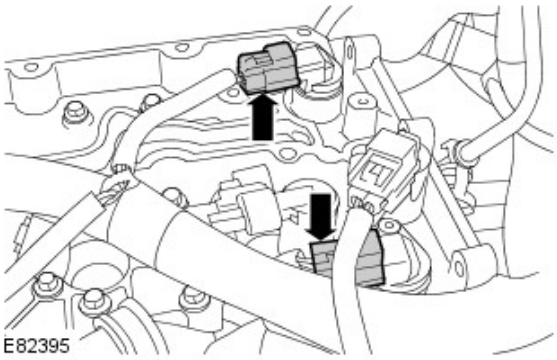
7. Disconnect the engine ground cable.

8. Disconnect the RH front HO2S electrical connector.

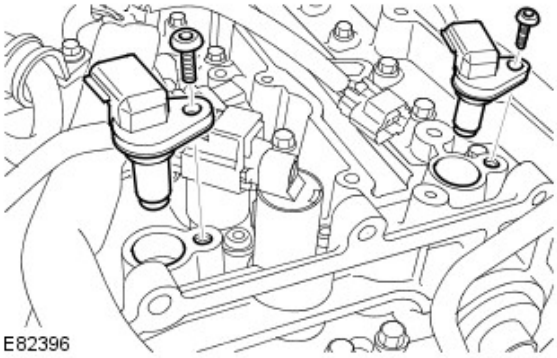




9. Disconnect the 6 fuel injector electrical connectors.

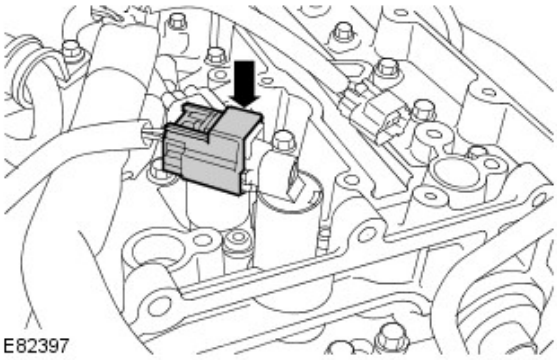


10. Disconnect the 2 camshaft position (CMP) sensor electrical conectors.



11. Remove the 2 CMP sensors.

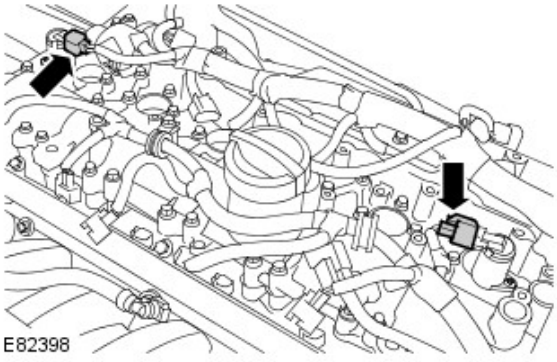
12. Disconnect the variable valve timing (VVT) solenoid.



13. **13.** CAUTION: Extreme cleanliness must be exercised when handling this component.

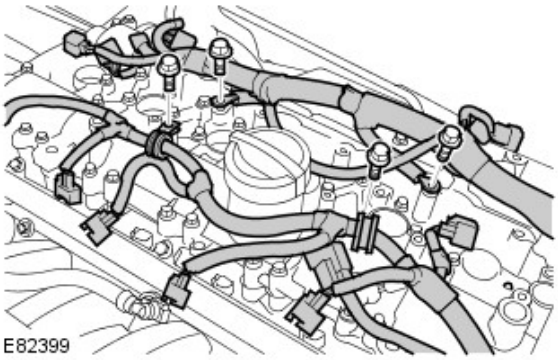
    Remove the VVT solenoid.

14. Disconnect the camshaft profile switching (CPS) solenoids.

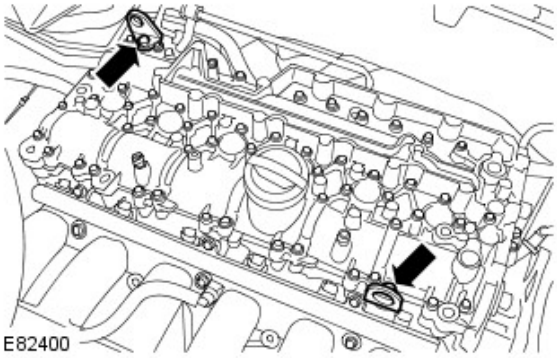


15. **15.** CAUTION: Extreme cleanliness must be exercised when handling this component.

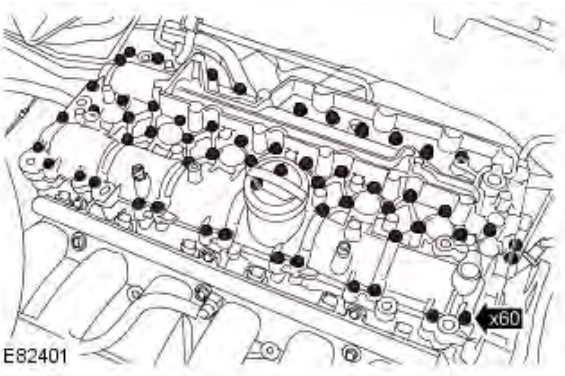
    Remove the CPS solenoids.



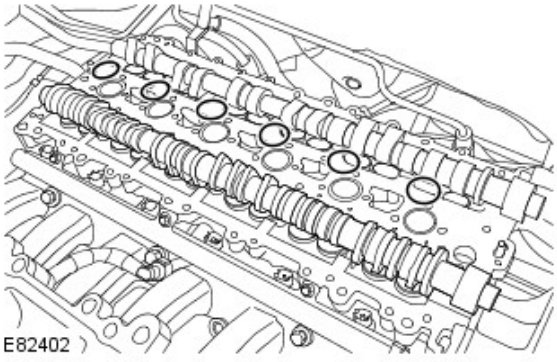
16. Release the cylinder head wiring harness.



17. Remove the 2 lifting brackets.



18. Remove the valve cover.

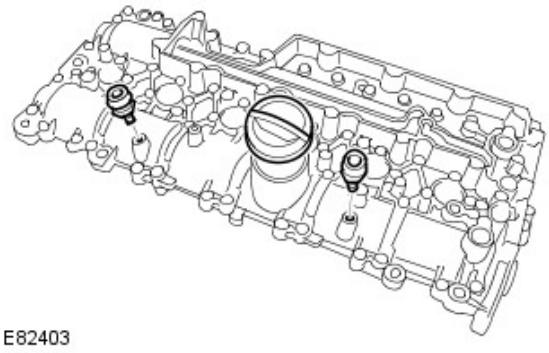


19. Remove and discard the 6 O-ring seals.

20. **20.** NOTE: Do not disassemble further if the component is removed for access only.

    Remove the oil filler cap.

21. Remove the 2 clips.



Installation

1. Install the clips.

2. Install the oil filler cap.

3. **3.** CAUTIONS:

   Extreme cleanliness must be exercised when handling these components.

   Make sure that the mating faces are clean and free of corrosion and foreign material.

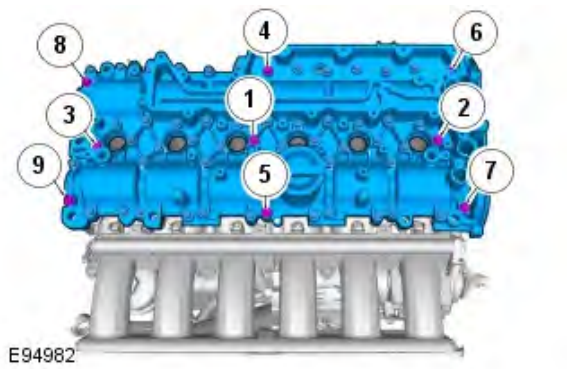
   Clean the component mating faces.

4. Install new O-ring seals.

5. For sealant information, refer to the engine specification section.

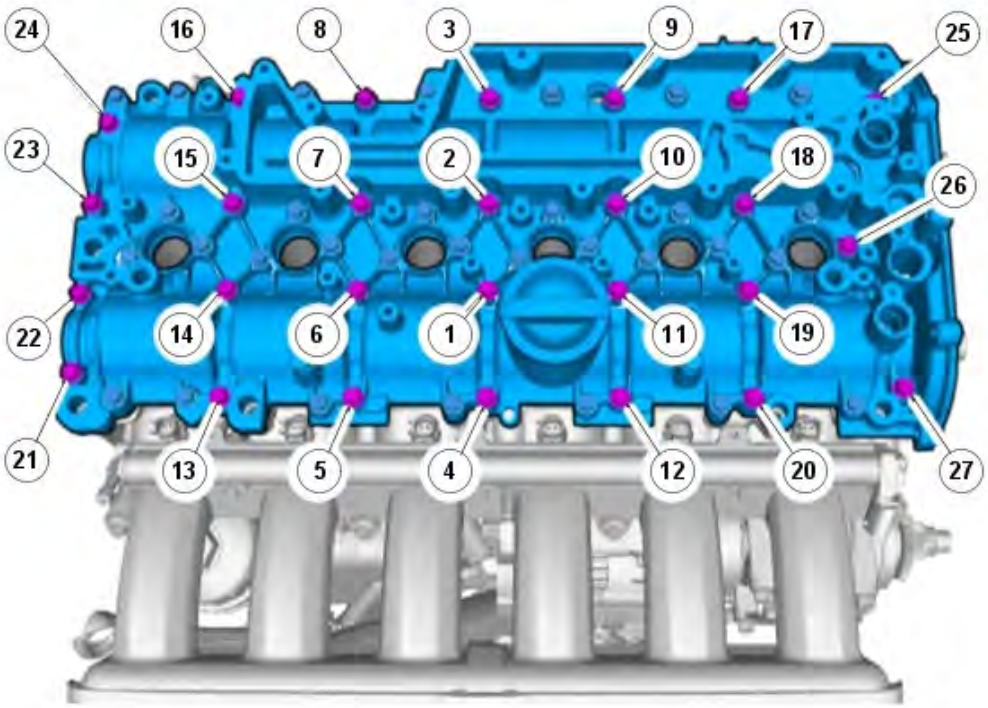
   Refer to: Specifications (303-01A Engine - I6 3.2L Petrol, Specifications).

6. Ap ' ·' e sealant as shown.
7. Sealant application.
8. **8.** NOTE: The component must be installed within 20 minutes of the application.



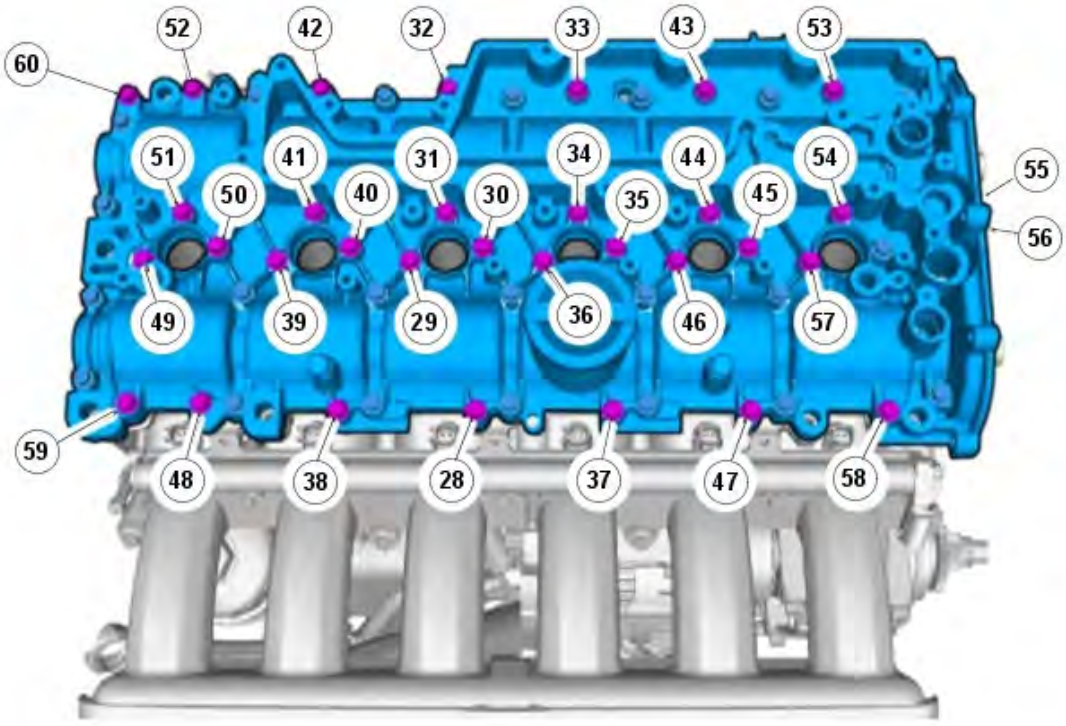
7. CAUTION: Extreme cleanliness must be exercised when handling these components.
   Special Tool(s): 303-1285.
   • NOTE: Do not tighten at this stage.
   Position the camshafts, if required.
   Using the sequence illustrated, tighten the valve cover to cylinder head bolts evenly and progressively a few turns at a time, until there is full contact.

9. *Torque:* 16 Nm



E94983

10. *Torque:* 16 Nm



E94984

11. Install the lifting brackets.

Torque: 48 Nm

12. Secure the cylinder head wiring harness.

Torque: 6 Nm

13. **13.** CAUTIONS:

    Extreme cleanliness must be exercised when handling this component.

    A new O-ring seal is to be installed.

    Install the CPS solenoids.

    Torque: 10 Nm

14. Connect the CPS solenoids.

15. **15.** CAUTIONS:

    Apply clean engine oil to the VVT solenoid shaft.

    Extreme cleanliness must be exercised when handling this component.

    A new O-ring seal is to be installed.

    Install the VVT solenoid.

    Torque: 10 Nm

16. Connect the VVT solenoid.

17. Install the CMP sensors.

    Torque: 10 Nm

18. Connect and secure the CMP sensor electrical connectors.

19. Connect the fuel injector electrical connectors.

20. Connect the ground cable.

    Torque: 6 Nm

21. Install the engine mount.

    Refer to: Engine Mount RH (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

22. Install the ignition coil-on-plugs.

    Refer to: Ignition Coil-On-Plug (303-07A Engine Ignition, Removal and Installation).

23. Install the crankcase vent oil separator.

    Refer to: Crankcase Vent Oil Separator (303-08A Engine Emission Control - I6 3.2L Petrol, Removal and Installation).

24. Install the timing component housing.

    Refer to: Timing Components Housing (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

25. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Camshafts

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

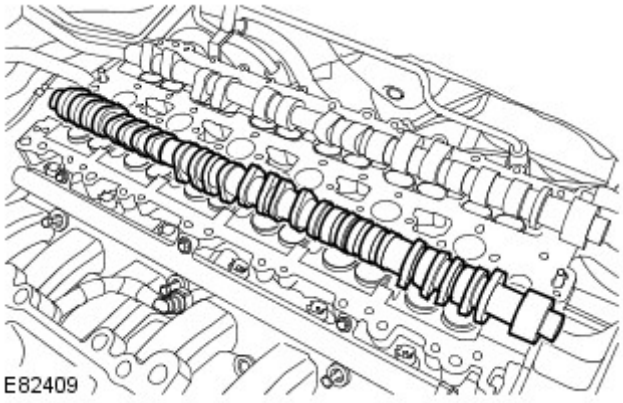
   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

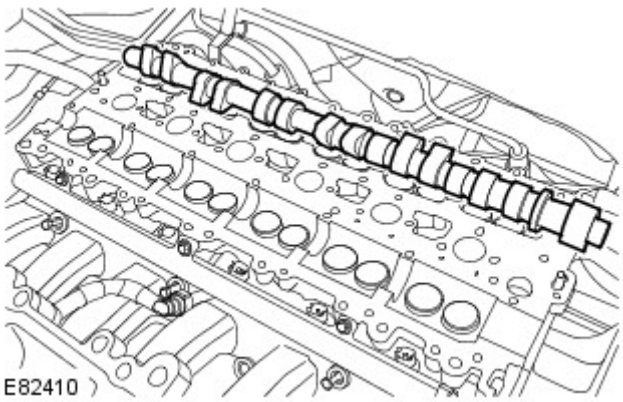
3. Remove the camshaft bearing housing.

   Refer to: Valve Cover (303-01A Engine - I6 3.2L Petrol, Removal and Installation).



4. **4.** CAUTION: Extreme cleanliness must be exercised when handling this component.

   Remove the intake camshaft.



5. **5.** CAUTION: Extreme cleanliness must be exercised when handling this component.

   Remove the exhaust camshaft.

Installation

1. **1.** CAUTION: Extreme cleanliness must be exercised when handling these components.

   Install the camshafts.

2. Check the valve clearances.

   Refer to: Valve Clearance Check (303-01A Engine - I6 3.2L Petrol, General Procedures).

3. Install the camshaft bearing housing.

   Refer to: Valve Cover (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

4. Connect the battery ground cable and install the cover.

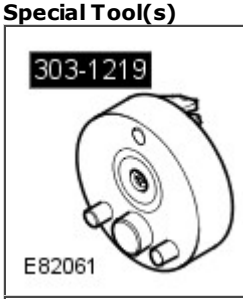
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Timing Chain

Removal and Installation

Special Tool(s)

	303-1219 Locking Tool, Crankshaft
	303-1223 Locking Tool, Camshaft
	303-1225 Locking Tool, Camshaft Tool
	303-1226 Locking Tool, Camshaft Tool

Removal

CAUTION: Extreme cleanliness must be exercised when handling these components.

• NOTE: Make sure the timing chain free length is on the tensioner run of the chain before releasing the tensioner locking device.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the crankshaft front oil seal.

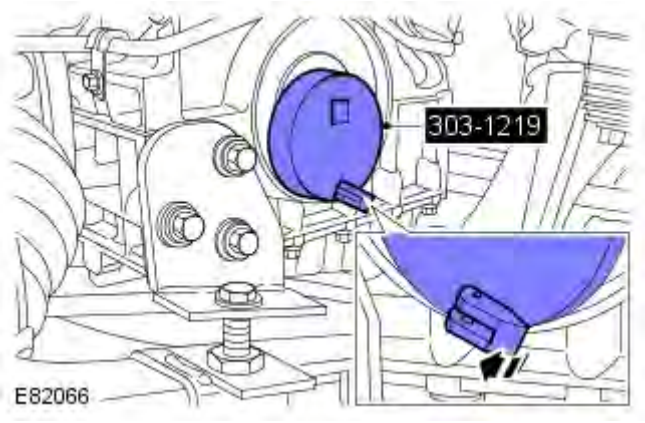
   Refer to: Engine Front Seal (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

4. Remove the RH engine mount.

Refer to: Engine Mount RH (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

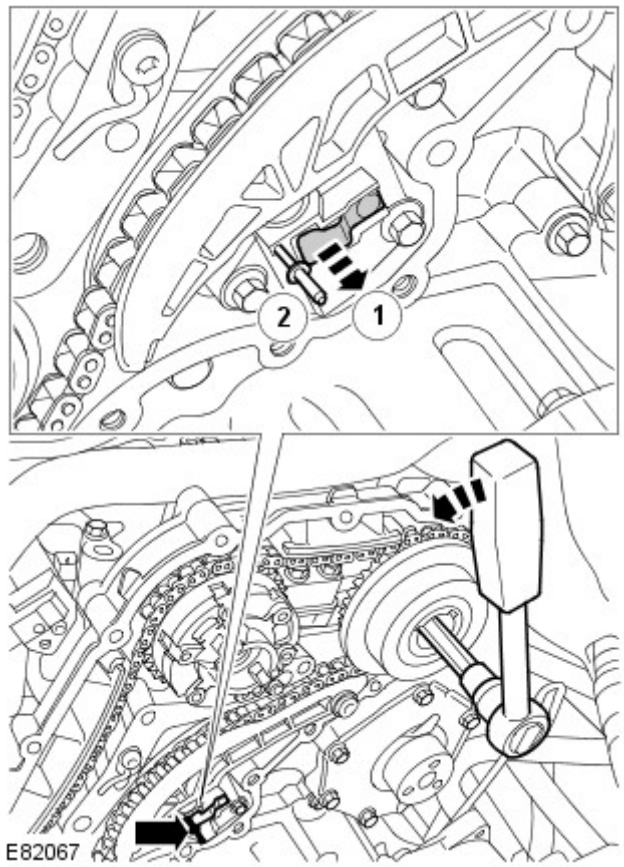
5. Remove the timing cover.

   Refer to: Timing Cover (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

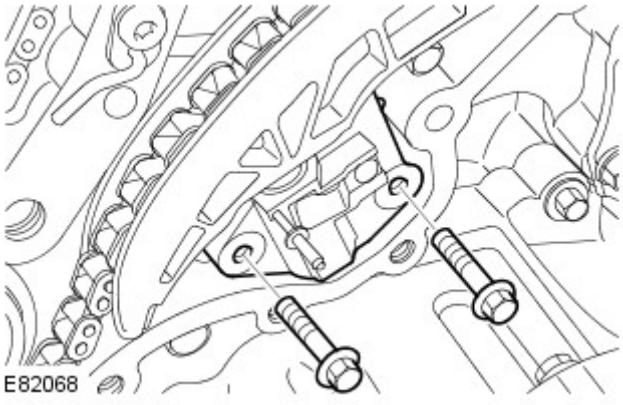


6. Position and lock the crankshaft.

   Special Tool(s): 303-1219



7.
   - To depress the chain tensioner piston and lock it in position with a 2mm, or less, diameter pin.
   - Apply an even pressure in a counter clockwise direction.
   - Lift the piston ratchet clip.
   - Install a pin with 2mm, or less, diameter.

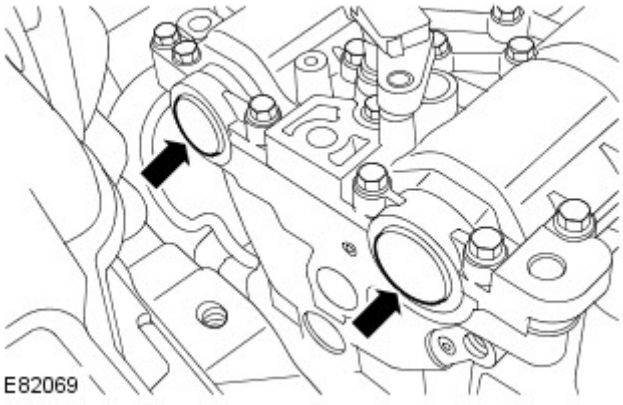


8. **8.** CAUTIONS:

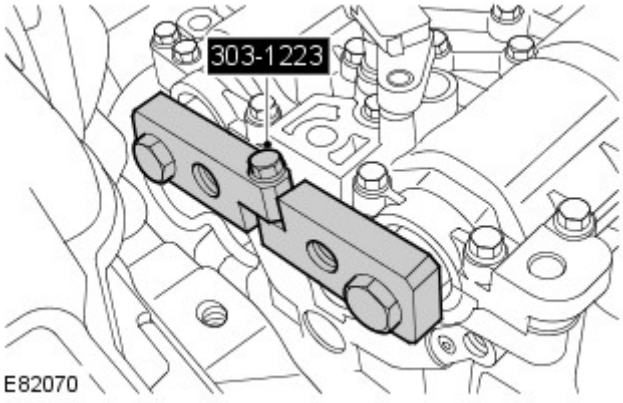
   Mark the components to aid installation.

   Extreme cleanliness must be exercised when handling this component.

   Remove the timing chain tensioner.



9. Remove and discard the camshaft bore plugs.



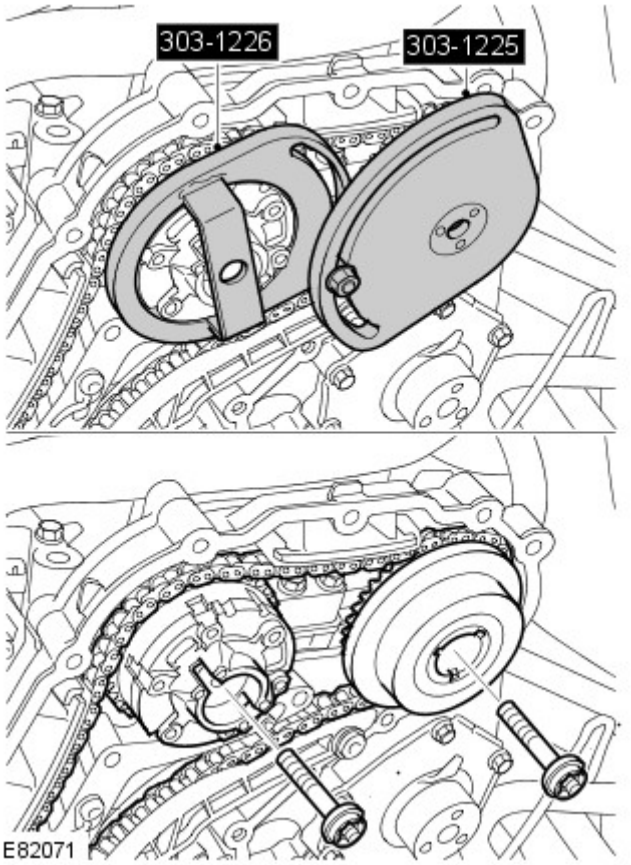
10. Install the camshaft alignment special tool.

    Special Tool(s): 303-1223

11. Using the special tool, lock the camshaft drive sprockets.

    Special Tool(s): 303-1225, 303-1226

12. Remove and discard the 2 camshaft sprockets bolts



13. Remove the sprockets and the chain.

Installation

1. Install the chain and the sprockets.
2. **2.** CAUTIONS:

   Do not tighten the camshaft sprocket bolts at this stage.

   Make sure that new bolts are installed.

   Install the sprocket retaining Torx bolts to the camshafts.
3. **3.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Extreme cleanliness must be exercised when handling these components.

   Install the timing chain tensioner.

   Torque: 10 Nm
4. Release the chain tensioner
5. Using the special tool, lock the camshaft drive sprockets.

   Special Tool(s): 303-1225, 303-1226
6. Tighten the exhaust camshaft drive sprocket.

Torque:
Stage 1:75 Nm
Stage 2:90°

7. Tighten the inlet camshaft drive sprocket.

   Torque: 110 Nm

8. Remove the camshaft alignment special tool.

9. **9.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   The plugs must be installed dry.

   Install new camshaft bore plugs.

10. Remove the crankshaft locking tool.

11. Install the crankshaft front oil seal.

    Refer to: Engine Front Seal (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

12. Install the timing cover.

    Refer to: Timing Cover (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

13. Install the RH engine mount.

    Refer to: Engine Mount RH (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

14. Connect the battery ground cable and install the cover.

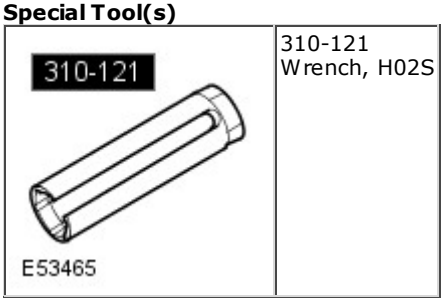
    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Exhaust Manifold

Removal and Installation

Special Tool(s)

	310-121 Wrench, H02S

Removal

WARNING: Observe due care when working near a hot exhaust system.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

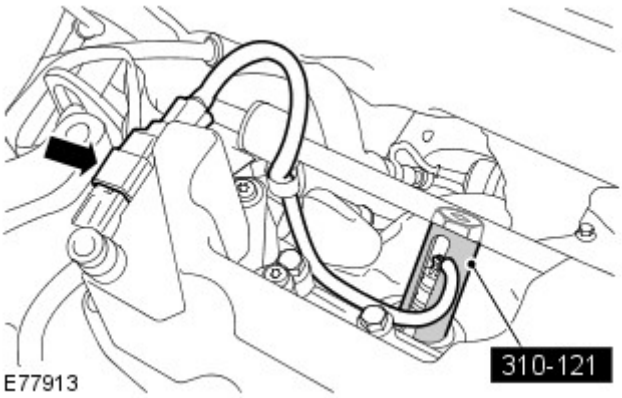
3. Remove the catalytic converters.

   Refer to: Catalytic Converter (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).

4. Remove the RH fender splash shield.

   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

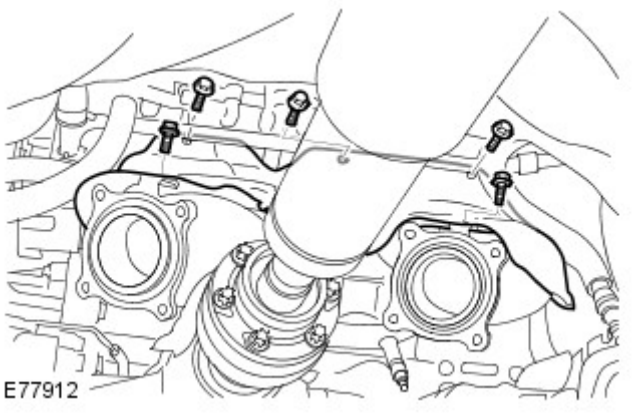
5. Disconnect the heated oxygen sensors (HO2S) electrical connectors.



6. **6.** WARNING: Do not twist the HO2S wiring harness on removal. Failure to follow this instruction may result in damage to the component.

   Remove the 2 HO2S.

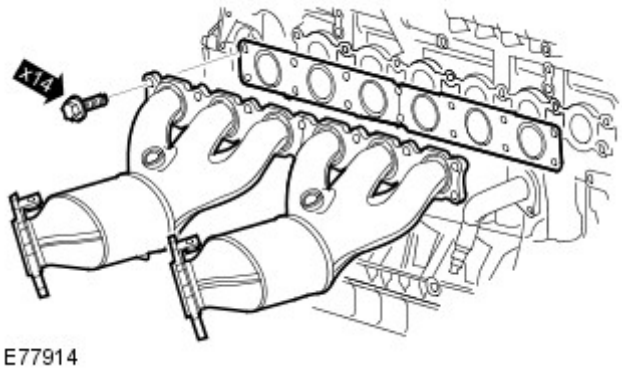
   Special Tool(s): 310-121



7. Remove the exhaust manifold heat shield.

8. Remove the 2 exhaust manifolds.

9. Remove and discard the 2 gaskets.



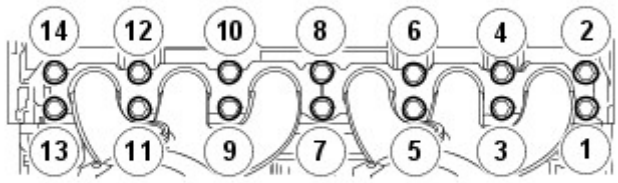
Installation

1. Install new gaskets.

2. **2.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

   Evenly and progressively, tighten the bolts in the sequence shown.

   Torque: 24 Nm



3. Install the exhaust manifold heat shield.

   Torque: 10 Nm

5. Connect the HO2S electrical connectors.
4. **4.** CAUTION: Make sure the anti-seize compound does not contact the HO2S tip.
6. Install the fender splash shield.

   Install the HO2S.

   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

   Special Tool(s): 310-121

   Torque: 45 Nm

7. Remove the catalytic converters.

   Refer to: Catalytic Converter (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).

8. Install the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Cylinder Head

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the fuel rail.

   Refer to: Fuel Rail (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).

4. Remove the generator.

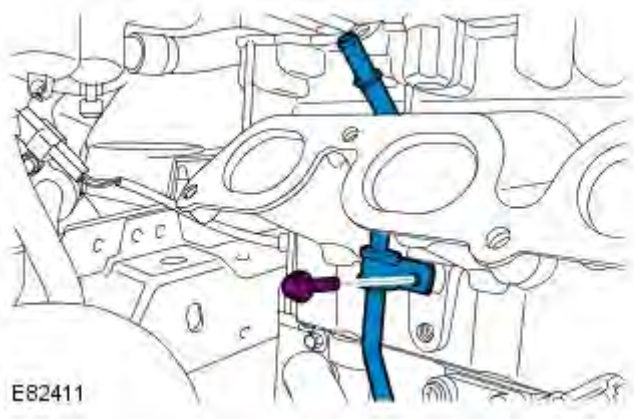
   Refer to: Generator - I6 3.2L Petrol (414-02 Generator and Regulator, Removal and Installation).

5. Remove both exhaust manifolds.

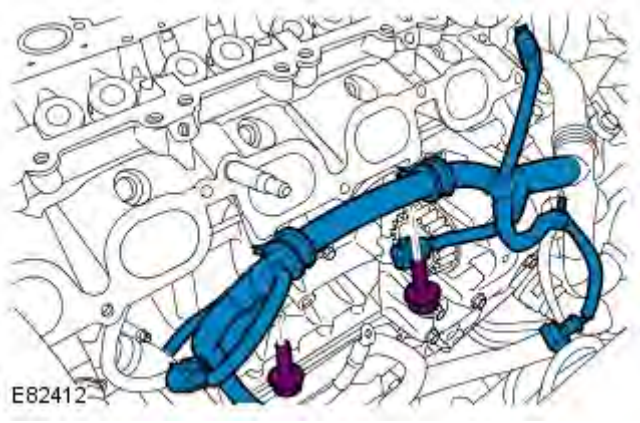
   Refer to: Exhaust Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

6. Remove the camshafts.

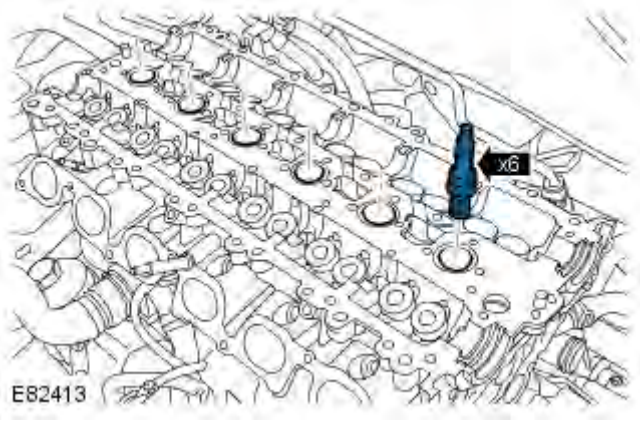
   Refer to: Camshafts (303-01A Engine - I6 3.2L Petrol, Removal and Installation).



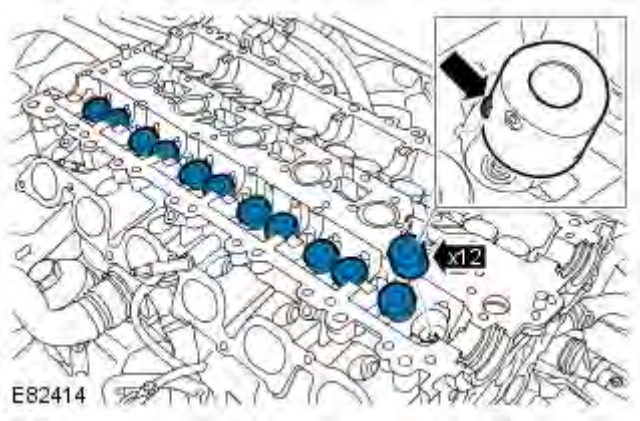
7. Release the fuel pipe.



8. Release the engine wiring harness clips.



9. Remove the spark plugs.

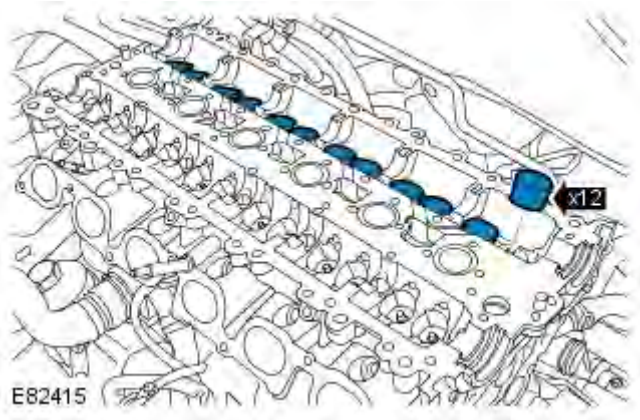


10. **10.** CAUTIONS:

⚠ Mark the components to aid installation.

⚠ Extreme cleanliness must be exercised when handling these components.

Remove the 12 two-stage hydraulic lash adjusters.



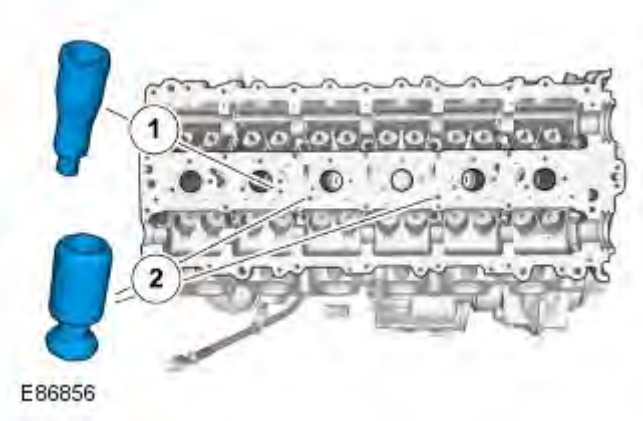
11. **11.** CAUTIONS:

⚠ Mark the components to aid installation.

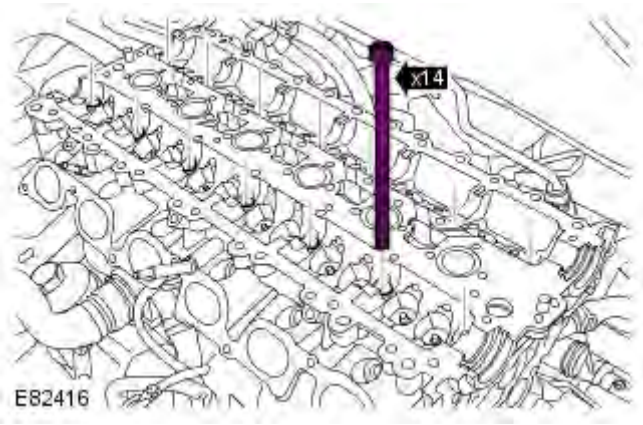
⚠ Extreme cleanliness must be exercised when handling these components.

Remove the 12 tappets.

12.



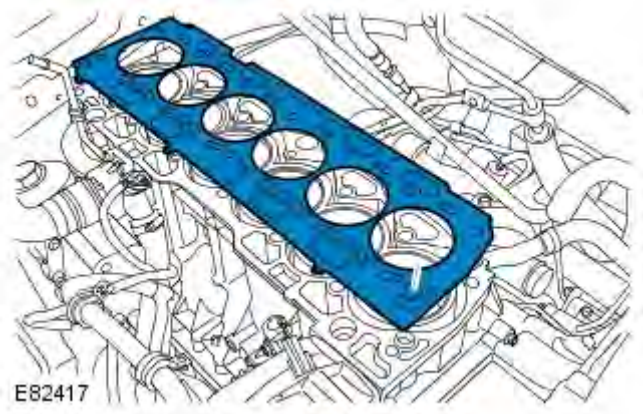
13. Remove and discard the 14 cylinder head bolts.



14. **14.** NOTE: This step requires the aid of another technician.

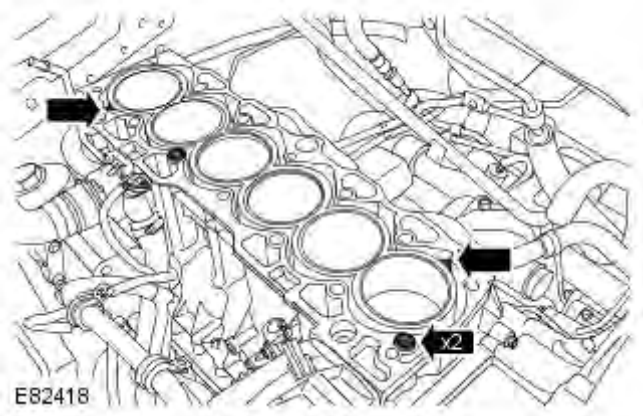
    Remove the cylinder head.

15. Remove and discard the cylinder head gasket.



16. **16.** NOTE: Make sure that these components are installed to the noted removal position.

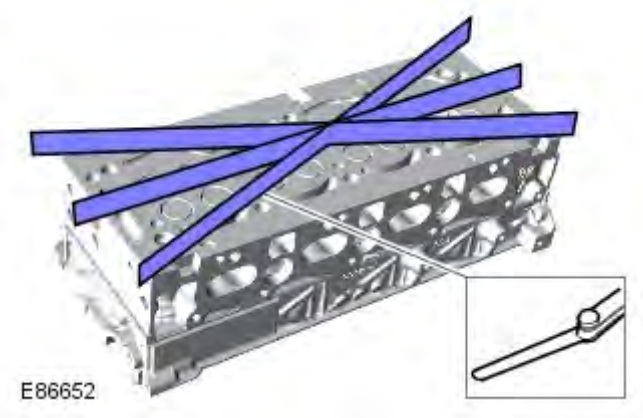
    - Remove the dowels.
    - Check that the cylinder block water jacket restrictors are installed.



Installation

1. Install the dowels.

2. Clean and inspect the cylinder head and cylinder block.



3. Check cylinder head face for distortion, across the center and from corner to corner.

   Refer to: Specifications (303-01A Engine - I6 3.2L Petrol, Specifications).

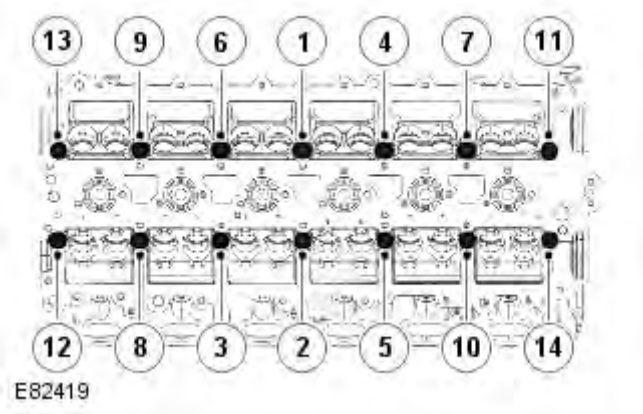
4. **4.** CAUTION: The head gasket must be installed over the cylinder block dowels.

   Install a new cylinder head gasket.

5. **5.** CAUTION: Make sure that the component is correctly located on the locating dowels.

   • NOTE: This step requires the aid of another technician.

   Install the cylinder head.



6. **6.** CAUTIONS:

   Make sure that new cylinder head bolts are installed.

   Take extra care not to damage the mating faces.

   • NOTE: The cylinder head tightening process is carried out once to 45 Nm, then the bolts are loosened and the final torque and angle applied.

   • NOTE: The cylinder head tightening process is carried out once to 45 Nm, then the bolts are loosened and the final torque and angle applied.

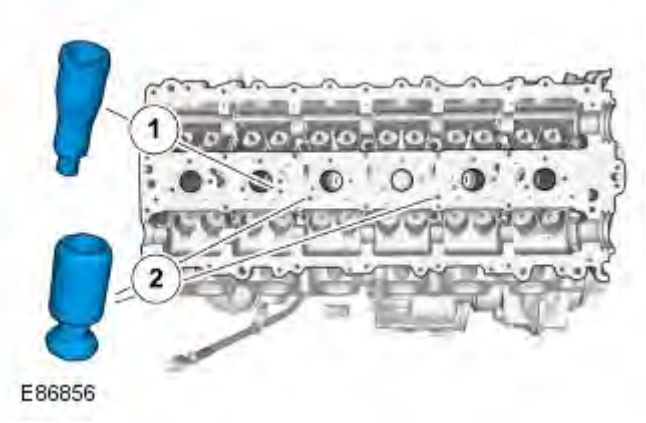
   - Tighten the cylinder head bolts in the sequence shown.

     Torque: 45 Nm
   - Check the cylinder head bolt torque in the sequence shown.

     Torque: 45 Nm
   - Tighten the cylinder head bolts in the sequence shown.

     Torque: 90°
   - Tighten the cylinder head bolts in the sequence shown.

     Torque: 180°



7. **7.** CAUTION: Make sure that the choke valves (1), (2) are in place.

8. **8.** CAUTIONS:

   Extreme cleanliness must be exercised when handling these components.

   Make sure that these components are installed to the noted removal position.

   Install the tappets.

9. **9.** CAUTIONS:

   Extreme cleanliness must be exercised when handling these components.

   Make sure that these components are installed to the noted removal position.

   Install the lash adjusters.

10. Install the engine wiring harness clips.

    Torque: 6 Nm

11. Install the spark plugs.

    Torque: 28 Nm

12. Secure the fuel line.

    Torque: 10 Nm

13. Install the camshafts.

    Refer to: Camshafts (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

14. Install the generator.

    Refer to: Generator - I6 3.2L Petrol (414-02 Generator and Regulator, Removal and Installation).

15. Install the fuel rail.

    Refer to: Fuel Rail (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).

16. Install both exhaust manifolds.

    Refer to: Exhaust Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

17. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Oil Pan

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

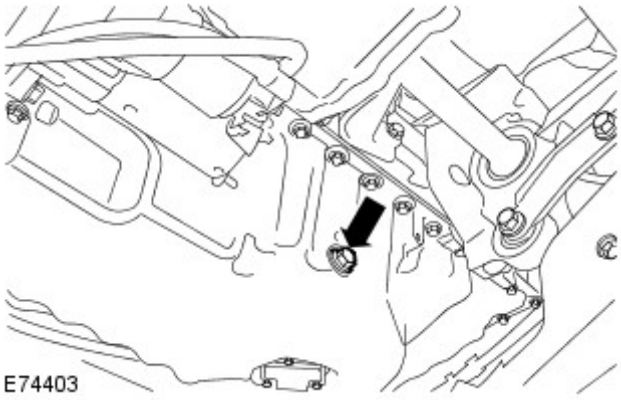
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

3. Remove the starter motor.

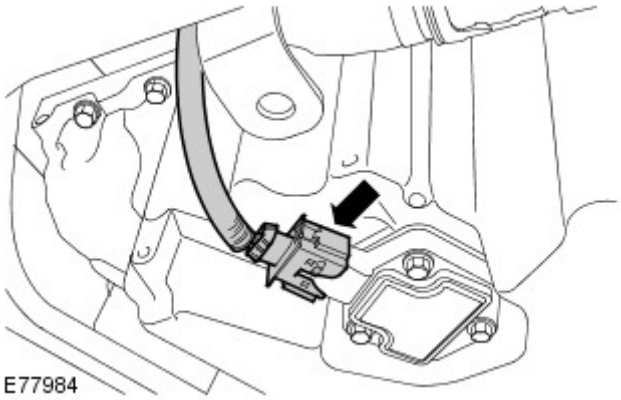
   Refer to: Starter Motor (303-06A Starting System - I6 3.2L Petrol, Removal and Installation).



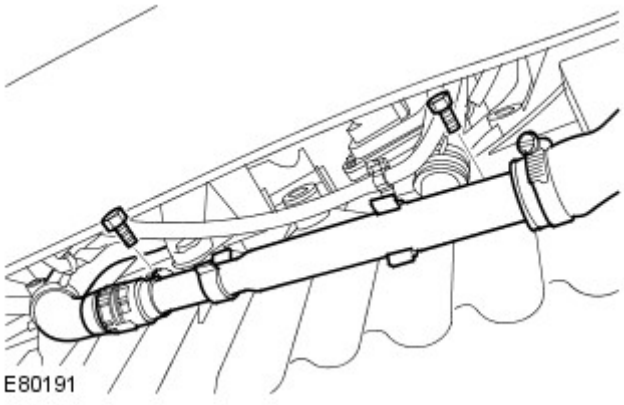
4. **4.** WARNING: Be prepared to collect escaping oil.

   CAUTION: Discard the seal.

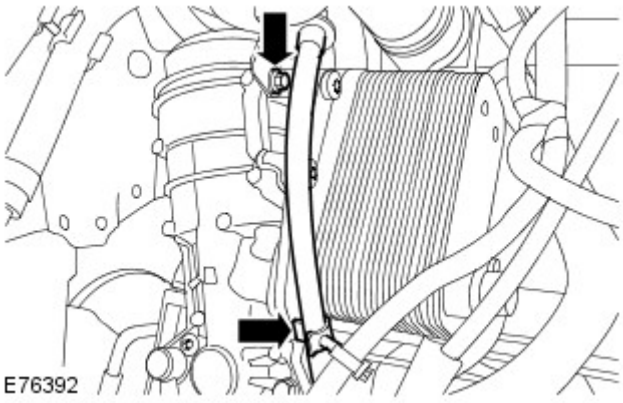
   Remove the lubricant drain plug.



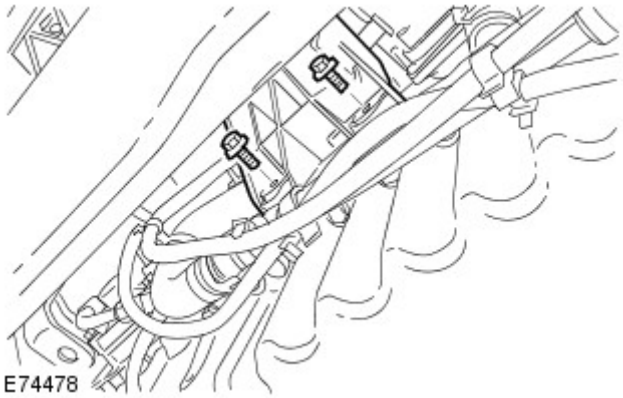
5. Disconnect the oil level sensor electrical connector.



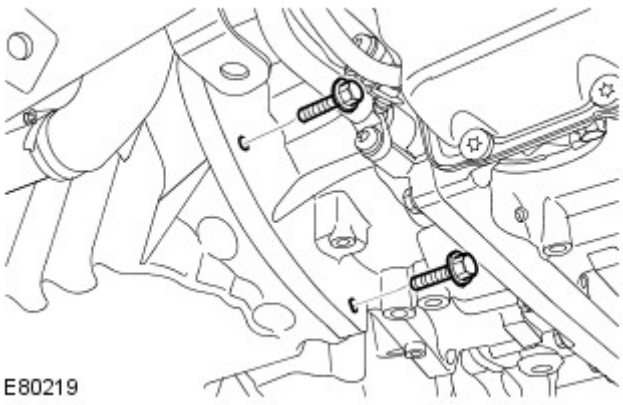
6. Release the coolant rail.



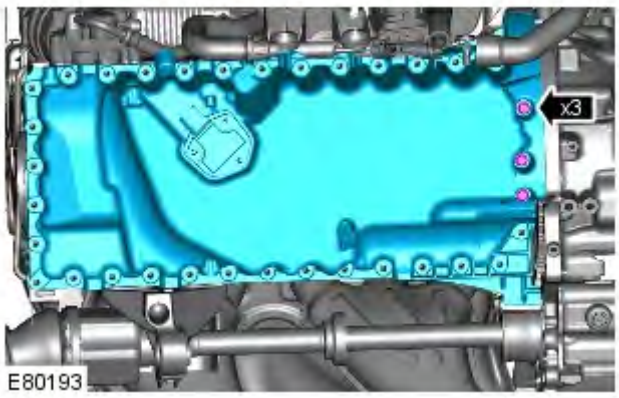
7. Remove the dipstick tube.



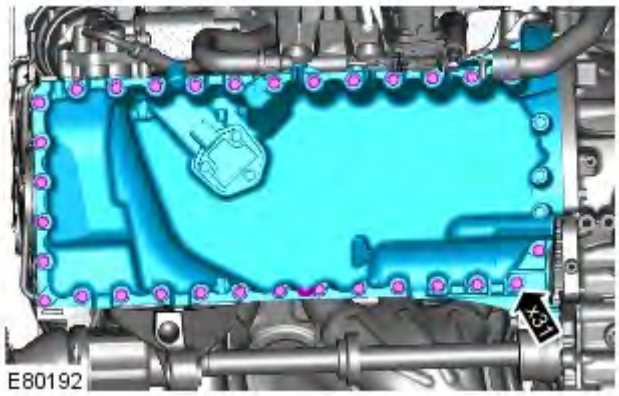
8. Remove the intake manifold lower bolts.



9. Remove the 2 sump to gearbox bolts.

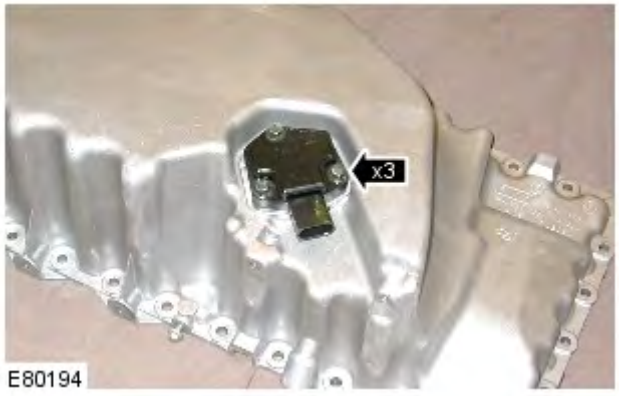


10. Remove the 3 oil pan bolts.



11. Remove the 31 oil pan bolts

12. Remove the oil pan gasket.



13. **13.** NOTE: Do not disassemble further if the component is removed for access only.

    Remove the oil level sensor.

Installation

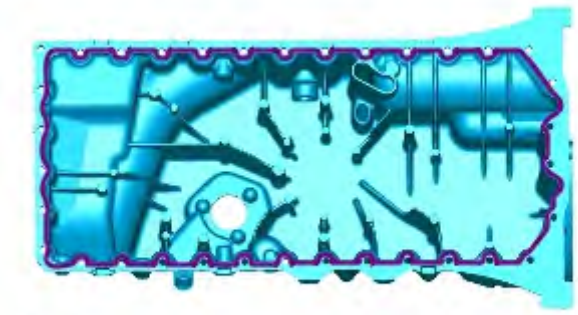
1. Install the oil level sensor.

   Torque: 8 Nm

2. For sealant information, refer to the engine specification section.

   Refer to: Specifications (303-01A Engine - I6 3.2L Petrol, Specifications).

3. Apply a bead of sealant, 2.5 mm diameter, to the area indicated.



E80195

4. Install the oil pan.

   Torque:
   M7 17 Nm
   M10 45 Nm

5. Secure the coolant rail.

   Torque: 10 Nm

6. Install the intake manifold.

   Torque: 10 Nm

7. **7.** CAUTION: Make sure that new sealing washers are installed.

   Install the lubricant drain plug.

   Torque: 38 Nm

8. Fill the engine with oil.

9. Install the starter motor.

   Refer to: Starter Motor (303-06A Starting System - I6 3.2L Petrol, Removal and Installation).

10. Check and top-up the engine oil.

11. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

12. Install the dipstick tube.

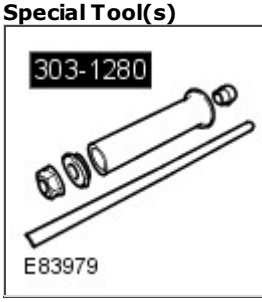
    Torque: 10 Nm

Published: 11-May-2011

Engine - I6 3.2L Petrol - Oil Pump

Removal and Installation

Special Tool(s)

	303-1280 Remover, Oil Pump Pin

Removal

CAUTION: Extreme cleanliness must be exercised when handling these components.

• NOTE: Always fit a new oil pump , as the pump gear is sprayed with a 'spacecoat' that allows accurate setting of the backlash ..

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

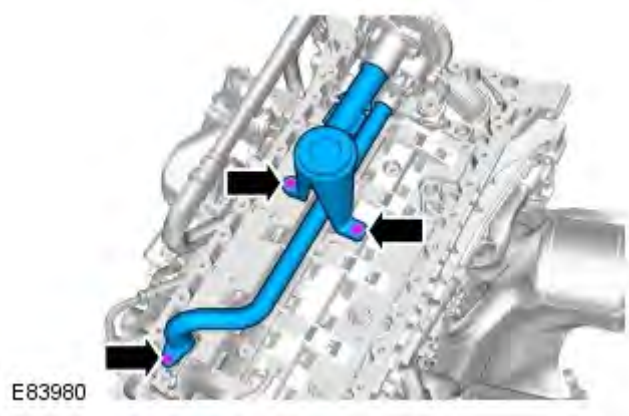
   Raise and support the vehicle.

3. Remove the oil pan.

   Refer to: Oil Pan (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

4. **4.** CAUTION: Discard the seal.

   Remove the oil strainer pick-up assembly.

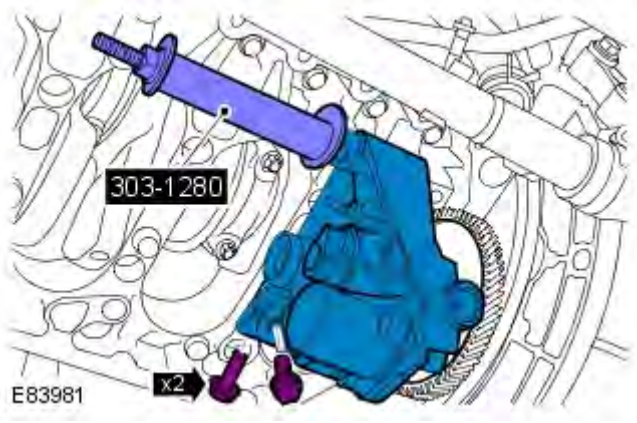


5. **5.** CAUTION: Discard the seals.

   Remove the oil pressure pipe.

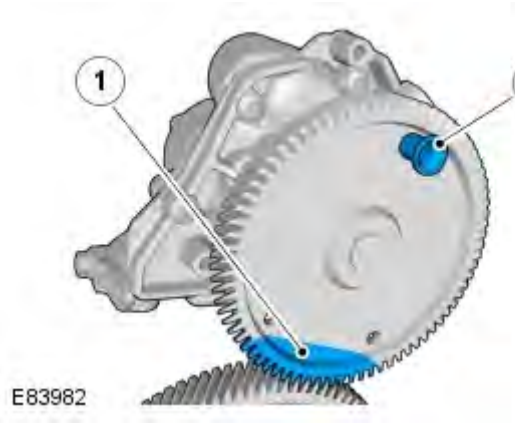
6. Remove the oil pump pivot pin.

   Special Tool(s): 303-1280



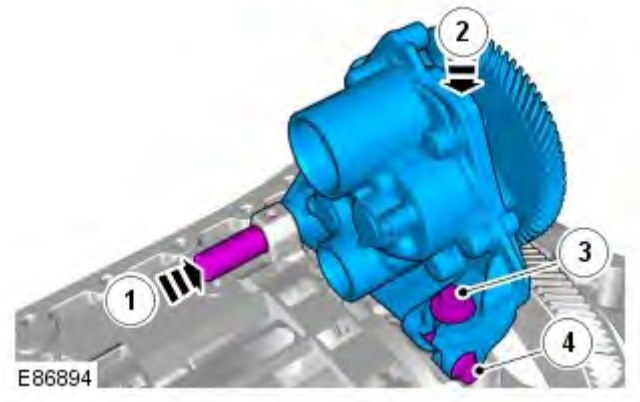
7. Remove the oil pump.

Installation



1.

- The oil pump drive has a coating in one place to set the gear clearance.
- Plastic pin is used to positon the gear for installation. Do Not remove this pin untill the oil pump is correctly installed.



2. **2.** CAUTION: "Make sure that a new component is installed. "

- Install the pin.
- Apply light pressure to the pump body.
- *Torque:* 17 Nm
- *Torque:* 10 Nm

3. Remove the oil pump locking pin.

4. **4.** NOTE: Install new O-ring seals.

   • NOTE: Lubricate new seals with clean engine oil.

   Install the oil pressure pipe.

   Torque: 17 Nm

5. **5.** CAUTION: A new O-ring seal is to be installed.

   • NOTE: Lubricate new seals with clean engine oil.

   Install the oil strainer pick-up assembly.

6. Install the oil pan.

   Refer to: Oil Pan (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

7. Connect the battery ground cable and install the cover.

   Torque: 17 Nm

Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Oil Cooler

Removal and Installation

Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

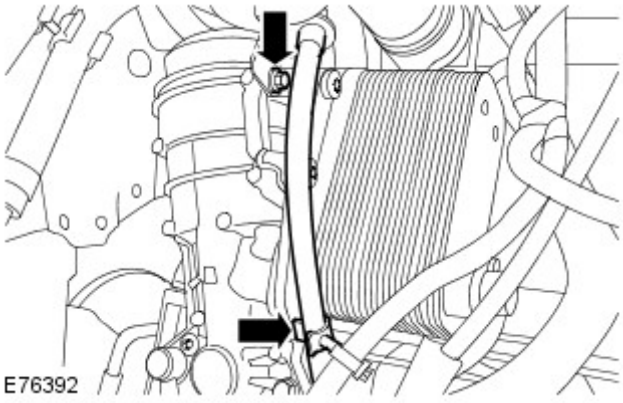
   Raise and support the vehicle.

2. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

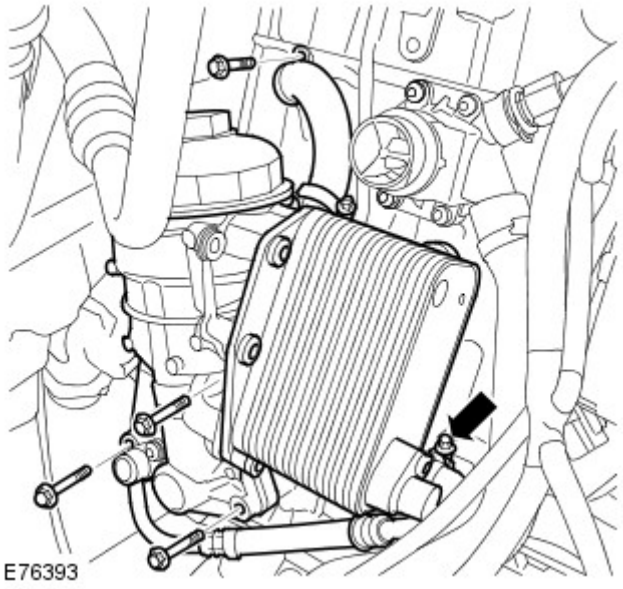
3. Remove the intake manifold assembly.

   Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).



4. Remove the dipstick tube.

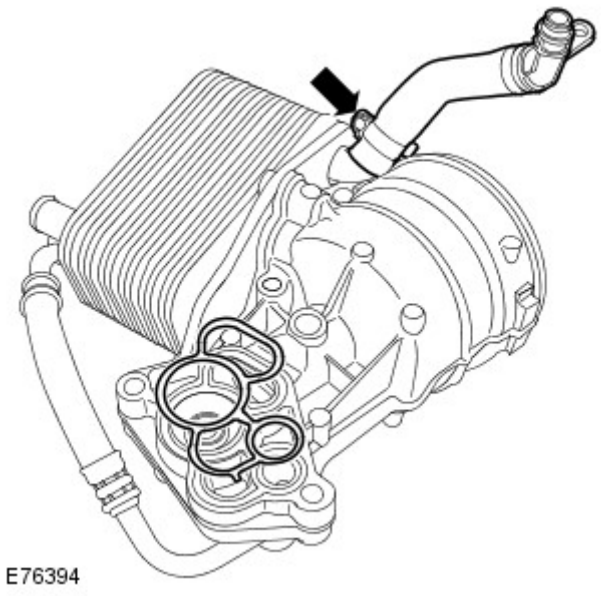
5. Loosen the element cover 4 complete turns to allow engine oil to drain from the filter cover.



6. **6.** CAUTION: Be prepared to collect escaping oil.

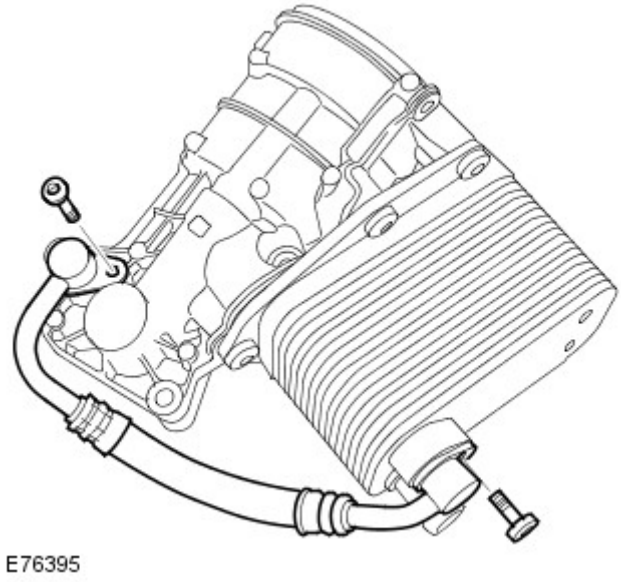
   Remove the oil filter assembly.

7. Remove and discard the gasket.

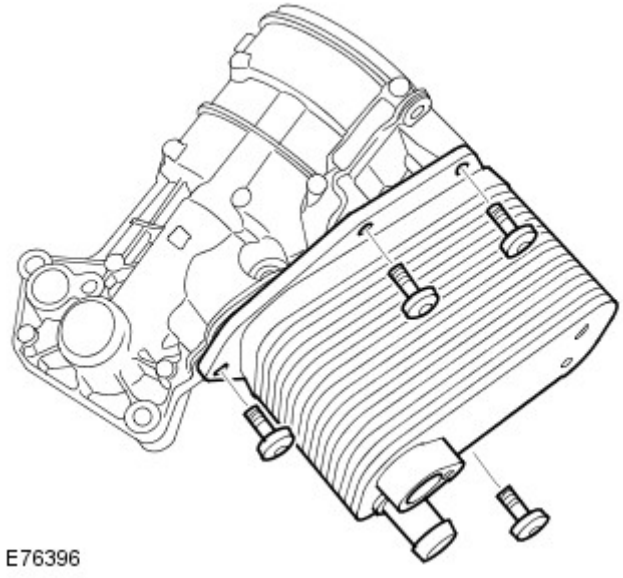

E76394

8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the coolant hose.


E76395

9. Remove the hose and discard the seals.


E76396

10. Remove the oil cooler.

11. Remove and discard the 2 gaskets.

Installation

1. Install new gaskets.
2. Install the engine oil cooler.

   Torque: 10 Nm
3. Install the hose.

   Torque: 10 Nm
4. Install and tighten the engine oil filter.

   Torque: 5 Nm
5. Install the coolant hose.
6. Install the new gasket.
7. Install the dipstick tube.

   Torque: 10 Nm
8. Install the intake manifold assembly.

   Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).
9. Fill and bleed the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).
10. Check and top-up the engine oil if required.

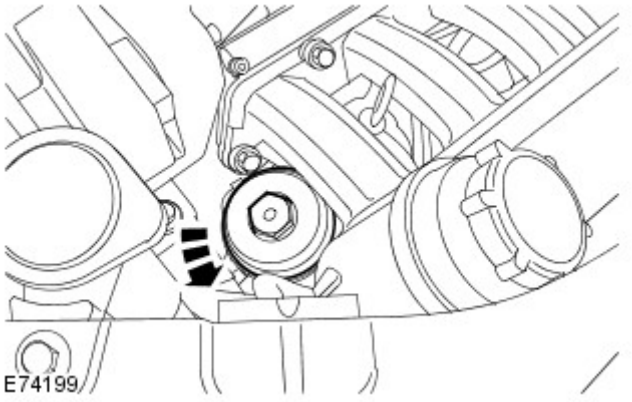
Published: 11-May-2011

Engine - I6 3.2L Petrol - Oil Filter Element

Removal and Installation

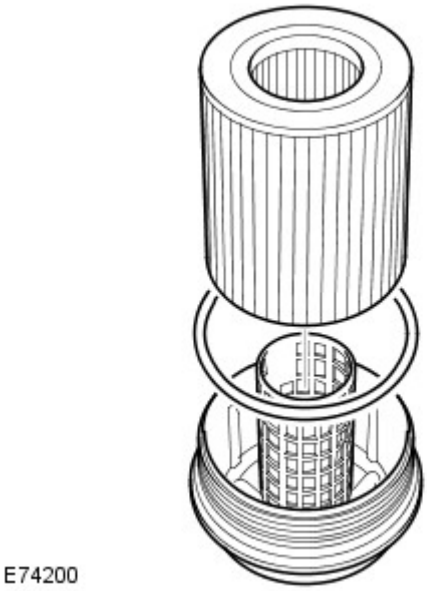
Removal

1. Release the PAS fluid reservoir from the bracket and tie aside.



2. Loosen the element cover 4 complete turns to allow engine oil to drain from the filter cover.

3.



Installation

1. Install the oil filter element.
2. Install the engine oil filter.

   Torque: 25 Nm
3. Secure the reservoir.
4. Check and top-up the engine oil.

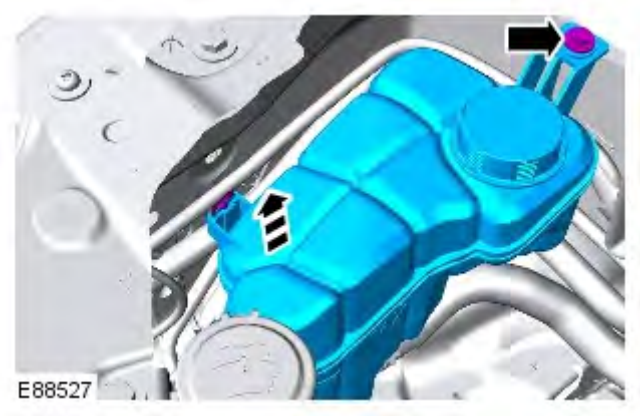
Published: 11-May-2011

Engine - I6 3.2L Petrol - Engine Upper Support Insulator

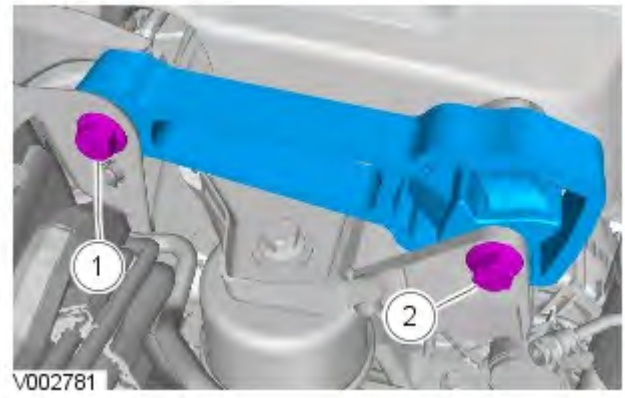
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 10 Nm



2. *Torque:* 110 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine - I6 3.2L Petrol - Engine Lower Support Insulator

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

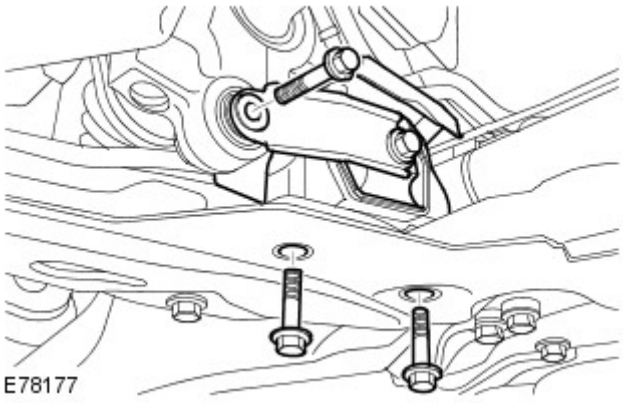
All vehicles

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

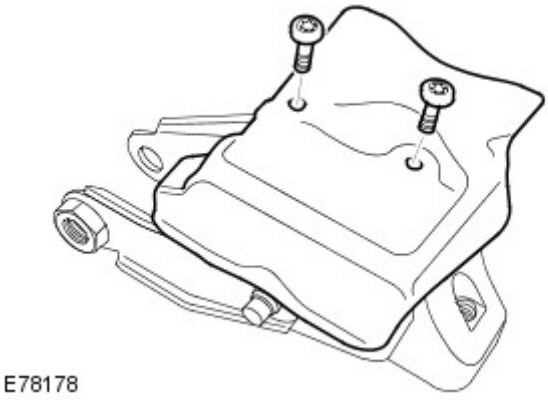


3. **3.** CAUTION: Make sure that these components are installed to the noted removal position.

   Remove the lower support insulator.

   Torque: 110 Nm

Vehicles with petrol engine

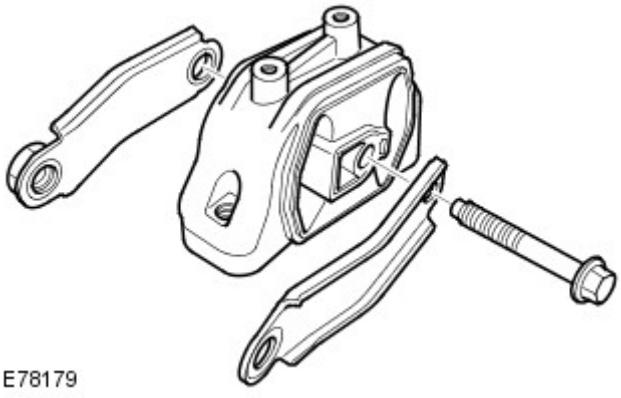


4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the heat shield.

   Torque: 10 Nm

All vehicles



5. Remove the engine mount link brackets.

   Torque: 110 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine - I6 3.2L Petrol - Engine Mount LH

Removal and Installation

General Equipment

Transmission jack

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. Support the transmission.

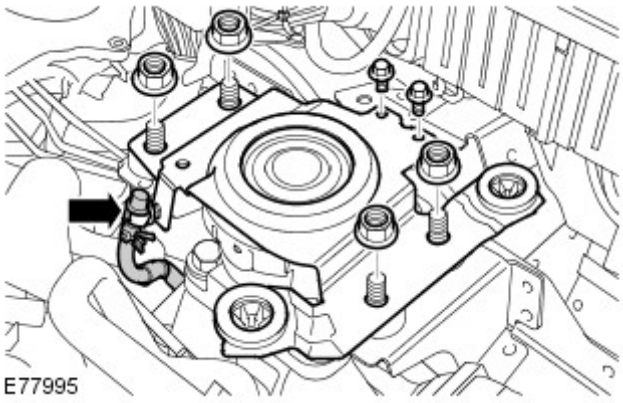
   General Equipment: Transmission jack

4. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

5. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).



6. **6.** WARNING: Make sure that new nuts are installed.

   • NOTE: Vehicles with automatic transmission have a breather pipe attached to the mounting.

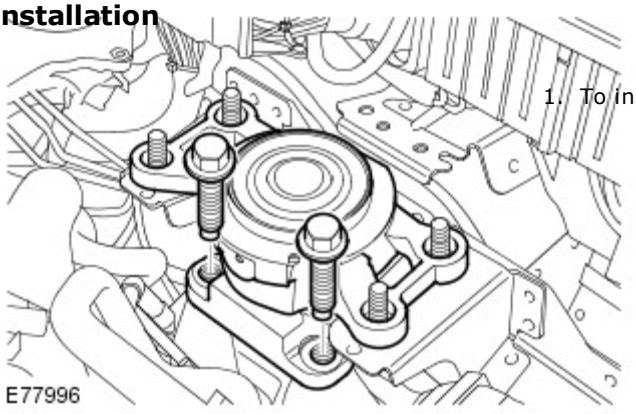
   Remove the bracket.

   Torque:
   M12 80 Nm
   M8 25 Nm

7. Remove the engine mount LH.

   Torque: 175 Nm

Installation



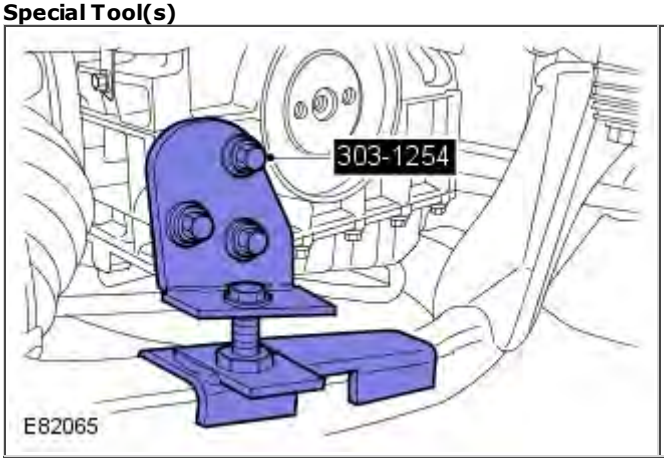
1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine - I6 3.2L Petrol - Engine Mount RH

Removal and Installation

Special Tool(s)

	303-1254 Support, Engine

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

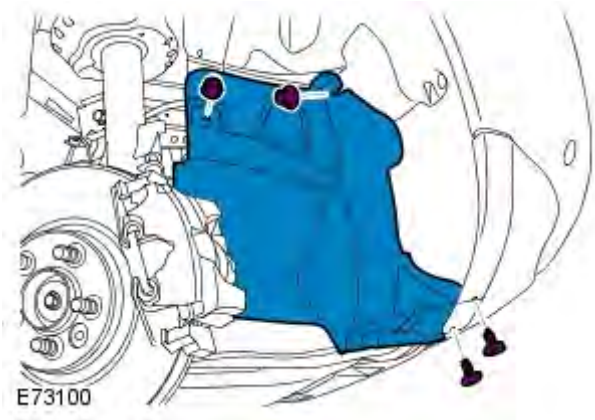
   Raise and support the vehicle.

2. Remove the engine undershield.

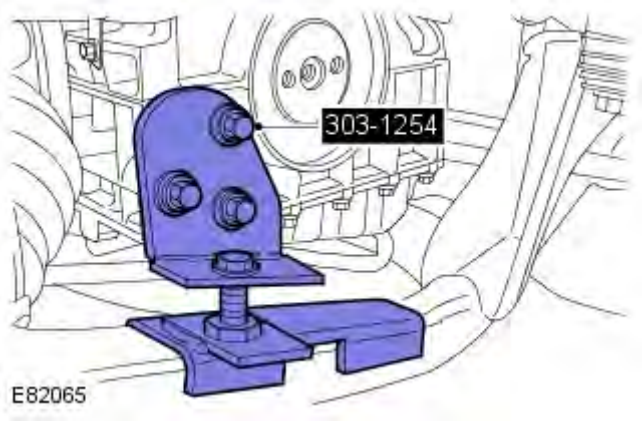
   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. Remove the RH front wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



4. Remove the fender splash shield extension panel.



5. Support the engine.

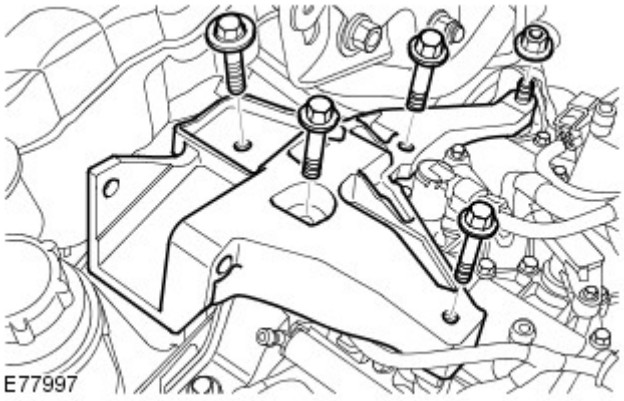
   Special Tool(s): 303-1254

6. Remove the engine cover.

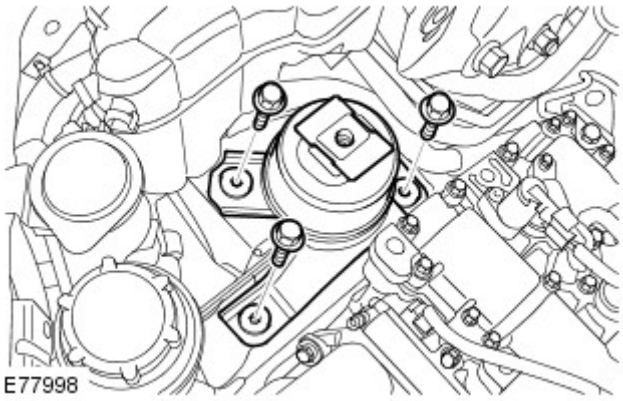
   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. Remove the stabilizer bar.

   Refer to: Engine Upper Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).



8. *Torque:*
   M10 45 Nm
   M12 80 Nm



9. *Torque:* 80 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine - I6 3.2L Petrol - Timing Cover

Removal and Installation

Special Tool(s)

	303-1227 Installer, Auxiliary Drive Seal
	303-1228 Holder, Generator Pulley

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

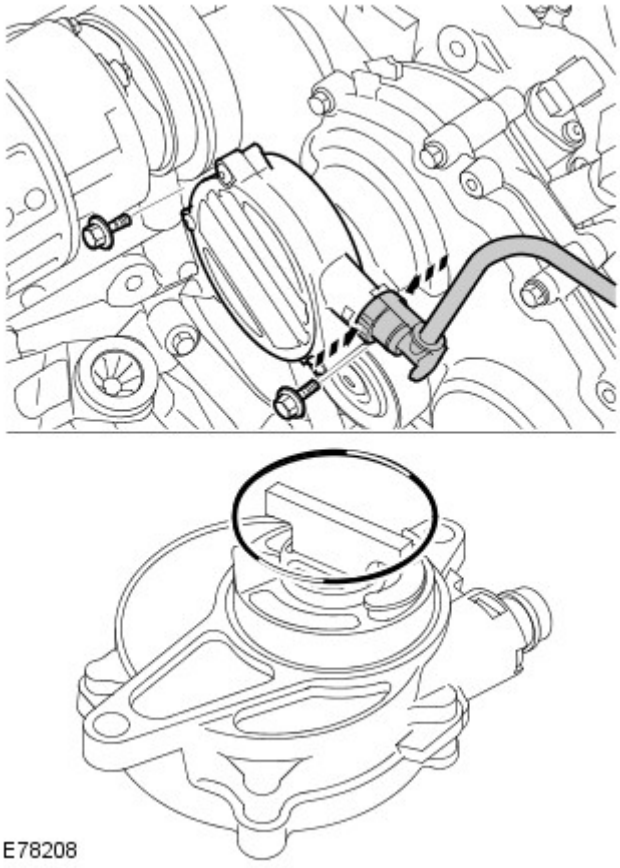
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Drain the coolant.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

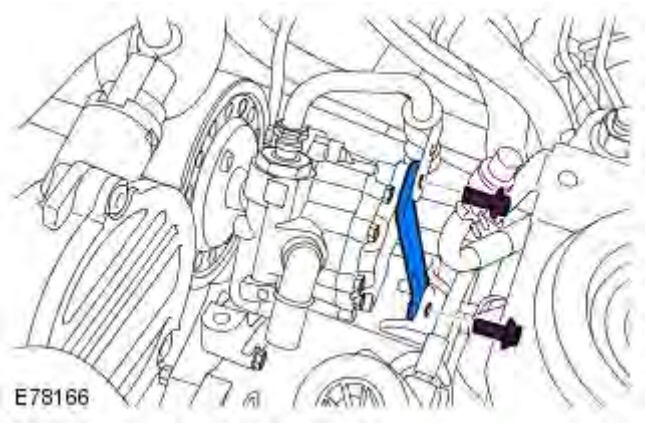
4. Remove the accessory drive pulley.

   Refer to: Accessory Drive Pulley (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

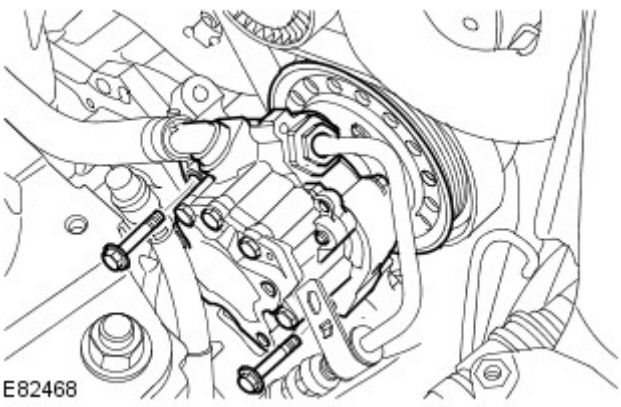


5. **5.** CAUTION: The O-ring seal is to be reused unless damaged.

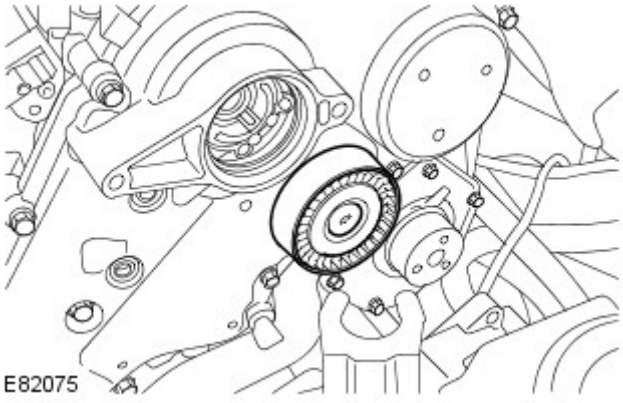
   Remove the brake vacuum pump.



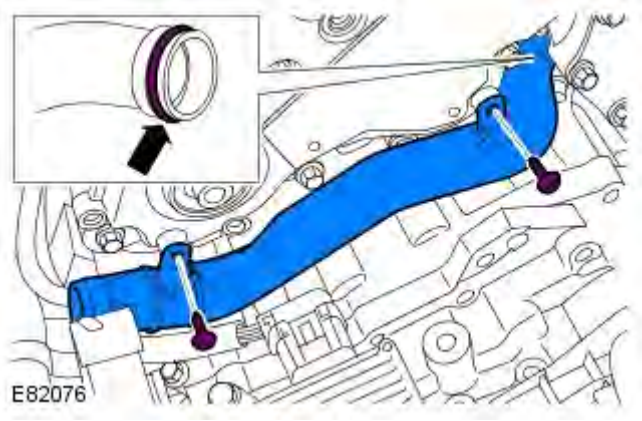
6. Remove the power steering pump support bracket.



7. Release the power steering pump and tie aside

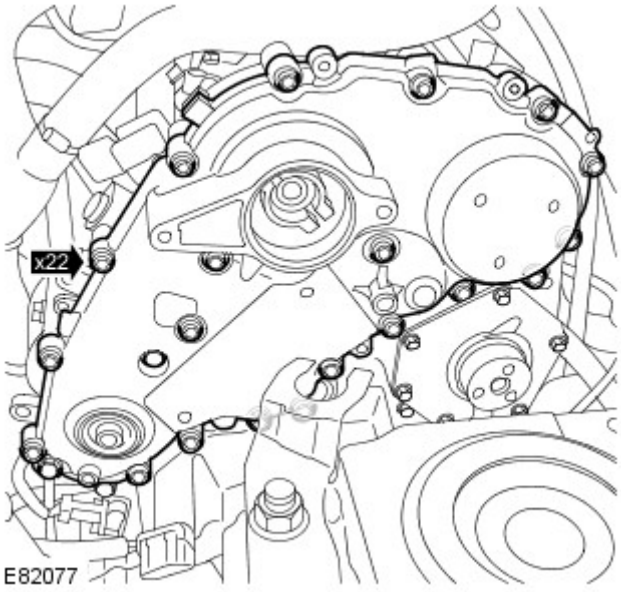


8. Remove the accessory drive belt idler pulley.



9. **9.** CAUTION: The O-ring seal is to be reused unless damaged.

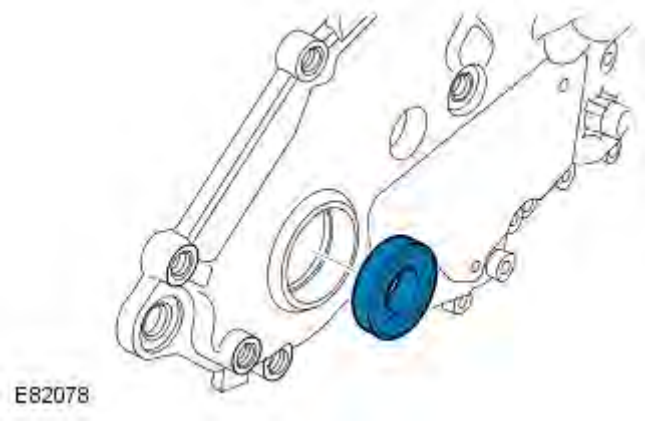
   Remove the coolant pump inlet pipe.



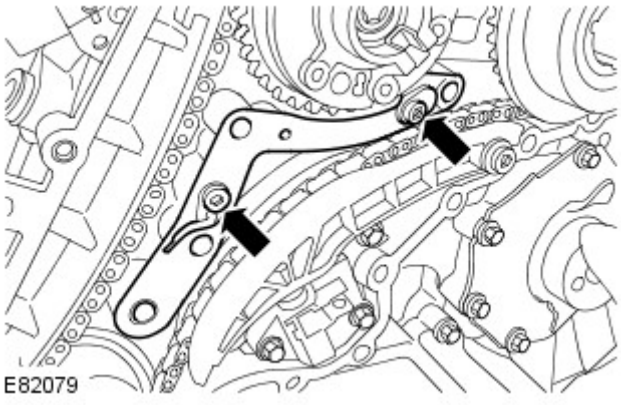
10. **10.** NOTE: Note the different lengths of the bolts.

    Remove the timing cover.

11. Remove and discard the gasket.



12. Remove and discard the seal.



13. **13.** CAUTION: Mark the components to aid installation.

    • NOTE: Do not disassemble further if the component is removed for access only.

    Remove the gasket and oil squirt jet.

Installation

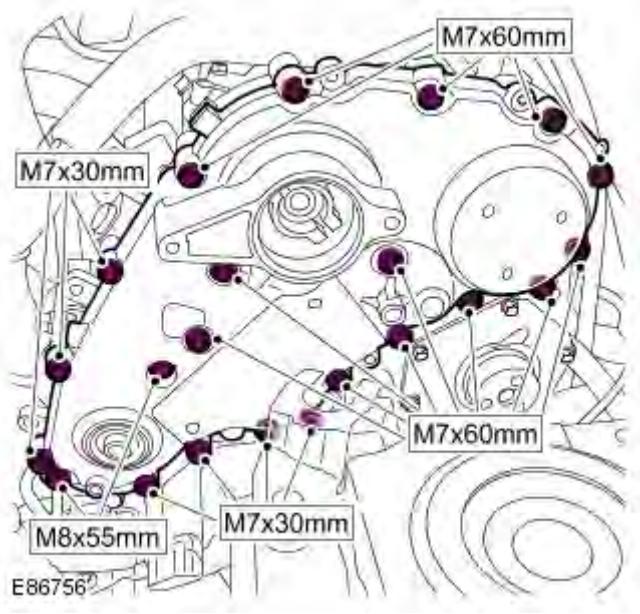
1. **1.** CAUTION: Make sure that the component aligns with the installation mark.

   Install the gasket and oil squirt jet.

   Torque: 6 Nm

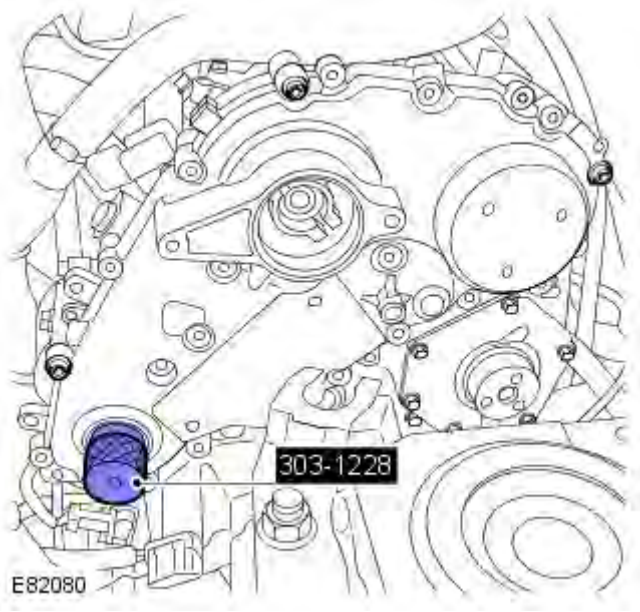
2. **2.** CAUTION: Make sure that the component is correctly located on the locating dowels.

   Install a new gasket.



3. **3.** CAUTION: Only tighten the bolts finger-tight at this stage.

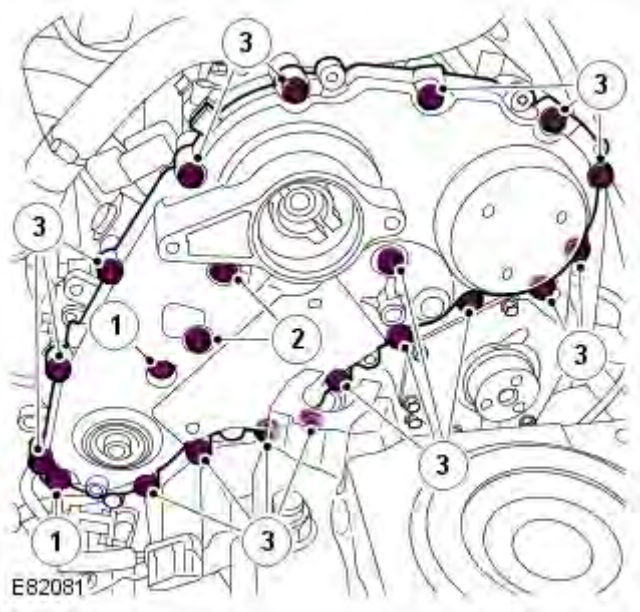
   Install the bolts as illustrated.



4. **4.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

   Align the timing cover.

   Special Tool(s): 303-1228

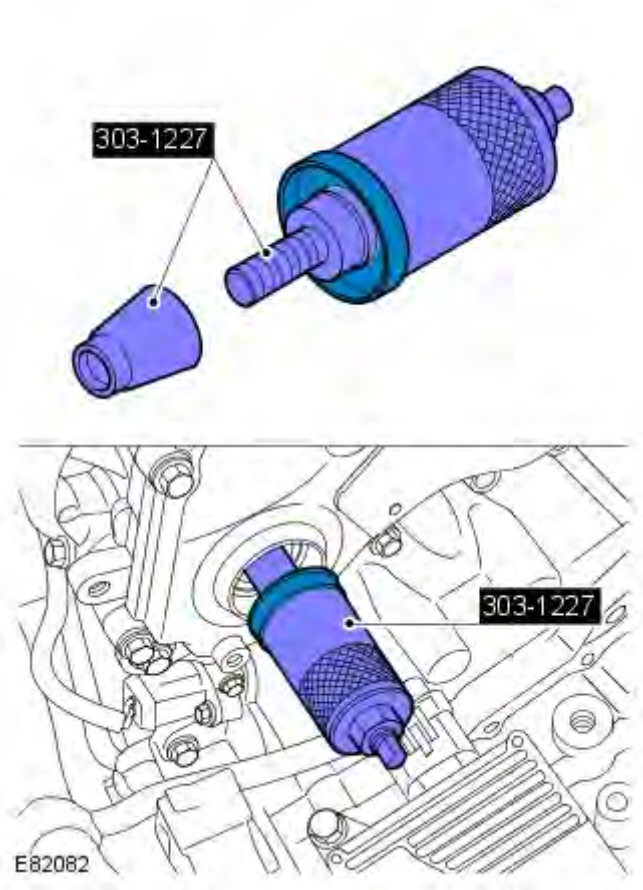


5. Tighten the bolts in the sequence illustrated.

   Torque:
   M8 25 Nm
   M7 16 Nm

6.
- Install the seal to the special tool.

Special Tool(s): 303-1227
- Remove the seal guide.



7. **7.** CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.
   - Install the special tool and seal assembly into the accesory drive shaft.
   - Install the seal.

8. **8.** CAUTIONS:

   A new O-ring seal is to be installed.

   Take extra care not to damage the seal.

   • NOTE: Lubricate the new O-ring seal with clean engine coolant.

   Install the coolant pump inlet pipe.

   Torque: 10 Nm

9. Install the power steering pump and support bracket.

   Torque: 25 Nm

10. **10.** CAUTIONS:

    A new O-ring seal is to be installed.

    Make sure that the component is clean, free of foreign material and lubricant.

    Install the brake vacuum pump.

    Torque: 17 Nm

11. Install the accessory drive belt idler pulley.

    Torque: 25 Nm

12. Install the accessory drive pulley.

    Refer to: Accessory Drive Pulley (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

13. Fill and bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

14. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Timing Components Housing

Removal and Installation

Special Tool(s)

	303-1232 Guide Pins

Removal

- NOTE: Take extra care when aligning and refitting the timing housing , as the seals can easily be damaged .

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

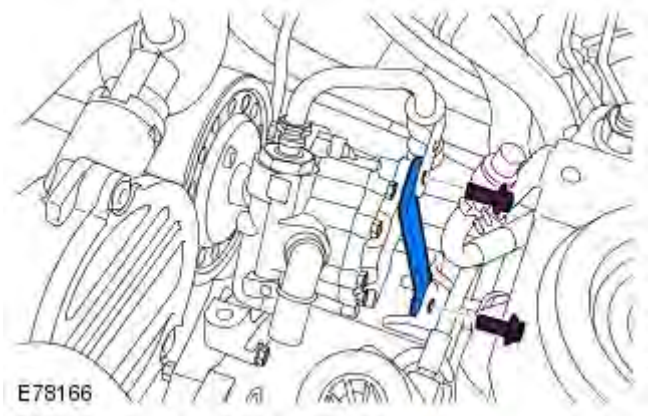
2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

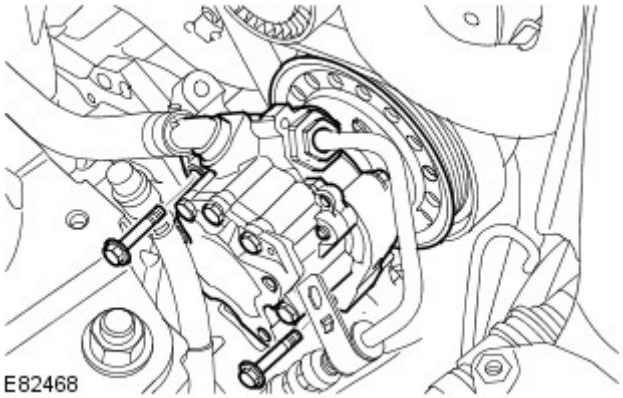
3. Remove the timing chain and sprockets.

   Refer to: Timing Chain (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

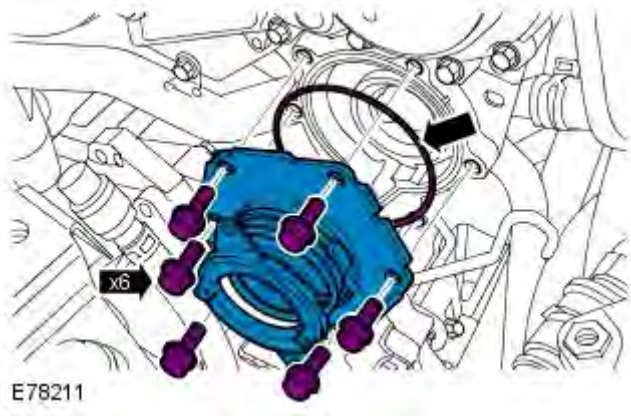
4. Disconnect the front LH HO2S and release the clip.



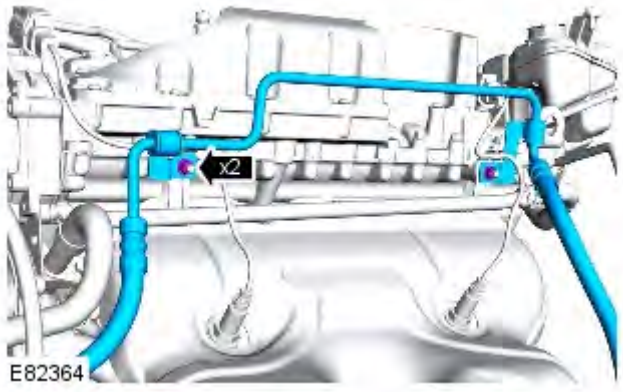
5. Remove the power steering pump support bracket



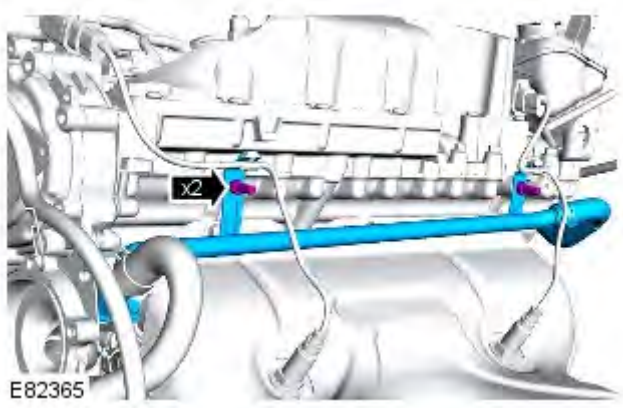
6. Release the power steering pump.



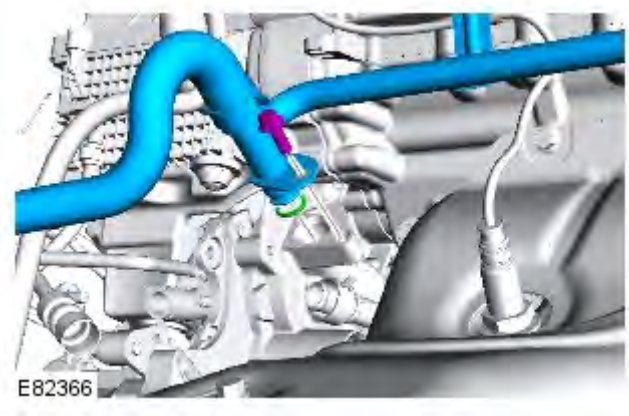
7. **7.** CAUTION: Discard the seal.



8. Release the power steering gear line.

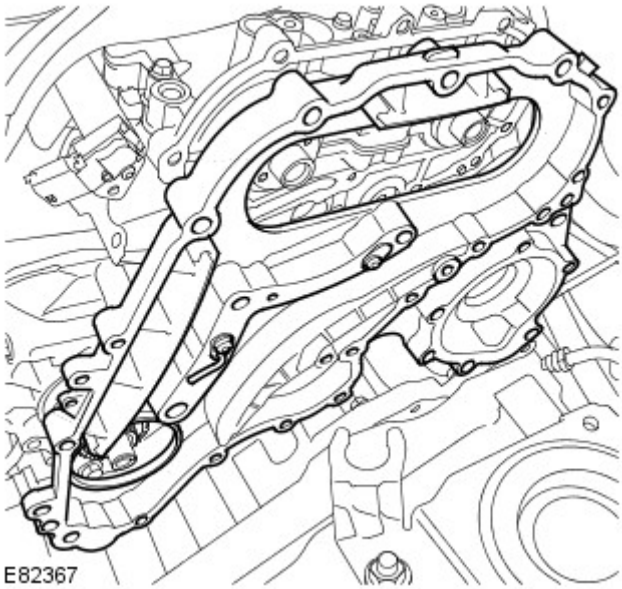


9. Release the coolant rail.

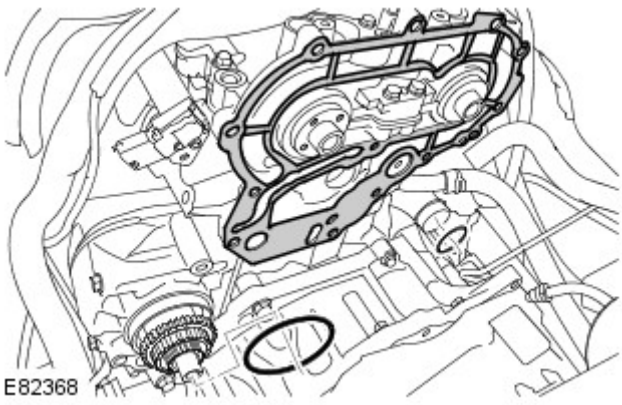


10. **10.** CAUTION: The O-ring seal is to be reused unless damaged.

    Disconnect the coolant rail hose from the coolant pump housing.

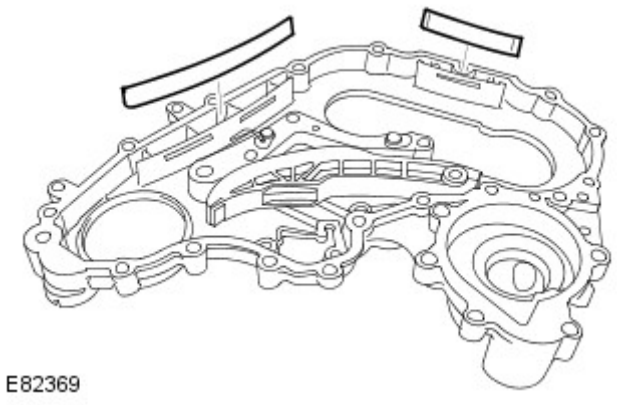


11.



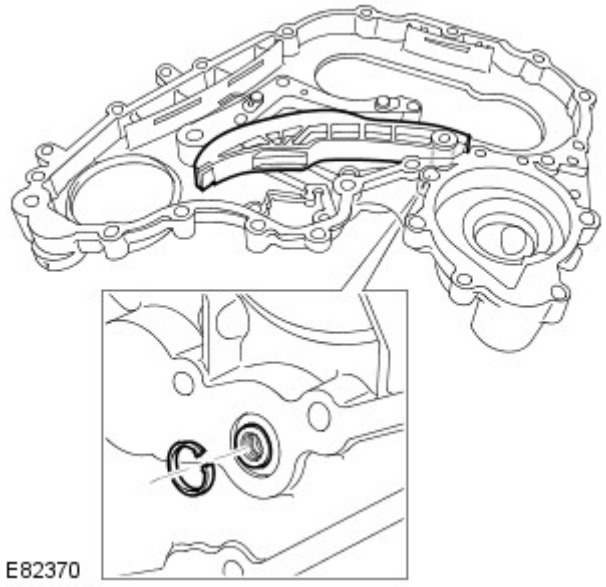
12. **12.** CAUTION: Discard the seal.

    • NOTE: Discard the gasket.



13. **13.** NOTE: Do not disassemble further if the component is removed for access only.

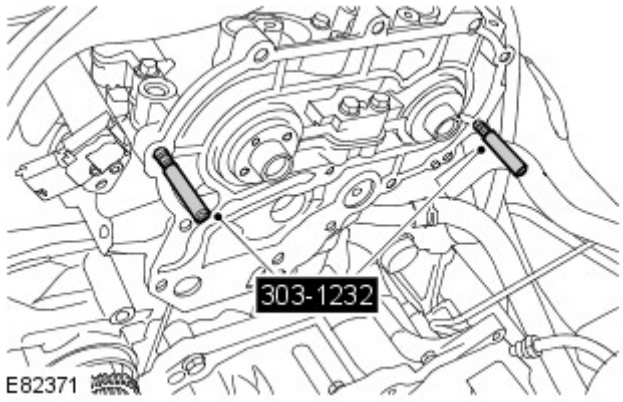
    Remove the 2 timing chain slippers.



14. Remove the timing chain tensioner slipper.

Installation

1. Install the timing chain slippers.
2. Install the timing chain tensioner slipper.



3. Install 2 guide pins to aid installation.

   Special Tool(s): 303-1232

4. **4.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

   Install the gasket and new seals.

5. **5.** CAUTIONS:

   Make sure that the gaskets are correctly located.

   Make sure that the mating faces are clean and free of corrosion and foreign material.

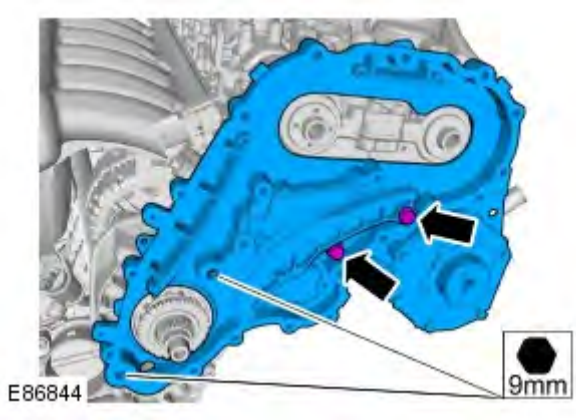
   Take extra care not to damage the seal.

   Only tighten the bolts finger-tight at this stage.

   Install the timing component housing.

6. Remove the guide pins.

   Special Tool(s): 303-1232



7.
   - Install the timing component housing.

     Torque: 16 Nm
   - Check the timing component housing alignment. Correct alignment is when the adjusters are in contact with the cylinder block gear housing.
   - Set adjusters if required, there should be no requirment of adjustment if the housing has not been replaced.

     Torque: 1 Nm

8. **8.** CAUTIONS:

   Make sure that the seal is correctly located.

   Make sure that the mating faces are clean and free of corrosion and foreign material.

   • NOTE: Lubricate the O-ring seal with clean coolant.

   Connect the coolant rail.

   Torque: 17 Nm

9. Install the coolant rail.

   Torque: 17 Nm

10. Install the power steering line.

    Torque: 17 Nm

11. **11.** CAUTIONS:

    Make sure that the mating faces are clean and free of corrosion and foreign material.

    Make sure that the seal is correctly located.

    Install the coolant pump.

Torque: 17 Nm

12. Install the power steering pump.

    Torque: 25 Nm

13. Connect and secure the HO2S electrical connectors.

14. Install the power steering pump support bracket.

    Torque: 25 Nm

15. Install the timing chain and sprockets.

    Refer to: Timing Chain (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

16. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Engine Front Seal

Removal and Installation

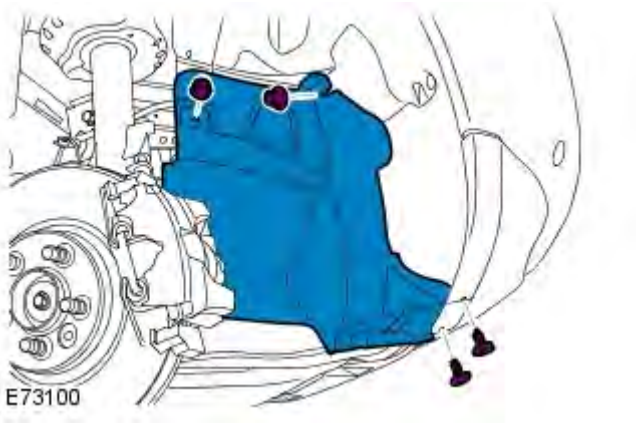
Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

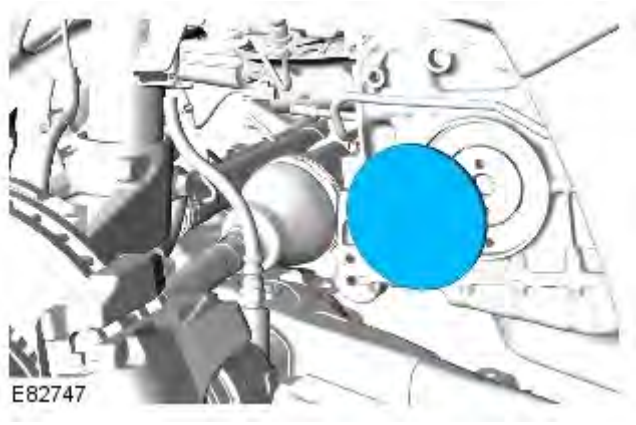
   Raise and support the vehicle.

2. Remove the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



3. Remove the fender splash shield extension panel.



4. Remove the crankshaft front oil seal.

Installation

1. **1.** CAUTION: The oil seal must be installed dry.

   Install the crankshaft front oil seal.

2. Install the fender splash shield extension panel.

3. Install the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

4. Check and top-up the engine oil.

Published: 11-May-2011

Engine - I6 3.2L Petrol - Crankshaft Rear Seal

Removal and Installation

Special Tool(s)

	303-1291 Installer, Crankshaft Rear Seal

Removal

1. Remove the cover and disconnect the battery ground cable.

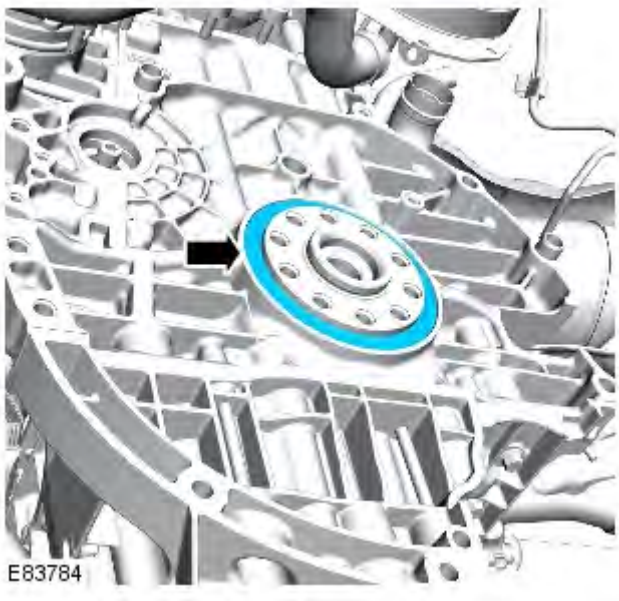
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

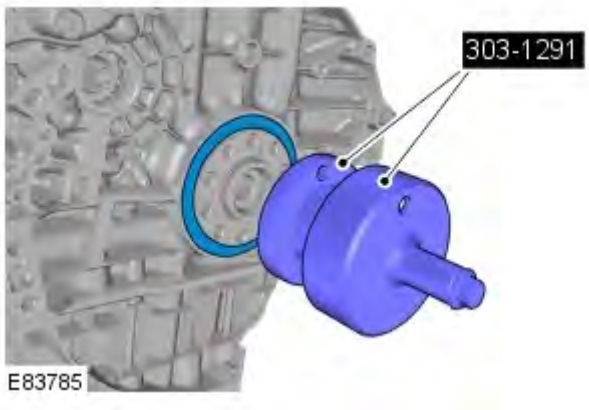
3. Remove the flexplate.

   Refer to: Flexplate (303-01A Engine - I6 3.2L Petrol, Removal and Installation).



4. **4.** CAUTION: Discard the seal.

Installation



1. **1.** CAUTIONS:

   Extreme cleanliness must be exercised when handling this component.

   "Make sure that a new component is installed. "

   Install the crankshaft rear seal.

   Special Tool(s): 303-1291

2. **2.** CAUTIONS:

   Extreme cleanliness must be exercised when handling these components.

   Make sure that new bolts are installed.

   Install the flexplate.

   Refer to: Flexplate (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

3. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Flexplate

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

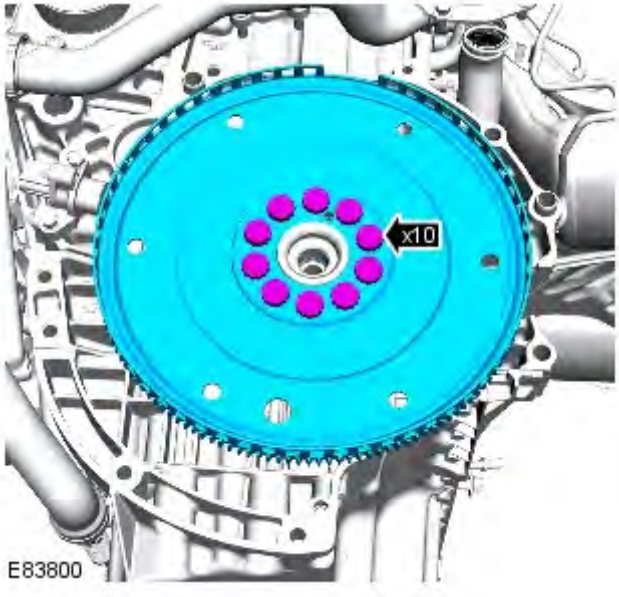
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

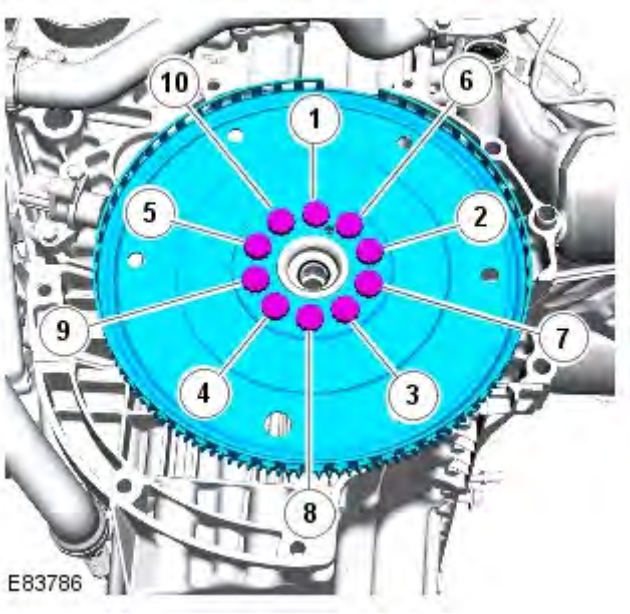
3. Remove the transmission and converter.

   Refer to: Transmission - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, Removal).



4. Remove the flexplate.

Installation



1. **1.** CAUTIONS:

   Extreme cleanliness must be exercised when handling these components.

   Make sure that new bolts are installed.

   Install the flexplate and tighten the bolts as illustrated.

   Torque:
   Stage 1:45 Nm
   Stage 2:50°

2. Install the transmission and converter.

   Refer to: Transmission - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, Removal).

3. Connect the battery ground cable and install the cover.

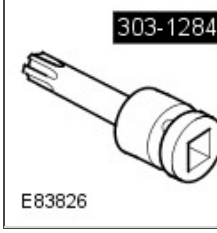
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 23-Aug-2011

Engine - I6 3.2L Petrol - Crankshaft Main Bearing Carrier

Removal and Installation

Special Tool(s)

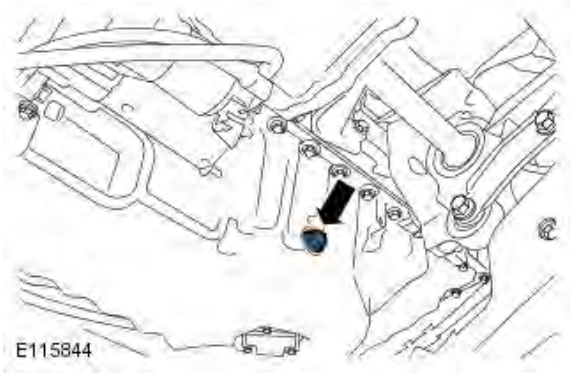
	303-1219 Locking Tool, Crankshaft
	303-1278 Aligner, Timing Cover
	303-1280 Remover, Oil Pump Pin
	303-1284 Torx Socket, Accessory Drive Pulley

Removal

- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.



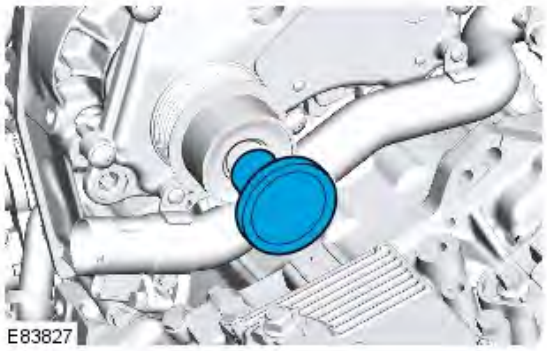
2. **2.** WARNING: Avoid skin contact with the specified material.
   - CAUTIONS:

   Hot fluid.

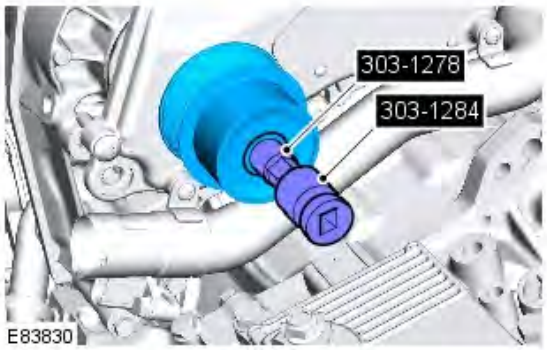
   Be prepared to collect escaping fluids.

   - *Torque:* 38 Nm
   - Remove and discard the sealing washer.

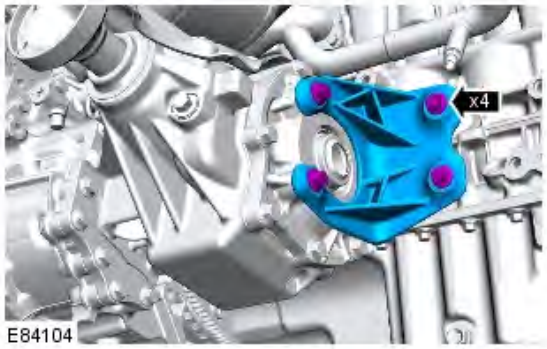
3. Refer to: Engine (303-01A Engine - I6 3.2L Petrol, Removal).



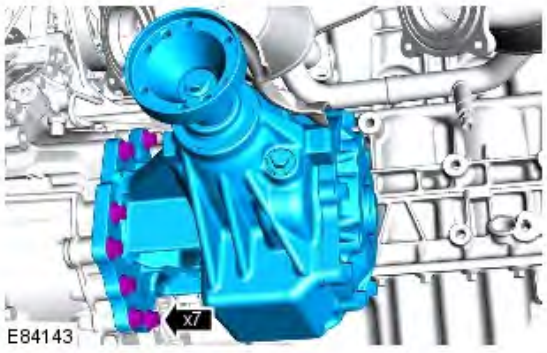
4.



5. *Special Tool(s):* 303-1284, 303-1278
Torque: 60 Nm

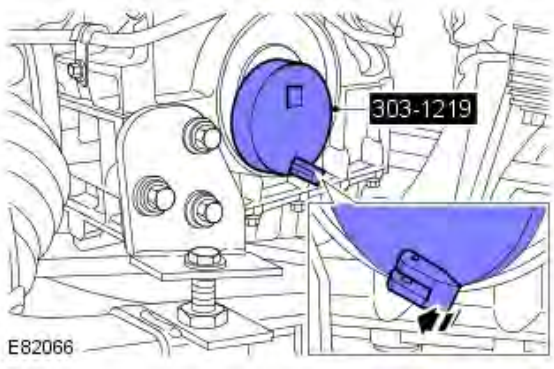


6. *Torque:* 65 Nm



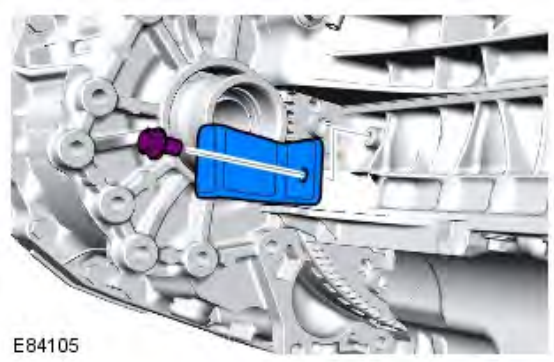
7. **7.** NOTE: This step requires the aid of another technician.

Torque: 65 Nm

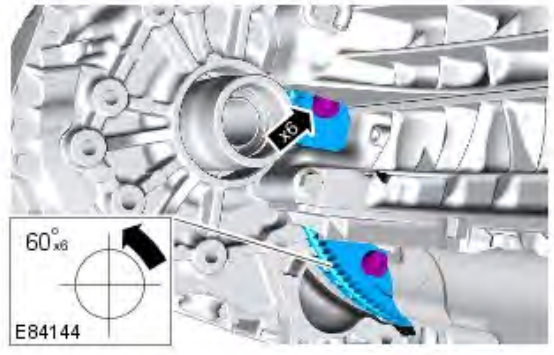


8. **8.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.
   - If the locking pin on the special tool is disengaged, the crankshaft can be rotated.

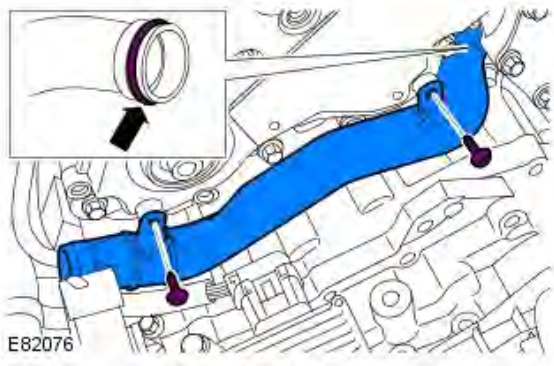
   Special Tool(s): 303-1219



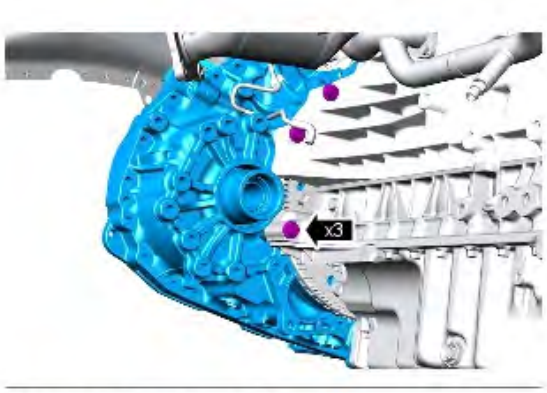
9. *Torque:* 10 Nm

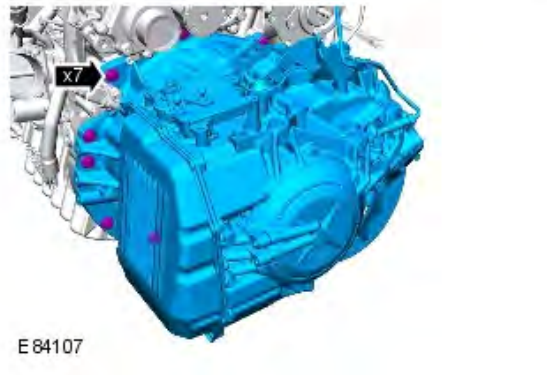


10. *Torque:* 47 Nm



11. *Torque:* 10 Nm



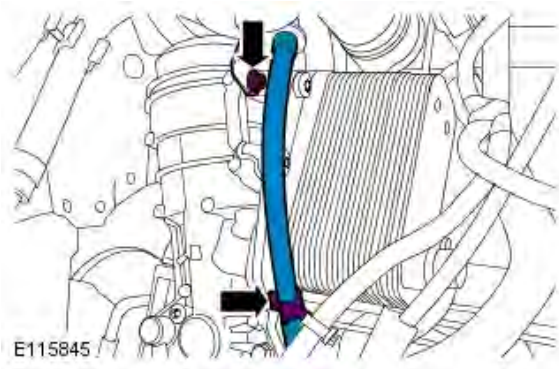


12. **12.** CAUTION: Make sure that the torque converter remains in the transmission.

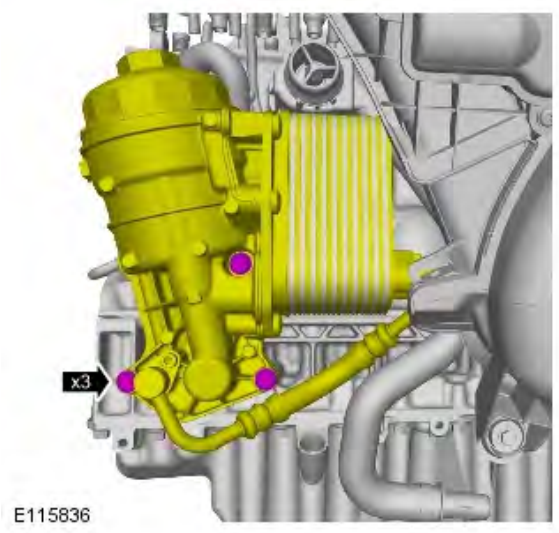
    • NOTE: This step requires the aid of another technician.

    Torque: 47 Nm

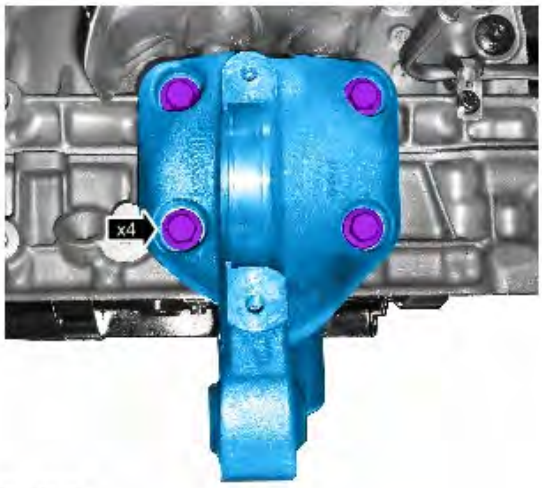
13. Mount the engine to an engine stand.



14. *Torque:* 10 Nm

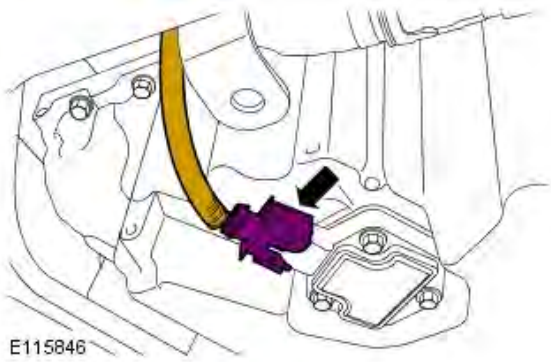


15. *Torque:* 10 Nm

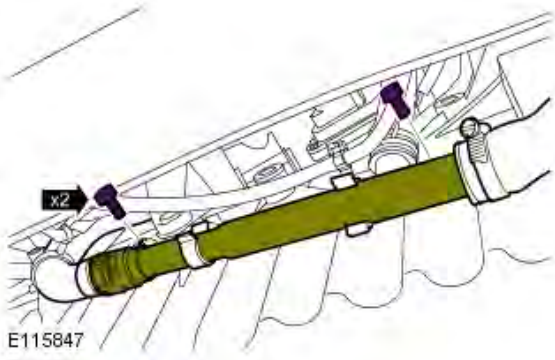


E115849

16. *Torque:* 48 Nm

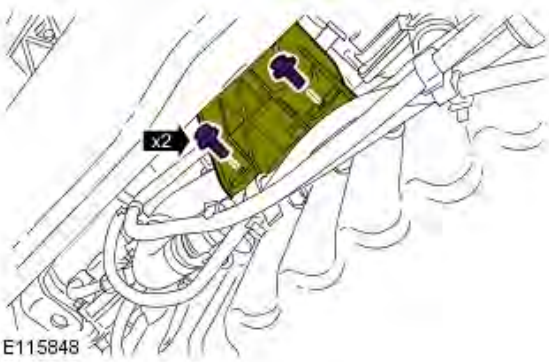

E115846

17.



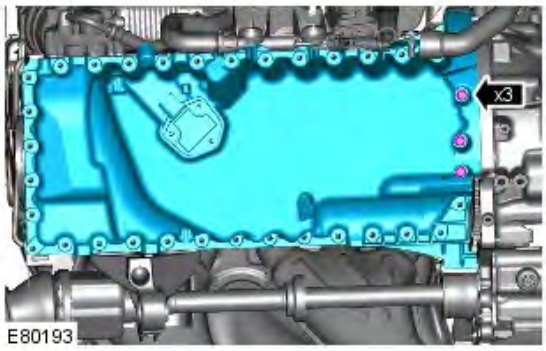
E115847

18. *Torque:* 10 Nm

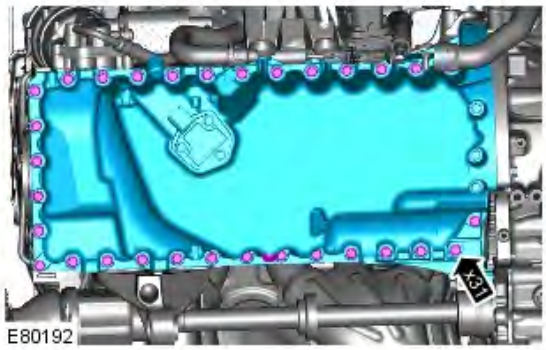


E115848

19. *Torque:* 10 Nm

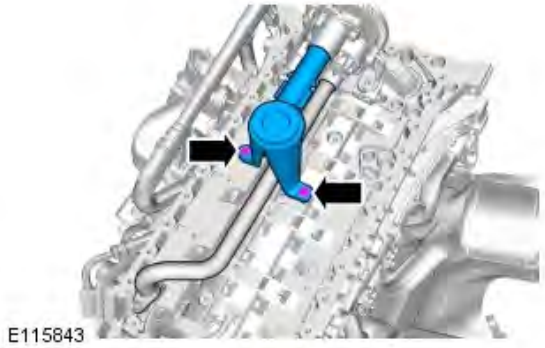


20. **20.** NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



21. **21.** NOTE: Make sure that all traces of the old sealant are removed from the mating faces.

Torque:
M7 17 Nm
M10 45 Nm



22. **22.** ⚠ CAUTION: Discard the seal.

Torque: 17 Nm

Vehicles built up to VIN:148530

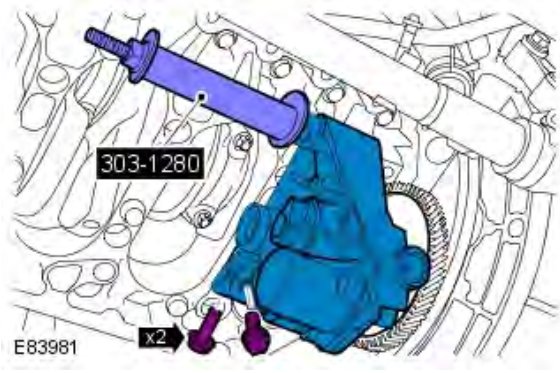
23. **23.** ⚠ CAUTION: Discard the seals.

Torque: 17 Nm

All vehicles

24. **24.** CAUTION: Discard the seals.

Torque: 17 Nm



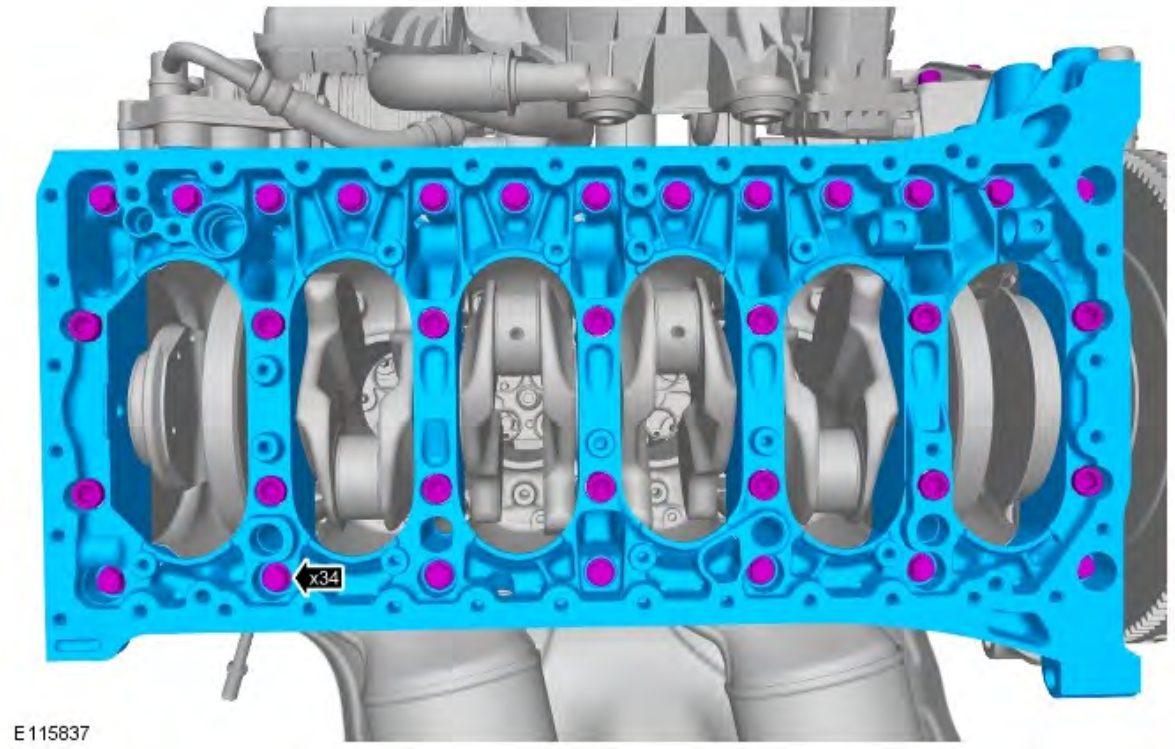
25.

- Remove the oil pump pivot pin.

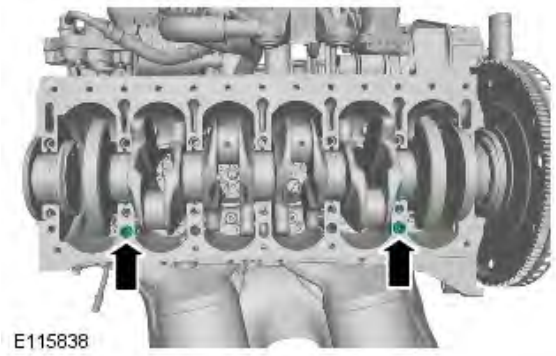
  Special Tool(s): 303-1280

26.

27.

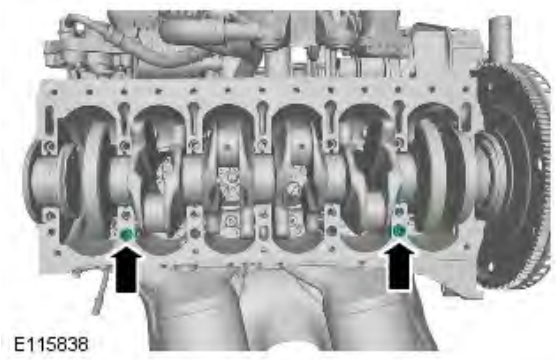


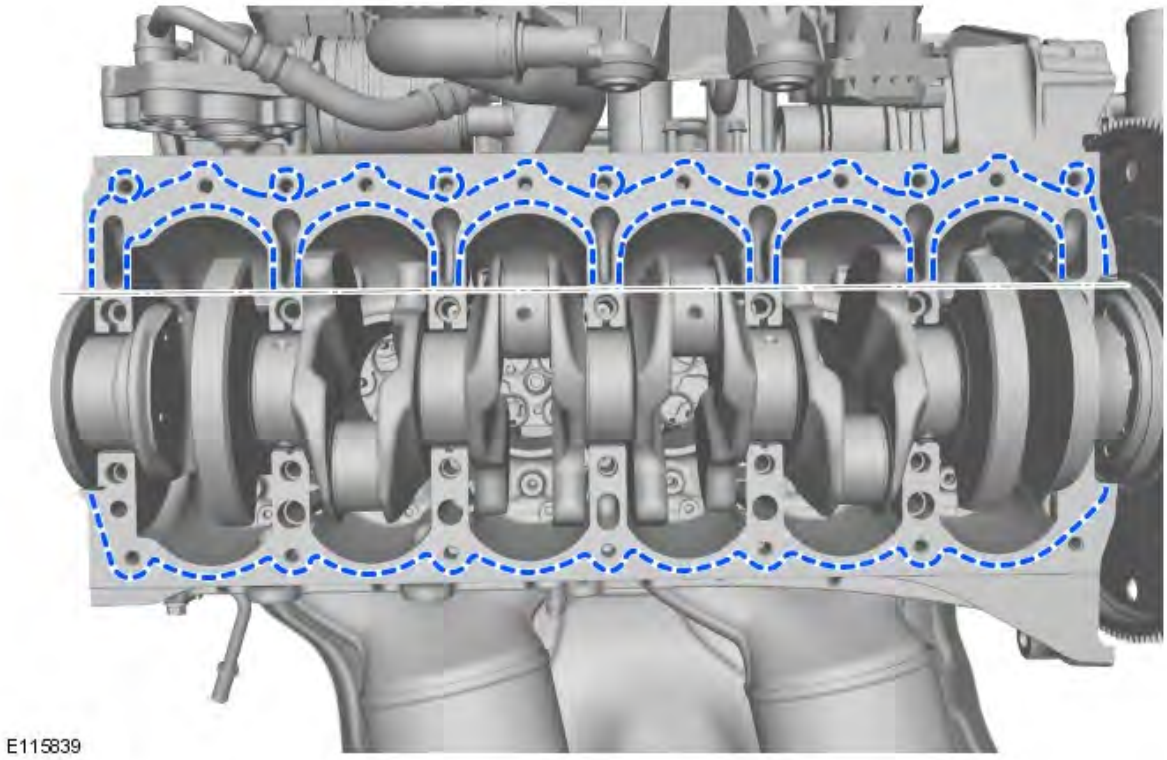
28.



Installation

1.





E115839

2. **2.** CAUTION: M
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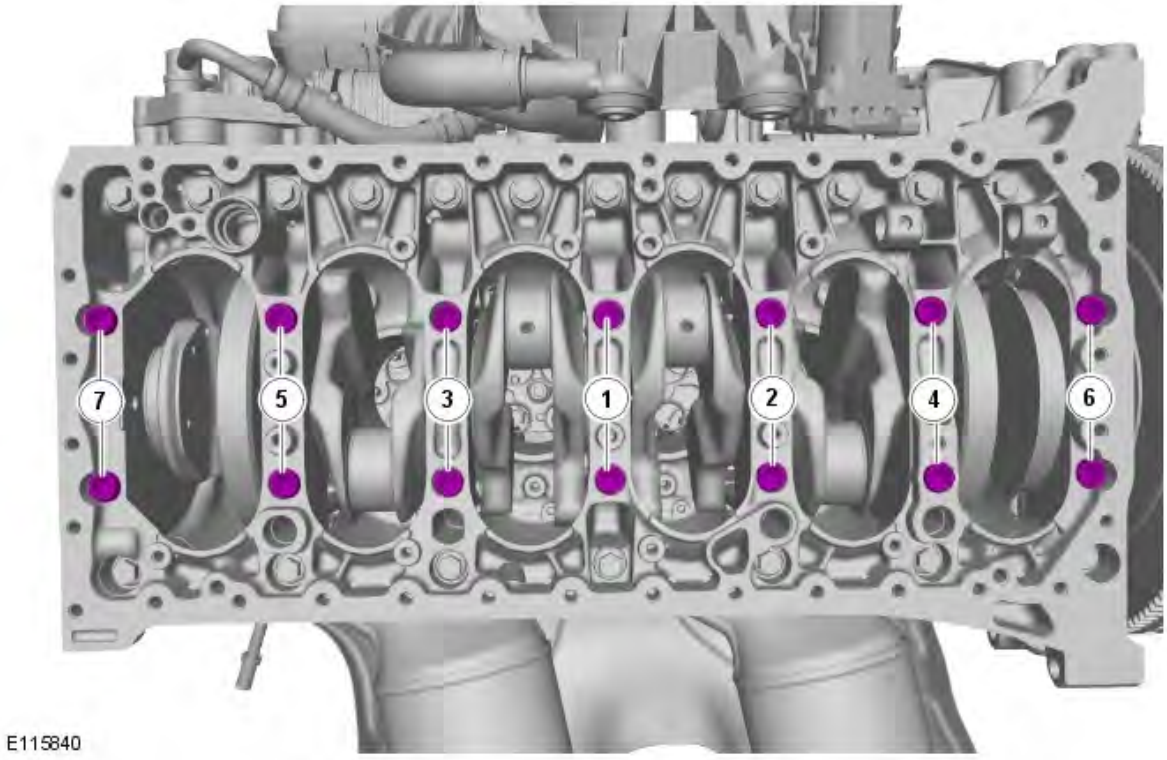
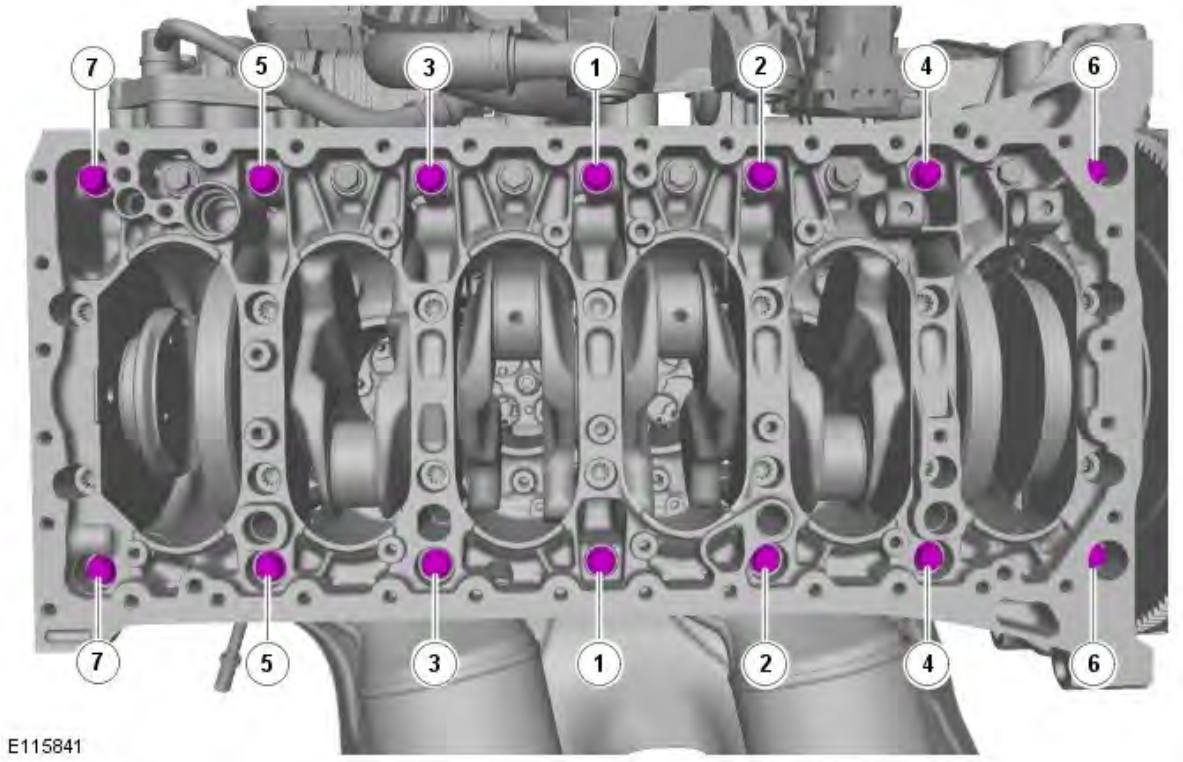


E115840

3. **3.** CAUTION: Tighten the bolts in the sequence shown.

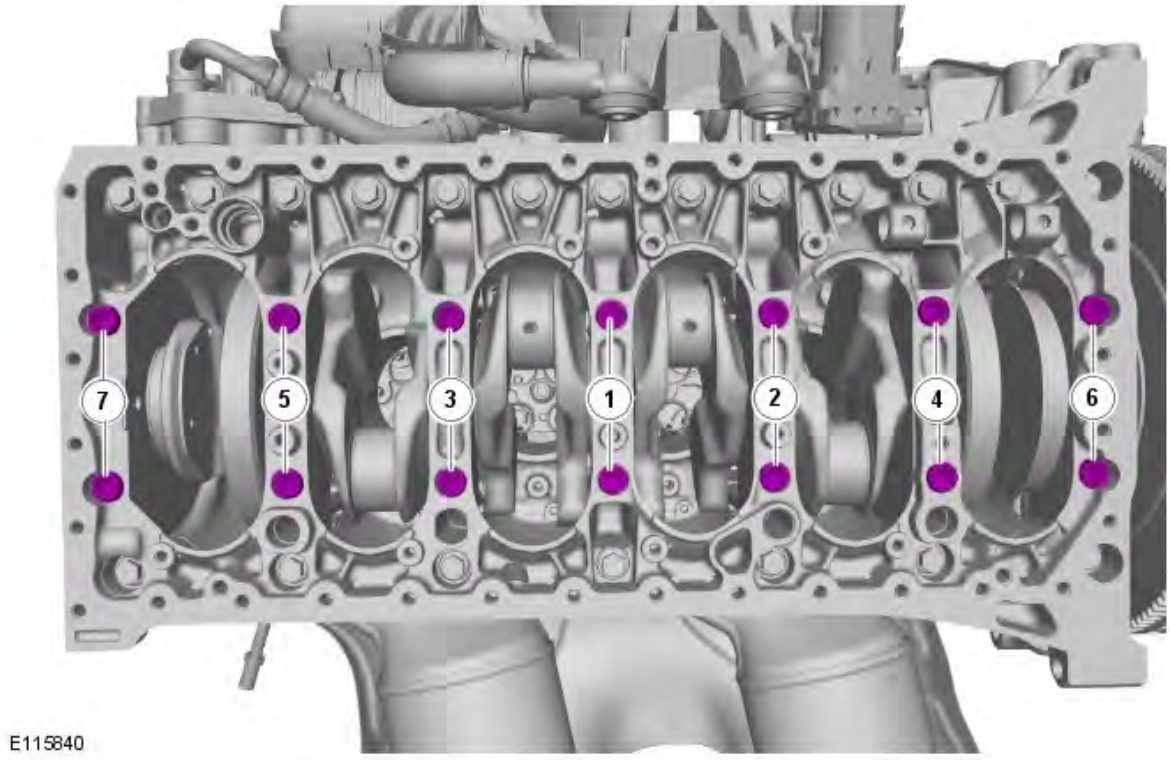
Torque:
Stage 1: 5 Nm
Stage 2: 30 Nm



E115841

4. **4.** CAUTION: Tighten the bolts in the sequence shown.

Torque:
Stage 1:
5 Nm
Stage 2:
25 Nm

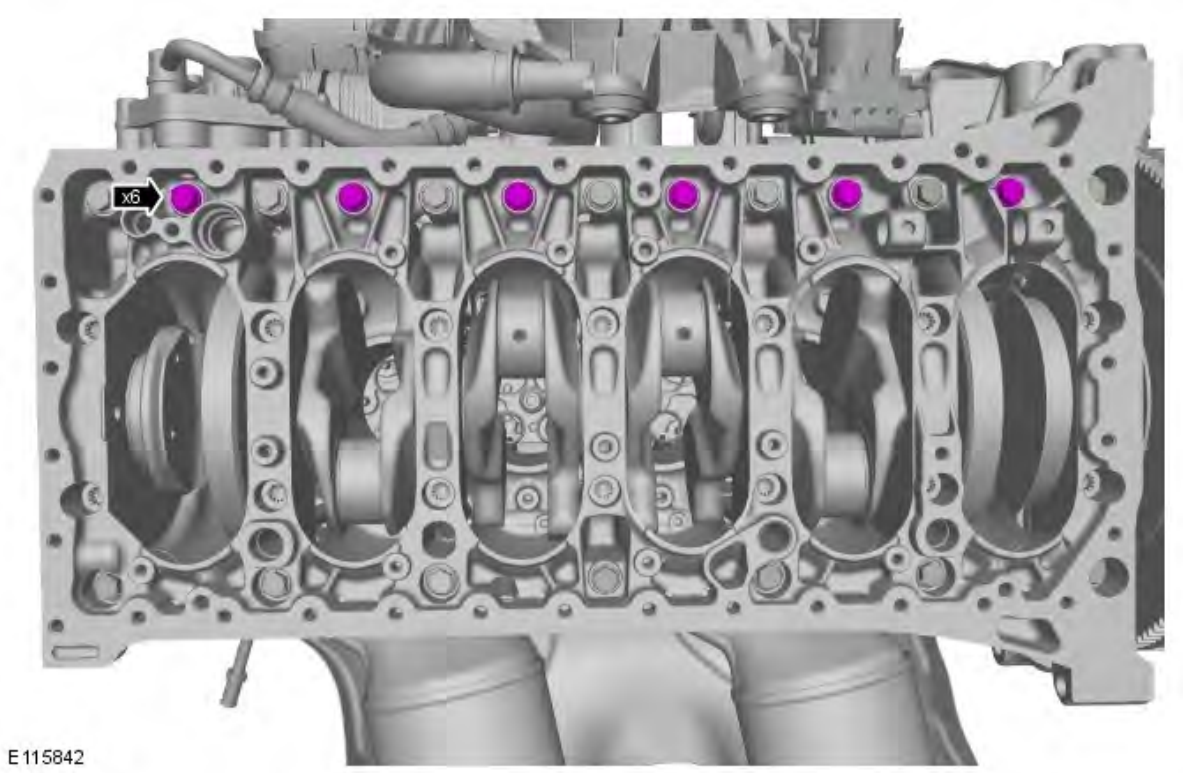


E115840

5. **5.** CAUTION: Tighten the bolts in the sequence shown.

Torque:
105°

6. *Torque:* 25 Nm

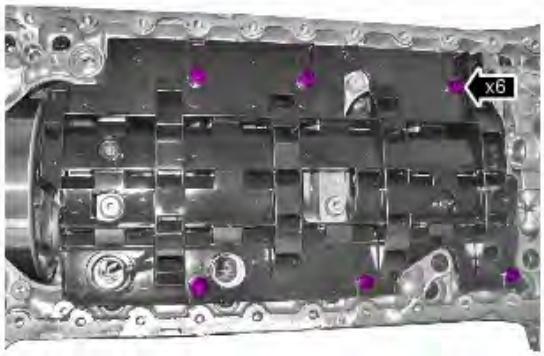


E115842

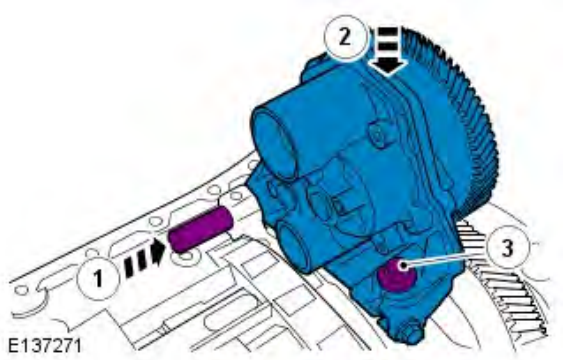
7. *Torque:* 10 Nm

E138942

8. *Torque:* 10 Nm

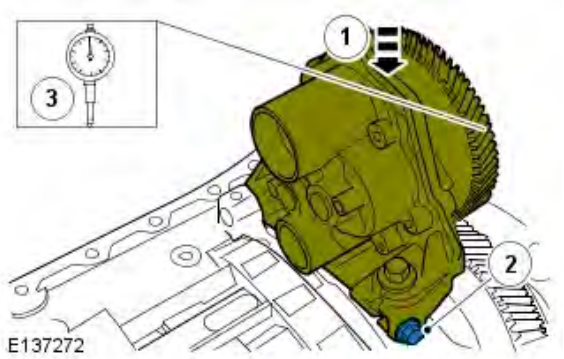


E138943



9.

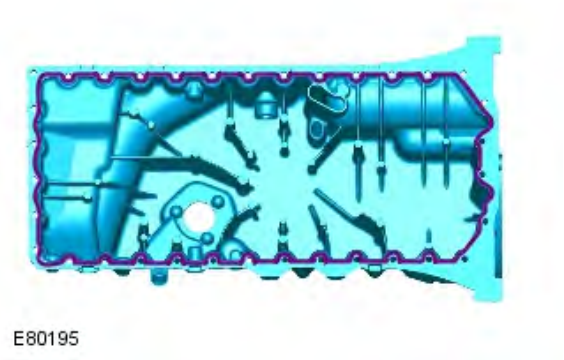
1. Install the pin.
2. Apply light pressure to the pump body.
3. *Torque:* 17 Nm



10.

1. Apply light pressure to the pump body.
2. *Torque:* 10 Nm
3. Measure the backlash

   Refer to: Specifications (303-01A Engine - I6 3.2L Petrol, Specifications).
4. If necessary, repeat the above procedure.



11. **11.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

- Apply a 2.5mm bead of sealant STC50550 (Loctite 5900) to the areas shown.

12. **12.** CAUTION: Make sure that new sealing washers are installed.

- Fill the engine with the recommended oil to the correct level.

  Refer to: Specifications (303-01A Engine - I6 3.2L Petrol, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Rear End Accessory Drive (READ) Idler Shaft Assembly

Removal and Installation

Special Tool(s)

	303-1486 Mandrel
	303-1488 Rear End Accessory Drive (READ) Idler Shaft Assembly Extractor

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

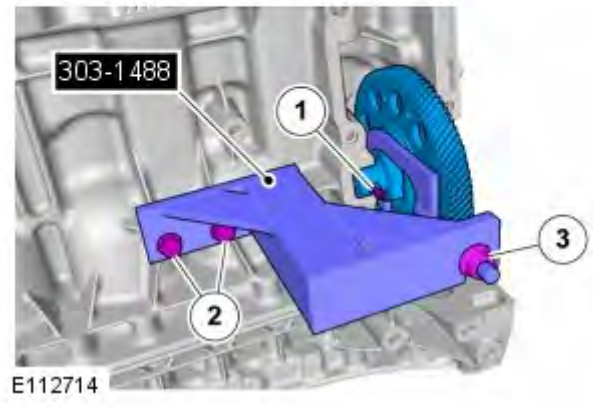
   Raise and support the vehicle.

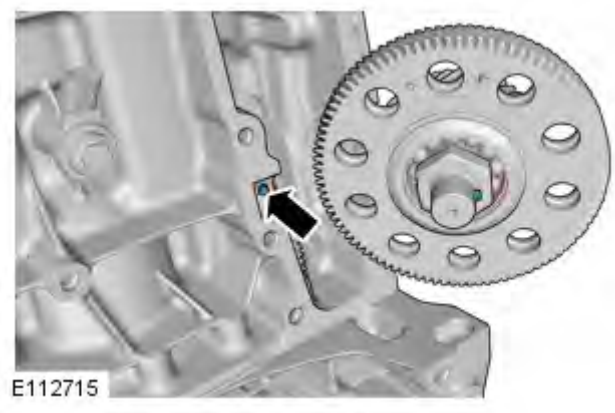
3. Refer to: Rear End Accessory Drive (READ) (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

4. **4.** CAUTION: Make sure that the locking pin is removed with the READ idler shaft assembly. Failure to do so may result in damage to the vehicle.

   1. Install a suitable screw into the locking pin.
   2. Install with the special tool.

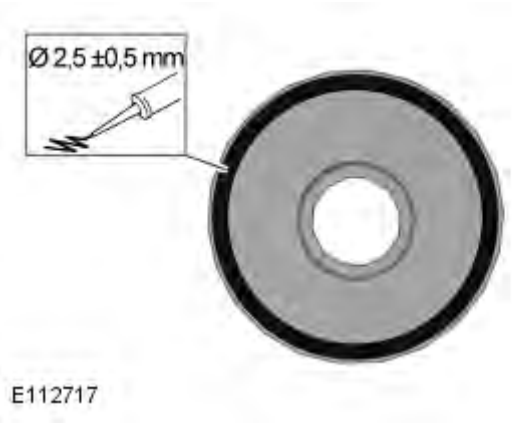
      Special Tool(s): 303-1488
   3. Tighten the nut to remove the READ idler shaft assembly and the locking pin.



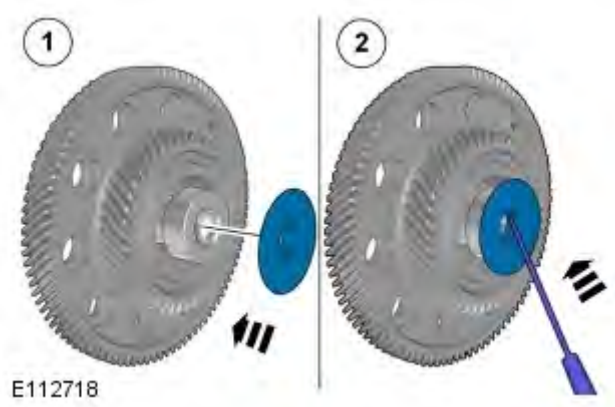


5. **5.** CAUTION: Inspect the locking pin for damage. If the locking pin is broken in the engine block, the engine block must be replaced. Failure to follow this instruction may result in damage to the vehicle.

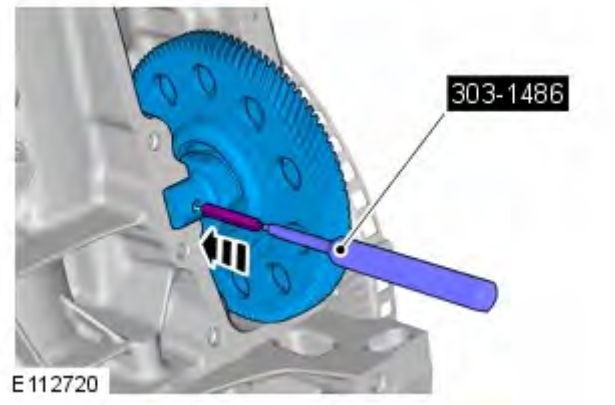
Installation



1. Apply a 2.5mm bead of sealant STC50550 (Loctite 5900) to the areas shown.



2. **2.** CAUTION: Make sure that the mating faces are clean and free of foreign material.
    1. Install the sealing washer to the READ idler shaft assembly.
    2. Using a suitable tool, deform the sealing washer to secure it to the READ idler assembly.



3. **3.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

    Special Tool(s): 303-1486

4. Refer to: Rear End Accessory Drive (READ) (303-05A Accessory Drive

- I6 3.2L Petrol, Removal and Installation).

5. Lower the vehicle.

6. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - I6 3.2L Petrol - Engine

Removal

Special Tool(s)

	205-857 Remover, Halfshaft

General Equipment

Powertrain Jack

• NOTE: In this procedure the engine and transmission are removed together.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Remove the plenum box access panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

5. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

6. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

7. Drain the coolant.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

8. Remove the starter motor.

   Refer to: Starter Motor (303-06A Starting System - I6 3.2L Petrol, Removal and Installation).

9. Remove the catalytic converters.

   Refer to: Catalytic Converter (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).

10. Remove the lower engine stabilizer bar.

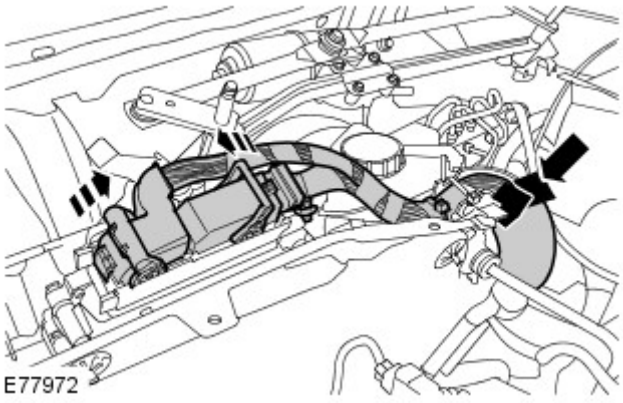
    Refer to: Engine Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

11. Remove the front subframe assembly.

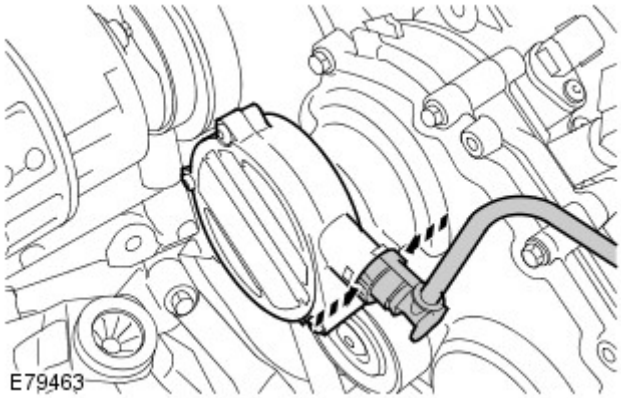
    Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting

System, Removal and Installation).

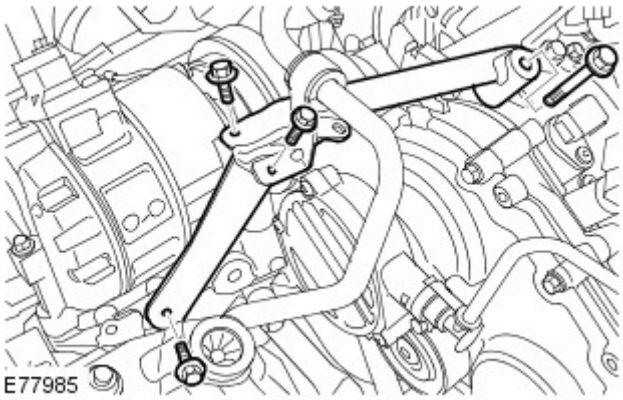
12. Siphon the fluid from the power steering reservoir.


E77972

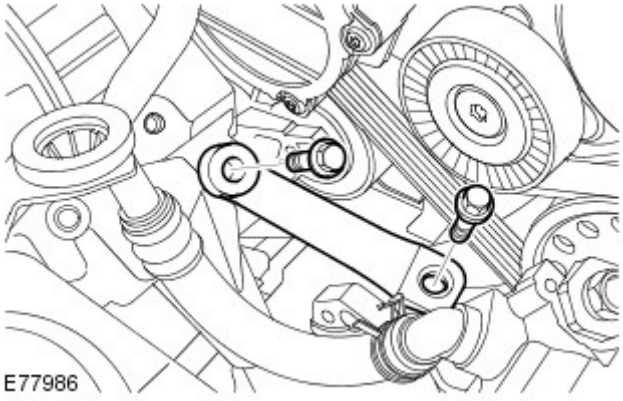
13. Disconnect the engine control module (ECM).


E79463

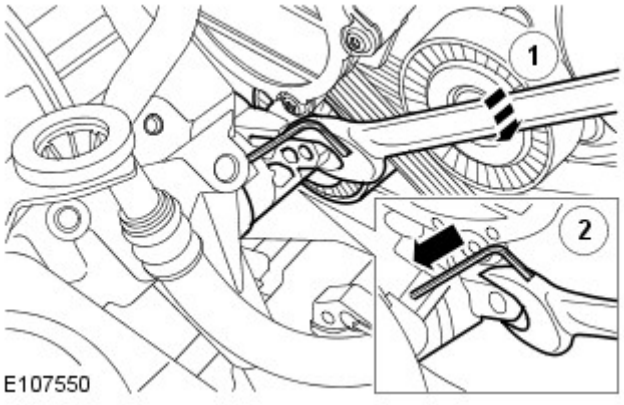
14. Disconnect the brake booster vacuum hose.


E77985

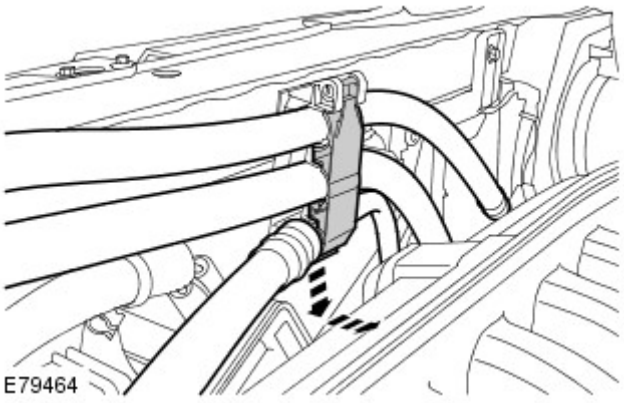
15. Remove the A/C compressor, upper support bracket.


E77986

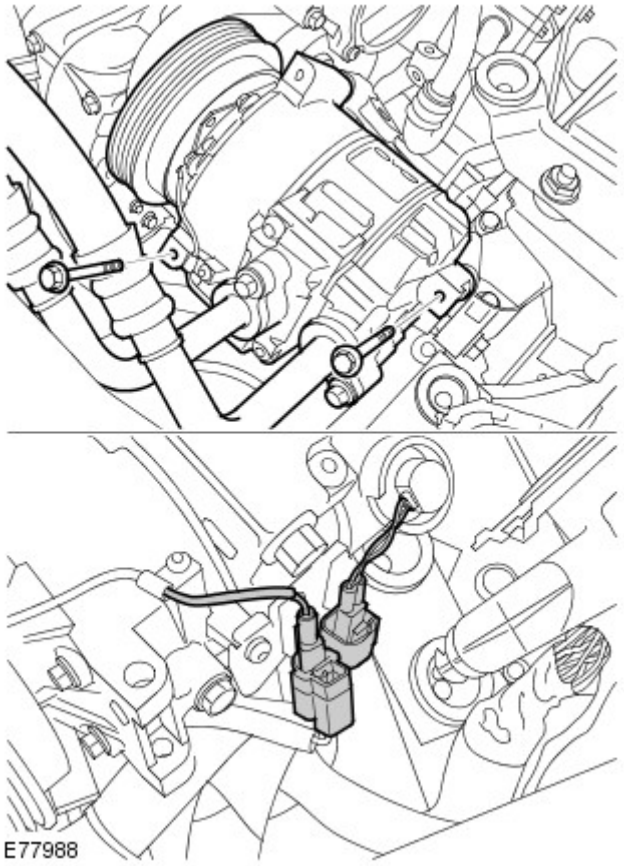
16. Remove the A/C compressor, lower support bracket.



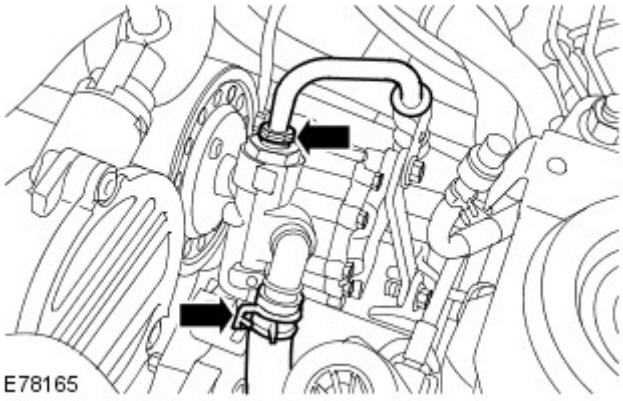
17. Using suitable tools, release the accessory drive belt tension.



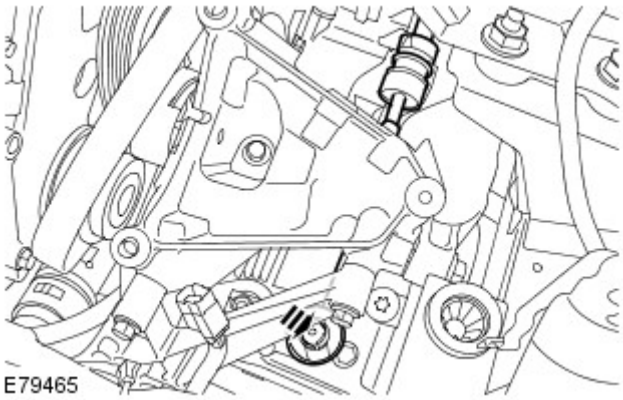
18. Release the A/C and PAS lines from the clip.



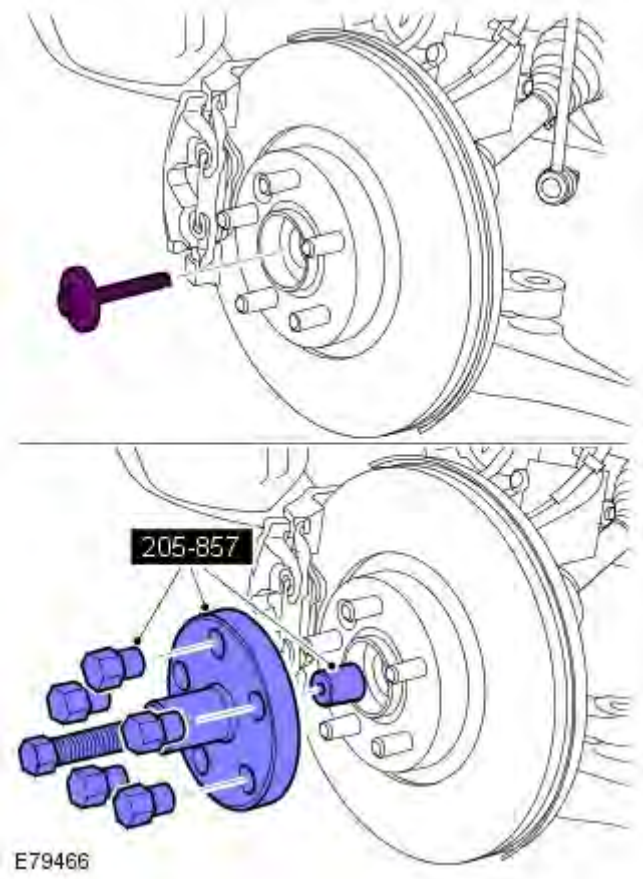
19. Release the A/C compressor and tie aside.



20. Disconnect the power steering fluid line.

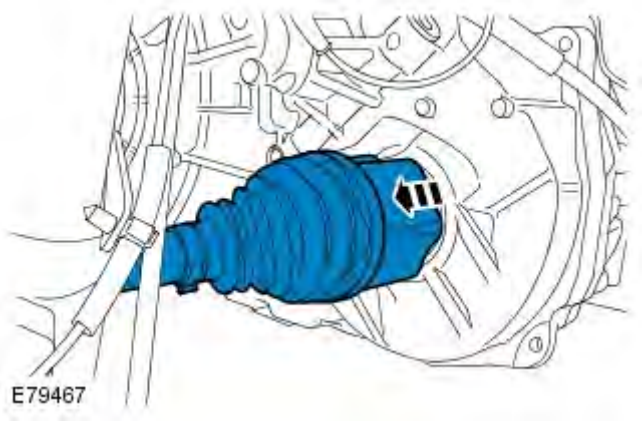


21. Release the selector lever cable.

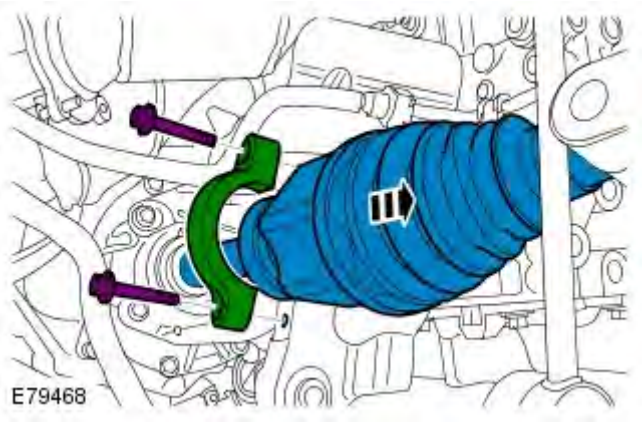


22. Release the LH and RH halfshafts.

    Special Tool(s): 205-857



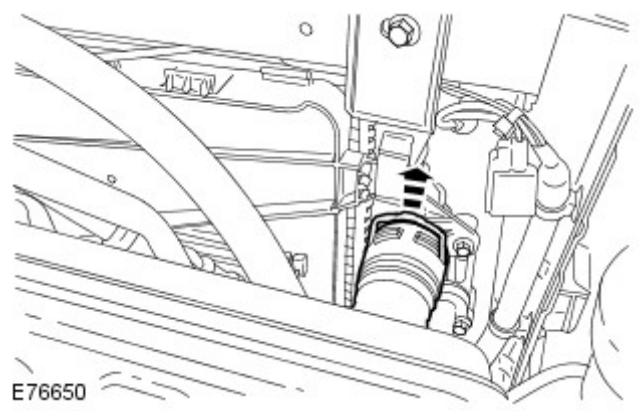
23. Remove the LH halfshaft.



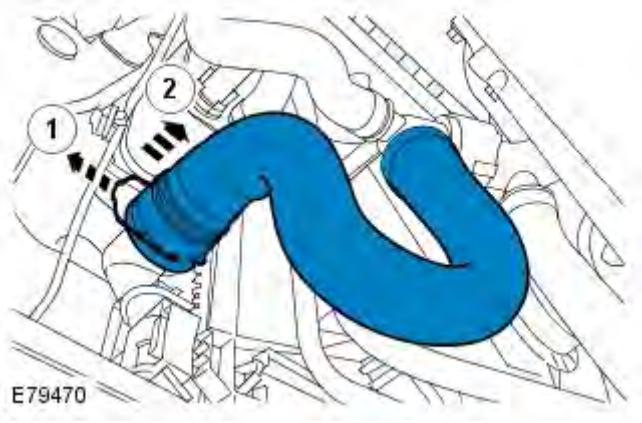
24. Remove the RH halfshaft.

25. Tie the suspension arms aside for access.

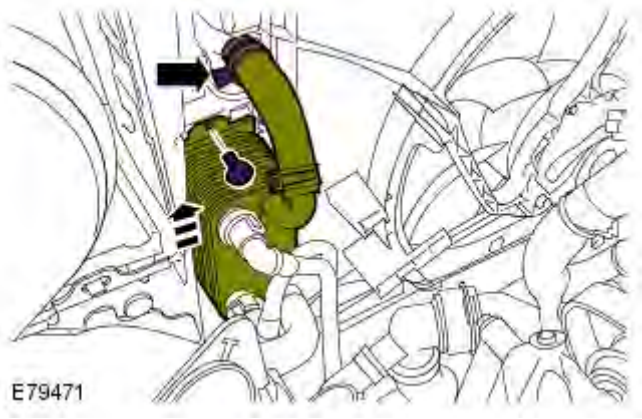
26. Disconnect the cooling fan control electrical connector.



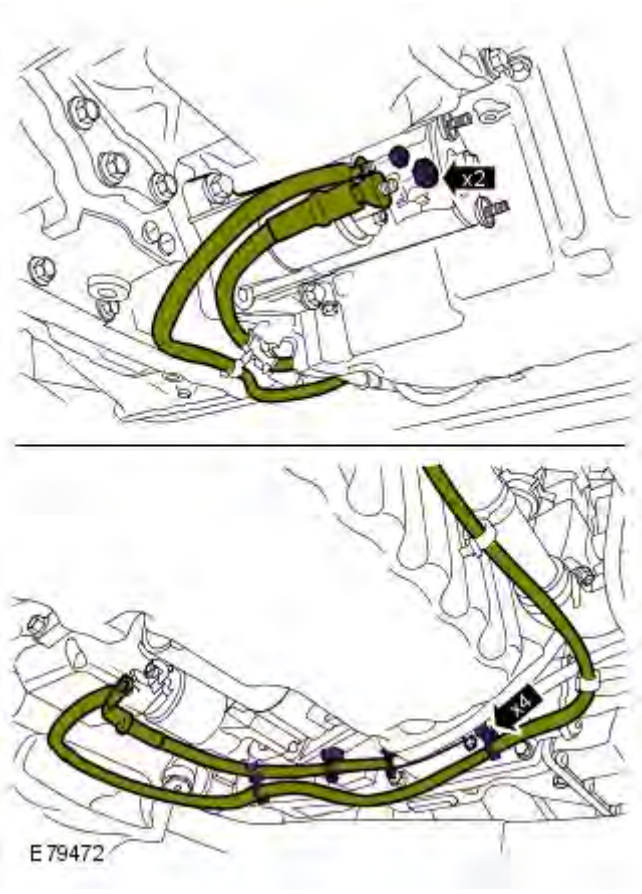
27. Remove the top hose.



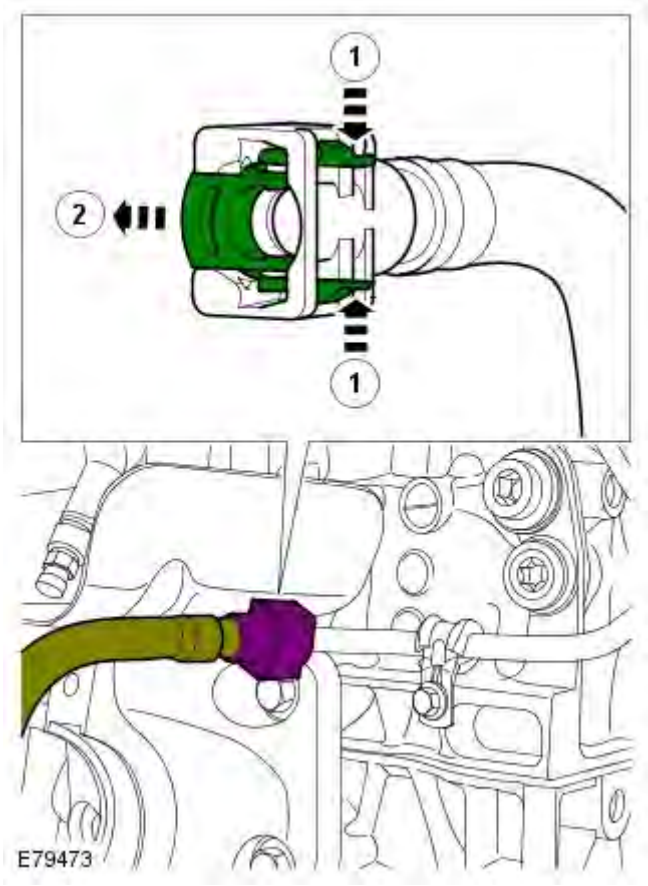
28. Disconnect the bottom hose.



29. Release the transmission fluid cooler.



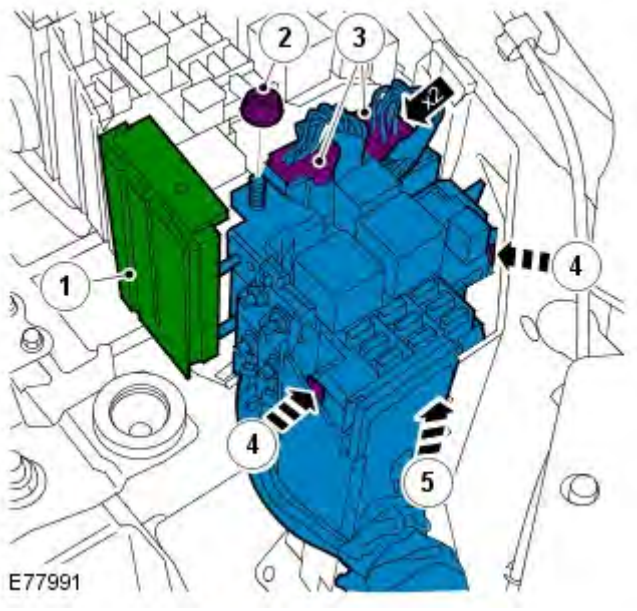
30. Disconnect the starter motor electrical connections.



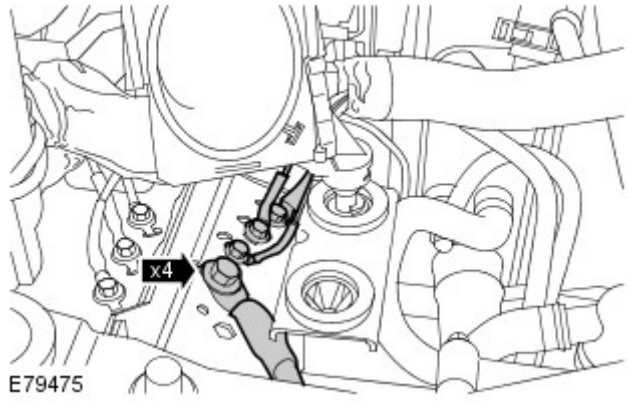
31. **31.** CAUTION: Be prepared to collect escaping fuel.

    Disconnect the fuel line.

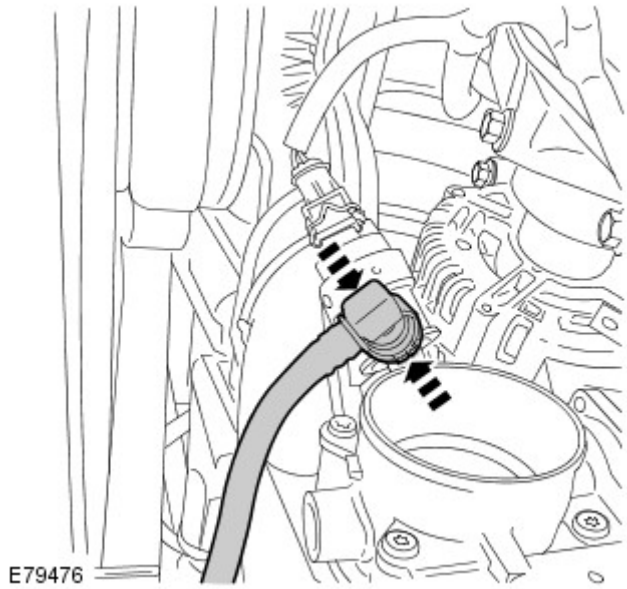
32. Release the RH ground cable.



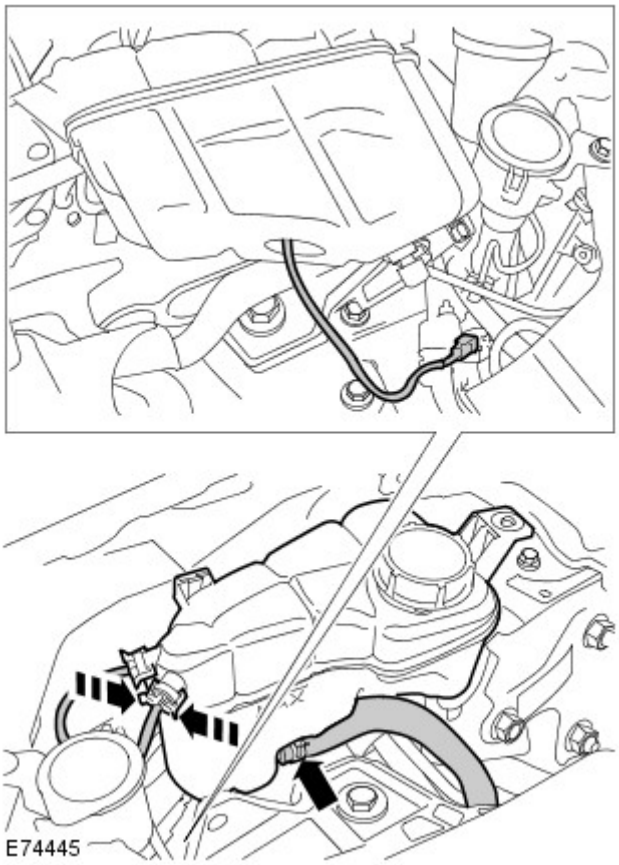
33. Disconnect the engine wiring harness.



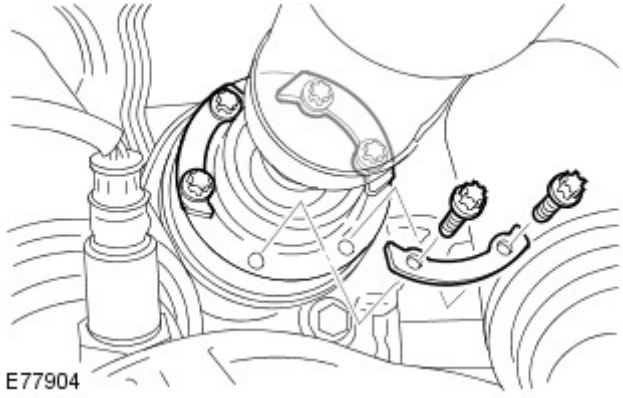
34. LH side: Release 4 engine compartment ground cables.



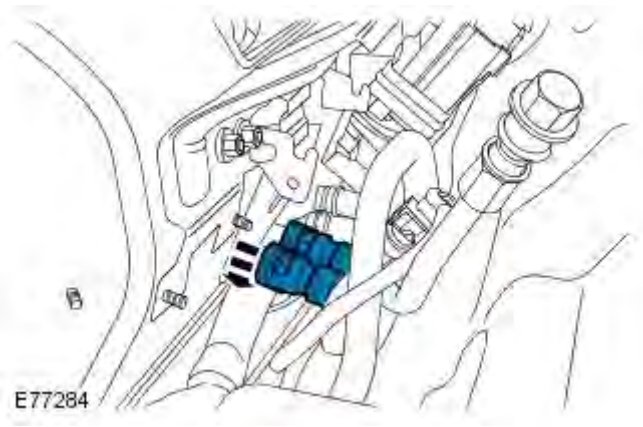
35. Release the clip and disconnect the purge line.



36. Remove the coolant expansion tank.



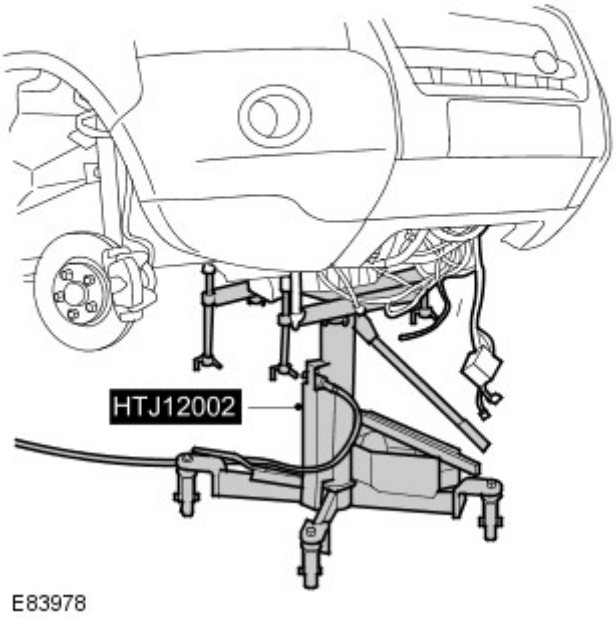
37. Release the driveshaft from the transmission drive flange.



38. Disconnect 2 heater hoses from the bulkhead.

39. Support the engine.

General Equipment: Powertrain Jack



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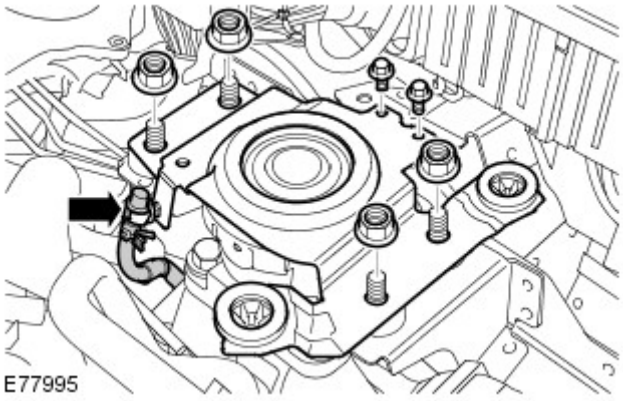
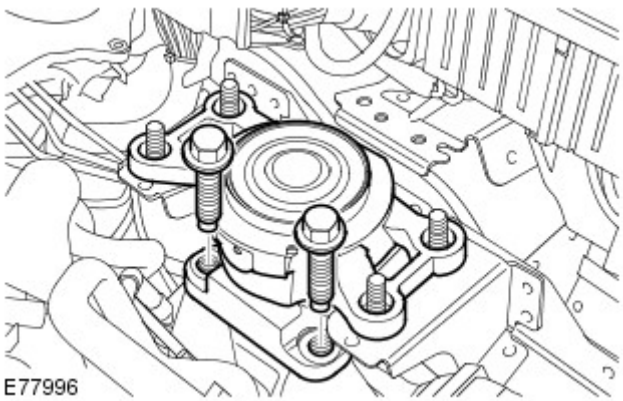
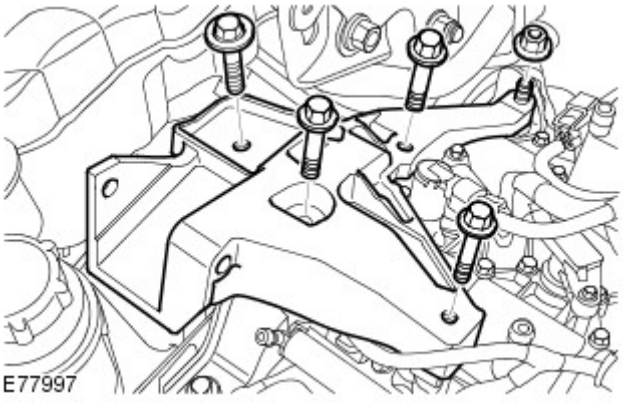

E77995

40. **40.** WARNING: Make sure that new nuts are installed.

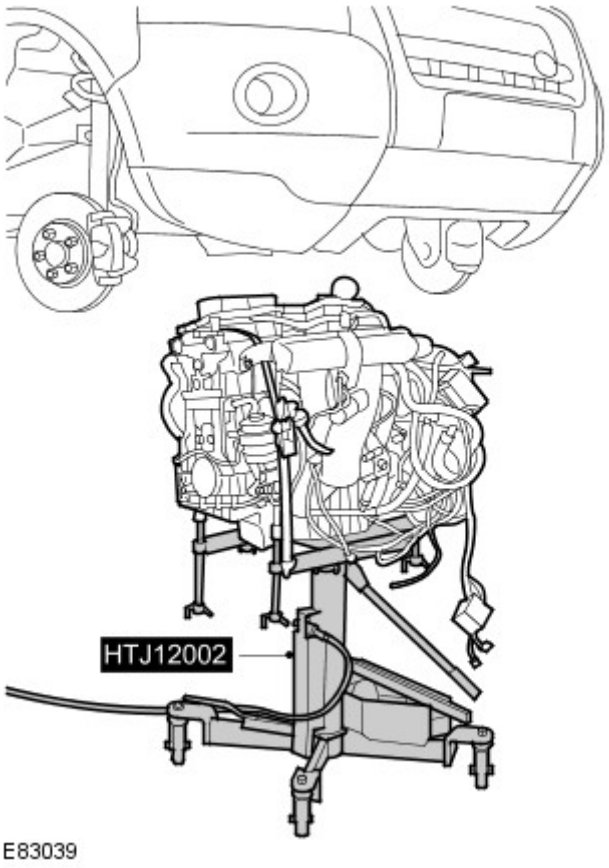
Remove the LH engine mount bracket.


E77996

41. Remove the LH engine mount.



42. RH side: Release the engine mount.



43. With assistance, carefully remove the engine and transmission.

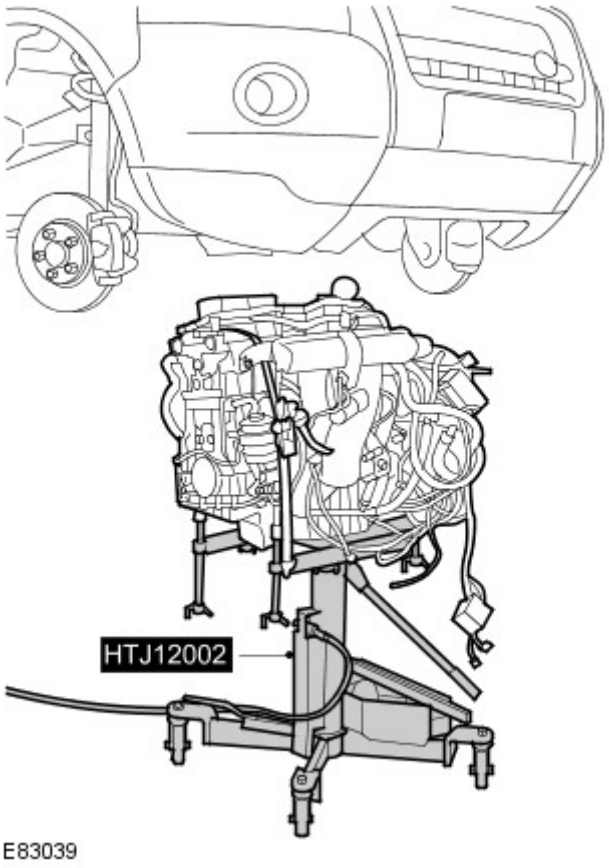
Published: 11-May-2011

Engine - I6 3.2L Petrol - Engine

Installation

General Equipment

Powertrain Jack



1. With assistance, carefully install the engine and transmission.

   General Equipment: Powertrain Jack

2. RH side: Install the engine mount.

   Torque: 80 Nm

3. Install the LH engine mount.

   Torque: 175 Nm

4. Install the bracket.

   Torque:
   M12 80 Nm
   M8 25 Nm

5. Remove the engine support.

6. Connect the bulkhead heater hoses.

7. **7.** CAUTIONS:

   Make sure that the component is clean, free of foreign material and lubricant.

   Make sure that new bolts are installed.

   Install the driveshaft.

Torque: 40 Nm

8. Install the coolant expansion tank.

   Torque: 10 Nm

9. Connect the purge line.

10. Connect the engine compartment ground cables.

    Torque:
    M8 25 Nm
    M6 10 Nm

11. Secure the engine wiring harness.

    Torque: 10 Nm

12. Install the RH ground cable.

    Torque: 10 Nm

13. **13.** CAUTIONS:

    A new O-ring seal is to be installed.

    Extreme cleanliness must be exercised when handling these components.

    Connect the fuel line.

14. Install the transmission fluid cooler.

15. Connect the coolant top hose.

16. Connect the coolant bottom hose.

17. Connect the cooling fan electrical connector.

18. Install the RH halfshaft support.

    Torque: 25 Nm

19. Install the LH halfshaft.

20. With assistance, install the halfshaft to the hub.

21. Install the halfshafts.

    Torque:
    Stage 1:45 Nm
    Stage 2:80°

22. Connect the selector cable to the transmission.

23. Connect the low pressure line to the power steering pump.

24. Secure the A/C and power steering lines.

25. Install the A/C compressor.

    Torque: 25 Nm

26. Install the A/C compressor, upper support bracket.

    Torque:
    M10 45 Nm
    M8 25 Nm
    M6 10 Nm

27. Install the A/C compressor, lower support bracket.

    Torque: 25 Nm

28. Connect the brake booster vacuum hose.

29. Connect the ECM electrical connectors.

30. Install the starter motor.

    Refer to: Starter Motor (303-06A Starting System - I6 3.2L Petrol, Removal and Installation).

31. Remove the front subframe assembly.

    Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

32. Install the lower engine stabilizer bar.

    Refer to: Engine Lower Support Insulator (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

33. Remove the catalytic converters.

    Refer to: Catalytic Converter (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).

34. Refill and bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

35. Install the air cleaner assembly.

    Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

36. Remove the battery tray.

    Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

37. Remove the plenum box access panel.

    Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

38. Remove the engine cover.

    Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

39. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

40. Refill and bleed the power steering.

    Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

41. Carry out the final halfshaft and suspension tightening with the vehicle on its wheels.

Published: 11-May-2011

Engine - TD4 2.2L Diesel -

Lubricants, Fluids, Sealers and Adhesives

Description	Description and part number.
'T' joints - ladder frame to engine block sealant	Three bond TB 1215J
Oil pan to block sealant	Three bond TB 1215J
Camshaft ladder sealant	Loctite 518 (8510302)
Engine Oil	SAE 5W-30 oils conforming to Ford WSS-M2C13B specification or ACEA A1 or B1

Capacities

Item	Capacity (liters/pints/US quarts)
Dry fill including filter	6.5/11.4/6.7
Service fill	5.9/10.4/6.2
Amount of oil required to bring level from the lower to the upper mark on the dipstick	1.5/2.6/1.6

Cylinder Head Gasket Selection

Piston Protusion	Thickness of Compressed Gasket	Number of holes at 'a'	Number of holes at 'b'
0.55 to 0.60 mm	1.25 ± 0.04 mm	1	1
0.61 to 0.65 mm	1.30 ± 0.04 mm	2	2
0.66 to 0.70 mm	1.35 ± 0.04 mm	3	3
0.71 to 0.75 mm	1.40 ± 0.04 mm	4	4

- 'a' and 'b' = Thickness identification

General Specification

Item	Specification
Type	2.2 litre, inline 4, turbocharged and intercooled diesel engine, twin overhead camshaft, 4 valves per cylinder
Cylinder arrangement	Inline 4
Cylinder numbering	No.1 from gearbox end
Bore - nominal	85.0 mm (3.346 in)
Stroke	96.0 mm (3.779 in)
Capacity	2179 cm^3 (132.9 in^3)
Firing order	1 - 3 - 4 - 2
Compression ratio	16.6:1
Direction of rotation	Clockwise viewed at FEAD
Maximum permissable cylinder head warp	0.03mm (0.00118 in)
Maximum power	
All markets except Belgium	118 kW (160 ps) @ 4000rpm
Belgium specification	110 kW (150 ps) @ 4000rpm
Maximum torque	400 Nm (295 lb-ft) @ 2000rpm
Engine oil pressure*:	
At 1750 rev/min	1.6 bar/160 kPa/23 lb/in^2
At 4000 rev/min	3.1 bar/310 kPa/45 lb/in^2
Balance shaft to crankshaft clearance:**	
Minimum	0.01mm
Maximum	0.07mm

*** Prior to checking the engine oil pressure, a road test of 6 miles (10 kilometres) must be carried out. Do not attempt to attain normal engine operating temperature by allowing the engine to idle.**

****If the backlash between the balance shaft and crankshaft is less than 0.01 mm or greater than 0.07 mm then the balance shaft assembly must be replaced.**

Torque Specifications

Description	Nm	lb-ft
Accessory drive belt idler bolt	48	35
Accessory drive belt tensioner bolt	48	35
Camshaft pulley bolt		
Stage 1	20	15
Stage 2	60°	60°
Camshaft timing belt cover bolts	6	5
Camshaft timing chain tensioner bolts	7	5
Crankshaft pulley bolt:		
Stage 1	70	52
Stage 2	60°	60°
Crankshaft rear seal retainer plate	9	7
Coolant outlet elbow	9	7
Cylinder head bolts	A	A
Dipstick tube bolt	10	7
Engine insulator lower	110	81
Engine insulator lower heat shield	10	7
Engine insulator lower link brackets	110	81
Engine insulator upper	110	81

Description	Nm	lb-ft
Engine mount bracket LH:		
M8*	25	18
M12*	80	59
Engine mount bracket RH:		
M12*	80	59
M14*	175	129
Engine mount LH bolt	175	129
Engine mount RH bolts	80	59
Flywheel bolts	A	A
Fuel injector wiring harness bolt	10	7
Fuel filter bracket bolts	25	18
Intake manifold runner control (IMRC) actuator bolt	10	7
Intake manifold adaptor and throttle housing bolt	6	5
Intake manifold bolts	9	7
Lifting brackets	10	7
Oil cooler brackets	10	7
Oil cooler to cylinder block bolts	20	15
Oil filler tube	9	7
Oil pan drain plug	20	15
Oil pan bolts	9	7
Oil pan extension panel:		
Stage 1	10	7
Stage 2	16	12
Oil pump bolts:	9	7
Stage 1	7	5
Stage 2	9	7
Oil separator bolts	7	5
Oil level sensor	8	6
Piston cooling jet bolt	10	7
Timing belt tensioner bolt	25	18
Timing belt idler pulley bolt	60	44
Timing belt rear cover	6	4
Valve cover bolts	10	7
Vacuum pump bolts	9	7

*** New nuts/bolts must be fitted**

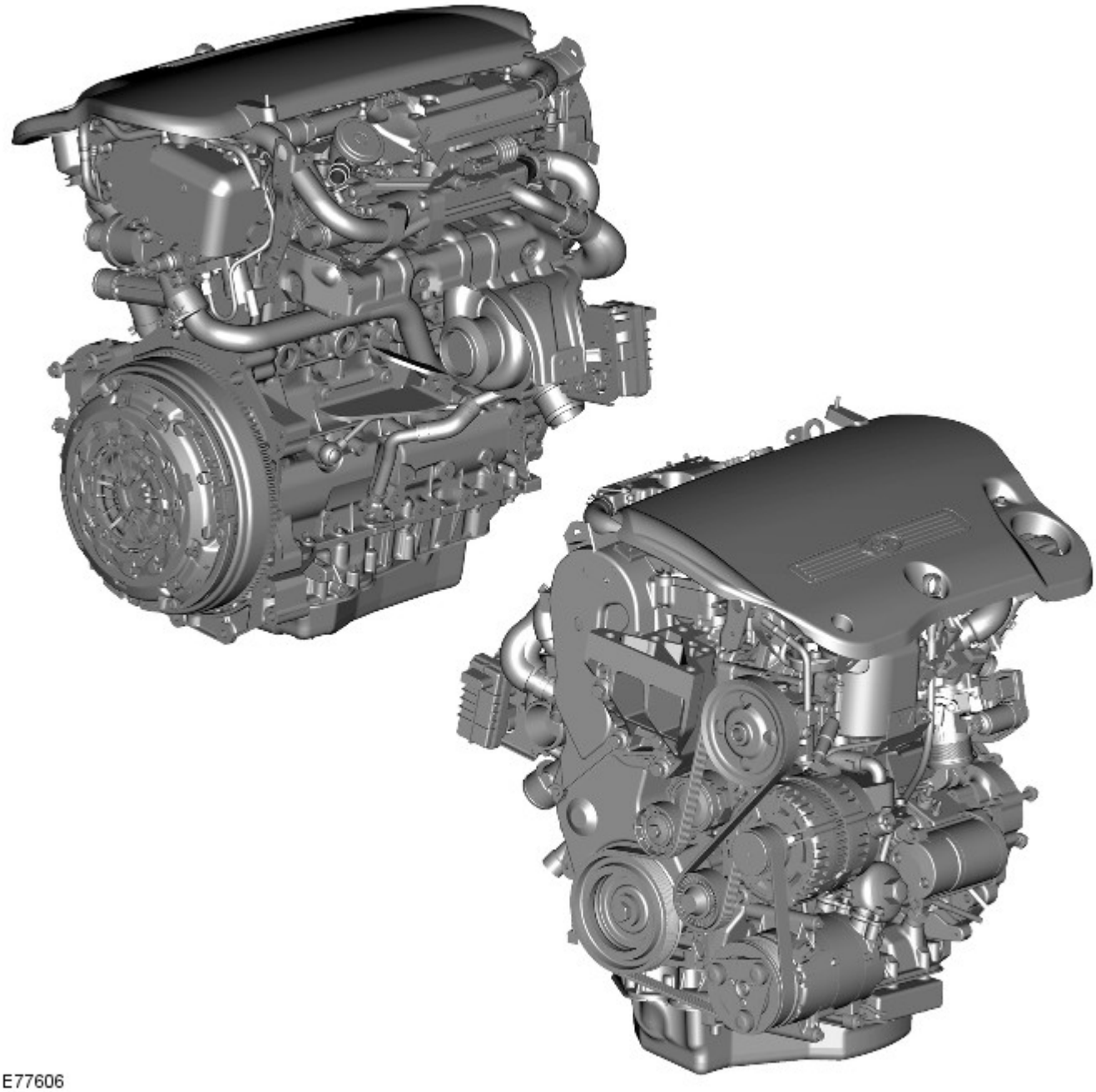
A = refer to procedure for correct torque sequence

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Engine

Description and Operation

EXTERNAL VIEW



E77606

OVERVIEW

• NOTE: Freelander 2 features a new TD4 diesel engine. This TD4 diesel engine is not previously used by Land Rover, and must not be mistaken for the Td4 diesel engine used with the previous Freelander model.

The new TD4 diesel engine may also be referred to, and appear in text as the 2.2L Duratorq-TDCi (DW) engine.

The TD4 diesel engine is a 2.2 liter in-line 4 cylinder assembly, comprising a Double Overhead Camshaft (DOHC) arrangement that operates 4 valves per cylinder. The valves are operated by roller-type finger rockers and hydraulic lash adjusters. Air and diesel fuel are delivered to the cylinders with an electronic controlled Variable Geometry Turbine (VGT) turbocharger, and Bosch Generation 3 common rail fuel system.

Engine operation is monitored, and optimum performance is achieved with an electronic engine management system and Bosch Engine Control Module (ECM).

The engine is a compact unit that occupies minimal space, and is designed to reduce produced levels of Noise, Vibration and Harshness (NVH). The reduced engine size allows the vehicle to achieve high levels of pedestrian protection, and meet the standards for high-speed crash performance.

Engine construction is formed with a precision machined, cast-aluminum alloy cylinder head and a laminated metal gasket,

securely bolted to the top of a machined cast-iron cylinder block. The cylinder head provides the location for the 16 valves (4 per combustion chamber), valve operating gear, camshafts and timing gear, fuel injectors and glow plugs. Drillings and galleries are formed within the cylinder head to provide lubricating oil and coolant flow.

The cylinder head is formed with the camshaft lower bearing cap castings, and is enclosed by a mating structural camshaft cover with sealing gasket. The camshaft cover is formed with the camshaft upper bearing cap castings, intake air filling tracts, and ports for the cylinder head cover, crankcase ventilation components.

An 'L' shaped cylinder head cover encloses the structural camshaft cover openings, and incorporates the Positive Crankcase Ventilation Valve (PCV), safety valve and crankcase ventilation connections.

An acoustic engine cover is installed above the engine, and comprises a polypropylene foam layer adhered to the underside of a thermo-plastic cover. The cover is tuned to absorb and reduce engine produced noise to acceptable NVH levels. A hole formed in the rear Left-hand (LH) side of the engine cover provides the location for the engine oil filler cap.

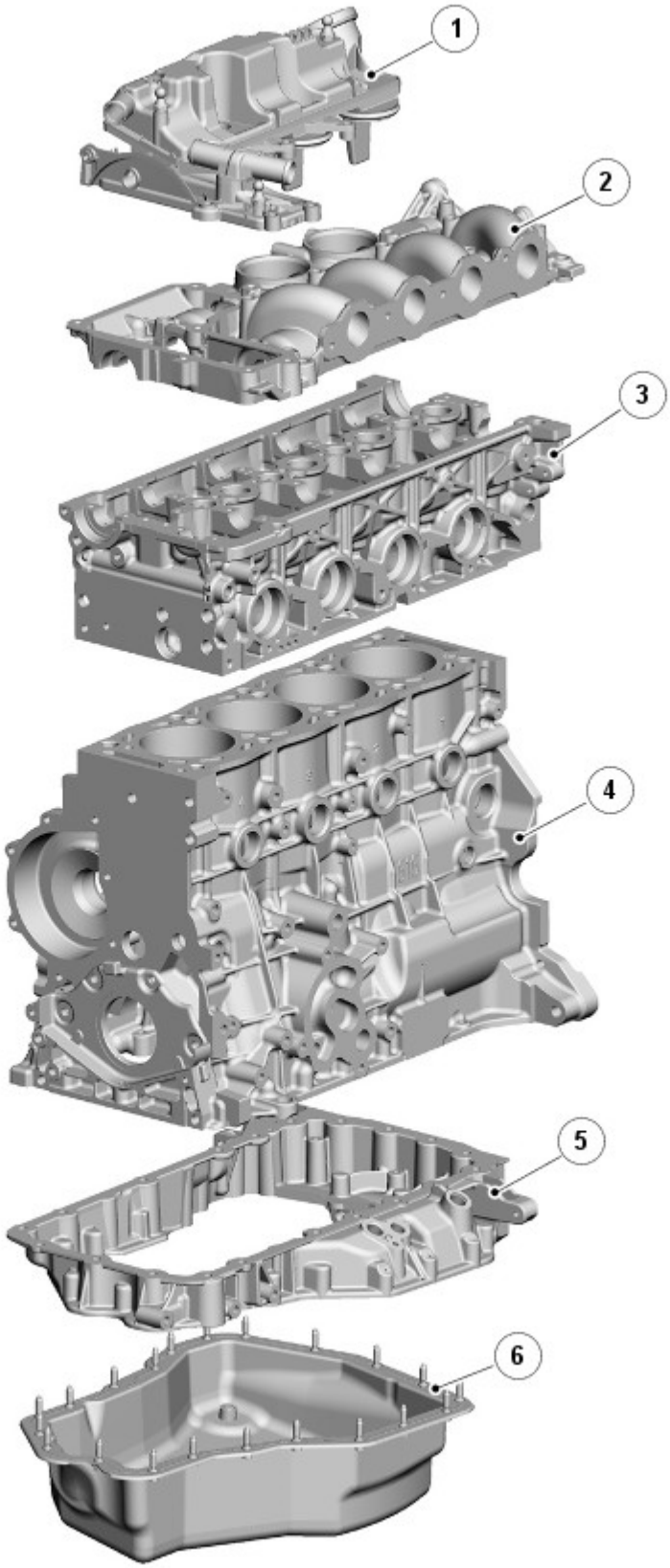
The cylinder block provides the location for the crankshaft and bearings, oil cooling jets, reciprocating components, and the counter-balance shaft housing. Galleries and drillings are formed in the cylinder block for lubricating oil and coolant flow. A counter-balance shaft housing is bolted to the underside of the cylinder block and is gear driven by the crankshaft. The counter-balance shaft assembly reduces engine NVH to provide a smooth power output.

An aluminum oil pan housing and a pressed steel oil pan are secured to the bottom of the cylinder block. The oil pan housing is sealed and bolted directly to the cylinder block. The oil pan is sealed with liquid sealant and attached to the oil pan housing to provide the lubrication system reservoir. The lubrication system oil pump is located inside the oil pan and is bolted to the underside of the cylinder block. The oil pump is chain driven by the crankshaft.

Engine cooling is achieved with a pressurized water-coolant system. An engine driven coolant pump distributes the coolant through galleries in the cylinder head and block.

Engine produced emissions comply with European Commission Directive (EUCD) Stage 4 legislative requirements. The limiting of resultant emission pollutants is acheived by use of an exhaust system catalytic converter, an optional Diesel Particulate Filter (DPF), advanced electronic engine management control, PCV, and Exhaust Gas Recirculation (EGR) system.

ENGINE STRUCTURE



E84622

Item	Part Number	Description
1	-	Cylinder head cover
2	-	Structural camshaft cover
3	-	Cylinder head
4	-	Cylinder block
5	-	Oil pan housing
6	-	Oil pan

Technical Features

The TD4 engine comprises the following key features:

- 16 valve DOHC arrangement, 4 valves per cylinder

- Fuel injectors centrally positioned to the combustion chamber
- Roller finger rockers with hydraulic lash adjusters
- Garrett Rotary Electronic Actuated (REA) variable geometry turbocharger
- Pierburg electronic controlled EGR valve with Visteon EGR cooler
- Bosch generation 3 fuel system with common fuel rail injection technology
- 7-hole piezo-electric type injectors (capable of 5 injections per stroke)
- Advanced Bosch EDC 16 engine management system
- Intake manifold incorporating variable swirl and port de-activation technology
- Electronic intake throttle for controlled engine shut-down
- Counter-balance shaft assembly
- Aluminum alloy cylinder head, and double wall cast-iron cylinder block
- Cylinder head design for optimum air swirl across the engine speed range
- Exhaust emission treatment with a diesel specific catalytic converter and an optional DPF
- Steel crankshaft with double damping flywheel and torsional vibration damper
- Emissions compliant with EUCD Stage 4 legislation.

Technical Details

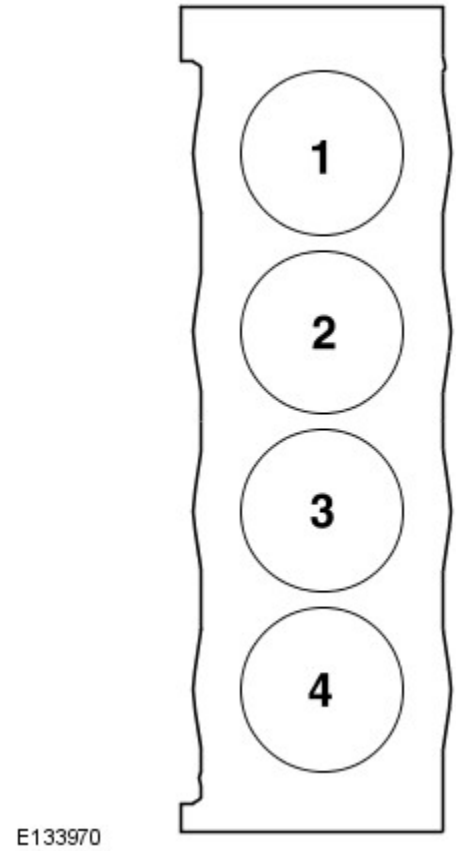
Technical details for the TD4 engine are shown below:

• NOTE: The TD4 engine cylinders are numbered from the rear of the engine (transmission end). Therefore, No. 1 cylinder is located at the rear of the engine.

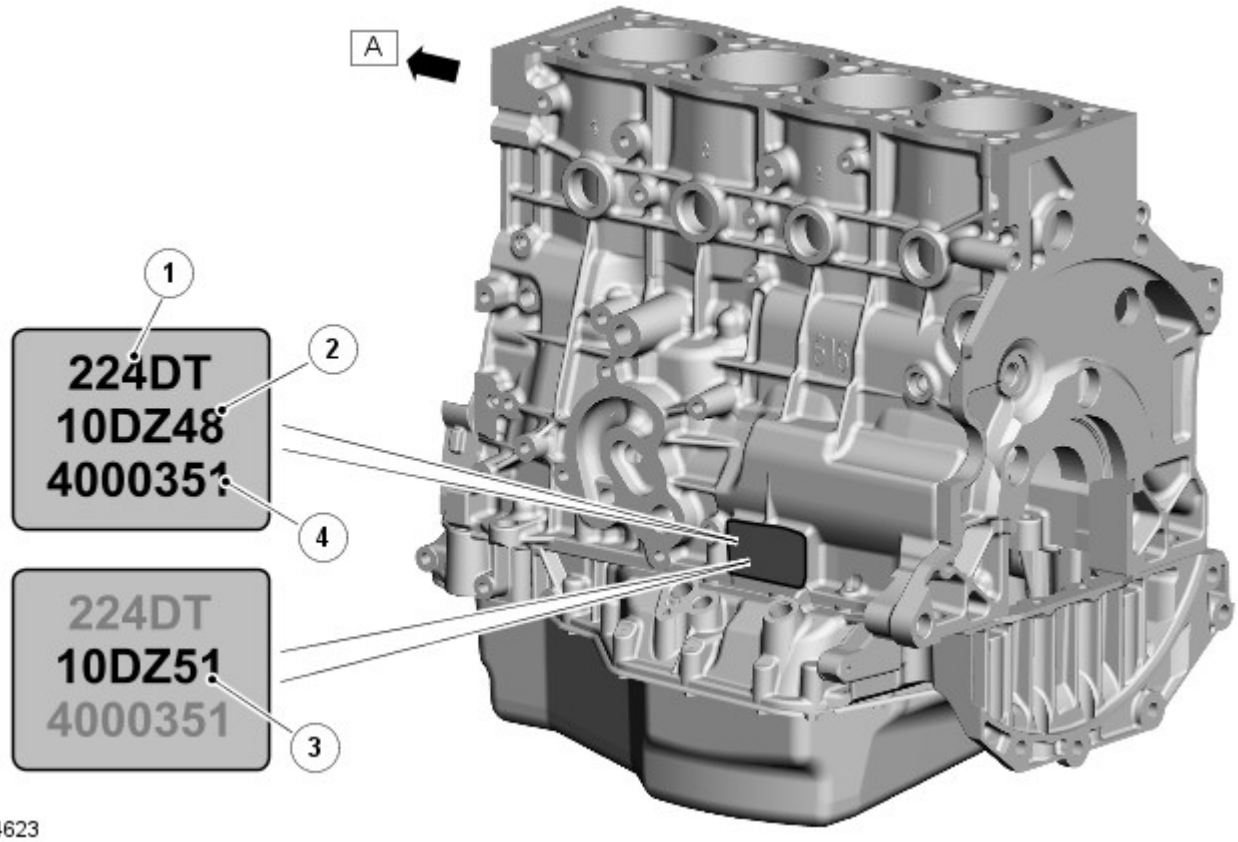
Item	Detail
Engine type	DW12BTED4
Configuration	4 cylinder in-line
Cylinder numbering	No. 1 cylinder at rear of engine (transmission end)
Engine installation	Transverse mounted, tilted 12 degrees toward rear
Bore / stroke	85 mm / 96 mm
Cubic capacity	2179 cm^3
Compression ratio	16.6:1
Emissions compliance	EUCD Stage 4
Maximum power output (kW EU)	118 kW @ 4000 rpm
Maximum torque	400 Nm @ 2000 rpm
Engine idle speed:	Manual transmission 750 rpm
	Automatic transmission 795 rpm
Engine maximum speed	5000 rpm
Firing order	1-3-4-2
Oil capacity	5.4 liters (5.7 US quarts)

Cylinder Numbering

The cylinders are numbered as shown below, with cylinder 4 at the front of the engine.



Engine Identification

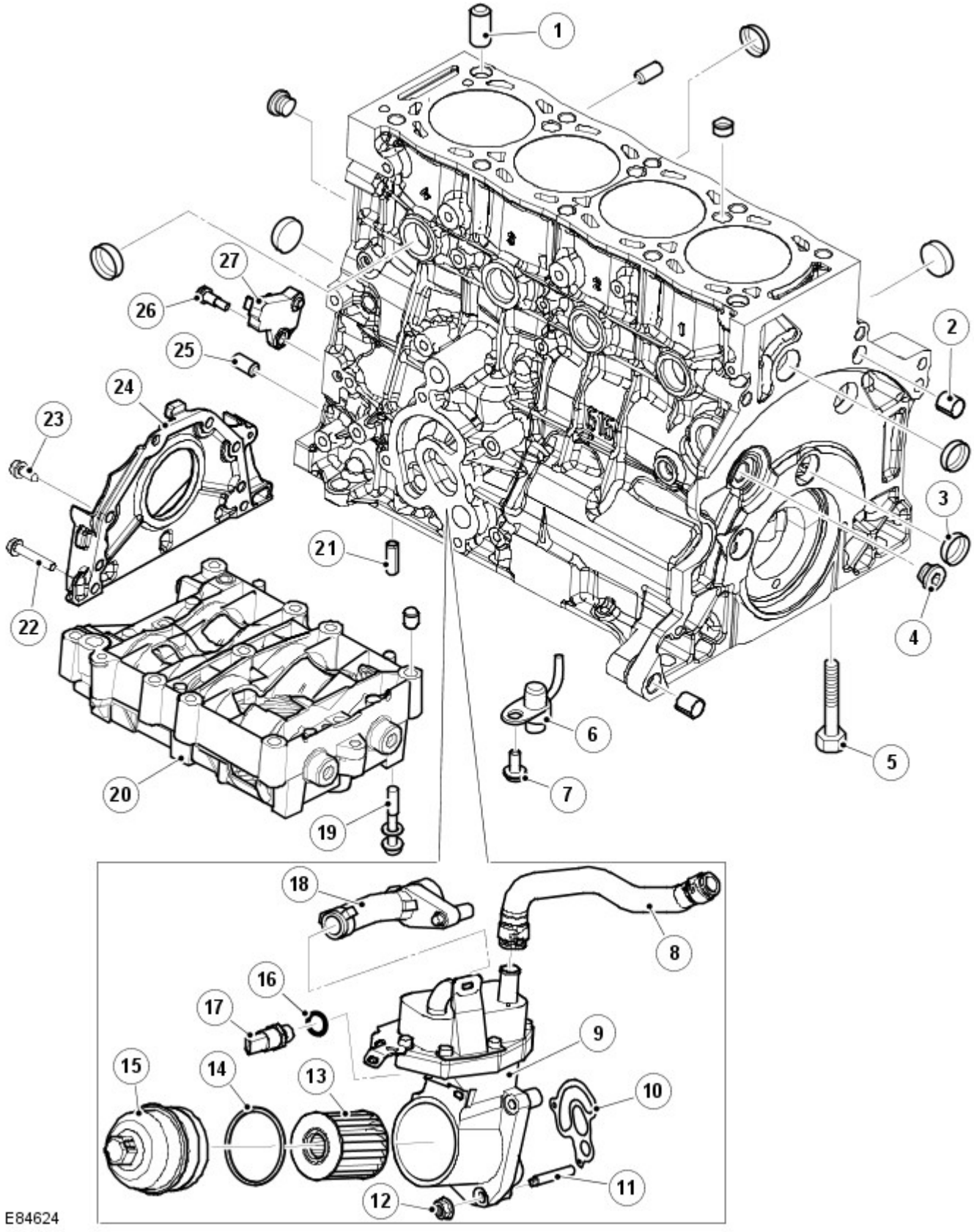


E84623

Item	Part Number	Description
A	-	Front of engine
1	-	Engine type
2	-	Engine variant (manual transmission)
3	-	Engine variant (automatic transmission)
4	-	Engine serial number

Engine identification details are located on the lower LH side (oil filter side) of the cylinder block.

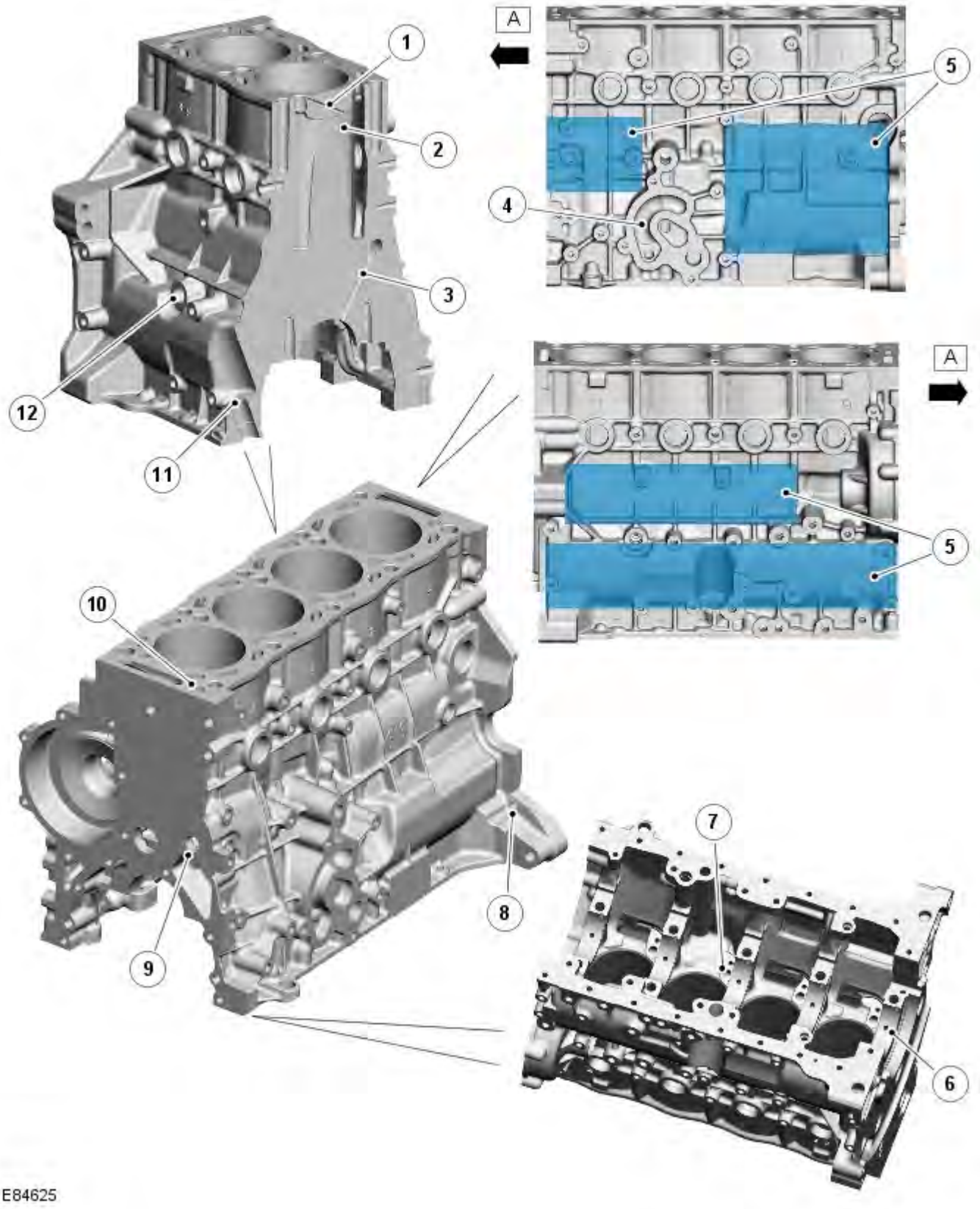
CYLINDER BLOCK COMPONENTS



Item	Part Number	Description
1	-	Cylinder head locating dowel (2 off)
2	-	Transmission housing locating dowels (2 off)
3	-	Core plug (12 off)
4	-	Main oil gallery sealing plug (2 off)
5	-	Main bearing cap bolt (10 off)
6	-	Oil spray jet (4 off)
7	-	Oil spray jet bolt (4 off)
8	-	Coolant return hose from oil cooler
9	-	Oil filter and cooler housing
10	-	Gasket
11	-	Stud (4 off)

12	-	Nut (4 off)
13	-	Oil filter element
14	-	O-ring
15	-	Oil filter cap
16	-	O-ring
17	-	Oil pressure switch
18	-	Coolant supply hose to oil cooler
19	-	Counter-balance shaft housing bolt (8 off)
20	-	Counter-balance shaft housing
21	-	Counter-balance shaft housing locating dowel (2 off)
22	-	Crankshaft front seal adaptor bolt (2 off)
23	-	Crankshaft front seal adaptor bolt (4 off)
24	-	Crankshaft front seal adaptor
25	-	Dowel (4 off)
26	-	Crankshaft position (CKP) sensor screw
27	-	CKP sensor

Cylinder Block



Item	Part Number	Description
A	-	Front of engine
1	-	Expansion chamber drilling
2	-	Coolant chamber
3	-	Main bearing oil supply drilling
4	-	Oil filter housing
5	-	Double layer wall (shaded areas)
6	-	Main bearing oil supply port
7	-	Oil spray jet locating port
8	-	Engine timing special tool location
9	-	Main oil gallery
10	-	Cylinder head oil supply drilling

11	-	VGT oil return port
12	-	VGT oil supply port

The cylinder block is manufactured from cast-iron and features double layer walls that provide high strength and rigidity. An air cushion is formed between the layers and also acts to reduce the NVH levels produced by the engine. The block features 5 bolted main bearing journals that also provide high strength and rigidity to the lower end of the engine.

The cylinders are directly bored into the cylinder block and do not require cylinder liners. Two guide sleeves are located in the cylinder block, and provided to correctly align the cylinder head and gasket to the cylinder block.

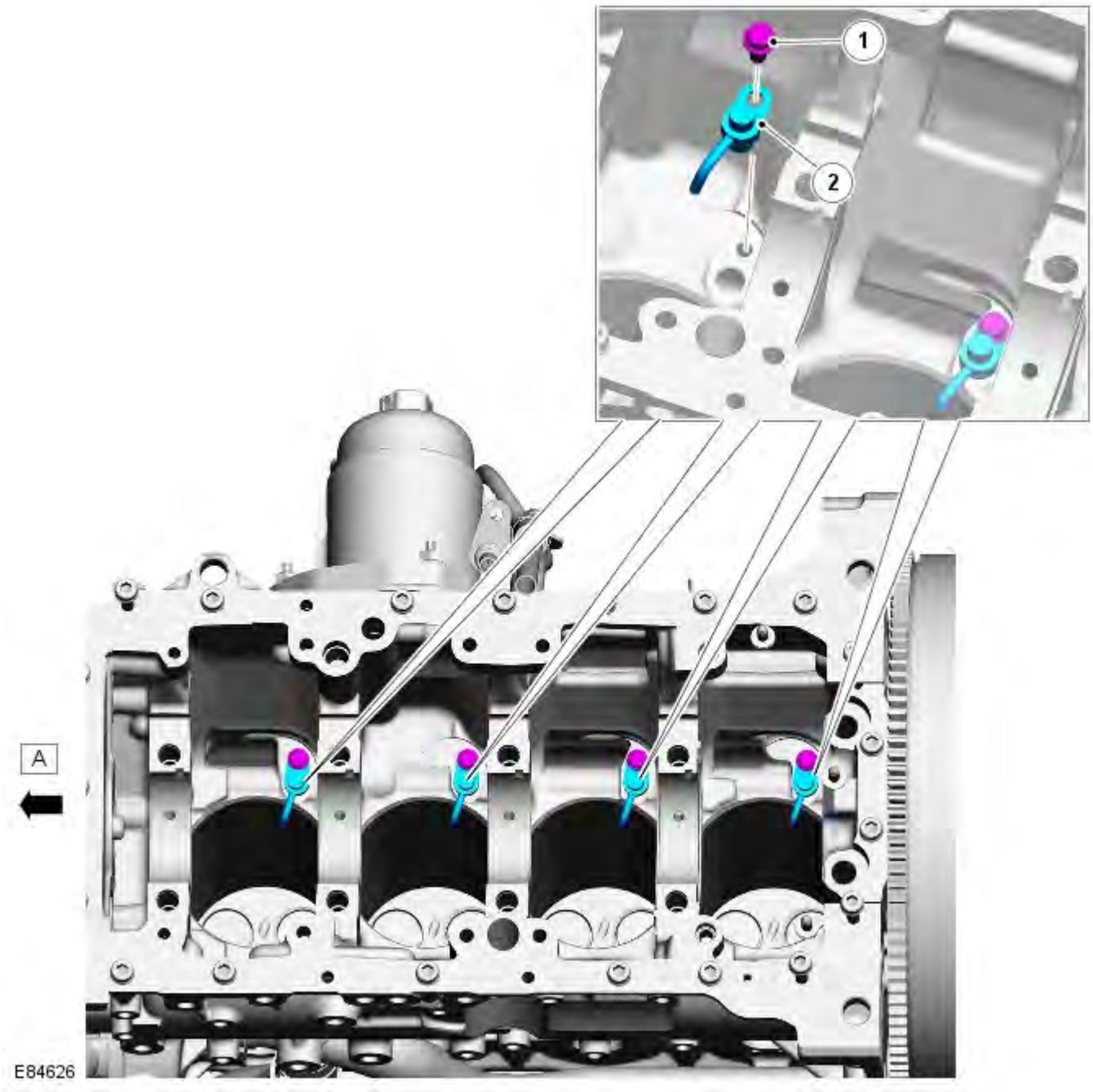
A hole formed in the LH rear of the cylinder block below the starter motor, provides the location for an engine timing special tool. When inserted, the special tool locates in a corresponding hole in the flywheel to temporarily hold the crankshaft with No. 1 piston at the Top Dead Center (TDC) position.

The oil filter and cooler housing, and main oil gallery are located on the LH side of the cylinder block. The main oil gallery is a longitudinal drilling that runs the length of the cylinder block, and supplies pressurized oil to all the engine moving components. Pressurized oil is diverted from the main oil gallery to supply the main and big-end bearings via diagonal oil drillings in the cylinder block, and in the crankshaft journals. The main oil gallery is sealed at each end with a screwed plug.

A cross drilling above No. 2 main bearing directs pressurized oil from the main oil gallery to a port at the Right-Hand (RH) side of the cylinder block. The port supplies pressurized oil via a banjo type connection to the VGT bearings. Return oil from the VGT is directed via a pipe and a connection at the RH side of the block, into the oil pan. A vertical drilling at the LH front of the cylinder block supplies pressurized oil from the main oil gallery, up to a corresponding oil gallery in the cylinder head.

Engine cooling is achieved with inter-cylinder coolant chambers and expansion chamber drillings, formed in the cylinder block coolant jacket. The coolant chambers direct coolant through openings in the block upper surface to the cylinder head. Core plugs seal the exterior openings formed in the cylinder block coolant jacket.

Oil Spray Jets

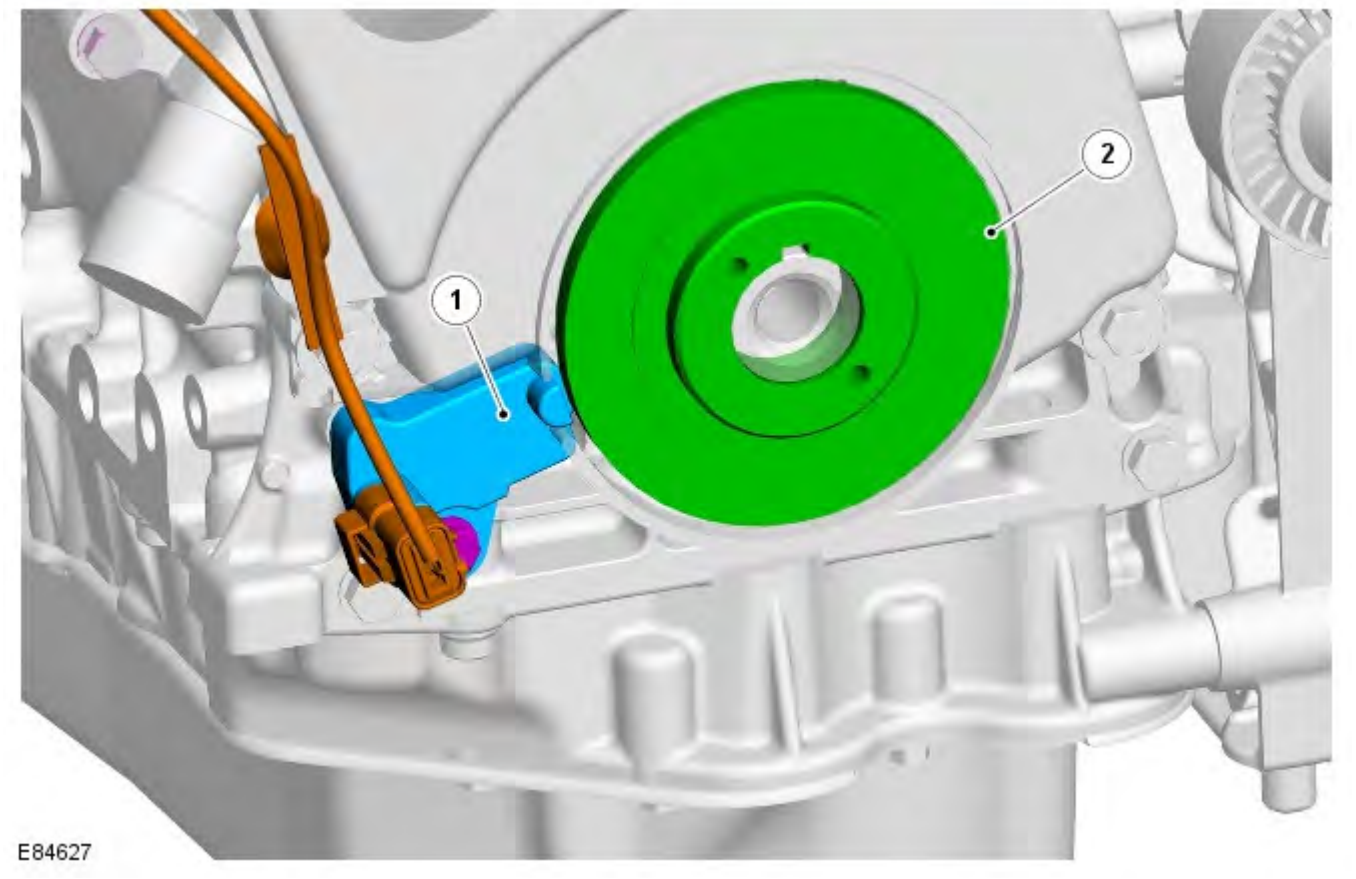


Item	Part Number	Description
A	-	Front of engine
1	-	Oil spray jet bolt (4 off)
2	-	Oil spray jet (4 off)

The 4 oil spray jets are installed in the LH side of cylinder block below each cylinder. The jet body is seated directly into the main oil gallery. Pressurized oil is sprayed beneath each piston to lubricate the cylinder wall and gudgeon pin, and to cool the piston crown. As the spray contacts the underside of the piston, the oil collects and flows around 2 formed cooling channels to cool the piston crown.

A valve installed in the spray jet body prevents oil spray, until the lubrication system pressure is greater than 0.5 bar (7.25 psi).

Crankshaft Position Sensor

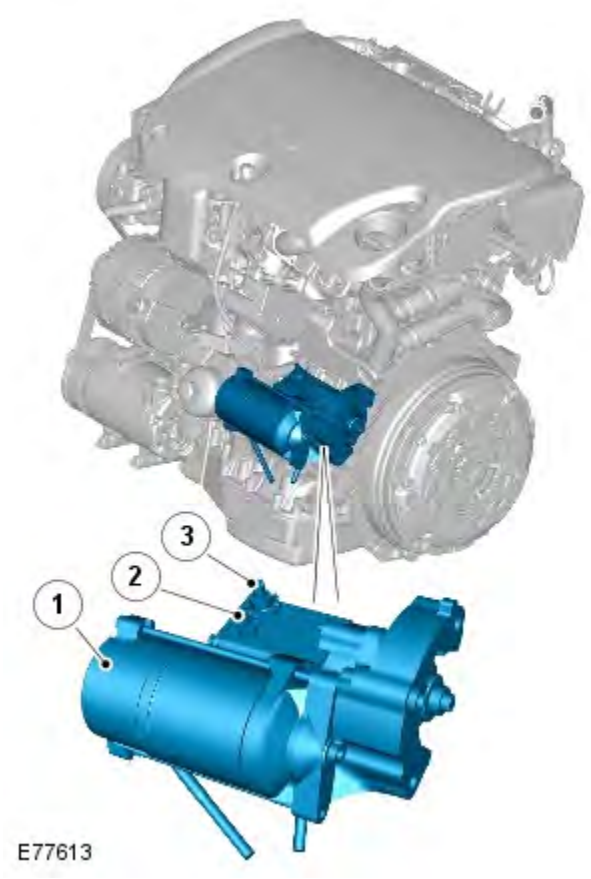


Item	Part Number	Description
1	-	CKP sensor
2	-	CKP sensor target ring

A CKP sensor is installed at the front of the engine, and is secured to the cylinder block with a locating dowel and screw. The position of the sensor is not adjustable. The sensor head is positioned close to a corresponding target ring located behind the crankshaft drive pulley. The target ring is keyed on to the crankshaft.

The sensor is a variable reluctance sensor that provides an input of engine crankshaft speed, and No. 1 piston position to the ECM. The information is used by the ECM to determine the quantity of fuel to be injected, start of fuel delivery, and quantity of exhaust gas to be recirculated.
For additional information, refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

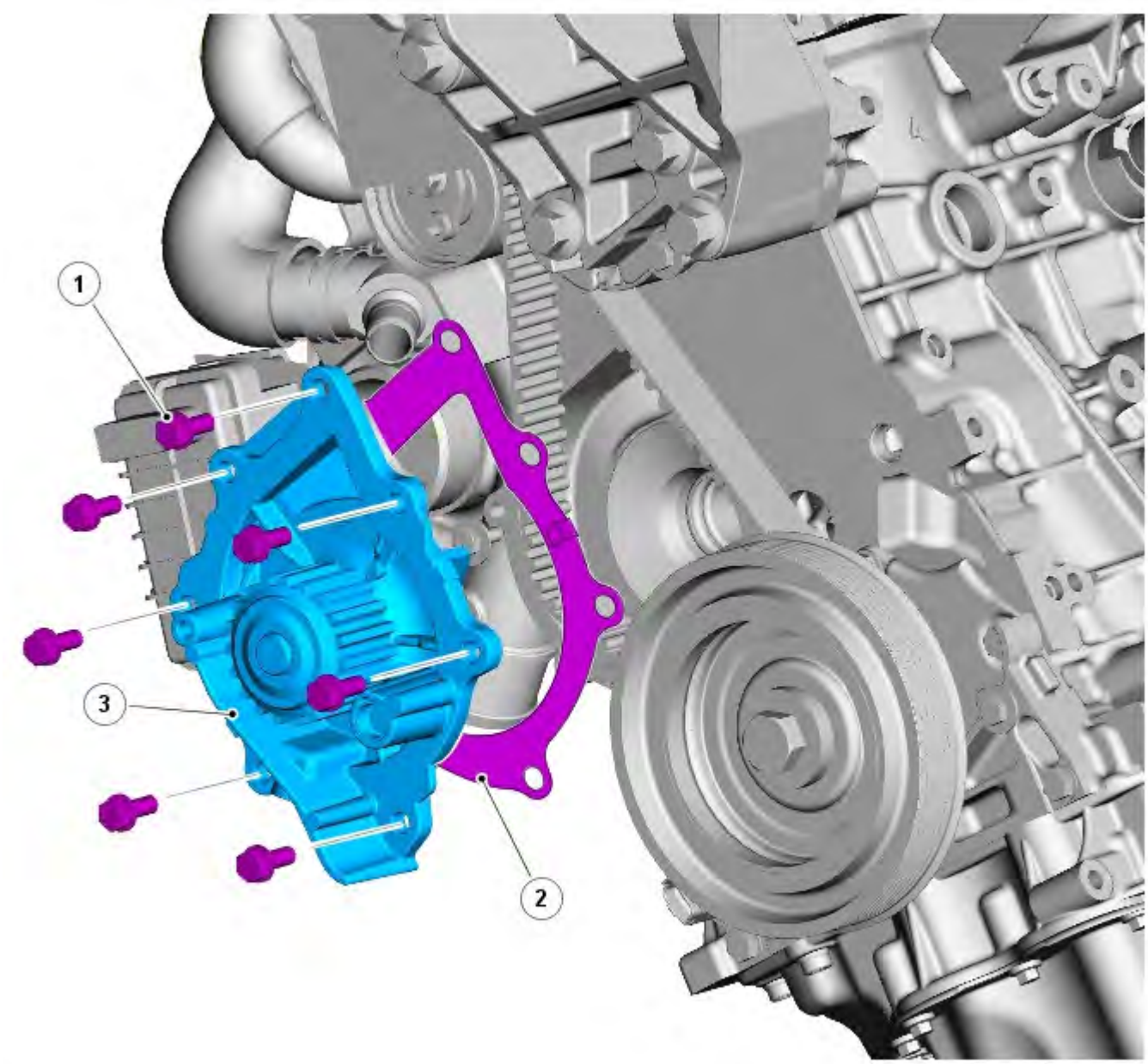
Starter Motor



Item	Part Number	Description
1	-	Starter motor
2	-	Battery to solenoid connection
3	-	Battery positive connection

The starter motor is located on the rear LH side of the engine at the cylinder block to oil pan housing split line. The motor is attached to the transmission casing with 3 fixings.
For additional information, refer to: Starting System (303-06B Starting System - TD4 2.2L Diesel, Description and Operation).

Coolant Pump



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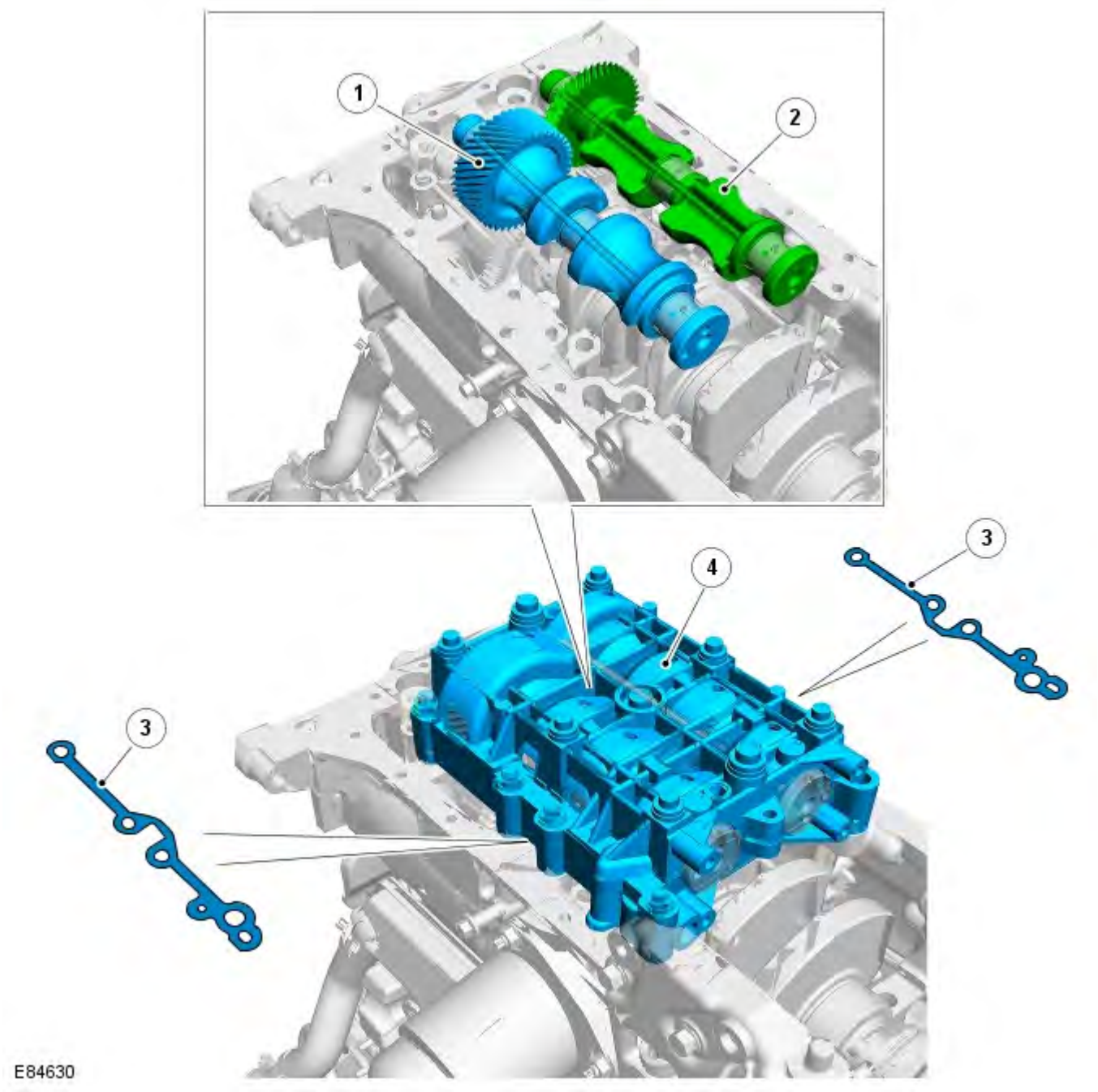
Item	Part Number	Description
1	-	Bolt (7 off)
2	-	Gasket
3	-	Coolant pump

The engine coolant pump is a centrifugal type, and is directly driven by the toothed camshaft belt. A sealing gasket and 7 bolts secure the pump to the front RH side of the cylinder block.
For additional information, refer to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Description and Operation).

Oil Filter and Cooler Assembly

A combined engine oil cooler and filter assembly is mounted on the LH side of the engine block, in-line with No. 3 cylinder. The filter housing contains a disposable paper filter element, and an oil pressure switch. For further information, refer to 'Lubrication System' within this section.

Counter-Balance Shaft Assembly

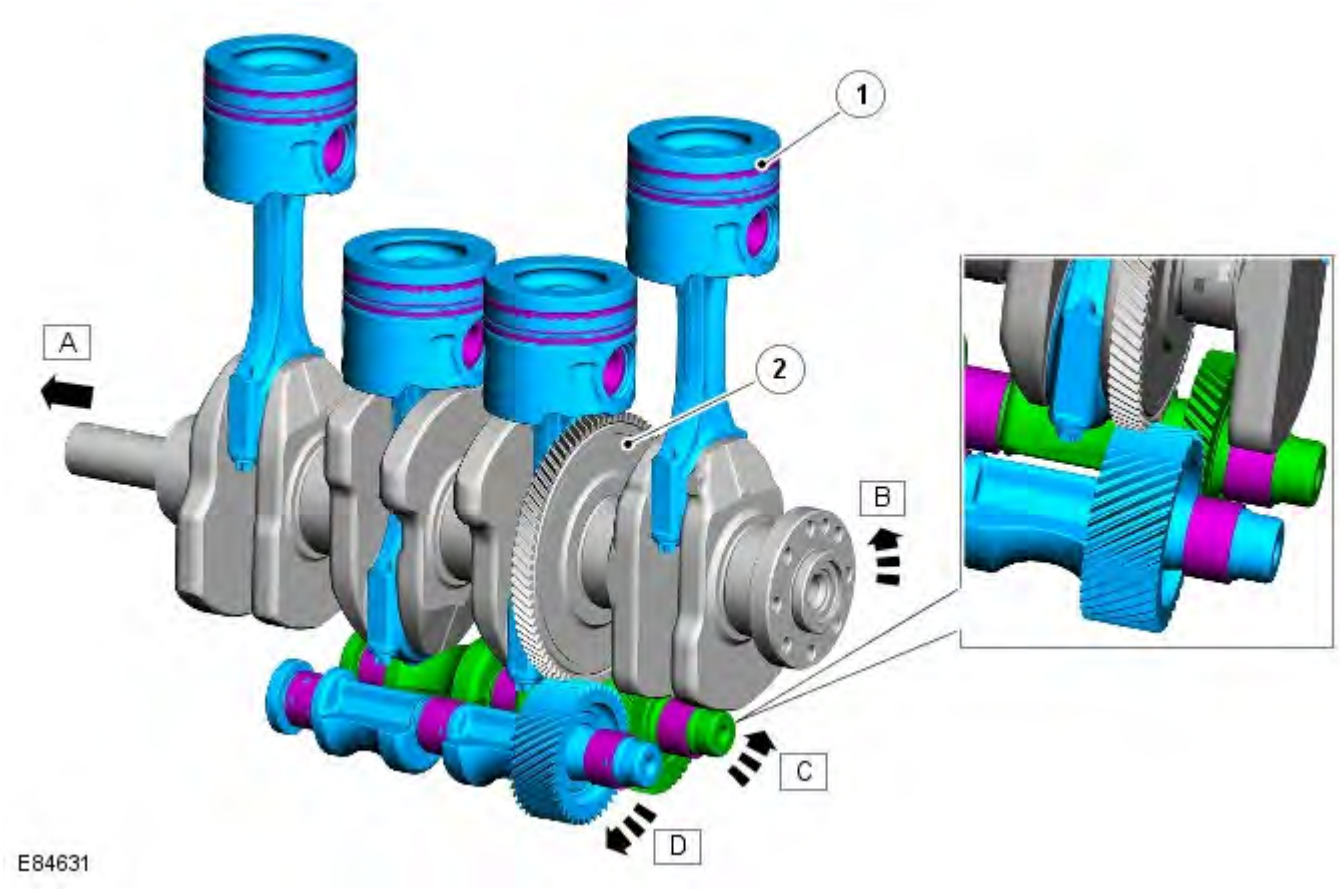


Item	Part Number	Description
1	-	Contra-rotating balance shaft
2	-	Balance shaft
3	-	Shim plate
4	-	Counter-balance shaft housing

The counter-balance shaft assembly contains 2 balance shafts and is located below the crankshaft. The assembly is attached with 8 bolts to the bottom of the cylinder block. The 2 shafts are each formed with a single helical drive gear, and are accurately machined and balanced as a matched assembly. The counter-balance shaft assembly must not be separated.

The counter-balance shaft housing provides the mounting location for the oil pump. A port at the front of the housing mates with an oil supply port from the oil pump. A further port at the top of the housing mates with a port in the cylinder block. Pressurized oil from the oil pump is directed through the counter-balance shaft housing port and cylinder block to the oil filter and cooler assembly.

Balance Shaft Drive



Item	Part Number	Description
A	-	Front of engine
B	-	Direction of crankshaft
C	-	Direction of balance shaft
D	-	Direction of contra-rotating balance shaft
1	-	No. 1 piston
2	-	Counter-balance shaft drive gear

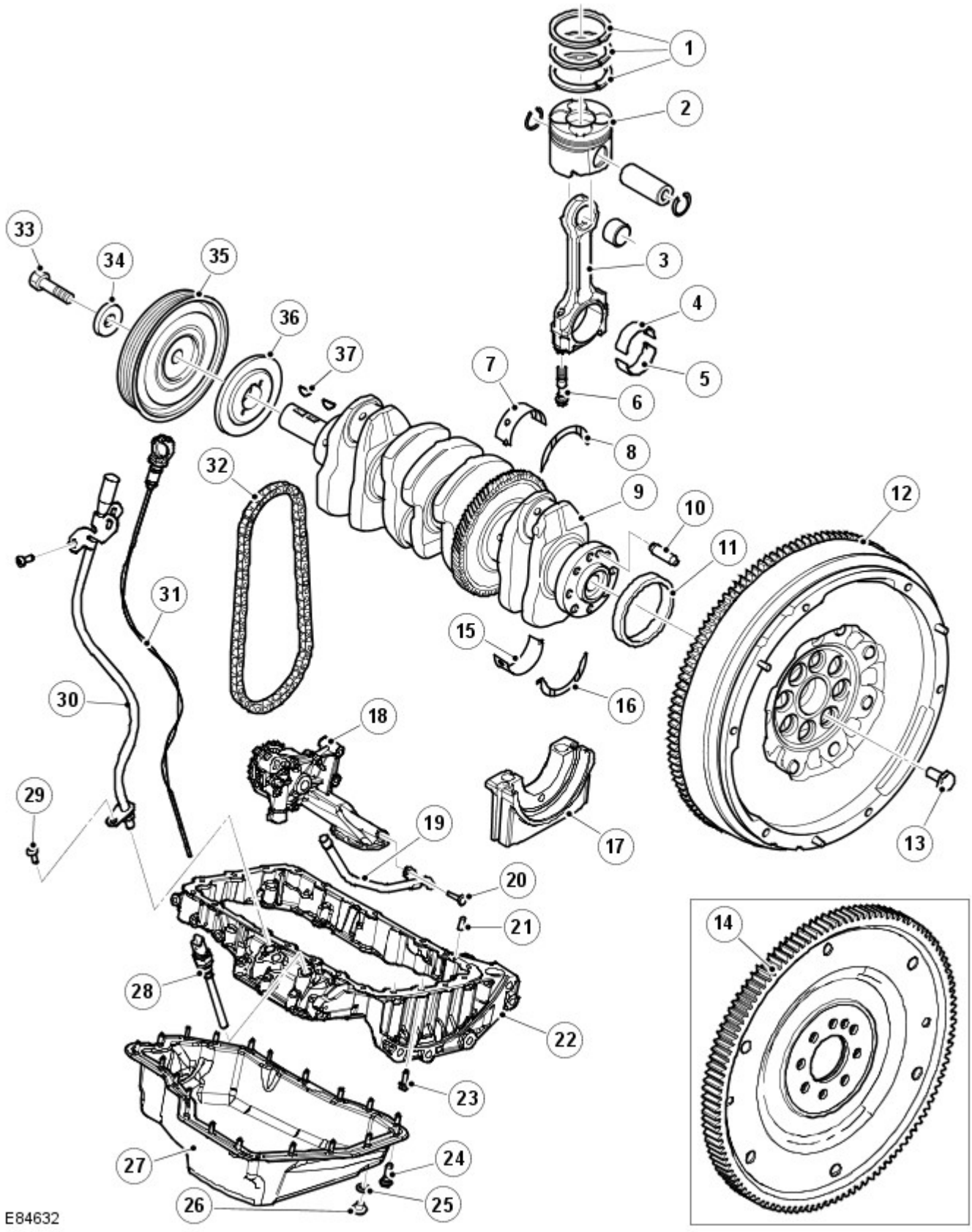
A formed helical drive gear on the crankshaft provides the drive to the counter-balance shaft assembly. The crankshaft drive gear contains twice the number of teeth as each of the balance shaft gears, and therefore drives the 2 balance shafts at twice crankshaft speed. The crankshaft gear drives the contra-rotating balance shaft in the opposite direction to the crankshaft. The remaining balance shaft is driven by the contra-rotating balance shaft in the direction of the crankshaft.

A shim plate is located between each side of the balance shaft housing and the cylinder block skirt. The shims are available in varying thickness and are used to provide the correct backlash between the crankshaft drive gear, and the contra-rotating shaft gear. The backlash between each balance shaft gear may be checked, but is not adjustable.

The rotating balance shafts create an opposing force to counter the imbalance forces produced by the engines reciprocating components. The imbalance is created in a 4 cylinder engine as pairs of pistons move in opposite directions during the engine strokes. To counter the opposing forces of the paired pistons, the balance shaft weights must be at Bottom Dead Center (BDC) when a piston pair is at TDC.

Lubrication of the counter-balance shaft assembly is by splash oil.

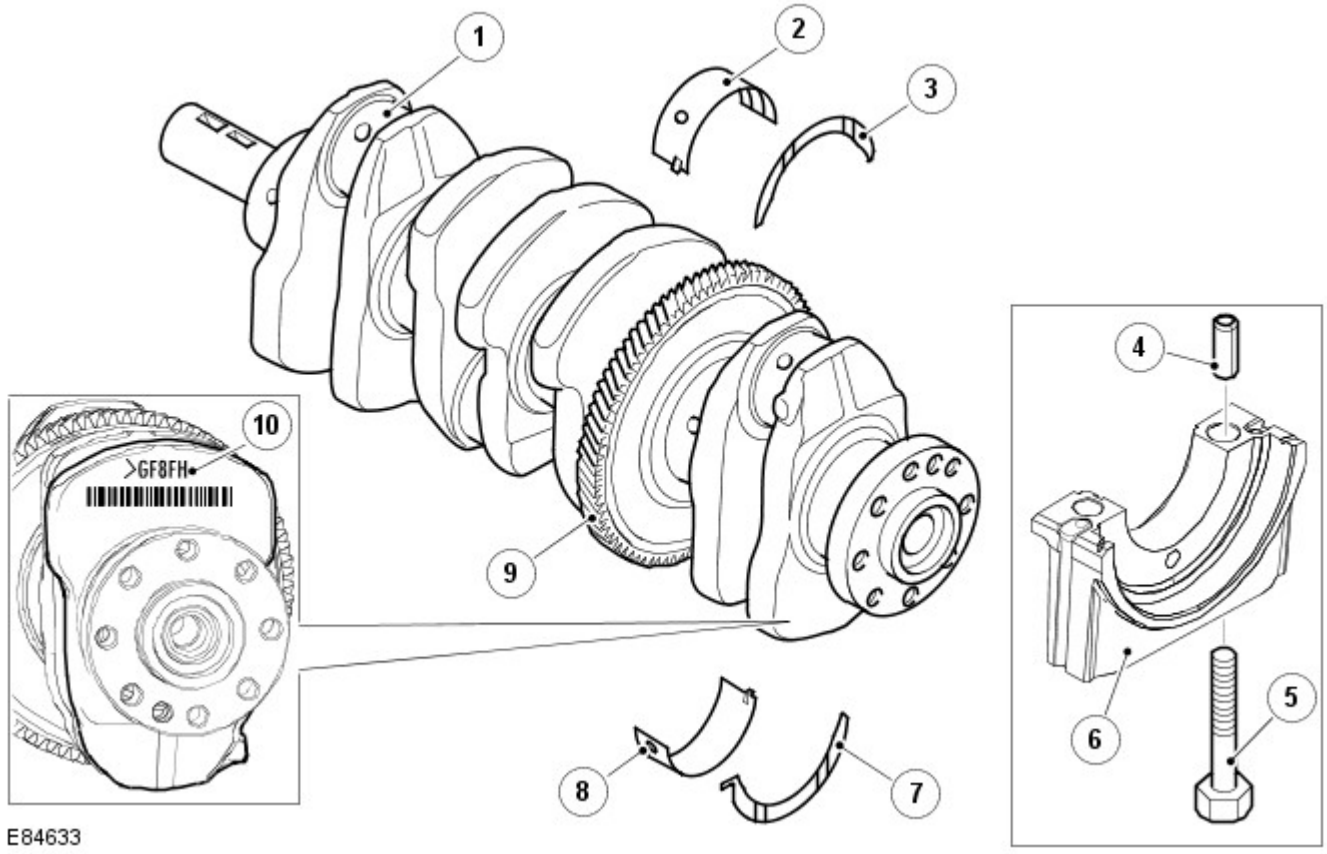
CRANKSHAFT AND OIL PAN COMPONENTS



Item	Part Number	Description
1	-	Piston ring set (3 rings per piston)
2	-	Piston assembly
3	-	Connecting rod assembly
4	-	Big-end bearing upper half shell (4 off)
5	-	Big-end bearing lower half shell (4 off)
6	-	Big-end bearing half cap bolt (8 off)
7	-	Main bearing upper half shell (4 off)
8	-	Upper thrust washer (2 off)
9	-	Crankshaft
10	-	Locating dowel
11	-	Crankshaft rear oil seal

12	-	Dual mass flywheel (manual transmission vehicles)
13	-	Bolt (8 off)
14	-	Torque converter flex-plate (automatic transmission vehicles)
15	-	Main bearing lower half shell (4 off)
16	-	Lower thrust washer (2 off)
17	-	Main bearing half cap (5 off)
18	-	Oil pump
19	-	Oil level gage tube (lower)
20	-	Bolt
21	-	Locating dowel
22	-	Oil pan housing
23	-	Oil pan housing bolt (20 off)
24	-	Oil pan captive bolt (21 off)
25	-	Oil drain plug seal
26	-	Oil drain plug
27	-	Oil pan
28	-	Oil temperature sensor
29	-	Screw (2 off)
30	-	Oil level gage tube (upper)
31	-	Oil level gage
32	-	Oil pump drive chain
33	-	Crankshaft pulley bolt
34	-	Plain washer
35	-	Crankshaft pulley and torsional vibration damper
36	-	CKP sensor target ring
37	-	Woodruff key (2 off)

Crankshaft and Main Bearings



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Item	Part Number	Description
1	-	Crankshaft
2	-	Main bearing upper half shell (4 off)
3	-	Upper thrust washer (2 off)
4	-	No. 1 main bearing cap locating dowel (2 off)
5	-	Main bearing cap bolt (10 off)
6	-	Main bearing half cap (5 off)
7	-	Lower thrust washer (2 off)
8	-	Main bearing lower half shell (4 off)
9	-	Counter-balance shaft drive gear
10	-	Main bearing classification markings

The crankshaft is manufactured from steel and formed with 5 main bearing and 4 connecting rod big-end journals. The main bearing journals locate in the cylinder block main bearing housings, and are clamped by the 5 main bearing half caps. Each main bearing half cap is stamped with the corresponding cylinder number for identification. The main bearing half cap identified with '1F' must be positioned at the transmission end of the engine (No. 1 end).

Lateral movement of the crankshaft is restricted by 4 half-round thrust washers, located on both sides of No. 2 main bearing. Lubrication grooves are formed on the thrust washers and must face toward the main bearing. The crankshaft end-float must be between 0.07 mm (0.003 in) and 0.32 mm (0.013 in).

Each main bearing housing and half cap contains an upper and lower bearing half shell manufactured from aluminum/tin. The upper half shells are formed with a drilling and annular groove to transfer pressurized oil from the main bearing, through crankshaft drillings to the connecting rod big-end bearings.

The main bearing half caps and the upper and lower bearing half shells are formed with a lug. The lug allows correct alignment of the bearing and cap, and prevents radial movement of the bearing.

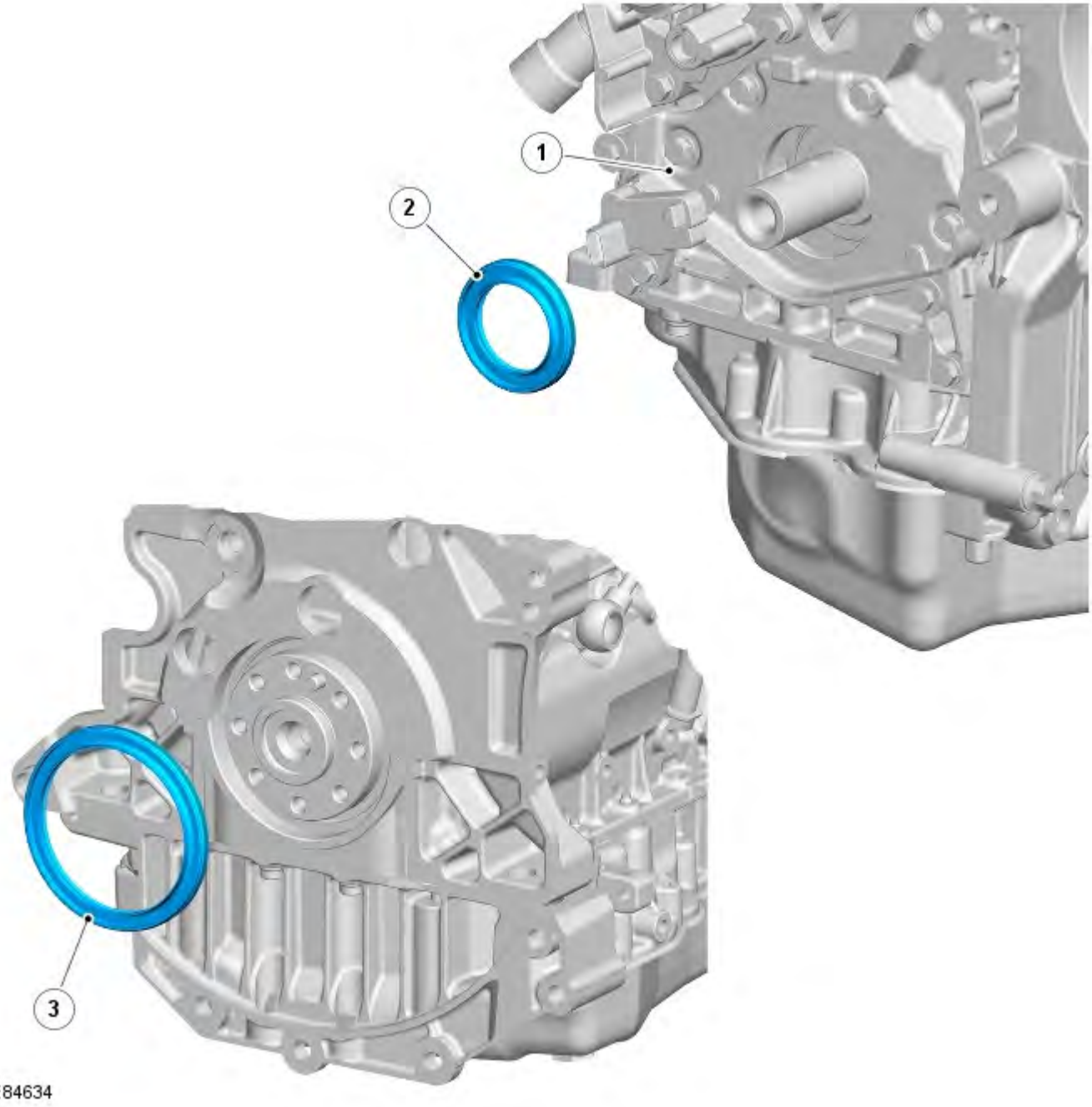
To maintain the correct crankshaft main bearing clearance, the main bearing half shells are available in varying thickness. The upper main bearing half shell is only available in 1 size; the lower main bearing half shell is available in 5 sizes. Both the upper and lower main bearing half shells are color coded for identification. To determine the correct size of bearing half shell, classification markings on the crankshaft front face and on the cylinder block front face are used in conjunction with a bearing size chart.

For further details on main bearing half shell installation, refer to the relevant Service Repair Procedures (SRP).

A drive gear is formed as a 'shrink-fit' on No. 3 crankshaft web, located between No. 2 main bearing journal and No. 2 connecting rod big-end journal. The drive gear is single helical cut and provides the drive to the counter-balance shaft gears. An 18 teeth spur gear is located on the front of the crankshaft, behind the front crankshaft sealing plate. The spur gear provides the drive to the oil pump assembly via a single row chain, and is locked to the crankshaft with a woodruff key.

A toothed gear mounted to the front of the crankshaft provides the drive for the camshaft timing belt. The drive gear contains 21 teeth and is keyed to the crankshaft with a woodruff key.

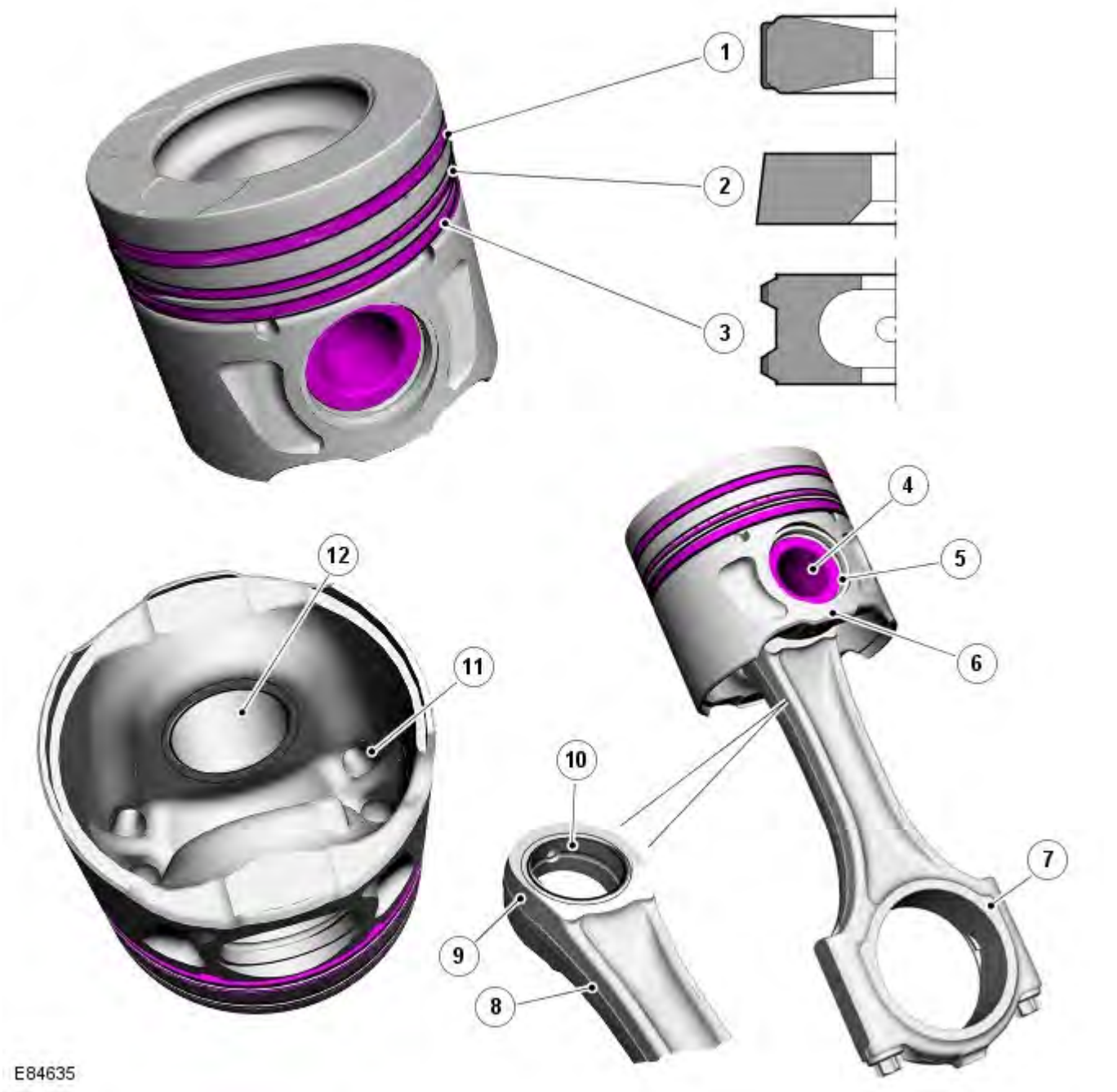
Crankshaft Oil Seals



Item	Part Number	Description
1	-	Crankshaft front seal adaptor
2	-	Crankshaft front oil seal
3	-	Crankshaft rear oil seal

The crankshaft is sealed to the cylinder block at the front and rear ends with lip type oil seals. Each seal is pressed into the corresponding front and rear cylinder block housing, with the lip facing the crankshaft. Special tools are required for removal and installation of the crankshaft seals.

Connecting Rods and Pistons



Item	Part Number	Description
1	-	Upper compression ring
2	-	Lower compression ring
3	-	Oil control 'scraper' ring
4	-	Gudgeon pin
5	-	Gudgeon pin circlip (2 off)
6	-	Piston and connecting rod assembly
7	-	Connecting rod big-end
8	-	Connecting rod shaft
9	-	Connecting rod small-end
10	-	Small-end bush
11	-	Piston crown cooling channel
12	-	Piston bush (2 off per piston)

The connecting rods are manufactured from forged steel with an 'I' beam shaft construction to provide high strength and durability. The connecting rod small-end is narrowed on each side to form a tapered head. The taper improves the distribution of force between the piston and connecting rod during the combustion stroke. A bronze bush is installed in the small-end, and formed with an internal groove to allow the flow of lubricating oil around the bush.

The connecting rod big-end is cut and machined at the joint to form a bearing housing and bearing cap that is secured by 2 bolts. The cylinder position is stamped on adjoining sides of the joint to identify matching connecting rods and bearing caps. A half shell bearing is installed in each half of the connecting rod big-end. The connecting rod bearing housings and shell bearings are manufactured with a lug that correctly aligns the bearing in the housing, and prevents radial movement of the bearing shells. During installation the lugs must face toward the LH side (oil filter side) of the engine.

To maintain the correct crankshaft big-end bearing clearance, the half shell bearings are available in varying thickness. The lower bearing half shell is only available in 1 size; the upper bearing half shell is available in 3 sizes.

For further details on connecting rod big-end bearing installation, refer to the relevant Service Repair Procedures (SRP).

The pistons are manufactured from aluminum alloy and are installed with 2 compression rings, and an oil control ring with a spiral spring. A steel insert is installed in the piston upper ring groove to provide reinforcement. The piston crown is a toroidal design that forms a pronounced bowl in the center of the piston head. Recesses are also formed in the piston crown to provide clearance for the 4 valve heads. This design of combustion chamber promotes high levels of swirl and turbulence required for complete combustion of the air/fuel mixture, and also improves the engine emissions.

The 3 piston rings must be installed with the ring gaps spaced at 120° (with permissible tolerance of 15° to 20°) to each other, around the piston. The 2 upper compression rings are stamped with 'top' to aid installation. The gap of the double beveled oil control ring must also be opposite the spiral spring joint.

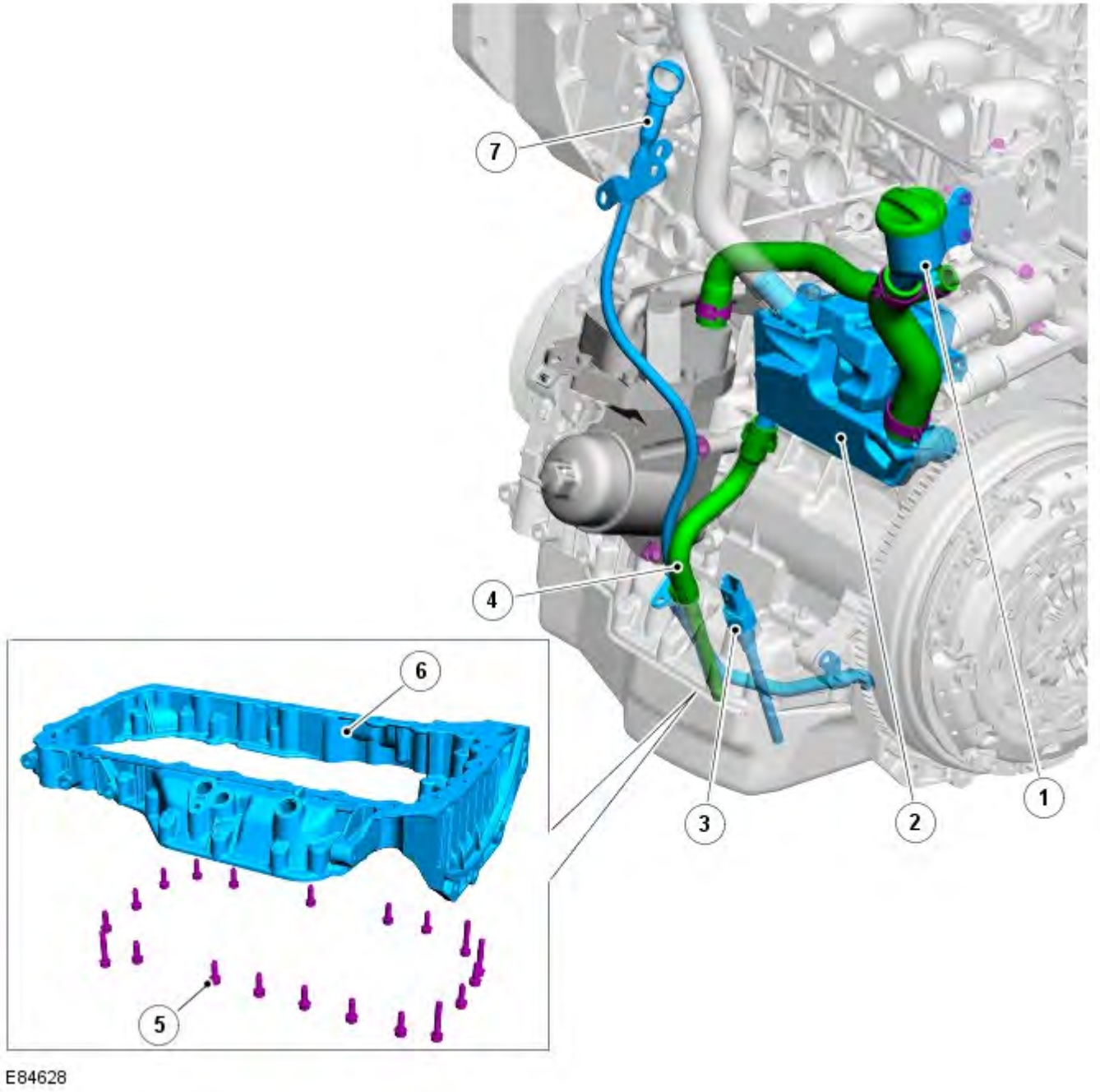
The full skirt piston is coated with a graphite based substance to reduce friction with the cylinder bore. The graphite based coating is especially important during the engine running in period and start-up. The piston also incorporates 2 oil cooling channels that are formed on the underside of the piston head.

Two bushed holes are formed at opposite sides of the piston skirt for installation of a fully floating gudgeon pin. The gudgeon pin passes through the piston bushed holes and connecting rod small-end, and is retained at each end with a circlip. The piston, gudgeon pin and connecting rod small-end are supplied with oil from an oil spray jet, located below each cylinder bore.

During installation of the pistons, the stamped direction arrow and 'DIST' on each piston crown must face toward the front of the engine (accessory drive end).

For further details on piston and piston ring installation, refer to the relevant Service Repair Procedures (SRP) manual.

Oil Pan Housing and Oil Separator



E84628

Item	Part Number	Description
1	-	Oil filler tube
2	-	Oil separator
3	-	Oil temperature sensor
4	-	Oil separator return pipe
5	-	Oil pan housing bolts (20 off)
6	-	Oil pan housing
7	-	Oil level gage

The aluminum oil pan housing is secured with 20 bolts to the bottom of the cylinder block, and forms an extension between the cylinder block and oil pan. The oil pan housing is required in order to increase the distance between the oil pump and oil pan, due to the installation of the counter-balance shaft assembly.

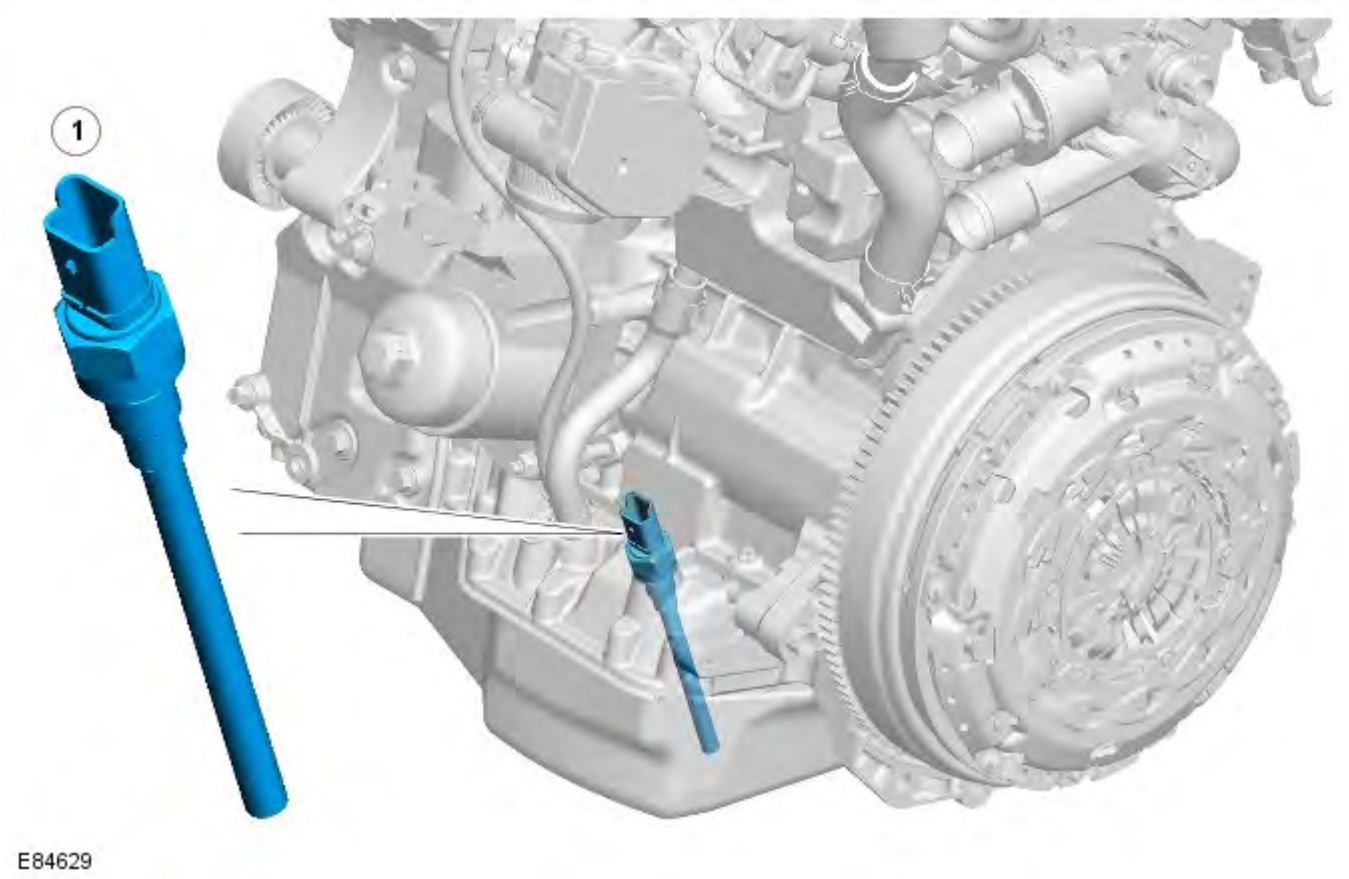
The rear of the oil pan housing provides the lower mounting points for the transmission casing. Drillings formed in the LH side of the housing provide the location for the oil level gage tube, oil temperature sensor, and the return hose from the crankcase ventilation oil separator.

The crankcase ventilation oil separator is also connected to the oil filler tube, located at the rear LH side of the engine. Oil for replenishing the system passes through the oil separator and return hose, and into the oil pan. An oil baffle plate is installed in the oil pan housing to reduce oil aeration and splash.

Oil Pump

The rotor type oil pump is located between the oil pan and oil pan housing, and attached with 5 bolts to the front of the counter-balance shaft assembly. The oil pump is driven by the crankshaft via a single row chain. For further information, refer to 'Lubrication System' within this section.

Oil Temperature Sensor



Item	Part Number	Description
1	-	Oil temperature sensor

The oil temperature sensor is located at the rear LH side of oil pan housing. The sensor body is screwed into the oil pan housing with the tip protruding into the oil pan. The sensor provides oil temperature information to the ECM.
For additional information, refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Oil Pan

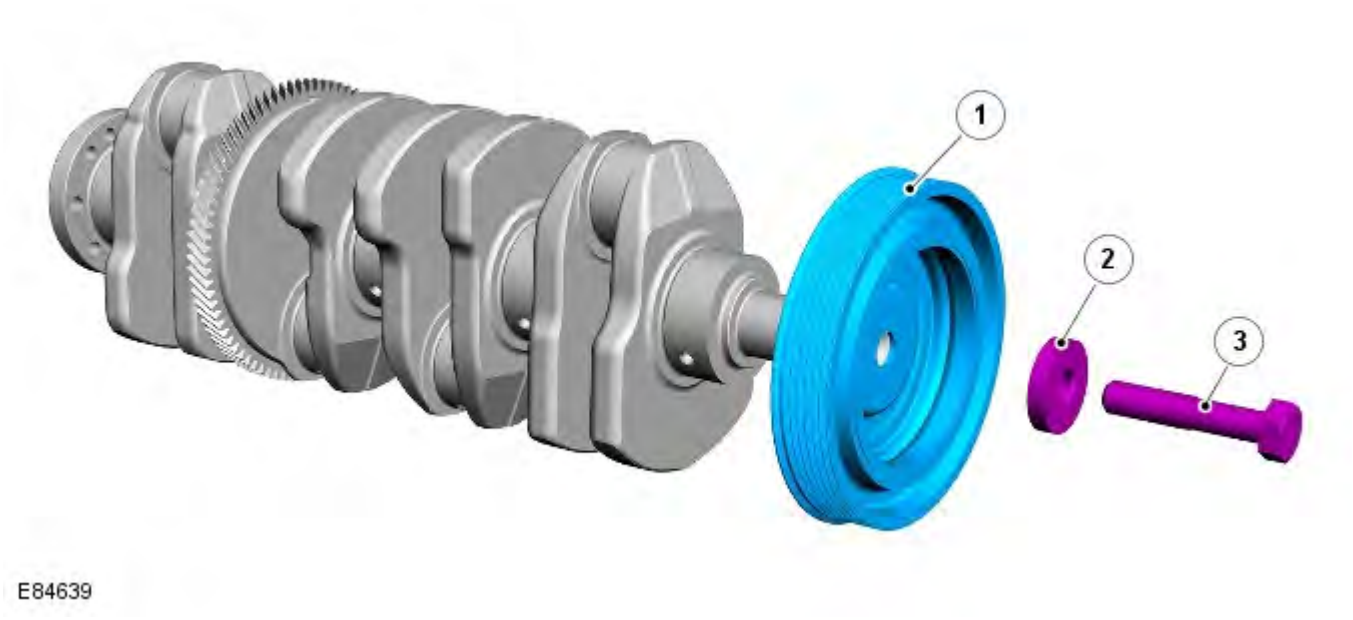
Item	Part Number	Description
1	-	Oil pan
2	-	Oil pan captive bolt (21 off)
3	-	Oil drain plug

The pressed steel oil pan is sealed with a liquid sealant, and secured with 21 captive bolts to the oil pan housing. An engine oil drain plug is located at the rear RH side of the oil pan.

• NOTE: The vehicle undertray must be removed to gain access to the oil pan drain plug.

The oil level gage is located on the LH side of the engine. Two notches in the end of the gage indicate the minimum and maximum oil levels. For further information, refer to 'Lubrication System' within this section.

Crankshaft Pulley and Torsional Vibration Damper



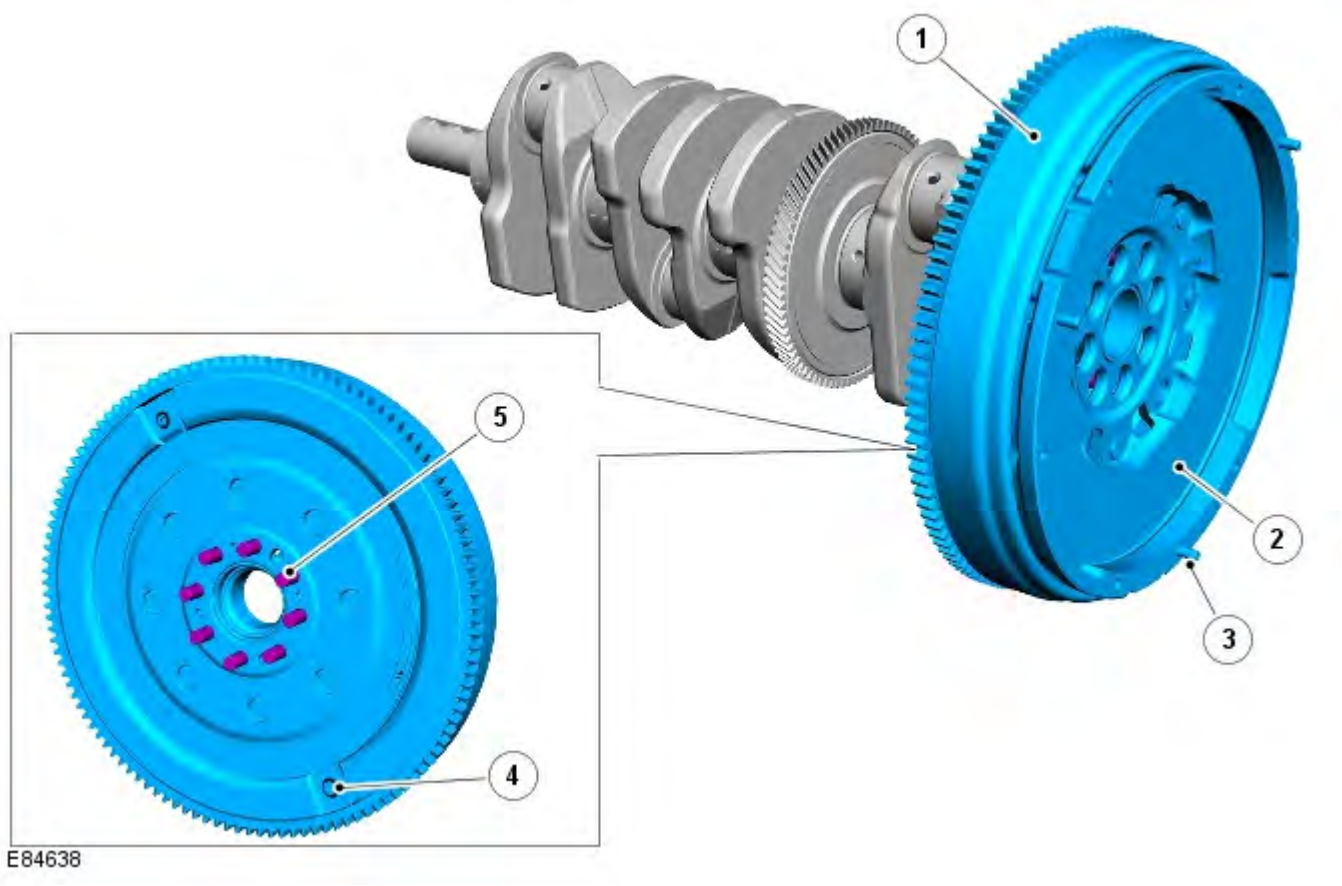
Item	Part Number	Description
1	-	Crankshaft pulley and torsional vibration damper
2	-	Plain washer
3	-	Crankshaft pulley bolt

The combined crankshaft pulley and torsional vibration damper provides drive from the crankshaft to the accessory components, via a 6 ribbed polyvee type drive belt.

The assembly is mounted to the front of the crankshaft in front of the CKP sensor ring, and is secured with a plain washer and bolt. The damper comprises a steel outer casing formed with drive belt grooves around the outer circumference, bonded to an inner rubber coupling and metal hub.

The torsional vibration damper acts to reduce vibrations produced by the engines reciprocal components.

Dual Mass Flywheel (Manual Transmission Vehicles Only)



Item	Part Number	Description
1	-	Dual mass flywheel
2	-	Clutch friction plate face
3	-	Clutch cover locating dowel (3 off)
4	-	Engine timing special tool location
5	-	Bolt (8 off)

The dual mass flywheel is installed on vehicles with manual transmission. On automatic transmission vehicles, a torque converter flex-plate is installed.

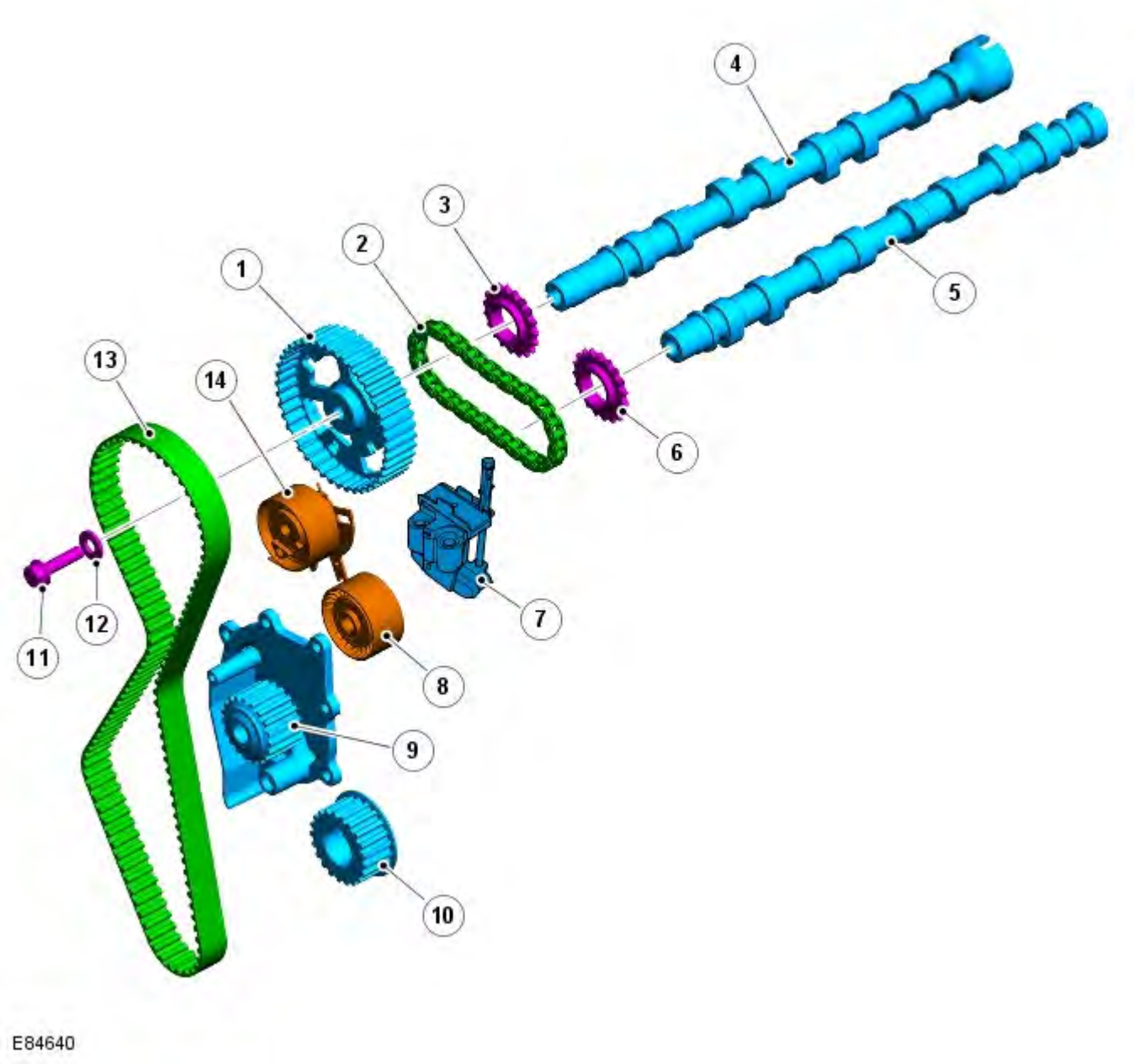
The dual mass flywheel comprises a primary mass and a secondary mass that transmits drive, via the clutch driven plate, to the gearbox. The secondary mass is supported on a roller bearing within the primary mass. The primary mass is secured to the flanged rear end of the crankshaft with 8 bolts. The drive between the primary and secondary masses is transmitted through a torsional spring damper. The flywheel provides a constant drive speed to the gearbox, without transmitting torsional and transient vibrations produced by the engine.

The outer face of the flywheel is machined to provide a smooth surface for the clutch friction plate to engage on. Three dowels are equally spaced around the outer edge of the secondary mass, and provide the location for the clutch cover assembly. The flywheel is dynamically balanced to eliminate vibrations from the rotating assembly.

A ring gear formed on the outer circumference of the primary mass allows the engagement of the starter motor.

Two holes are formed on the engine side of the dual mass flywheel. The larger diameter hole is provided to accept the insertion of an engine timing special tool.

CAMSHAFT TIMING COMPONENTS



E84640

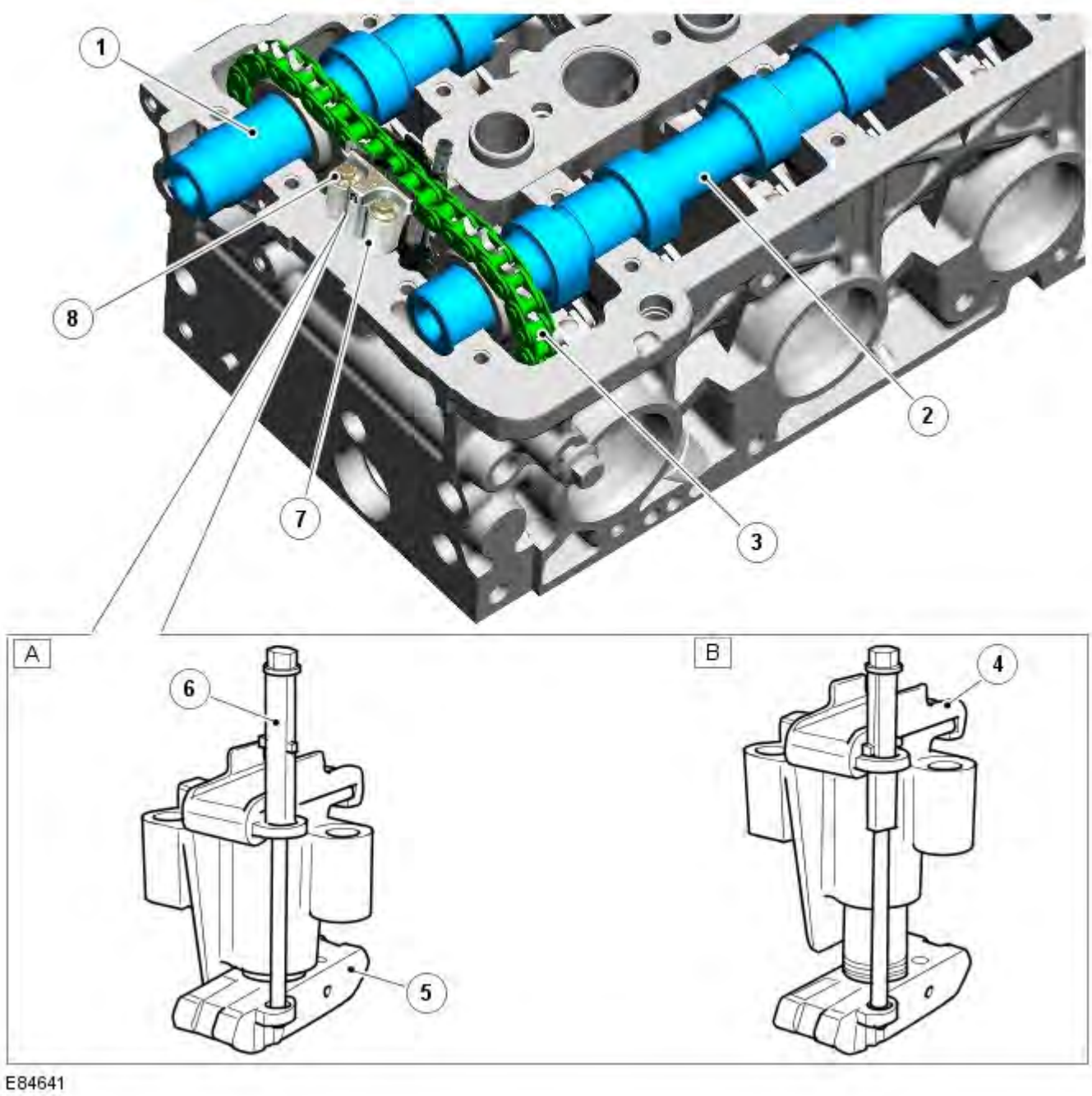
Item	Part Number	Description
1	-	Exhaust camshaft pulley
2	-	Camshaft timing chain
3	-	Exhaust camshaft drive gear
4	-	Exhaust camshaft
5	-	Intake camshaft
6	-	Intake camshaft drive gear
7	-	Timing chain hydraulic tensioner
8	-	Idler pulley
9	-	Coolant pump drive gear
10	-	Crankshaft drive gear
11	-	Bolt
12	-	Plain Washer
13	-	Camshaft drive belt
14	-	Automatic tensioner

Camshaft Drive

The crankshaft gear drives the exhaust camshaft via a toothed timing belt routed around the coolant pump, automatic tensioner and idler pulleys. The crankshaft and timing components rotate clockwise when viewed from the front of the engine. Correct belt tension is maintained by the spring loaded automatic tensioner, located on the RH front face of the cylinder block.

The tensioner also provides the means to remove the belt. The idler pulley is located behind the front engine mounting, and is secured to the cylinder block with the engine mounting lower bolt that passes through the center of the pulley.

Timing Chain Hydraulic Tensioner



E84641

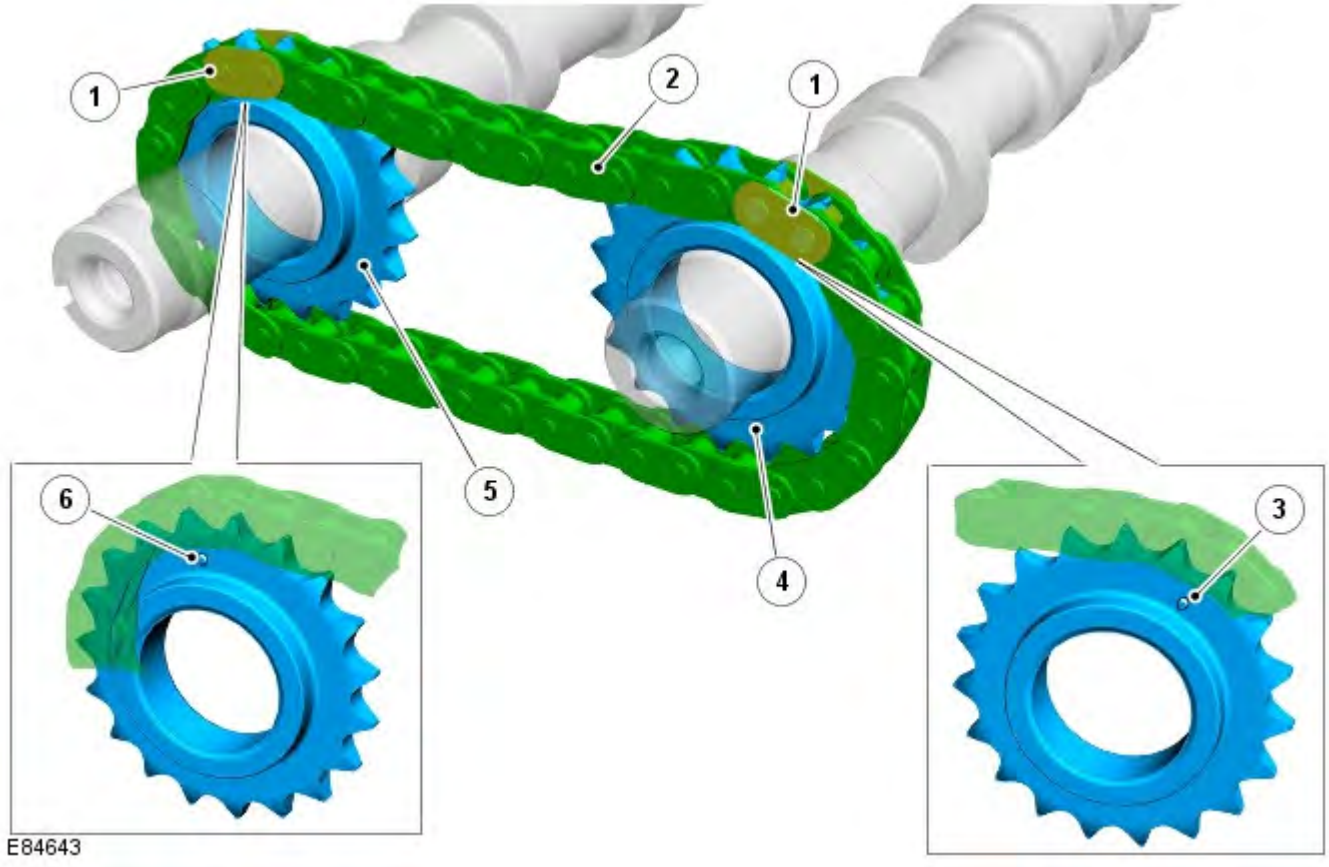
Item	Part Number	Description
A	-	Hydraulic tensioner - retained position
B	-	Hydraulic tensioner - released position
1	-	Exhaust camshaft
2	-	Intake camshaft
3	-	Camshaft timing chain
4	-	Upper chain guide
5	-	Tensioner head
6	-	Tensioner service pin
7	-	Hydraulic tensioner
8	-	Bolt (3 off)

The intake camshaft is driven by the exhaust camshaft via a short 40-link timing chain. The chain is routed around a drive gear formed on each of the camshafts. Chain tension is controlled by a hydraulic tensioner mounted between the camshafts, and secured with 3 screws to the cylinder head. The tensioner body is drilled with an oil passage that coincides with an oil port in the cylinder head.

The hydraulic tensioner assembly is positioned between the upper and lower sides of the chain, with the tensioner head acting on the lower side of the chain. The tensioner head and upper end of the tensioner are manufactured from molded plastic, and are formed with chain guides.

The tensioner body houses an integral plastic service pin that locates in the hydraulic tensioner head. The service pin remains integral with the tensioner and is used during maintenance to withdraw and lock the hydraulic tensioner in the retained position.

Camshaft Timing Chain

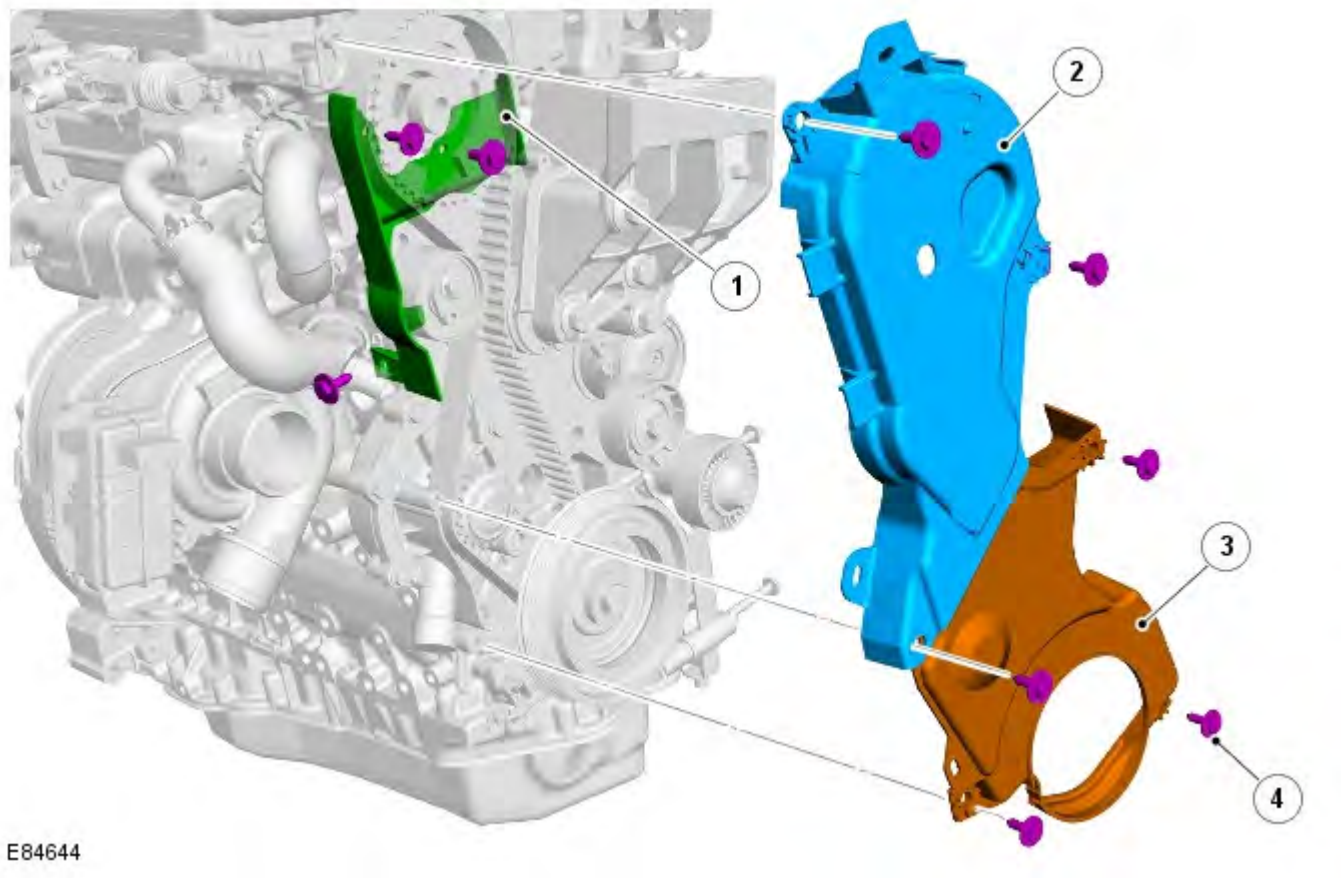


Item	Part Number	Description
1	-	Timing chain colored link
2	-	Camshaft timing chain
3	-	Intake camshaft timing mark
4	-	Intake camshaft drive gear
5	-	Exhaust camshaft drive gear
6	-	Exhaust camshaft timing mark

The chain is provided with 2 colored timing links that coincide with a timing mark on the front face of each camshaft drive gear. The timing marks are provided for correct setting of the camshaft and valve timing. For further details on setting the valve timing, refer to the relevant Service Repair Procedures (SRP) manual.

The timing chain and camshaft gears are splash lubricated with oil from the hydraulic tensioner.

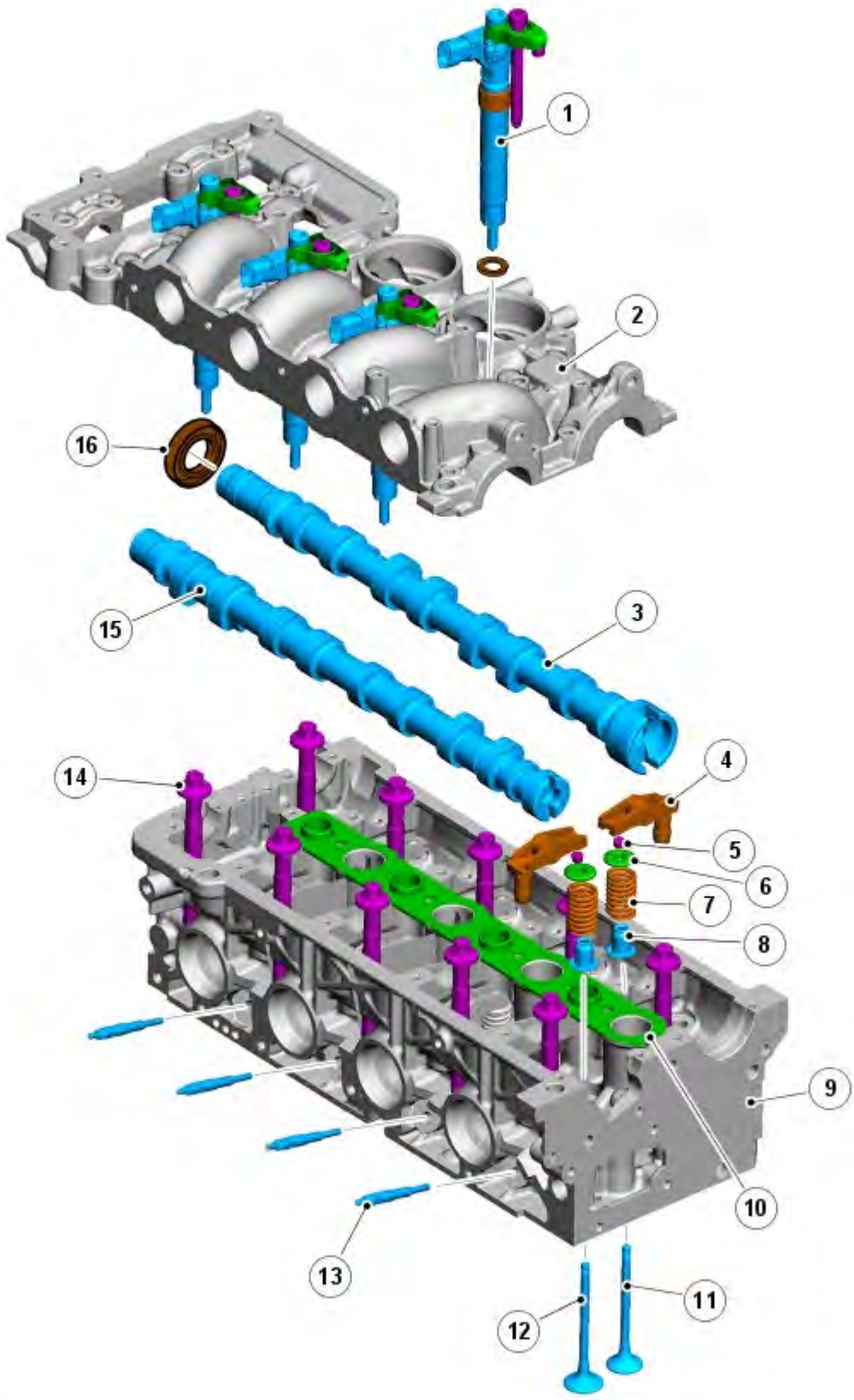
Camshaft Drive Component Covers



Item	Part Number	Description
1	-	Rear timing belt cover
2	-	Upper timing belt cover
3	-	Lower timing belt cover
4	-	Screw (9 off)

A 1-piece rear and 2-piece front timing belt cover encloses the camshaft drive components. The plastic timing covers are secured to the cylinder block and cylinder head with 9 screws. A hole is formed in the upper front timing belt cover, and is provided to allow the insertion of a special tool used to lock the exhaust camshaft pulley.

CYLINDER HEAD COMPONENTS

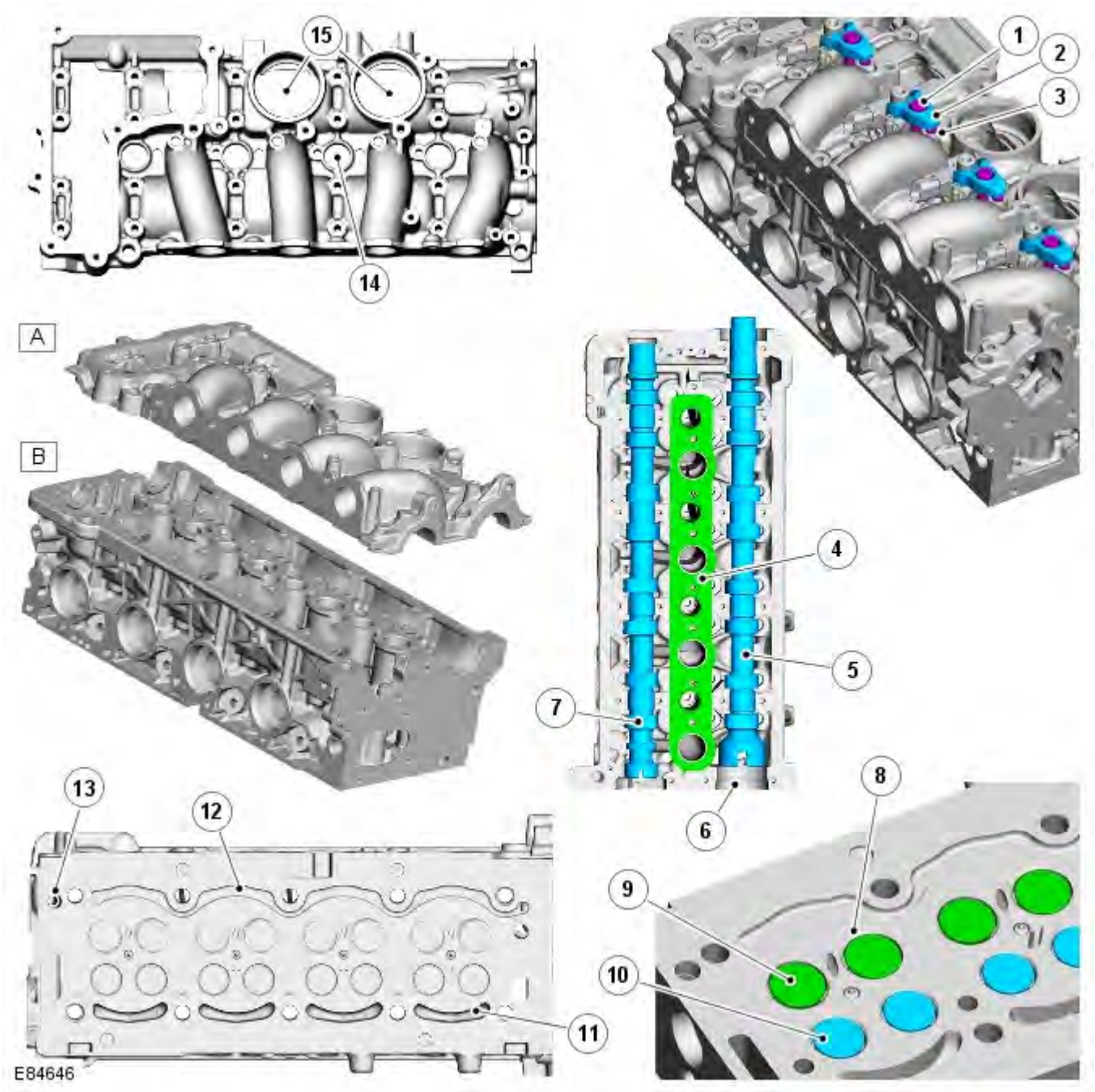


E84645

Item	Part Number	Description
1	-	High Pressure (HP) fuel injector (4 off)
2	-	Structural camshaft cover
3	-	Exhaust camshaft
4	-	Hydraulic lash adjuster and roller finger rocker (16 off)
5	-	Split taper collets (32 off)
6	-	Upper spring guide (16 off)
7	-	Valve spring (16 off)
8	-	Lower spring guide (16 off)
9	-	Cylinder head
10	-	Gasket
11	-	Exhaust valve (8 off)

12	-	Intake valve (8 off)
13	-	Glow plug (4 off)
14	-	Cylinder head bolt (10 off)
15	-	Intake camshaft
16	-	Cylinder head front oil seal

Cylinder Head and Structural Camshaft Cover



Item	Part Number	Description
A	-	Structural camshaft cover
B	-	Cylinder head
1	-	Injector mounting clamp bolt (4 off)
2	-	Injector mounting clamp (4 off)
3	-	Dowel (4 off)
4	-	Gasket
5	-	Exhaust camshaft
6	-	Camshaft bearing housing (5 per camshaft)
7	-	Intake camshaft
8	-	Intake port raised profile (at each intake port)
9	-	Intake valve
10	-	Exhaust valve
11	-	Cooling channel
12	-	Cooling channel
13	-	Oil supply port
14	-	Injector bore
15	-	PCV ports

The cylinder head and structural camshaft cover are manufactured to form mating parts. The parts are milled in a single operation and accurately positioned with 2 alignment sleeves. The 2 components must always be installed together, and not renewed as separate components. The cylinder head and camshaft cover are sealed to each other during manufacture with a gasket and silicone based sealant, and are secured with 27 bolts. An oil seal installed at the front of the cylinder head provides sealing of the exhaust camshaft housing. The open ports at the rear of the cylinder head are sealed with the vacuum pump and high-pressure fuel pump sealing rings.

Two alignment sleeves correctly locate the cylinder head and gasket to the cylinder block. The cylinder head is secured to the cylinder block with 10 deep-seated bolts.

• NOTE: The cylinder head bolts are not accessible with the structural camshaft cover installed.

• NOTE: The cylinder head is not to be reworked.

The cylinder head is manufactured from aluminum alloy, having valve seats and guides made of sintered steel. The cylinder head is precisely machined and milled to incorporate the 4 combustion chambers, camshaft lower bearing housings, oil drillings and coolant galleries, and the air intake, valve timing and fuel system component bores and housings.

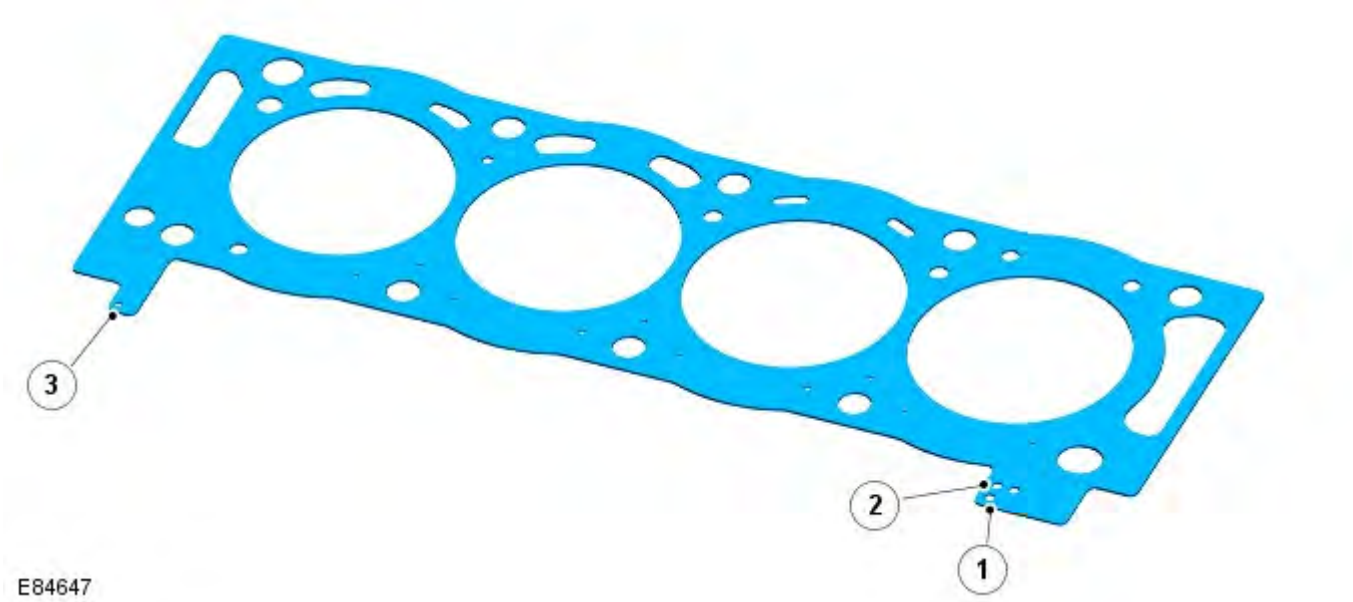
The design of the cylinder head maximizes air flow and swirl in the combustion chambers. The 2 intake valve seats are machined with raised profiles that act to promote swirl of the intake air flow. Combined with the action of the intake manifold helical port, the swirl effect of the 2 intake port profiles allows the air and injected fuel to completely mix, and reach the outer edge of the combustion chamber.

The structural camshaft cover is manufactured from aluminum alloy, and is machined on the upper surface with the camshaft upper bearing housings. The cover is also formed with 4 intake air filling tracts, fuel injector bores and orifices for the cylinder head cover PCV components. The intake air tracts join the intake air manifold to the cylinder head intake filling ports.

The cylinder head also provides the mounting locations for the following:

- Front engine mounting
- Front and rear engine lifting eyes
- Intake and exhaust manifolds
- EGR valve and cooler
- Fuel filter support bracket
- Thermal control module
- Vacuum pump and high-pressure fuel pump.

Cylinder Head Gasket

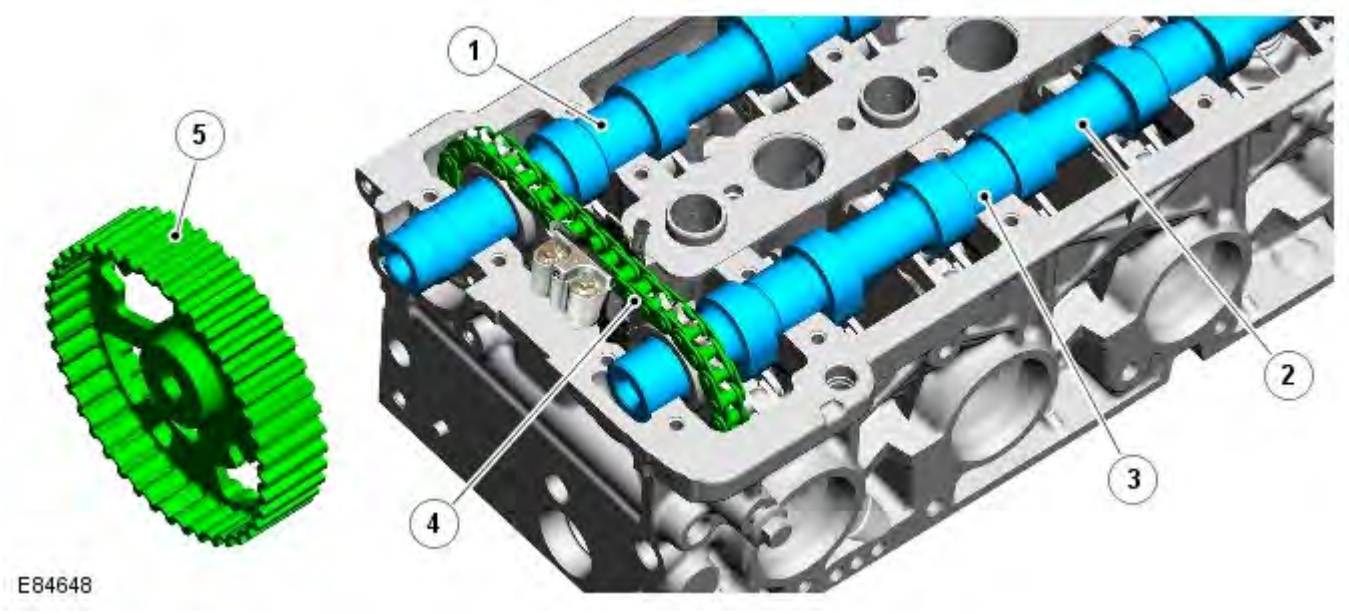


Item	Part Number	Description
1	-	Engine type identification
2	-	Gasket thickness identification
3	-	Gasket thickness identification

The cylinder head gasket is made from laminated metal and is available in 4 different thicknesses. Lugs formed on the side of the gasket are 'dot' marked to identify the engine type, and the thickness of the gasket installed. A new gasket is selected based on the piston protrusion measurement from the cylinder block.

For further details on cylinder head gasket selection, refer to the relevant Service Repair Procedures (SRP) manual.

Camshafts



Item	Part Number	Description
1	-	Exhaust camshaft
2	-	Intake camshaft
3	-	No. 3 bearing (end-float control)
4	-	Single row timing chain
5	-	Exhaust camshaft pulley

The intake and exhaust camshafts are manufactured from cast-iron. The 2 camshafts are mounted between the structural camshaft cover and cylinder head, with each camshaft located in 5 machined bearing housings. Shell bearings are not used in the bearing housings, the camshafts run directly in the aluminum bearing. Lateral movement of the camshafts is controlled by No. 3 camshaft bearing, and is not adjustable. The bearing is manufactured on both camshafts to provide the correct end-float.

• NOTE: In production, the camshaft end-float is 0.070 mm to 0.168 mm (0.003 in to 0.007 in). In service, if the end-float is out of specification the camshaft(s) and/or cylinder head and structural camshaft cover may require renewal.

Each camshaft has 8 machined lobes formed in pairs along the length of the camshaft. The camshaft lobes operate the inlet and exhaust valves through hydraulic lash adjusters and roller-type finger levers

A spur gear with 19 teeth is formed on the front end of each camshaft. The 2 gears are joined by a 40-link single row timing chain. The 2 camshaft gears are marked with a timing mark that coincides with the 2 colored links on the camshaft timing chain. A drive slot is formed in the rear end of each camshaft to provide the drive to the flange mounted vacuum pump and high-pressure fuel pump. The vacuum pump is driven by the inlet camshaft; the high-pressure fuel pump is driven by the exhaust camshaft.

The exhaust camshaft is driven by the crankshaft drive gear via a toothed timing belt. The exhaust camshaft pulley contains 42 teeth and is keyed and bolted to the front of the exhaust camshaft. The intake camshaft is driven by the exhaust camshaft via the single row chain.

The exhaust camshaft pulley is manufactured with cut-outs and a notch in the center hub. The cut-outs form the target area for the CMP sensor. The notch provides the location for a camshaft timing pin special tool. The special tool is used in conjunction with other special tools to set the exhaust camshaft during engine timing.

For further details on setting the engine valve timing, refer to the relevant Service Repair Procedures (SRP) manual.

Engine Valve Timing

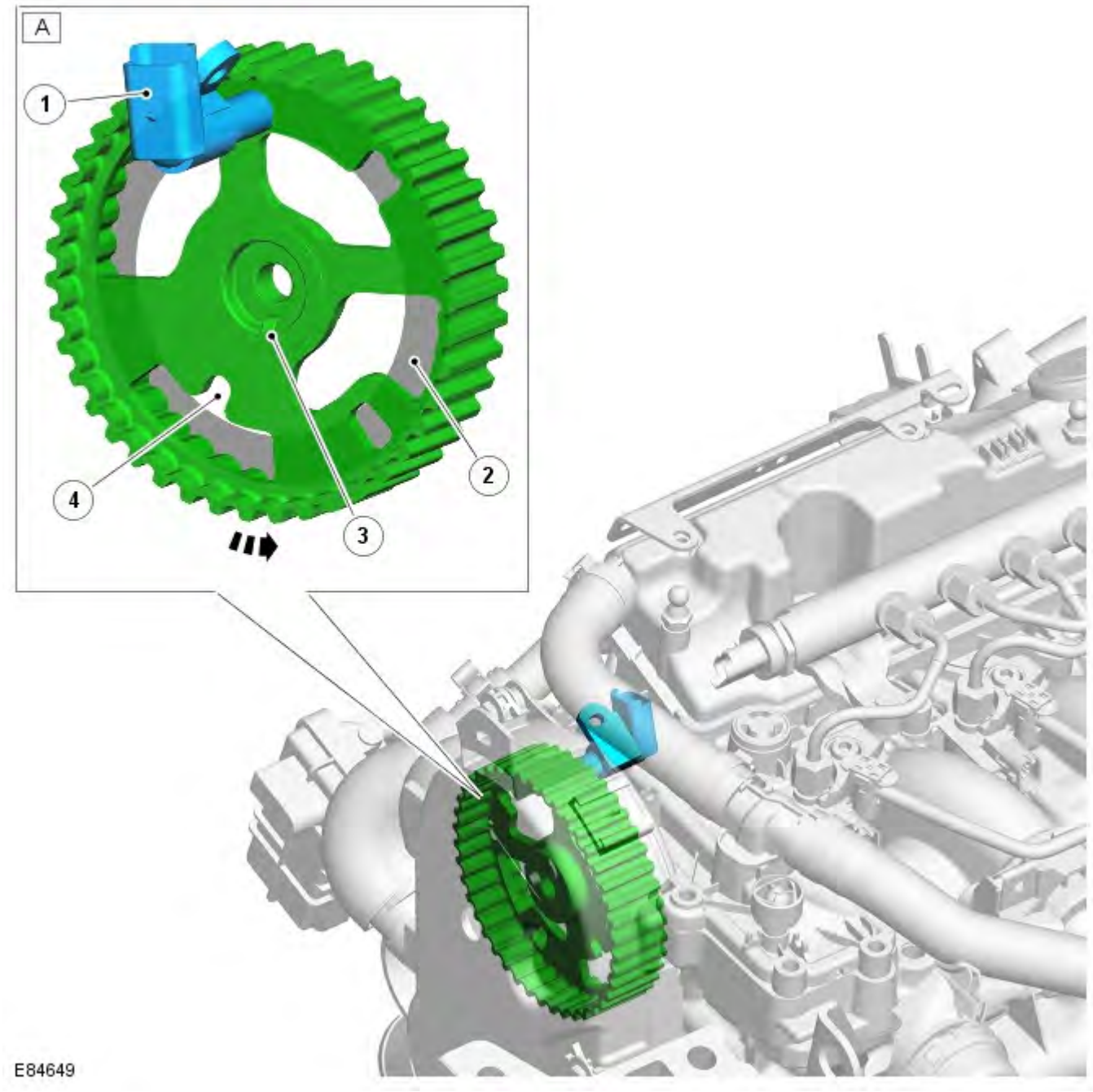
The valve timing values are shown in the following table:

Valve	Position
Inlet valve opens	15 degrees BTDC
Inlet valve closes	12 degrees ABDC
Exhaust valve opens	23 degrees BBDC
Exhaust valve closes	17 degrees ATDC

Key:

- BTDC = Before Top Dead Center
- ABDC = After Bottom Dead Center
- BBDC = Before Bottom Dead Center
- ATDC = After Top Dead Center.

Camshaft Position (CMP) Sensor



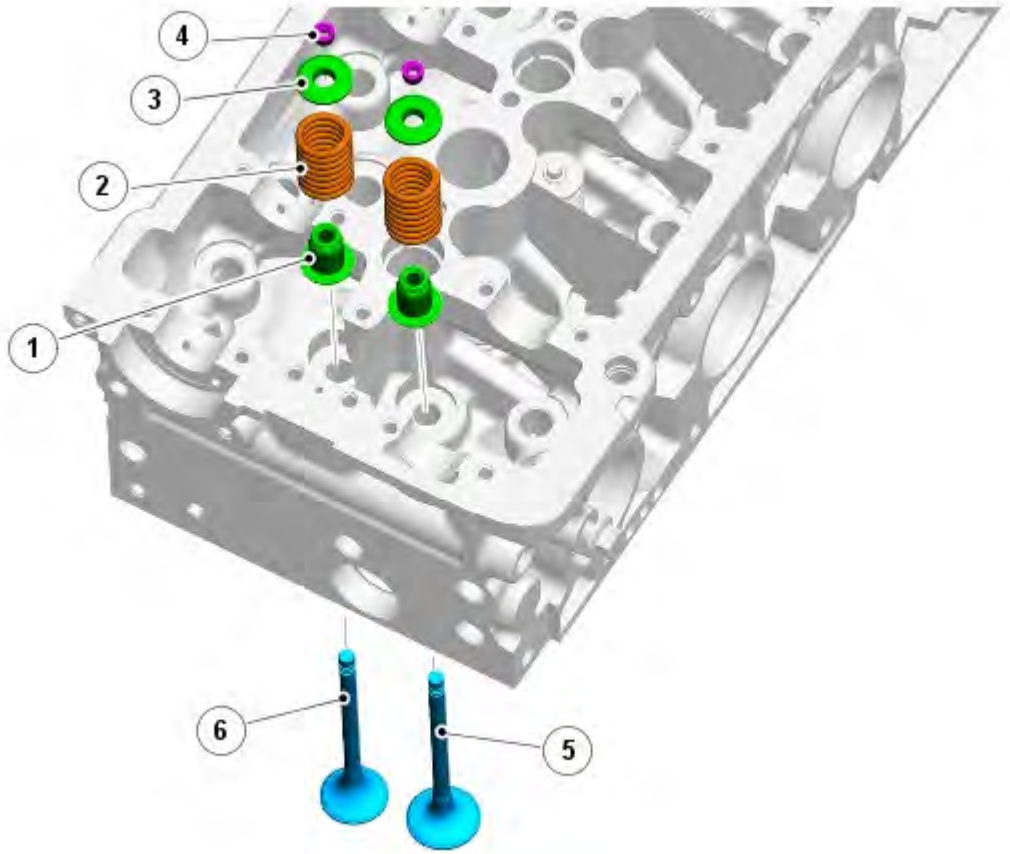
Item	Part Number	Description
A	-	Rear view of exhaust camshaft pulley
1	-	CMP sensor
2	-	CMP target area
3	-	Camshaft pulley key slot
4	-	Camshaft timing pin location

The CMP sensor is mounted at the front of the engine behind the exhaust camshaft drive pulley. The sensor tip protrudes through a hole in the cylinder head cover, and is positioned close to the camshaft pulley target area. The position of the sensor to the camshaft pulley is adjustable.

For further details on setting the CMP sensor gap, refer to the relevant Service Repair Procedures (SRP) manual.

The sensor is a variable reluctance sensor that provides a signal of No. 1 cylinder camshaft position to the ECM. The information is used by the ECM to determine the precise moment for injection during engine cranking.
For additional information, refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Intake and Exhaust Valves



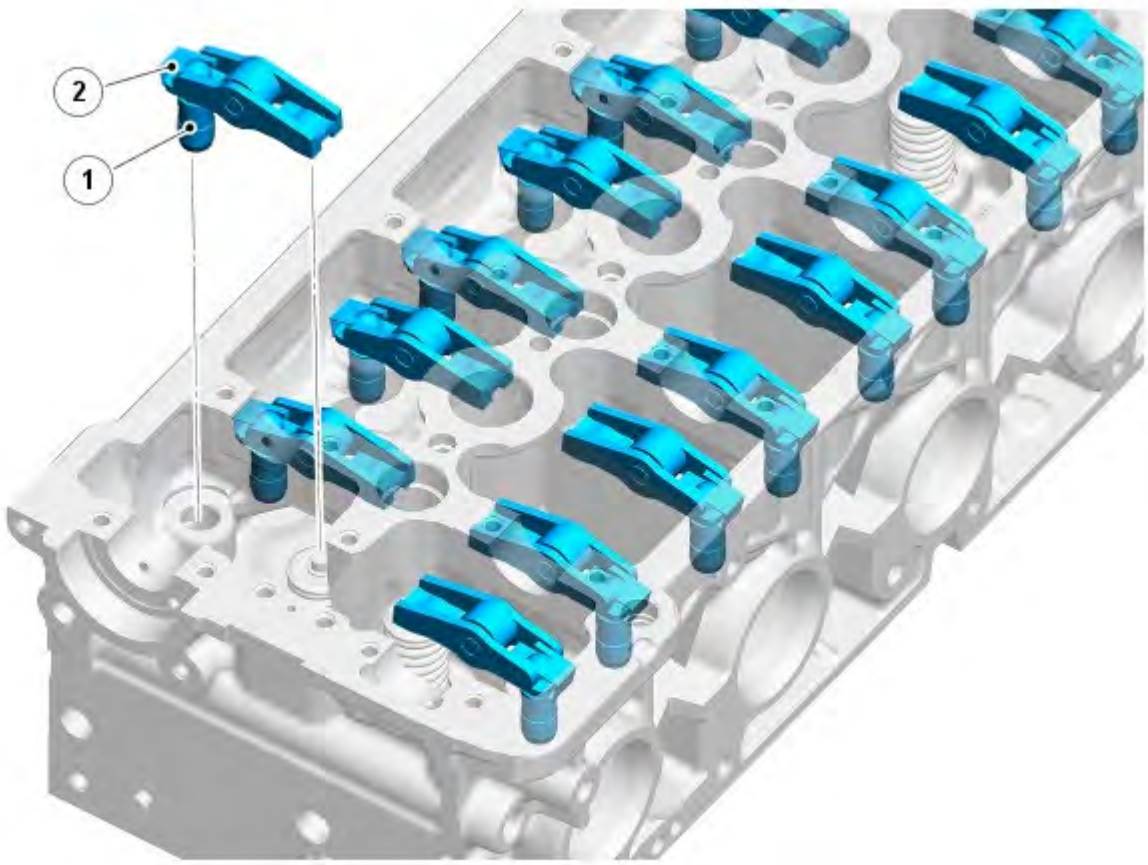
Item	Part Number	Description
1	-	Lower spring guide
2	-	Valve spring
3	-	Upper spring guide
4	-	Split taper collets
5	-	Intake valve
6	-	Exhaust valve

The cylinder head incorporates 2 overhead camshafts operating 4 valves per cylinder, via steel roller rockers with hydraulic lash adjusters.

The intake valve is produced from a single material having a head diameter of 24.70 mm (0.972 in). The exhaust valve head and stem are produced from different materials that are friction welded together. The exhaust valve head diameter is 22.33 mm (0.879 in). Both the intake and exhaust valve stem diameters are 6.0 mm (0.236 in).

The 16 valve springs are single helical-coil type, and manufactured from 3 mm (0.118 in) spring steel. Each spring is installed over a valve stem, with the spring located in a lower spring guide that seats against the cylinder head. The spring upper end locates in an upper spring guide that is attached to the valve stem with 2 split taper collets. The 2 taper collets are formed with grooves on the internal bore and locate in formed grooves in the upper valve stem. The lower spring guide also forms the valve stem seal and is installed with an O-ring.

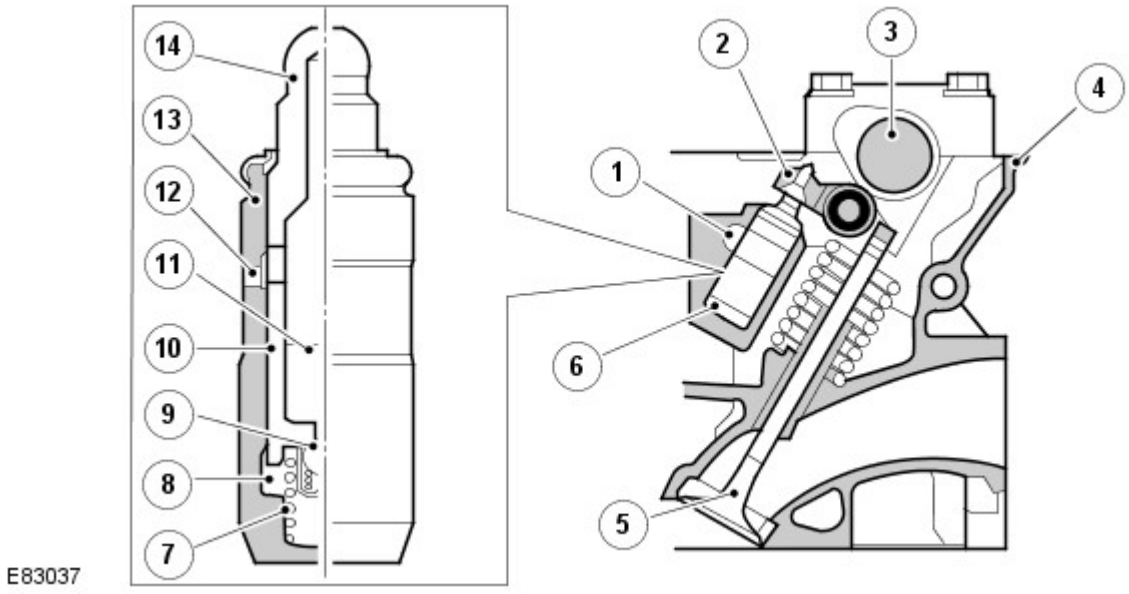
Hydraulic Lash Adjusters and Roller Finger Rockers



Item	Part Number	Description
1	-	Hydraulic lash adjuster
2	-	Roller finger rocker

The 16 valves are operated with roller-type finger rockers and hydraulic lash adjusters, actuated by the camshaft lobes. One end of the finger rocker rests on the end of the valve stem; the other end is attached to a hydraulic lash adjuster. The center of the finger rocker is formed with a roller that remains in contact with the camshaft lobe.

Typical Hydraulic Lash Adjuster



Item	Part Number	Description
1	-	Oil passage
2	-	Roller finger rocker
3	-	Camshaft
4	-	Cylinder head
5	-	Valve

6	-	Hydraulic lash adjuster
7	-	Plunger spring
8	-	High-pressure chamber
9	-	Ball valve
10	-	Plunger
11	-	Reservoir chamber
12	-	Oil passage
13	-	Hydraulic lash adjuster body
14	-	Plunger cap

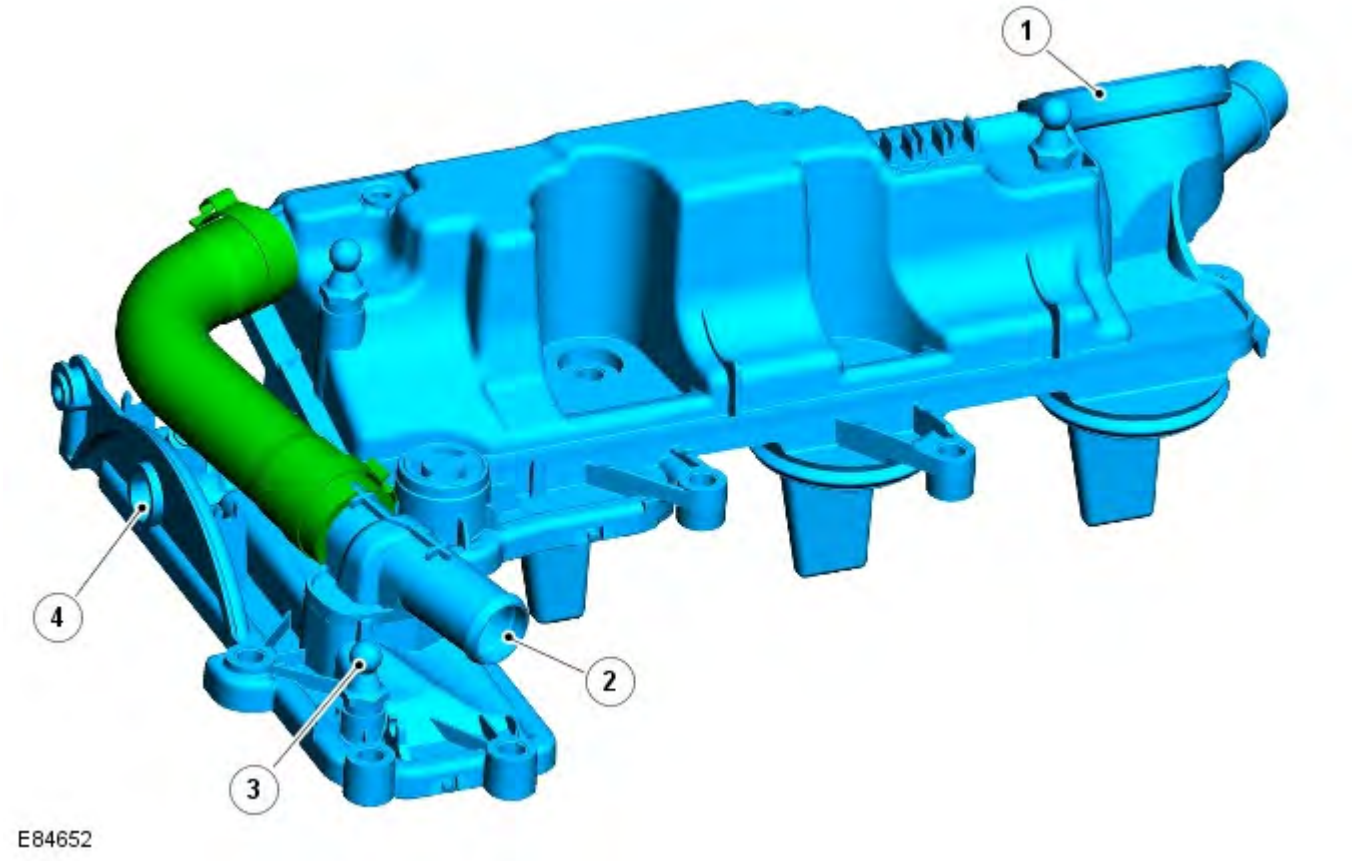
Movement of the camshaft lobe presses down on the finger rocker roller, and consequently, the hydraulic lash adjuster and valve mechanism are forced down together. The respective valve is forced down against valve spring pressure, and the hydraulic plunger is also forced into an oil chamber in the cylinder head. This type of valve actuation minimizes friction between the valve operating components, and also eliminates the requirement for manual adjustment.

The body of the hydraulic lash adjuster contains a plunger, and 2 chambers for oil feed and pressurized oil. The pressurized oil is supplied to the lash adjuster via the cylinder head oil gallery, and through a hole in the side of the lash adjuster body. The oil passes into a feed chamber within the lash adjuster, and then through to a separate pressure chamber via a one-way ball valve.

Oil flow from the pressure chamber is determined by the clearance between the lash adjuster outer body and the center plunger. Oil escapes up the side of the plunger each time the lash adjuster is operated. The downward pressure on the plunger forces a corresponding amount of oil in the lash adjuster body to be displaced.

As the camshaft lobe rotates further, downward pressure on the camshaft and finger rocker is removed. The lash adjuster plunger is forced up by the oil pressure contained in the pressure chamber. The pressure is not sufficient to affect valve operation, but is sufficient to eliminate the clearance between the finger rocker and top of the valve stem.

Cylinder Head Cover



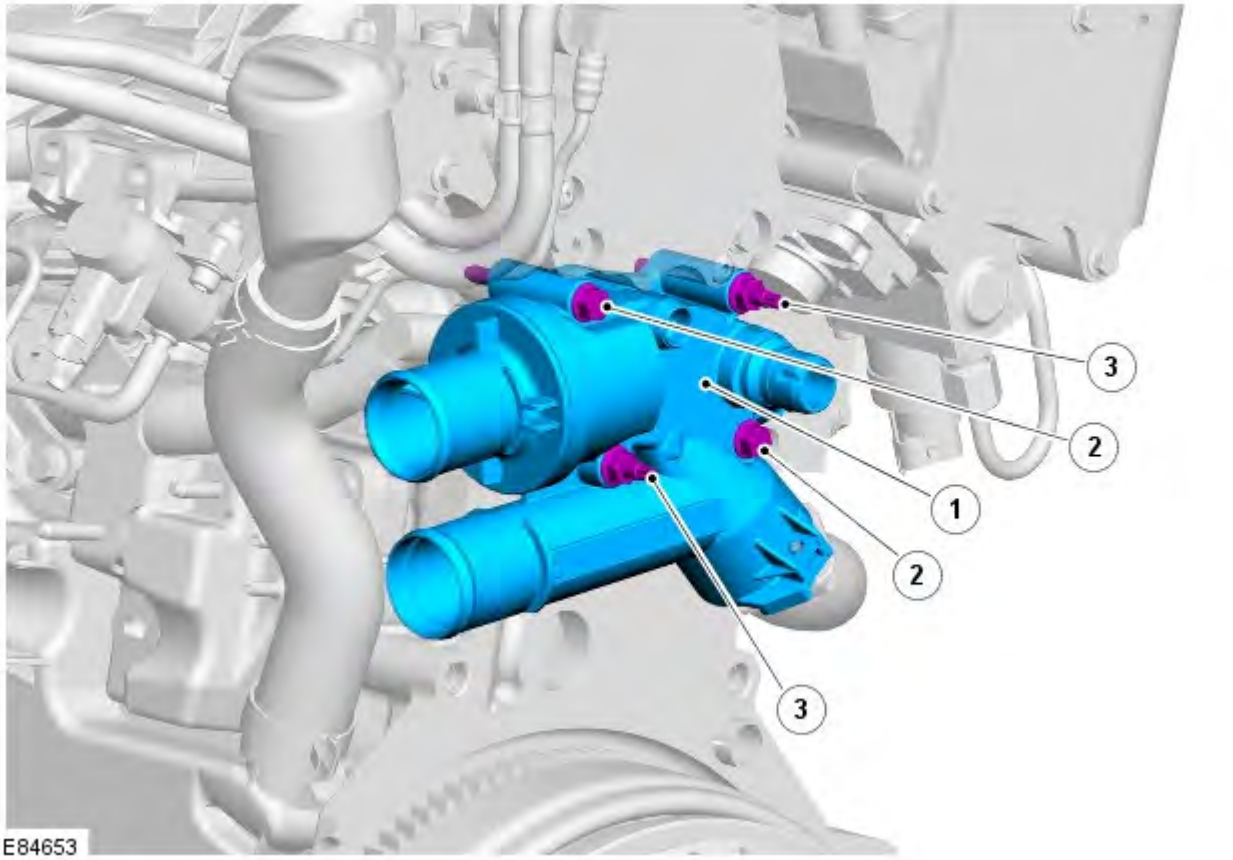
Item	Part Number	Description
1	-	PCV valve
2	-	Crankcase ventilation hose connection
3	-	Engine cover fixing
4	-	CMP sensor location

The 'L' shaped cylinder head cover is installed over the structural camshaft cover and encloses the exhaust camshaft, and the intake and exhaust camshaft drive openings. A preformed gasket and the PCV component O-rings provide the seal between the 2 covers.

The cylinder head cover is manufactured from composite materials, and incorporates the Positive Crankcase Ventilation Valve (PCV), safety valve and crankcase ventilation connections.
For additional information, refer to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Description and Operation).

The cylinder head cover provides the location for the CMP sensor, and 3 of the acoustic engine cover fixings.

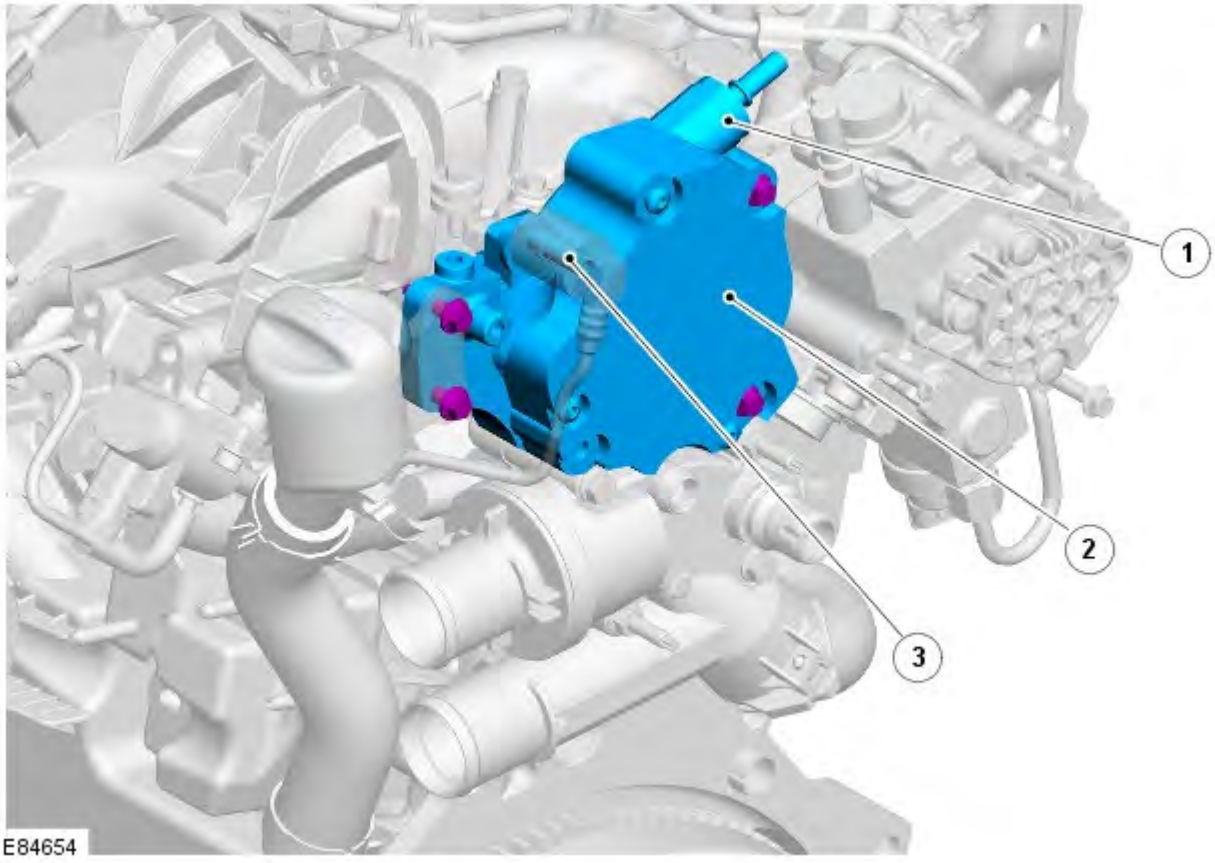
Thermal Control Module



Item	Part Number	Description
1	-	Thermal control module
2	-	Securing bolt (2 off)
3	-	Securing stud and nut (2 off)

The cooling system thermal control module is secured to the rear of the cylinder head by 2 studs with nuts and 2 bolts, and is sealed to the head with an O-ring. The module contains the cooling system thermostat and forms the junction for the cooling system hoses.
For additional information, refer to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Description and Operation).

Vacuum Pump



Item	Part Number	Description
1	-	Connection to brake booster
2	-	Vacuum pump
3	-	Connection to port de-activation valve

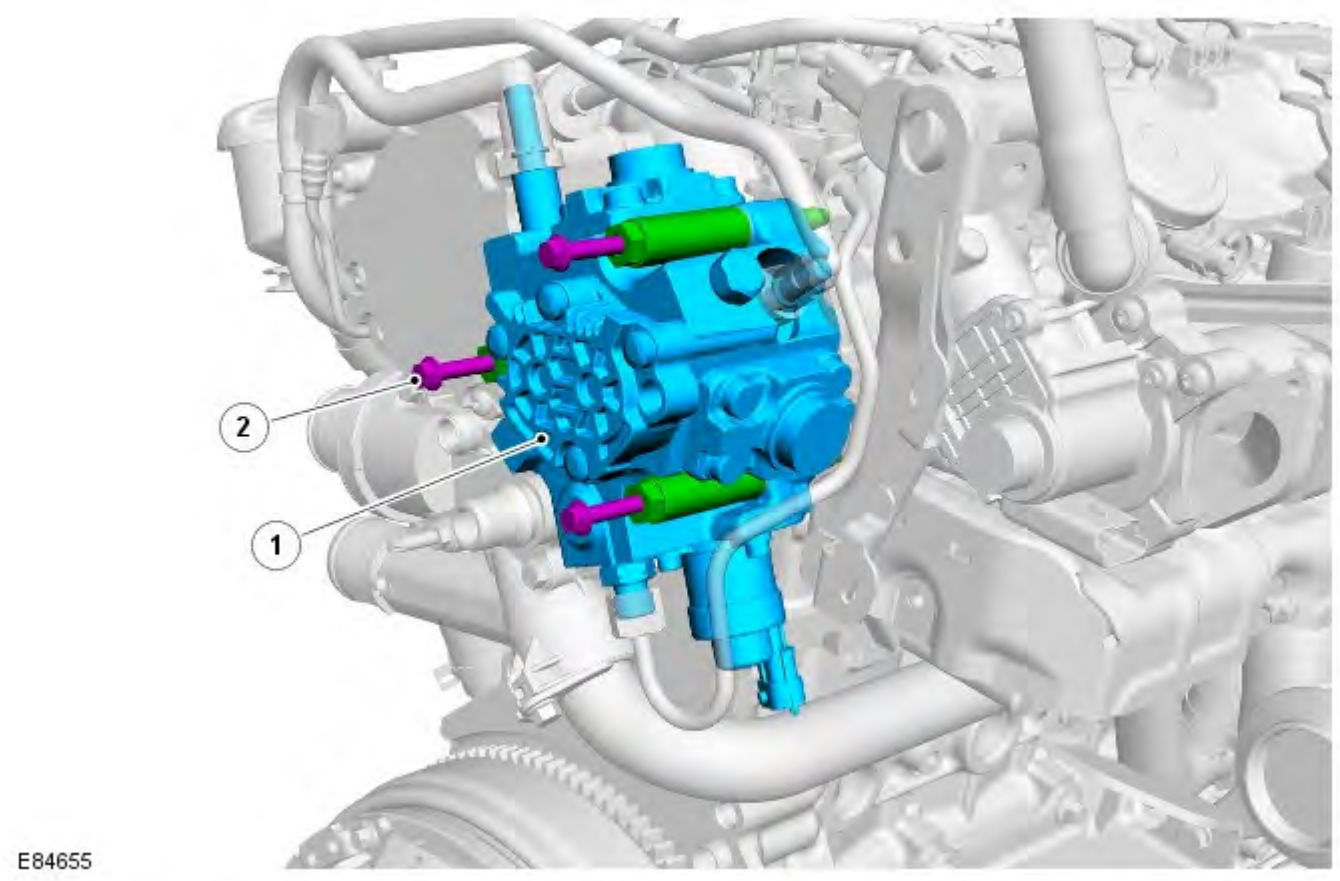
The vacuum pump is mounted with 3 bolts to the rear LH side of the cylinder head, and is driven by the intake camshaft. The pump housing is manufactured with a flanged face and a cylindrical housing that contains the pump drive shaft. The drive shaft housing protrudes into the cylinder head housing and is sealed with an O-ring. The end of the drive shaft is formed with a drive lug that locates in a corresponding slot formed in the end of the intake camshaft.

The vacuum pump is used for brake booster operation, and actuation of the intake manifold port de-activation device. For additional information, refer to:

Brake Booster (206-07 Power Brake Actuation, Description and Operation),
Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation),
Intake Air Distribution and Filtering (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Description and Operation).

High-Pressure Fuel Pump

- NOTE: HP pump protective crash shield not shown.



Item	Part Number	Description
1	-	High-pressure fuel pump
2	-	Bolt (3 off)

The high-pressure fuel pump is mounted with 3 bolts to the rear RH side of the cylinder head, and is driven by the exhaust camshaft. The pump housing is manufactured with a flanged face, and a cylindrical housing containing the pump drive shaft. The drive shaft housing protrudes into the cylinder head housing and is sealed with an O-ring.

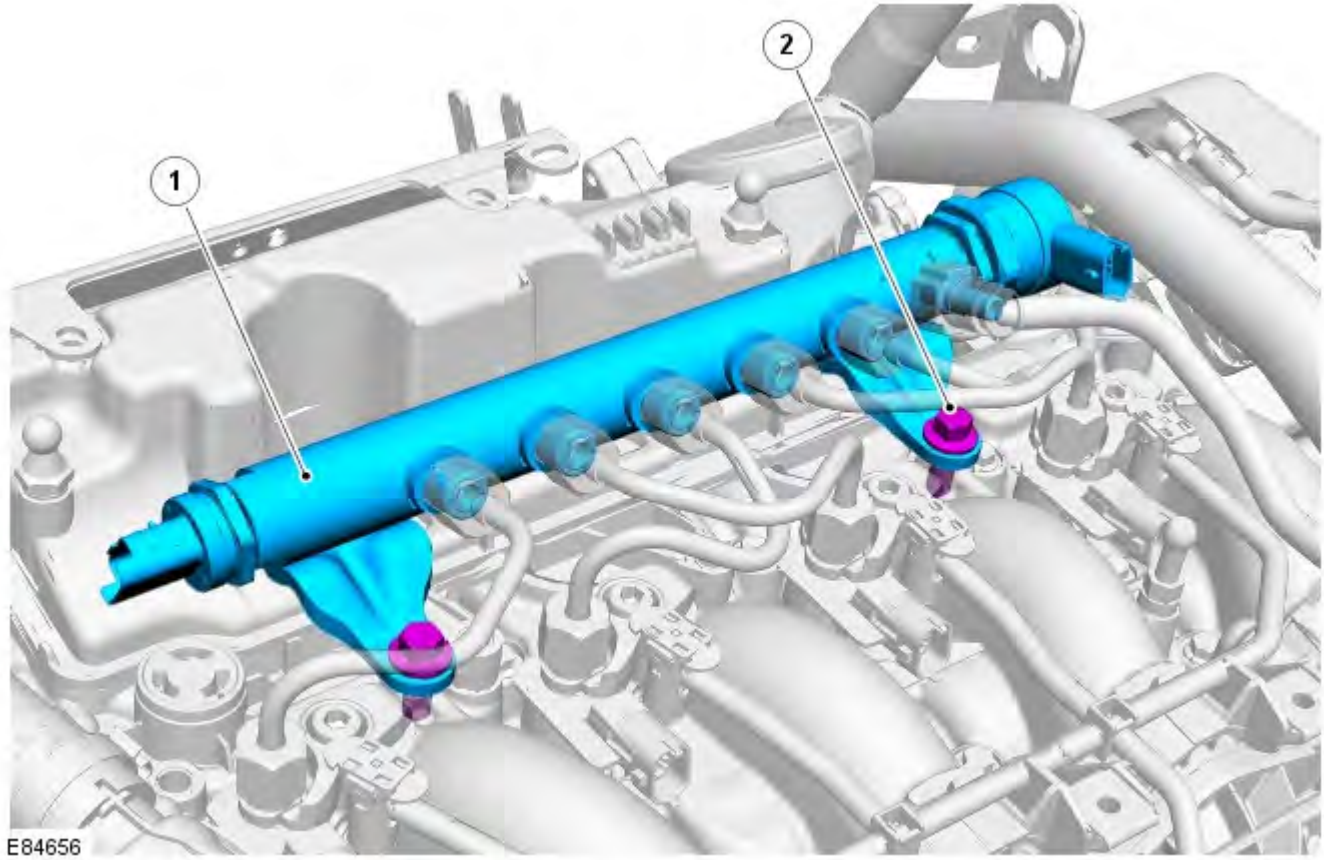
A drive plate is installed over the drive shaft end, and connects to a corresponding slot formed in the end of the exhaust camshaft.

A crash shield is installed to the front of the HP fuel pump to provide protection during a frontal impact.

The fuel pump is a 3 radial piston type that delivers fuel to the common fuel rail, under the control of the ECM. For additional information, refer to:

> Fuel Charging and Controls (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Description and Operation), Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

High-Pressure Common Fuel Rail



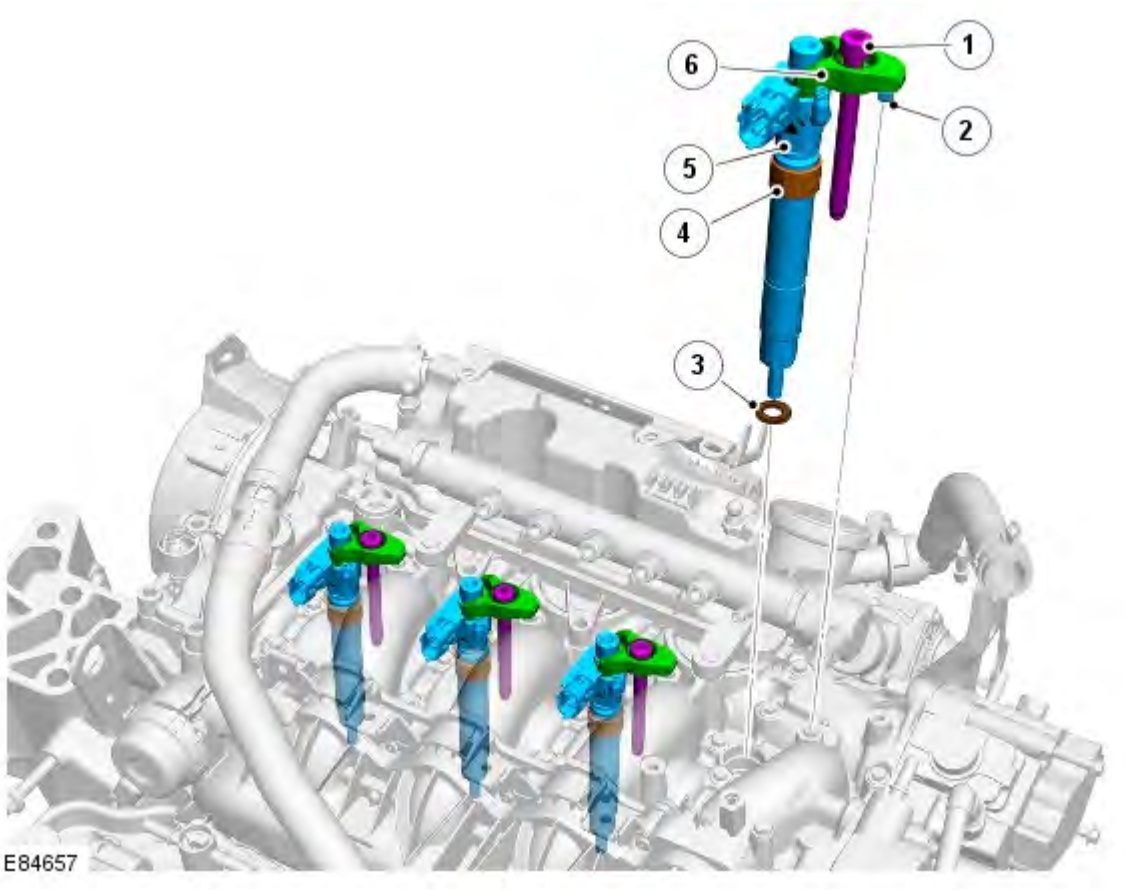
Item	Part Number	Description
1	-	High-pressure common fuel rail
2	-	Bolt (2 off)

The common fuel rail is manufactured from forged steel and is secured with 2 bolts to the cylinder head, above the line of the exhaust camshaft. The fuel rail stores pressurized fuel from the high-pressure fuel pump and delivers the fuel to the fuel injectors.

The fuel rail pressure is regulated by a Pressure Control Valve (PCV) located at the fuel pump end of the fuel rail, under the control of the ECM. A fuel pressure sensor installed in the opposite end of the fuel rail provides the actual fuel pressure signal to the ECM. For additional information, refer to:

> Fuel Charging and Controls (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Description and Operation), Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Fuel Injectors



Item	Part Number	Description
1	-	Injector mounting clamp bolt
2	-	Dowel
3	-	Copper washer
4	-	Centering ring
5	-	Injector
6	-	Injector mounting clamp

The 4 piezo-electric operated fuel injectors are centrally mounted above each cylinder combustion chamber. Each injector is sealed against the base of the injector bore with a copper washer. A centering ring installed over the injector body makes sure the injector is correctly positioned within the injector bore.

• NOTE: A new copper washer must be installed and the old washer discarded, whenever an injector is removed from the cylinder head. The centering ring may be re-used during injector removal.

The injector pipes are single use only, and must be renewed whenever a pipe connection is released.

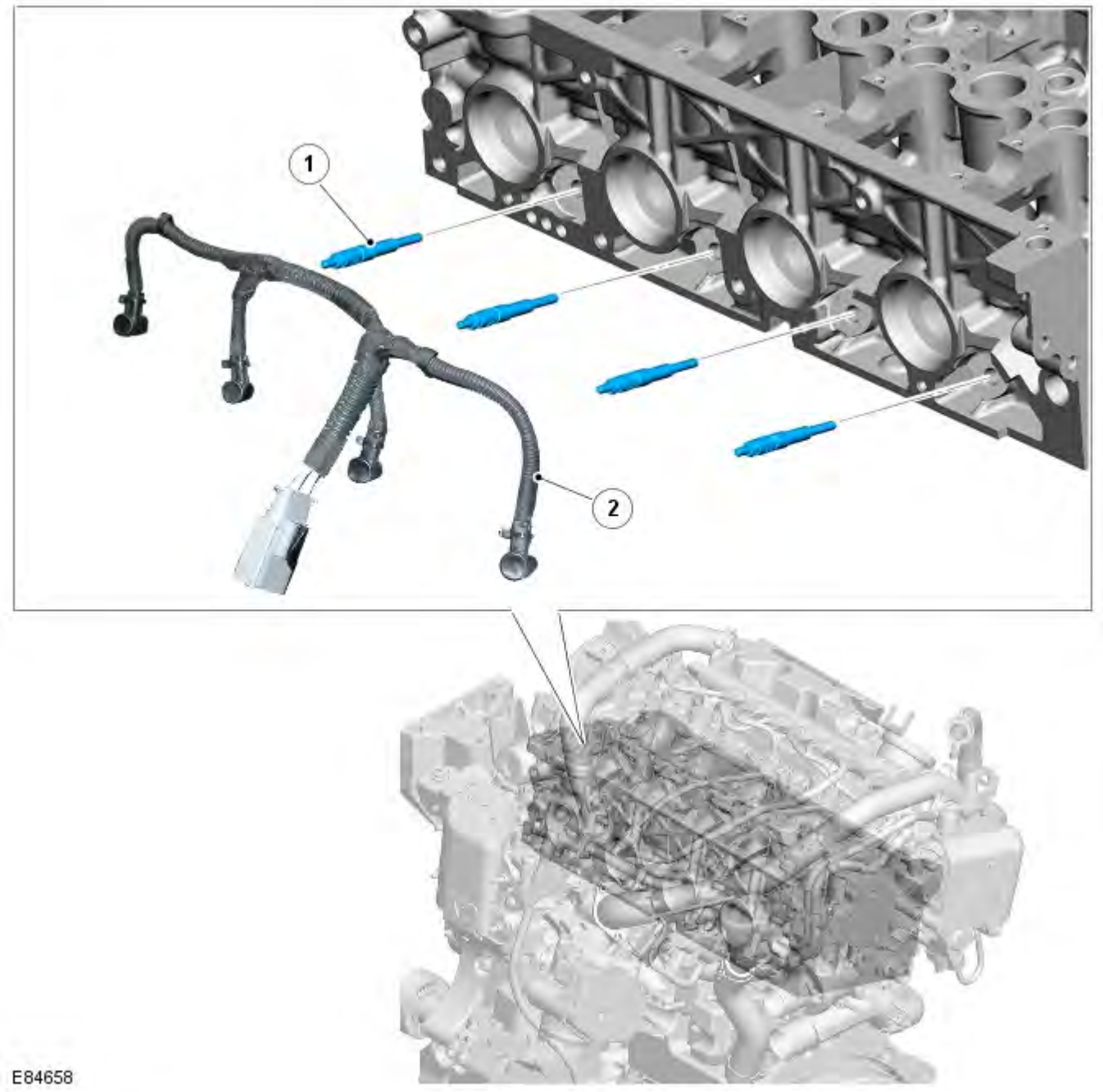
The injector is secured to the structural camshaft cover with an injector mounting clamp and bolt. A dowel that is a loose fit in the camshaft cover provides the anchor point for the opposite end of the injector mounting clamp.

• NOTE: Care must be taken when removing the structural camshaft cover or injectors to prevent accidental loss of the injector mounting clamp dowels.

Operation of the injectors is controlled directly by the ECM. For additional information, refer to:

> Fuel Charging and Controls (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Description and Operation), Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Glow Plugs



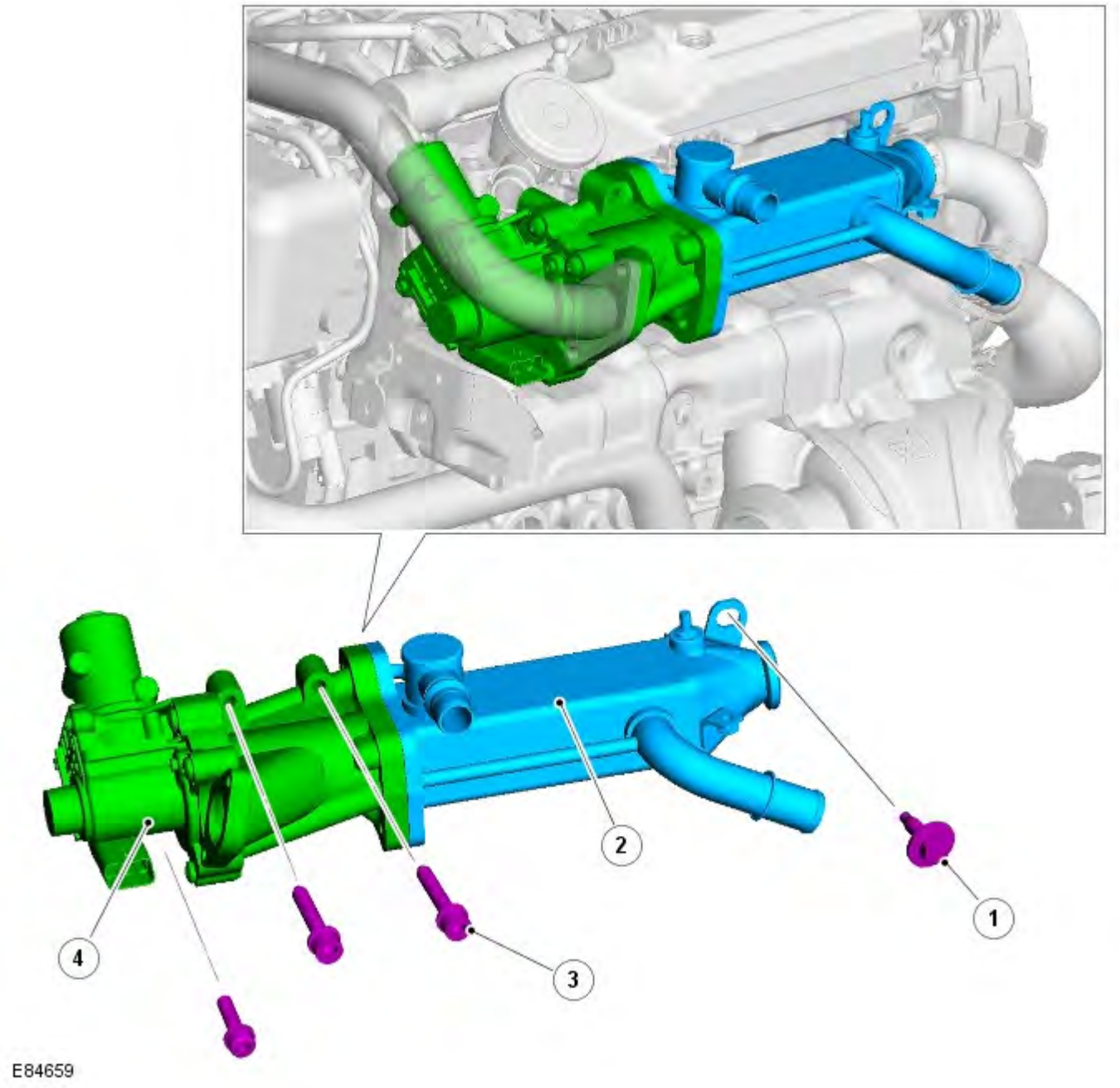
Item	Part Number	Description
1	-	Glow plug
2	-	Glow plug harness

The 4 glow plugs are installed at the lower RH side of the cylinder head, adjacent to each intake helical port. Each glow plug seats in a formed drilling with the tip protruding into the combustion chamber. The glow plugs are connected by a common electrical harness, and are controlled by the ECM.

The glow plugs pre-heat the combustion chamber before and during engine cranking to promote combustion. The glow plugs are essential for aiding engine starting, and also reduce emissions and engine noise of a cold engine. For additional information, refer to:

Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation), Glow Plug System (303-07B Glow Plug System, Description and Operation).

Exhaust Gas Recirculation (EGR) Valve and Cooler Assembly



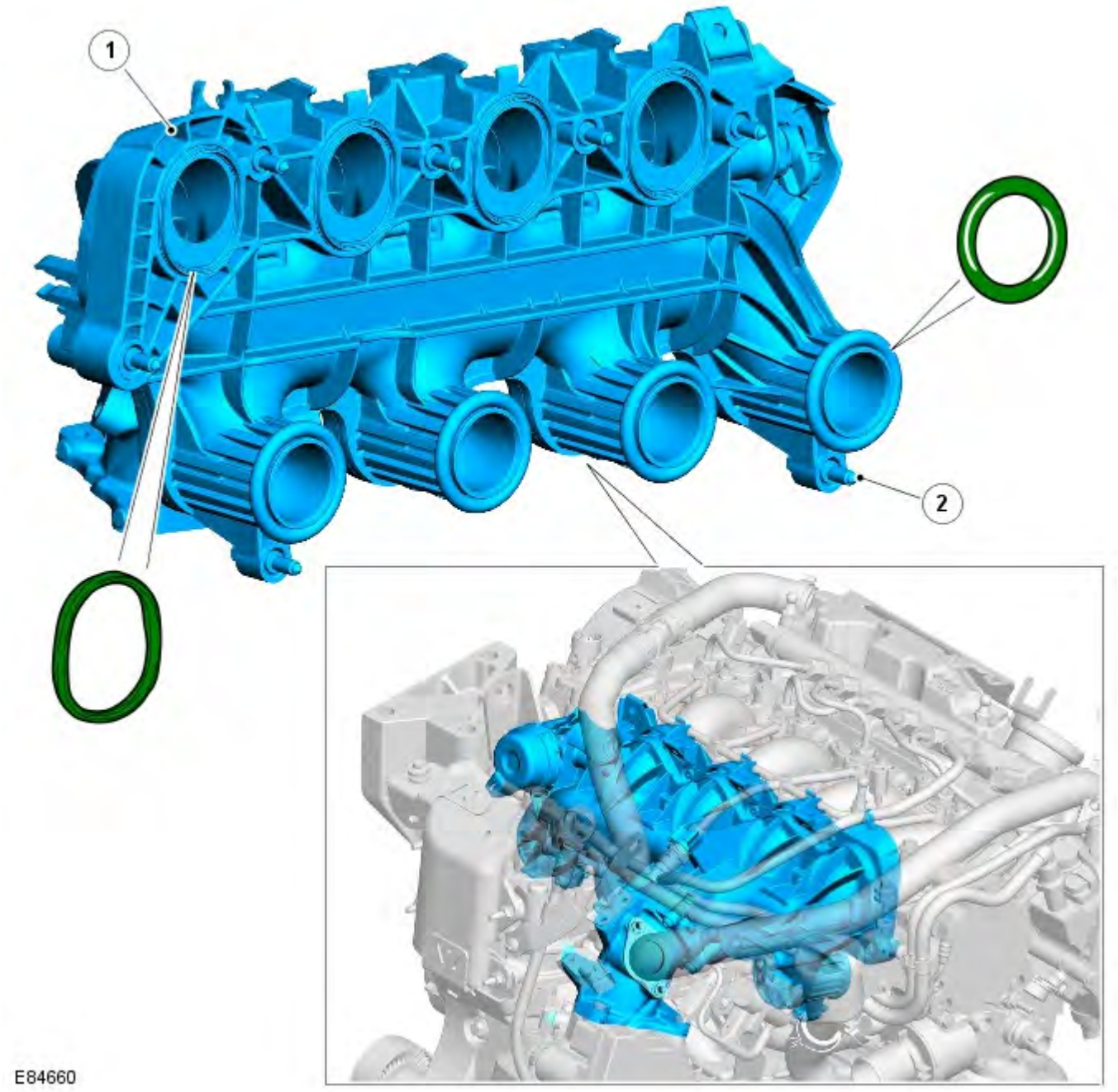
Item	Part Number	Description
1	-	Fixing to camshaft cover
2	-	EGR cooler
3	-	Bolt (3 off)
4	-	EGR valve

The EGR valve and cooler assembly is located on the RH side of the cylinder head above the exhaust manifold, and secured with 4 fixings. An inlet pipe connects the EGR cooler to the exhaust manifold. A gas transfer tube is routed across the engine and connects the EGR valve outlet to the intake manifold housing.

A pipe on the EGR cooler body connects to the climate control heater outlet hose, and provides the coolant supply to the EGR cooler. The EGR cooler outlet connects to the coolant rail, located on the RH side of the engine. The coolant rail is connected between the thermal control module and the coolant pump rear housing.
For additional information, refer to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Description and Operation).

The EGR is controlled by the ECM, and is enabled when the engine is at normal operating temperature and under cruising conditions.
For additional information, refer to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Description and Operation).

Intake Manifold



Item	Part Number	Description
1	-	Intake manifold
2	-	Bolt (7 off)

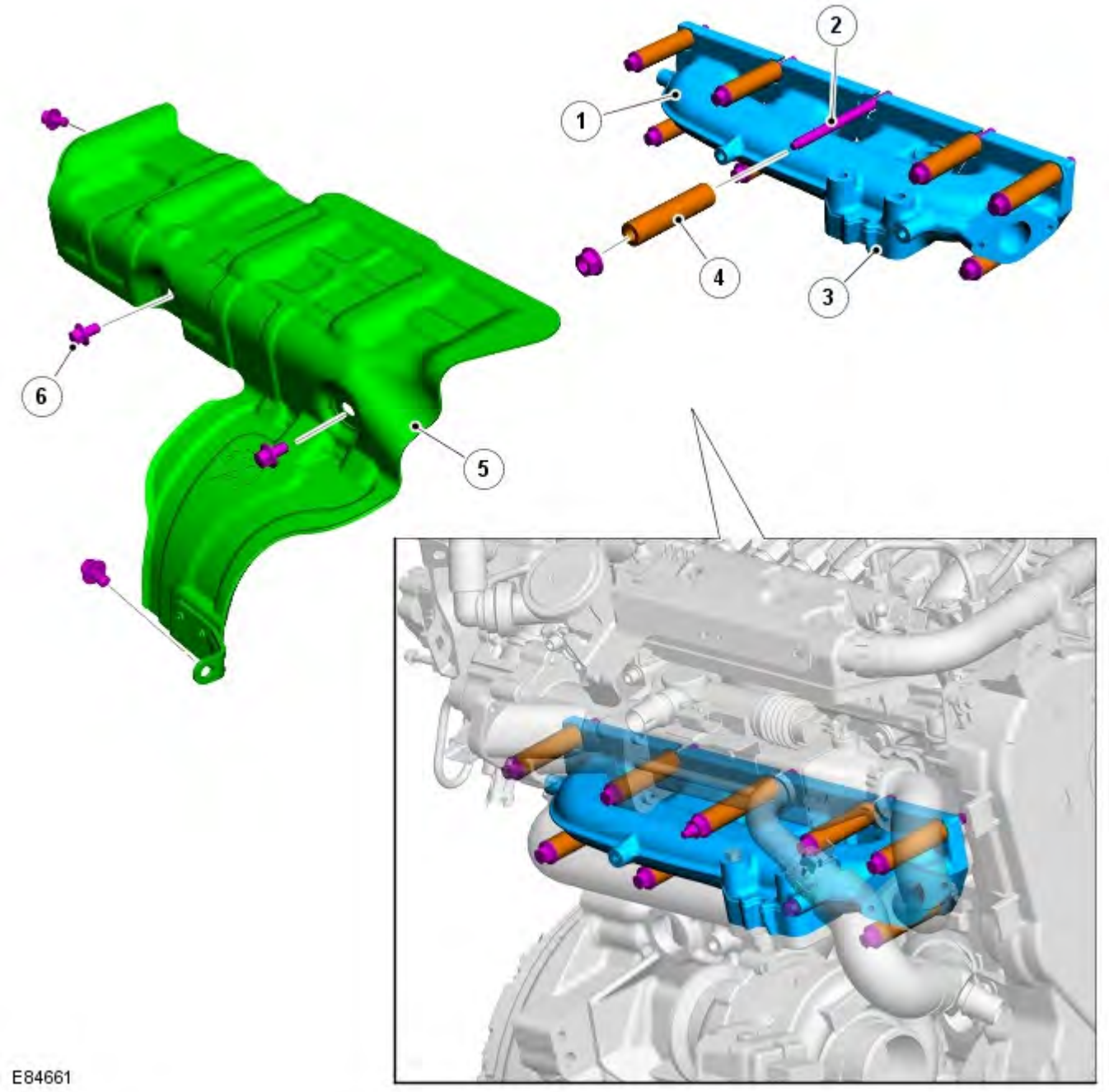
The intake manifold is located on the LH side of the engine, and attached to the cylinder head with 7 bolts. The 4 lower helical swirl ports and 4 upper filling ports are sealed to the cylinder head and structural camshaft cover with a shaped sealing ring. Care must be taken when installing the intake manifold that the sealing rings are correctly seated within the ports.

• NOTE: A small quantity of grease may be used to retain the sealing rings in the intake manifold ports during installation of the intake manifold.

The intake manifold provides the location for the electronic throttle assembly, and the port de-activation device components. A port on the RH side of the intake manifold provides the connection for the EGR gas transfer tube. For additional information, refer to:

Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation), Intake Air Distribution and Filtering (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Description and Operation).

Exhaust Manifold



Item	Part Number	Description
1	-	Exhaust manifold
2	-	Stud and nut (9 off)
3	-	Turbocharger mounting flange
4	-	Spacer (9 off)
5	-	Exhaust heat shield
6	-	Exhaust heat shield fixing (4 off)

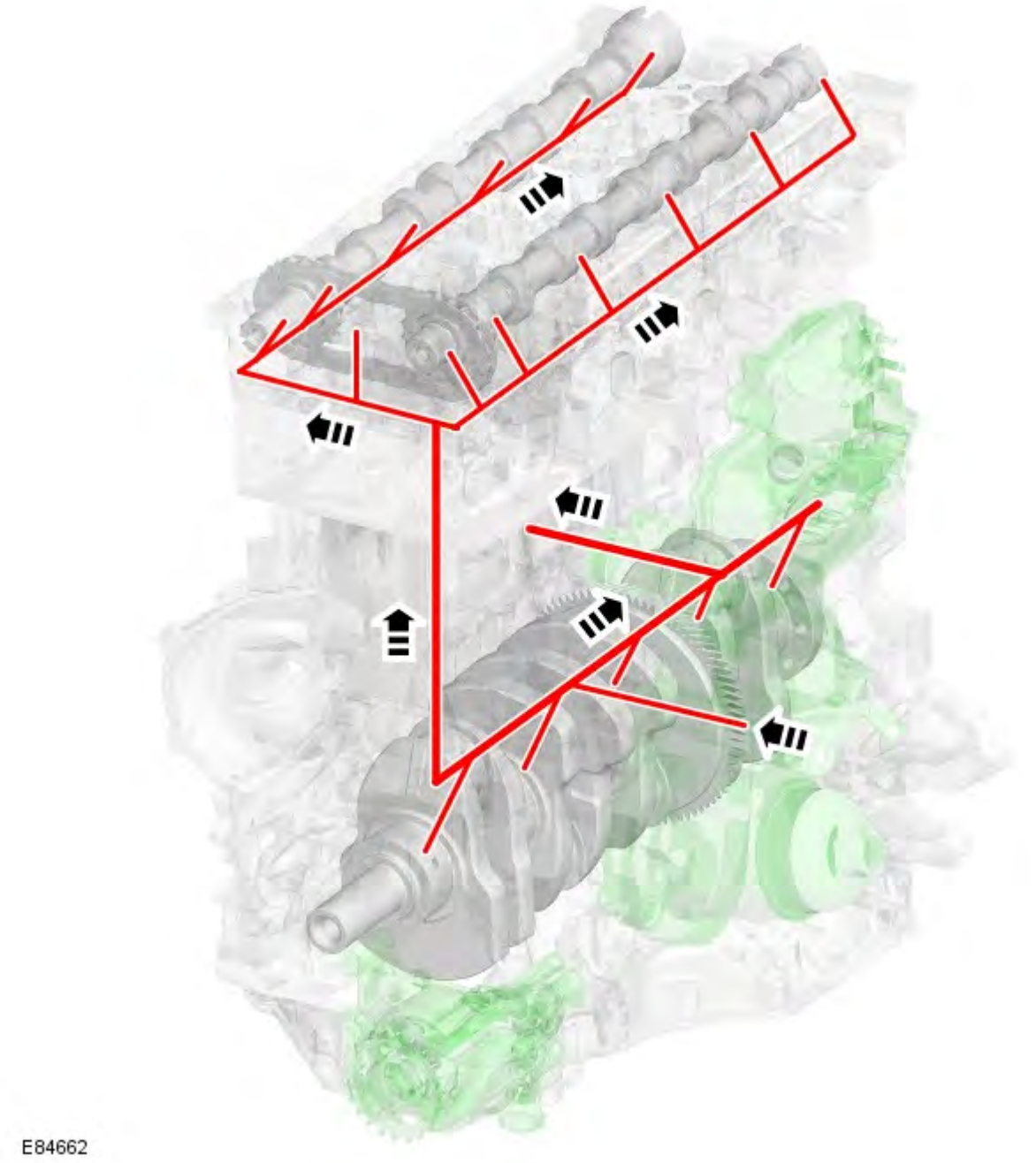
The exhaust manifold is attached to the RH side of the cylinder head with a gasket and 9 fixings. Spacers are installed on the fixings to allow for expansion and contraction of the manifold, while maintaining the clamping loads.

The manifold provides the mounting location for the Variable Geometry Turbocharger (VGT) assembly, and a connection to the EGR gas transfer tube. A heat shield is installed with 4 fixings over the exhaust manifold and VGT to protect other components, and to prevent accidental contact with the hot exhaust components.

The electronically controlled VGT is attached to the exhaust manifold outlet flange with 3 bolts. For additional information, refer to:

Turbocharger (303-04C Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel, Description and Operation),
Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Description and Operation),
Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

LUBRICATION SYSTEM



The lubrication system is a wet sump, pressure fed type. The oil lubricates the engine sliding surfaces, dissipates heat, absorbs fuel combustion residue and seals off the gap between the cylinder and piston.

The engine is lubricated by a force-fed oil circulation system comprising a full-flow oil filter and cooler assembly. The oil filter and cooler form an integral assembly mounted on the LH side of the cylinder block, in close proximity to the oil pump. Engine oil is cooled by the engine cooling system, and eliminates the requirement for an additional remotely mounted engine oil cooler.

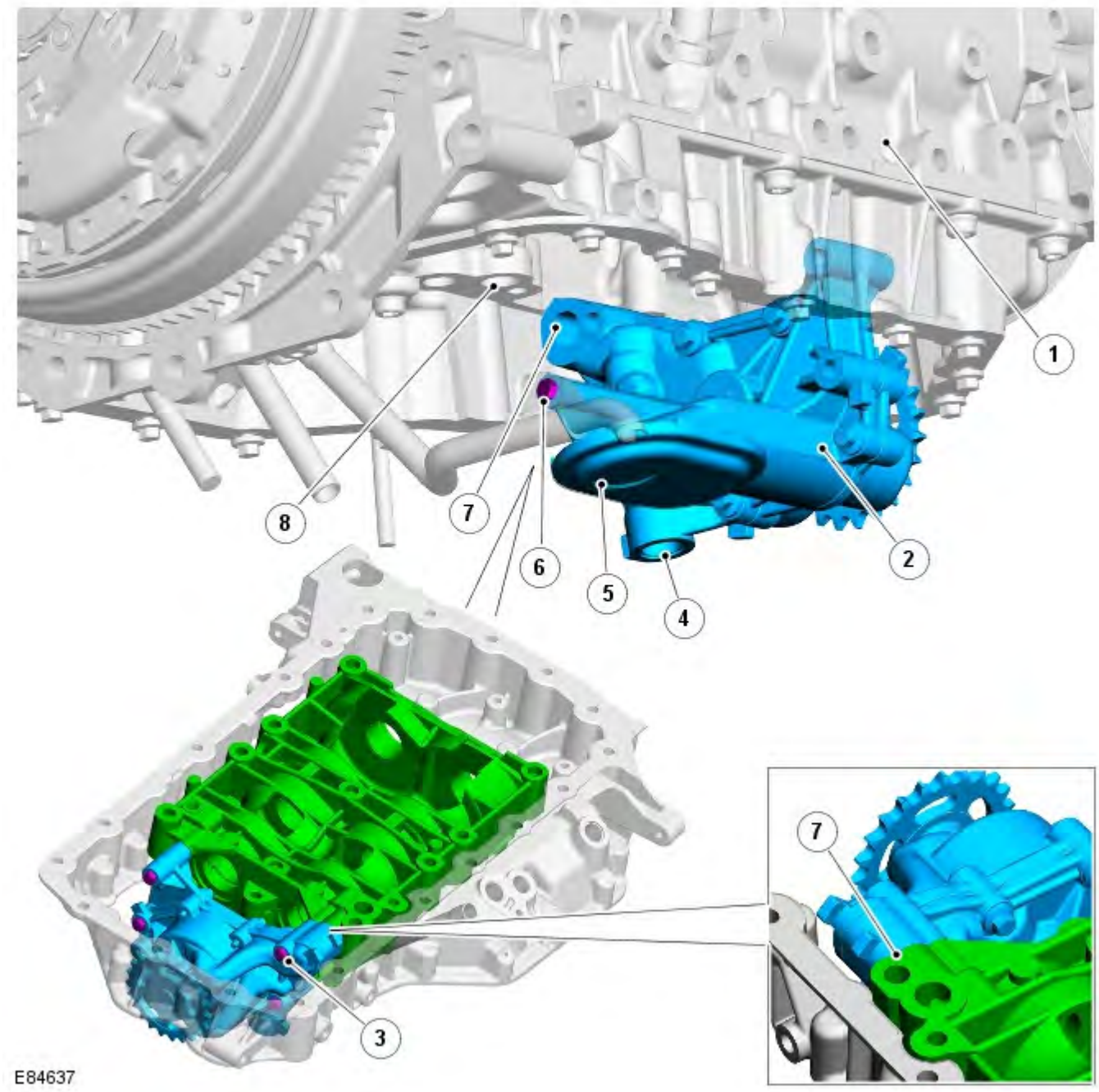
Oil is drawn out of the oil pan and pressurized by the crankshaft driven oil pump. The output from the oil pump is filtered and cooled before being distributed to the cylinder block main oil gallery. Drillings and galleries connected to the main oil gallery deliver pressurized oil to the cylinder block and cylinder head reciprocal component bearings. A drilling above No. 3 main bearing cap directs pressurized oil to a port at the rear RH side of the cylinder block. The port provides pressurized oil through a banjo connection and pipe to the turbocharger bearings.

All the engine moving parts are lubricated by pressure or splash oil. Pressurized oil is also provided for operation of the hydraulic lash adjusters and timing chain tensioner.

Oil is returned to the oil pan under gravity. Large drain holes cast in the cylinder head and cylinder block allow a quick return of the oil.

The lubrication system is replenished through the oil filler cap, located on the engine acoustic cover. An oil level gage is located on the LH side of the oil pan. Two marks at the end of the gage indicate the minimum and maximum oil levels. The difference between the minimum and maximum marks is approximately 1.5 liters (1.58 US quarts) of oil.

Oil Pump



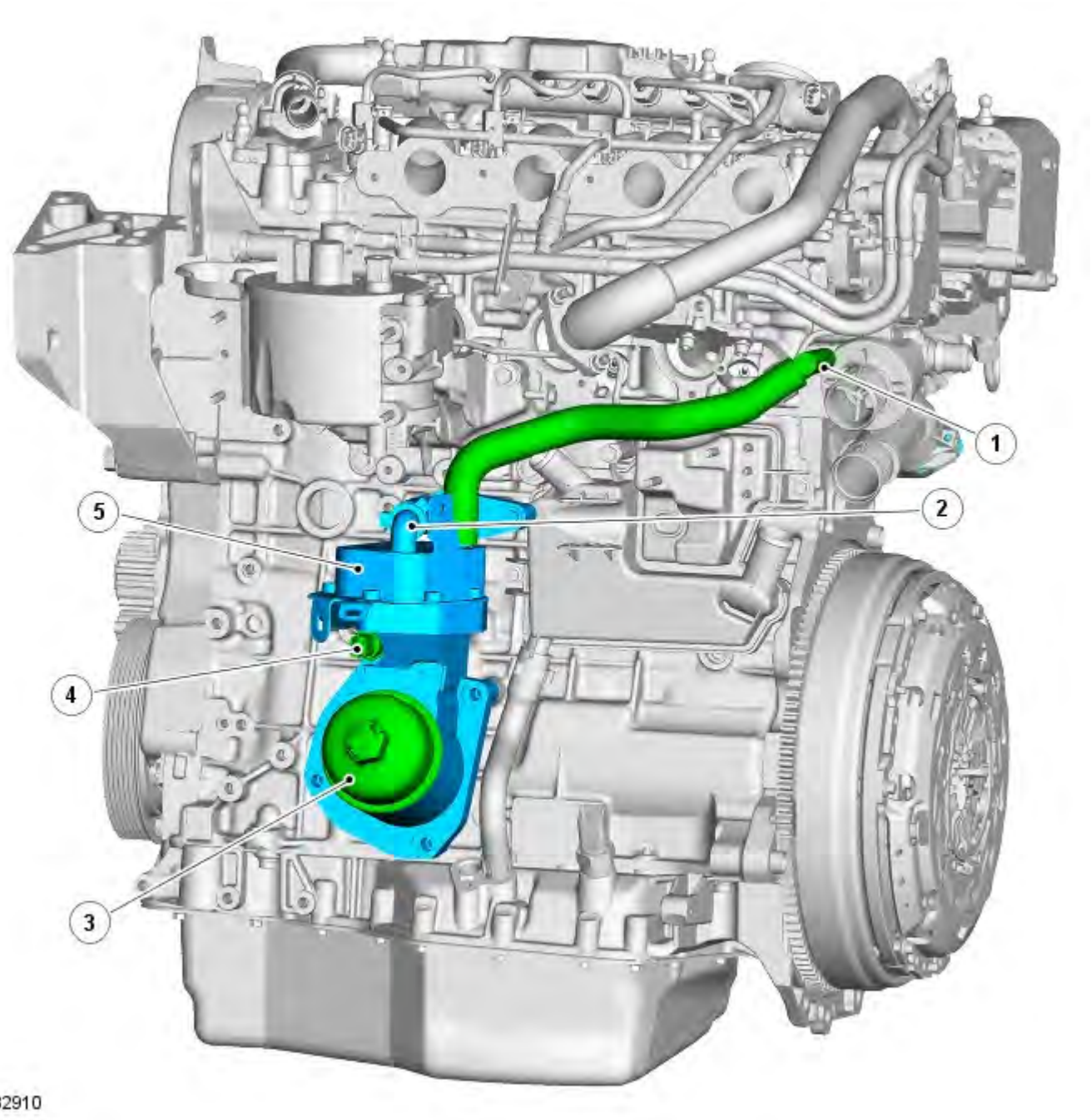
Item	Part Number	Description
1	-	Cylinder block
2	-	Oil pump
3	-	Mounting bolts (4 off)
4	-	Pressure relief valve housing
5	-	Oil pick up and strainer
6	-	Mounting bolt (1 off)
7	-	Oil pump outlet port
8	-	Oil pump supply to cylinder block

The rotor type oil pump is located between the oil pan and oil pan housing, and is attached with 4 bolts to the rear of the counter-balance shaft assembly. A further bolt at the oil strainer secures the oil pump to the oil level gage tube. The oil pump spur gear contains 21 teeth and is driven by the 18 teeth crankshaft gear, via a 48-link single row chain without tensioner.

The oil pick up and strainer protrude beneath the counter-balance shaft assembly and are immersed in the reservoir of oil. A connection between the oil pump outlet, a port in the counter-balance shaft housing, and the cylinder block directs pressurized oil from the oil pump to the oil filter and cooler assembly.

The oil pump creates a maximum oil pressure of 6.5 bar (94.3 psi) at 4500 rpm, with a delivery rate capable of 50 liters (53 US quarts) per minute. A pressure relief valve within the oil pump outlet protects the oil pump and lubrication system components from system over-pressure. The valve will open at approximately 8 bar (116 psi) to relieve excess oil pressure, directing the relieved oil back into the oil pan.

Oil Filter and Cooler Assembly



E82910

Item	Part Number	Description
1	-	Coolant return hose from oil cooler
2	-	Coolant supply hose from cylinder block
3	-	Oil filter housing
4	-	Oil pressure switch
5	-	Oil cooler

A combined engine oil cooler and filter assembly is mounted on the LH side of the engine block, in-line with No. 3 cylinder. The filter housing contains a disposable paper filter element that is accessed by unscrewing the filter housing cap.

The filter housing face mates with cylinder block outlet ports for the oil supply and return through the filter housing. A short hose connects the oil cooler to the cylinder block, and provides the coolant supply to the oil cooler. A hose connected between the oil cooler and front of the cylinder head provides the coolant return to the cooling system thermal control module.

The oil filter housing comprises an integral thermostatic valve to control oil flow through the oil cooler, dependent on the oil temperature. Oil from the cylinder block passes through the oil filter housing, and a partial flow is directed through the oil cooler before returning to the cylinder block.

An oil pressure switch with a screw type connection is installed in the oil filter housing, and is hardwired to the ECM. For additional information, refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq - Td4, Description and Operation).

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Engine

Diagnosis and Testing

Principle of Operation

For a detailed description of the 2.2L Diesel engine, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Engine (303-01B Engine - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

1. **1.** Verify the customer concern. Concerns have been separated into **Leaks** and **Noise Vibration and Harshness (NVH)** for ease of use.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical
• Intake air system leaks/damage • Fuel leaks • Coolant level • Coolant leaks. REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing). • Oil level • Oil leaks • Visibly damaged or worn parts • Loose or missing nuts or bolts

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Charts

Symptom Chart, Leaks

Symptom	Possible Cause	Action
External coolant leaks	• Damaged hose(s) • Damaged expansion tank • Damaged radiator • Leaking seals/gaskets • Cracked/damaged casings	For cooling system checks. REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing).
Internal coolant leaks. **Note: This may be indicated by the production of white smoke from the exhaust**	• Leaking seals/gaskets • Cracked/damaged casings	Check for cross contamination of cooling system and engine oil. Check for exhaust gases being emitted through header tank. For additional cooling system checks. REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing).
Engine overheats	• Insufficient coolant • Insufficient engine oil • Cooling system pressure cap fault • Thermostat not opening • Coolant pump failure • Cooling fan failure	Check for correct coolant/engine oil levels. For cooling system checks. REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing).
Engine takes too long to reach operating temperature	• Thermostat stuck open	For cooling system checks. REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing).
External oil leaks	• Gaskets • Seals • Hoses • Oil filter • Oil cooler • Damaged/Cracked	Clean and confirm the area of the leak. Visually check the condition of oil carrying components. Check the crankcase ventilation system. REFER to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Diagnosis and Testing).

Symptom	Possible Cause	Action
	casings • Crankcase ventilation system • Piston ring blow-by	Carry out a compression test, GO to Pinpoint Test A.
Internal oil leaks (leaks into coolant or combustion chamber) **Note: This may be indicated by the production of blue smoke from the exhaust**	• Gaskets • Seals • Hoses • Damaged/Cracked casings • Worn valve guides • Worn cylinder bores/pistons • Broken piston rings	Check for traces of oil in the coolant. Check for evidence of oil in the combustion chambers (deposits on the glow plugs, etc). Confirm oil consumption and vehicle usage with the owner/driver. Carry out an oil consumption test, GO to Pinpoint Test B.

• NOTE: As the checks suggested here are open to interpretation, they should be used as a guide only. Descriptions of noises, etc, are in general terms, so depend on a degree of experience on the part of the technician.

Symptom Chart, NVH

Symptom	Possible Cause	Action
Rattle/ticking from top of engine	• Valve gear noise • Camshaft bearing noise • Camshaft chain noise • Tensioner noise • Vacuum pump noise • High pressure fuel pump noise • Injector leaking	Check the engine oil level and pressure, GO to Pinpoint Test C. . Check the function of the hydraulic tappets and condition of camshaft lobes and bearings. Check the camshaft chains and tensioners, vacuum pump and high pressure fuel pump. Carry out injector leak test
Squeaking/Creaking/Squeal from front of engine	• Accessory drive belt • Accessory drive belt tensioner • Driven components on accessory drive belt	Check the accessory drive belt and driven components. REFER to: Accessory Drive (303-05B Accessory Drive - TD4 2.2L Diesel, Diagnosis and Testing).
Whine/Slap/Growl from front of engine	• Accessory drive belt • Accessory drive belt tensioner • Driven components on accessory drive belt • Timing belt noise • Timing belt tensioner noise	Check the accessory drive belt and driven components. REFER to: Accessory Drive (303-05B Accessory Drive - TD4 2.2L Diesel, Diagnosis and Testing). Check the timing belt and tensioners for noise/damage
Knock from lower half of engine (often worse with a cold engine)	• Engine oil level/pressure low • Piston slap • Piston pin noise • Connecting rod bearing noise	Check the engine oil level and pressure, GO to Pinpoint Test C. . Check for debris in the engine oil, check condition of engine components
Knock/Rumble from lower half of engine (often worse on overrun)	• Engine oil level/pressure low • Main bearing noise	Check the engine oil level and pressure, GO to Pinpoint Test C. . Check for debris in the engine oil, check condition of engine components
Whine/Whistle	• Intake air system leaks • Damaged turbocharger (when noise emanating from rear of engine)	Check for loose/damaged intake air system components. Check for excessive turbocharger shaft float **Note: a small amount of turbocharger shaft float is normal/acceptable**. Check for general damage to turbocharger
Misfire/Rough running	• Electronic engine controls • Fuel charging and controls • Intake air system leaks • Exhaust gas recirculation (EGR) system • Burnt/sticking valves • Worn valve guides • Worn cylinder bores/pistons • Broken piston rings • Damaged/Cracked casings	For electronic engine controls. REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Diagnosis and Testing). For fuel charging and controls systems tests. REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Diagnosis and Testing). Check intake air system for damage/leaks. For EGR system tests. REFER to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Diagnosis and Testing). Check for damaged engine components. Carry out a compression test, GO to Pinpoint Test A.

Pinpoint Tests

• NOTE: Where reference is made to 'suitable equipment', this refers to standard workshop equipment. Refer to the operating instructions for your own equipment when performing any tests.

PINPOINT TEST A : CHECK THE CYLINDER COMPRESSIONS
WARNING: Only compression testers able to read the higher compression pressures found in diesel engines should be used. Failure to follow this instruction may result in personal injury.

• NOTE: Where possible, compression testing should be carried out on an engine at normal operating temperature.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CARRY OUT A DRY CYLINDER COMPRESSION TEST	
	1 Make sure the parking brake is applied and that the selector lever is in neutral (or park for vehicles with automatic transmission).
	2 Set the ignition status to **OFF**.
	3 Remove the starter relay.
	4 Disconnect the starter motor solenoid connector.
	5 Connect a suitable remote starter device to the starter motor solenoid.
	6 Remove the glow plugs. REFER to: Glow Plugs (303-07B Glow Plug System, Removal and Installation).
	7 Install suitable adaptor in place of the glow plug in the first cylinder to be tested.
	8 Connect a suitable compression tester to the adaptor. See warning above.
	9 Using the remote starter device, crank the engine a minimum of five revolutions.
	10 Record the compression figure and the number of revolutions taken to reach it.
	11 Repeat steps 7 - 10 above for the remaining cylinders, cranking the engine for a similar number of revolutions each time.
	12 Compare the compression figures across all the cylinders.
	Are the compression figures within 10% of each other? **Yes** Unless the compression figures are universally very low (experience will indicate this), check for other causes for the customer complaint. **No** GO to A2.
A2: CARRY OUT A WET CYLINDER COMPRESSION TEST	
CAUTION: If engine oil is introduced into the cylinders, run the engine at 2,000 rpm for a minimum of ten minutes after completing testing to prevent damage to the catalytic converters. Failure to follow this instruction may result in damage to the vehicle.	
• NOTE: There is a combustion chamber in the top of each piston. Make sure that the oil is not allowed to run into this chamber.	
	1 Using a suitable oil can with a flexible spout, introduce a small amount of clean engine oil into the cylinder just before testing, such that the oil is able to run between the piston and the cylinder bore.
	2 Repeat steps 7 - 10 from the test above, introducing oil into each cylinder just before testing.
	3 Compare the compression figures across all the cylinders.
	Is the compression figure higher than the dry test? **Yes** A higher figure following the introduction of oil may indicate a worn or damaged cylinder bore, piston and/or piston rings. Disassembly would be required to confirm this. **No** If the compression figure is unaffected by the introduction of oil, but the figure is still less than 90% of the other cylinders, this may indicate a burnt and/or sticking valve, leaking head gasket, etc. Disassembly would be required to confirm this. Clear any DTCs which may have been induced by the test.

PINPOINT TEST B : OIL CONSUMPTION TEST

• NOTE: Oil consumption will vary, depending on a number of factors. New engines will normally use more oil than 'run-in' engines, once a consumption figure has been determined contact Dealer Technical Support for further assistance.

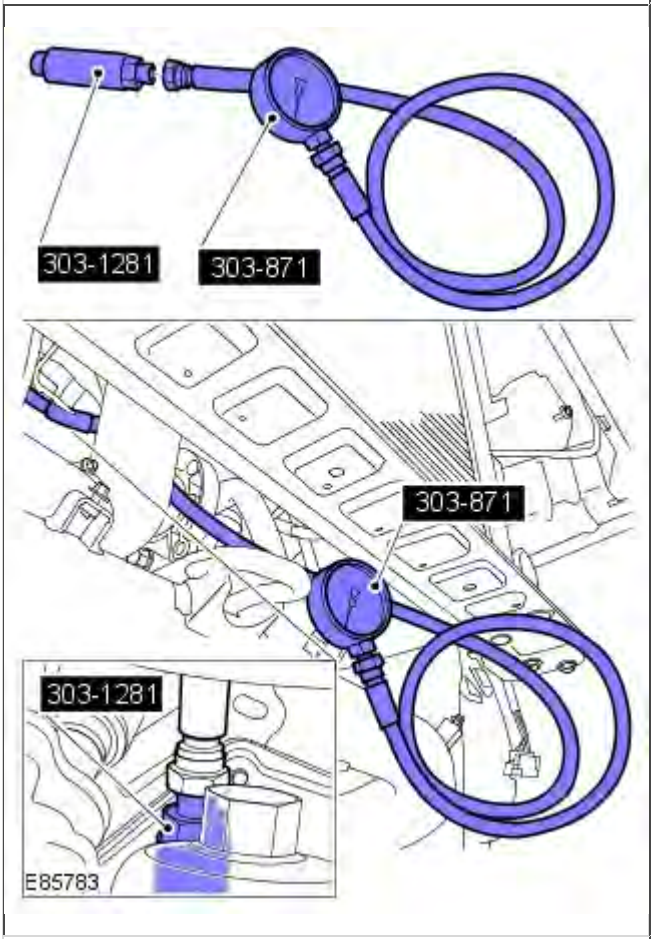
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK FOR EXCESSIVE OIL CONSUMPTION	
	1 Start the engine and allow it to run until it reaches normal operating temperature.
	2 Make sure the vehicle is parked on a level surface and switch off.
	3 Allow to settle for at least five minutes.
	4 Check the oil level.
	5 Correct the level, if necessary, and record the reading and mileage in the vehicle history.
	6 Make sure that the owner/driver is aware that a test is being carried out, and that they should not top-up their oil level for the duration of the test, but should check the level every 160-240 Km (100-150 miles).
	7 When the oil level reaches the **ADD** mark, the customer should bring the vehicle in to be checked.
	8 Top-up the oil to the level at the beginning of the test and record the amount of oil needed to do so, and the mileage covered in the course of the test.
	9 From this, the consumption can be calculated, and a decision made as to whether or not the consumption is considered excessive.
	Is the consumption excessive for the mileage and/or use? Contact Dealer Technical Support for further assistance. **Yes** Disassembly will be required to check the components indicated in the symptom chart. **No** No further action is necessary.

PINPOINT TEST C : CHECK THE ENGINE OIL PRESSURE

• NOTE: The vehicle must be driven a minimum of 6 miles (10 kilometers) prior to testing the oil pressure. Do not attempt to attain normal engine operating temperature by allowing the engine to idle.

• NOTE: Check and, if necessary, top-up the engine oil level before beginning this test.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK FOR LOW ENGINE OIL PRESSURE	

	1 Remove the oil pressure sensor. REFER to: Engine Oil Pressure (EOP) Sensor (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Removal and Installation).
	2 Connect the oil pressure gauge and adaptor in place of the oil pressure sensor.
	3 Start the engine and check for leaks at the gauge connection.
	4 Allow the engine to idle and monitor the oil pressure.
	5 Raise the engine speed to 4000 rpm and monitor the oil pressure.
	Is the oil pressure approximately 1.6 bar (23 lb/in²) at idle, and 3.1 bar (45 lb/in²) at 4000 rpm? **Yes** No fault is indicated at these pressures, oil pressure is considered normal. **No** Low pressure may indicate a problem with: oil pump, filtering, clearances within the engine. Check if there are any other indications of engine faults (noise, etc). High pressure may indicate a blockage in the lubrication system. If this is not resolved, high oil pressure will lead to engine oil leaks and other failures.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Engine Oil Draining and Filling

General Procedures

• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

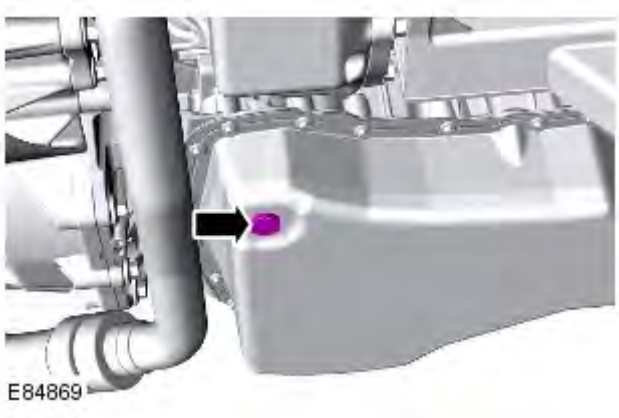
   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. Remove the oil filter.

   Refer to: Oil Filter Element (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



4. **4.** WARNING: Avoid skin contact with the specified material.

   • CAUTIONS:

   Hot fluid.

   Be prepared to collect escaping fluids.

   - *Torque:* 20 Nm
   - Remove and discard the sealing washer.

5. **5.** CAUTIONS:

   Make sure that the component is clean, free of foreign material and lubricant.

   Make sure that new sealing washers are installed.

   To install, reverse the removal procedure.

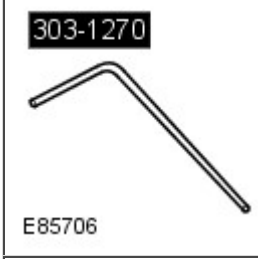
6. Check and top-up the engine oil.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Camshaft Timing

General Procedures

Special Tool(s)

	303-1270 Timing Pin, Crankshaft
	303-1277 Timing Pin, Camshaft

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

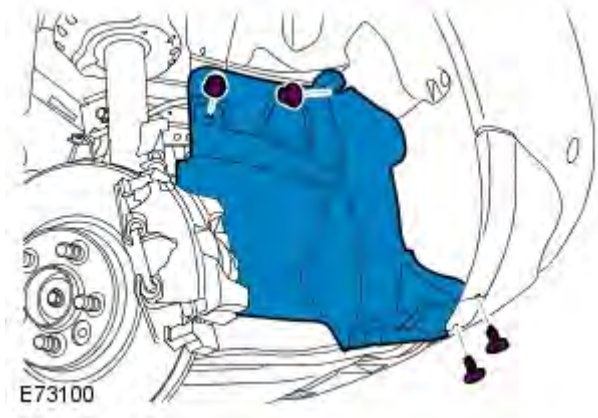
3. Remove the RH front wheel and tire.

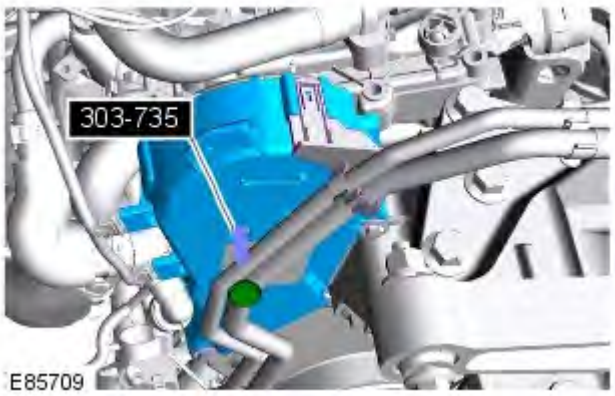
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

4. Remove the starter motor.

   Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

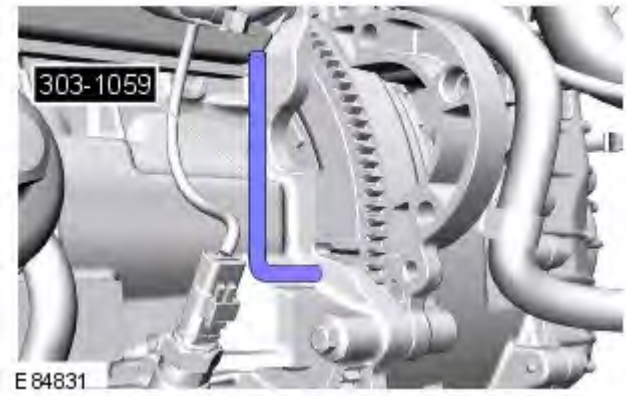
5.





6. **6.** CAUTION: Only rotate the crankshaft clockwise.
   - Remove the grommet.
   - Install the camshaft timing tool.

     Special Tool(s): 303-1277



7.
   - Install the crankshaft timing tool.

     Special Tool(s): 303-1270

8. If the camshaft timing is found to be incorrect, proceed with the adjustment.

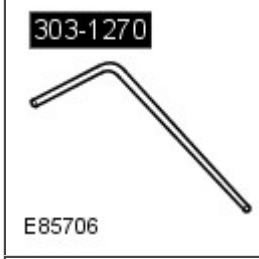
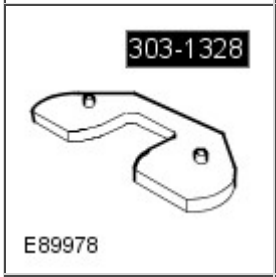
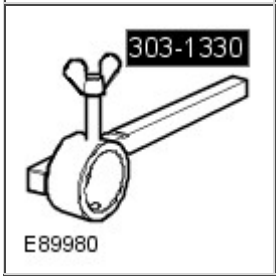
   Refer to: Timing Belt (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

Published: 11-May-2011

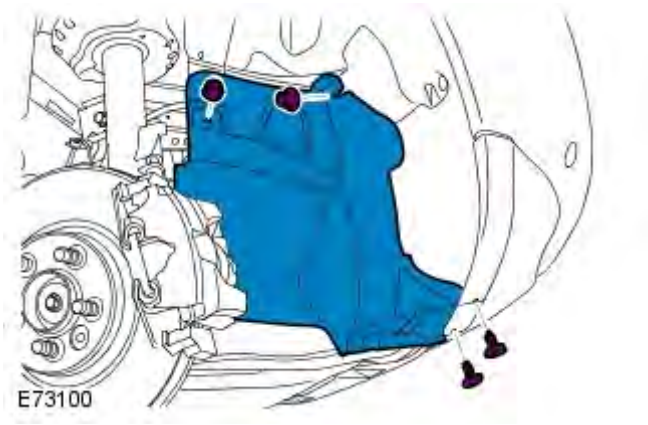
Engine - TD4 2.2L Diesel - Balance Shaft Backlash

General Procedures

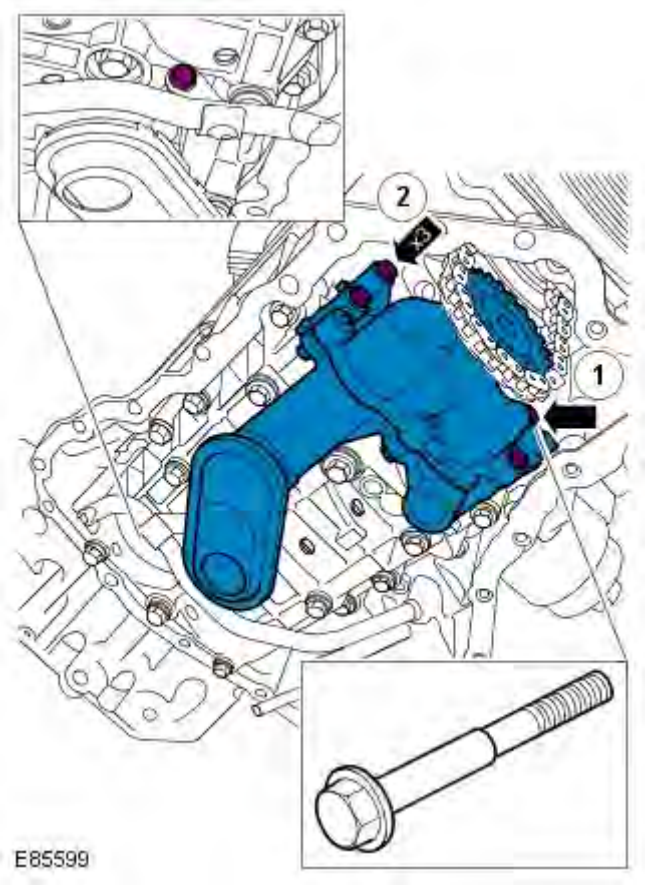
Special Tool(s)

	303-1270 Timing Pin, Crankshaft
	303-1328 Timing Plate, Balance Shafts
	303-1329 Locking Tool, Balance Shafts
	303-1330 Backlash Lever, Balance Shafts

• NOTE: The backlash can only be adjusted between the crankshaft and balance shaft assemblies. Incorrect backlash between the balance shafts will require the replacement of the balance shaft assembly.

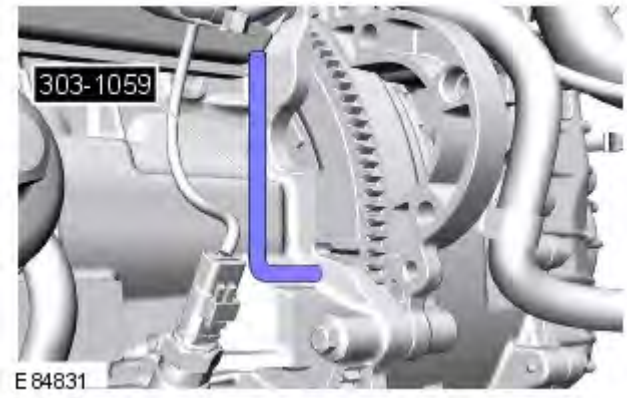


1.



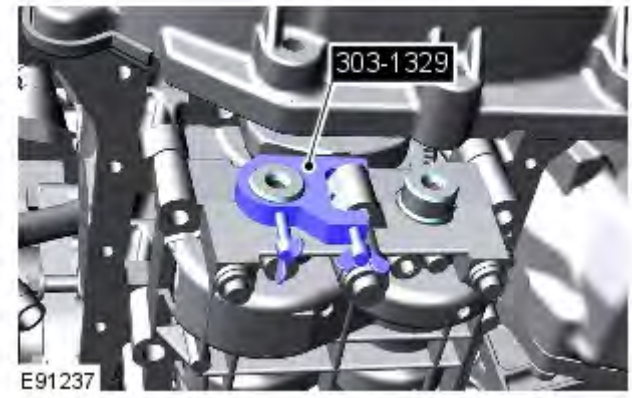
2. **2.** CAUTION: Note the fitted position of the component prior to removal.

   • NOTE: The shouldered bolt in position 1 locates the oil pump.



3. Rotate the crankshaft and install the crankshaft timing tool.

   Special Tool(s): 303-1270

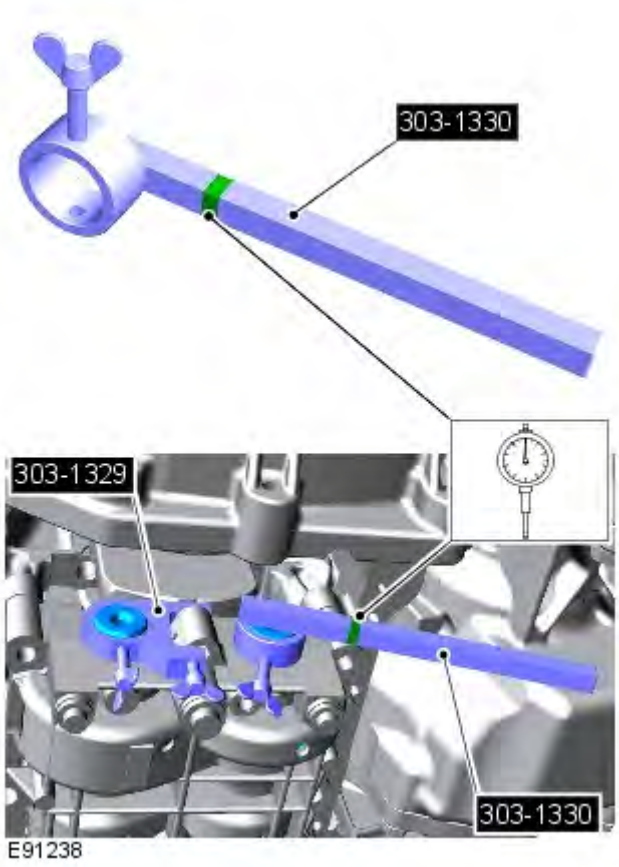


4. Lock the balance shafts.

   Special Tool(s): 303-1329

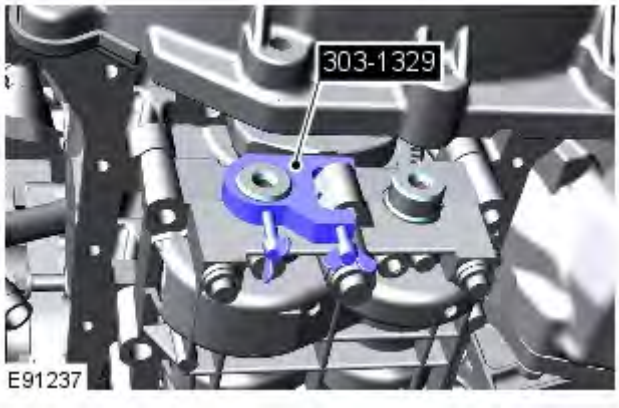
5. For balance shaft data, refer to engine specification section.

   Refer to: Specifications (303-01B Engine - TD4 2.2L Diesel, Specifications).



6.
- Measure the backlash between the balance shafts.

Special Tool(s): 303-1330
- Install and position a dial test indicator (DTI) to the measurement position on the special tool.
- If the backlash between the balance shafts is less than 0.01 mm or greater than 0.07 mm then the balance shaft assembly must be replaced.
- If a balance shaft assembly replacement is required, go to step 11.

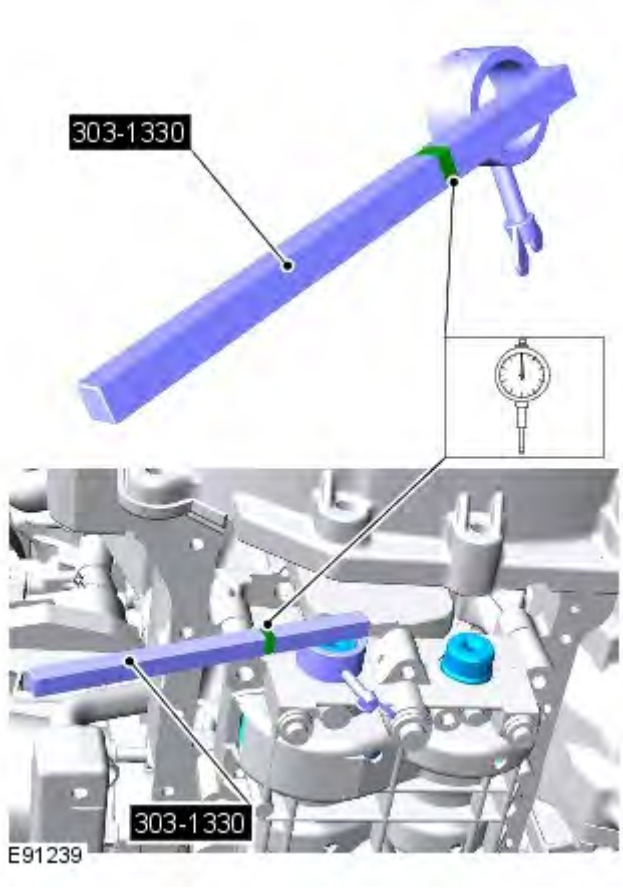


7. Remove the balance shaft locking tool.

Special Tool(s): 303-1329

8. Remove the crankshaft timing tool.

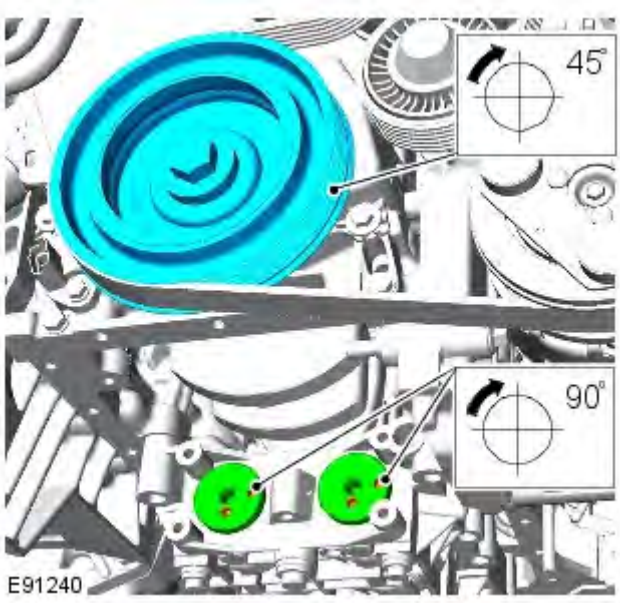
Special Tool(s): 303-1270



9.

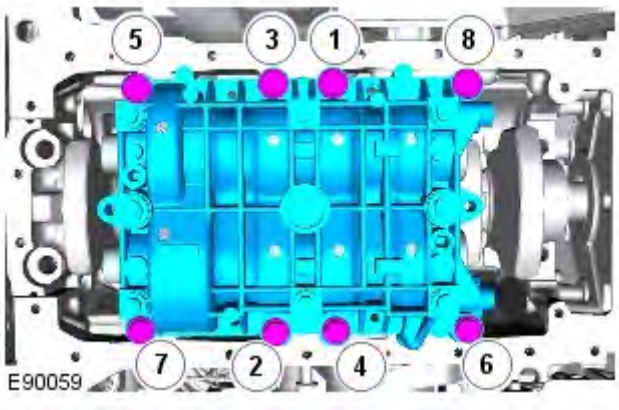
- Measure the backlash between the balance shaft and crankshaft.

Special Tool(s): 303-1330
- Install and position a dial test indicator (DTI) to the measurement position on the special tool.



10.

- Turn the crankshaft in the normal direction of rotation, measure and record the backlash on every quarter rotation of the balance shafts, until 8 readings are taken and the crankshaft has completed 1 revolution.
- Calculate the average backlash.
- If the backlash is out of tolerance, go to step 12.



11. **11.** CAUTIONS:

⚠ Make sure that the mating faces are clean and free of corrosion and foreign material.

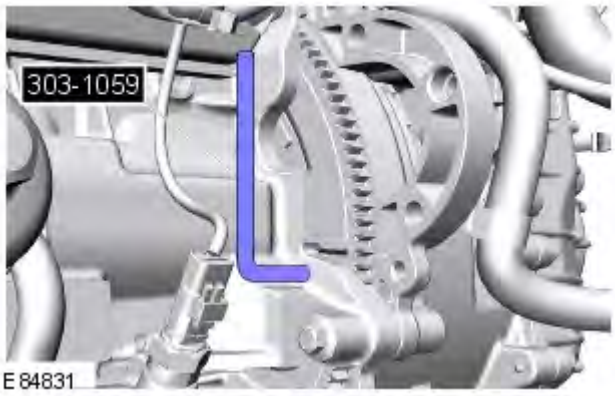
⚠ Make sure the locating dowels are installed correctly.

• NOTE: Make sure that this component is installed to the noted removal position.

- When a new balance shaft assembly is required.
- Remove the balance shaft assembly.
- Select and install the largest available shims.
- Install the new balance shaft assembly, tighten the bolts evenly in 2 stages to the sequence shown.

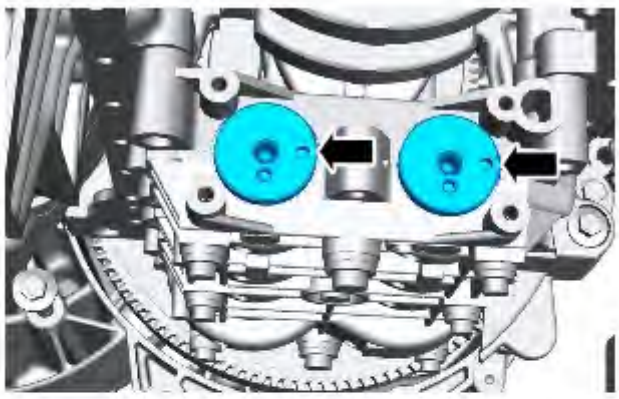
Torque:
Stage 1:5 Nm
Stage 2:22 Nm

- Repeat the backlash checking process.



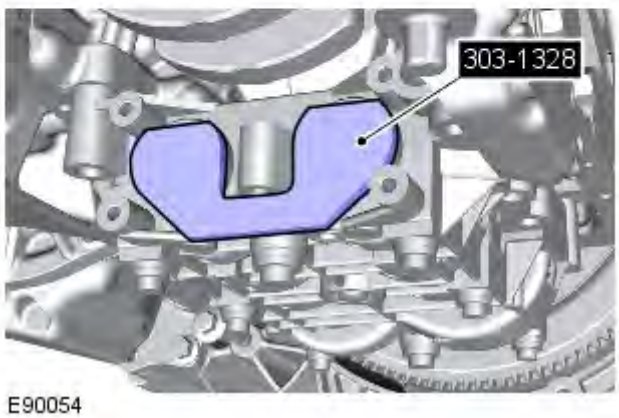
12. Rotate the crankshaft and install the crankshaft timing tool.

Special Tool(s): 303-1270



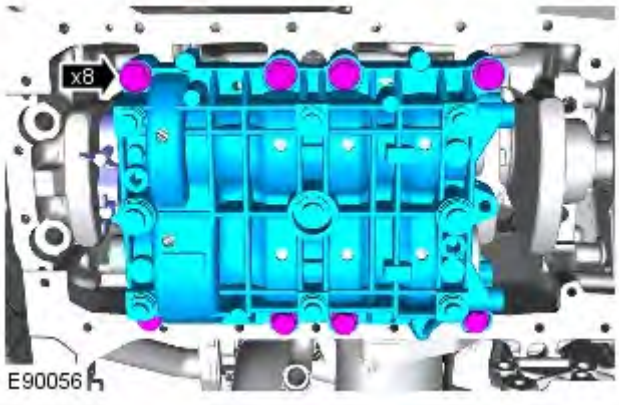
13. Install the balance shaft timing tool.

Special Tool(s): 303-1328



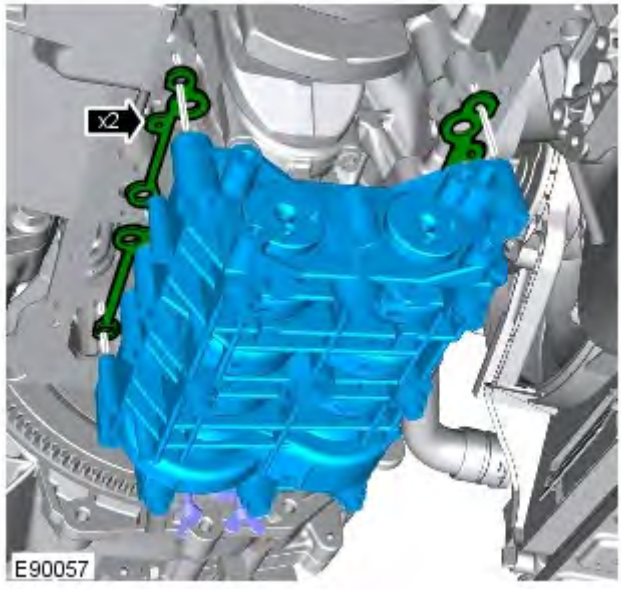
14. Install the balance shaft locking tool.

    Special Tool(s): 303-1329



15. **15.** CAUTION: Note the fitted position of the component prior to removal.

    Remove the balance shaft assembly.



16. **16.** CAUTIONS:

    Make sure that these components are installed to the noted removal position.

    Extreme cleanliness must be exercised when handling these components.

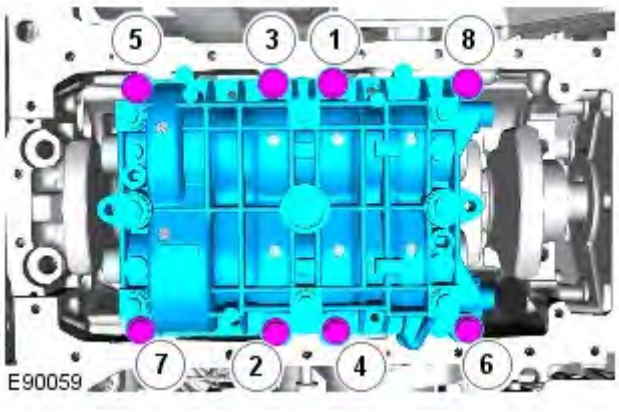
    Remove the 2 shims.

17. **17.** CAUTIONS:

    Make sure that these components are installed to the noted removal position.

    Extreme cleanliness must be exercised when handling these components.

    - Select and install the new shims.



18. **18.** CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.

    • NOTE: Make sure that this component is installed to the noted removal position.

    Tighten the bolts evenly in 2 stages to the sequence shown.

    Torque:
    Stage 1:5 Nm
    Stage 2:22 Nm

19. Remove the balance shaft timing and locking tools.

    Special Tool(s): 303-1329, 303-1328

20. Repeat the backlash checking process.

21. Install the fender splash shield extension panel.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Intake Manifold

Removal and Installation

Removal

1. Disconnect the battery ground cable.

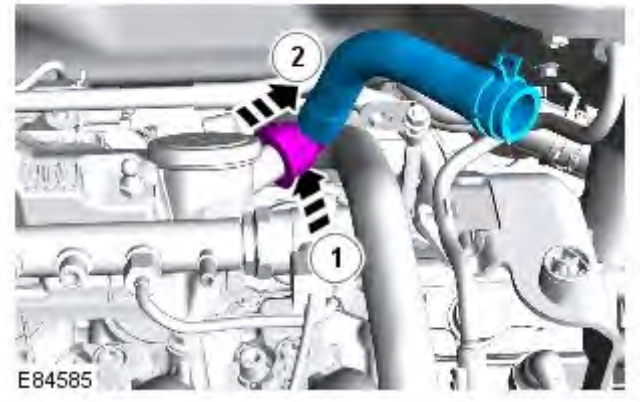
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the fuel filter.

   Refer to: Fuel Filter (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).



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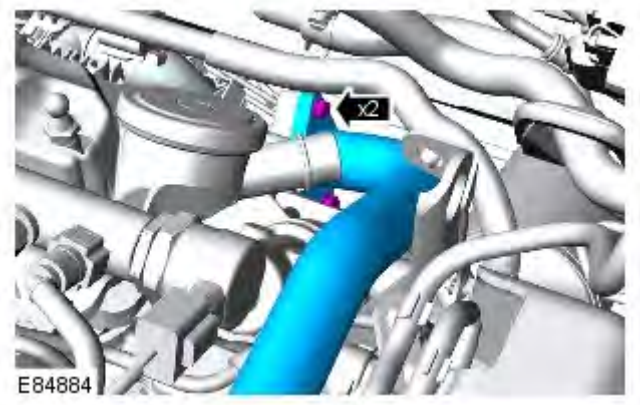

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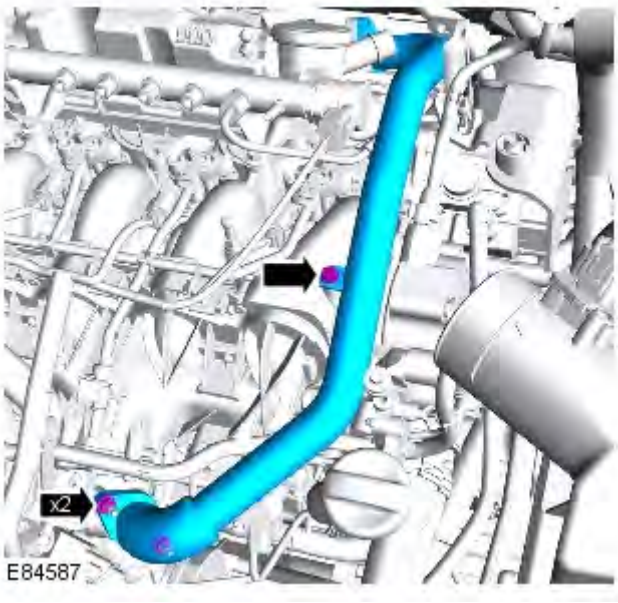
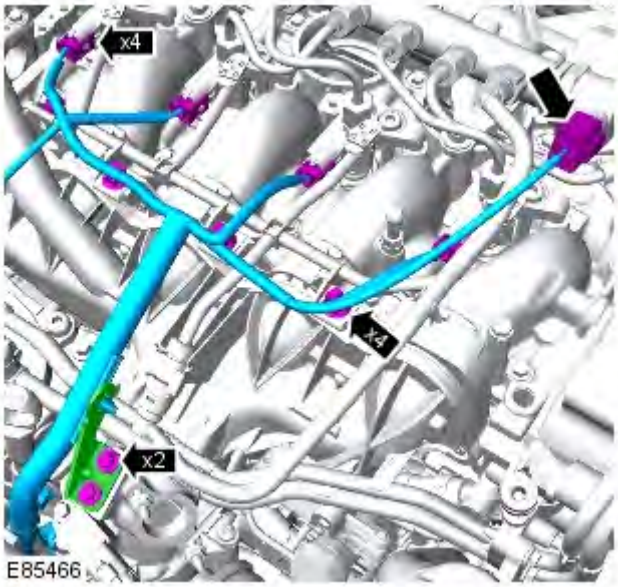


6. **6.** CAUTIONS:

   Discard the component.

   Make sure that all openings are sealed.



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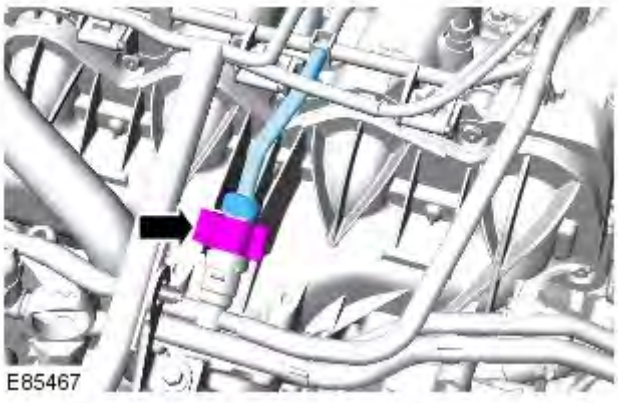

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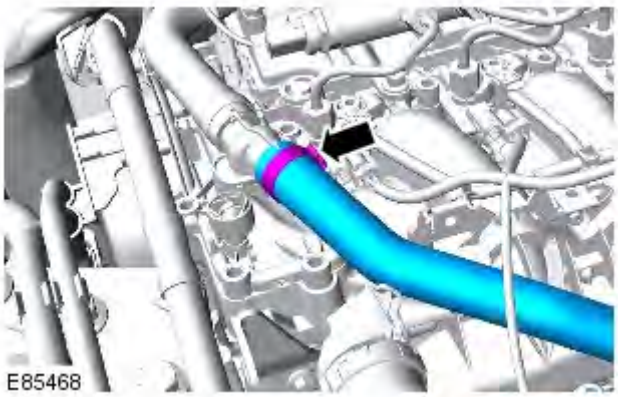
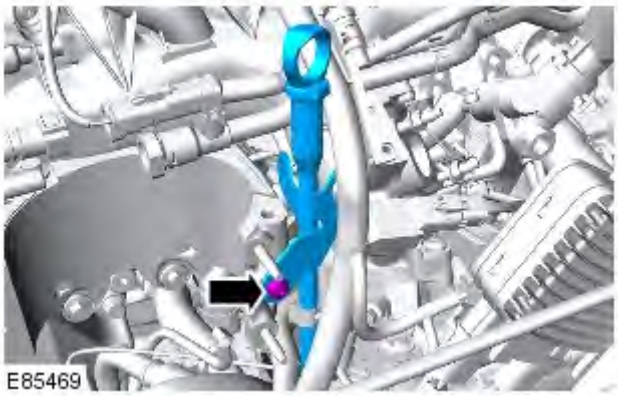


9. **9.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.



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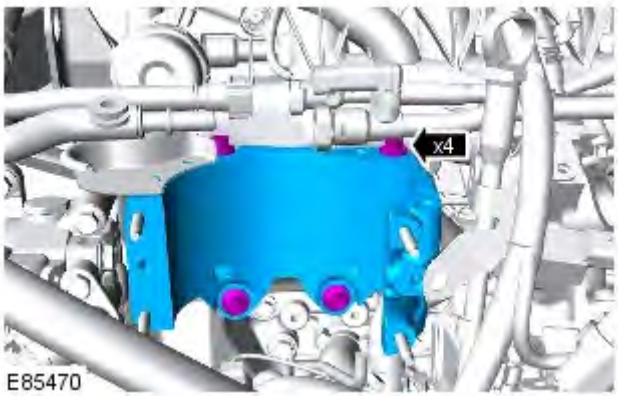

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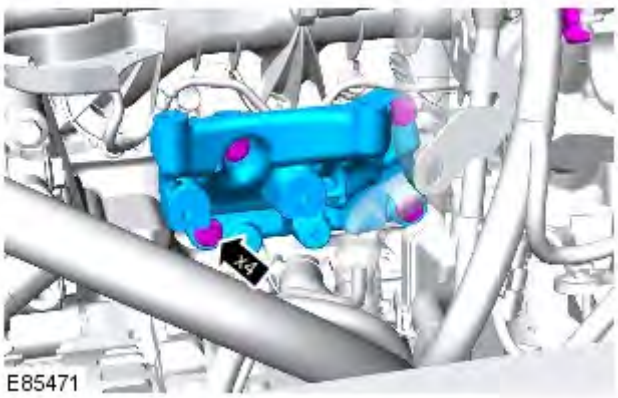
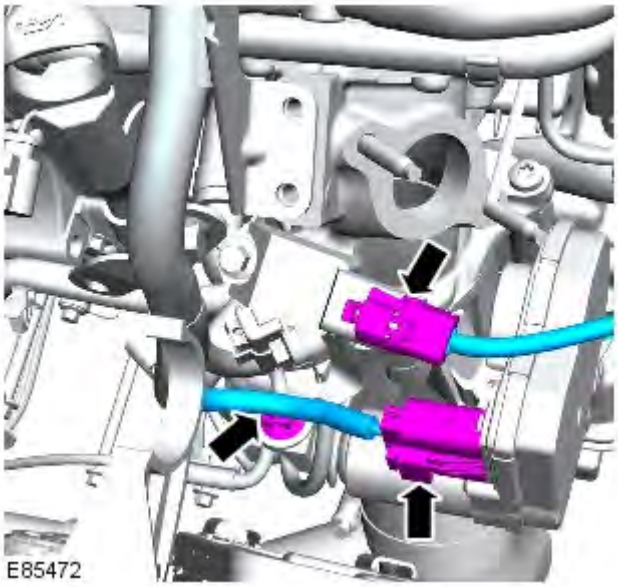


12.

13.



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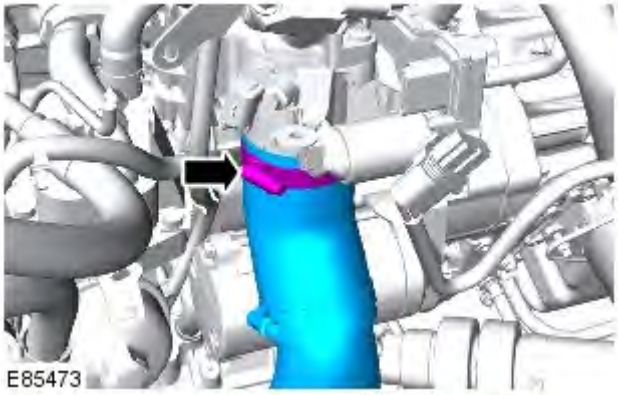

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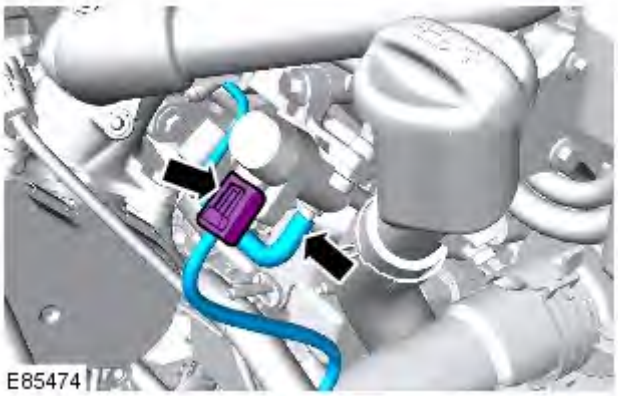
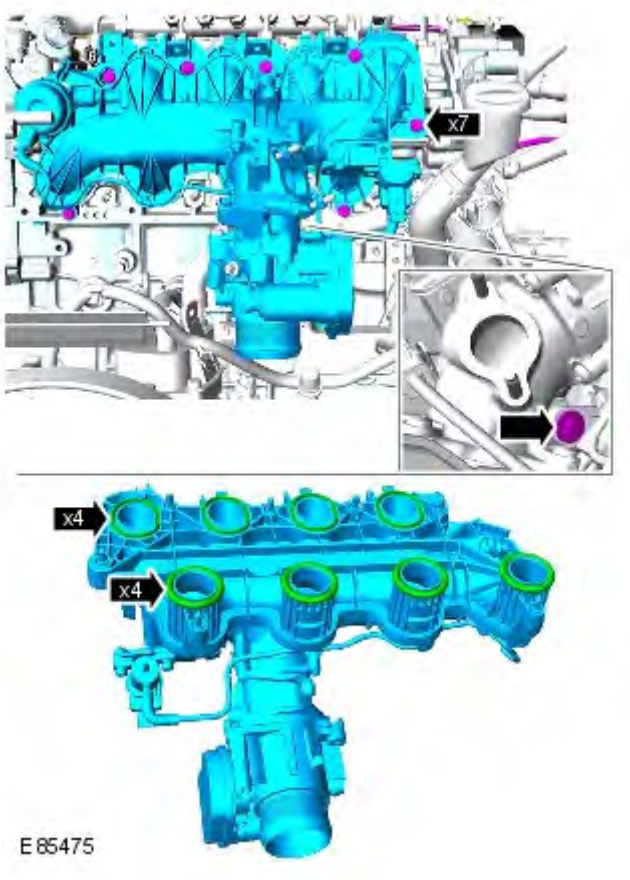
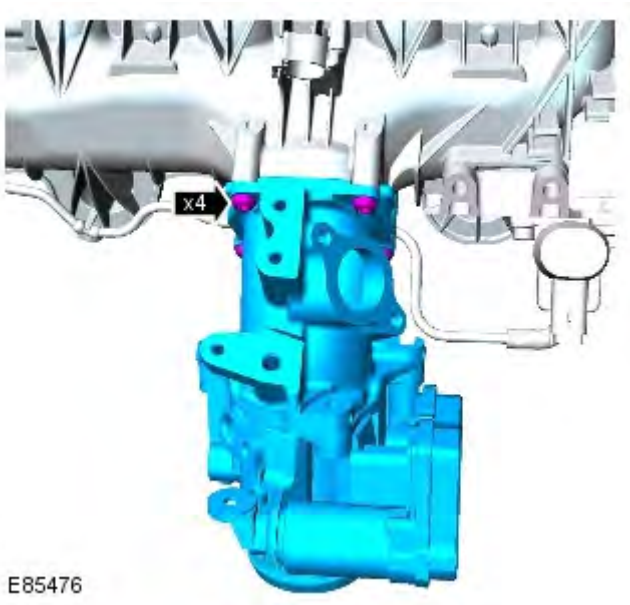




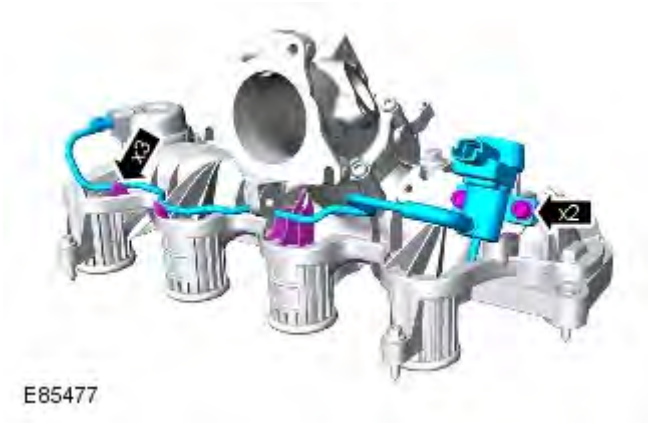
16. **16.** CAUTION: Discard the seals.



17. **17.** NOTE: Do not disassemble further if the component is removed for access only.

Remove the intake manifold adaptor and throttle housing.

18.



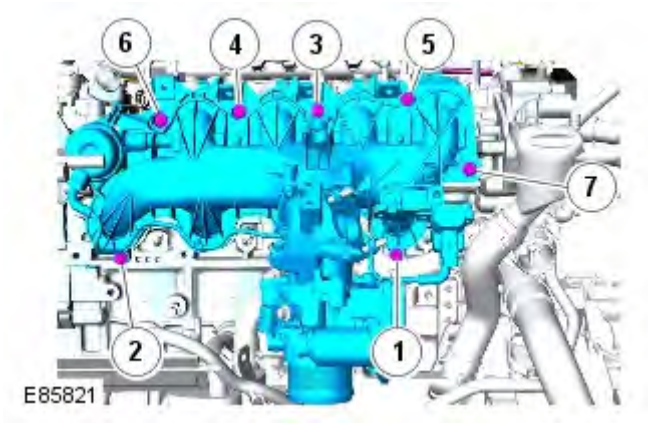
Installation

1. Install the intake manifold runner control (IMRC) actuator.

   Torque: 10 Nm

2. Install the intake manifold adaptor and throttle housing.

   Torque: 6 Nm



3. **3.** CAUTION: Install the new seals.

   Install the intake manifold.

   Torque: 9 Nm

4.
   - Connect the IMRC actuator electrical connector.
   - Connect the vacuum hose.

5. Connect the turbocharger outlet pipe.

6.
   - Connect the manifold absolute pressure (MAP) sensor electrical connector.
   - Connect the throttle position (TP) sensor electrical connector.

7. Install the fuel filter brackets.

   Torque: 25 Nm

8. Attach the oil level indicator tube.

   Torque: 10 Nm

9. **9.** NOTE: Install a new retaining clip.

10. **10.** CAUTIONS:

    Connect the crankcase vent hose.

"Make sure that a new component is installed. "

Make sure that the mating faces are clean and free of foreign material.

Install the EGR pipe.

Torque: 10 Nm

11. Attach the spill return line.

12. Connect and secure the fuel injector wiring harness electrical connectors.

    Torque: 10 Nm

13. Install the breather line.

14. Install the fuel filter.

    Refer to: Fuel Filter (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

15. Connect the battery ground cable.

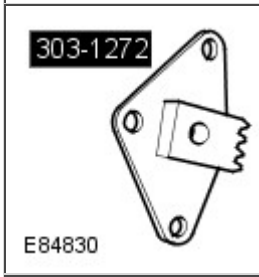
    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Crankshaft Pulley

Removal and Installation

Special Tool(s)

	303-1270 Timing Pin, Crankshaft
	303-1272 Locking Tool, Flywheel
	303-1277 Timing Pin, Camshaft

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the starter motor.

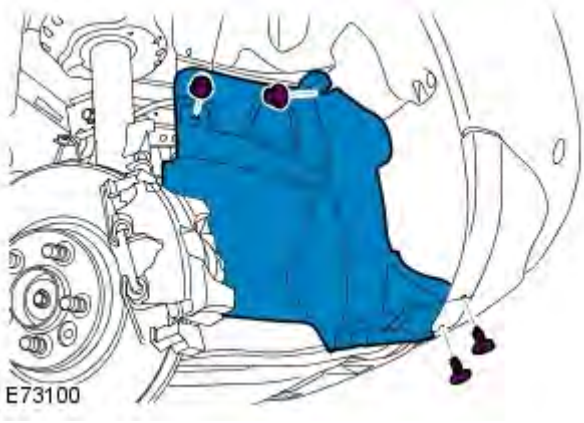
   Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

4. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

5. Remove the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



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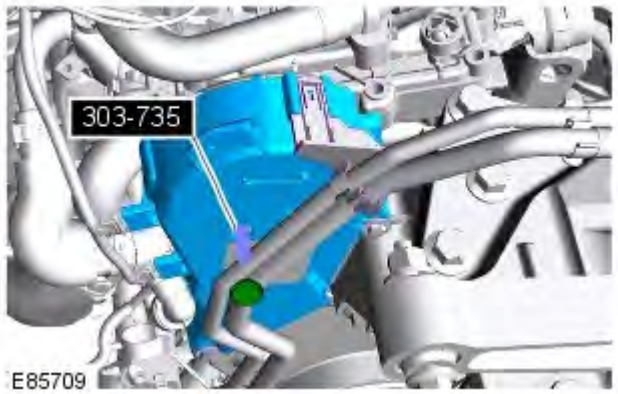


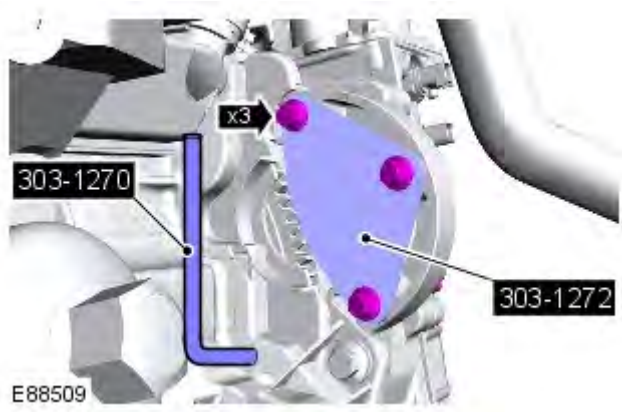
7.

- Remove the grommet.
- Install the camshaft timing tool.

Special Tool(s): 303-1277

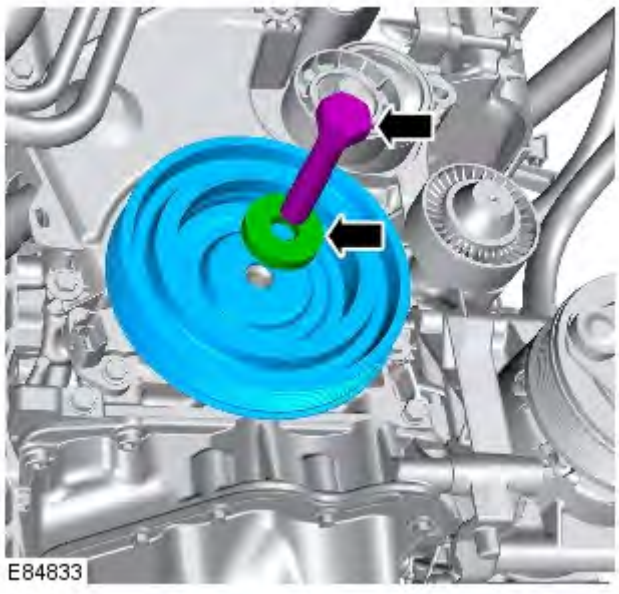
8. Install the crankshaft timing tool.

Special Tool(s): 303-1270



9. Install the crankshaft locking tool.

Special Tool(s): 303-1272



10. **10.** CAUTION: Make sure that a new crankshaft pulley bolt is installed.

    Torque:
    Stage 1:70 Nm
    Stage 2:82°

Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

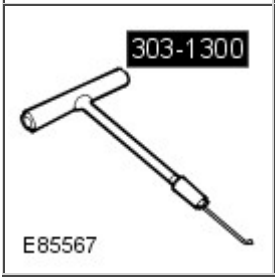
   To install, reverse the removal procedure.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Crankshaft Front Seal

Removal and Installation

Special Tool(s)

	303-1274 Installer, Crankshaft Front Seal
	303-1300 Remover, Crankshaft Seal

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

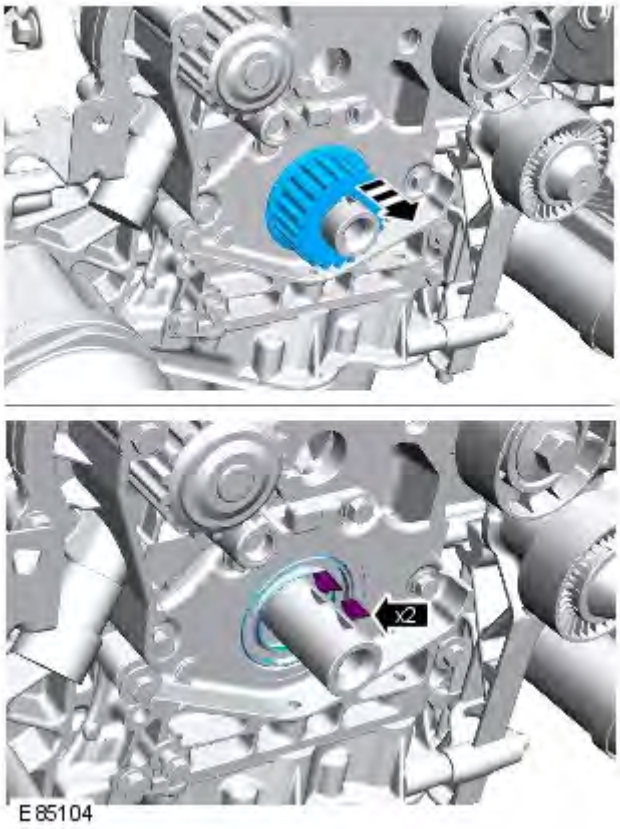
   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

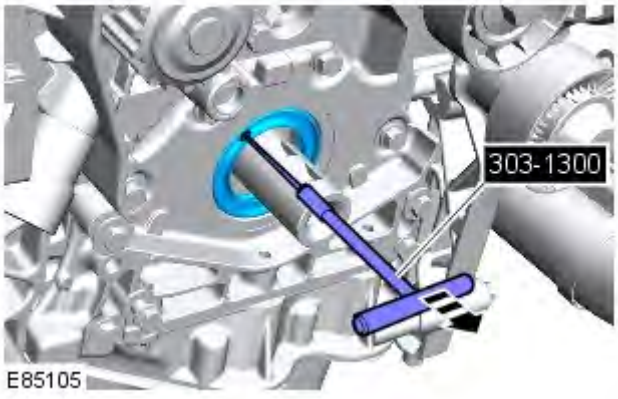
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the timing belt.

   Refer to: Timing Belt (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

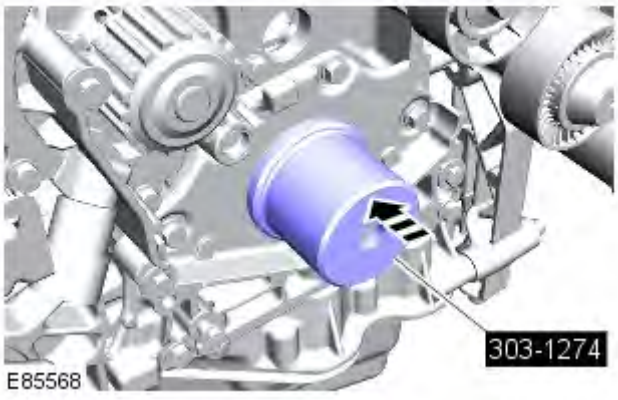


4. **4.** NOTE: Make sure that the component is installed to the position noted on removal.



5. *Special Tool(s):* 303-1300

Installation



1. **1.** CAUTION: Extreme cleanliness must be exercised when handling these components.

   Special Tool(s): 303-1274

2. **2.** CAUTIONS:

Make sure that the component is clean, free of foreign material and lubricant.

Make sure that these components are installed to the noted removal position.

Install the crankshaft key and sprocket.

3. Install the new timing belt.

   Refer to: Timing Belt (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

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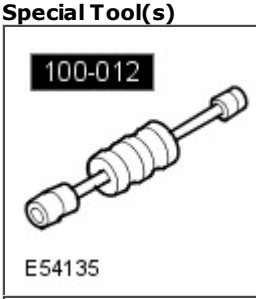
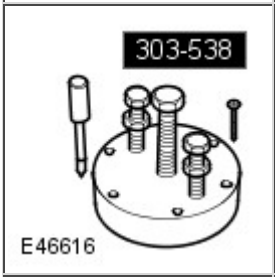
Engine - TD4 2.2L Diesel - Crankshaft Rear Seal

Removal and Installation

Special Tool(s)

	100-012 Slide Hammer
	303-1271 Installer, Seal
	303-538 Remover/Installer, Crankshaft Oil Seal
	308-615 Remover, Seals

Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

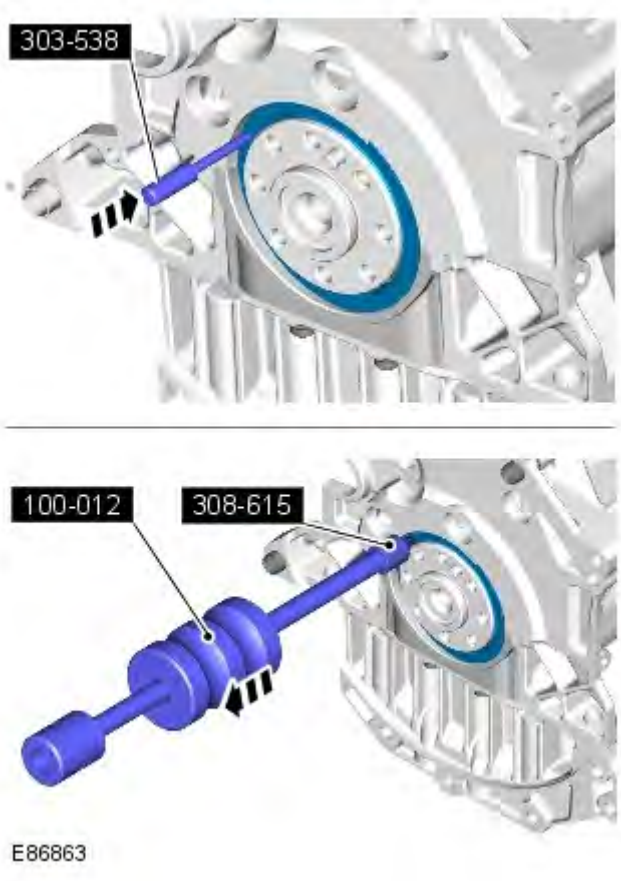
   Raise and support the vehicle.

3. Manual models: Remove the flywheel.

   Refer to: Flywheel (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Automatic models: Remove the flexplate.

   Refer to: Flexplate (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



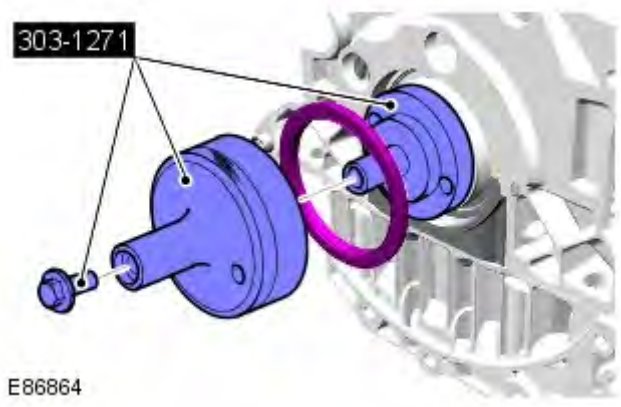
5. **5.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Take extra care not to damage the mating faces.

   Special Tool(s): 303-538, 308-615, 100-012

Installation



1. **1.** CAUTION: Take extra care not to damage the seal.

   Special Tool(s): 303-1271

2. Manual models: Install the flywheel.

   Refer to: Flywheel (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

3. Automatic models: Install the flexplate.

   Refer to: Flexplate (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Timing Cover

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

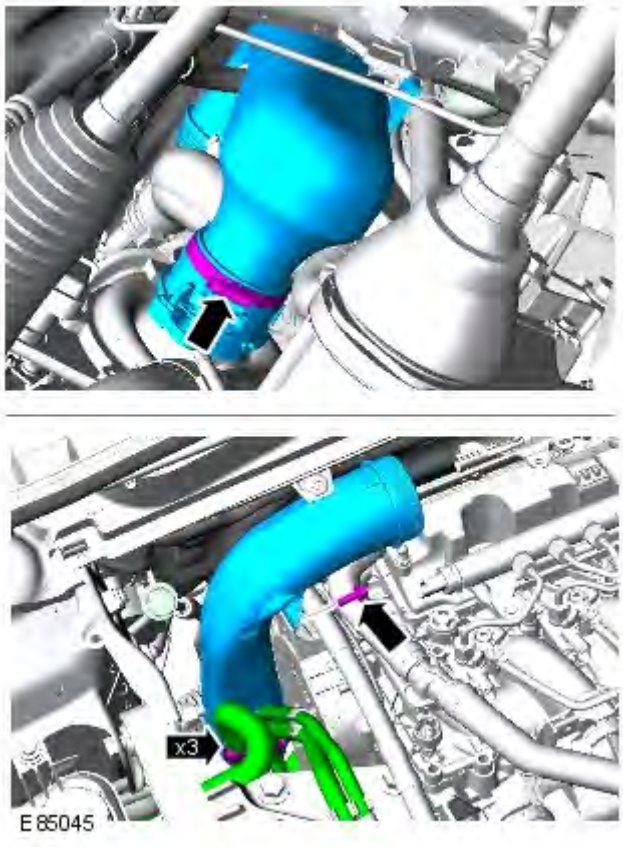
3. Remove the reluctor ring.

   Refer to: Crankshaft Position (CKP) Sensor Ring (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Removal and Installation).

4. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

5.



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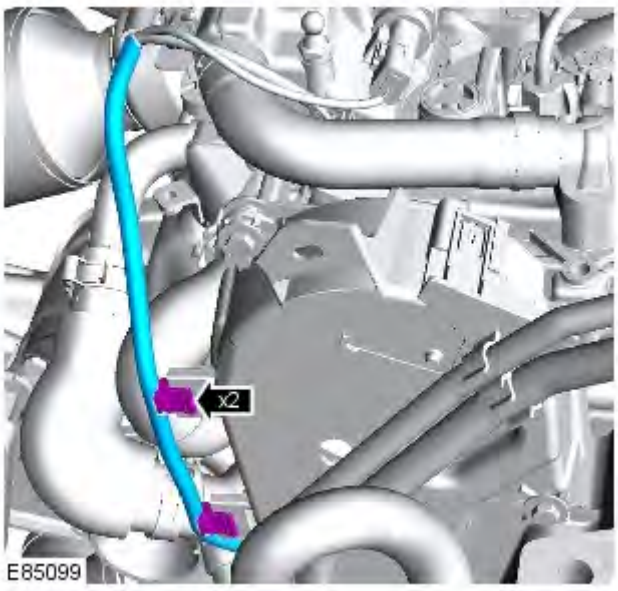
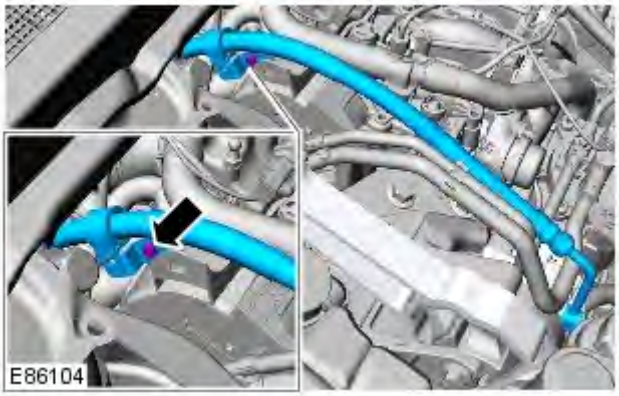
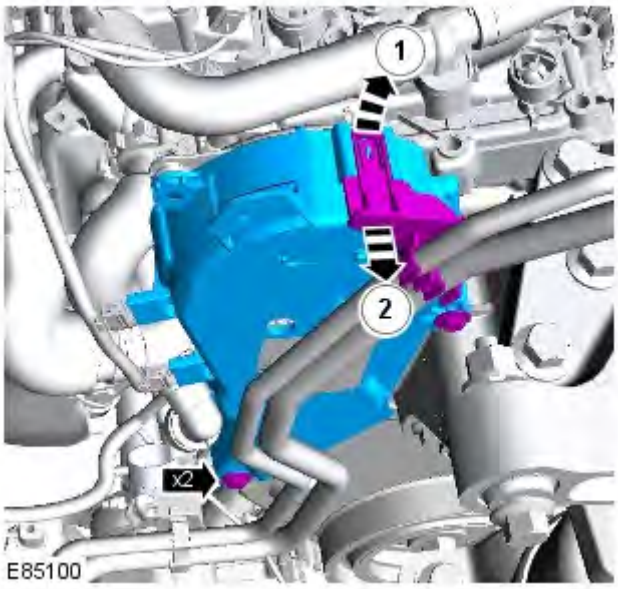
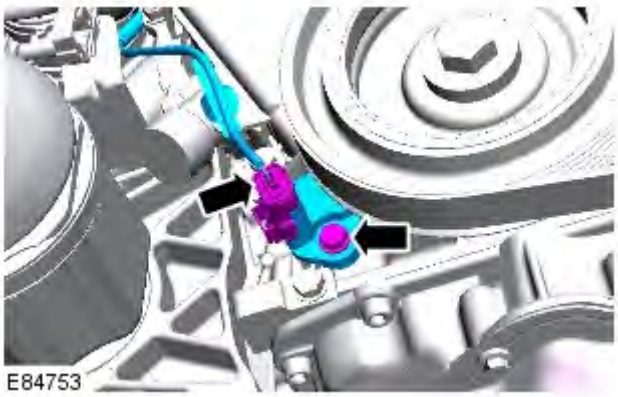


7. *Torque:* 7 Nm

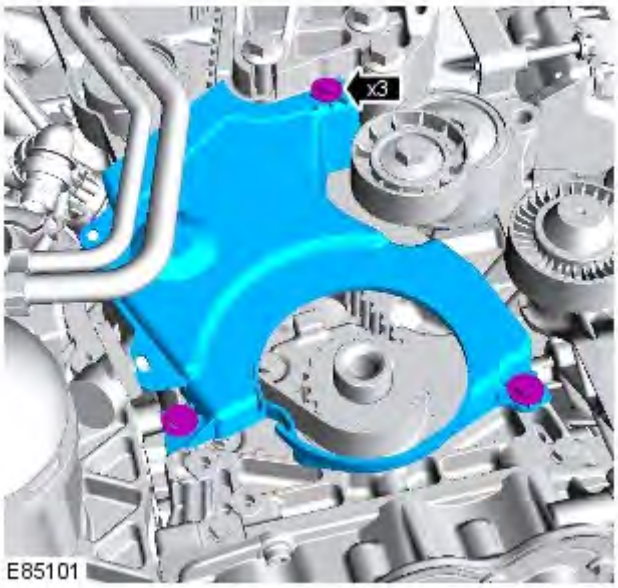


8. *Torque:* 7 Nm





9. **9.** CAUTION: Make sure that the wiring harnesses are correctly located.
    - *Torque:* 6 Nm



10. *Torque:* 6 Nm

11. **11.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

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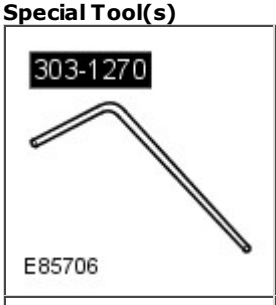
Engine - TD4 2.2L Diesel - Valve Cover

Removal and Installation

Special Tool(s)

	303-1270 Timing Pin, Crankshaft
	303-1277 Timing Pin, Camshaft

Removal

- NOTE: The valve cover and cylinder head is machined as an assembly and cannot be serviced separately.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

3. **3.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

4. Remove the camshaft seal.

   Refer to: Camshaft Seal (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

5. Remove the fuel rail.

   Refer to: Fuel Rail (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

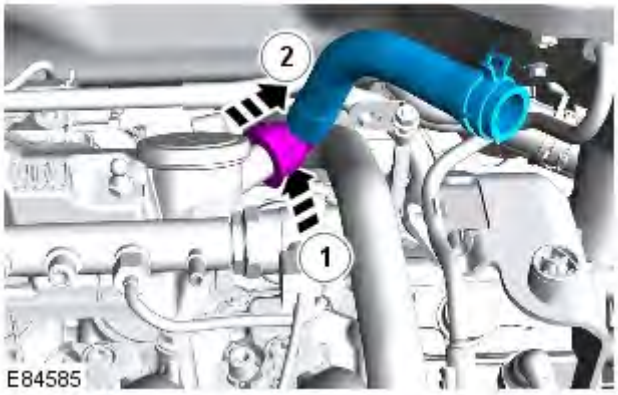
6. Remove the fuel injectors.

   Refer to: Fuel Injector (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

7. Remove the intake manifold.

   Refer to: Intake Manifold (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

8.



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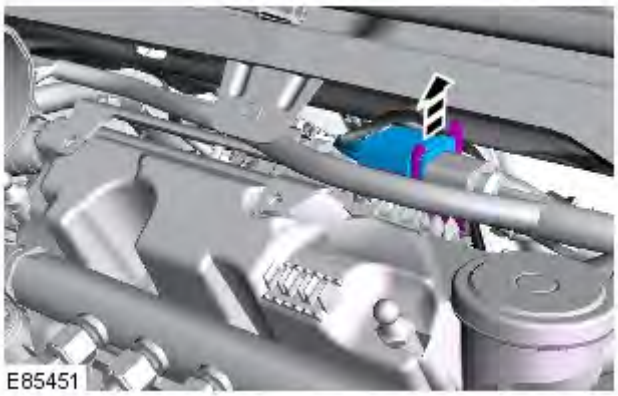

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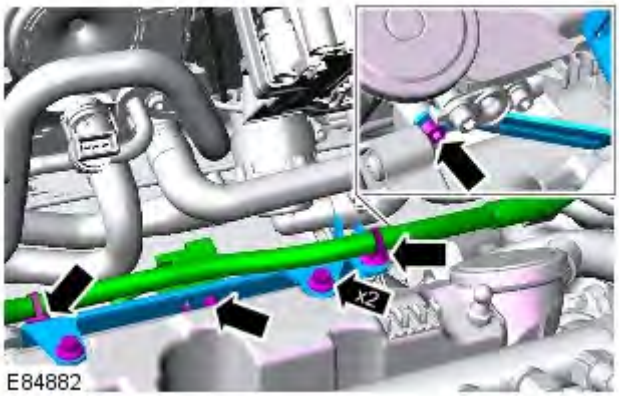
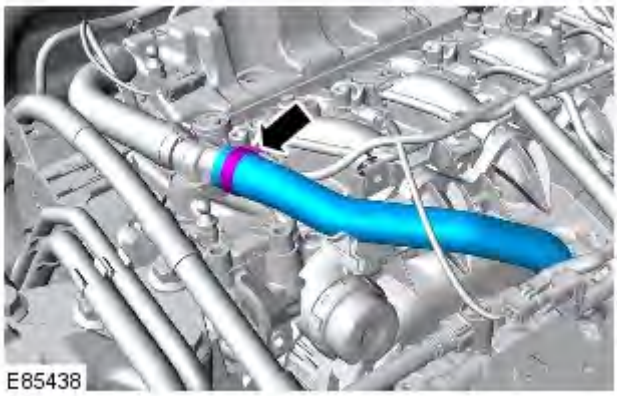
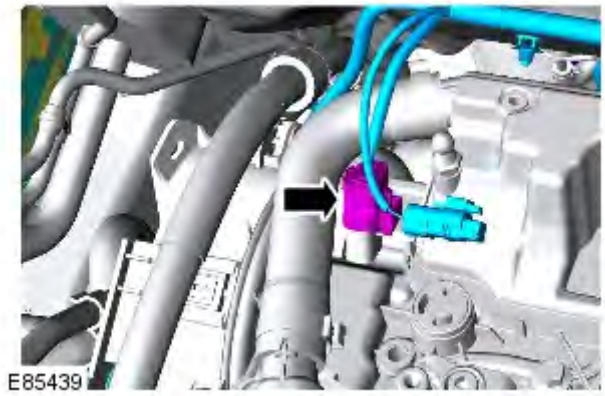


11. **11.** NOTE: Discard the retaining clip.





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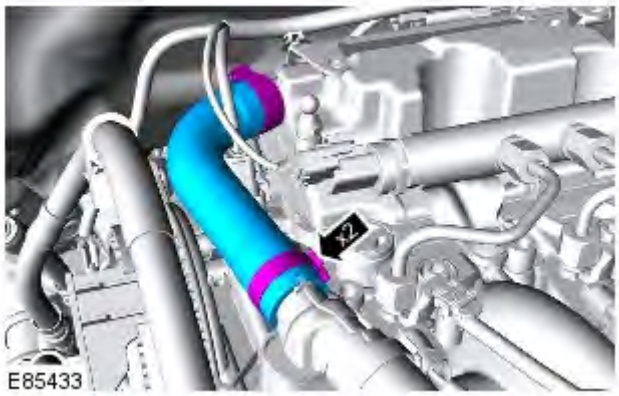
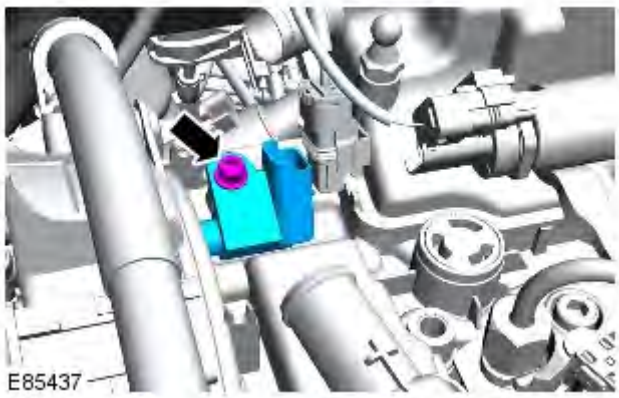


13. Remove and discard the hose clips.



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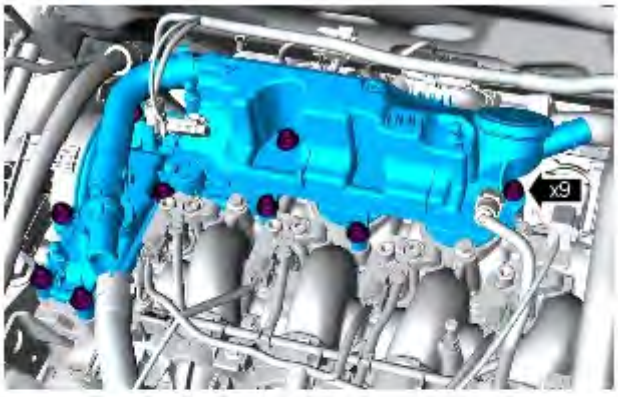
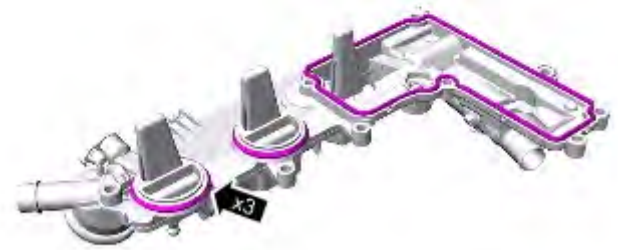
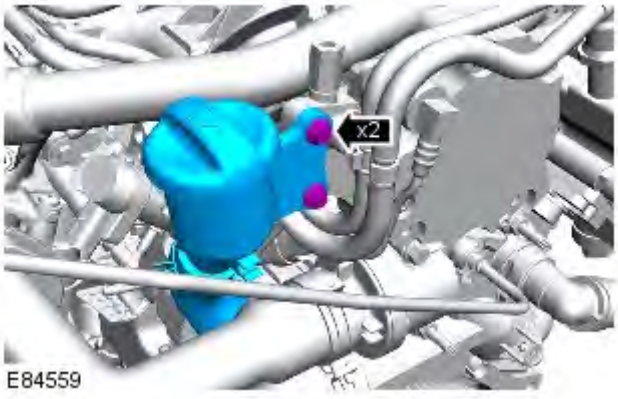




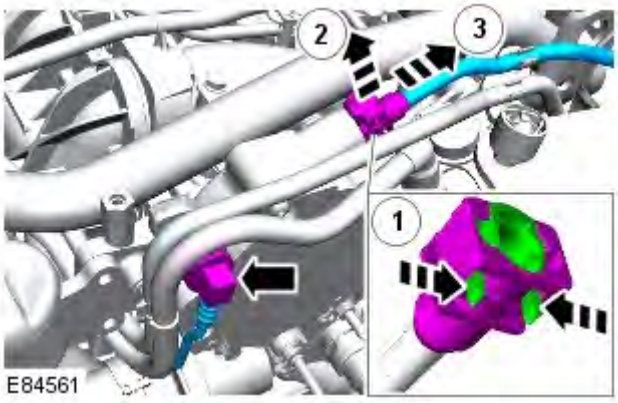
E85814

15. **15.** CAUTION: Discard the seals.



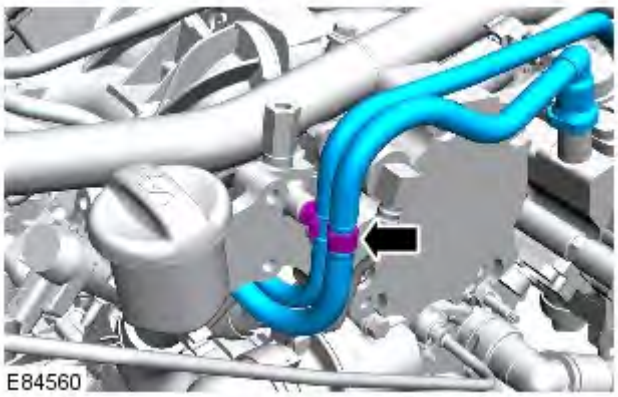
E84559

16.



E84561

17. **17.** CAUTION: Make sure that all openings are sealed.



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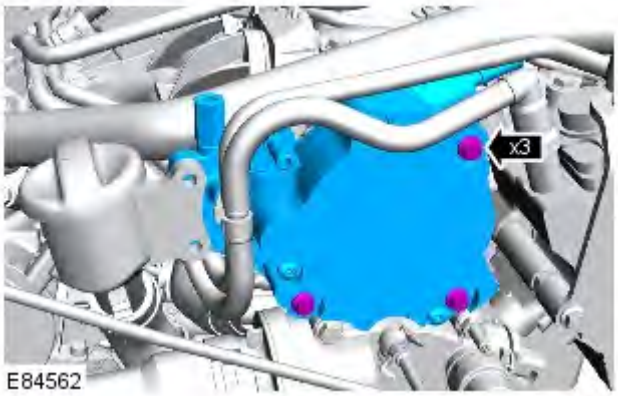
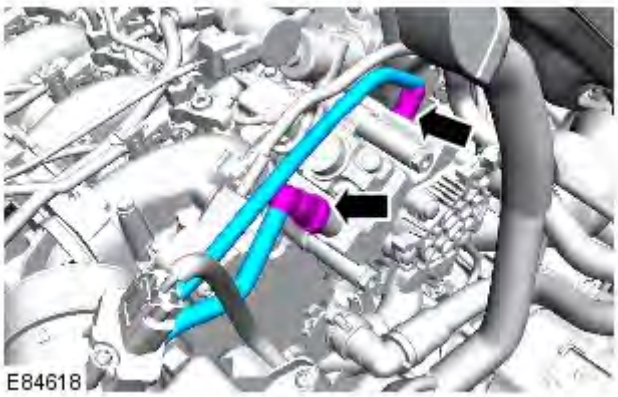


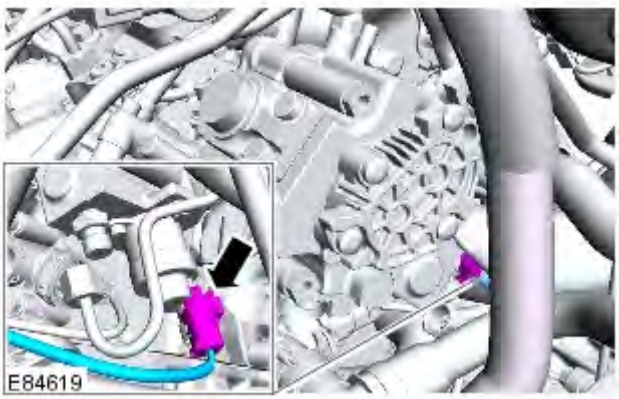
19. **19.** CAUTION: Discard the seal.



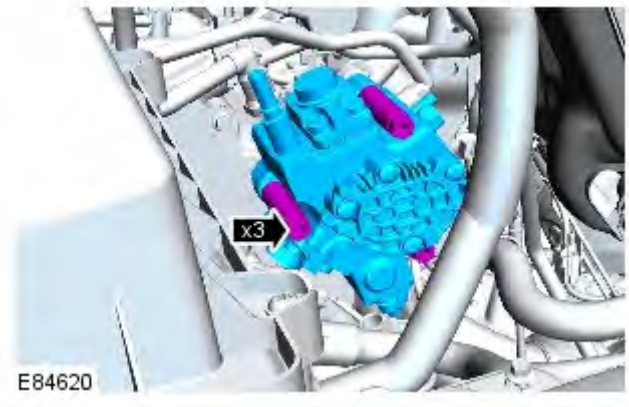
20. **20.** CAUTIONS:

Make sure that the area around the component is clean and free of foreign material.

Make sure that all openings are sealed. Use new blanking caps.

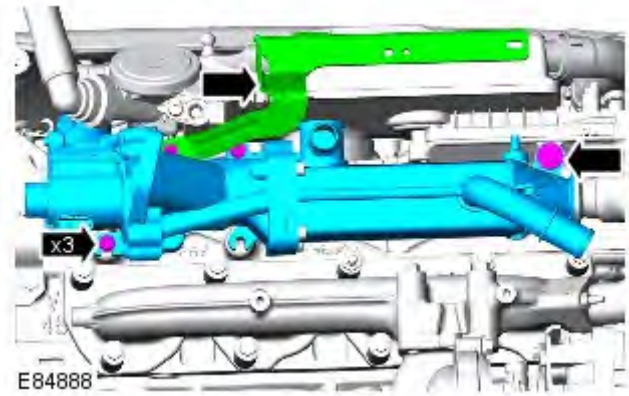


21.

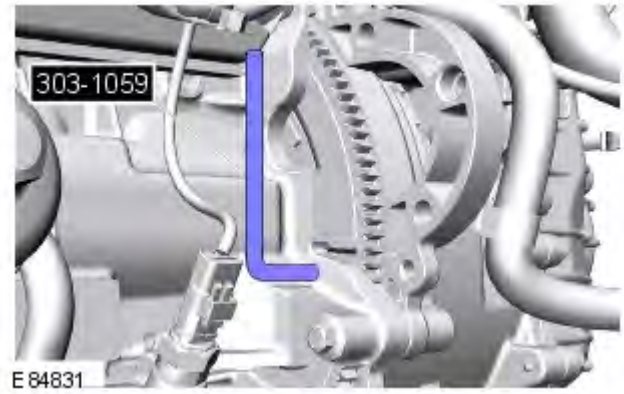


22. **22.** CAUTION: The O-ring seal is to be reused unless damaged.

    • NOTE: Make sure the fuel pump drive remains captive when removing the fuel pump.



23.

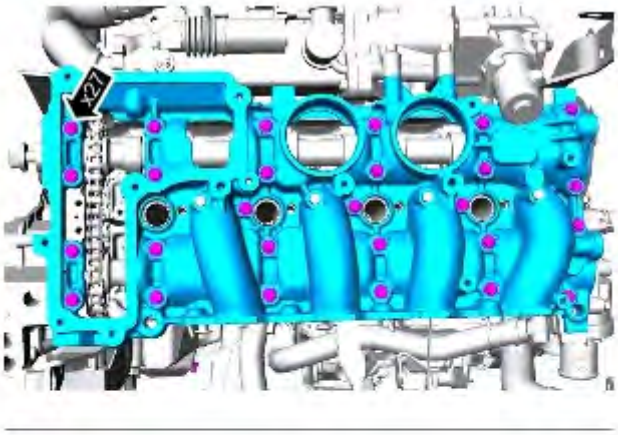


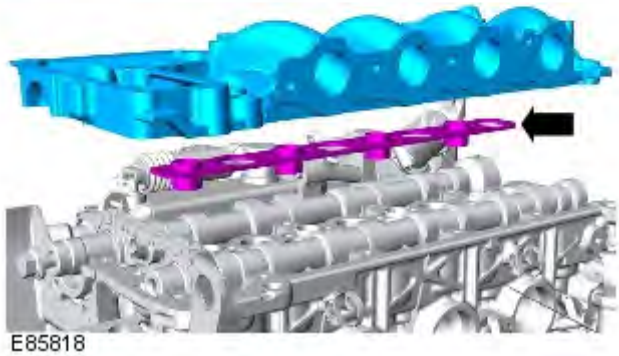
24. **24.** NOTE: The engine is now in the SAFE position.

- Remove the crankshaft timing tool.

  Special Tool(s): 303-1270
- Rotate the crankshaft through 90 degrees.

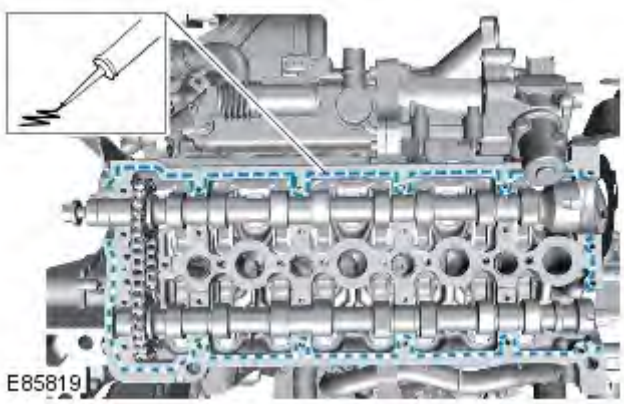
25. Retract and lock the camshaft drive chain tensioner.





26. **26.** NOTE: Discard the gasket.

Installation



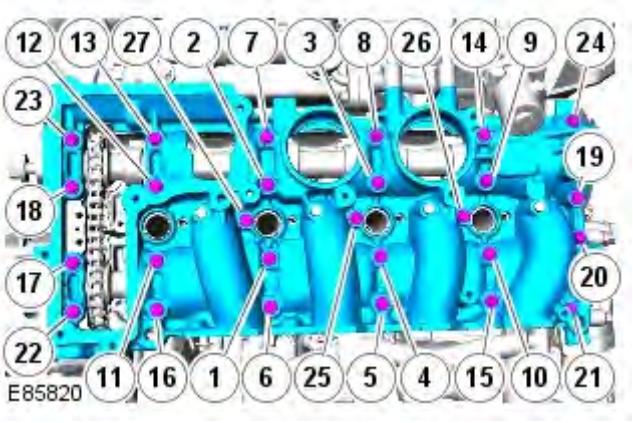
1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Apply a continuous bead of sealant to one surface.

   Refer to: Specifications (303-01B Engine - TD4 2.2L Diesel, Specifications).

2. Temporarily install the camshaft pulley and the pulley timing pin

   Special Tool(s): 303-1277



3. **3.** CAUTION: Lubricate the bearing surfaces with clean engine oil.

   • NOTE: Install a new gasket.

   - Install and lightly tighten bolts in sequence illustrated.
   - Tighten the bolts in the sequence illustrated.

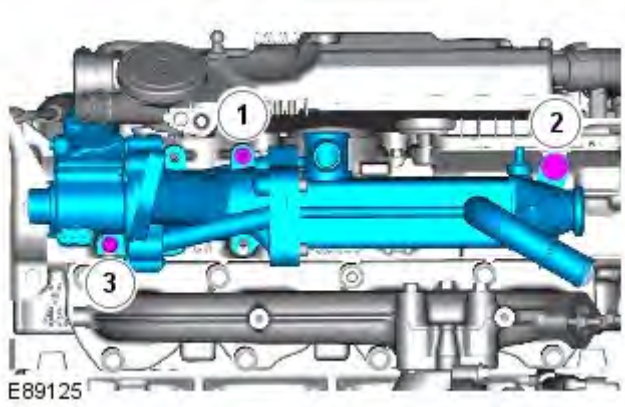
     Torque: 10 Nm

4. Release the chain tensioner

5. Rotate the crankshaft and install the crankshaft timing tool.

   Special Tool(s): 303-1270

6. Remove the camshaft pulley.



7.

   - Secure the EGR cooler.
   - Install the nuts, bolts and washers, do not tighten at this stage.
   - Tighten the nuts in the sequence shown.

     Torque: 6 Nm
   - Tighten the bolt in the sequence shown.

     Torque: 10 Nm

8. **8.** CAUTIONS:

   Extreme cleanliness must be exercised when handling this component.

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that the seal is correctly located.

   Install the fuel pump.

   Torque: 22 Nm

9. Connect the fuel shut off electrical connector.

10. **10.** WARNING: Before installing the components, ensure the area around the joint faces and connections are clean.

    Connect the fuel pump feed and return connectors.

11. **11.** CAUTIONS:

Make sure that the mating faces are clean and free of foreign material.

Make sure that the seal is correctly located.

Install the vacuum pump.

Torque: 9 Nm

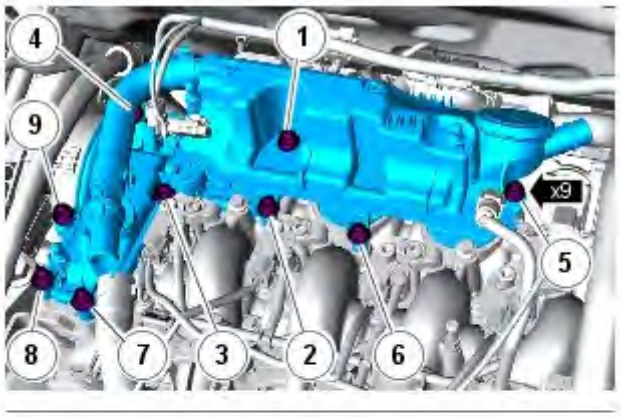
12. Secure the oil filler tube.

    Torque: 9 Nm

13. **13.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

    Connect the vacuum lines to the vacuum pump.

14. Secure the fuel lines.



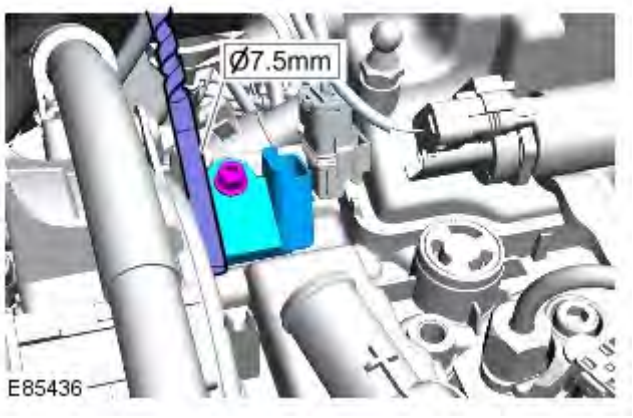
E85440

15. **15.** CAUTION: Tighten the bolts in the sequence shown.

    • NOTE: Install new seals.

    Install the valve cover vent oil separator.

    Torque: 9 Nm



16. **16.** CAUTION: Incorrect installation of the camshaft position (CMP) sensor could result in engine damage.
    - Insert a 7.5 mm diameter drill between the valve cover and the CMP sensor as shown, to achieve the correct alignment of the CMP sensor.
    - *Torque:* 4 Nm

17. **17.** NOTE: Install new retaining clips.

    Install the valve cover breather hose.

18. Connect the CMP sensor electrical connector.

19. **19.** NOTE: Install a new retaining clip.

    Connect and secure the engine breather line.

20. Install the oxygen sensor (HO2S) harness bracket.

    Torque: 9 Nm

21. Secure the HO2S harness.

22. Install the breather line.

23. Install the intake manifold.

    Refer to: Intake Manifold (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

24. Install the fuel injectors.

    Refer to: Fuel Injector (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

25. Install the fuel rail.

    Refer to: Fuel Rail (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

26. Install the camshaft seal.

    Refer to: Camshaft Seal (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

27. Install the air cleaner.

    Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

28. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System -

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Engine - TD4 2.2L Diesel - Camshafts

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

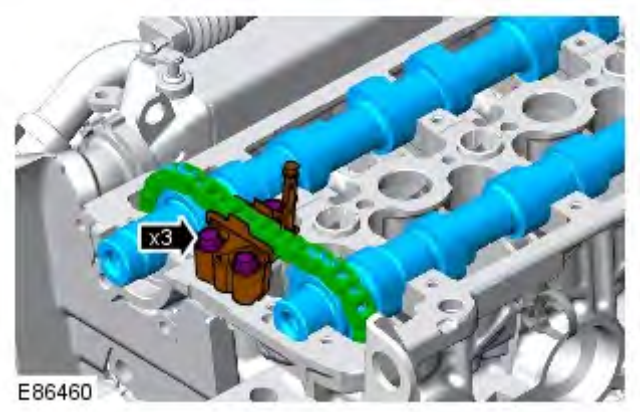
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

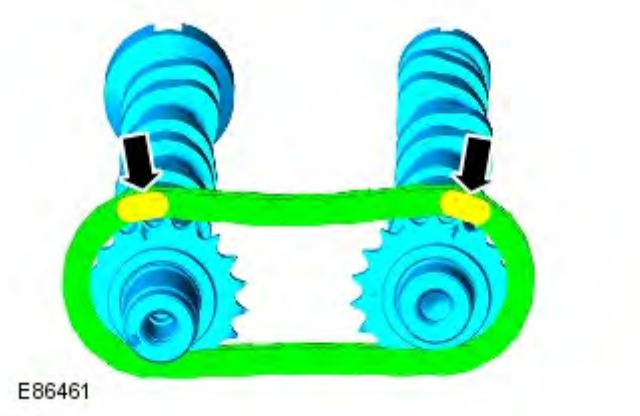
3. Remove the valve cover.

   Refer to: Valve Cover (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



4.

Installation



1. **1.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Lubricate the bearing surfaces with clean engine oil.

   Install the camshafts with the timing chain and tensioner. Align the chain timing links with the timing marks on the camshaft sprocket as shown.

2. Tighten the tensioner bolts.

   Torque: 7 Nm

3. Install the valve cover.

   Refer to: Valve Cover (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

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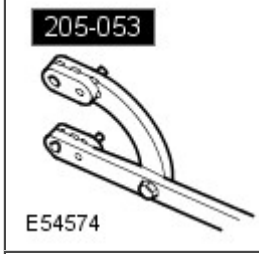
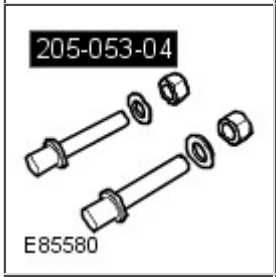
Engine - TD4 2.2L Diesel - Camshaft Seal

Removal and Installation

Special Tool(s)

	205-053 Retainer, Drive Flange
	205-053-04 Adapter, Drive Flange
	303-1276 Installer, Camshaft Seal
	303-935 Remover, Camshaft Seal

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

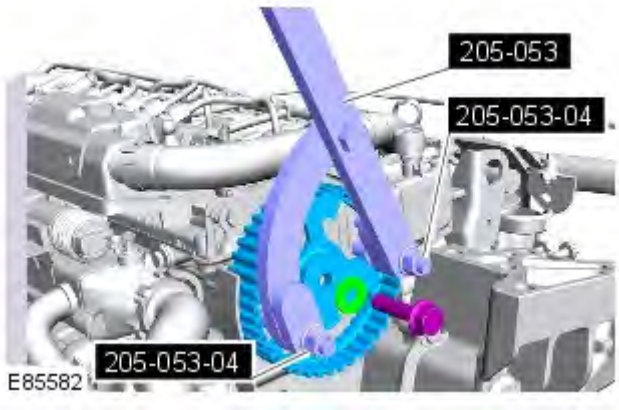
   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

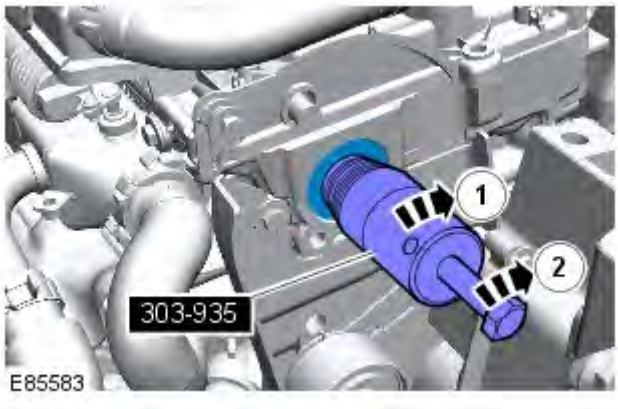
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the timing belt.

   Refer to: Timing Belt (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



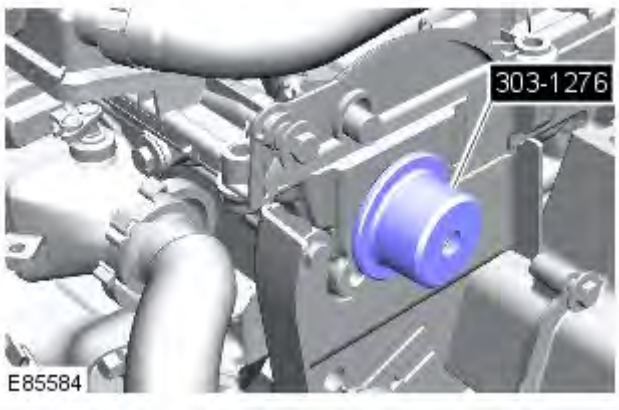
4. *Special Tool(s):* 205-053, 205-053-04



5. Remove the camshaft front seal.

   Special Tool(s): 303-935

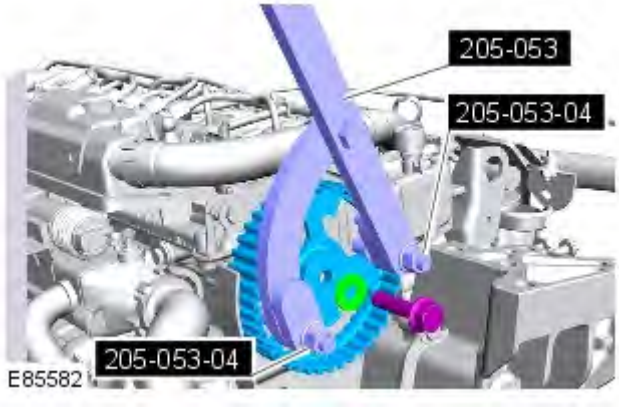
Installation



1. **1.** CAUTION: Extreme cleanliness must be exercised when handling these components.

   Install the new seal.

   Special Tool(s): 303-1276



2. **2.** WARNING: Make sure that a new bolt is installed.

   • CAUTIONS:

   Make sure that the component is clean, free of foreign material and lubricant.

   Make sure that the component is correctly located on the locating dowels.

   - *Torque:*
     Stage 1:20 Nm
     Stage 2:60°
   - *Special Tool(s):* 205-053, 205-053-04

3. Install the new timing belt.

Refer to: Timing Belt (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

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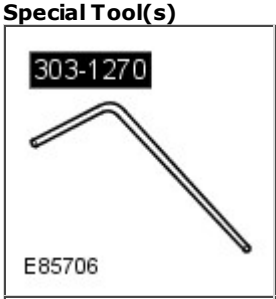
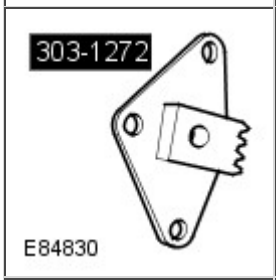
Engine - TD4 2.2L Diesel - Timing Belt

Removal and Installation

Special Tool(s)

	303-1270 Timing Pin, Crankshaft
	303-1272 Locking Tool, Flywheel
	303-1277 Timing Pin, Camshaft

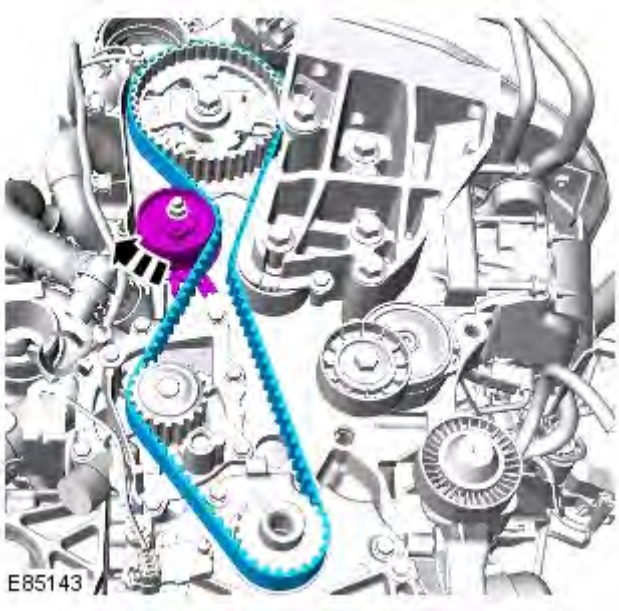
Removal

• NOTE: The timing and locking tools are installed to allow the timing cover to be removed. All tools must be left installed to allow the timing cover installation procedure to be followed.

1. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

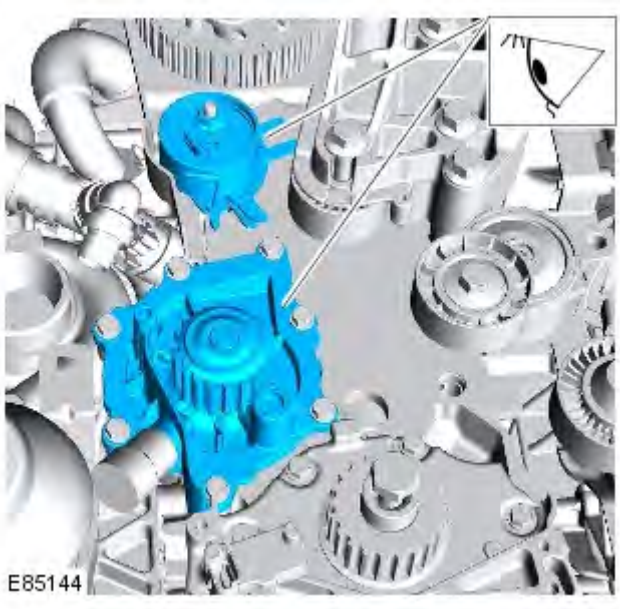
2. **2.** WARNING: Make sure to support the vehicle with axle stands.
   - Raise and support the vehicle.

3. Refer to: Timing Cover (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



4.

- Release the timing belt tension.
- Remove the timing belt.



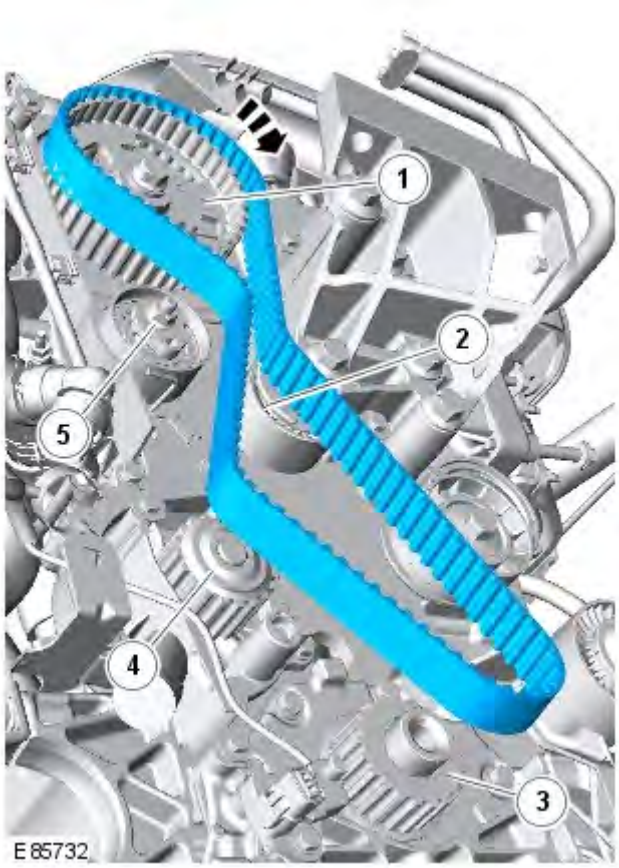
5.

- Check the condition of the roller and tensioner.
- Check the condition of the coolant pump.
- Install any of the above as necessary.

Installation

1.

- Make sure that the key is centered within the keyway.

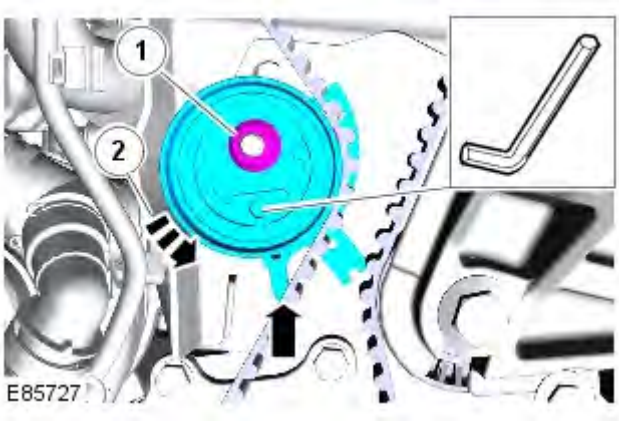


2. **2.** CAUTIONS:

The crankshaft or camshafts must not be rotated while the timing belt is removed.

Make sure that the timing belt is not folded to produce a loop with a diameter less than 35 mm.

- Install the new timing belt.
- Starting at the camshaft pulley, install the timing belt in a clockwise direction, in the sequence shown.



3.

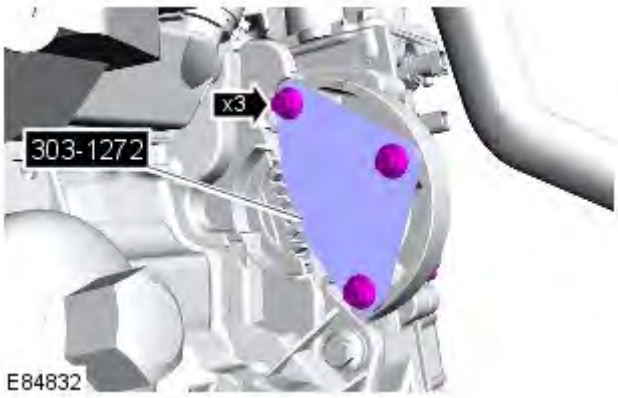
- Lightley tighten the timing belt tensioner bolt.
- Using an Allen key, adjust the tension counter-clockwise until the pointer is in the position illustrated.
- Tighten the tensioner bolt.

Torque: 25 Nm

4.

- Install the reluctor ring.
- Install the crankshaft damper using the original bolt.

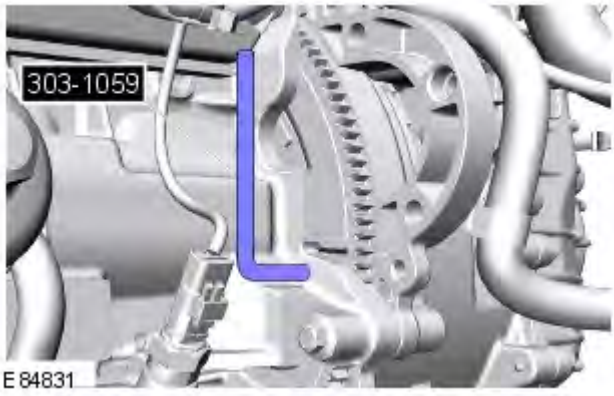
Torque: 70 Nm



5.

- Remove the crankshaft locking tool.

Special Tool(s): 303-1272



6.

- Remove the crankshaft timing tool.

Special Tool(s): 303-1270

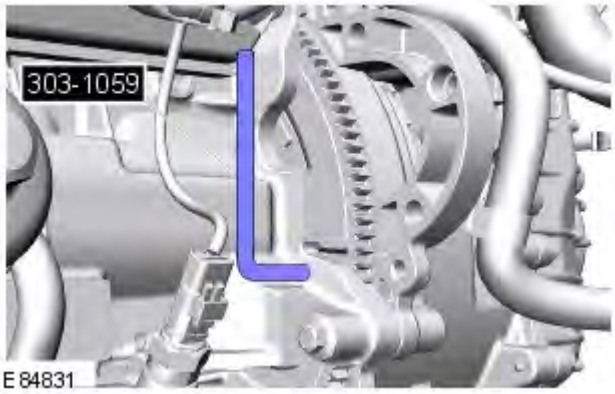
7.

- Remove the camshaft sprocket timing tool.

  Special Tool(s): 303-1277

8.

- Rotate the engine ten complete turns clockwise.



9.

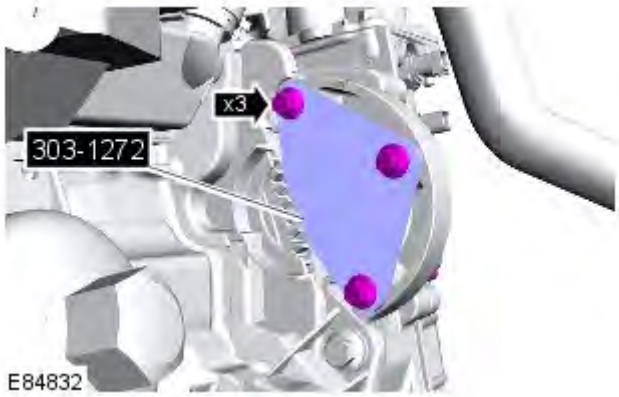
- Install the crankshaft timing tool.

  Special Tool(s): 303-1270

10.

- Install the camshaft sprocket timing tool.

  Special Tool(s): 303-1277



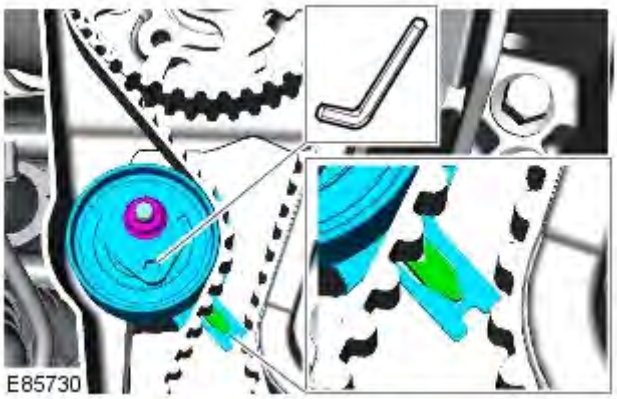
11.

- Install the crankshaft locking tool.

  Special Tool(s): 303-1272

12.

- Loosen the crankshaft damper bolt.



13. **13.** CAUTION: If the pointer position is incorrect, repeat the timing belt tensioning operation.

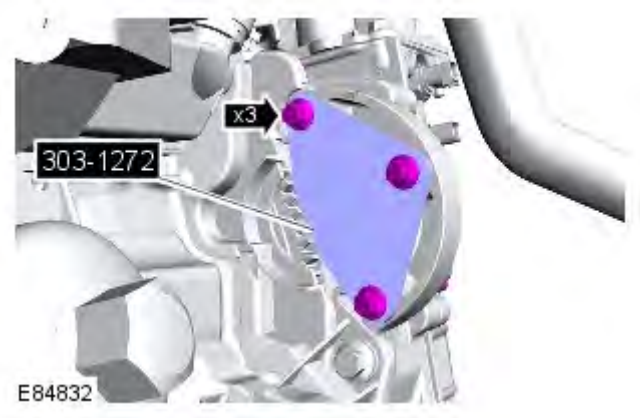
- Loosen the timing belt tensioner bolt.
- Using an Allen key, adjust the tensioner clockwise until the pointer is in the position illustrated.
- Tighten the tensioner bolt.

Torque: 25 Nm

14.

- Tighten the crankshaft damper.

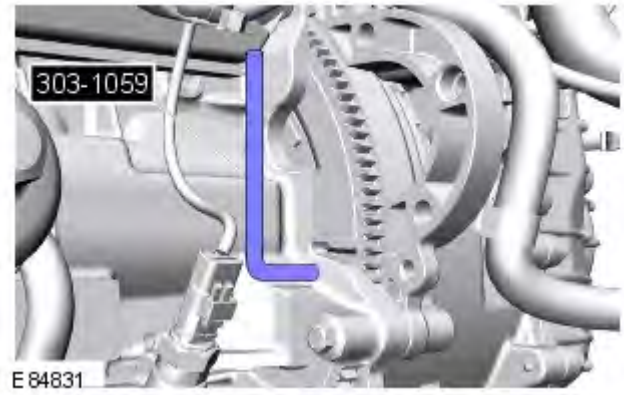
Torque: 70 Nm



15.

- Remove the crankshaft locking tool.

  Special Tool(s): 303-1272



16.

- Remove the crankshaft timing tool.

  Special Tool(s): 303-1270

17.

- Remove the camshaft sprocket timing tool.

  Special Tool(s): 303-1277

18.

- Rotate the engine two complete turns clockwise.

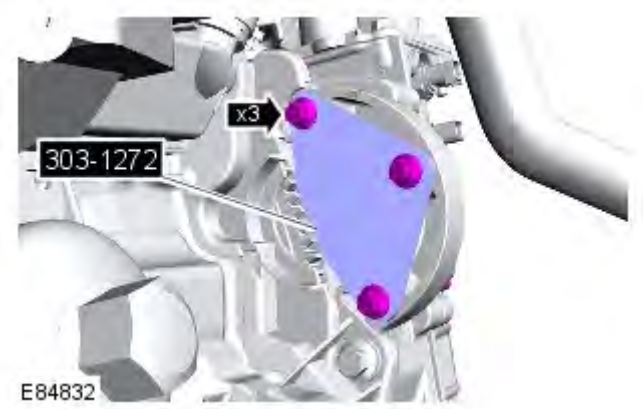
19.

- Check the timing belt tensioner is in the correct position. If not repeat the setting procedure.

20.

- Install the crankshaft timing tool.

  Special Tool(s): 303-1270



21.

- Install the crankshaft locking tool.

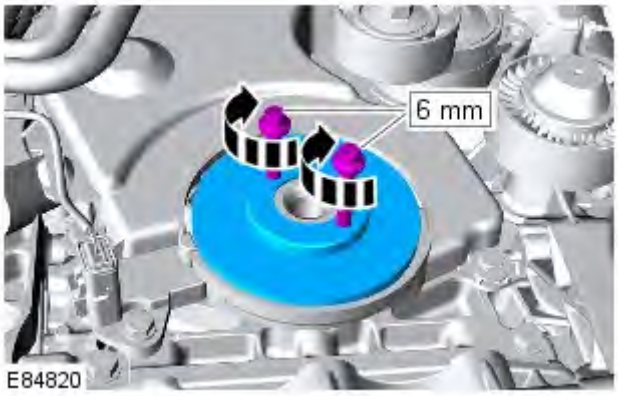
  Special Tool(s): 303-1272

22.

- Install the camshaft sprocket timing tool.

  Special Tool(s): 303-1277

23. **23.** CAUTION: Make sure that a new bolt is installed.
    - Remove the crankshaft damper.



24.
    - Remove the reluctor ring.

25. Refer to: Timing Cover (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

26. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Exhaust Manifold

Removal and Installation

Removal

WARNING: Observe due care when working near a hot exhaust system.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

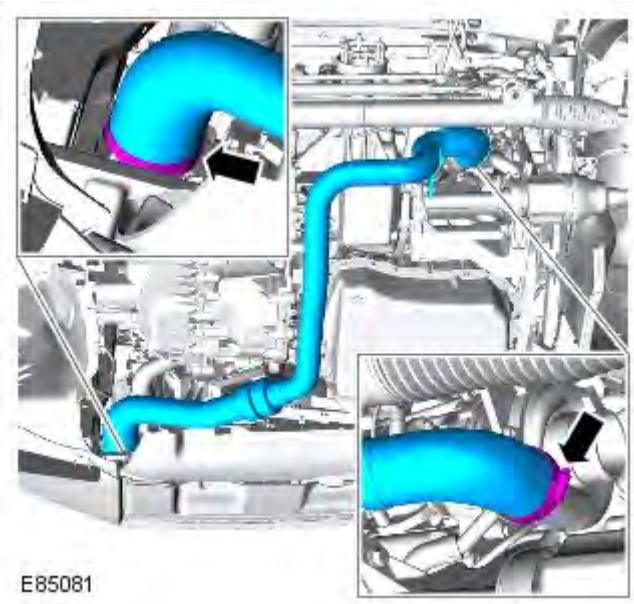
   Raise and support the vehicle.

2. Remove the exhaust gas recirculation (EGR) cooler.

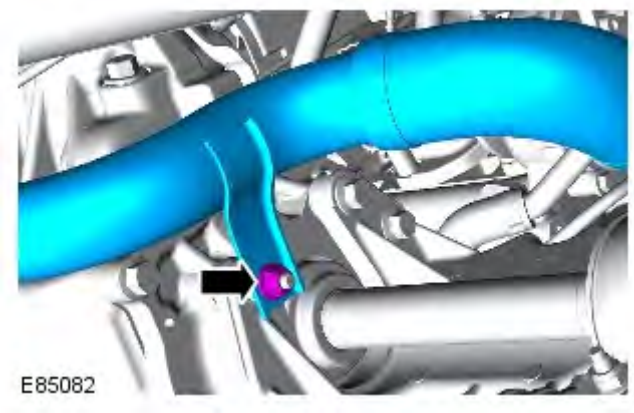
   Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08B Engine Emission Control - TD4 2.2L Diesel, Removal and Installation).

3. Remove the catalytic converter.

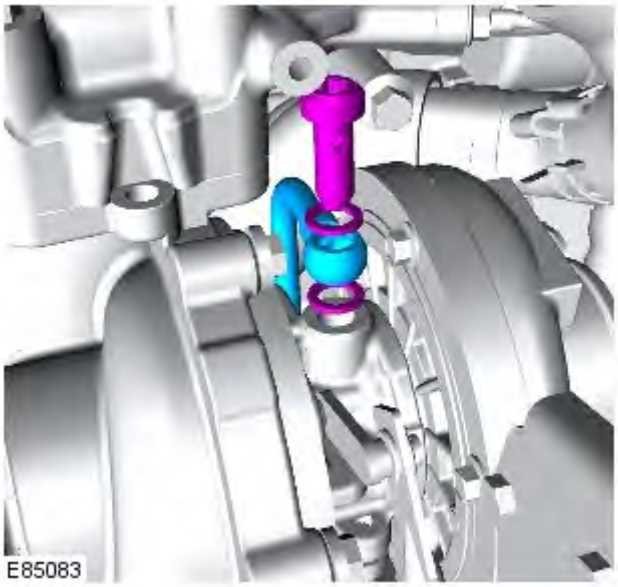
   Refer to: Catalytic Converter - Vehicles Without: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).



4. **4.** NOTE: Make sure that all openings are sealed.



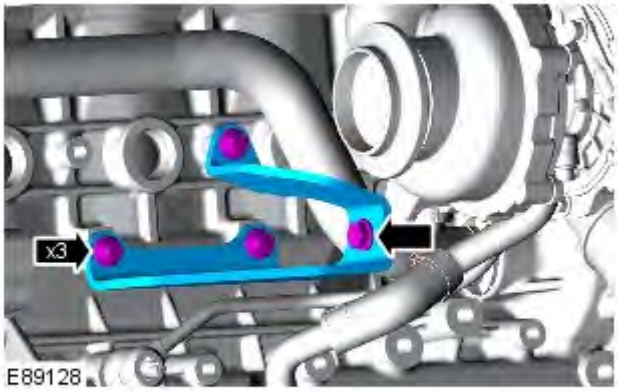
5.



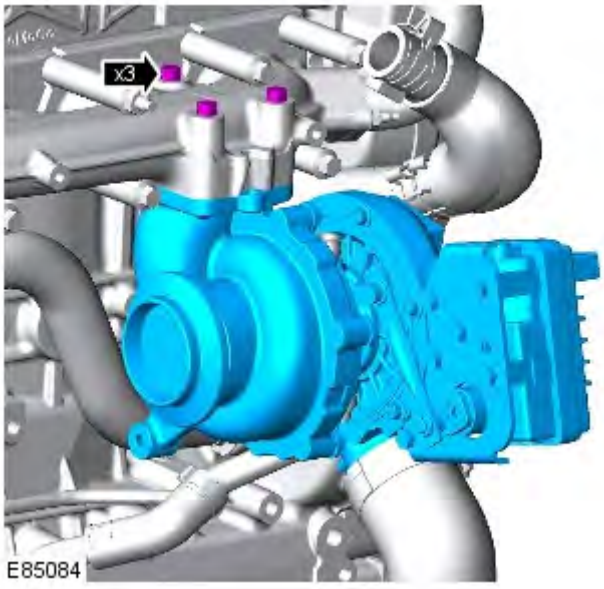
6. **6.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Make sure that all openings are sealed. Use new blanking caps.

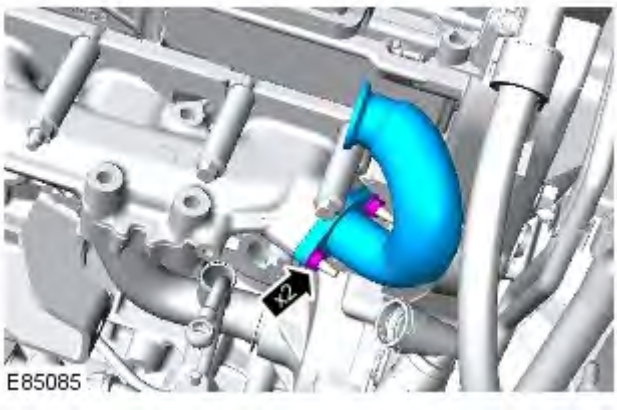


7.

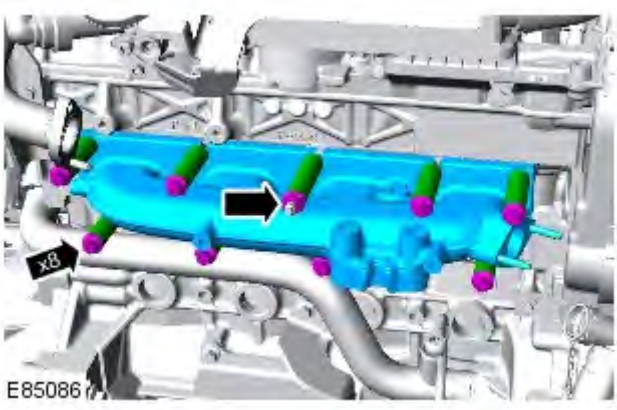


8. **8.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.

   Release the turbocharger.

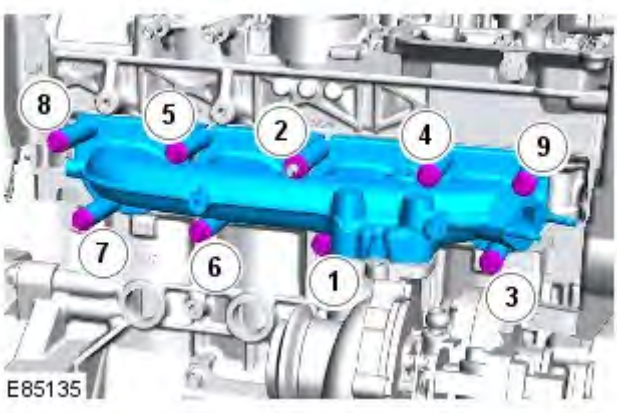


9. Remove the EGR cooler to exhaust manifold elbow.



10. **10.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.
    - NOTE: Discard the gasket.

Installation



1. **1.** CAUTION: Make sure that the area around the component is clean and free of foreign material.
    - Install a new gasket.
    - Install the exhaust manifold.
    - Evenly and progressively, tighten the bolts in the sequence shown.

    Torque: 25 Nm

2. Install the EGR cooler to exhaust manifold elbow.

    Torque: 10 Nm

3. **3.** CAUTIONS:

    Make sure that new bolts are installed.

    Extreme cleanliness must be exercised when handling this component.

    Carbon deposits must be carefully removed from both faces of the turbocharger and exhaust manifold prior to assembly.

    Install the turbocharger.

Torque: 24 Nm

4.
   - Install the turbocharger support bracket, but do not fully tighten at this stage.
   - Tighten the support bracket to turbocharger bolt.

     Torque: 24 Nm
   - Tighten the support bracket to cylinder block bolts.

     Torque: 24 Nm

5. **5.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Make sure that new sealing washers are installed.

   Connect the turbocharger oil feed line.

   Torque: 24 Nm

6. Install the turbocharger outlet pipe.

   Torque: 25 Nm

7. Install the catalytic converter.

   Refer to: Catalytic Converter - Vehicles Without: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

8. Install the EGR cooler.

   Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08B Engine Emission Control - TD4 2.2L Diesel, Removal and Installation).

9. Check and top-up the engine oil.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Cylinder Head

Removal and Installation

Removal

• NOTE: The valve cover and cylinder head is machined as an assembly and cannot be serviced separately.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the exhaust manifold.

   Refer to: Exhaust Manifold (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

4. Remove the camshafts.

   Refer to: Camshafts (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

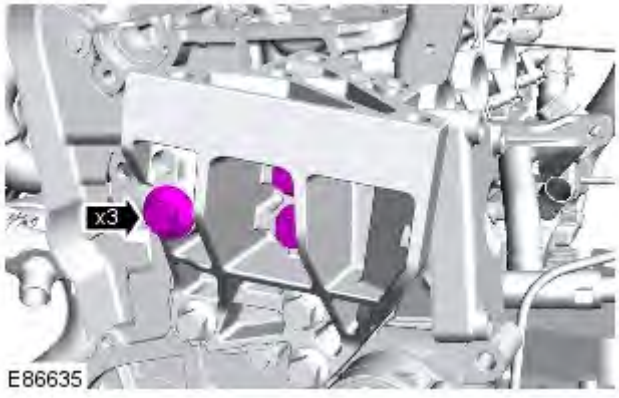
5. Remove the thermostat.

   Refer to: Thermostat (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation).

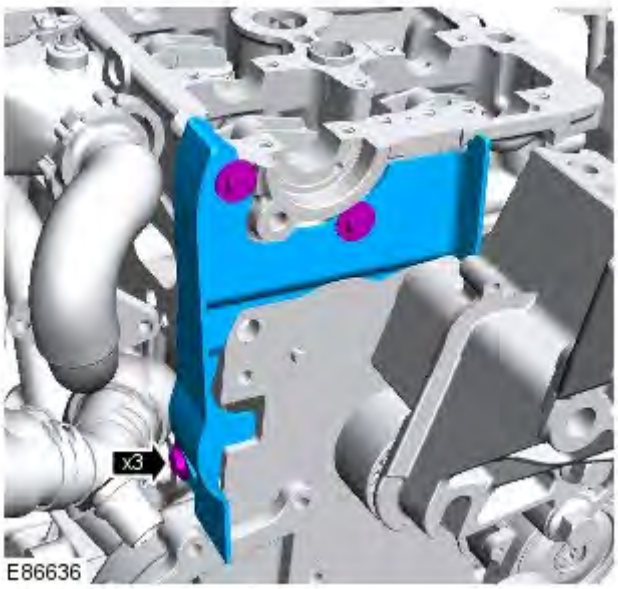
6. Remove the RH engine mount.

   Refer to: Engine Mount RH (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

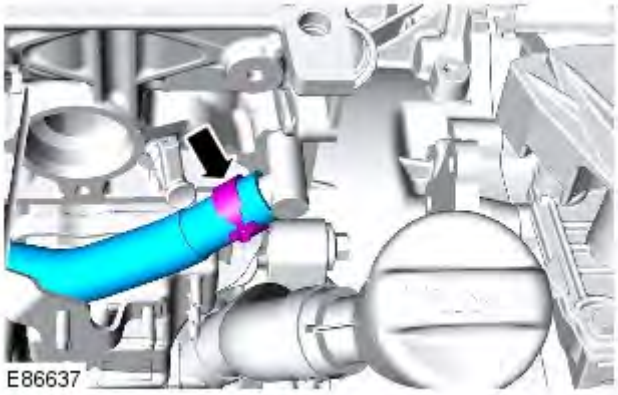
7.



8.



9.



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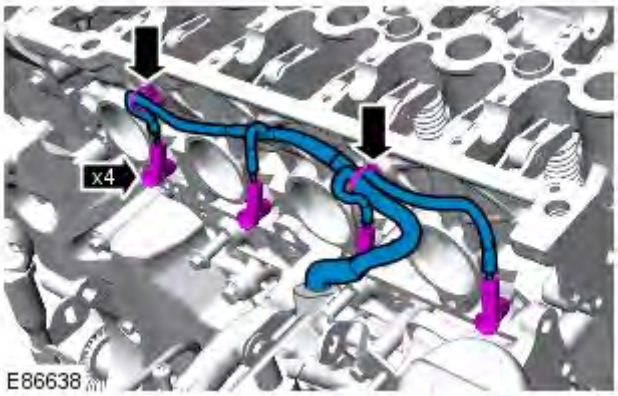
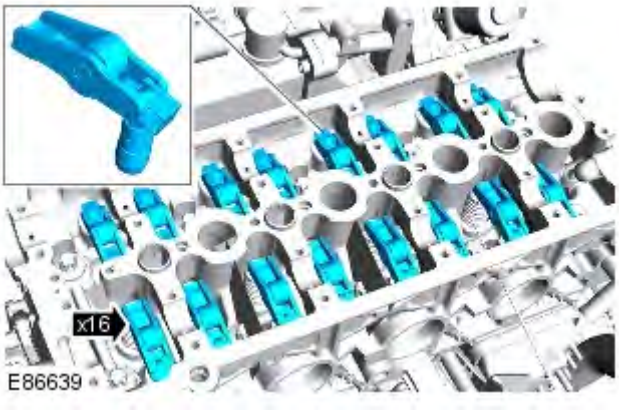
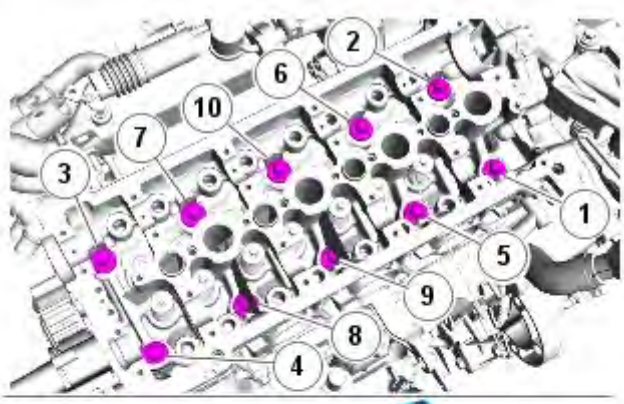
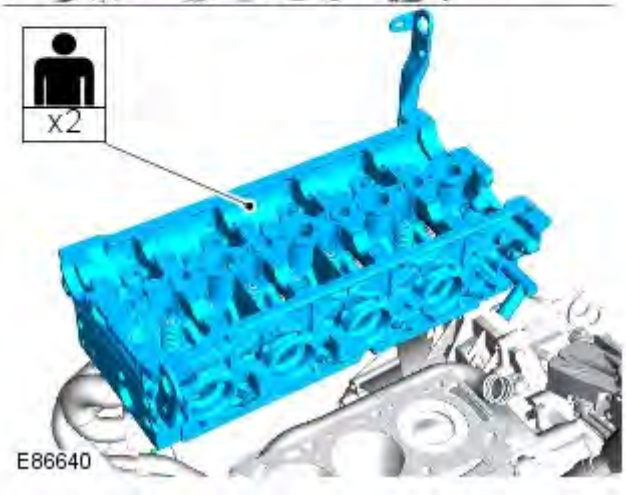




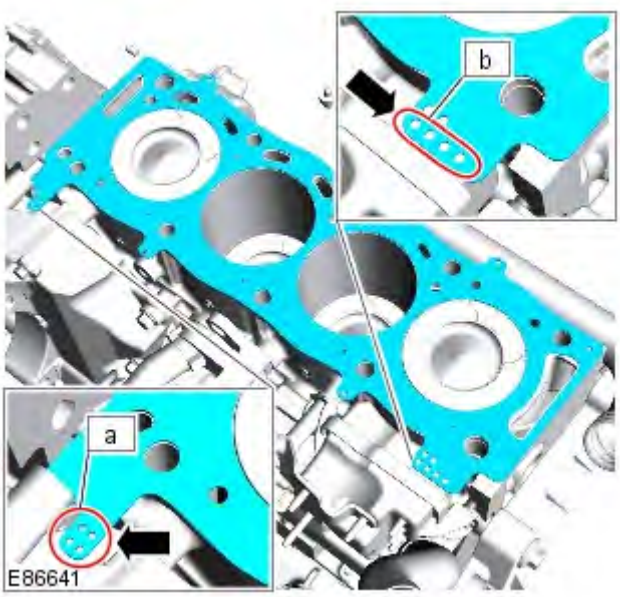
11. **11.** CAUTION: Note the fitted position of the component prior to removal.





12. **12.** WARNING: This step requires the aid of another technician.

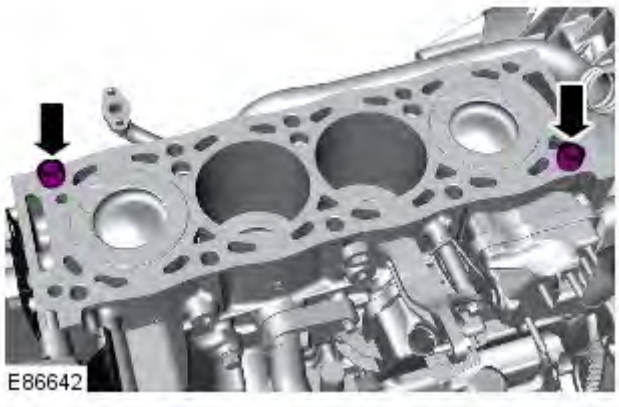
- Discard the bolts.



13. **13.** CAUTIONS:

⚠ Note the thickness of the gasket removed.

⚠ The gasket thickness is identified by the number of holes (1 to 4) at either of the locations shown.



14.

15. **15.** NOTE: Do not disassemble further if the component is removed for access only.

16.

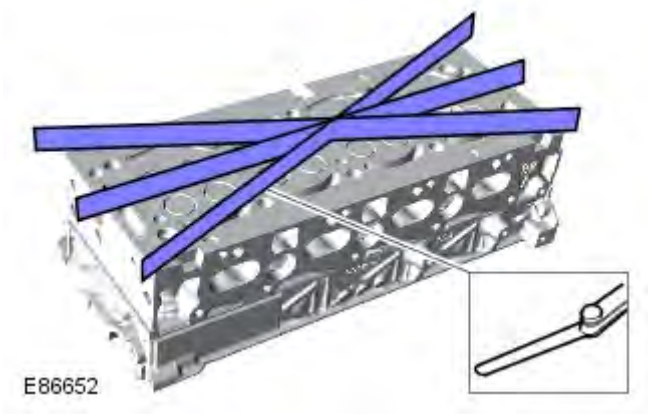
Installation

1. Install the lifting brackets and tighten the bolts.

   Torque: 10 Nm

2. **2.** CAUTION: Only use a plastic scraper to clean off the old gasket.

   Clean and inspect the cylinder head and cylinder block.



3. Check cylinder head face for distortion, across the center and from corner to corner.

   Refer to: Specifications (303-01B Engine - TD4 2.2L Diesel, Specifications).

4. If necessary, select the correct thickness cylinder head gasket.

   Refer to: Cylinder Head Gasket Selection - TD4 2.2L Diesel (303-00 Engine System - General Information, General Procedures).

5. **5.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure the locating dowels are installed correctly.

Make sure to install a gasket of the correct thickness

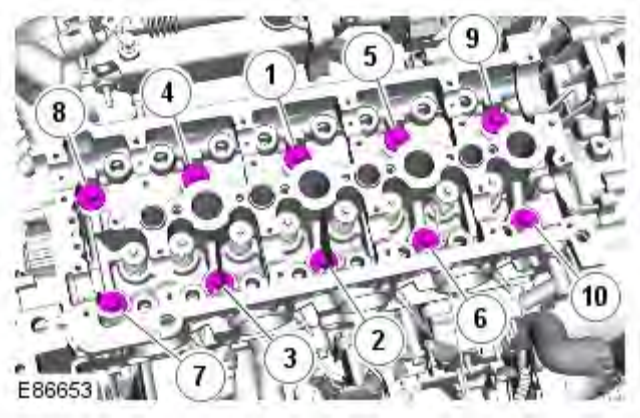
Make sure that the gasket is correctly located.

Install a new cylinder head gasket.

6. **6.** WARNING: This step requires the aid of another technician.

   CAUTION: Make sure that the component is correctly located on the locating dowels.

   Install the cylinder head.



7. **7.** CAUTION: Make sure that new cylinder head bolts are installed.

   Tighten the cylinder head bolts in three stages to the sequence shown.

   Torque:
   Stage 1: 20 Nm
   Stage 2: 60 Nm
   Stage 3: 220°

8. **8.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Lubricate the bearing surfaces with clean engine oil.

   Make sure that these components are installed to the noted removal position.

   Install the camshaft roller followers.

9. Connect the glow plug electrical connectors and secure the harness to the cylinder head.

10. Connect and secure the coolant hose.

11. Install the timing belt rear cover, tighten the bolts.

    Torque: 5 Nm

12. Install the engine RH mount bracket bolts.

    Torque:
    M12 80 Nm
    M10 60 Nm

13. Install the RH engine mount.

    Refer to: Engine Mount RH (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

14. Install the thermostat.

Refer to: Thermostat (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation).

15. Install the camshafts.

    Refer to: Camshafts (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

16. Install the exhaust manifold.

    Refer to: Exhaust Manifold (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

17. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Oil Pan

Removal and Installation

Removal

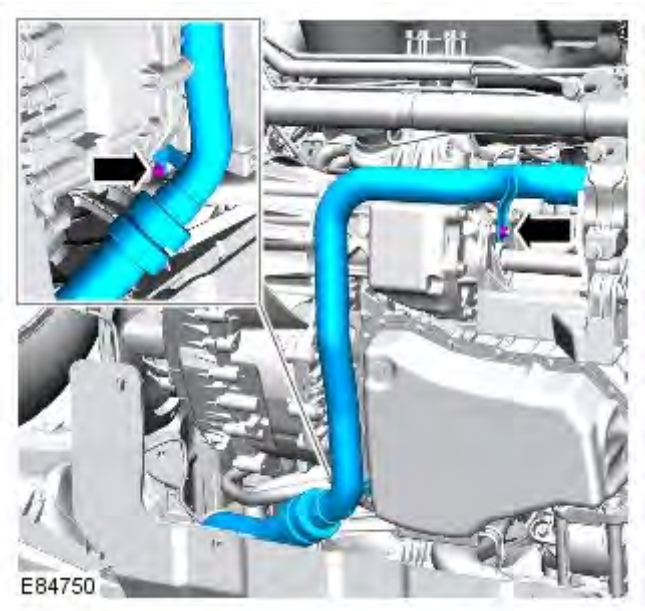
- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Drain the engine oil.

   Refer to: Engine Oil Draining and Filling (303-01B Engine - TD4 2.2L Diesel, General Procedures).



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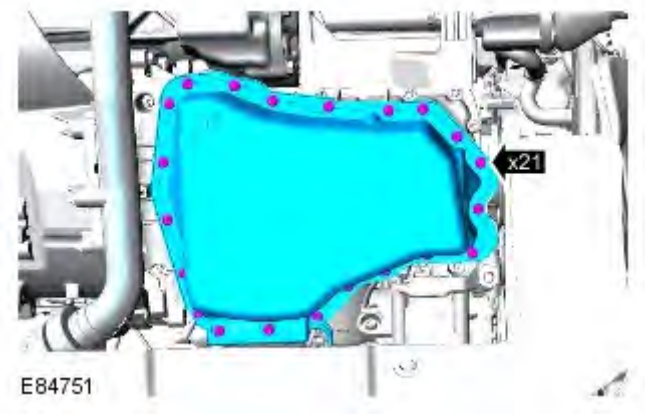
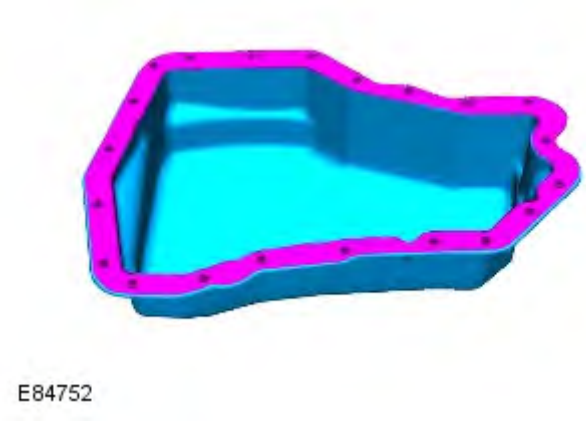


4. *Torque:* 9 Nm

5. For sealant information, refer to the engine specification section.

   Refer to: Specifications (303-01B Engine - TD4 2.2L Diesel, Specifications).

6.



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Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Oil Pump

Removal and Installation

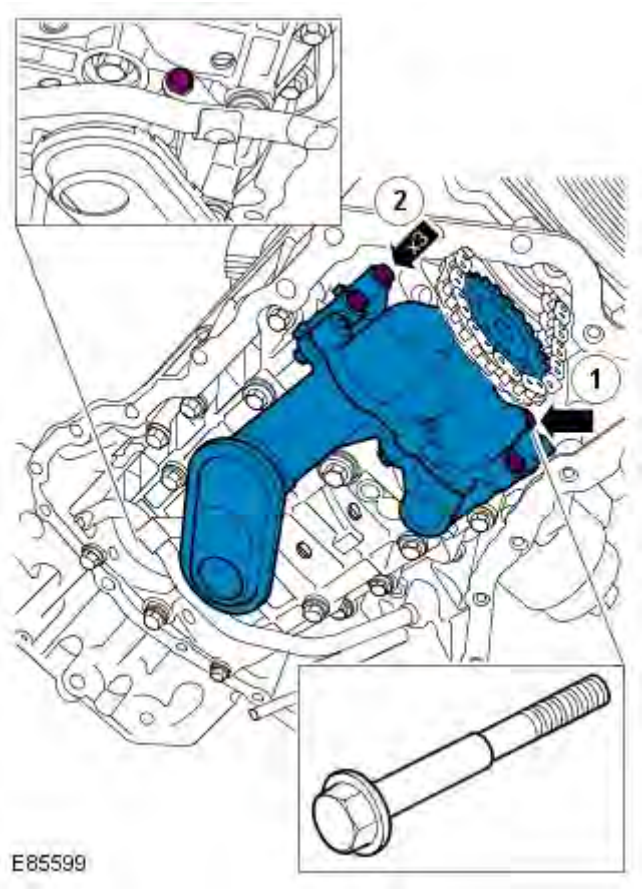
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the oil pan.

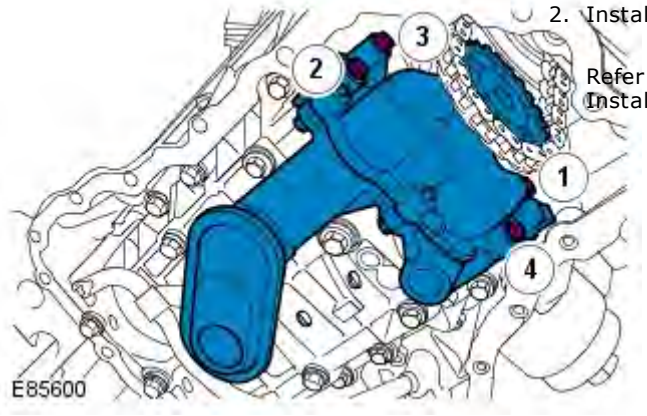
   Refer to: Oil Pan (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



3. **3.** CAUTION: Note the fitted position of the component prior to removal.

   • NOTE: The shouldered bolt in position 1 locates the oil pump.

Installation



1. **1.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that these components are installed to the noted removal position.

   • NOTE: The shouldered bolt in position 1 locates the oil pump.

   Tighten the bolts evenly in 2 stages to the sequence shown.

   Torque:
   Stage 1: 7 Nm
   Stage 2: 9 Nm

2. Install the oil pan.

   Refer to: Oil Pan (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Oil Cooler

Removal and Installation

Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Drain the coolant.

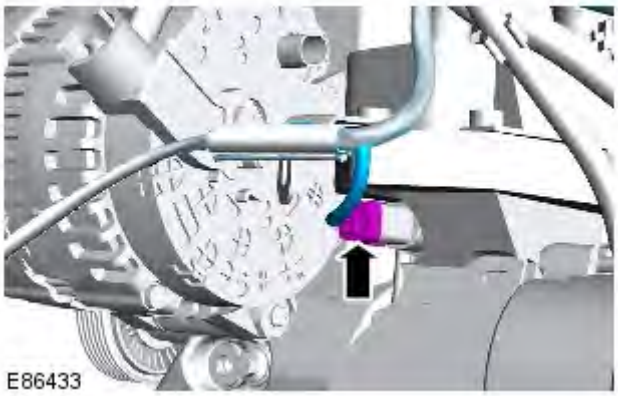
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

4. Remove the air conditioning (A/C) compressor.

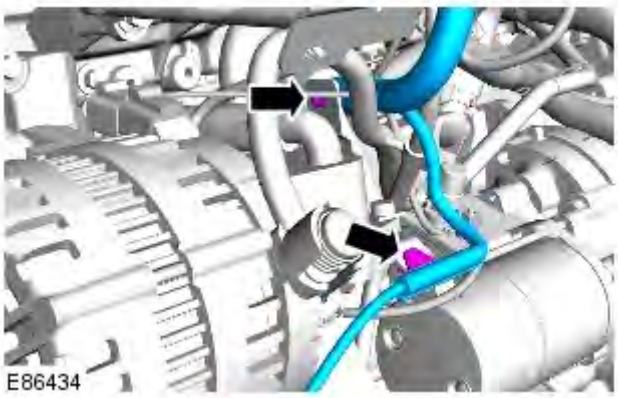
   Refer to: Air Conditioning (A/C) Compressor - TD4 2.2L Diesel (412-01 Climate Control, Removal and Installation).

5. Remove the throttle body.

   Refer to: Throttle Body (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).



6. Disconnect the engine oil pressure (EOP) sensor electrical connector.



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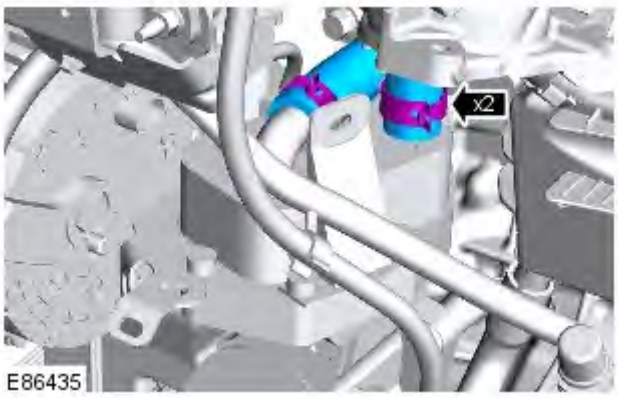

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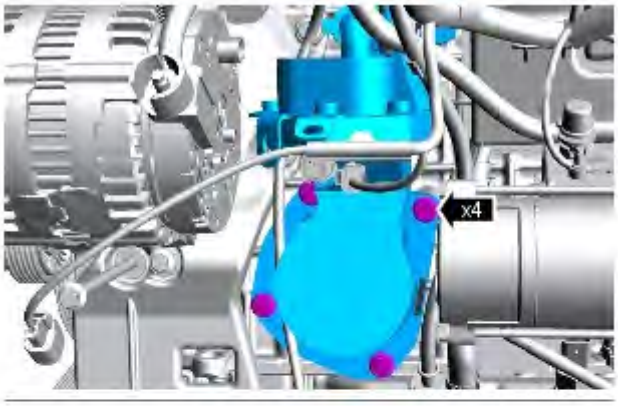
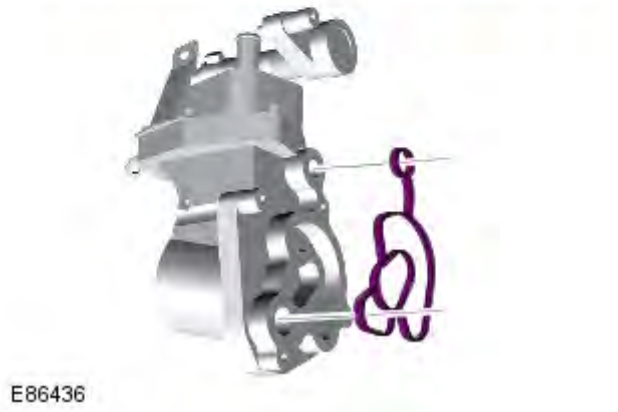


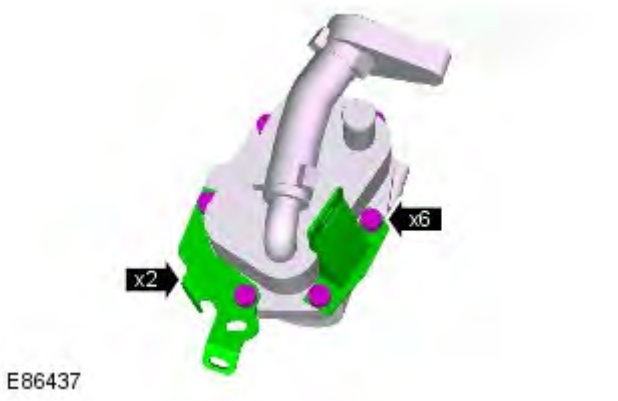
9. **9.** CAUTIONS:

   Be prepared to collect escaping fluids.

   Discard the seal.

   Torque: 20 Nm





10. **10.** CAUTION: Discard the seal.

    • NOTE: Do not disassemble further if the component is removed for access only.

    Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Oil Filter Element

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. **3.** WARNING: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

   • CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Discard the seal.

   Torque: 25 Nm

Installation

1. To install, reverse the removal procedure.

2. Check and top-up the engine oil.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Engine Mount LH

Removal and Installation

General Equipment

Transmission jack

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. Support the transmission.

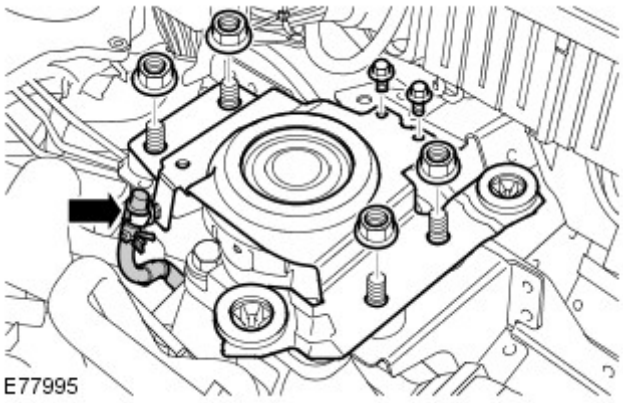
   General Equipment: Transmission jack

4. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

5. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).



6. **6.** WARNING: Make sure that new nuts are installed.

   • NOTE: Vehicles with automatic transmission have a breather pipe attached to the mounting.

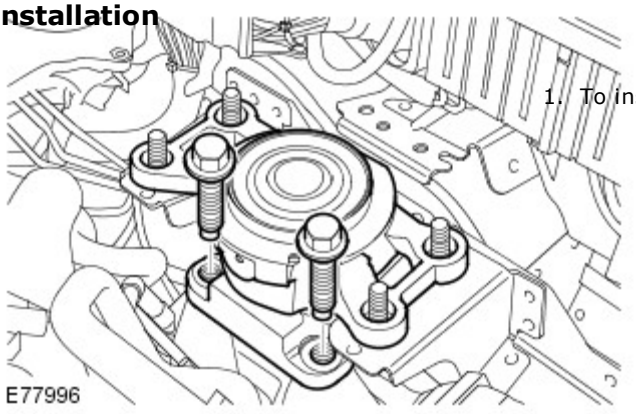
   Remove the bracket.

   Torque:
   M12 80 Nm
   M8 25 Nm

7. Remove the engine mount LH.

   Torque: 175 Nm

Installation



1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Engine Mount RH

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

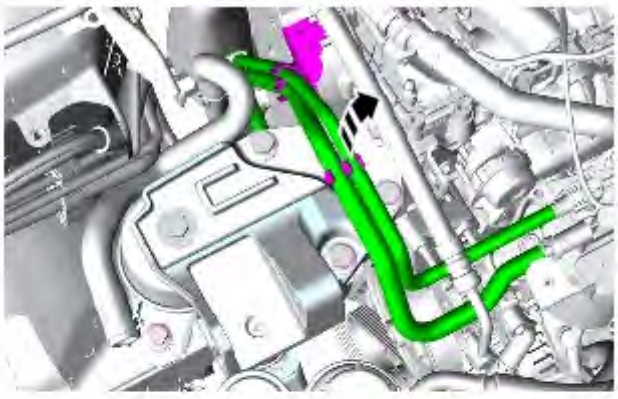
3. Support the engine.

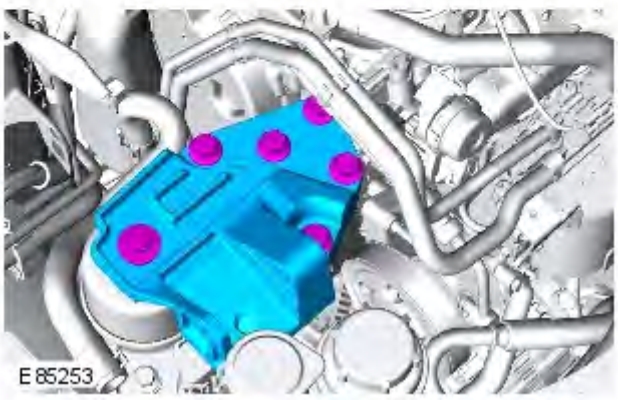
4. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

5. Remove the engine upper support insulator.

   Refer to: Engine Upper Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).





6. *Torque:*
   M14 175 Nm
   M12 80 Nm

7. *Torque:* 80 Nm

Installation

1. To install, reverse the removal procedure.

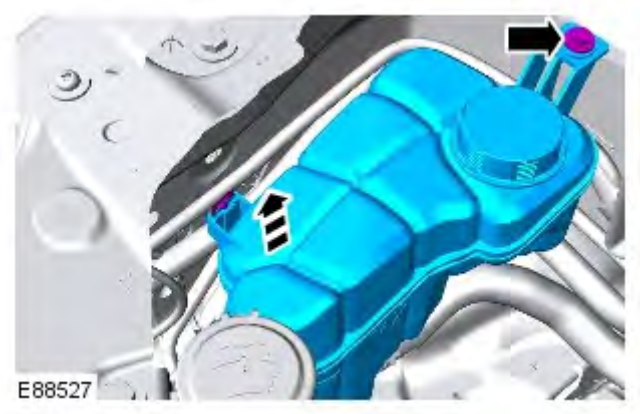
Published: 11-May-2011

Engine - TD4 2.2L Diesel - Engine Upper Support Insulator

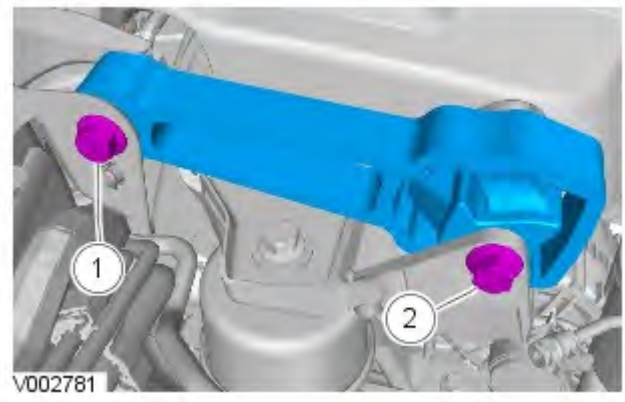
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 10 Nm



2. *Torque:* 110 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Engine Lower Support Insulator

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

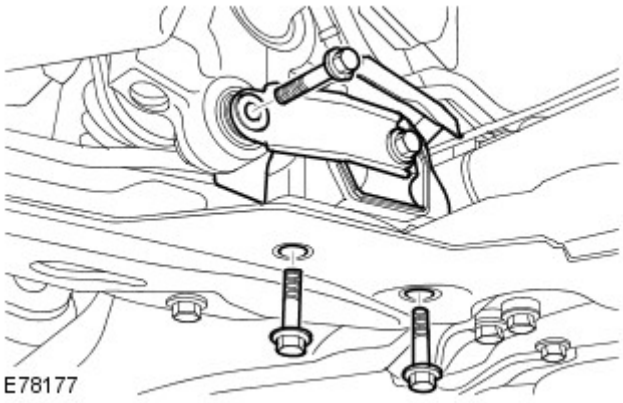
All vehicles

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

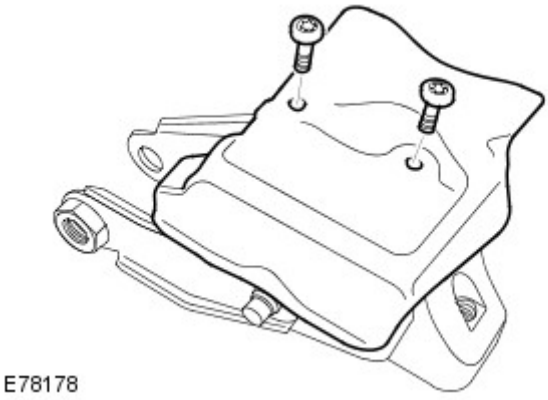


3. **3.** CAUTION: Make sure that these components are installed to the noted removal position.

   Remove the lower support insulator.

   Torque: 110 Nm

Vehicles with petrol engine

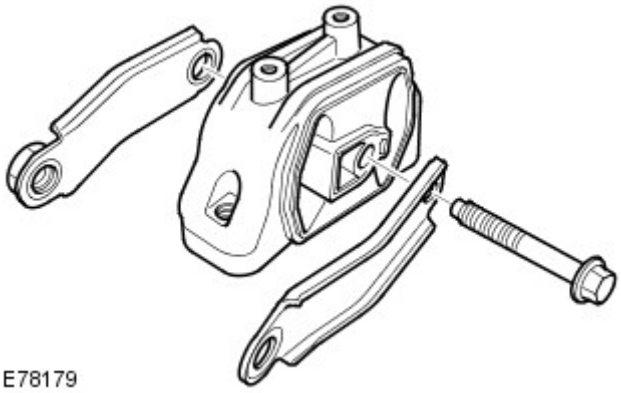


4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the heat shield.

   Torque: 10 Nm

All vehicles



5. Remove the engine mount link brackets.

   Torque: 110 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Oil Pan Extension

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

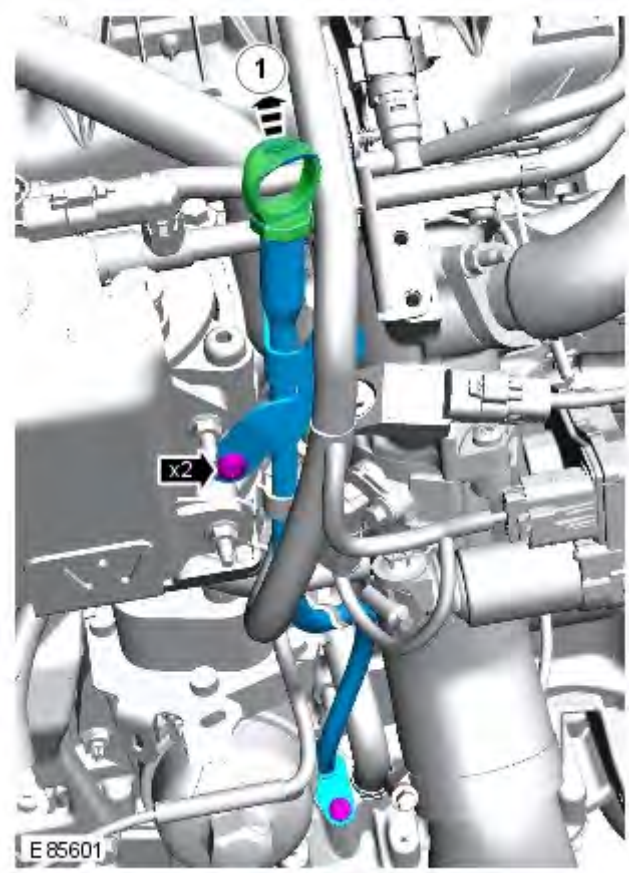
   Raise and support the vehicle.

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

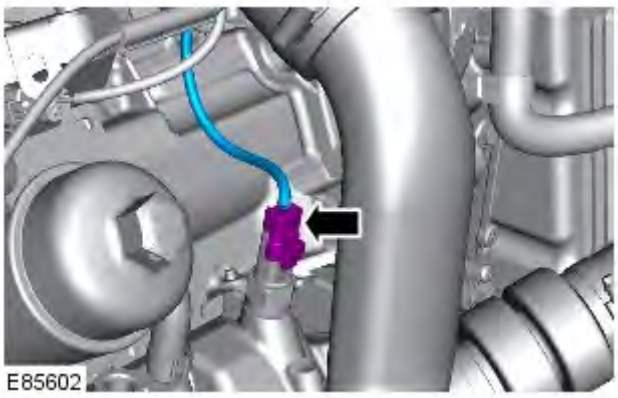
3. Remove the oil pan.

   Refer to: Oil Pan (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

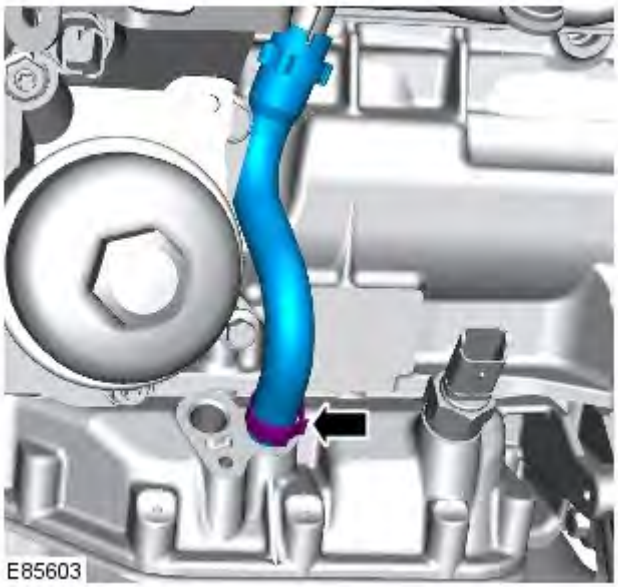


4. **4.** NOTE: Remove and discard the O-ring seal.

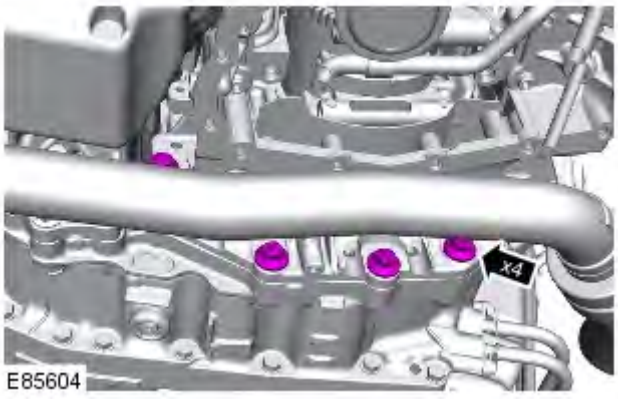
   Remove the dipstick tube.



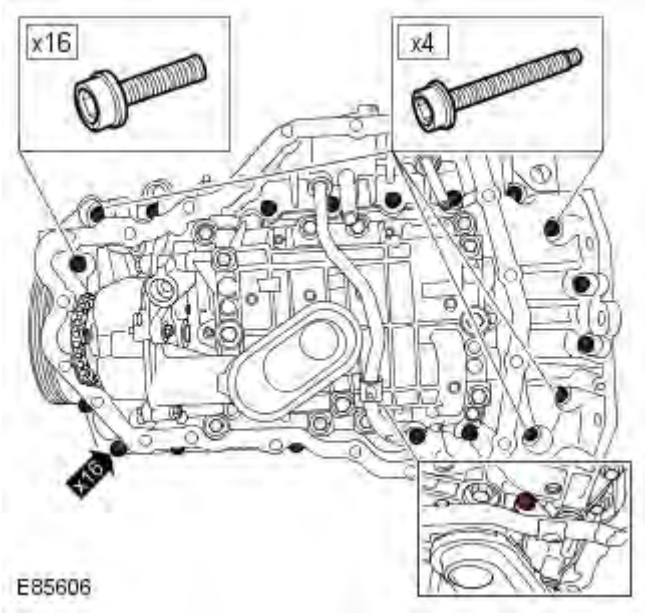
5. Disconnect the oil level sensor electrical sensor.



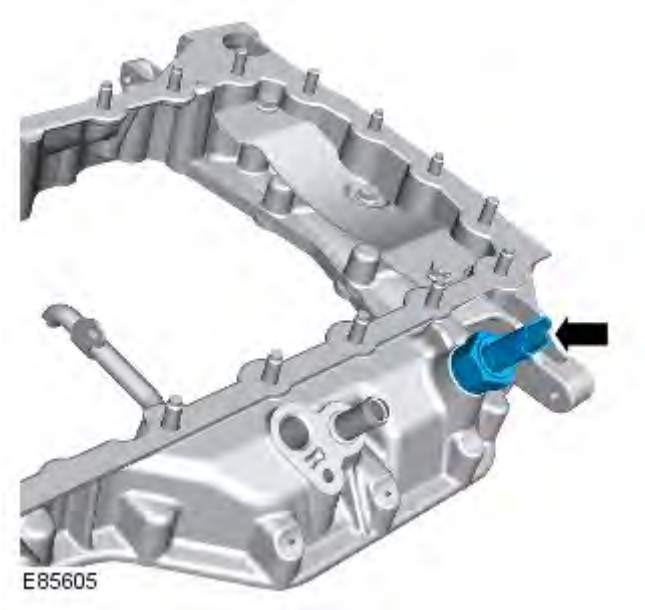
6. Release the crankcase vent oil separator drain tube.



7. Remove the 4 transmission bolts.



8. Remove the oil pan extension panel.



9. Remove the oil level sensor.

10. Remove the gasket.

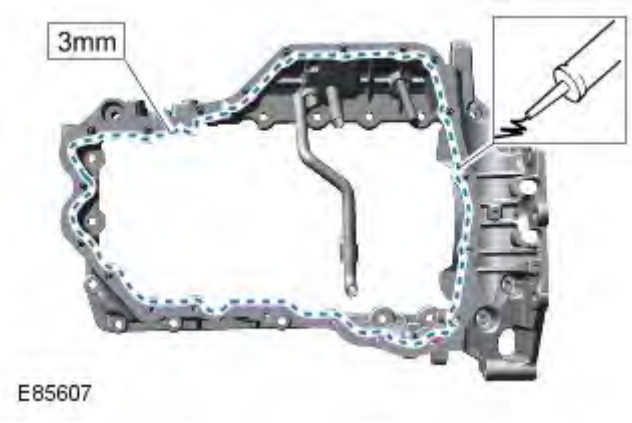
Installation

1. Install the oil level sensor.

   Torque: 8 Nm

2. For sealant specification, refer to the specifications section.

   Refer to: Specifications (303-01B Engine - TD4 2.2L Diesel, Specifications).



3. Apply a bead of sealant, 3 mm diameter, to the area indicated.

4. Install the oil pan extension panel.

   Torque:
   Stage 1:10 Nm
   Stage 2:16 Nm

5. Install the transmission retaining bolts.

   Torque: 47 Nm

6. Connect the crankcase vent oil separator drain tube.

7. Connect the oil level sensor electrical connector.

8. Install the dipstick.

9. Install the dipstick tube.

   Torque: 10 Nm

10. Install the oil pan.

    Refer to: Oil Pan (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

11. Install the engine cover.

    Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Flywheel

Removal and Installation

Removal

1. Disconnect the battery ground cable.

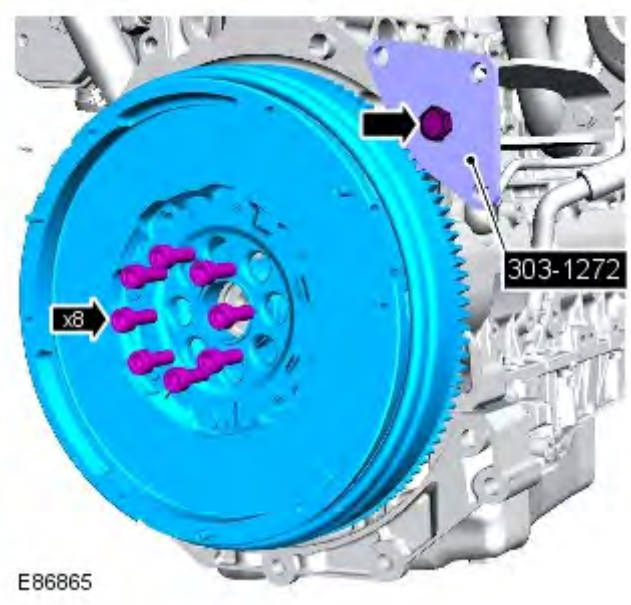
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the pressure plate and clutch disc.

   Refer to: Clutch Disc and Pressure Plate (308-01 Clutch, Removal and Installation).



4. **4.** NOTE: Restrain the flywheel.

Installation

1. **1.** CAUTIONS:

   Tighten the bolts in the sequence shown.

   Make sure that new bolts are installed.

   Torque:
   Stage 1:33 Nm
   Stage 2:34°

2. Install the clutch disc and pressure plate.

   Refer to: Clutch Disc and Pressure Plate (308-01 Clutch, Removal and Installation).

3. Connect the battery ground cable.

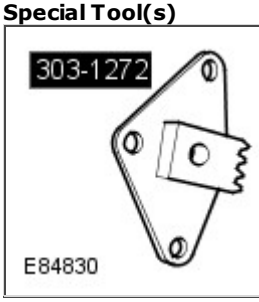
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Flexplate

Removal and Installation

Special Tool(s)

	303-1272 Locking Tool, Flywheel

Removal

• NOTE: The flywheel illustration is used, the flexplate tigtening sequence and bolt positions are the same.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the transmission and converter.

   Refer to: Transmission - TD4 2.2L Diesel (307-01 Automatic Transmission/Transaxle, Installation).

4. **4.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that new bolts are installed.

   Tighten the bolts in the sequence shown.

   - *Special Tool(s):* 303-1272
   - *Torque:*
     Stage 1:33 Nm
     Stage 2:34°

Installation

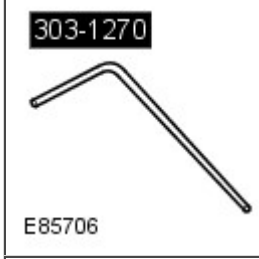
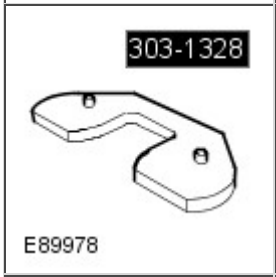
1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Balance Shaft Assembly

Removal and Installation

Special Tool(s)

	303-1270 Timing Pin, Crankshaft
	303-1328 Timing Plate, Balance Shafts
	303-1329 Locking Tool, Balance Shafts

Removal

• NOTE: This procedure contains removal and installation details only, if a back lash check is required it must be carried out before the balance shaft assembly is removed from the engine block.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the RH front wheel and tire.

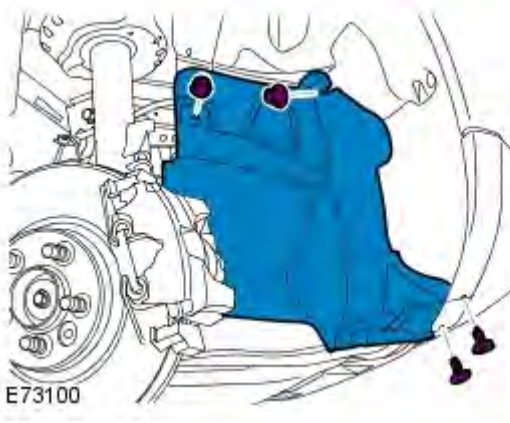
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

4. Remove the oil pan extension.

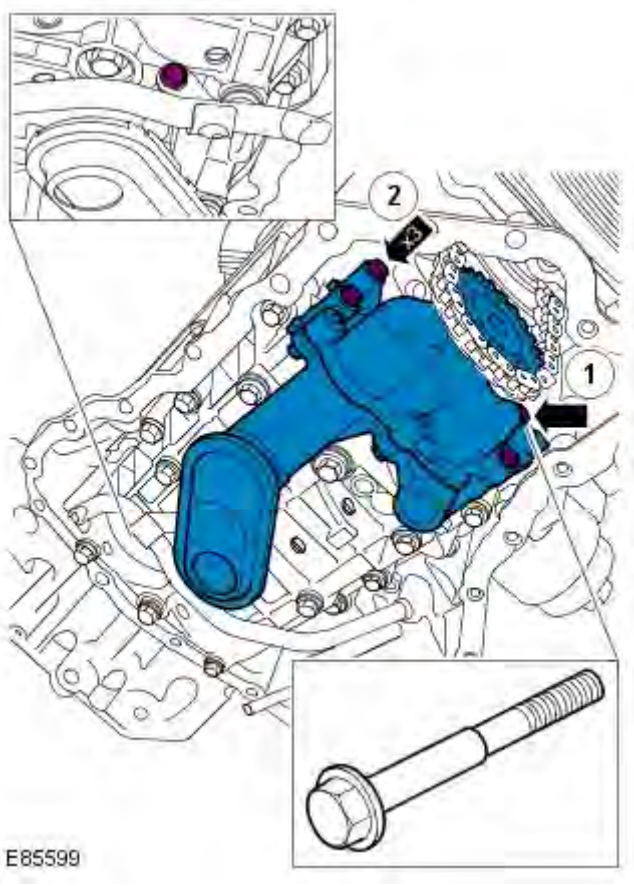
   Refer to: Oil Pan Extension (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

5. Remove the starter motor.

   Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).



6.

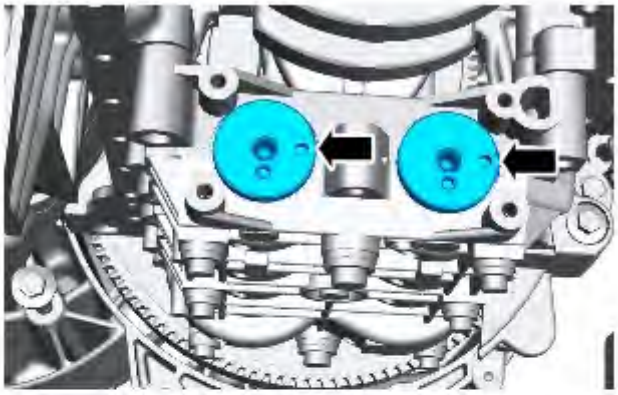


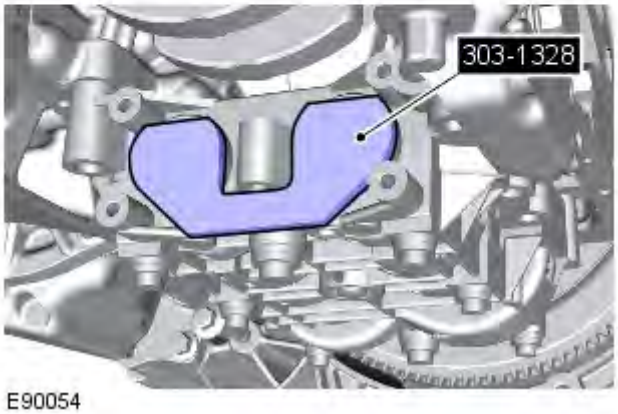
7. **7.** CAUTION: Note the fitted position of the component prior to removal.

   • NOTE: The shouldered bolt in position 1 locates the oil pump.

8. Rotate the crankshaft and install the crankshaft timing tool.

   Special Tool(s): 303-1270





E90054

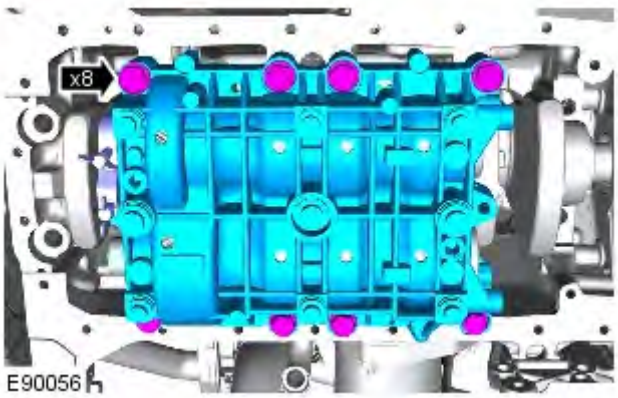
9. Install the balance shaft timing tool.

   Special Tool(s): 303-1328

E90055

10. Install the balance shaft locking tool.

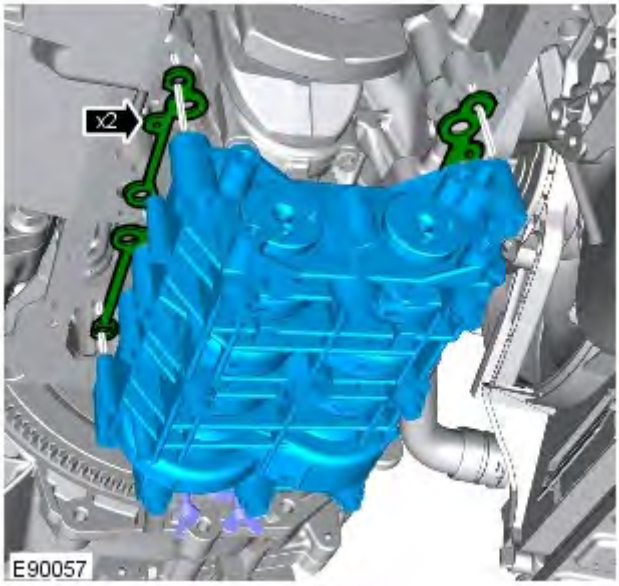
    Special Tool(s): 303-1329



E90056

11. **11.** CAUTION: Note the fitted position of the component prior to removal.

    Remove the balance shaft assembly.



12. **12.** CAUTIONS:

    Make sure that these components are installed to the noted removal position.

    Extreme cleanliness must be exercised when handling these components.

    Remove the 2 shims.

13. **13.** NOTE: Do not disassemble further if the component is removed for access only.

    Remove the dowels.

Installation

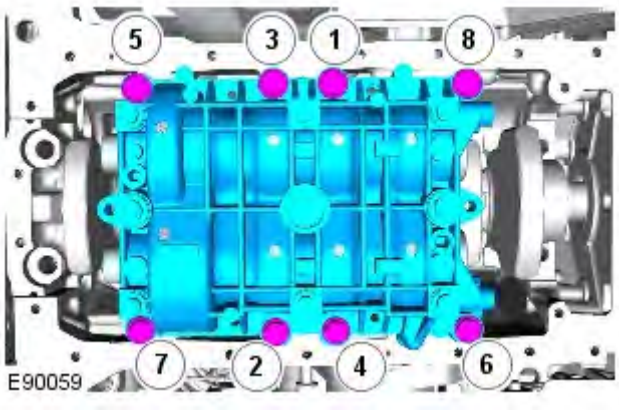
1. Install the dowels.

2. **2.** CAUTIONS:

   Make sure that these components are installed to the noted removal position.

   Extreme cleanliness must be exercised when handling these components.

   Install the shims.



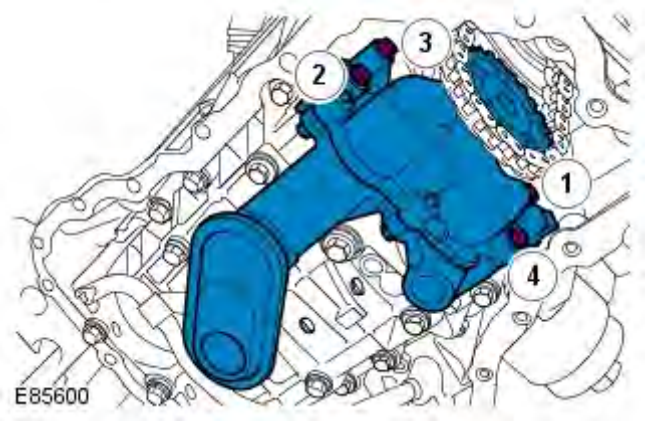
3. **3.** CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.

   • NOTE: Make sure that this component is installed to the noted removal position.

   Tighten the bolts evenly in 2 stages to the sequence shown.

   Torque:
   Stage 1:5 Nm
   Stage 2:22 Nm

4. Remove the balance shaft timing and locking tools.



5. **5.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that these components are installed to the noted removal position.

   Tighten the bolts evenly in 2 stages to the sequence shown.

   Torque:
   Stage 1:7 Nm
   Stage 2:9 Nm

6. Remove the crankshaft timing tool.

   Special Tool(s): 303-1270

7. Install the oil pan extension.

   Refer to: Oil Pan Extension (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

8. Install the fender splash shield extension panel.

9. Install the starter motor.

   Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

10. Install the front wheel and tire.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

11. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine - TD4 2.2L Diesel - Engine

Removal

Special Tool(s)

	205-857 Remover, Halfshaft

General Equipment

Powertrain Jack

• NOTE: In this procedure the engine is removed with the transmission.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Remove the plenum box access panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

5. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

6. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

7. Drain the coolant.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

8. Remove the catalytic converter.

   Refer to: Catalytic Converter - Vehicles Without: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

9. Recover the A/C refrigerant.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and

Charging (412-00 Climate Control System - General Information, General Procedures).

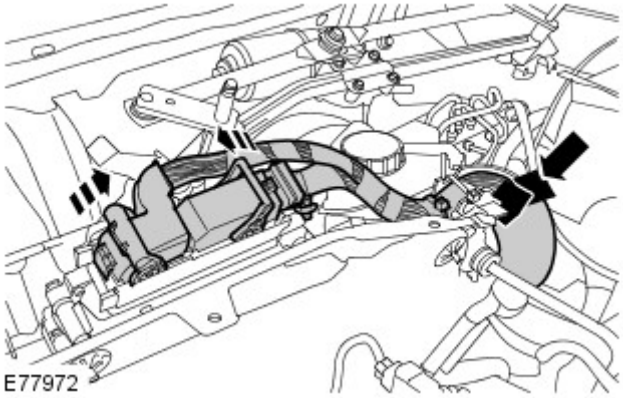
10. Remove the lower engine stabilizer bar.

    Refer to: Engine Lower Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

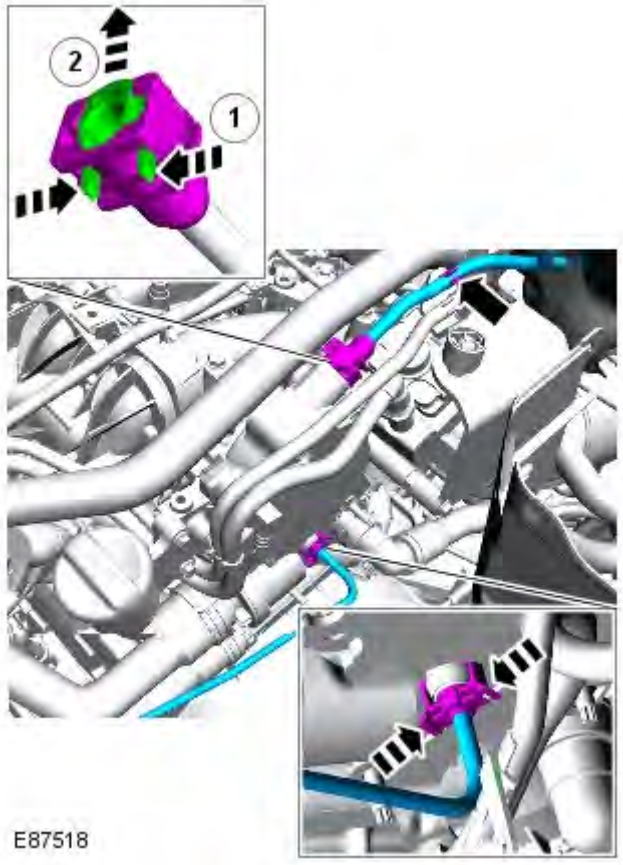
11. Remove the front subframe assembly.

    Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

12. Siphon the fluid from the power steering reservoir.


E77972

13. Disconnect the engine control module (ECM).



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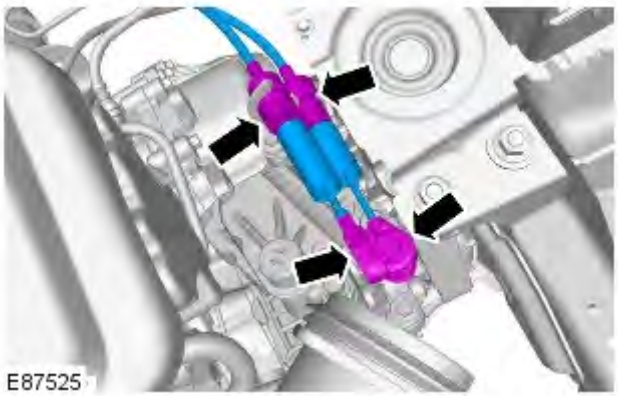

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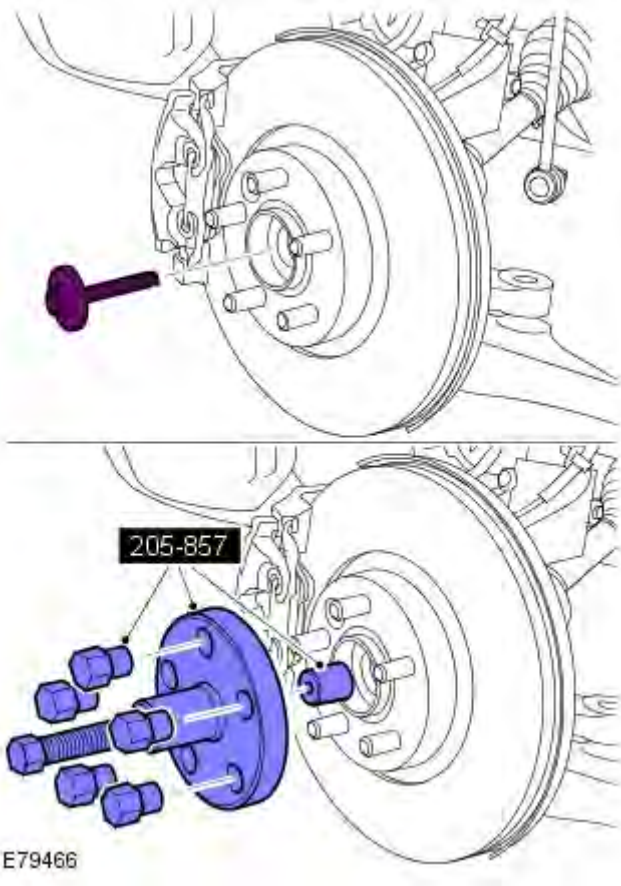
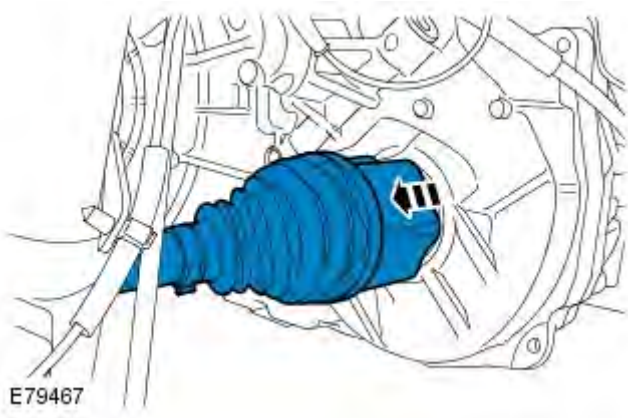
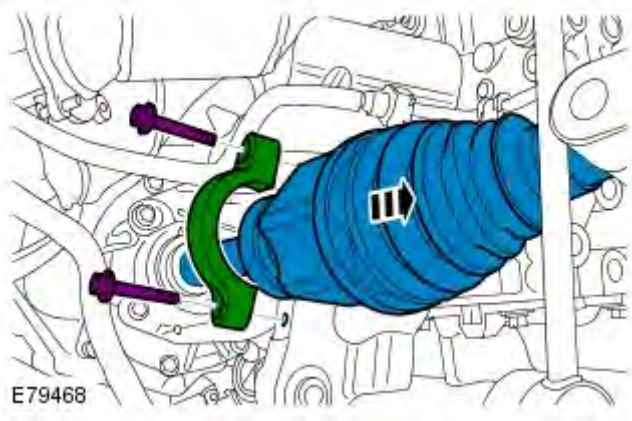


16. Release the LH and RH halfshafts.

Special Tool(s): 205-857



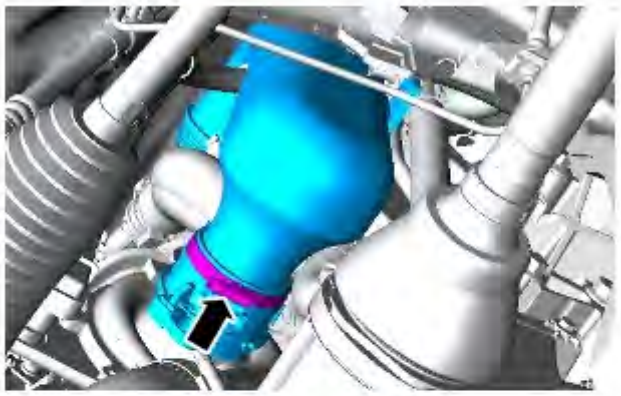
17. Remove the LH halfshaft.



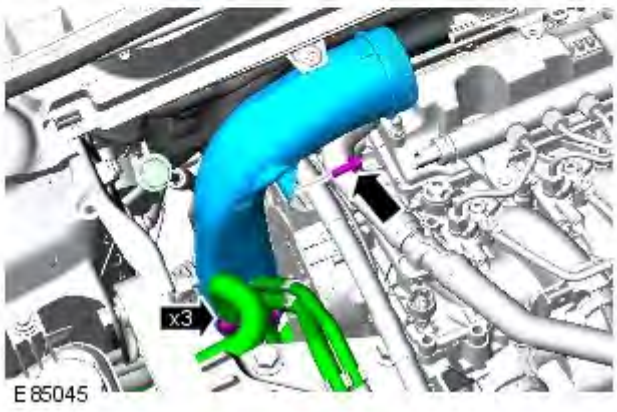
18. Remove the RH halfshaft.

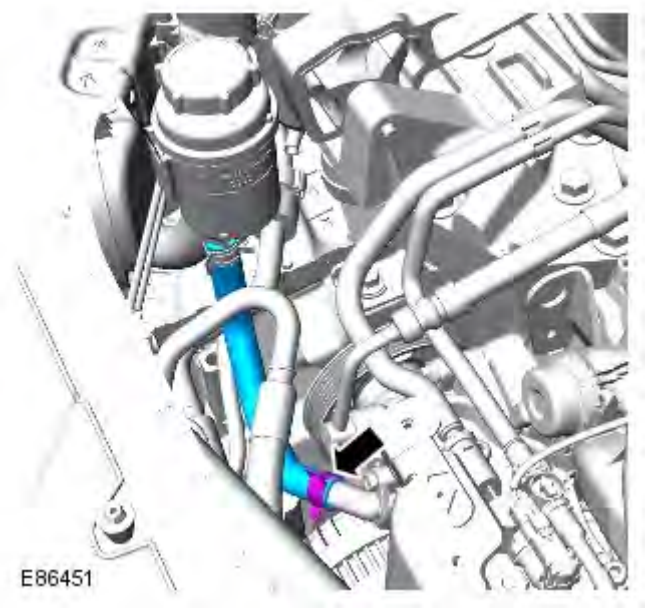
19. Tie the suspension arms aside for access.

20. Disconnect the cooling fan control electrical connector.



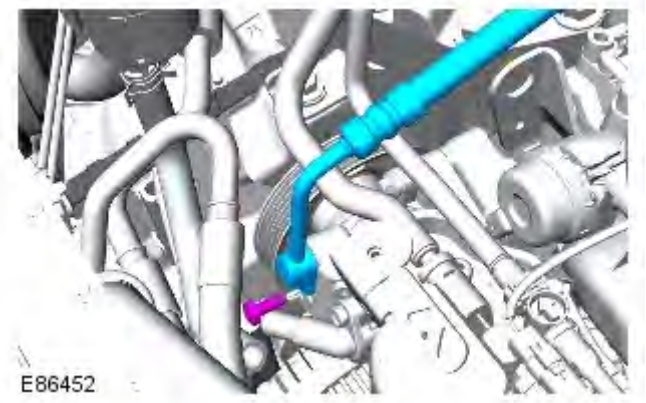
21. Remove the intake air duct.



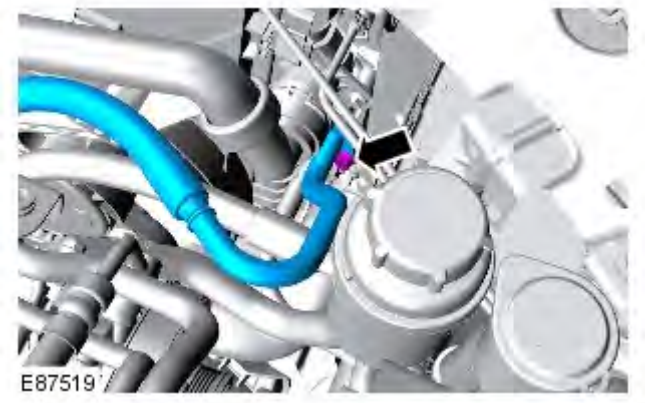


22. **22.** CAUTION: Be prepared to collect escaping fluids.

    Disconnect the low pressure line from the power steering pump.



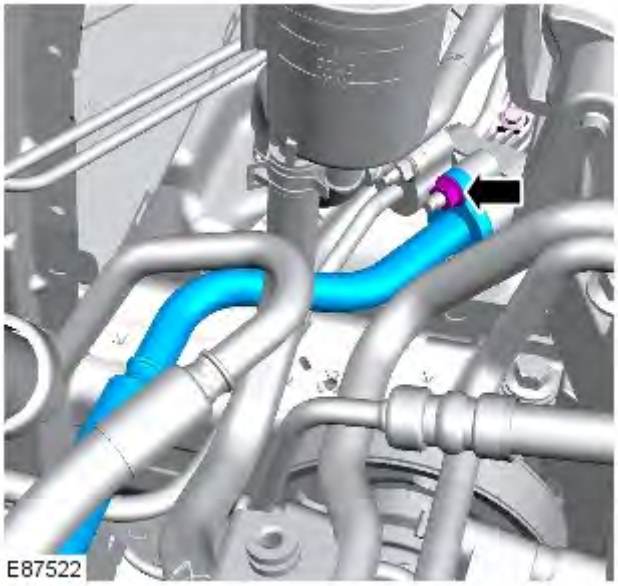
23. Release the power steering high-pressure pipe.



24. **24.** CAUTIONS:

    Discard the seal.

    Make sure that all openings are sealed.

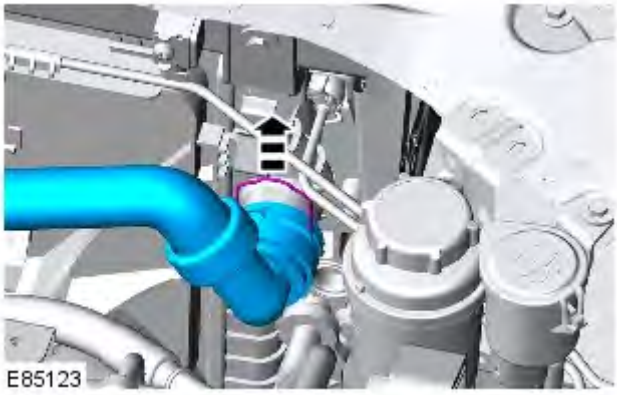


25. **25.** CAUTIONS:

    Discard the seal.

    Make sure that all openings are sealed.

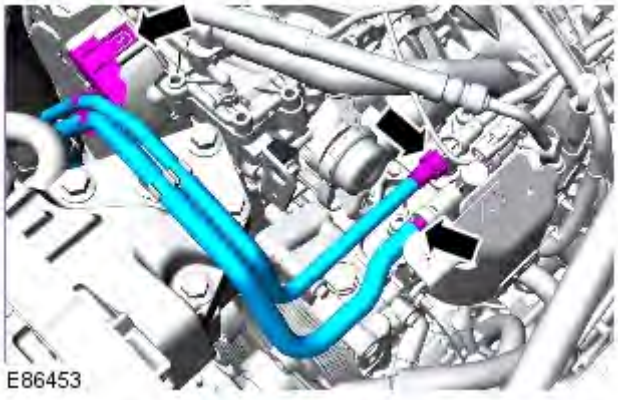
    Disconnect the A/C compressor low-pressure refrigerant line.



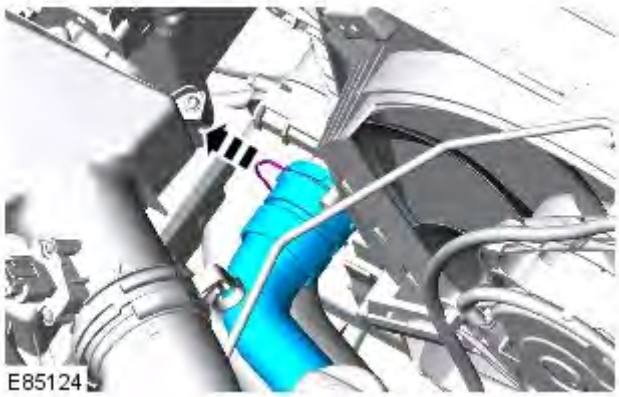
26. Remove the top hose.

27. **27.** CAUTION: Be prepared to collect escaping fuel.

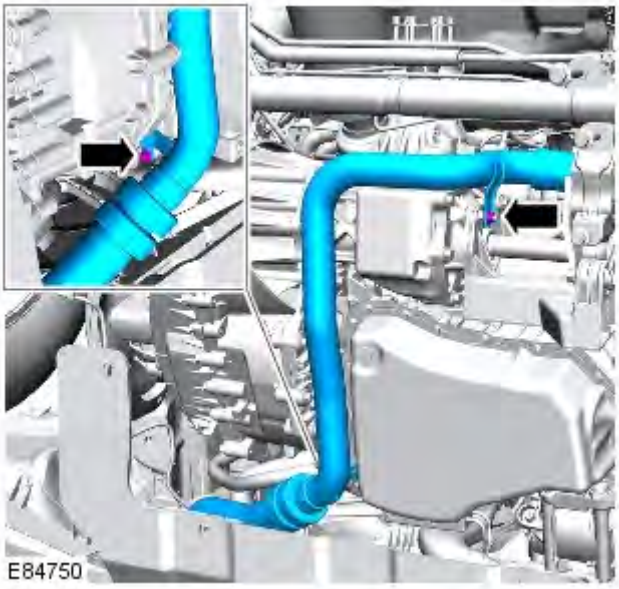
    Disconnect the 2 fuel lines.



28. Release the 2 fuel lines.

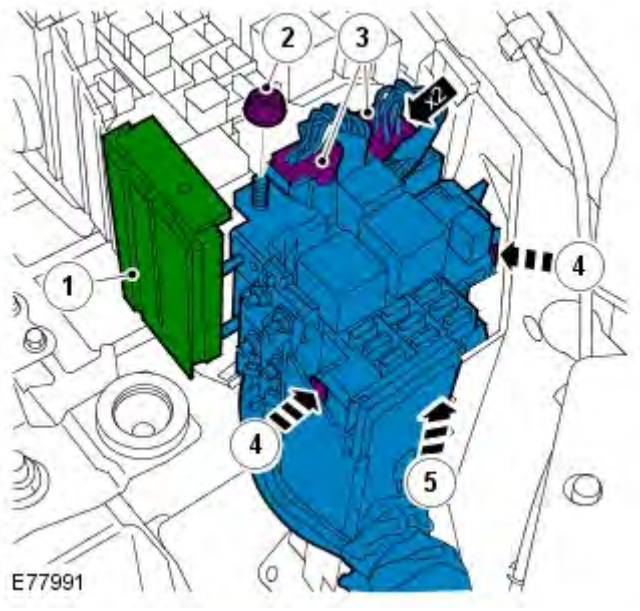


29. Disconnect the bottom hose.

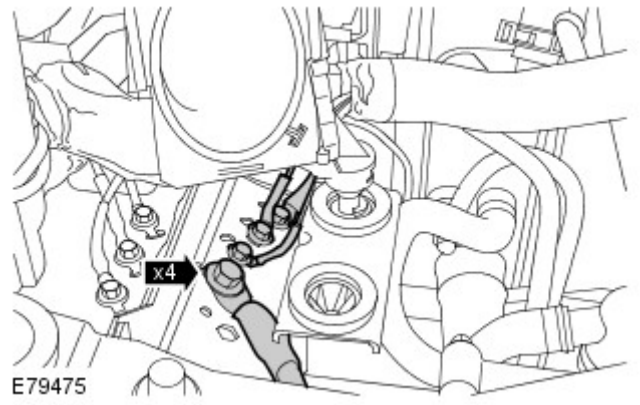


30. Remove the charge air cooler inlet pipe.

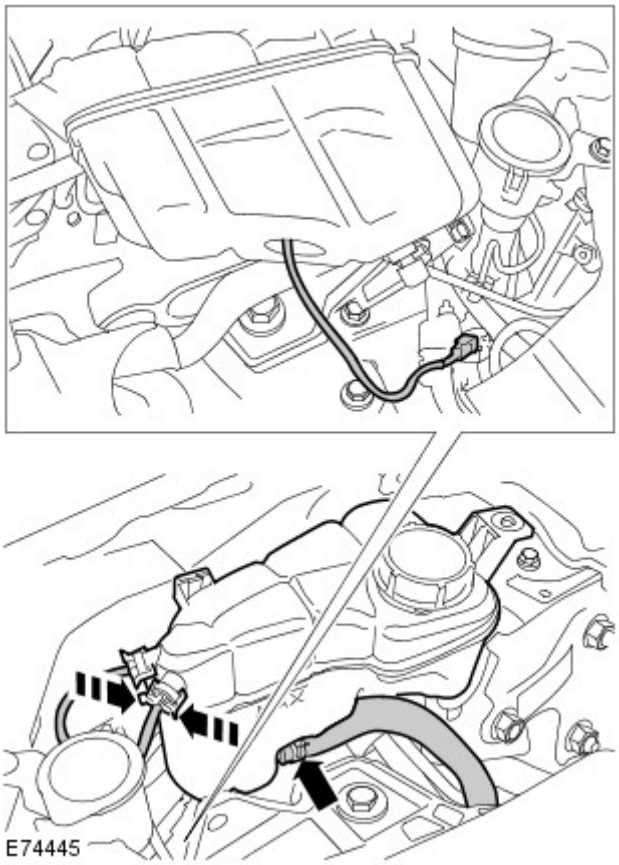
31. Disconnect the charge air cooler outlet hose.



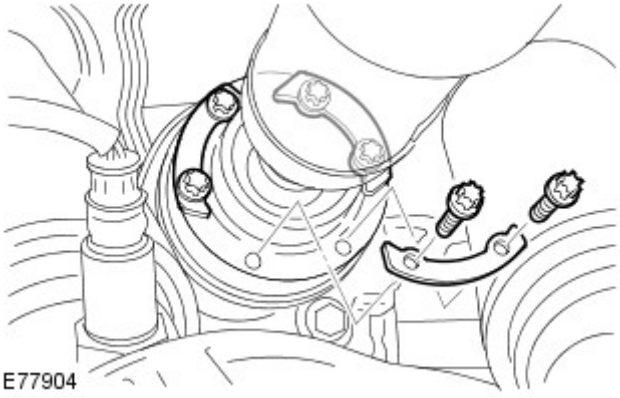
32. Disconnect the engine wiring harness.



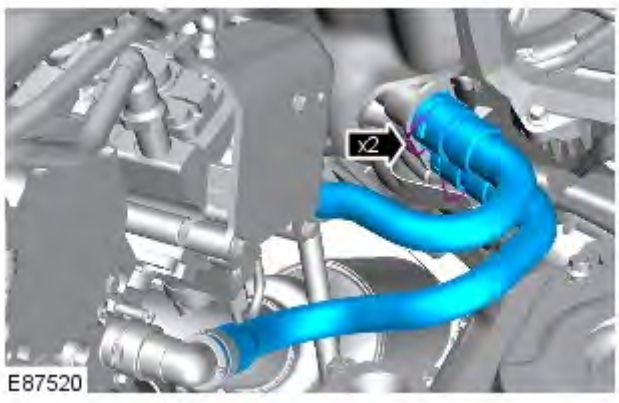
33. LH side: Release 4 engine compartment ground cables.



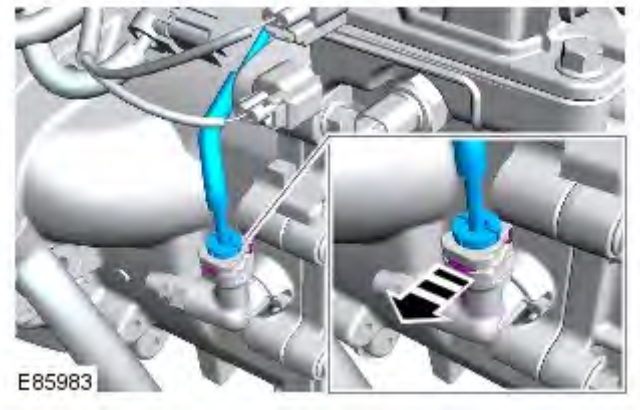
34. Remove the coolant expansion tank.



35. Release the driveshaft from the transmission drive flange.



36. Disconnect 2 heater hoses from the bulkhead.

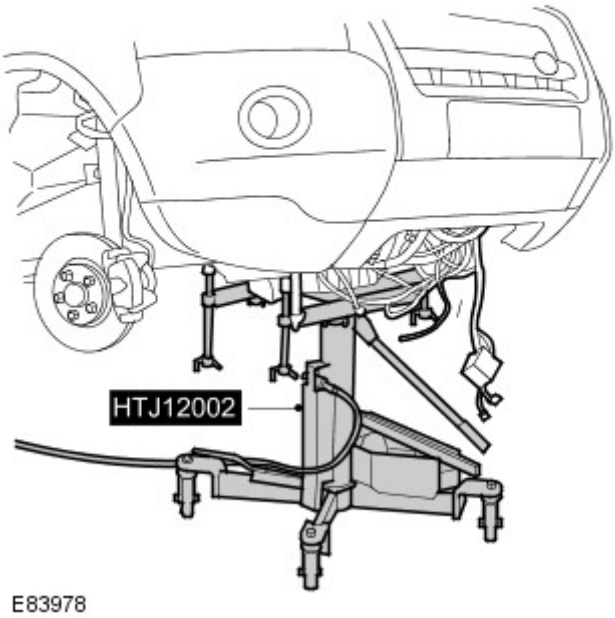


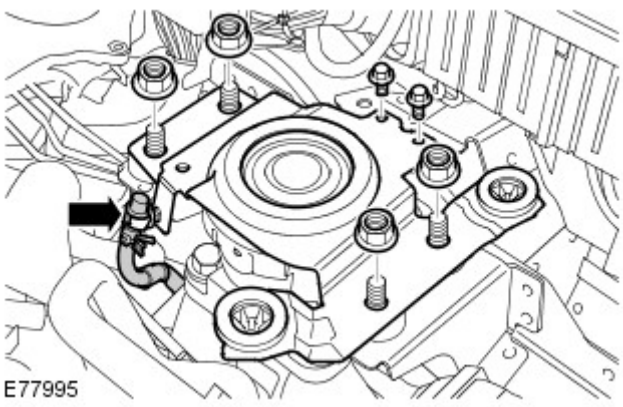
37. **37.** CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

    Disconnect the clutch fluid hose.

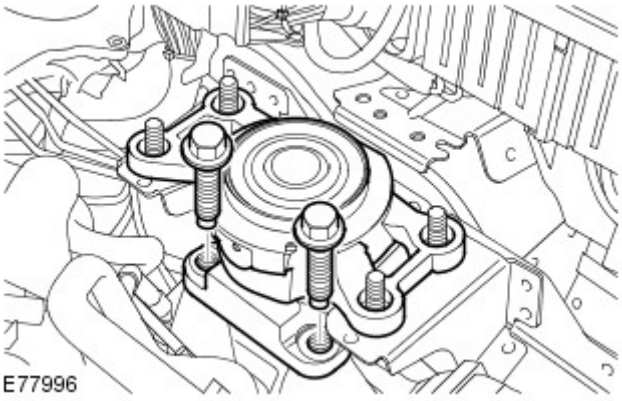
38. Support the engine.

    General Equipment: Powertrain Jack

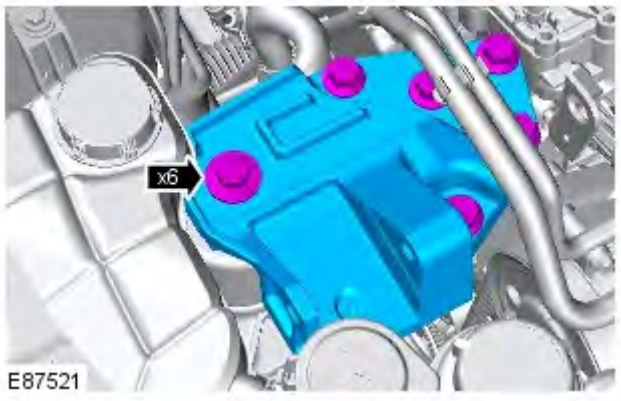




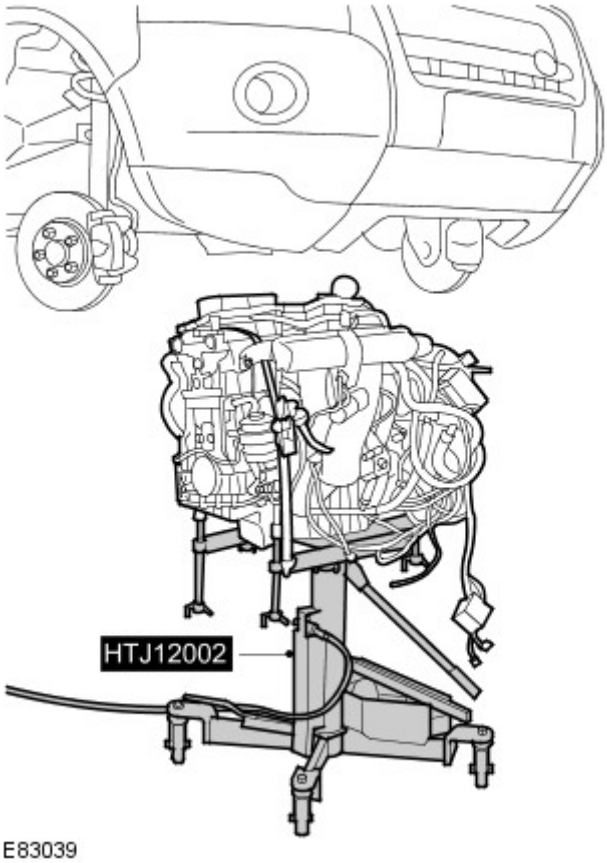
39. Remove the LH engine mount bracket.



40. Remove the LH engine mount.



41. RH side: Release the engine mount.



42. With assistance, carefully remove the engine and transmission.

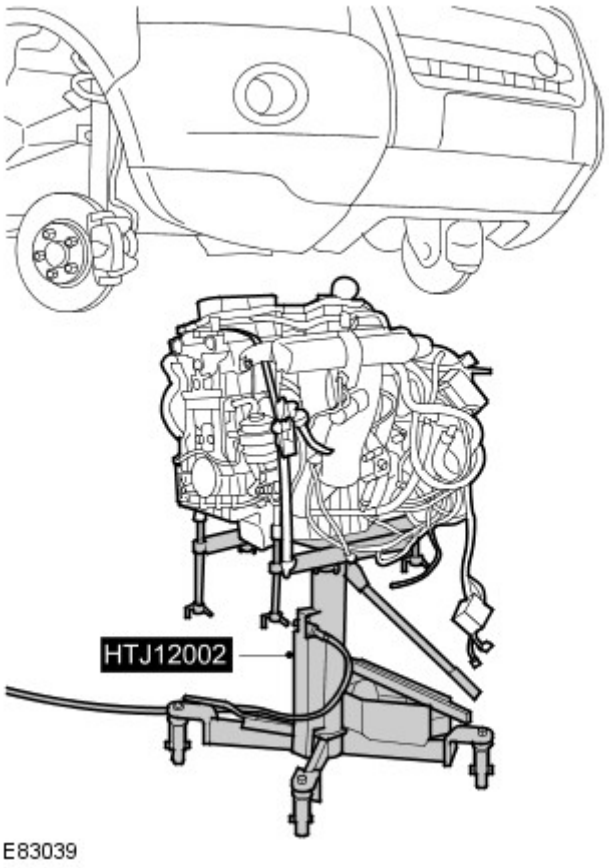
Published: 11-May-2011

Engine - TD4 2.2L Diesel - Engine

Installation

General Equipment

Powertrain Jack



1. With assistance, carefully install the engine and transmission.

   General Equipment: Powertrain Jack

2. RH side: Install the engine mount.

   Torque: 80 Nm

3. Install the LH engine mount.

   Torque: 175 Nm

4. Install the bracket.

   Torque:
   M12 80 Nm
   M8 25 Nm

5. Remove the engine support.

6. Connect the clutch fluid hose.

7. Connect the bulkhead heater hoses.

8. **8.** CAUTIONS:

   Make sure that the component is clean, free of foreign material and lubricant.

Make sure that new bolts are installed.

Install the driveshaft.

Torque: 40 Nm

9. Install the coolant expansion tank.

   Torque: 10 Nm

10. Secure the engine wiring harness.

    Torque: 10 Nm

11. **11.** CAUTION: Extreme cleanliness must be exercised when handling these components.

    Connect the fuel lines.

12. Connect the coolant top hose.

13. Connect the coolant bottom hose.

14. Connect the cooling fan electrical connector.

15. Install the RH halfshaft and support bracket.

    Torque: 25 Nm

16. Install the LH halfshaft.

17. With assistance, install the halfshaft to the hub.

18. Install the halfshafts.

    Torque:
    Stage 1:45 Nm
    Stage 2:80°

19. **19.** CAUTION: A new O-ring seal is to be installed.

    • NOTE: Lubricate the O-ring seals with clean refrigerant oil.

    Connect the A/C compressor high-pressure refrigerant line.

    Torque: 24 Nm

20. **20.** CAUTION: A new O-ring seal is to be installed.

    • NOTE: Lubricate the O-ring seals with clean refrigerant oil.

    Connect the A/C compressor low-pressure refrigerant line.

    Torque: 24 Nm

21. Connect the low pressure line to the power steering pump.

22. **22.** CAUTION: A new O-ring seal is to be installed.

    Connect the high-pressure power steering line to the power steering pump.

    Torque: 24 Nm

23. Secure the power steering high-pressure line.

    Torque: 10 Nm

24. Install the gear selector cables.

25. Connect the brake booster vacuum hose.

26. Connect the ECM electrical connectors.

27. Install the intake air duct.

28. Install the charge air cooler inlet pipe.

    Torque: 10 Nm

29. Install the front subframe.

    Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

30. Install the lower engine stabilizer bar.

    Refer to: Engine Lower Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

31. Install the catalytic converter.

    Refer to: Catalytic Converter - Vehicles Without: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

32. Refill and bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

33. Install the air cleaner assembly.

    Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

34. Install the battery tray.

    Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

35. Install the plenum chamber access panel.

    Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

36. Install the engine cover.

    Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

37. Carry out the low-pressure fuel system bleeding.

    Refer to: Fuel System Bleeding - TD4 2.2L Diesel (310-00 Fuel System - General Information, General Procedures).

38. Bleed the clutch system.

    Refer to: Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

39. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

40. Recharge the A/C system.

    Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

41. Refill and bleed the power steering.

    Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

42. Carry out the final halfshaft and suspension tightening with the vehicle on its wheels.

Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol -

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Anti-freeze	Texaco Extended Life Coolant (XLC) or any glycol based anti-freeze containing no methanol with only Organic Acid Technology (OAT) corrosion inhibitors
Anti-freeze concentration - Will provide frost protection to -40°C (-40°F)	50%
Specific gravity of coolant at 20°C (68°F), to protect against frost down to -40°C (-40°F)	1.068
Amount of anti-freeze to use for 50% concentration:	4.0 liters

Capacities

Item	Capacity (liters/pints/US quarts)
Cooling system capacity	8.0/14.0/8.5

General Specification

Item	Specification
Cooling fan:	
Standard fit - Single fan	500W
Hot climate - Twin fan	750W
Cooling system type	Pressurised, thermostatically controlled with remote header tank
Expansion tank	Seeber with integrated level sensor
Radiator	Valeo 28mm core with integrated drain cock and replaceable lower pin
Thermostat	Wax element
Starts to open	90° C
Fully open	100° C

Torque Specifications

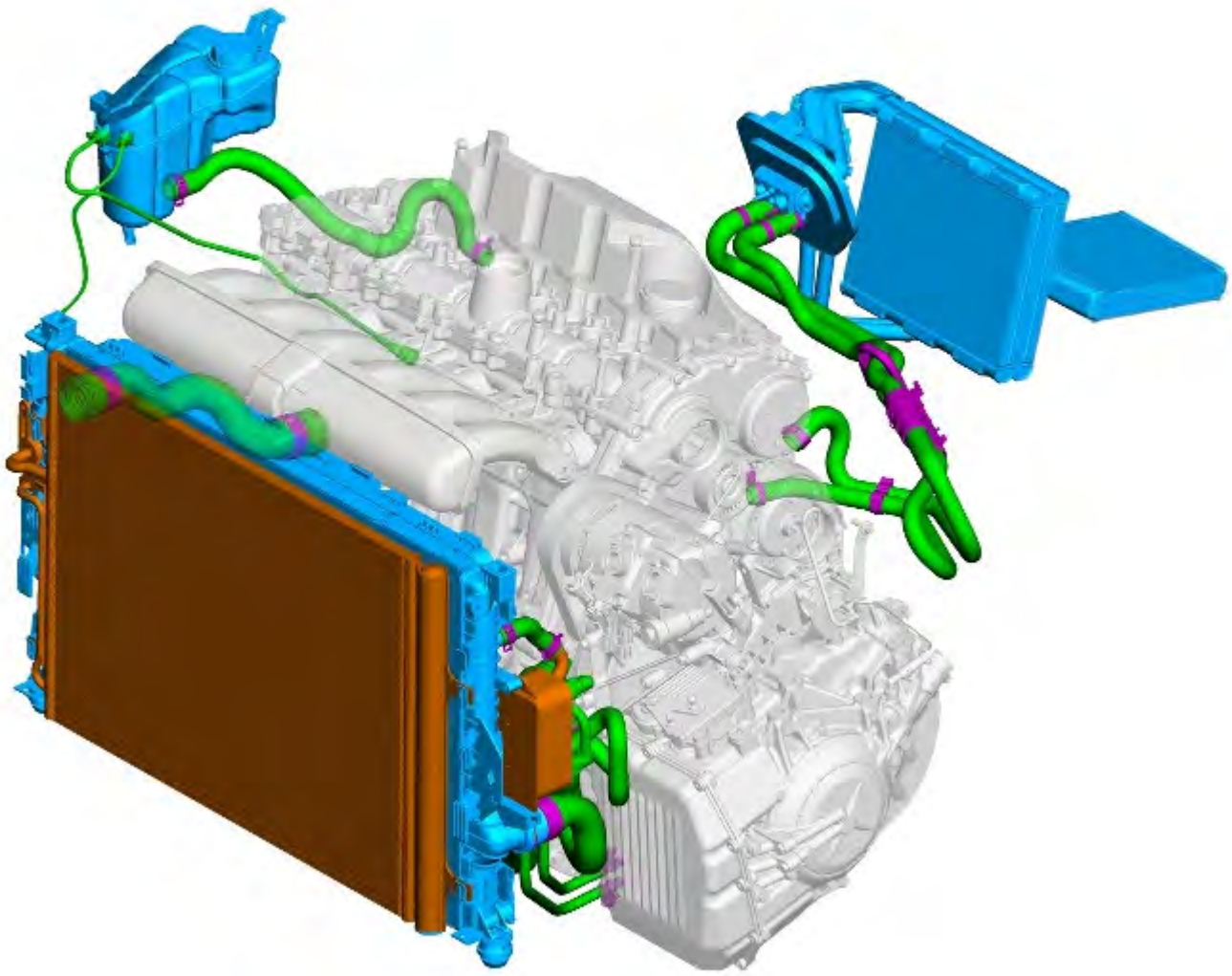
Description	Nm	lb-ft
Coolant expansion tank bolt	10	7
Coolant pump bolts	17	13
Coolant pump pulley bolts	10	7
Radiator bolts	6	5
Radiator drain plug	7	6
Thermostat housing bolts	10	7
Water inlet pipe bolts	17	13
Water inlet pipe drain nipple	7	5
Water outlet to block bolt	10	7

Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol - Engine Cooling

Description and Operation

COMPONENT LOCATION



E79459

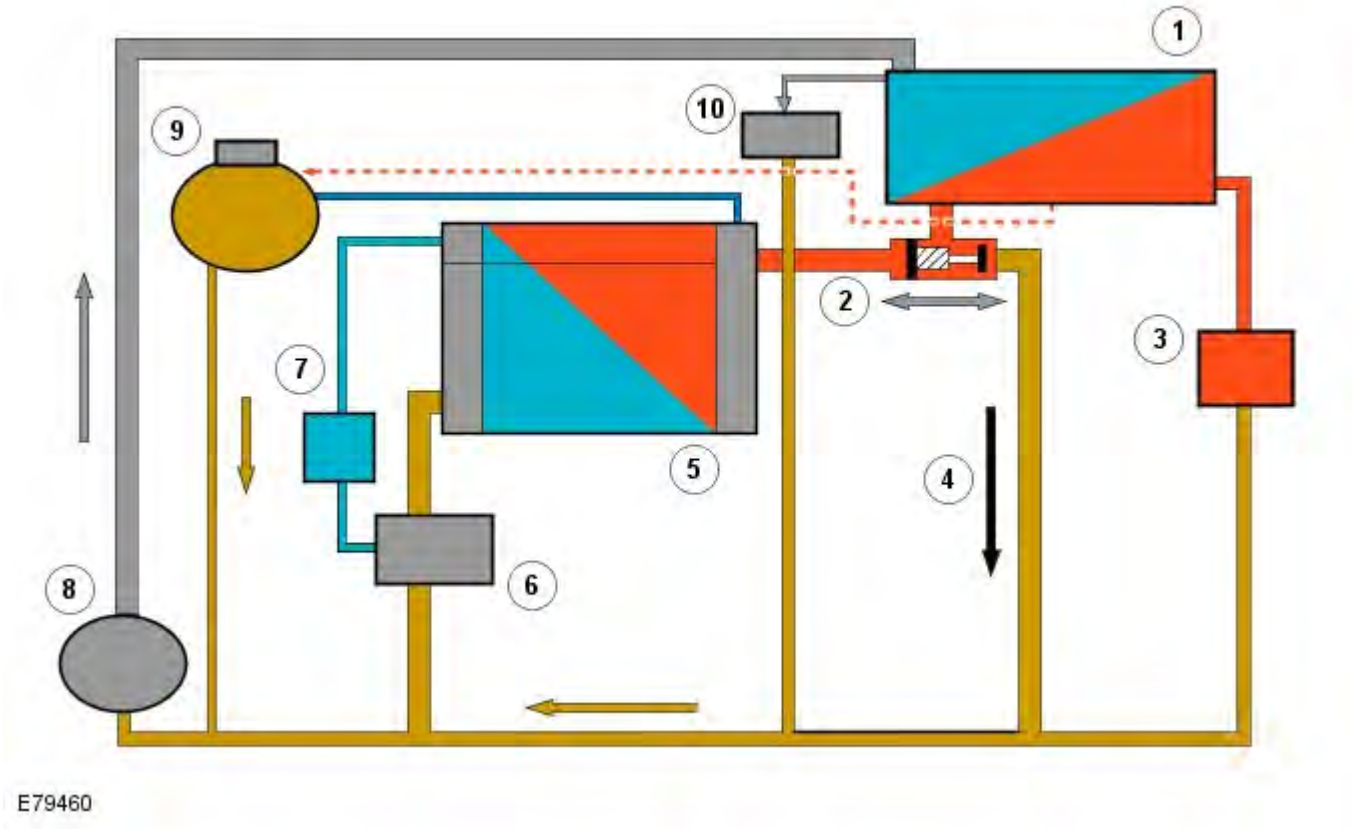
OVERVIEW

Because of its powerful engine, sophisticated transmission and traction system; the vehicle in the most demanding conditions will need to continually dissipate as much as 120 kW of heat to atmosphere. To compound the situation this typically occurs at low speeds when there is insufficient air being forced through the radiator to aid the cooling system. With this in mind and considering that the majority of vehicles rarely need to dissipate more than 10 kW of heat, the cooling system has been specially developed to cope with the severity of off-road driving and variable extremes of climate.

The cooling system functions using the cross-flow principle. The coolant is routed from the coolant pump into the engine block on the exhaust side of the engine and leaves the engine block at the rear edge, via the thermostat housing, on the intake side.

The thermostat is a wax thermostat. The coolant temperature sensor is located in the thermostat housing.

The coolant is pumped from the coolant pump to the engine through 2 connections. After passing through the engine, some of the coolant exits the engine block at the rear edge of the exhaust side to be routed through the passenger compartment element and onwards to the coolant pump.



E79460

Item	Part Number	Description
1	-	Engine
2	-	Thermostat
3	-	Cabin heater core
4	-	By-pass
5	-	Radiator
6	-	Venturi exit
7	-	Transmission oil cooler
8	-	Coolant pump
9	-	Coolant expansion tank
10	-	Engine oil cooler

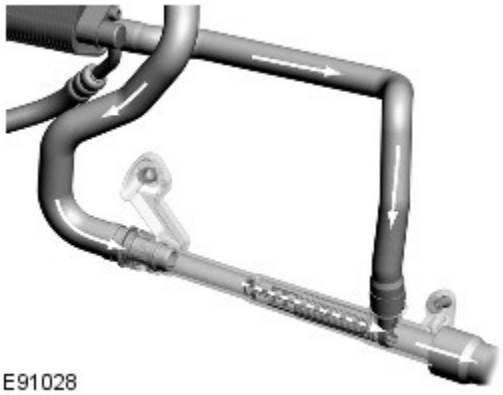
PRINCIPLES OF OPERATION

At idle, and low outdoor temperatures (lower than -10°C (14°F)) the engine's idle speed increases from approximately 650 rpm to approximately 750 rpm. This is to increase the coolant flow through the passenger compartment element, which, in turn, makes it possible to increase the heat in the passenger compartment. The coolant pump is driven by the power steering pump through a flange.

Coolant Flow - Closed Thermostat

Coolant leaves the engine block via the 2 circuits at the rear edge on the intake side of the engine.

- The coolant is routed from one of the circuits to the engine's oil cooler and onwards to the coolant pump.
- Coolant is routed from the other circuit to a 'by-pass' circuit where there is a valve. The valve is closed at engine speeds up to approximately 1500 rpm. At approximately 1500 rpm, the valve opens and coolant passes through the circuit. By keeping the valve closed at low engine speeds, a sufficient flow is guaranteed through the passenger compartment element to obtain a good climate (sufficient heat) in the passenger compartment.



E91028

Coolant Flow - Open Thermostat

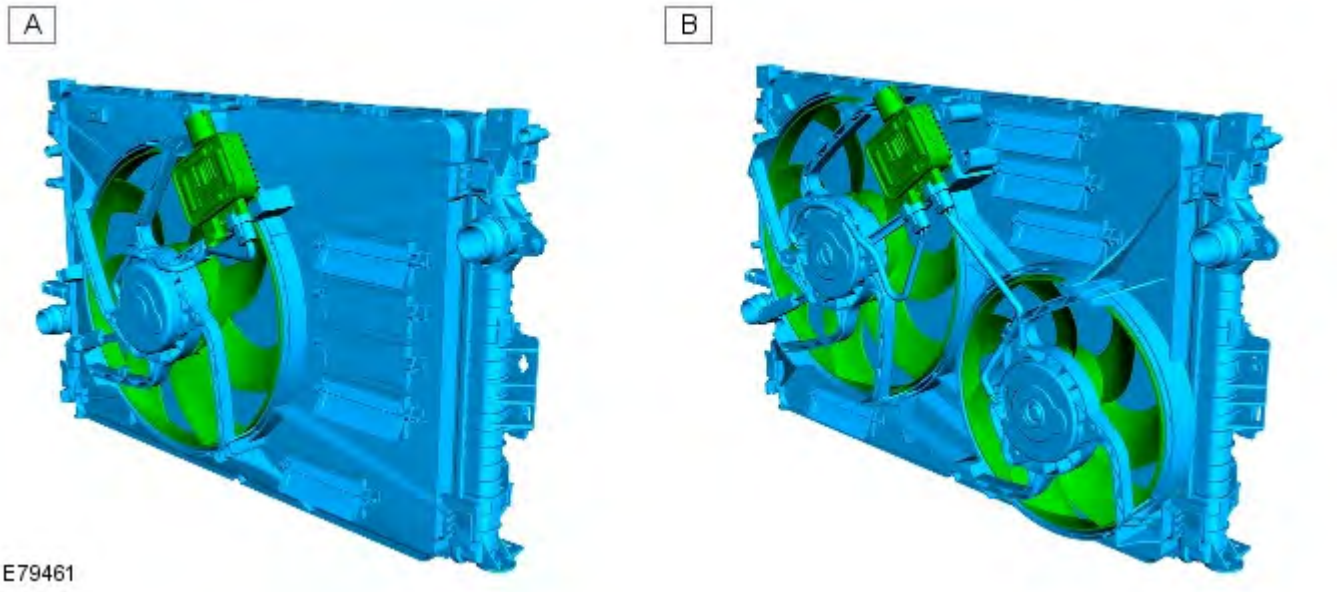
- When the thermostat opens, coolant is also routed to the radiator
- The radiator has an inlet on the Right Hand (RH) side and 2 outlets on the left-hand side
- The greater volume of cooled coolant is routed at the radiator's lower outlet to the coolant pump
- At the upper outlet some of the coolant is routed to the automatic transmission's oil cooler. Before the coolant reaches the oil cooler, it passes a 'choke' circuit through the radiator with a lower (slower) flow than other coolants. This provides optimum cooling of the coolant before it reaches the oil cooler, which in turn, provides effective cooling of the transmission oil. The coolant is routed from the oil cooler onwards to the coolant pump.

Bleeding

The engine has 2 bleed circuits connected to the expansion tank. One is located on the radiator and the other on the cylinder head.

Radiator and Cooling Fan(s)

The radiator, which dissipates heat from the engine coolant and engine mounted oil cooler, is manufactured from a 27 mm aluminum matrix with high-pressure injection molded end tanks.



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Item	Part Number	Description
A	-	Cold to mild climate radiator
B	-	Hot climate radiator

Dependant on climate conditions there are 2 specifications of radiator fan available:

- Cold to mild climates: a single fan unit designed around a 500W motor
- Hot climates: a twin fan unit features two motors delivering a total of 750W

Common to both fan types are:

- Electric motors with brushes
- The Engine Control Module (ECM) controls the fan speed via Pulse Width Modulation (PWM) signals to the Electronic Fan Control Module (EFCM)
- The fan speed is controlled at 4 levels:
  - Run-on occurs in 3 stages (i.e. depressing the fan speed)
  - The engine cooling fan is activated a certain time after the engine has been switched off to protect various engine components from overheating
  - The time the fan is activated and the speed of the fan is dependent on the coolant temperature and the driver's driving style (engine load) when the engine is switched off
  - The hotter the engine and the hotter the load, the higher the fan speed and the longer run-on time. The

maximum time of run-on is 360 seconds
- The EFCM can, by modulating the PWM control signal, inform the ECM about the fan's status and any faults.

PWM control of the fan motor provides variable control of fan speed to ensure minimum fan noise and reduced energy consumption when fan operation is required. The control module is mounted above the wade water entry lines
For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).

The coolant expansion tank provides an expansion volume and permits easy in-service bleeding of the cooling system. Coolant level sensing is precise to provide early warning in the event of low coolant level. To prevent intrusion into the expansion tank's casing, which could be a potential leak path, a magnetic float within the tank activates a switch located outside the tank.

Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol - Engine Cooling

Diagnosis and Testing

Principles of Operation

For a detailed description of the cooling system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Engine Cooling (303-03A Engine Cooling - I6 3.2L Petrol, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Coolant leaks • Coolant expansion tank • Electric fan • Radiator	• Fuse • Wiring harness • Loose or corroded connector(s) • Engine Coolant Temperature (ECT) sensor

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Coolant loss	• Hoses • Hose connections • Radiator • Coolant pump • Heater core • Gaskets • Engine casting cracks • Engine block core plugs	• GO to Pinpoint Test A.
Engine overheating	• Engine coolant (level/condition) • Thermostat • Fan motor • Fan motor fuses and/or circuits • ECT sensor • Engine control module (ECM) • Fan speed module	• GO to Pinpoint Test B.
Engine not reaching normal operating temperature	• Thermostat • Electric fan • Fan speed module	• GO to Pinpoint Test C.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P011600	Engine coolant temperature sensor 1 circuit range/performance	• Engine coolant temperature (ECT) sensor 1 circuit: high	Check the ECT sensor and circuits. Refer to the electrical guides. Install a

DTC	Description	Possible Cause	Action
		resistance • Engine coolant temperature (ECT) sensor failure	new sensor as required. REFER to: Engine Coolant Temperature (ECT) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P011621	Engine coolant temperature sensor 1 circuit range/performance - signal amplitude less than minimum	• Engine coolant temperature (ECT) sensor 1 circuit: short circuit to ground • Engine coolant temperature (ECT) sensor 1 circuit: open circuit • Engine coolant temperature (ECT) sensor failure	Check the ECT sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Engine Coolant Temperature (ECT) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P011622	Engine coolant temperature sensor 1 circuit range/performance - signal amplitude greater than maximum	• Engine coolant temperature (ECT) sensor 1 circuit: short circuit to power • Engine coolant temperature (ECT) sensor failure	Check the ECT sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Engine Coolant Temperature (ECT) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P011700	Engine coolant temperature sensor 1 circuit low	• Engine coolant temperature (ECT) sensor 1 circuit: short circuit to ground • Engine coolant temperature (ECT) sensor 1 circuit: open circuit • Engine coolant temperature (ECT) sensor failure	Check the ECT sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Engine Coolant Temperature (ECT) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P011800	Engine coolant temperature sensor 1 circuit high	• Engine coolant temperature (ECT) sensor 1 circuit: short circuit to power • Engine coolant temperature (ECT) sensor 1 circuit: open circuit • Engine coolant temperature (ECT) sensor failure	Check the ECT sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Engine Coolant Temperature (ECT) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P012500	Insufficient coolant temperature for closed-loop fuel control	• Damaged/Faulty coolant thermostat • Cooling fan fault • Engine coolant temperature sensor circuit: high resistance • Engine coolant temperature sensor failure	Check the cooling system operation. Rectify as necessary. Check for DTCs indicating a coolant temperature sensor fault.
P012800	Coolant thermostat (coolant temperature below thermostat regulating temperature)	• Damaged/Faulty coolant thermostat • Cooling fan fault • Engine coolant temperature sensor circuit: high resistance • Engine coolant temperature sensor failure	Check the cooling system operation. Rectify as necessary. Check for DTCs indicating a coolant temperature sensor fault.
P145C68	Fan system component error	• Cooling fan control module temperature failure	No action necessary. Code for information only.
P145D68	Fan system component error B	• Cooling fan control module high temperature indication	No action necessary. Code for information only.

Pinpoint Tests

PINPOINT TEST A : LOSS OF COOLANT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: VISUAL INSPECTION	
	1 Visually inspect for loss of coolant.
	2 Carry out a system pressure test. See component tests in this section.
	Is the engine cooling system leaking? **Yes** Rectify the leak as indicated by the test result. Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary. REFER to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications) / Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures). TEST the system for correct operation. **No** Verify the customer complaint.

PINPOINT TEST B : THE ENGINE OVERHEATS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK COOLANT	
WARNING: The cooling system is pressurized! Ensure the reservoir cap is never released until the system has cooled. Failure to follow these instructions may result in personal injury.	
	1 Check the coolant level and condition.
	Does the system contain sufficient coolant of the correct specification? **Yes** GO to B2. **No** Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary. REFER to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications) / Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures). Check for coolant loss. GO to B1.
B2: CHECK COOLANT EXPANSION TANK PRESSURE CAP	
	1 Check the coolant expansion tank pressure cap for damage/correct operation. REFER to the coolant expansion tank pressure cap pressure test in this section.
	Is the coolant expansion tank pressure cap operating correctly? **Yes** GO to B3. **No** INSTALL a new coolant expansion tank pressure cap. TEST the system for correct operation.
B3: CHECK THERMOSTAT	
	1 Check the thermostat for correct operation. REFER to the thermostat component test in this section.
	Is the thermostat operating correctly? **Yes** Check for correct operation of cooling fans, circuits, sensors, modules, etc. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). **No** INSTALL a new thermostat. REFER to: Thermostat (303-03A Engine Cooling - I6 3.2L Petrol, Removal and Installation). TEST the system for correct operation.

PINPOINT TEST C : THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THERMOSTAT	
	1 Check the thermostat for correct operation. REFER to the thermostat component test in this section.
	Is the thermostat operating correctly? **Yes** Check for correct operation of cooling fans, circuits, sensors, modules, etc. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). **No** INSTALL a new thermostat. REFER to: Thermostat (303-03A Engine Cooling - I6 3.2L Petrol, Removal and Installation). TEST the system for correct operation.

Component Tests

Cooling System Pressure Test

WARNING: Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1. **1.** Switch the engine off.
2. **2.** Open the hood and install protective fender covers.
3. **3.** Carefully remove the coolant expansion tank pressure cap from the coolant expansion tank to relieve pressure in the cooling system. Add coolant to coolant expansion tank as necessary.
4. **4.** Install the pressure tester equipment to the cooling system following manufacturers instructions. Reinstall the coolant expansion tank pressure cap (if pressure test equipment is not installed to the coolant expansion tank).
5. **5.** Pressurize the cooling system to the coolant expansion tank pressure cap lower limit.
6. **6.** Observe the gauge reading for approximately two minutes. Pressure should not drop during this time.
    - If system holds pressure, continue from step 8.

- If the pressure drops, check the complete cooling system for leaks. Also refer to engine system checks if a leak cannot be located in the cooling system. Correct any leaks found and recheck the system.

7. **7.** Release the system pressure and remove the pressure test equipment. Check the coolant level. Replenish as necessary with the correct coolant solution.
   REFER to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications).
8. **8.** Check the radiator overflow hose for any obstructions which may block the flow of coolant either to or from the coolant expansion tank.
9. **9.** Conduct the coolant expansion tank pressure cap pressure test in this section.

Coolant Expansion Tank Pressure Cap Pressure Test

WARNING: Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1. **1.** Remove the expansion tank pressure cap from the coolant expansion tank.
2. **2.** Use water to clean cap in area of rubber seal and vacuum relief valve. Following manufacturers instructions, install the coolant expansion tank pressure cap to the pressure tester.
3. • NOTE: If the pressure tester is pressurised too quickly, an erroneous pressure reading may result.

   3. Slowly pressurise the system until the pressure gauge reading stops increasing, and note highest pressure reading obtained.
4. **4.** Release pressure and repeat Step 3 at least twice to make sure the pressure test reading is repeatable and within specification.
5. **5.** If the pressure test gauge readings are not within specification, install a new coolant expansion tank pressure cap.

Thermostat Test

Remove the thermostat
REFER to: Thermostat (303-03A Engine Cooling - I6 3.2L Petrol, Removal and Installation).
Inspect for visible damage, note its opening temperature and immerse it in water. Heat the water until this temperature is reached. The thermostat should begin to open. If it does not begin to open, install a new thermostat.
REFER to: Thermostat (303-03A Engine Cooling - I6 3.2L Petrol, Removal and Installation).
If thermostat begins to open, continue to heat the water until the thermostat fully opens, 5.8 mm (0.2 in) or more off the seat. If it does not fully open, install a new thermostat.
REFER to: Thermostat (303-03A Engine Cooling - I6 3.2L Petrol, Removal and Installation).

Radiator Leak Test - Removed from the Vehicle

CAUTION: Do not leak test an aluminium radiator in the same water that is used to leak test copper/brass radiators. Flux and caustic cleaners may be present in the test water which will corrode aluminium. If a separate tank is not available, drain and rinse the test tank before testing an aluminium radiator.

Clean the radiator before leak testing to prevent contamination of the test tank. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol - Cooling System Draining, Filling and Bleeding

General Procedures

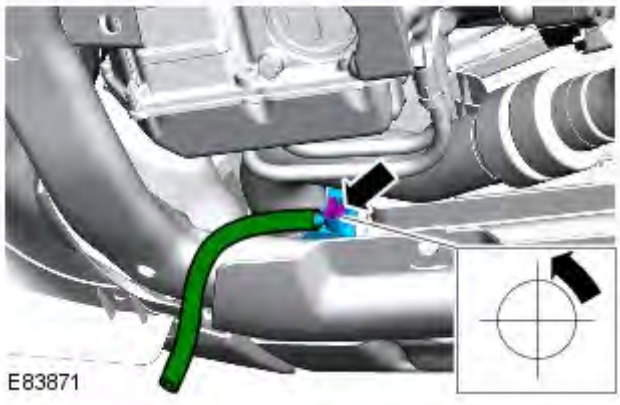
WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

1. Position the vehicle on a lift.
2. Set the heater controls to maximum.
3. Remove the engine undershield.

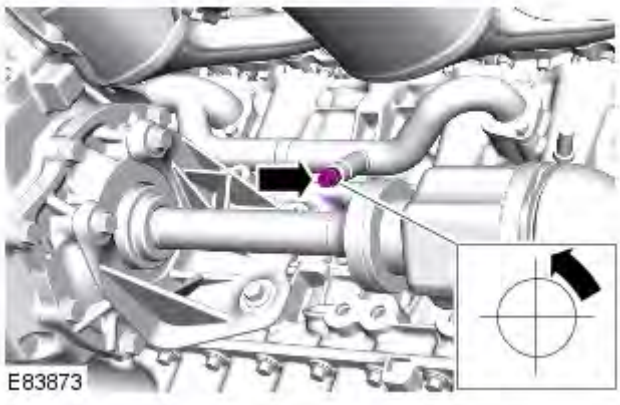
   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
4. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
5. **5.** WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

   Remove the coolant expansion tank cap.
6. Position a container to collect the fluid.



7. Attach a hose to the radiator drain tap. Open the tap.



8. Loosen the engine drain tap.
9. Close the radiator drain tap and remove the hose.
10. Tighten the engine drain tap.

Torque: 7 Nm

11. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

12. Connect exhaust extraction hoses to the tail pipes.

13. Refill the cooling system.

14. Start the engine and continue to fill the coolant until the maximum level is reached.

15. Install the coolant expansion tank cap.

16. Allow the engine to idle, until hot air is emitted at the face registers.

17. Switch the engine off and allow to cool.

18. Clean any spilt coolant from the vehicle.

19. Check and top-up the coolant if required.

20. Install the engine undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol - Thermostat

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

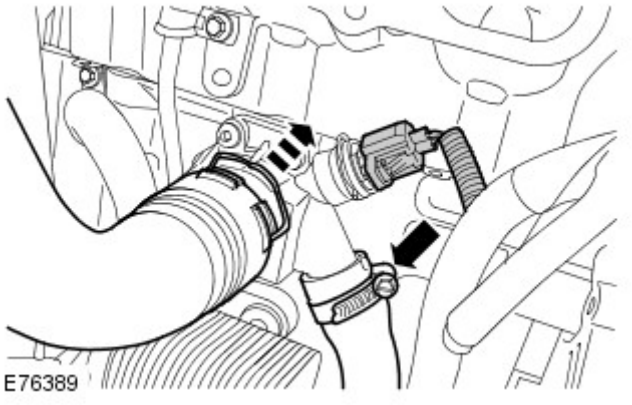
2. Remove the intake manifold assembly.

   Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

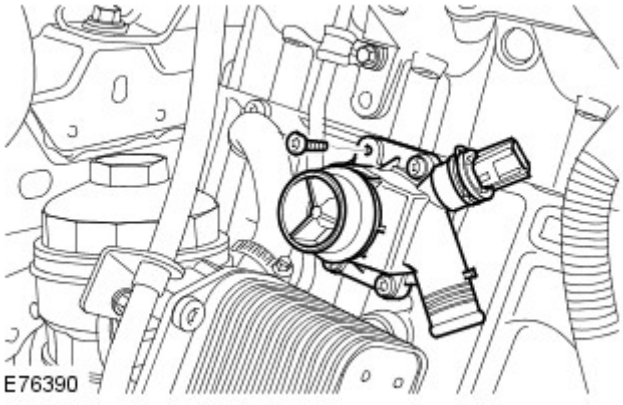
3. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

4.

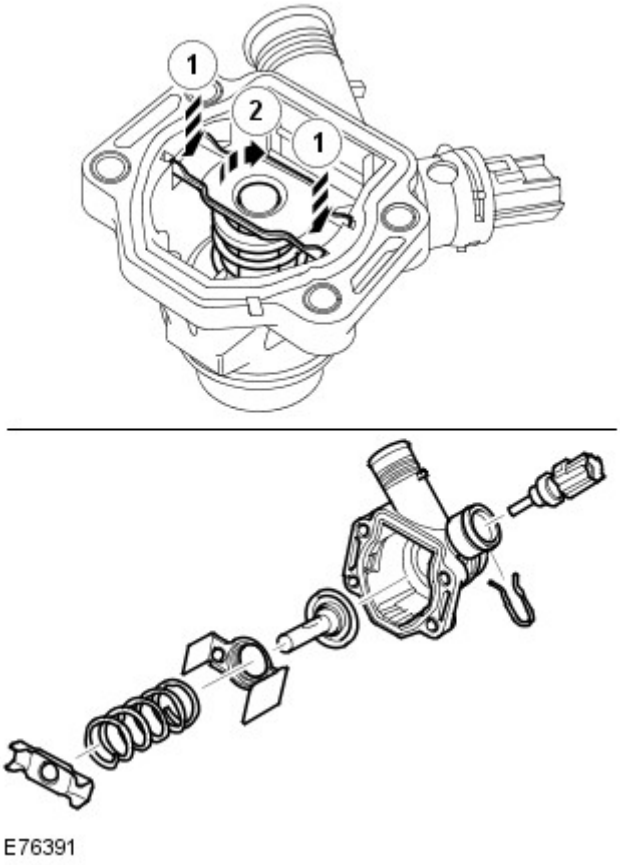


5. *Torque:* 10 Nm



6. Remove the thermostat.

7. Remove and discard the gasket.



8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the ECT sensor.

Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   To install, reverse the removal procedure.

2. **2.** NOTE: For NAS vehicles only.

   If required, carry out a long drive cycle.

   Refer to: Powertrain Control Module (PCM) Long Drive Cycle Self-Test (303-14A, General Procedures).

Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol - Coolant Pump

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the battery tray.

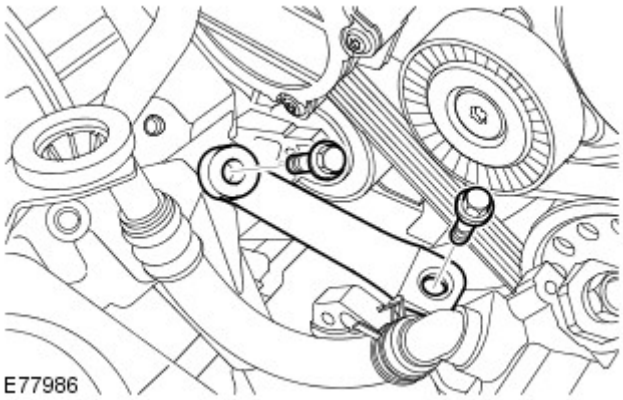
   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

4. Remove the air cleaner assembly.

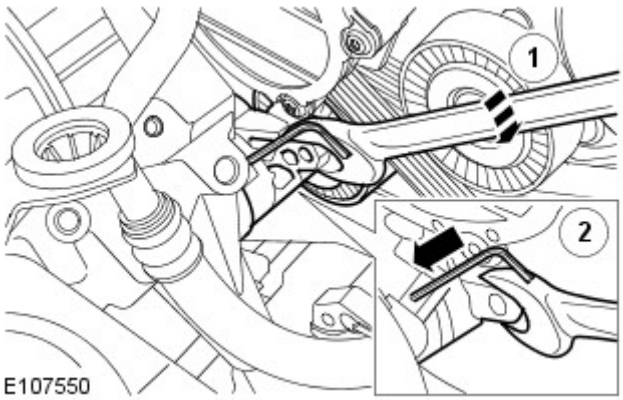
   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

5. Drain the coolant.

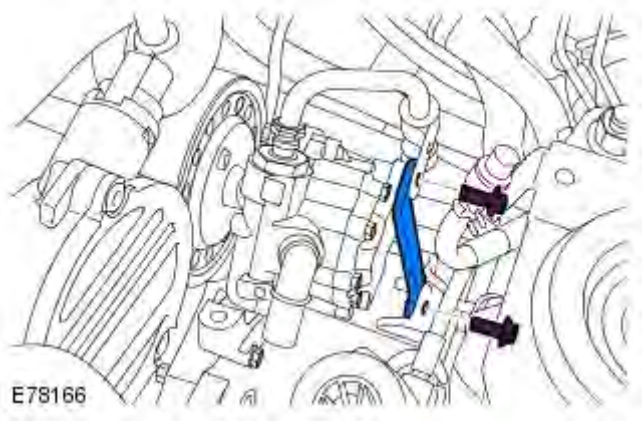
   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).



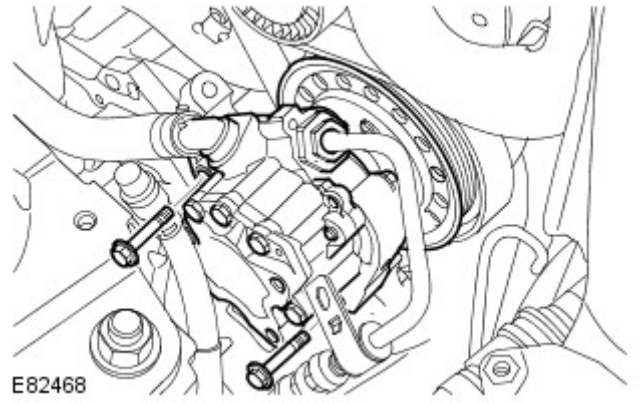
6. Remove the A/C compressor, lower support bracket.



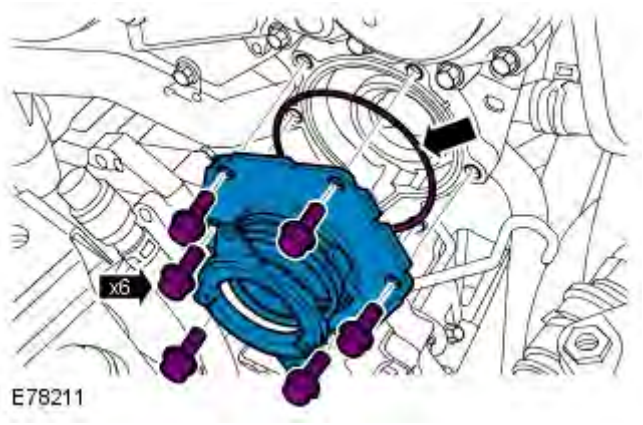
7. Using suitable tools, release the accessory drive belt tension.



8. Remove the power steering pump support bracket



9. Release the power steering pump.



10. **10.** NOTE: Discard the gasket.

    Remove the coolant pump.

Installation

1. **1.** NOTE: Install a new gasket.

   Install the coolant pump.

   Torque: 17 Nm

2. **2.** CAUTION: The accessory drive belt must be in position before the power steering pump is installed.

   Install the power steering pump.

   Torque: 25 Nm

3. Install the power steering pump support bracket.
4. Install the accessory drive belt.

   Torque: 25 Nm

5. Install the A/C compressor, lower support bracket.

   Torque: 25 Nm

6. Install the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

7. Install the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

8. Install the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

9. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

10. Fill and bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol - Radiator

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

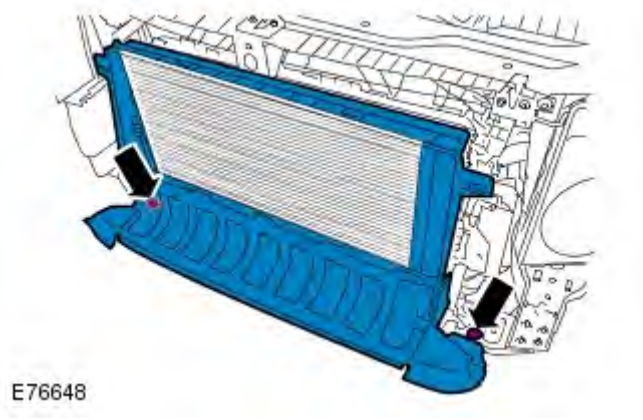
   Raise and support the vehicle.

2. Remove the bumper armature.

   Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

3. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).



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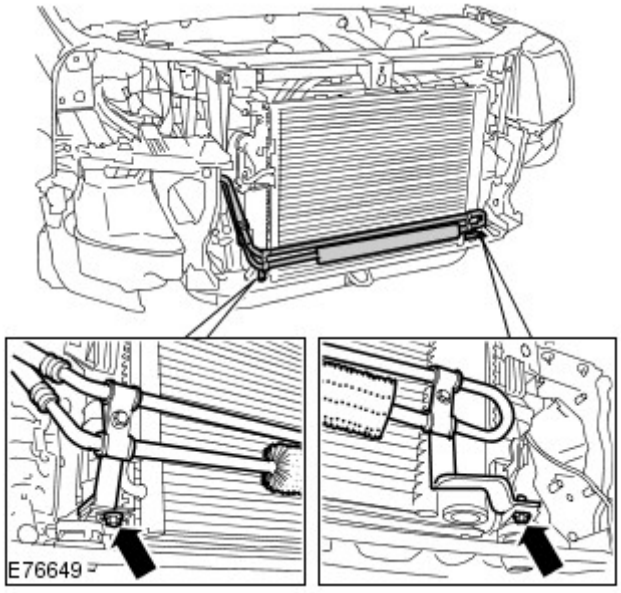
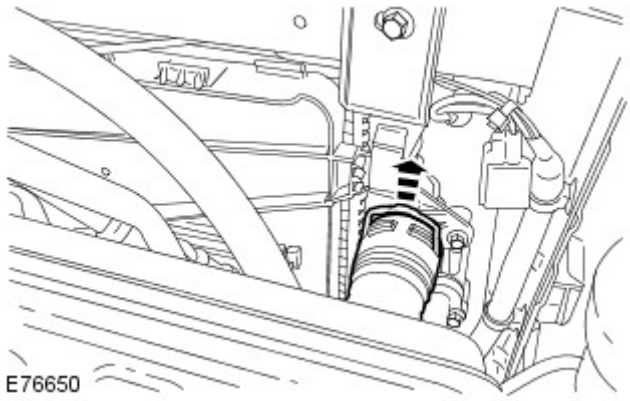


5. Release power steering cooler and secure aside.



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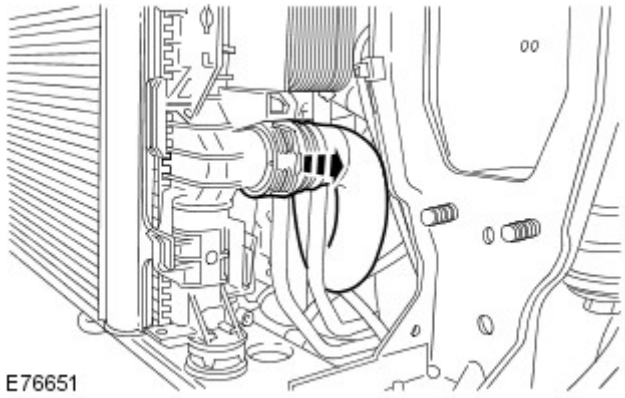

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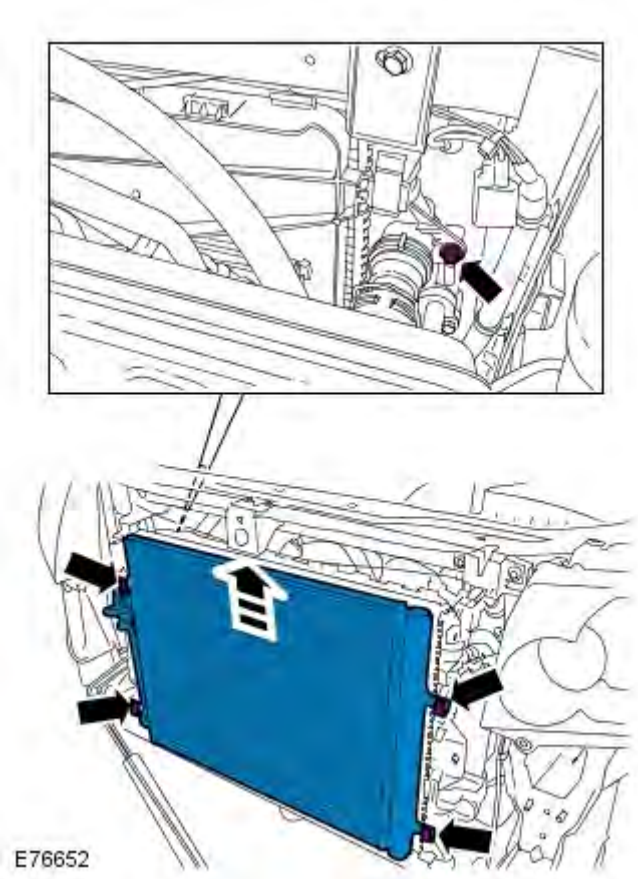
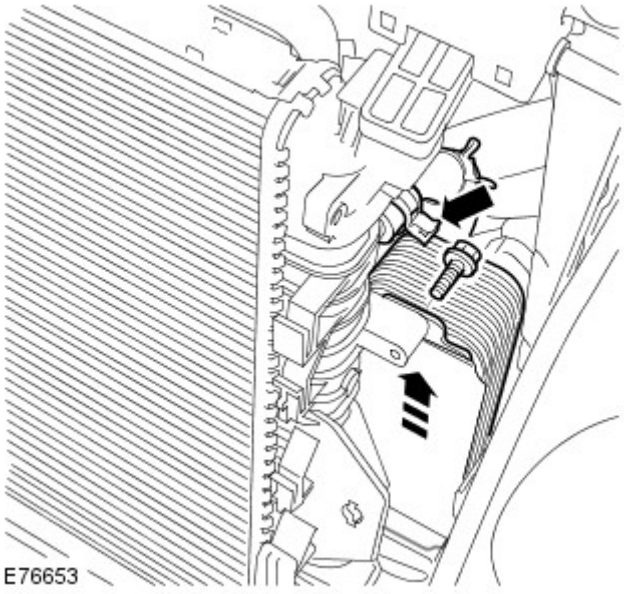
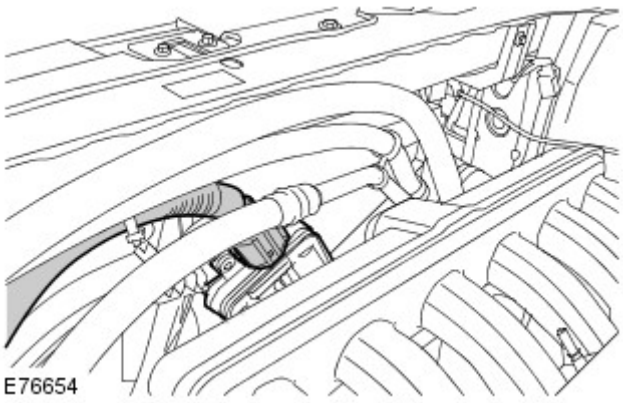


8. **8.** CAUTION: Protect the A/C condenser.

Release the A/C condenser and position aside.



9. Release the automatic transmission fluid cooler and tie aside.



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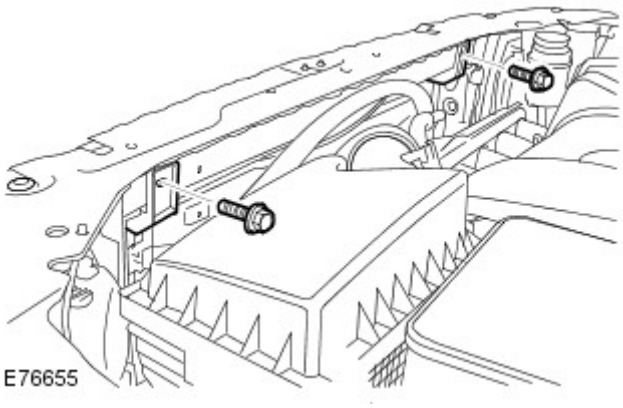

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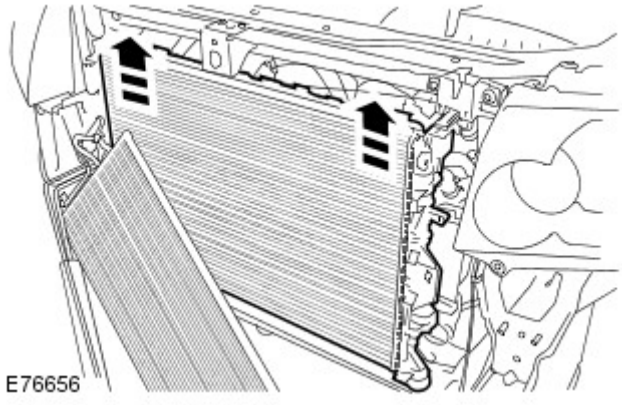
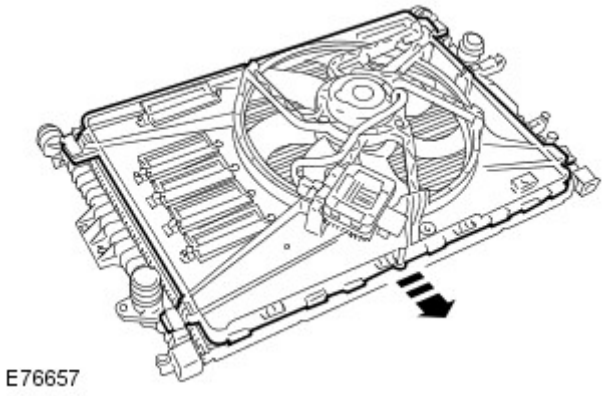
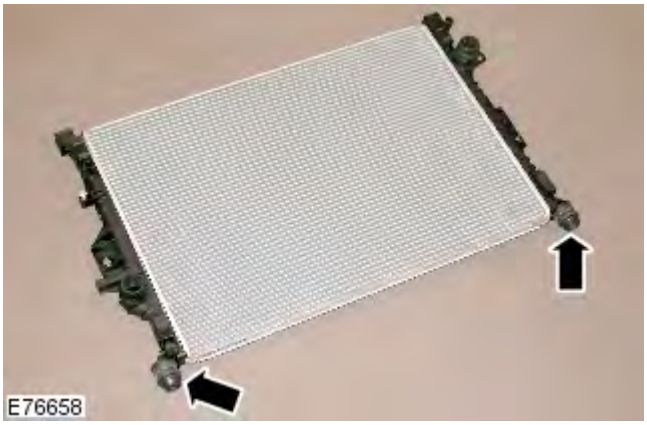


12. **12.** CAUTION: Protect the radiator during this operation.



13. **13.** NOTE: Do not disassemble further if the component is removed for access only.



14.

Installation

1. Install the rubber mounts.
2. Install the cooling fan assembly.
3. Carefully install the radiator.
4. Install the A/C condenser, and tighten the bolt.

   Torque: 10 Nm
5. Install the mountings and tighten the bolts.

   Torque: 6 Nm

6. Connect and secure the electrical connector.

7. Install the automatic transmission fluid cooler.

8. Connect the coolant top hose.

9. Connect the coolant lower hose.

10. Install the PAS cooler and tighten the bolts.

    Torque: 10 Nm

11. Install the air deflector.

12. Fill and bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

13. Install the bumper.

    Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol - Cooling Fan

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

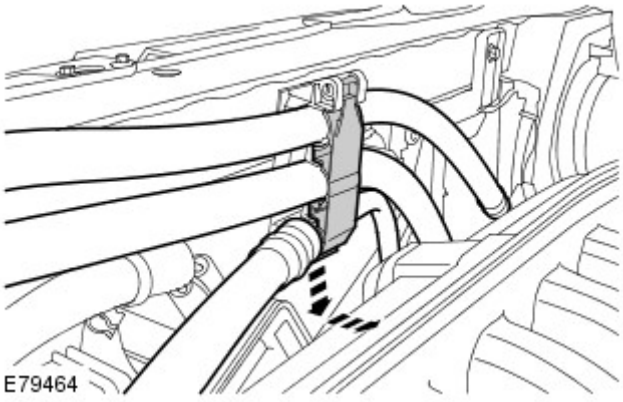
2. **2.** CAUTION: After switching off the ignition, wait for 2 minutes before disconnecting the battery. Failure to wait for 2 minutes will damage the navigation computer.

   Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

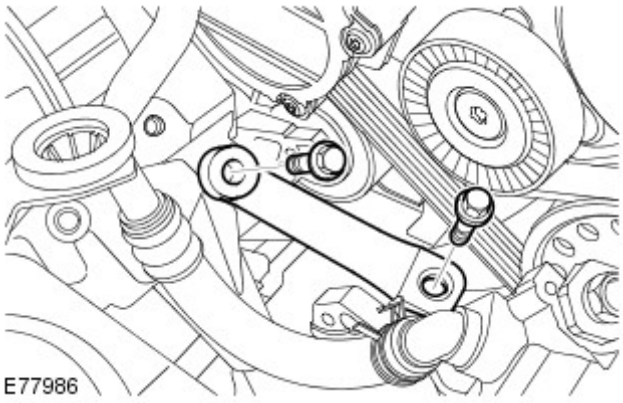
3. Remove the intake manifold.

   Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

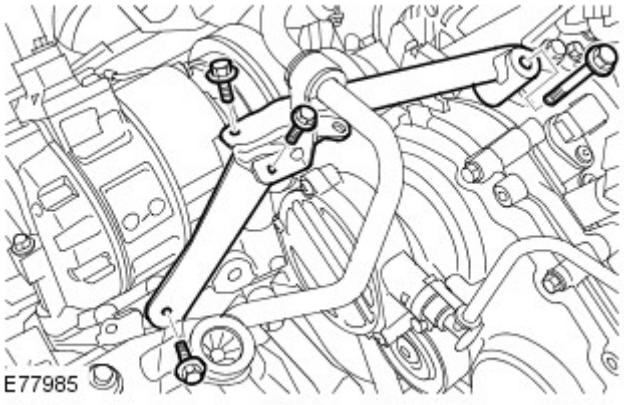


4. Release the A/C and power steering pipes.

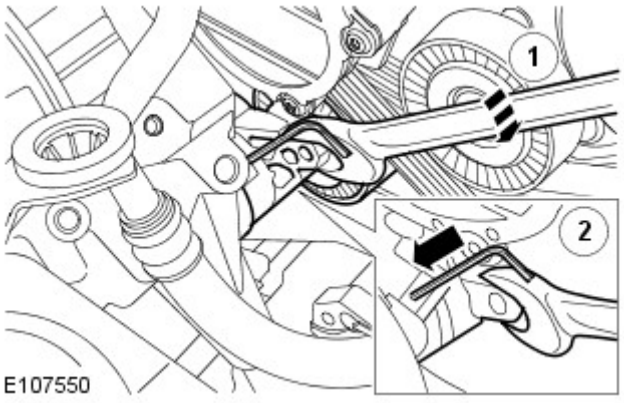
5. Remove the A/C line support bracket.



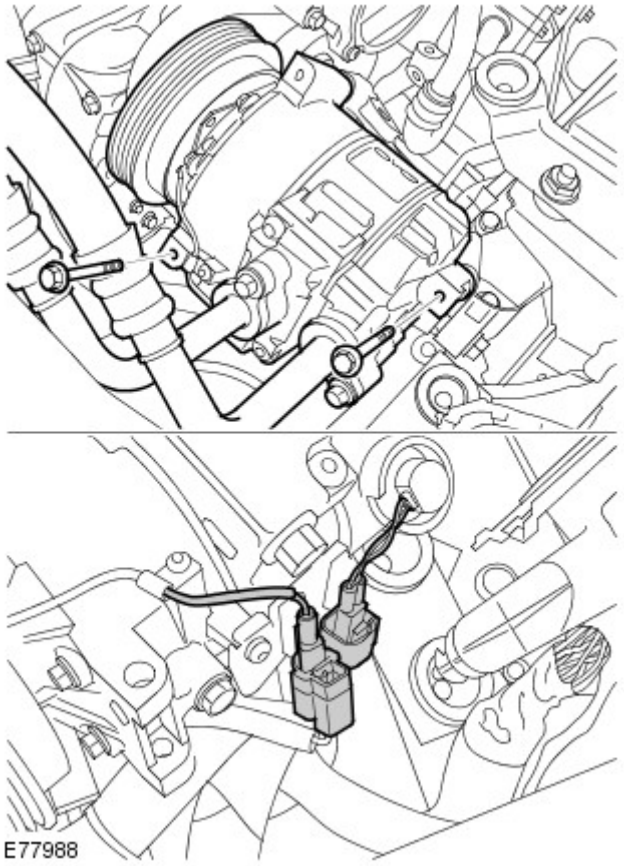
6. Remove the A/C compressor, lower support bracket.



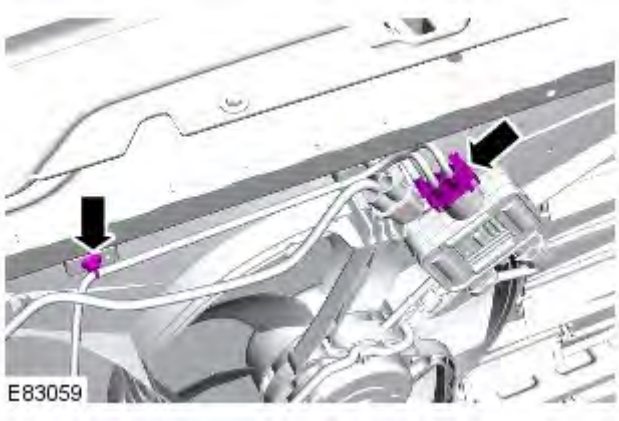
7. Remove the A/C compressor, upper support bracket.



8. Using suitable tools, release the accessory drive belt tension.

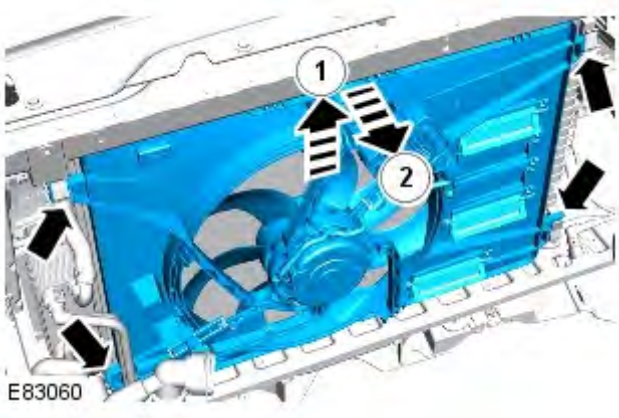


9. Release the A/C compressor and position aside.



10. Disconnect the cooling fan control electrical connector.

11. Release the cooling fan wiring harness.



12. Remove the cooling fan assembly.

Installation

1. Install the cooling fan assembly.
2. Install the A/C compressor.

   Torque: 25 Nm
3. Install the A/C compressor, upper support bracket.

   Torque:
   M10 45 Nm
   M8 25 Nm
   M6 10 Nm
4. Install the accessory drive belt.
5. Install the A/C compressor, lower support bracket.

   Torque: 25 Nm
6. Install the A/C line support bracket.

   Torque: 10 Nm
7. Secure the A/C pipes.
8. Secure the cooling fan harness.

9. Connect the cooling fan electrical connector.

10. Install the intake manifold.

    Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

11. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol - Cooling Fan Module

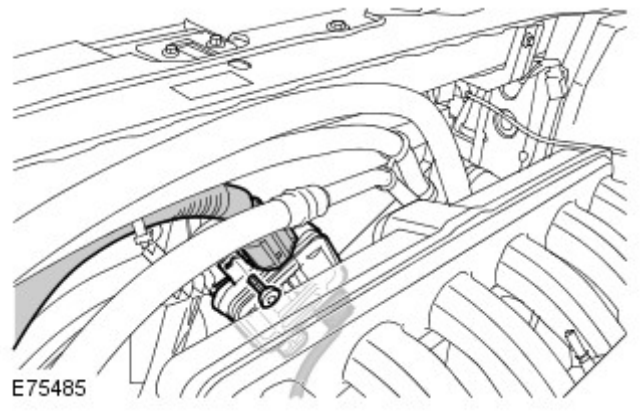
Removal and Installation

Removal

- NOTE: Petrol illustration shown, diesel similar.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).



2.
   - Remove the cooling fan module.
   - *Torque:* 6 Nm

Installation

1. To install, reverse the removal procedure.

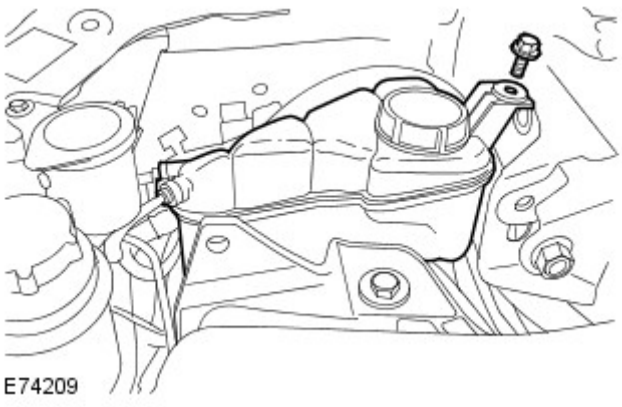
Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol - Coolant Expansion Tank

Removal and Installation

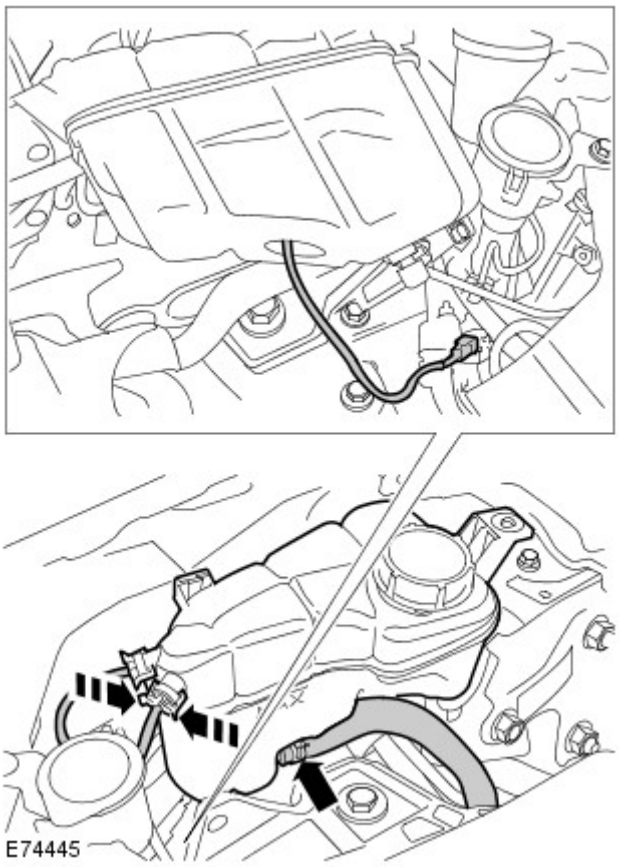
Removal

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.



1. *Torque:* 10 Nm

2. Clamp the relevant hose, to minimise coolant loss.



3. **3.** CAUTION: Be prepared to collect escaping coolant.

4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

2. Top-up the coolant.

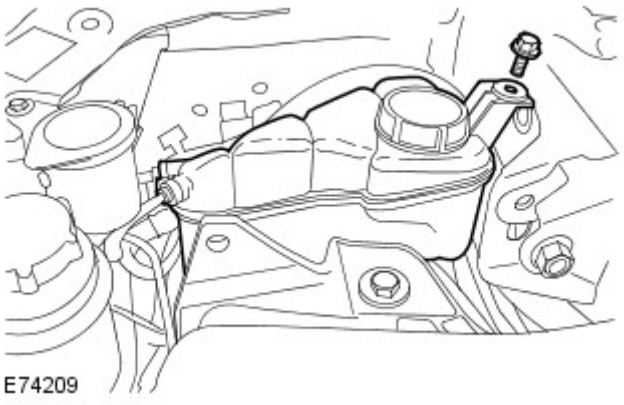
Published: 11-May-2011

Engine Cooling - I6 3.2L Petrol - Engine Coolant Level Switch

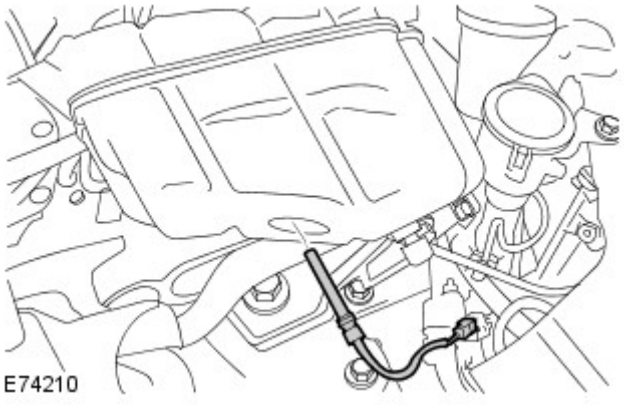
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 10 Nm



2.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel -

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Anti-freeze	Texaco Extended Life Coolant (XLC) or any glycol based anti-freeze containing no methanol with only Organic Acid Technology (OAT) corrosion inhibitors
Anti-freeze concentration - Will provide frost protection to -40°C (-40°F)	50%
Specific gravity of coolant at 20°C (68°F), to protect against frost down to -40°C (-40°F)	1.068
Amount of anti-freeze to use for 50% concentration:	4.25 liters

Capacities

Item	Capacity (liters/pints/US quarts)
Cooling system capacity	8.5/15.0/9.0

General Specification

Item	Specification
Coolant pump	21.5 liter/min : 2.8 bar
Cooling fan	750W/600W
Cooling system type	Pressurised, thermostatically controlled with remote header tank
Expansion tank	Seeber with integrated level sensor
Pressure cap rating	145 kPa (21lb/in²)
Radiator	Valeo 28mm core with integrated drain cock and replaceable lower pin
Thermostat	Wax element
Starts to open	83°C (181°F)
Fully open	91°C (200°C)

Torque Specifications

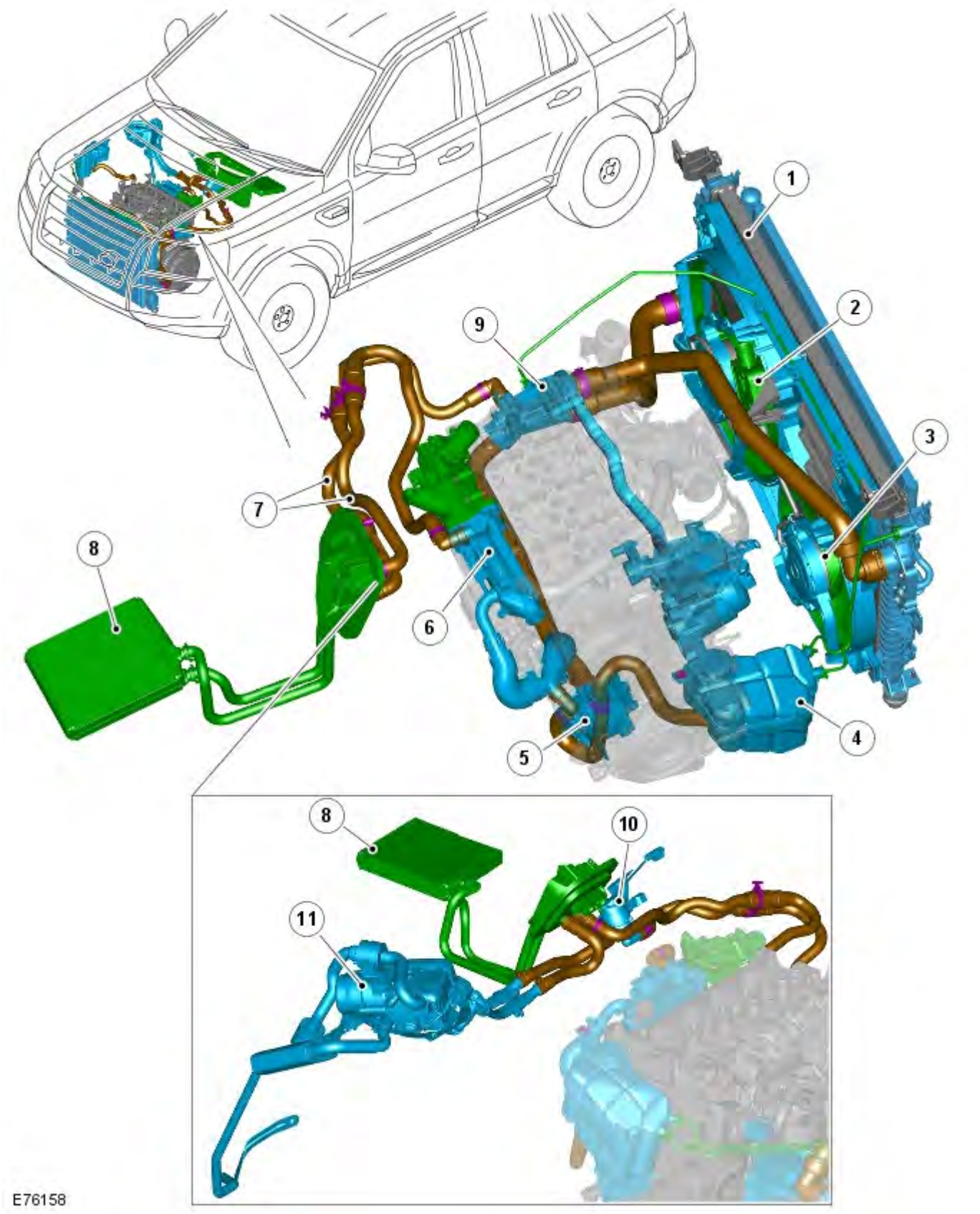
Description	Nm	lb-ft
A/C condenser to radiator	10	7
Automatic transmission fluid cooler	6	6
Coolant manifold to thermostat housing pipe.	8	6
Coolant expansion tank bolt	10	7
Coolant pump bolts	17	13
Cylinder block sealing plug	42	31
Radiator bolts	6	5
Radiator drain plug	7	6
Thermostat housing bolts	8	6
Wiring harness support bracket.	8	6

Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel - Engine Cooling

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Radiator
2	-	Twin electric fan control module
3	-	Twin electric fan assembly
4	-	Coolant reservoir with integral level sensor

5	-	Engine coolant pump
6	-	Exhaust Gas Recirculation (EGR) valve cooler
7	-	Heater connection hoses
8	-	Climate control system heater matrix
9	-	Thermal control module
10	-	Auxiliary coolant pump (cold climate vehicles)
11	-	Fuel Fired Booster Heater (FFBH) - (cold climate vehicle)

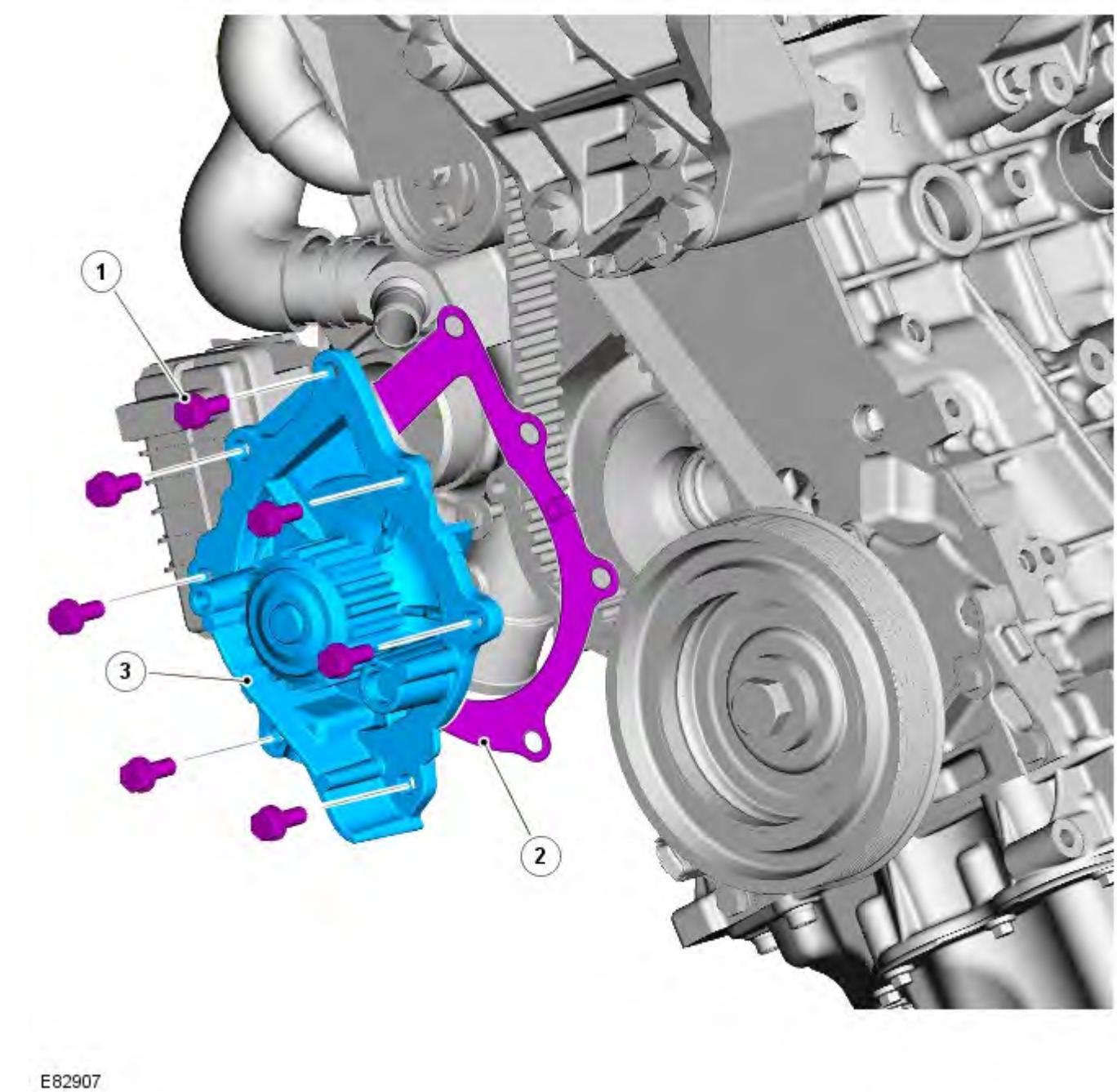
OVERVIEW

The main requirement of the TD4 diesel engine cooling system is to regulate the engines operating temperature, within an optimum range for all ambient and operating conditions. Additional functions of the cooling system are to provide heating to the climate control system, and cooling for the EGR system, engine lubrication system, and transmission lubrication system (automatic transmission models only).

The cooling system pipes and hoses feature quick release couplings to allow easy access to the system.

On cold climate market vehicles, the cooling system is modified to incorporate a FFBH and auxiliary cooling pump. The FFBH provides auxiliary heating to the vehicle cabin.
For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Description and Operation).

COOLANT PUMP



E82907

Item	Part Number	Description
1	-	Bolt (7 off)

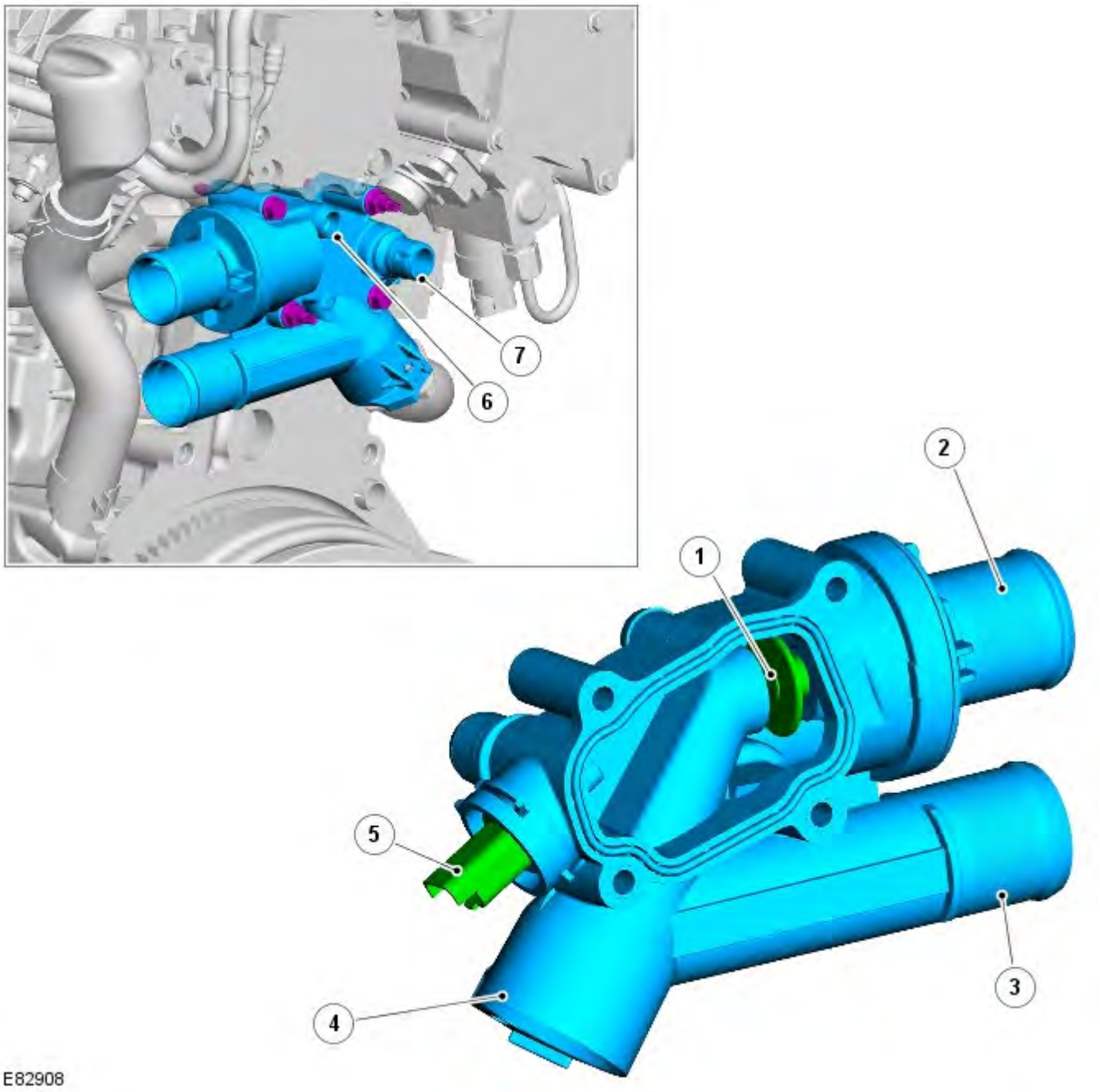
2	-	Gasket
3	-	Coolant pump

The centrifugal type coolant pump is mounted at the front of the engine and secured with 7 bolts. The pump is directly driven by the toothed camshaft belt and circulates coolant through the cylinder block and cylinder head, cooling system and heater circuit.

The coolant pump is able to deliver coolant at a rate of 215 liters/min (57 US gallons/min) at 2.8 bar (41 psi), creating a maximum external system pressure of 2.0 bar (30 psi).

A large diameter coolant rail located on the Right-Hand (RH) side of the engine connects the rear of the coolant pump housing to the thermal control module outlet. A connection on the coolant rail at the coolant pump housing end provides the coolant return from the EGR cooler.

THERMAL CONTROL MODULE



E82908

Item	Part Number	Description
1	-	Thermostat and by-pass valve
2	-	Radiator top hose connection
3	-	Radiator bottom hose connection
4	-	Coolant rail connection to coolant pump housing
5	-	Engine Coolant Temperature (ECT) sensor
6	-	Degas line connection
7	-	Supply to heater inlet

The thermal control module is mounted to the rear of the cylinder head with 2 studs and nuts, and 2 bolts and is sealed with an O-ring. The module comprises a wax type thermostat with by-pass valve, and an ECT sensor. Two connections on the Left-Hand (LH) side of the module provide the connection for the radiator top and bottom hoses.

The wax-type thermostat locates in the top hose connection to the radiator. A large diameter connection at the RH lower side connects the module to the coolant rail. Two small diameter outlets on the front of the module provide the connection for a supply hose to the heater matrix, and a degas line to the coolant reservoir.

The thermal control module promotes rapid warming of the engine to normal operating temperature by closing the return coolant connection from the engine to the radiator. During the engine warming period, the thermostat is closed and the by-pass valve is open. The by-pass port allows coolant to circulate through the closed engine circuit via the coolant pump, climate control heater circuit and EGR cooler.

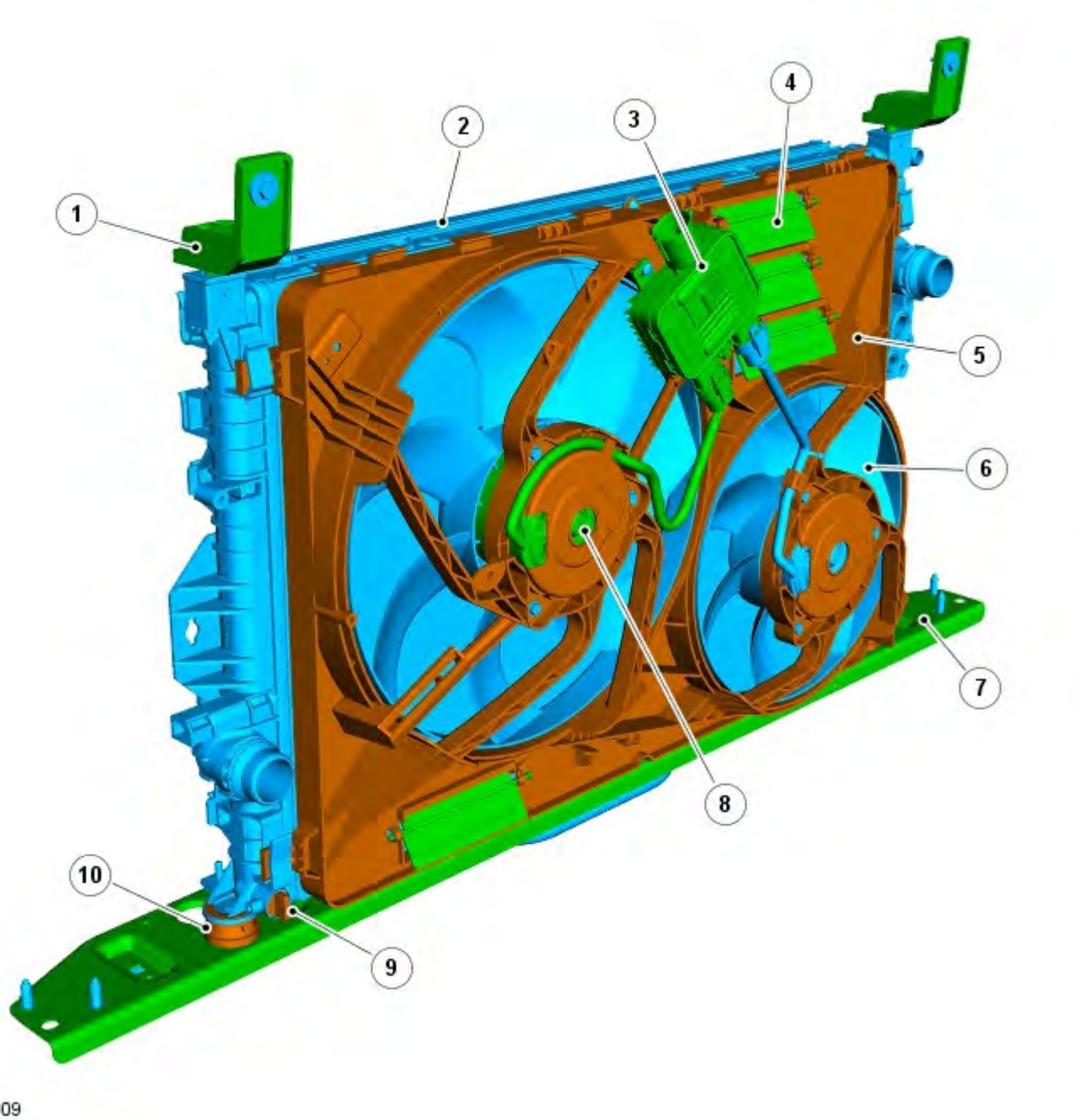
As the coolant temperature increases, the thermostat is opened and the by-pass valve is closed. The hot coolant returning from the engine is allowed to flow from the thermal control module to the radiator, through the open thermostat and top hose connection. Return coolant from the radiator flows through the bottom hose connection to the coolant pump, via the coolant rail.

The thermostat commences opening at 83°C (181°F), and is fully open at 91°C (196°F).

The ECT sensor is located in the thermal control module and secured in the housing with a clip. The ECT sensor provides an engine coolant temperature signal to the Engine Control Module (ECM). The signal is used by the ECM to control the operation of the 2 cooling fans.
For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

The ECM also communicates the ECT signal on the high speed Controller Area Network (CAN) bus to the Central Junction Box (CJB). The CJB transmits the ECT signal via the medium speed CAN bus to the instrument cluster, for display on the coolant temperature gage.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

RADIATOR



Item	Part Number	Description
1	-	Radiator upper support bracket
2	-	Radiator
3	-	Twin fan control module
4	-	High speed ram flaps (4 off)
5	-	Fan shroud
6	-	Electric fan
7	-	Radiator lower support bracket
8	-	Fan motor
9	-	Coolant drain point
10	-	Radiator lower support bush

The radiator is a right to left cross-flow type comprising an aluminum matrix. The bottom of the radiator is located in rubber bushes, and supported by a steel bracket screwed to the body longitudinal end plates. The top of the radiator is located in rubber bushes and is secured by brackets attached to the hood locking platform.

A hose connection on each side of the radiator provides the attachment for the top and bottom hose. A small diameter port in the top RH side provides a degas line connection to the coolant reservoir. A coolant drain point is provided on the bottom LH side of the radiator.

The rear of the radiator is covered with a fan shroud that also provides the mounting location for the twin fans and fan control module. The 4 high speed ram flaps located on the shroud are provided to assist the flow of cooling air into the engine compartment, regardless of fan operation. The ram flaps are operated by the ram air effect as air enters through the front grille. The ram flaps open when air speed through the radiator is sufficient to overcome the flap closing force.

On vehicles installed with AWF21 automatic transmission, the transmission fluid is cooled by an oil cooler mounted to the rear LH side of the radiator. The cooler is connected into the LH top third of the radiator (cold side) and causes a restriction to the flow of coolant across this portion of the radiator. As the coolant flow is restricted, the coolant travels at a slower rate creating a low temperature zone. This cools the coolant in that portion of the radiator more than the lower portion to provide increased cooling of the transmission oil.
For additional information, refer to: Transmission Cooling (307-02 Transmission/Transaxle Cooling, Description and Operation).

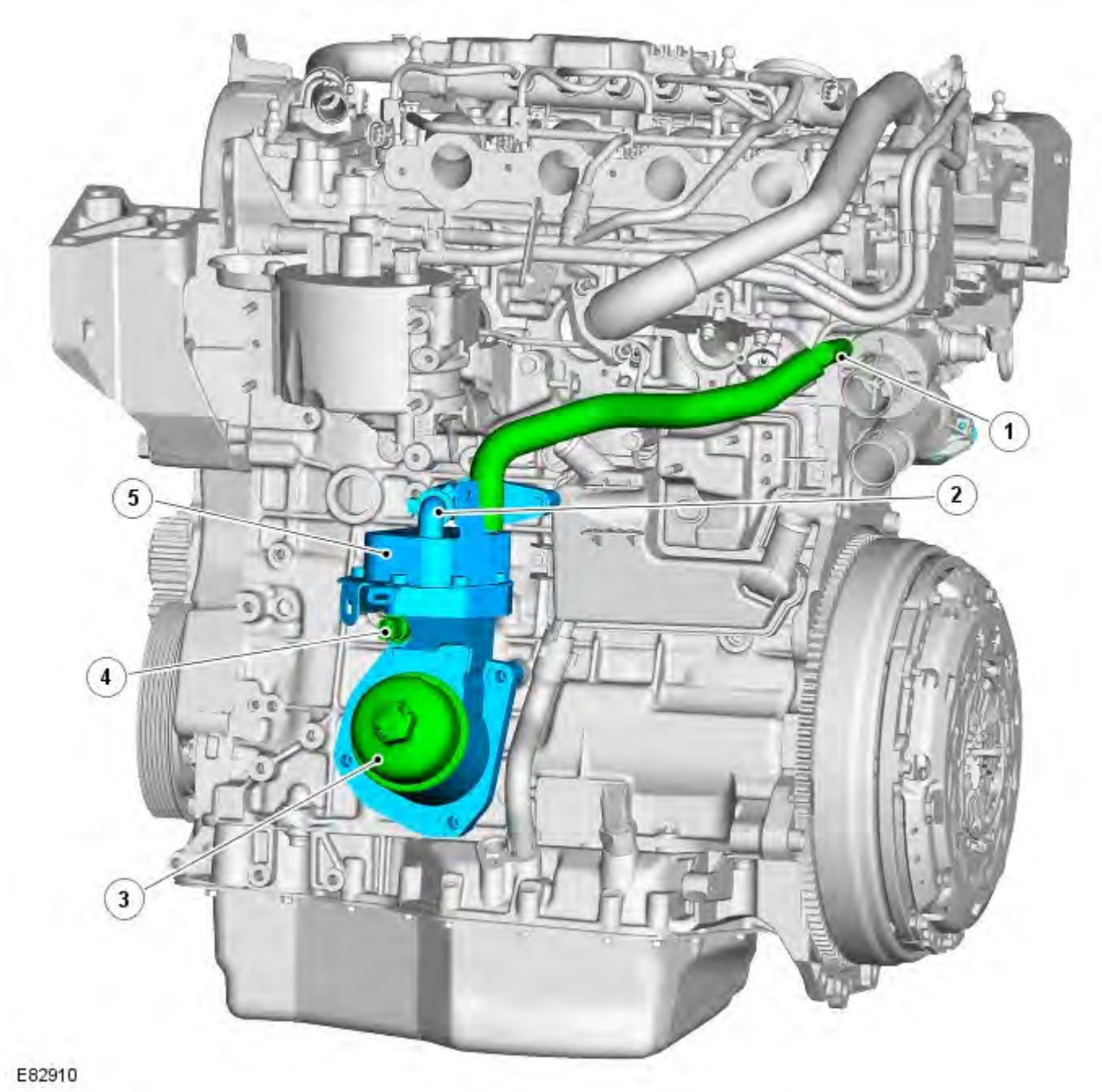
TWIN ELECTRIC FAN ASSEMBLY

A twin electric fan assembly is mounted to the fan shroud and attached to the rear of the radiator. The fans draw air through the radiator to regulate the coolant temperature, and provide cooling air through the engine compartment.

The fans are operated by the fan control module that receives a 0 to 100% Pulse Width Modulation (PWM) frequency signal from the ECM. The ECM varies the PWM signal based on inputs from various sensors. The fan control module uses the PWM signal to determine the required output voltage to the 2 cooling fan motors.
For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

Following certain engine operating conditions and with the ignition switched off, the fans will continue to operate under the control of the ECM to maintain engine cooling.

ENGINE OIL COOLER



Item	Part Number	Description
1	-	Coolant return from oil cooler
2	-	Coolant supply from cylinder block
3	-	Oil filter housing
4	-	Oil pressure switch
5	-	Oil cooler

The engine oil is cooled by an integrated oil filter and cooler assembly, located at the LH side of the engine. A short hose connects the oil cooler to the cylinder block and provides the coolant supply to the oil cooler. A hose connected between the oil cooler and front of the cylinder head provides the coolant return to the thermal control module.

COOLANT RESERVOIR

The coolant reservoir is incorporated into the system to provide sufficient air volume for coolant expansion, and to allow entrained air and gas to escape from the coolant. Degas lines connect the reservoir to the thermal control module and radiator.

The coolant level is monitored by an integral float type sensor located within the coolant reservoir. The coolant level sensor is connected to the CJB. On vehicles installed with a low-line instrument cluster, a low engine coolant level warning indicator lamp is illuminated if the coolant level falls below the level of the sensor. On vehicles installed with a high-line instrument cluster, a low coolant level message is displayed in the message center. For additional information, refer to:

Instrument Cluster (413-01 Instrument Cluster, Description and Operation),
Information and Message Center (413-08 Information and Message Center, Description and Operation).

The reservoir is sealed with a screw cap, and provides the means to replenish the system during service intervals. The reservoir cap incorporates a pressure relief valve that protects the cooling system from over pressure.

CLIMATE CONTROL HEATER MATRIX

The heater matrix is installed in the climate control assembly, located on the vehicle center line between the instrument panel and the engine bulkhead. Two pipes pass through the bulkhead into the engine compartment and connect to a supply and a return cooling system heater hose. The coolant supply hose is connected to an outlet on the thermal control module. The coolant return hose is connected to the EGR cooler.

The matrix is constructed from aluminum with two end tanks interconnected with tubes. Aluminum fins are located between the tubes and transfer heat to the passing air. Coolant is supplied to the heater matrix at all times when the engine is running.
For additional information, refer to: Heating and Ventilation (412-01 Climate Control, Description and Operation).

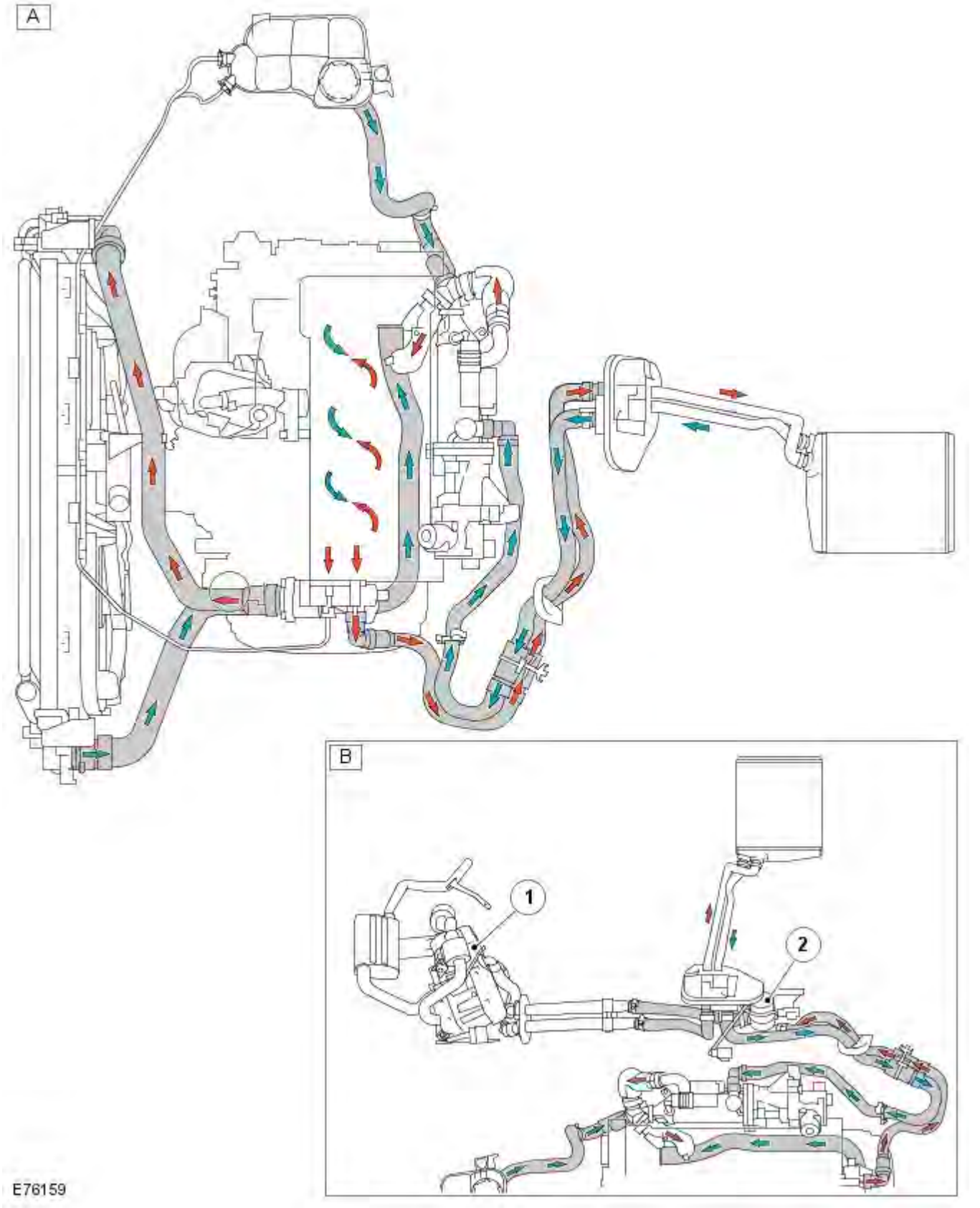
ENGINE COOLANT

The long-life engine coolant is silicate free and is not to be mixed with conventional engine coolant.

The cooling system contains approximately 8 liters (8.5 US quarts) of a 50/50 water and long life coolant concentration.

PRINCIPLES OF OPERATION

Cooling System Flow at Normal Operating Temperature



Item	Part Number	Description
A	-	Cooling system (temperate climate vehicles)
B	-	Additional cooling system components (cold climate vehicles)
1	-	FFBH
2	-	Auxiliary coolant pump

Engine Cold

During engine starting the coolant pump is driven by the camshaft drive belt and circulates coolant through the engine cylinder block, engine oil cooler and cylinder head. Coolant also flows through the climate control heater circuit and the EGR cooler. The thermostat is in the closed position and prevents the return of coolant from the engine to the radiator.

With the thermostat closed, the by-pass valve is open and directs the return coolant through the thermal control module and coolant rail to the coolant pump housing. The coolant continues to circulate and is progressively heated by the engine.

Entrained gases in the cooling system escape through the thermal control module degas line to the coolant reservoir.

The increasing coolant temperature is felt at the thermostat, and is registered on the instrument cluster coolant temperature gage via the ECM and ECT sensor signal.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

Engine Normal Operating Temperature

With the coolant temperature increasing, at 83°C (181°F) the thermostat reacts and commences opening. The by-pass valve is progressively closed. Hot coolant returning from the engine to the thermal control module is now allowed to pass through the top hose connection to the radiator. The flow of hot coolant to the radiator now forces cold coolant within the radiator and bottom hose to flow to the thermal control module.

During the thermostat opening period there is an initial temperature differential of the coolant at both sides of the thermostat. The thermostat reacts to the temperature differential and partially closes, while the by-pass valve opens further. The thermostat and by-pass valve continue to oscillate while the coolant temperature increases.

At a coolant temperature of 91°C (196°F) the thermostat is fully opened and the by-pass valve is fully closed. The return coolant from the engine is now fully circulated through the radiator and bottom hose. Coolant flows through the radiator from the RH tank to the LH tank, and is cooled by air passing through the matrix. Entrained gases in the radiator escape through the connected degas line to the coolant reservoir.

The increased coolant volume created by heat expansion causes the coolant level to rise through the connecting reservoir hose, and into the reservoir.

The temperature of the cooling system is constantly monitored by the ECM via the ECT sensor signal. The ECM uses the ECT signal to control operation of the cooling fans, and to adjust engine fueling. The ECM also operates the fans in response to inputs from the automatic transmission oil temperature sensor, Air Conditioning (A/C) system control switch, and the A/C pressure sensor. For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).
For additional information, refer to: Air Conditioning (412-01 Climate Control, Description and Operation).

The cooling fan speed is also influenced by vehicle road speed. The ECM adjusts the speed of the cooling fans to compensate for the ram air effect, using the CAN bus road speed signal received from the Anti-Lock Brake System (ABS) module.

When the engine is shut down, the coolant temperature and volume decrease. The thermostat starts to close as the coolant temperature decreases to 89°C (192°F), and is fully closed at 81°C (178°F). The coolant level within the reservoir decreases as coolant is drawn from the reservoir to replenish the system.

Following engine shut down when the coolant pump is stationary, the ECM may continue to operate the cooling fans for a pre-determined period to maintain engine cooling.

Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel - Engine Cooling

Diagnosis and Testing

Principles of Operation

For a detailed description of the cooling system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Coolant leaks • Coolant expansion tank • Electric fan • Radiator	• Fuse • Wiring harness • Loose or corroded connector(s) • Engine Coolant Temperature (ECT) sensor

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Coolant loss	• Hoses • Hose connections • Radiator • Coolant pump • Heater core • Gaskets • Engine casting cracks • Engine block core plugs	• GO to Pinpoint Test A.
Engine overheating	• Engine coolant (level/condition) • Thermostat • Fan motor • Fan motor fuses and/or circuits • ECT sensor • Engine control module (ECM) • Fan speed module	• GO to Pinpoint Test B.
Engine not reaching normal operating temperature	• Thermostat • Electric fan • Fan speed module	• GO to Pinpoint Test C.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P011600	Engine Coolant Temperature Sensor 1 Circuit	• Minimum temperature or increase not achieved within	Check integrity of cooling system. REFER to: Engine Cooling (303-03B

DTC	Description	Possible Cause	Action
	Range/Performance	time limit	Engine Cooling - TD4 2.2L Diesel, Diagnosis and Testing).
P011700	Engine Coolant Temperature Sensor 1 Circuit Low	• Engine coolant temperature sensor circuit - short to ground, open circuit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P011800	Engine Coolant Temperature Sensor 1 Circuit High	• Engine coolant temperature sensor circuit - short to power	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P048000	Fan 1 Control Circuit	• Fan control output 1 circuit - no load	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P04804B	Fan 1 Control Circuit	• Fan control output 1 circuit - over temperature	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P048100	Fan 2 Control Circuit	• Fan PWM power stage output 2 no load	Refer to electrical circuit diagrams and check cooling fan 2 control circuit for open circuit
P04814B	Fan 2 Control Circuit	• Fan PWM power stage output 2 excess temperature	Refer to electrical circuit diagrams and check cooling fan 2 control circuit for high resistance
P048300	Fan Performance	• Fan has stalled	Check and remove obstruction from cooling fan. Check for seizure of cooling fan
P069111	Fan 1 Control Circuit Low	• Fan control output 1 circuit - short to ground	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P069212	Fan 1 Control Circuit High	• Fan control output 1 circuit - short to power	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P069311	Fan 2 Control Circuit Low	• Cooling fan control circuit - short to ground	Refer to electrical circuit diagrams and check cooling fan control circuit for short to ground
P069412	Fan 2 Control Circuit High	• Cooling fan control circuit - short to power	Refer to electrical circuit diagrams and check cooling fan control circuit for short to power

Pinpoint Tests

PINPOINT TEST A : LOSS OF COOLANT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: VISUAL INSPECTION	
	1 Visually inspect for loss of coolant.
	2 Carry out a system pressure test. See component tests in this section.
	Is the engine cooling system leaking? **Yes** Rectify the leak as indicated by the test result. Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary. REFER to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications) / Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures). TEST the system for correct operation. **No** Verify the customer complaint.

PINPOINT TEST B : THE ENGINE OVERHEATS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK COOLANT	
	WARNING: The cooling system is pressurized! Ensure the reservoir cap is never released until the system has cooled. Failure to follow these instructions may result in personal injury.
	1 Check the coolant level and condition.
	Does the system contain sufficient coolant of the correct specification? **Yes** GO to B2. **No** Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary. REFER to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications) / Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures). Check for coolant loss. GO to Pinpoint Test A.
B2: CHECK COOLANT EXPANSION TANK PRESSURE CAP	
	1 Check the coolant expansion tank pressure cap for damage/correct operation. REFER to the coolant expansion tank pressure cap pressure test in this section.

	Is the coolant expansion tank pressure cap operating correctly? **Yes** GO to B3. **No** INSTALL a new coolant expansion tank pressure cap. TEST the system for correct operation.
B3: CHECK THERMOSTAT	
	1 Check the thermostat for correct operation. REFER to the thermostat component test in this section.
	Is the thermostat operating correctly? **Yes** Check for correct operation of cooling fans, circuits, sensors, modules, etc. REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Diagnosis and Testing). **No** INSTALL a new thermostat. REFER to: Thermostat (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation). TEST the system for correct operation.

PINPOINT TEST C : THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THERMOSTAT	
	1 Check the thermostat for correct operation. REFER to the thermostat component test in this section.
	Is the thermostat operating correctly? **Yes** Check for correct operation of cooling fans, circuits, sensors, modules, etc. REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Diagnosis and Testing). **No** INSTALL a new thermostat. REFER to: Thermostat (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation). TEST the system for correct operation.

Component Tests

Cooling System Pressure Test

WARNING: Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1. **1.** Switch the engine off.
2. **2.** Open the hood and install protective fender covers.
3. **3.** Carefully remove the coolant expansion tank pressure cap from the coolant expansion tank to relieve pressure in the cooling system. Add coolant to coolant expansion tank as necessary.
4. **4.** Install the pressure tester equipment to the cooling system following manufacturers instructions. Reinstall the coolant expansion tank pressure cap (if pressure test equipment is not installed to the coolant expansion tank).
5. **5.** Pressurize the cooling system to the coolant expansion tank pressure cap lower limit.
6. **6.** Observe the gauge reading for approximately two minutes. Pressure should not drop during this time.
   - If system holds pressure, continue from step 7.
   - If the pressure drops, check the complete cooling system for leaks. Also refer to engine system checks if a leak cannot be located in the cooling system. Correct any leaks found and recheck the system.
7. **7.** Release the system pressure and remove the pressure test equipment. Check the coolant level. Replenish as necessary with the correct coolant solution.
   REFER to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications).
8. **8.** Check the radiator overflow hose for any obstructions which may block the flow of coolant either to or from the coolant expansion tank.
9. **9.** Conduct the coolant expansion tank pressure cap pressure test in this section.

Coolant Expansion Tank Pressure Cap Pressure Test

WARNING: Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1. **1.** Remove the expansion tank pressure cap from the coolant expansion tank.
2. **2.** Use water to clean cap in area of rubber seal and vacuum relief valve. Following manufacturers instructions, install the coolant expansion tank pressure cap to the pressure tester.
3. • NOTE: If the pressure tester is pressurised too quickly, an erroneous pressure reading may result.

   3. Slowly pressurise the system until the pressure gauge reading stops increasing, and note highest pressure reading obtained.
4. **4.** Release pressure and repeat Step 3 at least twice to make sure the pressure test reading is repeatable and within specification.
5. **5.** If the pressure test gauge readings are not within specification, install a new coolant expansion tank pressure cap.

Thermostat Test

Remove the thermostat
REFER to: Thermostat (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation).
Inspect for visible damage, note its opening temperature and immerse it in water. Heat the water until this temperature is reached. The thermostat should begin to open. If it does not begin to open, install a new thermostat.
REFER to: Thermostat (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation).
If thermostat begins to open, continue to heat the water until the thermostat fully opens, 5.8 mm (0.2 in) or more off the seat. If it does not fully open, install a new thermostat.
REFER to: Thermostat (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation).

Radiator Leak Test - Removed from the Vehicle

CAUTION: Do not leak test an aluminium radiator in the same water that is used to leak test copper/brass radiators. Flux and caustic cleaners may be present in the test water which will corrode aluminium. If a separate tank is not available, drain and rinse the test tank before testing an aluminium radiator.

Clean the radiator before leak testing to prevent contamination of the test tank. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

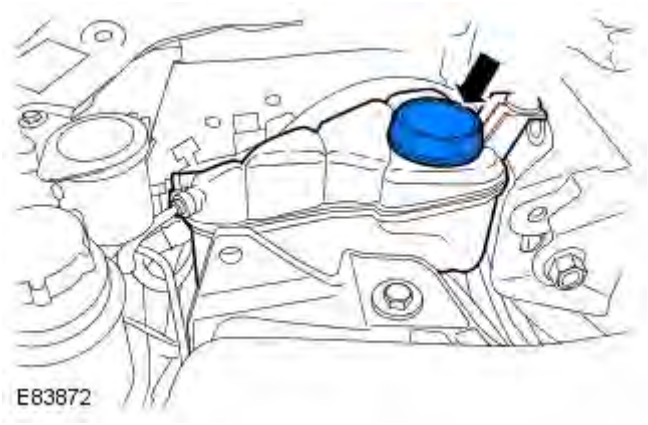
Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel - Cooling System Draining, Filling and Bleeding

General Procedures

1. Position the vehicle on a lift.

2. Set the heater controls to maximum.



3. **3.** WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

   Remove the coolant expansion tank cap.

4. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

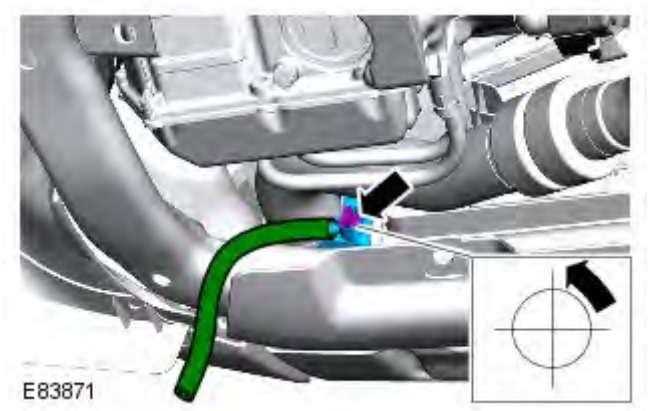
5. Remove the RH front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

6. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

7. Position a container to collect the fluid.



8. Attach a hose to the radiator drain tap. Open the tap.

9. *Torque:* 23 Nm

10. Tighten the radiator drain tap.

11. Install the drain plug.

12. Connect the battery ground cable.

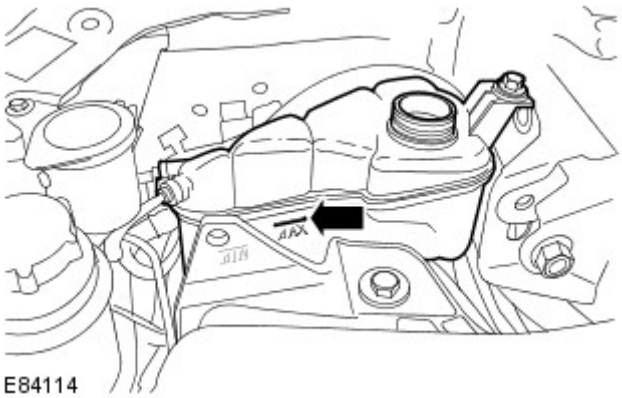
    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

13. Connect exhaust extraction hoses to the tail pipes.

14. Fill the cooling system to the upper level mark of the expansion tank.

15. Install the coolant expansion tank cap.

16. Hold the engine speed at 2000 rpm until warm air is expelled from the heater.



17. Fill the cooling system to the upper level mark of the expansion tank.

18. Switch the engine off and allow to cool.

19. Clean any spilt coolant from the vehicle.

20. Check and top-up the coolant if required.

21. Install the engine undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

22. Install the front wheel.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel - Cooling System Draining and Vacuum Filling

General Procedures

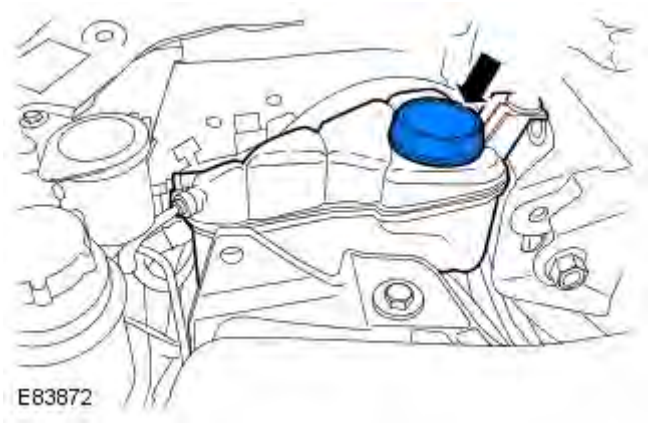
WARNING: To avoid having scalding hot coolant or steam blowing out of the cooling system, use extreme care when removing the coolant pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant pressure cap and turn it slowly until the pressure begins to release. Step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant pressure cap from the coolant expansion tank. Failure to follow these instructions may result in personal injury.

• CAUTIONS:

The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the vehicle.

Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

1. Set the heater controls to maximum HOT.



2. **2.** WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

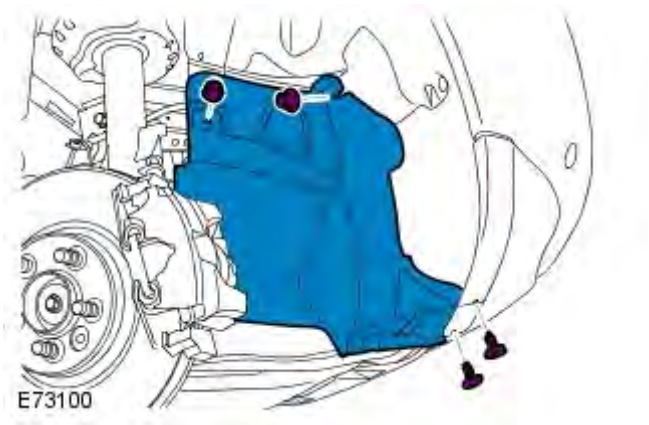
   Remove the coolant expansion tank cap.

3. **3.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

4. Remove the engine undershield.

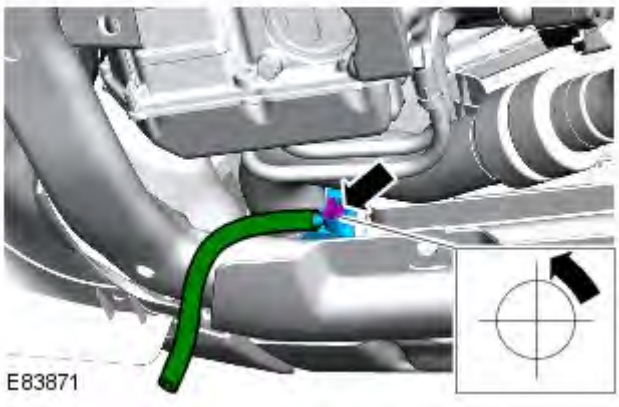
   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



5. **5.** NOTE: Wheel shown removed for clarity.

   Remove the front RH splash shield.

6. Position a container to collect the fluid.



7.

- Attach a hose to the radiator drain tap.
- Open the radiator drain tap.
- Drain the coolant from the radiator.

8.

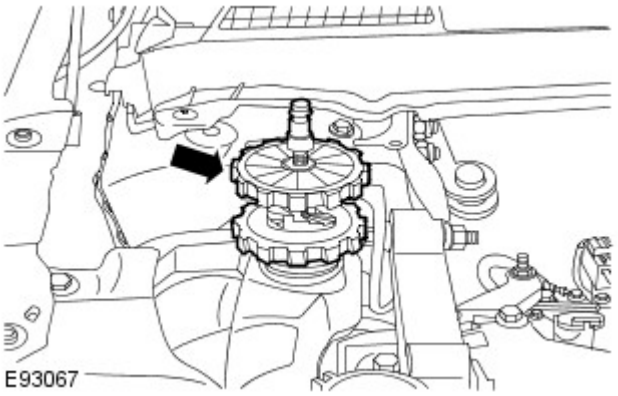
- Remove the drain plug.
- Drain the coolant from the engine.

9. Close the radiator drain tap and remove the hose.

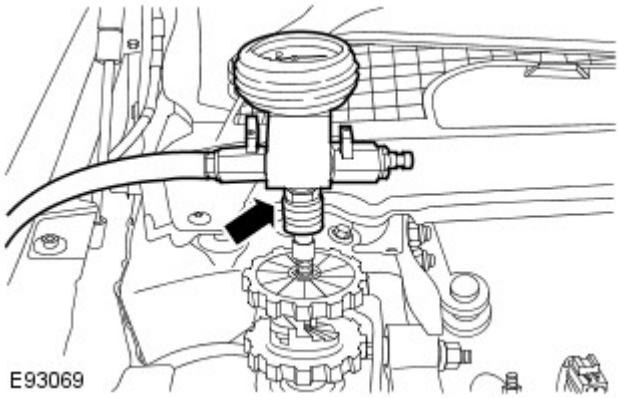
10. Install the drain plug.

    Torque: 23 Nm

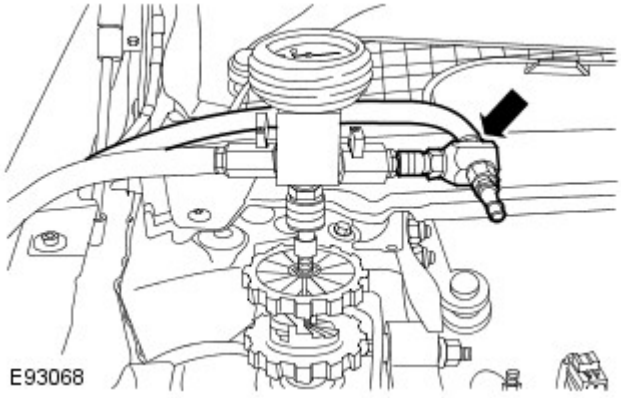
11. Prepare a sufficient amount of coolant to the specified concentration.



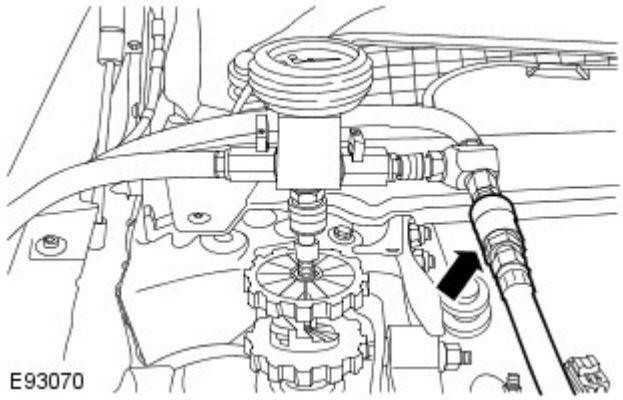
12. Install the cooling system vacuum refill adaptor to the expansion tank.



13. Install the vacuum filler gauge to the cooling system vacuum refill adaptor.



14. Install the venturi tube assembly to the vacuum filler gauge.

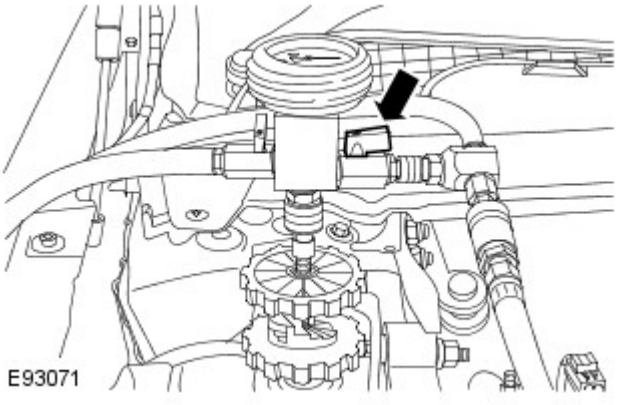


15. Connect a regulated compressed air supply to the venturi tube assembly.

16. **16.** NOTE: Make sure air cannot enter the hose.

    Position the coolant pick-up pipe into a container of clean coolant.

17. Position the evacuated air hose into a container.

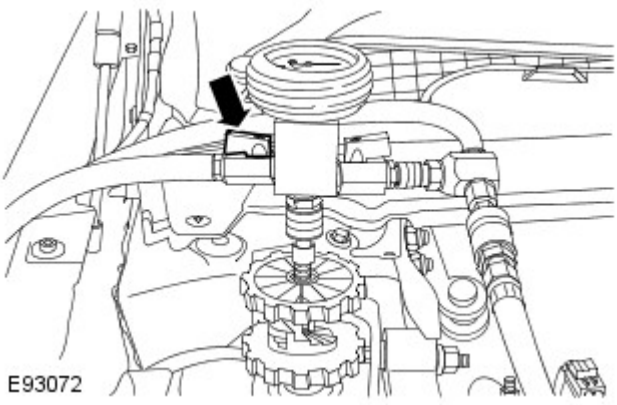


18. **18.** NOTE: Make sure the coolant supply valve is in the closed position on the vacuum filler gauge assembly.

    • NOTE: The coolant vacuum fill tool needs an air pressure of 6 to 8 bar (87 to 116 psi) to operate correctly.

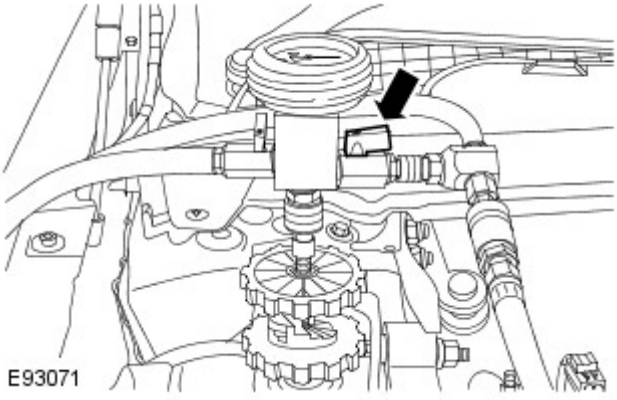
    • NOTE: Small diameter or long airlines may restrict airflow to the coolant vacuum fill tool.

    Open the air supply valve.

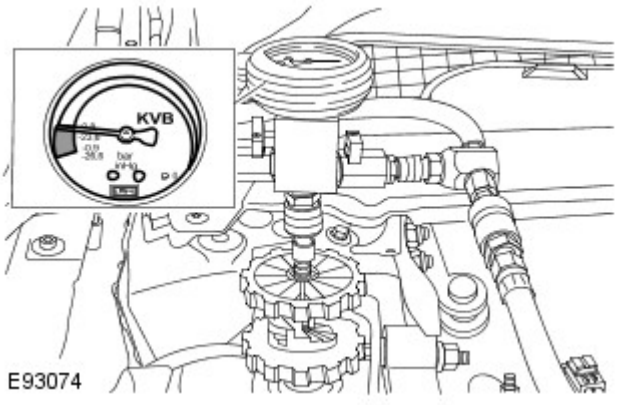


19. Open the coolant supply valve for 2 seconds to prime the coolant supply hose.

20. Apply air pressure progressively until the arrow on the vacuum filler gauge reaches the green segment.

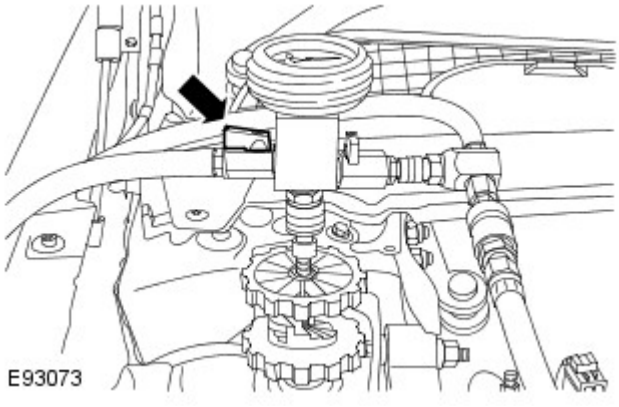


21. Close the air supply valve.



22.

- Allow 1 minute to check the vacuum is held.
- Disconnect the compressed air supply.



23. **23.** NOTE: Close the coolant supply valve when the coolant expansion tank MAX mark is reached or coolant movement has ceased.

    Open the coolant supply valve and allow the coolant to be drawn into the system.

24. Remove the vacuum filler gauge and cooling system vacuum refill adaptor assembly.

25. Connect exhaust extraction hoses to the tail pipes.

26. Start and run the engine.

27. Install the coolant expansion tank cap.

28. Hold the engine speed at 2000 rpm until warm air is expelled from the heater.

29. Switch the engine off and allow to cool.

30. Clean any spilt coolant from the vehicle.

31. **31.** WARNING: Since injury such as scalding could be caused by escaping steam or coolant, allow the vehicle cooling system to cool prior to carrying out this procedure.

    Check and top-up the coolant if required.

32. Install the front RH splash shield.

33. Install the engine undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel - Thermostat

Removal and Installation

Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. **3.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

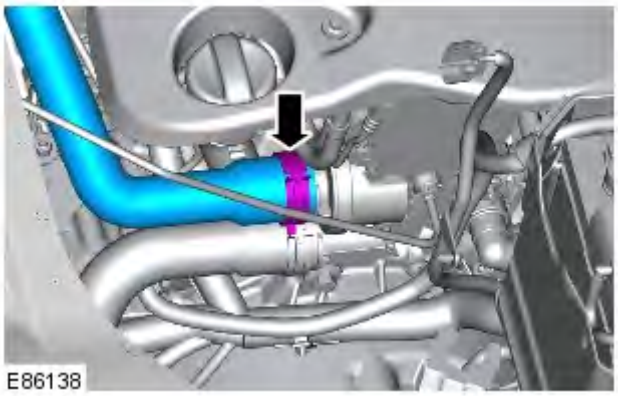
   Raise and support the vehicle.

4. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

5. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).



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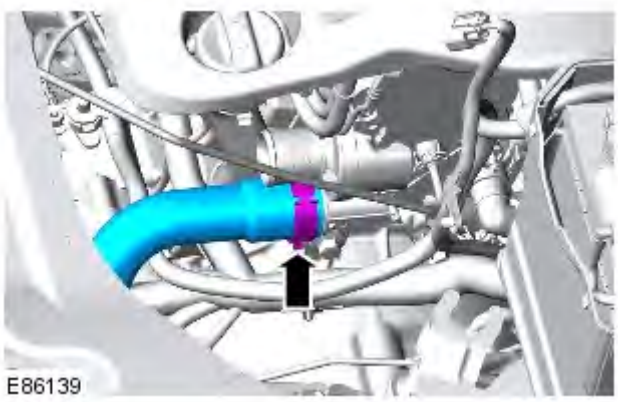

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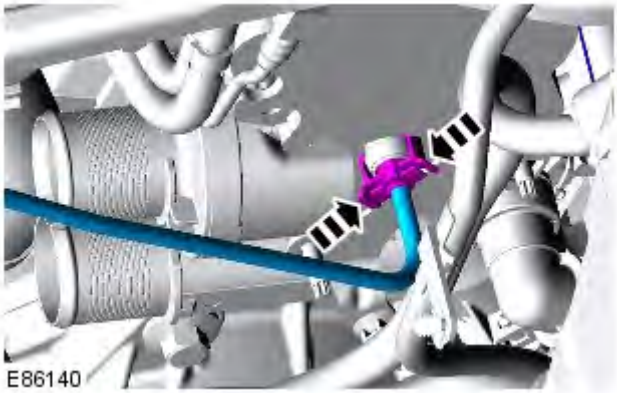

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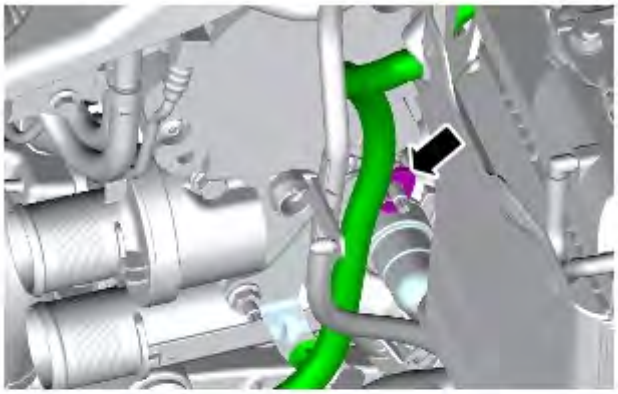

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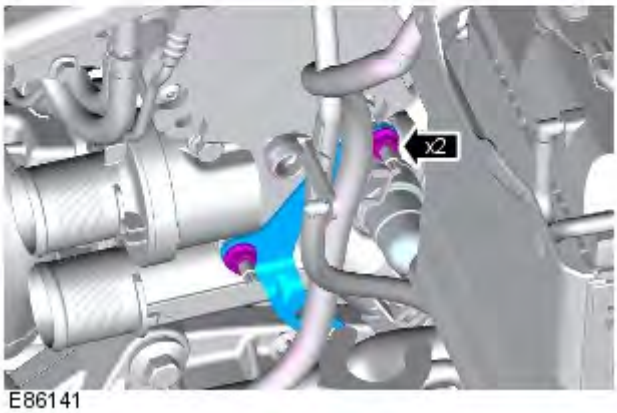
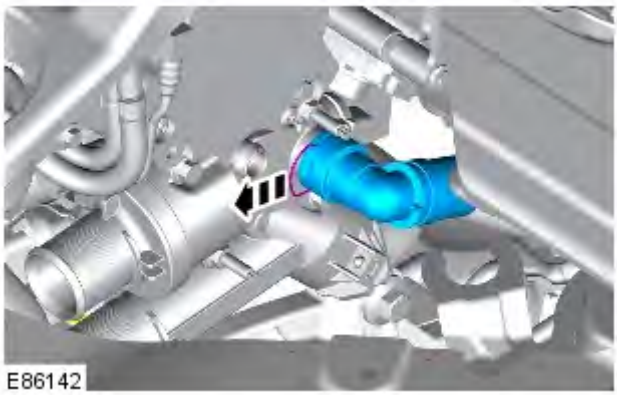


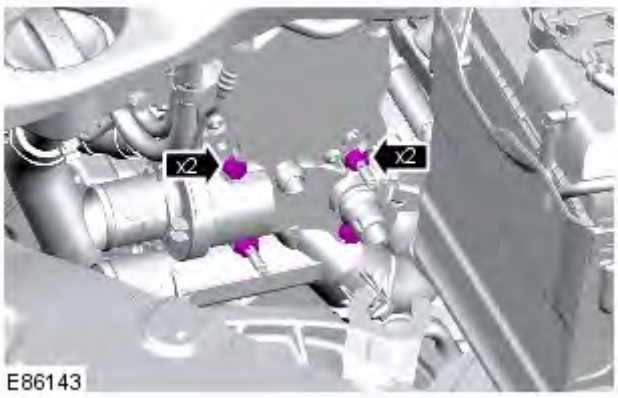


10. **10.** CAUTIONS:

⚠ The O-ring seal is to be reused unless damaged.

⚠ Be prepared to collect escaping coolant.

11.



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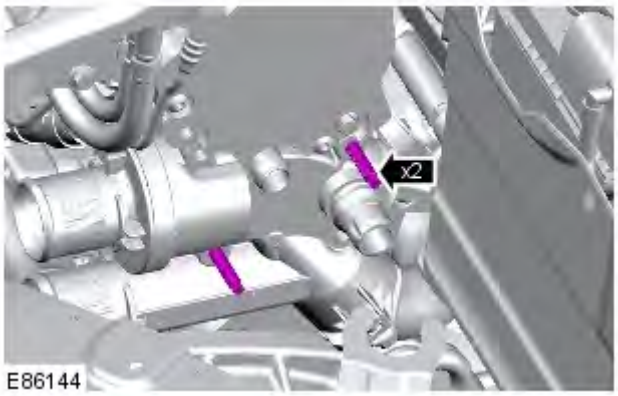

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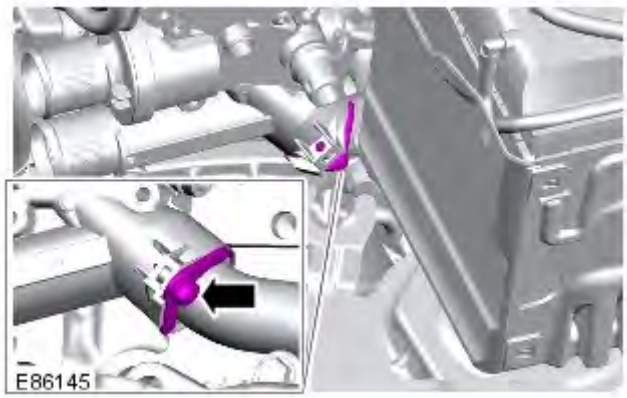

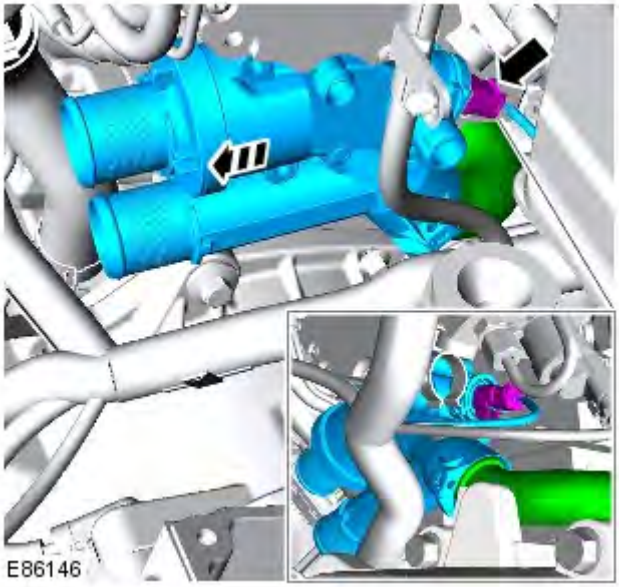

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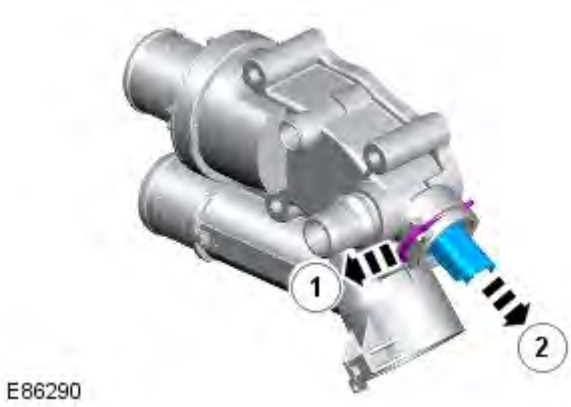
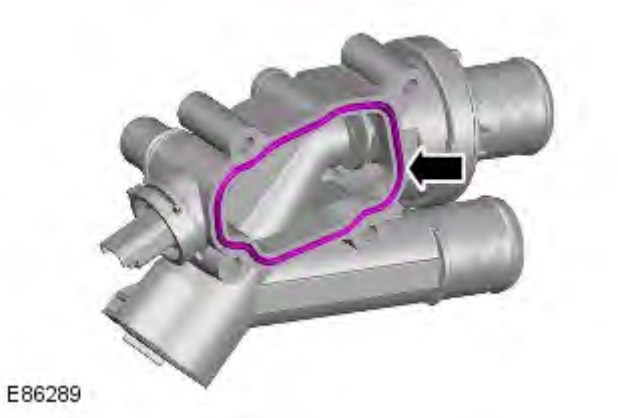


15. **15.** NOTE: Remove and discard the O-ring seal.



16. **16.** NOTE: Discard the gasket.

Installation

1. Install the engine coolant temperature (ECT) sensor.

2. **2.** CAUTIONS:

   Make sure that the gaskets are correctly located.

   Make sure that the mating faces are clean and free of foreign material.

   • NOTE: Install a new gasket.

- Install the thermostat housing.
- Connect the engine coolant tempreture (ECT) sensor electrical connector.

3. Secure the coolant manifold to thermostat housing pipe.

   Torque: 8 Nm

4. Install the studs.

   Torque: 7 Nm

5. Secure the thermostat housing.

   Torque: 8 Nm

6. Connect the heater outlet pipe.

7. Secure the wiring harness support bracket.

   Torque: 8 Nm

8. Connect the coolant hoses to the thermostat housing.

9. Install the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

10. Install the air cleaner assembly.

    Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

11. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

12. Refill and bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel - Coolant Pump

Removal and Installation

Removal

CAUTION: The crankshaft or camshafts must not be rotated while the timing belt is removed.

• NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

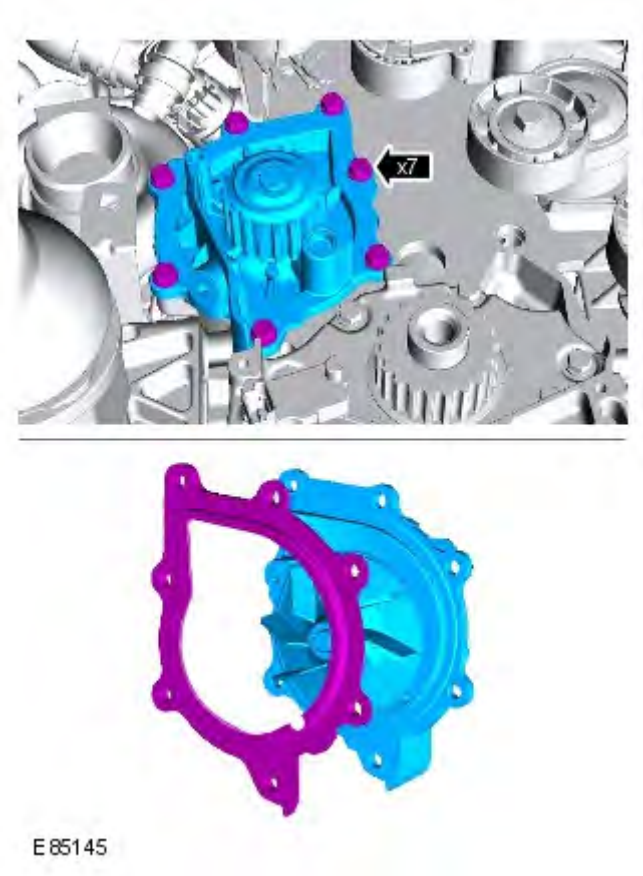
   Raise and support the vehicle.

3. Drain the coolant.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

4. Remove and discard the timing belt.

   Refer to: Timing Belt (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



5. **5.** CAUTION: Note the fitted position of the component prior to removal.

   • NOTE: Make sure that the component is clean, free of foreign material and lubricant.

   • NOTE: Install a new gasket.

   - *Torque:* 17 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel - Radiator

Removal and Installation

Removal

All vehicles

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the cooling fan motor and shroud.

   Refer to: Cooling Fan (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation).

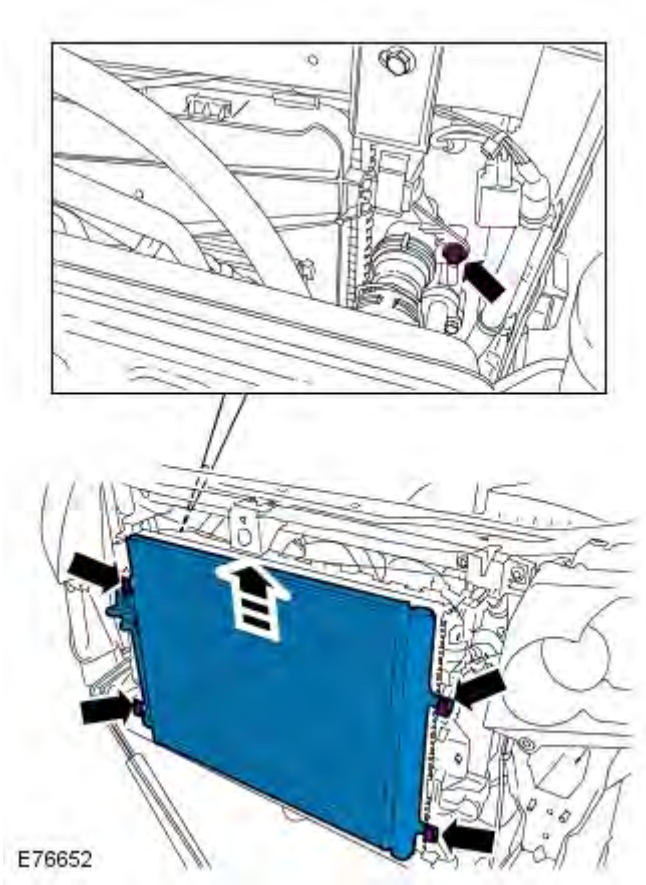
3. Remove the bumper armature.

   Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

4. Remove the charge air cooler.

   Refer to: Charge Air Cooler (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

5.



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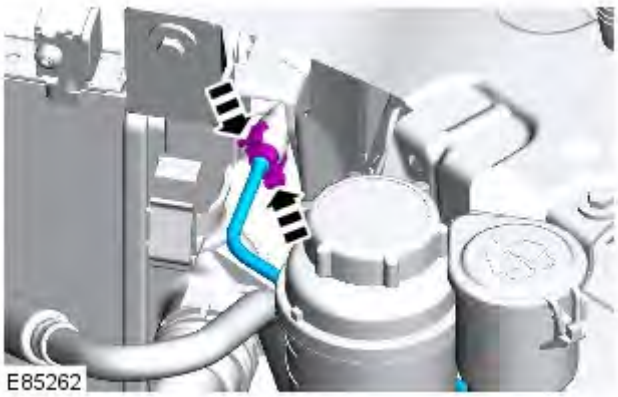
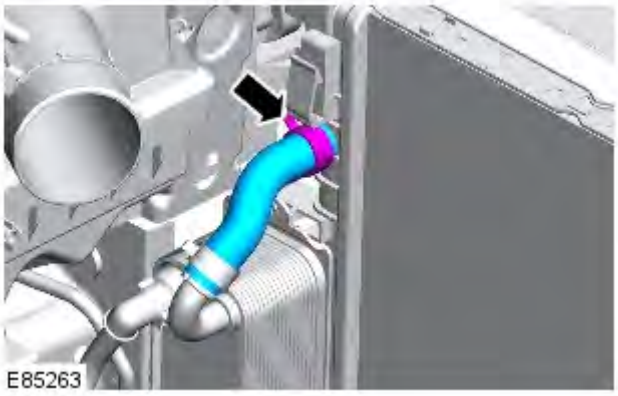


Vehicles with automatic transmission

7.



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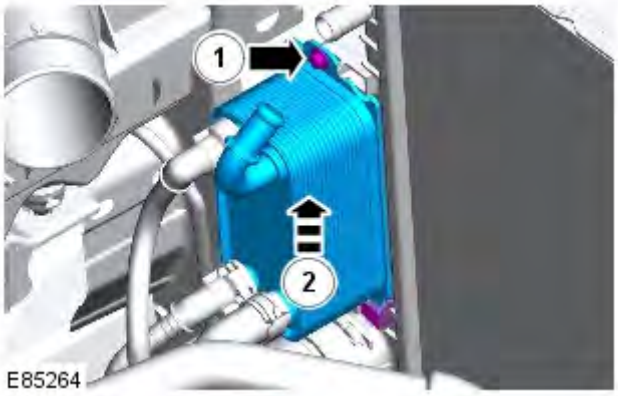
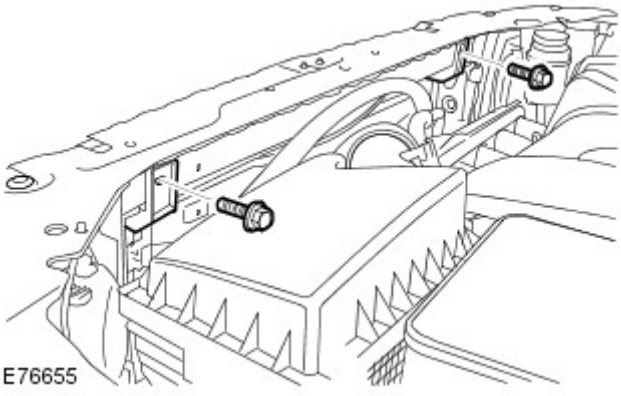
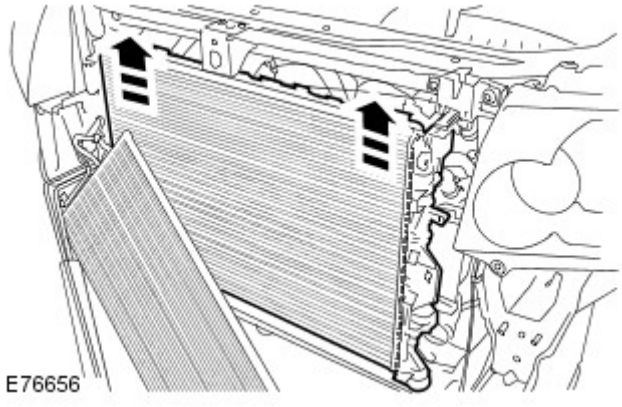


All vehicles

9.





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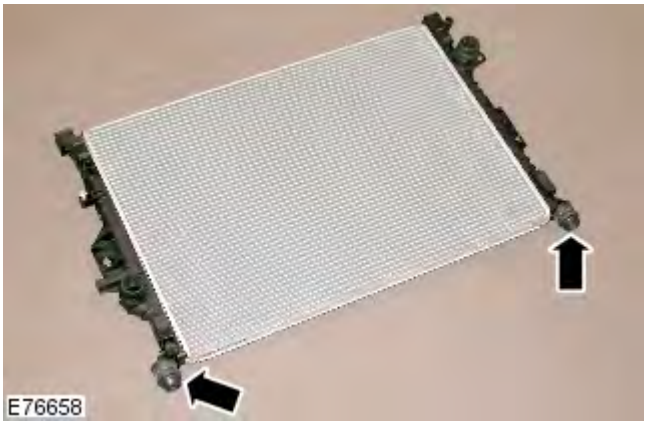


11.

Installation

All vehicles

1. Install the rubber mounts.
2. Carefully install the radiator.
3. Install the mountings and tighten the bolts.

   Torque: 6 Nm

Vehicles with automatic transmission

4. Install the automatic transmission fluid cooler.

   Torque: 6 Nm

5. Connect and secure the coolant hose.

All vehicles

6. Connect the coolant expansion tank hose to the radiator.
7. Attach the A/C condenser to the radiator.

   Torque: 10 Nm

8. Install the charge air cooler.

   Refer to: Charge Air Cooler (303-12B Intake Air Distribution and

Filtering - TD4 2.2L Diesel, Removal and Installation).

9. Install the bumper armature.

   Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

10. Install the cooling fan motor and shroud.

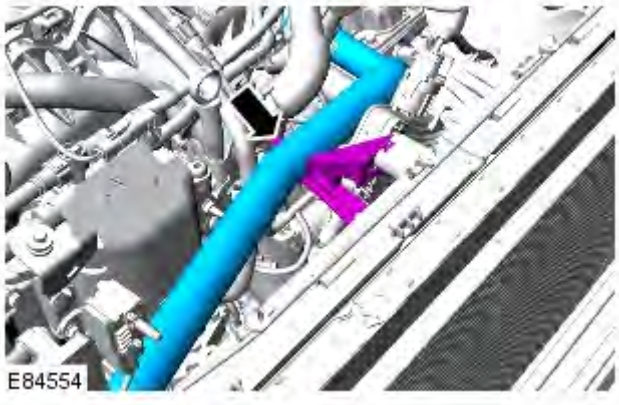
    Refer to: Cooling Fan (303-03B Engine Cooling - TD4 2.2L Diesel, Removal and Installation).

Published: 11-May-2011

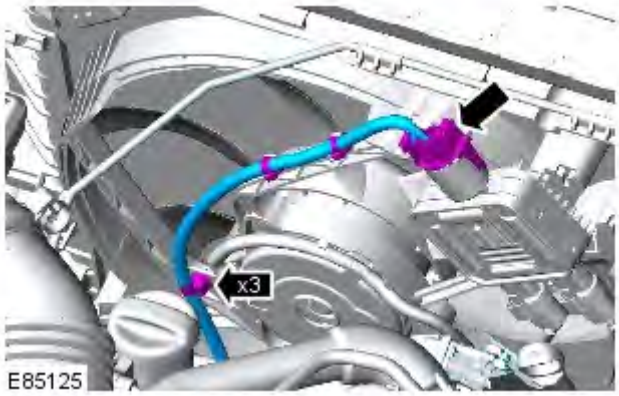
Engine Cooling - TD4 2.2L Diesel - Cooling Fan

Removal and Installation

Removal



1.



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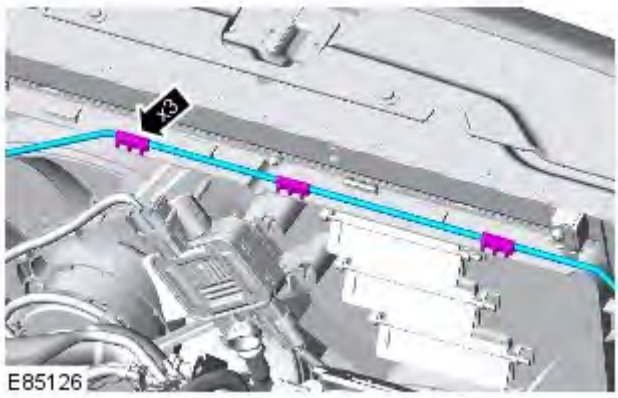

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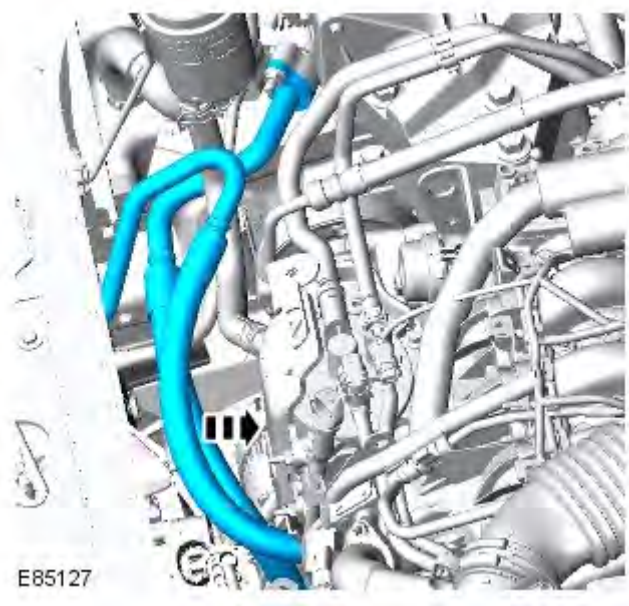
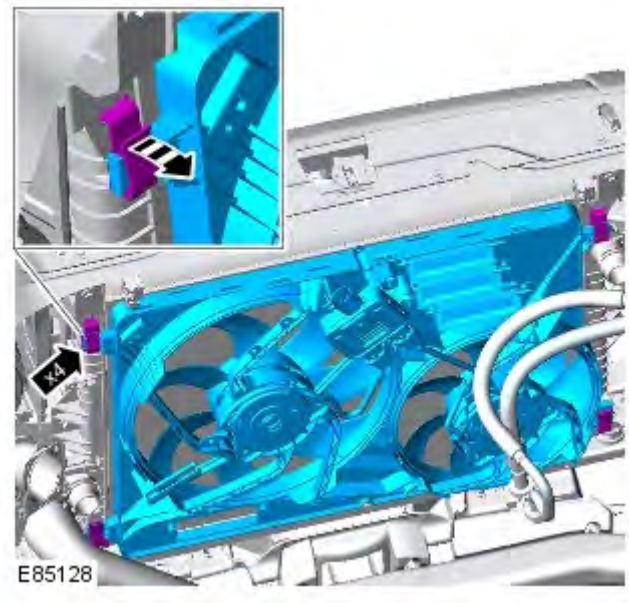


4.
- Tie the Air Conditioning (A/C) pipes aside.



5. **5.** CAUTION: Note the routing of the lines and hoses.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel - Cooling Fan Module

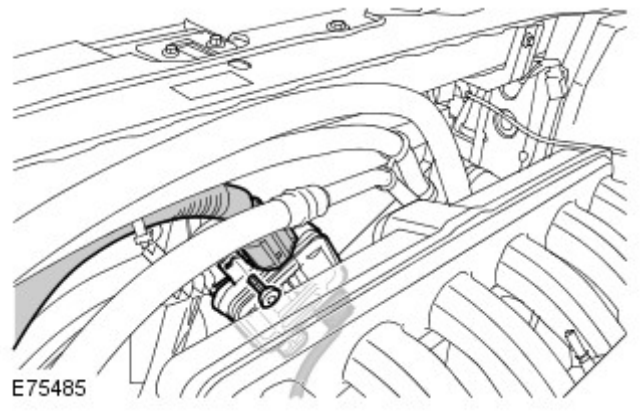
Removal and Installation

Removal

- NOTE: Petrol illustration shown, diesel similar.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).



2.
   - Remove the cooling fan module.
   - *Torque:* 6 Nm

Installation

1. To install, reverse the removal procedure.

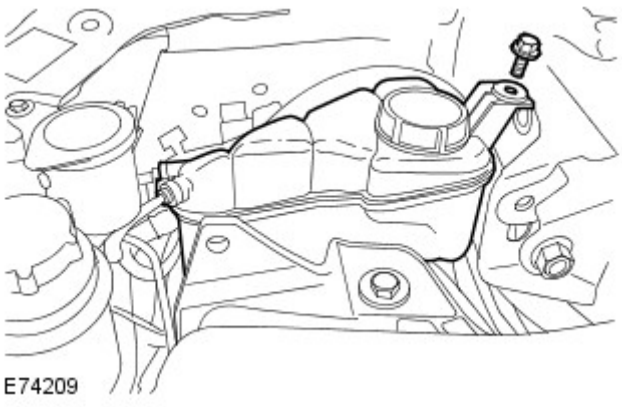
Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel - Coolant Expansion Tank

Removal and Installation

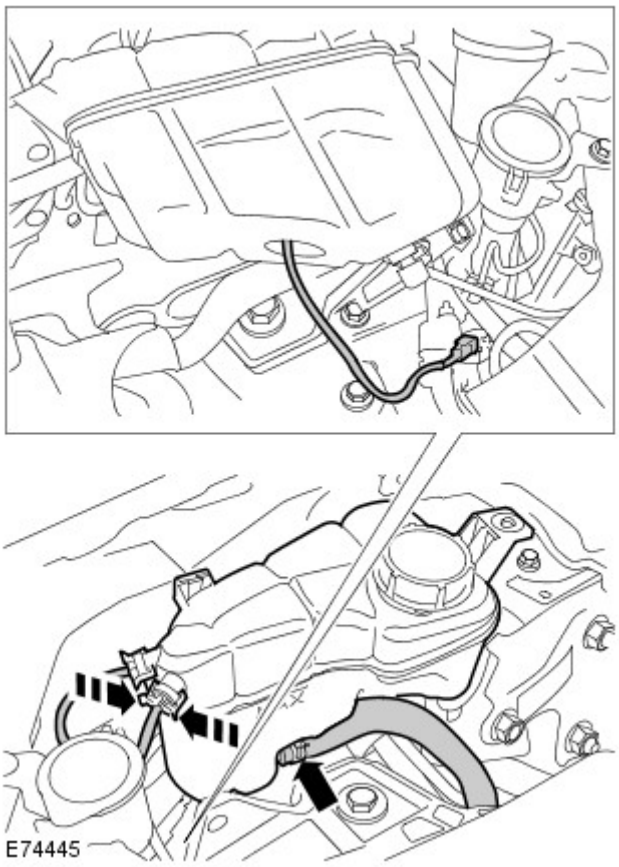
Removal

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.



1. *Torque:* 10 Nm

2. Clamp the relevant hose, to minimise coolant loss.



3. **3.** CAUTION: Be prepared to collect escaping coolant.

4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.
2. Top-up the coolant.

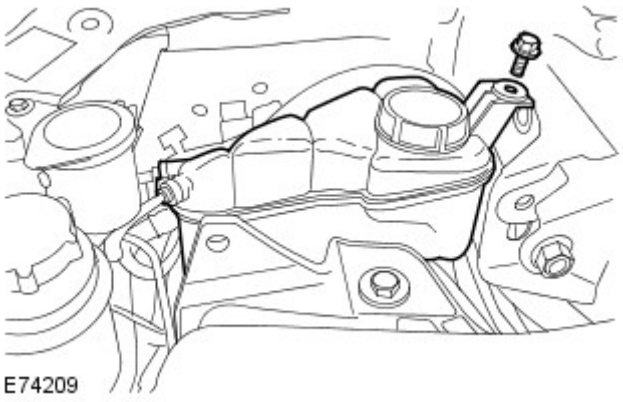
Published: 11-May-2011

Engine Cooling - TD4 2.2L Diesel - Engine Coolant Level Switch

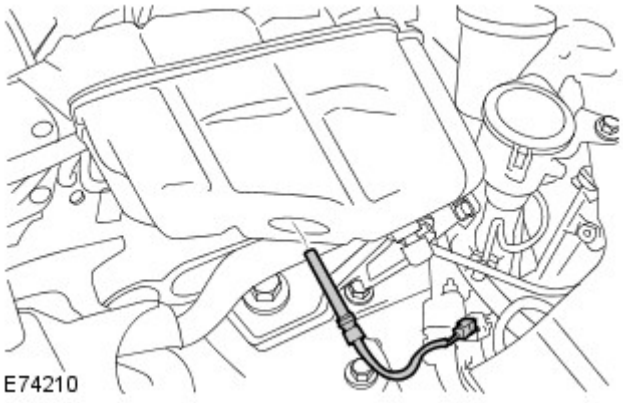
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 10 Nm



2.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Charging and Controls - I6 3.2L Petrol -

General Specification

Item	Specification
Recommended fuel:	
UK, Europe	91 - 98 RON
USA	Minimum 91 CLC or AKI
Fuel injectors:	
Make	Denso

Fuel Pressures

Component	bar	psi
Fuel rail - normal operating conditions - not using IDS	3.7	54
Fuel rail - normal operating conditions - using IDS	4.8	68
Fuel rail - engine off - using IDS	2.8 to 3.2	40 to 46
Fuel rail - cold start - using IDS	6.5	94

Torque Specifications

Description	Nm	lb-ft
Fuel injector clamp plate bolts	6	5
Fuel pressure regulator bolts	6	5
Fuel pump drive module retaining bolts	10	7
Fuel rail bolts	10	7
Fuel rail pressure sensor	6	5
Schreader valve bolts	6	5
Throttle body screws	8	6

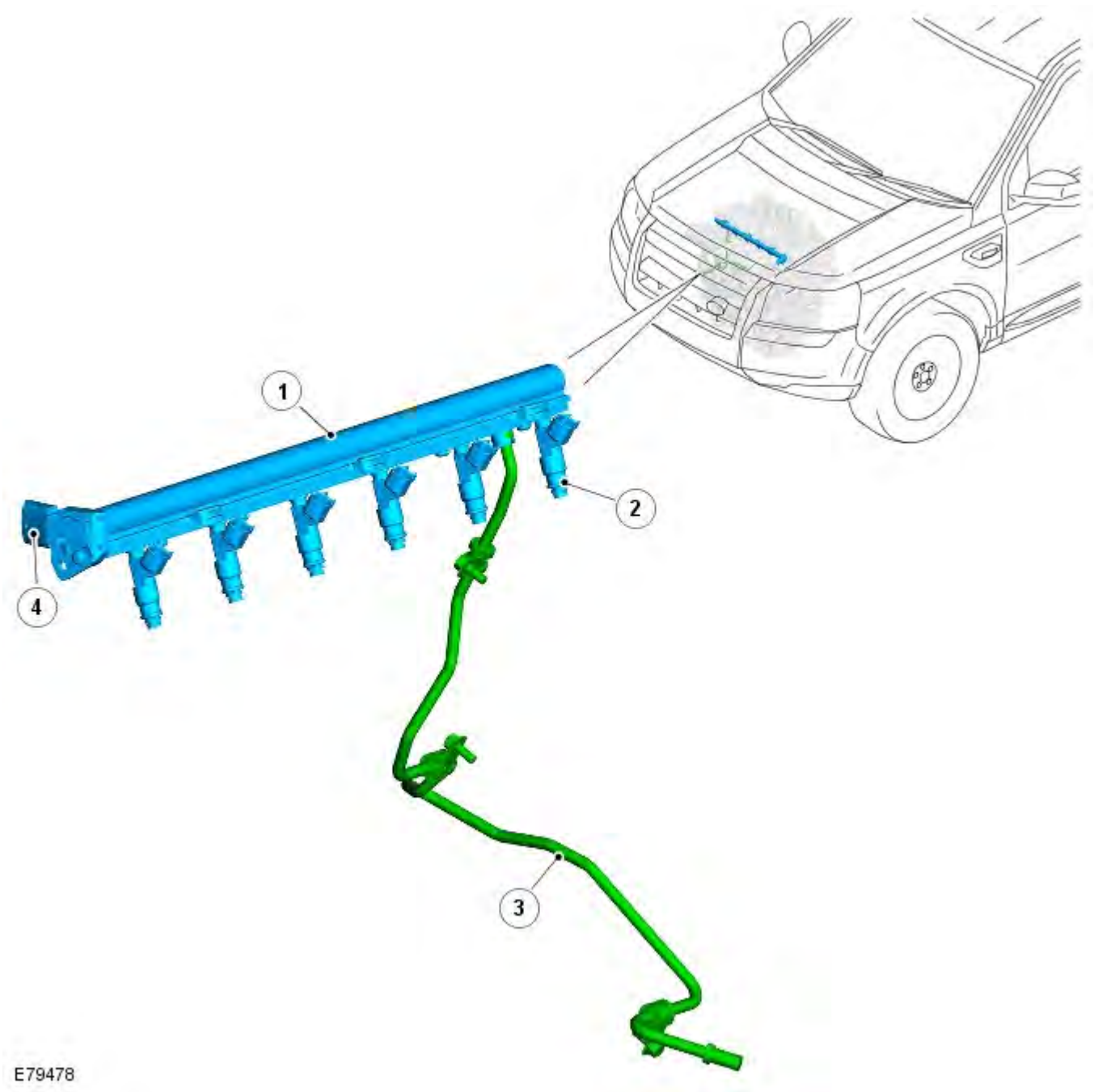
Published: 11-May-2011

Fuel Charging and Controls - I6 3.2L Petrol - Fuel Charging and Controls

Description and Operation

Authoring Template

COMPONENT LOCATION



Item	Part Number	Description
1	-	Fuel rail
2	-	Fuel injector
3	-	Fuel line
4	-	Fuel rail pressure and fuel temperature sensor

OVERVIEW

The fuel pump module, located in the fuel tank, is electronically regulated by the Engine Management System (EMS) to provide controlled pressure in the fuel rail
For additional information, refer to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Description and Operation).
.

Supplying the correct amount of fuel as required by the engine at any given moment, eliminates the requirement for additional pipes returning excess fuel to the fuel tank. The benefits of this type of system are:

- Reduced load on the electrical system

- Improved fuel economy
- Eliminates the effects of fuel pressurization and depressurization
- Eliminates the effects of engine-heat causing extra fuel vapor being generated in the fuel tank by returning fuel

Closed-loop Pulse Width Modulation (PWM) control, of the fuel pump module, via the Engine Control Module (ECM) regulates the amount of fuel supplied by the fuel pump to the fuel rail. The ECM receives signals from the combined fuel rail pressure and fuel temperature sensor, located on the fuel rail to indicate the pressure of fuel in the fuel rail. In response to these signals, plus other engine and driver demand signals, the ECM calculates the amount of fuel required and requests the fuel pump module to vary the fuel pump delivery to suit the engine's requirements.
For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).

The fuel pump maintains a fuel rail pressure 3.8 bar above manifold depression under normal operating conditions, though this is programmed to rise to 4.2 bar in response to either:

- cold start conditions, to improve fuel vaporization
- cold fuel conditions, as the colder the fuel the higher its viscosity

The fuel rail has an integrated pulsation damper and a connection for draining the fuel system.

The injectors supplied by the fuel rail; each have 4 micro-nozzles capable of injecting up to 18 mg of fuel under high-load conditions, the injectors also provide precision fueling across all engine speed and load conditions.

Published: 11-May-2011

Fuel Charging and Controls - I6 3.2L Petrol - Fuel Charging and Controls

Diagnosis and Testing

Principles of Operation

For a detailed description of the fuel charging and controls, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Fuel Charging and Controls (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• NOTE: For diagnostic purposes the cylinders are divided into two banks: Bank 1 - Cylinder numbers 1, 2 and 3. Bank 2 - Cylinders 4, 5 and 6

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Fuel level • Fuel leaks • Damaged fuel lines • Damaged push connect fittings • Fuel contamination/grade/quality • Throttle body • Damaged fuel tank filler pipe cap • Damaged fuel tank filler pipe	• Fuses • Loose or corroded electrical connectors • Harnesses • Sensor(s) • Engine Control Module (ECM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	• Engine breather system disconnected/restricted • Ignition system • Fuel system • Electronic engine control	• Ensure the engine breather system is free from restriction and is correctly installed • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing). • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
Engine cranks and fires, but will not start	• Evaporative emissions purge valve • Fuel pump • Spark plugs • HT short to ground (tracking) check rubber boots for cracks/damage • Ignition system	• For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing).
Difficult cold start	• Engine coolant level/anti-freeze content • Battery • Electronic engine controls • Fuel pump • Purge valve	• Check the engine coolant level and condition. REFER to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications). • Ensure the battery is in a fully charged and serviceable condition • Read DTCs and refer to DTC Index for electronic engine control tests.

Symptom	Possible Cause	Action
		REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing).
Difficult hot start	• Injector leak • Electronic engine control • Purge valve • Fuel pump • Ignition system	• Check for injector leak, install new injector as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation). • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing).
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	• Injector leak • Electronic engine control • Purge valve • Fuel pump • Ignition system	• Check for injector leak, install new injector as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation). • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing).
Engine stalls soon after start	• Breather system disconnected/restricted • ECM relay • Electronic engine control • Ignition system • Air intake system restricted • Air leakage • Fuel lines	• Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing). • Check for blockage in air filter element and air intake system • Check for air leakage in air intake system • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing).
Engine hesitates/poor acceleration	• Fuel pressure, fuel pump, fuel lines • Injector leak • Air leakage • Electronic engine control • Throttle motor • Restricted accelerator pedal travel (carpet, etc)	• For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Check for injector leak, install new injector as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol,

Symptom	Possible Cause	Action
	• Ignition system • Transmission malfunction	Removal and Installation). • Check for air leakage in air intake system • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to the DTC Index in this section for throttle motor tests • Ensure accelerator pedal is free from restriction • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing). • For transmission tests. REFER to: Diagnostics (307-01 Automatic Transmission/Transaxle, Diagnosis and Testing).
Engine backfires	• Fuel pump/lines • Air leakage • Electronic engine controls • Ignition system • Sticking variable camshaft timing (VCT) hub	• For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Check for air leakage in intake air system • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing). • Read DTCs and refer to DTC Index for VCT tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
Engine surges	• Fuel pump/lines • Electronic engine controls • Throttle motor • Ignition system	• For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to DTC Index in this section for throttle motor tests. • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing).
Engine detonates/knocks	• Electronic engine controls • Fuel pump/lines • Air leakage • Sticking VCT hub	• Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Check for air leakage in intake air system • Read DTCs and refer to DTC Index for VCT tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
No throttle response	• Electronic engine controls • Throttle motor	• Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to DTC Index in this section for throttle motor tests.

Symptom	Possible Cause	Action
Poor throttle response	• Breather system disconnected/restricted • Electronic engine control • Transmission malfunction • Traction control event • Air leakage	• Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For transmission system tests. REFER to: Diagnostics (307-01 Automatic Transmission/Transaxle, Diagnosis and Testing). • Check for air leakage in intake air system

DTC Index

• NOTE: If the control module/component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines that involve pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P008700	Fuel rail/system pressure - too low	• Leakage at the fuel lines • Fuel pressure sensor fault • Fuel pump fault • Fuel pump control module fault	Check the fuel system for leaks. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). Rectify as necessary. Check for DTCs indicating a fuel pressure, fuel pressure sensor, pump or pump module fault.
P008800	Fuel rail/system pressure - too high	• Restricted fuel lines • Fuel pressure sensor fault • Fuel pump fault • Fuel pump control module fault	Check the fuel system for damage/restrictions. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). Rectify as necessary. Check for DTCs indicating a fuel pressure, fuel pressure sensor, pump or pump module fault.
P008968	Fuel pressure regulator performance - algorithm based failures	• Low fuel pressure	Check for DTCs indicating a fuel pressure, fuel pressure sensor, pump or pump module fault.
P017068	Fuel trim, bank 1	• HO2S control outside limits	No action is necessary. The code will clear when the conditions no longer apply.
P017100	System too lean (bank 1)	• Intake air leak - Between MAF sensor and cylinder head • Fuel system restriction • MAF sensor fault - Low intake flow • Exhaust leak, before catalytic converter	Check for intake air leaks. Check for low fuel pressure and MAF sensor DTCs. Rectify as necessary. Check for exhaust leaks before the catalytic converter
P017200	System too rich (bank 1)	• Restricted air filter • Oil contaminated with fuel - Too many cold starts with vehicle subsequently not getting hot enough for long enough • Leaking fuel injectors • MAF sensor fault - High intake flow • Leaking evaporative emission system purge valve	Check the condition of the air cleaner element: REFER to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation). Check engine the oil condition. Check for leaking injectors. Check for MAF sensor, injector and evaporative emission system DTCs.
P017368	Fuel trim (bank 2)	• HO2S control outside limits	No action is necessary. The code will clear when the conditions no longer apply.
P017400	System too lean (bank 2)	• Intake air leak - Between MAF sensor and cylinder head • Fuel system restriction	Check for intake air leaks. Check for low fuel pressure and MAF sensor DTCs. Rectify as necessary. Check for exhaust leaks before the catalytic converter

DTC	Description	Possible Cause	Action
		• MAF sensor fault - Low intake flow • Exhaust leak, before catalytic converter	
P017500	System too rich (bank 2)	• Restricted air filter • Oil contaminated with fuel - Too many cold starts with vehicle subsequently not getting hot enough for long enough • Leaking fuel injectors • MAF sensor fault - High intake flow • Leaking evaporative emission system purge valve	Check the condition of the air cleaner element: REFER to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation). Check engine the oil condition. Check for leaking injectors. Check for MAF sensor, injector and evaporative emission system DTCs.
P018100	Fuel temperature sensor A circuit range/performance	• Fuel temperature sensor A circuit: high resistance • Fuel temperature sensor failure	Check the fuel temperature sensor and circuits. Refer to the electrical guides. Install a new sensor as necessary (the fuel temperature sensor is incorporated into the fuel rail pressure sensor). REFER to: Fuel Rail Pressure (FRP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P018200	Fuel temperature sensor A circuit low	• Fuel temperature sensor A circuit: short circuit to ground • Fuel temperature sensor A circuit: high resistance • Fuel temperature sensor failure	Check the fuel temperature sensor and circuits. Refer to the electrical guides. Install a new sensor as necessary (the fuel temperature sensor is incorporated into the fuel rail pressure sensor). REFER to: Fuel Rail Pressure (FRP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P018300	Fuel temperature sensor A circuit high	• Fuel temperature sensor A circuit: short circuit to power • Fuel temperature sensor A circuit: open circuit • Fuel temperature sensor failure	Check the fuel temperature sensor and circuits. Refer to the electrical guides. Install a new sensor as necessary (the fuel temperature sensor is incorporated into the fuel rail pressure sensor). REFER to: Fuel Rail Pressure (FRP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P019100	Fuel rail pressure sensor A circuit range/performance	• Fuel rail pressure (FRP) sensor A circuit: high resistance • Fuel rail pressure (FRP) sensor failure • Fuel pump driver module failure	Check the FRP sensor and circuits. Refer to the electrical guides. Install a new sensor as necessary. REFER to: Fuel Rail Pressure (FRP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation). Check for DTCs indicating fuel pump driver module faults. Rectify as necessary.
P019121	Fuel rail pressure sensor A circuit range/performance - signal amplitude less than minimum	• Fuel rail pressure (FRP) sensor A circuit: high resistance • Fuel rail pressure (FRP) sensor failure	Check the FRP sensor and circuits. Refer to the electrical guides. Install a new sensor as necessary. REFER to: Fuel Rail Pressure (FRP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P019122	Fuel rail pressure sensor A circuit range/performance - signal amplitude greater than maximum	• Fuel rail pressure (FRP) sensor A circuit: short circuit to power • Fuel rail pressure (FRP) sensor failure	Check the FRP sensor and circuits. Refer to the electrical guides. Install a new sensor as necessary. REFER to: Fuel Rail Pressure (FRP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P019200	Fuel rail pressure sensor A circuit low	• Fuel rail pressure (FRP) sensor A circuit: short circuit to ground • Fuel rail pressure (FRP) sensor A circuit: open circuit • Fuel rail pressure (FRP) sensor failure	Check the FRP sensor and circuits. Refer to the electrical guides. Install a new sensor as necessary. REFER to: Fuel Rail Pressure (FRP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P019300	Fuel rail pressure sensor A circuit high	• Fuel rail pressure (FRP) sensor A circuit: short circuit to power • Fuel rail pressure (FRP) sensor failure	Check the FRP sensor and circuits. Refer to the electrical guides. Install a new sensor as necessary. REFER to: Fuel Rail Pressure (FRP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P020100	Cylinder 1 injector circuit/open	• Injector circuit: short circuit to power • Injector circuit: open circuit • Injector circuit power supply: open circuit • Injector failure	Check the injector and circuits. Refer to the electrical guides. Install a new injector as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).

DTC	Description	Possible Cause	Action
P020200	Cylinder 2 injector circuit/open	• Injector circuit: short circuit to power • Injector circuit: open circuit • Injector circuit power supply: open circuit • Injector failure	Check the injector and circuits. Refer to the electrical guides. Install a new injector as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P020300	Cylinder 3 injector circuit/open	• Injector circuit: short circuit to power • Injector circuit: open circuit • Injector circuit power supply: open circuit • Injector failure	Check the injector and circuits. Refer to the electrical guides. Install a new injector as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P020400	Cylinder 4 injector circuit/open	• Injector circuit: short circuit to power • Injector circuit: open circuit • Injector circuit power supply: open circuit • Injector failure	Check the injector and circuits. Refer to the electrical guides. Install a new injector as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P020500	Cylinder 5 injector circuit/open	• Injector circuit: short circuit to power • Injector circuit: open circuit • Injector circuit power supply: open circuit • Injector failure	Check the injector and circuits. Refer to the electrical guides. Install a new injector as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P020600	Cylinder 6 injector circuit/open	• Injector circuit: short circuit to power • Injector circuit: open circuit • Injector circuit power supply: open circuit • Injector failure	Check the injector and circuits. Refer to the electrical guides. Install a new injector as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P046000	Fuel level sensor A circuit	• Fuel level sensor circuit: short circuit to ground • Fuel level sensor circuit: open circuit • Fuel level sensor circuit: short circuit to power • Fuel level sensor failure	Carry out a complete vehicle read for related DTCs. Rectify as necessary. Check the fuel level sensor and circuits. Refer to the electrical guides. Install a new sensor as necessary. REFER to: Fuel Level Sender (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).
P046100	Fuel level sensor A circuit range/performance	• Fuel level sensor stuck/jammed	Check the fuel level sensor for correct operation. Install a new sensor as necessary. REFER to: Fuel Level Sender (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).
P046400	Fuel level sensor A circuit intermittent	• Fuel level sensor A circuit: high resistance • Fuel level sensor failure	Check the fuel level sensor and circuits. Refer to the electrical guides. Install a new sensor as necessary. REFER to: Fuel Level Sender (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).
P062800	Fuel pump A control circuit low	• Fuel pump module control circuit: short circuit to ground • Fuel pump module control circuit: open circuit • Fuel pump control module failure	Check the fuel pump control module and circuits. Refer to the electrical guides. Refer to the warranty policy and procedures manual if a module is suspect.
P062900	Fuel pump A control circuit high	• Fuel pump module control circuit: short circuit to power • Fuel pump control module failure	Check the fuel pump control module and circuits. Refer to the electrical guides. Refer to the warranty policy and procedures manual if a module is suspect.
P134600	Fuel level sensor B circuit	• Fuel level sensor ejector malfunction	Carry out a complete vehicle read for related DTCs. Rectify as necessary.
P210100	Throttle actuator control motor circuit range/performance	• Throttle actuator control motor circuit: short circuit to ground • Throttle actuator control motor circuit: open circuit • Throttle actuator control motor circuit: short circuit to power • Throttle actuator control motor failure	Check the throttle motor and circuits. Refer to the electrical guides. Install a new throttle body as necessary. REFER to: Throttle Body (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P210177	Throttle actuator control motor circuit range/performance	• Throttle body contaminated/sticking • Throttle actuator control motor failure	Check the throttle body condition and operation. Clean the throttle body and recheck. Install a new throttle body as necessary.

DTC	Description	Possible Cause	Action
			REFER to: Throttle Body (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P210300	Throttle actuator control motor circuit high	• Throttle actuator control motor circuit: short circuit to power • Throttle actuator control motor failure	Check the throttle motor and circuits. Refer to the electrical guides. Install a new throttle body as necessary. REFER to: Throttle Body (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P211800	Throttle actuator control motor current range/performance	• Throttle actuator control motor circuit: short circuit to power • Throttle actuator control motor circuit: short circuit to ground • Throttle actuator control motor circuit: short circuit to power • Throttle actuator control motor failure	Check the throttle motor and circuits. Refer to the electrical guides. Install a new throttle body as necessary. REFER to: Throttle Body (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P211900	Throttle actuator control throttle body range/performance	• Throttle body contaminated/sticking	Check the condition and operation of the throttle body. Rectify as necessary. Install a new throttle body as necessary. REFER to: Throttle Body (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).

Published: 11-May-2011

Fuel Charging and Controls - I6 3.2L Petrol - Throttle Body

Removal and Installation

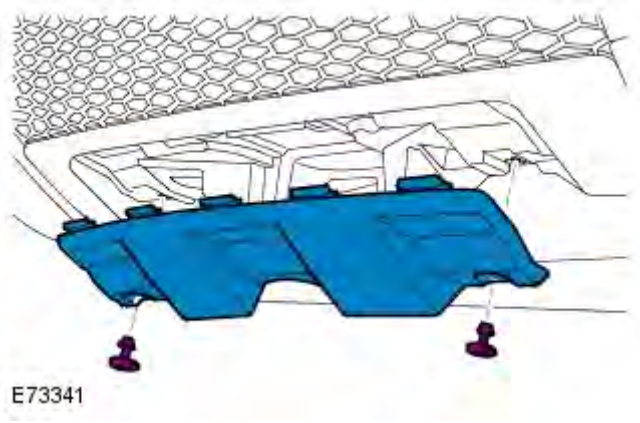
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



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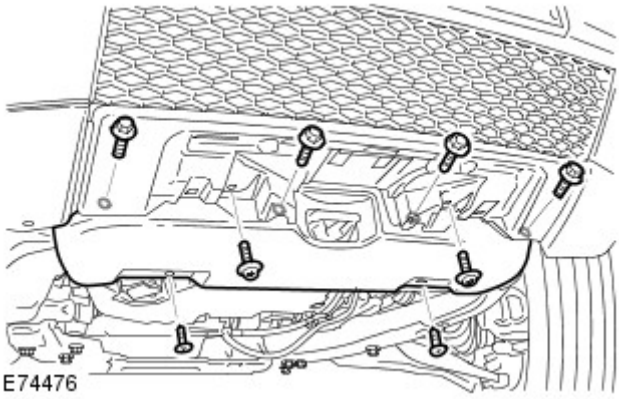

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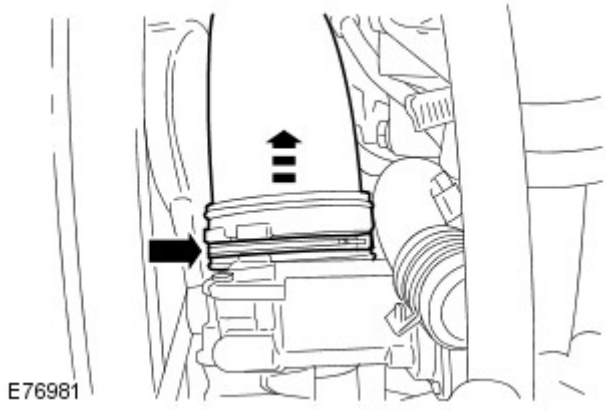
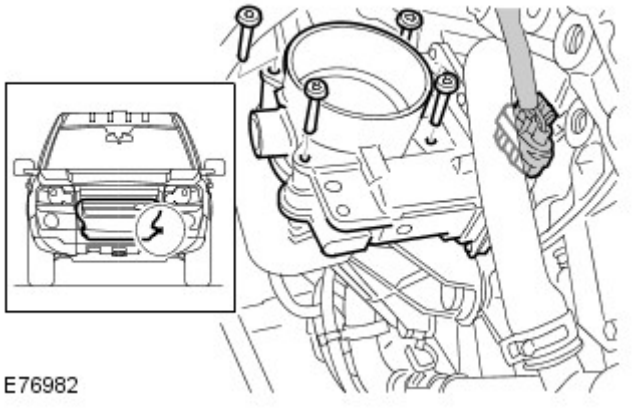


5. Release the air cleaner outlet pipe.



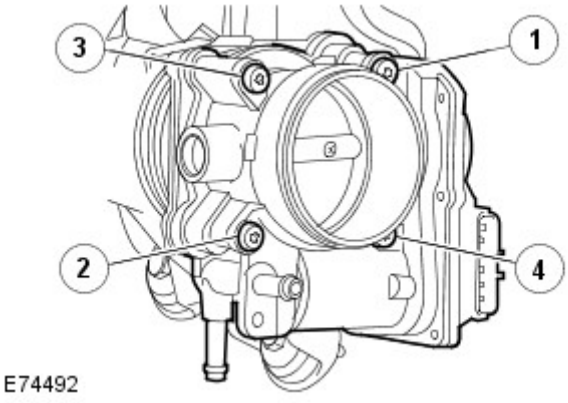
6. Remove the throttle body.

7. Remove and discard the gasket.

Installation

1. Clean the component mating faces.

2. Install a new gasket.



3. **3.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Install the throttle body and tighten the screws in the sequence shown.

   Torque: 8 Nm

4. Install the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

5. Install the front undershield.

6. Install the front towing eye cover.

Published: 11-May-2011

Fuel Charging and Controls - I6 3.2L Petrol - Fuel Injector

Removal and Installation

Removal

• NOTE: The process to remove a fuel injector is shown the the Fuel Rail procedure.

1. Remove the fuel injector.

   Refer to: Fuel Rail (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).

Installation

1. Install the fuel injector.

   Refer to: Fuel Rail (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).

Published: 11-May-2011

Fuel Charging and Controls - I6 3.2L Petrol - Fuel Rail

Removal and Installation

Removal

WARNING: Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

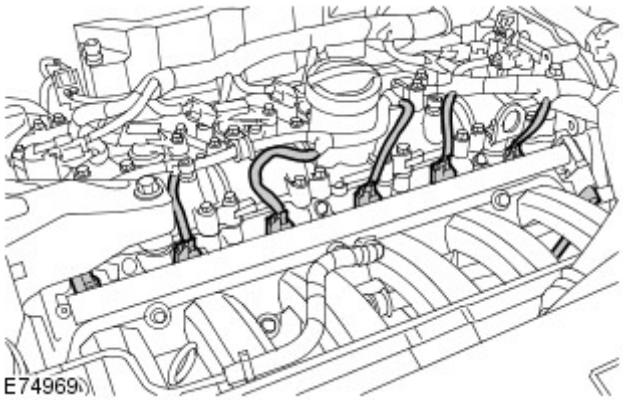
3. **3.** WARNINGS:

   Avoid flames, sparks or lighted substances.

   Be prepared to collect escaping fuel.

   Release the fuel pressure.

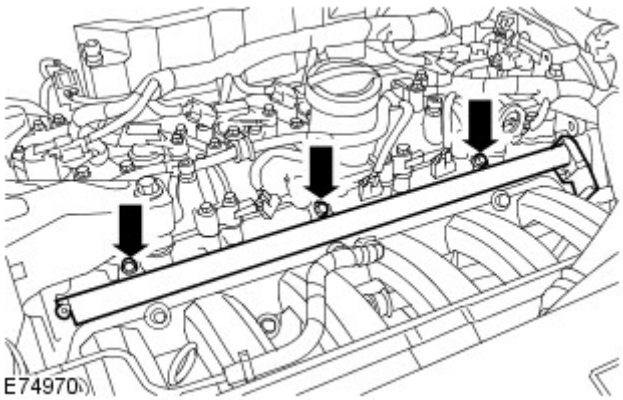
4.

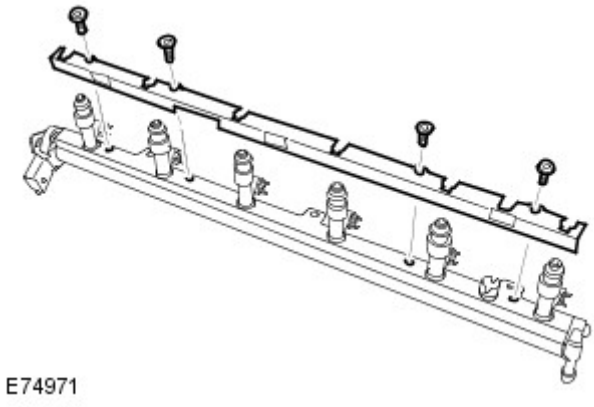


5. **5.** CAUTIONS:

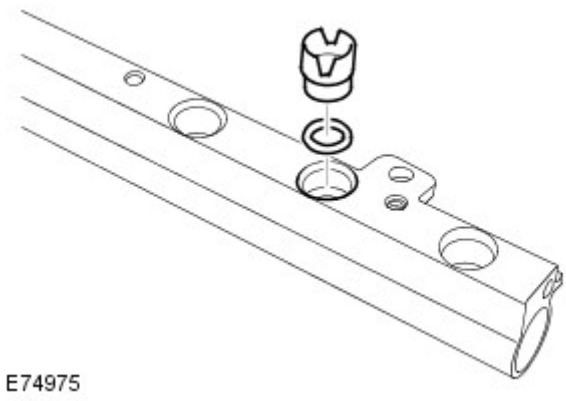
   Extreme cleanliness must be exercised when handling these components.

   Make sure that all openings are sealed.

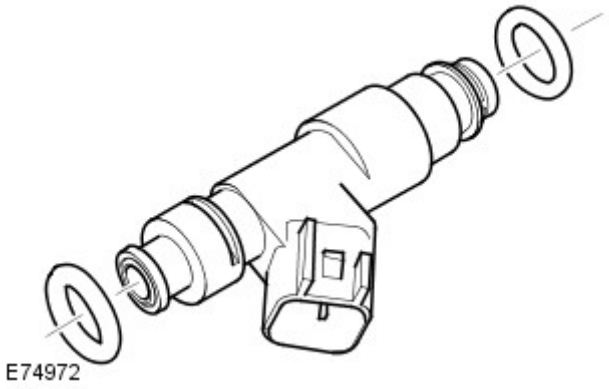



E74971

6. **6.** NOTE: Do not remove the fuel injectors, if the rail is being removed for access.


E74975

7. **7.** CAUTION: A new O-ring seal is to be installed.


E74972

8. **8.** CAUTION: Cap the fuel injector nozzle to prevent damage before storing vertically.

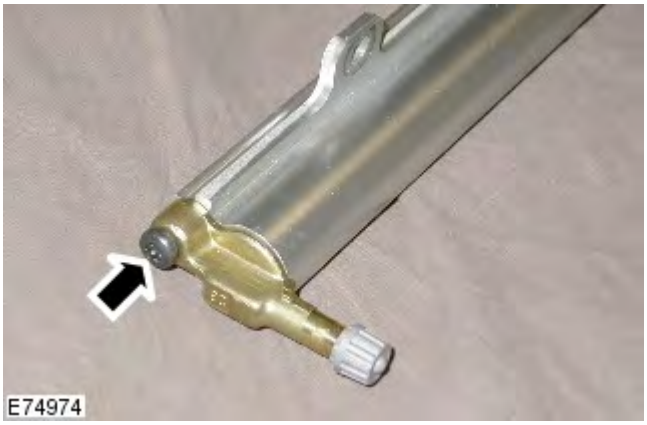
   • NOTE: Do not disassemble further if the component is removed for access only.

   • NOTE: If the fuel injectors are not being removed from the fuel rail only the lower O-ring seals will need to be renewed.

   Remove and discard the fuel injector O-ring seals.

E74973

9.



10.

Installation

1. **1.** CAUTION: A new O-ring seal is to be installed.

   Install the fuel rail Schraeder valve.

   Torque: 6 Nm

2. **2.** CAUTION: A new O-ring seal is to be installed.

   Install the fuel rail pressure sensor.

   Torque: 6 Nm

3. **3.** NOTE: Install new O-ring seals.

   Lubricate and install the new O-rings.

4. If removed, install the injectors.

5. **5.** CAUTION: A new O-ring seal is to be installed.

   Install the fuel line to fuel rail seal assembly.

6. Install the fuel injector clamp plate.

   Torque: 6 Nm

7. Install the fuel rail.

   Torque: 10 Nm

8. Connect and secure the electrical connectors.

9. Install the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

10. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Fuel Charging and Controls - I6 3.2L Petrol - Fuel Pump Driver Module (FPDM)

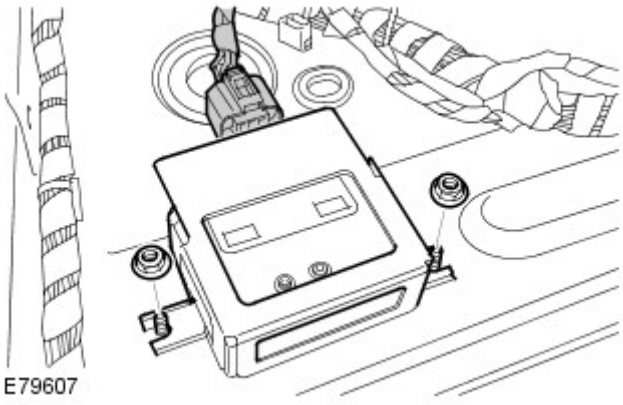
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the LH rear quarter trim panel.

   Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Charging and Controls - TD4 2.2L Diesel -

General Specification

Item	Specification
Maximum continuous flow	160 l/hr
Maximum engine consumption	40 l/hr
Maximum return flow	90 l/hr
Maximum pressure on return line	0.7 bar (10.2 lb/in²)
Minimum pressure at engine	0.5 bar (7.3 lb/in²)
Minimum pressure at filter	0.3 bar (4.4 lb/in²)
Recommended fuel	EN590

Fuel Pressures

Component	bar	lb/in²
Fuel pump (vacuum pressure):		
Cranking	0.133	1.9
Full load	0.267	3.9
High pressure fuel injection pump	1600	23206

Torque Specifications

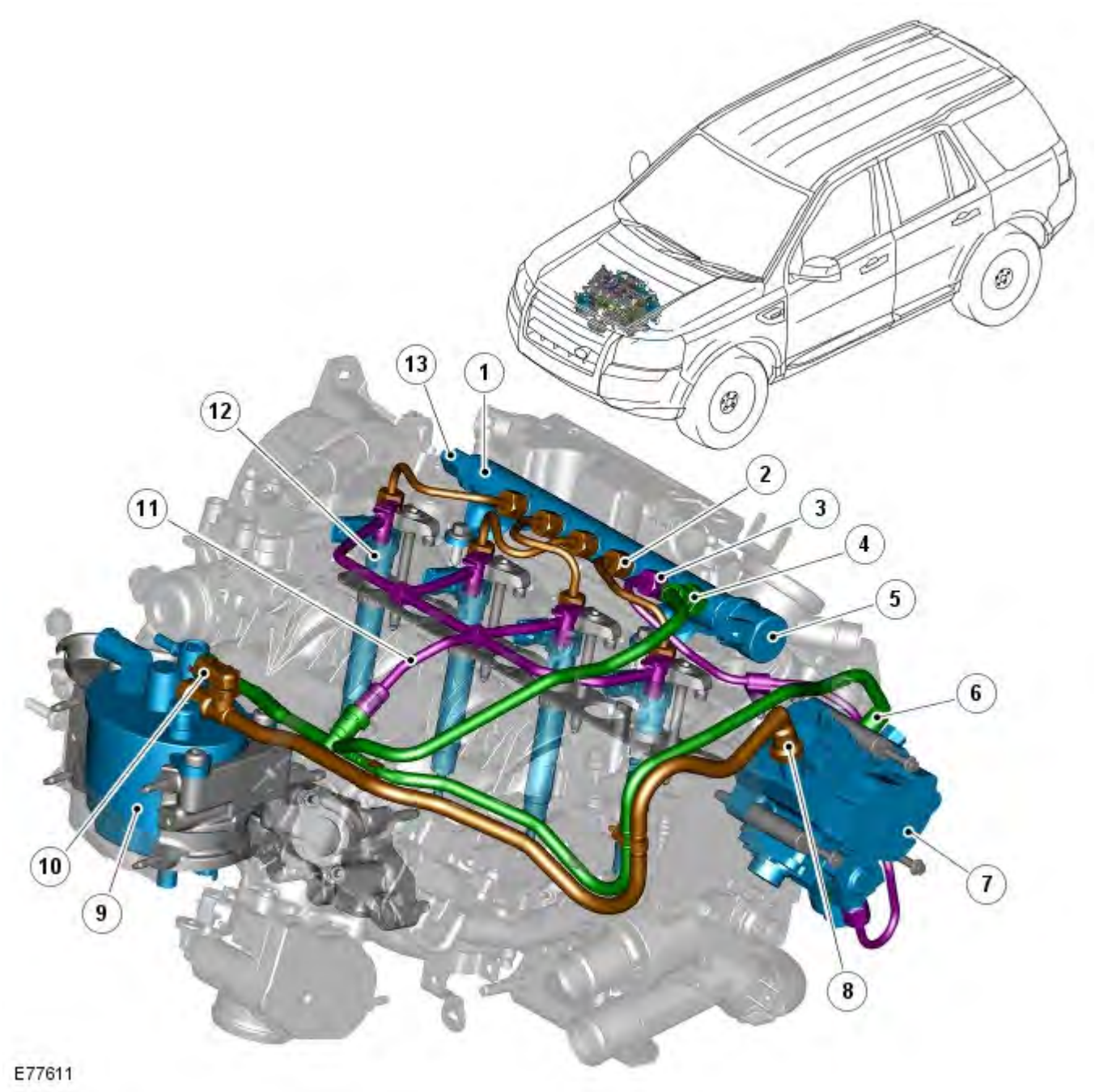
Description	Nm	lb-ft
EGR pipe	10	7
Fuel injector clamp retaining bolts	5 + 110°	4 + 110°
Fuel rail retaining bolts	18	13
Fuel pump to fuel rail high-pressure fuel line retaining bolt	10	7
Fuel pump to fuel rail high-pressure fuel line unions:		
Stage 1	22	16
Stage 2	25	18
Fuel injection pump securing bolts	22	16
Fuel pump bracket	10	7
High pressure fuel supply line unions:		
Stage 1	22	16
Stage 2	25	18
Throttle body screws	9	7

Published: 11-May-2011

Fuel Charging and Controls - TD4 2.2L Diesel - Fuel Charging and Controls

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Common fuel rail
2	-	High pressure pipe – fuel rail to injector (4 off)
3	-	High pressure pipe – pump to fuel rail
4	-	Pipe – fuel rail pressure relief
5	-	Fuel rail pressure control valve
6	-	Hose - high pressure pump leak off
7	-	High pressure fuel pump
8	-	Low pressure hose – fuel filter to pump
9	-	Fuel filter assembly
10	-	Fuel temperature sensor
11	-	Pipe - injector leak off
12	-	Injector (4 off)
13	-	Fuel rail pressure sensor

OVERVIEW

The TD4 diesel engine fuel charging and control system provides precise and instantaneous fuel delivery to the combustion

chambers. This provides optimum performance, allowing the engine to be extremely responsive to driver demands for all driving conditions. The fuel system features a Bosch Generation 3 common rail injection system that is monitored and controlled by an engine control module (ECM), to precisely control the fueling strategy.

Fuel charging is achieved with a low and high-pressure fuel system. The low-pressure fuel system comprises;

- a saddle type fuel tank
- tank mounted fuel delivery module with integral transfer pump
- fuel supply and return lines
- filter and water separator assembly
- a connecting hose between the fuel filter assembly and the fuel lift pump.

• NOTE: The fuel lift pump is integral with the high-pressure pump.

A return line and fuel leak off hoses from the high-pressure pump, injectors and common fuel rail form the remainder of the low-pressure fuel return circuit.
For additional information, refer to: Fuel Tank and Lines - 2.2L Duratorq-TDCi (DW) Diesel (310-01 Fuel Tank and Lines, Description and Operation).

The high-pressure fuel system comprises;

- a high-pressure fuel pump
- common fuel rail
- 4 piezo-injectors with high-pressure connection pipes
- a fuel pressure sensor.

The fuel charging and control system provides injection pressures of up to 1800 bar (26,106 psi). Finer atomization of the injected fuel is achieved with the 7 hole piezo injectors that are capable of near instantaneous response to the ECM commands, allowing up to 5 individual injections per stroke.

The high-pressure fuel pump is mounted at the rear of the cylinder head and is driven by the exhaust camshaft. A fuel lift pump is integral with the high-pressure pump and is therefore also driven when the exhaust camshaft rotates. The lift pump creates suction in the supply line to the fuel tank and draws the fuel from the tank. The fuel passes through the fuel filter and is then delivered at lift pump pressure to the high-pressure pump inlet port.

The advanced high-pressure fueling system enables pilot injections to be delivered ahead of the main charge of fuel. This produces a steady flame front and creates a progressive pressure rise in the cylinder similar to that achieved with petrol engines. This reduction in combustion lag between the injection of fuel and combustion occurring allows fuel to be injected while combustion is taking place, creating increased power and reducing created combustion noise, vibration and harshness (NVH) and emissions.

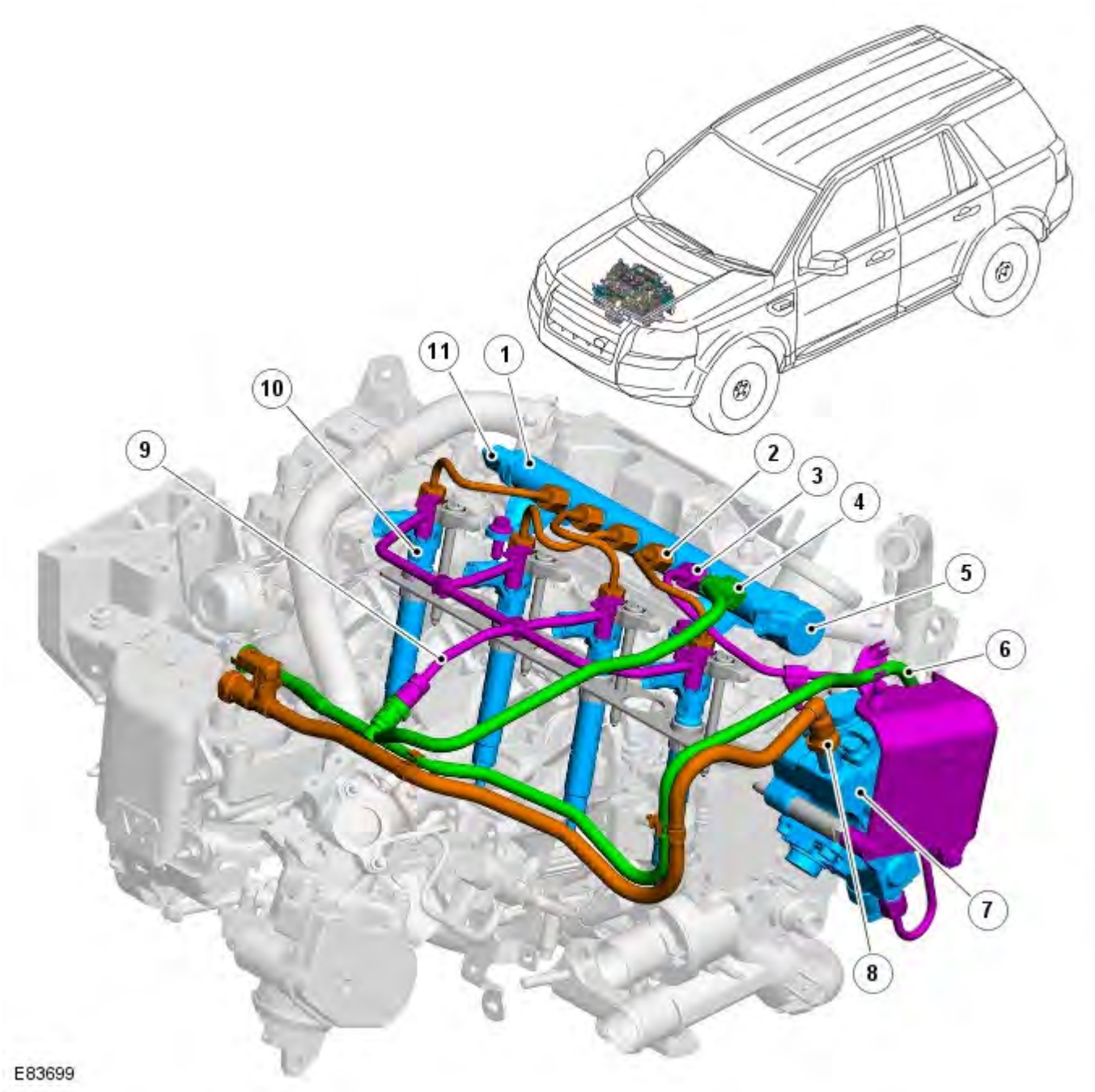
For models fitted with an exhaust system diesel particulate filter, the high-pressure fueling system also provides post combustion injection of fuel into the combustion chambers. When regeneration of the diesel particulate filter is requested, the ECM allows the fueling system to deliver fuel after the combustion stroke and into the commencement of the exhaust stroke. This post combustion injection process causes fuel to be burnt in the exhaust system and creates the high exhaust gas temperatures that are required to regenerate the diesel particulate filter.

Published: 11-May-2011

Fuel Charging and Controls - TD4 2.2L Diesel - Fuel Charging and Controls

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	High-Pressure (HP) common fuel rail
2	-	HP pipe – fuel rail to injector (4 off)
3	-	HP pipe – HP pump to fuel rail
4	-	Low Pressure (LP) pipe – fuel rail leak-off
5	-	Pressure Control Valve (PCV)
6	-	LP pipe - HP pump leak-off
7	-	HP fuel pump and integral lift pump
8	-	Fuel supply pipe - filter to lift pump
9	-	LP pipe - injector leak-off
10	-	Injector (4 off)
11	-	Fuel rail pressure sensor

OVERVIEW

The TD4 diesel engine fuel charging and control system provides precise and instantaneous fuel delivery to the engine combustion chambers. The fuel system features a Bosch Generation 3 common rail injection system that is monitored and controlled by the Engine Control Module (ECM), to precisely control the fueling strategy.
For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L

Diesel, Description and Operation).

Fuel injection pressure is generated independently of engine speed and fuel injection events. The HP fuel system is controllable to the optimum level for smooth operation, and is capable of developing an injection pressure up to 1,600 bar (23,206 psi). The fuel injection timing and volume are calculated by the ECM that also energizes the appropriate piezo-actuated injector.

The fuel system features a pre-injection (pilot) phase to reduce combustion noise and mechanical load. On vehicles installed with a Diesel Particulate Filter (DPF), the fuel system also provides a post-injection phase that is required for regenerating the DPF.
For additional information, refer to: Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Description and Operation).

This type of fuel system allows the TD4 engine to achieve excellent levels of performance and engine response, while being able to meet current and future exhaust emission legislation.

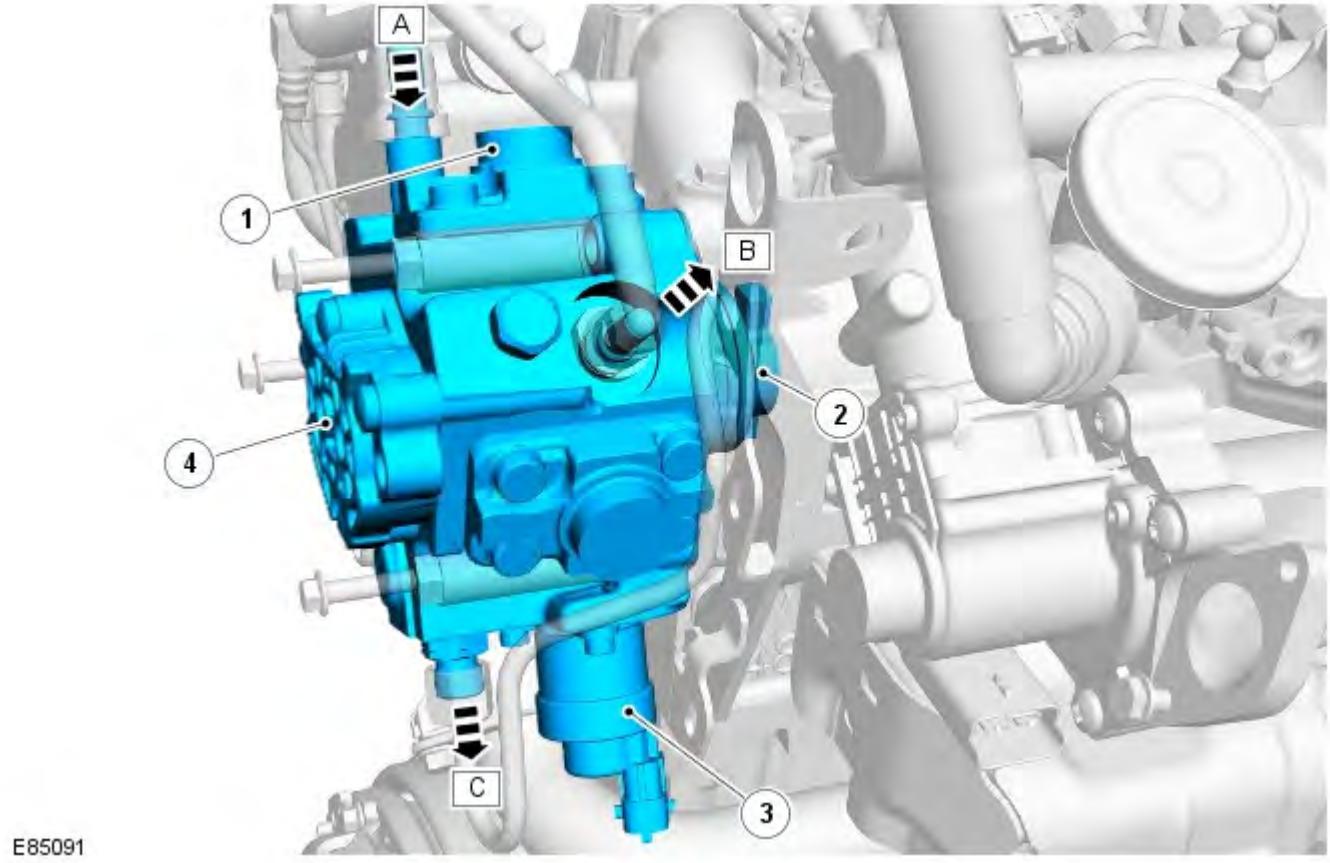
Fuel charging is achieved with a LP and HP fuel system. The LP fuel system comprises:

- Saddle type fuel tank
- Tank mounted fuel delivery module and integral transfer pump
- Fuel supply and return lines
- Filter and water separator assembly.
  For additional information, refer to: Fuel Tank and Lines (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Description and Operation).

The HP fuel system comprises:

- HP fuel pump with integral mounted lift pump and Volume Control Valve (VCV)
- Common fuel rail with integral PCV and pressure sensor
- 4 piezo-injectors
- HP connecting pipes
- Fuel leak-off pipes.

HIGH-PRESSURE FUEL PUMP



Item	Part Number	Description
A	-	Fuel supply connection - filter to lift pump
B	-	LP fuel return connection to filter
C	-	HP fuel supply connection to fuel rail
1	-	HP pump element (3 off)
2	-	HP pump drive shaft
3	-	VCV
4	-	Lift pump

The HP fuel pump is mounted to the rear of the cylinder head (transmission side), and is driven by the exhaust camshaft. The fuel pump is a 3-piston, radial plunger type, with the pumping elements spaced equally at 120 degrees apart. The high-pressure output from the pump elements is connected to a fuel ring circuit within the fuel pump, and provides a constant pressurized fuel supply to the fuel rail. The pump is capable of producing a maximum fuel pressure of 1,600 bar

(23,206 psi).

The fuel system HP pump comprises the following components:

- 3 HP pumping elements
- Integral lift pump
- Volume Control Valve (VCV).

The HP pump and integral lift pump must not be separated. The HP pump is not timed to the engine.

A controlled amount of fuel is allowed to leak-off through the HP pump, and returned through a leak-off pipe to the fuel filter. The leak-off fuel provides cooling and lubrication for the HP pump internal components.

Lift Pump

A fuel lift pump is mounted to the rear of the fuel pump, and forms an integral assembly with the HP pump. The fuel lift pump is a gear type pump and connected to the fuel filter supply line. The lift pump creates a vacuum (negative pressure) in the supply line to the fuel tank, and draws the fuel from the tank. The fuel passes through the fuel filter and is then delivered at lift pump pressure to the HP pump inlet port.

The lift pump normal operating, negative pressure values are shown for the following engine conditions:

Engine Condition	Lift Pump Negative Pressure
Cranking	-133 ± 7 mbar (-10 ± 0.5 cmHg)
Full load	-267 ± 133 mbar (-20 ± 10 cmHg)

Volume Control Valve (VCV)

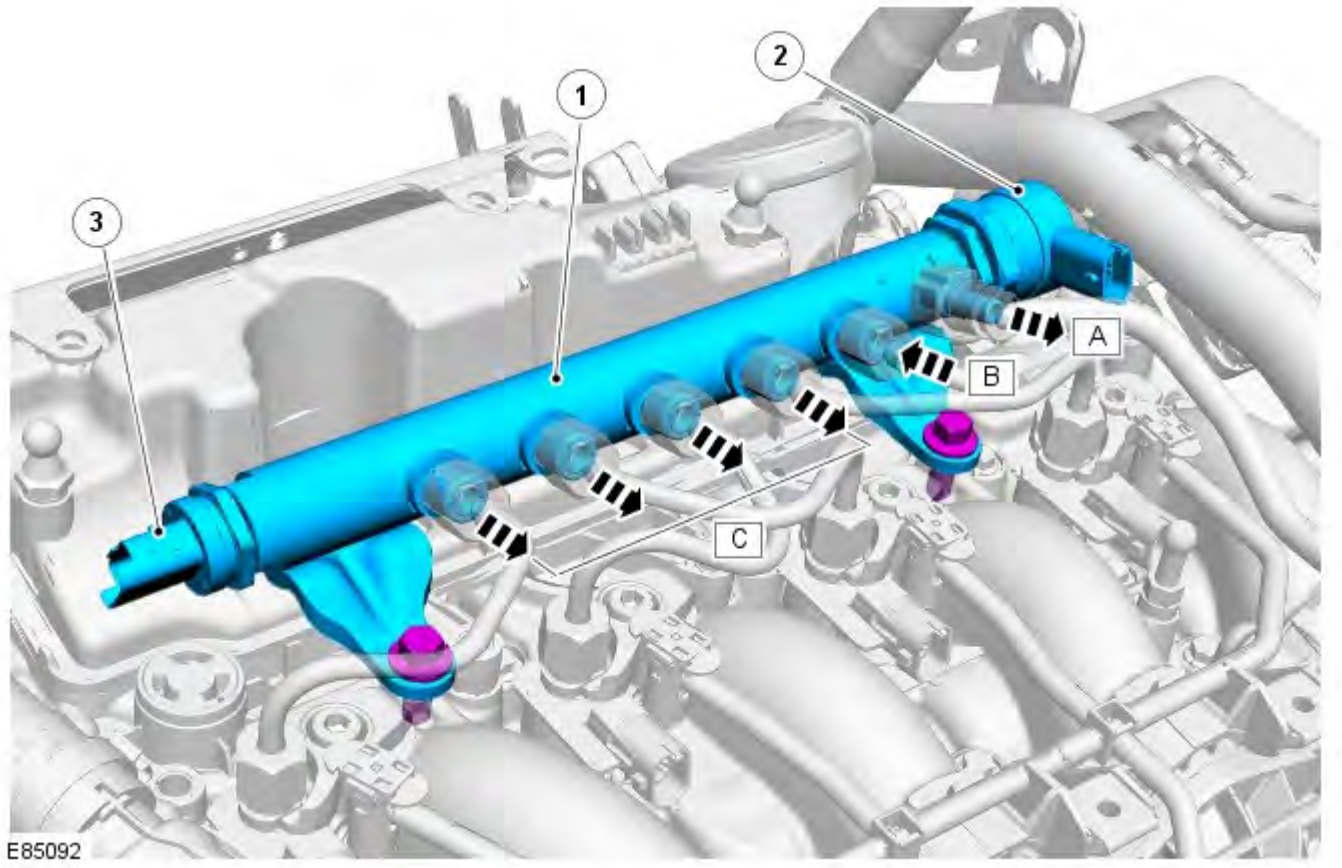
The VCV is mounted on the HP pump, and located in the feed port between the HP pump elements and the fuel lift pump. The VCV is a variable position solenoid-operated valve that is controlled by the ECM with a 12V Pulse Width Modulated (PWM) signal. The VCV controls the quantity of fuel delivered by the lift pump to the HP pump elements.

When the HP fuel pump rotates, pressure is created when the VCV is open and the fuel rail mounted PCV is closed. The VCV and PCV are variable position valves, and used by the ECM to control fuel delivery and fuel system pressure.

During the fuel heating period when the supply fuel temperature is less than 40°C (104°F), the ECM will fully open the VCV. Fuel volume and pressure is then controlled directly by the PCV under the control of the ECM.

The VCV is normally open when the solenoid is not energized by the ECM. The resistance value of the VCV solenoid coil is 2.8 ohms at 20°C (68°F).
For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

COMMON FUEL RAIL



Item	Part Number	Description
A	-	LP fuel return connection to filter
B	-	HP fuel supply connection – HP pump to fuel rail

C	-	HP pipe connection – fuel rail to injector (4 off)
1	-	Fuel rail
2	-	PCV
3	-	Fuel rail pressure sensor

The fuel rail is manufactured from forged steel and secured to the cylinder head with 2 fixings. The fuel rail stores pressurized fuel from the HP pump, and prevents pressure fluctuations in the HP system. A fuel rail pressure sensor and a PWM PCV are installed into the bore at each end of the fuel rail. The pressure sensor is installed at the accessory drive end of the fuel rail; the PCV installed at the transmission end of the fuel rail.

High-pressure fuel pipes connect the fuel rail to the HP pump and fuel injectors. A leak-off pipe connects the fuel rail to the fuel filter return circuit.

The common fuel rail, fuel pressure sensor and PCV form an integral assembly, and must not be separated. If a fault occurs that requires component renewal, then the complete fuel rail assembly must be renewed.

Fuel Rail Pressure Sensor

The fuel rail pressure sensor is mounted in the end of the fuel rail (accessory drive end) and connected to the ECM via the engine harness. The pressure sensor is provided with a 5V power supply, ground and signal connections. The fuel rail pressure sensor is a piezo-resistive type sensor containing an actuating diaphragm. Deflection of the diaphragm provides a proportional signal (output) voltage to the ECM, dependant on the fuel pressure within the fuel rail.

Pressure Sensor Parameters

Pressure Sensor Output Voltage	Fuel Rail Pressure
0.5V	230 bar (3,336 psi)
4.5V	1,600 bar (23,206 psi)

The ECM compares the sensor signal voltage to stored memory values, in order to calculate the actual fuel pressure present in the fuel rail. The ECM then uses the fuel rail pressure information to control the operating position of the VCV and PCV.
For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

Pressure Control Valve (PCV)

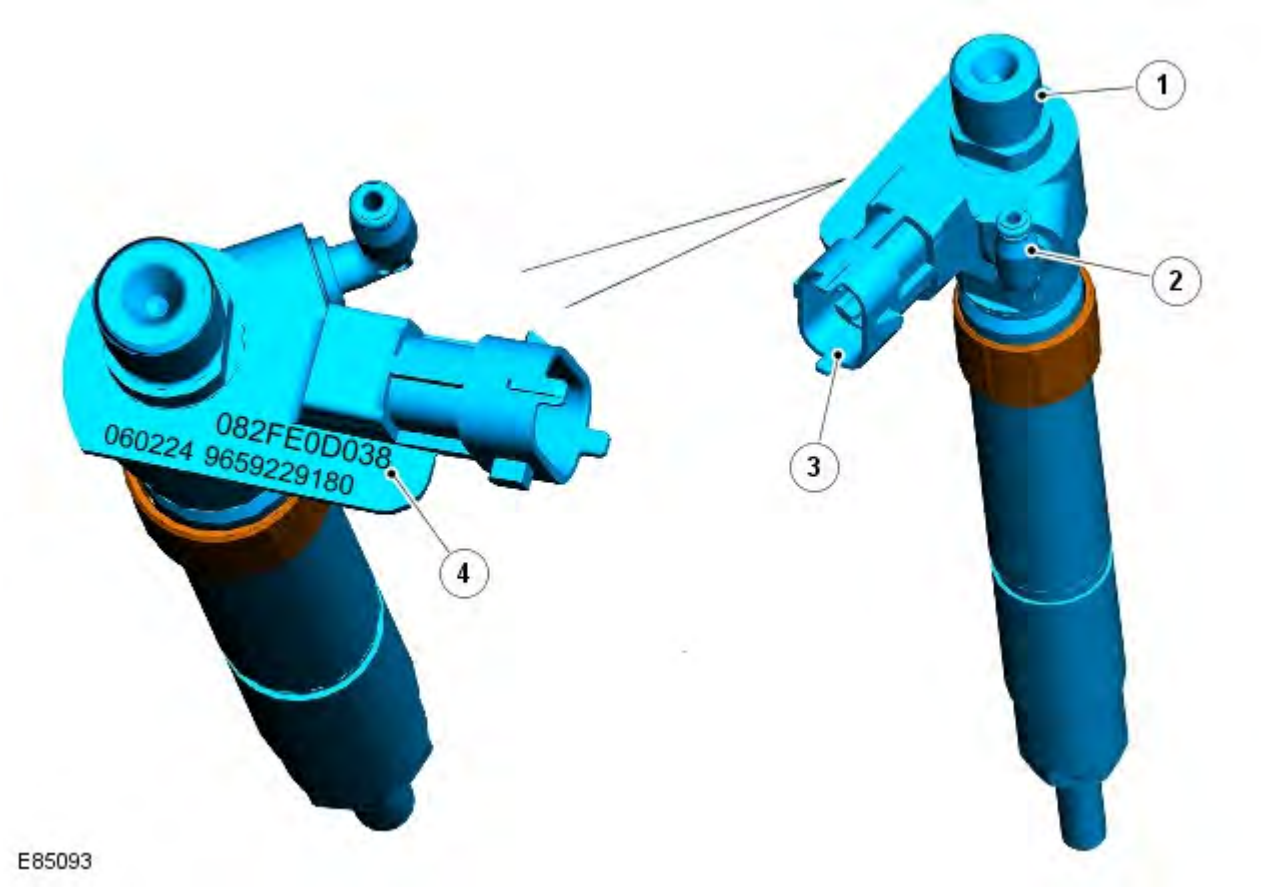
The PCV is mounted in the end of the fuel rail (transmission end) and connected to the ECM via the engine harness. The PCV is a solenoid-operated valve controlled by a 12V PWM signal. The ECM operates the PCV to adjust the fuel pressure within the fuel rail. Relieved fuel is directed through the fuel rail leak-off pipe to the fuel filter return circuit. The leak-off fuel also provides cooling and lubrication for the PCV.
For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

The PCV is normally open when the solenoid is not energized by the ECM. The resistance value of the PCV solenoid coil is 3.6 ohms at 20°C (68°F).

The PCV is also used by the ECM to provide direct control of the fuel system, in the following situations:

- During sudden transient phases in engine speed (suddenly lifting off the accelerator pedal, for example) where VCV action is not sufficient to affect the supply of fuel to the fuel rail.
- To control fuel pressure in the event that the VCV fails.
- During the fuel heating period, when supply fuel temperature is less than 40°C (104°F). The VCV is fully opened by the ECM and the HP pump compresses a maximum quantity of fuel to raise the fuel temperature. The PCV is then modulated by the ECM to provide leak-off fuel from the fuel rail to the fuel filter return circuit. The fuel is then recirculated through the fuel filter and back to the HP pump.
- When the fuel supply temperature is greater than 70°C (158°F). The PCV is modulated by the ECM to release fuel rail pressure, subsequently decreasing the fuel temperature to protect the fuel system components. Leak-off fuel from the fuel rail is directed to the fuel filter return circuit and back to the fuel tank.
- During engine shutdown to progressively collapse fuel rail pressure.

FUEL INJECTORS



Item	Part Number	Description
1	-	HP fuel supply connection from fuel rail
2	-	LP fuel leak-off connection to filter
3	-	Electrical connection to ECM
4	-	Injector 10-digit code

The 4 fuel injectors are of the piezo-electric actuated type, each manufactured with 7 spray holes in the injector nozzle. The injectors are located centrally within the cylinder head combustion chambers to spray atomized fuel directly onto the toroidal dome of the pistons.

Technical Details

Operating Parameter	Value
Supply voltage 110V to 150V	230 bar (3,336 psi) to 1,600 bar (23,206 psi)
Resistance	180 Kohms at 20°C (68°F)
Minimum charging time	100 µS
Minimum discharge time	100 µS
Spray nozzle diameter	143 µm
Maximum capable delivery	11 cm^3/second

During manufacture each injector is tested to measure the actual injected quantity of fuel, compared to a reference quantity for simulated conditions. The tests are used to categorize the injectors, the difference in the injection analysis results is translated to a 10-digit alpha-numerical code that is stamped on the injector casing.

The 10-digit codes are stored in the ECM memory along with the corresponding cylinder numbers for each injector, and an engine performance software map. The ECM recognizes each injector 10-digit code and adapts the operation of each injector to provide similar injection pressures and quantity of delivered fuel for the current operating condition, in accordance with the programmed software map.

The injector body contains a stack of piezo-electric crystals mounted above a control piston. The piezo crystals are actuated by a supply voltage from the ECM. The control piston is separated with a hydraulic chamber that acts to operate the needle valve via a domed piston and control drillings. The hydraulic chamber compensates for temperature changes within the injector assembly, and also allows the injector to operate with a constant reaction time, even after numerous operations.

The hydraulic chamber eliminates the requirement for contacting moving parts within this type of injector. In other types of injector these contact parts will wear, increasing the reaction time of the injector and subsequently affecting the engines performance and emissions.

On the vehicle, the hydraulic chamber is maintained by a 10 bar (145 psi) check valve located in the injector leak-off pipe junction.

Due to the Bosch Generation 3 technology and the injector hydraulic chamber, the injectors will operate with a near instantaneous response time to ECM commands. This provides a finer atomization of the injected fuel, and allows the ECM to precisely control the actuation period of the injector. During certain engine operating conditions, each injector is able to deliver a sequence of up to 5 injections during a single injection cycle. The sequence for an injection cycle of 5 individual deliveries is as follows:

- 2 pilot injections up to 3,200 Revolutions Per Minute (RPM)

- 1 control injection up to 4,500 RPM
- 1 main injection above 4,500 RPM
- 2 post-injections during DPF regeneration phase (no load values).

The pilot injection phase is delivered ahead of the main charge of fuel to produce a steady flame front, and create a progressive pressure rise in the cylinder. The pilot injection phase reduces the lag between the injection of fuel and combustion occurring, allowing the remaining charge of fuel to be injected while combustion is taking place. This injection principle creates an increase in power, and also reduces combustion Noise, Vibration and Harshness (NVH) and exhaust emissions.

On vehicles installed with an exhaust system DPF, the high-pressure fueling system provides a post-injection phase of fuel into the combustion chambers. During the regeneration stage of the DPF, the ECM allows fuel to be injected after the combustion stroke and into the commencement of the exhaust stroke. The post-injection phase causes fuel to burn in the exhaust system, creating high exhaust gas temperatures required to regenerate the DPF.

For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation) / Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Description and Operation).

Injector Service Information

CAUTION: This type of injector contains a hydraulic chamber. It is important that the injector is handled correctly to prevent the hydraulic chamber from emptying. The injector is to be capped and maintained in an upright position, and must not be laid on the side or shaken.

Do not attempt to remove carbon deposits from the diesel injector nozzle.

The injector is supplied as a complete assembly. The original injector must not be separated.

• NOTE: The TD4 engine cylinders are numbered from the rear of the engine (transmission end). Therefore, No. 1 cylinder and No. 1 injector are located at the rear of the engine.

A new copper washer must be installed and the old washer discarded, whenever an injector is removed from the cylinder head. The injector centering ring may be re-used.

If an injector is removed, the injector must be installed to the original cylinder, and does not require re-programming into the ECM.

If an injector is renewed, the new injector 10-digit code and corresponding cylinder number must be programmed into the ECM, using the Land Rover approved diagnostic system.

If the ECM is renewed, all 4 injector 10-digit codes and corresponding cylinder numbers must be programmed into the new ECM, using the Land Rover approved diagnostic system.

HIGH-PRESSURE FUEL AND LEAK-OFF PIPES

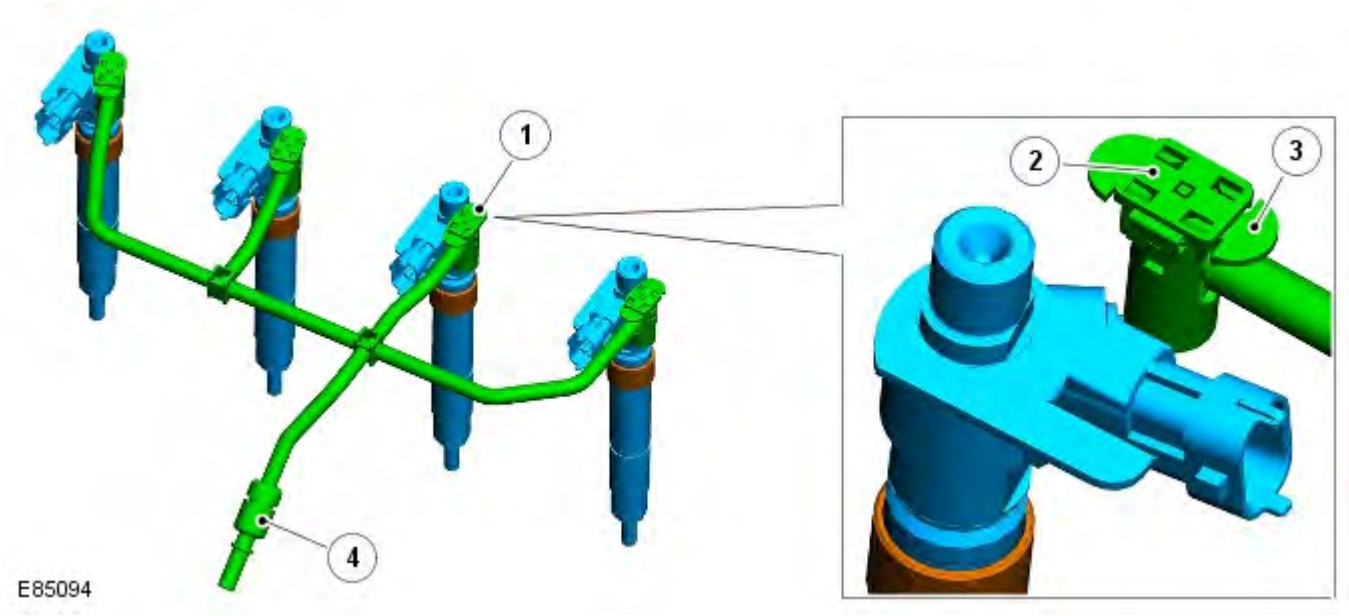
High-Pressure Fuel Pipe

The HP fuel pipes are connected between the HP pump and fuel rail, and between the fuel rail and the 4 injectors. The pipes are short in length, in order to maintain the maximum fuel system working pressure.

The pipes are single use only, and must be renewed whenever a pipe connection is released.

Leak-Off Pipes

The fuel system leak-off pipes are installed with quick release type couplings, and connect the fuel rail, injectors and HP pump to the fuel filter.



Item	Part Number	Description
1	-	Injector leak-off port connection
2	-	Connector locking clip
3	-	Connector release clip
4	-	Non-return valve

The injector leak-off pipe forms a single component, and is provided as a complete assembly. The injector connector comprises 2 moving parts. This 2-piece type of connection must be correctly removed from the injector otherwise the connector will be damaged.

To remove the injector leak-off connector, the center locking clip must first be pulled upward and then removed using the 2 lugs on the connector release clip. To install the leak-off connector, the connector must be pushed on to the injector leak-off port using the 2 lugs on the connector release clip, and then locked by pushing down on the center locking clip. A pronounced 'click' will be heard when removing or installing the center locking clip.

A 10 bar (145 psi) non-return valve is installed in the fuel injector leak-off pipe junction, and retains pressure within the injector. The 10 bar (145 psi) pressure is necessary to maintain fuel in the hydraulic chamber, and for correct operation of the injector.

Published: 11-May-2011

Fuel Charging and Controls - TD4 2.2L Diesel - Fuel Charging and Controls

Diagnosis and Testing

Principles of Operation

For a detailed description of the fuel charging and controls, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Description and Operation) / Turbocharger (303-04C Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Fuel level • Fuel leaks • Damaged fuel lines • Damaged push connect fittings • Fuel contamination/grade/quality • Throttle body	• Fuses • Loose or corroded electrical connectors • Harnesses • Sensor(s) • Engine Control Module (ECM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine cranks but does not start	• Fuel level • Contaminated fuel • Fuel system leaking/blocked • Air intake system • Electronic engine controls	Check fuel level and for contamination. Check fuel and air intake system integrity. Check for DTCs and refer to the relevant DTC Index
Difficult to start	• Fuel level • Contaminated fuel • Fuel system leaking/blocked • Air intake system • Electronic engine controls	Check fuel level and for contamination. Check fuel and air intake system integrity. Check for DTCs and refer to the relevant DTC Index
Rough idle	• Low/contaminated fuel • Fuel system leaking/blocked • Electronic engine controls	Check fuel level/condition. Check integrity of fuel and engine control systems. Check for DTCs and refer to relevant DTC Index.
Lack of power under acceleration	• Contaminated fuel • Air intake system • Blocked exhaust/catalytic converter • Turbocharger fault • Fuel system • Electronic engine controls • Low engine compressions	Check for fuel contamination. Check for DTCs and refer to relevant DTC Index. Check integrity of air intake, exhaust, turbocharger, and engine control systems
Engine stops/stalls	• Low/contaminated fuel • Fuel system • Air intake system • Electronic engine controls	Check for fuel contamination. Check for DTCs and refer to the relevant DTC Index. Check integrity of fuel, air intake, and engine systems

DTC Index

• NOTE: If the control module/component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines that involve pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P004513	Turbo charger/Supercharger Boost Control A Circuit / Open	• Turbo charger actuator power stage output 2 circuit - open load	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P004518	Turbo charger/Supercharger Boost Control A Circuit / Open	• Power stage temperature dependant current limitation	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P004519	Turbo charger/Supercharger Boost Control A Circuit / Open	• Turbo charger actuator power stage output 1 circuit - over current	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P004619	Turbo charger/Supercharger Boost Control A Circuit Range/Performance	• Power stage excess temperature	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P004711	Turbo charger/Supercharger Boost Control A Circuit Low	• Turbo charger actuator power stage output 1 circuit - short to ground	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P004714	Turbo charger/Supercharger Boost Control A Circuit Low	• Turbo charger actuator power stage output 2 circuit - short to ground	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P004718	Turbo charger/Supercharger Boost Control A Circuit Low	• Power stage current limitation	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P004800	Turbo charger/Supercharger Boost Control A Circuit High	• Actuator power stage error	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P004812	Turbo charger/Supercharger Boost Control A Circuit High	• Turbo charger actuator power stage output 1 circuit - short to power	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P004815	Turbo charger/Supercharger Boost Control A Circuit High	• Turbo charger actuator power stage output 2 circuit - short to power	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P008821	Fuel Rail/System Pressure - Too High	• Pressure control valve circuit - short to power • Pressure control valve stuck closed	Check for pressure control valve DTCs and refer to relevant DTC Index
P008822	Fuel Rail/System Pressure - Too High	• Leaking fuel system • Volume control valve circuit - short to ground, open circuit • Volume control valve stuck open	Check for fuel leaks. Refer to electrical circuit diagrams and check volume control valve circuit for short to ground, open circuit. Install a new high pressure fuel pump as required
P008824	Fuel Rail/System Pressure - Too High	• Leaking fuel system • Pressure control valve stuck • Pressure control valve circuit - short to ground, power, open circuit	Check for fuel leaks. Refer to electrical circuit diagrams and check pressure control valve circuit for short to ground, power, open circuit. Install a new pressure control valve as required
P008827	Fuel Rail/System Pressure - Too High	• Leak in high pressure section • Injector nozzle stuck open/worn • Worn high pressure pump, filter blocked • Leaking pressure control valve	Check for fuel leaks in high and low pressure systems, check for additional DTCs and refer to DTC Index

DTC	Description	Possible Cause	Action
		• Low pressure section pressure low (leak in system, pump output low)	
P009B00	Fuel Pressure Relief Control Circuit/Open	• Pressure control valve control circuit - open load	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009C00	Fuel Pressure Relief Control Circuit Low	• Pressure control valve control circuit - short to ground	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009D00	Fuel Pressure Relief Control Circuit High	• Pressure control valve control circuit - short to power	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009E00	Fuel Pressure Relief Control Performance/Stuck Off	• Pressure control valve power stage excess temperature	Refer to electrical circuit diagrams and check pressure control valve circuit for high resistance, if no fault identified install new ECM. Refer to the new module/component installation note at the top of the DTC Index
P00AF75	Turbo charger/Supercharger Boost Control A Module Performance	• Variable Gate Turbo charger sensor circuit - short to ground, power, open circuit • Variable Gate Turbo charger sensor failure	Refer to electrical circuit diagrams and check variable gate Turbo charger sensor circuit for short to ground, power, open circuit. Install a new Turbo charger as required
P018200	Fuel Temperature Sensor A Circuit Low	• Fuel temperature sensor voltage below lower limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P018300	Fuel Temperature Sensor A Circuit High	• Fuel temperature sensor voltage above upper limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P023422	Turbo charger/Supercharger A Over boost Condition	• Boost pressure control deviation below lower limit at full load	Check for turbo charger related DTCs and refer to the relevant DTC Index
P023700	Turbo charger/Supercharger Boost Sensor A Circuit Low	• Boost pressure sensor circuit - short to ground, open circuit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P023800	Turbo charger/Supercharger Boost Sensor A Circuit High	• Boost pressure sensor circuit - short to power	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P025100	Injection Pump Fuel Metering Control A	• Fuel metering unit control circuit - open load	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P02CC21	Cylinder 1 Fuel Injector Offset Learning at Min Limit	• Injector energising time calibration during overrun - time below lower limit	Install a new injector
P02CD22	Cylinder 1 Fuel Injector Offset Learning at Max Limit	• Injector energising time calibration during overrun - time above upper limit	Install a new injector
P02CE21	Cylinder 2 Fuel Injector Offset Learning at Min Limit	• Injector energising time calibration during overrun - time below lower limit	Install a new injector
P02CF22	Cylinder 2 Fuel Injector Offset Learning at Max Limit	• Injector energising time calibration during overrun - time above upper limit	Install a new injector
P02D021	Cylinder 3 Fuel Injector Offset Learning at Min Limit	• Injector energising time calibration during overrun - time below lower limit	Install a new injector
P02D122	Cylinder 3 Fuel Injector Offset Learning at Max Limit	• Injector energising time calibration during overrun - time above upper limit	Install a new injector
P02D221	Cylinder 4 Fuel Injector Offset Learning at Min Limit	• Injector energising time calibration during overrun - time below lower limit	Install a new injector
P02D322	Cylinder 4 Fuel Injector Offset Learning at Max Limit	• Injector energising time calibration during overrun - time above upper limit	Install a new injector
P02E013	Diesel Intake Air Flow Control Circuit/Open	• Throttle motor control circuit - open circuit	Refer to electrical circuit diagrams and check throttle control circuit for open circuit

DTC	Description	Possible Cause	Action
P02E100	Diesel Intake Air Flow Control Performance	• Throttle valve stuck during after run learning routine • Error in driver IC (CJ230 power stage) for Throttle Valve Actuator	Clear the DTC and re-test. If the DTC remains, install a new ECM. Refer to the new module/component installation note at the top of the DTC Index
P02E119	Diesel Intake Air Flow Control Performance	• Throttle motor control circuit - short circuit overload error	Refer to electrical circuit diagrams and check throttle control circuit for short circuit fault
P02E14B	Diesel Intake Air Flow Control Performance	• Excess Temperature in CJ230 power stage for Throttle Valve Actuator	Clear the DTC and re-test. If the DTC remains, install a new ECM. Refer to the new module/component installation note at the top of the DTC Index
P02E211	Diesel Intake Air Flow Control Circuit Low	• Throttle motor control circuit - short to ground	Refer to electrical circuit diagrams and check throttle control circuit for short to ground
P02E214	Diesel Intake Air Flow Control Circuit Low	• Throttle motor control circuit - short to ground	Refer to electrical circuit diagrams and check throttle control circuit for short to ground
P02E312	Diesel Intake Air Flow Control Circuit High	• Throttle motor control circuit - short to power	Refer to electrical circuit diagrams and check throttle control circuit for short to power
P02E315	Diesel Intake Air Flow Control Circuit High	• Throttle motor control circuit - short to power	Refer to electrical circuit diagrams and check throttle control circuit for short to power
P02E471	Diesel Intake Air Flow Control Stuck Open	• Throttle valve stuck during normal engine running - attempt to unstick valve unsuccessful	Check/clear throttle valve from obstruction/sticking
P02E571	Diesel Intake Air Flow Control Stuck Closed	• Throttle valve stuck closed during normal engine running - attempt to unstick valve unsuccessful	Check/clear throttle valve from obstruction/sticking
P02E728	Diesel Intake Air Flow Position Sensor Range/Performance	• Throttle valve open or closed position offset difference with first learning too large • Throttle valve open or closed position offset difference with previous learning too large	Check/clear throttle valve from obstruction/sticking, clear DTC and re-test. If the DTC remains, install a new throttle body
P02E800	Diesel Intake Air Flow Position Sensor Circuit Low	• Throttle position sensor circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check throttle position sensor circuit for short to ground, open circuit
P02E872	Diesel Intake Air Flow Position Sensor Circuit Low	• Throttle valve position deviation - valve stuck open	Check/clear throttle valve from obstruction/sticking
P02E900	Diesel Intake Air Flow Position Sensor Circuit High	• Throttle position sensor circuit - short to power	Refer to electrical circuit diagrams and check throttle position sensor circuit for short to power
P02E973	Diesel Intake Air Flow Position Sensor Circuit High	• Throttle valve position deviation - valve stuck closed	Check/clear throttle valve from obstruction/sticking
P031300	Misfire Detected With Low Fuel	• Low fuel - misfire induced by ECM to warn driver before shut off	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P062B00	Internal Control Module Fuel Injector Control Performance	• Overrun Monitor - injector energising times too long during overrun • Redundant shut off path error	Install a new ECM, refer to the new module/component installation note at the top of the DTC Index. REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 2.2L Diesel, Removal and Installation).
P062B16	Internal Control Module Fuel Injector Control Performance	• Redundant shut off path voltage too low	Install a new ECM, refer to the new module/component installation note at the top of the DTC Index. REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 2.2L Diesel, Removal and Installation).
P062B17	Internal Control Module Fuel Injector Control Performance	• Redundant shut off path voltage too high	Install a new ECM, refer to the new module/component installation note at the top of the DTC Index. REFER to: Powertrain Control Module (PCM)

DTC	Description	Possible Cause	Action
			(303-14 Electronic Engine Controls - 2.2L Diesel, Removal and Installation).
P129800	Injector Driver Module Failure	• ECM internal failure	Install a new module, refer to the new module/component installation note at the top of the DTC Index
P228800	Injector Control Pressure Too High	• Leaking fuel system • Fuel high pressure pump circuit - short to ground, open circuit • Fuel high pressure pump failure	Check for fuel leaks. Refer to the electrical circuit diagrams and check fuel high pressure pump circuit for short to ground, open circuit. Install a new high pressure pump as required
P256263	Turbo charger Boost Control Position Sensor A Circuit	• Position Error above stall timer limit for timer duration	Carry out ODST and install new turbo if fail condition identified
P256271	Turbo charger Boost Control Position Sensor A Circuit	• Turbo charger Actuator Position sensor detects actuator stuck during after run learning	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P256275	Turbo charger Boost Control Position Sensor A Circuit	• Turbo charger actuator stuck - motor switched off	Check Turbo charger vane actuator mechanism is free from obstruction and carbon build-up
P256277	Turbo charger Boost Control Position Sensor A Circuit	• Turbo charger Actuator Position sensor detects actuator stuck during after run learning	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P256371	Turbo charger Boost Control Position Sensor A Circuit	• Turbo charger actuator is sticking	Check Turbo charger vane actuator mechanism is free from obstruction and carbon build-up
P256372	Turbo charger Boost Control Position Sensor A Circuit Range/Performance	• Turbo charger vane actuator stuck open - unable to reach required position	Check Turbo charger vane actuator mechanism is free from obstruction and carbon build-up
P256373	Turbo charger Boost Control Position Sensor A Circuit Range/Performance	• Turbo charger vane actuator stuck closed - unable to reach required position	Check Turbo charger vane actuator mechanism is free from obstruction and carbon build-up
P256436	Turbo charger Boost Control Position Sensor A Circuit Low	• Turbo charger boost control position sensor A circuit - short to ground, power, open circuit • Turbo charger boost control position sensor failure	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system . Install a new sensor as required. REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel, Removal and Installation).
P256437	Turbo charger Boost Control Position Sensor A Circuit Low	• Turbo charger boost control position sensor A circuit - short to ground, power, open circuit • Turbo charger boost control position sensor failure	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system . Install a new sensor as required. REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel, Removal and Installation).
P256537	Turbo charger Boost Control Position Sensor A Circuit High	• Turbo charger boost control position sensor A circuit - short to ground, power, open circuit • Turbo charger boost control position sensor failure	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system . Install a new sensor as required. REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel, Removal and Installation).
P256538	Turbo charger Boost Control Position Sensor A Circuit High	• Turbo charger boost control position sensor A circuit - short to ground, power, open circuit • Turbo charger boost control position sensor failure	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system . Install a new sensor as required. REFER to: Turbocharger (303-04C Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel, Removal and Installation).

Published: 11-May-2011

Fuel Charging and Controls - TD4 2.2L Diesel - Fuel Injector

Removal and Installation

Removal

• WARNINGS:

Avoid flames, sparks or lighted substances.

Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.

• CAUTIONS:

Make sure that the area around the component is clean and free of foreign material.

Make sure that all openings are sealed. Use new blanking caps.

Fuel injectors must not be dismantled or the nozzles cleaned, not even with ultrasonic equipment. Install new fuel injectors if necessary.

Fuel injectors must be installed to their original position.

Cap the fuel injector nozzle to prevent damage before storing vertically.

Fuel injectors must be stored vertically and immediately capped when removed, to prevent the fuel from draining.

If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Bleed the fuel system by cranking the engine to purge the air from the system.

• NOTE: If the fuel injectors are to be removed or replaced as a set, installation should be done in pairs. Injectors 2 and 3, 1 and 4 respectively.

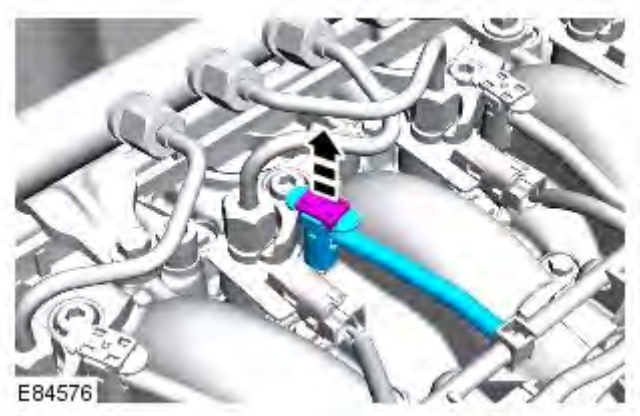
1. Disconnect the battery ground cable.

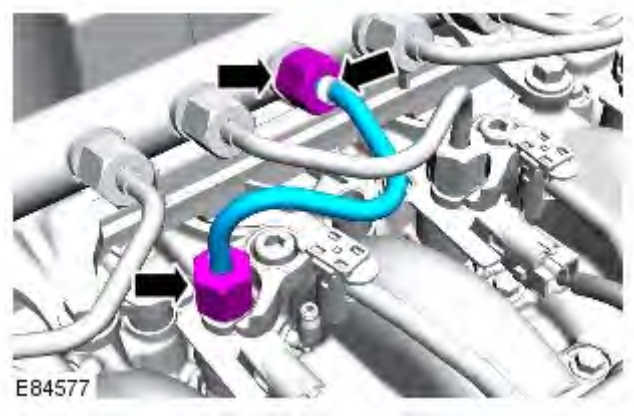
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



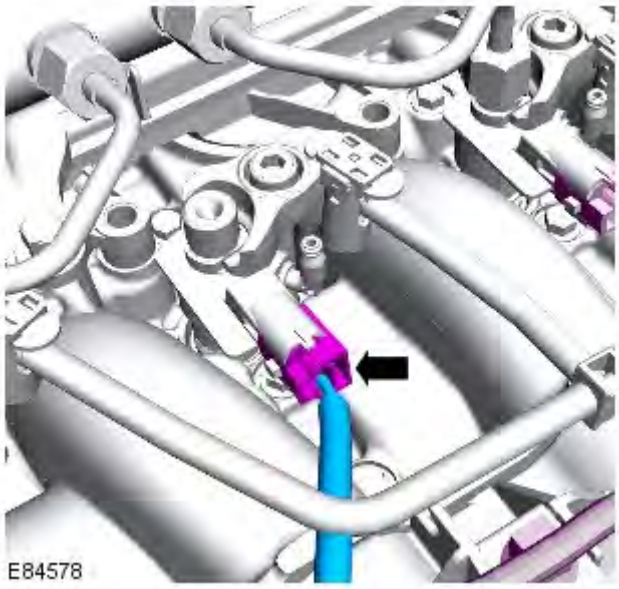


4. **4.** CAUTIONS:

   Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.

   Make sure that all openings are sealed. Use new blanking caps.

   Remove and discard the high-pressure fuel supply line.



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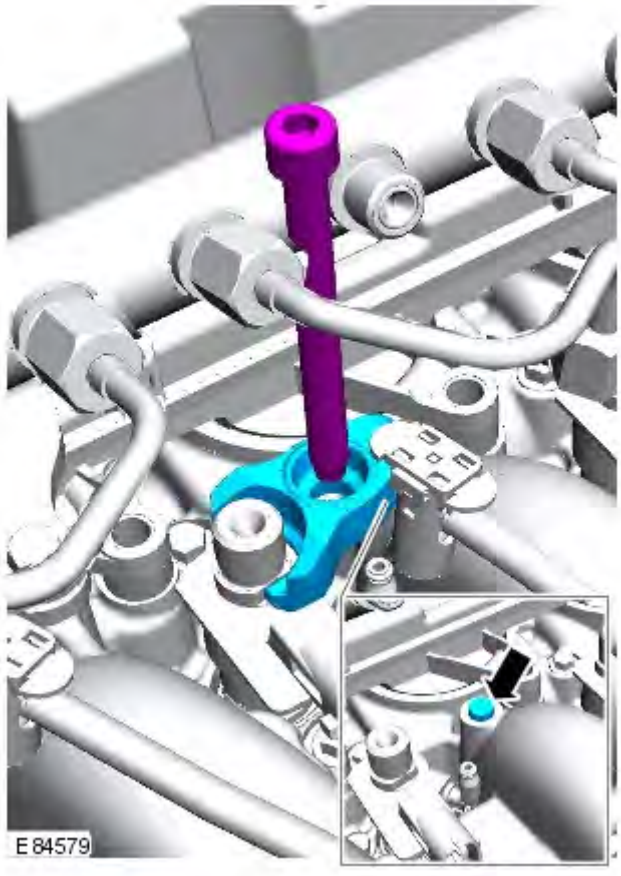
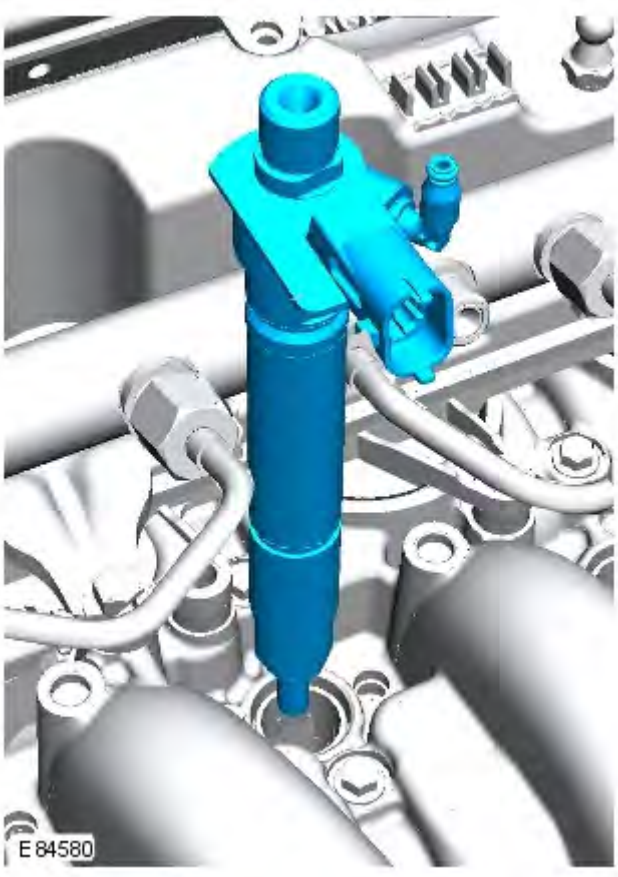


6. **6.** CAUTION: Note the position of the injector clamp peg



7. **7.** CAUTIONS:

Cap the fuel injector nozzle to prevent damage before storing vertically.

Fuel injectors must be stored vertically and immediately capped when removed, to prevent the fuel from draining.

Replace the washer.

Note the position of the plastic alignment sleeve.

Installation

1. **1.** CAUTIONS:

Make sure that the component is clean, free of foreign material and lubricant.

Make sure that a new sealing washer is installed.

Install the fuel injector.

Torque:
Stage 1:5 Nm
Stage 2:130°

2. **2.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

   - Install a new high-pressure fuel supply line but do not fully tighten at this stage.
   - Tighten the high-pressure fuel supply line.

   Torque:
   Stage 1:22 Nm
   Stage 2:25 Nm

3. Attach the spill return line and secure with the keeper.

4. Install the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

5. **5.** CAUTION: Bleed the fuel system by cranking the engine to purge the air from the system.

   Bleed the fuel system.

6. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Fuel Charging and Controls - TD4 2.2L Diesel - Fuel Rail

Removal and Installation

Removal

• WARNINGS:

Avoid flames, sparks or lighted substances.

Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.

• CAUTIONS:

Make sure that the area around the component is clean and free of foreign material.

Make sure that all openings are sealed. Use new blanking caps.

Bleed the fuel system by cranking the engine to purge the air from the system.

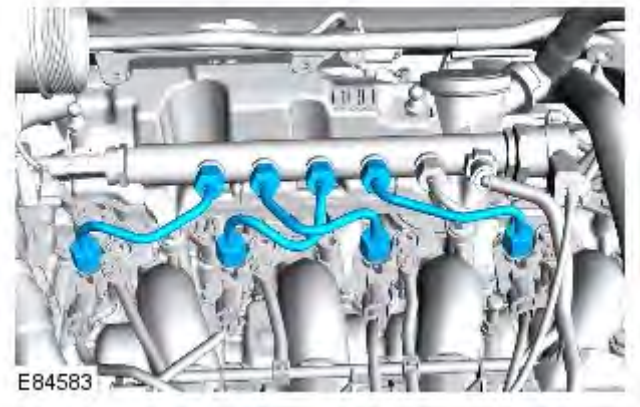
• NOTE: The fuel pressure and temperature sensors are an integral part of the fuel rail and must not be changed separately.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

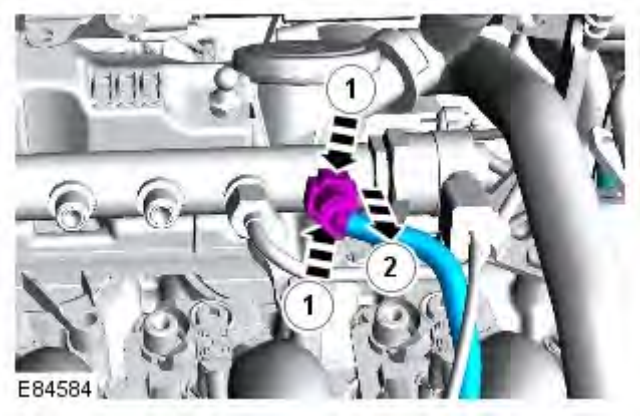


3. **3.** CAUTIONS:

   Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.

   Make sure that all openings are sealed. Use new blanking caps.

   Remove and discard the 4 high-pressure fuel supply lines.



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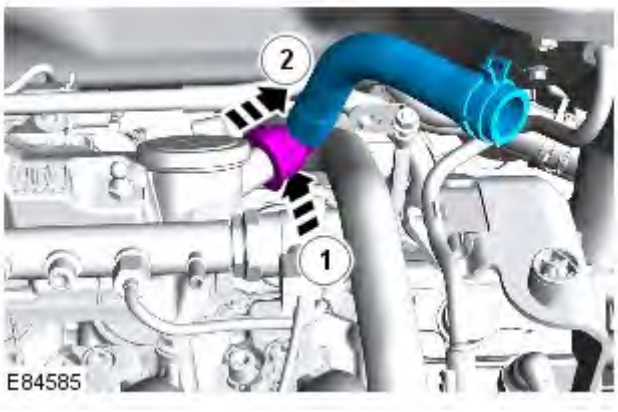

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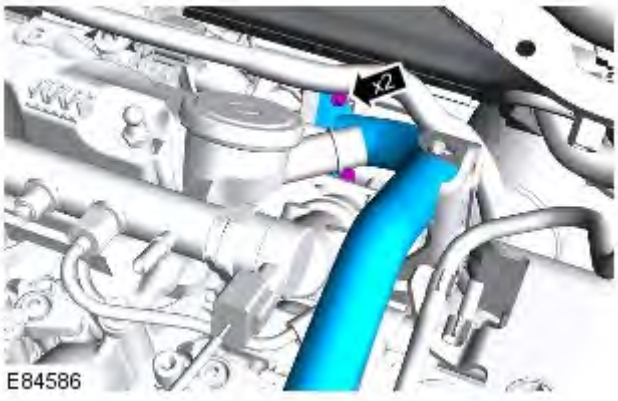

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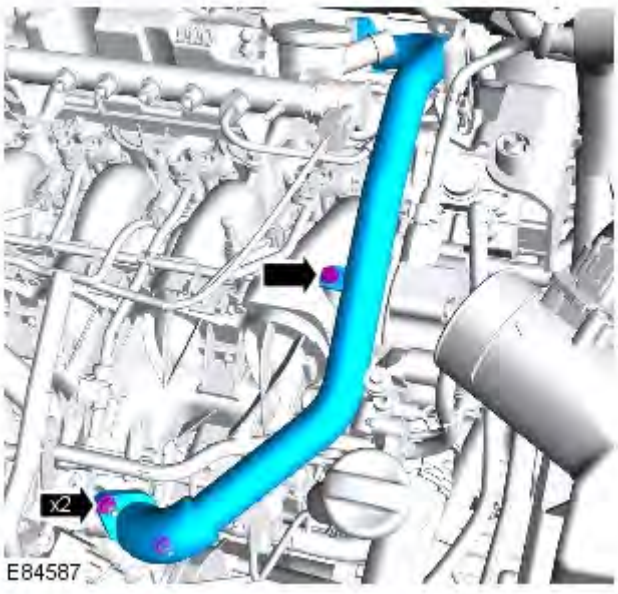
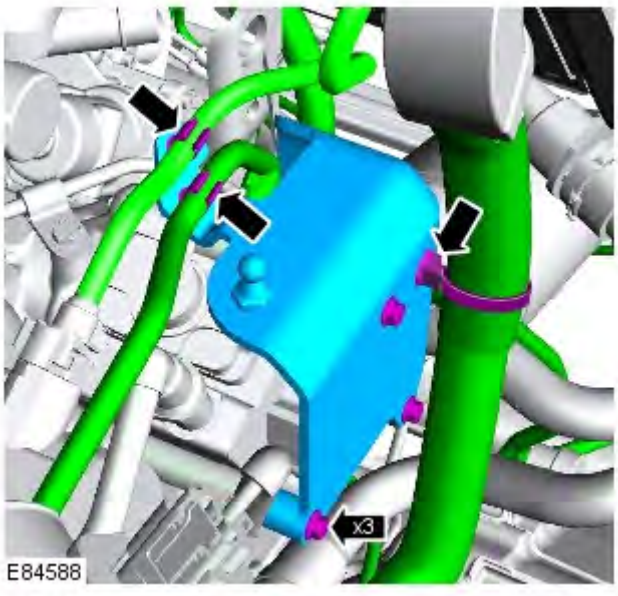


7. **7.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.



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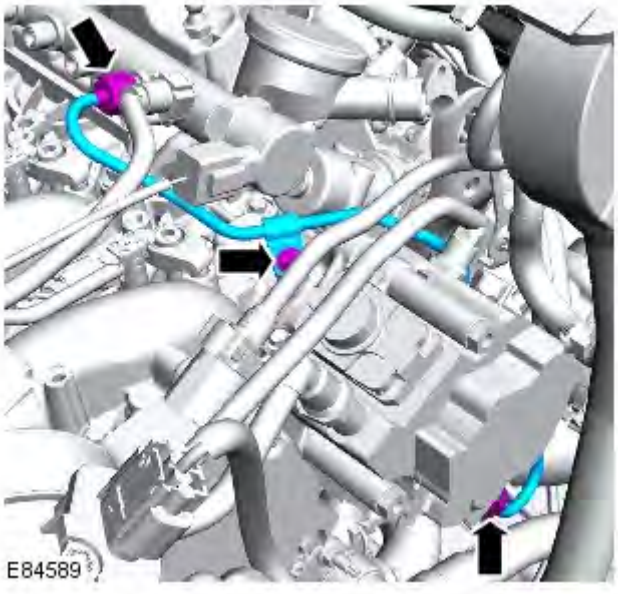


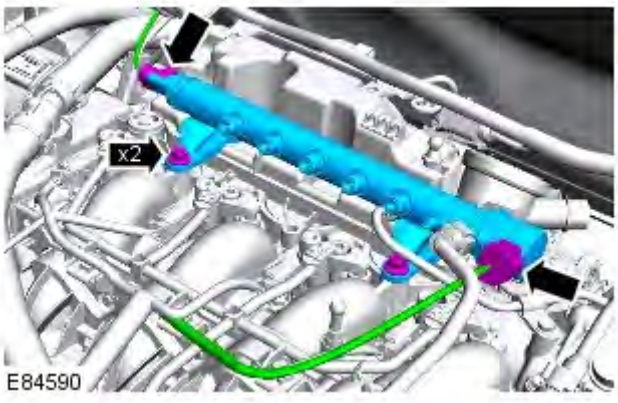
9. **9.** CAUTIONS:

Make sure that the area around the component is clean and free of foreign material.

Make sure that all openings are sealed. Use new blanking caps.

• NOTE: Use an additional wrench to prevent the component from rotating.

Release the fuel pump to fuel rail, high-pressure fuel line.



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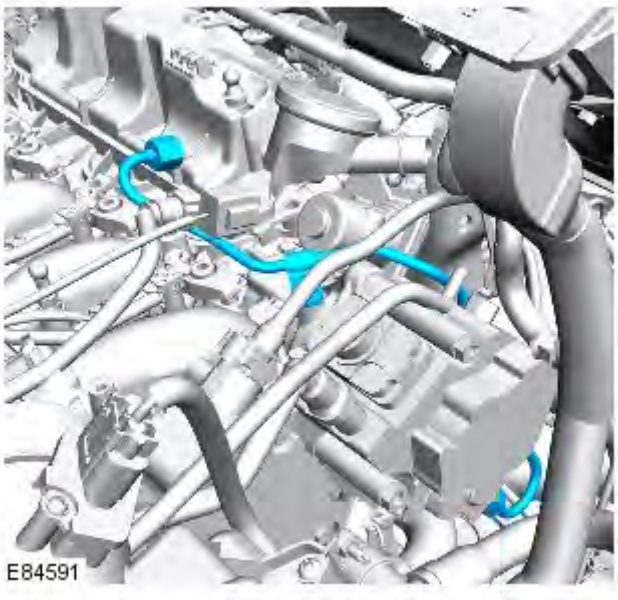


11. Remove and discard the fuel pump to fuel rail, high-pressure fuel line.

Installation

1. **1.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

   Install the new fuel pump to fuel rail, high-pressure fuel line.

2. **2.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

   Install the fuel rail.

   Torque: 22 Nm

3. **3.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

   - Attach the fuel pump to fuel rail high-pressure fuel supply line, but do not fully tighten at this stage.
   - Tighten the high-pressure fuel supply line.

     Torque:
     Stage 1:22 Nm
     Stage 2:25 Nm
   - Install the high-pressure fuel supply line bolt.

     Torque: 8 Nm

4. Install the fuel pump bracket.

   Torque: 8 Nm

5. Install the EGR pipe.

   Torque: 10 Nm

6. Install the breather line.

7. Connect the low-pressure fuel return line.

8. **8.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   The fuel injector high pressure fuel supply lines should be installed in pairs. Injectors 2 and 3, 1 and 4 respectively.

   - Install the new high-pressure fuel supply lines, but do not fully tighten at this stage.
   - Tighten the new high-pressure fuel supply lines.

     Torque:
     Stage 1:22 Nm
     Stage 2:25 Nm

9. Install the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

10. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

11. **11.** CAUTION: Bleed the fuel system by cranking the engine to purge the air from the system.

    Bleed the fuel system.

Published: 11-May-2011

Fuel Charging and Controls - TD4 2.2L Diesel - Fuel Pump

Removal and Installation

Removal

- WARNINGS:

Avoid flames, sparks or lighted substances.

Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.

- CAUTIONS:

Make sure that the area around the component is clean and free of foreign material.

Make sure that all openings are sealed. Use new blanking caps.

Bleed the fuel system by cranking the engine to purge the air from the system.

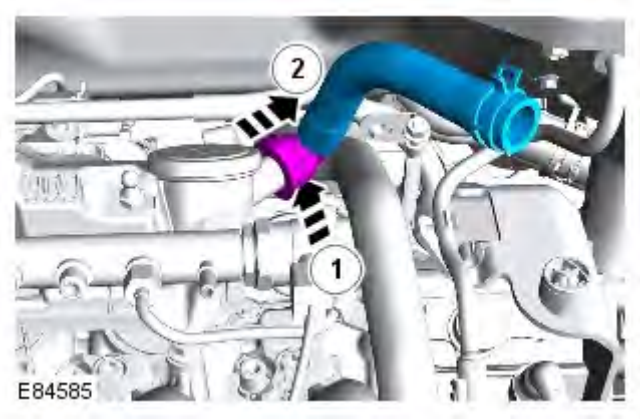
1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



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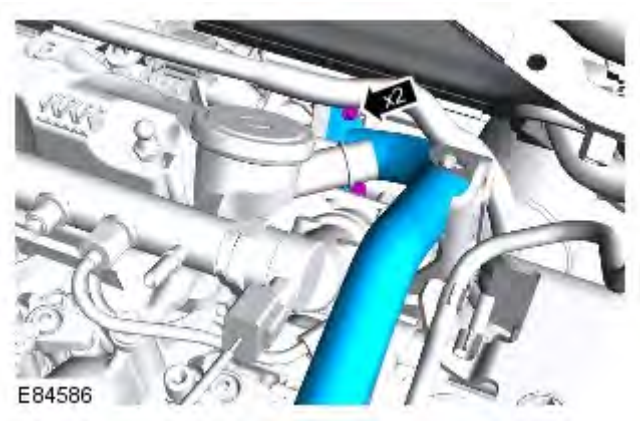
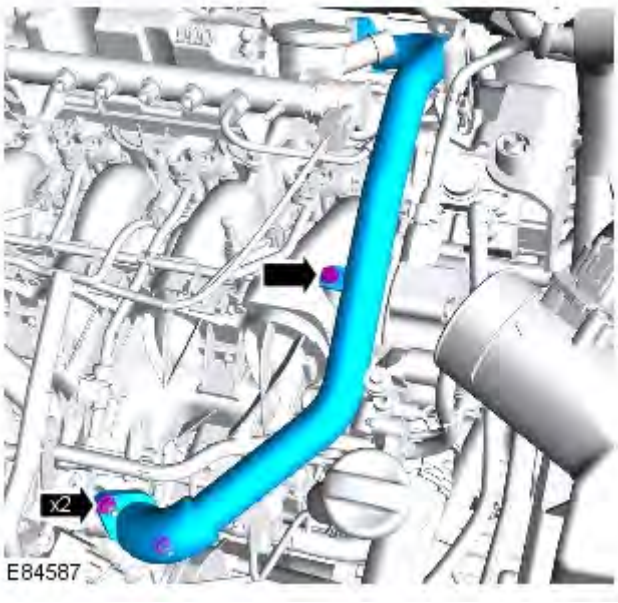
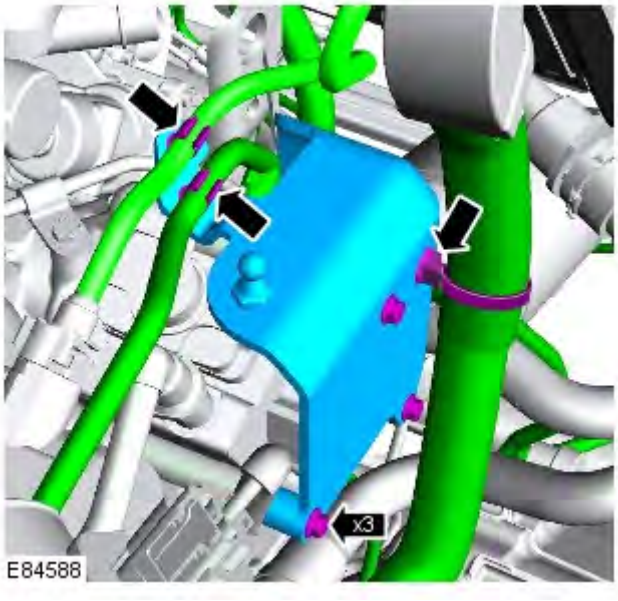




5. **5.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.



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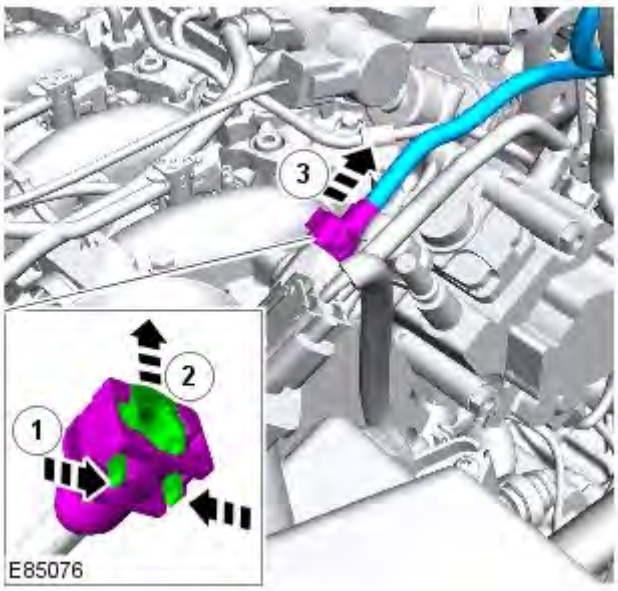
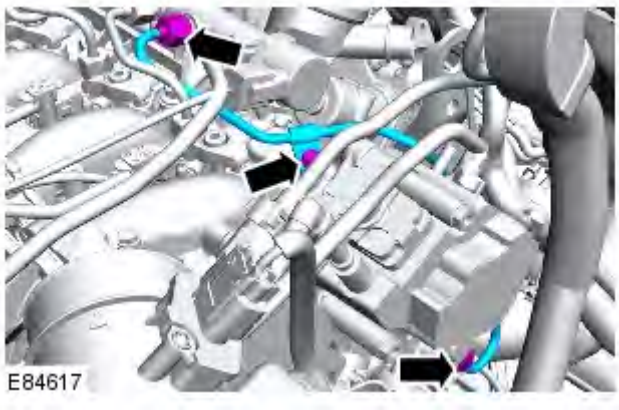


7. **7.** CAUTIONS:

Make sure that the area around the component is clean and free of foreign material.

Make sure that all openings are sealed. Use new blanking caps.



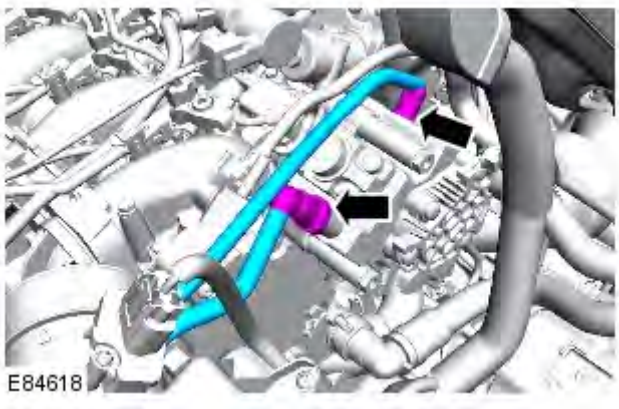
8. **8.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Make sure that all openings are sealed. Use new blanking caps.

   • NOTE: Use an additional wrench to prevent the component from rotating.

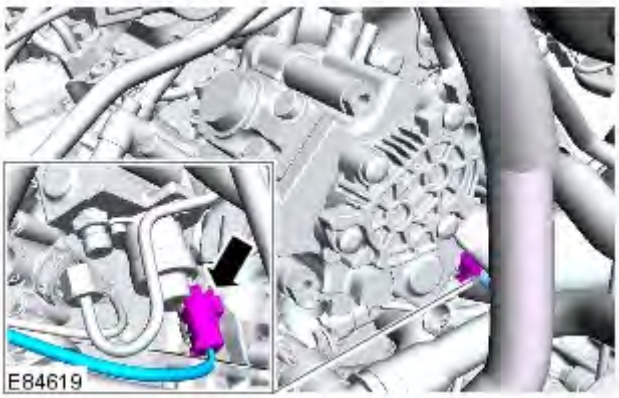
   Release the fuel pump to fuel rail, high-pressure fuel line.



9. **9.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Make sure that all openings are sealed. Use new blanking caps.



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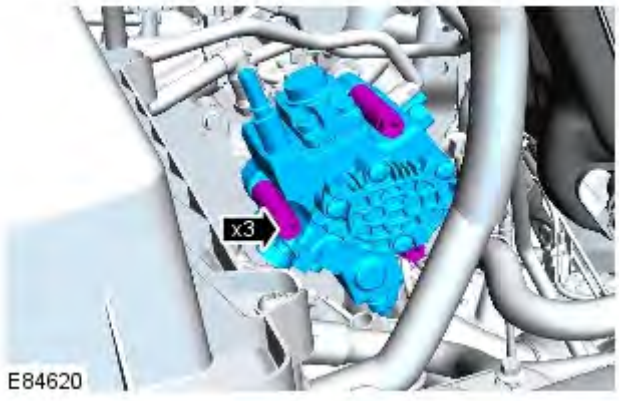
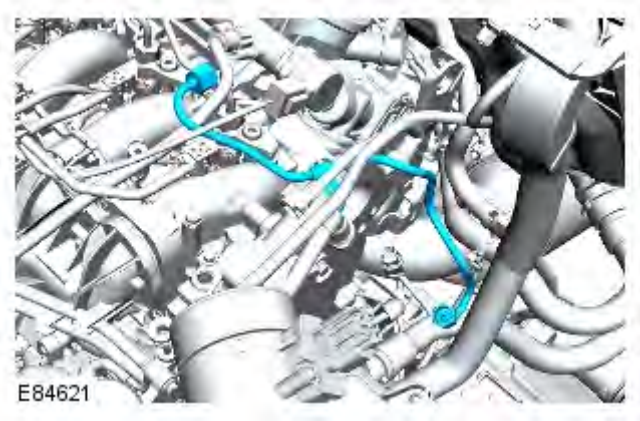


11. **11.** CAUTION: Discard the seal.

    • NOTE: Make sure the fuel pump drive remains captive when removing the fuel pump.



12. Remove and discard the fuel pump to fuel rail, high-pressure fuel line.

Installation

1. **1.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

   Install the new fuel pump to fuel rail, high-pressure fuel line.

2. **2.** CAUTIONS:

   Extreme cleanliness must be exercised when handling this component.

   Install a new seal.

   Install the fuel pump.

   Torque: 22 Nm

3. **3.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

   - Attach the fuel pump to fuel rail high-pressure fuel supply line, but do not fully tighten at this stage.
   - Tighten the high-pressure fuel supply line.

     Torque:
     Stage 1:22 Nm
     Stage 2:25 Nm
   - Install the high-pressure fuel supply line bolt.

     Torque: 8 Nm

4. Connect the brake booster vacuum line.

5. Install the fuel pump bracket.

   Torque: 8 Nm

6. Install the EGR pipe.

   Torque: 10 Nm

7. Install the breather line.

8. Install the engine cover.

Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

9. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

10. **10.** CAUTION: Bleed the fuel system by cranking the engine to purge the air from the system.

    Bleed the fuel system.

Published: 11-May-2011

Fuel Charging and Controls - TD4 2.2L Diesel - Throttle Body

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

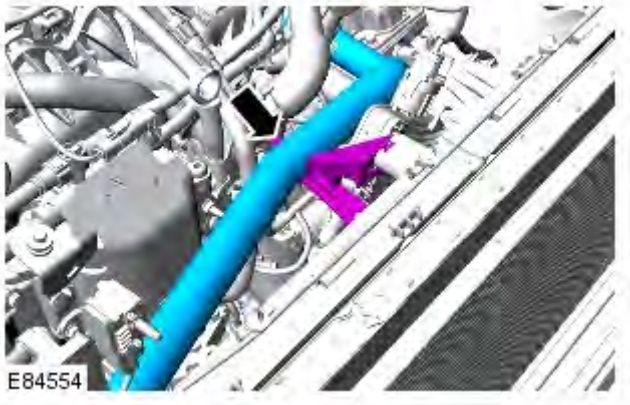
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the manifold absolute pressure (MAP) sensor.

   Refer to: Manifold Absolute Pressure (MAP) Sensor (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Removal and Installation).



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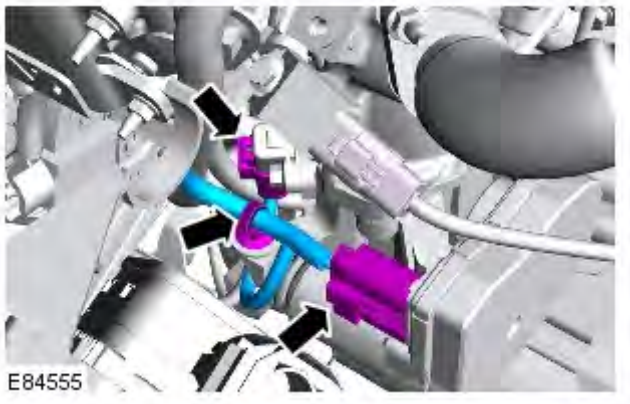

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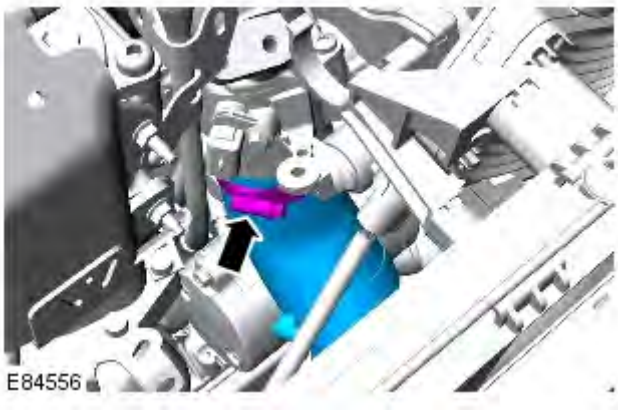
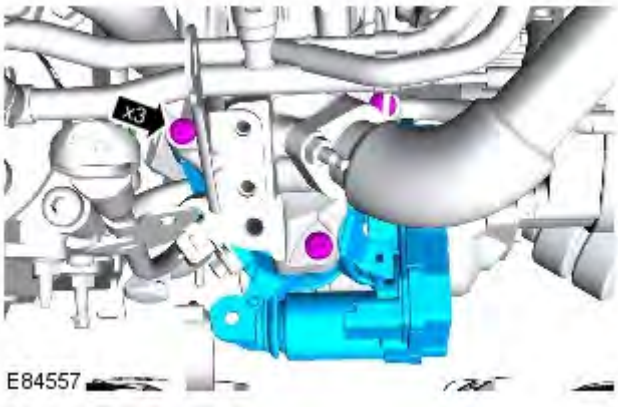


6. **6.** CAUTION: Make sure that all openings are sealed.



7. **7.** CAUTIONS:

   The seal is to be reused unless damaged.

   Make sure that all openings are sealed.

8. **8.** CAUTION: The seal is to be reused unless damaged.

   • NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Install the air temperature sensor.

2. **2.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Install the throttle body and tighten the screws evenly.

   Torque: 9 Nm

3. **3.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

Connect the intake hose and secure with the clip.

4. Connect the electrical connectors.

5. Secure the coolant top hose.

6. Install the MAP sensor.

   Refer to: Manifold Absolute Pressure (MAP) Sensor (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Removal and Installation).

7. Install the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

8. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel -

Turbocharger General Specification

Item	Specification
Type	Variable resistance
Pressure @ 2000rpm	1.1 bar (16 lb/in²)
Pressure @ 3000rpm	1.2 bar (17 lb/in²)

Torque Specifications

Description	Nm	lb-ft
Catalytic converter	25	18
Turbocharger oil return line	10	7
Turbocharger oil feed line bolt -with new oil feed line and bolt fitted		
Turbocharger oil feed line kit part number		
LR019465	17	13
LR006648	24	18
Turbocharger oil feed line bolt - with oil feed line and bolt re-used		
Engine Number		
10DZ584056159 onwards (manual transmission) or 10DZ594055667 onwards (automatic transmission)	17	13
Up to 10DZ584056158 (manual transmission) or up to 10DZ594055666 (automatic transmission)	24	18
Turbocharger heatshield retaining bolts	10	7
Turbocharger bolts*	24	18

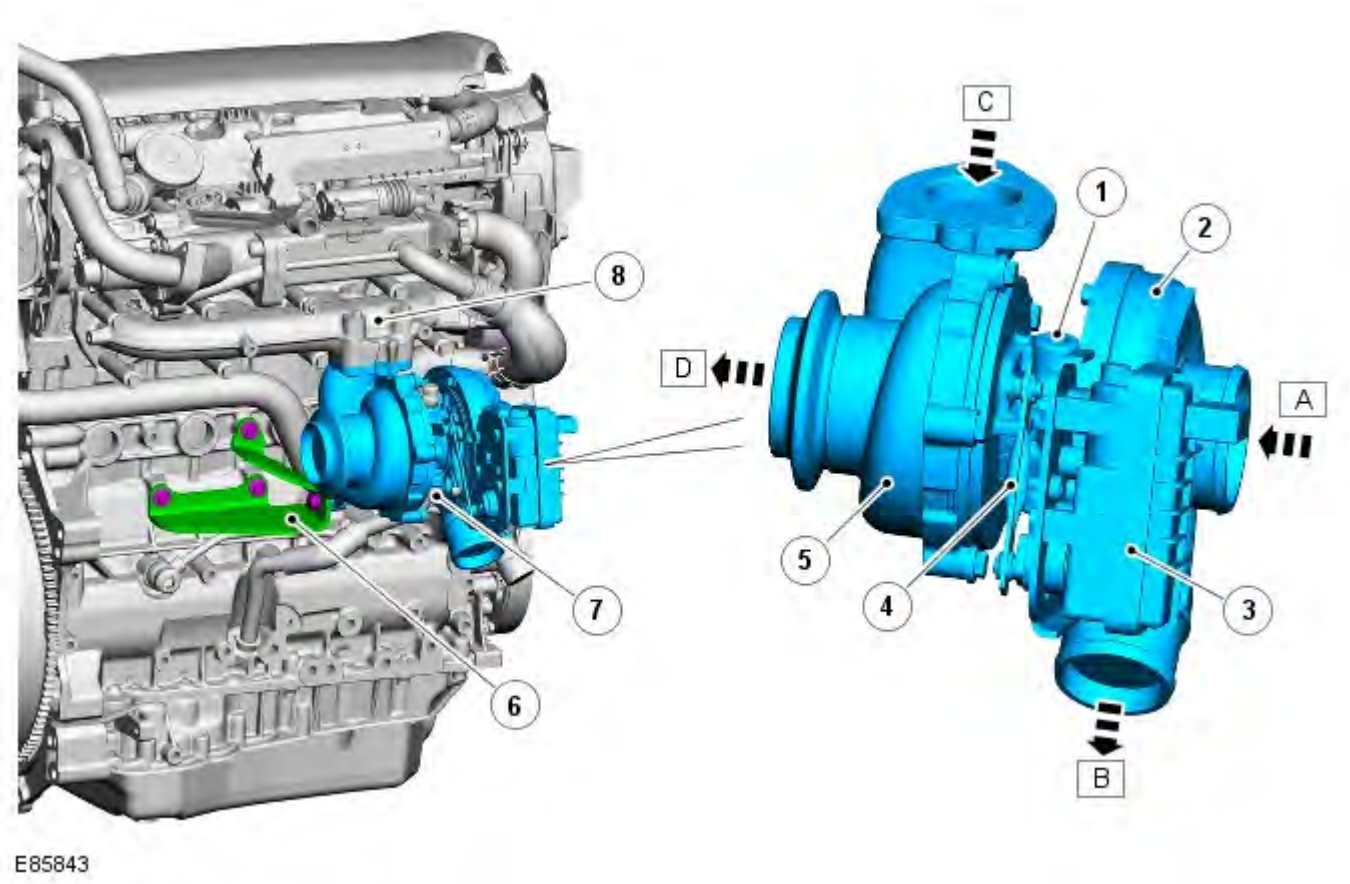
*** New nuts/bolts must be fitted**

Published: 11-May-2011

Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel - Turbocharger

Description and Operation

COMPONENT LOCATION



E85843

Item	Part Number	Description
A	-	Intake air from air filter
B	-	Compressed air to charge air cooler
C	-	Exhaust gas inlet
D	-	Exhaust gas outlet
1	-	Oil supply pipe
2	-	Compressor housing
3	-	Rotary Electronic Actuator (REA)
4	-	Variable vane actuator linkage
5	-	Turbine housing
6	-	Turbocharger support bracket
7	-	Oil return pipe
8	-	Exhaust manifold

OVERVIEW

The TD4 engine features a Garrett Rotary Electronic Actuated (REA) variable geometry turbocharger. The turbocharger is mounted to the exhaust manifold on the Right-Hand (RH) side of the engine, and secured to the cylinder block with a bracket. An oil pipe with banjo type fixing is attached between an outlet on the RH side of the cylinder block and the top of the turbocharger housing, and provides pressurized oil to the turbocharger bearings. An oil pipe attached to the bottom of the turbocharger is connected to the oil pan housing, and directs return oil from the turbocharger into the oil pan. A heat shield is installed over the turbocharger and exhaust manifold to protect other components, and to prevent accidental contact with the hot exhaust components.

The turbocharger comprises a turbine and compressor wheel mounted on a common shaft, enclosed within a cast housing. The common shaft is supported on 2 semi-floating bearings. The cast housing forms 2 chambers that closely surround the turbine and compressor wheels. The turbine wheel is positioned between the exhaust gas flow from the engine and the exhaust system. The compressor wheel is positioned in the intake air flow between the air filter and outlet to the charge air cooler.

During turbocharger operation, the turbine and compressor shaft may reach speeds in excess of 200,000 rpm, and produce a charge air (boost) pressure of up to 1.7 bar (25 psi). A pre-turbine pressure of 3 bar (44 psi) and a temperature of 800°C (1472°F) may be generated inside the turbine chamber.

A REA is attached to the compressor housing, and is connected via a linkage to a rotary adjusting ring located within the turbine housing. The internal circumference of the rotary adjusting ring houses a set of radial variable vanes. The variable vanes are positioned to intercept the exhaust gas flow from the engine, ahead of the turbine wheel.

The REA is directly controlled by the Engine Control Module (ECM). The ECM constantly controls the position of the actuator using input information from various engine and vehicle mounted sensors. A feed back sensor within the REA continuously informs the ECM of the actuator position during turbocharger operation. In the event that the variable vanes fail to reach the requested position, a Diagnostic Trouble Code (DTC) is stored in the ECM memory.

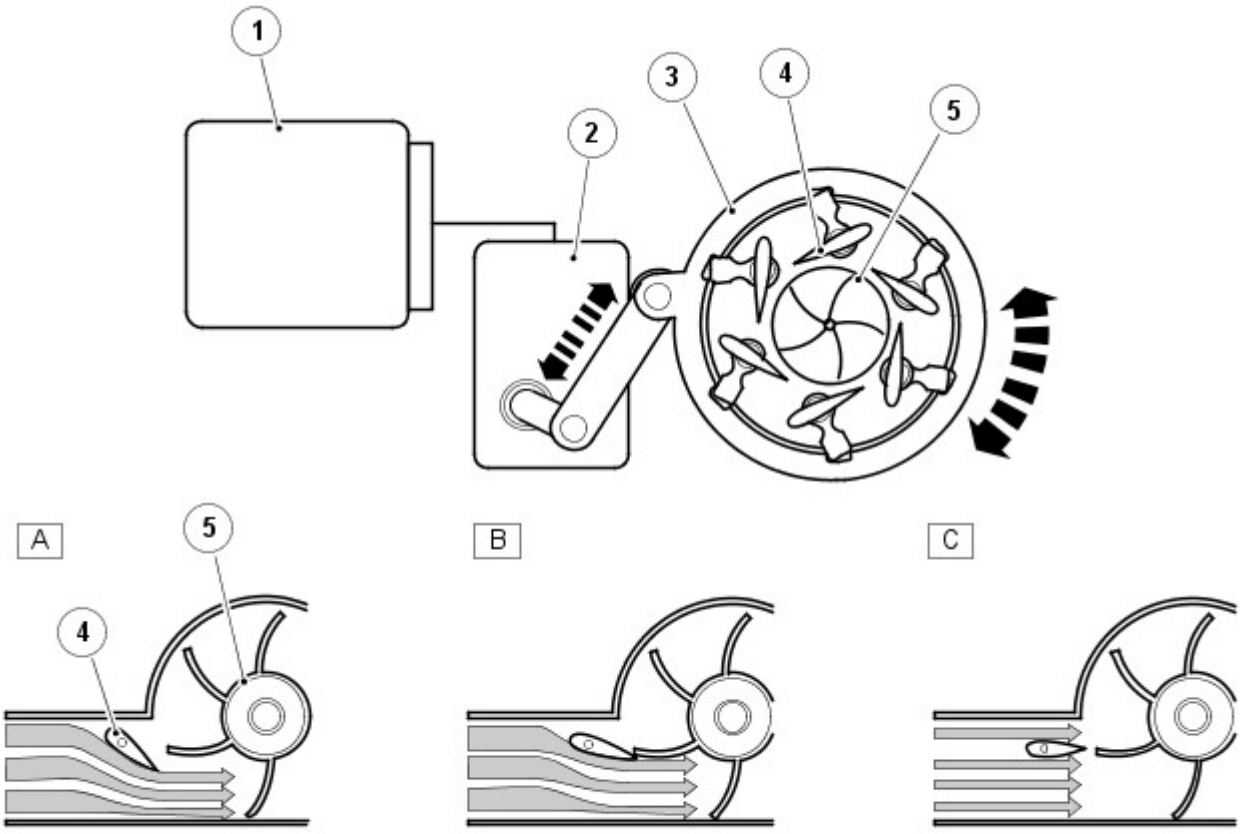
PRINCIPLES OF OPERATION

The turbocharger uses the energy of the exhaust gas flow from the engine to provide compressed (charged) air to the intake air system. The variable geometry vanes make sure the turbocharger produces the required level of intake air boost pressure for the current engine operating conditions.

The turbocharged engine provides the following advantages over a conventional naturally aspirated engine:

- Greater volumetric efficiency
- Improved engine power and torque
- Reduced fuel consumption
- Reduced emissions
- Re-use of exhaust gas energy
- Un-affected by altitude
- Limited periods of over-boost for immediate engine demands.

Typical Rotary Electronic Actuated Turbocharger



E80503

Item	Part Number	Description
A	-	Low engine speed
B	-	Moderate engine speed
C	-	Maximum engine speed
1	-	ECM
2	-	Rotary Electronic Actuator
3	-	Rotary adjusting ring
4	-	Variable vanes
5	-	Turbine wheel

In response to signals from various sensors, the ECM controls the REA to operate the rotary adjusting ring. Movement of the adjusting ring alters the pitch angle of the variable vanes to deflect the flow of exhaust gas onto the inside center or outside edge of the turbine wheel.

The maximum position of the turbocharger variable vanes (fully open) is also the emergency default position in the event of an electrical fault. The REA will move the variable vanes to the fully open position to prevent engine damage due to excessive boost pressure.

A - Low Engine Speed

At low engine speed the volume of exhaust gas leaving the engine is low. The vanes are moved toward the closed position to direct the exhaust gas flow to the outside edge of the turbine wheel. The closed position of the vanes creates a restriction to the gas flow and increases the gas velocity to the turbine wheel. The turbine wheel speed is increased, consequently producing more charge air (boost pressure) from the compressor.

B - Moderate Engine Speed

As engine speed and exhaust gas volume increase, the vanes are moved to the open position to direct the exhaust gas flow toward the center of the turbine wheel. The vanes do not restrict the exhaust gas flow and therefore exhaust gas velocity is dependant on engine speed. The turbine wheel speed is maintained due to the increased velocity of the gases leaving the engine and being directed toward the center area of the turbine wheel.

C - Maximum Engine Speed

At maximum engine speed the volume of exhaust gas leaving the engine is high. The vanes are moved toward the fully open position and do not affect the gas velocity. The exhaust gas flow contacts the center area of the turbine wheel to maintain the turbine wheel speed and boost pressure from the compressor.

Over-Boost Pressure

During periods of medium to hard acceleration, the turbocharger is required to produce a limited period of over-boost pressure from the compressor to meet the current engine fueling requirement. The ECM will request and allow the REA to move the variable vanes toward the closed position to increase the velocity of the already high-speed turbine wheel. The over-boost condition is allowed by the ECM for the limited period.

Barometric Pressure Sensor

At high altitude the turbocharger will function normally, but due to the lower ambient air pressure the turbine and compressor may tend to over-speed. A barometric pressure sensor is located in the ECM to prevent over-boost and possible engine damage occurring under these conditions. The ECM opens the variable vanes earlier during the opening phase to suit the altitude of the vehicle.

Turbocharger Lubrication

The rapid acceleration and deceleration demands of the turbocharger rely on a steady flow of clean oil. The oil supplied by the engine lubrication system provides lubrication to the turbocharger shaft and bearings, while also acting as a coolant for the turbocharger center housing.

To maintain the life expectancy of the turbocharger, the engine oil must be replenished at regular service intervals with the recommended quality and quantity of oil. The oil must have a free-flow through the turbocharger and an unrestricted return to the engine oil pan.

Published: 11-May-2011

Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel - Turbocharger Actuator Rod

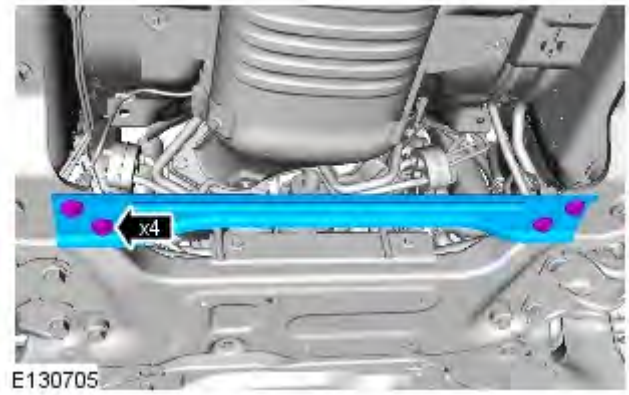
Removal and Installation

Removal

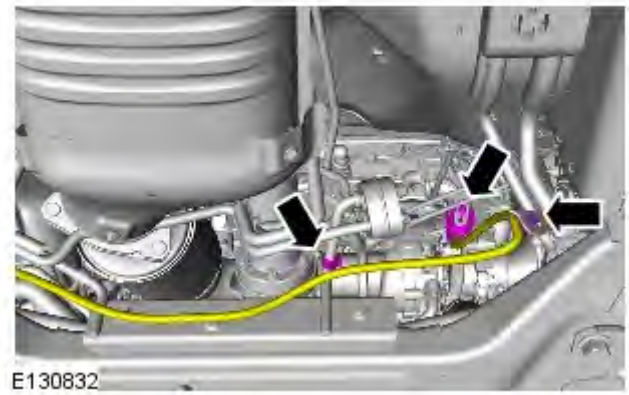
- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

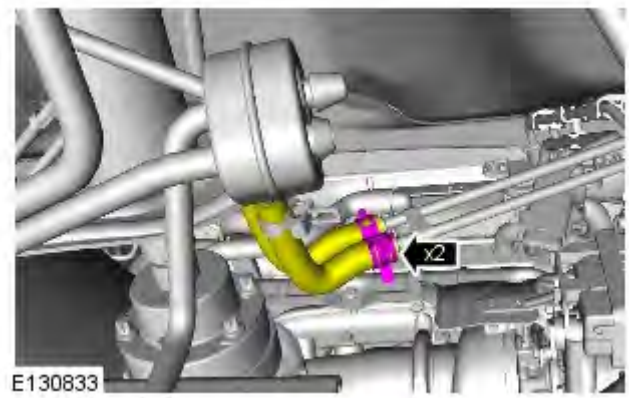
   Raise and support the vehicle.



2. *Torque:* 25 Nm

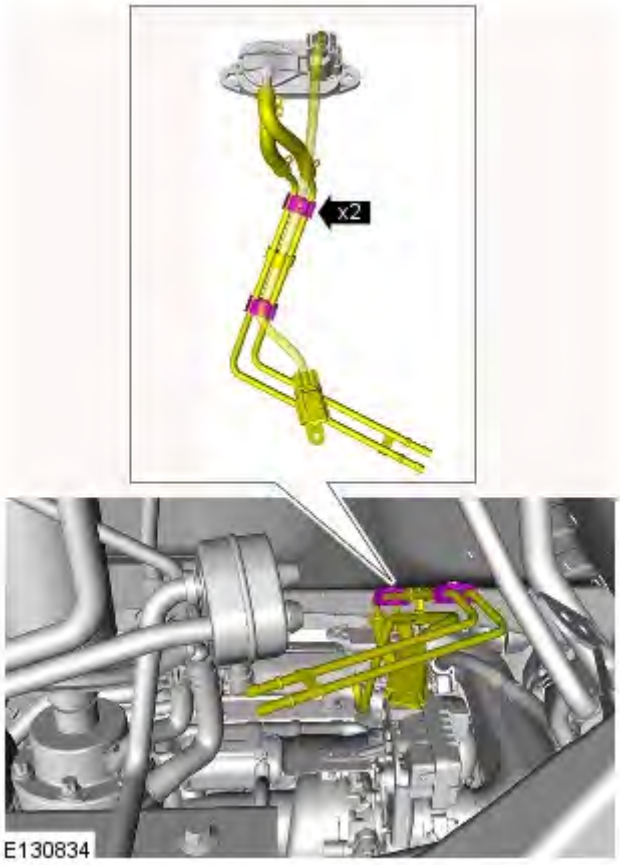


3. **3.** NOTE: Vehicles fitted with diesel particulate filter (DPF)



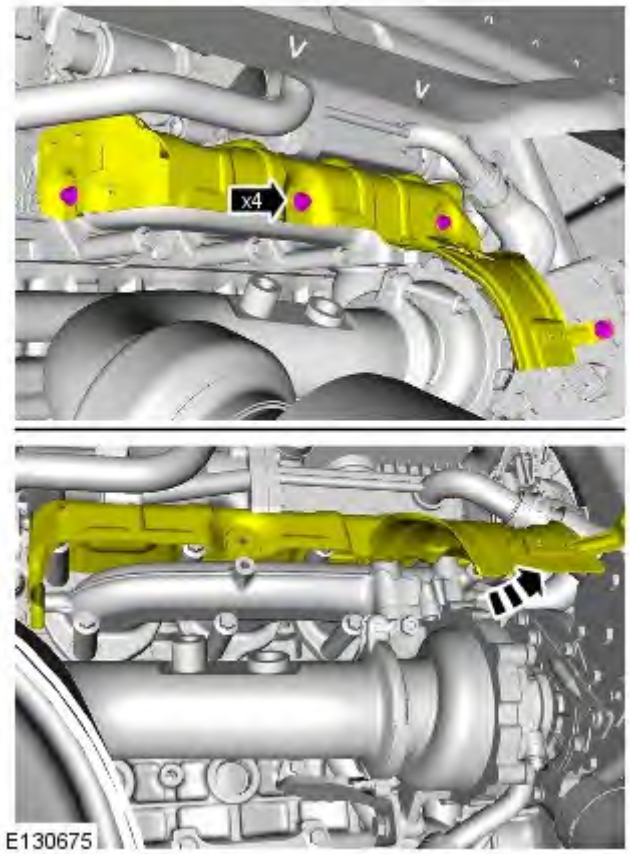
4. **4.** NOTE: Note the position of the hoses.

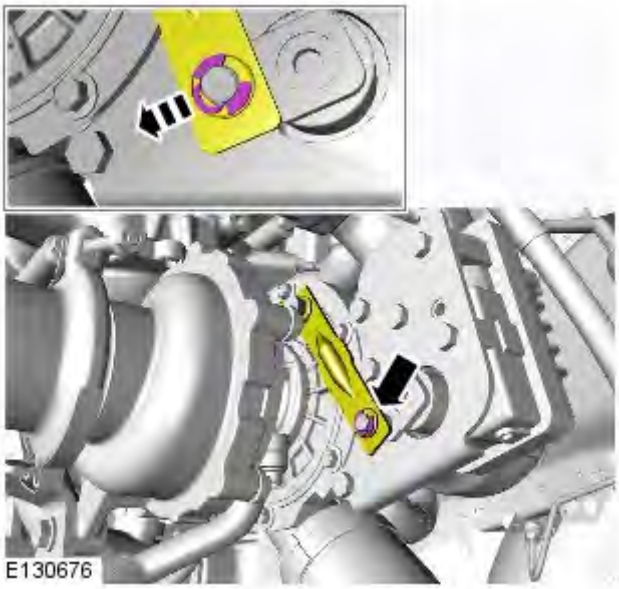
5.



6. **6.** NOTE: All vehicles.

Torque: 10 Nm





7. **7.** CAUTIONS:

   Do not apply sufficient force to deform the turbocharger variable vane actuator crank components.

   Do not apply rotational force to the turbocharger variable vane actuator crank during removal, as the worm gear can be damaged.

   - It may be necessary to place a suitable tool between the crank shoulder and the actuator rod, and leaver from side to side.

8.

- • NOTE: This may be difficult on the first few cycles due to internal carbon build up.

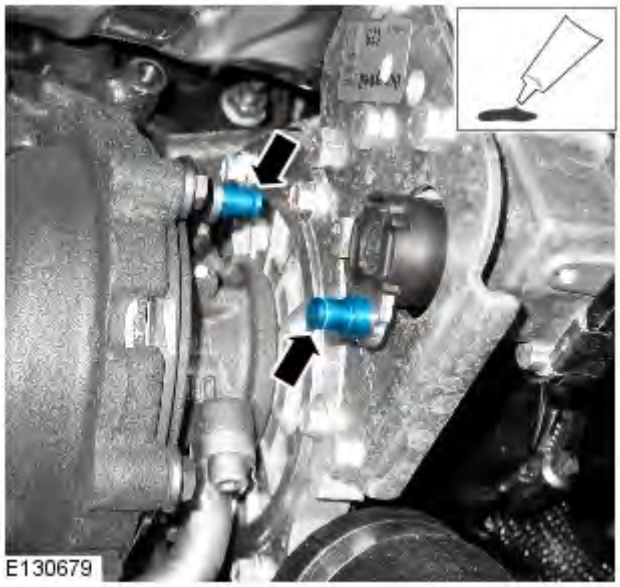
  Using finger pressure, cycle the turbocharger variable vane actuator mechanism to make sure movement is sufficient.
- Cycle 10-20 times as necessary to clear movement.

9. **9.** CAUTION: Do not use excessive force, or lever against the crank arm, as this may bend the crank arm, or damage the turbo mechanism.

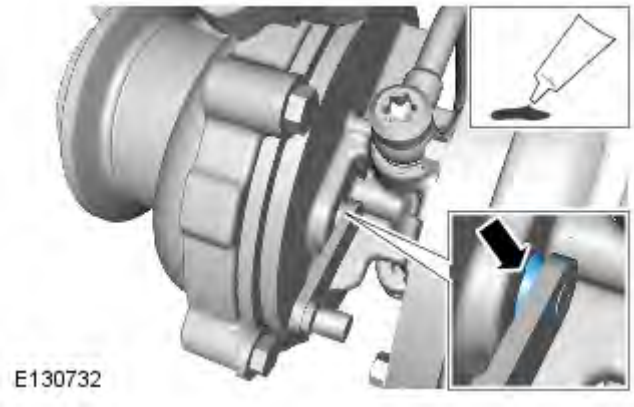
   - Use penetrating lubricant spray as required.

10. **10.** NOTE: It may be necessary to use a very fine wet and dry paper to polish and remove corrosion.
    - Apply penetrating oil to both turbo and actuator pins.
    - Clean the pin surfaces.

Installation



1.
    - Apply specified high temperature lubricant (Landrover Part No. LR029042) to both pins, making sure they are completely covered.



2.
    - Apply specified high temperature lubricant (Landrover Part No. LR029042) to the internal bush interface with the turbocharger.

3. **3.** NOTE: Install new retaining clips.

   • NOTE: Rotate the new retaining clips in the grooves with a suitable tool to check for correct installation.

   • NOTE: Apply grease over the actuator pins, and the actuator connections to protect.

   To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel - Turbocharger

Removal and Installation

Removal

WARNING: Observe due care when working near a hot exhaust system.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

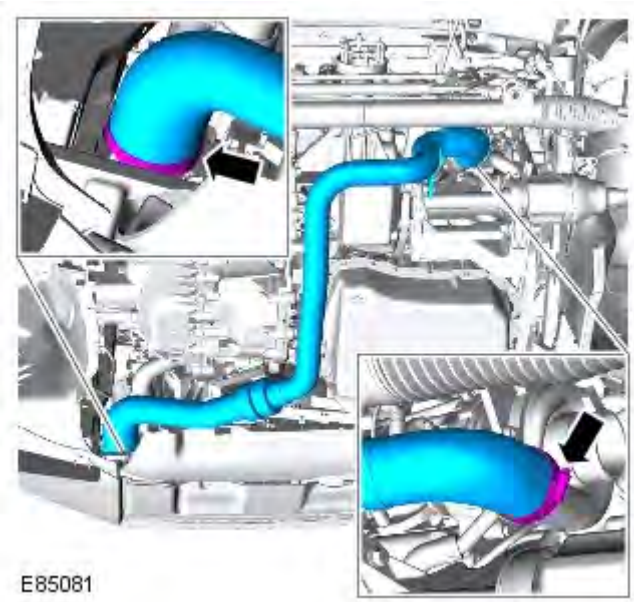
   Raise and support the vehicle.

2. Remove the exhaust gas recirculation (EGR) cooler.

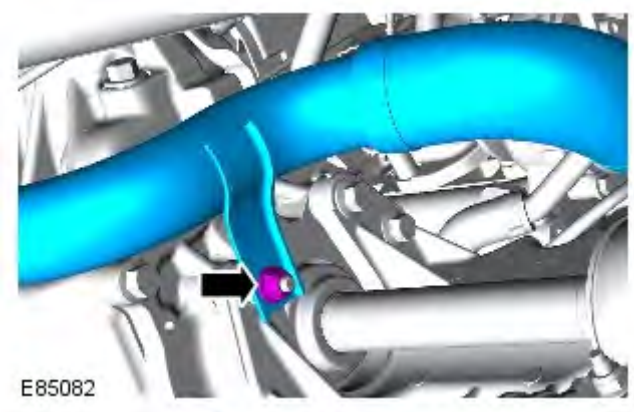
   Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08B Engine Emission Control - TD4 2.2L Diesel, Removal and Installation).

3. Remove the catalytic converter.

   Refer to: Catalytic Converter - Vehicles Without: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).



4. **4.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.



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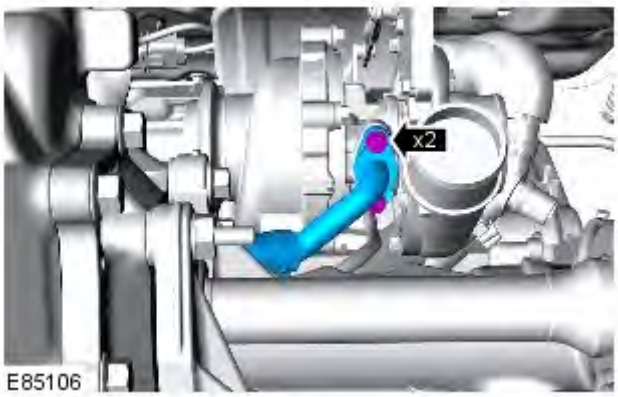
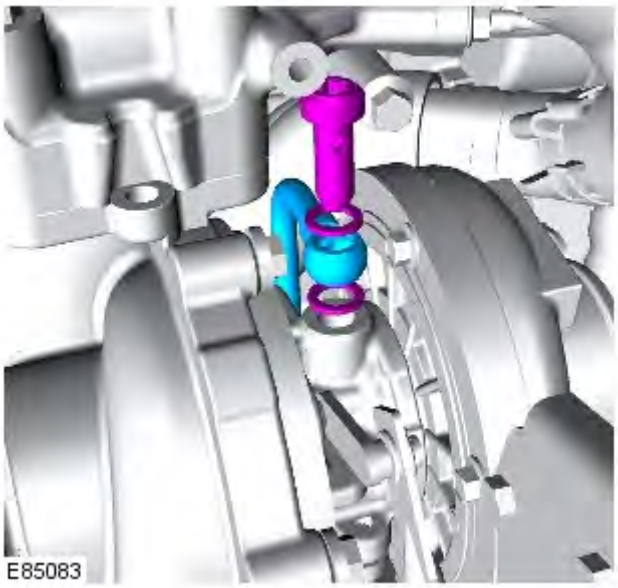
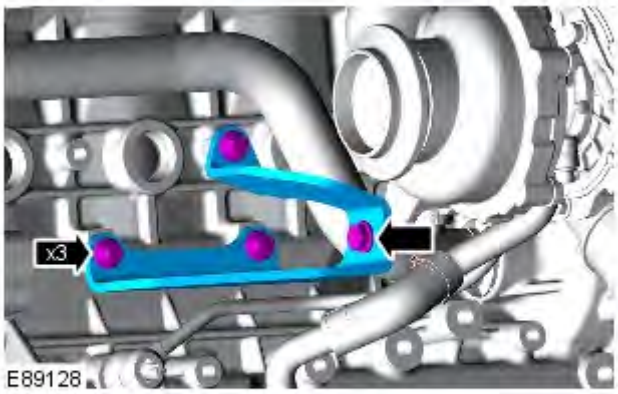


6. **6.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.



7. **7.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.



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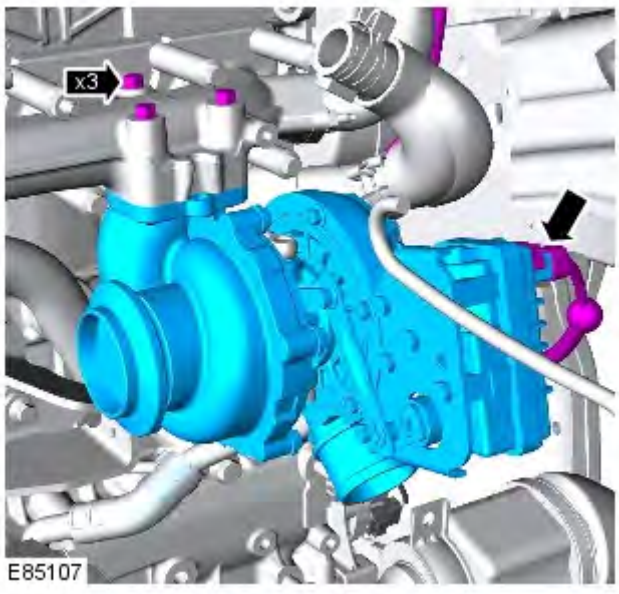


9. **9.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.

Installation

1. **1.** CAUTIONS:

   Make sure that the component is clean, free of foreign material and lubricant.

   Make sure that new bolts are installed.

   Install the turbocharger.

   Torque: 24 Nm

2. - Install the turbocharger support bracket, but do not fully tighten at this stage.
   - Tighten the support bracket to turbocharger bolt.

     Torque: 24 Nm
   - Tighten the support bracket to cylinder block bolts.

     Torque: 24 Nm

3. **3.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Make sure that new sealing washers are installed.

   • NOTE: For the turbocharger oil feed pipe bolt torque figure, refer to the specifications section.

   Connect the turbocharger oil feed pipe.

   Refer to: Specifications (303-04C Fuel Charging and Controls - Turbocharger - TD4 2.2L Diesel, Specifications).

4. **4.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

   • NOTE: Install a new gasket.

   Connect the turbocharger oil return pipe.

Torque: 10 Nm

5. Install the turbocharger outlet pipe.

   Torque: 25 Nm

6. Install the catalytic converter.

   Refer to: Catalytic Converter - Vehicles Without: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

7. Install the EGR cooler.

   Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08B Engine Emission Control - TD4 2.2L Diesel, Removal and Installation).

8. Check and top-up the engine oil.

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol -

Torque Specifications

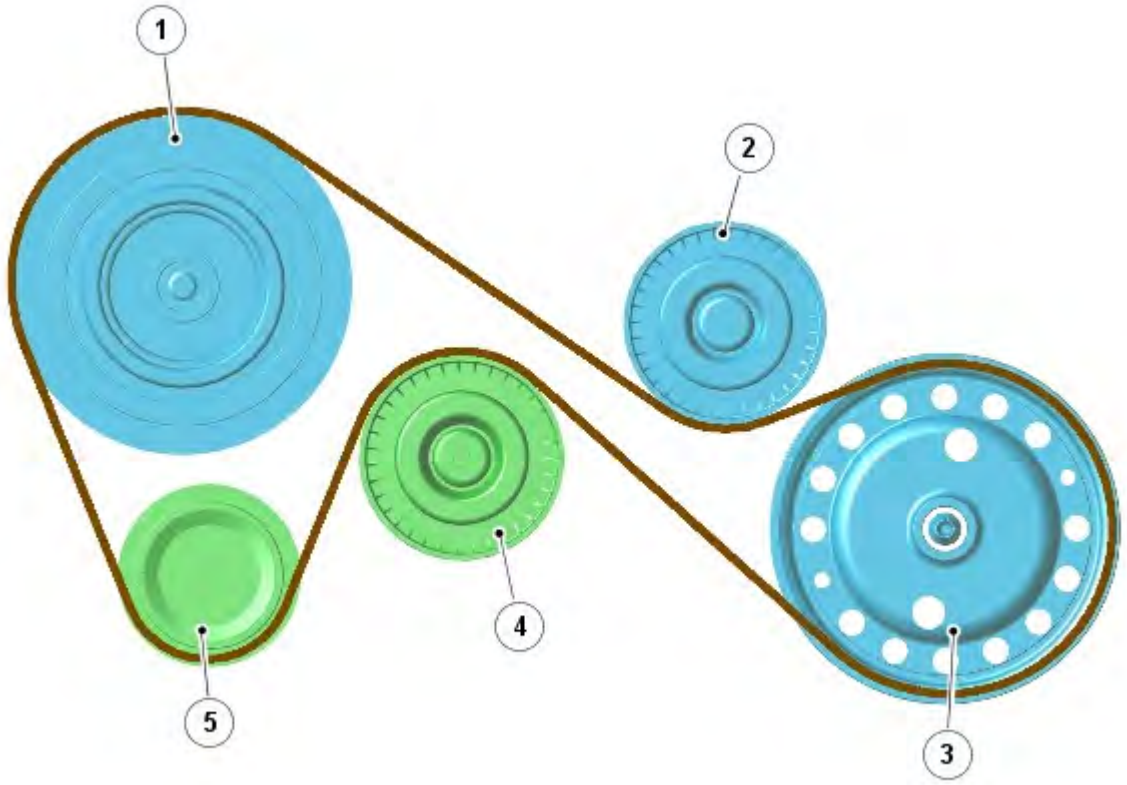
Description	Nm	lb-ft
Accessory drive belt idler pulley bolt	25	18
Accessory drive belt tensioner retaining bolt	25	18
Accessory drive component bracket:		
M10	50	36
M8	24	18
Accessory drive pulley	60	44

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Accessory Drive

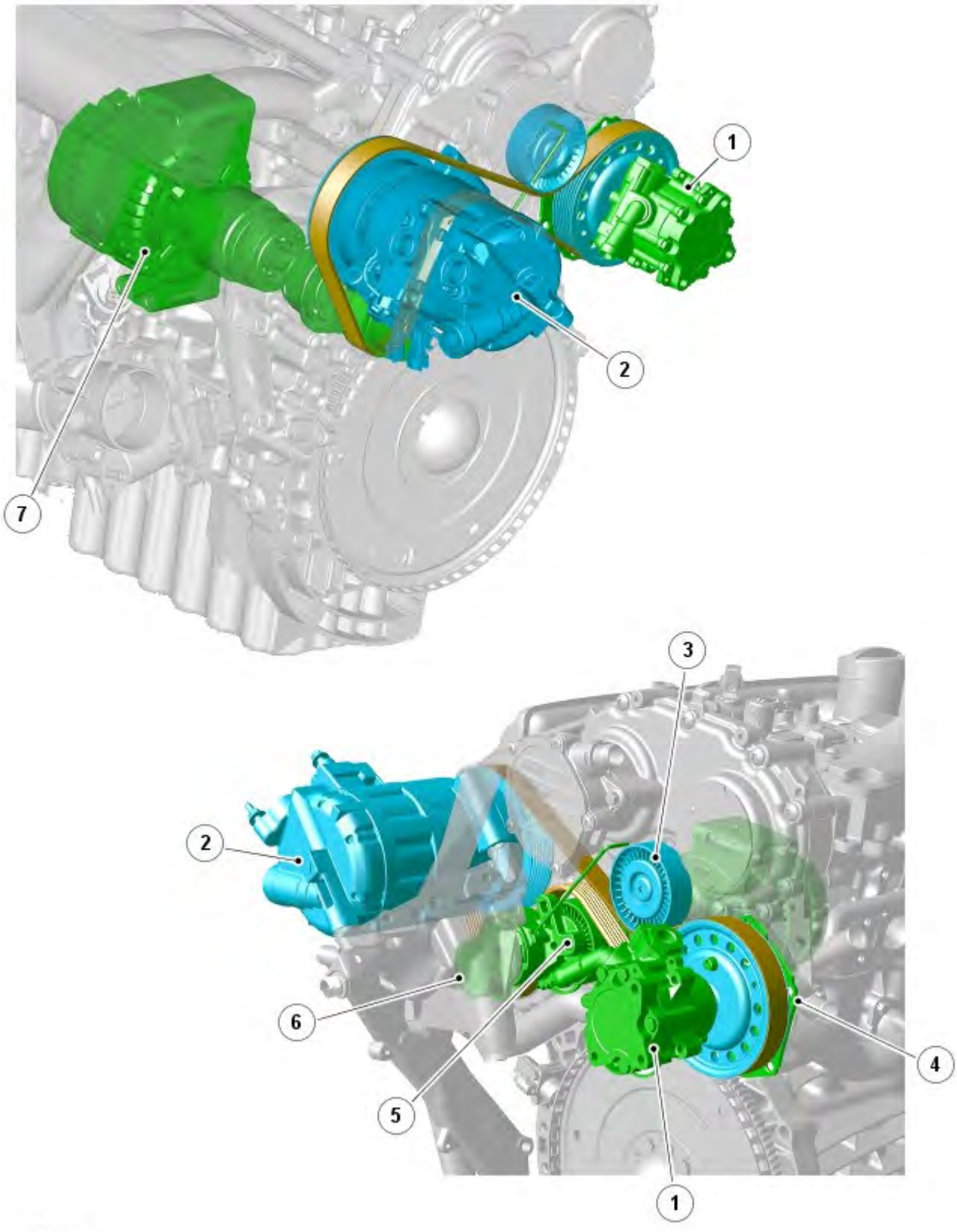
Description and Operation

COMPONENT LOCATION



E79495

Item	Part Number	Description
1	-	Air Conditioning (AC) compressor
2	-	Idler pulley
3	-	Power steering pump and coolant pump pulley
4	-	Adjuster pulley
5	-	Drive pulley



E79496

Item	Part Number	Description
1	-	Power Steering pump
2	-	AC compressor
3	-	Idler pulley
4	-	Coolant pump
5	-	Adjuster mechanism
6	-	Drive pulley
7	-	Generator

OVERVIEW

One of the major innovations to the engine's design is the positioning of the accessory drive and its associated ancillaries

at the rear of the engine. The accessory drive system overhangs the transmission, allowing the front of the engine to be free of protrusions. This unique design contributes to providing a compact and robust engine.

The polyvee accessory drive-belt obtains its drive from a shaft, powered by the crankshaft. The accessory drive-belt powers the:

- AC compressor,
- engine coolant pump, and
- power steering pump

The engine coolant pump and the power-steering pump share a common coupling.

Belt tension is maintained by an automatic tension system which provides a constant tension without belt slip.

The generator is directly attached by a coupling to the rear of the crankshaft driven shaft. This direct drive arrangement improves the generator's durability by preventing side-loadings, caused by the tension of a drive belt, acting on the generator's rotor bearing.

In addition to helping make the engine compact and robust, the novel arrangement of the accessory drive system also aids in reducing engine weight.

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Accessory Drive

Diagnosis and Testing

Principles of Operation

For a detailed description of the Rear End Accessory Drive (READ), refer to the relevant Description and Operation section of the workshop manual.
REFER to: Accessory Drive (303-05A Accessory Drive - I6 3.2L Petrol, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for system integrity and obvious signs of damage.

Visual Inspection

Mechanical
• READ belt • READ belt tension • READ belt tensioner • READ belt pulleys • READ belt pulley seals

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Cause	Action
READ belt noise or squeal	• READ belt pulley(s) • Lubricant or other contamination • READ belt	Check for pulley alignment, freedom of rotation and damage. Repair or install new parts as required. REFER to: Accessory Drive Component Bracket Alignment (303-05A Accessory Drive - I6 3.2L Petrol, General Procedures) / Accessory Drive Belt Idler Pulley (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation) / Accessory Drive Pulley (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation). Check READ belt for contamination. If contaminated, install a new belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation). Check READ belt for correct application
READ belt does not hold tension	• READ belt cracking or damaged • Tensioner worn or damaged	Inspect READ belt for cracking or damage. Install a new belt as required. REFER to: Accessory Drive Belt (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation). Check READ belt tensioner for damage and correct operation. Install a new READ belt tensioner as required. REFER to: Accessory Drive Belt Tensioner (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

Component Tests

READ belt tensioner

Static

The only checks required for the READ belt tensioner are for stick, grab or bind.

1. **1.** Remove the drive belt in the area of the tensioner.
2. **2.** Using the correct tool, rotate the tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.
3. **3.** If the tensioner meets the above criteria, proceed to the dynamic test. If the tensioner does not meet the above criteria install a new tensioner.
   REFER to: Accessory Drive Belt Tensioner (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

Dynamic

The READ belt tensioner can be checked dynamically as follows:

With the engine running, observe drive belt tensioner movement, the READ belt tensioner should move (respond) when the air conditioning clutch cycles (if equipped), the READ belt tensioner should move (respond) when the engine speed is increased rapidly. If the drive belt tensioner movement is erratic without air conditioning clutch cycling or engine acceleration, a pulley or shaft may be bent, or distorted. Excessive drive belt rideout (uneven depth of grooves in the drive belt) can also cause excessive drive belt tensioner movement. Check condition by installing a known good belt.
REFER to: Accessory Drive Belt (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

READ belt

1. **1.** With the engine off, check routing of the drive belt.
   REFER to: Accessory Drive (303-05A Accessory Drive - I6 3.2L Petrol, Description and Operation).

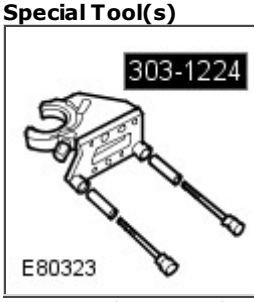
2. **2.** Inspect the drive belt tensioner wear indicator to confirm the drive belt is within operating range. Install a new drive belt as necessary .
   REFER to: Accessory Drive Belt (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Accessory Drive Component Bracket Alignment

General Procedures

Special Tool(s)

	303-1224 Aligner, A/C Bracket

• NOTE: This procedure is to be used where an accessory drive belt alignment or accessory drive component bracket alignment is required.

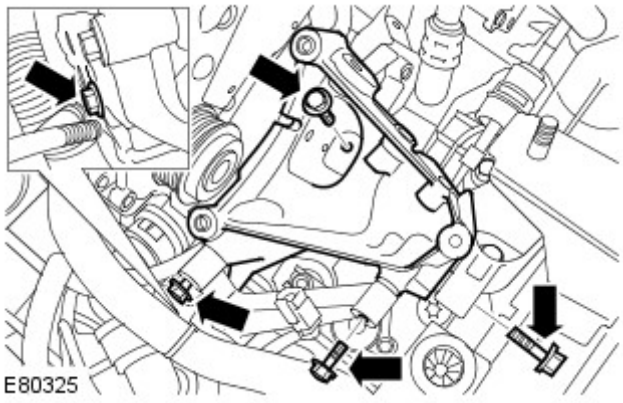
1. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

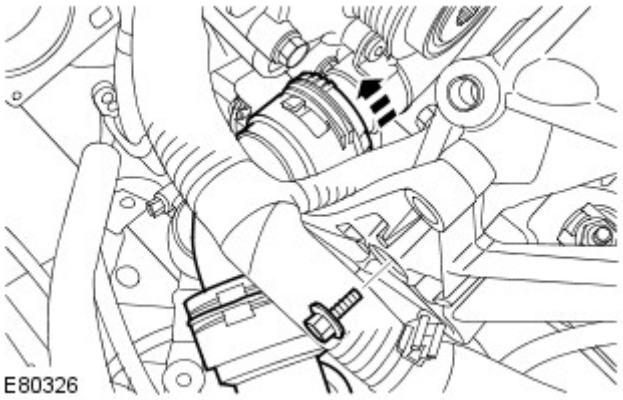
2. Remove the LH engine mount.

   Refer to: Engine Mount LH (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

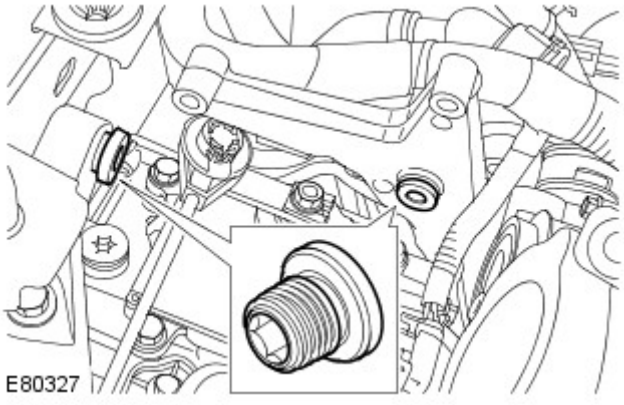
3. Raise and support the transmission to gain access to the engine mount bracket adjuster.



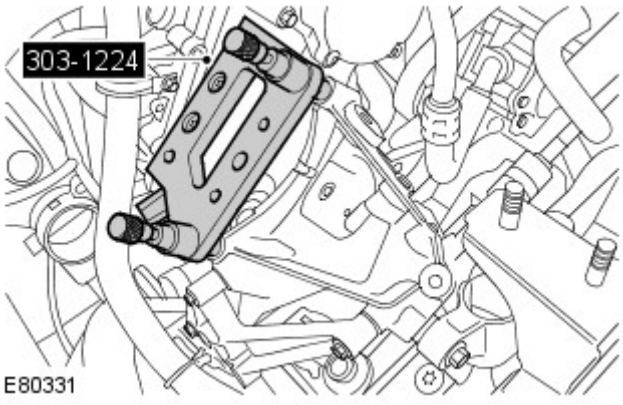
4. Release the bracket.



5. Disconnect the coolant hose, to enable removal of the bolt.

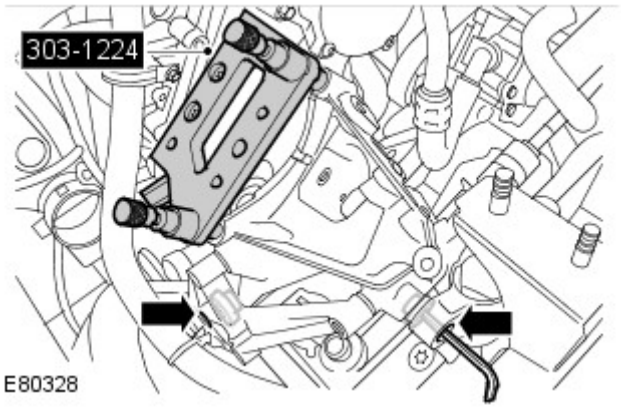


6. Back-off both adjusters.



7. Check the alignment of the bracket using the special tool.

   Special Tool(s): 303-1224



8. Set both adjusters as required.

9. Install the A/C compressor mounting bracket.

   Torque:
   M10 45 Nm
   M8 25 Nm

10. Connect and secure the coolant hose.

11. Install the LH engine mount.

    Refer to: Engine Mount LH (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

12. Refill the cooling system.

    Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Accessory Drive Belt

Removal and Installation

Removal

1. Remove the engine cover.

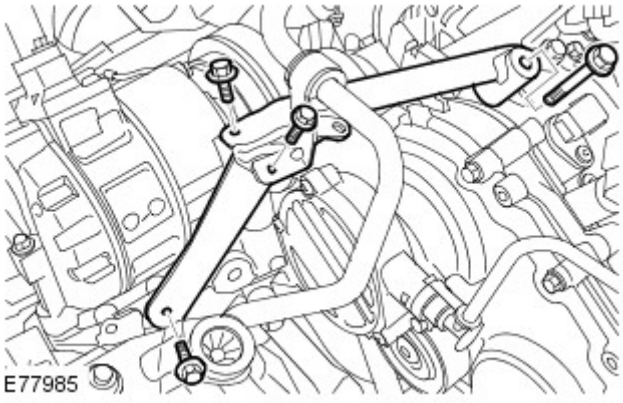
   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove the battery tray.

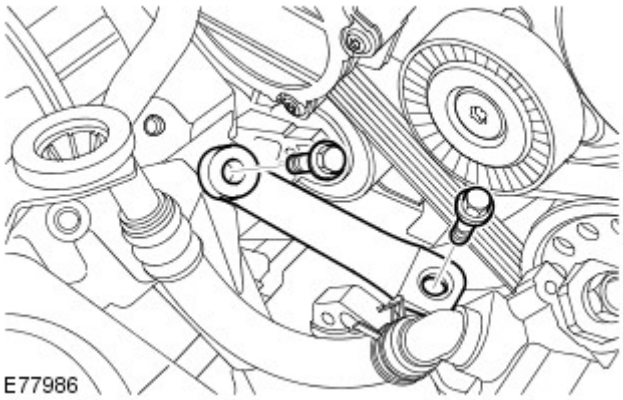
   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

3. Remove the air cleaner assembly.

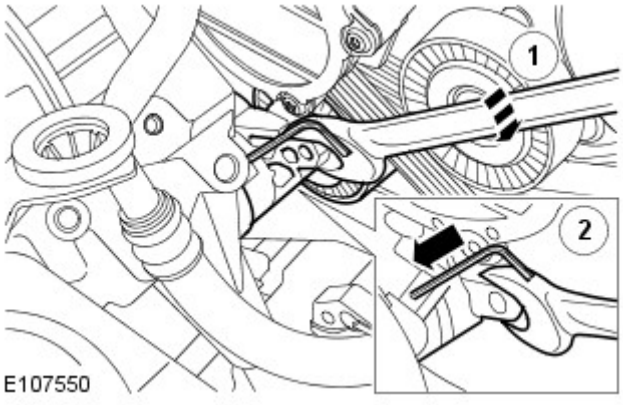
   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).



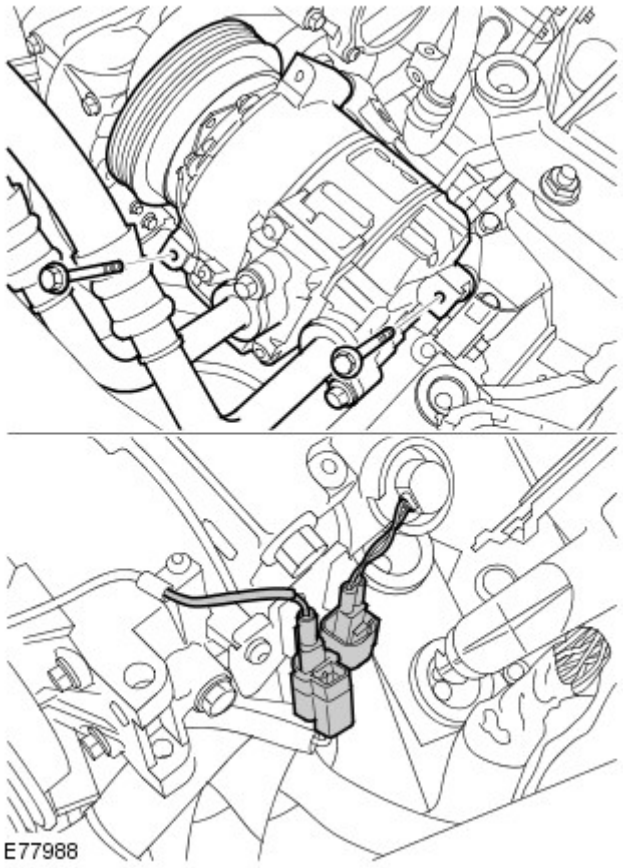
4. Remove the A/C compressor, upper support bracket.



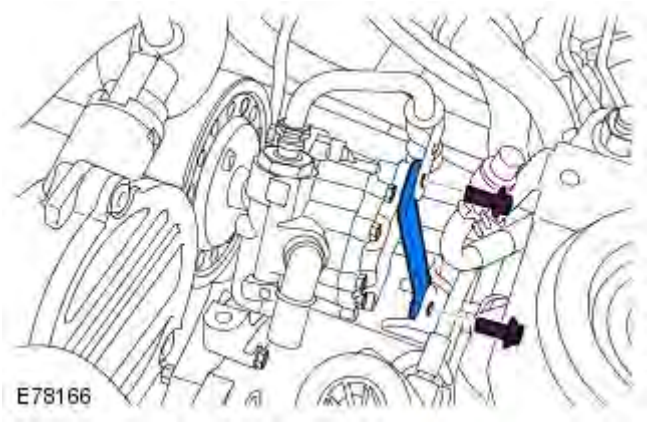
5. Remove the A/C compressor, lower support bracket.



6. Using suitable tools, release the accessory drive belt tension.



7. Release the A/C compressor and position aside.

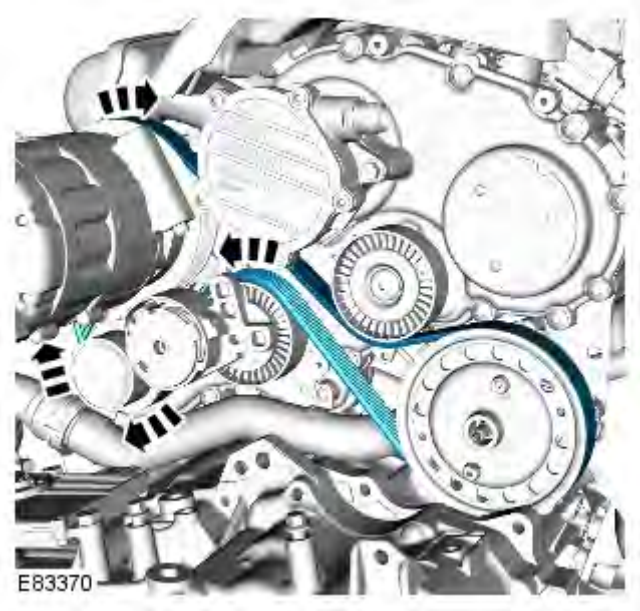


8. **8.** CAUTION: Note the fitted position of the component prior to removal.

   Release the PAS pump.

9. Remove the accessory drive belt.

Installation



1. Install the accessory drive belt.

2. **2.** NOTE: Make sure that the component is installed to the position noted on removal.

   Install the PAS pump.

   Torque: 25 Nm

3. Install the A/C compressor.

   Torque: 25 Nm

4. Install the accessory drive belt.

5. Install the A/C compressor, lower support bracket.

   Torque: 25 Nm

6. Install the A/C compressor, upper support bracket.

   Torque:
   M10 45 Nm
   M8 25 Nm
   M6 10 Nm

7. Install the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

8. Install the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

9. Install the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Accessory Drive Belt Tensioner

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

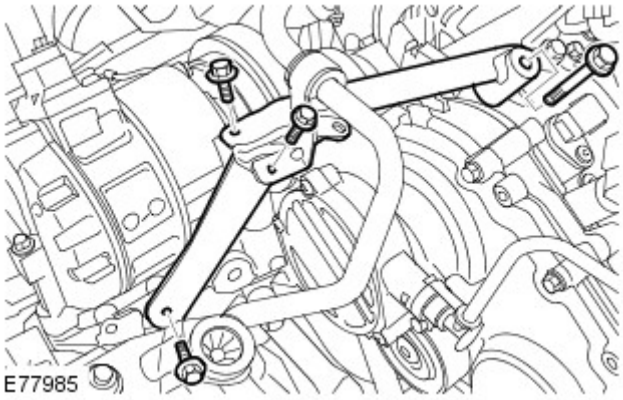
   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the battery tray.

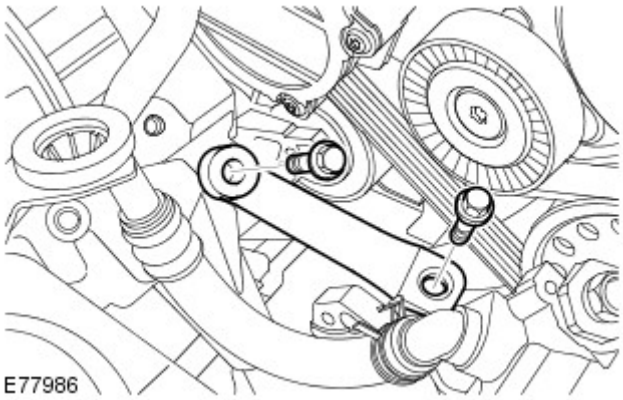
   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

4. Remove the air cleaner assembly.

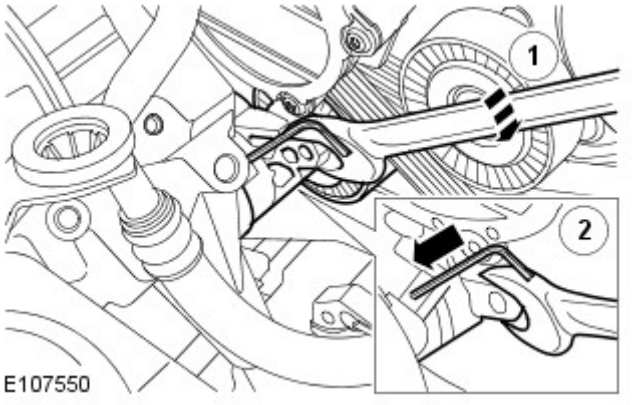
   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).



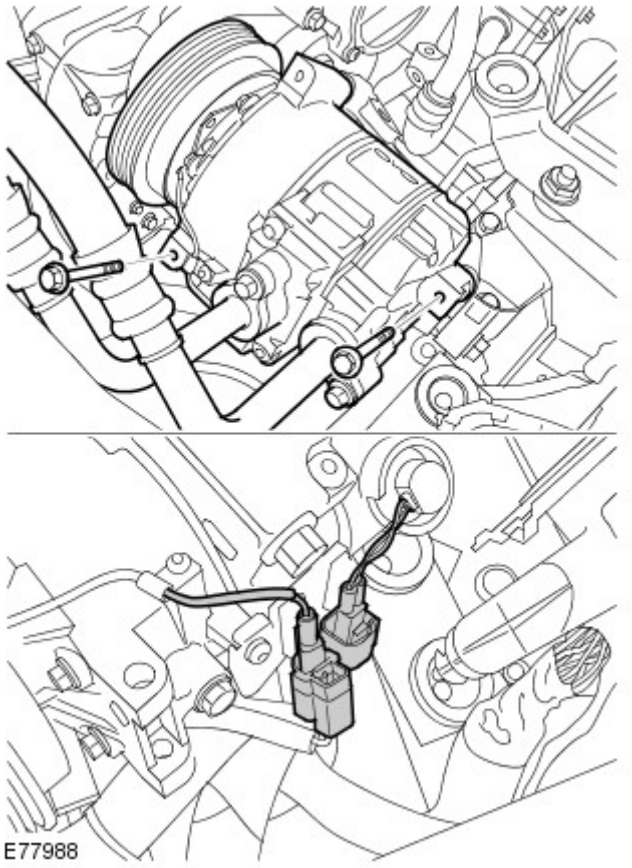
5. Remove the A/C compressor, upper support bracket.



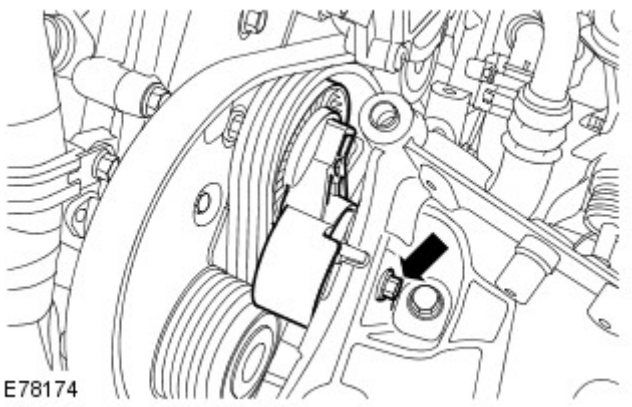
6. Remove the A/C compressor, lower support bracket.



7. Using suitable tools, release the accessory drive belt tension.



8. Release the A/C compressor and position aside.



9. Remove the accessory drive belt tensioner.

Installation

1. **1.** NOTE: Make sure that the component is installed to the position noted on removal.

Install the accessory drive belt tensioner.

Torque: 25 Nm

2. Install the A/C compressor.

   Torque: 25 Nm

3. Install the accessory drive belt.

4. Install the A/C compressor, lower support bracket.

   Torque: 25 Nm

5. Install the A/C compressor, upper support bracket.

   Torque:
   M10 45 Nm
   M8 25 Nm
   M6 10 Nm

6. Install the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

7. Install the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

8. Install the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

9. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Accessory Drive Belt Idler Pulley

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

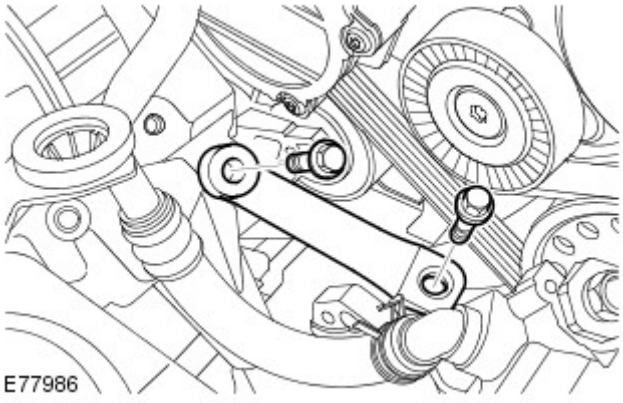
   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the battery tray.

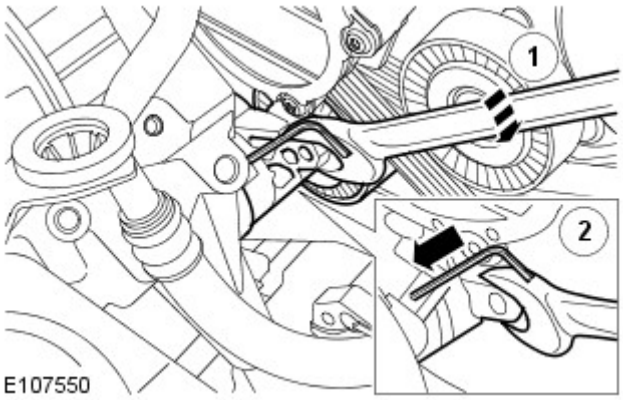
   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

4. Remove the air cleaner assembly.

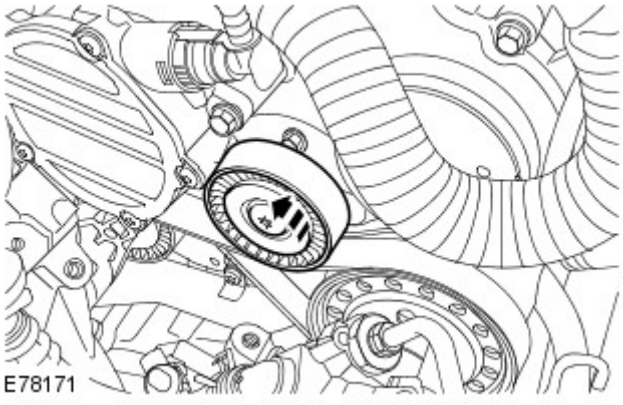
   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).



5. Remove the A/C compressor, lower support bracket.



6. Using suitable tools, release the accessory drive belt tension.



7. Remove the accessory drive belt idler pulley.

Installation

1. Install the accessary drive belt idler pulley.

   Torque: 25 Nm

2. Install the accessory drive belt.

3. Install the A/C compressor, lower support bracket.

   Torque: 25 Nm

4. Install the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

5. Install the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

6. Install the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Accessory Drive Pulley

Removal and Installation

Special Tool(s)

	303-1278 Aligner, Timing Cover
	303-1284 Torx Socket, Accessory Drive Pulley

Removal

- NOTE: Removal steps in this procedure may contain installation details.

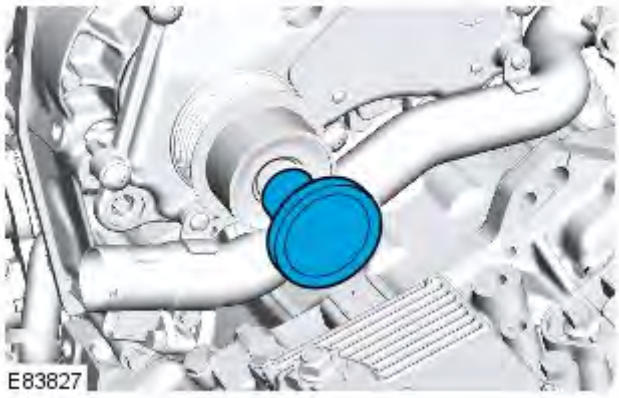
1. Remove the cover and disconnect the battery ground cable.

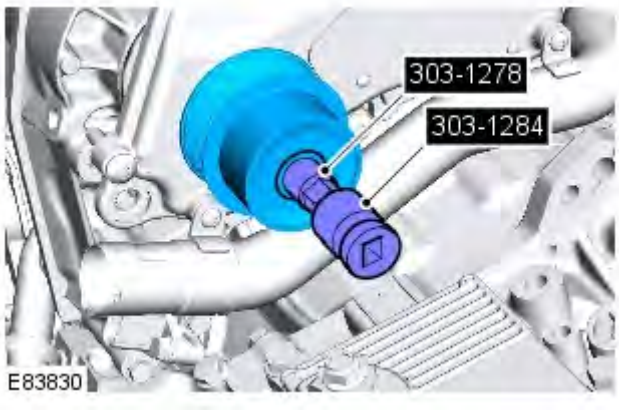
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the A/C compressor mounting bracket.

   Refer to: Accessory Drive Component Bracket (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

3.





4. *Special Tool(s):* 303-1284, 303-1278
   Torque: 60 Nm

Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   To install, reverse the removal procedure.

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Accessory Drive Component Bracket

Removal and Installation

Special Tool(s)

	303-1224 Aligner, A/C Bracket

Removal

• NOTE: It is only necessary to check the alignment of the bracket if the bracket has been replaced, or any of the components it mounts to have been adjusted or replaced.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

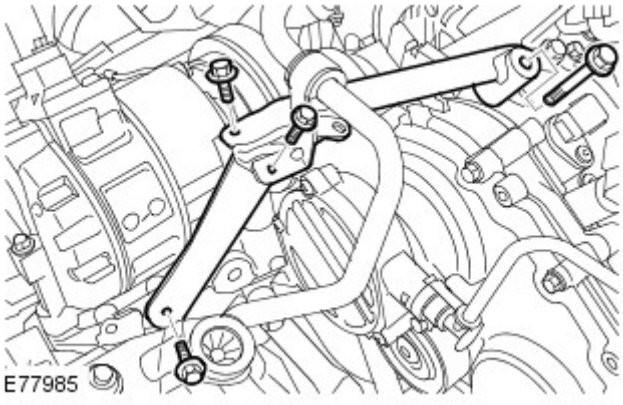
   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the battery tray.

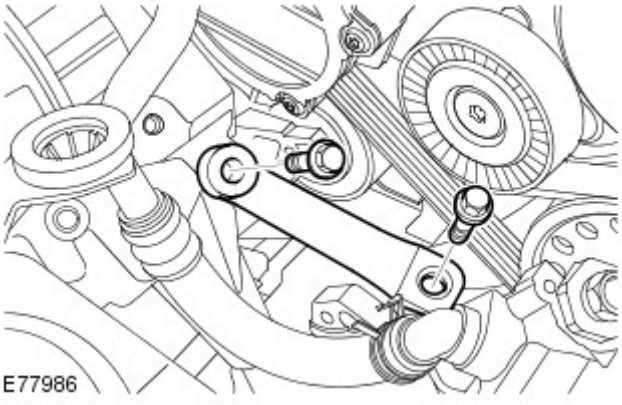
   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

4. Remove the air cleaner assembly.

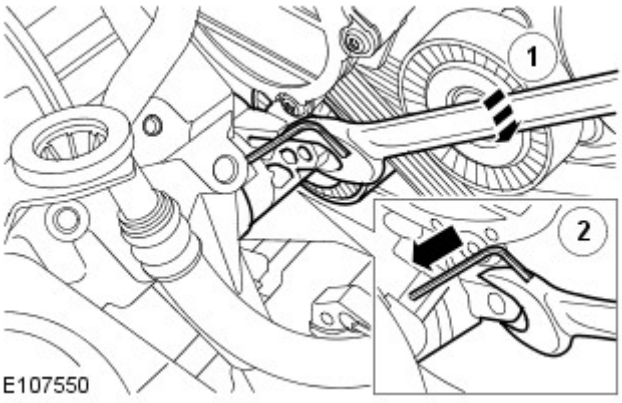
   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).



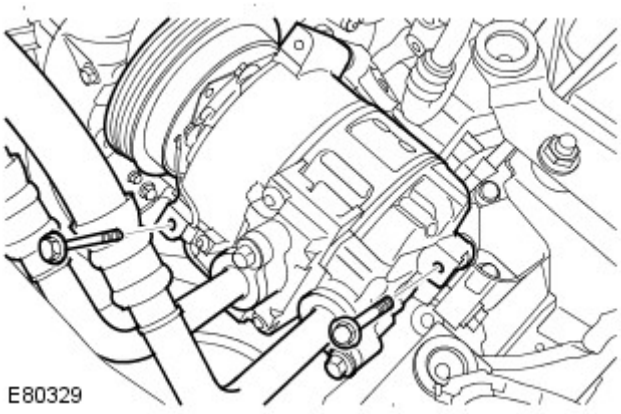
5. Remove the A/C compressor, upper support bracket.



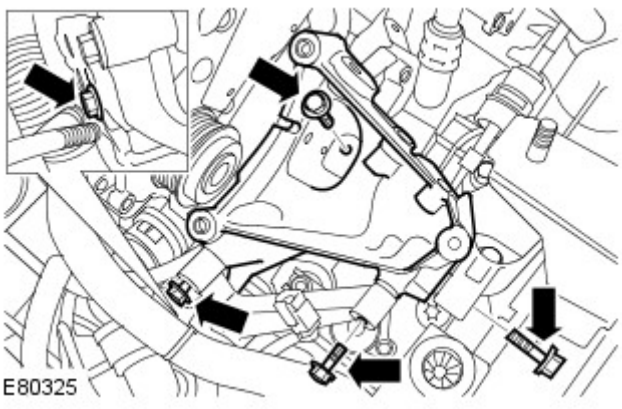
6. Remove the A/C compressor, lower support bracket.



7. Using suitable tools, release the accessory drive belt tension.



8. Release the A/C compressor and tie aside.



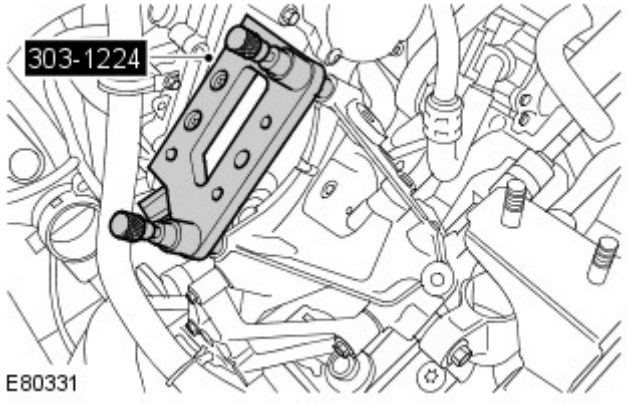
9. Remove the accessory drive component bracket.

10. **10.** NOTE: Do not disassemble further if the component is removed for access only.

    Remove the dowels.

Installation

1. Install the dowels.



2. **2.** NOTE: It is only necessary to check the alignment of the bracket if the bracket has been replaced, or any of the components it mounts to have been adjusted or replaced.

   Check the alignment of the bracket using the special tool.

   Special Tool(s): 303-1224

3. Install the accessory drive component bracket.

   Torque:
   M10 50 Nm
   M8 24 Nm

4. Install the A/C compressor.

   Torque: 25 Nm

5. Install the accessory drive belt.

6. Install the A/C compressor, lower support bracket.

   Torque: 25 Nm

7. Install the A/C compressor, upper support bracket.

   Torque:
   M10 45 Nm
   M8 25 Nm
   M6 10 Nm

8. Install the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

9. Install the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

10. Install the engine cover.

    Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

11. Connect the battery ground cable and install the cover.

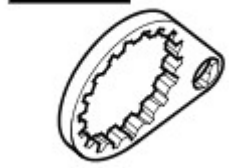
    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Accessory Drive Shaft Front Seal

Removal and Installation

Special Tool(s)

303-1220  E82420	303-1220 Holder, Generator Coupling
303-1221 E82720	303-1221 Puller, Generator Coupling
303-1222 E82421	303-1222 Installer, Generator Coupling Seal

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

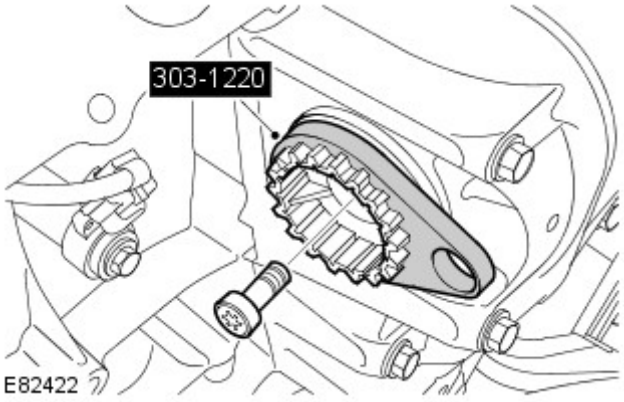
   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the generator.

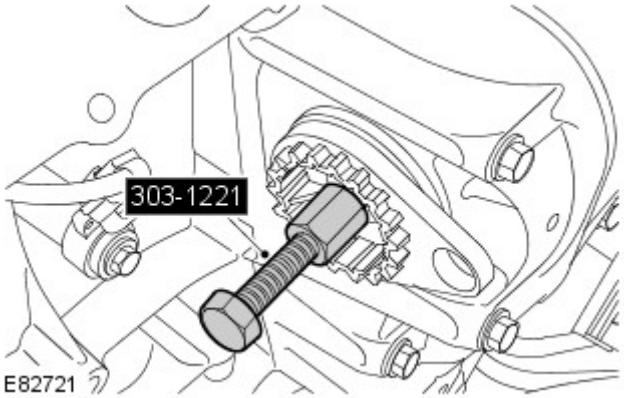
   Refer to: Generator - I6 3.2L Petrol (414-02 Generator and Regulator, Removal and Installation).



E82422

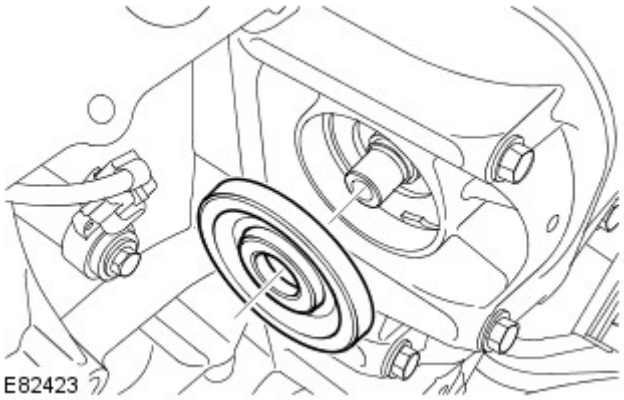
4. Remove the generator coupling bolt.

   Special Tool(s): 303-1220



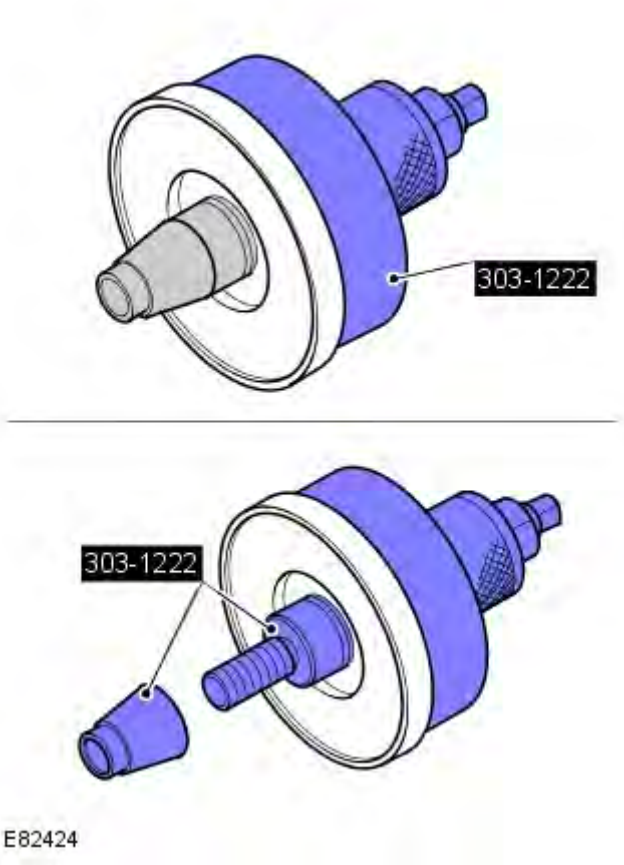
5. Remove the generator coupling.

   Special Tool(s): 303-1221



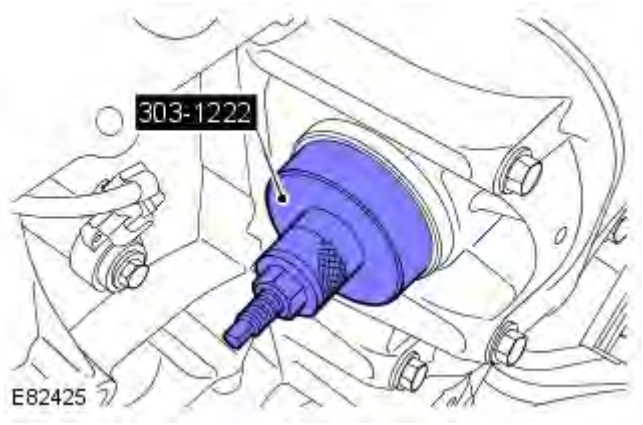
6. Remove and discard the seal.

Installation



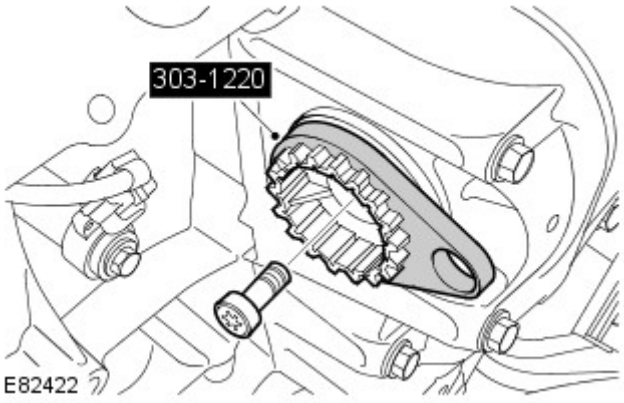
1. Install the seal onto the special tool.

   Special Tool(s): 303-1222



2. Install the new seal.

   Special Tool(s): 303-1222



3. Install the generator coupling.

   Special Tool(s): 303-1220
   Torque: 44 Nm

4. Install the generator.

   Refer to: Generator - I6 3.2L Petrol (414-02 Generator and Regulator, Removal and Installation).

5. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Accessory Drive Shaft Rear Seal

Removal and Installation

Special Tool(s)

	303-1227 Installer, Auxiliary Drive Seal

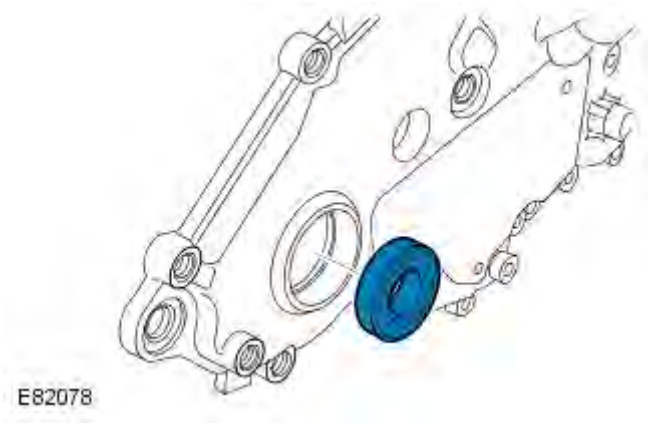
Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the accessory drive pulley.

   Refer to: Accessory Drive Pulley (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

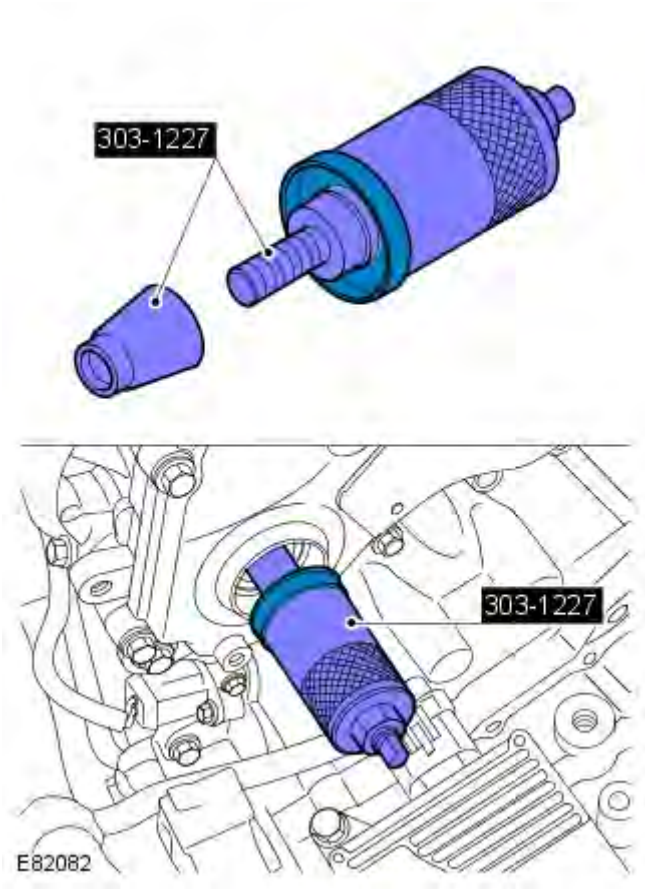


3. **3.** CAUTION: Discard the seal.

Installation

1.
   - Install the seal to the special tool

     Special Tool(s): 303-1227
   - Remove the seal guide.



2. **2.** CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.
   - Install the special tool and seal assembly into the accesory drive shaft.
   - Install the seal.

3. Install the accessory drive pulley.

   Refer to: Accessory Drive Pulley (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

4. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Accessory Drive - I6 3.2L Petrol - Rear End Accessory Drive (READ)

Removal and Installation

Special Tool(s)

	303-1487 Cylinder Block Pry Tool

Removal

- NOTE: Removal steps in this procedure may contain installation details.

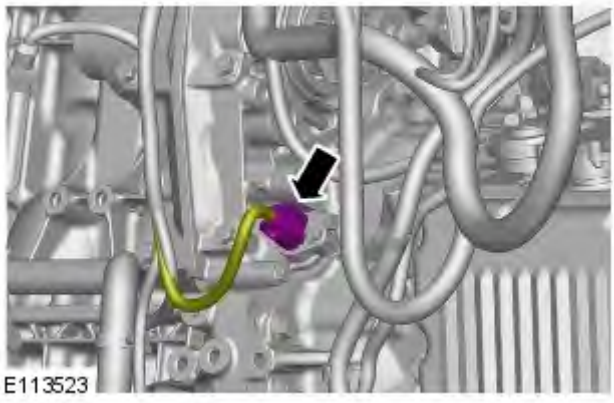
1. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

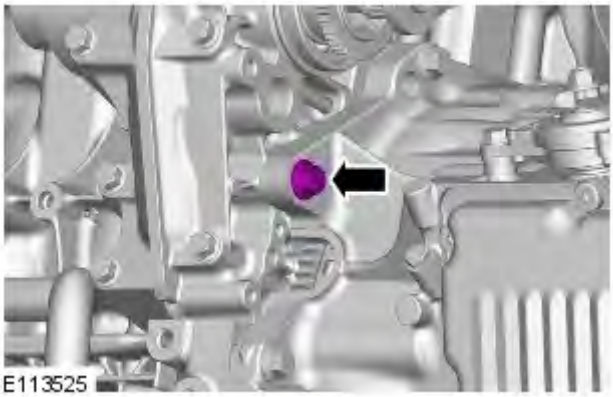
3. Refer to: Timing Components Housing (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

4. Refer to: Generator - I6 3.2L Petrol (414-02 Generator and Regulator, Removal and Installation).



5.

6.



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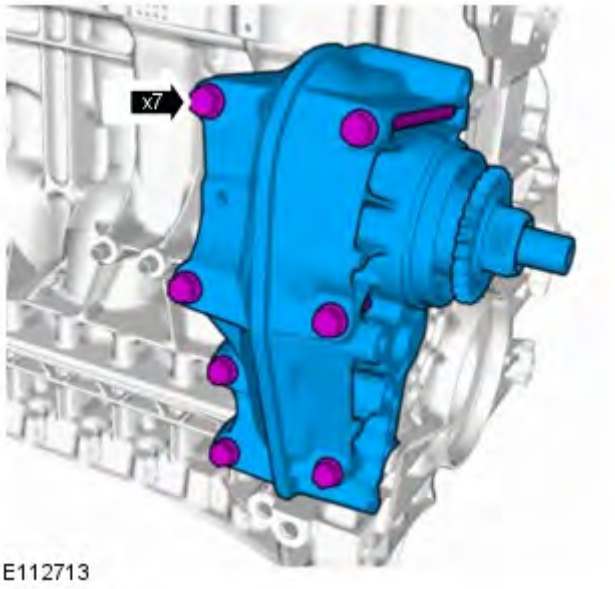

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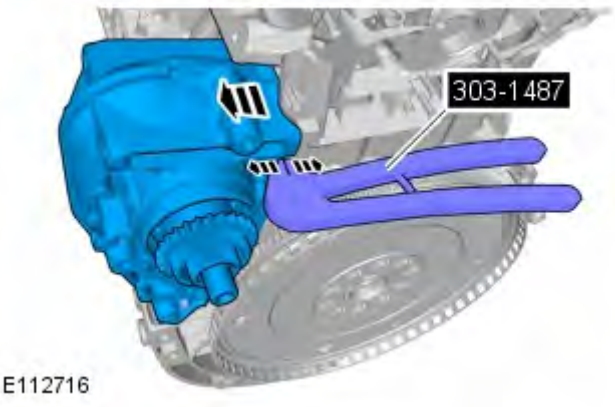
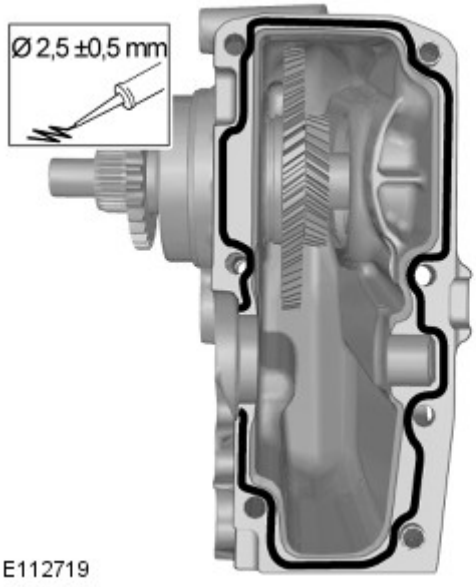


9. *Special Tool(s):* 303-1487

10. **10.** NOTE: Make sure that all traces of the old sealant are removed from the mating faces.

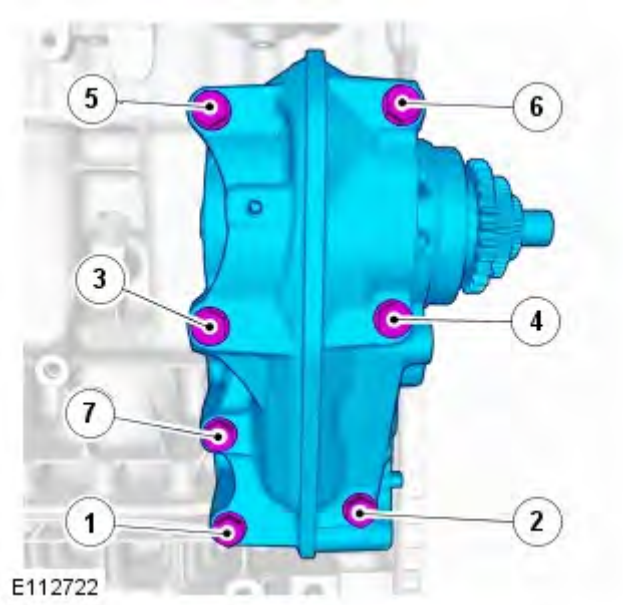
Installation

1.

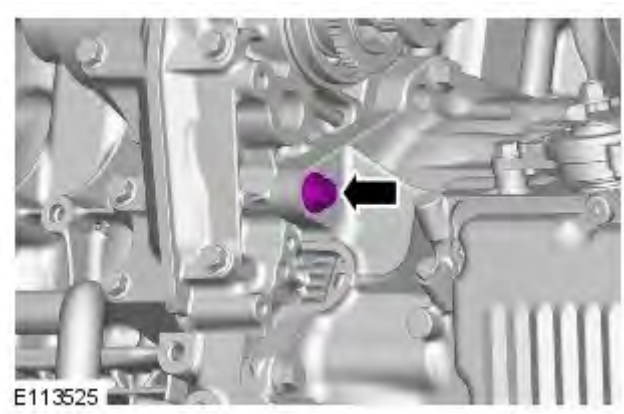


2.

- Apply a 2.5mm bead of sealant STC50550 (Loctite 5900) to the areas shown.

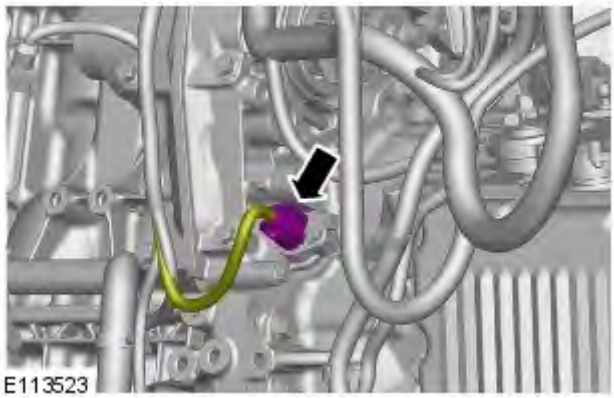


3. *Torque:*
   Stage 1:10 Nm
   Stage 2:24 Nm



4. *Torque:* 45 Nm

5. *Torque:* 10 Nm



6.

7. Refer to: Generator - I6 3.2L Petrol (414-02 Generator and Regulator, Removal and Installation).

8. Refer to: Timing Components Housing (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

9. Lower the vehicle.

10. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Accessory Drive - TD4 2.2L Diesel -

Torque Specifications

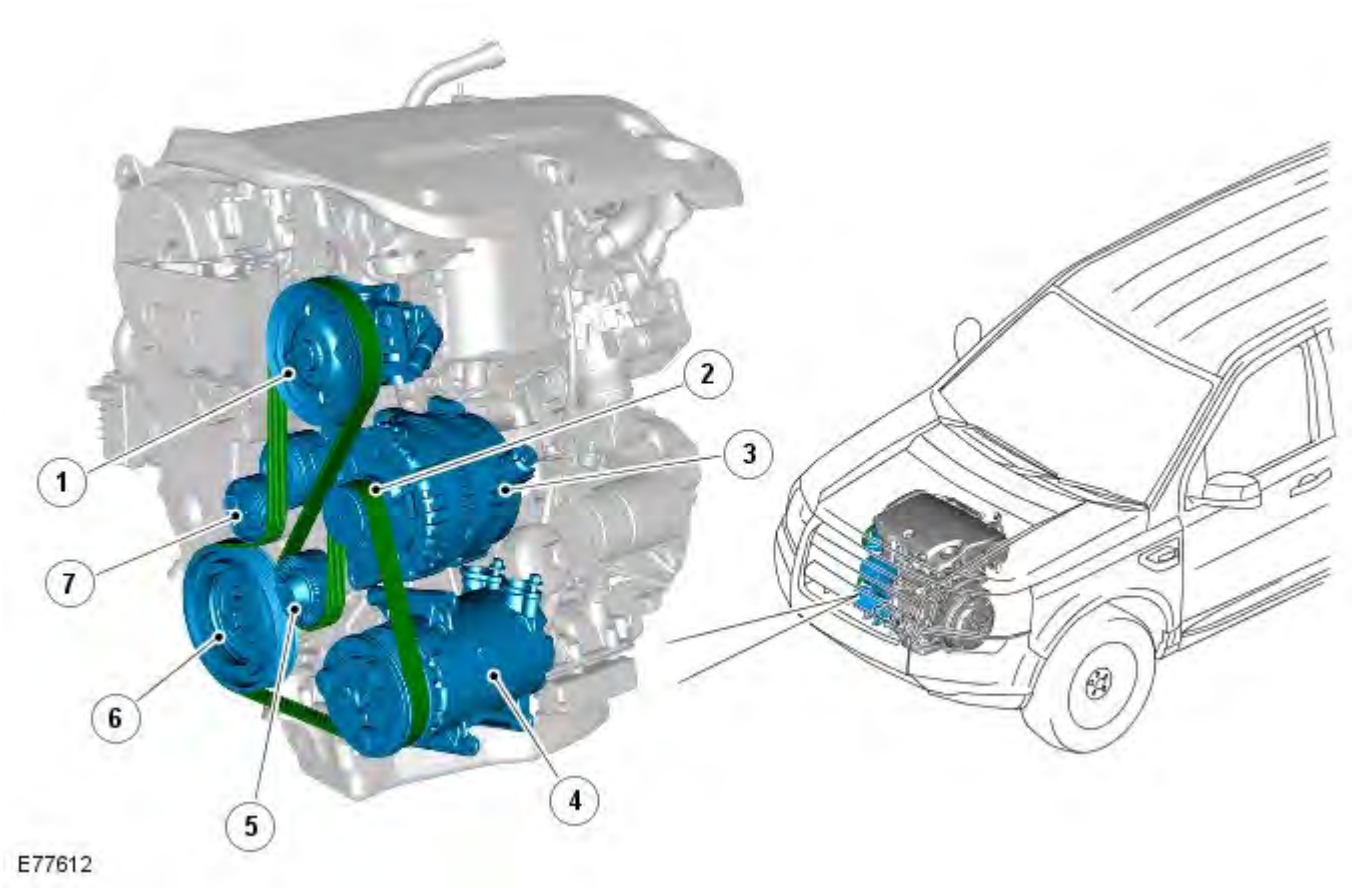
Description	Nm	lb-ft
Accessory drive belt tensioner retaining bolt	45	33
Accessory drive belt idler retaining bolt	45	33

Published: 11-May-2011

Accessory Drive - TD4 2.2L Diesel - Accessory Drive

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Power steering pump
2	-	Accessory drive belt
3	-	Generator
4	-	Air Conditioning (A/C) compressor
5	-	Idler pulley
6	-	Crankshaft drive pulley
7	-	Automatic tensioner

OVERVIEW

A combined crankshaft pulley and torsional vibration damper drive the engine mounted accessory components via a 6 ribbed polyvee drive belt. The drive belt is routed around the accessory component pulleys, and is maintained in full contact by an automatic tensioner and idler pulley.

AUTOMATIC TENSIONER

The automatic tensioner comprises a deflection pulley mounted to a spring loaded pivot arm. The tensioner is located on the longest side of the drive belt between the crankshaft and power steering pump pulleys. The automatic tensioner pre-loads the drive belt in order to drive the accessory components, without belt slip occurring.

The automatic tensioner also provides the means to remove and install the drive belt.

IDLER PULLEY

The idler pulley is located below the generator pulley, adjacent to the automatic tensioner. The idler pulley deflects the drive belt direction to increase the wrap angle around the generator and power steering pump pulleys.

Published: 11-May-2011

Accessory Drive - TD4 2.2L Diesel - Accessory Drive

Diagnosis and Testing

Principles of Operation

For a detailed description of the Front End Accessory Drive (FEAD), refer to the relevant Description and Operation section of the workshop manual.
REFER to: Accessory Drive (303-05B Accessory Drive - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for system integrity and obvious signs of damage.

Visual Inspection

Mechanical
• FEAD belt • FEAD belt tension • FEAD belt tensioner • FEAD belt pulleys • FEAD belt pulley seals

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Cause	Action
FEAD belt noise or squeal	• FEAD belt pulley(s) • Lubricant or other contamination • FEAD belt	Check for pulley alignment, freedom of rotation and damage. Repair or install new parts as required. REFER to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation) / Accessory Drive Belt Tensioner (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation) / Accessory Drive Belt Idler Pulley (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation). Check FEAD belt for contamination. If contaminated, install a new belt. REFER to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation). Check FEAD belt for correct application
FEAD belt does not hold tension	• FEAD belt cracking or damaged • Tensioner worn or damaged	Inspect FEAD belt for cracking or damage. Install a new belt as required. REFER to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation). Check FEAD belt tensioner for damage and correct operation. Install a new FEAD belt tensioner as required. REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

Component Tests

FEAD belt tensioner

Static

The only checks required for the FEAD belt tensioner are for stick, grab or bind.

1. **1.** Remove the drive belt in the area of the tensioner.
2. **2.** Using the correct tool, rotate the tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.
3. **3.** If the tensioner meets the above criteria, proceed to the dynamic test. If the tensioner does not meet the above criteria install a new tensioner.
   REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

Dynamic

The FEAD belt tensioner can be checked dynamically as follows:

With the engine running, observe drive belt tensioner movement, the FEAD belt tensioner should move (respond) when the air conditioning clutch cycles (if equipped), the FEAD belt tensioner should move (respond) when the engine speed is increased rapidly. If the drive belt tensioner movement is erratic without air conditioning clutch cycling or engine acceleration, a pulley or shaft may be bent, or distorted. Excessive drive belt rideout (uneven depth of grooves in the drive belt) can also cause excessive drive belt tensioner movement. Check condition by installing a known good belt.
REFER to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

FEAD belt

1. **1.** With the engine off, check routing of the drive belt.
   REFER to: Accessory Drive (303-05B Accessory Drive - TD4 2.2L Diesel, Description and Operation).

2. **2.** Inspect the drive belt tensioner wear indicator to confirm the drive belt is within operating range. Install a new drive belt as necessary .
   REFER to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

Published: 11-May-2011

Accessory Drive - TD4 2.2L Diesel - Accessory Drive Belt

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

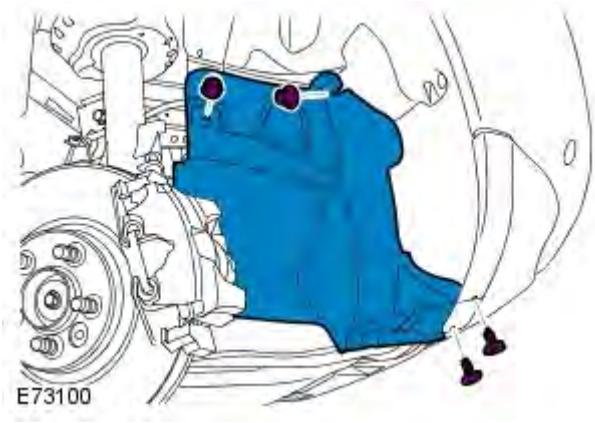
   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

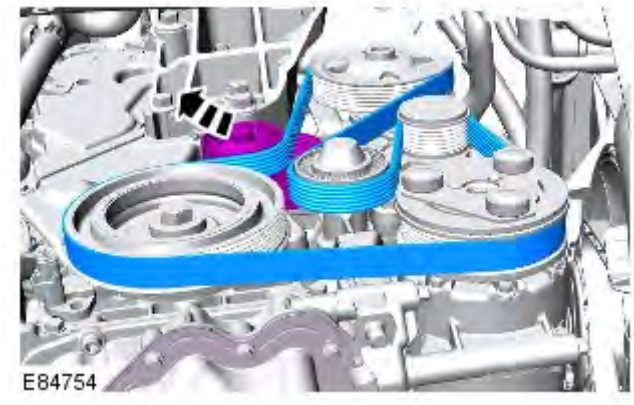
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the RH front wheel and tire.

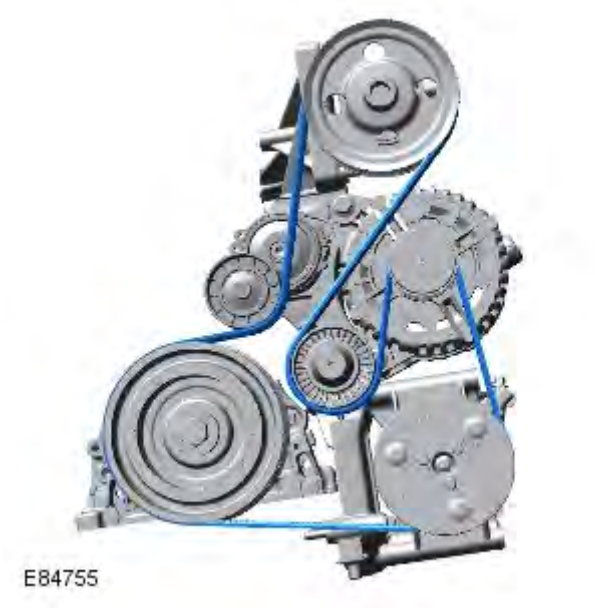
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



4.



5. Rotate the accessory drive belt tensioner clockwise.



6. **6.** CAUTION: Note the fitted position of the component prior to removal.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Accessory Drive - TD4 2.2L Diesel - Accessory Drive Belt Tensioner

Removal and Installation

Removal

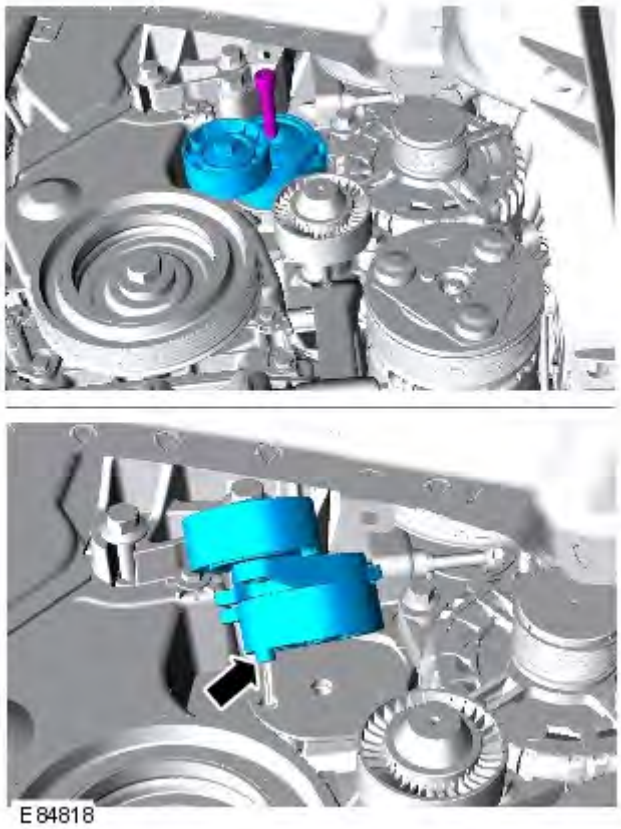
• NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the auxiliary drive belt.

   Refer to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).



3. **3.** NOTE: Make sure that the component is installed to the position noted on removal.
   - *Torque:* 45 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Accessory Drive - TD4 2.2L Diesel - Accessory Drive Belt Idler Pulley

Removal and Installation

Removal

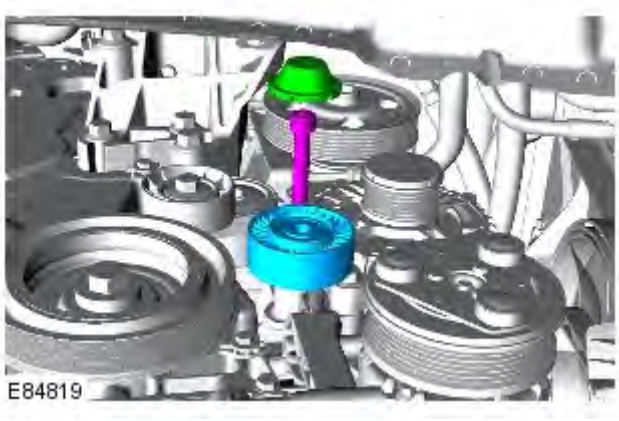
- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).



3. *Torque:* 45 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Starting System - I6 3.2L Petrol -

General Specification

Item	Specification
Starter motor:	
Make	Bosch
Type	1.4 kW
Voltage	12

Torque Specifications

Description	Nm	lb-ft
Starter motor bolts	45	33
Starter motor solenoid terminal nut*	10	7

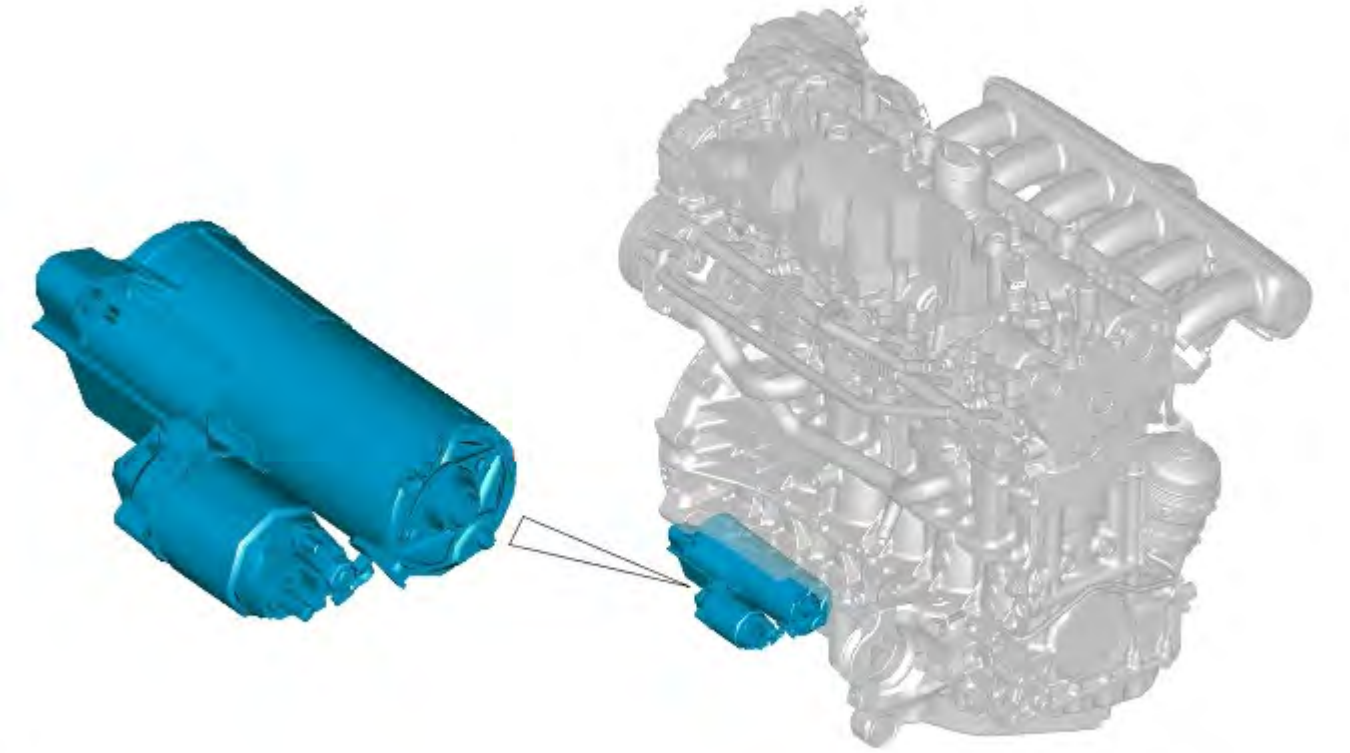
*** Damage to the internal connections will occur if this torque is exceeded**

Published: 11-May-2011

Starting System - I6 3.2L Petrol - Starting System

Description and Operation

COMPONENT LOCATION



E79497

OVERVIEW

The starter motor rated at 1.4 kW uses permanent magnets instead of field windings to provide a low-weight starter motor; with the use of planetary gears to deliver a good torque to weight ratio.

The starter relay is energized by a signal from the engine control module (ECM) when the ignition is in engine crank mode. The ECM checks that a valid code has been received before granting the engine crank mode request. When the request is granted the starter relay energizes the starter solenoid to engage the starter motor's pinion with the flexplate's ring gear. Once the engine has started and engine speed exceeds starter motor speed the pinion disengages to prevent over-cranking of the starter motor.

The electrical power for starter operation is supplied via a cable connected directly from the battery positive terminal to the solenoid.

Published: 11-May-2011

Starting System - I6 3.2L Petrol - Starting System

Diagnosis and Testing

Principles of Operation

For a detailed description of the starting system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Starting System (303-06A Starting System - I6 3.2L Petrol, Description and Operation) / Starting System (303-06B Starting System - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Gear selector lever cable adjustment • Starter Motor • Battery	• Battery • Fuses • Wiring harness • Damaged, loose or corroded connectors • Starter relay • Engine Control Module (ECM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
The engine does not crank (starter motor **does not** turn)	• Gear selector not in **P** or **N** position • Battery • Harness/Connectors • Starter motor • Starter relay • Start switch • Transmission control module (TCM) • Engine control module (ECM) • Engine seized	Make sure the gear selector is in the **P** or **N** position and correctly adjusted. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission/Transaxle External Controls, General Procedures). Check the battery condition and state of charge. REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing). Check the starter motor and harness. Check for DTCs and refer to relevant DTC Index
The engine does not crank (starter motor **does** turn)	• Starter motor installation • Starter motor • Ring gear	Check the starter motor installation (fasteners tight, starter motor square to engine, etc). Check the ring gear teeth for damage, foreign objects, etc.
Engine cranks too slowly	• Battery • Harness/Connectors • Starter motor • Engine oil incorrect grade	Check the battery condition and state of charge. REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing). Refer to the electrical circuit diagrams and test the starter motor and starter motor circuits
Engine cranks too fast	• Low engine compression	Check the engine compressions. REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
Excessive starter motor noise	• Starter motor • Starter motor installation/casing • Ring gear	Check the starter motor installation (fasteners tight, motor square to engine, etc). Check the starter motor casing condition. Check the ring gear teeth for damage, foreign objects, etc.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional

information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to 3 decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100A11	Fuel Pump Authorisation - circuit short to ground	• Fuel pump authorisation circuit - short to ground	Refer to electrical circuit diagrams and check fuel pump authorisation circuit for short to ground
B100A15	Fuel Pump Authorisation - circuit short to power or open	• Fuel pump authorisation circuit - short to power, open circuit	Refer to electrical circuit diagrams and check fuel pump authorisation circuit for short to power, open circuit
B102408	Transponder - Bus signal/Message Failures	• Transponder - Bus signal/message failures	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B102451	Start Control Unit - not programmed	• Start control unit - not configured	Re-configure the start control unit using the manufacturer approved diagnostic system
B102481	Start Control unit - invalid serial data received	• Invalid serial data received	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B102487	Start control unit - missing message	• Missing message	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B102496	Start control unit - component internal failure	• Internal failure	Install a new start control unit. REFER to: Start Control Unit (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).
B102581	Transponder - invalid serial data	• Invalid serial data received	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B102608	Steering Column Lock - Bus Signal/Message Failures	• Steering column lock - Bus signal/message failures	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B102651	Steering Column Lock - not programmed	• Steering column lock - not configured	Re-configure the steering column lock using the manufacturer approved diagnostic system
B102652	Steering Column Lock - not activated	• Request to enable the steering column lock supply not approved	• NOTE: If the vehicle is parked in circumstances where a continuous torque acts on the column (on partial lock, or tire against a curb) it could prevent the lock from disengaging. The driver may need to rock the steering wheel to allow the column lock to disengage. Clear DTC and test system with steering straight. If the DTC does not re occur advise the customer of the above note. If the DTC does reoccur - Check LIN circuit between steering column lock and CJB
B102671	Steering Column Lock - actuator stuck	• Should be set if the SCL is unable to reach locked and OK position	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B102682	Steering Column Lock	• Steering column lock incorrectly programmed	Install a new steering column lock
B102692	Steering Column Lock - performance or incorrect operation	• Micro switch/sensor fault	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B102694	Steering Column Lock - unexpected operation	• Status messages are received from the SCL when SCL should be turned off	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B102696	Steering Column Lock - component internal failure	• Internal failure	Install a new steering column lock, refer to the new module/component installation note at the top of the DTC Index
B108A23	Start button - signal stuck low	• SW1 and SW2 constantly active	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B108B23	Start Button Circuit "A" - signal stuck low	• SW1 constantly active for long time while button press detected at SW2	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B108B24	Start button circuit "A" - signal stuck high	• SW1 never active while button press detected at SW2	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
B108C23	Start button circuit "B" - signal stuck low	• SW2 constantly active for long time while button press detected at SW1	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B108C24	Start button circuit "B" - signal stuck high	• SW2 never active while button press detected at SW1	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B108D24	Start button circuit "C" signal stuck high	• SW3 never active while button press detected at SW1	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B10D794	PATS Key - unexpected operation	• No response from transponder in key	Replace key
C1A4121	Clutch Pedal Sensor - signal amplitude < minimum	• signal<3% of supply(5V)	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
C1A4122	Clutch Pedal Sensor - signal amplitude > maximum	• signal>=97% of supply(5V)	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
P051300	Incorrect immobilizer key	• Security key invalid	Program the keys using the approved diagnostic system.
P061511	Starter relay circuit	• Starter relay control circuit: short circuit to ground • Starter relay control circuit: open circuit • Starter relay failure	Check the starter relay and circuits. Refer to the electrical guides. Install a new relay as necessary.
P061512	Starter relay circuit	• Starter relay control circuit: short circuit to power • Starter relay failure	Check the starter relay and circuits. Refer to the electrical guides. Install a new relay as necessary.
P061513	Starter relay circuit	• Starter relay control circuit: open circuit • Starter relay failure	Check the starter relay and circuits. Refer to the electrical guides. Install a new relay as necessary.
P061711	Starter Relay Circuit High	• Starter motor relay control circuit, high side - short to ground	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P061712	Starter Relay Circuit High	• Starter motor relay control circuit, high side - short to power	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P085086	Park/Neutral switch input circuit	• Signal invalid	Carry out a complete vehicle read for related DTCs. Rectify as necessary.
P0A0F68	Engine failed to start	• Long cranking time	No action necessary. Code for information only.
P125983	Immobilizer to PCM Signal Error	• Checksum error	• NOTE: If the vehicle starts, ignore this DTC Check the CAN network between the ECM, ABS module and CJB. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P125984	Immobilizer to PCM Signal Error	• Signal below allowable range	• NOTE: If the vehicle starts, ignore this DTC Check the CAN network between the ECM and ABS module. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P125985	Immobilizer to PCM Signal Error	• Signal above allowable range	• NOTE: If the vehicle starts, ignore this DTC Run the ECM renew procedure using the manufacturer approved diagnostic system. If DTC remains, suspect ECM. Refer to the new module/component installation note at the top of the DTC Index
P125986	Immobilizer to PCM Signal Error	• Signal invalid	• NOTE: If the vehicle starts, ignore this DTC Run the ECM renew procedure using the manufacturer approved diagnostic system. If DTC remains, suspect ECM. Refer to the new module/component installation note at the top of the DTC Index
P125987	Immobilizer to PCM Signal Error	• Missing message	• NOTE: If the vehicle starts, ignore this DTC Check the CAN network between the ECM and CJB. Carry out CAN network integrity tests using the manufacturer approved diagnostic system
U010000	Lost Communication With ECM/PCM 'A'	• Lost communication with ECM	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
U010100	Lost Communication with TCM	• Lost communication with TCM	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U015500	Lost Communication With Instrument Panel Cluster (IPC) Control Module	• Lost communication with instrument cluster	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U021400	Lost Communication With Remote Function Actuation	• Lost communication with Remote Keyless Entry module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U023600	Lost Communication With Column Lock Module	• Lost communication with steering column lock module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U051500	Invalid data received from remote function actuation	• Invalid data received from keyless entry module	Check keyless entry module for DTCs and refer to DTC Index. Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system

Published: 11-May-2011

Starting System - I6 3.2L Petrol - Starter Motor

Removal and Installation

Removal

1. **1.** CAUTION: After switching of the ignition, wait for 2 minutes before disconnecting the battery. Failure to wait for 2 minutes will damage the navigation computer.

   Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

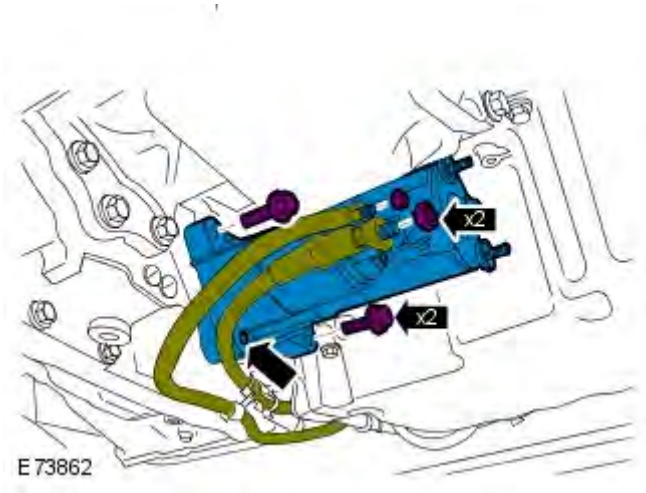
2. **2.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

3. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

4.



Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.

   Install the starter motor and tighten the bolts.

   Torque: 45 Nm

2. Connect the cable and lead to the starter motor solenoid and tighten the nuts.

   Torque: 10 Nm

3. Install the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

4. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Starting System - I6 3.2L Petrol - Start Control Unit

Removal and Installation

Removal

1. **1.** NOTE: This step must be performed if replacing the start control unit.

   • NOTE: Make sure that all keys (remote control handsets) are present when performing this procedure.

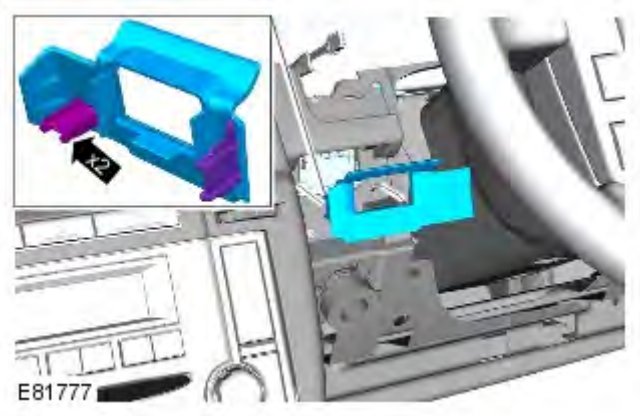
   Using the Land Rover approved diagnostic equipment, interrogate the start control unit and upload the stored data.

2. Make the SRS system safe.

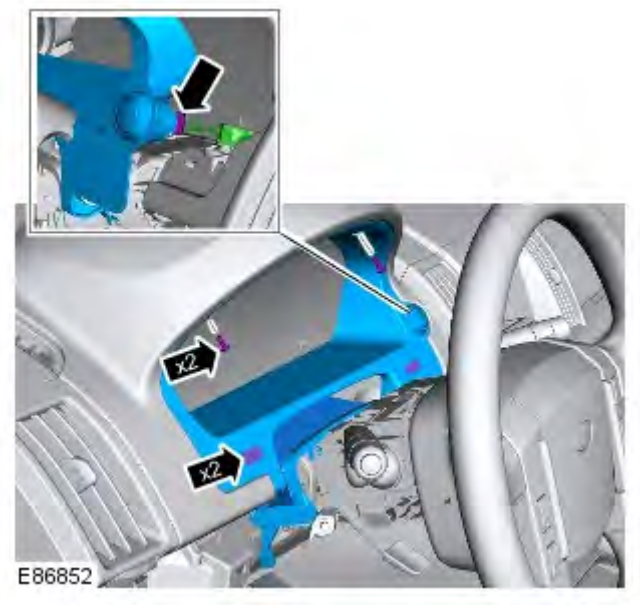
   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the driver lower air bag.

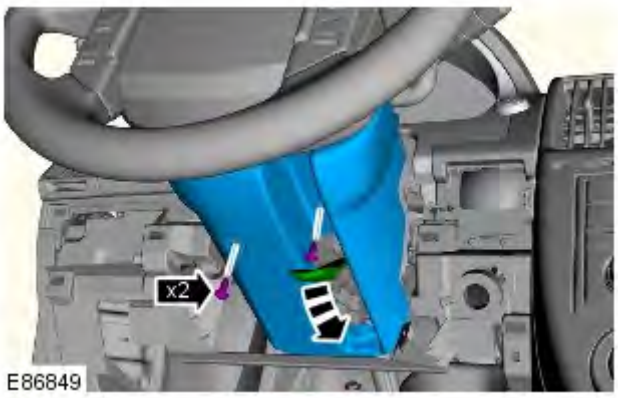
   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



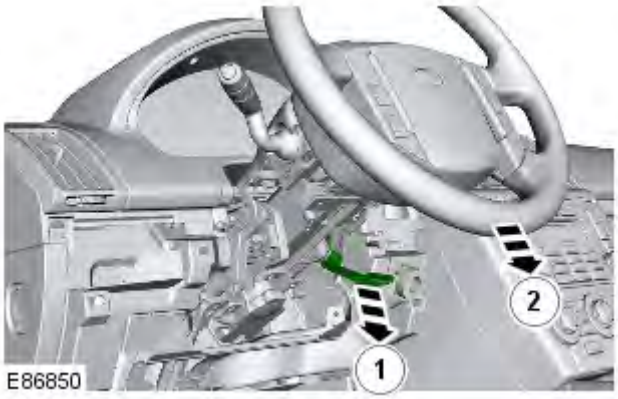
4. Remove the starter control unit trim cover.



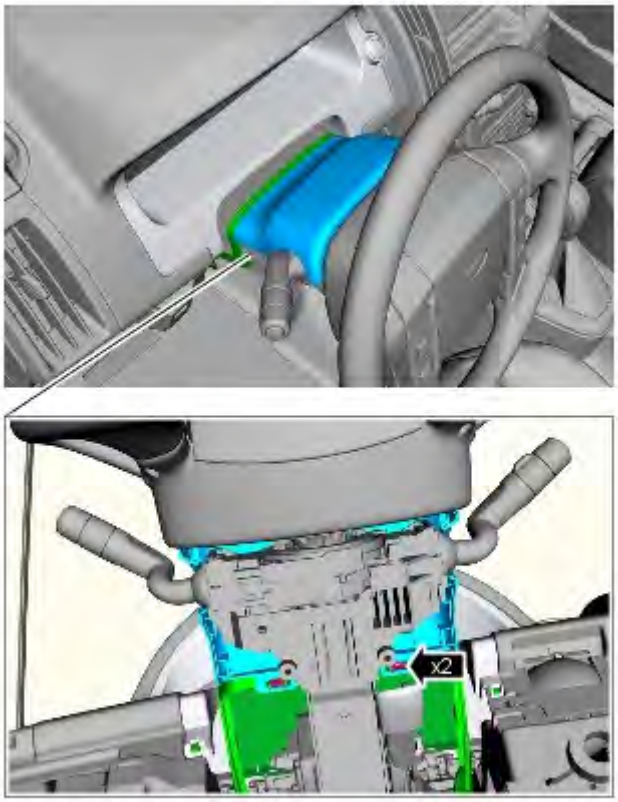
5. Remove the instrument cluster surround.



6. Remove the steering column lower cowl.



7. Adjust the steering column to its lowest position.



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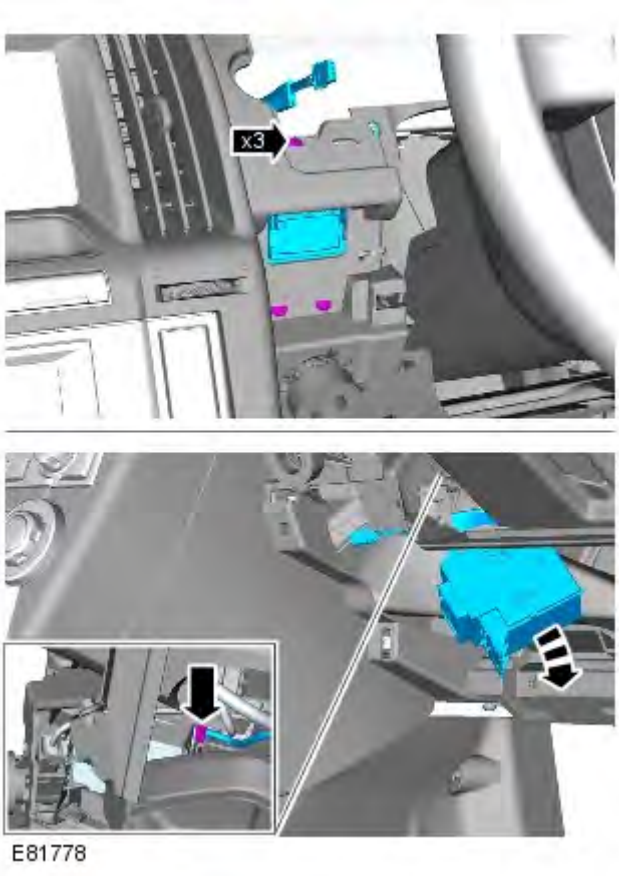

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9. Remove the start control unit.

Installation

1. To install, reverse the removal procedure.

2. Using the Land Rover approved diagnostic equipment, download the previously stored information to a new start control unit.

Published: 11-May-2011

Starting System - TD4 2.2L Diesel -

General Specification

Item	Specification
Starter motor:	
Make	Bosch
Type	2.0 kW
Voltage	12

Torque Specifications

Description	Nm	lb-ft
Solenoid terminal integral connector retaining nut	6	4
Starter motor positive terminal nut*	12	9
Starter motor bolts	40	30

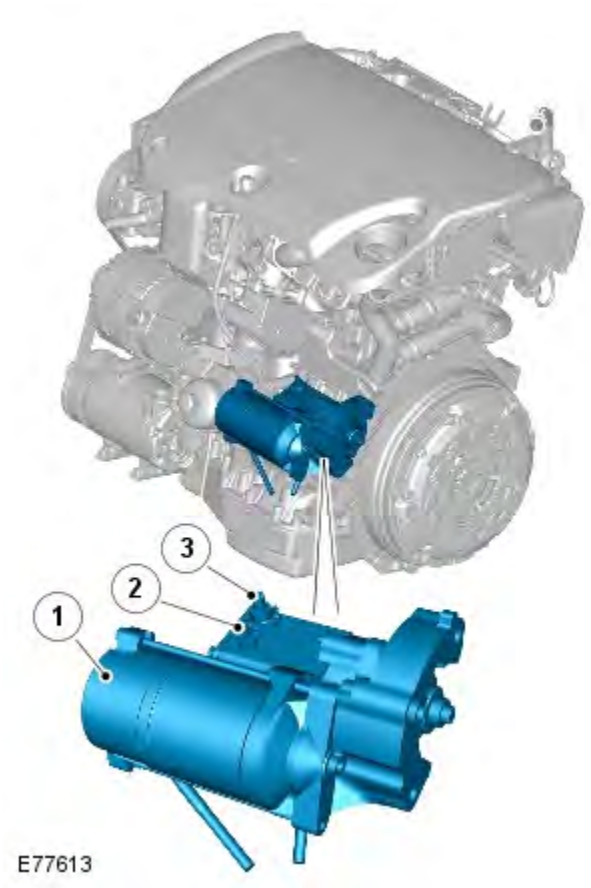
*** Damage to the internal connections will occur if this torque is exceeded**

Published: 11-May-2011

Starting System - TD4 2.2L Diesel - Starting System

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Starter motor
2	-	Battery to solenoid connection
3	-	Battery positive connection

OVERVIEW

The starter motor is rated at 2.0 kW and is manufactured by Denso as a sealed pinion only unit. The starter motor is an RA type that is offset in design; the solenoid is located directly behind the pinion to provide a more positive engagement with the flywheel ring gear. The motor is geared directly to the pinion and is a pre-engaged type comprising a series wound motor and an over-running clutch.

The motor is mounted on the Left-Hand (LH) side of the clutch housing and secured with 3 fixings. The pinion protrudes through an aperture to drive the flywheel via a ring gear.

A small diameter cable is connected between the Engine Control Module (ECM) and the solenoid. The solenoid is energized by a signal voltage from the ECM when the starter switch is pressed. When engine cranking is requested, the ECM checks for a received valid mobilization code before granting the crank request.
For additional information, refer to: Anti-Theft - Passive (419-01 Anti-Theft - Passive, Description and Operation).

Power for starter motor operation is supplied through a large diameter single cable, connected directly to the battery positive terminal. The cable is protected with a sealed 'CAL3' type fuse, located at the battery end of the cable.
For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

The cable is secured to the solenoid with an anti-rotational device and nut.

Published: 11-May-2011

Starting System - TD4 2.2L Diesel - Starter Motor

Removal and Installation

Removal

1. Disconnect the battery ground cable.

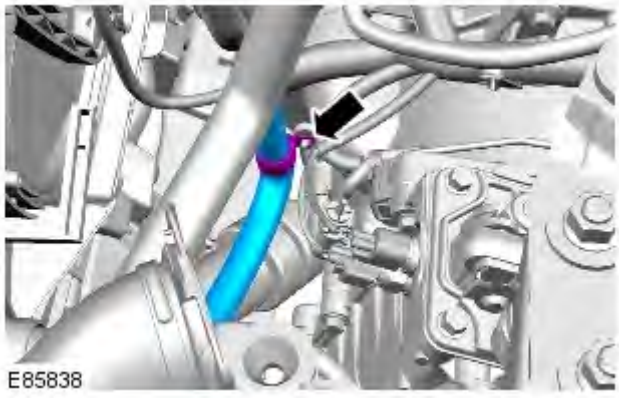
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).



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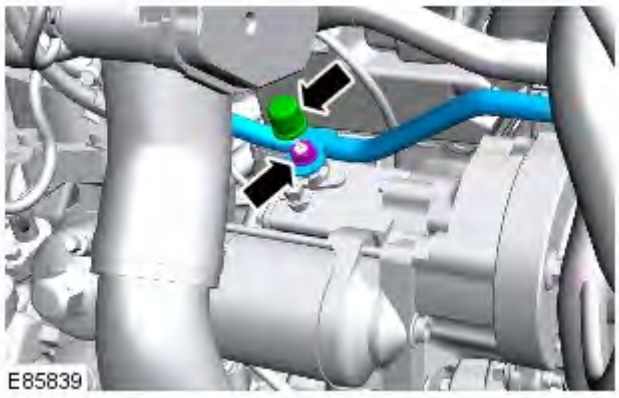
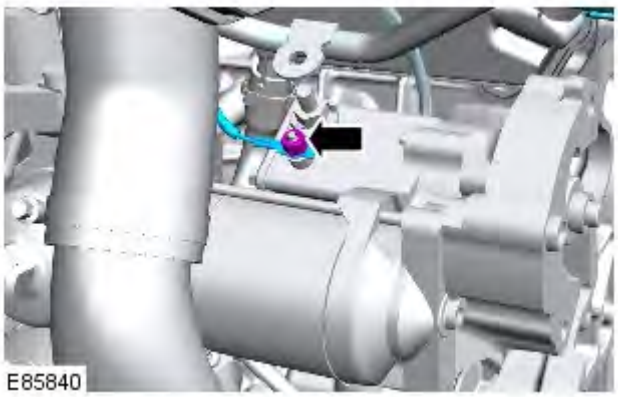
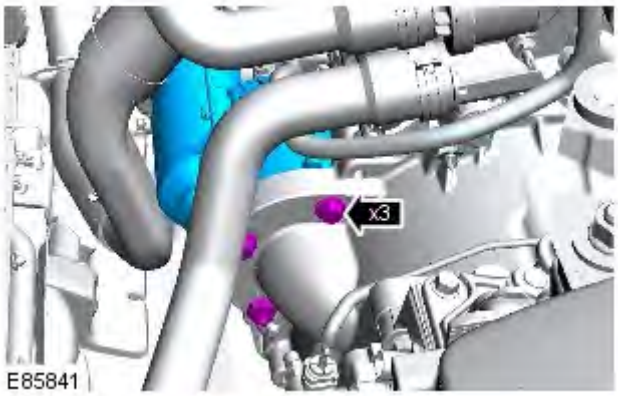


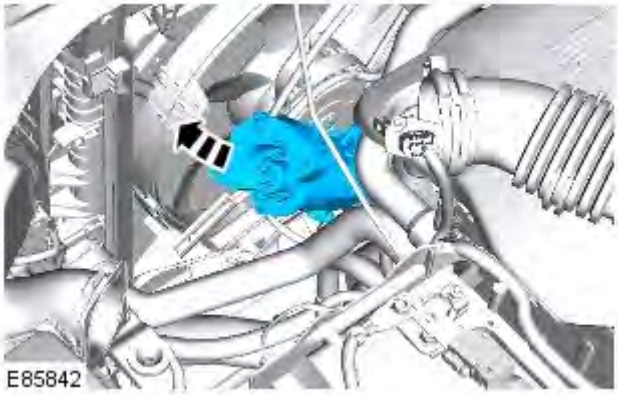
5. *Torque:* 12 Nm



6. *Torque:* 6 Nm



7. *Torque:* 40 Nm



8.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Starting System - TD4 2.2L Diesel - Starter Solenoid

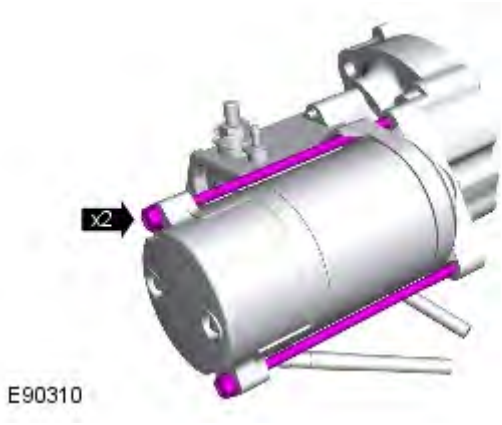
Removal and Installation

Removal

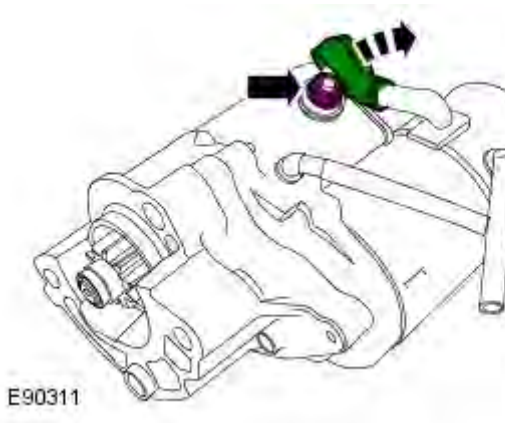
1. Remove the starter motor.

   Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

2. *Torque:* 10 Nm

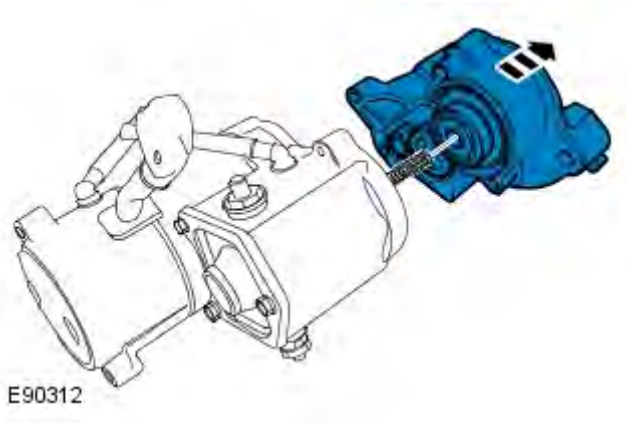


3. *Torque:* 10 Nm



4. *Torque:* 6 Nm

5.



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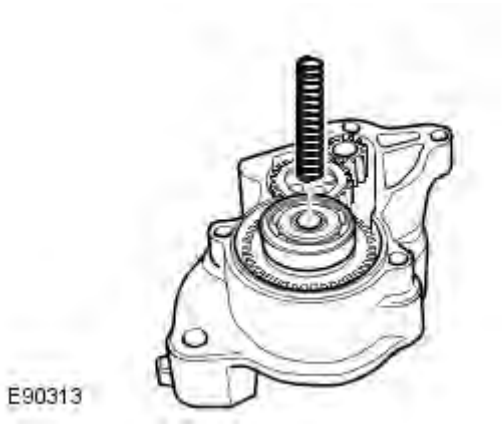

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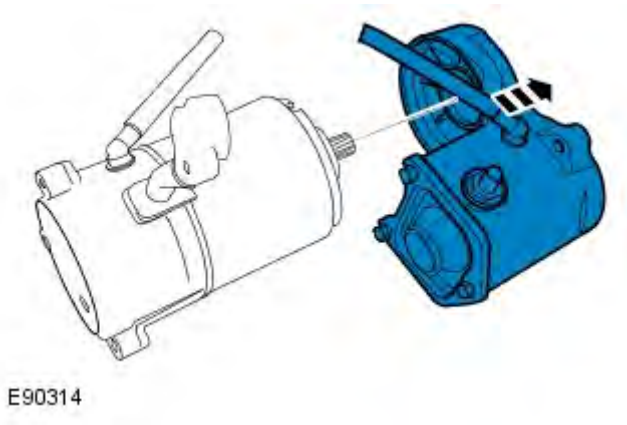


Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Starting System - TD4 2.2L Diesel - Start Control Unit

Removal and Installation

Removal

1. **1.** NOTE: This step must be performed if replacing the start control unit.

   • NOTE: Make sure that all keys (remote control handsets) are present when performing this procedure.

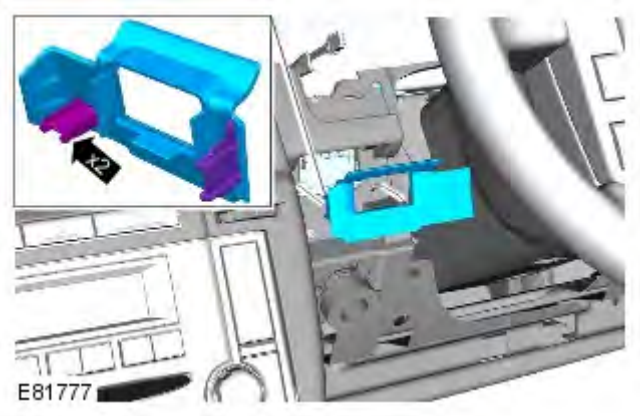
   Using the Land Rover approved diagnostic equipment, interrogate the start control unit and upload the stored data.

2. Make the SRS system safe.

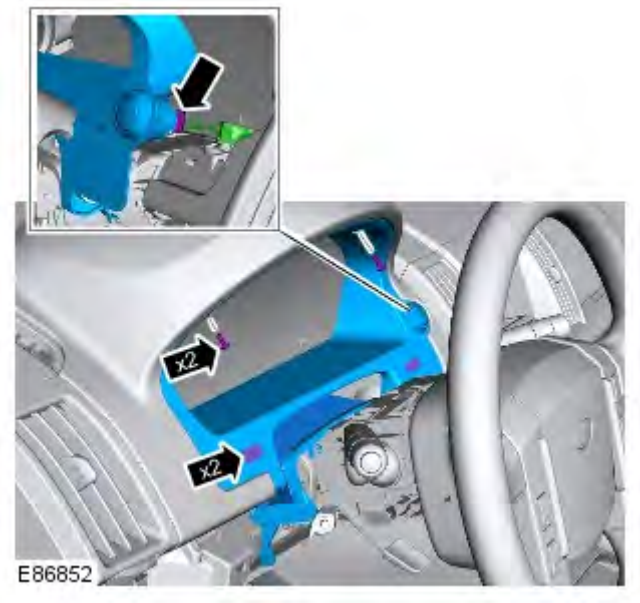
   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the driver lower air bag.

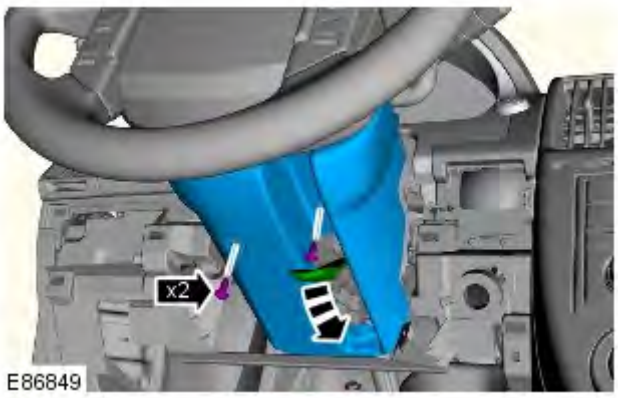
   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



4. Remove the starter control unit trim cover.



5. Remove the instrument cluster surround.



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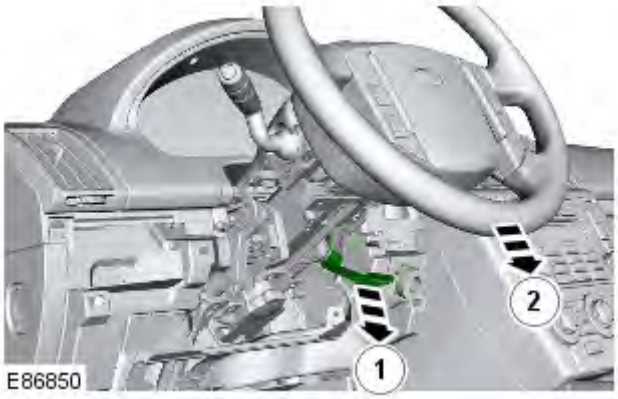
6. Remove the steering column lower cowl.



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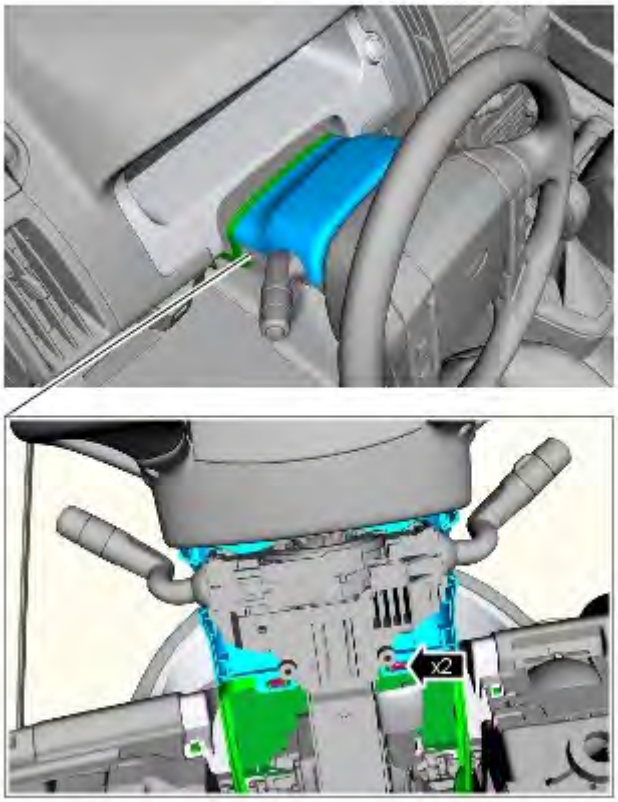
7. Adjust the steering column to its lowest position.



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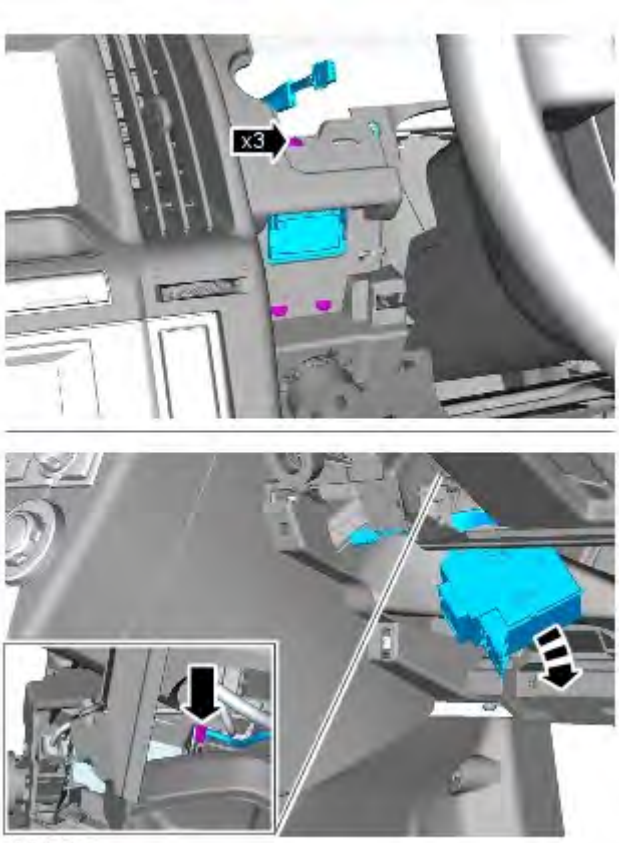

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9. Remove the start control unit.

Installation

1. To install, reverse the removal procedure.

2. Using the Land Rover approved diagnostic equipment, download the previously stored information to a new start control unit.

Published: 11-May-2011

Starting System - TD4 2.2L Diesel - Start Inhibit SwitchLHD AWD

Removal and Installation

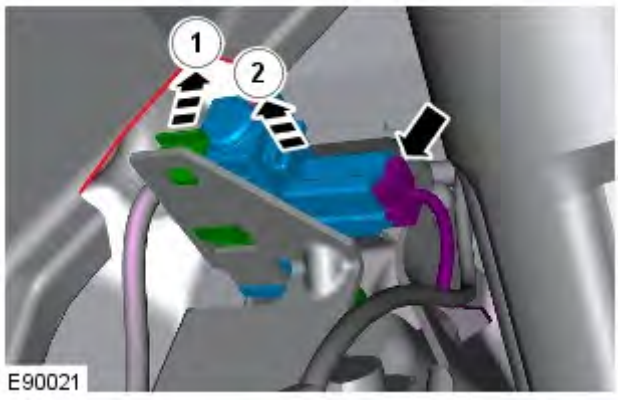
Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the driver lower air bag.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



3.

Installation

1. To install, reverse the removal procedure.

2. Using the Land Rover approved diagnostic equipment, follow the on-screen instructions and configure a new start inhibit switch.

Published: 11-May-2011

Starting System - TD4 2.2L Diesel - Start Inhibit SwitchRHD AWD

Removal and Installation

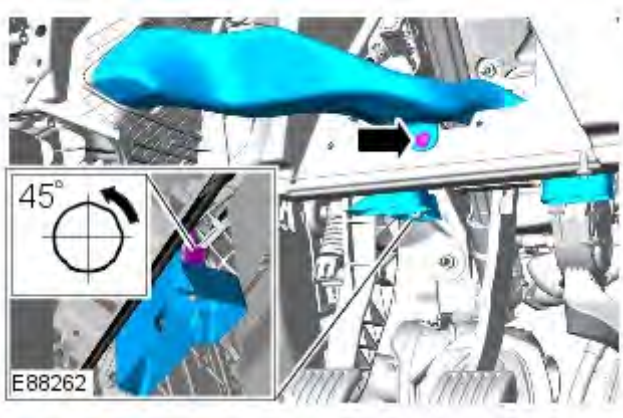
Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the driver lower air bag.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



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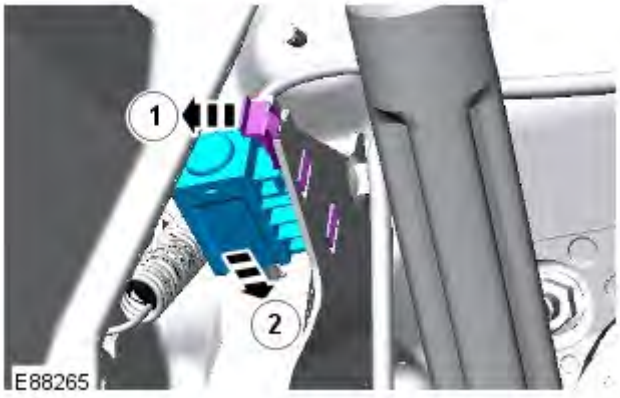

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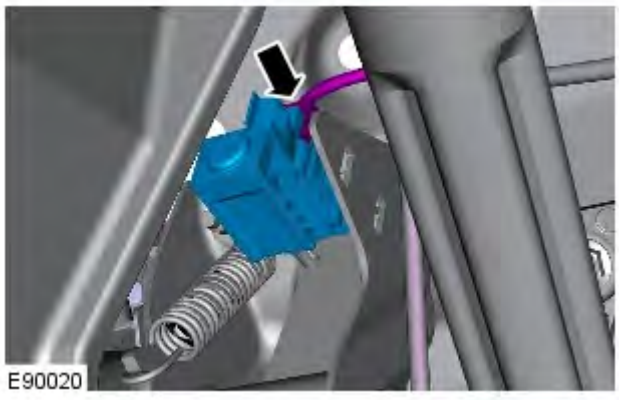


5.

Installation

1. To install, reverse the removal procedure.

2. Using the Land Rover approved diagnostic equipment, follow the on-screen instructions and configure a new start inhibit switch.

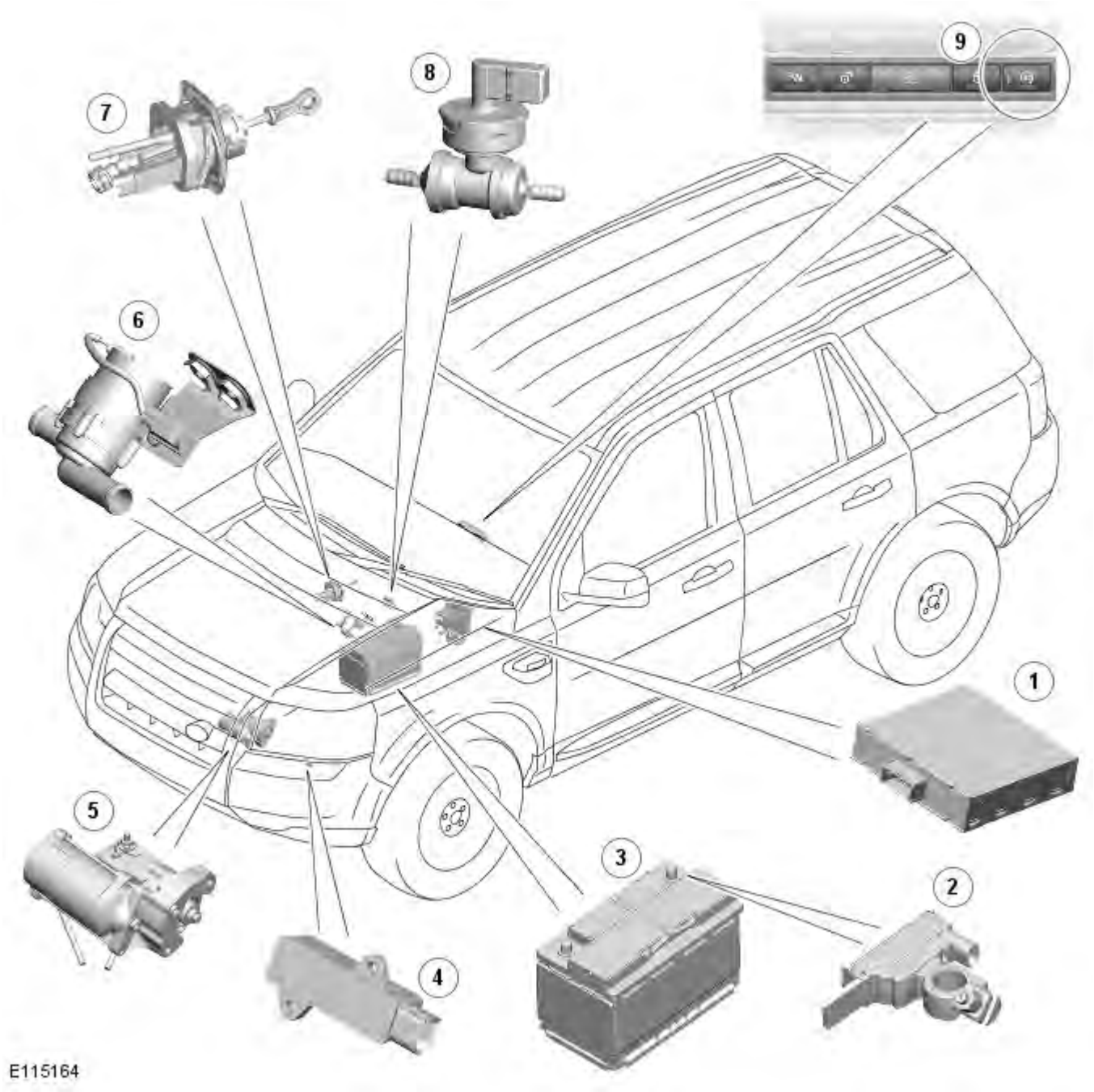
Published: 11-May-2011

Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009 - Starting System

Description and Operation

STOP/START SYSTEM

COMPONENT LOCATION



Stop/Start system component location

Item	Part Number	Description
1	-	Voltage quality module
2	-	Battery monitoring system module
3	-	Absorption glass mat battery
4	-	Gear neutral sensor
5	-	Starter motor
6	-	Auxiliary coolant pump
7	-	Linear clutch sensor
8	-	Brake vacuum sensor
9	-	Stop/Start switch

OVERVIEW

The TD4_e introduces the first intelligent 'Stop/Start' system into a Land Rover vehicle. The system automatically shuts down and restarts the vehicle's engine when the appropriate conditions are satisfied. This reduces the amount of time the engine spends idling, thereby improving fuel economy and reducing emissions. This is advantageous for vehicles which spend significant amounts of time in congested traffic, for example:

- waiting at traffic lights,
- frequently coming to a halt in traffic jams.

Gains from this technology in comparison to a previous TD4 vehicle without Stop/Start, and based on a legally defined 'European Drive Cycle' are typically in the range of:

- CO_2 emissions, reduced by almost 8 percent over the standard EU4 drive cycle, this equates to a reduction of 15g/km.
- Fuel consumption, improved by 3.8 miles per gallon; or 0.6 liters for every 62 miles / 100 kilometers.

• NOTE: Fuel economy and emission reduction will vary on driving style and traffic congestion.

Introduced as standard in the diesel vehicle with manual transmission, the Stop/Start system is automatically activated each time an ignition cycle occurs. However, the driver can deactivate the system by pressing the 'Eco' switch in the fascia.

Eco Stop/Start Switch

• NOTE: In addition to the Stop/Start system the 'Eco' switch also operates the Gear Shift Indicator system.

For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

The LED tell-tale light in the Eco switch is illuminated to inform the driver that the Stop/Start system is functioning correctly. The tell-tale light will extinguish if:

- The driver switches off the Stop/Start system.
- Either HDC (hill decent control) or TR (terrain response) is active.
- There is a system fault; for additional information, refer to the System Fault section below.

New software added to the ECM (engine control module) controls the operation of the Stop/Start system where in addition to its own dedicated components the Stop/Start system encompasses many other vehicle systems. Complex technology interconnects these systems and ensures all the necessary conditions are satisfied by monitoring, among others:

- position of the clutch pedal,
- gear selector position
- road speed
- state of vital vehicle systems
- environmental conditions.

If all necessary conditions are satisfied the Stop/Start system will automatically stop the engine if:

- the vehicle is stationary,
- the transmission is in neutral,
- the clutch pedal is fully released.

The driver will be notified that the engine is shutdown by the 'Eco' icon being illuminated in the instrument cluster. Other warnings normally associated with an engine shutdown, for example the ignition and low oil pressure indicators are suppressed so will not illuminate during an engine shutdown in a Stop/Start cycle.

Eco Stop/Start Indicator

The engine will automatically restart when the driver depresses the clutch, ready for a gear to be selected. The 'Eco' icon in the instrument cluster will extinguish at this point.

If system conditions are not approved by the ECM the Stop/Start system will not behave as expected, examples of this are:

- System inhibit: the engine will continue running even though the vehicle is stationary with the transmission in neutral and the clutch pedal fully released.
- System override: the engine has been stopped by the Stop/Start system but conditions have since changed, this will activate an early automatic engine restart.

These interventions are to ensure the Stop/Start system does not impact on:

- vehicle and occupant safety,
- driver requirements,
- occupant comfort,
- vehicle 'on-road' and 'off-road' capabilities.

Although the main control logic for Stop/Start operation resides in the ECM; the CJB (central junction box) has also been upgraded with new software to communicate engine shutdown inhibits to the ECM. In some instances, depending on the reason for the system intervention the driver will be notified via the message Center the reason for the intervention. For additional information, refer to message Center table below.

System conditions that influence the operation of the Stop/Start system are discussed further in the 'Stop Inhibitors, Start Initiators and Start Inhibitors' section, below.

WARNING: To avoid injury when performing repair work on the vehicle always disable the Stop/Start system by pressing the 'ECO' button, ensure that 'ECO STOP/START OFF' is displayed in the message Center and the ECO tell-tale light in the switch is extinguished.

MESSAGE CENTER

A number of driver information messages have been introduced to inform the driver of the Stop/Start system's status of operation.

The instrument cluster receives message Center data from the ECM via the CJB over the medium speed CAN (controller area network) bus. The CJB generates this data based on medium and high speed CAN bus inputs and hardwired inputs received from various system control modules. Software contained within the instrument cluster converts the data from the CJB into display messages for the driver.

Stop/Start Messages

Message	Other Warnings	Reason	Action
ECO STOP/START ON	Tell-tale light in the Eco switch illuminated.	The system has been switched off and then later switched on within the same ignition cycle.	If required, press the Eco switch to deactivate the Stop/Start system.
ECO STOP/START OFF	Tell-tale light in the Eco switch extinguished.	The Eco switch has been pressed.	If required, press the Eco switch to reactivate the Stop/Start system.
ECO STOP/START UNAVAILABLE	Tell-tale light in the Eco switch extinguished.	Either, HDC (hill decent control) or TR (terrain response) is active.	Deselect HDC or TR if terrain conditions permit.
SELECT NEUTRAL TO RESTART	None	The engine has been shutdown in a Stop/Start cycle and the driver has engaged a gear without depressing the clutch.	Depress clutch and select neutral.
RESTART REQUIRED PRESS CLUTCH	None	When an engine restart is required in a Stop/Start cycle but the driver's location is unknown. Either the driver's door or safety belt is unlatched.	Depress clutch.
ECO STOP/START FAULT	Tell-tale light in the Eco switch extinguished.	Stop/Start not available due to system or sub-system failure.	Connect Land Rover approved diagnostic equipment to diagnose fault.

• NOTE: 'SELECT NEUTRAL TO RESTART' can appear if the driver is resting their hand on the gear lever with enough pressure to move the transmission out of the neutral window without engaging a gear.

• NOTE: If after an unsuccessful automatic restart the driver is requested to restart the engine for example, by depressing the clutch. This action has to be completed within 50 seconds, otherwise the Stop/Start system will deactivate and a conventional start will be required.

REFINEMENT AND DURABILITY

Engine operating refinement has been maintained and in some cases refined to ensure the vehicle's occupants witness an almost seamless operation with regard to engine shutdown and restart within a Stop/Start cycle.

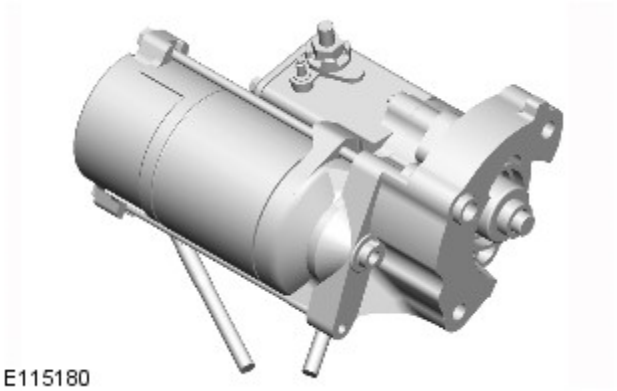
To reduce engine shake when the engine is shutting-down a revised throttle closing strategy is introduced, which ramps down the fuel injection in a more smooth and controlled manner. At the same time the generator is turned-off to reduce load on the engine.

ECM software changes and revised engine calibration further aid a smoother engine shutdown. Furthermore the optimized engine mounting strategy and tuning assists in reducing engine shake on engine start-up.

Components directly involved with engine start-up and shut-down have been either upgraded or replaced to withstand the increased frequency of Stop/Start cycles over the lifetime of the vehicle. These enhanced and more robust components are discussed in this section.

CAUTION: To maintain the correct operation of the Stop/Start system care must be taken when replacing components, that only approved parts are fitted as some components from earlier vehicles will fit the TD4_e.

Starter Motor



To improve durability due to the increased start-demands on the starter motor a number of improvements have been made:

- Grease seals have been upgraded.
- A hard wearing copper-tungsten contact material has been introduced to improve wear resistance within the starter solenoid.
- The pinion gear is manufactured from a harder grade of steel.

Flywheel Ring Gear

Due to the increased start-demands, the flywheel ring gear is manufactured from a harder grade of steel with 25% more carbon content which increases its durability.

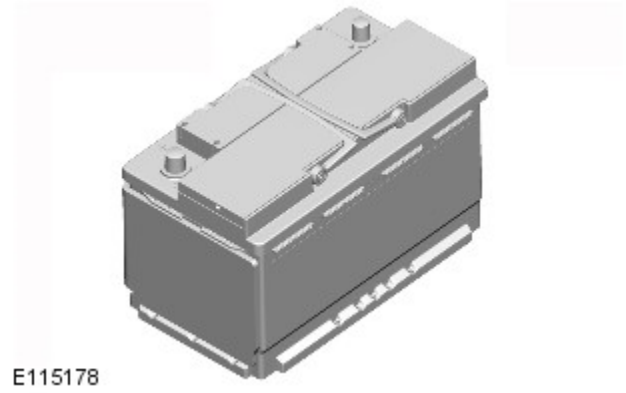
Dual Mass Flywheel

As with previous diesel powered vehicles a dual-mass flywheel is fitted to ensure refinement when the engine is being either started, stopped or running at low speeds.

To provide an even greater level of refinement due to the increased start and stop demands, a new friction disc has been developed for the TD4_e dual-mass flywheel. The new friction disc which is able to withstand seven-times the pressure of a standard disc is manufactured from polyetheretherketone also known as PEEK.

PEEK is a semi-crystalline thermoplastic, which is resistant to both organic and aqueous environments. It has a high-melting point making it resistant to thermal degradation. It is also one of the few plastics compatible with ultra-high vacuum applications and is typically used in bearings, piston parts and pumps.

Absorption Glass Mat Battery



E115178

Conventional batteries lose their capacity to hold charge overtime as their internal lead plates steadily deteriorate with the continual vibration and erosion that occurs with normal use. The rate of deterioration depends on a number of factors, including charge and discharge cycling rates. Therefore the extreme power consumption of a Stop/Start system would have a detrimental effect on the life-span of this type of battery.

To counteract the deeper discharge and recharge cycles of a Stop/Start system, a high-performance battery based on Absorption Glass Mat technology has been developed to reduce battery deterioration caused by excessive usage. The battery owes its success to the 'absorbent glass mat' which is a fine fibreglass mat compressed between the lead plates. The 'absorbent glass mat' also absorbs the battery acid, enabling a more efficient use of the cell's volume.

While the 'absorbent glass mat' permits the electrolyte to function normally, it also provides mechanical support for the lead plates, therefore reducing vibration and subsequent degradation. This technology substantially increases the effective charge and discharge life of the battery. The battery also has an extremely low internal resistance, resulting in a quicker reaction between acid and plate material.

Absorption glass mat battery technology offers several advantages:

- The battery remains completely spill and leak proof due to the absorption of the fibreglass mat.
- In freezing conditions, expanding fluid is unable to cause any damage as the plates are packed in fibreglass mats; consequently there is virtually no plate movement.
- Vibration or shock does not damage the battery.
- As electrolyte is contained through the acid in the mat, there is no need for battery maintenance.

The battery's capacity is 80Ah, meaning the battery is theoretically capable of supplying an 80 amp current for one hour. A typical engine restart will draw a very high current for a fraction of a second, so will have very little impact on the battery's total state of charge. An engine restart may typically consume about 0.001% of a new battery's full-charge capacity.

If a new battery is fitted to the vehicle, the BMS (battery monitoring system) module will require recalibrating to register the greater charge holding capacity of the battery, this is performed using Land Rover approved diagnostic equipment. If diagnostic equipment is not available the BMS module will recalibrate automatically however, this could take 48 hours to complete depending on vehicle usage. The Stop/Start system will not function correctly until the BMS module is recalibrated.

If the BMS module is replaced the module will recalibrate automatically; for additional information refer to the Battery Monitoring System section, below.

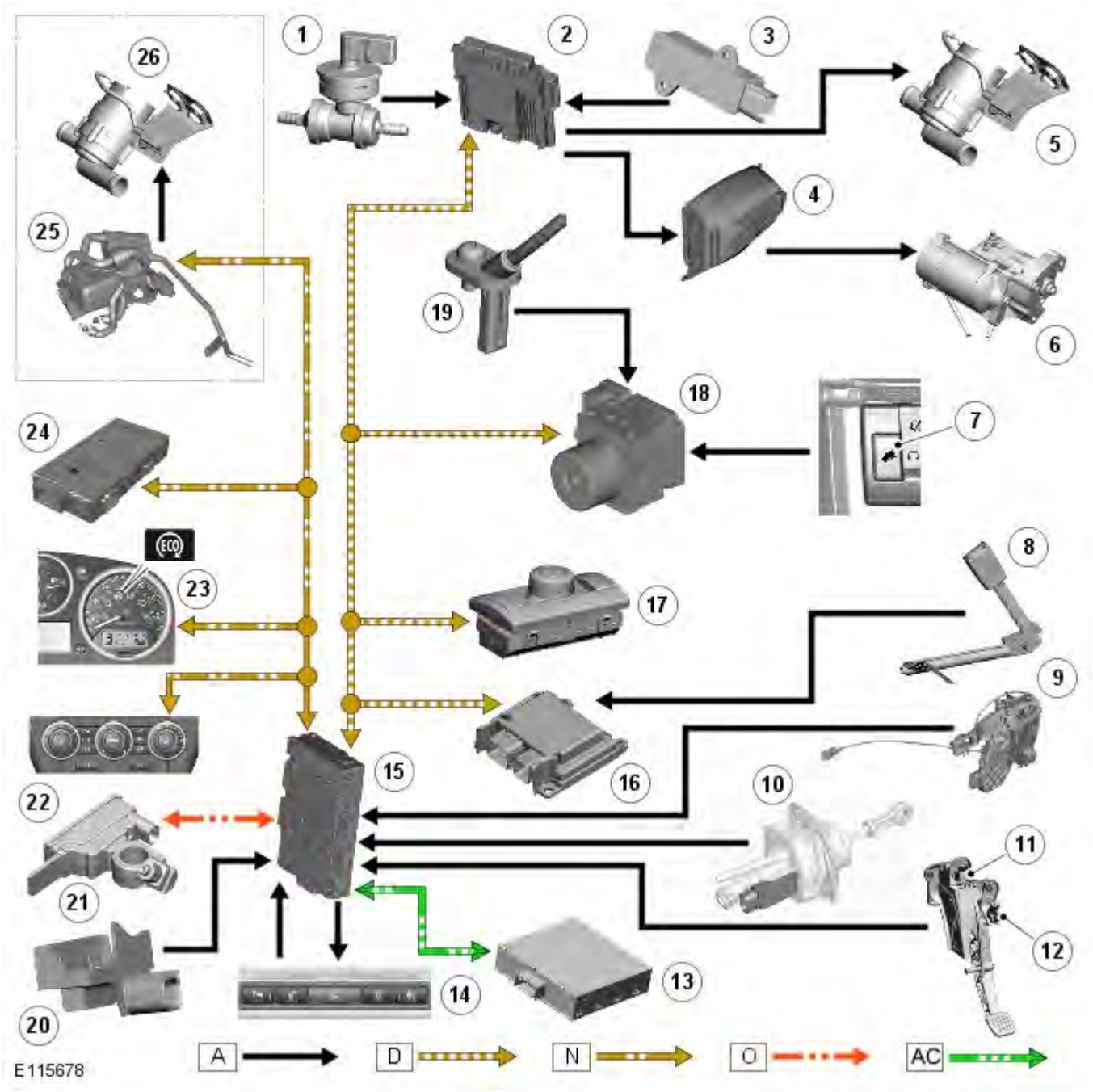
CONTROL DIAGRAM

New software added to the ECM controls the operation of the Stop/Start system where in addition to its own dedicated components the Stop/Start system encompasses many other vehicle systems. Complex technology interconnects these systems and many of the inputs associated with the Stop/Start system are relayed to the ECM and transmitted via the CJB, which has also been upgraded with new software. The control logic for inhibiting an engine shutdown during a Start/Stop cycle resides in the CJB. The CJB also acts as a gateway relaying this information to the ECM over the medium and high-speed CAN bus networks.

Eight vehicle harnesses have been modified to accommodate the Stop/Start system.

Stop/Start Control Diagram

• NOTE: **A** = Hardwired; **D** = High Speed CAN bus; **N** = Medium Speed CAN bus; **O** = LIN bus; **AC** = Diagnostic Link.



Item	Part Number	Description
1	-	Brake vacuum sensor
2	-	Engine control module
3	-	Gear neutral sensor
4	-	Battery junction box
5	-	Auxiliary coolant pump*
6	-	Starter motor
7	-	Hill decent control switch
8	-	Driver’s safety-belt buckle-switch
9	-	Driver’s door ajar-switch
10	-	Linear clutch switch
11	-	Clutch pedal top-of-travel switch
12	-	Clutch pedal bottom-of-travel switch
13	-	Voltage quality module
14	-	Stop/Start switch and status LED
15	-	Central junction box
16	-	Restraints control module
17	-	Terrain response control module
18	-	ABS (anti-lock brake system) module
19	-	Wheel speed sensor
20	-	Hood latch ajar switch
21	-	Battery monitoring system module
22	-	Automatic temperature control module
23	-	Instrument cluster
24	-	Trailer module

25	-	Fuel fired heater (if fitted)
26	-	Auxiliary coolant pump **

* Vehicles without fuel fired heater.

** Vehicles with fuel fired heater.

INTELLIGENT TECHNOLOGY

New and revised components as discussed in this section have been developed to ensure that all vehicle systems operate virtually uninterrupted in a Stop/Start cycle.

Voltage Quality Module

During an engine Stop/Start cycle the VQM (voltage quality module) maintains the vehicle’s electrical systems by supplying a support voltage around the vehicle's electronic components during an engine restart. This allows crucial vehicle systems to continue uninterrupted when there is a sudden draw of amps from the battery.

The vehicle’s starter motor consumes 2kW of electrical power and can draw several hundred amps of current from the battery during cranking. This sudden draw of current causes a momentary voltage drop around all the vehicle circuits. Many of the vehicle's electronic systems are designed to operate at a nominal 12 volts, so this sudden drop in battery voltage without the VQM installed would temporarily interrupt services such as:

- audio system
- cellular phone
- navigation system
- message Center.

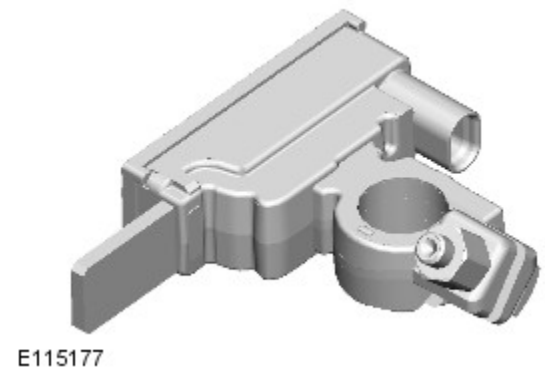
Once the engine is running a signal from the ECM triggers a relay within the VQM to bypass the converter stage and voltage control is given back to the vehicle's normal charging system. The VQM is specified to boost voltage for one second, although in many situations it can supply a voltage boost for up to 5 seconds.

The VQM is effectively a DC (direct current) converter, which converts a variable DC input voltage from as low as 6V up to a stable 12V DC output ± 0.5V.

Rated at a nominal 180W, it can supply up to 15 amps of load at 12 volts. The VQM can tolerate instantaneous spikes up to 300 Watts, enough to maintain uninterrupted power to vehicle systems during engine cranking.

VQM faults are transmitted via a diagnostic link to the CJB where they are held; the fault codes can be diagnosed using Land Rover approved diagnostic equipment.

Battery Monitoring System



Mounted on the battery negative terminal the BMS (battery monitoring system) module is integral with the battery negative cable.

Battery health status is a fundamental factor in the correct operation of the Stop/Start system. Computation of the battery status is performed by the BMS module and will initiate a ‘Stop Inhibitor’ or ‘Start Initiator’ in a Stop/Start cycle if the battery cannot meet the required demand. For additional information refer to the ‘Stop Inhibitors, Start Initiators and Start

Inhibitors' section, below.

The battery status information is transmitted from the BMS module over the LIN (local interconnect network) bus to the CJB which has a two-way communication with the BMS module. The control logic for inhibiting engine shutdown and initiating an early engine restart during a Start/Stop cycle resides in the CJB. The CJB also acts as the gateway relaying this information to the ECM over the high-speed CAN bus.

Battery status information is also transmitted from the CJB over the medium-speed CAN bus to the instrument cluster. The instrument cluster displays battery charge warning messages to indicate generator or battery monitoring system faults to the driver.

The BMS module constantly computes the status of the electrical system on the basis of the following data:

- battery deterioration
- battery state of charge
- battery current demand.

If any of these factors show a low measurement, the ECM suspends the Stop/Start feature until more battery power is available. The factors are discussed below:

Battery deterioration

Although fitted with a high-performance battery based on AGM (absorption glass mat) technology, the charge holding capacity of the battery will still deteriorate, however at a much slower rate than a conventional battery. This degradation will reflect on the amount of charge the battery can hold until it reduces to a condition where the battery will need replacing.

The battery monitoring system calculates the condition of the battery by observing a range of inputs including:

- ambient temperature
- charge and discharge activity
- voltage and
- internal resistance.

The latest condition value of the battery is stored in the dedicated memory of the BMS to ensure the most accurate forecast of the batteries condition.

State of charge

The BMS analyses how much charge has been drawn or replenished to determine the battery's present state of charge.

Current demand

During a Stop/Start cycle when vehicle system use is in high demand, for example the following are operating:

- head lights
- climate control
- audio system.

The battery will discharge more rapidly due to the high current demand.

In this event the BMS calculates various factors to determine how long the battery can supply a current at the present level of demand. This calculation is used by the CJB to determine if to authorize whichever is needed in the Stop/Start cycle, either to:

- prevent an engine stop, or
- initiate an engine restart.

To provide this information to the CJB the BMS module calculates a range of battery variables, including:

- state of charge
- battery surface temperature to calculate the internal temperature
- internal resistance
- voltage
- current flow into and from the battery.

The battery monitoring system calculates these variables against programmed detailed battery life models to determine how long the given current can be supported.

Battery monitoring system modes

The battery monitoring system has three distinct modes:

- Active mode: during normal vehicle operation, battery data is uploaded and calculated every second.
- Sleep mode: during ignition off, battery data is uploaded every second and calculated every hour to reduce inactive current drain.
- Transport mode: battery monitoring intervals are minimized.

Battery replacement

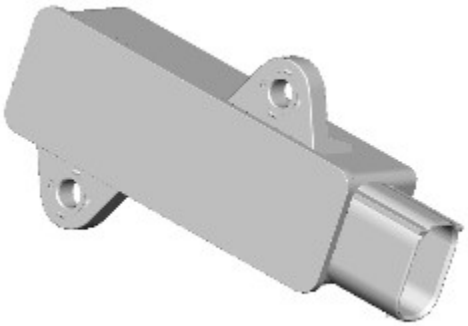
If a new battery is fitted to the vehicle, the BMS (battery monitoring system) module will require recalibrating to register the greater charge holding capacity of the battery, this is performed using Land Rover approved diagnostic equipment. If a diagnostic system is not available the BMS module will recalibrate automatically however, this could take 48 hours to complete depending on vehicle usage. The Stop/Start system will not function correctly until the BMS module is recalibrated.

If the BMS module is replaced the module will re-calibrate automatically.

CAUTION: To avoid damage/malfunctioning of the BMS module, always use a suitable body ground point rather than the battery negative terminal when connecting a slave power supply.

For additional information, refer to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Gear Neutral Sensor



E115179

A PLCD (permanent magnet linear contactless displacement) sensor is located on the exterior of the transmission casing and hardwired to the ECM. The sensor's function is to detect that neutral gear has been selected within a calibrated window.

No calibration is necessary for the Gear Neutral Sensor upon replacement, it is however monitored and a DTC will be logged should a fault occur. Fault codes can be diagnosed using Land Rover approved diagnostic equipment.

Linear Clutch Sensor

E115181

To ensure an engine restart during a Stop/Start cycle does not delay the getaway demands of city driving, the engine is restarted in approximately 800 milliseconds. This is achieved through the linear clutch sensor triggering an engine restart when the clutch pedal is at the start of its downward travel. So while the driver continues to depress the clutch through the rest of its travel the engine restart is already in progress.

The linear clutch sensor is a PLCD (permanent magnet linear contactless displacement) type and is located on the clutch master cylinder and hardwired to the CJB. The sensor provides the CJB with a continuous input of the clutch pedal's position; this information is relayed to the ECM on the high-speed CAN bus. The 'top of travel' signal is used to authorize an automatic engine restart if all other system conditions are approved.

The linear clutch sensor also provides a 'bottom of travel' signal near the end of the clutch pedal's travel. This signal is used if the engine stalls and is a requirement to authorize a stall recovery. This is unique function that allows the engine to restart automatically if all other system conditions are approved. For additional information refer to the Stall Recovery section, below.

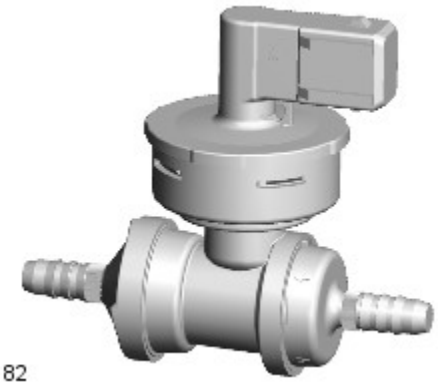
A magnet inside the clutch master cylinder provides the position indicator for the linear clutch sensor. For this reason, if the master cylinder is replaced the correct replacement master cylinder must be identified and fitted.

The two existing clutch position-switches, located on the clutch pedal housing and used as inputs for various vehicle systems, are also utilized by the Stop/Start system for plausibility checks.

If a fault develops with the linear clutch sensor a DTC will be logged in the CJB.

• NOTE: The Stop/Start system will not function correctly if the driver rests their foot on the clutch pedal while driving the vehicle.

Brake Vacuum Sensor



E115182

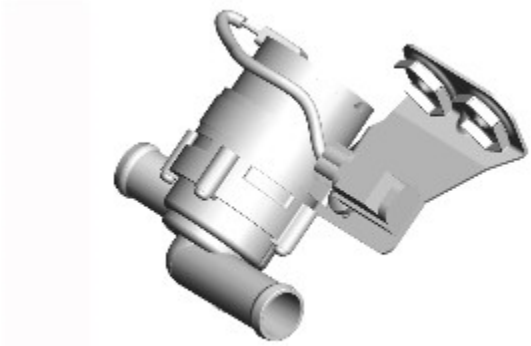
To ensure the vehicle's braking system is never compromised, a brake vacuum sensor is introduced on Stop/Start vehicles to monitor vacuum reserves in the brake servo. The vacuum sensor is mounted in the vacuum pipe and hardwired to the ECM. In the event of brake vacuum decreasing below a set threshold during a Stop/Start cycle the ECM will send a signal to either:

- Restart the engine and consequently replenish vacuum reserves.
- Inhibit the engine shutting down if vacuum reserves are not sufficient.

An example of vacuum reserves depleting, is by the driver repeatedly pressing the brake pedal when the engine is shutdown during a Start/Stop cycle. This action will initiate an engine restart when vacuum reserves decrease below the set threshold.

If a fault develops with the brake vacuum sensor a DTC will be logged in the CJB.

Auxiliary Coolant Pump



E115183

During a Stop/Start cycle when the engine is shutdown and consequently the engine-driven coolant pump is stationary, the desired set cabin temperature cannot be maintained for a prolonged period, especially in cold ambient temperatures. To counteract this, an auxiliary electric coolant-pump has been integrated into the cooling system to maintain the coolant flow through the cabin's heater core. This supporting circulation therefore prolongs the set temperature setting in the cabin and accordingly prevents an early engine restart.

Depending on vehicle classification the auxiliary coolant pump is either:

- Hardwired directly to the ECM.
- Or if the vehicle is fitted with a FFBH (fuel fired booster heater), the FFBH coolant pump is utilized and activated via the FFBH.

The functionality of both types of auxiliary coolant pump is the same with regards the Stop/Start system.

To disguise the activation sound of the auxiliary pump, the pump is activated at the same time as the engine shuts down.

Remote Handset

To allow the driver ease of use, a revised remote handset release has been introduced. This allows the driver to instantly release the remote handset from the start control module when the engine is shutdown in a Stop/Start cycle.

The vehicle reverts to the conventional remote handset release when not in a Stop/Start cycle, that is by pressing the ignition Start/Stop button before releasing the remote handset.

Stall Recovery

In the event of an engine stall, the Stop/Start system enters a unique 'stall recovery' mode. This feature automatically attempts to restart the engine as soon as the driver fully depresses the clutch pedal; the natural reaction of the driver when experiencing a stalled engine situation.

Once the clutch sensor detects the 'bottom of travel' threshold, refer to 'Linear Clutch Sensor', the starter motor is activated to restart the engine. The warning indicators normally associated with an engine stall, for example the ignition and low oil pressure indicators in the instrument cluster will be suppressed so will not illuminate. The Eco indicator does

however remain illuminated.

A 'stall recovery' event is the only state when the Stop/Start system will permit the engine to be started when the transmission is in gear; hence the requirement for the clutch pedal to be fully depressed. If the stall recovery fails and the engine does not restart, the driver will be requested via the Message Center to 'select neutral' to attempt another restart.

If the engine does not restart after this request the 'stall recovery' mode will time-out and deactivate. At this point the 'Eco' icon in the instrument panel will extinguish and the lights usually associated with an engine stall will illuminate. As a result the driver will be required to perform a conventional engine restart.

Although stall recovery is a feature of the Stop/Start system it is possible for it to activate independently from the Stop/Start parameters. For example:

- If the Stop/Start system has been deactivated by the driver stall recovery will still function.
- Stall recovery will activate at ambient temperatures as low as (minus) - 2°C, whereas the Stop/System operating temperature threshold is above 4°C.
- Different to the operation of the Stop/Start system, stall recovery will still function when the vehicle is towing; refer to the 'Trailer Towing' section.

• NOTE: As the necessary criteria will not have been satisfied when the vehicle is at the beginning of a journey stall recovery will not function. For example, if the vehicle stalls when leaving the garage or driveway a conventional engine restart will be required.

Trailer Towing

The Stop/Start system will automatically disable when trailer lights are detected by the CJB via signals from the trailer module, this information is then transmitted to the ECM. It is not possible for the system to detect when a trailer power plug is inserted in the vehicle's towing socket so it uses operation of the trailer lights as its indicator.

The trailer towing system inhibits Stop/Start as it is possible that trailer power requirements could interfere with the operation of the battery monitoring system. In particular, a trailer battery could reverse the feed current to the vehicle during an engine cranking event, this could possibly:

- Confuse the battery monitoring system into detecting an unrealistically small current at engine cranking.
- Rupture the fuse associated with the trailer module.

Climate Control System

• NOTE: The 'ECON' button has been renamed 'A/C' to prevent confusion with the Stop/Start system 'Eco' switch.

A number of changes have been made to the logic and operation of climate control system, within a Stop/Start cycle to:

- maintain occupant comfort
- prevent windshield misting
- conserve battery power.

This has been achieved by the ATC (automatic temperature control) module monitoring and varying, as necessary various climate control functions within a Stop/Start cycle.

In some circumstances the ATC has the capability to inhibit an engine shutdown or initiate an engine restart within a Stop/Start cycle. This is achieved by the ATC module communicating with the CJB on the medium speed CAN. The various override functions the ATC has in a Stop/Start cycle are discussed below:

Coolant temperature

The ATC module will inhibit an engine shutdown or initiate an engine restart within a Stop/Start cycle if the coolant temperature falls below the calculated threshold to support the cabin temperature set by the vehicle occupants.

Windshield demisting

The variant of climate control fitted to the vehicle influences the software changes that have been made. For example, the base climate-control system does not have a humidity sensor, as used on a highline system to initiate a windshield demist. Therefore, a calculation for demisting the windshield is made using the signals from the rain sensor and ambient temperature sensor. Using the probability that windshield misting will occur if it is raining and the ambient temperature is cool, the ATC will presume a windshield demist is required and start the engine when in a Stop/Start cycle.

Evaporator temperature the main cause of windshield misting is also monitored and the high-line climate control system will periodically cool the evaporator as necessary to reduce misting during a Stop/Start cycle. The system operates the windshield demist shutter and if the evaporator is wet the shutter will remain closed for a few seconds after an engine restart until the vapor is dissipated.

If the driver selects either 'programmed defrost' or the 'windshield heater' it is assumed that a quick demist of the windshield is required. Therefore, the ATC via the CJB will either: inhibit an engine shutdown or initiate an engine restart.

Heater fan speed

During an engine shutdown the ATC monitors cabin temperature and maintains the fan speed at a level that will conserve, for as long as possible the heat in the core of the cabin heater. If the driver selects a higher fan speed and the heat cannot be maintained in the heater core, the engine will restart.

Heated rear window and heated seats

If the heated rear window or heated seats are active or activated during an engine shutdown event the power output of the relevant system will be interrupted until the engine is restarted. The tell-tale light in the relevant switch will illuminate to indicate the system is active even though the system is receiving no power. This feature is used to conserve battery power.

Fuel fired heater

The FFBH (fuel fired booster heater) and Stop/Start system will not operate simultaneously, due to low ambient temperatures being a factor in the function of both systems.

Hood Latch Ajar-Switch

WARNING: To avoid injury when performing repair work on the vehicle always disable the Stop/Start system by pressing the 'ECO' button, ensure that 'ECO STOP/START OFF' is displayed in the message Center and the ECO tell-tale light in the switch is extinguished.

The hood latch ajar-switch hardwired to the CJB, has two functions:

- Acts as a stop inhibitor, allowing the engine to remain running if the hood latch is released.
- Deactivates the Stop/Start system if an engine stop is taking place, this results in an engine stalled condition. The engine can be restarted using the ignition button. Stall recovery will not function in this condition; refer to the Stall Recovery section.

After the hood is closed reactivation of the Stop/Start system is achieved by manually starting the engine.

System Fault

The Stop/Start system is automatically activated each time an ignition cycle occurs; the driver will be informed the system is operating by the tell-tale light in the Eco switch illuminating. If the tell-tale light does not illuminate this will indicate that there is either a system fault or the system is not available. Only when the driver attempts to activate the system by pressing the 'Eco' button will they be informed of a fault by 'ECO STOP/START FAULT' being displayed in the message Center.

Owing to the Stop/Start system's complexity due to many other vehicle modules and communication networks involved in its function. It is recommended that all other system faults be initially diagnosed and eliminated when investigating Stop/Start faults as these could affect the operation of the Stop/Start system.

System DTC (diagnostic trouble code)can be diagnosed using Land Rover approved diagnostic equipment.

STOP INHIBITORS, START INITIATORS AND START INHIBITORS

A number of selectable features or vehicle situations can influence the operation of the Stop/Start system's operation. These can, depending on the particular circumstances:

- prevent the engine shutting down (stop inhibitor),
- initiate an autonomous restart (start initiator),
- prevent an engine restart (start inhibitor).

Stop Inhibitors

Under normal circumstances the Stop/Start system will automatically shutdown the engine if:

- the vehicle is stationary,
- the transmission is in neutral,
- the clutch pedal is fully released.

The following conditions will inhibit the engine from shutting down:

Driver effected stop inhibitor

The following driver effected conditions will inhibit the engine from shutting down:

- Driver switches off the Stop/Start system
- Transmission not in neutral
  ((note that the driver resting their hand on the gear lever can move the transmission out of the neutral window without engaging a gear))
- Clutch pedal not fully released
- Accelerator pedal depressed
- Hood is open
- Driver's door is open
- Driver's safety belt is disengaged
- HDC (hill decent control) is active
- TR (terrain response) mode is active
- Climate control system used above calibrated threshold
- Windshield demist is operating
- Trailer electrical connection detected

Vehicle system effected stop inhibitor

The following vehicle system conditions will inhibit the engine from shutting down:

- Driver switches off the Stop/Start system
- Brake servo vacuum below threshold
- Battery cold cranking capability below threshold
- Battery state of charge is low
- Catalytic converter outside either pre or post calibration range
- DPF (diesel particulate filter) is regenerating
- Engine coolant temperature below threshold
- Engine oil temperature below threshold

Environmental effected stop inhibitor

The following environmental conditions will inhibit the engine from shutting down:

- External temperature above 35°C
- External temperature below 4°C

Start Initiators

When the engine has shutdown within a Stop/Start cycle the following conditions will initiate an early restart within the same Stop/Start cycle:

Driver effected start initiator

The following driver effected conditions will initiate an early engine restart:

- Driver switches off the Stop/Start system
- Vehicle speed above calibrated threshold 3 Km/hour (2 mile/hour)
  - A restart will only occur if the transmission is in neutral and the driver's presence is detected for example, the driver's safety belt remains secured and the driver's door remains latched
- Brake servo vacuum below threshold (driver operating brake pedal)
- HDC (hill decent control) is activated
- TR (terrain response) mode is activated
- A higher heater fan speed is selected
- Windshield demist is activated

Vehicle system effected start initiator

The following vehicle system conditions will initiate an early engine restart:

- Battery cranking capability is near its lower threshold
- Battery state of charge is near its lower threshold
- Windshield demist activates
- The interior cabin temperature decreases below or increases above the occupant's set thresholds

Environmental effected start initiator

The following environmental conditions will initiate an early engine restart:

- External temperature rises above 35°C
- External temperature reduces below 4°C

Start Inhibitors

When the engine has shutdown within a Stop/Start cycle the following conditions will prevent an automatic restart:

Driver effected start inhibitor

The following driver effected conditions will inhibit an automatic engine restart:

- Hood has been opened
- The accelerator pedal is depressed
- Gear selector moved out of neutral; message Center will display: 'Select Neutral To Restart'
- Driver's safety belt is disengaged; this is an automatic start inhibitor therefore the engine can be restarted by depressing the clutch pedal
- Driver's door is unlatched; this is an automatic start inhibitor therefore the engine can be restarted by depressing the clutch pedal

Vehicle system effected start inhibitor

The following vehicle system conditions will inhibit an automatic engine restart:

- Engine has shutdown for longer than 5 minutes: a conventional restart will be required
- There is a system fault

Published: 11-May-2011

Engine Ignition -

General Specification

Item	Specification
Spark plugs	
Vehicles built up to VIN 7H038589	
Make	NGK
Type	LPR6D
Gap	0.6mm (non-adjustable)
Vehicles built after VIN 7H038589	
Make	NGK
Type	ILRF6B
Gap	0.75mm ± 0.05mm
Ignition coils:	
Make	Denso
Type	Coil-on-plugs

Torque Specifications

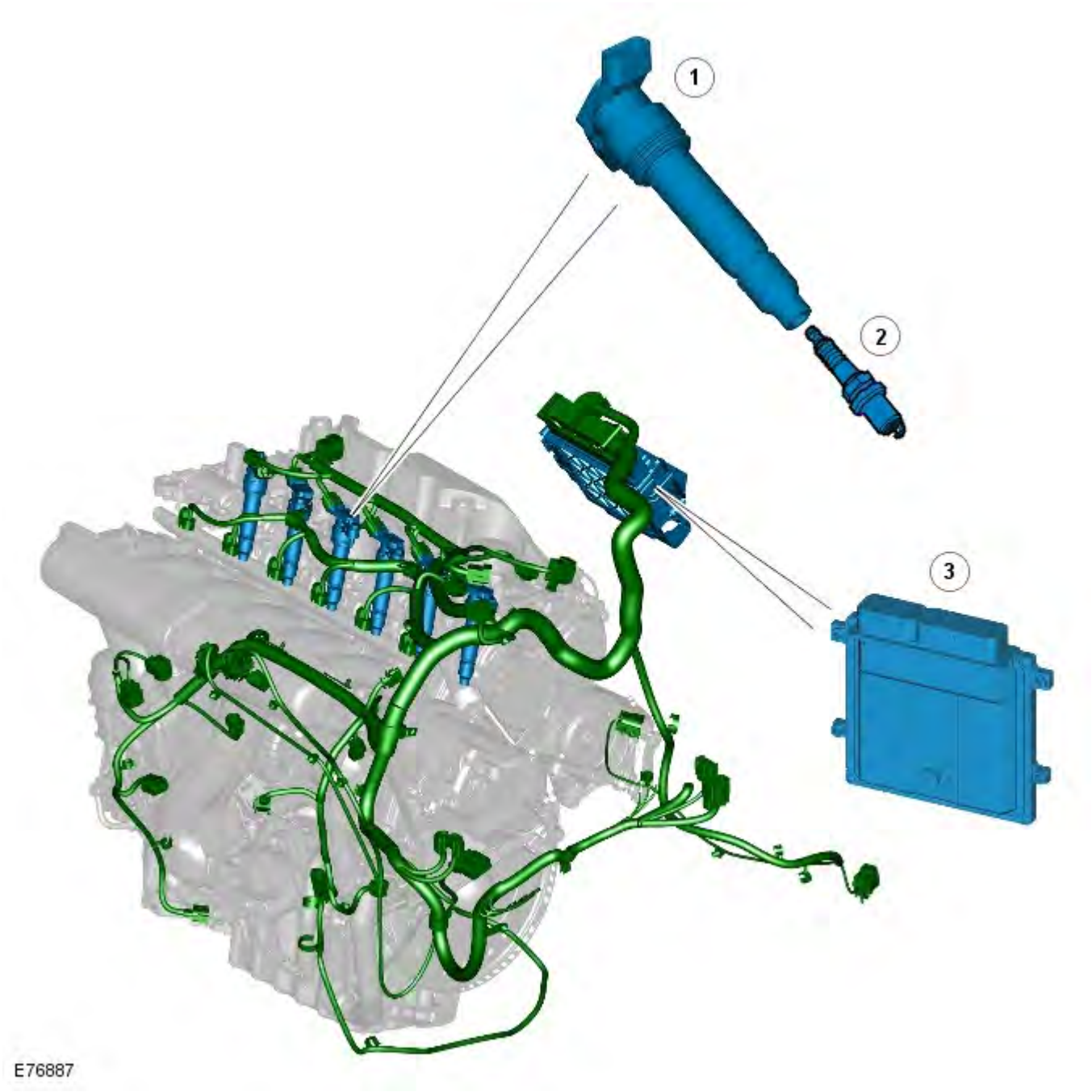
Description	Nm	lb-ft
Ignition coil retaining bolts	10	7
Spark plugs	28	21

Published: 11-May-2011

Engine Ignition - Engine Ignition

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Ignition coil
2	-	Spark plug
3	-	Engine Control Module (ECM)

OVERVIEW

The 3.2L Si6 engine ignition system has a single iridium tipped spark plug per cylinder, with each spark plug powered by an on-plug ignition coil. The ignition coils are directly driven by the ECM.

Power for the ignition coils is supplied from the main relay and a fuse in the BJB. A capacitor is connected in parallel with the power supplies to the ignition coils to suppress RFI (radio frequency interference).

Each ignition coil contains a power stage to switch the current in the primary circuit. The ECM controls the switching with a signal to the power stage. The ECM monitors operation of the ignition coils using a feedback signal from each of the power stages. If a fault is detected the ECM stores an appropriate fault code.

The ECM varies the dwell time of the ignition coils depending on battery voltage and engine speed, to ensure a constant energy level is produced in the secondary coil each time the power stage is switched. This ensures a good spark is always produced by the spark plug without excessive primary current flow, thus avoiding overheating or damage to the ignition

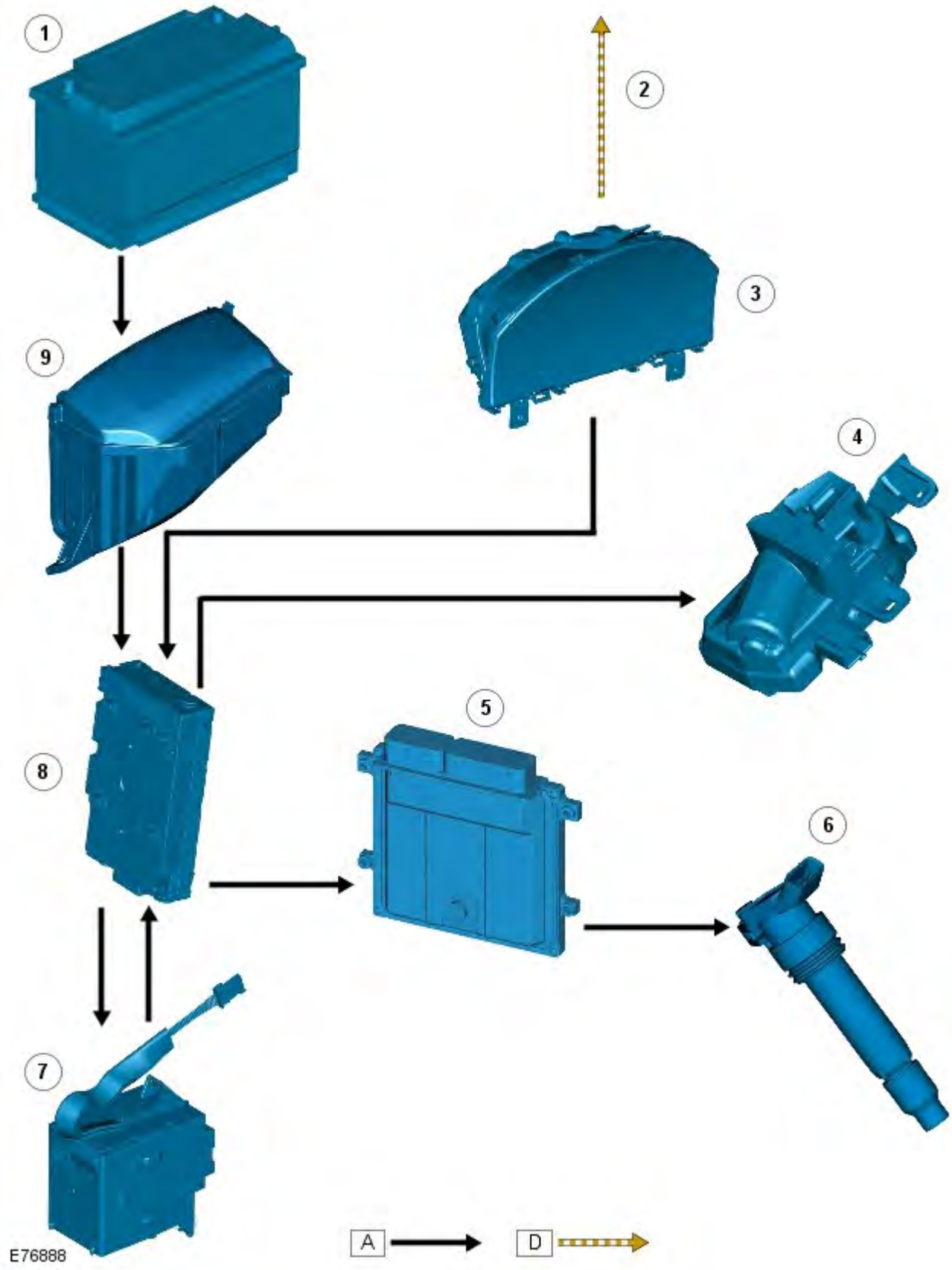
coils.

The ECM calculates the ignition timing for individual cylinders from:

- Engine speed
- Camshaft position
- Engine load
- Engine temperature
- The knock control function
- On automatic transmission models, the shift control function
- The idle speed control function.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High speed CAN bus



Item	Part Number	Description
1	-	Battery
2	-	CAN bus to other vehicle systems
3	-	Instrument cluster
4	-	Electronic steering column lock
5	-	ECM
6	-	Ignition coil
7	-	Keyless start control module and start/stop switch
8	-	CJB
9	-	BJB

Published: 11-May-2011

Engine Ignition - Engine Ignition

Diagnosis and Testing

Principles of Operation

For a detailed description of the ignition system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Engine Ignition (303-07A Engine Ignition, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Engine oil level • Cooling system coolant level • Fuel level • Fuel contamination/grade/quality	• Fuses • Wiring harness • Loose or corroded electrical connectors • Ignition coils • Sensor(s) • Engine Control Module (ECM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	• Engine breather system disconnected/restricted • Engine ignition system • Fuel system • Electronic engine controls	• Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index in this section for engine ignition system tests • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to the DTC Index for electronic engine controls. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
Engine cranks and fires, but will not start	• Evaporative emissions purge valve • Fuel pump • Spark plugs • HT short to ground (tracking) check rubber boots for cracks/damage • Ignition coil failure(s)	• For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • For spark plug tests, Visually inspect the spark plug for cracks, damage, carbon buildup or wet fouling, check the condition of the ground electrode, the center electrode tip and the spark plug HT contact and confirm that the spark plug gap is correctly set using a wire gauge taking care not to cause damage to the center or ground electrode tips. Install new spark plug(s) as required. • For engine ignition coil circuit tests, check for DTCs and refer to the DTC Index
Difficult cold start	• Engine coolant level-anti-freeze content • Battery • Electronic engine controls • Fuel pump • Purge valve	• Check the engine coolant level and anti-freeze content. REFER to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications). • Ensure the battery is in a fully charged and serviceable condition • Read DTCs and refer to DTC Index for electronic engine controls. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and

Symptom	Possible Cause	Action
		• Lines - I6 3.2L Petrol, Diagnosis and Testing). • For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing).
Difficult hot start	• Injector leak • Electronic engine controls • Purge valve • Fuel pump • Engine ignition system	• Check for leaking injectors • Read DTCs and refer to the DTC Index for electronic engine controls. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to DTC Index in this section for engine ignition system tests
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	• Injector leak • Electronic engine controls • Purge valve • Fuel pump • Engine ignition system	• Check for leaking injectors • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). • For fuel system tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). • Read DTCs and refer to DTC Index in this section for engine ignition system tests
Engine stalls soon after start	• Breather system disconnected/restricted • Electronic engine control • Engine ignition system • Air intake system restricted • Air leakage • Fuel lines	• Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index for electronic engine control. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to DTC Index in this section for engine ignition system tests • Check for blockage in air filter element and air intake system • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing).
Engine hesitates/poor acceleration	• Fuel pressure, pump and lines • Injector leak • Air leakage • Electronic engine controls • Engine ignition system • Transmission malfunction • Restricted pedal travel (carpet, etc)	• For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Check for injector leak • Check for leakage from air intake system • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to DTC Index in this section for engine ignition system tests • For transmission tests. REFER to: Diagnostics (307-01 Automatic Transmission/Transaxle, Diagnosis and Testing). • Ensure accelerator pedal is free from restriction
Engine backfires	• Fuel pump and lines • Air leakage • Electronic engine controls • Engine ignition system • Sticking Variable Camshaft Timing (VCT) hub	• For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Check for leakage in air intake system • Read DTCs and refer to DTC Index for electronic engine controls. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to DTC Index in this section for engine ignition system tests • Read DTCs and refer to DTC Index for VCT tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).

Symptom	Possible Cause	Action
Engine surges	• Fuel pump and lines • Electronic engine controls • Engine ignition system	• For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to DTC Index for electronic engine controls. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • Read DTCs and refer to DTC Index in this section for engine ignition system tests
Engine detonates/knocks	• Electronic engine controls • Fuel pump and lines • Air leakage • Sticking VCT hub	• Read DTCs and refer to DTC Index for electronic engine controls • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • Check for leakage from air intake system • Read DTCs and refer to DTC Index for VCT tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
No throttle response	• Electronic engine controls	• Read DTCs and refer to DTC Index for electronic engine control tests
Poor throttle response	• Breather system disconnected/restricted • Electronic engine control • Transmission malfunction • Traction control event • Air leakage	• Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index for electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For transmission tests. REFER to: Diagnostics (307-01 Automatic Transmission/Transaxle, Diagnosis and Testing). • Check for leakage from air intake system

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after the pinpoint tests have been carried out, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P131500	Persistent misfire	• ECM to ignition coil circuit fault - Cylinder misfire DTCs also set • Ignition coil failure • Spark plug failure/fouled /incorrect gap • Fuel delivery pressure low • Fuel injector circuit faults - Injector DTCs also set	Check for DTCs indicating an ignition or fuel related fault. Rectify as necessary.
P136700	Ignition spare	• Ignition failure signal circuit: short circuit to ground • Ignition failure signal circuit: open circuit • Ignition failure signal circuit: short circuit to power • Ignition coil failure	Check the ignition failure signal circuit. Refer to the electrical guides. Rectify as necessary. Install a new coil as necessary. REFER to: Ignition Coil-On-Plug (303-07A Engine Ignition, Removal and Installation).
P136800	Ignition spare	• Ignition failure signal circuit: short circuit to ground • Ignition failure signal circuit: open circuit • Ignition failure signal circuit: short circuit to power • Ignition coil failure	Check the ignition failure signal circuit. Refer to the electrical guides. Rectify as necessary. Install a new coil as necessary. REFER to: Ignition Coil-On-Plug (303-07A Engine Ignition, Removal and Installation).

Published: 11-May-2011

Engine Ignition - Ignition Coil-On-Plug

Removal and Installation

Removal

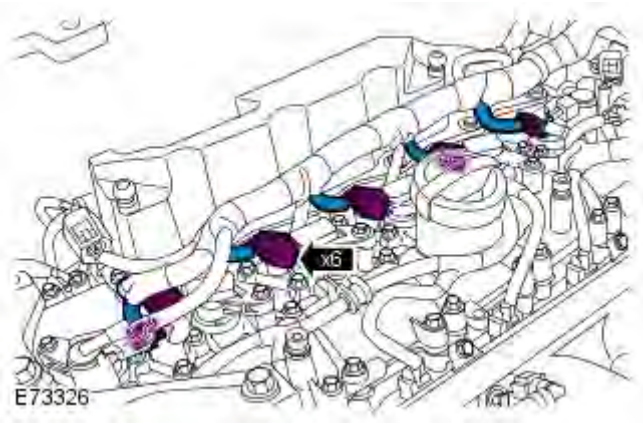
1. **1.** CAUTION: After switching of the ignition, wait for 2 minutes before disconnecting the battery. Failure to wait for 2 minutes will damage the navigation computer.

   Disconnect the battery ground cable.

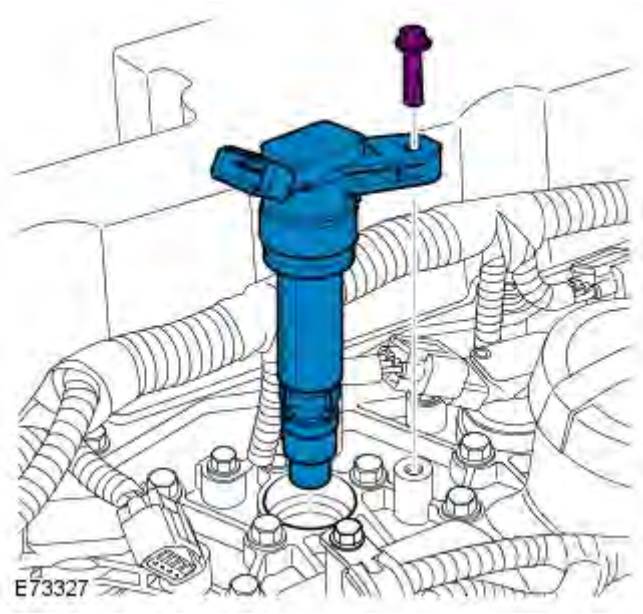
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. Disconnect the 6 ignition coil-on-plugs.



4.

Installation

1. Install the ignition coil-on-plugs.

   Torque: 10 Nm

2. Connect the ignition coil-on-plug electrical connections.

3. Install the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine Ignition - Spark Plugs

Removal and Installation

Removal

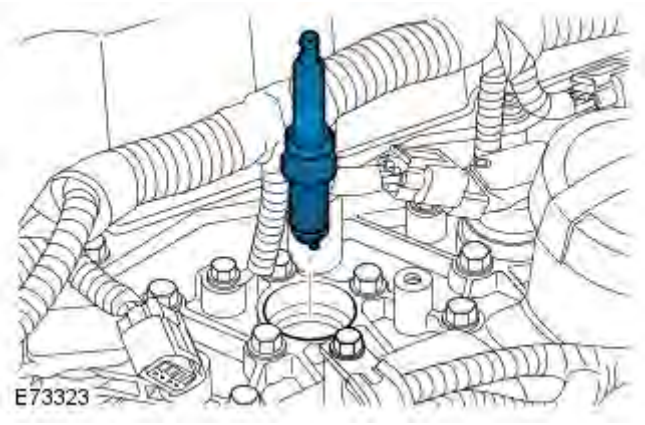
1. **1.** CAUTION: After switching of the ignition, wait for 2 minutes before disconnecting the battery. Failure to wait for 2 minutes will damage the navigation computer.

   Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the ignition coil-on-plugs.

   Refer to: Ignition Coil-On-Plug (303-07A Engine Ignition, Removal and Installation).



3. *Torque:* 28 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Glow Plug System -

Torque Specifications

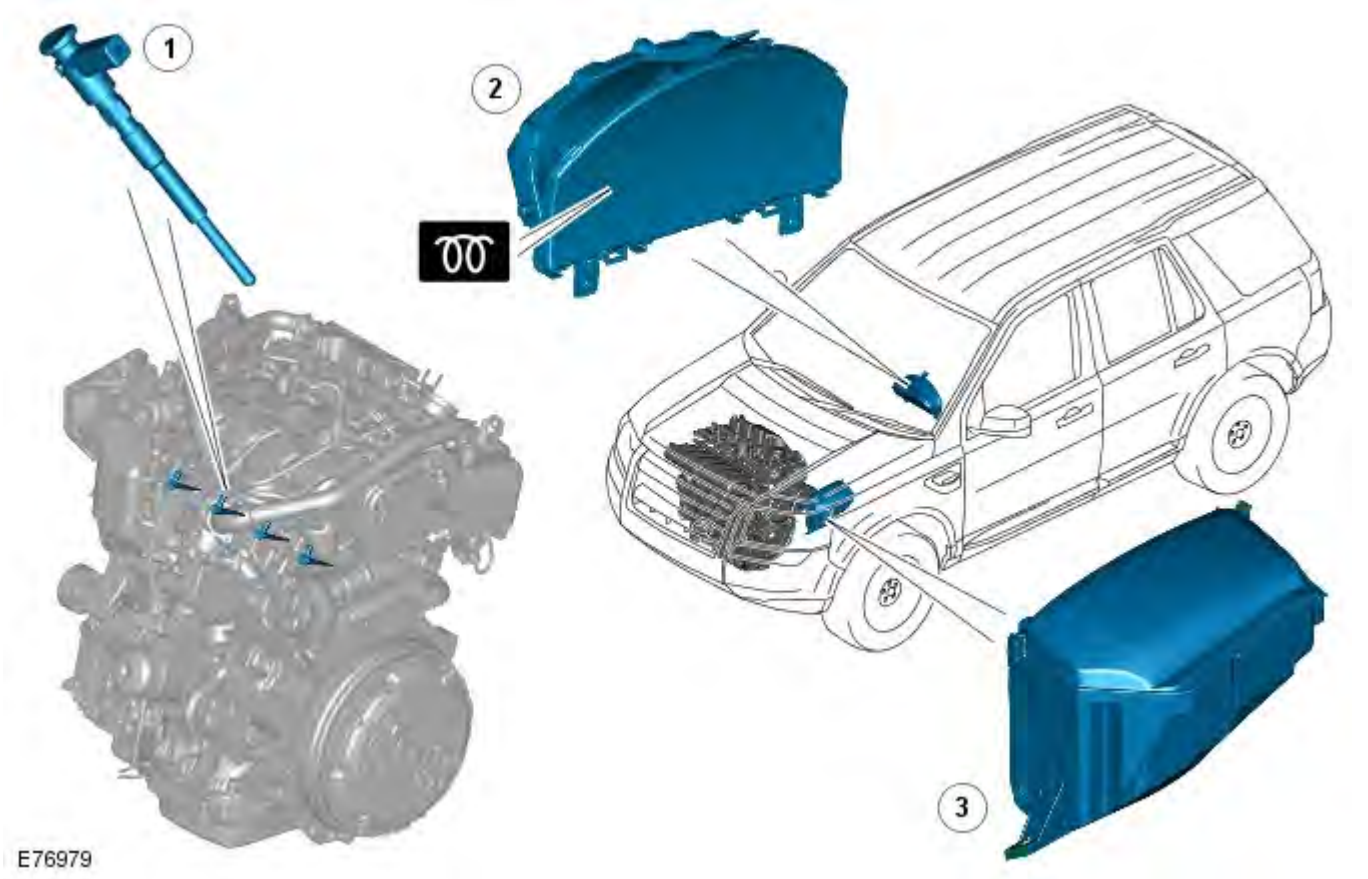
Description	Nm	lb-ft
Glow plugs	10	7

Published: 11-May-2011

Glow Plug System - Glow Plug System

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Glow plugs
2	-	Glow plug warning indicator lamp
3	-	BJB

OVERVIEW

A glow plug is installed in the inlet side of each cylinder, to heat the combustion chambers before and during cranking. This aids cold starting, reduces emissions and engine noise when idling from a cold engine.

A wiring harness on each bank of glow plugs is connected to a separate relay and fusible link in the BJB (battery junction box) . Each glow plug is grounded through its fixing in the cylinder head. Operation of the glow plug relays is controlled by the ECM , which also controls the illumination of the glow plug indicator in the instrument cluster.

Each glow plug is a tubular heating element which contains a spiral filament encased in magnesium oxide powder. At the tip of the tubular heating element is the heater coil. Behind the heater coil, and connected in series, is a control coil. The control coil regulates the current to the heater coil to safeguard against overheating.

OPERATION

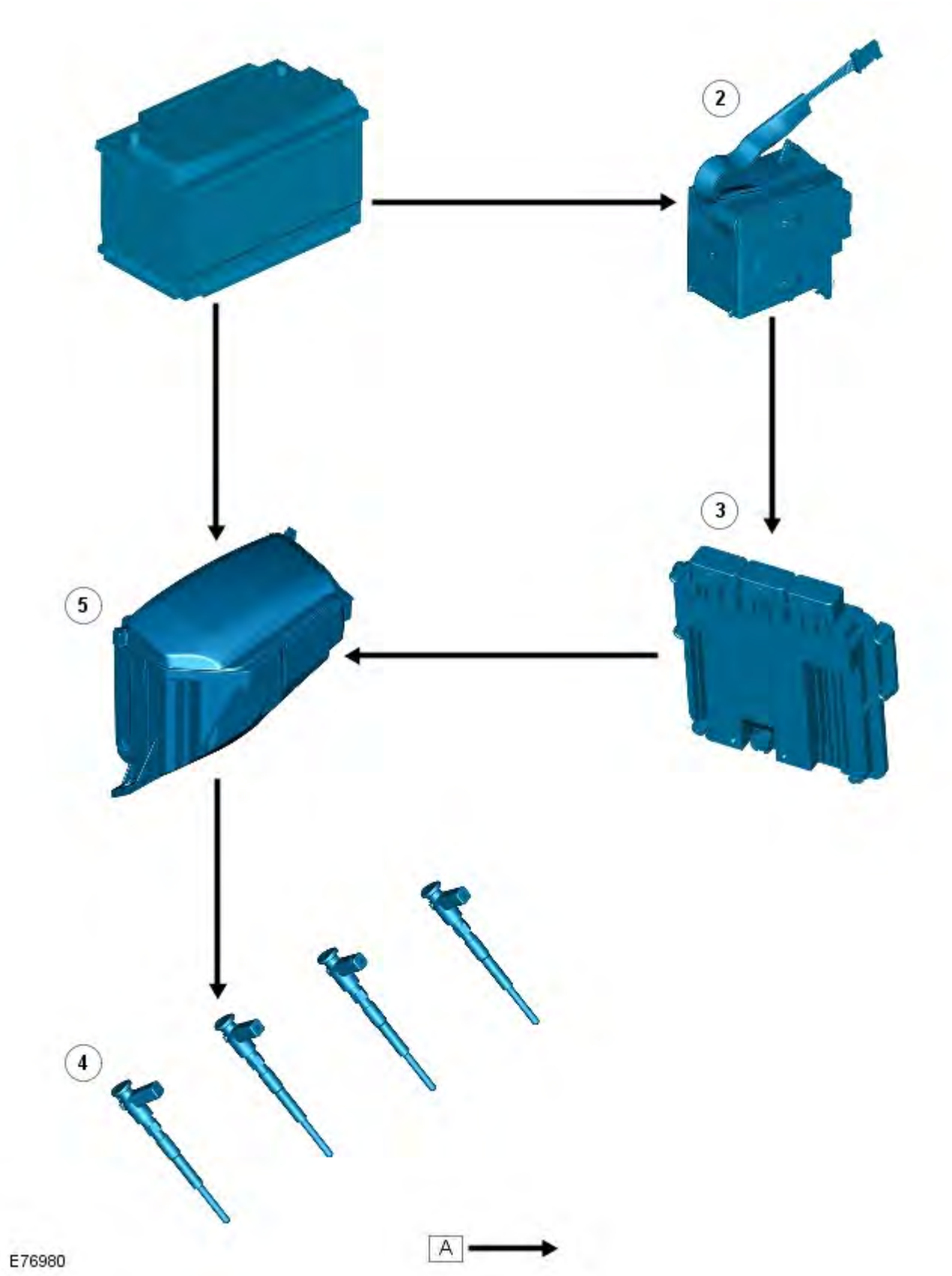
There are three phases of glow plug heating: Pre heating, crank heating and post heating. The ECM (engine control module) determines the heating times from the ECT (engine coolant temperature) . The lower the ECT (engine coolant temperature) , the longer the heating times.

When the ignition switch is switched to mode II, the ECM (engine control module) calculates any required heating times and, if heating is required, energizes the glow plug relays in the BJB (battery junction box) . When pre heating is required, the ECM (engine control module) also sends a message to the instrument cluster, on the high speed CAN (controller area network) bus, to request illumination of the glow plug indicator. The glow plug indicator remains illuminated for the duration of the pre heating phase, or until the ignition switch is turned to the crank position, whichever occurs first. If required, the ECM (engine control module) keeps the glow plug relays energized during cranking and for the duration of any post heating phase.

The ECM (engine control module) monitors the drive circuit of the glow plug relays for plausibility of operation, continuity, and short and open circuits. If a fault is detected, the ECM (engine control module) stores a related fault code and permanently illuminates the glow plug indicator while the ignition switch is in mode II.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired



Item	Part Number	Description
1	-	Battery
2	-	Start/stop switch and control module
3	-	ECM
4	-	Glow plugs
5	-	BJB

Published: 11-May-2011

Glow Plug System - Glow Plug System

Diagnosis and Testing

Principles of Operation

For a detailed description of the glow plug system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Glow Plug System (303-07B Glow Plug System, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage.

Visual Inspection

Electrical
• Fuse(s) • Glow plug relay • Engine management control relay • Wiring harness • Electrical connector(s) • Glow plug(s) • Engine control module (ECM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P038000	Glow Plug/Heater Circuit A	• Glow plug system fault - failure of a glow plug, relay failure, short circuit in a glow plug or over current	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P038300	Glow Plug Control Module Control Circuit Low	• Glow plug relay control circuit - short to ground	Refer to electrical circuit diagrams and check glow plug relay control circuit for short to ground
P038400	Glow Plug Control Module Control Circuit High	• Glow plug relay control circuit - short to power	Refer to electrical circuit diagrams and check glow plug relay control circuit for short to power
P138A00	Glow Plug Control Module Control Circuit Range/Performance	• Glow plug relay excess temperature	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P138B00	Glow Plug Control Module System Voltage	• Glow plug system fault - short circuit in a glow plug, over-current or relay stuck	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Published: 11-May-2011

Glow Plug System - Glow Plugs

Removal and Installation

Removal

CAUTION: Extreme cleanliness must be exercised when handling these components.

• NOTE: The TD4 engine cylinders are numbered from the rear of the engine (transmission end). Therefore, Number 1 cylinder and number 1 injector are located at the rear of the engine.

• NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

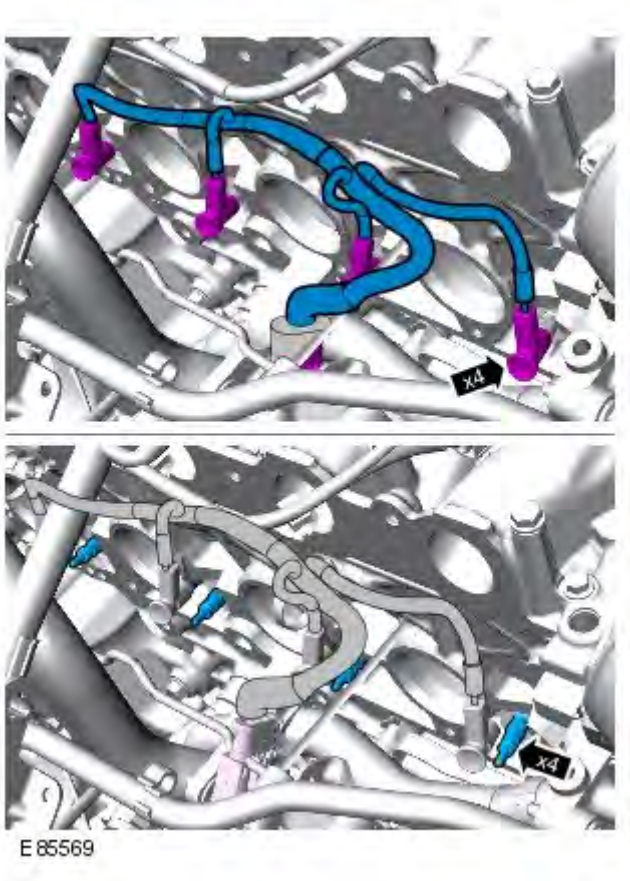
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the intake manifold.

   Refer to: Intake Manifold (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).



4. **4.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Make sure that all openings are sealed. Use new blanking caps.

   Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine Emission Control - I6 3.2L Petrol -

Torque Specifications

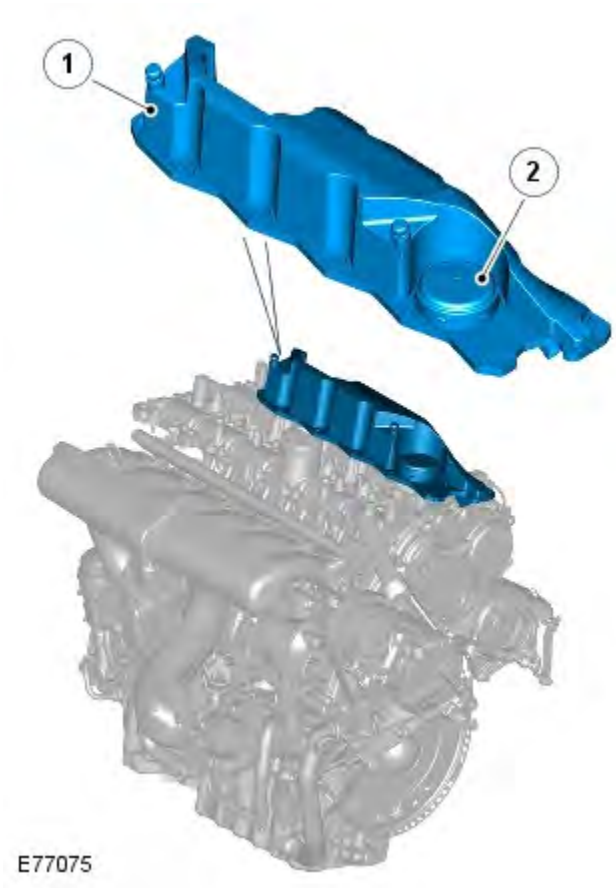
Description	Nm	lb-ft
Crankcase vent oil separator retaining bolts	10	7
Exhaust gas recirculation (EGR) cooler to exhaust manifold bolts	25	18

Published: 11-May-2011

Engine Emission Control - I6 3.2L Petrol - Engine Emission Control3.2L

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Camshaft cover
2	-	positive crankcase ventilation (PCV) valve

OVERVIEW

The engine crankcase is ventilated through a PCV valve located on the camshaft cover. The crankcase gasses are transferred internally to the PCV. The PCV valve prevents reverse airflow into the crankcase.

Published: 11-May-2011

Engine Emission Control - I6 3.2L Petrol - Engine Emission Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the engine emissions systems, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Engine Emission Control - 3.2L (303-08 Engine Emission Control - 3.2L, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• NOTE: For diagnostic purposes the cylinders are divided into two banks: Bank 1 - Cylinder numbers 1, 2 and 3. Bank 2 - Cylinders 4, 5 and 6

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage.

Visual Inspection

Mechanical
• Engine breather hoses

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	• Engine breather system disconnected/restricted	Ensure the engine breather system is free from restriction and is correctly installed
Engine stalls soon after start	• Breather system disconnected/restricted	Ensure the engine breather system is free from restriction and is correctly installed
Poor throttle response	• Breather system disconnected/restricted	Ensure the engine breather system is free from restriction and is correctly installed
Excessive emissions	• Engine breather system restricted	Ensure the engine breather system is free from restriction and is correctly installed
Engine oil leaks	• Engine breather system restricted	Ensure the engine breather system is free from restriction and is correctly installed

Published: 11-May-2011

Engine Emission Control - I6 3.2L Petrol - Crankcase Vent Oil Separator

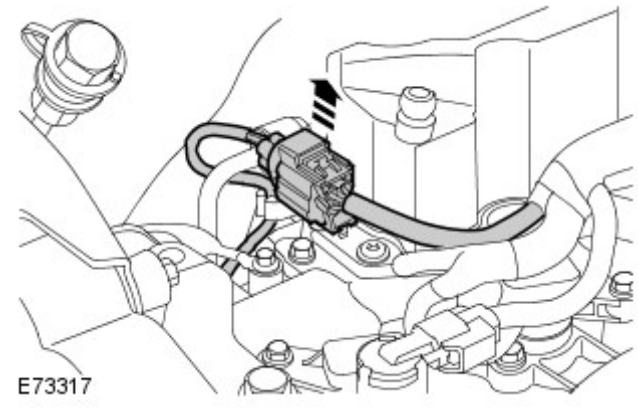
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).



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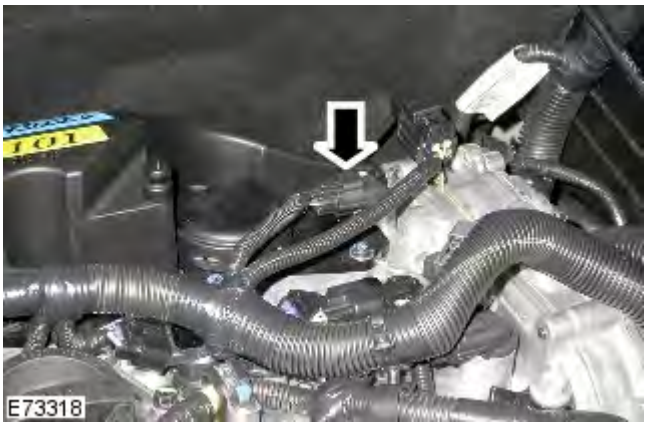

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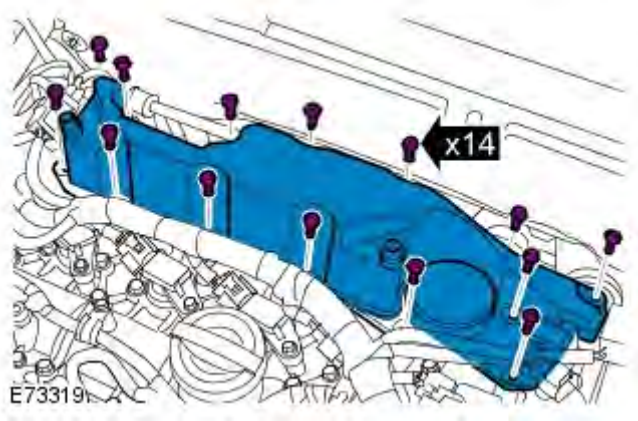
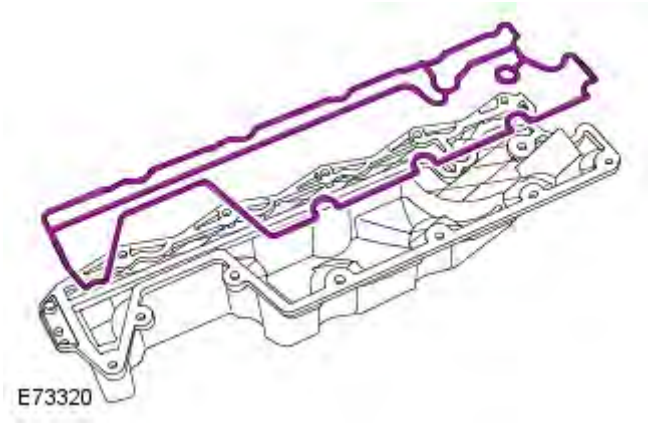


4. *Torque:* 10 Nm



5. **5.** NOTE: The gasket is to be reused unless damaged.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Engine Emission Control - TD4 2.2L Diesel -

Torque Specifications

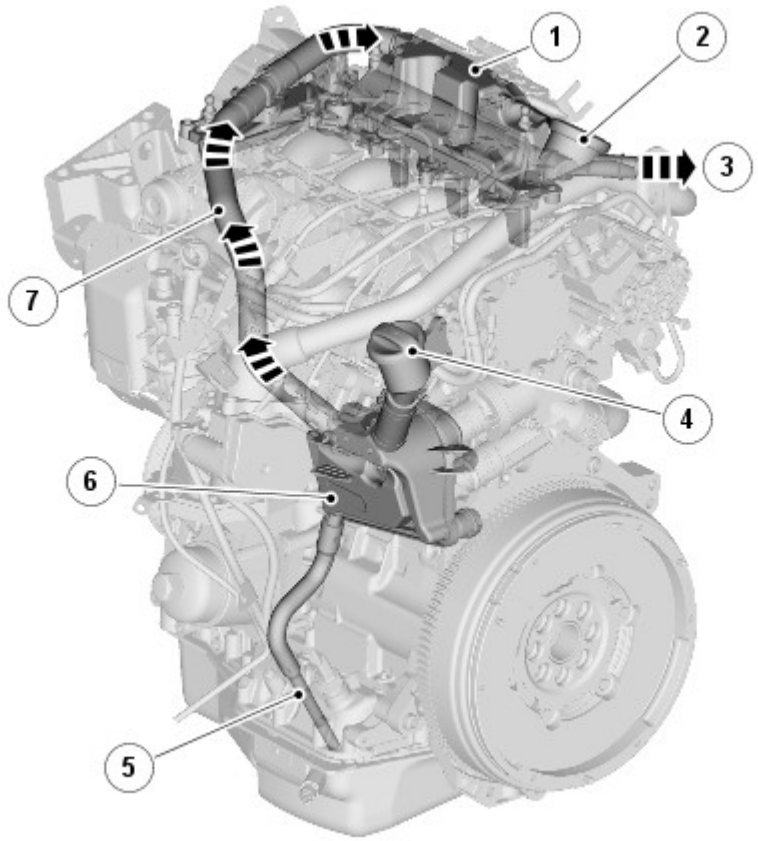
Description	Nm	lb-ft
Crankcase vent oil separator	9	7
Crankcase vent oil separator, wiring harness bracket.	10	7
Crankcase vent oil separator to cylinder block, bracket.		
M6	10	7
M8	25	18
EGR Cooler bolts	10	7
EGR Cooler cross-over pipe securing bolt	10	7
EGR Valve inlet tube bolts	10	7
EGR Valve outlet tube bolts	10	7
EGR Valve nuts	10	7
EGR Valve screws	6	4
Exhaust manifold heatshield	10	7
Fuel filter brackets	25	18
HO2S Wiring harness bracket	8	6
Intake manifold adaptor	6	4
Intake manifold adaptor, wiring harness bracket	10	7

Published: 10-Jun-2011

Engine Emission Control - TD4 2.2L Diesel - Engine Emission Control

Description and Operation

COMPONENT LOCATION



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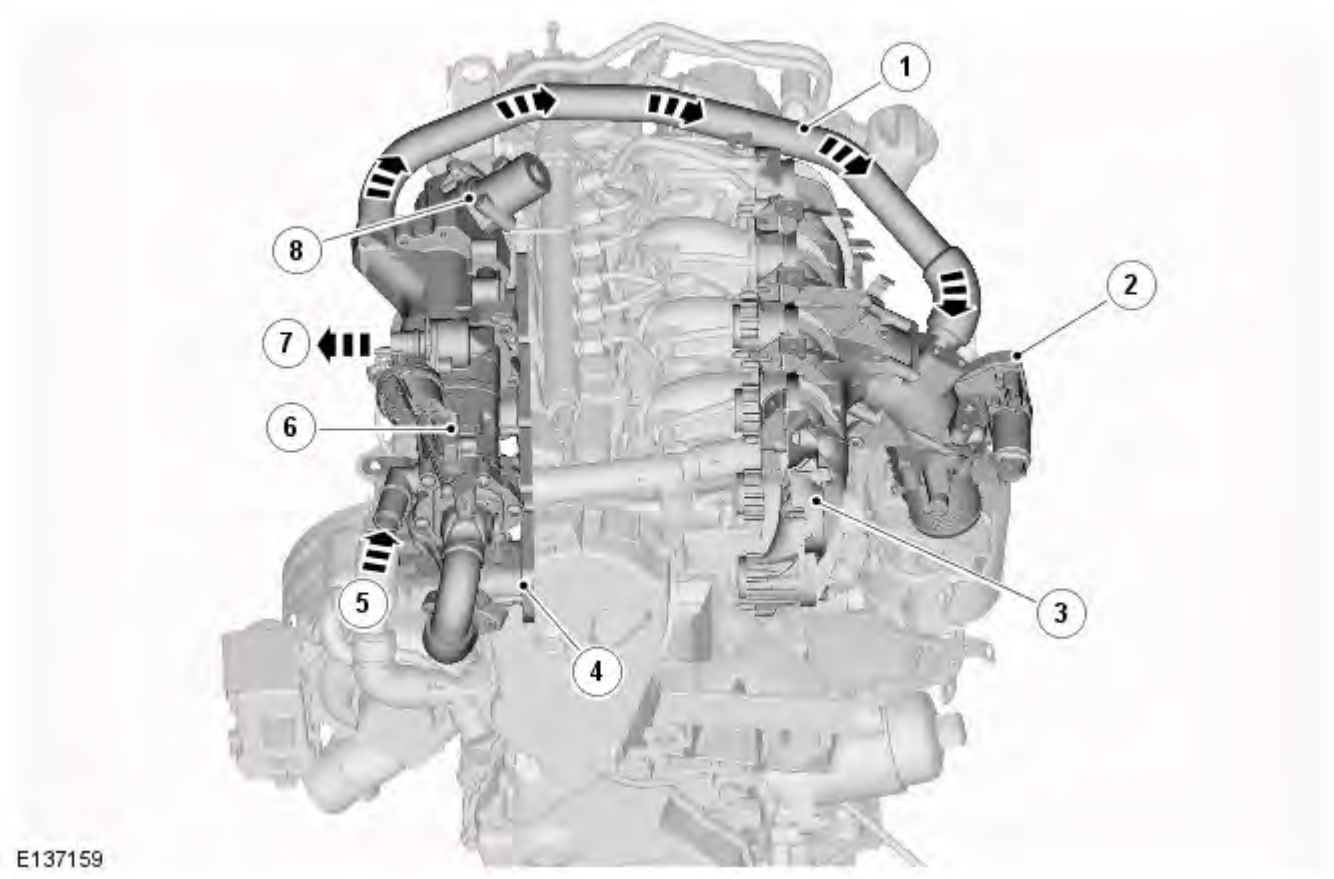
Item	Part Number	Description
1	-	Camshaft cover
2	-	Positive crankcase ventilation (PCV) valve
3	-	Crankcase gas vent to air intake duct
4	-	Oil filler cap
5	-	Oil return tube
6	-	Crankcase vent oil separator
7	-	Crankcase gas ventilation tube - showing flow direction



Item	Part Number	Description
1	-	Exhaust gas transfer tube - showing flow direction
2	-	Throttle body
3	-	Intake manifold
4	-	Exhaust manifold
5	-	Coolant inlet
6	-	Exhaust gas recirculation (EGR) cooler
7	-	Coolant outlet
8	-	Exhaust gas recirculation (EGR) Valve and Actuator

OVERVIEW

Crankcase Ventilation System

To prevent the build-up of gases in the engine's crankcase, the crankcase gases are drawn into the oil separator where oil particles are removed from the gases. The oil is then drained down to the engine's oil pan and the gases are directed into the engine's air intake system.

Prior to the oil-free gases entering the air intake system, a positive crankcase ventilation (PCV) valve operates to minimize crankcase pressure variations caused by engine air demand and engine operating conditions.

Exhaust Gas Recirculation (EGR) System

Harmful nitrogen oxides (NOx) a constituent of the exhaust gases, are formed by the reaction between oxygen and nitrogen at high temperatures. Reducing the engine's combustion temperature and therefore the amount of NOx produced is achieved by recirculating a proportion of the exhaust gases. The recirculated exhaust gases replace some of the engine's intake air as this reduces the oxygen content within the cylinders and lowers the peak combustion temperature by several hundred degrees.

To reduce the temperature as well as increase the density of the inducted fuel charge, the recirculated exhaust gases are passed through the Exhaust Gas Recirculation (EGR) cooler. The EGR cooler utilizes coolant from the engine cooling system to reduce the exhaust gas temperature. Exhaust gases entering the EGR cooler reach temperatures of approximately 500C; the EGR cooler lowers the temperature of the gases, to 250-300C before they exit the cooler.

SYSTEM OPERATION

CRANKCASE VENTILATION SYSTEM OPERATION

Crankcase gasses are drawn into the oil separator unit from the crankcase and the oil pan by a vacuum created by a connection into the air induction system.

The crankcase gasses are circulated around the oil separator and through the camshaft cover where the gas and oil are separated. The gas is returned to the inlet side of the air induction system prior to the turbocharger. The collected oil is drained down to the sump.

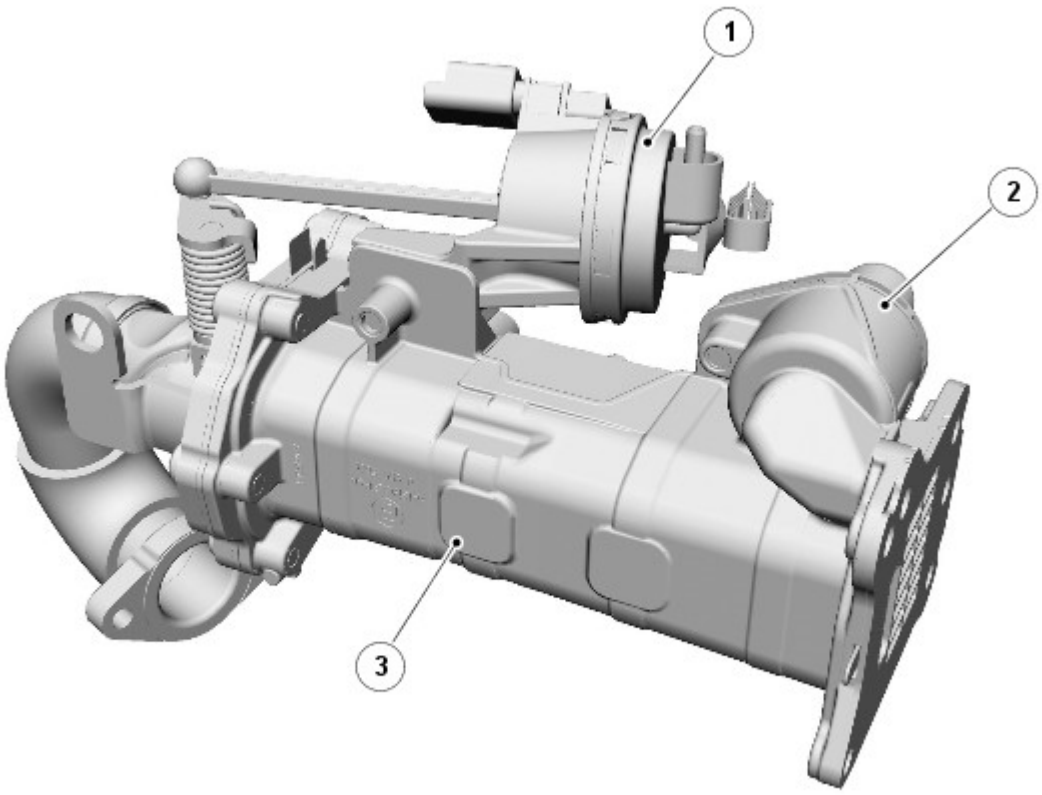
EXHAUST GAS RECIRCULATION (EGR) SYSTEM

An electrically actuated valve, mounted on the outlet side of the EGR cooler and controlled by the ECM (engine control

module), regulates the amount of exhaust gases recirculated into the air intake system. The ECM uses signals from various engine sensors and calculates a response based on the embedded software algorithm to control exhaust gas recirculation. The ECM transmits this control signal to the valve's actuator, which is closed-loop controlled with the mass air flow (MAF) sensor providing the feedback to the ECM.

COMPONENT DESCRIPTION

Exhaust Gas Recirculation (EGR) Valve and Cooler Assembly



E131827

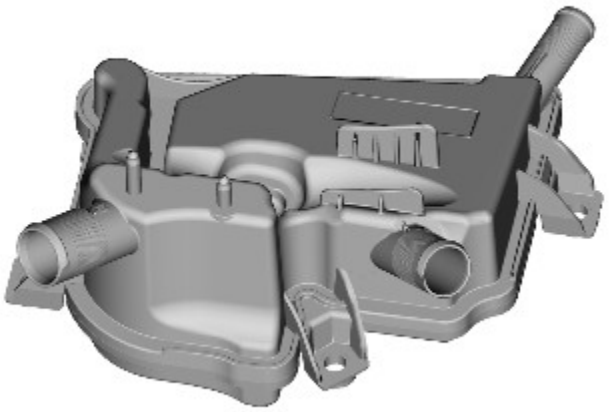
Item	Part Number	Description
1	-	Actuator
2	-	Coolant outlet
3	-	Cooler

The EGR valve and cooler assembly is located on the RH side of the cylinder head above the exhaust manifold, and secured with 4 fixings. An inlet pipe connects the EGR cooler to the exhaust manifold. A gas transfer tube is routed across the engine and connects the EGR valve outlet to the intake manifold housing.

A pipe on the EGR cooler body connects to the climate control heater outlet hose, and provides the coolant supply to the EGR cooler. The EGR cooler outlet connects to the coolant rail, located on the RH side of the engine. The coolant rail is connected between the thermal control module and the coolant pump rear housing.
For additional information, refer to: Engine Cooling (303-03A Engine Cooling - I6 3.2L Petrol, Description and Operation).

The EGR is controlled by the ECM, and is enabled when the engine meets the correct operating temperatures and under cruising conditions.

Oil Separator



E135014

The crankcase ventilation oil separator is also connected to the oil filler tube, located at the rear LH side of the engine. Oil for replenishing the system passes through the oil separator and return hose, and into the oil pan. An oil baffle plate is installed in the oil pan housing to reduce oil aeration and splash.

Published: 11-May-2011

Engine Emission Control - TD4 2.2L Diesel - Engine Emission Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the engine emission control systems, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• EGR valve • EGR pipes/hoses • Vacuum system • Engine breather system	• Wiring harness • Electrical connector(s) • Fuses(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Rough idle, lack of power under acceleration, excessive fuel consumption, excessive black smoke	• EGR valve stuck	Check EGR valve for correct operation. Check for related DTCs and refer to the DTC Index
Excessive engine blow-by/crankcase pressure	• Engine breather system blocked/restricted • Excessive engine wear	Check engine breather system for blockage/restriction. Check for excessive engine wear REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P040500	Exhaust Gas Recirculation Sensor A Circuit Low	• EGR Valve position sensor voltage below lower limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P040600	Exhaust Gas Recirculation Sensor A Circuit High	• EGR Valve position sensor voltage above upper limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P042E00	Exhaust Gas Recirculation Control Stuck Open	• EGR Valve stuck during normal engine running - attempt to unstick valve unsuccessful	Check/clear EGR valve from obstruction/sticking

DTC	Description	Possible Cause	Action
P042F00	Exhaust Gas Recirculation Control Stuck Closed	• EGR Valve stuck during normal engine running - attempt to unstick valve unsuccessful • EGR Valve stuck during after run tests	Check/clear EGR valve from obstruction/sticking
P048900	Exhaust Gas Recirculation Control Circuit Low	• EGR Valve position deviation - valve stuck open	Check/clear EGR valve from obstruction/sticking
P049000	Exhaust Gas Recirculation Control Circuit High	• EGR Valve position deviation - valve stuck closed	Check/clear EGR valve from obstruction/sticking
P140200	Exhaust Gas Recirculation Metering Orifice Restricted	• EGR valve closed position offset difference with first learning too large • EGR valve closed position offset difference with previous learning too large	Check/clear EGR valve from obstruction/sticking, clear DTC and re-test. If DTC remains, install new EGR valve
P148700	Exhaust Gas Recirculation Check Solenoid Circuit	• EGR valve H-Bridge driver error	Clear the DTC and re-test. If the DTC remains, install a new ECM
P154500	Exhaust Gas Recirculation High Side Control Circuit / Open	• Exhaust gas recirculation control circuit 1 (positive) - open circuit • Exhaust gas recirculation control circuit 2 (negative) - open circuit	Refer to electrical circuit diagrams and check exhaust gas recirculation control circuit for open circuit
P154611	Exhaust Gas Recirculation High Side Control Circuit Low	• Exhaust gas recirculation control circuit 1 (positive) - short to ground • Exhaust gas recirculation control circuit 2 (negative) - short to ground	Refer to electrical circuit diagrams and check exhaust gas recirculation control circuit for short to ground
P154712	Exhaust Gas Recirculation High Side Control Circuit High	• Exhaust gas recirculation control circuit 1 (positive) - short to power • Exhaust gas recirculation control circuit 2 (negative) - short to power	Refer to electrical circuit diagrams and check exhaust gas recirculation control circuit for short to power

Published: 11-May-2011

Engine Emission Control - TD4 2.2L Diesel - Exhaust Gas Recirculation (EGR) Valve

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the EGR cooler.

   Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08B Engine Emission Control - TD4 2.2L Diesel, Removal and Installation).

Installation

1. Install the EGR cooler.

   Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08B Engine Emission Control - TD4 2.2L Diesel, Removal and Installation).

Published: 11-May-2011

Engine Emission Control - TD4 2.2L Diesel - Exhaust Gas Recirculation (EGR) Cooler

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the secondary bulkhead center panel.

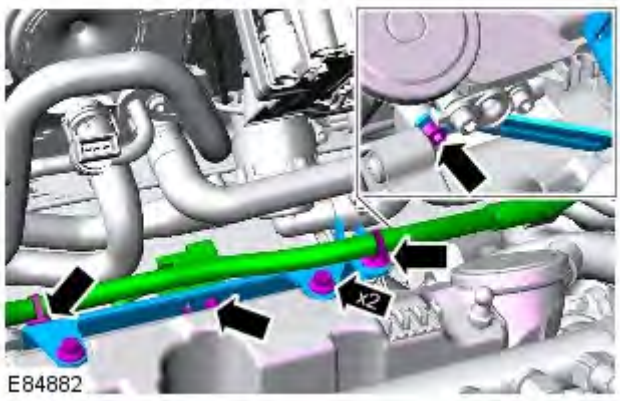
   Refer to: Secondary Bulkhead Center Panel - TD4 2.2L Diesel (501-02 Front End Body Panels, Removal and Installation).

3. Drain the coolant.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

4. Remove the heated oxygen sensor (HO2S).

   Refer to: Heated Oxygen Sensor (HO2S) (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Removal and Installation).



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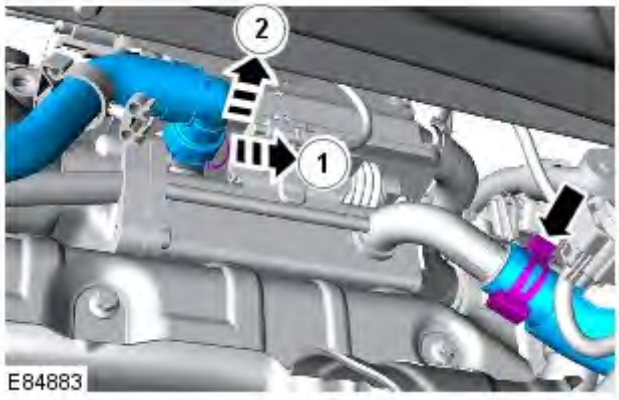

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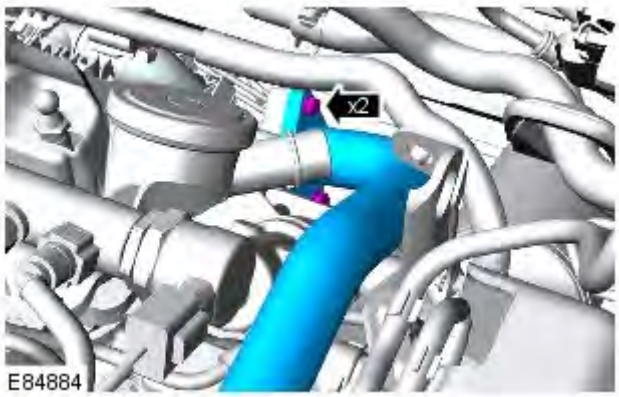

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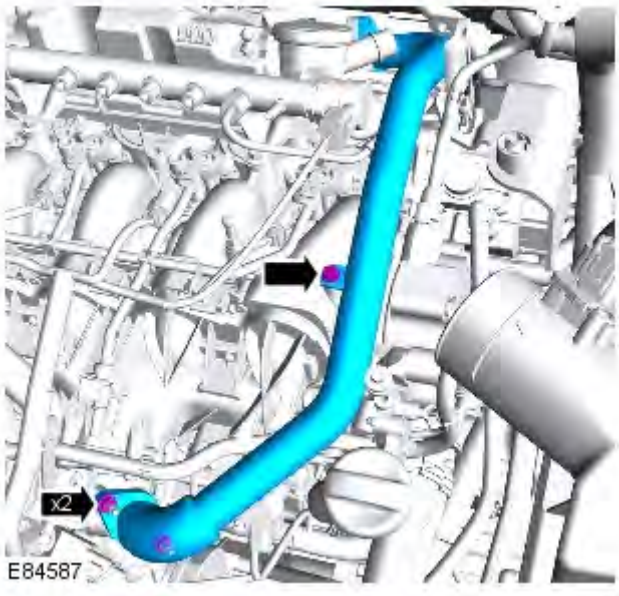
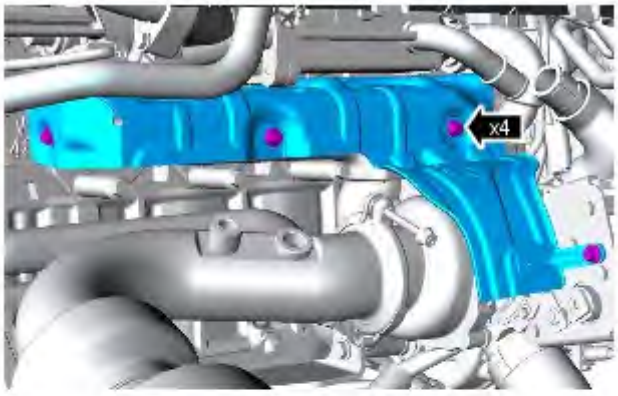


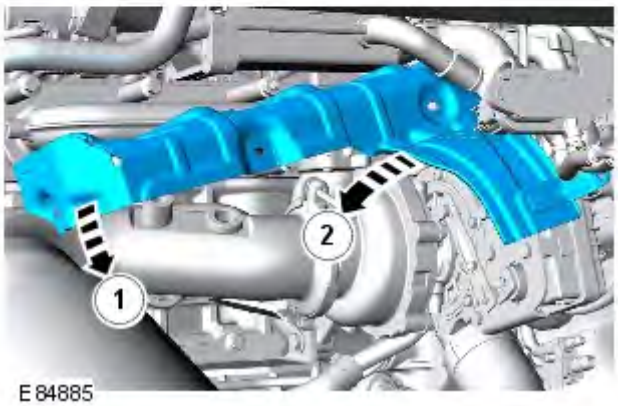
8. **8.** CAUTIONS:

Make sure that all openings are sealed. Use new blanking caps.

Discard the component.

9.





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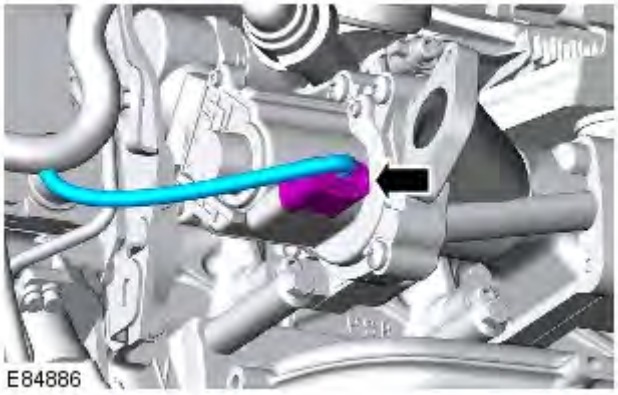
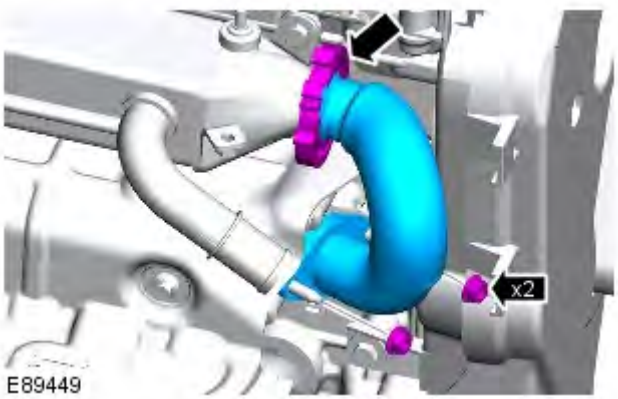
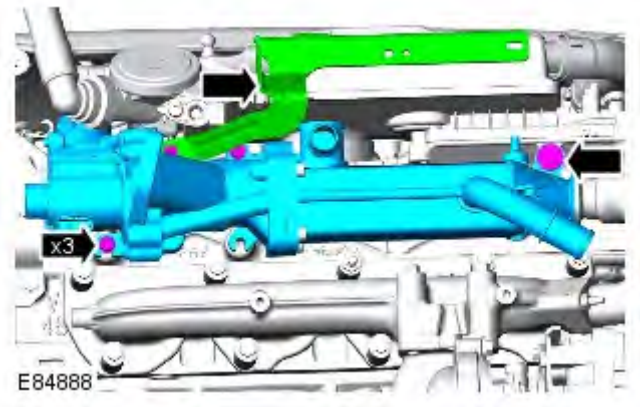


11. **11.** CAUTION: Discard the components.





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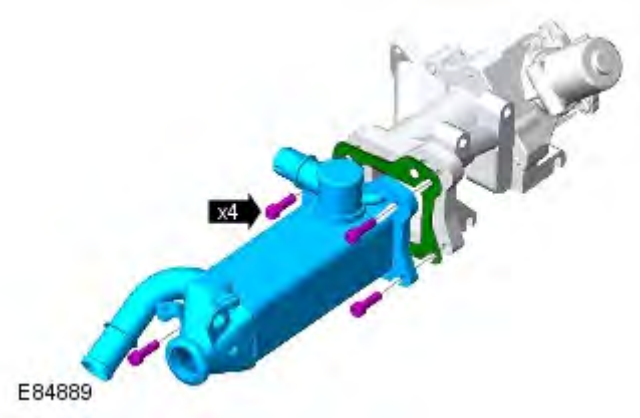


13. **13.** NOTE: Do not disassemble further if the component is removed for access only.

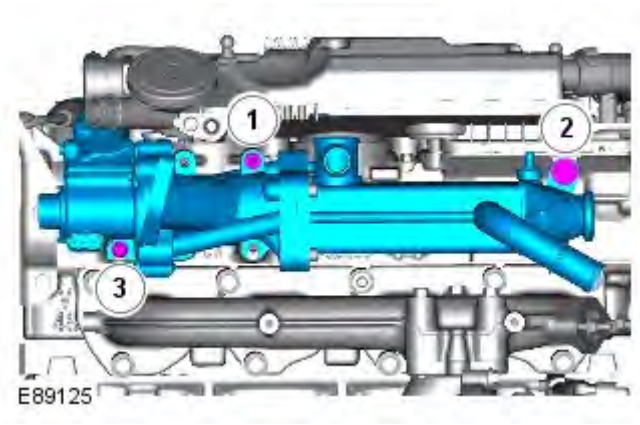
    • NOTE: Discard the gasket.

Installation

1. **1.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

   Install the EGR valve.

   Torque: 10 Nm



2.
   - Install the EGR cooler.
   - Install the nuts and bolt, but do not fully tighten at this stage.
   - Tighten the nuts in the sequence shown.

     Torque: 6 Nm
   - Tighten the bolt in the sequence shown.

     Torque: 10 Nm

3. **3.** CAUTIONS:

   Make sure that the component is clean, free of foreign material and lubricant.

   "Make sure that new components are installed. "

   Install the EGR cooler to exhaust manifold elbow.

Torque: 10 Nm

4. Connect the EGR valve electrical connector.

5. Install the exhaust manifold heat shield.

   Torque: 10 Nm

6. **6.** CAUTIONS:

   Make sure that the component is clean, free of foreign material and lubricant.

   "Make sure that a new component is installed. "

   Install the cooler to inlet manifold EGR pipe.

   Torque: 10 Nm

7. Connect the coolant hoses and secure with the clips.

8. Install the HO2S wiring harness bracket.

   Torque: 8 Nm

9. Install the HO2S.

   Refer to: Heated Oxygen Sensor (HO2S) (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Removal and Installation).

10. Fill and bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

11. Install the secondary bulkhead center panel.

    Refer to: Secondary Bulkhead Center Panel - TD4 2.2L Diesel (501-02 Front End Body Panels, Removal and Installation).

Published: 11-May-2011

Engine Emission Control - TD4 2.2L Diesel - Crankcase Vent Oil Separator

Removal and Installation

Removal

- CAUTIONS:

Make sure that all openings are sealed. Use new blanking caps.

Make sure that the area around the component is clean and free of foreign material.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

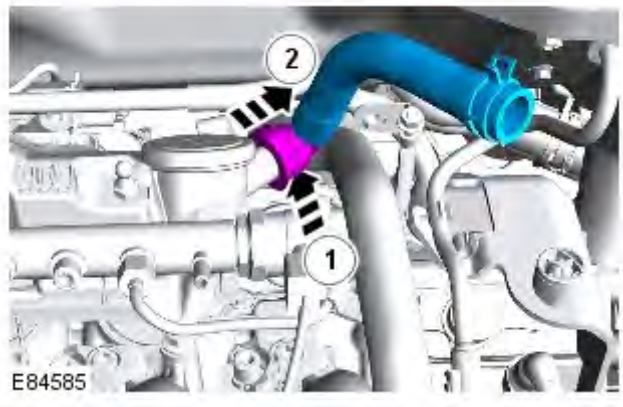
2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the throttle body.

   Refer to: Throttle Body (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

4.



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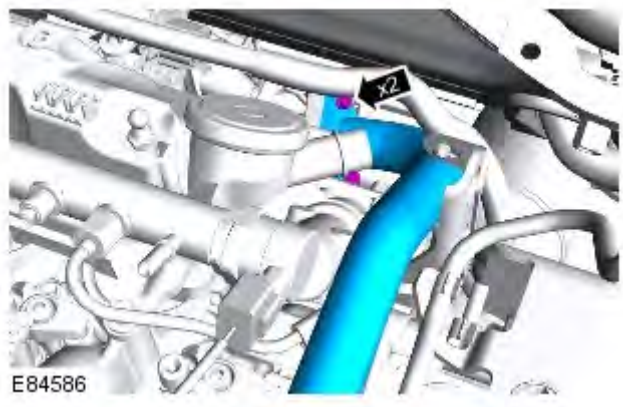
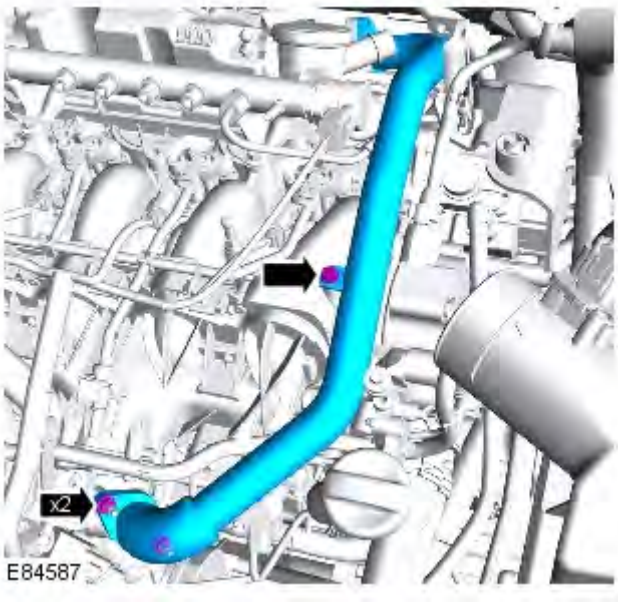
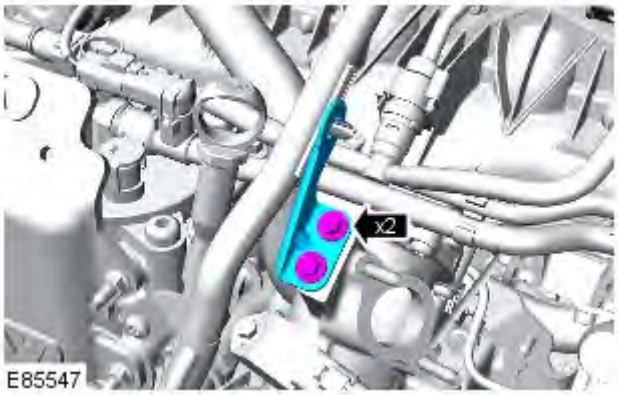




6. **6.** CAUTIONS:

   Discard the component.

   Make sure that all openings are sealed.



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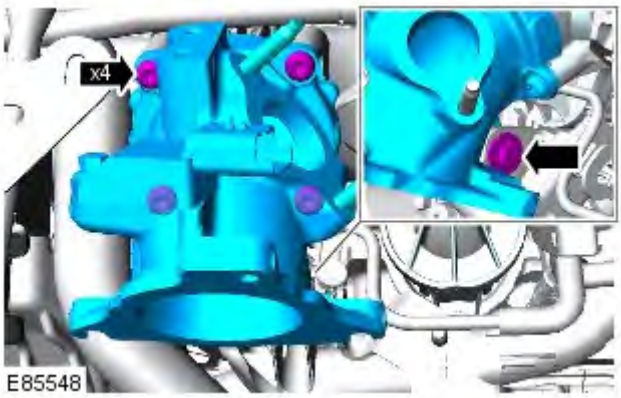

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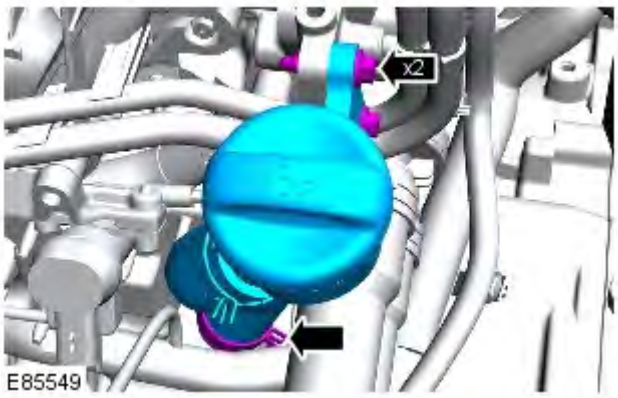
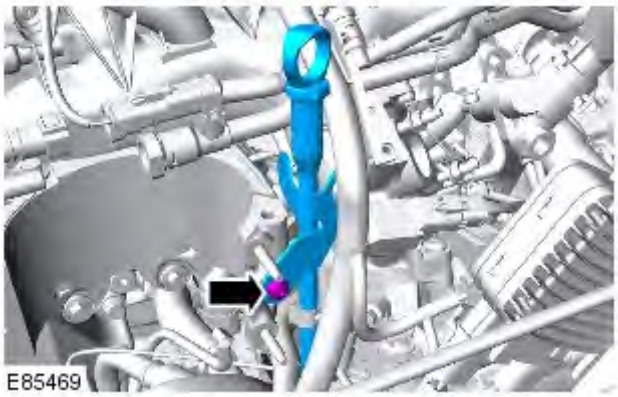


10. Remove the fuel filter.

    Refer to: Fuel Filter (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

11.



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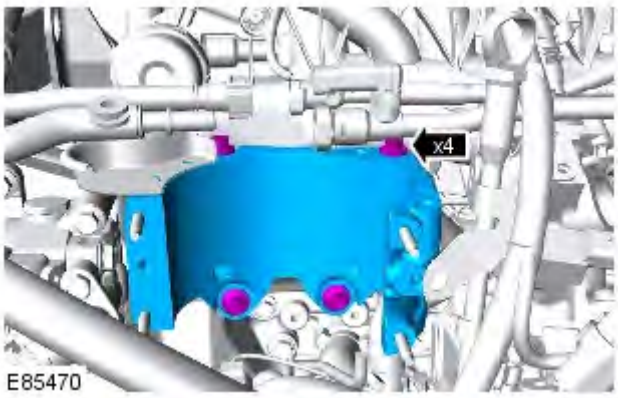

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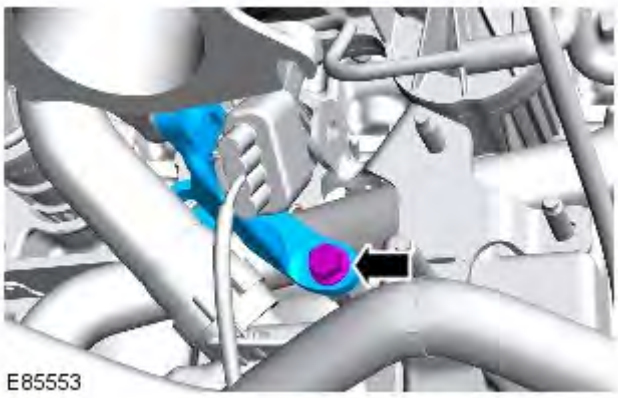

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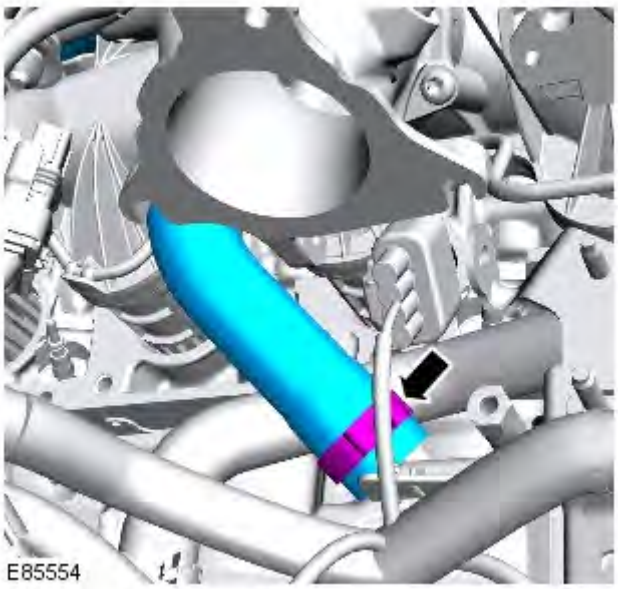

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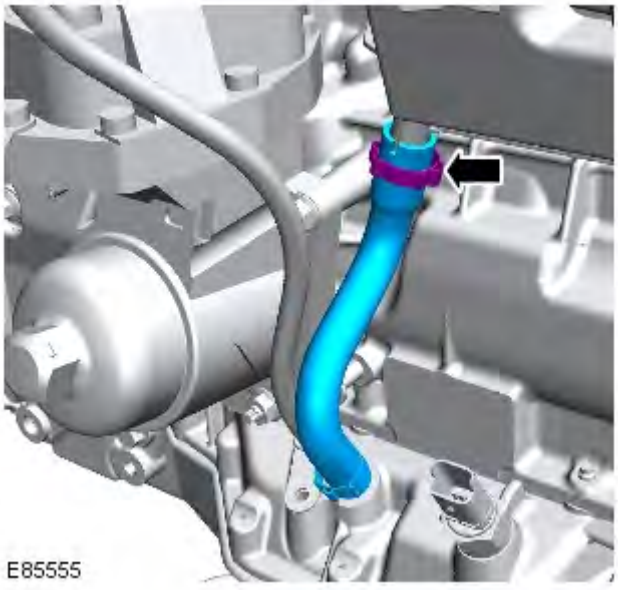

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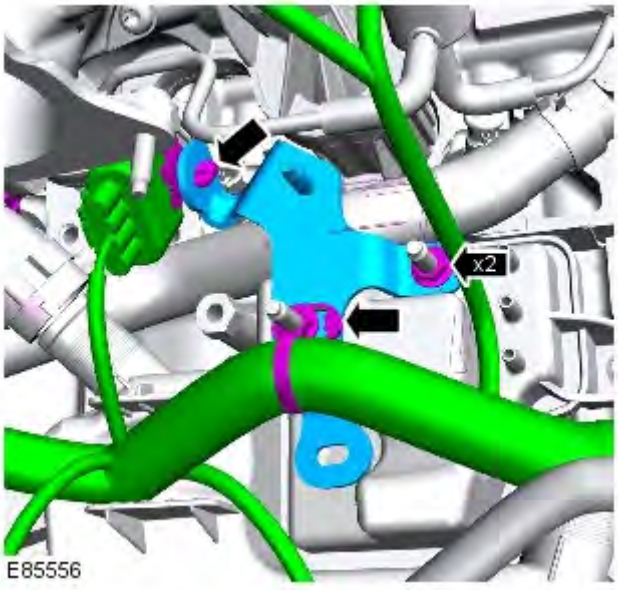

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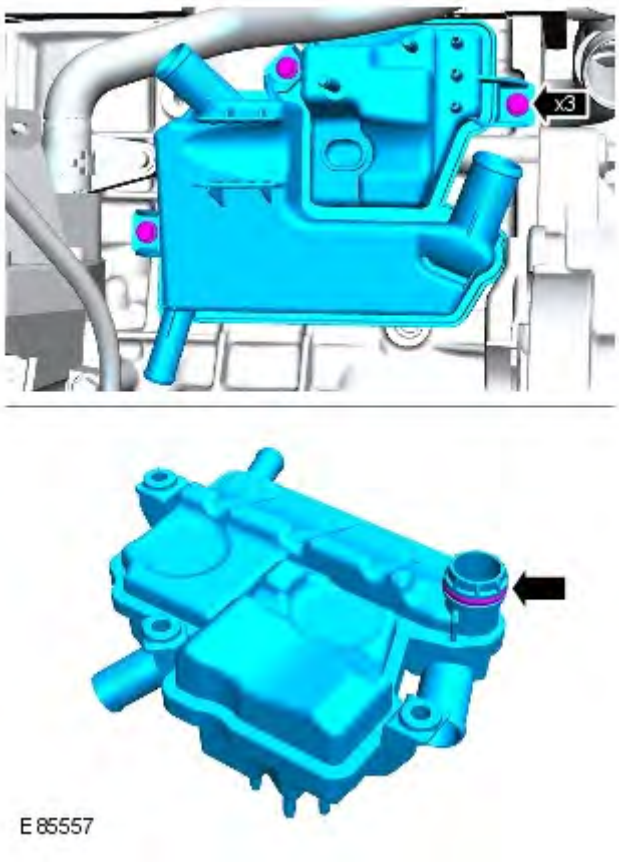


Installation

1. **1.** CAUTION: A new O-ring seal is to be installed.
   Install the crankcase vent oil separator.

   Torque: 10 Nm

2. Install the crankcase vent oil separator, wiring harness bracket.

   Torque: 10 Nm

3. **3.** NOTE: Install new retaining clips.
   Connect the crankcase vent hoses.

4. Install the crankcase vent oil separator to cylinder block, bracket.

   Torque:
   M6 10 Nm
   M8 25 Nm

5. Install the fuel filter brackets.

   Torque: 25 Nm

6. Attach the oil level indicator tube.

   Torque: 10 Nm

7. Install the fuel filter.

Refer to: Fuel Filter (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

8. **8.** NOTE: Install a new retaining clip.

   Inatall the engine oil filler tube.

   Torque: 10 Nm

9. Install the intake manifold adaptor.

   Torque: 6 Nm

10. Install the intake manifold adaptor, wiring harness bracket.

    Torque: 10 Nm

11. **11.** CAUTIONS:

    "Make sure that a new component is installed. "

    Make sure that the mating faces are clean and free of foreign material.

    Install the EGR pipe.

    Torque: 10 Nm

12. Install the breather line.

13. Install the throttle body.

    Refer to: Throttle Body (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

14. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Engine Emission Control - TD4 2.2L Diesel - Valve Cover Vent Oil Separator

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

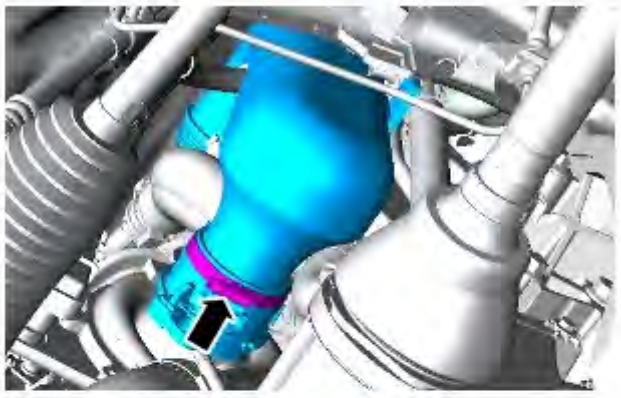
2. **2.** WARNING: Make sure to support the vehicle with axle stands.

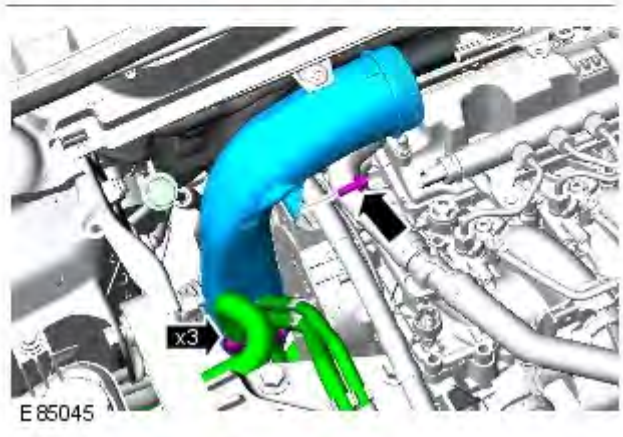
   Raise and support the vehicle.

3. Remove the fuel rail.

   Refer to: Fuel Rail (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

4.





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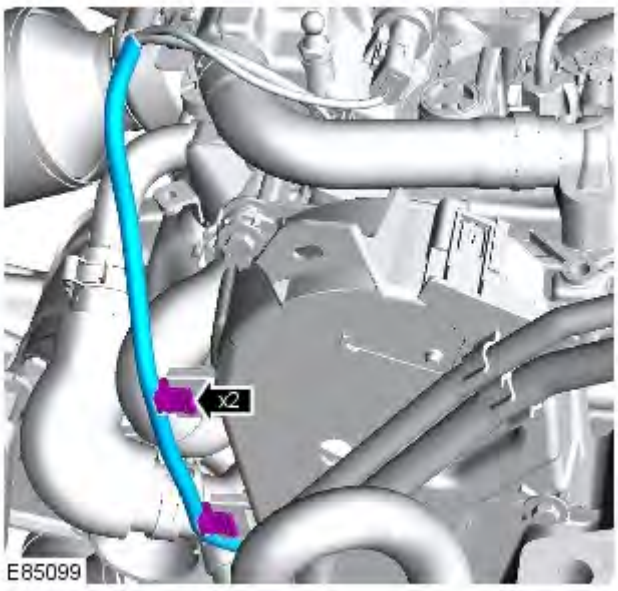
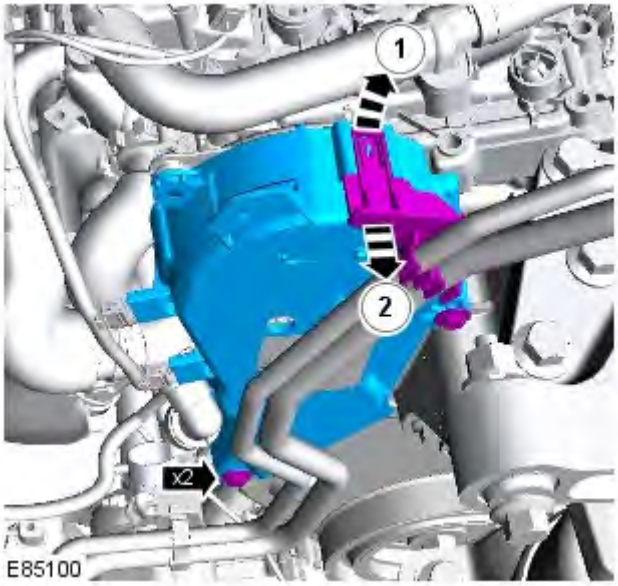


6. *Torque:* 6 Nm



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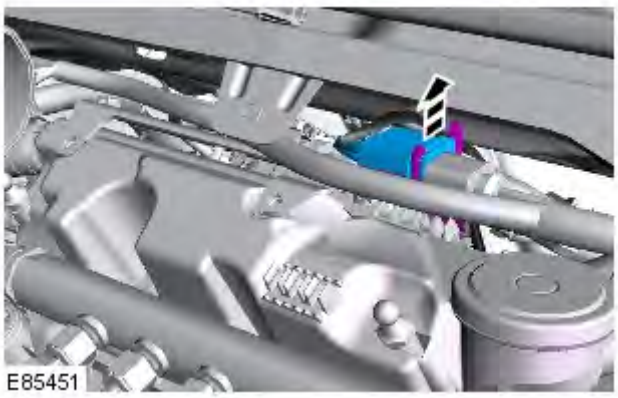
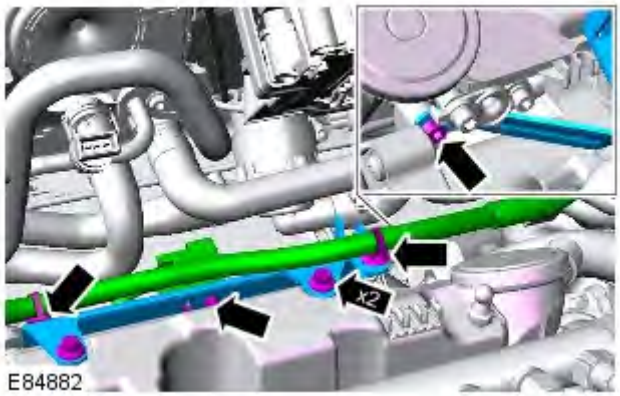
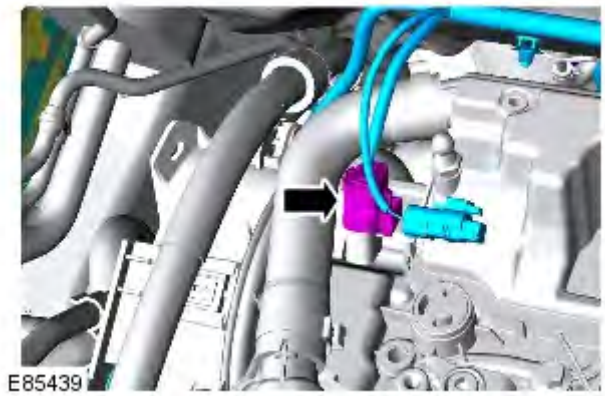




8. *Torque:* 8 Nm



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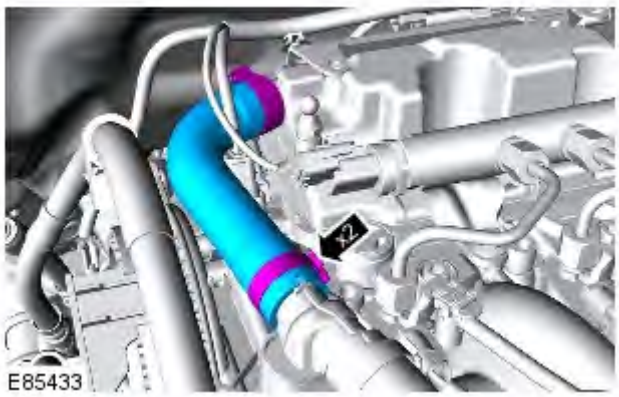
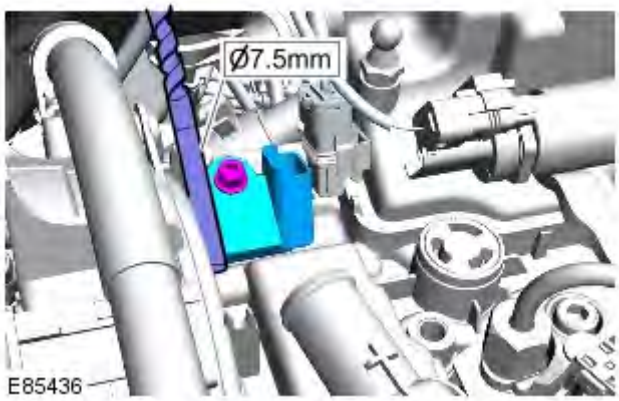
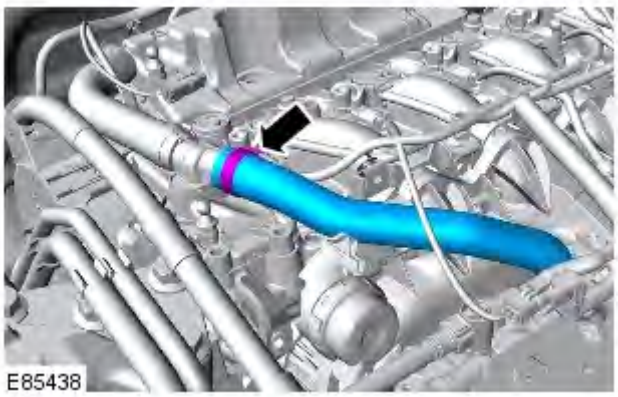


10. Remove and discard the hose clips.

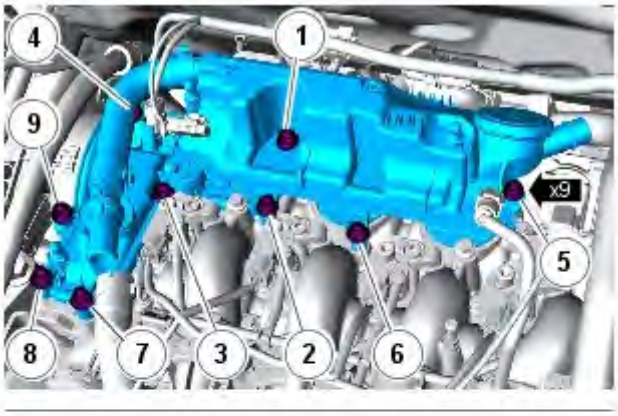


11. **11.** CAUTION: Incorrect installation of the camshaft position (CMP) sensor could result in engine damage.

- Insert a 7.5 mm diameter drill between the valve cover and the CMP sensor as shown, to achieve the correct alignment of the CMP sensor.
- *Torque:* 4 Nm



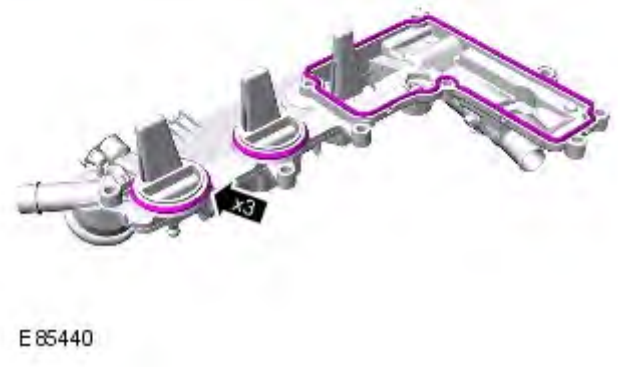
12. Remove and discard the hose clip.



13. **13.** CAUTION: Tighten the bolts in the sequence shown.

    • NOTE: Remove and discard the O-ring seals.

    Torque: 9 Nm



Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.

   To install, reverse the removal procedure.

Published: 11-May-2011

Intake Air Distribution and Filtering - I6 3.2L Petrol -

Torque Specifications

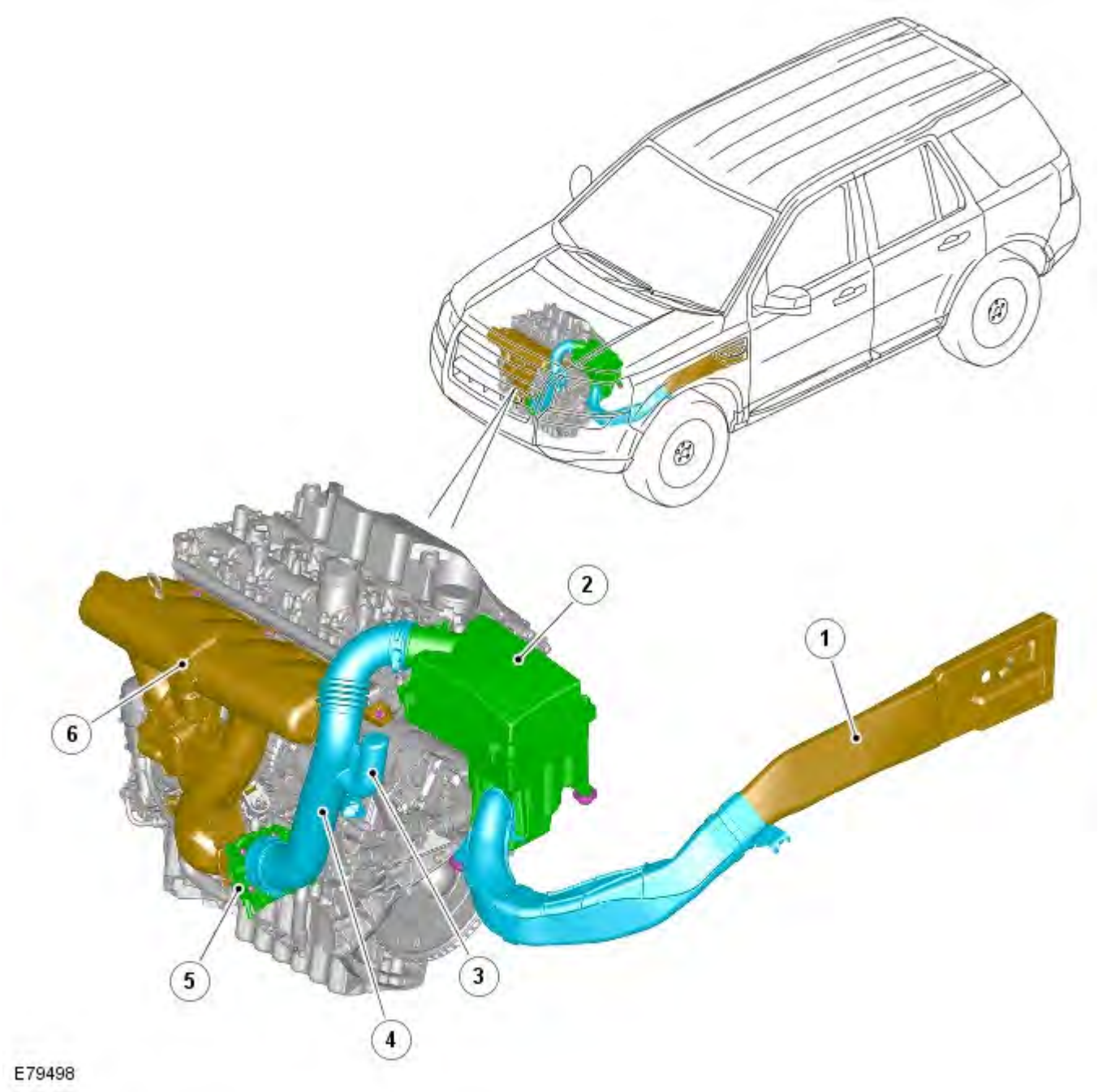
Description	Nm	lb-ft
Air cleaner housing bolts	6	4

Published: 11-May-2011

Intake Air Distribution and Filtering - I6 3.2L Petrol - Intake Air Distribution and Filtering

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Air intake duct - dirty air
2	-	Air filter housing
3	-	Resonator
4	-	Air intake duct - clean air
5	-	Throttle body
6	-	Intake manifold

OVERVIEW

The air intake system has been designed to:

- make available the appropriate air supply to the engine,
- while providing a wade-proof system to ensure vehicle off-road durability

Fresh air is supplied into the system, through the Left Hand (LH) vent located on the front fender. The vent is positioned above the vehicle's wade line to minimize the risk of water entering the system. This positioning of the vent also prevents hot air from the engine-compartment being drawn into the engine.

A polyfibre porous duct providing low intake noise, directs air into the base of the rigid injection-molded air filter housing. The filter housing is supported on 4 elastomer mountings to minimize noise transmission to the vehicle's body structure. A one-way drain valve, incorporated in the base of the filter housing, releases any water that may have entered the system. Intake air is cleaned as it passes through an oil-soaked filter element which offers minimal obstruction to the flow of air.

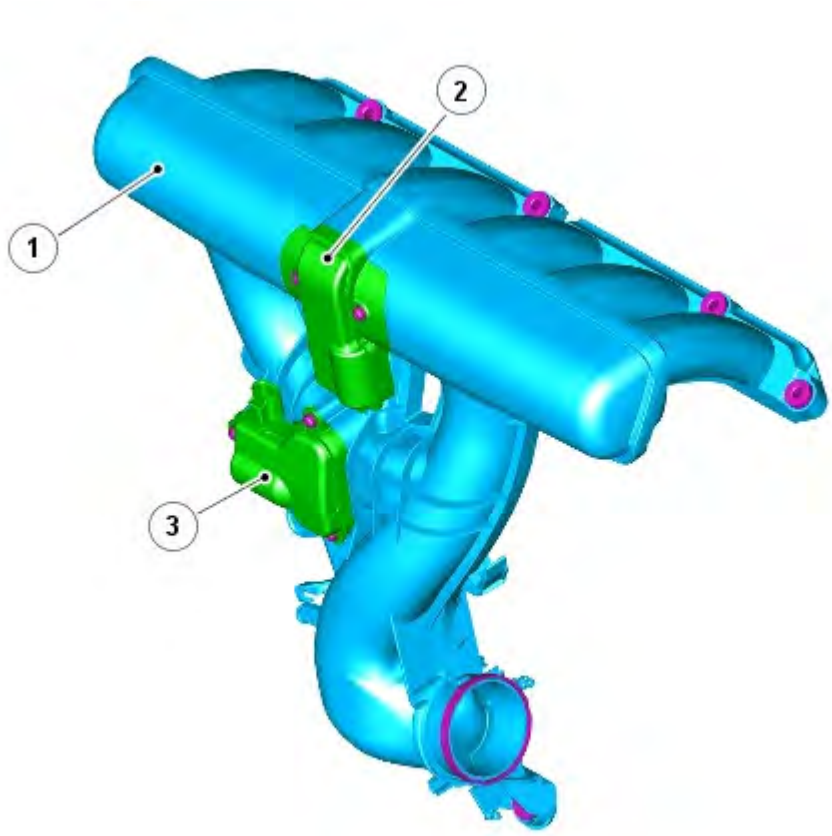
Clean air passes through the Mass Air Flow (MAF) sensor and along a sealed polypropylene duct to the throttle body and intake manifold. The clean air duct features a single quarter-wave resonator tube to enhance engine sound quality during intake manifold tract switching events.

Computational fluid dynamics were extensively used in the design and refinement of the system to minimize air-pressure drop.

The intake manifold is capable of varying both intake tract length and plenum volume. Two separate valves control these features:

- the variable tract valve, and
- the variable plenum valve

Intake Manifold



E81148

Item	Part Number	Description
1	-	Intake manifold
2	-	Variable plenum valve
3	-	Variable tract valve

At low engine speeds, long intake tracts are functioned to provide optimum engine torque; shorter tracts are used at medium speeds, again to optimize engine torque for the existing engine speed range.

At higher engine speeds the benefits of optimizing the tract lengths are outweighed by necessity of maintaining an appropriate supply of air to meet the engine's requirements. Therefore, the plenum valve is opened to create a single, large plenum volume to provide the maximum quantity of air to charge the engine's cylinders.

Variable Induction System Functionality

Engine Speed	Tract Valve	Plenum Valve	Effect
Below 3800 rev/m	Closed	Closed	Long tracts
Between 3800 – 4800 rev/min	Open	Closed	Short tracts
Above 4800 rev/min	Open	Open	Open plenum

PRINCIPLE OF OPERATION

Low Engine Speed

• NOTE: Both throttles closed. The air is routed the long way.

E89641

At engine speeds up to 2100 rpm, optimum filling is achieved by how the exhaust gases leave the cylinders. When the exhaust gases leave the cylinders, a empty chamber is created behind the exhaust gases, whereupon a low pressure is created in the cylinders.

By also making adjustments when the intake valves open/close, positive pressure differences are obtained between the cylinder and intake manifold. The intake air is drawn into the cylinders resulting in optimum cylinder filling.

Engine Speed Up To Approximately 3700rpm

- NOTE: Both throttles are closed.

E89642

The pulsations, which increase at speeds over 2100 rpm, are forced the long way round. When the pulsation speed is constant and the engine speed is relatively low, the pulsations have a long time to reach the cylinders at the correct time.

However, certain losses occur when a proportion of the pulsations disappear the back way to the air filter (and add to the engine's sound pattern).

Engine Speed From 3700 To 4700rpm

- NOTE: The lower throttle is open whilst the upper one is closed.

E89643

The pulsations must have access to a shorter route to make it to the cylinders in time. The shorter route is obtained by allowing the lower throttle to be open, which means that the pulsations reach the cylinders in time.

Certain losses occur, however, when a proportion of the pulsations take the long way round and a proportion take the back way round to the air filter.

Engine Speed Over 4700 rpm

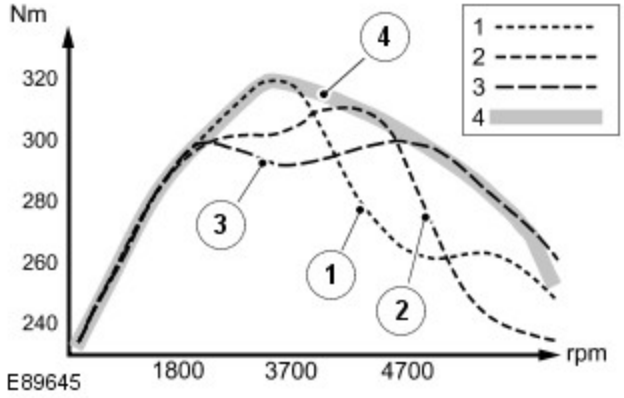
- NOTE: Both the upper throttle and the lower throttle are open.

E89644

In this position, the pulsations are only determined by the short intake pipe's geometry.

The total volume for all cylinders now accessible is necessary to have sufficient access to air.

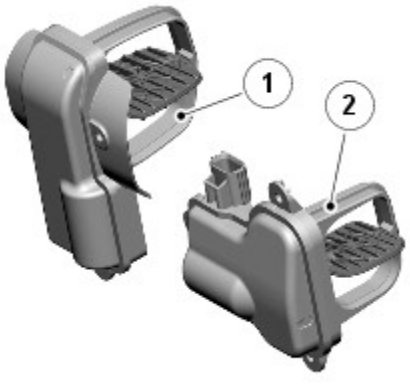
Torque Development



Item	Part Number	Description
1	-	Both throttles closed
2	-	Only the lower throttle open
3	-	Both the throttles open
4	-	Official torque curve

By combining the throttle's position, in principle, three different torque curves are produced, which combined, give a flat torque curve for a naturally aspirated engine.

Throttle Units (Actuators)



Item	Part Number	Description
1	-	Upper throttle unit
2	-	Lower throttle unit

The throttle units consist of throttle, Direct Current (DC) motor, worm gear and internal electronics.

The Engine Control Module (ECM) controls the position of the throttle by modulating the relevant throttle unit's control signal. If the signal shifts from low (approximately 1 volt) to high (approximately 10 volts) the internal electronics interpret it as the throttle must close. If the signal shifts from high to low, the throttle must open.
For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).

If an actuator fails and the flap is in the open position, it is not possible to remove the actuator and flap assembly from the inlet manifold. A small indentation on the body of the actuator allows for a 3 mm Allen key to be pushed through the

thin membrane wall of the actuator housing. The Allen key can be engaged in the spindle of the actuator motor, which allows the flap to be turned to the closed position and consequently the actuator and flap assembly can then be removed from the intake manifold.

Published: 11-May-2011

Intake Air Distribution and Filtering - I6 3.2L Petrol - Intake Air Distribution and Filtering

Diagnosis and Testing

Principles of Operation

For a detailed description of the intake air distribution and filtering system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Hoses and ducts (damage/connections) • Air cleaner element (contaminated/blocked) • Restricted air intake • Seals and gaskets	• Mass Air Flow (MAF) sensor • Throttle body • Harness (security/damage) • Connections (security/damage)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Vehicle does not start/hard starting/poor performance	• Restricted/blocked air intake • Restricted/blocked air cleaner element	• Ensure the air intake system is free from blockage and is correctly installed • Install a new air cleaner element as necessary. REFER to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).
Excessive intake noise	• Intake pipe disconnected/damaged after the air cleaner • Air cleaner assembly incorrectly assembled/damaged	• Check for correct installation and integrity of air intake system • Check for correct installation and integrity of the air cleaner assembly. REFER to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
P010100	Mass or volume air flow A circuit range/performance	• Mass air flow (MAF) sensor circuit: short circuit to ground • Mass air flow (MAF) sensor	Check the MAF sensor and circuits. Refer to the electrical guides. Install a new sensor as required.

DTC	Description	Possible Causes	Action
		circuit: open circuit • Mass air flow (MAF) sensor failure	REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P010121	Mass or volume air flow A circuit range/performance - signal amplitude less than minimum	• Mass air flow (MAF) sensor circuit: short circuit to ground • Mass air flow (MAF) sensor circuit: open circuit • Mass air flow (MAF) sensor failure	Check the MAF sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P010122	Mass or volume air flow A circuit range/performance - signal amplitude greater than maximum	• Mass air flow (MAF) sensor circuit: short circuit to power • Mass air flow (MAF) sensor failure	Check the MAF sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P010200	Mass or volume air flow A circuit low	• Mass air flow (MAF) sensor circuit: short circuit to ground • Mass air flow (MAF) sensor circuit: open circuit • Mass air flow (MAF) sensor failure	Check the MAF sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P010300	Mass or volume air flow A circuit high	• Mass air flow (MAF) sensor circuit: short circuit to power • Mass air flow (MAF) sensor failure	Check the MAF sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P010600	Manifold absolute pressure/BARO sensor range/performance	• Faulty hose connection • Manifold absolute pressure (MAP)/BARO sensor circuit: high resistance • Manifold absolute pressure (MAP)/BARO sensor failure	Check the hose connection/condition. Rectify as necessary. Check the MAP/BARO sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Manifold Absolute Pressure (MAP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P010621	Manifold absolute pressure/BARO sensor range/performance	• Manifold absolute pressure (MAP)/BARO sensor circuit: short circuit to ground • Manifold absolute pressure (MAP)/BARO sensor circuit: open circuit • Manifold absolute pressure (MAP)/BARO sensor failure	Check the MAP/BARO sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Manifold Absolute Pressure (MAP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P010622	Manifold absolute pressure/BARO sensor range/performance	• Manifold absolute pressure (MAP)/BARO sensor circuit: short circuit to power • Manifold absolute pressure (MAP)/BARO sensor failure	Check the MAP/BARO sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Manifold Absolute Pressure (MAP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P010700	Manifold absolute pressure/BARO sensor low	• Manifold absolute pressure (MAP)/BARO sensor circuit: short circuit to ground • Manifold absolute pressure (MAP)/BARO sensor circuit: open circuit • Manifold absolute pressure (MAP)/BARO sensor failure	Check the MAP/BARO sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Manifold Absolute Pressure (MAP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P010800	Manifold absolute pressure/BARO sensor high	• Manifold absolute pressure (MAP)/BARO sensor circuit: short circuit to power • Manifold absolute pressure (MAP)/BARO sensor failure	Check the MAP/BARO sensor and circuits. Refer to the electrical guides. Install a new sensor as required. REFER to: Manifold Absolute Pressure (MAP) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P011100	Intake air temperature sensor 1 circuit range/performance	• Intake air temperature (IAT) sensor 1 circuit: high resistance • Intake air temperature (IAT) sensor failure	Check the IAT sensor and circuits (the IAT sensor is incorporated into the MAF sensor). Refer to the electrical guides. Install a new sensor as required. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P011200	Intake air temperature sensor 1 circuit low	• Intake air temperature (IAT) sensor 1 circuit: short circuit to ground • Intake air temperature (IAT) sensor 1 circuit: open circuit • Intake air temperature (IAT) sensor failure	Check the IAT sensor and circuits (the IAT sensor is incorporated into the MAF sensor). Refer to the electrical guides. Install a new sensor as required. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).

DTC	Description	Possible Causes	Action
P011300	Intake air temperature sensor 1 circuit high	• Intake air temperature (IAT) sensor 1 circuit: short circuit to power • Intake air temperature (IAT) sensor 1 circuit: open circuit • Intake air temperature (IAT) sensor failure	Check the IAT sensor and circuits (the IAT sensor is incorporated into the MAF sensor). Refer to the electrical guides. Install a new sensor as required. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P011400	Intake air temperature sensor 1 circuit intermittent/erratic	• Intake air temperature (IAT) sensor 1 circuit: high resistance • Intake air temperature (IAT) sensor failure	Check the IAT sensor and circuits (the IAT sensor is incorporated into the MAF sensor). Refer to the electrical guides. Install a new sensor as required. REFER to: Mass Air Flow (MAF) Sensor (303-14A Electronic Engine Controls - I6 3.2L Petrol, Removal and Installation).
P017100	System too lean (bank 1)	• Intake air leak - Between MAF sensor and cylinder head • Fuel system restriction • MAF sensor fault - Low intake flow • Exhaust leak, before catalytic converter	Check for intake air leaks. Check for low fuel pressure and MAF sensor DTCs. Rectify as necessary. Check for exhaust leaks before the catalytic converter
P017200	System too rich (bank 1)	• Restricted air filter • Oil contaminated with fuel - Too many cold starts with vehicle subsequently not getting hot enough for long enough • Leaking fuel injectors • MAF sensor fault - High intake flow • Leaking evaporative emission system purge valve	Check the condition of the air cleaner element: REFER to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation). Check engine the oil condition. Check for leaking injectors. Check for MAF sensor, injector and evaporative emission system DTCs.
P017400	System too lean (bank 2)	• Intake air leak - Between MAF sensor and cylinder head • Fuel system restriction • MAF sensor fault - Low intake flow • Exhaust leak, before catalytic converter	Check for intake air leaks. Check for low fuel pressure and MAF sensor DTCs. Rectify as necessary. Check for exhaust leaks before the catalytic converter
P017500	System too rich (bank 2)	• Restricted air filter • Oil contaminated with fuel - Too many cold starts with vehicle subsequently not getting hot enough for long enough • Leaking fuel injectors • MAF sensor fault - High intake flow • Leaking evaporative emission system purge valve	Check the condition of the air cleaner element: REFER to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation). Check engine the oil condition. Check for leaking injectors. Check for MAF sensor, injector and evaporative emission system DTCs.
P050600	Idle air control system RPM lower than expected	• Intake air restriction • Restricted/Contaminated injector/fuel system • Accessory drive overload (defective/seized component) • Variable intake system (VIS) fault • Throttle body fault	Check the intake air system, air cleaner, etc. Check the fuel system for restriction/contamination. Check the accessory drive driven components for excessive resistance to turning/seizure. Rectify as necessary. Check for DTCs indicating a VIS or throttle body fault.
P050700	Idle air control system RPM higher than expected	• Intake air leakage • Variable intake system (VIS) fault • Throttle body fault	Check the intake air system for leakage. Rectify as necessary. Check for DTCs indicating a VIS or throttle body fault.
P050B00	Cold start ignition timing performance	• Blocked intake system • Sticking/slow throttle • Poor engine condition	Check the intake air system, including the air cleaner element. Carry out a complete vehicle read for related DTCs. Rectify as necessary.
P061A00	Internal control module torque performance	• Air leakage in the intake system after the MAF sensor and throttle body • Throttle body fault • Mass air flow (MAF) sensor fault • Engine coolant temperature (ECT) sensor fault • Flywheel sensor fault	Retrieve the flight recorder data and customer statement for return to engineering for analysis. Check the intake system for leakage. Check for DTCs indicating a throttle body, sensor or VVT fault. Rectify as necessary. Refer to the warranty policy and procedures manual if a module is suspect.

DTC	Description	Possible Causes	Action
		• Manifold air pressure (MAP) sensor fault • Camshaft reset valve fault • Variable vale timing (VVT) fault • ECM fault	
P061A62	Internal control module torque performance - signal compare failure	• Air leakage in the intake system after the MAF sensor and throttle body • Throttle body fault • Mass air flow (MAF) sensor fault • Engine coolant temperature (ECT) sensor fault • Flywheel sensor fault • Manifold air pressure (MAP) sensor fault • Camshaft reset valve fault • Variable vale timing (VVT) fault • ECM fault	Retrieve the flight recorder data and customer statement for return to engineering for analysis. Check the intake system for leakage. Check for DTCs indicating a throttle body, sensor or VVT fault. Rectify as necessary. Refer to the warranty policy and procedures manual if a module is suspect.
P061B64	Internal control module torque performance - signal plausibility failure	• Air leakage in the intake system after the MAF sensor and throttle body • Throttle body fault • Mass air flow (MAF) sensor fault • Engine coolant temperature (ECT) sensor fault • Flywheel sensor fault • Manifold air pressure (MAP) sensor fault • Camshaft reset valve fault • Variable valve timing (VVT) fault • ECM fault	Retrieve the flight recorder data and customer statement for return to engineering for analysis. Check the intake system for leakage. Check for DTCs indicating a throttle body, sensor or VVT fault. Rectify as necessary. Refer to the warranty policy and procedures manual if a module is suspect.
P222700	Barometric pressure circuit - range/performance	• BARO sensor failure - the BARO sensor is internal to the ECM	Refer to the warranty policy and procedures manual if a module is suspect.
P222721	Barometric pressure circuit range/performance - signal amplitude less than minimum	• BARO sensor failure - the BARO sensor is internal to the ECM	Refer to the warranty policy and procedures manual if a module is suspect.
P222722	Barometric pressure circuit range/performance - signal amplitude greater than maximum	• BARO sensor failure - the BARO sensor is internal to the ECM	Refer to the warranty policy and procedures manual if a module is suspect.
P222800	Barometric pressure circuit low	• BARO sensor failure - the BARO sensor is internal to the ECM	Refer to the warranty policy and procedures manual if a module is suspect.
P222900	Barometric pressure circuit high	• BARO sensor failure - the BARO sensor is internal to the ECM	Refer to the warranty policy and procedures manual if a module is suspect.

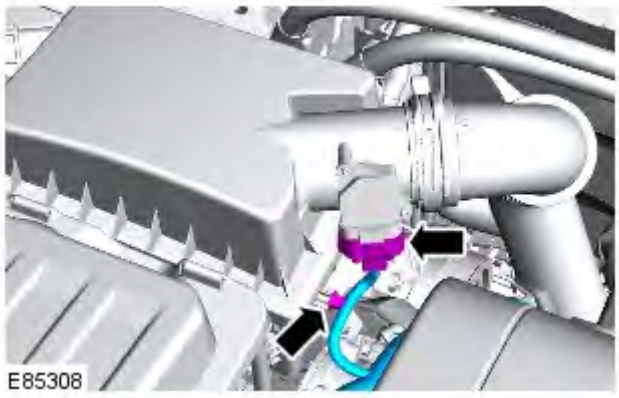
Published: 11-May-2011

Intake Air Distribution and Filtering - I6 3.2L Petrol - Air Cleaner

Removal and Installation

Removal

- NOTE: Petrol model shown, diesel similar.



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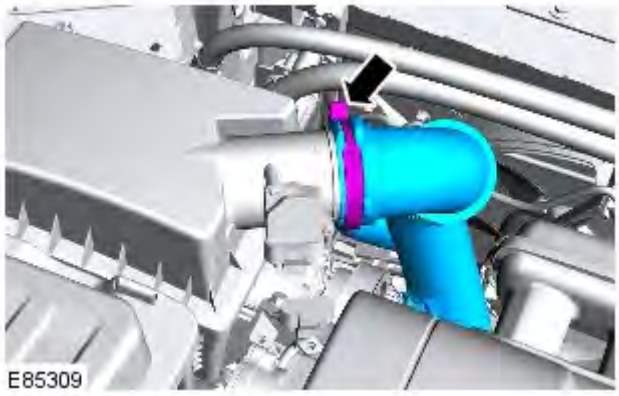

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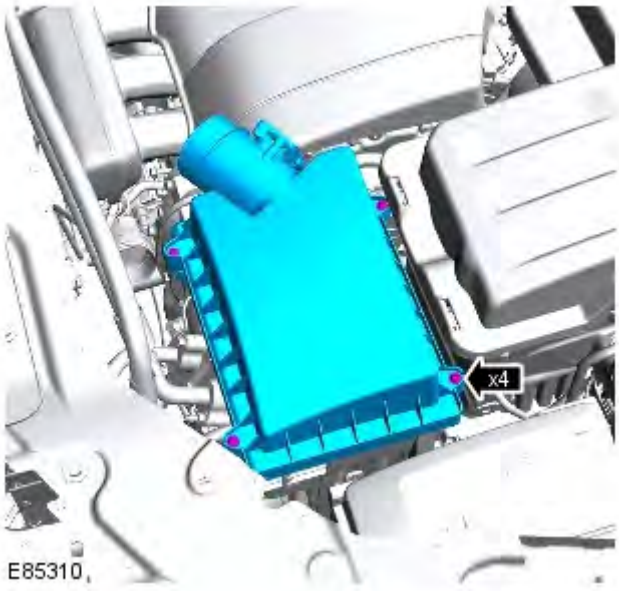

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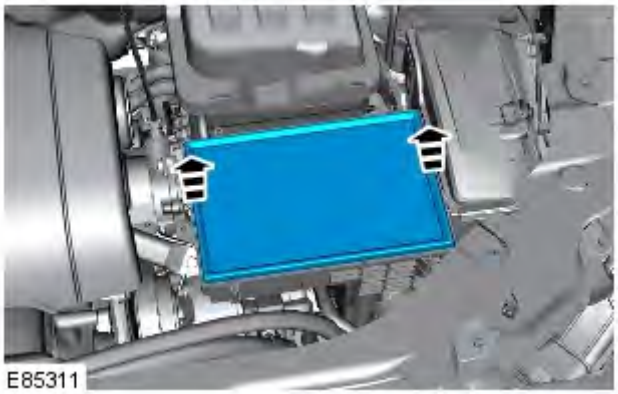

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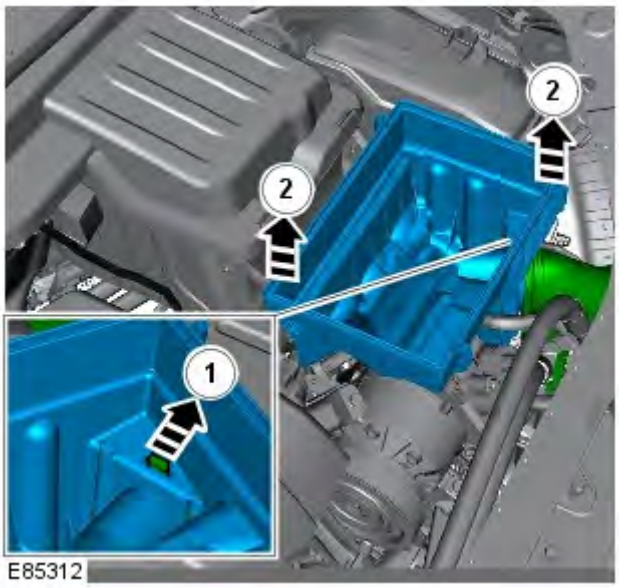
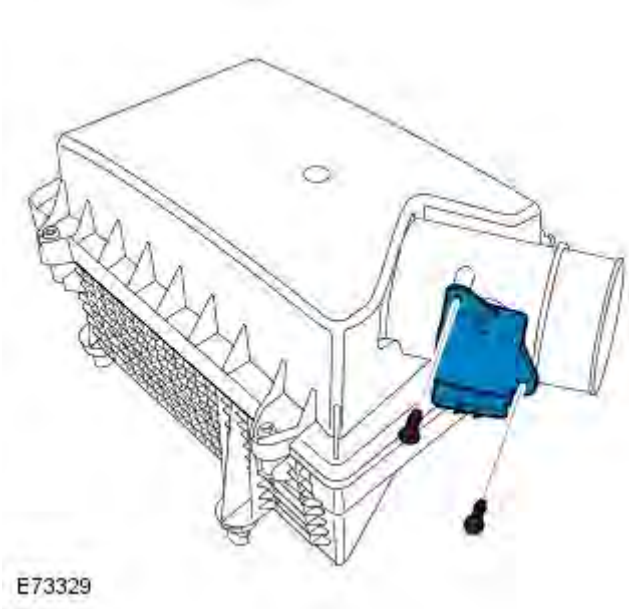


5. **5.** NOTE: Note the fitted position.



6. **6.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. Install the air cleaner element.
2. Install the MAF sensor.

3. **3.** NOTE: Align to the position noted on removal.

   Install the air cleaner housing.

4. Install the air cleaner outlet pipes.

5. Connect the MAF sensor electrical connector.

Published: 11-May-2011

Intake Air Distribution and Filtering - TD4 2.2L Diesel -

Torque Specifications

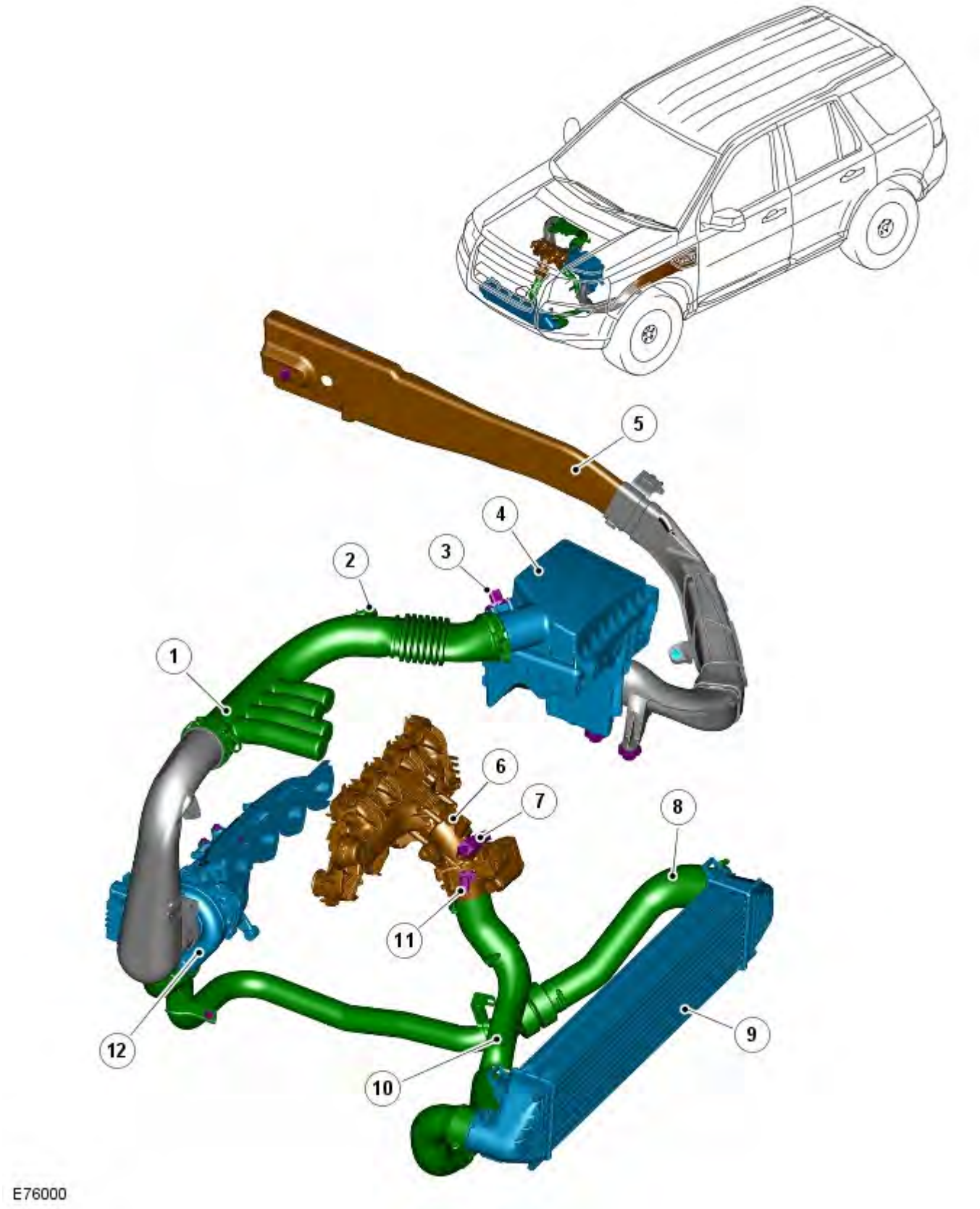
Description	Nm	lb-ft
Charge air cooler bolts	10	7
Intake air resonator	10	7

Published: 11-May-2011

Intake Air Distribution and Filtering - TD4 2.2L Diesel - Intake Air Distribution and Filtering

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Clean air duct
2	-	Crankcase ventilation connection

3	-	Mass Air Flow (MAF) sensor
4	-	Air filter housing
5	-	Dirty air intake duct
6	-	Electronic throttle and intake manifold assembly
7	-	Manifold Absolute Pressure (MAP) sensor
8	-	Hose - turbocharger to charge air cooler
9	-	Charge air cooler
10	-	Hose - charge air cooler to electronic throttle (3 piece)
11	-	Intake Air Temperature (IAT) sensor
12	-	Turbocharger and exhaust manifold

OVERVIEW

The TD4 engine intake air system provides filtered and pressurized air to the engine cylinders, to promote complete combustion of the injected fuel under all engine conditions.

A dirty air intake duct is located behind the Left-Hand (LH) front fender and is connected to the air filter housing. Air is drawn into the intake air duct and directed through an oil impregnated replaceable filter element, located within the air filter housing. The filtered intake air is then directed through the clean air duct to the compressor side of the turbocharger.

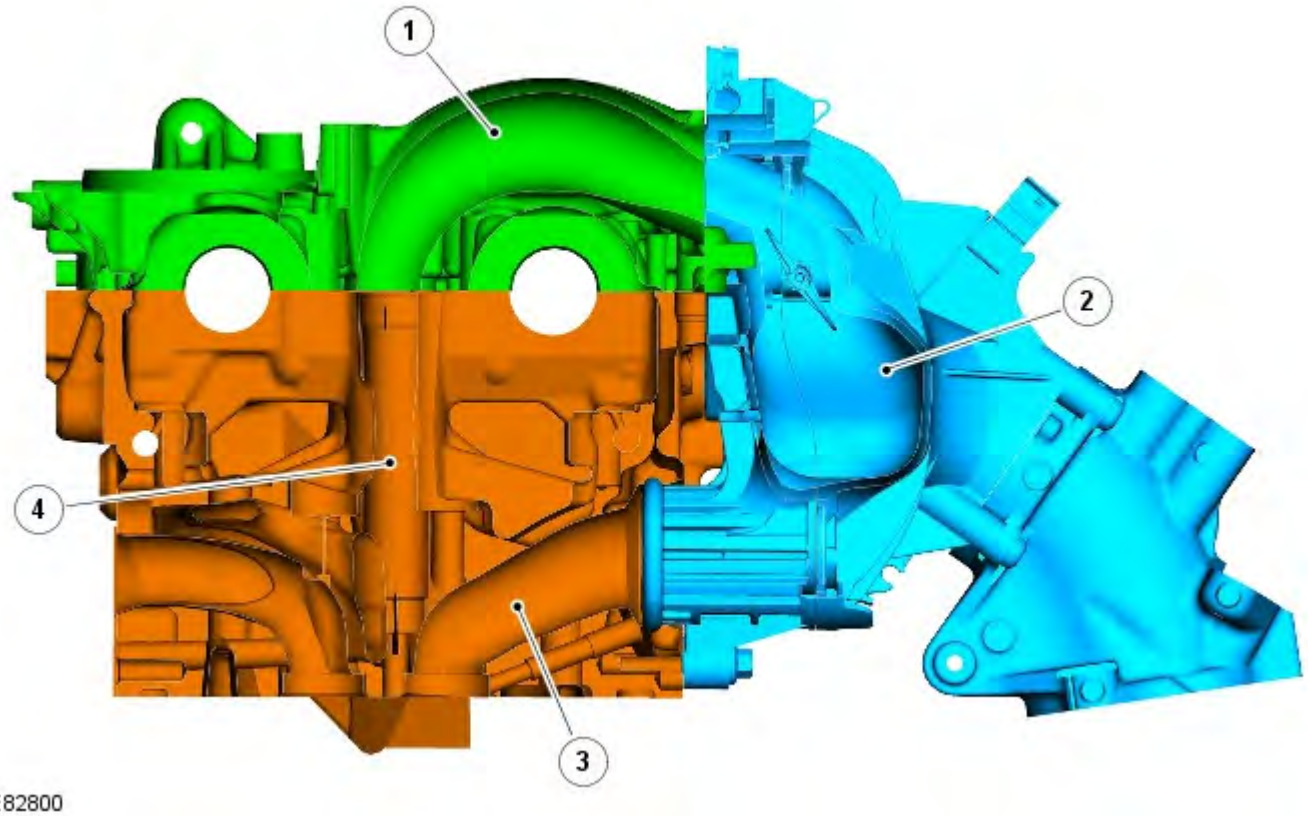
The clean air duct is manufactured to incorporate 4-quarter wave tubes and a connection to the crankcase ventilation system. The quarter wave tubes reduce the Noise, Vibration and Harshness (NVH) levels created by the air traveling through the duct. The connection to the crankcase ventilation system allows environmentally harmful gases and vapors to be drawn from the engine crankcase, and into the clean air duct. The gases and vapors are mixed with the filtered intake air and burned in the cylinders.

The turbocharger compresses and directs the pressurized hot intake air through a large bore connecting hose to the charge air cooler. The air passes through the charge air cooler and is subsequently cooled to increase the intake air density. The output side of the charge air cooler directs the cool dense air through a large bore connecting hose to the electronic throttle and intake manifold, where the air is then distributed via the intake manifold ports to the individual engine cylinders.

Exhaust gas via the Exhaust Gas Recirculation (EGR) system is also directed into the intake air system to reduce Oxides Of Nitrogen (NOX) emissions. A pipe connects the EGR valve located at the Right-Hand (RH) side of the engine, to the intake manifold located at the Left-Hand (LH) side of the engine. The exchange of exhaust gas into the intake manifold is controlled by the Engine Control Module (ECM) during certain engine operating conditions.
For additional information, refer to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Description and Operation).

Electronic sensors are strategically located around the intake air system and constantly provide information of IAT, MAF and MAP to the ECM. This information is processed and used by the ECM for adjusting engine performance to meet the current operating conditions, and driver demands.
For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

INTAKE MANIFOLD



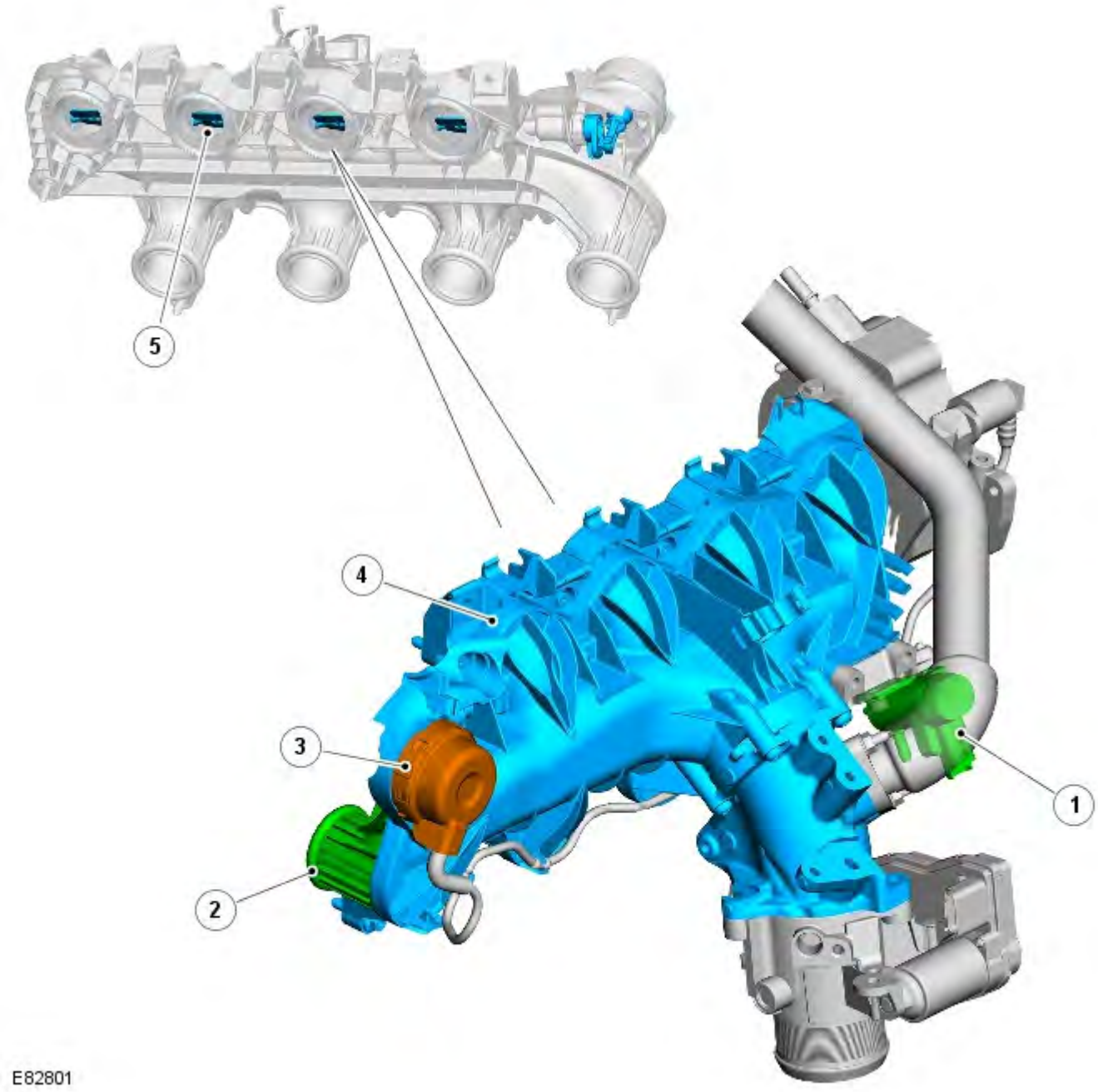
Item	Part Number	Description
1	-	Intake air filling tract
2	-	Intake manifold
3	-	Cylinder head swirl port
4	-	Cylinder head filling port

The TD4 cylinder head and intake manifold are designed to optimize levels of swirl across the engines speed range, and provide a high volume of air into the cylinders. The intake manifold is designed with a lower row of 4 helical swirl ports, and an upper row of 4 filling ports with port-deactivation device. The 8 ports are sealed to the cylinder head and structural camshaft cover mating ports with a shaped sealing ring. The helical swirl port is configured to create optimum swirl for efficient combustion; while the filling port is provided to supply high volumes of air without disturbing in-cylinder swirl. The intake manifold port de-activation device is controlled by the ECM.
For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

Each cylinder is supplied air through the helical swirl port, and when activated, through the filling port. The helical swirl port is always open and directs air from the intake manifold lower port at a tangent into the combustion chamber. The filling port is normally closed, and is only opened during certain engine operating conditions by the ECM. When opened the filling port directs air from the intake manifold upper port, and through the curved intake tracts into the combustion chamber. The intake tracts are cast with the structural camshaft cover, and join the intake manifold upper filling ports to the cylinder head machined filling ports.

At low engine loads gas flow is so low that the filling port is closed off. This has the effect of raising gas velocity through the helical port and increasing in-cylinder swirl to the optimum rate. To avoid the risk of the high gas flow creating excessive swirl, the ECM opens the filling port under high gas-flow conditions to maintain consistent optimum swirl across the engines operating range.

Intake Manifold Port De-Activation



Item	Part Number	Description
1	-	Solenoid-operated valve
2	-	Intake manifold helical swirl port
3	-	Vacuum-operated actuator
4	-	Intake manifold filling port
5	-	Butterfly valve (4 off)

Port de-activation is operated by 4-butterfly valves connected on a common shaft within the intake manifold. Each butterfly valve is housed within a corresponding intake manifold upper filling port. The common shaft is connected to a vacuum-operated actuator, and is operated by a solenoid valve under the control of the ECM. The vacuum required for port de-activation is supplied from the engine mounted vacuum pump.

For additional information, refer to:

Engine (303-01B Engine - TD4 2.2L Diesel, Description and Operation),
Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

Port de-activation (opening of the filling ports) only occurs when the coolant temperature is greater than 10°C, and under the following conditions:

- Engine speed is greater than 1,800 rpm.
- Engine load is greater than 15%.

Published: 11-May-2011

Intake Air Distribution and Filtering - TD4 2.2L Diesel - Intake Air Distribution and Filtering

Diagnosis and Testing

Principles of Operation

For a detailed description of the intake air distribution and filtering system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Intake Air Distribution and Filtering (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Hoses and ducts (damage/connections) • Air cleaner element (contaminated/blocked) • Restricted air intake • Seals and gaskets	• Mass Air Flow (MAF) sensor • Secondary Air Injection (AIR) Manifold Absolute Pressure (MAP) sensor • Throttle body • Harness (security/damage) • Connections (security/damage)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Vehicle does not start/hard starting/poor performance	• Restricted/blocked air intake • Restricted/blocked air cleaner element	• Ensure the air intake system is free from blockage and is correctly installed • Install a new air cleaner element as necessary. REFER to: Air Cleaner Element (303-12, Removal and Installation).
Excessive intake noise	• Intake pipe disconnected/damaged after the air cleaner • Air cleaner assembly incorrectly assembled/damaged	• Check for correct installation and integrity of air intake system • Check for correct installation and integrity of the air cleaner assembly. REFER to: Air Cleaner Element (303-12, Removal and Installation).

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
P006900	MAP - Barometric Pressure Correlation	• Boost pressure sensor circuit - short to ground, power, open circuit • Barometric pressure sensor failure	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic

DTC	Description	Possible Causes	Action
			system
P007200	Ambient Air Temperature Sensor Circuit Low	• Ambient air temperature sensor circuit - short to ground, open circuit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P007300	Ambient Air Temperature Sensor Circuit High	• Ambient air temperature sensor circuit - short to power	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009700	Intake Air Temperature Sensor 2 Circuit Low	• Intake air temperature sensor voltage below lower limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009800	Intake Air Temperature Sensor 2 Circuit High	• Intake air temperature sensor voltage above upper limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P010000	Mass or Volume Air Flow A Circuit	• MAF Sensor signal circuit - short to ground, power, open circuit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P010221	Mass or Volume Air Flow A Circuit Low	• Air flow PWM raw signal above upper limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P010226	Mass or Volume Air Flow A Circuit Low	• Air flow PWM corrected signal above upper limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P010322	Mass or Volume Air Flow A Circuit High	• Air flow PWM raw signal above upper limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P010327	Mass or Volume Air Flow A Circuit High	• Air flow PWM corrected signal above upper limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P011200	Intake Air Temperature Sensor 1 Circuit Low	• Intake air temperature sensor 1 circuit - short to ground	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P110222	Mass Air Flow Sensor in Range But Lower Than Expected	• Air Mass (measured) is too low (not plausible) with calculated reference air mass during overrun: ratio of calculated/actual too high	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P110321	Mass Air Flow Sensor in Range But Higher Than Expected	• Air Mass (measured) is too high (not plausible) with calculated reference air mass during overrun: ratio of calculated/actual too low	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P222700	Barometric Pressure Circuit Range/Performance	• Atmospheric Pressure Sensor defective	Install a new module, refer to the new module/component installation note at the top of the DTC Index. REFER to: Powertrain Control Module (PCM) (303-14, Removal and Installation).

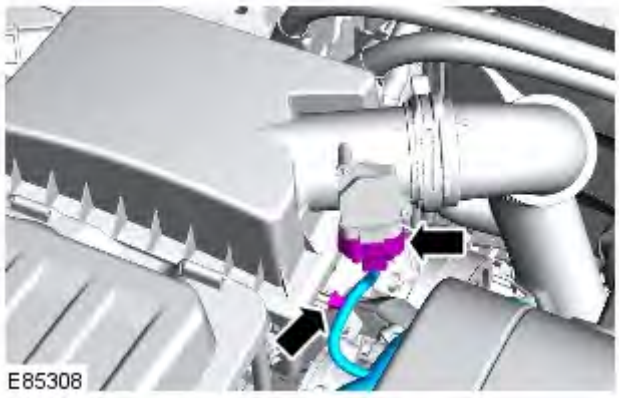
Published: 11-May-2011

Intake Air Distribution and Filtering - TD4 2.2L Diesel - Air Cleaner

Removal and Installation

Removal

- NOTE: Petrol model shown, diesel similar.



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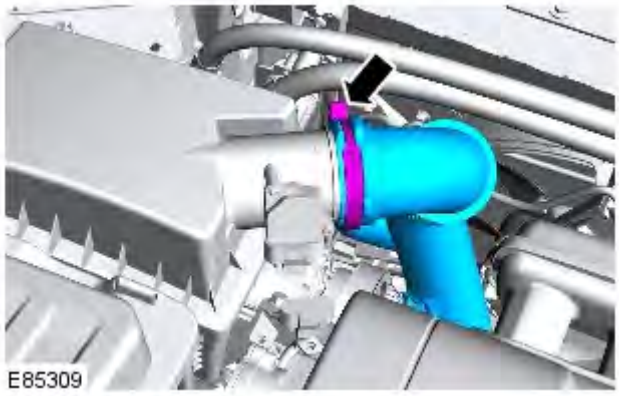

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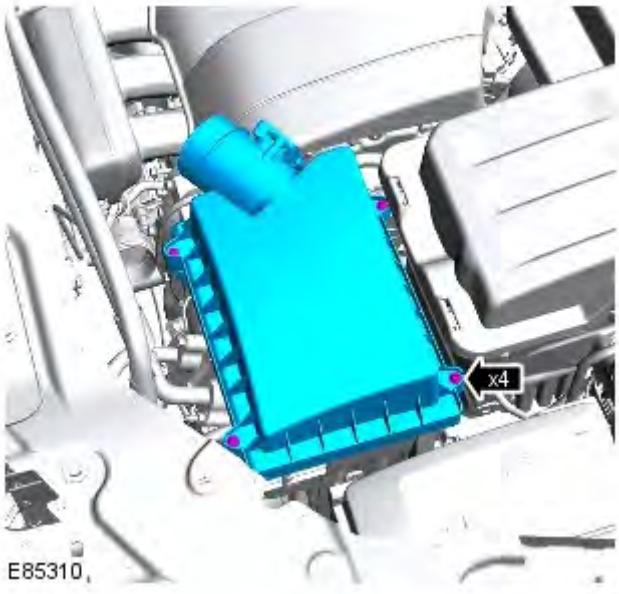

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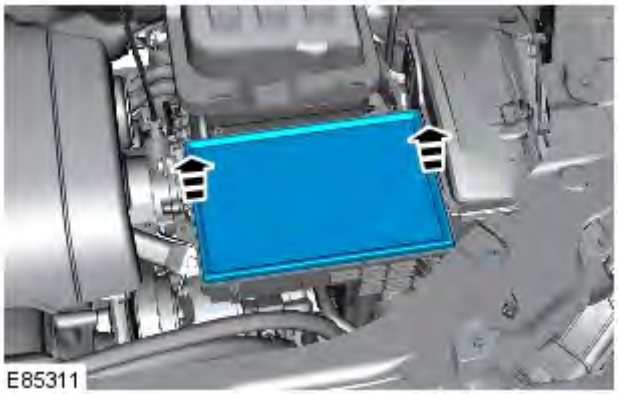

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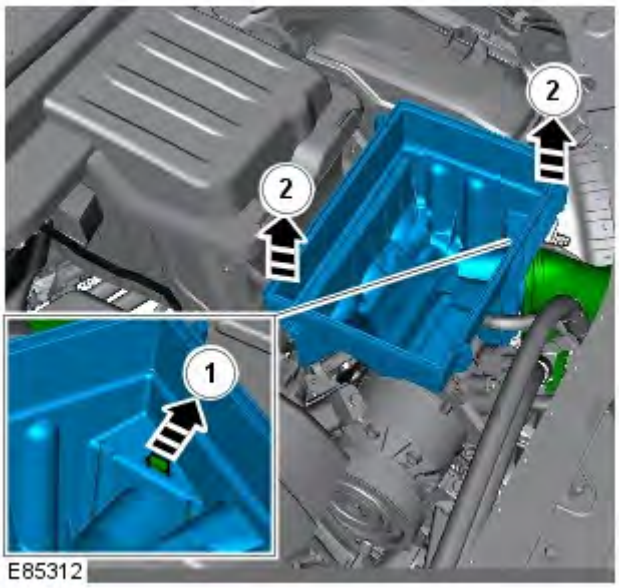
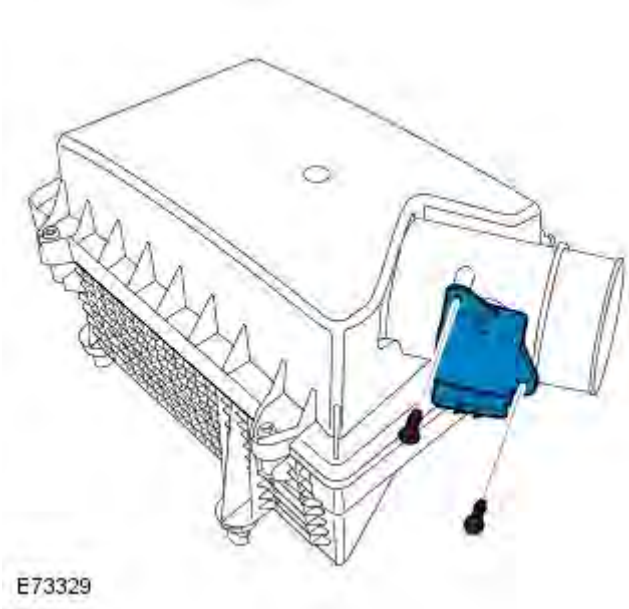


5. **5.** NOTE: Note the fitted position.



6. **6.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. Install the air cleaner element.
2. Install the MAF sensor.

3. **3.** NOTE: Align to the position noted on removal.

   Install the air cleaner housing.

4. Install the air cleaner outlet pipes.

5. Connect the MAF sensor electrical connector.

Published: 11-May-2011

Intake Air Distribution and Filtering - TD4 2.2L Diesel - Charge Air Cooler

Removal and Installation

Removal

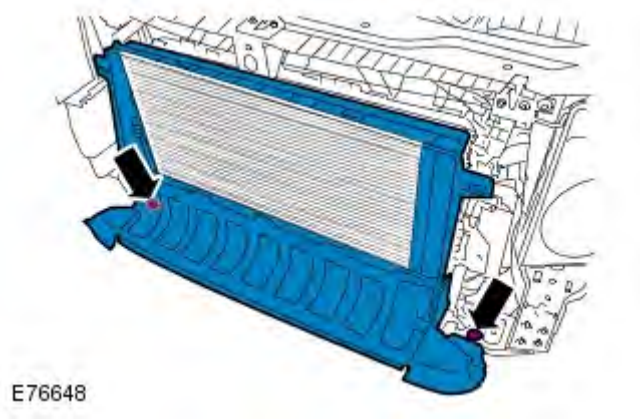
- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the front bumper.

   Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).



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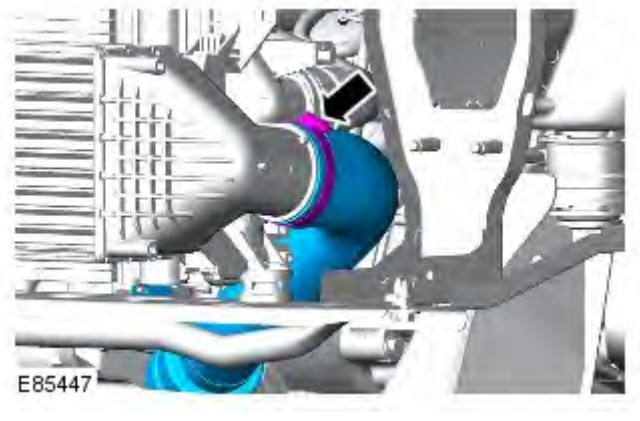

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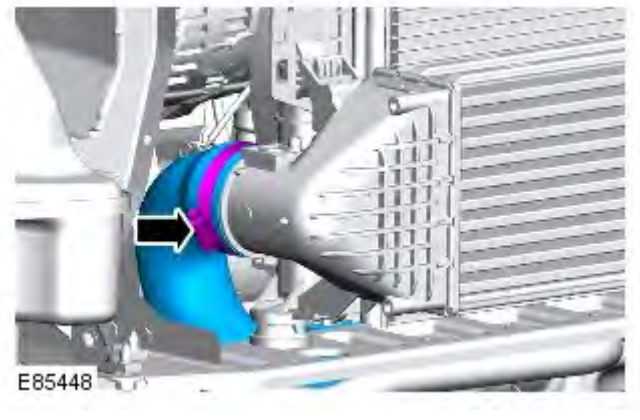
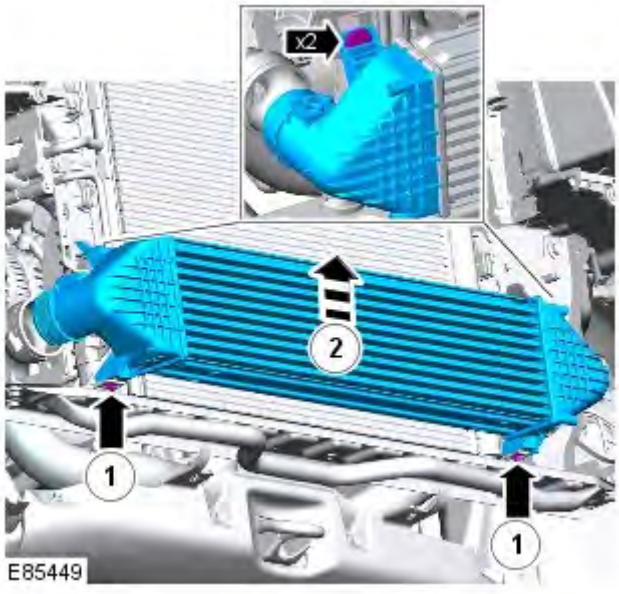


5. *Torque:* 5 Nm



6. *Torque:* 10 Nm

Installation

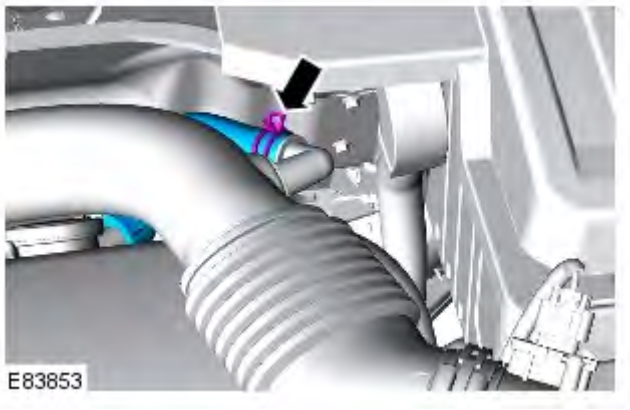
1. To install, reverse the removal procedure.

Published: 11-May-2011

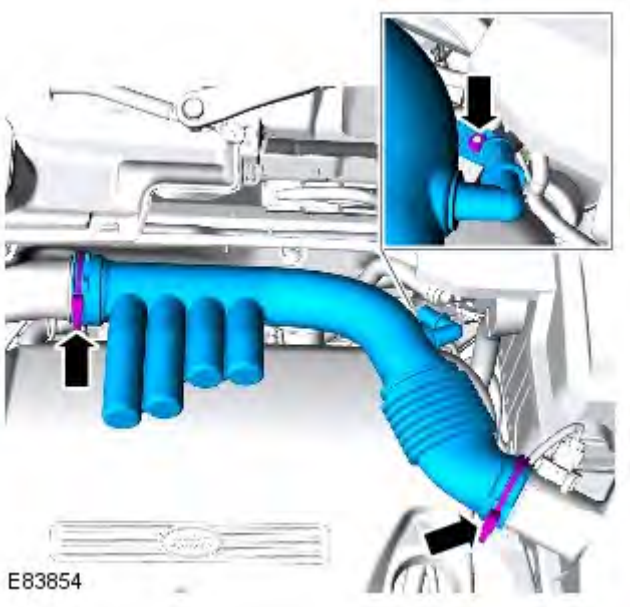
Intake Air Distribution and Filtering - TD4 2.2L Diesel - Intake Air Resonator

Removal and Installation

Removal



1.



2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Evaporative Emissions -

Torque Specifications

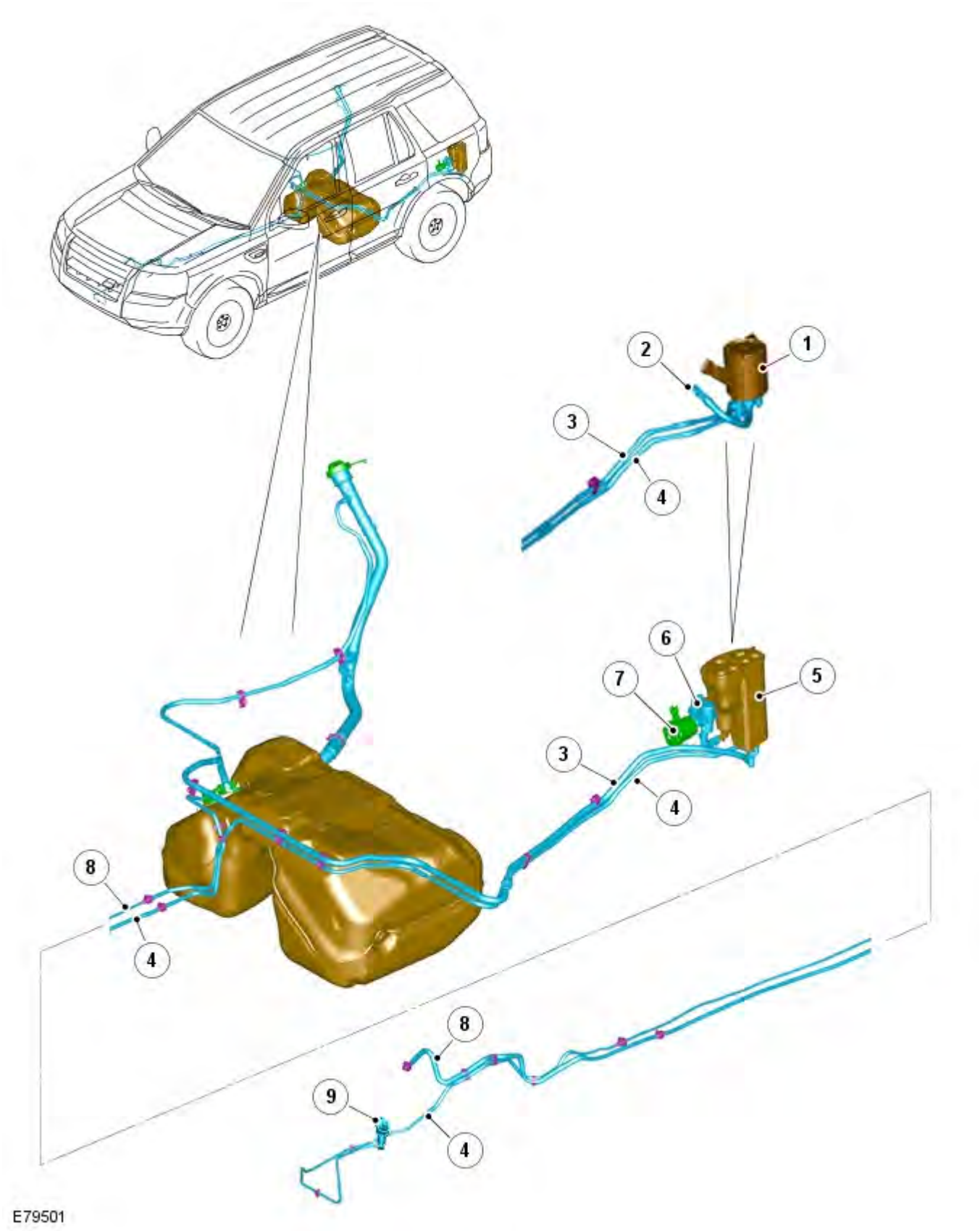
Description	Nm	lb-ft
Evaporative emissions canister bolts	10	7
Evaporative emissions canister pipe nuts	10	7
Fuel tank leakage monitoring pump filter	10	7
Fuel tank leakage monitoring pump	10	7

Published: 11-May-2011

Evaporative Emissions - Evaporative Emissions

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Evaporative emission canister - Rest Of World (ROW) derivative
2	-	Vent pipe and filter
3	-	Vapor pipe to evaporative emission canister
4	-	Vapor purge pipe to intake manifold

5	-	Evaporative emission canister - North American Specification (NAS) derivative
6	-	Fuel tank leakage monitoring pump
7	-	Fuel tank leakage monitoring pump filter
8	-	Fuel delivery pipe to engine
9	-	Evaporative emission canister purge valve

OVERVIEW

The evaporative emission (EVAP) control system reduces the level of hydrocarbons released into the atmosphere by fuel vapor venting from the fuel tank. The system comprises a charcoal canister, purge valve and interconnecting vent pipes and hoses.

Fuel vapor is generated by the fuel in the tank and the amount of vapor produced increases as the fuel heats up. Fuel vapor can flow freely to the charcoal canister via the tank venting system. The venting system consists of roll over valves and a liquid vapor separator mounted internally in the tank and then externally via a breather line. The breather line allows the fuel vapor to flow to the charcoal canister.

On NAS vehicles the vapor generated in the fuel tank during refueling flows without restriction to the charcoal canister.

On all vehicles except NAS, the vapor is restricted in its path to the charcoal canister but can flow freely during the refueling operation to atmosphere, via the filler opening.

The vapor passes into the charcoal canister where it is absorbed and stored by the charcoal. Because there is a limit to the amount of vapor the canister can contain, the fuel vapor is purged from the canister when the engine is running and burned in the engine.

PRINCIPLES OF OPERATION

Charcoal Canister

The charcoal canister contains a bed of activated charcoal or carbon. The charcoal is produced using special manufacturing techniques to treat the charcoal with oxygen. The oxygen treatment opens up millions of pores between the carbon atoms resulting in a highly porous charcoal with a very large effective surface area which is capable of absorbing large quantities of fuel vapor. Once treated the charcoal is known as 'activated' carbon or charcoal. The charcoal canister on NAS vehicles uses a higher grade charcoal to meet the requirements of the emission regulations.

On-board Refueling Vapor Recovery

To meet On-board Refueling Vapor Recovery (ORVR) requirements, the fuel tank and associated components are designed to minimize fuel vapor loss during refueling. This is achieved by preventing fuel vapor from the fuel tank venting directly to the atmosphere. Instead fuel vapor is directed into the Evaporative Emission (EVAP) canister where it is stored before being purged at intervals into the engine’s intake manifold.

During vehicle refueling the narrow fuel-filler-tube below the fuel-dispenser nozzle region, provides a liquid seal against the escape of vapor. A check valve also located in the filler-tube opens to incoming fuel to prevent splash back.

As the fuel tank fills, fuel vapor is routed to the EVAP canister's charcoal filter, where it is absorbed by the charcoal's activated granules. The hydrocarbons from the fuel vapor are retained within the canister, allowing only purified air to be released to atmosphere through the canister's vent pipe. The hydrocarbons stored in the canister are purged at intervals into the engine for combustion.

The EVAP canister purge valve is located in the engine compartment. The Engine Control Module (ECM) operates the valve to purge fuel vapor from the EVAP canister into the engine for combustion. Purge rates (the extent that the purge valve opens) are determined by the engine operating conditions. The purge rates are adjusted to maintain vehicle driving characteristics and exhaust emissions at optimum levels. Engine operating conditions that affect the purge rate are:

- speed and load,
- engine coolant temperature,
- time from engine start-up,
- closed loop fueling

Owing to the limited storage-volume of the EVAP canister:

- NAS derivative - 2.5 liter
- ROW derivative - 0.7 liter

the charcoal filter is continually regenerated.

Regeneration is achieved when the engine is running, by drawing air through the EVAP canister, via the vent pipe, into the engine for combustion.

Fuel Tank Leakage Monitoring

Fuel tank leakage monitoring is a legislative requirement for NAS vehicles. The monitoring system periodically checks the EVAP system and fuel tank for leaks when the ignition is off.

The monitoring system comprises the previously described components of the EVAP system with the following additional components:

- air pump, and
- dust filter

The pump is connected to the vent pipe of the EVAP canister and incorporates:

- a Positive Temperature Coefficient (PTC) heating element,

- change over valve, and
- a reference orifice

The pump is only operated when the ignition is 'off' and as controlled by the ECM. The ECM also monitors the pump operation and the change over valve for faults. The dust filter protects the pump from the ingress of moisture and foreign particles.

The fuel tank leakage monitoring test is performed if the following factors are present:

- the engine has been operating for at least 10 minutes and is now at rest,
- the fuel in the tank is between 15 and 85 percent volume,
- the ambient temperature is above 0°C (32°F) and less than 40°C (104°F),
- the engine has not been started for at least 3 hours prior to its last operation

The pump is operated to pressurize the fuel tank and the electrical current used to operate the pump is measured with the change-over valve in different states. A comparison of the current draw in each state indicates the degree of any fuel vapor leak; if appropriate the ECM records the appropriate Diagnostic Trouble Code (DTC).

Published: 11-May-2011

Evaporative Emissions - Evaporative Emissions

Diagnosis and Testing

Principles of Operation

For a detailed description of the evaporative emissions system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Fuel filler cap and seal • Fuel filler neck • Diagnostic Monitoring of Tank Leakage (DMTL) fresh air filter (restriction, etc) • Fuel tank (leaks, damage, etc) • Fuel lines and joints, etc • Carbon canister • Purge valve • DMTL pump module	• Fuses • Connectors • Harnesses • Purge valve • DMTL pump

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.
5. • NOTE: On all vehicles equipped with Diagnostic Monitor Tank Leakage (DMTL), there is a requirement to blank off the ventilation port (large diameter stub pipe) of the DMTL module, to prevent mis-diagnosis when carrying out a smoke test.

   5. Where K-Line, Vacutec or other proprietary smoke test equipment is available, it should be utilised to assist with Evaporative Emissions System leak diagnosis.

Symptom Chart

Symptom	Possible Cause	Action
Difficulty in filling fuel tank	• Restriction in the vapor line between the fuel tank and the carbon canister outlet/atmospheric port	Check for restrictions/damage, etc (see visual inspection)
Fuel smell	• System leak • Purge valve inoperative	Check for leaks, check the purge valve operation. GO to Pinpoint Test A.
'Check Fuel Filler Cap' displayed on Message Center	• Fuel filler cap missing/not tightened after refuelling	Check the fuel filler cap and seal

DTC Index

• NOTE: If the module is suspect and the vehicle remains under the manufacturer warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P044100	Evaporative emission system - incorrect purge flow	• Evaporative emission canister vent restricted • Canister to purge valve pipe	Check the condition and installation of the evaporative emission system. Check the operation of the purge valve. Install new

DTC	Description	Possible Cause	Action
		damaged/restricted • The purge valve is stuck in the open or closed position	components as necessary
P044200	Evaporative emission system leak detected (small leak)	• The dynamic monitoring of tank leakage (DMTL) system has detected a small leak in the evaporative emission system	Carry out a check of the fuel system integrity using local equipment (Vacutec/K-Line, etc). Rectify as necessary
P044400	Evaporative emission system purge control valve circuit open	• Purge valve circuit: open circuit • Purge valve failure	Check the purge valve and circuits. Refer to the electrical guides. Install a new valve as necessary
P044700	Evaporative emission system vent control circuit open	• Evaporative emission system change-over valve (COV) circuit(s): open circuit • Evaporative emission system change-over valve (COV) circuit(s): short circuit to ground • Evaporative emission system change-over valve (COV) failure	Check the COV and circuits. Refer to the electrical guides. Install a new valve as necessary (the COV is incorporated into the fuel tank leakage monitoring pump)
P044800	Evaporative emission system vent control circuit shorted	• Evaporative emission system change-over valve (COV) circuit(s): short circuit to power • Evaporative emission system change-over valve (COV) failure	Check the COV and circuits. Refer to the electrical guides. Install a new valve as necessary (the COV is incorporated into the fuel tank leakage monitoring pump)
P045500	Evaporative emission system leak detected (gross leak/no flow)	• Fuel filler cap not fitted • Fuel filler cap seal missing • Evaporative emission system leak, canister, pipework, etc • Evaporative emission system change-over valve (COV) failure	Check the fuel filler cap and seal condition and fitment. Carry out a check of the fuel system integrity using local equipment (Vacutec/K-Line, etc). Rectify as necessary
P045800	Evaporative emission system purge control valve circuit low	• Purge valve circuit: short circuit to ground • Purge valve circuit: open circuit • Purge valve failure	Check the purge valve and circuits. Refer to the electrical guides. Install a new valve as necessary
P045900	Evaporative emission system purge control valve circuit high	• Purge valve circuit: short circuit to power • Purge valve failure	Check the purge valve and circuits. Refer to the electrical guides. Install a new valve as necessary
P240100	Evaporative emission system leak detection pump control circuit low	• Fuel tank leakage monitoring pump control circuit: short circuit to ground • Fuel tank leakage monitoring pump control circuit: open circuit • Fuel tank leakage monitoring pump failure	Check the fuel tank leakage monitoring pump and circuits. Refer to the electrical guides. Install a new pump as necessary
P240200	Evaporative emission system leak detection pump control circuit high	• Fuel tank leakage monitoring pump control circuit: short circuit to power • Fuel tank leakage monitoring pump failure	Check the fuel tank leakage monitoring pump and circuits. Refer to the electrical guides. Install a new pump as necessary
P240500	Evaporative emission system leak detection pump sense circuit low	• Fuel tank leakage monitoring pump sense circuit: short circuit to ground • Fuel tank leakage monitoring pump sense circuit: open circuit • Fuel tank leakage monitoring pump failure	Check the fuel tank leakage monitoring pump and circuits. Refer to the electrical guides. Install a new pump as necessary
P240600	Evaporative emission system leak detection pump sense circuit high	• Fuel tank leakage monitoring pump sense circuit: short circuit to power • Fuel tank leakage monitoring pump failure	Check the fuel tank leakage monitoring pump and circuits. Refer to the electrical guides. Install a new pump as necessary
P240800	Fuel cap sensor/switch circuit	• CAN circuit: open circuit • CAN circuit: short circuit to ground • CAN module fault	Carry out a complete read for related DTCs. Rectify as necessary. Refer to the warranty policy and procedures manual if a module is suspect
P240B00	Evaporative emission system leak detection pump heater circuit low	• Fuel tank leakage pump heater control circuit: short circuit to ground • Fuel tank leakage pump heater control circuit: open circuit • Fuel tank leakage monitoring pump failure	Check the fuel tank leakage monitoring pump and circuits. Refer to the electrical guides. Install a new pump as necessary

DTC	Description	Possible Cause	Action
P240C00	Evaporative emission system leak detection pump heater circuit high	• Fuel tank leakage pump heater control circuit: short circuit to power • Fuel tank leakage monitoring pump failure	Check the fuel tank leakage monitoring pump and circuits. Refer to the electrical guides. Install a new pump as necessary
P245000	Evaporative emission control system switching valve performance/stuck open	• Evaporative emission control system switching valve (COV) circuit: short circuit to ground • Evaporative emission control system switching valve (COV) circuit: open circuit • Evaporative emission control system switching valve (COV) circuit: short circuit to power • Evaporative emission control system switching valve (COV) fault	Check the COV and circuits. Refer to the electrical guides. Rectify as necessary. Install a new COV as necessary (the COV is integral with the fuel tank leakage monitoring pump)
P245100	Evaporative emission control system switching valve stuck closed	• Evaporative emission control system switching valve (COV) circuit: short circuit to ground • Evaporative emission control system switching valve (COV) circuit: open circuit • Evaporative emission control system switching valve (COV) circuit: short circuit to power • Evaporative emission control system switching valve (COV) fault	Check the COV and circuits. Refer to the electrical guides. Rectify as necessary. Install a new COV as necessary (the COV is integral with the fuel tank leakage monitoring pump)

Pinpoint Tests

PINPOINT TEST A : EVAPORATIVE SYSTEM INCORRECT PURGE FLOW	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FUEL FILLER CAP INSTALLATION AND CONDITION OF CANISTER, PIPES AND CONNECTORS	
	1 Make sure that the fuel filler cap is correctly installed and tightened.
	2 Check the condition of the carbon canister.
	3 Check the condition of all accessible pipes and connectors in the vapor line.
	Are the canister and all pipes and connectors in good condition? **Yes** GO to A2. **No** REPAIR as necessary. CLEAR the DTC, test the system for normal operation.
A2: CHECK THAT THE PURGE VALVE IS OPERATING	
	1 Disconnect the vapor pipe from the inlet port of the evaporative purge valve.
	2 **RUN** the engine for 2 minutes, making sure that the engine reaches normal operating temperature.
	3 Check that the evaporative purge valve is operating, by touch or by sound (using a stethoscope, it will be possible to hear the valve operating).
	Is the valve operating? **Yes** CHECK for related DTCs. Refer to the DTC Index above. **No** CHECK for purge valve related DTCs and refer to DTC Index.

Published: 11-May-2011

Evaporative Emissions - Evaporative Emission Canister

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

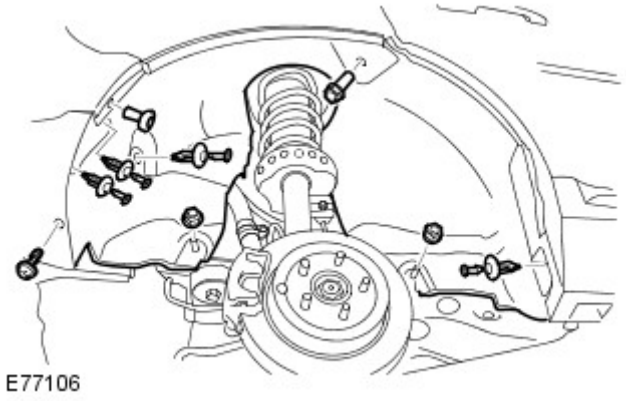
2. **2.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

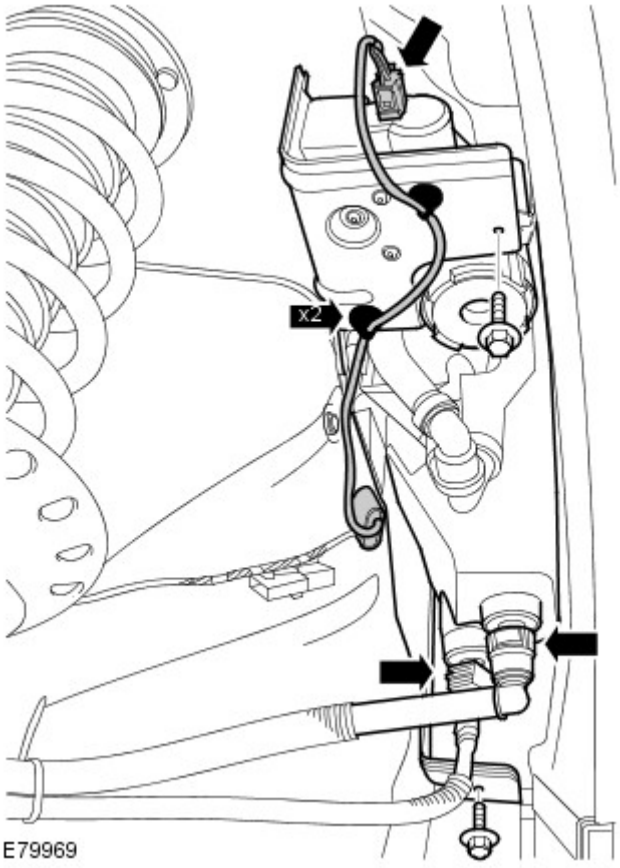
   Raise and support the vehicle.

3. Remove the rear wheel.

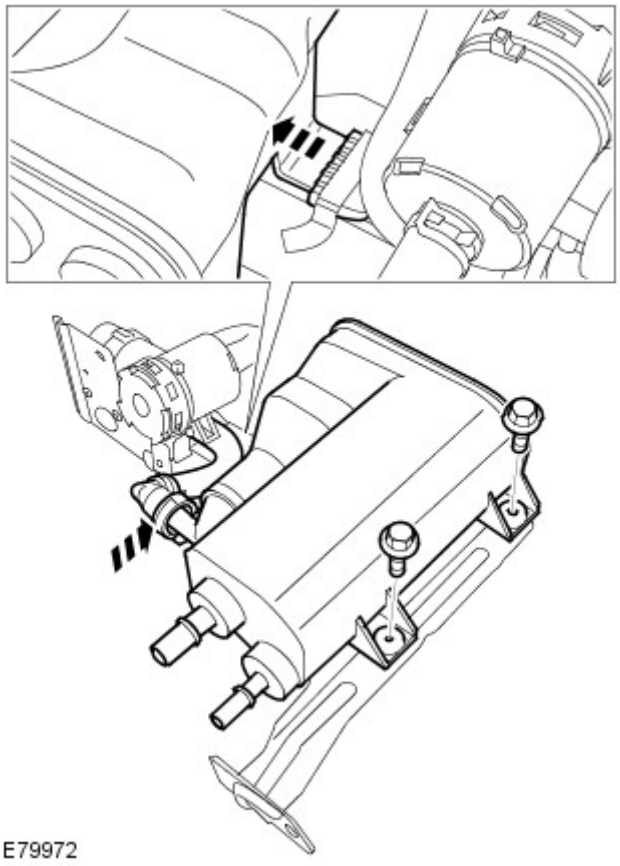
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

4.





5. *Torque:* 10 Nm



6. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Evaporative Emissions - Evaporative Emission Canister Purge Valve

Removal and Installation

Removal

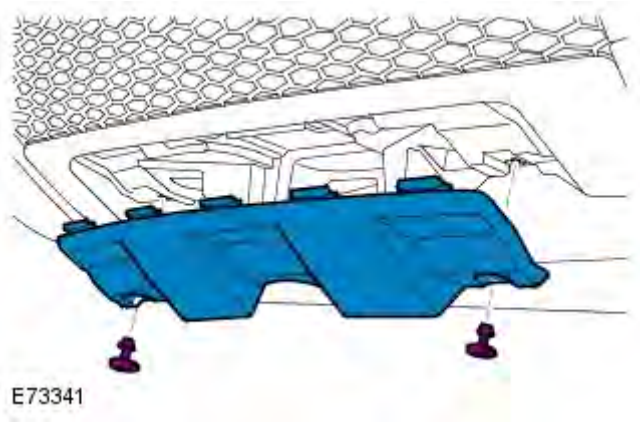
- NOTE: Take care not to disconnect the purge line from the rear of the intake manifold, when removing the purge valve.
- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



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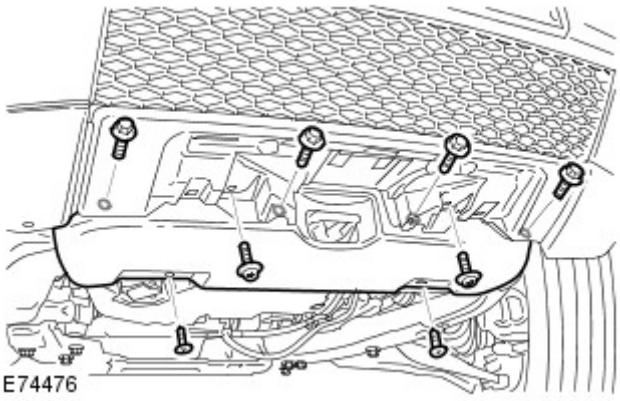

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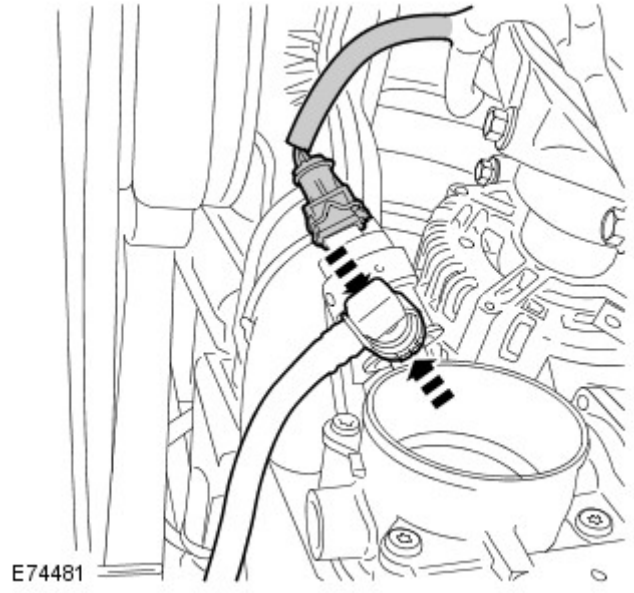

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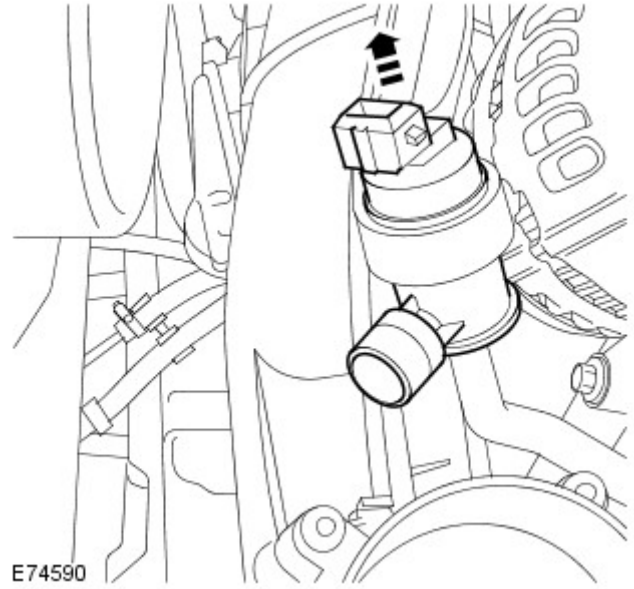


7. Remove the clip.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Evaporative Emissions - Fuel Tank Leakage Monitoring Pump Filter

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

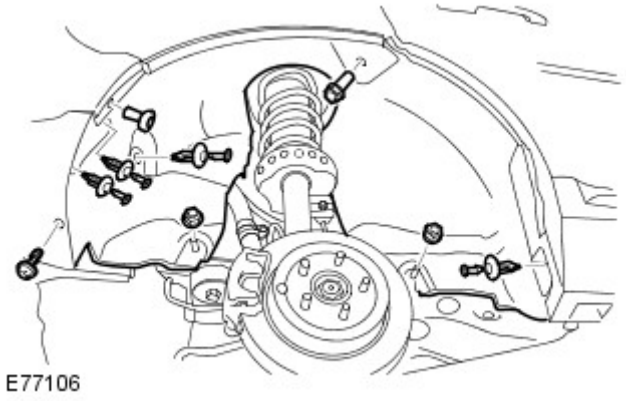
2. **2.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

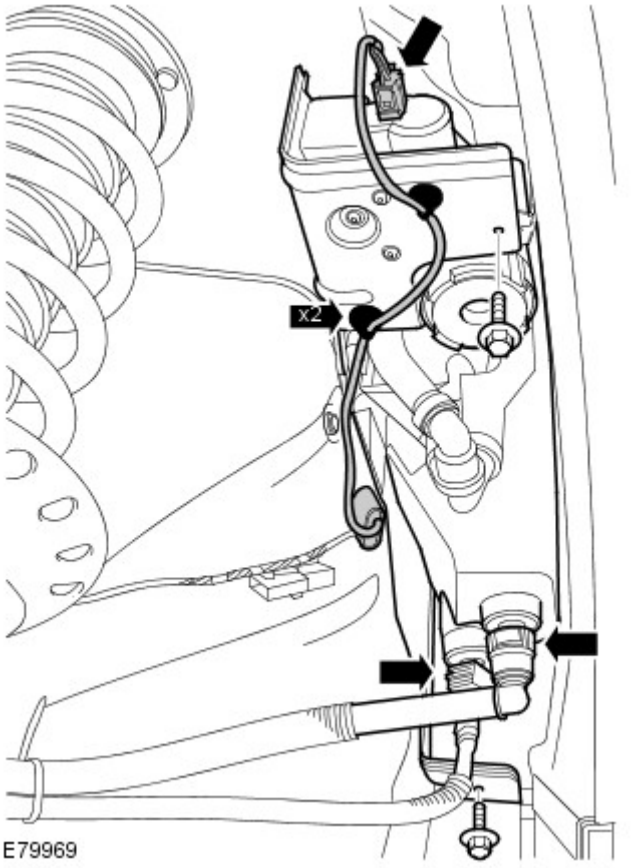
   Raise and support the vehicle.

3. Remove the rear wheel.

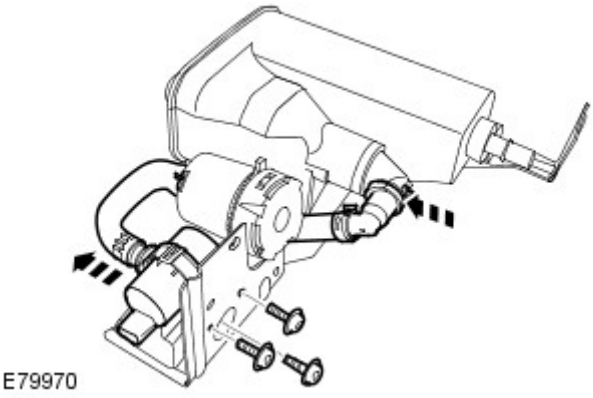
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

4.





5. *Torque:* 10 Nm



6.

Installation

1. To install, reverse the removal procedure.

Published: 12-Dec-2011

Evaporative Emissions - Fuel Tank Leakage Monitoring Pump

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

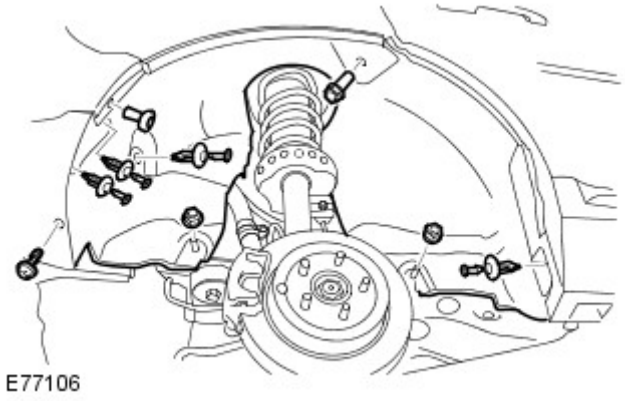
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

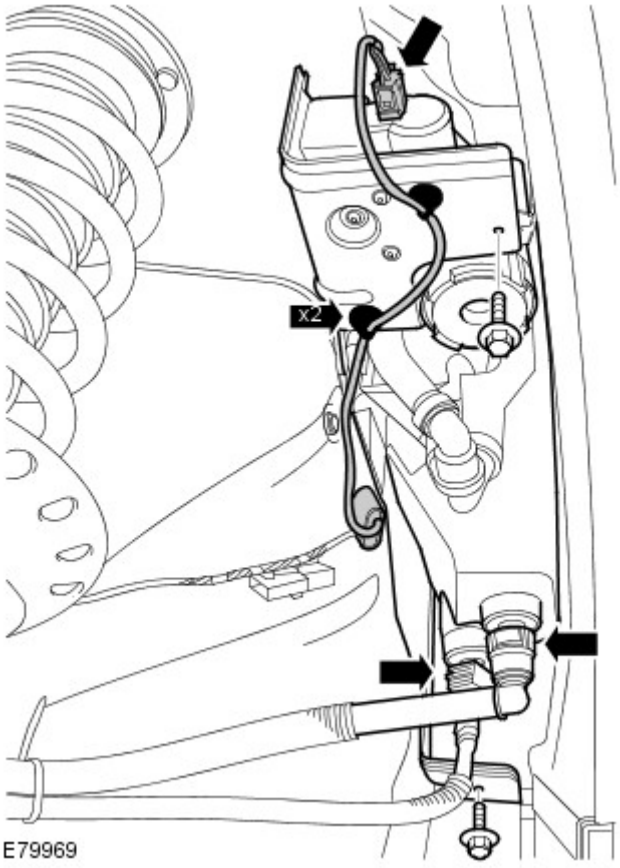
   Raise and support the vehicle.

3. Remove the rear wheel.

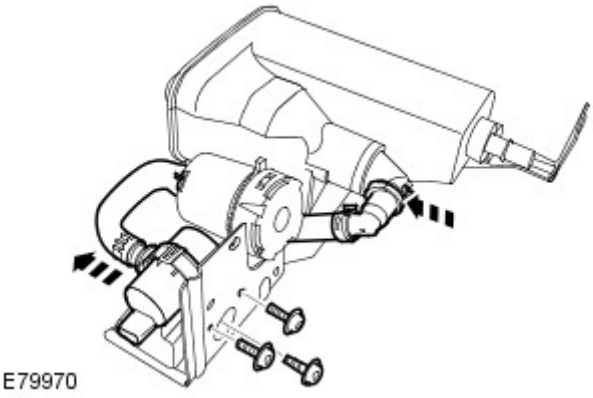
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



4. **4.** NOTE: Right-hand shown, left-hand similar.



5. *Torque:* 10 Nm



6. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol -

Item	Specification
Heated oxygen sensor (H02S) removal*	Apply WD40 or equivalent
Heated oxygen sensor (H02S) threads	Apply suitable high temperature anti-seize compound to threads of sensor (Castrol Optimol)

*** Apply to area around sensor threads prior to attempting to remove sensor**

General Specification

Item	Specification
Engine management system:	
Make	Denso
Camshaft position sensor:	
Make	Denso
Type	MRE (hall affect)
Crankshaft position sensor:	
Make	Denso
Type	Variable reluctance

Torque Specifications

Description	Nm	lb-ft
Camshaft position (CMP) sensor bolt+	10	7
Catalyst monitor sensor	45	33
Catalyst monitor sensor harness support bolt	6	5
Crankshaft position (CKP) sensor Torx bolt	10	7
Engine control module (ECM) bracket bolts	6	4
Flywheel sensor bolt	10	7
Flywheel sensor bracket screws	10	7
Fuel rail pressure sensor	6	5
Heated oxygen sensor (H02S)++	45	33
Knock sensor retaining bolt	20	14
Mass air flow (MAF) sensor Torx screws	2	1

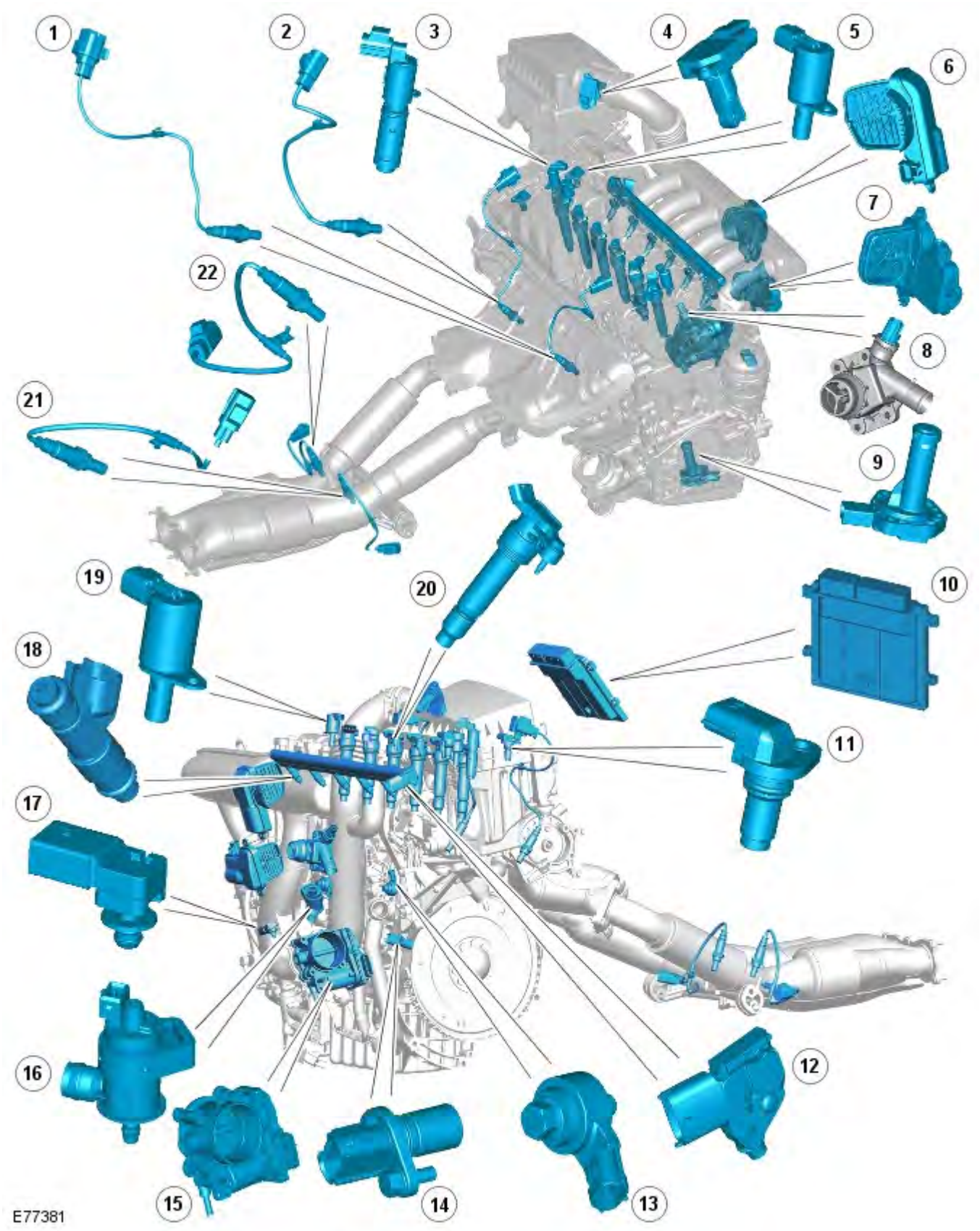
+ Apply clean engine oil to a new CMP sensor O-ring seal

++ Apply anti-seize lubricant to threads of sensor - See Lubricants

Electronic Engine Controls - I6 3.2L Petrol - Electronic Engine Controls

Description and Operation

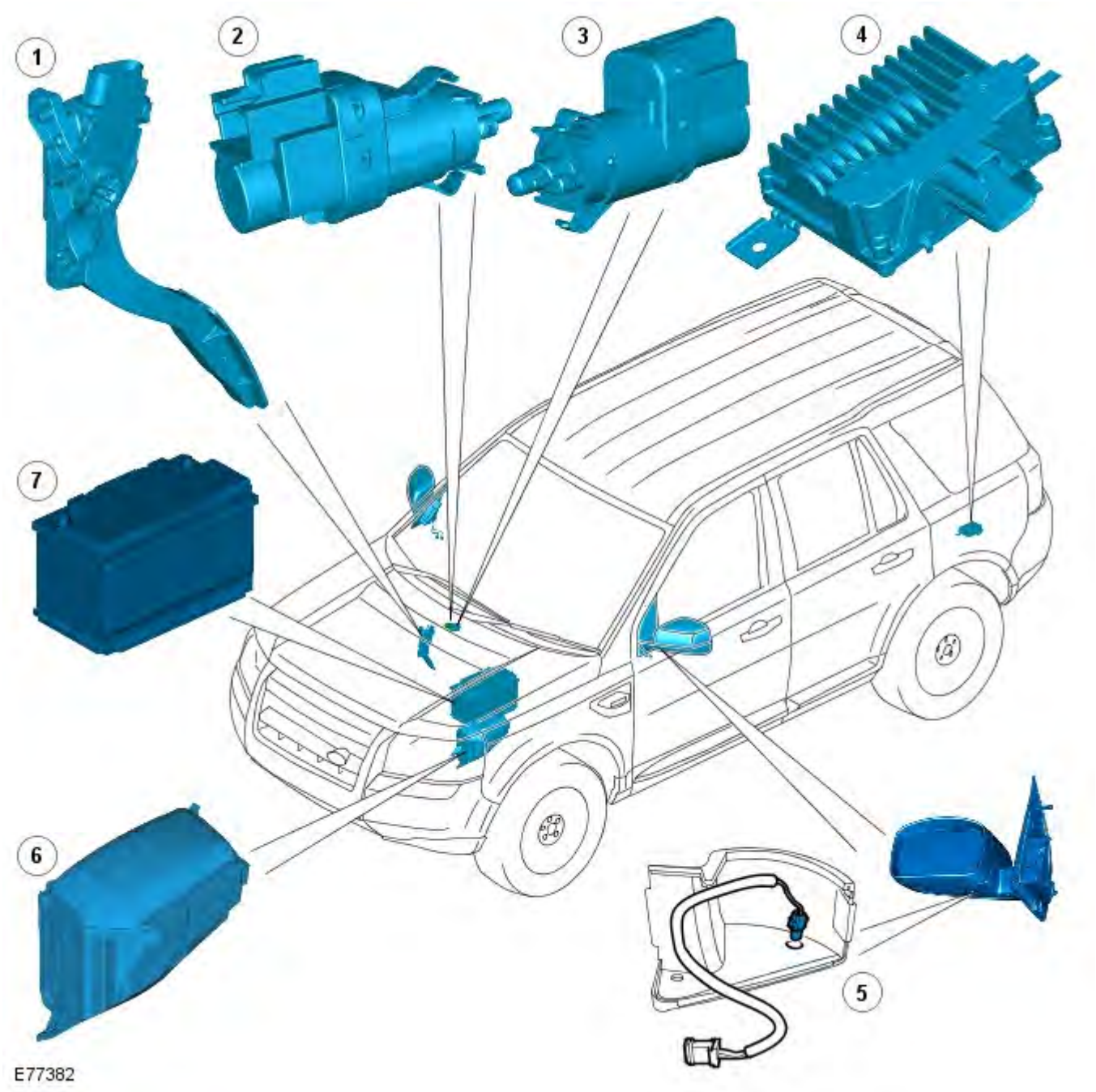
COMPONENT LOCATION SHEET 1 OF 2



Item	Part Number	Description
1	-	Heated Oxygen Sensor (HO2S) Pre-catalyst
2	-	HO2S Pre-catalyst
3	-	Variable Camshaft Timing (VCT) solenoid
4	-	Mass Air Flow (MAF) sensor

5	-	Camshaft Profile Switching (CPS) solenoid - rear
6	-	Plenum variable intake manifold valve
7	-	Intake tract variable intake manifold valve
8	-	Engine Coolant Temperature (ECT) sensor
9	-	Engine oil level/temperature sensor
10	-	Engine Control Module (ECM)
11	-	Camshaft Position (CMP) sensor (2 off)
12	-	Fuel rail temperature/pressure sensor
13	-	Knock sensors (2 off)
14	-	Crankshaft Position (CKP) sensor
15	-	Electric throttle
16	-	Purge valve
17	-	Manifold Absolute Pressure (MAP) sensor
18	-	Injectors (6 off)
19	-	CPS solenoid - Front
20	-	Ignition coil (6 off)
21	-	HO2S Post-catalyst
22	-	HO2S Post-catalyst

COMPONENT LOCATION SHEET 2 OF 2



Item	Part Number	Description
1	-	Accelerator Pedal Position (APP) sensor
2	-	Speed control inhibitor switch
3	-	Stop lamp switch

4	-	Fuel Pump Driver Module (FPDM)
5	-	Ambient air temperature sensor
6	-	Battery Junction Box (BJB)
7	-	Battery

OVERVIEW

The Engine Control Module (ECM) controls the following:

- Engine fueling
- Ignition timing
- Closed loop fueling
- Knock control
- Idle speed control
- Emission control
- On Board Diagnostics
- Speed control.

The ECM controls engine fueling by providing sequential fuel injection to all cylinders. Ignition is controlled by a direct ignition system, provided by 6 plug top coils. The ECM is able to detect and correct for ignition knock on each cylinder and adjust the ignition timing for each cylinder to achieve optimum performance.

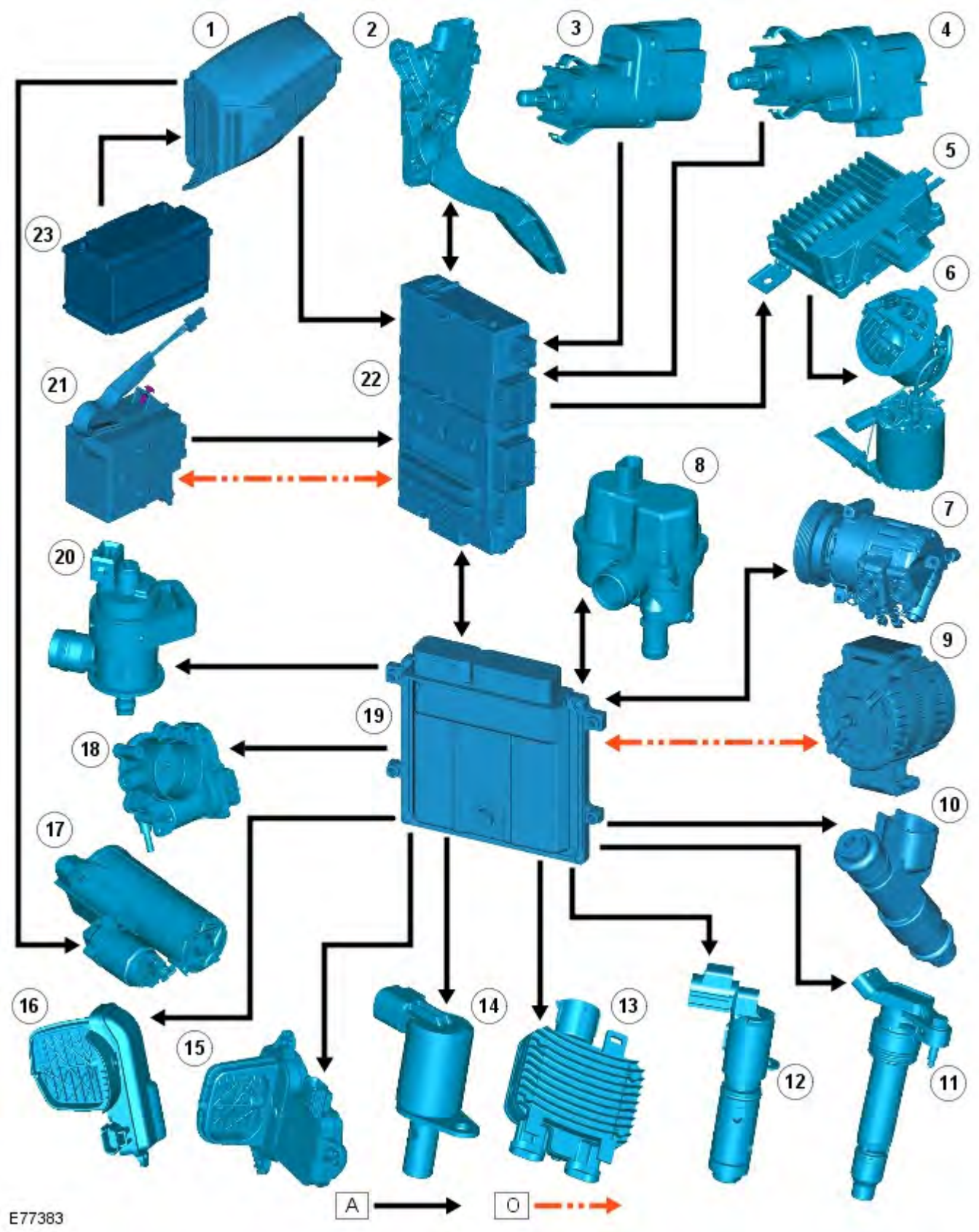
The ECM uses a torque-based strategy to generate the torque required by the driver and other vehicle control modules. The ECM uses various sensors to determine the torque required from the engine. The ECM also interfaces with other vehicle electronic control modules via the high speed Controller Area Network (CAN) bus, to obtain additional information (for example road speed from the Anti-lock Brake System (ABS) module). The ECM processes these signals and decides how much torque to generate. Torque is then generated by using various actuators to supply air, fuel and spark to the engine.

The ECM also uses an electronic throttle system which comprises the electric throttle assembly and an Accelerator Pedal Position (APP) sensor.

The ECM also interfaces with the immobilization system to help prevent the vehicle being started without proper authorization.
For additional information, refer to: Anti-Theft - Active (419-01, Description and Operation).

CONTROL DIAGRAM SHEET 1 OF 2

• NOTE: **A** = Hardwired; **N** = Medium speed CAN bus; **O** = Local Interconnect Network (LIN) bus

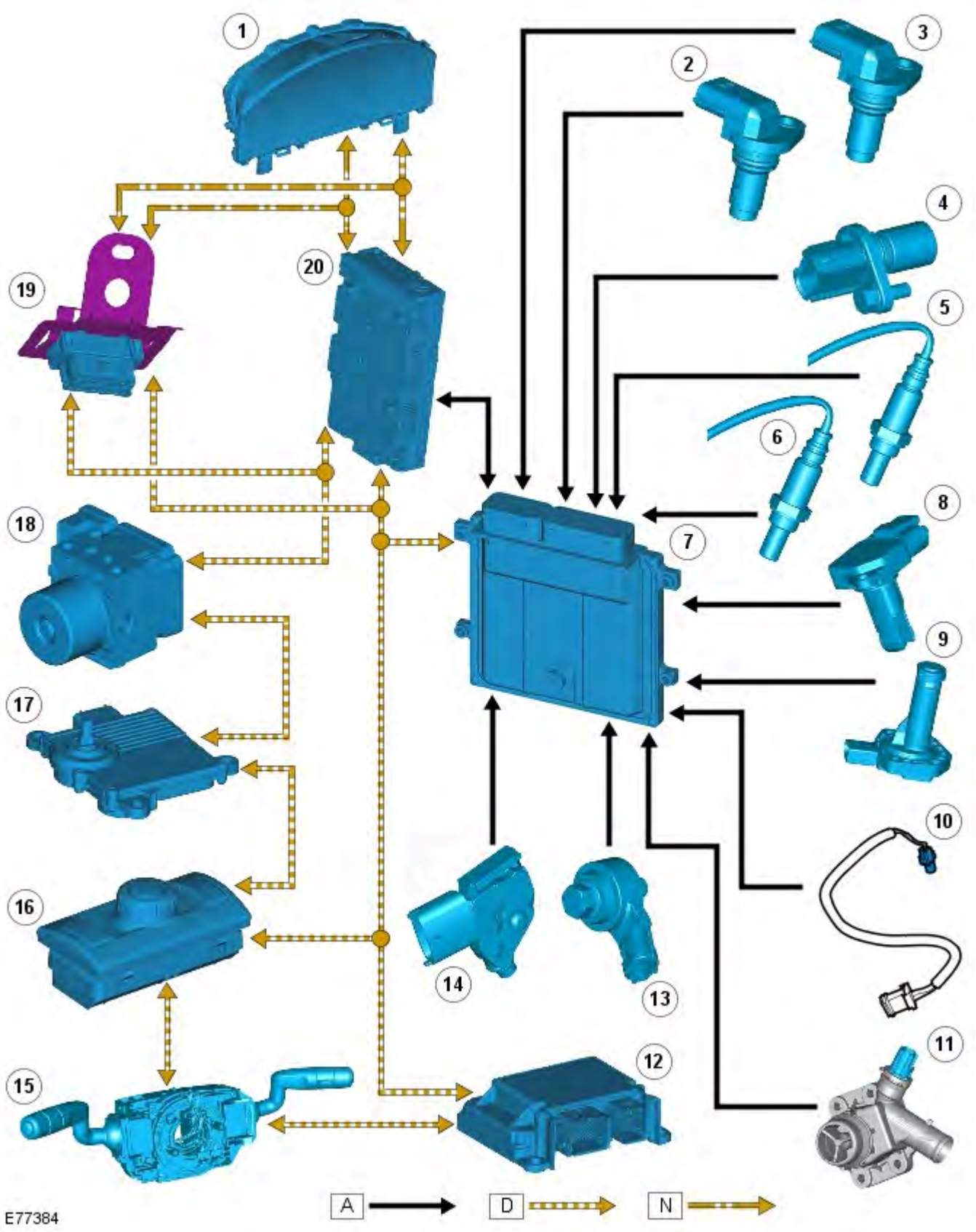


Item	Part Number	Description
1	-	BJB
2	-	APP sensor
3	-	Speed control inhibit switch
4	-	Stop lamp switch
5	-	FPDM
6	-	Fuel pump
7	-	Air Conditioning (A/C) compressor
8	-	Fuel tank leakage monitoring module (North American Specification (NAS) only)
9	-	Generator
10	-	Injectors (6 off)
11	-	Ignition coils (6 off)

12	-	VCT solenoid
13	-	Electric fan control module
14	-	CPS solenoids- front/rear
15	-	Intake tract variable intake manifold valve
16	-	Plenum variable intake manifold valve
17	-	Starter motor
18	-	Electric throttle
19	-	ECM
20	-	Purge valve
21	-	Start/stop switch
22	-	Central Junction Box (CJB)
23	-	Battery

CONTROL DIAGRAM SHEET 2 OF 2

- NOTE: **A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus



Item	Part Number	Description
1	-	Instrument cluster
2	-	Intake CMP sensor
3	-	Exhaust CMP sensor
4	-	CKP sensor
5	-	Pre-catalyst HO2S
6	-	Post catalyst HO2S
7	-	ECM
8	-	MAF/IAT
9	-	Engine oil level/temperature sensor
10	-	Ambient Air Temperature (AAT) sensor
11	-	ECT sensor

12	-	Restraints Control Module (RCM)
13	-	Knock sensors (2 off)
14	-	Fuel rail temperature/pressure sensor
15	-	Clockspring
16	-	Terrain response control module
17	-	Transmission Control Module (TCM)
18	-	ABS module
19	-	Diagnostic socket
20	-	CJB

ENGINE CONTROL MODULE (ECM)

The ECM is located on a bracket in a central position on the engine compartment firewall. The ECM is attached to a housing and secured with 4 screws. The housing is located in the bracket and locked in position.

The ECM is supplied with battery voltage from fuses located in the BJB. A permanent battery supply is provided to ensure adaptive data is not lost when the engine is switched off.

A regulator, located within the ECM, supplies a 5V current to internal components such as the micro-processor unit. Other components or functions requiring full battery voltage are controlled by external relays or internal power stages.

The micro-processor within the ECM receives signals from different components and control modules and uses a program within the ECM software to interpret the signal information and issue signals which relate to how the engine components and functions should be controlled.

The ECM receives inputs from the following:

- CMP sensors
- CKP sensor
- Fuel rail pressure sensor
- MAF sensor
- Knock sensors
- Fuel rail temperature/pressure sensor
- ECT sensor
- Engine oil level/temperature sensor
- Manifold Absolute Pressure (MAP) sensor
- Electric throttle - Throttle Position (TP) sensor
- APP sensor
- Fuel tank leakage monitoring module (NAS only)
- Cooling fan control
- Heated Oxygen sensors (HO2S)
- Stop lamp switch (via Central Junction Box (CJB))
- Speed control inhibit switch
- Intake Air Temperature (IAT) sensor
- Ambient Air Temperature (AAT) sensor
- Transmission Control Module (TCM).

The ECM sends outputs to the following:

- Main relay
- Air Conditioning (A/C) relay
- Fuel injectors
- Ignition coils
- Engine cooling fan control
- Electric throttle
- Electric fuel pump driver module
- Variable Camshaft Timing (VCT) solenoids
- Starter relay control
- Variable intake manifold control valves
- Variable inlet cam profile switching solenoid valves
- Transmission Control Module (TCM).

SENSORS

The ECM optimizes engine performance by interpreting signals from numerous vehicle sensors and other inputs. Some of these signals are produced by the actions of the driver, some are supplied by sensors located on and around the engine

and some are supplied by other vehicle systems.

Camshaft Position (CMP) Sensor

Two CMP sensors are located in the camshaft housing at the Left Hand (LH) end of the engine. The sensors are located in a hole in the housing and are secured with a screw. There is a CMP sensor for each camshaft.

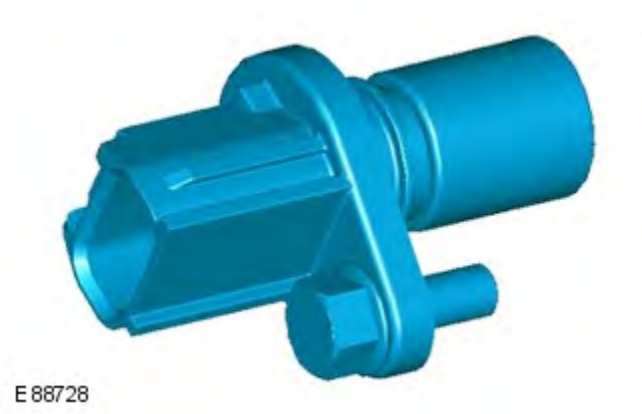
The CMP sensors monitor the position of the camshafts to establish ignition timing order, fuel injection triggering and for accurate Variable Camshaft Timing (VCT) operation. The ECM can also use the CMP sensors to determine which cylinder has a misfire or knock using the CMP signal output.

The CMP sensor is a Hall-effect sensor which switches a 5V supply from the ECM on and off. The supply is switched when teeth machined onto a pulse wheel on the camshaft pass by the tip of the sensor. The teeth are of differing shapes, so the ECM can determine the exact position of the camshaft at any time. When one of the teeth passes by the sensor tip, a signal is transmitted to the ECM which can vary between 0 and 5V. The signal is high when a tooth is directly adjacent to the sensor and is low when the tooth is away from the sensor.

Failure of one or both of the sensors will result in the ECM using a default map for ignition timing and knock control will be disabled.

The ECM monitors the sensor for correct function and can diagnose and store fault codes for sensor faults. These can be retrieved using a Land Rover approved diagnostic system.

Crankshaft Position (CKP) Sensor



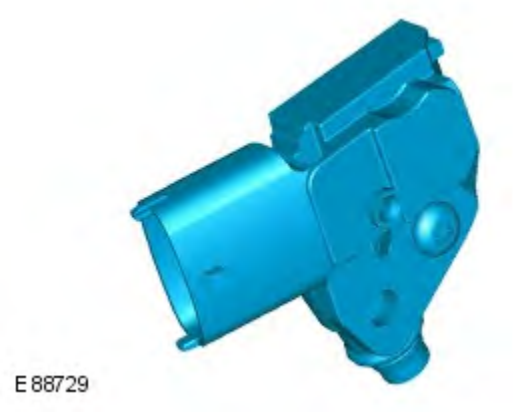
The CKP sensor is located on the forward side of the transmission torque converter housing, in line with the engine flywheel. The sensor is secured with a bolt into a bracket attached to the gear housing. A reluctor ring is fitted to the outer diameter of the crankshaft flexplate and the sensor reacts to the gaps in the reluctor ring to determine engine speed and position information. The sensor has 2 wires from the ECM sensor ground and a feedback signal.

The CKP sensor is an inductive type sensor which produces a sinusoidal output voltage signal. This voltage is induced by the proximity of the moving reluctor ring gaps, which excite the magnetic flux around the tip of the sensor when each gap passes. This output voltage will increase in magnitude and frequency as the engine speed rises determined by an increase in the speed at which the gaps on the reluctor ring pass the sensor. The signal voltage can be as low as 0.1V at low engine speeds and up to 100V at high engine speeds. The ECM does not react to the output voltage (unless the voltage is extremely low or high), instead it measures the time intervals between each pulse (signal frequency). The signal is determined by the number of gaps passing the sensor, and the speed at which they pass. The reluctor ring has 2 gaps missing to give the ECM a synchronization point and determine the position of the crankshaft. The CKP sensor signal is also used for misfire detection.

The signal produced by the CKP sensor is critical to engine running. Failure of the sensor when the engine is running will result in the engine stopping immediately. The engine can be restarted using signals from the CMP sensors but the engine speed will be limited to 3000 rpm and the Malfunction Indicator Lamp (MIL) will be illuminated.

The ECM monitors the sensor for correct function and can diagnose and store fault codes for sensor faults. These can be retrieved using a Land Rover approved diagnostic system.

Fuel Rail Pressure/Temperature Sensor



The fuel rail pressure/temperature sensor is located on the LH end of the fuel rail. The ECM supplies the combined pressure and temperature sensor with a 5V reference voltage and a ground and measures the returned signals for pressure and temperature.

Fuel pressure

The fuel pressure sensor is a peizo resistor type sensor. The sensor receives a 5V reference voltage from the ECM and produces an analogue signal of between 0 and 5V depending on the pressure sensed. Low pressure gives a low voltage output and consequently high pressure gives a higher voltage output. The ECM uses this pressure signal to adjust the fuel pump module output pressure by sending controlling signals to the FPDM and for injector timing.

The ECM monitors the fuel pressure sensor for faults and can store fault related codes. These can be retrieved using a Land Rover approved diagnostic system. Sensor operation can also be checked using a Land Rover approved diagnostic system to check fuel pressure. If no fuel pressure is in the fuel rail, the sensor will read and output atmospheric pressure.

Fuel Temperature

The fuel temperature sensor is a Negative Temperature Co-efficient (NTC) sensor. The sensing thermistor element resistance decreases as the sensor temperature increases. The ECM supplies the sensor with a 5V reference voltage and a ground and measures the returned signal as a temperature.

The resistance in the sensor changes with fuel temperature. A low fuel temperature will result in a high voltage being returned to the ECM and high fuel temperature will return a low voltage reading of between 0 - 5V.

The ECM monitors the fuel temperature sensor for faults and can store fault related codes. These can be retrieved using a Land Rover approved diagnostic system. The ECM uses the ECT temperature signal as a default but only up to a maximum of 100°C (212°F).

Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor

The MAF/IAT sensor is located in the outlet pipe from the air cleaner housing. The combined MAF/IAT functions are connected to the ECM on separate wires. The sensor has an extended moulding which is located in a central position in the air flow through the air cleaner housing outlet pipe, through which the air flow and temperature are measured.

Mass Air Flow (MAF) Sensor

The MAF sensor measures the mass of air being drawn into the engine. The air mass is calculated by the cooling effect of inlet air passing over a 'hot film' element contained within the sensor. The higher the air flow, the greater the cooling effect on the element which in turn lowers the electrical resistance of the 'hot film' element. The ECM uses this resistance value to calculate the air mass or volume of air flowing into the engine.

The MAF sensor receives a battery voltage supply via the ECM and the main relay. The ECM provides a ground and a signal path for the resistance signal from the 'hot film' sensor. The analogue signal from the MAF sensor varies between 0.5 and 5V. Low air flow gives a low voltage and high air flow gives a high voltage.

The MAF signal is used by the ECM to determine:

- the correct fuel quantity (injection period) to maintain the correct air/fuel ratio required for correct operation of the engine and the catalysts

- the ignition timing
- the engine load.

The ECM monitors the MAF sensor for faults and can store fault related codes. These can be retrieved using a Land Rover approved diagnostic system.

Intake Air Temperature (IAT) Sensor

The IAT sensor measures the temperature of the intake air entering the engine. The sensor is a temperature dependant resistor (thermistor). The thermistor is a NTC sensor element. The element resistance decreases as the sensor temperature increases. The ECM supplies the sensor with a 5V reference voltage and a ground and measures the returned signal as a temperature.

The resistance in the sensor changes with intake air temperature. A low intake air temperature will result in a high voltage being returned to the ECM and high intake air temperature will return a low voltage reading of between 0 - 5V.

The ECM monitors the IAT sensor for faults and can store fault related codes. These can be retrieved using a Land Rover approved diagnostic system. If the IAT sensor fails, the ECM uses a default temperature value using the fuel rail pressure/temperature sensor.

Knock Sensors

Two knock sensors are located on the front of the engine and are each secured to threaded holes in the engine cylinder block with a bolt. The knock sensors are used by the ECM to monitor combustion knocking or vibration generated by ignition combustion. The knock sensors are each connected to the ECM via a twisted pair of wires which reduces electrical interference disrupting the signal produced.

Each knock sensor contains a peizo-ceramic crystal which produces a voltage when an external force applies pressure or load on it. When the engine is running, compression waves produced by the combustion process, creates pressure waves which pass through the engine cylinder block. These pressure waves are detected by the knock sensors and the deflection of the crystal caused by the pressure waves causes the sensors to produce an output signal. The signals are passed to the ECM which compares them with stored mapped signals in its memory.

The ECM can then determine when the correct combustion occurs in individual cylinders. If incorrect combustion detonation is detected, the ECM can retard the ignition timing on that cylinder for a number of combustion cycles. The ignition timing will be gradually returned to its optimal settings. If the knock is still detected the ECM will increase the injection period, which has a cooling effect on that cylinder.

The signals from the knock sensors are used in conjunction with the CMP sensors and the CKP sensor to determine the ignition cycle and therefore identify which cylinder is knocking. The ECM is programmed to use ignition maps based on high quality 95-98 RON fuel. If fuel of a poor quality such as 91 RON is used the engine may suffer from knock (pinking) for a period of time. The ECM is capable of learning and adapting to the low grade fuel and will modify its internal ignition mapping to compensate for the low grade fuel. This feature of the ECM is called adaption.

If one or both knock sensors fail or the signal becomes implausible, the ECM will cancel closed loop control of the ignition system. The ECM will use a default 'safe' ignition map to ensure the pre-detonation does not damage the engine by setting maximum retard control on spark advance. The driver may notice 'pinking' under certain driving conditions and a loss of performance. The ECM monitors the knock sensors for faults and can store fault related codes. These can be retrieved using a Land Rover approved diagnostic system.

Engine Coolant Temperature (ECT) Sensor

E88732

The ECT sensor is located in the thermostat housing, on the front of the engine, below the inlet manifold. The ECT sensor is a thermistor type sensor used by the ECM to monitor the engine coolant temperature. The ECM uses the temperature information for the following functions:

- regulate the injection period
- set engine idle target speed
- control the engine cooling fan(s)
- determine operation of the A/C compressor
- determine operation of the purge valve and catalytic converter heating function.

The sensor is a Negative Temperature Co-efficient (NTC) thermistor element. The element resistance decreases as the sensor temperature increases. The ECM supplies the sensor with a 5V reference voltage and a ground and measures the returned signal as a temperature.

The ECT sensor is important to the correct running of the engine as a richer mixture is required at low engine coolant temperatures for efficient starting and smooth cold running. As the engine coolant temperature increases, the ECM uses the temperature signal from the sensor to lean off the fuel mixture to maintain optimum emissions and performance.

The ECM monitors the ECT sensor for faults and can store fault related codes. These can be retrieved using a Land Rover approved diagnostic system. If the ECT sensor fails, the ECM uses a default value of 90°C (194°F). The electric fan control module is sent a default coolant temperature value of 105°C (221°F) and switches the cooling fan on permanently.

Engine Oil Level/Temperature Sensor

E88733

The engine oil level/temperature sensor is located on the underside of the engine and is secured in the engine oil pan with 3 screws and is sealed with an O-ring seal. The ECM supplies the sensor with a 5V reference voltage and two wires supply the temperature and oil level signals back to the ECM.

Two types of engine oil level/temperature sensor are used. On earlier models a capacitive oil level sensor is fitted and was replaced by an ultrasound level sensor on later models. The principle of the temperature sensor is the same in both sensor types. The sensors can be identified by differences in the sensor housings; the capacitive sensor has the electrical connector moulded square to the base of the sensor, the ultrasonic sensor has the connector moulded at a slight angle to the base of the sensor.

The ECM uses both the oil level and temperature signals to calculate the oil level. Temporary oil level changes caused by hill driving or cornering are taken into account by the ECM using additional information such as vehicle speed and engine load.

Engine Oil Level Sensor - Capacitance Type

The engine oil level sensor comprises two capacitive gauge elements. These measure the resistance to electrical current passing through the engine oil.

There are two capacitors, one measuring the permittivity of the oil and a second with two plates set vertically measuring the height. The second capacitor will have a proportion of oil and air between the plates and since the permittivity of air is different to that of oil, the permittivity reading will change as the level of oil decreases and the air between the plate gap increases. This permittivity reading is compared to that of the oil (taken by the first capacitor) and an oil level is derived.

Engine Oil Level Sensor - Ultrasound Type

The engine oil level sensor uses an ultrasonic pulse, which is reflected back from the surface of the oil. The time it takes for this signal to return to the sensor is turned into a PWM signal and is sent to the ECM. The ECM determines the time taken for the ultrasonic pulse signal to be received and calculates it into an oil level figure.

Engine Oil Temperature Sensor

The engine oil temperature sensor is a Positive Temperature Co-efficient (PTC) thermistor element. The element resistance increases as the sensor temperature decreases. The ECM supplies the sensor with a 5V reference voltage and a ground and measures the returned signal as a temperature. A low oil temperature will result in a low voltage being returned to the ECM and high oil temperature will return a high voltage reading.

The ECM monitors the engine oil level/temperature sensor for faults and can store fault related codes. These can be retrieved using a Land Rover approved diagnostic system. If the sensor fails, the ECM uses the engine coolant temperature sensor signal value as a substitute.

Manifold Absolute Pressure (MAP) Sensor

The MAP sensor is located in the lower part of the intake manifold. The MAP sensor measures the absolute pressure in the intake manifold. The sensor is a semi-conductor type sensor which responds to pressure acting on a membrane within the sensor, altering the output voltage. The sensor receives a 5V reference voltage and a ground from the ECM and returns a signal of between 0.5 - 4.5V to the ECM. A low pressure returns a low voltage signal to the ECM and a high pressure returns a high voltage.

The MAP sensor detects quick pressure changes in the intake manifold after the electric throttle. The signal is used in conjunction with the MAF sensor signal to calculate the injection period.

The ECM monitors the engine MAP sensor for faults and can store fault related codes. These can be retrieved using a Land Rover approved diagnostic system. If the sensor fails, the ECM uses the MAF/IAT sensor signal value as a substitute.

Electric Throttle

The electric throttle is located at the entrance of the intake manifold and is secured to the manifold with four Torx head bolts. The throttle also provides for the connection of the air cleaner housing outlet pipe which is secured to the throttle body with a clip.

The electric throttle comprises the throttle body, a round throttle disc which is actuated by a damper motor and a throttle position sensor. The electric throttle is controlled by the ECM and receives positional signals from the TP sensor. If a failure of the motor occurs, the throttle disc is returned to its closed position by the springs, with limited engine speed available to the driver.

Spindle Damper Motor

The motor is a DC damper motor which drives a gear wheel and two springs; one for opening and one for closing. The motor rotates the spindle to which the throttle disc is attached. PWM signals from the ECM control the damper motor to adjust the position of the throttle disc, regulating the amount of air entering the inlet manifold for combustion.

Movement of the motor is achieved by changing the polarity of the power supply to the DC motor, allowing it to be operated in both directions. The throttle disc and the motor has two maximum positions; throttle disc closed which allows minimal air flow through the electric throttle into the intake manifold and throttle disc open which allows maximum air flow

into the intake manifold.

Throttle Position (TP) Sensor

The TP sensor is housed in the electric throttle assembly and is used to check the position of the throttle disc. Two permanent magnets in the sensor connected to the throttle disc affect two Hall effect sensors. As the spindle is rotated the magnets rotate around the Hall effect sensors and produce offset analogue signals back to the ECM. The ECM compares these signals to stored values to ensure that they show an accurate throttle disc position. The offset signals are that one Hall effect sensor produces a higher voltage as the throttle angle increases and the other sensor produces a lower voltage as the throttle angle increases.

The ECM performs a self test and a calibration routine on the throttle disc position at each ignition cycle. This is achieved by the ECM powering the damper motor to fully close the throttle disc and then fully open the throttle disc.

The ECM monitors the DC damper motor and the TP sensor for faults and can store fault related codes. These can be retrieved using a Land Rover approved diagnostic system.

Accelerator Pedal Position (APP) Sensor

The APP sensor is located on the accelerator pedal. The sensor comprises a plastic housing which contains two potentiometers and an analogue/digital converter. The potentiometers are connected to a common shaft which is actuated by movement of the accelerator pedal.

The APP sensor provides the ECM and the CJB with information relating to the position of the accelerator pedal. The ECM uses this information to actuate the damper motor in the electric throttle assembly to move the throttle disc to the correct angle in relation to the pedal position.

The APP sensor receives a fused 12V supply from the CJB, which is controlled by the ignition relay in the BJB. The CJB also provides the sensor with a ground. The sensor provides two outputs; the analogue output is transmitted directly to the CJB, which in turn issues the signal to the ECM on the CAN bus, the second output is the Pulse Width Modulation (PWM) signal which is transmitted directly to the ECM. Both the analogue and PWM signals transmit the same positional information.

The ECM uses the PWM signal to calculate the required position of the electric throttle disc in the electric throttle. In the event of a failure of the PWM signal, the ECM uses the analogue signal received from the CJB as a replacement. If the analogue signal is also incorrect or missing, the ECM limits the maximum engine speed to 2000 rpm.

The PWM and the analogue signal are used for diagnosing faults with the APP sensor. If the ECM detects a difference between the analogue and PWM signals a fault code is stored. The ECM will use the signal with the lowest value for electric throttle control. The APP sensor position and any stored fault codes can be read using a Land Rover approved diagnostic system.

Heated Oxygen (HO2S) Sensors

E88737

Four HO2S are used by the ECM to measure the oxygen content of the exhaust gasses leaving the engine. Two upstream sensors measure the gasses before they pass through the catalytic converter and two additional downstream sensors measure the gasses after they have passed through the catalytic converter.

The HO2S receive a fused power supply from the main relay in the BJB. Each HO2S is also connected to the ECM on three wires which provide a PWM control of the sensor heating coil, a ground and a signal line.

HO2S Preheating

The HO2S (often referred to as a Lambda (λ) sensor) only operates efficiently at temperatures above 300°C (572°F). The normal operating temperature is between 300°C and 850 °C (572°F and 1562°F) and the HO2S is electrically preheated so it reaches the optimum working temperature quickly. Another reason for the preheating is to maintain a normal operating temperature to prevent condensation which could damage the sensor.

The sensor heating coil is a PTC resistor. The heating coil is supplied with battery voltage via the main relay and provided with a ground by the ECM. When the ECM provides the ground the current will pass through the coil. When the sensor is cold, the resistance through the PTC resistor is low and a high current will pass through the coil. The ECM provides a PWM ground initially. As the PTC resistor heats up the resistance increases reducing the current flow. This is sensed by the ECM which gradually reduces the PWM ground to a continuous ground.

The coil is heated immediately following an engine start for a period of approximately 20 seconds and also during low load conditions when the temperature of the exhaust gasses is insufficient to maintain the optimum sensor temperature. The ECM controls the application of the PWM signal to prevent sensor damage due to thermal shock caused by the sensor heating too quickly. The ECM can diagnose faults in the heater coil and record fault codes which can be retrieved using a Land Rover approved diagnostic system.

Upstream HO2S

Two upstream HO2S are used and are located in each exhaust manifold, between the engine and the catalytic converter. The HO2S comprises a solid electrolyte Zirconium dioxide cell surrounded by a gas permeable ceramic. The output voltage from the sensor is dependent on the level of O_2 passing through the permeable ceramic coating. Nominal voltage for λ=1 is 300 to 500mV. As the fuel/air mixture becomes richer (λ<1) the voltage rises to up to 900mV. As the mixture becomes weaker (λ>1) the voltage falls towards 0mV.

The upstream HO2S is used by the ECM to monitor the oxygen content of the exhaust gasses leaving the engine before they reach the catalytic converter. The ECM will check the output from the HO2S to determine the combustion mixture and ensure λ=1 is obtained. λ=1 is the optimum air/fuel ratio which relates to a mixture of 14.7 kg air per 1 kg of fuel (14.7:1).

The HO2S uses current regulation and outputs a linear signal dependent on the ratio of exhaust gas oxygen to ambient oxygen. The oxygen content of the exhaust gasses is measured by comparing it with ambient air drawn into the HO2S.

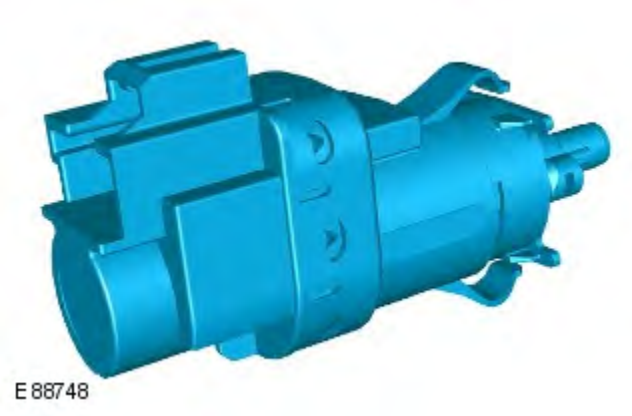
Downstream HO2S

Two downstream HO2S are used and are located in the each exhaust system after the starter catalytic converter. The downstream HO2S are used by the ECM to monitor the oxygen content of the exhaust gasses leaving the catalytic converter. The ECM can use this information to check (when the conditions for catalyst diagnostics have been met) for correct operation of the catalytic converter.

The ECM uses the information from the downstream HO2S to enhance the signals from the upstream HO2S.

The downstream HO2S are similar in their construction to the upstream HO2S with the exception of the output signal to the ECM. The output signal is a binary signal where the amplitude of the signal curve changes considerably when the oxygen content in the exhaust gasses changes. The oxygen content of the exhaust gasses leaving the catalytic converter are measured by comparing it with ambient air drawn into the HO2S.

Stop Lamp Switch



The stop lamp switch is attached to the brake pedal bracket, adjacent to the speed control inhibit switch. When the brake pedal is pressed, a plate on the pedal moves away from the switch plunger allowing the plunger to extend and complete the switch contacts.

The switch receives a permanent, fused battery voltage via the BJB and the CJB. The switch is connected to the ECM which provides the ground path. The ground (battery voltage signal) is used by the ECM as a switch operation signal. The ground from the switch is routed via the CJB to the ECM which allows the CJB to also determine the switch operation.

The CJB uses the completed ground when the switch is operated to activate the stop lamps.

The ECM can diagnose the operation of the stop lamp switch and the status of the switch can be read using a Land Rover approved diagnostic system.

Ambient Air Temperature (AAT) Sensor

The AAT sensor is located in the underside of the Left Hand (LH) exterior door mirror. The sensor is a Negative Temperature Co-efficient (NTC) thermistor element. The element resistance decreases as the sensor temperature increases which produces a low signal voltage. The ECM supplies the sensor with a 5V reference voltage and a ground and measures the returned signal voltage as an outside temperature.

The AAT signal is used by the ECM for a number of functions including engine cooling fan control and A/C compressor displacement control. The ECM also transmits a message on the high speed CAN bus relating to the current outside temperature for use by other control modules.

The ECM can diagnose the operation of the AAT sensor and the sensor output values can be read using a Land Rover approved diagnostic system.

Fuel Pump Driver Module (FPDM)

The FPDM is located in the LH rear corner of the luggage compartment, behind the trim panel and is secured to the LH chassis longitudinal with 2 screws.

The FPDM receives a battery supply via the fuel pump relay in the CJB. The relay is energised by the CJB when a request is received from the ECM. Two wires connect the FPDM to the fuel pump motor and a ground is via a body ground point. The ECM is connected to the FPDM on a single wire and this is used to control the pump pressure output and consequently the pump output pressure. The ECM uses signals from the MAP sensor, the fuel rail pressure/temperature sensor and the MAF/IAT sensor to determine and control the pump output.

The ECM outputs a PWM signal to the FPDM. The frequency of the signal determines the duty cycle of the FPDM which subsequently controls the pump pressure output. The frequency of the PWM signal represents half of the 'on' time of the pump. If the ECM outputs a PWM signal of 50% on time, the FPDM will operate the pump at 100% (permanently on). If the ECM outputs a PWM signal of 5%, the FPDM will operate the pump at 10% on time. The FPDM will only operate the fuel pump if it receives a PWM signal from the ECM of between 4% and 50%. If the ECM requires the pump to be stopped, the ECM transmits a PWM signal at a cycle of 75%.

If the power supply to the FPDM from the CJB or the fuel pump relay is disrupted for any reason, the fuel pump will not operate. The FPDM is monitored by the ECM for faults. Faults with the FPDM are stored in the ECM as fault codes which can be retrieved using a Land Rover approved diagnostic system.

Variable Camshaft Timing (VCT) Solenoid

The VCT solenoid is located in the LH end of the cylinder head and is secured with a bolt. The VCT solenoid is a valve which controls the oil flow to the VCT unit.

The VCT solenoid receives a fused battery supply via the main relay. The ECM provides a pulsed ground for the solenoid.

The VCT solenoid comprises an electro-magnetic valve with a spring loaded piston. Slots in the piston allows oil to be channelled to the VCT unit. The VCT unit rotates the inlet camshaft to adjust the camshaft timing as required. The direction in which the camshaft is rotated is dependent on the chamber in the VCT unit which is supplied with oil pressure from the slot in the VCT solenoid piston.
For additional information, refer to: Engine - 3.2L (303-01, Description and Operation).

An oil filter is located in the intake channel for the VCT solenoid to prevent contaminants affecting the function of the valve.

Operation of the valve is controlled by the ECM. The ECM provides a PWM ground for the VCT solenoid. This allows oil to be directed to different chambers in the VCT unit at variable rates, allowing the camshaft angle position to be controlled smoothly and precisely.

The ECM can diagnose the operation of the VCT solenoid and store fault related codes. The codes can be read using a Land Rover approved diagnostic system.

Camshaft Profile Switching (CPS) Solenoid - Front/Rear

Two CPS solenoids are located at each end of the cylinder head, adjacent to the inlet camshaft and are each secured with a bolt. The CPS solenoids supply oil pressure to the hydraulic tappet locking pins allowing the camshaft profile to be changed. Each solenoid controls the oil pressure supply to the hydraulic tappet locking pins on 3 cylinders.
For additional information, refer to: Engine - 3.2L (303-01, Description and Operation).

The CPS solenoids receive a fused battery supply via the main relay. The ECM provides a ground for the solenoid, which actuates a valve within the solenoid allowing oil pressure to adjust the camshaft profile.

The ECM can diagnose the operation of the CPS solenoids and store fault related codes. The codes can be read using a Land Rover approved diagnostic system.

Ignition Coils

Six plug top coils are used on the i6 engine and are located in recesses in the top of the cylinder head. The coils are controlled by the ECM and receive a fused, battery voltage supply via the main relay. The ECM controls the spark timing and production by switching the primary circuit of each coil to ground allowing the charge which has built up in the coil to produce a spark at the spark plug.

Each coil contains a power stage which controls the primary current and the ECM sends a signal to each coil to operate the power stage switching at the appropriate time. Each coil has a feedback wire to the ECM which allows the ECM to diagnose each individual coil and store fault related codes. The codes can be read using a Land Rover approved diagnostic system.

A suppressor is mounted on the camshaft cover adjacent to ignition coil 3 to prevent interference from the coils and/or the injectors affecting audio operation.

Fuel Injectors

Six fuel injectors are used on the i6 engine and are located on the inlet side of the cylinder head. The injectors are sealed in the cylinder head with O-ring seals and held in position by the fuel rail.

The injectors receive a fused battery voltage supply via the main relay. The ECM operates the injectors by grounding solenoid valves in the injector. When the ground is applied the solenoid valve operates and the injector sprays pressurized fuel from the fuel rail into the cylinder intake ports. The amount of fuel injected and the timing of the injection period is controlled by the ECM using data from other sensors.

The ECM can monitor the injector operation by monitoring the ground line from the injector. Each injector can be diagnosed by the ECM and fault codes stored. The codes can be read using a Land Rover approved diagnostic system.

Variable Intake System (VIS)

The VIS changes the length of the inlet manifold using two ECM controlled actuators which move flaps to control the air flow. The actuators operate singularly or together to adjust the length of the inlet tract.

Using an 'H' bridge, the intake and plenum actuator's internal electronics changes the actuator motor's polarity and therefore the flap position. At each flap position change, the DC actuator motor is powered for approximately 0.5 seconds. The worm gear design ensures that the flap remains in the desired position, even when the electric motors are not powered.

Intake Tract Variable Manifold

The ECM controls the position of the flaps by modulating the relevant actuator's control signal. If the signal shifts from low (approximately 1 volt) to high (approximately 10 volts) the internal electronics interpret it as the flap must close. If the signal shifts from high to low, the flap must open.

At engine speeds of less than 3800 rpm both the intake and plenum flaps are closed. At engine speeds of approximately 3800 rpm and higher the intake flap begins to open, effectively shortening the length of the intake manifold. At engine speeds of 4800 rpm or higher both the intake and plenum flaps are open, providing the shortest length of intake manifold.

VIS Flap Functionality

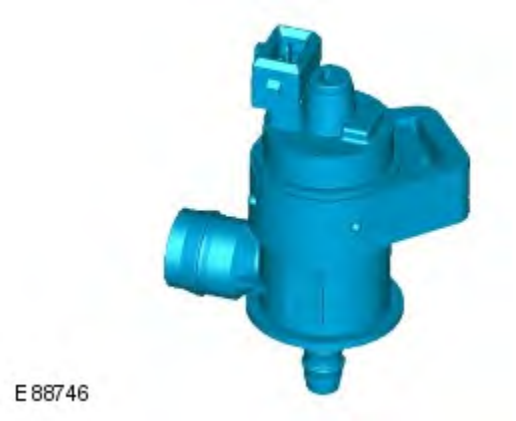
Engine Speed	Intake Tract Flap	Plenum Intake Flap	Effect
Less than 3800 rpm	Closed	Closed	Long tracts
3800 to 4800 rpm	Open	Closed	Short tracts
More than 4800 rpm	Open	Open	Open plenum

Plenum Variable Intake Manifold

The ECM diagnoses via the actuator if the flap has assumed the correct position. It does this, by comparing the desired air flow with the actual air flow. A fault code is stored if the deviations are outside the tolerances. The codes can be read using a Land Rover approved diagnostic system.

If an actuator fails and the flap is in the open position, it is not possible to remove the actuator and flap assembly from the inlet manifold. A small indentation on the body of the actuator allows for a 3 mm Allen key to be pushed through the thin membrane wall of the actuator housing. The Allen key can be engaged in the spindle of the actuator motor which allows the flap to be turned to the closed position and consequently the actuator and flap assembly can then be removed from the intake manifold.

Purge Valve



The purge valve is located on a bracket on the inlet manifold, above the electric throttle. The valve has a hose connection on the bottom which connects into the electric throttle and allows the fuel vapors to be drawn into the inlet manifold. A larger connection on the side of the valve is connected via a pipe to the evaporative (EVAP) emission canister which is located in the LH wheel arch behind the liner.

The purge valve controls the flow of fuel vapor from the EVAP canister to the engine intake manifold. Vacuum in the intake manifold draws the vapor from the canister once the purge valve is open and burns the vapor as part of the combustion process.

The ECM controls the operation of the purge valve when engine operating conditions are correct to add the fuel vapor to the combustion process. The valve is an electro-magnetic solenoid valve which receives a fused battery voltage supply via the main relay. The ECM uses a PWM ground to control the operation of the valve. By altering the frequency of the PWM ground signal, the ECM can control the rate at which valve is open. This allows the ECM to precisely control the amount of fuel vapor passing from the EVAP canister.
For additional information, refer to: Evaporative Emissions (303-13, Description and Operation).

The ECM can diagnose faults with the purge valve and store fault related codes. The codes can be read using a Land Rover approved diagnostic system.

Fuel Tank Leakage Monitoring Module (NAS only)

The fuel tank leakage monitoring module is located in the LH rear wheel arch, adjacent to the EVAP canister. A port on the side of the module provides for the attachment of a dust filter, through which fresh air is drawn into the EVAP canister. A port on the underside of the module is connected by a short curved hose to the EVAP canister. This connection allows fresh air to be drawn into the canister during the purge process and also allows the system to be pressurized by the module for leakage testing.

The fuel tank leakage monitoring module receives a fused battery voltage supply via the main relay. The module is connected to the ECM which provides a ground for the module when leak detection is required.

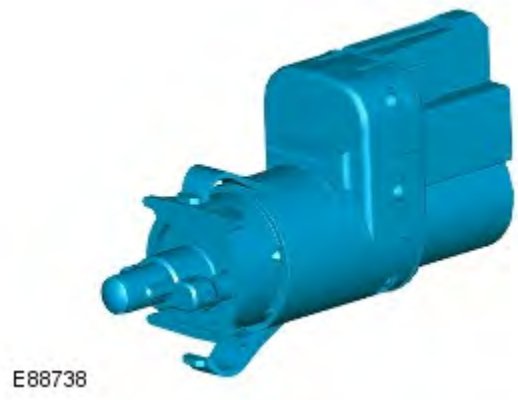
The fuel tank leakage monitoring module comprises an electric air pump, a solenoid valve and a heater element. The air pump is used to pressurize the EVAP system for leak testing. The solenoid valve is normally open, but closes when energized by the ECM to close the system to allow it to be pressurized. The PTC heater element is used to warm the pump before operation.

The fuel tank leakage monitoring system periodically checks the EVAP system and the fuel tank vent system for leaks when the ignition is off. The system can also be activated for a diagnostic check by the ECM.

The ECM checks for leaks in the system by operating the air pump in the fuel tank leakage monitoring module. The module air pump is activated and the ECM monitors the current draw on the air pump motor. A reference orifice is provided in the module which allows the ECM to make a comparison and establish a reference figure for measuring the current draw on the air pump motor when air is pumped through the orifice.
For additional information, refer to: Evaporative Emissions (303-13, Description and Operation).

The ECM can diagnose faults with the air pump and the solenoid valve and store fault related codes. These codes can be read using a Land Rover approved diagnostic system.

Speed Control Inhibit Switch



The speed control inhibit switch is attached to the brake pedal bracket, adjacent to the stop lamp switch. When the brake pedal is pressed, a plate on the pedal moves away from the switch plunger allowing the plunger to extend and complete the switch contacts.

The switch receives a power supply from the CJB which senses the completed ground path when the switch is operated. The switch has two functions; it is used for starting purposes when the brake pedal must be pressed before engine cranking is allowed and it is used to suspend speed control operation when speed control is active and the brake pedal is pressed.

The CJB can diagnose the operation of the speed control inhibit switch and the status of the switch can read using a Land Rover approved diagnostic system.

Main Relay

The main relay is located in the BJB. The operation of the main relay is controlled by the ECM which provides a ground path for the main relay coil, energizing the relay and closing the relay contacts.

The main relay supplies battery voltage to the following engine sensors and actuators:

- Electric throttle - TP sensor (via ECM)
- Fuel injectors
- Ignition coils
- Coil Capacitor
- Variable inlet cam profile switching solenoid - front and rear
- Intake tract variable manifold motor
- Plenum variable intake manifold motor
- HO2S
- Purge valve
- Fuel tank leakage monitoring pump (NAS only).

Air Conditioning (A/C) Pressure Sensor

The refrigerant pressure sensor provides the Air Temperature Control (ATC) module with a pressure input from the high pressure side of the refrigerant system. The refrigerant pressure sensor is hardwired to the ECM, which uses the signal to control operation of the A/C compressor and to calculate the additional load on the engine when the A/C compressor is operating.

The ECM also broadcasts the refrigerant high pressure value over the high speed Controller Area Network (CAN) bus to the CJB. The CJB relays the signal to the ATC module over the medium speed CAN bus to increase the amount of recirculated air if required.

Air Conditioning (A/C) Relay

The A/C relay is located in the BJB. The operation of the A/C relay is controlled by the ECM which provides a ground path for the A/C relay coil, energizing the relay and closing the relay contacts.

When the relay contacts are closed, battery voltage is supplied via the relay to the A/C compressor clutch. The ECM controls the operation of the variable displacement compressor using a signal line to the compressor and received signals from the A/C pressure sensor.

Air Conditioning Compressor Control

Compressor displacement is controlled by the ECM based on current evaporator temperature and target evaporator temperature signals received from the ATC module. From these values the ECM calculates the required compressor displacement and provides a Pulse Width Modulated (PWM) signal to the compressor solenoid valve. The compressor solenoid valve is mounted on the rear of the compressor and interprets the PWM signal as a displacement value and alters the position of the internal swash plate accordingly.

The ECM will also reduce the displacement of the A/C compressor to its minimum level if 'full throttle' or automatic transmission 'kick down' is requested. This feature is not present on Gulf specification vehicles. Compressor clutch engagement is controlled by the ECM.

Engine Cooling Fan Control

The ECM has a hardwired connection with the cooling fan control module. The ECM outputs a PWM signal to the fan control module which relates to the required fan speed. The fan speed is determined by factors such as engine coolant temperature and A/C operation. The fan control module reacts to the received signal by controlling the operating voltage of

the fan motors. The fan control module confirms the fan speed operation on the same connection back to the ECM.

Starter Motor Relay

The starter motor relay is located in the BJB. The operation of the starter motor relay is controlled by the ECM which provides a ground path for the relay coil, energizing the relay and closing the relay contacts. When the relay contacts are closed, battery voltage is supplied, via the starter motor relay, to the starter module solenoid coil. The starter solenoid is energized and connects the starter motor with a direct battery feed to operate the starter motor.

Once the engine has started, the ECM removes the starter motor relay ground, opening the relay contacts and terminating the battery feed to the starter solenoid, which in turn stops the operation of the starter motor.
For additional information, refer to: Starting System - 3.2L (303-06, Description and Operation).

Fuel Pump Module

The fuel pump is controlled by the FPDM which in turn is controlled by the ECM. The FPDM provides positive and negative feeds to the fuel pump motor which is controlled with a PWM output. The fuel pump is run for 2 seconds to prime the fuel system once ignition on is sensed by the ECM.
For additional information, refer to: Fuel Tank and Lines (310-01, Description and Operation).

Malfunction Indicator Lamp (MIL)

The MIL is located in the instrument cluster and is illuminated by a CAN message from the ECM when an emission related fault occurs. The ECM also illuminates the MIL when requested to do so by the TCM and to perform a bulb check when the ignition is switched on. There is no MIL illumination for non emission related engine management faults. All engine faults are recorded with a Diagnostic Trouble Code (DTC) which can be retrieved using a Land Rover approved diagnostic system.
For additional information, refer to: Electronic Engine Controls - 3.2L (303-14, Diagnosis and Testing).

Generator Feedback Signal

The generator has a Local Interconnect Network (LIN) bus connection direct to the ECM. The LIN bus is used by the ECM to request voltage for battery charging and to monitor the fault status of the generator.

PRINCIPLES OF OPERATION

Starting Process

The ECM will only allow engine crank, spark and injector functions when the following conditions are met:

- A hardwired Park/Neutral signal is received from the Transmission Control Module (TCM)
- A hardwired ignition signal is received from the CJB
- A hardwired crank request signal is received from the CJB
- Encrypted data exchange between the instrument cluster and the ECM is verified.

Before the CJB will send the hardwired ignition signal, it must satisfactorily complete the following:

- Exchange encrypted data with the start control module to validate the remote handset.

Additionally, before the CJB will send the hardwired crank request signal it must receive the following signals:

- Brake signal from the speed control inhibit switch
- Hardwired transmission in Park (P) or Neutral (N) signal from the selector lever assembly.

With the remote handset inserted in the start control module and the stop/start button is pressed, the start control module issues battery voltage high signal on the LIN bus connection to the CJB and the fuel pump is run for 2 seconds to prime the fuel system. The CJB uses this signal together with the stop lamp switch signal and issues a crank request message on the high speed CAN bus to the ECM.

The ECM, on receipt of the crank request message, then provides a power and ground supply to the starter relay in the BJB, closing the relay contacts. Battery voltage is supplied via a fuse through the starter relay and is passed to the starter motor solenoid coil. The coil is energized, closing the solenoid contacts and allowing a fuse battery voltage supply direct from the battery to operate the starter motor and crank the engine and simultaneously switch the fuel pump on.

The ECM operates the starter motor until the engine starts which is determined by the engine speed exceeding a pre-determined value.

Auto Start

The ECM has an auto start function which allows the engine to continue cranking if the stop/start button is released. The starter motor will operate until the engine starts or a pre-determined period of time has elapsed which is based on engine coolant temperature. Low engine coolant temperatures allow longer crank times. If the engine does not rotate or the engine speed is low, the ECM removes the power supply and ground from the starter relay stopping the crank process.

Start Prevention

Operation of the starter motor will not be allowed or will be interrupted if:

- the engine is running and the engine speed has exceeded a predetermined speed
- the encrypted data exchange between the instrument cluster, ECM, CJB and start control module has failed to identify the remote handset
- the gear selector lever is not in the park 'P' or neutral 'N' position. The signal is determined from a signal from the TCM and also the transmission mounted position switch
- the brake pedal is not pressed.

Engine Stop Process

To stop the engine the stop/start button must be pressed. Forcibly removing the remote handset from the start control module will not stop the engine. On models with automatic transmission, once the engine has stopped the remote handset will not be released by the start control module until the transmission selector lever is in the Park (P) position.

Throttle Control

The ECM controls the positioning of the throttle disc in the electric throttle using information from the APP sensor and the TP sensor. Data from the A/C pressure sensor, TCM, ECT sensor, MAF sensor and the MAP/IAT sensor is also used to determine the correct throttle control.

The two Hall effect sensors in the TP sensor are designated 1 and 2. Both sensors output an increasing voltage as the throttle disc angle increases. Small air flows through the throttle require comprehensive regulation, therefore the voltage rise in one of the sensors increases more quickly than the other sensor which gives accurate control of the throttle and ensure the throttle disc is in the correct position.

The ECM monitors the signals from both sensors to ensure they are within the minimum and maximum thresholds and that the signals correspond to the same throttle disc position. If there is a difference in the signals the ECM uses a default throttle signal calculated from the electric throttle load, engine speed and air pressure and temperature signals. The sensor whose output signal is closest to the calculated throttle disc angle will be used as the correct output. A fault code will be recorded for the other sensor and this can be read using a Land Rover approved diagnostic system. The ECM then monitors the remaining sensor output signal and compares it against the calculated value. If a difference in the comparison occurs the ECM will discount the output from both sensors and disable the electric throttle control and revert to a limp home mode. The throttle disc has springs for opening and closing and the ECM can measure the load applied by these springs for a load signal. If a fault occurs which prevents the damper motor from being operated, the springs return the throttle disc to a position which allows a throttle opening large enough to allow the vehicle to driven, but with reduced drive ability.

Throttle Adaptions

The ECM has a learning adaption which allows the ECM to calculate the precise control required for the electric throttle damper motor. The adaption process is performed when the ignition is on and the engine is not running. The throttle disc is moved by the damper motor to the fully closed position and the ECM records the values output by the TP sensor potentiometers.

If the permanent battery supply to the ECM has been removed, then previous adaptions will have been lost. If adaptions are stored, then the ECM compares the stored adaption values with the current throttle angle and uses an average of the stored and current values to create the new adaption value.

If the electric throttle unit has been replaced, the power supply must be removed from the ECM to erase all previously stored adaption values.

Fuel Pressure Regulation

Fuel pressure regulation is controlled by the ECM to respond to fuel pressure demand and provides stepless control of the pump output using the FPDM to control the pump operation. The ECM can vary the fuel pressure to between 55.1 lbf/in^2 (3.8 bar) and 72.5 lbf/in^2 (5 bar). The high pressure is only used in extreme conditions such as heavy engine loads and engine starts.

The ECM uses the signals from the fuel rail pressure/temperature sensor to determine information regarding the pressure and temperature of the fuel and provide precise injection periods, improving engine starting under all conditions. The advantage of controlling the fuel pump output pressure are that pump power consumption is reduced, lowering the load on the power supply system and reducing fuel consumption, improved service life of the pump and reduced fuel pump noise.

• NOTE: When the ignition is switched off the FPDM reduces the fuel line pressure regulation to 29 lbf/in^2 (2 bar) to help reduce injector leakage.

Knock Control

Knock occurs in a cylinder when the fuel and air self ignites at the wrong timing. This can occur either before or after the spark is produced. The fuel mixture can ignite in different areas of the combustion chamber and results in a fast combustion process creating several separate fuel combustions which together combine to produce a mechanical knocking sound. The sounds produce a certain type of vibration through the engine cylinder block and these are detected by the knock sensors. The two knock sensors detect knocks on cylinders 1, 2 and 3 and 4, 5 and 6 respectively.

The vibrations act upon the peizo crystals within the sensors which results in a voltage being produced which is sensed by the ECM. The ECM, using the CMP sensors and the CKP sensor, can determine which cylinder(s) are knocking. The ECM is able to filter the signal to detect vibrations created during normal engine operation and discard them from the knock detection. The ignition timing is gradually advanced until the knocking is detected once again.

Once the ECM has determined knocking is occurring using other inputs such as catalytic converter temperature for example in addition to the signals from the knock sensors, it first retards the ignition timing and subsequently richens the air/fuel if required.

Variable Camshaft Timing (VCT) Control

The inlet camshaft is controlled by the ECM using the VCT solenoid. The exhaust camshaft is fixed and its timing cannot be changed.

Both camshafts are driven indirectly from the crankshaft via a chain. The chain is driven from a shaft in the gear housing assembly.
For additional information, refer to: Engine - 3.2L (303-01, Description and Operation).
The VCT allows the ECM to adust the inlet camshaft position in relation to the crankshaft, altering the timing of the opening and closing of the inlet and exhaust valves relative to the crankshaft position. This allows the ECM to provide increased engine performance, improved idle quality and reduced emissions.

The position of the inlet camshaft is determined by the ECM using signals from the CKP sensor and the CMP sensors. The ECM can then use the VCT solenoid valve to control the angle of the camshaft by controlling the flow of oil to the VCT unit.

The camshaft is secured to the rotor in the VCT unit. Oil pressure supplied to either side of the VCT unit from the VCT solenoid valve can rotate the rotor and hence the camshaft in either direction. The VCT solenoid is operated by the ECM using PWM, high frequency switching which provides rapid and precise control of the inlet camshaft position. The inlet camshaft position can be adjusted within 40 degrees of crankshaft rotation.

Camshaft Profile Switching (CPS) Control

The inlet camshaft has, in addition to the VCT control, a CPS function which is also controlled by the ECM. The CPS control can vary the valve lift height and duration of the camshaft lobes by adjusting the area of the hydraulic tappet which acts on one of two cam lobe profiles. The CPS control is via two CPS solenoid valves, located at each end of the inlet camshaft. The CPS solenoid valves control the position of hydraulic tappet assemblies which can be set in one of two positions; low and high.

Two CPS solenoids are used so that the hydraulic tappets can be adjusted when no load is applied, for example the cam lobes are off the hydraulic tappets and the cam base circle is acting on the tappet, this keeps the stress on components to a minimum. One CPS solenoid supplies oil pressure to the hydraulic tappets of cylinders 1, 2 and 4 and the second CPS solenoid supplies oil pressure to the tappets of cylinders 3, 5 and 6.

At engine start and at low engine oil temperatures (below 40°C (104°F)) the ECM does not direct engine oil pressure to the hydraulic tappets and therefore the hydraulic tappets are in their spring loaded, low position.
For additional information, refer to: Engine - 3.2L (303-01, Description and Operation).

Ignition Control

The ECM calculates the optimum ignition timing based on pre-programmed maps and information from the following sensors:

- CKP sensor
- CMP sensors
- MAF sensor
- ECT sensor
- Electric throttle TP sensor
- Knock sensors
- TCM
- Ignition coils.

During engine starting the ECM uses a fixed ignition setting. When the engine has started and the vehicle is being driven, the ECM adjusts the ignition timing accordingly using other parameters such as engine speed, load and temperature.

Once the engine has reached its normal operating temperature, the ECM monitors the signals from the knock sensors. If any of the cylinders produce knocking, the ignition timing for that cylinder will be retarded until the knocking has stopped. The ignition is then gradually advanced back to the normal timing or until the knocking re-occurs.

The ECM uses information from the TCM to provide torque limitation during transmission shifts. The ignition timing is adjusted to momentarily reduce the engine torque output to give a smooth transmission shift and reduce load on the transmission.

Air Conditioning (A/C) Compressor Control

The ECM controls the operation of the A/C compressor and reacts to requests from the ATC module via the high speed CAN bus. The compressor is a variable displacement unit and the ECM controls, via a solenoid, the displacement of the compressor to adjust load during certain driving conditions.

During engine start-up, moving from a standstill and under hard acceleration, the ECM sets the minimum displacement of the compressor to reduce the effect on the engine torque output. The ECM uses information from the ATC module, the A/C pressure sensor, the electric throttle TP sensor and the ECT sensor to determine compressor control. The ATC module transmits climate control and driver requests to the ECM and the ECM determines the priority of these requests over engine performance.

Published: 20-Jul-2011

Electronic Engine Controls - I6 3.2L Petrol - Electronic Engine Controls

Diagnosis and Testing

Principles of Operation

For a detailed description of the electronic engine controls, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• NOTE: For diagnostic purposes the cylinders are divided into two banks: Bank 1 - Cylinder numbers 1, 2 and 3. Bank 2 - Cylinders 4, 5 and 6.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious mechanical or electrical faults.

Visual Inspection

Mechanical	Electrical
• Engine oil level • Cooling system coolant level • Fuel level • Fuel contamination/grade/quality • Throttle body • Variable valve timing (VVT) units	• Fuses • Wiring harness • Electrical connector(s) • Sensor(s) • Variable valve timing (VVT) solenoids • Engine Control Module (ECM) • Transmission Control Module (TCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the symptom chart or DTC index.
    - Make sure that all DTCs are cleared following rectification.

Symptom Chart

Symptom (general)	Symptom (specific)	Possible causes	Action
Non-Start	Engine does not crank	• Security system /Immobilizer engaged • Engine control module (ECM) relay fault • Battery discharged • Starting system fault • Engine seized	Check that the security system is disarmed. Check the ECM relay operation. Check the battery and starter systems. Refer to the electrical guides. Check that the engine turns by hand.
	Engine cranks, but does not fire	• Low/contaminated fuel • Ignition system fault • Fuel system fault • Crankshaft position (CKP) sensor fault • Engine control module (ECM) fault	Check the fuel level and condition. Check for DTCs indicating ignition, fuel or sensor faults. Rectify as necessary. Refer to the warranty policy and procedures manual if an ECM is suspect.
	Engine cranks and fires, but will not start	• Evaporative emissions purge valve fault • Fuel system fault • Spark plugs fouled/incorrect gap • Ignition coil fault(s)	Check for DTCs indicating evaporative emissions, fuel or ignition system faults. Rectify as necessary.
Difficult to start	Difficult to start cold	• Check coolant anti-freeze content • Battery discharged • Crankshaft position (CKP) sensor fault • Fuel system fault • Evaporative emissions purge valve fault	Check the coolant anti-freeze content. Check the battery condition and state of charge. Check for DTCs indicating a sensor, fuel system or evaporative emissions system fault. Rectify as necessary.

Symptom (general)	Symptom (specific)	Possible causes	Action
	Difficult to start hot	• Injector leak • Fuel system fault • Fuel temperature sensor fault • Intake air temperature (IAT) sensor fault • Mass air flow (MAF) sensor fault • Evaporative emissions purge valve fault • Ignition system fault	Check for DTCs indicating an injector, fuel system or sensor fault. Check the evaporative emission and ignition systems. Rectify as necessary.
	Difficult to start after hot soak (vehicle standing after engine has reached operating temperature)	• Injector leak • Fuel system fault • Fuel temperature sensor fault • Intake air temperature (IAT) sensor fault • Mass air flow (MAF) sensor fault • Evaporative emissions purge valve fault • Ignition system fault	Check for DTCs indicating an injector, fuel system or sensor fault. Check the evaporative emission and ignition systems. Rectify as necessary.
	Engine cranks too fast/slow	• Battery discharged • Starting system fault • Compressions high/low	Check the battery condition and state of charge. Check the starter system. Refer to the electrical guides. Check the engine compressions. Rectify as necessary.
Engine stalls	Engine stalls soon after start	• Breather system disconnected/restricted • Air filter restricted • Fuel line fault • Engine control module (ECM) relay fault • Mass air flow (MAF) sensor fault • Ignition system fault	Check the engine breather and intake systems. Check the fuel lines for leakage, etc.. Check for DTCs indicating an ECM relay, sensor or ignition system fault. Rectify as necessary.
	Engine stalls on overrun	• Engine control module (ECM) relay fault • Throttle position (TP) sensors fault	Check for DTCs indicating an ECM relay or TP sensor fault. Rectify as necessary.
	Engine stalls at steady speed	• Engine control module (ECM) relay fault • Crankshaft position (CKP) sensor fault • Throttle position (TP) sensors fault	Check for DTCs indicating an ECM relay or sensor fault. Rectify as necessary.
	Engine stalls with speed control enabled	• Engine control module (ECM) relay fault	Check for DTCs indicating an ECM relay fault. Rectify as necessary.
	Engine stalls when manoeuvring	• Additional engine loads (power steering, air conditioning (A/C), etc.) • Engine control module (ECM) relay fault • Throttle position (TP) sensors fault • Transmission malfunction • Controller area network (CAN) malfunction	Check the accessory drive systems. Check for DTCs indicating an ECM relay, sensor, transmission or CAN fault. Rectify as necessary.
Poor driveability	Engine hesitates/poor acceleration	• Fuel line fault • Fuel pump fault • Injector leak • Fuel pressure fault • Throttle position (TP) sensors fault • Throttle motor fault • Ignition system fault • Heated oxygen sensor (HO2S) fault • Transmission malfunction • Restricted accelerator pedal travel (carpet, etc.) • Accelerator pedal position (APP) sensor fault	Check the fuel lines and intake air system. Check for DTCs indicating a fuel pump or pressure fault. Check for DTCs indicating a TP sensor or motor fault. Check for DTCs indicating an ignition, sensor or transmission fault. Check the APP sensor for full movement, etc.. Rectify as necessary.
	Engine backfires	• Fuel pump fault • Fuel line fault • Mass air flow (MAF) sensor fault • Heated oxygen sensor (HO2S)	Check the fuel pump and lines. Check for DTCs indicating a sensor, ignition or VVT fault. Rectify as necessary.

Symptom (general)	Symptom (specific)	Possible causes	Action
		fault • Ignition system fault • Sticking variable valve timing (VVT) hub • Accelerator pedal position (APP) sensor fault	
	Engine surges	• Fuel pump fault • Fuel line fault • Mass air flow (MAF) sensor fault • Throttle position (TP) sensors fault • Throttle motor fault • Ignition system fault	Check the fuel pump and lines. Check for DTCs indicating a sensor or ignition system fault. Rectify as necessary.
	Engine detonates/knocks	• Fuel pump fault • Fuel line fault • Fuel quality • Knock sensor (KS)/circuit malfunction • Mass air flow (MAF) sensor fault • Heated oxygen sensor (HO2S) fault • Sticking variable valve timing (VVT) hub • Barometric pressure (BARO) sensor malfunction (internal engine control module (ECM) fault)	Check the fuel pump and lines. Check the fuel for contamination and correct grade. Check for DTCs indicating a sensor, VVT or ECM fault. Rectify as necessary. Refer to the warranty policy and procedures manual if an ECM is suspect.
	No throttle response	• Accelerator pedal position (APP) sensor fault • Throttle position (TP) sensors fault • Throttle motor fault	Check for DTCs indicating a sensor or throttle motor fault. Rectify as necessary.
	Speed control inhibited or disabled	• Default mode enabled • Speed control switch(es) • Throttle position (TP) sensors fault • Controller area network (CAN) fault	Check the message center for default messages. Check for DTCs indicating a speed control, sensor or CAN fault. Rectify as necessary.
	Poor throttle response	• Breather system disconnected/restricted • Accelerator pedal position (APP) sensor fault • Throttle position (TP) sensors fault • Engine coolant temperature (ECT) sensor fault • Mass air flow (MAF) sensor fault • Transmission malfunction	Check the engine breather system. Check for DTCs indicating a sensor or transmission fault. Rectify as necessary.
	Engine defaults, warning light and messages. Refer to the owner handbook	• Throttle position (TP) sensors fault • Mass air flow (MAF) sensor fault • Engine coolant temperature (ECT) sensor fault	Check for DTCs indicating a sensor fault. Rectify as necessary.

DTC Index

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If diagnostic trouble codes are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00REFER to: Diagnostic Trouble Code (DTC) Index - I6 3.2L Petrol, DTC: Engine Control Module (ECM) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Camshaft Position (CMP) Sensor

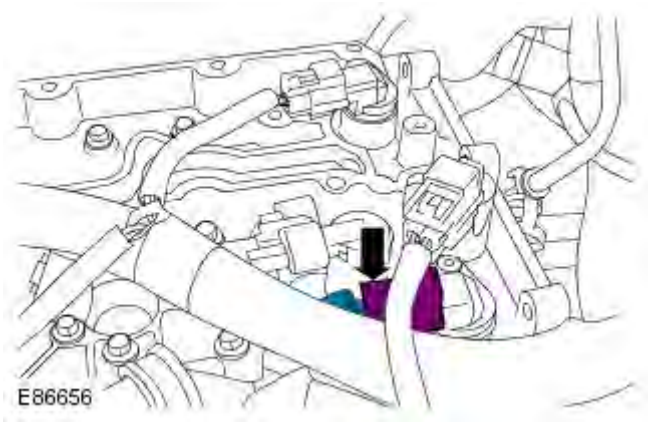
Removal and Installation

Removal

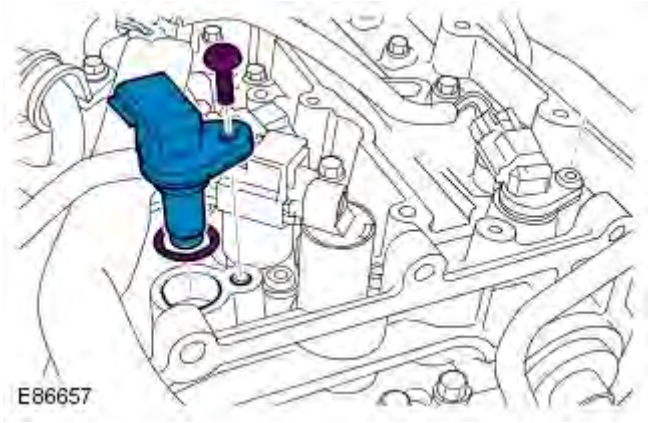
• NOTE: Removal steps in this procedure may contain installation details.

1. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.



3. **3.** CAUTIONS:

   Note the fitted position of the special washer.

   Discard the seal.

   Torque: 10 Nm

Installation

1. **1.** CAUTIONS:

   Make sure that the mating faces are clean and free of corrosion and foreign material.

   A new O-ring seal is to be installed.

   To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Crankshaft Position (CKP) Sensor

Removal and Installation

Removal

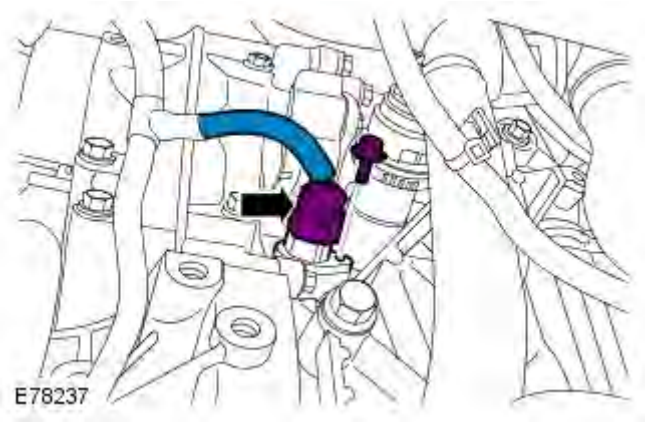
• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



3. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Engine Coolant Temperature (ECT) Sensor

Removal and Installation

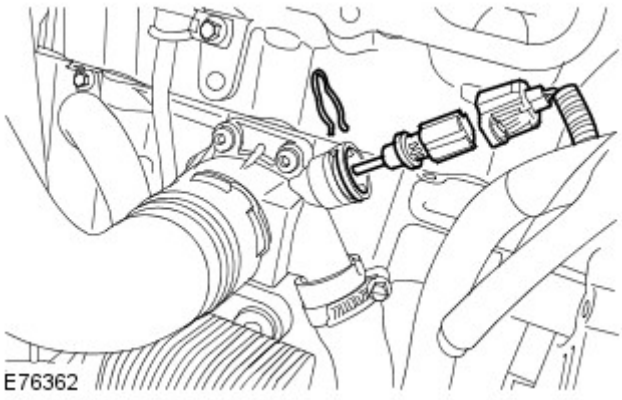
Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Raise and support the vehicle.

2. Remove the intake manifold assembly.

   Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).



3. **3.** CAUTIONS:

   Be prepared to collect escaping fluids.

   Note the fitted position of the seal.

   Remove the ECT sensor.

Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

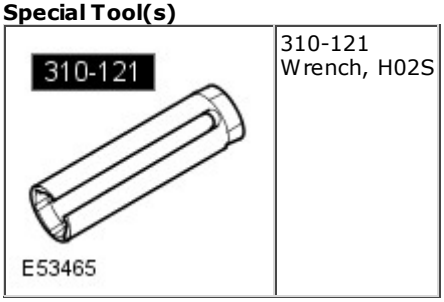
   To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Heated Oxygen Sensor (HO2S)

Removal and Installation

Special Tool(s)

	310-121 Wrench, H02S

Removal

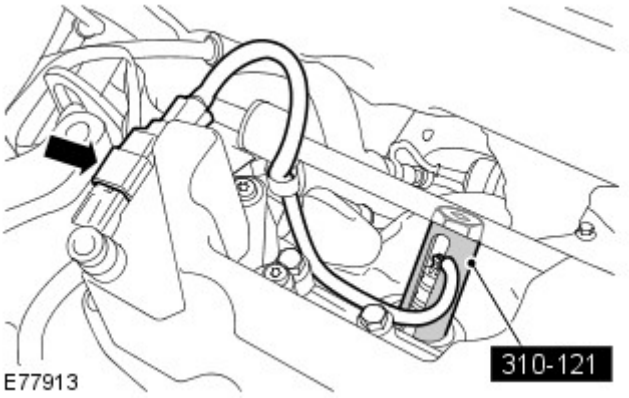
1. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. **2.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

3. Disconnect the heated oxygen sensors (HO2S) electrical connectors.



4. Using the special tool, remove the heated oxygen sensor (HO2S).

   Special Tool(s): 310-121

Installation

1. For H02S anti-seize compound information, refer to the specification section.

2. **2.** CAUTION: Make sure the anti-seize compound does not contact the HO2S tip.

   Apply anti-seize compound to the sensor threads.

3. Install the HO2S.

   Special Tool(s): 310-121
   Torque: 45 Nm

4. Connect the HO2S electrical connector.

5. Install the engine cover.

Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Catalyst Monitor Sensor

Removal and Installation

Special Tool(s)

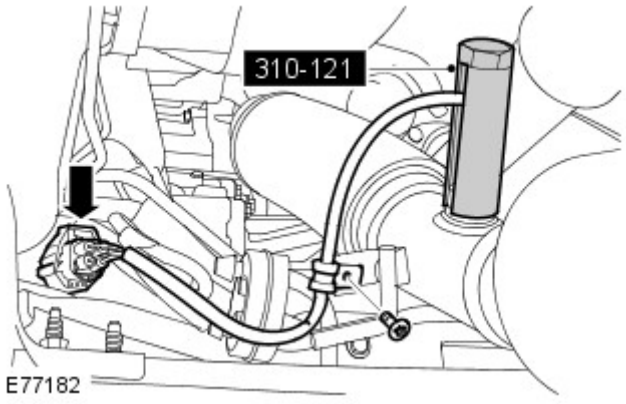
	310-121 Wrench, H02S

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise the vehicle on a lift.

2.
   - *Torque:* 6 Nm



3.
   - *Torque:* 45 Nm
   - *Special Tool(s):* 310-121

Installation

1. To install, reverse the removal procedure.

2. **2.** NOTE: For NAS vehicles only.

   If required, carry out a long drive cycle.

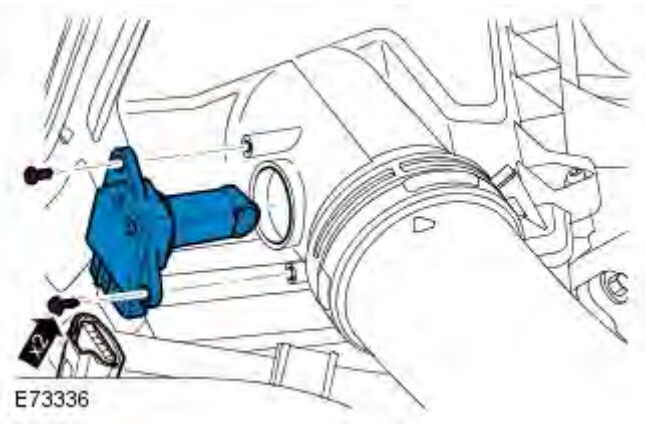
   Refer to: Powertrain Control Module (PCM) Long Drive Cycle Self-Test (303-14A, General Procedures).

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Mass Air Flow (MAF) Sensor

Removal and Installation

Removal



1. *Torque:* 2 Nm

Installation

1. To install, reverse the removal procedure.

2. **2.** NOTE: For NAS vehicles only.

   If required, carry out a short drive cycle.

   Refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14A, General Procedures).

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Manifold Absolute Pressure (MAP) Sensor

Removal and Installation

Removal

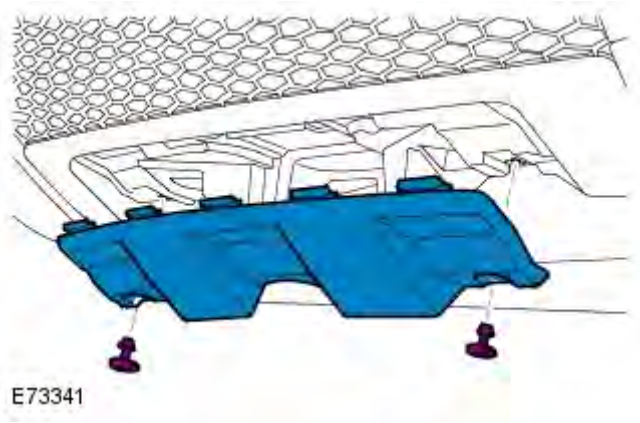
1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

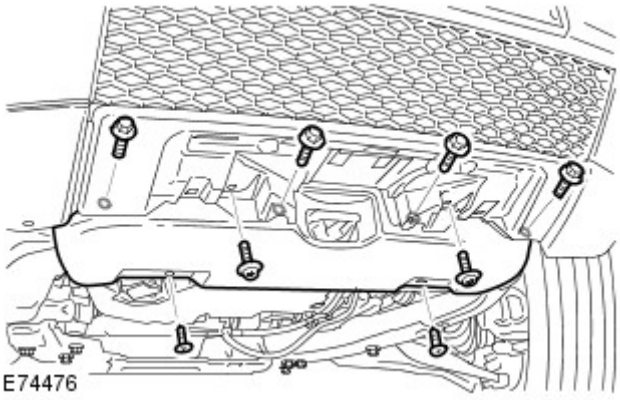
2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

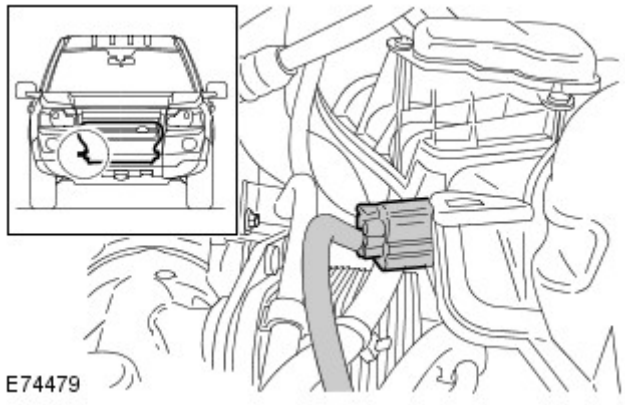
3.

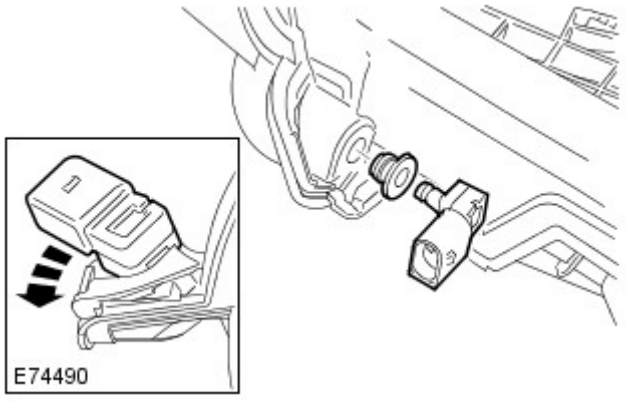


4.



5.





6.

Installation

1. To install, reverse the removal procedure.
2. **2.** NOTE: For NAS vehicles only.

   If required, carry out a short drive cycle.

   Refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14A, General Procedures).

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Engine Control Module (ECM)

Removal and Installation

Removal

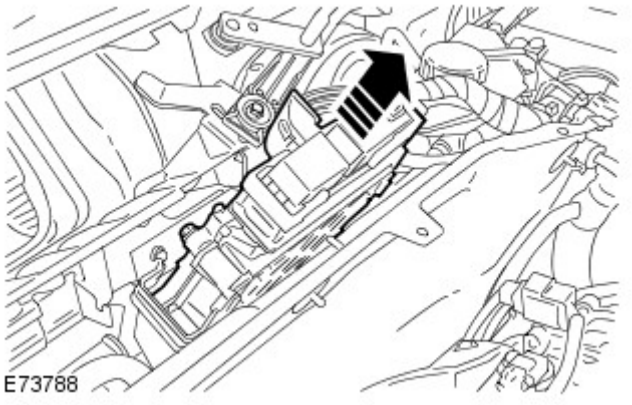
- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

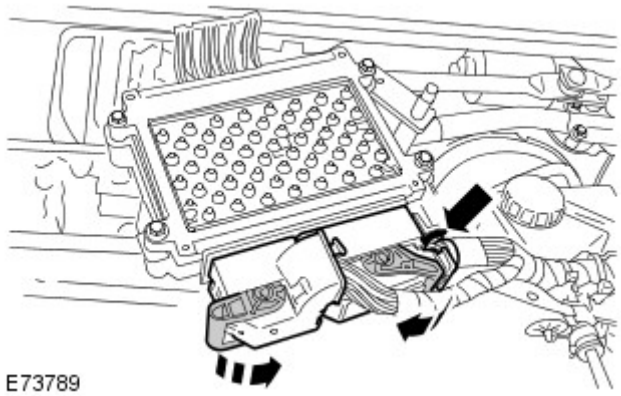
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the plenum chamber panel.

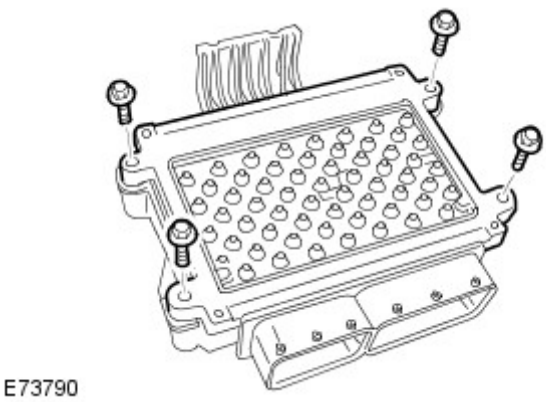
   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



3.



4. Petrol ECM shown, diesel similar.



5. *Torque:* 6 Nm

Installation

All vehicles

1. To install, reverse the removal procedure.

Vehicles with diesel particulate filter (DPF)

2. Renew the engine oil and filter.

   Refer to: Engine Oil Draining and Filling (303-01B Engine - TD4 2.2L Diesel, General Procedures).

All vehicles

3. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Fuel Rail Pressure (FRP) Sensor

Removal and Installation

Removal

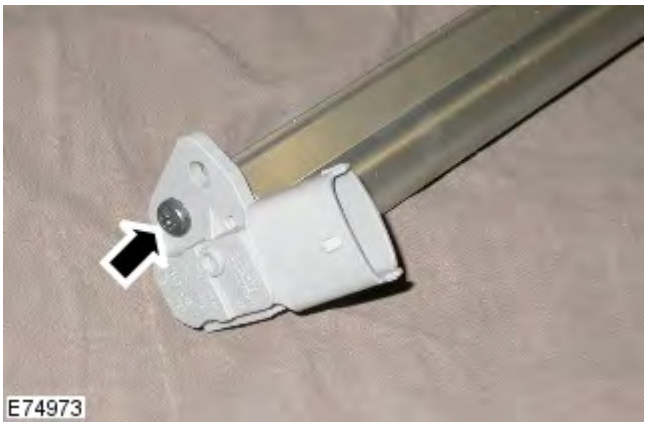
• NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the fuel rail.

   Refer to: Fuel Rail (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).



3. *Torque:* 6 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Front Knock Sensor (KS)

Removal and Installation

Removal

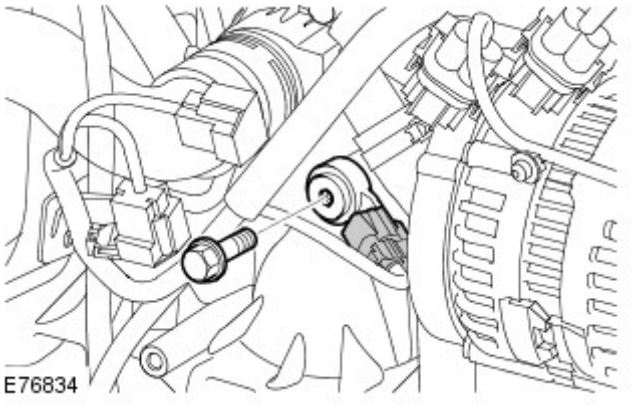
- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the oil cooler assembly.

   Refer to: Oil Cooler (303-01A Engine - I6 3.2L Petrol, Removal and Installation).



3. **3.** CAUTIONS:

   Make sure that the mating faces are clean and free of corrosion and foreign material.

   Mark the components to aid installation.

   Remove the knock sensor (KS).

   Torque: 20 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - I6 3.2L Petrol - Rear Knock Sensor (KS)

Removal and Installation

Removal

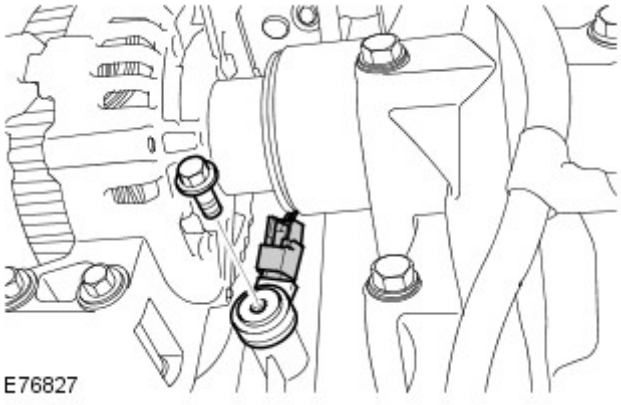
- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the intake manifold.

   Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).



3. **3.** CAUTIONS:

   Make sure that the mating faces are clean and free of corrosion and foreign material.

   Mark the components to aid installation.

   Remove the knock sensor (KS).

   Torque: 20 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel -

General Specification

Item	Specification
Engine management system:	
Make	BOSCH
Type	EDC 15 C2
Camshaft position sensor:	
Make	Electrifil
Type	Hall effect
Crankshaft position sensor:	
Make	Electrifil
Type	Hall effect

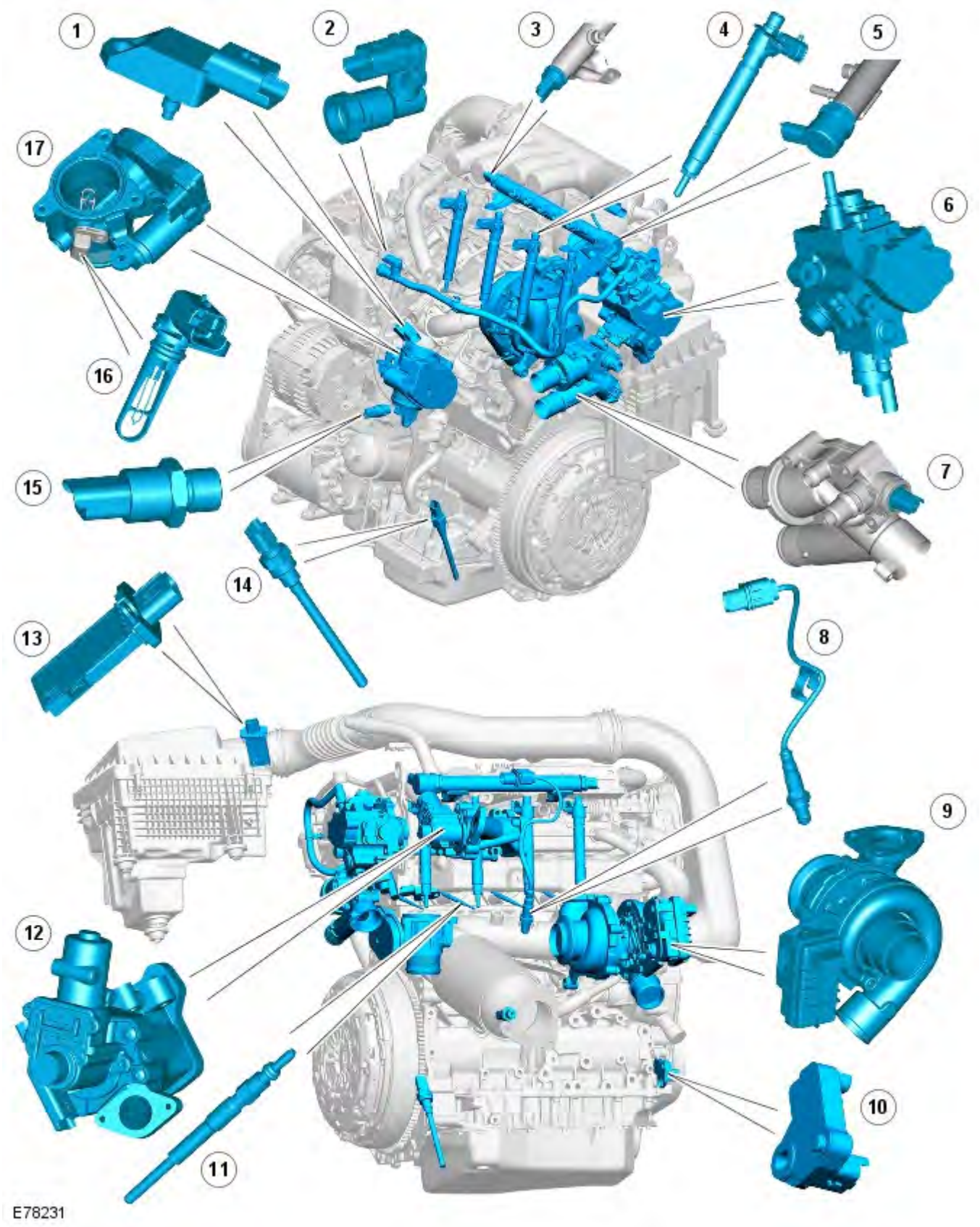
Torque Specifications

Description	Nm	lb-ft
Camshaft position (CMP) sensor retaining bolt	6	5
Crankshaft position (CKP) sensor retaining bolt	10	7
Engine oil pressure (EOP) sensor	35	26
Intake air temperature sensor (IAT)	10	7
Intake Manifold Runner Control (IMRC) Actuator	10	7
Manifold absolute pressure (MAP) sensor	10	7
Mass air flow (MAF) sensor retaining screws	2	1
Oil temperature/level sensor	27	20
Turbocharger Boost Pressure Sensor	8	7

Electronic Engine Controls - TD4 2.2L Diesel - Electronic Engine Controls

Description and Operation

COMPONENT LOCATION SHEET 1 OF 2

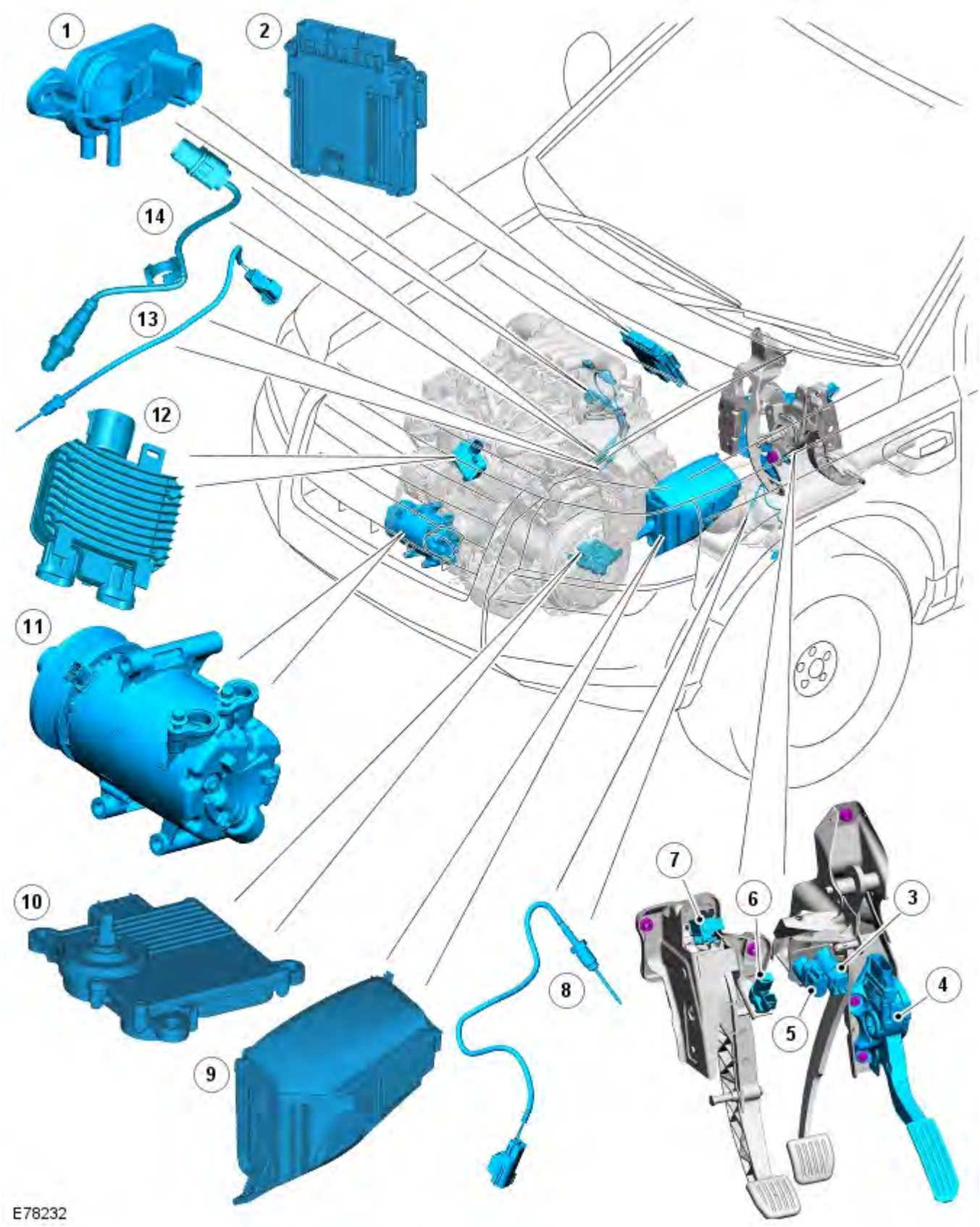


Item	Part Number	Description
1	-	manifold absolute pressure (MAP) sensor
2	-	Fuel temperature sensor
3	-	Fuel rail pressure sensor
4	-	Injector (4 off)

5	-	Pressure control valve
6	-	Fuel pump (incorporating volume control valve)
7	-	engine coolant temperature (ECT) sensor
8	-	heated oxygen sensor (HO2S)
9	-	Variable nozzle turbocharger (VNT) controller
10	-	crankshaft position (CKP) sensor
11	-	Glow plugs (4 off)
12	-	exhaust gas recirculation (EGR) valve
13	-	mass air flow (MAF)/intake air temperature (IAT) sensor
14	-	Oil level and temperature sensor (Diesel Particulate Filter (DPF) vehicles only)
15	-	engine oil pressure (EOP) sensor
16	-	IAT sensor
17	-	Electric throttle

COMPONENT LOCATION SHEET 2 OF 2

- NOTE: left-hand (LH) drive vehicle shown, right-hand (RH) drive similar



Item	Part Number	Description
1	-	Differential pressure sensor (DPF vehicles only)
2	-	engine control module (ECM)
3	-	Stoplamp switch
4	-	accelerator pedal position (APP) sensor
5	-	Speed control inhibit switch
6	-	Start inhibit switch
7	-	Clutch switch
8	-	Downstream exhaust temperature sensor (DPF vehicles only)
9	-	battery junction box (BJB)
10	-	transmission control module (TCM) (automatic vehicles only)
11	-	air conditioning (A/C) compressor

12	-	Cooling fan control module
13	-	Upstream temperature sensor (DPF vehicles only)
14	-	Heated oxygen sensor

OVERVIEW

The TD4 diesel engine has an Electronic Diesel Control (EDC) engine management system. The system is controlled by an ECM which is able to monitor, adapt and precisely control the fuel injection. The ECM uses multiple sensor inputs and precision control of actuators to achieve optimum performance during all driving conditions.

The ECM controls fuel delivery to all 4 cylinders via a common rail injection system. The common rail system uses a fuel rail to accumulate highly pressurized fuel and feed the 4, electronically controlled injectors. The fuel rail is located in close proximity to the injectors, which assists in maintaining full system pressure at each injector at all times.

The ECM uses the drive by wire principle for acceleration control. Accelerator pedal demand is communicated to the ECM by 2 potentiometers located in a throttle position sensor. The ECM uses the 2 signals to determine the position, rate of movement and direction of movement of the pedal. The ECM then uses this data, along with other engine information from other sensors, to achieve the optimum engine response.

The ECM processes information from the following input sources:

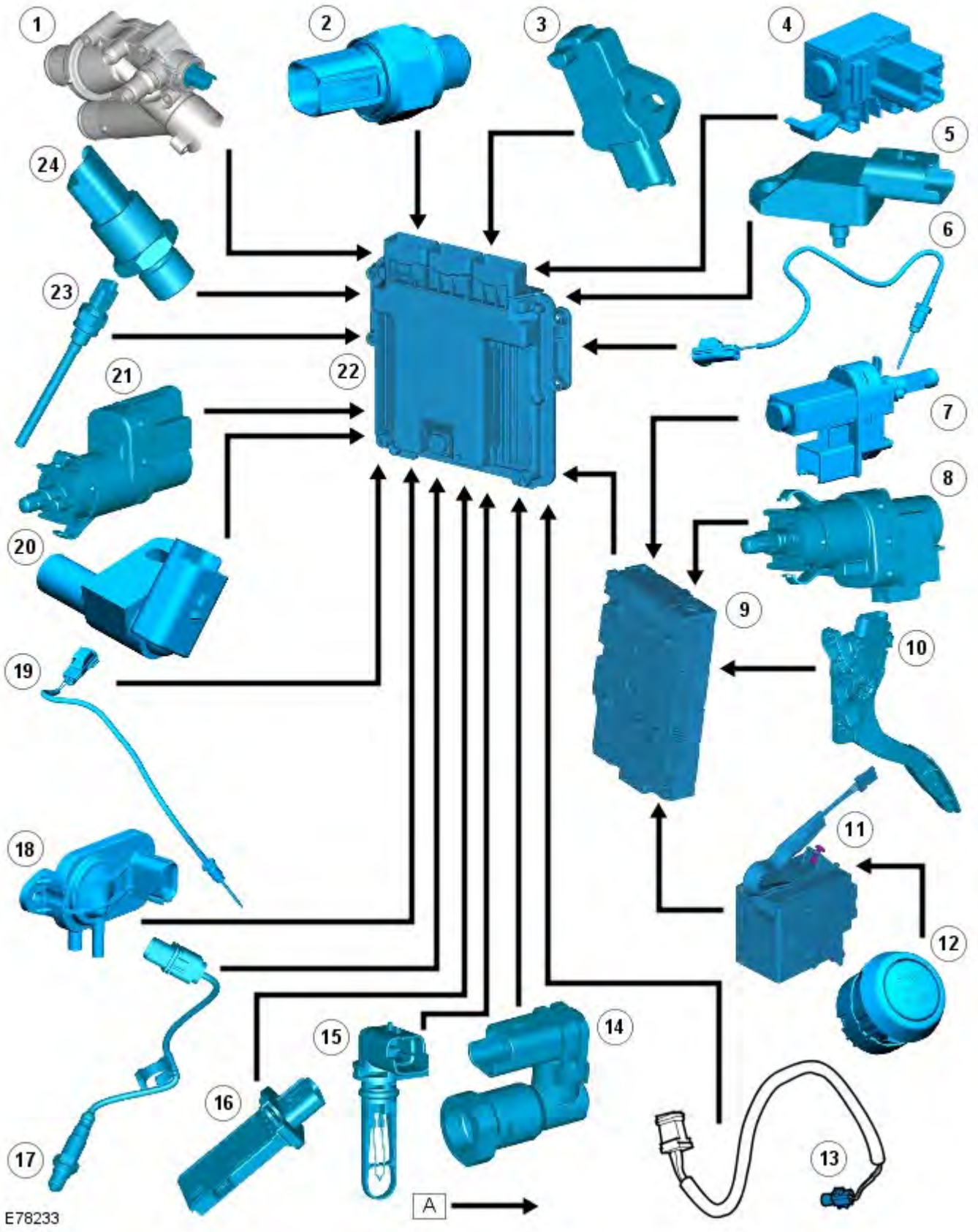
- camshaft position (CMP)
- CKP
- Manifold air temperature and pressure
- Engine coolant temperature
- Oil temperature
- Intake air flow and temperature
- Fuel temperature

The ECM outputs controlling signals to the following sensors and actuators:

- Fuel injectors (4 off)
- Cooling fan control module
- Electric throttle valve
- Electronic vane controlled turbocharger
- Port deactivation
- Fuel pressure control valve
- Fuel volume control valve
- EGR
- Glow plugs (4 off).

CONTROL DIAGRAM SHEET 1 OF 2

• NOTE: **A** = Hardwired

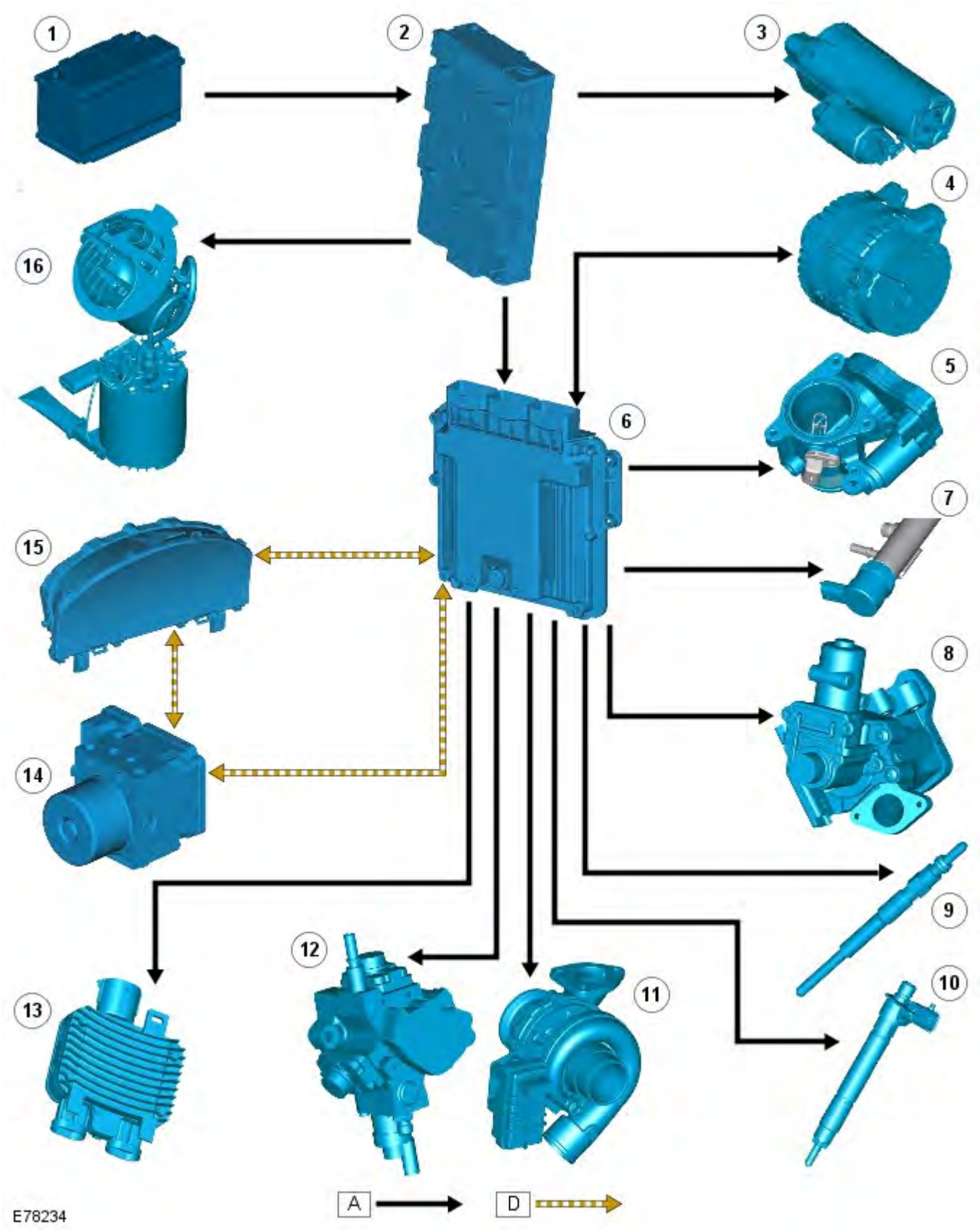


Item	Part Number	Description
1	-	ECT sensor
2	-	1st gear position switch
3	-	CKP sensor
4	-	Start inhibit switch
5	-	MAP sensor
6	-	Down stream exhaust temperature sensor
7	-	Clutch switch
8	-	Stoplamp switch
9	-	central junction box (CJB)
10	-	APP sensor
11	-	Start control module

12	-	Start control switch
13	-	Ambient air temperature sensor
14	-	Fuel temperature sensor
15	-	IAT sensor
16	-	MAF sensor
17	-	HO2S
18	-	Differential pressure sensor
19	-	Upstream exhaust temperature sensor
20	-	CMP sensor
21	-	Speed control inhibit switch
22	-	ECM
23	-	Oil level and temperature sensor
24	-	EOP sensor

CONTROL DIAGRAM SHEET 2 OF 2

- NOTE: **A** = Hardwired; **D** = High speed controller area network (CAN)



Item	Part Number	Description
1	-	Battery
2	-	CJB
3	-	Starter motor
4	-	Generator
5	-	Electric throttle
6	-	ECM
7	-	Pressure control valve
8	-	EGR valve
9	-	Glow plug
10	-	Injector
11	-	Variable nozzle turbocharger (VNT) controller

12	-	Fuel pump (incorporating volume control valve)
13	-	Fan control module
14	-	anti-lock brake system (ABS) module
15	-	Instrument cluster
16	-	Fuel transfer pump

Published: 12-Jul-2011

Electronic Engine Controls - TD4 2.2L Diesel - Electronic Engine Controls

Diagnosis and Testing

Principles of Operation

For a detailed description of the electronic engine controls, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Fuel level (minimum of four liters for run out of fuel strategy) • Contaminated fuel • Engine oil level • Cooling system coolant level • Fuel system • Air intake system • Vacuum system	• Wiring harness • Electrical connector(s) • Fuses(s) • Relay(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine Non-Start		
Engine does not crank	• Security system/Immobilizer engaged • Battery • Powertrain control module relay • Park/Neutral switch • Brake/clutch switches • Throttle valve stuck • Starting system • Engine seized	Check that security system is disarmed. Ensure battery is in fully charged and serviceable condition. Check for DTCs and refer to relevant DTC Index. Check Park/neutral and Brake/clutch switches. Ensure correct start procedure is being adhered to. Check engine is not seized
Engine cranks but does not start	• Contaminated fuel • Engine breather system disconnected/restricted • Throttle valve stuck • Air intake system • Fuel system • Electronic engine controls	Check for fuel contamination. Check engine breather and air intake system integrity. Ensure correct start procedure is being adhered to. Check for DTCs and refer to the relevant DTC Index
Difficult To Start		
Difficult to start cold	• Check engine coolant level/anti-freeze content • Battery • Electronic engine controls • Exhaust gas recirculation (EGR) valve stuck open • Fuel pump	Check engine coolant level/condition. Ensure battery is in fully charged and serviceable condition. Check for DTCs and refer to relevant DTC Index
Difficult to start hot	• Electronic engine controls • Injector leak • Fuel system • Intake air system • Exhaust gas recirculation valve stuck open • Blocked exhaust/catalytic converter • Engine compressions low	Check for DTCs and refer to the relevant DTC Index. Check engine, fuel, intake air, exhaust, systems for integrity

Symptom	Possible Cause	Action
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	• Injector leak • Electronic engine controls • Fuel pump • Exhaust gas recirculation valve stuck open	Check fuel and engine control systems for DTCs and refer to the relevant DTC Index
Engine cranks too fast/slow	• Battery • Compressions high/low • Starting system	Check battery is fully charged and in serviceable condition. Check engine compressions. Check integrity of starting system
Driveability		
Rough idle	• Low/contaminated fuel • Fuel system • Air intake system • Electronic engine controls	Check fuel level/condition. Check for DTCs and refer to relevant DTC Index. Check integrity of fuel, air intake, and engine systems
Engine idle speed high, low, erratic	• Air intake system • Excessive blow-by • Exhaust gas recirculation valve • Turbo charger bearing/seal • Electronic engine controls	Check for DTCs and refer to the relevant DTC Index. Check integrity of air intake, Turbo charger, and engine systems
Lack of power under acceleration	• Contaminated fuel • Air intake system • Blocked exhaust/catalytic converter • Turbo changer fault • Fuel system • Electronic engine controls • Low engine compressions	Check for fuel contamination. Check for DTCs and refer to relevant DTC Index. Check integrity of air intake, exhaust, Turbo charger, and engine systems
Engine stops/stalls	• Contaminated fuel • Fuel system • Air intake system • Electronic engine controls	Check for fuel contamination. Check for DTCs and refer to the relevant DTC Index. Check integrity of fuel, air intake, and engine systems
Diesel Particulate Filter (DPF) Warning Messages		
'DPF Full Visit Dealer' message displayed. Torque derate, regeneration locked out (DTC P200200 also logged)	• Particulate filter soot mass quantity above maximum threshold	CAUTION: All intake air system leaks MUST be rectified before carrying out dynamic regeneration. Check for and rectify any related DTCs. Check for correct installation and integrity of intake air system, rectify as required. Carry out dynamic regeneration using the manufacturer approved diagnostic system
'Reduced Engine Performance' message displayed. No effect to driveability. Regeneration reduced to lower level (2) (DTC P054516 also logged)	• Pre-catalytic converter temperature sensor circuit voltage below threshold	Refer to electrical circuit diagrams and check pre-catalytic converter temperature sensor circuit for short to ground or open circuit
'Reduced Engine Performance' message displayed. No effect to driveability (DTC P222700 also logged)	• Atmospheric pressure sensor defective	Clear DTC, run engine for 2 minutes, set ignition status to OFF (power down), run engine for further 2 minutes, set ignition status to OFF (power down), set ignition status to ON and read DTCs. If DTC still present refer to new module/component installation note at the top of the DTC Index
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Torque derate, regeneration locked out (DTC P244A16 also logged)	• Particulate filter differential pressure below limit	Clear DTC, cycle ignition status from ON to OFF (power down) a minimum of six times, set ignition status to ON, if DTC remains install a new differential pressure sensor
'DPF Full Visit Dealer' message displayed. Torque derate, regeneration locked out (DTC P244B68 also logged)	• Particulate filter differential pressure high - engine protection active	CAUTION: All intake air system leaks MUST be rectified before carrying out dynamic regeneration. Check for correct installation and integrity of differential pressure sensor hoses, rectify as required. Check for correct installation and integrity of intake air system, rectify as required. Carry out dynamic regeneration using the manufacturer approved diagnostic system
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Torque derate, regeneration locked out (DTC P244C00 also logged)	• Downstream catalytic converter temperature sensor voltage below lower limit • Sensor failure	Refer to the electrical circuit diagrams and check downstream catalytic converter temperature sensor circuit for open circuit. Install new temperature sensor as required

Symptom	Possible Cause	Action
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Torque derate, regeneration locked out (DTC P244D00 also logged)	• Downstream catalytic converter temperature sensor voltage above upper limit • Sensor failure	Refer to the electrical circuit diagrams and check downstream catalytic converter temperature sensor circuit for short to power. Install new temperature sensor as required
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Regeneration locked out (DTC P245300 also logged)	• Particulate filter stationary corrected differential pressure below minimum	Differential pressure sensor hoses crossed over
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Torque derate, regeneration locked out (DTC P245500 also logged)	• Particulate filter differential pressure sensor voltage above upper limit • Sensor failure	Refer to the electrical circuit diagrams and check differential pressure sensor supply circuit for short to power. Install a new sensor as required
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Torque derate, regeneration locked out (DTC P245600 also logged)	• Leaking or blocked differential pressure sensor hoses • Differential pressure sensor circuit short, open circuit • Sensor failure	Check for split/degraded, blocked differential pressure sensor hoses, refer to electrical circuit diagrams and check differential pressure sensor circuits for short, open circuit. Install a new sensor as required
'Oil Service required' message displayed (DTC P250F00 also displayed)	• Engine oil contaminated	Check engine oil condition, renew as required
'Oil Service required' message displayed (DTC P252F00 also displayed)	• Engine oil contaminated	Check engine oil condition, renew as required
'Oil Service required' message displayed (DTC P253F00 also displayed)	• Engine oil contaminated	Check engine oil condition, renew as required
'Reduced Engine Performance' message displayed. No effect to driveability, regeneration reduced to lower level (2) (DTC P208000 also logged)	• Exhaust gas temperature sensor 1 plausibility fault	Refer to electrical circuit diagrams and check upstream catalytic converter temperature sensor circuit for short circuit, open circuit
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Regeneration locked out (DTC P244A00 also logged)	• Signal not plausible. Differential pressure sensor hose line defective	Check for correct installation and integrity of differential pressure sensor hoses, rectify as required
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Torque derate, regeneration locked out (DTC P244B22 also logged)	• Signal amplitude > maximum. Particulate filter uncorrected differential pressure value above limit in after run	CAUTION: All intake air system leaks MUST be rectified before carrying out dynamic regeneration. Check for correct installation and integrity of differential pressure sensor hoses, rectify as required. Check for correct installation and integrity of intake air system, rectify as required. Carry out dynamic regeneration using the manufacturer approved diagnostic system
'DPF Full' message displayed, with see hand book icon (DTC P245200 also logged)	• Poor driving style, unable to facilitate regeneration	• Refer driver to hand book
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Torque derate, regeneration locked out (DTC P245400 also logged)	• Particulate filter differential pressure sensor voltage below lower limit • Sensor failure	Refer to the electrical circuit diagrams and check differential pressure sensor supply circuit for short, open circuit. Install a new sensor as required
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Torque derate, regeneration locked out (DTC P208400 also logged)	• Exhaust gas temperature sensor 2 plausibility fault	Refer to electrical circuit diagrams and check downstream catalytic converter temperature sensor circuit for short circuit, open circuit
'Reduced Engine Performance' message displayed. No effect to driveability, regeneration reduced to lower level (2) (DTC P054617 also logged)	• Pre-catalytic converter temperature sensor circuit voltage above threshold	Refer to electrical circuit diagrams and check pre-catalytic converter temperature sensor circuit for short to power
'Reduced Engine Performance' or 'Engine System Fault' message displayed. Regeneration locked out (DTC P244A00	• Signal not plausible. Differential pressure sensor hose line defective	Check for correct installation and integrity of differential pressure sensor hoses, rectify as required

Symptom	Possible Cause	Action
also logged)		
'Reduced Engine Performance' message displayed. No effect to driveability, regeneration reduced to lower level (2) (DTC P244B22 also logged)	• Signal amplitude > maximum. Particulate filter uncorrected differential pressure value above limit in after run	CAUTION: All intake air system leaks MUST be rectified before carrying out dynamic regeneration. Check for correct installation and integrity of differential pressure sensor hoses, rectify as required. Check for correct installation and integrity of intake air system, rectify as required. Carry out dynamic regeneration using the manufacturer approved diagnostic system
'DPF Full Visit Dealer' message displayed. Torque derate, regeneration locked out (DTC P244A97 also logged)	• Particulate filter differential pressure sensor blocked	Check for blocked/restricted Differential Pressure sensor and hoses

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - TD4 2.2L Diesel, DTC: Engine Control Module (ECM) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Camshaft Position (CMP) Sensor

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

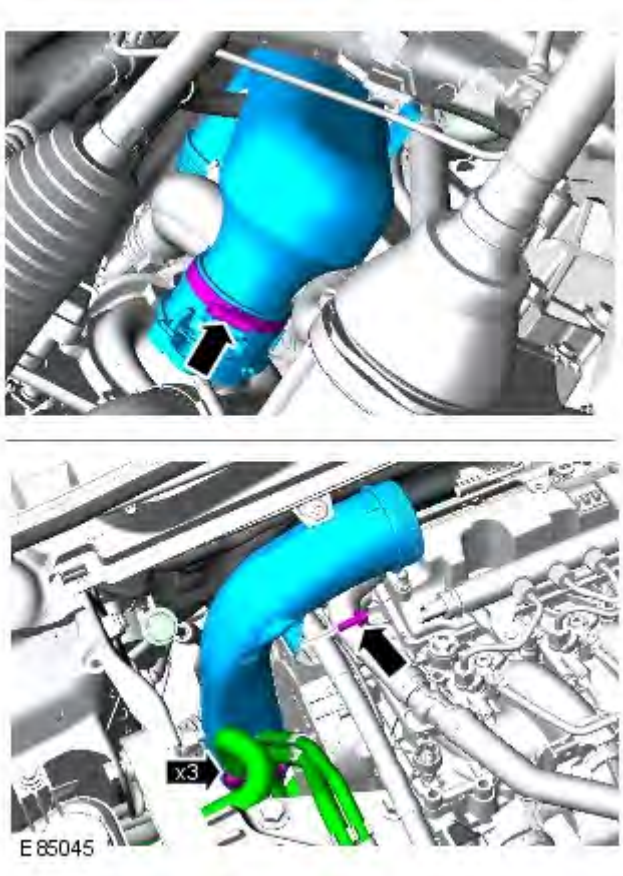
2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4.



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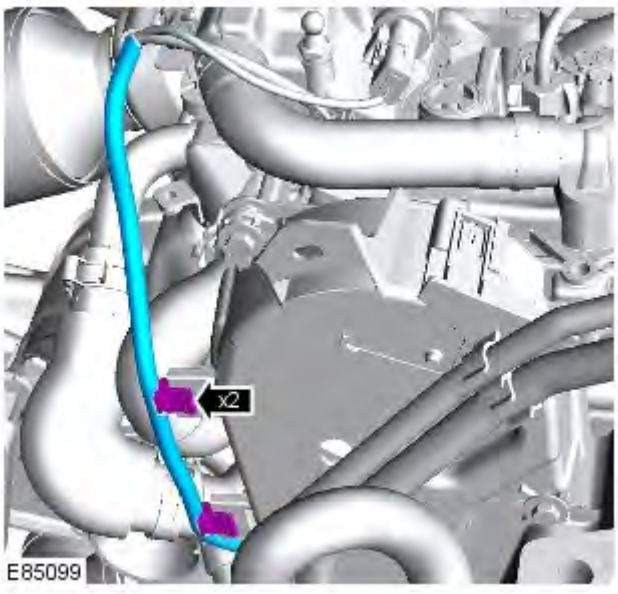
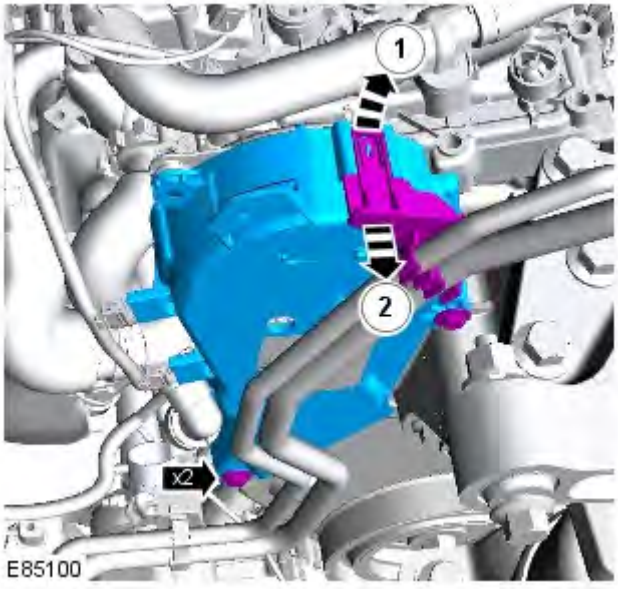
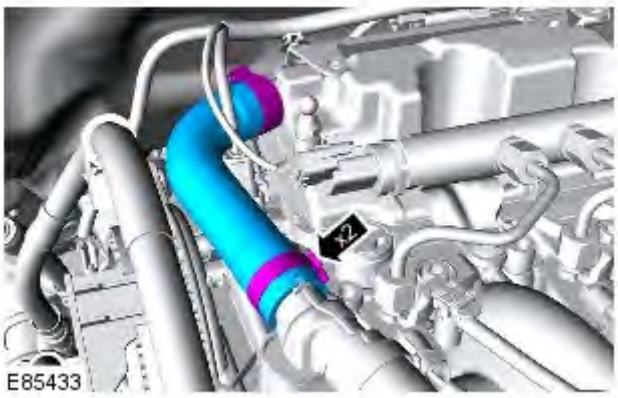
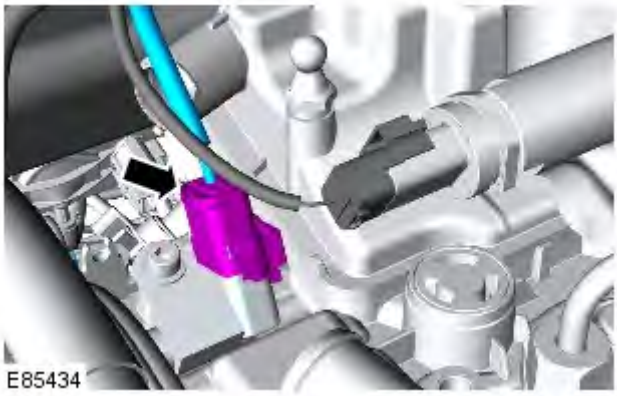


6. *Torque:* 6 Nm



7. Remove and discard the hose clips.





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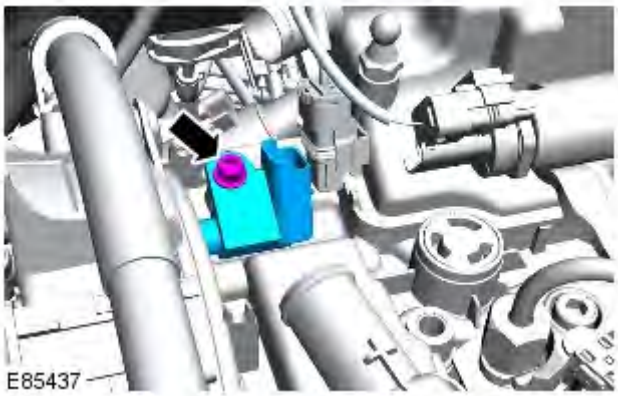
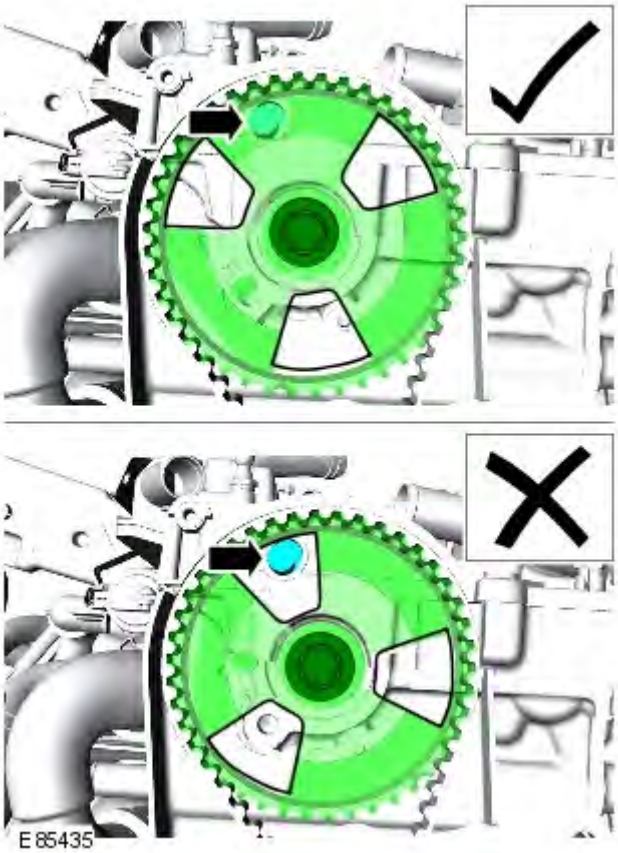
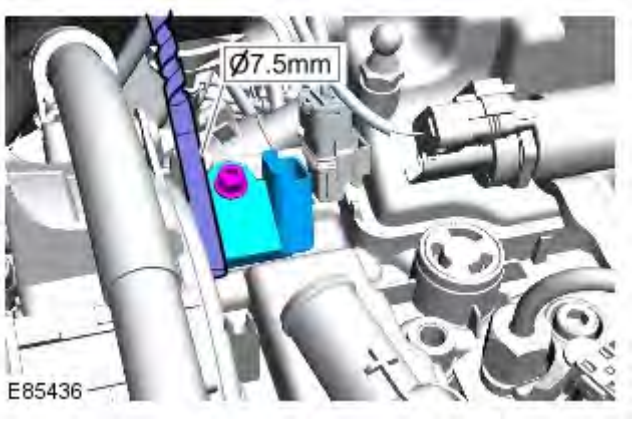


9. *Torque:* 4 Nm



10. **10.** CAUTION: Incorrect installation of the camshaft position (CMP) sensor could result in engine damage.

    New CMP sensor only: The CMP sensor tip must rest on one of the 4 webs on the back of the camshaft pulley, to achieve the correct alignment of the CMP sensor.



11. **11.** CAUTION: Incorrect installation of the camshaft position (CMP) sensor could result in engine damage.

    Used CMP sensor only: Insert a 7.5 mm diameter drill between the valve cover and the CMP sensor as shown, to achieve the correct alignment of the CMP sensor.

Installation

1. **1.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

   To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Crankshaft Position (CKP) Sensor

Removal and Installation

Removal

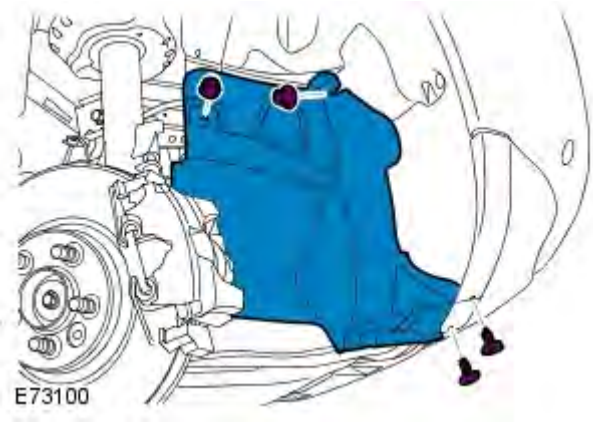
• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



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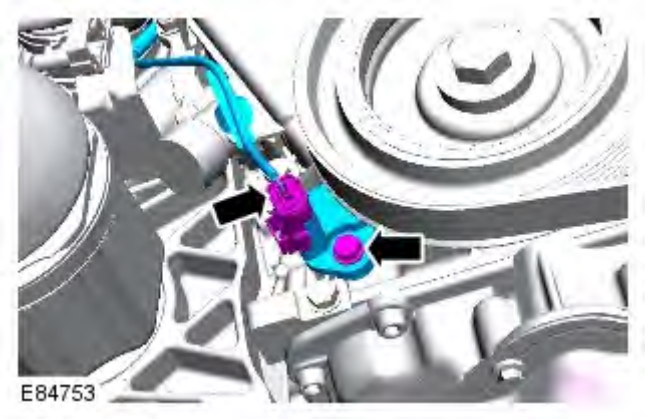


4. **4.** CAUTION: Make sure that the wiring harnesses are correctly located.

   Torque: 8 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Engine Coolant Temperature (ECT) Sensor

Removal and Installation

Removal

1. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

2. Remove the engine cover.

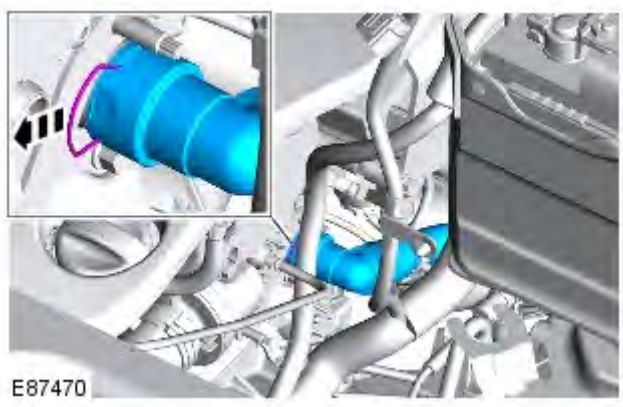
   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

4. **4.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

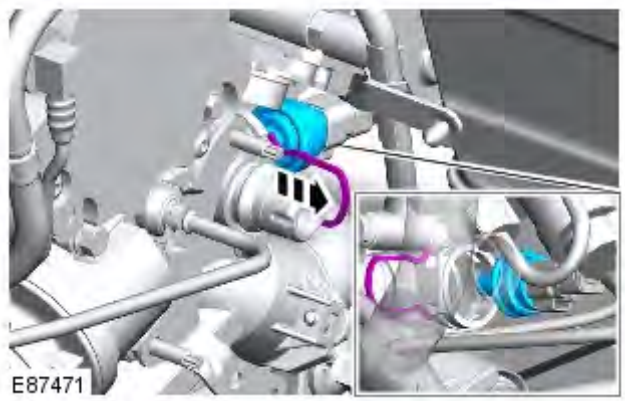
   Raise and support the vehicle.



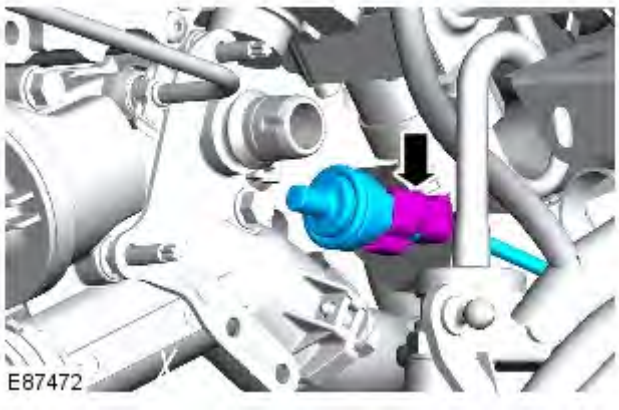
5. **5.** CAUTIONS:

   Be prepared to collect escaping coolant.

   A new O-ring seal is to be installed.



6. **6.** NOTE: Remove and discard the O-ring seal.



7.

Installation

1. Connect the engine coolant temperature (ECT) sensor electrical connector.

2. **2.** CAUTION: A new O-ring seal is to be installed.

   Install the engine coolant temperature (ECT) sensor.

3. Connect the heater outlet pipe.

4. Install the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

5. Install the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

6. Refill and bleed the cooling system.

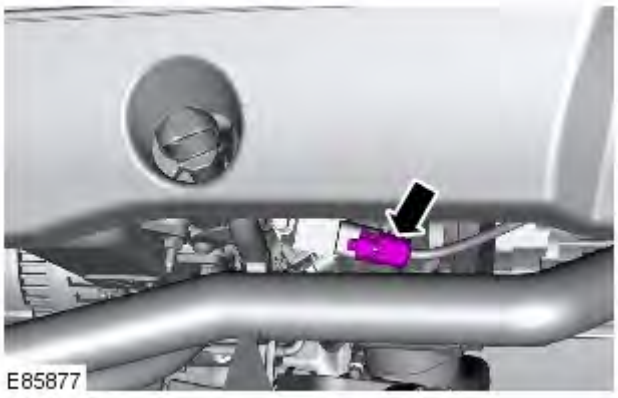
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Manifold Absolute Pressure (MAP) Sensor

Removal and Installation

Removal



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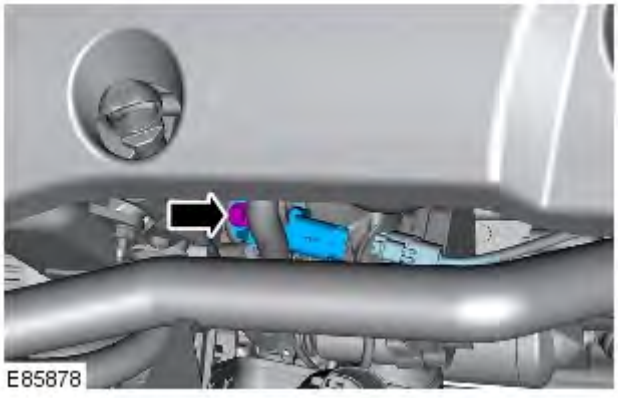


2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Intake Air Temperature (IAT) Sensor

Removal and Installation

Removal

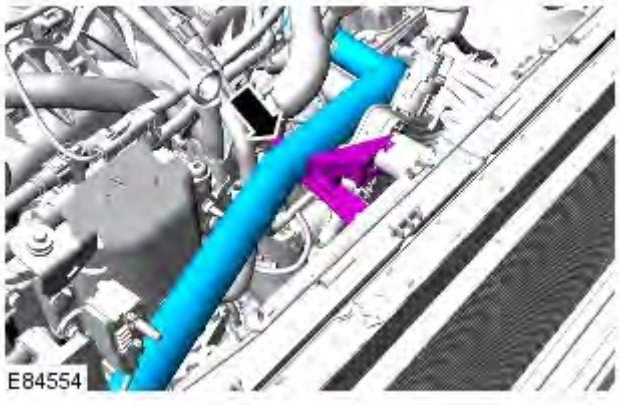
- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).



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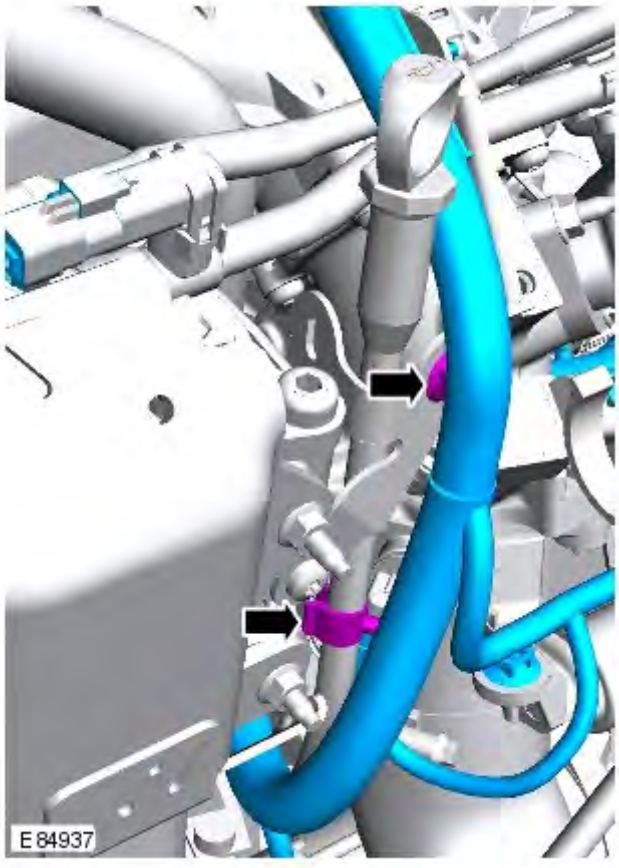

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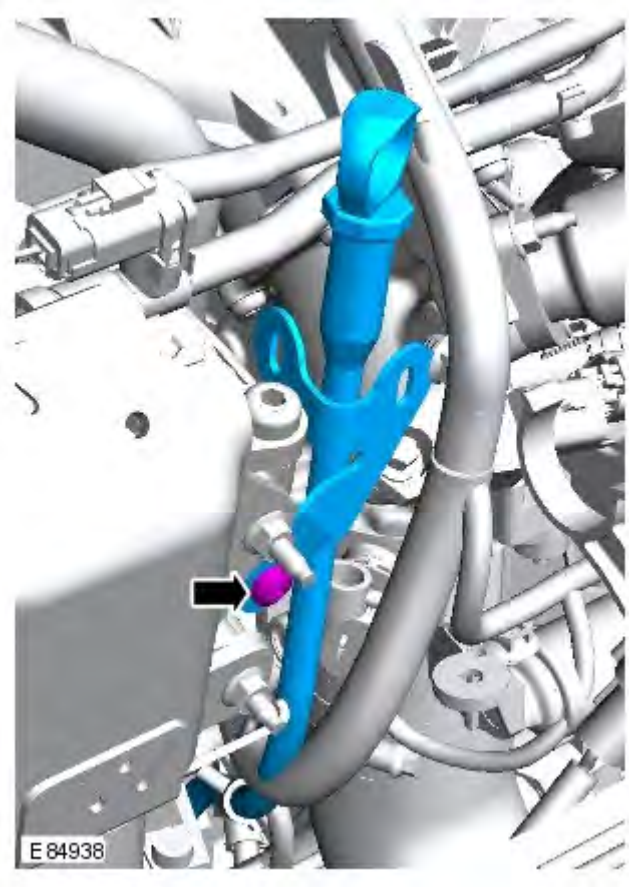
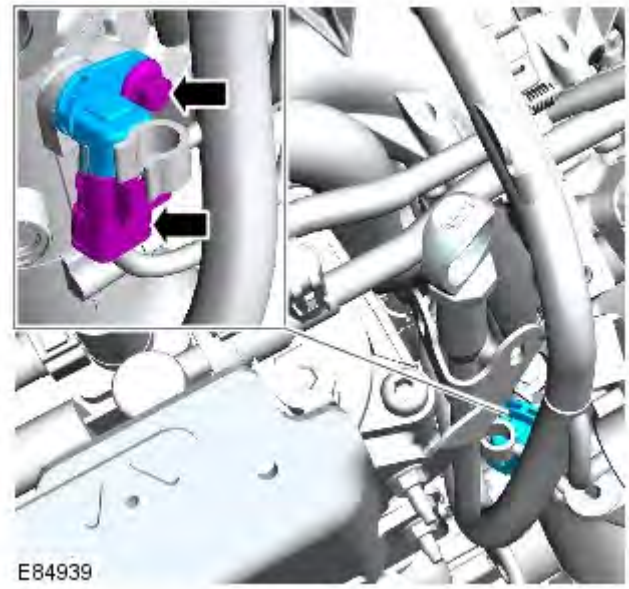


5. *Torque:* 10 Nm



6. **6.** CAUTION: A new O-ring seal is to be installed.

Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

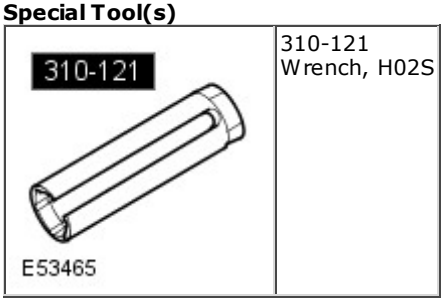
   To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Heated Oxygen Sensor (HO2S)

Removal and Installation

Special Tool(s)

	310-121 Wrench, H02S

Removal

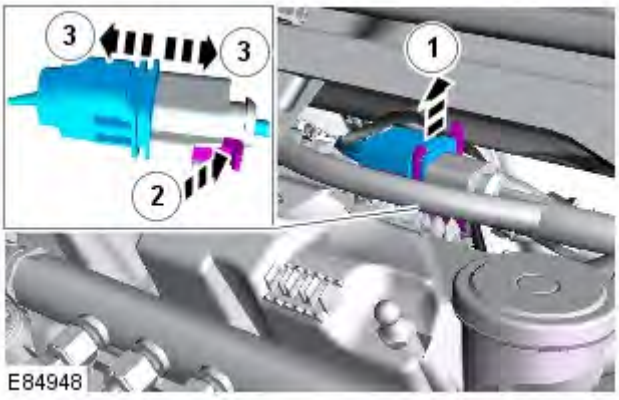
WARNING: Observe due care when working near a hot exhaust system.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).



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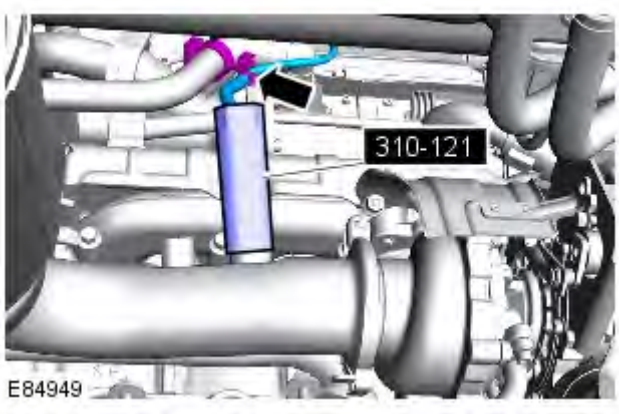


4. Using the special tool, remove the heated oxygen sensor (HO2S).

   Special Tool(s): 310-121

Installation

1. For H02S anti-seize compound information, refer to the specification

section.

Refer to: Specifications (303-08B Engine Emission Control - TD4 2.2L Diesel, Specifications).

2. **2.** CAUTION: Make sure the anti-seize compound does not contact the HO2S tip.

   Apply anti-seize compound to the sensor threads.

3. Install the HO2S.

   Special Tool(s): 310-121
   Torque: 45 Nm

4. Connect the HO2S electrical connector.

5. Install the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Engine Oil Pressure (EOP) Sensor

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

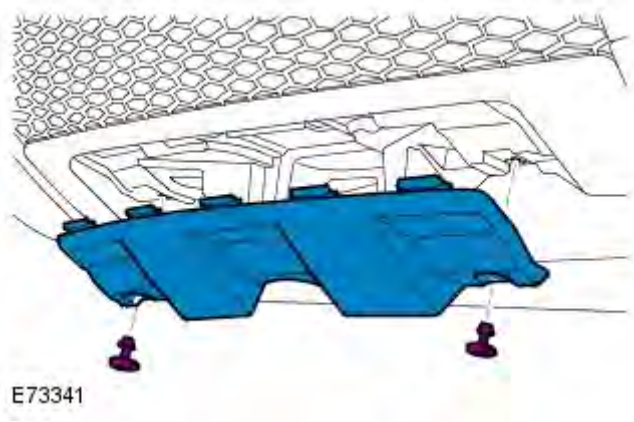
1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Raise and support the vehicle.

3. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



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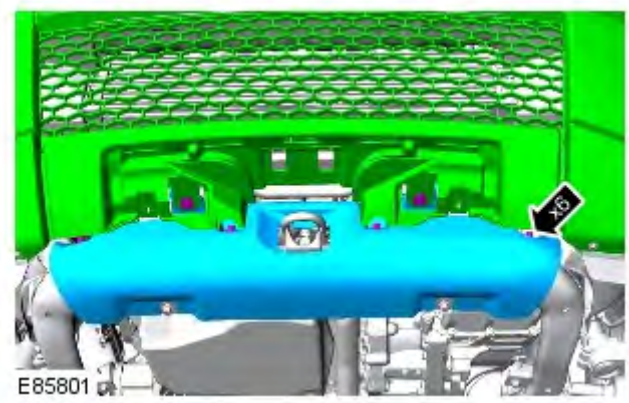

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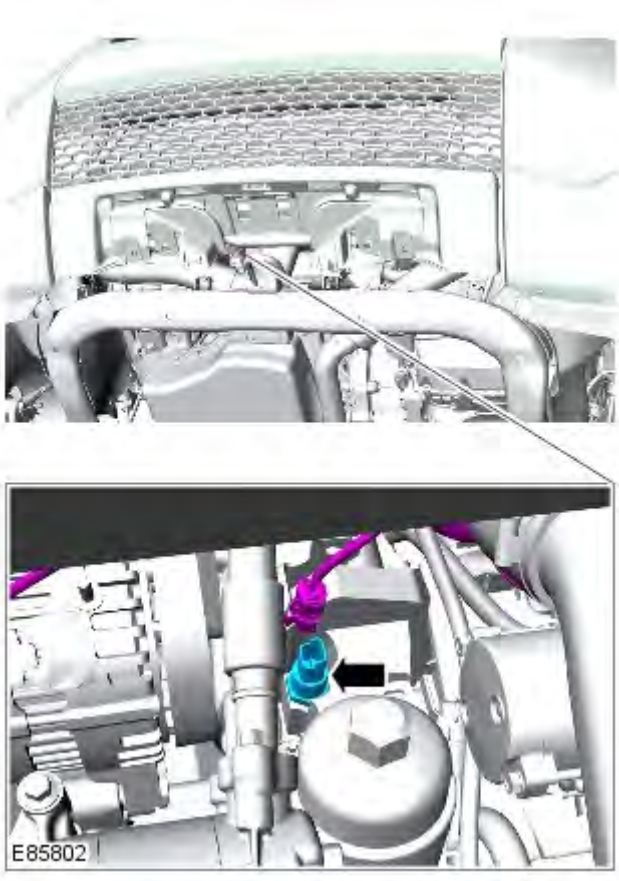


6. **6.** CAUTIONS:

   Be prepared to collect escaping fluids.

   Replace the washer.

   Torque: 32 Nm

Installation

1. To install, reverse the removal procedure.
2. Check and top-up the engine oil if required.

Published: 11-May-2011

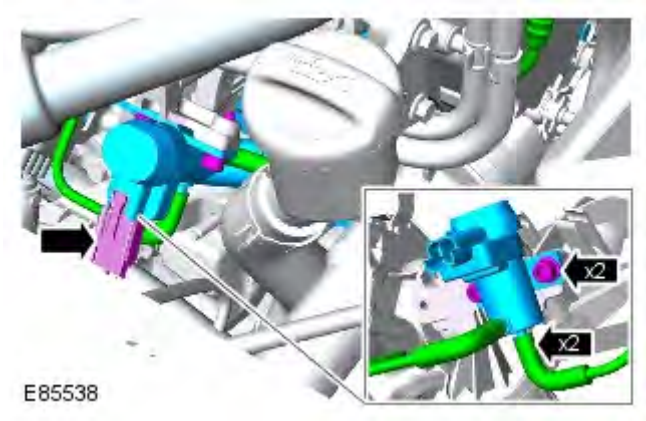
Electronic Engine Controls - TD4 2.2L Diesel - Intake Manifold Runner Control (IMRC) Actuator

Removal and Installation

Removal

1. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. *Torque:* 10 Nm

Installation

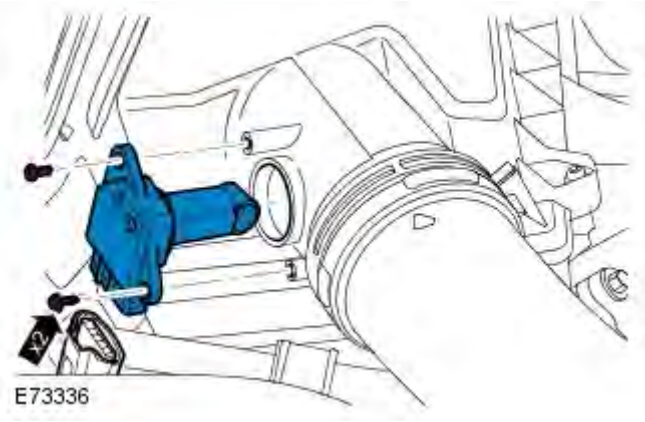
1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Mass Air Flow (MAF) Sensor

Removal and Installation

Removal



1. *Torque:* 2 Nm

Installation

1. To install, reverse the removal procedure.

2. **2.** NOTE: For NAS vehicles only.

   If required, carry out a short drive cycle.

   Refer to: Powertrain Control Module (PCM) Short Drive Cycle Self-Test (303-14A, General Procedures).

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Crankshaft Position (CKP) Sensor Ring

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the crankshaft pulley.

   Refer to: Crankshaft Pulley (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

3. **3.** CAUTION: "Make sure that a new component is installed. "

   • NOTE: M6 bolts can be used to extract the component.

   • NOTE: Make sure that this component is installed to the noted removal position.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Engine Control Module (ECM)

Removal and Installation

Removal

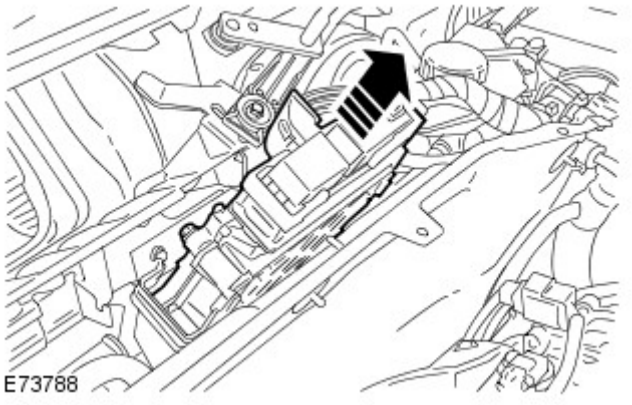
- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



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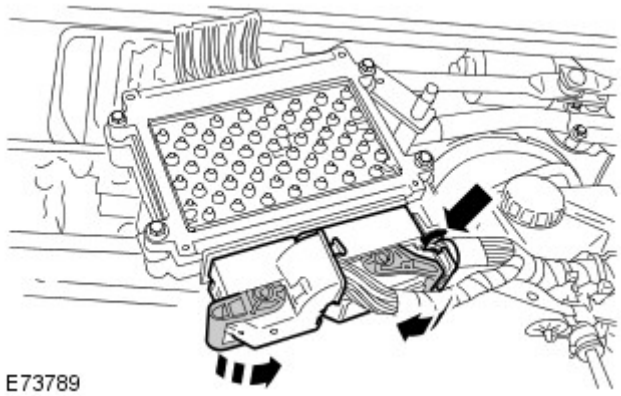
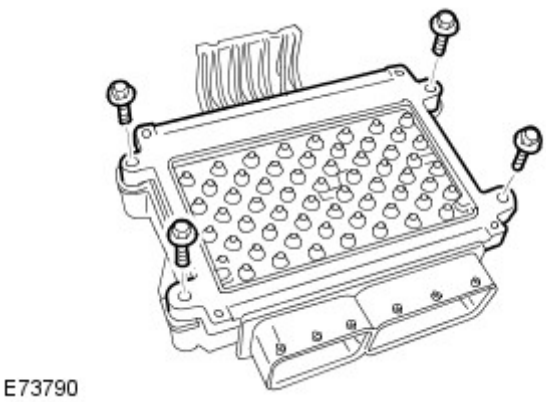


4. Petrol ECM shown, diesel similar.



5. *Torque:* 6 Nm

Installation

All vehicles

1. To install, reverse the removal procedure.

Vehicles with diesel particulate filter (DPF)

2. Renew the engine oil and filter.

   Refer to: Engine Oil Draining and Filling (303-01B Engine - TD4 2.2L Diesel, General Procedures).

All vehicles

3. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Fuel Temperature Sensor

Removal and Installation

Removal

- WARNINGS:

Avoid flames, sparks or lighted substances.

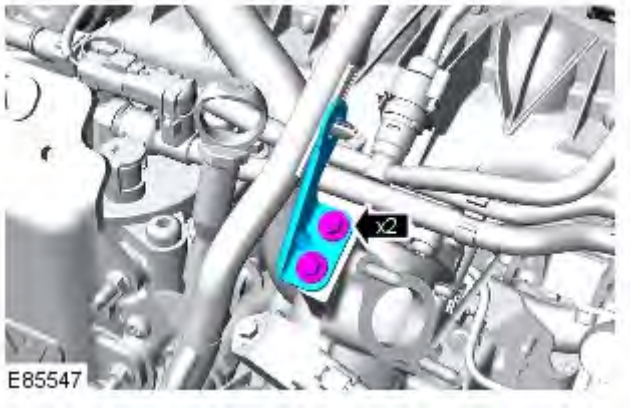
Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.

1. Remove the cover and disconnect the battery ground cable.

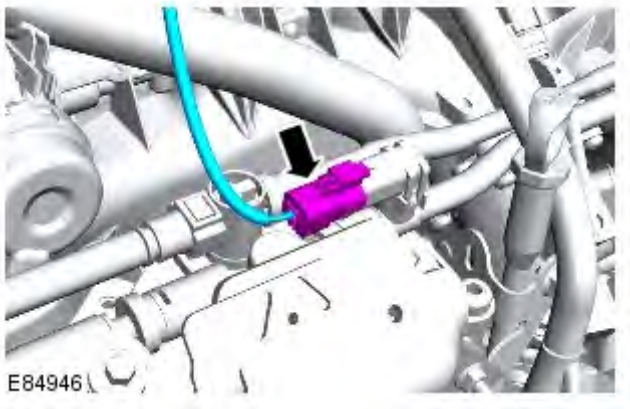
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. *Torque:* 10 Nm



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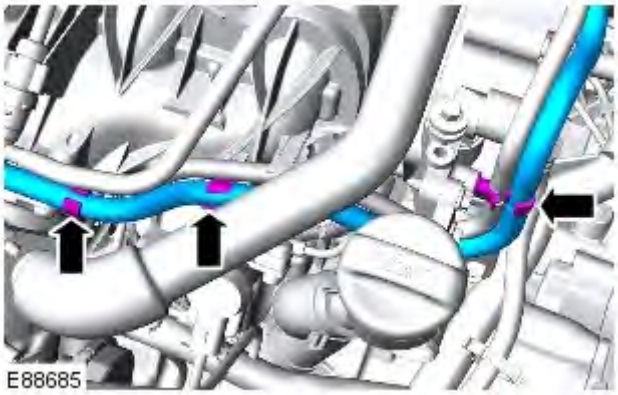

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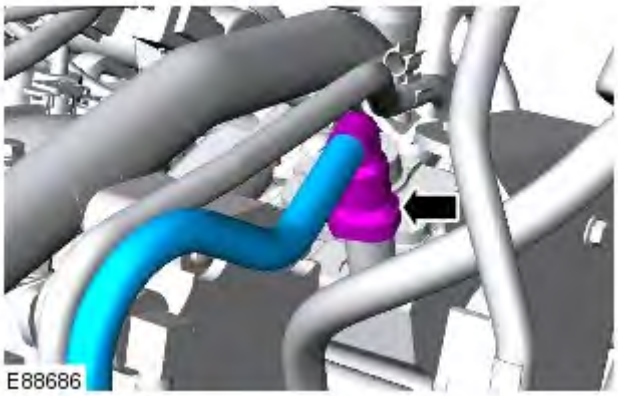
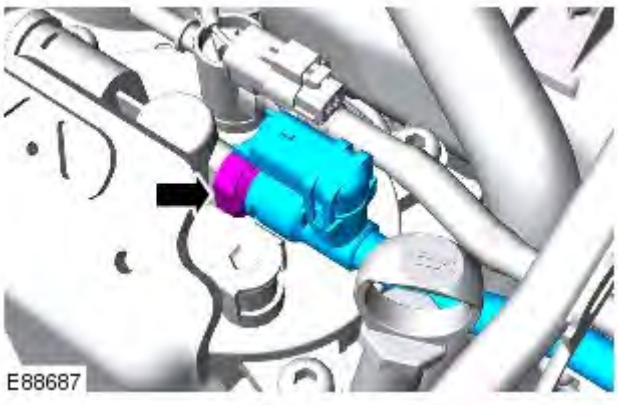


6. **6.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Be prepared to collect escaping fluids.

   Make sure that all openings are sealed. Use new blanking caps.



7. **7.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Be prepared to collect escaping fluids.

   Make sure that all openings are sealed. Use new blanking caps.

Installation

1. **1.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

   To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Oil Temperature Sensor

Removal and Installation

Removal

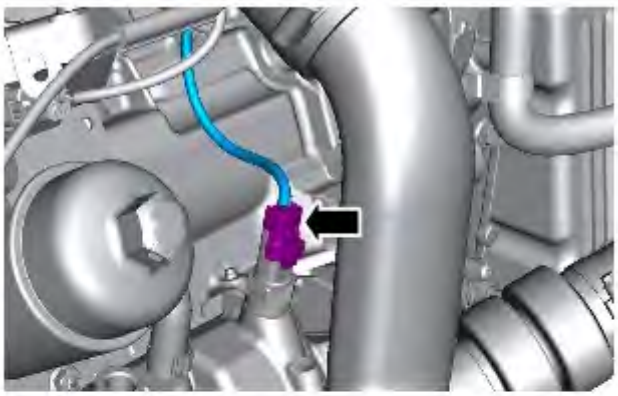
- NOTE: Removal steps in this procedure may contain installation details.

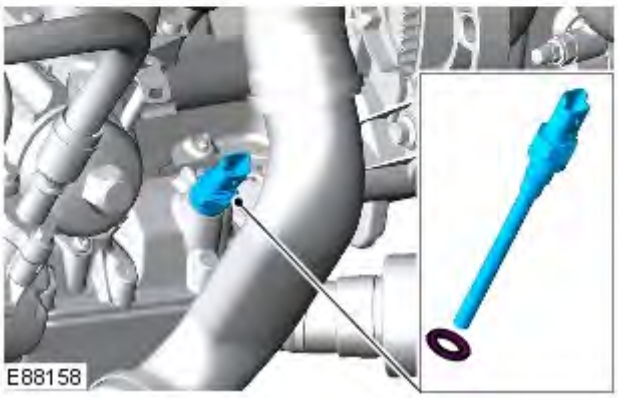
1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the starter motor.

   Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).





3. **3.** CAUTION: Make sure that a new sealing washer is installed.

   Torque: 27 Nm

Installation

1. To install, reverse the removal procedure.

2. Check and top-up the engine oil if required.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Clutch Pedal Position (CPP) SwitchLHD AWD

Removal and Installation

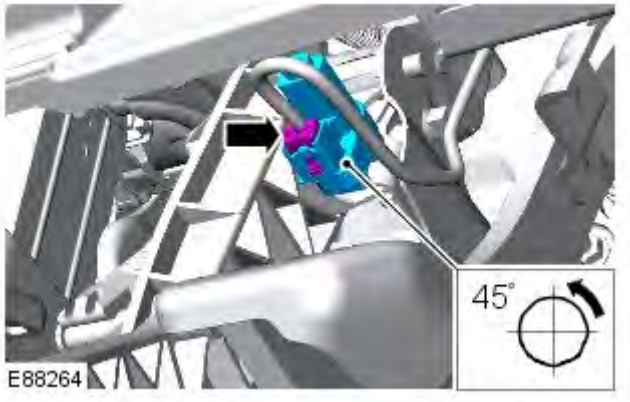
Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the driver lower air bag.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



3.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Clutch Pedal Position (CPP) SwitchRHD AWD

Removal and Installation

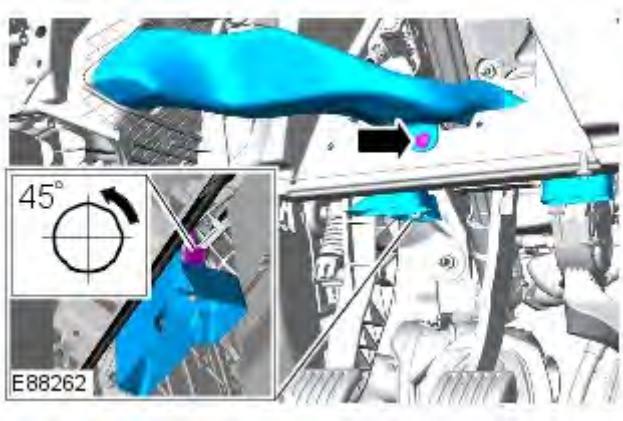
Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the driver lower air bag.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



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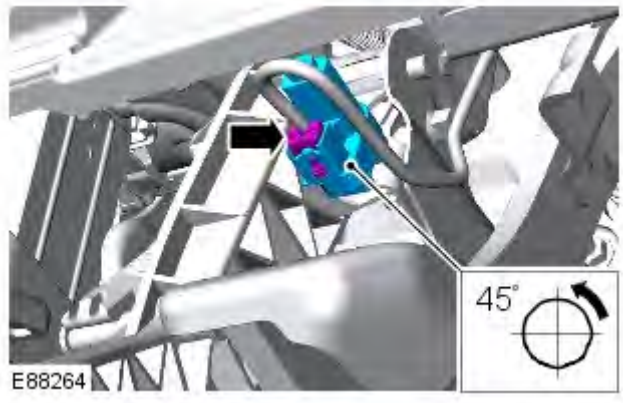


4.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Exhaust Gas Temperature Sensor

Removal and Installation

Removal

WARNING: Observe due care when working near a hot exhaust system.

- NOTE: Removal steps in this procedure may contain installation details.

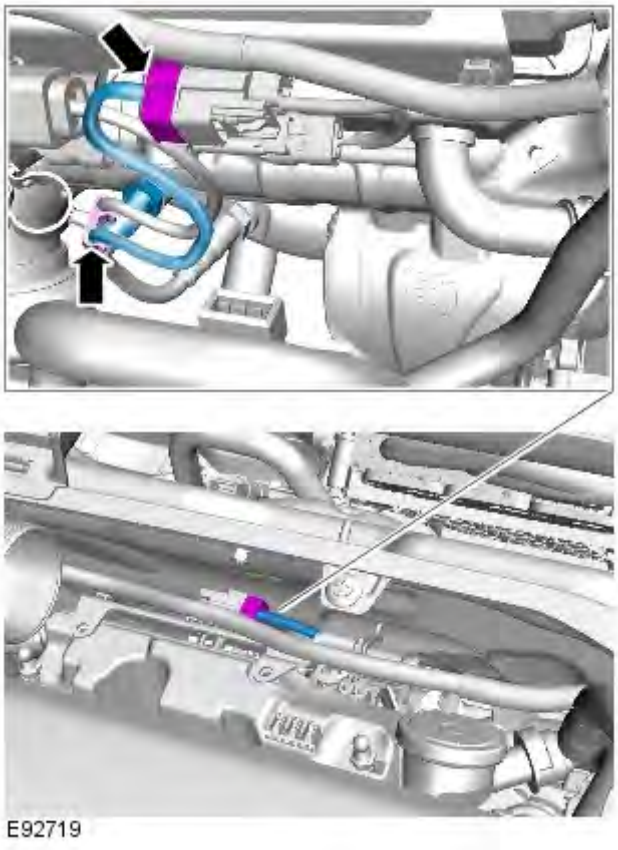
1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

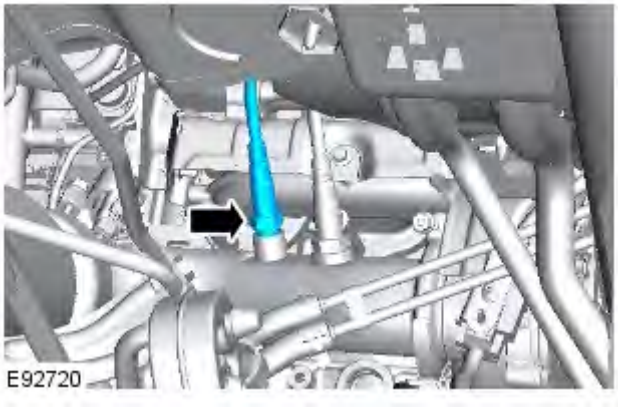
   Raise and support the vehicle.

2. Remove the engine cover.

   Refer to: Engine Cover - 2.2L Diesel (501-05, Removal and Installation).

3.





4. **4.** CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

   Torque: 35 Nm

Installation

1. Apply anti-seize compound to the sensor threads.

   Refer to: Specifications (303-08, Specifications).

2. To install, reverse the removal procedure.

Published: 11-May-2011

Electronic Engine Controls - TD4 2.2L Diesel - Diesel Particulate Filter (DPF) Temperature Sensor

Removal and Installation

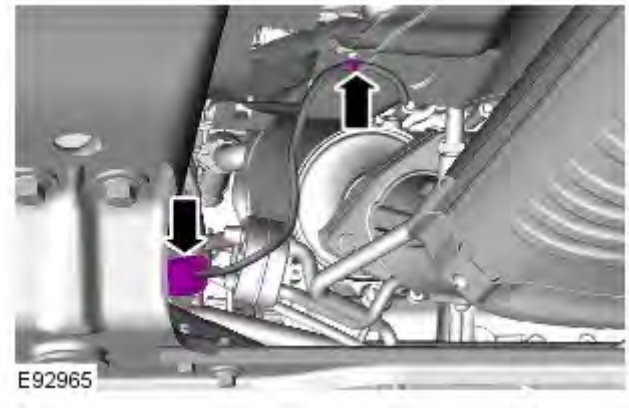
Removal

WARNING: Observe due care when working near a hot exhaust system.

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.



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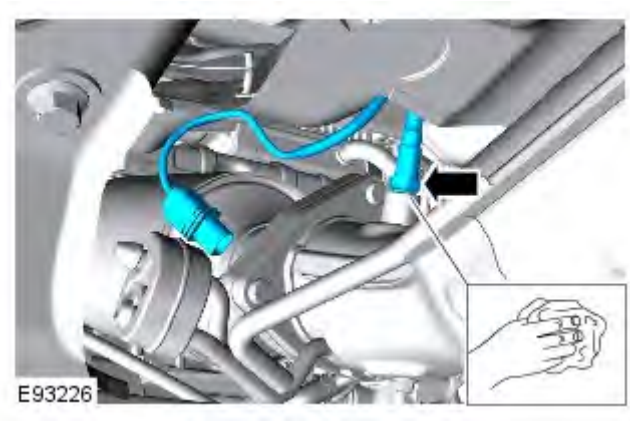


3. **3.** CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

   Torque: 35 Nm

Installation

1. Apply anti-seize compound to the sensor threads.

   Refer to: Specifications (303-08, Specifications).

2. To install, reverse the removal procedure.

Published: 11-May-2011

Automatic Transmission/Transaxle -

Lubricants, Fluids, Sealers and Adhesives

• CAUTIONS:

* Do not use any lubricant other than that specified

+ Do not over lubricate

Item	Specification
Recommended lubricant - 3.2 Petrol *	Esso JWS 3309 US. Land Rover Part No LR002748
Recommended lubricant - 2.2 Diesel, Vehicles built up to 2011 *	Esso JWS 3309 US. Land Rover Part No LR002748
Recommended lubricant - 2.2 Diesel, Vehicles built from 2011 *	Nippon AW-1. Land Rover Part No LR0022460
Torque converter nose+	Molykote FB180
Driveshaft spline grease	Weicon Anti Seize - 6G92M1C27AA
Fluid pan to transmission sealant	LR002912

Capacities

CAUTION: * A final oil level/check/top-up must be carried out when the unit has been installed

Item	Capacity (liters/pints/US quarts)
Initial dry fill*	7.0/12.3/7.4

General Specification

Item	Specification
Automatic transmission	Aisin AWF21 (6 speed auto)
Torque - Maximum:	
3.2 Petrol	315 Nm (232 lb-ft)
2.2 Diesel	450 Nm (332 lb-ft)
Gear ratios:	
First	4.148:1
Second	2.370:1
Third	1.556:1
Fourth	1.155:1
Fifth	0.859:1
Sixth	0.686:1
Reverse	3.394:1
Final drive ratio:	
3.2 Petrol	3.750:1
2.2 Diesel	3.329:1
Torque converter:	
3.2 Petrol	D260 170K
2.2 Diesel	D260 186K2
Transmission control module:	
Location	Integrated onto top transmission casing
Type - 3.2 Petrol, Vehicles built from 2007 to 2009	SH 7055
Type - 2.2 Diesel, Vehicles built from 2007 to 2010	SH 7055
Type - 3.2 Petrol, Vehilces built up to 2011	SH 7058
Type - 3.2 Petrol and 2.2 Diesel, Vehicles built from 2011	SH 7058

Torque Specifications

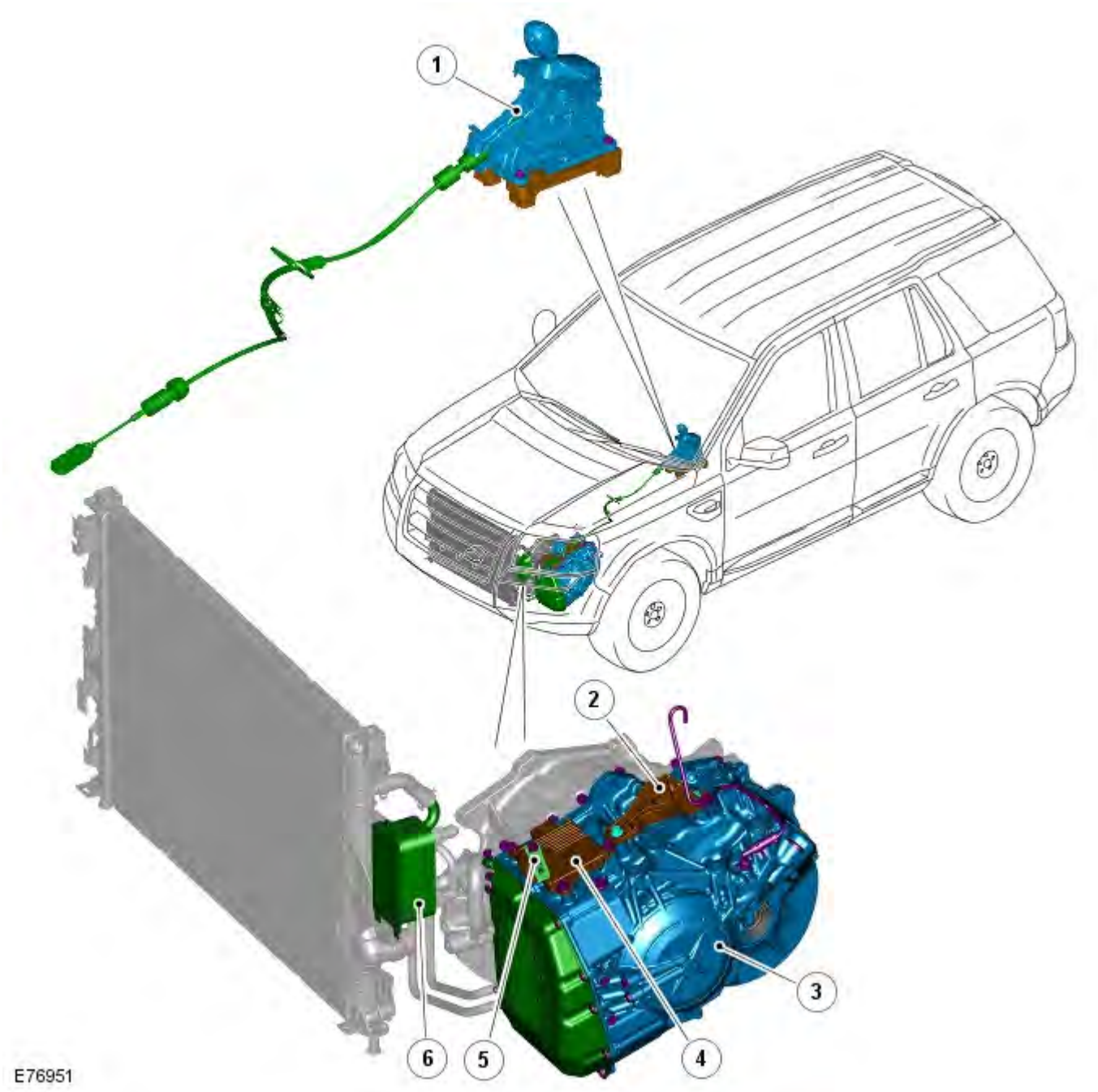
Description	Nm	lb-ft
3 way solenoid S1	10	7
3 way solenoid S2	10	7
Cover plate bolt - PTU side - 2.2 Diesel only	24	18
Cover plate bolt- starter side - 2.2 Diesel only	24	18
Drain plug bolt	47	35
Fill plug Torx bolt	39	29
Flexplate to torque converter bolts	60	44
Fluid pan Torx bolts	13	10
Lock plate bolt - oil temperature sensor	10	7
Main control valve body bolts	10	7
Overflow Torx bolt	7	5
Suction cover - valve body assy	10	7
Transmission control module (TCM) bolts	24	18
Transmission control module (TCM) support bracket	25	18
Speed Sensor - Input	5	3.7
Transmission to engine bolts - M10:		
3.2 Petrol	48	35
2.2 Diesel	65	48
Transmission to engine bolts - M8 - petrol 3.2l engine only	24	18

Published: 11-May-2011

Automatic Transmission/Transaxle - Transmission Description

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Transmission selector lever assembly
2	-	Cable bracket
3	-	Automatic transmission
4	-	Transmission Control Module (TCM)
5	-	Lever arm
6	-	Transmission fluid cooler

OVERVIEW

The AW F21 automatic transmission is a 6 speed, electronically controlled unit manufactured by Aisin AW in Japan. The transmission represents the latest in automatic transmission technology for a transverse, All Wheel Drive (AWD) unit. The transmission features lock-up slip control, 'CommandShift™' functions and automatic and driver selectable modes to give the optimum on and off road performance.

The transmission is controlled by a TCM which contains software to provide operation as a semi-automatic 'CommandShift™' transmission. The TCM allows the transmission to be operated as a conventional automatic unit by selecting P, R, N, D on the selector lever. Movement of the selector lever across the gate to the 'M/S' position puts the transmission into electronic 'Sport' mode. Further movement of the lever in a longitudinal direction to the + or – position

puts the transmission into electronic manual 'CommandShift™' mode.
For additional information, refer to: External Controls (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation).

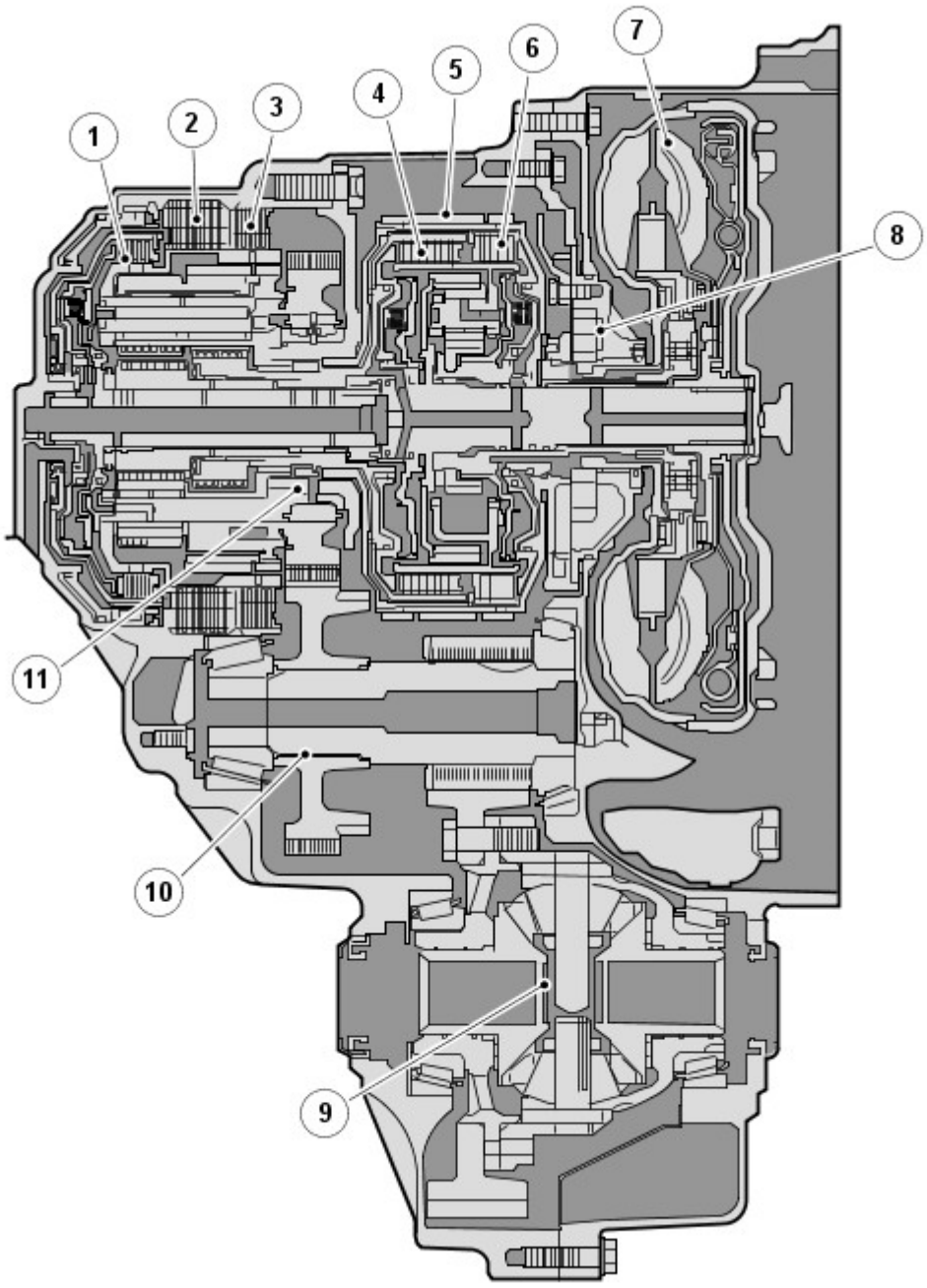
The AW F21 transmission has the following features:

- Designed to be maintenance free
- Torque capacity of 450 Nm
- Transmission fluid is fill for life
- The torque converter features a controlled slip feature with electronically regulated lock-up control on gears 2 to 6
- Shift programs controlled by the TCM
- TCM has an adaptive capability to ensure efficient gear shift quality throughout the service life of the transmission
- Diagnostics available from the TCM via the high speed Controller Area Network (CAN) bus.

TRANSMISSION

The transmission comprises the main casing which houses all of the transmission components. The torque converter is located in a separate converter housing.

AW F21 Automatic Transmission - Sectional View



E83814

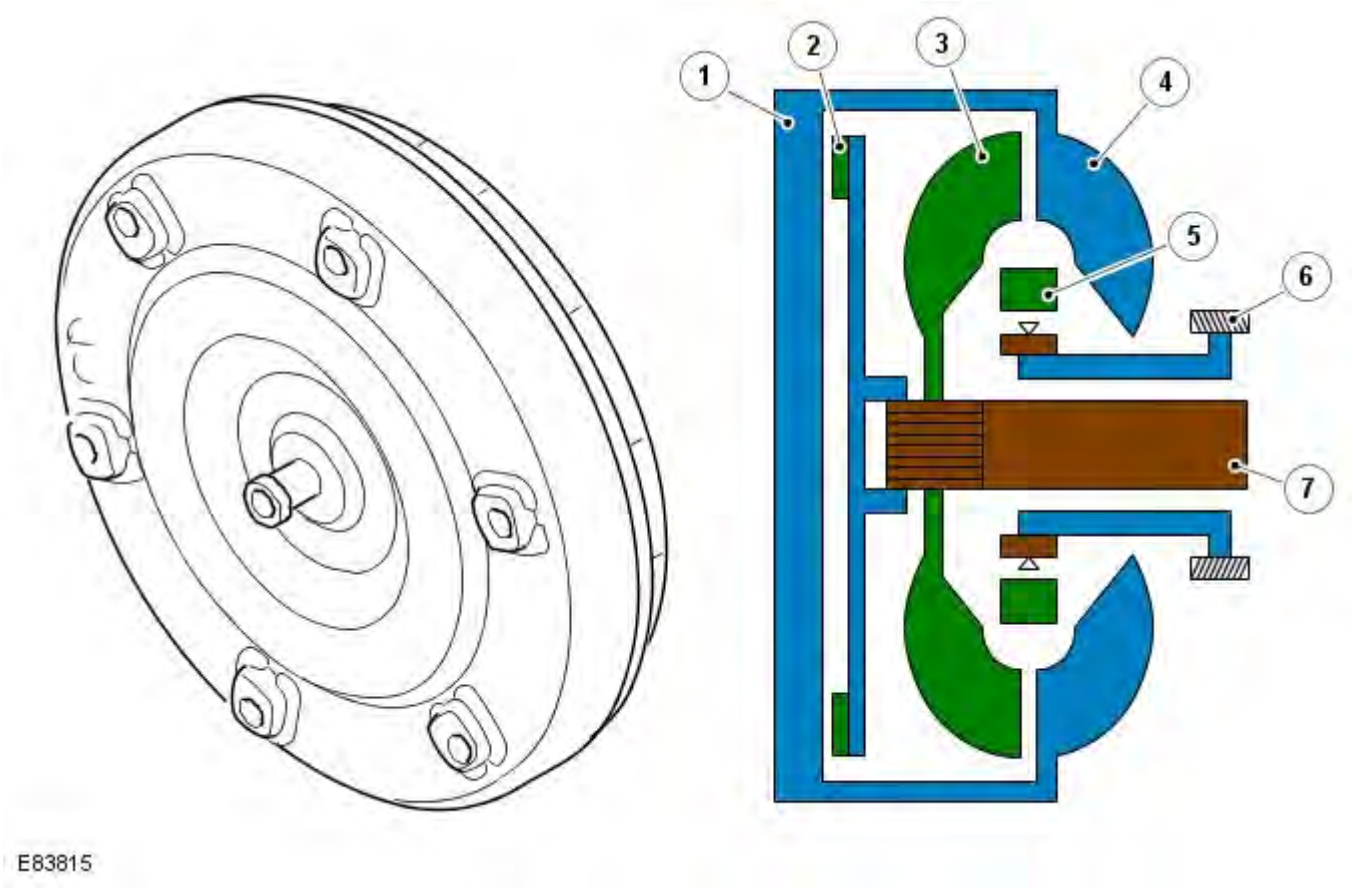
Item	Part Number	Description
1	-	Clutch - C2
2	-	Brake - B2
3	-	One-way clutch - F1
4	-	Clutch - C1
5	-	Brake - B1

6	-	Clutch - C3
7	-	Torque converter
8	-	Fluid pump
9	-	Differential assembly
10	-	Counter driven gear
11	-	Counter drive gear

The main casing retains the fluid at the bottom. A combined drain/filler plug is located in the bottom of the casing. The oil level is checked by removing the inner fill plug when the transmission fluid is at a temperature of between 50 to 60°C (122 to 140°F). When the oil flow becomes a drip from the plug hole, the level is correct.

The transmission has a fluid cooler which is located on the Left Hand (LH) end of the radiator. The cooler is connected to the transmission converter housing by 2 pipes. The fluid cooler is connected into the engine cooling system and cools the transmission fluid by heat transfer through the cooler to the engine coolant.
For additional information, refer to: Transmission Cooling (307-02 Transmission/Transaxle Cooling, Description and Operation).

TORQUE CONVERTER



Item	Part Number	Description
1	-	Torque converter housing
2	-	Lock-up clutch
3	-	Turbine
4	-	Impeller
5	-	Stator
6	-	Fluid pump
7	-	Input shaft

The torque converter is the coupling element between the engine and the transmission and is located in the transmission housing, on the engine side of the transmission. The driven power from the engine crankshaft is transmitted hydraulically and mechanically through the torque converter to the transmission. The torque converter is connected to the engine by a drive plate.

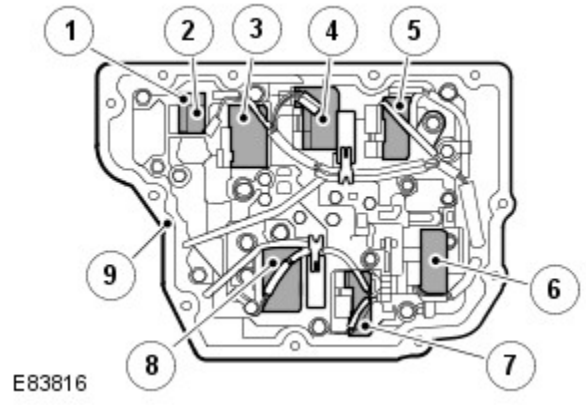
The torque converter comprises an impeller, a stator and a turbine. The torque converter is a sealed unit with all components located between the converter housing cover and the impeller. The two components are welded together to form a sealed, fluid filled housing. With the impeller welded to the converter housing cover, the impeller is therefore driven at engine crankshaft speed.

The torque converter contains a hydraulically operated lock-up clutch which is controlled by the TCM via a solenoid in the valve block which actuates spool valves to control the hydraulic pressure applied to the clutch. This allows the TCM to provide 3 modes of converter operation; unlocked, partially locked and fully locked.

VALVE BLOCK

The valve block is located in a vertical position at the front of the transmission main casing, behind a sealed cover. The valve block contains a number of solenoids, dampers and spool valves to control the transmission operation. The solenoids are controlled by the TCM to provide gear changes and smooth transition between ratio changes.

Solenoids



Item	Part Number	Description
1	-	3-Way solenoid - S1
2	-	3-Way solenoid - S2
3	-	Line pressure control solenoid - SLT
4	-	Shift control solenoid - SLC2
5	-	Shift control solenoid - SLC1
6	-	Lock-up control solenoid - SLU
7	-	Shift control solenoid - SLC3
8	-	Shift control solenoid - SLB1
9	-	Valve block

Shift Control Solenoids - SLC1, SLC2, SLC3, SLB1

The shift control solenoids (SLC1, SLC2, SLC3 and SLB1) are installed on the front valve body. The solenoids respond to inputs from the TCM and control the hydraulic pressure applied to the clutches (C1, C2 and C3) and to the brake B1 to provide smooth shifting. The TCM uses a single or a combination of these solenoids to provide shifts from 1st to 6th gear.

If a solenoid fails, the TCM will remove the current to the shift control solenoids and the transmission will use limp home mode, to prevent damage to the transmission.

Line Pressure Control Solenoid - SLT

The line pressure control solenoid (SLT) is installed on the front valve body. The solenoid is controlled in a linear manner by the TCM which uses throttle opening degree signals and engine torque information from the Engine Control Module (ECM) to determine the solenoid operation. The solenoid controls the line pressure applied to the clutches and brakes to provide smooth shifting.

If the solenoid fails, the TCM will remove the current supplied to the solenoid. Maximum line pressure will be applied to the clutches and brakes unless the failure is due to the solenoid valve sticking, which may result in low line pressure.

Lock-Up Control Solenoid - SLU

The lock-up control solenoid is installed on the front valve body. The solenoid is controlled in a linear manner by the TCM which uses engine speed, throttle opening degree signals and transmission speed sensor signals to determine the solenoid operation. The solenoid controls the amount of lock-up or slip required for the torque converter lock-up clutch.

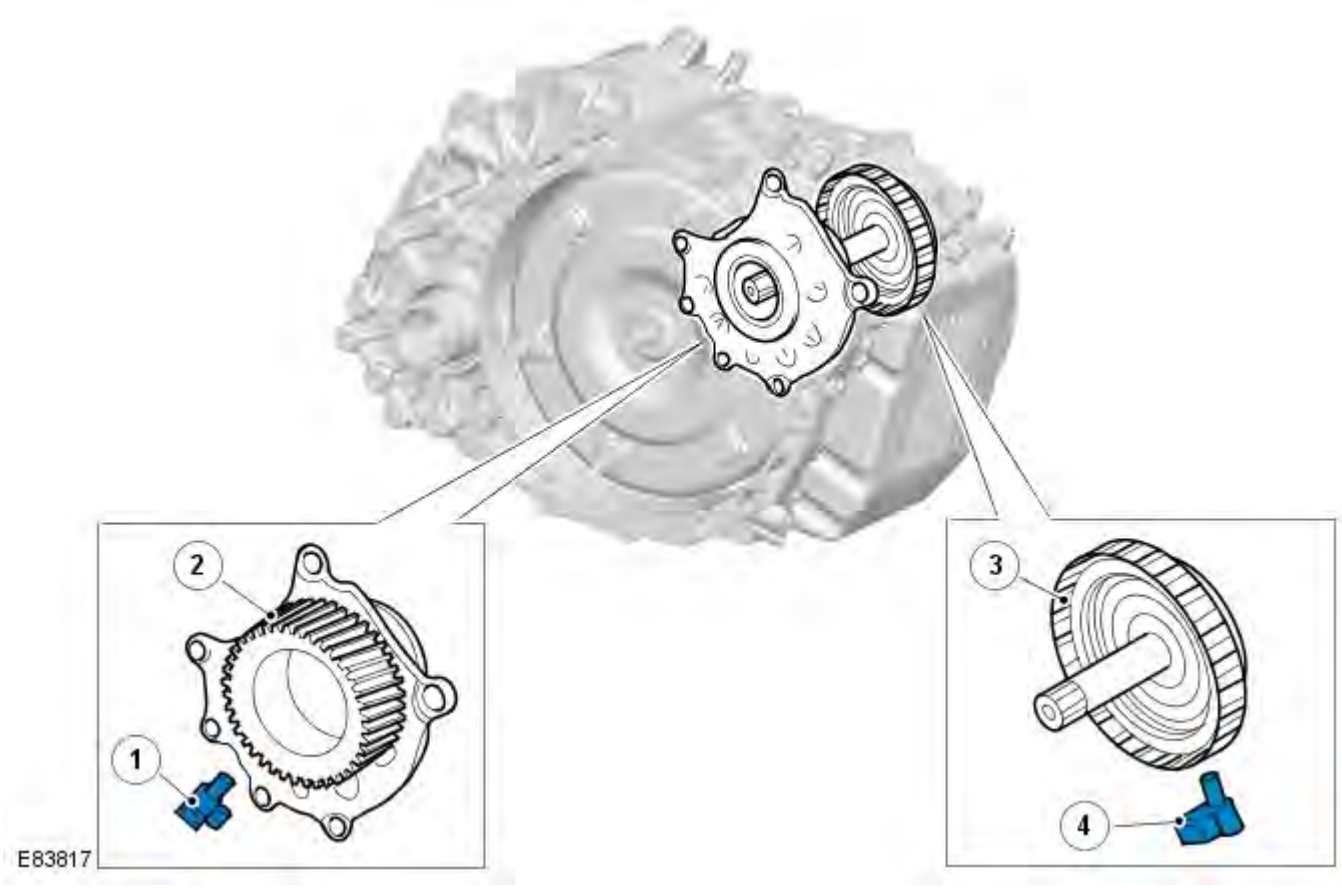
If the solenoid fails, the TCM removes the current supplied to the solenoid which results in no torque converter lock-up being applied.

3-Way Solenoid - S1, S2

The 3-way solenoid (S1) is located on the center valve body and solenoid (S2) is located on the front valve body. The solenoids are on/off solenoids controlled by the TCM. A combination of the 2 solenoids is used to operate either the 1st gear engine braking or enable gear shifts.

If a solenoid fails, the TCM will remove the current supplied to both solenoids.

Speed Sensors



Item	Part Number	Description
1	-	Speed Sensor (SP) - Output shaft speed
2	-	Counter drive gear
3	-	C2 clutch drum
4	-	Speed sensor (NIN)

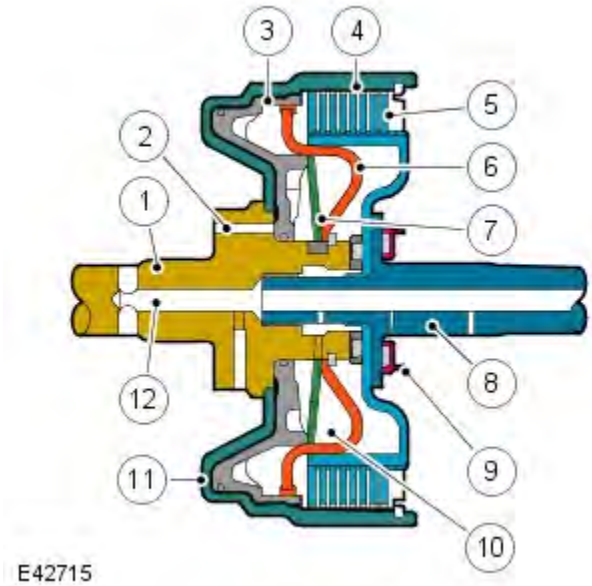
Two speed sensors (NIN and SP) are used in the transmission and are located within the transmission housing. Speed sensor (SP) is located adjacent to the counter drive gear and reads from the gear teeth to provide an output shaft speed signal. Speed sensor (NIN) is located adjacent to the clutch C" drum and reads off teeth on the outer circumference of the drum to provide an input shaft speed. Both speed signals are received by the TCM which uses the 2 signals to calculate engine torque output, shift timing and torque converter lock-up.

Fluid Temperature Sensor

The fluid temperature sensor is integrated into the internal wiring harness within the transmission. It detects the fluid temperature in the hydraulic pressure control circuit and transmits a signal corresponding to the temperature to the TCM. The TCM monitors the temperature and provides smooth gear shifts across a wide range of temperatures.

DRIVE CLUTCHES

Multiplate Drive or Brake Clutch – Typical



Item	Part Number	Description
1	-	Input shaft
2	-	Main pressure supply port
3	-	Piston
4	-	Cylinder – External plate carrier
5	-	Clutch plate assembly
6	-	Baffle plate
7	-	Diaphragm spring
8	-	Output shaft
9	-	Bearing
10	-	Dynamic pressure equalisation chamber
11	-	Piston chamber
12	-	Lubrication channel

There are three drive clutches and two brake clutches (B2 is a multiplate brake clutch & B1 is a double wrap brake band) used in the AW F21 transmission. Each clutch comprises one or more friction plates dependent on the output controlled. A typical clutch consists of a number of steel outer plates and inner plates with friction material bonded to each face.

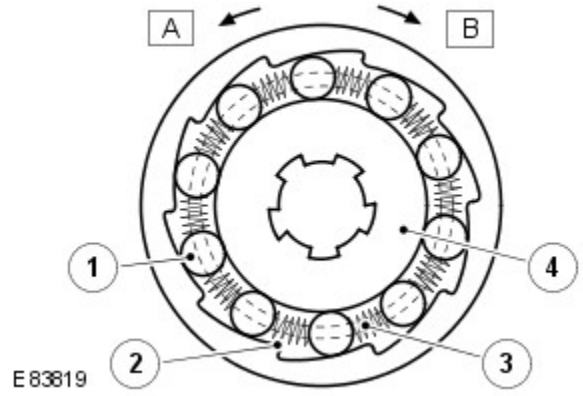
Clutch / Brake	Operation
C1 Clutch	Connects the front planetary carrier to the rear planetary rear sun gear
C2 Clutch	Connects the intermediate shaft to the rear planetary carrier
C3 Clutch	Connects the front planetary carrier to the rear planetary middle sun gear
B1 Brake	Locks the rear planetary middle sun gear
B2 Brake	Locks the rear planetary carrier

The clutch plates are held apart mechanically by a diaphragm spring and hydraulically by dynamic pressure. The pressure is derived from a lubrication channel which supplies fluid to the bearings etc. The fluid is passed via a drilling in the output shaft into the chamber between the baffle plate and the piston. To prevent inadvertent clutch application due to pressure build up produced by centrifugal force, the fluid in the dynamic pressure equalization chamber overcomes any pressure in the piston chamber and holds the piston off the clutch plate assembly.

When clutch application is required, main pressure from the fluid pump is applied to the piston chamber from the supply port. This main pressure overcomes the low pressure fluid present in the dynamic pressure equalization chamber. The piston moves, against the pressure applied by the diaphragm spring, and compresses the clutch plate assembly. When the main pressure falls, the diaphragm spring pushes the piston away from the clutch plate assembly, disengaging the clutch.

One-Way Clutch

One-Way clutch - Typical

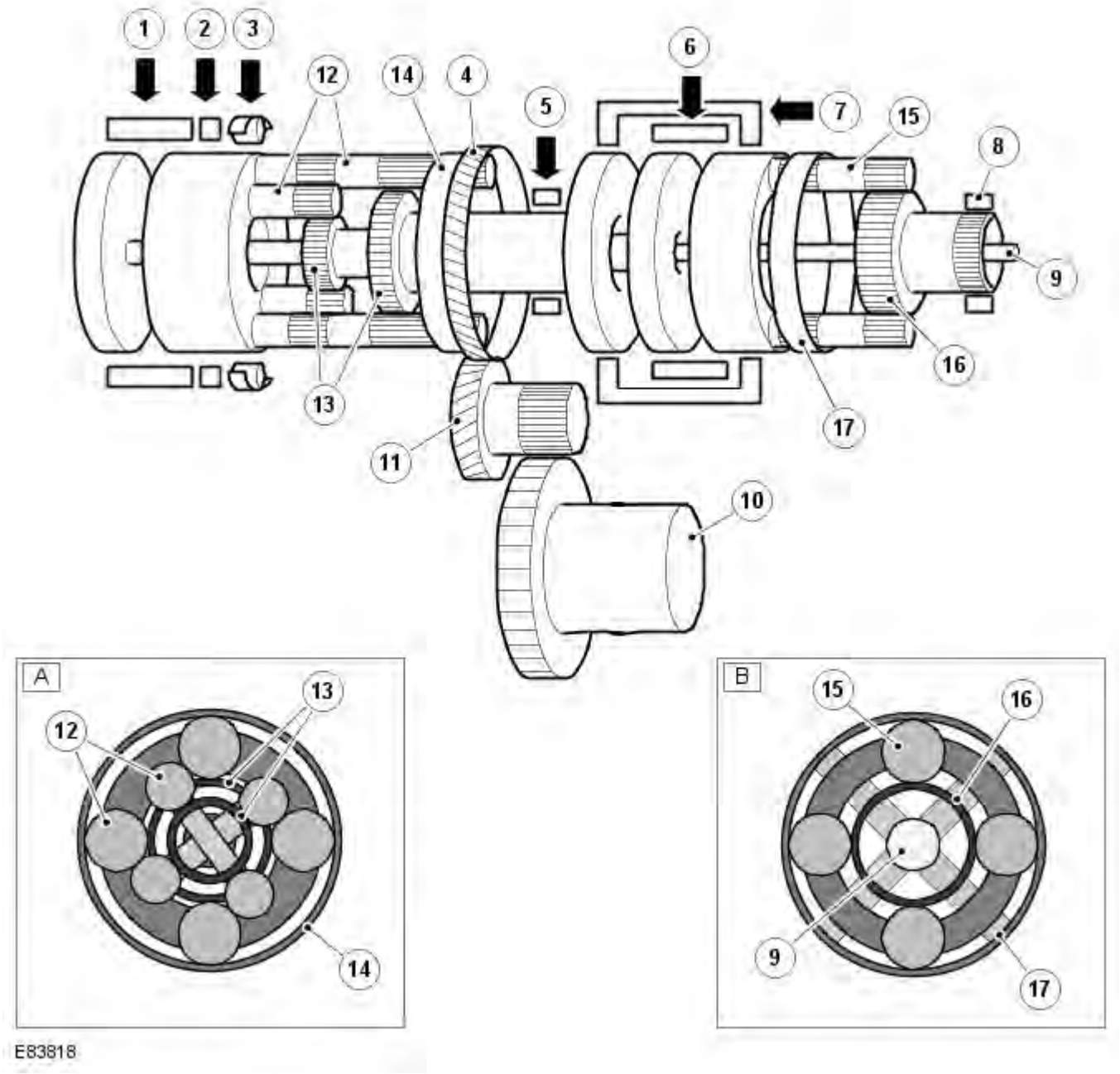


Item	Part Number	Description
1	-	Roller
2	-	Cage
3	-	Spring
4	-	Inner race

The roller clutch used on the one-way clutch uses parallel rollers, located between the smooth, cylindrical inner race and the inclined cam faces of the clutch body. Springs are used to hold the rollers in position between the two contact faces.

When the clutch is rotated in a clockwise direction, the rollers become trapped between the inner race and the inclined cam faces of the clutch body, providing positive (locked) rotation of the inner race, locking the counter-clockwise rotation of the rear planetary carrier. When the clutch is rotated in a clockwise direction, the rollers are moved away from the inclined cam faces and can rotate freely (unlocked) with the clutch body, providing no drive from the clutch to the rear planetary carrier. In this condition the clutch can rotate freely on the inner race.

PLANETARY GEAR TRAIN



Item	Part Number	Description
A	-	Double web planetary gear train - Rear
B	-	Single web planetary gear train - Front
1	-	Clutch C2
2	-	Brake B2
3	-	Free wheel clutch F2
4	-	Counter drive gear
5	-	Brake B1
6	-	Clutch C1
7	-	Clutch C3
8	-	Fluid pump
9	-	Input shaft
10	-	Differential gear assembly
11	-	Counter gear assembly
12	-	Pinion gears
13	-	Sun gears
14	-	Ring gear
15	-	Pinion gear
16	-	Sun gears
17	-	Ring gear

The planetary gear trains used on the AW F21 transmission comprise a single web planetary gear train and a double web planetary gear train. These gear trains are known as Ravignaux type gear trains and together produce the six forward gears and the one reverse gear.

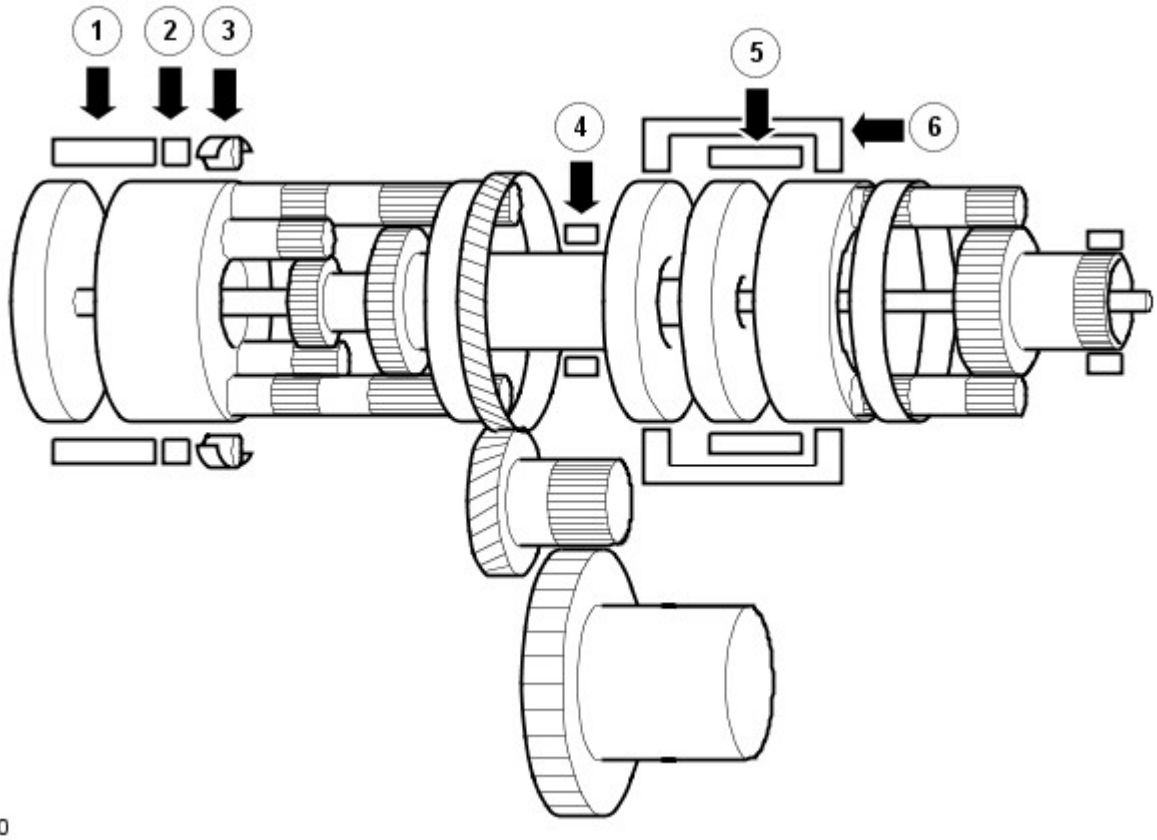
Engine torque is transferred, via operation of single or combinations of clutches to the two planetary gear trains. Both gear trains are controlled by reactionary inputs from brake clutches to produce the six forward gears and one reverse gear. The

ratios are as follows:

Gear	1st	2nd	3rd	4th	5th	6th	Reverse
Ratio	4.148	2.370	1.556	1.155	0.859	0.686	3.394

POWER FLOWS

Operation of the transmission is controlled by the TCM which electrically activates various solenoids to control the transmission gear selection. The sequence of solenoid activation is based on programmed information in the TCM memory and physical transmission operating conditions such as vehicle speed, throttle position, engine load and selector lever position.



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Item	Part Number	Description
1	-	Clutch - C2
2	-	Brake - B2
3	-	One-way clutch - F1
4	-	Brake - B1
5	-	Clutch - C1
6	-	Clutch - C3

Power Flow - 1st Gear Engine Braking

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	Engine Brake	-	X	X	X	X	X

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	Engine Brake	X	-	-	-	X	X

X = Operating

When the engine brake is active, driving force is transmitted to the transmission from the road wheels, via the power transfer unit. The rear planetary carrier is locked from clockwise rotation by the one-way clutch (F1) and brake (B2). This results in torque from the wheels being transmitted directly to the engine, providing engine braking.

Power Flow - 1st Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	1st Gear	-	X	X	X	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	1st Gear	X	-	-	-	-	X

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Rear sun gear
  - Locked: Carrier
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates in a clockwise direction along with the planetary pinion gear which also rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis.

The front planetary carrier rotates clockwise in the same direction as the planetary pinion gear. The clutch (C1) is activated and locks the planetary carrier to the rear planetary sun gear.

Rear Planetary Gear Train

The planetary sun gear rotates in a clockwise direction. The planetary short pinion gear rotates in a counter-clockwise direction. The planetary carrier attempts to rotate in the same direction but is restrained by the one-way clutch (F1).

The long pinion gear rotates clockwise on its axis and the middle sun gear rotates counter-clockwise while idling. The ring gear is rotated by the long pinion gear and drives the counter drive gear in a clockwise direction.

The counter driven gear is driven in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

Power Flow - 2nd Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	2nd Gear	-	X	X	-	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	2nd Gear	X	-	-	X	-	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Rear sun gear
  - Locked: Middle sun gear
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates in a clockwise direction along with the planetary pinion gear which also rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis.

The front planetary carrier rotates clockwise in the same direction as the planetary pinion gear. The clutch (C1) is activated and locks the planetary carrier to the rear planetary sun gear.

Rear Planetary Gear Train

The planetary sun gear and the carrier rotate in a clockwise direction. The middle sun gear is locked by the brake (B1). The short pinion gears rotate counter-clockwise on its axis and orbits in a clockwise direction. The long pinion gears rotates clockwise on its axis and its orbit.

The ring gear is rotated in a clockwise direction by the long pinion gear. The ring gear and the counter drive gear both rotate in a clockwise direction.

The counter driven gear is driven in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow - 3rd Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	3rd Gear	-	X	-	X	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	3rd Gear	X	-	-	X	-	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Middle sun gear
  - Locked: -
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates in a clockwise direction along with the planetary pinion gear which also rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis.

The front planetary carrier rotates clockwise in the same direction as the planetary pinion gear. The clutch (C1) is activated and locks the planetary carrier to the rear planetary sun gear. Clutch (C3) is also activated and locks the carrier to the middle sun gear.

Rear Planetary Gear Train

The planetary short pinion gear and the long pinion gear are engaged which causes both pinion gears to lock due to the different rotational directions. Torque from the sun gear and middle sun gear is transmitted to the planetary ring gear which rotates clockwise in the same direction as the planetary carrier.

The counter drive gear rotates in a clockwise direction with the ring gear.

The counter driven gear is rotated in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow - 4th Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	4th Gear	-	-	X	X	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	4th Gear	X	X	-	-	-	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Rear sun gear, Carrier
  - Locked: -
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates in a clockwise direction along with the planetary pinion gear which also rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis.

The front planetary carrier rotates clockwise in the same direction as the planetary pinion gear. The clutch (C1) is activated and locks the planetary carrier to the rear planetary sun gear. The intermediate shaft rotates in the same direction as the input shaft. Clutch (C2) is also activated rotates in the same direction as the intermediate shaft.

Rear Planetary Gear Train

The planetary carrier rotates in a clockwise direction with the intermediate shaft. The short pinion gear rotates clockwise on its axis and orbits at a faster speed than the sun gear. The long pinion gear rotates counter-clockwise on its axis and orbit. The rotation of the ring gear is in a clockwise direction and is slower than the rotation of the carrier due to the long pinion gear's rotation is counteracted by the planetary carrier.

The counter drive gear rotates in a clockwise direction with the ring gear.

The counter driven gear is rotated in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow - 5th Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	5th Gear	X	-	-	X	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	5th Gear	-	X	X	-	-	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Middle sun gear
  - Locked: -
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates in a clockwise direction along with the planetary pinion gear which also rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis.

The front planetary carrier rotates clockwise in the same direction as the planetary pinion gear. The clutch (C3) is activated and locks the planetary carrier to the rear planetary middle sun gear. The intermediate shaft rotates in the same direction as the input shaft. Clutch (C2) is also activated and rotates in the same direction as the intermediate shaft.

Rear Planetary Gear Train

The middle sun gear rotates clockwise in the same direction as clutch (C3). The deceleration of the front planetary gear slows the speed of the input shaft. The intermediate shaft rotates clockwise in the same direction as the input shaft. The planetary carrier also rotates clockwise in the same direction as the intermediate shaft.

The long pinion gear rotates clockwise on its axis and orbit. The carrier rotates faster than the middle sun gear which causes the middle pinion gear to be cancelled out by the speed difference. The middle pinion gear orbits and rotates on its axis in a clockwise direction.

The planetary ring gear rotates in a clockwise direction. The speed of the ring gear is faster than the planetary carrier because the long pinion gear's rotation is combined with the planetary carrier's speed. The counter drive gear rotates in a clockwise direction with the ring gear.

The counter driven gear is rotated in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow - 6th Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
D	6th Gear	X	-	X	-	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position	Clutch			Brake		One-Way clutch
	C1	C2	C3	B1	B2	F1

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
D	6th Gear	-	X	-	X	-	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: -
  - Locked: -
  - Output: -
- Rear planetary gear train
  - Input: Carrier
  - Locked: Middle sun gear
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The intermediate shaft rotates clockwise in the same direction as the torque converter. Clutch (C2) locks the intermediate shaft to the rear planetary carrier.

Rear Planetary Gear Train

The planetary carrier rotates clockwise in the same direction as the intermediate shaft. The planetary long pinion gear rotates clockwise on its axis and orbit. The rotational speed of the middle sun gear increases with input shaft speed because it is locked.

The planetary ring gear rotates in a clockwise direction. The speed of the ring gear is faster than the planetary carrier because the long pinion gear's rotation is combined with the planetary carrier's speed. The counter drive gear rotates in a clockwise direction with the ring gear.

The counter driven gear is rotated in a counter-clockwise direction which in turn drives the differential ring gear in a clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow - Reverse Gear

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
R	Reverse Gear - Less than 11 volts	X	X	-	X	-	-
R	Reverse Gear - More than 11 volts	X	X	X	X	-	-

X = Operating

Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
R	Reverse Gear - Less than 11 volts	-	X	-	X	-	-
R	Reverse Gear - More than 11 volts	-	-	-	-	X	-

X = Operating

The planetary gear trains are in the following conditions:

- Front planetary gear train
  - Input: Ring gear
  - Locked: Sun gear
  - Output: Carrier
- Rear planetary gear train
  - Input: Middle sun gear
  - Locked: Carrier
  - Output: Ring gear

Front Planetary Gear Train

The input shaft rotates in a clockwise direction, driven by the torque converter. The planetary ring gear rotates clockwise with the input shaft.

The pinion gear rotates clockwise on its axis and orbit. The planetary sun gear is locked by the fluid pump which causes it to press against the planetary ring gear and orbit the sun gear, rotating on its axis. The planetary carrier rotates clockwise with the pinion gear orbit.

Clutch (C3) is activated and rotates clockwise and locks the planetary carrier to the rear planetary middle sun gear.

Rear Planetary Gear Train

The middle sun gear rotates clockwise with the clutch (C3), but at a lower speed than the input shaft. Brake (B2) is activated and locks the planetary carrier. The long pinion gear rotates counter-clockwise which in turn rotates the ring gear counter-clockwise.

The counter drive gear rotates in a counter-clockwise direction with the ring gear at the same speed.

The counter driven gear is rotated in a clockwise direction which in turn drives the differential ring gear in a counter-clockwise direction.

• NOTE: Engine braking is available when this gear is selected.

Power Flow Neutral

Solenoid Operation

Transmission Selector Lever Position		Solenoid					
		SLC 1	SLC 2	SLC 3	SLB 1	S1	S2
N	Neutral	X	X	X	X	-	-

X = Operating

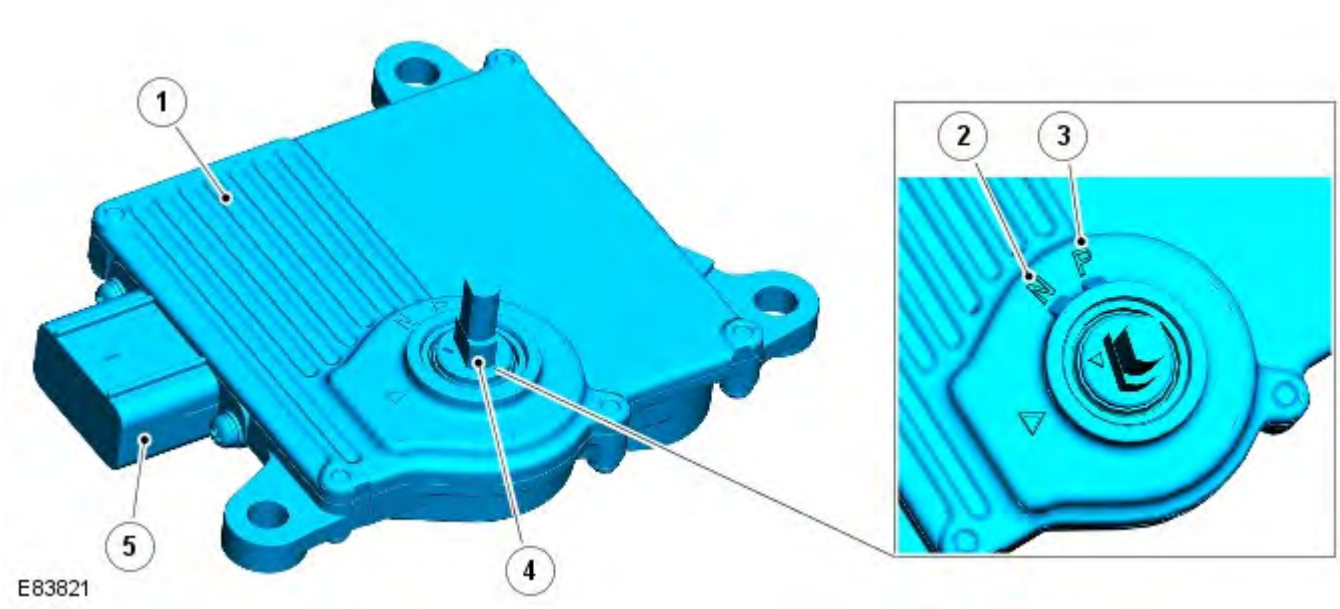
Clutch and Brake Operation

Transmission Selector Lever Position		Clutch			Brake		One-Way clutch
		C1	C2	C3	B1	B2	F1
R	Reverse Gear	-	-	-	-	-	-

X = Operating

In neutral, all the solenoids, except the 3 way solenoids, are energised and the clutches and brakes are all disengaged. This allows rotation from the input shaft to rotate the front planetary gear train without transferring any drive to the differential ring gear.

TRANSMISSION CONTROL MODULE (TCM)



Item	Part Number	Description
1	-	TCM
2	-	'Neutral 'N' position
3	-	Park 'P' position
4	-	Position sensor/manual shaft
5	-	Electrical connector

The TCM is located on the top of the transmission casing and is connected on the high speed CAN bus to send and receive information to and from other system modules.

The TCM outputs signals to operate the transmission solenoid valves to control the hydraulic operation of the transmission.

The ECM supplies the engine management data on the high speed CAN bus system. The TCM requires engine data to efficiently control the transmission operation, using for example; crankshaft torque, engine speed, accelerator pedal angle, engine temperature etc.

The TCM processes signals from the transmission speed and temperature sensors, ECM and other vehicle systems. From the received signal inputs and pre-programmed data, the module calculates the correct gear, torque converter clutch setting and optimum pressure settings for gear shift and lock-up clutch control.

The steering angle sensor and the ABS module also supply data to the TCM on the high speed CAN bus system. The TCM uses data from these systems to suspend gear changes when the vehicle is cornering and/or the Anti-lock Brake System (ABS) module is controlling braking or traction control.

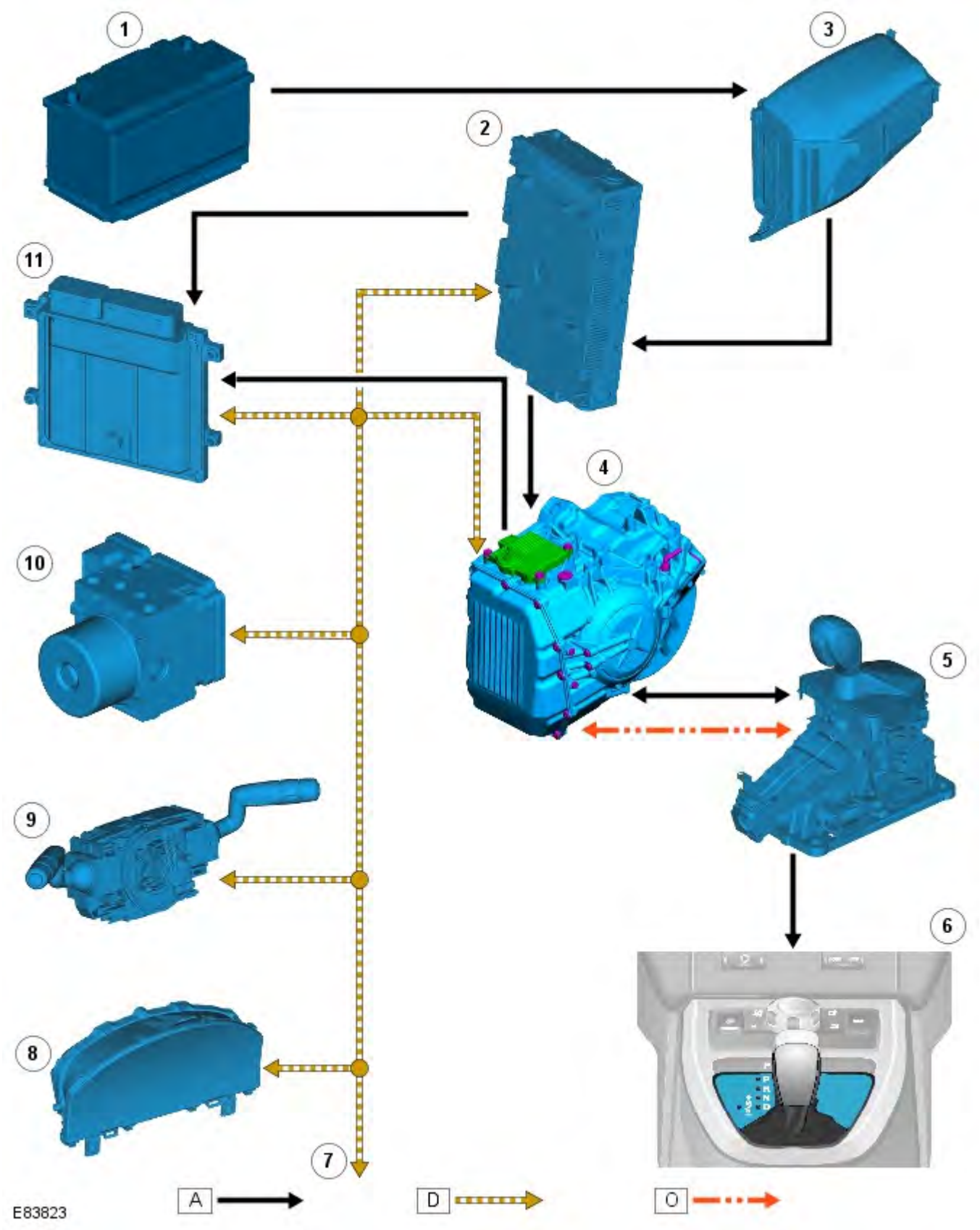
The TCM is positioned over the manual shaft which protrudes through an oil seal on the top face of the main casing. The shaft locates in a rotary position sensor and turns the sensor in the appropriate direction when a selection is made using the selector lever. The rotary position sensor is a Hall effect sensor which outputs a specified voltage relating to the selected selector lever position.

The selector lever is connected to the automatic transmission and the rotary position sensor in the transmission by a Bowden cable. Movement of the selector lever moves the position switch via the Bowden cable and the switch position informs the TCM of the selected position; P, R, N or D. The sport and manual +/- 'CommandShift™' switch passes sport or manual selections to the TCM on a Local Interconnect Network (LIN) bus. The TCM outputs appropriate information on the high speed CAN bus which is received by the instrument cluster to display the gear selection information in the message center.

If the TCM or transmission requires replacement, a setting procedure must be performed using a Land Rover approved diagnostic system to allow the TCM to learn the neutral position of the transmission. The TCM uses the neutral position as a reference point for each of the gear positions P, R, N and D.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box (BJB)
3	-	Central Junction Box (CJB)

4	-	TCM
5	-	Selector lever
6	-	Selector lever PRND and M/S Light Emitting Diode (LED) displays
7	-	High speed CAN bus to other vehicle systems
8	-	Instrument cluster
9	-	Steering angle sensor
10	-	ABS module
11	-	ECM

INSTRUMENT CLUSTER

E83822

Item	Part Number	Description
1	-	Malfunction Indicator Lamp (MIL)
2	-	P R N D display
3	-	Sport mode display
4	-	'CommandShift™' transmission status display
5	-	Message center

The instrument cluster is connected to the TCM via the CAN. Transmission status is transmitted by the TCM and displayed to the driver on one of two displays in the instrument cluster.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

Malfunction Indicator Lamp (MIL)

The MIL is located in the upper left hand corner of the instrument cluster, within the tachometer. Transmission related faults which may affect the vehicle emissions output will illuminate the MIL.

The MIL is illuminated by the ECM on receipt of a relevant fault message from the TCM on the CAN. The nature of the fault can be diagnosed using a Land Rover approved diagnostic system which reads fault codes stored in the TCM memory.

Transmission Status Display

The transmission status display is located on the right hand side of the instrument cluster, in the speedometer LCD display. The display shows the selector lever P R N D position and in the case of manual ('CommandShift™') mode, the selected gear. When the selector lever is moved to the 'Sport' position, 'SPORT' is displayed below the CommandShift™ gear display.

Symbol	Description
P	Park selected
R	Reverse selected
N	Neutral selected
D	Drive selected
1	1st gear selected ('CommandShift™' mode)
2	2nd gear selected ('CommandShift™'mode)
3	3rd gear selected ('CommandShift™'mode)

Symbol	Description
4	4th gear selected ('CommandShift™'mode)
5	5th gear selected ('CommandShift™'mode)
6	6th gear selected ('CommandShift™'mode)
SPORT	Sport mode selected

Message Center Display

The message center is located below the speedometer and the tachometer at the bottom of the instrument cluster. The message center is a Liquid Crystal Display (LCD) to relay vehicle status information to the driver.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

CONTROLLER AREA NETWORK (CAN)

The high speed CAN broadcast bus network is used to connect the powertrain modules. The CAN bus is connected between the following electronic units:

High Speed CAN Bus

- TCM
- Instrument cluster
- Steering angle sensor
- Restraints control module
- Engine Control Module (ECM)
- ABS module
- Adaptive Front lighting System (AFS) control module
- Diagnostic socket.

The CAN bus allows a fast exchange of data between modules. The CAN bus comprises two wires which are identified as CAN high (H) and CAN low (L). The two wires are colored yellow/black (H) and yellow/brown (L) and are twisted together to minimise electromagnetic interference (noise) produced by the CAN bus messages.
For additional information, refer to: Communications Network (418-00 Module Communications Network, Description and Operation).

In the event of CAN bus failure, the following symptoms may be observed:

- Transmission operates in default mode
- Torque converter lock-up clutch control is disabled
- Gear position indication in instrument cluster LCD inoperative (this will also occur with any transmission fault).

DRIVING MODES

A number of different driving modes are available. Some can be selected by the driver and some are automatically initiated by the TCM to adapt to different driving conditions.

- Normal
- Sport
- Manual 'CommandShift™'
- Cooling
- Hill Descent Control (HDC)
- Cruise
- Limp home
- Coast
- Fast off recognition
- Uphill and Trailer
- Downhill
- Wide Throttle
- Terrain Response
- Reverse lock-out

Normal

Normal mode is automatically selected by the TCM when the ignition is switched on. In this mode all automatic and adaptive modes are active. Normal mode uses gear shift and lock-up maps which provide the optimum of fuel consumption, emissions and driveability, depending on the driving style.

If the transmission is operated in sport mode or 'CommandShift™' mode and the selector lever is moved back to the drive 'D' position, then normal mode operation is resumed.

Sport

Sport mode provides enhanced acceleration and responsiveness by the use of sports shift maps. This mode allows the transmission to down shift more readily and hold gears for longer at higher engine speeds.

Manual 'CommandShift™'

Manual 'CommandShift' mode allows the transmission to operate as a semi-automatic transmission. The driver can change up and down the six forward gears with the freedom of a manual transmission.

Shift maps are provided to protect the engine at high speeds. The TCM will automatically change up to a higher gear ratio to prevent engine overspeed and change down to a lower gear ratio to avoid engine laboring and stalling.

When kick-down is requested the TCM shifts down to the lowest available gear. When the vehicle is stationary, the driver can select 1st, 2nd or 3rd to start off.

When moving from a standstill, upshifts can be pre-selected by making '+' selections with the selector lever for the number of upshifts required. The TCM then performs the requested number of upshifts when appropriate shift points are reached. For example; when moving off in 1st gear, if 3 '+' selections are made in quick succession, the TCM will automatically upshift through the gears to 4th gear as the vehicle accelerates, without any further selections being made.

Cooling

Cooling mode is activated when the TCM detects excessively high transmission fluid or engine coolant temperatures. When this mode is active torque converter lock-up is activated earlier to minimize a further rise in fluid and/or engine coolant temperature and assist fluid cooling.

Hill Descent Control (HDC)

The HDC mode assists the ABS module in controlling the downhill speed of the vehicle. When HDC is active, the TCM selects the most appropriate gear for the descent to maximize engine braking.

Maximum engine braking is applied using a shift map which initiates later upshifts and early downshifts.

Cruise

When speed control is activated, the TCM receives a speed control active message on the high speed CAN bus. The TCM activates a speed control map which minimizes up and down shifts.

Cruise mode is active when speed control is selected on and the transmission is in drive 'D', sport 'S', HDC or Terrain Response Grass/gravel/snow program. Unique cruise maps override the current mode to provide a smooth driving feel and mode reselection.

Limp Home

If a transmission fault is detected by the TCM, the TCM adopts a limp home strategy and a message 'TRANSMISSION FAULT LIMITED GEARS AVAILABLE' is displayed in the message center. If the fault has an effect on engine emissions, the MIL in the instrument cluster will also be illuminated.

In limp home mode, P, R and N functions operate normally (if the fault allows these selections) and the TCM locks the transmission in 3rd gear to allow the driver to take the vehicle to a Land Rover dealer or approved repairer. Torque converter lock-up is disabled and reverse-lock-out will not function.

If the vehicle is stopped and subsequently restarted in the limp home mode condition, the TCM operates normally until the fault which caused the condition is detected again.

Coast

Coast mode provides earlier downshifts during coasting dependant on output shaft deceleration rate to improve driveability and refinement by avoiding negative to positive driveline torque reversals transmission during the downshifts.

Fast Off Recognition

Fast off recognition is activated when the TCM detects that the driver has released the accelerator pedal quickly. This is detected by the TCM monitoring for a high level of negative pedal angle from ECM signals on the high speed CAN bus. If this condition is detected, the TCM holds the current gear ratio to allow the driver to complete the manoeuvre without the need for a downshift. The mode can remain active for a predetermined length of time or if the driving style remains passive.

Fast off recognition mode assists vehicle stability and is used in conjunction a lateral acceleration input during cornering to maintain the current gear until the corner is negotiated.

Uphill and Trailer

Uphill and trailer mode can be active when the transmission is operating in normal, sport or Terrain Response modes. When the vehicle is pulling a trailer or driving up an incline, the TCM detects the increased resistance by monitoring engine torque and speed signals received from the ECM on the high speed CAN bus and also transmission output shaft speed sensor signals. Uphill and trailer mode will provide downshifts to prevent a drop in transmission torque output and maintain driving force.

Downhill

Downhill mode can be active when the transmission is operating in normal, sport or Terrain Response modes. When the vehicle is descending an incline the TCM detects a reduction in resistance by monitoring engine torque and speed signals received from the ECM on the high speed CAN bus and also transmission output shaft speed sensor signals. Downhill mode assists engine braking by selecting an appropriate gear reducing the load required on the brakes.

Wide Throttle

Wide open throttle mode operates for part throttle upshifts and kick-down upshifts. It provides consistent wide open throttle upshift performance under all driving conditions. The full engine speed range is used in all driving modes; normal, sport, hill modes and Commandshift. Compensation is used for delays (hydraulic and electronic) in gear change request to gear change start to provide smooth changes and correct shift point correction.

Terrain Response

The Terrain Response system has a unique set of shift maps for each of the Terrain Response programs. These programs override existing modes; for example when HDC is active and the 'Sand', 'Mud and Ruts' or 'Grass/Gravel/Snow' programs are selected, a specific Terrain Response map is used, not the HDC mode shift map detailed previously.

Reverse Lock-Out

If the selector lever is moved from N to R and the vehicle is travelling forwards, reverse selection is prevented if the vehicle speed is 11 km/h (6.8 mph) or more. When reverse lock-out is activated, the clutch (C3) is released without energizing solenoid (SLC3), preventing the transmission from selecting reverse gear.

TRANSMISSION FAULT STATUS

If the TCM detects a fault with the transmission system, it will enter a default (limp home) mode to prevent further damage to the transmission and allow the vehicle to be driven. If possible reverse gear will be available and also 3rd gear only.

When a fault is detected a high speed CAN message is sent from the TCM and is received by the instrument cluster. The instrument cluster illuminates the MIL (if required) and displays an applicable message in the message center.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

Some transmission faults may not illuminate the MIL or display a fault message, but the driver may notice a reduction in shift quality.

ENGINE SPEED AND TORQUE MONITORING

The ECM constantly supplies the TCM with information on engine speed and torque through messages on the CAN bus. The TCM uses this information to calculate the correct and appropriate timing of shift changes.

If the messages are not received by the ECM, the TCM will implement a back-up strategy to protect the transmission from damage and allow the vehicle to be driven.

In the event of an engine speed or torque signal failure, the transmission will adopt the electrical limp home mode with the transmission operating in a fixed gear.

TOWING FOR RECOVERY

WARNING: Ensure that the remote handset remains docked whilst the vehicle is being towed. Removing the remote handset will engage the steering lock, which will prevent the vehicle from steering correctly.

If the engine cannot be run whilst the vehicle is being towed, there will be no power assistance for the steering or brakes. This will result in greater effort being required to steer or slow the vehicle, and greatly increased stopping distances.

CAUTION: The vehicle should only be towed with four wheels on the ground. Towing with two wheels on the ground will result in serious damage to the transmission.

The vehicle should only be towed for a maximum of 80 km (50 miles), at a maximum speed of 80 km/h (50 mph). Towing for a greater distance, or at a higher speed may result in serious damage to the transmission.

• NOTE: The recommended recovery method is by trailer or recovery vehicle.

Secure the towing attachment from the recovery vehicle to the front towing eye.

Insert the remote handset in the start control module and switch on the ignition by pressing the start/stop button once.

• NOTE: Leaving the ignition switched on for extended periods will cause the battery to drain.

Apply the foot brake, and move the selector lever to the neutral 'N' position. With the footbrake still applied, release the park brake. If electrical power to the selector is not available, the emergency release lever on the selector lever can be used to release the interlock solenoid.

The vehicle can be towed a maximum of 80 km (50 miles) at a maximum speed of 80 km/h (50 mph).

Park the vehicle on firm, level ground. Apply the park brake and move the selector lever to the park 'P' position.

Switch off the ignition and remove the remote handset.

CAUTION: The vehicle cannot be towed in a reverse direction.

Published: 11-May-2011

Automatic Transmission/Transaxle - Diagnostics

Diagnosis and Testing

Principles of Operation

For a detailed description of the Automatic transmission/transaxle:
REFER to: Transmission Description (307-01 Automatic Transmission/Transaxle, Description and Operation).

Fluid Level and Condition Check

CAUTION: The vehicle should not be driven if the fluid level is low as internal failure can result.

• NOTE: The transmission fluid temperature must be between 50°C (122°F) and 60°C (140°F) whilst checking level. Should the temperature rise above this figure, abort the check and allow the transmission fluid to cool.

This vehicle is not equipped with a fluid level indicator. An incorrect level may affect the transmission operation and could result in transmission damage. To correctly check and add fluid to the transmission:REFER to: (307-01 Automatic Transmission/Transaxle)

Transmission Fluid Level Check - I6 3.2L Petrol (General Procedures),
Transmission Fluid Level Check - TD4 2.2L Diesel (General Procedures).

Fluid Condition Check

Use the following procedure to check the fluid condition, which is a good indicator of the internal condition of the transmission:

1. **1.** Check the fluid level.
2. **2.** Observe the colour and the odour of the fluid. The colour under normal circumstances should be reddish, not brown or black.
    - If in doubt, compare the fluid with that from a new, sealed container.
3. **3.** Allow the fluid to drip onto a facial tissue and examine the stain.
4. **4.** If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical, electrical or hydraulic faults.

Visual Inspection

Mechanical	Electrical	Hydraulic
• Damaged shift mechanism/linkages • Damaged automatic transmission casing • Check the transmission selector lever cable for correct adjustment	• Blown fuse(s) • Damaged, loose or corroded connectors • Wiring harness	• Fluid level too high/low • Poor condition of fluid • Fluid leak

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the DTC index.
    - Make sure that all DTCs are cleared following rectification.

DTC Index

• NOTE: If the control module/transmission is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/transmission.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Transmission Control Module (TCM) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Automatic Transmission/Transaxle - Transmission Fluid Level CheckI6 3.2L Petrol

General Procedures

WARNING: Observe due care when draining, as the fluid can be very hot.

1. Ensure that the automatic transmission is in 'P' and the handbrake is fully applied.
2. Remove the air cleaner housing.

   Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).
3. Clean the area around the transmission fluid filler plug.

4. Remove the transmission fluid filler plug.
5. **5.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   • NOTE: Make sure that the vehicle is standing on a level surface.

   Raise and support the vehicle.
6. Remove the front undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
7. Clean the area around the transmission fluid level plug.
8. Place a container under the transmission.
9. Lower the vehicle.
10. Add 0.5 litres of transmission fluid.
11. **11.** CAUTION: A new O-ring seal is to be installed.

    Install the transmission fluid filler plug.

    Torque: 40 Nm
12. Install the air cleaner housing.

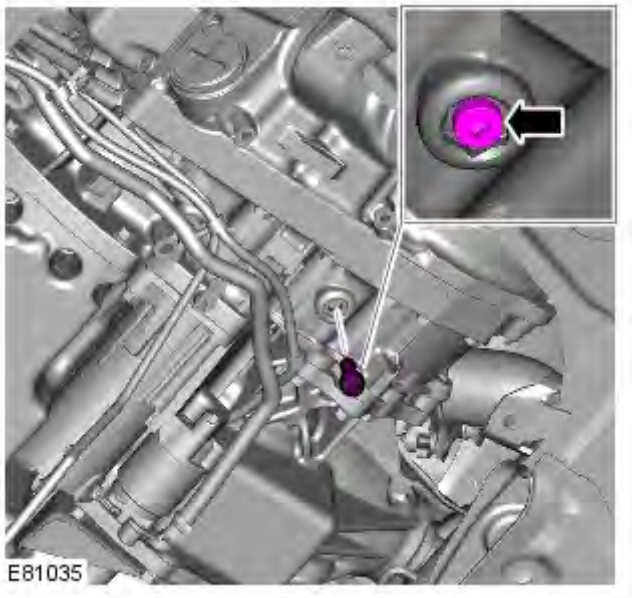
Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

13. Connect the Land Rover approved diagnostic equipment. Start and run the engine.

14. Using the diagnostic equipment to monitor the transmission fluid temperature, allow the temperature to reach 60 degrees C.

15. Move the selector lever from 'P' through all the gear positions, pausing in each gear position for 2-3 seconds and return to the 'P' position.

16. Raise the vehicle.



17. **17.** WARNING: Wear protective gloves.

    • NOTE: The fluid level plug and drain plug both use the same point on the transmission. The inner plug is the level indication and the outer plug is to drain the fluid.

    Remove the transmission fluid level plug.

18. With the engine running a small amount of fluid should drip out of the level plug.

19. **19.** CAUTION: A new O-ring seal is to be installed.

    Install the transmission fluid level plug.

    Torque: 7 Nm

20. Install the front undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

Published: 11-May-2011

Automatic Transmission/Transaxle - Transmission Fluid Drain and RefillI6 3.2L Petrol

General Procedures

WARNING: Observe due care when draining, as the fluid can be very hot.

1. Ensure that the automatic transmission is in 'P' and the handbrake is fully applied.
2. Remove the air cleaner housing.

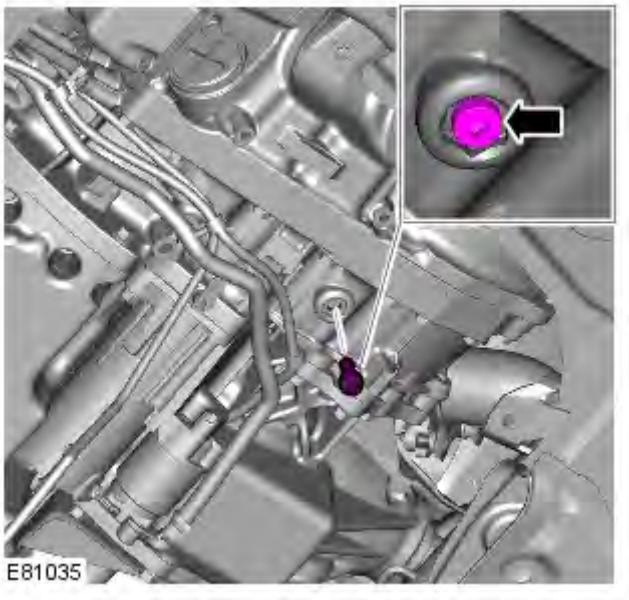
   Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).
3. Clean the area around the transmission fluid filler plug.

4. Remove the transmission fluid filler plug.
5. **5.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   • NOTE: Make sure that the vehicle is standing on a level surface.

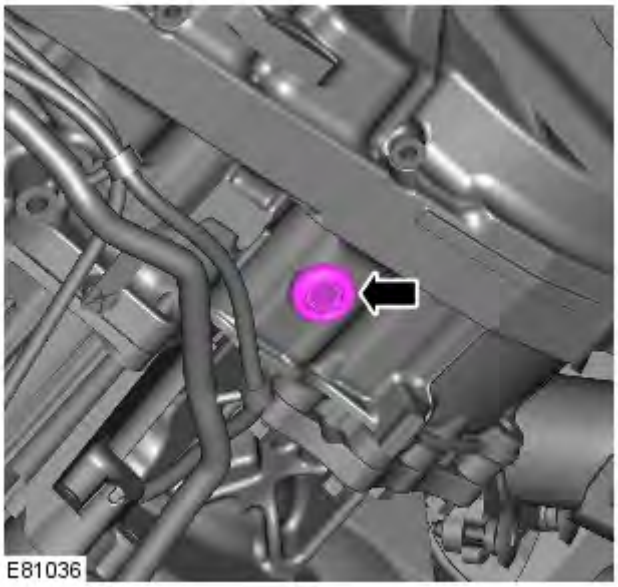
   Raise and support the vehicle.
6. Remove the front undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
7. Clean the area around the transmission fluid level and drain plugs.
8. Place a container under the transmission.



9. **9.** NOTE: The fluid level plug and drain plug both use the same point on the transmission. The inner plug is for level indication and the outer plug is to drain the fluid.

   Remove the transmission fluid level plug.



10. Remove the transmission fluid drain plug.

11. **11.** NOTE: Install a new gasket.

    Install the transmission fluid drain plug.

    Torque: 47 Nm

12. Lower the vehicle.

13. Fill the transmission with the correct fluid until it runs from the level plug.

14. Install the transmission fluid level plug.

    Torque: 7 Nm

15. Add an additional 0.5 litres of transmission fluid.

16. **16.** CAUTION: A new O-ring seal is to be installed.

    Install the transmission fluid filler plug.

Torque: 40 Nm

17. Install the air cleaner housing.

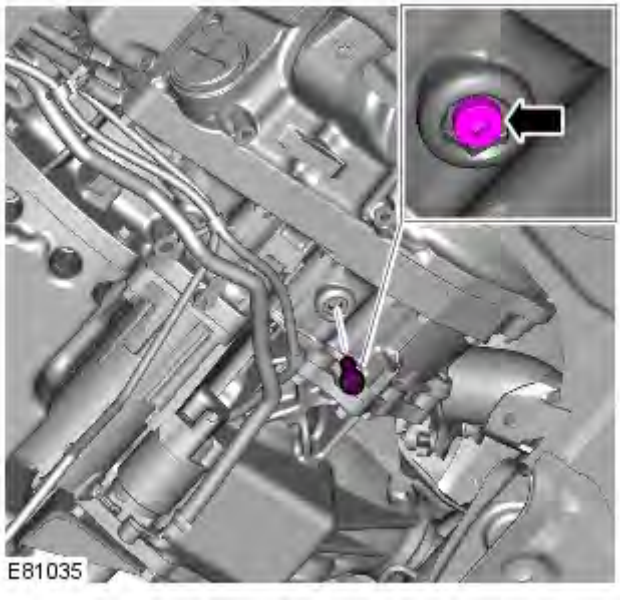
    Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

18. Connect the Land Rover approved diagnostic equipment. Start and run the engine.

19. Using the diagnostic equipment to monitor the transmission fluid temperature, allow the temperature to reach 60 degrees C.

20. Move the selector lever from 'P' through all the gear positions, pausing in each gear position for 2-3 seconds and return to the 'P' position.

21. Raise the vehicle.



22. **22.** WARNING: Wear protective gloves.

    Remove the transmission fluid level plug.

23. With the engine running a small amount of fluid should drip out of the level plug.

24. **24.** CAUTION: A new O-ring seal is to be installed.

    Install the transmission fluid level plug.

    Torque: 7 Nm

25. Install the front undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

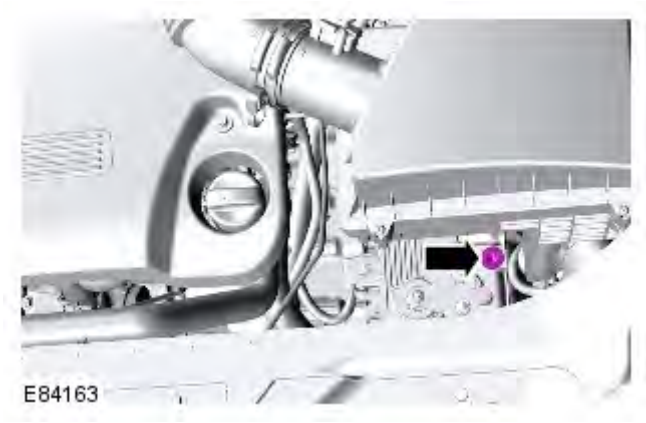
Published: 11-May-2011

Automatic Transmission/Transaxle - Transmission Fluid Level CheckTD4 2.2L Diesel

General Procedures

WARNING: Observe due care when draining, as the fluid can be very hot.

1. Ensure that the automatic transmission is in 'P' and the handbrake is fully applied.
2. Clean the area around the transmission fluid filler plug.
3. Remove the transmission fluid filler plug.



4. **4.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   • NOTE: Make sure that the vehicle is standing on a level surface.

   Raise and support the vehicle.
5. Remove the front undershield.

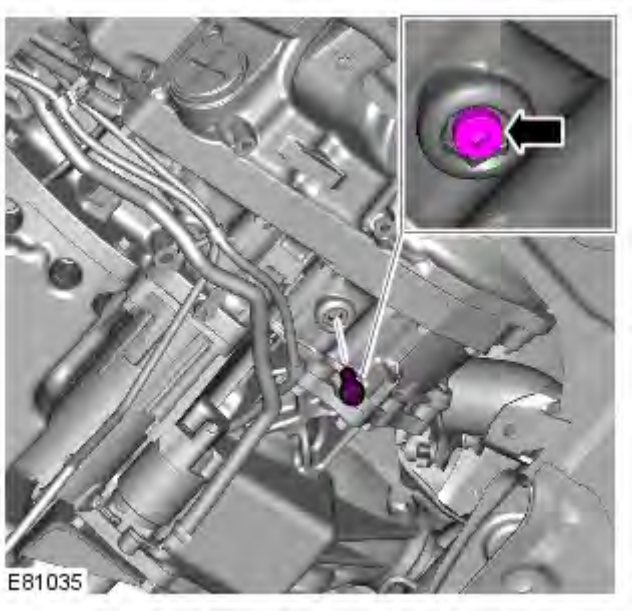
   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
6. Clean the area around the transmission fluid level plug.
7. Place a container under the transmission.
8. Lower the vehicle.
9. Add 0.5 litres of transmission fluid.
10. **10.** CAUTION: A new O-ring seal is to be installed.

    Install the transmission fluid filler plug.

    Torque: 40 Nm
11. Connect the Land Rover approved diagnostic equipment. Start and run the engine.
12. Using the diagnostic equipment to monitor the transmission fluid temperature, allow the temperature to reach 60 degrees C.

13. Move the selector lever from 'P' through all the gear positions, pausing in each gear position for 2-3 seconds and return to the 'P' position.

14. Raise the vehicle.



15. **15.** NOTE: The fluid level plug and drain plug both use the same point on the transmission. The inner plug is the level indication and the outer plug is to drain the fluid.

    Remove the transmission fluid level plug.

16. With the engine running a small amount of fluid should drip out of the level plug.

17. **17.** CAUTION: A new O-ring seal is to be installed.

    Install the transmission fluid level plug.

    Torque: 7 Nm

18. Install the front undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

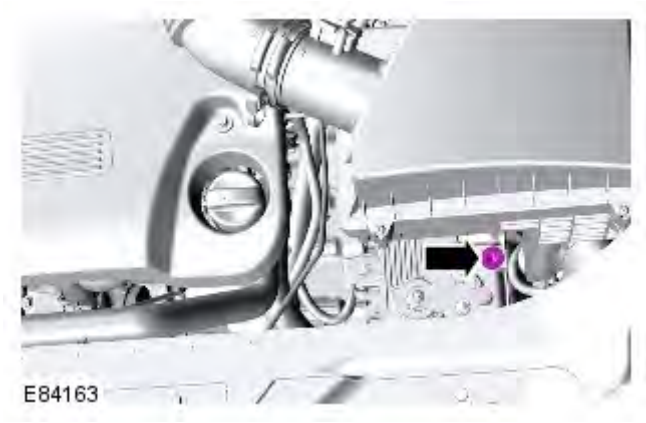
Published: 11-May-2011

Automatic Transmission/Transaxle - Transmission Fluid Drain and RefillTD4 2.2L Diesel

General Procedures

WARNING: Observe due care when draining, as the fluid can be very hot.

1. Ensure that the automatic transmission is in 'P' and the handbrake is fully applied.
2. Clean the area around the transmission fluid filler plug.

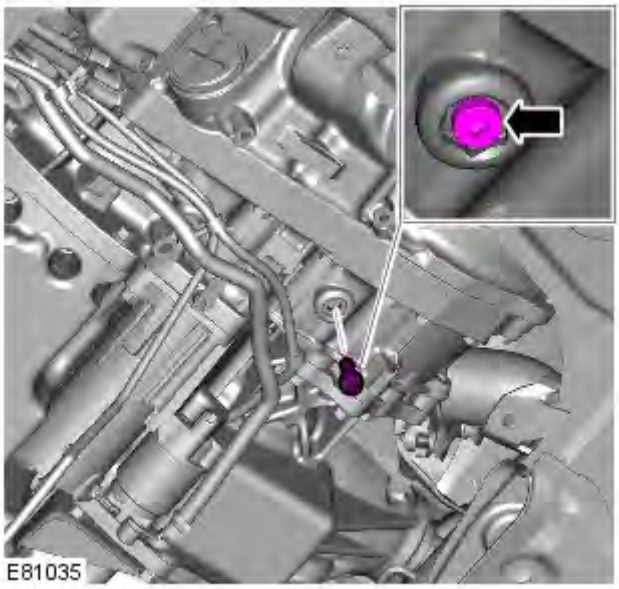


3. Remove the transmission fluid filler plug.
4. **4.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

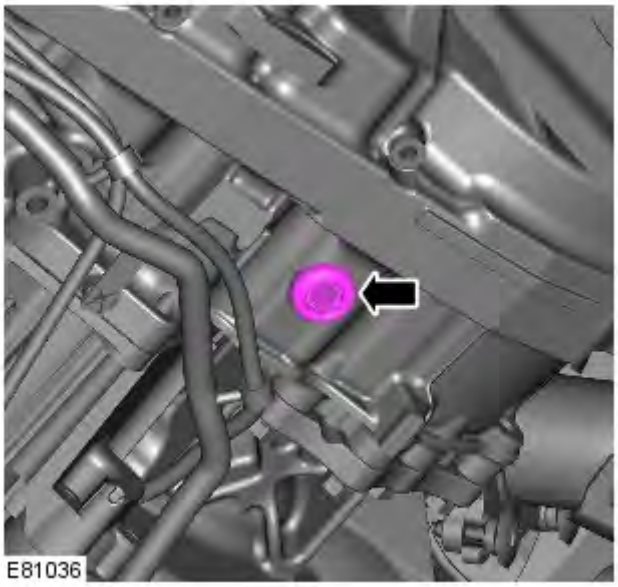
   • NOTE: Make sure that the vehicle is standing on a level surface.

   Raise and support the vehicle.
5. Remove the front undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
6. Clean the area around the transmission fluid level and drain plugs.
7. Place a container under the transmission.



8. Remove the transmission fluid level plug.



9. Remove the transmission fluid drain plug.

10. **10.** NOTE: Install a new gasket.

    Install the transmission fluid drain plug.

    Torque: 47 Nm

11. Lower the vehicle.

12. Fill the transmission with the correct fluid until it runs from the level plug.

13. Install the transmission fluid level plug.

    Torque: 7 Nm

14. Add an additional 0.5 litres of transmission fluid.

15. **15.** CAUTION: A new O-ring seal is to be installed.

    Install the transmission fluid filler plug.

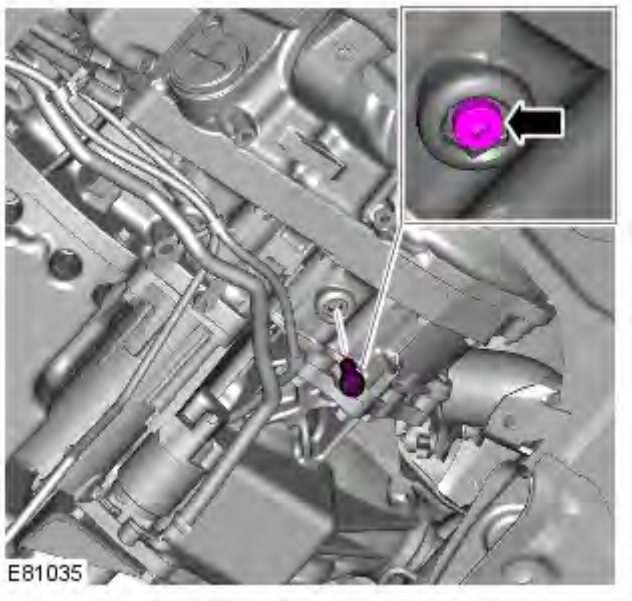
Torque: 40 Nm

16. Connect the Land Rover approved diagnostic equipment. Start and run the engine.

17. Using the diagnostic equipment to monitor the transmission fluid temperature, allow the temperature to reach 60 degrees C.

18. Move the selector lever from 'P' through all the gear positions, pausing in each gear position for 2-3 seconds and return to the 'P' position.

19. Raise the vehicle.



20. **20.** WARNING: Wear protective gloves.

    • NOTE: The fluid level plug and drain plug both use the same point on the transmission. The inner plug is the level indication and the outer plug is to drain the fluid.

    Remove the transmission fluid level plug.

21. With the engine running a small amount of fluid should drip out of the level plug.

22. **22.** CAUTION: A new O-ring seal is to be installed.

    Install the transmission fluid level plug.

    Torque: 7 Nm

23. Install the front undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

Published: 11-May-2011

Automatic Transmission/Transaxle - Selector Shaft SealI6 3.2L Petrol

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the transmission control module (TCM).

   Refer to: Transmission Control Module (TCM) - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, Removal and Installation).

4. **4.** CAUTIONS:

   Take extra care not to damage the mating faces.

   "Make sure that a new component is installed. "

Installation

1. **1.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Install the seal, flush with the transmission case.

   To install, reverse the removal procedure.

Published: 11-May-2011

Automatic Transmission/Transaxle - Selector Shaft SealTD4 2.2L Diesel

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the transmission control module (TCM).

   Refer to: Transmission Control Module (TCM) - TD4 2.2L Diesel (307-01 Automatic Transmission/Transaxle, Removal and Installation).

4. **4.** CAUTIONS:

   Take extra care not to damage the mating faces.

   "Make sure that a new component is installed. "

Installation

1. **1.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Install the seal, flush with the transmission case.

   To install, reverse the removal procedure.

Published: 11-May-2011

Automatic Transmission/Transaxle - Transmission Control Module (TCM)I6 3.2L Petrol

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

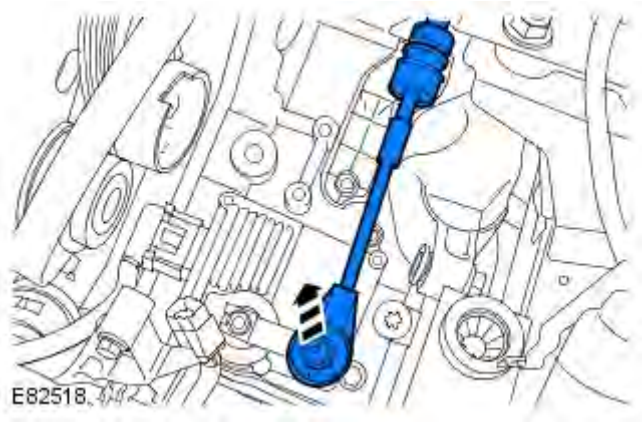
   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

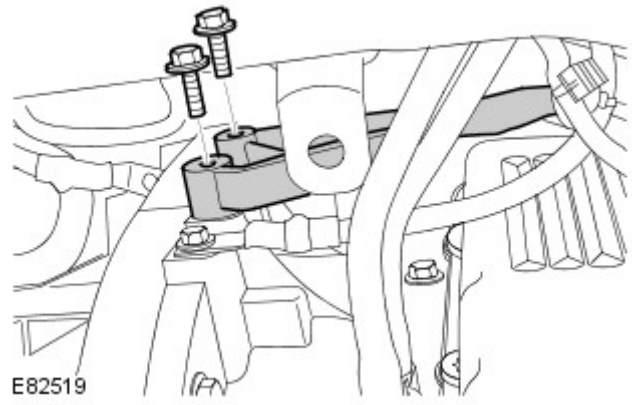
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the A/C compressor mounting bracket.

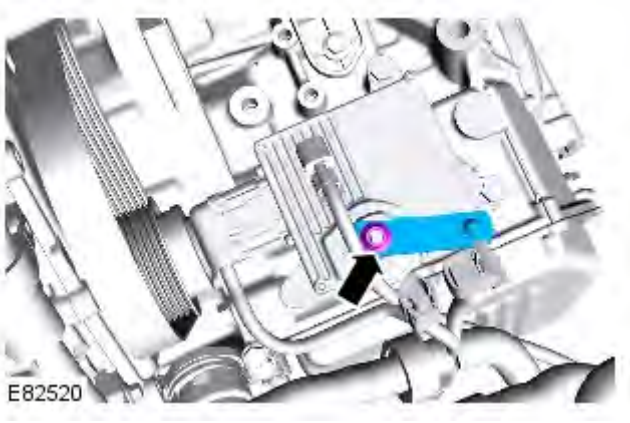
   Refer to: Accessory Drive Component Bracket (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).



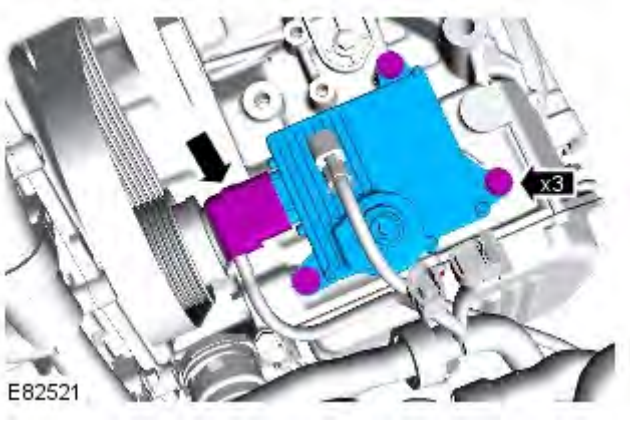
4. Release and disconnect the selector lever cable.



5. Release the support bracket.



6. Remove the transmission selector lever.



7.

Installation

1. Install the TCM.

   Torque: 24 Nm

2. Install the transmission selector lever.

   Torque: 13 Nm

3. Secure and connect the selector lever cable.

4. Install the support bracket.

   Torque: 25 Nm

5. Install the A/C compressor mounting bracket.

   Refer to: Accessory Drive Component Bracket (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

6. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

7. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Automatic Transmission/Transaxle - Transmission Control Module (TCM)TD4 2.2L Diesel

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

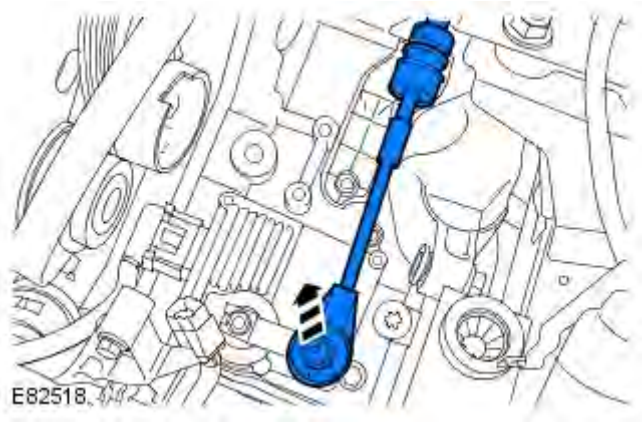
   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

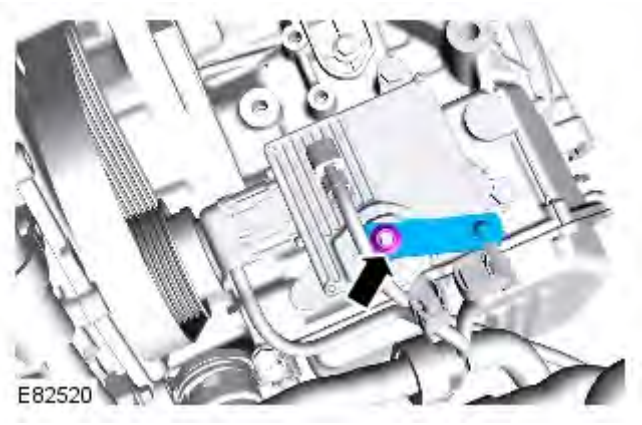
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the air cleaner assembly.

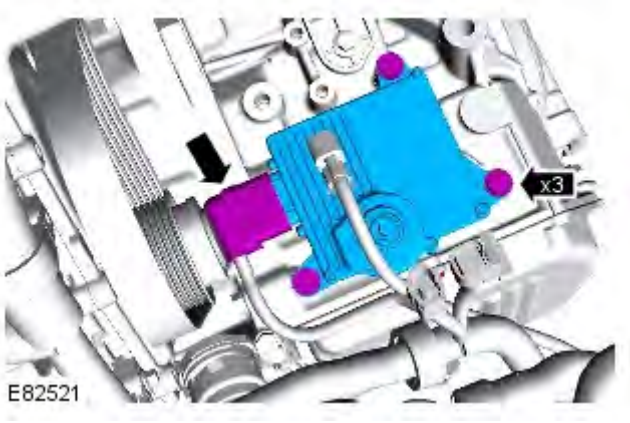
   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).



4. Release and disconnect the selector lever cable.



5. Remove the transmission selector lever.



6. Remove the transmission control module (TCM).

Installation

1. Install the TCM.

   Torque: 24 Nm

2. Install the transmission selector lever.

   Torque: 13 Nm

3. Secure and connect the selector lever cable.

4. Install the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

5. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

6. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Automatic Transmission/Transaxle - Torque Converter SealI6 3.2L Petrol

Removal and Installation

Special Tool(s)

	307-597 Installer, Torque Converter Seal
	307-613 Holding Pins, Torque Converter

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the transmission and converter.

   Refer to: Transmission - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, Removal).

4. Remove the torque converter retainer.

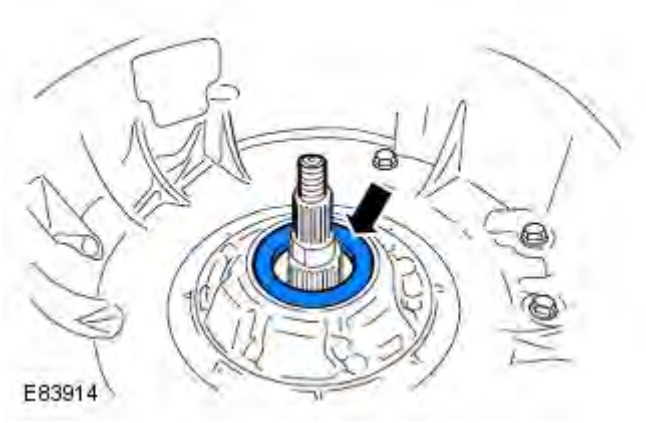
5. **5.** CAUTIONS:

   Be prepared to collect escaping oil.

   Make sure that all openings are sealed.

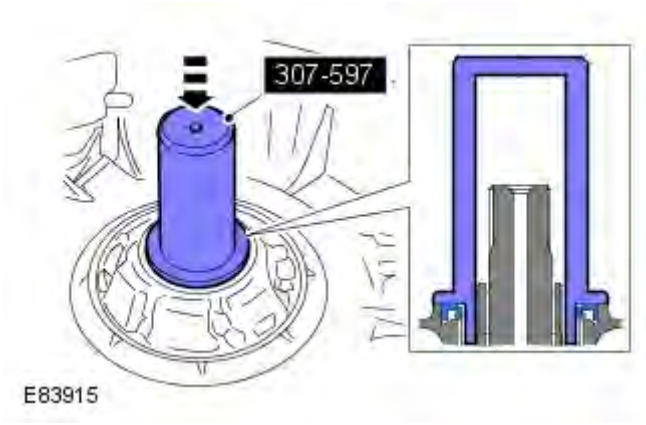
   Remove the torque converter.

   Special Tool(s): 307-613



6. Carefully remove and discard the torque converter fluid seal.

Installation



1. **1.** CAUTIONS:

   Extreme cleanliness must be exercised when handling this component.

   Make sure that the mating faces are clean and free of foreign material.

   Install a new torque converter fluid seal.

   Special Tool(s): 307-597

2. **2.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Take extra care when handling the component.

   Align the torque converter and oil pump drive before installing the torque converter.

   - While installing the torque converter, carefully rotate the torque converter until the oil pump drive engages.

     Special Tool(s): 307-613

3. Install the torque converter retainer.

4. Install the transmission and converter.

   Refer to: Transmission - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, Removal).

5. Connect the battery ground cable and install the cover.

Published: 11-May-2011

Automatic Transmission/Transaxle - Torque Converter SealTD4 2.2L Diesel

Removal and Installation

Special Tool(s)

	307-597 Installer, Torque Converter Seal
	307-613 Holding Pins, Torque Converter

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the transmission and converter.

   Refer to: Transmission - TD4 2.2L Diesel (307-01 Automatic Transmission/Transaxle, Installation).

4. Remove the torque converter retainer.

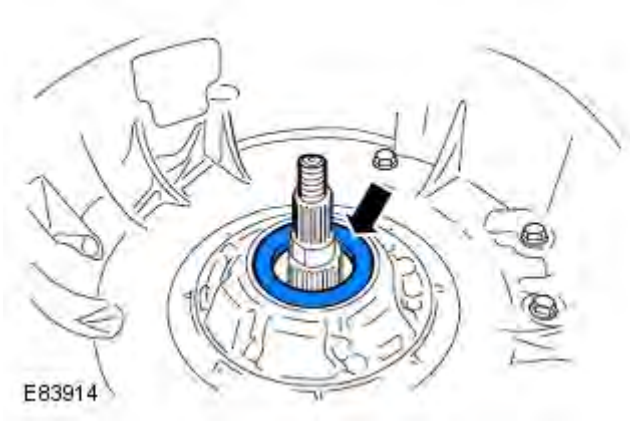
5. **5.** CAUTIONS:

   Be prepared to collect escaping oil.

   Make sure that all openings are sealed.

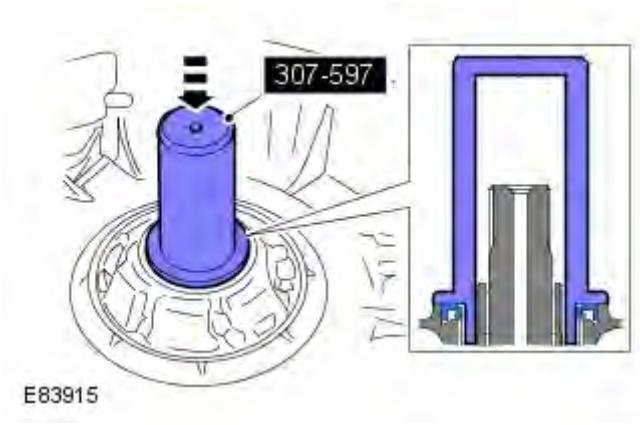
   Remove the torque converter.

   Special Tool(s): 307-613



6. Carefully remove and discard the torque converter fluid seal.

Installation



1. **1.** CAUTIONS:

   Extreme cleanliness must be exercised when handling this component.

   Make sure that the mating faces are clean and free of foreign material.

   Install a new torque converter fluid seal.

   Special Tool(s): 307-597

2. **2.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Take extra care when handling the component.

   Align the torque converter and oil pump drive before installing the torque converter.

   - While installing the torque converter, carefully rotate the torque converter until the oil pump drive engages.

     Special Tool(s): 307-613

3. Install the torque converter retainer.

4. Install the transmission and converter.

   Refer to: Transmission - TD4 2.2L Diesel (307-01 Automatic Transmission/Transaxle, Installation).

5. Connect the battery ground cable and install the cover.

Published: 11-May-2011

Automatic Transmission/Transaxle - Input Shaft Speed (ISS) SensorI6 3.2L Petrol

Removal and Installation

Removal

CAUTION: Extreme cleanliness must be exercised when handling these components.

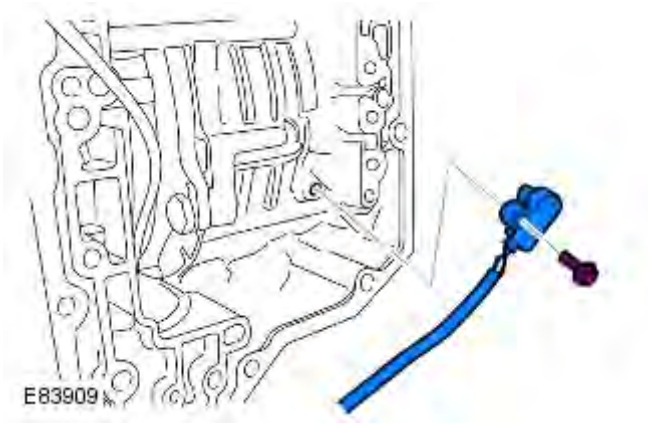
• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the valve body.

   Refer to: Main Control Valve Body (307-01 Automatic Transmission/Transaxle, Removal and Installation).



3. **3.** CAUTION: Extreme cleanliness must be exercised when handling this component.

   Torque: 6 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Automatic Transmission/Transaxle - Transmission Fluid Pan, Gasket and Filter

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

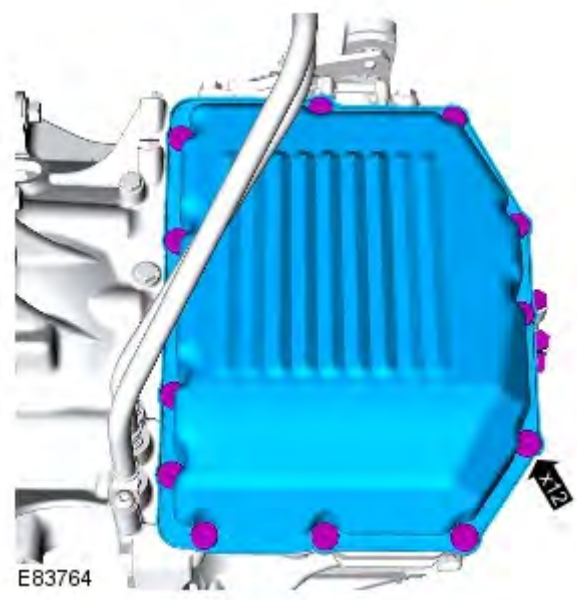
3. Drain the transmission fluid.

   Refer to: Transmission Fluid Drain and Refill - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, General Procedures).

4. Remove the front subframe assembly.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

5. **5.** CAUTION: Be prepared to collect escaping oil.

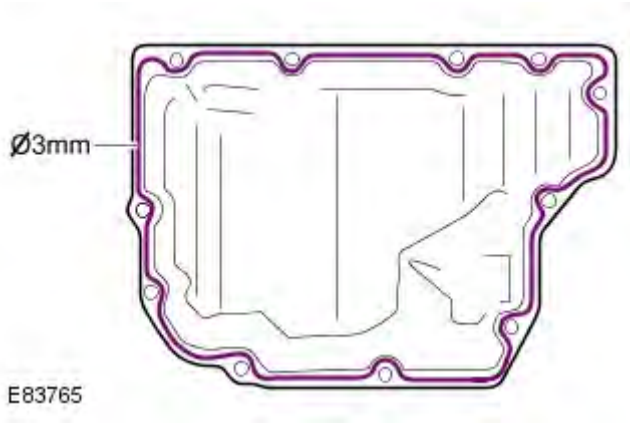


6. Remove the gasket.

Installation

1. For sealant specification, refer to the specifications section.

   Refer to: Specifications (307-01 Automatic Transmission/Transaxle, Specifications).



2. Apply a bead of sealant, 3 mm diameter, to the area indicated.

3. Install the fluid pan.

   Torque: 14 Nm

4. Install the front subframe.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

5. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

6. Refill the transmission with fluid.

   Refer to: Transmission Fluid Drain and Refill - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, General Procedures).

Published: 11-May-2011

Automatic Transmission/Transaxle - Transmission Fluid Pan

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

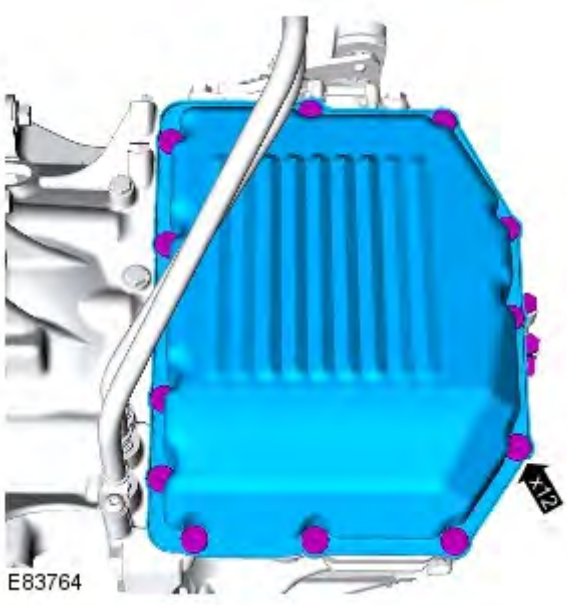
   Raise and support the vehicle.

2. Drain the transmission fluid.

   Refer to: Transmission Fluid Drain and Refill - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, General Procedures).

3. Remove the front subframe assembly.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



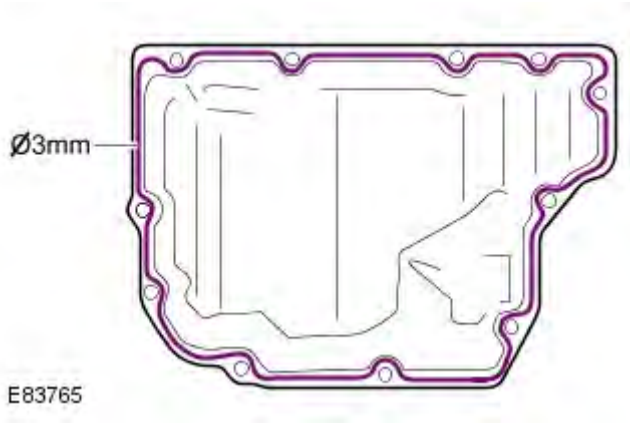
4. **4.** CAUTION: Be prepared to collect escaping oil.

5. Remove the gasket.

Installation

1. For sealant specification, refer to the specifications section.

   Refer to: Specifications (307-01 Automatic Transmission/Transaxle, Specifications).



2. Apply a bead of sealant, 3 mm diameter, to the area indicated.

3. Install the fluid pan and tighten in a diagonal sequence.

   Torque: 14 Nm

4. Install the front subframe.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

5. Refill the transmission with fluid.

   Refer to: Transmission Fluid Drain and Refill - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, General Procedures).

Published: 11-May-2011

Automatic Transmission/Transaxle - Main Control Valve Body

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

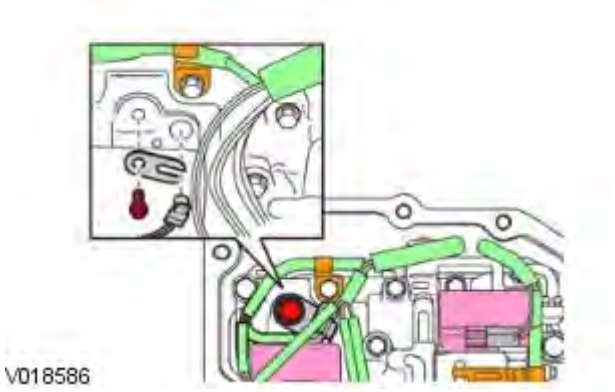
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the oil pan.

   Refer to: Transmission Fluid Pan (307-01 Automatic Transmission/Transaxle, Removal and Installation).


V018586

4. Remove the oil temperature sensor.

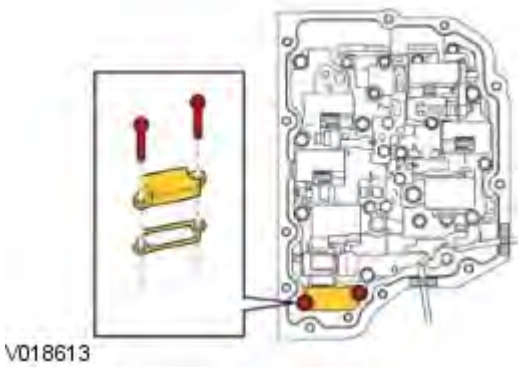
V018585

5. **5.** CAUTIONS:

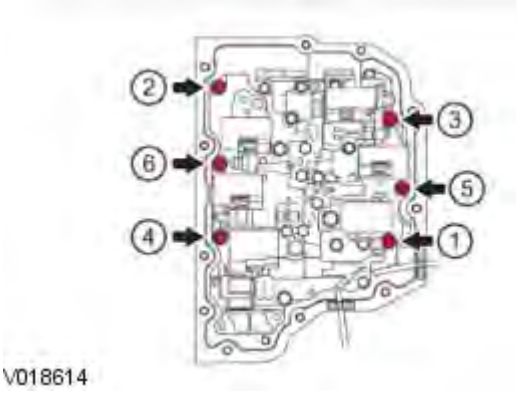
   Take extra care not to damage the wiring harnesses.

   Note the fitted position of the component prior to removal.

   Release the transmission wiring harness.


V018613

6. Remove the suction cover and discard the gasket.



V018614

7.

V018615

8. **8.** CAUTIONS:

⚠ Note the fitted position of the component prior to removal.

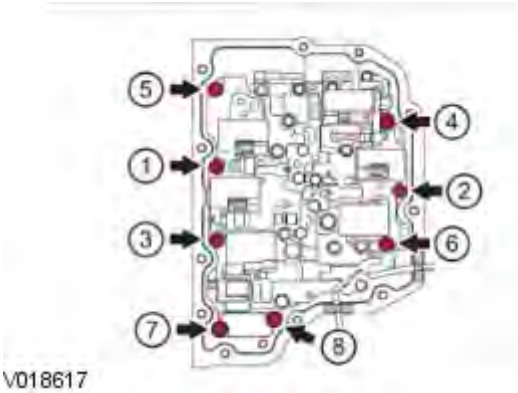
⚠ Take extra care not to damage the wiring harnesses.

Installation

1. **1.** NOTE: Make sure that this component is installed to the noted removal position.

   Install the valve body, do not tighten at this stage.

2. Install the suction cover and new gasket, do not tighten at this stage.



V018617

3. Tighten the bolts in the sequence illustrated.

   Torque: 10 Nm

4. **4.** ⚠ CAUTION: Make sure that the wiring harnesses are correctly located.

   Position and connect the wiring harness.

5. **5.** ⚠ CAUTION: A new O-ring seal is to be installed.

   • NOTE: Lubricate the new O ring seal with transmission fluid.

   Install the oil temperature sensor.

Torque: 10 Nm

6. Install the oil pan.

   Refer to: Transmission Fluid Pan (307-01 Automatic Transmission/Transaxle, Removal and Installation).

7. Connect the battery ground cable and install the cover.

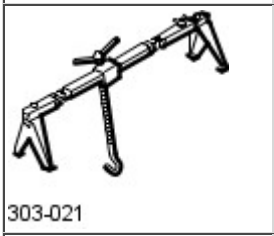
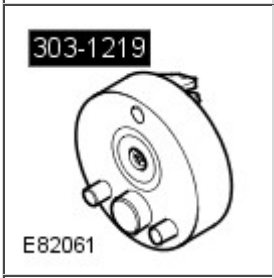
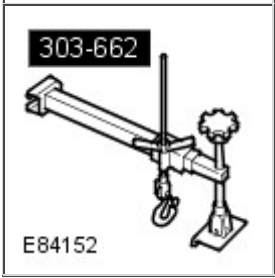
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Automatic Transmission/Transaxle - TransmissionI6 3.2L Petrol

Removal

Special Tool(s)

	205-857 Remover, Halfshaft
	303-021 Engine support bracket
	303-1219 Locking Tool, Crankshaft
	303-662 Support Beam Arm and Hook Assembly, Engine

General Equipment

Powertrain Jack

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the starter motor.

   Refer to: Starter Motor (303-06A Starting System - I6 3.2L Petrol, Removal and Installation).

4. Drain the transmission fluid.

   Refer to: Transmission Fluid Drain and Refill - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, General Procedures).

5. Drain the coolant.

Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

6. Remove the accessory drive pulley.

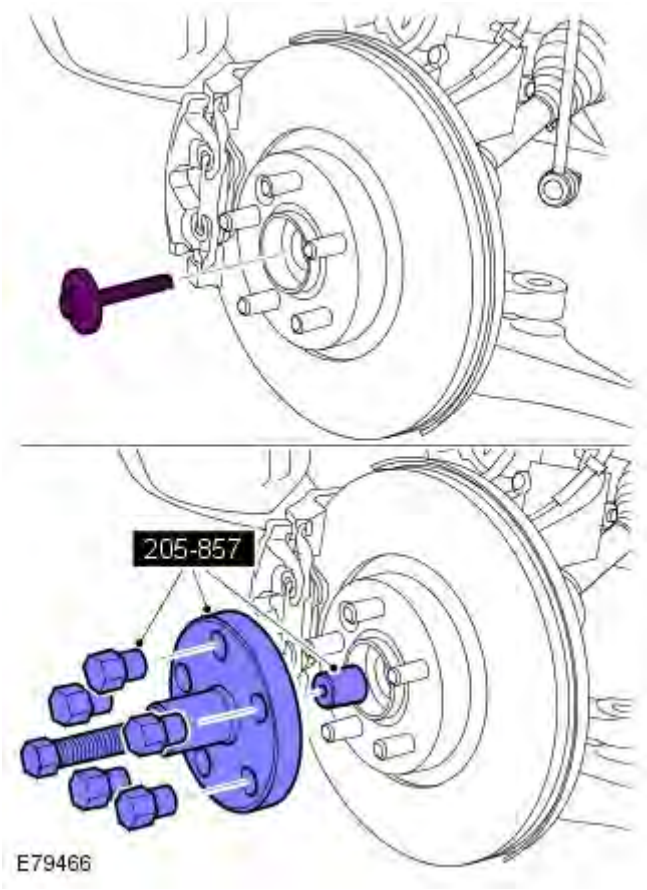
   Refer to: Accessory Drive Pulley (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

7. Remove the front subframe assembly.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

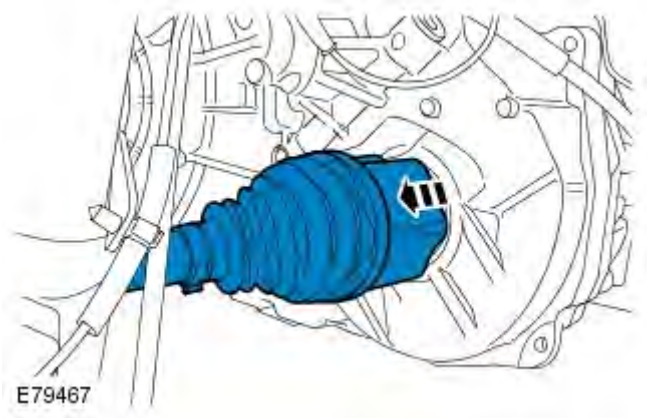
8. Remove the crankshaft front oil seal.

   Refer to: Engine Front Seal (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

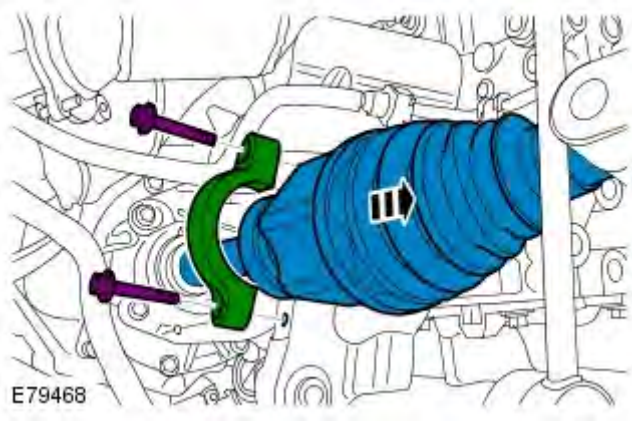


9. Release the LH and RH halfshafts.

   Special Tool(s): 205-857

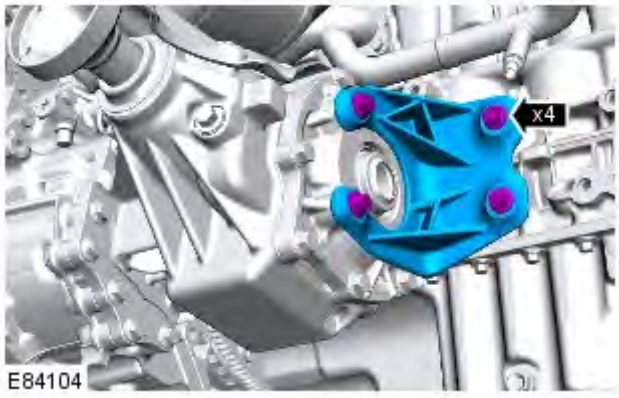


10. Remove the LH halfshaft.

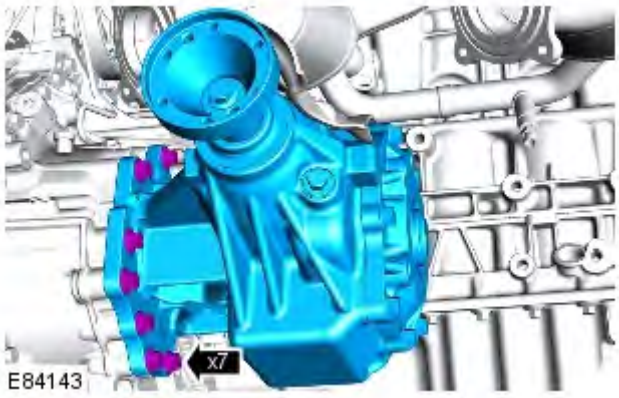


11. Remove the RH halfshaft.

12. Tie the suspension arms aside for access.

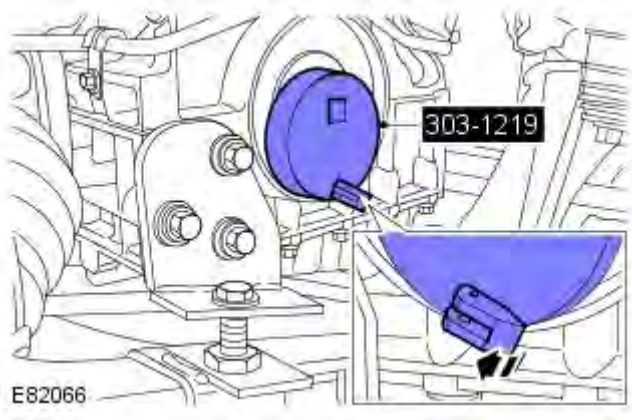


13. Remove the power transfer unit support bracket.



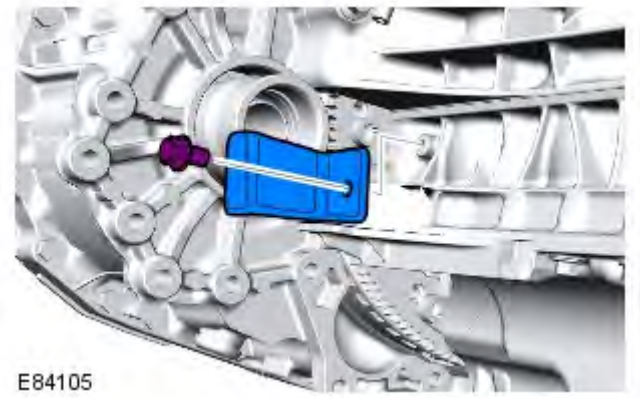
14. **14.** NOTE: This step requires the aid of another technician.

    Remove the power transfer unit assembly.

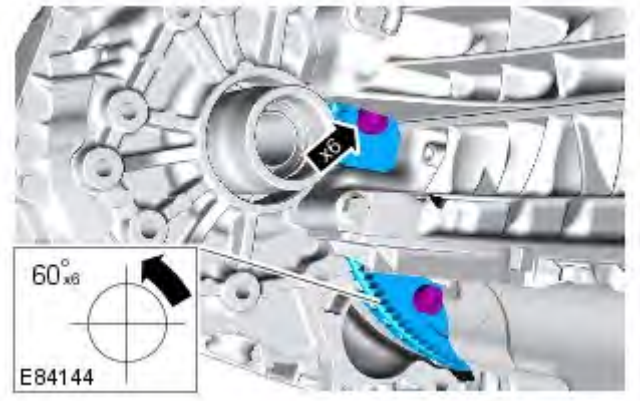


15. If the locking pin on the special tool is disengaged, the crankshaft can be rotated.

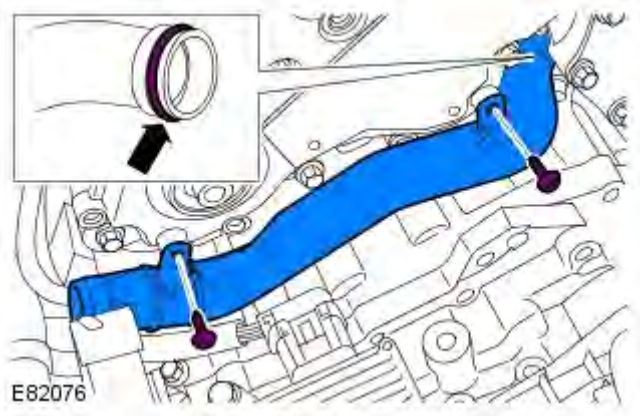
    Special Tool(s): 303-1219



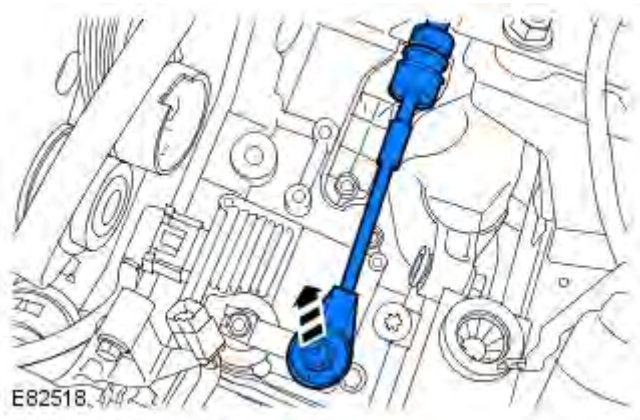
16. Remove the access cover.



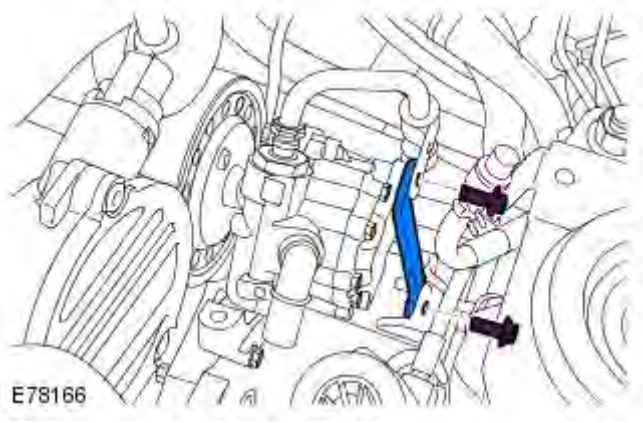
17. Release the flexplate.



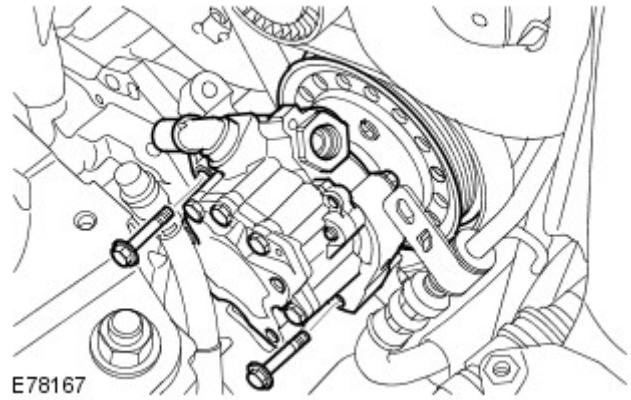
18. Remove the coolant pump inlet pipe.



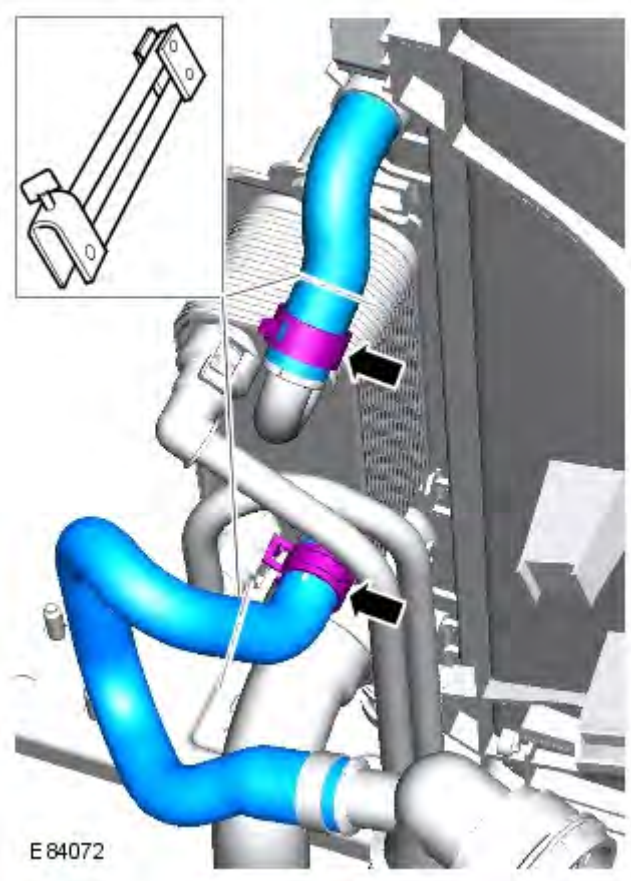
19. Release and disconnect the selector lever cable.



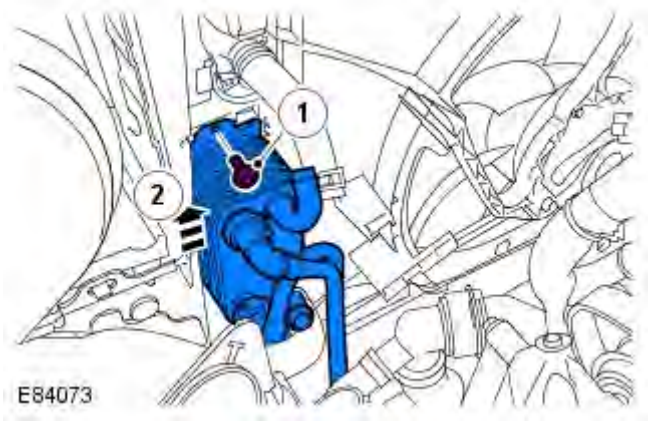
20. Release the power steering pump mounting bracket.



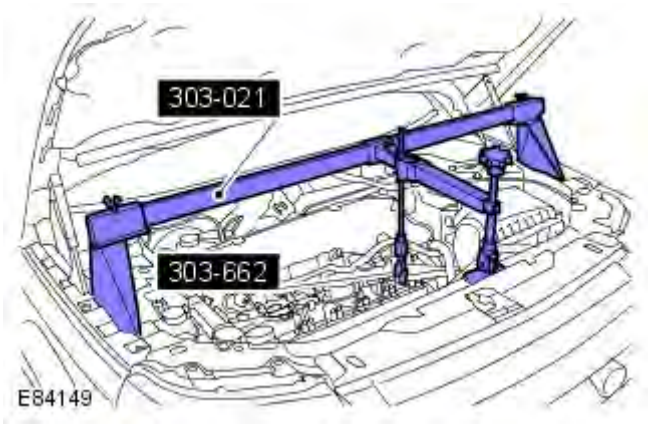
21. Release the power steering pump and tie aside



22. Disconnect the 2 transmission fluid cooler coolant hoses.



23. Release the automatic transmission fluid cooler.

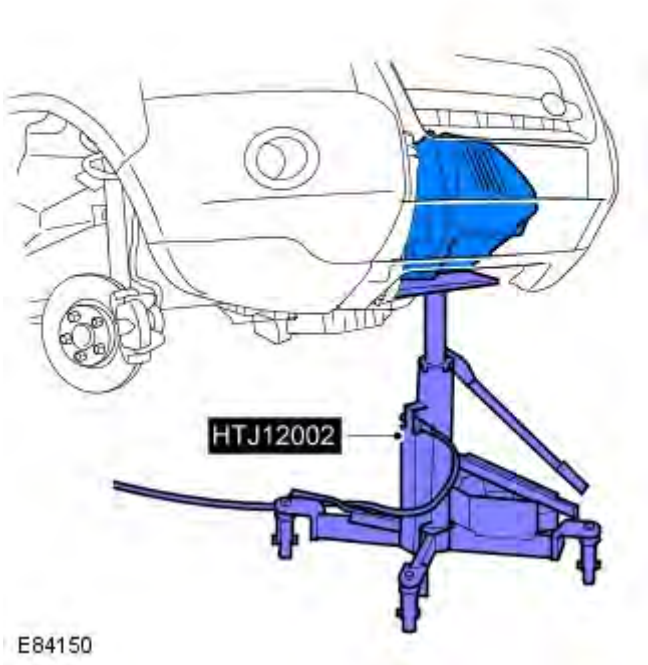


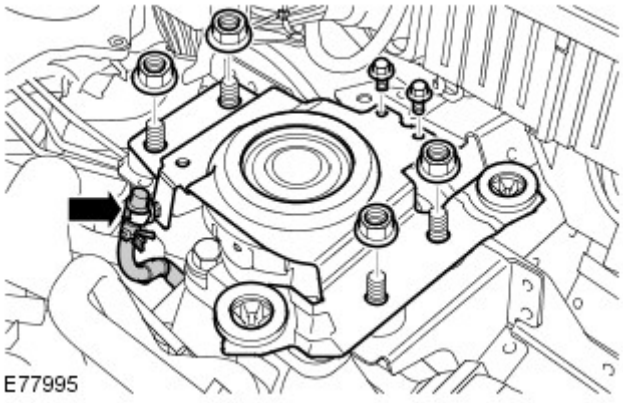
24. Support the engine.

    Special Tool(s): 303-021, 303-662

25. Support the transmission.

    General Equipment: Powertrain Jack

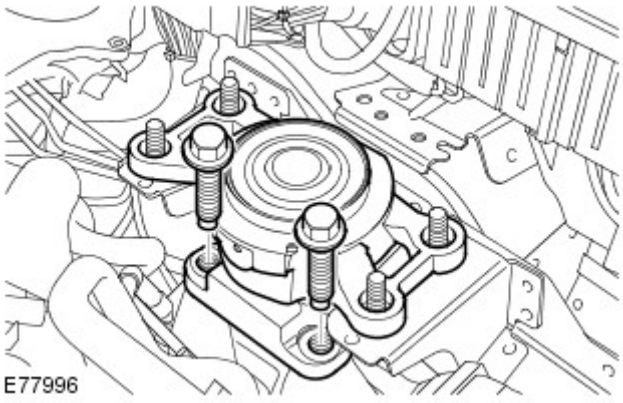




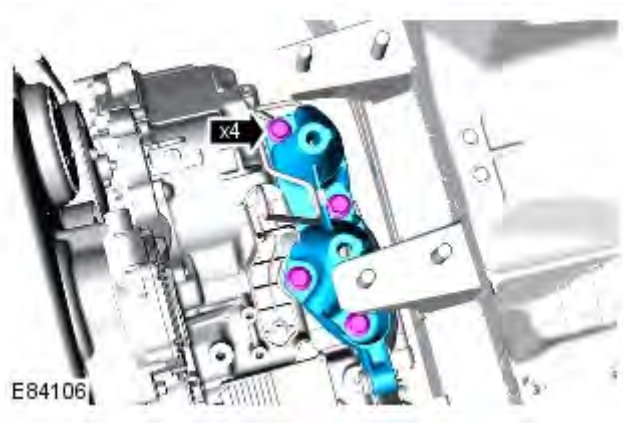
26. **26.** WARNING: Make sure that new nuts are installed.

    • NOTE: Vehicles with automatic transmission have a breather pipe attached to the mounting.

    Remove the bracket.

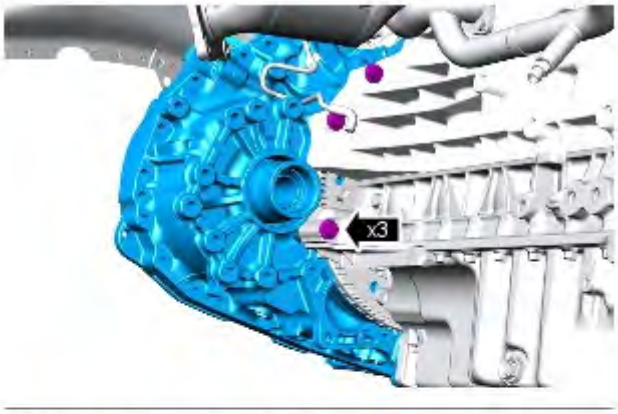


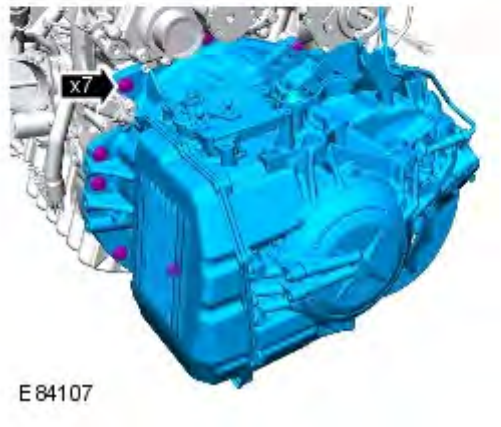
27. Remove the LH engine mount.



28. Remove the engine mount bracket.

29. Remove the 9 transmission bolts.





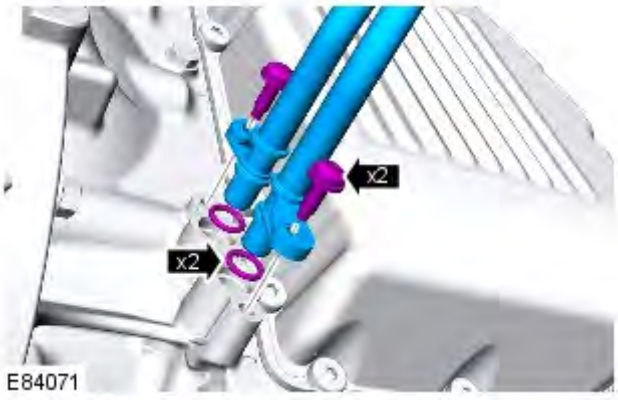
30. **30.** CAUTION: Make sure that the torque converter remains in the transmission.

    • NOTE: This step requires the aid of another technician.

    Remove the transmission and converter.

31. **31.** CAUTION: Make sure that the dowels are still located on the engine and not the transmission.

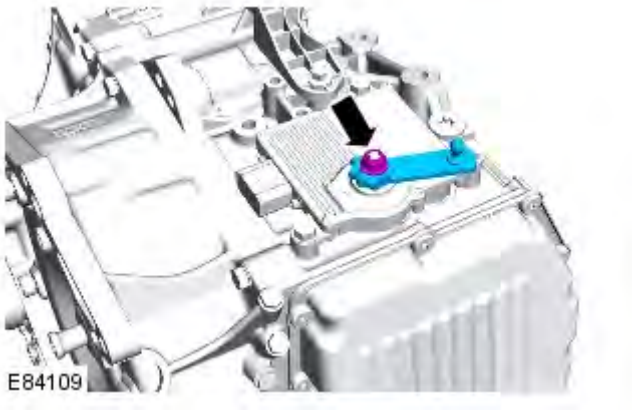
    Install the torque converter retainer.



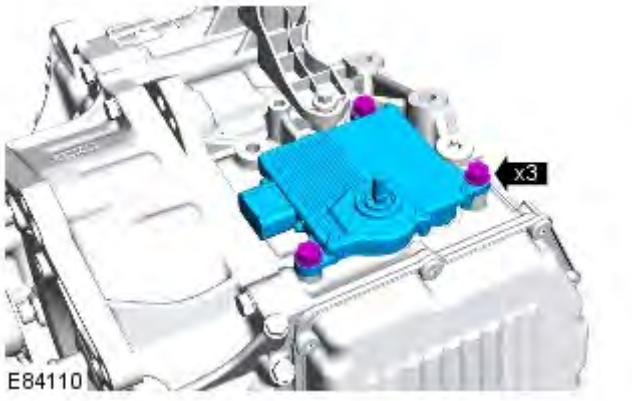
32. **32.** CAUTION: Be prepared to collect escaping fluids.

    • NOTE: Do not disassemble further if the component is removed for access only.

    Remove the transmission fluid cooler.



33. Remove the transmission selector lever.



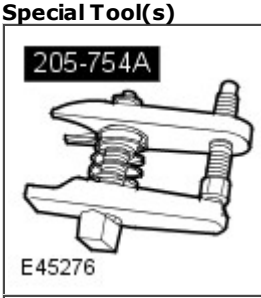
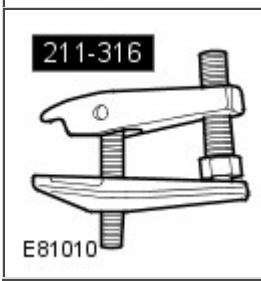
34. Remove the transmission control module (TCM).

Published: 11-May-2011

Automatic Transmission/Transaxle - TransmissionTD4 2.2L Diesel

Removal

Special Tool(s)

	205-754A Splitter, Ball Joints
	211-316 Separator, Ball Joint

General Equipment

Powertrain Jack

• NOTE: If the transmission is to be removed for access, there is no need to drain the transmission fluid as long as the fluid cooler is not disconnected from the transmission assembly.

• NOTE: If the transmission is to be removed for access, there is no need to drain the transmission fluid as long as the fluid cooler is not disconnected from the transmission assembly.

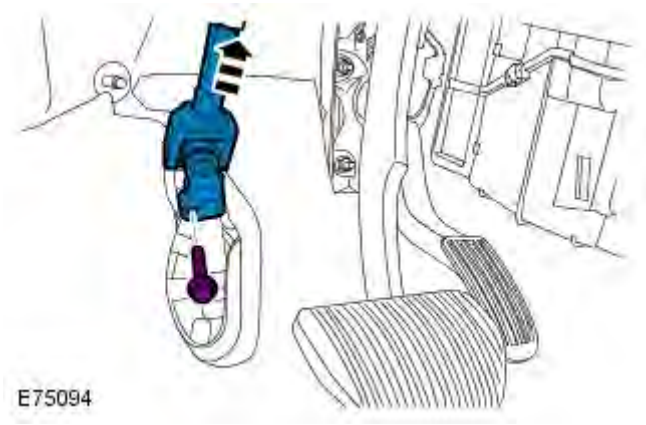
1. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Siphon the fluid from the power steering reservoir.

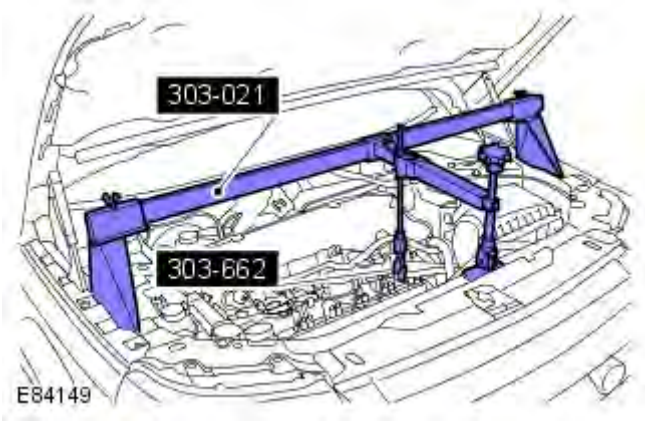


4. **4.** WARNING: Make sure that a new steering column flexible coupling bolt is installed.

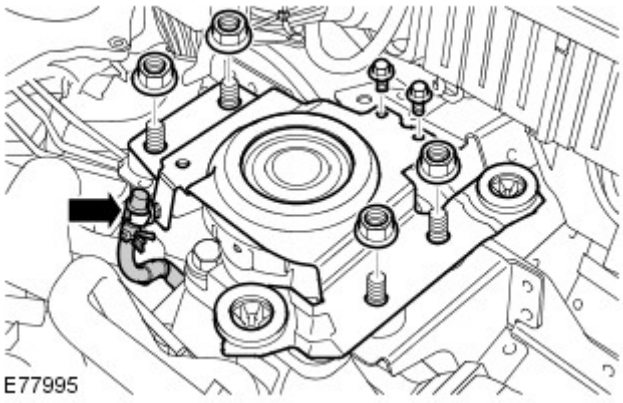
   Disconnect the lower steering column from the steering gear.

5. Remove the starter motor.

   Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).



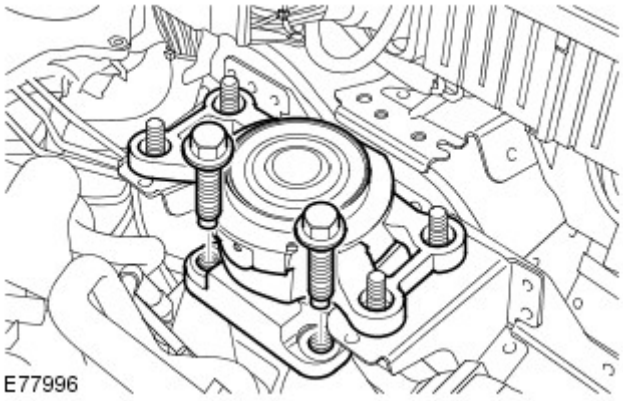
6. Support the engine.



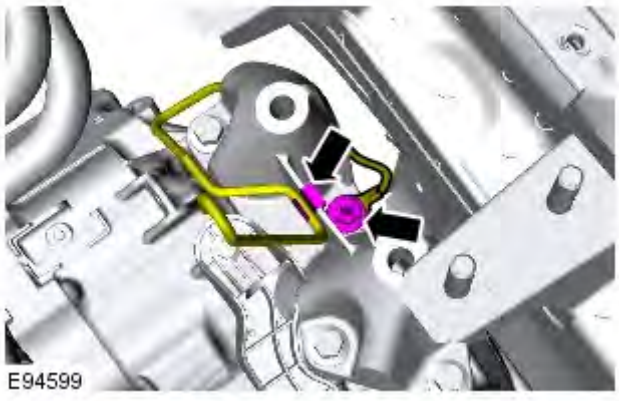
7. **7.** WARNING: Make sure that new nuts are installed.

   • NOTE: Vehicles with automatic transmission have a breather pipe attached to the mounting.

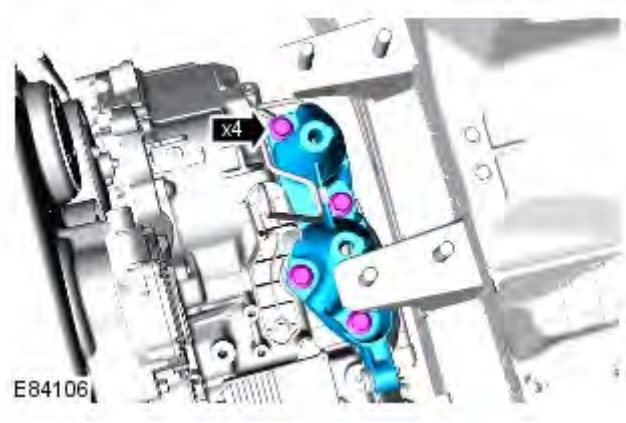
   Remove the bracket.



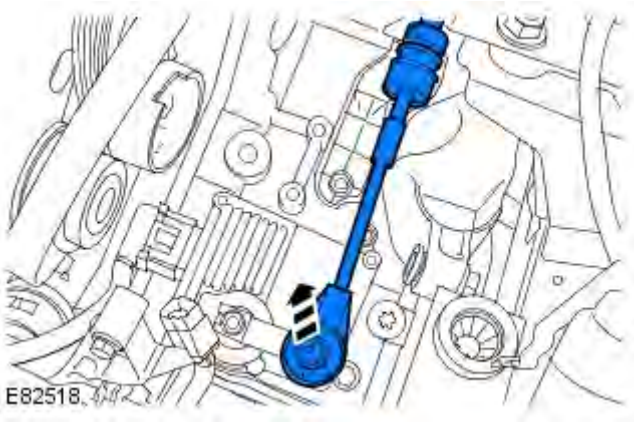
8. Remove the LH engine mount.



9. Remove the earth strap.



10. Remove the engine mount bracket.



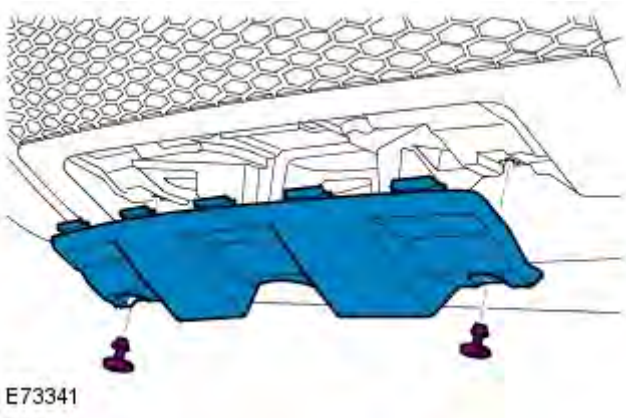
11. Release and disconnect the selector lever cable.

12. Drain the transmission fluid.

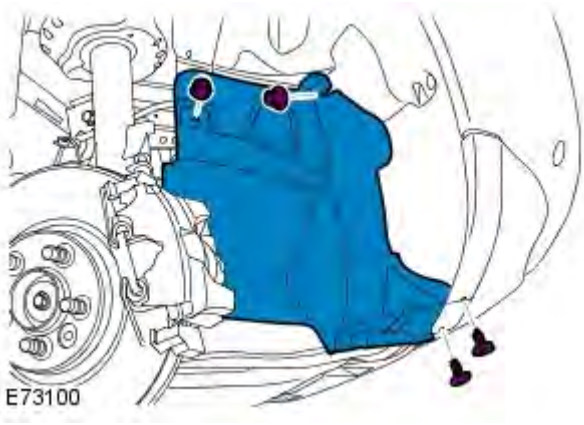
    Refer to: Transmission Fluid Drain and Refill - TD4 2.2L Diesel (307-01 Automatic Transmission/Transaxle, General Procedures).

13. Remove the front wheels and tires.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

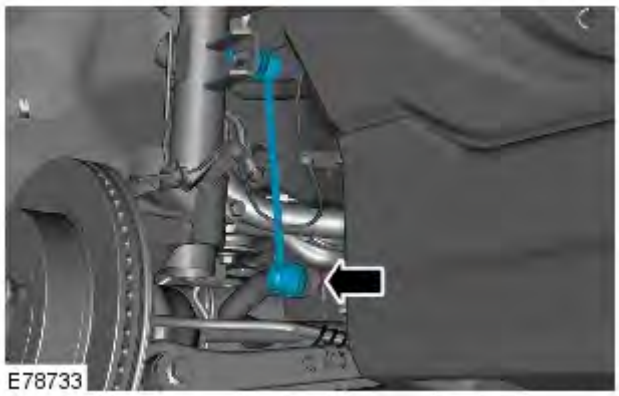


14. Remove the towing eye cover.
15. Remove the 2 bolts securing bumper cover.



16. **16.** NOTE: RH illustration shown, LH is similar.

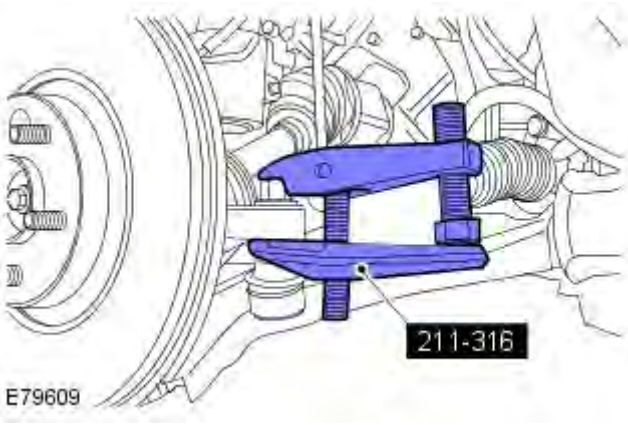
    Remove both the fender splash shield extension panels.



17. **17.** CAUTION: Make sure that the ball joint ball does not rotate.

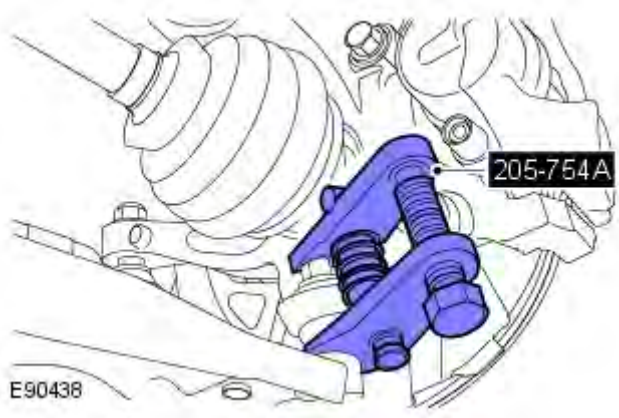
    • NOTE: Discard the 2 nuts.

    Disconnect both front stabilizer bar links from the stabilizer bar.



18. Using the special tool, release the LH and RH tie-rod end ball joints.

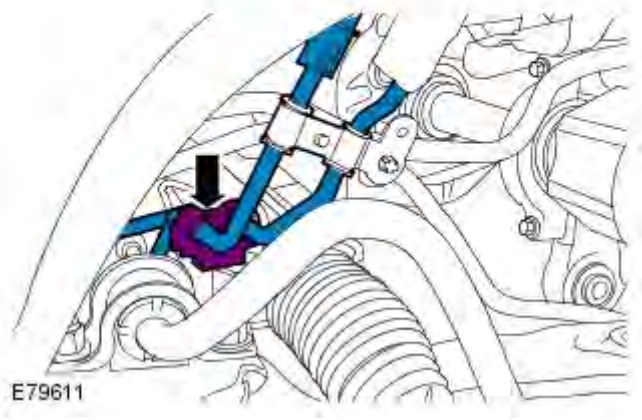
    Special Tool(s): 211-316

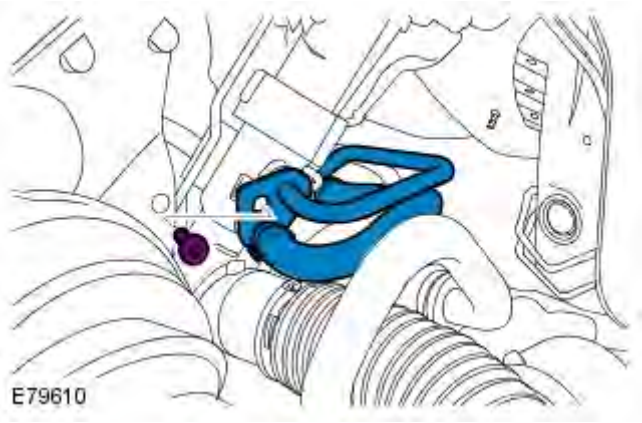


19. Using the special tool, remove the lower arm ball joint.

    Special Tool(s): 205-754A

20. Release the PAS lines.



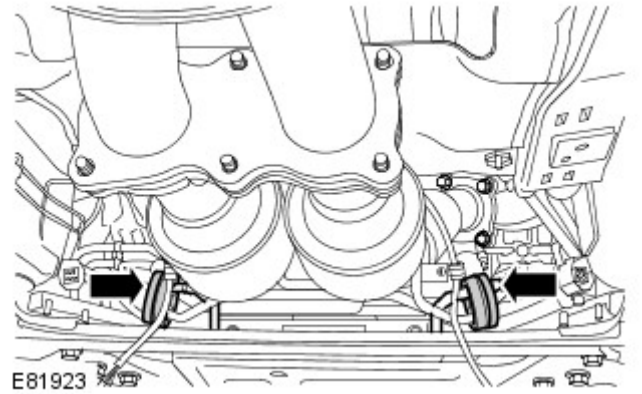


21. **21.** CAUTION: Be prepared to collect escaping fluids.

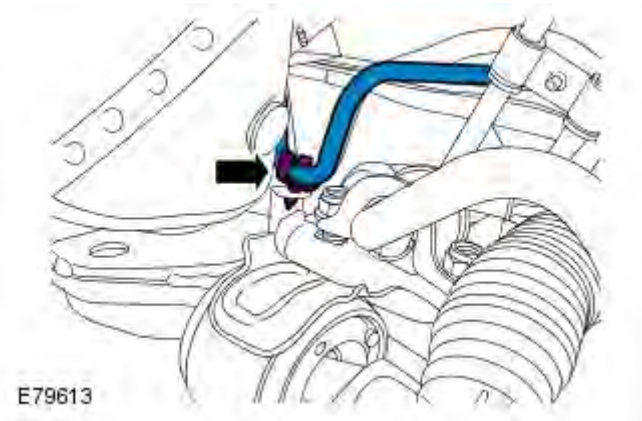
    • NOTE: Make sure that all openings are sealed.

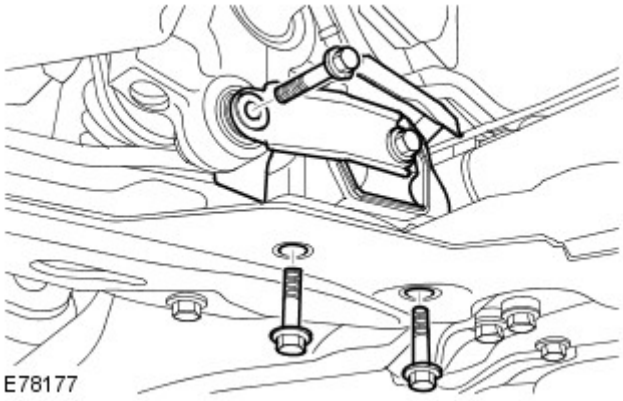
    Disconnect the pressure lines from the power steering gear.

22. Release the downpipe catalytic converter.

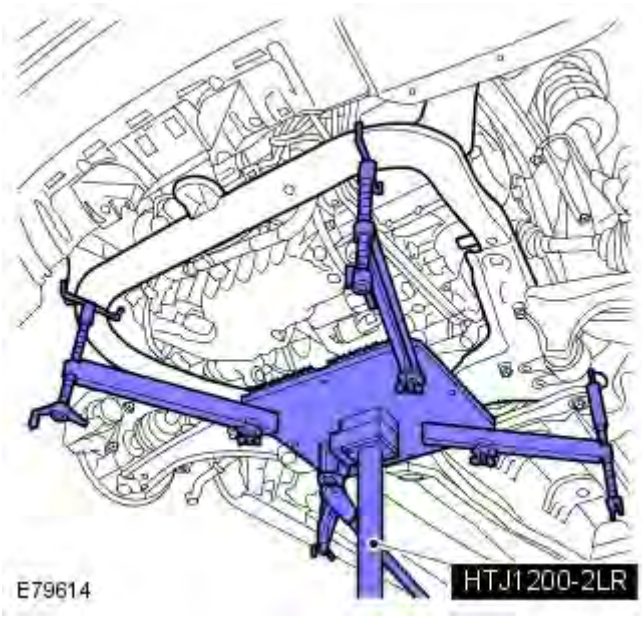


23. Release the fuel line.



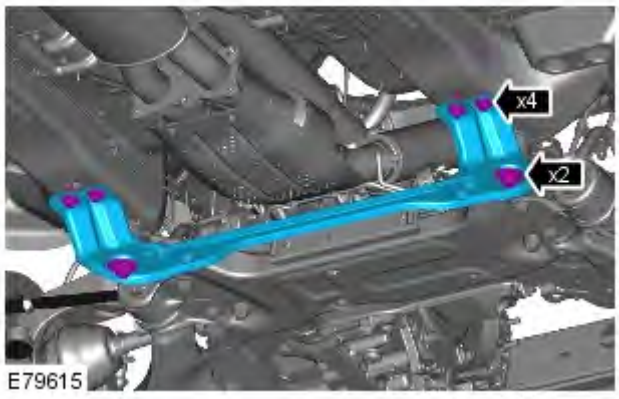


24. Remove the lower support insulator.



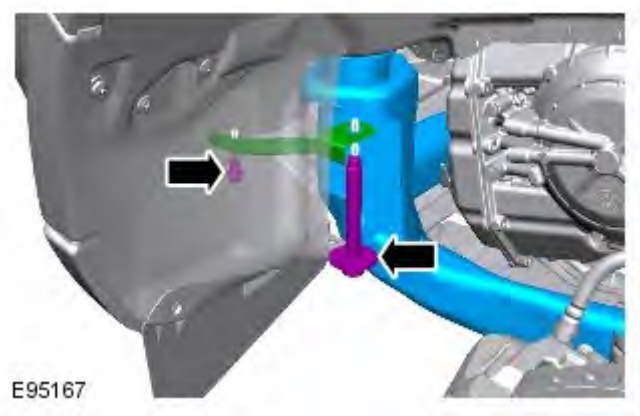
25. Support the subframe.

General Equipment: Powertrain Jack



26. **26.** CAUTION: Make sure that new subframe bolts are installed.

Remove the front subframe cross-brace.

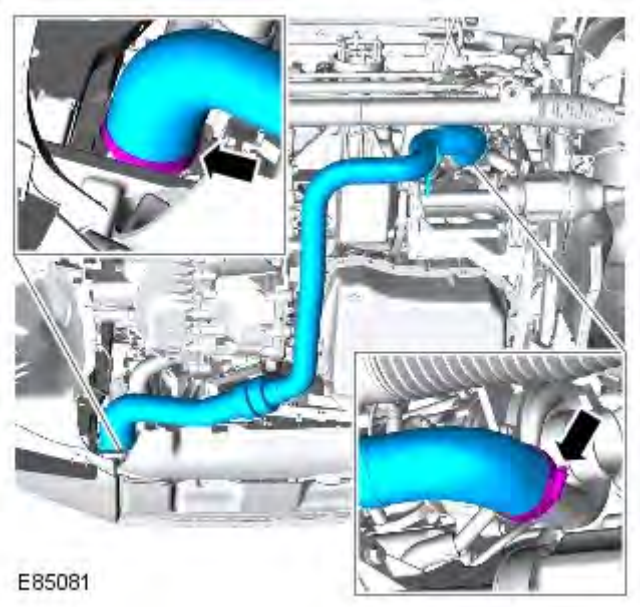


27. **27.** CAUTIONS:

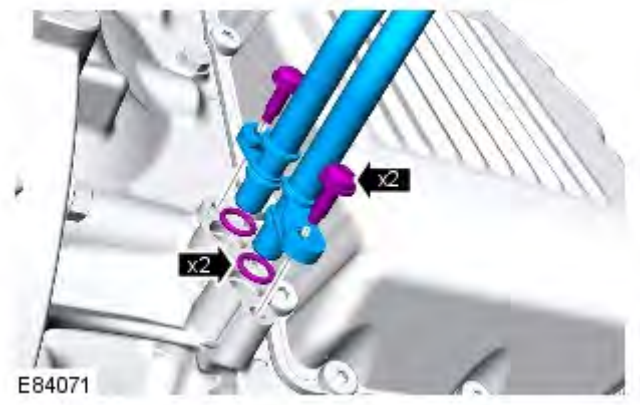
⚠ Mark the components to aid installation.

⚠ Make sure that new subframe bolts are installed.

Lower the front subframe assembly.



28. Remove the turbocharger outlet pipe.



29. **29.** CAUTIONS:

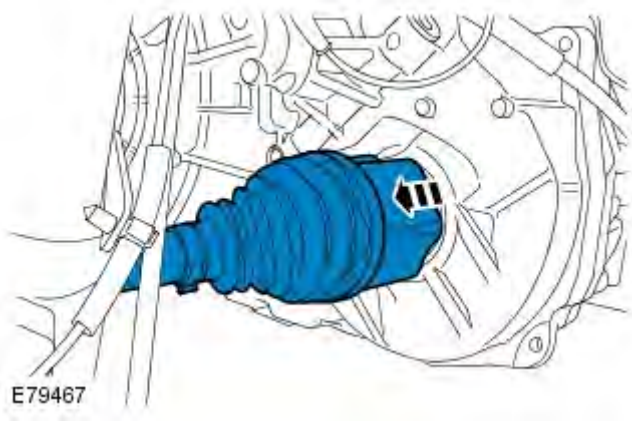
⚠ Be prepared to collect escaping fluids.

⚠ Make sure that all openings are sealed.

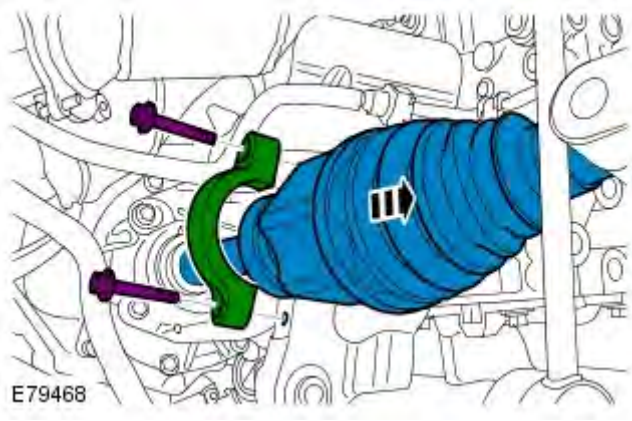
⚠ Discard the seals.

⚠ Make sure that the area around the component is clean and free of foreign material.

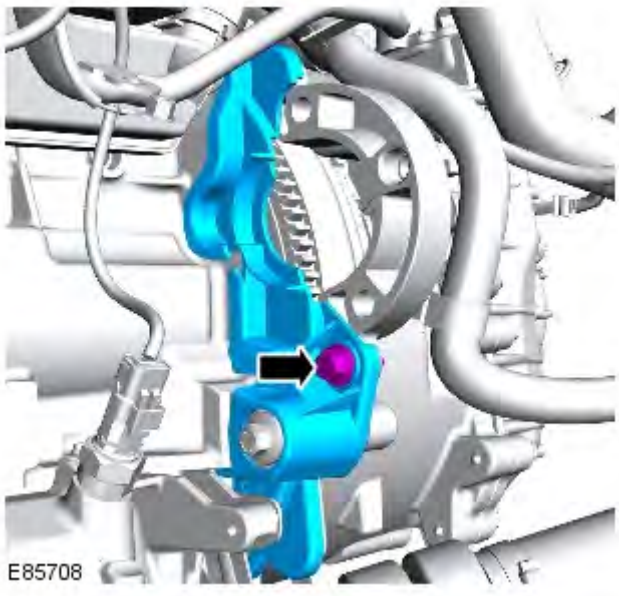
Disconnect the 2 transmission cooler lines.



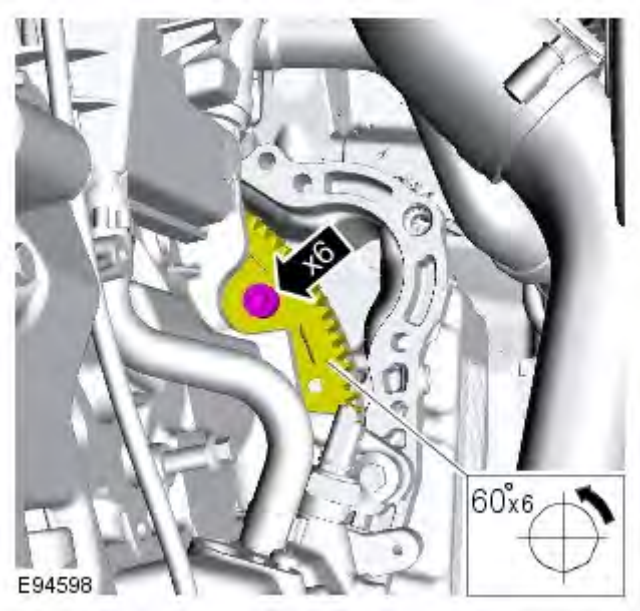
30. Release the LH halfshaft.



31. Release the RH halfshaft.



32. Remove the access cover.

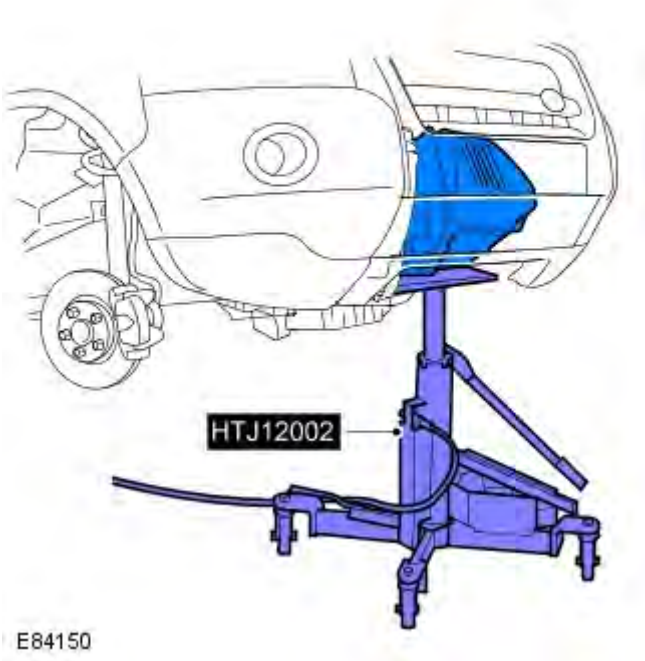


33. **33.** NOTE: Discard the bolts.

    Remove and discard the torque coverter bolts.

34. Support the transmission.

    General Equipment: Powertrain Jack



35. **35.** CAUTION: Make sure that the torque converter remains in the transmission.

    • NOTE: This step requires the aid of another technician.

    Remove the transmission and converter.

36. **36.** CAUTION: Make sure that the dowels are still located on the engine and not the transmission.

    Install the torque converter retainer.

Published: 11-May-2011

Automatic Transmission/Transaxle - TransmissionI6 3.2L Petrol

Installation

General Equipment

Powertrain Jack

1. Install the TCM.

   Torque: 24 Nm

2. Install the transmission selector lever.

   Torque: 13 Nm

3. Install the transmission fluid cooler.

   Torque: 10 Nm

4. Remove the torque converter retainer.

5. **5.** CAUTIONS:

   Make sure that the torque converter remains in the transmission.

   Make sure that the component is correctly located on the locating dowels.

   Make sure that the mating faces are clean and free of corrosion and foreign material.

   • NOTE: This step requires the aid of another technician.

   Install the transmission and converter.

6. Install the transmission retaining bolts.

   Torque: 47 Nm

7. Remove the transmission support.

   General Equipment: Powertrain Jack

8. Install the engine mount bracket.

   Torque: 90 Nm

9. Install the engine mount LH.

   Torque: 175 Nm

10. **10.** WARNING: Make sure that new nuts are installed.

    Install the bracket.

    Torque:
    M12 80 Nm
    M8 25 Nm

11. Remove the engine support.

12. Secure and connect the selector lever cable.

13. Install the transmission oil cooler.

14. Connect the transmission fluid cooler coolant hoses.

15. Install the power steering pump.

    Torque: 25 Nm

16. Install the coolant pump inlet pipe.

    Torque: 10 Nm

17. Attach the flexplate.

    Torque: 47 Nm

18. Install the access cover.

    Torque: 10 Nm

19. Remove the crankshaft locking tool.

20. **20.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

    • NOTE: This step requires the aid of another technician.

    Install the power transfer unit.

    Torque: 65 Nm

21. Install the power transfer unit support bracket.

    Torque: 65 Nm

22. Install both the halfshafts.

23. Install the RH halfshaft support.

    Torque: 25 Nm

24. **24.** CAUTION: Make sure that new bolts are installed.

    Torque:
    Stage 1:45 Nm
    Stage 2:80°

25. Install the crankshaft front oil seal.

    Refer to: Engine Front Seal (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

26. Install the front subframe.

    Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

27. Install the accessory drive pulley.

    Refer to: Accessory Drive Pulley (303-05A Accessory Drive - I6 3.2L Petrol, Removal and Installation).

28. Install the starter motor.

    Refer to: Starter Motor (303-06A Starting System - I6 3.2L Petrol, Removal and Installation).

29. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

30. Fill and bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

31. Refill the transmission with fluid.

    Refer to: Transmission Fluid Drain and Refill - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, General Procedures).

32. If a new component is to be installed, configure using Land Rover approved diagnostic equipment.

33. **33.** NOTE: For NAS vehicles only.

    If fitting new or exchange components, carry out long drive cycle.

    Refer to: Powertrain Control Module (PCM) Long Drive Cycle Self-Test (303-14A, General Procedures).

Published: 11-May-2011

Automatic Transmission/Transaxle - TransmissionTD4 2.2L Diesel

Installation

General Equipment

Powertrain Jack

• NOTE: If the transmission is to be removed for access, there is no need to drain the transmission fluid as long as the fluid cooler is not disconnected from the transmission assembly.

• NOTE: If the transmission is to be removed for access, there is no need to drain the transmission fluid as long as the fluid cooler is not disconnected from the transmission assembly.

1. **1.** CAUTION: Make sure that the dowels are still located on the engine and not the transmission.

   Remove the torque converter retainer.

2. **2.** CAUTIONS:

   Make sure that the torque converter remains in the transmission.

   Make sure that the component is correctly located on the locating dowels.

   Make sure that the mating faces are clean and free of corrosion and foreign material.

   Make sure that the dowels are still located on the engine and not the transmission.

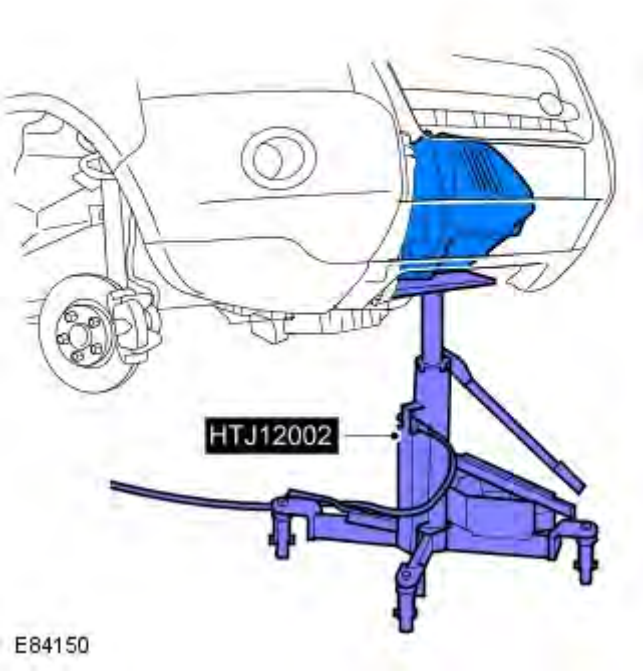
   • NOTE: This step requires the aid of another technician.

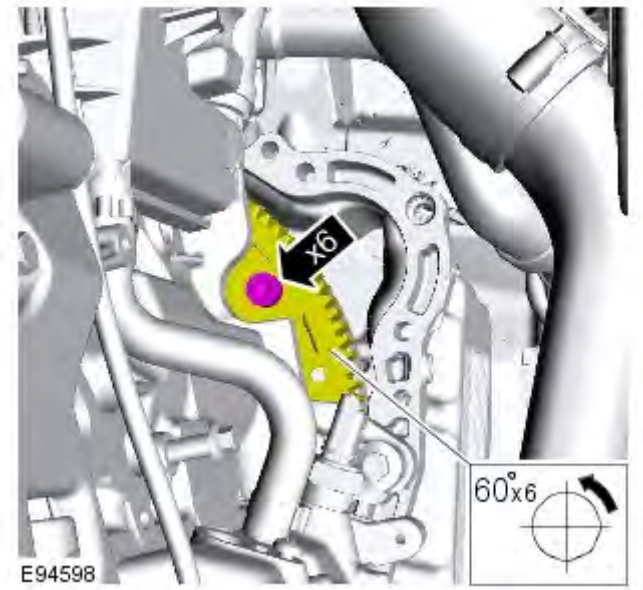
   Install the transmission and converter.

   Torque: 47 Nm

3. Remove the transmission support.

   General Equipment: Powertrain Jack

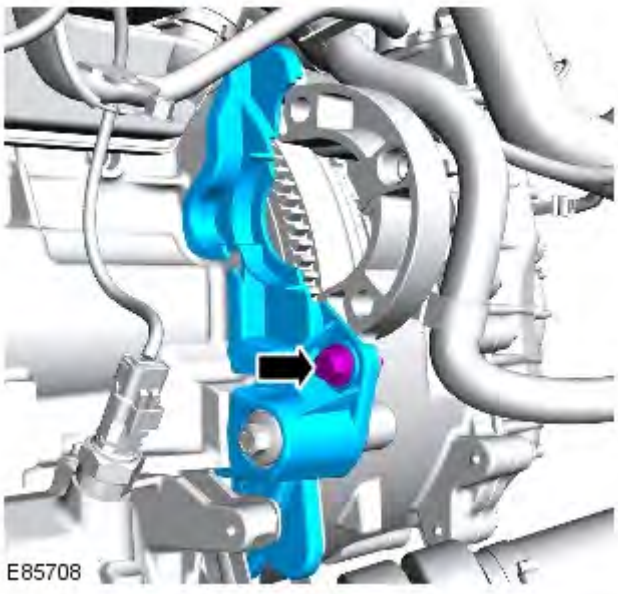




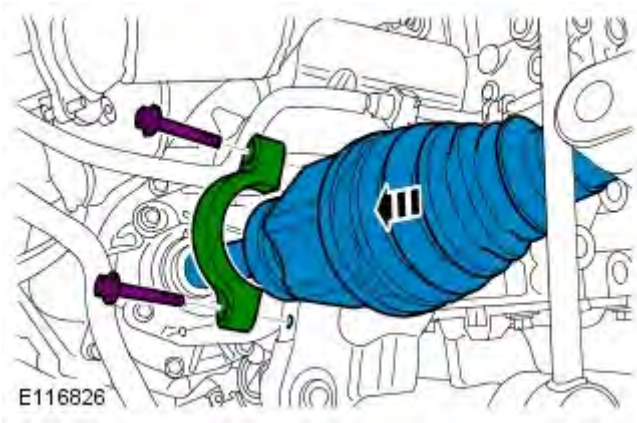
4. **4.** CAUTION: Make sure that new bolts are installed.

   Secure the torque convertor to the flexplate.

   Torque: 60 Nm



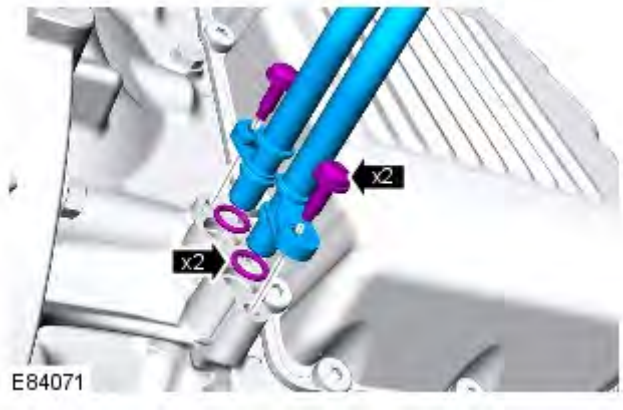
5. Install the access cover.



6. Install the RH halfshaft.

Torque:
Drive shaft support 25 Nm

7. Install the LH halfshaft.



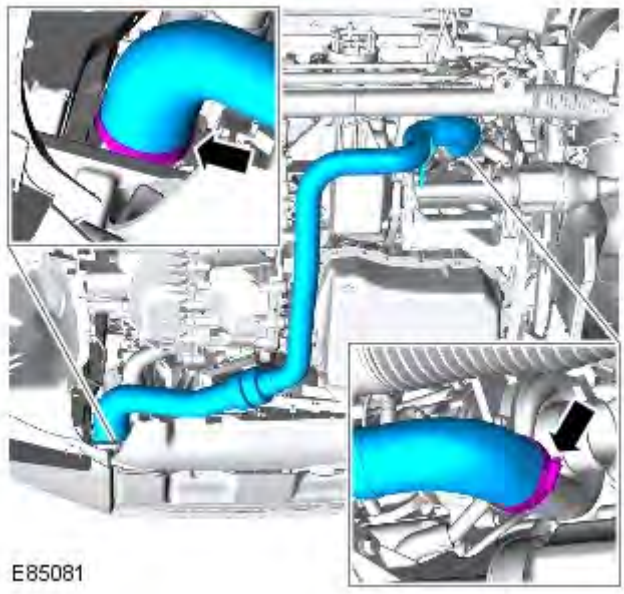
8. **8.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

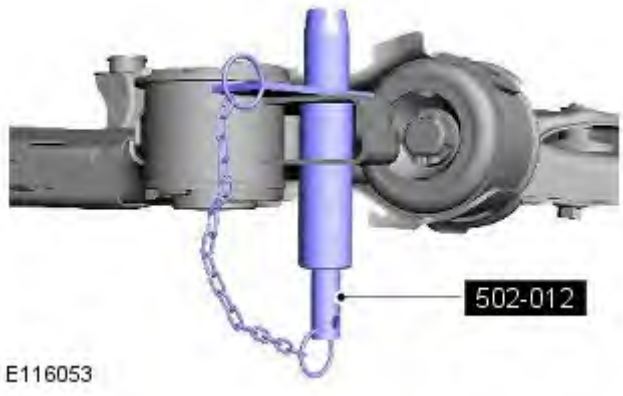
   Install new o-ring seals

   Connect the transmission fluid cooler lines.

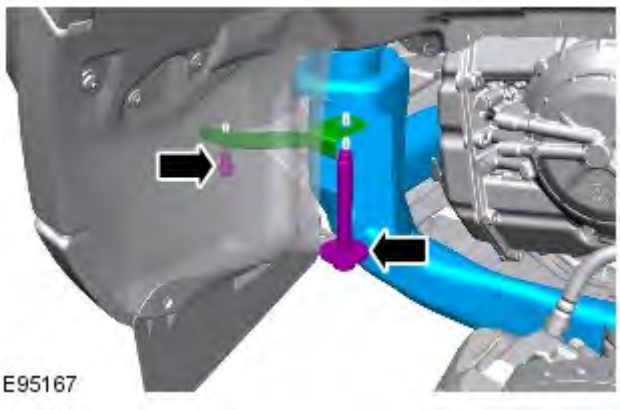
   Torque: 10 Nm



9. Install the turbocharger outlet pipe.



10. Install the alignment tool to the front subframe.

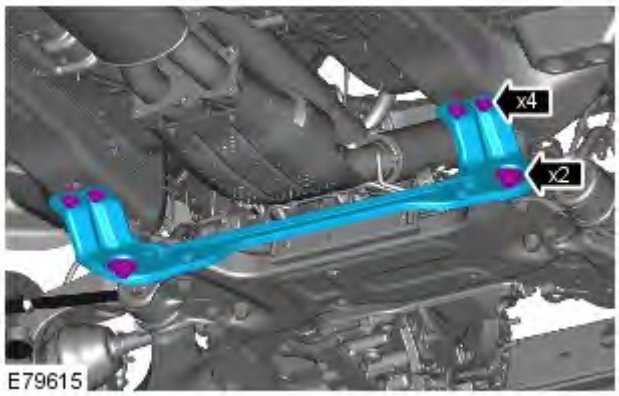


11. **11.** CAUTION: Make sure that new subframe bolts are installed.

    • NOTE: Install but do not fully tighten the front subframe mounting bolts.

    Install the front subframe.

    Torque:
    Support bracket bolts 25 Nm
    Subframe bolts
    Stage 1:140 Nm
    Stage 2:240°

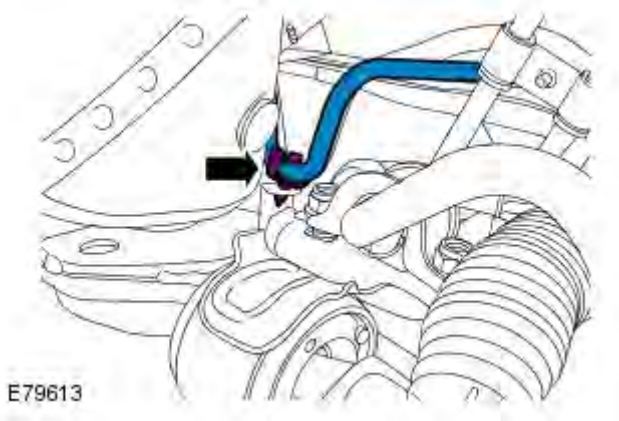


12. **12.** CAUTION: Make sure that new bolts are installed.

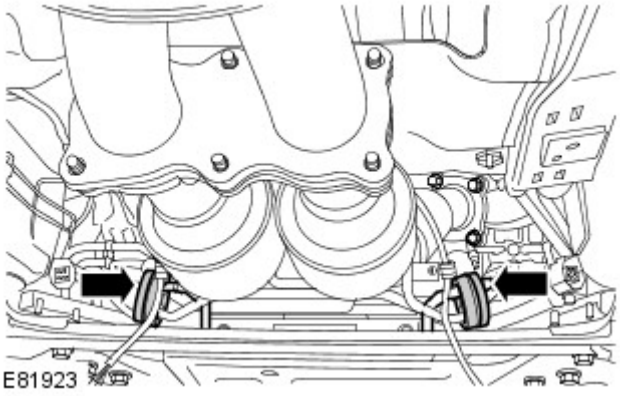
    • NOTE: Install but do not fully tighten the rear subframe mounting bolts.

    Install the subframe cross-brace.

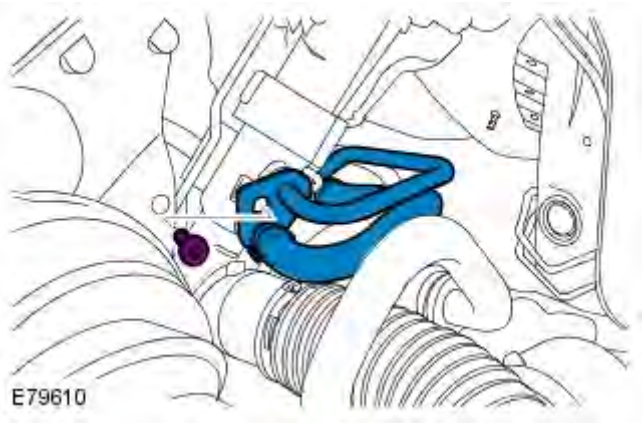
    Torque:
    Cross brace bolts 45 Nm
    Subframe bolts
    Stage 1:140 Nm
    Stage 2:240°



13. Install the fuel line.



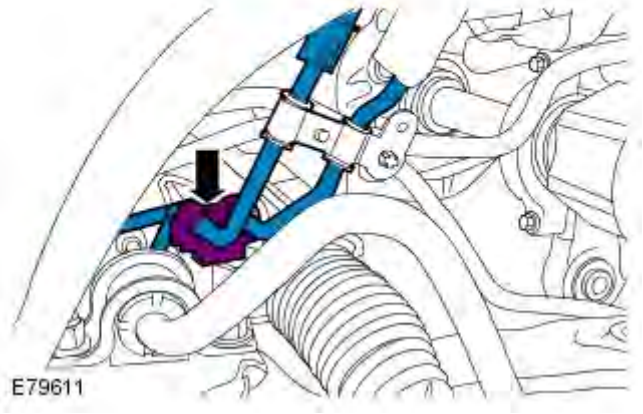
14. Secure the downpipe catalytic converter.

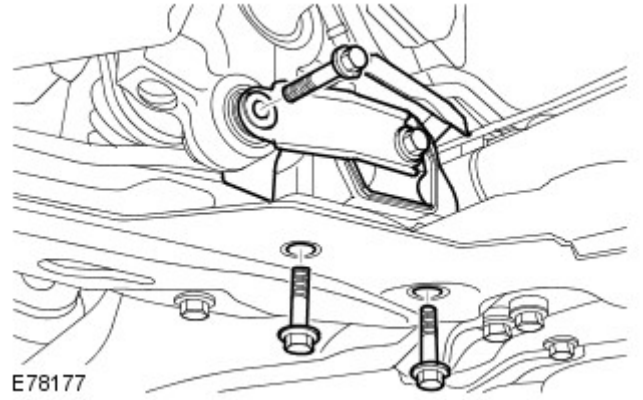


15. Connect the steering gear pressure lines.

    Torque: 25 Nm

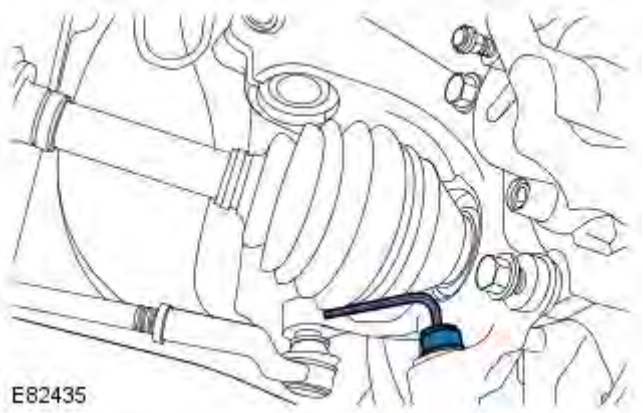
16. Secure the power steering lines.





17. Install the lower support insulator.

    Torque: 110 Nm

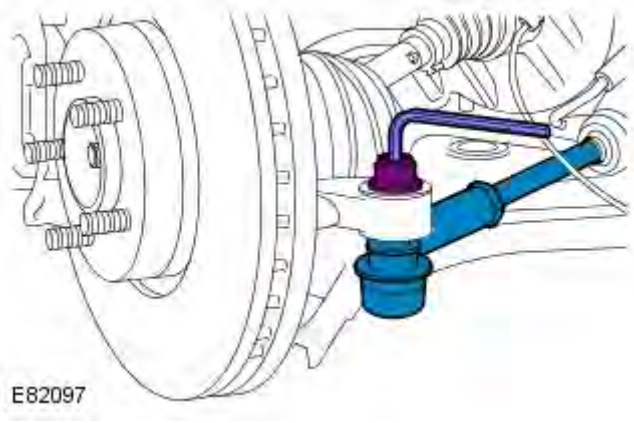


18. **18.** WARNING: Make sure that a new lower arm ball joint nut is installed.

    CAUTION: Make sure that the ball joint ball does not rotate.

    Install the lower arm ball joint

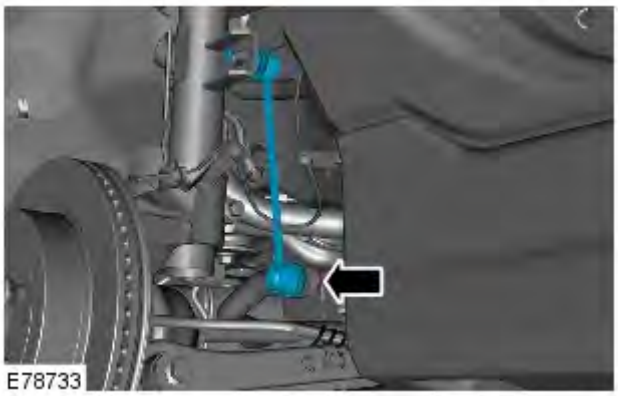
    Torque: 110 Nm



19. **19.** WARNING: Make sure that new nuts are installed.

    Connect the tie-rod end ball joints.

    Torque: 80 Nm

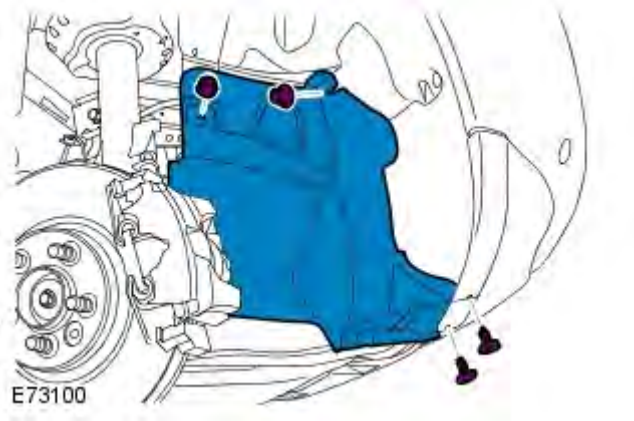


20. **20.** WARNING: Make sure that new nuts are installed.

    CAUTION: Make sure that the ball joint ball does not rotate.

    Connect both front stabilizer bar links to the stabilizer bar.

    Torque: 55 Nm

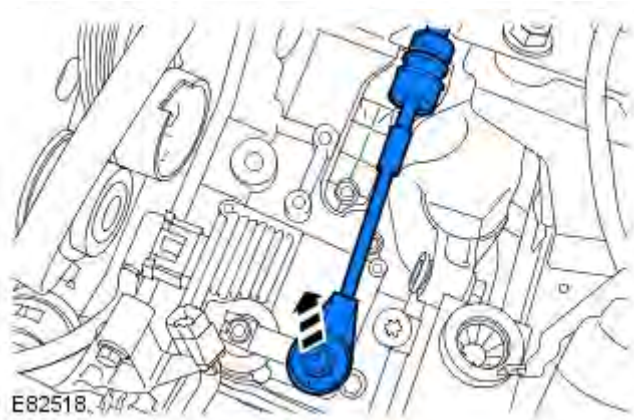


21. **21.** NOTE: RH illustration shown, LH is similar.

    Install the LH fender splash shield extension panel.

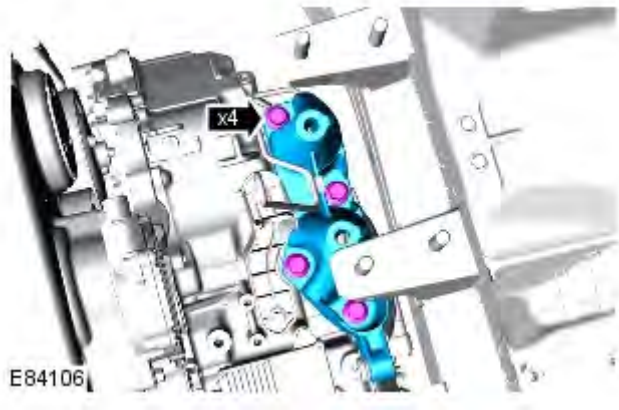
22. Install the front wheels and tires.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



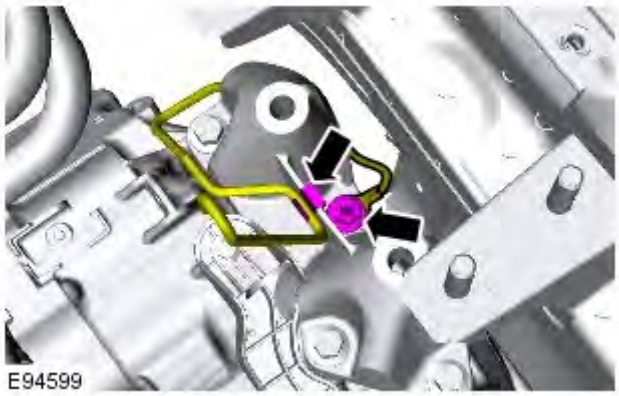
23. Install the towing eye cover.
24. Secure and connect the selector lever cable.

    Torque:
    Bumper cover securing bolts 10 Nm



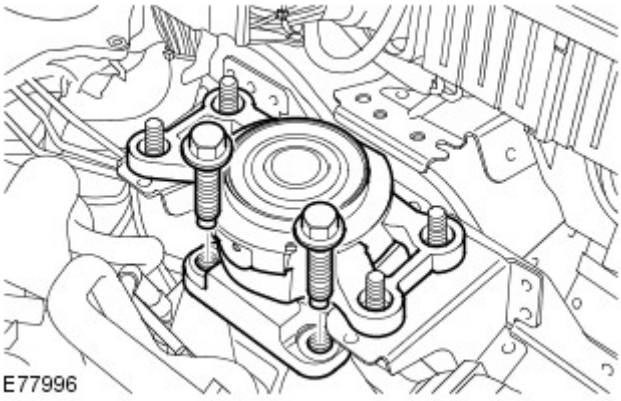
25. Install the engine mount bracket.

    Torque: 90 Nm



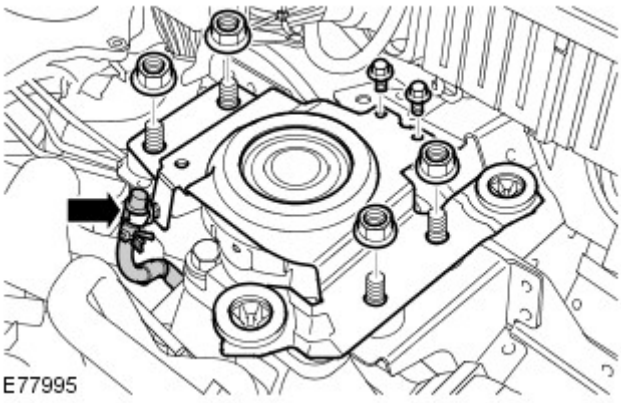
26. Install the earth strap.

    Torque: 25 Nm



27. Install the LH engine mount.

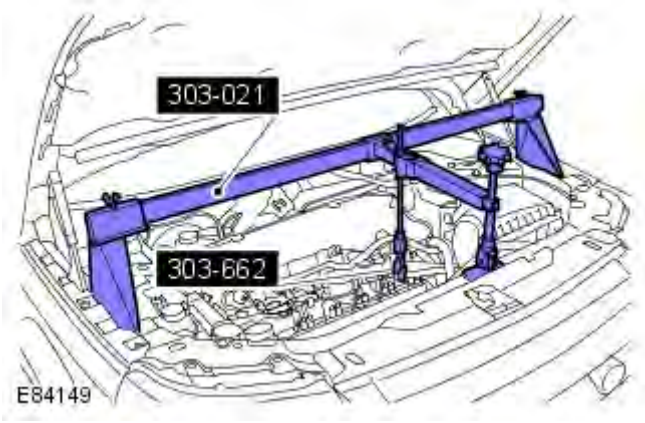
    Torque: 175 Nm



28. **28.** WARNING: Make sure that new nuts are installed.

    Install the bracket.

    Torque:
    M12 80 Nm
    M8 25 Nm



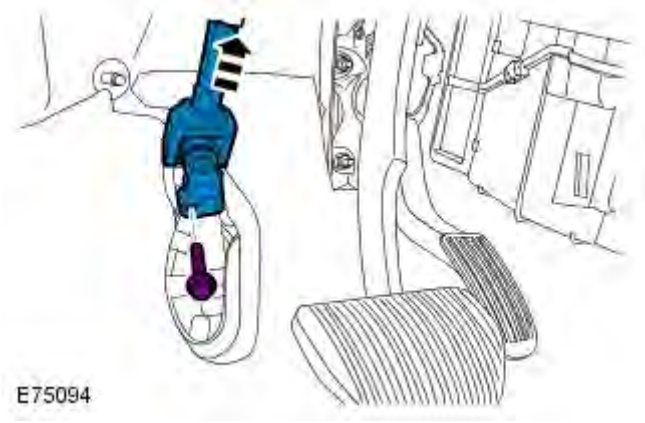
29. Remove the engine support.

30. Install the starter motor.

    Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

31. Install the battery tray.

    Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).



32. **32.** WARNING: Make sure that a new steering column flexible coupling bolt is installed.

    Connect the steering column to the steering gear.

    Torque: 25 Nm

33. **33.** CAUTION: Make sure there is sufficient power steering fluid in the reservoir before starting engine. Failure to follow this instruction may result in damage to the vehicle.

    Fill the transmission with fluid.

    Refer to: Transmission Fluid Drain and Refill - TD4 2.2L Diesel (307-01 Automatic Transmission/Transaxle, General Procedures).

34. Refill and bleed the power steering.

    Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

35. If a new component is to be installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Transmission/Transaxle Cooling -

Torque Specifications

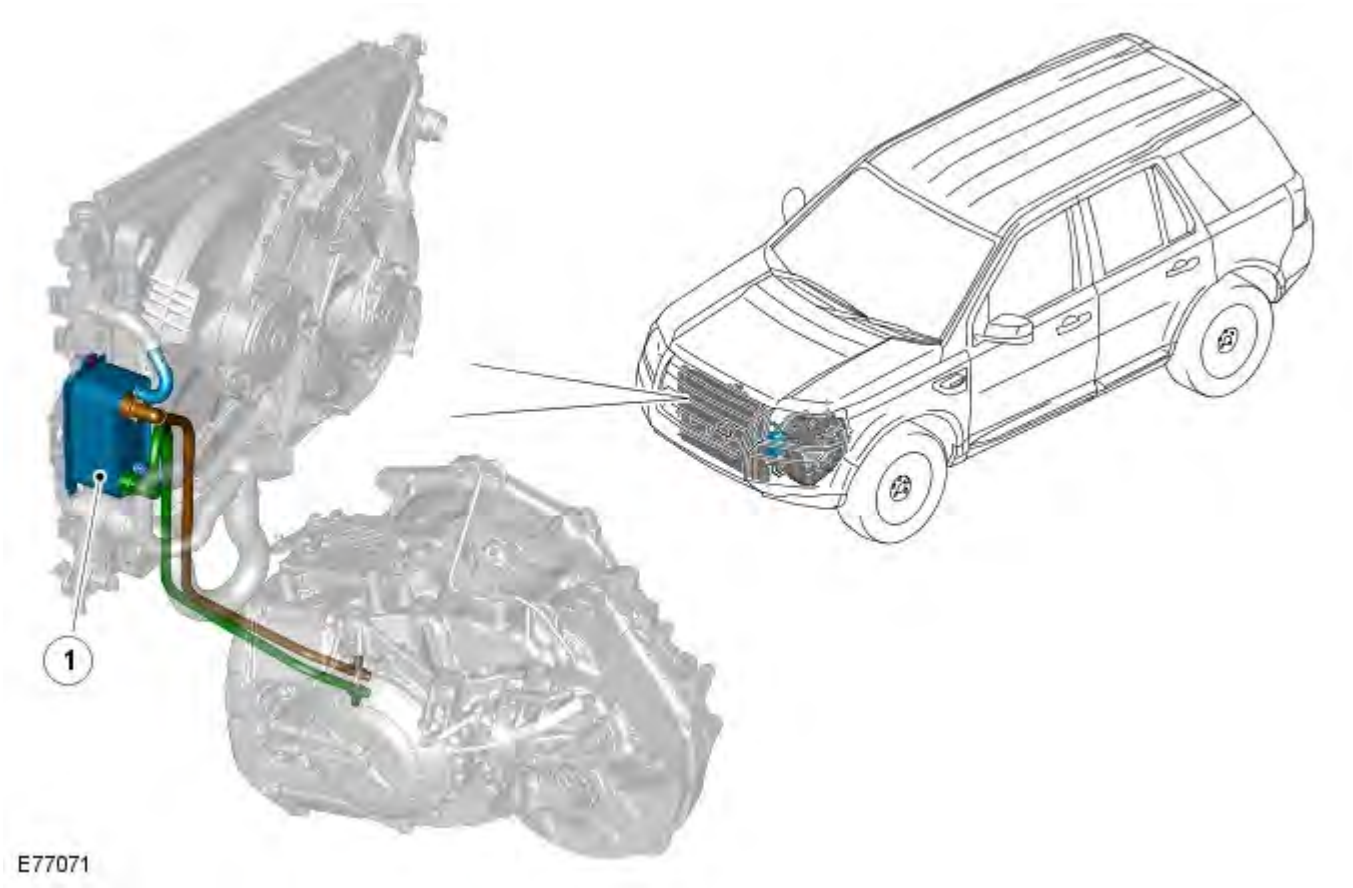
Description	Nm	lb-ft
Transmission fluid cooler bolt	10	7

Published: 11-May-2011

Transmission/Transaxle Cooling - Transmission Cooling

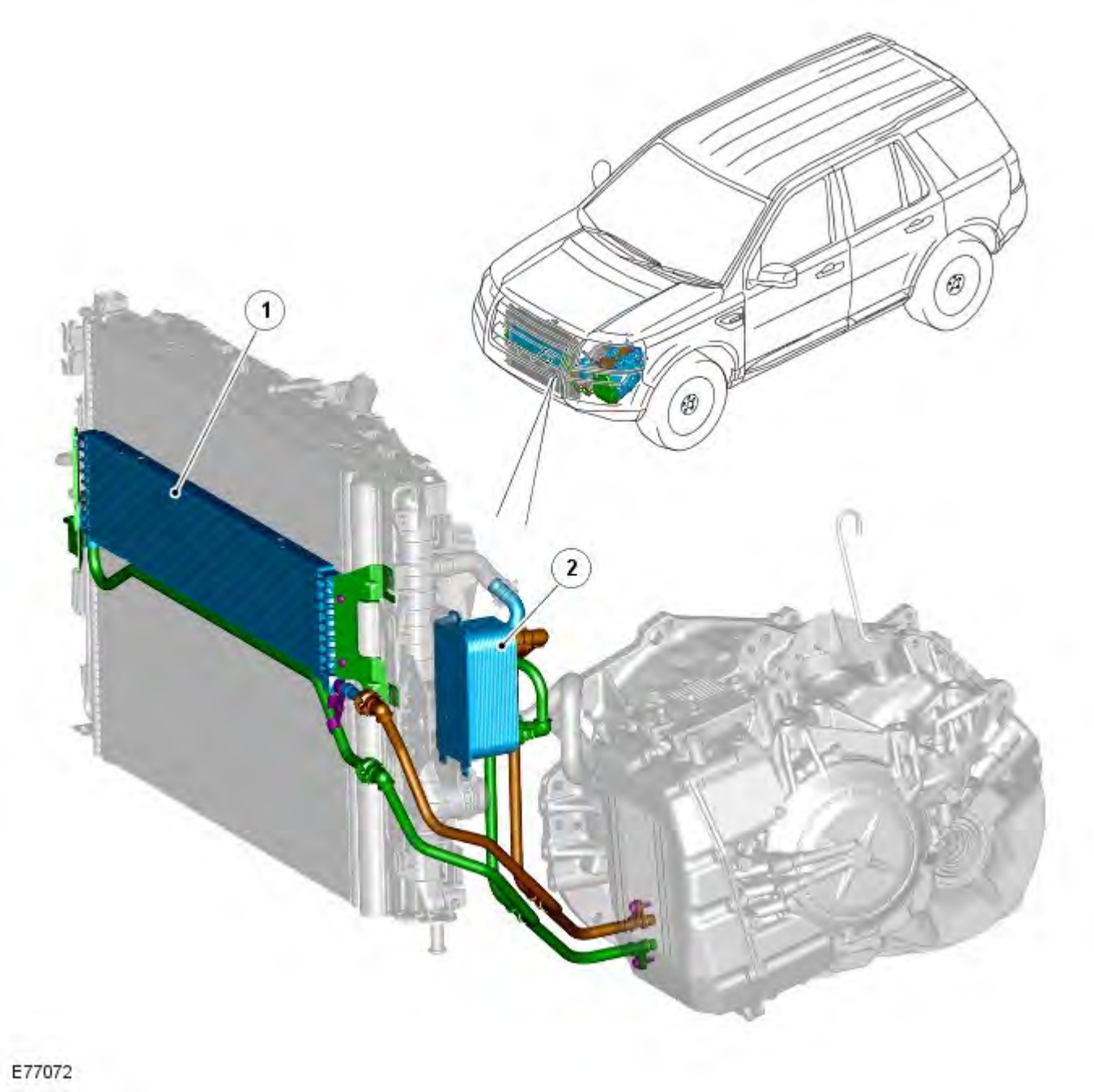
Description and Operation

COMPONENT LOCATION - STANDARD CLIMATE



Item	Part Number	Description
1	-	Transmission fluid cooler

COMPONENT LOCATION - HOT CLIMATE



E77072

Item	Part Number	Description
1	-	Air blast transmission cooler
2	-	Engine coolant transmission cooler

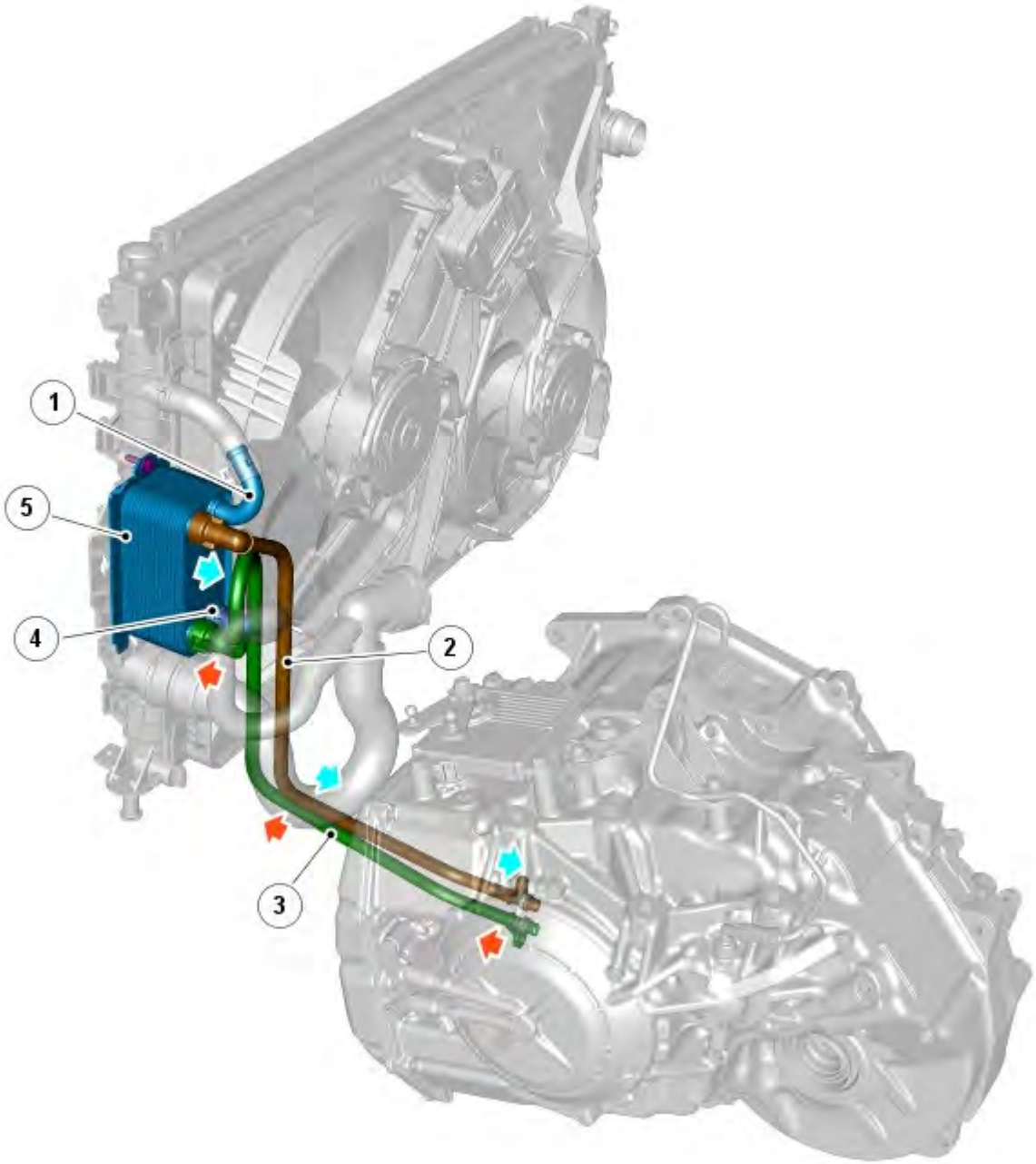
OVERVIEW

The AWF21 transmission uses an external fluid cooler to reduce the temperature of the transmission fluid.

In standard climate markets a plate type cooler is used and uses engine coolant to reduce the fluid temperature.

In hot climate markets, an air blast cooler is used in addition to the plate type cooler used on standard climate vehicles. This provides additional cooling for the higher ambient temperatures experienced in these countries.

COOLER - STANDARD CLIMATE



E77073

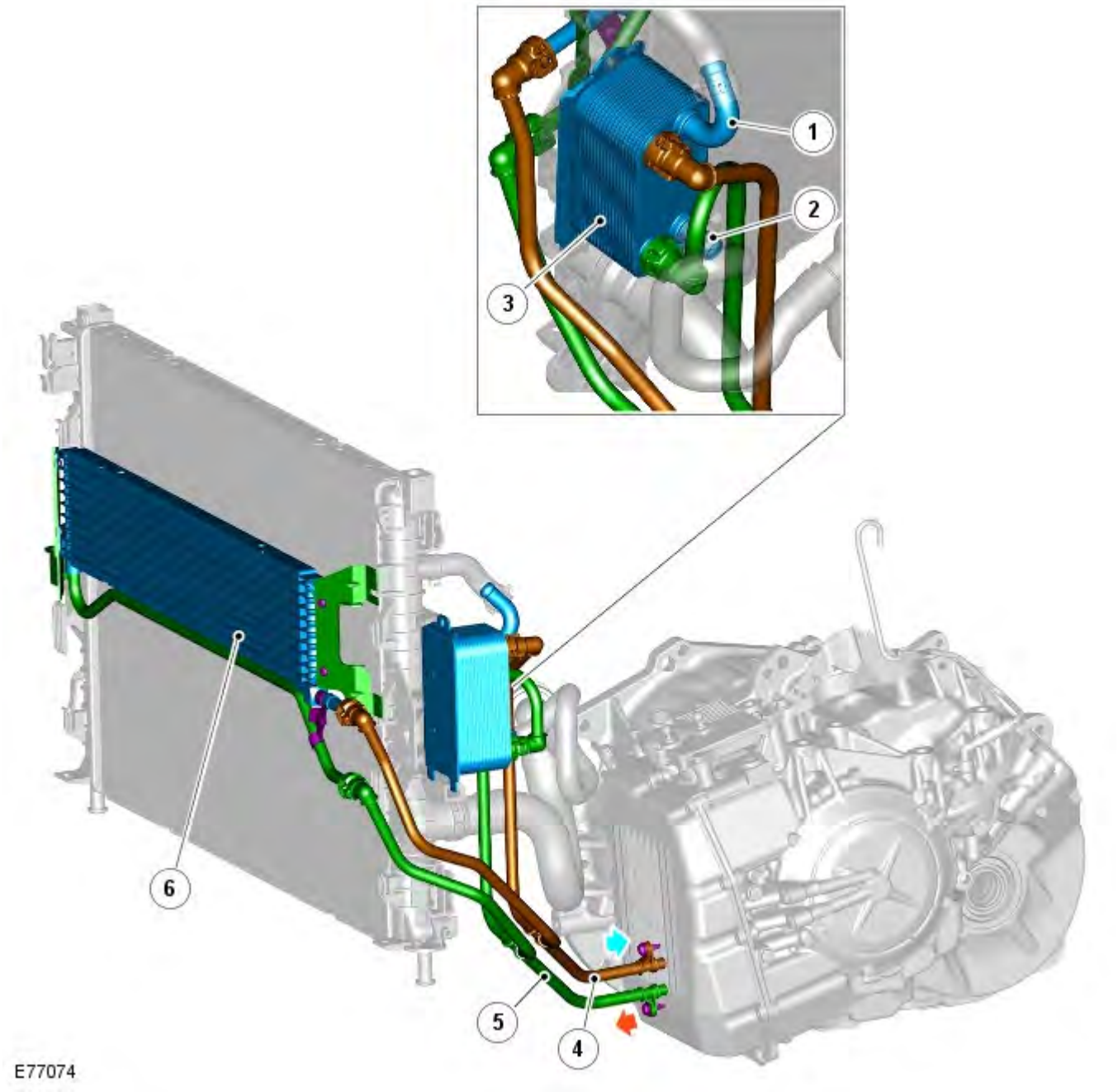
Item	Part Number	Description
1	-	Engine coolant inlet
2	-	Transmission fluid pipe - to transmission
3	-	Transmission fluid pipe - from transmission
4	-	Engine coolant outlet
5	-	Transmission cooler

The transmission fluid cooler is attached to the Left Hand (LH) end of the radiator. The fluid cooler is an aluminum housing comprising louvred fins and plates. The plates allow a cross-flow of transmission fluid and engine coolant through the cooler. The plates are immersed in engine coolant from the 'cold' side of the radiator which provides cooling of the transmission fluid by the temperature differential between the transmission fluid and the engine coolant.

The engine cooling system has a low temperature zone in the top third of the radiator. The engine coolant flow through this section of the radiator is restricted by the transmission fluid cooler. Therefore the engine coolant has a slower flow rate across the cooling tubes of this section of the radiator. This cools the engine coolant more than the lower part of the radiator and consequently provides increased cooling of the transmission fluid.

Fluid is supplied from the transmission fluid pump into the lower connection of the cooler. After passing through the cooler, the fluid passes out of the upper connection and is returned to transmission fluid pan.

COOLER - HOT CLIMATE



Item	Part Number	Description
1	-	Engine coolant inlet
2	-	Engine coolant outlet (hidden)
3	-	Transmission coolant transmission cooler
4	-	Transmission fluid pipe - to transmission
5	-	Transmission fluid pipe - from transmission
6	-	Transmission air blast cooler

In hot climate markets, the transmission fluid cooling system uses the same cooler as the standard climate system, but with an additional air blast cooler located in front the radiator and the Air Conditioning (A/C) condenser.

The operation of the fluid cooler is as described for the standard climate cooler. The air blast cooler comprises 2 end tanks, interconnected with hollow plates. The plates allow transmission fluid to flow from one end tank to the other, with the air flowing over the plates cooling the fluid as it passes through the cooler.

The transmission fluid output from the transmission pump is split between the standard climate cooler and the air blast cooler. Some of the transmission fluid from the transmission pump is diverted into the air blast cooler. The fluid flows through plates in the cooler and the air flow over the plates removes the heat from the fluid. The fluid is then directed back to a tee connection with the fluid pipe to the standard climate cooler and is then returned to the transmission.

Published: 11-May-2011

Transmission/Transaxle Cooling - Transmission Cooling

Diagnosis and Testing

Principles of Operation

For a detailed description of the automatic transmission cooling system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Transmission Cooling (307-02 Transmission/Transaxle Cooling, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for system integrity and obvious signs of mechanical damage.

Visual Inspection

Mechanical
• Feed and return tubes • Connections to the automatic transmission and the automatic transmission fluid cooler • Automatic transmission fluid level

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Cause	Action
Over heating of the automatic transmission	Obstruction in the automatic transmission fluid cooler	• Flush out the automatic transmission fluid cooler with new automatic transmission fluid • If the flushing is unsuccessful, install a new cooler. REFER to: Transmission Fluid Cooler - I6 3.2L Petrol (307-02 Transmission/Transaxle Cooling, Removal and Installation) / Transmission Fluid Cooler - TD4 2.2L Diesel (307-02 Transmission/Transaxle Cooling, Removal and Installation).
Over heating of the automatic transmission	Obstruction in the automatic transmission fluid tubes	• Flush out the automatic transmission fluid cooler tubes with new automatic transmission fluid • If the flushing is unsuccessful install new automatic transmission fluid cooler tubes
Loss of automatic transmission fluid	Connections to the automatic transmission and the automatic transmission fluid cooler	• Check the integrity of tubes, connections and seals • Check the torque of the tube fixings. REFER to: Specifications (307-02 Transmission/Transaxle Cooling, Specifications).
Loss of automatic transmission fluid	Leak at automatic transmission fluid cooler	• Check the integrity of tubes, connections and seals • Check the torque of the tube fixings. REFER to: Specifications (307-02 Transmission/Transaxle Cooling, Specifications). • Check for automatic transmission fluid contamination of the engine coolant. Install new cooler as required. REFER to: Transmission Fluid Cooler - I6 3.2L Petrol (307-02 Transmission/Transaxle Cooling, Removal and Installation) / Transmission Fluid Cooler - TD4 2.2L Diesel (307-02 Transmission/Transaxle Cooling, Removal and Installation).

Published: 11-May-2011

Transmission/Transaxle Cooling - Transmission Fluid CoolerI6 3.2L Petrol

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

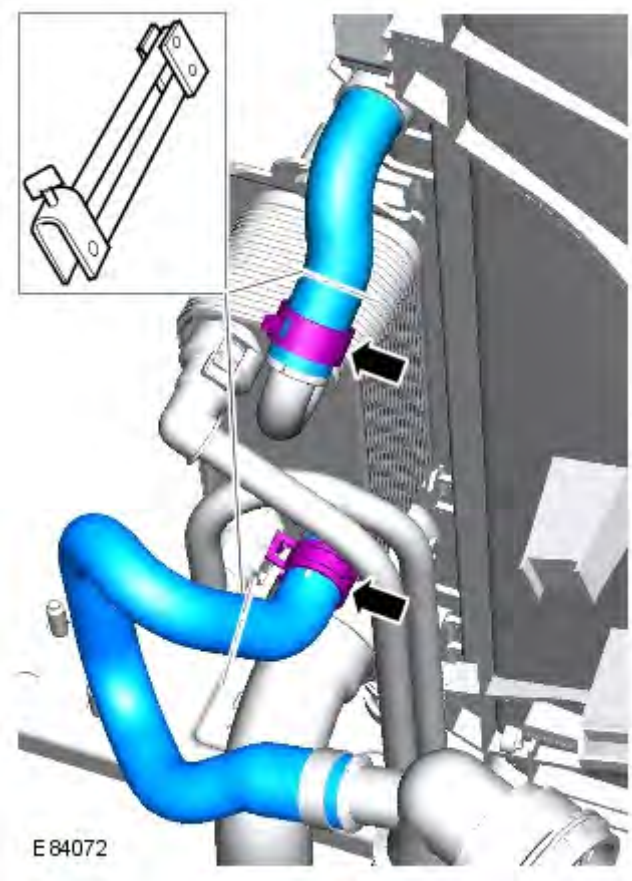
2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Drain the transmission fluid.

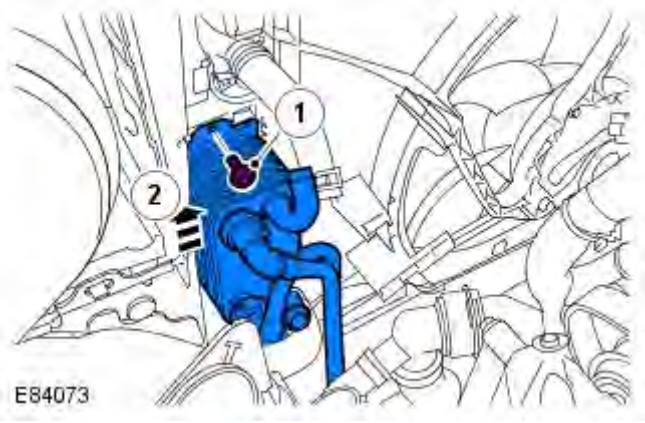
   Refer to: Transmission Fluid Drain and Refill - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, General Procedures).

4. Clamp the relevant hoses, to minimise the coolant loss.

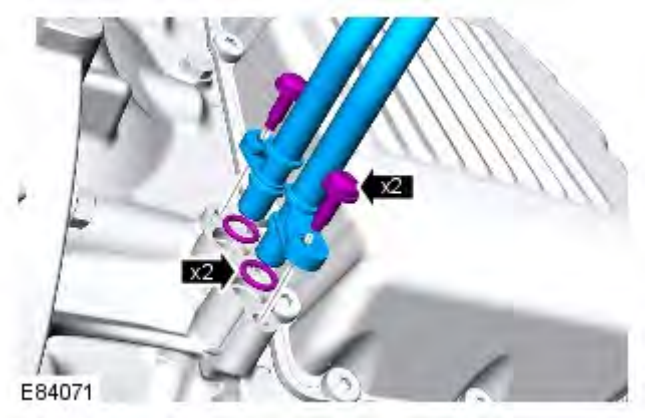


5. **5.** CAUTION: Be prepared to collect escaping coolant.

   Disconnect the 2 transmission fluid cooler coolant hoses.



6. Release the automatic transmission fluid cooler.



7. **7.** CAUTIONS:

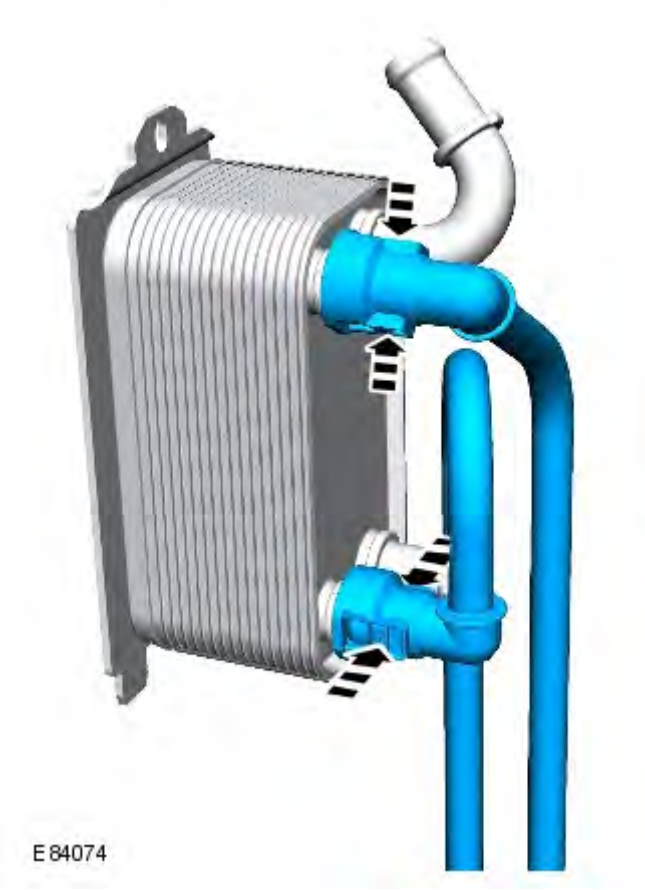
   Be prepared to collect escaping fluids.

   Make sure that all openings are sealed.

   Discard the seals.

   • NOTE: Do not disassemble further if the component is removed for access only.

   Remove the transmission fluid cooler.



8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. Install the fluid cooler hoses.

2. Connect and secure the coolant hoses.

3. Install the transmission fluid cooler.

   Torque: 10 Nm

4. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

5. Refill the transmission with fluid.

   Refer to: Transmission Fluid Drain and Refill - I6 3.2L Petrol (307-01 Automatic Transmission/Transaxle, General Procedures).

Published: 11-May-2011

Transmission/Transaxle Cooling - Transmission Fluid CoolerTD4 2.2L Diesel

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

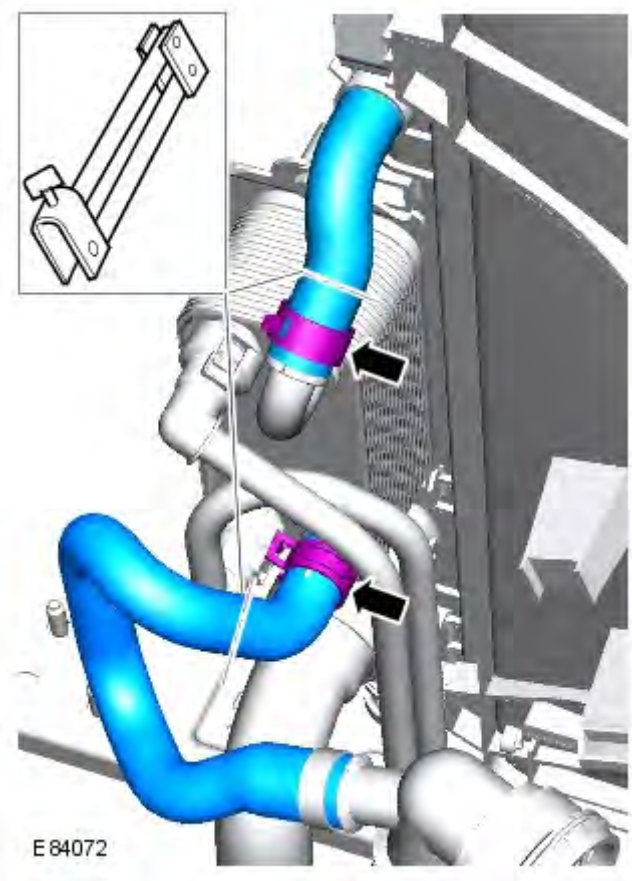
2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Drain the transmission fluid.

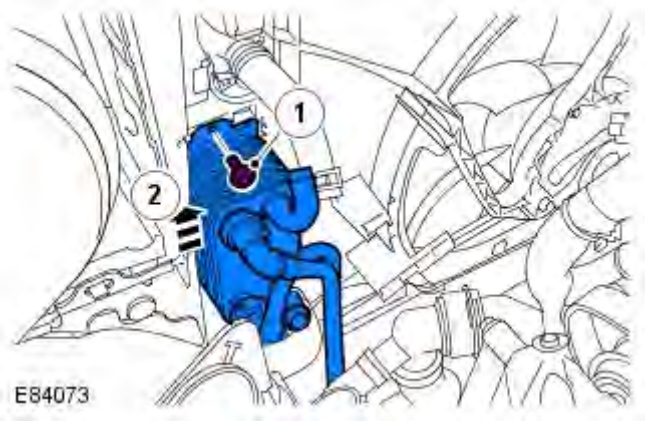
   Refer to: Transmission Fluid Drain and Refill - TD4 2.2L Diesel (307-01 Automatic Transmission/Transaxle, General Procedures).

4. Clamp the relevant hoses, to minimise the coolant loss.

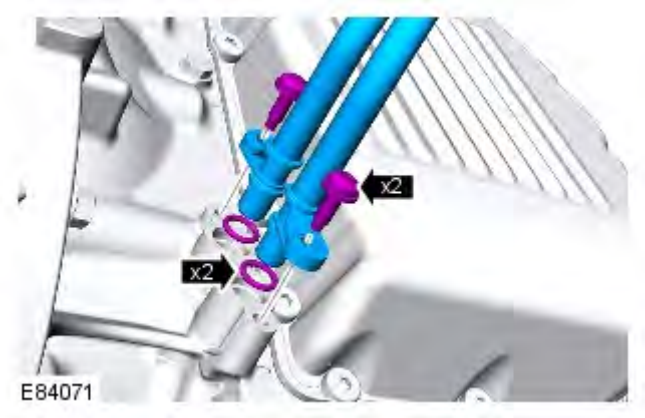


5. **5.** CAUTION: Be prepared to collect escaping coolant.

   Disconnect the 2 transmission fluid cooler coolant hoses.



6. Release the automatic transmission fluid cooler.



7. **7.** CAUTIONS:

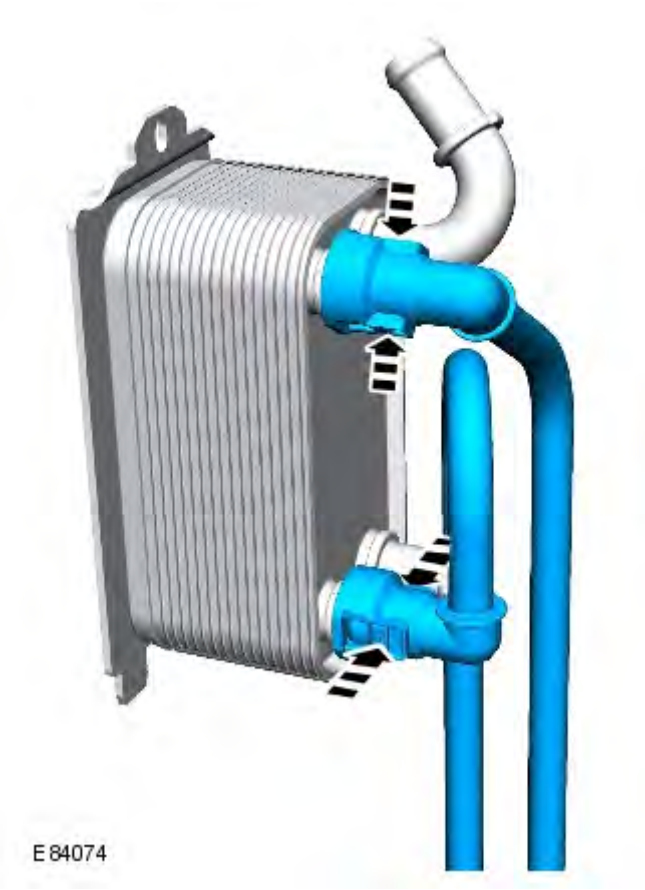
   Be prepared to collect escaping fluids.

   Make sure that all openings are sealed.

   Discard the seals.

   • NOTE: Do not disassemble further if the component is removed for access only.

   Remove the transmission fluid cooler.



8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. Install the fluid cooler hoses.

2. Connect and secure the coolant hoses.

3. Install the transmission fluid cooler.

   Torque: 10 Nm

4. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

5. Refill the transmission with fluid.

   Refer to: Transmission Fluid Drain and Refill - TD4 2.2L Diesel (307-01 Automatic Transmission/Transaxle, General Procedures).

Published: 11-May-2011

Automatic Transmission/Transaxle External Controls -

General Specification

Item	Specification
Type	Cable shift

Torque Specifications

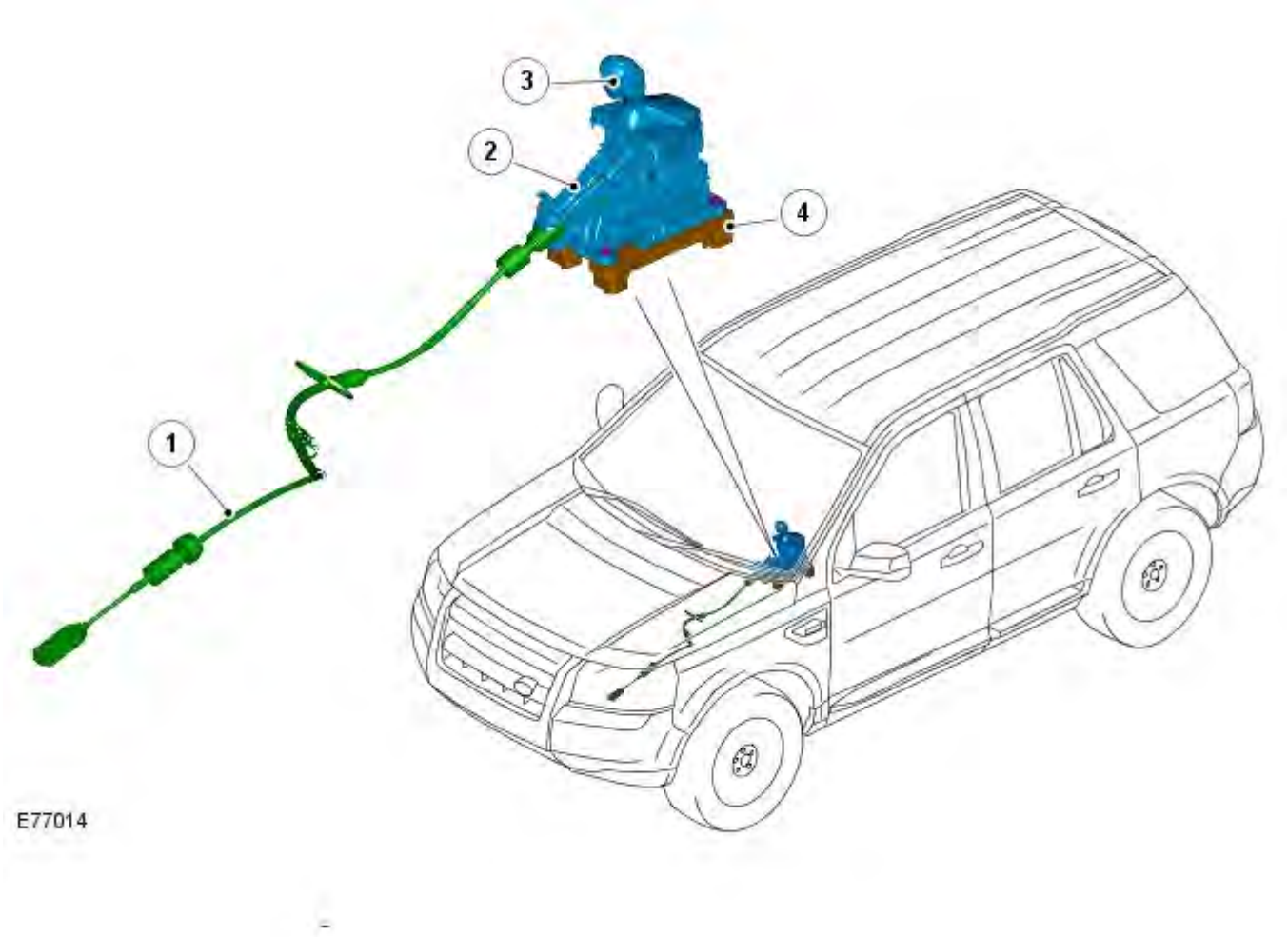
Description	Nm	lb-ft
Abutment bracket to gearbox bolt	24	18
Shift assembly to floor	10	7
Shift cable grommet to body bolt	7	5
Shift lever to gearbox	14	10

Published: 11-May-2011

Automatic Transmission/Transaxle External Controls - External Controls

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Selector cable
2	-	Selector lever assembly
3	-	Selector knob, gaiter and illumination module
4	-	Selector lever mounting plate

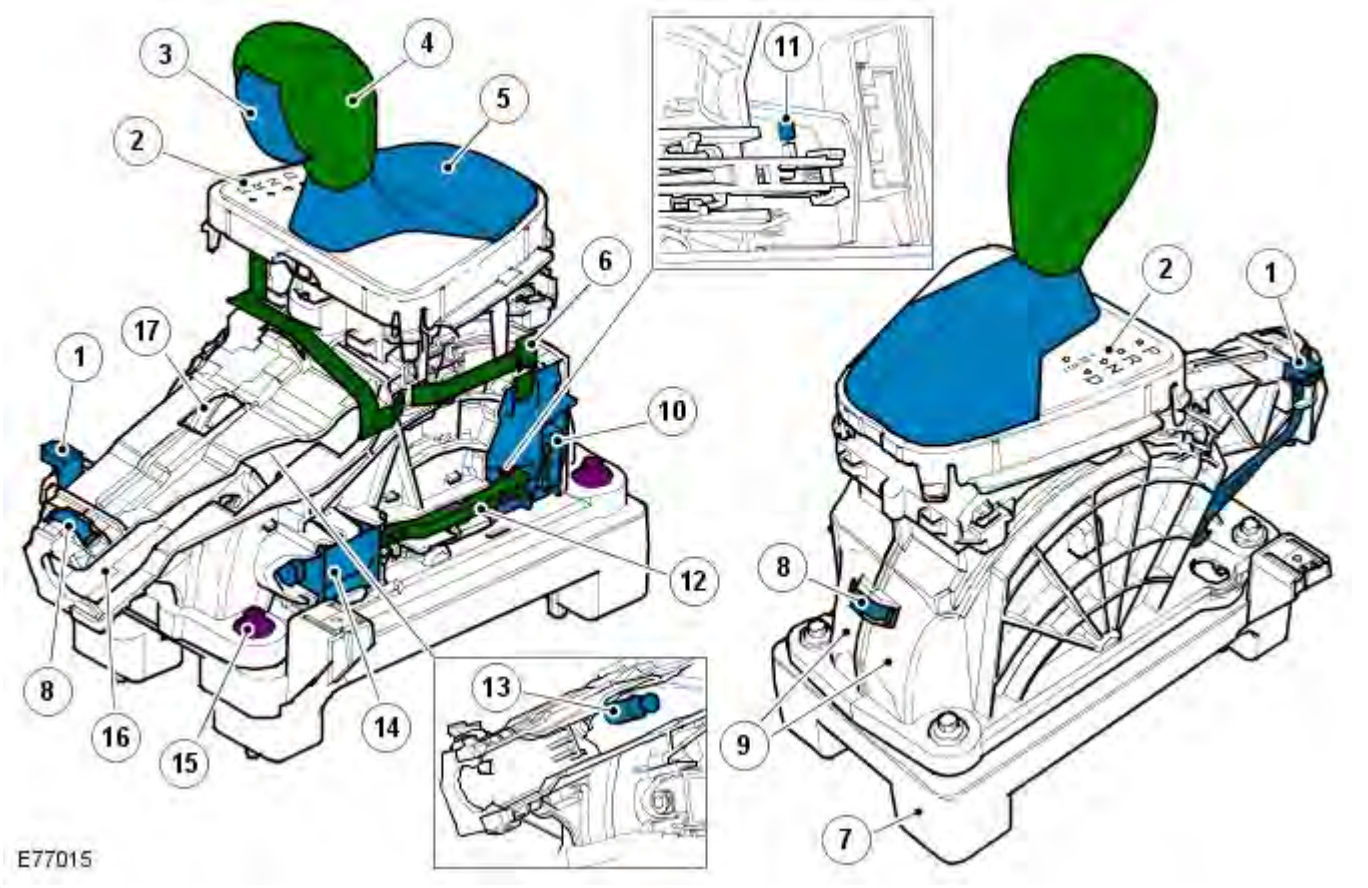
OVERVIEW

The automatic transmission external controls comprise a selector lever assembly and a transmission cable. The selector lever allows the driver to select forward or reverse gears and also to engage sport or manual 'CommandShift™' modes.

Movement of the selector lever is confirmed to the driver by illumination of the applicable position Light Emitting Diode (LED) on the selector lever trim finisher and by an applicable message displayed in the instrument cluster message centre.

SELECTOR LEVER

- NOTE: Right Hand (RH) drive version shown



Item	Part Number	Description
1	-	Interlock solenoid - Emergency release lever
2	-	Selector position Light Emitting Diodes (LED's)
3	-	Selector lever button
4	-	Knob
5	-	Gaiter
6	-	PCB ribbon cable and connector
7	-	Selector lever mounting plate
8	-	Spring clip
9	-	Shift housing Left Hand (LH) and Right Hand (RH)
10	-	Gear shift module
11	-	Optical sensor alignment mark
12	-	Sensor arm
13	-	Cable attachment ball pin
14	-	Shift interlock solenoid
15	-	Mounting bolt (4 off)
16	-	Cable abutment aperture
17	-	Cable adjustment/setting aperture

The selector lever assembly is located in a central position on the transmission tunnel, between the front driver and passenger seats and is secured to the transmission tunnel with 4 bolts. The selector lever assembly is a non-serviceable electro-mechanical assembly which is used by the driver to select the required transmission mode.

Selections made using the selector lever are passed to the transmission lever arm by a cable. A ball pin is attached to the lever mechanism and provides for the attachment of the cable.

There are five selector lever positions and two additional positions for manual 'CommandShift™' operation:

- **P** (Park) - Prevents the vehicle from moving by locking the transmission
- **R** (Reverse) - Select only when the vehicle is stationary and the engine is at idle
- **N** (Neutral) - No torque transmitted to drive wheels
- **D** (Drive) - This position uses all six forward gears
- **M/S** (Sport Mode) - This position uses all forward gears in 'D' but will upshift at higher engine speeds to improve acceleration and downshift at higher engine speed to give increased engine braking
- **+ and -** Manual ('CommandShift™') mode - Movement of the selector lever in the +/- positions, when the lever is in the M/S position, will operate the transmission in manual (CommandShift™) mode allowing the driver to manually select all six forward gears.

The selector lever position is displayed to the driver on the selector position LED and in the instrument cluster. In 'CommandShift™' mode, if a gear is selected but the Transmission Control module (TCM) logic prevents selection of that gear, the requested gear will be initially displayed. The TCM will engage the next allowed gear and then display that gear.

Sensor Module

A sensor module is located on the LH side of the selector lever. The sensor module is an intelligent unit and controls the selector position LED operation and also the shift interlock solenoid operation. The sensor module comprises a Printed

Circuit Board (PCB) and Hall effect sensors which detect the selected position of the selector lever (M/S and +/-) via a magnet located on the lever mechanism. The signals from the Hall sensors are passed from a connector on the sensor module to the TCM on a Local Interconnect Network (LIN) bus.

The sensor module main connector uses four pins for LIN bus, ground, power and neutral inputs and outputs. A second connector allows for the connection of a ribbon cable from the selector position LED for night illumination and position illumination. A third connector supplies power and ground connections to the shift interlock solenoid.

The sensor module also includes an optical sensor which determines that the selector lever is in the Park (P) position. The sensor is located behind the module housing and is not visible. Alignment marks on the sensor housing and the sensor arm must be aligned when the selector lever is in the Park (P) position. When these 2 marks are aligned the optical sensor/park position is correctly adjusted. This adjustment is set at the point of manufacture and does not require re-setting under normal operating conditions.

Sport/Manual +/- CommandShift™

The sensor module contains the hall effect sensors to activate the sport/manual mode and also the sensors which provide the +/- signals. When the selector lever is moved to the manual/sport position, the magnet located in the selector lever mechanism is moved within proximity of the M/S hall effect sensor on the PCB. This provides the signal which is received by the TCM, which in turn initiates sport mode.

When the lever is moved to the + or - position, the magnet is moved within proximity of one of the hall effect sensors positioned either side of the M/S hall effect sensor. When an input from either the + or - sensors is received, manual CommandShift™ mode will be initiated. In this position a spring will move the selector lever back to the centre position when released. To leave the CommandShift™ mode, return the lever to the 'D' position.

Shift Interlock

The shift interlock solenoid is located on the LH side of the selector lever assembly. The solenoid operates two locking levers which engage with the lever mechanism and lock it in the Park (P) and Neutral (N) positions. When the ignition is off, the solenoid is de-energized, locking the selector lever in the Park (P) position. If the selector lever is in any position other than Park (P), the remote handset cannot be removed from the start control module until the lever is moved to the Park (P) position.

The shift interlock solenoid has a mechanical connection to the sensor module using a sensor arm. Movement of the solenoid is transferred via the sensor arm to the sensor module which detects the movement using an optical sensor. The sensor arm movement provides a confirmation to the sensor module that the solenoid is in its interlocked position. The sensor arm has a ratchet adjustment for alignment of the optical sensor and is factory set and must not be adjusted.

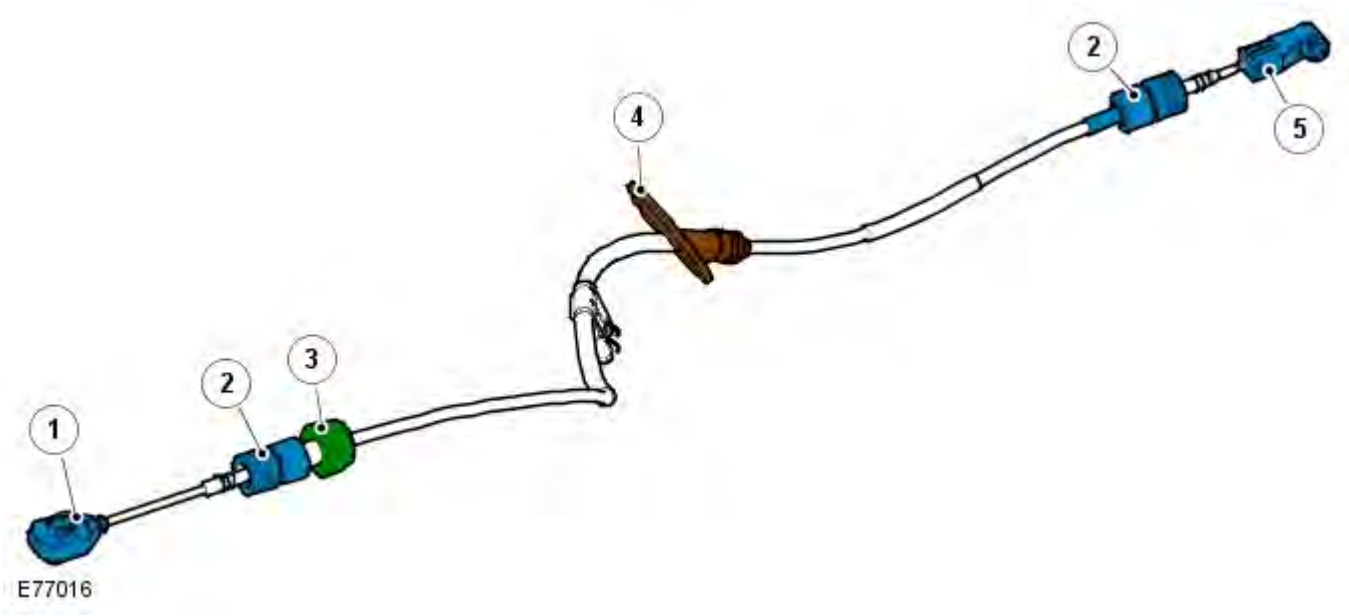
The shift interlock solenoid locks the selector lever in the park position or the neutral position to prevent inadvertent selections on the selector lever. The interlock is released when the ignition is on and the driver presses the brake pedal. A signal from the brake switch is passed on the high speed Controller Area Network (CAN) bus to the TCM and is then passed on the LIN bus to the sensor module. On receipt of this signal the sensor module logic energizes the solenoid if in the Park (P) position or de-energizes the solenoid if in the Neutral (N) position, releasing the interlock mechanism.

If the selector lever is left in the 'N' position for more than 3 seconds, the solenoid will be energized and the selector lever will become locked in the 'N' position. To move the selector lever from the 'N' position in this condition, the footbrake must be applied. This prevents the selector lever from being moved to the 'D' or 'R' position unintentionally and the application of the brakes also prevents the vehicle 'creeping' when the gear is engaged. Movement of the selector lever from the 'P' or 'N' positions is also prevented if the TCM senses the engine speed is above 2500 rev/min, even if the brake pedal is depressed.

If a fault occurs with the shift interlock solenoid, the sensor module, the brake switch or associated wiring, an emergency release lever is provided to disconnect the interlock mechanism. The emergency release lever can be accessed by using a tool to remove the selector lever trim finisher from the floor console. The finisher can be lifted to gain access to the release lever which is located at the front the selector lever assembly and is colored yellow for identification.

• NOTE: The selector lever cannot be moved from the 'Park' position if the ignition is switched off unless the emergency release lever is used.

TRANSMISSION CABLE



Item	Part Number	Description
1	-	Transmission eye end
2	-	Abutment
3	-	Damper weight
4	-	Bulkhead grommet
5	-	Selector lever arm eye end and setting button

The transmission cable assembly is a one-piece, push/pull cable connected between the transmission and the selector lever.

The selector lever end of the cable has an adjustable eye end which locates on a ball pin on the selector lever. An abutment on the cable outer sheath locates in an aperture at the front of the selector lever shift housing.

A fireproof grommet seal is positioned approximately half way along the length of the cable and seals the cable through a hole in the bulkhead.

The transmission end of the cable also has an eye end which locates on a ball pin on the end of the transmission lever arm. An abutment on the outer sheath locates in a bracket attached to the top of the transmission.

Linear movement of the selector lever is transferred, via the inner cable, into movement of the transmission lever arm. The lever arm converts the linear movement of the selector cable into rotary movement of the manual shaft in the transmission.

Cable Setting Procedure

The correct cable adjustment is achieved by use of a yellow button in the selector lever arm eye end. The setting process is to ensure that the transmission is in Park (P) and the selector lever is in its detente park position. This can be checked by selecting the Park (P) position and with the park brake released, rocking the vehicle forward and back to ensure that the transmission parking pawl is engaged.

Once the cable is in the correct position, the yellow setting button can be engaged with the serrated portion of the cable. Access to the setting button is through the aperture in the upper face of the shift housing.

The cable should be reset whenever any part of the transmission shift system has been disturbed or replaced, including the transmission, operating arms, abutment brackets cables or selector lever assembly.

Published: 11-May-2011

Automatic Transmission/Transaxle External Controls - External Controls

Diagnosis and Testing

Principles of Operation

For a detailed description of the automatic transmission external controls, refer to the relevant Description and Operation section in the workshop manual.
REFER to: External Controls (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Check for correct gear selector lever cable adjustment. REFER to: Selector Lever Cable (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation). • Visibly damaged or worn components • Loose or missing fasteners	• Fuse(s) • Loose or corroded electrical connector(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check the TCM for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P070500	Transmission range sensor A circuit (PRNDL input)	• Incorrect adjustment of the gear selector lever cable • Incorrect adjustment of the gear position sensor • Internal transmission control module (TCM) fault	Check the adjustment of the gear selector lever cable and sensor. REFER to: Selector Lever Cable (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation). Refer to the warranty policy and procedures manual if a module is suspect.
P070600	Transmission range sensor A circuit range/performance	• Incorrect adjustment of the gear selector lever cable • Incorrect adjustment of the gear position sensor • Internal transmission control module (TCM) fault	Check the adjustment of the gear selector lever cable. REFER to: Selector Lever Cable (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation). Calibrate the gear position sensor using the approved diagnostic system. Refer to the warranty policy and procedures manual if a module is suspect.
P070900	Transmission range sensor A circuit intermittent	• Incorrect adjustment of the gear selector lever cable • Incorrect adjustment of the gear position sensor • Internal transmission control module (TCM) fault	Check the adjustment of the gear selector lever cable. REFER to: Selector Lever Cable (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation). Calibrate the gear position sensor using the approved diagnostic system. Refer to the warranty policy and procedures manual if a module is suspect.

DTC	Description	Possible Cause	Action
P085A00	Gear shift module B communication circuit	• LIN circuit fault between the gear selector module (GSM) and transmission control module (TCM)	Check the LIN circuits. Refer to the electrical guides. Rectify as necessary.
P086011	Gear shift module A communication circuit	• LIN circuit fault between the gear selector module (GSM) and transmission control module (TCM)	Check the LIN circuits. Refer to the electrical guides. Rectify as necessary.
P086012	Gear shift module A communication circuit	• LIN circuit fault between the gear selector module (GSM) and transmission control module (TCM)	Check the LIN circuits. Refer to the electrical guides. Rectify as necessary.
P086013	Gear shift module A communication circuit	• LIN circuit fault between the gear selector module (GSM) and transmission control module (TCM)	Check the LIN circuits. Refer to the electrical guides. Rectify as necessary.
P086087	Gear shift module A communication circuit - missing message	• LIN circuit fault between the gear selector module (GSM) and transmission control module (TCM)	Check the LIN circuits. Refer to the electrical guides. Rectify as necessary.
P092800	Gear shift lock solenoid circuit open	• Gear shift lock solenoid circuit: short circuit to ground • Gear shift lock solenoid circuit: open circuit • Gear shift lock solenoid circuit: short circuit to power • Gear shift lock solenoid fault	Check the gear shift lock solenoid and circuits. Refer to the electrical guides. Rectify as necessary.
P092811	Gear shift lock solenoid circuit open	• Gear shift lock solenoid circuit: short circuit to ground • Gear shift lock solenoid fault	Check the gear shift lock solenoid and circuits. Refer to the electrical guides. Rectify as necessary.
P092812	Gear shift lock solenoid circuit open	• Gear shift lock solenoid circuit: short circuit to power • Gear shift lock solenoid fault	Check the gear shift lock solenoid and circuits. Refer to the electrical guides. Rectify as necessary.
P092813	Gear shift lock solenoid circuit open	• Gear shift lock solenoid LIN circuit: open circuit • Gear shift lock solenoid fault	Check the gear shift lock solenoid and LIN circuits. Refer to the electrical guides. Rectify as necessary.
P093000	Gear shift lock solenoid circuit low	• Gear shift lock solenoid circuit: short circuit to ground • Gear shift lock solenoid circuit: open circuit • Gear shift lock solenoid fault	Check the gear shift lock solenoid and circuits. Refer to the electrical guides. Rectify as necessary.
P093100	Gear shift lock solenoid circuit high	• Gear shift lock solenoid circuit: short circuit to power • Gear shift lock solenoid fault	Check the gear shift lock solenoid and circuits. Refer to the electrical guides. Rectify as necessary.
P093111	Gear shift lock solenoid circuit high	• Gear shift lock solenoid LIN circuit: short circuit to ground • Gear shift lock solenoid fault	Check the gear shift lock solenoid and LIN circuits. Refer to the electrical guides. Rectify as necessary.
P093112	Gear shift lock solenoid circuit high	• Gear shift lock solenoid LIN circuit: short circuit to power • Gear shift lock solenoid fault	Check the gear shift lock solenoid and LIN circuits. Refer to the electrical guides. Rectify as necessary.
P173D00	Ignition key lock solenoid circuit open	• Shift lock solenoid circuit: open circuit • Shift lock solenoid fault	Check the shift lock solenoid and circuits (between the gear selector module and the transmission control module). Refer to the electrical guides. Rectify as necessary.
P173E00	Ignition key lock solenoid circuit low	• Shift lock solenoid circuit: short circuit to ground • Shift lock solenoid fault	Check the shift lock solenoid and circuits (between the gear selector module and the transmission control module). Refer to the electrical guides. Rectify as necessary.

DTC	Description	Possible Cause	Action
P173F00	Ignition key lock solenoid circuit high	• Shift lock solenoid circuit: short circuit to power • Shift lock solenoid fault	Check the shift lock solenoid and circuits (between the gear selector module and the transmission control module). Refer to the electrical guides. Rectify as necessary.
U210511	Switch Pack Signal "A"	• Shift Lock position signal circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check shift lock position signal circuit for short to ground, open circuit
U210512	Switch Pack Signal "A"	• Shift Lock position signal circuit - short to power	Refer to electrical circuit diagrams and check shift lock position signal circuit for short to power

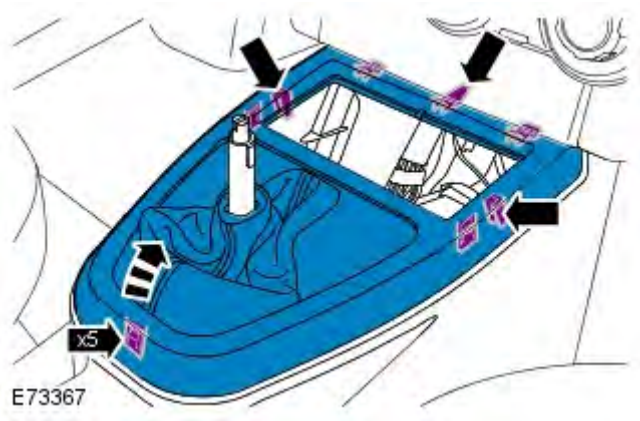
Published: 11-May-2011

Automatic Transmission/Transaxle External Controls - Selector Lever Cable Adjustment

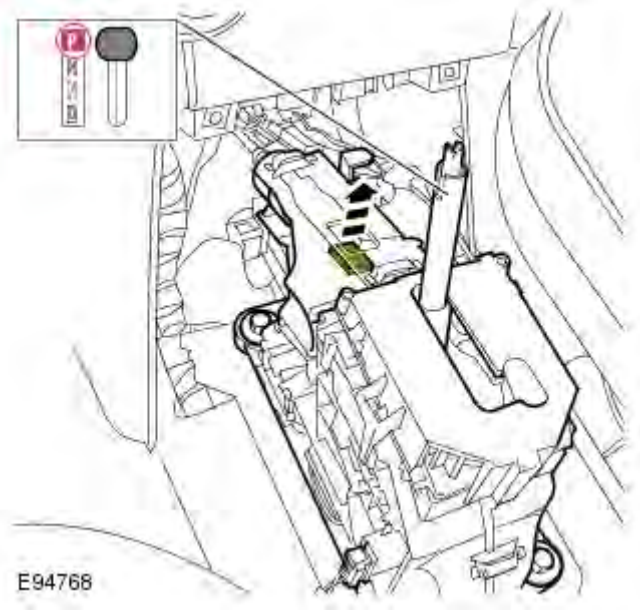
General Procedures

1. Check the operation of the transmission selector lever.
2. Remove the gear selector knob.

   Refer to: Selector Lever Knob (307-05, Removal and Installation).

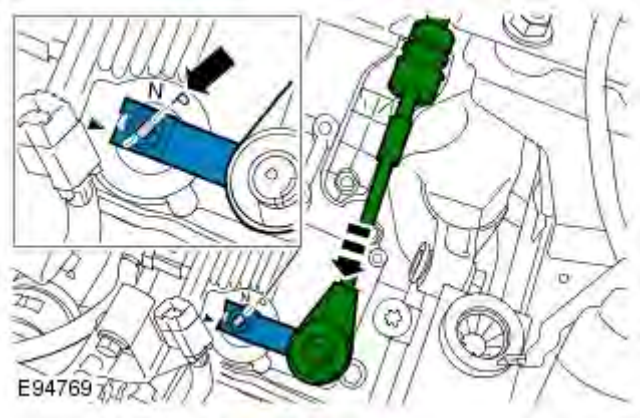


3.

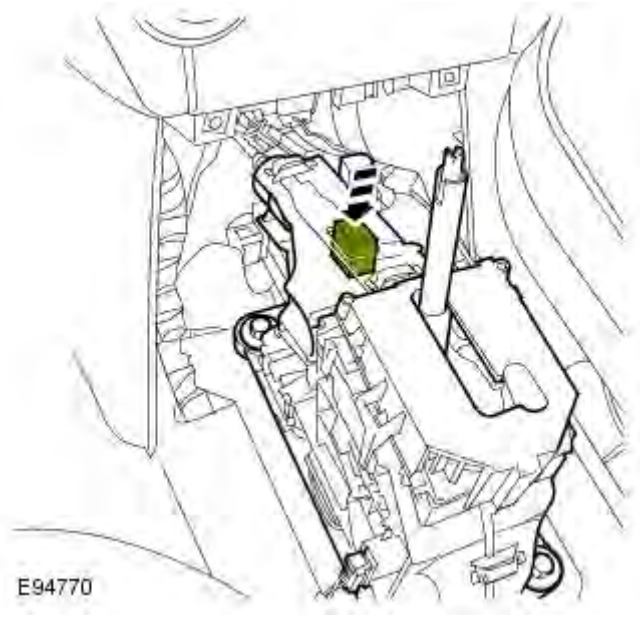


4. **4.** CAUTION: Make sure that the selector lever and the gearshift mechanism are in the park (P) position.

   Release the selector cable adjuster.



5. **5.** CAUTION: Make sure that the selector lever and the gearshift mechanism are in the park (P) position.



6. Lock the selector cable adjuster.

7. Secure the gear selector cover.

8. Install the gear selector knob.

   Refer to: Selector Lever Knob (307-05, Removal and Installation).

Published: 11-May-2011

Automatic Transmission/Transaxle External Controls - Selector Lever Assembly

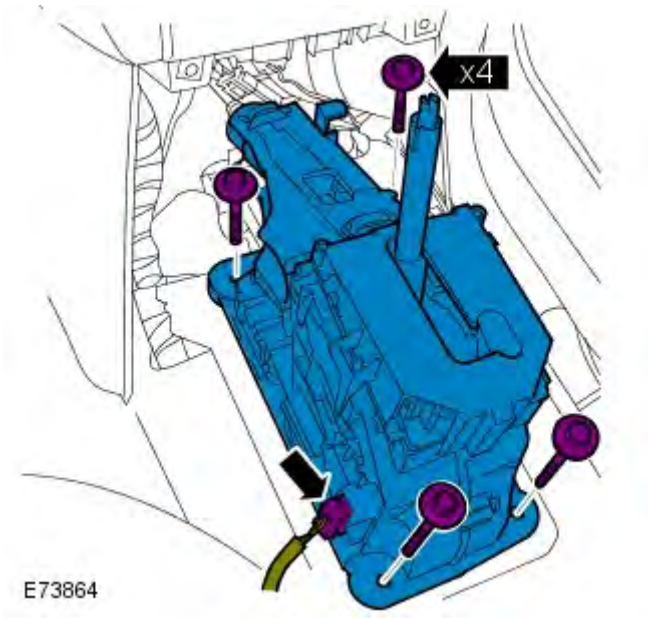
Removal and Installation

Removal

1. Remove the floor console.

   Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

2.
   - Position the transmission selector lever into PARK.
   - Depress and hold the selector cable ball joint release button, using a lever carefully disconnect the cable.
   - Release the cable.



3.
   - *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Automatic Transmission/Transaxle External Controls - Selector Lever Cable

Removal and Installation

Removal

CAUTION: Make sure that the selector lever and the gearshift mechanism are in the park (P) position.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the driveshaft.

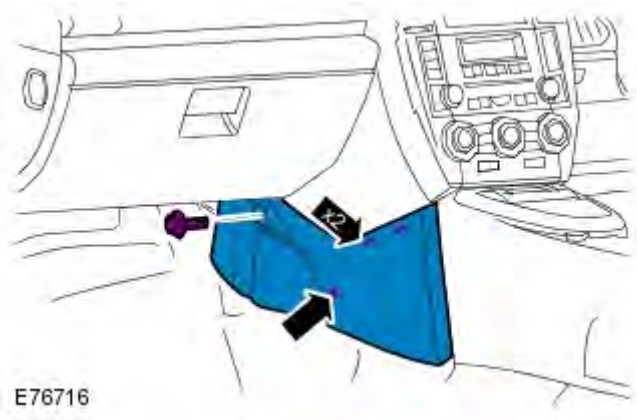
   Refer to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

3. Remove the floor console.

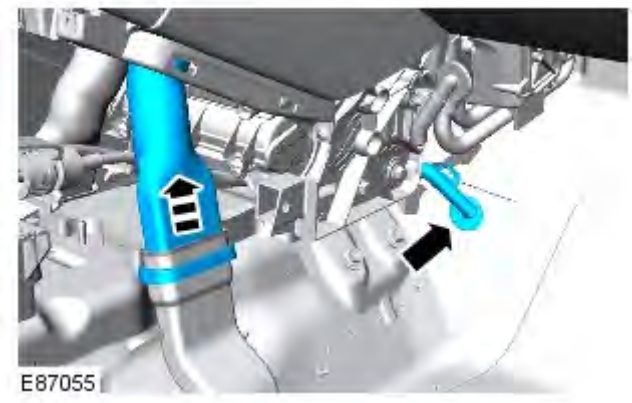
   Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

4. Remove the air cleaner assembly.

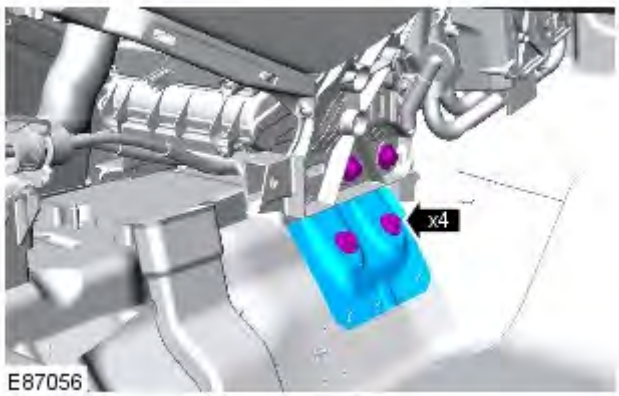
   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).



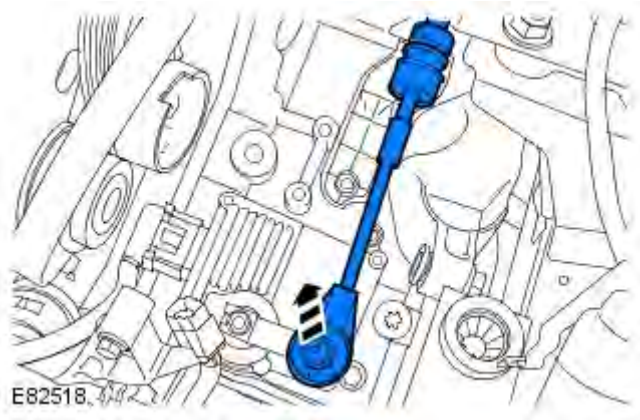
5. Remove the instrument panel, lower trim panels.



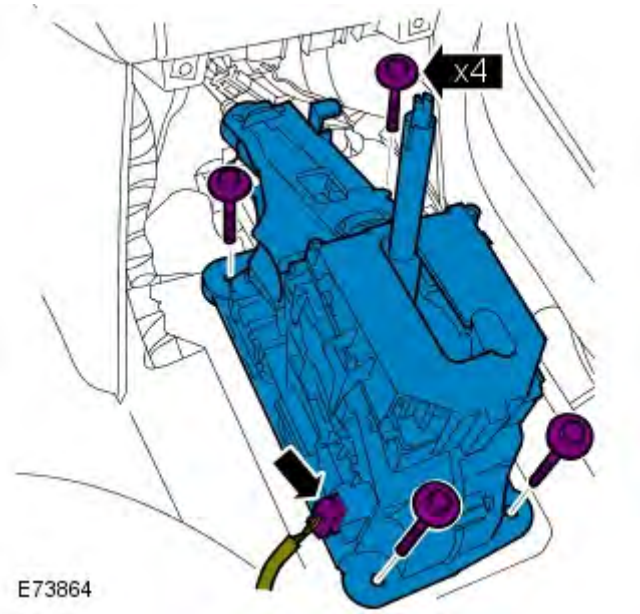
6.



7. Remove the RH instrument pack lower bracket.

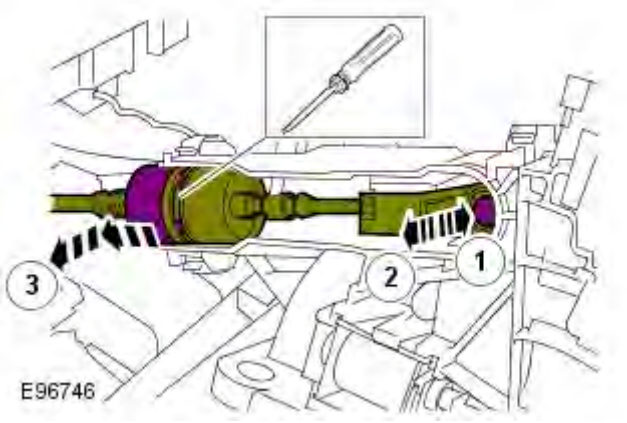


8.



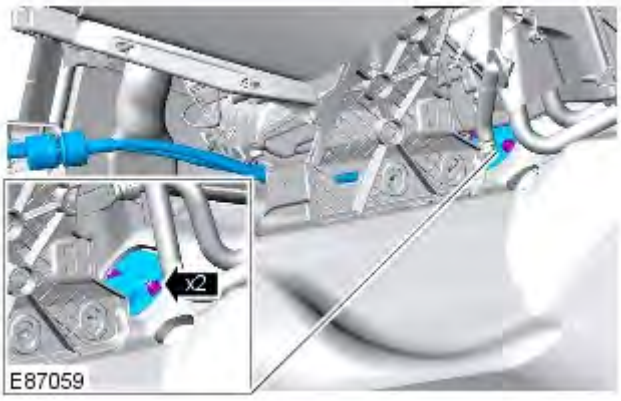
9.

- Position the transmission selector lever into PARK.

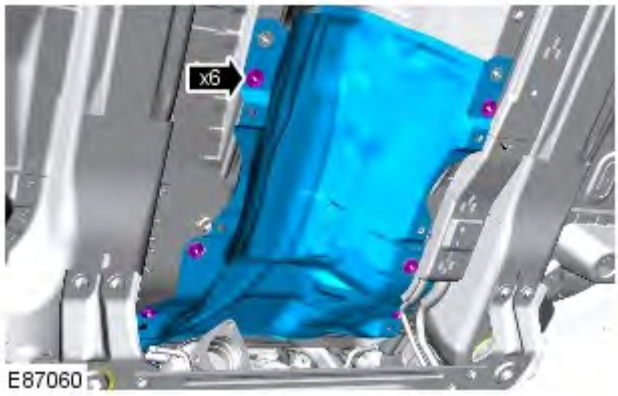


10.

- Depress and hold the selector cable ball joint release button, using a lever carefully disconnect the cable.
- Disconnect and remove the cable.



11. Release the cable sealing plate.



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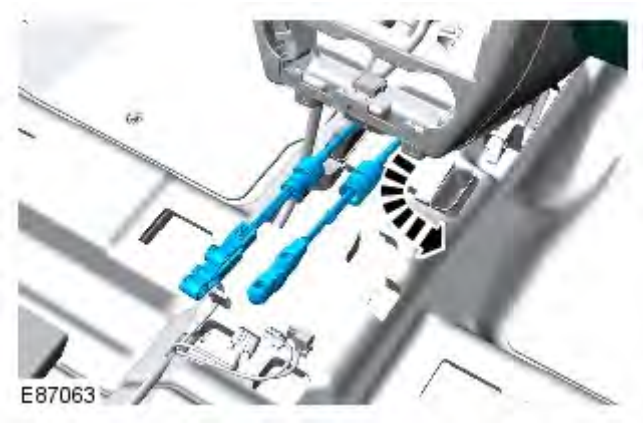
13.



14. **14.** NOTE: This step requires the aid of another technician.

    Remove the gear selector cable assembly.

Installation

1. **1.** NOTE: This step requires the aid of another technician.

   Install the selector cable.

2. Secure the cables in the clips.

3. Install the heat shield.

4. Secure the selector cables.

5. Install the sealing plate.

   Torque: 7 Nm

6. Install the gearshift lever.

   Torque: 10 Nm

7. Connect the selector cable ball joints.

8. Install the instrument pack bracket.

   Torque: 25 Nm

9. Secure the drain tube and heater duct.

10. Install the instrument panel, lower trim panels.

11. Install the air cleaner assembly.

    Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

12. Install the floor console.

    Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

13. Install the driveshaft.

    Refer to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

Published: 07-Nov-2011

Automatic Transmission/Transaxle External Controls - Selector Lever Knob, Boot and Bezel

Removal and Installation

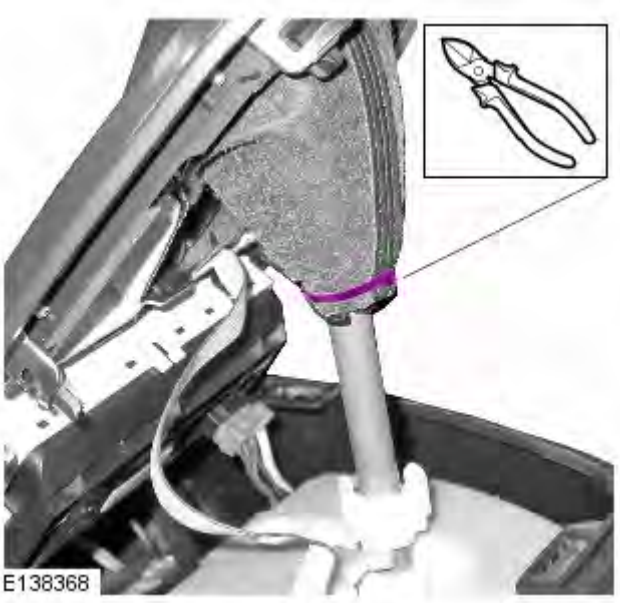
Removal

• NOTE: Make sure that the selector lights function correctly. If the ribbon cable is damaged it will be necessary to remove the floor console to access the ribbon cable connector on the selector lever assembly.

1. Position the gearshift lever in NEUTRAL.
2. Switch the ignition off.
3.
   - Release the gear lever surround by pulling upwards firmly at the rear.

4.

- Release the locking ring.



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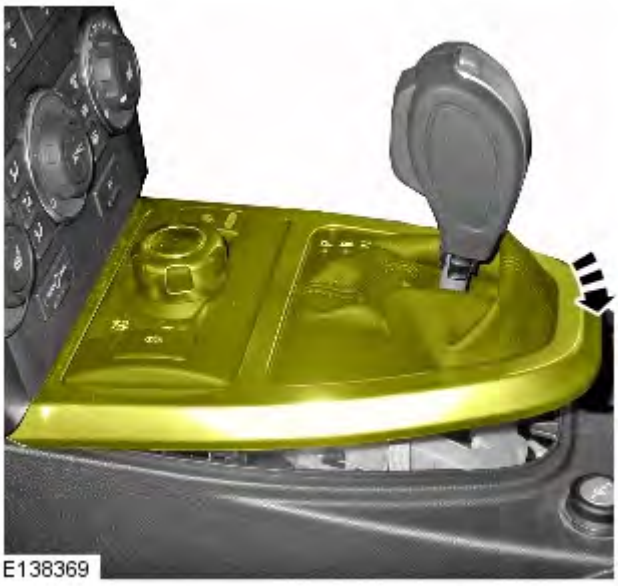

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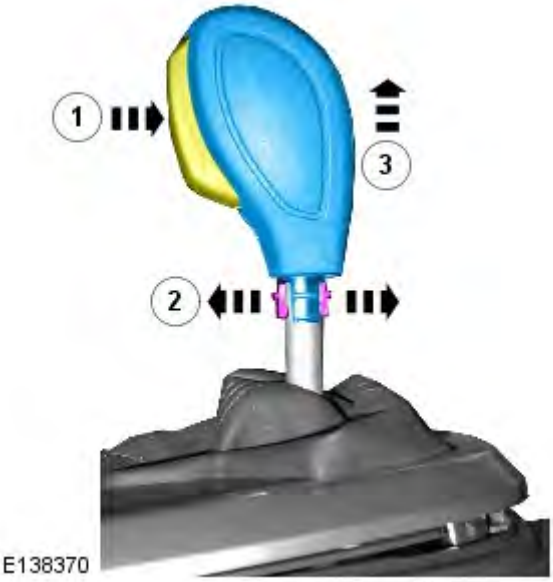
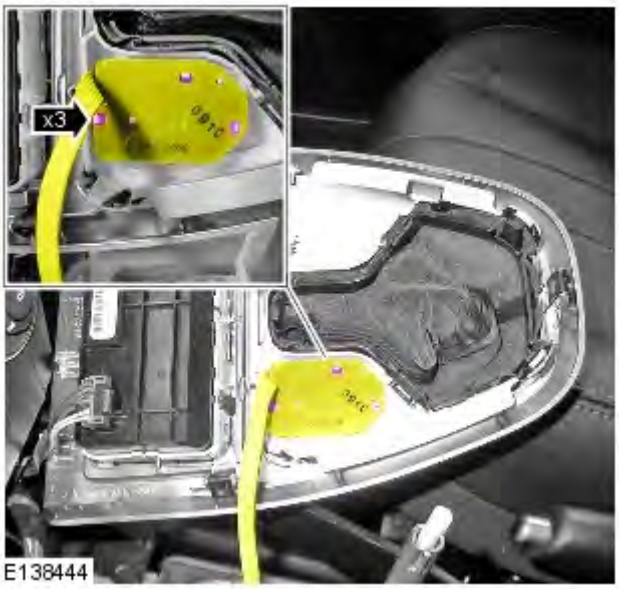


7. **7.** WARNING: The selector lever knob will be released suddenly, keep face clear during removal.

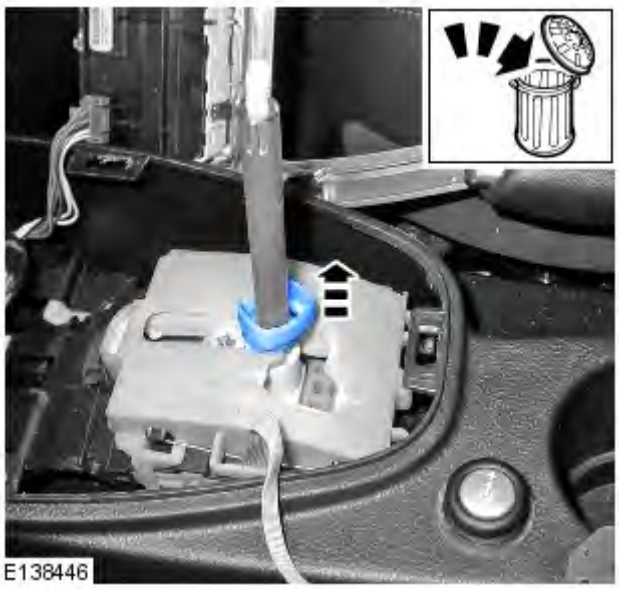
CAUTION: Make sure the selector lever button is depressed when removing the selector lever knob. Failure to follow this instruction may result in damage to the selector lever assembly.

8.



9. **9.** CAUTION: Take care not to touch the printed side of the printed circuit board (PCB).

10. **10.** CAUTION: Discard the component.



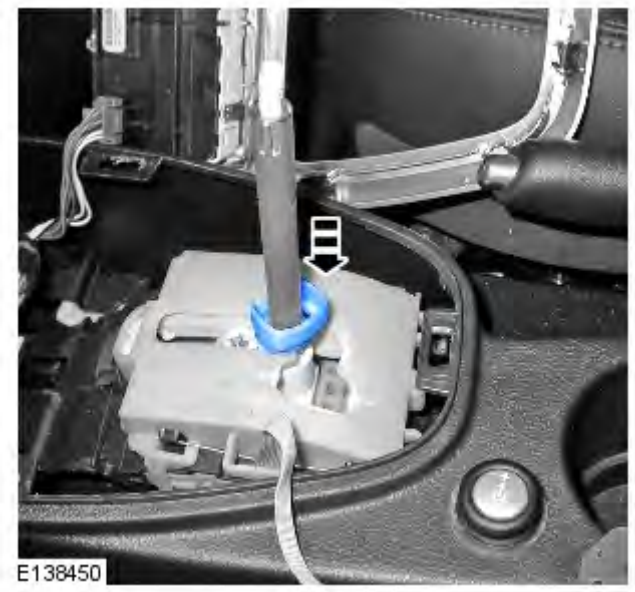
11. **11.** CAUTION: Discard the component.

E138447

12. **12.** CAUTION: Discard the component.

    Remove and discard the selector lever assembly printed circuit board.

Installation

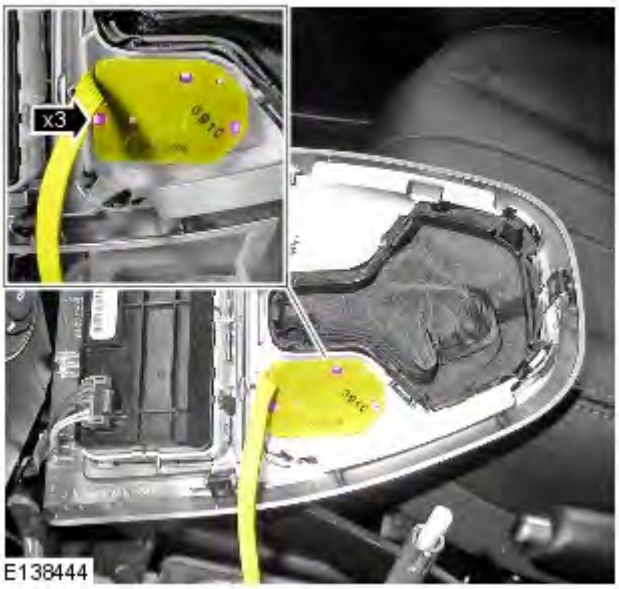


E138450

1.

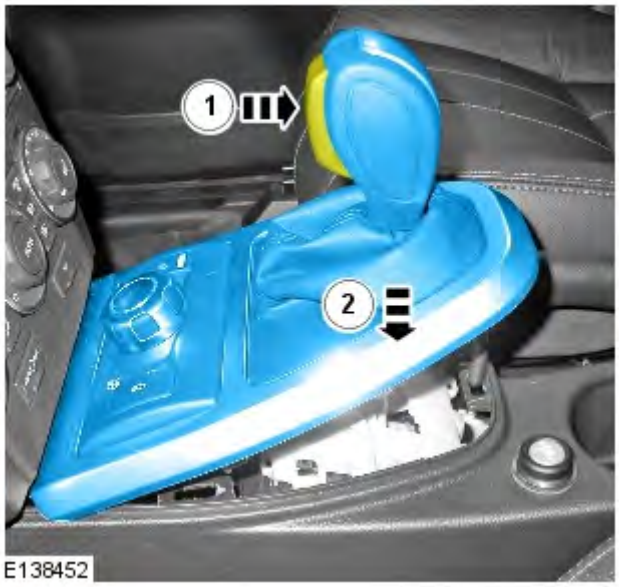
E138451

2.



E138444

3. **3.** CAUTION: Take care not to touch the printed side of the printed circuit board (PCB).



E138452

4. **4.** CAUTIONS:

Make sure the selector lever button is depressed when installing the selector lever knob. Failure to follow this instruction may result in damage to the selector lever assembly.

Make sure the ribbon cable is routed in front of the selector shaft.

E138374

5. **5.** NOTE: Make sure the cut out on the locking ring faces towards the front of the vehicle.
   - Install the locking ring.

E138376

6.
   - Secure into the 3 clips.

7. Switch the ignition on.

8. Position the transmission selector lever into PARK.

Published: 11-May-2011

Manual Transmission/Transaxle and Clutch - General Information -

Lubricant

Item	Specification
Recommended lubricant	Castrol BOT 350 M3 - Land Rover (vehicles built from 2011 onwards)
	Castrol MTF97309 - Land Rover (vehicles built upto 2011)

Capacities

Item	Capacity (liters/pints/US quarts)
Initial dry fill	1.9/3.3/2.0

General Specification

Item	Specification
Transmission make/type	M66 EH50
Gears	6 speed manual
Synchromesh:	
Triple	1st and 2nd
Dual	3rd
Single	4th, 5th, 6th and reverse
Torque - Maximum	380 Nm (280 lb-ft)
Gear ratios:	
First	3.750:1
Second	1.905:1
Third	1.182:1
Fourth	0.838:1
Fifth	0.652:1
Sixth	0.540:1
Reverse	3.436:1

Torque Specifications

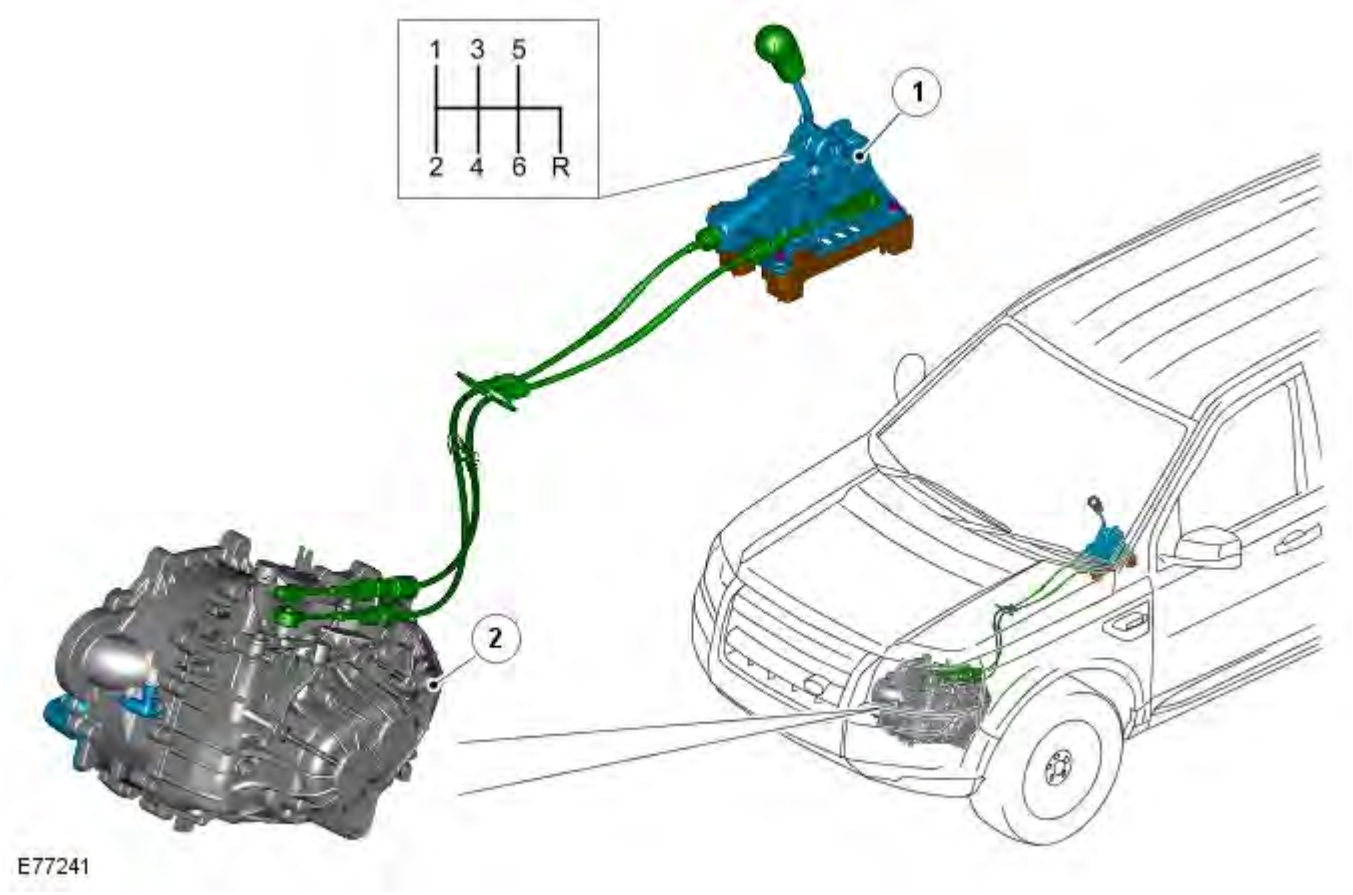
Description	Nm	lb-ft
Earth cable to transmission mounting bracket	25	18
Front flywheel closing panel	60	44
Front subframe		
Stage 1	140	103
Stage 2	240°	
Rear flywheel closing panel	24	18
Subframe cross-brace		
M16	140	103
M10	45	33
Transmission bolts	65	48
Transmission mounting bracket		
M8	24	18
M12	80	59
Transmission mounting to body mounting	175	129
Transmission fluid drain plug	30	22
Transmission fluid filler plug	35	26

Published: 11-May-2011

Manual Transmission/Transaxle and Clutch - General Information - Manual Transmission and Clutch

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Selector lever
2	-	Manual transmission

OVERVIEW

The M66EHA50 manual transmission is a 6 speed unit manufactured by Getrag-Ford in Cologne, Germany. The transmission is a highly compact 4 shaft design, incorporating the front final drive gear, and is adapted for All Wheel Drive (AWD) by providing a connection from the final drive carrier to the Power Transfer Unit. The transmission is capable of transferring high torque from the engine.

The transmission features two mechanical shift cables from the selector lever and an electronic reverse inhibitor.

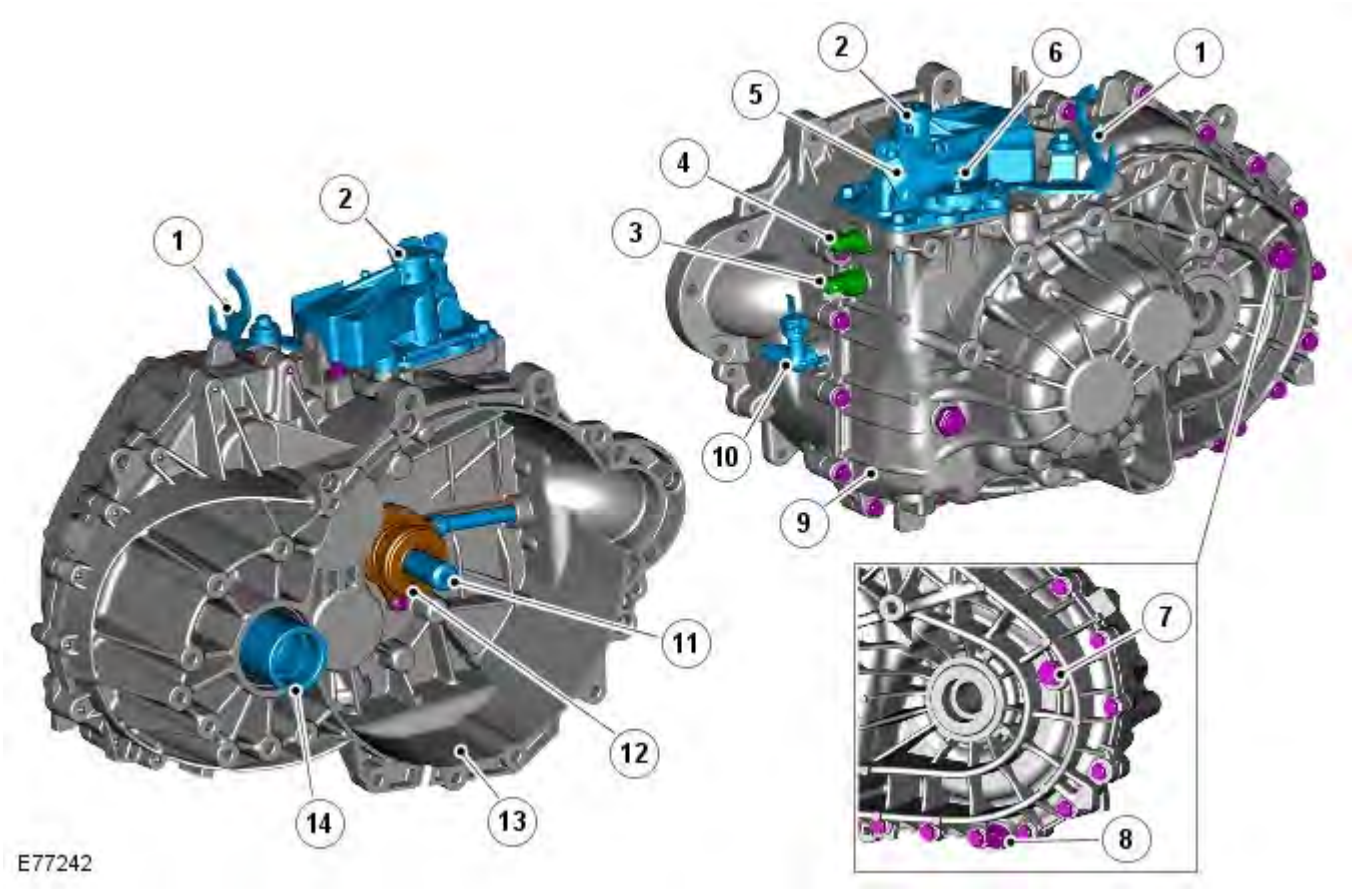
The M66EH50 manual transmission has the following features:

- 380 Nm torque capacity (with torque truncation in 1st and reverse gears)
- Dry weight 61 kg
- Transmission oil is fill for life - 1.9L fill to level plug Oil spec MTF97309
- Front differential integral with transmission
- 6 forward gears
- 4th to 6th gears and reverse gear have single cone synchronization
- 3rd gear is double cone synchronized
- 1st and 2nd gears have triple cone synchronization.

The clutch system used is a conventional single driven plate and a diaphragm spring clutch cover assembly. The clutch is hydraulically operated by operation of the clutch pedal which disengages the drive from the engine crankshaft to the transmission.

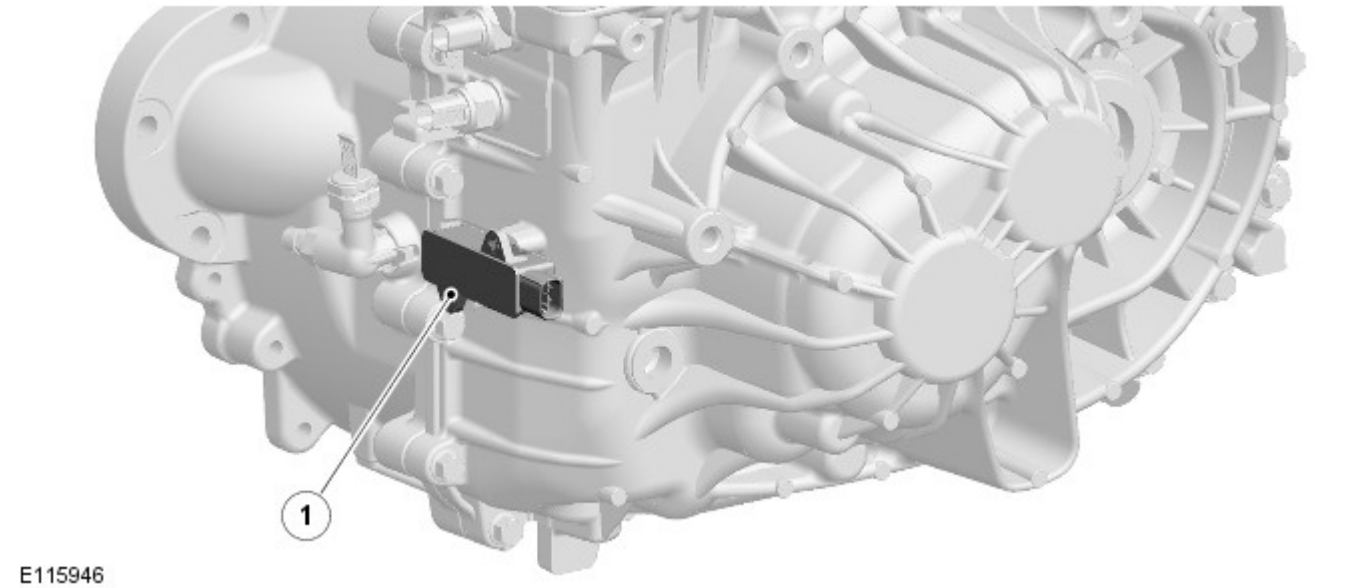
TRANSMISSION

For shift cable and selector lever description refer to External Controls.
For additional information, refer to: External Controls (308-06 Manual Transmission/Transaxle External Controls, Description and Operation).



Item	Part Number	Description
1	-	Cable retaining bracket
2	-	Longitudinal lever
3	-	1st gear detection switch
4	-	Reverse switch
5	-	Lateral lever
6	-	Shift cable ball end
7	-	Transmission oil level/filler plug
8	-	Transmission drain plug
9	-	Transmission casing
10	-	Hydraulic clutch bleed adaptor
11	-	Input shaft
12	-	Clutch slave cylinder
13	-	Clutch housing
14	-	Differential output (Right Hand (RH) side)

Neutral Gear Sensor - Stop/Start Vehicles - From 2010 MY

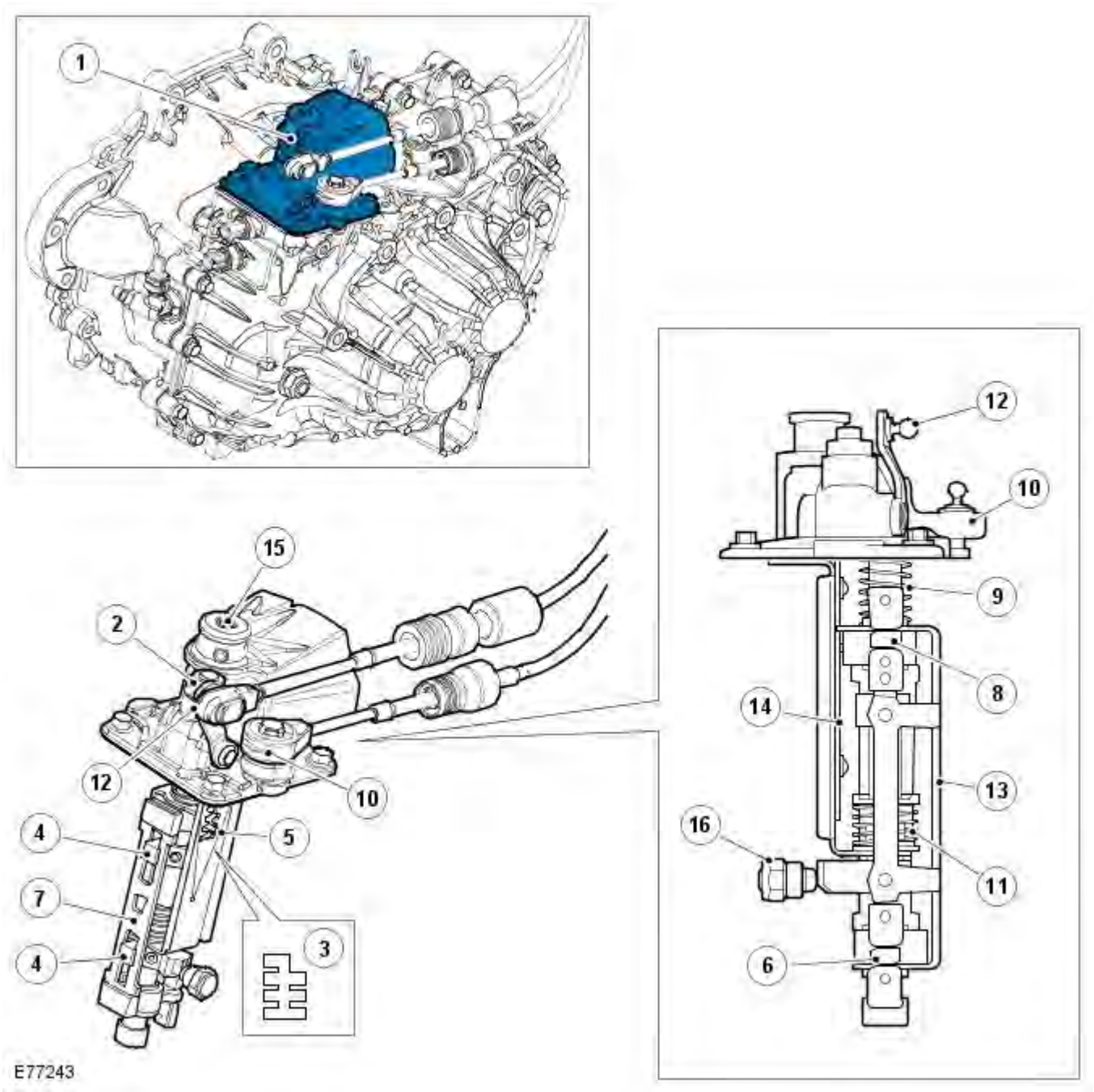


Item	Part Number	Description
1	-	Neutral gear sensor

Neutral Gear Sensor

A PLCD (Permanent Magnet Linear Contactless Displacement) sensor is introduced on Stop/Start vehicles and located on the exterior of the transmission casing and hardwired to the ECM. The sensor's function is to detect that neutral gear has been selected within a calibrated window.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

Shift Control Mechanism



Item	Part Number	Description
1	-	Shift control mechanism
2	-	Ball limiter 5th - 6th gear control
3	-	Gearshift gate
4	-	Flange
5	-	Gear shift gate pin
6	-	Lower gear selector
7	-	Gear selector rod
8	-	Upper gear selector
9	-	Spring
10	-	Longitudinal lever
11	-	Spring
12	-	Lateral lever
13	-	Catch plate
14	-	Carrier plate
15	-	Bleed cap

16	-	Ball limiter for gear selector

The transmission is operated by two shift cables which are attached to the selector lever. Movement of the selector lever is passed via the cables to two lever mechanisms on the top of the transmission. The levers operate a shift control mechanism within the transmission to select the requested gear ratio.

The shift control mechanism is located at the front of the transmission and transfers the shift cable movement into gear selections.

The shift control mechanism is a one-piece assembly which is retained in the transmission housing with 4 bolts. The shift control mechanism moves the upper and lower gear selector forks via the lateral and longitudinal levers on the top of the shift control mechanism. There are 2 upper selector forks and 2 lower selector forks as follows:

- The 2 upper gear selector forks are used to engage reverse, 1st or 2nd gears
- The 2 lower gear selector forks are used to engage 3rd, 4th, 5th and 6th gears.

The 4 selector forks transfer movement from the shift control mechanism to the relevant shift coupling sleeve. The shift forks are mounted in bearings in the transmission case.

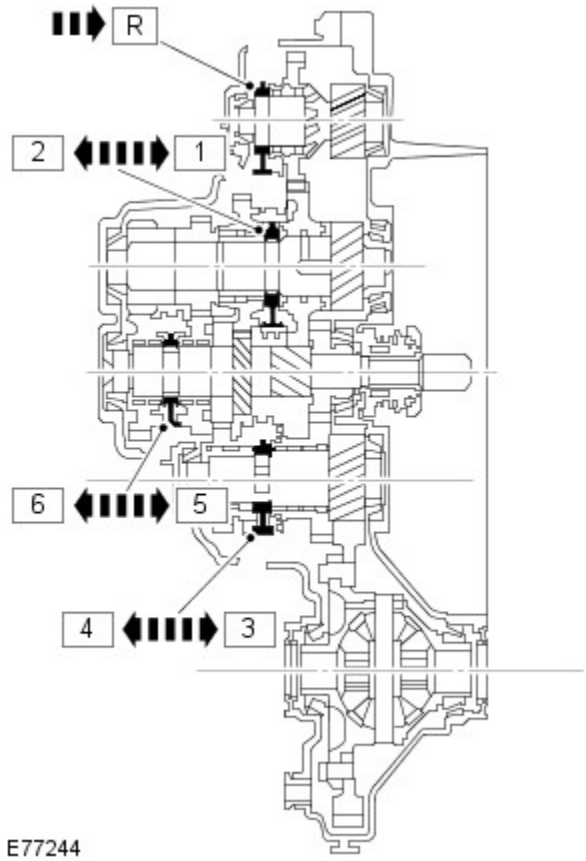
Two carrier plates transfer torque from the longitudinal lever to the sliding gear selectors. The carriers are located and run in a groove in the gear selector plate.

The carrier plates can move vertically between 4 positions. The different gears are selected from one of the 4 positions as follows:

- Uppermost position - gear selector selects reverse gear
- Second uppermost position - gear selector selects 1st and 2nd gears
- Second lowest position - gear selector selects 5th and 6th gears
- Lowest position - gear selector selects 3rd and 4th gears.

The shift control mechanism has two springs that return the selector lever to the neutral position.

Transmission Shift Selector Shafts



The above illustration shows the coupling sleeves for each gear cluster. Movement of these sleeves as selected by the shift control mechanism, connect the required gear trains together to produce the required output ratio.

The coupling sleeve is part of the synchronizing hub assembly which also consists of a flange and the hub. Each synchronizing hub is joined to its shaft by splines and rotates with it. Idler wheels are fitted on both sides of each synchronizing hub. The idler wheels rotate freely on the shaft (with the exception of reverse gear). Each idler wheel is constantly engaged in its pinion. The synchronizing set is positioned between the synchronizing hub and the idler wheel.

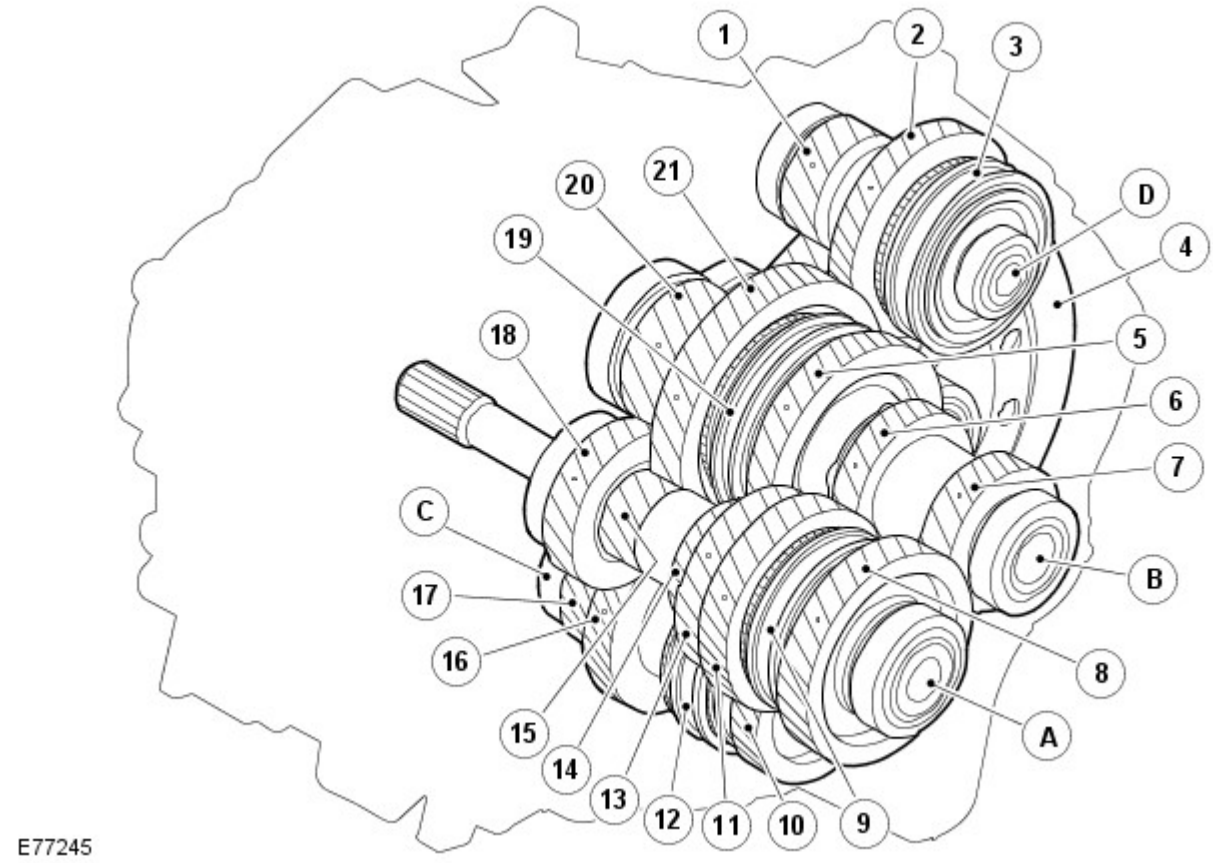
The synchronizing units are positioned on the shafts in the transmission as follows:

- The synchronizing unit for 1st - 2nd gear is on the intermediate shaft 1st - 2nd, 5th - 6th
- The synchronizing unit for 3rd - 4th gear is on the intermediate shaft 3rd - 4th
- The synchronizing unit for 5th-6th gear is on the input shaft
- The synchronizing unit for reverse gear is on the reverse shaft.

The synchronizing rings expand when heated by the same amount as the components they are in contact with. As a result

no safety margin is required to counter expansion. The idler wheels for single and double synchronization have no cones. An inner ring on the synchronizer unit performs this function instead.

Transmission Gear Cluster



Item	Part Number	Description
A	-	Input shaft
B	-	Intermediate shaft 1st to 2nd, 5th to 6th
C	-	Intermediate shaft 3rd to 4th
D	-	Reverse shaft
1	-	Reverse final gear
2	-	Reverse idler gear
3	-	Reverse gear coupling sleeve
4	-	Final gear - Differential
5	-	2nd gear - idle gear
6	-	5th gear
7	-	6th gear
8	-	6th gear - idle gear
9	-	5th to 6th gear coupling sleeve
10	-	4th gear - idle gear
11	-	5th gear - idle gear
12	-	3rd to 4th gear coupling sleeve
13	-	4th gear
14	-	2nd gear path
15	-	1st gear path
16	-	3rd gear - idle gear
17	-	3rd to 4th final gear pinion
18	-	3rd gear
19	-	1st to 2nd gear coupling sleeve
20	-	1st to 2nd and 5th to 6th final gear pinion
21	-	1st gear - idle gear

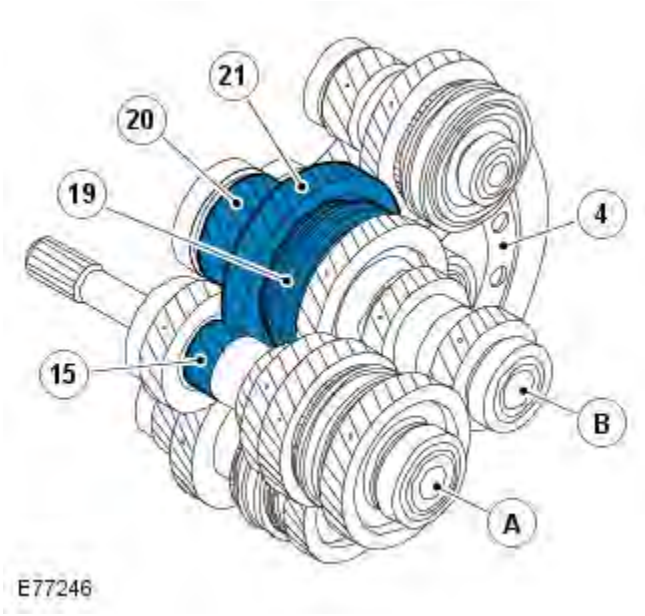
The gear wheels are located on four shafts, as follows:

- Input shaft
- Intermediate shaft 1-2, 5-6
- Intermediate shaft 3-4
- Reverse shaft.

In order to keep the shafts short, the clutch gears are welded directly to the idler wheel and needle bearings with inner rings are used instead of snap rings. The inner rings sit on the shaft inside the idler gears and extend lengthwise outside each idler gear. When the components on the shafts are pulled together the inner rings counterhold, so that the idler wheels have the clearance that they require to rotate. The components of the input shafts are pulled together with a bolt located in the end of the shaft. Components of intermediate shaft 3rd -4th are held together with a press joint and a bolt located in the end of the shaft. The components of intermediate shaft 1st -2nd, 5th -6th are held together with the press

joint of the 5th and 6th gear pinion.

1st Gear Power Flow

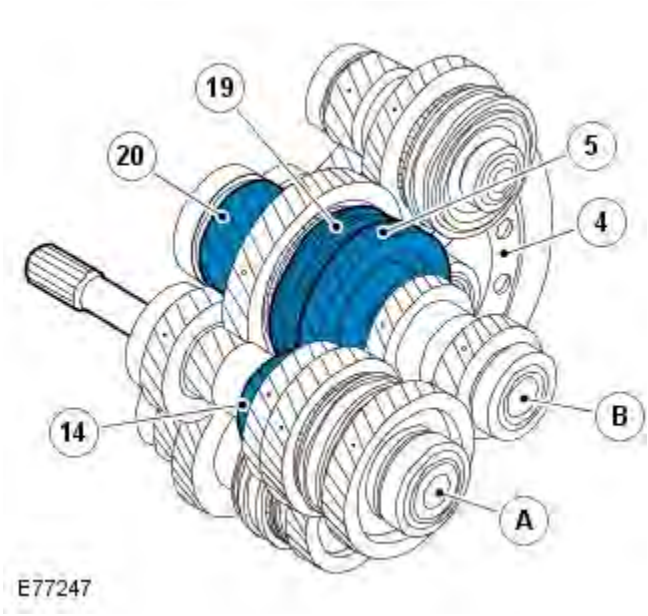


Item	Part Number	Description
A	-	Input shaft
B	-	Intermediate shaft 1st - 2nd and 5th - 6th
4	-	Ring gear
15	-	1st gear
19	-	1st - 2nd gear coupling sleeve
20	-	Final drive 1st - 2nd and 5th - 6th
21	-	1st gear idler gear

When 1st gear is selected, the coupling sleeve for 1st - 2nd gear is moved by a gear selector fork along the synchronizing hub towards the 1st gear idler gear. The coupling sleeve and the synchronizing hub lock the 1st gear idler gear at the intermediate shaft 1st - 2nd and 5th - 6th.

Engine torque is transferred to the input shaft via the clutch. The 1st gear rack on the input shaft transfers the power to the 1st gear idler gear. From there the power is transferred to the intermediate shaft 1st - 2nd and 5th - 6th and to the final drive, which in turn transfers power to the ring gear. The ring gear is connected to the drive shafts through the differential.

2nd Gear Power Flow



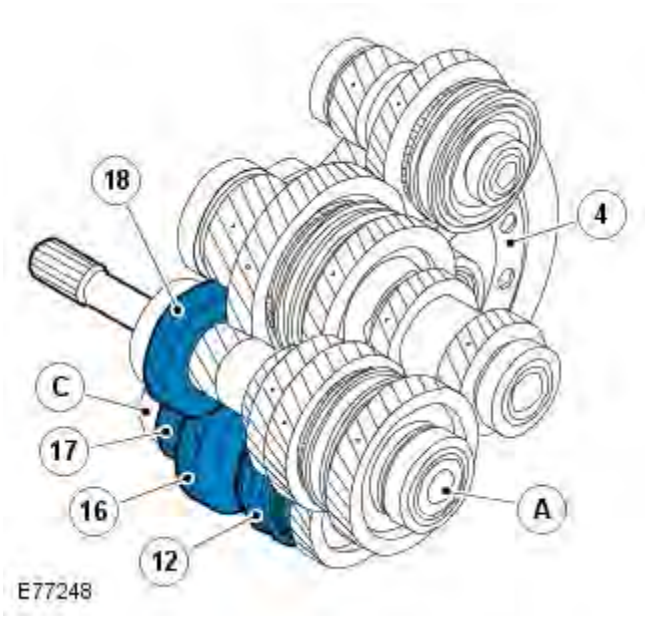
Item	Part Number	Description
A	-	Input shaft
B	-	Intermediate shaft 1st - 2nd and 5th - 6th
4	-	Ring gear
5	-	2nd gear idler gear
14	-	2nd gear
19	-	1st - 2nd gear coupling sleeve

20	-	Final drive 1st - 2nd and 5th - 6th

When 2nd gear is selected, the coupling sleeve for 1st - 2nd gear is moved by a gear selector fork along the synchronizing hub towards the 2nd gear idler gear. The coupling sleeve and the synchronizing hub lock the 2nd gear idler gear at the intermediate shaft 1st - 2nd and 5th - 6th.

Engine torque is transferred to the input shaft via the clutch. The 2nd gear rack on the input shaft transfers the power to the 2nd gear idler gear. From there the power is transferred to the intermediate shaft 1st - 2nd and 5th - 6th and to the final drive, which in turn transfers power to the ring gear. The ring gear is connected to the drive shafts through the differential.

3rd Gear Power Flow

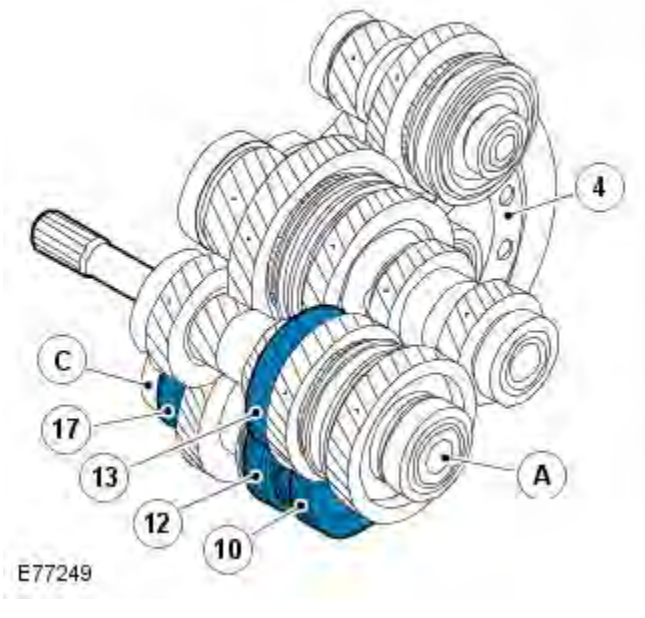


Item	Part Number	Description
A	-	Input shaft
C	-	Intermediate shaft 3rd - 4th
4	-	Ring gear
12	-	3rd - 4th gear coupling sleeve
16	-	3rd gear idler gear
17	-	Final drive 3rd - 4th
18	-	3rd gear

When 3rd gear is selected, the coupling sleeve for 3rd - 4th gear is moved by a gear selector fork along the synchronizing hub towards the 3rd gear idler gear. The coupling sleeve and the synchronizing hub lock the 3rd gear idler gear at the intermediate shaft 3rd - 4th.

Engine torque is transferred to the input shaft via the clutch. The 3rd gear rack on the input shaft transfers the power to the 3rd gear idler gear. From there the power is transferred to the intermediate shaft 3rd - 4th and to the final drive, which in turn transfers power to the ring gear. The ring gear is connected to the drive shafts through the differential.

4th Gear Power Flow



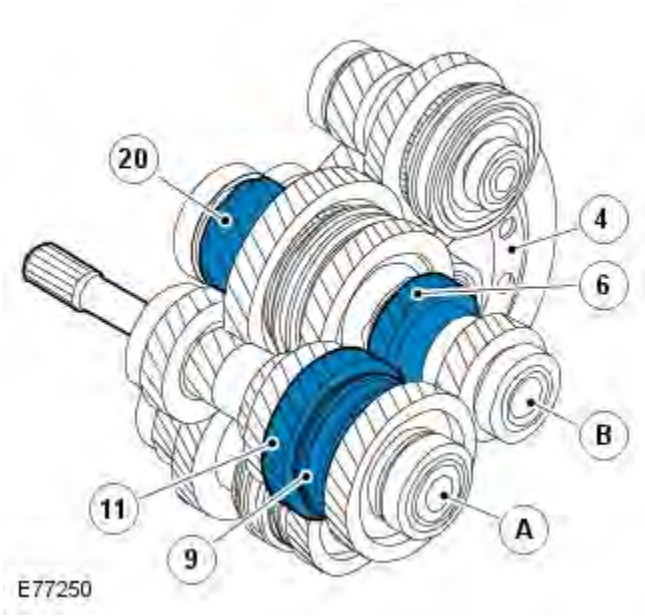
Item	Part Number	Description

A	-	Input shaft
C	-	Intermediate shaft 3rd - 4th
4	-	Ring gear
10	-	4th gear idler gear
12	-	3rd - 4th gear coupling sleeve
13	-	4th gear
17	-	Final drive 3rd - 4th

When 4th gear is selected, the coupling sleeve for 3rd - 4th gear is moved by a gear selector fork along the synchronizing hub towards the 4th gear idler gear. The coupling sleeve and the synchronizing hub lock the 4th gear idler gear at the intermediate shaft 3rd - 4th.

Engine torque is transferred to the input shaft via the clutch. The 4th gear rack on the input shaft transfers the power to the 4th gear idler gear. From there the power is transferred to the intermediate shaft 3rd - 4th and to the final drive, which in turn transfers power to the ring gear. The ring gear is connected to the drive shafts through the differential.

5th Gear Power Flow

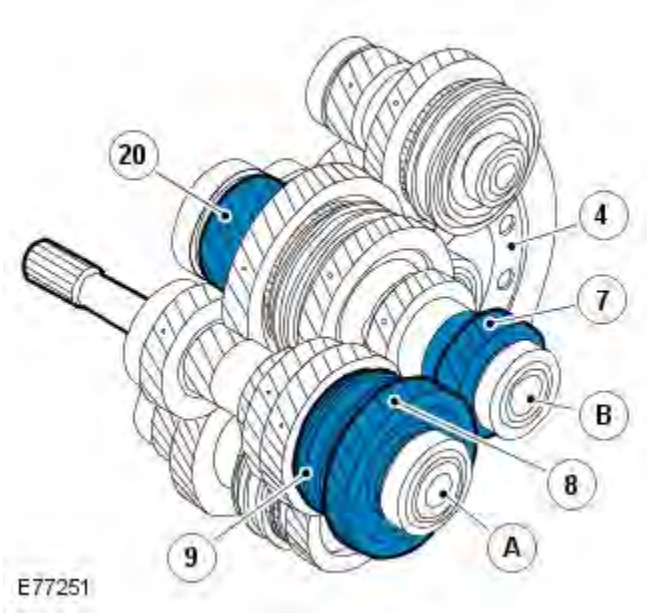


Item	Part Number	Description
A	-	Input shaft
B	-	Intermediate shaft 1st - 2nd and 5th - 6th
4	-	Ring gear
6	-	5th gear
9	-	5th - 6th gear coupling sleeve
11	-	5th gear idler gear
20	-	Final drive 1st - 2nd and 5th - 6th

When 5th gear is selected, the coupling sleeve for 5th - 6th gear is moved by a gear selector fork along the synchronizing hub towards the 5th gear idler gear. The coupling sleeve and the synchronizing hub lock the 5th gear idler gear at the input shaft.

Engine torque is transferred to the input shaft via the clutch. The 5th - 6th coupling sleeve and 5th gear idler gear located on the input shaft, transfer the power to the 5th gear. From there the power is transferred to the intermediate shaft 1st - 2nd and 5th - 6th and to the final drive, which in turn transfers power to the ring gear. The ring gear is connected to the drive shafts through the differential.

6th Gear Power Flow

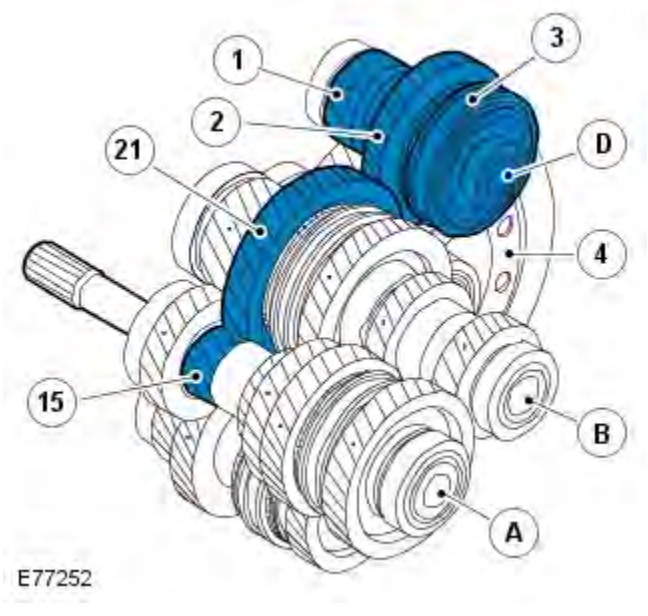


Item	Part Number	Description
A	-	Input shaft
B	-	Intermediate shaft 1st - 2nd and 5th - 6th
4	-	Ring gear
7	-	6th gear
8	-	6th gear idler gear
9	-	5th - 6th gear coupling sleeve
20	-	Final drive 1st - 2nd and 5th - 6th

When 6th gear is selected, the coupling sleeve for 5th - 6th gear is moved by a gear selector fork along the synchronizing hub towards the 6th gear idler gear. The coupling sleeve and the synchronizing hub lock the 6th gear idler gear at the input shaft.

Engine torque is transferred to the input shaft via the clutch. The 5th - 6th coupling sleeve and 6th gear idler gear located on the input shaft, transfer the power to the 6th gear. From there the power is transferred to the intermediate shaft 1st - 2nd and 5th - 6th and to the final drive, which in turn transfers power to the ring gear. The ring gear is connected to the drive shafts through the differential.

Reverse Gear Power Flow



Item	Part Number	Description
A	-	Input shaft
B	-	Intermediate shaft 1st - 2nd and 5th - 6th
D	-	Reverse shaft
1	-	Final drive for reverse gear
2	-	Reverse gear idler gear
3	-	Reverse gear coupling sleeve
4	-	Ring gear
15	-	1st gear
21	-	1st gear idler gear

When reverse gear is selected, the coupling sleeve for reverse gear is moved by a gear selector fork along the

synchronizing hub towards the reverse gear idler gear.

The coupling sleeve and synchronizing hub lock the reverse gear idler gear at the reverse shaft.

The torque of the engine is transferred via the clutch to the input shaft. The 1st gear on the input shaft transfers power to the 1st gear idler gear. The power is then transferred to the reverse gear idler gear and then to the reverse gear coupling sleeve. From there power is transferred to the intermediate shaft 1st - 2nd and 5th - 6th and to the final drive which in turn transfers power to the ring gear. The ring gear is connected to the drive shafts through the differential.

Differential

The differential distributes drive from the transmission equally between the LH and RH front half shafts and also provides drive torque to the rear differential via the power transfer unit.

The differential is located at the rear of the transmission housing. Both sides of the differential are connected to the LH and RH drive shafts, supplying torque to the front wheels The differential is also connected to the Power Transfer Unit via a splined shaft to the RH side of the transmission, supplying torque to the rear driveline.

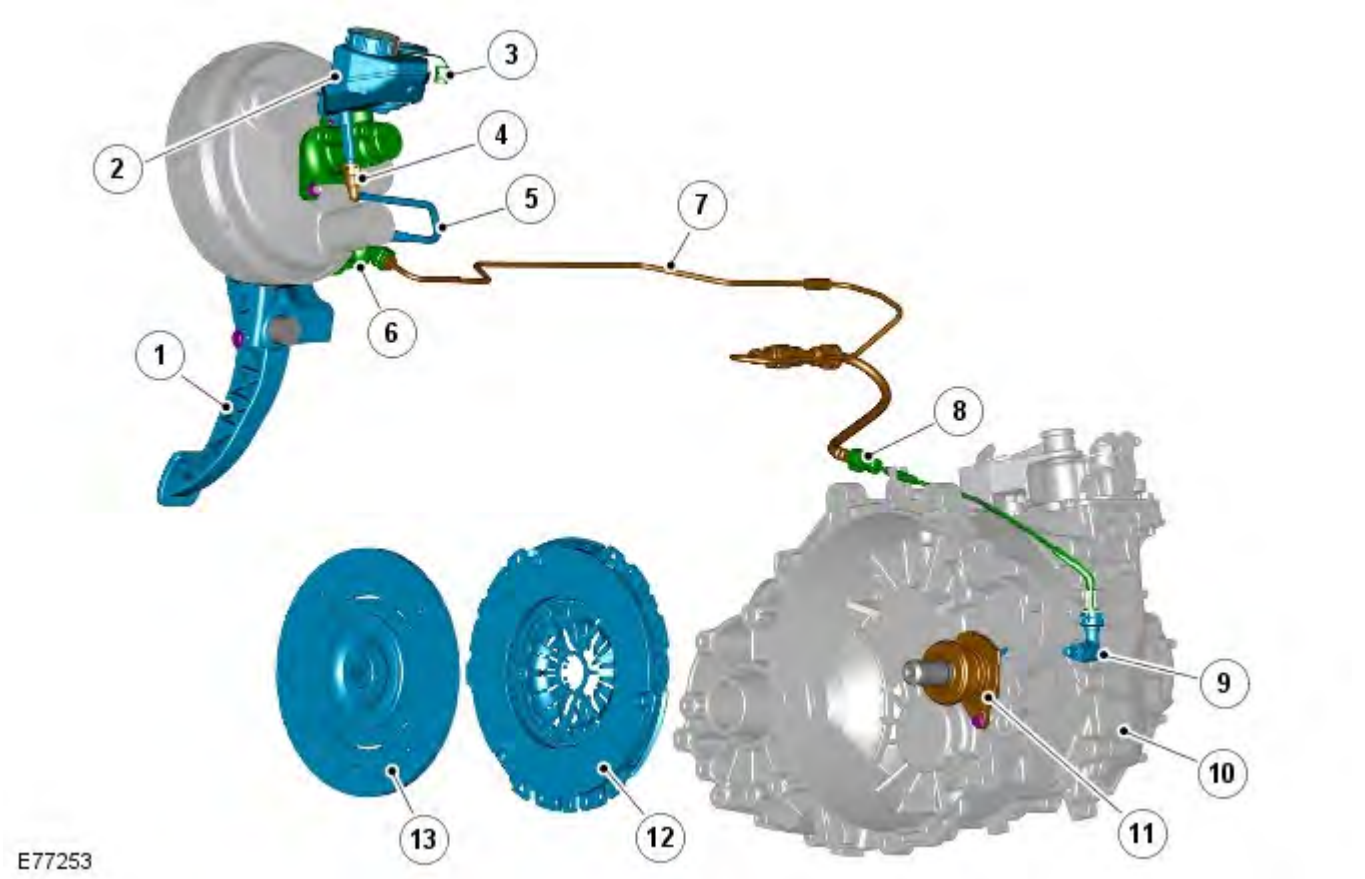
Reverse Switch

The reverse switch is located in the front of the transmission casing, above the 1st gear detection switch. The switch is used by the Anti-lock Brake System (ABS) module for Hill Descent Control (HDC) and also for reversing lamp operation.

1st Gear Position Switch

The 1st gear switch is located on the front of the transmission casing, below the reverse switch. The switch is used by the ABS module for HDC.

CLUTCH



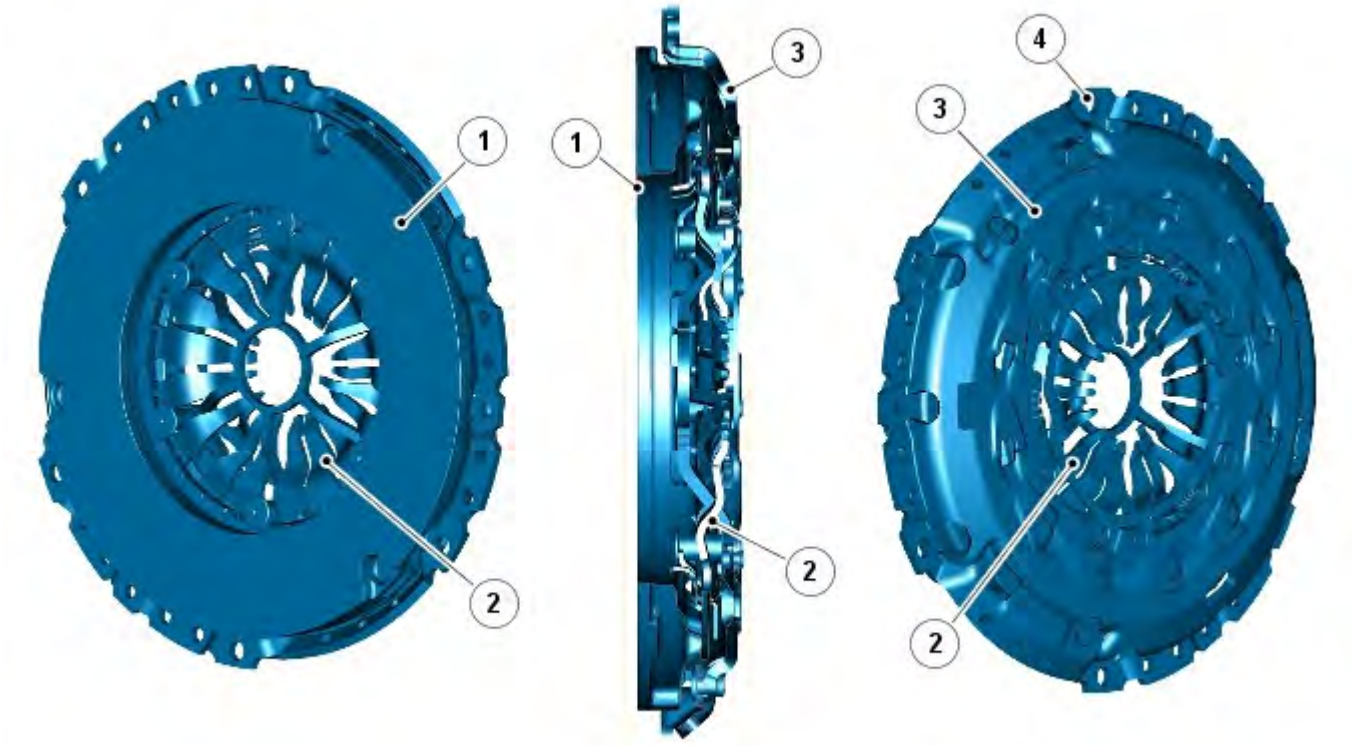
Item	Part Number	Description
1	-	Clutch pedal
2	-	Brake/clutch reservoir
3	-	Fluid level sensor
4	-	Connector
5	-	Low pressure hose
6	-	Master cylinder
7	-	High pressure clutch line
8	-	Connector
9	-	Clutch bleed adaptor
10	-	Transmission
11	-	Slave cylinder and release bearing
12	-	Clutch cover assembly
13	-	Driven (friction) plate

The clutch is a conventional single driven plate and diaphragm spring clutch cover assembly which is hydraulically actuated

from the clutch pedal.

The main components of the clutch are the clutch cover assembly (pressure plate), the engine flywheel and the driven plate (friction plate). Together with flywheel and driven plate, the clutch cover forms a friction system and is mounted to the flywheel by bolts in the housing.

Clutch Cover



E77325

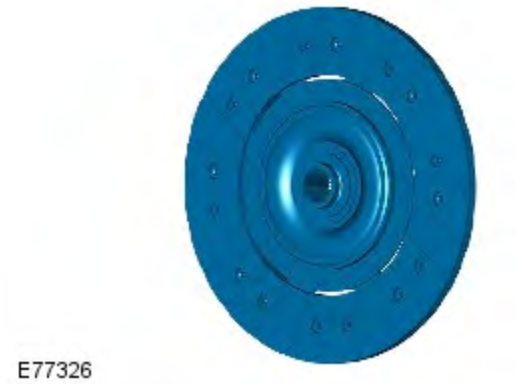
Item	Part Number	Description
1	-	Contact plate
2	-	Diaphragm spring
3	-	Cover
4	-	Mounting holes

The clutch cover ensures that the engine torque is transferred via the driven plate to the transmission intake shaft. The contact force required for transferring engine torque is provided by a slotted diaphragm spring. The diaphragm spring allows the driver to apply less pressure on the clutch pedal due to low engaging force. A contact plate provides the friction surface for the driven plate to engage on.

The diaphragm spring is of the compressed type which is actuated by the slave cylinder. When the slave cylinder is operated, the force from the diaphragm spring is transferred through the clutch cover housing into the flywheel it is bolted to, releasing the pressure on the driven plate and disengaging the drive to the transmission.

The clutch cover contact plate is attached to the clutch housing by plate springs. Cams on the contact plate project through the openings in the housing and the outer diaphragm springs are supported on the cams. The contact plate is attached to the housing by bolts and wire rings. When the slave cylinder is operated, the pressure on the diaphragm springs is released and the contact plate can pivot on the cams, releasing the pressure on the driven plate.

Driven Plate



E77326

The driven plate is the central connection element in the clutch. In combination with the clutch cover assembly, it separates and links engine and powertrain by connecting the engine crankshaft to the transmission input shaft.

The driven plate is a rigid type friction plate. The flywheel is of the dual mass type and absorbs torque fluctuations generated by the combustion processes to reduce noise and wear in the transmission.

Dual Mass Flywheel

The dual mass flywheel comprises two main components; the primary side which is attached to the engine crankshaft and the secondary side to which the clutch cover assembly is attached.

The primary side has the starter ring gear attached to its outer circumference. The ring gear is used by the starter motor to rotate the engine during engine crank at start up. The primary side is secured to the crankshaft with eight bolts. A dowel in the crankshaft flange ensures that the flywheel is correctly located.

The secondary side has the smooth friction surface on which the driven plate friction material engages. Dowels and fixing holes allow for the correct alignment and attachment of the clutch cover assembly.

The primary and secondary sides are connected with long coil springs. The two sides can rotate against each other, limited by the coil springs, which absorb torque loading on clutch engagement and torsional vibrations from the engine.

Published: 11-May-2011

Manual Transmission/Transaxle and Clutch - General Information - Manual Transaxle and Clutch

Diagnosis and Testing

Principles of Operation

For a detailed description of the manual transmission/transaxle and clutch, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Manual Transmission and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Description and Operation),
Clutch Controls (308-02 Clutch Controls, Description and Operation),
External Controls (308-06 Manual Transmission/Transaxle External Controls, Description and Operation),
Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Description and Operation),
Transfer Case (308-07B Transfer Case, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Transmission fluid leaks • Clutch fluid leaks • Missing fixings • Switches • Shift mechanisms	• Wiring harnesses • Switches

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

• NOTE: Check transmission fluid level prior to carrying out any further diagnosis.
REFER to: Transmission Fluid Level Check (308-03 Manual Transmission/Transaxle, General Procedures).

Symptom	Possible Cause	Action
Significant effort required when downshifting or synchronizer crashing	• Gear shift mechanism • Gear synchronization is inadequate	Check integrity of gear shift mechanism and for correct installation. If gear synchronization is inadequate, install a new transmission. Refer to the new module/component installation note at the top of the DTC Index
Gear jumps out of engagement while driving	• Worn or broken synchronizer components • Manufacturing error (incorrect gear wheel toothing or synchronizer ring)	Install a new transmission, refer to the new module/component installation note at the top of the DTC Index
Gearshift linkage does not operate freely (stiff or partially seized)	• Excessive friction in lever bearing • Gearshift selector cables assembly damaged or worn • Gear shift mechanism • Possible fault in transmission	Check and install a new lever bearing as necessary. Check integrity of gearshift cables and mechanism, and for correct installation. If internal components are suspect, install a new transmission, refer to the new module/component installation note at the top of the DTC Index
Brief scratching noise during gear shifting	• Inadequate gear synchronization	Install a new transmission, refer to the new module/component installation note at the top of the DTC Index
Leak from transmission housing	• Leak from breather • Leak from fill/drain plugs • Sealing lip of the input/output shaft oil seals damaged • Leak from the selector shaft oil seal • Leak from crankshaft rear seal • Leak from clutch hydraulics	Check and rectify fluid leaks from breather, fill/drain plugs, seals and clutch hydraulics
Clicking noises in reverse gear	• Gear wheels chipped	Install a new transmission, refer to the new module/component installation note at the top of the DTC Index

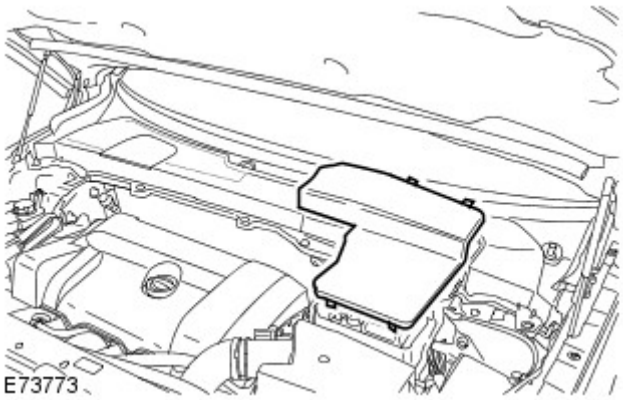
Symptom	Possible Cause	Action
Gear wheels banging when shifting	• Low transmission fluid level • Clutch not clearing • Selector forks or synchronizer rings	Check and top-up transmission fluid. Check for correct operation of clutch. If selector fork or synchronizer rings suspect, install a new transmission, refer to the new module/component installation note at the top of the DTC Index
Noises in the forward gears	• Low transmission fluid level • The engine/transmission assembly is in contact with the chassis/body • Engine/transmission flange bolts • Input and output shaft bearings	Check top-up transmission fluid. Ensure engine/transmission assembly is not in contact with the chassis/body. Tighten engine/transmission flange bolts to correct torque. REFER to: Specifications (308-00 Manual Transmission/Transaxle and Clutch - General Information, Specifications). If input or output bearings are suspect, install a new transmission, refer to the new module/component installation note at the top of the DTC Index
Gears jump out of engagement	• Engine/transmission support insulator • Gearshift linkage malfunction • Internal components	Repair and install new engine/transmission support insulator as necessary. Check gearshift mechanism is installed and adjusted correctly. If internal components are suspect, install a new transmission, refer to the new module/component installation note at the top of the DTC Index
One of the gears (particularly reverse) cannot be selected	• Gearshift linkage malfunction • Transmission internal selection problem	Check gearshift mechanism is installed and adjusted correctly. If internal components are suspect, install a new transmission, refer to the new module/component installation note at the top of the DTC Index
Unable to select first and second gears (third, sixth and reverse ok)	• Broken selector pin in gate guide (internal to transmission shift mechanism)	Install new transmission internal shift mechanism (do not install new transmission for this fault)
Gearshift linkage has excessive play	• Gearshift lever bearing worn • Gearshift selector cables assembly damaged or worn	Check and install new gearshift lever bearing and cables as necessary
Clutch slipping	• Clutch pedal free play • Sticking clutch pedal • Clutch pressure plate and diaphragm springs • Clutch drive plate friction material worn/contaminated • Flywheel • Slave cylinder sticking • Excessive temperature	Check clutch pedal has sufficient free play and is not sticking. Check and install new clutch pressure and drive plates as necessary. Check integrity of flywheel. Check and install new slave cylinder as required
Clutch chatter or shudder	• Engine mounts • Oil contamination on drive plate • Diaphragm springs • Clutch pressure plate • Flywheel	Check integrity of engine mountings. Check integrity and for contamination of clutch components. Check condition of flywheel. Rectify and install new components as necessary
Clutch drag (difficulty shifting)	• Insufficient brake fluid • Air in clutch hydraulic system • Clutch pedal free play • Insufficient clutch pedal travel • Diaphragm springs • Drive plate friction material contamination • Clutch disc splines	Check/top-up brake hydraulic fluid level and check clutch hydraulic system for leaks. Check clutch free play and travel. Check integrity of clutch, ensure drive plate moves freely on the input shaft splines
Clutch pedal pulsation	• Clutch and brake pedal pivot shaft not correctly lubricated • Damaged springs in pressure plate • Release bearing noisy or worn • Flywheel	Check for free movement of clutch pedal at pivot. Check integrity of clutch pressure plate, release bearing and flywheel

Published: 11-May-2011

Manual Transmission/Transaxle and Clutch - General Information - Clutch System Bleeding

General Procedures

1. Check that all the clutch line connections are tight and that there are no signs of leaks.



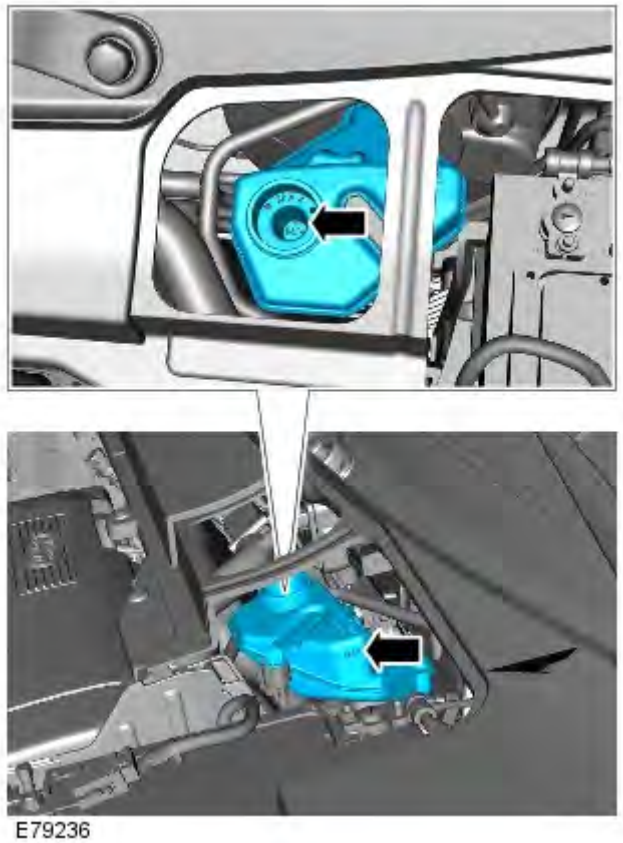
2.

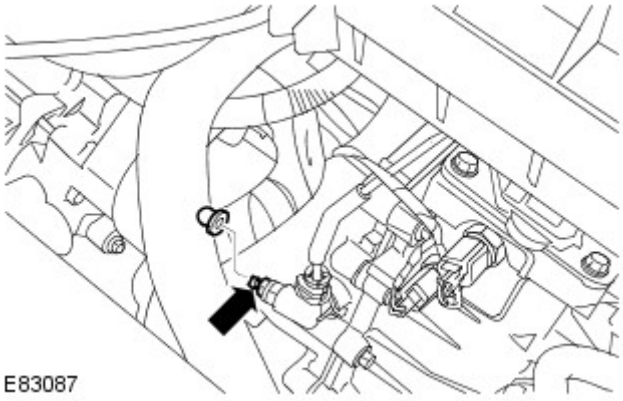
3. **3.** WARNING: Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.

   CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

   Remove the brake fluid reservoir cap.

4. Fill the brake fluid reservoir to the MAX mark.




E83087

5. Attach the clear bleed tube to the clutch bleed screw and immerse the free end of the bleed tube in a bleed jar containing a small quantity of approved brake fluid.

6. Loosen the bleed screw by two complete turns.

7. **7.** CAUTION: The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.

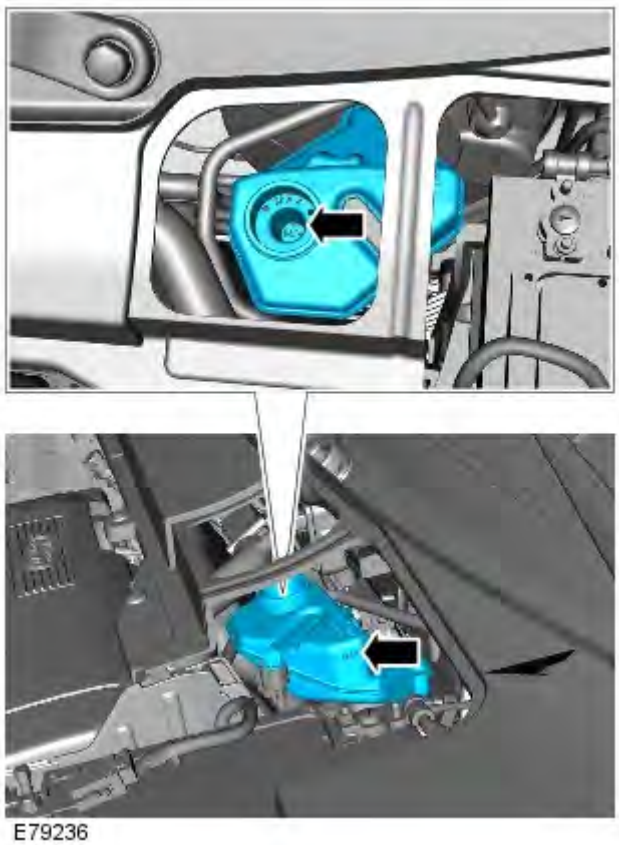
   Depress the clutch pedal steadily through its full stroke. With the pedal held down, close the bleed screw. When the bleed screw is fully closed, allow the clutch pedal to return to the rest position. Repeat the procedure until a flow of clean, air-free fluid is being pumped into the bleed jar.

8. **8.** CAUTION: Make sure the bleed screw cap is installed after bleeding. This will prevent corrosion to the bleed screw.

   With the clutch pedal fully depressed, tighten the bleed screw.

   Torque: 10 Nm

9. Fill the brake fluid reservoir to the MAX mark.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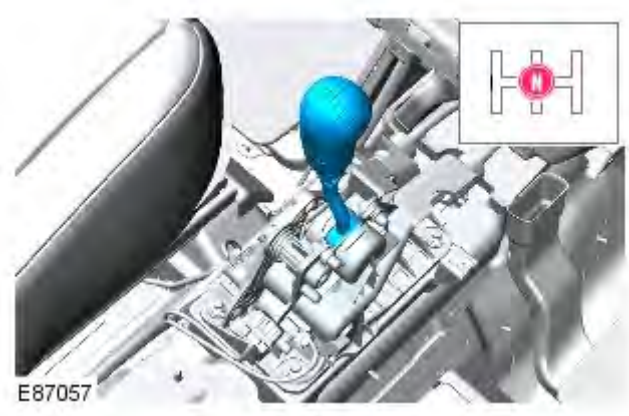
Published: 11-May-2011

Manual Transmission/Transaxle and Clutch - General Information - Gearshift Cable Adjustment

General Procedures

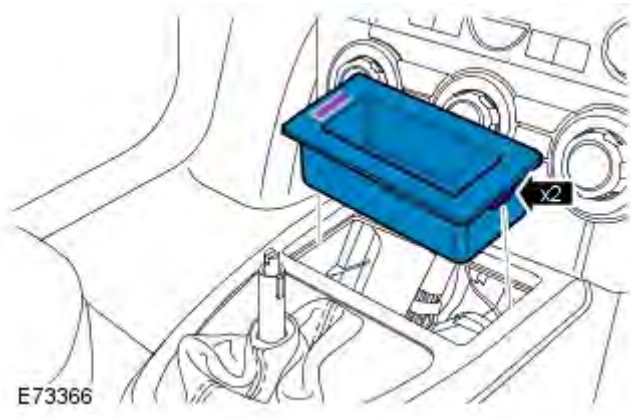
1. Check the gearshift operation.



2. Position the gearshift lever in NEUTRAL.

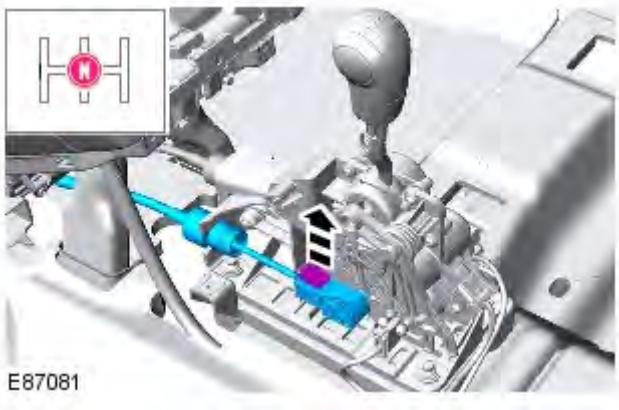
3. Remove the gear selector knob.

   Refer to: Gearshift Lever Knob (308-06 Manual Transmission/Transaxle External Controls, Removal and Installation).



4.

5.



6.
- Release the LH cable securing clip.
- Allow the gearshift lever to come to rest in the neutral position.
- Secure the cable selector clip, without disturbing the gearshift selector lever position.

7. Secure the gear selector cover.

8. Install the stowage compartment tray.

9. Install the gear selector knob.

   Refer to: Gearshift Lever Knob (308-06 Manual Transmission/Transaxle External Controls, Removal and Installation).

Published: 11-May-2011

Clutch -

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Recommended hydraulic fluid	SHELL DONAX YB DOT4 ESL FLUID

General Specification

Item	Specification
Clutch make/type	LUK - Self adjusting clutch
Clutch size	250 mm (9.84 in)
Clutch plate friction material	Valeo 810 DS
Master cylinder make	FTE
Slave cylinder make/type	FTE Concentric slave cylinder

Torque Specifications

Description	Nm	lb-ft
Clutch cover to flywheel bolts - vehicles built up to 11MY* +	23	17
Clutch cover to flywheel bolts - vehicles built 11MY onwards* +	29	21

*** Tighten bolts progressively by diagonal selection.**

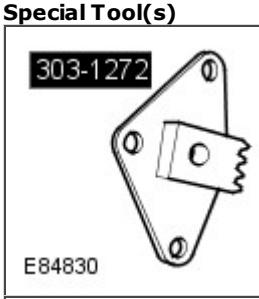
+ New bolts must be installed.

Published: 11-May-2011

Clutch - Clutch Disc and Pressure Plate

Removal and Installation

Special Tool(s)

	303-1272 Locking Tool, Flywheel
	308-667 Aligner, Clutch

Removal

1. Disconnect the battery ground cable.

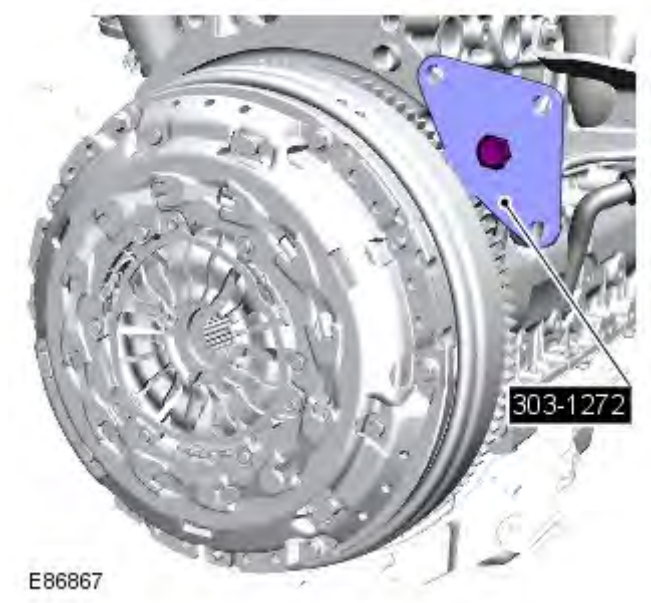
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

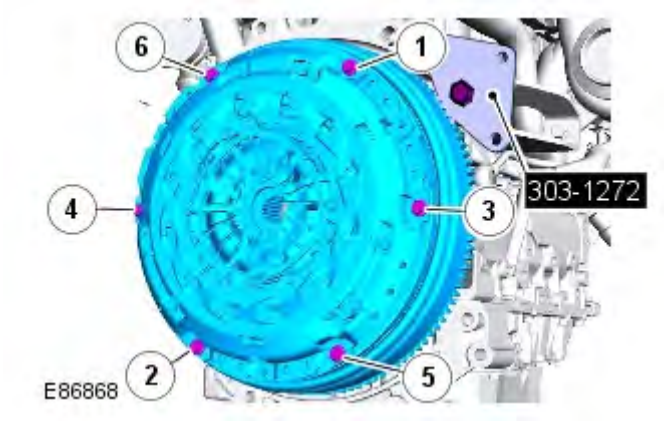
   Raise and support the vehicle.

3. Remove the transmission assembly.

   Refer to: Transmission (308-03 Manual Transmission/Transaxle, Removal).



4. *Special Tool(s):* 303-1272

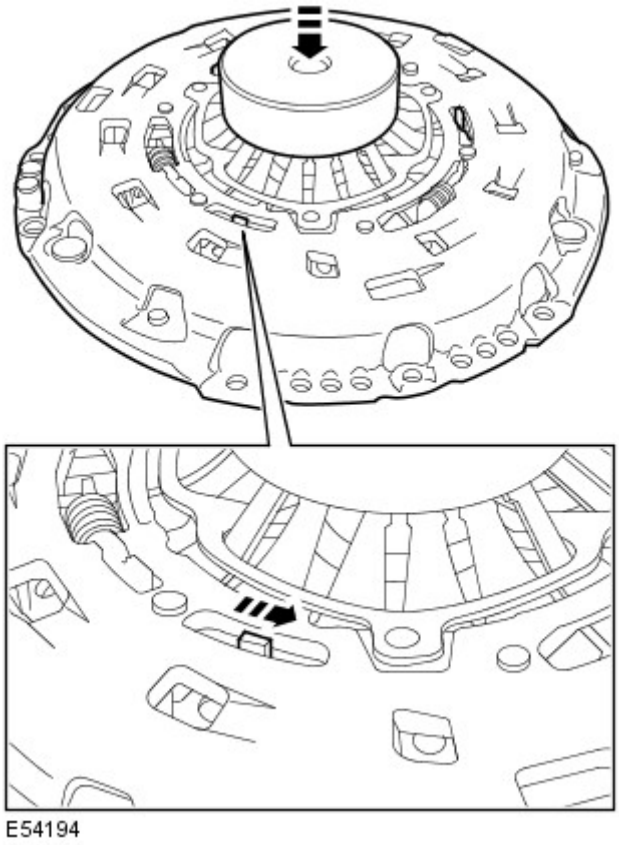


5. **5.** CAUTION: Discard the bolts.

   • NOTE: Loosen the bolts of the clutch pressure plate each two turns at a time in the sequence shown.

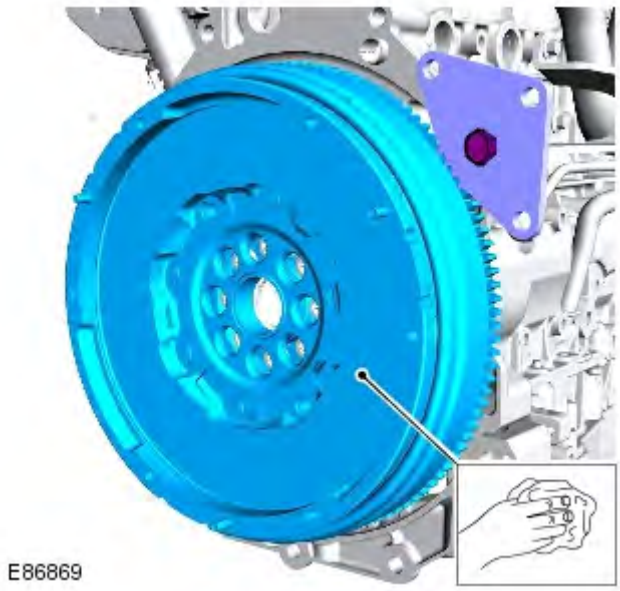
   • NOTE: Restrain the flywheel.

Installation



1. **1.** NOTE: The clutch cover is self adjusting. It is recommended that a clutch disc and clutch cover is replaced as an assembly. If a used clutch cover is assembled with a new clutch disc, the clutch cover adjustment must be reset prior to assembly. With the clutch cover supported under its outside edge, press down evenly on the diaphragm fingers as shown, until the clutch cover adjustment ring can be rotated fully counterclockwise. With the adjustment ring held in this position, release the pressure on the diaphragm fingers. The adjustment ring will be held in this position until self adjustment on the application of the clutch pedal.

   Check, and if necessary, reset the clutch pressure plate.

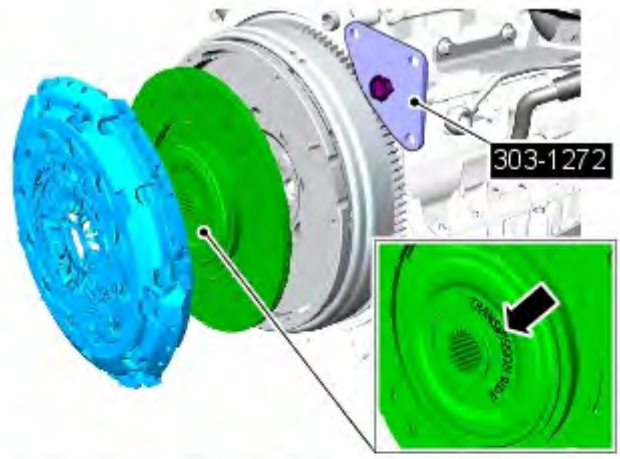


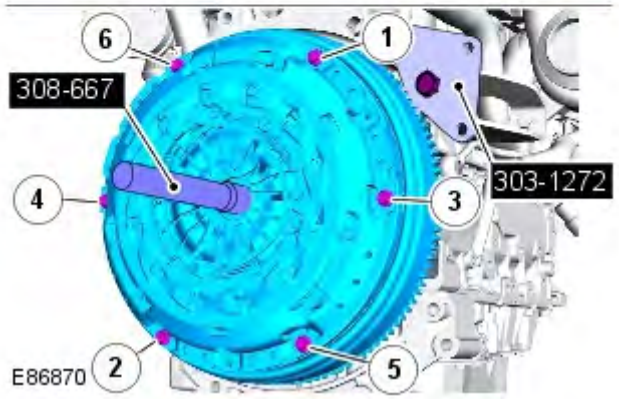
2. **2.** CAUTIONS:

⚠ Examine the flywheel for signs of scoring or overheating. Renew if worn or damaged.

⚠ Examine the clutch release bearing for signs of wear or damage. Renew if necessary.

Clean the component mating faces.





3. **3.** CAUTIONS:

⚠ Make sure that new bolts are installed.

⚠ Install the clutch disc with 'TRANSMISSION SIDE' marking against the clutch cover.

• NOTE: Restrain the flywheel.

• NOTE: Follow the indicated sequence and tighten the bolts of the clutch pressure plate each two turns at a time until the specified tightening torque is achieved.

Special Tool(s): 308-667
Torque: 23 Nm

4. Remove the special tool.

   Special Tool(s): 303-1272

5. Install the transmission.

   Refer to: Transmission (308-03 Manual Transmission/Transaxle, Installation).

6. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 12-May-2011

Clutch Controls -

Torque Specifications

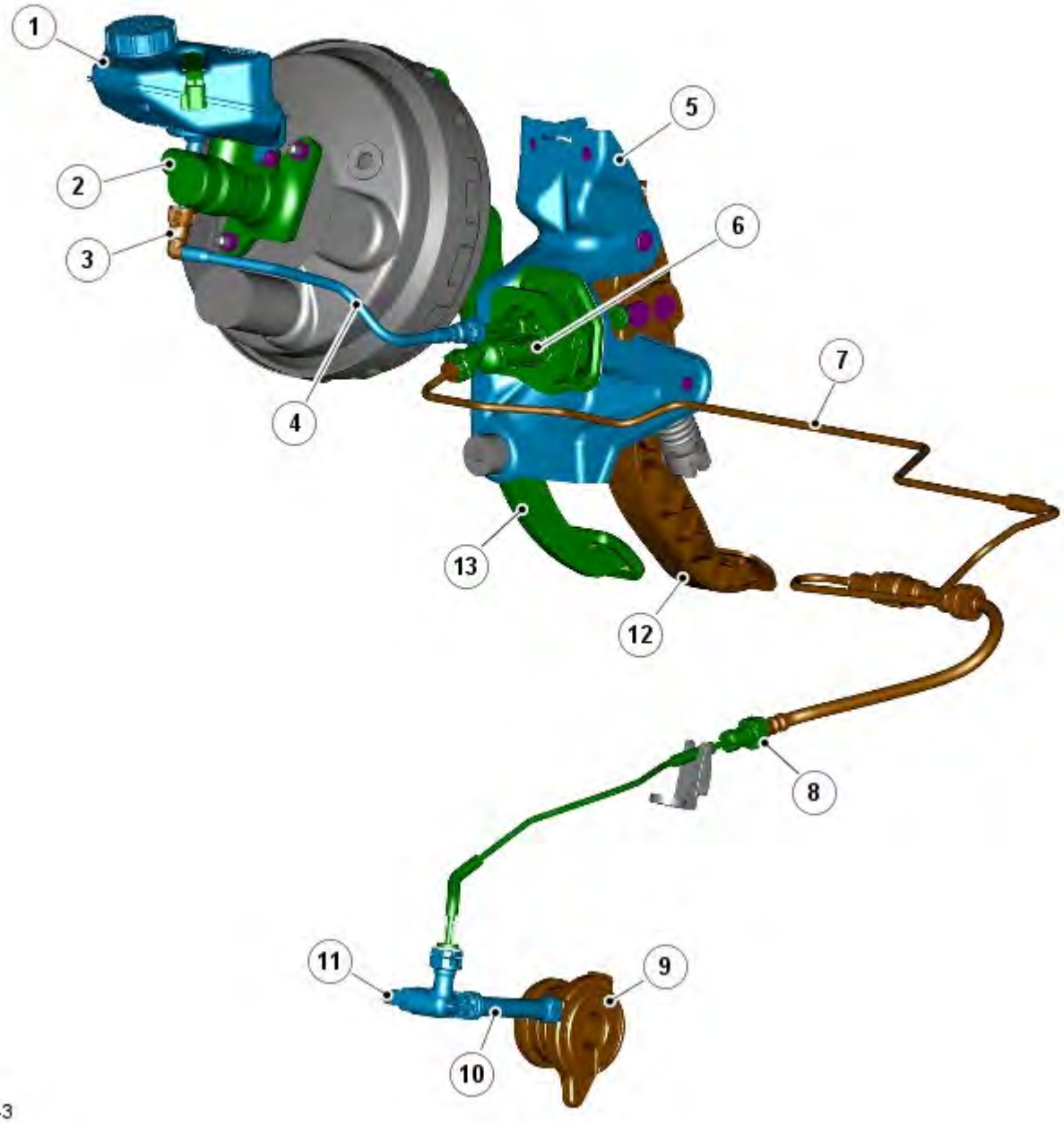
Description	Nm	lb-ft
Clutch bleed screw	10	7
Clutch pedal box nuts	24	18
Clutch slave cylinder bolts	11	8

Published: 11-May-2011

Clutch Controls - Clutch Controls

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Brake/clutch reservoir
2	-	Brake master cylinder
3	-	Connector
4	-	Low pressure hose
5	-	Clutch pedal bracket
6	-	Clutch master cylinder
7	-	High pressure hose
8	-	Connector
9	-	Clutch slave cylinder and release bearing
10	-	Hydraulic adaptor and peak torque limiter
11	-	Bleed screw
12	-	Clutch pedal
13	-	Brake pedal

OVERVIEW

The clutch is a conventional single, damped driven plate and a self-adjusting diaphragm spring clutch cover assembly

which is hydraulically actuated from the clutch pedal.

Pressing the clutch pedal pressurizes the hydraulic fluid in the master cylinder. The fluid pressure is transferred via a pipe from the master cylinder to the slave cylinder in the transmission. The fluid pressure operates the slave cylinder which in turn pushes the fingers of the clutch cover, releasing the driven plate and disengaging the drive from the engine crankshaft to the transmission.

A hydraulic clutch bleed adaptor is located on the front of the transmission. The adaptor provides the connection between the pressure pipe from the master cylinder to the slave cylinder. The adaptor contains a bleed screw to purge the clutch hydraulic system of air after service replacement of one of the hydraulic components. The adaptor also includes a peak torque limiter. This prevents instant clutch engagement if the driver accidentally releases the clutch lever to prevent damage to the driveline components.

Stop/Start Vehicles - From 2010 MY

Clutch Master Cylinder and Linear Clutch Sensor

The linear clutch sensor, located on the clutch master cylinder and hardwired to the CJB, is used to sense the position of the clutch pedal. It is used in conjunction with other sensor outputs to trigger an engine restart, engine stop or stall recovery on Stop/Start vehicles. It is also used along with the first and reverse gear switches to complete clutch plausibility.

A magnet inside the clutch master cylinder provides the position indicator for the linear clutch sensor. For this reason, if the master cylinder is replaced the correct replacement master cylinder must be identified and fitted.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

Linear Clutch Sensor

Published: 11-May-2011

Clutch Controls - Clutch Controls

Diagnosis and Testing

Principles of Operation

For additional information.
REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

Published: 11-May-2011

Clutch Controls - Clutch Slave Cylinder

Removal and Installation

Removal

• NOTE: The clutch slave cylinder and release bearing are a combined assembly and cannot be serviced separately.

1. Disconnect the battery ground cable.

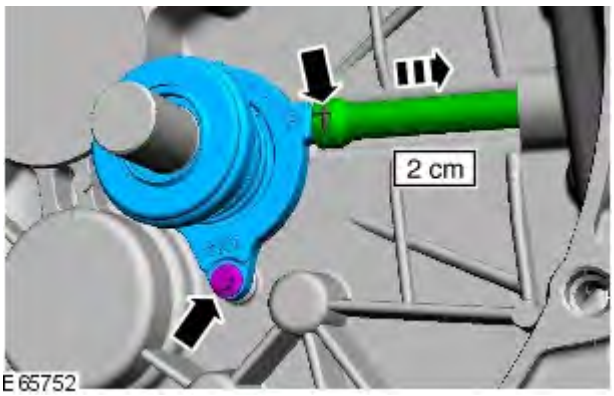
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the transmission assembly.

   Refer to: Transmission (308-03 Manual Transmission/Transaxle, Removal).



4. **4.** CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

   Torque: 11 Nm

Installation

1. To install, reverse the removal procedure.

2. Bleed the clutch system.

   Refer to: Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

3. Install the transmission.

   Refer to: Transmission (308-03 Manual Transmission/Transaxle, Removal).

4. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Clutch Controls - Clutch Master CylinderRHD AWD

Removal and Installation

Removal

1. Remove the clutch pedal assembly.

   Refer to: Clutch Pedal - RHD AWD (308-02 Clutch Controls, Removal and Installation).

Installation

1. Install the clutch pedal assembly.

   Refer to: Clutch Pedal - RHD AWD (308-02 Clutch Controls, Removal and Installation).

Published: 11-May-2011

Clutch Controls - Clutch Master CylinderLHD AWD

Removal and Installation

Removal

1. Remove the clutch pedal assembly.

   Refer to: Clutch Pedal - LHD AWD (308-02 Clutch Controls, Removal and Installation).

Installation

1. Install the clutch pedal assembly.

   Refer to: Clutch Pedal - LHD AWD (308-02 Clutch Controls, Removal and Installation).

Published: 11-May-2011

Clutch Controls - Clutch PedalRHD AWD

Removal and Installation

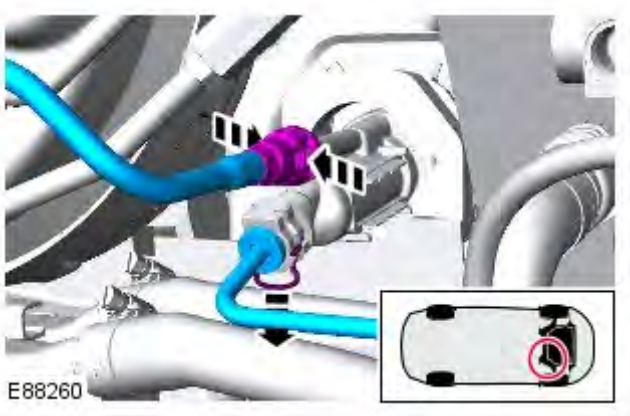
Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the secondary bulkhead center panel.

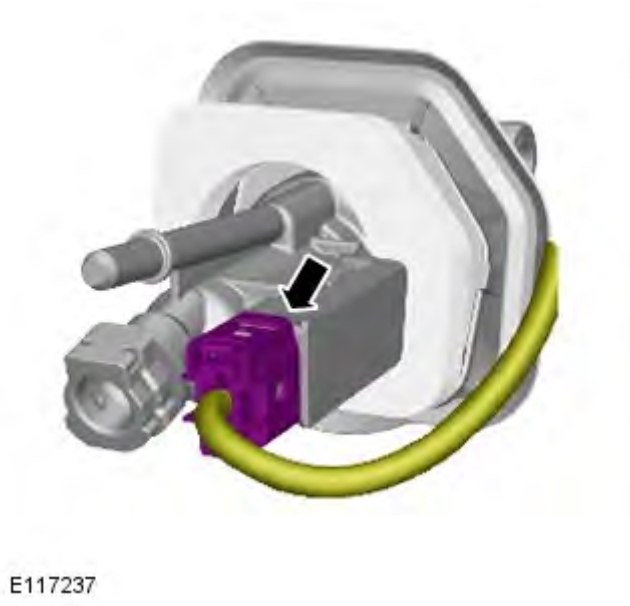
   Refer to: Secondary Bulkhead Center Panel - TD4 2.2L Diesel (501-02 Front End Body Panels, Removal and Installation).



3. **3.** CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

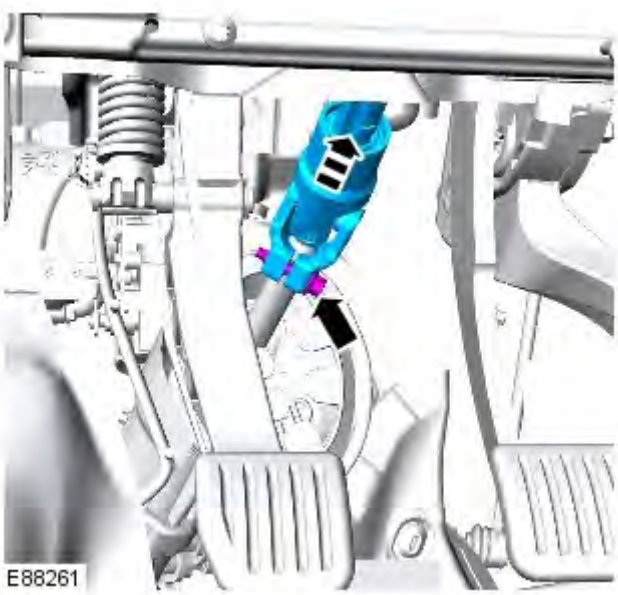
   • NOTE: Position cloth to collect fluid spillage.

4. **4.** NOTE: If equiped



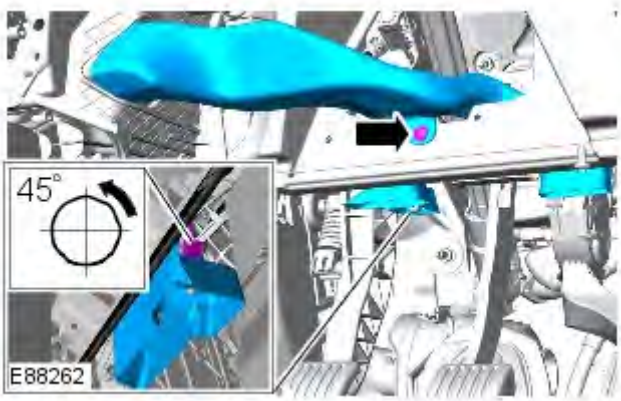
5. Remove the driver lower air bag.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



6. **6.** WARNING: Make sure that a new bolt is installed.

   Torque: 25 Nm



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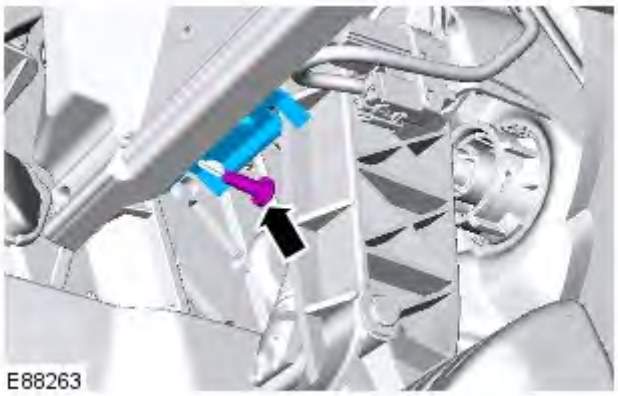

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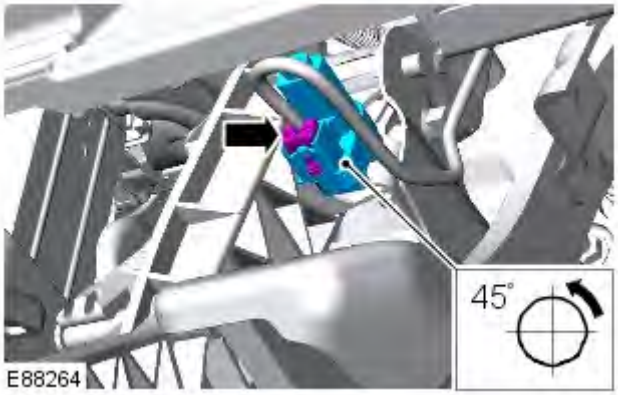

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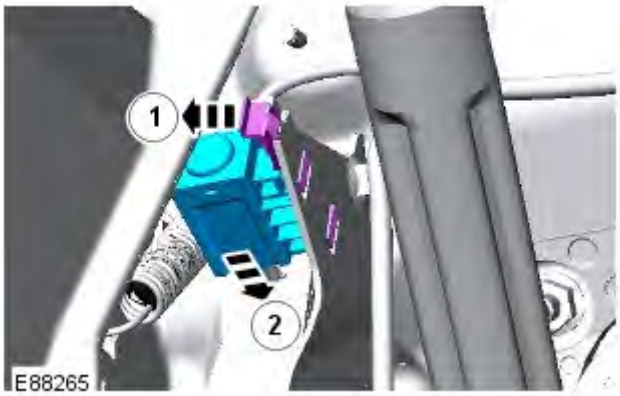

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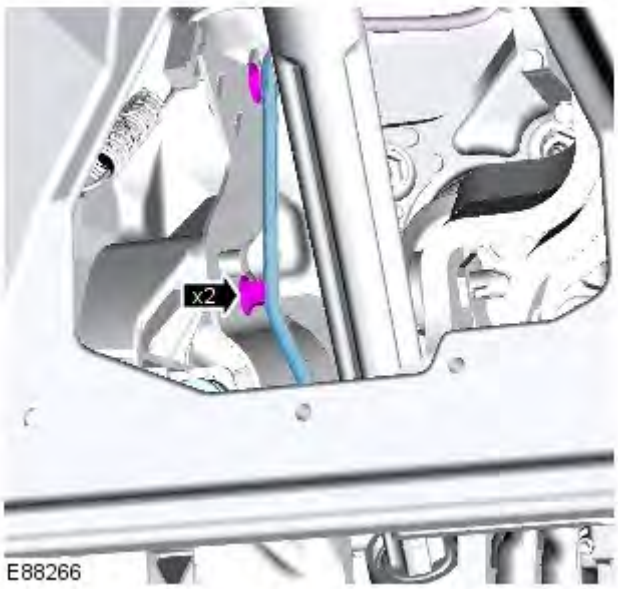
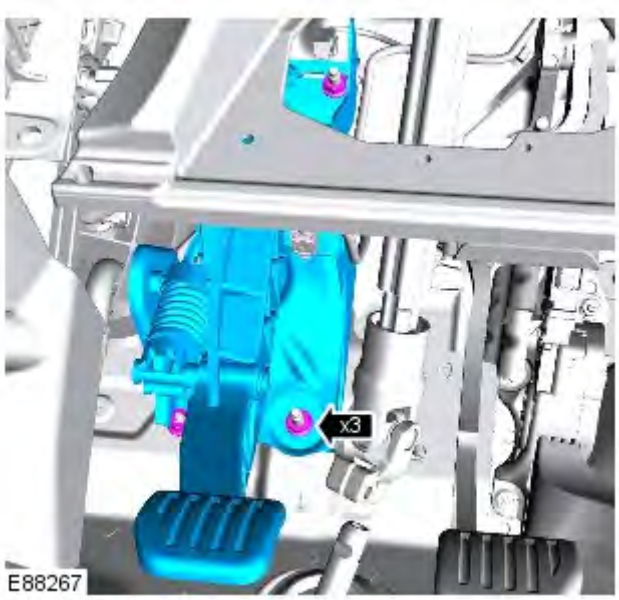
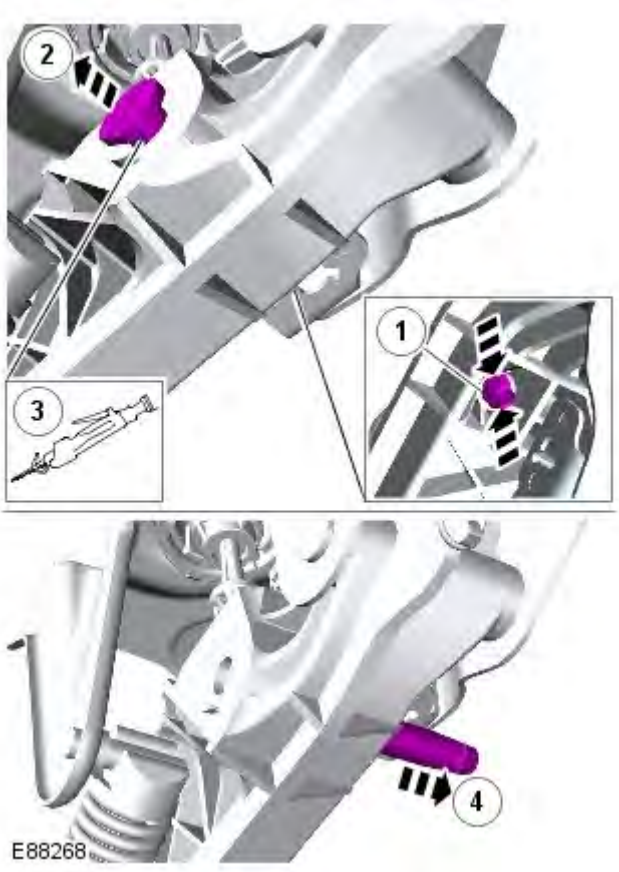




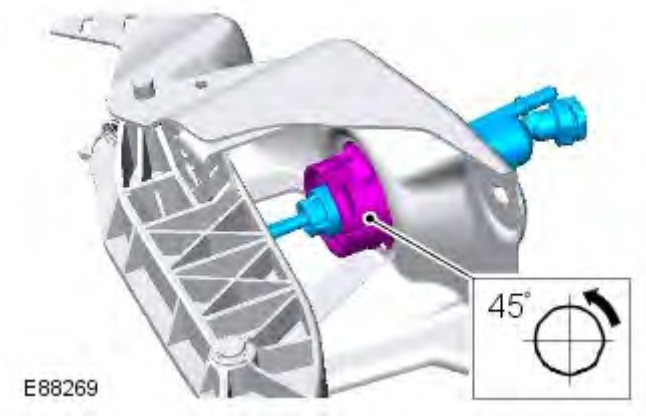
12. *Torque:* 24 Nm



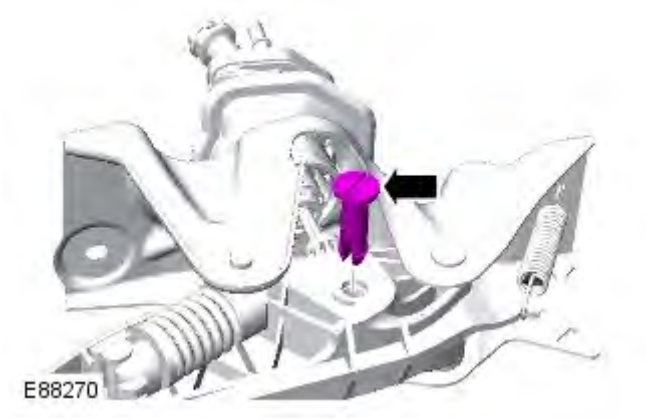
13. **13.** CAUTION: "Make sure that a new component is installed. "

    • NOTE: Do not disassemble further if the component is removed for access only.

14.



Installation



1. **1.** CAUTION: "Make sure that a new component is installed. "
2. To install, reverse the removal procedure.
3. Bleed the clutch system.

   Refer to: Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

Published: 11-May-2011

Clutch Controls - Clutch PedalLHD AWD

Removal and Installation

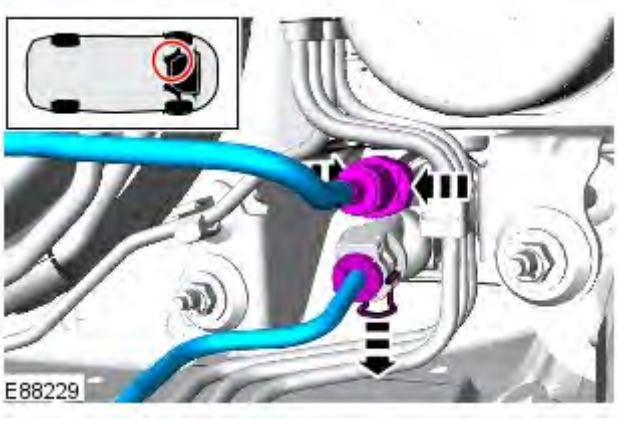
Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

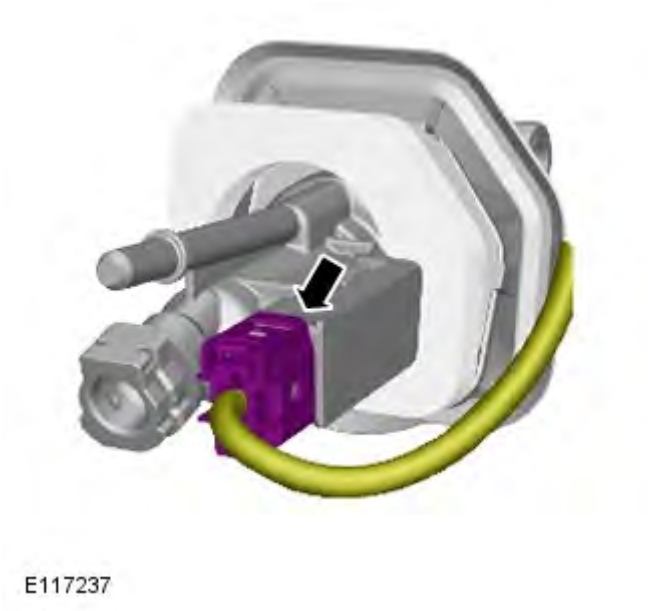
2. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).



3. **3.** CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

   • NOTE: Position cloth to collect fluid spillage.

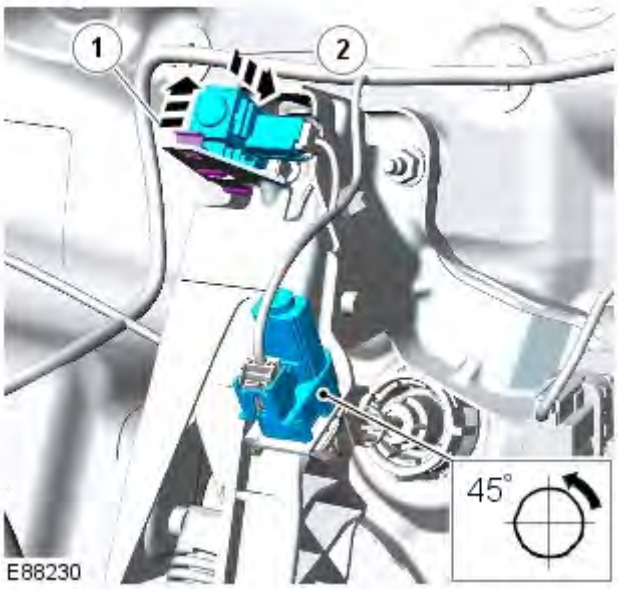


4. **4.** NOTE: If equiped

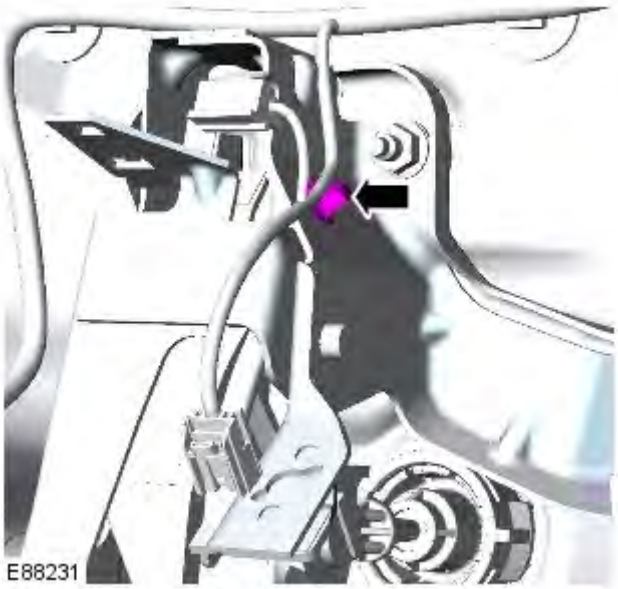
5. Remove the instrument panel assembly.

   Refer to: Instrument Panel - TD4 2.2L Diesel (501-12 Instrument Panel and Console, Removal and Installation).

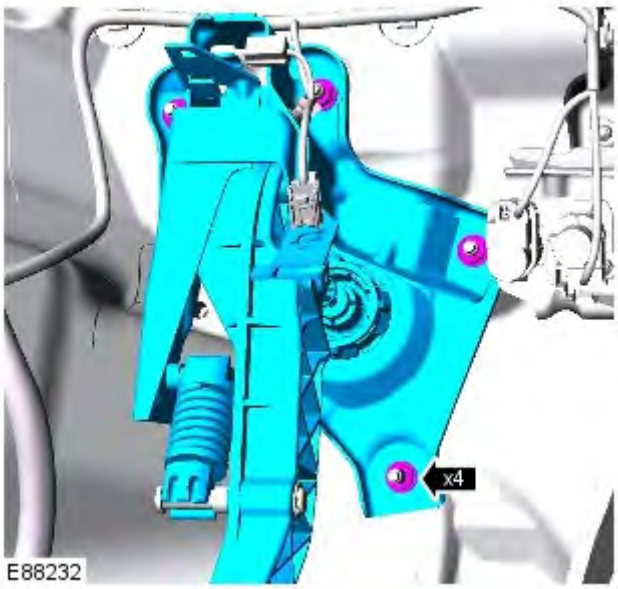
6.

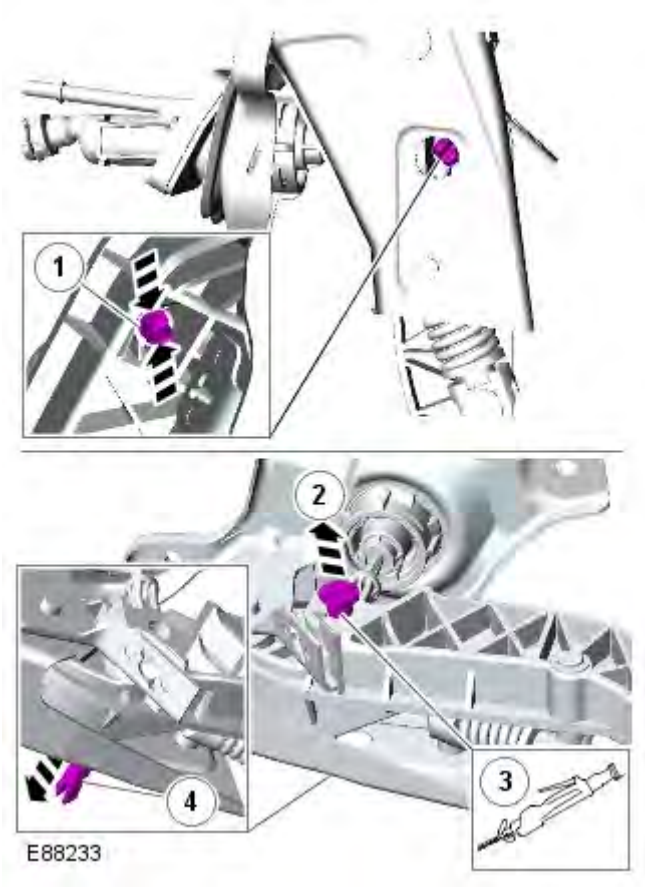


7.



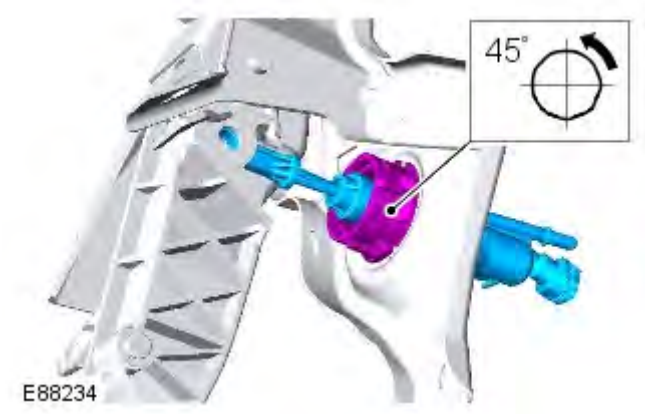
8. *Torque:* 24 Nm





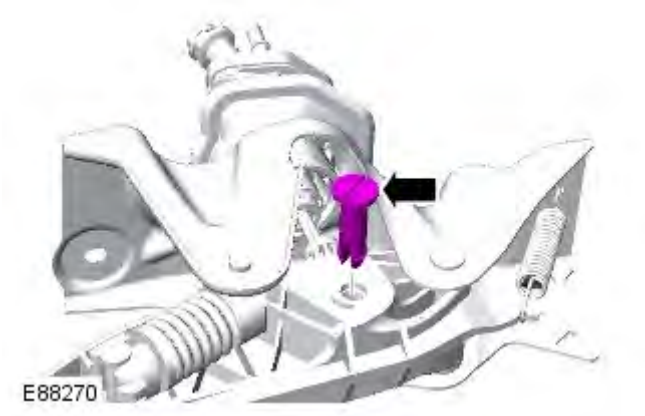
9. **9.** CAUTION: "Make sure that a new component is installed. "

   Cut the head off the clevis pin to allow removal.



10.

Installation



1. **1.** CAUTION: "Make sure that a new component is installed. "

2. To install, reverse the removal procedure.

3. Bleed the clutch system.

   Refer to: Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

Published: 11-May-2011

Manual Transmission/Transaxle - Transmission Draining and Filling

General Procedures

WARNING: Observe due care when draining, as the fluid can be very hot.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   • NOTE: Make sure that the vehicle is standing on a level surface.

   Raise and support the vehicle.

2. Remove the front undershield.

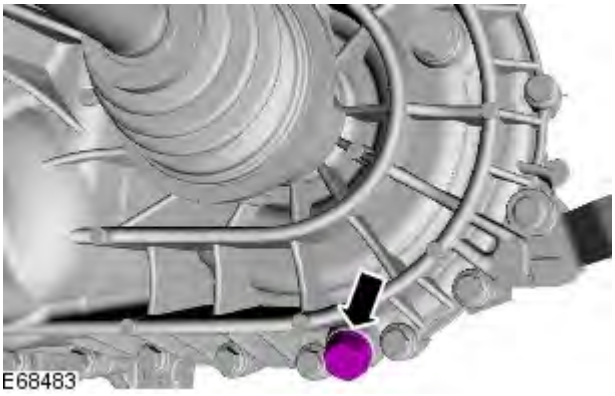
   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. Clean the area around the transmission fluid level/filler plug.

4. Remove the transmission fluid filler/level plug.

5. Clean the area around the transmission fluid drain plug.

6. Place a container under the transmission.



7. Remove the transmission fluid drain plug.

8. **8.** CAUTION: Replace the washer.

   Install the transmission fluid drain plug.

   Torque: 30 Nm

9. Fill the transmission with the correct fluid until it runs from the level/filler plug.

10. **10.** CAUTION: Replace the washer.

    Install the transmission fluid filler/level plug.

    Torque: 35 Nm

11. Install the front undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

Published: 11-May-2011

Manual Transmission/Transaxle - Transmission Fluid Level Check

General Procedures

WARNING: Observe due care when draining, as the fluid can be very hot.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   • NOTE: Make sure that the vehicle is standing on a level surface.

   Raise and support the vehicle.

2. Remove the front undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. Clean the area around the transmission fluid level/filler plug.

4. Remove the transmission fluid filler/level plug.

5. Fill the transmission with the correct fluid until it runs from the level/filler plug.

6. **6.** CAUTION: Replace the washer.

   Install the transmission fluid filler/level plug.

   Torque: 35 Nm

7. Install the front undershield.

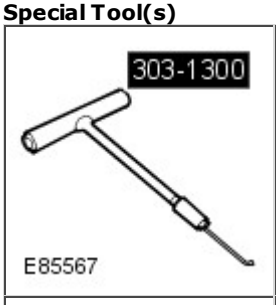
   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

Published: 11-May-2011

Manual Transmission/Transaxle - Halfshaft Seal RH

Removal and Installation

Special Tool(s)

	303-1300 Remover, Crankshaft Seal
	303-882 Installer, Halfshaft Seal

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the RH halfshaft.

   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

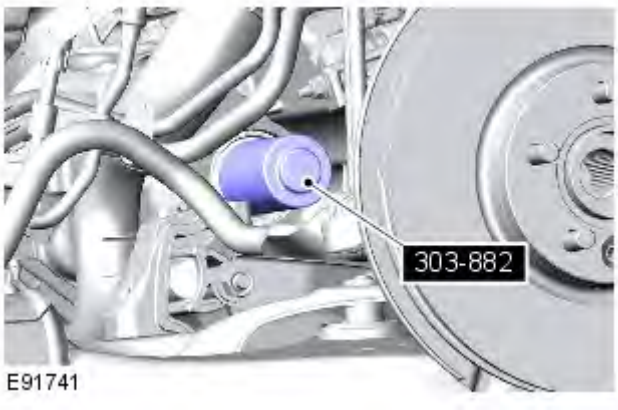
3. **3.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Take extra care not to damage the mating faces.

   Special Tool(s): 303-1300

Installation



1. *Special Tool(s):* 303-882

2. Install the RH halfshaft.

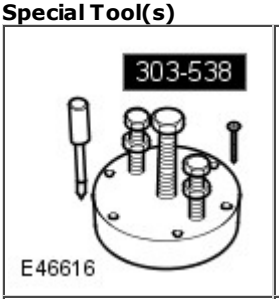
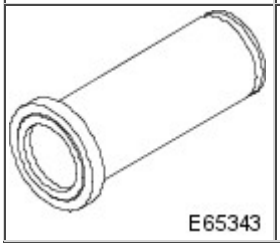
   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

Published: 11-May-2011

Manual Transmission/Transaxle - Input Shaft Seal

Removal and Installation

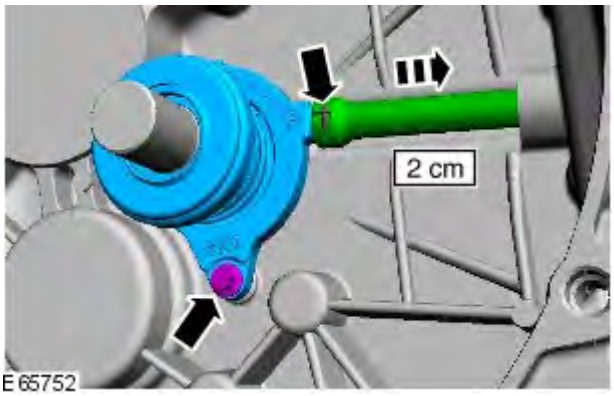
Special Tool(s)

	303-538 Remover/Installer, Crankshaft Oil Seal
	308-643 Installer, Input Shaft Seal

Removal

1. Remove the transmission assembly.

   Refer to: Transmission (308-03 Manual Transmission/Transaxle, Removal).



2. **2.** CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

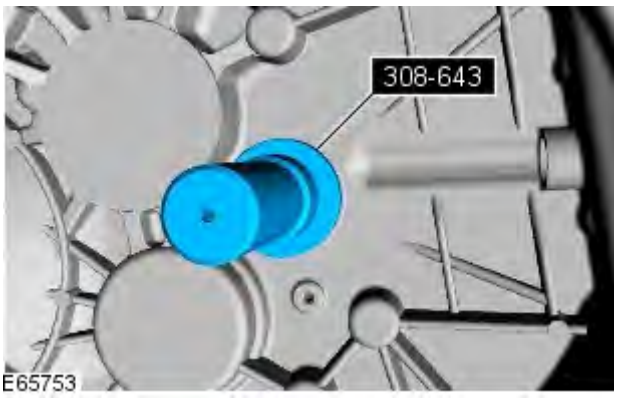
3. **3.** CAUTION: Take special care to avoid damaging the bearing.

   Special Tool(s): 303-538

4. Screw a 2.5 x 15 mm self-tapping screw, a maximum of 2 turns into the input shaft seal and remove the seal using a pair of pliers.

Installation

1. Apply adhesive tape over the splines of the input shaft to prevent the input shaft oil seal being damaged.



2. *Special Tool(s):* 308-643

3. Remove the adhesive tape.

4. Install the clutch slave cylinder.

   Torque: 11 Nm

5. Install the transmission assembly.

   Refer to: Transmission (308-03 Manual Transmission/Transaxle, Removal).

6. Bleed the clutch system.

   Refer to: Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

Published: 11-May-2011

Manual Transmission/Transaxle - Intermediate Shaft Seal

Removal and Installation

Special Tool(s)

	303-1300 Remover, Crankshaft Seal
	307-595 Installer, Intermediate Shaft Seal

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the power transfer unit.

   Refer to: Power Transfer Unit - TD4 2.2L Diesel, Vehicles With: M66 6-Speed Manual Transmission AWD (308-07B Transfer Case, Removal and Installation).

3. **3.** CAUTIONS:

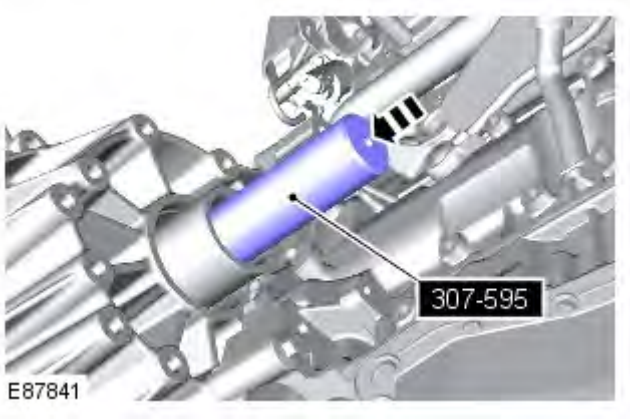
   Take extra care not to damage the mating faces.

   Make sure that the area around the component is clean and free of foreign material.

   • NOTE: Some oil spillage is inevitable during this operation.

   Special Tool(s): 303-1300

Installation



1. **1.** CAUTION: Take extra care not to damage the seal.

   Special Tool(s): 307-595

2. Install the power transfer unit.

   Refer to: Power Transfer Unit - TD4 2.2L Diesel, Vehicles With: M66 6-Speed Manual Transmission AWD (308-07B Transfer Case, Removal and Installation).

Published: 11-May-2011

Manual Transmission/Transaxle - Transmission

Removal

Special Tool(s)

	205-754A Splitter, Ball Joints
	211-316 Separator, Ball Joint

General Equipment

Powertrain Jack

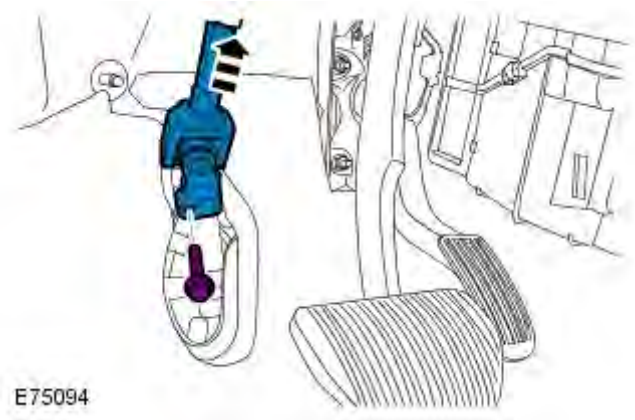
1. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Siphon the fluid from the power steering reservoir.

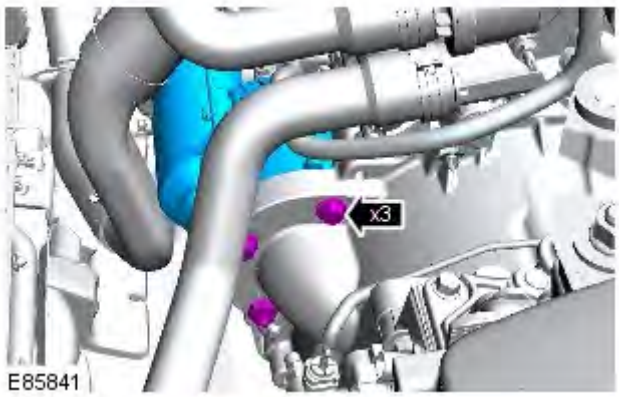


4. **4.** WARNING: Make sure that a new steering column flexible coupling bolt is installed.

   Disconnect the lower steering column from the steering gear.

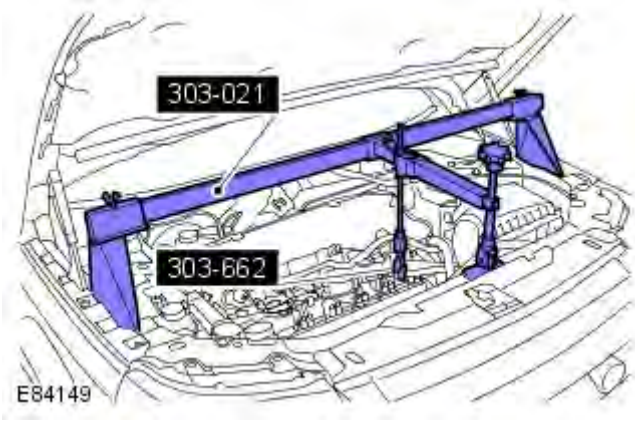
5. Remove the gear selector assembly.

   Refer to: Gearshift Linkage (308-06 Manual Transmission/Transaxle External Controls, Removal and Installation).

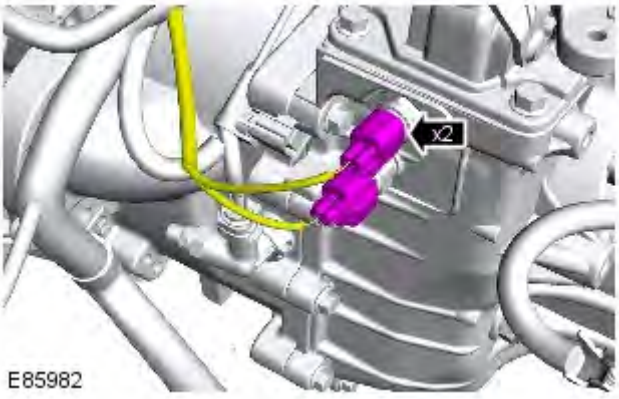


6. Remove the starter motor.

   Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

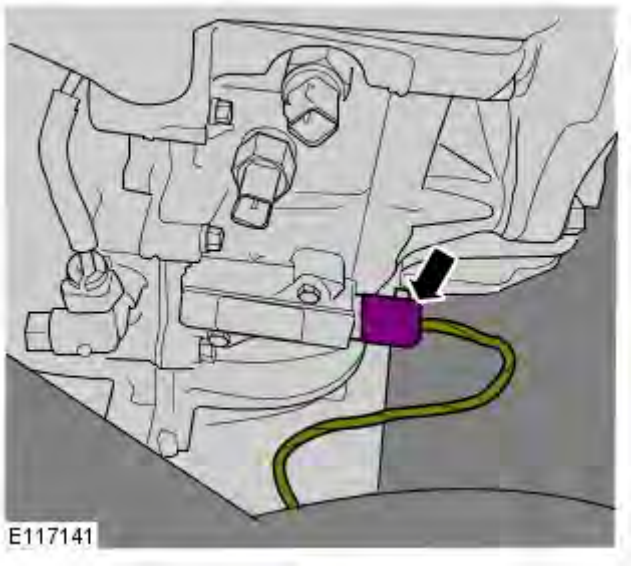


7. Support the engine.



8.

9. **9.** NOTE: If equipped.



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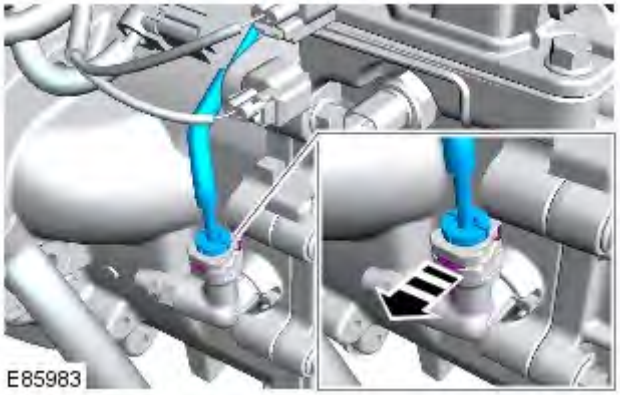

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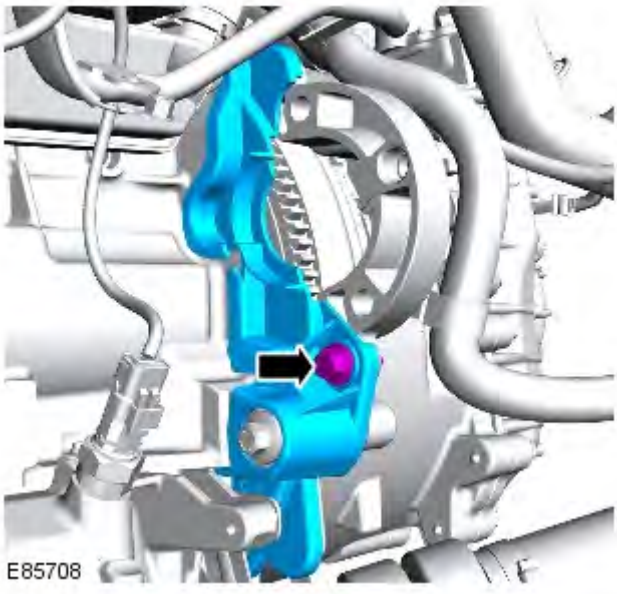

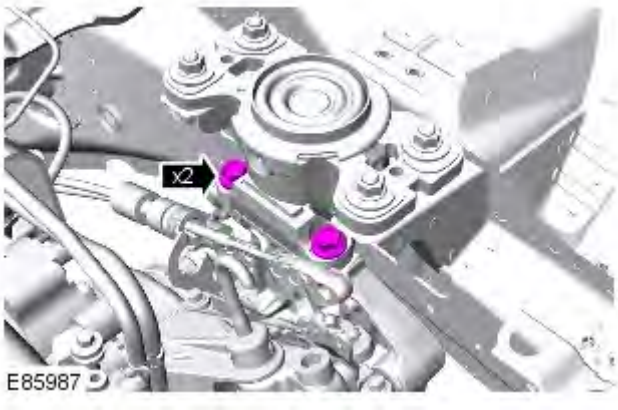

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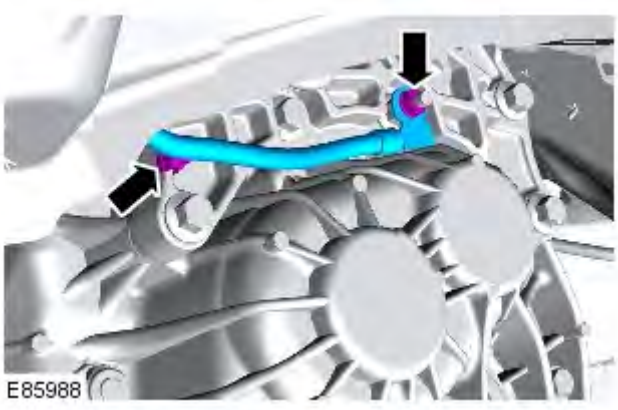


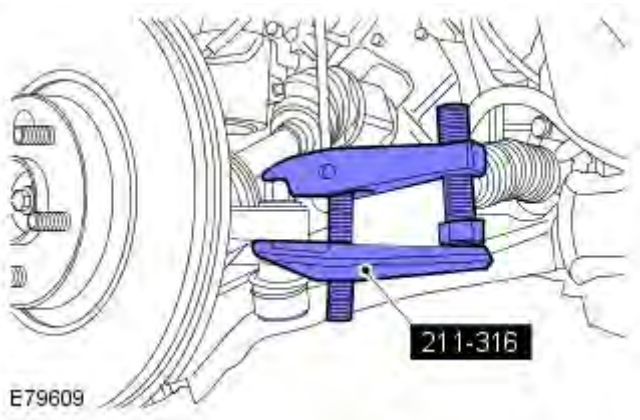
13.

14. Drain the transmission fluid.

    Refer to: Transmission Draining and Filling (308-03 Manual Transmission/Transaxle, General Procedures).

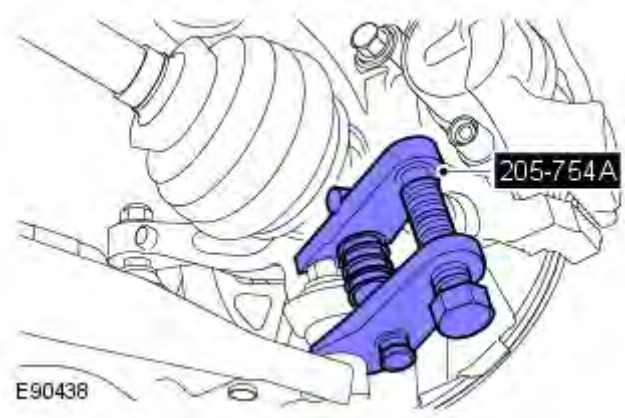
15. Remove the front wheels and tires.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



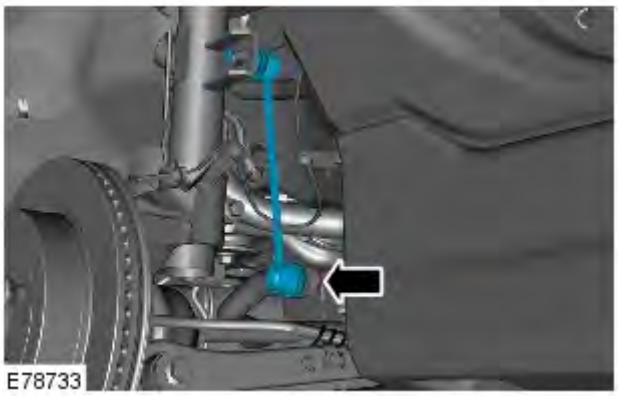
16. Using the special tool, release the LH and RH tie-rod end ball joints.

    Special Tool(s): 211-316



17. Using the special tool, remove the lower arm ball joint.

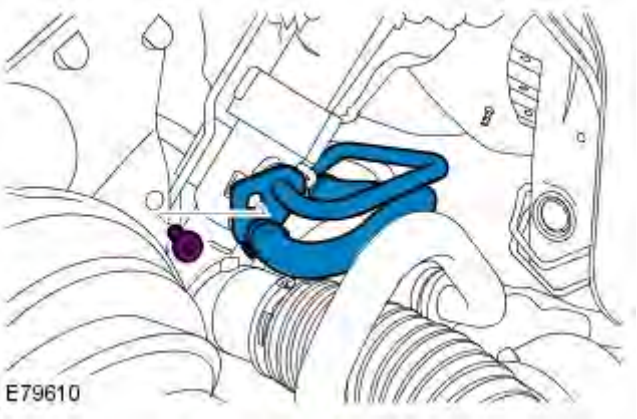
    Special Tool(s): 205-754A



18. **18.** CAUTION: Make sure that the ball joint ball does not rotate.

    • NOTE: Discard the 2 nuts.

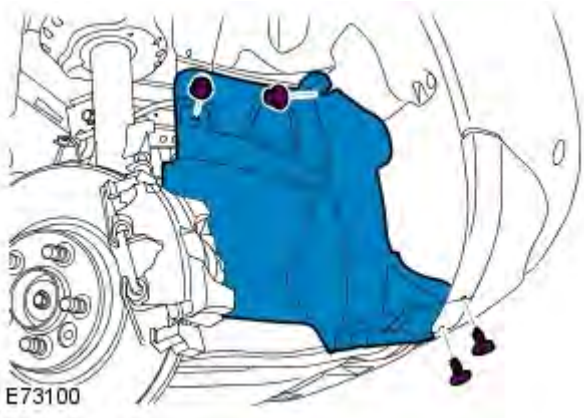
    Disconnect both front stabilizer bar links from the stabilizer bar.



19. **19.** CAUTION: Be prepared to collect escaping fluids.

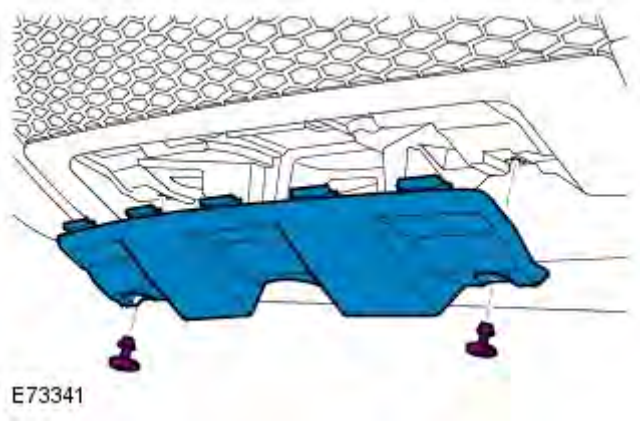
    • NOTE: Make sure that all openings are sealed.

    Disconnect the pressure lines from the power steering gear.



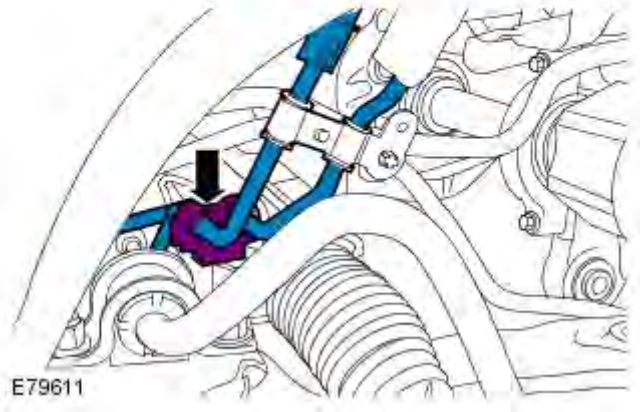
20. **20.** NOTE: RH illustration shown, LH is similar.

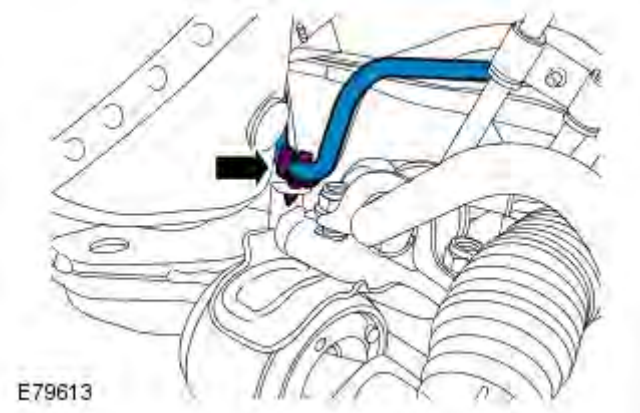
    Remove both the fender splash shield extension panels.


E73341

21. Remove the towing eye cover.
22. Remove the 2 bolts securing bumper cover.

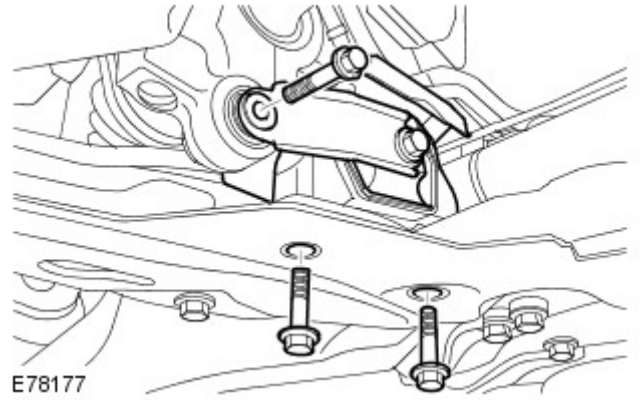
23. Release the PAS lines.


E79611

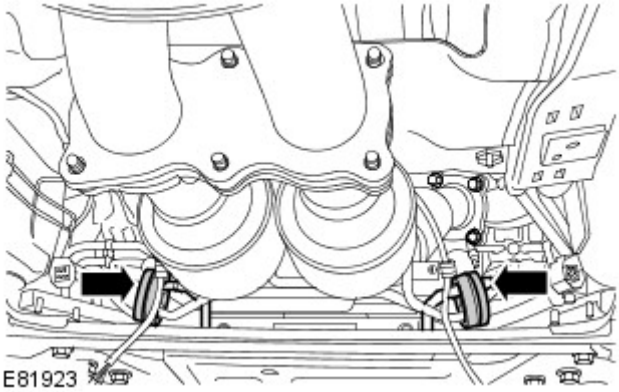

E79613

24. **24.** CAUTION: Be prepared to collect escaping fluids.
    - NOTE: Make sure that all openings are sealed.

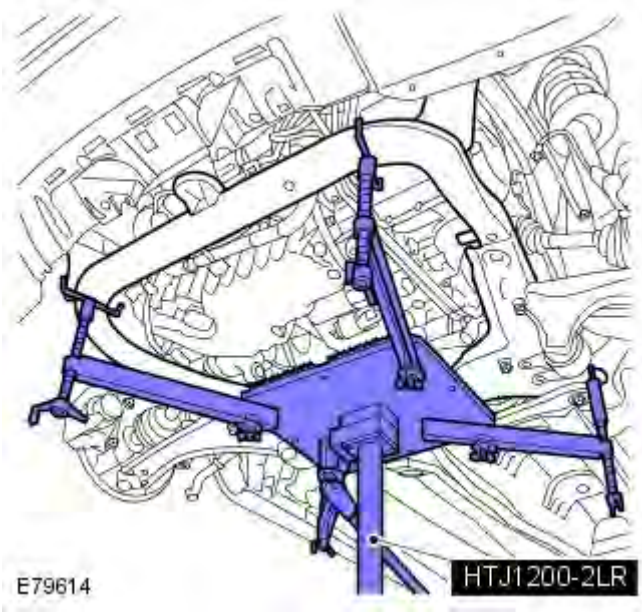
    Release the fuel line.


E78177

25. Remove the lower support insulator.

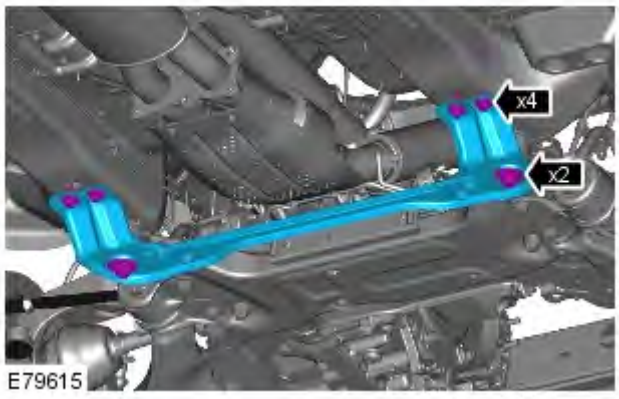


26. Release the downpipe catalytic converter.



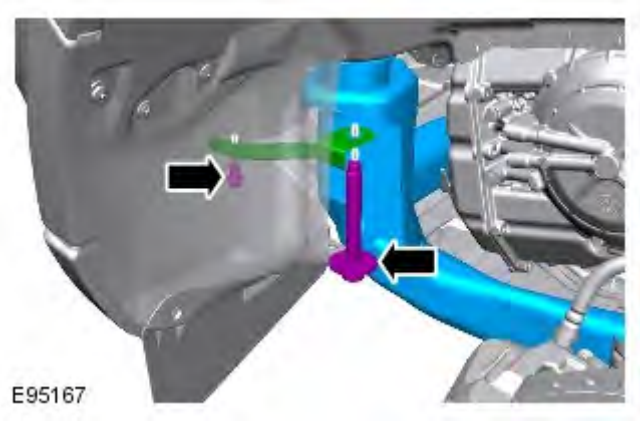
27. Support the subframe.

General Equipment: Powertrain Jack



28. **28.** CAUTION: Make sure that new subframe bolts are installed.

Remove the front subframe cross-brace.

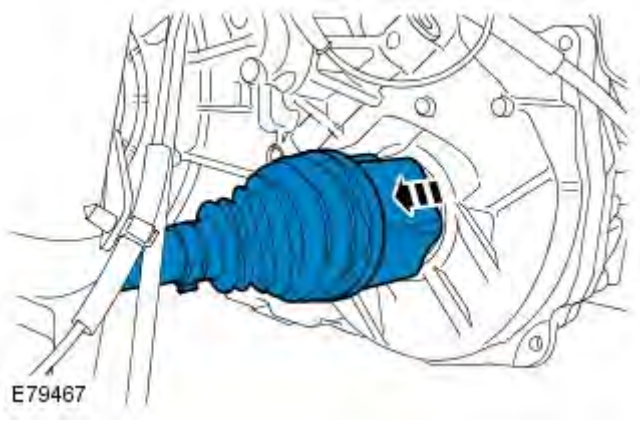


29. **29.** CAUTIONS:

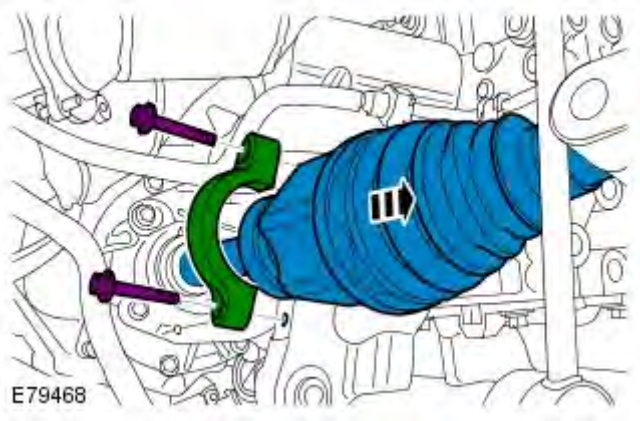
    Mark the components to aid installation.

    Make sure that new subframe bolts are installed.

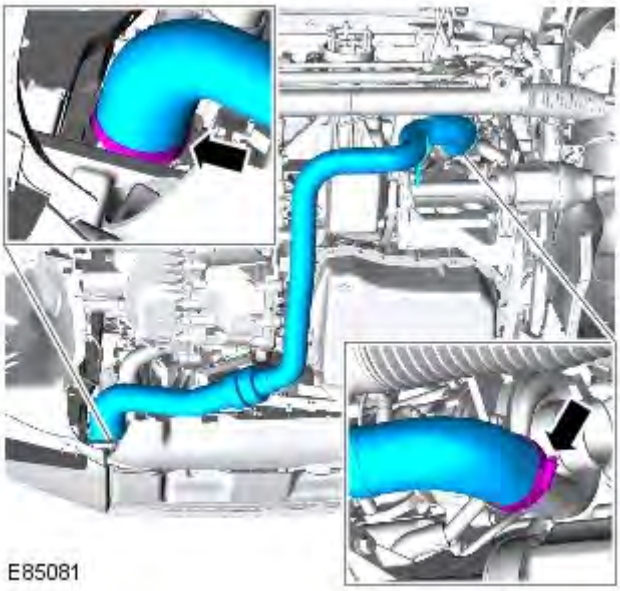
    Lower the front subframe assembly.



30. Release the LH halfshaft.



31. Release the RH halfshaft.

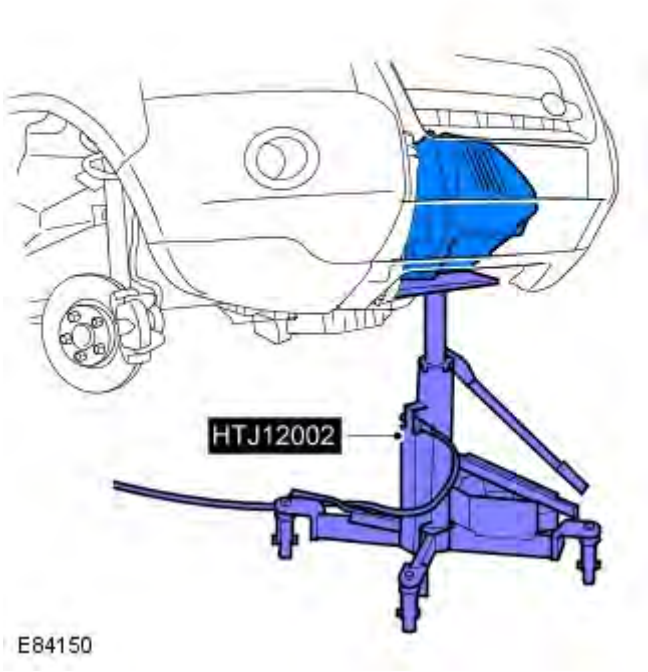


32. Remove the turbocharger outlet pipe.

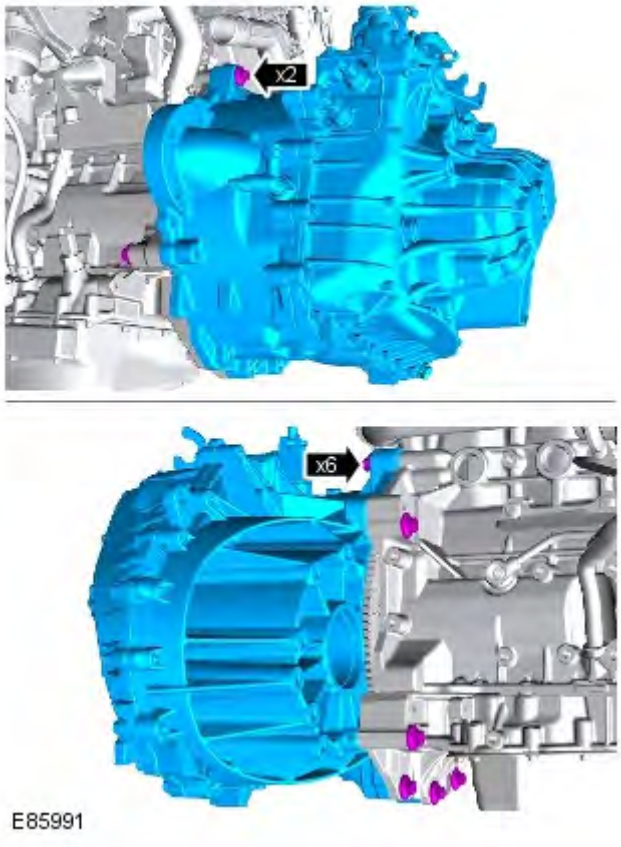
33.

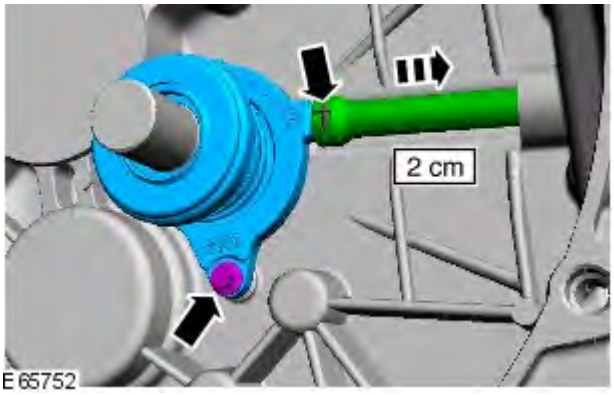
34. Support the transmission.

General Equipment: Powertrain Jack



35.





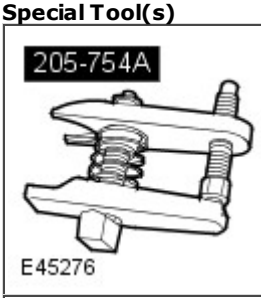
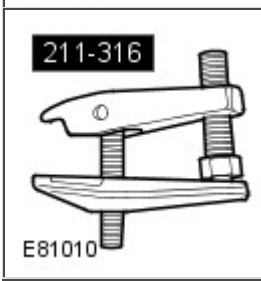
36. **36.** CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

Published: 11-May-2011

Manual Transmission/Transaxle - Transmission

Removal

Special Tool(s)

	205-754A Splitter, Ball Joints
	211-316 Separator, Ball Joint

General Equipment

Powertrain Jack

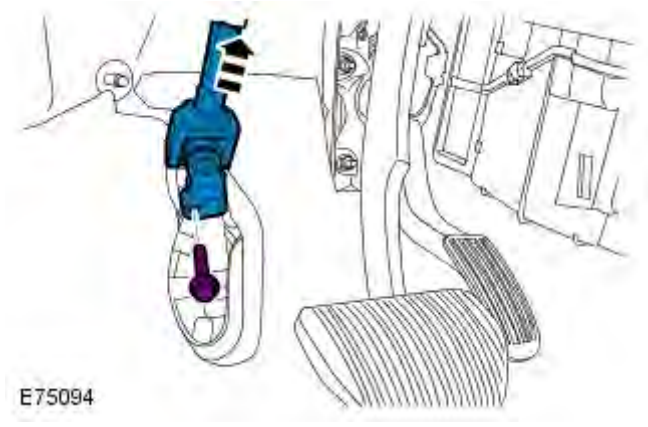
1. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Siphon the fluid from the power steering reservoir.

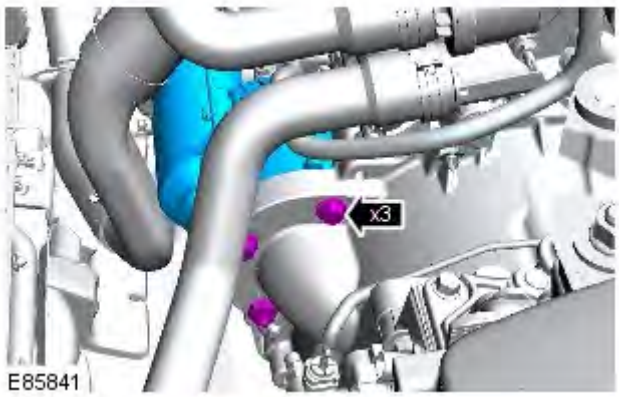


4. **4.** WARNING: Make sure that a new steering column flexible coupling bolt is installed.

   Disconnect the lower steering column from the steering gear.

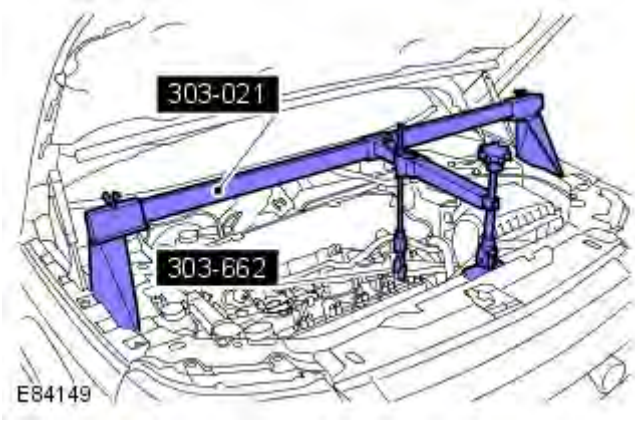
5. Remove the gear selector assembly.

   Refer to: Gearshift Linkage (308-06 Manual Transmission/Transaxle External Controls, Removal and Installation).

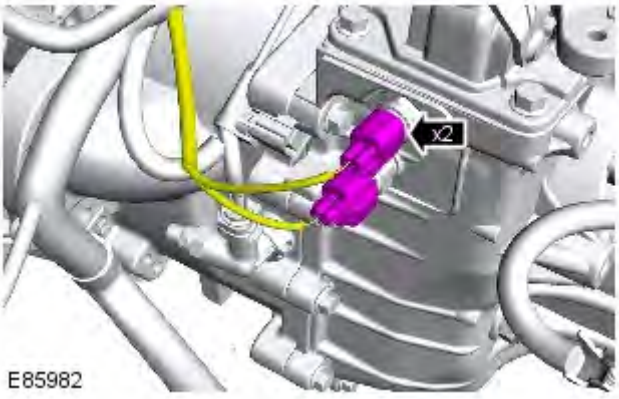


6. Remove the starter motor.

   Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

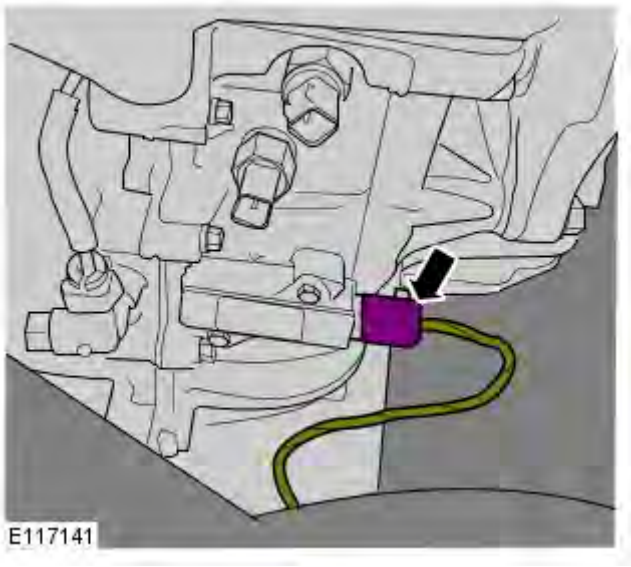


7. Support the engine.

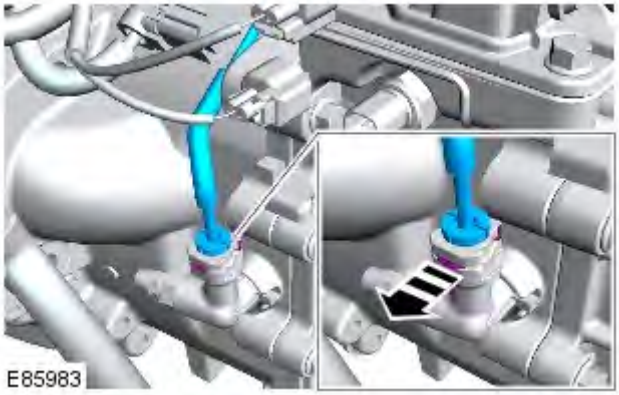


8.

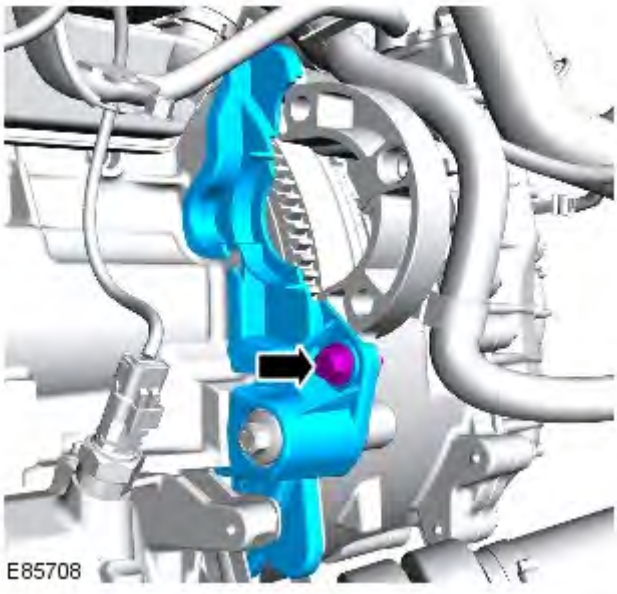
9. **9.** NOTE: If equipped.

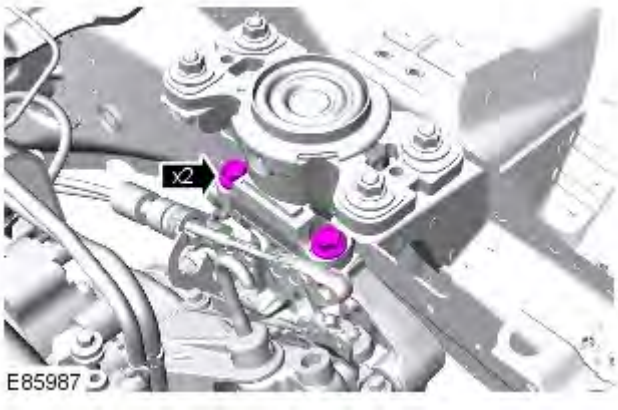


10.

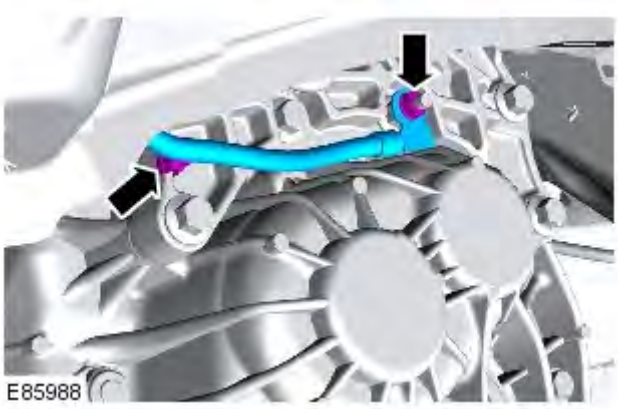


11.





12.



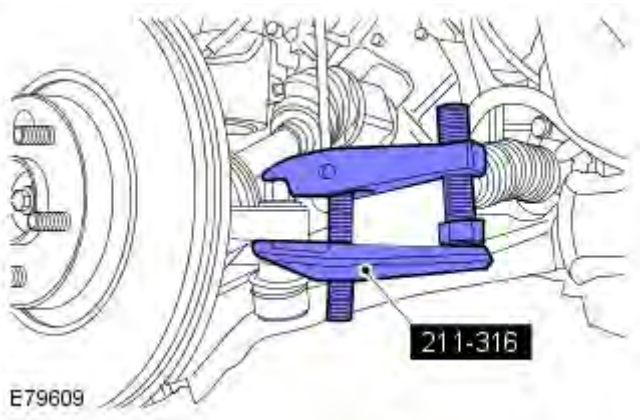
13.

14. Drain the transmission fluid.

    Refer to: Transmission Draining and Filling (308-03 Manual Transmission/Transaxle, General Procedures).

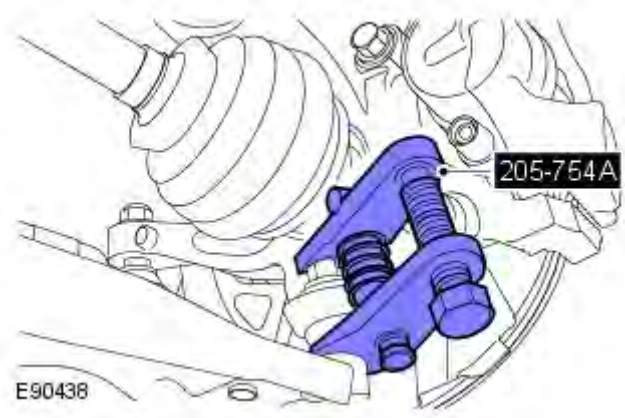
15. Remove the front wheels and tires.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



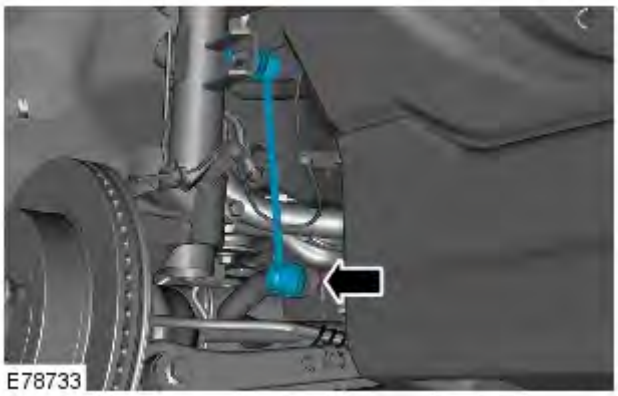
16. Using the special tool, release the LH and RH tie-rod end ball joints.

    Special Tool(s): 211-316



17. Using the special tool, remove the lower arm ball joint.

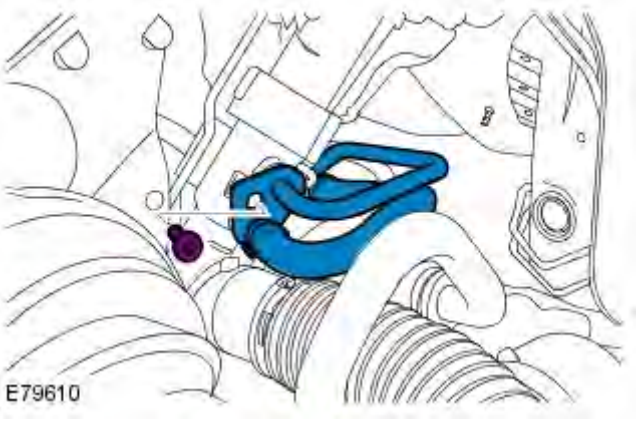
    Special Tool(s): 205-754A



18. **18.** CAUTION: Make sure that the ball joint ball does not rotate.

    • NOTE: Discard the 2 nuts.

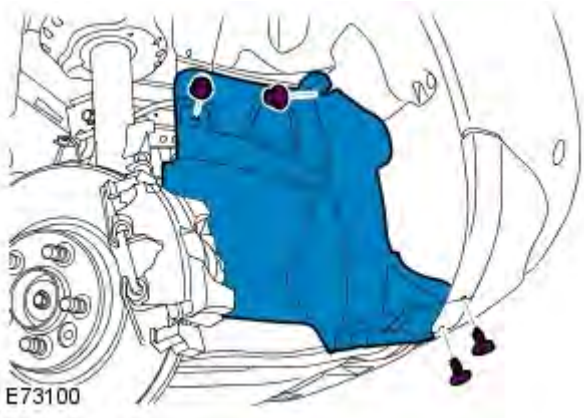
    Disconnect both front stabilizer bar links from the stabilizer bar.



19. **19.** CAUTION: Be prepared to collect escaping fluids.

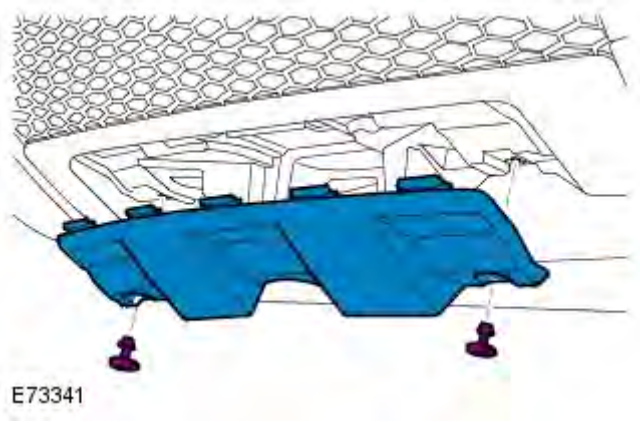
    • NOTE: Make sure that all openings are sealed.

    Disconnect the pressure lines from the power steering gear.



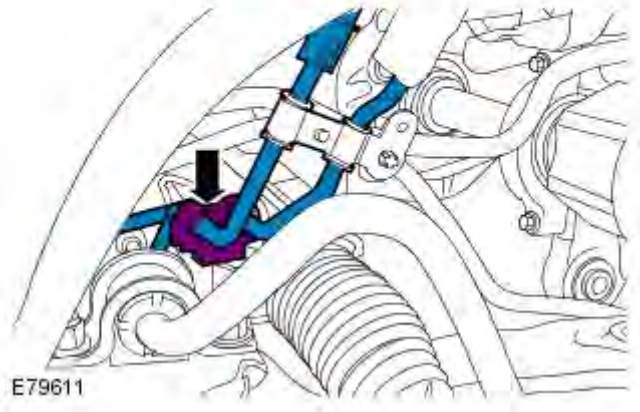
20. **20.** NOTE: RH illustration shown, LH is similar.

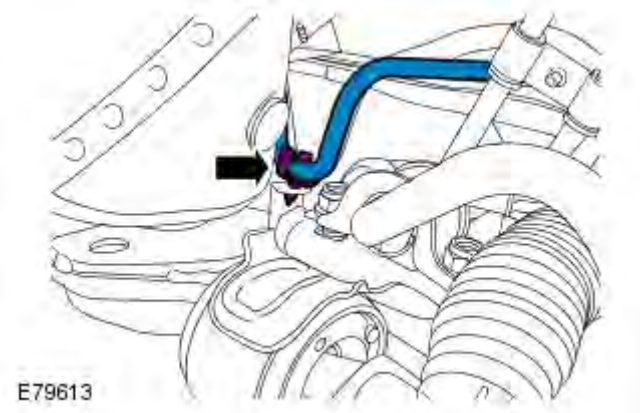
    Remove both the fender splash shield extension panels.


E73341

21. Remove the towing eye cover.
22. Remove the 2 bolts securing bumper cover.

23. Release the PAS lines.

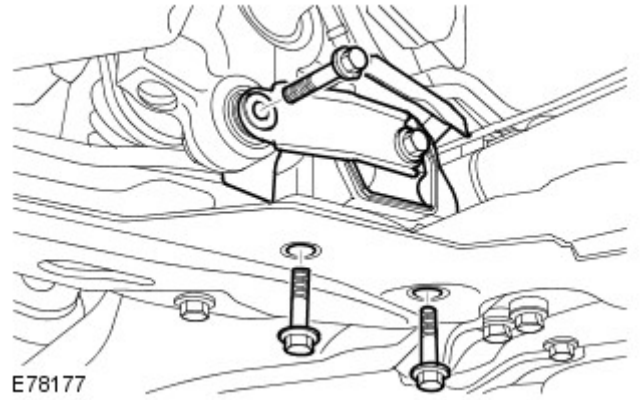

E79611


E79613

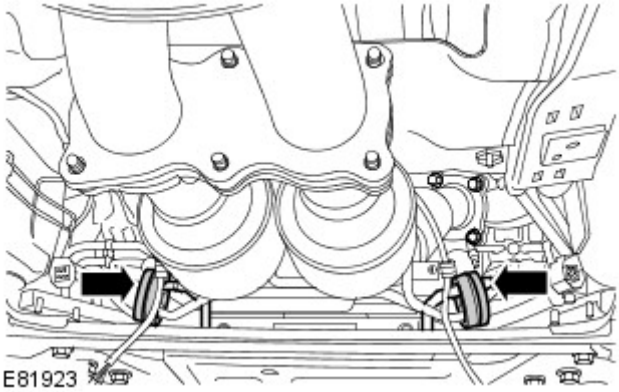
24. **24.** CAUTION: Be prepared to collect escaping fluids.

    • NOTE: Make sure that all openings are sealed.

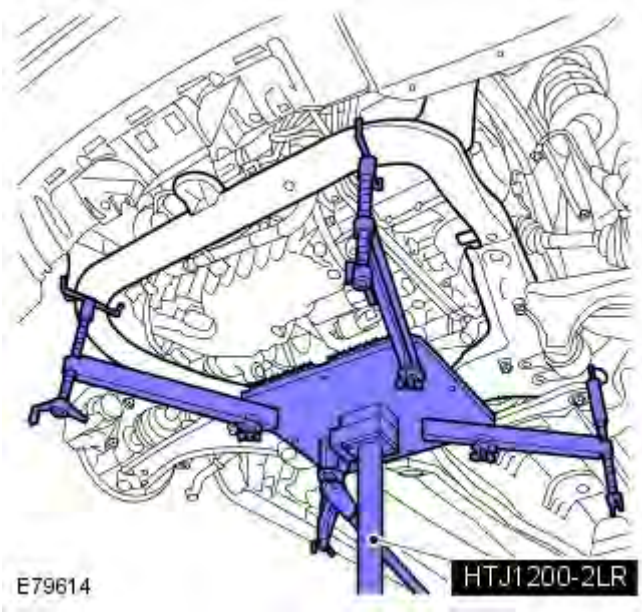
    Release the fuel line.


E78177

25. Remove the lower support insulator.

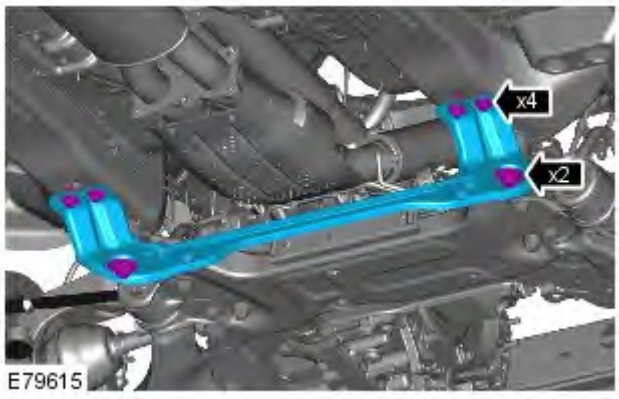


26. Release the downpipe catalytic converter.



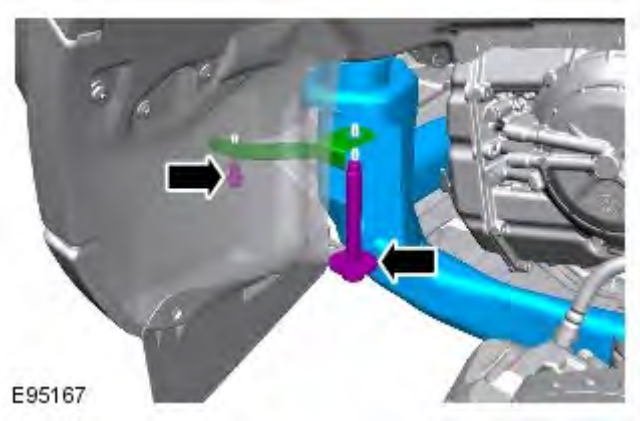
27. Support the subframe.

General Equipment: Powertrain Jack



28. **28.** CAUTION: Make sure that new subframe bolts are installed.

Remove the front subframe cross-brace.

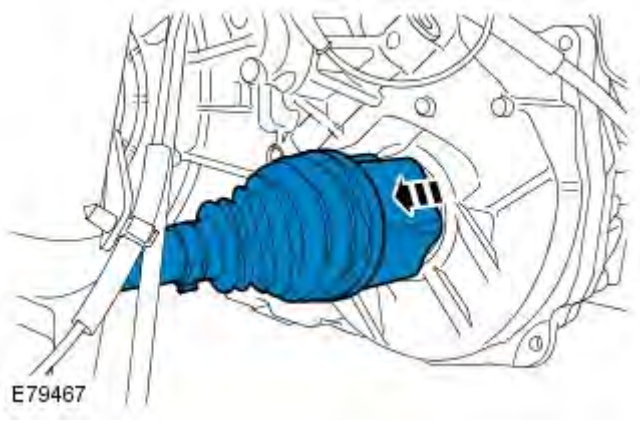


29. **29.** CAUTIONS:

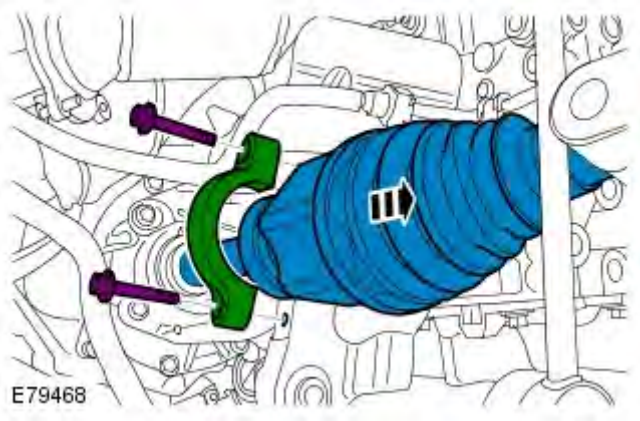
    Mark the components to aid installation.

    Make sure that new subframe bolts are installed.

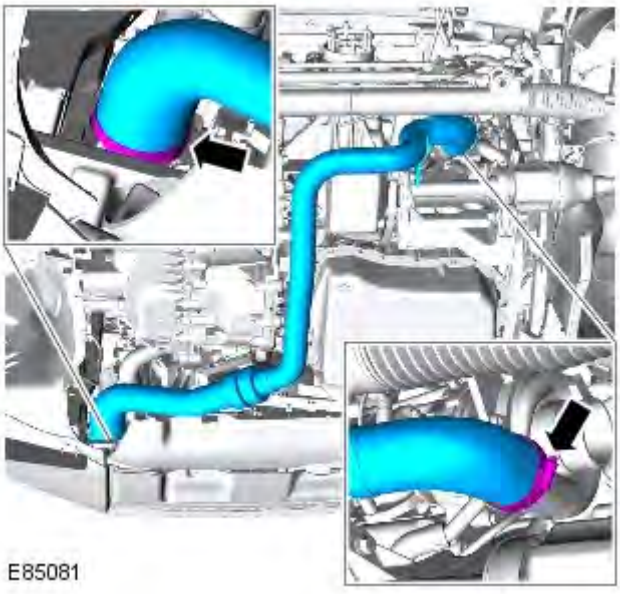
    Lower the front subframe assembly.



30. Release the LH halfshaft.



31. Release the RH halfshaft.

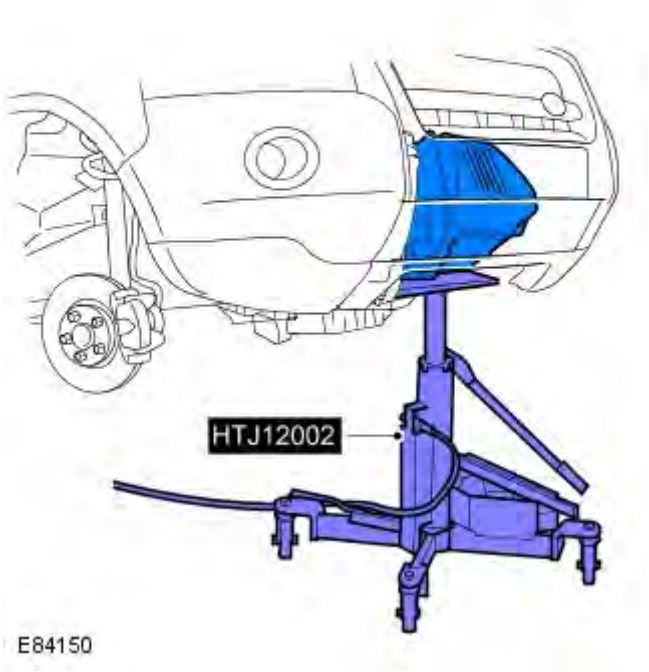


32. Remove the turbocharger outlet pipe.

33.

34. Support the transmission.

General Equipment: Powertrain Jack



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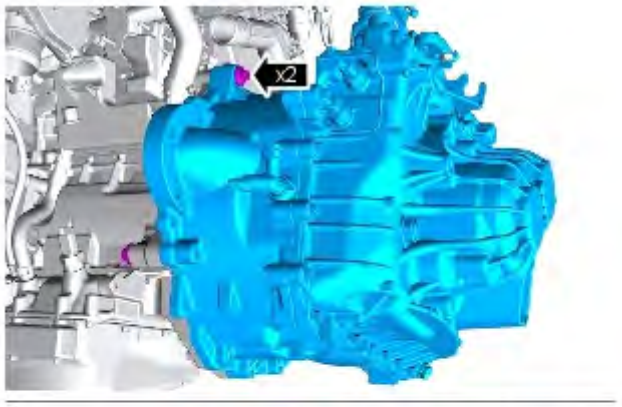
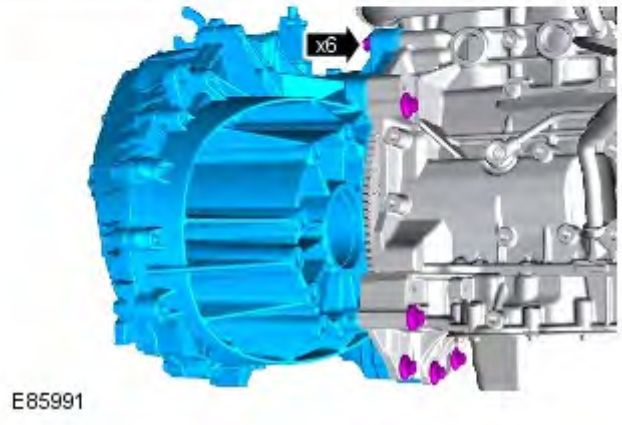
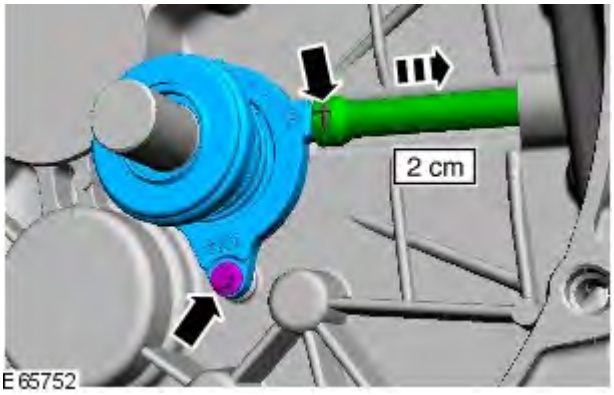


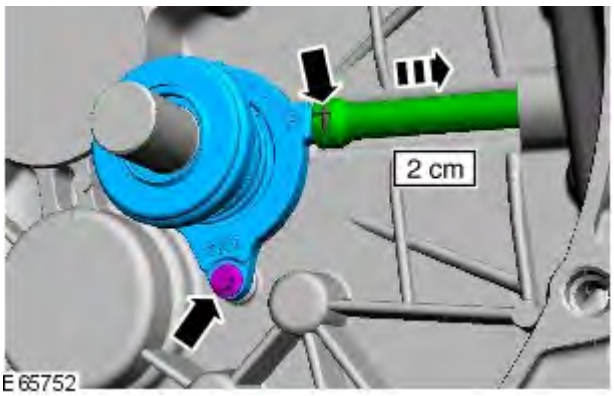




36. **36.** CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

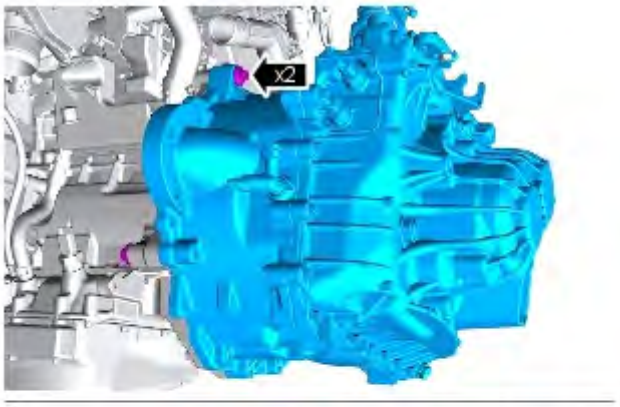
Manual Transmission/Transaxle - Transmission

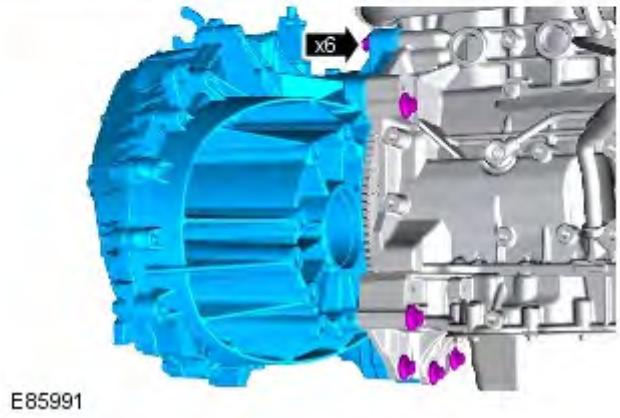
Installation



1. Install the clutch slave cylinder.

   Torque: 11 Nm



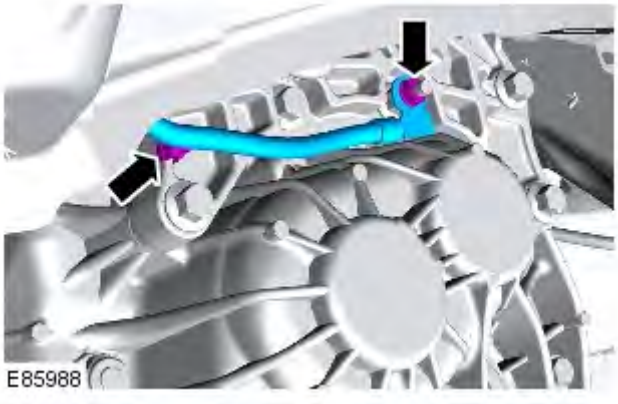


2. Install the transmission assembly.

   Torque: 65 Nm

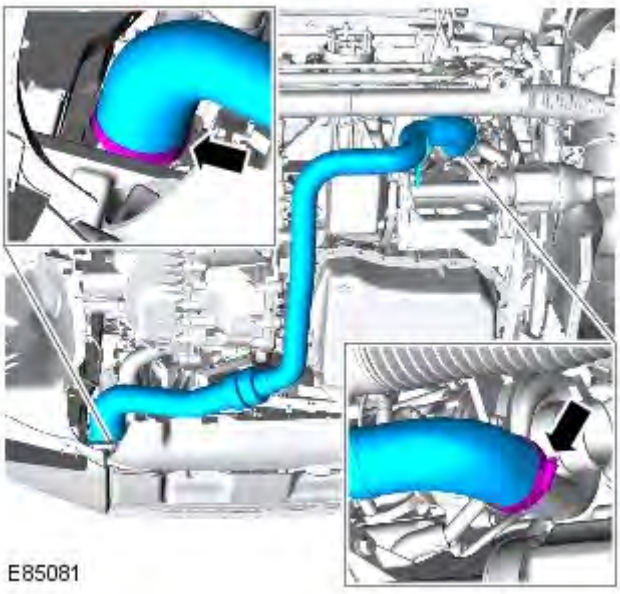
3. Install the transmission mounting bracket.

   Torque:
   M12 80 Nm
   M8 24 Nm

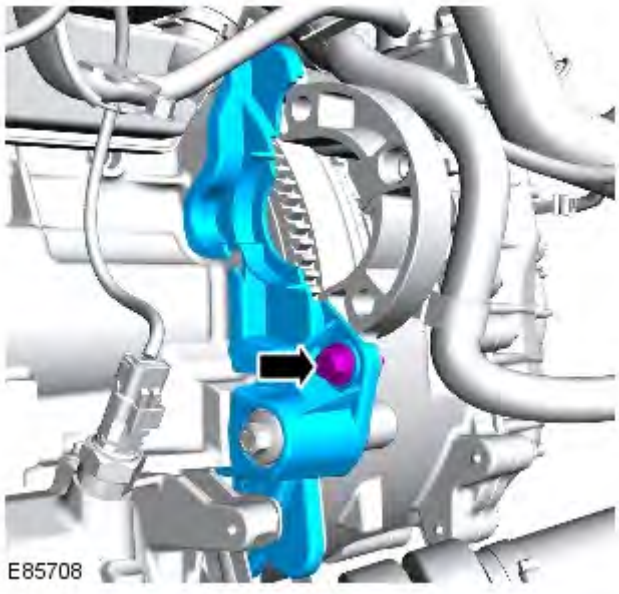


4. Secure the earth cable to the transmission mounting bracket.

   Torque: 25 Nm

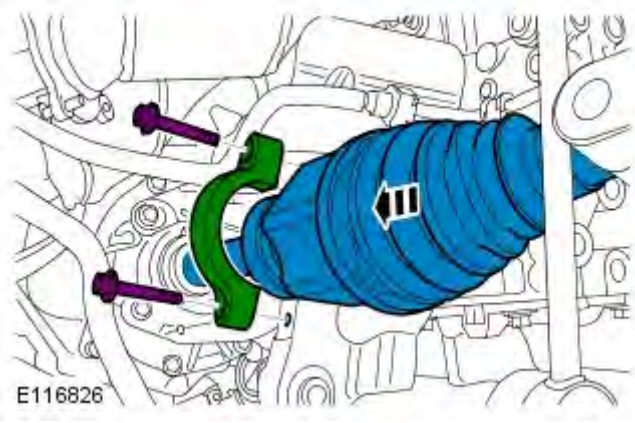


5. Install the turbocharger outlet pipe.



6. Install the front flywheel closing panel.

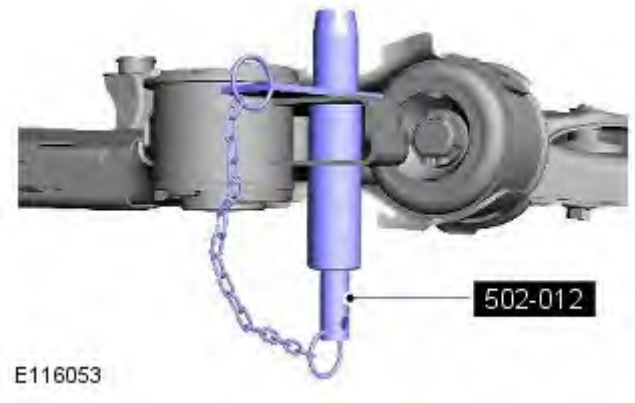
   Torque: 60 Nm



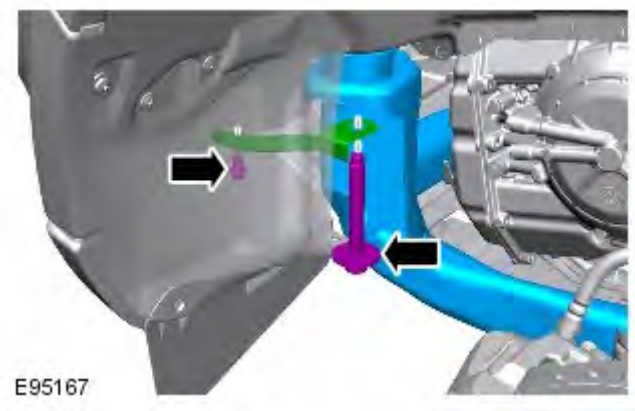
7. Install the RH halfshaft.

   Torque:
   Drive shaft support 25 Nm

8. Install the LH halfshaft.



9. Install the alignment tool to the front subframe.

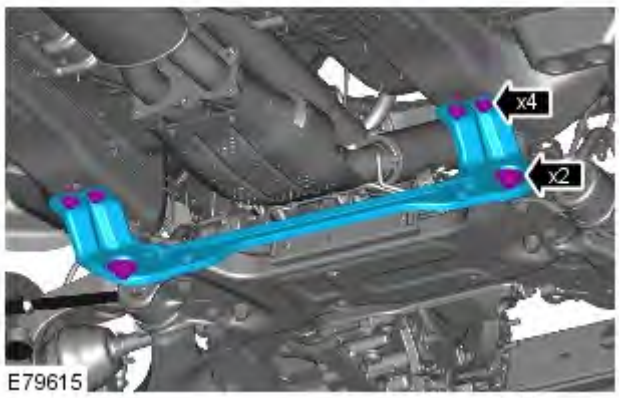


10. **10.** CAUTION: Make sure that new subframe bolts are installed.

    • NOTE: Install but do not fully tighten the front subframe mounting bolts.

    Install the front subframe.

    Torque:
    Support bracket bolts 25 Nm
    Subframe bolts
    Stage 1:140 Nm
    Stage 2:240°

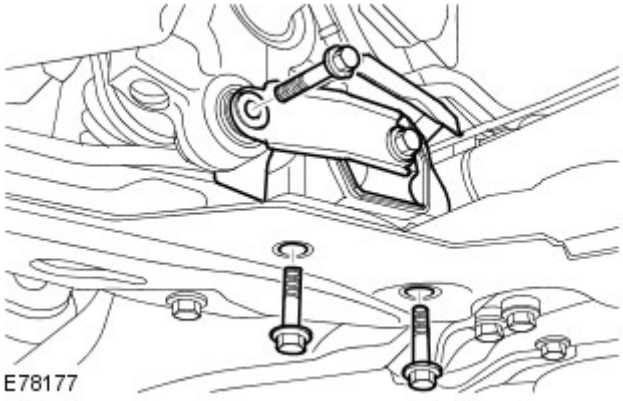


11. **11.** CAUTION: Make sure that new bolts are installed.

    • NOTE: Install but do not fully tighten the rear subframe mounting bolts.

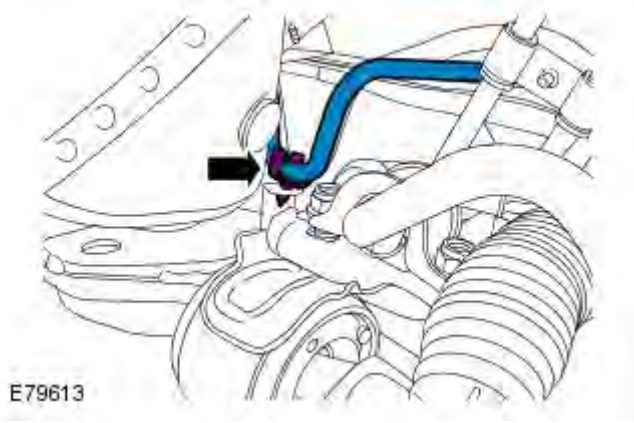
    Install the subframe cross-brace.

    Torque:
    Cross brace bolts 45 Nm
    Subframe bolts
    Stage 1:140 Nm
    Stage 2:240°

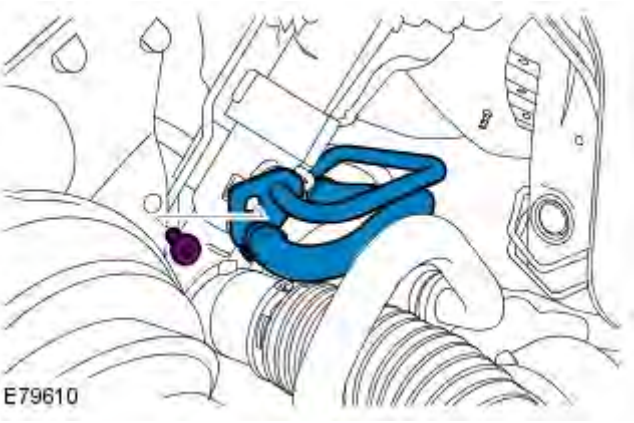


12. Install the lower support insulator.

    Torque: 110 Nm



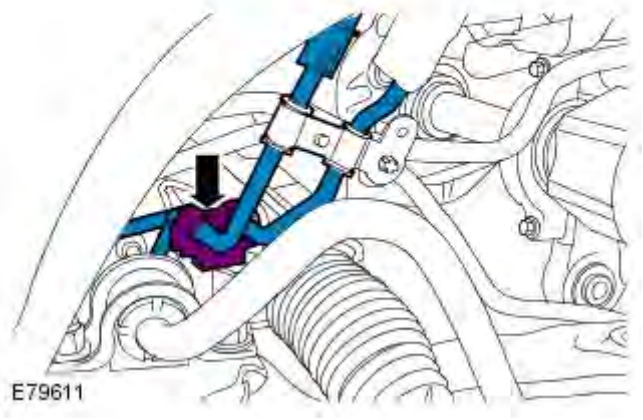
13. Install the fuel line.



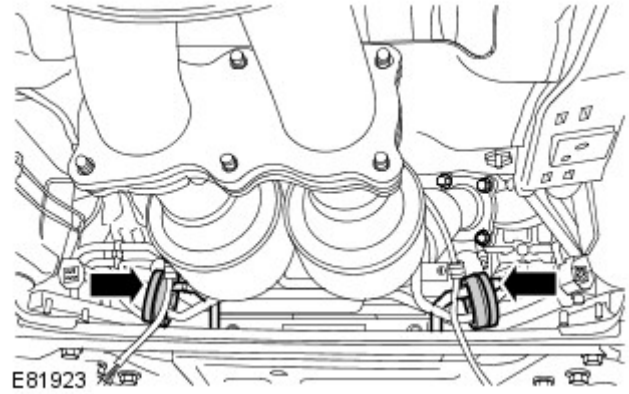
14. Connect the steering gear pressure lines.

    Torque: 25 Nm

15. Install the power steering fluid line to the clip.



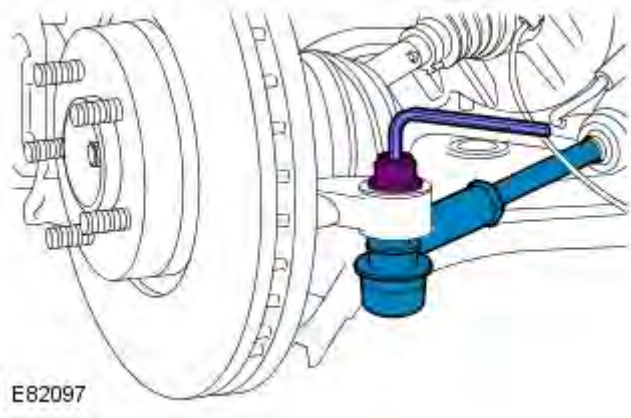
16. Secure the downpipe catalytic converter.



17. **17.** WARNING: Make sure that new nuts are installed.

    Connect the LH and RH tie-rod end ball joints.

    Torque: 80 Nm

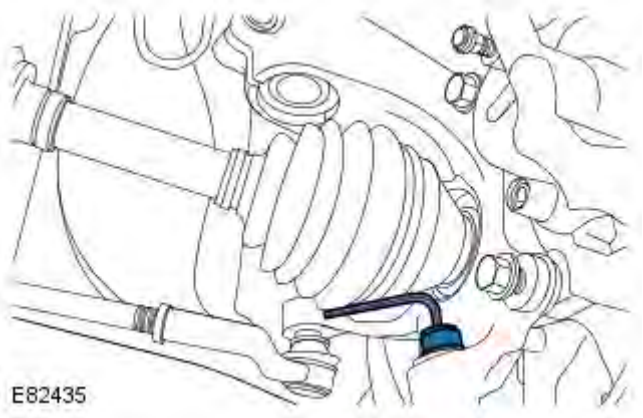


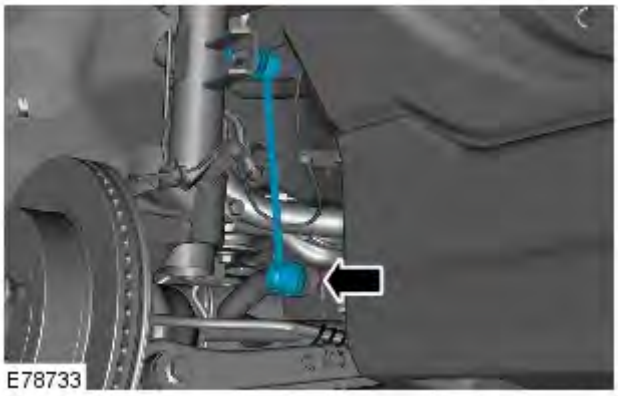
18. **18.** WARNING: Make sure that a new lower arm ball joint nut is installed.

    CAUTION: Make sure that the ball joint ball does not rotate.

    Install the lower arm ball joint

    Torque: 110 Nm



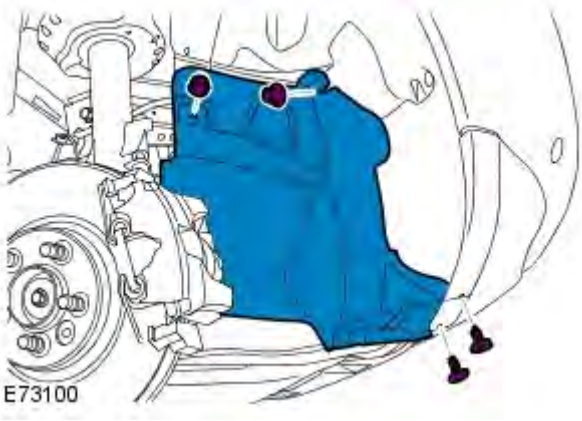


19. **19.** WARNING: Make sure that new nuts are installed.

    CAUTION: Make sure that the ball joint ball does not rotate.

    Connect both front stabilizer bar links to the stabilizer bar.

    Torque: 55 Nm

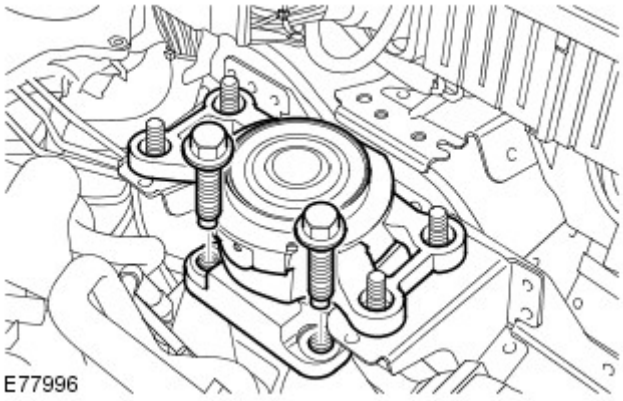


20. **20.** NOTE: RH illustration shown, LH is similar.

    Install both the fender splash shield extension panels.

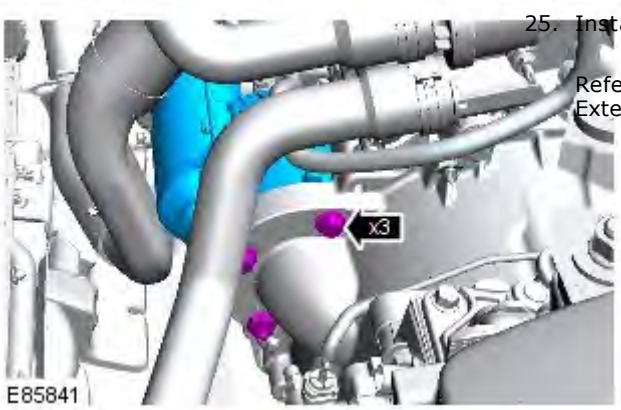
21. Install the front wheels and tires.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



22. Install the 2 bolts securing the transmission mounting to the body mounting.

    Torque: 175 Nm

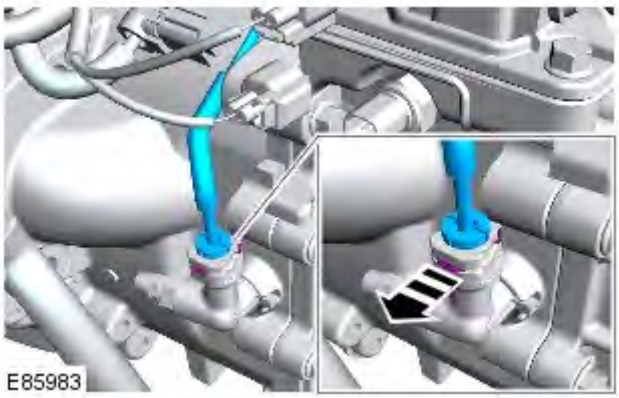


23. Remove the engine support.

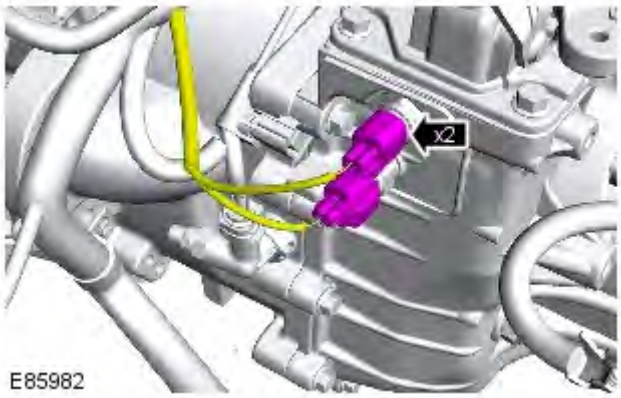
    Refer to: Starter Motor (303-06B Starting System - TD4 2.2L Diesel, Removal and Installation).

25. Install the gear selector assembly.

    Refer to: Gearshift Linkage (308-06 Manual Transmission/Transaxle External Controls, Removal and Installation).



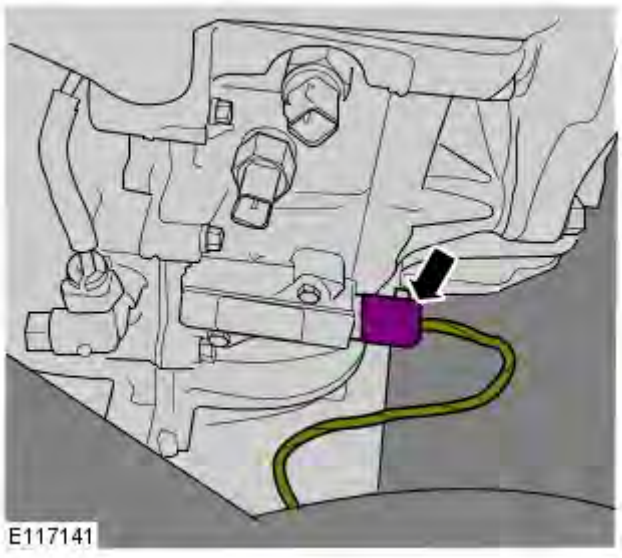
26. Connect the clutch slave cylinder hydraulic hose and secure with the clip.

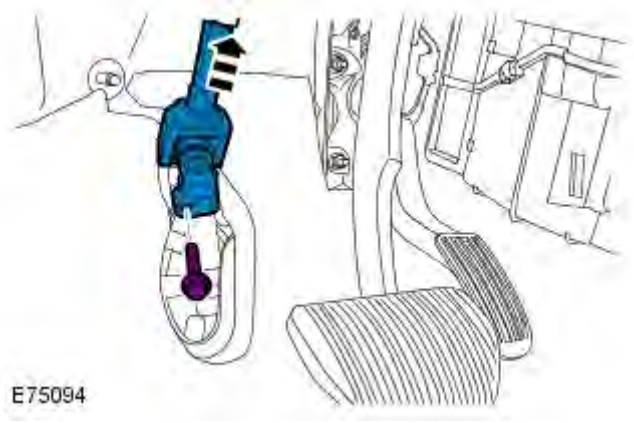


27. Connect the 1st and reverse gear position switch electrical connectors.

28. **28.** NOTE: If equipped.

    • NOTE: An audible click is heard when the clips are fully latched.





29. **29.** WARNING: Make sure that a new steering column flexible coupling bolt is installed.

    Connect the steering column to the steering gear.

    Torque: 25 Nm

30. Refill the transmission with fluid.

    Refer to: Transmission Draining and Filling (308-03 Manual Transmission/Transaxle, General Procedures).

31. Install the battery tray.

    Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

32. Bleed the clutch system.

    Refer to: Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

33. Refill and bleed the power steering.

    Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Published: 11-May-2011

Manual Transmission/Transaxle External Controls -

Torque Specifications

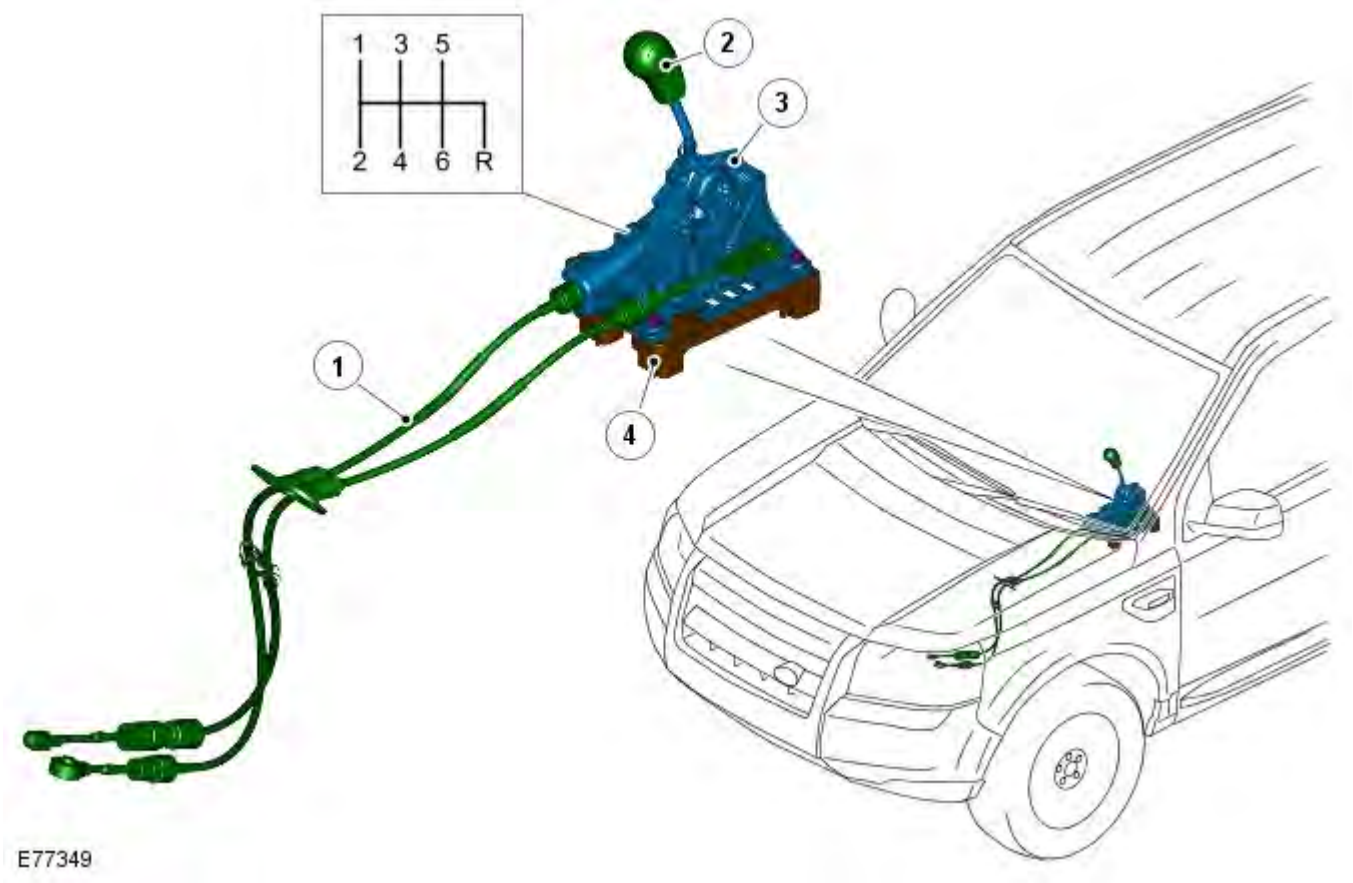
Description	Nm	lb-ft
Gearshift lever bolts	10	7
Gearshift mechanism bracket bolts	24	18

Published: 11-May-2011

Manual Transmission/Transaxle External Controls - External Controls

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Shift cables
2	-	Gear knob
3	-	Selector lever assembly
4	-	Selector lever mounting plate

INTRODUCTION

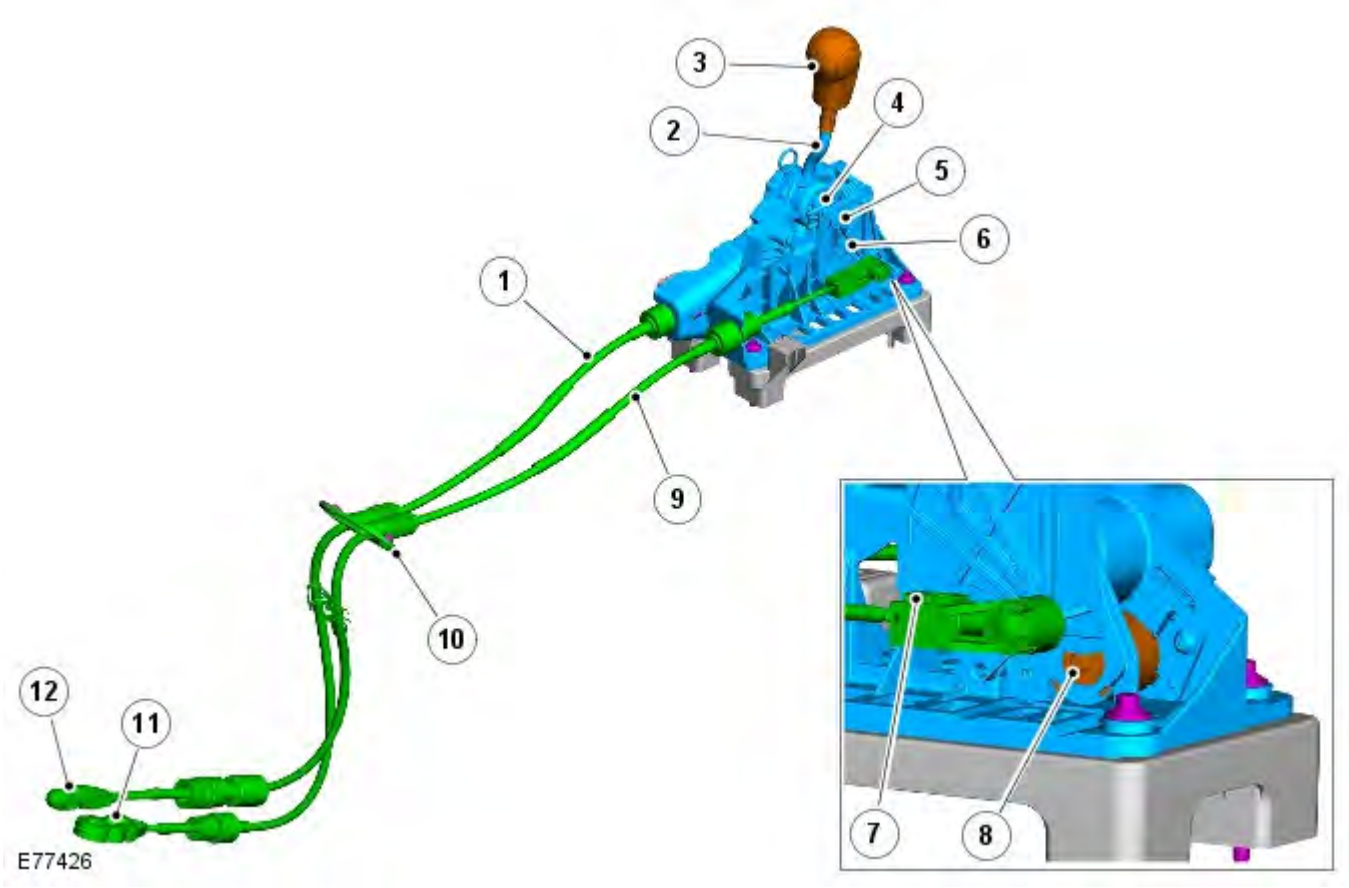
The manual transmission external controls comprise a selector lever assembly and 2 shift cables. The selector allows the driver to engage the 6 forward gears and reverse gear.

The selector lever assembly is located in a central position on the transmission tunnel, between the front driver and passenger seats and is secured to the transmission tunnel with 4 bolts. The selector lever assembly is a non-serviceable mechanical assembly.

Selections made using the selector lever are passed to the transmission lever arm by the shift cables. Ball pins on the selector lever provide for the attachment of the shift cables.

The selector has a vehicle speed dependent solenoid interlock device. This ensures that the driver is prevented from accidentally selecting reverse gear.

Selector Lever and Shift Cables



Item	Part Number	Description
1	-	Longitudinal shift cable
2	-	Gear selector lever
3	-	Gear knob
4	-	Centring spring
5	-	Ball end
6	-	Lever plate
7	-	Lateral cable adjustment button
8	-	Interlock solenoid
9	-	Lateral shift cable
10	-	Bulkhead seal
11	-	Longitudinal shift cable - transmission attachment
12	-	Lateral shift cable - transmission attachment

The selector lever assembly is a plastic moulded construction. The lever is attached to a gimbal mechanism which allows easy movement in the lateral and longitudinal planes.

The lever has a ball end on its base to which the longitudinal shift cable is attached. This cable passes all longitudinal movements of the lever to the transmission. A second ball end is attached at 90 degrees to the lever and engages with a centering spring. The centering spring returns the lever to a position between 3rd and 4th gears when neutral is selected.

The second ball end locates in a rotating lever plate. This plate is spring loaded and has ball end for attachment of the lateral shift cable. The lever plate rotates with movement of the selector lever from side to side and passes lateral movements of the selector lever to the lateral shift cable.

The two shift cables have abutments which locate in the selector lever assembly and in brackets on the transmission. The lateral shift cable is adjustable at the cable ball end attachment. Both shift cables have eye-ends which locate on ball ends on the transmission selector shift mechanism levers.

Inhibition of reverse gear is achieved through a solenoid interlock device located on the selector lever assembly. When the solenoid is energized, movement of the lever plate is restricted to prevent the reverse gear position being accessed. The solenoid is activated at speeds in excess of 25 km/h (15 mph) to prevent inadvertent selection of reverse gear. The solenoid is deactivated at speeds below 15 km/h (9 mph). The Central Junction Box (CJB) controls the solenoid operation using speed signals received on the high speed Controller Area Network (CAN) bus from the Anti-lock Brake System (ABS).

The lateral shift (select) cable has an adjustment/setting mechanism at the selector lever end. The purpose of the mechanism is to accommodate vehicle to vehicle build tolerances. This ensures that the selector lever movements are correctly aligned with the movements of the gearbox selector lever. This is essential to ensure the correct operation of the selector mechanism. The fore/aft (shift) cable does not require any adjustment or setting.

Cable Setting Procedure

The correct cable adjustment is achieved by use of a yellow adjustment button in the selector lever arm eye end of the lateral shift cable.

Ensure that the transmission is in neutral and release the yellow adjustment button. Allow the centering spring to centre the selector lever in the lateral direction.

Once the cable is in the correct position, the yellow adjustment button can be pressed back into the 'locked' position to engage with the serrated portion of the cable. Ensure that the selector lever is not moved before the button is pressed.

Check the cable for the correct setting by selecting 3rd gear and checking that the lateral movement of the selector lever feels symmetrical.

The cable should be reset whenever any part of the transmission selector assembly has been disturbed or replaced, including the transmission, cables or selector lever assembly.

Published: 11-May-2011

Manual Transmission/Transaxle External Controls - External Controls

Diagnosis and Testing

Principles of Operation

For additional information.
REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

Published: 11-May-2011

Manual Transmission/Transaxle External Controls - Gearshift Linkage

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

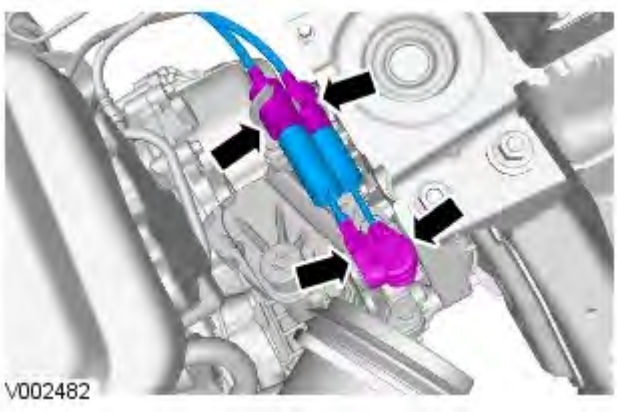
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the air cleaner assembly.

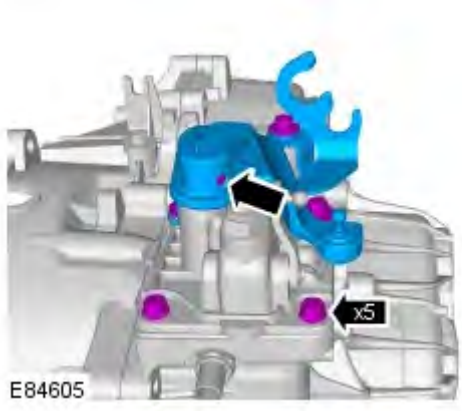
   Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

3. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

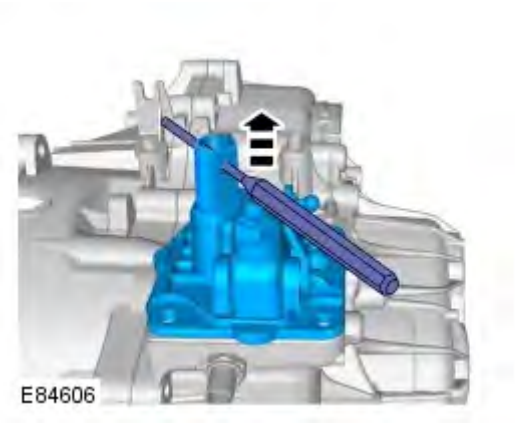


4.



5. *Torque:* 24 Nm

6.



Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.

   To install, reverse the removal procedure.

Published: 11-May-2011

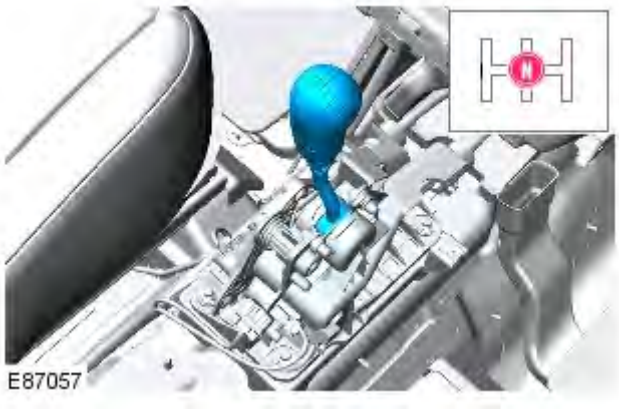
Manual Transmission/Transaxle External Controls - Gearshift Lever

Removal and Installation

Removal

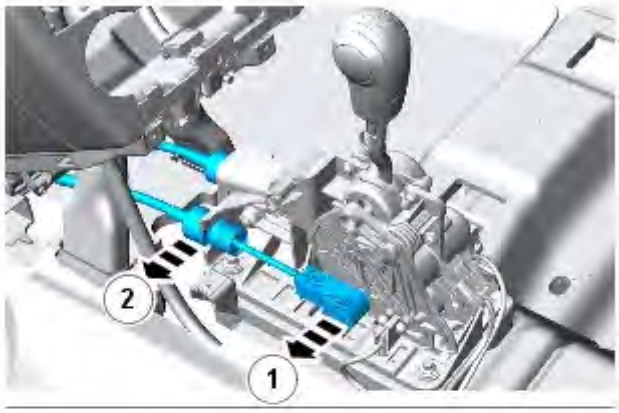
1. Remove the floor console.

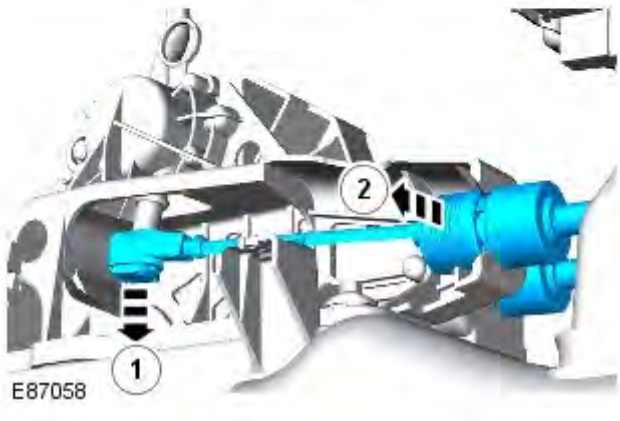
   Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

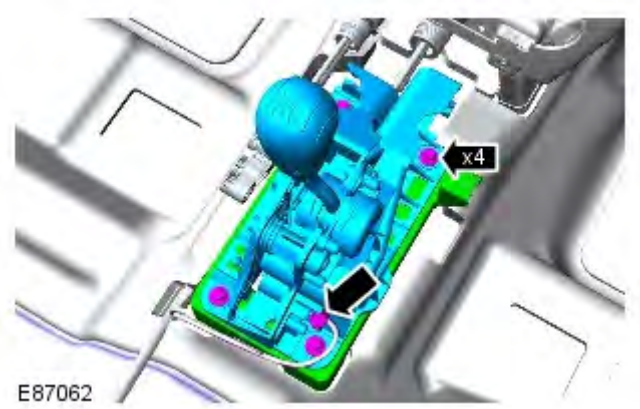


2. **2.** NOTE: Neutral must be selected before the cables are released to allow the cables to be correctly set on the install.

3.







4.

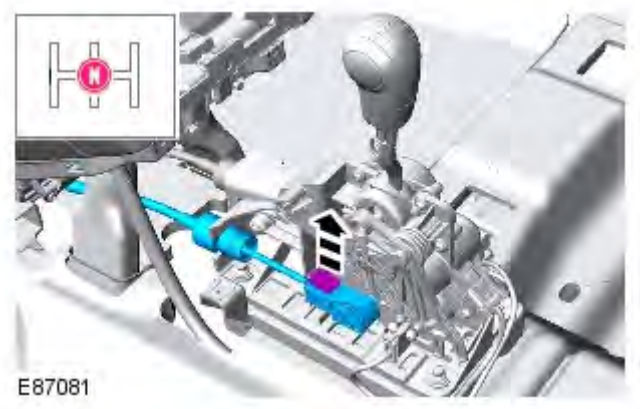
Installation

1. Install the gearshift lever.

   Torque: 10 Nm

2. Secure the selector cables.

3. Connect the selector cable ball joints.



4.

- Release the LH cable securing clip.
- Allow the gearshift lever to come to rest in the neutral position.
- Secure the cable selector clip, without disturbing the gearshift selector lever position.

5. Install the floor console.

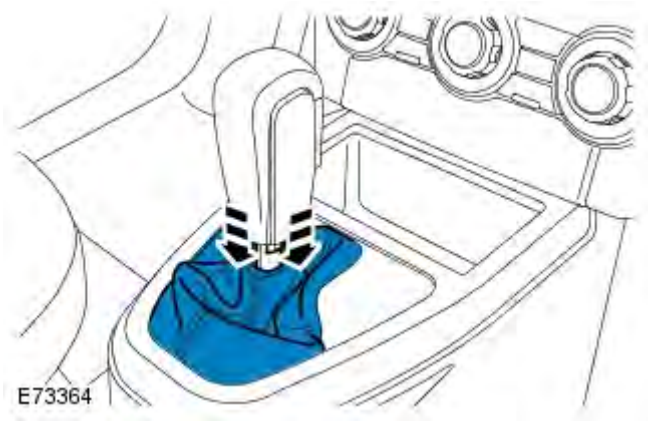
   Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

Published: 11-May-2011

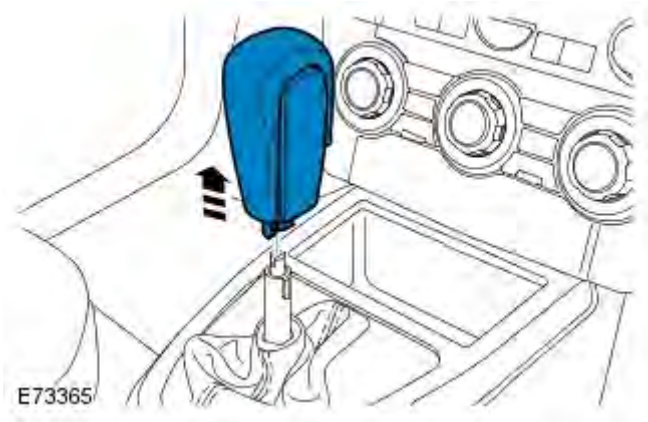
Manual Transmission/Transaxle External Controls - Gearshift Lever Knob

Removal and Installation

Removal



1.



2. **2.** WARNING: The selector lever knob will be released suddenly, keep face clear during removal.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Manual Transmission/Transaxle External Controls - Gearshift Cables

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the driveshaft.

   Refer to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

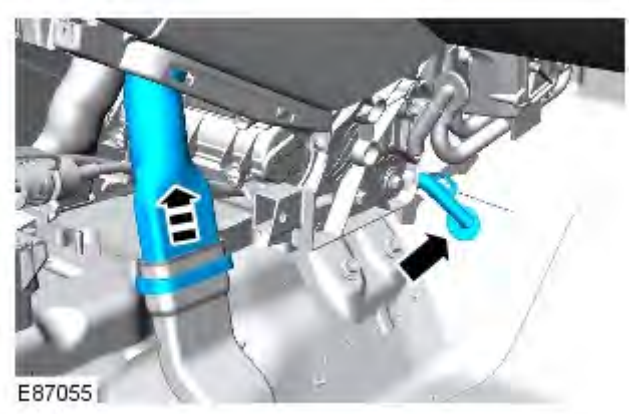
3. Remove the floor console.

   Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

4. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

5. Remove the instrument panel, lower trim panels.



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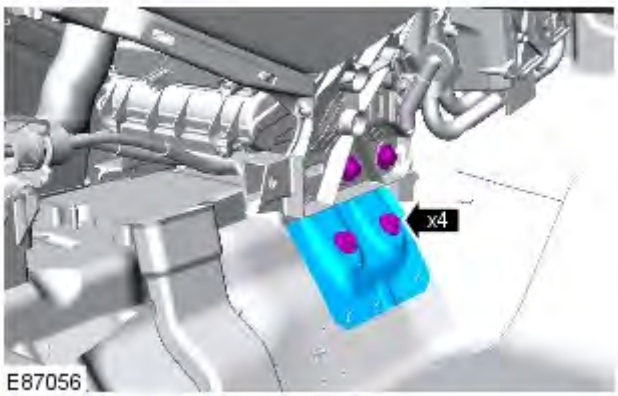
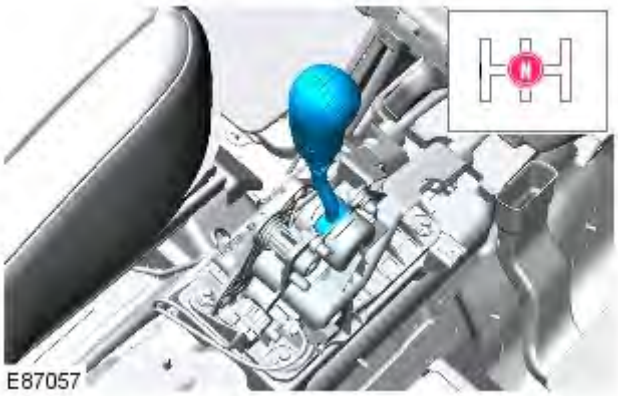
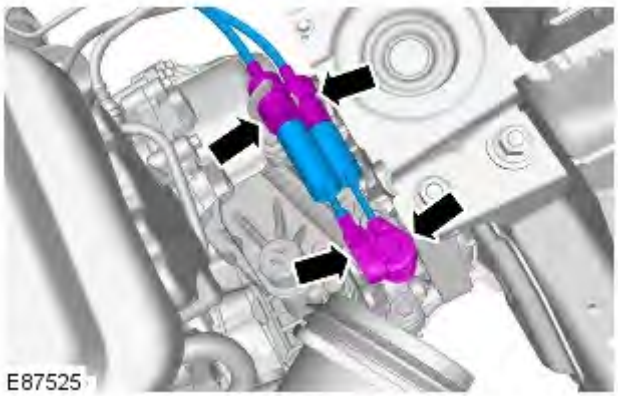


7. Remove the RH instrument pack lower bracket.



8. **8.** NOTE: Neutral must be selected before the cables are released to allow the cables to be correctly set on the install.



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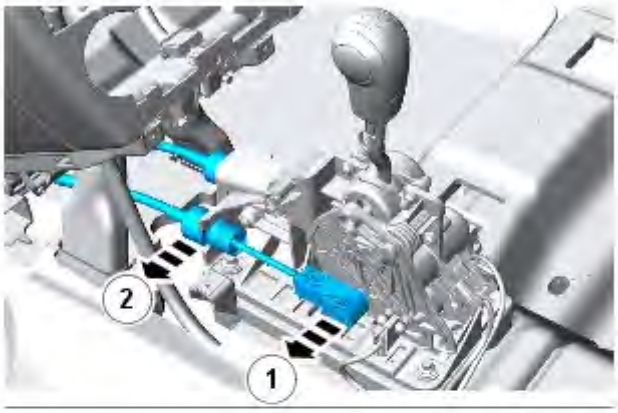
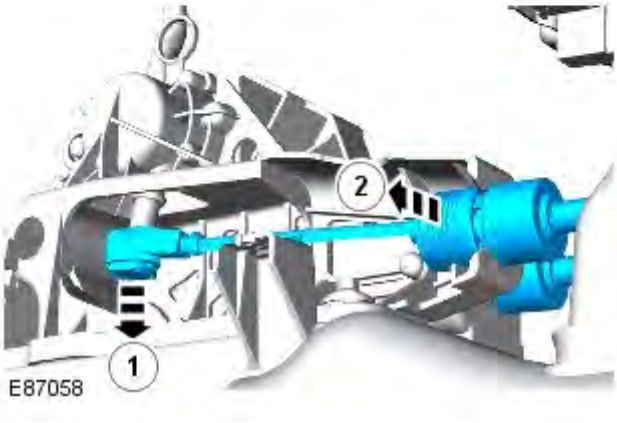
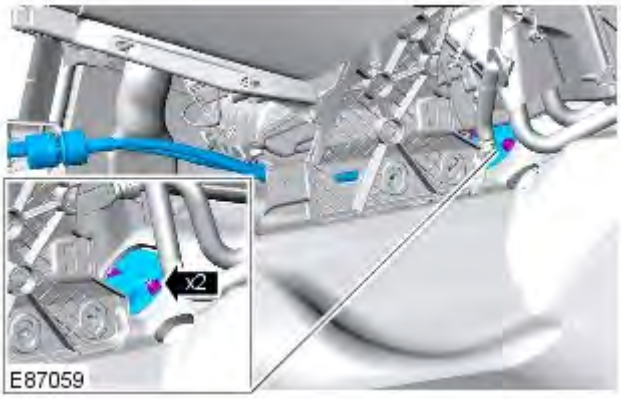




11. Release the cable sealing plate.



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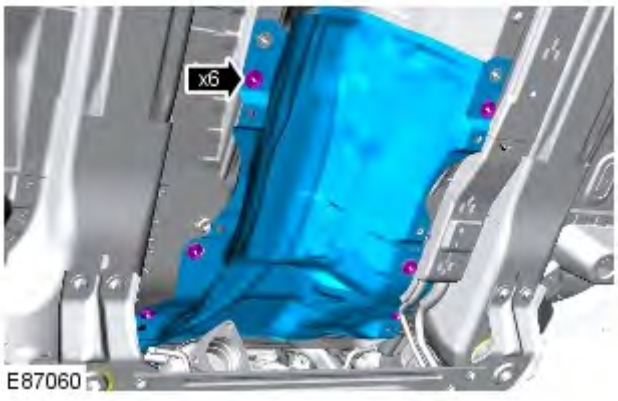

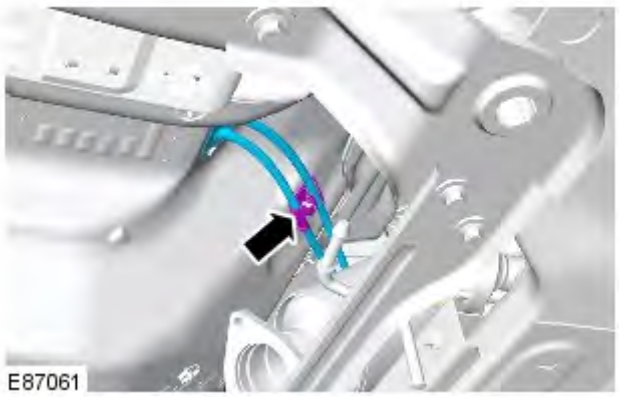

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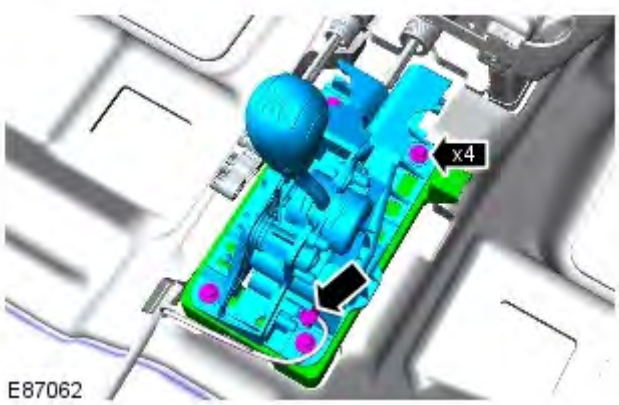

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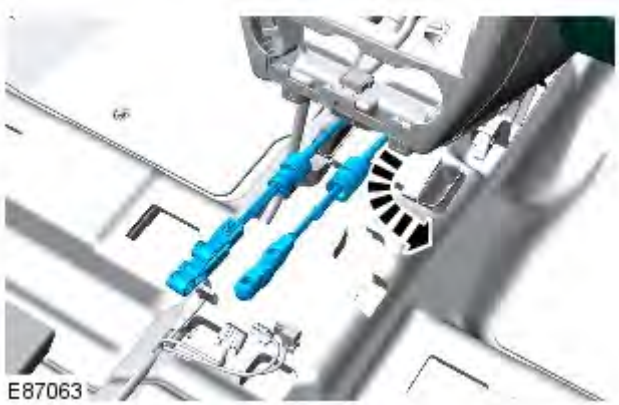


15. **15.** NOTE: This step requires the aid of another technician.

    Remove the gearshift cable assembly.

Installation

1. **1.** NOTE: This step requires the aid of another technician.

   Install the gearshift cable assembly.

2. Install the gearshift lever.

   Torque: 10 Nm

3. Secure the cables in the clips.

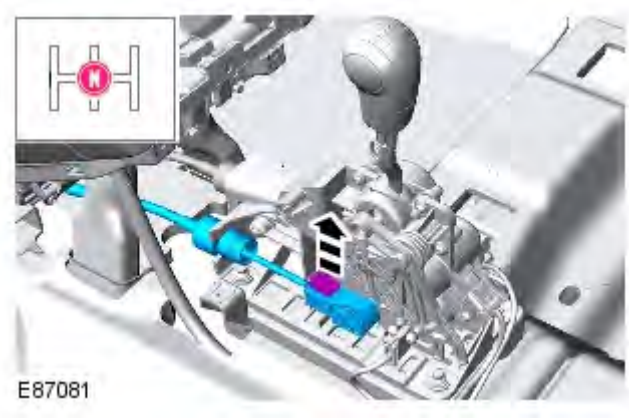
4. Install the heat shield.

5. Secure the selector cables.

6. Install the sealing plate.

   Torque: 7 Nm

7. Connect the selector cable ball joints.



8.
   - Release the LH cable securing clip.
   - Allow the gearshift lever to come to rest in the neutral position.
   - Secure the cable selector clip, without disturbing the gearshift selector lever position.

9. Install the instrument pack bracket.

   Torque: 25 Nm

10. Secure the drain tube and heater duct.

11. Install the instrument panel, lower trim panels.

12. Install the air cleaner assembly.

    Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

13. Install the floor console.

    Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

14. Install the driveshaft.

    Refer to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

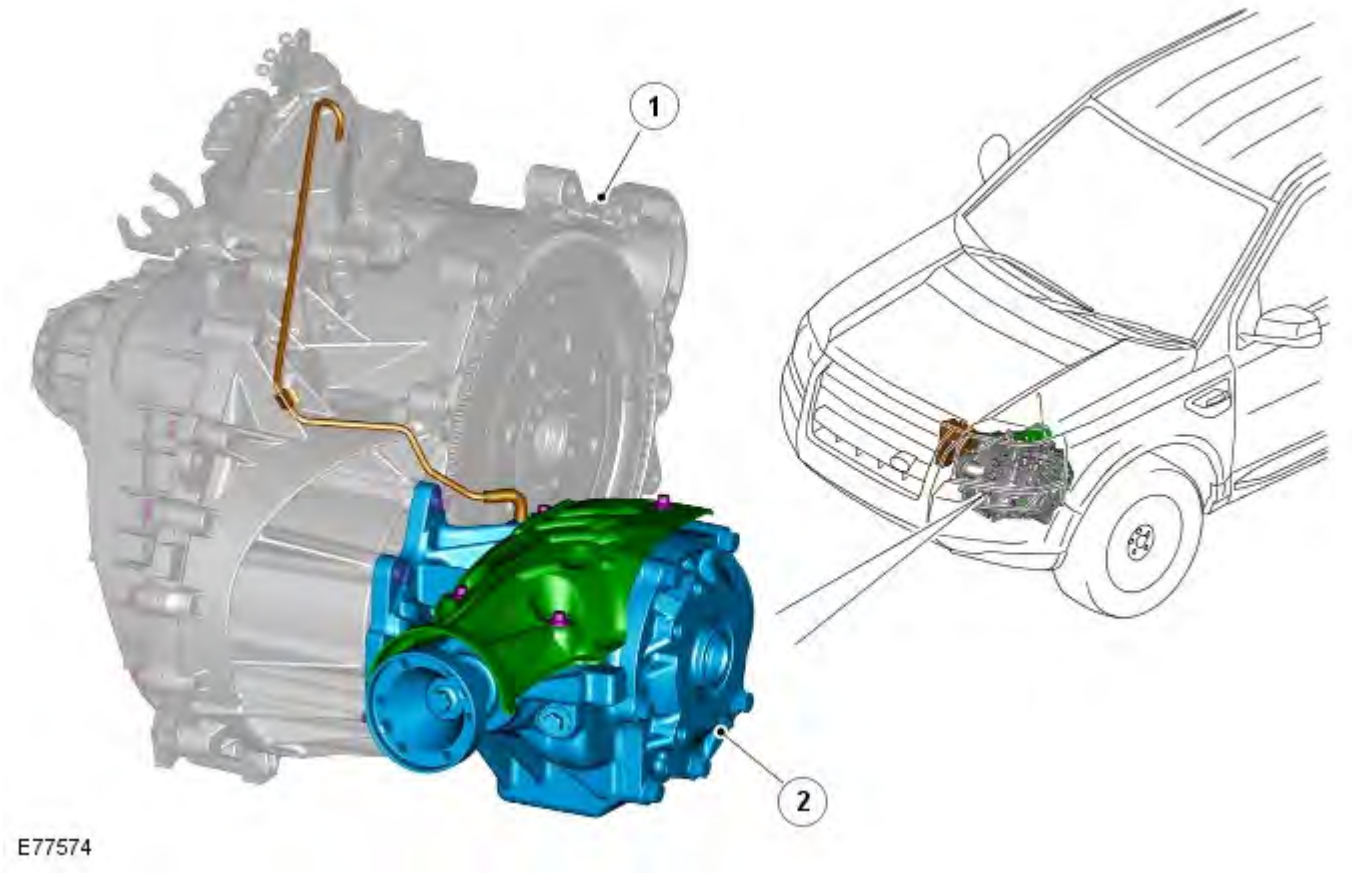
Published: 11-May-2011

Four-Wheel Drive Systems - Four-Wheel Drive Systems

Description and Operation

COMPONENT LOCATION

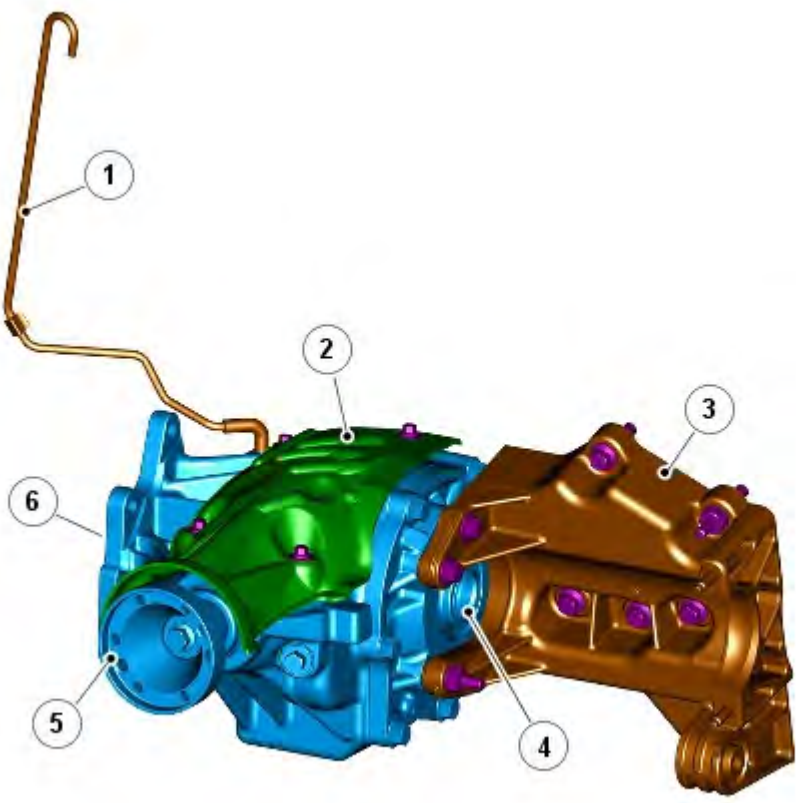
- NOTE: Manual transmission shown, automatic transmission similar.



Item	Part Number	Description
1	-	Transmission
2	-	Power Transfer Unit

OVERVIEW

The power transfer unit is located at the rear of the engine and is attached directly to the transmission casing and to the engine cylinder block via a bracket. The power transfer unit is a common unit between the petrol and diesel engine variants and also automatic and manual transmissions.



E77575

Item	Part Number	Description
1	-	Breather tube
2	-	Heat shield
3	-	Engine mounting bracket
4	-	Right Hand (RH) half shaft seal
5	-	Drive shaft mounting flange
6	-	Transmission differential input shaft spline

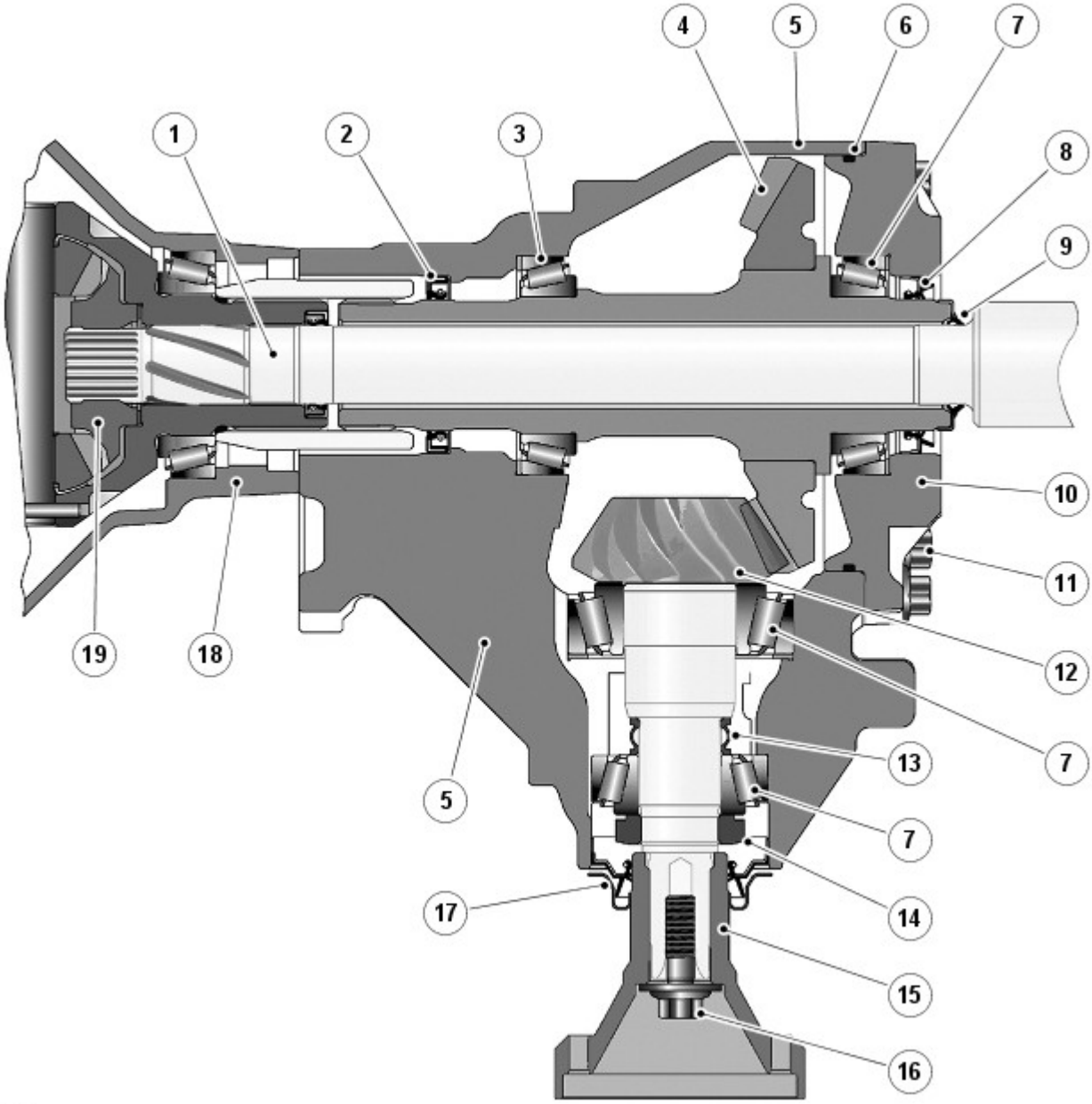
The power transfer unit is driven directly from the transmission differential via a hollow shaft through which the RH half shaft passes. (The Left Hand (LH) half shaft is driven directly from the transmission differential). Drive is taken to the drive shaft via a low-offset hypoid bevel gear, configured for minimal power loss across the speed range. The power transfer unit transfers drive from the transmission differential to the drive shaft and rear differential, no drive from the power transfer unit is passed to the to front halfshafts.

The power transfer unit has the following features:

- 1500 Nm torque capacity
- 2.58:1 output ratio to drive shaft
- Oil filled for life
- Remote breather.

The power transfer unit has an internal bearing pre-load system. This allows the output seal to be changed in service without disturbing the bearing pre-load.

POWER TRANSFER UNIT



E84242

Item	Part Number	Description
1	-	Right Hand (RH) half shaft
2	-	Oil seal
3	-	Taper roller bearing
4	-	Crown wheel drive gear
5	-	Casing
6	-	O ring seal
7	-	Taper roller bearings
8	-	Oil seal and flinger
9	-	Oil seal
10	-	Housing
11	-	Bolts
12	-	Pinion gear
13	-	Collapsible spacer
14	-	Pre-load nut
15	-	Drive flange
16	-	Flange head bolt
17	-	Oil seal and flinger
18	-	Transmission casing
19	-	Transmission differential

The power transfer unit comprises a crown wheel drive gear and a pinion gear drive shaft which are housed in a casing.

The crown wheel drive gear is mounted longitudinally across the unit. The Left Hand (LH) end of the gear has splines which mate with corresponding splines in the transmission differential output sleeve. The drive gear is hollow which allows for the fitment of the Right Hand (RH) half shaft. The half shaft is located through the hollow drive gear and mates with splines in the transmission differential. The half shaft is driven by the transmission differential and receives no drive from

the power transfer unit.

The crown wheel is supported in the casing on opposing taper roller bearings which are pressed into the casing and the housing. The drive gear is retained in the casing by a housing which is bolted to the casing and sealed with an O ring seal. The housing is fitted with a triple edge oil seal and flinger on the outer end of the housing which direct dirt and moisture away from the area of the drive gear. Another seal is fitted which prevents the ingress of dirt and moisture between the drive gear and the RH half shaft.

The pinion gear is located in the housing at 90 degrees to the crown wheel drive gear. The pinion gear is supported in the casing on opposing taper roller bearings. The pinion gear is retained in the housing with a pre-load nut. The outer end of the pinion gear is splined and mates with the drive shaft output flange. The flange is secured with a flanged bolt which is screwed into the pinion gear.

A collapsible spacer is located between the outer taper roller bearing and a shoulder on the pinion gear. The collapsible spacer holds the bearing in alignment and also collapses under pressure applied to the pre-load nut. This allows the pre-load nut to be tightened to a predetermined torque, which collapses the spacer, setting the correct bearing pre-load and the correct meshing of the pinion gear and crown wheel drive gear teeth.

Drive from the transmission differential drives the crown wheel drive gear, which in turn rotates the pinion gear. Drive is passed from the pinion gear to the drive shaft and the rear differential via the drive flange attached to the pinion gear shaft.

Published: 25-Nov-2011

Transfer Case -

Lubricants, Fluids, Sealers and Adhesives

Item	Land Rover Part No.
Input shaft splines grease	6G92M1C27AA
Power transfer unit fluid - vehicles with 3.2 petrol and 2.2 diesel	LR003137
Power transfer unit fluid - vehicles with 2.0 petrol	LR003136

Capacities

Description	Lubricant	Capacity (liters/pints/US quarts)
Power transfer unit	BOT 118 PLUS 75W-90	0.75/1.3/0.79

General Specification

Item	Ratio
3.2 Petrol auto	3.750:1
2.2 Diesel manual	4.533:1
2.2 Diesel auto	3.329:1
2.0 Petrol auto	2.583:1

Torque Specifications

Description	Nm	lb-ft
Axle mounting bracket bolts	24	18
Oil drain plug	35	26
Oil filler plug	35	26
Pinion nut	48	35
Power transfer unit front mounting bracket heat shield	10	7
Power transfer unit bracket to engine block bolts	65	48
Power transfer unit bracket to power transfer unit bolts	65	48
Power transfer unit to transmission housing bolts	65	48

Published: 11-May-2011

Transfer Case - Transfer Case

Description and Operation

For additional information, refer to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Description and Operation).

Published: 11-May-2011

Transfer Case - Transfer Case

Diagnosis and Testing

Principles of Operation

For additional information.
REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

Published: 11-May-2011

Transfer Case - Transfer Case Fluid Level Check

General Procedures

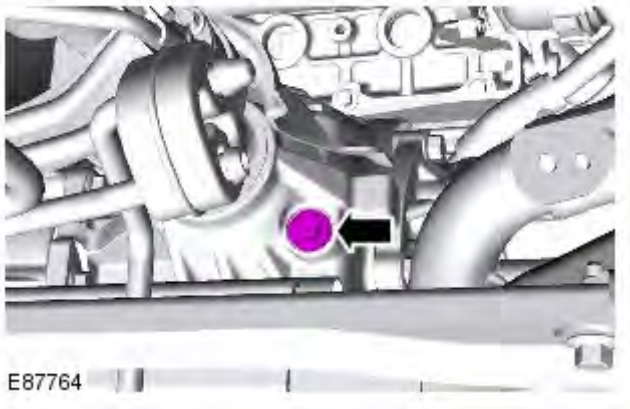
CAUTION: The fluid filler plug is not a fluid level plug.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise the vehicle on a lift.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



3. **3.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

4. **4.** CAUTION: The fluid filler plug is not a fluid level plug.

   Top-up the transfer case with recommended fluid, until the fluid is level with bottom of filler plug hole. Remove 120 ml for correct fluid capacity as shown in Specification section.

   Refer to: Specifications (308-07B Transfer Case, Specifications).

5. **5.** CAUTION: Replace the washer.

   Install the fluid filler plug.

   Torque: 35 Nm

6. Install the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

Published: 11-May-2011

Transfer Case - Power Transfer UnitI6 3.2L Petrol

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

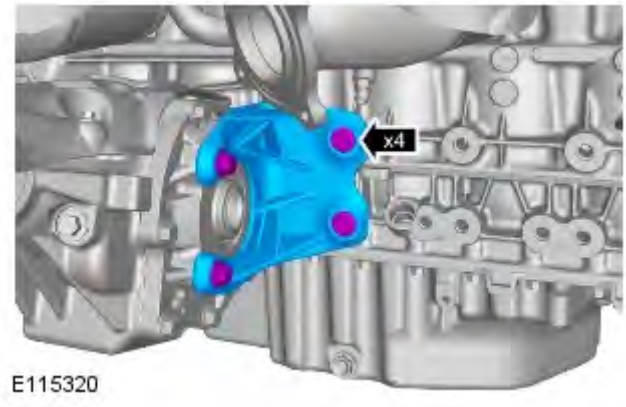
1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

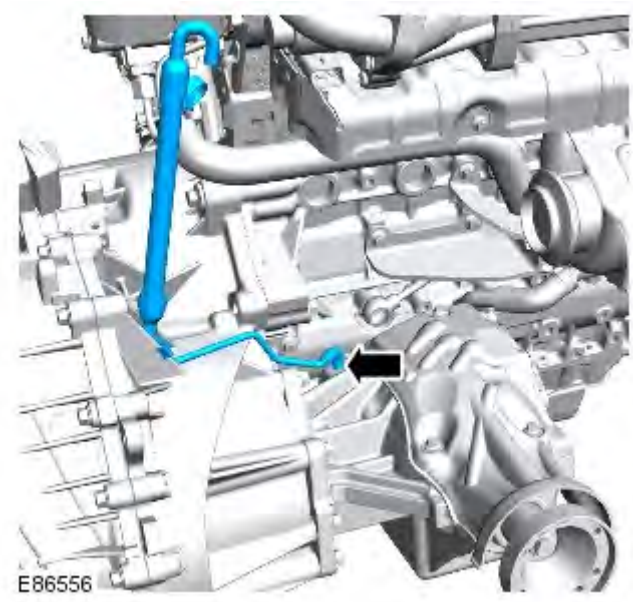
2. Refer to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

3. Refer to: Catalytic Converter (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).

4. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).



5. *Torque:* 65 Nm



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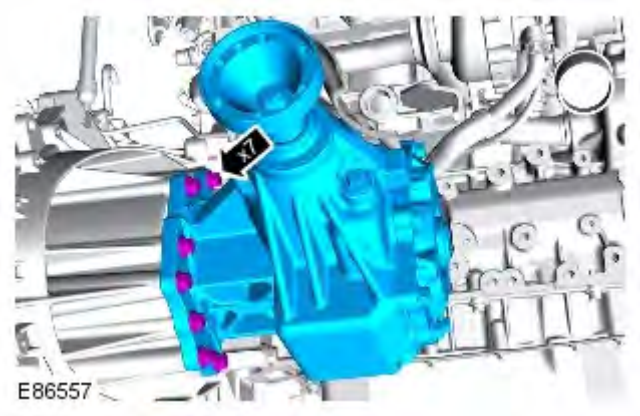
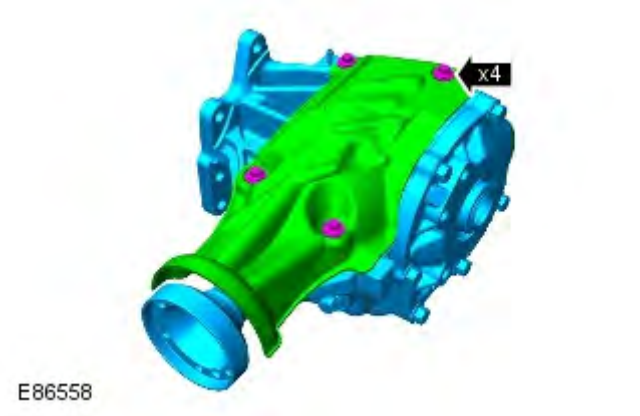


7. **7.** NOTE: This step requires the aid of another technician.

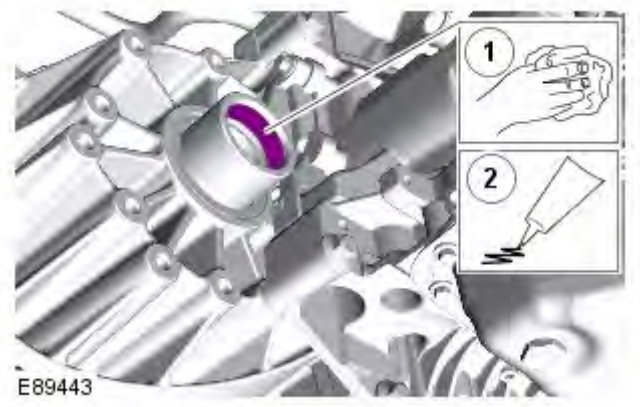
   Torque: 60 Nm



8. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.



2. **2.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

   • NOTE: Apply the required quantity of grease the correct specification.

   Refer to: Specifications (308-07B Transfer Case, Specifications).

Published: 11-May-2011

Transfer Case - Power Transfer UnitTD4 2.2L Diesel, Vehicles With: M66 6-Speed Manual Transmission AWD

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise the vehicle on a lift.

2. Remove the driveshaft.

   Refer to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

3. Remove the catalytic converter.

   Refer to: Catalytic Converter - Vehicles Without: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

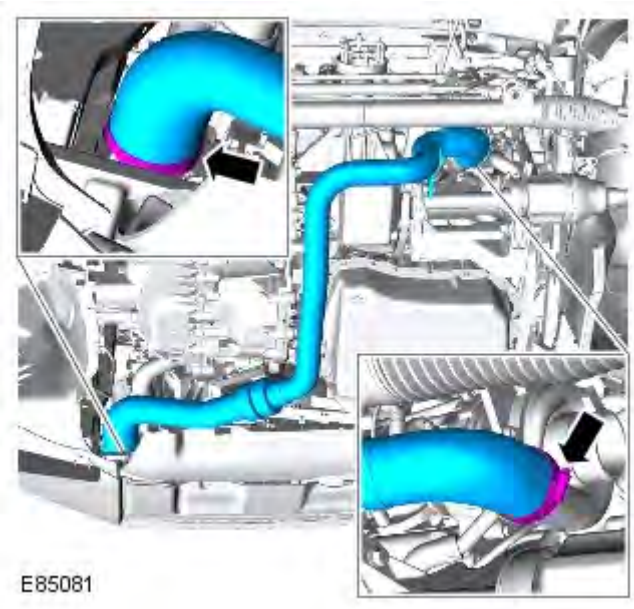
4. Remove the lower engine stabilizer bar.

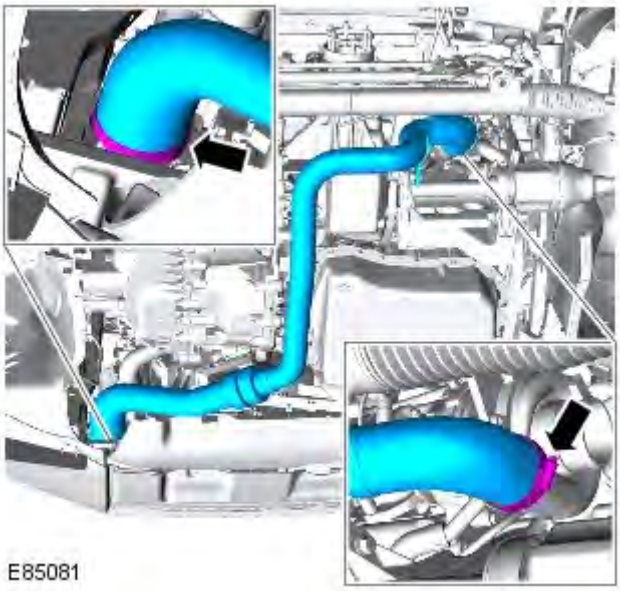
   Refer to: Engine Lower Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

5. Remove the RH halfshaft.

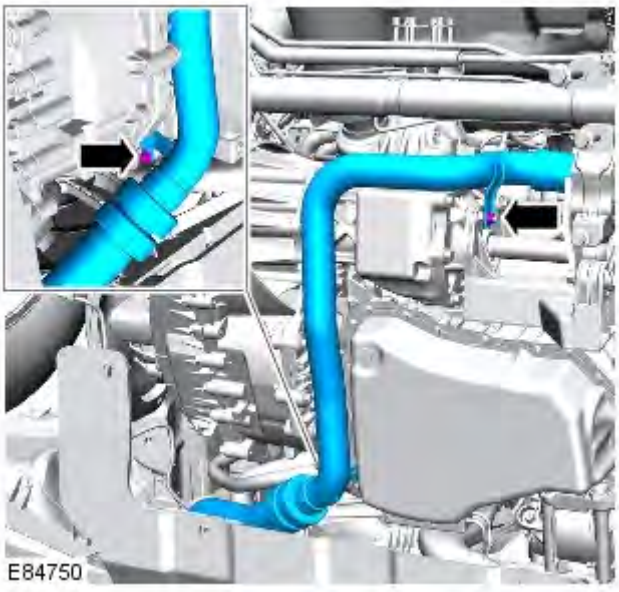
   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

6.

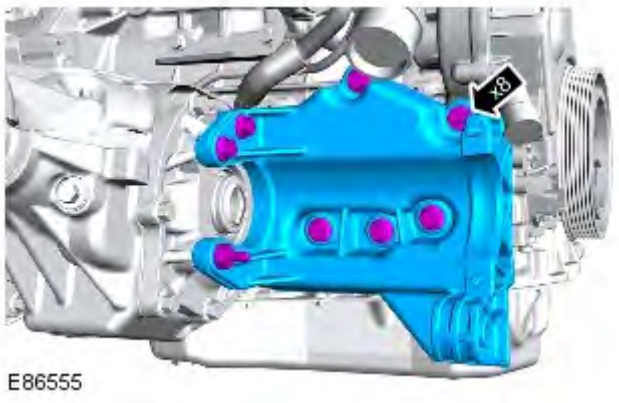




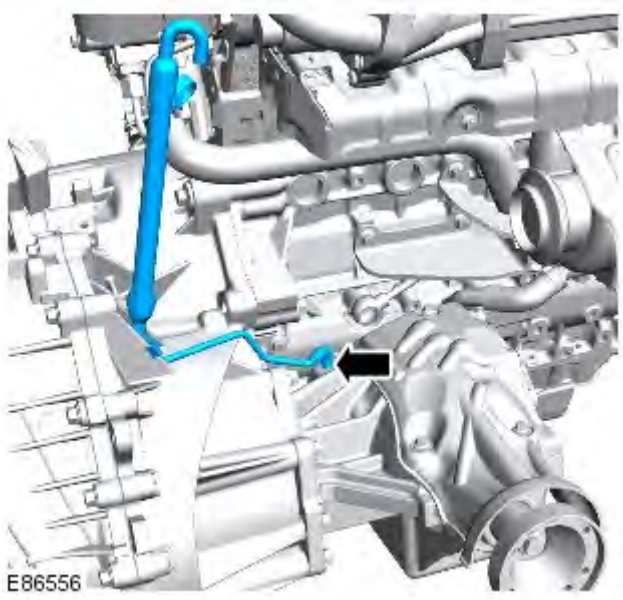
7. *Torque:* 25 Nm



8. *Torque:* 10 Nm



9. *Torque:* 65 Nm



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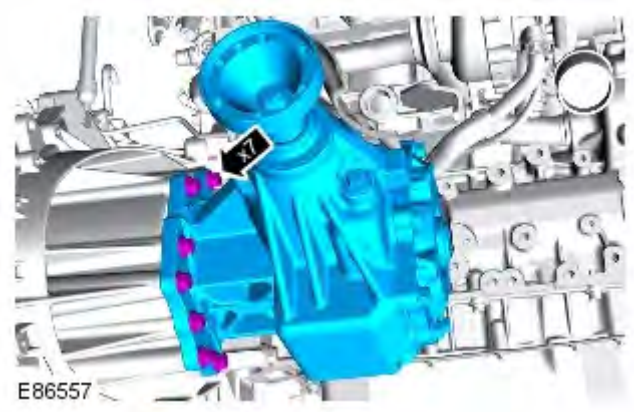
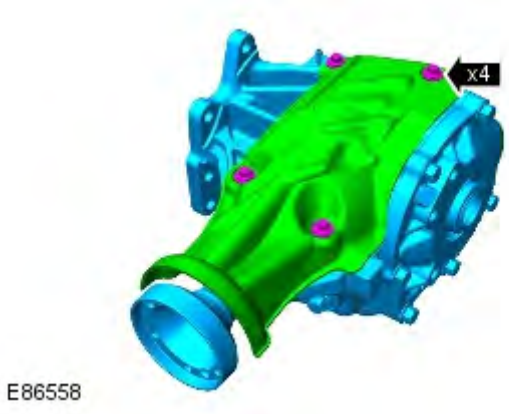


11. **11.** NOTE: This step requires the aid of another technician.

    Torque: 60 Nm



12. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Transfer Case - Power Transfer UnitTD4 2.2L Diesel, Vehicles With: M66 6-Speed Manual Transmission AWD

Removal and Installation

Removal

1. Raise the vehicle on a lift.

2. Remove the driveshaft.

   Refer to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

3. Remove the catalytic converter.

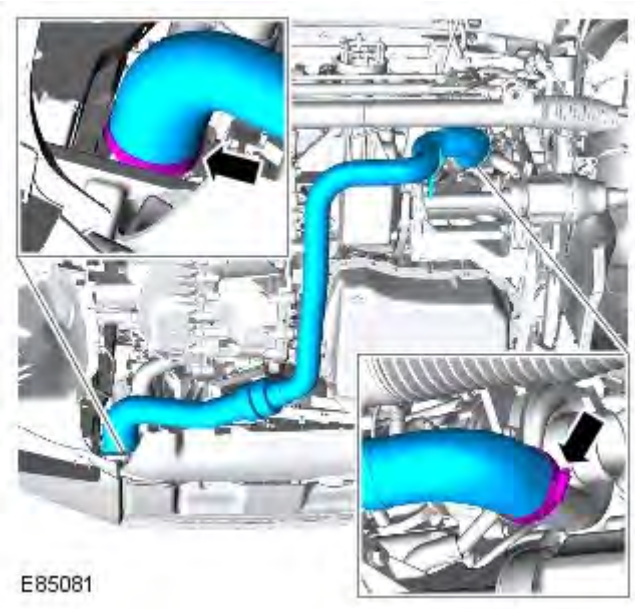
   Refer to: Catalytic Converter - Vehicles Without: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

4. Remove the lower engine stabilizer bar.

   Refer to: Engine Lower Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

5. Remove the RH halfshaft.

   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).



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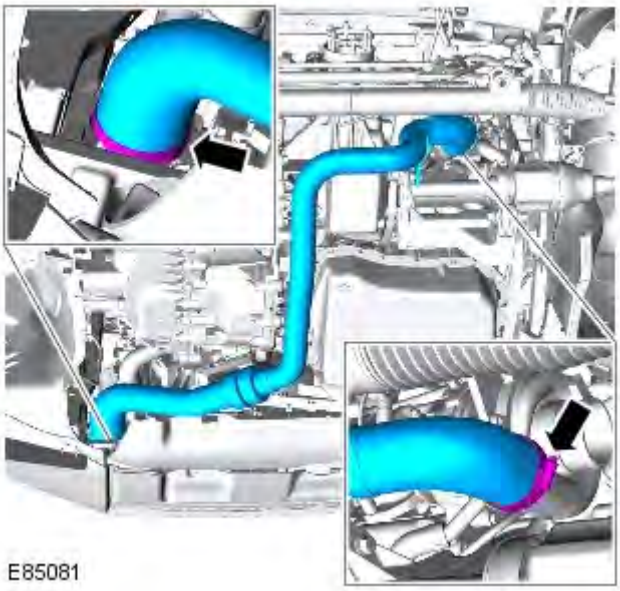
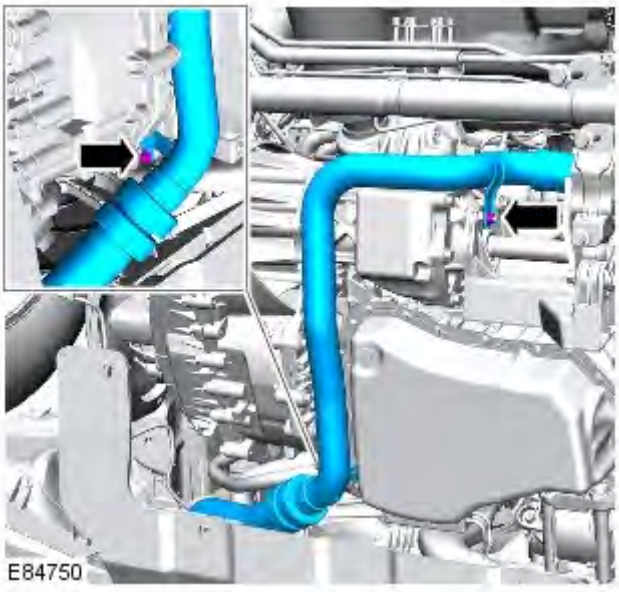
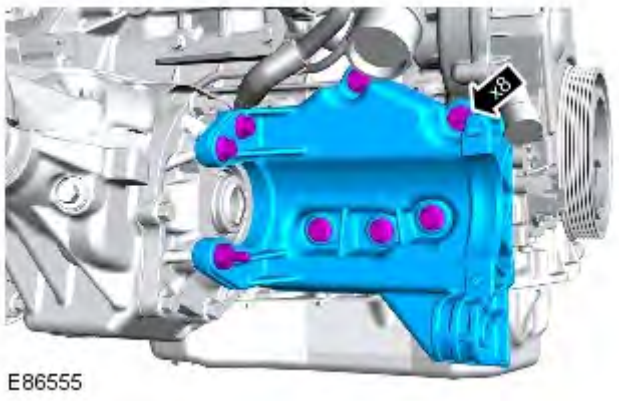


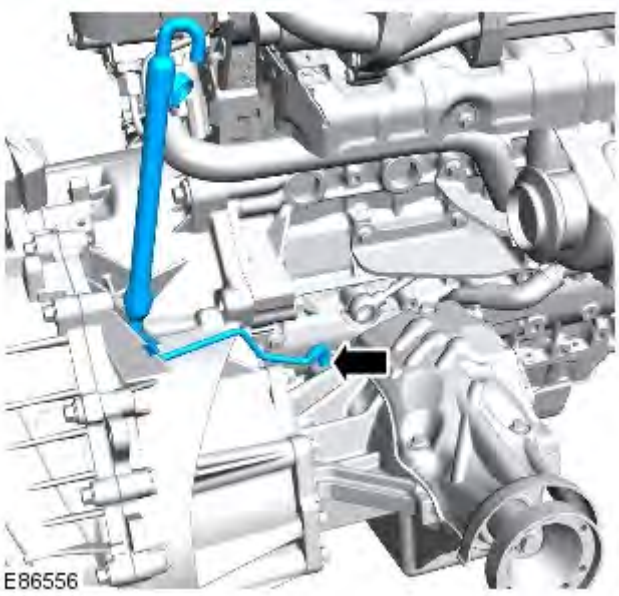
7. *Torque:* 25 Nm



8. *Torque:* 10 Nm



9. *Torque:* 65 Nm



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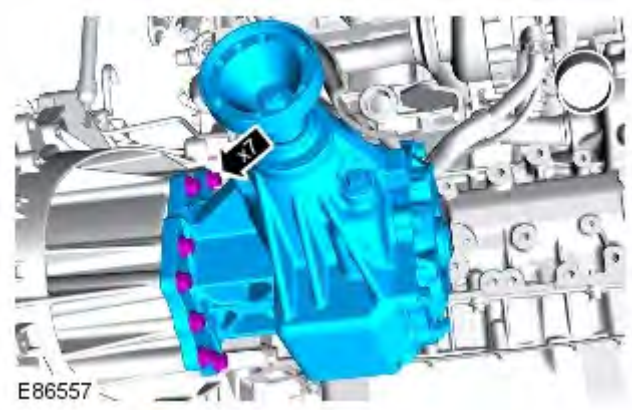
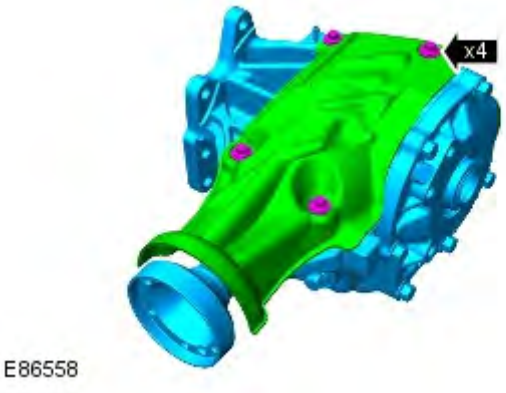


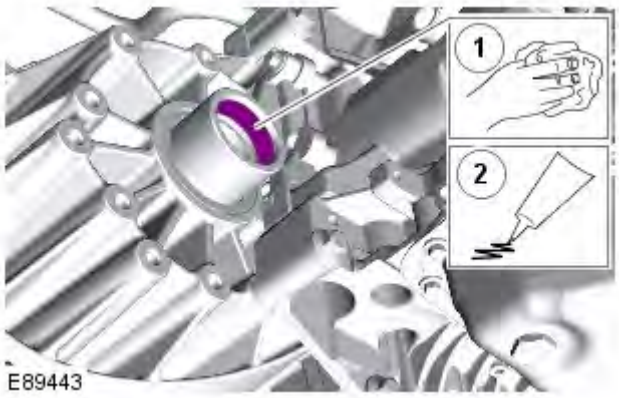
11. **11.** NOTE: This step requires the aid of another technician.

    Torque: 60 Nm



12. *Torque:* 10 Nm

Installation



1. **1.** CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

   • NOTE: Apply the required quantity of grease the correct specification.

   For fluid specification, refer to the specification's section.

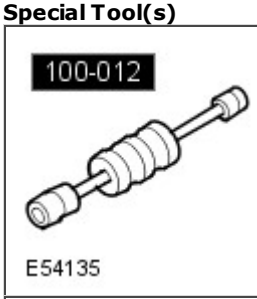
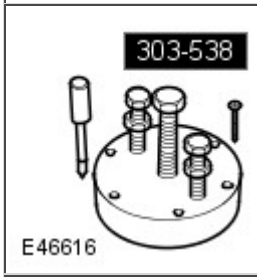
2. To install, reverse the removal procedure.

Published: 11-May-2011

Transfer Case - Transfer Case Connecting Sleeve Seals

Removal and Installation

Special Tool(s)

	100-012 Slide Hammer
	303-538 Remover/Installer, Crankshaft Oil Seal
	307-594 Installer, Seal
	308-615 Remover, Seals

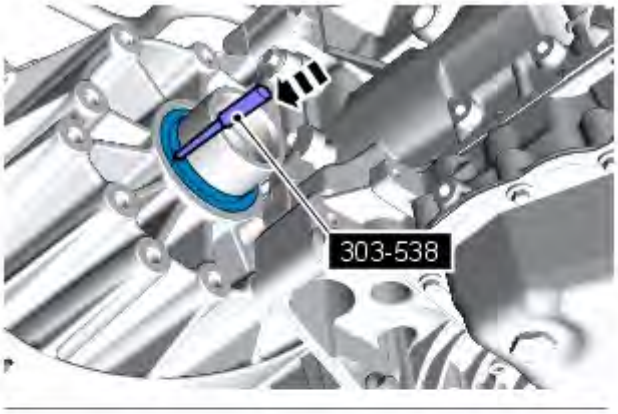
Removal

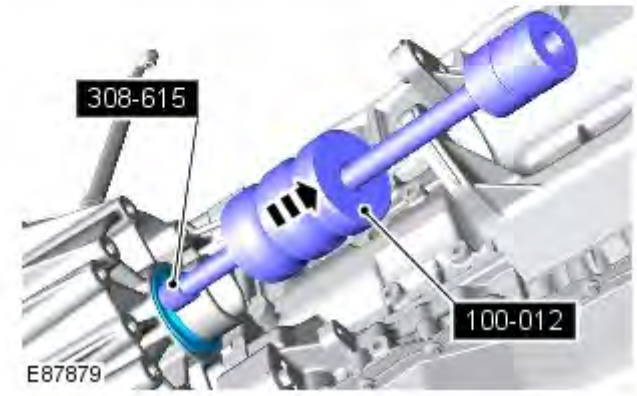
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the power transfer unit.

   Refer to: Power Transfer Unit - TD4 2.2L Diesel, Vehicles With: M66 6-Speed Manual Transmission AWD (308-07B Transfer Case, Removal and Installation).





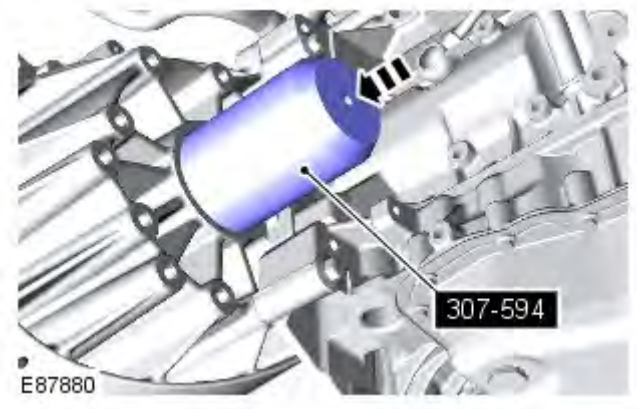
3. **3.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Take extra care not to damage the mating faces.

   Special Tool(s): 303-538, 308-615, 100-012

Installation



1. **1.** CAUTION: Take extra care not to damage the seal.

   Special Tool(s): 307-594

2. Install the power transfer unit.

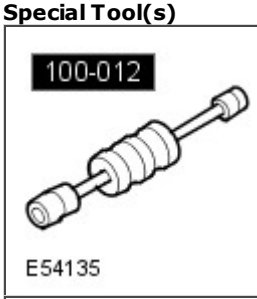
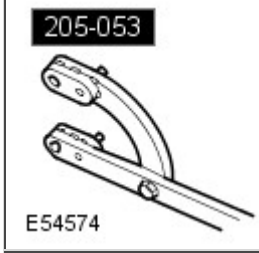
   Refer to: Power Transfer Unit - TD4 2.2L Diesel, Vehicles With: M66 6-Speed Manual Transmission AWD (308-07B Transfer Case, Removal and Installation).

Published: 11-May-2011

Transfer Case - Transfer Case Rear Seal

Removal and Installation

Special Tool(s)

	100-012 Slide Hammer
	205-053 Retainer, Drive Flange
	205-871 Installer, Transfer Case Rear Seal
	308-615 Remover, Seals
	308-617 Depth Drill, Seal Remover

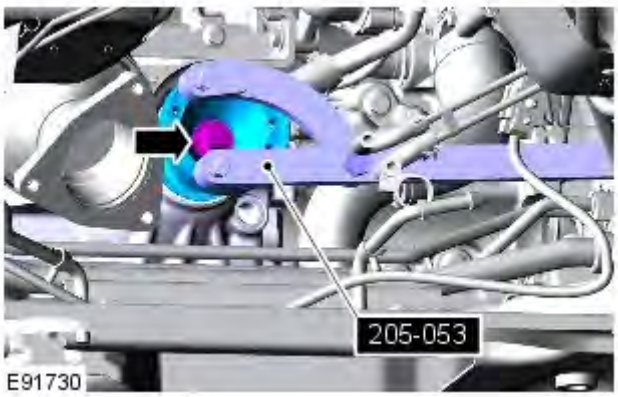
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the driveshaft.

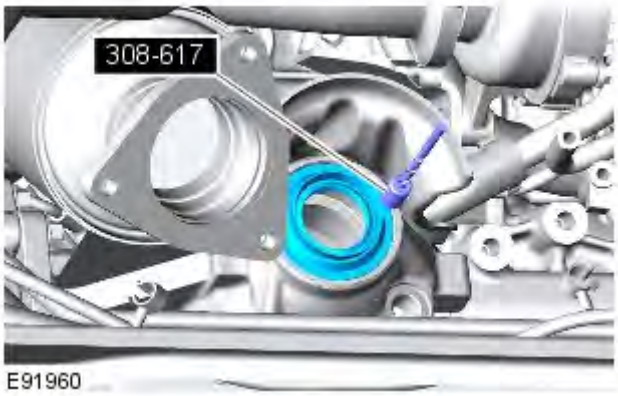
   Refer to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).
   Refer to: Driveshaft - Vehicles With: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).



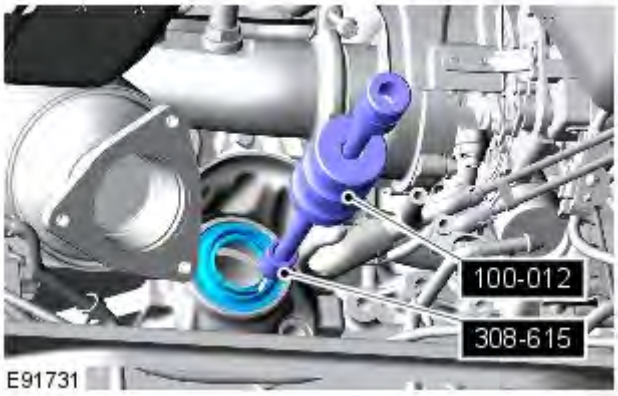
3. **3.** CAUTION: Make sure that a new bolt is installed.

   • NOTE: Position cloth to collect fluid spillage.

   Special Tool(s): 205-053
   Torque: 48 Nm



4. *Special Tool(s):* 308-617



5. **5.** CAUTIONS:

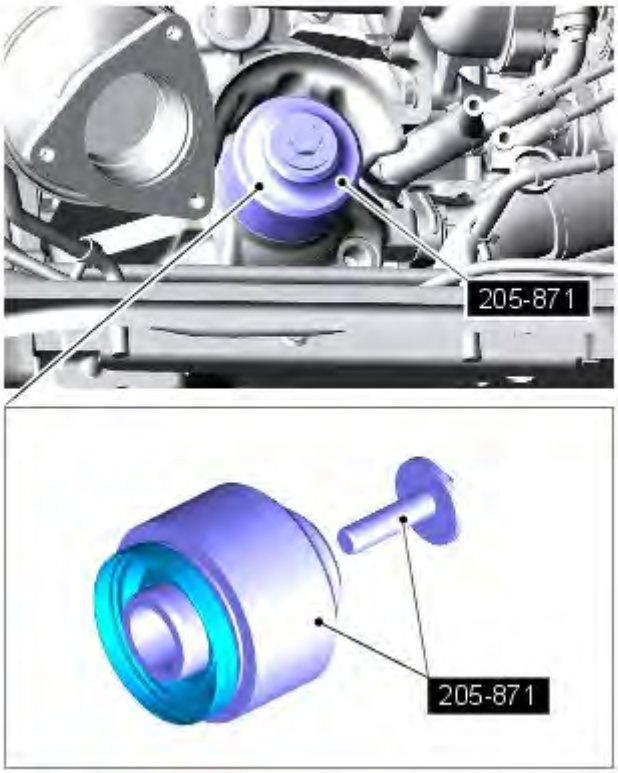
   Make sure that the area around the component is clean and free of foreign material.

   Take extra care not to damage the mating faces.

   Special Tool(s): 308-615, 100-012

Installation

1. *Special Tool(s):* 205-871



E91733

2. To install, reverse the removal procedure.

3. Install the driveshaft.

   Refer to: Driveshaft - Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).
   Refer to: Driveshaft - Vehicles With: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

4. Check and top-up the transfer case fluid level.

   Refer to: Transfer Case Fluid Level Check (308-07B Transfer Case, General Procedures).

Published: 11-May-2011

Transfer Case - Transfer Case Seal LH

Removal and Installation

Special Tool(s)

	100-012 Slide Hammer
	205-873/1 Remover/Installer, Transfer Case Seal
	205-873/2 Protector, Transfer Case Seal
	205-873/3 Punch/Screws, Transfer Case Seal

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the power transfer unit.

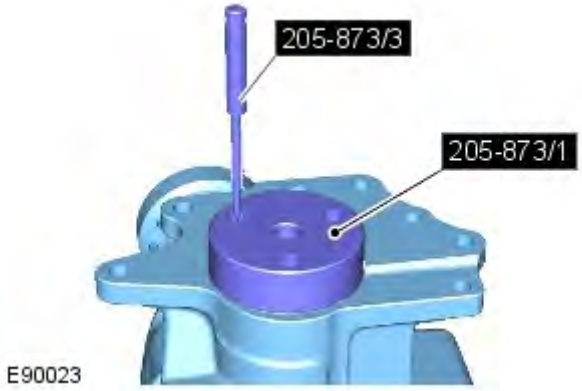
   Refer to: Power Transfer Unit - TD4 2.2L Diesel, Vehicles With: M66 6-Speed Manual Transmission AWD (308-07B Transfer Case, Removal and Installation).

E90022

3. **3.** CAUTIONS:

⚠ Take extra care not to damage the seal.

⚠ Inspect the seal, replace if damaged



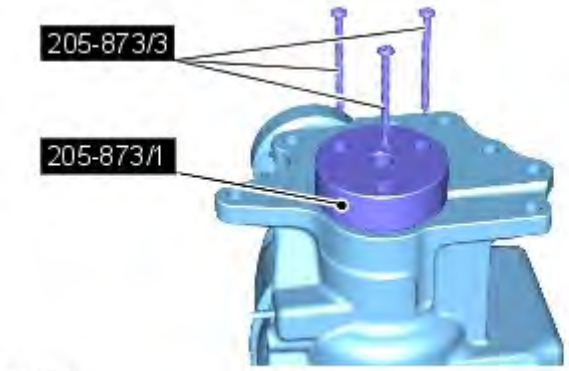
E90023

4. **4.** CAUTIONS:

⚠ Make sure that the area around the component is clean and free of foreign material.

⚠ Take extra care not to damage the mating faces.

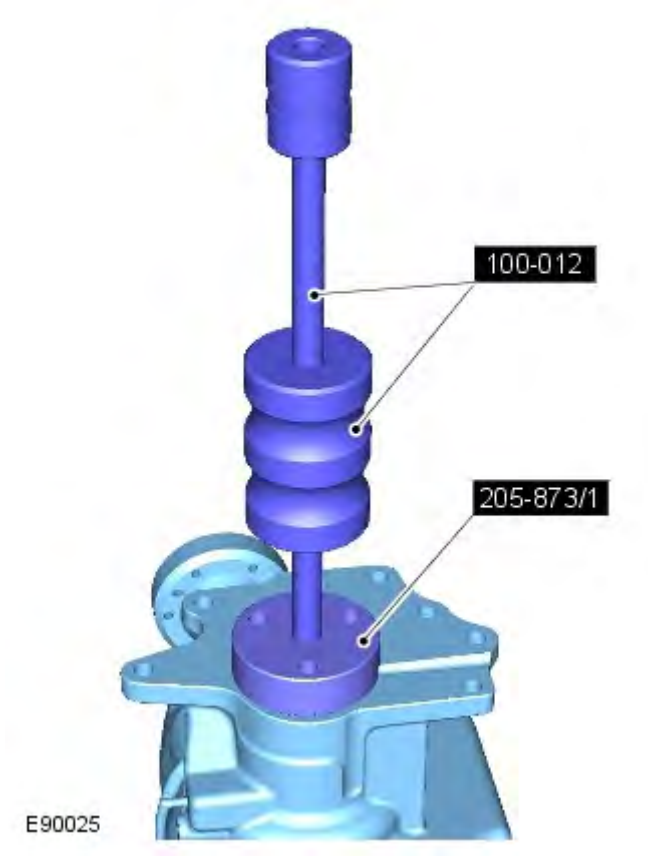
Special Tool(s): 205-873/1, 205-873/3



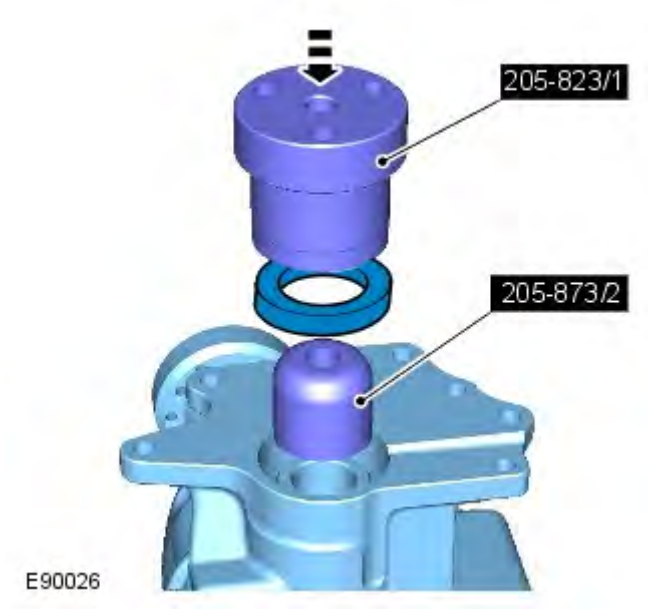
E90024

5.

6. *Special Tool(s):* 100-012



Installation



1. **1.** CAUTION: A soft faced hammer should be used to avoid damaging the special tool and creating debris.

   Special Tool(s): 205-873/2

2. To install, reverse the removal procedure.

3. Install the power transfer unit.

   Refer to: Power Transfer Unit - TD4 2.2L Diesel, Vehicles With: M66 6-Speed Manual Transmission AWD (308-07B Transfer Case, Removal and Installation).

4. Check and top-up the transfer case fluid level.

Published: 11-May-2011

Transfer Case - Transfer Case Seal RH

Removal and Installation

Special Tool(s)

	100-012 Slide Hammer
	205-872 Installer, Transfer Case Seal
	308-615 Remover, Seals
	308-617 Depth Drill, Seal Remover

Removal

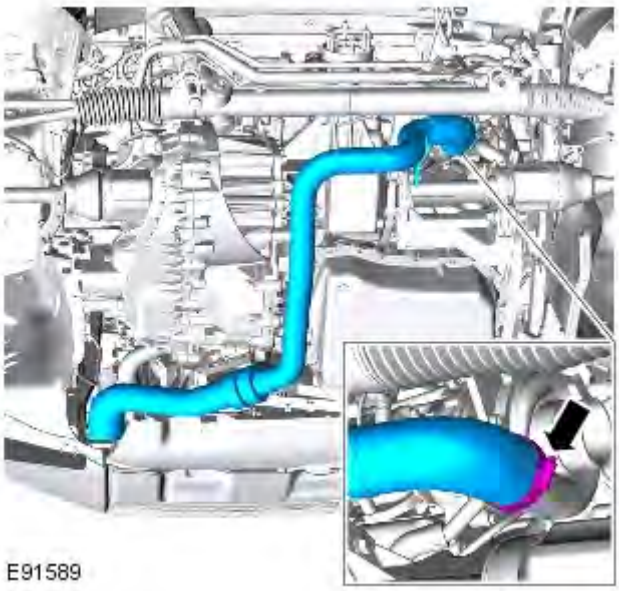
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

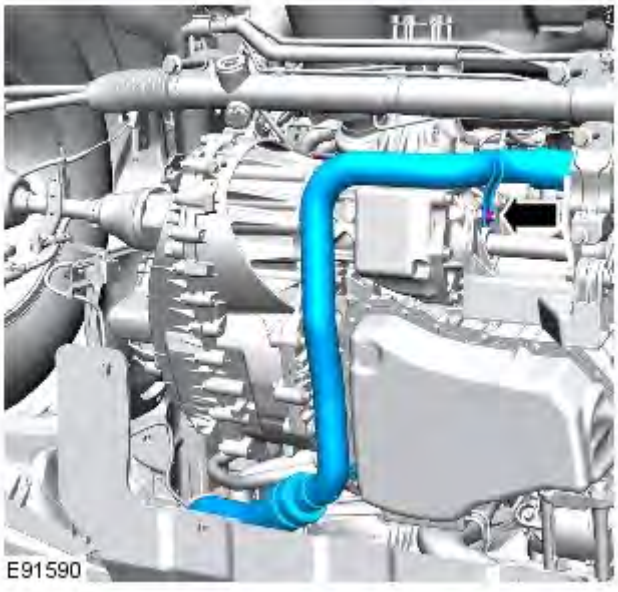
2. Remove the RH front halfshaft seal.

   Refer to: Halfshaft Seal RH (308-03 Manual Transmission/Transaxle, Removal and Installation).

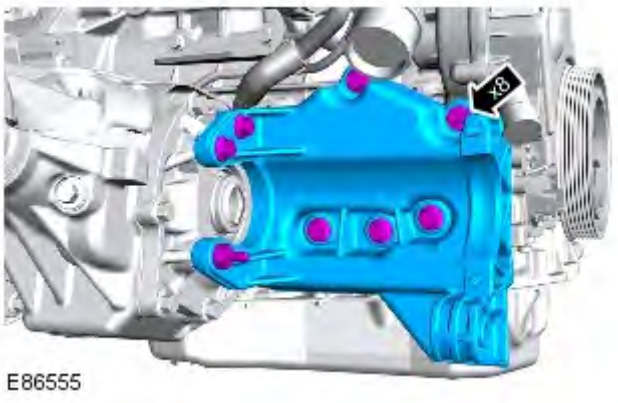
3.

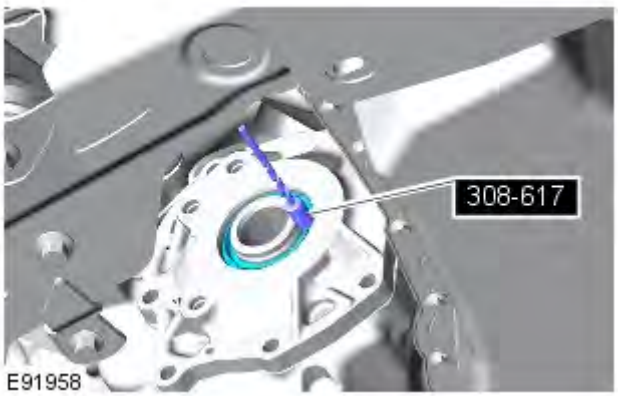


4. *Torque:* 25 Nm

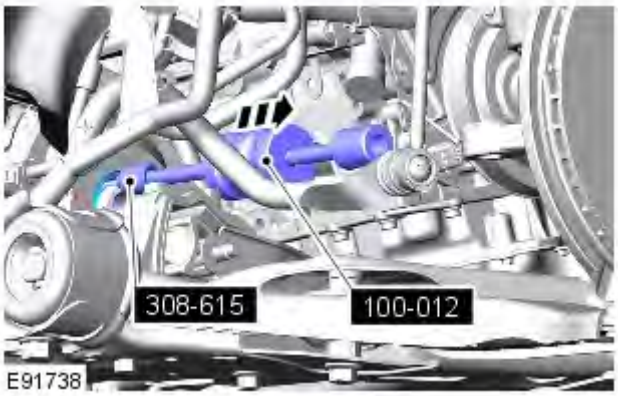


5. *Torque:* 65 Nm





6. *Special Tool(s):* 308-617



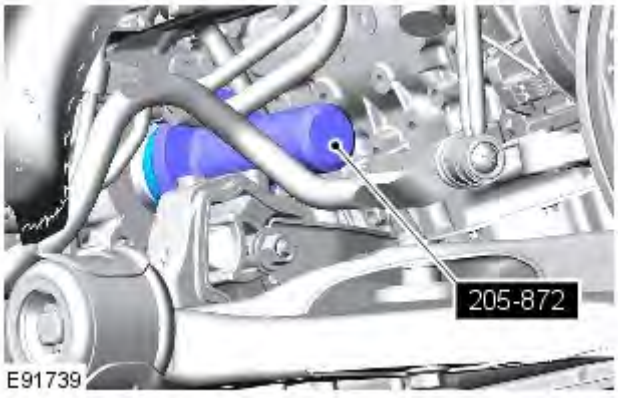
7. **7.** CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Take extra care not to damage the mating faces.

   Special Tool(s): 308-615, 100-012

Installation



1. *Special Tool(s):* 205-872

2. To install, reverse the removal procedure.

3. Check and top-up the transfer case fluid level.

   Refer to: Transfer Case Fluid Level Check (308-07B Transfer Case, General Procedures).

Published: 11-May-2011

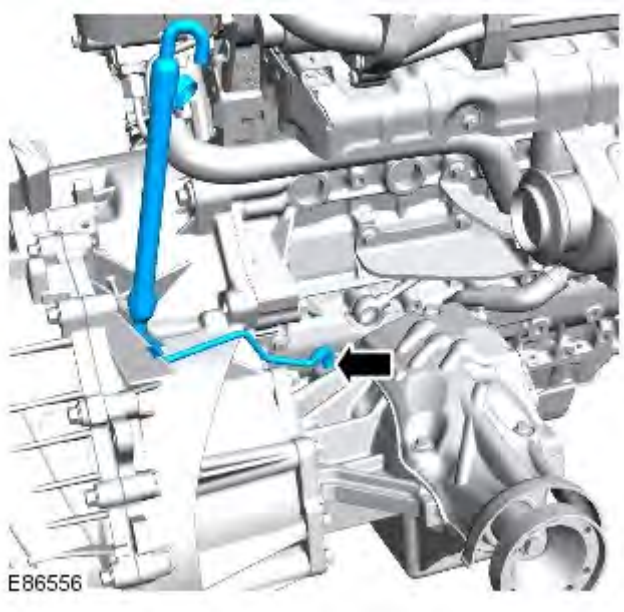
Transfer Case - Transfer Case Vent

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.



2. **2.** CAUTION: Make sure that the area around the component is clean and free of foreign material.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exhaust System - I6 3.2L Petrol -

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Heated oxygen sensor (H02S) removal*	WD40 or Suitable alternative
Heated oxygen sensor (H02S) threads	Apply suitable high temperature anti-seize compound to threads of sensor

*** Apply to area around sensor threads prior to attempting to remove sensor**

General Specification

Item	Specification
Catalytic converters - location	Fitted in the front section of the exhaust system
Exhaust manifolds	Manifold assemblies (2) with three fabricated branches merging into an integral catalytic converter are fitted to the cylinder head.
Exhaust system	stainless steel exhaust system supplied as two separate assemblies. Front section incorporating two catalytic converters and a rear section incorporating centre and rear silencers

Torque Specifications

Description	Nm	lb-ft
Catalyst monitor sensor	45	33
Catalytic converter to exhaust manifold bolts*	30	22
Catalytic converter to centre muffler nuts and retaining clamp	24	18
Exhaust manifold bolts	A	A
Exhaust manifold heatshield bolts	10	7
Exhaust support brackets to front subframe / floor bolts	24	18
Exhaust support bracket to centre bearing carrier bolts	24	18
Exhaust tail pipe trim screws	3	2
Front muffler service sleeve clamp nuts	40	28
Heated oxygen sensor (H02S)+	45	33

*** It is not appropriate to either fit or remove these fixings using air tools due to a risk of cold welding/snapping.**

+ Apply anti-seize lubricant to threads of sensor - See Lubricants

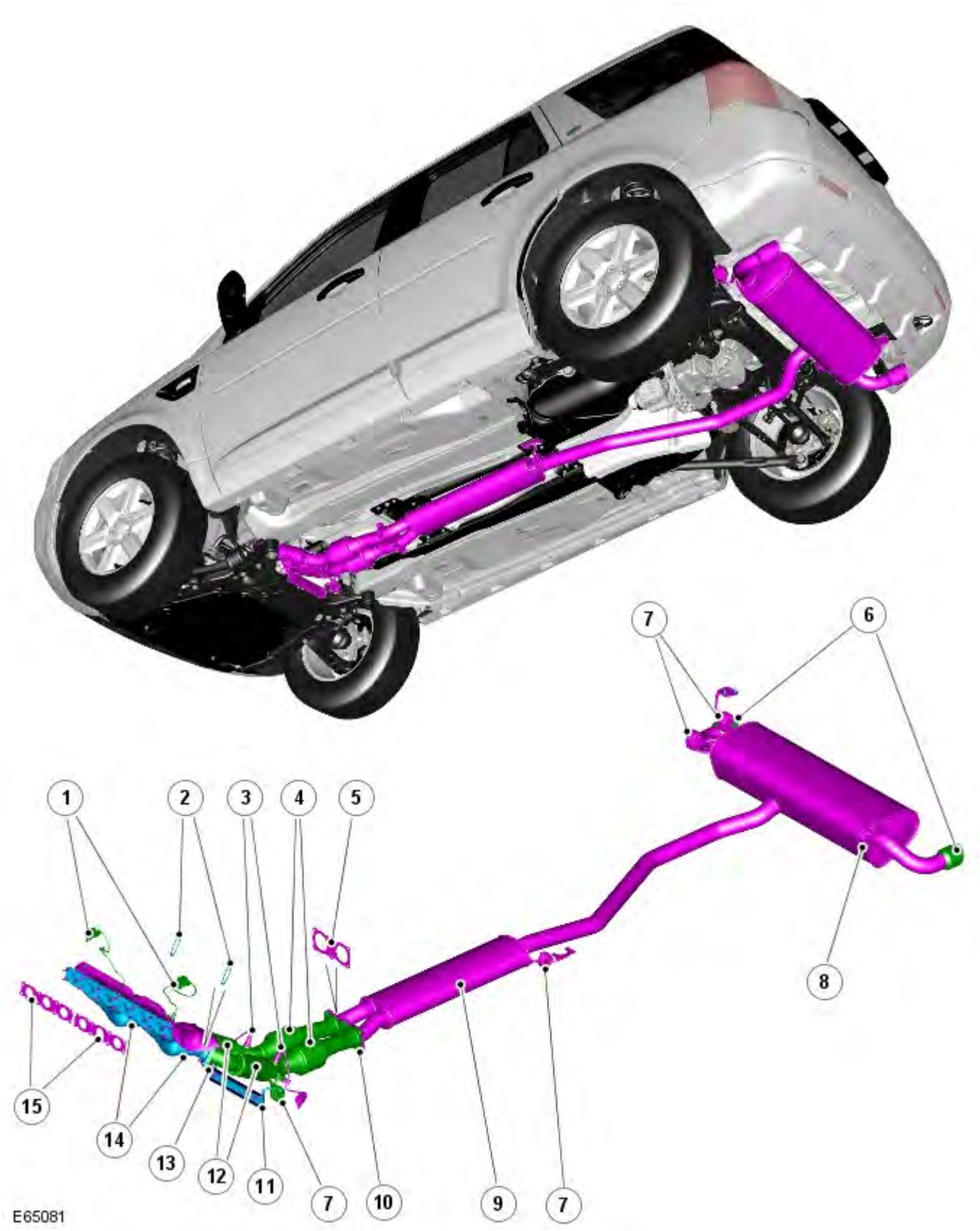
A = refer to procedure for correct torque sequence

Published: 11-May-2011

Exhaust System - I6 3.2L Petrol - Exhaust System

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Heated Oxygen Sensor (HO2S) - Pre-Catalyst (2 off)
2	-	Gasket (2 off)
3	-	HO2S - Post catalyst (2 off)
4	-	Flexible coupling

5	-	Gasket
6	-	Tailpipe finisher (optional)
7	-	Mounting rubber (6 off)
8	-	Rear muffler
9	-	Centre muffler
10	-	Flange
11	-	Bracket
12	-	Catalytic converter (2 off)
13	-	Flange
14	-	Catalytic converter (2 off)
15	-	Exhaust manifold gaskets

OVERVIEW

The 3.2L SI6 exhaust system is fabricated from stainless steel and is supplied as two separate assemblies; a front section incorporating two catalytic converters and a rear section incorporating centre and rear silencers.

EXHAUST MANIFOLDS

The exhaust manifold comprises two separate manifold assemblies. One manifold is used for cylinders 1 to 3 and the second manifold is used for cylinders 4 to 6. The manifolds are sealed to the cylinder head with a gasket and secured with 14 bolts.

Each manifold comprises three fabricated branches which merge into an integral catalytic converter. A threaded boss is positioned where the three branches merge and provides for the fitment of a pre-catalyst HO2S. The catalytic converter outlets have offset flanges which mate with corresponding flanges on the front section exhaust system.

A bracket on each outlet flange allows for the attachment of an exhaust manifold heat shield.

FRONT SECTION

The front section has two flanged pipes which mate with the offset flanges of the exhaust manifolds. The flanges are sealed with gaskets and secured with bolts. The flanges are connected via curved pipes to decouplers which provide a flexible joint in the system. The outlet from each decoupler comprises a curved pipe with a threaded boss which provides for the fitment of a post-catalyst HO2S.

Each pipe is connected into a smaller catalytic converter which in turn is connected to a double flange which mates with the rear section of the exhaust system.

Two mounting rubbers are located at the rear of the flexible coupling and are attached to a bracket mounted on the front subframe.

REAR SECTION

The rear section has a double flange which mates with the double flange of the front section. The double flanges of each section are sealed with a gasket and secured with studs, washers and nuts. Two short pipes from the double flange connect into the centre muffler.

The centre muffler is a fabricated unit with a capacity of 7.6 liters. The muffler comprises a pair of perforated baffle tubes contained within the muffler body. The two baffle tubes merge into one single tube which provides the outlet from the muffler. A rubber mounting is attached to the rear of the muffler and attaches to a hanger bracket located on the underside of the vehicle floorpan.

A single pipe from the rear of the centre muffler is routed along the underside of the vehicle body to the rear muffler. The pipe enters the rear muffler through a connection in the forward face of the muffler.

The rear muffler is a fabricated unit with a capacity of 29.3 liters. The rear muffler is positioned transversely at the rear of the vehicle, forward of the rear bumper. The muffler comprises baffle plates and perforated baffle tubes. Each end of the muffler body has an outlet which direct exhaust gasses to exit at the rear of the vehicle. The muffler is supported by a single rubber mounting on the Left Hand (LH) side and by two rubber mountings on the Right Hand (RH) side.

CATALYTIC CONVERTERS

The catalytic converters are fitted in the front section of the exhaust system, after the HO2S.

The HO2S monitors the exhaust gasses leaving the engine. The engine management system uses this information to provide accurately metered quantities of fuel to the combustion chambers to ensure the most efficient use of fuel and to minimise the exhaust emissions.

In the catalytic converters, the exhaust gases are passed through honeycombed ceramic elements coated with a special surface treatment called 'washcoat'. The washcoat increases the surface area of the ceramic elements by a factor of approximately 7000. On top of the washcoat is a coating containing platinum, which is the active constituent for converting harmful emissions into inert by-products. The platinum adds oxygen to the carbon monoxide and the hydrocarbons in the exhaust gases, to convert them into carbon dioxide and water respectively.

Published: 11-May-2011

Exhaust System - I6 3.2L Petrol - Exhaust System

Diagnosis and Testing

Principles of Operation

For a detailed description of the exhaust system, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Description and Operation),
Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for system integrity and obvious signs of mechanical damage.

Visual Inspection

Mechanical
• Leaks • Metal fatigue • Pipes, mufflers and catalytic converters • Joints • Mountings • Clearance around components

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

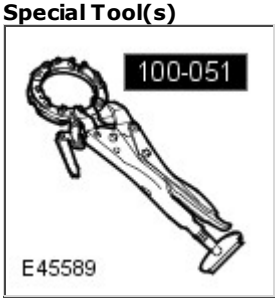
Symptom	Possible Cause	Action
Excessively noisy/leaking exhaust	• Exhaust system/components	• Inspect exhaust system, refer to Visual Inspection above • Rectify leaks or Install new components as necessary. Refer to Removal and Installation instructions in this section
Loss of power	• Restricted exhaust system • Fuel system • Ignition system • Electronic engine control	• Install new exhaust components as necessary. Refer to Removal and Installation instructions in this section • For fuel system tests. REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Diagnosis and Testing). • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing). • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing) / Electronic Engine Controls - 2.2L Duratorq-TDCi (DW) Diesel (303-14 Electronic Engine Controls - 3.2L, Diagnosis and Testing).

Published: 11-May-2011

Exhaust System - I6 3.2L Petrol - Rear Muffler

Removal and Installation

Special Tool(s)

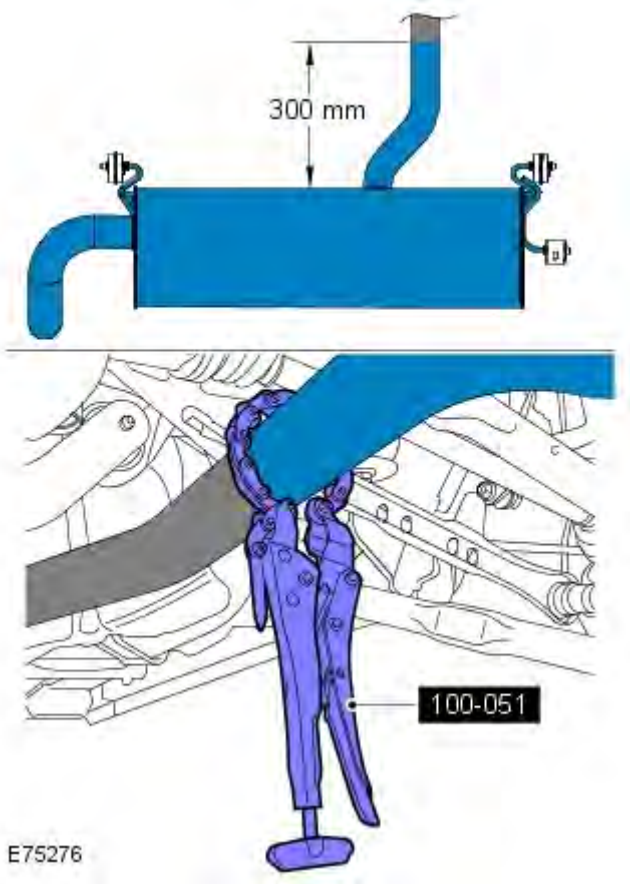
	100-051 Cutter, Exhaust Pipe

Removal

- NOTE: Removal steps in this procedure may contain installation details.

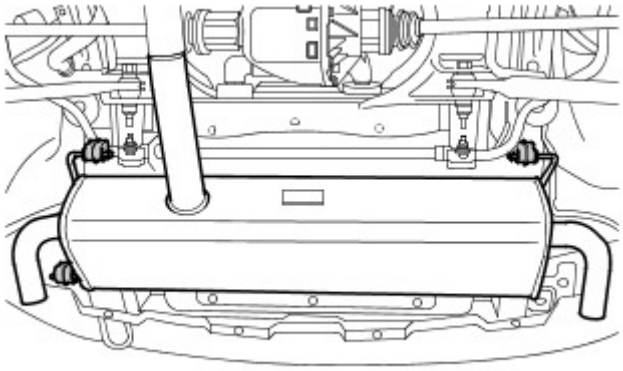
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise the vehicle on a lift.



2. Using the special tool, cut the exhaust pipe at a distance of 300mm from the front of the rear muffler.

   Special Tool(s): 100-051



E75275

3. **3.** WARNING: This step requires the aid of another technician.

Installation

1. Install the rear muffler and tighten the service sleeve.

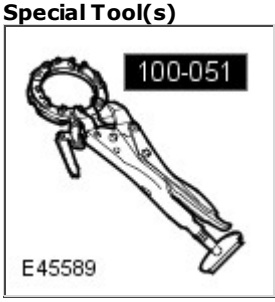
   Torque: 40 Nm

Published: 11-May-2011

Exhaust System - I6 3.2L Petrol - Front Muffler

Removal and Installation

Special Tool(s)

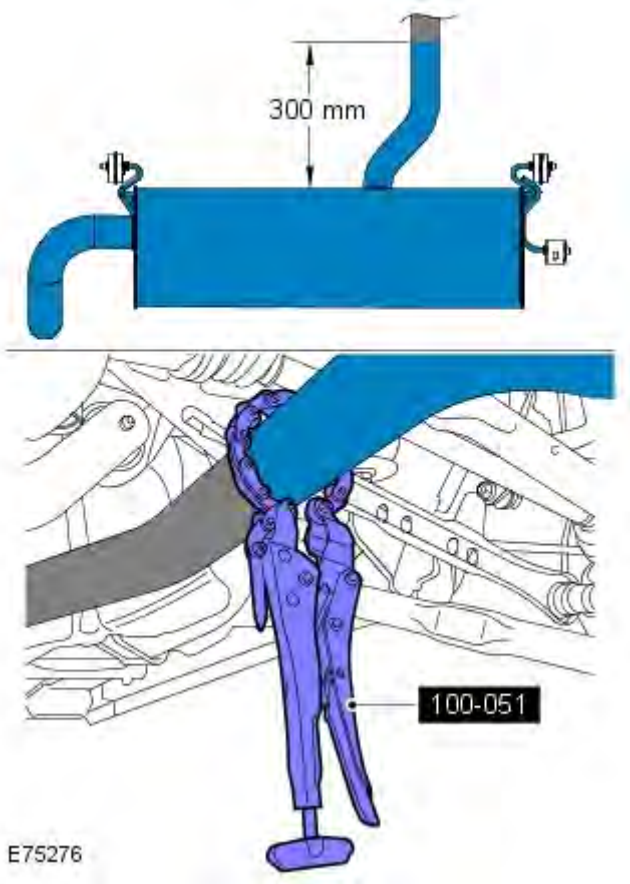
	100-051 Cutter, Exhaust Pipe

Removal

- NOTE: Removal steps in this procedure may contain installation details.

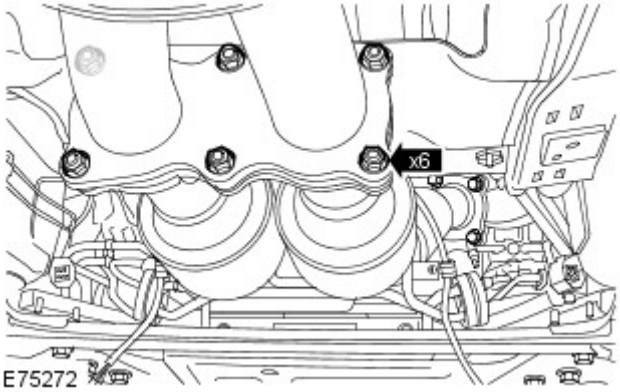
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise the vehicle on a lift.



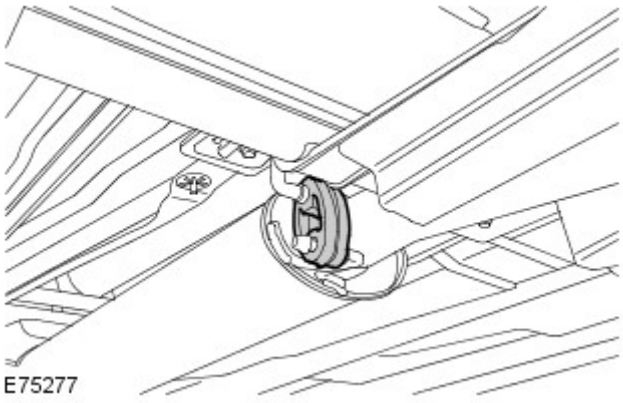
2. Using the special tool, cut the exhaust pipe at a distance of 300mm from the front of the rear muffler.

   Special Tool(s): 100-051



3. **3.** NOTE: Discard the gasket.

   Torque: 25 Nm



4.

Installation

1. **1.** NOTE: Install a new gasket.

   Install the front muffler and tighten the service sleeve.

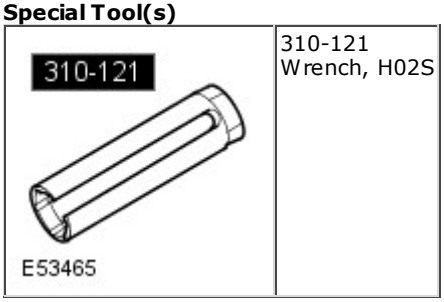
   Torque: 40 Nm

Published: 11-May-2011

Exhaust System - I6 3.2L Petrol - Catalytic Converter

Removal and Installation

Special Tool(s)

	310-121 Wrench, H02S

Removal

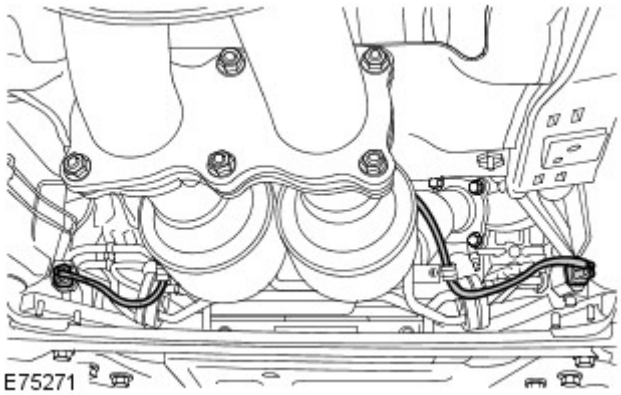
- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

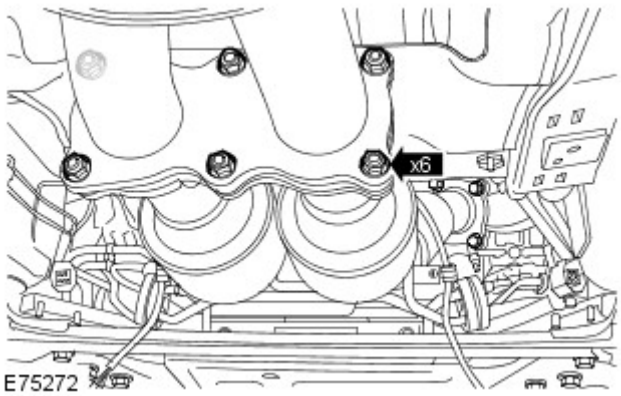
   Raise the vehicle on a lift.

2. Remove the front splash shield.

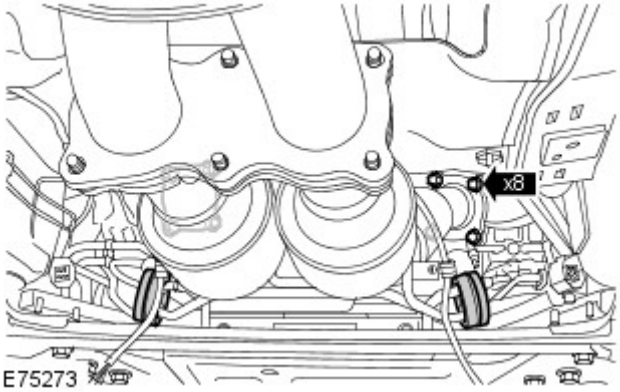
   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



3.

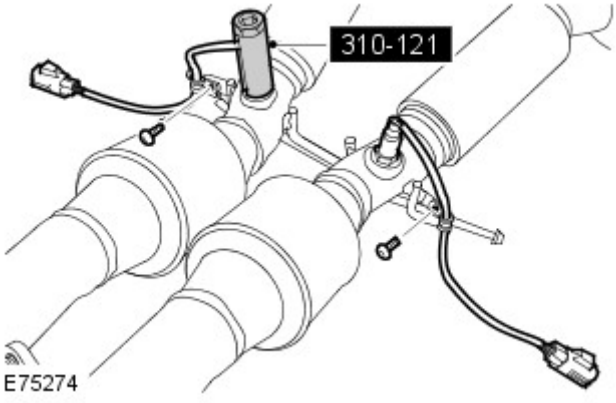


4. *Torque:* 25 Nm



5. **5.** CAUTION: Discard the bolts.

   Torque: 27 Nm



6. *Special Tool(s):* 310-121
   Torque:
   M18 45 Nm
   M5 6 Nm

Installation

1. To install, reverse the removal procedure.

2. **2.** NOTE: For NAS vehicles only.

   If required, carry out a long drive cycle.

   Refer to: Powertrain Control Module (PCM) Long Drive Cycle Self-Test (303-14 Electronic Engine Controls - 3.2L, General Procedures).

Published: 11-May-2011

Exhaust System - I6 3.2L Petrol - Exhaust System

Removal and Installation

Removal

WARNING: Observe due care when working near a hot exhaust system.

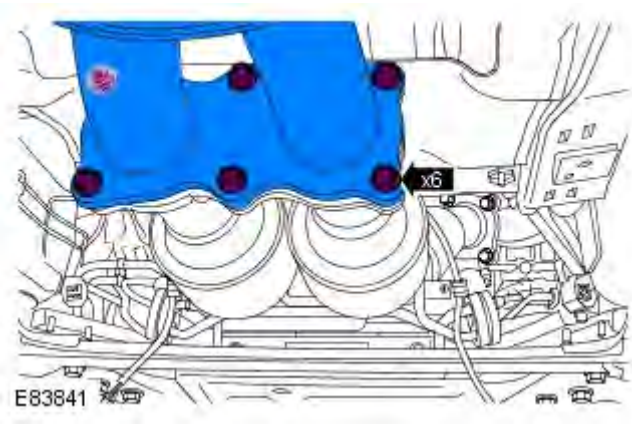
- NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

Vehicles with petrol engine

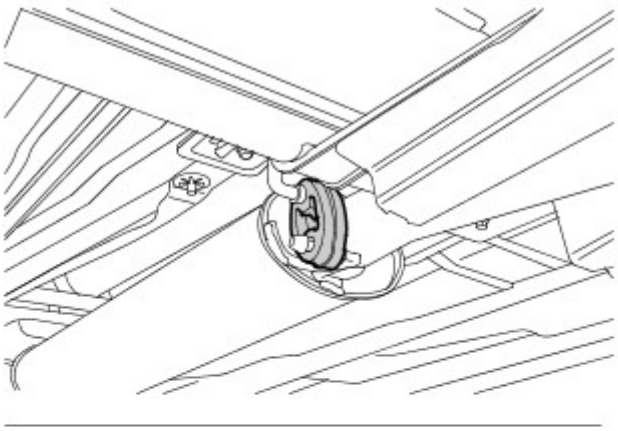


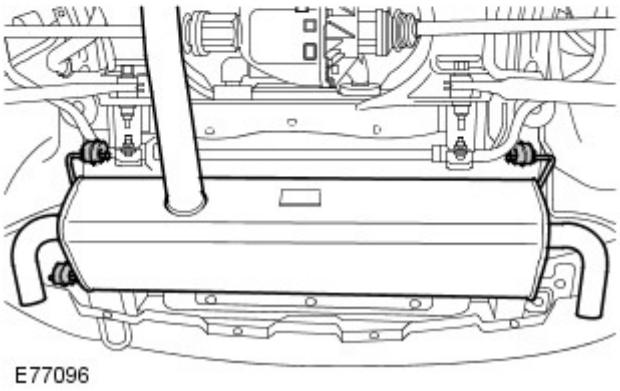
2. *Torque:* 25 Nm

Vehicles with diesel engine

3. *Torque:* 40 Nm

All vehicles





4. **4.** WARNING: This step requires the aid of another technician.

Vehicles with petrol engine

5. Remove and discard the gasket.

All vehicles

6. **6.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the rubber mounts.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exhaust System - TD4 2.2L Diesel -

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Heated oxygen sensor (H02S) removal*	WD40 or suitable alternative
Heated oxygen sensor (H02S) threads	Apply suitable high temperature anti-seize compound to threads of sensor

*** Apply to area around sensor threads prior to attempting to remove sensor**

General Specification

Item	Specification
Catalytic converters - type/location	An oxidizing catalytic converter is fitted in the front section of the exhaust system
Exhaust manifold - Location	A manifold assembly is fitted to the cylinder head.
Exhaust system	Stainless steel exhaust system supplied as two separate assemblies. Front section incorporating a catalytic converter and a rear section incorporating a rear silencer

Torque Specifications

Description	Nm	lb-ft
Catalytic converter to center section retaining clamp	40	30
Catalytic converter to turbocharger housing retaining clamp	10	7
Exhaust manifold elbow to EGR cooler	25	18
Exhaust manifold heat shield bolts	10	7
Exhaust manifold heat shield nuts	10	7
Exhaust manifold retaining nuts	24	18
Exhaust manifold retaining studs	7	5
Exhaust support brackets to subframe / floor	25	18
Heated oxygen sensor (H02S)++	45	33

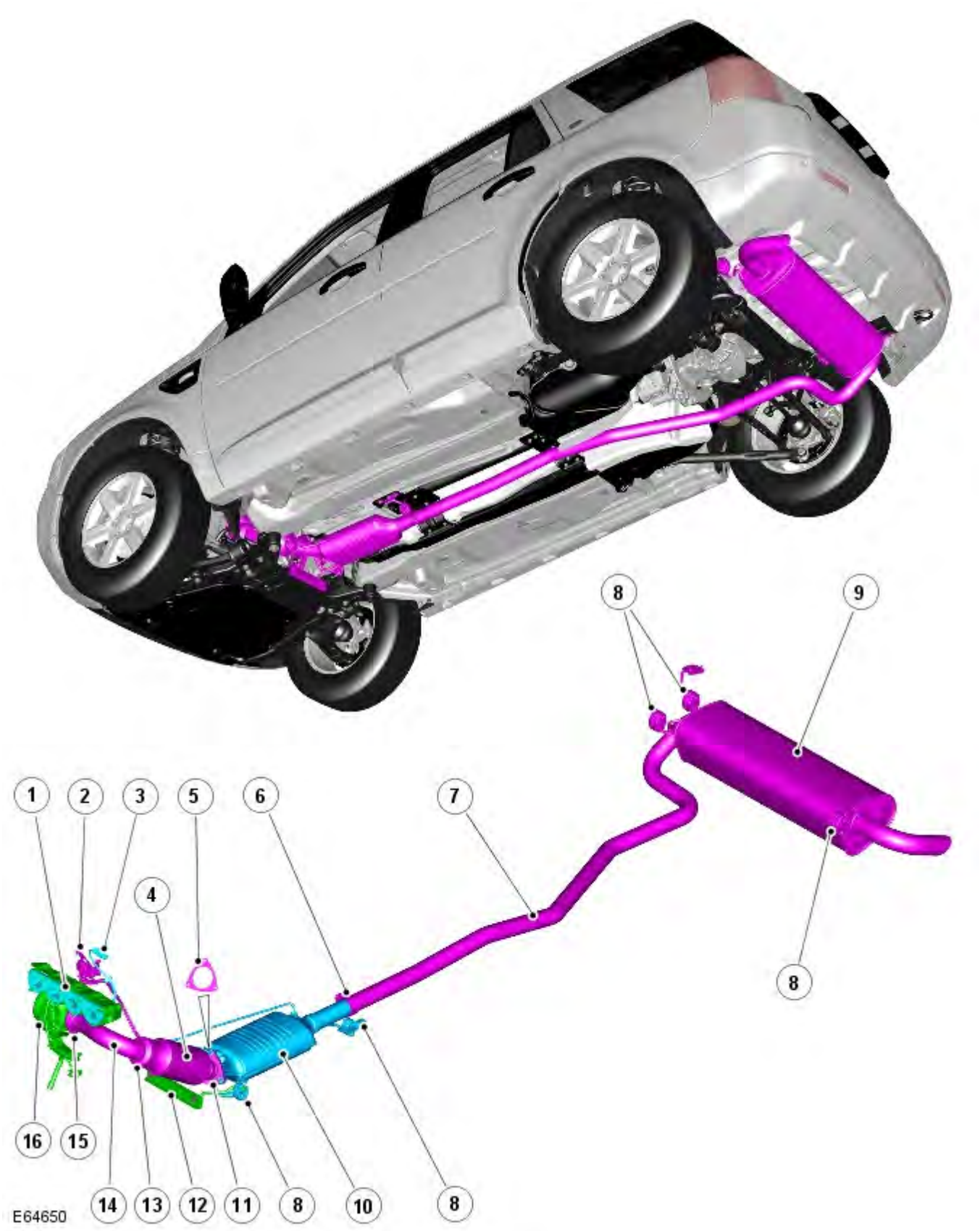
+ Apply anti-seize lubricant to threads of sensor - See Lubricants

Published: 11-May-2011

Exhaust System - TD4 2.2L Diesel - Exhaust System

Description and Operation

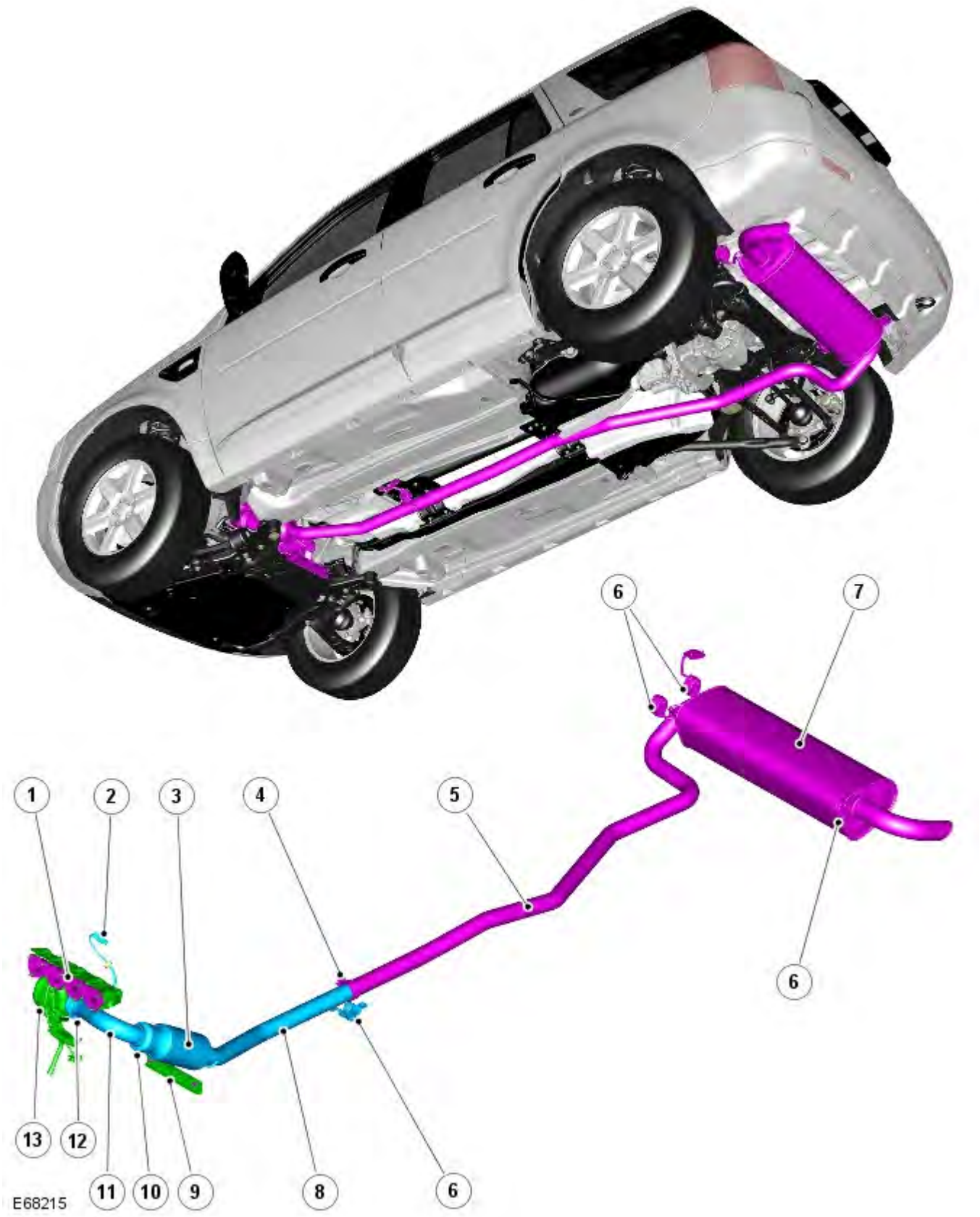
COMPONENT LOCATION - WITH DIESEL PARTICULATE FILTER



Item	Part Number	Description
1	-	Exhaust manifold (ref only)
2	-	Pressure differential sensor
3	-	Heated Oxygen Sensor (HO2S) (ref only)
4	-	Catalytic converter

5	-	Gasket
6	-	'Torca' clamp
7	-	Connecting pipe
8	-	Mounting rubber (6 off)
9	-	Rear muffler
10	-	Diesel Particulate Filter (DPF)
11	-	Flange
12	-	Body hanger
13	-	Decoupler
14	-	Outlet elbow
15	-	'V' clamp and gasket
16	-	Turbocharger (ref only)

COMPONENT LOCATION - WITHOUT DIESEL PARTICULATE FILTER



Item	Part Number	Description
1	-	Exhaust manifold (ref only)
2	-	HO2S (ref only)
3	-	Catalytic converter
4	-	'Torca' joint
5	-	Rear connecting pipe
6	-	Mounting rubber (5 off)
7	-	Rear muffler
8	-	Front connecting pipe
9	-	Body hanger
10	-	Decoupler
11	-	Outlet elbow

12	-	'V' clamp and gasket
13	-	Turbocharger (ref only)

OVERVIEW

The 2.2L DW12 exhaust system is fabricated from stainless steel and is supplied as two separate assemblies; a front section incorporating a catalytic converter and a rear section incorporating a rear silencer.

In some markets, the exhaust system incorporates a Diesel Particulate Filter (DPF) which allows the vehicle to exceed European Stage 4 emission standards.

The system is attached to the underside of the body with six mounting rubbers (five mounting rubbers on vehicles without DPF) which are located on mild steel hanger bars that are welded to the system. The mounting rubbers locate on corresponding hangers which are welded or bolted to the underside of the vehicle body.

FRONT SECTION

The front section has a flared end which mates with a corresponding feature on the turbocharger. The joint is secured together using a 'V' band clamp sealed with a gasket.

The flange is formed on a fabricated outlet elbow which in turn is welded to the de-coupler. The elbow incorporates a threaded boss which provides the location for the HO2S. The decoupler, which provides a flexible joint, is welded to the body of the catalytic converter.

Vehicles without DPF

A short front connecting pipe section from the catalytic converter mates with the rear connecting pipe of the system and is secured with a 'Torca' joint. A mounting rubber is located near to the catalyst and attaches to a body hanger bracket mounted on the body.

Vehicles with DPF

The catalytic converter has a flange and gasket joint which mates with a flange on the DPF. The DPF outlet has a short front connecting pipe which mates with the rear connecting pipe of the system and is secured with flange joint. Two mounting rubbers are located near to the catalyst and attach to a body hanger bracket mounted on the body.

REAR SECTION

The rear section has long connecting pipe section which mates with the front connecting pipe behind the catalyst or DPF and is secured with a 'Torca' joint. The pipe section is routed along the underside of the vehicle and connects into the Right Hand (RH) end of the rear muffler.

The rear muffler is a fabricated unit with a capacity of 29.3 liters. The muffler contains perforated baffles and tubes which reduce noise as the exhaust gases pass through the silencer. The exhaust gasses enter the muffler at the Right Hand (RH) end and exit via a pipe on the Left Hand (LH) end. The exit pipe faces the rear of the vehicle and is curved downwards to direct exhaust gasses away from the rear of the vehicle.

CATALYTIC CONVERTER

The oxidizing catalytic converter, which has a capacity of 2 liters, is fitted in the front section of the exhaust system, after the HO2S. The catalytic converter is common to vehicles with or without the DPF.

The HO2S monitors the exhaust gasses leaving the engine. The engine management system uses this information to provide accurately metered quantities of fuel to the combustion chambers to ensure the most efficient use of fuel and to minimize the exhaust emissions.

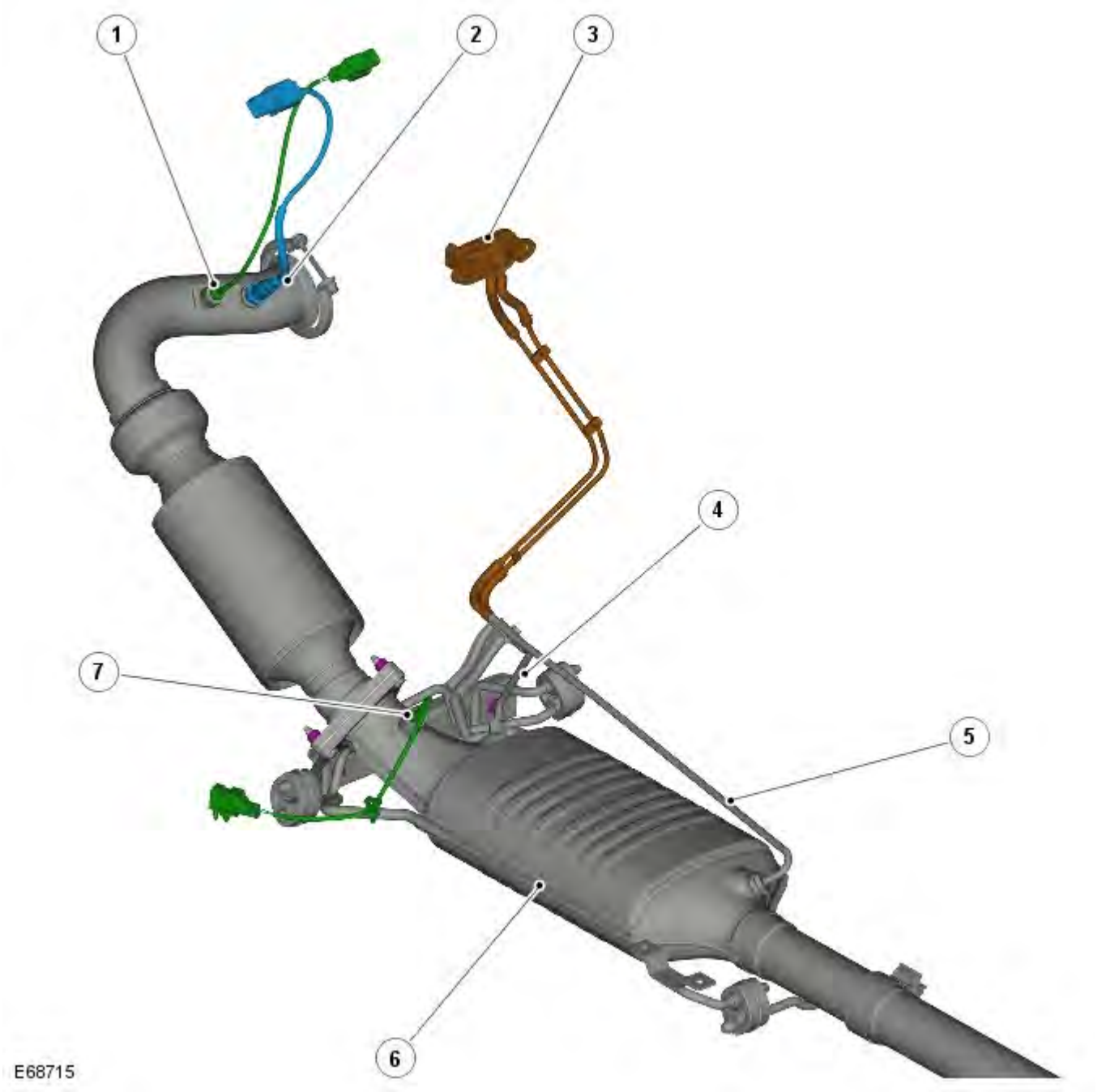
To further reduce the carbon monoxide and hydrocarbons content of the exhaust gases, a catalytic converter is integrated into the front pipe of the exhaust system. In the catalytic converter the exhaust gases are passed through honeycombed ceramic elements coated with a special surface treatment called 'washcoat'.

The washcoat increases the surface area of the ceramic elements by a factor of approximately 7000. On top of the washcoat is a coating containing platinum, which is the active constituent for converting harmful emissions into inert by-products. The platinum adds oxygen to the carbon monoxide and the hydrocarbons in the exhaust gases, to convert them into carbon dioxide and water respectively.

DIESEL PARTICULATE FILTER (if fitted)

The Diesel Particulate Filter (DPF) system reduces diesel particulate emissions to negligible levels.

DPF System Components



Item	Part Number	Description
1	-	Temperature sensor
2	-	HO2S
3	-	Differential pressure sensor
4	-	High pressure sensor pipe
5	-	Low pressure sensor pipe
6	-	Diesel particulate filter
7	-	Temperature sensor

The particulate emissions are the black fumes emitted from the diesel engine under certain load conditions. The emissions are a complex mixture of solid and liquid components with the majority of the particulates being carbon microspheres on which hydrocarbons from the engine's fuel and lubricant condense.

The DPF system comprises the following components:

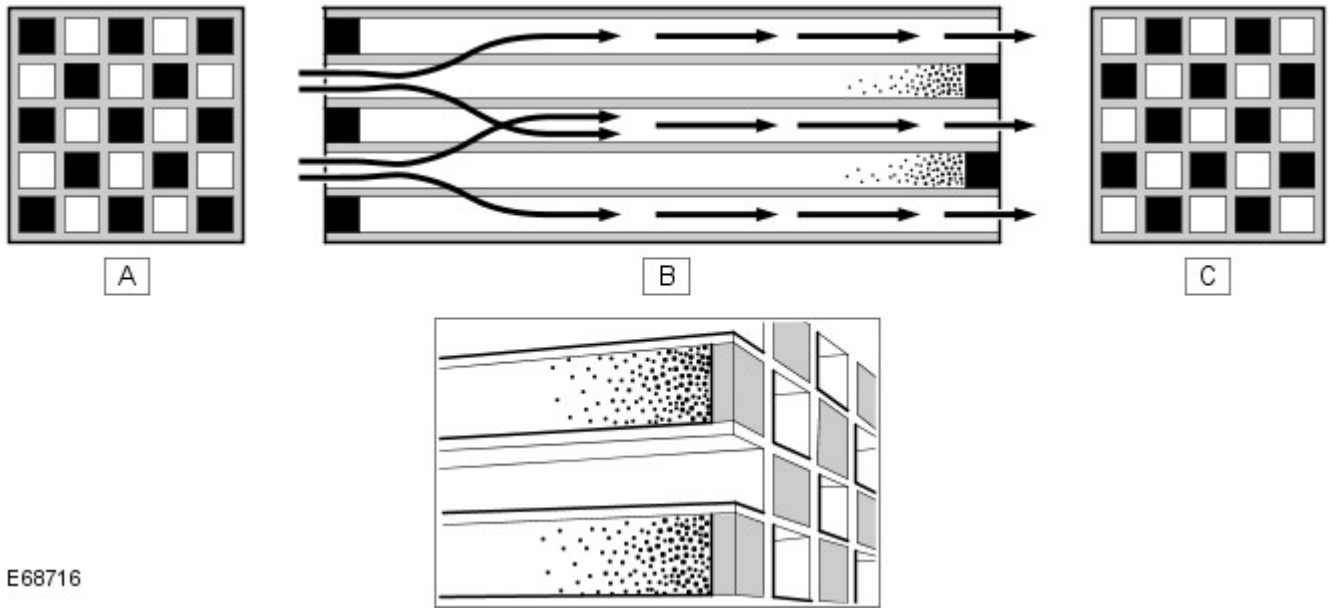
- Diesel particulate filter
- DPF control software incorporated into the Engine Control Module (ECM)
- Differential pressure sensor.

Diesel Particulate Filter

The DPF is located in the exhaust system, downstream of the catalytic converter. A major feature of the DPF is its ability for regeneration. Regeneration is the burning of particulates trapped by the filter to prevent obstruction to the free flow of exhaust gasses. The regeneration process takes place at calculated intervals and is not noticeable by the driver of the vehicle.

Regeneration is most important, since an overfilled filter can damage the engine through excessive exhaust back pressure and can itself be damaged or destroyed. The material trapped in the filter is in the most part carbon particles with some

absorbed hydrocarbons.



Item	Part Number	Description
A	-	Front face showing alternate closed cells
B	-	Side view showing exhaust gas flow through the filter and particulate build up
C	-	Rear face showing alternate closed cells

The DPF uses a filter technology based on a filter with a catalytic coating. The DPF is made from silicon carbide housed in a steel container and has excellent thermal shock resistance and thermal conductivity properties. The DPF is designed for the engine's operating requirements to maintain the optimum back pressure requirements.

The porous surface of the filter consists of thousands of small parallel channels positioned in the longitudinal direction of the exhaust system. Adjacent channels in the filter are alternately plugged at the end. This design forces the exhaust gasses to flow through the porous filter walls, which act as the filter medium. Particulate matter which are too big to pass through the porous surface are collected and stored in the channels.

The collected particulate matter, if not removed, can create an obstruction to exhaust gas flow. The particles are removed by a regeneration process which incinerates the particles.

The regeneration process uses NO^2 to remove the particles from the DPF. The NO^2 is generated by the catalytic converter upstream of the DPF. The catalytic converter produces temperatures in excess of 250°C (482°F) at which point the regeneration process is started.

DPF regeneration is controlled by the temperature of the exhaust gasses and the DPF. The DPF includes a wash coat to the filter surface which comprises platinum and other active components and is similar to the catalytic converter. At certain exhaust gas and DPF temperatures the wash coat promotes combustion and incineration of the particles in addition to oxidizing carbon monoxide and hydrocarbon emissions.

The exhaust gas and DPF temperatures are controlled by the DPF software located in the ECM. The DPF software monitors the load status of the DPF based on driving style, distance traveled and signals from the differential pressure sensor and temperature sensors. When the particulate loading of the DPF reaches predetermined levels, the DPF is actively regenerated by adjusting, in conjunction with the ECM, various engine control functions such as:

- fuel injection
- intake air throttle
- exhaust gas recirculation
- turbocharger boost pressure control.

The regeneration process is possible because of the flexibility of the common-rail fuel injection engine which provides precise control of fuel flow, fuel pressure and injection timing which are essential requirements to promote the efficient regeneration process.

Two processes are used to regenerate the DPF; passive and active.

Passive Regeneration

Passive regeneration requires no special engine management intervention and occurs during normal engine operation. The passive regeneration involves a slow conversion of the particulate matter deposited in the DPF into carbon dioxide. This process is active when the DPF temperature reaches 250°C (482°F) and is a continuous process when the vehicle is being driven at higher engine loads and speeds.

During passive regeneration, only a portion of the particulate matter is converted into carbon dioxide. This is due to the chemical reaction process which is only effective within the normal operating temperature range of 250°C to 500°C (482°F to 932°F).

Above this temperature range the conversion efficiency of the particulates into carbon dioxide increases as the DPF temperature is raised. These temperatures can only be achieved using the active regeneration process.

Active Regeneration

Active regeneration starts when the particulate loading of the DPF reaches a threshold as monitored or determined by the DPF control software. The threshold calculation is based on driving style, distance traveled and back pressure signals from the differential pressure sensor.

Active regeneration generally occurs every 450 miles (725 km) although this is dependant on how the vehicle is driven. For example, if the vehicle is driven at low loads in urban traffic regularly, active regeneration will occur more often. This is due to the rapid build-up of particulates in the DPF than if the vehicle is driven at high speeds when passive regeneration will have occurred.

The DPF software incorporates a mileage trigger which is used as back-up for active regeneration. If active regeneration has not been initiated by a back pressure signal from the differential pressure sensor, regeneration is requested based on distance traveled.

Active regeneration of the DPF is commenced when the temperature of the DPF is increased to the combustion temperature of the particles. The DPF temperature is raised by increasing the exhaust gas temperature. This is achieved by introducing post-injection of fuel after the pilot and main fuel injections have occurred.

This is determined by the DPF software monitoring the signals from the two DPF temperature sensors to establish the temperature of the DPF. Depending on the DPF temperature, the DPF software requests the ECM to perform either one or two post-injections of fuel:

- The first post-injection of fuel retards combustion inside the cylinder which increases the temperature of the exhaust gas.
- The second post-injection of fuel is injected late in the power stroke cycle. The fuel partly combusts in the cylinder, but some unburnt fuel also passes into the exhaust where it creates an exothermic event within the catalytic converter, further increasing the temperature of the DPF.

The active regeneration process takes approximately 20 minutes to complete. The first phase increases the DPF temperature to 500°C (932°F). The second phase further increases the DPF temperature to 600°C (1112°F) which is the optimum temperature for particle combustion. This temperature is then maintained for 15-20 minutes to ensure complete incineration of the particles within the DPF. The incineration process converts the carbon particles to carbon dioxide and water.

The active regeneration temperature of the DPF is closely monitored by the DPF software to maintain a target temperature of 600°C (1112°F) at the DPF inlet. The temperature control ensures that the temperatures do not exceed the operational limits of the turbocharger and the catalytic converter. The turbocharger inlet temperature must not exceed 830°C (1526°F) and the catalytic converter brick temperature must not exceed 800°C (1472°F) and the exit temperature must remain below 750°C (1382°F).

During the active regeneration process the following ECM controlled events occur:

- The turbocharger is maintained in the fully open position. This minimizes heat transmission from the exhaust gas to the turbocharger and reduces the rate of exhaust gas flow allowing optimum heating of the DPF. If the driver demands an increase in engine torque, the turbocharger will respond by closing the vanes as necessary.
- The throttle is closed as this assists in increasing the exhaust gas temperature and reduces the rate of exhaust gas flow which has the effect of reducing the time for the DPF to reach the optimum temperature.
- The Exhaust Gas Recirculation (EGR) valve is closed. The use of EGR decreases the exhaust gas temperature and therefore prevents the optimum DPF temperature being achieved.

If, due to vehicle usage and/or driving style, the active regeneration process cannot take place or is unable to regenerate the DPF, the dealer can force regenerate the DPF. This is achieved by either driving the vehicle until the engine is at its normal operating temperature and then driving for a further 20 minutes at speeds of not less than 30 mph (48 km/h) or by connecting a Land Rover approved diagnostic system to the vehicle which will guide the technician through a regeneration procedure to clean the DPF.

Diesel Particulate Filter Control

The DPF requires constant monitoring to ensure that it is operating at its optimum efficiency and does not become blocked. The ECM contains DPF software which controls the monitoring and operation of the DPF system and also monitors other vehicle data to determine regeneration periods and service intervals.

The DPF software can be divided into three separate control software modules; a DPF supervisor module, a DPF fuel management module and a DPF air management module.

These three modules are controlled by a fourth software module known as the DPF co-ordinator module. The co-ordinator module manages the operation of the other modules when an active regeneration is requested. The DPF supervisor module is a sub-system of the DPF co-ordinator module.

DPF Fuel Management Module

The DPF fuel management module controls the following functions:

- Timing and quantity of the four split injections per stroke (pilot, main and two post injections).
- Injection pressure and the transition between the three different calibration levels of injection.

The above functions are dependant on the condition of the catalytic converter and the DPF.

The controlled injection determines the required injection level in addition to measuring the activity of the catalytic converter and the DPF. The fuel management calculates the quantity and timing for the four split injections, for each of the three calibration levels for injection pressure, and also manages the transition between the levels.

The two post injections are required to separate the functionality of increasing in-cylinder gas temperatures and the production of hydrocarbons. The first post injection is used to generate the higher in-cylinder gas temperature while simultaneously retaining the same engine torque output produced during normal (non-regeneration) engine operation. The second post injection is used to generate hydrocarbons by allowing unburnt fuel into the catalytic converter without producing increased engine torque.

DPF Air Management Module

The DPF air management module controls the following functions:

- EGR control
- Turbocharger boost pressure control
- Intake air temperature and pressure control.

During active regeneration, the EGR operation is disabled and the closed-loop activation of the turbocharger boost controller is calculated. The air management module controls the air in the intake manifold to a predetermined level of pressure and temperature. This control is required to achieve the correct in-cylinder conditions for stable and robust combustion of the post injected fuel.

The module controls the intake air temperature by actuating the EGR throttle and by adjustment of the turbocharger boost pressure control.

DPF Co-ordinator Module

The DPF co-ordinator module reacts to a regeneration request from the supervisor module by initiating and co-ordinating the following DPF regeneration requests:

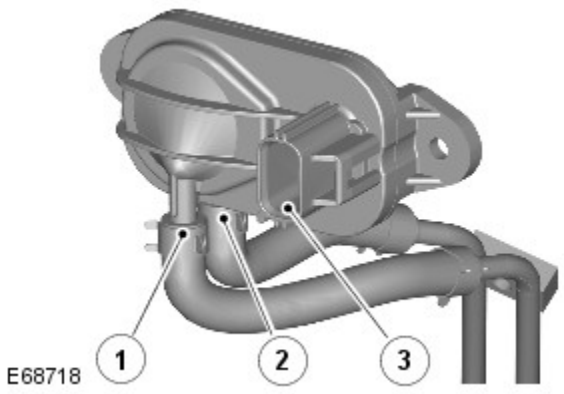
- EGR cut-off
- Turbocharger boost pressure control
- Engine load increase
- Control of air pressure and temperature in the intake manifold
- Fuel injection control.

When the supervisor module issues a regeneration request, the co-ordinator module requests EGR cut-off and a regeneration specific turbocharger boost pressure control. It then waits for a feedback signal from the EGR system confirming that the EGR valve is closed.

When the EGR valve is closed, the co-ordinator module initiates requests to increase engine load by controlling the intake air temperature and pressure.

Once confirmation is received that intake conditions are controlled or a calibration time has expired, the co-ordinator module then changes to a state awaiting an accelerator pedal release manoeuver from the driver. If this occurs or a calibration time has expired, the co-ordinator module generates a request to control fuel injections to increase exhaust gas temperature.

Differential Pressure Sensor



Item	Part Number	Description
1	-	High pressure connection
2	-	Low pressure connection
3	-	Electrical connector

The differential pressure sensor is located in the engine compartment, on the lower RH side of the bulkhead. The sensor is located on two studs and secured with nuts.

The differential pressure sensor is used by the DPF software to monitor the condition of the DPF. Two pipe connections on the sensor are connected by pipes to the inlet and outlet ends of the DPF. The pipes allow the sensor to measure the inlet and outlet pressures of the DPF.

As the amount of particulates trapped by the DPF increases, the pressure at the inlet side of the DPF increases in comparison to the DPF outlet. The DPF software uses this comparison, in conduction with other data, to calculate the accumulated amount of trapped particulates.

By measuring the pressure difference between the DPF inlet and outlet and the DPF temperature, the DPF software can determine if the DPF is becoming blocked and requires regeneration.

Differential Particulate Filter Temperature Sensors

Two temperature sensors are used in the DPF system. One is located in the turbocharger outlet elbow, adjacent to the HO2S and the second sensor is located in the DPF inlet.

The sensors measure the temperature of exhaust gas exiting the turbocharger and before it passes through the DPF and provides the information needed to calculate the DPF temperature.

The information is used, in conjunction with other data, to estimate the amount of accumulated particulates and to control

the DPF temperature.

Instrument Cluster Indications

For drivers who make regular short journeys at low speeds, it may not be possible to efficiently regenerate the DPF. In this case, the DPF software will detect a blockage of the DPF from signals from the differential pressure sensor and will alert the driver as follows.

Item	Part Number	Description
1	-	'DPF FULL' message
2	-	'DPF FULL VISIT DEALER' message

The driver will be alerted to this condition by a message 'DPF FULL' accompanied by a handbook symbol. As detailed in the Owners Handbook, the driver should drive the vehicle until the engine is at its normal operating temperature and then drive for a further 20 minutes at speeds of not less than 30 mph (48 km/h). Successful regeneration of the DPF is indicated to the driver by the 'DPF FULL' message no longer being displayed. If the DPF software detects that the DPF is still blocked, the message will change to 'DPF FULL VISIT DEALER', the driver should take the vehicle to an authorized dealer to have the DPF force regenerated.

Diesel Particulate Filter Side Effects

The following section details some side effects caused by the active regeneration process.

Engine Oil Dilution

Engine oil dilution can occur due to small amounts of fuel entering the engine crankcase during the post-injection phases. This has made it necessary to introduce a calculation based on driving style to reduce oil service intervals if necessary. The driver is alerted to the oil service by a message in the instrument cluster.

The DPF software monitors the driving style and the frequency of the active regeneration and duration. Using this information a calculation can be made on the engine oil dilution. When the DPF software calculates the engine oil dilution has reached a predetermined threshold (fuel being 7% of engine oil volume) a service message is displayed in the instrument cluster.

Depending on driving style, some vehicles may require an oil service before the designated interval. If an service message is displayed, the vehicle will be required have a full service and the service interval counter will be reset.

Fuel consumption

During the active regeneration process of the DPF, there will be an increase in fuel consumption. However, because active regeneration occurs infrequently and for limited periods of time, the overall effect on fuel consumption is approximately 2%. The additional fuel used during the active regeneration process is accounted for in the instantaneous and average fuel consumption displays in the instrument cluster.

Published: 11-May-2011

Exhaust System - TD4 2.2L Diesel - Catalytic ConverterVehicles Without: Diesel Particulate Filter (DPF)

Removal and Installation

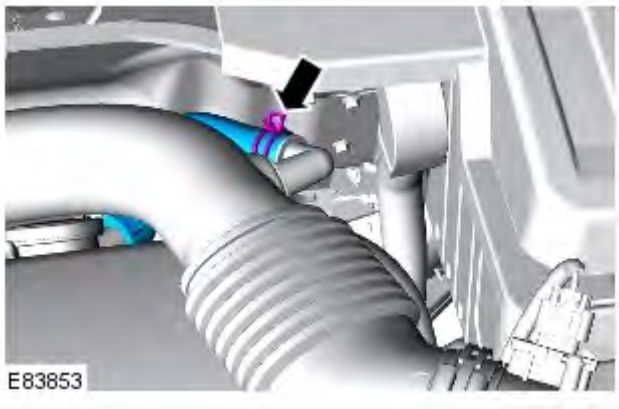
Special Tool(s)

	310-121 Wrench, H02S

Removal

1. Raise the vehicle on a lift.

2.



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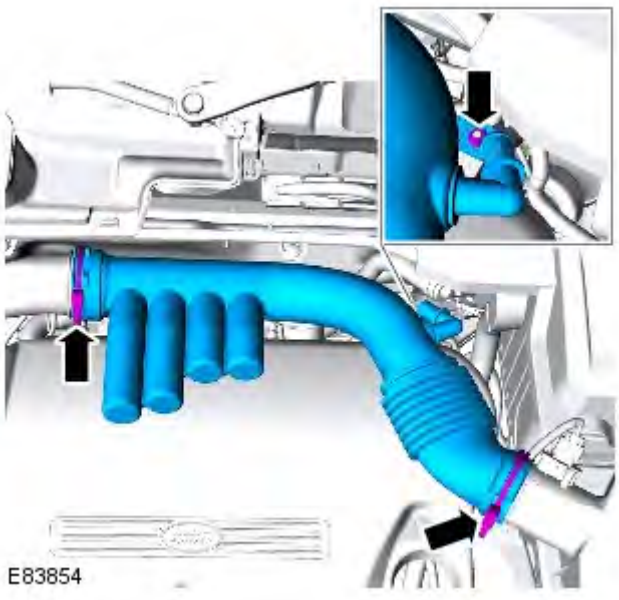
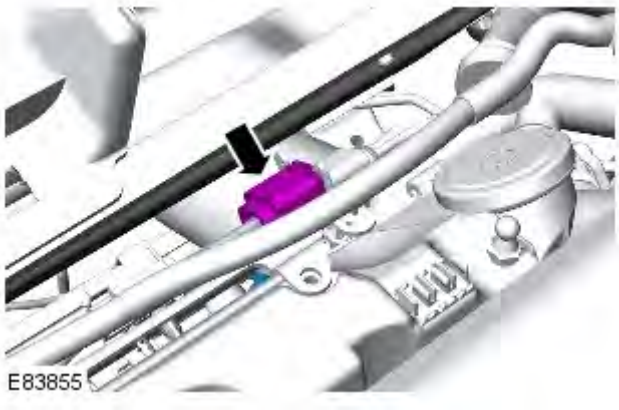
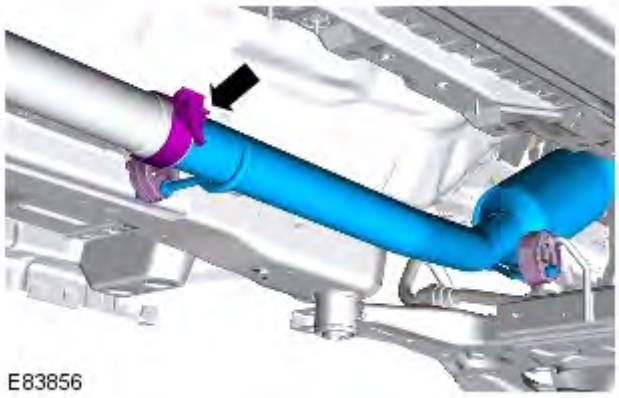




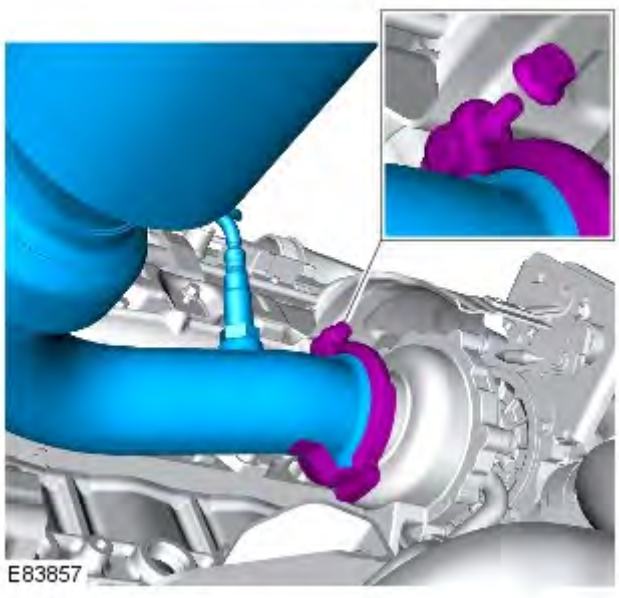
4.

5. Remove the front splash shield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

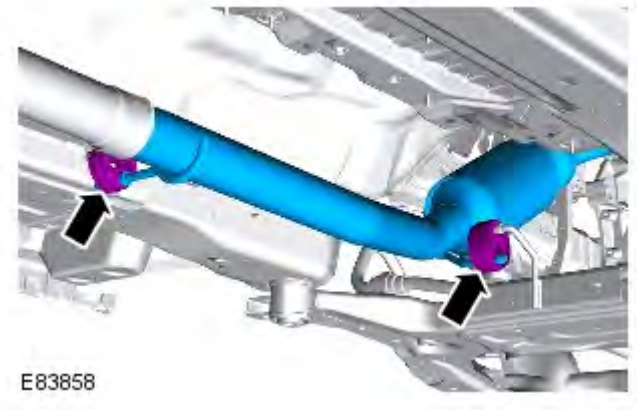


6. *Torque:* 40 Nm



7. **7.** NOTE: Install a new gasket.

   Torque: 10 Nm



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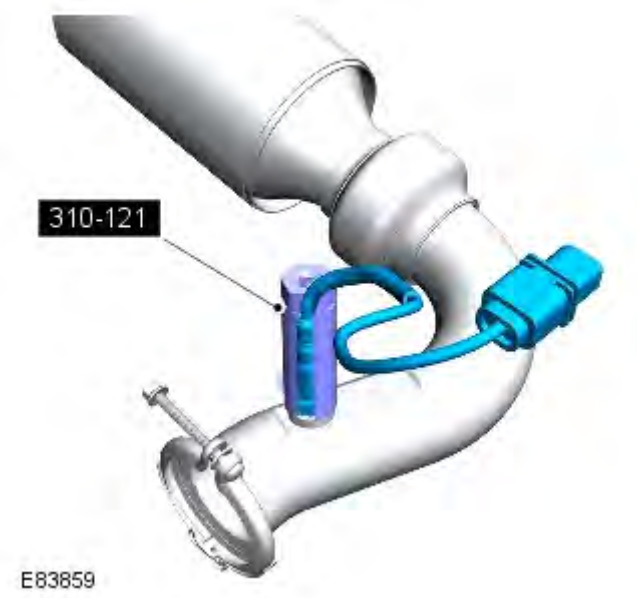


9. .

Special Tool(s): 310-121
Torque: 45 Nm

Installation

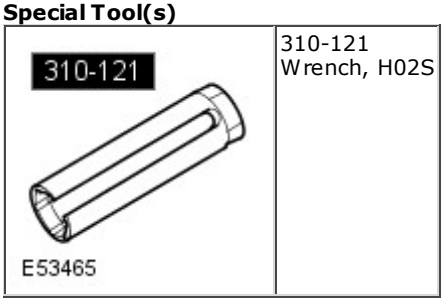
1. To install, reverse the removal procedure.

Published: 11-May-2011

Exhaust System - TD4 2.2L Diesel - Catalytic ConverterVehicles With: Diesel Particulate Filter (DPF)

Removal and Installation

Special Tool(s)

	310-121 Wrench, H02S

Removal

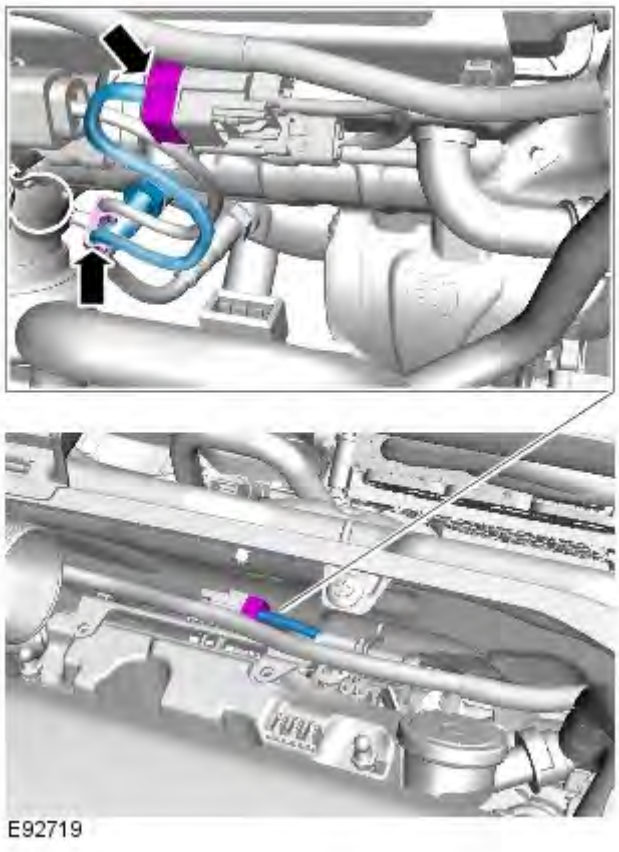
1. **1.** WARNING: Make sure to support the vehicle with axle stands.

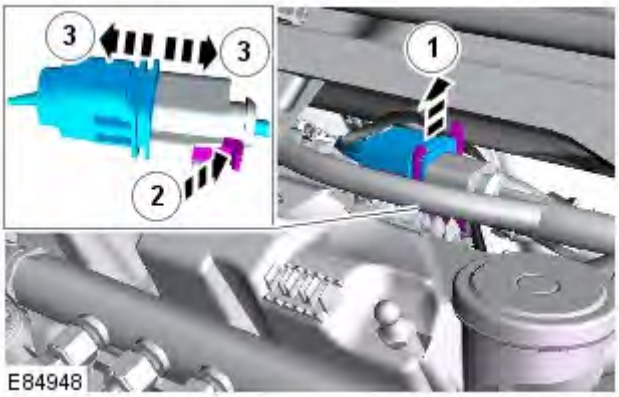
   Raise the vehicle on a lift.

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.





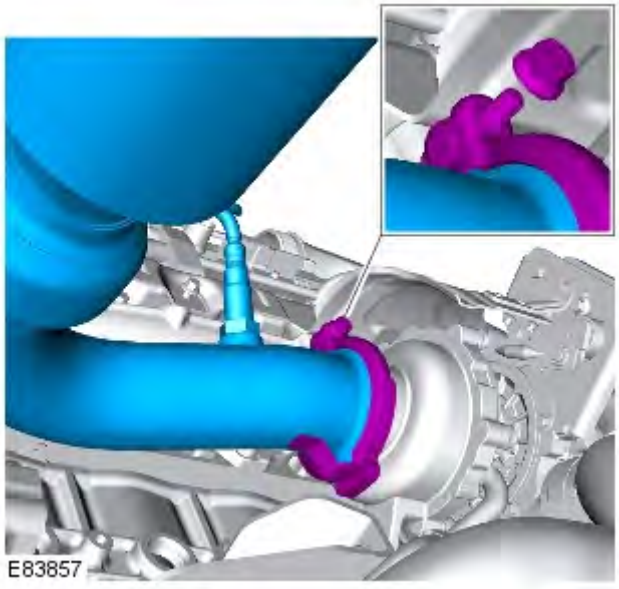
4.

5. Remove the engine undershield.

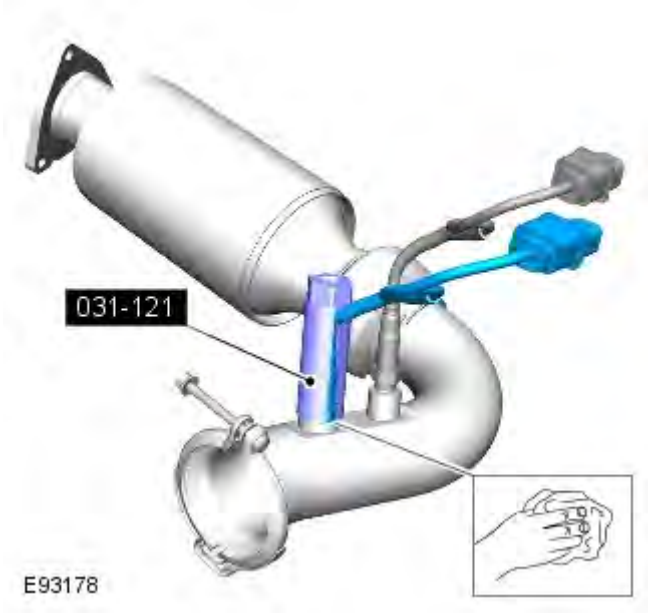
   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

6. Remove the DPF.

   Refer to: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).



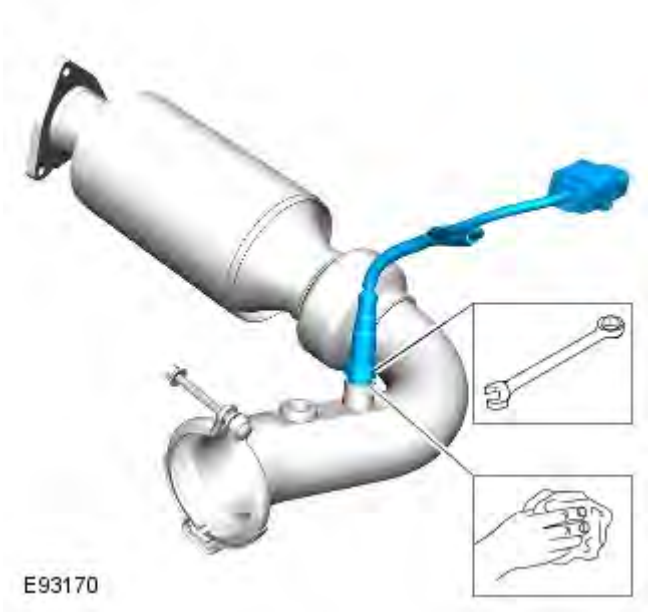
7. **7.** NOTE: Install a new gasket.



8. **8.** CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

   Special Tool(s): 310-121

9.



Installation

1. Apply anti-seize compound to the sensor and pipe union thread.

   Refer to: Specifications (303-08B Engine Emission Control - TD4 2.2L Diesel, Specifications).

2. Install the temperature sensor.

   Torque: 35 Nm

3. Install the HO2S.

   Special Tool(s): 310-121
   Torque: 45 Nm

4. **4.** CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

Only tighten the nut finger tight at this stage.

Install the catalyst.

5. Install the DPF.

   Refer to: Diesel Particulate Filter (DPF) (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

6. Tighten the nut clamping the catalyst to the turbocharger.

   Torque: 10 Nm

7. Install the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

8. Connect the heated oxygen sensor (H02S) electrical connector.

9. **9.** CAUTION: Make sure that the wiring harnesses are correctly routed.

   Connect the temperature sensor electrical connector.

10. Install the engine cover.

    Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Exhaust System - TD4 2.2L Diesel - Exhaust System

Removal and Installation

Removal

WARNING: Observe due care when working near a hot exhaust system.

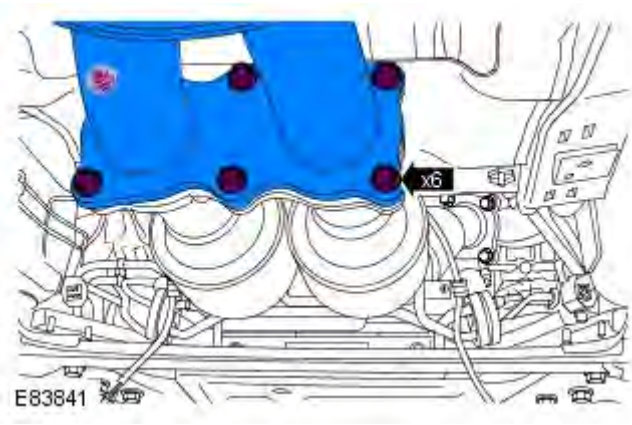
- NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

Vehicles with petrol engine

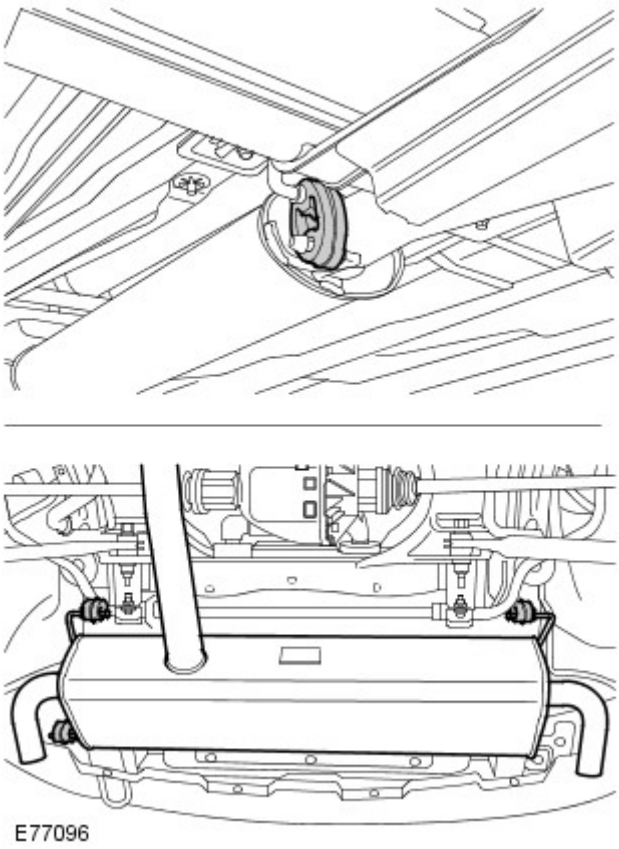


2. *Torque:* 25 Nm

Vehicles with diesel engine

3. *Torque:* 40 Nm

All vehicles



4. **4.** WARNING: This step requires the aid of another technician.

Vehicles with petrol engine

5. Remove and discard the gasket.

All vehicles

6. **6.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the rubber mounts.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exhaust System - TD4 2.2L Diesel - Diesel Particulate Filter (DPF)

Removal and Installation

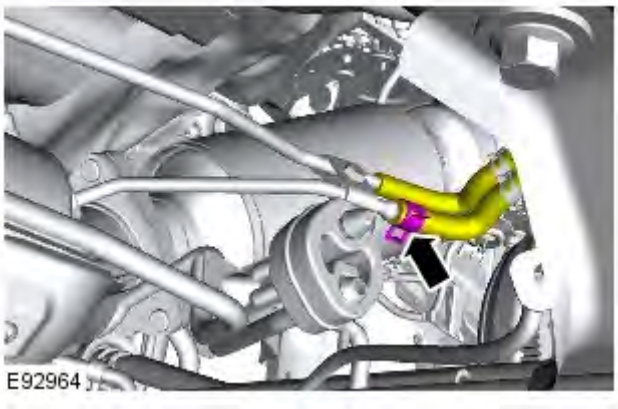
Removal

WARNING: Observe due care when working near a hot exhaust system.

1. Raise the vehicle on a lift.
2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
3. Remove the exhaust system.

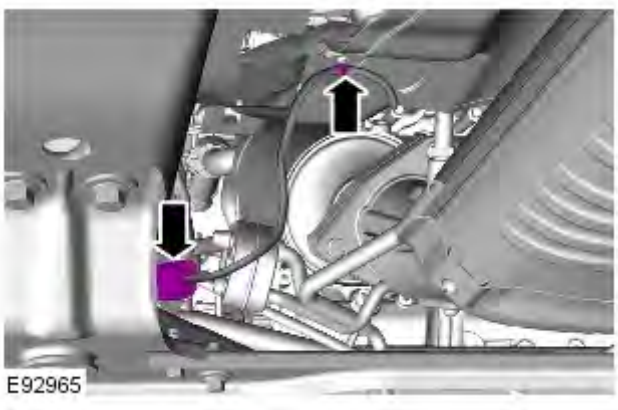
   Refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).



4. **4.** CAUTIONS:

   Mark the components to aid installation.

   Always plug any open connections to prevent contamination.



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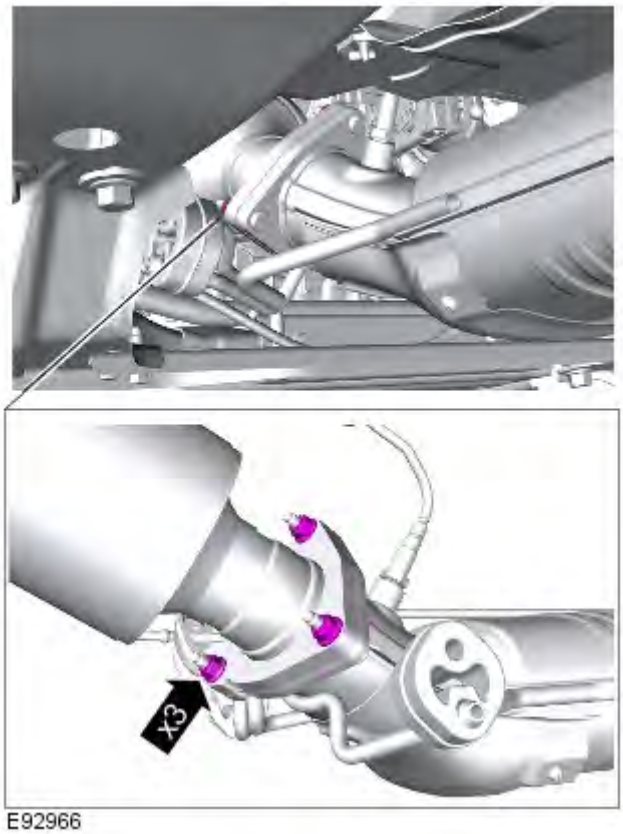

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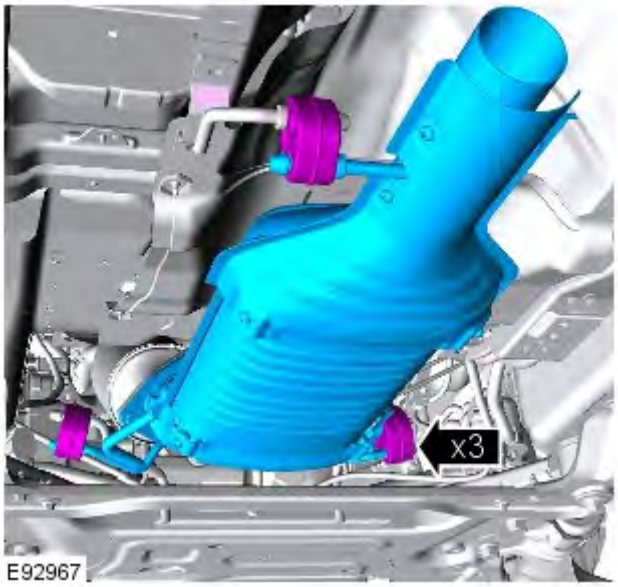
6. **6.** CAUTION: Discard the nuts.



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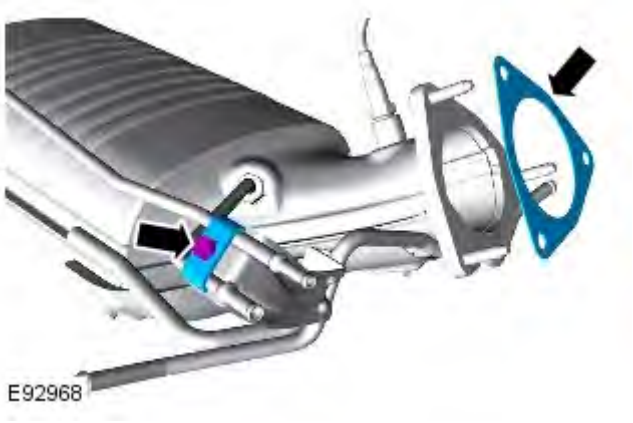
7.



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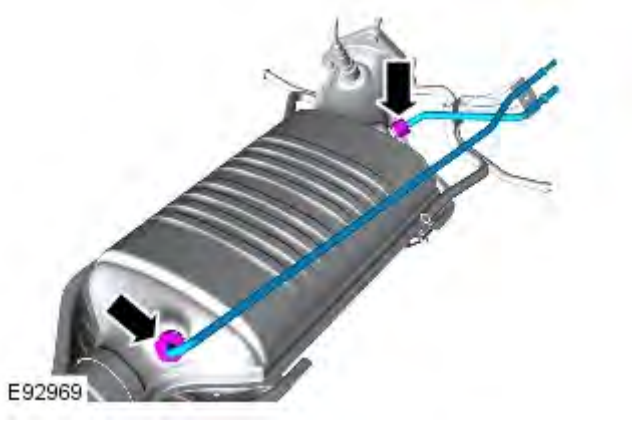


9. **9.** CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

10. **10.** CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Installation

1. Apply anti-seize compound to the sensor and pipe union thread.

   Refer to: Specifications (303-08B Engine Emission Control - TD4 2.2L Diesel, Specifications).

2. Install the temperature sensor.

   Torque: 35 Nm

3. Install the pressure sensing pipes.

   Torque: 25 Nm

4. Install the pipe clamp.

   Torque: 10 Nm

5. **5.** WARNING: Make sure that new nuts are installed.

   CAUTION: Make sure that the mating faces are clean and free of foreign material.

   • NOTE: Install a new gasket.

   Install the diesel particulate filter.

   Torque: 25 Nm

6. **6.** CAUTION: Make sure that the wiring harnesses are correctly located.

   Connect the temperature sensor electrical connector.

7. **7.** CAUTIONS:

   Make sure that the installation marks are aligned.

   Secure the high pressure hose with a clip.

   Connect the sensor hoses.

8. Install the exhaust system.

   Refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).

9. Install the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

Published: 11-May-2011

Exhaust System - TD4 2.2L Diesel - Diesel Particulate Filter (DPF) Differential Pressure Sensor

Removal and Installation

Removal

WARNING: Observe due care when working near a hot exhaust system.

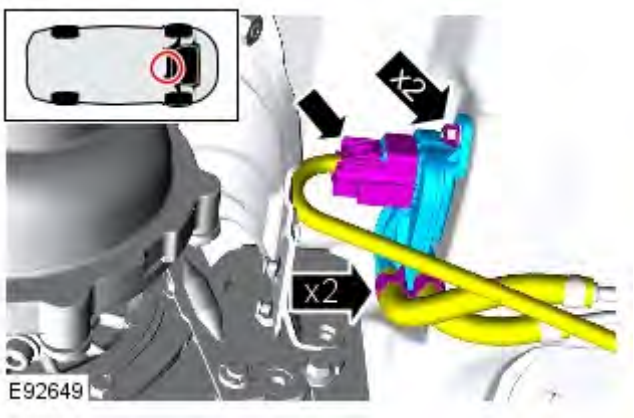
- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



3. **3.** CAUTIONS:

   Make sure that these components are installed to the noted removal position.

   Always plug any open connections to prevent contamination.

   Torque: 6 Nm

Installation

1. To install, reverse the removal procedure.

Published: 27-May-2011

Fuel System - General Information - Fuel Tank Draining

General Procedures

• WARNINGS:

Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.

Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

• NOTE: It is possible that up to 18 litres of fuel may be left in the tank after draining.

1. Open the fuel filler door and remove the cap.

2. Disconnect the battery ground cable.

   Refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

3. Connect the fuel tank drain equipment ground cable to the vehicle.

4. **4.** WARNING: Fuel may still be present in the fuel tank after draining.

   Remove the fuel from the fuel tank, via the filler neck, using the fuel tank draining equipment. Follow the manufacturer's operating instructions.

5. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel System - General Information - Fuel System BleedingTD4 2.2L Diesel

General Procedures

Special Tool(s)

	310-163 Bleeder, Fuel System

• WARNINGS:

Avoid flames, sparks or lighted substances.

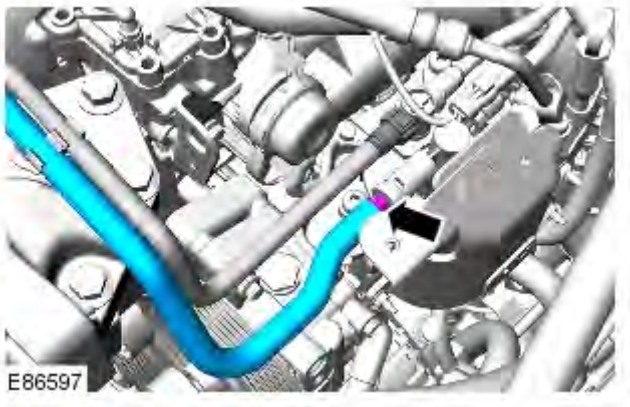
Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.

CAUTION: Make sure that the area around the component is clean and free of foreign material.

1. This procedure is necessary if any of the following fuel system components are removed, disconnected or replaced: Fuel tank, low pressure fuel lines or the fuel filter.

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. **3.** CAUTIONS:

   Extreme cleanliness must be exercised when handling these components.

   Be prepared to collect escaping fuel.

   Disconnect the fuel line.

4. **4.** CAUTION: Be prepared to collect escaping fuel.

   • NOTE: Make sure that the fuel flow direction arrow on the special tool is pointing towards the fuel filter.

   - Install the special tool between the fuel supply line and the fuel filter.

     Special Tool(s): 310-163
   - Prime the fuel filter by squeezing the hand pump several times until the pump is hard.

5.
   - Remove the special tools.

Special Tool(s): 310-163
- Connect the fuel lines.

6. Install the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Fuel Tank and Lines - I6 3.2L Petrol -

Capacities

Item	Capacity (liters/gallons)
Fuel tank	70.0/15.4

General Specification

Item	Specification
System type	ERFS Electronic Returnless Fuel System
Fuel delivery module	PAG Module
Fuel pump:	
Maximum output @ 11.5 volts min	110l/hr max
Operating pressure	Variable
Maximum operating pressure	3.8 Bar max
Fuel tank sender units	Magnetic Passive Position Sensor (MAPPS)

Torque Specifications

Description	Nm	lb-ft
Fuel tank bolts*	25	18
Fuel tank filler pipe lower bracket	10	7
Fuel tank filler pipe upper bracket	10	7

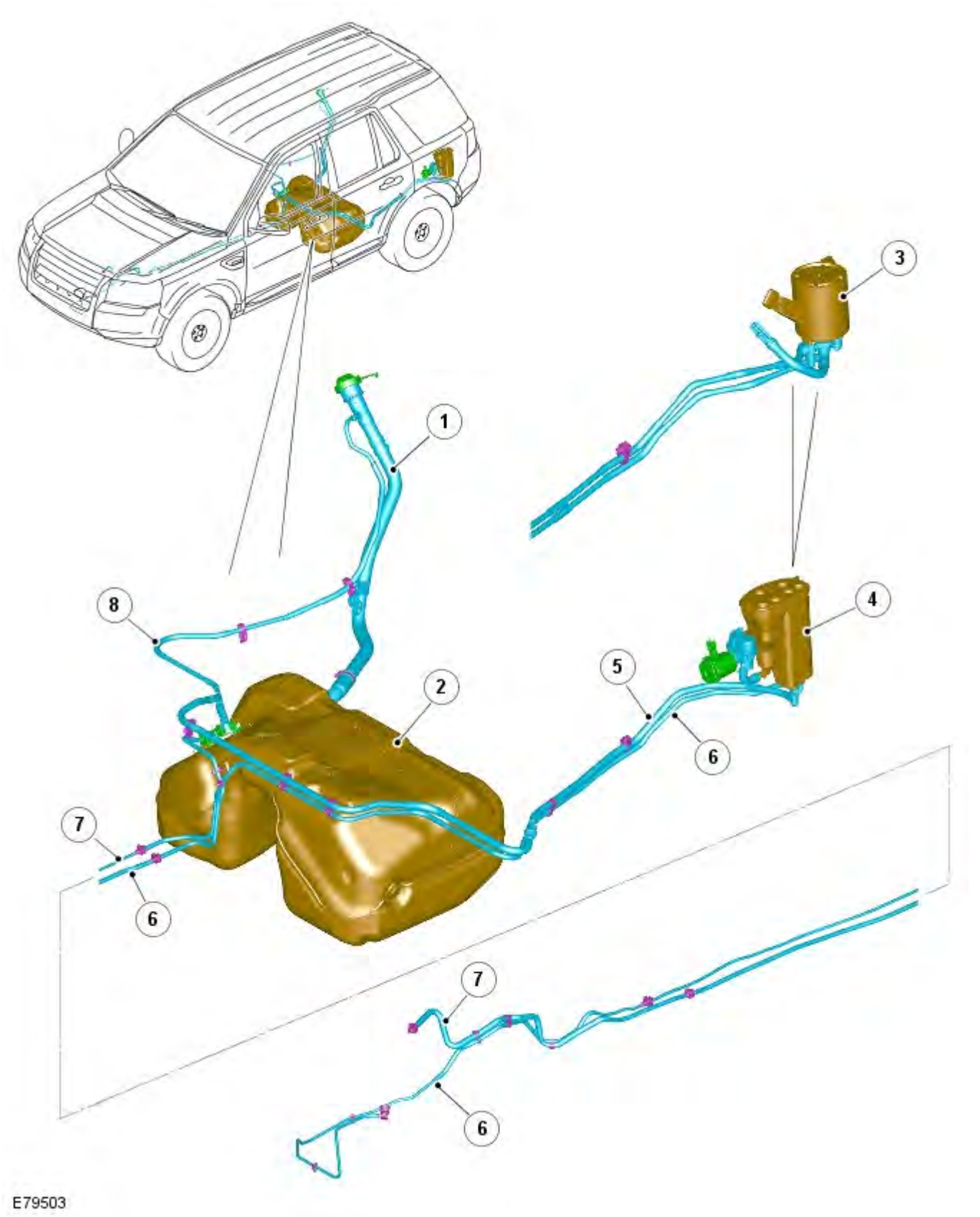
*** New nuts/bolts must be fitted**

Published: 11-May-2011

Fuel Tank and Lines - I6 3.2L Petrol - Fuel Tank and Lines

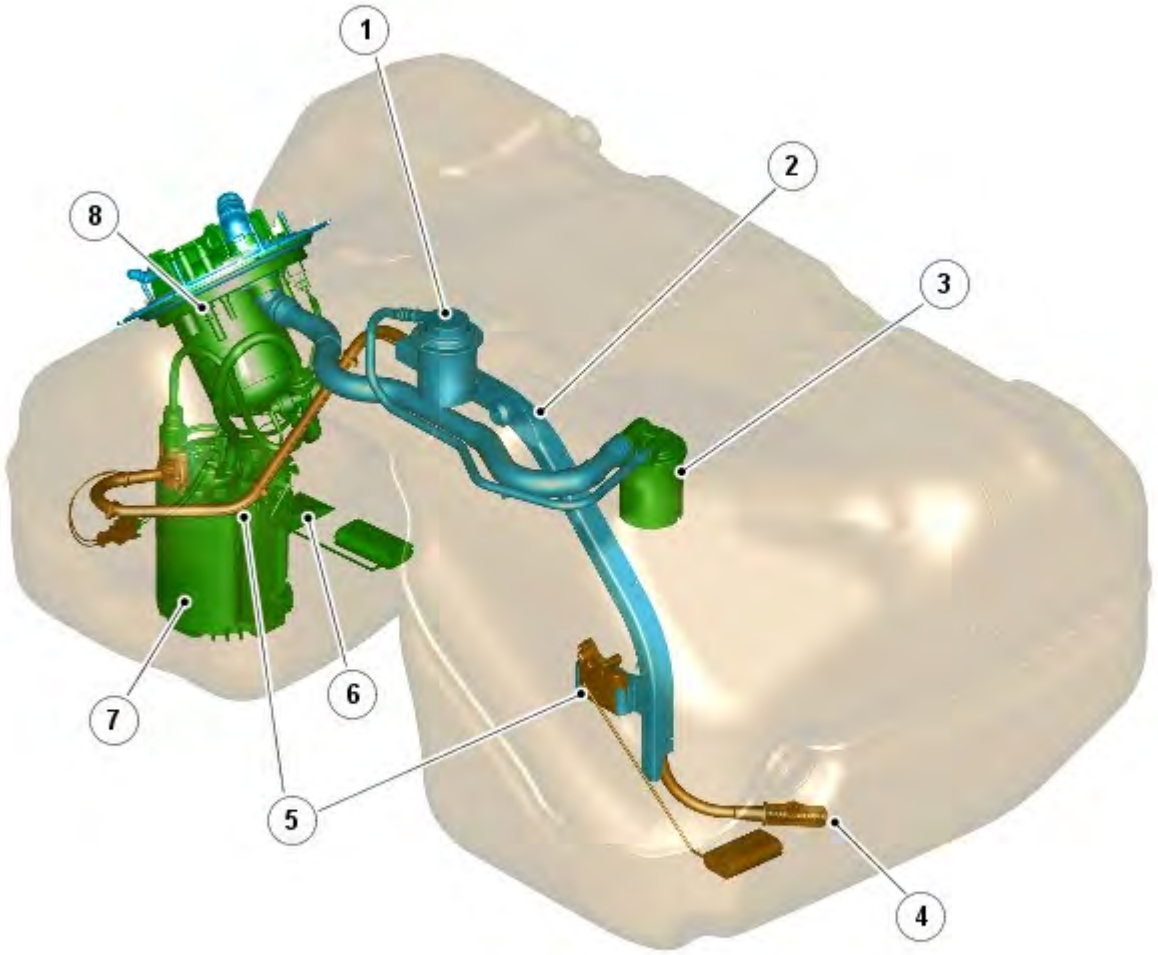
Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Filler neck
2	-	Fuel tank
3	-	Evaporative emission canister - Rest of World (ROW) derivative
4	-	Evaporative emission canister - North American Specification (NAS) derivative

5	-	Vapor pipe to evaporative emission canister
6	-	Vapor purge pipe to intake manifold
7	-	Fuel delivery pipe to engine
8	-	Breather pipe



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Item	Part Number	Description
1	-	Roll Over Valve (ROV)
2	-	Crossover tube assembly
3	-	Fill limit vent valve
4	-	Coarse fuel filter
5	-	Fuel gage sender units
6	-	Primary fuel filter
7	-	Fuel delivery module
8	-	Fuel filter element

OVERVIEW

The 70 liter saddle-type fuel tank is located below the rear seat and astride the driveshaft.

The fuel tank is manufactured using the latest six-layer laminated blow-molding technology providing both high mechanical strength and complete emissions integrity. The fuel filler neck is produced from aluminum to balance high-strength with low-weight. In the event of an accident damaging the filler neck, an inlet check valve in the tank's filler stub prevents fuel escaping.

A single pump supplies the engine's fuel demands while also supplying the fuel to power the venturi. The rapid flow of fuel through the venturi nozzle creates a depression which draws fuel back across the saddle into the pump side of the tank.

The fuel gage senders are sealed units which use magnetic actuation in place of electrical contacts; this prevents the

problem of chemical contamination of electrical components.

To meet on-board refueling vapor recovery (ORVR) requirements, the fuel tank and associated components are designed to minimize fuel vapor loss during refueling. This is achieved by preventing fuel vapor from the fuel tank venting directly to the atmosphere. Instead fuel vapor is directed into the evaporative emission (EVAP) canister where it is stored before being purged at intervals to the engine's intake manifold.
For additional information, refer to: Evaporative Emissions (303-13 Evaporative Emissions, Description and Operation).

Roll Over Valve (ROV)

The ROV is connected via pipes to a liquid vapour separator. The separator is connected via a pipe to the tank breather outlet in the pump module flange. The ROV contains a non-return valve, which closes in the event of the vehicle overturning, preventing liquid fuel escaping from the tank via the breather pipe.

Published: 13-Jul-2011

Fuel Tank and Lines - I6 3.2L Petrol - Fuel Tank and Lines

Diagnosis and Testing

Principles of Operation

For a detailed description of the fuel tank and lines systems, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Fuel Tank and Lines (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• NOTE: For diagnostic purposes the cylinders are divided into two banks: Bank 1 - Cylinder numbers 1, 2 and 3. Bank 2 - Cylinders 4, 5 and 6

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Fuel leaks • Damaged fuel lines • Damaged push connect fittings • Fuel level • Fuel contamination/grade/quality • Damaged fuel tank filler pipe cap • Damaged fuel tank filler pipe	• Fuses • Loose or corroded electrical connectors • Harnesses • Fuel Pump Driver Module (FPDM) • Central Junction Box (CJB) • Fuel pump relay • Engine Control Module (ECM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	• Engine breather system disconnected/restricted • Ignition system • Fuel system • Electronic engine controls	• Ensure the engine breather system is free from restriction and is correctly installed • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing). • For fuel system tests. Read DTCs and refer to DTC Index in this section • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
Engine cranks and fires, but will not start	• Evaporative emissions purge valve • Fuel pump • Spark plugs • Ignition coil failure(s)	• For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). • For fuel pump tests. Check for DTCs and refer to DTC Index in this section • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing).
Difficult cold start	• Check engine coolant level/anti-freeze content • Battery • Electronic engine controls • Fuel pump • Evaporative emissions purge valve	• Check the engine coolant level and condition. REFER to: Specifications (303-03A Engine Cooling - I6 3.2L Petrol, Specifications). • Ensure the battery is in a fully charged and serviceable condition • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For fuel system tests. Read DTCs and refer to DTC Index in this section • For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing).

Symptom	Possible Cause	Action
Difficult hot start	• Injector leak • Electronic engine controls • Evaporative emissions purge valve • Fuel pump • Ignition system • Injector leak	• Carry out injector leak tests, install new injectors as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation). • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). • For fuel system tests. Read DTCs and refer to DTC Index in this section • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing).
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	• Electronic engine controls • Evaporative emissions purge valve • Fuel pump • Ignition system	• Carry out injector leak tests, install new injectors as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation). • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For purge valve tests. REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). • For fuel system tests. Read DTCs and refer to DTC Index in this section • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing).
Engine stalls soon after start	• Breather system disconnected/restricted • ECM relay • Electronic engine controls • Ignition system • Air intake system restricted • Air leakage • Fuel lines	• Ensure the engine breather system is free from restriction and is correctly installed • For ECM relay and electronic engine controls tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing). • Check for blockage in air cleaner element and air intake system • Check for leakage in air intake system • For fuel line tests. GO to Pinpoint Test A.
Engine hesitates/poor acceleration	• Fuel pressure, fuel pump, fuel lines • Injector leak • Air leakage • Electronic engine controls • Ignition system • Transmission malfunction • Restricted pedal travel (carpet, etc)	• For fuel pressure tests. GO to Pinpoint Test B. For fuel line tests. GO to Pinpoint Test A. For fuel pump tests, check DTCs and refer to DTC Index in this section • Carry out fuel injector leak tests, install new injectors as necessary. REFER to: Fuel Injector (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation). • Check for leakage from air intake system • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing). • For transmission system tests. REFER to: Diagnostics (307-01 Automatic Transmission/Transaxle, Diagnosis and Testing). • Ensure accelerator pedal is free from restriction
Engine backfires	• Fuel pump, fuel lines • Air leakage • Electronic engine controls • Ignition system • Sticking variable camshaft timing (VCT) hub	• For fuel pump tests. Read DTCs and refer to DTC Index in this section. For fuel line tests. GO to Pinpoint Test A. • Check for leakage from air intake system • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For ignition system tests. REFER to: Engine Ignition (303-07A Engine

Symptom	Possible Cause	Action
		• Ignition, Diagnosis and Testing). • For VCT system tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
Engine surges	• Fuel pump, fuel lines • Electronic engine controls • Ignition system	• For fuel pump tests, read DTCs and refer to DTC Index in this section. For fuel line tests. GO to Pinpoint Test A. • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For ignition system tests. REFER to: Engine Ignition (303-07A Engine Ignition, Diagnosis and Testing).
Engine detonates/knocks	• Electronic engine controls • Fuel pump, fuel lines, fuel quality • Air leakage • Sticking VCT hub	• For electronic engine control tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). • For fuel pump tests, read DTCs and refer to DTC Index in this section. For fuel line tests. GO to Pinpoint Test A. • Check for leakage from air intake system • For VCT system tests. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).

DTC Index

• NOTE: If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to section 100-00.
REFER to:

Diagnostic Trouble Code (DTC) Index - I6 3.2L Petrol, DTC: Engine Control Module (ECM) (100-00 General Information, Description and Operation),
Diagnostic Trouble Code (DTC) Index - I6 3.2L Petrol, DTC: Engine Control Module (ECM) - From 10MY (100-00, Description and Operation).

PINPOINT TEST A : CHECK THE FUEL LINES	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE FUEL LINES FOR RESTRICTIONS	
	WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.
	1 Detach the fuel line from the fuel rail and from the fuel pump module.
	2 Using an air line gently blow through the line checking for blockages or restrictions.
	Is a blockage or restriction evident? **Yes** CLEAR/REPAIR the blocked or restricted fuel line and test the system for normal operation. **No** GO to A2.
A2: CHECK THE FUEL TANK LINES FOR RESTRICTIONS	
	1 Remove the fuel pump module locking ring. REFER to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).
	2 Detach the fuel lines from the fuel pump module.
	3 Using an air line gently blow through the tank lines checking for blockages or restrictions.

	Is a blockage or restriction evident? **Yes** CLEAR/REPAIR the blocked or restricted fuel line and test the system for normal operation. **No** CHECK for DTCs and symptoms indicating another cause for the problem. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).

PINPOINT TEST B : CHECK THE FUEL SYSTEM PRESSURE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE PUMP ACTIVITY	
	1 Remove the rear seat cushion. REFER to: Rear Seat Cushion (501-10 Seating, Removal and Installation).
	2 Set ignition status to ON, engine OFF.
	3 Listen for pump noise.
	Can the fuel pump be heard running? **Yes** GO to B2. **No** CHECK for DTCs. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
B2: CHECK THE FUEL SYSTEM PRESSURE	
	WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.
	1 Make sure the vehicle is in **Park** and apply the parking brake.
	2 Set ignition status to OFF
	• NOTE: Place suitable absorbent material around the Schraeder valve to absorb any spillage when connecting the gauge set.
	3 Connect adapter 310-162 and gauge assembly 310-116 to the fuel Schraeder valve. Remove the absorbent material and dispose of safely.
	4 Disconnect and plug the vacuum hose from the pressure regulator.
	5 Open the valve on the fuel pressure gauge and adapter 310-116/162.
	6 Set ignition status to ON, engine OFF.
	7 Record the fuel pressure reading.
	Is the fuel pressure 3.6 - 4.2 bar (52.2 - 60.9 lb/in²)? **Yes** GO to B3. **No** CHECK for DTCs. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
B3: CHECK THE FUEL SYSTEM PRESSURE WITH THE ENGINE CRANKING	
	1 Apply footbrake and press start button.
	2 Record the fuel pressure reading when engine cranking.
	Is the fuel pressure 3.6 - 4.2 bar (52.2 - 60.9 lb/in²)? **Yes** GO to B4. **No** CHECK for DTCs. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing).
B4: CHECK THE FUEL SYSTEM PRESSURE WITH THE ENGINE IDLING (WHERE POSSIBLE)	
	1 With engine running.
	Is the fuel pressure 3.6 - 4.2 bar (52.2 - 60.9 lb/in²)? **Yes** CHECK for DTCs and symptoms indicating another cause of the problem. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing). **No** CHECK the fuel pump module power and ground circuits.

Published: 11-May-2011

Fuel Tank and Lines - I6 3.2L Petrol - Fuel Filter Element

Removal and Installation

Special Tool(s)

	310-123 Locking Ring, Fuel Tank

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

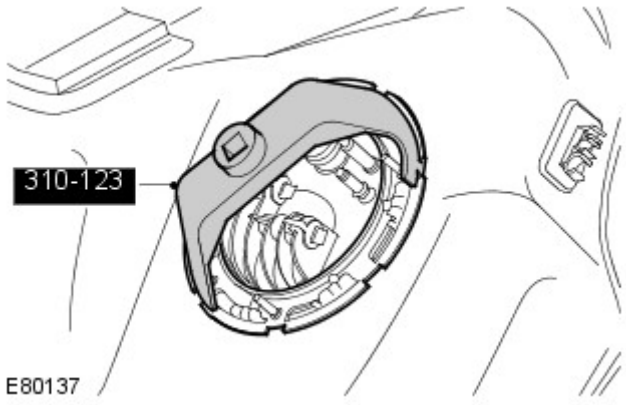
2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the fuel tank.

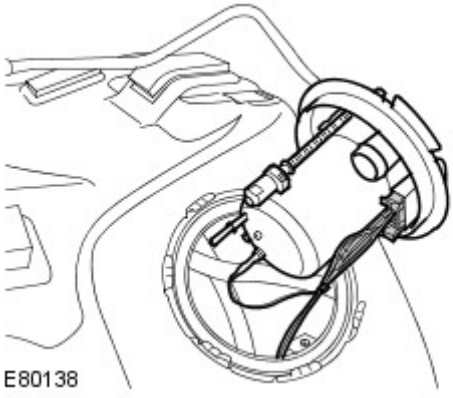
   Refer to: Fuel Tank (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).

4. Remove the fuel tank pad.

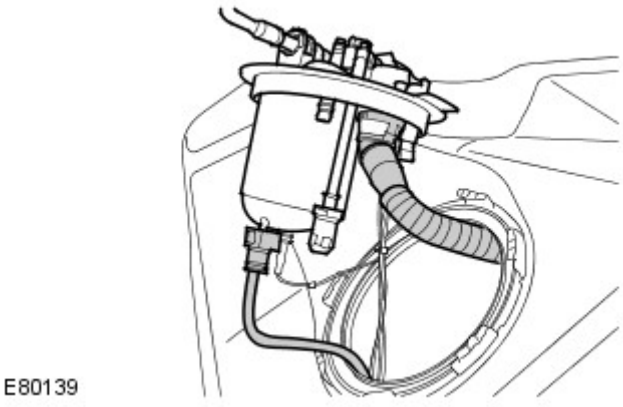


5. **5.** CAUTION: Extreme cleanliness must be exercised when handling these components.
   - Remove the fuel pump module locking ring.

     Special Tool(s): 310-123
   - *Torque:* 200 Nm



6. **6.** CAUTION: A new O-ring seal is to be installed.



7.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Tank and Lines - I6 3.2L Petrol - Fuel Tank

Removal and Installation

Special Tool(s)

	310-123 Locking Ring, Fuel Tank

General Equipment

Powertrain Jack

Removal

- WARNINGS:

Fuel may still be present in the fuel tank after draining.

Avoid flames, sparks or lighted substances.

- CAUTIONS:

Extreme cleanliness must be exercised when handling these components.

Make sure that all openings are sealed. Use new blanking caps.

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

All vehicles

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Drain the fuel tank.

   Refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

3. Remove the coin tray.

4. Release the adjusting nut and disconnect the parking brake cables from the compensator.

5. Fold the RH rear seat cushion forwards.

6. Release the carpet and remove the grommet.

Vehicles with fuel fired heater

7. **7.** CAUTIONS:

⚠ Extreme cleanliness must be exercised when handling these components.

⚠ Make sure that all openings are sealed. Use new blanking caps.

All vehicles

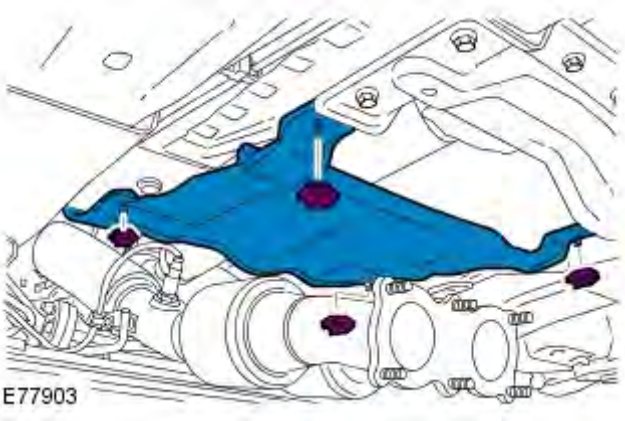
8. Disconnect the electrical connector and the breather hose.

9. **9.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

10. Remove the exhaust system.

    Refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).



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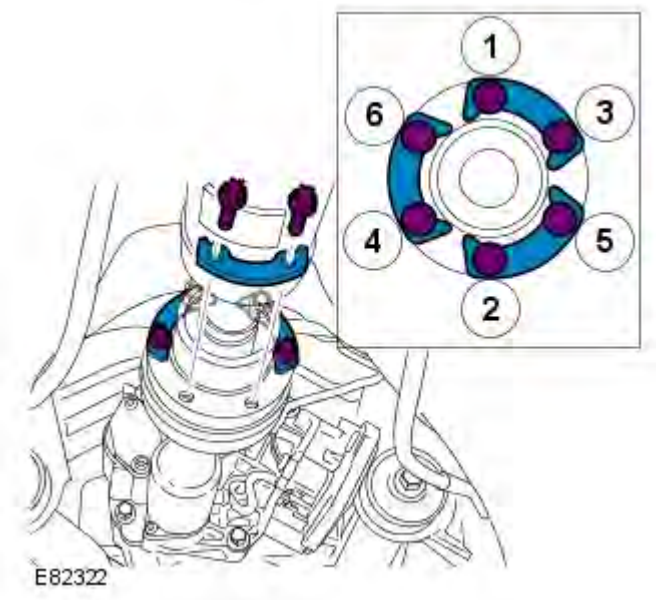


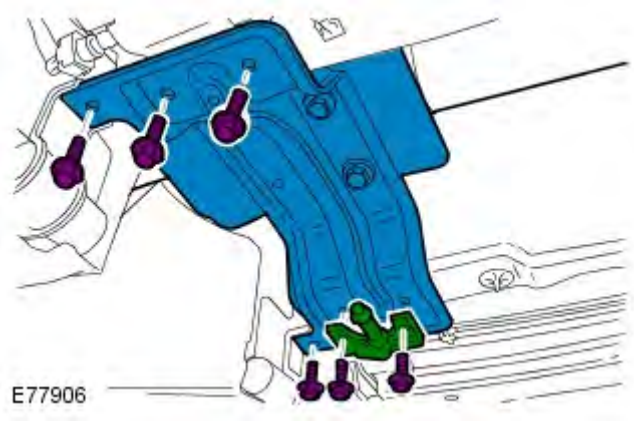
12. **12.** WARNING: Do not lever the driveshaft joints to release from the power transfer unit or the rear differential flanges.

    • CAUTIONS:

    Make sure that the driveshaft is supported with suitable retaining straps.

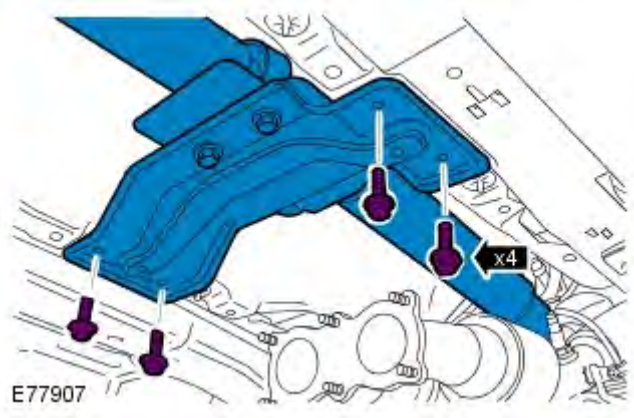
    Make sure that new bolts are installed.

    Torque: 40 Nm



13. **13.** NOTE: All vehicles built up to VIN 180237

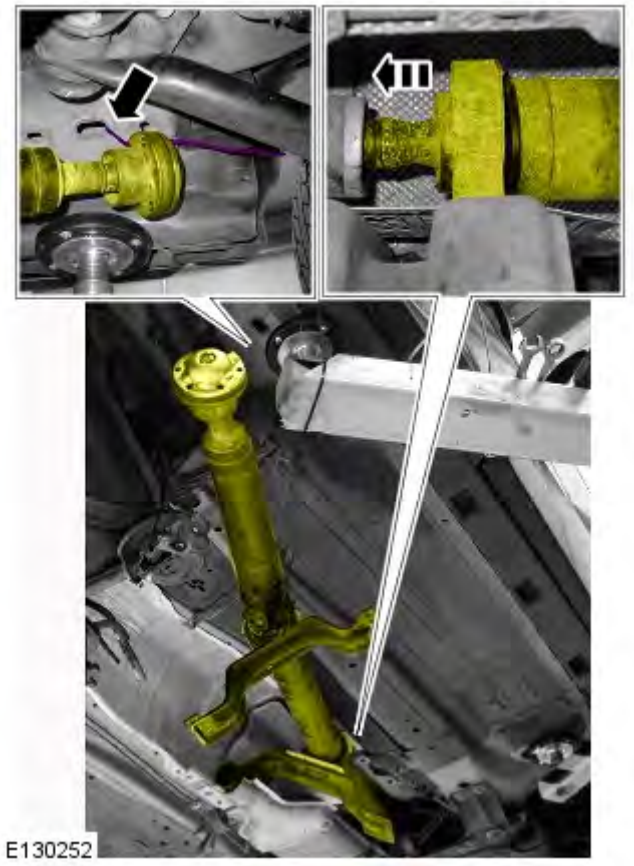
    - *Torque:* 25 Nm



14. **14.** NOTE: All vehicles.

    • NOTE: This step requires the aid of another technician.

    - *Torque:* 25 Nm



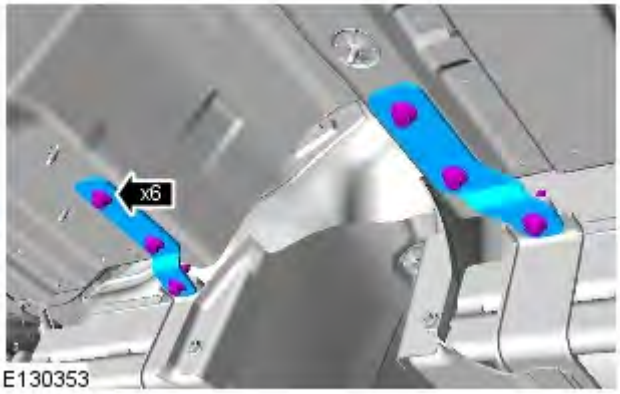
15. **15.** CAUTIONS:

    Make sure that the centre driveshaft joint is compressed. Failure to follow this instruction may result in damage to the component.

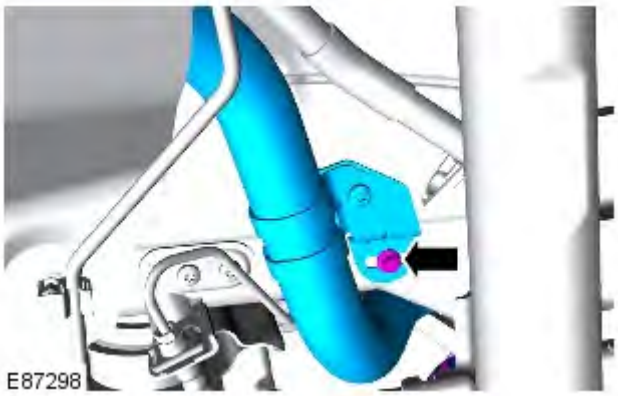
    To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

    • NOTE: This step requires the aid of another technician.

    - Compress the propshaft centre joint.
    - Tie the propshaft to the right hand side of the vehicle.



16. **16.** NOTE: Si6 built from VIN 180238
    - *Torque:* 25 Nm



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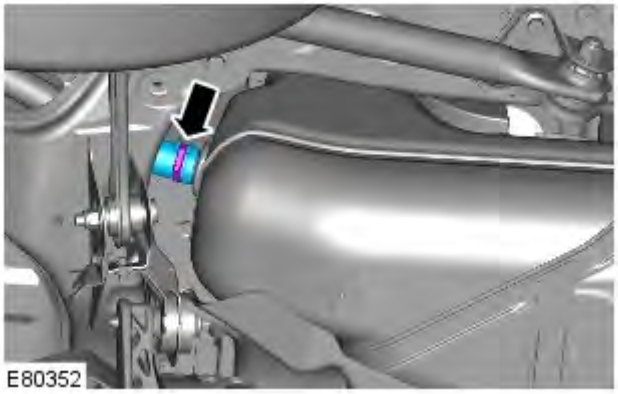

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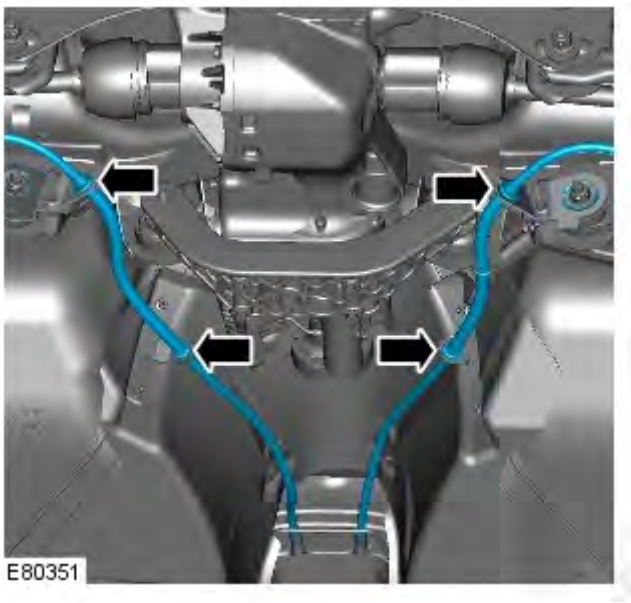
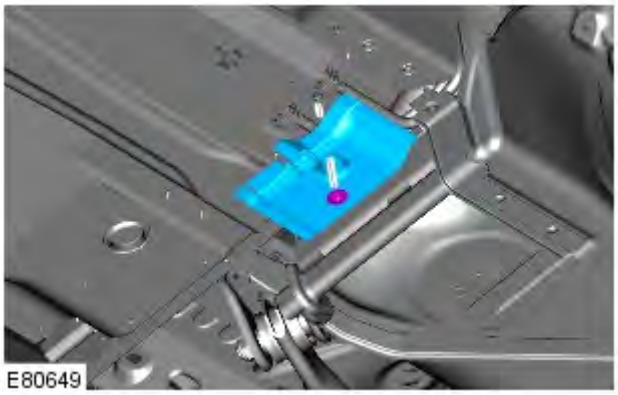
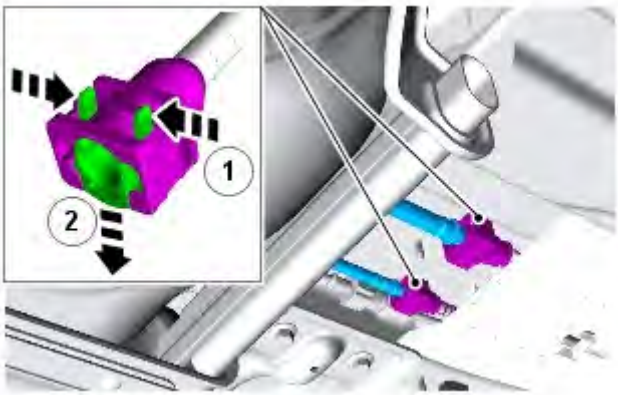


19. Release the parking brake cables from the fuel tank cradle.



20. Remove the fuel line cover.



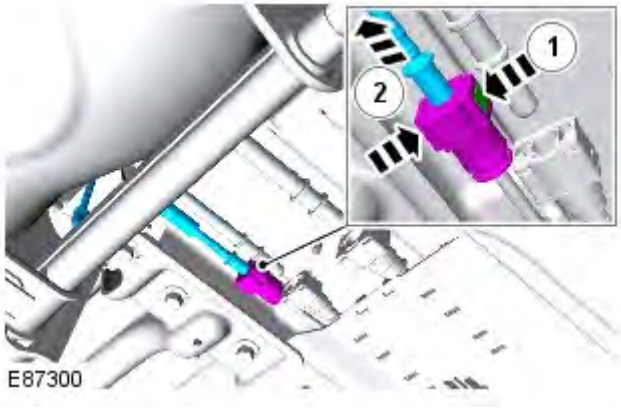
21. **21.** CAUTIONS:

⚠ Extreme cleanliness must be exercised when handling these components.

⚠ Make sure that all openings are sealed. Use new blanking caps.

Disconnect the 2 fuel lines.

Vehicles with fuel fired heater



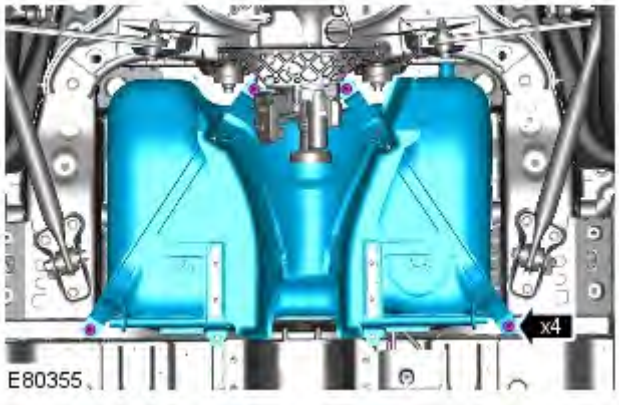
22. **22.** CAUTIONS:

⚠ Extreme cleanliness must be exercised when handling these components.

⚠ Make sure that all openings are sealed. Use new blanking caps.

All vehicles

23.



24. **24.** ⚠ WARNING: This step requires the aid of another technician.

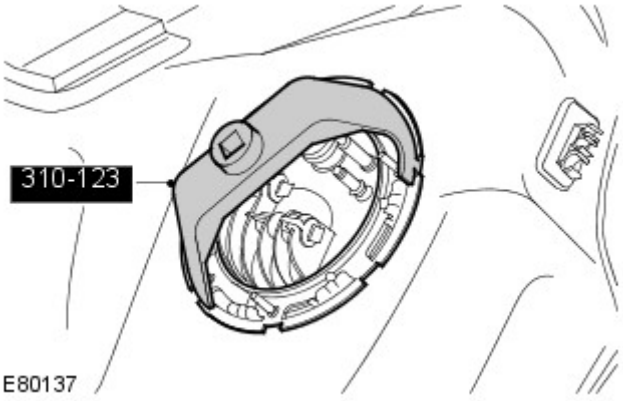
⚠ CAUTION: Make sure that new bolts are installed.

Remove the fuel tank.

General Equipment: Powertrain Jack
Torque: 25 Nm

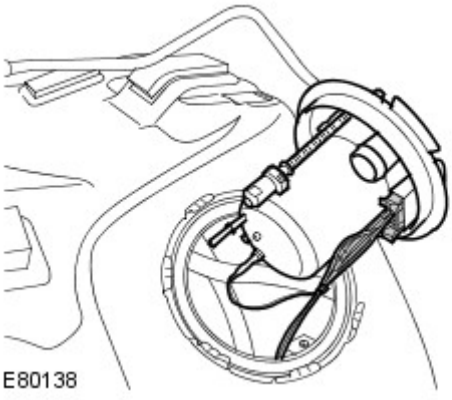
25. **25.** NOTE: Do not disassemble further if the component is removed for access only.

Remove the fuel tank pad.



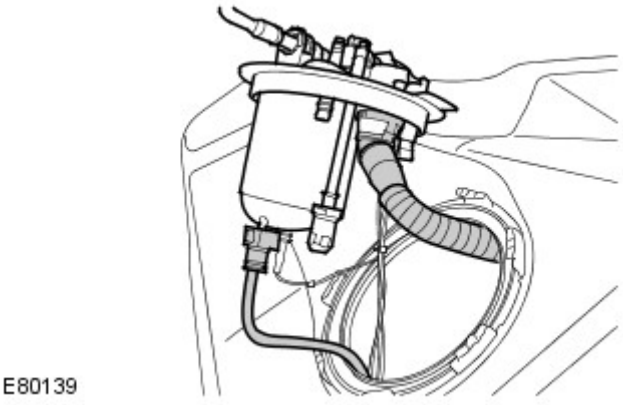
26. **26.** CAUTION: Extreme cleanliness must be exercised when handling these components.
    - Remove the fuel pump module locking ring.

      Special Tool(s): 310-123
    - *Torque:* 200 Nm



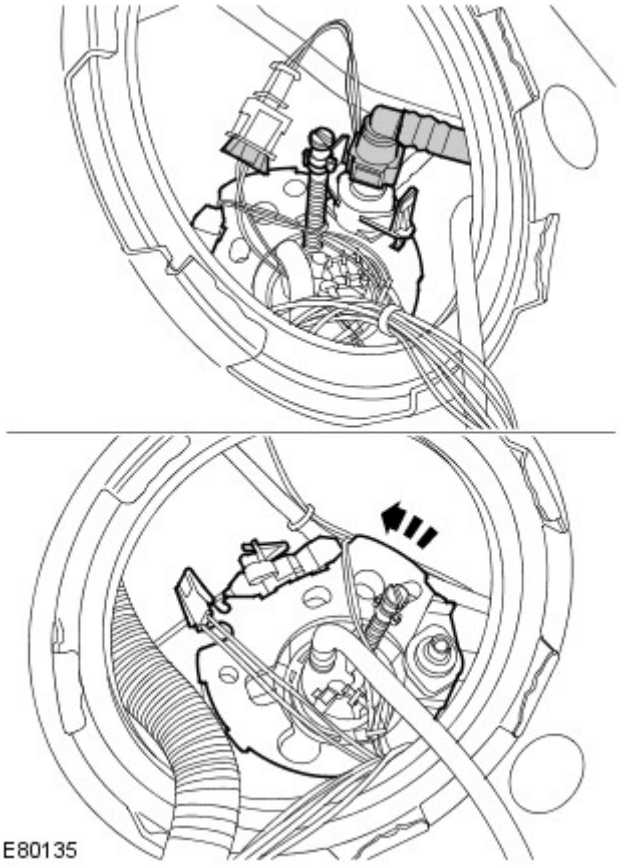
27. **27.** CAUTION: A new O-ring seal is to be installed.

    Release the fuel filter.



28. **28.** NOTE: Petrol illustration shown, diesel similar.

    Remove the fuel filter.


E80135

29. **29.** NOTE: Petrol illustration shown, diesel similar.

    Remove the fuel pump module.

E80145

30.

- Push down to release the fuel sender from clip.
- Slide fuel sender assembly forward to release from the bracket.
- Manoeuvre fuel sender out of the tank.

E80354

31. Remove the fuel tank cradle.

Installation

1. To install, reverse the removal procedure.

2. Refill the fuel tank.

3. Adjust the parking brake.

   Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

Published: 11-May-2011

Fuel Tank and Lines - I6 3.2L Petrol - Fuel Tank Filler Pipe

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

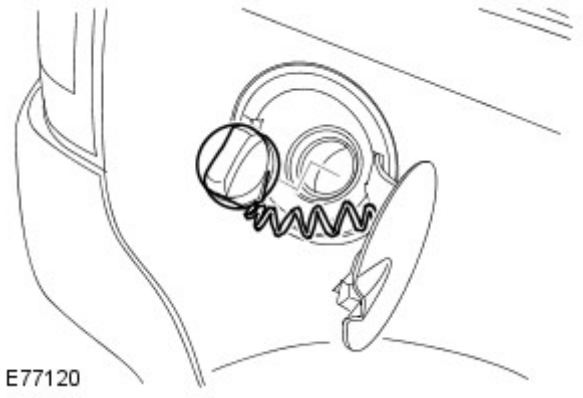
1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the rear wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3.



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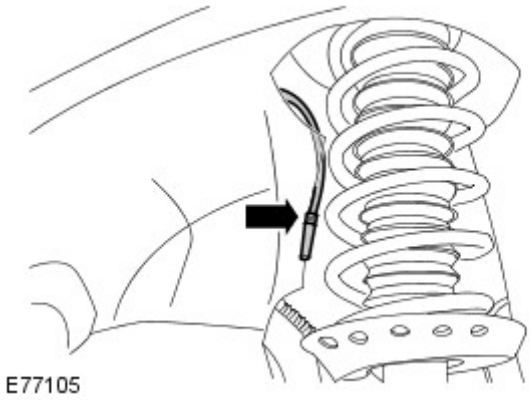

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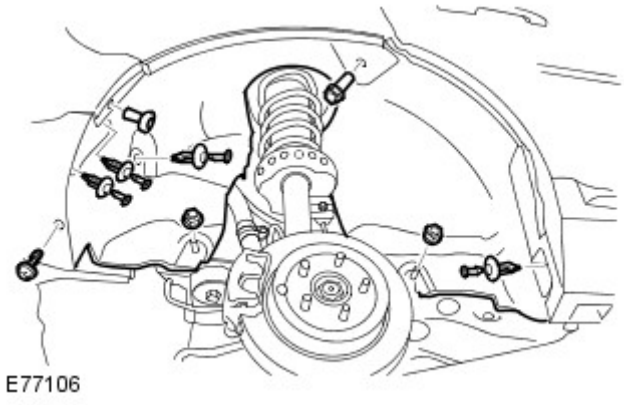
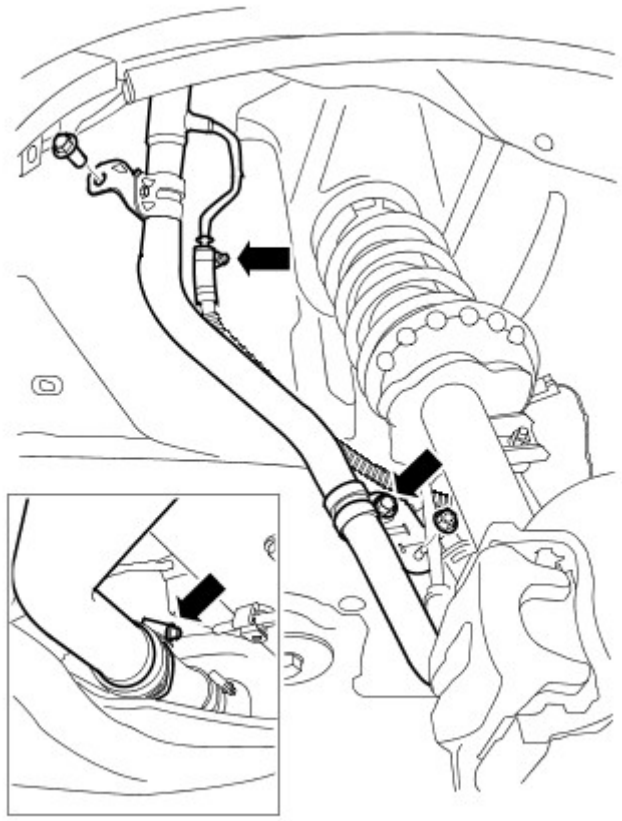


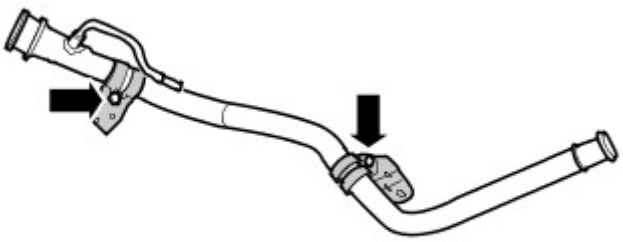


E77107

6.
- Remove the nut and bolt securing the fuel tank filler pipe to the body.

Torque: 10 Nm
- Loosen the fuel tank filler pipe lower bracket.

Torque: 10 Nm
- Loosen the clip and disconnect the fuel filler hose from the fuel tank.
- Loosen the clip and disconnect fuel filler pipe vent hose.



E77108

7. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Tank and Lines - I6 3.2L Petrol - Fuel Pump and Sender Unit

Removal and Installation

Removal

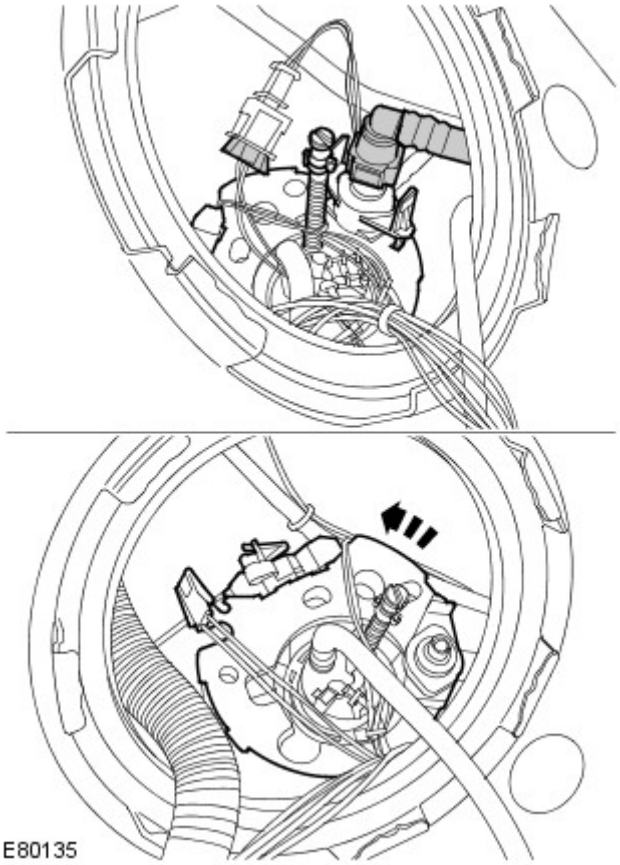
- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the fuel filter.

   Refer to: Fuel Filter Element (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).



3. **3.** CAUTION: Extreme cleanliness must be exercised when handling these components.

   Remove the fuel pump module.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Tank and Lines - I6 3.2L Petrol - Fuel Level Sender

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the fuel pump module.

   Refer to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).

4. Remove the LH fuel level sender.

Installation

1. To install, reverse the removal procedure.

Published: 08-Dec-2011

Fuel Tank and Lines - I6 3.2L Petrol - Fuel Pump and Sender Unit Filter

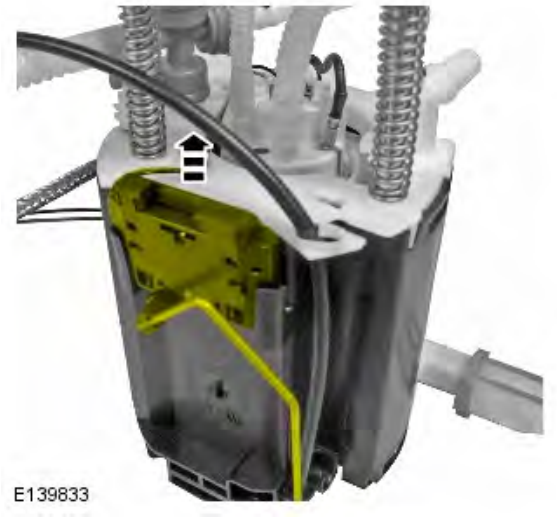
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

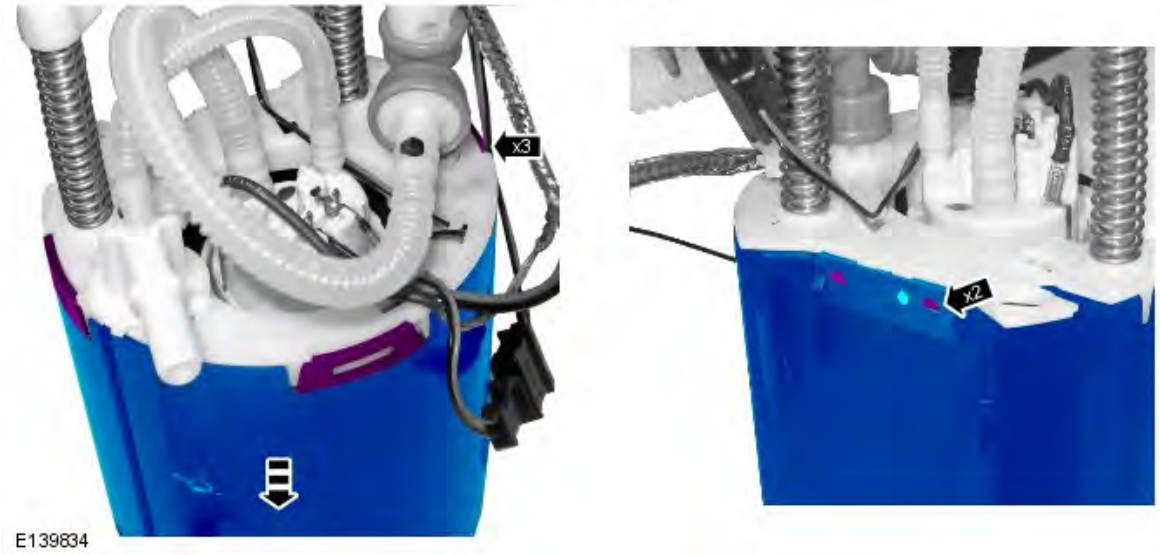
1. Refer to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).

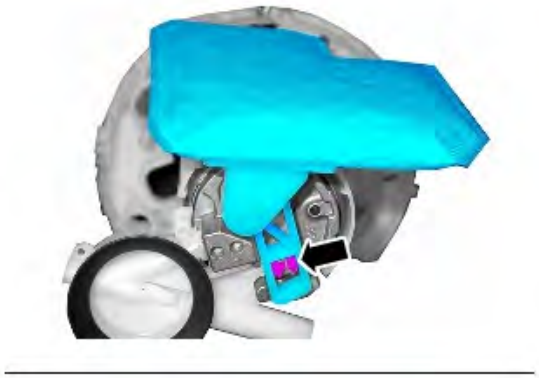
2.



3. **3.** CAUTION: Care must be taken not to damage the component.

   Using a suitable screwdriver, release the locking tangs and remove the housing.





E140646

4. **4.** CAUTION: Make sure that the fuel pump and sender unit filter remains located behind the lip of the fuel pump and sender unit prior to installation.

   • NOTE: Note the orientation of the component prior to removal.

   Release the locking tangs and remove the filter from the fuel pump and sender unit.

Installation

E139837

1. **1.** CAUTION: Install the magnet from the service kit. If the magnet has already been installed, check the magnet for foreign material and remove as necessary.

2. **2.** CAUTIONS:

   Make sure that all components are installed fully home to the fuel pump and sender unit.

   Make sure that the components are installed to the noted position in the removal steps.

   To install, reverse the removal procedure.

Published: 24-Oct-2011

Fuel Tank and Lines - I6 3.2L Petrol - Fuel Pump and Sender Unit Filter Magnet

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).

2.

Installation

1. **1.** CAUTION: Make sure that the component is installed fully home to the fuel pump and sender unit.

   To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Tank and Lines - TD4 2.2L Diesel -

Capacities

Item	Capacity (liters/gallons)
Fuel tank	68.0/14.9

General Specification

Item	Specification
Fuel delivery module	PAG Module
Location	in the RH side of the tank
Maximum output @12.5 volts	160l/hr
Operating pressure	0.2 Bar
Fuel tank sender units	MAgnetic Passive Position Sensor (MAPPS)

Torque Specifications

Description	Nm	lb-ft
Degas nipple	15	11
Fuel filter brackets	25	18
Fuel filter cover nuts	9	7
Fuel filter to retaining bracket bolt	9	7
Fuel pressure pipe to block	10	7
Fuel pump bolts	22	16
Fuel tank bolts*	25	18
Fuel tank filler pipe brackets	10	7

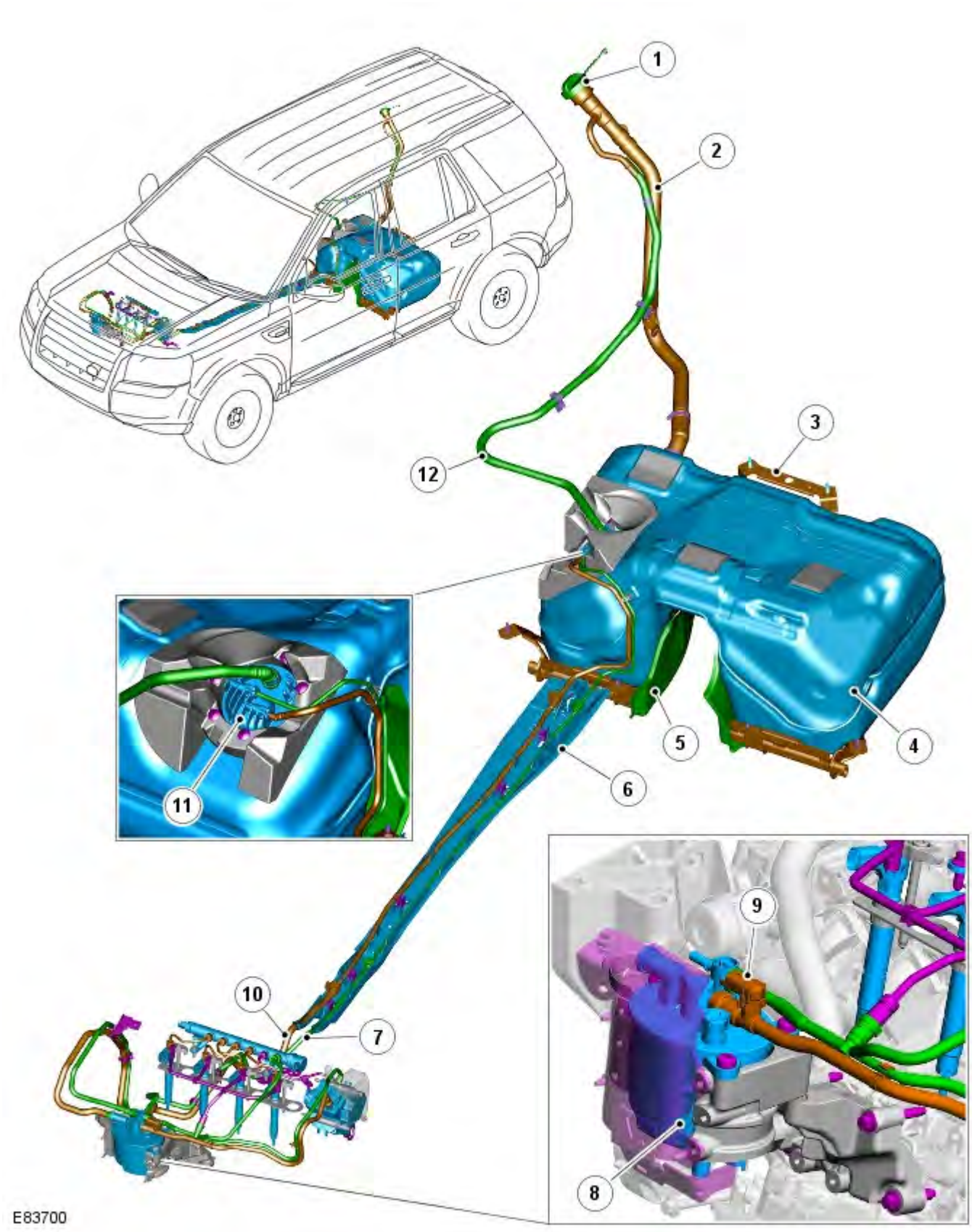
*** New nuts/bolts must be fitted**

Published: 11-May-2011

Fuel Tank and Lines - TD4 2.2L Diesel - Fuel Tank and Lines

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Fuel tank filler cap and lanyard
2	-	Fuel tank filler pipe
3	-	Fuel tank support cradle
4	-	Fuel tank

5	-	Exhaust heat shield
6	-	Fuel line underfloor protection tray
7	-	Fuel return line
8	-	Fuel filter assembly
9	-	Fuel temperature sensor
10	-	Fuel supply line
11	-	Fuel delivery module
12	-	Hose - fuel tank breather

OVERVIEW

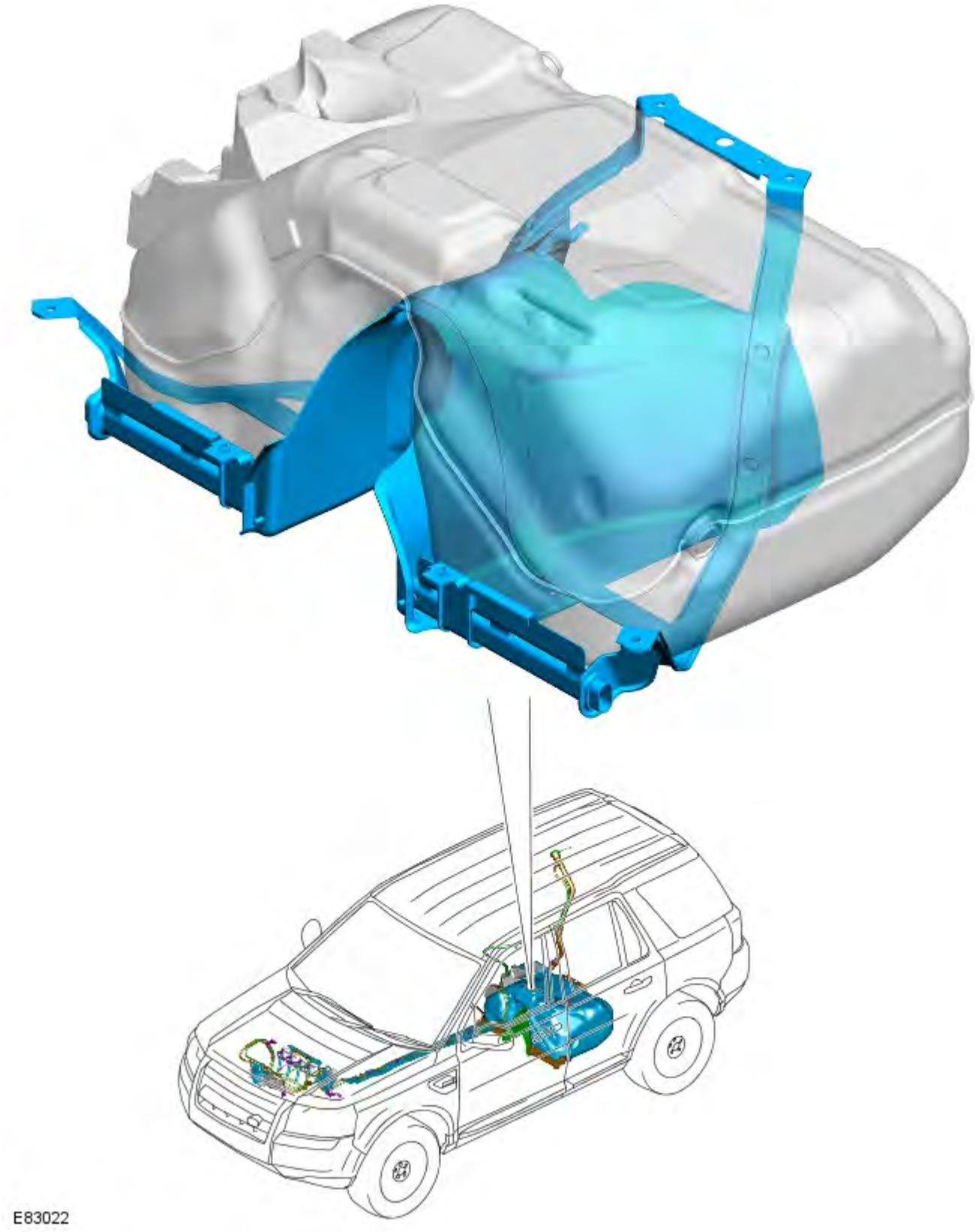
The TD4 diesel fuel system incorporates a low and high-pressure (HP) circuit to provide the engine with sufficient fuel for all operating conditions. The low-pressure (LP) system comprises:

- Molded plastic saddle-type fuel tank
- Fuel delivery module (with integral in-tank pump)
- Fuel level sensors
- Fuel supply and return lines
- Fuel filter assembly.

• NOTE: Fuel is drawn from the fuel tank by the engine mounted lift pump. The in-tank pump does not deliver fuel to the engine, and only delivers fuel through the 2 jet pumps to maintain fuel in the fuel delivery pot.

The HP system features a Bosch Generation 3 common rail injection system.
For additional information, refer to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Description and Operation).

FUEL TANK CONSTRUCTION



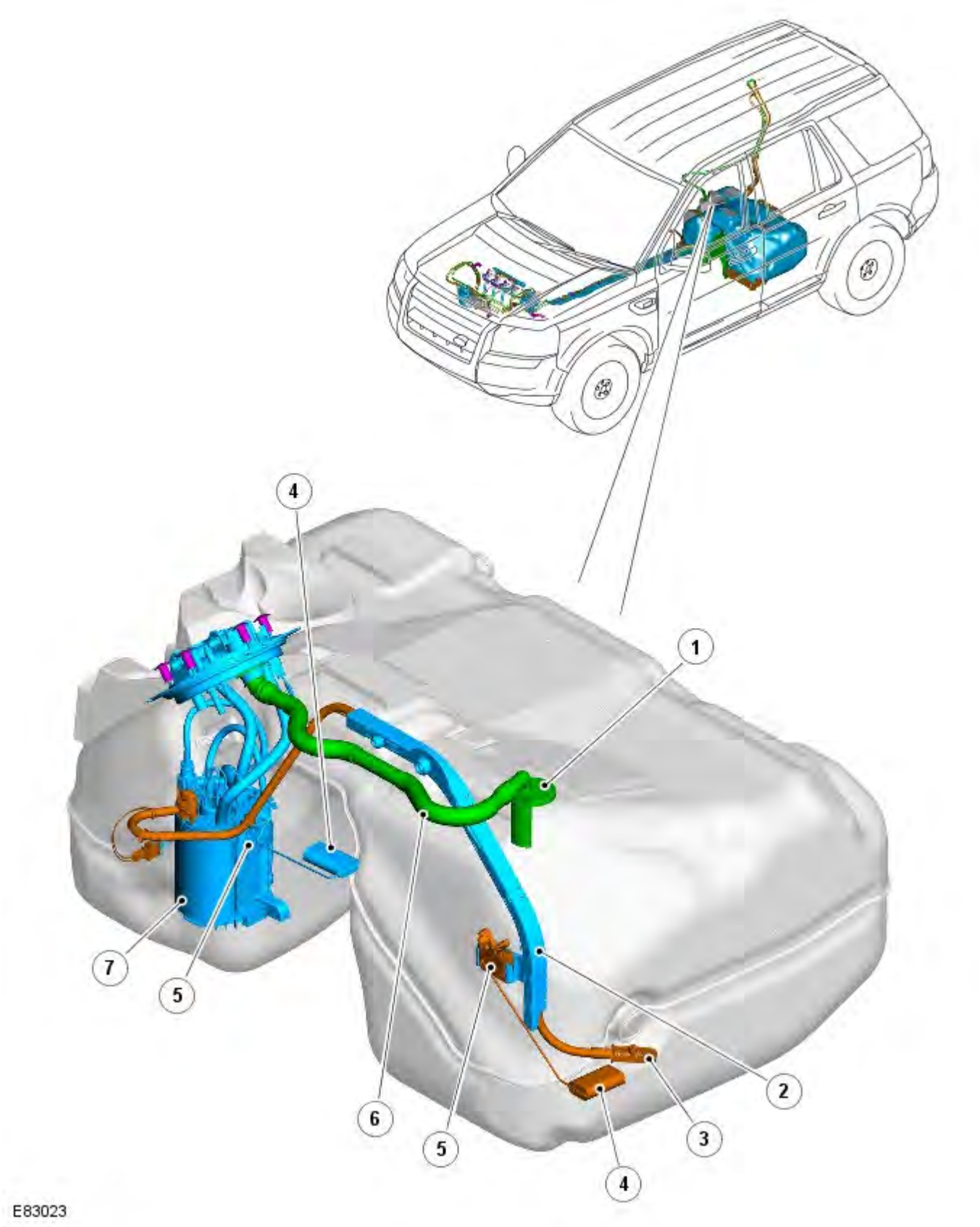
The fuel tank has a useable capacity of 68.0 liters (18.0 US gallons) and is designed with a run dry strategy to prevent air entering the HP fuel system. The tank is formed from a 6-layer laminated blow-molded plastic to provide high mechanical strength and complete emissions integrity. The tank is a sealed unit with internal access being via the fuel delivery module aperture located on the Right-Hand (RH) side of the tank.

The fuel tank is located centrally below the rear seat position and is formed to straddle the driveshaft and exhaust system.

A mounting cradle and 6 bolts secure the fuel tank to the vehicle. When the cradle is attached to the chassis, the tank is positively secured via foam pads that bear against the underfloor. The cradle is manufactured from steel and incorporates large diameter steel tubing to protect the fuel tank leading edge from underbody damage. The cradle also provides the location for the parking brake cable brackets.

A saddle shaped heat shield is attached to the cradle to protect the fuel tank from exhaust system temperature.

FUEL TANK INTERNAL COMPONENTS



Item	Part Number	Description
1	-	Fuel tank breather valve
2	-	Crossover tube
3	-	Coarse filter
4	-	Fuel sender unit float (2 off)
5	-	MAgnetic Passive Position Sensor (MAPPS) fuel sender unit (2 off)
6	-	Fuel tank breather hose
7	-	Fuel delivery module

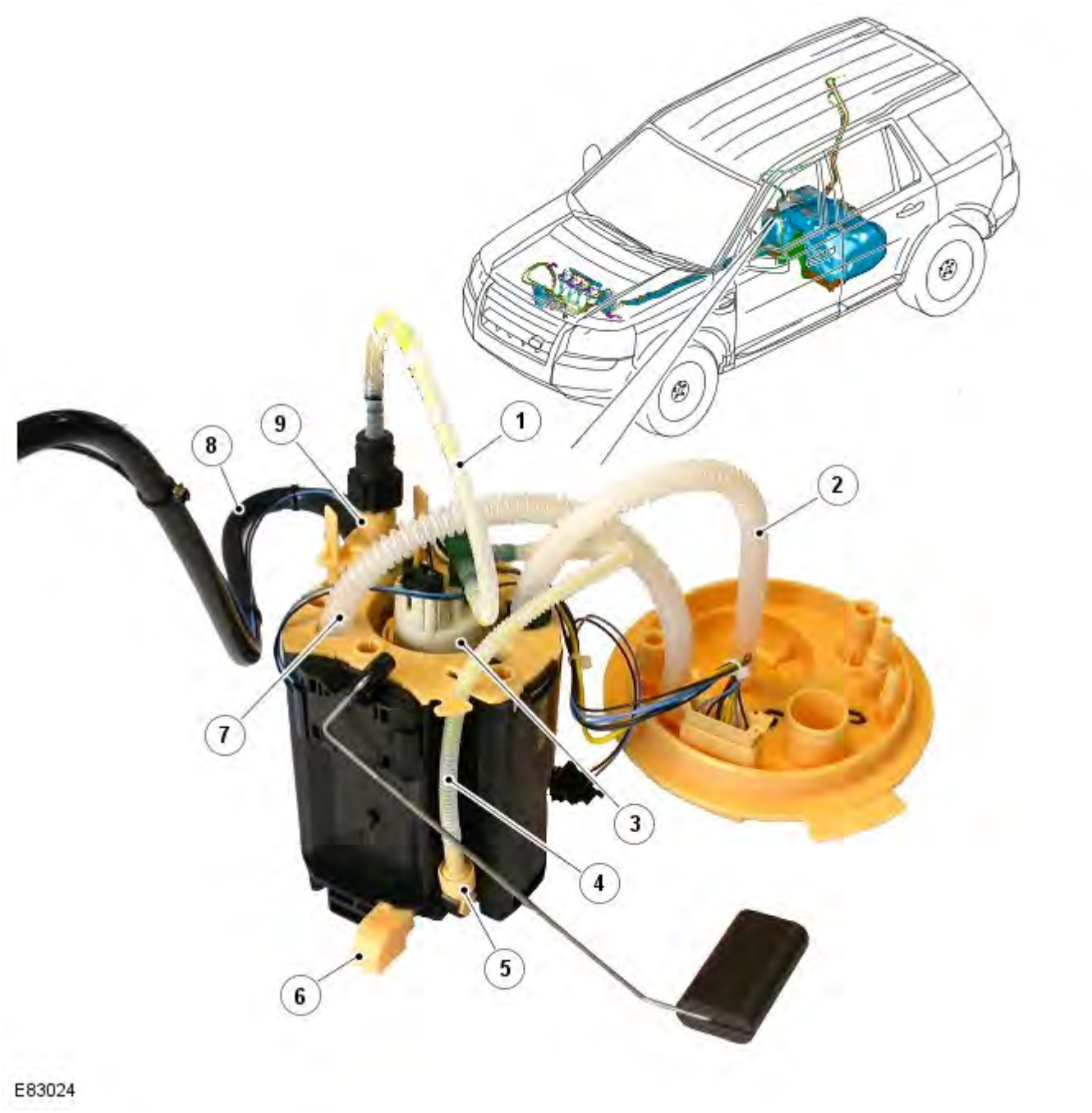
The fuel tank comprises the following internal components:

- Internal mounting bracket
- Fuel delivery module and crossover tube
- 2 MAPPS type fuel sender units
- Breather valve.

Internal Mounting Bracket

The internal mounting bracket is molded into the tank casing and provides the location for the breather valve, and crossover tube assembly.

Fuel Delivery Module



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Item	Part Number	Description
1	-	In-tank pump supply to jet pump
2	-	Fuel supply to engine fuel filter
3	-	In-tank pump
4	-	In-tank pump supply to jet pump
5	-	Jet pump (usable side of tank)
6	-	Inlet from usable side of tank
7	-	Return fuel from engine fuel filter
8	-	Crossover tube (from unusable side of tank)
9	-	Jet pump (unusable side of tank)

The fuel delivery module is located in the RH side of the tank, and is secured to the bottom of the tank with a welded bayonet-type lock ring. The top flange of the fuel delivery module assembly provides the internal and external interface for the tank electrical and fuel connections. The flange is formed with a 6-pin external electrical connector that is connected to the 2 MAPPS fuel level sensors, and the in-tank pump.

The fuel delivery module flange is sealed to the tank with an O-ring and secured with a locking ring.

The lower part of the fuel delivery module forms the fuel delivery pot, and provides the location for the in-tank pump and the 2 jet pumps. The delivery pot provides a constant reservoir of fuel for the engine drawn fuel supply. The engine fuel supply and return lines are immersed in the delivery pot.

The delivery pot is maintained full by the 2 jet pumps. The in-tank pump draws fuel from within the fuel delivery pot and forces the fuel through the 2 jet pumps. The flow of fuel through each jet pump creates a venturi effect that draws fuel from both sides of the fuel tank into the fuel delivery pot. Surplus fuel entering the fuel delivery pot overflows into the usable side of the fuel tank.

A valve is located in the lower (usable tank side) jet pump supply orifice. The valve is open when the in-tank pump is energized and the lower jet pump is supplying fuel into the fuel delivery pot. The valve will close when the in-tank pump is de-energized to prevent fuel draining from the fuel delivery pot.

The in-tank pump is energized by the fuel pump relay located in the Central Junction Box (CJB). The Engine Control Module (ECM) energizes the fuel pump relay at all times when the ignition is in power modes 4 (Accessory) to 9 (Engine crank).
For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

A modified fuel delivery module is installed for cold climate market vehicles that feature a fuel fired booster heater and auxiliary fuel pump. The modified fuel delivery module incorporates a separate fuel supply line that connects to an auxiliary fuel pump, mounted on the exterior RH side of the tank. An additional fuel line connects the auxiliary fuel pump to the fuel fired booster heater.
For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Description and Operation).

Fuel Sender Units

The 2 MAPPS fuel sender units are located on either side of the saddle shaped tank, and connect to the internal electrical connections on the fuel delivery module flange. Each sensor provides an electrical signal to the CJB that is proportionate to the fuel level in each side of the tank.

The actual fuel level in the tank is calculated by the CJB and transmitted via the medium speed Controller Area Network (CAN) bus to the instrument cluster.

A warning lamp is incorporated in the instrument cluster and will illuminate when the fuel level is at, or below a predetermined level. On vehicles with a high-line instrument cluster, a message is displayed and a chime is sounded to inform the driver to refuel.

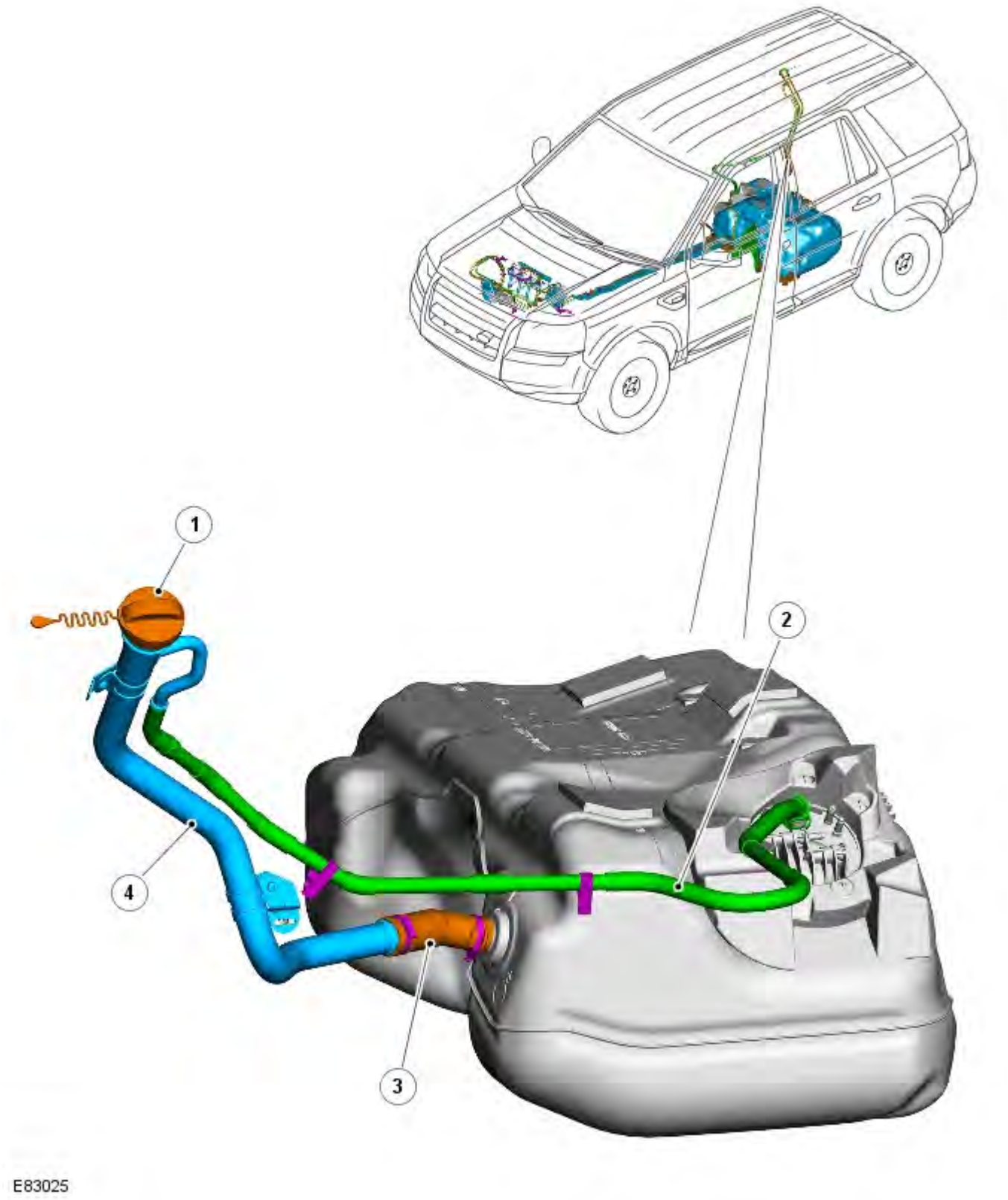
For additional information, refer to:

Instrument Cluster (413-01 Instrument Cluster, Description and Operation),
Information and Message Center (413-08 Information and Message Center, Description and Operation).

Fuel Tank Breather Valve

The breather valve is located in the fuel tank and is connected to the fuel delivery module flange via an internal breather hose. The breather valve allows air to escape and enter the fuel tank to compensate for the changing volume within the tank.

FUEL TANK FILLER



Item	Part Number	Description
1	-	Filler cap and lanyard
2	-	Tank external breather hose
3	-	Filler pipe stub hose
4	-	Filler pipe

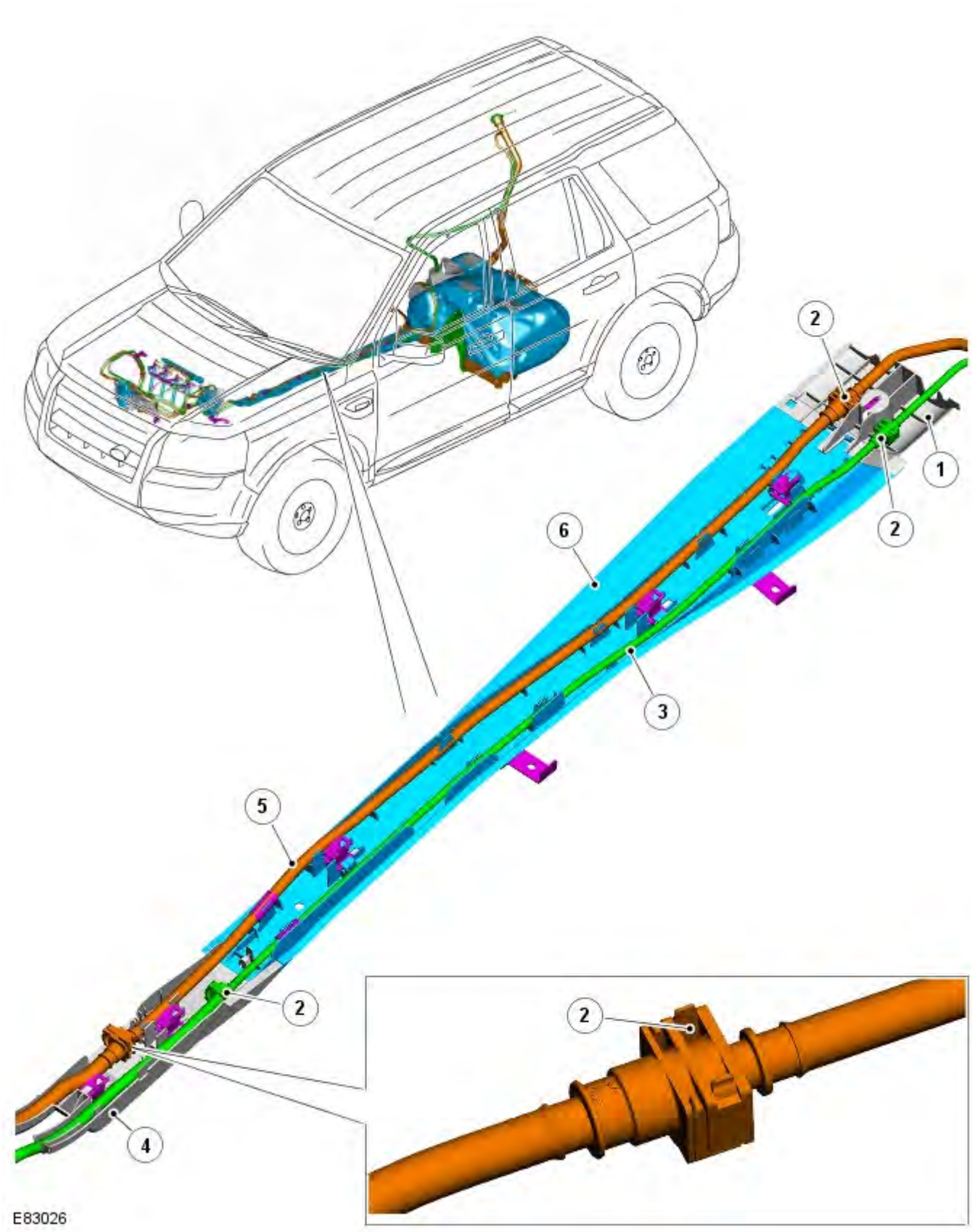
The fuel tank is filled through an aluminum filler pipe that is connected via a molded rubber stub hose to the rear RH side of the tank. A screw cap is installed to seal the filler pipe opening.

An inline check valve is mounted inside the filler pipe stub hose at the tank, and is retained in the closed position by a spring. The check valve is only opened when the vehicle is refueled. The check valve minimizes fuel spillage in the event that the filler pipe is damaged during an accident.

A breather hose is routed from the fuel filler pipe to the fuel delivery module flange. The breather hose connects to the

breather pipe on the fuel delivery module flange.

FUEL LINES



Item	Part Number	Description
1	-	Rear access cover
2	-	Quick-fit type connector (4 off)
3	-	Fuel return line
4	-	Front access cover
5	-	Fuel supply line
6	-	Underfloor protection tray

The fuel supply and return lines are routed along the vehicle underfloor, and housed within a plastic protection tray. The

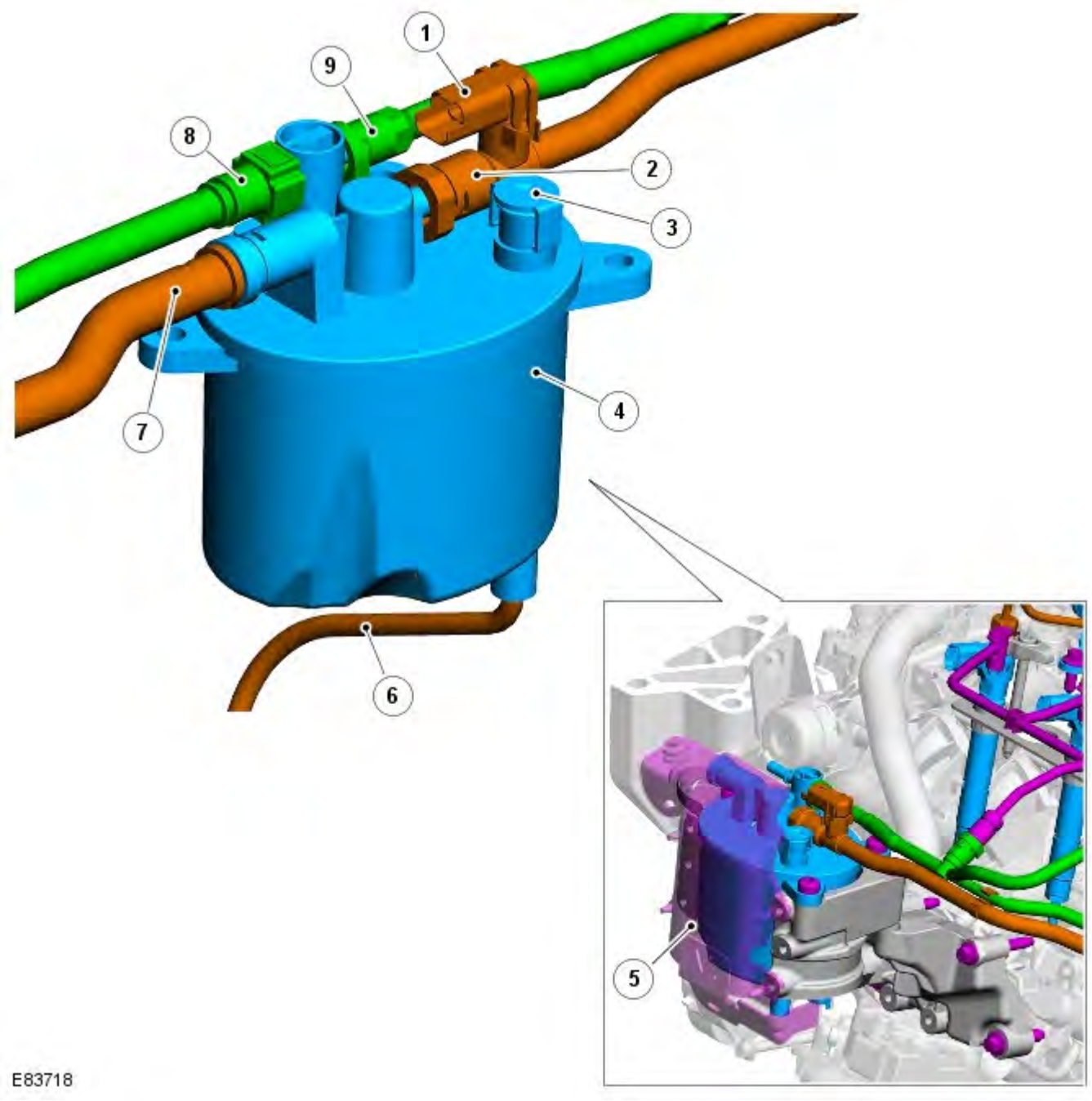
protection tray is secured with integral clips on the inside of the tray to studs along the underfloor.

CAUTION: The fuel line quick-fit type connector is a new design connector installed to the TD4 vehicle. During maintenance procedures the quick-fit type connector must be released and connected correctly to prevent fuel leakage. Use the correct method detailed in the relevant section of the Service Repair Manual (SRP) to release and connect the connector. Incorrect operation of the quick-fit type connector will result in damage to the connector and cause fuel leakage.

The quick-fit type fuel connector is not a self sealing connector, and will not prevent fuel flow when disconnected.

The fuel supply and return lines are connected at each end with a quick-fit type connector. The connector is not self-sealing and will not prevent fuel flow when the fuel line is separated.

FUEL FILTER ASSEMBLY



Item	Part Number	Description
1	-	Fuel temperature sensor
2	-	Fuel supply to HP pump
3	-	Water drain screw
4	-	Fuel filter canister
5	-	Fuel canister crash shield
6	-	Water drain point
7	-	Fuel supply from tank
8	-	Fuel return to tank
9	-	Fuel return from HP fuel system

The fuel filter canister is located at the front RH side of the engine compartment, and mounted within an engine support

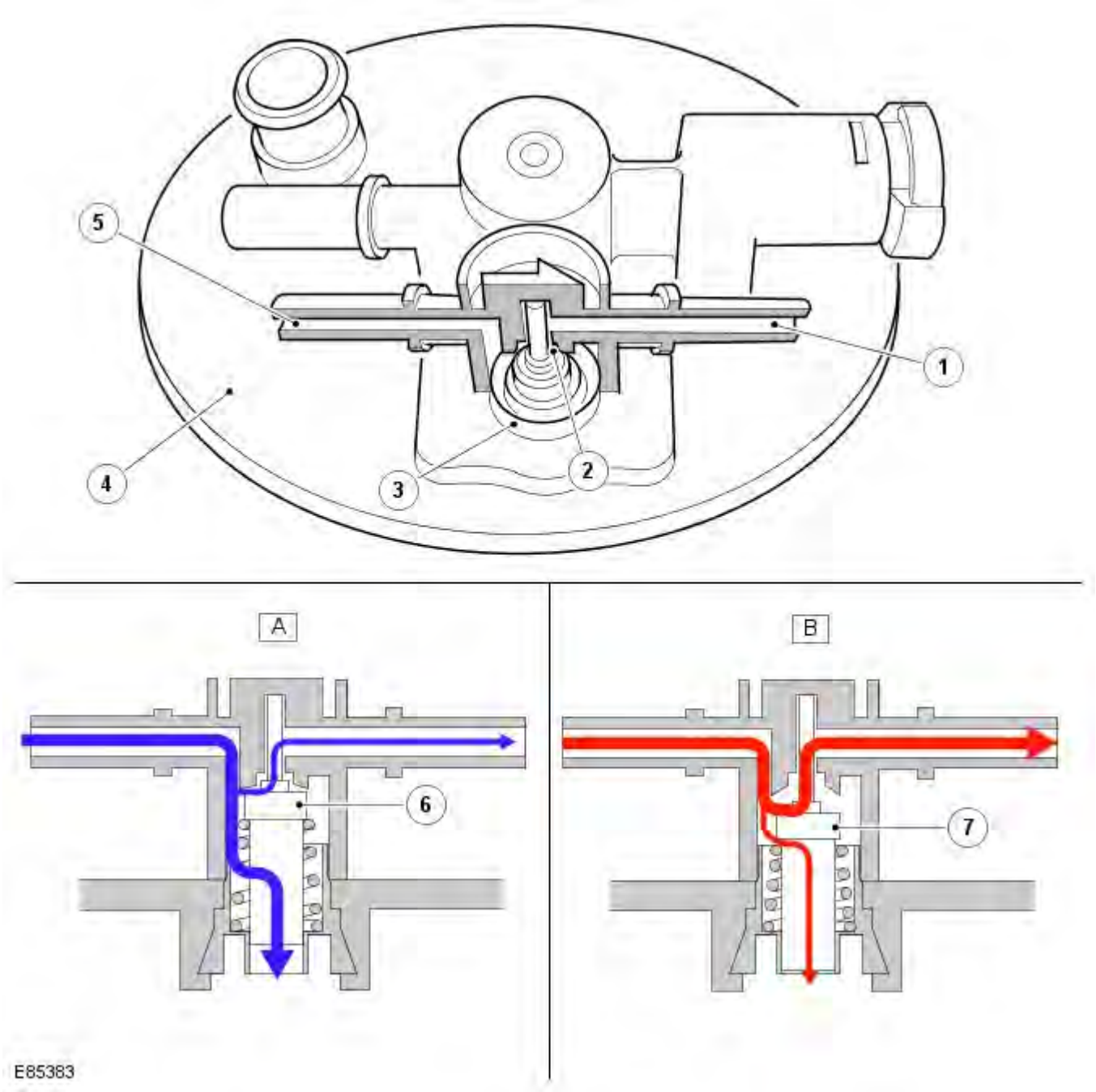
bracket. A crash shield is installed to protect the filter canister in the event of a frontal impact. The filter canister is manufactured from heat resistant and flame-proof durable plastic, and contains a paper type filter element.

The fuel temperature sensor is incorporated within the fuel supply line connection on the fuel filter canister. The sensor provides the ECM with a signal voltage that is proportional to the actual fuel temperature. The signal is used by the ECM in conjunction with other vehicle sensors, to calculate the actual fuel pressure required in the HP fuel rail.
For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

A bleed screw and drain point are located on the filter canister. The bleed screw allows water content in the fuel to be drained off during service intervals.

Fuel Filter Pre-Heat Function

The fuel filter features a fuel pre-heat function that operates when the return fuel temperature is below 10°C (50°F). The pre-heat function recirculates a quantity of return fuel from the HP fuel system through the filter canister to prevent fuel waxing, and improve the engine performance during cold running.



Item	Part Number	Description
A	-	Return fuel temperature less than 10°C (50°F)
B	-	Return fuel temperature greater than 20°C (68°F)
1	-	Fuel return to tank
2	-	Fuel return passage outlet
3	-	Fuel return passage by-pass port
4	-	Fuel filter head
5	-	Fuel return from HP fuel system
6	-	Wax-type thermostatic valve (by-pass open)

7	-	Wax-type thermostatic valve (by-pass closed)

The fuel filter canister head incorporates a wax-type thermostatic valve and spring, located in the fuel return passage between the HP fuel system and fuel tank return connections. The thermostatic valve is seated in a by-pass port that connects the fuel return passage to the fuel filter canister chamber.

The thermostatic valve is operated by the temperature of the fuel in the fuel return passage, felt at the upper side of the thermostatic valve; and the temperature of the supply fuel in the canister chamber, felt at the under side of the thermostatic valve.

The quantity of return fuel recirculated through the filter canister chamber is proportional to the temperature of the return fuel, and the position of the thermostatic valve.

Return Fuel Temperature	Percentage Return Fuel to Tank	Percentage Recirculated Fuel
Less than 10°C (50°F)	5 - 10%	90 - 95%
Greater than 20°C (68°F)	95 - 100%	0 - 5%

Fuel Temperature Less Than 10°C (50°F)

The thermostatic valve is in the contracted position and held off the by-pass port seat. The upper side of the thermostatic valve almost closes off the fuel return passage outlet due to the position of the thermostatic valve, and the light pressure applied by the spring.

A large proportion of returned fuel to the filter passes through the open by-pass port and is recirculated in the fuel filter canister chamber. A small proportion of the return fuel is allowed to pass across the thermostatic valve and is directed through the fuel return passage outlet to the fuel tank.

Fuel passing through the fuel return passage outlet also provides the lubrication for the thermostatic valve stem.

Fuel Temperature Greater Than 20°C (68°F)

The thermostatic valve expands against spring pressure to almost close off the fuel return passage by-pass port, and opens the fuel return passage outlet.

A small proportion of return fuel to the filter passes through the partially open by-pass port and is recirculated in the fuel filter canister chamber. A large proportion of the return fuel passes across the thermostatic valve and is directed through the open fuel return passage outlet to the fuel tank.

Published: 11-May-2011

Fuel Tank and Lines - TD4 2.2L Diesel - Fuel Tank and Lines

Diagnosis and Testing

Principles of Operation

For a detailed description of the fuel tank and lines systems, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Fuel Tank and Lines (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Fuel leaks • Damaged fuel lines • Damaged push connect fittings • Fuel level • Fuel contamination/grade/quality • Damaged fuel tank filler pipe cap • Damaged fuel tank filler pipe	• Fuses • Loose or corroded electrical connectors • Harnesses • Fuel Pump Driver Module (FPDM) • Central Junction Box (CJB) • Fuel pump relay • Engine Control Module (ECM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	• Low/contaminated fuel • Intake air leakage • Fuel system leak, blocked/restricted • Electronic engine controls	• Check for low/contaminated fuel • Check integrity of intake air system • Check fuel system for leaks and blockage/restriction. Read DTCs and refer to relevant DTC Index • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14, Diagnosis and Testing).
Difficult to start	• Glowplug fault • Low/contaminated fuel • Check engine coolant level/anti-freeze content • Battery • Intake air system leak • Electronic engine controls • Injector leak • Fuel system leak, blocked/restricted	• Check integrity of glowplug system • Check for low/contaminated fuel • Check the engine coolant level and condition. REFER to: Specifications (303-03B Engine Cooling - TD4 2.2L Diesel, Specifications). • Ensure the battery is in a fully charged and serviceable condition • Check intake air system for leaks • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14, Diagnosis and Testing). • Carry out injector leak tests, install new injectors as necessary. REFER to: Fuel Injector (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation). • Check fuel system for leaks and blockage/restriction. Read DTCs and refer to relevant DTC Index
Rough idle	• Intake air system leak • Low/contaminated fuel • Fuel system leak, blocked/restricted • EGR valve fault	• Check intake air system for leaks • Check for low/contaminated fuel • Check fuel system for leaks and blockage/restriction. Read DTCs and refer to relevant DTC Index • Check EGR system for failure. REFER to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Diagnosis and Testing).

Symptom	Possible Cause	Action
Engine hesitates/poor acceleration	• Intake air system leak • Restricted exhaust system • Fuel system leak, blocked/restricted • EGR valve fault • Turbocharger actuator fault	• Check intake air system for leaks • Check exhaust system for blockage/restriction • Check fuel system for leaks and blockage/restriction. Read DTCs and refer to relevant DTC Index • Check EGR system for failure. REFER to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Diagnosis and Testing). • Check for turbocharger actuator fault. Read DTCs and refer to relevant DTC Index
Engine stops/stalls	• Breather system disconnected/restricted • Intake air system leak/restricted • Electronic engine controls • Fuel system leak, blocked/restricted • EGR valve fault	• Ensure the engine breather system is free from restriction and is correctly installed • Check intake air system for leaks/restriction • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Diagnosis and Testing). • Check fuel system for leaks and blockage/restriction. Read DTCs and refer to relevant DTC Index • Check EGR system for failure. REFER to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Diagnosis and Testing).
Excessive fuel consumption	• Fuel pressure, fuel pump, fuel lines blocked/contaminated, leaking • Injector leak • Electronic engine controls • EGR valve fault	• Check fuel lines for leakage, blockage/restriction. For fuel pump tests, check DTCs and refer to relevant DTC Index • Carry out fuel injector leak tests, install new injectors as necessary. REFER to: Fuel Injector (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation). • For electronic engine control tests. REFER to: Electronic Engine Controls (303-14, Diagnosis and Testing). • Check EGR system for failure. REFER to: Engine Emission Control (303-08B Engine Emission Control - TD4 2.2L Diesel, Diagnosis and Testing).

DTC Index

• NOTE: If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P008821	Fuel Rail/System Pressure - Too High	• Pressure control valve circuit - short to power • Pressure control valve stuck closed	Check for pressure control valve DTCs and refer to relevant DTC Index
P008822	Fuel Rail/System Pressure - Too High	• Leaking fuel system • Volume control valve circuit - short to ground, open circuit • Volume control valve stuck open	Check for fuel leaks. Refer to electrical circuit diagrams and check volume control valve circuit for short to ground, open circuit. Install a new high pressure fuel pump as required
P008824	Fuel Rail/System Pressure - Too High	• Leaking fuel system • Pressure control valve stuck • Pressure control valve circuit - short to ground, power, open circuit	Check for fuel leaks. Refer to electrical circuit diagrams and check pressure control valve circuit for short to ground, power, open circuit. Install a new pressure control valve as required

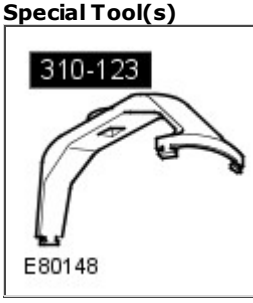
DTC	Description	Possible Cause	Action
P008827	Fuel Rail/System Pressure - Too High	• Leak in high pressure section • Injector nozzle stuck open/worn • Worn high pressure pump, filter blocked • Leaking pressure control valve • Low pressure section pressure low (leak in system, pump output low)	Check for fuel leaks in high and low pressure systems, check for additional DTCs and refer to DTC Index
P009B00	Fuel Pressure Relief Control Circuit/Open	• Pressure control valve control circuit - open load	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009C00	Fuel Pressure Relief Control Circuit Low	• Pressure control valve control circuit - short to ground	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009D00	Fuel Pressure Relief Control Circuit High	• Pressure control valve control circuit - short to power	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P009E00	Fuel Pressure Relief Control Performance/Stuck Off	• Pressure control valve power stage excess temperature	Refer to electrical circuit diagrams and check pressure control valve circuit for high resistance, if no fault identified install new ECM. Refer to the new module/component installation note at the top of the DTC Index
P031300	Misfire Detected With Low Fuel	• Low fuel - misfire induced by ECM to warn driver before shut off	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P115A68	Low Fuel Level - Forced Limited Power (event information DTC only)	• Low fuel - second warning after cluster warning lamp illuminated	Check for additional related DTCs and refer to relevant DTC Index
P115B68	Low Fuel Level - Forced Engine Shutdown (event information DTC only)	• Low fuel - first warning after cluster warning lamp illuminated • Low fuel - fuel empty, engine shut off	Check fuel level. Check for additional related DTCs and refer to relevant DTC Index
P226600	Water in Fuel Sensor Circuit Low	• Fuel Filter Water In Fuel switch short circuit to ground	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P226700	Water in Fuel Sensor Circuit High	• Fuel Filter Water In Fuel switch short circuit to battery	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P228800	Injector Control Pressure Too High	• Leaking fuel system • Fuel high pressure pump circuit - short to ground, open circuit • Fuel high pressure pump failure	Check for fuel leaks. Refer to the electrical circuit diagrams and check fuel high pressure pump circuit for short to ground, open circuit. Install a new high pressure pump as required

Published: 11-May-2011

Fuel Tank and Lines - TD4 2.2L Diesel - Fuel Tank

Removal and Installation

Special Tool(s)

	310-123 Locking Ring, Fuel Tank

General Equipment

Powertrain Jack

Removal

- WARNINGS:

Fuel may still be present in the fuel tank after draining.

Avoid flames, sparks or lighted substances.

- CAUTIONS:

Extreme cleanliness must be exercised when handling these components.

Make sure that all openings are sealed. Use new blanking caps.

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

All vehicles

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Drain the fuel tank.

   Refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

3. Remove the coin tray.

4. Release the adjusting nut and disconnect the parking brake cables from the compensator.

5. Fold the RH rear seat cushion forwards.

6. Release the carpet and remove the grommet.

Vehicles with fuel fired heater

7. **7.** CAUTIONS:

Extreme cleanliness must be exercised when handling these components.

Make sure that all openings are sealed. Use new blanking caps.

All vehicles

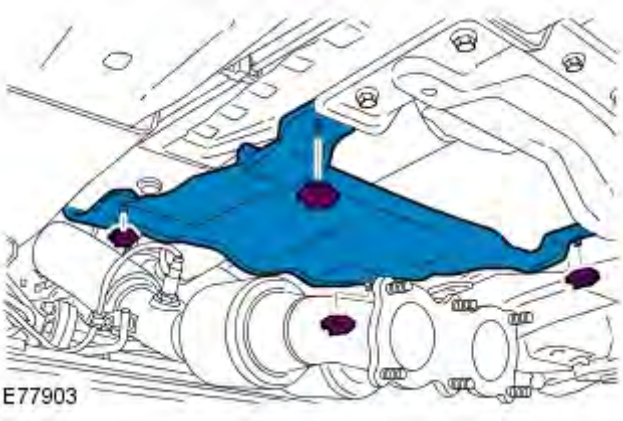
8. Disconnect the electrical connector and the breather hose.

9. **9.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

10. Remove the exhaust system.

    Refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).



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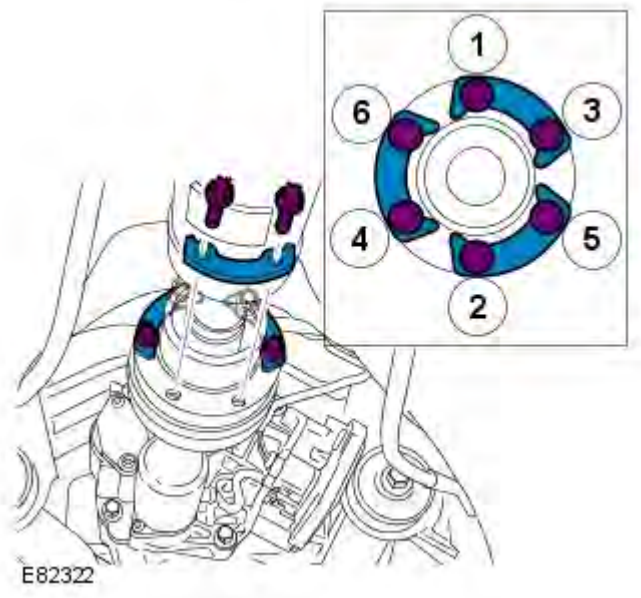


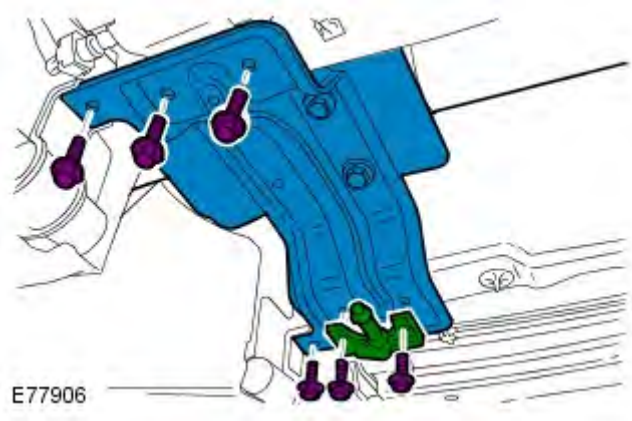
12. **12.** WARNING: Do not lever the driveshaft joints to release from the power transfer unit or the rear differential flanges.

    • CAUTIONS:

    Make sure that the driveshaft is supported with suitable retaining straps.

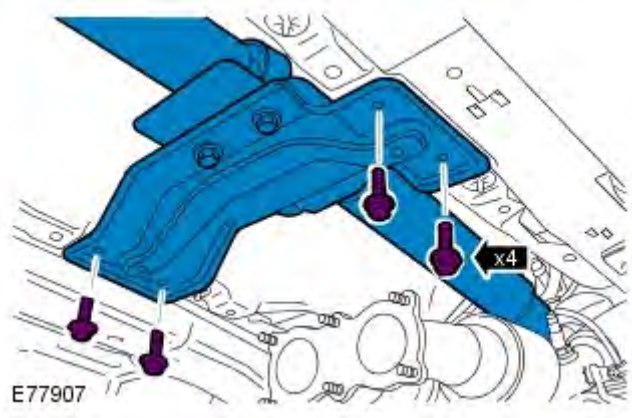
    Make sure that new bolts are installed.

    Torque: 40 Nm



13. **13.** NOTE: All vehicles built up to VIN 180237, and all TD4 Automatics built from VIN 180238

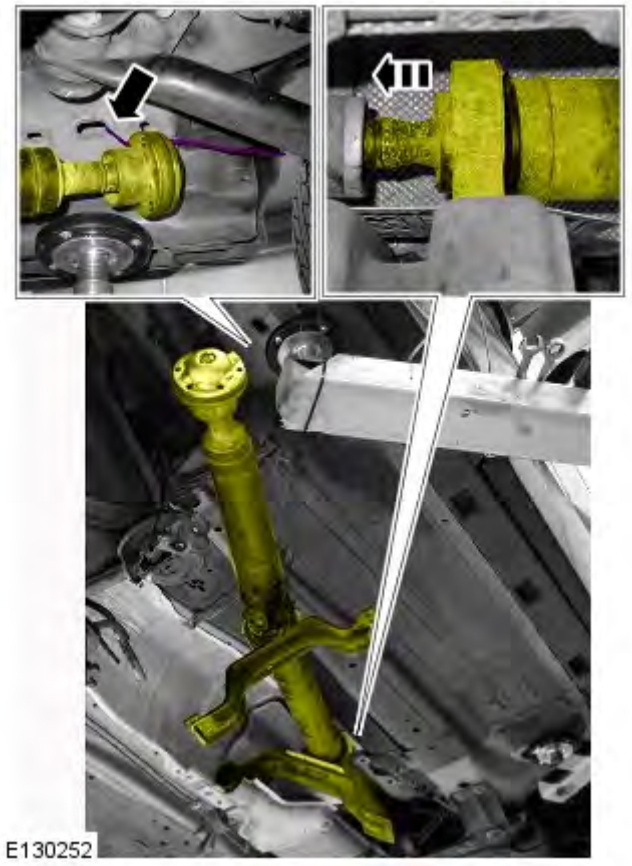
    - *Torque:* 25 Nm



14. **14.** NOTE: All vehicles.

    • NOTE: This step requires the aid of another technician.

    - *Torque:* 25 Nm



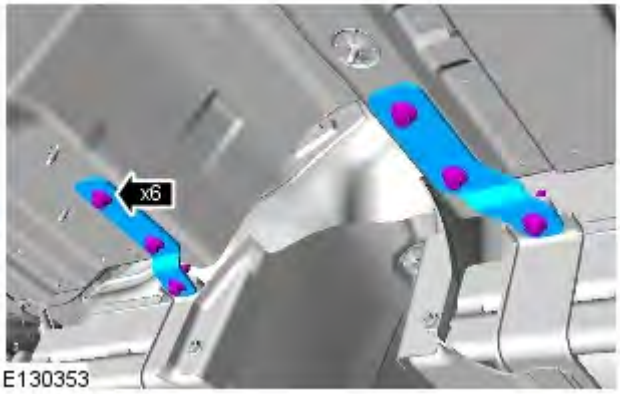
15. **15.** CAUTIONS:

    Make sure that the centre driveshaft joint is compressed. Failure to follow this instruction may result in damage to the component.

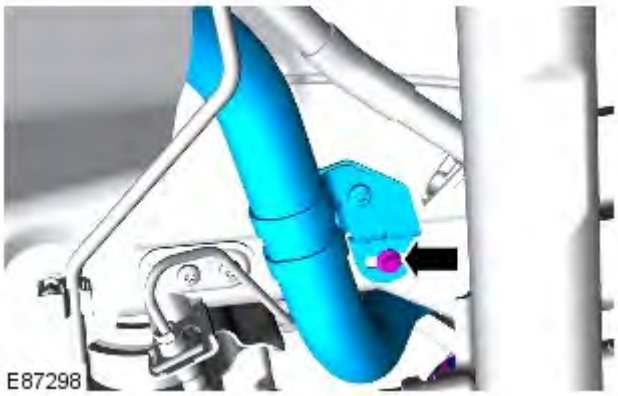
    To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

    • NOTE: This step requires the aid of another technician.

    - Compress the propshaft centre joint.
    - Tie the propshaft to the right hand side of the vehicle.



16. **16.** NOTE: TD4 Manual built from VIN 180238
    - *Torque:* 25 Nm



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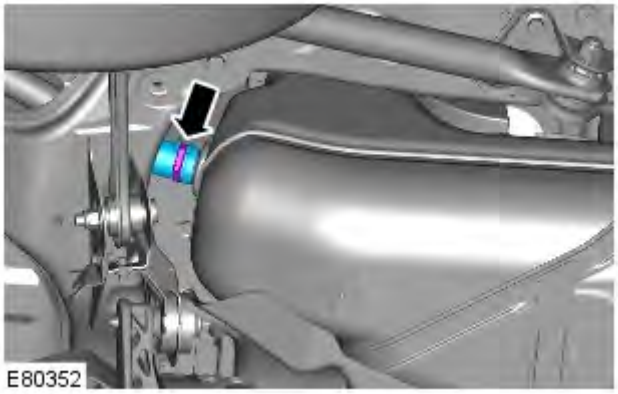

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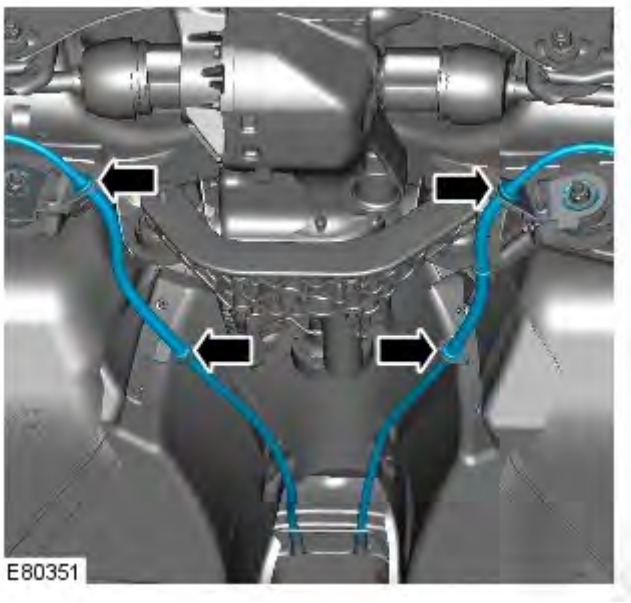
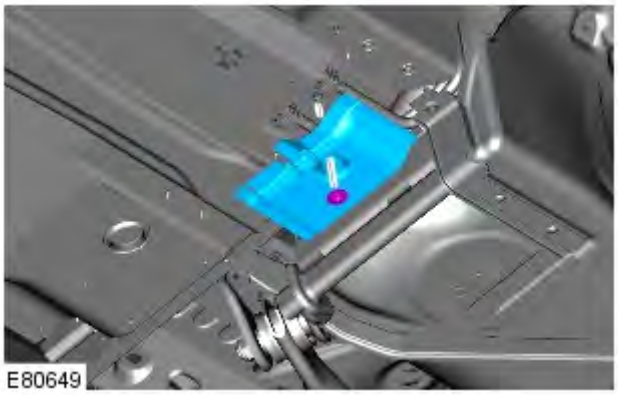
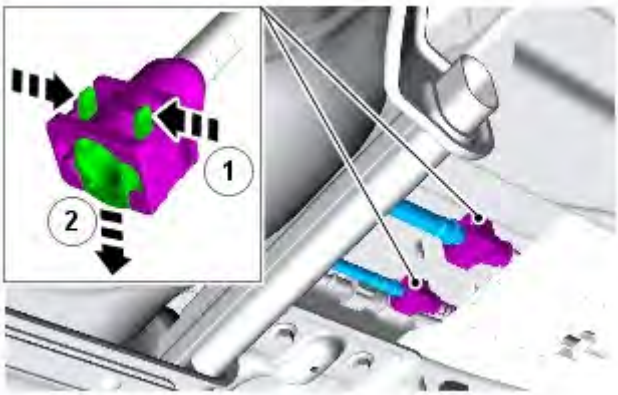


19. Release the parking brake cables from the fuel tank cradle.



20. Remove the fuel line cover.



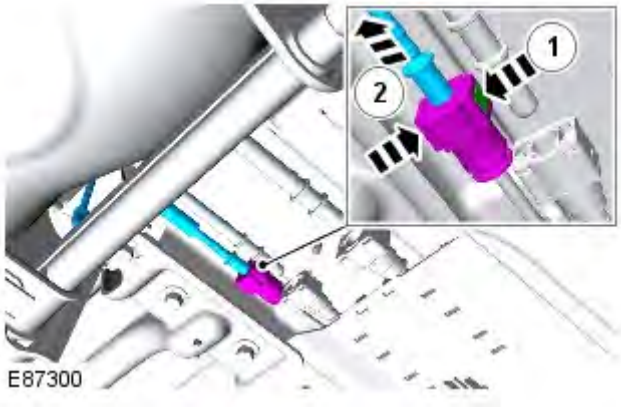
21. **21.** CAUTIONS:

⚠ Extreme cleanliness must be exercised when handling these components.

⚠ Make sure that all openings are sealed. Use new blanking caps.

Disconnect the 2 fuel lines.

Vehicles with fuel fired heater



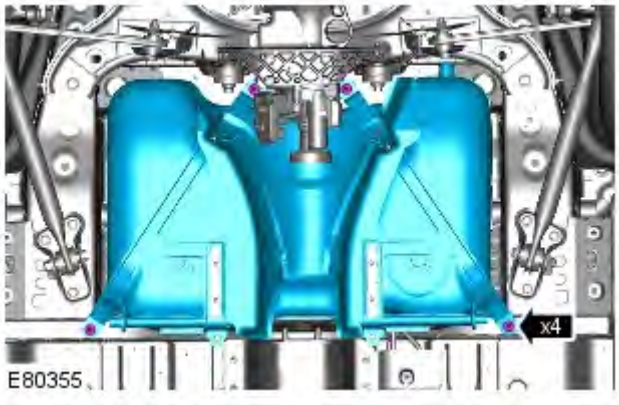
22. **22.** CAUTIONS:

⚠ Extreme cleanliness must be exercised when handling these components.

⚠ Make sure that all openings are sealed. Use new blanking caps.

All vehicles

23.



24. **24.** ⚠ WARNING: This step requires the aid of another technician.

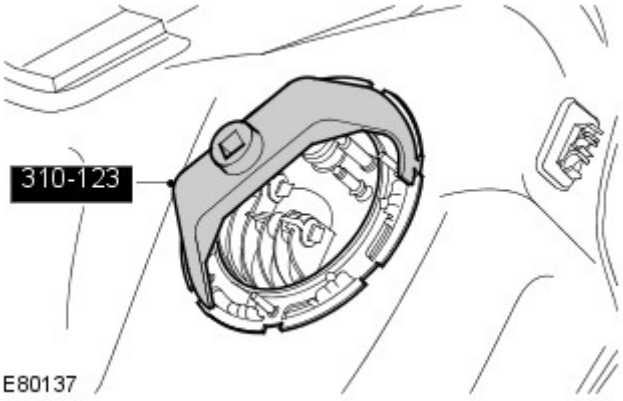
⚠ CAUTION: Make sure that new bolts are installed.

Remove the fuel tank.

General Equipment: Powertrain Jack
Torque: 25 Nm

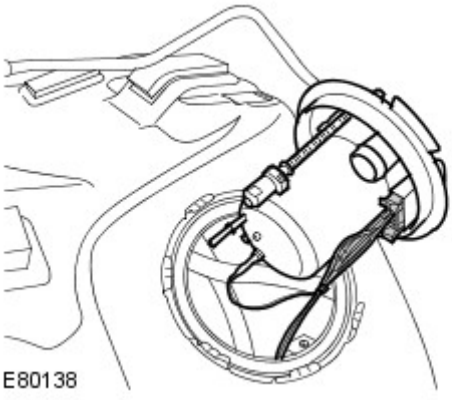
25. **25.** NOTE: Do not disassemble further if the component is removed for access only.

Remove the fuel tank pad.



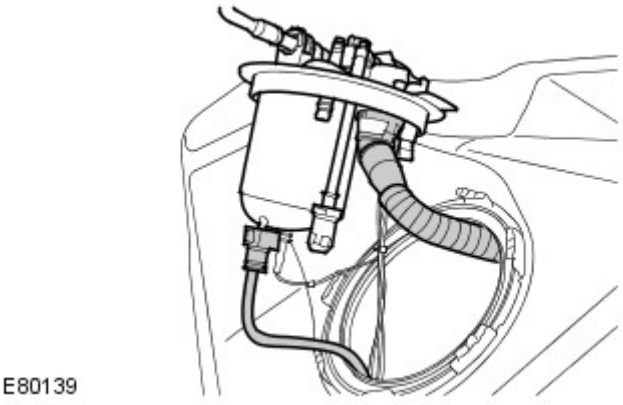
26. **26.** CAUTION: Extreme cleanliness must be exercised when handling these components.
    - Remove the fuel pump module locking ring.

      Special Tool(s): 310-123
    - *Torque:* 200 Nm



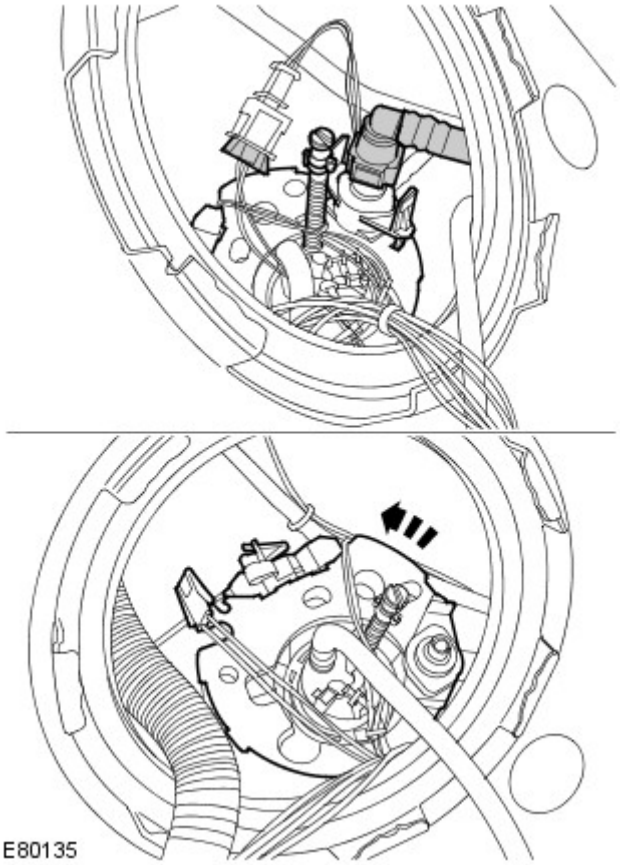
27. **27.** CAUTION: A new O-ring seal is to be installed.

    Release the fuel filter.



28. **28.** NOTE: Petrol illustration shown, diesel similar.

    Remove the fuel filter.


E80135

29. **29.** NOTE: Petrol illustration shown, diesel similar.

    Remove the fuel pump module.

E80145

30.

- Push down to release the fuel sender from clip.
- Slide fuel sender assembly forward to release from the bracket.
- Manoeuvre fuel sender out of the tank.

E80354

31. Remove the fuel tank cradle.

Installation

1. To install, reverse the removal procedure.

2. Refill the fuel tank.

3. Adjust the parking brake.

   Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

Published: 11-May-2011

Fuel Tank and Lines - TD4 2.2L Diesel - Fuel Level Sender

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the fuel pump and sender unit.

   Refer to: Fuel Pump and Sender Unit (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

4. Remove the LH fuel level sender.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Tank and Lines - TD4 2.2L Diesel - Fuel Tank Filler Pipe

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

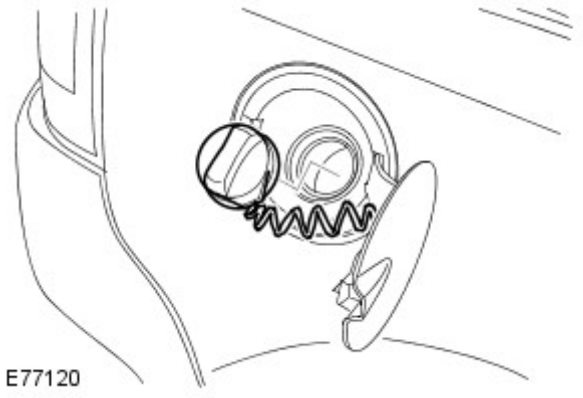
1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the rear wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3.



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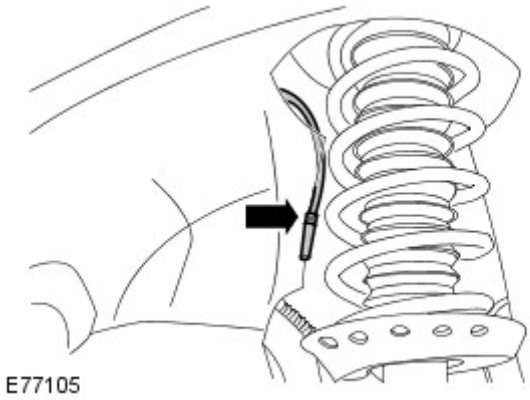

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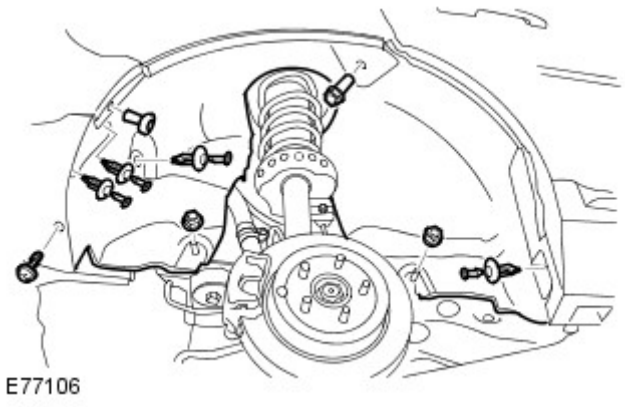
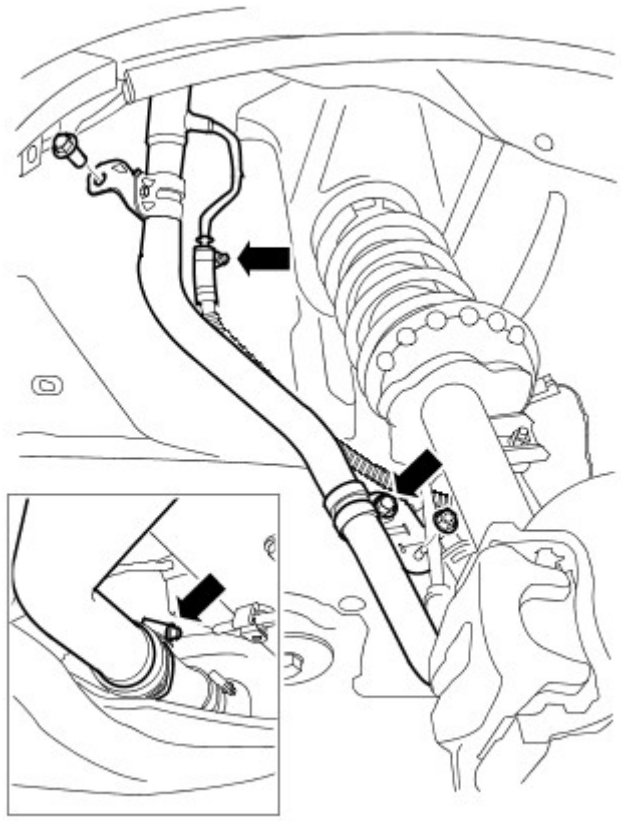


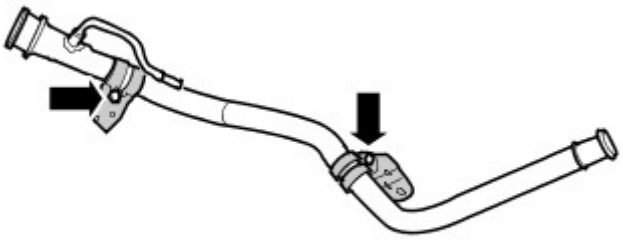


E77107

6.
- Remove the nut and bolt securing the fuel tank filler pipe to the body.

Torque: 10 Nm
- Loosen the fuel tank filler pipe lower bracket.

Torque: 10 Nm
- Loosen the clip and disconnect the fuel filler hose from the fuel tank.
- Loosen the clip and disconnect fuel filler pipe vent hose.



E77108

7. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Fuel Tank and Lines - TD4 2.2L Diesel - Fuel Filter

Removal and Installation

Removal

- WARNINGS:

Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.

Avoid flames, sparks or lighted substances.

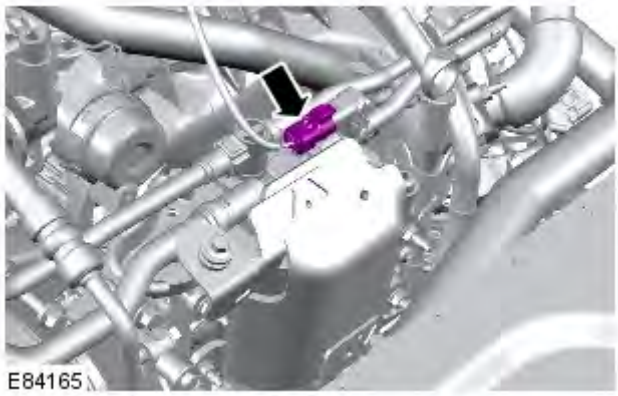
Be prepared to collect escaping fuel.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).



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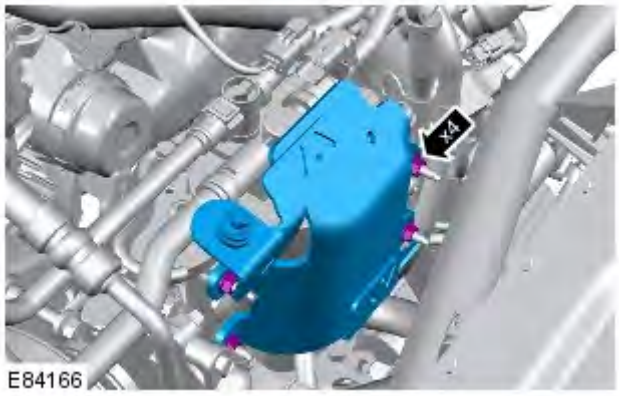
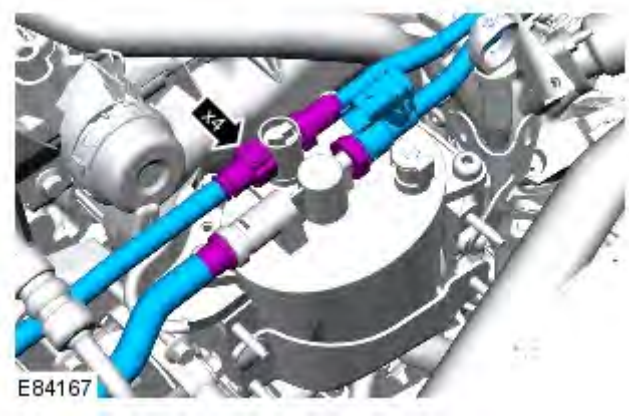


4. *Torque:* 9 Nm



5. **5.** CAUTIONS:

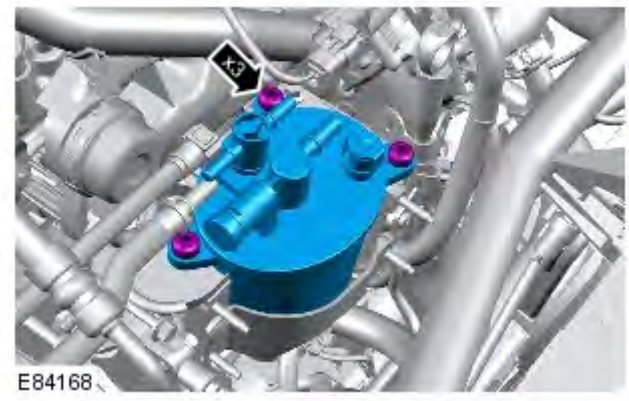
   Make sure that no strain is placed on the fuel lines and wiring harnesses.

   Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient temperature.

   Be prepared to collect escaping fuel.

   Make sure that all openings are sealed. Use new blanking caps.

   Extreme cleanliness must be exercised when handling this component.



6. *Torque:* 9 Nm

7.

Installation

1. To install, reverse the removal procedure.

2. Bleed the fuel system.

   Refer to: Fuel System Bleeding - TD4 2.2L Diesel (310-00 Fuel System - General Information, General Procedures).

Published: 11-May-2011

Fuel Tank and Lines - TD4 2.2L Diesel - Fuel Pump and Sender Unit

Removal and Installation

Removal

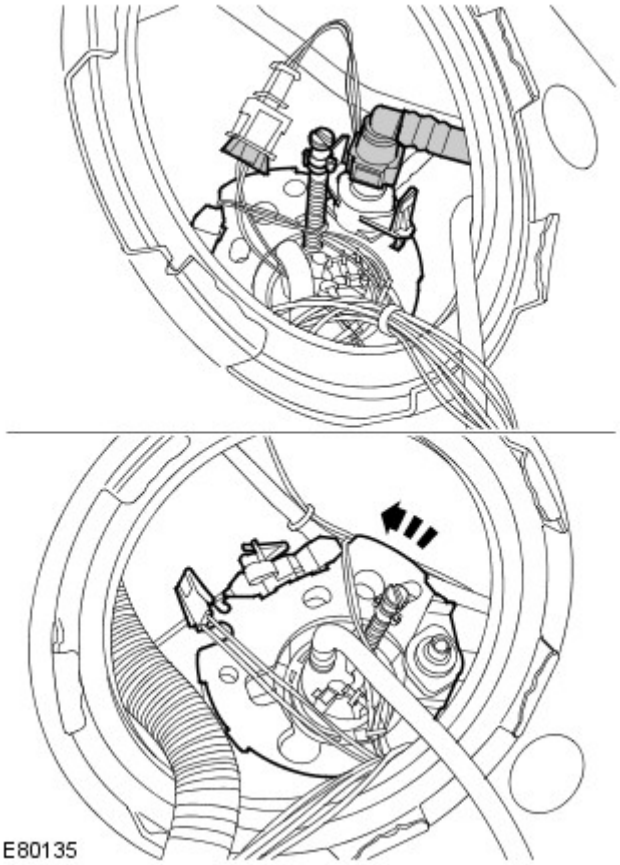
- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the fuel filter.

   Refer to: Fuel Filter (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).



3. **3.** CAUTION: Extreme cleanliness must be exercised when handling these components.

Installation

1. To install, reverse the removal procedure.

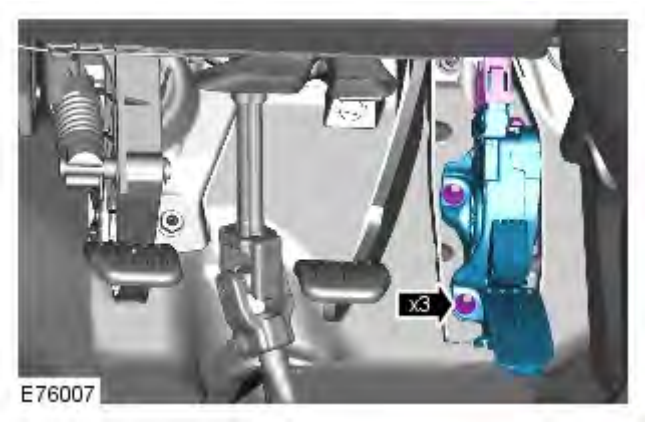
Published: 11-May-2011

Acceleration Control - Accelerator Pedal

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Speed Control - I6 3.2L Petrol -

Torque Specifications

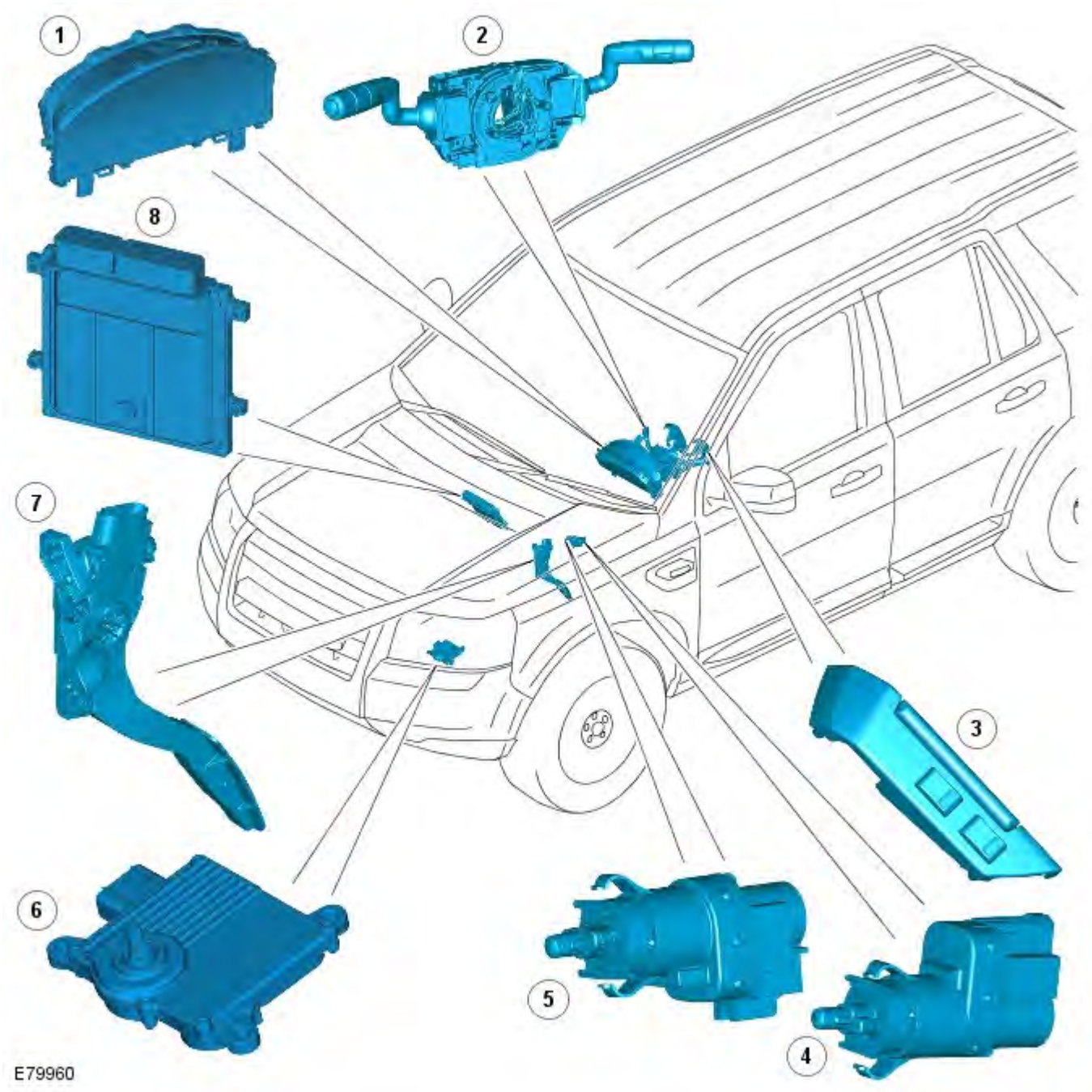
Description	Nm	lb-ft
Accelerator pedal assembly nuts	10	7
Speed control switch Torx bolts	3	2

Published: 11-May-2011

Speed Control - I6 3.2L Petrol - Speed Control

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Instrument cluster
2	-	Clockspring
3	-	Speed control steering wheel switches
4	-	Speed control inhibit switch
5	-	Stoplamp switch
6	-	Transmission Control Module (TCM)
7	-	Accelerator Pedal Position (APP)
8	-	Engine Control Module (ECM)

OVERVIEW

The speed control system maintains a set speed selected by the driver until operation is suspended or cancelled by a further input from the driver and is controlled by the ECM.

The speed control system comprises the following components:

- A set +/- switch
- A RESUME switch

- A CANCEL switch.

The system also uses the following:

- The ECM
- The stoplamp switch.
- The APP sensor

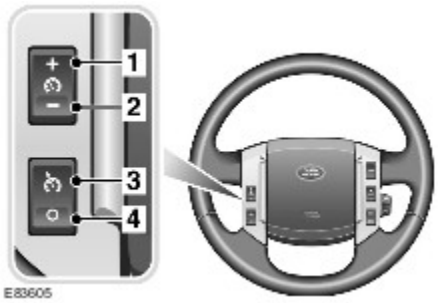
The ECM controls the set speed by modifying engine speed/torque and requesting gear changes from the transmission (automatic variants only).

The speed control system also uses inputs from the brake pedal switch, the APP sensor, the ECM and the ABS control module.

The speed control is operated by the driver using only the steering wheel switches. When speed is active, the ECM regulates the PWM signals to the fuel injectors to adjust the fuel supply as required to maintain the set speed.

During speed control operation, the ECM controls vehicle speed by adjusting fuel injection duration and timing. When the accelerator pedal is pressed with speed control active, the ECM outputs a calculated throttle angle signal in place of the actual throttle angle signals produced by the APP sensor. The calculated throttle angle is derived from fuel demand.

CONTROL SWITCHES



Item	Part Number	Description
1	-	Set target speed/increase speed
2	-	Set target speed/decrease speed
3	-	Resume set speed
4	-	Speed control suspend.

The speed control switches are located on the LH side of the steering wheel. The switches are connected via fly leads directly to the clock spring. All the speed control switches are non-latching momentary rocker switches. The minimum set speed is 18 mph (30 (km/h). Speed control is automatically suspended if the vehicle speed falls below 15 mph (24 km/h).

The speed control switches are resistive ladder type switches. There are three rocker switches associated with speed control, two of which are for adaptive speed control (where specified). The switches vary the resistance of a signal voltage sent to the ECM. The switches receive a 5 volt reference supply. The ECM measures the returned voltage to determine which switch has been pressed.

Suspend Switch

The suspend/resume switch controls the selection of speed control. When the ignition is in position II, a single press of the suspend switch will activate the suspend mode. This temporarily switches off the speed control system, but retains the previously set speed in the ECM memory.

Resume Switch

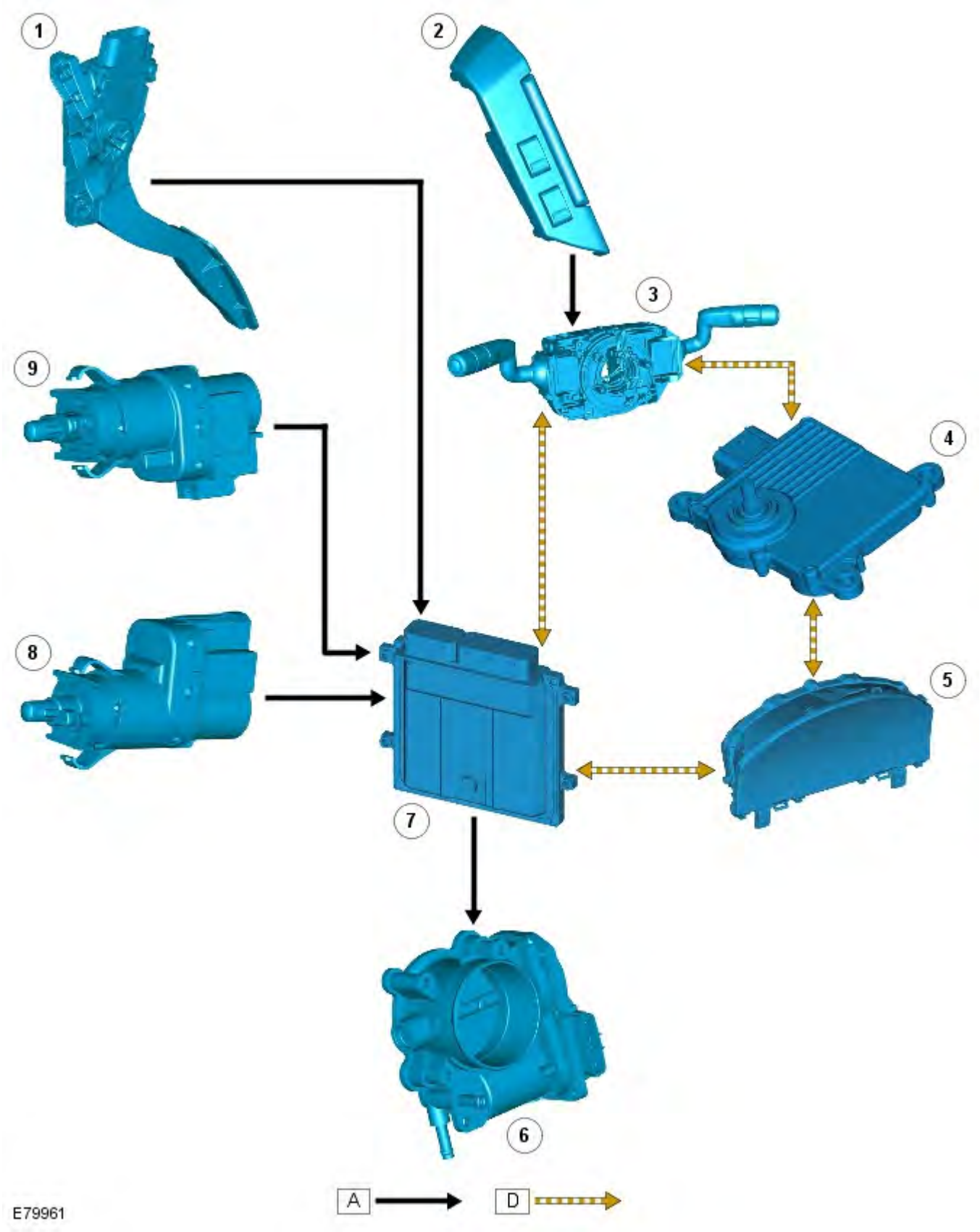
A second press of the switch re-activates the previously set speed after the speed control has been suspended by pressing the suspend switch or by depressing the brake pedal.

Set Speed/Increase/Decrease Speed (+/–) Switches

When the speed control system is active, pressing the '+' switch sets the controlled speed to the current road speed of the vehicle. Subsequent momentary presses of the switch increases the set road speed by 0.6 mph (1 km/h). If the switch is pressed and held the road speed will continue to increase until the switch is released. Momentarily pressing the '–' switch, decreases the set speed by 0.6 mph (1 km/h). If the switch is pressed and held, the set speed is decreased until the switch is released.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High speed CAN bus



Item	Part Number	Description
1	-	APP
2	-	Speed control steering wheel switches
3	-	Clockspring
4	-	TCM
5	-	Instrument cluster
6	-	Electric throttle
7	-	ECM
8	-	Speed control inhibit switch
9	-	Stoplamp switch

Published: 11-May-2011

Speed Control - I6 3.2L Petrol - Speed Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the speed control system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Speed Control - 3.2L (310-03, Description and Operation) /
Speed Control - 2.2L Diesel (310-03B Speed Control - TD4 2.2L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Speed control inhibit switch • Stop lamp switch • Steering wheel rotation sensor	• Fuses • Wiring harness • Electrical connector(s) • Steering wheel switches • Brake switch • Speed control inhibit switch • Transmission Control Module (TCM) • Engine Control Module (ECM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Speed control inhibited or disabled	• Steering wheel speed control switch(s) • Steering wheel speed control switch circuit • Throttle sensors • Brake switch	• Refer to electrical circuit diagrams and check steering wheel speed control switches and circuits • Check ECM for throttle related DTCs and refer to the DT Index. REFER to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing) / Electronic Engine Controls (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Diagnosis and Testing). • Refer to the electrical circuit diagrams and check brake switches and circuits
Unable to regulate/adjust vehicle speed	• Steering wheel switch malfunction	• Refer to electrical circuit diagrams and check steering wheel speed control switch and circuits
Unable to cancel speed control from steering wheel	• Steering wheel switch malfunction	• Refer to electrical circuit diagrams and check steering wheel speed control switch and circuits
Unable to cancel speed control from brake pedal	• Brake switch malfunction	• Refer to the electrical circuit diagrams and check brake switches and circuits

DTC Index

• NOTE: If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B10AC86	Cruise Control Switch - Signal invalid	• Signal invalid	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B10AC87	Cruise Control Switch - Missing message	• Missing message	Carry out the pinpoint tests associated to this DTC using the manufacturer approved diagnostic system
B10AC95	Cruise Control Switch - Wrong assembly	• Mis-match between Car Configuration File and vehicle	Check/up-date Car Configuration File using the manufacturer approved diagnostic system
C004064	Brake Pedal Switch "A" - Signal plausibility failure	• Brake pedal switch circuit - short to ground, short to power, open circuit • Brake pedal switch failure	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Install a new brake switch as required. REFER to: Speed Control Deactivator Switch (310-03B Speed Control - TD4 2.2L Diesel, Removal and Installation).
P012023	Accelerator pedal position sensor A circuit - signal stuck low	• Accelerator pedal position (APP) sensor A circuit: short circuit to ground • Accelerator pedal position (APP) sensor failure	Check the APP sensor and circuits. Refer to the electrical guides. Install a new sensor as required.
P012024	Accelerator pedal position sensor A circuit - signal stuck high	• Accelerator pedal position (APP) sensor A circuit: short circuit to power • Accelerator pedal position (APP) sensor A circuit: open circuit • Accelerator pedal position (APP) sensor power supply circuit: open circuit • Accelerator pedal position (APP) sensor ground circuit: open circuit • Accelerator pedal position (APP) sensor failure	Check the APP sensor and circuits. Refer to the electrical guides. Install a new sensor as required.
P012038	Accelerator pedal position sensor A circuit - signal frequency incorrect	• Accelerator pedal position (APP) sensor A circuit: loose connection • Accelerator pedal position (APP) sensor A circuit: interference • Accelerator pedal position (APP) sensor failure	Check the APP sensor and circuits. Refer to the electrical guides. Install a new sensor as required.
P012100	Throttle/Pedal Position Sensor A Circuit Range/Performance	• Analogue accelerator pedal ADC error	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P012200	Throttle/Pedal Position Sensor A Circuit Low	• Analogue accelerator pedal duty cycle below lower limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P012300	Throttle/Pedal Position Sensor A Circuit High	• Analogue accelerator pedal duty cycle above upper limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P012400	Throttle/Pedal Position Sensor A Intermittent	• Analogue accelerator pedal signal - noisy, disturbance	Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P022000	Accelerator pedal position switch B circuit	• Accelerator pedal position (APP) sensor B circuit: short circuit to ground • Accelerator pedal position (APP) sensor B circuit: open circuit • Accelerator pedal position (APP) sensor B circuit: short circuit to power • Accelerator pedal position (APP) sensor failure	Check the APP sensor and circuits. Refer to the electrical guides. Carry out a complete vehicle read for APP sensor DTCs. Rectify as necessary.
P022023	Accelerator pedal position sensor B circuit - signal stuck low	• Accelerator pedal position (APP) sensor B circuit: short circuit to ground • Accelerator pedal position (APP) sensor B circuit: open circuit • Accelerator pedal position (APP) sensor failure	Check the APP sensor and circuits. Refer to the electrical guides. Carry out a complete vehicle read for APP sensor DTCs. Rectify as necessary.
P022024	Accelerator pedal position sensor B circuit - signal stuck high	• Accelerator pedal position (APP) sensor B circuit: short circuit to power • Accelerator pedal position (APP) sensor failure	Check the APP sensor and circuits. Refer to the electrical guides. Carry out a complete vehicle read for APP sensor DTCs. Rectify as necessary.

DTC	Description	Possible Cause	Action
P022082	Accelerator pedal position sensor B circuit	• Accelerator pedal position (APP) sensor B circuit: short circuit to ground • Accelerator pedal position (APP) sensor B circuit: open circuit • Accelerator pedal position (APP) sensor B circuit: short circuit to power • Controller area network (CAN) circuit: open circuit • Controller area network (CAN) circuit: short circuit to ground • Controller area network (CAN) circuit: short circuit to power • Accelerator pedal position (APP) sensor failure	Check the APP sensor and circuits. Check the CAN circuits. Refer to the electrical guides. Carry out a complete vehicle read for APP sensor DTCs. Rectify as necessary.
P022200	Accelerator pedal position sensor B circuit low	• Accelerator pedal position (APP) sensor B circuit: short circuit to ground • Accelerator pedal position (APP) sensor B circuit: open circuit • Accelerator pedal position (APP) sensor failure	Check the APP sensor and circuits. Refer to the electrical guides. Carry out a complete vehicle read for APP sensor DTCs. Rectify as necessary.
P022300	Throttle/Pedal Position Sensor/Switch B Circuit High	• PWM accelerator pedal duty cycle above upper limit	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P050429	Brake switch A/B correlation - general signal failures - signal invalid	• Brake switch circuit: short circuit to ground • Brake switch circuit: open circuit • Brake switch circuit: high resistance • Brake pedal switch failure • Brake control module fault	Carry out a complete vehicle read for related DTCs. Rectify as necessary. Check the brake switch and circuits. Refer to the electrical guides. Install a new brake switch as necessary. REFER to: Speed Control Deactivator Switch (310-03B Speed Control - TD4 2.2L Diesel, Removal and Installation).
P050462	Brake Switch A/B Correlation	• Brake pedal switch signal compare failure	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P050464	Brake Switch A/B Correlation	• Brake pedal switch signals not plausible	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P050465	Brake switch A/B correlation	• Brake switch circuit: short circuit to ground • Brake switch circuit: open circuit • Brake switch circuit: high resistance • Brake pedal switch failure • Brake control module fault	Carry out a complete vehicle read for related DTCs. Rectify as necessary. Check the brake switch and circuits. Refer to the electrical guides. Install a new brake switch as necessary. REFER to: Speed Control Deactivator Switch (310-03B Speed Control - TD4 2.2L Diesel, Removal and Installation).
P057100	Brake Switch A Circuit	• Brake switch error - inspectible fault counter beyond limit	Refer to electrical circuit diagrams and check both brake switch circuits for short/open circuit faults. Check/install new brake switch as required
P080600	Clutch Position Sensor Circuit Range/Performance	• Error with at least one clutch pedal switch	Refer to electrical circuit diagrams and check Bottom of Travel clutch switch circuit, carry out CAN network integrity tests using the manufacturer approved diagnostic system
P083100	Clutch Pedal Switch 'A' Circuit Low	• Top Of Travel clutch switch circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check Top Of Travel clutch switch circuit for short to ground, open circuit
P083200	Clutch Pedal Switch 'A' Circuit High	• Top Of Travel clutch switch circuit - short to power	Refer to electrical circuit diagrams and check Top Of Travel clutch switch circuit for short to power
P083300	Clutch Pedal Switch 'B' Circuit	• Error with 75% switch	Refer to electrical circuit diagrams and check Bottom of Travel clutch switch circuit
P193B00	Throttle/Pedal Signal	• Analogue accelerator pedal CAN signal error	Carry out CAN network integrity tests using the manufacturer approved diagnostic system
P210100	Throttle actuator control motor circuit range/performance	• Throttle actuator control motor circuit: short circuit to ground • Throttle actuator control motor circuit: open circuit • Throttle actuator control motor circuit: short circuit to power • Throttle actuator control motor failure	Check the throttle motor and circuits. Refer to the electrical guides. Install a new throttle body as necessary. REFER to: Throttle Body (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).

DTC	Description	Possible Cause	Action
P210177	Throttle actuator control motor circuit range/performance	• Throttle body contaminated/sticking • Throttle actuator control motor failure	Check the throttle body condition and operation. Clean the throttle body and recheck. Install a new throttle body as necessary. REFER to: Throttle Body (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P210300	Throttle actuator control motor circuit high	• Throttle actuator control motor circuit: short circuit to power • Throttle actuator control motor failure	Check the throttle motor and circuits. Refer to the electrical guides. Install a new throttle body as necessary. REFER to: Throttle Body (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P211800	Throttle actuator control motor current range/performance	• Throttle actuator control motor circuit: short circuit to power • Throttle actuator control motor circuit: short circuit to ground • Throttle actuator control motor circuit: short circuit to power • Throttle actuator control motor failure	Check the throttle motor and circuits. Refer to the electrical guides. Install a new throttle body as necessary. REFER to: Throttle Body (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P211900	Throttle actuator control throttle body range/performance	• Throttle body contaminated/sticking	Check the condition and operation of the throttle body. Rectify as necessary. Install a new throttle body as necessary. REFER to: Throttle Body (303-04A Fuel Charging and Controls - I6 3.2L Petrol, Removal and Installation).
P213562	Accelerator pedal position sensor A/B voltage correlation	• Accelerator pedal position (APP) sensor signal circuit: open circuit • Accelerator pedal position (APP) sensor signal circuit: short circuit to ground • Accelerator pedal position (APP) sensor signal circuit: short circuit to power • Accelerator pedal position (APP) sensor fault	Carry out a complete vehicle read for related DTCs. Check the APP sensor and circuits. Refer to the electrical guides. Rectify as necessary.
P213800	Throttle/Pedal Position Sensor/Switch D/E Voltage Correlation	• Accelerator Pedal plausibility - plausibility violated	Refer to electrical circuit diagrams and check accelerator pedal circuits for short, open circuit faults. Check/install new pedal as required
P213827	Throttle/Pedal Position Sensor/Switch D/E Voltage Correlation	• Accelerator Pedal plausibility - dynamic plausibility violated	Refer to electrical circuit diagrams and check accelerator pedal circuits for short, open circuit faults. Check/install new pedal as required
P213828	Throttle/Pedal Position Sensor/Switch D/E Voltage Correlation	• Accelerator Pedal plausibility - extended plausibility violated	Refer to electrical circuit diagrams and check accelerator pedal circuits for short, open circuit faults. Check/install new pedal as required

Published: 11-May-2011

Speed Control - I6 3.2L Petrol - Speed Control Switch

Removal and Installation

Removal

1. Disconnect the battery ground cable.

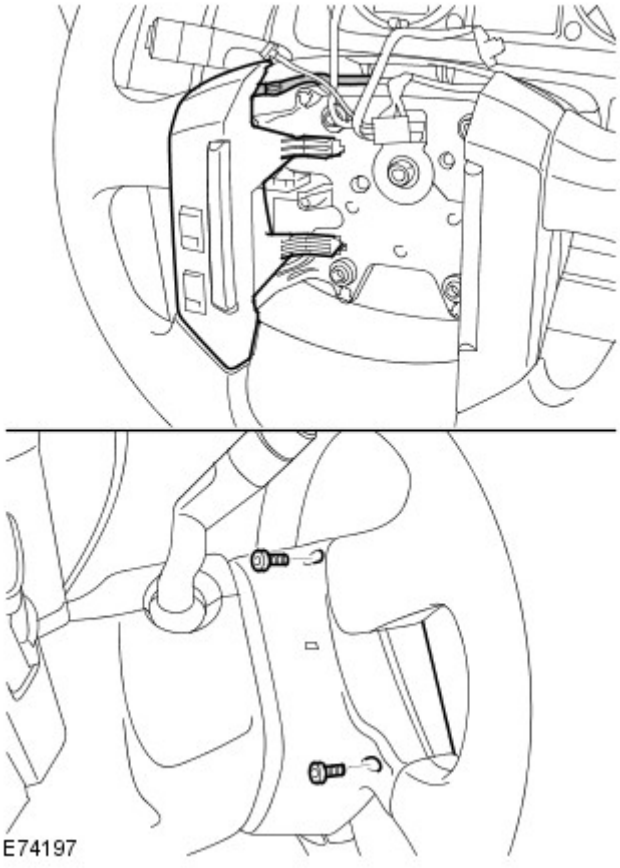
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Make the SRS system safe.

   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20, General Procedures).

3. Remove the driver air bag module.

   Refer to: Driver Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



4.
   - Remove the 2 Torx screws.
   - Disconnect the electrical connector.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Speed Control - I6 3.2L Petrol - Speed Control Actuator

Removal and Installation

Removal

1. Remove the accelerator pedal assembly.

   Refer to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation).

Installation

1. Install the accelerator pedal assembly.

   Refer to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation).

Published: 11-May-2011

Speed Control - I6 3.2L Petrol - Speed Control Deactivator Switch

Removal and Installation

Removal

Right-hand drive vehicles

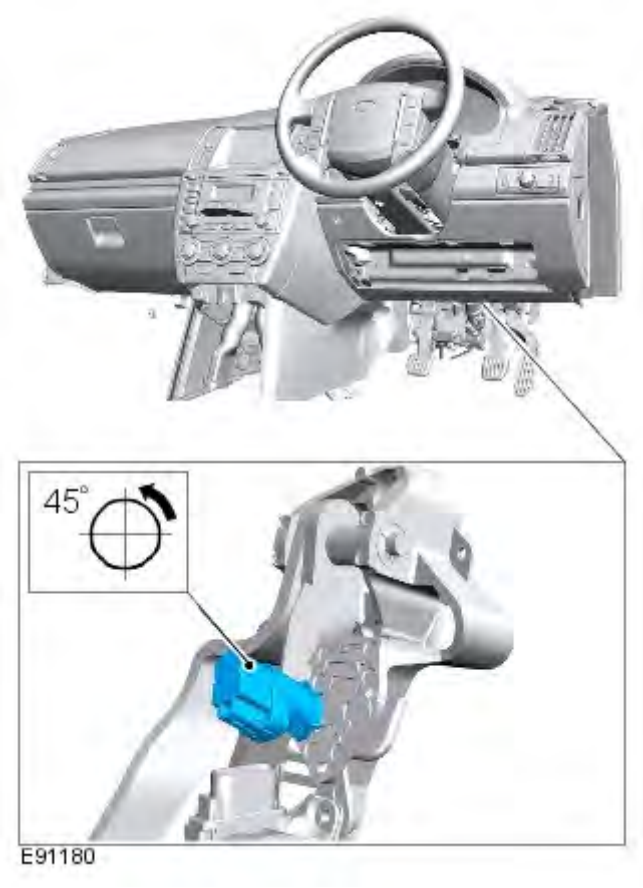
1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the stoplamp switch.

   Refer to: Stoplamp Switch (417-01 Exterior Lighting, Removal and Installation).

All vehicles



3. **3.** CAUTION: The switch has a latching device that only allows the switch to be removed or installed when the switch plunger is depressed.

   • NOTE: RHD illustration shown, LHD is similar.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Speed Control - TD4 2.2L Diesel -

Torque Specifications

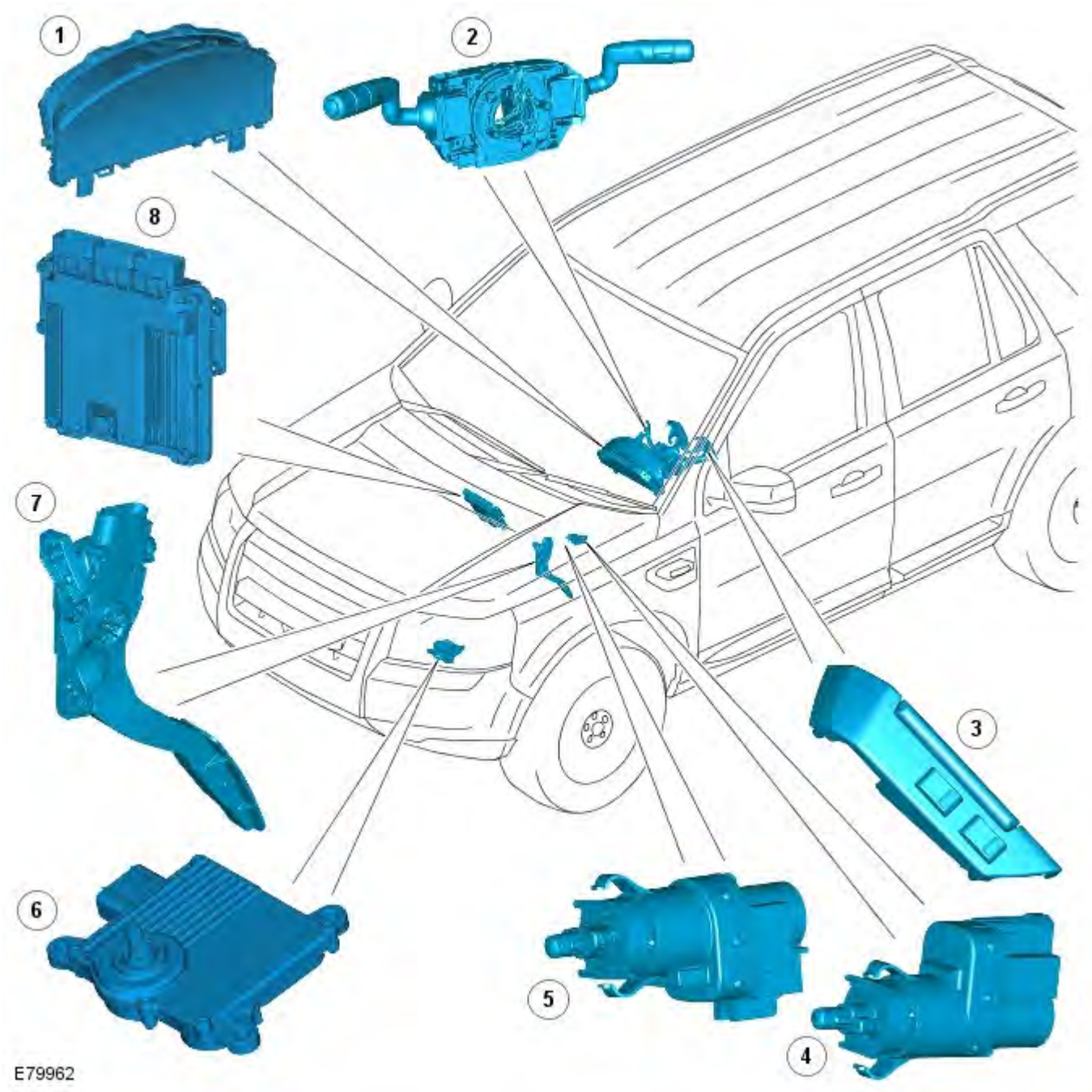
Description	Nm	lb-ft
Accelerator pedal assembly nuts	10	7

Published: 11-May-2011

Speed Control - TD4 2.2L Diesel - Speed Control2.2L Diesel

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Instrument cluster
2	-	Clockspring
3	-	Speed control steering wheel switches
4	-	Speed control inhibit switch
5	-	Stoplamp switch
6	-	transmission control module (TCM)
7	-	accelerator pedal position (APP)
8	-	engine control module (ECM)

OVERVIEW

The speed control system maintains a set speed selected by the driver until operation is suspended or cancelled by a further input from the driver and is controlled by the ECM.

The speed control system comprises the following components:

- A set +/- switch
- A RESUME switch

- A CANCEL switch.

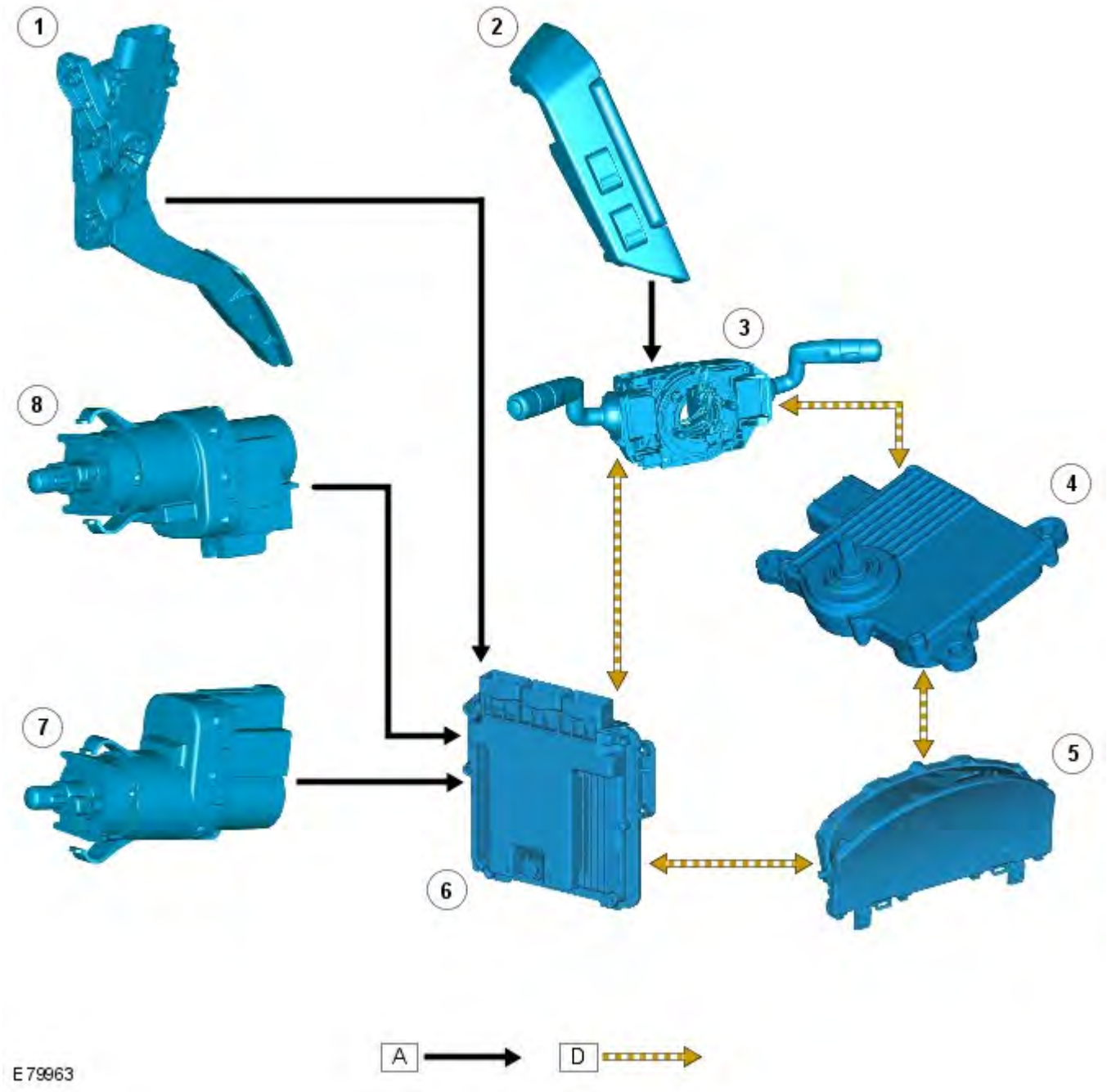
The system also uses the following:

- The ECM
- The stoplamp switch.
- The APP sensor
- A clutch switch

The ECM controls the set speed by modifying engine speed/torque and requesting gearchanges from the transmission (automatic variants only).

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High speed controller area network (CAN) bus



Item	Part Number	Description
1	-	APP
2	-	Speed control steering wheel switches
3	-	Clockspring
4	-	TCM
5	-	Instrument cluster
6	-	ECM
7	-	Stoplamp switch
8	-	Speed control inhibit switch

Published: 11-May-2011

Speed Control - TD4 2.2L Diesel - Speed Control Switch

Removal and Installation

Removal

1. Disconnect the battery ground cable.

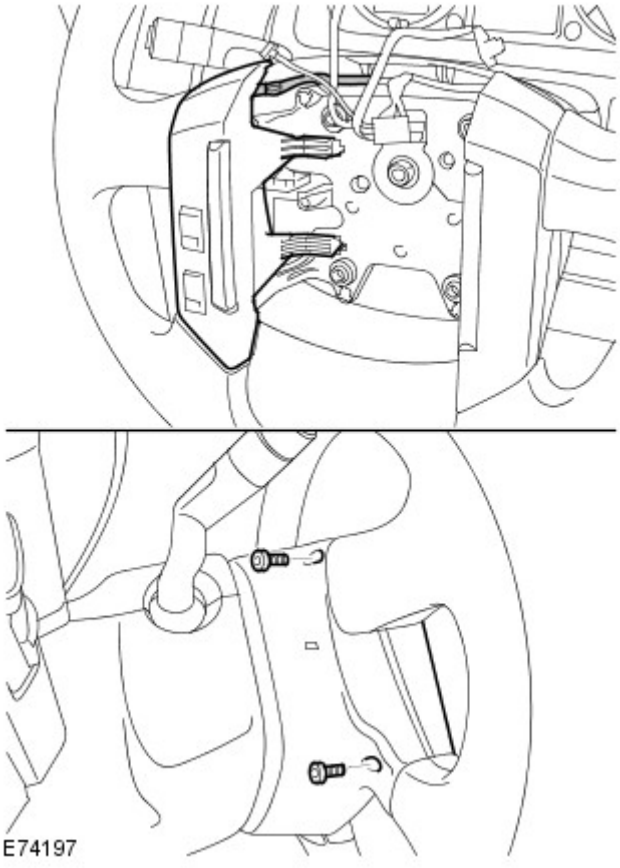
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Make the SRS system safe.

   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20, General Procedures).

3. Remove the driver air bag module.

   Refer to: Driver Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



4.
   - Remove the 2 Torx screws.
   - Disconnect the electrical connector.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Speed Control - TD4 2.2L Diesel - Speed Control Actuator

Removal and Installation

Removal

1. Remove the accelerator pedal assembly.

   Refer to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation).

Installation

1. Install the accelerator pedal assembly.

   Refer to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation).

Published: 11-May-2011

Speed Control - TD4 2.2L Diesel - Speed Control Deactivator Switch

Removal and Installation

Removal

Right-hand drive vehicles

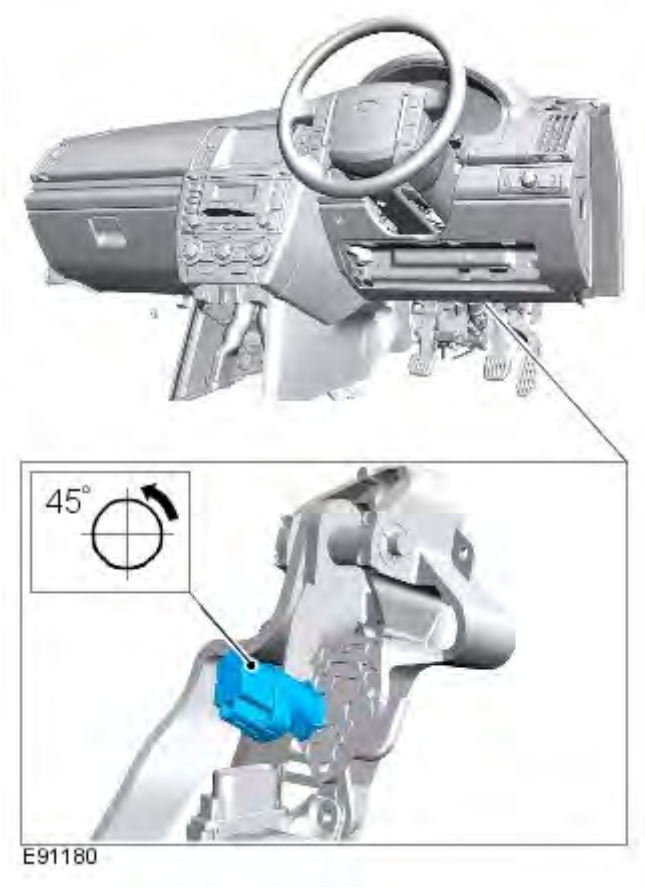
1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the stoplamp switch.

   Refer to: Stoplamp Switch (417-01 Exterior Lighting, Removal and Installation).

All vehicles



3. **3.** CAUTION: The switch has a latching device that only allows the switch to be removed or installed when the switch plunger is depressed.

   • NOTE: RHD illustration shown, LHD is similar.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control System - General Information -

Climate Control

Type	Description
Heating, ventilation and air conditioning unit	Manual single zone or a dual zone automatic system fitted. Both systems controlled by ATC module.
Compressor:	
3.2L Petrol	Zexel-Valeo KC-88 externally controlled variable displacement A/C compressor
2.2L Diesel	Visteon VS16 internally controlled variable displacement A/C compressor

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Compressor oil	WSH-M1C321-B
Refrigerant	R134a (CF^3CH^2F)

General Specification

Item	Description
Compressor - 3.2L Petrol	Zexel-Valeo KC-88
Compressor - 2.2L Diesel	Visteon VS16
Sensor locations:	
Ambient temperature sensor	LH Door mirror
Cabin temperature sensor (dual zone systems only)	Mounted behind a grill on the drivers side of the instrument panel, adjacent the steering column.
cabin humidity sensor (Optional fit)	located within the interior mirror and comprises 3 individual elements
Evaporative temperature sensor	Mounted on the LH side of the heater casing
High pressure sensor	Located between the condenser and the thermostatic expansion valve
Pollution sensor	RH side of the heater casing.
Solar sensor	Center of dash top

Capacities

Item	Capacity
Total system capacity	730 grams ± 10 grams

Published: 06-Jul-2011

Climate Control System - General Information - Climate Control System

Diagnosis and Testing

Principles of Operation

For a detailed description of the climate control system, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Air Distribution and Filtering (412-01 Climate Control, Description and Operation),
Heating and Ventilation (412-01 Climate Control, Description and Operation),
Air Conditioning (412-01 Climate Control, Description and Operation),
Control Components (412-01 Climate Control, Description and Operation),
Electric Booster Heater (412-02B Auxiliary Climate Control, Description and Operation),
Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Coolant level • Refrigerant leaks (UV lamp) • Drive belt • Compressor • Cooling fan • Control flap(s) • Duct(s) • Register(s) • Cabin air filter • Hose(s) • Coolant pump • Fuel Fired Booster Heater • Fuel Fired Booster Heater fuel pump • Fuel Fired Booster Heater fuel pipes	• Fuse(s) • Circuit • Blower motor • Electrical connector(s) • Compressor • Cooling fan • Actuators • Climate control assembly

3. **3.** Listen for any unusual noises during climate control system operation.
4. **4.** Inspect the refrigerant system with an ultraviolet (UV) lamp for traces of UV sensitive leak trace dye.
5. **5.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
6. **6.** If the cause is not visually evident, check Climate Control Module, Engine Control Module (ECM), Fuel Fired Booster Heater and Central Junction Box (CJB) for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Climate Control System

• NOTE: If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Climate Control System

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Heating Ventilation and Air Conditioning Control Module (HVAC) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Climate Control System - General Information - Air Conditioning (A/C) System Recovery, Evacuation and Charging

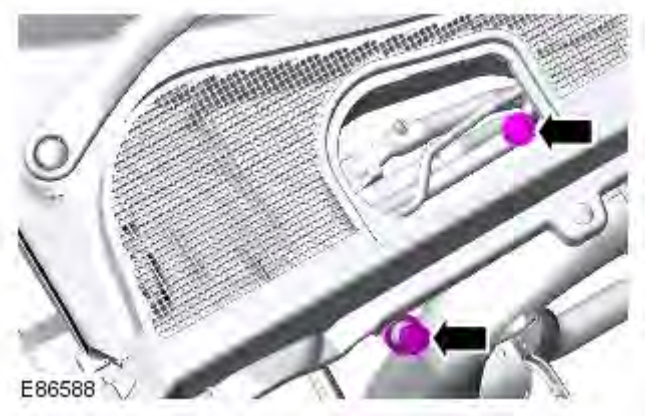
General Procedures

1. **1.** WARNING: Servicing must be carried out by personnel familliar with both vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

   • NOTE: The receiver drier need only be changed under the following circumstances: There is dirt in the refrigerant circuit (eg. compressor seizure), the system is leaking and refrigerant has been lost to atmosphere, or the refrigerant circuit has been open more than 24 hours, due to repair.

   Refrigerant recovery and recycle.

2. Remove the access cover.



3. Remove the dust covers from the high and low pressure connections.

4. Connect the high and low pressure lines to the appropriate connections.

5. Open the valves on the connections.

6. Turn the valves on the station to the correct positions.

7. Allow the system to recover the refrigerant from the system.

8. Close the valves on the refrigerant station.

9. Close the valves on the connections.

10. Disconnect the high and low pressure connections.
12. Evacuation.

13. Remove the dust covers from the high and low pressure connections.

14. Connect the high and low pressure lines to the appropriate connections.

15. Open the valves on the connections.

16. Allow the station to evacuate the A/C system.

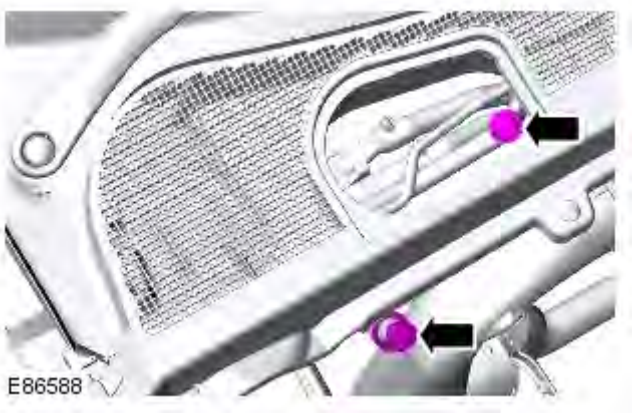
17. **17.** CAUTION: The system must be evacuated immediatley before recharging commences. Delay between evacuation and recharging is not permitted

    Recharging

18. Close the valves on the refrigerant station.

19. Close the valves on the connections.

20. Disconnect the high and low pressure connections.



21. Install the dust covers to the connectors.

    Torque: 6 Nm

22. Install the access cover.

Published: 11-May-2011

Climate Control -

Torque Specifications

Description	Nm	lb-ft
A/C compressor refridgerant line connections	24	18
A/C condenser refridgerant line connections	10	7
Compressor lower support bracket - 3.2 Petrol	25	18
Compressor upper support bracket - 3.2 Petrol:		
M10	45	33
M8	25	18
M6	10	7
Compressor mounting bolts - All engines	25	
Condenser core bolts	10	7
Heater core and evaporator core housing bolts	7	6
Heater housing to bulkhead Torx bolts	7	6
Pressure transducer	8	6
Thermostatic expansion valve bolts	4	3
Thermostatic expansion valve nut	9	7

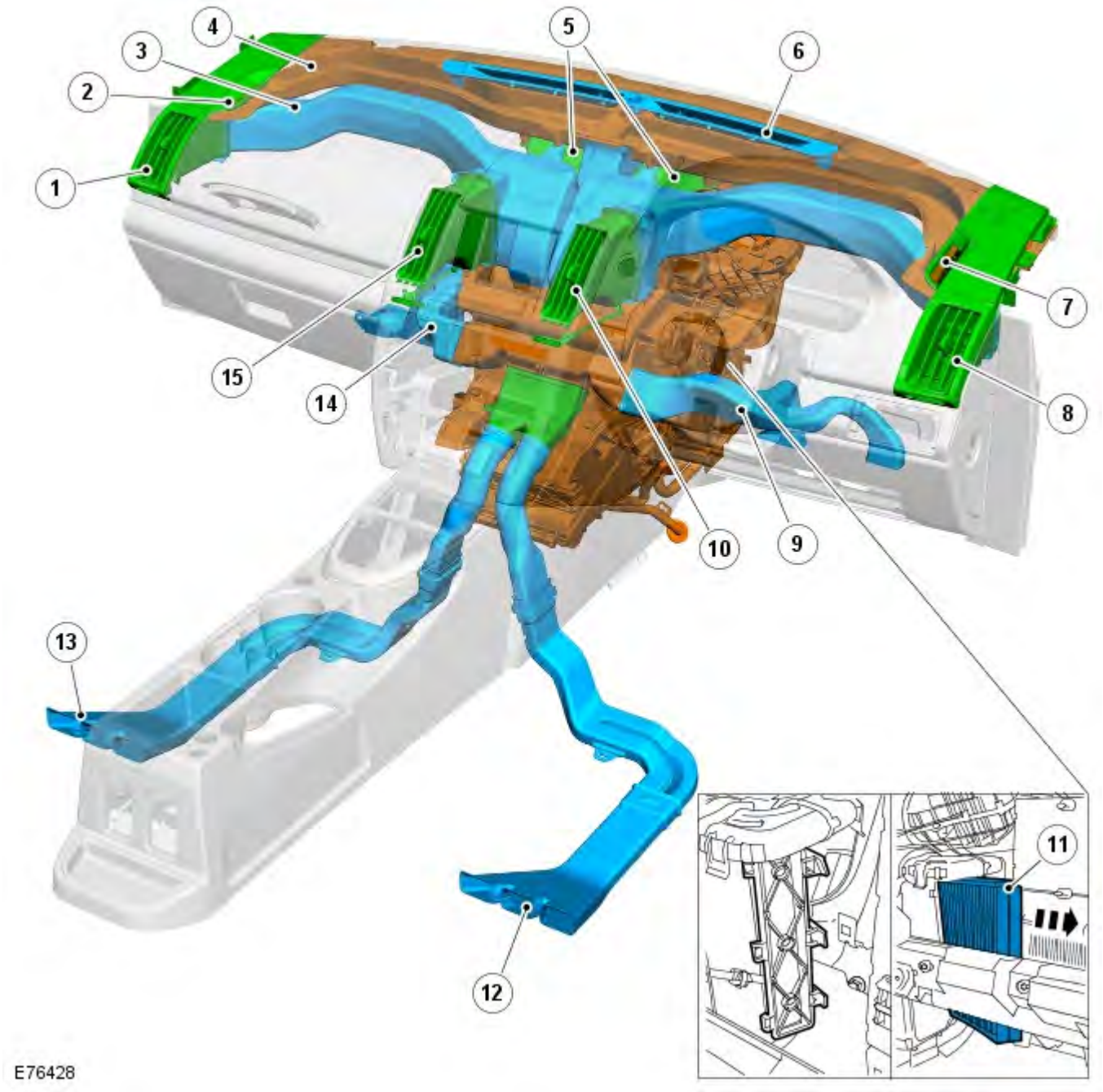
Published: 11-May-2011

Climate Control - Air Distribution and Filtering

Description and Operation

COMPONENT LOCATION

- NOTE: Right Hand Drive (RHD) shown, Left Hand Drive (LHD) similar



Item	Part Number	Description
1	-	Passenger face level/side window register
2	-	Side window vent
3	-	Face level duct
4	-	Side window duct
5	-	Windshield duct
6	-	Windshield vent
7	-	Side window vent
8	-	Driver face level/side window register
9	-	Driver footwell duct
10	-	Instrument panel center register
11	-	Cabin air filter
12	-	Rear cabin Right Hand (RH) duct
13	-	Rear cabin Left Hand (LH) duct
14	-	Passenger footwell duct
15	-	Instrument panel center register

OVERVIEW

The air distribution and filtering system controls the distribution and quality of air supplied into the front and rear of the cabin. The system consists of:

- Air ducts
- Air registers and vents
- A cabin air filter.

AIR DUCTS

The air ducts distribute air from the heater assembly to the various registers and vents in the instrument panel and to the rear of the vehicle.

The face level/side window duct and the windshield duct form part of the instrument panel assembly.

Each front footwell duct is a snap fit into the side of the heater assembly and secured to the cross car beam by a single screw. The front footwell ducts also provide a location for the footwell lamps.

The rear cabin ducts are also a snap fit into the heater assembly. Each duct runs underneath the carpet and is secured to the floor of the vehicle by a single screw located beneath the front seat.

AIR REGISTERS AND VENTS

The air registers allow the vehicle occupants to control the flow and direction of air from the air ducts. The instrument panel contains 4 air registers; 1 mounted on either end of the instrument panel and 2 mounted centrally.

The air vents are fixed outlets. The instrument panel contains 4 air vents; 1 mounted on either end of the instrument panel and 2 mounted along the top edge, below the windshield.

CABIN AIR FILTER

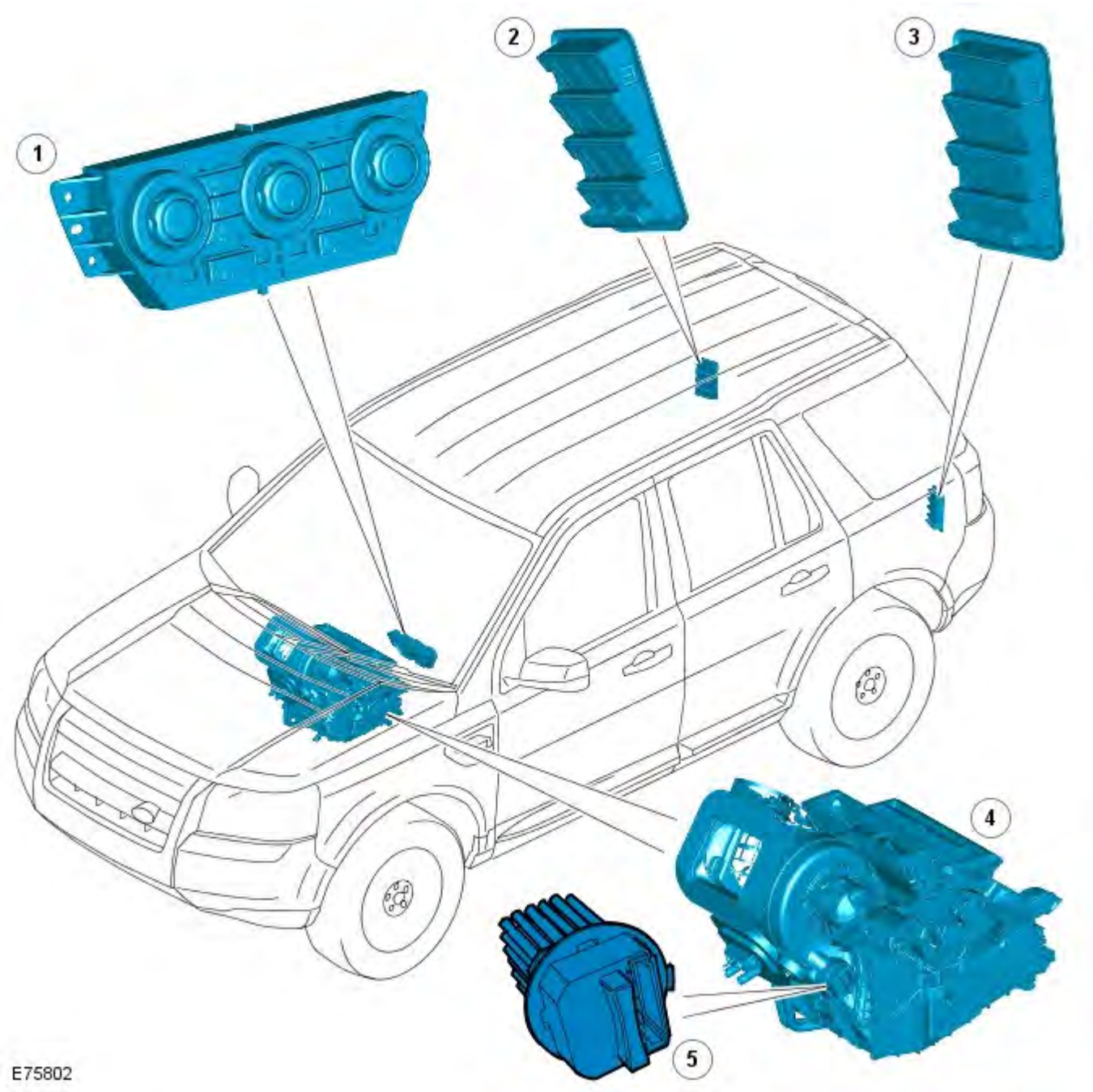
The cabin air filter is located behind the RH side of the instrument panel and is housed within the heater assembly. The filter removes odors and fine particles, including pollen, from the air entering the heater assembly.

Published: 11-May-2011

Climate Control - Heating and Ventilation

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Automatic Temperature Control (ATC) module
2	-	Right Hand (RH) ventilation outlet
3	-	Left Hand (LH) ventilation outlet
4	-	Heater assembly
5	-	Blower motor control module

OVERVIEW

Two levels of heating and ventilation are available. High specification vehicles are fitted with a dual zone automatic system, which can provide different temperature settings for the LH and RH sides of the cabin. The dual zone system may also be fitted with a pollution sensor to control the quality of air in the cabin.

Lower specification vehicles are fitted with a single zone manual system.

The heater assembly for both systems is installed on the vehicle center line, between the instrument panel and the engine bulkhead.

The ATC module controls operation of the blower motor via the blower motor control module, which is mounted on the bulkhead side of the heater assembly casing.For additional information, refer to: (412-01 Climate Control)

Air Distribution and Filtering (Description and Operation),
Air Conditioning (Description and Operation),
Control Components (Description and Operation).

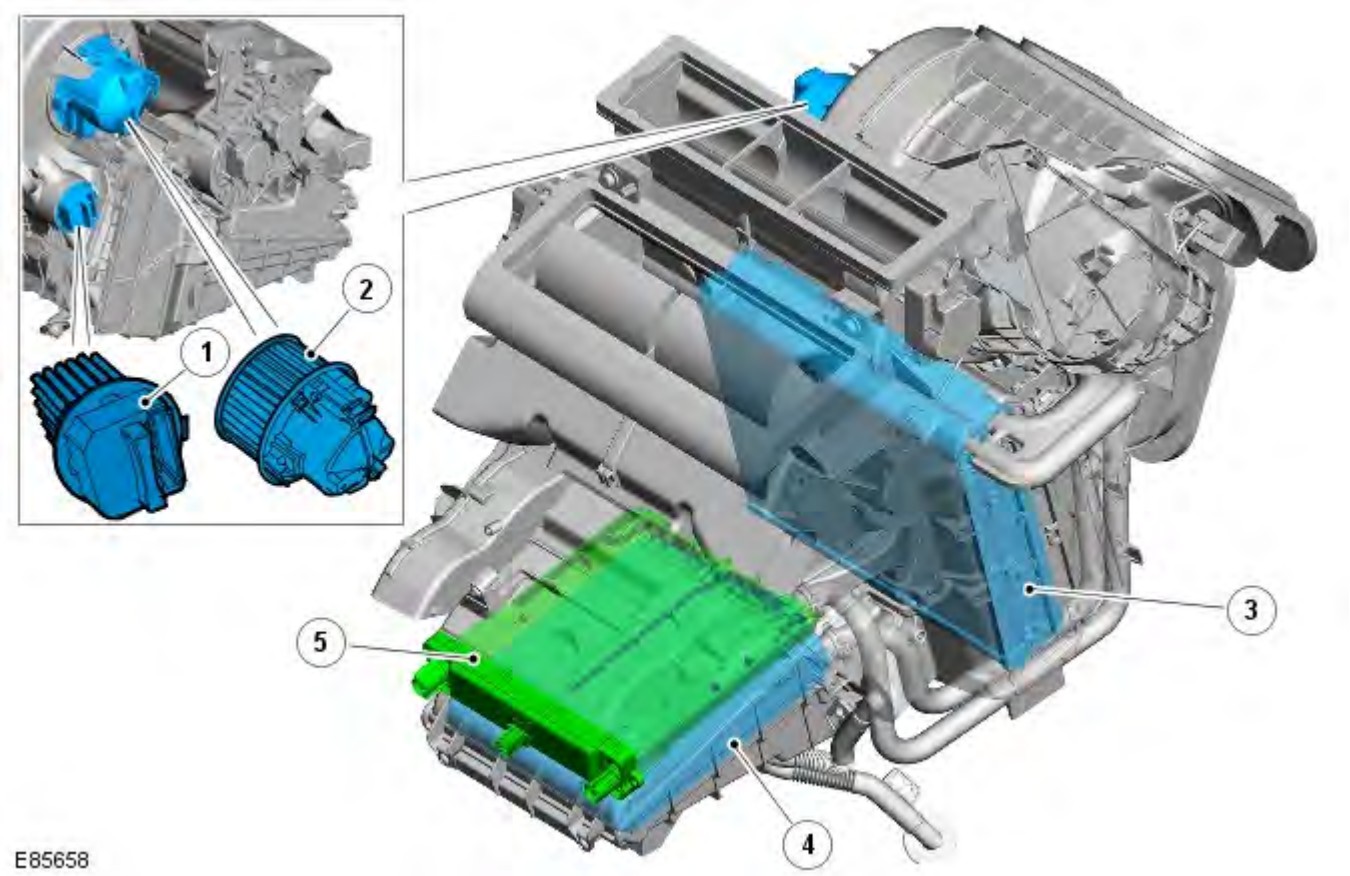
Some vehicles may also be fitted with an auxiliary heater. For additional information, refer to: (412-02B Auxiliary Climate Control)

Electric Booster Heater (Description and Operation),
Fuel Fired Booster Heater (Description and Operation).

AUTOMATIC TEMPERATURE CONTROL MODULE

Air distribution and temperature is controlled by the Automatic Temperature Control (ATC) module, which is integral with the control panel. In response to commands from the control panel, the ATC module controls operation of either 3 (single zone) or 5 (dual zone) stepper motors mounted on the heater assembly casing.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

HEATER ASSEMBLY



Item	Part Number	Description
1	-	Blower motor control module
2	-	Blower motor
3	-	Air Conditioning (A/C) evaporator
4	-	Heater core
5	-	Electric booster heater

The heater assembly controls the temperature of the air supplied to the air distribution ducts, as directed by the ATC module. The heater assembly is mounted on the vehicle center line and comprises the following components:

- Blower motor
- Heater core
- Cabin air filter.
  For additional information, refer to: Air Distribution and Filtering (412-01 Climate Control, Description and Operation).
- A/C evaporator.
  For additional information, refer to: Air Conditioning (412-01 Climate Control, Description and Operation).
- Air intake flap and stepper motor.
  For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).
- Air distribution flaps and stepper motors.
  For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).
- Temperature blend flaps and stepper motors.
  For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).
- Electric booster heater (if fitted).
  For additional information, refer to: Electric Booster Heater (412-02 Auxiliary Climate Control, Description and Operation).

Blower Motor

The blower motor comprises an open hub, centrifugal fan powered by an electric motor. Operation of the blower motor is controlled by the ATC module in conjunction with the blower motor control module. The ATC module provides a Pulse Width Modulated (PWM) signal to the blower motor control module based on the required blower speed. The blower motor control module interprets the PWM signal as a blower motor speed and controls the voltage to the blower motor accordingly.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

Heater Core

The heater core provides the heat source to warm the air being supplied into the cabin. The heater core is an aluminum, 2 pass, fin and tube heat exchanger installed across the width of the heater assembly. Two aluminum tubes attached to the heater core extend through the engine bulkhead and connect to the engine cooling system. When the engine is running, engine coolant is constantly circulated through the heater core by the coolant pump. For additional information, refer to:

Engine Cooling (303-03A Engine Cooling - I6 3.2L Petrol, Description and Operation),
Engine Cooling (303-03B Engine Cooling - TD4 2.2L Diesel, Description and Operation).

VENTILATION OUTLETS

The ventilation outlets allow the free flow of air through the cabin. The outlets are installed in the LH and RH rear quarter panels, behind the tail lamps.

Each ventilation outlet comprises a grille covered by a soft rubber flap, and is effectively a non-return valve. The flaps open and close automatically depending on the differential between cabin and outside air pressures.

PRINCIPLES OF OPERATION

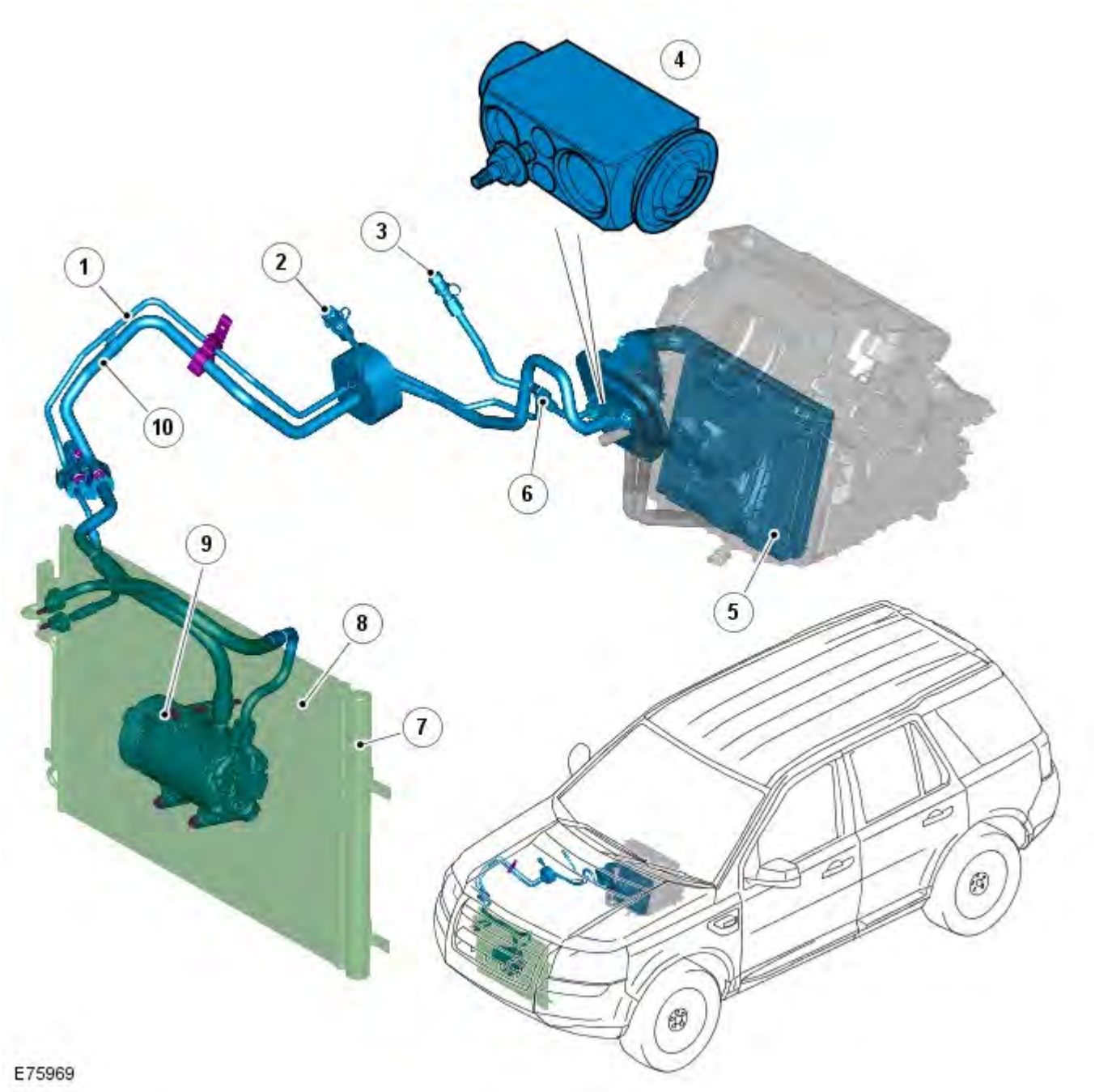
Operation of the heating and ventilation system is controlled by the ATC module.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

Published: 11-May-2011

Climate Control - Air Conditioning

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	High pressure line
2	-	High pressure servicing connection
3	-	Low pressure servicing connection
4	-	Thermostatic expansion valve
5	-	Evaporator
6	-	Refrigerant pressure sensor
7	-	Receiver/Drier
8	-	Condenser
9	-	Air Conditioning (A/C) compressor
10	-	Low pressure line

OVERVIEW

The A/C system transfers heat from the cabin to the outside atmosphere to provide the heater assembly with dehumidified cool air.

The A/C system is a sealed closed loop system, filled with a charge weight of R134a refrigerant as the heat transfer medium. The refrigerant charge weight for both i6 and TD4 vehicles is 730 g. Oil is added to the refrigerant to lubricate the

internal components of the A/C compressor.

Although different units, the A/C compressors fitted to both the i6 petrol engine and the TD4 diesel engine are both variable displacement units. The displacement (flow of refrigerant) is controlled to match the thermal load of the evaporator.

Operation of the A/C system is controlled by the Automatic Temperature Control (ATC) module.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

A/C COMPRESSOR

• NOTE: i6 A/C compressor shown, TD4 similar

The A/C compressor is driven by the engine accessory drive belt and circulates refrigerant around the system by compressing low pressure, low temperature vapor from the evaporator and discharging the resultant high pressure, high temperature vapor to the condenser.

To protect the system from excessive pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve vents excess pressure into the engine compartment.

i6

i6 vehicles are fitted with a Zexel-Valeo KC-88 variable displacement A/C compressor. Compressor displacement is controlled by the Engine Control Module (ECM) based on current evaporator temperature and target evaporator temperature signals received from the ATC module. From these values the ECM calculates the required compressor displacement and provides a Pulse Width Modulated (PWM) signal to the compressor solenoid valve. The compressor solenoid valve is mounted on the rear of the compressor and interprets the PWM signal as a displacement value and alters the position of the internal swash plate accordingly.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

The ECM will also reduce the displacement of the A/C compressor to its minimum level if 'full throttle' or automatic transmission 'kick down' is requested. This feature is not present on Gulf specification vehicles.

Compressor clutch engagement is controlled by the ECM.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

TD4

TD4 vehicles are fitted with a Visteon VS16 variable displacement A/C compressor. Displacement is controlled internally by a control valve, which is integral with the compressor. The control valve measures the input and output pressures of the refrigerant entering and leaving the compressor and controls the angle of the internal swash plate accordingly.

• NOTE: There is no external control over A/C compressor swash plate angle. Consequently, compressor displacement is neither measured nor calculated by any external control component.

Compressor clutch engagement is controlled by the ECM.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

CONDENSER

Item	Part Number	Description
1	-	Condenser
2	-	Receiver/Drier

The condenser transfers heat from the refrigerant to the surrounding air to convert the high pressure vapor from the compressor into a liquid. The condenser is installed immediately in front of the radiator. Two brackets on each end tank attach the condenser to the end tanks of the radiator.

The condenser is classified as a sub-cooling condenser and consists of a fin and tube heat exchanger core installed between 2 end tanks. Divisions in the end tanks separate the heat exchanger into a 4 pass upper (condenser) section and a 2 pass lower (sub-cooler) section.

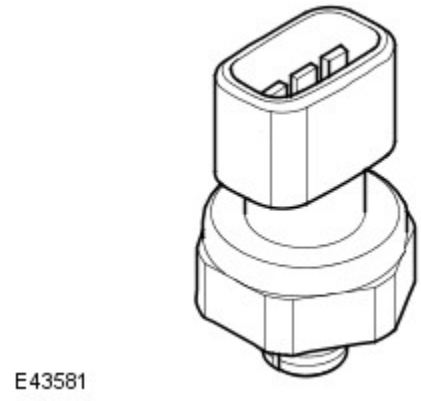
The RH end tank provides the connections to the high pressure line from the A/C compressor and the low pressure line to the evaporator.

RECEIVER/DRIER

The receiver/drier is integral with the condenser LH end tank and removes solid impurities and moisture from the refrigerant. It also acts as a reservoir for liquid refrigerant to accommodate changes of heat load at the evaporator.

Refrigerant entering the receiver drier passes through a filter and a desiccant pack, then collects in the base of the unit before flowing through the outlet pipe back to the condenser.

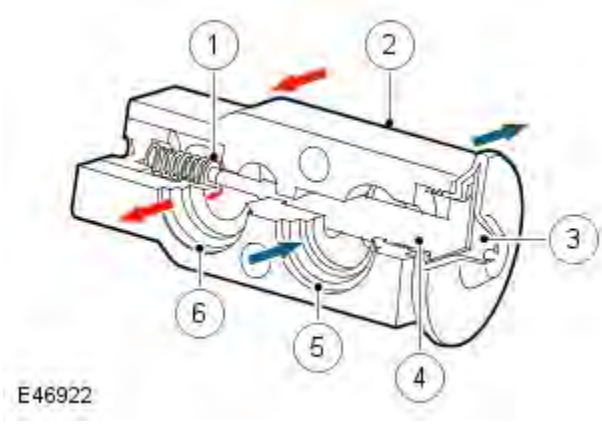
REFRIGERANT PRESSURE SENSOR



The refrigerant pressure sensor provides the ATC module with a pressure input from the high pressure side of the refrigerant system. The refrigerant pressure sensor is hardwired to the ECM, which uses the signal to control operation of the A/C compressor and to calculate the additional load on the engine when the A/C compressor is operating. The ECM also broadcasts the refrigerant high pressure value over the high speed Controller Area Network (CAN) bus to the Central Junction Box (CJB). The CJB relays the signal to the ATC module over the medium speed CAN bus to increase the amount of recirculated air if required.

The refrigerant pressure sensor is located in the refrigerant line between the condenser and the thermostatic expansion valve.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

THERMOSTATIC EXPANSION VALVE



Item	Part Number	Description
1	-	Metering valve
2	-	Housing
3	-	Diaphragm
4	-	Temperature sensor
5	-	Outlet passage from evaporator
6	-	Inlet passage from evaporator

The thermostatic expansion valve meters the flow of refrigerant into the evaporator, to match the refrigerant flow with the heat load of the air passing through the evaporator.

The thermostatic expansion valve is a block type valve located behind the heater assembly, and attached to the inlet and outlet ports of the evaporator. The thermostatic expansion valve consists of an aluminum housing containing inlet and outlet passages. A ball and spring metering valve is installed in the inlet passage and a temperature sensor is installed in the outlet passage. The temperature sensor consists of a temperature sensitive tube connected to a diaphragm. The bottom end of the temperature sensitive tube acts on the ball of the metering valve. Pressure on top of the diaphragm is controlled by the evaporator outlet temperature conducted through the temperature sensitive tube. The bottom of the diaphragm senses evaporator outlet pressure.

Liquid refrigerant flows through the metering valve into the evaporator. The restriction across the metering valve reduces the pressure and temperature of the refrigerant. The restriction also changes the liquid stream of refrigerant into a fine spray, to improve the evaporation process. As the refrigerant passes through the evaporator, it absorbs heat from the air flowing through the evaporator. The increase in temperature causes the refrigerant to vaporize and increase in pressure.

The temperature and pressure of the refrigerant leaving the evaporator acts on the diaphragm and temperature sensitive tube, which regulate the metering valve opening and so control the volume of refrigerant flowing through the evaporator. The warmer the air flowing through the evaporator, the more heat available to evaporate refrigerant and thus the greater volume of refrigerant allowed through the metering valve.

EVAPORATOR

The evaporator is installed in the heater assembly, between the blower and the heater core, to absorb heat from the exterior or recirculated air. Low pressure, low temperature refrigerant changes from liquid to vapor in the evaporator, absorbing large quantities of heat as it changes state.

Most of the moisture in the air passing through the evaporator condenses into water, which drains out of the vehicle by passing through a drain tube to the underside of the vehicle.

REFRIGERANT LINES

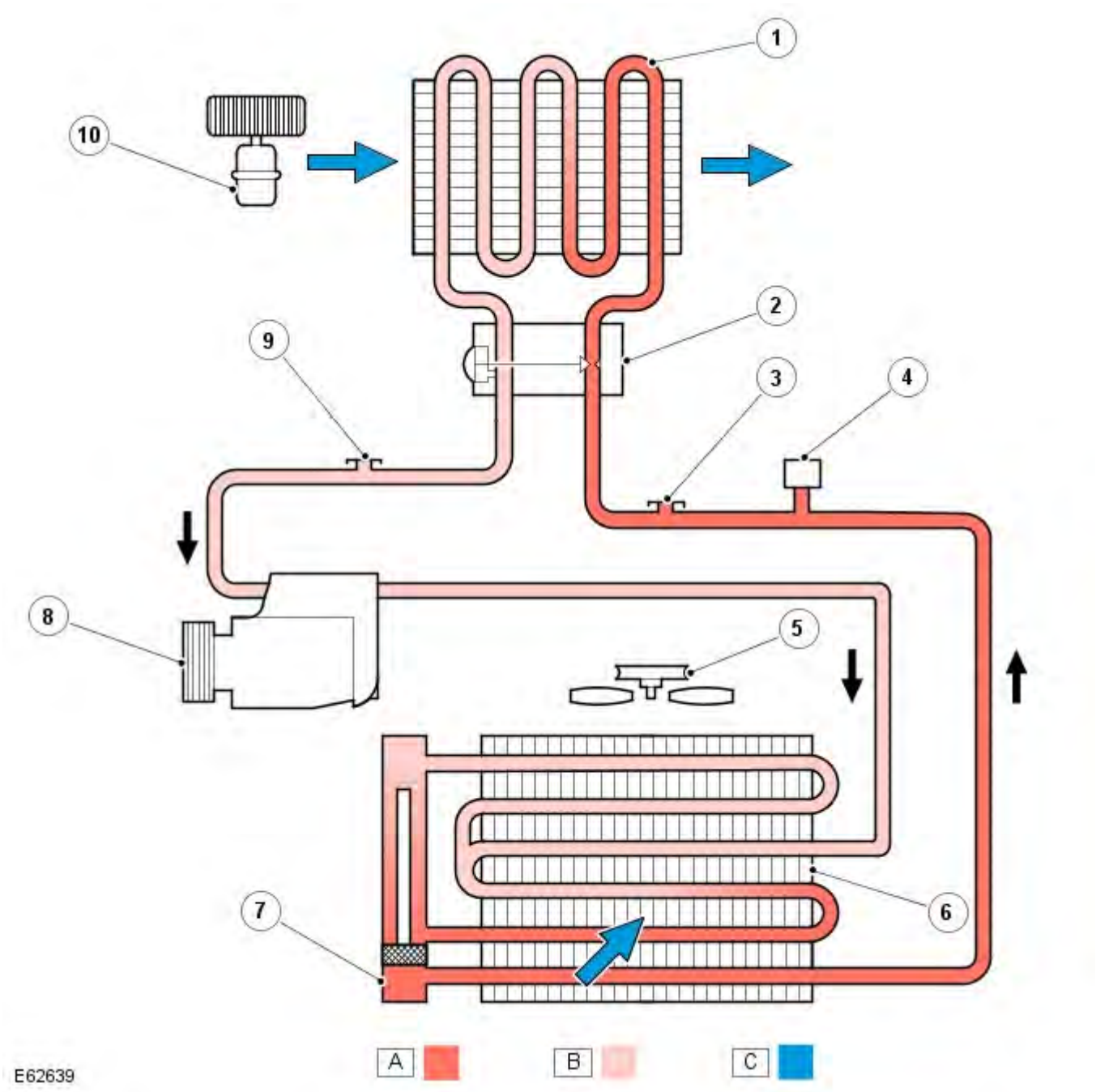
To maintain similar flow velocities around the A/C system the diameter of the refrigerant lines varies to suit the 2 pressure/temperature regimes. Larger diameter pipes are installed in the low pressure/temperature regime and smaller diameter pipes are installed in the high pressure/temperature regime.

Nylon lined, low permeability rubber hoses are used in the low pressure line into the A/C compressor, and in the high pressure line from the condenser. The remainder of the refrigerant lines are manufactured from steel.

Low and high pressure charging connections are incorporated into the refrigerant lines for system servicing.

CONTROL DIAGRAM

• NOTE: **A** = Refrigerant liquid; **B** = Refrigerant vapor; **C** = Air flow



Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	High pressure servicing connection
4	-	Refrigerant pressure sensor
5	-	Engine cooling fan
6	-	Condenser
7	-	Receiver/Drier
8	-	A/C compressor
9	-	Low pressure servicing connection
10	-	Cooling fan

PRINCIPLES OF OPERATION

To accomplish the transfer of heat, the refrigerant is circulated around the system, where it passes through 2 pressure/temperature regimes. In each of the regimes the refrigerant changes state, during which process maximum heat absorption or dissipation occurs.

The low pressure/temperature regime is from the thermostatic expansion valve, through the evaporator to the compressor. The refrigerant decreases in pressure and temperature at the thermostatic expansion valve then changes state from a liquid to a vapor in the evaporator to absorb heat.

The high pressure/temperature regime is from the compressor, through the condenser and receiver drier assembly to the thermostatic expansion valve. The refrigerant increases in pressure and temperature as it passes through the compressor, then releases heat and changes state from a vapor to a liquid in the condenser.

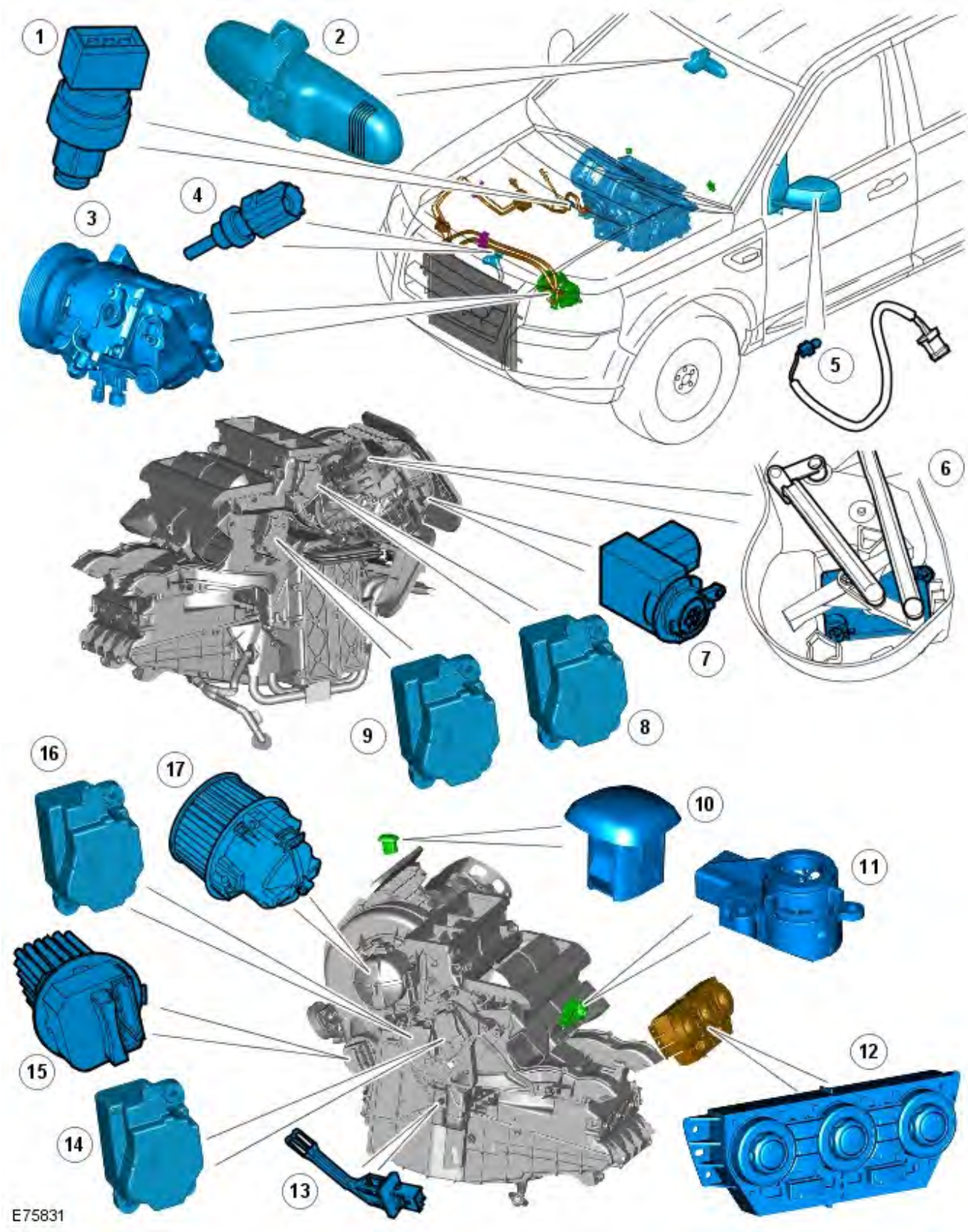
Operation of the A/C system is controlled by the Automatic Temperature Control (ATC) module.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

Published: 11-May-2011

Climate Control - Control Components

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Refrigerant pressure sensor
2	-	Cabin humidity sensor (if fitted)
3	-	Air Conditioning (A/C) compressor (i6 shown)
4	-	Engine Coolant Temperature (ECT) sensor
5	-	Ambient air temperature sensor
6	-	Air intake stepper motor

7	-	Pollution sensor (if fitted)
8	-	Windshield distribution (defrost) stepper motor
9	-	Right Hand (RH) temperature blend stepper motor
10	-	Sunload sensor
11	-	Cabin temperature sensor
12	-	Automatic Temperature Control (ATC) module
13	-	Evaporator temperature sensor
14	-	Left Hand (LH) temperature blend stepper motor
15	-	Blower motor control module
16	-	Face/feet distribution stepper motor
17	-	Blower motor

OVERVIEW

The climate control system incorporates the heating, ventilation and A/C systems. There are 2 main types of climate control system available;

- a single zone manual system
- a dual zone automatic system.

The climate control functions for both systems are controlled by the ATC module. The ATC module is mounted in the center console and contains both the system electronic software and user controls.

The ATC module works in conjunction with a number of other vehicle control modules, including the Engine Control Module (ECM), which controls a number of climate control sub-systems on receipt of requests from the ATC module.

The single zone climate control system features manual control for air temperature, air distribution and air source, although a small amount of automatic control does exist in the ATC software. In response to system inputs, the ATC module controls the operation of 3 stepper motors mounted on the heater assembly. The stepper motors then adjust the position of the air temperature, air distribution and air source flaps accordingly.

The dual zone climate control system features automatic control of air temperature, air distribution and blower motor speed. The ATC module is also able to control individual temperature requests for both the driver and passenger side of the cabin.

• NOTE: The ATC module can only maintain a maximum temperature difference between the 2 sides of the cabin of up to approximately 3ºC (4ºF). This is due to the movement and mix of air within the cabin.

The dual zone climate control system features 2 additional sensors; a cabin temperature sensor and a sunload sensor. The cabin temperature sensor provides a temperature feedback to enable the ATC module software maintain a constant cabin temperature. The sunload sensor provides a reading of solar loading on the vehicle occupants and enables the ATC module to adjust the output from the climate control system accordingly.

Higher specification versions of the dual zone climate control system are also available. These systems feature 2 more additional sensors; a pollution sensor and a cabin humidity sensor.

The pollution sensor detects pollutants entering the cabin, allowing the ATC module to react by changing the position of the air intake flap. The cabin humidity sensor calculates the probability of misting on the windshield. The ATC module monitors the signal from the cabin humidity sensor and adjusts blower speed, air distribution and A/C compressor displacement accordingly.

Stop/Start Vehicles - From 2010 MY

To support the Stop/Start system, a number of changes have been made to the logic and operation of climate control system within a Stop/Start cycle to:

- maintain occupant comfort
- prevent windshield misting
- conserve battery power.

This has been achieved by the ATC (automatic temperature control) module monitoring and varying when necessary, various climate control functions within a Stop/Start cycle.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

To maintain the cabin temperature when the engine is shutdown in a Stop/Start cycle, an auxiliary electric coolant-pump has also been integrated into the cooling system to maintain the coolant flow through the cabin's heater core. The pump is directly hardwired to the ECM. On vehicles fitted with a FFH (fuel fired heater), the FFH coolant pump is utilized and activated via the FFH.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

• NOTE: From 2010 MY, the 'ECON' switch will be labeled 'A/C' to prevent confusion with the 'Eco' switch which operates the 'Stop/Start' and 'Gear Change Indicator' systems.

ATC MODULE

The ATC module is mounted in the center console and is integral with the control panel. The module works in conjunction with the ECM to control all aspects of heating, ventilation, and A/C. An 18-pin electrical connector on the rear of the module provides hardwired, Controller Area Network (CAN) bus and Local Interconnect Network (LIN) bus connections to allow interaction with A/C system components and other vehicle control modules.
For additional information, refer to: Communications Network (418-00 Module Communications Network, Description and Operation).

Six different ATC modules (2 single zone, 4 dual zone) are available, depending on vehicle specification. Low specification vehicles feature 3 rotary controllers and 3 top hinged momentary switches to control the quality, temperature and distribution of air into the cabin. High specification vehicles feature 3 rotary controllers, 6 top hinged momentary switches, and 2 dual function momentary switches to control the quality, temperature and distribution of air into the cabin.

In addition to the A/C system, the ATC module controls operation of:

- The seat heaters
- The rear window heater
- The windshield heater
- The exterior mirror heaters.

For more information, refer to the 'Principles of Operation' section below.

COMPRESSOR SOLENOID VALVE

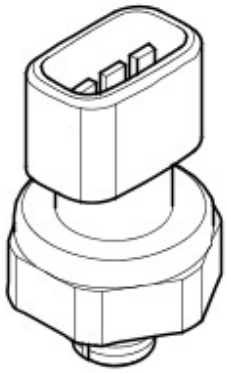
Item	Part Number	Description
1	-	Compressor solenoid valve

The compressor solenoid valve is integral with the A/C compressor. Operation of the solenoid valve is controlled by the ECM using a Pulse Width Modulated (PWM) signal of differing values. By controlling the flow of refrigerant (displacement) through the compressor, the solenoid valve can control evaporator operating temperature and cabin humidity by varying the pressure within the A/C system.

• NOTE: The A/C compressor solenoid valve is fitted to i6 petrol vehicles only.

For additional information, refer to: Air Conditioning (412-01 Climate Control, Description and Operation).

REFRIGERANT PRESSURE SENSOR



E43581

The refrigerant pressure sensor provides the ECM with a pressure input from the high pressure side of the refrigerant system. The pressure sensor is located in the refrigerant line between the condenser and the thermostatic expansion valve.

The ECM supplies a 5 V reference feed to the pressure sensor and receives a return signal voltage, between 0 V and 5 V, related to system pressure. The ECM uses the signal from the sensor to protect the refrigerant system from extremes of pressure.

If the pressure within the refrigerant system exceeds the minimum or maximum pressure limits, the ECM will;

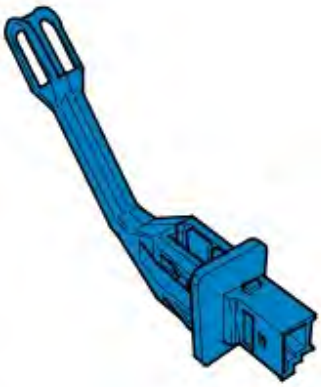
- disable the A/C compressor (TD4 vehicles)
- reduce A/C compressor displacement (i6 vehicles).

If a reduction in A/C compressor displacement fails to bring the system back into it's optimum pressure range, the i6 ECM will disable the A/C compressor.

The ECM constantly sends a refrigerant system pressure signal to the ATC module. The signal is transmitted from the ECM to the Central Junction Box (CJB) over the high speed CAN bus. The CJB acts as a gateway and provides the pressure signal to the ATC module over the medium speed CAN bus.

If the pressure within the refrigerant system rises above its maximum pressure limit, the ATC module will increase the amount of recirculated air entering the cabin. This helps lower the pressure within the refrigerant system and thus helps to avoid having to disable the A/C compressor.

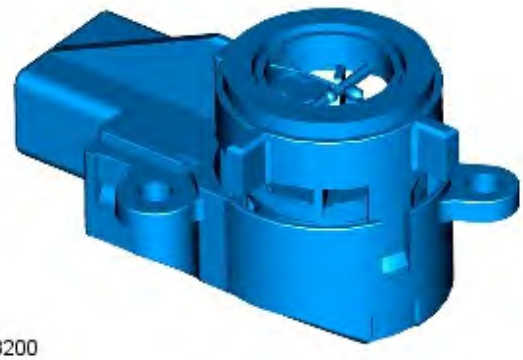
EVAPORATOR TEMPERATURE SENSOR



E78199

The evaporator temperature sensor is a Negative Temperature Coefficient (NTC) thermistor. The sensor is mounted on the LH side of the heater casing, and measures the temperature of cooled air once it has traveled over the evaporator. The sensor receives a 5 V reference feed from the ATC module. By monitoring the returned voltage, the ATC module can calculate the resistance of the sensor and hence evaporator temperature.

CABIN TEMPERATURE SENSOR



E78200

The cabin temperature sensor comprises a NTC thermistor and a motor. The sensor is mounted behind a grill on the drivers side of the instrument panel, adjacent the steering column.

• NOTE: The cabin temperature sensor is only fitted to vehicles with a dual zone, automatic climate control system.

The motor is provided an electrical feed from the ATC module and draws cabin air in through the grill and over the thermistor. The thermistor receives a 5 V reference feed from the ATC module. By monitoring the returned voltage, the ATC module can calculate air temperature within the cabin.

CABIN HUMIDITY SENSOR

The cabin humidity sensor is located within the interior mirror and comprises 3 individual elements:

- A humidity sensor
- An air temperature sensor
- A windshield glass temperature sensor.

• NOTE: The cabin humidity sensor is an optional fit only.

The readings from these 3 sensors combine to reduce the risk of misting on the windshield.

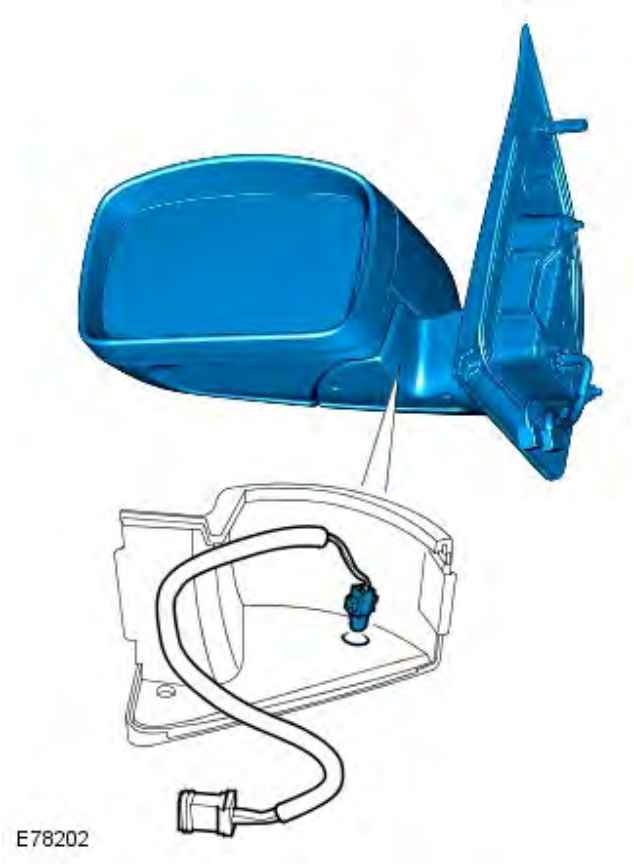
The humidity sensor element is contained behind a nylon mesh cover. The sensor comprises an element made up of film capacitors on different substrates. The dielectric is a polymer which absorbs or releases water proportional to the humidity of the air being drawn through the sensor. This causes a change in the capacitance of the sensor.

Humidity within the cabin is controlled by raising or lowering the temperature of the evaporator. An increase in evaporator temperature increases the moisture content of the air in the cabin. Lowering the evaporator temperature reduces the moisture content of the air in the cabin.

The capacitance of the sensor, together with both temperature values, are provided as LIN bus messages to the ATC module. The ATC module uses these signals to calculate the dew point of the air at the windshield. When the temperature of the windshield glass reaches or falls below this value, misting is likely to occur. In this instance, the ATC module will;

- raise the temperature of the air leaving the heater assembly
- adjust the position of the windshield distribution (defrost) stepper motor
- adjust the position of the air intake stepper motor
- reduce A/C compressor displacement (i6 only)
- power the windshield heater elements (if fitted).

AMBIENT AIR TEMPERATURE SENSOR



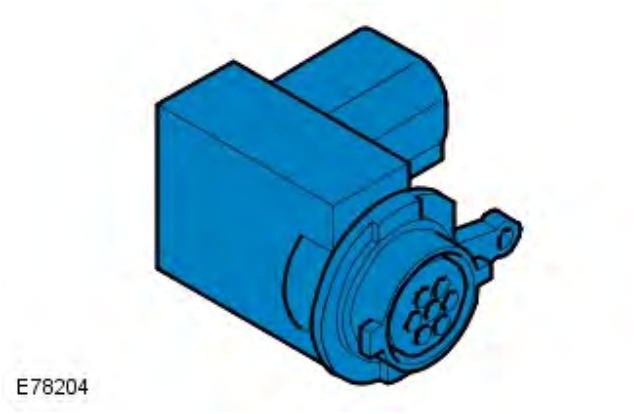
The ambient air temperature sensor is a NTC thermistor, and is mounted in the LH door mirror. The sensor receives a 5 V reference feed from the ECM. By monitoring the returned voltage, the ECM can calculate the resistance of the sensor and hence ambient air temperature. The ECM transmits an ambient air temperature value over the high speed CAN bus. This value is relayed to the ATC module by the CJB over the medium speed CAN bus.

SUNLOAD SENSOR

The sunload sensor is mounted in the center of the instrument panel upper surface. The sensor contains a photoelectric cell, which provides the CJB with an input of light intensity equating to the solar heating effect on the cabin.

The solar heating value is transmitted from the CJB to the ATC module over the medium speed CAN bus. The ATC module compensates for the solar heating effect by adjusting blower speed, air output temperature and air distribution to maintain the required cabin temperature.

POLLUTION SENSOR



The pollution sensor allows the ATC module to monitor intake air for the level of carbon monoxide (CO) and oxides of nitrogen (NOx). The sensor is mounted on the RH side of the heater casing.

• NOTE: The pollution sensor is an optional fit on vehicles with a dual zone, automatic climate control system.

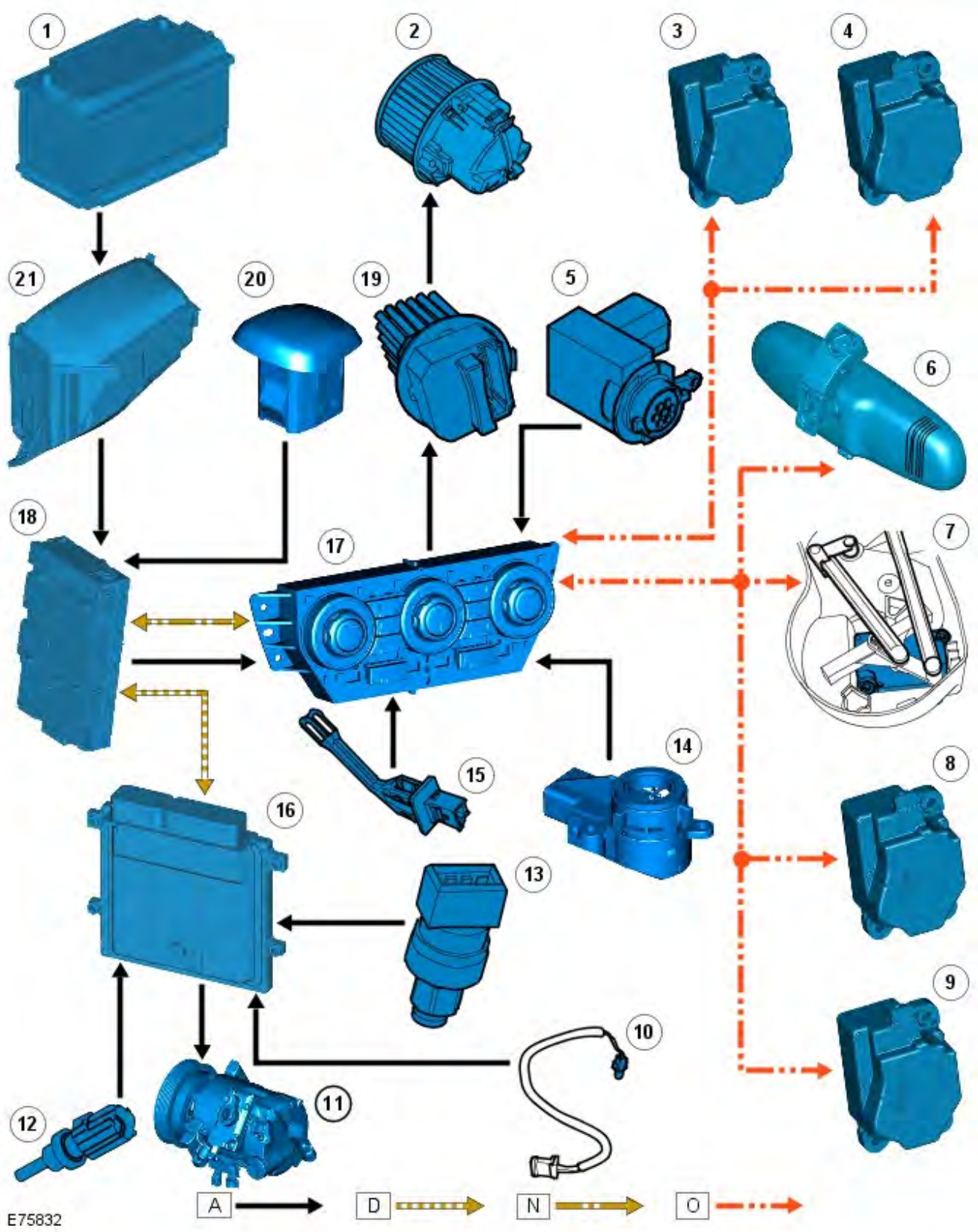
The pollution sensor is provided an ignition controlled feed from the Battery Junction Box (BJB) and provides one of the following 4 signals to the ATC module based on ambient air quality:

- Static or reduced pollution levels
- Small increase in pollution levels
- Medium increase in pollution levels
- Rapid or large increase in pollution levels.

Based on the signal from the pollution sensor, the ATC module is able to control the intake air source to reduce the amount of contaminants entering the cabin. This function is fully automatic, but can be overridden by manual selection of the air intake source using the fresh/recirculated air switch on the control panel.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High Speed CAN bus; **N** = Medium Speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1	-	Battery
2	-	Blower motor
3	-	LH temperature blend stepper motor
4	-	Windshield distribution (defrost) stepper motor
5	-	Pollution sensor
6	-	Cabin humidity sensor
7	-	Air intake stepper motor
8	-	RH temperature blend stepper motor
9	-	Face/feet distribution stepper motor
10	-	Ambient air temperature sensor
11	-	A/C compressor solenoid - i6 only
12	-	ECT sensor
13	-	Refrigerant pressure sensor

14	-	Cabin temperature sensor
15	-	Evaporator temperature sensor
16	-	ECM
17	-	ATC module
18	-	Fuse 27, CJB
19	-	Blower motor control module
20	-	Sunload sensor
21	-	Fusible link 17, BJB

PRINCIPLES OF OPERATION

Intake Air Control - Single Zone Manual System

The intake air source is controlled manually by pressing the fresh/recirculated air switch located on the control panel. When pressed, the ATC module will illuminate the switch tell-tale Light Emitting Diode (LED) and close the air intake door. A second press of the switch will cause the ATC module to extinguish the switch LED and open the air intake door, allowing fresh air to enter the cabin.

• NOTE: The ATC module will reduce the amount of fresh air entering the cabin to reduce the ram effect caused by forward motion of the vehicle.

When recirculated air is selected, the ATC module will return the air intake door to the open position after a period of 3 minutes. This helps prevent misting within the cabin. The 3 minute time period for recirculated air can be overridden by pressing and holding the fresh/recirculated air switch until the switch LED flashes 3 times. The air intake door will now remain closed until the next drive cycle.

The ATC module controls the position of the air intake door by providing LIN bus messages to the air intake door stepper motor. A Hall effect sensor located within the stepper motor informs the ATC module that movement of the stepper motor is taking place.

Intake Air Control - Dual Zone Automatic System

The intake air source is controlled automatically unless overridden by pressing the fresh/recirculated air switch located on the control panel. Under automatic control, the ATC module determines the required position of the air intake door using its 'comfort' algorithm based on inputs from the ambient air temperature sensor and the cabin temperature sensor.

When the vehicle first enters power mode 6 (ignition on), the tell-tale LED on the fresh/recirculated air switch will be illuminated and the air intake source will be automatically controlled by the ATC module. The ATC module will control the intake air source according to ambient air temperature and requested cabin temperature. The intake air door will be opened to allow fresh air into the cabin, although a small amount of recirculated air will also be present.

• NOTE: The ATC module will reduce the amount of fresh air entering the cabin to reduce the ram effect caused by forward motion of the vehicle.

A single press of the fresh/recirculated air switch will extinguish the tell-tale LED. The ATC module will now close the air intake door and provide only recirculated air into the cabin for a period of 3 minutes. After this period, the ATC module will return the air intake door to automatic control. This helps prevent misting within the cabin.

A second press of the fresh/recirculated air switch will also return the intake air source to automatic control and illuminate the tell-tale LED.

The 3 minute time period for recirculated air can be overridden by pressing and holding the fresh/recirculated air switch until the switch LED flashes 3 times. The air intake door will now remain closed until the next drive cycle.

The ATC module controls the position of the air intake door by providing LIN bus messages to the air intake door stepper motor. A Hall effect sensor located within the stepper motor informs the ATC module that movement of the stepper motor is taking place.

Intake Air Control - Dual Zone Automatic System with Pollution Sensor

The intake air source is controlled automatically unless overridden by pressing the fresh/recirculated air switch located on the control panel. Under automatic control, the ATC module determines the required position of the air intake door using its 'comfort' algorithm based on inputs from the ambient air temperature sensor, the cabin temperature sensor and the pollution sensor.

• NOTE: The ATC module will reduce the amount of fresh air entering the cabin to reduce the ram effect caused by forward motion of the vehicle.

When the vehicle first enters power mode 6 (ignition on), the 'AUTO' tell-tale LED on the fresh/recirculated air switch will be illuminated and the air intake source will be automatically controlled by the ATC module. A single press of the fresh/recirculated air switch will extinguish the 'AUTO' tell-tale LED and illuminate the 'MAN' tell-tale LED. The ATC module will now close the air intake door and provide only recirculated air into the cabin for a period of 3 minutes. After this period, the ATC module will return the air intake door to automatic control. This helps prevent misting within the cabin.

A second press of the fresh/recirculated air switch will extinguish both the 'AUTO' and 'MAN' tell-tale LED's. The ATC module will now control the intake air source according to ambient air temperature and requested cabin temperature. The air intake door will be opened to allow fresh air into the cabin, but a small amount of recirculated air will also be present. The amount of recirculated air is determined by the ATC module using its 'comfort' algorithm based on inputs from the ambient air temperature sensor and the cabin temperature sensor.

A third press of the fresh/recirculated air switch returns the air intake source to automatic control and will illuminate the 'AUTO' tell-tale LED.

The 3 minute time period for recirculated air can be overridden by pressing and holding the fresh/recirculated air switch until the switch LED's flash 3 times. The air intake door will now remain closed until the next drive cycle.

The ATC module controls the position of the air intake door by providing LIN bus messages to the air intake door stepper

motor. A Hall effect sensor located within the stepper motor informs the ATC module that movement of the stepper motor is taking place.

Air Temperature Control - Single Zone Manual System

Cabin temperature selection is made by turning the LH rotary controller to the required position. Turning the controller counter clockwise will lower the temperature of the air exiting the heater assembly; turning the controller clockwise will raise the temperature of the air exiting the heater assembly.

Maximum heating and cooling is represented on the control panel by a red and blue dot respectively. When either maximum heating or cooling is selected, the 'comfort' algorithm in the ATC module will adopt a suitable strategy for air source, air distribution and blower speed to maintain maximum heating or cooling within the cabin.

The ATC module adjusts the temperature of the air exiting the heater assembly by moving the position of the temperature blend door. The temperature blend door directs a proportion of cooled air from the evaporator through the heater core to produce the required temperature output. The ATC module adjusts the position of the temperature blend door by providing LIN bus messages to the blend door stepper motor. A Hall effect sensor located within the stepper motor informs the ATC module that movement of the stepper motor is taking place.

Air Temperature Control - Dual Zone Automatic System

Dual zone systems feature 2 rotary heating controllers, which allow individual climate control for the LH and RH sides of the cabin. Temperature selection can be made by turning the controller to the required temperature marked on the control panel. Turning either controller past the 16°C (61°F) mark will initiate the maximum cooling strategy; turning either controller past the 28°C (82°F) mark will initiate the maximum heating strategy.

• NOTE: Maximum cooling or heating can only be achieved if both rotary controllers are set to the same position.

The ATC module is able to maintain constant temperatures in both sides of the cabin by monitoring the feedback from the cabin temperature sensor. Unless any manual overrides have been selected, the ATC module will automatically control the intake air source, air distribution into the cabin and blower speed to maintain the required temperatures.

Dual zone systems feature 2 temperature blend doors, allowing individual temperature output for the LH and RH sides of the cabin.

• NOTE: The drivers side temperature setting has priority over the passengers side temperature setting.

The temperature blend doors are mounted on the LH side of the heater assembly and direct a proportion of cooled air from the evaporator through the heater core to provide the required temperature outputs. The ATC module controls the position of the temperature blend doors by providing LIN bus messages to the blend door stepper motors. Hall effect sensors located within the stepper motors inform the ATC module that movement of the stepper motors is taking place.

Blower Motor Control - Single Zone Manual System

Blower motor speed is set by turning the RH rotary controller to the required position. The RH rotary controller allows the selection of 14 blower motor speeds. Turning the controller fully counter clockwise will turn the blower motor off.

Operation of the blower motor is controlled by the ATC module via the blower motor control module. The ATC module provides a PWM signal to the blower motor control module based on the selected blower speed. The blower motor control module interprets the PWM signal as a blower motor speed and controls the voltage to the blower motor accordingly.

Blower Motor Control - Dual Zone Automatic System

Blower motor speed is controlled automatically by the ATC module unless a manual override has been requested. Manual overrides to blower motor speed can be made by turning the central rotary controller to the required position. The rotary controller allows the manual selection of 7 blower motor speeds. Turning the controller fully counter clockwise will turn the blower motor off. When a manual override has been made, the 'AUTO' LED located in the center of the rotary controller will extinguish.

• NOTE: The central rotary controller contains 2 LED's. The top (round) LED will illuminate when the blower motor is under automatic control. The bottom (rectangular) LED will illuminated when air distribution into the cabin is under automatic control (see below).

The blower motor can be returned to automatic control by pressing the 'AUTO' switch located in the center of the rotary controller. Under automatic control, the ATC module varies the speed of the blower motor in line with its 'comfort' algorithm to maintain the required cabin temperature. The ATC module will also vary the blower motor speed to compensate for the ram effect on intake air produced by forward movement of the vehicle.

Operation of the blower motor is controlled by the ATC module via the blower motor control module. The ATC module provides a PWM signal to the blower motor control module based on the required blower speed. The blower motor control module interprets the PWM signal as a blower motor speed and controls the voltage to the blower motor accordingly.

Air Distribution Control - Single Zone Manual System

Air distribution into the cabin can be adjusted by turning the central rotary controller to the required position. The ATC module adjusts the position of the air distribution door to the required position by providing LIN bus messages to the air distribution door stepper motor. A Hall effect sensor located within the stepper motor informs the ATC module that movement of the stepper motor is taking place.

Air Distribution Control - Dual Zone Automatic System

Air distribution into the cabin is controlled automatically by the ATC module unless any manual overrides have been requested. Manual overrides can be made by pressing the appropriate air distribution momentary switch on the control panel. If a manual override has been requested, the 'AUTO' LED located in the center of the blower motor rotary controller will extinguish.

• NOTE: The central rotary controller contains 2 LED's. The top (round) LED will illuminate when the blower motor is under automatic control (see above). The bottom (rectangular) LED will illuminated when air distribution into the cabin is under

automatic control.

Air distribution can be returned to automatic control by pressing the 'AUTO' switch located in the center of the blower motor rotary controller. This will illuminate the 'AUTO' LED and allow the ATC module to control air distribution in line with its 'comfort' algorithm

Air distribution is controlled by 2 air distribution doors. The ATC module controls the position of the air distribution doors by providing LIN bus messages to the door stepper motors. Hall effect sensors located within the stepper motors inform the ATC module that movement of the stepper motors is taking place.

ECON - Single Zone Manual System

Pressing the 'ECON' momentary switch on the control panel will switch off the A/C system. When selected, the ATC module will transmit a message over the high speed CAN bus to the ECM requesting the A/C compressor is disabled. The ECM disables the compressor by de-energizing the A/C compressor control relay located in the BJB. The tell-tale LED in the switch will illuminate to alert the vehicle occupants that the system is in 'ECON' mode.

When 'ECON' mode is selected, temperature control is still available but no cooling of intake air will take place. The minimum output air temperature from the system will be ambient air temperature plus any heat pick up in the air intake path.

A/C can be switched back on by pressing the 'ECON' switch a second time. This will also extinguish the 'ECON' LED.

Stop/Start Vehicles - From 2010 MY

From 2010 MY, the 'ECON' switch will be labeled ‘A/C’ to prevent confusion with the ‘Eco’ switch which operates the ‘Stop/Start’ and 'Gear Change Indicator' systems.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

ECON - Dual Zone Automatic System

Pressing the 'ECON/OFF' momentary switch in the control panel will switch off the A/C system. When selected, the ATC module will transmit a message over the high speed CAN bus to the ECM requesting the A/C compressor is disabled. The ECM disables the compressor by de-energizing the A/C compressor control relay located in the BJB. The 'ECON' tell-tale LED in the switch will illuminate to alert the vehicle occupants that the system is in 'ECON' mode.

When 'ECON' mode is selected, temperature control is still available but no cooling of intake air will take place. The minimum output air temperature from the system will be ambient air temperature plus any heat pick up in the air intake path.

A second press of the 'ECON/OFF' switch will extinguish the 'ECON' LED and illuminate the 'OFF' LED. When in 'OFF' mode the ATC module sets the blower motor speed to 0. Air distribution into the cabin will remain as previously selected. All LED's on the control panel will be extinguished, although night time illumination will remain active.

• NOTE: When in 'OFF' mode, the heated seat, heated windshield and heated rear window functions will still be available.

A third press of the 'ECON/OFF' switch returns the system to normal (A/C) operation and extinguishes the 'OFF' LED. The system can be returned to automatic operation at any time by pressing the 'AUTO' switch mounted in the central (blower motor) rotary controller.

Stop/Start Vehicles - From 2010 MY

From 2010 MY, the 'ECON' switch will be labeled ‘A/C’ to prevent confusion with the ‘Eco’ switch which operates the ‘Stop/Start’ and 'Gear Change Indicator' systems.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

Programmed Defrost

The programmed defrost function is only available on vehicles fitted with a dual zone heating, ventilation and A/C system. The function is selected by pressing the 'PROG' momentary switch on the control panel. When selected, the ATC module provides maximum windshield defrosting/demisting by configuring the system as follows:

- 'AUTO' mode off
- Intake air set to fresh air
- Air distribution set to windshield
- Blower motor speed set to maximum
- Heated windshield on
- Rear window heater on.

When programmed defrost is selected, the set temperature will remain unchanged. Programmed defrost can be cancelled by any of the following methods:

- Pressing any air distribution momentary switch
- Pressing the 'AUTO' switch located in the center of the blower motor rotary controller
- Pressing the 'PROG' momentary switch a second time.

• NOTE: Blower motor speed can be adjusted without terminating programmed defrost.

Windshield Heater

The windshield heater comprises 2 heater elements, LH and RH, bonded between the glass laminations. The system is switched on by pressing the momentary switch located on the control panel. When selected, the ATC module transmits a heating request on the high speed CAN bus to the CJB. On receipt of the message, the CJB energizes the windshield heater relay located in the BJB by providing a ground path for the relay coil. The energized relay provides a battery feed to both heater elements. After a period of 4 minutes the ATC module removes the request for windshield heating. The CJB then powers down the windshield heater by removing the ground path for the relay coil.

The ATC module will only request windshield heater operation if the engine is running. An engine status signal is provided to the ATC module by the ECM over the high speed CAN bus.

Rear Window Heater

The rear window heater comprises a single heater element bonded to the inner surface of the glass. The system is switched on by pressing the momentary switch located on the control panel. When selected, the ATC module transmits a heating request on the high speed CAN bus to the CJB. On receipt of the message, the CJB energizes the rear window heater relay located in the Auxiliary Junction Box (AJB) by providing a ground path for the relay coil. The energized relay provides a battery feed to the heater element. After a period of 12 minutes the ATC module removes the heating request. The CJB then powers down the rear window heater by removing the ground path for the relay coil.

The ATC module will only request rear window heater operation if the engine is running. An engine status signal is provided to the ATC module by the ECM over the high speed CAN bus.

Exterior Mirror Heaters

Operation of the exterior mirror heaters is fully automatic and requires no input from the driver. The exterior mirror heaters are active when the ambient air temperature is below 5°C (41°F) and engine coolant temperature is below 65°C (149°F). Ambient air and engine coolant temperature values are provided by the ECM on the high speed CAN bus. On receipt of these temperature values, the CJB determines if exterior mirror heating is required.

The CJB requests exterior mirror heating by transmitting a high speed CAN bus message to both the drivers and passenger door modules. The door modules provide feed and ground paths to the respective exterior mirror heating elements. When ambient and engine coolant temperature rises above the values stated earlier, the CJB transmits a high speed CAN bus message to the door modules cancelling the heating request.

Seat Heaters

Operation of the seat heaters is controlled by the ATC module on receipt of a heating request from either of the seat heater momentary switches located on the control panel. The switches are mounted in the LH and RH rotary controllers. A single press of a seat heater switch will implement low level heating and illuminate a tell-tale LED. A second press of the switch will implement high level heating and illuminate 2 tell-tale LED's. A third press of the switch will turn the seat heater off.

Seat heating requests are transmitted from the ATC module to the seat heater control modules on the LIN bus. Two seat heater control modules are fitted, one under each front seat. The seat heater control modules provide an electrical supply to the seat heater elements and a temperature sensor located in the seat cushion.

The seat heater control module provides a 5 V reference feed to the seat heater temperature sensor. The seat heater temperature sensor is an NTC thermistor. By monitoring the returned voltage, the control module can calculate the temperature of the seat. If the temperature rises above the target temperature, the control module will disable operation of the heater elements.

Published: 11-May-2011

Climate Control - Blower MotorLHD AWD

Removal and Installation

Special Tool(s)

E89027	412-140 Remover/Installer, Blower Motor

Removal

1. **1.** NOTE: The recirculation blend door must be closed in order for the removal of the recirculation blend door housing.

   Activate recirculation.

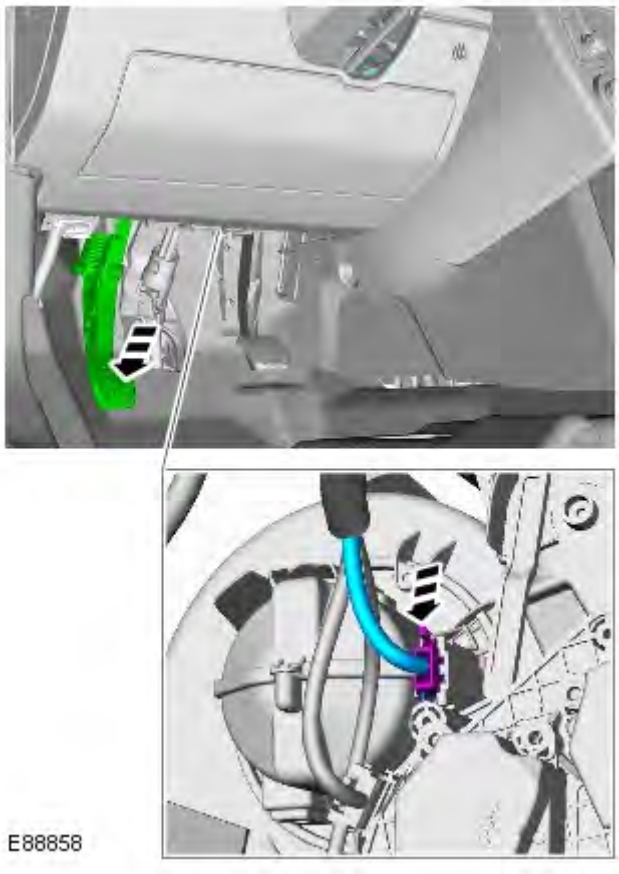
2. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the accelerator pedal assembly.

   Refer to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation).

4.

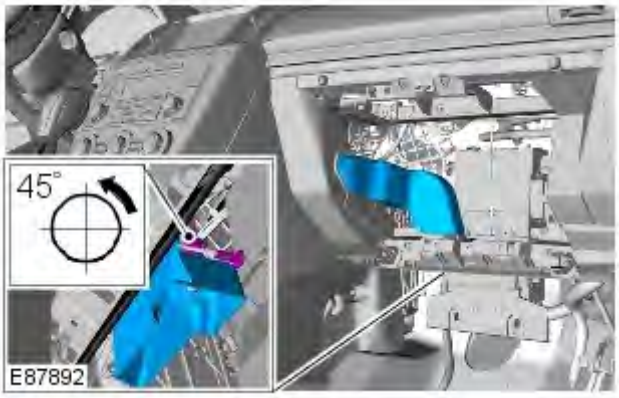


5. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and

Console, Removal and Installation).

6.



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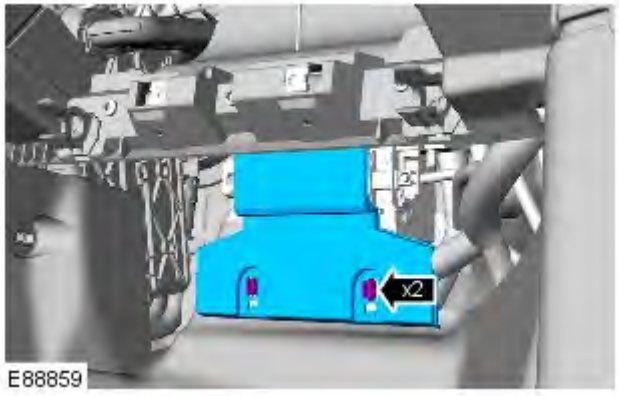

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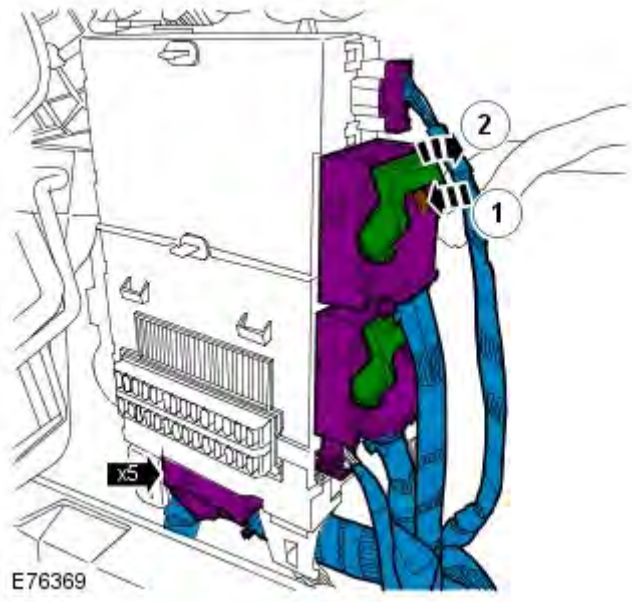

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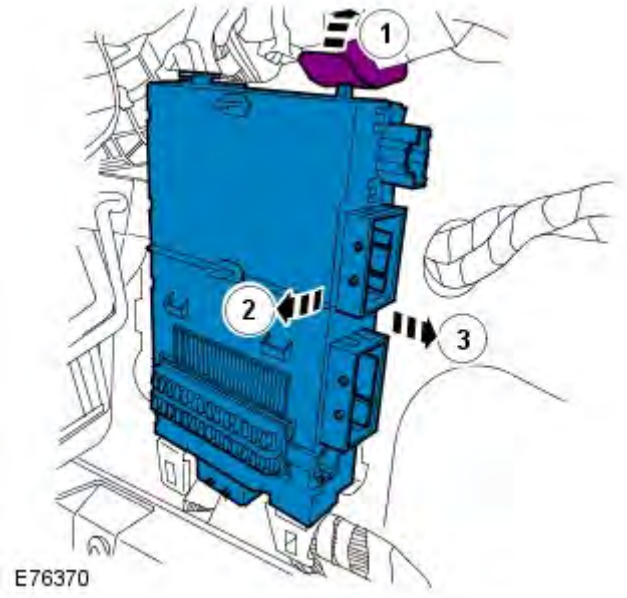

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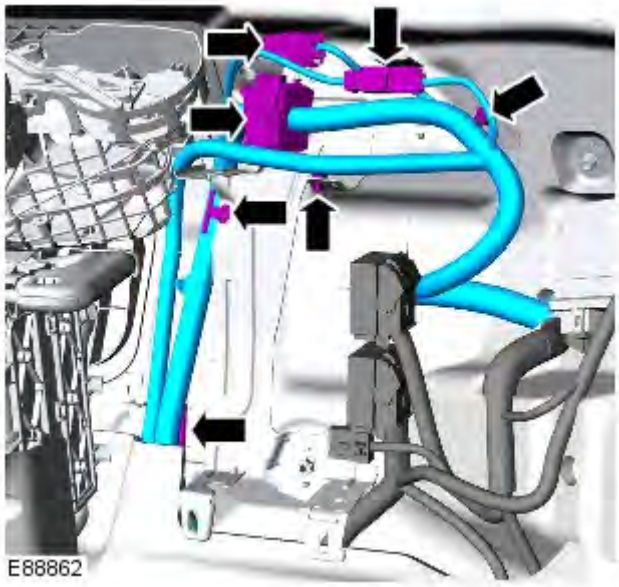
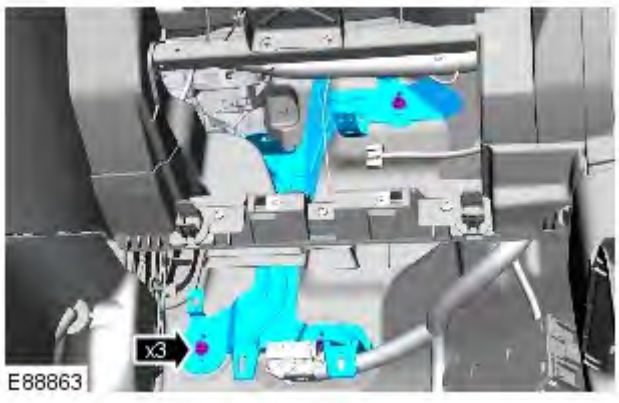


11. Remove the CJB bracket.



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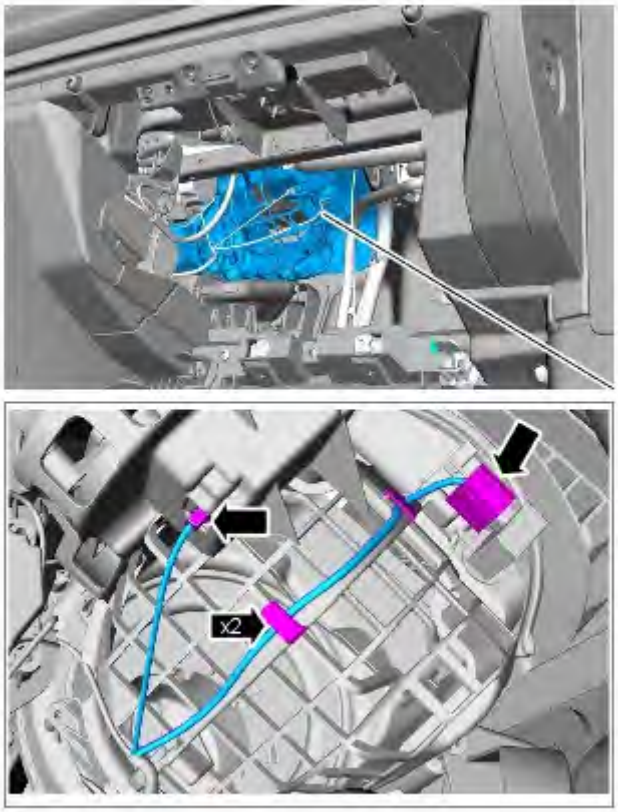

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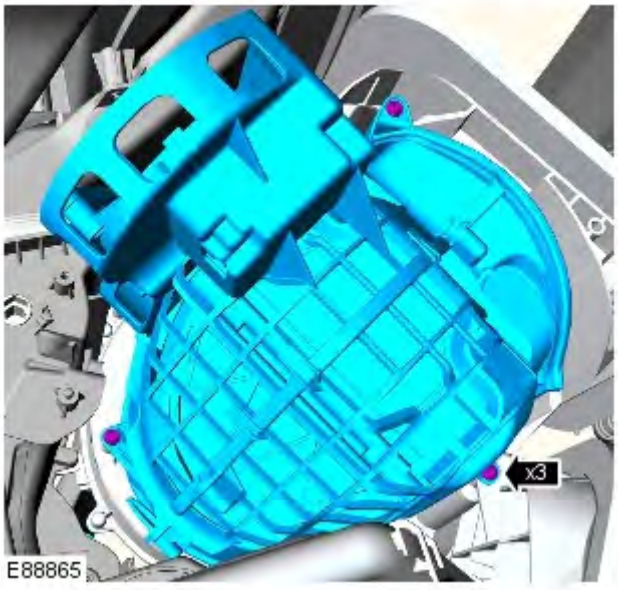

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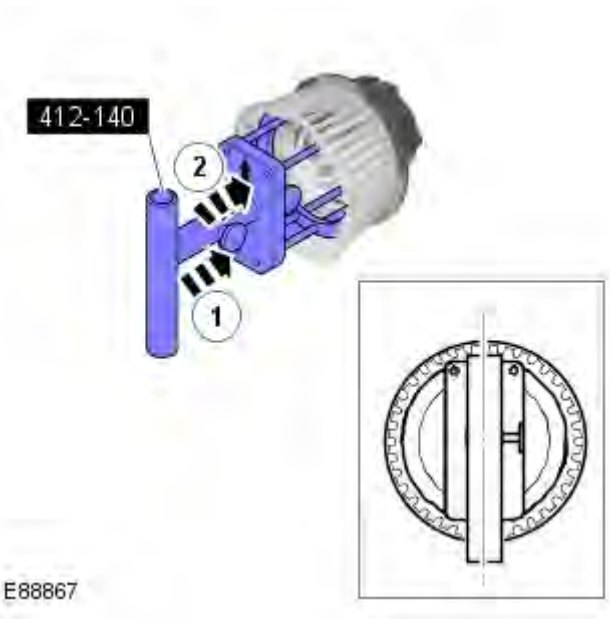
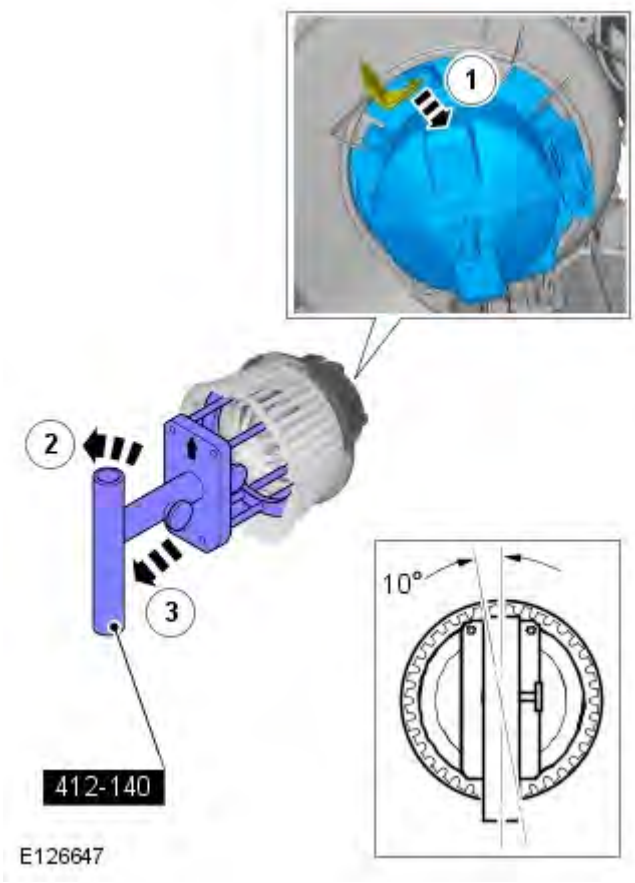
14. Install the special tool guide to the blower motor.

    Special Tool(s): 412-140



15. With the marking upwards, use the guide to install the remainder of the special tool to the blower motor.

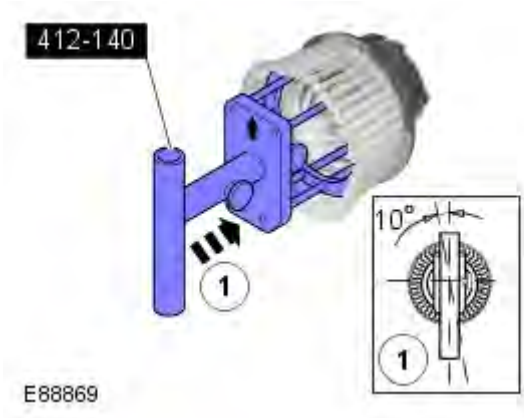
    Special Tool(s): 412-140



16. **16.** CAUTION: Make sure that the special tool is correctly located.
    - Rotate the special tool counter-clockwise to release the blower motor assembly.

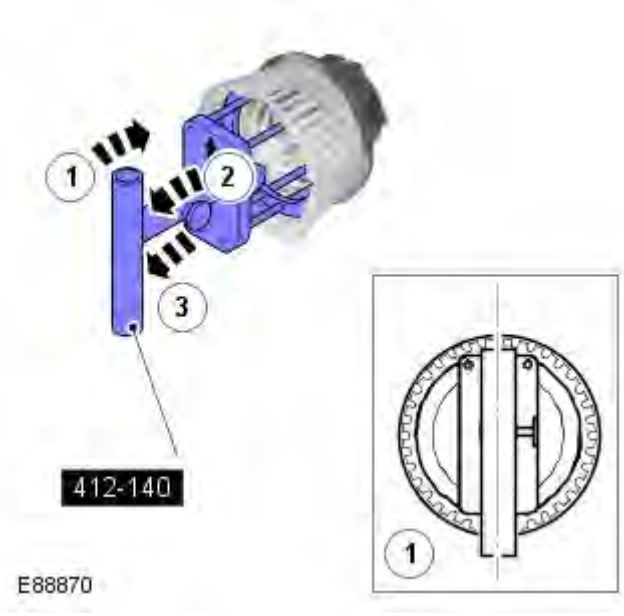
      Special Tool(s): 412-140
    - Remove the blower motor assembly.
    - Release the blower motor locking tang.

Installation



1. Using the special tool, install the blower motor assembly approximately 10 degrees counter-clockwise from the vertical position.

   Special Tool(s): 412-140



2. Rotate the special tool clockwise to secure the blower motor assembly.

   Special Tool(s): 412-140

3. Install the recirculation blend door housing assembly.

4.
   - Connect the recirculation blend door actuator electrical connector.
   - Connect the air quality sensor electrical connector.
   - Secure the wiring harness.

5. Install the CJB bracket.

   Torque: 10 Nm

6. Secure the wiring harnesses to the CJB bracket.

7. Install the CJB.

8. Connect the 5 electrical connectors to the CJB and secure the front carpet.

9. Install the CJB lower access cover.

10. Install the passenger side footwell duct.

11. Install the glove compartment.

    Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

12. Connect the blower motor electrical connector.

13. Install the accelerator pedal assembly.

    Refer to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation).

14. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Climate Control - Blower MotorRHD AWD

Removal and Installation

Special Tool(s)

E89027	412-140 Remover/Installer, Blower Motor

Removal

All vehicles

1. **1.** NOTE: The recirculation blend door must be closed in order for the removal of the recirculation blend door housing.

   Activate recirculation.

2. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Vehicles with manual transmission

3. Remove the clutch pedal assembly.

   Refer to: Clutch Pedal - RHD AWD (308-02 Clutch Controls, Removal and Installation).

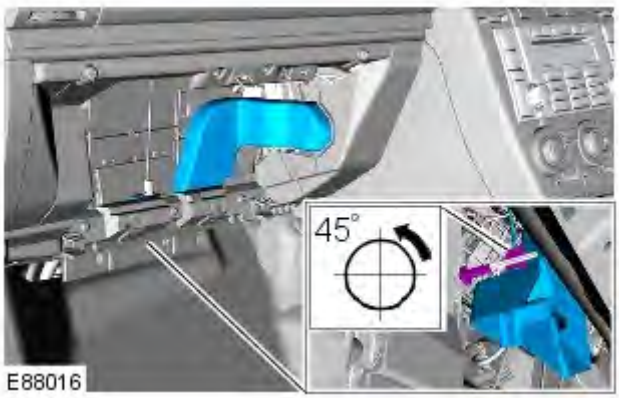
All vehicles

4.

5. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

6.



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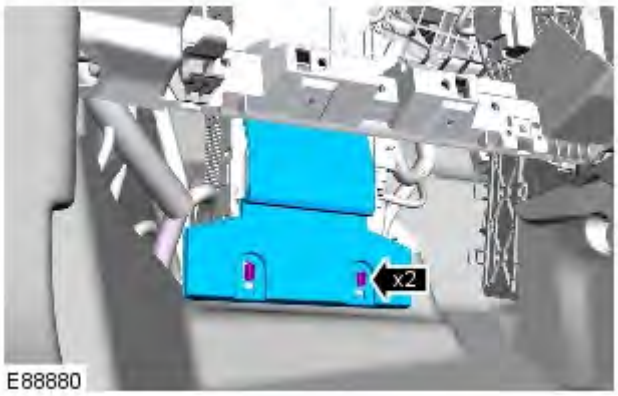

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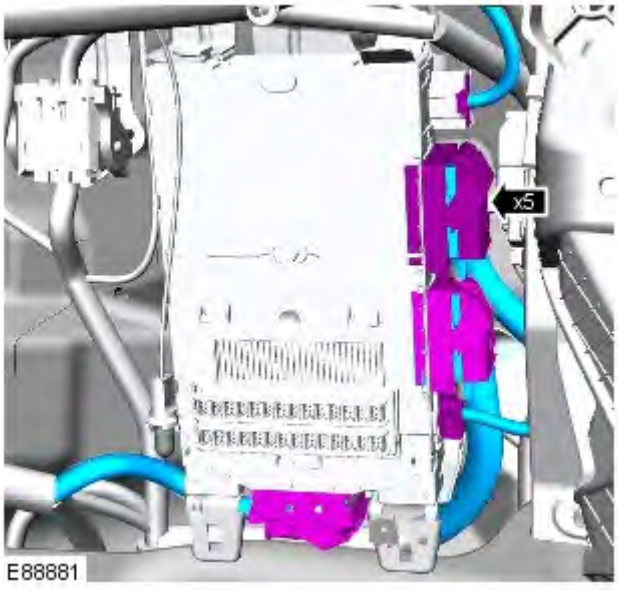

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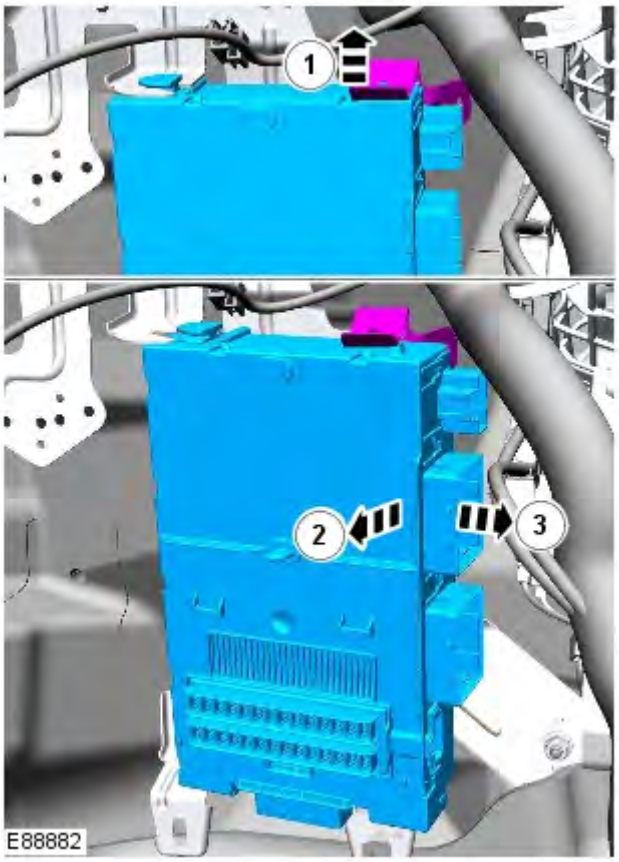

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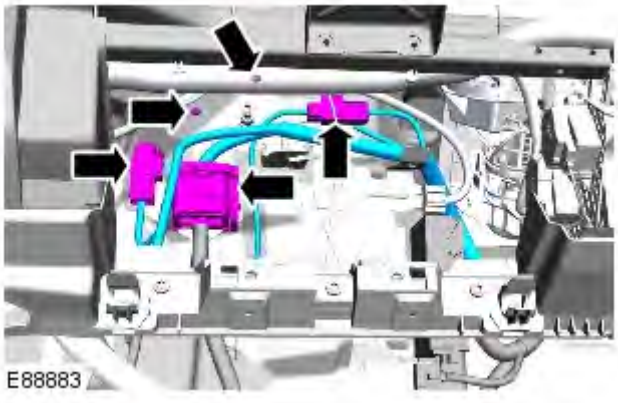
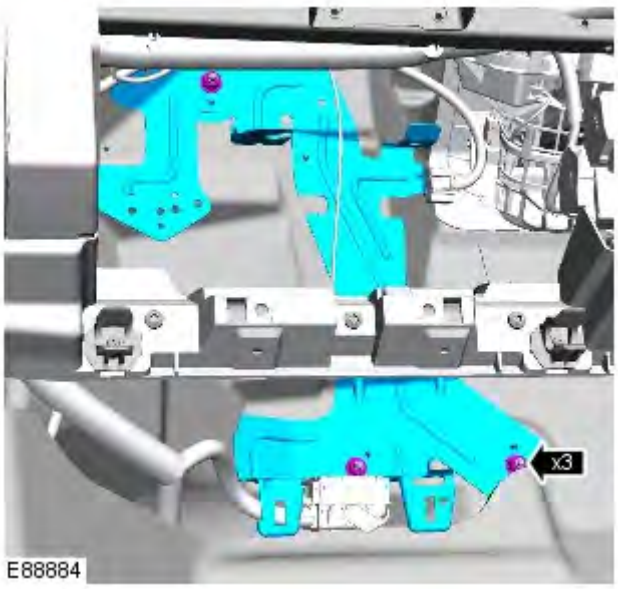
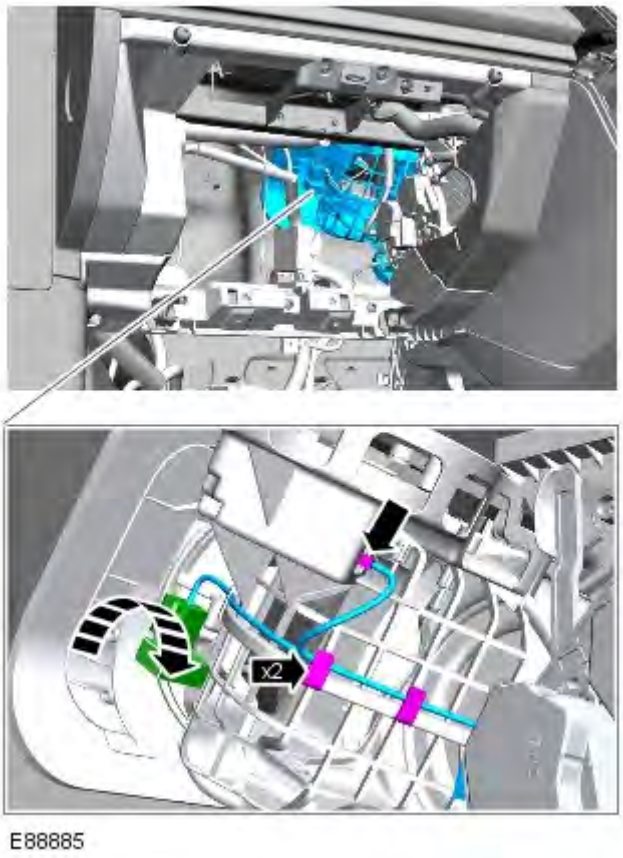




11. Remove the central junction box (CJB) retaining bracket.



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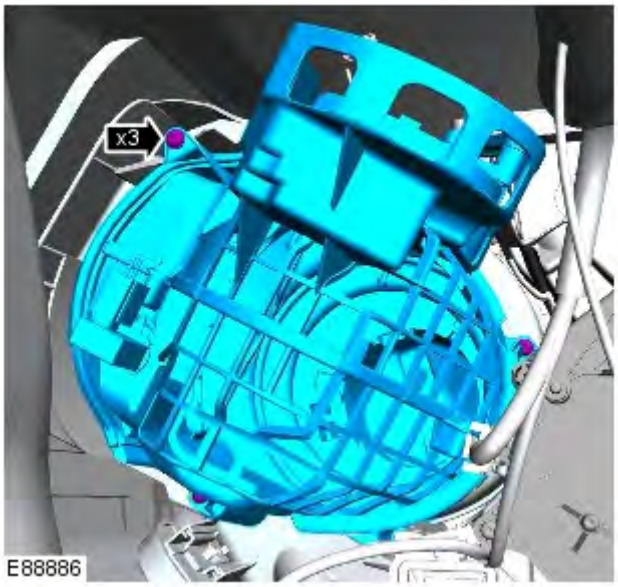

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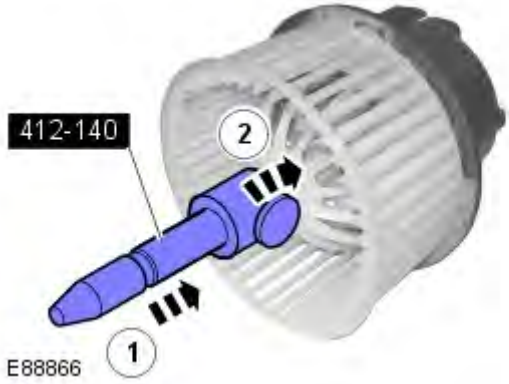
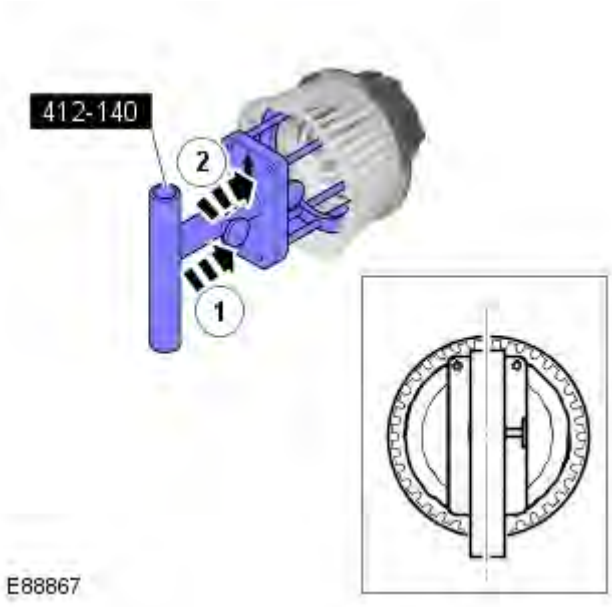


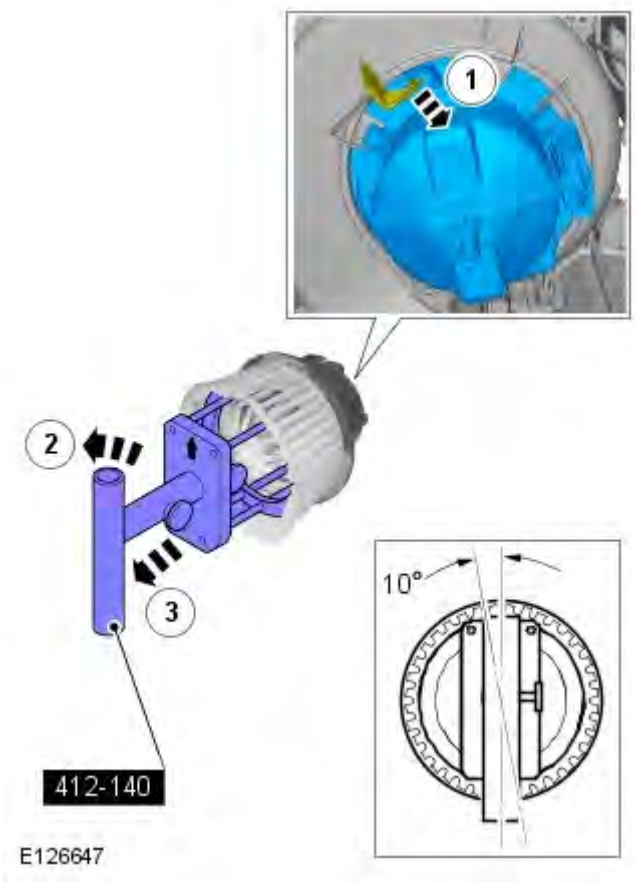
14. Install the special tool guide to the blower motor.

Special Tool(s): 412-140



15. With the marking upwards, use the guide to install the remainder of the special tool to the blower motor.

Special Tool(s): 412-140

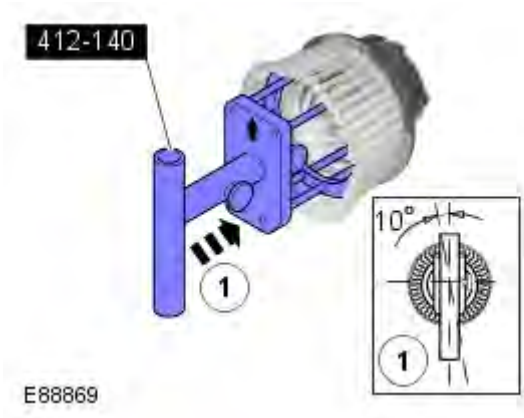


16. **16.** CAUTION: Make sure that the special tool is correctly located.
    - Rotate the special tool counter-clockwise to release the blower motor assembly.

      Special Tool(s): 412-140
    - Remove the blower motor assembly.
    - Release the blower motor locking tang.

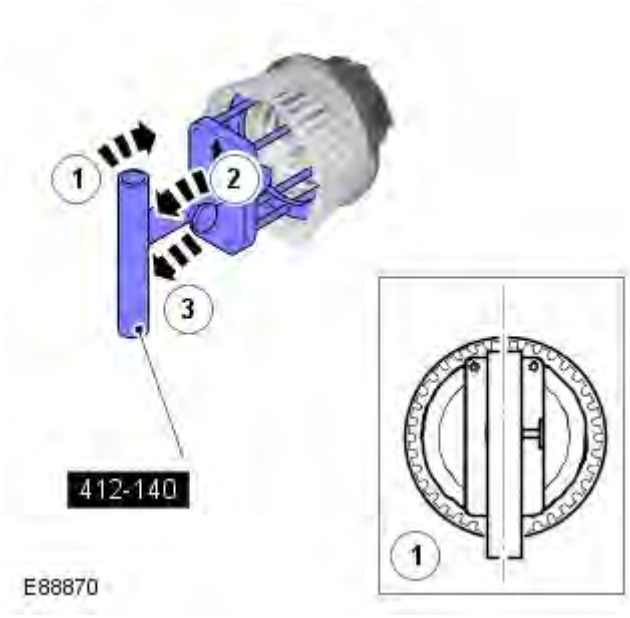
Installation

All vehicles



1. Using the special tool, install the blower motor assembly approximately 10 degrees counter-clockwise from the vertical position.

   Special Tool(s): 412-140



2. Rotate the special tool clockwise to secure the blower motor assembly.

   Special Tool(s): 412-140

3. Install the recirculation blend door housing assembly.

4.
   - Connect the recirculation blend door actuator electrical connector.
   - Secure the air quality sensor.
   - Secure the wiring harness.

5. Install the CJB bracket.

   Torque: 10 Nm

6. Secure the wiring harnesses to the CJB bracket.

7. Install the CJB.

8. Connect the 5 electrical connectors to the CJB and secure the front carpet.

9. Install the CJB lower access cover.

10. Install the passenger side footwell duct.

11. Install the glove compartment.

    Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

12. Connect the blower motor electrical connector.

Vehicles with manual transmission

13. Install the clutch pedal assembly.

    Refer to: Clutch Pedal - RHD AWD (308-02 Clutch Controls, Removal and Installation).

All vehicles

14. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

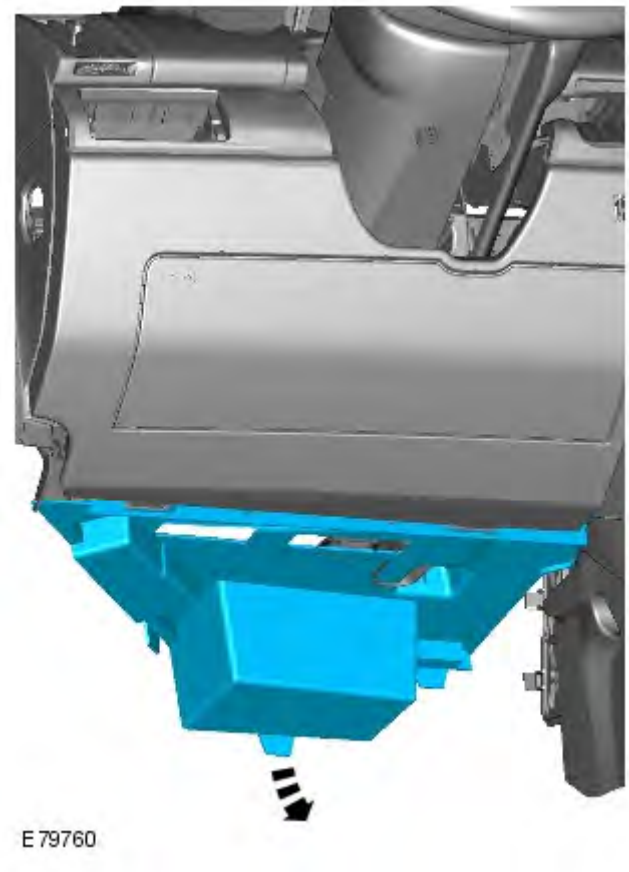
Published: 11-May-2011

Climate Control - Blower Motor Resistor

Removal and Installation

Removal

1.



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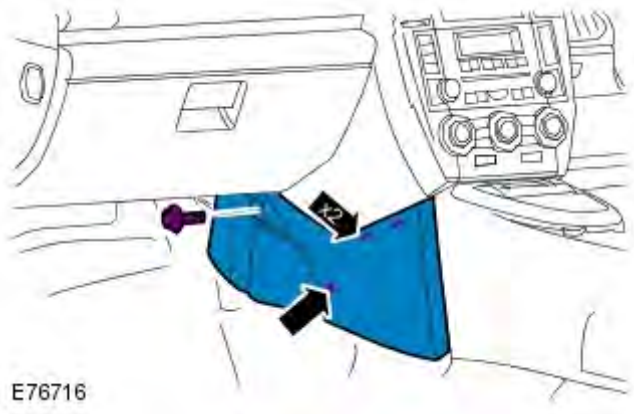

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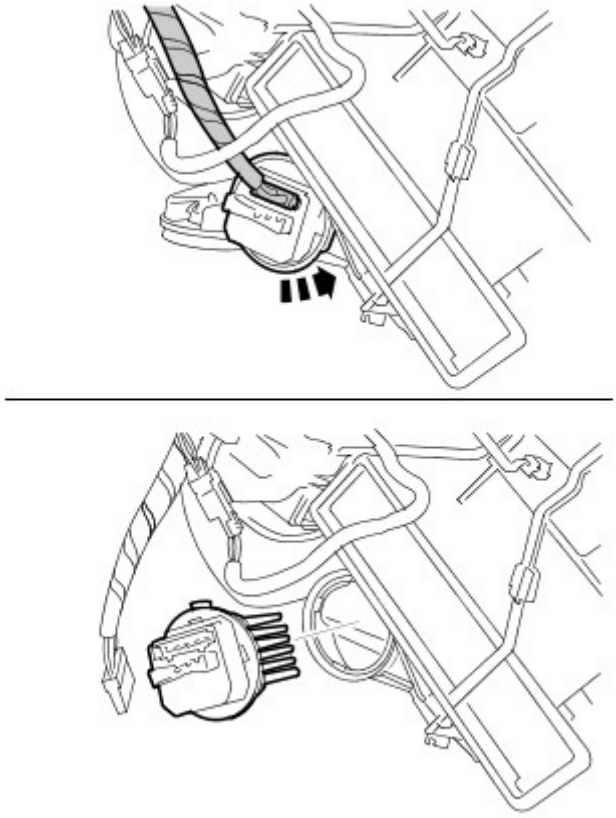


E76717

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - Footwell Vent/Duct Blend Door ActuatorLHD AWD

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

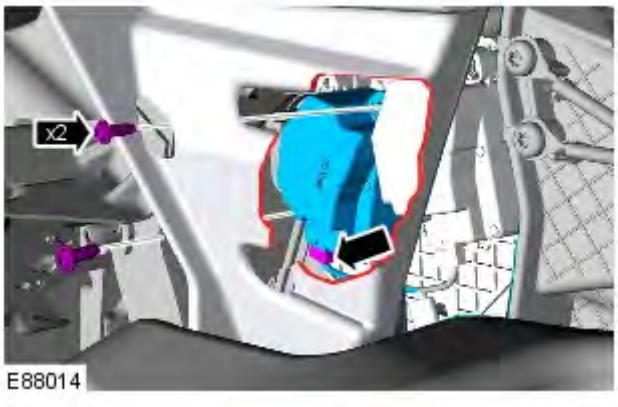
   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

2. Remove the steering column.

   Refer to: Steering Column (211-04 Steering Column, Removal and Installation).

3. Remove the driver lower air bag module support bracket.

   Torque: 7 Nm



4.

Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

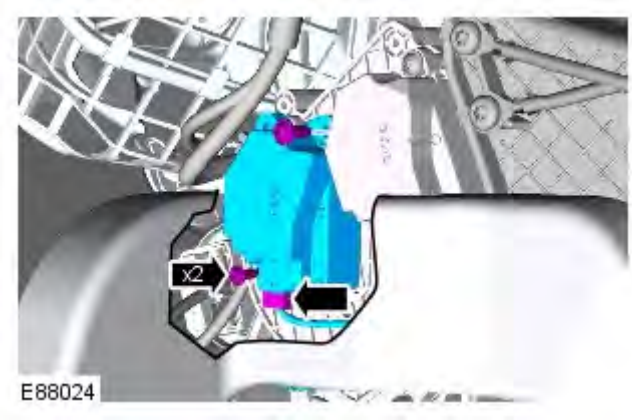
Climate Control - Footwell Vent/Duct Blend Door ActuatorRHD AWD

Removal and Installation

Removal

1. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).



2.

Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

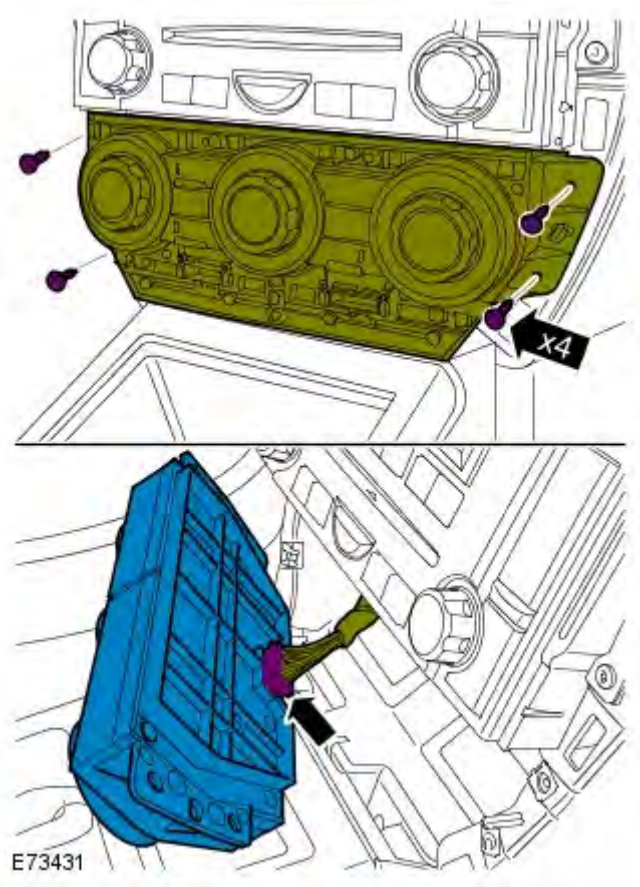
Climate Control - Climate Control Assembly

Removal and Installation

Removal

1. Remove the instrument panel console.

   Refer to: Instrument Panel Console (501-12 Instrument Panel and Console, Removal and Installation).



2. Remove the climate control assembly.

Installation

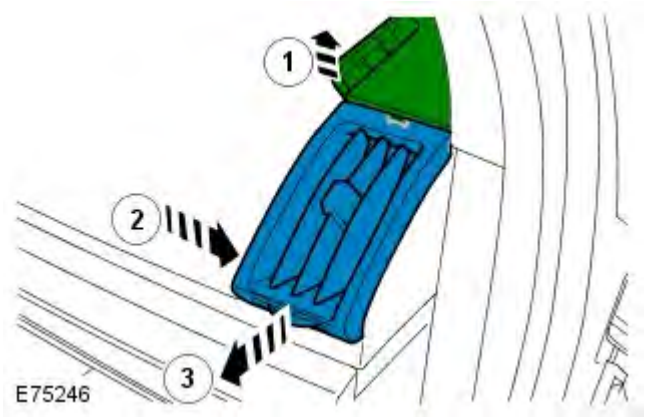
1. Install is the reverse of removal.

Published: 11-May-2011

Climate Control - Driver Side Register

Removal and Installation

Removal



1. **1.** NOTE: Right-hand shown, left-hand similar.

   Remove the register.

Installation

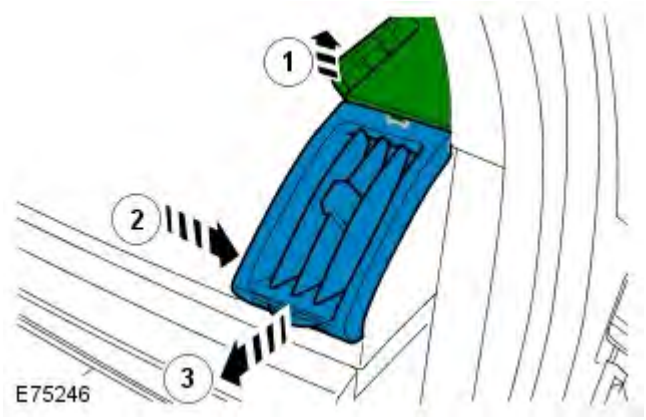
1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - Passenger Side Register

Removal and Installation

Removal



1. **1.** NOTE: Right-hand shown, left-hand similar.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - Pollen Filter

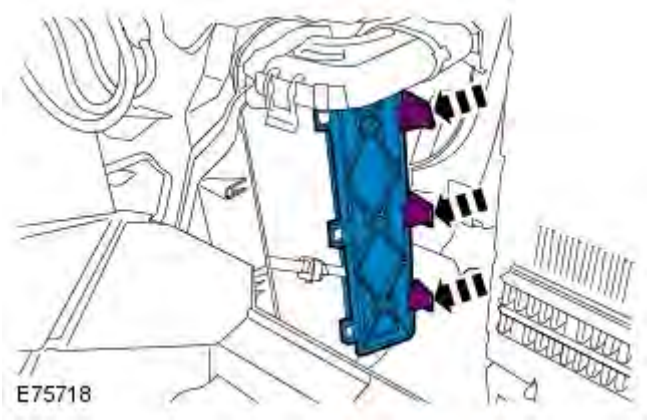
Removal and Installation

Removal

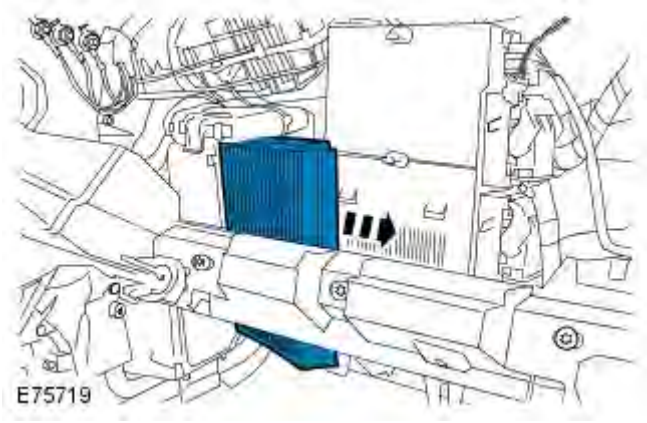
1. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

2.



3.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - Recirculation Blend Door Actuator

Removal and Installation

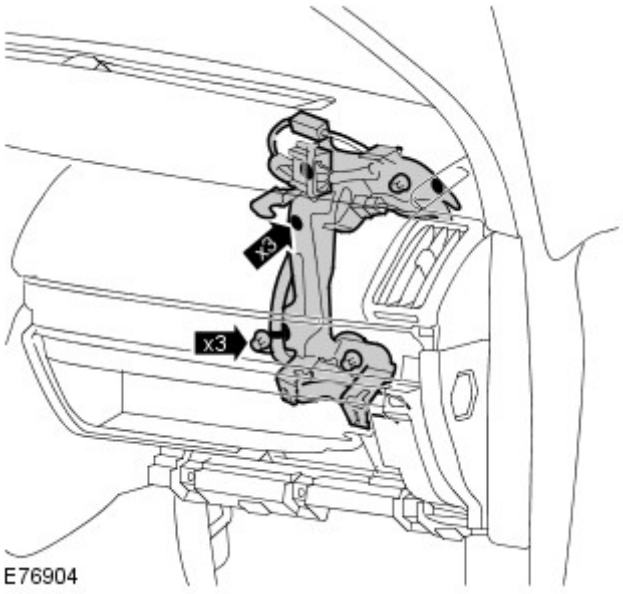
Removal

1. Disconnect the battery ground cable.

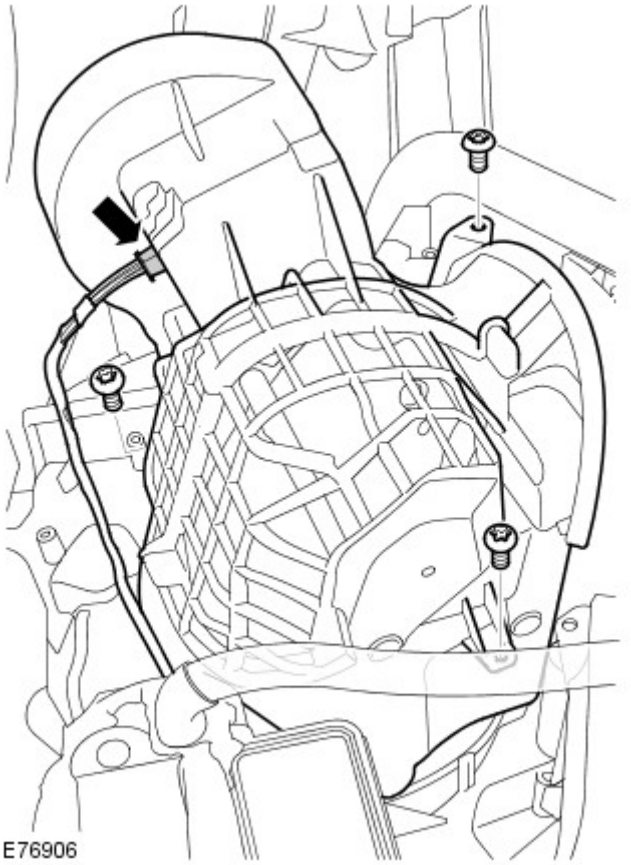
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the CJB.

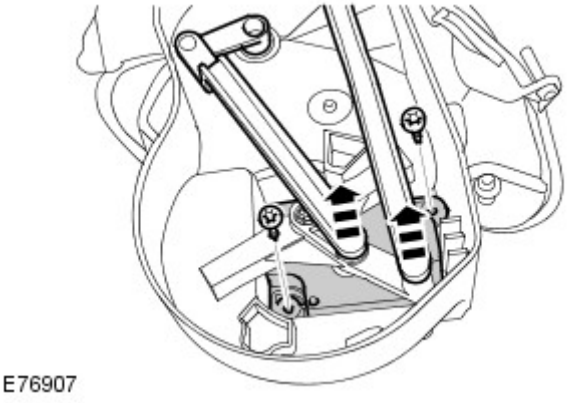
   Refer to: Central Junction Box (CJB) (418-00 Module Communications Network, Removal and Installation).



3. *Torque:* 10 Nm



4. **4.** NOTE: Note the fitted position.



5.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - Plenum Chamber

Removal and Installation

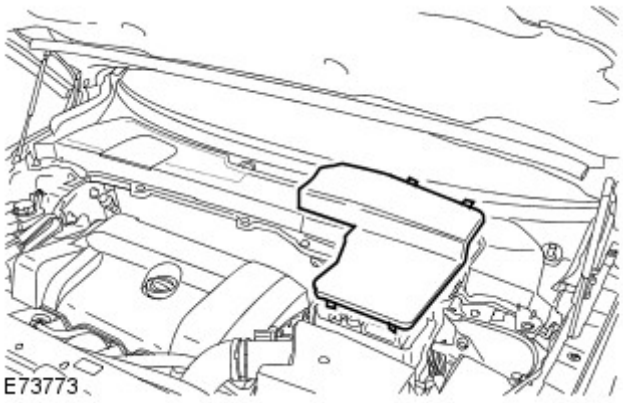
Removal

1. Remove the RH wiper arm.

   Refer to: Wiper Pivot Arm (501-16 Wipers and Washers, Removal and Installation).

2. Repeat the above procedure for the other wiper arm.

3.



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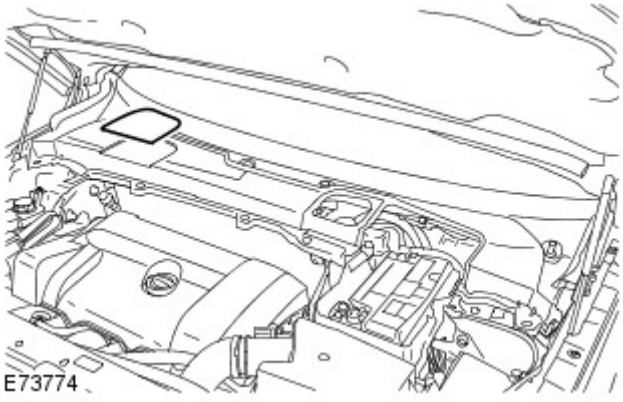
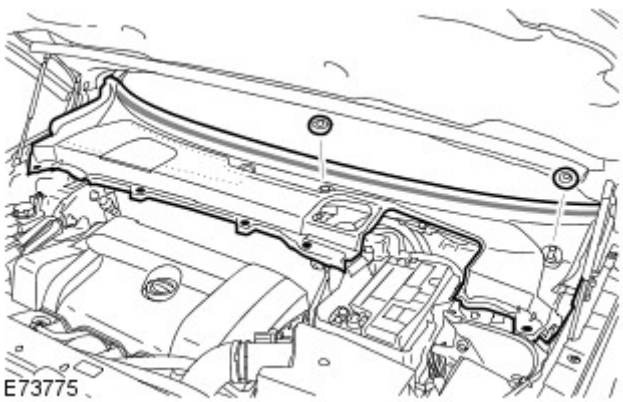


5. **5.** WARNING: This step requires the aid of another technician.

   Remove the plenum chamber panel.

6. **6.** NOTE: Do not disassemble further if the component is removed for access only.



Published: 11-May-2011

Climate Control - Thermostatic Expansion Valve

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

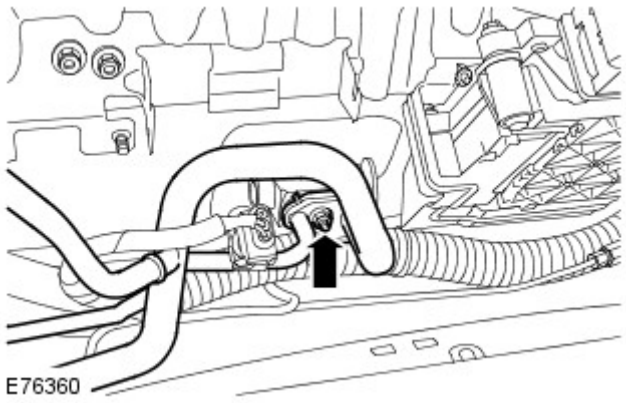
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Recover the A/C refrigerant.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

3. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



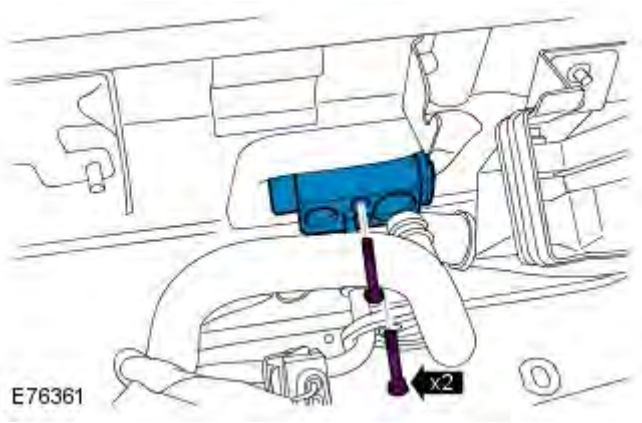
4. **4.** CAUTIONS:

   Make sure that all openings are sealed. Use new blanking caps.

   Lubricate the new seals with clean refrigerant oil.

   • NOTE: Install new O-ring seals.

   Torque: 9 Nm



5. *Torque:* 4 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - EvaporatorLHD AWD

Removal and Installation

Removal

• NOTE: The removal of this component involves cutting an aperture in the evaporator housing wall and cutting through the high and low pressure A/C lines. A service repair kit is supplied to cover this procedure.

1. Disconnect the battery ground cable.

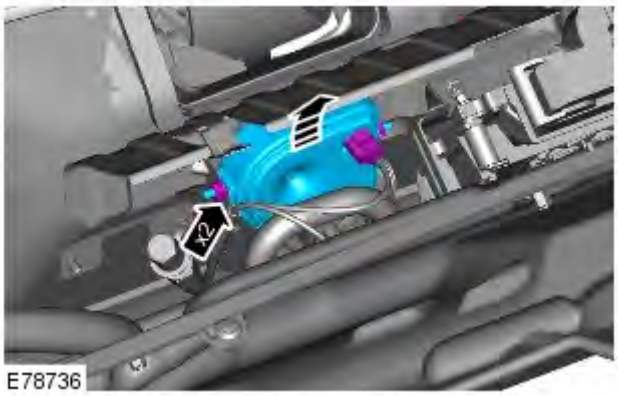
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Recover the A/C refrigerant.

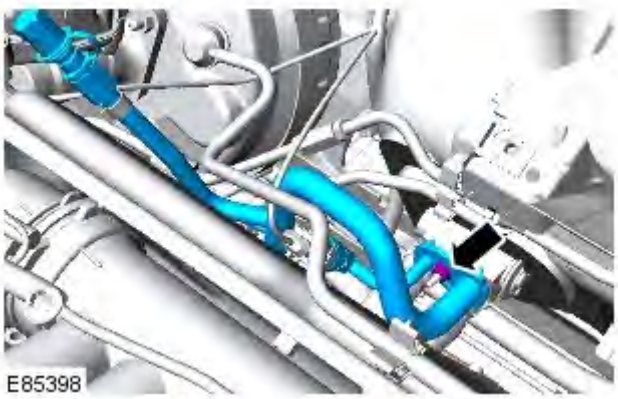
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

3. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



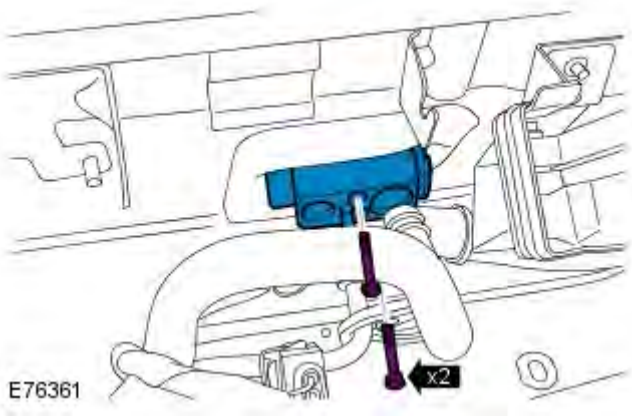
4. If installed, remove the anti-theft alarm horn with integral battery.



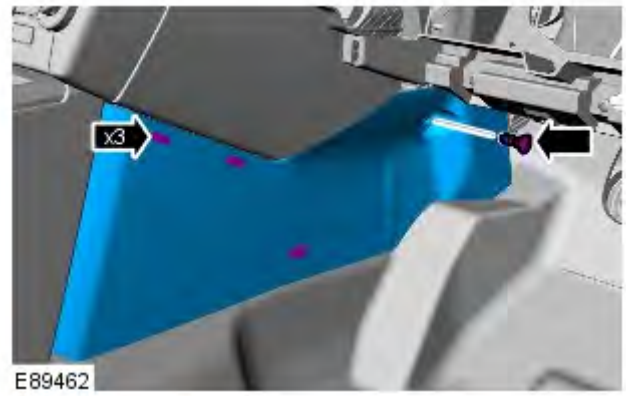
5. **5.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.

   Disconnect the A/C pipes from the TXV.

6.



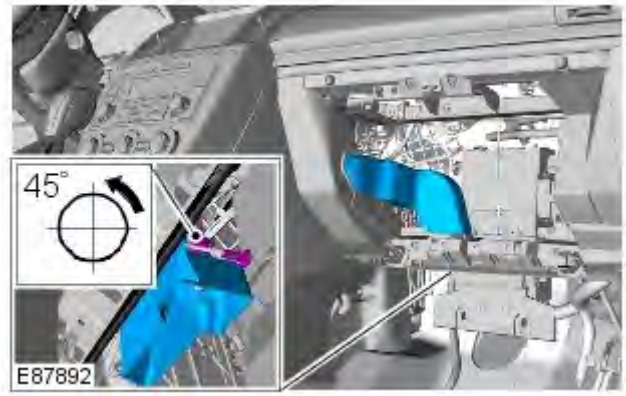
7. Remove the RH floor console extension.



8. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

9.



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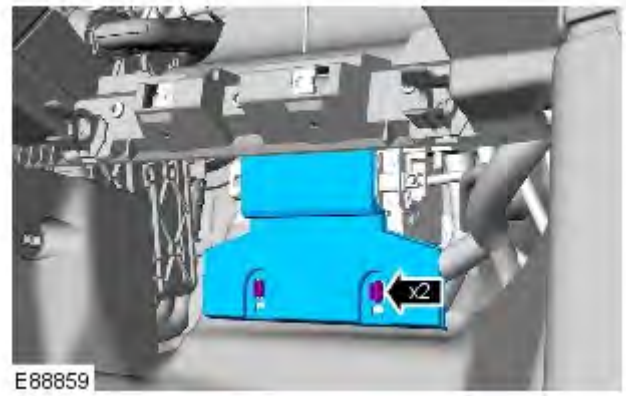

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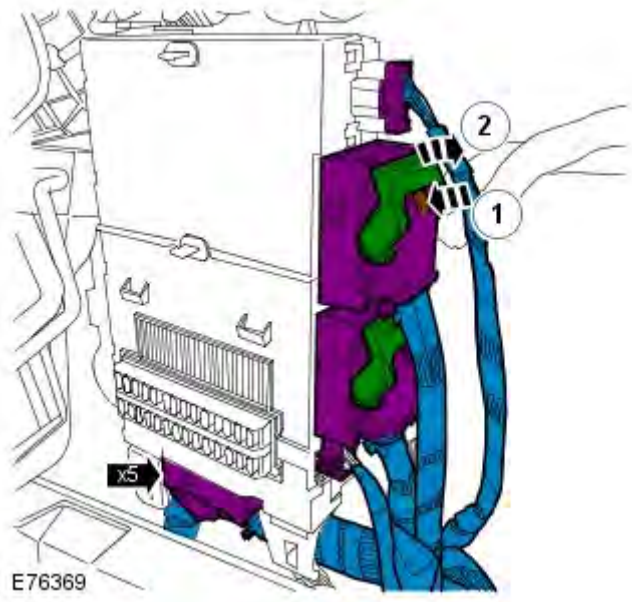

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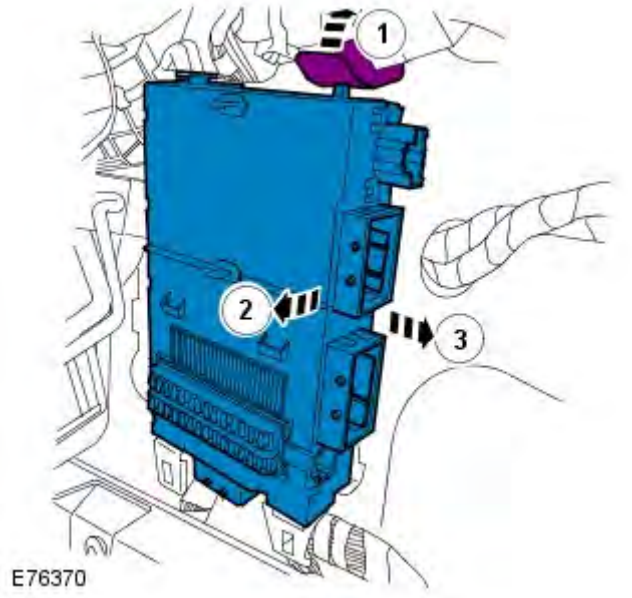
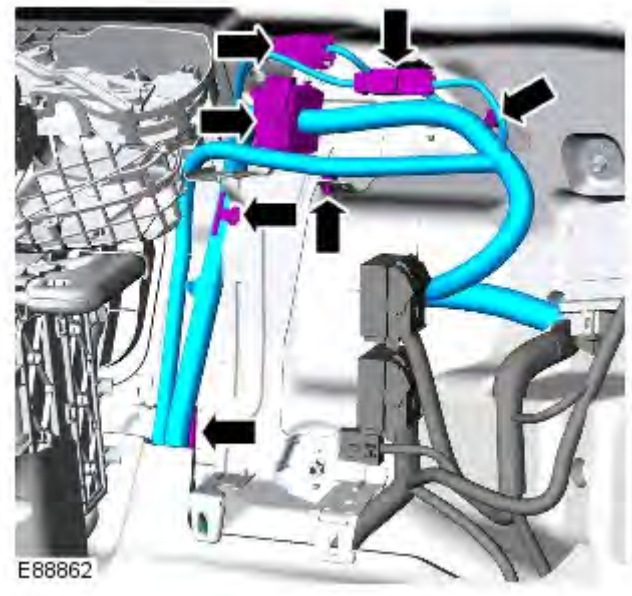
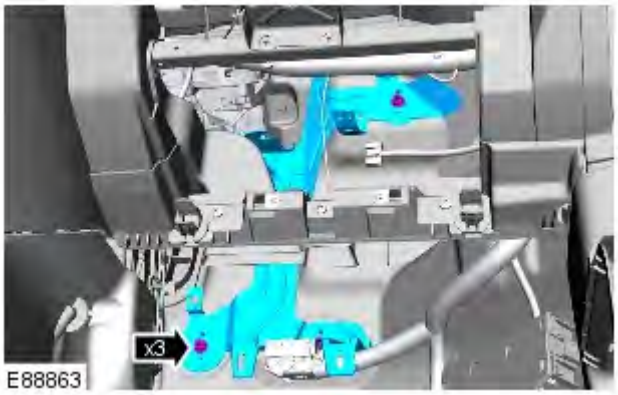
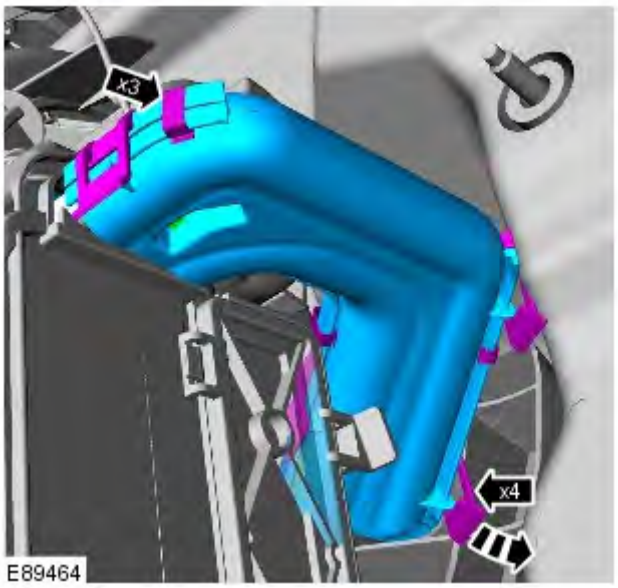


13.

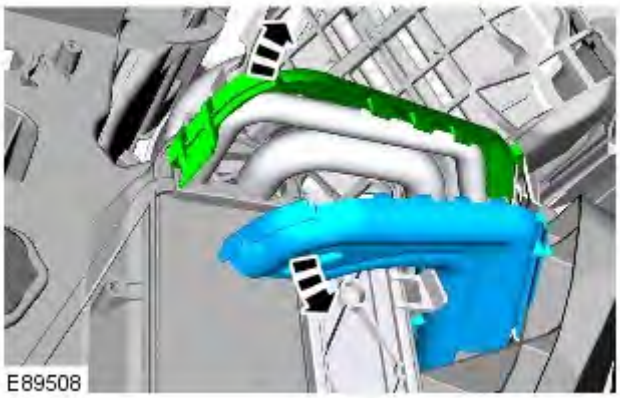




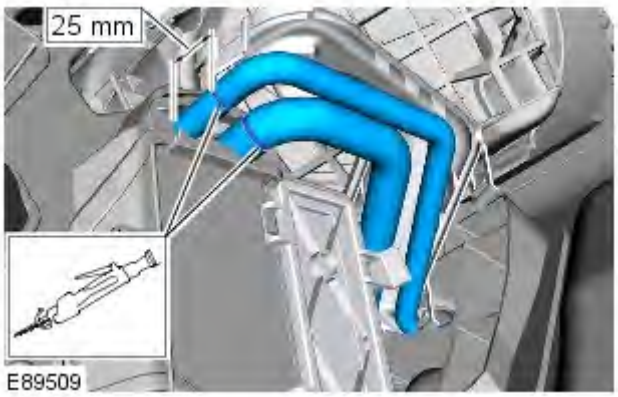
14. Remove the CJB bracket.



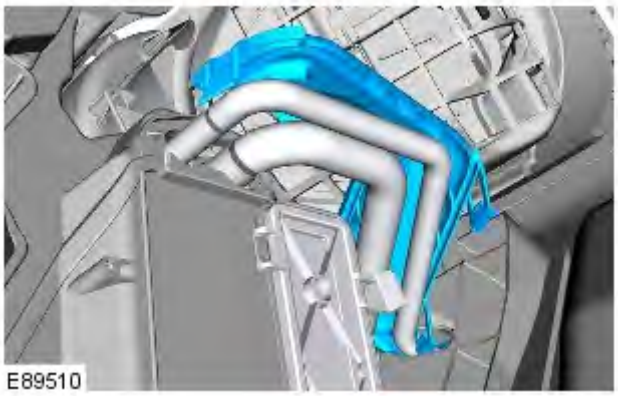
15.
- Remove the 3 spring clips.
- Release the 4 plastic clips.



16.
- Remove the lower cover.
- Position the upper cover aside for access.



17. Cut the A/C pipes at the marked position.



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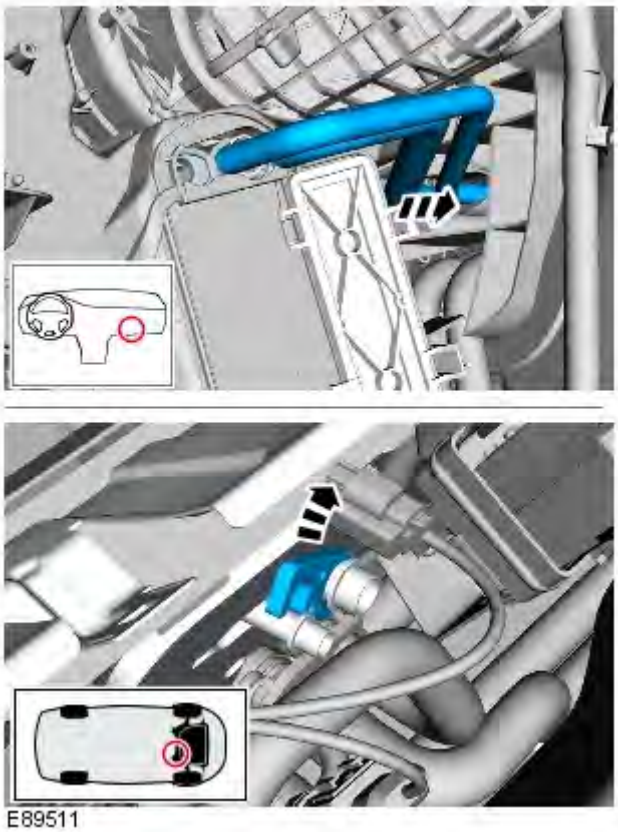
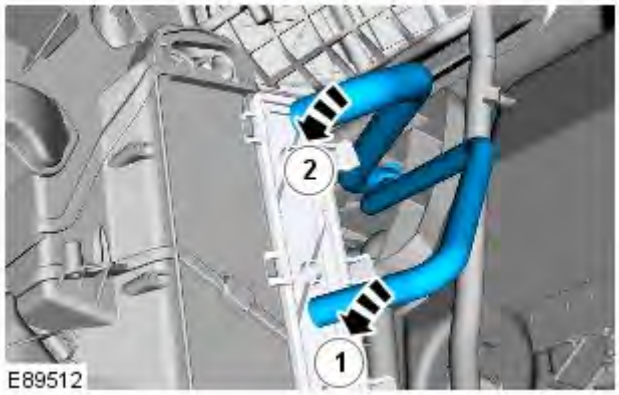
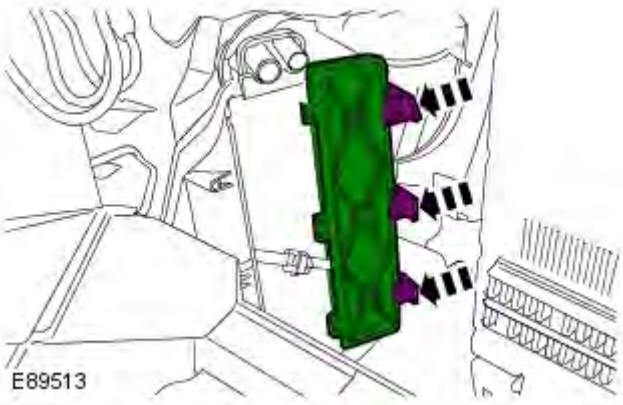


19. Guide the cut evaporator pipes through the bulkhead so that approximately 20mm is visible in the engine compartment.



20. Remove the evaporator pipes.



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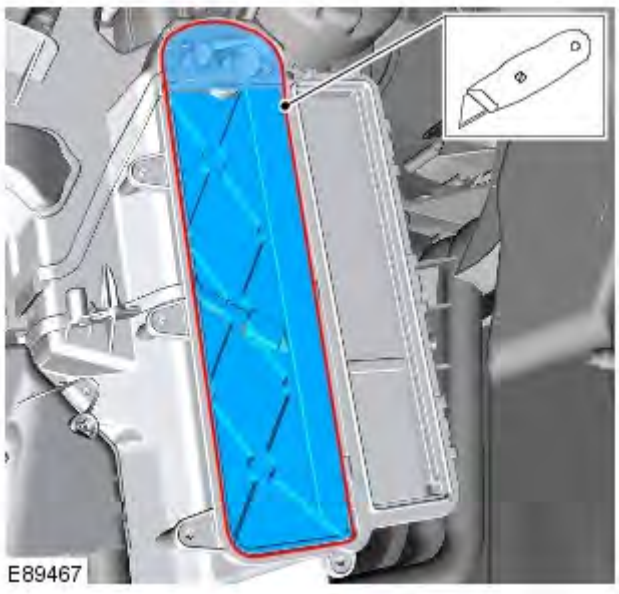

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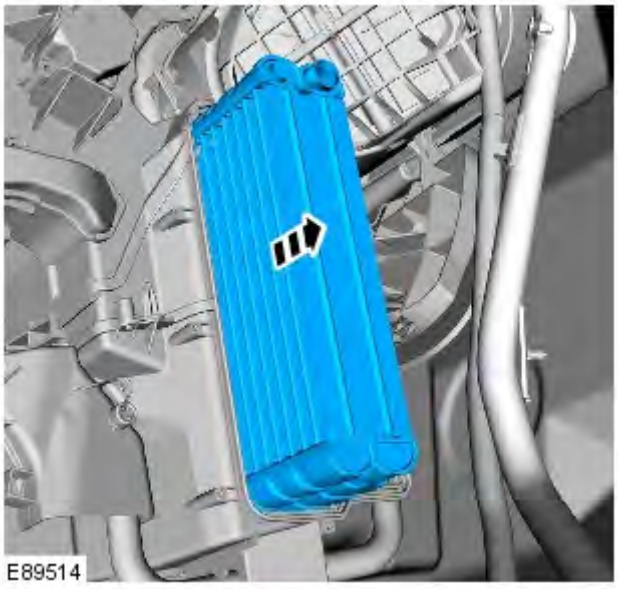

E89514

23. Remove the evaporator core.

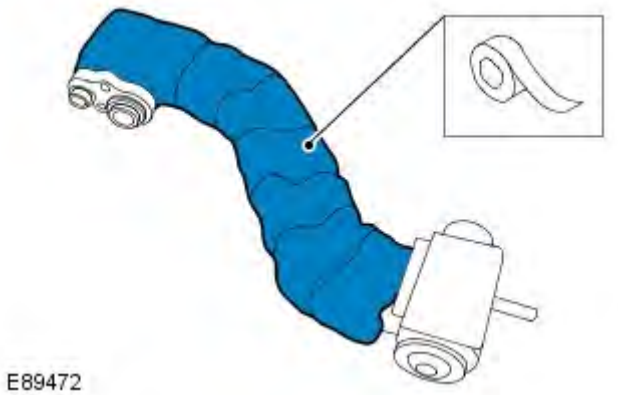
24. Remove any debris from the heater core and evaporator core housing.

Installation

E89469

1. Apply the foam strips from the service kit to the evaporator core.

2. Install the evaporator core.


E89472

E89515

3
4. Install the pollen filter cover.
   - Install the service door.
   - Secure the 4 clips.
   - Install the 4 screws.
5. Apply the asphalt tape from the service kit to the service replacement evaporator pipes.

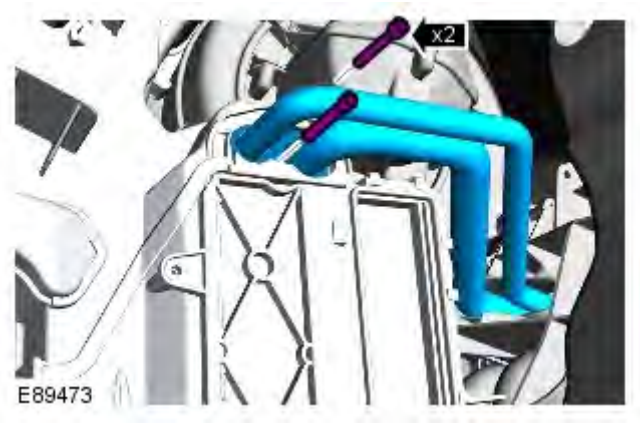
6. **6.** CAUTION: Make sure that all openings are sealed. Use new

blanking caps.

Remove the TXV assembly from the service replacement evaporator pipes.

7. Guide the service replacement evaporator pipes through the bulkhead so that approximately 20mm is visible in the engine compartment.

8. Install the TXV captive clamping plate.



9. **9.** NOTE: Install new O-ring seals.

   Install the service replacement evaporator pipes to the evaporator.

   Torque: 5 Nm

10. Install the CJB bracket.

    Torque: 10 Nm

11. Secure the wiring harnesses to the CJB bracket.

12. Install the CJB.

13. Connect the 5 electrical connectors to the CJB and secure the front carpet.

14. Install the CJB lower access cover.

15. Install the passenger side footwell duct.

16. Install the glove compartment.

    Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

17. Install the RH floor console extension.

18. **18.** NOTE: Install new O-ring seals.

    Install the TXV assembly.

    Torque: 4 Nm

19. **19.** NOTE: Install new O-ring seals.

    Connect the A/C pipes to the TXV and tighten the M6 nut.

    Torque: 9 Nm

20. Install the anti-theft alarm horn with integral battery.
21. Install the plenum chamber panel.

Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

22. Recharge the A/C system.

    Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

23. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Climate Control - EvaporatorRHD AWD

Removal and Installation

Removal

• NOTE: The removal of this component involves cutting an aperture in the evaporator housing wall and cutting through the high and low pressure A/C lines. A service repair kit is supplied to cover this procedure.

All vehicles

1. Make the SRS system safe.

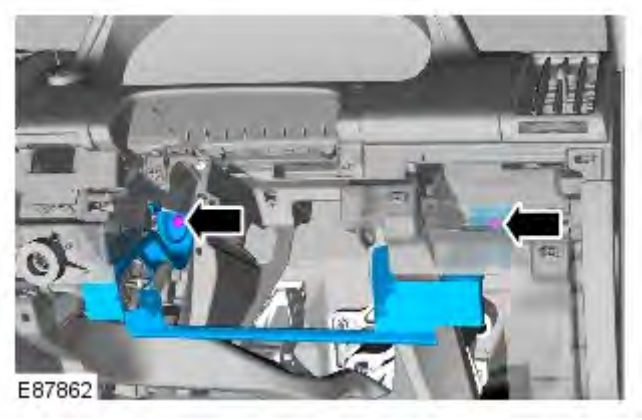
   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

2. Recover the A/C refrigerant.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

3. Remove the steering column.

   Refer to: Steering Column (211-04 Steering Column, Removal and Installation).



4. Remove the driver lower air bag module support bracket.

Vehicles with manual transmission

5. Remove the clutch pedal assembly.

   Refer to: Clutch Pedal - RHD AWD (308-02 Clutch Controls, Removal and Installation).

Vehicles with automatic transmission

6. Remove the secondary bulkhead center panel.

   Refer to: Secondary Bulkhead Center Panel - TD4 2.2L Diesel (501-02 Front End Body Panels, Removal and Installation).

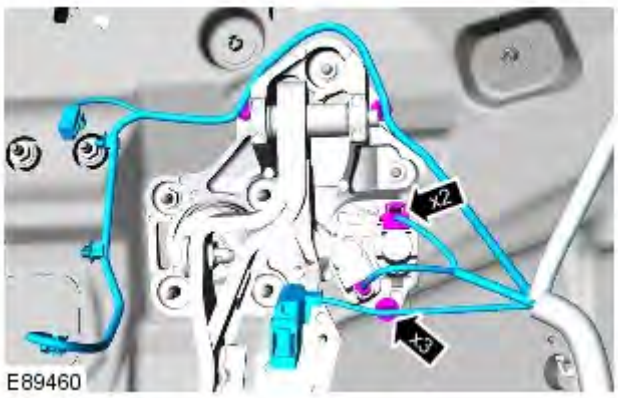
All vehicles

7. Remove the accelerator pedal assembly.

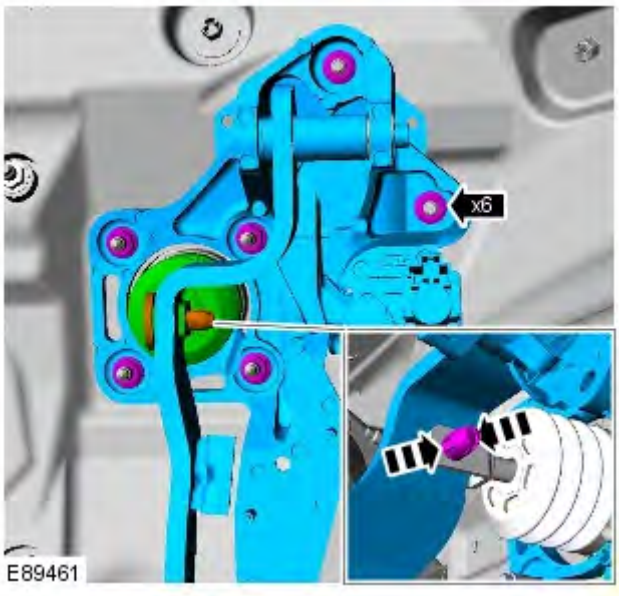
   Refer to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation).

Vehicles with manual transmission

8.

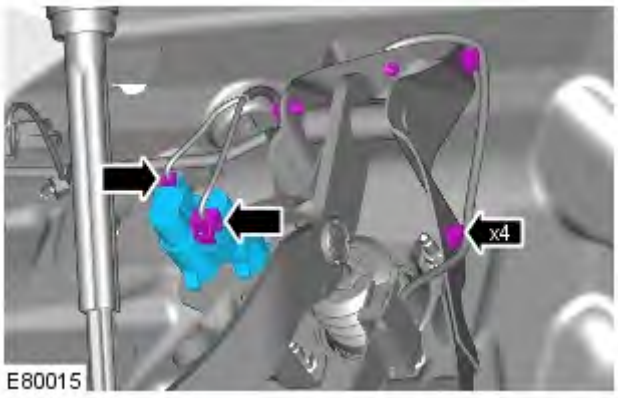


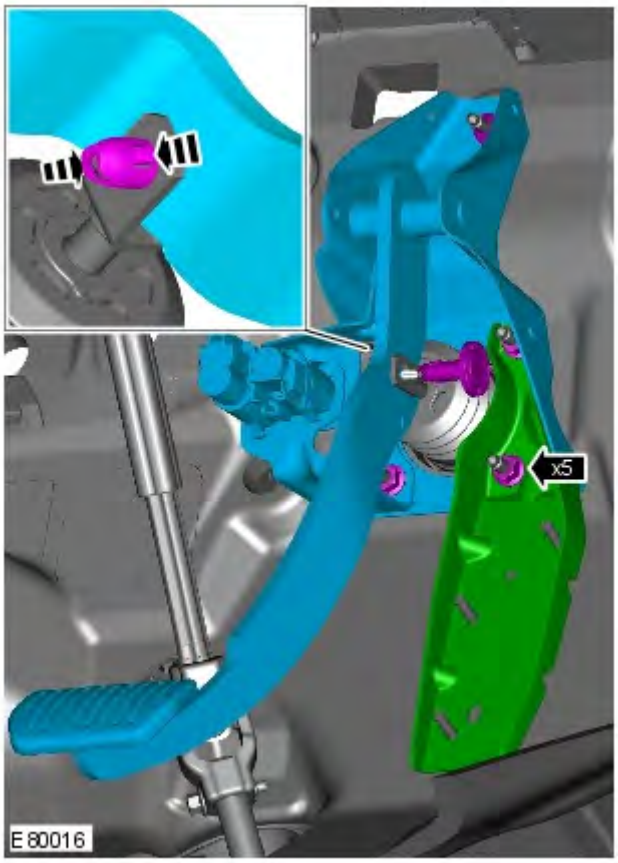
9. Remove the brake pedal assembly.



Vehicles with automatic transmission

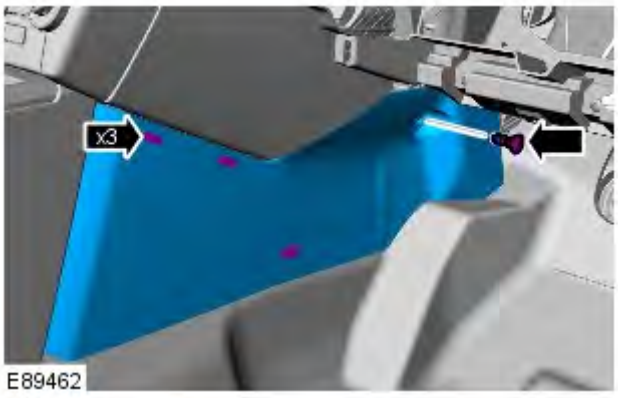
10.



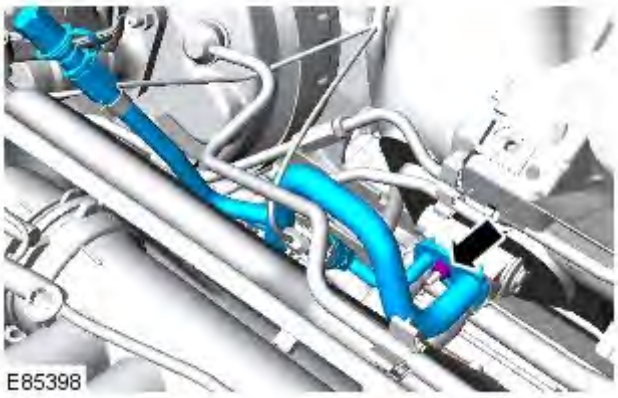


11. Remove the brake pedal assembly.

All vehicles



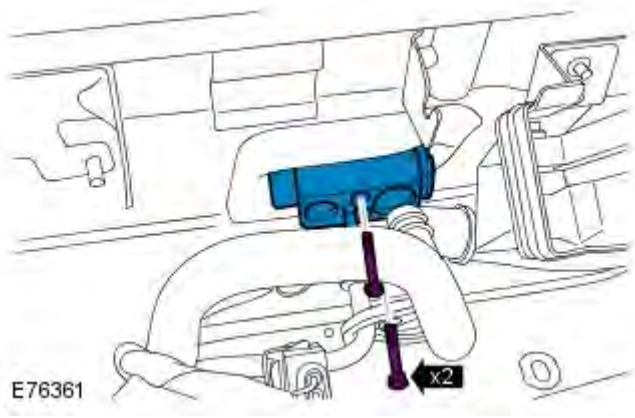
12. Remove the RH floor console extension.



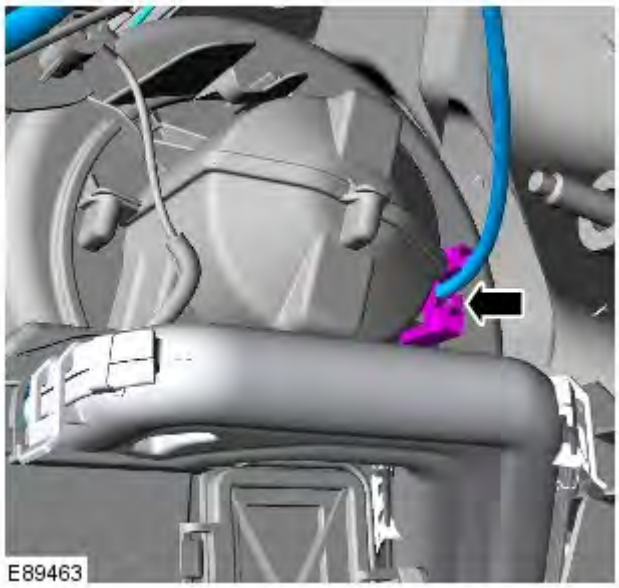
13. **13.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.

    Disconnect the A/C pipes from the TXV.

14.

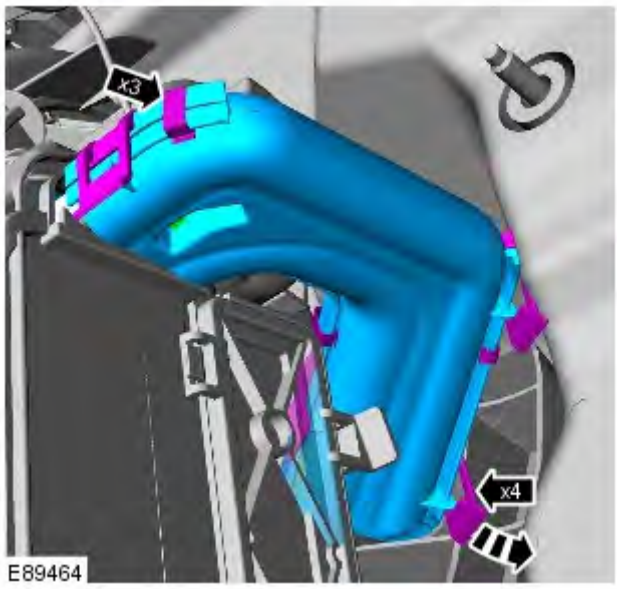


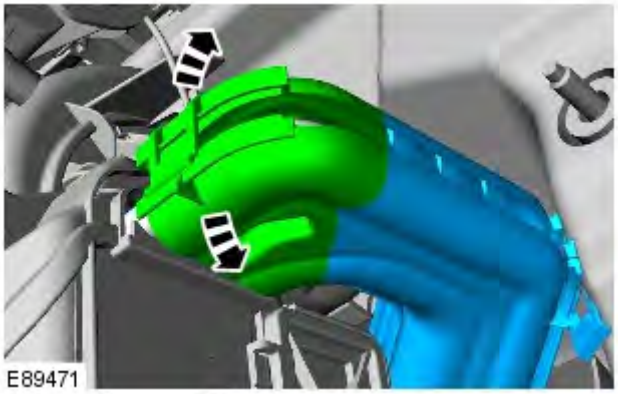
15. Disconnect the blower motor electrical connector.



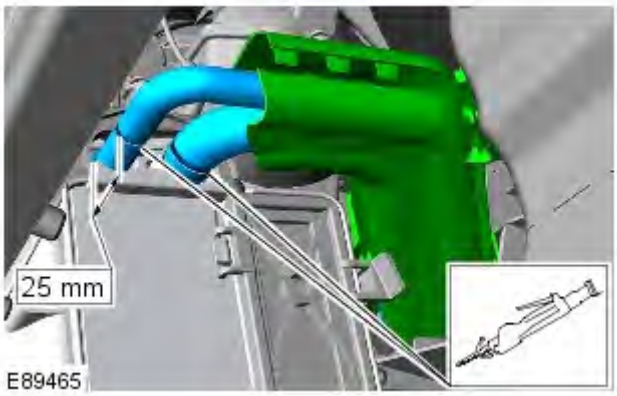
16.

- Remove the 3 spring clips.
- Release the 4 plastic clips.



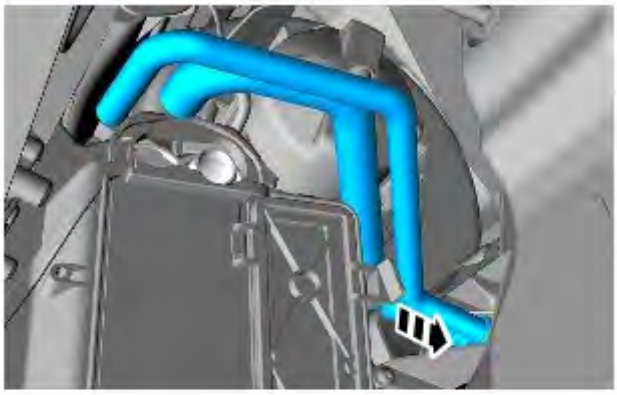


17. Carefully ease apart and break the plastic pipe covers.

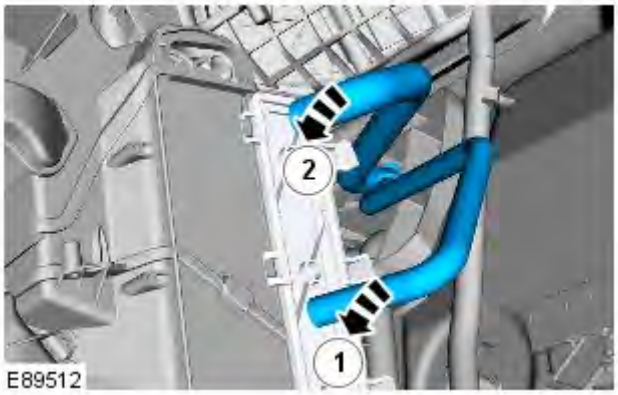


18. Cut the A/C pipes at the marked position.

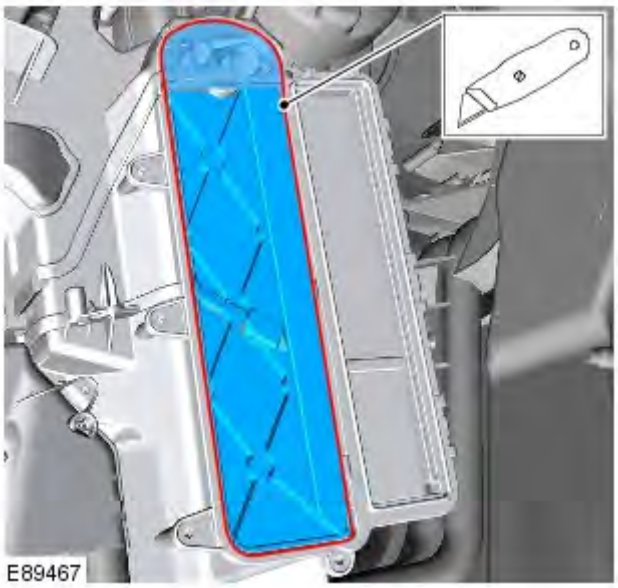
19. Remove the remainder of the plastic pipe covers.



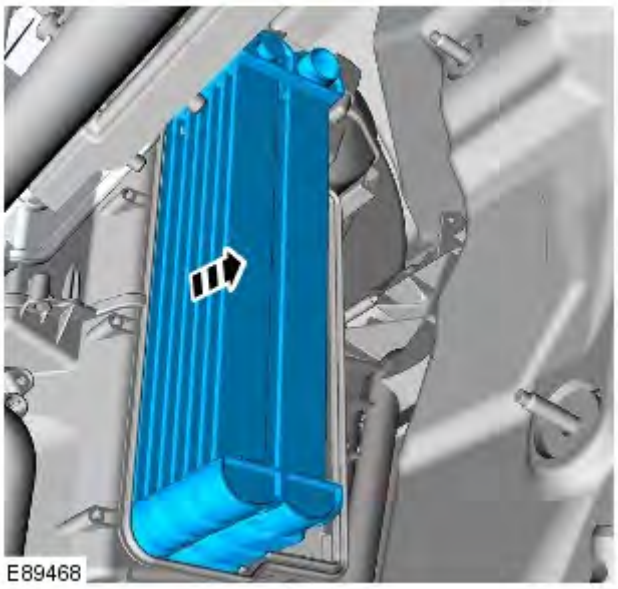
20. Guide the cut evaporator pipes through the bulkhead so that approximately 20mm is visible in the engine compartment.



21. Remove the evaporator pipes.



22.



23. Remove the evaporator core.

24. Remove any debris from the heater core and evaporator core housing.

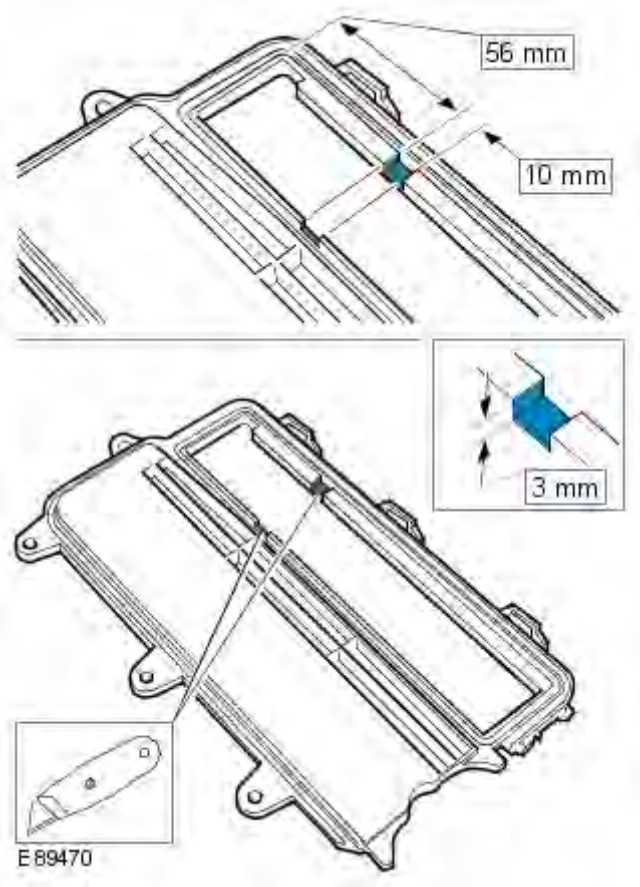
Installation

All vehicles

E89469

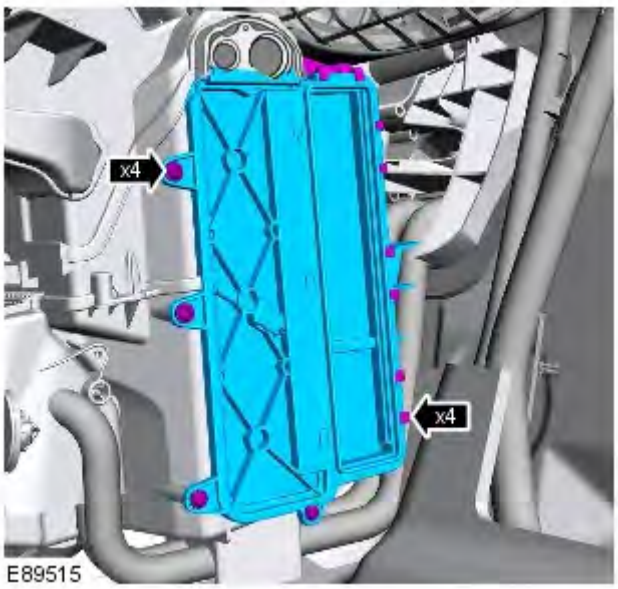
1. Apply the foam strips from the service kit to the evaporator core.

2. Install the evaporator core.

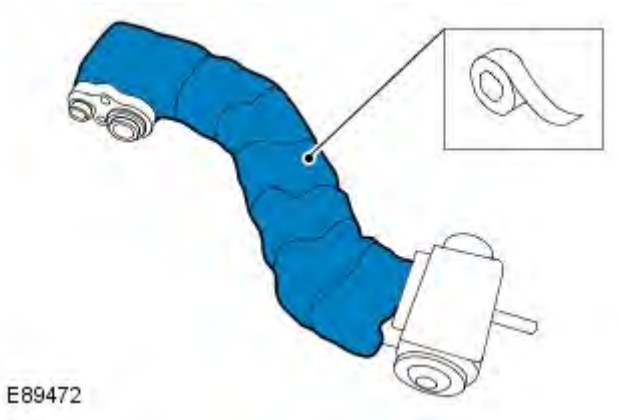


E89470

3. Cut a slot in each side of the service door to accommodate the heater core and evaporator core housing.



4.
- Install the service door.
- Secure the 4 clips.
- Install the 4 screws.



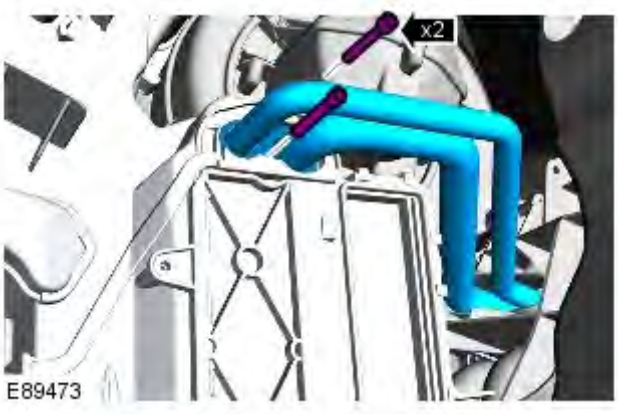
5. Apply the asphalt tape from the service kit to the service replacement evaporator pipes.

6. **6.** CAUTION: Make sure that all openings are sealed. Use new blanking caps.

   Remove the TXV assembly from the service replacement evaporator pipes.

7. Guide the service replacement evaporator pipes through the bulkhead so that approximately 20mm is visible in the engine compartment.

8. Install the TXV captive clamping plate.



9. **9.** NOTE: Install new O-ring seals.

   Install the service replacement evaporator pipes to the evaporator.

   Torque: 5 Nm

10. Connect the blower motor electrical connector.

11. **11.** NOTE: Install new O-ring seals.

    Install the TXV assembly.

    Torque: 4 Nm

12. **12.** NOTE: Install new O-ring seals.

    Connect the A/C pipes to the TXV and tighten the M6 nut.

    Torque: 9 Nm

13. Install the RH floor console extension.

14. Install the brake pedal assembly.

    Torque: 25 Nm

15. Install the brake pedal clevis pin.

16. Connect the stoplamp switch and speed control deactivator switch electrical connectors.

17. Secure the wiring harness to the brake pedal bracket.

18. Install the accelerator pedal assembly.

    Refer to: Accelerator Pedal (310-02 Acceleration Control, Removal and Installation).

Vehicles with automatic transmission

19. Install the secondary bulkhead center panel.

    Refer to: Secondary Bulkhead Center Panel - TD4 2.2L Diesel (501-02 Front End Body Panels, Removal and Installation).

Vehicles with manual transmission

20. Install the clutch pedal assembly.

    Refer to: Clutch Pedal - RHD AWD (308-02 Clutch Controls, Removal and Installation).

All vehicles

21. Install the driver lower air bag module support bracket.

    Torque: 7 Nm

22. Install the steering column.

    Refer to: Steering Column (211-04 Steering Column, Removal and Installation).

23. Recharge the A/C system.

    Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information,

General Procedures).

24. Connect the battery ground cable.

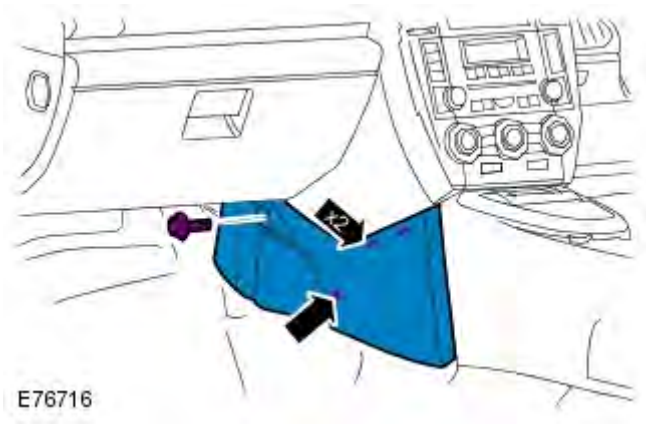
    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

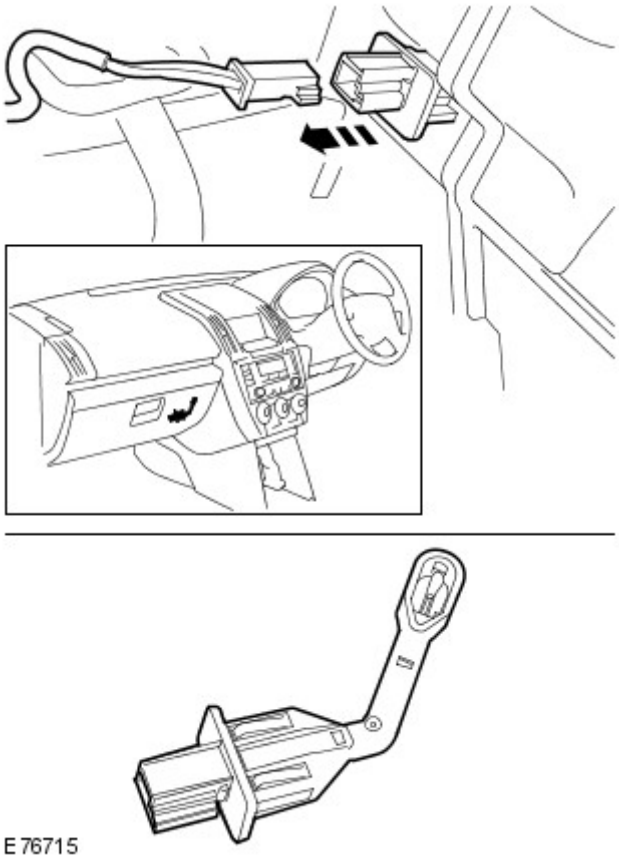
Climate Control - Evaporator Temperature Sensor

Removal and Installation

Removal



1.



2.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - Heater Core

Removal and Installation

Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

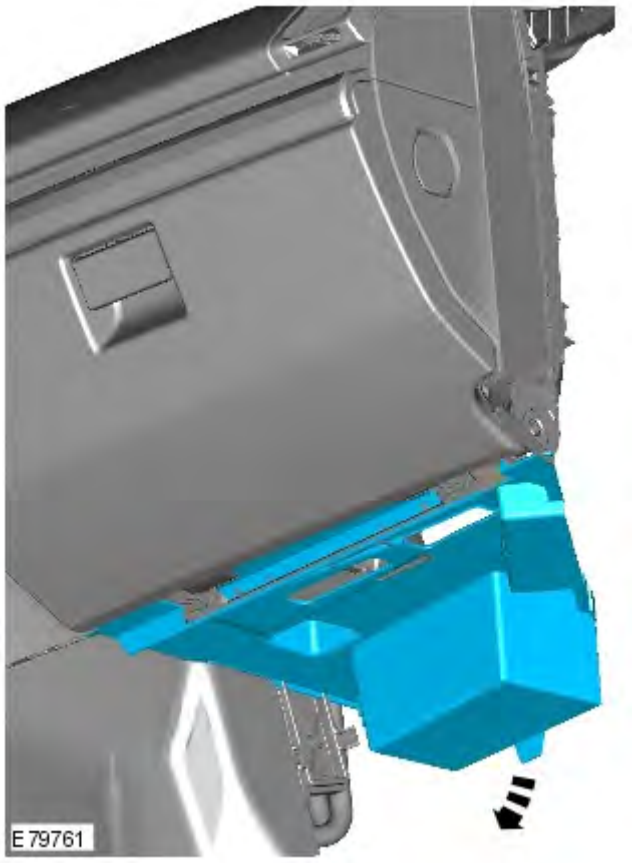
2. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).

3. Remove the selector lever.

   Refer to: Selector Lever Assembly (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).

4.

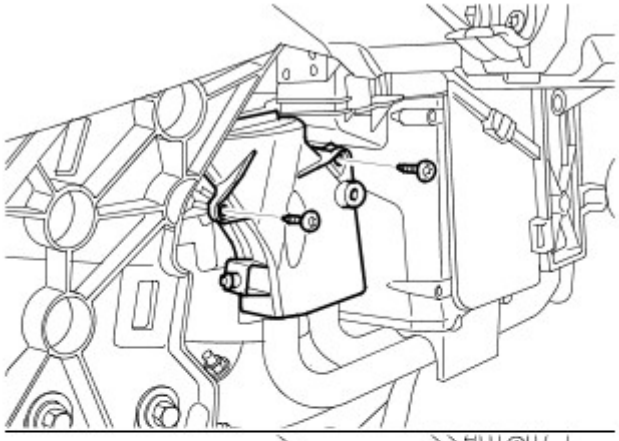


5. Remove the cowl side trim panel.

   Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

6.

7.



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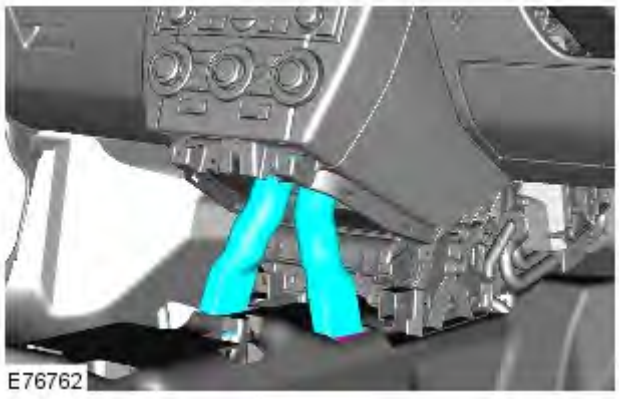
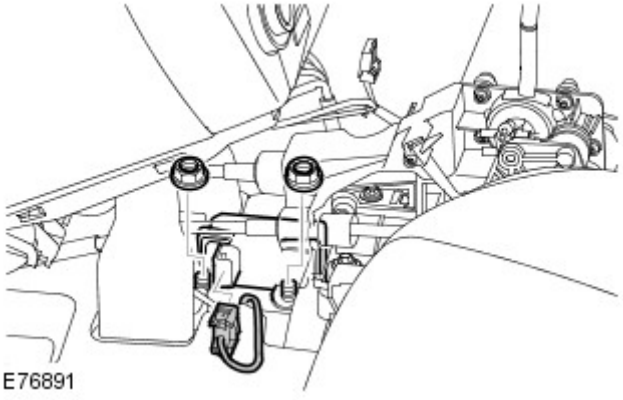
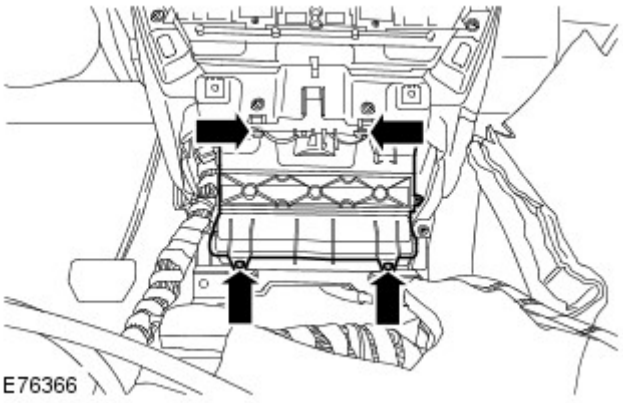
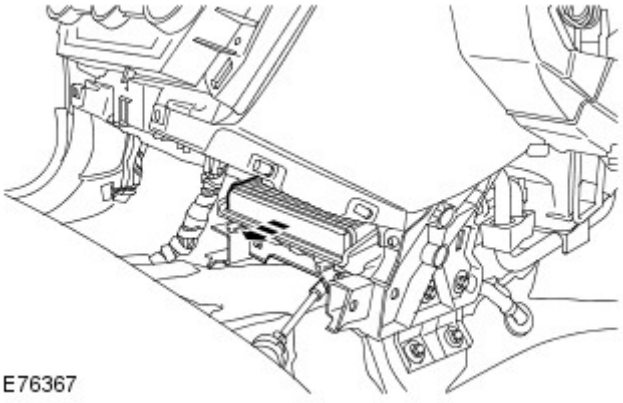




9. *Torque:* 6 Nm



10. **10.** CAUTION: Be prepared to collect escaping coolant.



11.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - CondenserI6 3.2L Petrol

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

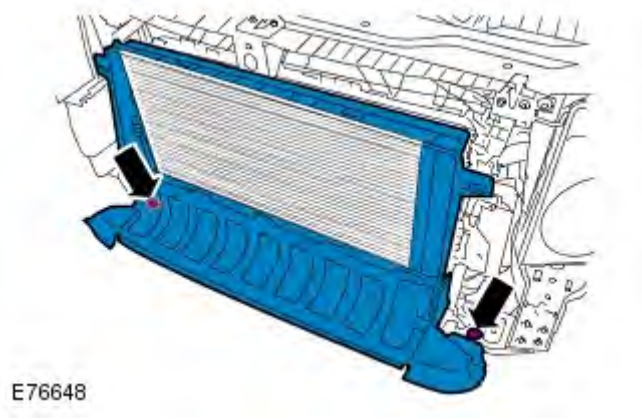
   Raise and support the vehicle.

3. Recover the A/C refrigerant.

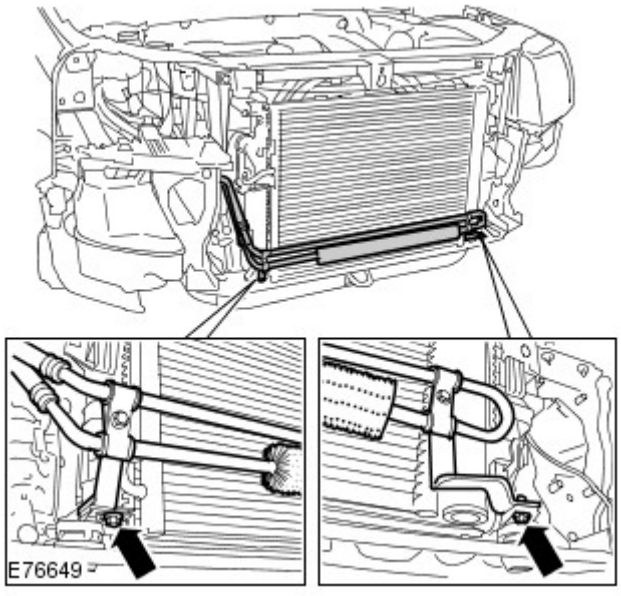
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

4. Remove the front bumper.

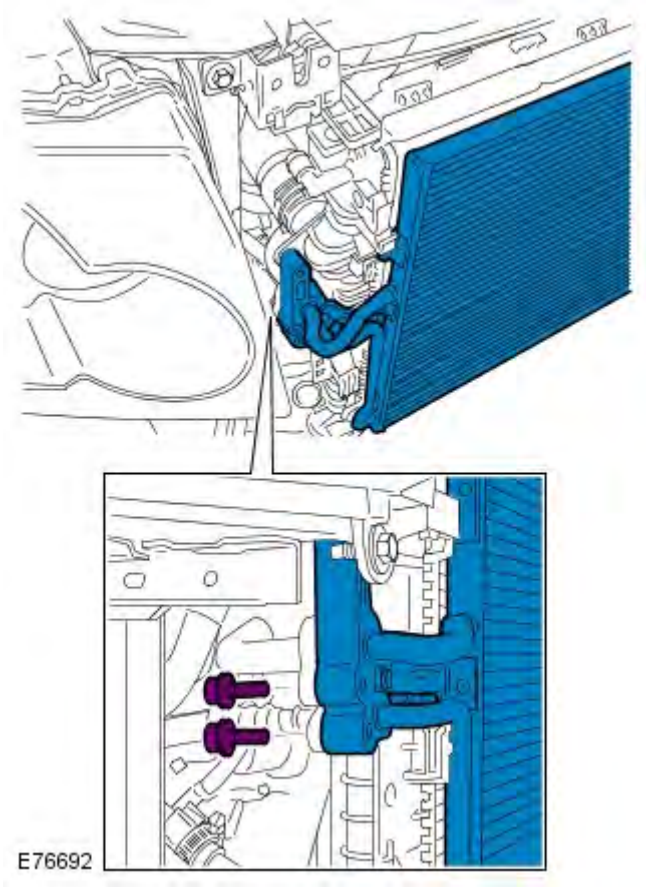
   Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).



5. Remove the radiator air deflector.



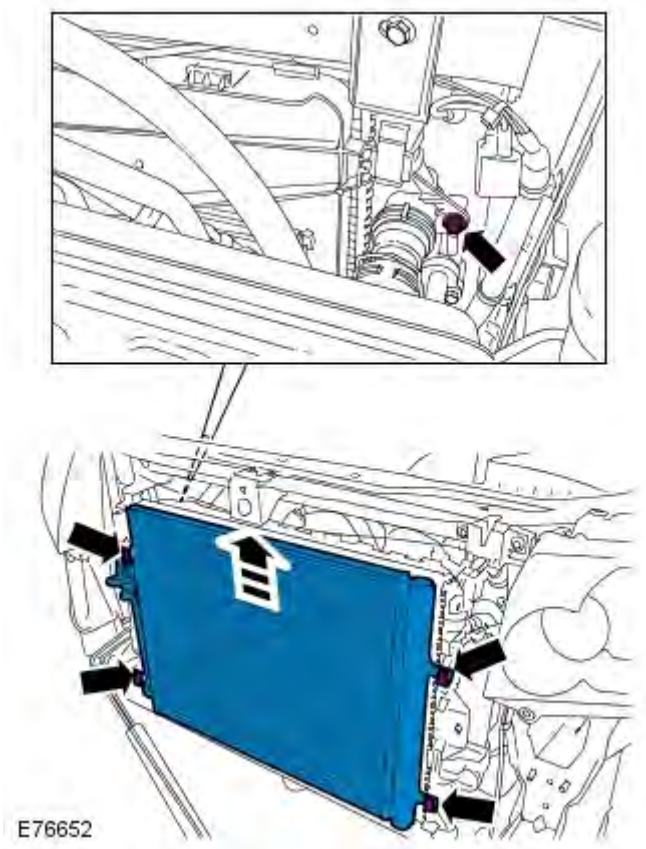
6. Release power steering cooler and secure aside.



7. **7.** CAUTION: Make sure that all openings are sealed.

   • NOTE: Remove and discard the O-ring seals.

   Disconnect the A/C condenser refrigerant lines.



8. Remove the A/C condenser.

Installation

1. Install the A/C condenser, and tighten the bolt.

Torque: 10 Nm

2. **2.** CAUTION: Extreme cleanliness must be exercised when handling these components.

   • NOTE: Lubricate the O-ring seals with clean refrigerant oil.

   Connect the A/C condenser refrigerant lines, tighten the bolts.

   Torque: 10 Nm

3. Install the PAS cooler and tighten the bolts.

   Torque: 10 Nm

4. Install the air deflector.

5. Install the front bumper.

   Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

6. Recharge the A/C system.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

7. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Climate Control - CondenserTD4 2.2L Diesel

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

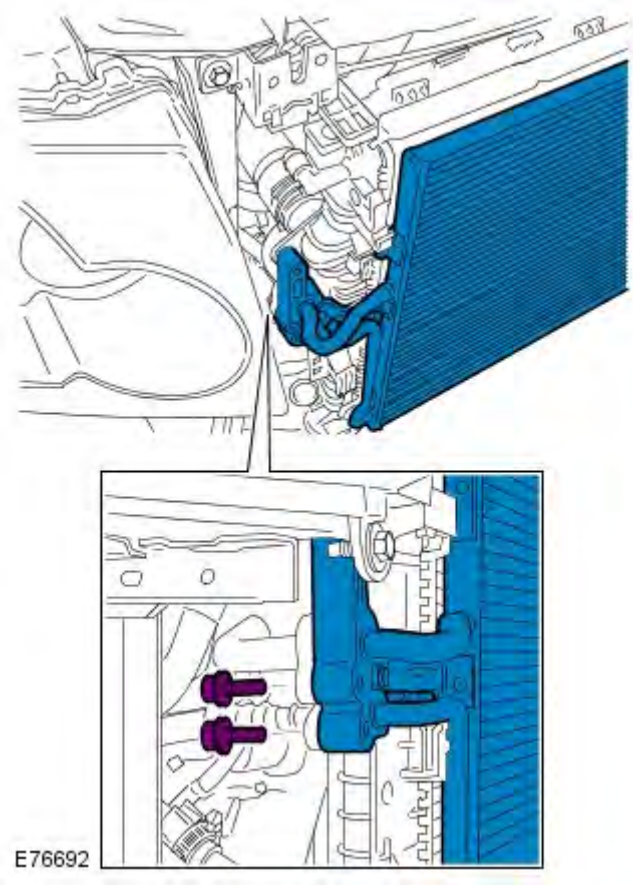
   Raise and support the vehicle.

3. Remove the charge air cooler.

   Refer to: Charge Air Cooler (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

4. Recover the A/C refrigerant.

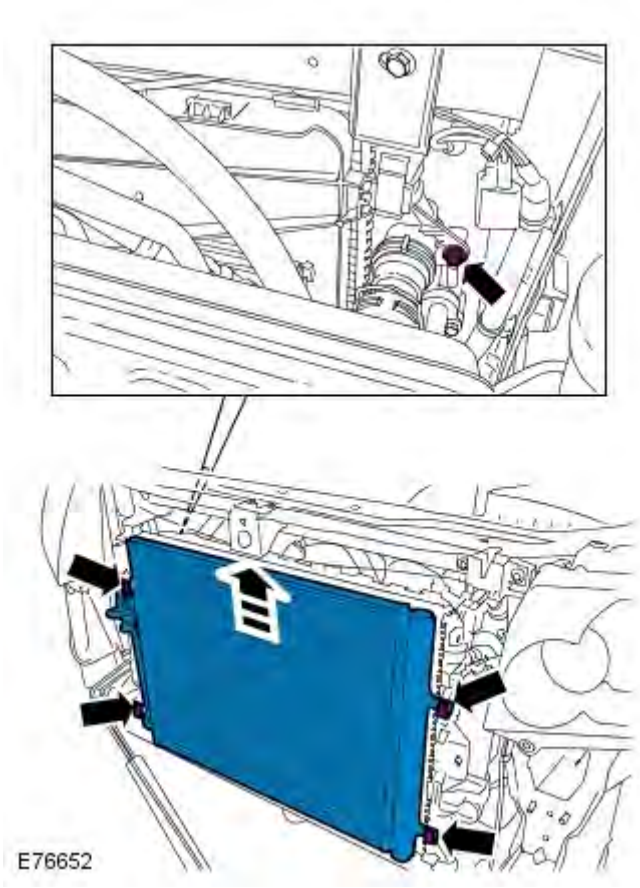
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).



5. **5.** CAUTION: Make sure that all openings are sealed.

   • NOTE: Remove and discard the O-ring seals.

   Disconnect the A/C condenser refrigerant lines.



6. Remove the A/C condenser.

Installation

1. Install the A/C condenser, and tighten the bolt.

   Torque: 10 Nm

2. **2.** CAUTION: Extreme cleanliness must be exercised when handling these components.

   • NOTE: Lubricate the O-ring seals with clean refrigerant oil.

   Connect the A/C condenser refrigerant lines, tighten the bolts.

   Torque: 10 Nm

3. Install the charge air cooler.

   Refer to: Charge Air Cooler (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

4. Recharge the A/C system.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

5. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

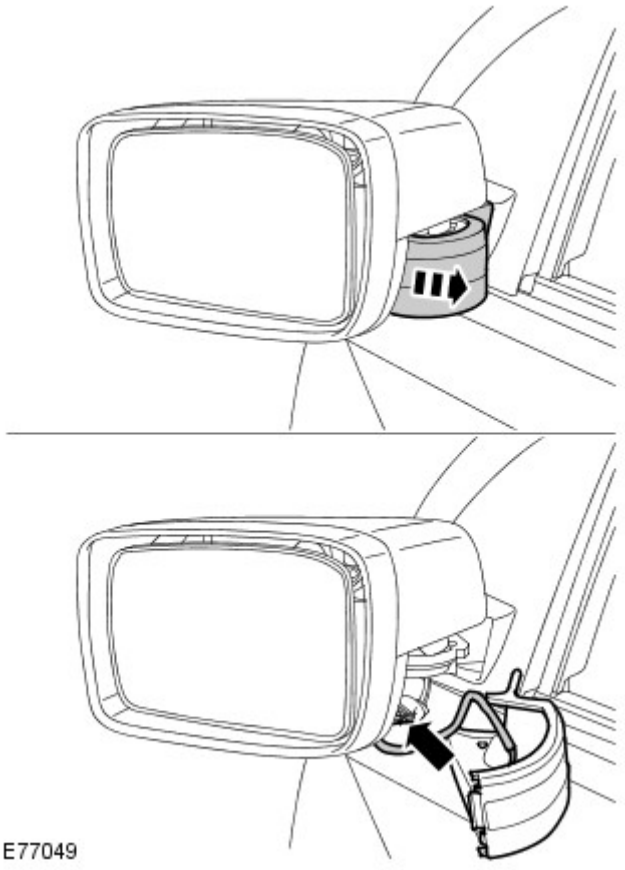
Published: 11-May-2011

Climate Control - Ambient Air Temperature Sensor

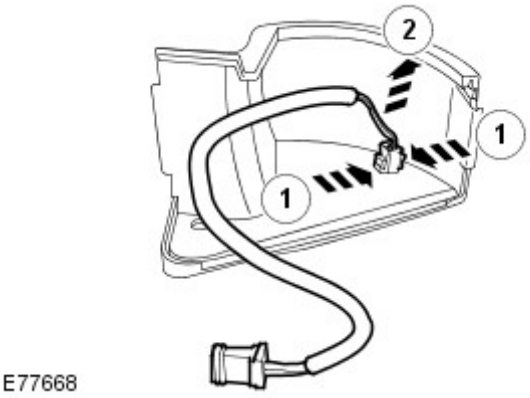
Removal and Installation

Removal

1.



2.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - Air Conditioning (A/C) CompressorI6 3.2L Petrol

Removal and Installation

Removal

CAUTION: Make sure that the specified amount of refrigerant oil is added.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Recover the air conditioning (A/C) refrigerant.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

3. Remove the engine cover.

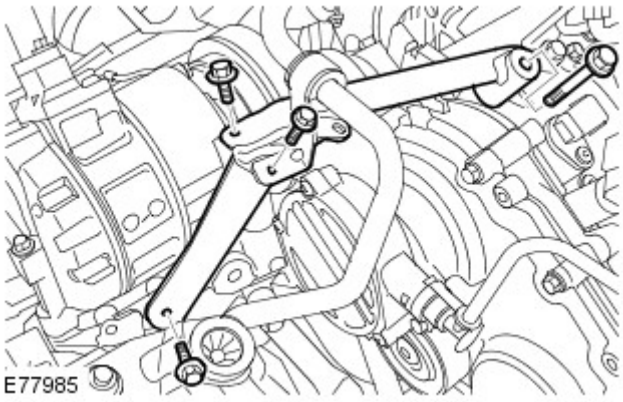
   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Remove the battery tray.

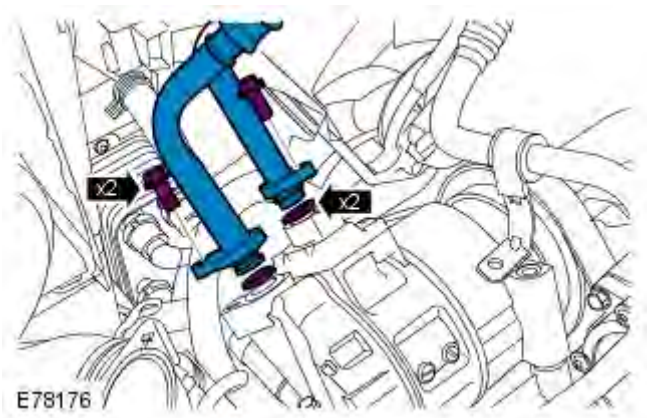
   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

5. Remove the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).



6. Remove the A/C compressor, upper support bracket.

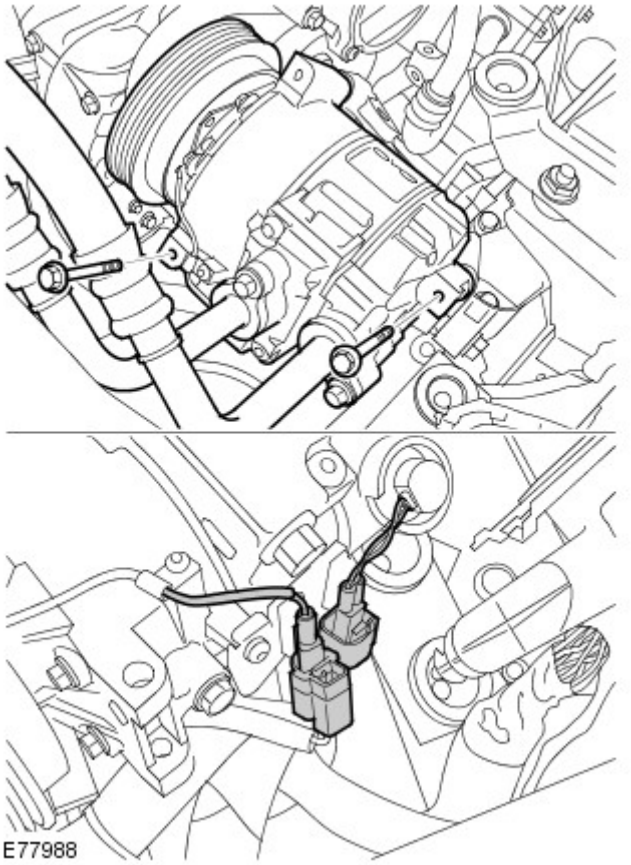


7. Remove the A/C compressor, lower support bracket.
8. Using suitable tools, release the accessory drive belt tension.
9. CAUTIONS:

   Make sure that all openings are sealed. Use new blanking caps.

   Extreme cleanliness must be exercised when handling these components.

   Disconnect the A/C compressor refrigerant lines.



10. Remove the A/C compressor.

Installation

1. Install the A/C compressor.

   Torque: 25 Nm

2. **2.** CAUTION: Lubricate the new seals with clean refrigerant oil.

   Connect the A/C compressor refrigerant lines.

   Torque: 24 Nm

3. Install the accessory drive belt.

4. Install the A/C compressor, lower support bracket.

   Torque: 25 Nm

5. Install the A/C compressor, upper support bracket.

   Torque:
   M10 45 Nm
   M8 25 Nm
   M6 10 Nm

6. Install the air cleaner assembly.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

7. Install the battery tray.

Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

8. Recharge the A/C system.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

9. Install the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

10. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Climate Control - Air Conditioning (A/C) CompressorTD4 2.2L Diesel

Removal and Installation

Removal

CAUTION: Make sure that the specified amount of refrigerant oil is added.

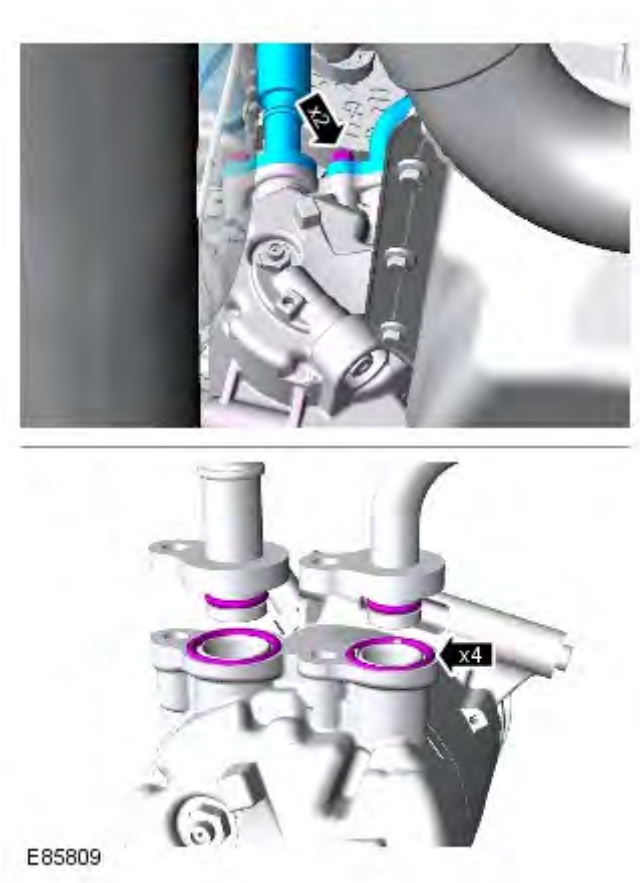
- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Recover the A/C refrigerant.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).



3. **3.** CAUTIONS:

   Make sure that all openings are sealed. Use new blanking caps.

   Lubricate the new seals with clean refrigerant oil.

   - NOTE: Install new O-ring seals.

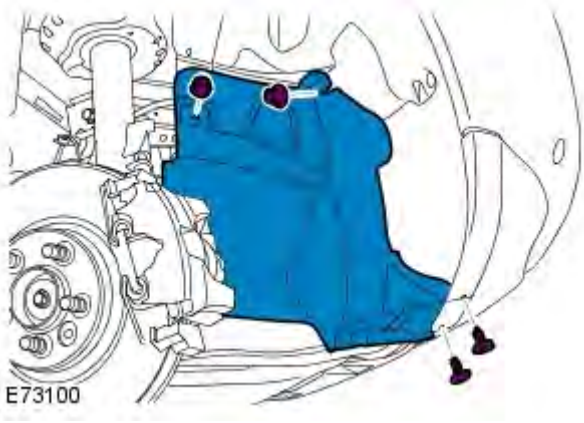
   Torque: 24 Nm

4. **4.** WARNING: Make sure to support the vehicle with axle stands.

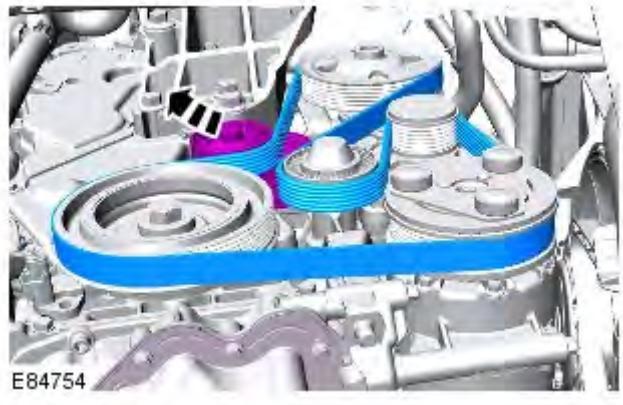
   Raise and support the vehicle.

5. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

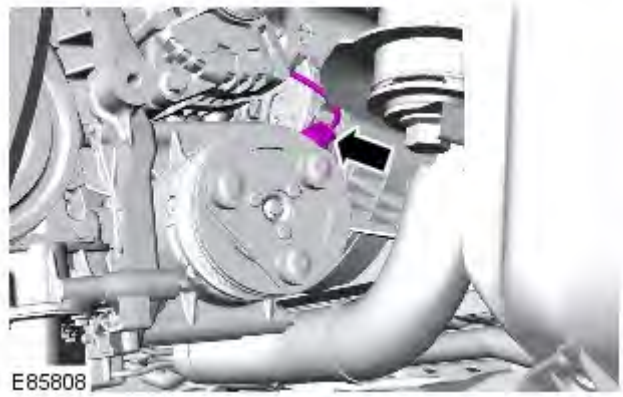


6.



7.

- Release the accessory drive belt from the A/C compressor pulley.



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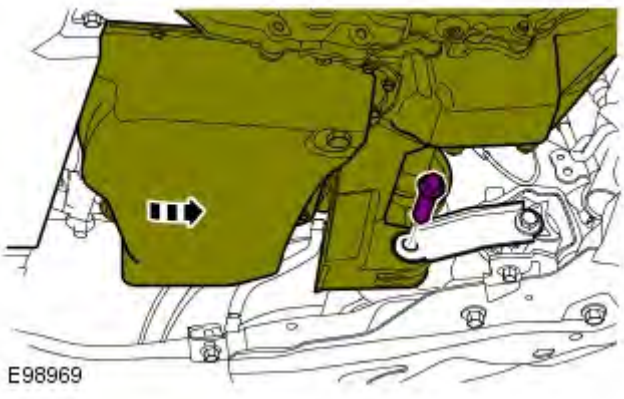
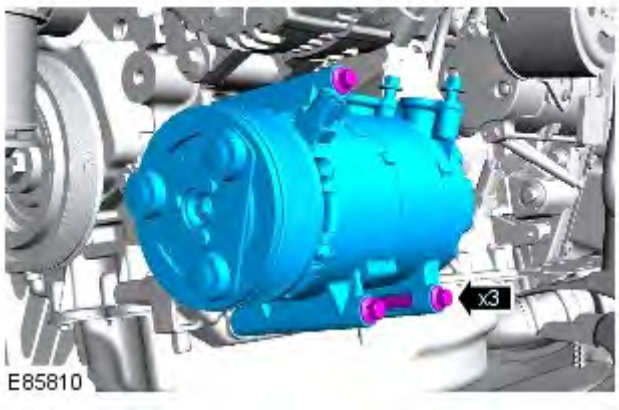


9. *Torque:* 110 Nm



10. *Torque:* 25 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - Heater Core and Evaporator Core Housing

Removal and Installation

Removal

1. Make the SRS system safe.

2. Remove the instrument panel.

   Refer to: Instrument Panel - TD4 2.2L Diesel (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Instrument Panel - I6 3.2L Petrol (501-12 Instrument Panel and Console, Removal and Installation).

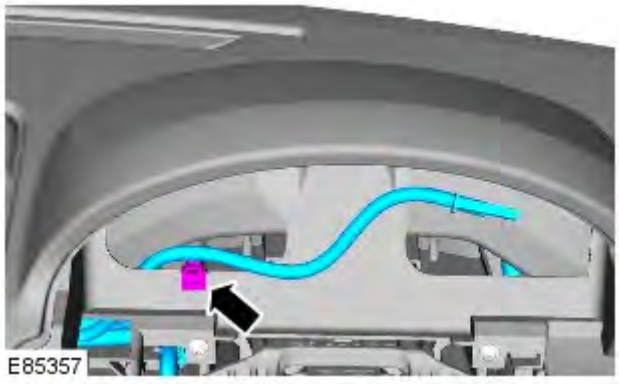
3. Remove the clockspring.

   Refer to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

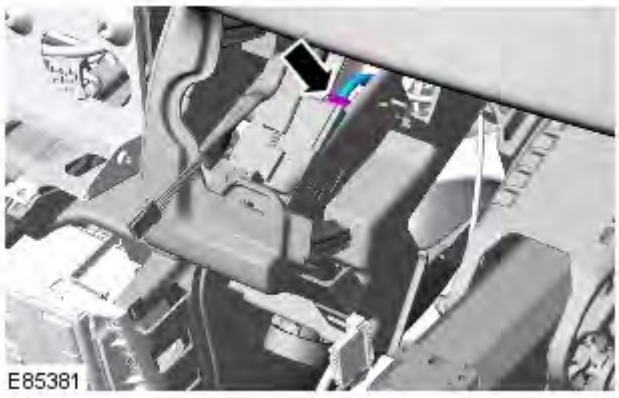
4. Remove the instrument cluster.

   Refer to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation).

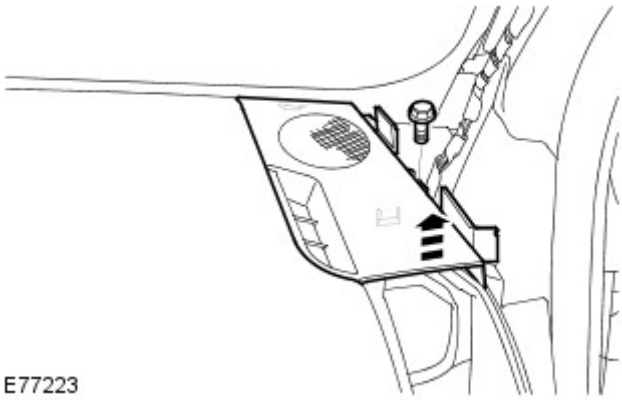
5.



6. Disconnect the keyless start module electrical connector.



7. Disconnect the in-vehicle temperature sensor.



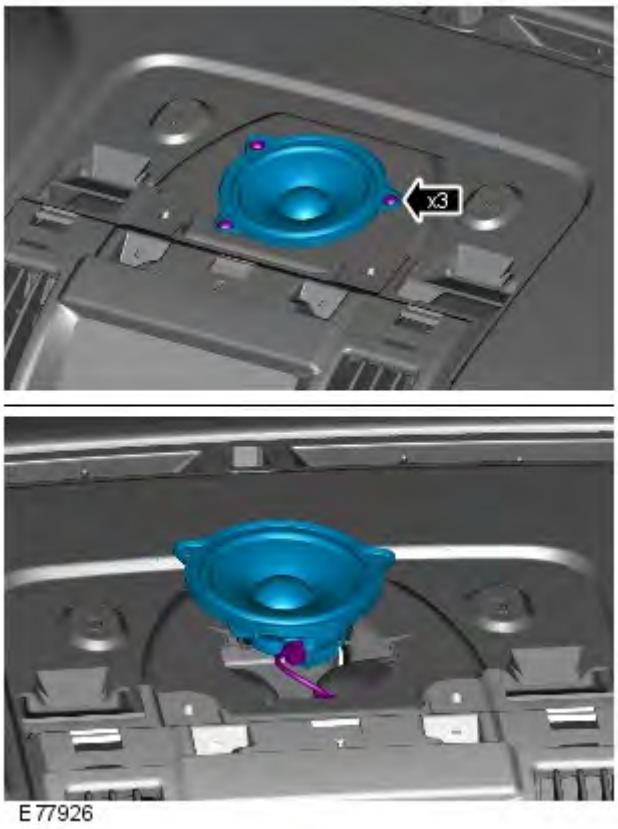
8. Remove both upper trim panels.

9. Remove both instrument panel speakers.

10. Remove the video display.

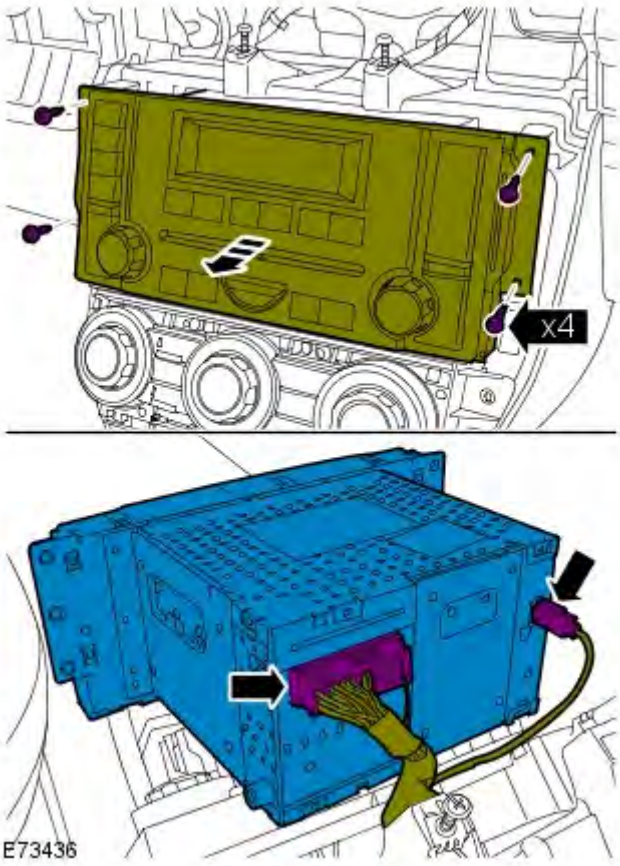
    Refer to: Video Display (415-01 Information and Entertainment System, Removal and Installation).

11. Remove the center speaker.

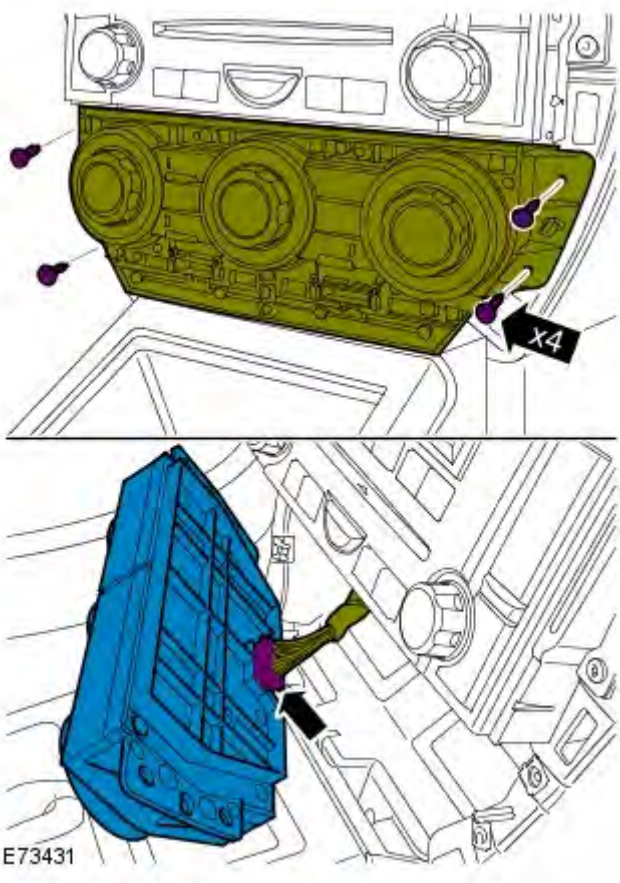


E77926

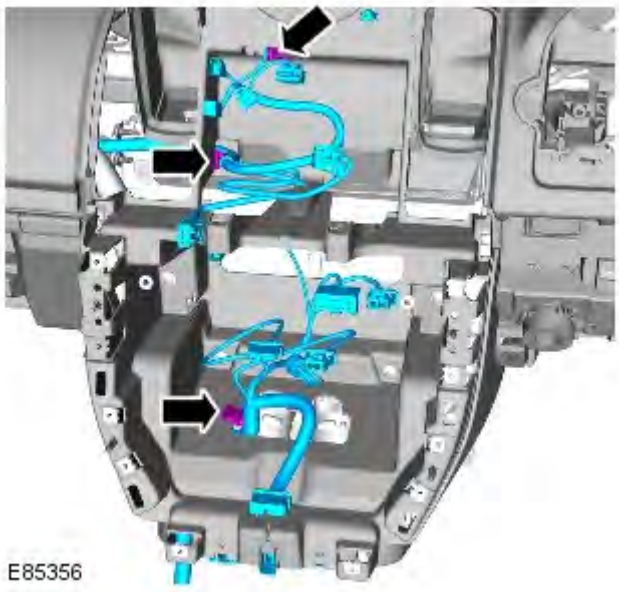
12. Remove the audio unit.



E73436

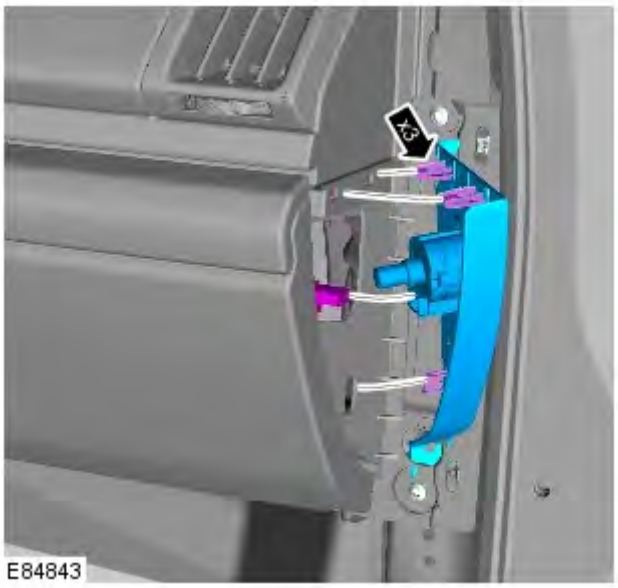


13. Remove the climate control assembly.



14.

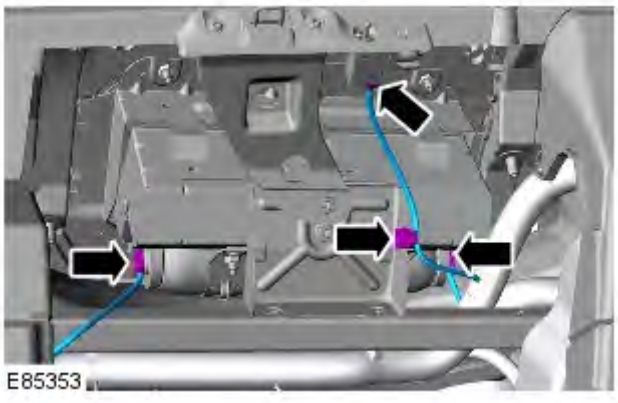
15.



16. Remove the passenger side instrument panel end trim panel.

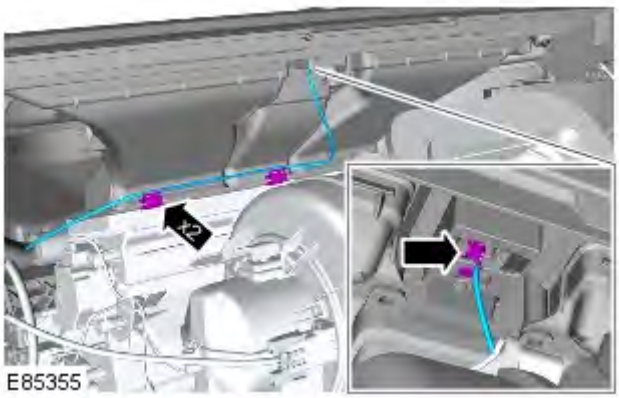
17. Remove the glove compartment.

    Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).



18. Release the wiring harness from the instrument panel upper section.

19.



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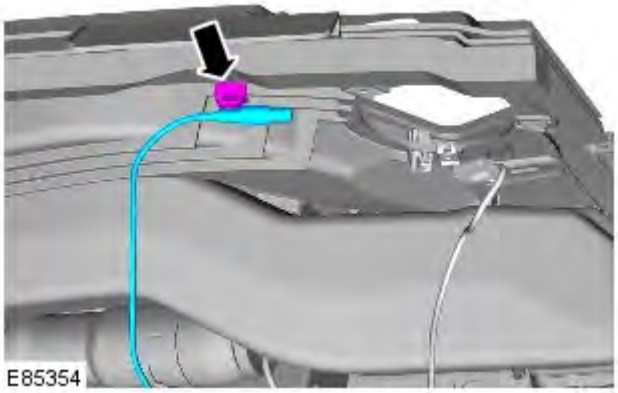
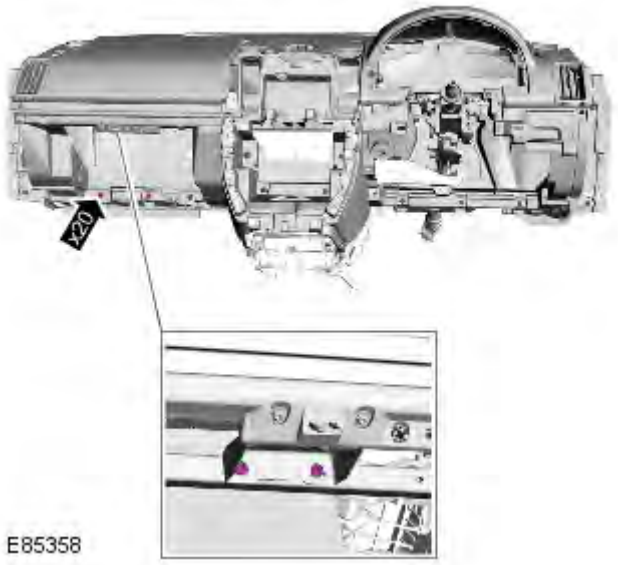
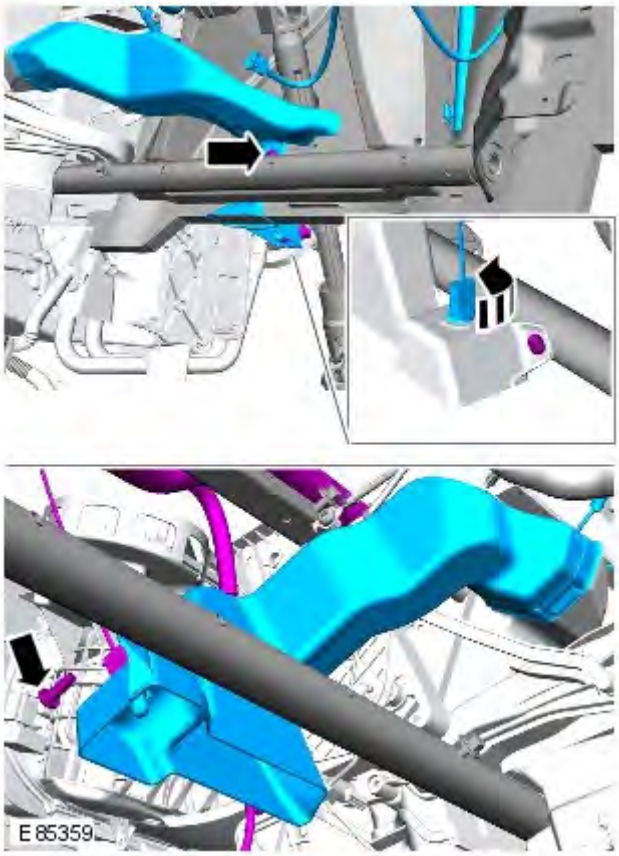
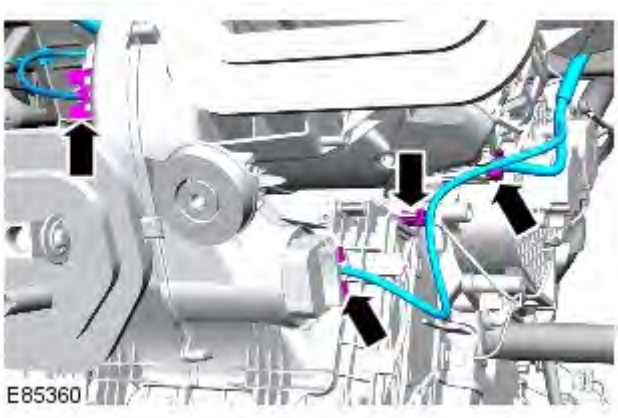


21. With assistance, remove the instrument panel upper section.

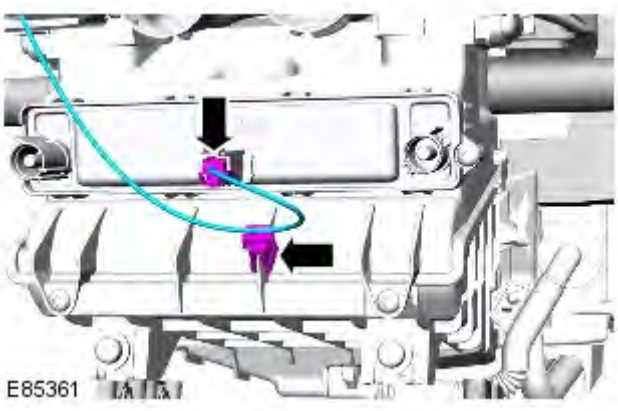




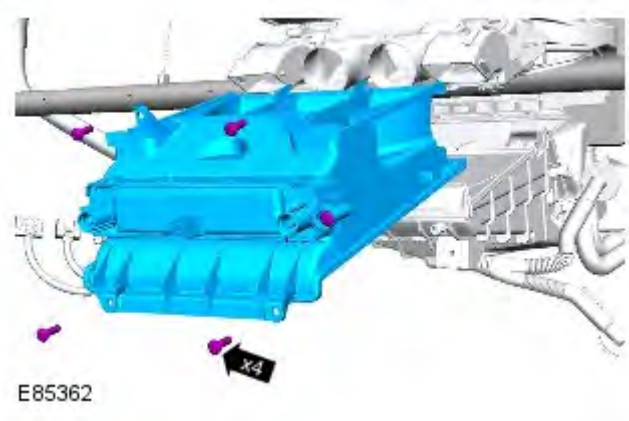
22. Remove both front footwell ducts.



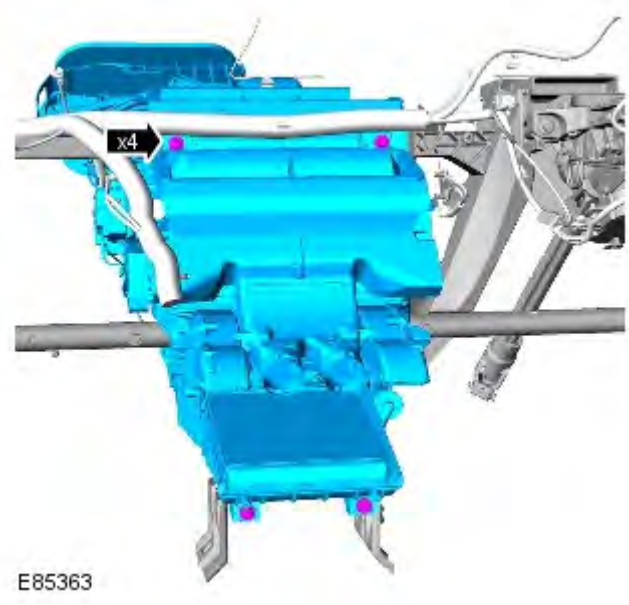
23. Disconnect the wiring harness from the heater core and evaporator core housing.



24. Disconnect the electric booster heater core.



25.



26. Remove the heater core and evaporator core housing.

Installation

1. Install the heater core and evaporator core housing.

   Torque: 7 Nm

2. Install the electric booster heater assembly.

3. Connect the electric booster heater core.

4. Connect the wiring harness to the heater and evaporator core housing.

5. Install both front footwell ducts.

6. With assistance, install the instrument panel upper section.

7. Install the passenger air bag module support bracket bolts.

   Torque: 10 Nm

8. Secure the wiring harness to the instrument panel upper section.

9. Connect the passenger air bag module electrical connectors.

10. Install the glove compartment.

    Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

11. Install the passenger side instrument panel end trim panel.

12. Secure the wiring harness support bracket.

13. Install the climate control assembly.

14. Install the audio unit.

15. Install the center speaker.

16. Install the video display.

    Refer to: Video Display (415-01 Information and Entertainment System, Removal and Installation).

17. Install both instrument panel speakers.

18. Install both upper trim panels.

19. Connect the in-vehicle temperature sensor electrical connector.

20. Connect the keyless start module electrical connector.

21. Install the instrument cluster.

    Refer to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation).

22. Install the clockspring.

    Refer to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

23. Install the instrument panel.

    Refer to: Instrument Panel - TD4 2.2L Diesel (501-12 Instrument Panel and Console, Removal and Installation).
    Refer to: Instrument Panel - I6 3.2L Petrol (501-12 Instrument Panel and Console, Removal and Installation).

24. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

25. Return the steering column to its original position.

Published: 11-May-2011

Climate Control - Air Conditioning (A/C) Pressure Transducer

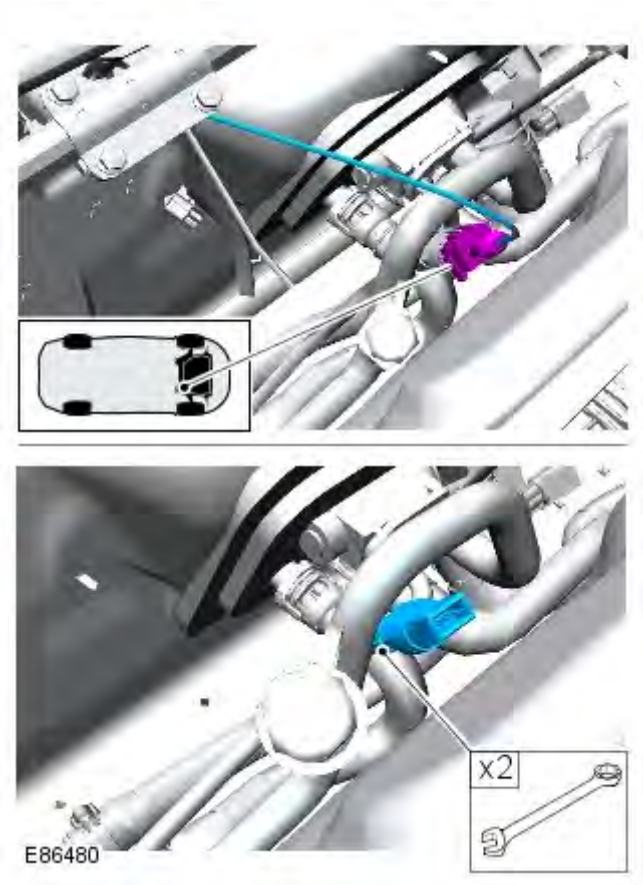
Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Remove the plenum chamber.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



2. **2.** CAUTIONS:

   Extreme cleanliness must be exercised when handling these components.

   Make sure that all openings are sealed. Use new blanking caps.

   • NOTE: Use an additional wrench to prevent the component from rotating.

   Torque: 8 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

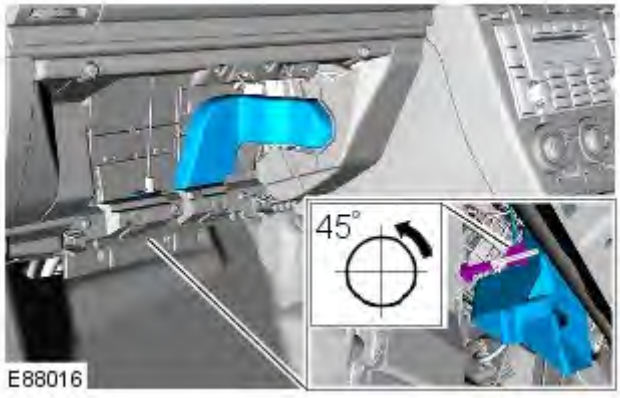
Climate Control - Temperature Blend Door Actuator LHRHD AWD

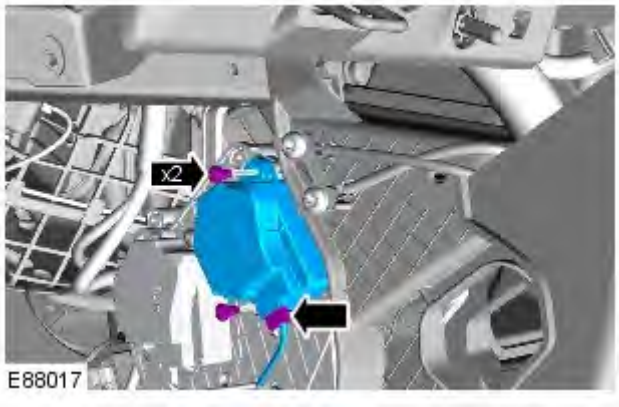
Removal and Installation

Removal

1. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

2. 

3. 

Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Climate Control - Temperature Blend Door Actuator LHLHD AWD

Removal and Installation

Removal

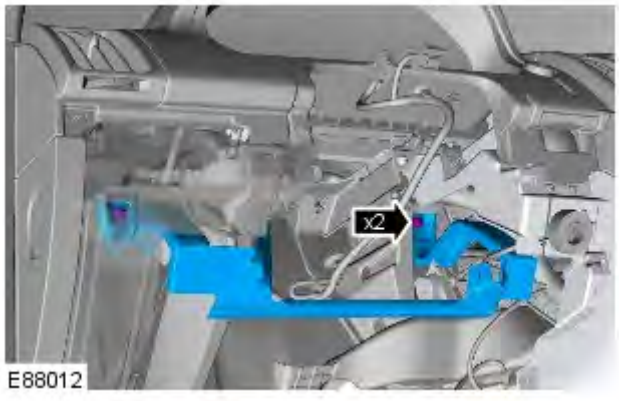
- NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

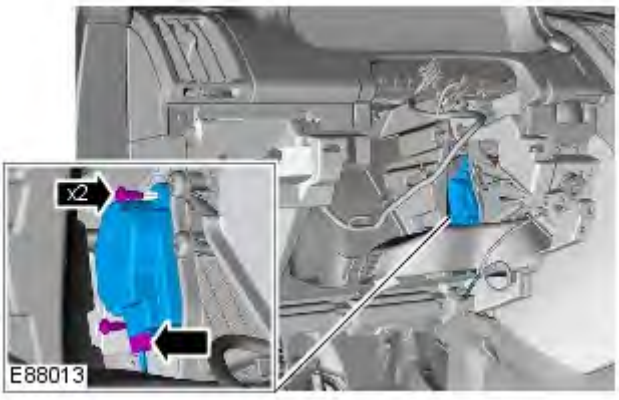
2. Remove the steering column.

   Refer to: Steering Column (211-04 Steering Column, Removal and Installation).



3. Remove the driver lower air bag module support bracket.

   Torque: 7 Nm



4.

Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Climate Control - Temperature Blend Door Actuator RHRHD AWD

Removal and Installation

Removal

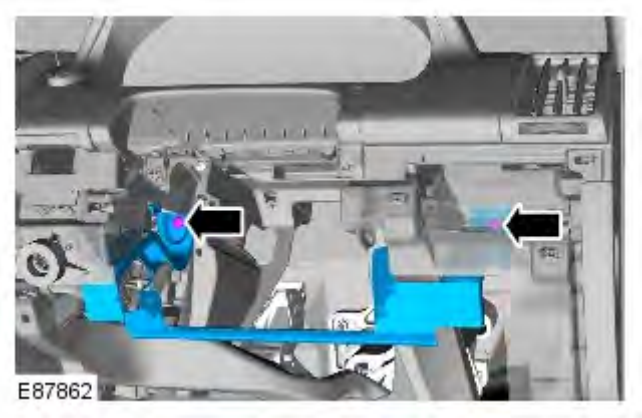
- NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

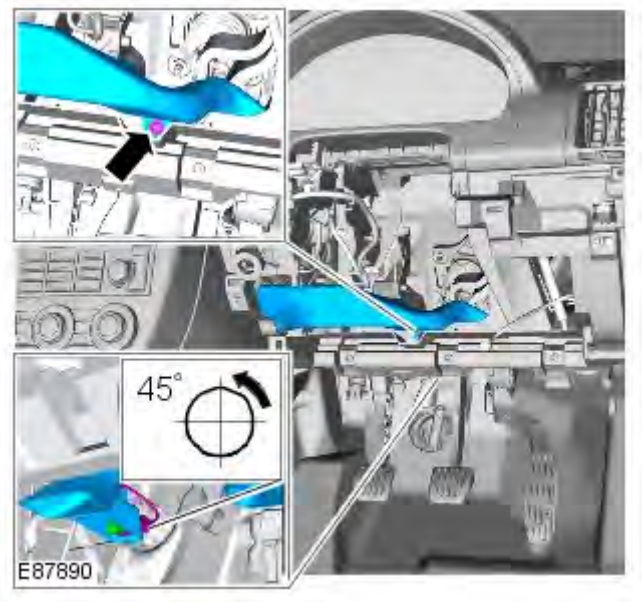
2. Remove the steering column.

   Refer to: Steering Column (211-04 Steering Column, Removal and Installation).

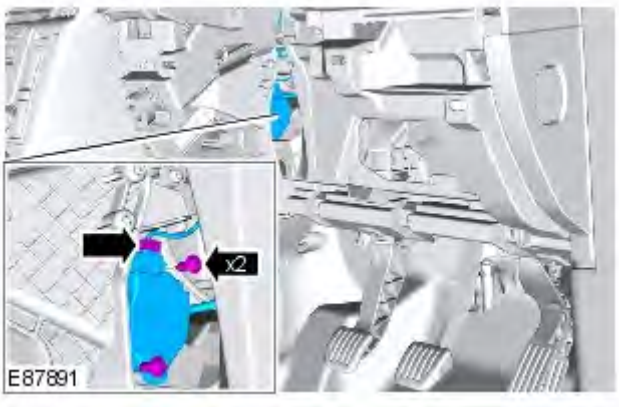


3. Remove the driver lower air bag module support bracket.

   Torque: 7 Nm



4.



5.

Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Climate Control - Temperature Blend Door Actuator RHLHD AWD

Removal and Installation

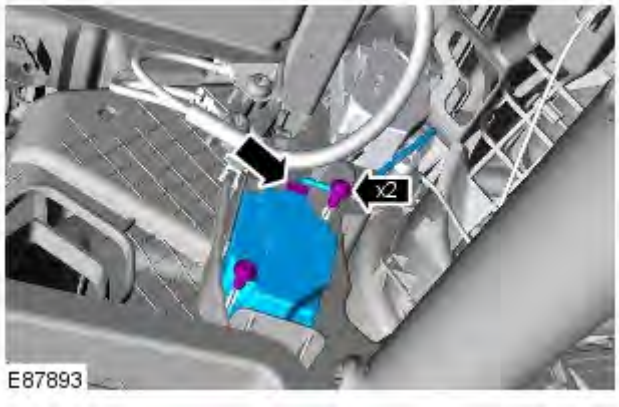
Removal

1. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

2.

3.



Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Climate Control - Defrost Vent/Register Blend Door ActuatorLHD AWD

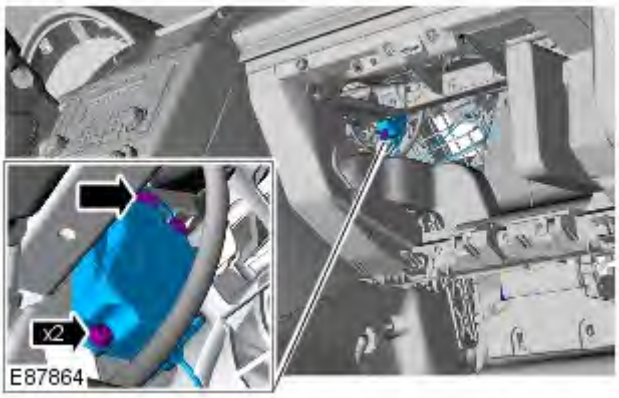
Removal and Installation

Removal

1. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

2.



Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Climate Control - Defrost Vent/Register Blend Door ActuatorRHD AWD

Removal and Installation

Removal

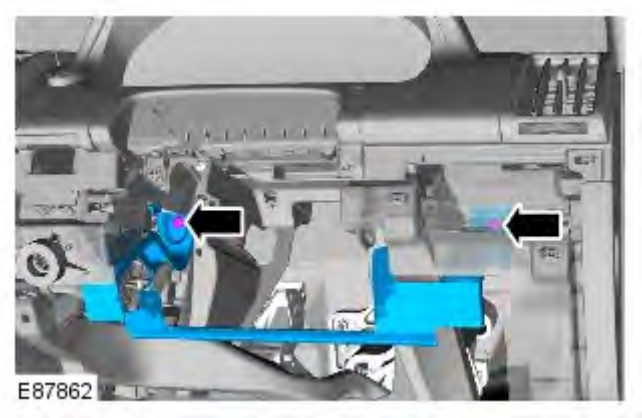
- NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

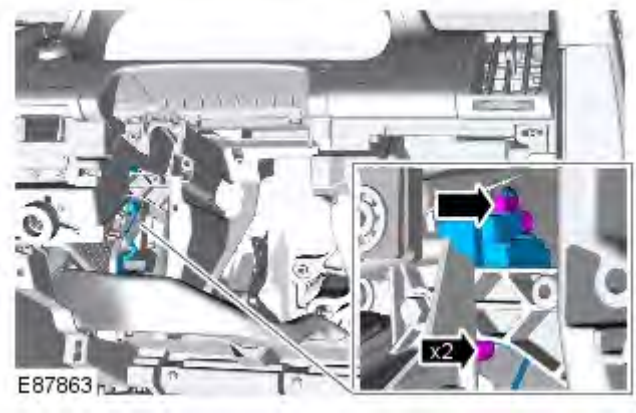
2. Remove the steering column.

   Refer to: Steering Column (211-04 Steering Column, Removal and Installation).



3. Remove the driver lower air bag module support bracket.

   Torque: 7 Nm



4.

Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Climate Control - Ambient Air Quality SensorLHD AWD

Removal and Installation

Removal

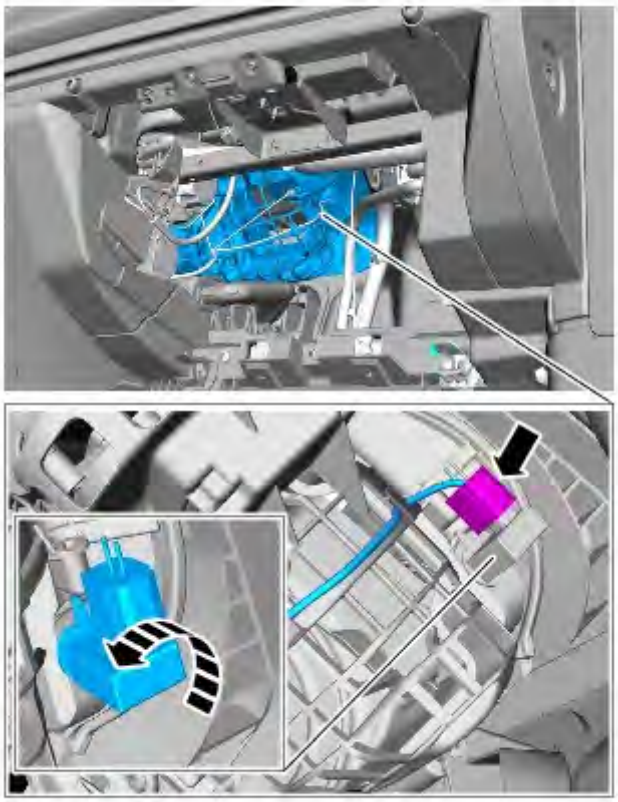
1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the CJB.

   Refer to: Central Junction Box (CJB) (418-00 Module Communications Network, Removal and Installation).

3.



E89541

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Climate Control - Ambient Air Quality SensorRHD AWD

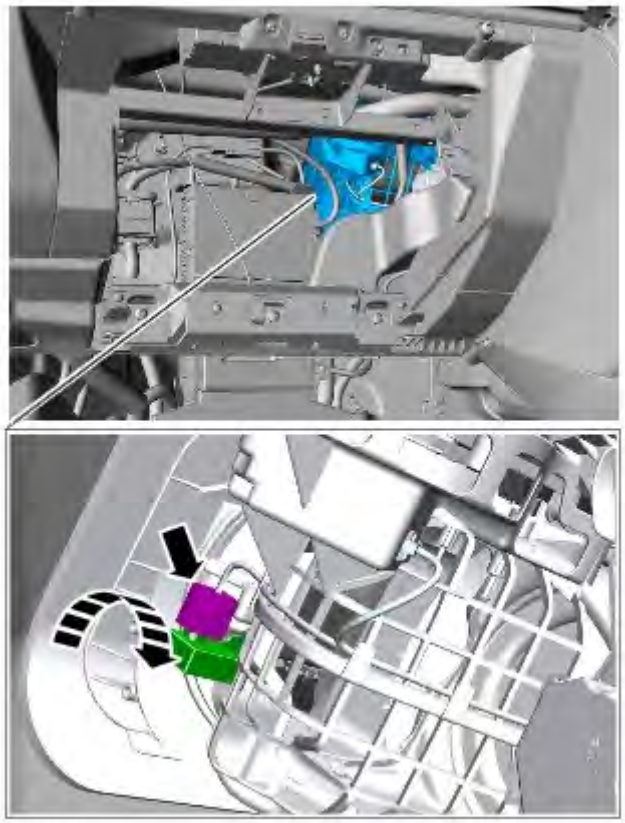
Removal and Installation

Removal

1. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

2.



E89790

Installation

1. To install, reverse the removal procedure.

Published: 26-Jul-2011

Auxiliary Heating - Fuel Fired Booster Heater

Diagnosis and Testing

Overview

For information on the description and operation of the system, refer to section 412-02 -REFER to:

Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Description and Operation),
Fuel Fired Booster Heater (412-02B, Description and Operation),
Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation),
Fuel Fired Booster Heater Fuel Pump (412-02B Auxiliary Climate Control, Removal and Installation),
Fuel Fired Booster Heater Coolant Pump (412-02B Auxiliary Climate Control, Removal and Installation),
Fuel Fired Booster Heater Glow Plug And Burner Assembly (412-02B Auxiliary Climate Control, Removal and Installation).

Auxiliary Heating in the workshop manual.

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious mechanical or electrical faults.

Visual inspection

Mechanical	Electrical
• Fuel fired heater assembly - Combustion air fan - Coolant inlet/outlet - Heat exchanger - Temperature sensor - Exhaust - Fuel inlet - Air inlet - Evaporator • Auxiliary fuel pump and lines • Auxiliary coolant pump	• Fuses • Harnesses • Electrical connector(s) • Controller area network (CAN) circuits • Control module(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the symptom chart or DTC index.

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Fuel Fired Booster Heater Module, for additional Diagnosis and Testing information refer to the relevant Diagnosis and Testing Section

DTC index

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Auxiliary Heater Control Module (AHCM) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Auxiliary Climate Control -

Torque Specifications

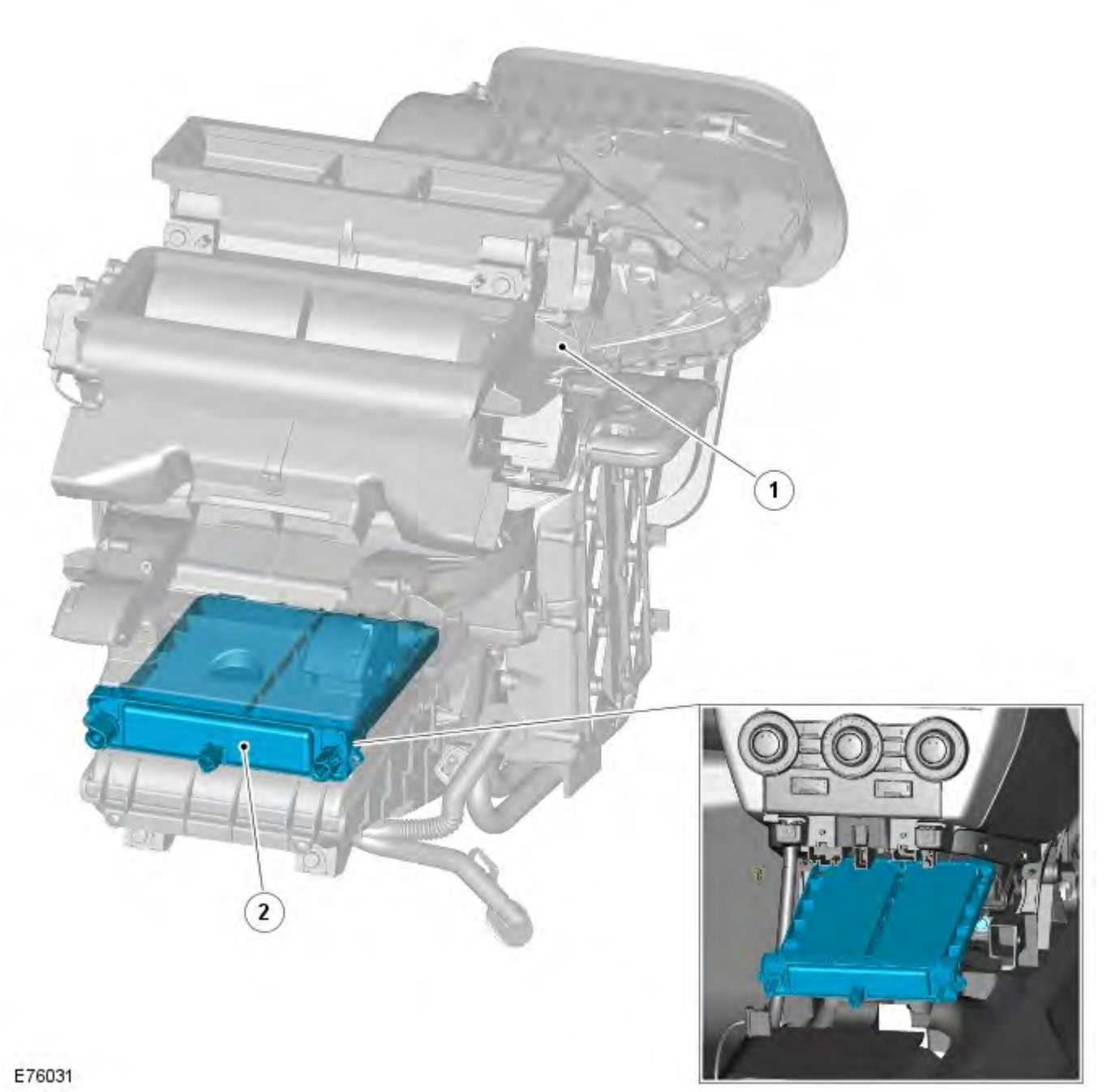
Description	Nm	lb-ft
Electric booster heater Torx screws	2	1
Fuel fired booster heater bolts	10	7
Feul fired booster heater fuel pump bolts	10	7

Published: 11-May-2011

Auxiliary Climate Control - Electric Booster Heater

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Heater assembly
2	-	Electric booster heater

OVERVIEW

Due to the slower warm up times associated with the diesel engine, an electric booster heater may be fitted to increase heater performance. The electric booster heater does this by heating the air leaving the heater assembly.

The electric booster heater comprises ceramic coated thermistor elements and a microcontroller. A request for electric booster heater operation originates in the Automatic Temperature Control (ATC) module. This request is transmitted to the Central Junction Box (CJB) over the medium speed Controller Area Network (CAN) bus. The CJB interprets this request and outputs a Pulse Width Modulation (PWM) signal to the electric booster heater microcontroller. The duration of the pulses provided by the CJB is proportional to the amount of heating required.

The amount of heating requested by the ATC is based on:

- Ambient air temperature
- Engine Coolant Temperature (ECT)
- Heating request.

• NOTE: There is also a minimum blower motor speed required electric booster heater operation.

The electric booster heater is limited to 1.25 kW. If electrical load management is in force, electric booster heater performance will be reduced.

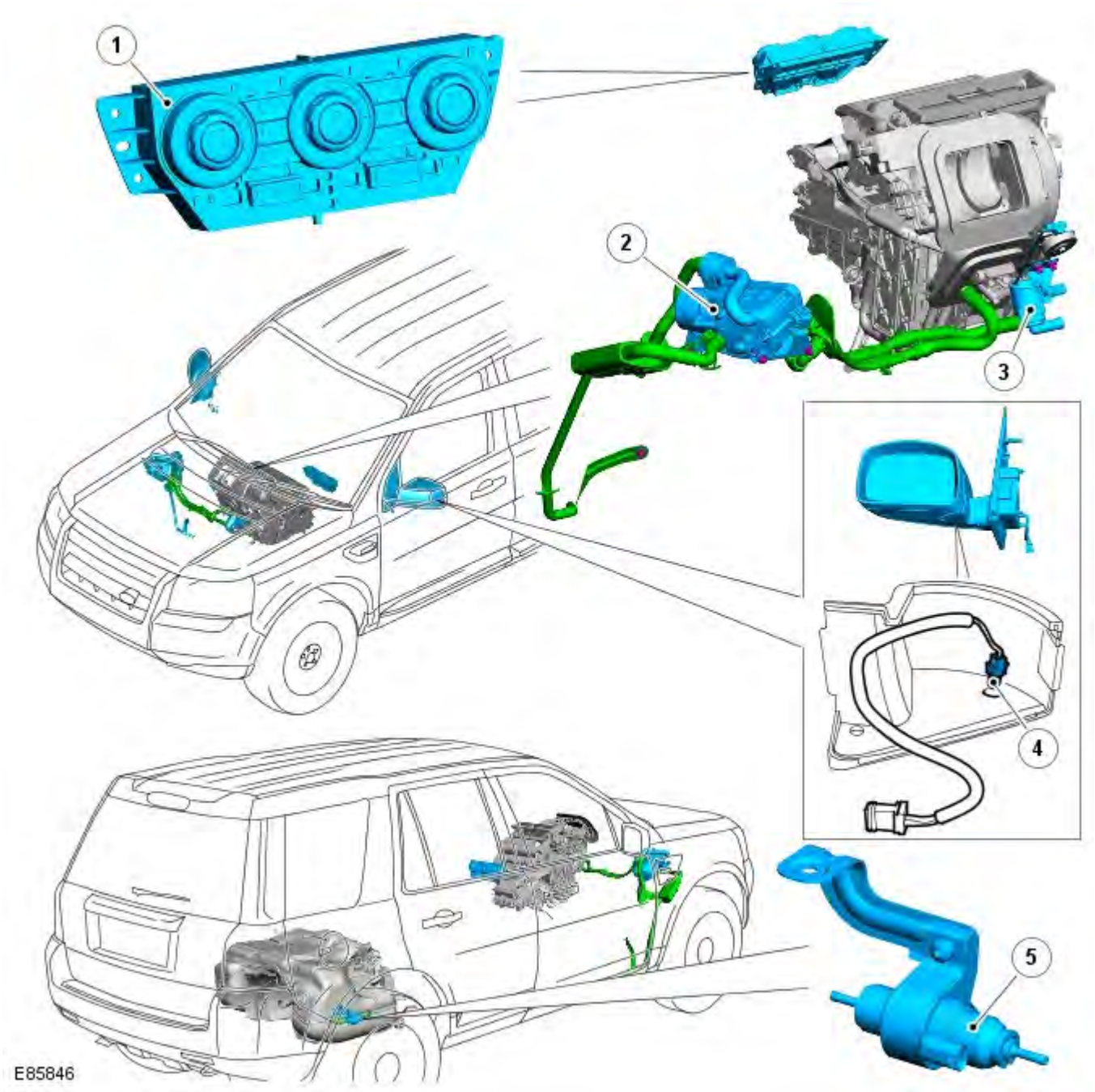
• NOTE: Vehicles fitted with an electric booster heater and heated windshield will also be fitted with an uprated 180 amp generator.
For additional information, refer to: Generator - TD4 2.2L Diesel (414-02 Generator and Regulator, Description and Operation).

Published: 11-May-2011

Auxiliary Climate Control - Fuel Fired Booster Heater

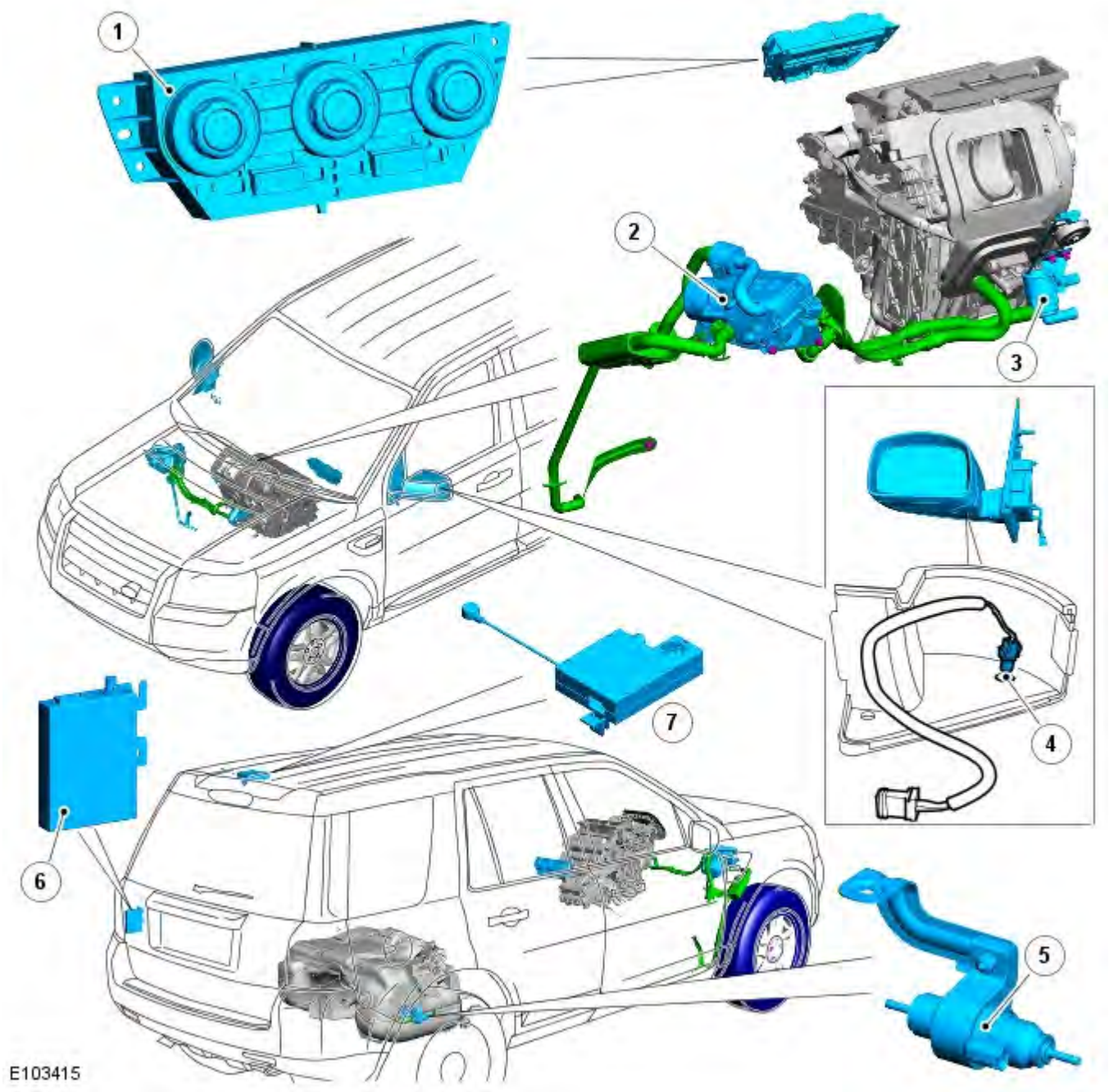
Description and Operation

COMPONENT LOCATION - VEHICLES WITHOUT FFBH REMOTE CONTROL



Item	Part Number	Description
1	-	Automatic Temperature Control (ATC) module
2	-	Fuel Fired Booster Heater (FFBH)
3	-	Auxiliary coolant pump
4	-	Ambient air temperature sensor
5	-	Auxiliary fuel pump

COMPONENT LOCATION - VEHICLES FROM 2009MY WITH FFBH REMOTE CONTROL



Item	Part Number	Description
1	-	Automatic Temperature Control (ATC) module
2	-	Fuel Fired Booster Heater (FFBH)
3	-	Auxiliary coolant pump
4	-	Ambient air temperature sensor
5	-	Auxiliary fuel pump
6	-	FFBH Receiver
7	-	FFBH antenna matching unit

OVERVIEW

The Fuel fired Booster Heater (FFBH) is rated at 5 kW and compensates for the relatively low coolant temperatures inherent in the diesel engine. The unit is located behind the Right Hand (RH) front fender splash shield and heats engine coolant downstream of the heater core.

Operation of the FFBH is controlled by the Automatic Temperature Control (ATC) module via the medium speed Controller Area Network (CAN) bus. Operation of the FFBH is influenced by:

- Ambient air temperature
- Engine coolant temperature.

The FFBH will operate if the ambient air temperature is lower than 5 °C (41 °F) and stop if ambient temperature reaches 8 °C (46 °F). Operation of the FFBH may also be inhibited if the fuel level drops below a predetermined level.

Remote Operation - Vehicles from 2009MY

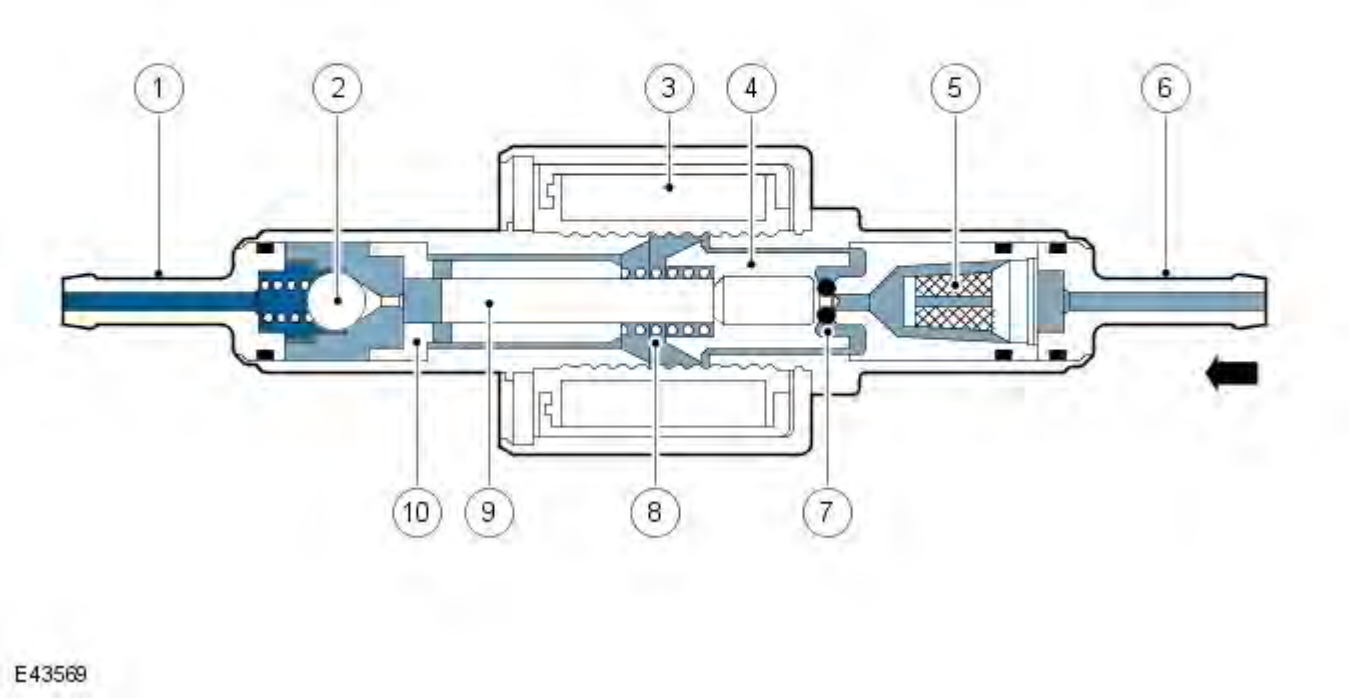
On vehicles from 2009MY the FFBH has remote operation. The remote system includes the addition of a FFBH receiver,

FFBH antenna matching unit and a remote handset for operation of the system. The FFBH unit remains as previously fitted but has upgraded software. The Engine Control Module (ECM) also has a software calibration upgrade. The instrument cluster message center displays FFBH messages when required.

AUTOMATIC TEMPERATURE CONTROL MODULE

The ATC module is mounted in the center console and is integral with the control panel. The module works in conjunction with the ECM to control all aspects of heating, ventilation, and Air Conditioning (A/C).
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

AUXILIARY FUEL PUMP



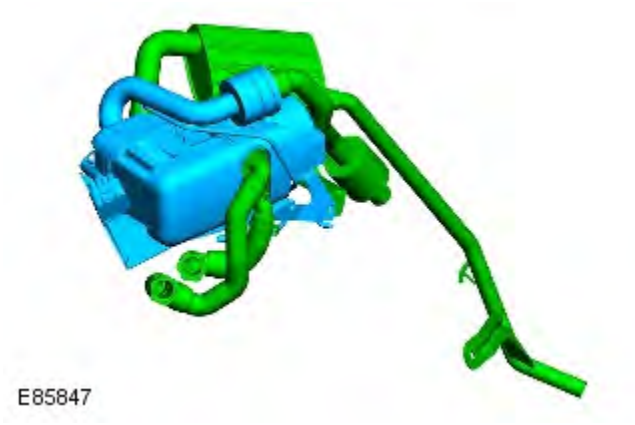
Item	Part Number	Description
1	-	Fuel line connector
2	-	Non return valve
3	-	Solenoid coil
4	-	Plunger
5	-	Filter insert
6	-	Fuel line connector
7	-	O-ring seal
8	-	Spring
9	-	Piston
10	-	Bush

The auxiliary fuel pump is mounted on the RH side of the fuel tank and regulates the fuel supply to the FFBH. The pump is a self priming, solenoid operated plunger pump, controlled by a Pulse Width Modulation (PWM) signal from the control module in the FFBH. When the pump is de-energized, it provides a positive shut-off of the fuel supply.

The solenoid coil of the auxiliary fuel pump is installed around a housing which contains a plunger and piston. The piston locates in a bush, and a spring is installed on the piston between the bush and the plunger. A filter insert and a fuel line connector are installed in the inlet end of the housing. A non return valve and a fuel line connector are installed in the fuel outlet end of the housing.

While the solenoid coil is de-energized, the spring holds the piston and plunger in the closed position at the inlet end of the housing. An O-ring seal on the plunger provides a fuel tight seal between the plunger and the filter insert, preventing any flow through the pump. When the solenoid coil is energized, the piston and plunger move towards the outlet end of the housing, until the plunger contacts the bush; fuel is then drawn in through the inlet connection and filter. The initial movement of the piston also closes transverse drillings in the bush and isolates the pumping chamber at the outlet end of the housing. Subsequent movement of the piston then forces fuel from the pumping chamber through the non return valve and into the line to the fuel fired booster heater. When the solenoid de-energizes, the spring moves the piston and plunger back towards the closed position. As the piston and plunger move towards the closed position, fuel flows past the plunger and through the annular gaps and transverse holes in the bush to replenish the pumping chamber.

FUEL FIRED BOOSTER HEATER (FFBH)

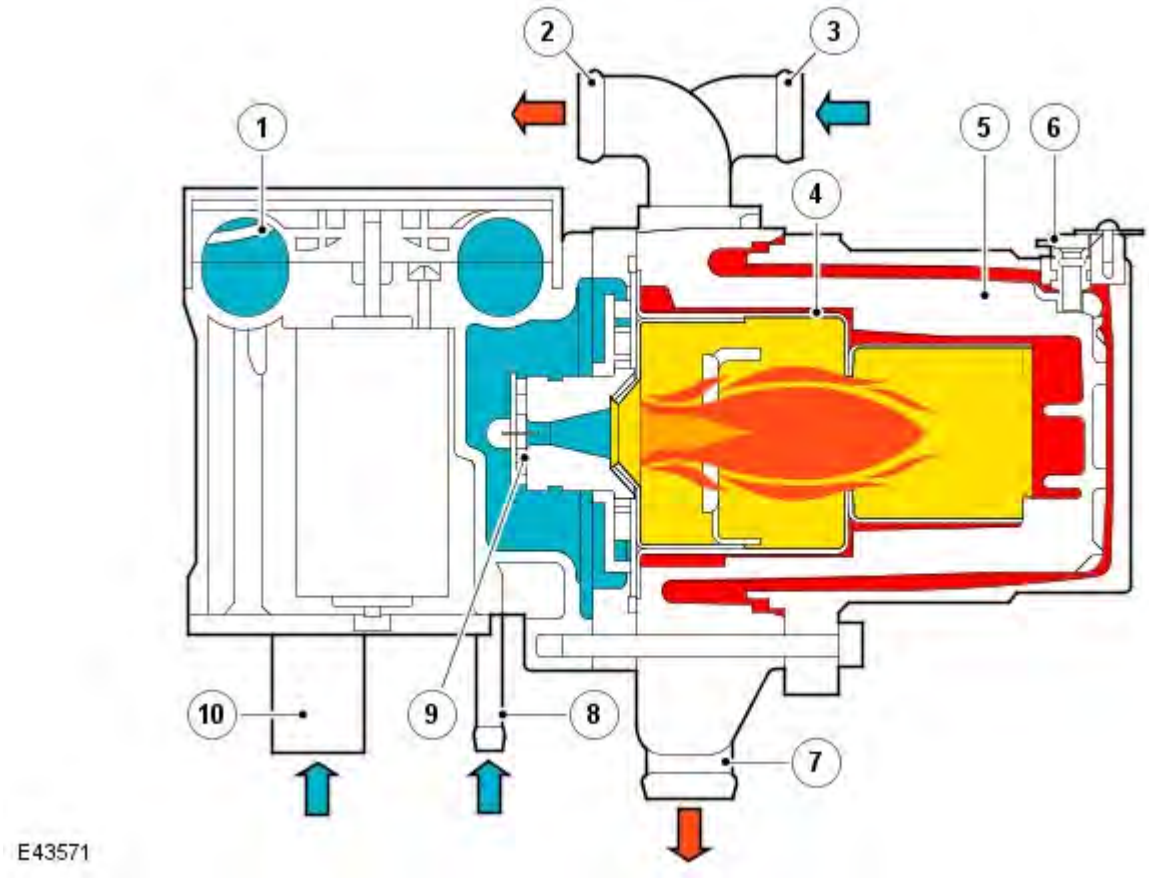


The FFBH is installed in the coolant supply line to the heater assembly and is located behind the RH front fender splash shield. Two electrical connectors connect the FFBH to the vehicle wiring.

The FFBH comprises the following:

- A combustion air fan
- A burner housing
- A heat exchanger
- An air inlet hose and muffler
- An exhaust pipe and muffler
- A control module.

Sectioned View of Typical Fuel Fired Booster Heater



Item	Part Number	Description
1	-	Combustion air fan
2	-	Coolant outlet
3	-	Coolant inlet
4	-	Burner insert
5	-	Heat exchanger
6	-	Temperature sensor
7	-	Exhaust
8	-	Fuel inlet
9	-	Evaporator
10	-	Air inlet

Combustion Air Fan

The combustion air fan regulates the flow of air into the FFBH to support combustion of the fuel supplied by the auxiliary fuel pump. It is also used to purge and cool the FFBH.

Burner Housing

The burner housing contains the burner insert and also incorporates connections for the exhaust pipe, the coolant inlet from the auxiliary coolant pump and the coolant outlet to the vehicle heater.

The burner insert incorporates the fuel combustion chamber, an evaporator and a glow pin and flame sensor. Fuel from the auxiliary fuel pump is supplied to a venturi, where it evaporates and enters the combustion chamber to mix with air from the combustion air fan. The glow pin and flame sensor provides the ignition source for the fuel:air mixture and, once combustion is established, monitors the flame.

Heat Exchanger

The heat exchanger transfers heat generated by combustion to the coolant. Two sensors are installed in the heat exchanger casing to provide the control module with inputs of Engine Coolant Temperature (ECT). The control module uses the temperature inputs to control system operation.

Air Inlet Hose and Muffler

A canister type muffler is included in the air inlet supply line. The muffler reduces the noise caused by induction roar.

Exhaust Pipe and Muffler

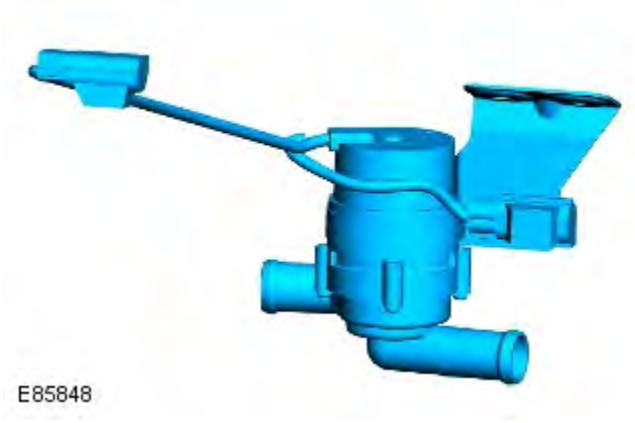
The exhaust pipe and muffler directs exhaust combustion gases to atmosphere below the front RH wheel arch. Exhaust vapor may be visible when the FFBH is running, depending on atmospheric conditions.

Control Module

The control module controls and monitors operation of the FFBH system. An internal flow of air from the combustion air fan ventilates the control module to prevent it overheating.

The control module is powered by a permanent feed from the Battery Junction Box (BJB), and communicates with the ATC module over the medium speed Controller Area Network (CAN) bus.

AUXILIARY COOLANT PUMP



The auxiliary coolant pump is mounted on the heater casing and is used to assist coolant flow through the FFBH and the heater core.

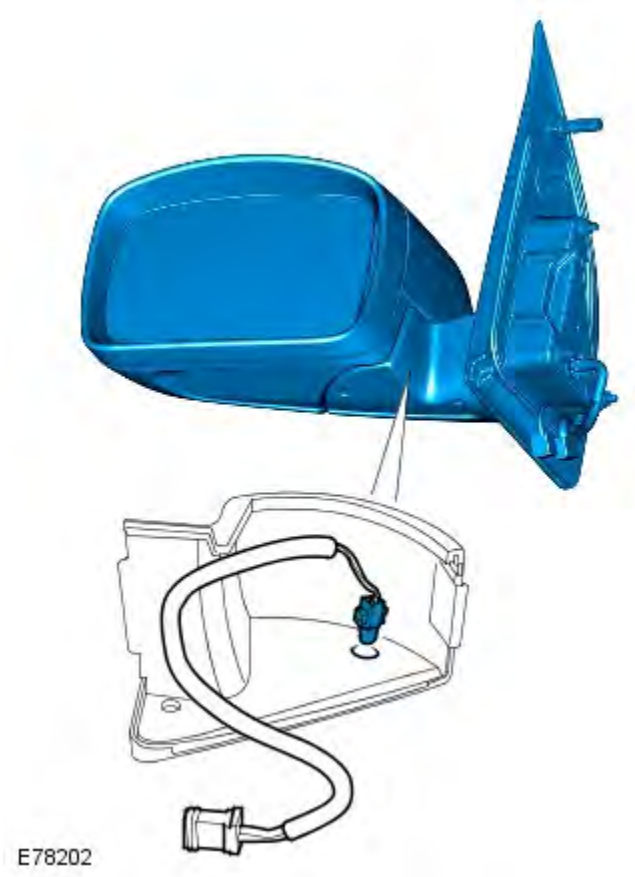
The auxiliary coolant pump runs continuously while the FFBH is active. When the FFBH is inactive, coolant flow is reliant on the engine coolant pump. Operation of the auxiliary coolant pump is controlled by a power feed direct from the control module within the FFBH.

Stop/Start Vehicles - From 2010 MY

During a Stop/Start cycle when the engine is shutdown and consequently the engine-driven coolant pump is stationary, the desired set cabin temperature cannot be maintained for a prolonged period, especially in cold ambient temperatures. To counteract this an auxiliary electric coolant-pump, controlled by the ECM (engine control module), has been integrated into the cooling system to maintain the coolant flow through the cabin's heater core. This supporting circulation prolongs the set temperature setting in the cabin and accordingly prevents an early engine restart.

On vehicles fitted with a Fuel Fired Booster Heater (FFBH) the additional auxiliary coolant pump is not installed. In its place the FFBH auxiliary coolant pump is utilized to circulate the coolant in an engine shutdown situation. The pump is activated via the FFBH by the CJB (central junction box).
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

AMBIENT AIR TEMPERATURE SENSOR



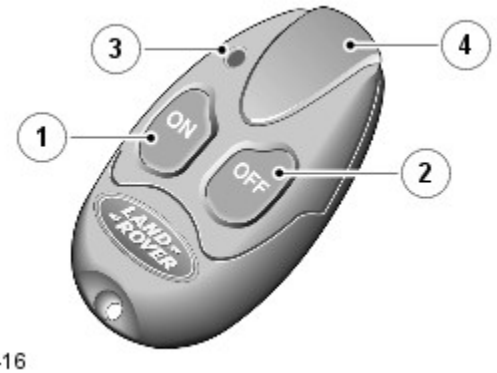
The ambient air temperature sensor is a Negative Temperature Co-efficient (NTC) thermistor, and is mounted in the Left Hand (LH) door mirror. The sensor is connected to the Engine Control Module (ECM) which transmits an ambient air temperature value over the high speed CAN bus. This value is relayed to the ATC module by the Central Junction Box (CJB) over the medium speed CAN bus.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

REMOTE CONTROL COMPONENTS - VEHICLES FROM 2009MY WITH FFBH REMOTE CONTROL

The addition of remote control retains the FFBH components fitted to pre 2009MY vehicles with the addition of the following components:

- FFBH with upgraded software and calibration
- FFBH remote handset
- FFBH remote receiver
- Receiver power, communication and antenna harnesses
- Antenna matching unit harness to connect receiver co-axial cable to existing DAB antenna in side window.

FFBH Remote Handset



E103416

Item	Part Number	Description
1	-	On button
2	-	Off button
3	-	LED operation indicator
4	-	Antenna

The remote handset allows the driver to remotely activate the FFBH without entering the vehicle. The handset has a range of at least 100 m (328 ft) in free space, although this distance may be decreased depending on the location of obstacles such as buildings. The handset is powered by a 3.3 volt CR1/3N replaceable battery which can be accessed by removing a cover from the rear of the handset. The battery life in the remote handset is approximately 300 FFBH cycles. One cycle is defined as a handset button press followed by 30-minute burn time with flashing LED feedback.

The remote handset has a green Light Emitting Diode (LED) to indicate the FFBH is active. When the 'ON' button is pressed on the handset for more than 2 seconds, the LED will illuminate for 2 seconds. After the 2 second period has passed, the LED will illuminate for 50 ms every 2 seconds for up to the 30 minute on time of the FFBH. The LED will only stop flashing if the 'OFF' button is pressed or the 30 minute on timer has elapsed.

Remote Handset LED Indicator Functionality

The LED illuminates in different ways to alert the driver to the various states of the FFBH remote control system as follows:

- Illuminates green for 2 seconds when the ON button has been pressed to show that the receiver unit has successfully received the handset on request. The FFBH may now start operating providing that fuel level, battery voltage and coolant temperature variables are within limits.
- Flashes green for 50 ms every 2 seconds to indicate that the FFBH may be active.
- Illuminates red for 2 seconds when the OFF button has been pressed to show that the receiver unit has successfully received the handset off request. The FFBH should then stop operating.
- Flashes green or red for 2 seconds when pressing the ON or OFF buttons to indicate that the signal was not received by the FFBH receiver
- Illuminates orange before changing to green or red to show that remote handset battery voltage is low
- Flashes orange for 5 seconds to show that signal was not received by the FFBH and that the remote handset battery requires replacement.

Remote Handset Pairing

Each remote handset must be 'paired' to the receiver to enable communications. Each handset has a unique identification number which is stored by the receiver. The receiver can store up 3 handset identification numbers. If a fourth handset is paired to the receiver, the receiver will replace the first paired handset number with that for the fourth handset in the receiver memory. Subsequently, the first paired handset will no longer be paired and will not be recognised by the receiver.

The following procedure details the pairing process:

- Remove fuse FA5 from the Rear Junction Box (RJB)
- Wait for a minimum of 5 seconds
- Replace fuse to position FA5 in the RJB
- Within 5 seconds of replacing the fuse (and restoring the receiver power supply), press and hold the remote

handset OFF button
- Confirmation of successful pairing is displayed by the remote handset LED illuminating in a red color for 2 seconds.

• NOTE: The pairing process relies on the FFBH receiver having the power supply removed and then the power supply re-instated. The fuse method is the easiest method but it can also be achieved by battery disconnection or removal of the harness connector from the receiver unit.

Receiver

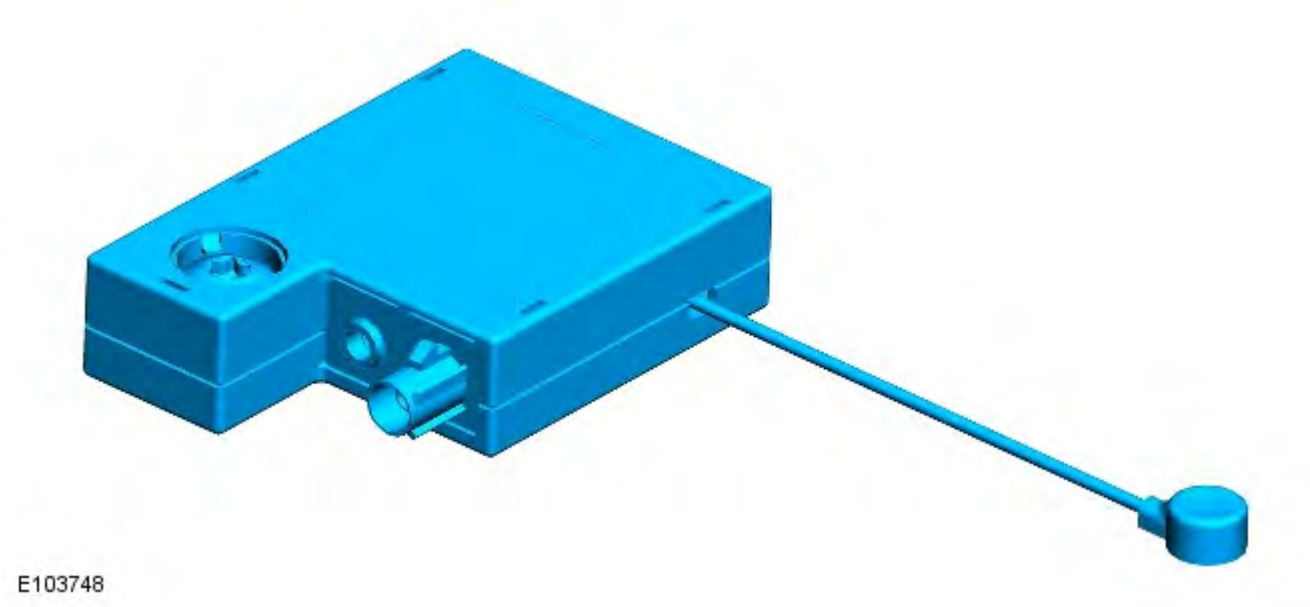
E103417

The receiver is located in the LH side of the luggage compartment. The receiver is mounted on an integral bracket which in turn is attached to the audio system bracket which locates the High Definition (HD) radio receiver.

The receiver is connected to the antenna on the LH side window with a co-axial cable. Radio Frequency (RF) signals from the remote handset are received by the antenna and passed via the antenna matching unit and co-axial cable to the receiver. The receiver processes the signals and transmits appropriate messages to the FFBH on a dedicated bus.

Antenna and Antenna Matching Unit

Antenna Matching Unit


E103748

The FFBH antenna is located in the LH rear side window and uses the same antenna elements as used by the audio Digital

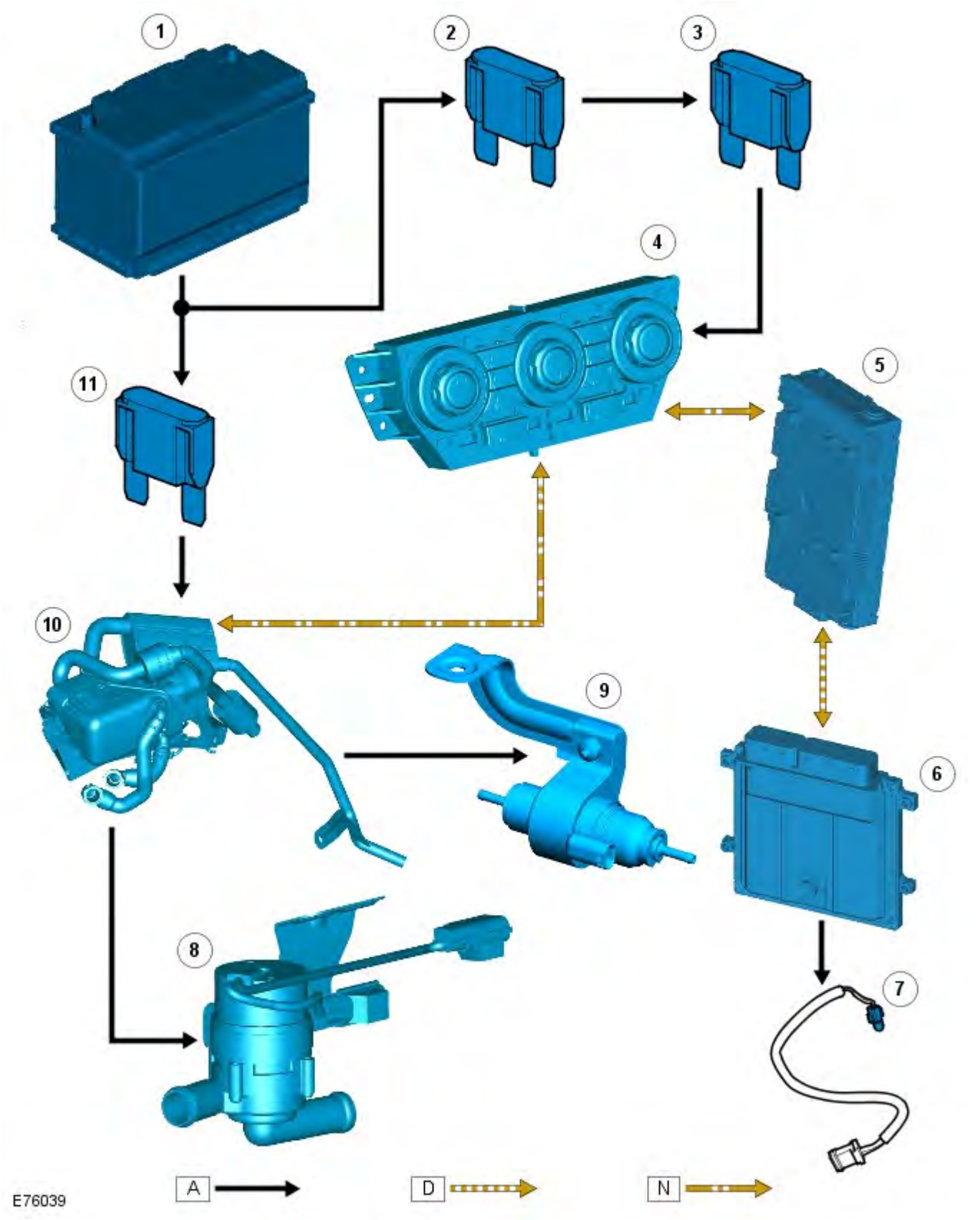
Audio Broadcast (DAB) system.

Situated above the DAB antenna unit, behind the headlining, is an antenna matching unit. A flying lead from this unit connects directly to a stud on the glass antenna. The receiver unit connects to the matching unit via a co-axial cable.

The glass mounted antenna receives RF transmitted signals from the remote handset and transmits them, via the matching unit and co-axial cable, to the FFBH receiver.

CONTROL DIAGRAM - VEHICLES WITHOUT FFBH REMOTE CONTROL

• NOTE: **A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus

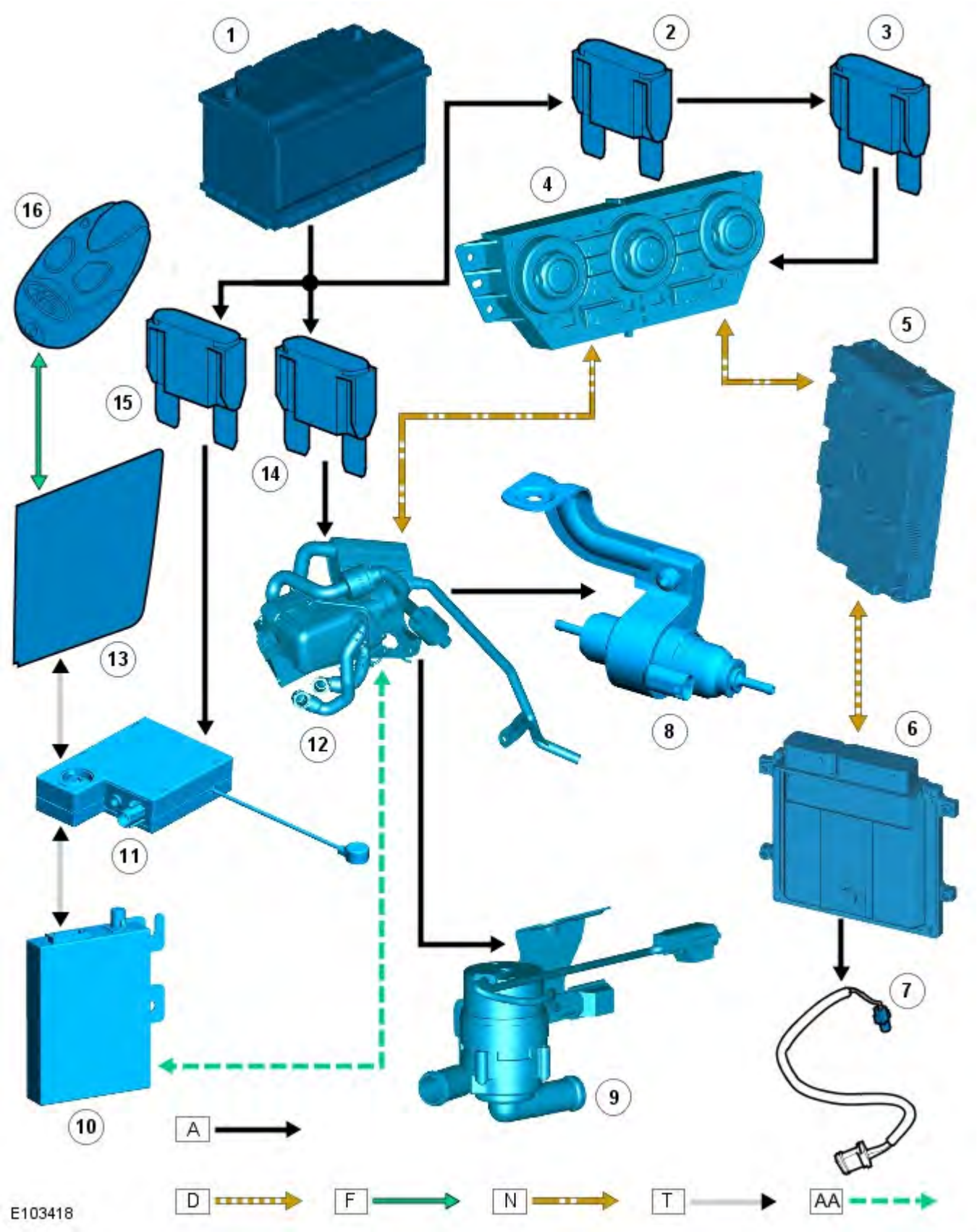


Item	Part Number	Description

1	-	Battery
2	-	Fuse 17, BJB
3	-	Fuse 27, CJB
4	-	ATC module
5	-	CJB
6	-	Engine Control Module (ECM)
7	-	Ambient air temperature sensor
8	-	Auxiliary coolant pump
9	-	Auxiliary fuel pump
10	-	Fuel fired booster heater
11	-	Fuse 32, BJB

CONTROL DIAGRAM - VEHICLES FROM 2009MY WITH FFBH REMOTE CONTROL

• NOTE: **A** = Hardwired; **D** = High speed CAN bus; **F** = RF Transmission; **N** = Medium speed CAN bus; **T** = Co-axial; **AA** = Webasto 'W' bus



Item	Part Number	Description
1	-	Battery
2	-	Fuse 17, BJB
3	-	Fuse 27, CJB
4	-	ATC module
5	-	CJB
6	-	Engine Control Module (ECM)
7	-	Ambient air temperature sensor
8	-	Auxiliary fuel pump
9	-	Auxiliary coolant pump
10	-	FFBH Receiver (Vehicles from 2009MY)
11	-	Antenna matching unit

12	-	Fuel fired booster heater
13	-	FFBH/DAB antenna (Vehicles from 2009MY)
14	-	Fuse 32, BJB
15	-	Fuse FA5, RJB
16	-	FFBH Remote handset (Vehicles from 2009MY)

PRINCIPLES OF OPERATION

If a heating request is received and the ambient air temperature is less than or equal to 5°C (41 °F), the ATC module transmits a 'supplemental heat' message to the FFBH control module over the medium speed CAN bus. The control module responds by returning a 'supplemental heat' status message back to the ATC module. The control module will now initiate the FFBH start sequence.

If the heating request is removed, or ambient air temperature rises to 8°C (46 °F), the ATC module transmits a 'heater off' message to the FFBH control module over the medium speed CAN bus. Again, the control module responds by returning a 'heater off' status message back to the ATC module. The control module will now de-activate the FFBH.

If maximum heating is requested, Engine Coolant Temperature (ECT) becomes the overriding factor. In this instance, the ATC module will change the CAN bus message from 'heater off' to 'supplemental heat' when ECT is below or equal to 70°C (158°F). If ECT rises to 78°C (172°F) the ATC module returns the message to 'heater off'.

The control module will not start the FFBH, or will discontinue operation, if any of the following occur:

- The control module is in the error lockout mode (see **Diagnostics**, below).
- The engine is not running, or stops running for approximately 4 seconds. The time delay is included for stall detection.
- A 'fuel cut-off' message is received from the CJB over the medium speed CAN bus.
  For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).
- A low fuel level message is received from the CJB over the medium speed CAN bus (see table below).
  For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

The control module will control FFBH operation based on the following levels of fuel in the tank.

Fuel Level, liters (US Gallons)	Description
7.5 (1.98)	Start
4.5 (1.18)	Stop
10.5 (2.77)	Restart

Start Sequence

At the beginning of a start sequence, the FFBH control module;

- energizes the glow pin and flame sensor to pre heat the combustion chamber
- starts the combustion air fan at slow speed
- and energizes the auxiliary coolant pump.

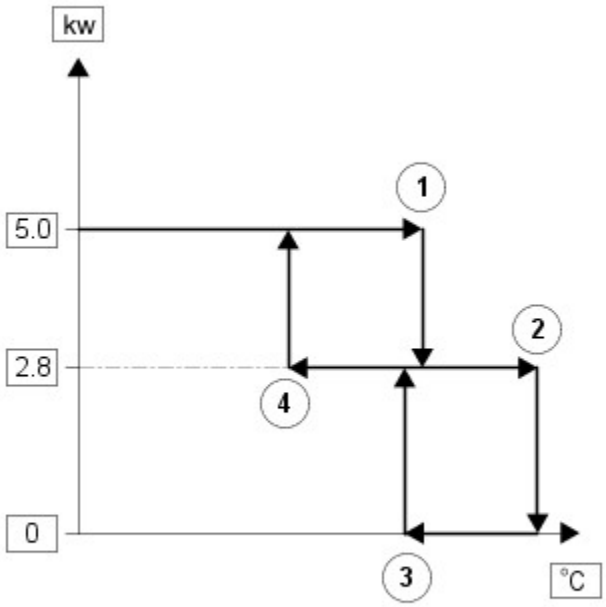
After approximately 30 seconds, the control module energizes the auxiliary fuel pump at the starting sequence speed. The fuel delivered by the auxiliary fuel pump evaporates in the combustion chamber, mixes with air from the combustion air fan and is ignited by the glow pin and flame sensor. The control module then progressively increases the speed of the auxiliary fuel pump and the combustion air fan. Once combustion is established the control module switches the glow pin and flame sensor to the flame sensing function to monitor combustion. From the beginning of the start sequence to stable combustion at full load takes approximately 150 seconds.

Full and Part Load Combustion

While the FFBH is running, the control module cycles the heater between full load combustion, part load combustion and a control idle phase of operation, depending on the temperature of the coolant in the heat exchanger.

The heat output level at part load combustion is 2.8 kW. This rises to 5 kW at full load combustion. The control module transmits the amount of fuel used by the FFBH to the instrument cluster, and the FFBH coolant temperature to the ATC module.

Switching Point Temperatures



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Switching Point		Temperature, ºC (ºF)
Item Number	Description	
1	Full load to part load	79ºC (174ºF)
2	Part load to control idle	90ºC (194ºF)
3	Control idle to part load	74ºC (165ºF)
4	Part load to full load	69ºC (156ºF)

After the start sequence, the control module maintains full load combustion until the coolant temperature reaches switching point temperature 1. At this temperature, the control module decreases the speed of the auxiliary fuel pump and the combustion air fan to half speed, to produce part load combustion. The control module maintains part load combustion while the coolant temperature remains between switching point temperatures 2 and 4. At part load combustion the temperature of the coolant will increase or decrease depending on the amount of heat required to heat the vehicle interior. If the coolant temperature decreases to switching point temperature 4, the control module increases the speed of the auxiliary fuel pump and the combustion air fan to full speed, to return to full load combustion. If the coolant temperature increases to switching point temperature 2, the control module enters a control idle phase of operation.

On entering the control idle phase, the control module immediately switches the auxiliary fuel pump off, to stop combustion, and starts a timer for the combustion air fan. After a 2 minute cool down period, the control module switches the combustion air fan off and then remains in the control idle phase while the coolant temperature remains above switching point temperature 3. If the coolant temperature decreases to switching point temperature 3, the control module initiates a start to part load combustion. A start to part load combustion takes approximately 90 seconds.

In order to limit the build up of carbon deposits on the glow pin and flame sensor, the control module also enters the control idle phase if continuous combustion time exceeds 72 minutes (at part load, full load or a combination of both). After the cool down period, if the coolant is still in the temperature range that requires additional heat, the control module restarts the fuel fired booster heater.

Shutdown

To stop the FFBH, the control module de-energizes the auxiliary fuel pump to stop combustion, but continues operation of the combustion air fan and the auxiliary coolant pump for a time, to cool down the FFBH. The cool down time is 100 seconds if the FFBH was operating at part load combustion and 175 seconds if the FFBH was operating at full load combustion.

Diagnostics

The control module monitors the fuel fired booster heater system for faults. Diagnostic Trouble Code's (DTC)'s are stored in a volatile memory in the control module, which can be interrogated by the Land Rover approved diagnostic system via the medium speed CAN bus.

The control module also incorporates an error lockout mode of operation that inhibits operation to prevent serious faults from causing further damage to the system. In the error lockout mode, the control module immediately stops the auxiliary fuel pump, and stops the combustion air fan and auxiliary coolant pump after a cool down time of approximately 2 minutes. Error lockout occurs for:

- **Start failure and flameout:** If a start sequence fails to establish combustion, or a flameout occurs after combustion is established, the control module immediately initiates another start sequence. The start failure or flameout is also recorded by an event timer in the control module. The event timer is increased by one after each

start failure or flameout, and decreased by one if a subsequent start is successful. If the event timer increases to three (over any number of drive cycles), the control module enters the error lockout mode.
- **Heat exchanger casing overheat:** To protect the system from excessive temperatures, the control module enters the error lockout mode if the heat exchanger coolant temperature exceeds 125 °C (257 °F).
- **Battery voltage out of limits:** Error lockout will occur if battery voltage falls below 10.25 or rises above 15.5 volts.

The error lockout mode can be cleared using the Land Rover approved diagnostic system, or by disconnecting the battery power supply for a minimum of 10 seconds.

Remote Operation - Vehicles from 2009MY with FFBH Remote Control

The 868.3 MHz Radio Frequency (RF) signals transmitted by the remote handset are received by the DAB/FFBH antenna located in the LH rear side window. The signals received by the antenna are detected by the FFBH receiver. A 'handshake' signal is sent back from the receiver to the handset to confirm a valid on or off request and activate the handset LED accordingly. The receiver processes the signal it received and transmits the appropriate signals via a dedicated bus to the FFBH control module.

• NOTE: The 'handshake' signal only confirms handset-receiver communications were successful, and not that the FFBH has turned on.

When the FFBH is activated by the remote handset, the FFBH control module will allow the FFBH to operate for 30 minutes or until an off request is received from the remote handset or CJB. During the 30 minute period, the FFBH may operate in either full load combustion, part load combustion or a controlled idle phase of operation, depending on the temperature of the coolant in the heat exchanger.

Pre-burn Thresholds

The FFBH unit will only activate remotely if the following threshold conditions are met:

- Pre-burn battery voltage check: ≥11.5V (voltage at FFBH terminals)
- Pre-burn coolant temperature check: ≤15°C (internal FFBH measurement)
- Pre-burn fuel level check: ≥7.5 liters (value stored in FFBH at ignition off)

The fuel level value stored within the FFBH unit is only updated when the engine is running. When starting the FFBH via remote control with the engine off, the fuel level value used in the FFBH calculations will be that stored at the last key off event. It is therefore possible for the FFBH to fail to operate remotely if the engine was stopped with a low fuel level; if the fuel tank is subsequently refuelled, the FFBH stored fuel level will still read low if the engine has not been started since refuelling.

If the FFBH does not activate due to low battery voltage or low fuel level, the FFBH control module transmits a message is passed on the medium and high speed CAN buses, via the CJB to the instrument cluster message center which will display one of the following messages at ignition on:

- AUXILIARY HEATER UNAVAILABLE LOW FUEL
- AUXILIARY HEATER UNAVAILABLE LOW BATTERY.

If both low fuel and low battery voltage messages are valid, the instrument cluster message center will alternate between the two messages.

Remote Control 'Park Heat' to ATC 'Supplementary Heat' Transitions

• NOTE: The FFBH can still be activated by the ATC module as previously described

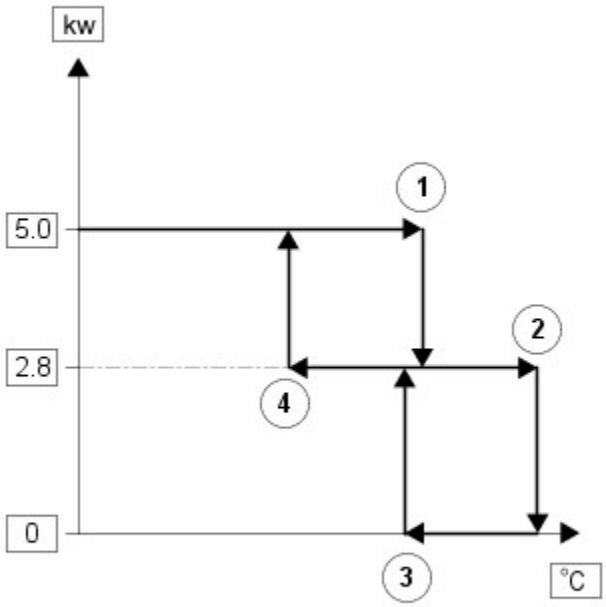
If the FFBH has been operated remotely ('park heat') and the vehicle is started whilst the FFBH is still active, it will transition into the ATC-controlled 'supplementary heat' mode if the ATC requests it.

Should the ATC then send a message to the FFBH to turn off, the FFBH will remain active if 30 minutes has not yet elapsed from the original remote control 'park heat' request. Once the remainder of 30 minutes has elapsed, the FFBH will turn off.

Switching Point Temperatures

When remotely started the FFBH uses a different set of switching point temperatures to the normal 'supplemental heat' mode. This is because the remote start feature can start the FFBH with the engine off – thus different thresholds are required to optimise the heating of the engine coolant.

Switching Point Temperatures



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Switching Point		Temperature, ºC (ºF)
Item Number	Description	
1	Full load to part load	80ºC (176ºF)
2	Part load to control idle	90ºC (194ºF)
3	Control idle to part load	50ºC (122ºF)
4	Part load to full load	70ºC (158ºF)

Published: 11-May-2011

Auxiliary Climate Control - Electric Booster Heater

Removal and Installation

Removal

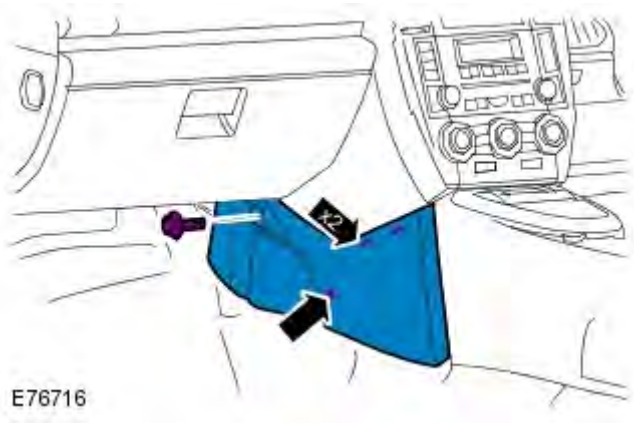
• NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

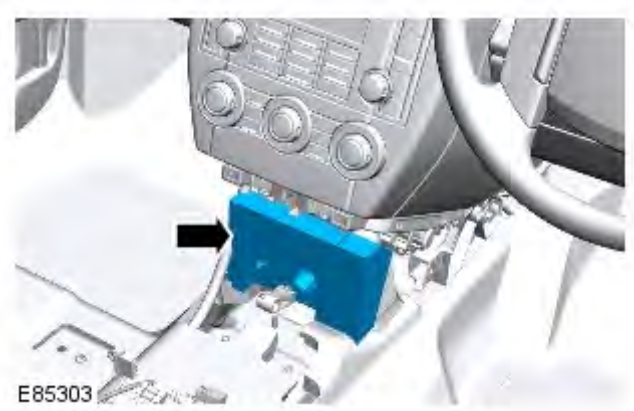
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the selector lever.

   Refer to: Selector Lever Assembly (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).
   Refer to: Gearshift Lever (308-06 Manual Transmission/Transaxle External Controls, Removal and Installation).



3. Remove both floor console extensions.



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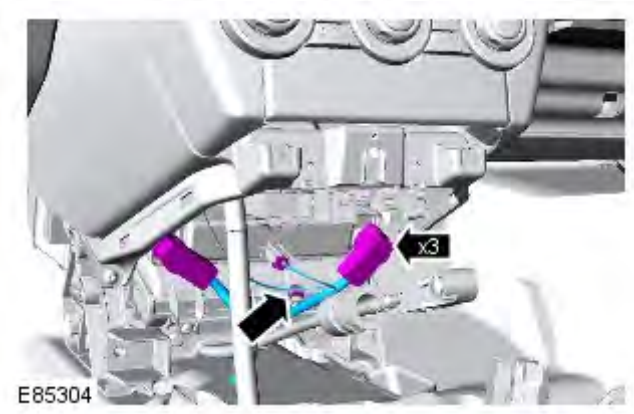

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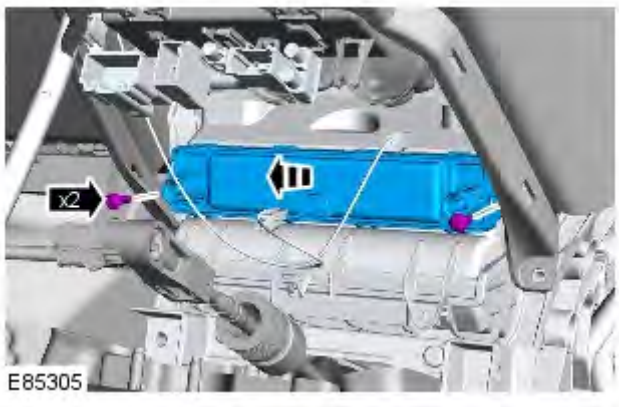
6.



7. *Torque:* 2 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Auxiliary Climate Control - Fuel Fired Booster Heater

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

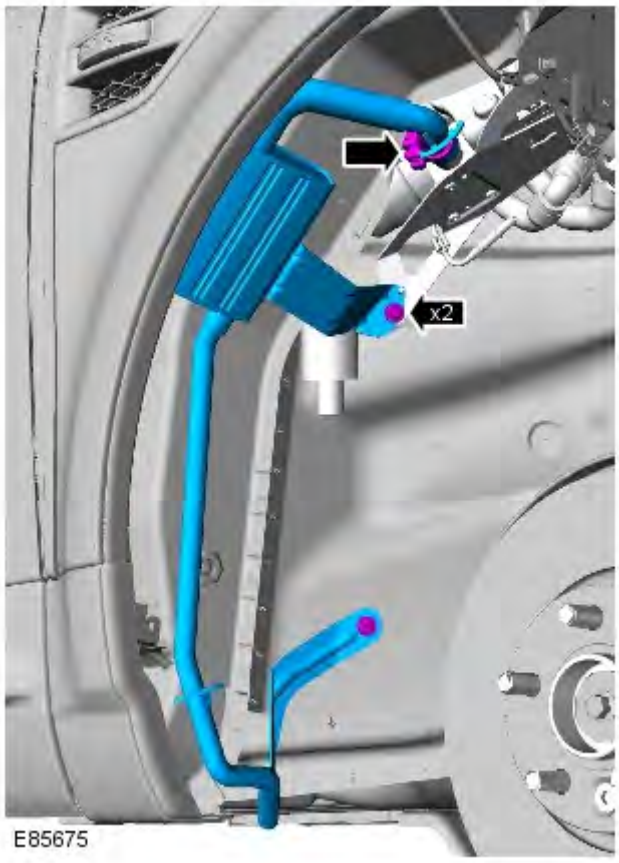
   Raise and support the vehicle.

3. Drain the coolant.

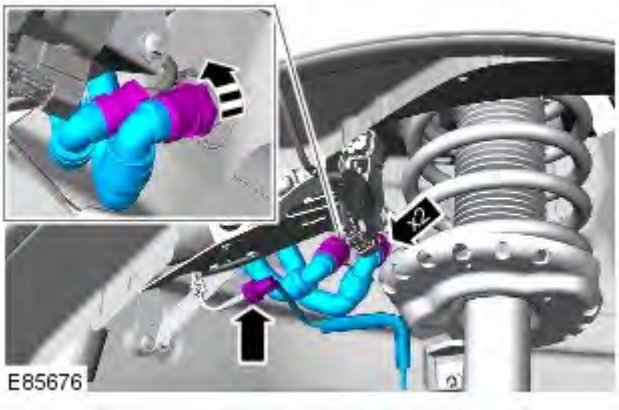
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - TD4 2.2L Diesel, General Procedures).

4. Remove the RH fender splash shield.

   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).



5. *Torque:* 10 Nm

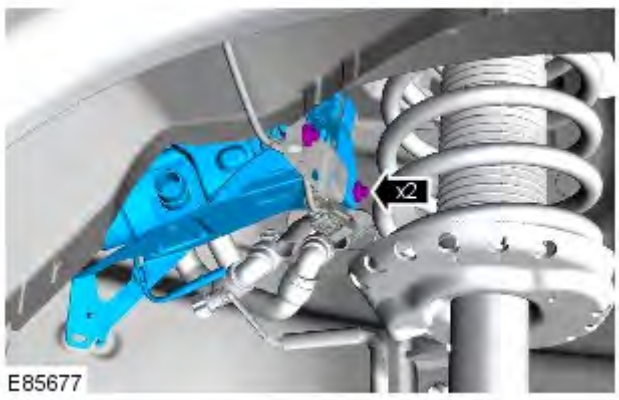


6. **6.** CAUTIONS:

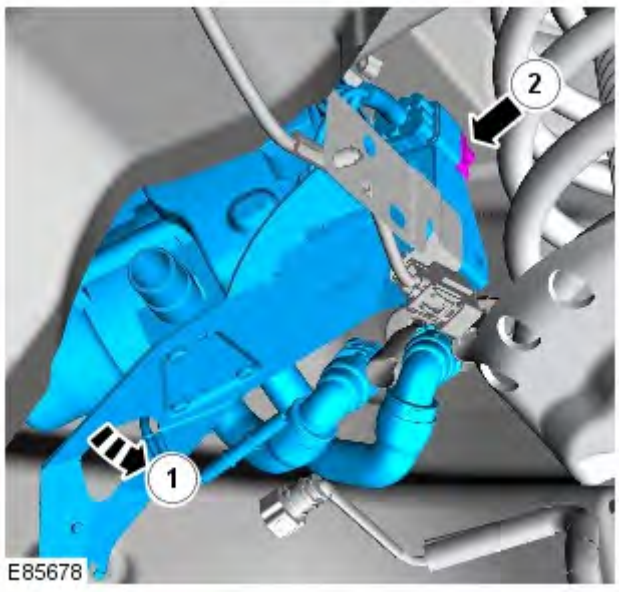
   Be prepared to collect escaping fluids.

   Make sure that all openings are sealed. Use new blanking caps.

   - Position a container to collect spillage.
   - Disconnect the 2 coolant hoses.
   - Disconnect the fuel line.



7. *Torque:* 10 Nm



8. Remove the fuel fired booster heater.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Auxiliary Climate Control - Fuel Fired Booster Heater Fuel Pump

Removal and Installation

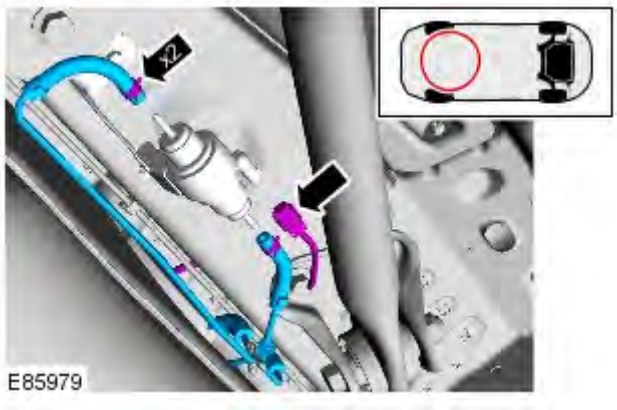
Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

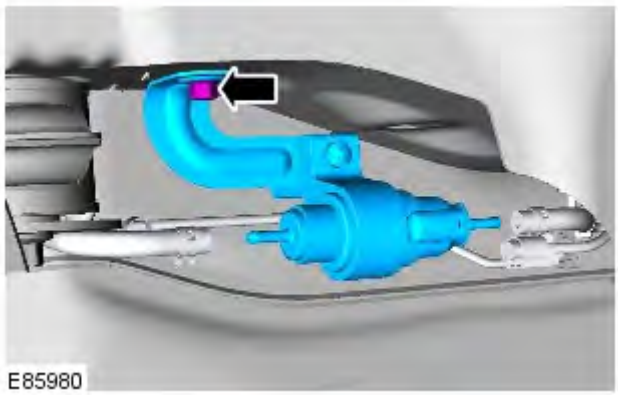
2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

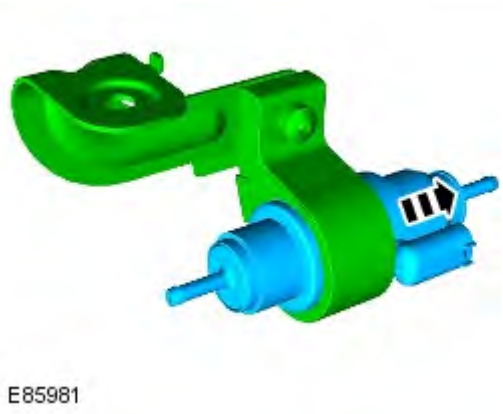


3. **3.** WARNING: Be prepared to collect escaping fuel.

   CAUTION: Make sure that all openings are sealed. Use new blanking caps.



4. *Torque:* 10 Nm



5. **5.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

Published: 11-May-2011

Auxiliary Climate Control - Fuel Fired Booster Heater Coolant Pump

Removal and Installation

Removal

1. Disconnect the battery ground cable.

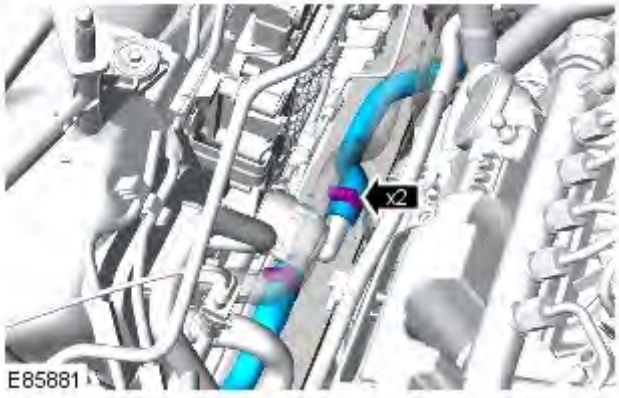
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

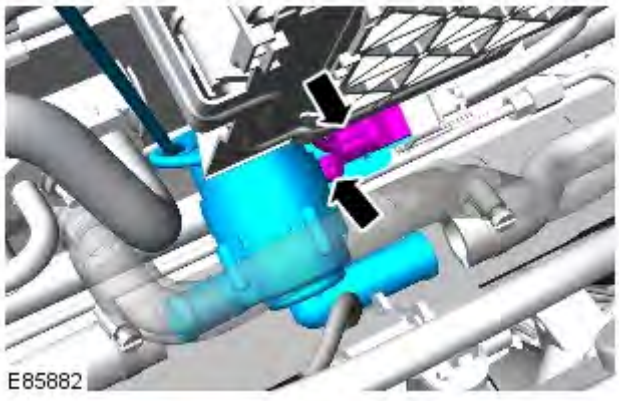
   Raise and support the vehicle.

3. Remove the secondary bulkhead center panel.

   Refer to: Secondary Bulkhead Center Panel - TD4 2.2L Diesel (501-02 Front End Body Panels, Removal and Installation).



4. **4.** CAUTION: Be prepared to collect escaping coolant.
   - Clamp the hoses to minimize coolant loss.
   - Disconnect the coolant hoses from the fuel fired booster heater coolant pump.



5. Remove the fuel fired booster heater coolant pump.

Installation

1. Install the fuel fired booster heater coolant pump.
2. Connect the coolant hoses to the fuel fired booster heater coolant pump.
3. Install the secondary bulkhead center panel.
4. Connect the battery ground cable.
5. Check and top up the coolant.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Auxiliary Climate Control - Fuel Fired Booster Heater Glow Plug And Burner Assembly

Removal and Installation

Removal

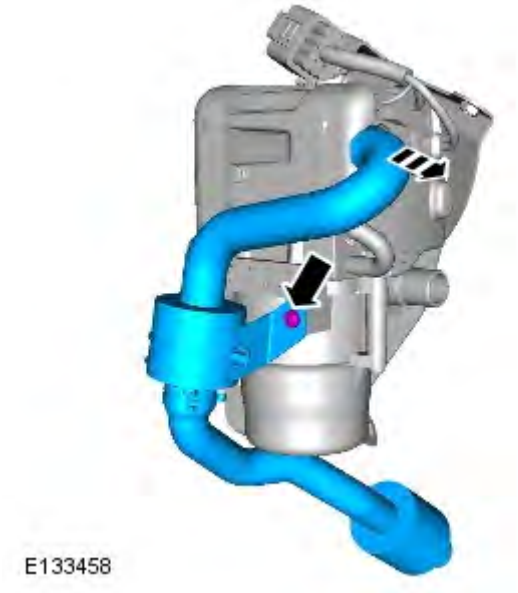
• NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

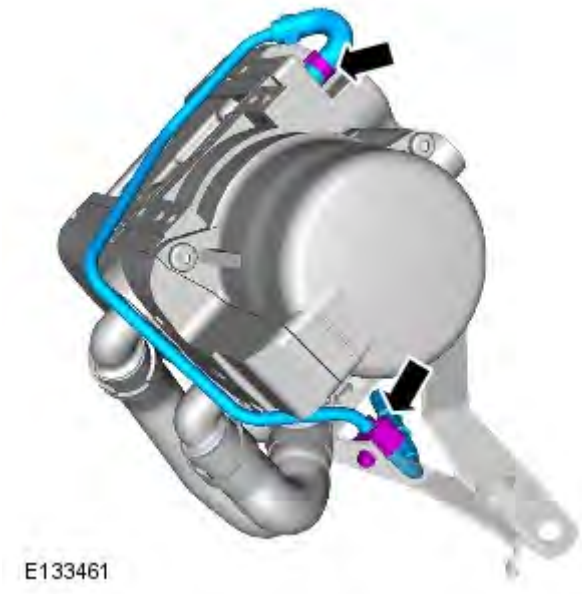
2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation).



4. *Torque:* 10 Nm



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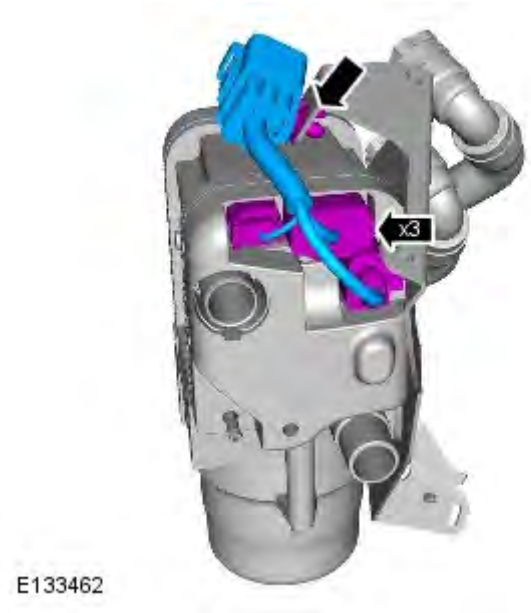
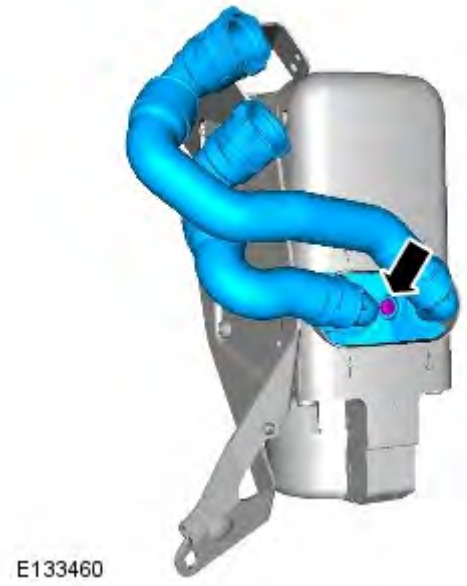


E133462

7. *Torque:* 7.5 Nm


E133460

8. *Torque:* 10 Nm

E133459

9.

E131524

10.

E131525

11.

E131526

12.

13. **13.** NOTE: Remove and discard the gasket.

    Torque: 7 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Instrument Cluster - Instrument Cluster

Description and Operation

COMPONENT LOCATION - UK

Item	Part Number	Description
1	-	Tachometer
2	-	Engine temperature gage
3	-	Fuel level gage
4	-	Speedometer
5	-	Message center - high line instrument cluster only
6	-	Warning indicator lamp display - low line instrument cluster only

• NOTE: The 'Rest of World' instrument cluster is the same as the UK instrument cluster but does not have a miles per hour (mph) scale on the speedometer.

COMPONENT LOCATION - NORTH AMERICA

Item	Part Number	Description
1	-	Tachometer
2	-	Engine temperature gage
3	-	Fuel level gage
4	-	Speedometer
5	-	Message center - high line instrument cluster only
6	-	Warning indicator lamp display - low line instrument cluster only

OVERVIEW

The instrument cluster is located in the instrument panel, above the steering column. The instrument cluster comprises analogue gages and a number of warning indicator lamps to display system status. High line instrument clusters also feature a Liquid Crystal Display (LCD) message center to provide vehicle operation details to the driver. The message center is located in a central position in the high line instrument cluster.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).
Low line instrument clusters feature warning indicator lamps in place of the message center.

ANALOGUE GAGES

Tachometer

The tachometer is located on the Left Hand (LH) side of the instrument cluster and displays engine speeds of up to 8000 Revolutions Per Minute (RPM) on petrol variants, and 6000 RPM on diesel variants. The tachometer is driven by an engine speed signal, which originates from the Crankshaft Position (CKP) sensor. This signal is transmitted over the high speed Controller Area Network (CAN) bus by the Engine Control Module (ECM). The Central Junction Box (CJB) acts as a gateway

and transmits the engine speed signal to the instrument cluster on the medium speed CAN bus. The signal is received by the instrument cluster microprocessor and the output from the microprocessor drives the tachometer.

Engine Temperature Gage

The engine temperature gage is located in the center of the instrument cluster and is driven by medium speed CAN bus messages from the CJB. The CJB receives an Engine Coolant Temperature (ECT) signal from the ECM over the high speed CAN bus when the vehicle enters power mode 6 (ignition on). The needle pointer position translates to the following approximate temperatures.

Engine Coolant Temperature °C (°F)		Pointer Position
Petrol	Diesel	
Ignition off	Ignition off	Park
40 (104)	40 (104)	Cold (blue segment)
75 (167)	75 (167)	Beginning of normal
119 (246)	113 (235)	End of normal
125 (257)	118 (244)	Beginning of hot (red segment)
130 (266)	123 (253)	End of hot

If the ECT signal rises above 118 °C (244 °F) on diesel vehicles, or 127 °C (260 °F) on petrol vehicles, the instrument cluster will illuminate the high ECT warning indicator. If the instrument cluster fails to receive an ECT signal from the CJB, the engine coolant temperature gage will move to the 'end of hot' position and the warning indicator will be illuminated.

Fuel Level Gage

The fuel level gage is located in the center of the instrument cluster and displays fuel tank contents when the vehicle is in power mode 6. When the ignition is switched off, the pointer returns to the park position.

Two Magnetic Passive Position Sensors (MAPPS) are located in the saddle type fuel tank, one on either side. The resistance values for both sensors are measured by the CJB through a series of hardwired connections. The CJB converts both values to medium speed CAN messages for delivery to the instrument cluster. The instrument cluster uses the 2 CAN bus messages to calculate the total amount of fuel in both halves of the tank. The instrument cluster will also damp the total fuel value to eliminate constant pointer movement due to fuel moving in the tank.

The following table shows the approximate fuel tank level and the respective needle pointer position.

Fuel Quantity Liters (US gallons)		Pointer Position
Petrol	Diesel	
0 (0)	0 (0)	Mechanical zero
1 (0.2)	2.5 (0.6)	Below empty
2.8 (0.7)	3.8 (1)	Indicated empty
11.9 (3.1)	10.3 (2.7)	Low fuel level indicator illuminated
13.9 (3.7)	12.3 (3.2)	Low fuel level indicator extinguished
16.9 (4.5)	16.7 (4.4)	Quarter full
33.8 (8.9)	33.4 (8.8)	Half full
50.8 (13.4)	50 (13.2)	Three quarters full
66.9 (17.7)	68 (18)	Indicated full
70.5 (18.6)	70.5 (18.6)	Over full

If the instrument cluster fails to receive the fuel level signals from the CJB the fuel level gage will move to the empty position and the low fuel level indicator will be illuminated.

Speedometer

The speedometer is located on the Right Hand (RH) side of the cluster and is available in 3 variants:

- Major scale mph, minor scale kilometers per hour (kph)
- Major scale kph, minor scale mph
- Major scale kph only.

The speedometer is driven by medium speed CAN bus signals transmitted by the CJB. The vehicle speed signal is provided to the CJB by the Anti-lock Brake System (ABS) module over the high speed CAN bus and is an average of all 4 wheel speed sensor signals.

The speedometer also incorporates the odometer.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

WARNING INDICATORS

E83977

Item	Part Number	Description
1	-	Ignition/No charge indicator
2	-	Low oil pressure warning indicator
3	-	Malfunction Indicator Lamp (MIL) (petrol vehicles only)
4	-	Safety belt warning indicator
5	-	Supplemental Restraint System (SRS) warning indicator
6	-	Left Hand (LH) turn signal indicator
7	-	Brake warning indicator (low fluid/Emergency Brake Assist (EBA)/Electronic Brake force Distribution (EBD))
8	-	High Engine Coolant Temperature (ECT) warning indicator
9	-	Headlamp high beam indicator
10	-	Tire Pressure Monitoring System (TPMS) indicator
11	-	Anti-lock Brake System (ABS) warning indicator
12	-	Low fuel indicator
13	-	Right Hand (RH) turn signal indicator
14	-	Parking brake indicator - not used
15	-	Parking brake indicator
16	-	Rear fog lamp indicator
17	-	Front fog lamp indicator
18	-	Adaptive Front lighting System (AFS) indicator
19	-	Speed control indicator
20	-	Trailer indicator
21	-	Low washer fluid indicator (low line only)
22	-	Low engine coolant level warning indicator (low line only)

23	-	Transmission warning indicator (low line only)
24	-	Hill Descent Control (HDC) fault indicator (low line only)
25	-	Door open indicator (low line only)
26	-	Engine management system warning indicator (low line only)
27	-	Side lamp indicator
28	-	Dynamic Stability Control (DSC) indicator
29	-	HDC active indicator
30	-	Anti-theft alarm indicator
31	-	Glow plug indicator (diesel vehicles only)
32	-	Fuel fired booster heater indicator (if fitted)

The low line instrument cluster contains 39 indicators, the high line instrument cluster 27. The indicators in high line instrument clusters are supplemented by messages in the message center.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

The warning indicators can be split into 2 groups; self controlled and externally controlled. Self controlled warning indicators are dependent on software logic within the instrument cluster for activation. Externally controlled indicators are supplied with current from another system controlling module or illuminated by the instrument cluster on receipt of a medium speed CAN bus message from the CJB.

Ignition/No Charge Indicator

The ignition/no charge indicator is controlled by the instrument cluster software and illuminated by medium speed CAN bus signals from the ECM via the CJB. The indicator illuminates in a red color when the vehicle enters power mode 6 and is extinguished when the engine is started.

If the indicator remains illuminated after the engine has started or illuminates when driving, the alternator charge output has failed.

Low Oil Pressure Warning Indicator

The low oil pressure warning indicator is illuminated by the instrument cluster on receipt of a medium speed CAN bus signal from the CJB. The signal originates in the ECM and is generated by the engine oil level sensor on petrol vehicles and the engine oil pressure sensor on diesel vehicles.

The indicator illuminates in a red color when the vehicle enters power mode 6 for a 3 second bulb check. If the bulb subsequently illuminates when the engine is running, the engine should be stopped immediately it is safe to do so.

Malfunction Indicator Lamp

The Malfunction Indicator Lamp (MIL) is illuminated by the instrument cluster on receipt of a medium speed CAN bus signal from the CJB. The signal originates in the ECM and is generated if an On-Board Diagnostic (OBD) fault has been detected which will cause excessive emissions output. This may relate to either an engine management or transmission fault.

The MIL is illuminated in an amber color when the vehicle enters power mode 6 for a 3 second bulb check. The bulb check in this instance is carried out by the ECM via the CJB, not the instrument cluster. If the MIL subsequently illuminates the vehicle should be interrogated using the Land Rover approved diagnostic system at the earliest opportunity.

Safety Belt Warning Indicator

The safety belt warning indicator will illuminate in a red color on receipt of a medium speed CAN bus signal from the CJB. The signal originates in the Restraints Control Module (RCM), which monitors the status of the occupant classification system and switches located in the safety belt buckles.

Three variations of warning are available depending on vehicle configuration:

- Reminder (all vehicles except North American Specification (NAS) vehicles)
- Federal Motor Vehicle Safety Standard (FMVSS) 208 reminder (NAS vehicles only)
- Belt Minder

The conditions for safety belt warning indicator illumination are as follows:

Reminder

- Vehicle in power mode 6
- Drivers safety belt not secured in its buckle
- Large passenger detected in front passenger seat with an unsecured safety belt.

The warning indicator will remain illuminated until either the ignition is switched off or conditions 2 and 3 no longer exist.

FMVSS-208 Reminder

- Vehicle in power mode 6
- Drivers safety belt not secured in its buckle.

The warning indicator will remain illuminated for 65 seconds and will be accompanied by a single 6 second chime from the instrument cluster sounder.

• NOTE: The warning indicator and chime will not activate if these conditions arise 75 seconds after the vehicle has entered power mode 6.

The warning indicator will be extinguished and the sounder cancelled if the ignition is switched off or the driver's safety belt is secured in its buckle.

Belt Minder

- Vehicle in power mode 6 (all vehicles except NAS vehicles)
- Vehicle in power mode 6 for 75 seconds (NAS vehicles only)
- Vehicle speed is greater than 6 mph (10 kph)
- Drivers safety belt not secured in its buckle
- Large passenger detected in front passenger seat with an unsecured safety belt.

The warning indicator will flash at a frequency of 2 Hz while accompanied by a chime from the instrument cluster for 10 seconds. This is followed by a 10 second period where the warning indicator is permanently illuminated and the sounder is silent. This 10 second cycle will be repeated for a maximum of 190 seconds or any of the conditions listed above cease to exist.

Supplemental Restraint System Warning Indicator

The Supplemental Restraint System (SRS) warning indicator is illuminated on receipt of a medium speed CAN bus signal from the CJB. The signal originates in the RCM which monitors the condition of the SRS and illuminates the red warning indicator accordingly.

The SRS warning indicator is illuminated by the RCM for a 6 second bulb check when the vehicle first enters power mode 6. If a fault is detected with the indicator, the instrument cluster returns a medium speed CAN bus signal via the CJB to the RCM and a Diagnostic Trouble Code (DTC) is stored in the RCM's memory. The message 'SrS' will also be displayed in the odometer.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

Left and Right Hand Turn Signal Indicators

The green left and right hand turn signal indicators are illuminated on receipt of medium speed CAN bus signals from the CJB. The CJB provides a CAN bus signal with one of the following values:

- 0 - LH steering column multi-function switch in the central position
- 1 - LH steering column multi-function switch in the LH turn position
- 2 - LH steering column multi-function switch in the RH turn position
- 3 - Hazard flashers requested.

If the vehicle is in power mode 6 the instrument cluster will flash the appropriate turn signal indicator if a medium speed CAN bus signal is received with a value of 1 or 2. Medium speed CAN bus signals with a value of 3 will activate both the LH and RH turn signal indicators simultaneously irrespective of power mode.

When activated, the left and right hand turn signal indicators will be accompanied by 'tick tock' chimes from the instrument cluster sounder.

Brake Warning Indicator

EBA and EBD warnings are transmitted to the CJB from the ABS module over the high speed CAN bus. These signals are relayed to the instrument cluster on the medium speed CAN bus and will activate the brake warning indicator when the vehicle is in power mode 6. If an EBA warning is requested, the indicator will illuminate in an amber color. If an EBD warning is requested, the indicator will illuminate in a red color.

Low brake fluid level warnings are also transmitted to the instrument cluster from the CJB on the medium speed CAN bus. The signal originates in the ABS module which receives a hardwired input from the brake fluid level sensor. If a low brake fluid warning is requested, the indicator will illuminate in a red color when the vehicle is in power mode 6.

The brake warning indicator is also subject to a 3 second bulb check when the vehicle first enters power mode 6. The indicator will illuminate in a amber color for 1.5 seconds then a red color for 1.5 seconds.

High Engine Coolant Temperature Warning Indicator

The red high Engine Coolant Temperature (ECT) warning indicator is controlled by the engine temperature gage software (see above).

Headlamp High Beam Indicator

The blue headlamp high beam indicator is illuminated on receipt of a medium speed CAN bus signal from the CJB. The signal originates in the light switch module and is transmitted to the CJB over the LIN bus. The instrument cluster will only illuminate the headlamp high beam indicator when the vehicle is in power mode 6 and the LH steering column multi-function switch is moved to the high beam position.

Tire Pressure Monitoring System Indicator

The Tire Pressure Monitoring System (TPMS) indicator is controlled by the instrument cluster on receipt of medium speed CAN bus signals from the CJB. The signal originates in the TPMS module. The indicator is illuminated in an amber color for a 3 second bulb check by the TPMS module when the vehicle enters power mode 6. If the indicator remains illuminated or flashes after the engine is started or when driving, the TPMS has developed a fault. The tire pressures should be monitored manually until the fault is rectified.
For additional information, refer to: Wheels and Tires (204-04 Wheels and Tires, Description and Operation).

Anti-lock Brake System Warning Indicator

The Anti-lock Brake System (ABS) warning indicator is controlled by the ABS module which transmits a high speed CAN bus message to the CJB. The CJB relays the message to the instrument cluster over the medium speed CAN bus. The warning indicator is illuminated in an amber color for 3 seconds for a bulb check by the ABS module when the vehicle enters power mode 6. If the warning indicator remains illuminated or illuminates when driving, an ABS fault has occurred and the ABS function will not be available.

During the bulb check, if the warning indicator comes on for 0.5 second, then goes off for 0.5 second and is then

illuminated for the remaining 2 seconds of the bulb check, this indicates that faults are stored in the ABS module memory.

If the warning indicator was illuminated due to a wheel speed sensor fault, the indicator will remain illuminated at the next ignition cycle, even if the fault is rectified. When the vehicle is driven above a speed of 20 km/h (12.5 mph) the indicator will be extinguished. This allows the ABS module to perform a thorough check of the system and to establish that the output from the replaced sensor is correct.

Low Fuel Level Indicator

The low fuel level indicator is controlled by the fuel level gage software (see above). When the vehicle enters power mode 6, the low fuel indicator is illuminated in an amber color for a 3 second bulb check. If the fuel level gage software determines the low fuel indicator should be illuminated, it flashes the indicator at a rate of 2 Hz for 5 seconds. The first flash is accompanied by a chime from the instrument cluster sounder. After the 5 second flashing period the indicator will remain illuminated until fuel is added to the tank or the vehicle ignition is switched off.

Parking Brake Indicator

The red parking brake indicator is illuminated on receipt of a medium speed CAN bus signal from the CJB. The signal originates in the parking brake microswitch, which is hardwired to the CJB. The parking brake indicator will only illuminate if the parking brake is applied and the vehicle is in power mode 6.

Rear Fog Lamp Indicator

The rear fog lamp indicator is illuminated on receipt of a medium speed CAN bus signal from the CJB. The indicator is illuminated in an amber color if the vehicle is in power mode 6 and rear fog lamp operation has been requested.

Front Fog Lamp Indicator

The front fog lamp indicator is illuminated on receipt of a medium speed CAN bus signal from the CJB. The indicator is illuminated in a green color if the vehicle is in power mode 6 and front fog lamp operation has been requested.

Adaptive Front Lighting System Indicator

The Adaptive Front lighting System (AFS) indicator is controlled by the AFS module. The AFS module is hardwired to the CJB, which relays signals to the instrument cluster over the medium speed CAN bus. When the vehicle enters power mode 6, the AFS indicator is illuminated in an amber color for a 3 second bulb check. If during AFS operation a fault is detected, the AFS indicator will flash at a frequency of 2 Hz.

Speed Control Indicator

The speed control indicator is controlled by the ECM, which transmits a speed control active signal to the instrument cluster via the CJB. The indicator will illuminate in an amber color when the vehicle is in power mode 6 and speed control is active.

Trailer Indicator

The trailer indicator is controlled by the instrument cluster on receipt of medium speed CAN bus signals from the CJB. When a trailer is connected to the vehicle electrical system and the turn signal indicator switch is operated, the CJB transmits a signal to the instrument cluster to operate the trailer indicator. The instrument cluster software controls the flash rate of the indicator which flashes in a green color. The trailer indicator flashes slowly, at the same rate as the turn signal indicators.

Low Washer Fluid Indicator

The low washer fluid indicator is illuminated on receipt of a medium speed CAN bus signal from the CJB. The signal originates in the low washer fluid level switch, which is hardwired to the CJB.

The amber low washer fluid indicator is subject to a 3 second bulb check when the vehicle enters power mode 6. If a low washer fluid level is detected for more than 15 seconds when the vehicle is in power mode 6, the instrument cluster will illuminate the indicator.

Low Engine Coolant Level Warning Indicator

The low engine coolant level warning indicator is illuminated on receipt of a medium speed CAN bus signal from the CJB when the vehicle is in power mode 6. The signal originates in the ECM, which transmits the signal to the CJB over the high speed CAN bus.

When the vehicle enters power mode 6, the amber low engine coolant level warning indicator is illuminated for a 3 second bulb check. If the warning indicator remains illuminated after this period, the engine cooling system should be checked for leaks and topped up as necessary.

Transmission Warning Indicator

The transmission warning indicator displays automatic transmission and active-on demand coupling warnings. The warning indicator is illuminated on receipt of medium speed CAN bus signals from the CJB. The signals originate in the Transmission Control Module (TCM) and the active-on demand coupling control module respectively and are transmitted to the CJB over the high speed CAN bus.

The transmission warning indicator is a dual color indicator, which is subject to a 3 second bulb check when the vehicle enters power mode 6. For the first 1.5 seconds of the bulb check the indicator illuminates in an amber color, followed by 1.5 seconds illuminated in a red color.

The table below details warning indicator color against message center message.

Message Center Message	Warning Indicator Color	
	Automatic Transmission Related Warning	Active On-demand Coupling Related Warning
TRANSMISSION FAULT	Amber	Red
TRANSMISSION FAULT AND OVERHEAT	Red	n/a
TRANSMISSION FAULT LIMITED GEARS AVAILABLE	Red	n/a
TRANSMISSION FAULT TRACTION REDUCED	n/a	Red
TRANSMISSION OVERHEAT SLOW DOWN	Amber	Red

Hill Descent Control Fault Warning Indicator

The amber Hill Descent Control (HDC) warning indicator is illuminated on receipt of medium speed CAN bus signals from the CJB . The signals originate in the ABS module and are transmitted to the CJB over the high speed CAN bus.

When the vehicle enters power mode 6, the HDC warning indicator is subject to a 3 second bulb check. If during HDC operation the HDC warning indicator illuminates it signifies that the 'fade out' strategy has been invoked due to component failure.

If the HDC warning indicator flashes it signifies that the 'fade out' strategy has been invoked due to brake system overheat. In this instance, the first flash is accompanied by a chime from the instrument cluster and the green HDC active indicator will be extinguished.
For additional information, refer to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).

Door Open Indicator

The door open indicator is illuminated on receipt of medium speed CAN bus signals from the CJB. The signals originate in the door modules, which are hardwired to the CJB. The door open indicator will illuminate in a red color if a door open signal is received by the CJB from any door module while the vehicle is in power mode 6.

Engine Management System Warning Indicator

The engine management system warning indicator is illuminated on receipt of medium speed CAN bus signals from the CJB. The signals originate in the ECM and are transmitted to the CJB over the high speed CAN bus.

The amber engine management system warning indicator is illuminated for a 3 second bulb check when the vehicle enters power mode 6. If the indicator subsequently illuminates a DTC will be logged in the ECM which should be interrogated using the Land Rover approved diagnostic system.

Side Lamp Indicator

The green side light indicator is illuminated on receipt of a medium speed CAN bus signal from the CJB. The signal originates in the light switch module and is transmitted to the CJB over the Local Interconnect Network (LIN) bus. The instrument cluster will only illuminate the side lamp indicator when the vehicle is in power mode 6.

Dynamic Stability Control Indicator

The Dynamic Stability Control (DSC) indicator is illuminated by the instrument cluster on receipt of medium speed CAN bus signals from the CJB. The signal originates in the ABS module. The indicator is illuminated in an amber color for 3 seconds for a bulb check when the vehicle enters power mode 6. If no faults exist, the indicator is extinguished after the bulb check period.

When DSC is active, the indicator flashes to inform the driver that the system is regulating engine output and braking forces. If the indicator remains illuminated after the bulb check period or illuminates when driving, the DSC system has a fault or DSC has been deselected by the driver using the DSC switch on the floor console.

Hill Descent Control Active Indicator

The HDC active indicator is illuminated by the instrument cluster on receipt of medium speed CAN bus signals from the CJB. The signal originates in the ABS module. The indicator is illuminated in a green color when HDC is active and the vehicle speed is below a predetermined threshold. If the vehicle speed is faster than the threshold limit, the HDC indicator will flash until the vehicle speed is reduced. On high line instrument clusters a supporting message will also be displayed in the message center. For additional information, refer to:

> Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation),
> Information and Message Center (413-08 Information and Message Center, Description and Operation).

If the use of HDC causes the brake discs to exceed their pre-determined temperature, the HDC system initiates a 'fade out'. The HDC indicator flashes during 'fade out' and on high line instrument clusters a supporting message is displayed in the message center. When the brake discs have cooled sufficiently, HDC is reactivated and the HDC indicator is permanently illuminated.

Anti-theft Alarm Indicator

The anti-theft alarm indicator is controlled directly from the CJB via a hardwired connection. There is no software functionality within the instrument cluster to control operation of the anti-theft alarm indicator.
For additional information, refer to: Anti-Theft - Active (419-01A Anti-Theft - Active, Description and Operation).

Glow Plug Indicator

The glow plug indicator is illuminated on receipt of a medium speed CAN bus signal from the CJB. The signal originates in the diesel ECM and indicates the glow plugs are operational. The indicator will illuminate in an amber color when the vehicle enters power mode 6 and a glow plugs active signal is received from the ECM. When the combustion pre-heat procedure has been carried out, the ECM informs the instrument cluster to extinguish the glow plug indicator.

For additional information, refer to: Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation).

Overspeed Warning Indicator

The amber overspeed warning indicator is illuminated on receipt of a medium speed CAN bus signal from the CJB when the vehicle is in power mode 6. The vehicle speed signal originates in the ABS module and is the same as that used by the speedometer (see above).

The instrument cluster will flash the overspeed warning indicator at a rate of 2 Hz for 5 seconds if a speed of greater than 75 mph (120 kph) is reached. The first flash of the indicator will be accompanied by a chime from the instrument cluster. If the vehicle stays at this speed, the indicator will remain illuminated after the 5 second flashing period. The instrument cluster will extinguish the indicator if vehicle speed drops below 71 mph (114 kph).

Stop/Start Vehicles - From 2010 MY

Eco 'Stop/Start' Indicator

The TD4_e introduces the first intelligent 'Stop/Start' system into a Land Rover vehicle. The system automatically shuts down and restarts the vehicle's engine when the appropriate conditions are satisfied. This reduces the amount of time the engine spends idling, thereby improving fuel economy and reducing emissions. The driver will be notified that the engine is shutdown by the 'Eco' icon being illuminated in the instrument cluster. Other warning lights normally associated with an engine shutdown, for example the ignition and low oil pressure indicators are suppressed so will not illuminate during an engine shutdown in a Stop/Start cycle.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

Eco Switch

The Stop/Start system is automatically activated each time an ignition cycle occurs. However, the driver can deactivate the system by pressing the 'Eco' switch in the fascia.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

The Eco switch also operates the Gear Shift Indicator; for additional information refer to Gear Shift Indicator section, below.

CAR CONFIGURATION FILE

The car configuration file contains all relevant data about the specification and market condition of the vehicle, immobilization codes and driver personal settings. The master repository for this information is the CJB, with a back up being held in the instrument cluster. The information is continuously transferred between the 2 components to ensure the data is constantly backed-up.

CAUTION: When a new instrument cluster is to be installed, the Land Rover approved diagnostic system must be connected to the vehicle and the instrument cluster renewal procedure followed. This will ensure that vehicle coding data is correctly installed in the new instrument cluster. The Land Rover approved diagnostic system will also record the current

service interval data and restore the settings in the new instrument cluster.

When a new instrument cluster is installed, the Land Rover approved diagnostic system is used to transfer the car configuration file data from the CJB to the replacement instrument cluster. Vehicle coding data such as engine type and market is retrieved and used to update the replacement instrument cluster.

The car configuration file will also need to be updated using the Land Rover approved diagnostic system if the vehicle is modified in service from its original factory specification. This can include fitting non-standard wheels and/or tires, or optional accessory dealer fit components with an electrical interface.

GEAR SHIFT INDICATOR - FROM 2010 MY

OVERVIEW

A Gear Shift Indicator in the instrument cluster illuminates to advise the driver when to select a higher gear to attain better fuel efficiency from the vehicle. If the indicator is obeyed the driver can achieve fuel savings of up to 5%.

Gear shift indicator

Introduced in the manual transmission vehicle as standard, the Gear Shift Indicator is automatically activated each time an ignition cycle occurs. However, the driver can deactivate the indicator by pressing the 'Eco' switch on the fascia.

• NOTE: The 'Eco' switch also operates the Stop/Start system.

For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

Eco switch

The Gear Shift Indicator illuminates to advise the driver to select a higher gear, the indicator depending on driver action and driving conditions behaves as follows:

- Extinguishes when a higher gear is selected.
- Extinguishes before a higher gear is selected if driver demand or driving conditions change.
- Extinguishes after 12 seconds if the indicator is ignored; either of the two following conditions can reset the indicator:
  - the driver makes a further gear selection,
  - the driver accelerates after exiting a sharp corner.

The Gear Shift Indicator is designed only to assist the driver, gear selection remains the driver's decision based on other driving conditions affecting the vehicle.

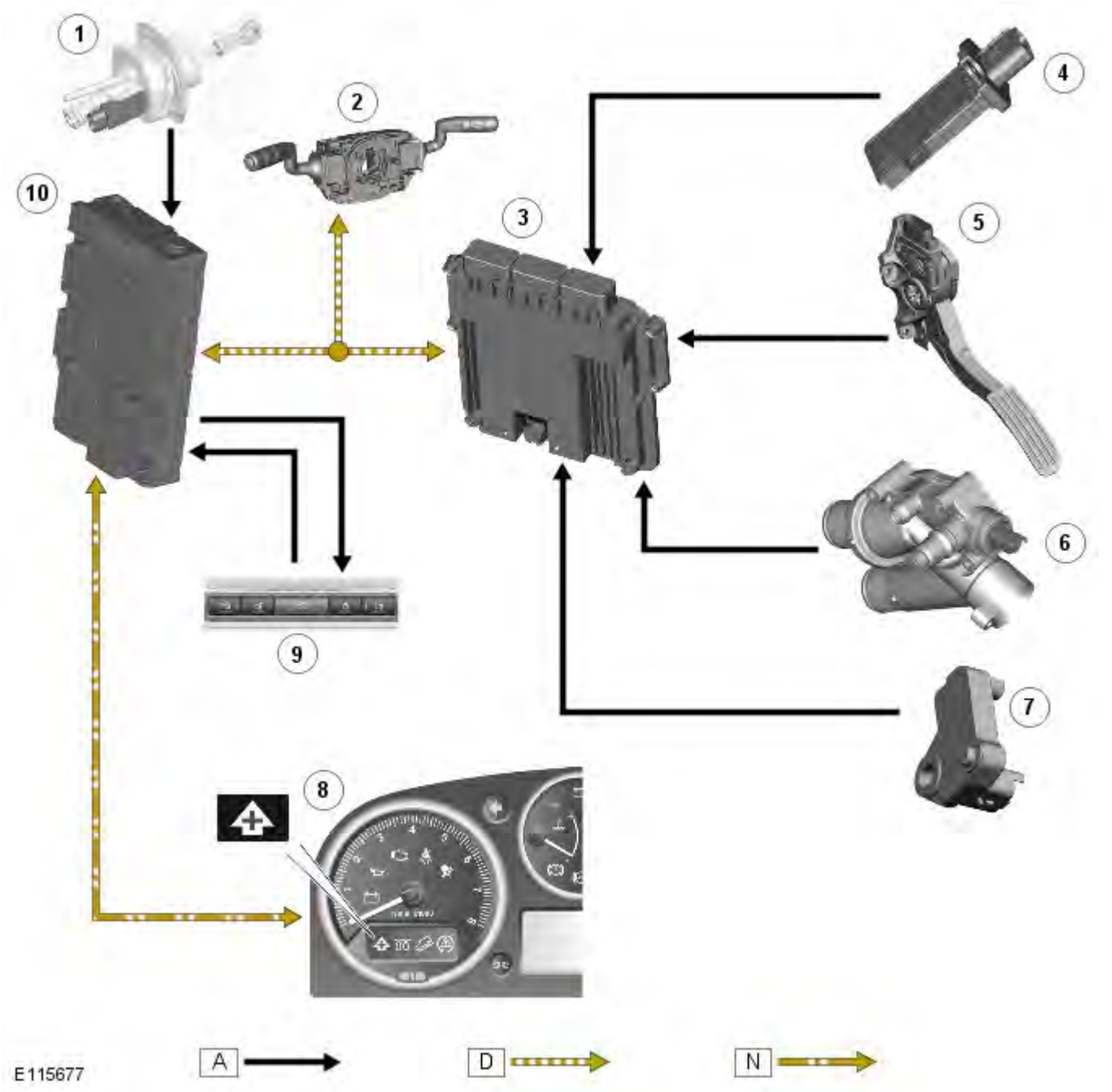
The Gear Shift Indicator:

- Does not advise when to select a lower gear.
- Cannot predict the gradient or curvature of the road ahead.

CONTROL DIAGRAM

Gear Shift Indicator Control Diagram

• NOTE: **A** = Hardwired; **D** = High Speed CAN bus; **N** = Medium Speed CAN bus.



Item	Part Number	Description
1	-	Linear clutch sensor
2	-	Steering wheel module including steering angle sensor
3	-	Engine control module
4	-	Mass air flow sensor / Intake air temperature sensor
5	-	Accelerator pedal position sensor
6	-	Coolant temperature sensor
7	-	Crankshaft position sensor
8	-	Instrument cluster
9	-	Eco switch
10	-	Central junction box

PRINCIPLES OF OPERATION

The Gear Shift Indicator takes advantage of the fully mapped engine to continually calculate the engines performance and whether a higher gear would provide improved fuel efficiency. The ECM (engine control module) interprets which gear is currently selected from analysis of the following EEC (electronic engine control) component inputs:

- Engine load; input from the MAF (mass air flow) sensor.
- Driver's accelerator position and demand; input from the APP (accelerator pedal position) sensor.
- Engine temperature; input from the coolant temperature sensor.
- Engine speed; input from the CKP (crankshaft position) sensor.
- Vehicle speed; input from the ECM via signals from the ABS (anti-lock brake system) module on the high-speed CAN (controller area network).

Using these inputs the ECM uses an algorithm to monitor the driver’s torque and performance demand in the current gear to establish if the same torque and performance could be achieved in the next highest gear to improve fuel efficiency, without introducing engine laboring.

The signal from the Steering Angle Sensor is used to inhibit illumination of the Gear Shift Indicator when the vehicle is traveling round a bend in the road.

Linear clutch sensor

The linear clutch sensor a component introduced with the Stop/Start system is used to reset the indicator lamp each time a gear change is executed.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

The two existing clutch position-switches located on the clutch pedal housing and used as inputs for various vehicle systems, are also used by the Gear Shift Indicator system for plausibility checks.

- NOTE: The Gear Shift Indicator will not function if there is fault with the Stop/Start system.

For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

Published: 11-May-2011

Instrument Cluster - Instrument Cluster

Diagnosis and Testing

Principles of Operation

For a detailed description of the Instrument Cluster, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Fluid levels • Accessory installations	• Fuse • Wiring harness • Electrical connectors • Instrument cluster • Central Junction Box (CJB) • Engine Control Module (ECM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Instrument Cluster (IPC) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Instrument Cluster - Instrument Cluster

Removal and Installation

Removal

• NOTE: When a new instrument cluster is to be installed, the Land Rover approved diagnostic system must be connected to the vehicle and the instrument cluster renewal procedure followed. This will allow vehicle coding data and current service interval data to be correctly installed to the new instrument cluster.

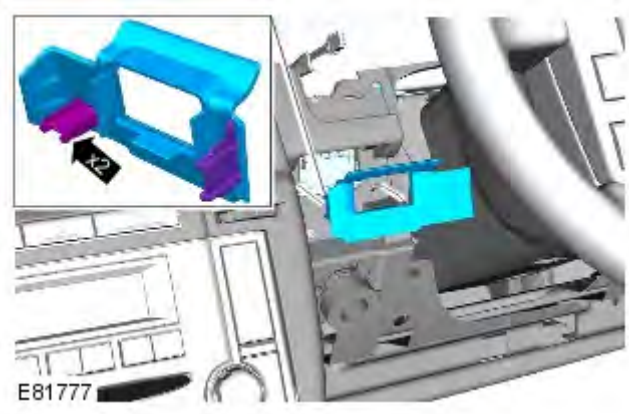
• NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

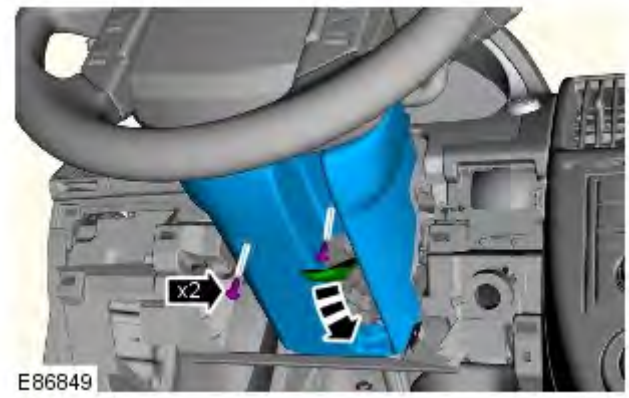
2. Remove the driver lower air bag module.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



3. **3.** NOTE: RHD illustration shown, LHD is similar.

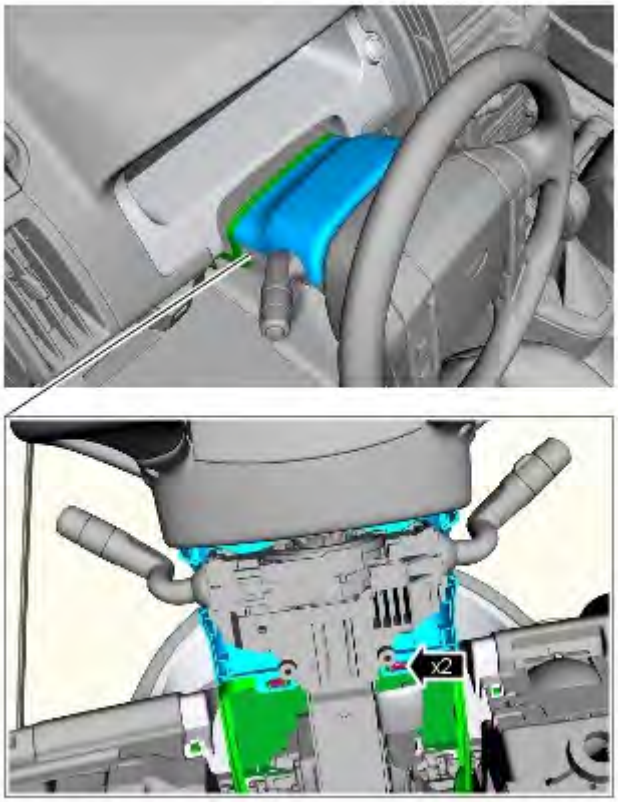
   Remove the keyless start control module trim cover.



4. Remove the steering column lower cowl.

5. Adjust the steering column to its lowest position.

6.



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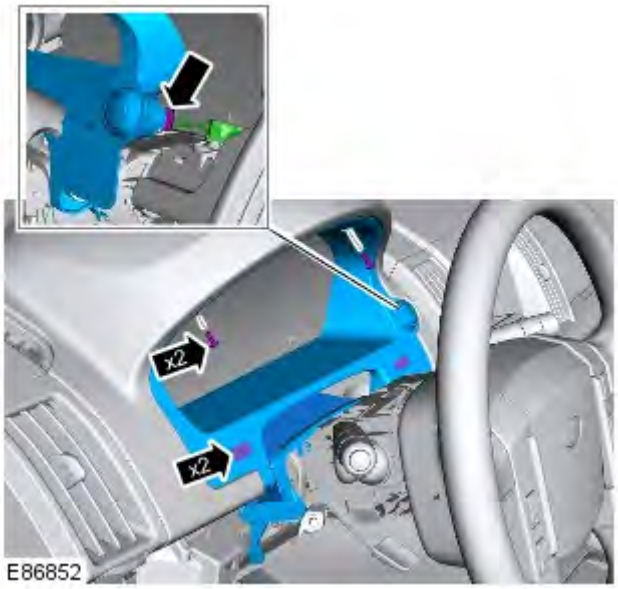
7. **7.** NOTE: Take extra care when releasing the clips.

   Remove the instrument cluster surround.



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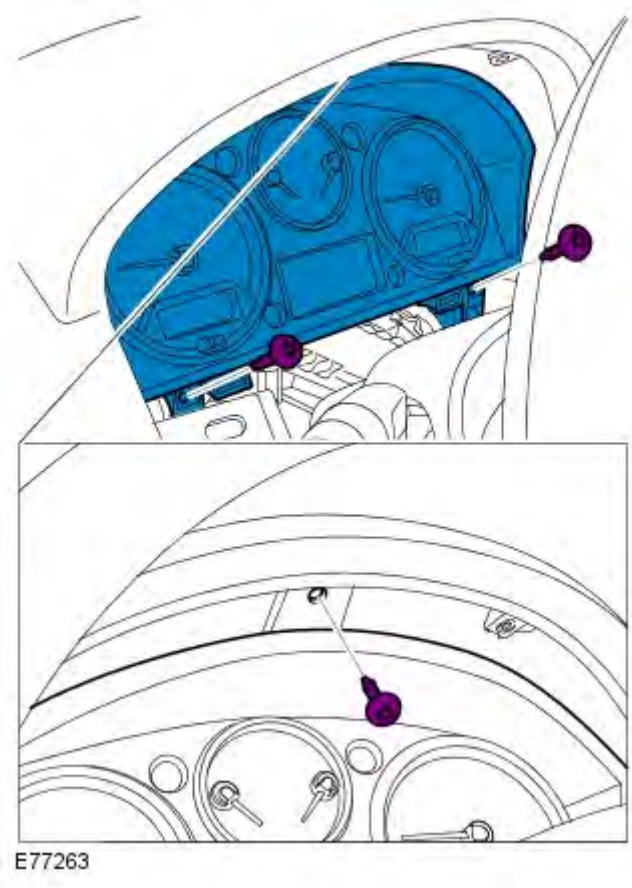


8.

- Remove the 3 Torx screws.

9.

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Horn -

Torque Specifications

Description	Nm	lb-ft
Horn bracket	25	18
Horn nut	10	7

Published: 11-May-2011

Horn - Horn

Description and Operation

COMPONENT LOCATION

Item	Part Number	Description
1	-	Central Junction Box (CJB)
2	-	Horn switches
3	-	Relay R10 (Battery Junction Box (BJB))
4	-	Horns

OVERVIEW

The vehicle horns are operated by pressing either of the vertical bars mounted on the steering wheel. Horn switch status is monitored by the CJB via the steering wheel module. When either of the switches is pressed the CJB energizes the horn relay (relay R10), which is located within the BJB. The energized horn relay provides a battery feed to the 2 vehicle horns. Both horns are mounted on brackets and secured to the center of the front cross member, forward of the radiator.

The vehicle horns will also sound if the anti-theft alarm system is activated. If this occurs, operation of the vehicle horns is controlled automatically by the CJB.
For additional information, refer to: Anti-Theft - Active (419-01A Anti-Theft - Active, Description and Operation).

Published: 11-May-2011

Horn - Horn

Diagnosis and Testing

Principles of Operation

For a detailed description of the horn system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Horn (413-06 Horn, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Horn switches • Clock spring/steering angle sensor • Horns	• Fuses/relays (refer to electrical guide) • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connections • Central Junction Box (CJB) • Battery Junction Box (BJB)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check CJB for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1C5512	Horn Relay Coil Circuit - circuit short to power	• Horn relay control circuit - short to power	Refer to electrical circuit diagrams and check horn relay control circuit for short to power
B1C5514	Horn Relay Coil Circuit- circuit short to ground or open	• Horn relay control circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check horn relay control circuit for short to ground, open circuit
U012600	Lost Communication With Steering Angle Sensor Module	• Lost communication with steering angle sensor	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system

Published: 11-May-2011

Horn - Horn

Removal and Installation

Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the front wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the front bumper cover.

   Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).

4.
   - *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Horn - Horn Switch

Removal and Installation

Removal

1. Disconnect the battery ground cable.

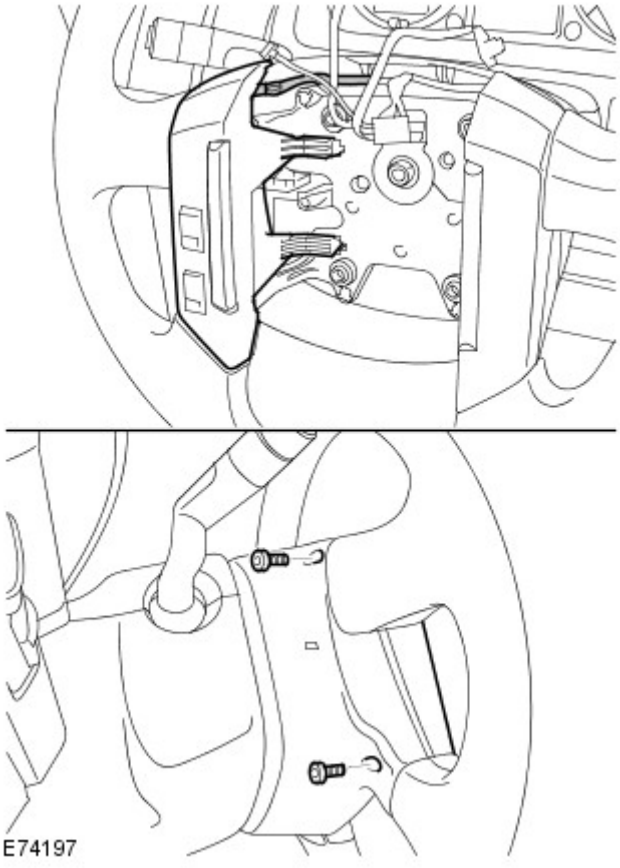
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the driver air bag module.

   Refer to: Driver Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



4.
   - Remove the 2 Torx screws.
   - Disconnect the electrical connector.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Information and Message Center -

Item	Specification
Message centre	Liquid crystal display
Location	Centre of instrument cluster (high line vehicles only)

Published: 11-May-2011

Information and Message Center - Information and Message Center

Description and Operation

COMPONENT LOCATION

Item	Part Number	Description
1	-	Message center
2	-	Odometer

OVERVIEW

The message center is a Liquid Crystal Display (LCD) located in a central position in the instrument cluster. The message center displays system and vehicle status information to the driver.

- NOTE: Vehicles before 2010 MY: The message center is fitted to high line instrument clusters only.
- NOTE: Vehicles from 2010 MY: the message center is fitted as standard to all vehicles.

The instrument cluster receives message center data from the Central Junction Box (CJB) over the medium speed Controller Area Network (CAN) bus. The CJB generates this data based on medium and high speed CAN bus inputs and hardwired inputs received from various system control modules. Software contained within the instrument cluster converts the data from the CJB into display messages for the driver.

DISPLAY MODES

The message center has 8 different display modes as shown in the table below.

Display Mode	Description	Format
0	Blank	No display
1	Pre-check	System pre-check
2	Normal	Ambient air temperature display only
3	Trip computer	Ambient air temperature and trip computer display
4	Warning/Status message	Status and warning information only
5	Terrain Response	Terrain Response information available in 3 (A, B, and C) formats depending on active functions
6	Not used	Not used
7	Diagnostic	Test images displayed to check LCD function

Display Mode 0

This mode is entered when the ignition is switched off and the CAN bus network is asleep. No characters or symbols are displayed when in this mode. The mode is exited when either power mode 6 (ignition on) is active or the driver enters the customer configuration 'Information' mode.

Display Mode 1

This mode is entered when power mode 6 is first active. The full screen message 'SYSTEM CHECK IN PROGRESS' is displayed for approximately 3 seconds while the instrument cluster carries out an internal diagnostic routine. After the 3 second time period, display mode 2 will become active. If during the 3 second period the ignition is switched off, the message center will revert back to display mode 0.

Display Mode 2

This is the normal operating mode of the message center and will automatically become active after display mode 1.

Display Mode 3

This mode is entered by pressing the trip computer button when the message center is in display mode 2. Trip computer information will be displayed for 20 seconds after which time the display will revert back to display mode 2.

Display Mode 4

This mode is entered automatically if the message center receives warning or status messages from the CJB. The whole screen is used to display warning/status messages, over writing the ambient air temperature (display mode 2) and trip computer (display mode 3) information. Warning messages are displayed for 3 seconds, after which the display will return to the previous display mode (2 or 3). Status messages do not extinguish until the status is rectified, for example screen wash is added to the windshield washer bottle to remove the 'LOW WASHER FLUID' message. If more than 1 status message is present, the screen will scroll through each message at 3 second intervals.

All current warning/status messages are scrolled through at 3 second intervals when the vehicle first enters power mode 6, and when the ignition is switched off. These are displayed in order of priority, the most important message being displayed first.

Display Mode 5

Display mode 5 is entered when Terrain Response is selected. This mode has 3 formats. Format 5A displays the same information as display mode 3 with the addition of a Terrain Response icon in the top left hand (LH) corner of the screen, and a steering wheel direction icon displayed centrally at the top of the screen.

Depending on the Terrain Response CAN message received from the CJB, the screen will enter either display mode 5B or display mode 5C. When in display mode 5B the whole screen will be used to display Terrain Response messages, over writing the information shown in mode 5A.

If the screen adopts display mode 5C the top third of the screen will display all Terrain Response option icons. The lower two thirds of the screen will display Terrain response messages.

The instrument cluster provides a feedback signal to the Terrain Response control module informing it that the relevant Terrain Response information is being displayed. The Terrain Response messages for all 3 display mode 5 formats can be overwritten however if the message center receives a high priority warning/status message. If the message center is unable to display Terrain Response messages due to this occurrence, the instrument cluster changes the feedback signal to the control module from a value of 1 to a value of 0.

Display Mode 7

Display mode 7 is a diagnostic mode and can only be accessed using the Land Rover approved diagnostic system. The diagnostic routine can be found in '413-00 Instrument Pack and Panel Illumination' under the 'Content Model' menu.

When in display mode 7, 4 different patterns are displayed to check that all areas of the LCD are functional.

MESSAGE PRIORITY

Messages are assigned priorities which are defined by the effect on driving safely and the functional ability of the vehicle. New messages are displayed accompanied by a chime from the instrument cluster sounder. The messages are divided into 3 priority groups.

Priority Group 1

This group of messages have a direct effect on the driving ability and safety of the vehicle, 'ENGINE SYSTEM FAULT' for example. This message would require an immediate reaction from the driver in response to the message. Priority 1 messages will also be accompanied by the appropriate warning indicator flashing and a continuous chime from the instrument cluster. If more than one priority 1 message is present, each message is displayed in turn at 3 second intervals.

Priority Group 2

This group of messages do not directly affect the driving ability or safety of the vehicle, 'CHECK BRAKE PADS' for example. This message must be noted by the driver and the cause rectified as soon as possible. Each of these messages is displayed once when power mode 6 is entered or when the fault occurs for a predetermined time period. These messages can be recalled by the driver by pressing the trip reset button for more than 3 seconds.

Priority Group 3

This group of messages relate to low priority messages, 'LOW WASHER FLUID' for example. Depending on the message, some messages are only shown at the end of a journey to avoid annoyance to the driver. The messages will be accompanied by a chime when the ignition is switched off to alert the driver to their presence.

MESSAGE LIST

Messages are displayed in a language appropriate for the market specification of the vehicle. The language can be changed if required using the Land Rover approved diagnostic system.

• NOTE: The list below is shown in alphabetical order.

Message	Other Warnings	Reason	Action
BONNET OPEN	None	Hood open or not fully closed	Close hood
CHECK ALL TYRE PRESSURES	Amber Tire Pressure Monitoring System (TPMS) indicator illuminated	Advisory message. Low pressure warning limit reached in more than 1 wheel in low speed mode or warning limit reached in any running wheel and no location specified by TPMS. For additional information, refer to: Wheels and Tires (204-04 Wheels and Tires, Description and Operation).	Check all tire pressures and adjust accordingly
CHECK ALL TYRE PRESSURES FRONT LEFT LOW	Amber TPMS indicator illuminated	Low pressure warning limit reached in front left tire in low speed mode	Check tire pressure and adjust accordingly
CHECK ALL TYRE PRESSURES FRONT RIGHT LOW	Amber TPMS indicator illuminated	Low pressure warning limit reached in front right tire in low speed mode	Check tire pressure and adjust accordingly
CHECK ALL TYRE PRESSURES REAR LEFT LOW	Amber TPMS indicator illuminated	Low pressure warning limit reached in rear left tire in low speed mode	Check tire pressure and adjust accordingly
CHECK ALL TYRE PRESSURES REAR RIGHT LOW	Amber TPMS indicator illuminated	Low pressure warning limit reached in rear right tire in low speed mode	Check tire pressure and adjust accordingly
CHECK SPARE TYRE PRESSURE	Amber TPMS indicator illuminated for 20 seconds and again at subsequent ignition cycles	Low pressure warning limit reached in spare tire	Check tire pressure and adjust accordingly
CRANKING WILL COMMENCE AFTER GLOW PERIOD	Glow plug indicator illuminated	Ambient air temperature below 0ºC (32ºF)	None
CRUISE CONTROL NOT PERMITTED	None	Vehicle operating parameters outside threshold for speed control operation	None
DPF FULL	Handbook symbol illuminated in message center	Diesel particulate filter requires regenerating	For additional information, refer to: Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Description and Operation).
DPF FULL VISIT DEALER	None	Regeneration of the diesel particulate filter was unsuccessful	Use the Land Rover approved diagnostic system to force regeneration of the diesel particulate filter.
DRIVER DOOR OPEN	None	Drivers door open or not fully closed	None
DSC SWITCHED OFF	Amber Dynamic Stability Control (DSC) indicator illuminated	System not available due to DSC switched off by driver	Press DSC switch to reactivate system
ECO STOP/START FAULT	Tell-tale light in the Eco switch extinguished	Stop/Start not available due to system or sub-system failure	Connect Land Rover approved diagnostic system to diagnose fault
ECO STOP/START OFF	Tell-tale light in the Eco switch extinguished	The Eco switch has been pressed	If required, press the Eco switch to reactivate the Stop/Start system
ECO STOP/START ON	Tell-tale light in the Eco switch illuminated	The system has been switched off and then later switched on within the same ignition cycle	If required, press the Eco switch to deactivate the Stop/Start system

Message	Other Warnings	Reason	Action
ECO STOP/START UNAVAILABLE	Tell-tale light in the Eco switch extinguished	Either Hill Decent Control (HDC) or Terrain Response (TR) is active	Deselect HDC or TR if terrain conditions permit
ENGINE SYSTEM FAULT	Malfunction Indicator Lamp (MIL) illuminated	Engine Control Module (ECM) has detected a fault in the engine management system	Connect Land Rover approved diagnostic system to diagnose fault
FRONT LEFT TYRE PRESSURE NOT MONITORED	Amber TPMS indicator flashes for 75 seconds then remains illuminated	No transmission from front left TPMS pressure sensor	Connect Land Rover approved diagnostic system to diagnose fault
FRONT PASSENGER DOOR OPEN	None	Front passenger door open or not fully closed	None
FRONT RIGHT TYRE PRESSURE NOT MONITORED	Amber TPMS indicator flashes for 75 seconds then remains illuminated	No transmission from front right TPMS pressure sensor	Connect Land Rover approved diagnostic system to diagnose fault
FUEL TANK CAP LOOSE OR MISSING	None	North American vehicles only. Diagnostic Monitoring of Tank Leakage (DMTL) pump unable to pressurize the fuel system. For additional information, refer to: Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Description and Operation).	Tighten or replace the fuel tank cap. Check fuel system for leaks.
GRASS GRAVEL SNOW	Grass Gravel Snow Terrain Response icon displayed in message center	Advisory message. Terrain Response rotary control has been moved to the Grass Gravel Snow position. Program will become active after 2 seconds	None
GRASS GRAVEL SNOW PROGRAM SELECTED	Grass Gravel Snow Terrain Response icon displayed in message center	Advisory message. Terrain Response Grass Gravel Snow special program has been selected for more than 2 seconds and is currently active	None
HDC FAULT SYSTEM NOT AVAILABLE	Single chime from instrument cluster sounder	Hill Descent Control (HDC) system fault. Drive with care and do not attempt to descend steep slopes. For additional information, refer to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).	Connect Land Rover approved diagnostic system to diagnose fault
HDC NOT AVAILABLE IN THIS GEAR	Green HDC active indicator flashes	Incorrect gear selected for HDC to operate. For additional information, refer to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).	Select correct gear before attempting descent
HDC NOT AVAILABLE SPEED TOO HIGH	Green HDC active indicator flashes	HDC not available as current vehicle speed is above operating threshold. For additional information, refer to: Anti-Lock Control - Stability Assist (206-09C Anti-Lock Control - Stability Assist, Description and Operation).	Reduce speed before attempting descent
HDC TEMPORARILY NOT AVAILABLE SYSTEM COOLING	Green HDC active indicator flashes	HDC system switched off while brake system is cooling	Wait until message is extinguished before attempting descent
HDC SWITCHED OFF	Single chime from instrument cluster sounder	HDC system switched off by driver, Terrain Response system or speed threshold has been exceeded	None
HIGH ENGINE SPEED FOR COOLING	None	Idle speed increased to assist engine cooling	None
KEY IN IGNITION	Continuous chime from instrument cluster sounder	Advisory message informing the driver that the remote handset has been left in the start control module, the ignition has been switched off, and the drivers door is open	Remove the remote handset from the start control module
LEFT REAR DOOR OPEN	None	Left rear door open or not fully closed	None
LIGHTS ON	Continuous chime from instrument cluster sounder	Advisory message that the exterior lamps are switched on, the remote handset has been removed from the start control module and the drivers door has been opened	Switch off exterior lamps
LOW COOLANT LEVEL	None	Engine coolant level below recommended level	Check engine cooling system for leaks and top up as necessary
LOW WASHER FLUID	Single chime from instrument cluster sounder at ignition on (power mode 6)	Washer fluid level below threshold	Add water and additive mixture to windshield washer bottle
MEMORY 1 SELECTED	None	Confirmation that memory function has been successfully carried out	None
MEMORY 2 SELECTED	None	Confirmation that memory function has been successfully carried out	None
MEMORY 3 SELECTED	None	Confirmation that memory function has been successfully carried out	None

Message	Other Warnings	Reason	Action
MEMORY 1 STORED	Single chime from instrument cluster sounder	Confirmation that settings have been stored in the memory	None
MEMORY 2 STORED	Single chime from instrument cluster sounder	Confirmation that settings have been stored in the memory	None
MEMORY 3 STORED	Single chime from instrument cluster sounder	Confirmation that settings have been stored in the memory	None
MUD RUTS	Mud Ruts Terrain Response icon displayed in message center	Advisory message. Terrain Response rotary control has been moved to the Mud Ruts position. Program will become active after 2 seconds	None
MUD RUTS PROGRAM SELECTED	Mud Ruts Terrain Response icon displayed in message center	Advisory message. Terrain Response Mud Ruts special program has been selected for more than 2 seconds and is currently active	None
OIL SERVICE REQUIRED VISIT DEALER	'SERVICE' displayed in odometer	Advisory message informing driver that a diesel particulate filter regeneration cycle has caused the engine oil to become diluted. For additional information, refer to: Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Description and Operation).	Carry out service and reset Service Interval Indicator (SII) using the Land Rover approved diagnostic system
PRESS BRAKE WHEN STARTING	None	Advisory message to allow engine starting. Vehicles with automatic transmission only	None
PRESS CLUTCH WHEN STARTING	None	Advisory message to allow engine starting. Vehicles with manual transmission only	None
PROGRAM CHANGE IN PROGRESS	Selected Terrain Response icon displayed in message center	Vehicle operating conditions prevent selection of special program. For additional information, refer to: Ride and Handling Optimization (204-06 Ride and Handling Optimization, Description and Operation).	If operating conditions change within 60 seconds selected program will be activated. For additional information, refer to: Ride and Handling Optimization (204-06 Ride and Handling Optimization, Description and Operation).
REAR LEFT TYRE PRESSURE NOT MONITORED	Amber TPMS indicator flashes for 75 seconds then remains illuminated	No transmission from rear left TPMS pressure sensor	Connect Land Rover approved diagnostic system to diagnose fault
REAR RIGHT TYRE PRESSURE NOT MONITORED	Amber TPMS indicator flashes for 75 seconds then remains illuminated	No transmission from rear right TPMS pressure sensor	Connect Land Rover approved diagnostic system to diagnose fault
RECOMMEND COMMAND SHIFT FOR DEEP SOFT SAND	Sand Terrain Response icon displayed center	Advisory message for Terrain Response special program. Only displayed on vehicles with automatic transmission	Select Command Shift if required
RECOMMEND STARTING IN 2ND GEAR FOR SLIPPERY CONDITIONS	Grass Gravel Snow Terrain Response icon displayed in message center	Advisory message for Terrain Response special program. Only displayed on vehicles with manual transmission once every ignition cycle	Select 2nd gear if required
REDUCED ENGINE PERFORMANCE	None	A fault has occurred that has reduced engine power output	Connect Land Rover approved diagnostic system to diagnose fault
RESTART REQUIRED PRESS CLUTCH	None	When an engine restart is required in a Stop/Start cycle but the driver's location is unknown. Either the driver's door or safety belt is unlatched	Depress clutch
RIGHT REAR DOOR OPEN	None	Right rear door open or not fully closed	None
SAND	Sand Terrain Response icon displayed in message center	Advisory message. Terrain Response rotary control has been moved to the Sand position. Program will become active after 2 seconds	None
SAND PROGRAM SELECTED	Sand Terrain Response icon displayed in message center	Advisory message to inform driver that Terrain Response Sand special program has been selected for more than 2 seconds and is currently active	None
SELECT NEUTRAL TO RESTART	None	The engine has been shutdown in a Stop/Start cycle and the driver has engaged a gear without depressing the clutch.	Depress clutch and select neutral
SELECT PARK OR NEUTRAL TO START ENGINE	None	Advisory message to allow engine starting	None
SPECIAL PROGRAMS OFF	Special programs off icon displayed in message center	Advisory message to inform driver that system is in special programs off mode	None
SPECIAL PROGRAM TEMPORARILY NOT AVAILABLE	Current Terrain Response program icon displayed in message center	Temporary condition making special programs unavailable. Terrain Response defaults to special programs off mode	Drive off-road with care until temporary condition resolved
SYSTEM CHECK IN PROGRESS	None	Instrument cluster internal diagnostic routine	None

Message	Other Warnings	Reason	Action
TAILGATE OPEN	None	Tailgate open or not fully closed	None
TERRAIN RESPONSE SPECIAL PROGRAMS NOT AVAILABLE	Single chime from instrument cluster sounder and special programs off icon displayed in message center	Terrain Response special programs not available due to system failure. Drive off-road with care. For additional information, refer to: Ride and Handling Optimization (204-06 Ride and Handling Optimization, Description and Operation).	Connect Land Rover approved diagnostic system to diagnose fault
TERRAIN RESPONSE SPECIAL PROGRAMS OFF	All 5 Terrain Response icons displayed in message center	Advisory message to inform driver that Terrain Response special programs are off	None
TERRAIN RESPONSE SYSTEM FAULTY	Single chime from instrument cluster sounder and special programs off icon displayed in message center	There may be a fault with the Terrain Response system rather than a sub-system fault. For additional information, refer to: Ride and Handling Optimization (204-06 Ride and Handling Optimization, Description and Operation).	Drive off-road with care until temporary condition resolved. Connect Land Rover approved diagnostic system to diagnose fault
TERRAIN RESPONSE SYSTEM NOT AVAILABLE	Single chime from instrument cluster sounder and special programs off icon displayed in message center	Terrain Response special programs not available due to system failure.	Drive off-road with care until temporary condition resolved. Connect Land Rover approved diagnostic system to diagnose fault
TRANSMISSION COMMAND SHIFT SELECTED	None	Advisory message. Movement of the selector lever in + or - positions when selector lever in M/S position	None
TRANSMISSION FAULT	None	Advisory message to inform driver that the Transmission Control Module (TCM) has detected a fault with the automatic transmission. For additional information, refer to: External Controls (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation).	Connect Land Rover approved diagnostic system to diagnose fault
TRANSMISSION FAULT AND OVERHEAT	None	Advisory message to inform driver that the TCM has detected a fault with the automatic transmission and the temperature is too high. For additional information, refer to: External Controls (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation).	Connect Land Rover approved diagnostic system to diagnose fault
TRANSMISSION FAULT LIMITED GEARS AVAILABLE	None	Advisory message to inform driver that the TCM has detected a fault with the automatic transmission and performance may be affected. For additional information, refer to: External Controls (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation).	Connect Land Rover approved diagnostic system to diagnose fault
TRANSMISSION FAULT TRACTION REDUCED	Single chime from instrument cluster sounder	TCM has stopped transmitting CAN bus messages. Message also displayed if fault detected in active on demand coupling. For additional information, refer to: External Controls (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation), Rear Drive Axle and Differential (205-02 Rear Drive Axle/Differential, Description and Operation).	Connect Land Rover approved diagnostic system to diagnose fault
TRANSMISSION OVERHEAT SLOW DOWN	None	Advisory message to inform driver that transmission or active on demand coupling temperature too high. Slow down or stop to assist coolingFor additional information, refer to: External Controls (307-05 Automatic Transmission/Transaxle External Controls, Description and Operation), Rear Drive Axle and Differential (205-02 Rear Drive Axle/Differential, Description and Operation).	Check transmission and active on demand coupling for faults
TYRE PRESSURE MONITORING SYSTEM FAULT	Amber TPMS indicator flashes for 75 seconds then remains illuminated	TPMS fault, no transmission from more than one pressure sensor, or CAN bus signals missing. For additional information, refer to: Wheels and Tires (204-04 Wheels and Tires, Description and Operation).	Connect Land Rover approved diagnostic system to diagnose fault
TYRE PRESSURES LOW FOR SPEED	Amber TPMS indicator illuminated	Low pressure warning limit reached in high speed mode. For additional information, refer to: Wheels and Tires (204-04 Wheels and Tires,	Check all tire pressures and adjust accordingly

Message	Other Warnings	Reason	Action
		Description and Operation).	
AUXILIARY HEATER UNAVAILABLE LOW FUEL (vehicles from 2009MY with Fuel Fired Booster Heater (FFBH))	None	Fuel level in fuel tank is at or below threshold when FFBH 'ON' request is made.	Replenish fuel in fuel tank
AUXILIARY HEATER UNAVAILABLE LOW BATTERY (Vehicles from 2009MY with FFBH)	None	Battery voltage is below threshold when FFBH 'ON' request is made.	Investigate reason for low battery voltage. Follow the procedures in the Battery Care Manual to establish the condition of the battery.

TRIP COMPUTER

Trip computer information is shown in the bottom half of the message center when the screen is in display mode 3.

Trip Meter

A microprocessor in the instrument cluster calculates the trip data based on a wheel speed signal broadcast by the Anti-lock Brake System (ABS) module over the high speed CAN bus. The CJB acts as a gateway and transmits the wheel speed signal to the instrument cluster over the medium speed CAN bus.

The trip meter displays the distance the vehicle has traveled since the last trip meter reset. The trip meter can be reset by pressing and holding the trip computer button for more than 1 second. The trip meter can display up to a distance of 999.9 miles or kilometers. When this figure is exceeded the trip meter starts again from 0 miles or kilometers.

The trip data is stored in the instrument cluster Random Access Memory (RAM) and will be lost if the battery is disconnected.

Average Fuel Consumption

The instrument cluster receives 2 fuel tank level readings on the medium speed CAN bus via the CJB. The instrument cluster calculates an average value of the amount of usable fuel in the tank from the 2 signals. Every 200 meters of vehicle travel the instrument cluster re-calculates this value to determine how much fuel has been used. This value is then averaged over the last 31 miles (50 kilometers) of travel and displayed in the trip computer.

The distance traveled signal originates in the ABS module and is received by the instrument cluster over the medium speed CAN bus via the CJB.

Range

The range value is calculated using the average fuel consumption value (see above) and the fuel tank level value. By dividing the fuel tank level value by the average fuel consumption value the instrument cluster can calculate the distance the vehicle can travel with the current amount of usable fuel in the tank before refilling is necessary.

Average Speed

The average speed signal is calculated using the vehicle speed signal supplied by the CJB over the medium speed CAN bus. This signal originates in the ABS module and is an average of the 4 wheel speed signals. This value is divided by the time since the last trip computer reset to calculate the average vehicle speed.

ODOMETER

The odometer is located in the speedometer and displays the total distance the vehicle has traveled. This is calculated using the same signal as that used for the trip meter.

The odometer display can show 6 characters and distances up to 999,999 miles or kilometers. The value is stored in a protected area of the instrument clusters Electronically Erasable Programmable Read Only Memory (EEPROM) every 1.2 miles (2 kilometers) of vehicle travel. When the ignition is switched off, back up odometer values are also stored in the following modules:

- CJB
- ABS module
- ECM
- Restraints Control Module (RCM)
- Driver door module
- Passenger door module.

The odometer values in these modules are sent to the instrument cluster over the medium speed CAN bus within the first 2 seconds of the vehicle entering power mode 6. If the values received are the same, the cluster determines the odometer value has not been tampered with. If any value is outside of a 186 mile (300 kilometer) window the instrument cluster stores a Diagnostic Trouble Code (DTC) and will display the majority value. The DTC can be retrieved using the Land Rover approved diagnostic system.

Vehicle Operating Modes

The vehicle has 4 operating modes, which allow certain features to be enabled and disabled:

- Normal (nor)
- Factory (fact)
- Transport (transp)
- Crash (crash)

The current vehicle operating mode, shown in parenthesis above, is displayed in the odometer for 5 seconds when the vehicle first enters power mode 6.

• NOTE: 'Nor' is only displayed in the Odometer when the vehicle operating mode is changed to normal from any of the other vehicle operating modes. Under all other conditions, 'Nor' is not displayed.

The vehicle operating mode can be changed using the Land Rover approved diagnostic system.

Gear Position

The gear position indicator shows the current automatic transmission selector lever position. During normal operation the display will show P (park), R (reverse), N (neutral) and D (drive). When the transmission is operated in 'CommandShift™' mode, the odometer displays the currently selected manual gear; 1, 2, 3, 4, 5 or 6.

In the event of either a CAN bus failure, or if the TCM detects a transmission overheat situation, the odometer will display the letter 'E' in the same area of the display as the 'CommandShift™' selected gear information.

Supplemental Restrain System Warning Indicator

If the instrument cluster detects the Supplemental Restraint System (SRS) warning indicator has failed, the message 'SrS' will be displayed in the odometer and a DTC stored. The DTC can be retrieved from the instrument cluster using the Land Rover approved diagnostic system.

Service Interval Indicator

The Service Interval Indicator (SII) informs the driver when the next vehicle service is due. The instrument cluster monitors the distance the vehicle has traveled and the time elapsed since the last service.

If vehicle distance is the trigger for the SII, 'SERVICE' will be displayed in the odometer accompanied by a distance qualifier (either 'MILES' or 'KM' depending on the instrument cluster specification). A distance counter will also be displayed in the top Right Hand (RH) corner of the odometer. If the point at which a service is required is passed, the counter will display a negative value. When activated, the SII is displayed for 5 seconds when the vehicle enters power mode 6.

If time is the trigger for the SII, 'SERVICE' will be displayed in the odometer accompanied by a clock symbol. A counter will also be displayed in the top RH corner of the odometer. If the point at which a service is required is passed, the counter will display a negative value. Again, when activated the SII is displayed for 5 seconds when the vehicle enters power mode 6.

If both the distance and time triggers are activated, the SII will display the distance information for 5 seconds, followed by the time information for 5 seconds.

When a service has been carried out, the SII will need to be re-set. This can be done using the Land Rover approved diagnostic system or following a manual re-set procedure. The manual re-set mode is entered by carrying out the following routine:

- Press and hold the trip reset button with the vehicle stationary and in a power mode less than 6.
- While holding the trip reset button, enter the vehicle into power mode 6.
- Release the trip reset button within 10 seconds of entering power mode 6.

If the manual re-set mode has been successfully entered 'dISt' or 'DATE' will be displayed in the odometer, depending on which trigger has been activated.

To clear the 'dISt' trigger press, and hold the trip reset button for more than 5 seconds within 10 seconds of entering the manual re-set mode. If successful, 'RESET' will be displayed in the odometer for 5 seconds. If the date trigger has not been activated 'END' will then be displayed in the odometer.

• NOTE: The distance trigger will not reset if the distance the vehicle has traveled is less than 20% of the next service interval value.

If the date trigger has been activated, 'DATE' will be displayed in the odometer. To clear the trigger, press and hold the trip reset button for more than 5 seconds within 10 seconds of 'DATE' being displayed. If successful, 'RESET' will be displayed within the odometer for 5 seconds followed by 'END'. The odometer will now exit re-set mode.

AMBIENT AIR TEMPERATURE

The instrument cluster can display the ambient air temperature reading in either degrees Celsius or Fahrenheit. The ambient air temperature signal originates in the ambient air temperature sensor. The sensor is a Negative Temperature Coefficient (NTC) thermistor, and is mounted in the LH door mirror. A temperature value is calculated by the ECM and broadcast over the high speed CAN bus to the instrument cluster.

If the temperature value falls below 4ºC (39ºF) the message center will flash the low ambient air temperature icon 5 times. This is accompanied by a chime from the instrument cluster sounder. The low ambient air temperature icon will be repeated if the ambient air temperature rises above 6ºC (43ºF) then drops below 4ºC (39ºF) again or a new ignition cycle is started.

Published: 11-May-2011

Warning Devices -

Torque Specifications

Description	Nm	lb-ft
Low tire pressure module bolts	10	7

Published: 11-May-2011

Warning Devices - Warning Devices

Diagnosis and Testing

Tire pressure monitor system is controlled via the Central Junction Box (CJB), for further information.
REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Published: 11-May-2011

Parking Aid -

General Specification

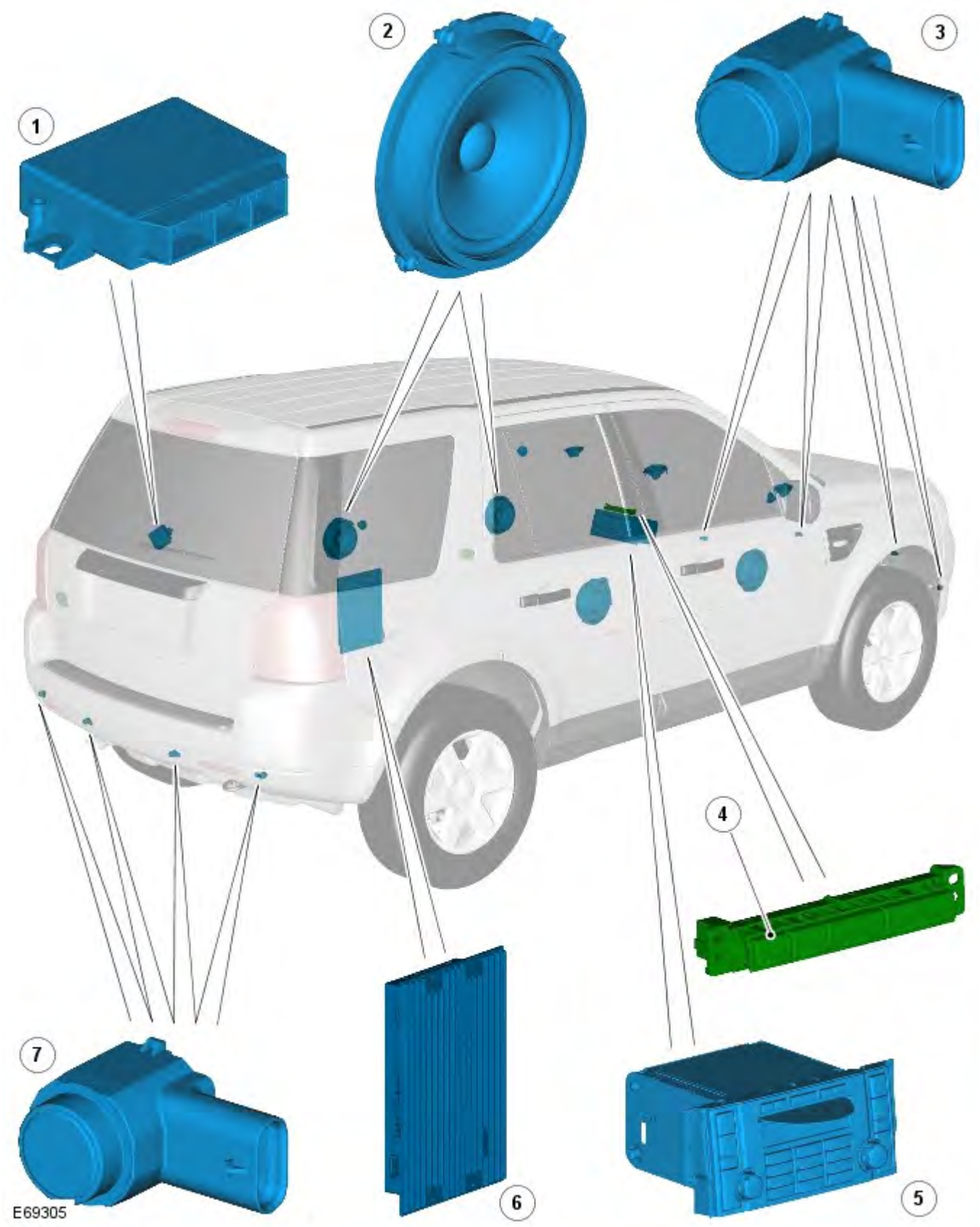
Item	Specification
Detection (Rear):	
Center sensors	1800 mm (70.9 in)
Side sensors	600 mm (23.6 in)
Continuous tone	300 mm (11.8 in)
Detection (Front):	
Center sensors	800 mm (31.5 in)
Side sensors	600 mm (23.6 in)
Continuous tone	300 mm (11.8 in)

Published: 11-May-2011

Parking Aid - Parking Aid

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Parking aid module
2	-	Front and rear audio speakers
3	-	Front parking aid sensor (4 off)
4	-	Parking aid switch

5	-	Integrated Control Module (ICM)
6	-	Power amplifier
7	-	Rear parking aid sensor (4 off)

OVERVIEW

Two levels of parking aid system can be fitted; a rear only system or a front and rear system.

The parking aid system provides an audible warning to the driver when any obstacles are in the path of the vehicle during forward (if front sensors are fitted) or reverse parking manoeuvres. The system consists of four ultrasonic sensors in each bumper, a parking aid module and a parking aid switch.

At low speeds, the parking aid module uses the ultrasonic sensors to monitor the area around the front and rear bumpers. If an object is detected within a monitored area, the module then outputs a warning using the audio system speakers. The sensors can detect solid objects such as posts, walls and other vehicles and can also detect less solid objects such as a wire mesh fence. Objects very close to the ground may not be detected, but because of their low height may not cause damage to the vehicle.

The parking aid system comprises the following components:

- Parking aid module
- Parking aid switch
- Eight parking aid sensors.

The parking aid module communicates via the medium speed Controller Area Network (CAN) bus with the audio system via the Integrated Control Module (ICM). The audio system then outputs the applicable warning tones from the front or rear speakers when an object is detected. The medium speed CAN bus is also used to collect vehicle data from other vehicle systems.

Parking Aid Module

The parking aid module is located on the Left Hand (LH) side of the luggage compartment, behind the 'C' pillar trim panel.

The parking aid module has three connectors which provide for power, ground and CAN bus connections, front parking aid sensors and rear parking aid sensors.

The medium speed CAN bus connections provide for the receipt of the following information from other systems:

- Anti-lock Brake System (ABS) module - Road speed signal
- Transmission Control Module (TCM) - Reverse gear engaged signal
- Trailer module - Trailer attached to vehicle
- Instrument cluster - Ambient temperature signal.

The module also outputs messages on the medium speed CAN bus which are received by the Integrated Control Module (ICM). The ICM processes these messages and converts them into Media Orientated System Transport (MOST) signals which are passed to the audio system power amplifier. These signals are then used by the power amplifier to emit the applicable warning tones from the front or rear audio speakers when an object is detected by the front or rear parking aid sensors. A warning tone can also be emitted to alert the driver to a fault in the parking aid system.

The parking aid module performs self check routines and when the system is active checks the sensor wiring for short or open circuits. If a fault is detected a code is stored in a memory in the module and if necessary either the front and/or rear sensors can be disabled. The driver is made aware of any fault condition by the parking aid switch Light Emitting Diode (LED) flashing and a continuous warning tone being emitted for 3 seconds, in place of the normal short tones when the system is functioning normally. Fault codes can be read using the Integrated Diagnostic System (IDS) via the diagnostic socket.

Parking Aid Sensors

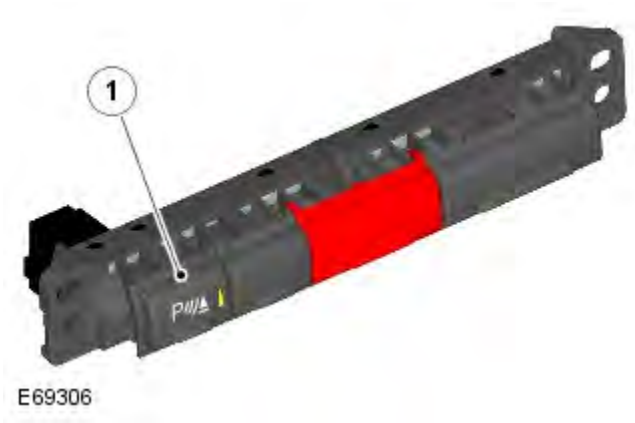
Four ultrasonic sensors are located in the front and rear bumpers. Each sensor comprises a sensor and a bumper insert. The insert ensures that each sensor is correctly orientated in relation to its location in the bumper.

Each sensor has a three pin connector which mates with a bumper harness, which in turn is connected to the main body harness. Three pins provide for power supply, ground and signal lines to and from the parking aid module.

Each sensor comprises a plastic housing which contains a piezo electric disc. The disc resonates at a frequency of 34.8kHz, producing the ultrasonic output. The disc also receives the reflected echo signal from any objects within range.

The parking aid module controls the operation of each sensor using a digital output on the signal line. The module controls the sensor in one of two modes; combined transmitter and receiver mode or receiver mode only.

Parking Aid Switch



Item	Part Number	Description
1	-	Parking aid switch

The parking aid switch is located in the instrument panel switch pack, above the touch screen. The switch is the LH switch with an integral LED.

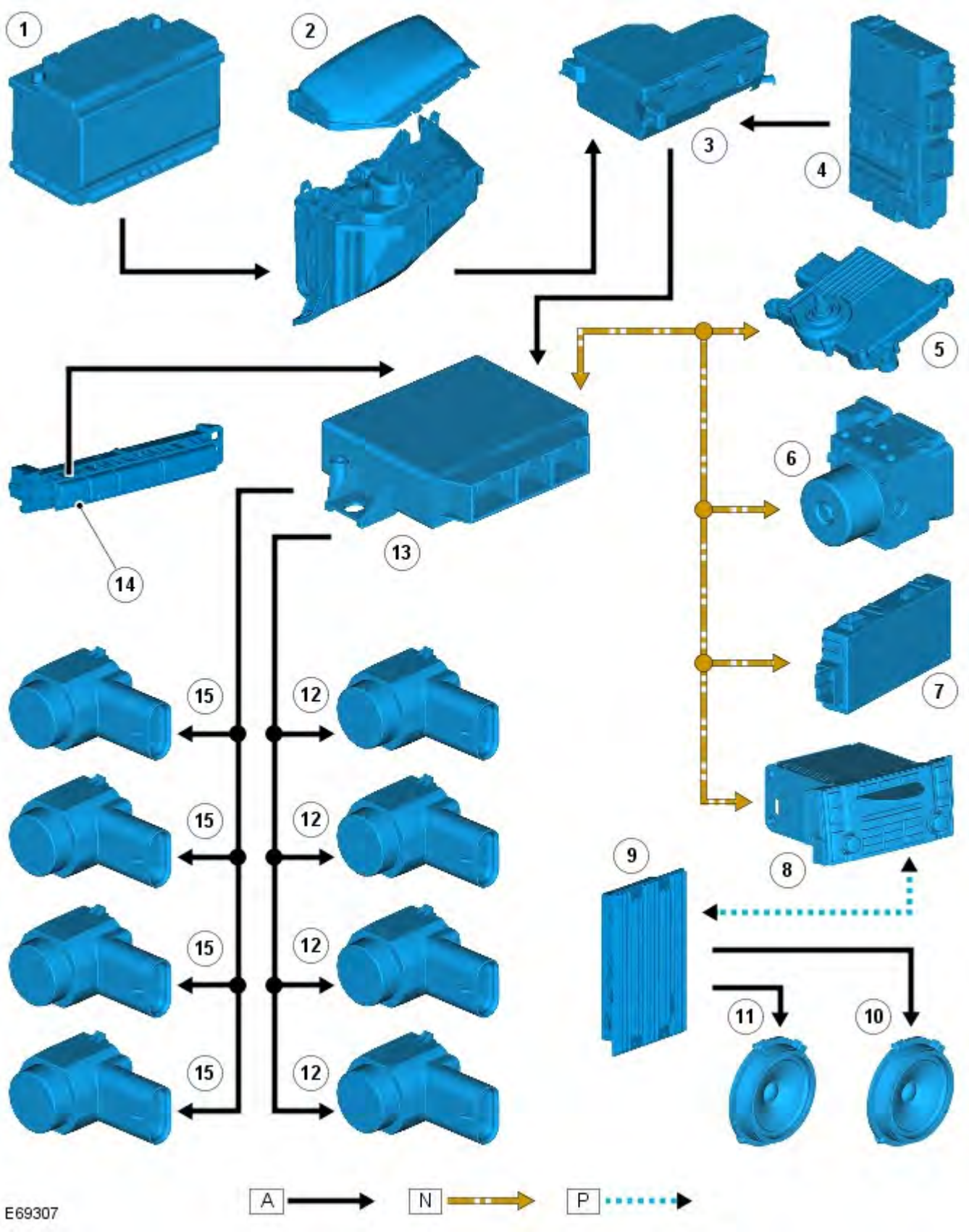
The switch is a non-latching push switch which allows the driver to select the parking aid system on or off. When pressed, the switch momentarily connects a ground to the parking aid module. The LED indicates when the parking aid system is active. The LED is controlled by the parking aid module.

The switch allows the driver to disable the parking aid system when reverse gear is selected or to activate the parking sensors when not in reverse gear.

If a fault exists in the parking aid system, the LED flashes continuously when reverse gear is selected or the driver selects the parking sensors on, using the switch.

CONTROL DIAGRAM

- NOTE: **A** = Hardwired; **N** = Medium speed CAN Bus; **P** = Fiber Optic MOST



Item	Part Number	Description
1	-	Battery
2	-	Power distribution box
3	-	Auxiliary junction box
4	-	Central Junction Box (CJB)
5	-	Transmission Control Module (TCM)
6	-	Anit-lock Brake System (ABS) module
7	-	Trailer module
8	-	Integrated Control Module (ICM)
9	-	Power amplifier
10	-	Front audio speakers
11	-	Rear audio speakers

12	-	Rear parking aid sensor
13	-	Parking aid module
14	-	Parking aid switch
15	-	Front parking aid sensor

PRINCIPLES OF OPERATION

When the parking aid module activates the system, the switch LED is illuminated and a single tone is emitted from the front and rear audio speakers to indicate that the system is operating. The parking aid module then processes signals received from the sensors to determine if there is an object with the detection range of the sensors.

In the combined mode, the sensors emit a series of ultrasonic impulses and then switch to receiver mode to receive the echo reflected by an obstacle within the detection range. The received echo signals are amplified and converted from an analogue signal to a digital signal by the sensor. The digital signal is passed to the parking aid module and compared with pre-programmed data stored in an EEPROM within the module. The module receives this data via the signal line from the sensor and calculates the distance from the object using the elapsed time between the transmitted and received impulse. The duration of the impulse duration is determined by the module, with the sensor controlling the frequency of the impulse output.

In receiver mode, the sensor receives impulses that were emitted by adjacent sensors. The module uses this information to precisely determine the position and distance of the object.

If no objects are detected there are no further warning tones. If an object is detected, repeated audible tones are emitted from either the front or rear audio speakers as appropriate. The time delay between the tones decreases as the distance between the object and the vehicle decreases, until at approximately 250 mm (10 inches), the audible tone becomes continuous.

If, after the initial detection of an object, there is no decrease in distance between the object and the vehicle, the audible warning tones remain constant if the object is detected by a central sensor or stops after 3 seconds if the object is detected by a corner sensor.

The audible tones will stop if the vehicle is moved out of reverse gear. The module continues to monitor the distance and will resume the warning tones if a decrease in distance is detected.

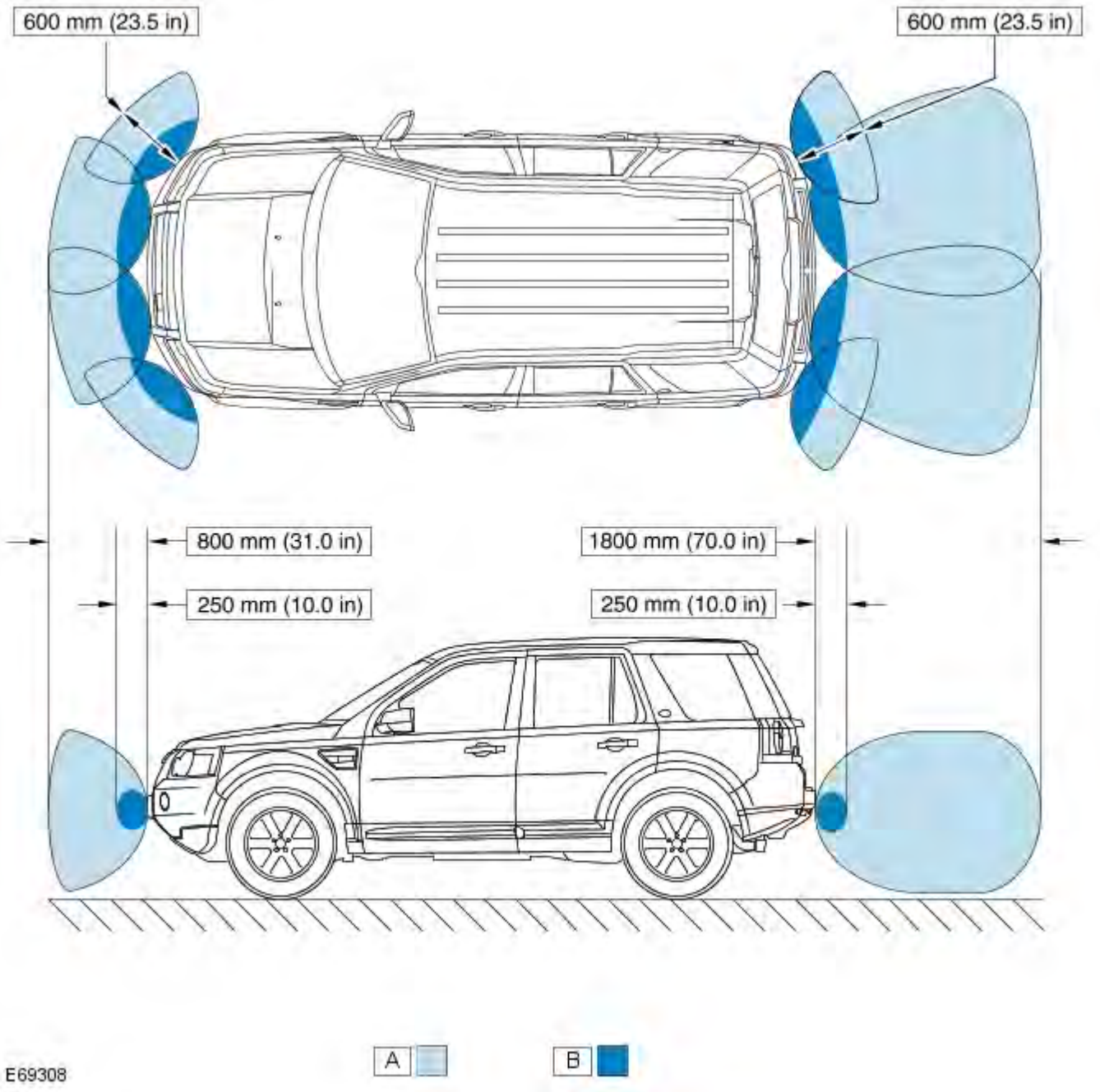
System operation is cancelled when the parking aid switch is pressed or the ignition is switched off. System operation is also cancelled if the vehicle travels more than 50 m (164 ft) or the vehicle forward speed exceeds 30 km/h (19 mph).

The system can detect when a trailer is connected to the vehicle by a message output on the medium speed CAN bus from the trailer module. When the parking aid module detects that a trailer is connected to the vehicle, the rear sensors are disabled to prevent constant warnings due to the close proximity of the trailer.

The parking aid module also incorporates software that compensates for the effects of frost, ice or rain on the sensors. Ice compensation occurs if the ambient temperature, received on a medium speed CAN bus message from the instrument cluster, is less than 6°C (43°F).

Distance Calculation

- NOTE: **A** = Intermittent warning tone; **B** = Continuous warning tone



The maximum detection range for the front sensors is 800 mm (31 inches) for the central sensors and 600 mm (23.5 inches) for the corner sensors.

The maximum detection range for the rear sensors is 1800 mm (70 inches) for the central sensors and 600 mm (23.5 inches).

Published: 11-May-2011

Parking Aid - Parking Aid

Diagnosis and Testing

Principle of Operation

For a detailed description of the parking aid system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Parking Aid (413-13 Parking Aid, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

• NOTE: Particular attention should be paid to the following items where DTCs may not be logged:

- Check for contamination (e.g. dirt, grime, frosting, ice) around the parking aid sensors, if so refer to the parking aid section in the vehicle handbook.
- Check for the correct installation and alignment of the sensors to the bumper.
- Spurious detection of the ground may occur during front system operation on an up-slope, or down slope.

Visual Inspection

Electrical
• Fuse(s) • Relay(s) • Wiring Harness • Electrical connector(s) • Front parking aid sensor(s) and holders • Rear parking aid sensor(s) and holders • Audio system. REFER to: Information and Entertainment System (415-01 Information and Entertainment System, Diagnosis and Testing). • Parking aid switch and LED • Parking aid module

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

• NOTE: When carrying out repair/diagnosis of the system, on removal of the front or rear bumper inspect the sensor connectors to ensure they were correctly latched and check fly leads for signs of chaffing or trapped wires.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Parking Aid Module (PAM) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Parking Aid - Front Inner Parking Aid Sensor

Removal and Installation

Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

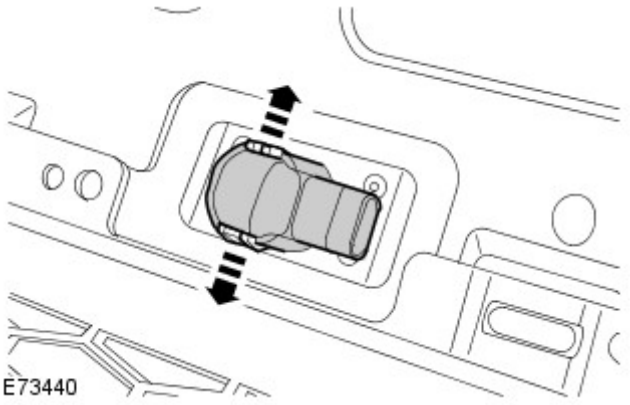
2. Remove the front wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the front bumper cover.

   Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).

4.



Installation

1. **1.** CAUTION: If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.

   To install, reverse the removal procedure.

Published: 11-May-2011

Parking Aid - Front Outer Parking Aid Sensor

Removal and Installation

Removal

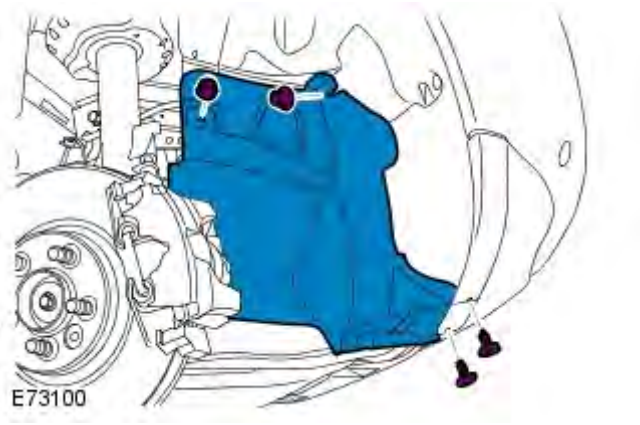
• NOTE: Removal of the RH front outer parking aid sensor will require the removal of the front bumper cover.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

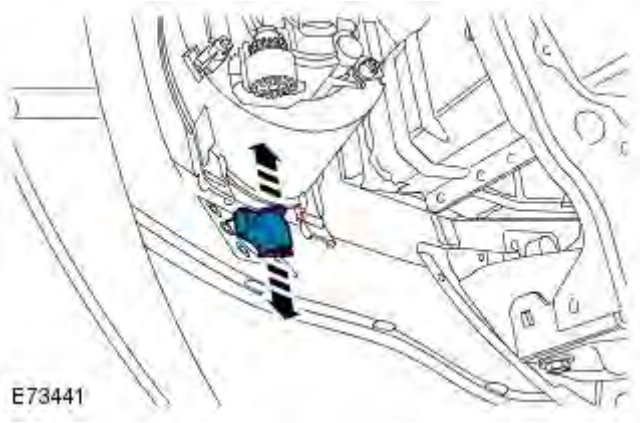
   Raise and support the vehicle.

2. Remove the front wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



3.



4.

Installation

1. **1.** CAUTION: If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.

   To install, reverse the removal procedure.

Published: 11-May-2011

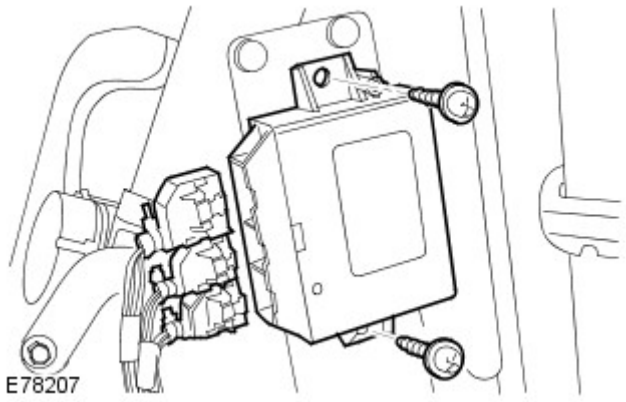
Parking Aid - Parking Aid Module

Removal and Installation

Removal

1. Remove the LH rear quarter trim panel.

   Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. Remove the parking aid module.

Installation

1. To install, reverse the removal procedure.

2. If a new component is to be installed, configure using IDS.

Published: 11-May-2011

Parking Aid - Rear Inner Parking Aid Sensor

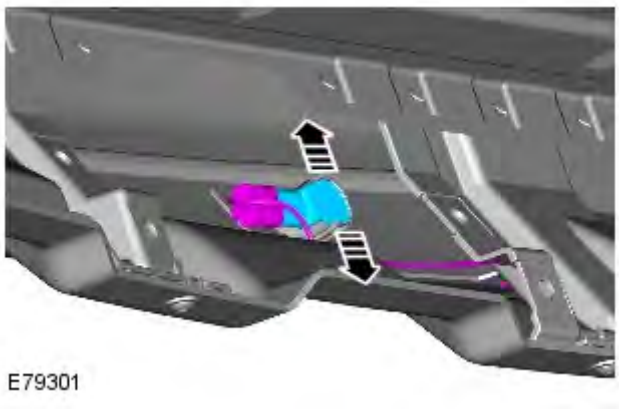
Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2.



Installation

1. **1.** CAUTION: If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.

   To install, reverse the removal procedure.

Published: 11-May-2011

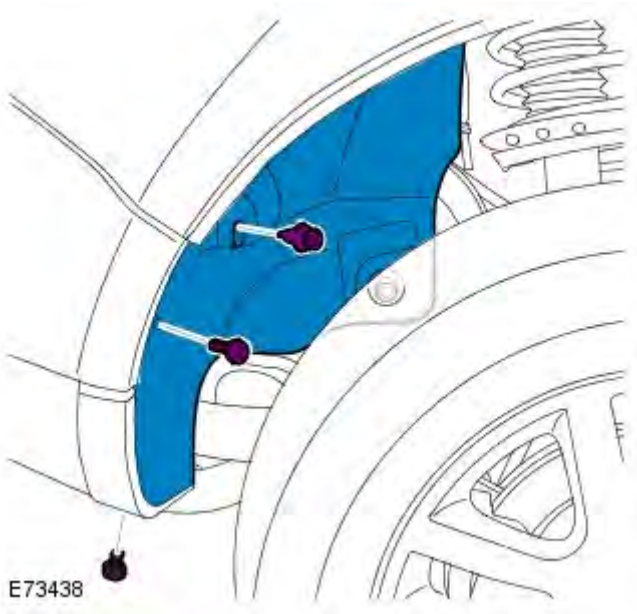
Parking Aid - Rear Outer Parking Aid Sensor

Removal and Installation

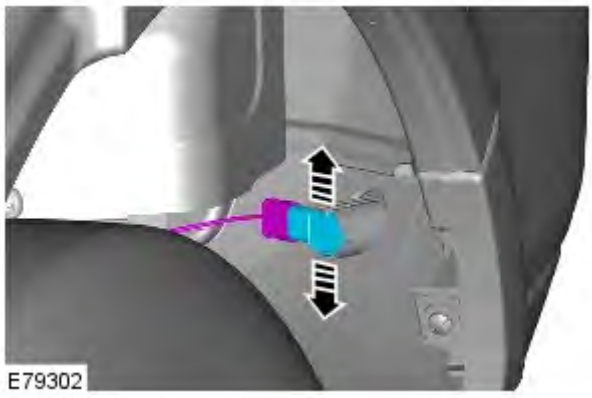
Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.



2. Release the fender splash shield.



3.

Installation

1. **1.** CAUTION: If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.

   To install, reverse the removal procedure.

Published: 11-May-2011

Battery and Charging System - General Information -

Vehicle Jump (Emergency) Starting - Using another vehicle

• WARNINGS:

During normal use, batteries emit explosive hydrogen gas sufficient to cause severe explosions and capable of causing serious injury - keep sparks and naked lights away from the engine compartment.

DO NOT attempt to start the disabled vehicle if it is suspected that the electrolyte in the battery is frozen.

Suitable eye protection must be worn when working in the vicinity of the battery.

Take care when working near rotating parts of the engine.

Prior to attempting to start the disabled vehicle, ensure that the parking brake is applied or suitably chock the wheels. Ensure that 'P' - PARK - Automatic Transmission or NEUTRAL - Manual Transmission is selected.

• CAUTIONS:

Ensure that all electrical loads are switched **OFF** prior to connecting booster cables and disconnect booster cables prior to using electrical equipment.

Ensure that the battery of the **DONOR** vehicle is of 12 volt capacity and that all electrical loads on the disabled vehicle are switched **OFF** prior to connecting booster cables.

Ensure that there is no physical contact between the donor and disabled vehicles other than the booster cables.

• NOTE: **Disconnect battery:** If the remote control handset is not functioning, it will be necessary to manually unlock the vehicle using the key.

Carry out the following operation in the sequence given:
1. Connect one end of the Red **(+)** booster cable to the positive **(+)** battery terminal of the **DISABLED** vehicle.
2. Connect the other end of the Red **(+)** booster cable to the positive **(+)** battery terminal of the **DONOR** vehicle.
3. Connect one end of the Black **(-)** booster cable to the Ground **(-)** battery terminal of the **DONOR** vehicle.
4. Connect the other end of the Black **(-)** booster cable to a good earth point e.g. unpainted metal surface or engine mounting at least 0.5 m (20.0 in) from the battery or fuel lines on the **DISABLED** vehicle.
5. Start the engine of the **DONOR** vehicle and allow it to idle for a few minutes.
6. Start the engine of the **DISABLED** vehicle.
7. Allow engines of both vehicles to idle for a few minutes then switch off the engine of the **DONOR** vehicle.
8. Disconnect the Black **(-)**booster cable from the earth point of the **PREVIOUSLY DISABLED** vehicle.
9. Disconnect the Black **(-)**booster cable from the battery of the **DONOR** vehicle.
10. Disconnect the Red **(+)** booster cable from the battery of the **DONOR** vehicle.
11. Disconnect the Red **(+)** booster cable from the battery of the **PREVIOUSLY DISABLED** vehicle.

Vehicle Jump (Emergency) Starting - Using a Slave Battery/Starting Aid

• WARNINGS:

During normal use, batteries emit explosive hydrogen gas sufficient to cause severe explosions and capable of causing serious injury - keep sparks and naked lights away from the engine compartment.

DO NOT attempt to start the disabled vehicle if it is suspected that the electrolyte in the battery is frozen.

Suitable eye protection must be worn when working in the vicinity of the battery.

Take care when working near rotating parts of the engine.

Prior to attempting to start the disabled vehicle, ensure that the parking brake is applied or suitably chock the wheels. Ensure that 'P' - PARK - Automatic Transmission or NEUTRAL - Manual Transmission is selected.

• CAUTIONS:

Ensure that all electrical loads are switched **OFF** prior to connecting booster cables and disconnect booster cables prior to using electrical equipment.

Ensure that the slave battery/starting aid are of 12 volt capacity and that all electrical loads on the disabled vehicle are switched **OFF** prior to connecting booster cables.

Carry out the following operation in the sequence given:
1. Connect the end of the Red **(+)** booster cable to the positive **(+)** battery terminal vehicle of the vehicle.
2. Connect the end of the Black **(-)** booster cable to a good earth point e.g. unpainted metal surface or engine mounting at least 0.5 m (20.0 in) from the battery or fuel lines on the vehicle.
3. Start the engine of the vehicle and allow it to idle.
4. Disconnect the Black **(-)** booster cable from the earth point of the vehicle.
Disconnect the Red **(+)** booster cable from the battery terminal of the vehicle.

Published: 14-Jul-2011

Battery and Charging System - General Information - Battery Care

Description and Operation

12V LEAD ACID BATTERY CARE MANUAL FOR DEALER / RETAILER USE

1. INTRODUCTION

2. GENERAL RULES FOR BATTERY CARE

3. EQUIPMENT (MINIMUM STANDARD)

4. HEALTH AND SAFETY PRECAUTIONS

5. DETERMINING BATTERY CONDITION

6. BATTERY CHARGING AND MAINTENANCE

7. CHARGING SYSTEM TEST AND DIAGNOSIS

8. VEHICLE QUIESCENT CURRENT TESTING

APPENDIX A: BATTERY TEST PROCESS

APPENDIX B: BATTERY REPORT FORM - IN SERVICE BATTERIES ONLY

1. INTRODUCTION

This publication sets out, for the benefit of dealers / retailers worldwide, requirements for the care and maintenance of batteries, from the vehicles hand-over to the dealer / retailer to the handover to the customer or in the case of a spare part battery from is delivery to the dealer / retailer to its fitment to a customer vehicle.

It applies to all types of 12 volt Lead Acid Batteries used, whether they are conventional flooded technology or Absorbed Glass Mat (AGM) technology and also applies to both Primary and Secondary or Auxiliary Batteries.

The clearly laid out and illustrated sections guide dealers / retailers through each stage of the vehicles or spare parts receipt, storage, pre-delivery and customer hand-over. This publication can be used as a guide to the handling and care of batteries in service. It is vital to appreciate that unless each process is rigorously applied on all vehicles, the customer will receive a vehicle with a battery or a spare part battery which will not provide a satisfactory service life.

It is very important that all tests quoted throughout this publication are adhered to. If they are applied incorrectly batteries could be scrapped unnecessarily. Refer to the battery testing section for detailed information.

It is equally important therefore to note the following key points:

- Most new vehicles leave the factory with either a transit relay installed and/or have a transit mode programmed into the vehicle control modules. The transit relay must be removed and the transit mode disabled (where applicable) using an approved diagnostic system, **NOT MORE THAN 24 HOURS** before the customer takes delivery.
- 12 Volt Lead Acid Batteries rely on internal chemical processes to create a voltage and deliver current. These processes and the internal chemical structure of the battery can be damaged if the battery is allowed to discharge over a number of weeks / months, or is left in a discharged state for a lengthy time period. For this reason the battery must be tested / re-charged if necessary every month, and **MUST BE** re-charged after every three month period of storage. Refer to the vehicle storage manual and update the vehicle history sheet.
- Under no circumstances should the battery be disconnected with the engine running because under these conditions the alternator can give a very high output voltage. This high transient voltage will damage the electronic components in the vehicle. Loose or incomplete battery connections may also cause high transient voltage.
- On vehicles with conventional ignition keys, these must not be left in the ignition lock barrel when the transit relay has been removed, otherwise quiescent current will increase and the battery will discharge more rapidly.
- Two types of Lead acid batteries are used; standard Flooded type and AGM (Absorbed Glass Mat) or VRLA (Valve regulated Lead Acid) types. AGM batteries offer improved resistance to cycling as seen in stop start applications. AGM Batteries are fully sealed and cannot have the electrolyte level topped up.

Dealers and retailers involved in the storage, handling of vehicles and spare parts batteries have a responsibility to ensure that only vehicles and spare parts having a fully satisfactory battery may be processed further through the distribution selling chain.

• NOTE: It is very important that test processes quoted throughout this publication are adhered to.

If they are not adhered to correctly batteries could be scrapped unnecessarily or a battery with an issue remains in use. Refer to the battery testing section for detailed information.

2. GENERAL RULES FOR BATTERY CARE

Frequency of Battery Condition Checks.

Any battery in storage whether it is in a vehicle or in spare parts inventory must have its charge status checked every 30 days as described in Appendix A, and must be recharged every 90 days as described in the "Battery Charging and Maintenance" section of this manual.

Dealer Demonstration Vehicles

Due to the high depth of discharge a dealer demonstration vehicle battery may experience, batteries that are fitted to vehicles used as dealer demonstration vehicles must be connected to a power supply / charger capable of delivering 50 Amps or more whilst the vehicle is being demonstrated and the engine is not running. This will prevent the battery from being damaged from "energy throughput " wear out during a demonstration.

Software Reflash, SDD work or Ignition On related Workshop Activities.

Due to the high electrical current demand and high depth of Discharge that can occur during vehicle software re-flash activities, SDD work or ignition on related work in the workshop, vehicles that are undergoing such activities MUST have the electrical system on the vehicle supported with a power supply / charger / vehicle maintainer capable of delivering 50 Amps or more.

Jump Starting New vehicles Before They Have Been Delivered to the Customer.

- It is the dealer / retailers responsibility to ensure the battery is not allowed to go flat by following the instructions and processes defined in this manual.
- However if circumstances dictate that a new vehicle must be jump started due to a flat battery whilst the vehicle is in the dealer / retailers care, the battery on this vehicle must be replaced with a new one prior to delivery to the customer at the dealer / retailers liability.
- The vehicle should also undergo investigation as to why the battery went flat.
- Do not connect the jump starting cable to the negative (-) terminal of the battery. Always connect to the recommended earthing point. As defined in the owners handbook or service documentation for that vehicle.

Jump Starting or Boost Charging Vehicles in Service

Do not connect the jump starting cable to the negative (-) terminal of the battery. Always connect to the recommended earthing point. As defined in the owners handbook or service documentation for that vehicle.

Charging AGM Batteries

AGM batteries must not be charged with voltages above 14.8 Volts. Doing so will damage them.

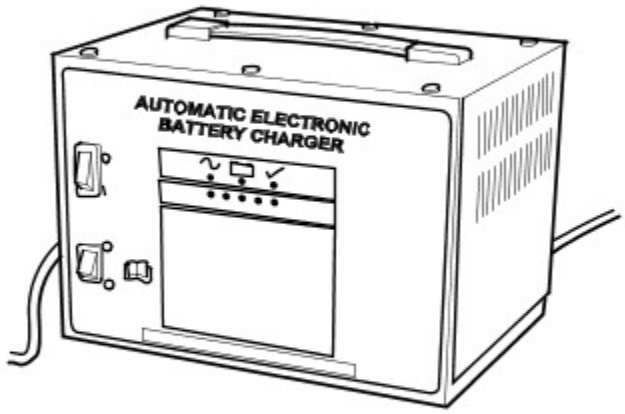
Testing AGM Batteries

Midtronics 393, 394, 493 and 494 testers are not capable of testing AGM batteries. Doing so can give an incorrect result.

When it is necessary to test an AGM battery use the Midtronics EXP1080 tester or the GR1 Diagnostics Charger.

3. EQUIPMENT (MINIMUM STANDARD) (pictures are for illustration only)

Traction Battery Charger (or similar stand-alone charger)



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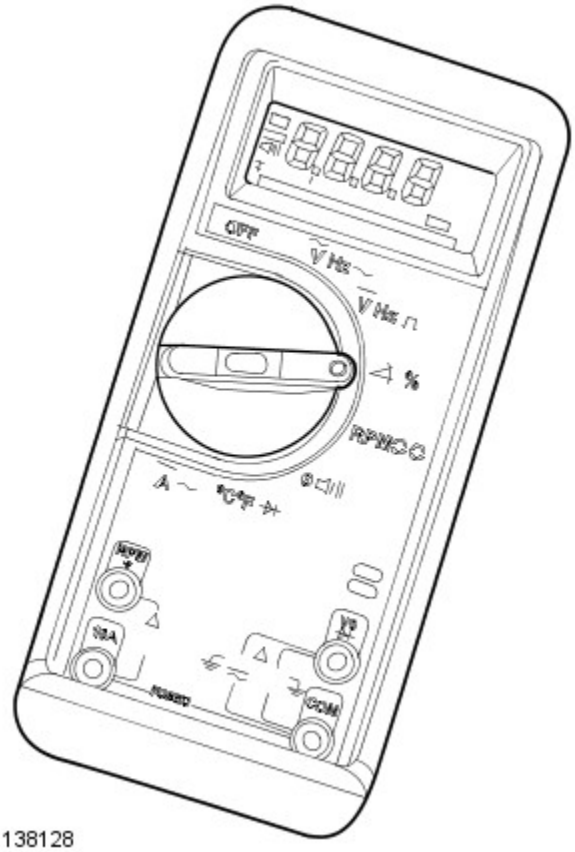
Midtronics EXP1080 Hand-Held Tester

Digital Multi-Meter or Digital Volt-Ohm Meter (DVOM)



Midtronics GR-1 Diagnostic Charger

E138129

4. HEALTH AND SAFETY PRECAUTIONS

• WARNINGS:

BATTERY CELLS CONTAIN SULPHURIC ACID AND EXPLOSIVE MIXTURES OF HYDROGEN AND OXYGEN GASES. IT IS THEREFORE ESSENTIAL THAT THE FOLLOWING SAFETY PRECAUTIONS ARE OBSERVED.

Batteries emit highly explosive hydrogen at all times, particularly during charging. To prevent any potential form of ignition occurring when working in the vicinity of a battery:

- Do not smoke when working near batteries.
- Avoid sparks, short circuits or other sources of ignition in the battery vicinity.
- Switch off current before making or breaking electrical connections.
- Ensure battery charging area is well ventilated.
- Ensure the charger is switched off when: a) connecting to a battery; b) disconnecting from the battery.
- Always disconnect the ground cable from the battery terminal first and reconnect it last.

Batteries contain poisonous and highly corrosive acid. To prevent personal injury, or damage to clothing or the vehicle, the following working practices should be followed when topping up, checking electrolyte specific gravity, removal, refitting or carrying batteries:

- Always wear suitable protective clothing (an apron or similar), safety glasses, a face mask and suitable gloves.
- If acid is spilled or splashed onto clothing or the body, it must be neutralized immediately and then rinsed with clean water. A solution of baking soda or household ammonia and water may be used as a neutralizer.
- In the event of contact with the skin, drench the affected area with water. In the case of contact with the eyes, bathe the affected area with cool clean water for approximately 15 minutes and seek urgent medical attention.
- If battery acid is spilled or splashed on any surface of a vehicle, it should be neutralized and rinsed with clean water.
- Heat is generated when acid is mixed with water. If it becomes necessary to prepare electrolyte of a desired specific gravity, SLOWLY pour the concentrated acid into water (not water into acid), adding small amounts of acid while stirring. Allow the electrolyte to cool if noticeable heat develops. With the exception of lead or lead-lined containers, always use non-metallic receptacles or funnels. Do not store acid in excessively warm locations or in direct sunlight.

Due to their hazardous contents, the disposal of batteries is strictly controlled. When a battery is scrapped, ensure it is disposed of safely, complying with local environmental regulations. If in doubt, contact your local authority for advice on disposal facilities.

5. DETERMINING BATTERY CONDITION

The tools used for determining the condition of the battery will depend upon whether it is installed in a vehicle or in spare parts inventory. Concerning an installed battery, procedures will vary if the vehicle is new, or already in service with a

customer.

• NOTE: The term `New Vehicle' refers to a vehicle at any part of the delivery process from leaving the factory to arriving at a port of entry, dealership, retailer, including any storage facilities en route or a vehicle being stored prior to sale at dealership / retailer.

• NOTE: Midtronics 393, 394. 493 and 494 testers must not be used to test AGM batteries as these testers are not capable of correctly testing AGM batteries and can give an incorrect result. For AGM battery testing use the EXP1080 tester or the GR1 Diagnostics charger.

NEW VEHICLES

A Midtronics tester should be used to assess the condition of the battery for new vehicles. The test results should be recorded on the Storage History Sheet (see Vehicle Storage manual).

Scenario 1 - Dealership / Retailer (Responsibility: Dealer / Retailer)

1. Within 24 hours of arrival at the dealer / retailer proceed as follows:

- Perform a Midtronics battery test (See Appendix A.)
- Carry out the recommended actions accordingly.

2. If the Midtronics result is "Good Battery" the vehicle may be stored.

- For all new vehicles in storage the transit relay MUST be fitted, or the Transit Mode enabled where used. For vehicles without a transit relay or a Transit Mode, the battery negative cable MUST BE DISCONNECTED from the battery.

3. The battery must be tested and/or re-charged every month and MUST be re-charged after every three month period.

4. Record your test results on the Storage History Sheet (see Vehicle Storage Manual) to indicate when a re-charge will be necessary.

Scenario 2 - Delivery to the Customer (Responsibility: Dealer / Retailer)

• NOTE: It is essential that the following actions are conducted in the 24 hours prior to the agreed hand over time:

1. Perform a Midtronics Battery test (See Appendix A).

2. Carry out the recommended actions accordingly.

3. The vehicle should only be released to the customer if Midtronics has tested the battery as "Good Battery"

Spare Part Batteries

Lead acid batteries will, as a result of natural chemical processes, slowly self discharge themselves over a period of time (even when open circuit and no electrical load applied).

In the case of spare parts batteries, a Midtronics tester should be used to assess the condition of new spare parts batteries.

The batteries must be stored such that they cannot get wet and are not in direct sunlight.

Any batteries which are dropped must be scrapped. This applies even if no external damage is apparent.

Scenario 1 - Spare Part Batteries Within Dealer Stock But Not Yet Fitted To A Vehicle (Responsibility: Dealer / Retailer)

1. For a battery in the Dealer parts or in ready to use stock but not yet fitted to a vehicle the following rules must be followed:

- Check the battery condition on receipt by performing a Midtronics battery test (See Appendix A).
- Batteries should only be returned to storage if the Midtronics tester indicates "Good Battery".
- The battery condition should be rechecked every 30 days by performing a Midtronics battery test (See Appendix A).
- If required batteries should be recharged as described in the "Battery Charging and Maintenance" section of this manual.

2. 2 All batteries must be controlled via a FIFO (First In First Out) process to ensure aged batteries are not held and the batteries are not allowed to age unnecessarily.

VEHICLES IN SERVICE

The Midtronics hand-held tester or the Midtronics Diagnostic Charger are the preferred tools to assess battery condition for vehicles in service. The test results should be recorded on the In-Service Battery Report Form (See Appendix B).

Midtronics Testing - In-Service Testing Only

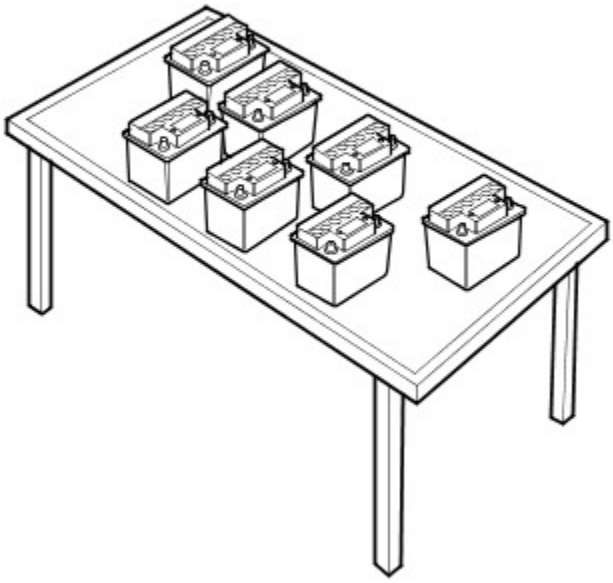
• NOTE: The battery surface charge must be removed before this test in accordance with the procedure in Appendix A. Ensure that the battery terminal connectors are clean. When connecting the Midtronics testing equipment, connect the RED clip to the positive (+) battery terminal first, and then connect the BLACK clip to the negative (-) battery terminal. Rock the clips backward and forward to ensure a good connection to the battery.

1. Perform a Midtronics battery test (See Appendix A).

2. Carry out the recommended actions accordingly.

6. BATTERY CHARGING AND MAINTENANCE

BATTERY CHARGING



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It is essential that a suitably ventilated defined area exists in each dealership / retailer for battery charging. Likewise, an area should be allotted for scrap batteries, and clearly indicated as such. It is recommended that dealers / retailers always have fully charged batteries ready for use. However the battery MUST BE tested and charged if necessary every month, and charged after three months irrespective of any test.

• CAUTIONS:

⚠ Batteries must be re-charged after a maximum of 3 months storage (see Storage History sheet in the New Vehicle Storage Manual).

⚠ It is very important that when charging batteries using the traction charger or other stand-alone chargers that the charger is set for the correct type of battery before charging commences. If the wrong switch is selected the result would be a battery that is not charged fully and / or overheating can occur. Follow the manufacturers operating instructions.

⚠ Do not charge AGM batteries with voltages over 14.8 volts as this will damage the battery.

To bring a serviceable but discharged battery back to a fully charged condition proceed as follows:

- Check and if necessary top-up the battery electrolyte level.
- Charge the battery using the Midtronics Diagnostic Charger (USA) or Traction Charger (all other markets) following the manufacturers operating instructions.

• NOTE: When using the Midtronics Diagnostic Charger, automatic mode must always be used. After charging and analysis, the charger may display 'Top-Off Charging', press STOP to end. Do not stop charging until the current falls to 5A or less, otherwise the battery will not be fully charged.

POST-CHARGE TEST METHODS

New Batteries, Batteries in Storage and In-Service Batteries

The purpose of this test is to ensure that the charging process has fully charged the battery.

• NOTE: IT IS RECOMMENDED THAT THIS TEST IS CONDUCTED AT LEAST 24 HOURS AFTER THE CHARGE CYCLE IS COMPLETED.

CAUTION: DO NOT connect the tester to any other circuit or chassis point.

1. Attach the Midtronics Tester to the battery.

2. Follow the instructions on the tester to test the battery. Ensure the correct battery type and size is selected.

3. Perform the action based on the tester results (see the tester results chart in the Vehicles in Service sub -section of Determining Battery Condition Section).

4. Enter the readings and test code obtained on the In Service Battery Report Form.

• NOTE: Midtronics 393, 394. 493 and 494 testers must not be used to test AGM batteries as these testers are not capable of correctly testing AGM batteries and can give an incorrect result. For AGM battery testing use the EXP1080 tester or the GR1 Diagnostics charger.

BATTERY REPLACEMENT

If it is determined that a battery requires replacement, always refer to the appropriate section of the workshop manual for instructions on removing and installing the battery from the vehicle.

On in service vehicles fitted with a Battery Monitoring System (BMS), the BMS module must be reset following the installation of a new battery. The BMS module reset procedure must be performed using an approved diagnostic system.

CHECK/TOP-UP BATTERY ELECTROLYTE – Only Applicable to certain Flooded Types of Battery.

• WARNINGS:

AGM TECHNOLOGY BATTERIES ARE FULLY SEALED FOR LIFE AND NO ATTEMPT SHOULD BE MADE TO CHECK OR TOP UP THE ELECTROLYTE LEVEL.

BEFORE CHECKING AND TOPPING-UP THE BATTERY ELECTROLYTE, REFER TO THE HEALTH AND SAFETY PRECAUTIONS SECTION.

Check to ensure the battery is of a type suitable for topping up. These types of batteries will have cell plugs visible on the top face of the battery or a removable access panel to allow access to the cells.

On batteries with a clear or opaque case and level marks, check the electrolyte level by visual inspection of the maximum level indicator mark on the battery casing indicating adequate level above the battery separators.

On batteries with black cases, remove the cell plugs or access panel and ensure the electrolyte level is level with the indicator in the cell hole. A flashlight may be required to see the electrolyte level on this type of battery.

CAUTION: **DO NOT** overfill.

If the electrolyte level is low, top-up using distilled water.

Maintenance free and Valve Regulated (AGM) batteries are sealed and therefore cannot be topped up.

CHARGING SYSTEM TEST AND DIAGNOSIS

For all vehicles, refer to the Charging System - Diagnosis and Testing in section 414-00 of the Workshop Manual.

VEHICLE QUIESCENT CURRENT TESTING

• NOTE: On vehicles fitted with a Battery Monitoring System (BMS), the diagnostic routine for quiescent drain testing in the approved diagnostic system should be utilized.

• NOTE: If a customer complains of a vehicle battery that discharges continuously or when left for a prolonged period of time, it is recommended that a quiescent drain test is performed as described below.

• NOTE: The battery drain should be measured using an approved diagnostic system or a Digital Multi-Meter (DVOM).

The vehicle should be in the locked/armed state (for example vehicle alarm fully armed), all doors, engine and luggage compartment lids are open and latched (so as to appear closed from an electrical point of view). The test should take place after the vehicle has entered shutdown mode. The time taken for this to occur after the ignition is switched off varies according to model - Refer to Quiescent Drain in section 414-00 of the Workshop Manual.

• NOTE: When the vehicle is armed, the effect of the security system Light Emitting Diode (LED) flashing is to cause a pulsation in the measured current drain. In this case, either the average current should be taken (using a Digital Multi-Meter (DVOM) with an averaging system) or the current reading taken, ignoring the brief high current peaks.

EQUIPMENT

Approved diagnostic system with current probe or Digital Multi-Meter (DVOM) with current probe.

METHOD OF MEASUREMENT

Using an Approved Diagnostic System

1. Switch off all electrical loads and ensure that the ignition is off.

2. Connect the current probe to the approved diagnostic system.

3. Calibrate the probe.

4. Install a clamp around the battery lead/junction box lead.

5. Go to the Quiescent Current Testing section.

Using a Digital Multi-Meter (DVOM)

• NOTE: Do not use an in-line DVOM to measure the quiescent drain on vehicles fitted with an electronic throttle. The current exceeds the maximum amount the fuse in the DVOM is capable of handling.

1. Switch off all electrical loads and ensure that the ignition is off.

2. Connect the current probe to the DVOM.

3. Calibrate the probe.

4. Install a clamp around the battery lead/junction box lead.

5. Go to the following Quiescent Current Testing section.

QUIESCENT CURRENT TESTING

1. Switch ignition to ‘on’ or select ignition mode in keyless vehicles and switch to ‘off’ (do not crank).

2. Remove key from ignition switch (where applicable).

3. Open and latch all doors, hood and luggage compartment lid.

4. Lock the vehicle using the remote function on the remote handset. (Single lock only to avoid volumetric alarm arming).

5. Remove any other potential electrical drains such as accessories plugged into accessory sockets.

6. Record the amperage readings after the shutdown period. The model specific Amperage readings for quiescent drain are referenced in Quiescent Drain in section 414-00 of the Workshop Manual

7. Record the final reading on the battery report form Appendix B.

• NOTE: The preferred method of testing following an excessive current consumption figure is to use a current probe around individual junction box leads to the various suspected circuits to identify a potential cause. This is in preference to the old method of removing fuses for the following reasons:

- Many modules take a considerable time to power down. Each time a fuse is removed and re-fitted, the quiescent drain current may take an extended period of time to return to normal (typically up to 45 minutes).
- The drain may be caused by a module remaining active and preventing the quiescent drain from reducing to normal levels.
- The drain may be caused by a relay winding that is activated. Pulling the fuse can allow this to ‘reset’ and the drain will be lost and go un-diagnosed.

APPENDIX A BATTERY TEST PROCESS

It is recommended that this test is conducted at least 24 hours after the vehicle engine has been run or the battery charged to avoid the need of surface charge removal or if this time constraint is unacceptable due to circumstances, then conduct the charge strip removal process.

Part 1 - Surface Charge Removal

• NOTE: Before carrying out a battery test you must ensure that there is no battery surface charge present.

• NOTE: The battery may be tested either on a bench or on the vehicle.

- In the case of on-vehicle testing, the battery must be isolated from the vehicle by removal of the battery negative (-) cable from the battery terminal before the measurement is taken unless the vehicle has a transit relay fitted or is in transit mode.

A vehicle which has had its battery charged or been driven in a 24 hour period before the test, must have its surface charge removed using one of the following methods:

1. If 24 hours have passed since the last time the engine was run or the battery charged, proceed to `Part 2 - Battery Test'.

2. Turn on the ignition. Switch on the headlamps on high beam for a minimum 3 minutes.

3. Switch off the headlamps. For vehicles tested after the transit relay has been removed, disconnect the battery by removal of the negative (-) cable. Vehicles with a transit relay fitted or with a low current transport mode enabled do not need to have the battery disconnected.

4. Wait a maximum of 5 minutes before recording test results for any battery measurements.

Part 2 - Battery Test

• NOTE: The battery surface charge must be removed before this test in accordance with the procedure in Part 1 above. Ensure that the battery terminal connectors are clean. When connecting the Midtronics testing equipment, connect the RED clip to the positive (+) battery terminal first, and then connect the BLACK clip to the negative (-) battery terminal. Rock the clips backward and forward to ensure a good connection to the battery.

• NOTE: Midtronics 393, 394. 493 and 494 testers must not be used to test AGM batteries as these testers are not capable of correctly testing AGM batteries and can give an incorrect result. For AGM battery testing use the EXP1080 tester or the GR1 Diagnostics charger.

CAUTION: **DO NOT** connect the tester to any other circuit or chassis point other than the battery negative terminal.

1. Attach the Midtronics tester to the battery.

2. Follow the instructions on the tester to test the battery. Ensure the correct battery type and size is selected.

3. Perform the action based on the tester results (see table below).

4. Enter the readings and test code obtained on the Battery Report Form (Appendix B) or equivalent which records as a minimum the technician's name, Vehicle Identification Number (VIN), Date of check, Midtronics code and Battery Voltage from the Midtronics tester.

At the end of the test, the battery negative (-) cable should be re-attached to the battery terminal.

TESTER RESULTS	ACTION
GOOD BATTERY	Return to service.
GOOD RE-CHARGE	Fully charge battery and return to service.
CHARGE AND RE-TEST	Fully charge battery. Remove surface charge. Re-test battery. If same result replace battery.
REPLACE BATTERY OR BAD CELL BATTERY	Verify surface charge removed. Disconnect battery from vehicle and re-test. If result repeats after surface charge removal, replace battery. **DO NOT RECHARGE**.
UNABLE TO DO TEST	Disconnect battery from vehicle and re-test.

APPENDIX B : BATTERY REPORT FORM - IN SERVICE BATTERIES ONLY

• NOTE: Fields marked with * are mandatory and must be completed.

General Information	YES / NO		YES / NO
Customer Name:		Dealer/Retailer Code:	*
Repair Order Number:	*	Battery Date Code:	*
Repair Order Date:	*	Number of Times Battery Charged:	*
Repair Order Date:		Technicians Name:	*
Vehicle Identification Number (VIN):	*	Technicians Signature:	*
Give a detailed description of the symptoms experienced by the customer (attach a separate sheet if necessary)			
-			
-			
-			
-			
-			
-			

General Information	YES / NO		YES / NO	
Diagnostics (Battery Testing)				
1: Loose battery clamps	Yes	*	No	*
2: Loose hold down clamps	Yes		No	
3: Corroded terminal posts	Yes	*	No	*
4: Physical damage/leaks	Yes		No	
5: Low electrolyte	Yes	*	No	*
6: FEAD belt tension	OK	*	Not OK	*
7: Surface charge removed	Yes	*	No	*
8: Voltage (appendix A)	Yes	*	No	*
9: Quiescent Drain	mA	*		
10: Vent tube correctly installed	Yes		No	
11: Midtronics test				
Code before charging	*			
If Midtronics indicates that the battery needs re-charging, charge the battery for 24 hours				
Code after charge	*			
Result after charge	*			
If "good and re-charge" charge the battery for an additional 24 hours.				
If "charge and re-test" for both before and after 24 hours charge renew the battery				
Only renew the battery if "renew battery", "bad cell" or charge and re-test has been displayed twice.				
Comments				
-				
-				
-				
-				
-				

Published: 20-Oct-2011

Battery and Charging System - General Information - Quiescent Drain

Description and Operation

QUIESCENT DRAIN - TYPICAL VALUES

• NOTE: The quiescent drain after the initial shutdown period should not exceed the value shown in the table.

Land Rover Quiescent Drain Values

MODEL	SHUT DOWN PERIOD (minutes)	TYPICAL VALUES BATTERY DRAIN (mA)
Range Rover (LM) - Up to 2009MY	30	16.0 - 18.0
Range Rover (LM) - From 2010MY	20 (after lock/arm condition) [2]	<30
	33 (unlocked)	<30
Range Rover Sport (LS) - Up to 2007MY	20	<22
Range Rover Sport (LS) - From 2007MY to 2010MY	30	<25
Range Rover Sport (LS) - From 2010MY	3 (after lock/arm condition) [2]	<30
	33 (unlocked)	<30
Range Rover Evoque (LV) - From 2012MY	20 (after lock and arm condition)	<20
Discovery 3/LR3 (LA) - Up to 2007MY	20	<22
Discovery 3/LR3 (LA) - From 2007MY to 2010MY	30	<25
Discovery 4/LR4 (LA) - From 2010MY	3 (after lock/arm condition) [2]	<30
	33 (unlocked)	<30
Freelander 2/LR2 (LF) - From 2007MY	35 (single locked or unlocked)	<23.6
	12 (double locked)	<23.6
Freelander (LN) - Up to 2007MY	10	24-25 - without Becker Navigation system
	10	27-28 - with Becker Navigation system
Defender (LD) - 1998MY to 2007MY	30	<21
Defender (LD) - from 2007MY	<30	<30
Discovery Series 2 (LT)	30	<30

• NOTE:

1. The total current drain will be higher if certain approved accessories are fitted (for example: tracker, trailer module, etc.)

2. Applies to vehicles without Tire Pressure Monitoring System (TPMS). Vehicle shut-down period with TPMS is approximately 15 minutes.

Published: 05-Dec-2011

Battery and Charging System - General Information - Charging System

Diagnosis and Testing

Principles of Operation

For a detailed description of the charging system, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Battery Care (414-00, Description and Operation),
Battery and Cables (414-01, Description and Operation),
Generator - ID4 2.4L Diesel (414-02, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

• NOTE: Check the vehicle battery condition and state of charge before condemning any of the charging system components. For additional information, refer to the battery care manual.

For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to section 100-00. REFER to: (100-00)

Diagnostic Trouble Code (DTC) Index - DTC: Engine Control Module (PCM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Instrument Cluster (IPC) (Description and Operation).

Visual Inspection

Mechanical	Electrical
• Generator • Drive belt • Drive belt tensioner • Generator pulley • Check the security of the generator fixings	• Generator • Battery • Mega-fuse • Engine/generator ground connection • Harness(s) • Electrical connector(s) • Engine Control Module (ECM) • Central junction box (Freelander 2 only)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Symptom	Possible Cause	Action
Charge warning lamp does not illuminate	• Warning lamp/circuit - fault • Generator - internal fault • CAN Bus - circuit fault • Engine control module - internal fault	• Check the warning lamp function with the ignition on and the engine off • Repair the circuit as necessary • Check for DTCs indicating a generator, CAN or engine control module fault
Charge warning lamp stays on/battery discharges	• Accessory drive belt - fault • Generator pulley slipping on shaft • Generator - internal	• Check the battery and generator cables • Refer to the electrical guides • Check for DTCs indicating a generator fault • Check the accessory drive belt condition and tension

Symptom	Possible Cause	Action
	fault • Battery cable - fault • CAN Bus - circuit fault • Engine control module internal fault • Central junction box	• Check that the pulley does not rotate independently of the generator • Check for DTCs indicating a CAN, central junction box or engine control module fault
Charge warning lamp intermittent	• Accessory drive belt slipping • Battery cable - fault • Generator - circuit fault • Generator - internal fault • CAN Bus - circuit fault	• NOTE: Use of a power pack or boost charger may bring the warning lamp on until disconnected • Check the accessory drive belt condition and tension • Check the battery and generator cables refer to the electrical guides • Check for DTCs indicating a generator or CAN circuit fault
Battery discharges without the charge warning lamp staying on	• Battery - fault • Battery quiescent drain • Intermittent generator - fault	• Check the battery condition • Check for battery quiescent drain • Check for DTCs indicating a generator fault • If no other reason for discharge can be found, check the circuit. Refer to the electrical guides
Noise (mechanical)	• Accessory drive belt slipping	• Check the accessory drive belt condition and tension • Disconnect the accessory drive belt and check that the generator rotates freely

Test Procedure

PINPOINT TEST A : BOSCH NON-BMS GENERATOR DIAGNOSTIC FLOW CHART	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: MIDTRONICS BATTERY TEST	
• NOTE: The battery must be fully charged and any battery defects rectified before continuing with generator diagnosis	
• NOTE: The voltmeter must display readings to three decimal places (i.e. 0.001V)	
• NOTE: **Ignition on** is position 2 on a keyed ignition system	
• NOTE: **Ignition on** is two short presses of the start button (power mode 6) with keyless ignition system	
	1 Using a Midtronics hand held tester or the Midtronics GR-1 diagnostic charger, carry out the "Midtronics battery test" as detailed in the battery care manual. REFER to: Battery Care (414-00, Description and Operation).
	2 Record battery diagnostic result on the provided form
	Does the battery pass the "Midtronics battery test"? **Yes** GO to B1. **No** Rectify any battery defects before continuing with generator diagnosis GO to Pinpoint Test B.

PINPOINT TEST B : BOSCH NON-BMS GENERATOR DIAGNOSTIC FLOW CHART	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: GENERATOR OUTPUT	
• NOTE: Freelander 2 = The heated rear screen is timed to operate for 12 minutes	
• NOTE: Defender = The heated rear screen is timed to operate for 8 minutes	
	1 Connect a voltmeter to the vehicle battery
	2 Switch ignition state to on (engine off)
	3 Turn off all electrical loads e.g. (blower, radio, interior lights etc.)
	4 Start the engine, switch on the heated rear screen • Ensure the heated rear screen is **on** (see note above) and that the air conditioning system is **off**.
	5 Wait 90 seconds
	6 Record the battery voltage **(V1)** shown on the multimeter
	Does battery voltage **(V1) = 14.8 volts** or **greater** at idle? **Yes** Install a new generator. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component **No** GO to B2.
B2: BATTERY VOLTAGE AT IDLE	
	1 Using battery voltage reading **(V1)**
	Does battery voltage **(V1) = 13 volts** or **greater** at idle **(But less than 14.8 volts)**? **Yes** GO to B3. **No** GO to Pinpoint Test C.
B3: BATTERY WARNING LAMP	
	1 The battery voltage is **(V1) = 13 volts** or **greater** at idle **(but less than 14.8 volts)**

	Is the battery warning lamp illuminated? **Yes** GO to Pinpoint Test C. **No** The generator output is within the expected range, **Do not replace the generator**. If customer concern is still evident contact dealer technical support

PINPOINT TEST C : BOSCH NON-BMS GENERATOR DIAGNOSTIC FLOW CHART	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CIRCUIT CHECKS	
• NOTE: Freelander 2 = Charge warning lamp is driven by the central junction box (from the powertrain control module) to the instrument panel cluster via the CAN bus	
• NOTE: Defender = Charge warning lamp is driven by the powertrain control module to the instrument panel cluster via the CAN bus	
	1 **Freelander 2** = Refer to the electrical circuit diagrams and check the (LIN) circuit between the generator and the engine control module for short circuit to ground, short circuit to power, open circuit, high resistance faults
	2 **Defender** = Refer to the electrical circuit diagrams and check the (D+ and ALTMON) circuits between the generator and the engine control module for short circuit to ground, short circuit to power, open circuit, high resistance faults
	Are any circuit faults evident? **Yes** Repair the circuit as required GO to Pinpoint Test B. **No** GO to Pinpoint Test D.

PINPOINT TEST D : BOSCH NON-BMS GENERATOR DIAGNOSTIC FLOW CHART	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CIRCUIT CHECKS 1	
• NOTE: Freelander 2 = The heated rear screen is timed to operate for 12 minutes	
• NOTE: Defender = The heated rear screen is timed to operate for 8 minutes	
	1 Connect a voltmeter to the vehicle battery
	2 Switch ignition state to on (engine off)
	3 Turn off all electrical loads e.g. (blower, radio, interior lights etc.)
	4 Start the engine, switch on the heated rear screen • Ensure the heated rear screen is **on** (see note above) and that the air conditioning system is **off**.
	5 Voltage measurement • Measure the voltage drop between the generator body and battery negative terminal and record the value **(V2)**
	Does the voltage drop value **(V2) = less than 0.3 Volts ?** **Yes** GO to D2. **No** Switch off engine. Circuit check. Refer to the electrical circuit diagrams, check the **generator body** and **battery negative cables** for loose or corroded connections. Repair any circuit faults, retest the generator GO to Pinpoint Test B.
D2: CIRCUIT CHECKS 2	
	1 Voltage measurements • Measure the voltage drop between the generator **B+ terminal** and **battery positive terminal** and record value **(V3)**
	Does the voltage drop value **(V3) = less than 0.3 Volts ?** **Yes** Install a new generator. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component **No** Switch off engine. Circuit check. Refer to the electrical circuit diagrams check the generator **B+ terminal** and **positive battery cables** for loose or corroded connections. Repair any circuit faults, retest the generator GO to Pinpoint Test B.

Published: 11-May-2011

Battery, Mounting and Cables -

General Specification

Item	Specification
Battery - All models:	
Type	Exide H7
Capacity	80Ah/700CCA
Reserve capacity	125 minutes

Battery Disconnect/Connect

CAUTION: The vehicle status and battery condition must be established before attempting battery disconnect/connect. Reference must be then made to the following table to establish the relevant procedure to be followed.

• NOTE: Vehicles fitted with a fuel fired booster heater will require a 5 minute wait before telestart function will operate. Cycle the ignition off->on->off. Wait 5 minutes to allow fuel fired booster heater to store vehicle configuration parameters.

Vehicle status	Battery charged	Battery discharged
	Procedure	Procedure
Engine running	1	
Vehicle powered down, locked and alarmed	2	3
Vehicle unlocked	4	5

Procedure 1

Disconnect battery	Connect battery
1. Apply parking brake or alternatively, chock wheels	**1.** Ensure that all electrical loads are switched **OFF**
2. Switch off ignition and remove the remote control.	**2.** Connect battery leads - GROUND lead last
3. Wait 2 minutes for engine management system to 'power down'	**3.** Switch on ignition
4. Open the hood	**4.** Reset radio station preset buttons.
5. Disconnect battery - GROUND lead first	**5.** Reset clock
	6. Reset electric window one-touch facility. Power window up to hard stop, release switch, reapply and hold for 1 second (relay in door will click). Lower window to stop, reapply and hold for one second. One touch should now work

Procedure 2

Disconnect battery	Connect battery
1. Unlock the vehicle and disarm the alarm using the remote control	**1.** Ensure that all electrical loads are switched **OFF**
2. Apply parking brake or alternatively, chock wheels	**2.** Connect battery leads - GROUND lead last
3. Wait 2 minutes for engine management system to 'power down'	**3.** Switch on ignition
4. Open the hood	**4.** Reset radio station preset buttons.
5. Disconnect battery - GROUND lead first	**5.** Reset clock
	6. Reset electric window one-touch facility. Power window up to hard stop, release switch, reapply and hold for 1 second (relay in door will click). Lower window to stop, reapply and hold for one second. One touch should now work

• NOTE: **1. Disconnect battery -** If the remote control is not functioning, it will be necessary to manually unlock the vehicle using the key.

Procedure 3

Disconnect battery	Connect battery
1. Unlock the vehicle from the LH front door using the key	**1.** Ensure that all electrical loads are switched **OFF**
2. Enter the vehicle, and dock the remote control to silence the alarm.	**2.** Connect battery leads - GROUND lead last
3. Remove the remote control and wait 2 minutes for engine management system to 'power down'	**3.** Switch on ignition
4. Open the hood	**4.** Reset radio station preset buttons.
5. Disconnect battery - GROUND lead first	**5.** Reset clock
	6. Reset electric window one-touch facility. Power window up to hard stop, release switch, reapply and hold for 1 second (relay in door will click). Lower window to stop, reapply and hold for one second. One touch should now work

• NOTE: **1. Connect battery -** If there is insufficient capacity in the battery to disarm the alarm, the alarm may sound on reconnection of the battery - Step 2 will disarm the alarm

Procedure 4

Disconnect battery	Connect battery

1. Apply parking brake or alternatively, chock wheels	**1.** Ensure that all electrical loads are switched **OFF**
2. Open the hood	**2.** Connect battery leads - GROUND lead last
3. Disconnect battery - GROUND lead first	**3.** Switch on ignition
	4. Reset radio station preset buttons.
	5. Reset clock
	6. Reset electric window one-touch facility. Power window up to hard stop, release switch, reapply and hold for 1 second (relay in door will click). Lower window to stop, reapply and hold for one second. One touch should now work

Procedure 5

Disconnect battery	**Connect battery**
1. Apply parking brake or alternatively, chock wheels	**1.** Ensure that all electrical loads are switched **OFF**
2. Open the hood	**2.** Connect battery leads - GROUND lead last
3. Disconnect battery - GROUND lead first	**3.** Switch on ignition
	4. Reset radio station preset buttons.
	5. Reset clock
	6. Reset electric window one-touch facility. Power window up to hard stop, release switch, reapply and hold for 1 second (relay in door will click). Lower window to stop, reapply and hold for one second. One touch should now work

Torque Specifications

Description	Nm	lb-ft
Battery tray to support bracket	10	7
Battery terminal nuts	10	7
Battery support bracket to body:		
M8 nut	24	18
M8 bolt	24	18

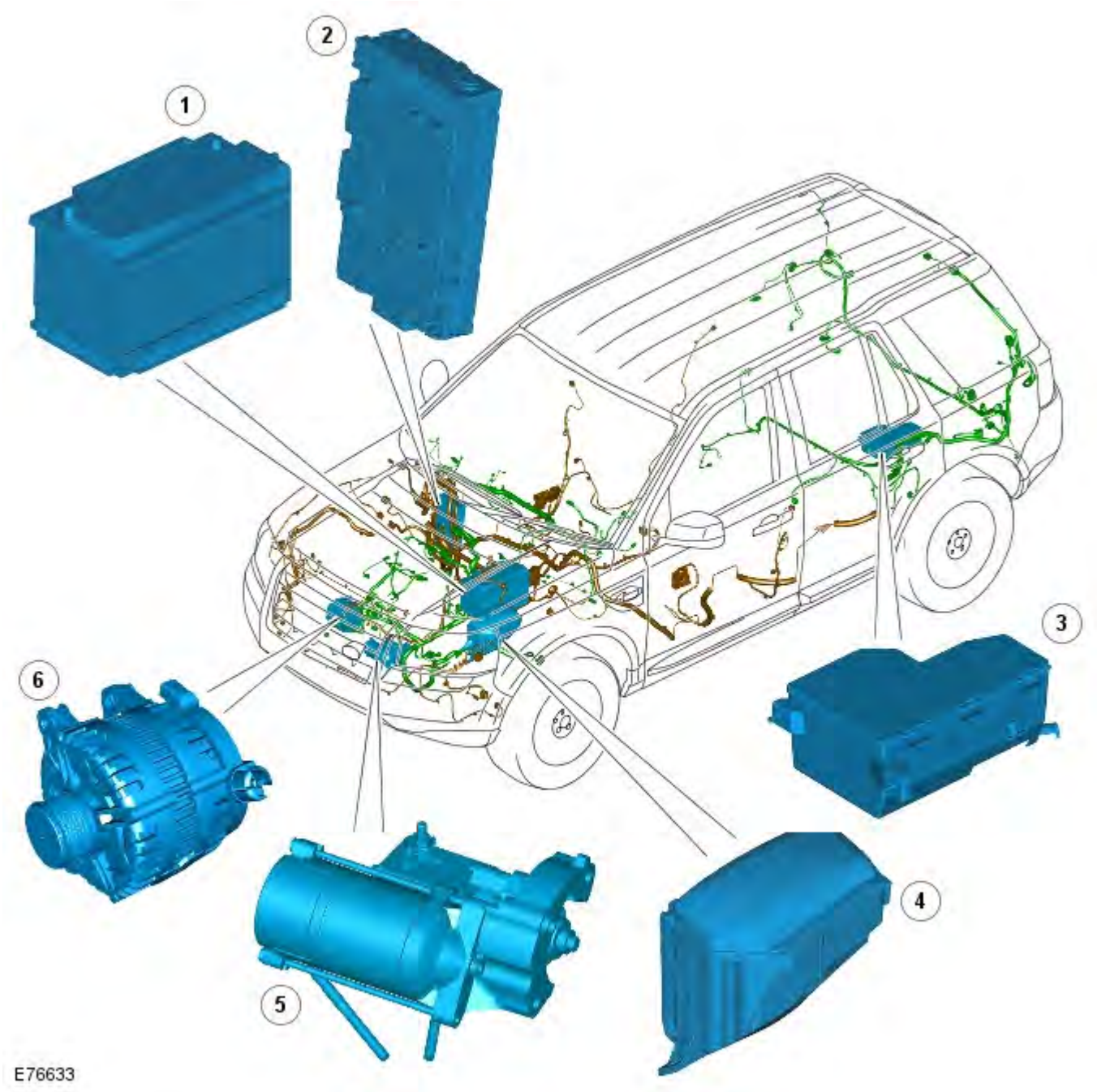
Published: 11-May-2011

Battery, Mounting and Cables - Battery and Cables

Description and Operation

COMPONENT LOCATION

- NOTE: TD4 shown, i6 similar



Item	Part Number	Description
1	-	Battery
2	-	Central Junction Box (CJB)
3	-	Auxiliary Junction Box (AJB)
4	-	Battery Junction Box (BJB)
5	-	Starter motor
6	-	Generator

OVERVIEW

The battery is located behind a cover on the Left Hand (LH) side of the engine compartment. The battery sits in a tray and is secured in position with a clamp plate and bolt assembly. The battery supplies electrical power to the starter motor, generator and BJB.

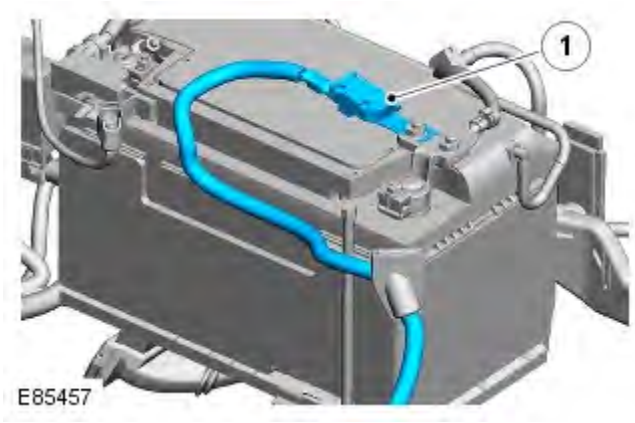
The BJB is mounted adjacent the LH front suspension turret. The BJB contains fusible links, blade and J-case fuses, and relays to distribute electrical power to various vehicle systems and junction boxes.

• NOTE: The fusible links are mounted on the inboard side of the BJB behind a series of removable covers.

The CJB is mounted behind the glovebox and receives its main power supply from the BJB. In addition to containing blade fuses, the CJB is the main controller for a number of vehicle systems. These functions are outlined in the relevant sections of this manual.

The AJB is located beneath the luggage compartment carpet, adjacent the spare wheel well. The AJB is a modular design, and comprises up to 3 individual elements depending on vehicle specification. The AJB contains blade and J-case fuses, and relays to distribute electrical power to systems used at the rear of the vehicle. The AJB receives its main power supply from the BJB.

Starter Fuse



Item	Part Number	Description
1	-	Starter fuse

Incorporated in the cable between the battery and the starter motor/generator is a CAL3 starter fuse. The fuse is mounted adjacent the battery positive terminal and is integral with the cable assembly. In the event of fuse failure, the complete cable assembly must be replaced.

Wire Color Codes

New wire color codes have been introduced in the Electrical Circuit Diagrams. These new codes are shown in the table below.

Color	Code
Black	BK
Blue	BU
Brown	BN
Green	GN
Grey	GY
Orange	OG
Red	RD
Violet	VT
White	WH
Yellow	YE

Tracer wire color codes are separated from the main wire color code by a hyphen, thus BU-RD equates to a blue wire with a red tracer. For more information, refer to the Electrical Circuit Diagrams and the Electrical Library.

POWER MODES

The CJB controls the power supplies for the various vehicle functions. There are 9 power modes available which are used by various systems to determine the operating condition of the vehicle. Only 3 of these modes will be noticeable to the driver and technicians as follows:

- Power mode 4 - Accessory
- Power mode 6 - Ignition
- Power mode 9 - Engine crank.

Transport Mode

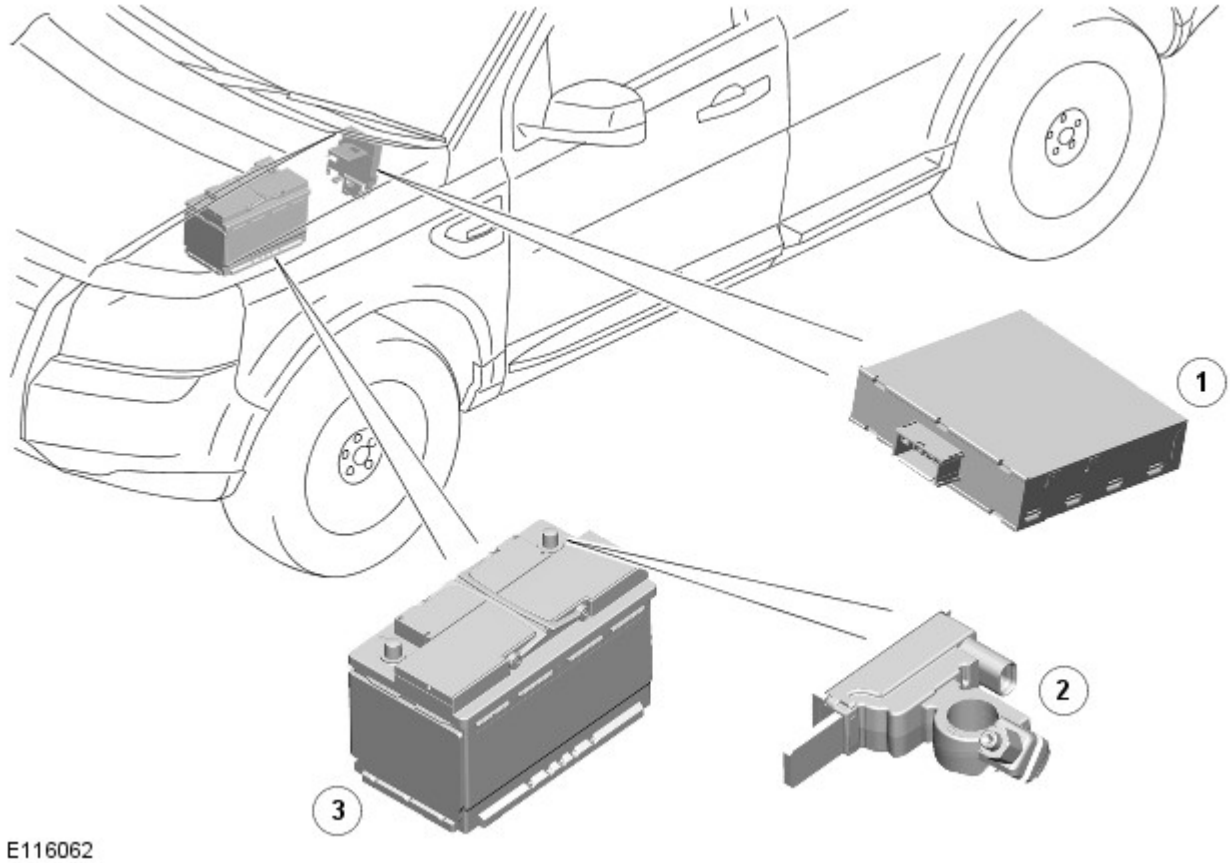
All new vehicles will be delivered from the factory in transport mode. Transport mode replaces the traditional transit relay and inhibits a number of electrical systems and features to eliminate quiescent drain from the battery during delivery. When the vehicle is in transport mode 'transp' will be displayed in the instrument cluster odometer.

To remove the vehicle from transport mode, the Land Rover approved diagnostic system must be connected during the Pre-Delivery Inspection (PDI). For more information, refer to the PDI manual.

Stop/Start Vehicles - From 2010 MY

Component Location

The TD4_e is the first Land Rover fitted with an intelligent ‘Stop/Start’ system; the following components have been introduced to support the Stop/Start vehicle.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).



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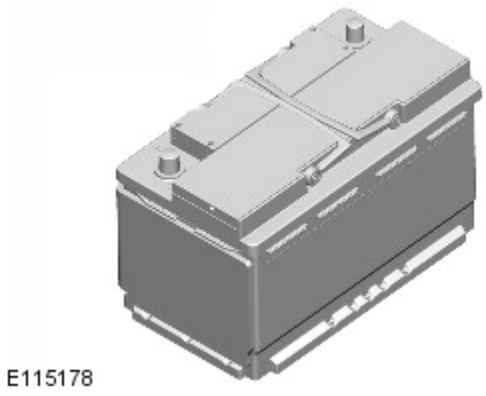
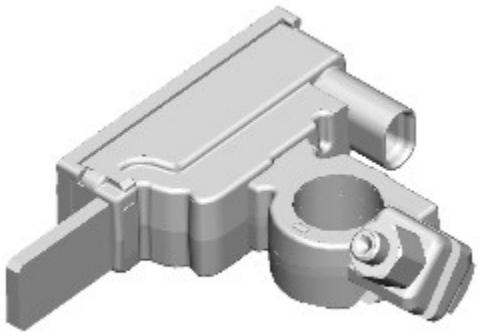
Item	Part Number	Description
1	-	Voltage quality module
2	-	Battery monitoring module
3	-	Absorption glass mat battery

Absorption Glass Mat Battery


E115178

To counteract the extreme power consumption of a Stop/Start system, a high-performance battery based on Absorption Glass Mat technology has been introduced. The battery owes its superiority over a conventional battery to the 'absorbent glass mat' which is a fine fibreglass mat compressed between the lead plates.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

Battery Monitoring System



E115177

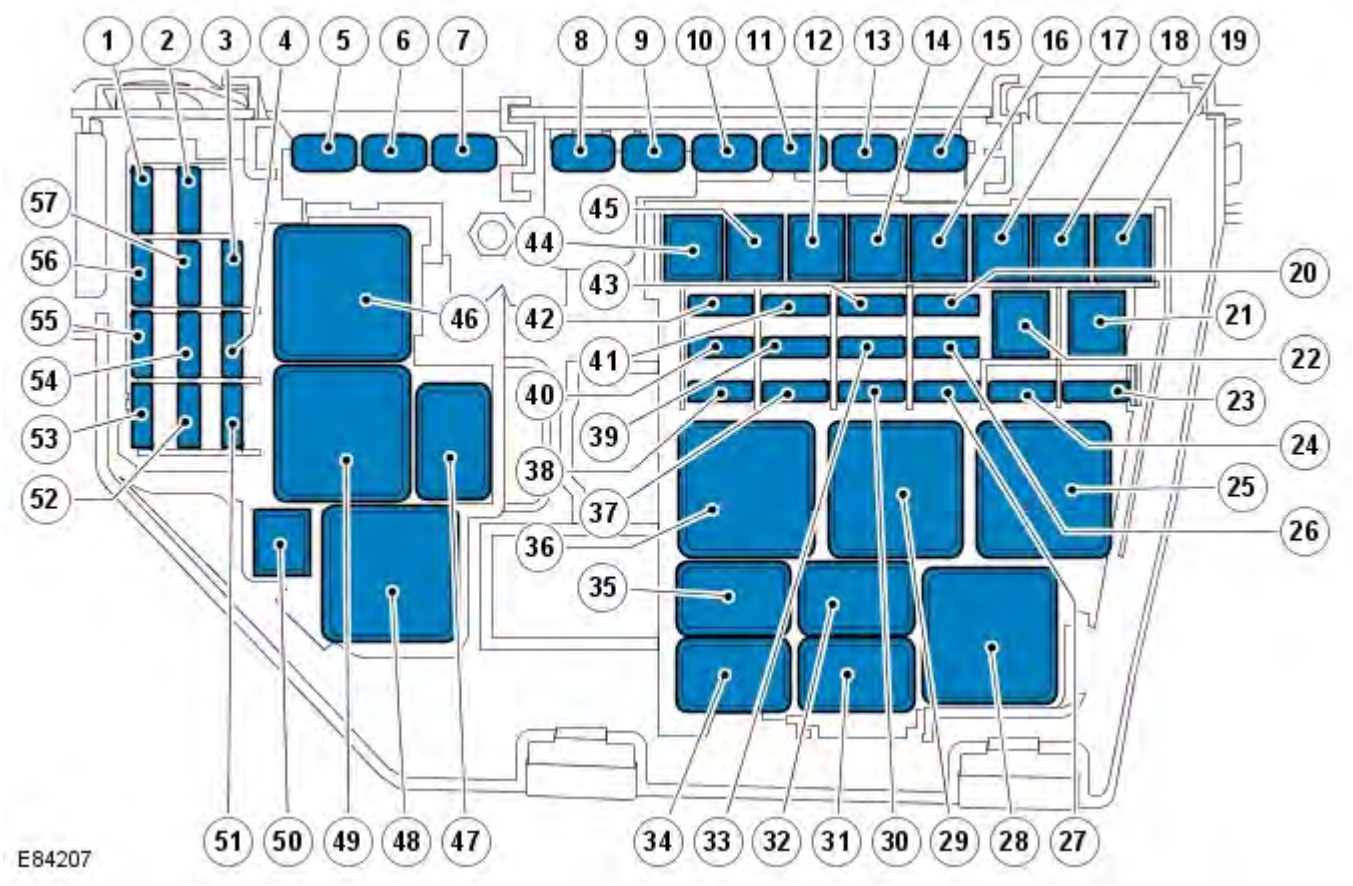
Optimal battery health is a fundamental factor in the correct operation of the Stop/Start system, therefore to calculate and communicate the battery status a Battery Monitoring System (BMS) module is introduced.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

Voltage Quality Module

E115176

During an engine Stop/Start cycle the Voltage Quality Module (VQM) maintains the vehicle’s electrical systems by supplying a support voltage around the vehicle's electronic components during an engine restart. This allows crucial vehicle systems to continue uninterrupted when there is a sudden draw of current from the battery.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

BATTERY JUNCTION BOX



Relays

Name	Item Number	Vehicle	Description
Relay R1	46	All	Starter motor
Relay R2	49	TD4	BJB fuses 6, 8, 9, 11, 12 and 14
Relay R2	49	i6	BJB fuses 1, 6, 8, 9, 11 and 12
Relay R3	47	All	Air Conditioning (A/C) compressor clutch
Relay R4	48	TD4	Glow plugs, BJB fuse 1
Relay R5	36	All	BJB fuses 39 (climate control) and 45 (cigar lighter/accessory socket)
Relay R6	29	All	BJB fuses 34 and 35 (heated windshield)
Relay R7	25	All	BJB fuses 37, 38, 41, 42, 43 and 44
Relay R8	35	All	Windshield wiper motor (fast/slow speed)
Relay R9	32	All	Headlamp washer pump
Relay R10	28	All	LH horn, Right Hand (RH) horn
Relay R11	34	All	BJB relay 8 (windshield wipers)
Relay R12	31	All	Headlamp washer pump

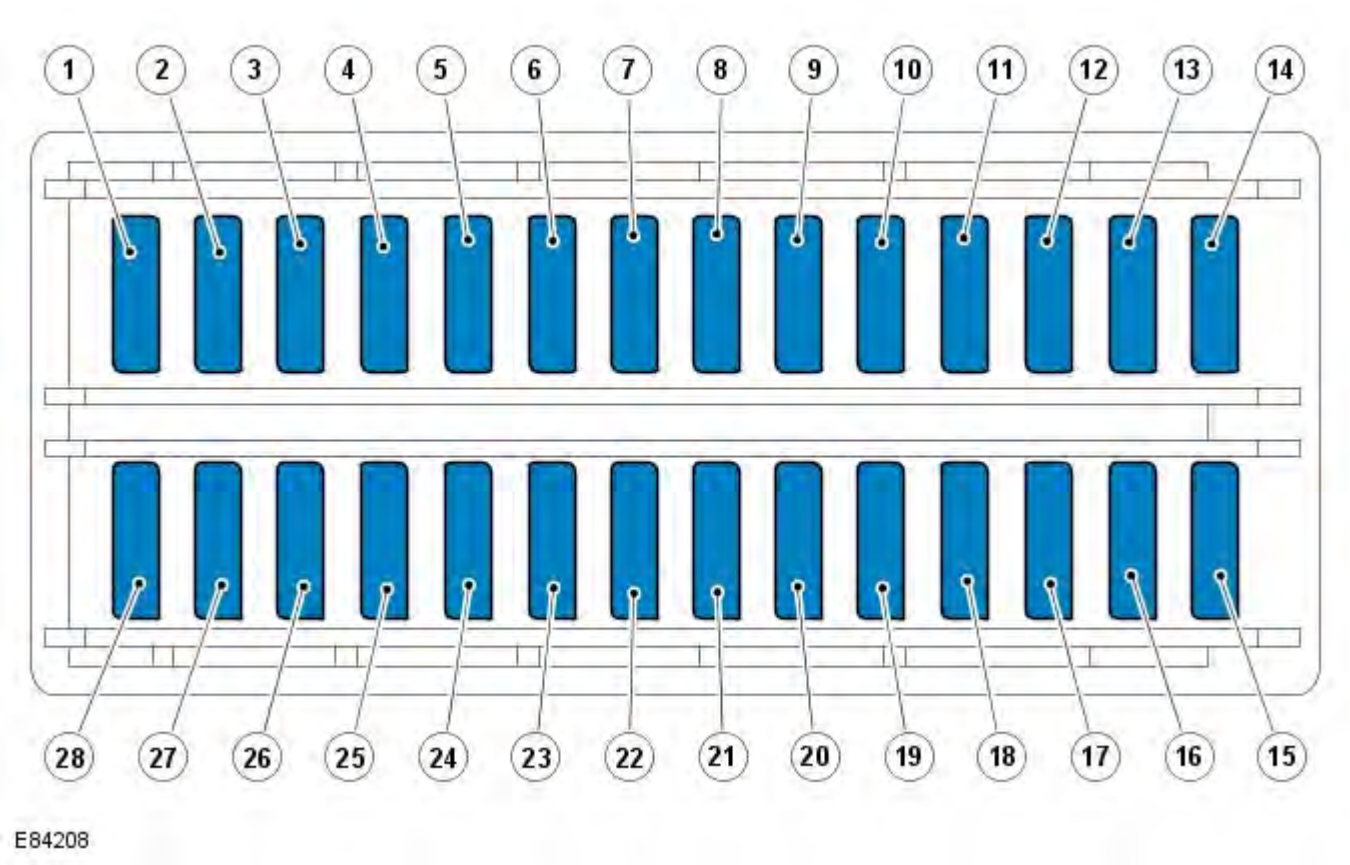
Fuses

Name	Item Number	Vehicle	Description
Fuse F1	1	TD4	Engine Control Module (ECM) (glowplug monitoring)
Fuse F1	1	i6	Diagnostic Monitoring of Tank Leakage (DMTL) leak detection pump
Fuse F2	2	Automatic transmission	Transmission Control Module (TCM)
Fuse F3	5	All	Engine cooling fan module
Fuse F4	6	TD4	BJB relay R4 (glow plugs)
Fuse F5	7	All	Not used
Fuse F6	56	TD4	Front heated oxygen sensor (HO2S)
Fuse F6	56	i6	HO2S', purge control valve
Fuse F7	57	All	BJB relays R2 and R3
Fuse F8	3	TD4	ECM (fuel injectors)
Fuse F8	3	i6	ECM (electric throttle)
Fuse F9	55	TD4	Mass Air Flow (MAF) sensor

Name	Item Number	Vehicle	Description
Fuse F9	55	i6	Fuel injectors, MAF sensor, ECM
Fuse F10	54	TD4	Not used
Fuse F10	54	i6	ECM
Fuse F11	4	TD4	Fuel rail pressure control valve, BJB relay R4 coil
Fuse F11	4	i6	Intake Camshaft Position (CMP) sensor, exhaust CMP sensor, Variable Camshaft Timing (VCT) solenoid, variable plenum valve, variable intake tract valve, ECM, A/C compressor clutch
Fuse F12	53	TD4	Exhaust Gas Recirculation (EGR) valve, port deactivation actuator
Fuse F12	53	i6	Ignition coils
Fuse F13	52	All	BJB relay R3 (A/C compressor clutch)
Fuse F14	51	TD4	Fuel pump (volume control valve)
Fuse F14	51	i6	Not used
Fuse F15	50	All	BJB relay R1 (starter motor)
Fuse F16	8	TD4	Electric booster heater
Fuse F16	8	i6	Not used
Fuse F17	9	All	CJB fuses 6, 8, 21, 22, 23, 24, 25, 26, 27 and 28, interior lamp Field Effect Transistor (FET), exterior lamp FET's, (CJB), electric steering column lock/instrument cluster relay (CJB), battery saver relay, central electronic module (CJB)
Fuse F18	10	All	CJB fuses 7, 9, 10, 11, 13 and 14, exterior lamp FET's
Fuse F19	11	All	AJB fuses FA1 to FA11
Fuse F20	13	All	AJB fuses FB9, AJB relay RB1
Fuse F21	15	All	AJB relay RD1
Fuse F22	44	All	BJB relays R8 and R11 (windshield wipers)
Fuse F23	45	All	Not used
Fuse F24	12	All	BJB relays R9 and R12 (headlamp washer pump)
Fuse F25	14	All	Anti-lock Brake System (ABS) module (valves)
Fuse F26	16	All	ABS module (pump)
Fuse F27	17	All	Not used
Fuse F28	18	All	Blower motor, blower motor control module
Fuse F29	19	All	Not used
Fuse F30	42	All	Not used
Fuse F31	41	All	BJB relay R10 (horn)
Fuse F32	43	TD4	Fuel fired booster heater
Fuse F32	43	i6	Not used
Fuse F33	20	All	BJB relays R5, R6, R7 and R10, light control module
Fuse F34	22	All	LH heated windshield element
Fuse F35	21	All	RH heated windshield element
Fuse F36	40	All	Not used
Fuse F37	39	All	Heated washer jets
Fuse F38	33	Adaptive Front lighting System (AFS)	RH headlamp motor
Fuse F39	26	All	Pollution sensor, air intake stepper motor, LH temperature blend stepper motor, RH temperature blend stepper motor, face/feet distribution stepper motor, windshield (defrost) distribution stepper motor

Name	Item Number	Vehicle	Description
Fuse F40	38	All	Not used
Fuse F41	37	All	CJB fuses 1 to 4
Fuse F42	30	Manual transmission	ECM
Fuse F42	30	Automatic transmission	ECM, TCM
Fuse F43	27	AFS	AFS control module
Fuse F43	27	Headlamp leveling	Headlamp leveling control module
Fuse F44	24	AFS	LH headlamp motor
Fuse F45	23	All	Cigar lighter/accessory socket

CENTRAL JUNCTION BOX



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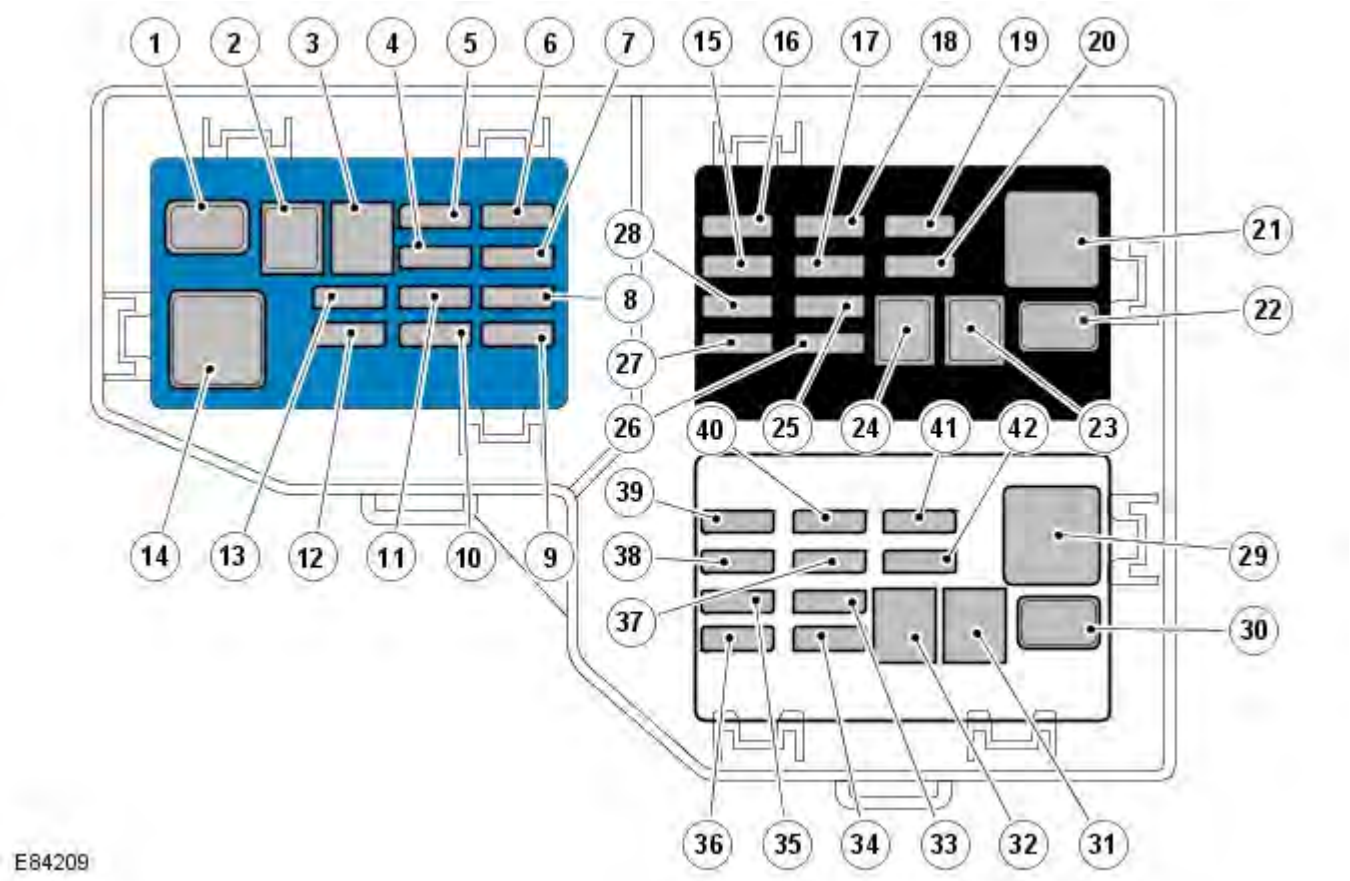
Fuses

Name	Item Number	Vehicle	Description
Fuse F1	1	All	Rain/light sensor
Fuse F2	2	All	Restraints Control Module (RCM), occupant classification system sensor
Fuse F3	3	All	ABS module
Fuse F4	4	TD4	Instrument cluster, electric booster heater, Terrain Optimization™ rotary control, automatic dimming interior mirror, light switch module, passenger airbag disabled indicator, Accelerator Pedal Position (APP) sensor
Fuse F4	4	i6	Instrument cluster, Terrain Optimization™ rotary control, automatic dimming interior mirror, light switch module, passenger airbag disabled indicator, Accelerator Pedal Position (APP) sensor
Fuse F5	5	All	Not used
Fuse F6	6	All	Audio head unit, Infotainment Control Module (ICM)
Fuse F7	7	All	LH steering column multi-function switch
Fuse F8	8	All	Instrument cluster

Name	Item Number	Vehicle	Description
Fuse F9	9	All	LH headlamp main beam, RH headlamp main beam
Fuse F10	10	All	Roof opening panel control unit
Fuse F11	11	All	LH reversing lamp, RH reversing lamp, automatic dimming interior mirror
Fuse F12	12	All	Not used
Fuse F13	13	All	LH front fog lamp, RH front fog lamp
Fuse F14	14	All	Windshield and rear screen washer pump
Fuse F15	28	All	Not used
Fuse F16	27	All	Not used
Fuse F17	26	All	Front interior lamp, rear interior lamp, LH vanity mirror lamp, RH vanity mirror lamp, glovebox lamp, driver door latch switch, luggage compartment lamp
Fuse F18	25	All	Not used
Fuse F19	24	All	Drivers seat control module, drivers seat switch pack, lumbar support switch, battery power save relay
Fuse F20	23	All	Rear screen wiper motor, AJB relay RA2
Fuse F21	22	All	Radio Frequency (RF) receiver, intrusion detection module
Fuse F22	21	All	Fuel delivery module
Fuse F23	20	All	Electric steering column lock
Fuse F24	19	All	Not used
Fuse F25	18	All	Fuel filler flap release motor and liftgate latch
Fuse F26	17	All	Diagnostic socket, battery backed sounder
Fuse F27	16	All	Automatic Temperature Control (ATC) module, start control module
Fuse F28	15	All	Stop lamp switch

AUXILIARY JUNCTION BOX



The Auxiliary Junction Box (AJB) comprises up to 3 individual elements, depending on vehicle specification. The casing of each junction box is color coded as follows:

- AJB 1 = Black
- AJB 2 = White
- AJB 4 = Blue

• NOTE: AJB 3 is not used on Freelander 2

Auxiliary Junction Box 1 Relays

Name	Item Number	Vehicle	Description
Relay RA1	21	All	Heated rear screen
Relay RA2	22	All	Rear screen wiper motor

Auxiliary Junction Box 1 Fuses

Name	Item Number	Vehicle	Description
Fuse FA1	16	All	Driver door module
Fuse FA2	15	All	Passenger door module
Fuse FA3	28	All	LH rear door module
Fuse FA4	27	All	RH rear door module
Fuse FA5	18	All	Not used
Fuse FA6	17	All	Rear accessory socket
Fuse FA7	25	All	AJB relay RA1
Fuse FA8	26	All	Not used
Fuse FA9	19	All	Trailer connector (battery feed)
Fuse FA10	20	All	Drivers seat control module, drivers seat switch pack
Fuse FA11	23	All	Trailer control module
Fuse FA12	24	All	Not used

Auxiliary Junction Box 2 Relays

Name	Item Number	Vehicle	Description
Relay RB1	29	All	AJB fuses FB1 to FB8
Relay RB2	30	All	Not used

Auxiliary Junction Box 2 Fuses

Name	Item Number	Vehicle	Description
Fuse FB1	39	All	Parking aid module
Fuse FB2	38	All	Not used
Fuse FB3	35	All	Driver seat heat control module
Fuse FB4	36	All	Passenger seat heat control module
Fuse FB5	40	All	Trailer connector (fridge)
Fuse FB6	37	All	Active on-demand coupling
Fuse FB7	33	All	Not used
Fuse FB8	34	All	Not used
Fuse FB9	41	All	Passenger power operated seat relay
Fuse FB10	42	All	Not used
Fuse FB11	31	All	Not used
Fuse FB12	32	All	Not used

Auxiliary Junction Box 4 Relays

Name	Item Number	Vehicle	Description
Relay RD1	14	All	Media Orientated System Transport (MOST) ring break
Relay RD2	1	All	Not used

• NOTE: Relay RD1 is a 'plug in' ring break, not a relay

Auxiliary Junction Box 4 Fuses

Name	Item Number	Vehicle	Description
Fuse FD1	9	All	Infotainment Control Module (ICM), navigation computer
Fuse FD2	8	All	Not used
Fuse FD3	7	All	Digital Audio Broadcast (DAB) amplifier, DAB/Satellite Digital Audio Radio Service (SDARS) tuner
Fuse FD4	6	All	Telephone control module
Fuse FD5	10	All	Not used
Fuse FD6	11	All	Audio head unit, Integrated Audio Module (IAM)
Fuse FD7	4	All	Not used
Fuse FD8	5	All	Not used
Fuse FD9	12	All	Audio amplifier
Fuse FD10	13	All	Not used
Fuse FD11	2	All	Not used
Fuse FD12	3	All	Not used

Published: 11-May-2011

Battery, Mounting and Cables - Battery

Diagnosis and Testing

For further information, refer to battery care manual and
REFER to: Charging System (414-00, Diagnosis and Testing).

Published: 11-May-2011

Battery, Mounting and Cables - Battery

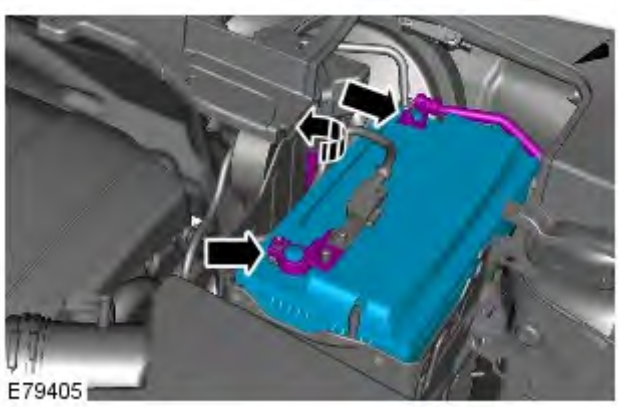
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

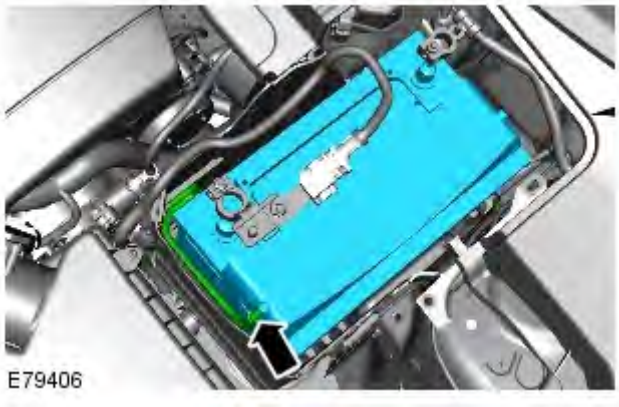
1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).



2. **2.** NOTE: Apply petroleum jelly to the battery terminals.

   Torque: 5 Nm



3.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

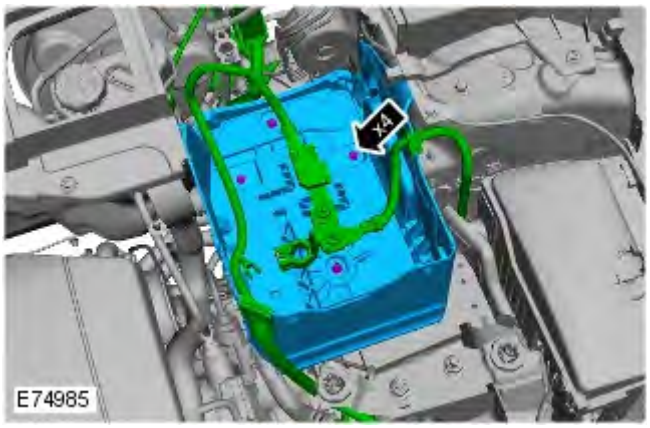
Battery, Mounting and Cables - Battery Tray

Removal and Installation

Removal

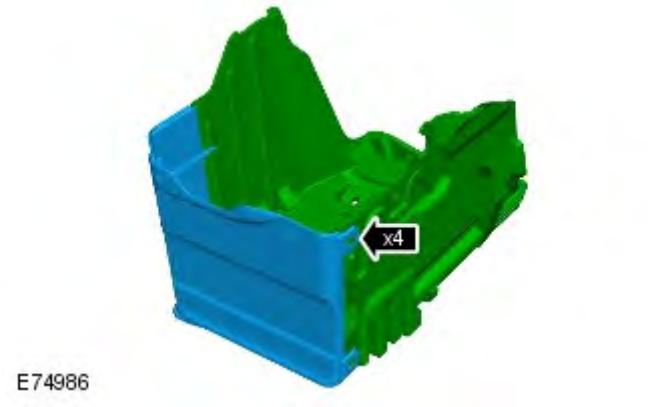
1. Remove the battery.

   Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).



2. **2.** NOTE: Removal steps in this procedure may contain installation details.

   Torque: 10 Nm



3. **3.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Generator and Regulator -

General Specification

Item	Specification
Generator - 3.2L Petrol:	
Make/type	Bosch
Output	90/150 amps @25° C
Voltage control	Externally controlled by EMS using LIN protocol to communicate.
Voltage setpoint regulation	Controlled by software resident in EMS
Generator - 2.2L Diesel:	
Make/type	Bosch
Output - Standard	90/150 amps @25° C
Output - Optional	105/180 amps @ 25° C
Voltage Control	Externally controlled by EMS using LIN protocol to communicate.
Voltage Regulation	Controlled by software resident in EMS

Torque Specifications

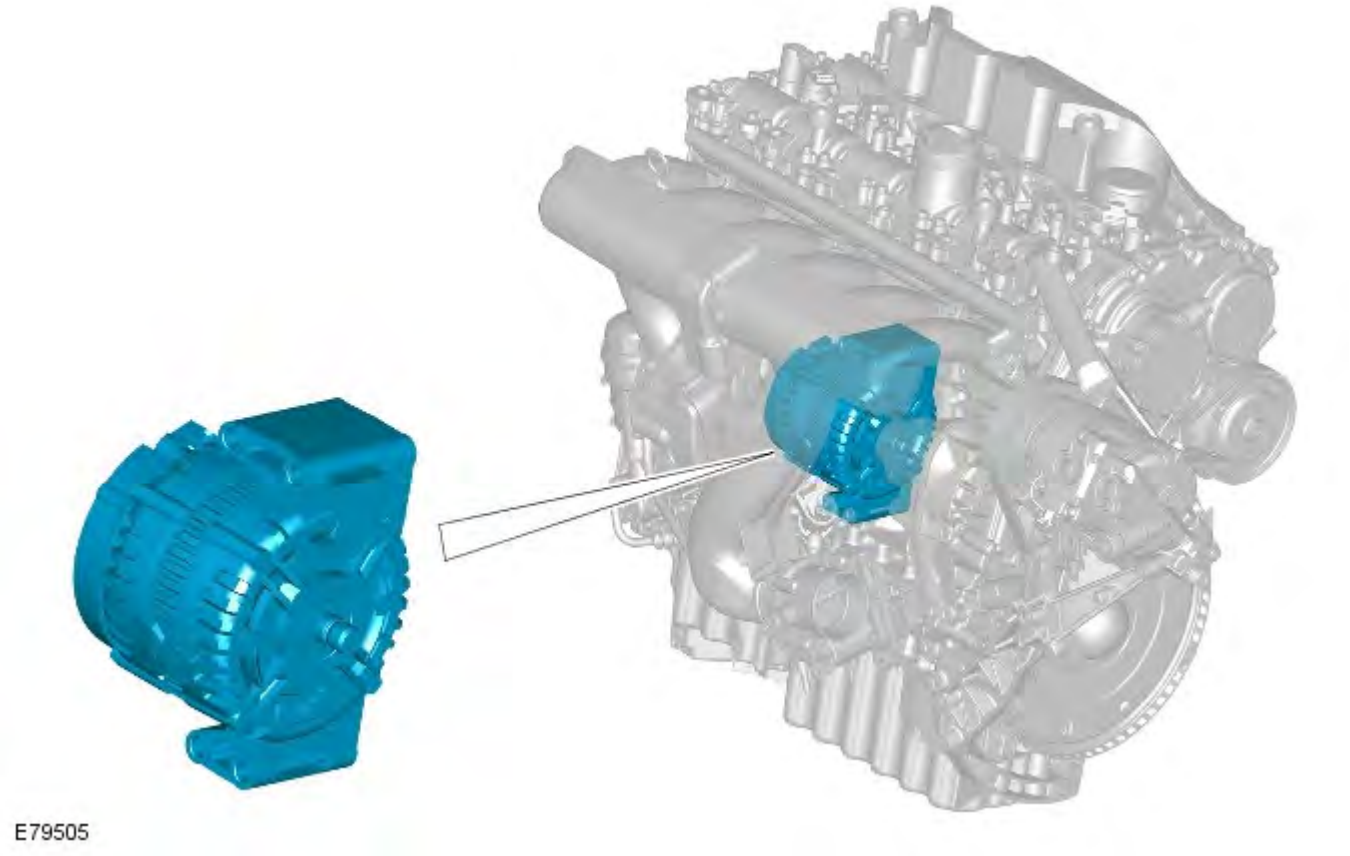
Description	Nm	lb-ft
Battery harness connection nut - 3.2L Petrol	12	9
battery cable to the generator nut - 2.2L Diesel	24	18
Drive belt idler pulley - 2.2L Diesel	48	35
Generator coupling	75	55
Generator bolts - 3.2L Petrol	24	18
Generator bolts - 2.2L Diesel	48	35

Published: 11-May-2011

Generator and Regulator - GeneratorI6 3.2L Petrol

Description and Operation

COMPONENT LOCATION



OVERVIEW

The generator used on the Si6 obtains a direct drive from a shaft powered by the crankshaft; a coupling unit attaches the generator to the shaft. This direct drive arrangement improves the generator's durability by preventing side-loadings, caused by the tension of a drive belt, acting on the generator's rotor bearing.

The generator has an output of 90/150 amps, and comprises a:

- stator,
- rotor,
- rectifier pack, and
- regulator

The stator consists of a flat core pack into which the stator wires are pressed. The rotor comprises a field winding, wound around an iron core and mounted on a shaft. The rotor is housed within the stator and is mounted on bearings to provide smooth running and support.

The rectifier converts the Alternating Current (AC) produced in the stator coils into Direct Current (DC), as required by the vehicle electrical system. The rectifier comprises 6 semi-conductor diodes mounted on a heat sink that dissipates the resultant heat.

The regulator provides a controlled variable voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the rectified and regulated DC current from the generator via a large diameter cable to the battery positive terminal. The second terminal provides the Local Interconnect Network (LIN) bus connection between the regulator and the Engine Control Module (ECM).

The regulator connects via the LIN bus to the ECM, and the ECM also connects via the high speed Controller Area Network (CAN) bus to the Central Junction Box (CJB). The CJB contains software maps that provide a mathematical model of battery electrolyte temperature, and constantly receives information from the ECM regarding the actual battery voltage. Based on the information received, the CJB then communicates via the high speed CAN bus to the ECM a predicted output voltage that is required from the regulator to effectively charge the battery.

A corresponding message is then communicated by the ECM to the regulator via the LIN bus, to meet the output voltage determined by the CJB. This control cycle is repeated under a closed-loop condition.

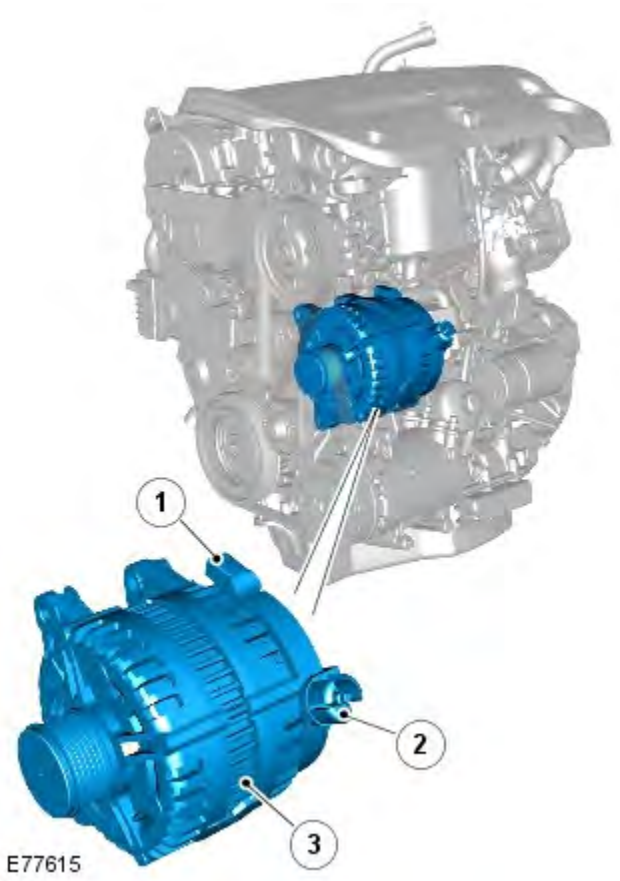
The LIN bus is also used to communicate a fault in the wiring or the connections from the generator to the ECM. A fault code will be generated and stored in the ECM and if necessary, the charge warning indicator lamp will be displayed in the instrument cluster after a short delay. During engine starting the charge warning indicator lamp is illuminated in the instrument cluster when the ignition is energized, and will extinguish when the engine starts and the ECM detects a generator output voltage.

Published: 11-May-2011

Generator and Regulator - GeneratorTD4 2.2L Diesel

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Local Interconnect Network (LIN) bus connection
2	-	Battery positive connection
3	-	Generator

OVERVIEW

A single self-exciting generator is located at the front of the engine on the Left-Hand (LH) side of the cylinder block. Two generators are available for the TD4 engine, dependent on vehicle specification. The generators are rated at 90/150 amps and 115/180 amps respectively. The larger rated generator is used on cold climate market vehicles installed with a heated front windshield and electric booster heater.
For additional information, refer to: Electric Booster Heater (412-02B Auxiliary Climate Control, Description and Operation).

The generator pulley incorporates a one-way clutch that reduces Noise, Vibration and Harshness (NVH), and improves the life of the accessory drive belt. The one-way clutch allows the belt to drive the pulley without slip occurring, but prevents the generator from driving the belt during transients in engine speed ('belt whip') due to the high rotational inertia of the generator internal components.

The generator comprises the following major components:

- Stator
- Rotor
- Rectifier pack
- Regulator.

The stator consists of a flat core pack into which the stator wires are pressed.

The rotor comprises a field winding, wound around an iron core and mounted on a shaft. The rotor is housed within the stator and mounted on bearings to provide smooth running and support, due to the side loading applied by the drive belt tension.

The rectifier comprises 6 semi-conductor diodes mounted on a heat sink. The heat sink dissipates the resultant heat created in the electrical conversion process. The rectifier converts the Alternating Current (AC) produced in the stator coils into Direct Current (DC) that is required by the vehicle electrical system.

The regulator provides a controlled variable voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the rectified and regulated DC current from the generator, via a large diameter cable to the battery positive terminal. The second terminal provides the LIN bus connection between the regulator and the Engine Control Module (ECM).

The regulator is connected via the LIN bus to the ECM, the ECM is also connected via the high speed Controller Area Network (CAN) bus to the Central Junction Box (CJB). The CJB contains software maps that provide a mathematical model of battery electrolyte temperature, and constantly receives information from the ECM regarding the actual battery voltage. Based on the information received, the CJB then communicates via the high speed CAN bus to the ECM a predicted output voltage that is required from the regulator to effectively charge the battery. A corresponding message is then communicated by the ECM to the regulator via the LIN bus, to meet the output voltage determined by the CJB. This control cycle is repeated under a closed-loop condition.

The LIN bus is also used to communicate a mechanical failure, or fault in the wiring and connections from the generator to the ECM. A Diagnostic Trouble Code (DTC) is stored in the ECM and if necessary, the charge warning indicator lamp is illuminated in the instrument cluster after a short delay.

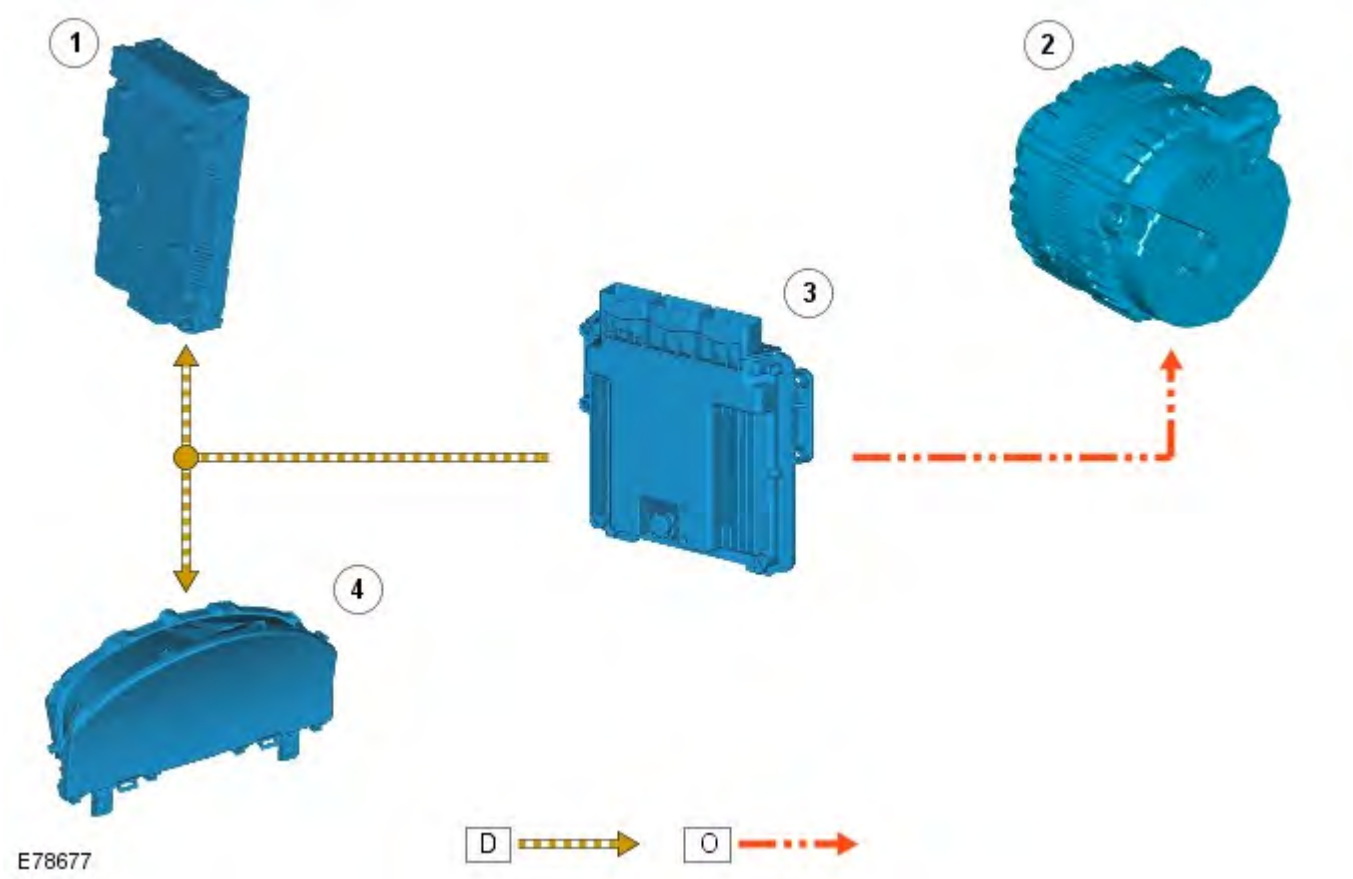
During engine starting the charge warning indicator lamp is illuminated in the instrument cluster when the ignition is energized, and is extinguished when the engine starts and the ECM detects a generator output voltage.

Stop/Start Vehicles - From 2010 MY

Due to the additional loads a higher rated 180 amp generator is used on Stop/Start vehicles.
For additional information, refer to: Starting System (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

CONTROL DIAGRAM

- NOTE: **D** = High speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1	-	CJB
2	-	Generator
3	-	ECM
4	-	Instrument cluster

Published: 11-May-2011

Generator and Regulator - Generator

Diagnosis and Testing

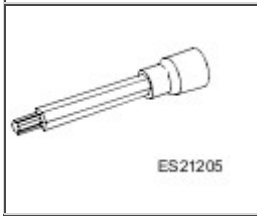
For additional information.
REFER to: Charging System (414-00, Diagnosis and Testing).

Published: 11-May-2011

Generator and Regulator - GeneratorI6 3.2L Petrol

Removal and Installation

Special Tool(s)

	303-1255 Installer, Generator dowels
	303-1278 Aligner, Timing Cover
	303-502 Socket, Flywheel Bolt

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

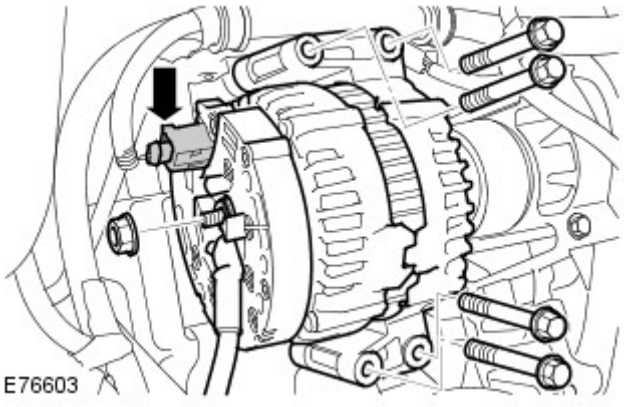
2. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the intake manifold.

   Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

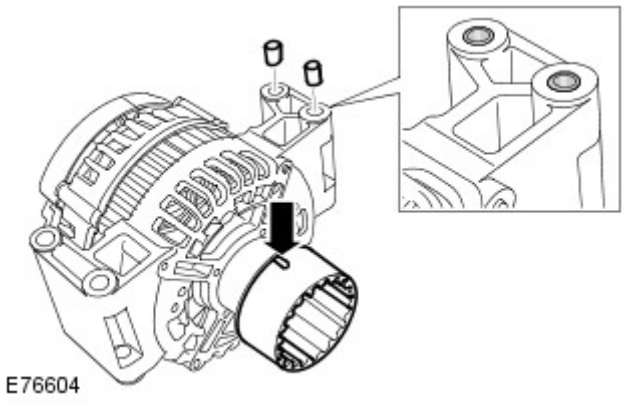
4. Disconnect the generator harness.



5. Remove the generator.

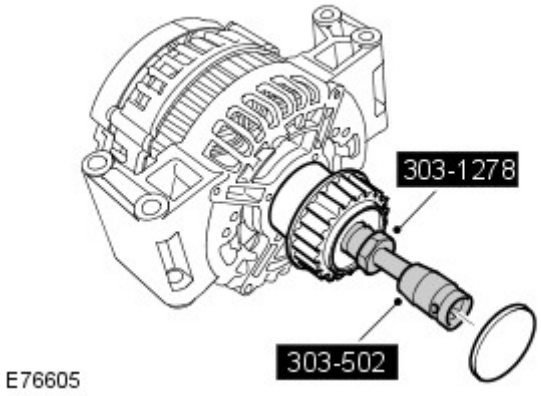
6. **6.** CAUTION: Mark the components to aid installation.

   Remove the coupling.



7. **7.** NOTE: Do not disassemble further if the component is removed for access only.

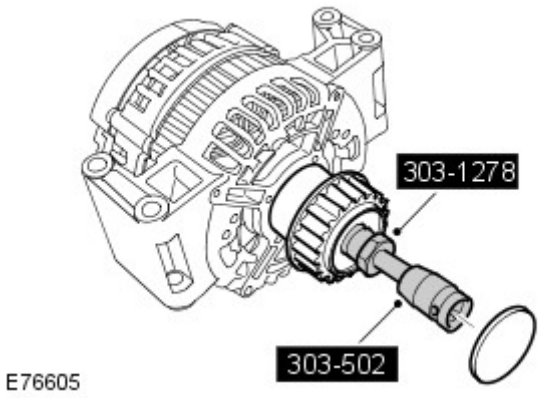
   Remove the dowels.



8. Remove the generator coupling.

   Special Tool(s): 303-1278, 303-502

Installation



1. Install the generator coupling.

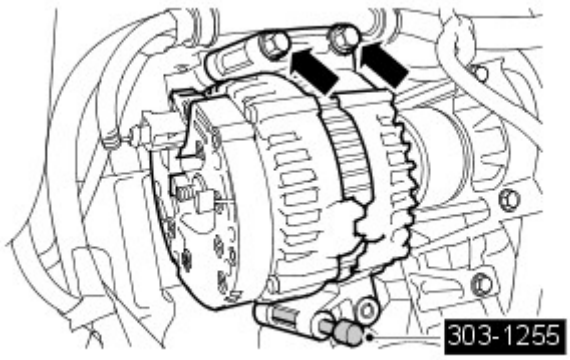
   Torque: 75 Nm

2. Install the locating dowels flush with the generator casing.

3. **3.** NOTE: Make sure that the installation marks are aligned.

   Install the coupling.

4. Locate the generator and install and lightly tighten the upper bolts.



E81975

5. Using the special tool, install the dowels to align the generator.

   Special Tool(s): 303-1255

6. Tighten the generator bolts.

   Torque: 24 Nm

7. Connect the generator harness and tighten the nut.

   Torque: 12 Nm

8. Install the intake manifold.

   Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

9. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Generator and Regulator - GeneratorTD4 2.2L Diesel

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the fuel filter.

   Refer to: Fuel Filter (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

3. **3.** WARNING: Make sure to support the vehicle with axle stands.

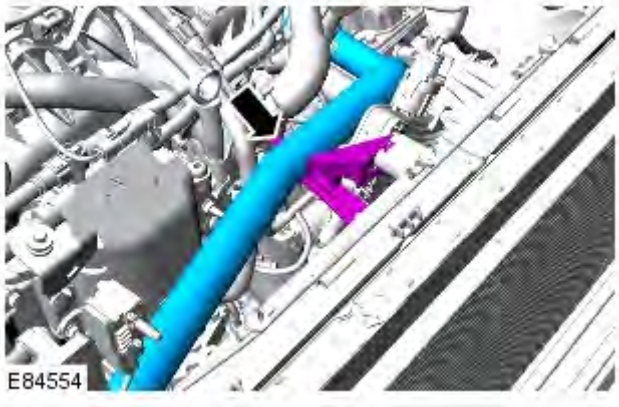
   Raise and support the vehicle.

4. Remove the engine undershield.

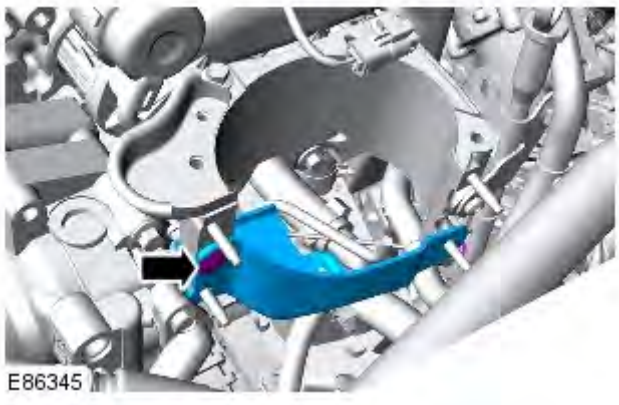
   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

5. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).



6.



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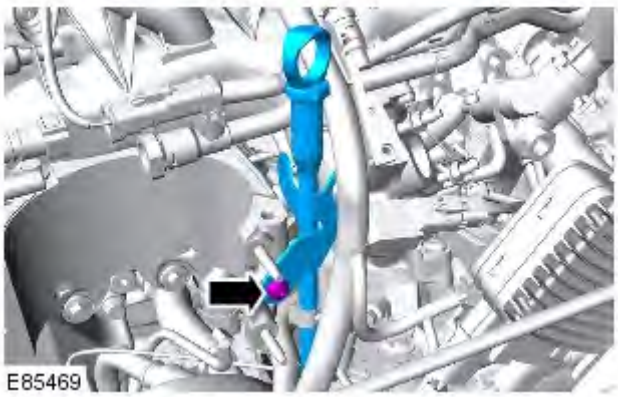

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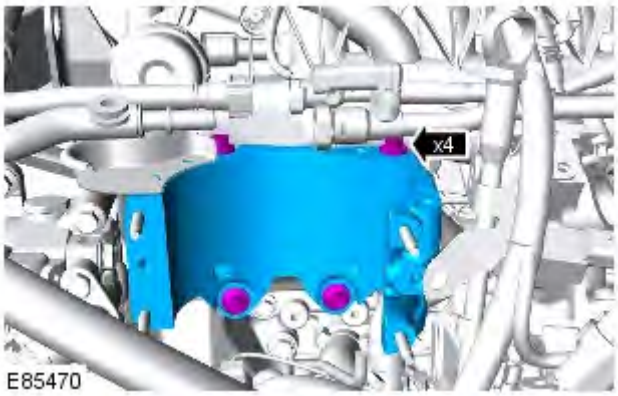
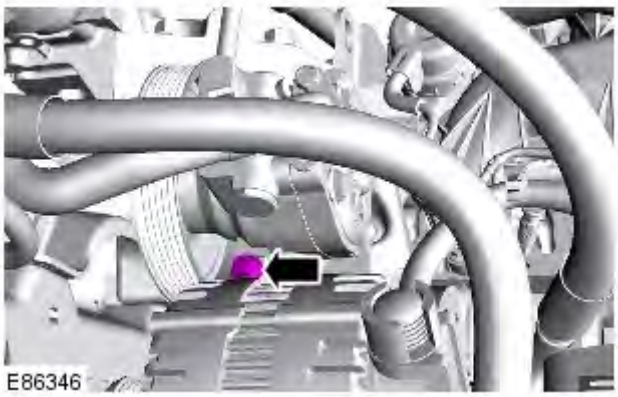
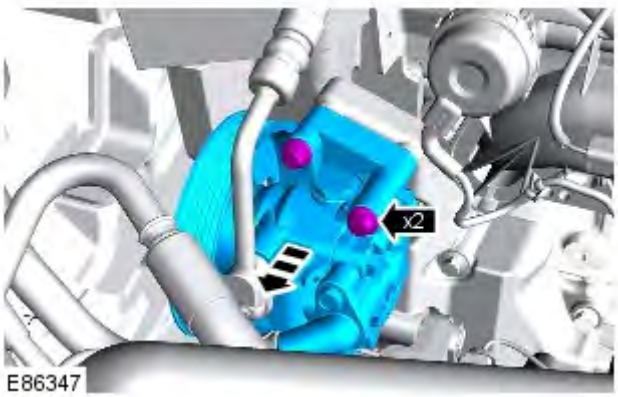
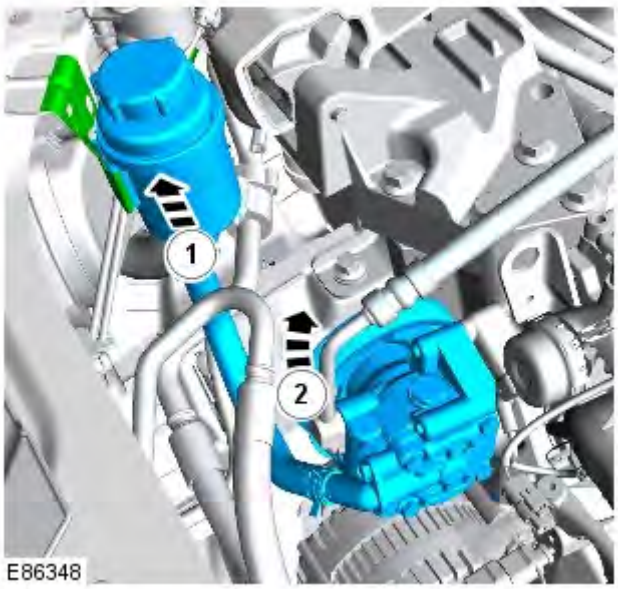


10.

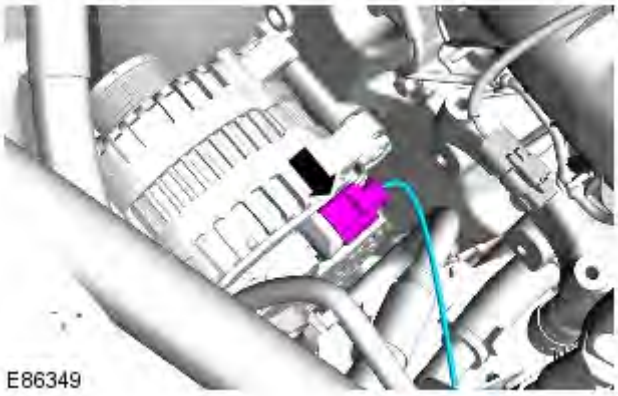


11. Release the power steering pump.





12. **12.** WARNING: Power steering fluid is extremely flammable. Make sure that power steering fluid is not spilt over the engine and that the power steering fluid reservoir cap is sealed.



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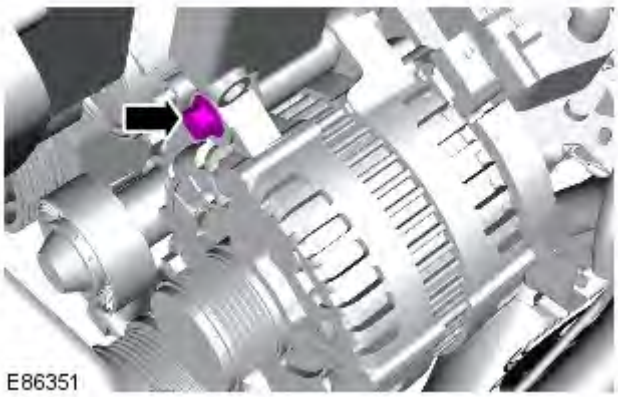

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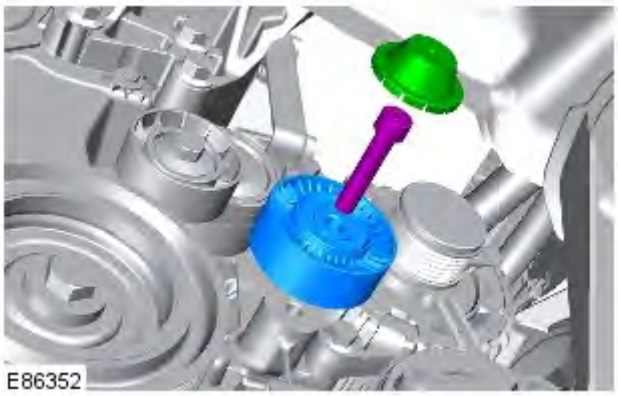
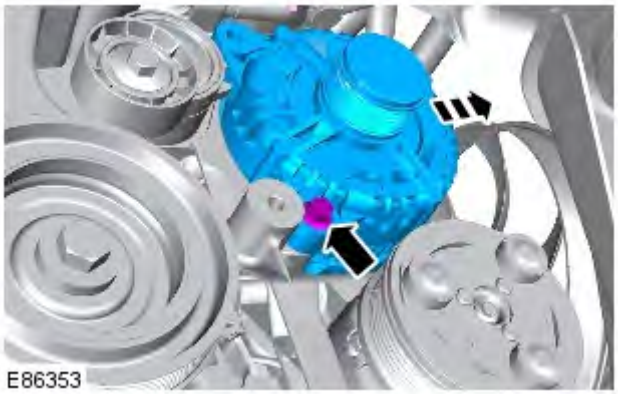


16. **16.** CAUTION: Make sure that the mating faces are clean and free of foreign material.



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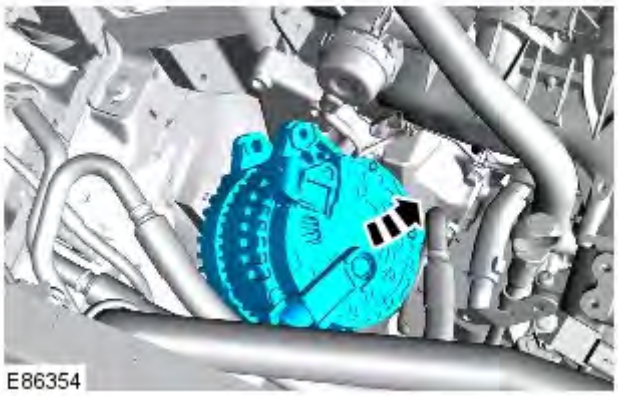


18.

Installation

1. **1.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Install the generator.

2. Install the 2 generator bolts.

   Torque: 48 Nm

3. Install the accessory drive belt idler pulley.

   Torque: 48 Nm

4. Install the accessory drive belt idler pulley dust cap.

5. Connect the generator electrical connector.

6. Connect the battery cable to the generator.

   Torque: 24 Nm

7. Attach the power steering fluid reservoir.

8. **8.** CAUTION: Make sure that the mating faces are clean and free of foreign material.

   Install the power steering pump.

   Torque: 24 Nm

9. Install the fuel filter support bracket.

   Torque: 20 Nm

10. Attach the oil level indicator tube to the fuel filter support bracket.

    Torque: 10 Nm

11. Install the inner fuel filter shield.

12. Secure the coolant top hose.

13. Install the accessory drive belt.

    Refer to: Accessory Drive Belt (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

14. Install the engine undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

15. Install the fuel filter.

    Refer to: Fuel Filter (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

Published: 11-May-2011

Information and Entertainment System - General Information - Cellular Phone

Diagnosis and Testing

Principles of Operation

For a detailed description of the Cellular Phone systems, refer to the relevant Description and Operation section in the workshop manual. REFER to: Cellular Phone (415-01 Information and Entertainment System, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Microphone • Bluetooth antenna	• Electrical connectors • Wiring harness for damage or corrosion • Fuses

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the concern and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to relevant DTC Index.

Symptom Chart

Symptom	Action
Unable to pair	• GO to Pinpoint Test A.
Not Auto Connecting	• GO to Pinpoint Test B.
No Audio to 3rd Party	• GO to Pinpoint Test C.
No Audio from 3rd Party	• GO to Pinpoint Test D.
No Audio	• GO to Pinpoint Test E.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Cellular Telephone Control Module (Bluetooth Telephone Module) (BPM) (100-00 General Information, Description and Operation).

Pinpoint Tests

PINPOINT TEST A : UNABLE TO PAIR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: 'NO PHONE FITTED' DISPLAY	

• NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the bluetooth function is activated and the telephone handset is placed within the vehicle cabin area.	
	1 Carry out checks to determine if 'No Phone Fitted' is shown on vehicle display.
	Is 'No Phone Fitted' displayed? **Yes** GO to A2. **No** Locate the connected telephone and if not Customer telephone, disconnect from the system.
A2: TELEPHONE BLUETOOTH DEVICE SEARCH	
	1 Carry out Bluetooth device search using Customer handset.
	Is 'Land Rover' identified in Bluetooth device list? **Yes** Select device from list, then continue with diagnosis.GO to A3. **No** Carry out further Bluetooth device search, to a maximum of 4 times, waiting approximately 20 seconds between searches. If 'Land Rover' still not identified in Bluetooth device list, set ignition status to OFF, wait approximately 30 seconds and set ignition status to ON. Carry out further Bluetooth device search, to a maximum of 4 times, waiting approximately 20 seconds between searches. If 'Land Rover' still not identified in Bluetooth device list, contact your local in market support for further assistance.
A3: TELEPHONE HANDSET ERROR	
	1 Check for any error shown on the telephone handset when 'Land Rover' is selected from the Bluetooth device list.
	Was an error immediately shown on the telephone handset? **Yes** Wait approximately 10 seconds then re-attempt selection, to a maximum of 4 times, waiting approximately 10 seconds between each attempt. If error still being displayed, contact your local in market support for assistance. **No** Enter PIN '2121' then continue with diagnosis.GO to A4.
A4: PIN ENTRY STATUS	
	1 Check for successful PIN entry.
	Was PIN entry successful? **Yes** GO to A5. **No** Wait approximately 10 seconds then re-attempt PIN entry, to a maximum of 4 times, waiting approximately 10 seconds between each attempt. If PIN entry is still un-successful, contact your local in market support for assistance.
A5: 'NO PHONE FITTED' DISPLAY	
	1 Carry out checks to determine if 'No Phone Fitted' is still shown on vehicle display.
	Is 'No Phone Fitted' still displayed? **Yes** From the telephone handset, select the connect option for the 'Land Rover' device identified in the Bluetooth device list. If 'No Phone Fitted' is still displayed, suspect a telephone handset fault. Carry out Pinpoint test again using known good telephone handset. **No** The telephone is paired and connected to the system. No further action is required for this symptom.

PINPOINT TEST B : NOT AUTOMATICALLY CONNECTING	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: BLUETOOTH MODULE PAIRED DEVICE LIST	
• NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the bluetooth and auto connect functions are activated and the telephone handset is placed within the vehicle cabin area.	
	1 Carry out checks to determine if the Customer telephone is shown in the Bluetooth Module paired device list.
	Is the Customer telephone in the Bluetooth Module paired device list? **Yes** GO to B2. **No** Carry out Unable to Pair Pinpoint Test.GO to A.
B2: CUSTOMER HANDSET PAIRED DEVICE LIST	
	1 Carry out checks to determine if the Bluetooth Module is shown in the Customer telephone paired device list.
	Is the Bluetooth Module in the Customer telephone paired device list? **Yes** GO to B3. **No** Carry out Unable to Pair Pinpoint Test.GO to A.
B3: CUSTOMER TELEPHONE IN POSITION 1	
	1 Carry out checks to determine if the Customer telephone is in position 1 in the Bluetooth Module paired device list.
	Is the Customer telephone in position 1? **Yes** GO to B4. **No** Advise Customer that auto connection will only be attempted with the device that is shown in position 1 in Bluetooth Module paired device list.
B4: CHECK FOR DTC B1A56-13	

	1 Using Manufacturer approved diagnostic system, check for DTC B1A56-13.
	Is DTC B1A56-13 logged? **Yes** Carry out remedial actions as outlined in DTC Index. If symptom remains, contact your local in market support for assistance. **No** GO to B5.
B5: BLUETOOTH CONNECTION	
	1 Carry out checks to determine if Bluetooth connection icon is shown on Customer Bluetooth telephone screen but shows 'No Phone Fitted' on vehicle screen.
	Is Bluetooth connection icon shown on the Customer handset but 'No Phone Fitted' displayed on vehicle screen? **Yes** GO to B9. **No** GO to B6.
B6: 'LAND ROVER' AUTHORISATION	
• NOTE: Some handsets may require operator intervention to manually authorise connection.	
	1 Carry out checks to determine if 'Land Rover' is authorised in the Customer Bluetooth telephone device list menu.
	Is 'Land Rover' authorised in the Customer Bluetooth telephone device list menu? **Yes** GO to B7. **No** Advise customer that 'Land Rover' needs to be authorised in the Customer Bluetooth telephone device list menu, or operator intervention may be required to manually authorise connection.
B7: SEARCH FOR DEVICES SCREEN	
	1 Select the search for devices button on the vehicle display.
	Does pressing the search for devices button bring up the searching screen on the vehicle display? **Yes** Contact your local in market support for assistance. **No** GO to B8.
B8: CYCLE IGNITION AND CHECK SEARCH FOR DEVICES SCREEN	
	1 Lock vehicle (wait 60s) before unlocking and turning Ignition status back to ON.
	Does pressing the search for devices button bring up the searching screen on the vehicle display? **Yes** No further action required for this Symptom. Possible intermitent fault. **No** Contact your local in market support for assistance.
B9: PAIRED DEVICE	
	1 Check Customer telephone paired device list to establish which device the Customer telephone is connected to.
	Is the Customer telephone connected to the vehicle? **Yes** Lock vehicle (wait 60s) before unlocking and turning Ignition status back to ON. If Not Automatically Connecting, contact you local in market support for assistance. **No** Using the Customer telephone controls, disconnect from the currently connected device and delete from paired device list. Lock vehicle (wait for 60s) before unlocking and turning Igition status to ON. If Not Automatically Connecting, contact your local in market support for assistance.

PINPOINT TEST C : NO AUDIO TO THIRD PARTY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: MICROPHONE DIAGNOSTIC TROUBLE CODES (DTCS)	
• NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.	
	1 Using the Manufacturer approved diagnostic system, check for any logged microphone DTCs in Audio Front Control module.
	Is DTC B1D79-01 logged? **Yes** Carry out diagnosis of electrical failure as advised in Action column of DTC Index. **No** Contact your local in market support for assistance.

PINPOINT TEST D : NO AUDIO FROM THIRD PARTY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: 'IN CALL' DISPLAY	
• NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.	
	1 Carry out checks to determine if 'In Call' is shown on the vehicle display.
	Is vehicle display showing 'In Call'? **Yes** Contact your local in market support for assistance. **No** Call has ended. No further action is required for this symptom.

PINPOINT TEST E : NO AUDIO

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: AUDIO FROM THIRD PARTY	
• NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.	
	1 Establish from Customer feedback/symptom if there is Audio from the Third Party.
	Is there Audio from the Third Party? **Yes** GO to E2. **No** Refer to the 'No Audio From Third Party' Pinpoint test.GO to D.
E2: AUDIO TO THIRD PARTY	
	1 Establish from Customer feedback/symptom if there is Audio to the Third Party.
	Is there Audio to the Third Party? **Yes** GO to E3. **No** Refer to the 'No Audio To Third Party' Pinpoint test.GO to C.
E3: CD OR RADIO AUDIO	
	1 Establish from Customer feedback/symptom if there is Audio from the CD or Radio.
	Is there Audio from the CD or Radio? **Yes** GO to E4. **No** Suspect MOST ring fault, refer to electrical circuit diagrams and check/rectify MOST ring as necessary.
E4: TELEPHONE HANDSET AUDIO	
	1 Establish from Customer feedback/symptom if there is Audio from the telephone handset.
	Is there Audio from the telephone handset? **Yes** Ensure vehicle is parked. Disconnect and reconnect handset. If issue not resolved, contact your local in market support for assistance. **No** Contact you local in market support for assistance.

Published: 26-Jul-2011

Information and Entertainment System - General Information - Information and Entertainment System

Diagnosis and Testing

Principles of Operation

For a detailed description of the Information and Entertainment systems, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Audio System (415-01 Information and Entertainment System, Description and Operation),
Speakers (415-01 Information and Entertainment System, Description and Operation),
Navigation System (415-01 Information and Entertainment System, Description and Operation),
Antenna (415-02 Antenna, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Integrated audio module • Information and entertainment module • Audio amplifier • Compact disc player jammed, not loading • Scratched/dirty compact discs • Speakers • Navigation system DVD player mechanism	• Fuses • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connector(s) • Routing of fibre optic harnesses • Correct engagement of optical connectors • Correct placement of optical connectors (ring order) • Correct assembly of optical connectors (backout, etc) • Damage to fibre (chafing, abrasion, kinking, cuts, etc) • Integrated audio module • Information and entertainment module • Audio amplifier • Speakers • Navigation system display • Navigation system module • GPS antenna • Wiring harness for damage and corrosion • ABS Module • Audio unit

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to relevant DTC Index.

Navigation System Symptom Chart

Symptom	Possible Cause	Action
Poor satellite reception	• Electrical harness open/short circuit, dis-connected • Component failure • No reception from satellite	GO to Pinpoint Test B.
Map disc will not insert/eject	• Electrical harness open/short circuit, dis-connected • Component failure • Map disc failure	GO to Pinpoint Test C.
Black screen (navigation map screen does not display)	• Electrical harness open/short circuit, dis-connected • Component failure • GVIF cable	GO to Pinpoint Test D.
Navigation map screen color is abnormal	• Electrical harness open/short circuit, dis-connected • Component failure • GVIF cable	GO to Pinpoint Test E.
Vehicle's current position mark turns independently	• Electrical harness open/short circuit, dis-connected • Component failure • Vehicle on a turntable in a parking building	GO to Pinpoint Test F.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B12), or determine if any prior approval programme is in operation, prior

to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Information and Entertainment Module (Low Line)

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Infotainment Control Module (ICM) - Low Line (100-00 General Information, Description and Operation).

Information and Entertainment Module (High Line)

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Infotainment Control Module (ICM) - High Line (100-00 General Information, Description and Operation).

Audio Front Control Module (ACM)

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Audio Front Control Module (ACM) (100-00 General Information, Description and Operation).

Audio Amplifier Module (AAM)

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Audio Amplifier Module (AAM) (100-00 General Information, Description and Operation).

Front Control Display Interface Module (FCDIM) (high level display front)

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Front Controls Display Interface Module (FCDIM) - Front Integrated Control Panel (100-00 General Information, Description and Operation).

Navigation Control Module (NCM)

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Navigation Control Module (NAV) (100-00 General Information, Description and Operation).

Satellite Radio Module (SRM)

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Satellite Digital Audio Radio System Module (SARM) (100-00 General Information, Description and Operation).

Digital Audio Broadcast Module (DAB)

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Digital Audio Broadcast Module (DABM) (100-00 General Information, Description and Operation).

High Definition Tuner Module (HDR)

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: High Definition Radio Module (HDR) (100-00 General Information, Description and Operation).

Pinpoint Tests

• NOTE: Visually inspect for any of the following conditions and rectify any fault identified prior to carrying out any tests on the MOST Network.

- Any sharp bends in the optical fibre harness (check for this before disturbing any module or connector)
- Incorrect engagement of any optical connectors
- Incorrect engagement of any electrical connectors
- Damage to the optical fibre harness (chafing, abrasion, kinking, cuts, break, etc)
- Incorrect assembly of the optical network

• NOTE: Unless otherwise stated, ensure vehicle ignition status is set to 'ON' when carrying out MOST Network tests.

PINPOINT TEST A : MOST NETWORK TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK HLDF DISPLAY	
	1 Check HLDF display
	Is the HLDF showing a flashing Land Rover logo, or a blank screen? **Yes** GO to A2. **No** No ring break fault has occurred. Suspect invalid Car Configuration File parameter faults, check modules on MOST Network for related DTCs and refer to the relevant DTC Index.

A2: CHECK RD1 RING BREAK LINK	
	1 Check the RD1 Ring Break link in Auxiliary Junction Box (AJB) is not disconnected or open circuit.
	Is the RD1 Ring Break link in Auxiliary Junction Box (AJB) disconnected or open circuit? **Yes** Rectify the fault condition and re-test vehicle. **No** GO to A3.
A3: INITIATE RING BREAK DIAGNOSTIC (RBD) & READ DTCS	
	1 Ensure RD1 Ring Break link is in AJB.
	2 Ensure remote key is inserted into key holder.
	3 Set vehicle ignition status from 'OFF' to 'ON'.
	4 Clear all DTCs.
	5 Remove RD1 Ring Break link from AJB, wait at least ten seconds, re-insert RD1 Ring Break link into AJB.
	6 Wait at least 30 seconds for RBD to initiate and complete.
	7 Read all DTCs.
	Is DTC U1A1587 logged? **Yes** GO to A4. **No** Check HLDF for additional DTCs and refer to relevant DTC Index.
A4: CHECK FOR FAILURE AT INTERMEDIATE CONNECTOR C23T PIN 2	
	1 Disconnect the MOST network intermediate connector C23T.
	Is the bright red light visible at MOST intermediate connector C23T pin 2? **Yes** GO to A5. **No** GO to A6.
A5: CHECK FOR FAILURE AT FIRST HALF OF MOST NETWORK	
	1 Connect the Optical Bus Tester (OBT) to intermediate connector C23T using adaptor lead supplied.
	2 Switch OBT 'ON' and set to 2+0 option.
	3 Select the visible LED option.
	Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home menu screen' or Land Rover logo? **Yes** Fault is in second half of MOST Network. Disconnect OBT and re-connect intermediate connector.GO to A13. **No** Disconnect OBT from intermediate connector C23T and connect optical LINK providedGO to A10.
A6: CHECK FOR FAILURE AT INFORMATION AND ENTERTAINMENT MODULE	
	1 Disconnect MOST connector C2ME05B from information and entertainment module.
	Is the bright red light visible at module side of connector C2ME05B pin 2? **Yes** If there is a HLDF installed to the vehicle.GO to A7. If there is no HLDF installed, the fault is in the optical fibre between C2ME05B pin 2 and C23T pin 2, rectify the fault and re-test the vehicle. **No** Install a new information and entertainment module and re-test vehicle.
A7: CHECK FOR FAILURE OF OPTICAL FIBRE TO HLDF	
	1 Re-connect MOST connector C2ME05B to information and entertainment module.
	2 Disconnect MOST connector C2MN08C from HLDF.
	Is the bright red light visible at harness side of MOST connector C2MN08C pin 1? **Yes** GO to A8. **No** Fault is in optical fibre harness between C2ME05B pin 2 and C2MN08C pin 1, rectify the fault and re-test vehicle.
A8: CHECK FOR FAILURE OF OPTICAL FIBRE FROM HLDF	
	1 Connect OBT to HLDF MOST connector C2MN08C.
	2 Switch OBT 'ON' and set to 2+0 option.
	3 Select the visible LED option.
	Is the bright red light visible at MOST intermediate connector C23T pin 2? **Yes** GO to A9. **No** Fault is in optical fibre harness between C23T pin 2 and C2MN08C pin 2, rectify the fault and re-test vehicle.
A9: CHECK FOR FAILURE AT HLDF	
	1 Connect the optical Link provided to MOST intermediate connector C23T.
	Is the Rx lamp/LED permanently 'ON' and the HLDF permanently displaying blank screen? **Yes** Check/repair power feed and ground lines to HLDF. If power feed and ground lines ok, install a new HLDF. REFER to: Video Display (415-01 Information and Entertainment System, Removal and Installation). **No** Check integrity of intermediate connector C23T connections, and re-test vehicle.
A10: CHECK FOR FAILURE OF OPTICAL FIBRE TO INTEGRATED AUDIO MODULE	
	1 Disconnect MOST connector C2ME44B from integrated audio module.

	Is the bright red light visible at harness side of MOST connector C2ME44B pin 1? **Yes** GO to A11. **No** Fault is in optical fibre harness between C23T pin 1 and C2ME44B pin 1, rectify the fault and re-test vehicle.
A11: CHECK FOR FAILURE AT INTEGRATED AUDIO MODULE	
	1 Connect OBT to integrated audio module MOST connector C2ME44B.
	2 Switch OBT 'ON' and set to 2+0 option.
	3 Select the visible LED option.
	Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying Land Rover logo? **Yes** Check/repair power feed and ground lines to integrated audio module. If power feed and ground lines ok, install a new integrated audio module. **No** GO to A12.
A12: CHECK FOR FAILURE OF OPTICAL FIBRE FROM INTEGRATED AUDIO MODULE	
	1 Disconnect MOST connector C2ME05B from information and entertainment module.
	2 Switch OBT 'ON' and set to 2+0 option.
	3 Press red 'TEST' button on OBT and observe harness side of connector C2ME05B pin 1
	Is the bright red light visible at harness side of connector C2ME05B pin 1? **Yes** Install a new information and entertainment control module. **No** Fault is in optical fibre harness between C2ME05B pin 1 and C2ME44B pin 2, rectify the fault and re-test vehicle.
A13: CHECK FOR INSTALLATION OF NAVIGATION MODULE	
	1 Check for installation of Navigation module.
	Is there a Navigation module installed to vehicle? **Yes** GO to A14. **No** GO to A16.
A14: CHECK FOR FAILURE OF OPTICAL FIBRE TO NAVIGATION MODULE	
	1 Disconnect MOST connector C3MN08C from the navigation module.
	Is the bright red light visible at harness side of connector C3MN08C pin 1? **Yes** GO to A15. **No** Fault is in optical fibre harness between C3MN08C pin 1 and C23S pin 2, rectify the fault and re-test vehicle.
A15: CHECK FOR FAILURE AT NAVIGATION MODULE	
	1 Connect OBT to navigation module MOST connector C3MN08C.
	2 Switch OBT 'ON' and set to 2+0 option.
	3 Select the visible LED option.
	Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home screen menu' or Land Rover logo? **Yes** Check/repair power feed and ground lines to navigation module. If power feed and ground lines ok, install a new navigation module. REFER to: Navigation System Digital Versatile Disc (DVD) Unit (415-01 Information and Entertainment System, Removal and Installation). **No** Disconnect OBT and reconnect navigation module MOST connector C3MN08C.GO to A16.
A16: CHECK FOR FAILURE OF OPTICAL FIBRE TO AUDIO AMPLIFIER MODULE	
	1 Disconnect MOST connector C4ME27C from the audio amplifier module.
	Is the bright red light visible at harness side of connector C4ME27C pin 1? **Yes** GO to A17. **No** Fault is in optical fibre harness between C3MN08C pin 2 (or C23S pin 2, if Navigation module not installed to vehicle) and C4ME27C pin 1, rectify the fault and re-test vehicle.
A17: CHECK FOR FAILURE AT AUDIO AMPLIFIER MODULE	
	1 Connect OBT to audio amplifier module MOST connector C4ME27C.
	2 Switch OBT 'ON' and set to 2+0 option.
	3 Select the visible LED option.
	Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home screen menu' or Land Rover logo? **Yes** Check/repair power feed and ground lines to audio amplifier module. If power feed and ground lines ok, install a new audio amplifier module. REFER to: Subwoofer Amplifier (415-01 Information and Entertainment System, Removal and Installation). **No** Disconnect OBT and reconnect audio amplifier module MOST connector C4ME27C.GO to A18.
A18: CHECK FOR INSTALLATION OF BLUETOOTH MODULE	
	1 Check for installation of bluetooth module.

	Is there a bluetooth module installed to the vehicle? **Yes** GO to A19. **No** GO to A21.
A19: CHECK FOR FAILURE OF OPTICAL FIBRE TO BLUETOOTH MODULE	
	1 Disconnect MOST connector C4MM22B from the bluetooth module.
	Is the bright red light visible at harness side of connector C4MM22B pin 1? **Yes** GO to A20. **No** Fault is in optical fibre harness between C4ME27C pin 2 and C4MM22B pin 1, rectify the fault and re-test vehicle.
A20: CHECK FOR FAILURE AT BLUETOOTH MODULE	
	1 Connect OBT to bluetooth module MOST connector C4MM22B.
	2 Switch OBT 'ON' and set to 2+0 option.
	3 Select the visible LED option.
	Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home screen menu' or Land Rover logo? **Yes** Check/repair power feed and ground lines to bluetooth module. If power feed and ground lines ok, install a new bluetooth module. REFER to: Bluetooth Module (415-01 Information and Entertainment System, Removal and Installation). **No** Disconnect OBT and reconnect bluetooth module MOST connector C4MM22B.GO to A21.
A21: CHECK FOR INSTALLATION OF DIGITAL AUDIO BROADCAST/SATELLITE RADIO MODULE	
	1 Check for installation of digital audio broadcast/satellite radio module.
	Is there a digital audio broadcast/satellite radio module installed to the vehicle? **Yes** GO to A22. **No** GO to A24.
A22: CHECK FOR FAILURE OF OPTICAL FIBRE TO DIGITAL AUDIO BROADCAST/SATELLITE RADIO MODULE	
	1 Disconnect MOST connector C4ME43B from the digital audio broadcast/satellite radio module.
	Is the bright red light visible at harness side of connector C4ME43B pin 1? **Yes** GO to A23. **No** Fault is in optical fibre harness between C4MM22B pin 2 (or C4ME27C pin 2, if bluetooth module not installed) and C4ME43B pin 1, rectify the fault and re-test vehicle.
A23: CHECK FOR FAILURE AT DIGITAL AUDIO BROADCAST/SATELLITE RADIO MODULE	
	1 Connect OBT to digital audio broadcast/satellite radio module MOST connector C4ME43B.
	2 Switch OBT 'ON' and set to 2+0 option.
	3 Select the visible LED option.
	Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home screen menu' or Land Rover logo? **Yes** Check/repair power feed and ground lines to digital audio broadcast/satellite radio module. If power feed and ground lines ok, install a new digital audio broadcast/satellite radio module. REFER to: Satellite Radio Tuner (415-01 Information and Entertainment System, Removal and Installation). **No** GO to A24.
A24: CHECK FOR FAILURE OF OPTICAL FIBRE TO INTERMEDIATE CONNECTOR C23S PIN 1	
	1 Disconnect intermediate connector C23S.
	2 Switch OBT 'ON' and set to 2+0 option.
	3 Press red 'TEST' button on OBT and observe harness side of connector C23S pin 1.
	Is the bright red light visible at harness side of connector C23S pin 1? **Yes** No fault is indicated with the MOST Network, check all connectors and re-test vehicle. **No** Fault is in optical fibre harness between C4ME43B pin 2, if digital audio broadcast/satellite radio module is installed (or C4MM22B pin 2, if digital audio broadcast/satellite radio module not installed or C4ME27C pin 2, if bluetooth module not installed), and C23S pin 1, rectify the fault and re-test vehicle.

Navigation System Pinpoint Tests

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval Program is in operation, prior to the installation of a new module/component.

• NOTE: Navigation Diagnostic Screen Access

- 1.With the vehicle at rest, place the ignition switch in either "ACC", "ON", or start the engine.
- 2.On the "Menu" screen, press the top center of the screen for more than three seconds.
- 3.Enter the PIN code, and then touch "OK". 660: Diagnosis Menu screen 661: System Check screen (DTC code verification screen) 662: GPS Information screen.
- 4.The diagnostics screen will be displayed.

PINPOINT TEST B : POOR SATELLITE RECEPTION	
• NOTE: Move the vehicle to an open area, radio waves from satellites may not be received inside buildings.	
• NOTE: Correct the vehicle cursor to the current location.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: SYSTEM CHECK FOR DTCS	
	1 Check the system for DTCs which may be logged.
	Are any system DTCs logged? **Yes** Carry out repair actions to correct the DTCs logged. Check satellite reception.GO to B3. **No** GO to B2.
B2: RETRO-INSTALL INSTALLATIONS CHECK	
	1 Check to see if there are any retro-install installations (anti-theft, radar, etc.)
	Are there any retro-install installations? **Yes** Aftermarket items may cause either electrical or radio frequency interference that can cause satellite reception to deteriorate. Remove the power supply (including backup power supplies) from any aftermarket items installed. If reception returns to normal after disconnection of aftermarket items, carry out the following. Alter the installation position of any aftermarket items.Check satellite reception.GO to B3. **No** GO to B3.
B3: SATELLITE RECEPTION CHECKS	
	1 Check the 'ST' column of the navigation diagnostics GPS information screen (PIN code 662) after 10 minutes have passed. There must be more than 4 'P's displayed for accurate positioning. Check the 'HDOP' value, this must be less than 5.
	Are there more than 4 'P's displayed and is HDOP less than 5? **Yes** Satellite reception is normal. **No** Confirm the GPS antenna is connected to the navigation module. Refer to the electrical circuit wiring diagrams and check the integrity of the coaxial cable and connectors from the Navigation Control Module (NCM) to the GPS antenna. Install a new GPS antenna or coaxial cable as required. Re-check satellite reception.

PINPOINT TEST C : MAP DISC WILL NOT INSERT/EJECT	
• NOTE: Ensure the parking brake is applied, and ignition status is set to Auxiliary or ON.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK NAVIGATION DISC SLOT SHUTTER	
	1 Check the navigation map disc slot shutter is open.
	Is the navigation map disc slot shutter is open? **Yes** GO to C2. **No** Open the map disc slot shutter. GO to C2.
C2: CHECK NAVIGATION MAP DISC WILL INSERT/EJECT	
	1 Check that it is possible to insert/eject navigation map disc.
	Is it possible to insert/eject navigation map disc? **Yes** Operation is normal. **No** Refer to the electrical circuit diagrams and check power supply and ground connections to the Navigation Control Module (NCM). If power supply and ground connections are good, install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST D : BLACK SCREEN (NAVIGATION MAP SCREEN DOES NOT DISPLAY)	
• NOTE: Ensure the parking brake is applied, and ignition status is set to Auxiliary or ON.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK SCREEN SAVER FUNCTION	
	1 Check the screen saver function operation.
	Does the screen saver function operate? **Yes** Press the display panel button.GO to D2. **No** GO to D2.
D2: CHECK DISPLAY BACKLIGHT	
	1 Check the display backlight operation.
	Does the display backlight operate? **Yes** Refer to the electrical circuit diagrams and check the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected. If the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected, check and install a new GVIF cable as required. Refer to the new module/component installation note

	at top of DTC Index. If the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected and **NOT** damaged, check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index. Re-check the system. **No** Check the HLDF display. Re-check the system.

PINPOINT TEST E : NAVIGATION MAP SCREEN COLOUR IS ABNORMAL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: COLOUR BAR CHECK	
	1 Carry out the display diagnostics 'colour bar check' (PIN code 660).
	Are the results of the display diagnostics 'colour bar check' normal? **Yes** Check the HLDF display. Re-check the system. **No** Check the condition of the map disc for dirt or scratches. Refer to the electrical circuit diagrams and check the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected. If the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected, check and install a new GVIF cable as required. Refer to the new module/component installation note at top of DTC Index. If the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected and **NOT** damaged, check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index. Re-check the system.

PINPOINT TEST F : VEHICLE'S CURRENT POSITION MARK TURNS INDEPENDENTLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: VEHICLES CURRENT POSITION MARK TURNS INDEPENDENTLY	
	1 Determine if the ignition status was turned to Auxiliary or On, while the vehicle was in motion with steering turned such as after an engine stall.
	Was ignition status set to Auxiliary or On? **Yes** The angular speed of the vehicle at the time of the ignition status change will be logged as the standard value. To re-set the standard value, turn ignition status to 'OFF' then to 'Auxiliary' or 'On' with the vehicle stationary. Re-test the vehicle. **No** Check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST G : CAR CURRENT POSITION NOT STABLE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: SYSTEM CHECK FOR DTCS	
	1 Check the system for DTCs which may be logged.
	Are any system DTCs logged? **Yes** Carry out repair actions to correct the DTCs logged. Re-check the system for car current position not stable. **No** GO to G2.
G2: VEHICLE SPEED INPUT CHECK	
	1 Select Vehicle Sensor from the navigation diagnostic menu screen (PIN code 660), check Current speed. The current speed must match the speedometer.
	From the Vehicle Sensor screen, does the current speed must match the speedometer? **Yes** GO to G3. **No** Carry out MOST ring circuit checks. Check the Anti-Lock Brake System Module for related DTCs and refer to the relevant DTC Index. Carry out network integrity tests using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required.
G3: CHECK NUMBER OF SATELLITES	
	1 From the navigation diagnostic GPS information screen (PIN code 662), check the number of satellites displayed.
	Is the number of satellites displayed on the screen 0? **Yes** Carry out pinpoint test A "Poor Satellite Reception" **No** GO to G4.
G4: CHECK IF SYMPTOMS ARE OCCURRING IN PARTICULAR LOCATIONS	
	1 Confirm if the 'car current position not stable' symptom is occurring in particular locations.

	Is the 'car current position not stable' symptom occurring in particular locations? **Yes** Signal reflections from buildings or a particular location may be responsible. **No** Carry out pinpoint test A "Poor Satellite Reception"

PINPOINT TEST H : MAP DISPLAY IS INCOMPLETE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: SYSTEM CHECK FOR DTCS	
	1 Check the system for DTCs which may be logged.
	Are any system DTCs logged? **Yes** Carry out repair actions to correct the DTCs logged. Re-check the system for 'Map display is incomplete'. **No** GO to H2.
H2: CHECK MAP DISC	
	1 Check map disc for contamination, deformation, cracks, scratches or non-genuine disc and correct market.
	Has a fault been identified with the map disc? **Yes** Replace the map disc. Re-check the system for 'Map display is incomplete'. **No** Check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST I : NO NAVIGATION VOICE GUIDANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK ALL AUDIO OUTPUT SYSTEMS	
	1 Check audio output across all systems.
	Is there sound output across all systems? **Yes** GO to I2. **No** GO to I3.
I2: CHECK VOICE GUIDANCE SOFT KEY	
	1 Check navigation screen menu, voice guidance soft key is not set to OFF position.
	Is the voice guidance soft key set to OFF position? **Yes** Set the voice guidance soft key to ON position. Re-check the system **No** GO to I3.
I3: VOLUME LEVEL CHECK	
	1 Check the volume level is not set too low.
	Is the volume level set too low? **Yes** Increase the volume level and re-test vehicle. **No** Refer to electrical circuit diagrams and check integrity of amplifier and speaker system wiring harness and connectors. GO to I4.
I4: NAVIGATION VOICE ONLY NOT AUDIBLE	
• NOTE: Only the navigation voice cannot be heard.	
	1 Press the 'Navigation voice repeat' soft key.
	After the navigation voice repeat soft key is pressed, can voice still not be heard even though it has become louder? **Yes** Check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index. **No** Operation is normal.

PINPOINT TEST J : NO RESPONSE TO PRESSING NAVIGATION MENU	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: NO RESPONSE TO PRESSING NAVIGATION MENU	
• NOTE: 15 minutes are required for the program to update. If the engine is accidentally turned OFF, start the engine again, and wait for 15 minutes.	
	1 Check that the engine was not turned 'OFF' during a navigation software update.
	Was the engine turned 'OFF' during a navigation software update? **Yes** Check the correct map disc is inserted into the Navigation Control Module (NCM). Start the engine and allow to idle for 15 minutesTurn the engine 'OFF', and then start the engine again.Verify that the navigation screen displays. Navigation was in the program update mode. **No** GO to J3.

J2: NO RESPONSE TO PRESSING NAVIGATION MENU	
	1 Check that the engine was not turned 'OFF' after inserting the new map disc.
	Was the engine turned 'OFF' after inserting the new map disc? **Yes** Check the correct map disc is inserted into the Navigation Control Module (NCM). Start the engine and allow to idle for 15 minutesTurn the engine 'OFF', and then start the engine again. **No** GO to J3.
J3: NO RESPONSE TO PRESSING NAVIGATION MENU	
	1 Check the "Loading" button on the navigation diagnostics screen (PIN code 660) has been pressed, and "YES" has been selected.
	Has the "Loading" button on the navigation diagnostics screen been pressed, and has "YES" been selected? **Yes** Check the correct map disc is inserted into the Navigation Control Module (NCM). Start the engine and allow to idle for 15 minutesTurn the engine 'OFF', and then start the engine again. **No** Refer to electrical circuit diagrams and check integrity of navigation system wiring harness and connectors. GO to J4.
J4: SYSTEM CHECK FOR DTCS	
	1 Check the system for DTCs which may be logged.
	Is DTC U300055 logged? **Yes** Using the manufacturer approved diagnostic system check/amend the Car Configuration File parameter in block 2, byte 127 to match vehicle market/specification. If the DTC remains check navigation system module part number and ensure the correct component is installed to vehicle market/specification. **No** GO to J5.
J5: NO RESPONSE TO PRESSING NAVIGATION MENU	
	1 Turn the engine 'OFF', wait for a moment, and then turn the engine 'ON' again.
	Does the navigation screen fail to display even if the navigation button is pressed? **Yes** Check the HLDF is installed correctly. Check the Navigation Control Module (NCM) is installed correctly. **No** Operation is normal.

Published: 11-May-2011

Information and Entertainment System -

Torque Specifications

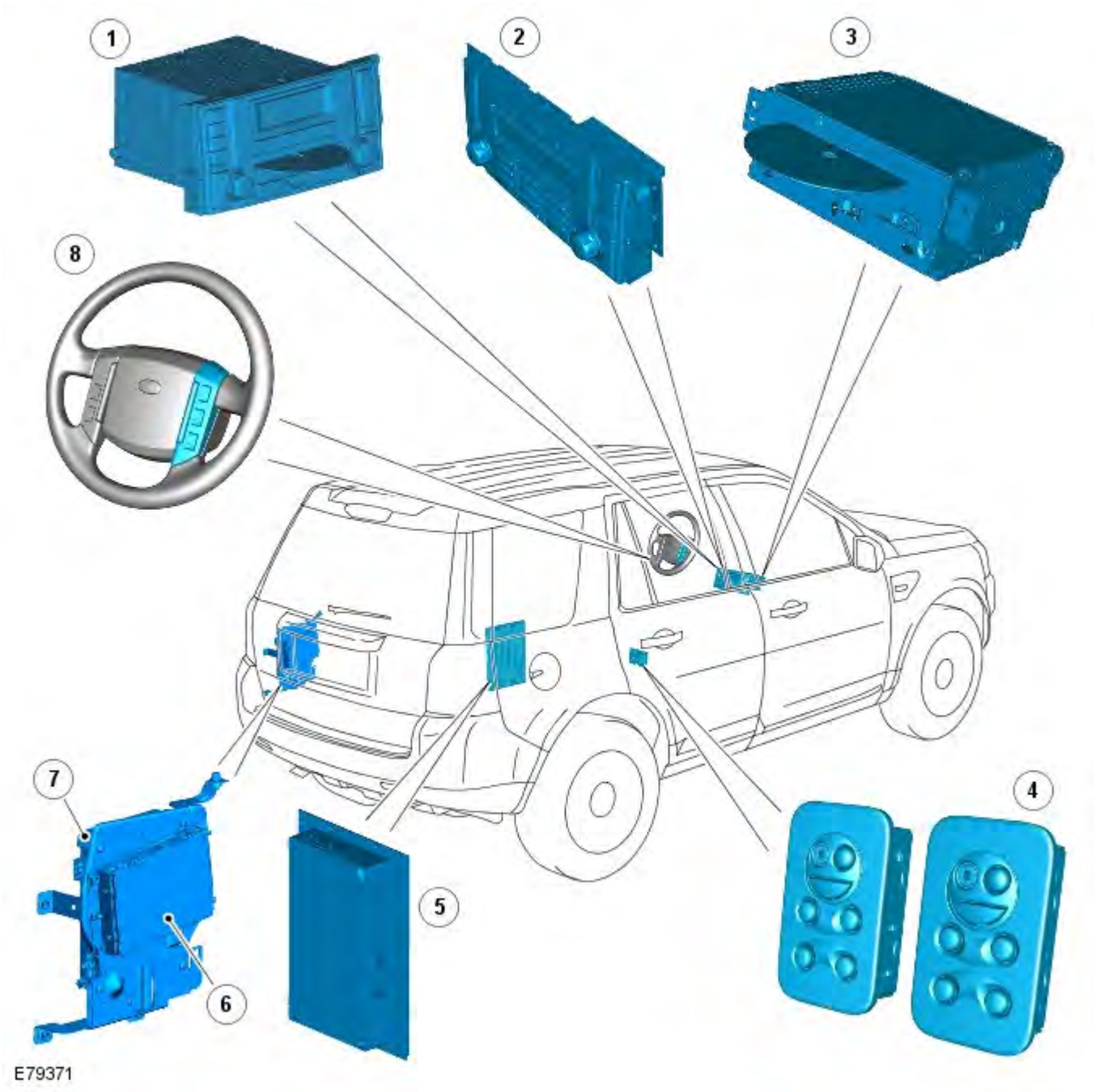
Description	Nm	lb-ft
Audio amplifier bolts	4	3
Audio unit	4	3
Bluetooth module retaining bolts	10	7
Front door speaker	1	1
Instrument panel speaker	1	1
Navigation digital Versatile Disc (DVD) unit retaining bolts	6	4
Rear door speaker	1	1
Satellite radio tuner bracket nuts	10	7
Satellite radio tuner to mounting bracket bolts:		
M5	6	4
M6	10	7
Subwoofer amplifier bracket nuts	10	7
Subwoofer to bracket bolts	10	7
Liftgate speaker to casing bolts	1	1
Liftgate speaker to liftgate Torx screws	1	1
Video display bolts	3	2

Published: 11-May-2011

Information and Entertainment System - Audio System

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Audio head unit
2	-	Infotainment Control Module (ICM)
3	-	Integrated Audio Module (IAM)
4	-	Rear headphone sockets and audio control
5	-	Audio amplifier
6	-	Satellite Digital Audio Radio Service (SDARS) module (NAS Only)
7	-	High Definition (HD) Radio (NAS only - from 2009MY)
8	-	Steering wheel remote audio controls

OVERVIEW

The audio system contains the following functions:

- CD player
- AM/FM tuner
- Digital Audio Broadcast (DAB)/SDARS radio systems (where available)
- HD radio system (where available).

The audio system is available in 2 versions, Standard and Premium.

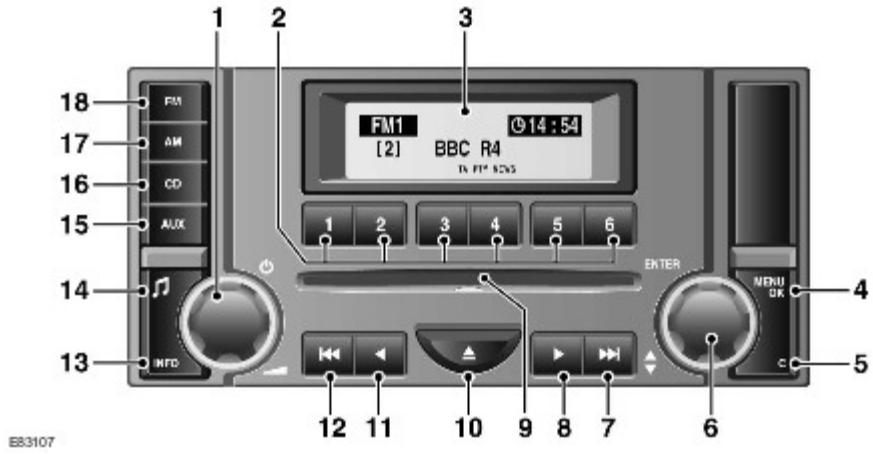
The Standard audio system uses an internal amplifier which directly drives the system speakers and contains a single disc Compact Disc (CD) player. The Standard audio system is controlled purely from the head unit and the remote steering wheel controls. The head unit is connected to the vehicle on the medium speed Controller Area Network (CAN) bus. This allows the unit to be interrogated for diagnostic purposes.

The Premium audio system comprises the following components:

- Integrated Audio Module (IAM)
- Infotainment Control Module (ICM)
- Separate audio amplifier
- Rear seat audio control modules with head phone sockets
- Surround sound speaker system

Control of the Premium audio system is via the ICM located in the center of the instrument panel. Control signals from the ICM are sent to the rest of the audio system on the Media Orientated System Transport (MOST) ring. The ICM is the timing master for the MOST ring and also hosts a gateway function between the medium speed CAN bus and the MOST ring. Audio signals are sent on the MOST ring from the Integrated Audio Module to the amplifier.

LOW LINE AUDIO SYSTEM



Item	Part Number	Description
1	-	On/Off volume control
2	-	Radio preset/CD select buttons
3	-	Information display
4	-	Audio menu button
5	-	Exit button
6	-	Audio menu rotary controller
7	-	Seek up/next track
8	-	Manual tuning up/CD next track
9	-	CD slot
10	-	CD eject
11	-	Manual tuning down/CD previous track
12	-	Seek down/previous track
13	-	Info button
14	-	Tone/volume settings button
15	-	Auxiliary mode button
16	-	CD mode button
17	-	AM waveband button
18	-	FM waveband button

The low line audio head unit contains the following functionality:

- Amplitude Modulation (AM)/Frequency Modulation (FM) Radio tuner
- Single disc CD player
- Amplifier

The audio head unit communicates with other vehicle systems on the CAN bus.

The audio head unit contains an internal amplifier which directly drives the vehicle speakers.
For additional information, refer to: Speakers (415-01 Information and Entertainment System, Description and Operation).

The audio head unit incorporates a power management function. Should the vehicle battery level drop below a predetermined level the unit will limit its functionality. The audio head unit receives CAN signals which help it determine the wake up/shut down process.

Transit Mode

Transit mode is used to reduce the vehicle battery current drain whilst the vehicle is being stored or transported. Transit mode is entered/exited via a CAN signal from the Land Rover approved diagnostic tool. In transit mode the following circuits will be disabled:

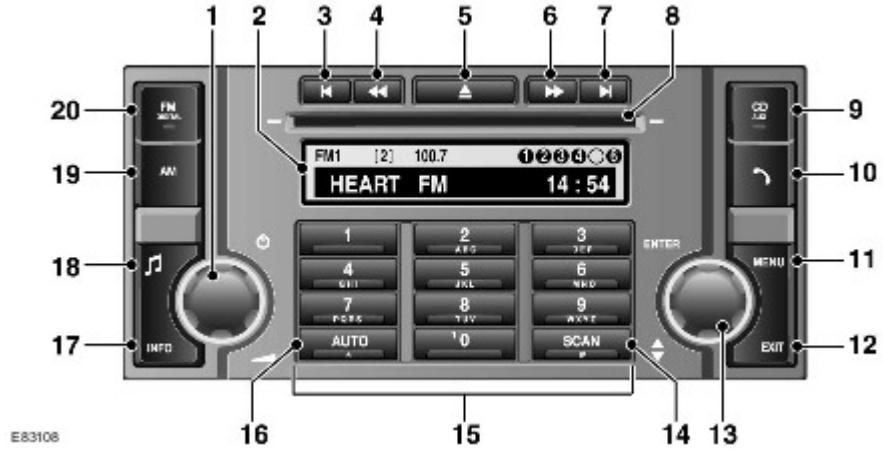
- Aux and phone call

- Clock
- Antenna power
- Light Emitting Diode (LED) illumination.

In transit mode the CAN port and the ON/OFF switch are the only circuits that are left active.

The CAN port is left open to allow the EXIT from transit mode signal to be received. The ON/OFF switch is left active to allow feedback to the driver via the head unit LCD (liquid crystal display), that the unit is in transit mode should the driver attempt to power up the head unit. This will only occur when the vehicle engine is running and the battery is above 12.3 Volts.

HIGH LINE AUDIO SYSTEM



Item	Part Number	Description
1	-	On/Off volume control
2	-	Information display
3	-	Seek down/previous track
4	-	Manual tuning down/CD previous track
5	-	CD eject
6	-	Manual tuning up/CD next track
7	-	Seek up/next track
8	-	CD slot
9	-	Mode button
10	-	Telephone mode button
11	-	Audio menu button
12	-	Exit button
13	-	Audio menu rotary controller
14	-	Scan button
15	-	Keypad
16	-	Autostore button
17	-	Info button
18	-	Tone/volume settings button
19	-	AM waveband button
20	-	FM waveband button

The High Line Audio system is based around an Integrated Audio Module (IAM) which communicates on the Media Orientated System Transport (MOST). The ICM communicates on medium speed CAN and MOST buses.

The IAM contains the following functionality:

- Radio tuner
- CD player (Single CD or Six disc in dash changer)
- Auxiliary input (for any device featuring a 3.5mm jack plug output).

The ICM is woken up by CAN bus activity. The IAM is woken up by the MOST ring.

The ICM is the Bus Master for the MOST system and contains the timing master for the MOST system.

TUNER

The IAM incorporates a AM/FM tuner which allows for 30 FM pre-sets (FM1 FM2 FM a) and 20 AM (10 AM and 10 AM a, for Europe the 10 strongest LW and MW will be stored in frequency order). Pre-set stations are stored in the IAM and ICM memory. The radio tuner also incorporates the following radio functions:

- Auto tune
- Traffic announcements (TA) – Europe only
- Radio Data System (RDS) EON function (Radio Broadcast Data System RBDS in NAS markets)
- Seek station
- Tune up/down
- Scan
- PTY

• NOTE: On vehicles fitted with the HD radio module, the module replaces the AM/FM function in the IAM. AM and FM antennae are connected directly into the HD radio module and not into the IAM; therefore the AM/FM functions in the IAM

are disabled.

CD PLAYER

The IAM CD player is a 6 disc multi changer located in the center of the instrument panel. The CD multi changer is capable of playing commercial CDs, CDRs, CDRWs and MP3 discs.

Random Play

The random play feature works in two different ways:

- Random play of tracks on a CD
- Random play of all tracks on any CD in the autochanger

The single disc random feature plays all the tracks on the selected CD in a random order. All the tracks on that disc will be played before a new random sequence is played. If a new CD is selected while in random mode, the random mode will be cancelled and play will commence from the first track.

In multi disc mode the IAM uses the current track as the first random track and will then play a further 2 tracks (if available) from this CD. The IAM will then randomly select another CD, and play 3 random tracks. This sequence continues until all tracks from all CD's are played back.

MP3 Function

The CD player has the capability to play MP3 files. The MP3 discs follow a format of folders and files within the folder. It is also possible to place all the files in the root directory on the CD.

The random and repeat features follow the normal CD random and repeat feature functions.

Automatic Volume Control (AVC)

AVC controls the audio volume in relation to vehicle speed. As vehicle speed increases the audio level is adjusted to compensate for extra road and vehicle noise. There are 4 settings for AVC:

- Off
- Low
- Medium
- High

The default setting is medium.

Changing the AVC level is accessed by a long press of the TONE button and selection of the AVC using the rotary encoder to change the level.

The vehicle speed signal is used to enable the ICM to calculate the volume adjustment required. The vehicle speed signal is received over the medium speed CAN. The signal is an average of the four wheel speed sensor signals. Should an invalid speed signal be received the AVC will not alter the output volume.

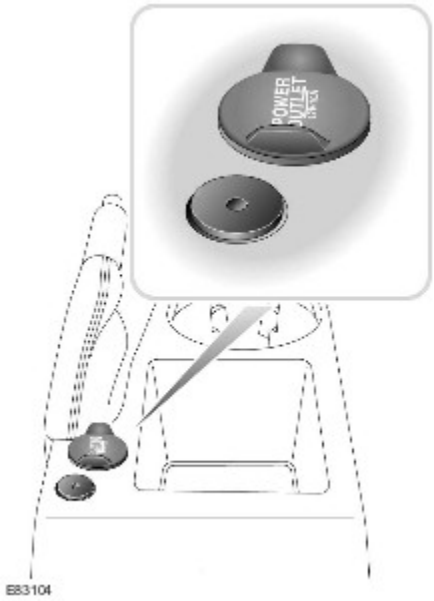
AVC is controlled by the audio amplifier.

CD Error Messages

When an CD error occurs, the IAM will alert the user by showing a display related to the error. This will be displayed while the CD audio mode is selected until the error is corrected. The CD related error does not affect other areas of the IAM. The user is able to select a different audio source.

Error Message in IAM display	Cause
Deck error	Mechanical Error, CD stuck, Servo related error, etc.
Hot disc	Internal CD temperature too high
Disc unreadable	Invalid Disc, CD ROM inserted, disc inserted upside-down, etc.

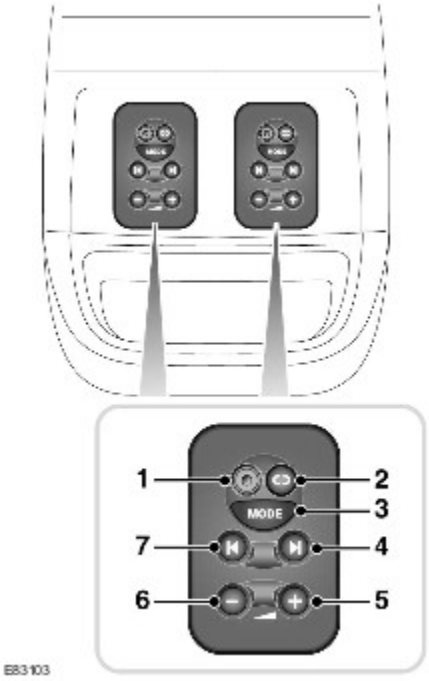
AUXILIARY SOCKET



The auxiliary connector is located at the rear of the center console. AUX (Auxiliary Input) mode allows extra equipment to be connected to the vehicle's audio system. Items such as a personal stereo, MP3 player, hand-held navigation unit etc., can be plugged in to the vehicle's audio system.

To listen to an auxiliary input source the portable device must be connected via the 3.5 mm stereo jack socket. If the device has a line out socket it is preferable that this is used for connection. Press and hold the AUX button on premium audio units. On standard audio units, press and release the AUX button.

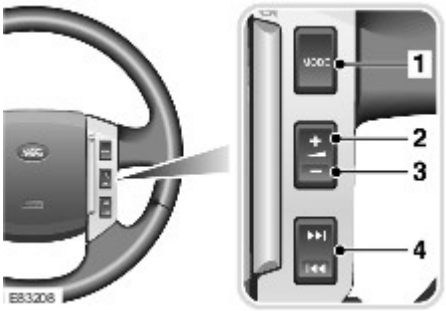
REAR SEAT HEADPHONE MODULES



Item	Part Number	Description
1	-	Headphone socket
2	-	CD select button
3	-	Mode button
4	-	Search up button
5	-	Volume increase button
6	-	Volume decrease button
7	-	Search down button

The rear seat headphone modules are located on the rear of the center console. The rear seat headphone modules allow the rear seat passenger to listen to audio via standard headphones. The modules allow the rear seat passengers to control which audio source they want to listen to and the volume. The rear headphone modules do not override the control of the audio head unit.

STEERING WHEEL CONTROLS



Item	Part Number	Description
1	-	Mode button
2	-	Volume increase button
3	-	Volume decrease button
4	-	Radio seek up/down, Next preset/previous preset, CD next/previous track button

The steering wheel mounted audio control switches are located on the RH side of the steering wheel. The switches are a resistive ladder type which return a different voltage to the ICM in response to different switches being pressed.
For additional information, refer to: Steering Column Switches (211-05 Steering Column Switches, Description and Operation).

SDARS (NAS Only)

The SDARS systems operate in the S-Band frequency range (2.3 GHz) and, as a result of the use of satellite transmission have the ability to provide CD quality audio broadcasts over very large areas (typically continents). SDARS service providers transmit a signal from their up-link facility (which is the original point of transmission of data, voice or other information through an antenna system) to a satellite where the signal is then down linked to both the terrestrial repeater network and the individual SDARS car radios. The radio switches between the satellite signal and the repeater signal depending on the strength of the signal at any given time.

Land Rover will be using the Sirius Satellite Radio service provider in the USA.

The SDARS systems comprise:

- Satellites
- Ground repeaters
- Up-link ground stations
- Radio receiver systems

The SDARS system uses three satellites on an inclined elliptical orbit. This ensures that each satellite spends approximately 16 hours a day over the continent of the USA, with at least one satellite over the country at any one time.

The satellites beam their signals down to the ground where the signal is picked up by receivers or is transmitted to repeater stations to cover built up areas where the signal is obscured.

SDARS is a subscription based service which requires the user to contact Sirius to obtain a subscription. In order to obtain a subscription the SDARS unit ID number will need to be retrieved from the unit. This is achieved as follows:

- Press the MENU button and then rotate the menu control to scroll to advanced settings.
- Rotate the menu control to scroll to SIRIUS ID and press the menu control to select it.
- The Sirius ID is shown on the display screen.

If no subscription has been taken the ICM will display the Sirius telephone number. To subscribe to Sirius use the displayed phone this number. The user will need payment details, the Sirius ID number and details of the required package.

The SDARS function is accessed by pressing the FM button and then pressing again to toggle through the SAT1 and SAT2 sources. SAT1 and SAT2 operate in the same manner as FM1 and FM2.

The SDARS module is located in the rear Left Hand (LH) side of the luggage compartment. The SDARS module is connected to the rest of the audio system on the MOST ring. This allows control signals and received audio to be routed around the system to the relevant module. The SDARS antenna is located in the roof mounted pod and is hardwired to the SDARS module.

HIGH DEFINITION (HD) RADIO - From 2009MY (NAS Only)

HD radio is the registered trademark for the In-Band On-Channel (IBOC) technology selected by the Federal Communications Commission (FCC) for terrestrial digital audio broadcasting in the United States. A large number of radio stations now broadcast in both AM and FM. FM frequencies are capable of transmitting multiple frequency streams on a single FM frequency. HD radio has an advantage over SDARS in that it is free to receive and requires no subscription.

HD radio enhances the sound quality of the received signal so that FM reception gives near CD quality digital reproduction and AM reception sounds as rich as analog FM stereo. Both AM and FM HD radio offer static-free, crystal-clear reception. An additional benefit is FM Multicasting – the ability to broadcast multiple program streams over a single FM frequency (for example 97.7-1, 97.7-2, etc.). The HD radio module is capable of receiving the traditional analogue transmissions of radio stations not transmitting digital broadcasts in addition to receiving the digital transmissions broadcast alongside the analogue transmissions from radio stations who offer digital output.

The HD radio module replaces the AM/FM function in the IAM. AM and FM antennae are connected directly into the HD radio module and not into the IAM; therefore the AM/FM functions in the IAM are disabled.

The broadcast audio signals are digitally compressed by the radio transmitter. Audio is also transmitted in its current

analogue form alongside the digital transmission. The HD radio module receives the analogue and digital signals via the vehicle AM and FM antennae along with accompanying text transmissions. These signals are decoded by the module and played as an audio output or displayed as an information text on the head unit LCD display or the ICM LCD display depending the system installed.

The HD radio module is located in the LH side of the luggage compartment. The module receives a fused power supply from the AJB. The module is also connected on the MOST ring and is able to communicate with the other entertainment and information systems in the vehicle.

CLOCK

The ICM contains the master clock functionality. Other vehicle infotainment modules that require clock functionality use the time supplied from the ICM.

The clock is available to any control module that is connected to an interconnecting bus, for example, either of the CAN buses or the MOST ring.

The clock display configurable to show in AM / PM or 24 hour format. Midnight is shown as 12:00AM or 00:00 respectively. The default condition, if not specified, after power on or delivery, should default to 12:00PM or 00:00. Depending upon the market set the clock will default to either 12 or 24 hour format.

The time is adjusted from the ICM. Under conditions when any bus could be asleep or shut down, the ICM does not allow clock adjustments.

AMPLIFIERS

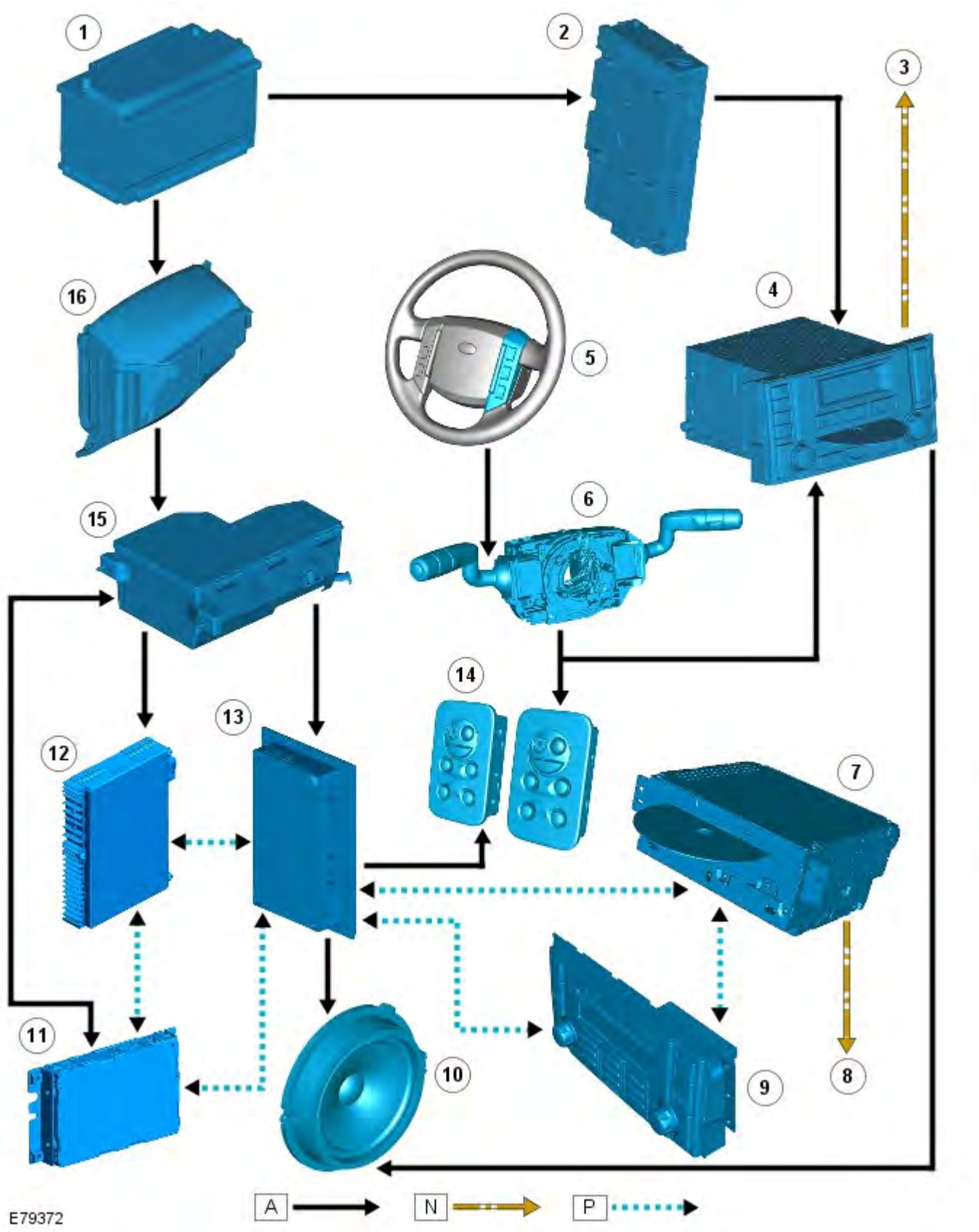
The audio system has three amplification options dependant on the audio system specified:

- Internal amplifier
- Harman kardon
- Harman kardon LOGIC 7

The amplifier is located in the Right Hand (RH) corner of the luggage compartment and is connected to the audio system via the MOST bus. Speaker connections are hardwired.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired connection; **D** = Medium speed CAN bus; **P** = MOST



Item	Part Number	Description
1	-	Battery
2	-	CJB
3	-	CAN out to other vehicle systems
4	-	Audio head unit
5	-	Steering wheel controls
6	-	Clockspring
7	-	Integrated Audio Module (IAM)
8	-	CAN out to other vehicle systems
9	-	Infotainment Control Module (ICM)
10	-	Speakers
11	-	SDARS module (NAS only)

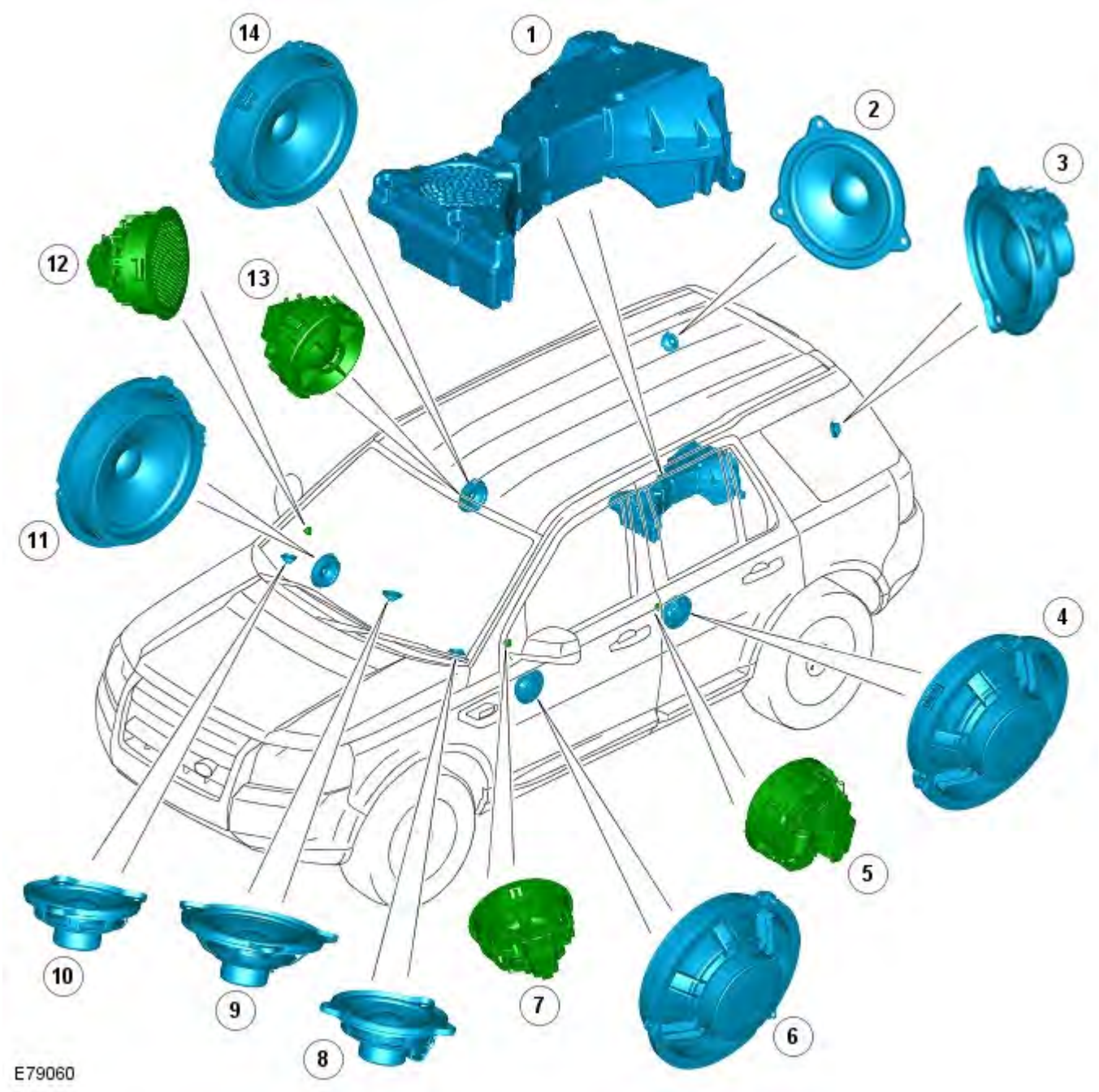
12	-	HD radio module (NAS only - from 2009MY)
13	-	Audio amplifier
14	-	Rear headphone sockets and audio control
15	-	AJB
16	-	BJB

Published: 11-May-2011

Information and Entertainment System - Speakers

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Subwoofer enclosure
2	-	Rear RH surround speaker
3	-	Rear LH surround speaker
4	-	Rear LH mid range speaker
5	-	Rear LH high range speaker
6	-	Front LH mid/low range speaker
7	-	Front LH high range speaker
8	-	Front LH mid range speaker
9	-	Center fill speaker
10	-	Front RH mid range speaker
11	-	Front RH mid/low range speaker
12	-	Front RH high range speaker
13	-	Rear RH high range speaker
14	-	Rear RH mid range speaker

OVERVIEW

Depending on the audio system fitted there are 3 different speaker configurations, these are:

Base audio

- 2 Front door mounted mid/low range speakers
- 2 Front door mounted high range speakers
- 2 Rear door mounted mid/low range speakers
- 2 Rear door mounted high range speakers

Mid range audio system

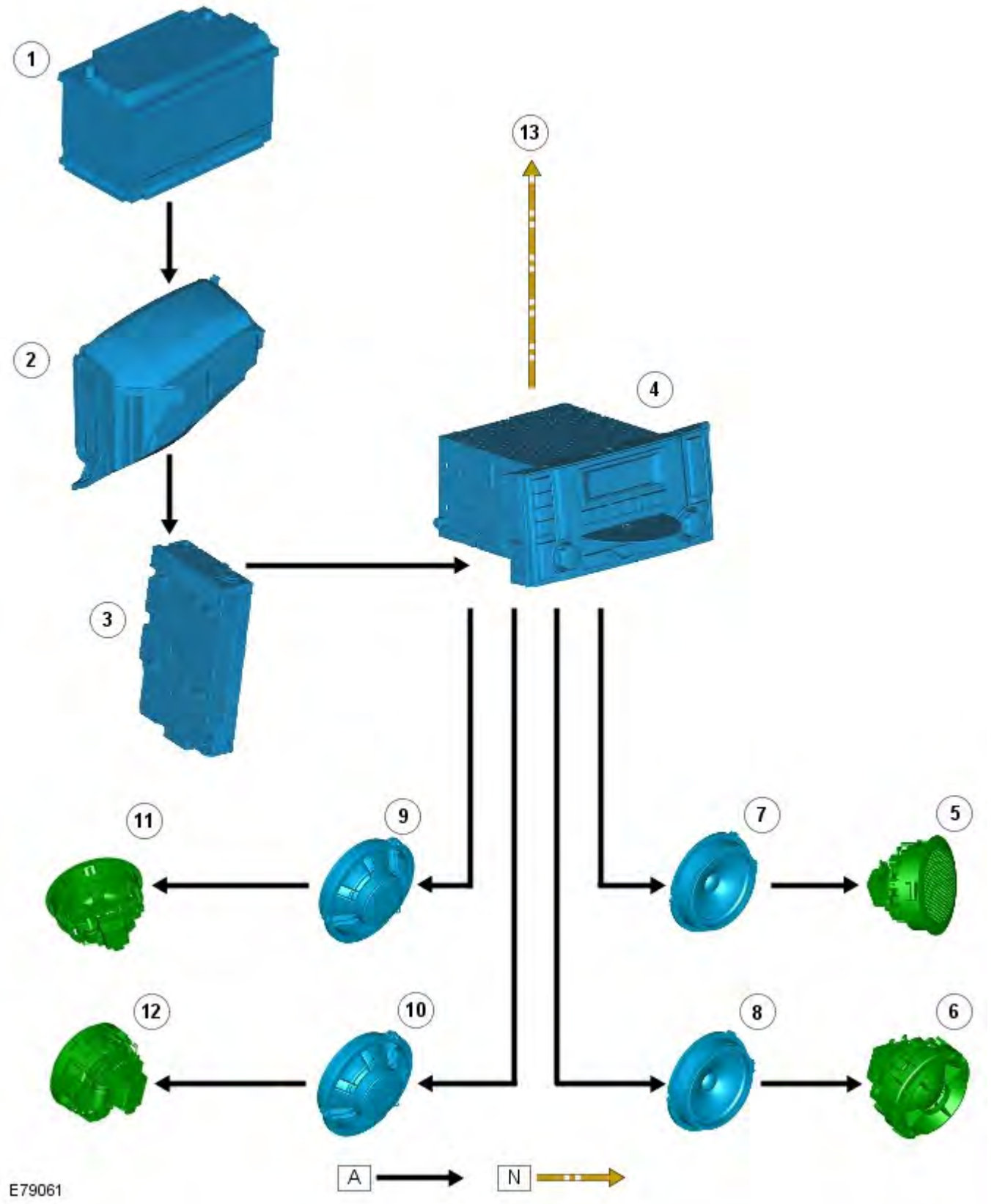
- 2 Front door mounted mid/low range speakers
- 2 Front door mounted high range speakers
- 2 Rear door mounted mid/low range speakers
- 2 Rear door mounted high range speakers
- Rear loadspace mounted sub-woofer enclosure

High line audio system

- 2 Front door mounted low range speakers
- 2 Front door mounted high range speakers
- 2 Rear door mounted mid/low range speakers
- 2 Rear door mounted high range speakers
- Rear loadspace mounted sub-woofer enclosure
- 2 Mid range speakers mounted on the instrument panel
- 1 center fill speaker centrally located in the instrument panel
- 2 rear surround speakers mounted in the rear C pillars

CONTROL DIAGRAM SHEET 1 of 3

• NOTE: **A** = Hardwired; **N** = Medium speed CAN bus

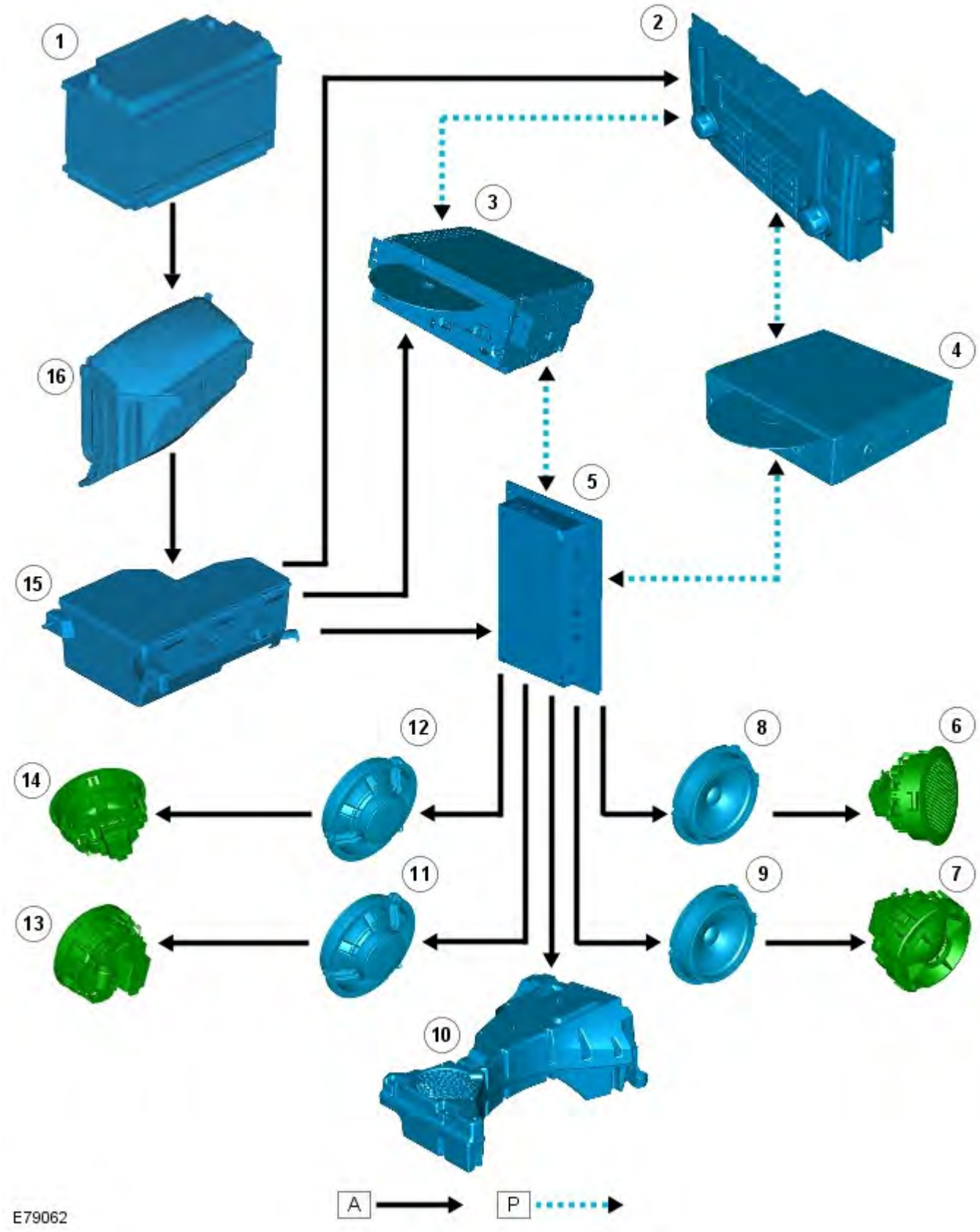


Item	Part Number	Description
1	-	Battery
2	-	BJB
3	-	CJB
4	-	Audio head unit
5	-	Front RH high range speaker
6	-	Rear RH high range speaker
7	-	Front RH mid/low range speaker
8	-	Rear RH mid/low range speaker
9	-	Front LH mid/low range speaker
10	-	Rear LH mid/low range speaker
11	-	Front LH high range speaker

12	-	Rear LH high range speaker

CONTROL DIAGRAM SHEET 2 of 3

- NOTE: **A** = Hardwired; **P** = MOST

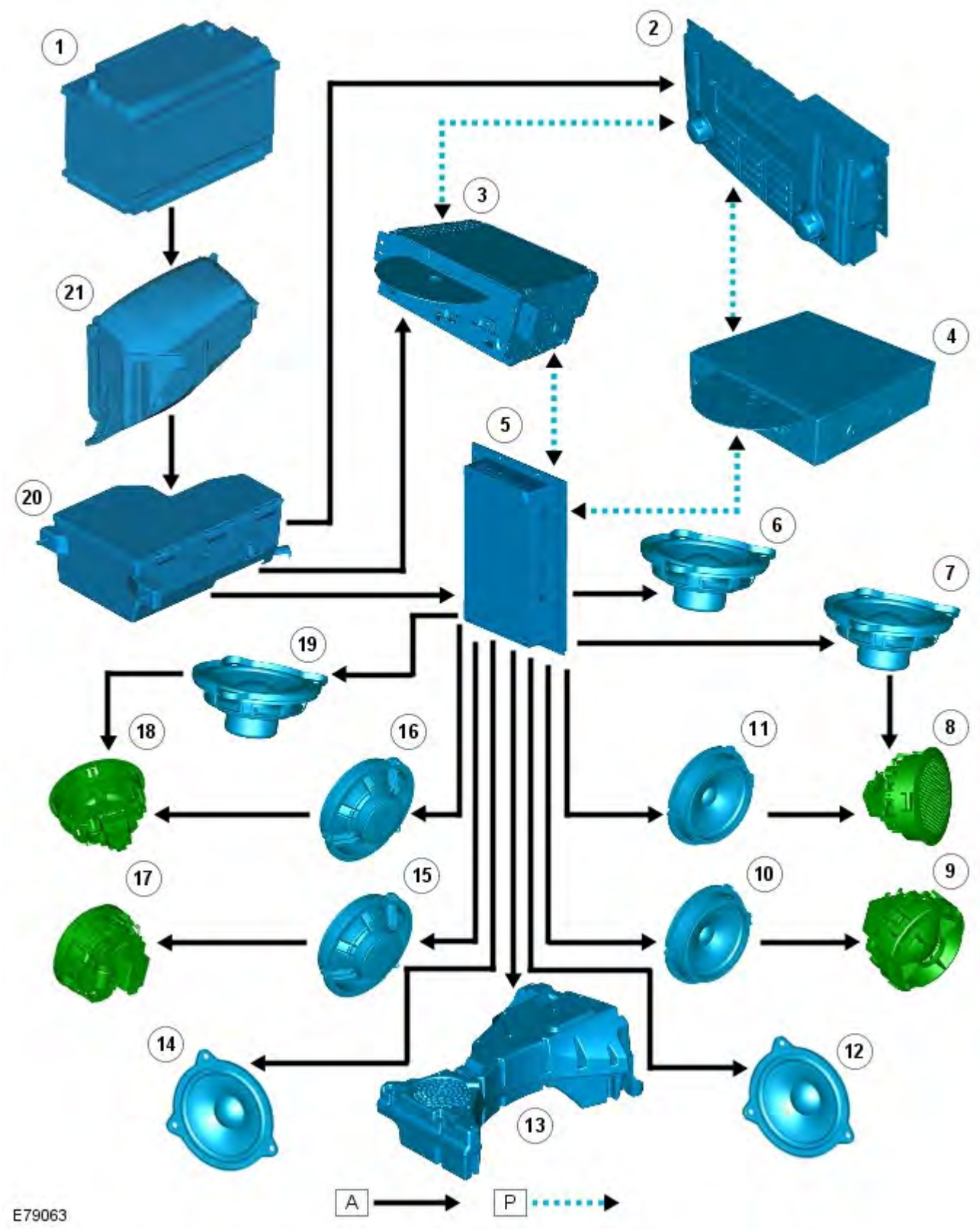


Item	Part Number	Description
1	-	Battery
2	-	Infotainment control module
3	-	Integrated audio module
4	-	Navigation computer
5	-	Audio amplifier

6	-	Front RH high range speaker
7	-	Rear RH high range speaker
8	-	Front RH mid/low range speaker
9	-	Rear RH mid/low range speaker
10	-	Subwoofer enclosure
11	-	Rear LH mid/low range speaker
12	-	Front LH mid/low range speaker
13	-	Rear LH high range speaker
14	-	Front LH high range speaker
15	-	AJB
16	-	BJB

CONTROL DIAGRAM SHEET 3 of 3

- NOTE: **A** = Hardwired; **P** = MOST



Item	Part Number	Description
1	-	Battery
2	-	Infotainment control module
3	-	Integrated audio module
4	-	Navigation computer
5	-	Audio amplifier
6	-	Front center fill speaker
7	-	Front RH mid range speaker
8	-	Front RH high range speaker
9	-	Rear RH high range speaker
10	-	Rear RH mid/low range speaker
11	-	Front RH low range speaker

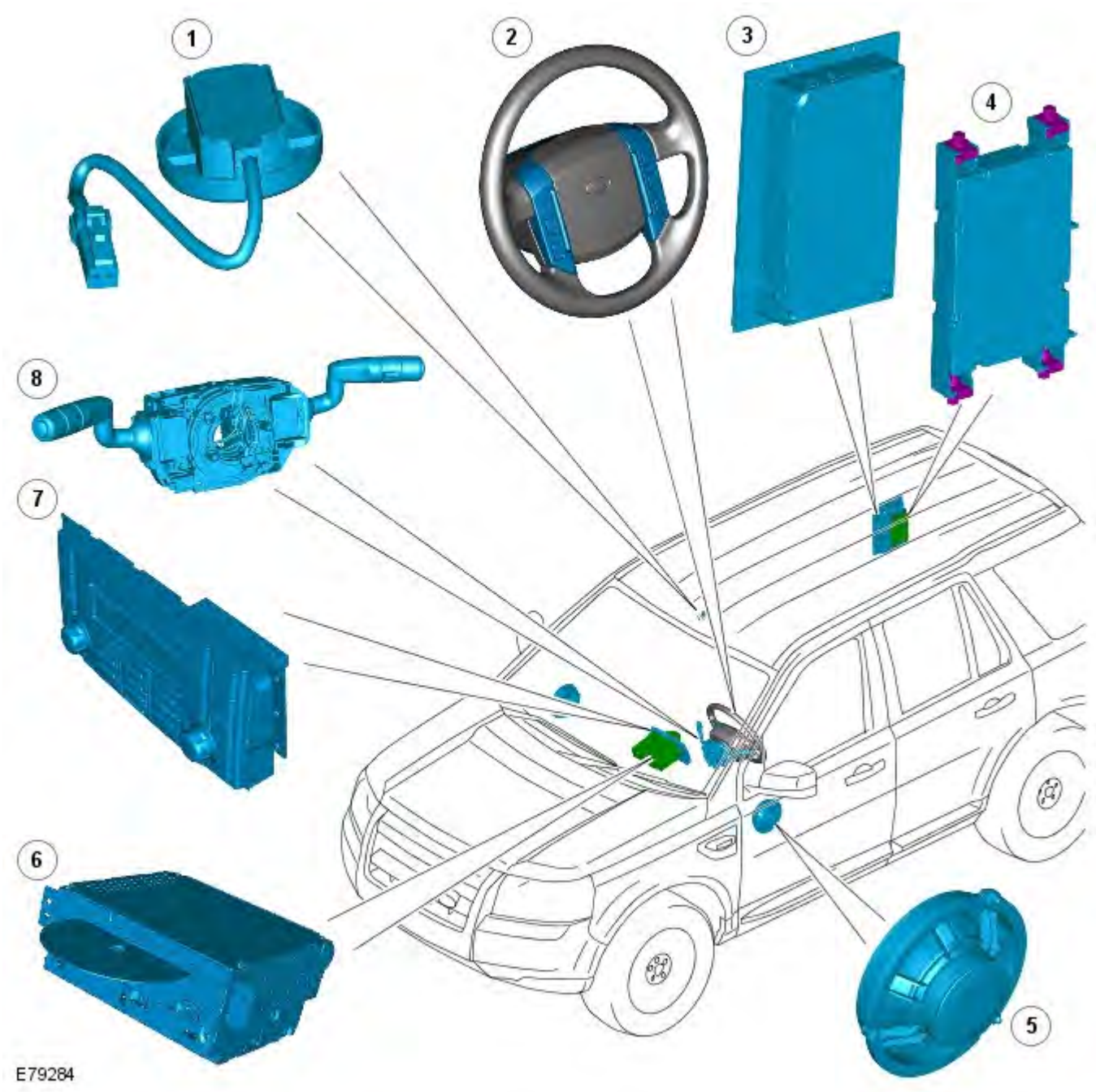
12	-	Rear RH surround speaker
13	-	Subwoofer
14	-	Rear LH surround speaker
15	-	Rear LH mid/low range speaker
16	-	Front LH mid range speaker
17	-	Rear LH high range speaker
18	-	Front LH high range speaker
19	-	Front LH mid range speaker
20	-	AJB
21	-	BJB

Published: 11-May-2011

Information and Entertainment System - Cellular Phone

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Microphone
2	-	Steering wheel switches
3	-	Audio amplifier
4	-	Telephone control module
5	-	Speakers
6	-	Integrated audio module (IAM)
7	-	Infotainment control module (ICM)
8	-	Clockspring

OVERVIEW

The system allows the driver to use a Bluetooth equipped cellular phone handset through the vehicles Information and Entertainment system.

• NOTE: There is no physical connection (cradle) between the phone handset and the telephone control module. Communications between the 2 components are purely Bluetooth. This can limit the available functions dependant on the handset used.

The cellular phone system comprises the following components:

- Telephone control module
- Microphone

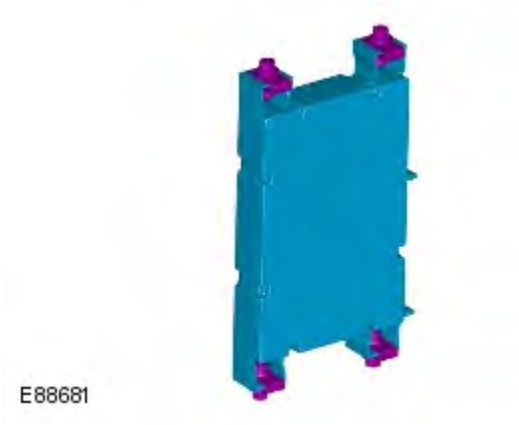
Phone dialing is achieved using one of the following methods:

- Dialing a number using the ICP keypad
- Selecting a number from the handsets phonebook via the ICM
- Selecting from the handsets call register via the ICM

The Telephone control module is connected to the Information and Entertainment system on the MOST ring. This allows audio and control signals to be routed to and from the telephone control module. The telephone control module has an integral Bluetooth antenna.

Telephone handsets must be paired with the telephone control module before they can be used with the vehicle system. Up to five telephone handsets can be paired with the vehicle, but only one telephone can used at a time.

PHONE MODULE

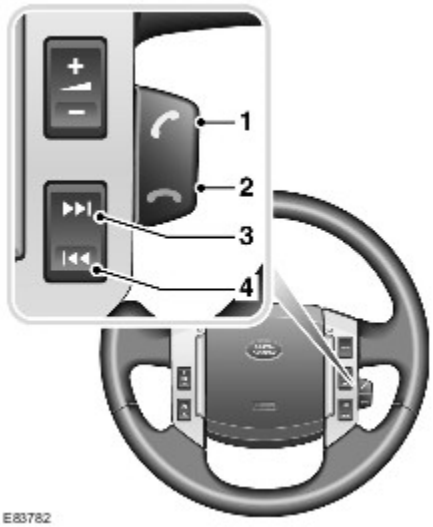


The telephone control module is located in the rear RH side of the loadspace. The phone module is connected on the MOST ring to the rest of the entertainment system.

MICROPHONE

The microphone is located in the overhead console which surrounds the front interior lamp. The microphone is hardwired to the IAM.

CONTROL SWITCHES



E83782

Item	Part Number	Description
1	-	Answer call or dial switch
2	-	End or reject call switch
3	-	Menu next button
4	-	Menu previous button

The steering wheel mounted telephone control switches are located on the RH side of the steering wheel. The switches are a resistive ladder type which return a different voltage to the ICM in response to different switches being pressed.
For additional information, refer to: Steering Column Switches (211-05 Steering Column Switches, Description and Operation).

The following table details the cellular phone steering wheel switch functions.

Switch	Functions
Mode	Change audio source no change to display. (Also changes ICM display to match source)
|<< >>|	Scroll through phonebook down / Up (While Display is in Phone mode)
Send key	Last 10 dialed calls, initiate call, accept call (While Display is in Phone mode)

ICM Control Switches

E83781

Item	Part Number	Description
1	-	Call status icon
2	-	Paired telephone name
3	-	Clock
4	-	Telephone mode button
5	-	MENU button
6	-	EXIT button
7	-	ENTER button
8	-	Keypad
9	-	On or off or volume button

Accessing the cellular phone system from the ICM allows the user various options depending on the Bluetooth version of the phone.

TELEPHONE VOICE CONTROL

The vehicle system is able to use any voice tags which are stored in the mobile telephone. There is no voice dialing feature of the cellular telephone system.

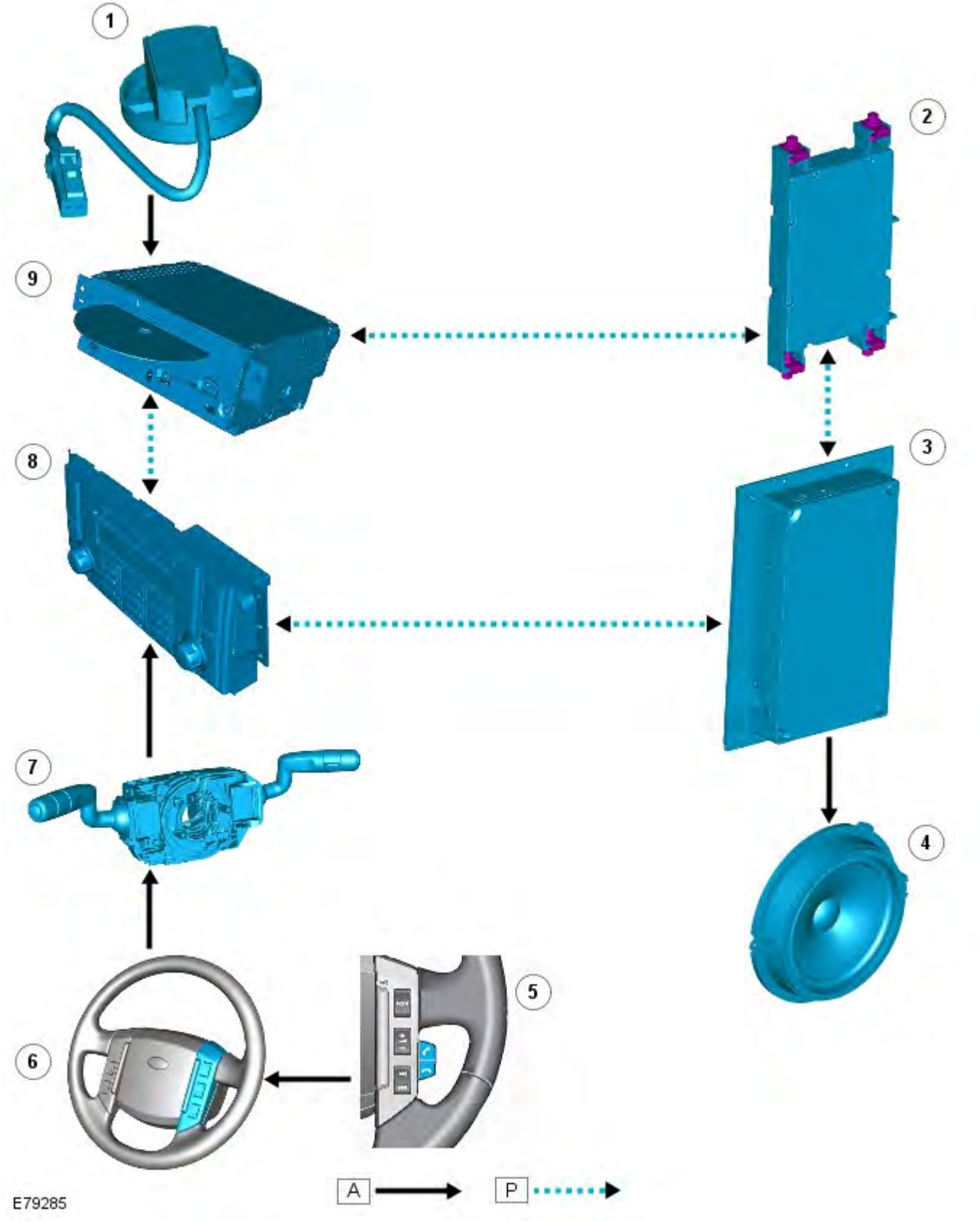
Voice dialing is accessed via a long press of the RH rotary ENTER button. The ICM displays that Voice tag dialing is in progress and an audible prompt is generated from th e telephone control module. After the prompt the handset waits several seconds for the voice command.

PRINCIPLES OF OPERATION

The phone system is controlled from the ICM and/or the steering wheel mounted switches. Control signals from the steering wheel switches are sent via the clock spring and the steering wheel module to the ICM. The ICM sends control signals on the MOST ring to the telephone control module. Audio is sent on the MOST ring to the audio amplifier and is output on the vehicle speaker system.

CONTROL DIAGRAM

- NOTE: **A** = Hardwired; **P** = MOST



Item	Part Number	Description

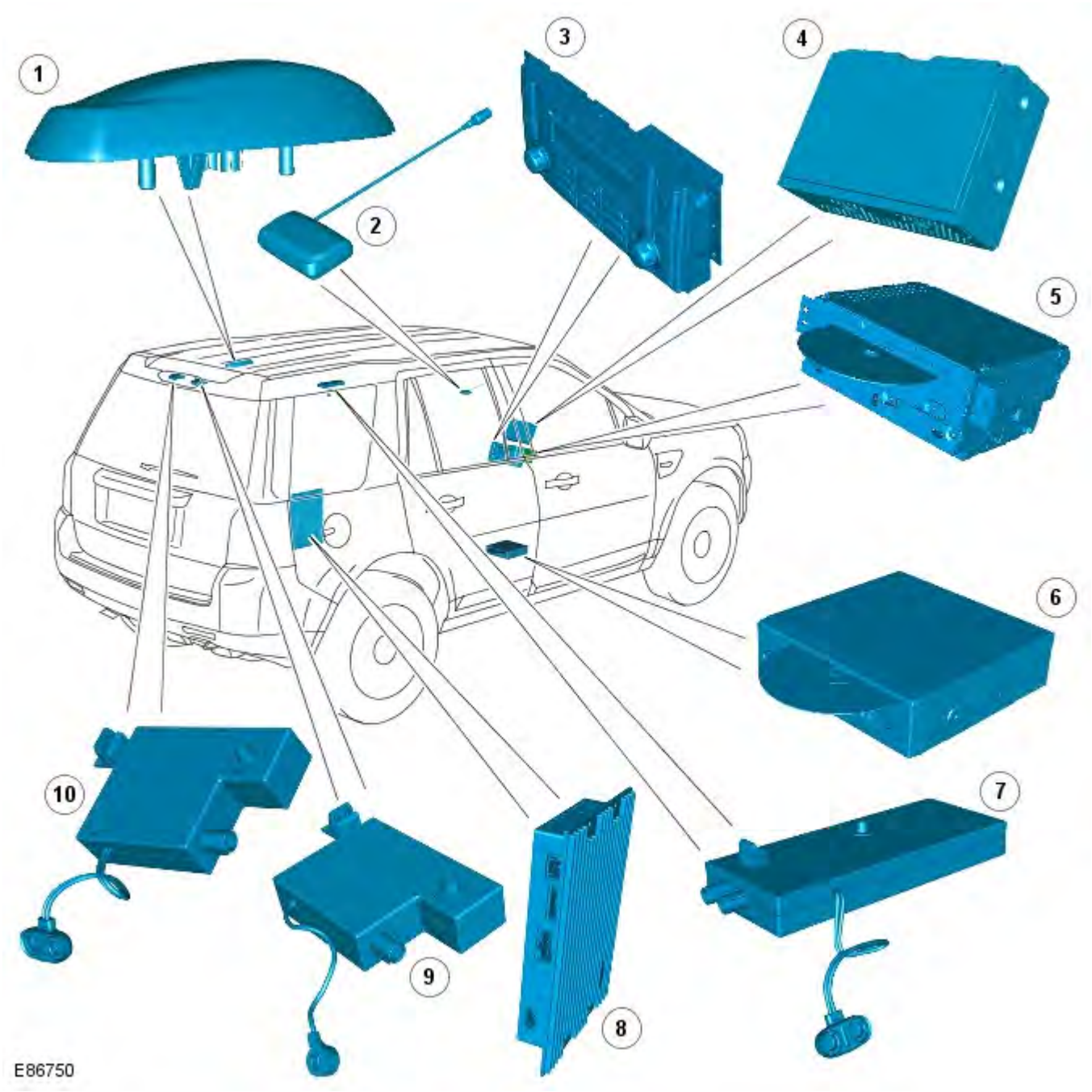
1	-	Microphone
2	-	Telephone control module
3	-	Audio amplifier
4	-	Speakers
5	-	Steering wheel mounted call switches
6	-	Steering wheel mounted audio control switches
7	-	Clockspring
8	-	Infotainment control module (ICM)
9	-	Integrated audio module (IAM)

Published: 11-May-2011

Information and Entertainment System - Navigation System

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Global positioning system (GPS) antenna
2	-	Vehicle Information and Communication System (VICS) beacon antenna - Japan only
3	-	Control panel and infotainment control module
4	-	Touch screen display
5	-	Integrated audio module
6	-	Navigation computer
7	-	AM (amplitude modulation) / FM (frequency modulation) antenna amplifier – non diversity system, or AM/FM diversity antenna amplifier
8	-	Audio amplifier
9	-	VICS/TMC antenna amp
10	-	Twin FM antenna amp for diversity tuning

OVERVIEW

The navigation system provides audible and visual route guidance information to enable the driver to reach a desired destination. The system allows the driver to choose the desired route using minor or major roads or highways with the option of three routes. Directions to hospitals, museums, monuments and hotels are also available. The computer uses

map information stored on a DVD to determine the best route for the journey and provide the driver with details of directions and approaching junctions.

The navigation system is controlled by the driver from the touch screen display. Control signals from the touch screen display are sent on the Media Orientated System Transport (MOST) ring to the infotainment control module where they are then transmitted on the MOST ring to the navigation computer. The navigation computer uses a dedicated Gigabit Video Interface (GVIF) to transmit video signals to the touch screen display.

Vehicles with navigation systems also incorporate additional traffic information systems. These are market dependant and are as follows:

- Europe - Traffic Message Channel (TMC).
- Japan - Vehicle Information and Communication System (VICS).
- NAS - No additional system.

Navigation Computer

The navigation computer located under the right-hand front seat, houses the DVD drive that reads the map data from the region specific DVD. Access to the DVD slot is from the rear of the seat.

A button, located adjacent to the DVD slot, is provided to eject the DVD from the unit. Prior to ejecting the disc the slot protection has to be slid to the side. If the ignition is on, or the entertainment system is in 1-hour mode, one press of the button will eject the DVD.

Connected to the MOST bus, the navigation computer generates its own graphics and transmits them to the touch screen display on a dedicated Gigabyte Video Interface (GVIF) bus.

The navigation computer also incorporates the following:

- GPS receiver
- VICS receiver (Japan only)
- Traffic Message Channel (TMC) receiver

The GPS receiver receives information from between 1 and 8 satellites at any one time. This information is received from the GPS antenna. The built in GPS receiver is used for calculating the position (i.e. latitude, longitude and height), direction and speed.

The navigation computer contains a solid state piezo gyro which measures the motion of the vehicle around its vertical axis. The gyro operates on the principle known as the Coriolis force. The Coriolis force is the force that appears to accelerate a body moving away from its rotational axis against the direction of rotation of the axis.

To calculate the vehicle's current position, direction and speed, the navigation computer uses:

- speed signals transmitted on the high-speed CAN from the ABS module to the MOST ring,
- and signals transmitted from the GPS antenna and the gyro sensor.

For the Japanese market the navigation computer incorporates a VICS receiver. The VICS receiver, receives information from the VICS beacon antenna in the center of the instrument panel and the electric Frequency Modulation (FM) antenna. Using this information the VICS system monitors information regarding traffic conditions from roadside transmitters, and if necessary, adjusts the navigation instructions accordingly to avoid traffic congestion.

For certain European markets the navigation computer incorporates the Traffic Message Channel (TMC) receiver. The TMC receiver decodes TMC data. The navigation computer then displays this information on the touch screen display and re-routes the navigation guidance system to avoid traffic congestion. The TMC data is received via the electric FM antenna.

The navigation computer uses non-volatile memory to store settings and configuration information when it is powered down. This process takes place just before the computer turns off.

Touch Screen Display

E86752

The touch screen display is located in the center of the instrument panel and is the dedicated interface with the navigation system. The touch screen display does not operate any other vehicle systems. The screen is a touch sensitive 7 inch liquid crystal display (LCD) screen containing 800 x 480 pixels in a 15:9 format. The touch screen display is connected to the Information and Entertainment system on the MOST ring. The MOST ring is a fiber optic communications data bus that allows high speed transfer of control instructions and audio around the system.

The touch screen display processes its own video for system operation but receives the navigation graphics from the navigation computer on a dedicated serial link called Gigabit Video Interface (GVIF).

The touch screen display navigation control signals are sent on the MOST ring to the navigation computer.

GPS Antenna

E86753

The Global Positioning System (GPS) antenna is located on the rear of the vehicle's roof. The GPS antenna is connected to navigation computer by a single co-axial cable and passes signals from the GPS satellites to the navigation computer's built in receiver for processing.

It is possible for the GPS antenna to lose the signal from the GPS satellites:

- In hilly or tree lined areas
- Built up areas with tall buildings
- In multi storey car parks
- In garages
- In tunnels
- In bridges
- During heavy rain or thunderstorms.

When the signal is lost the navigation computer will continue to give guidance using memory mapped data from the DVD map until the signal is restored.

For additional information, refer to: Antenna (415-02, Description and Operation).

VICS Beacon Antenna - Japan Only

The VICS beacon antenna is located on top of the instrument panel. The antenna receives infra red and RF signals from road side transmitters. The Antenna is connected to the navigation computer which incorporates a VICS receiver.

For additional information, refer to: Antenna (415-02, Description and Operation).

Control Panel and Infotainment Control Module

The control panel incorporates switches for audio system and telephone control. The navigation system is operated from the touch display screen via signals on the MOST ring. Hard switches on the control panel send CAN signals to the infotainment control module which transfers signals to the relevant module on the MOST ring.

The infotainment control module is the gateway between the medium-speed CAN bus and the infotainment system MOST bus.

For additional information, refer to: Audio System (415-01, Description and Operation).

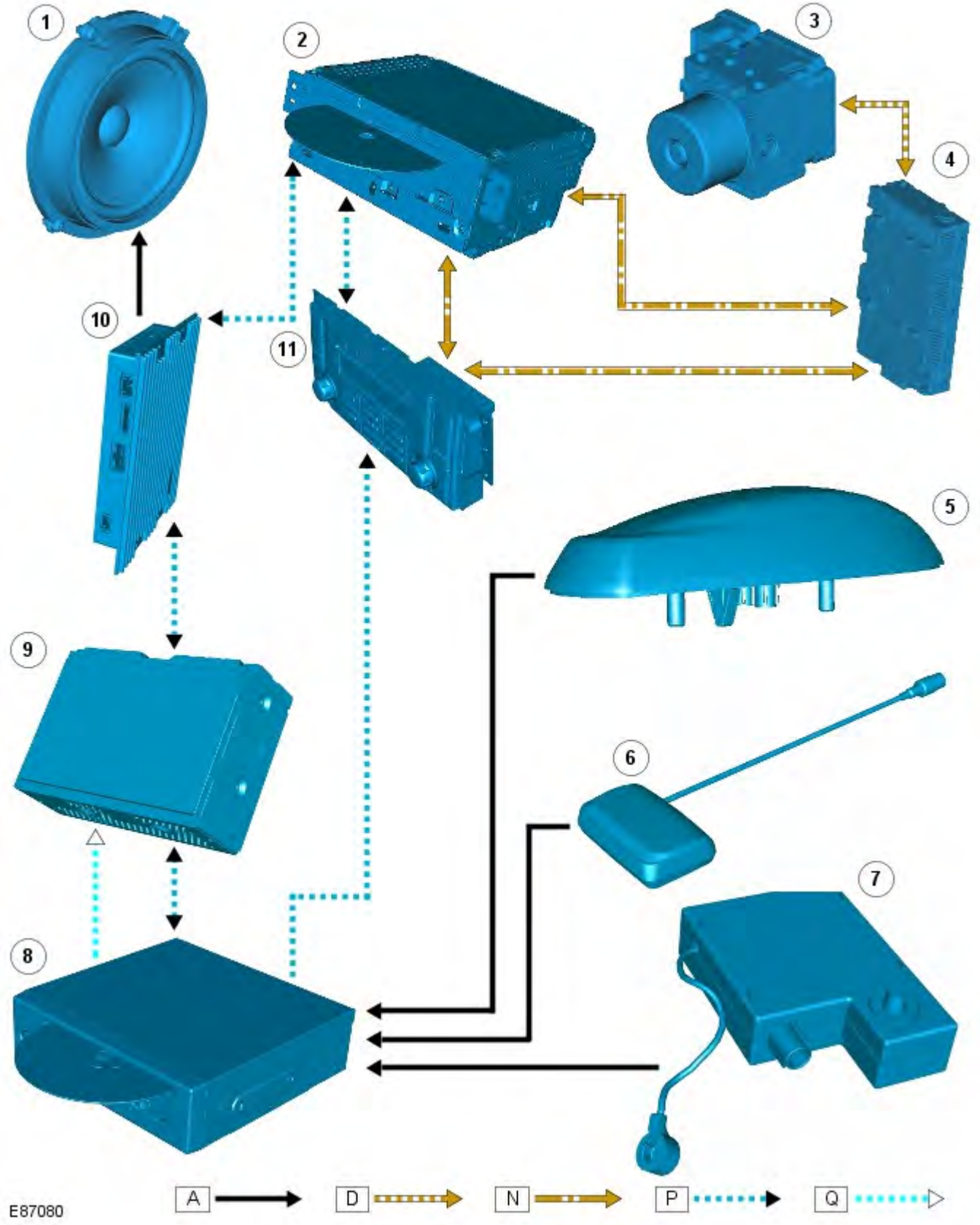
Integrated Audio Module

Audio signals are sent on the MOST ring from the Integrated Audio Module to the amplifier.

For additional information, refer to: Audio System (415-01, Description and Operation).

CONTROL DIAGRAM

- NOTE: **A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus; **P** = MOST; **Q** = GVIF



Item	Part Number	Description
1	-	Speakers
2	-	Integrated audio module
3	-	Anti-lock brake system (ABS) control module
4	-	Central junction box (CJB)
5	-	Global positioning system (GPS) antenna
6	-	Vehicle Information and Communication System (VICS) beacon antenna - Japan only
7	-	Traffic Message Channel (TMC) antenna amplifier - Europe only
8	-	Navigation computer
9	-	Touch screen display (TSD)
10	-	Audio amplifier
11	-	Infotainment control module (ICM)

PRINCIPLES OF OPERATION

The system used to calculate the current position of the vehicle is called the Global Positioning System (GPS). The system utilizes satellites which are owned by the United States Department of Defense. A total of 24 satellites orbit the earth every 12 hours at a height of 20,000 km (12500 miles), and between 5 and 11 of these satellites can be seen from a single point at any given time. The orbits are tilted to the earth's equator by 55 degrees to ensure coverage of polar regions. Each satellite transmits radio signals to provide information about the satellite's position, for example the latitude, longitude, altitude, almanac data and an accurate time signal generated by an on-board atomic clock. Each satellite contains four atomic clocks.

The vehicle needs to receive data from at least four different satellites to give a three dimensional fix on its current position.

As the vehicle moves, this information is continually being updated. The computer determines which satellites are 'visible' to the system and their current position and relationship to each other. Using this information the computer can account for positional deviations of the satellites and compensate to enhance the accuracy of the navigation system.

The Global Positioning System (GPS) signal is also known as the Precision Positioning Signal (PPS).

PPS predictable accuracy is:

- 22 meters horizontal accuracy
- 27.7 meters vertical accuracy
- 200 nanoseconds time accuracy.

The navigation system receives GPS information via the GPS antenna. The GPS signals are used by the navigation computer to calculate the vehicles position. Once the driver has entered a destination, the navigation computer can calculate a route, based on the driver's pre-determined preferences or the default settings in the navigation computer.

The navigation system receives GPS (global positioning system) information via the GPS antenna. The GPS signals are used by the navigation computer to calculate the vehicles position. Once the driver has input a desired destination the navigation computer can calculate a route, based on the drivers pre-determined preferences or the default settings in the navigation computer.

The navigation system is accessed by pressing the navigation soft key on the touch screen display.

Navigation is initiated by the driver entering a destination. This can be achieved by:

- Entering in an address using the touch screen display.
- Entering a post code.
- Choosing a previous destination
- Choosing a point of interest from the map disc database.
- Choosing the home location.
- Choosing a memory stored location.

The driver is then guided to the destination by a scrolling map display and voice guidance. The display can be varied by scale and display type.

In addition to the navigation system there are two market dependant systems that supply extra information to the navigation system and the driver. These are:

- Traffic Message Channel (TMC) – Europe only.
- Vehicle Information and Communication System (VICS) - Japan only.

Traffic Message Channel (TMC)

The Traffic Message Channel (TMC) traffic data is currently broadcast in many European countries.

TMC is a function of the FM (frequency modulation) Radio Data System (RDS). The system broadcasts real-time traffic and weather information. TMC information is received via the normal FM radio antenna.

Data messages are received and decoded by the TMC receiver and passed onto the navigation system, which then delivers them via the navigation system interface. TMC messages can be filtered by the navigation computer so that only those relevant to the current journey are displayed, allowing the navigation system to offer dynamic route guidance - alerting the driver of a problem on the planned route and calculating an alternative route to avoid the incident. All TMC events on the map can be viewed not just the ones on the calculated route.

TMC traffic information systems conform to a global standard that has been adopted by:

- traffic data gatherers,
- information service providers,
- broadcasters, and
- vehicle/receiver manufacturers.

All TMC receivers use the same list of event codes, while the location database (on the map disc) contains both a country-specific set of location codes for the strategic European road network.

Vehicle Information and Communication System (VICS)

The Vehicle Information and Communication System (VICS) is broadcast in the Japanese market.

The VICS system supplies the navigation computer with information that enables the computer to inform the vehicle driver of traffic conditions in the vehicle's vicinity and calculate an alternative route if necessary. Information is transmitted to the navigation system through three routes:

1. Radio Frequency Transmission

Radio frequency transmission is generally transmitted from road side beacons mainly on highways. The information transmitted is as follows:

- Traffic congestion
- Travel time to next intersection
- Traffic conditions in surrounding areas and highway turn offs
- Traffic accidents
- Speed limits
- Lane regulations
- Tire change
- Parking availability at highway service areas and parking areas.

2. Infra-red Transmission.

Infra-red transmission is received by the beacon antenna mounted on the top of the instrument panel. Infra-red transmissions are transmitted from road side beacons on major trunk roads. The information transmitted is:

- Traffic congestion and travel time
- Traffic accidents
- Breakdowns
- Road works restrictions
- Parking availability.

3. FM (frequency modulation) Transmissions.

FM (frequency modulation) transmissions are received via the FM antenna, broadcast as part of the normal RDS FM transmission.

Information transmitted is:

- Traffic congestion and travel time for wide areas
- Traffic accidents, road works, speed limits and lane restrictions for a wide area
- Parking availability information.

Published: 11-May-2011

Information and Entertainment System - Information and Entertainment System

Diagnosis and Testing

For additional information.
REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

Published: 11-May-2011

Information and Entertainment System - Audio Unit

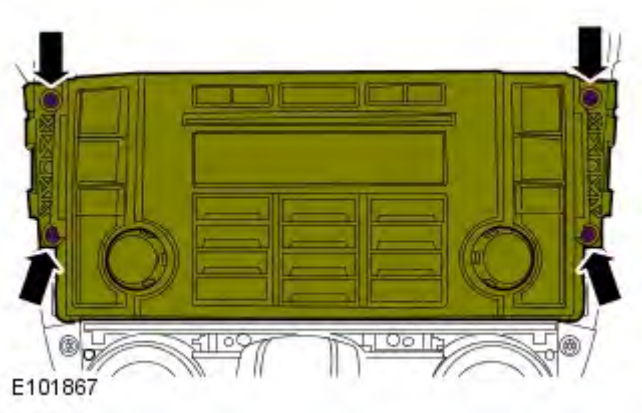
Removal and Installation

Removal

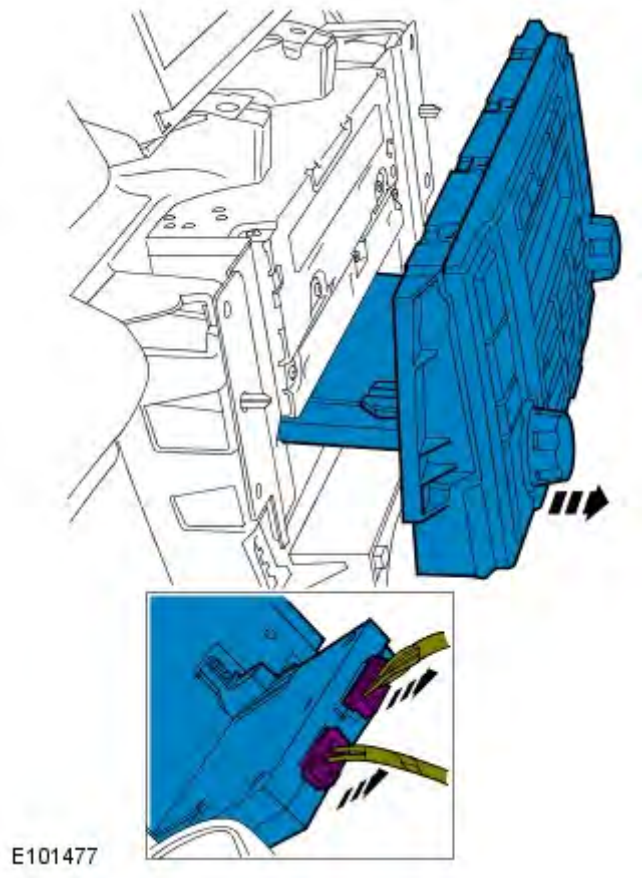
- NOTE: Removal steps in this procedure may contain installation details.

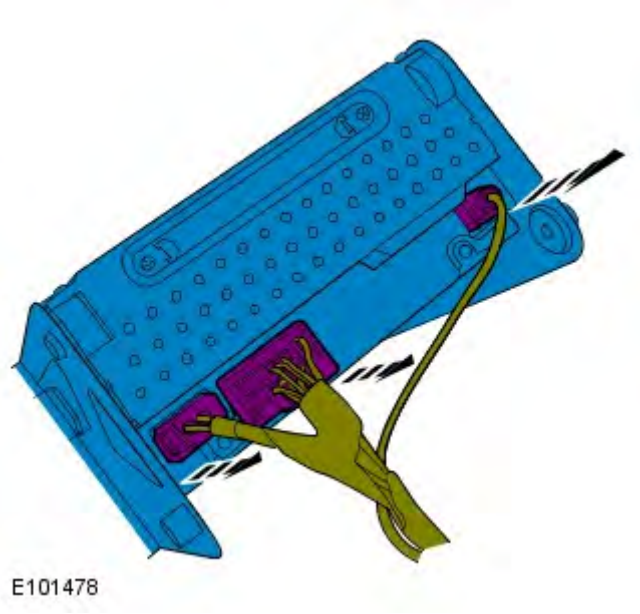
1. Refer to: Instrument Panel Console (501-12 Instrument Panel and Console, Removal and Installation).

2.

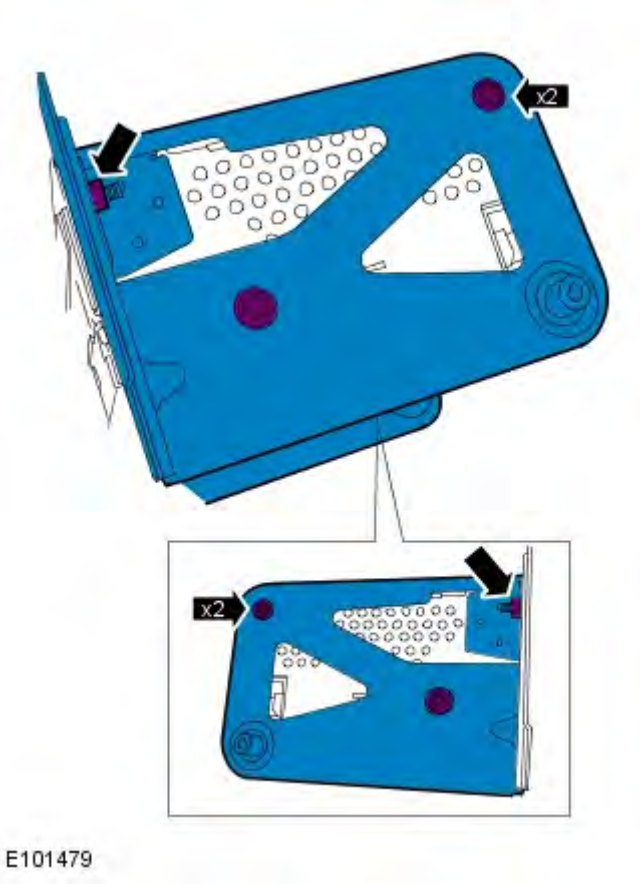


3.





4. **4.** NOTE: Do not disassemble further if the component is removed for access only.



5. **5.** CAUTION: During installation the top edge of the brackets must be aligned with the top edge of the audio unit. Failure to do so may result in damage to the vehicle.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

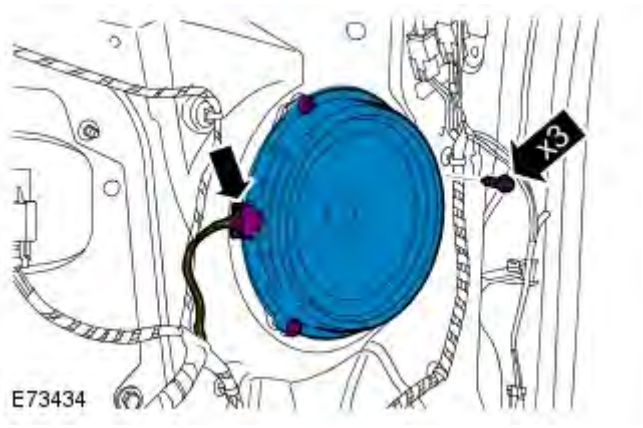
Information and Entertainment System - Front Door Speaker

Removal and Installation

Removal

1. Remove the front door trim panel.

   Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.

Installation

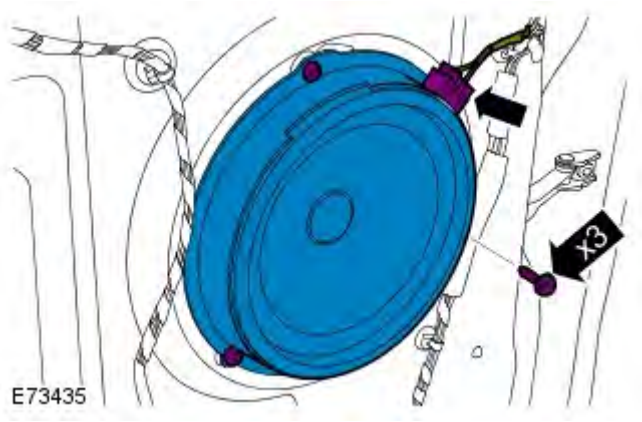
1. To install, reverse the removal procedure.

Published: 11-May-2011

Information and Entertainment System - Rear Door Speaker

Removal and Installation

Removal



1. Remove the rear door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.

Installation

1. To install, reverse the removal procedure.

2. Install the rear door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Information and Entertainment System - Video Display

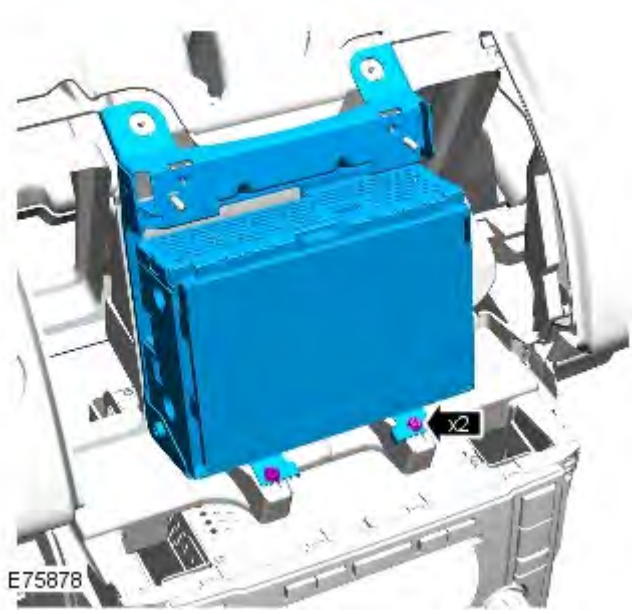
Removal and Installation

Removal

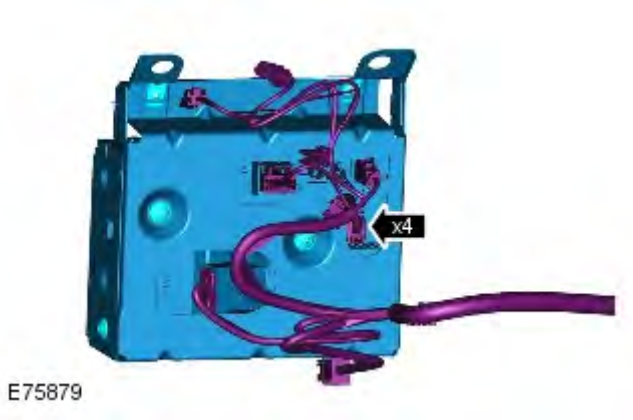
1. Remove the instrument panel console.

   Refer to: Instrument Panel Console (501-12 Instrument Panel and Console, Removal and Installation).

2.



3.



4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Information and Entertainment System - Audio Unit Antenna

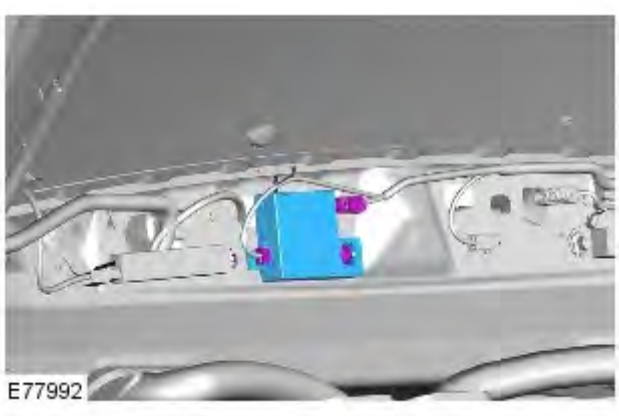
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the liftgate upper trim panel.

   Refer to: Liftgate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. Remove the audio unit antenna.

   Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Information and Entertainment System - Satellite Radio Tuner

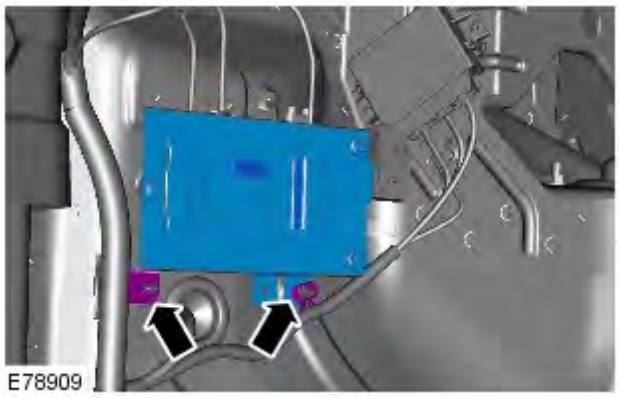
Removal and Installation

Removal

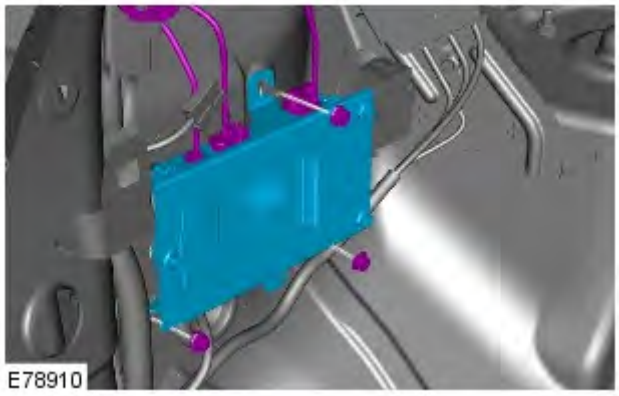
• NOTE: Removal steps in this procedure may contain installation details.

1. Remove the LH rear quarter trim panel.

   Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.

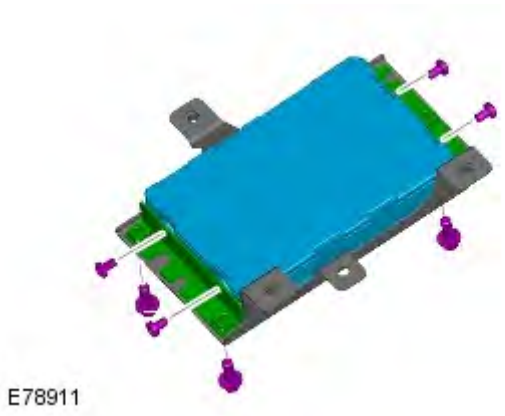


3. **3.** CAUTIONS:

   Make sure that the fiber optic cables are not bent to a radius of less than 25 mm.

   Make sure that the optical connectors are clean and free of foreign material.

   Torque: 10 Nm



4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

   Torque:
   M5 6 Nm
   M6 10 Nm

Installation

1. To install, reverse the removal procedure.

2. If a new component is to be installed, configure using Land Rover

Published: 11-May-2011

Information and Entertainment System - Cellular Phone Antenna

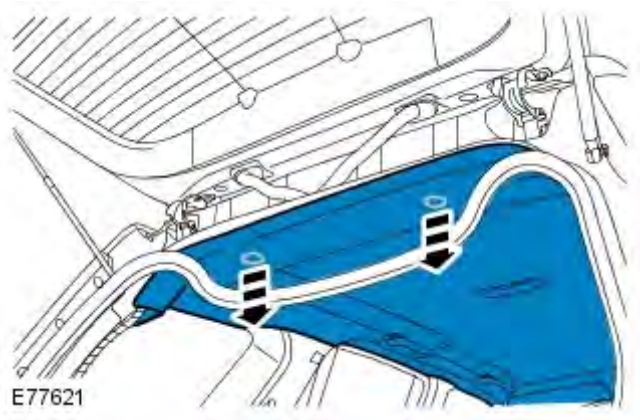
Removal and Installation

Removal

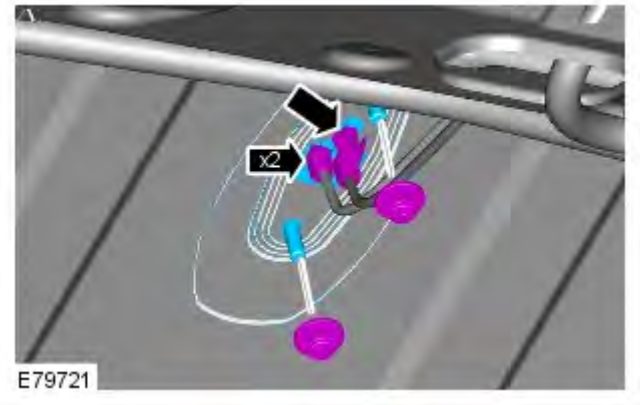
- NOTE: Removal steps in this procedure may contain installation details.

1. Remove both D-pillar upper trim panels.

   Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. Release the rear of the headliner.



3. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Information and Entertainment System - Subwoofer Amplifier

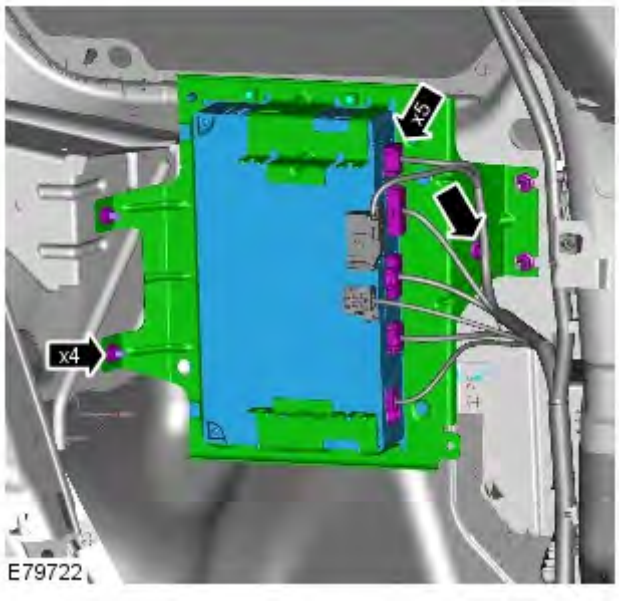
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the bluetooth module.

   Refer to: Bluetooth Module (415-01 Information and Entertainment System, Removal and Installation).

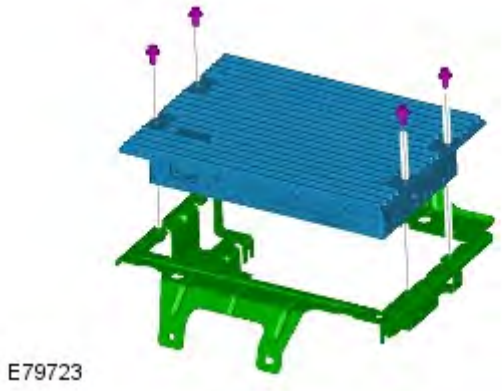


2. **2.** CAUTIONS:

   Make sure that the fiber optic cables are not bent to a radius of less than 25 mm.

   Make sure that the optical connectors are clean and free of foreign material.

   Torque: 10 Nm



3. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

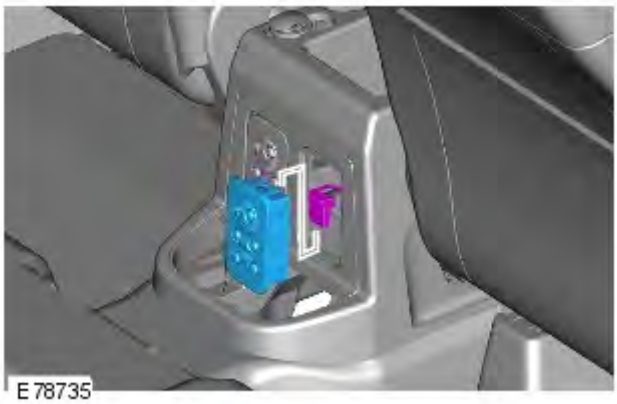
Information and Entertainment System - Rear Auxiliary Audio Controls

Removal and Installation

Removal

1. Remove the coin tray.

2. Remove the audio control switch.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Information and Entertainment System - Bluetooth Module

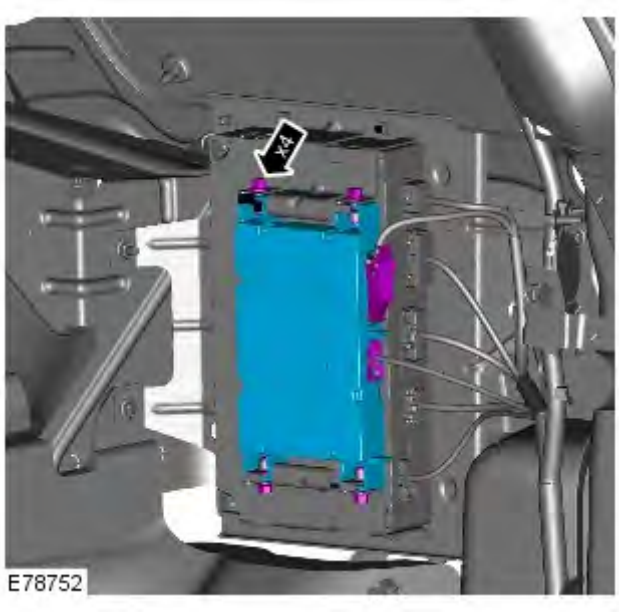
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the RH rear quarter trim panel.

   Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. **2.** CAUTIONS:

   Make sure that the fiber optic cables are not bent to a radius of less than 25 mm.

   Make sure that the optical connectors are clean and free of foreign material.

   Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.

2. If a new component is to be installed, configure using IDS.

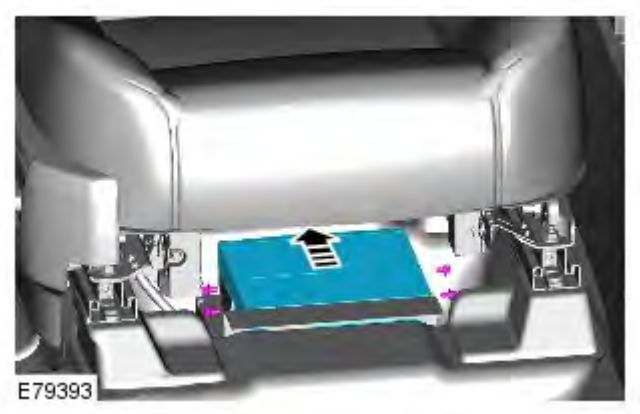
Published: 11-May-2011

Information and Entertainment System - Navigation System Digital Versatile Disc (DVD) Unit

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 6 Nm

2. **2.** CAUTIONS:

   Make sure that the fiber optic cables are not bent to a radius of less than 25 mm.

   Make sure that the optical connectors are clean and free of foreign material.

Installation

1. To install, reverse the removal procedure.
2. If a new component is to be installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Antenna -

Torque Specifications

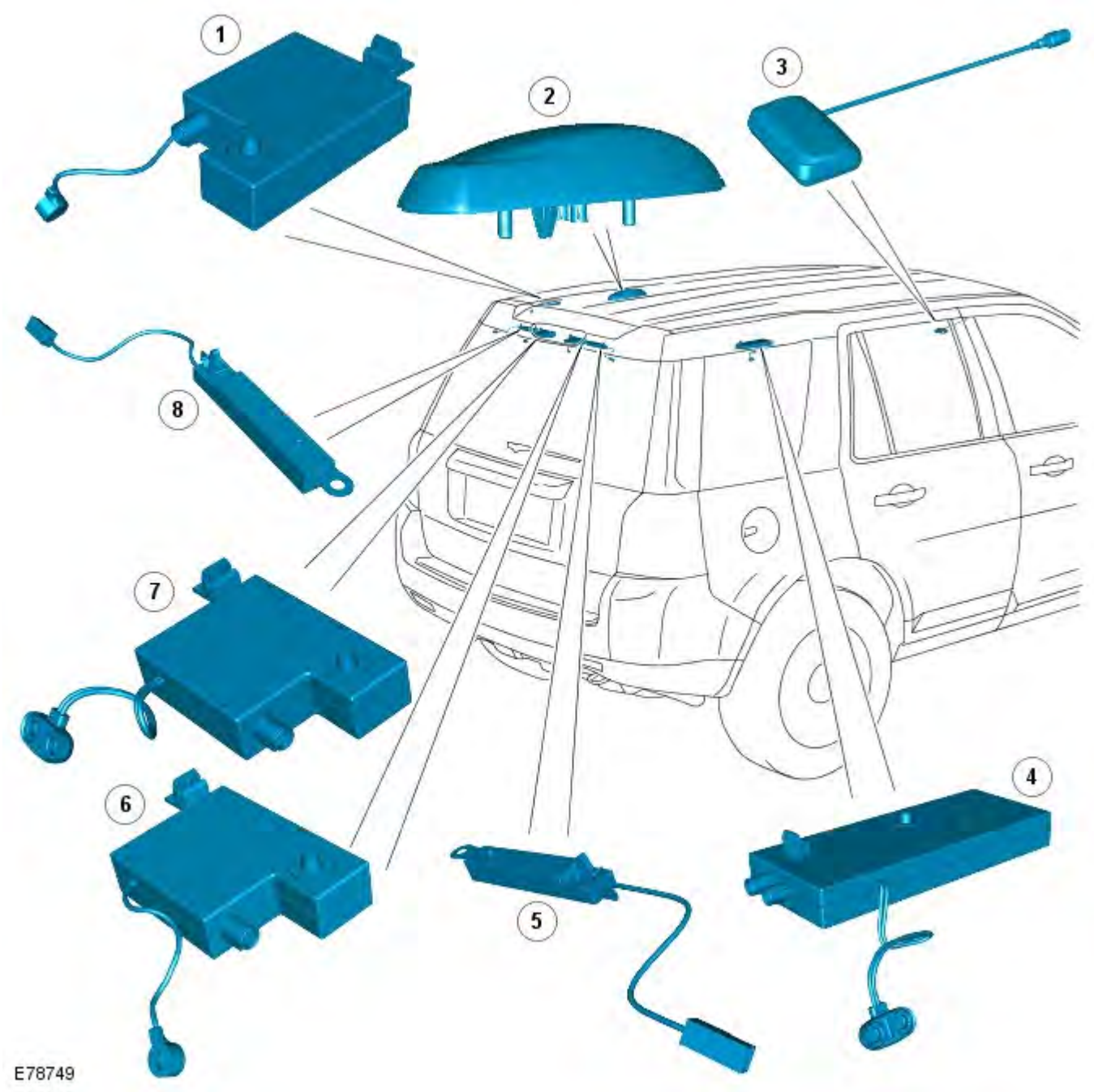
Description	Nm	lb-ft
Audio unit antenna	10	7
Cellular phone antenna	10	7

Published: 11-May-2011

Antenna - Antenna

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	DAB band III amplifier (where fitted)
2	-	GPS/SDARS/DAB L band antenna pod
3	-	VICS beacon antenna
4	-	AM/FM antenna amplifier (non diversity system) or AM/FM diversity antenna amplifier
5	-	RH RF filter
6	-	VICS/TMC antenna amp
7	-	Twin FM antenna amp for diversity tuning
8	-	LH RF filter

OVERVIEW

The antenna systems fitted to the vehicle comprise:

- AM/FM screen mounted antennae or AM/FM diversity system
- FM diversity antenna
- GPS antenna (where fitted)
- SDARS antenna (NAS only) (NAS only, roof pod mounted) or DAB antenna (where fitted, roof pod)
- VICS beacon antenna (Japan only)

- Digital Audio Broadcasting (DAB) system antenna (side screen or roof pod mounted depending on system)

The AM/FM antenna is etched onto the RH side window glass. The antenna has an amplifier located just above the window. This amplifier will vary upon the entertainment and information system fitted to the vehicle. High line systems will have a larger amplifier for diversity tuning.

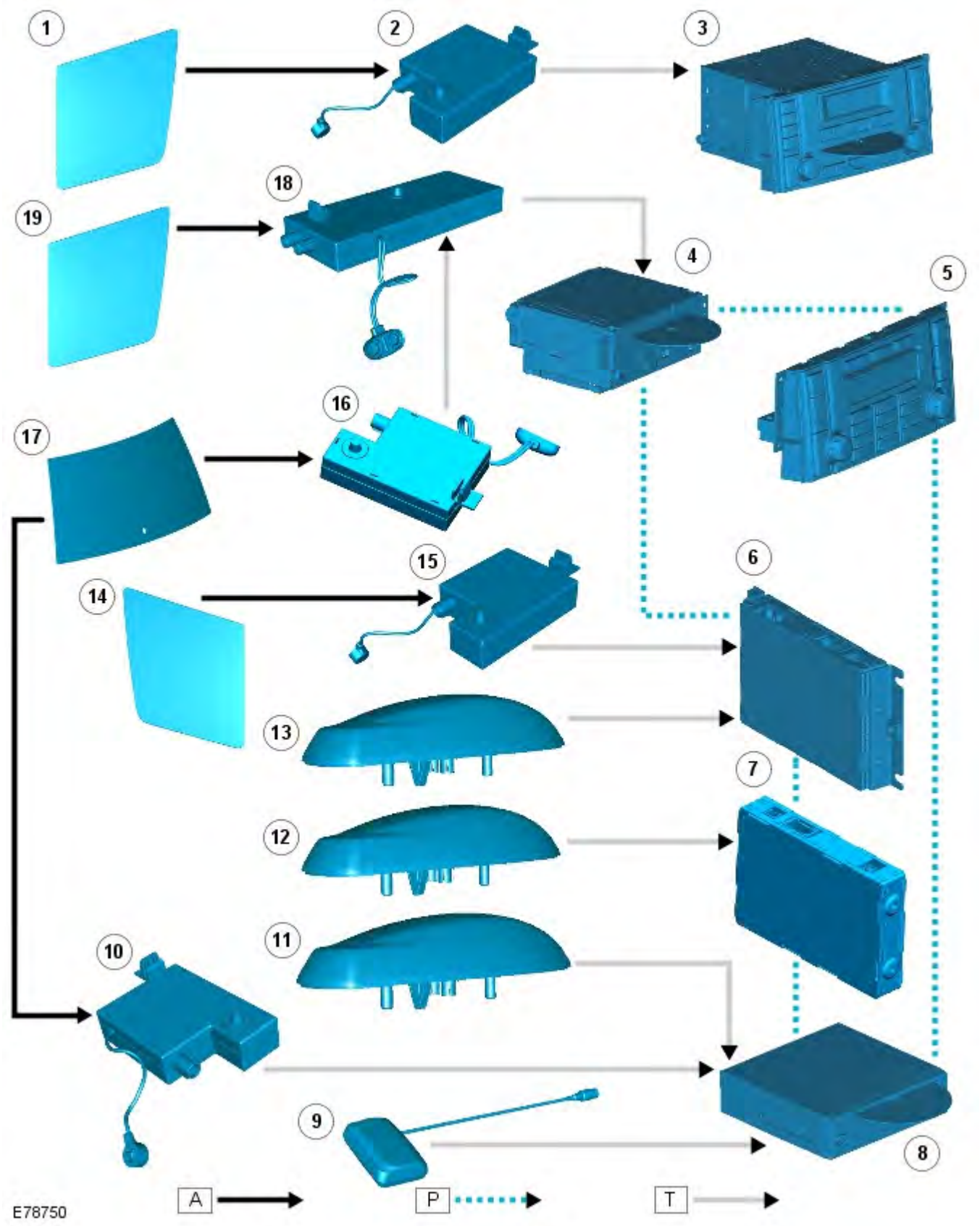
The rear window incorporates 2 FM antennae and a VICS/TMC antenna etched onto the glass. The 2 FM antennae are used in the diversity tuning system along with the respective antenna amplifiers.

The LH side window antenna is used for DAB band III signal reception.

• NOTE: The telephone control module incorporates a Bluetooth antenna. This is integral to the module and as such is not serviceable.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **P** = MOST; **T** = CoAxial



Item	Part Number	Description
1	-	Rear RH screen AM/FM antenna
2	-	AM/FM antenna amplifier
3	-	Low line head unit
4	-	Integrated audio module
5	-	ICM
6	-	DAB tuner
7	-	SDARS tuner
8	-	Navigation computer
9	-	VICS beacon antenna
10	-	TMC antenna amplifier
11	-	GPS antenna

12	-	SDARS antenna
13	-	DAB L band antenna
14	-	Rear LH side screen DAB antenna
15	-	DAB antenna amplifier
16	-	Diversity antenna amplifier
17	-	Rear screen FM antenna
18	-	Diversity antenna amplifier
19	-	Rear RH screen AM/FM antenna
16	-	

Published: 11-May-2011

Antenna - Antenna

Diagnosis and Testing

For additional information.
REFER to: Information and Entertainment System (415-01 Information and Entertainment System, Diagnosis and Testing).

Published: 11-May-2011

Exterior Lighting -

Bulb Specifications

Bulb	Type	Rating
Approach lamps	Capless W5W	5W
Front fog lamps	Halogen H11	55W
Halogen headlamps - High beam	Halogen H7	55W
Halogen headlamps - Low beam - NAS	Halogen H11	55W
Halogen headlamps - Low beam - ROW	Halogen H7	55W
High mounted stop lamp (HMSL)	W16W	16W
License plate lamps	Capless W5W	5W
NAS - Side marker lamps - front/rear	Capless W5W	5W
Rear fog lamps	Bayonet P21	21W
Reverse lamps	Bayonet P21	21W
Side lamps - Front	Capless W5W	5W
Side turn signal lamps	Capless W5W	5W
Stop/Tail lamps	Bayonet - Twin filament P21/5	21W/5W
Turn signal indicators - Front - NAS	Bayonet 7507 or PY21W	21W
Turn signal indicators - Front - ROW	Bayonet P21W	21W
Turn signal indicators - Rear	PY21	21W
Xenon headlamps - Low/High beam	Xenon D1S	35W

Torque Specifications

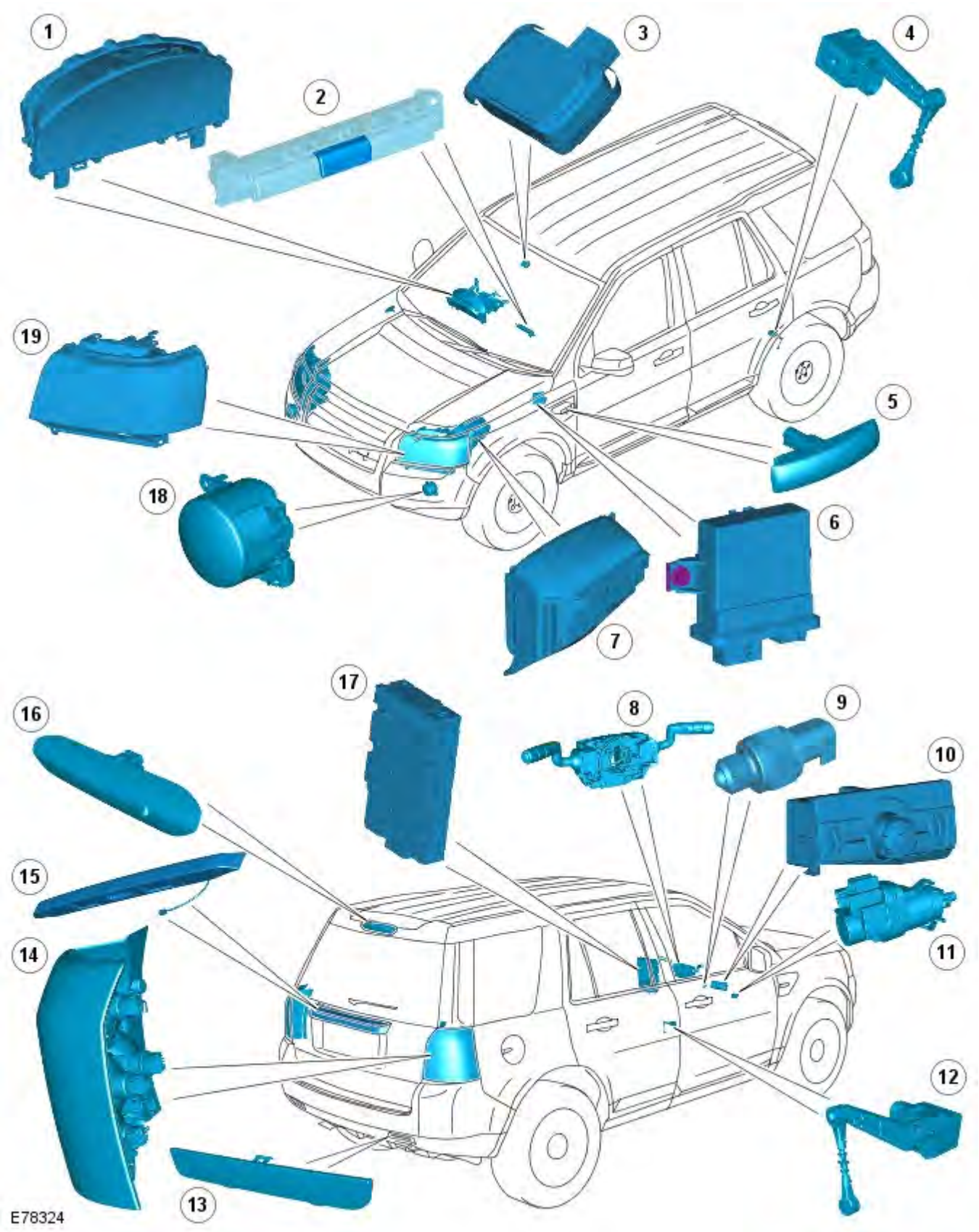
Description	Nm	lb-ft
Front fog lamp Torx bolts	2	1
Headlamp retaining bolts	6	4
Tail lamp retaining screws	1	1

Published: 11-May-2011

Exterior Lighting - Exterior Lighting

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Instrument cluster
2	-	Hazard flasher switch
3	-	Rain/Light sensor
4	-	Rear height sensor (Xenon headlamps only)

5	-	Side turn signal lamp
6	-	Headlamp leveling module or Adaptive Front lighting System (AFS) control module
7	-	Battery Junction Box (BJB)
8	-	Column stalk multifunction switch
9	-	Reverse lamp switch (Manual transmission only)
10	-	Light switch module
11	-	Stop lamp switch
12	-	Front height sensor (Xenon headlamps only)
13	-	Reflector
14	-	Rear lamp assembly
15	-	License plate lamps
16	-	High mounted stop lamp
17	-	Central Junction Box (CJB)
18	-	Front fog lamp
19	-	Headlamp assembly

OVERVIEW

Three levels of exterior lighting are available depending on vehicle specification:

- Halogen headlamps
- Bi-xenon High Intensity Discharge (HID) headlamps
- Bi-xenon HID Adaptive Front lighting System (AFS) headlamps.

A light switch module is located in the instrument panel and allows the driver to select the appropriate operation of the exterior lighting systems.

The rear lamp assemblies contain side lamps, stop lamps, reverse lamps, turn signal indicators and rear fog lamps. On North American Specification (NAS) vehicles the rear lamp assembly also includes a side marker lamp. The rear lamp assemblies require removal for bulb replacement. Two reflectors are mounted in the rear bumper.

All versions of the headlamps have impact resistant polycarbonate lens'. Removable covers at the rear of the headlamps allow for bulb replacement. The headlamps require removal for bulb replacement.

The halogen headlamps have large complex surface reflectors to optimise the beam patterns in low beam only. A high beam only reflector is located on the inboard side of the headlamp. Headlamp leveling on the halogen headlamps is manually adjusted using a rotary thumbwheel located in the light switch module which operates leveling motors located in the headlamp.

The bi-function HID headlamps and the AFS headlamps use a projector unit with a D1S xenon bulb which operates in both low and high beam. An additional halogen high beam only reflector is located on the inboard side of the headlamp. Headlamp leveling is automatic on the HID headlamps. Front and rear height sensors are located on the Left Hand (LH) side of the front and rear axles. These measure the vehicle attitude and a headlamp leveling module, which is located on the bulkhead 'A' pillar behind the glovebox, automatically controls the headlamp vertical alignment.

Headlamp powerwash is a standard fitment on HID headlamps.

Turn signal indicators and high and low beam functions are controlled from the LH steering column multifunction switch. The turn signal indicators have a lane change feature. A single press and release of the multifunction switch in either direction will operate the selected turn signal indicators for 3 cycles.

The exterior lighting is controlled by the CJB. The CJB is the main controlling module for vehicle body systems and is located behind the glovebox in the instrument panel.

The CJB provides circuit protection for all exterior lighting circuits.

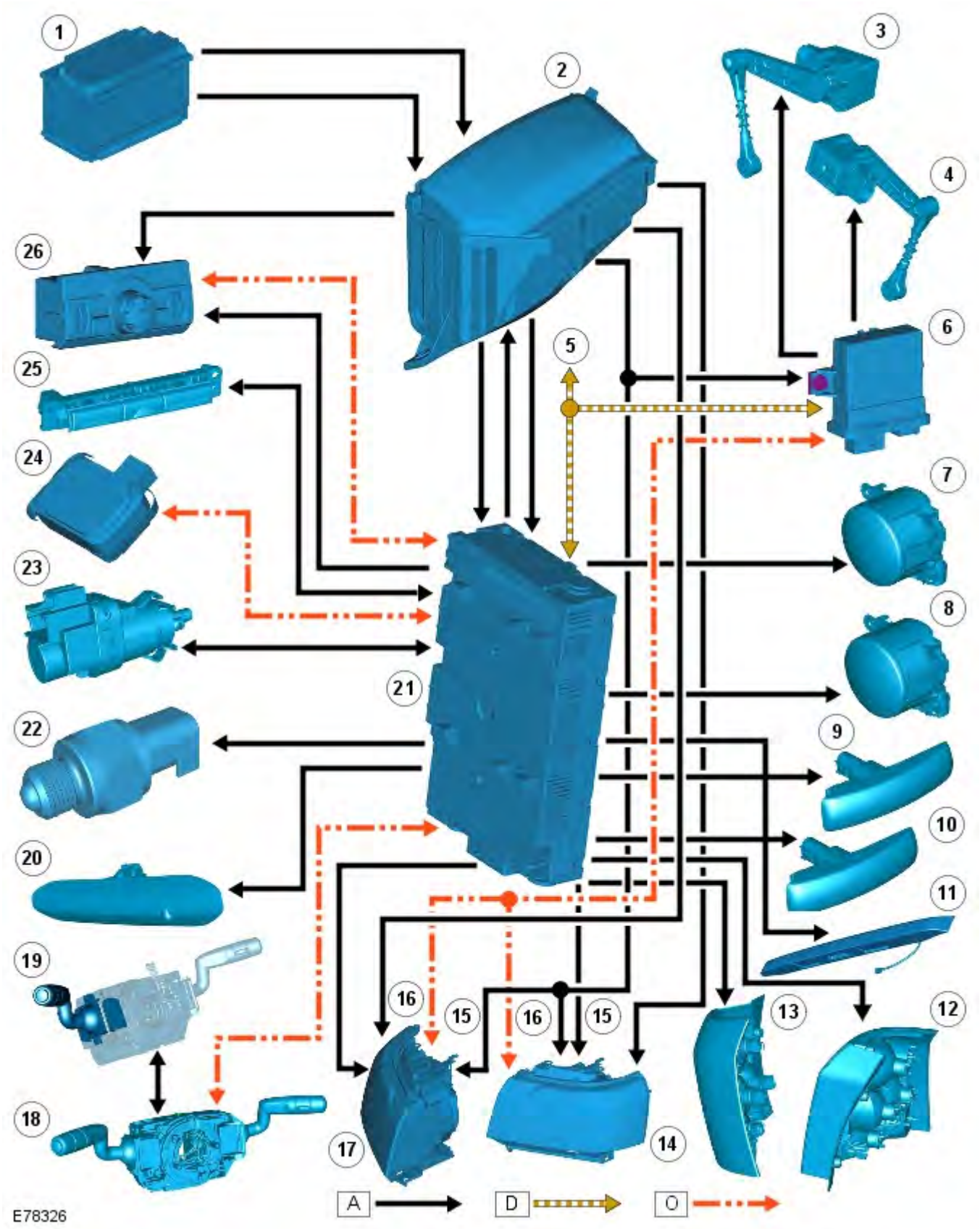
Exterior Bulb Type/Rating

The following table shows the bulbs used for the exterior lighting system and their type and specification.

Bulb	Type	Rating
Halogen Headlamps - Low beam - Rest Of World (ROW)	Halogen H7	55W
Halogen Headlamps - Low beam - North American Specification (NAS)	Halogen H11	55W
Xenon headlamps - Low/High Beam	Xenon D1S	35W
Headlamps - High Beam	Halogen H7	55W
Front fog lamps	Halogen H11	55W
Rear fog lamps	Bayonet P21	21W
Turn signal indicator lamps - Front - ROW	Bayonet PY21W	21W
Turn signal indicator lamps - Front - NAS	Bayonet 7507A or PY21W	21W
Side turn signal lamps - Up to 2009MY	Capless W5W Clear	5W
Side turn signal lamps - From 2009MY	Capless WY5W Orange	5W
Turn signal indicator lamps - Rear - Up to 2009MY	Bayonet PY21 Orange	21W
Turn signal indicator lamps - Rear - From 2009MY	Bayonet Silvervision PY21W SV	21W
Side lamps - Front	Capless W5W	5W
Stop/Tail lamps	Bayonet - Twin filament P21/5	21W/5W
High mounted stop lamp	W16W	16W
License plate lamps	Capless W5W	5W
Reversing lamps	Bayonet P21	21W
NAS - Side marker lamp (rear)	Capless W5W	5W

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box (BJB)
3	-	Front height sensor
4	-	Rear height sensor
5	-	High speed Controller Area Network (CAN) bus to other vehicle systems
6	-	Headlamp leveling module
7	-	Right Hand (RH) front fog lamp
8	-	Left Hand (LH) front fog lamp
9	-	LH side turn signal lamp

10	-	RH side turn signal lamp
11	-	License plate lamps
12	-	LH rear lamp assembly
13	-	RH rear lamp assembly
14	-	LH headlamp assembly
15	-	AFS control module
16	-	Headlamp leveling motor
17	-	RH headlamp assembly
18	-	Steering wheel module
19	-	LH steering column multifunction switch
20	-	High mounted stop lamp
21	-	Central Junction Box (CJB)
22	-	Reverse switch (manual transmission only)
23	-	Stoplamp switch
24	-	Rain/light sensor
25	-	Hazard flasher switch
26	-	Light switch module
27	-	Fuse 15A (F33)

CENTRAL JUNCTION BOX (CJB)

The CJB receives exterior lighting related inputs from the following switches:

- Light switch module
  - Side lamp position
  - Headlamp position
  - Automatic (AUTO) position (if fitted)
  - Front fog lamp switch (if fitted)
  - Rear fog lamp switch
  - Dimmer control
  - Headlamp leveling control (if fitted).
- Brake switch
- LH steering column multifunction switch for turn signal indicators and high beam/headlamp flash
- Hazard flasher switch
- Rain/light sensor (LIN signal).

Circuit Protection

Two 60 Amp fusible links in the battery junction box protect the power feed to the CJB LH and RH lighting circuits respectively. All exterior lighting circuits are protected by Field Effect Transistors (FETs), located in the CJB, which can detect overloads and short circuits.

The FETs respond to heat generated by increased current flow caused by a short circuit. On a normal circuit this would cause the fuse to blow. The FETs respond to the heat increase and disconnect the supply to the affected circuit. When the fault is rectified or the FET has cooled, the FET will reset and operate the circuit normally. If the fault persists the FET will cycle, disconnecting and reconnecting the power supply. The CJB stores fault codes which can be retrieved using a Land Rover approved diagnostic system. The fault code will identify that there is a fault on a particular output which assist in fault detection.

Alarm Indications

The exterior lighting system is used for alarm arm and disarm requests. When the driver locks or unlocks the vehicle, a visual indication of a successful lock or unlock request is displayed to the driver by the hazard flashers operating a number of times.
For additional information, refer to: Anti-Theft - Active (419-01A Anti-Theft - Active, Description and Operation).

Lights On Warning chime

When the ignition in the off (power mode 0) or auxiliary (power mode 4) mode and the lighting control rotary switch is in the side lamp or headlamp position, a warning chime will sound if the driver's door is opened. This indicates to the driver that the exterior lights have been left on. The chime is generated from the instrument cluster sounder on receipt of a lights on signal, a door open signal and an ignition switch off signal from the CJB on the high speed CAN bus.

Crash Signal Activation

When a crash signal is transmitted from the Restraints Control Module (RCM), the CJB activates the hazard flashers and the turn signal indicators in the instrument cluster. The hazard flashers will continue to operate until the ignition mode is changed to the auxiliary power mode 4or the off power mode 0 or the RCM no longer transmits the crash signal.
For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).

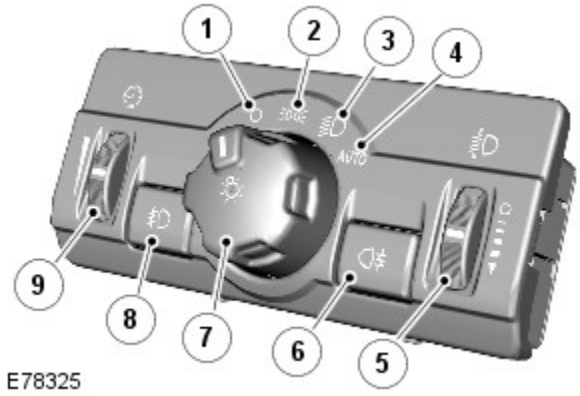
Headlamp Timer

The CJB controls a headlamp timer function which allows the headlamps to remain on for a period of time after leaving the vehicle. This is a driver convenience feature which illuminates the driveway after leaving the vehicle.

This feature can only be activated by pulling the high beam ' flash-to-pass' on the LH steering column multifunction switch. It can be deactivated either by timing out or by pulling the multifunction switch again.

The default setting can be changed by a Land Rover or authorized dealer . The default timing is set to 30s but can be changed to 0s (OFF), 30s (default), 60s, 90s, 120s, 150s and 180s.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

LIGHT SWITCH MODULE



Item	Part Number	Description
1	-	Off position
2	-	Side lamps position
3	-	Headlamps position
4	-	Automatic headlamps position (if fitted)
5	-	Headlamp leveling rotary control (halogen headlamps only)
6	-	Rear fog lamp switch
7	-	Lighting control rotary switch
8	-	Front fog lamps switch
9	-	Interior illumination dimmer rotary control

The light switch module is located in the driver's side of the instrument panel and allows the driver to control the operation of the exterior lighting system. Three variants of the module are available to cover different vehicle specifications and market variants.

All switch operations are detected by the light switch module and sent as Local Interconnect Network (LIN) messages to the CJB.

Lighting Control Rotary Switch

The light control module has a central rotary switch which allows the following selections:

- All exterior lamps off
- Side lamps on
- Headlamps on
- Automatic headlamps active.

Headlamp Leveling (ROW halogen headlamps only)

• NOTE: Headlamp levelling is not available on NAS vehicles with halogen headlamps.

A rotary leveling thumbwheel is located on the RH side of the light switch module. The rotary thumbwheel is connected to a rheostat which gives a variable output to the headlamp leveling stepper motors. The motors respond to the output and move to adjust the headlamp vertical alignment as required.

The control has no defined positions but can be adjusted as required to compensate for a drop in height at the rear of the vehicle and avoid dazzle to oncoming drivers.

Dimmer Control

A rotary dimmer thumbwheel is located on the LH side of the light switch module. The dimmer control provides a Pulse Width Modulated (PWM) output to control the illumination brightness of the instrument panel and other instrument panel illumination.

The dimmer switch operates using a rotary thumbwheel which is connected to a rheostat and a high side switch. The rheostat is a variable resistor which provides a high or low resistance according to its set position. This output is passed to a switchable capacitor or a high side switch. The high side switch uses the output from the rheostat to determine the switching frequency of the capacitor which provides the PWM output of between 8 and 12V to determine the brightness of the illumination.

Fog Lamps

Two switches are provided for selection of the front and rear fog lamps. The front fog lamp switch is only fitted to vehicles with front fog lamps.

The fog lamp switches are momentary switches, which when pressed, generate a LIN bus message from the light switch module to the CJB. The fog lamps remain active until deselected using the applicable fog lamp switch or the headlamps are switched off or the ignition power mode 6 is changed to the off power mode 0.

Automatic Headlamps

The automatic headlamp function is a driver assistance system. The driver can override the system operation by selection of side lamp or headlamp on if the ambient light conditions require front and rear lighting to be active.

The automatic headlamp system uses a light sensor and the CJB, which are connected via the LIN bus to control the headlamp functionality.

A light sensor is incorporated in the rain/light sensor located on the inside of the windshield, below the rear view mirror. The wiper system also uses the rain/light sensor for automatic wiper operation.
For additional information, refer to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

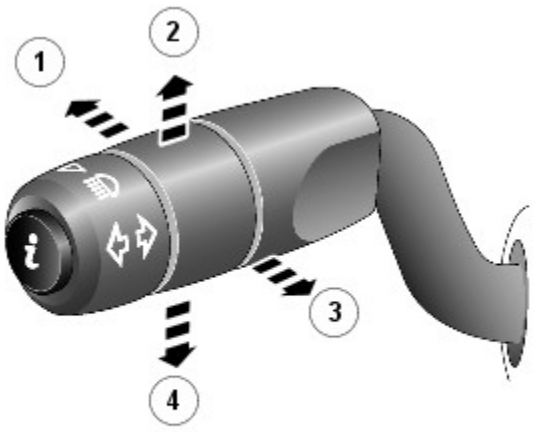
The light sensor measures the ambient light around the vehicle in a vertical direction and also the angular light level from the front of the vehicle. The rain/light sensor uses vehicle speed signals, wiper switch position and the park position of the front wipers to control the system.

The automatic headlamp operation uses ambient light levels which are monitored by photodiodes incorporated in the rain/light sensor. The rain/light sensor sends a lights on/off request to the CJB on the LIN bus, which responds by switching on the low beam headlamps, front side lamps, license plate lamps and rear tail lamps. The automatic headlamps are activated under the following conditions:

- Twilight
- Darkness
- Rain
- Tunnels
- Underground or multistoried car parks.

Operation of the automatic headlamps requires the ignition to be on (power mode 6), the lighting control rotary switch to be in the 'AUTO' position and a lights on request signal from the light sensor.

LEFT HAND STEERING COLUMN MULTIFUNCTION SWITCH



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Item	Part Number	Description
1	-	High beam
2	-	RH turn signal indicator
3	-	Headlamp high beam flash
4	-	LH turn signal indicator

The steering column multifunction switch is located on the left hand side of the steering column and controls the following functions:

- Headlamp low/high beam
- Headlamp high beam flash
- Left/right turn signal indicator lamps
- Trip computer functions.

The high beam on and flash functions are hardwired to the steering wheel module. When the switch is operated in either position a ground path via the switch is completed for the selected function which is sensed by the steering wheel module. The steering wheel module then issues a message on the Local Interconnect Network (LIN) bus to the CJB which activates the selected function.

The turn signal indicator lamps are connected and operate in a similar way with the ground path completed for the selected function which is sensed by the steering wheel module the module then issues a message relating to the selected function to CJB which in turn activates the requires turn signal indicator.

HEADLAMP ASSEMBLY

Three headlamp variants are available depending on model specification; halogen, bi-xenon and bi-xenon with Adaptive Front lighting System (AFS).

The headlamps are sealed units, with scratch resistant polycarbonate lenses bonded to the headlamp body. Two sealed access covers and a sealed housing provide a watertight environment for the headlamp internal components. To prevent fogging of the lens and to allow the headlamp unit to 'breath' in response to internal temperature changes, a vent is located at the outer rear face of the headlamp body. The vent is covered by a Gortex waterproof membrane. This allows

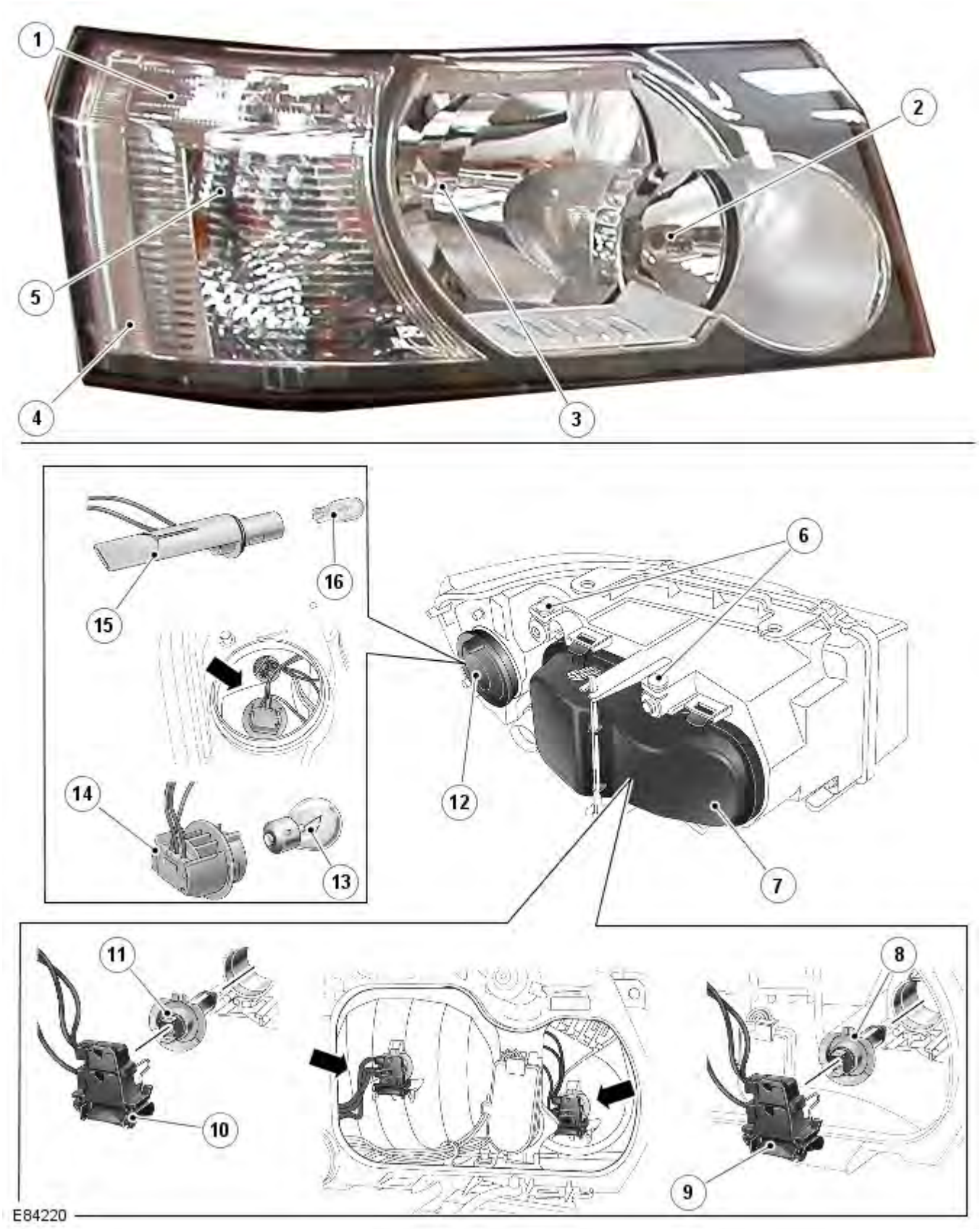
ventilation of the headlamp while preventing the ingress of water.

The headlamps can be quickly removed for bulb replacement due to the unique 'Rail Lock' system. Headlamp access requires the removal of 2 bolts securing the headlamp to the bonnet closing panel. A locking lever at the rear of the headlamp can then be lifted, releasing a locking tab at the base of the headlamp body. The headlamp can then be pulled forward on the rail and, after disconnection of the harness connector, removed from the vehicle. The 'Rail Lock' system ensures that the headlamp alignment is not compromised during the removal process.

Each headlamp has two access covers at the rear. The larger cover requires the locking lever to be released from its guide slots to allow access to the cover. The cover can then be removed by releasing 2 tabs to allow the high and low beam bulbs to be changed. The circular rubber cover is a push fit onto the rear of the lamp assembly. Removal of the cover gives access to the side lamp and turn signal indicator bulbs.

On NAS vehicles, the side lamp is colored orange. The side lamp lens is designed so that light from the side lamp bulb also illuminates the orange colored reflector area at the side of the lamp without the need for an additional bulb.

Halogen Headlamps

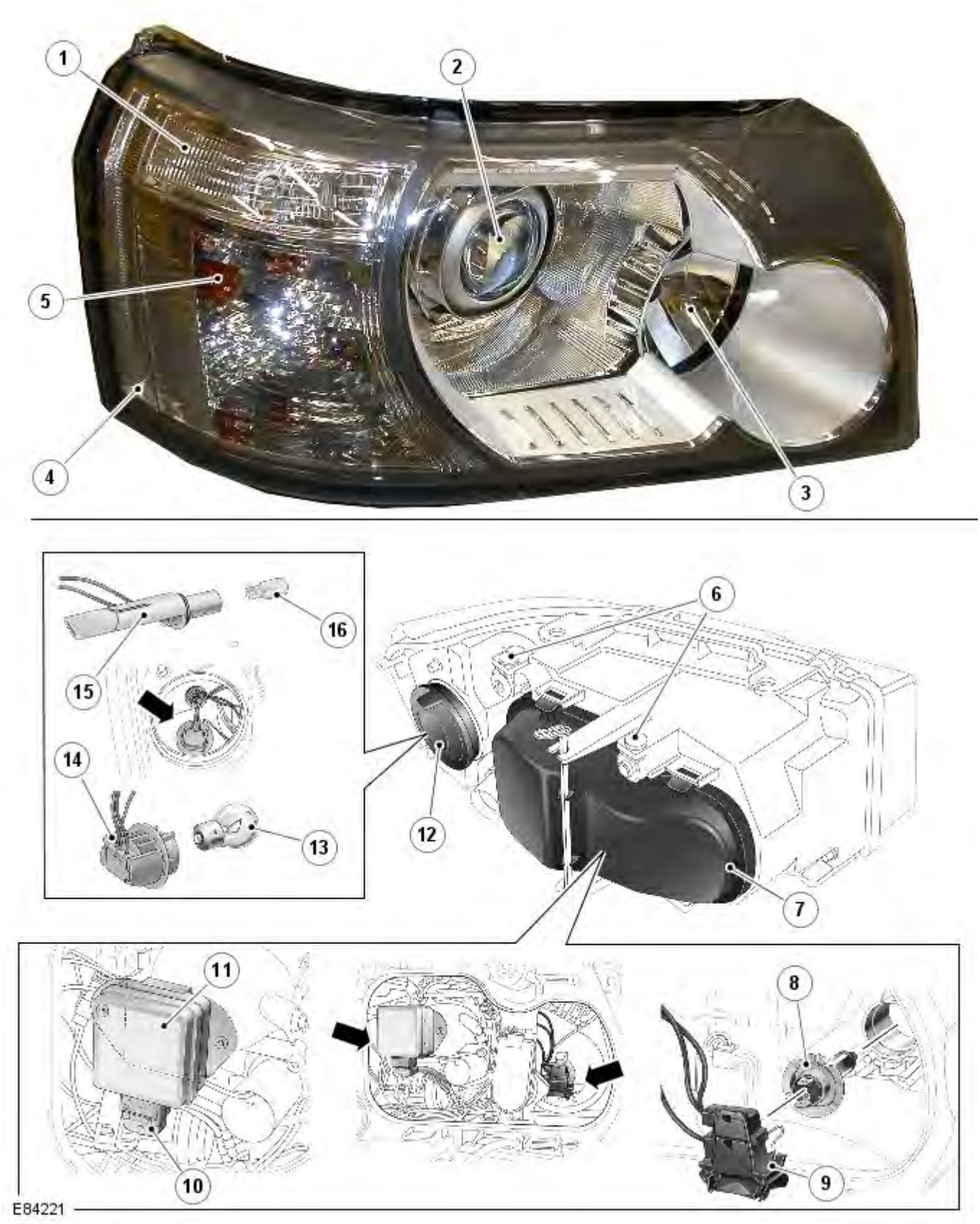


Item	Part Number	Description
1	-	Side lamp (and side marker lamp on NAS vehicles)
2	-	High beam halogen headlamp
3	-	Low beam halogen headlamp
4	-	Side marker reflex (NAS only)
5	-	Turn signal indicator
6	-	Manual beam adjusters
7	-	Cover
8	-	High beam halogen bulb
9	-	High beam bulb holder
10	-	Low beam bulb holder
11	-	Low beam halogen bulb

12	-	Cover
13	-	Turn signal indicator bulb
14	-	Turn signal indicator bulb holder
15	-	Side lamp bulb holder
16	-	Side lamp bulb

The ROW halogen headlamp has 2 H7 55W halogen bulbs for both high and low beam for ROW vehicles. On NAS vehicles, the low beam halogen headlamp uses an H11 55W halogen bulb.

Bi-Xenon Headlamps



Item	Part Number	Description
1	-	Side lamp (and side marker lamp on NAS vehicles)

2	-	Low and high beam bi-xenon headlamp
3	-	High beam halogen headlamp
4	-	Side marker reflex (NAS only)
5	-	Turn signal indicator
6	-	Manual beam adjusters
7	-	Cover
8	-	High beam halogen bulb
9	-	High beam bulb holder
10	-	Bi-xenon D1S bulb electrical connector
11	-	Bi-xenon D1S bulb
12	-	Cover
13	-	Turn signal indicator bulb
14	-	Turn signal indicator bulb holder
15	-	Side lamp bulb holder
16	-	Side lamp bulb

The xenon headlamp uses a complex surface reflector for the halogen fill-in high beam only unit. This uses the same halogen H7 55W bulb as used on the halogen headlamp. A bi-xenon projector module is fitted for the low beam headlamp but also operates as a high beam unit.

Safety Precautions

The following safety precautions must be followed when working on the xenon headlamp system:

- DO NOT attempt any procedures on the xenon headlamps when the lights are switched on
- Handling of the D1S Xenon bulb must be performed using suitable protective equipment, e.g. gloves and goggles
- The glass part of the bulb must not be touched
- Xenon bulbs must be disposed of as hazardous waste
- Only operate the lamp in a mounted condition in the reflector.

WARNING: **The Xenon system generates up to 28000 volts and contact with this voltage could lead to fatality. Make sure that the headlamps are switched off before working on the system.**

Headlamp Construction and Functionality

The xenon lamp or High Intensity Discharge (HID) lamp as they are sometimes called, comprises an ellipsoidal lens with a solenoid controlled shutter to change the beam output from low to high beam.

• NOTE: If the light control module rotary switch is in the OFF position, the xenon lamps do not operate when the high beam 'flash' function is operated. If the rotary switch is in the headlamps position or AUTO position with the low beam lamps active, the xenon low beam will remain on when the high beam 'flash' function is operated.

The xenon headlamp system is controlled by the CJB using a control module for each headlamp and an igniter. The control modules and the igniters provide the regulated power supply required to illuminate the xenon bulbs through their start-up phases of operation.

The xenon headlamp is a self contained unit located within the headlamp assembly. The unit comprises a reflector, the lens, a shutter controller and the xenon bulb, which as an assembly is known as the projector module.

The reflector provides the mounting for the xenon bulb which is an integral part of the igniter. The igniter locates in an aperture at the rear of the reflector and is secured with 2 Torx screws to ensure correct alignment in the reflector.

A shutter is used to change the beam projection from low beam to high beam and visa versa. The shutter controller is a solenoid which operates the shutter mechanism via a lever. When the shutter is in the low beam position, it masks some of the light emitted from the reflector, providing a defined low beam cut-off.

A tourist lever mechanism is located on the right hand side of the projector module. This mechanism moves a flap to blank off a portion of the beam spread to enable the vehicle to be driven in opposite drive hand markets without applying blanking decals to the headlamp lens. The beam is changed by removing the cover at the rear of the lamp assembly and moving a small lever located at the side of the projector module.

The xenon bulb illuminates when an arc of electrical current is established between two electrodes within the bulb. The xenon gas sealed in the bulb reacts to the electrical excitation and the heat generated by the current flow to produce the blue/white light.

To operate at full efficiency, the xenon bulb goes through three stages of operation before full output for continuous operation is achieved. The three phases are; start-up phase, warm-up phase and continuous phase.

In the start-up phase, the bulb requires an initial high voltage starting pulse of up to 30000 volts to establish the arc. This is produced by the igniters. The warm-up phase begins once the arc is established. The xenon control modules regulate the supply to the bulbs to 2.6A which gives a lamp output of 75W. During this phase, the xenon gas begins to illuminate brightly and the environment within the bulb stabilises ensuring a continual current flow between the electrodes. When the warm-up phase is complete, the xenon control modules change to continuous phase. The supply voltage to the bulb is reduced and the operating power required for continual operation is reduced to 35W. The process from start-up to continuous phase is completed in a very short time.

The xenon system is controlled by the CJB, the two xenon control modules and the two igniters. The xenon control modules (one per headlamp) receive an operating voltage from the CJB when the headlamps are switched on. The modules regulate the power supply required through the phases of start-up.

The igniters (one per headlamp) generate the initial high voltage required to establish the arc. The igniters have integral coils which generate high voltage pulses required for start-up. Once the xenon bulbs are operating, the igniters provide a closed circuit for regulated power supply from the control modules.

ADAPTIVE FRONT LIGHTING SYSTEM (AFS)

The system operates by the AFS control module receiving inputs from the engine control module for engine running signal, the ABS module for steering angle and vehicle speed and a reverse gear input from the transmission.

The AFS control module processes these signals and provides an output to the headlamp leveling motors to adjust the headlamp horizontal aim according to vehicle speed and steering angle.

• NOTE: In markets with Daytime Running Lamps (DRL), the AFS system will not operate when the DRL are active.

The AFS control module is connected on the high speed CAN bus to receive information from other vehicle systems. The control module is connected to the AFS power module on a dedicated Local Interconnect Network (LIN) bus. The AFS control module calculates, using input data from other systems, the required position of the horizontal adjustment of the projector modules. The position information is then output on the LIN bus to the AFS power module located on each headlamp assembly. This module then outputs the appropriate signals to power the AFS stepper motors in the headlamp to the appropriate position.

The horizontal position of the projector modules is dependant on a number of input variables. The position is determined by vehicle speed and steering angle. When reverse gear is elected, the projector modules are moved to the straight ahead position to avoid glare to other road users.

The angles of each projector module differ to give the correct spread of light, for example, when turning left, the left hand projector module will have a greater swivelling angle than the right hand projector module.

In the event of a failure of the AFS system, a warning indicator in the instrument cluster flashes to warn the driver. The AFS warning indicator illuminates when the ignition switch is in power mode 6 and will flash continuously until the fault is rectified.

Illumination of the AFS warning indicator does not necessarily mean that there is a fault with the AFS system. The fault may be caused by a failure of another system such as steering angle sensor or the vehicle speed signal missing, preventing the AFS system operating correctly.

HEADLAMP LEVELING

Headlamp leveling provides for the adjustment of the vertical aim of the headlamps to minimize glare to other road users when the vehicle attitude changes due to vehicle loading.

Two types of headlamp leveling are available dependant on the type of headlamps fitted to the vehicle:

- Manual headlamp leveling - Halogen headlamps only (ROW vehicles only)
- Automatic headlamp leveling - Xenon headlamps only.

Manual Headlamp Leveling - ROW Halogen Headlamps Only

Manual headlamp levelling is only available on ROW vehicles with halogen headlamps.

• NOTE: Headlamp levelling is not available on NAS vehicles with halogen headlamps.

The manual system comprises the following components:

- Two headlamp levelling motors
- Headlamp leveling rheostat rotary control.

When the ignition is in ignition power mode 6, power is supplied to the light control module via the ignition relay in the BJB and a fuse in the CJB. Power is also supplied via the ignition relay in the BJB to the headlamp leveling motor in each headlamp assembly.

Movement of the leveling rotary control produces a variable voltage output, which is sensed by the motors. The motors react to the supplied voltage and move the headlamp to the requested position which relates to the supplied voltage from the leveling rotary control. The headlamps can only be lowered from their unladen position to compensate for changes in vehicle attitude due to loading.

The manual headlamp leveling rotary control has no defined positions which relate to the vehicle loading. The approximate rotary thumbwheel control position for a given loading is shown in the following table:

Rotary Control Rotation	Vehicle Load
0	Driver only or Driver and front seat passenger
1/4	Driver and passengers in all seats
½	Maximum gross vehicle weight
Full	Maximum rear axle load

Automatic Headlamp Leveling - Xenon Headlamps Only

Automatic headlamp leveling is only available on vehicles with xenon headlamps. The system is not a Dynamic headlamp levelling system and changes in vehicle inclination due to positive and negative acceleration are not compensated.

Automatic headlamp leveling provides for the static, periodic adjustment of the vertical aim of the headlamps to minimise glare to other road users when the vehicle attitude changes due to loading.

Automatic headlamp leveling is controlled by a headlamp leveling module which is located on the bulkhead, adjacent to the instrument panel on the passenger side 'A' pillar.

• NOTE: On vehicles with the AFS system, the headlamp leveling software is incorporated into the AFS control module and the module is known as the AFS control module.

The headlamp leveling system comprises the following components and information from other vehicle systems:

- Front and rear vehicle height sensors
- Two headlamp leveling, vertical adjustment motors

- Headlamp leveling module (or AFS control module if vehicle is fitted with AFS)
- Ignition in power mode 6.

When the ignition is in power mode 6, power is supplied, via the ignition relay in the BJB, to the light control module, the headlamp leveling motors (or AFS motors if fitted) and to the headlamp leveling module (or AFS control module if fitted).

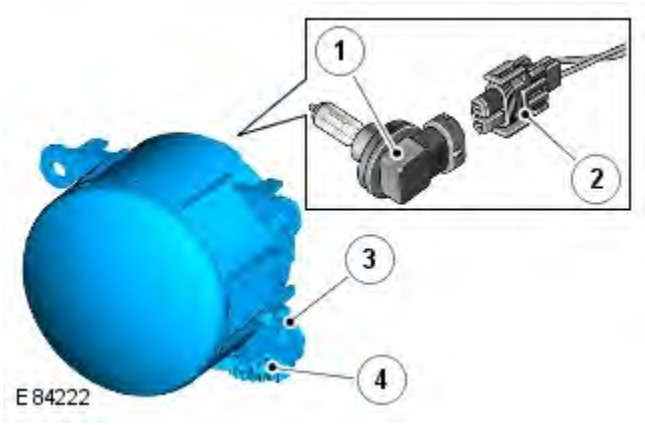
When the light control module rotary switch is moved to the side lamp or headlamp position, a Local Interconnect Network (LIN) bus message is passed from the light control module to the CJB for the selected function. The CJB then issues a 'lights on' message on the high speed CAN bus to the headlamp leveling module (or AFS control module if fitted).

The headlamp leveling module (or AFS control module if fitted) uses signals from the front and rear height sensors to periodically re-align the vertical aim of the headlamps to their optimum position.

DAYTIME RUNNING LAMPS (DRL)

DRL are a market requirement in certain countries.
For additional information, refer to: Daytime Running Lamps (DRL) (417-04 Daytime Running Lamps (DRL), Description and Operation).

FRONT FOG LAMP



Item	Part Number	Description
1	-	Bulb and holder
2	-	Harness connector
3	-	Attachment hole (4 off)
4	-	Beam alignment adjuster

Front fog lamps are available as an option or standard fitment on vehicles fitted with HID headlamps and headlamp powerwash.

Two front fog lamps are located in apertures in the front bumper. Each lamp is secured in the bumper with 3 Torx screws which are covered with a removable finisher. The fog lamp has an adjuster which is used to set the fog lamp to the correct alignment.

The fog lamp uses a 55W halogen H11 bulb which is located in an integral holder. The holder is located in a hole in the rear of the fog lamp housing and is turned to lock in position.

The front fog lamps are controlled by the CJB. When the ignition switch is in ignition power mode 6 and the light control module rotary switch is in the side lamp or headlamp position, the front fog lamp button can be pressed to activate the front fog lamps. A front fog lamp warning indicator is illuminated in the instrument cluster when the front fog lamps are active.

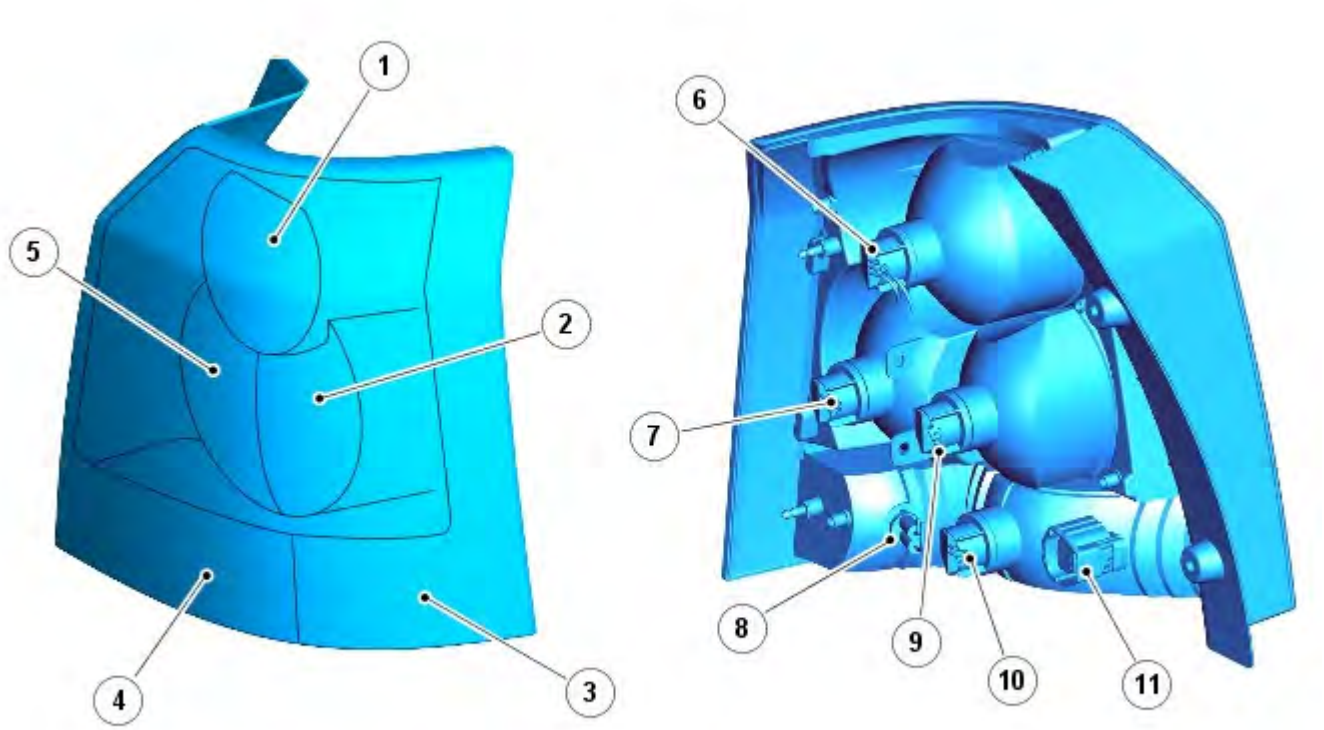
Front Fog Lamp Functionality (NAS and Canadian Markets Only)

The front fog lamps operate as described previously but with the following differences which cover local laws governing lamp usage.

If the low beam headlamps and the front fog lamps are on at the same time, when the high beam headlamps are switched on, the front fog lamps will be automatically switched off. When the high beam headlamps are subsequently switched off, the front fog lamps will be switched on automatically.

• NOTE: The front fog lamps will also be switched off if the high beam 'flash' function is operated.

REAR LAMP ASSEMBLY



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Item	Part Number	Description
1	-	Stop/tail lamp
2	-	Reversing lamp
3	-	Side marker lamp (NAS only)
4	-	Rear fog lamp
5	-	Turn signal indicator lamp
6	-	Stop/tail lamp bulb holder
7	-	Turn signal indicator lamp bulb holder
8	-	Side marker bulb holder (NAS only)
9	-	Reversing lamp bulb holder
10	-	Rear fog lamp bulb holder
11	-	Connector plug

The rear lamp assembly is a one piece unit which contains a stop/tail lamp, a turn signal indicator lamp, a reversing lamp and a fog lamp. Five bayonet fitting bulbs are used (six on NAS vehicles with the addition of a side marker lamp). These are located in holders which fit into the applicable hole in the lamp housing and are locked by rotating. Each bulb holder is connected by wires to a connector on the rear of the lamp housing.

The rear lamp assembly is located in a recess in the vehicle body. Two studs on the outer edge of the lamp housing locate in plastic clips the vehicle body. The lamp is secured with two screws which are located on the inner edge of the lamp housing, near the tailgate aperture.

Rear Stop/Tail Lamp

The upper lamp is a combined stop and tail lamp and uses a 21W/5W bayonet fitting bulb. The stop lamp uses the 21W bulb filament and the side lamp uses the 5W bulb filament.

The stop lamp is activated when the ignition is in the ignition power mode 6 and the brake pedal switch is active (by depressing the brake pedal). The high mounted stop lamp will also be activated when the brake pedal is pressed. The stop lamps can also be activated by the Anti-lock Brake system (ABS) when Hill Descent Control (HDC) is active. The ABS module send a high speed CAN bus message to the CJB which supplies power to the stop lamps and high mounted stop lamp.

The side lamps are operated by selecting side lamps or headlamps on the light switch module. The side lamps are operational at all times and are not dependant on the ignition power mode 6. The side lamps will also be illuminated when the light switch module is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

Turn Signal Indicator Lamp

The turn signal indicator lamp is located below the stop/tail lamp and uses a orange colored, 21W bayonet fitting bulb. On vehicles from 2009MY a 'Silvervision' bulb is used.

The turn signal indicator lamps are operated by the left hand steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition in the ignition power mode 6, the hazard flasher switch is active at all times. When active, the turn signal indicator lamps will flash at a frequency cycle of 360ms on and 360ms off.

If a bulb fails, the remaining turn signal indicator lamp bulb on that side of the vehicle flashes at normal speed. The applicable turn signal indicator in the instrument cluster will flash at double speed to alert the driver to the bulb failure.

Reversing Lamp

The reversing lamp is located adjacent to the turn signal lamp and uses a 21W bayonet fitting bulb.

The reversing lamp is active when the ignition is in the ignition power mode 6 and the CJB receives a reverse selected signal on the medium speed Controller Area Network (CAN) bus. The automatic transmission has a reverse switch which senses when reverse is selected.

Rear Fog Lamp

The rear fog lamp is located at the bottom of the rear lamp and uses a 21W bayonet fitting bulb.

The rear fog lamp is controlled by the light control module. When the ignition switch is in the ignition power mode 6 and the light control module is in the side lamp or headlamp position, the rear fog lamp switch on the light control module can be pressed to activate the rear fog lamps. A rear fog lamp warning indicator is illuminated in the instrument cluster when the rear fog lamps are active.

Side Marker Lamp (NAS only)

The side marker lamp is located in the outer part of the rear lamp, adjacent to rear fog lamp and uses a W5W wedge fitting bulb.

The side marker lamp bulb, which is fitted in a holder locates in an aperture in the rear lamp housing and is rotated to lock in position. The side marker lamp is active at all times when the side lamps are selected on using the light control module. The side marker lamps will also be illuminated when the light control module rotary switch is in the 'AUTO' position and a 'lights on' signal is received by the CJB from the light sensor.

HAZARD FLASHERS

The hazard flashers are controlled by a non-latching switch in the centre of the instrument panel. The hazard flashers operate at all times when selected and are not dependant on the ignition power mode.

When the hazard flashers are selected on, all of the front, rear and side turn signal indicator lamps operate as previously described and both left and right turn signal indicators in the instrument cluster also flash. The hazard warning flashers flash at a rate of 360ms on and 360ms off. When the hazard flashers are active, they override any request for turn signal lamp operation.

If a trailer is fitted, the trailer turn signal lamps will flash at the same frequency as the vehicle indicators. The trailer warning indicator in the instrument cluster will also flash. If a trailer bulb is defective, the trailer warning indicator will not flash.

The hazard flashers can also be activated by a crash signal from the Restraints Control module (RCM). This is received by the CJB which activates the hazard flashers. The hazard flashers can be cancelled by changing the ignition power mode to the auxiliary power mode 4 or the off power mode 0 or the crash mode is cancelled by the restraints control module.

LICENSE PLATE LAMPS

Two license plate lamps are fitted in the tailgate handle, above the license plate in the upper tailgate. Each lamp uses a 5W capless type bulb.

The lamps are secured in the upper liftgate handle with integral clips. The lamps can be released from the handle using a small, flat blade screwdriver. The license plate lamps are active at all times when the side lamps or headlamps are switched on.

HIGH MOUNTED STOP LAMP

The high mounted stop lamp is located in the liftgate. Access to the lamp is by removal of the upper liftgate interior trim panel. After releasing the lamp retaining clips, the lamp can be removed from outside the vehicle.

The lamp comprises a plastic housing with a red colored lens. The lamp is illuminated by a single 16W capless type bulb.

The high mounted stop lamp is activated, along with the tail lamp stop lamps, when the ignition is in ignition power mode 6 and the brake pedal switch is active (by pressing the brake pedal).

The high mounted stop lamp and the stop lamps can also be activated by the ABS when Hill Descent Control (HDC) is active. A signal on the high speed CAN bus from the ABS module is passed to the CJB which supplies power to the stop lamps.

SIDE TURN SIGNAL LAMPS

The side turn signal lamps are located in the front fender air vents. On vehicles from 2009MY, the side turn signal lamps have clear lenses and orange colored bulbs. The lamps are clipped into an aperture in the vent panel and can be removed by sliding rearwards and releasing the front edge of the lamp from the vent.

The side turn signal lamps use a 5W capless bulb which is located in a holder. The lamps have the same functionality as the front and rear turn signal indicator lamps and are operated by the left hand steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition in the ignition power mode 6, the hazard flasher switch is active at all times, regardless of the power mode. When active, the side turn signal lamps will flash at a frequency cycle of 360ms on and 360ms off. If a side turn signal lamp bulb fails, the turn signal indicator lamps continue to flash at the normal rate.

TRAILER LIGHTING

Several different types of trailer socket can be fitted to the vehicle depending on market specifications. Refer to the Electrical Reference Library for specific socket details.

The CJB monitors the turn signal indicator lamps and can detect if more than two lamps are fitted (the side turn signal lamps are not monitored). When a trailer is detected, the trailer warning indicator in the instrument cluster will flash in synchronisation with the turn signal indicators.

If one or more of the turn signal indicator lamps on the vehicle or the trailer are defective, the trailer warning indicator will not flash to alert the driver to the bulb failure.

DIAGNOSTICS

The diagnostic socket is located in the lower instrument panel closing panel, on the driver's side, below the steering column. Various lighting system functions are monitored by different systems which can store fault information. This can be retrieved using a Land Rover approved diagnostic system.

Published: 11-May-2011

Exterior Lighting - Headlamps

Diagnosis and Testing

Principles of Operation

For a detailed description of the exterior lighting system, refer to the Description and Operation section 417-00 - Exterior Lighting of the workshop manual.

Safety Information

• WARNINGS:

The Xenon Headlamp system generates up to 28,000 volts. Make sure that the headlamps are switched off before working on the system. Failure to follow this instruction may lead to fatality.

The following safety precautions must be followed when working on the Xenon Headlamp System:

- DO NOT attempt any procedures on the Xenon Headlamps or circuits when the system is energized.
- Handling of the xenon bulb must be performed using suitable protective equipment, e.g. gloves and goggles. The glass part of the bulb must not be touched.
- Only operate the lamp in a mounted condition in the reflector.
- All safety procedures and precautions must be followed to prevent personal injury.

CAUTION: Xenon bulbs must be disposed of as hazardous waste.

There are instructions on the correct procedures for Xenon Headlamp System repairs in the manual, refer to section 100-00 - General Information, Standard Workshop Practices of the workshop manual.

Inspection And Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
    - Note that intermittent fault reports may be due to the cycling operation of the field effect transistors (FETs)
2. **2.** Visually inspect for obvious mechanical or electrical faults.

Visual Inspection Chart

Mechanical	Electrical
• Headlamp(s) condition and installation • Bulb(s) and installation • Bulb holder(s) and installation • Lighting control switch and installation • Left-hand Steering Column Multifunction Switch and installation	• Fuses • Relays • Wiring harness • Loose or corroded connector(s) • Battery junction box (BJB) • Central junction box (CJB) • Adaptive Front Lighting System (AFS) module • Headlamp Power modules • Instrument Cluster (IPC) • Steering Angle Sensor Module (SASM) • Transmission Control Module (TCM) • Engine Control Module (ECM) • Anti-lock Brake System Module • Air Suspension Control Module • Local Interconnect Network (LIN) circuits • Controller area network (CAN) circuits

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the symptom chart or DTC index.
    - Because the DTCs are stored in more than one module, a complete vehicle read is recommended
    - Make sure that all DTCs are cleared following rectification

DTC Index

Adaptive Front Lighting System (AFS) Control Module

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

• NOTE: Prior to installation/replacement of the Headlamp Assembly carry out all relevant internal visual and mechanical checks for correct cable location and termination including: checks for corroded, bent or backed out pins or terminals, incorrectly inserted connectors and harness damage due to chaffing or incorrect routing.

• NOTE: If the control module has been removed and reinstalled, carry out a DTC code clear, cycle the ignition state to off, then on. This will erase any DTCs that have been logged during the module installation procedure

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Headlamp Control Module (HCM) (100-00 General Information, Description and Operation).

Symptom Chart

Symptom	Possible Causes	Action
Low beam lamp(s) inoperative High beam lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Circuit fault • Lighting control switch fault • Left-hand steering column multifunction switch fault	Check the bulb and fuse condition (see visual inspection). Check the headlamp circuits. Check the lighting control switch function. Check the left-hand steering column multifunction switch operation. Refer to the electrical guides. Check for DTCs indicating a headlamp or related circuit fault.
Low beam lamp(s) dim High beam lamp(s) dim	• Incorrect bulb rating • Tourist lever set in the wrong position • Circuit fault • Lighting control switch fault • Left-hand steering column multifunction switch fault	Check the bulb condition and rating. Check the tourist lever is set correctly. Check the headlamp circuits. Check the lighting control switch function. Check the left-hand steering column multifunction switch function. Refer to the electrical guides.
Low beam lamp(s) stuck on High beam lamp(s) stuck on	• Circuit fault • Lighting control switch fault • Left-hand steering column multifunction switch fault • Headlamp timer function fault	Check the headlamp circuits. Check the lighting control switch function. Check the left-hand steering column multifunction switch operation. Check the headlamp timer function. Refer to the electrical guides. Check for DTCs indicating a headlamp circuit fault
Headlamp low/high beam switching function inoperative	• Circuit fault • Left-hand steering column multifunction switch fault • Xenon lamp shutter mechanism fault	Check the headlamp circuits. Check the left-hand steering column multifunction switch operation. Check the xenon lamp shutter mechanism operation. Refer to the electrical guides. Check for DTCs indicating a headlamp circuit fault
Warning lamp(s) inoperative	• Fuse(s) blown • Lighting control switch fault • Left-hand steering column multifunction switch inoperative • Circuit fault • Instrument cluster fault	Check the fuse(s) (see visual inspection). Check the lighting control switch function. Check the left-hand steering column multifunction switch function. Check the warning lamp circuits. Refer to the electrical guides. Check for DTCs indicating an instrument cluster or CAN system fault.
Headlamp Wet - Internal	• Condensation • Water Ingress	Check for outstanding Technical Service Bulletins (TSBs) relating to 'Headlamp Internal Condensation'. Carry out the instructions in the service bulletin to determine if the fault is related to condensation or water ingress.

Published: 11-May-2011

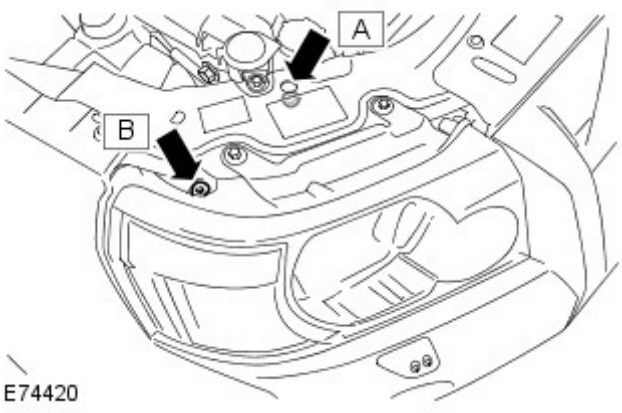
Exterior Lighting - Headlamp Adjustment

General Procedures

- NOTE: The headlamp setting is 1.2 % below horizontal and parallel.
- NOTE: NAS vehicles have vertical adjustment only.

1. Align the headlamp beam setting equipment to one headlamp.

2. Switch the headlamps on and to dipped beam.



3. **3.** NOTE: NAS vehicles have vertical adjustment only.
   - Adjust the headlamps with an Allen Key.
   - Rotate the adjusters A and B by an equal amount for vertical alignment.
   - Rotate the adjuster 'B' for horizontal alignment.

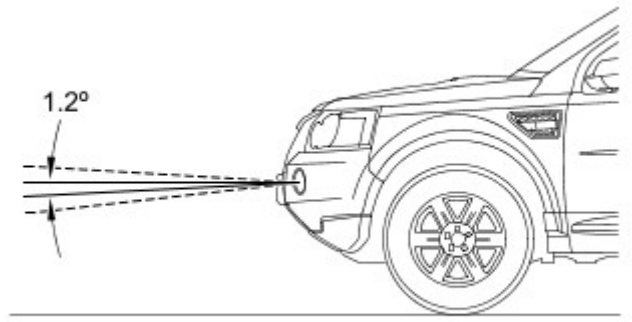
4.
   - To adjust the second headlamp, repeat the above procedure.

Published: 11-May-2011

Exterior Lighting - Front Fog Lamp Adjustment

General Procedures

1. Align the beam setting equipment to one fog lamp.

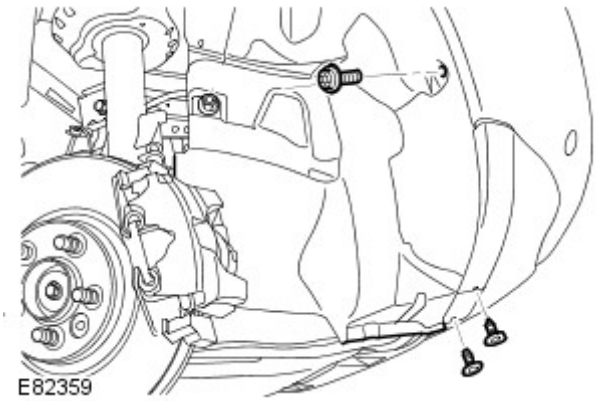


E82362

2. **2.** NOTE: The fog lamp beam should be set at 1.2% below the horizontal and parallel.

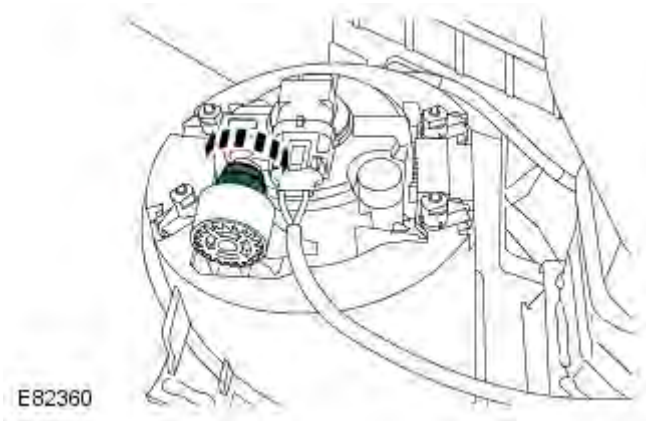
   Check the fog lamp beam alignment.

3. Turn the steering on to full lock for access.



E82359

4. Release the front bumper cover from the fender splash shield.



E82360

5. Adjust the fog lamp using the thumb wheel.

6. Install the fender splash shield.

7. To adjust the second fog lamp, repeat the above procedure.

Published: 11-May-2011

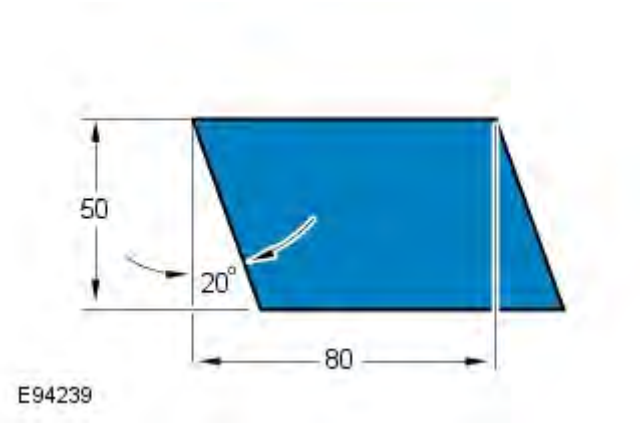
Exterior Lighting - Headlamp Masking

General Procedures

- NOTE: This process is for vehicles fitted with halogen headlamps only.

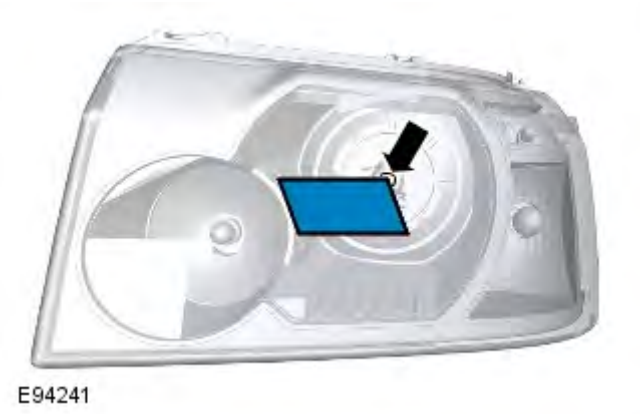
Right-hand drive vehicles

1.



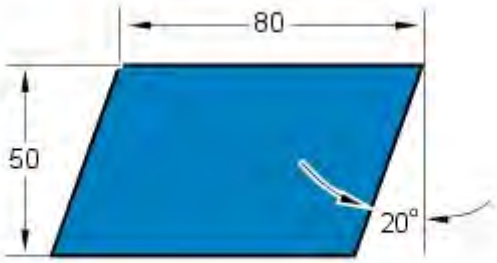
2.

3.



Left-hand drive vehicles

4.



E94238

5.

E94242

6.

E94243

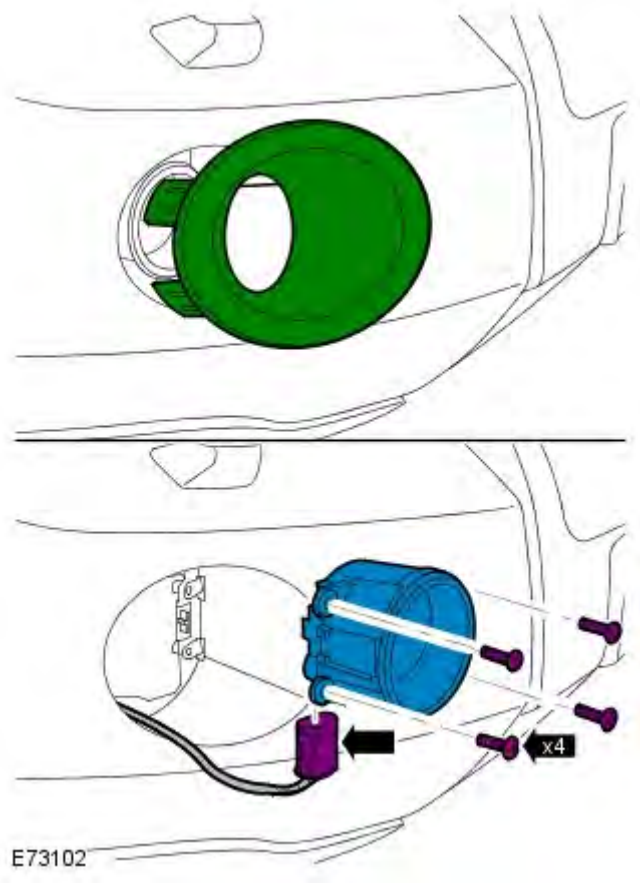
Published: 11-May-2011

Exterior Lighting - Front Fog Lamp LH

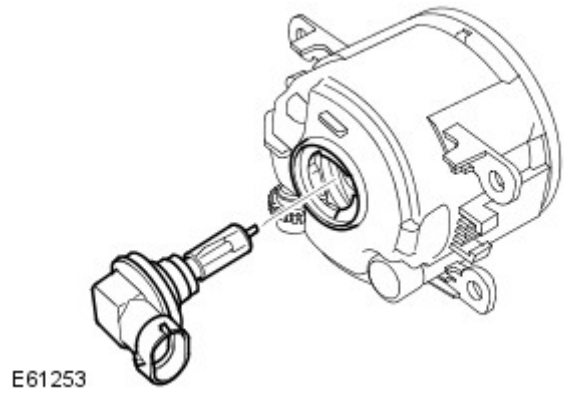
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 2.5 Nm



2. **2.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.
2. Check the fog lamp beam alignment.

   Refer to: Front Fog Lamp Adjustment (417-01 Exterior Lighting, General Procedures).

Published: 11-May-2011

Exterior Lighting - Headlamp Assembly

Removal and Installation

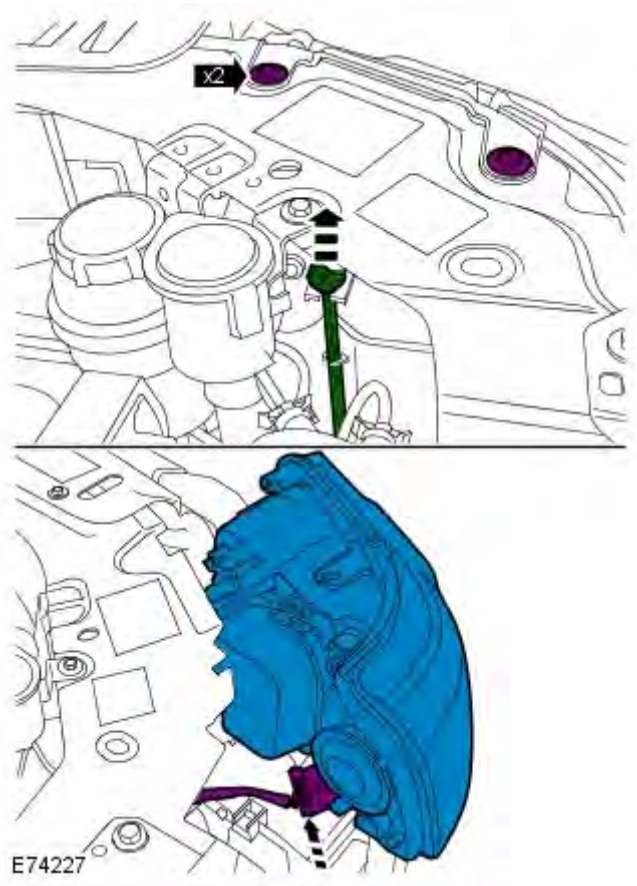
Removal

WARNING: Vehicles fitted with Xenon headlamps, the following precautions must be observed. Failure to comply may result in exposure to ultra violet rays, severe electric shock, burns or the risk of explosion. Ensure the headlamps are switched off at all times. Eye and hand protection must be worn. Never switch on the lamps or test the bulbs with the lamp holder released from the headlamp.

• NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

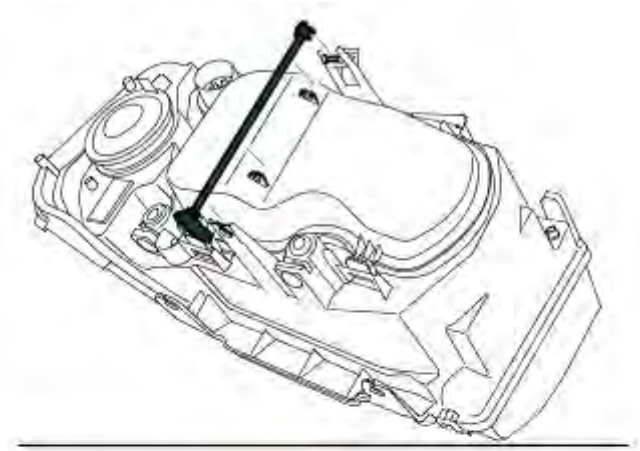
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

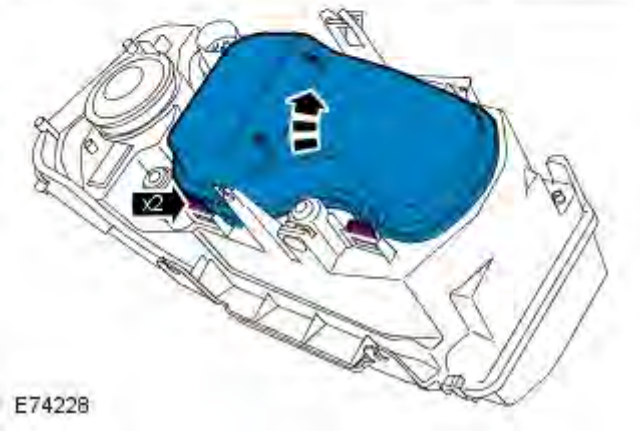


2. *Torque:* 4 Nm

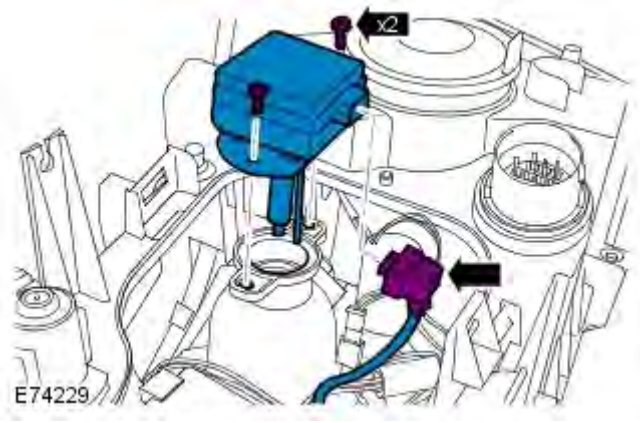
3. **3.** NOTE: Do not disassemble further if the component is removed for access only.

4.





5.



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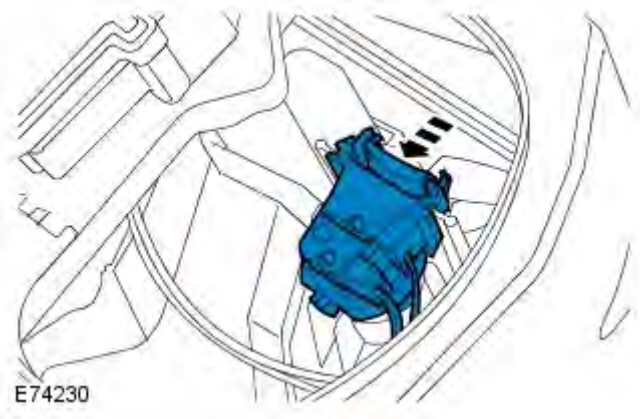

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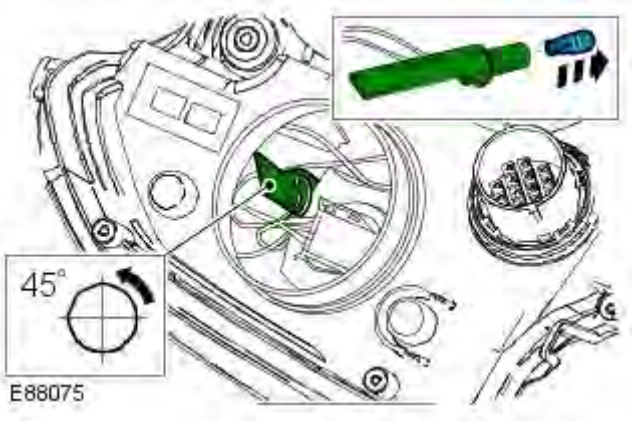
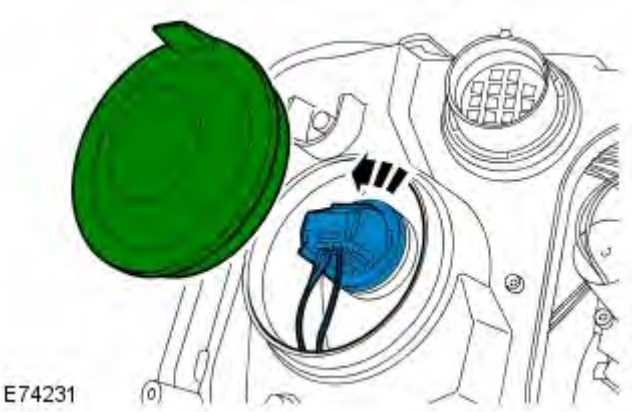
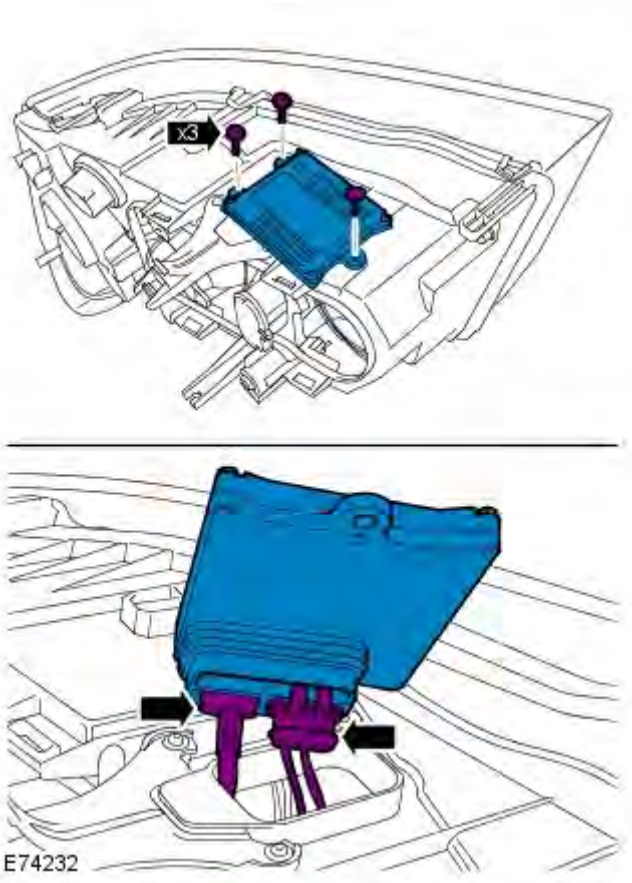


8.



9.



Installation

1. To install, reverse the removal procedure.

2. Check the headlamp alignment and adjust if necessary.

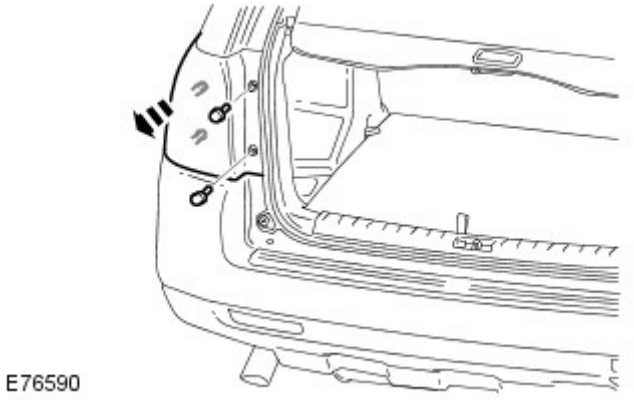
Published: 11-May-2011

Exterior Lighting - Rear Lamp Assembly

Removal and Installation

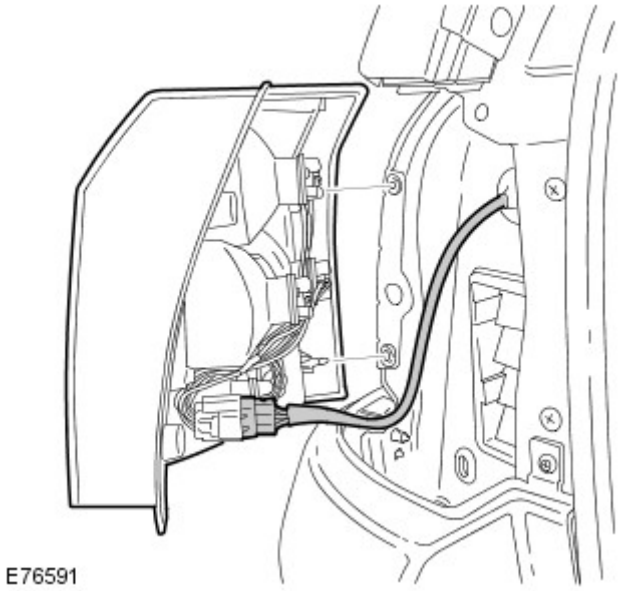
Removal

- NOTE: Removal steps in this procedure may contain installation details.

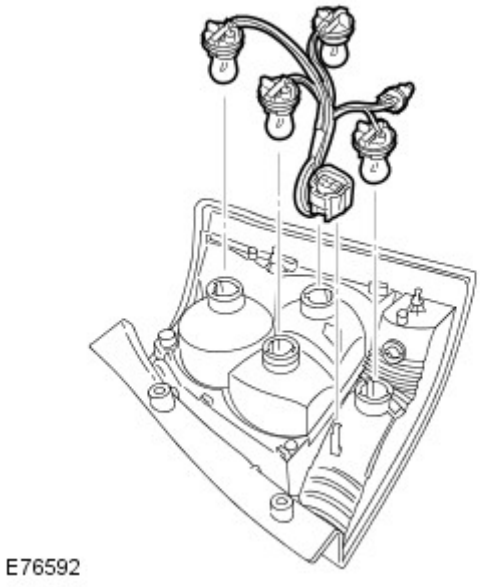


1. **1.** CAUTION: Take extra care not to damage the edges of the component.

   Torque: 2 Nm



2.



3. **3.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exterior Lighting - High Mounted Stoplamp

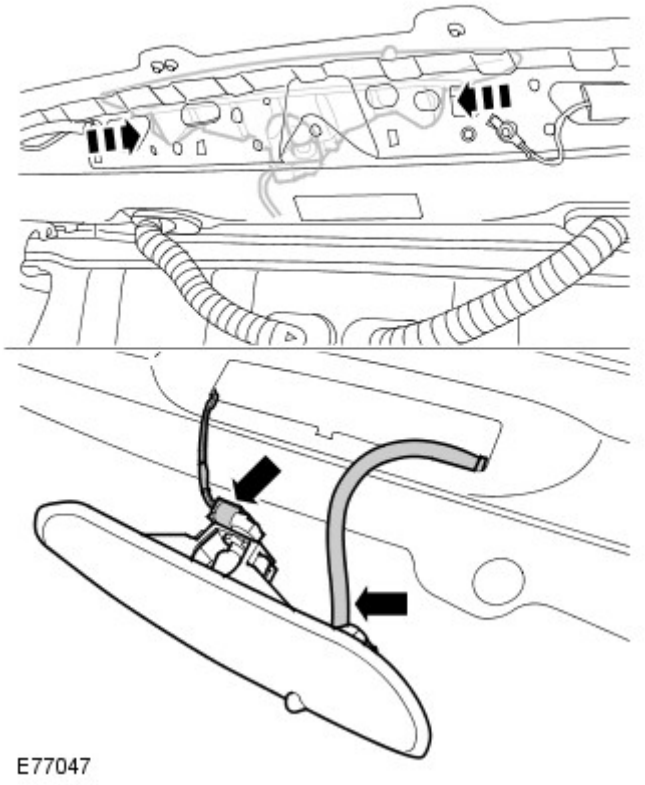
Removal and Installation

Removal

1. Remove the liftgate upper trim panel.

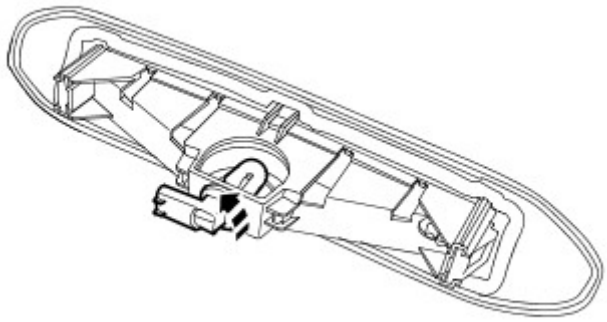
   Refer to: Liftgate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



E77047

3. **3.** NOTE: Do not disassemble further if the component is removed for access only.



E77048

Installation

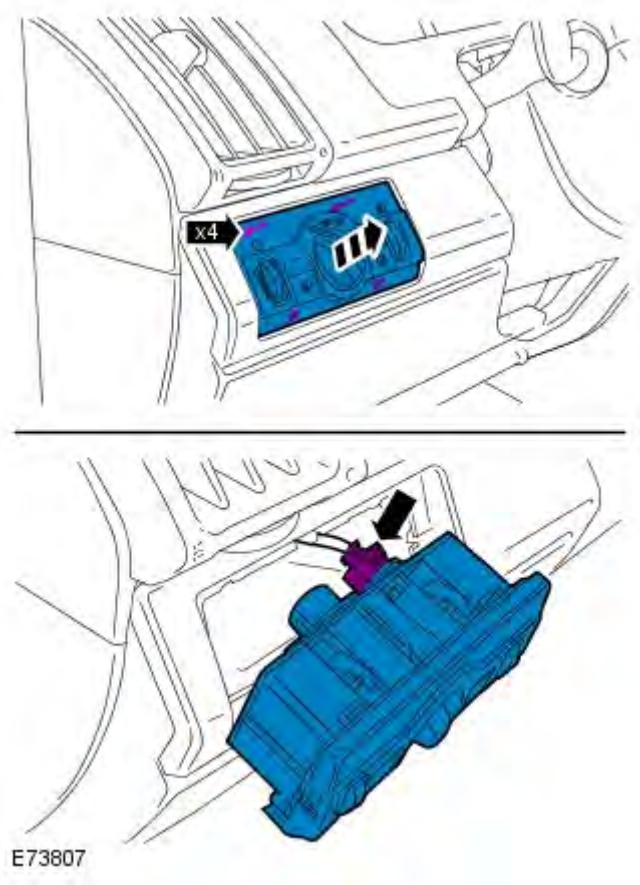
1. To install, reverse the removal procedure.

Published: 11-May-2011

Exterior Lighting - Headlamp Switch

Removal and Installation

Removal



1. **1.** CAUTION: Protect the surrounding trim to avoid damage.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exterior Lighting - Side Turn Signal Lamp

Removal and Installation

Removal

1.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exterior Lighting - Headlamp Leveling Module

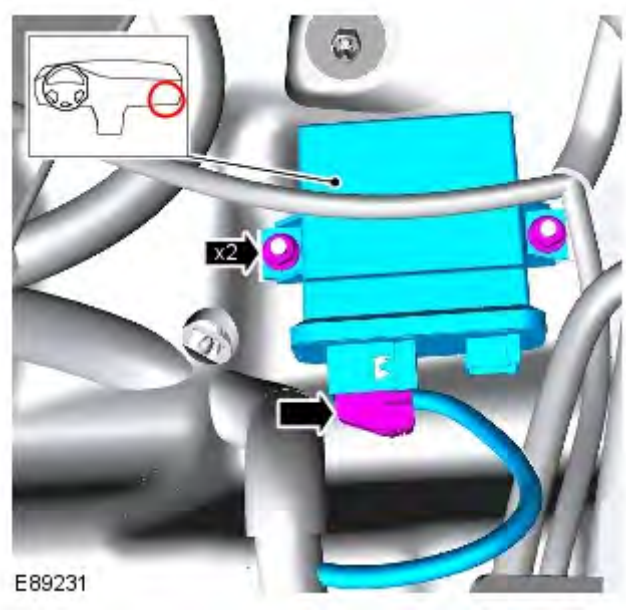
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).



2. *Torque:* 7 Nm

Installation

1. To install, reverse the removal procedure.

2. Using the Land Rover approved diagnostic system, calibrate a new module.

Published: 11-May-2011

Exterior Lighting - Trailer Module

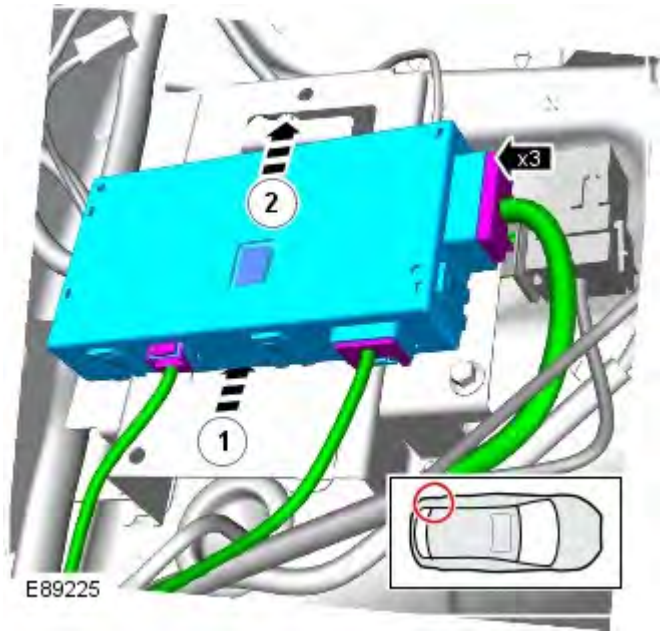
Removal and Installation

Removal

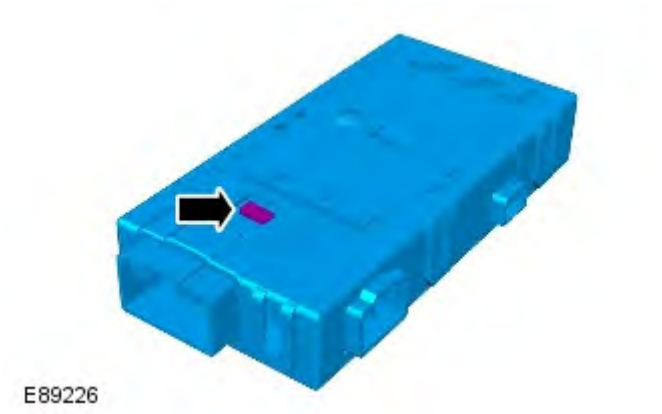
• NOTE: The trailer module is fitted with a replaceble fuse.

1. Remove the LH rear quarter trim panel.

   Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. Remove the trailer module.



3. **3.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the fuse.

Installation

1. To install, reverse the removal procedure.

2. Using the Land Rover approved diagnostic system, calibrate a new module.

Published: 11-May-2011

Exterior Lighting - Stoplamp Switch

Removal and Installation

Removal

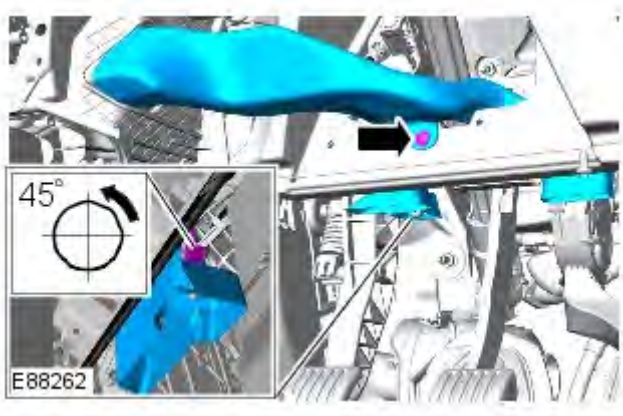
Right-hand drive vehicles

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

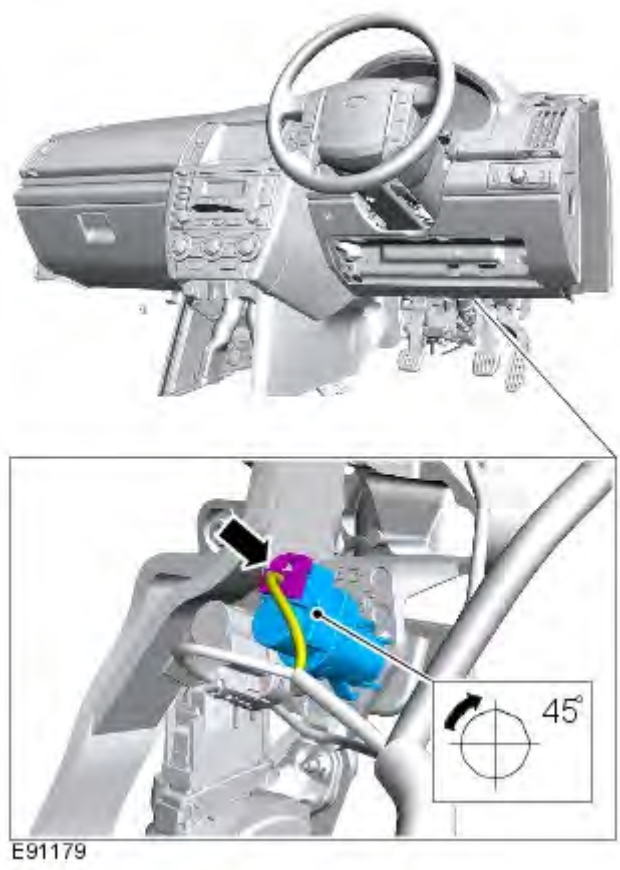
2. Remove the driver lower air bag.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



3.

All vehicles



4. **4.** CAUTION: The switch has a latching device that only allows the switch to be removed or installed when the switch plunger is depressed.

   • NOTE: RHD illustration shown, LHD is similar.

Published: 11-May-2011

Interior Lighting -

Bulb Specifications

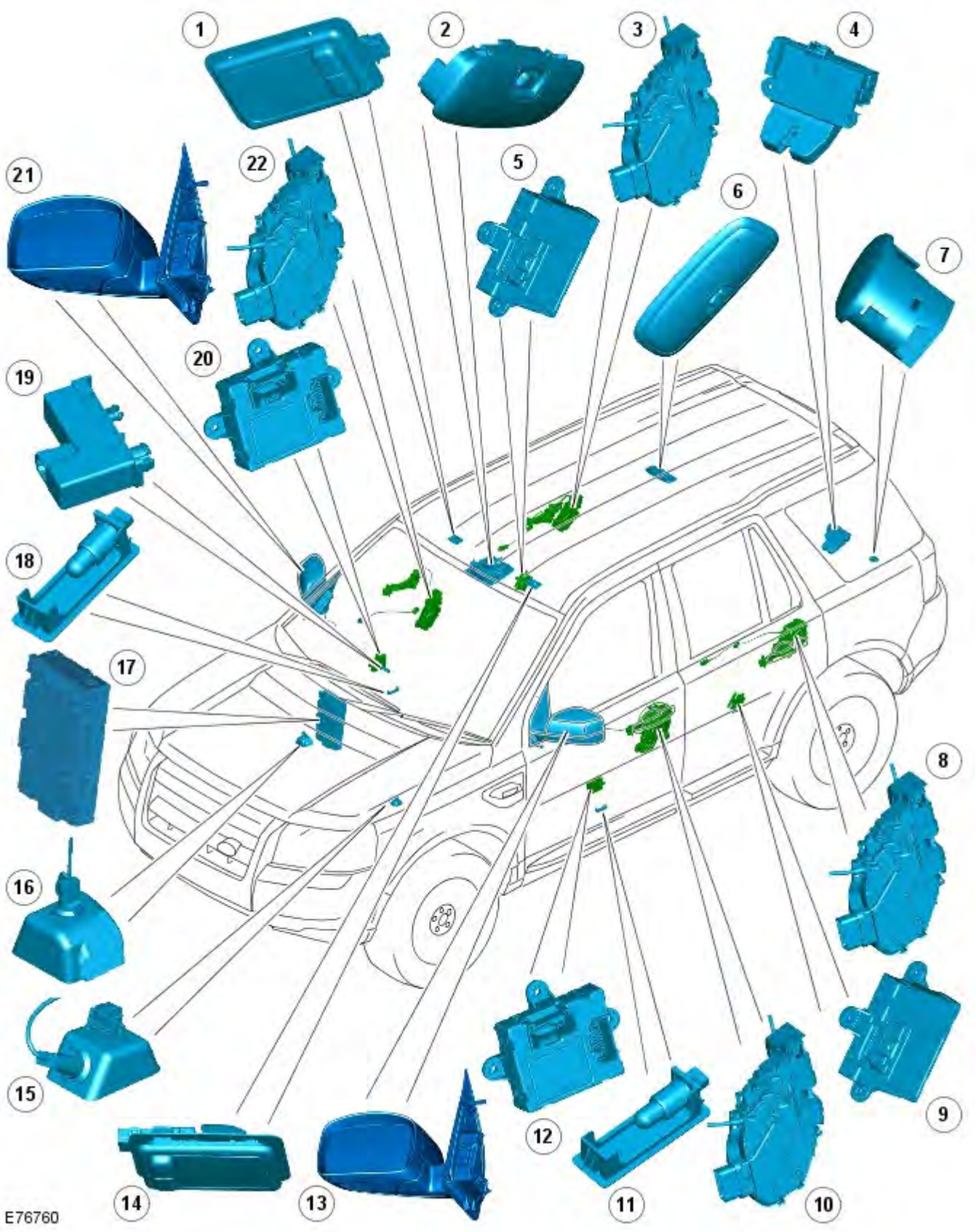
Bulb	Type	Rating
Glovebox lamp	W5W	5W
Interior lamps	W5W	5W
Luggage/liftgate lamps	W5W	5W
Luggage/footwell lamps	W5W	5W
Puddle lamps	W5W	5W
Vanity mirror lamp	W5W	5W

Published: 11-May-2011

Interior Lighting - Interior Lighting

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Vanity mirror lamp
2	-	Front interior lamp (includes map reading lamps from 2009MY)
3	-	Rear door latch switch
4	-	Liftgate release motor

5	-	Rear door module
6	-	Rear interior lamp
7	-	Luggage compartment lamp
8	-	Rear door latch switch
9	-	Rear door module
10	-	Driver door latch switch
11	-	Driver door lamp
12	-	Driver door module
13	-	Exterior mirror lamp
14	-	Vanity mirror lamp
15	-	Driver footwell lamp
16	-	Passenger footwell lamp
17	-	Central Junction Box (CJB)
18	-	Passenger door lamp
19	-	Glovebox lamp
20	-	Passenger door module
21	-	Exterior mirror lamp
22	-	Passenger door latch switch

OVERVIEW

Operation of the interior lighting system, with the exception of the door and mirror lamps, is controlled by the CJB. Door and mirror lamp operation is controlled by the relevant door module.

In order to control the interior lighting system, the CJB receives inputs from the 4 door latch switches and the liftgate release motor. The system also interacts with the central locking system, illuminating the interior lamps and the mirror lamps on receipt of an unlock request. This request is transmitted to the CJB from the Radio Frequency (RF) receiver.

The front and rear roof mounted interior lamps contain a 3 position rocker switch. Automatic (Courtesy) operation of the lamps can be overridden by moving the switch to the 'always on' or 'always off' position.

If 'Courtesy' lighting is active and a hinged panel is left open, the CJB will extinguish all interior lamps after a period of 15 minutes. If a manual request for interior lighting has been made, the CJB will extinguish the lamps after a period of 30 minutes.

Pressing the light symbol on the remote handset will activate the 'Approach Lamp' feature. When activated, the CJB illuminates the mirror lamps and a number of exterior lamps.
For additional information, refer to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

On vehicles from 2009MY, the front interior lamp incorporates 2 map reading lamps. The front interior lamp is fitted with 2 additional switches which control each lamp and operate independantly of the interior lighting functionality.

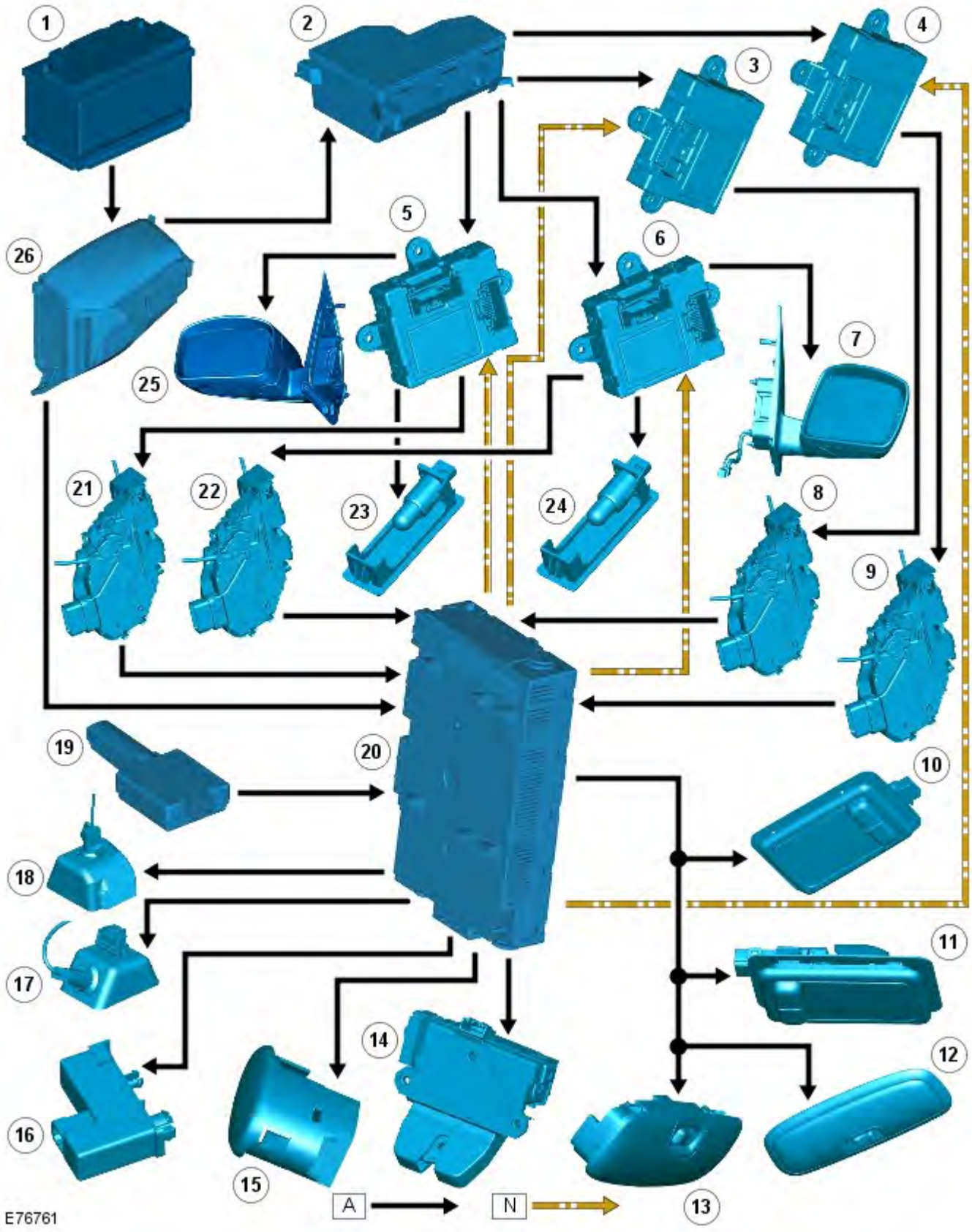
Transport Mode

All new vehicles will be delivered from the factory in transport mode. Transport mode inhibits a number of electrical systems and features, including the interior lamps, to eliminate quiescent drain from the battery during delivery. When the vehicle is in transport mode 'transp' will be displayed in the instrument cluster odometer.

To remove the vehicle from transport mode, the Land Rover approved diagnostic system must be connected during the Pre-Delivery Inspection (PDI). For more information, refer to the PDI manual.

CONTROL DIAGRAM

- NOTE: **A** = Hardwired; **N** = Medium speed Controller Area Network (CAN) bus



Item	Part Number	Description
1	-	Battery
2	-	Auxiliary Junction Box (AJB)
3	-	Rear door module
4	-	Rear door module
5	-	Driver door module
6	-	Passenger door module
7	-	Exterior mirror lamp
8	-	Rear door latch switch
9	-	Rear door latch switch
10	-	Vanity mirror lamp
11	-	Vanity mirror lamp

12	-	Rear interior lamp
13	-	Front interior lamp (includes map reading lamps on vehicles from 2009MY)
14	-	Liftgate release motor
15	-	Luggage compartment lamp
16	-	Glovebox lamp
17	-	Driver footwell lamp
18	-	Passenger footwell lamp
19	-	RF receiver
20	-	CJB
21	-	Driver door latch switch
22	-	Passenger door latch switch
23	-	Driver door lamp
24	-	Passenger door lamp
25	-	Exterior mirror lamp
26	-	Battery Junction Box (BJB)

PRINCIPLES OF OPERATION

Operation and control of the interior lamps can be split into 3 main groups.

Front and Rear Interior Lamps, Footwell Lamps, and Load Space Lamp

The CJB controls operation of these lamps by providing a voltage feed to both sides of each lamp. By increasing or decreasing the voltage supplied to one side of the lamp, the CJB controls the current flow through the lamp and thus the lighting level. This feature is controlled via the interior lamp Field Effect Transistor (FET), which is integral with the CJB and allows the CJB to ramp up and ramp down the illumination levels of the lamps when required. The CJB controls the ramp up time to 1.3 seconds, and the ramp down time to 2.6 seconds.

If the vehicle is involved in an accident violent enough to trigger the Supplemental Restraint System (SRS), the Restraints Control Module (RCM) will provide a 250 Hz 'crash' signal to the CJB. On receipt of this signal the CJB will illuminate the front and rear interior lamps, the footwell lamps and the load space lamp for up to 30 minutes. The CJB will extinguish the interior lamps prior to the 30 minute period elapsing if the crash signal from the RCM is replaced with a 10 Hz 'normal' signal.

Vanity Mirror and Glovebox Lamps

The vanity mirror lamps and the glovebox lamp are provided a voltage feed by the CJB. When vanity mirror lamp operation is selected by pressing the relevant switch, a ground path is created causing the lamp to illuminate. Glovebox lamp illumination is controlled by a microswitch which is integral with the lamp assembly. When the glovebox is opened, the switch contacts close creating a ground path for the lamp.

Door and Mirror Lamps

Operation of the door and mirror lamps is controlled by the door modules in conjunction with the CJB. The CJB provides a feed to each door latch switch. When a door is opened, the switch contacts close providing a feed to the relevant door module. On receipt of this feed, the module illuminates its door lamp by providing a feed and ground path.

The driver and front passenger door modules also control operation of the mirror lamps. When a valid unlock request is received from the RF receiver, the CJB notifies the driver and front passenger door modules via the medium speed CAN bus. On receipt of the CAN bus message the door module illuminates the relevant mirror lamp by providing a feed and ground path.

Published: 11-May-2011

Interior Lighting - Interior Lighting

Diagnosis and Testing

Principles of Operation

For a detailed description of the interior lighting system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Interior Lighting (417-02 Interior Lighting, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Bulbs	• Fuses/relays (refer to electrical guide) • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connections

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B113C11	Hazard switch illumination - circuit short to ground	• Hazard switch illumination circuit - short to ground	Refer to electrical circuit diagrams and check hazard switch illumination circuit for short to ground
B113C15	Hazard switch illumination - circuit short to power or open	• Hazard switch illumination circuit - short to power, open circuit	Refer to electrical circuit diagrams and check hazard switch illumination circuit for short to power, open circuit
B1D1312	Interior Lights #1 Circuit - circuit short to power	• Instrument panel interior lights circuit - short to power	Refer to electrical circuit diagrams and check instrument panel interior lights circuit for short to power
B1D1314	Interior Lights #1 Circuit - circuit short to ground or open	• Instrument panel interior lights circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check instrument panel interior lights circuit for short to ground, open circuit
B1D1A12	Interior Lights Circuit 'C' - circuit short to power	• Roof console interior lights circuit - short to power	Refer to electrical circuit diagrams and check roof panel interior lights circuit for short to power
B1D1A14	Interior Lights Circuit 'C' - circuit short to ground or open	• Roof console interior lights circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check roof panel interior lights circuit for short to ground, open circuit
U025200	Lost Communication With Lighting Control Module - Rear 'B'	• Lost communication with trailer module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system
U201011	Switch Illumination - circuit short to ground	• Switch illumination circuit - short to ground	Refer to electrical circuit diagrams and check switch illumination circuit for short to ground

DTC	Description	Possible Cause	Action
U201015	Switch Illumination - circuit short to power or open	• Switch illumination circuit - short to power, open circuit	Refer to electrical circuit diagrams and check switch illumination circuit for short to power, open circuit

Published: 11-May-2011

Daytime Running Lamps (DRL) -

Item	Specification
Daytime running lamps	Full intensity low beam headlamps are permanently illuminated when the vehicle is being driven. For additional information, refer to: Daytime Running Lamps (DRL) (417-04 Daytime Running Lamps (DRL), Description and Operation).

Published: 11-May-2011

Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL)

Description and Operation

OVERVIEW

DRL use the full intensity low beam headlamps which are permanently illuminated when the vehicle is being driven. DRL are used in a number of markets and there are 2 systems to cover these markets.

For additional information, refer to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

DRL CANADIAN MARKET

DRL for this market use full intensity low beam headlamps. The side marker lamps, tail lamps and license plate lamps will be on, but instrument cluster illumination will be off. DRL are active when the following parameters are met:

- PARK is not selected on automatic transmission selector lever
- Power mode 6 (ignition on) detected by the auxiliary junction box
- Handbrake is not applied.

• NOTE: If the rotary switch on the light switch module is moved to the headlamp position, DRL are deactivated and normal side lamp and headlamp functionality is operational.

• NOTE: Adaptive Front lighting System (AFS) (where fitted) is non-functional when the DRL are active unless the rotary switch on the light switch module is moved to the headlamp position.

• NOTE: When DRL are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally.

• NOTE: When DRL are active, the headlamp powerwash function is non-functional, unless the rotary switch on the light switch module is moved to the headlamp position.

The high beam headlamp function using the left hand steering column stalk switch will be deactivated. When the selector lever is in the PARK position on automatic transmission vehicles, DRL are turned off. This is to reduce battery discharge during long periods of engine idling in cold climate conditions. When the selector lever is moved from the PARK position, normal DRL functionality is restored.

When the handbrake is applied, DRL are turned off to reduce battery discharge.

DRL DENMARK, HOLLAND, NORWAY, SWEDEN, FINLAND AND POLAND

• NOTE: DRL for Poland is on vehicles from 2008MY.

DRL for these markets use full intensity low beam headlamps. Side lamps and license plate lamps will be on, but instrument cluster illumination will be off. DRL are active when the following parameters are met:

- Power mode 6 (ignition on) detected by the auxiliary junction box
- The rotary switch on the light switch module is in the off position.

• NOTE: When DRL are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally. The high beam headlamp function using the left hand steering column stalk switch will be deactivated.

• NOTE: When DRL are active, the headlamp powerwash function is non-functional, unless the rotary switch on the light switch module is moved to the headlamp position.

If the rotary switch on the light switch module is moved to the side lamp or headlamp positions, DRL are deactivated and normal side lamp and headlamp functionality is operational.

Published: 11-May-2011

Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL)

Diagnosis and Testing

Principles of Operation

For a detailed description of the daytime running lamps system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Daytime Running Lamps (DRL) (417-04 Daytime Running Lamps (DRL), Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage and system integrity.

Visual Inspection

Electrical
• Fuses (refer to the electrical guide) • Bulbs • Switches • Electrical connectors • Wiring harness

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the relevant Diagnostic section and DTC Index.

Published: 11-May-2011

Module Communications Network -

Torque Specifications

Description	Nm	lb-ft
Battery junction box (BJB) retaining bolt	10	7
Battery positive cable to battery junction box (BJB) nut	10	7
Body panel ground cable nuts	10	7
Central junction box (CJB) bracket retaining nuts	10	7
Engine compartment ground cable nuts:		
M6	10	7
M8	25	18

Published: 11-May-2011

Module Communications Network - Communications Network

Description and Operation

OVERVIEW

A number of different types of communication network are incorporated into the vehicle wiring harnesses for the transmission of commands and information between control modules. The configuration installed on a particular vehicle depends on the model and equipment level.

The communication networks available on the vehicle are:

- Local Interconnect Network (LIN) bus
- Medium speed Controller Area Network (CAN) bus
- High speed CAN bus
- Media Orientated System Transport (MOST) ring

Bus	Baud Rate
LIN bus	9.6 kbits/s
Medium speed CAN bus	125 kbits/s
High Speed CAN bus	500 kbits/s
MOST ring	24 Mbits/s

LOCAL INTERCONNECT NETWORK BUS

The Local Interconnect Network (LIN) bus is a low speed broadcast network that employs master and slave components. The master component transmits a message along a single wire to the slave components identifying which slave is to respond. The message has a header (slave identifier) and an empty data field. The identified slave component fills the data field with the relevant information and returns a message to the master component along the same wire.

CONTROLLER AREA NETWORK BUS

The Controller Area Network (CAN) bus is a high speed broadcast network where control modules automatically transmit information every few microseconds. Information is broadcast down a pair of twisted wires, known as 'CAN high' and 'CAN low'. Information is transmitted on the CAN bus as a voltage difference between the 2 wires.

Two CAN bus networks are used on the vehicle; medium speed and high speed, with the Central Junction Box (CJB) acting as a gateway between the 2 networks. The table below shows the wire colors used on both networks.

Network	High	Low
Medium Speed	Grey and orange	Violet and orange
High Speed	White and blue	White

MEDIA ORIENTATED SYSTEM TRANSPORT (MOST) RING

The Media Orientated System Transport (MOST) ring uses fiber optic cables to transport data and audio signals around the information and entertainment system. The fiber optic cables are arranged in a ring, with each unit on the ring having a 'MOST in' and 'MOST out' connection.

The MOST ring is a synchronous network. A timing master supplies the clock and all other components on the ring synchronize their operation to this clock. The timing master for the MOST ring is the integrated control module.

When handling MOST fiber optic cables the following precautions should be observed:

- After disconnection of any cables carefully install appropriate dust caps to protect the mating faces of the connectors from damage and contamination.
- Avoid introducing bends of less than 25 mm (0.98 inches) radius or kinks into the fiber optic cable during service or repair. Tight bends or kinks could impair operation, cause immediate system failure, or future system failure.
- Avoid excessive force, strain or stress on the fibers or connectors especially permanent stress after reinstallation.

Ring Break Diagnostics

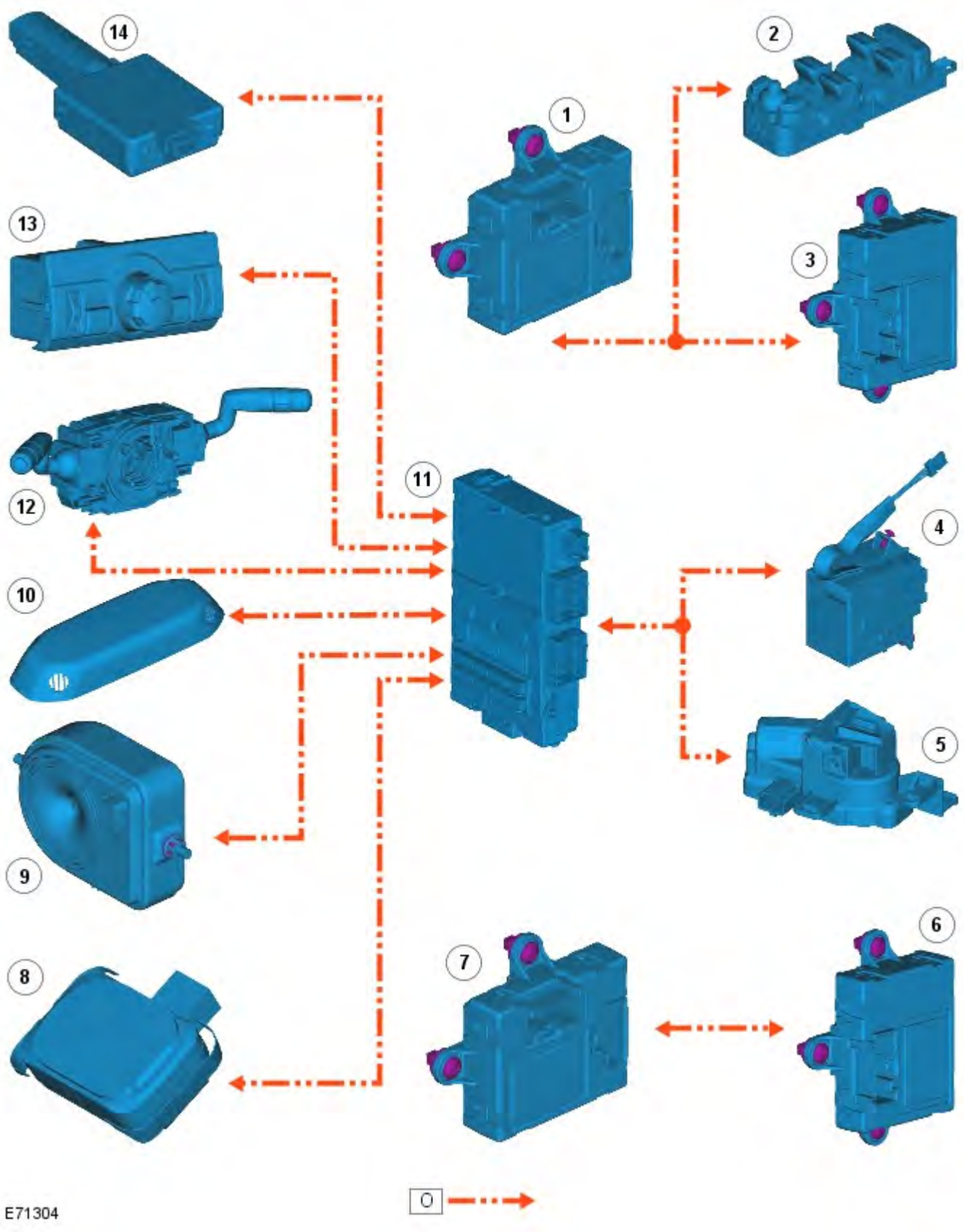
Incorporated into the Auxiliary Junction Box (AJB) is a Ring Break Diagnostics (RBD) link. The RBD link houses a copper link which when removed initiates the ring break diagnostics mode. The ring break diagnostics mode allows the technician to locate an optical fiber break in the MOST ring. To initiate the ring break diagnostics mode, carry out the following process:

- Connect the Land Rover approved diagnostic system.
- Ensure the vehicle is in power mode 4 or greater.
- Remove the RBD link for the length of time specified by the Land Rover approved diagnostic system.
- Replace the RBD link.

After approximately 30 seconds a Diagnostic Trouble Code (DTC) will be logged in the Integrated Control Module, identifying the location of the fault. The DTC can be read and interrogated using the Land Rover approved diagnostic system.

CONTROL DIAGRAM - LIN BUS (SHEET 1 OF 2)

• NOTE: **O** = LIN bus

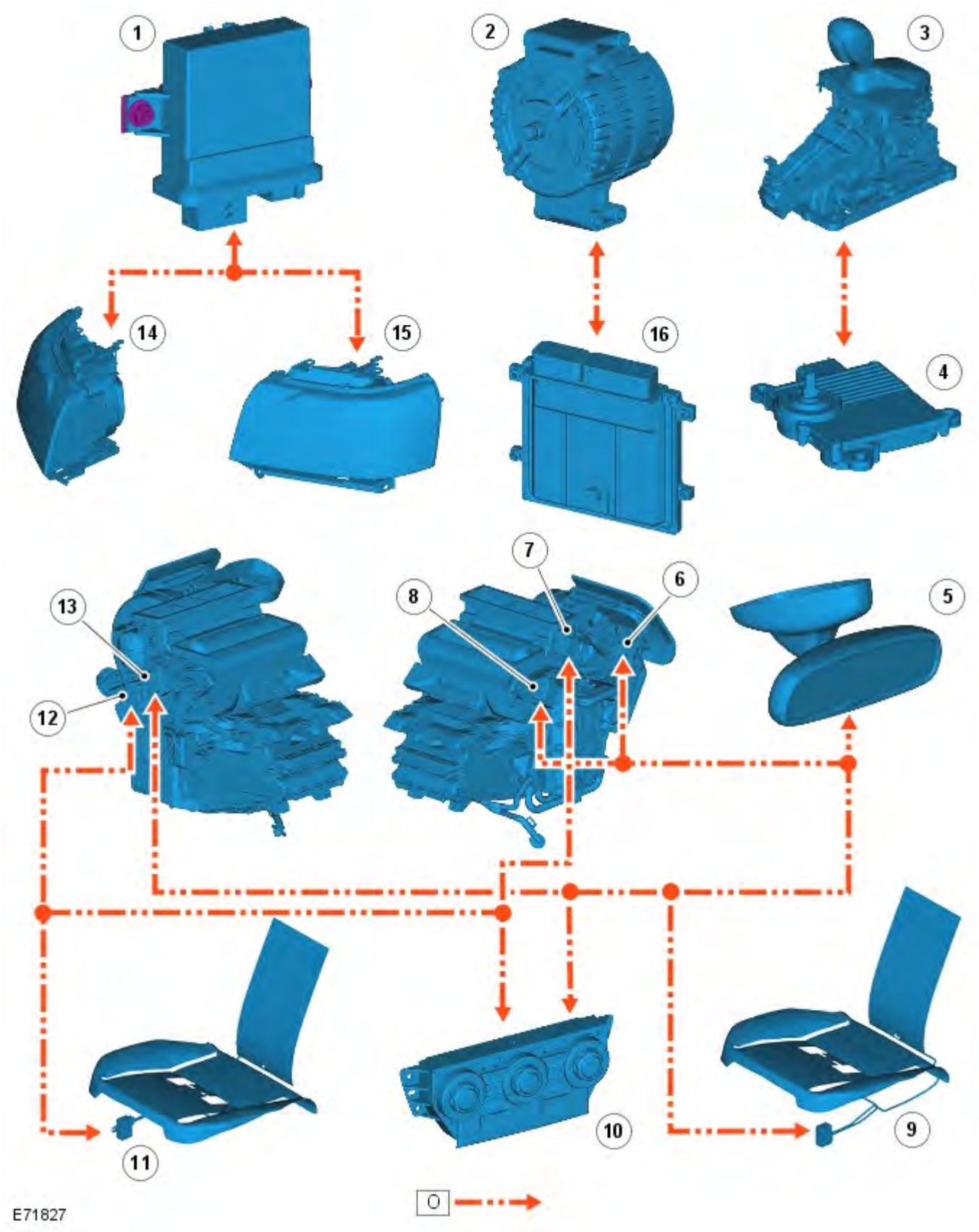


Item	Part Number	Description
1	-	Driver door module
2	-	Driver door switch pack
3	-	Rear door module (driver side)
4	-	Start control module
5	-	Electronic steering column lock
6	-	Rear door module (passenger side)
7	-	Passenger door module
8	-	Rain sensor
9	-	Battery backed sounder
10	-	Intrusion detection module
11	-	CJB

12	-	Steering wheel module
13	-	Light switch module
14	-	Radio Frequency (RF) receiver

CONTROL DIAGRAM - LIN BUS (SHEET 2 OF 2)

• NOTE: **O** = LIN bus

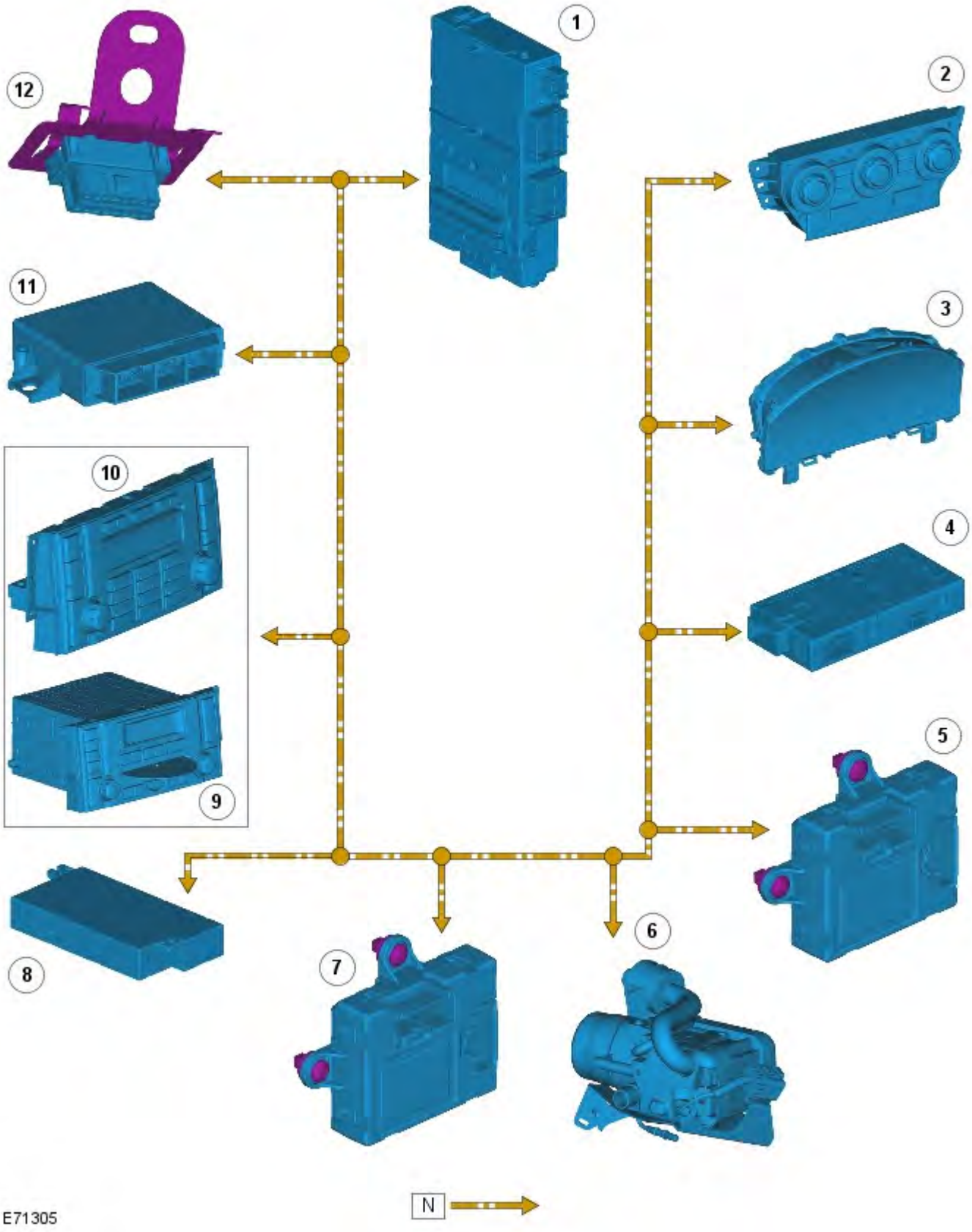


Item	Part Number	Description
1	-	Headlamp leveling control module
2	-	Generator control module
3	-	Selector lever module

4	-	Transmission Control Module (TCM)
5	-	Cabin humidity sensor
6	-	Air intake stepper motor
7	-	Windshield distribution (defrost) stepper motor
8	-	Right Hand (RH) temperature blend stepper motor
9	-	RH seat heat module
10	-	Automatic Temperature Control (ATC) module
11	-	Left Hand (LH) seat heat module
12	-	LH temperature blend stepper motor
13	-	Face/feet stepper distribution motor
14	-	RH headlamp control module
15	-	LH headlamp control module
16	-	Engine Control Module (ECM)

CONTROL DIAGRAM - MEDIUM SPEED CAN BUS

- NOTE: **N** = Medium speed CAN bus

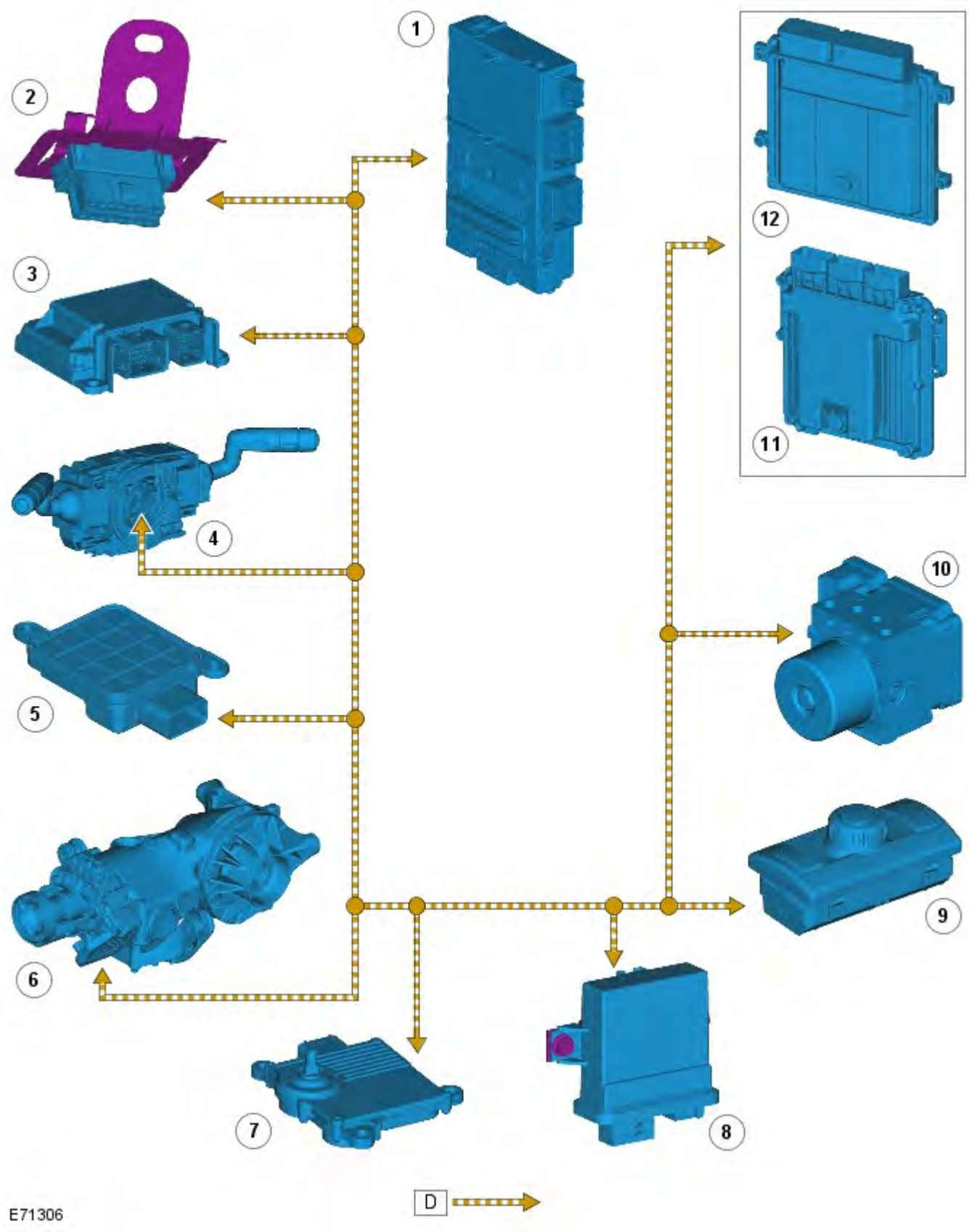


Item	Part Number	Description
1	-	CJB
2	-	ATC module
3	-	Instrument cluster (Intelligent Drivers Module)
4	-	Trailer module
5	-	Driver door module
6	-	Fuel fired booster heater
7	-	Passenger door module
8	-	Seat memory module
9	-	Integrated head unit/Integrated control module - Low line audio
10	-	Integrated control module - High line audio
11	-	Parking aid module

12	-	Diagnostic socket

CONTROL DIAGRAM - HIGH SPEED CAN BUS

• NOTE: **D** = High speed CAN bus

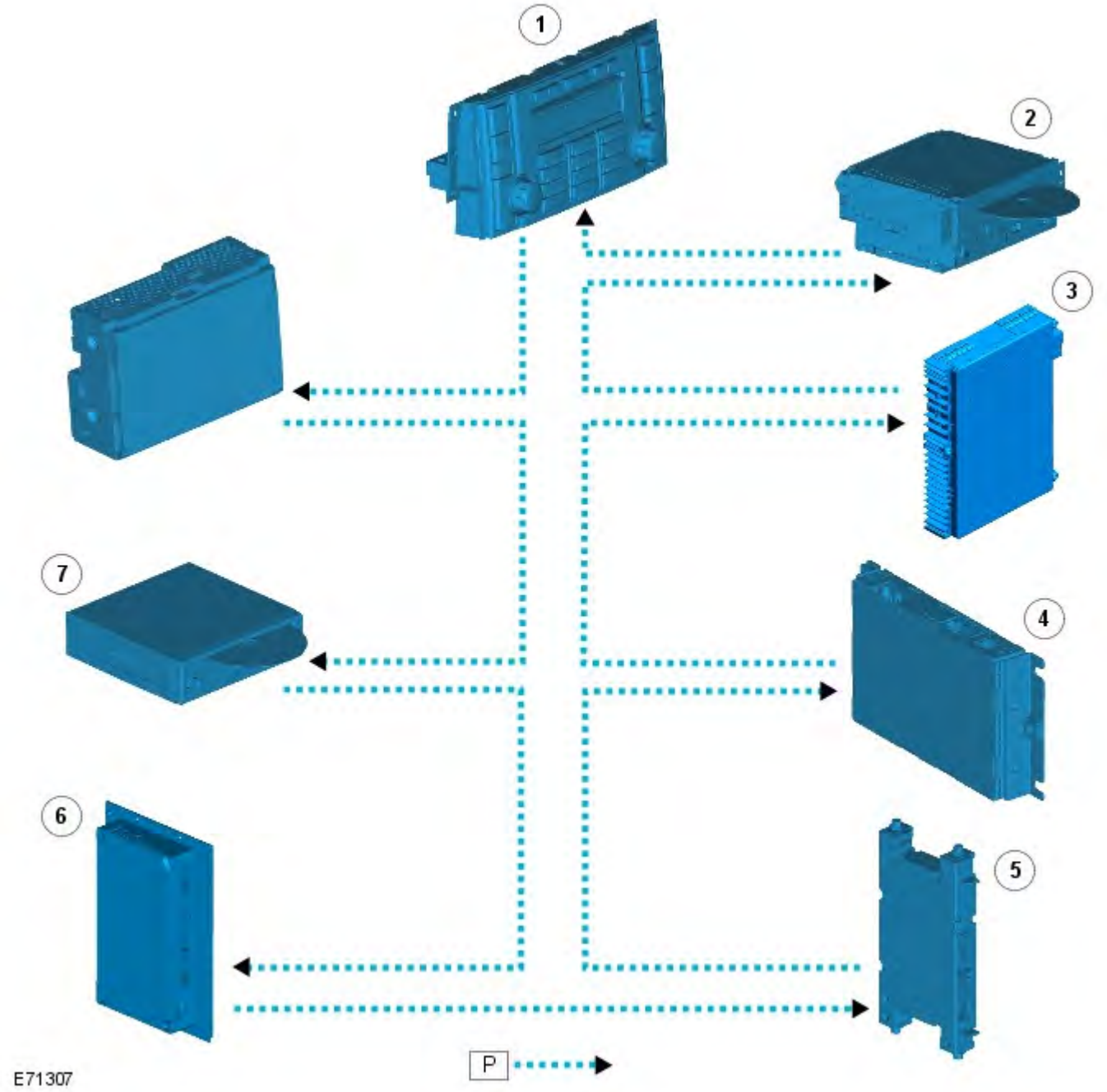


Item	Part Number	Description
1	-	CJB
2	-	Diagnostic socket
3	-	Restraints Control Module (RCM)
4	-	Steering wheel angle sensor
5	-	Occupant classification sensor - North American Specification (NAS) vehicles only

6	-	Electronic rear differential control module
7	-	TCM
8	-	Headlamp leveling control module
9	-	Terrain Response control module
10	-	Anti-lock Brake System (ABS) module
11	-	ECM - TD4
12	-	ECM - i6

CONTROL DIAGRAM - MOST

• NOTE: **P** = MOST



Item	Part Number	Description
1	-	Integrated control module
2	-	Integrated head unit
3	-	High Defination (HD) radio module (NAS only from 2009MY)
4	-	Digital Audio Broadcast (DAB) receiver / Satellite Digital Audio Radio Sytem (SDARS) (NAS only from 2009MY) receiver
5	-	Bluetooth telephone module
6	-	Amplifier
7	-	Satellite navigation computer
8	-	Touch Screen Display (TSD)

Published: 06-Jul-2011

Module Communications Network - Communications Network

Diagnosis and Testing

Principles of Operation

For a detailed description of the Communications Network, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Communications Network (418-00 Module Communications Network, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage and system integrity.

Visual Inspection

Electrical
• Fuses (refer to electrical guide) • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connections • Routing of fibre optic harnesses • Correct engagement of optical connectors • Correct placement of optical connectors (ring order) • Correct assembly of optical connectors (backout, etc) • Damage to fibre (chafing, abrasion, kinking, cuts, etc)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Body Control Module (BCM) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Module Communications Network - Central Junction Box (CJB)

Removal and Installation

Removal

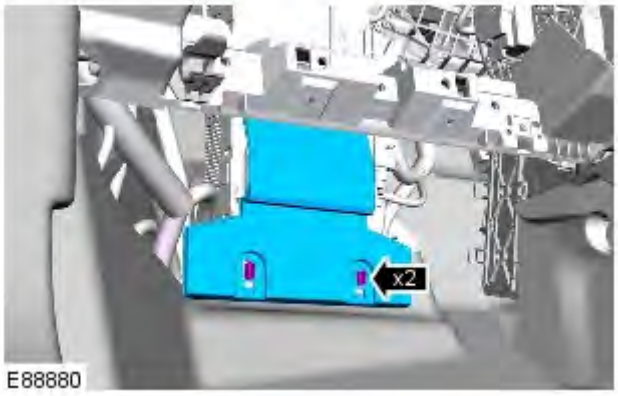
1. If renewing the CJB, use Land Rover approved diagnostic equipment to interrogate the module and upload the stored data, prior to removal of the CJB.

2. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).



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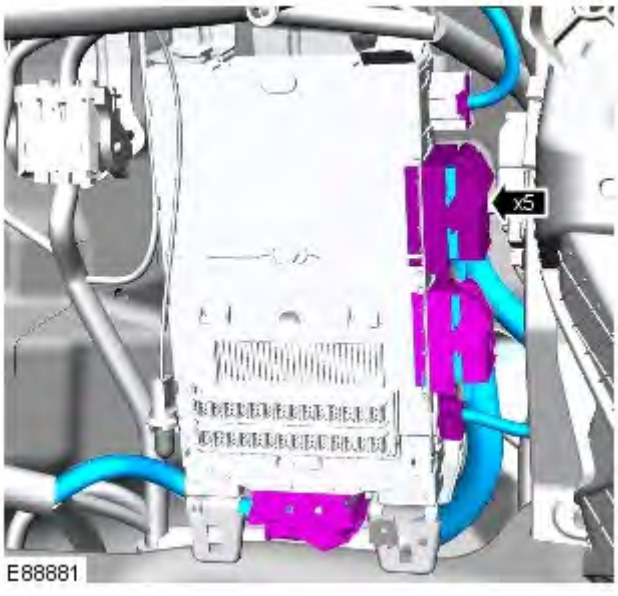

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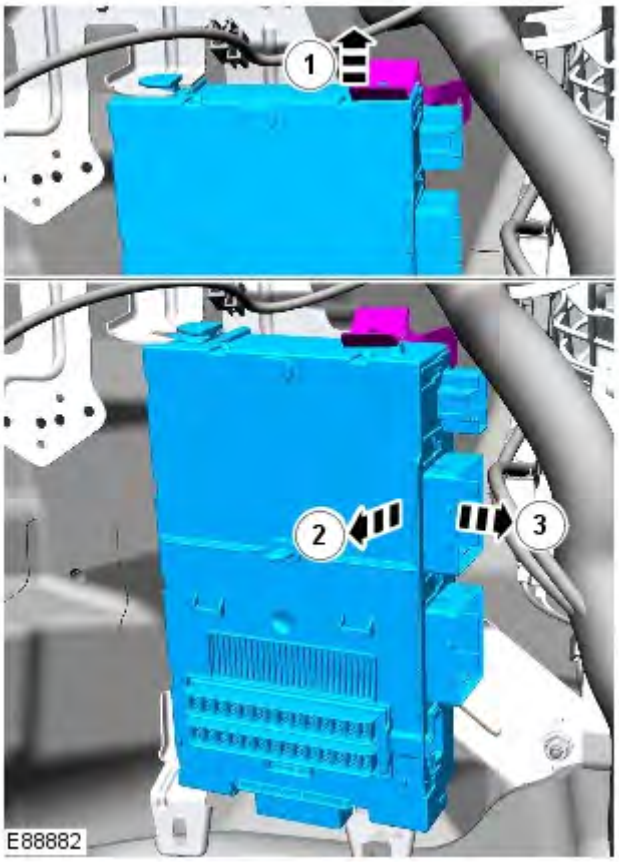


6.

Installation

1. **1.** NOTE: The Central Junction Box is pre-programmed by Land Rover and therefore no IDS connection is required. Original remote keys will function. Any additional remote keys will no longer function.

   To install, reverse the removal procedure.

Published: 11-May-2011

Module Communications Network - Battery Junction Box (BJB)TD4 2.2L Diesel

Removal and Installation

Removal

1. Remove the bumper armature.

   Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

2. Remove the air cleaner housing.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

3. Remove the secondary bulkhead center panel.

   Refer to: Secondary Bulkhead Center Panel - TD4 2.2L Diesel (501-02 Front End Body Panels, Removal and Installation).

4. Remove the brake booster.

   Refer to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation).

5. Remove the ABS module.

   Refer to: Anti-Lock Brake System (ABS) Module (206-09A Anti-Lock Control, Removal and Installation).

6. Remove the fuel fired booster heater.

   Refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation).

7. Remove both headlamps.

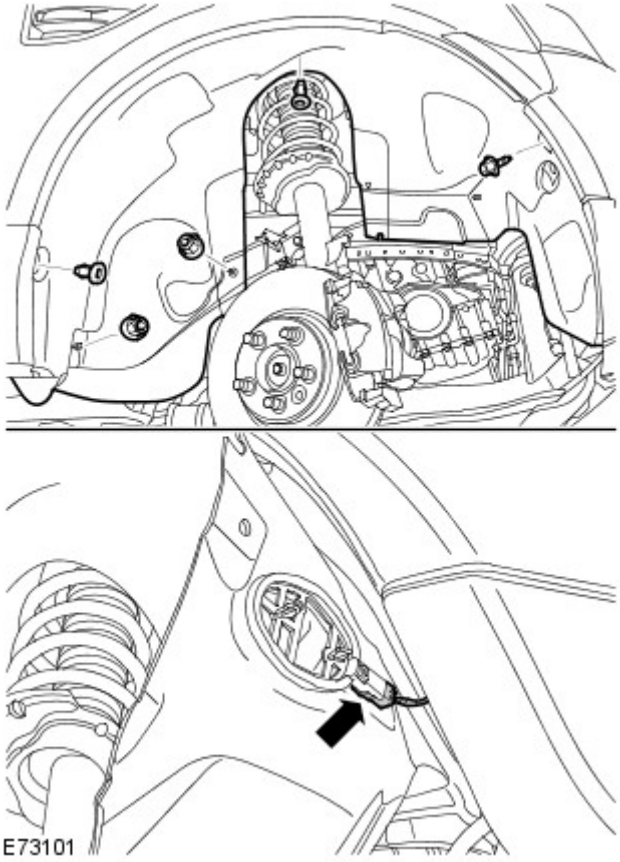
   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

8. Remove the engine upper support insulator.

   Refer to: Engine Upper Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

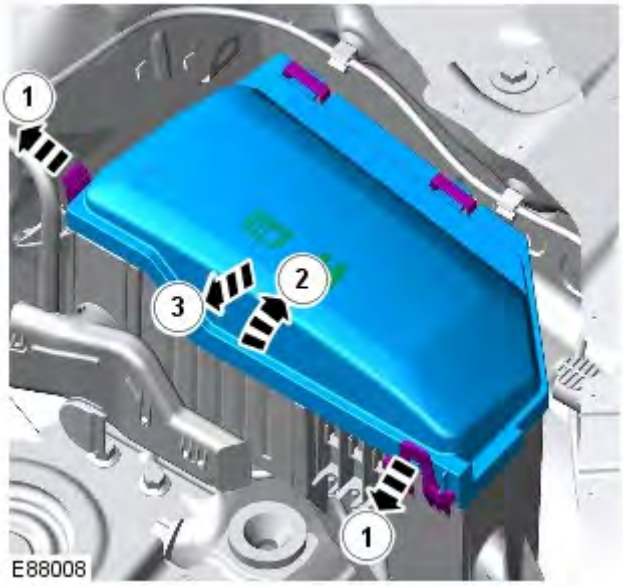
9. Remove the glove compartment lid.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).



10. **10.** NOTE: RHD illustration shown, LHD is similar.

    Remove the LH fender splash shield.



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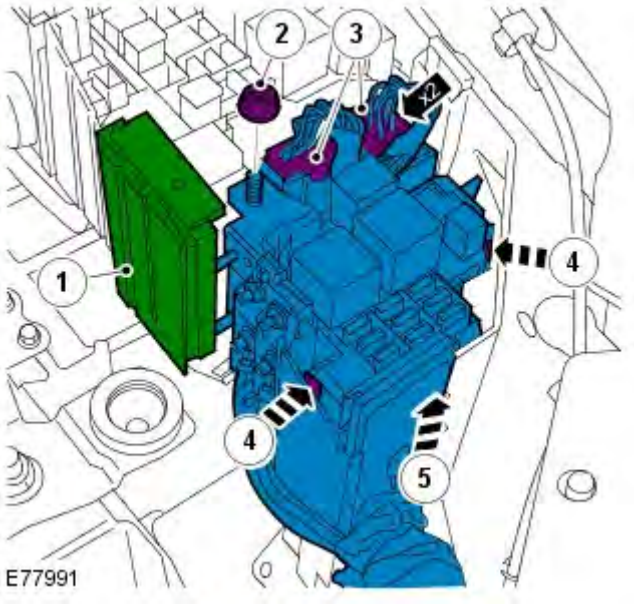

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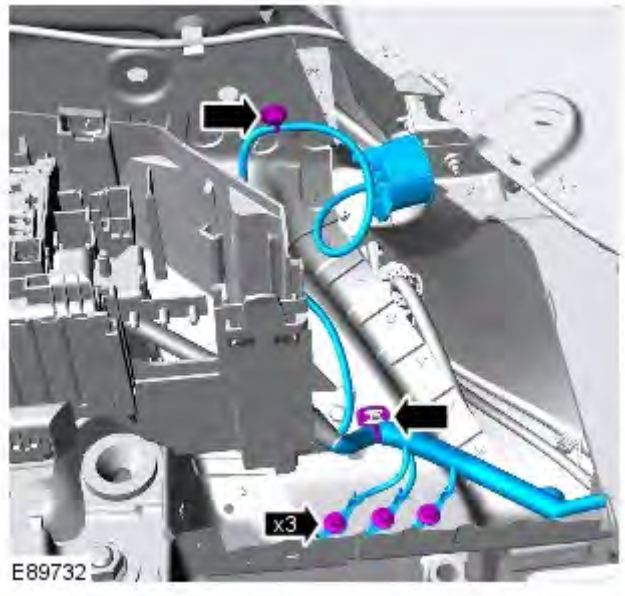

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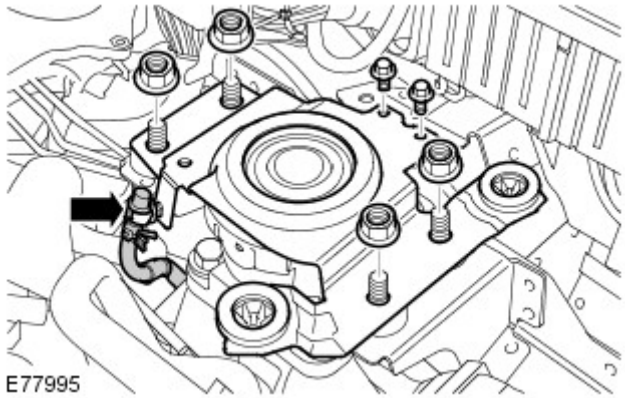

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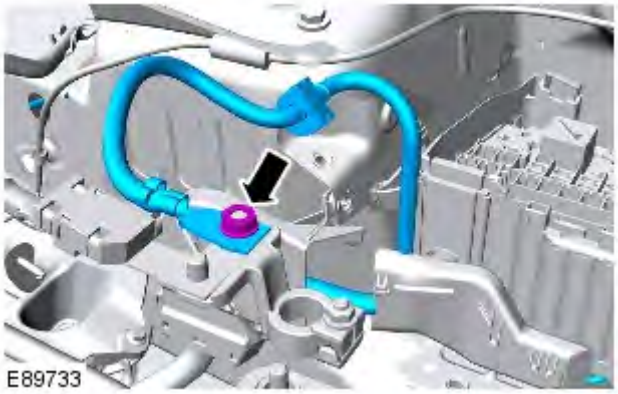

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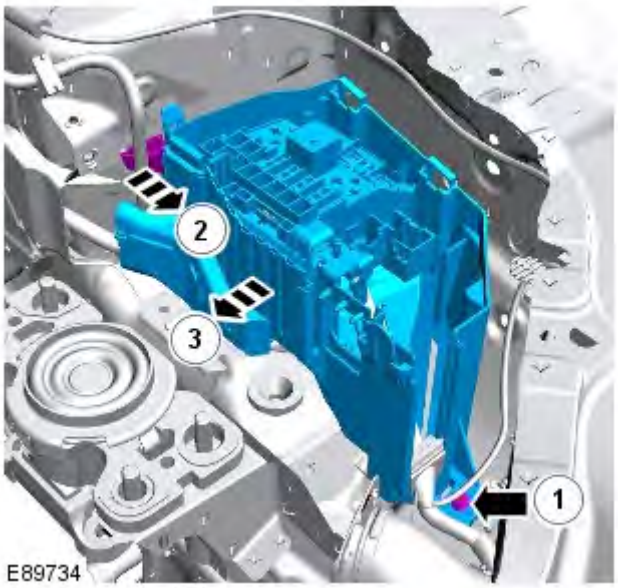

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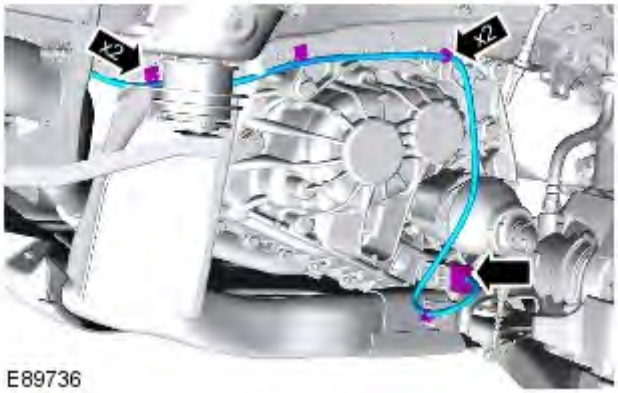

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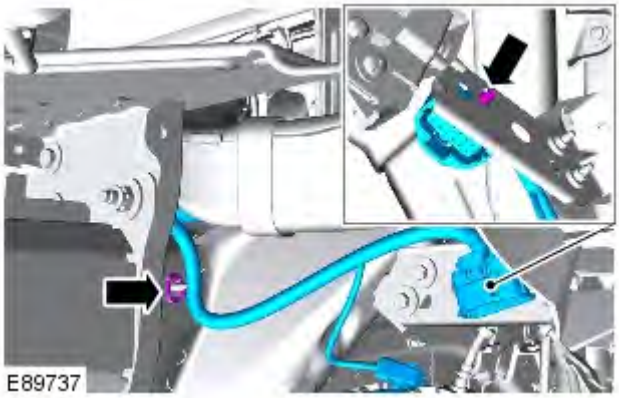

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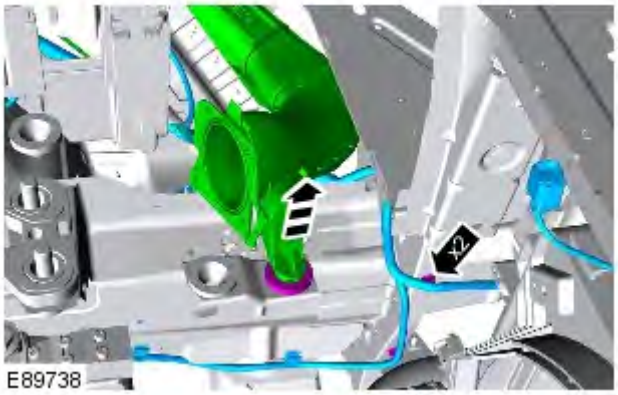
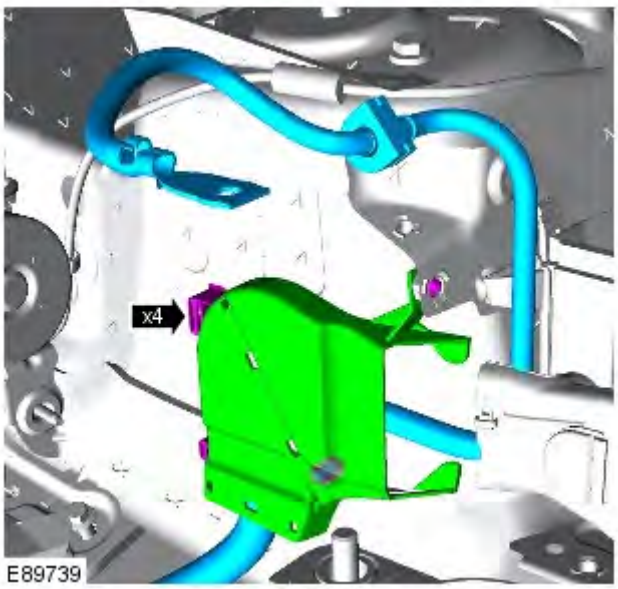


20. Release the harness and withdraw into engine bay area.

21.



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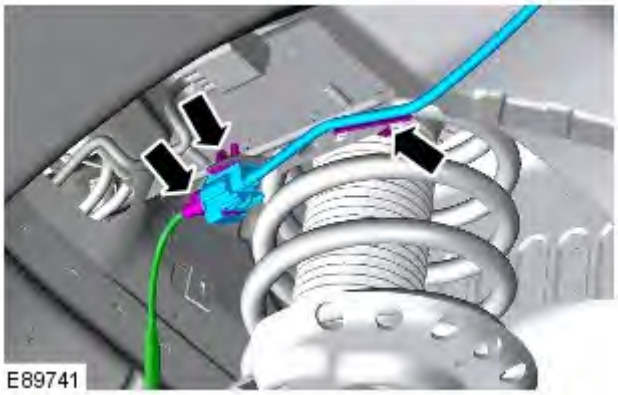

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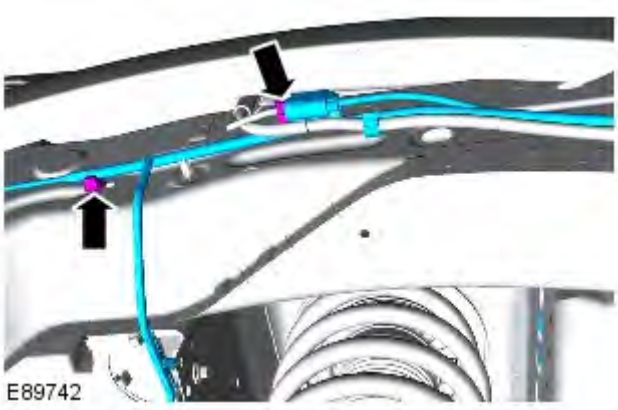

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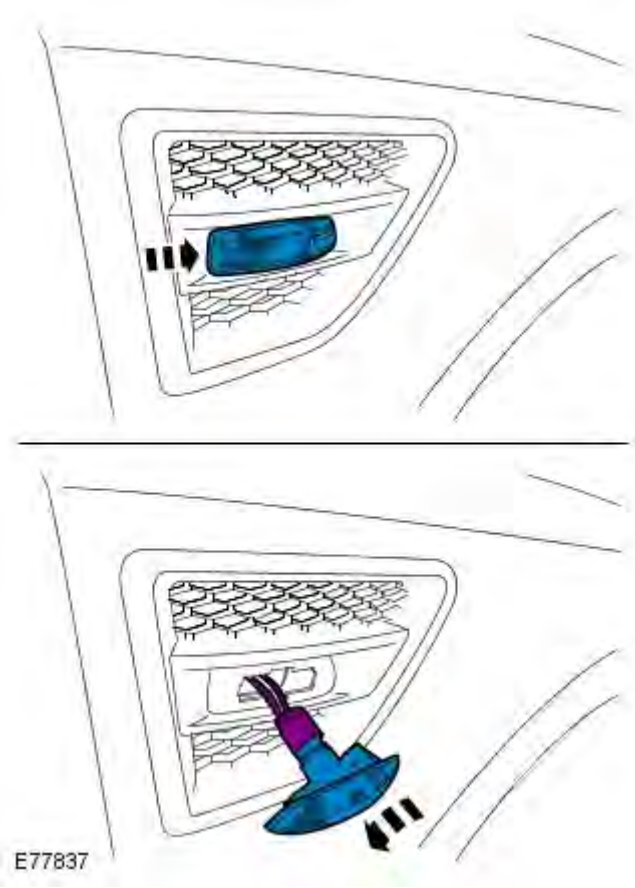

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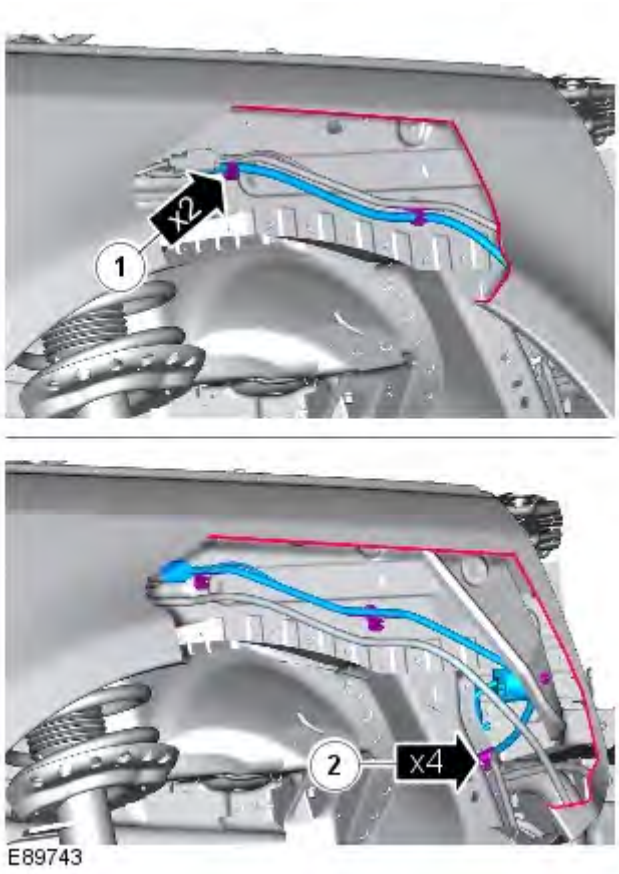

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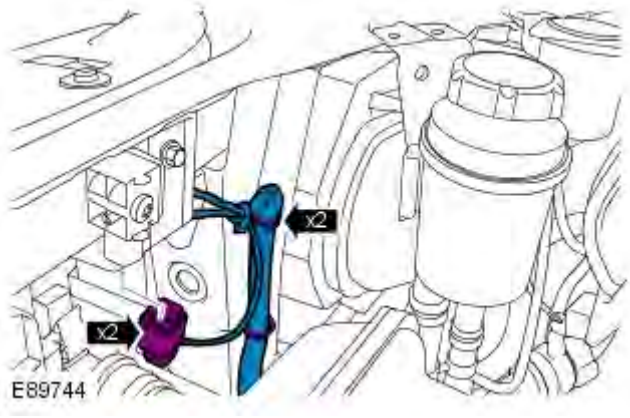

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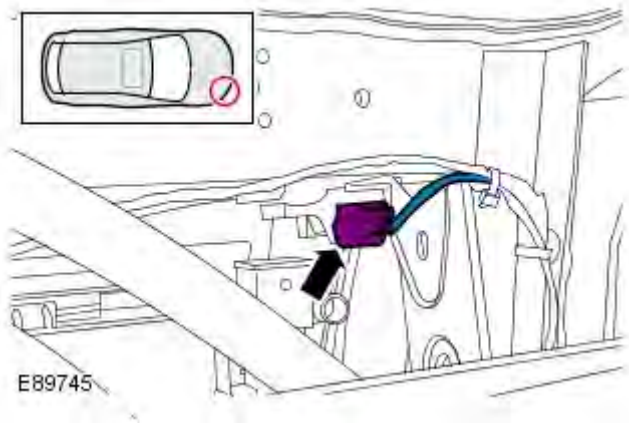

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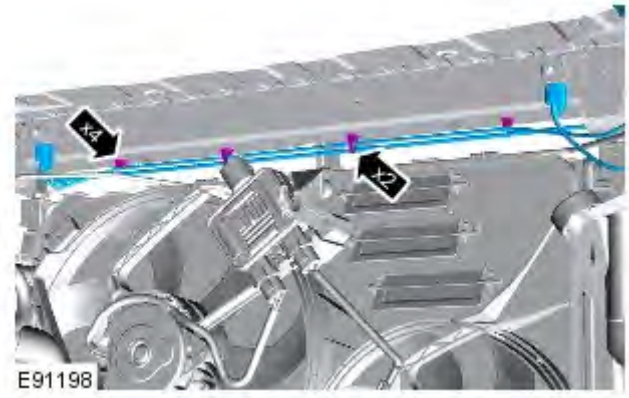

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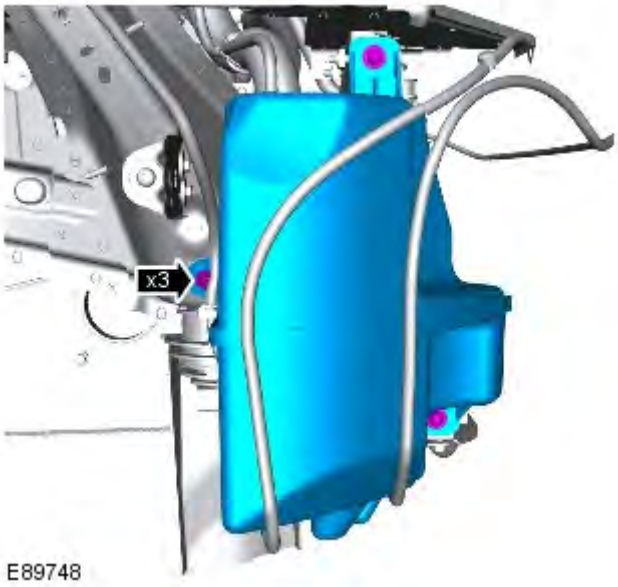

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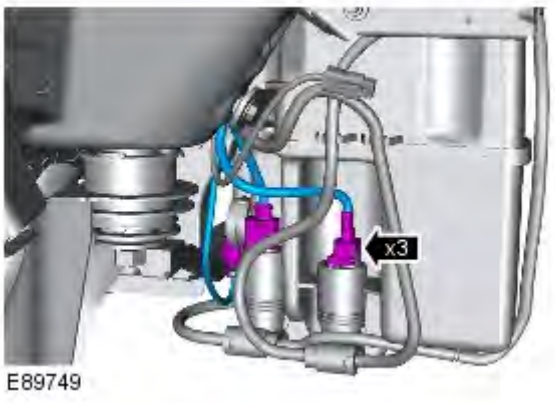

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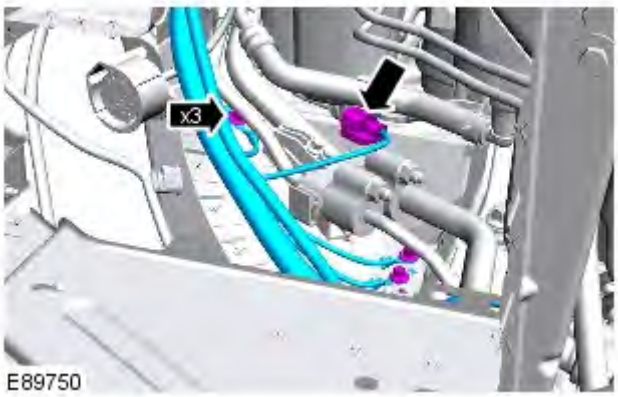

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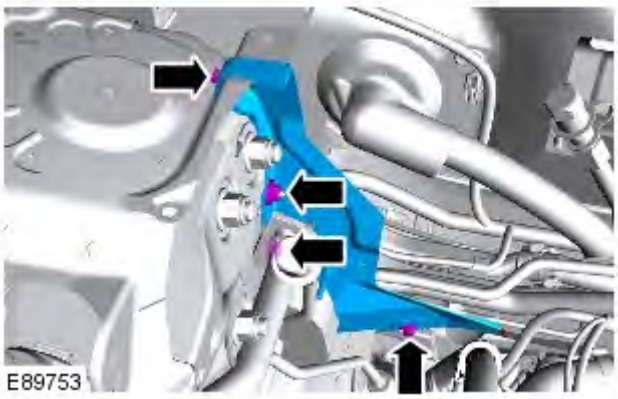
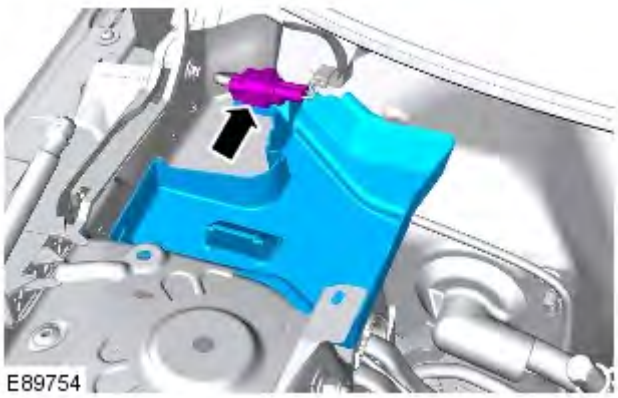
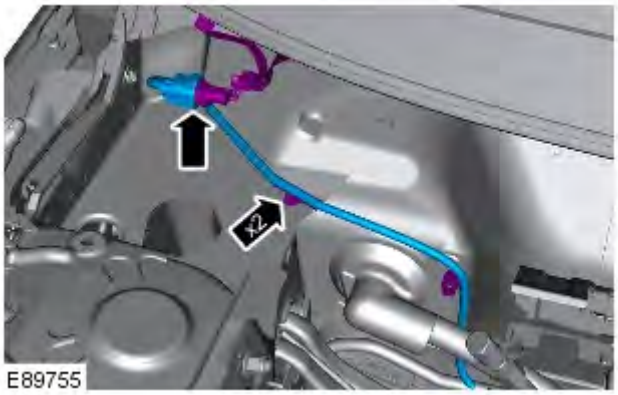


35. Unclip the windscreen heater electrical connector from the plenum side extension panel and remove the panel.





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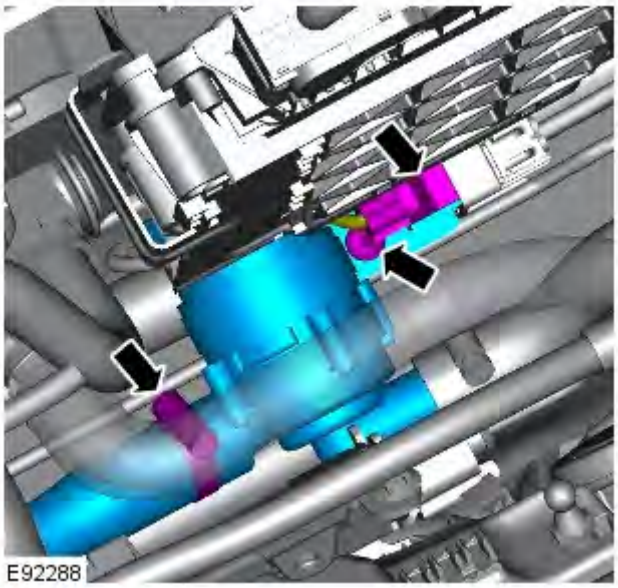
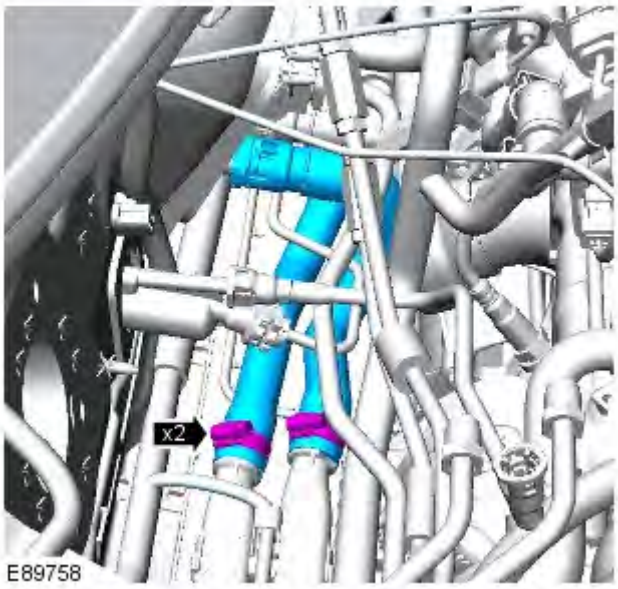
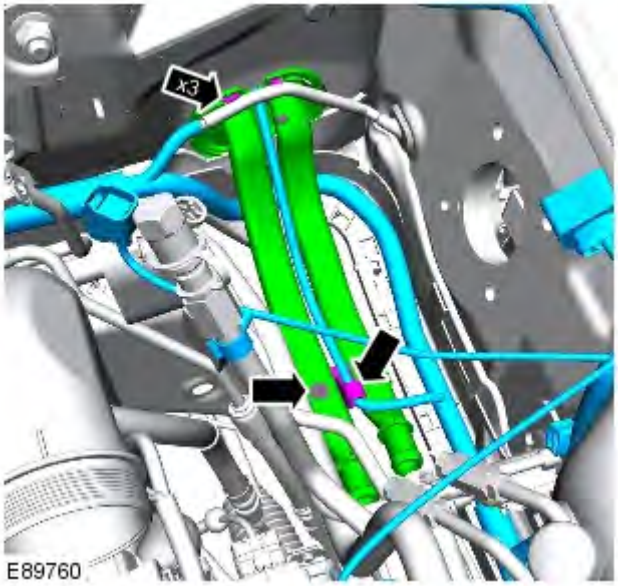


37. **37.** NOTE: LHD illustration shown, RHD is similar.

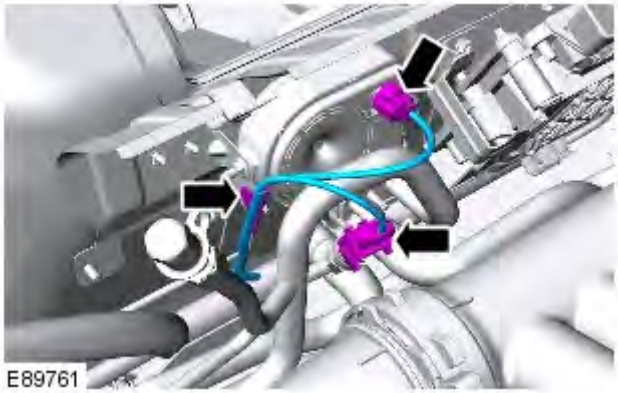


38. **38.** NOTE: LHD illustration shown, RHD is similar.

39.

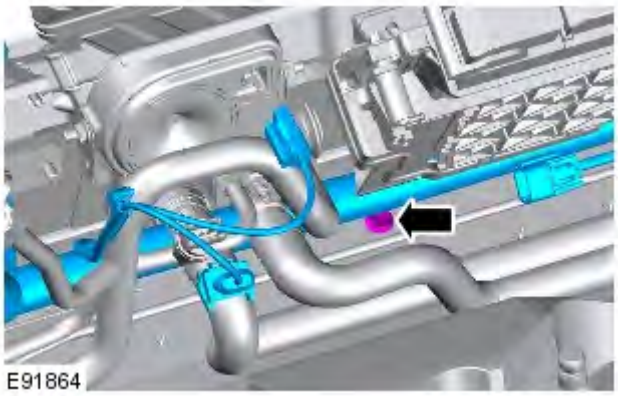


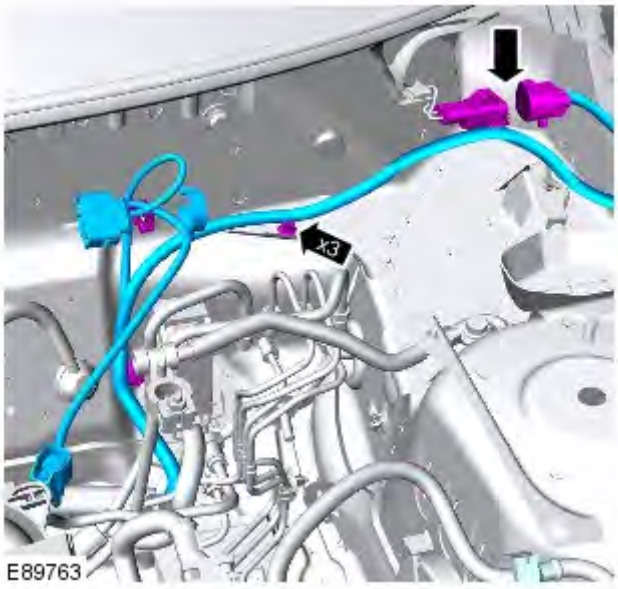
40. **40.** NOTE: LHD illustration shown, RHD is similar.



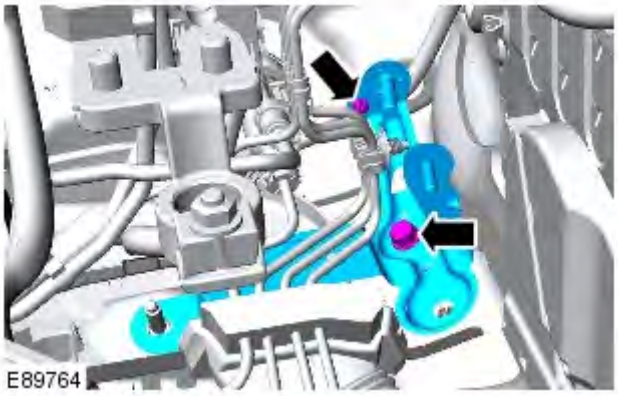
41. **41.** NOTE: LHD illustration shown, RHD is similar.

Release the engine compartment harness from clip securing it to the vehicle bulkhead.





42. **42.** NOTE: RHD illustration shown, LHD is similar.



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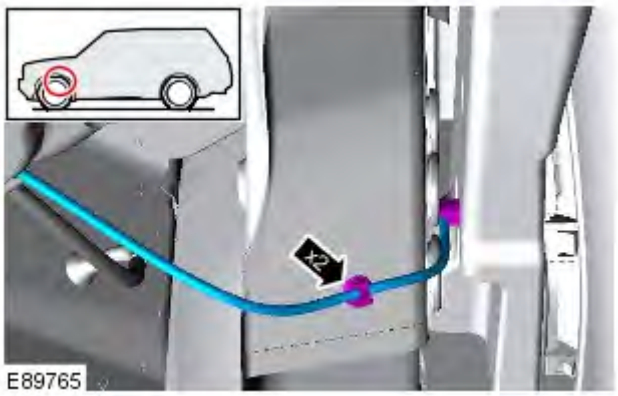
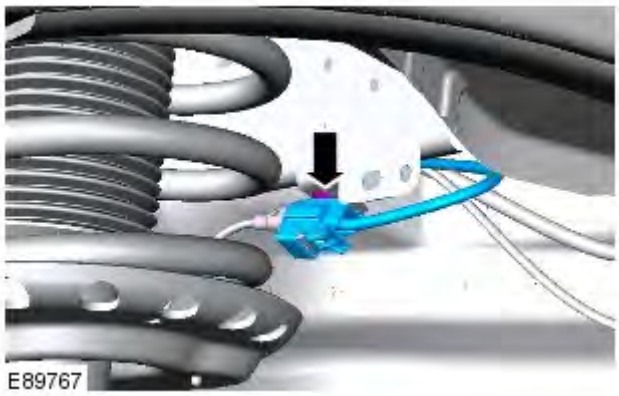
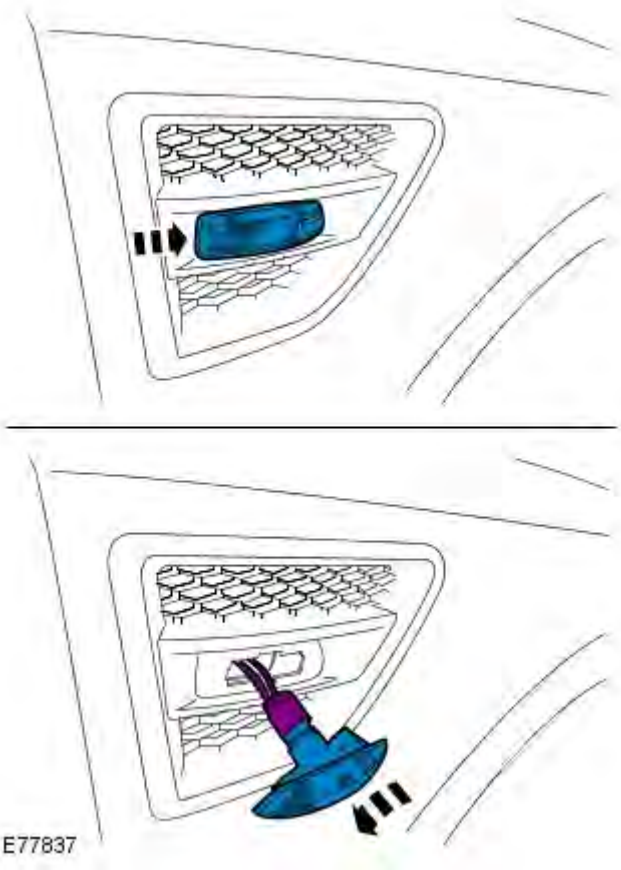


44. **44.** NOTE: LHD illustration shown, RHD is similar.

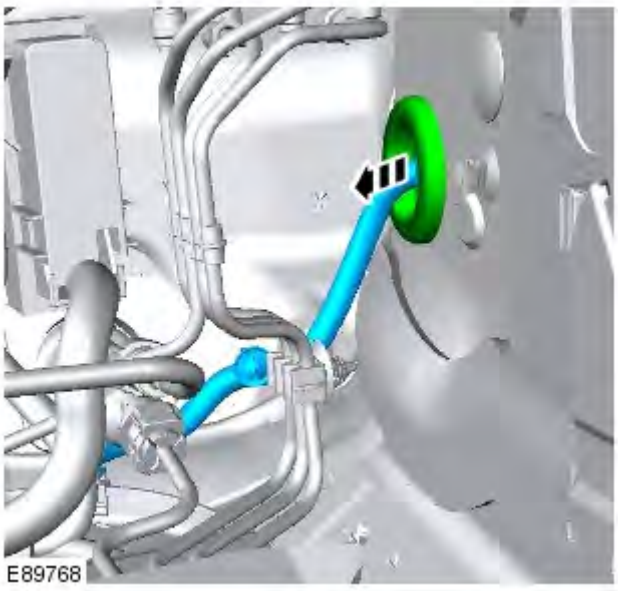
45.



46. **46.** NOTE: LHD illustration shown, RHD is similar.

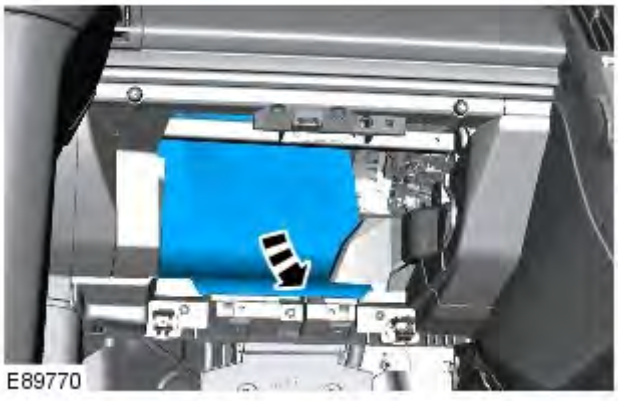


47. Release the LH side repeater from the vehicle body and disconnect the electrical connector.

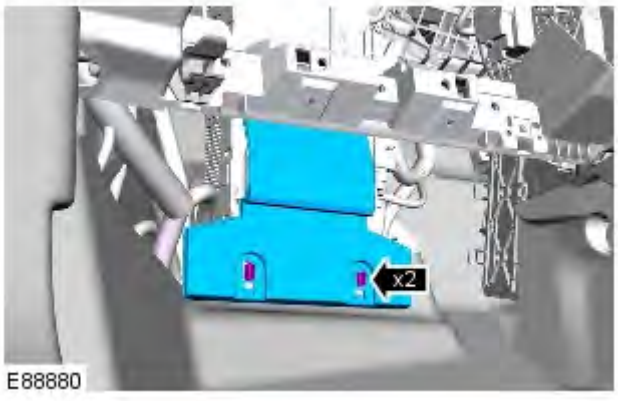


48. **48.** NOTE: LHD illustration shown, RHD is similar.

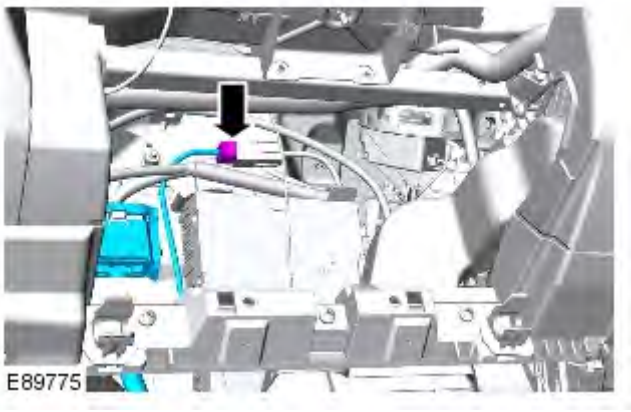
49. Unclip the harness tray from the vehicle bulkhead and route the RHS of the harness around the brake pipes into the LHS of the engine bay.



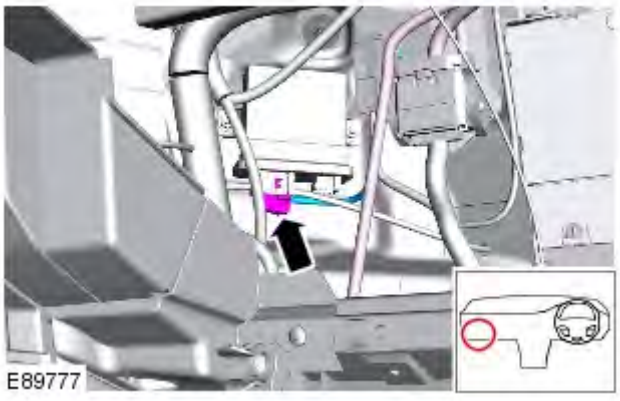
50. **50.** NOTE: RHD illustration shown, LHD is similar.



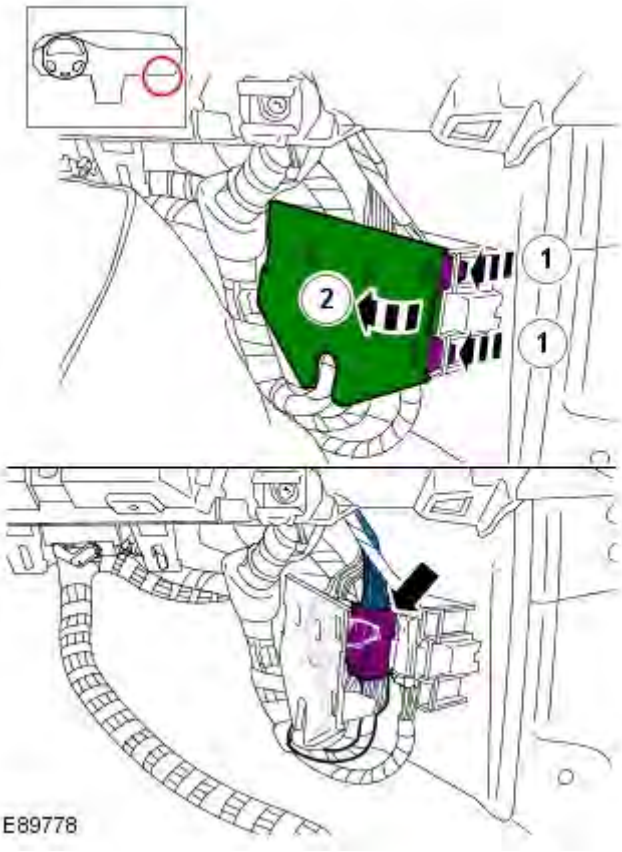
51. **51.** NOTE: RHD illustration shown, LHD is similar.



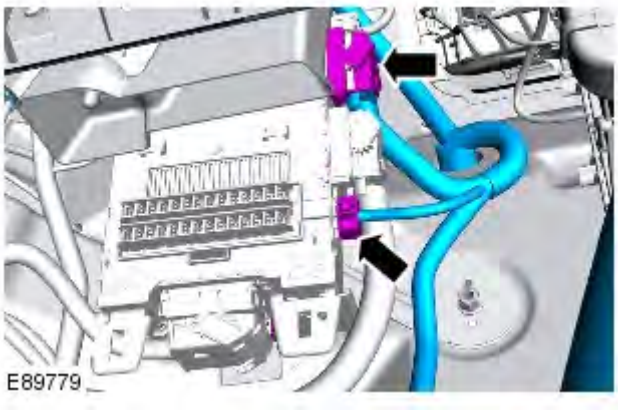
52. **52.** NOTE: RHD illustration shown, LHD is similar.



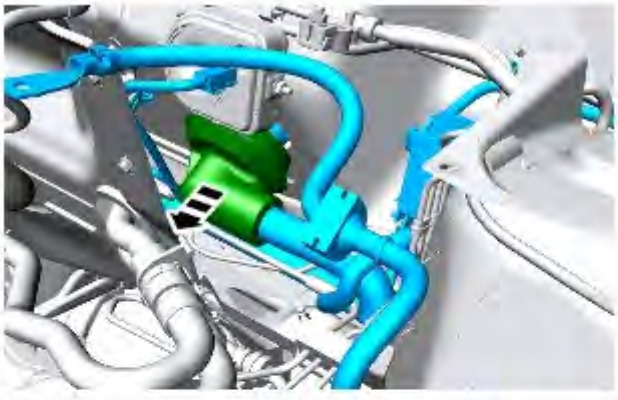
53. **53.** NOTE: LHD illustration shown, RHD is similar.



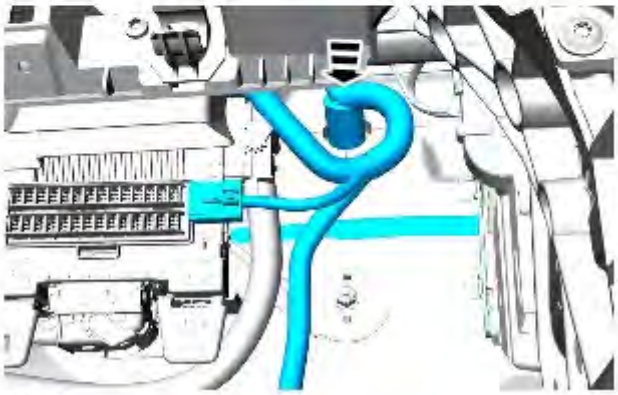
54. **54.** NOTE: LHD illustration shown, RHD is similar.



55. **55.** NOTE: RHD illustration shown, LHD is similar.



56. **56.** NOTE: RHD illustration shown, LHD is similar.



Installation

1. Place harness to vehicle plenum, feed connectors into inside of vehicle and install grommet. Use assistance inside vehicle to pull connectors through.

2. Secure harness tray clips and secure rubber grommet to vehicle body.

3. Install and secure fusebox to body.

   Torque: 10 Nm

4. Install the engine mounting plate.

   Torque:
   M8 24 Nm
   M12 80 Nm

5. Secure the engine harness to the fusebox.

6. Install and secure the battery lead to the fusebox and install the small battery lead cover.

   Torque: 10 Nm

7. Connect the two electrical connectors to the BJB.

8. Secure the 3 earth points and secure the harness clips to the vehicle body.

   Torque: 10 Nm

9. Secure the battery lead to the battery terminal clamp.

   Torque: 25 Nm

10. Install the fuse box cover.

11. Install the harness cover to the suspension turret.

12. Feed harness under the air cleaner duct and secure the duct to the grommet.

13. Secure headlamp and bumper harness clips.

14. Connect the height sensor electrical connector and secure the harness with the clips.

15. Install headlamp mounting plate.

    Torque: 10 Nm

16. Connect the side repeater electrical connector.

17. Connect the heated washer jet electrical connection and secure the harness to the vehicle body.

18. Connect the ABS sensor and secure the harness to the vehicle body.

19. Secure the washer pipe to the harness and secure the harness to the body.

20. Connect the crash sensor electrical connectors.

21. Connect the the bonnet lock electrical connector

22. Secure the harness to the body and then secure the bonnet release cable to the harness.

23. Secure the washer pipe to the washer bottle.

24. Install the washer bottle and connect the electrical connections.

    Torque: 10 Nm

25. Secure the 3 ground cables to the vehicle body.

    Torque: 10 Nm

26. Secure the harness to the vehicle body.

27. Connect the the bonnet lock electrical connector

28. Install the RH secondary bulkhead mounting bracket.

    Torque: 10 Nm

29. Install the inner plenum plate and secure the electrical connector to the plate.

30. Connect the heated screen RH electrical connector.

31. Install the auxiliary coolant pump and connect the feed hose.

    Torque: 10 Nm

32. Install the FFB heater coolant feed and return pipes.

33. Connect the FFB heater coolant feed and return hoses to the pipes.

34. Connect the A/C pressure switch and the BBUS electrical connectors. Also secure the harness to the vehicle body.

35. Secure the engine compartment harness to the vehicle bulkhead.

36. Secure the harness tray to the LHS of the vehicle bulkhead.

37. Connect the LH heated screen electrical connector and secure the harness to the vehicle body.

38. Feed the harness into the LH wheel arch and secure the grommet.

39. Install the ABS modulator bracket.

    Torque: 25 Nm

40. Install the LH side repeater lamp and secure the clips to the vehicle body.

41. Connect the rear washer pipe.

42. Connect the ABS sensor electrical connector and secure the harness to the vehicle body.

43. Connect the two electrical connectors to the CJB.

44. Connect the main engine compartment harness to the instrument panel harness and close the cover.

45. Connect the main engine compartment harness to the headlamp levelling ECU.

46. Connect the 3 floor harness electrical connections.

47. Install the fuse cover and refit the sound deadening sheet.

48. Install the LH fender splash shield.

    Torque: 6 Nm

49. Install the glove compartment lid.

    Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

50. Install the engine upper support insulator.

    Refer to: Engine Upper Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

51. Install both headlamps.

    Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

52. Install the fuel fired booster heater.

    Refer to: Fuel Fired Booster Heater (412-02B Auxiliary Climate Control, Removal and Installation).

53. Install the ABS module.

    Refer to: Anti-Lock Brake System (ABS) Module (206-09A Anti-Lock Control, Removal and Installation).

54. Install the brake booster.

    Refer to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation).

55. Install the secondary bulkhead center panel.

    Refer to: Secondary Bulkhead Center Panel - TD4 2.2L Diesel (501-02 Front End Body Panels, Removal and Installation).

56. Install the air cleaner housing.

    Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

57. Install the bumper armature.

    Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

Published: 11-May-2011

Module Communications Network - Battery Junction Box (BJB)I6 3.2L Petrol

Removal and Installation

Removal

1. Remove the bumper armature.

   Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

2. Remove the air cleaner housing.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

3. Remove the secondary bulkhead center panel.

   Refer to: Secondary Bulkhead Center Panel - I6 3.2L Petrol (501-02 Front End Body Panels, Removal and Installation).

4. Remove the brake booster.

   Refer to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation).

5. Remove the ABS module.

   Refer to: Anti-Lock Brake System (ABS) Module (206-09A Anti-Lock Control, Removal and Installation).

6. Remove both headlamps.

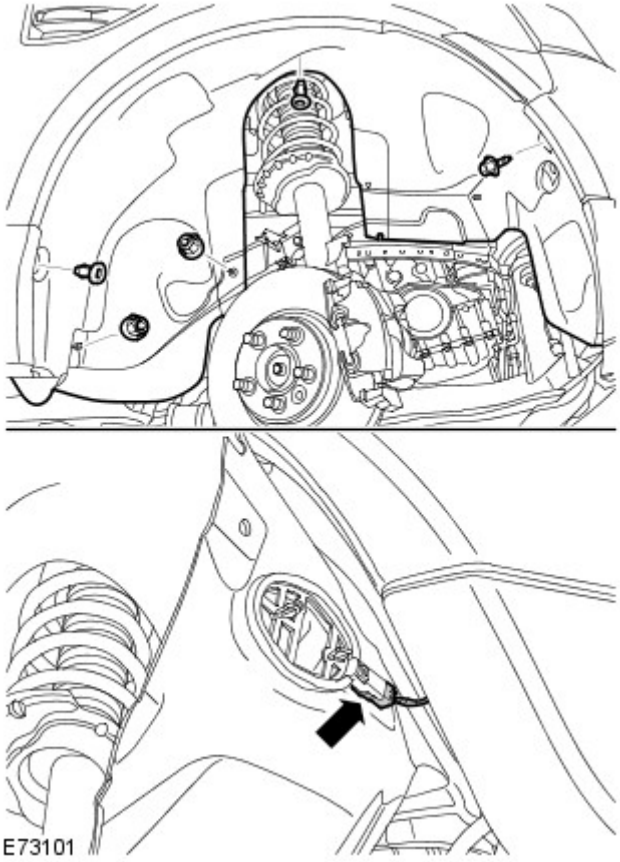
   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

7. Remove the engine upper support insulator.

   Refer to: Engine Upper Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

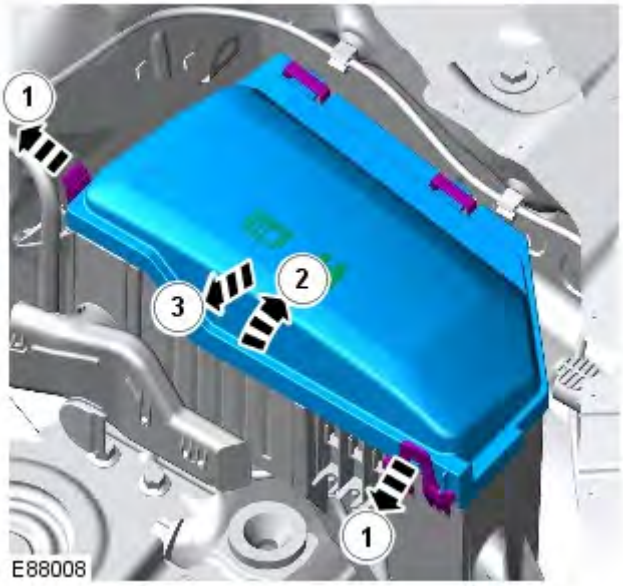
8. Remove the glove compartment lid.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).



9. **9.** NOTE: RHD illustration shown, LHD is similar.

   Remove both front fender splash shields.



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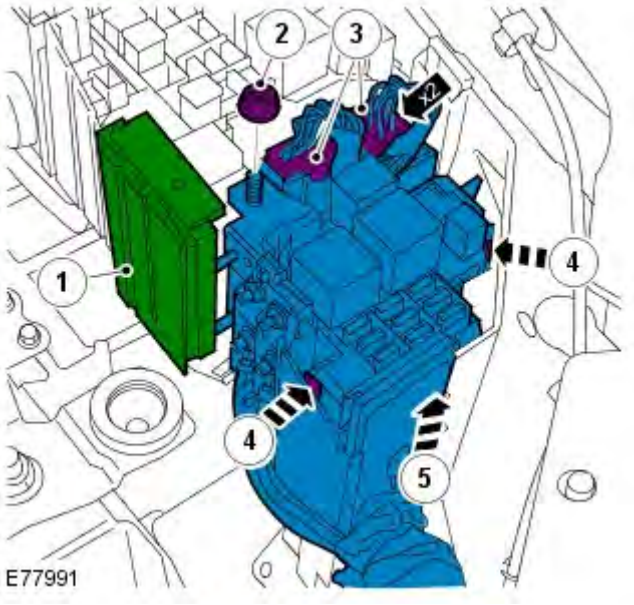

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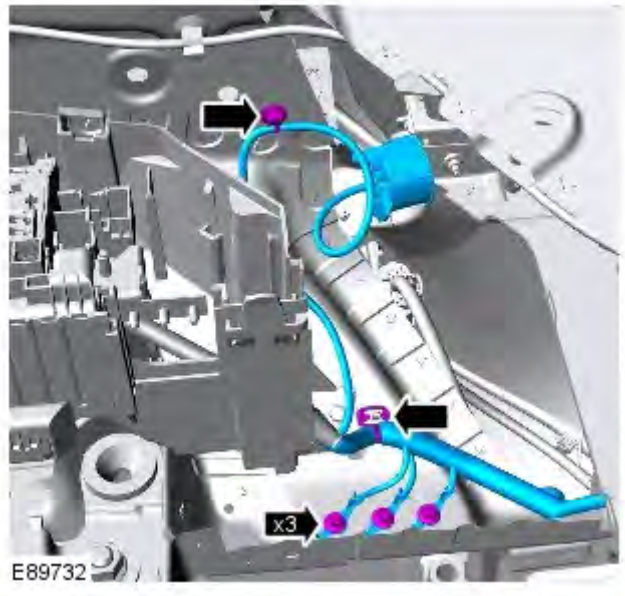

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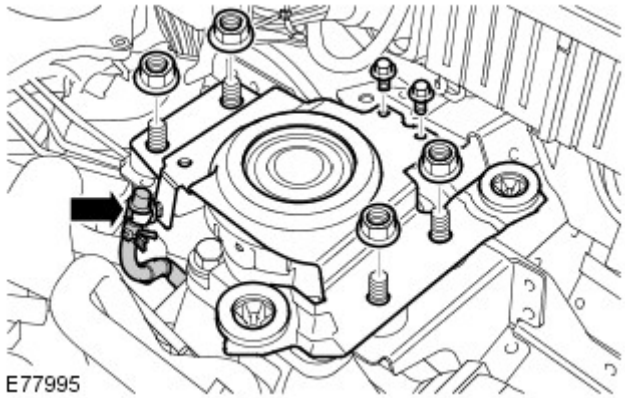

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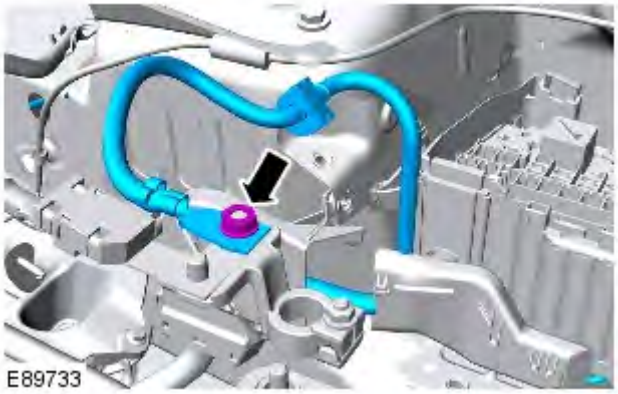

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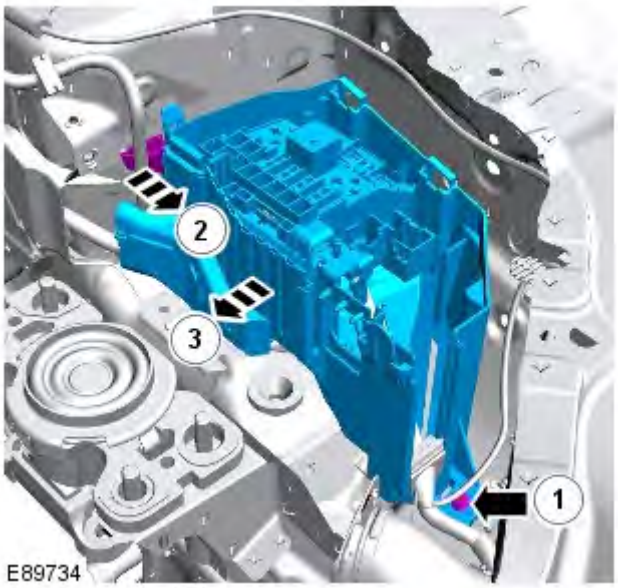

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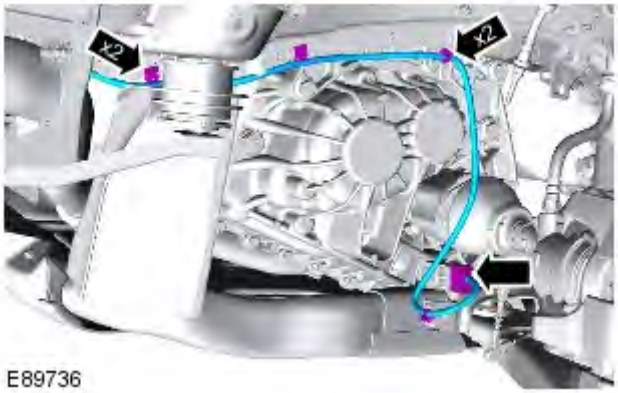

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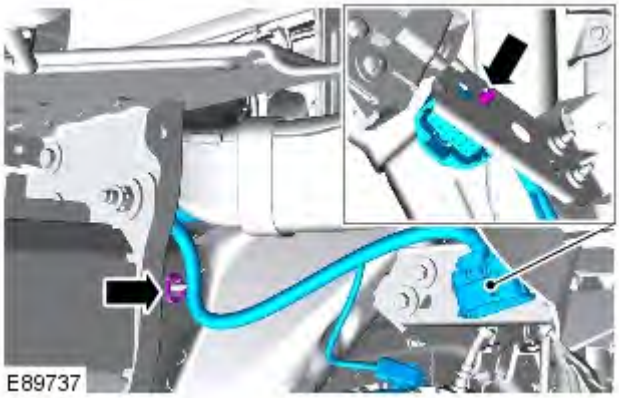
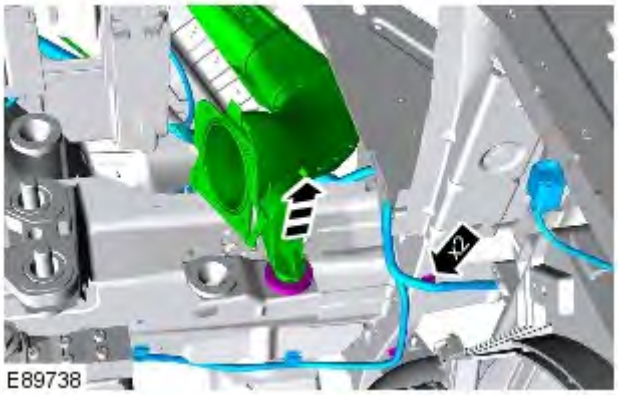
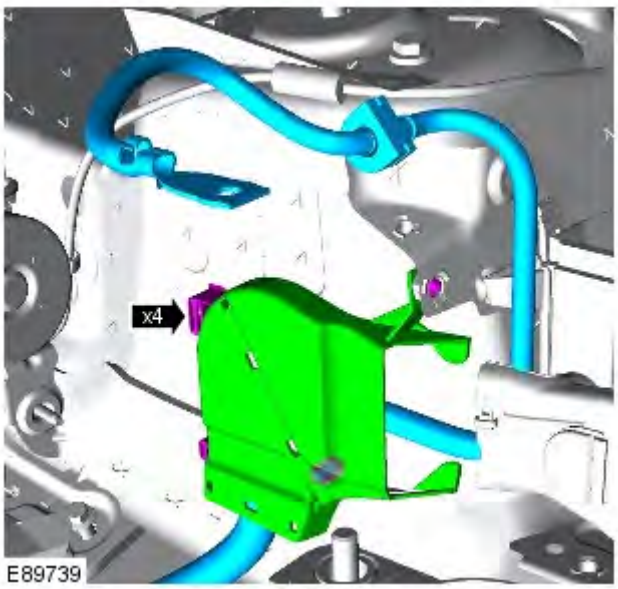
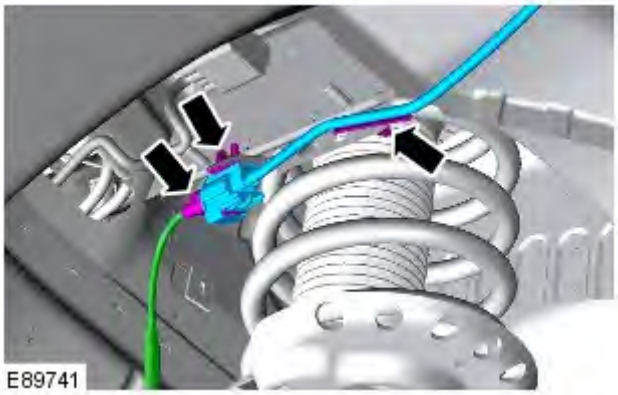


19. Release the harness and withdraw into engine bay area.





20. Release the harness cover and withdraw harness into engine bay area.



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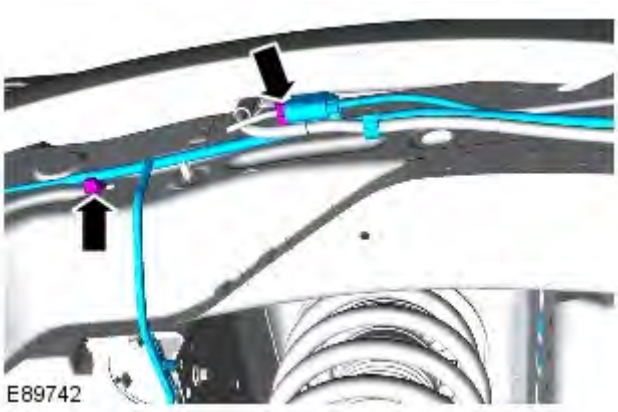

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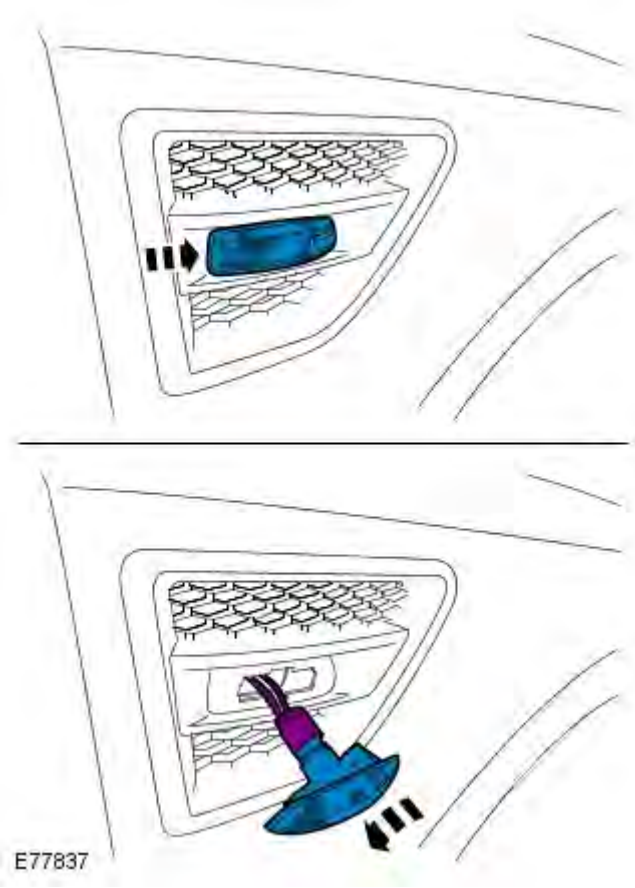

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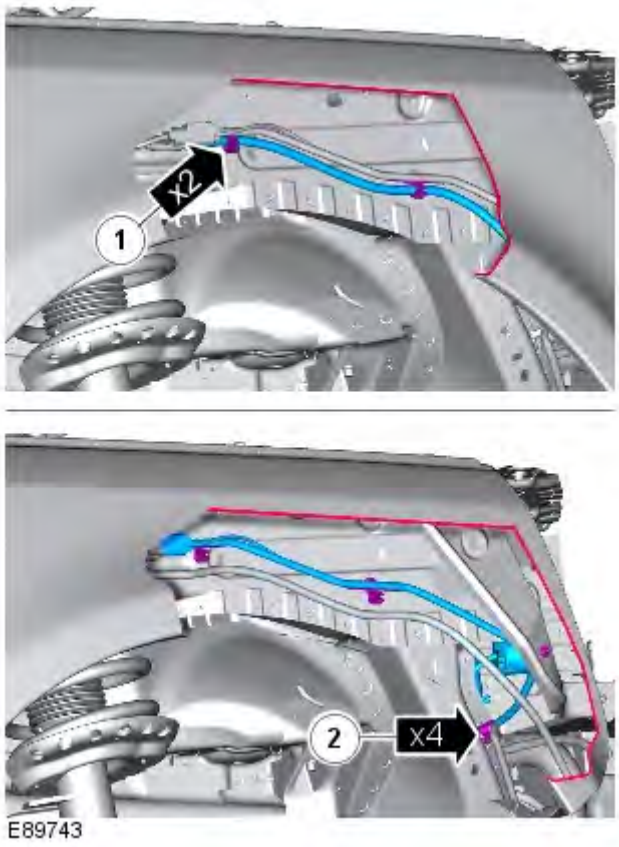
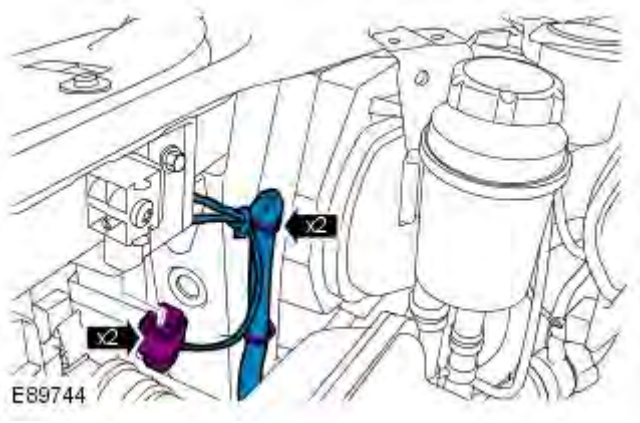
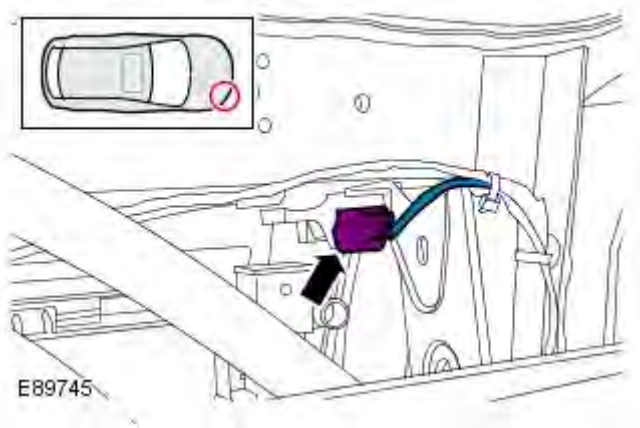




25. Repeat for both sides.



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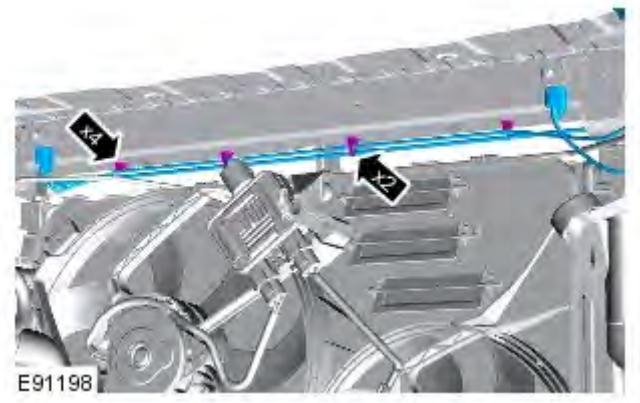

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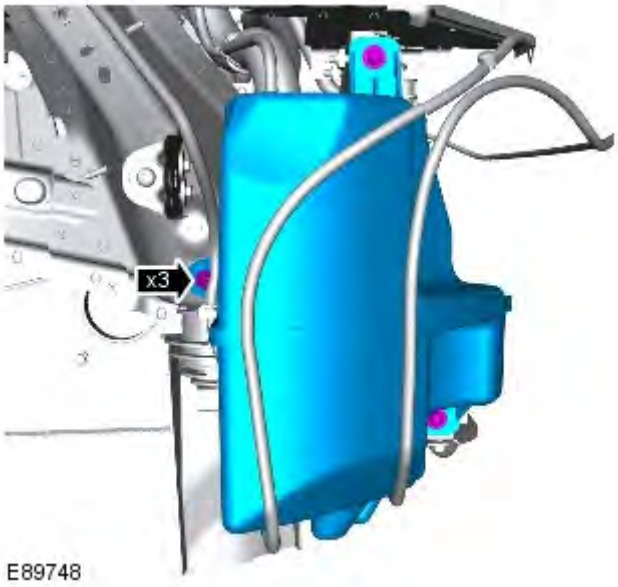

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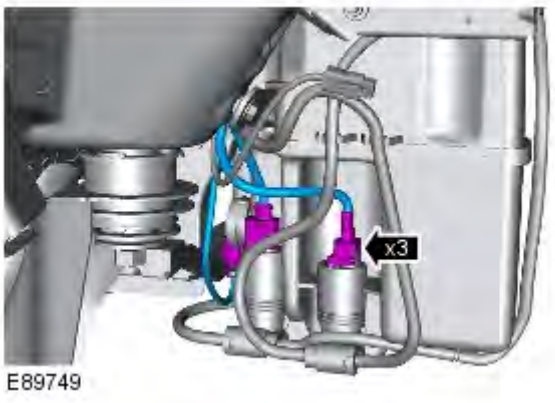

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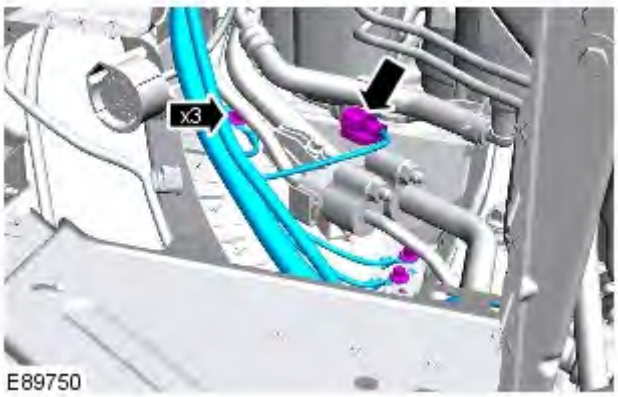
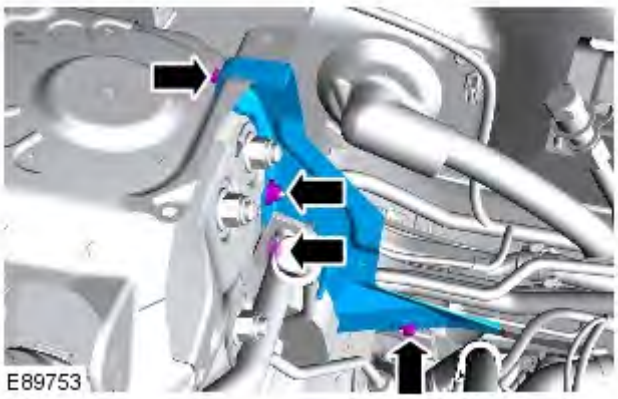
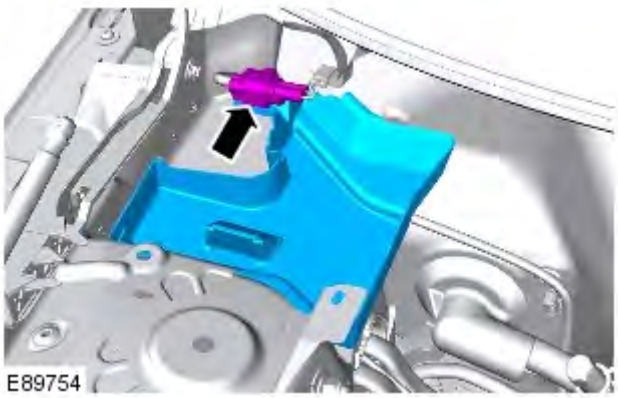


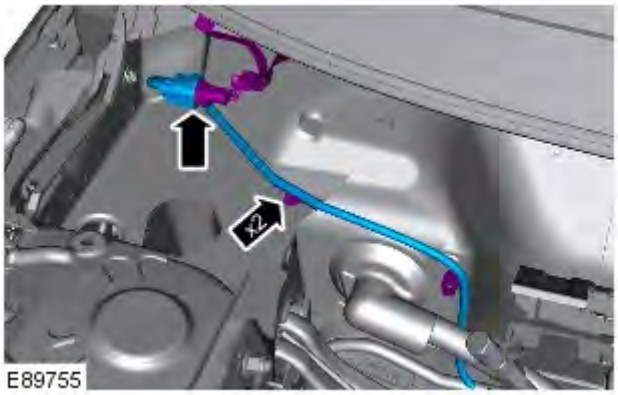
32.

33.



34. Unclip the windscreen heater electrical connector from the plenum side extension panel and remove the panel.





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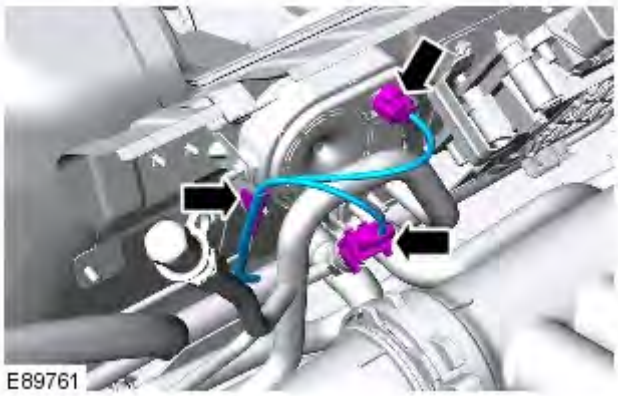
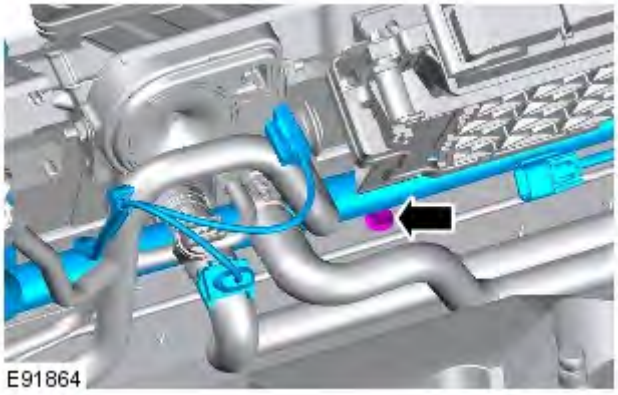
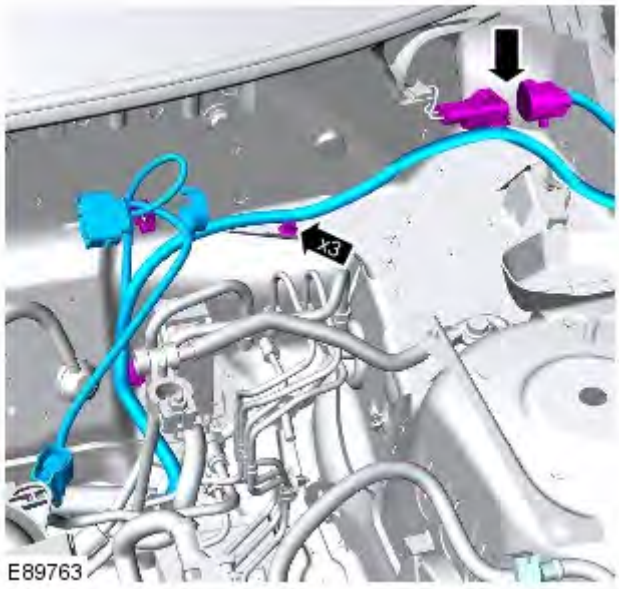


36. **36.** NOTE: LHD illustration shown, RHD is similar.



37. Release the engine compartment harness from clip securing it to the vehicle bulkhead.

38. **38.** NOTE: RHD illustration shown, LHD is similar.



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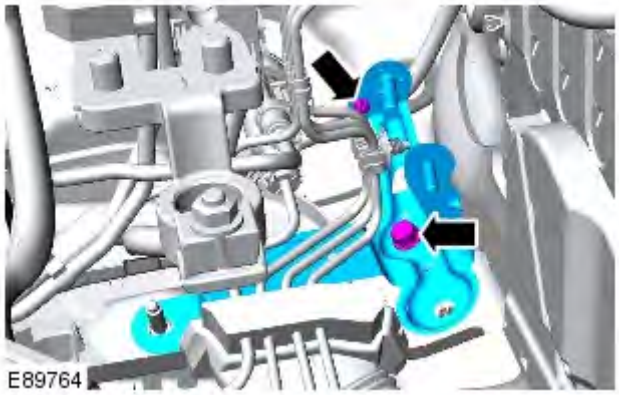

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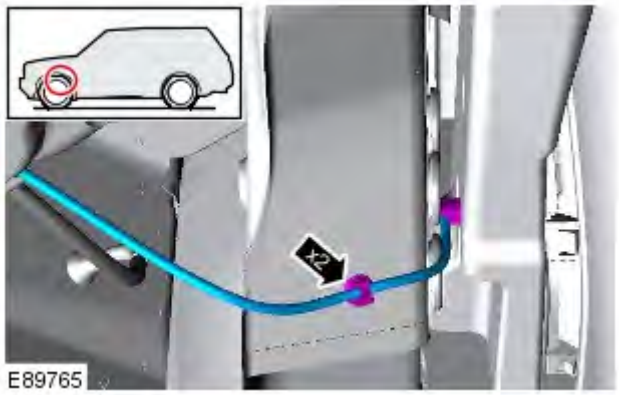
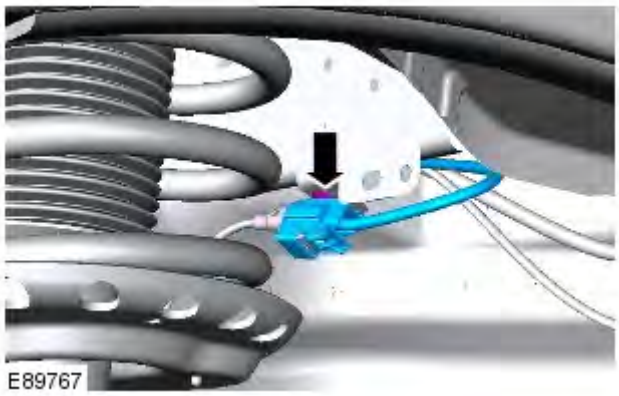
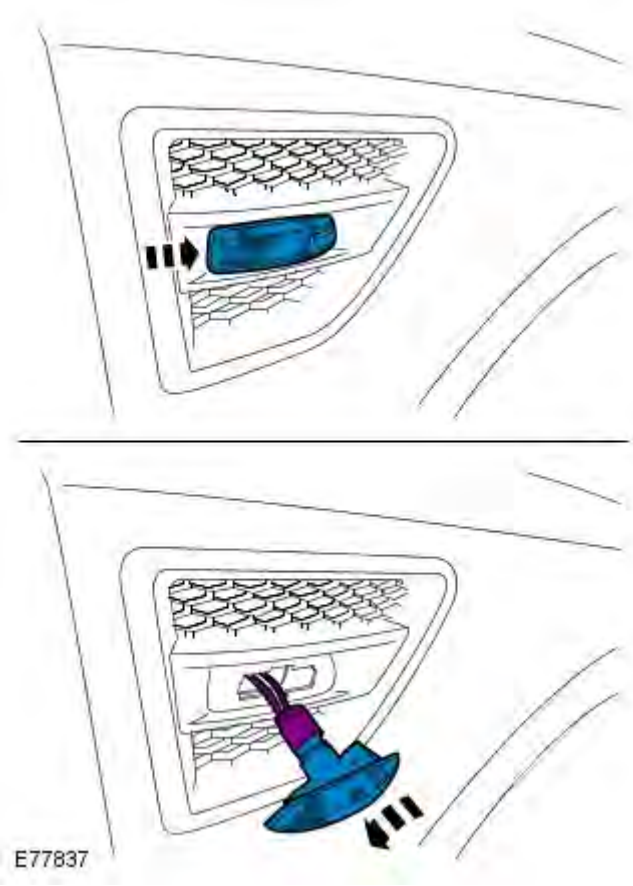


41. **41.** NOTE: RHD illustration shown, LHD is similar.



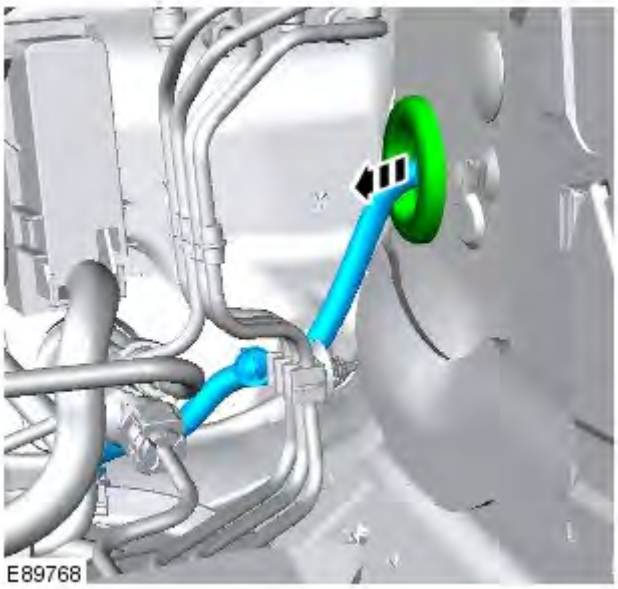
42. **42.** NOTE: RHD illustration shown, LHD is similar.

RH side front: Release the ABS sensor lead and disconnect the electrical connector.

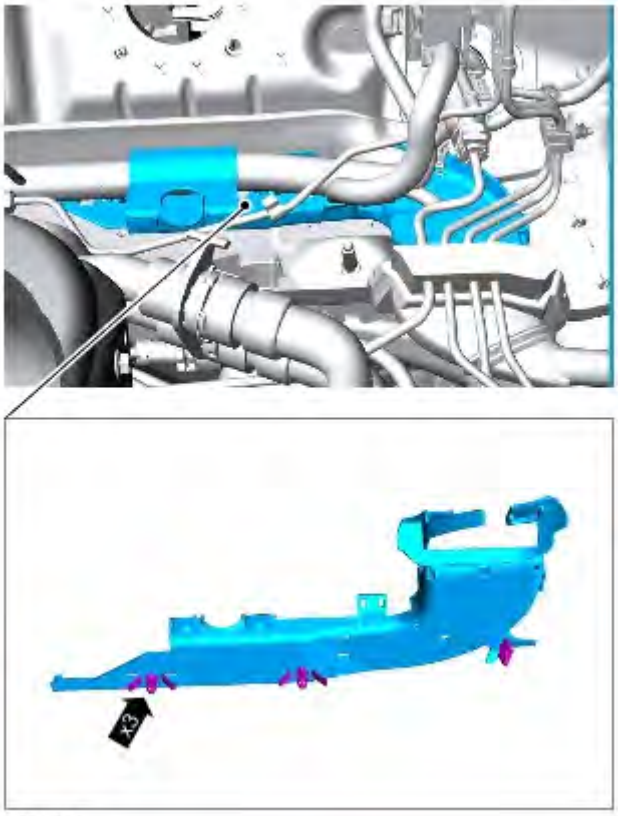


43. **43.** NOTE: RH illustration shown, LH is similar

Release the LH side repeater from the vehicle body and disconnect the electrical connector.

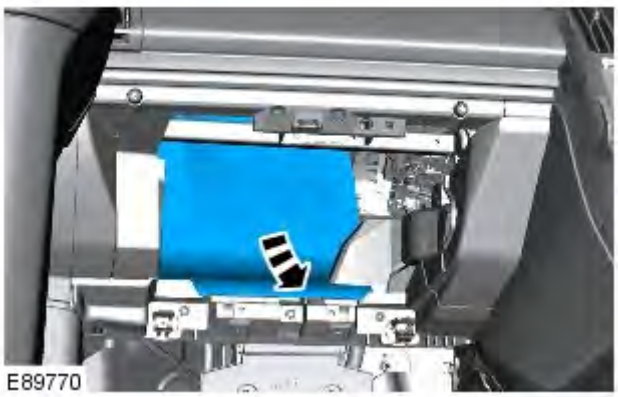


44. **44.** NOTE: RHD illustration shown, LHD is similar.

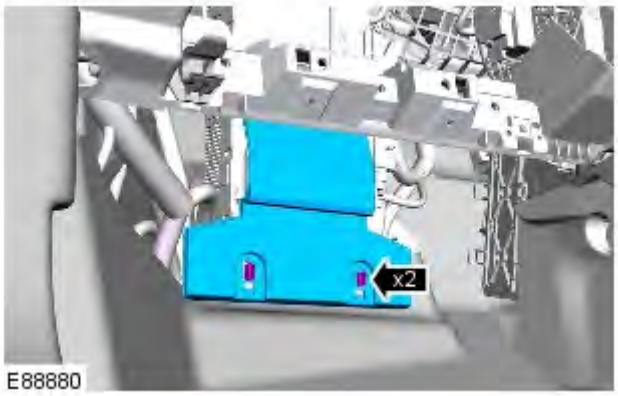


45. **45.** NOTE: RHD illustration shown, LHD is similar.

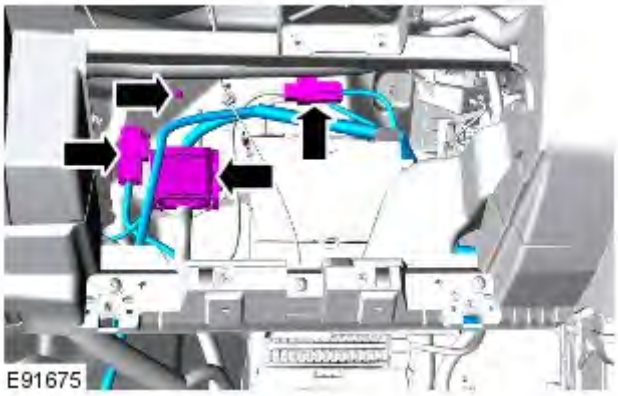
Unclip the harness tray from the vehicle bulkhead and route the RHS of the harness around the brake pipes into the LHS of the engine bay.



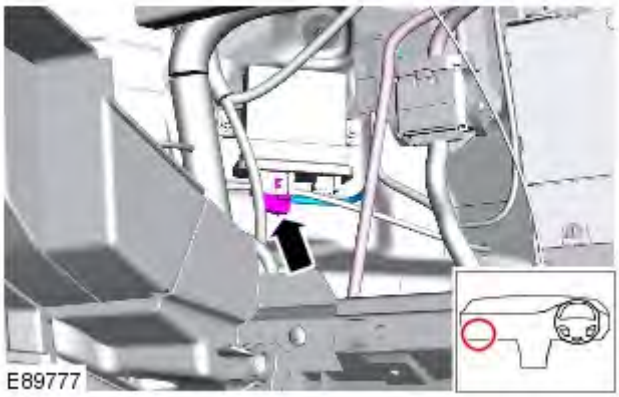
46. **46.** NOTE: RHD illustration shown, LHD is similar.



47. **47.** NOTE: RHD illustration shown, LHD is similar.

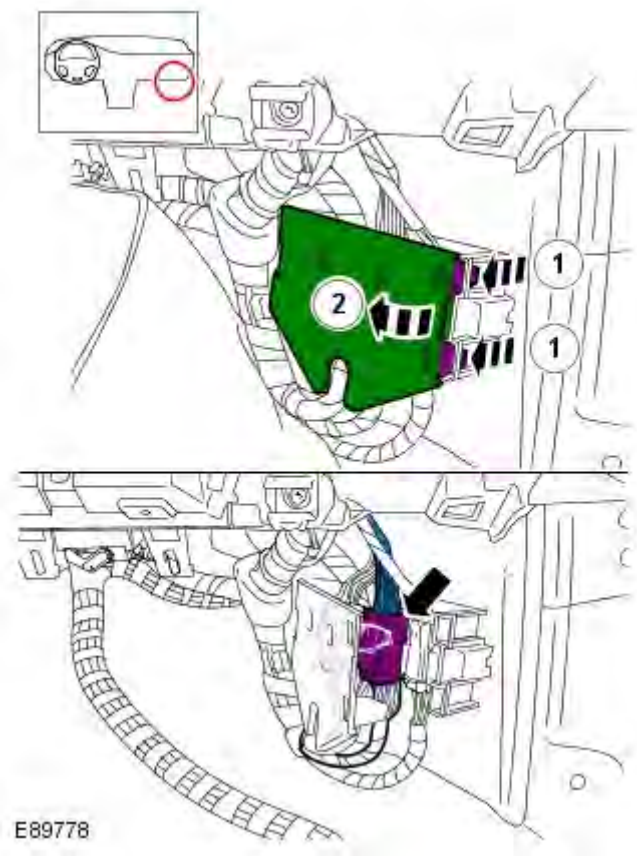


48. **48.** NOTE: RHD illustration shown, LHD is similar.

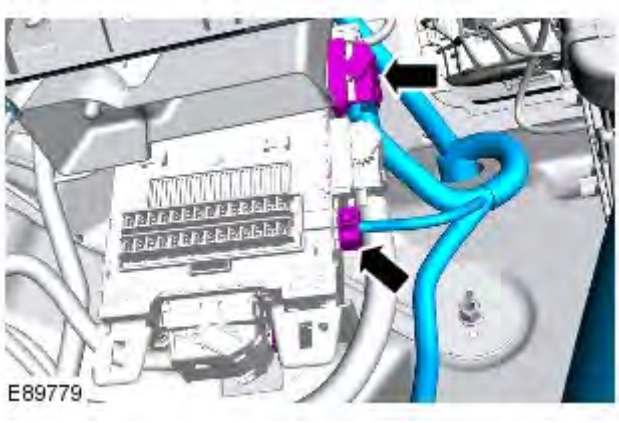


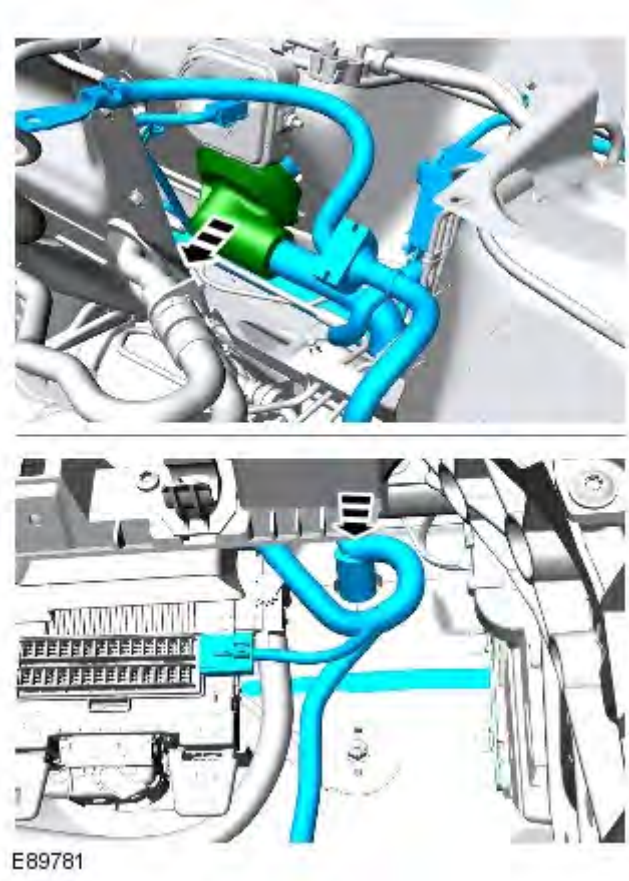
49. **49.** NOTE: RHD illustration shown, LHD is similar.

50. **50.** NOTE: LHD illustration shown, RHD is similar.



51. **51.** NOTE: RHD illustration shown, LHD is similar.





52. **52.** NOTE: RHD illustration shown, LHD is similar.

    With assistance, release the harness.

53. **53.** NOTE: With assistance remove the component.

    Remove the engine compartment harness.

Installation

1. Place harness to vehicle plenum, feed connectors into inside of vehicle and install grommet. Use assistance inside vehicle to pull connectors through.

2. Secure harness tray clips and secure rubber grommet to vehicle body.

3. Install and secure fusebox to body.

   Torque: 10 Nm

4. Install the engine mounting plate.

   Torque:
   M8 24 Nm
   M12 80 Nm

5. Secure the engine harness to the fusebox.

6. Connect the two electrical connectors to the BJB.

7. Install and secure the battery lead to the fusebox and install the small battery lead cover.

   Torque: 10 Nm

8. Secure the 3 earth points and secure the harness clips to the vehicle body.

   Torque: 10 Nm

9. Secure the battery lead to the battery terminal clamp.

   Torque: 25 Nm

10. Install the fuse box cover.

11. Install the harness cover to the suspension turret.

12. Feed harness under the air cleaner duct and secure the duct to the grommet.

13. Secure headlamp and bumper harness clips.

14. Connect the height sensor electrical connector and secure the harness with the clips.

15. Install headlamp mounting plate.

    Torque: 10 Nm

16. Connect the side repeater electrical connector.

17. Connect the heated washer jet electrical connection and secure the harness to the vehicle body.

18. Connect the ABS sensor and secure the harness to the vehicle body.

19. Secure the washer pipe to the harness and secure the harness to the body.

20. Connect the crash sensor electrical connectors.

21. Connect the the bonnet lock electrical connector

22. Secure the harness to the body and then secure the bonnet release cable to the harness.

23. Secure the washer pipe to the washer bottle.

24. Install the washer bottle and connect the electrical connections.

    Torque: 10 Nm

25. Secure the 3 ground cables to the vehicle body.

    Torque: 10 Nm

26. Secure the harness to the vehicle body.

27. Connect the coolant level sensor electrical connector.

28. Install the RH secondary bulkhead mounting bracket.

    Torque: 10 Nm

29. Install the inner plenum plate and secure the electrical connector to the plate.

30. Connect the heated screen RH electrical connector.

31. Connect the BBUS electrical connector.

32. Connect the A/C pressure switch electrical connector.

33. Secure the engine compartment harness to the vehicle bulkhead.

34. Secure the harness tray to the LHS of the vehicle bulkhead.

35. Connect the LH heated screen electrical connector and secure the harness to the vehicle body.

36. Feed the harness into the LH wheel arch and secure the grommet.

37. Install the ABS modulator bracket.

    Torque: 25 Nm

38. Install the LH side repeater lamp and secure the clips to the vehicle body.

39. Connect the rear washer pipe.

40. Connect the ABS sensor electrical connector and secure the harness to the vehicle body.

41. Connect the two electrical connectors to the CJB.

42. Connect the main engine compartment harness to the instrument panel harness and close the cover.

43. Connect the main engine compartment harness to the headlamp levelling ECU.

44. Connect the 3 floor harness electrical connections.

45. Install the fuse cover and refit the sound deadening sheet.

46. Install the LH fender splash shield.

    Torque: 6 Nm

47. Install the glove compartment lid.

    Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

48. Install the engine upper support insulator.

Refer to: Engine Upper Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

49. Install both headlamps.

    Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

50. Install the ABS module.

    Refer to: Anti-Lock Brake System (ABS) Module (206-09A Anti-Lock Control, Removal and Installation).

51. Install the brake booster.

    Refer to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation).

52. Install the secondary bulkhead center panel.

    Refer to: Secondary Bulkhead Center Panel - I6 3.2L Petrol (501-02 Front End Body Panels, Removal and Installation).

53. Install the air cleaner housing.

    Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).

54. Install the bumper armature.

    Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

Published: 11-May-2011

Wiring Harnesses -

Torque Specifications

Description	Nm	lb-ft
Cylinder head ground	6	5
Ground cables	10	7
Wiring harness support bracket bolts	10	7

Published: 11-May-2011

Wiring Harnesses - Wiring Harness

Description and Operation

Introduction

CAUTION: Do **not** use any other heat shrink sleeve other than the approved glue lined heat shrink sleeve mentioned in the repair procedure.

The purpose of this document is to promote quick and efficient minor repair to harness connectors or cables using approved methods and the wiring harness repair kit. Repairs may only be made to cables and connectors which have been mechanically, **not electrically** damaged. It also applies where the whole extent of the damage can be clearly identified and rectified.

Care and neatness are essential requirements in making a perfect repair.

Caution:

At the time of this first issue of the Harness Repair Guide, do not approve repairs to any of the following circuits:

- Any media orientated system transport network harnesses.
- Supplement restraint system (SRS) firing circuits (Air bags).
- Link lead assembles, which are unique to safety critical circuits such as anti-lock brake system (ABS) and thermocouple circuits. An example of this is the ABS wheel speed sensors with moulded connectors.
- 4. Screened cables, leads and wiring harness(s).

If any harness(s) with defective electrical connector terminals or wires from the above circuits are a concern, new components must be installed.

Repair Kit

CAUTION: Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

The wiring harness repair kit has been produced which comprises:

- Pre-terminated wiring harness(s) of different sizes and types
- Three sizes of butt splice connectors
- A selection of colored cable identification sleeves
- Two sizes of glue lined heat shrink sleeves
- Crimping pliers
- A wire cutter and insulation stripper
- An electrical connector terminal extraction handle and tips

A suitable heat source, for shrinking heat shrink sleeves will be required.

The pre-insulated diamond grip range of electrical connector terminals and in-line, butt splice connectors contained within the wiring harness repair kit are the **only** acceptable product for the repairs of wiring harnesses. The butt connectors not only grip the wire but also the insulation, making a very secure joint.

If an electrical connector terminal is not included in the wiring harness repair kit then approval for the repair is **NOT** given and in these circumstances a new wiring harness must be installed.

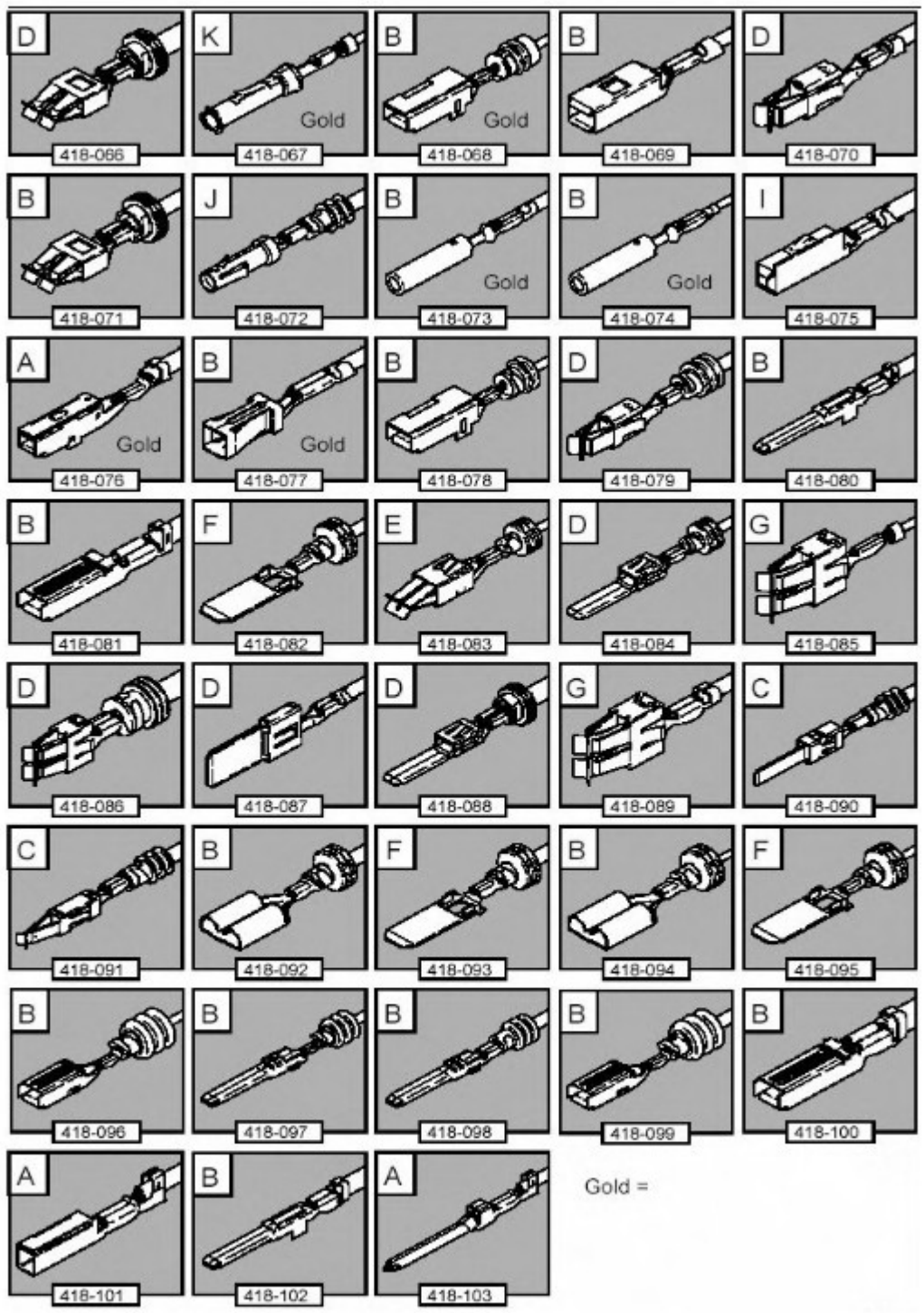
Pre-Terminated Wiring Harness(s) and Butt Splice Connectors

All pre-terminated wiring harness(s) and butt splice connectors in the wiring harness repair kit are contained in bags which can be resealed after use. Each bag is marked with the part number of the items stored within the bag. Each storage compartment in the wiring harness repair kit is identified with the corresponding part number. Make sure that pre-terminated wiring harness(s) and connectors are not mixed up it is advisable to only open one bag at a time and to reseal the bag securely before opening another bag. Also, replace the bag in its mating part number compartment within the case.

The pre-terminated wiring harness(s) are supplied with the insulation in one of three colors, red, blue or yellow. The colors do not apply to any particular circuit but to the harness wire size. See the Relationship Table in the Repair Method section.

Butt splice connectors are also supplied with red, blue or yellow coverings, which must be matched to the pre-terminated wiring harness insulation color.

Pre-Terminated Wiring Harness(s)



E130741

The illustration shows:

- The pre-terminated wiring harness(s) which are included in the wiring harness repair kit
- The part number of the pre-terminated wiring harness
- The letter showing the extractor tip which must be used to remove this type of electrical connector terminal
- Those electrical connector terminals which are gold

Some of the pre-terminated wiring harness(s) have seals installed to the insulation for sealed connector applications. It is essential for prevention of moisture ingress that a sealed pre-terminated wiring harness must be used where a sealed terminal was removed.

CAUTION: Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the

glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

Two sizes of heat shrink sleeving are supplied in the wiring harness repair kit. Each heat shrink sleeve contains a sealant glue. These must be used when connecting wiring harness(s) or electrical connector terminal(s) at all times. The smaller diameter heat shrink sleeve is to be used with the red and blue butt splice connectors and the larger diameter sleeve with the yellow butt splice connectors.

For ease and speed, some of the pre-terminated wiring harness(s) may already have the insulation partly stripped at the splice end. If the repair requires insulation to be stripped from the cable, refer to the Relationship Table for the correct length of insulation to be stripped.

The Pre-Terminated Wiring Harness(s) illustration shows the electrical connector terminal type, the part number of the pre-terminated wiring harness and the letter of the extractor tip which must be used to extract the electrical connector terminal from the connector housing. Additionally, those electrical connector terminal(s) which are gold are identified, all others are therefore, tinned and not gold.

Wiring Harness Cable Identification Sleeves

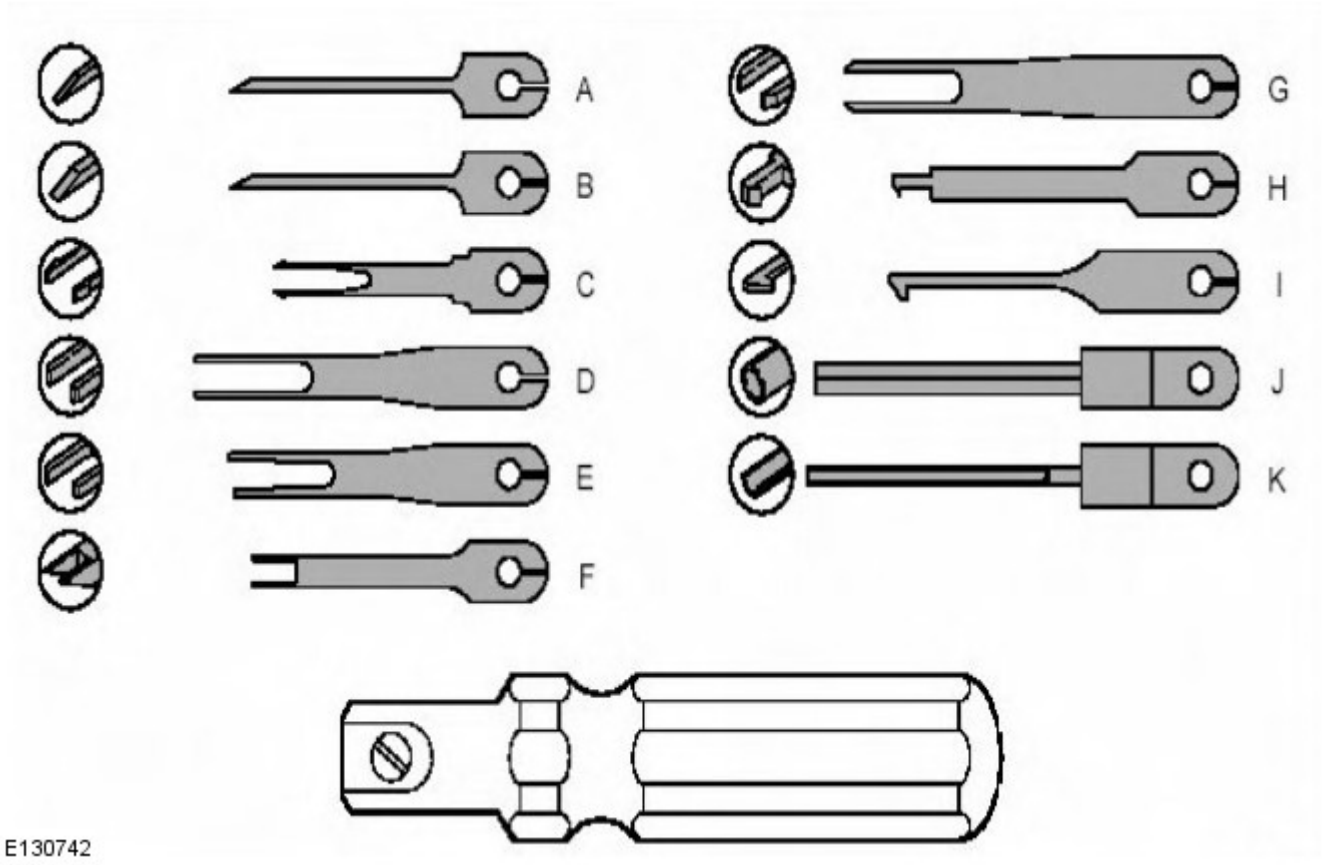
A selection of colored sleeves are contained in the wiring harness repair kit for maintaining the wiring harness cable identification on the pre-terminated wiring harness. Place the correct colored sleeve(s) over the pre-terminated wiring harness insulation as near to the electrical connector as possible with the main wiring harness cable color nearest to the electrical connector.

For example, if the original wiring harness cable color is pink with a black trace put the pink wiring harness cable identification sleeve on the pre-terminated wiring harness first followed by a black sleeve, and slide both along the wiring harness cable to the electrical connector terminal.

Extraction Handle and Tips

The extraction handle, in conjunction with the correct tip, is used to remove a terminal from an electrical connector. Each tip contained in the wiring harness repair kit is marked with an identification letter, A to K inclusive. Each tip has been specially designed to extract a particular type of electrical connector terminal. The use of any other tool is **not** recommended and is liable to cause damage to the electrical connector. The tip is fastened to the handle by a screw which holds the tip firmly yet allows it to be easily replaced.

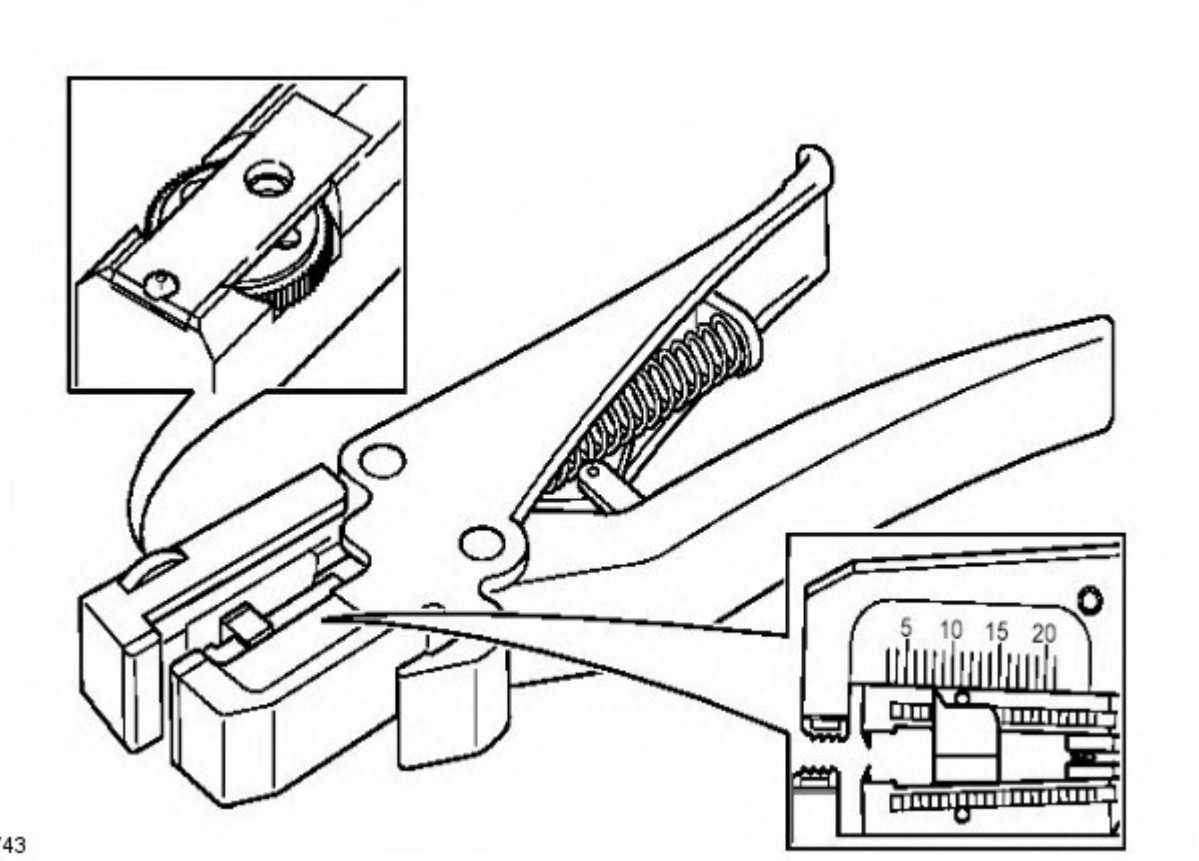
Extraction Handle and Tips



Insulation Stripper

The moving jaw has an adjuster wheel which has a series of holes in it. Turning the wheel and placing the cable in the matching size hole will automatically adjust the jaw to the correct pressure. Note that some wiring harness(s) may have a harder insulation and slight adjustment of the wheel may be needed to make a clean strip but exercise care not to damage the wire.

Insulation Stripper

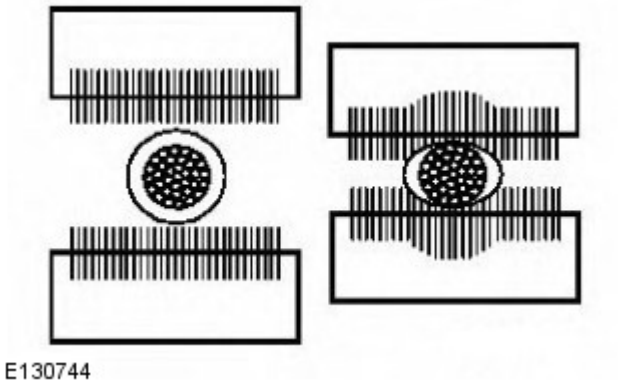


E130743

By pressing the outer edges of the wiring harness cable length stop together the adjuster can be slid up or down the jaw. This decreases or increases the length by which the wiring harness cable insulation will be stripped from the pre-terminated wiring harness or wiring harness wire. The adjuster has a position indicator to align with a graduated scale and this sets the correct length in millimetres, of insulation to be stripped. The amount of insulation to be stripped is shown in the Relationship Table.

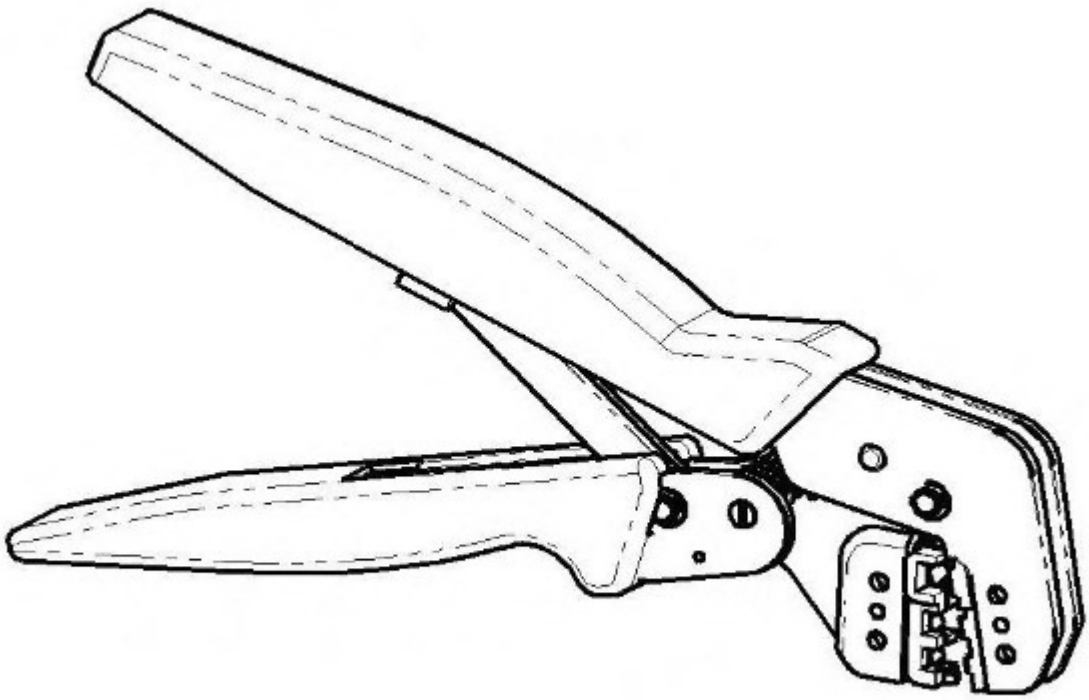
The illustration shows the insulation stripper tool and a wiring harness correctly gripped in the jaws. A wire cutter is provided on the outer side of the fixed jaw.

Cable Correctly Gripped in Stripper Blades


E130744

Crimping Pliers

Crimping Pliers



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The crimping pliers have a moving jaw and a stationary jaw, with three different sized crimping enclosures. Each of the enclosures is identified by a red, blue or yellow coloured dot which corresponds to the three colours of the pre-terminated wiring harness(s) and butt splice connector colors.

List of Parts

Description	Part Number	Quantity
Wiring Harness Repair Kit	418-S065	1
Pre-Terminated Wiring Harness(s)	418-066 to 418-103 inclusive	10 each
Glue Lined Heat Shrink Pack – small diameter	418-104	25 per pack
Glue Lined Heat Shrink Pack – larger diameter	418-105	10 per pack
Case Assembly Comprising – carry case, lid, inner lid, base, insert, trays foam spacers	418-106	1
Butt Splice Connector – Red	418-107	50 per pack
Butt Splice Connector – Blue	418-108	50 per pack
Butt Splice Connector – Yellow	418-109	20 per pack
Extraction Tool Handle	418-110	1
Extraction Tip Pack consists of 2 spare screws plus	418-S111	1
Tip A	418-118	1
Tip B	418-119	1
Tip C	418-120	1
Tip D	418-121	1
Tip E	418-122	1
Tip F	418-123	1
Tip G	418-124	1
Tip H	418-125	1
Tip I	418-126	1
Tip J	418-127	1
Tip K	418-128	1
Sleeve Identification Pack – for Red insulation	418-112	500
Sleeve Identification Pack – for Blue insulation	418-113	500
Sleeve Identification Pack – for Yellow insulation	418-114	500
Instruction Manual	JTP 593	1
Crimping Pliers	YRW500010	1
Wire Stripping Tool	418-117	1

Items can be ordered from:

SPX United Kingdom Limited

Ironstone Way

Brixworth

Northants

NN6 9UD

United Kingdom

Telephone: +44 (0) 1327 704461

Fax: +44 (0) 1327 706632

Repair Methods

CAUTION: **Several different types and sizes of terminal may be found in a single electrical connector housing.**

It is necessary to identify:

- The conductor (wire) size of the affected wiring harness
- The electrical connector range from which the damaged wiring harness is to be removed
- The terminal type

Use of the approved diagnostic tool will greatly assist in the quick identification of electrical connectors and faulty pin terminal(s).

Reference can also be made to the vehicle Electrical Guides, held by Dealers, to identify wiring harness(s) and electrical connector(s).

By using the Relationship Table, the wiring harness conductor (wire) size can be related to a suitable pre-terminated wiring harness by the color of the insulation. Also, the correct length of insulation to be stripped from the wiring harness lead is identified.

Relationship Table

CABLE RANGE	SPLICE	STRIP LENGTH
0.35 mm² to 1.50 mm²	RED	6.00 to 7.00 mm
1.00 mm² to 2.50 mm²	BLUE	6.00 to 7.00 mm
4.00 mm² to 6.00 mm²	YELLOW	9.00 to 9.50 mm

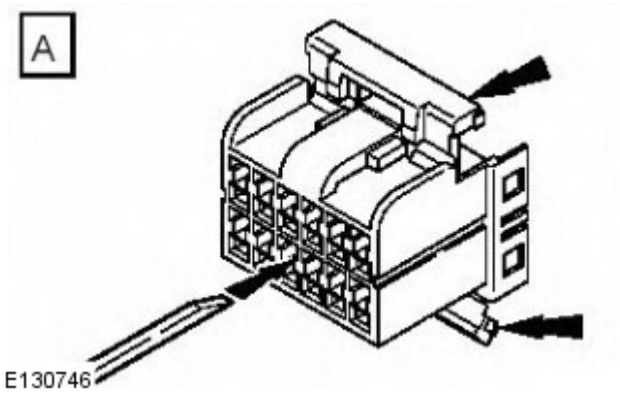
Electrical Connector Terminal Extraction

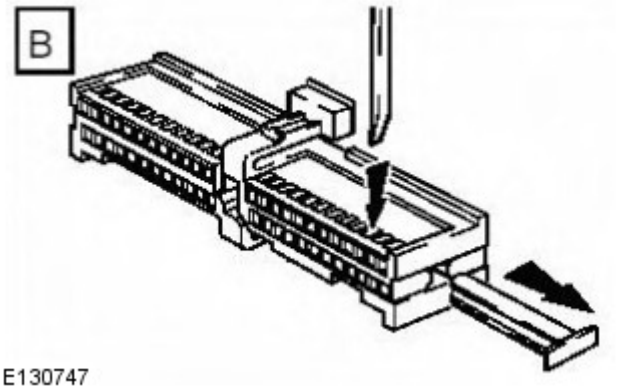
It must be noted that some electrical connector(s) have anti-backout devices which prevent the terminals from being removed from the electrical connector. Some examples of these are shown in following illustrations. The anti-backout device must be released before attempting to remove the terminal from the electrical connector. Some anti-backout devices require a special tip to release the device and these have been included in the kit. Most can be released by carefully using a suitable small screwdriver.

Various types of electrical connector have seals installed internally or externally to prevent moisture ingress. These normally do not have to be removed but make sure that they are installed when the electrical connectors are connected.

The illustrations show examples of each tip used on different types of electrical connector(s). There are a large number of different types of electrical connector used on vehicles therefore only one example using each tip is shown. Technicians experience and judgement will dictate which type of tip should be used for those electrical connector(s) which are not shown. Care should be exercised to avoid further damage when removing the terminals from the electrical connector.

• NOTE: **Examples of the extraction tips and anti-backout tips.**





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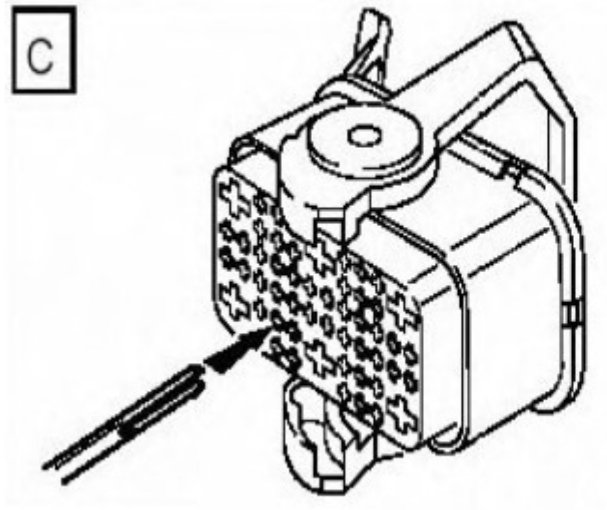

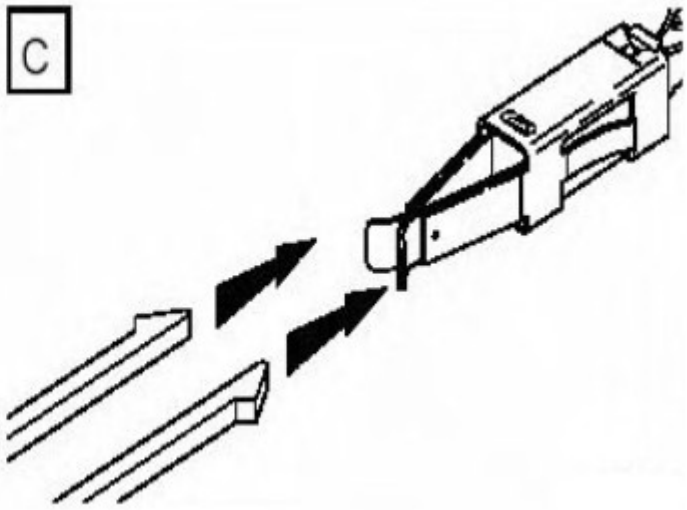

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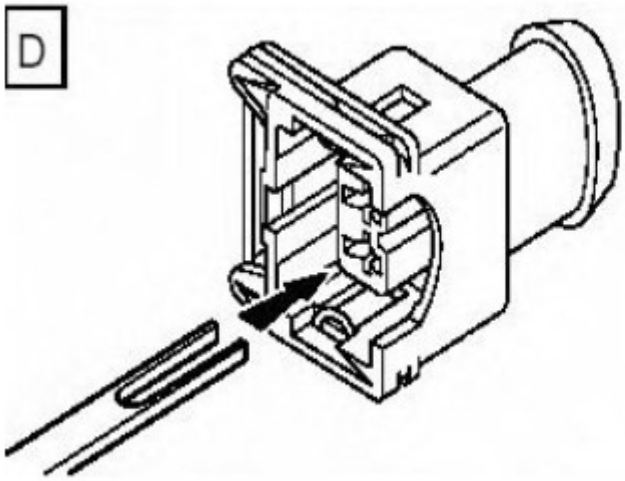

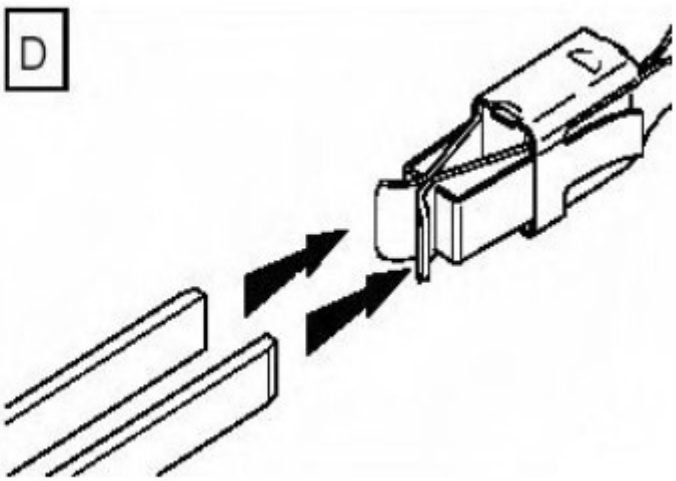

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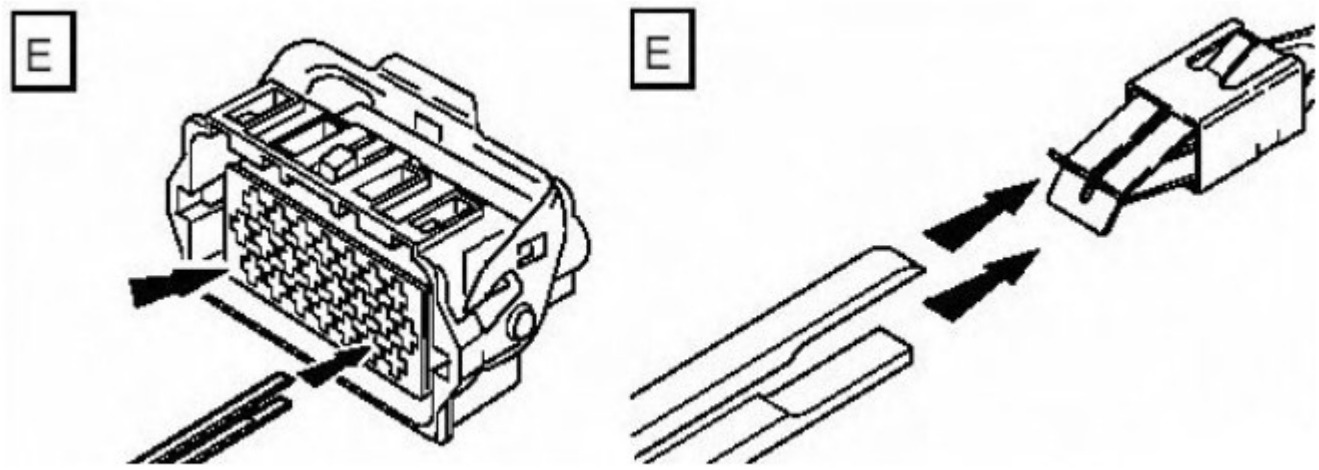

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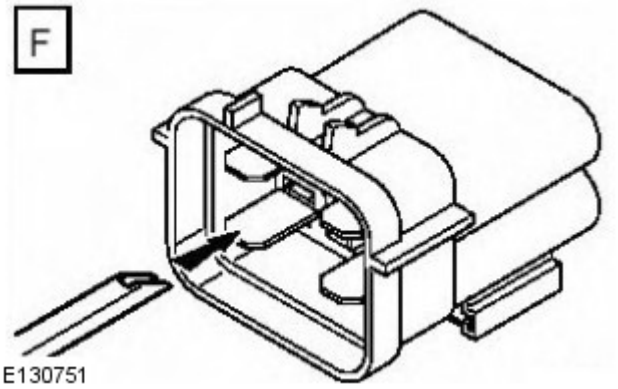

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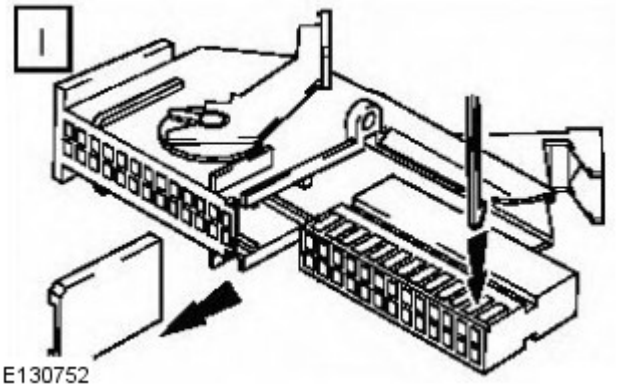

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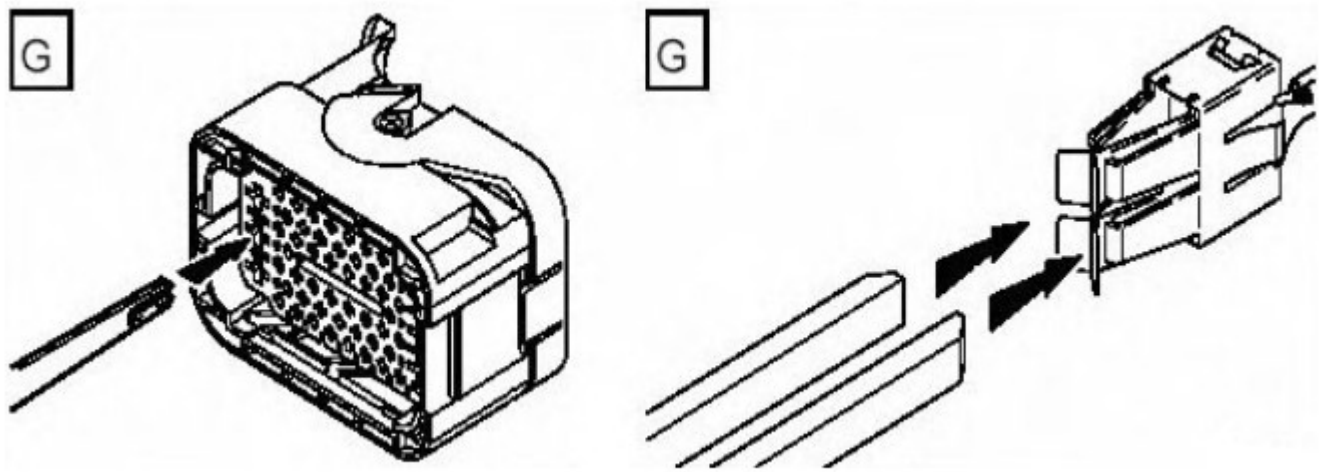

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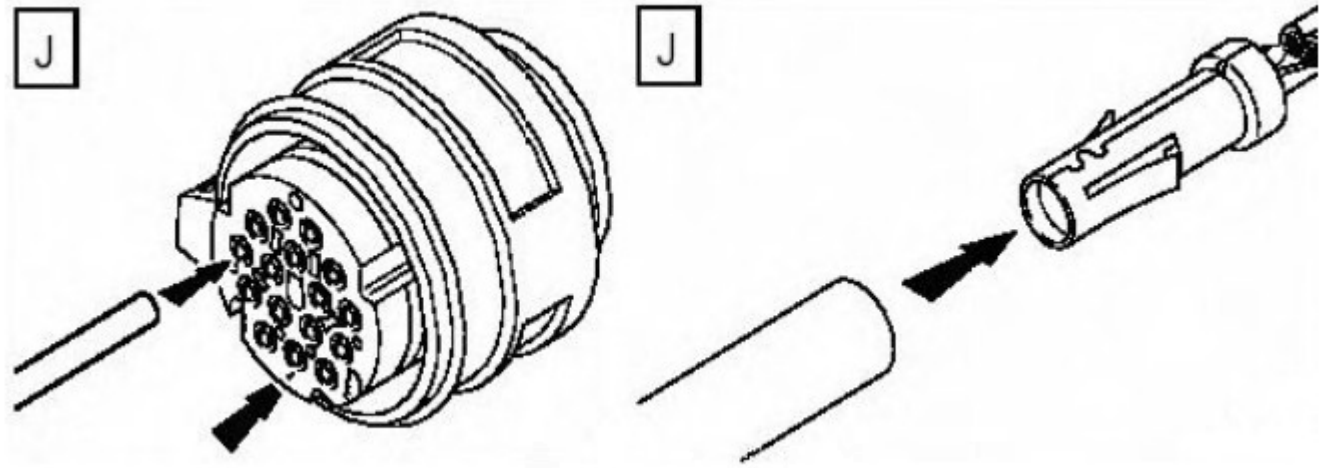

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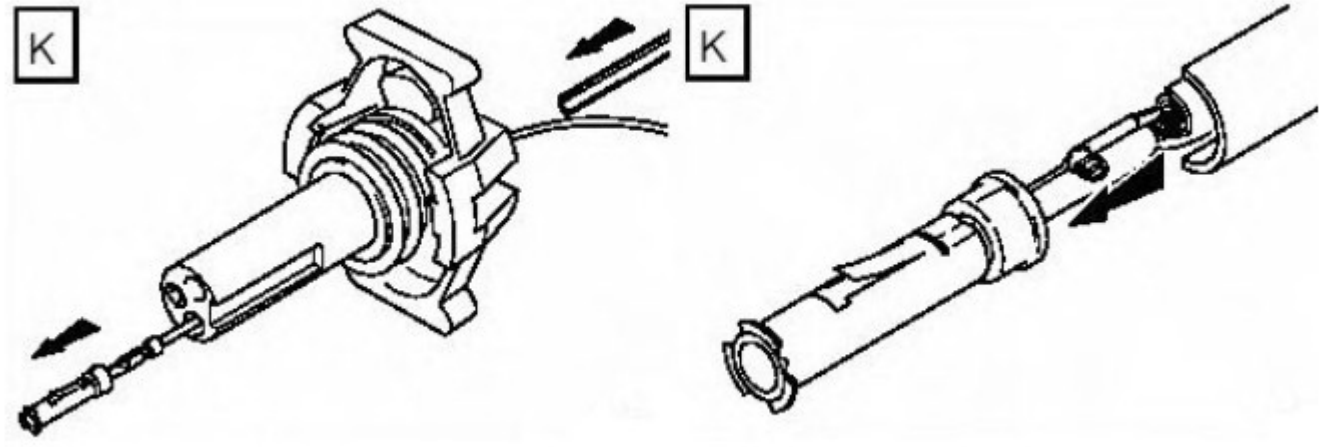


E130755

• NOTE: The chart shows the electrical connector types, terminal pins/sockets, extractor tip and anti-backout tip.

Electrical connector terminal type	Pin or socket	Extractor tip	Anti-backout tip
Mulitlock 040 series	D	A	
Mulitlock 040 series	B	A	
Mulitlock 070 series	B	B	

Electrical connector terminal type	Pin or socket	Extractor tip	Anti-backout tip
Mulitlock 040 series	D	B	
Econoseal III 070 series	D	B	
Econoseal III 070 series	B	B	
Econoseal III 070 series	B	B	
Econoseal III J2	D	B	
Econoseal III 250 series	B	F	
Econoseal III 250 series	D	B	
Econoseal III 250 series	B	F	
Econoseal III 250 series	D	B	
Micro-timer II 1.5mm	D	C	
Micro-timer II 1.5mm	B	C	
Std power timer 4.8 flat	D	G	
Std power timer 5.8 flat	B	D	
Std power timer 5.8 flat	B	D	
Std power timer 2.8 flat	D	D	
Std power timer 4.8 flat	D	G	
Std power timer 5.8 flat	B	D	
Ford 2.8 flat	D	E	H
Mulitlock 070 series	D	B	
Mulitlock 070 series	B	B	
Junior power timer 2.8 flat	D	D	
Sumitomo TS90 connector	B	B	H
Modu IV gold plated	D	B	
Mulitlock 040 series gold plated	D	A	
Micro qualock	D	I	
EECV	D	B	
EECV	D	B	
Kostal dia 1.50 series	D	J	
AMP 6.3 flat	D	B	
Junior power timer 2.8 flat	D	D	
2.8 series	D	B	I
Sumitomo TS90 connector	D	B	H
Ducon 0.60 gold plated	D	K	
AMP 6.3 flat	D	D	
Econoseal III 250 series	B	F	

Repair Procedure

• CAUTIONS:

Do not use crimping pliers, insulation strippers, butt splice connectors, heat shrink sleeves or pre-terminated wiring harness(s) that are not supplied with the Jaguar wiring harness repair kit. Each part has been designed to be used only with the other parts in this wiring harness repair kit.

Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

It is not correct to make more than five repair joints on the wiring harness to any electrical connector and if more damage is found at the same electrical connector then a new wiring harness must be installed.

- Remove the faulty terminal from the electrical connector using the extractor tool and correct tip. Make sure that any anti-backout device is released before trying to remove the terminal.
- CAUTION: : A number of electrical connector terminals are gold plated or gold flashed. When defective, they must be installed with a gold pre-terminated wiring harness(s) from the wiring harness repair kit. It is not always easy to identify the female as gold but the male pins are visually easier, therefore always check both male and female terminals to identify those which are gold. Under no circumstances are gold and tin terminals to be mixed as this will lead to early failure of the electrical contact.

  • NOTE: Never use a harness lead with a smaller diameter than the original harness lead.

  Select the correct size and type of pre-terminated wiring harness and butt splice connector from the wiring harness repair kit.
- Using the wire cutter on the stripping tool, cut the pre-terminated wiring harness and the harness cable to the required length.
- • NOTE: See illustration: **Stripping Insulation**

  From the Relationship Table, find the correct length of insulation to be stripped from the pre-terminated wiring harness and set the adjustable cable length stop to the correct length. Place the pre-terminated wiring harness in the wire stripper and remove the insulation.
- Put the cable identification sleeve(s) on to the wiring harness with the main cable colour nearest to the terminal.
- During this next step do not overtighten. Place the selected butt splice connector in the crimping tool, matching the aperture and the butt connector colours. Make sure that the window indentation in the butt connector is resting over the guide bar on the lower jaw. Partially close the grip until the butt connector is securely held in the aperture. This will give support to the butt connector while the pre-terminated wiring harness is inserted into it.
- • NOTE: See illustration: **Spice Correctly Located**

Insert the pre-terminated wiring harness into the butt connector and make sure that the wire is against the wire stop. Close the grip firmly, crimping the lead to the butt connector. When the handles have been completely closed the butt connector will be freed from the tool as the handles are released. If the handles have not been completely closed then the jaws will hold the butt connector and it cannot be removed from the tool until the crimp is fully made by closing the handles completely.

- Make sure that the harness cable has been squarely cut and the correct length of insulation removed. If more than one splice is needed the butt connectors must be not be crimped to the wiring harness at the same distance from the connector. The splices must be staggered to prevent a bulk of splices in the same area of the wiring harness.
- It is preferable to cover the butt splice joint with heat shrink sleeve. This is desirable not essential, except where the electrical connector is a sealed electrical connector. Use the smaller diameter sleeve for red and blue pre-terminated wiring harness(s) and the large diameter sleeve for the yellow pre-terminated wiring harness(s). It is advisable to place the heat shrink over the completed joint but in some instances the sleeve will not pass over the terminal. Check, and if required, place the correct size sleeve onto the harness cable or pre-terminated wiring harness before crimping the butt splice to the wiring harness.
- Place the harness cable into the butt splice with the splice window over the guide bar. Make sure that the cable harness wire is against the stop in the butt splice, crimp the butt splice connector to the wiring harness.
- Gently pull the harness cables each side of the butt splice to make sure that a secure joint has been made.
- WARNING: Do not use a naked flame in areas where fuel or oil have been spilt. Clean the area of residual oil and fuel and wait until the fuel spill has fully evaporated.

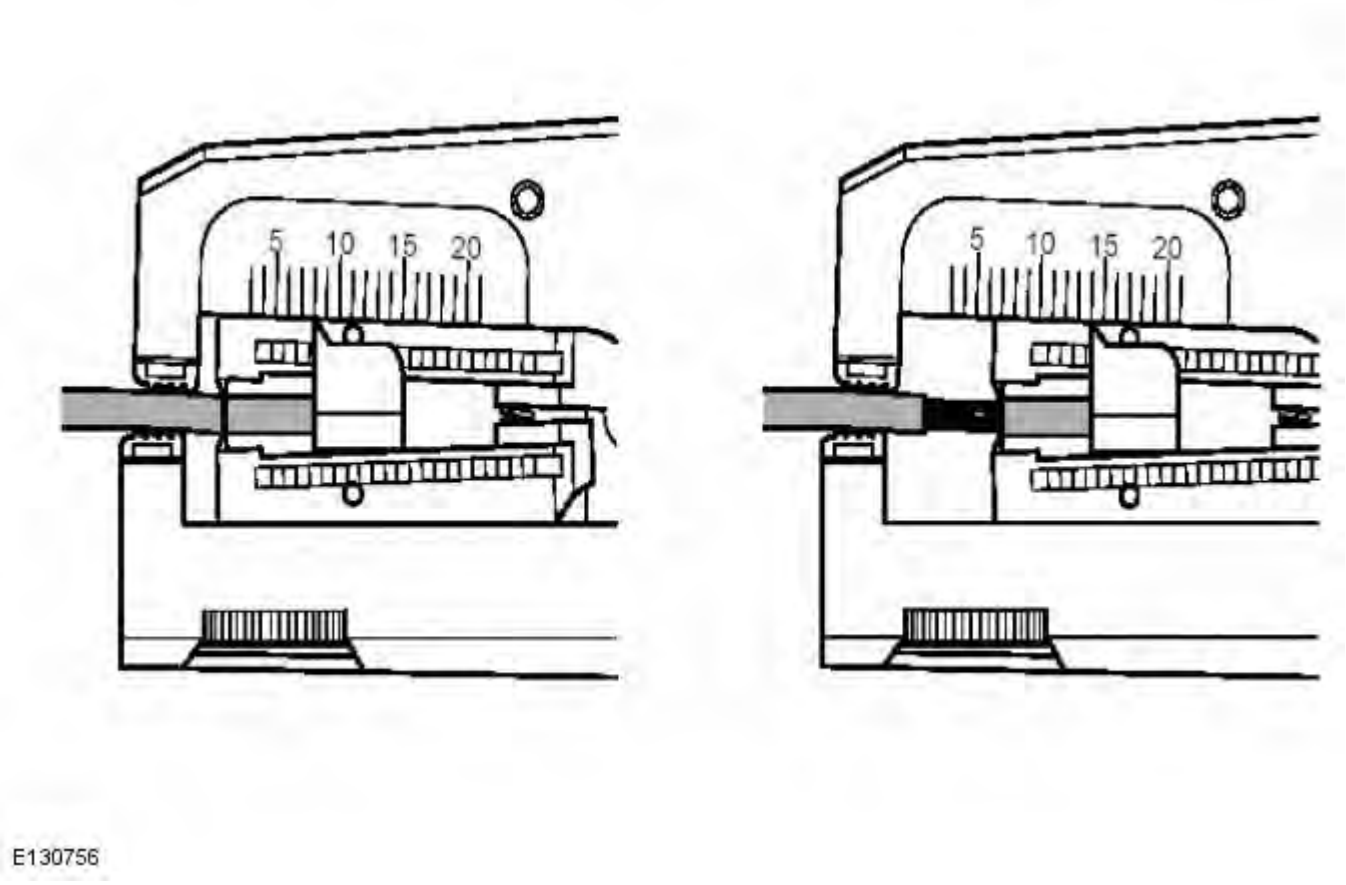
  • CAUTIONS:

  When using a heat source make sure that it is localised and causes no damage to surrounding materials.

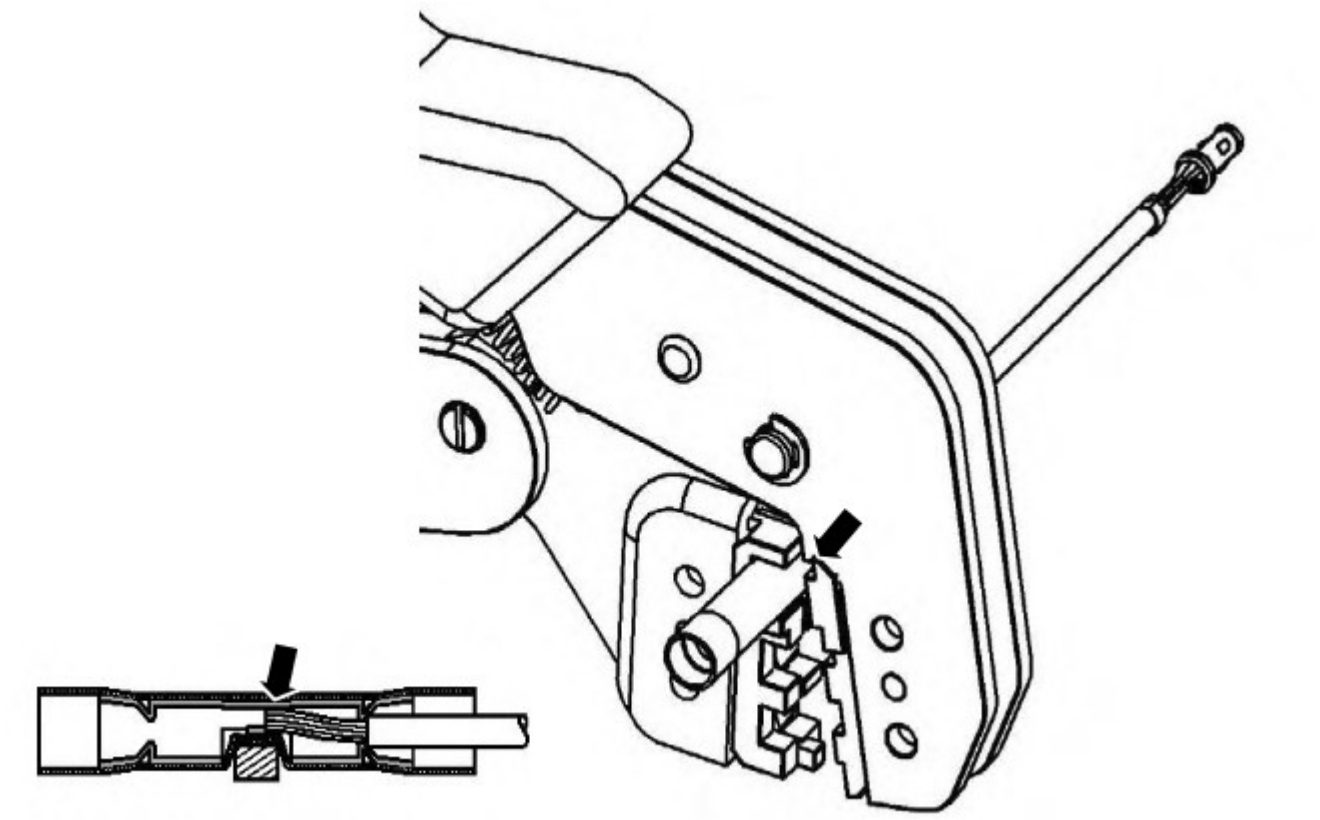
  Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

  Using a suitable heat source, shrink the sleeve over the butt splice.
- If further pre-terminated wiring harness(s) are to be installed to the same electrical connector, make sure that the lead is cut at a different length to the previous joint. This makes sure that the splices will, where possible, be staggered on the wiring harness and prevent a bulk of splices in one area.
- When all of the splices have been made, fit the terminal(s) to the electrical connector, taking care that the terminals are correctly orientated.
- Install the wiring harness cover and secure with adhesive electrical tape. Do not cover the wiring harness right to the electrical connector as the terminals must have a little movement and not be firmly bound to the electrical connector or wiring harness. Make sure that the cable identification sleeve(s) are showing at the wiring harness electrical connector.

Stripping Insulation



Spice Correctly Located



E130757

Published: 11-May-2011

Wiring Harnesses - Wiring Harness Repair

General Procedures

1. For additional information, refer to: Wiring Harness (418-02 Wiring Harnesses, Description and Operation).

Published: 11-May-2011

Wiring Harnesses - Engine Wiring HarnessI6 3.2L Petrol

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the battery tray.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

4. Remove the plenum chamber.

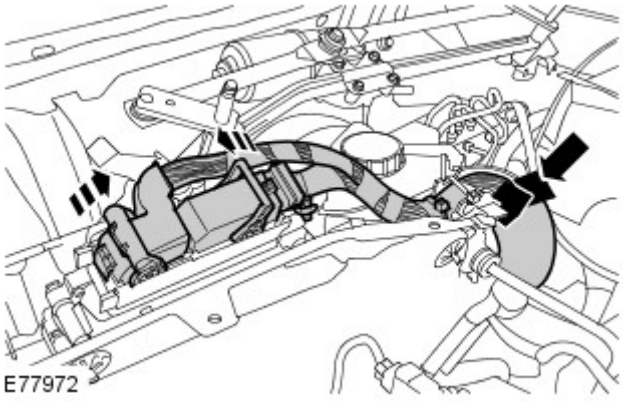
   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

5. Remove the intake manifold assembly.

   Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

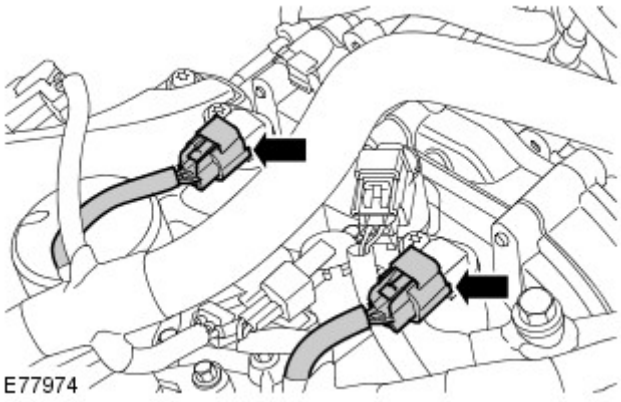
6. Remove the RH engine mount.

   Refer to: Engine Mount RH (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

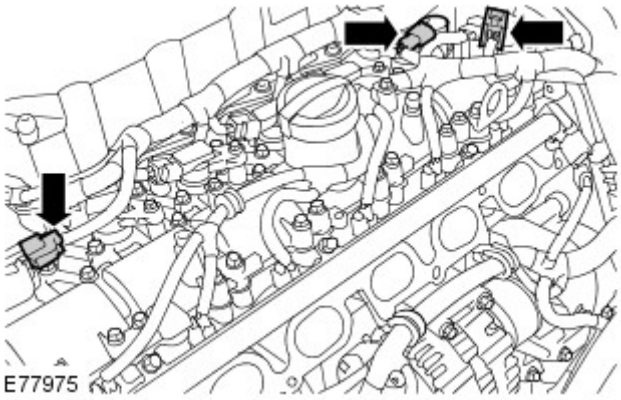


7. Disconnect the 2 engine control module electrical connectors.

8. Release and disconnect the 2 LH HO2S electrical connectors.

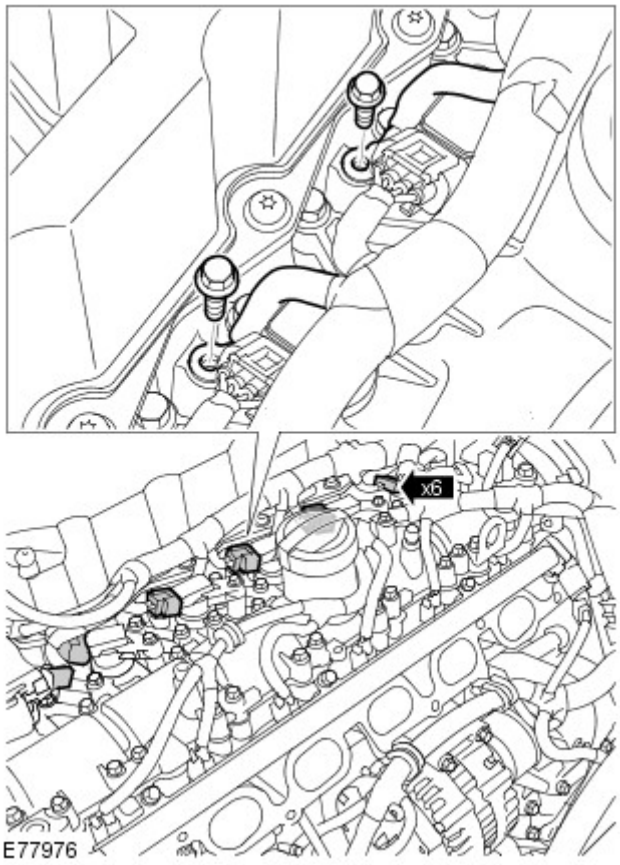


9. Disconnect the 2 camshaft position (CMP) sensor electrical conectors.

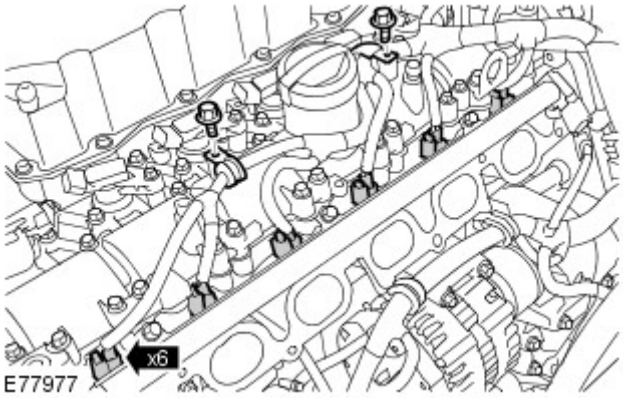


10. Disconnect the 3 variable camshaft timing solenoid electrical connectors.

11. Disconnect the 6 ignition coil-on-plugs.



12. Disconnect the 6 fuel injector electrical connectors.



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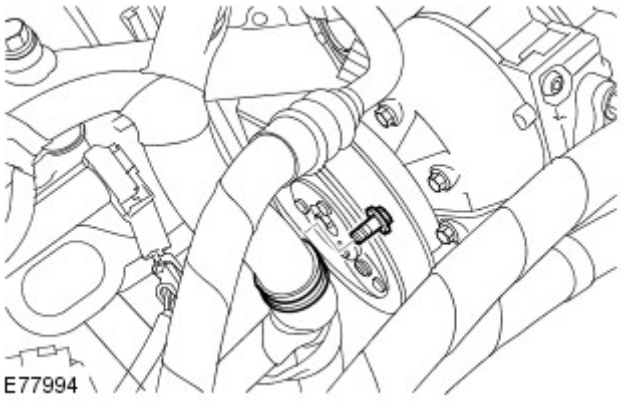
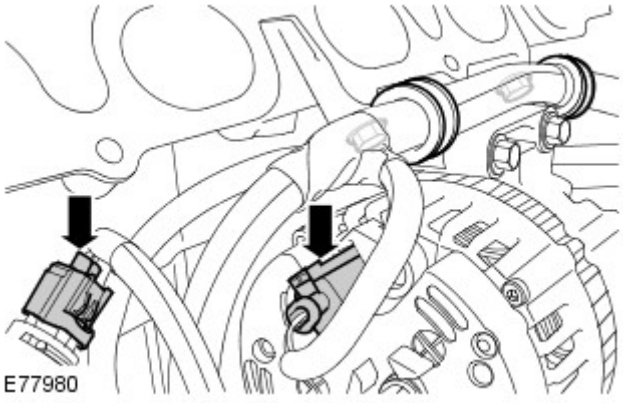
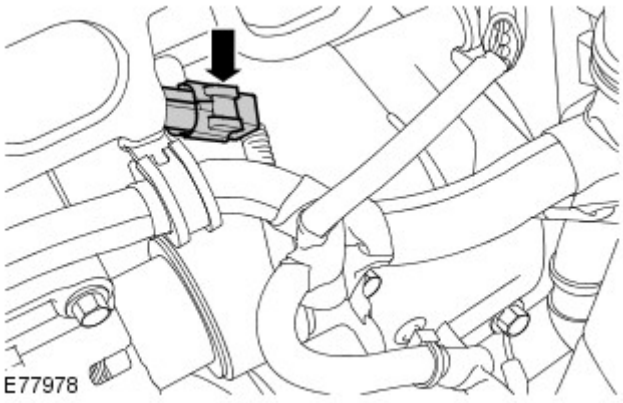


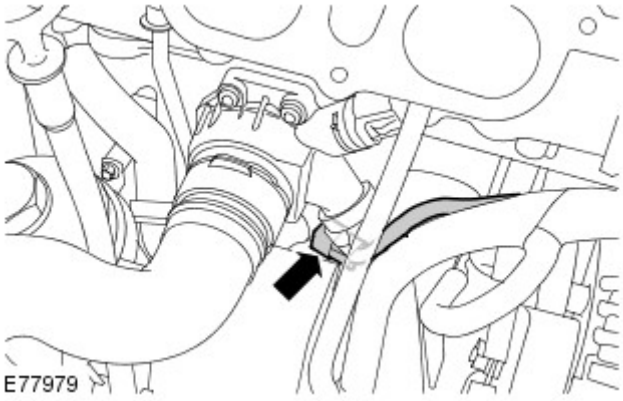
14. Disconnect the engine coolant temperature (ECT) sensor electrical connector.



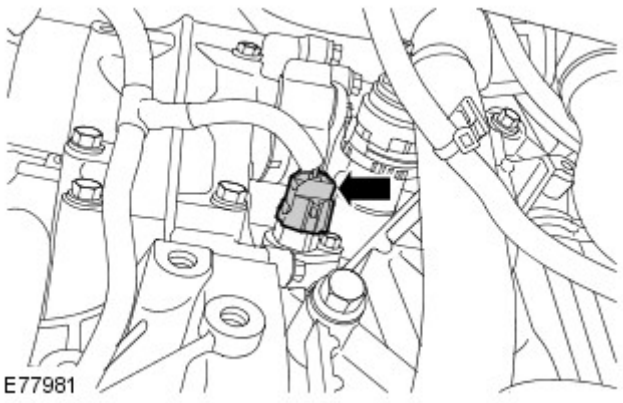
15. Disconnect the generator connector.



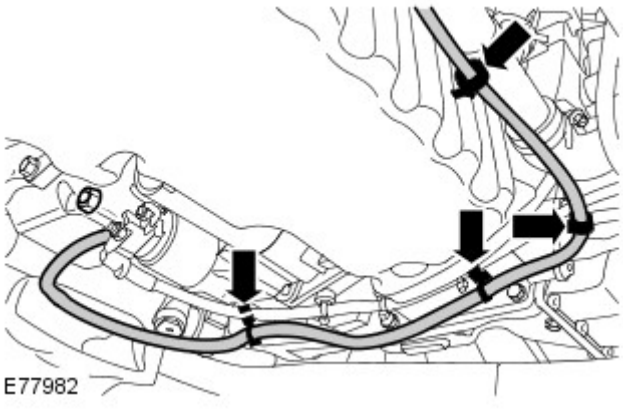
16. Disconnect the front knock sensor (KS) connector.



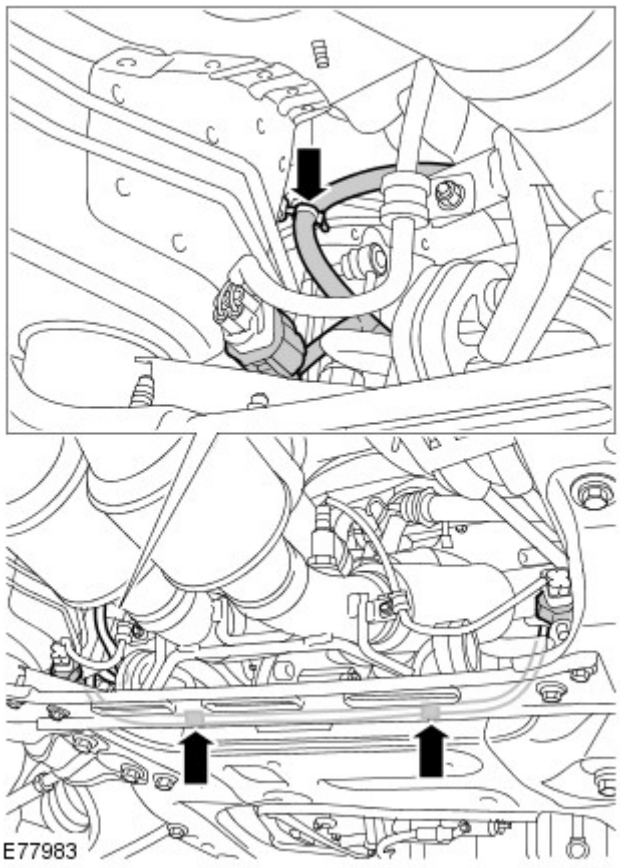
17. Disconnect the rear knock sensor (KS) connector.



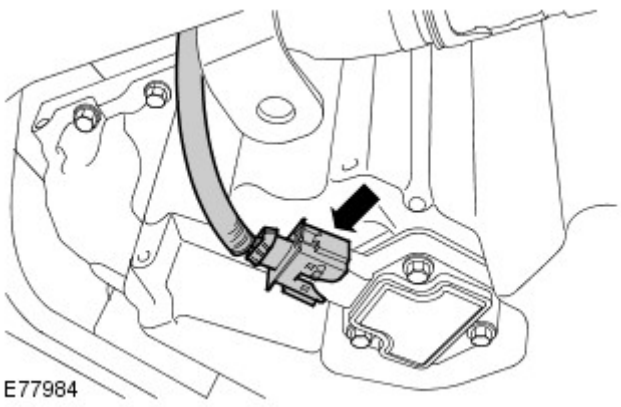
18. Disconnect the crankshaft position (CKP) sensor electrical connector.



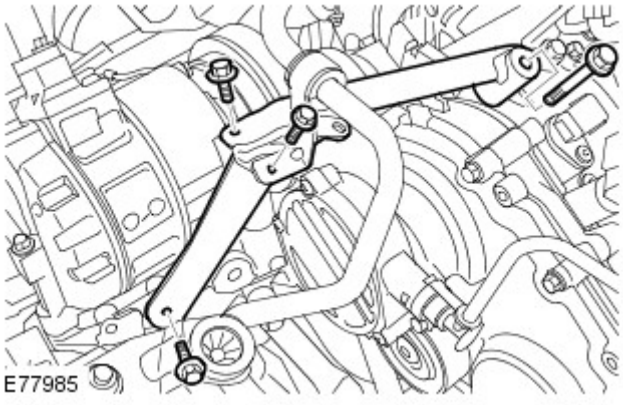
19. Disconnect the starter motor electrical connector.



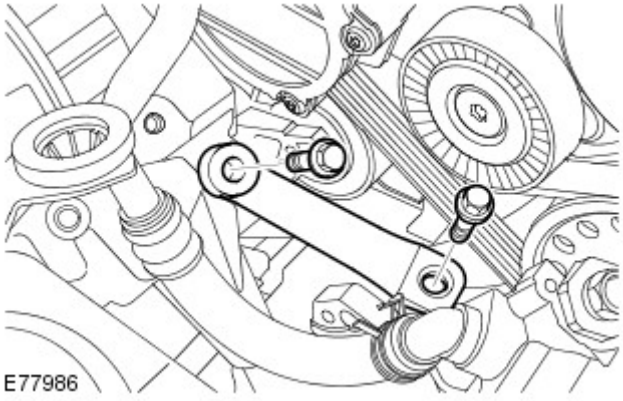
20. Release the catalyst monitor sensor wiring harness.



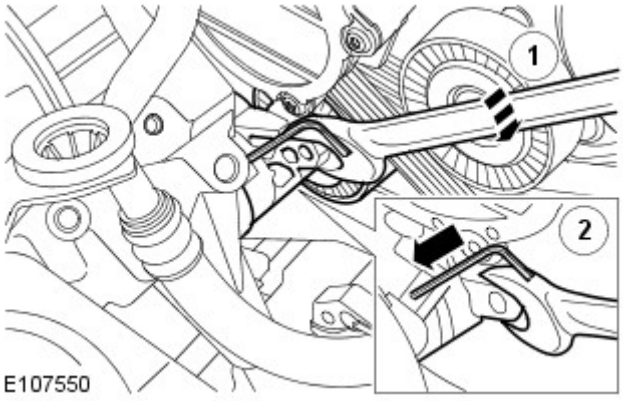
21. Disconnect the oil level sensor electrical connector.



22. Remove the A/C compressor, upper support bracket.

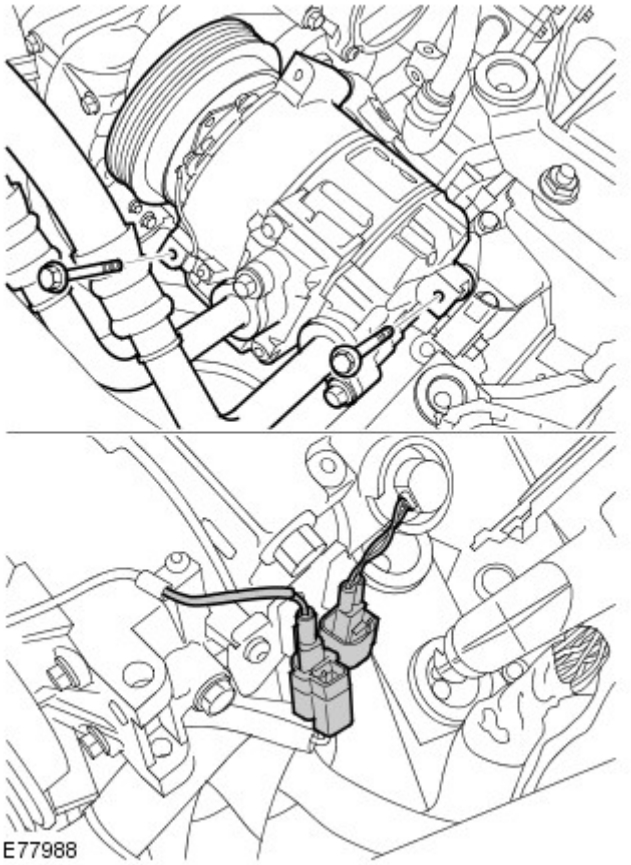


23. Remove the A/C compressor, lower support bracket.

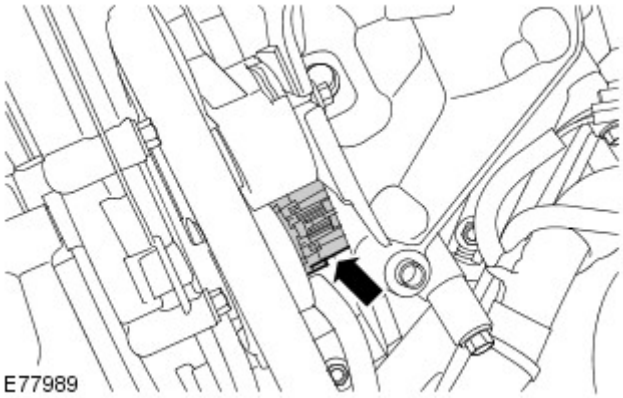


24. Using suitable tools, release the accessory drive belt tension.

25. Release the A/C compressor and position aside.


E77988

26. Disconnect the transmission electrical connector.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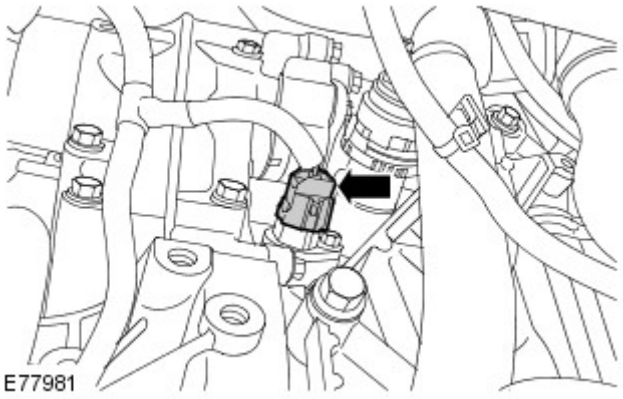
27. Release the 3 ground cables.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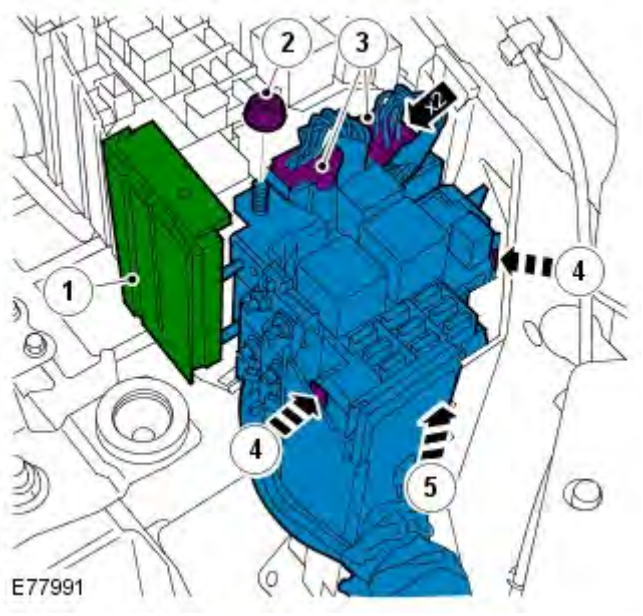


28. Disconnect the engine wiring harness.

29. Remove the engine wiring harness.

Installation

1. Install the engine wiring harness.
2. Connect the engine wiring harness.

   Torque: 10 Nm
3. Attach the ground cables.

   Torque: 10 Nm
4. Connect the transmission electrical connector.
5. Install the A/C compressor.

   Torque: 25 Nm
6. Install the accessory drive belt.
7. Install the A/C compressor, lower support bracket.

   Torque: 25 Nm
8. Install the A/C compressor, upper support bracket.

   Torque:
   M10 45 Nm
   M8 25 Nm
   M6 10 Nm
9. Connect the oil level sensor electrical connector.
10. Attach the catalyst monitor sensor wiring harness.
11. Connect the starter motor electrical connector.

Torque: 10 Nm

12. Connect the CKP sensor electrical connector.

13. Connect the generator electrical connector.

    Torque: 10 Nm

14. Connect the KS electrical connectors.

15. Connect and secure the ECT sensor electrical connector.

16. Connect the fuel injector electrical connectors.

17. Connect the coil-on-plug electrical connectors.

18. Disconnect the variable camshaft timing solenoids.

19. Connect the HO2S electrical connectors.

20. Connect the ECM electrical connectors.

21. Install the engine mount.

    Refer to: Engine Mount RH (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

22. Install the intake manifold.

    Refer to: Intake Manifold (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

23. Install the air intake plenum.

    Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

24. Install the battery tray.

    Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

25. Connect the battery ground cable and install the cover.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Wiring Harnesses - Engine Wiring HarnessTD4 2.2L Diesel

Removal and Installation

Removal

- NOTE: Make sure the wiring harness is routed correctly.

All vehicles

1. Remove the air cleaner housing.

   Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - TD4 2.2L Diesel, Removal and Installation).

2. Remove the fuel filter.

   Refer to: Fuel Filter (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

3. Remove the engine compartment closing panel.

   Refer to: Secondary Bulkhead Center Panel - TD4 2.2L Diesel (501-02 Front End Body Panels, Removal and Installation).

4. Remove the battery carrier.

   Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

5. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

6. Remove the front RH splash shield.

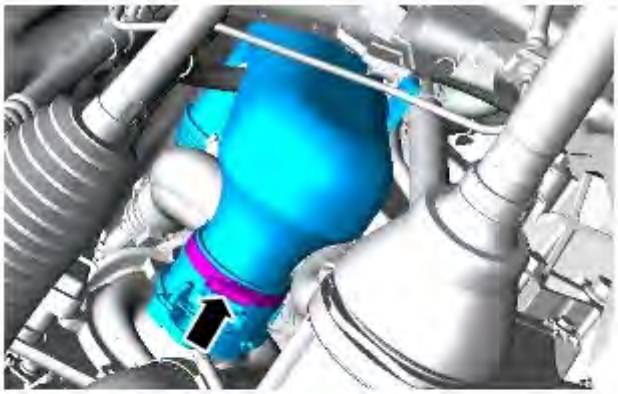
   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

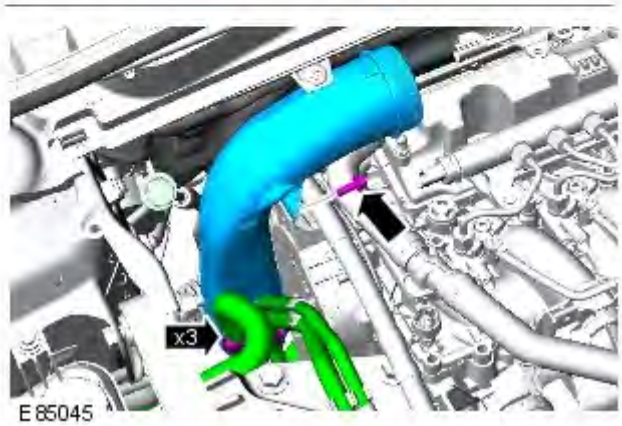
7. **7.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

All vehicles

8. *Torque:* 10 Nm





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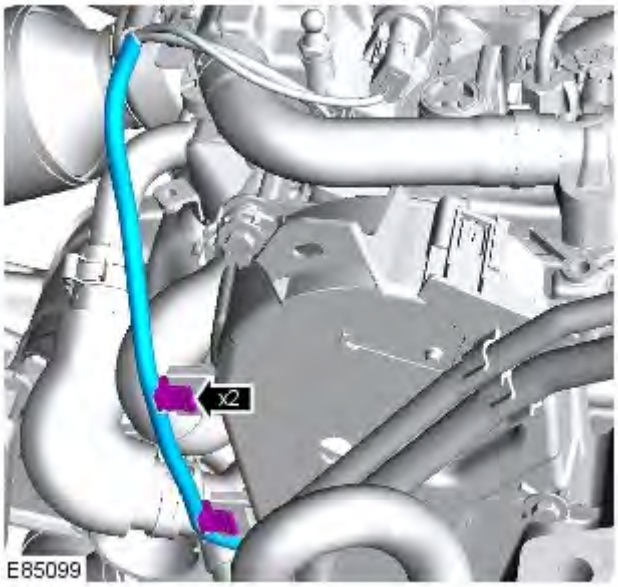

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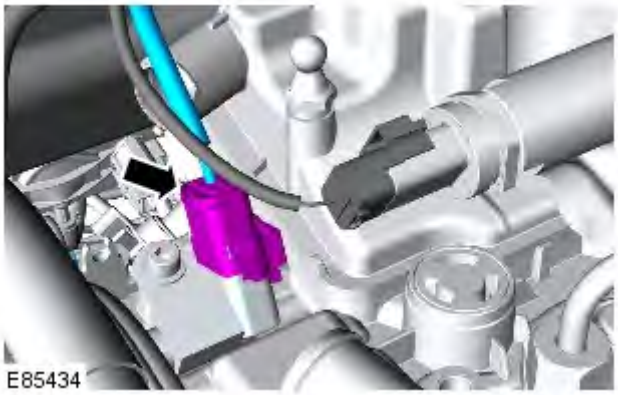

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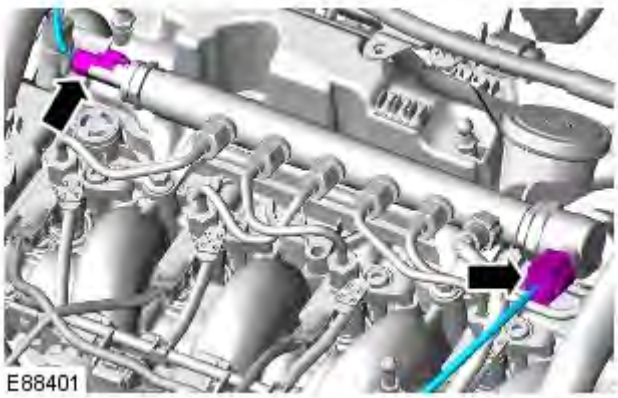

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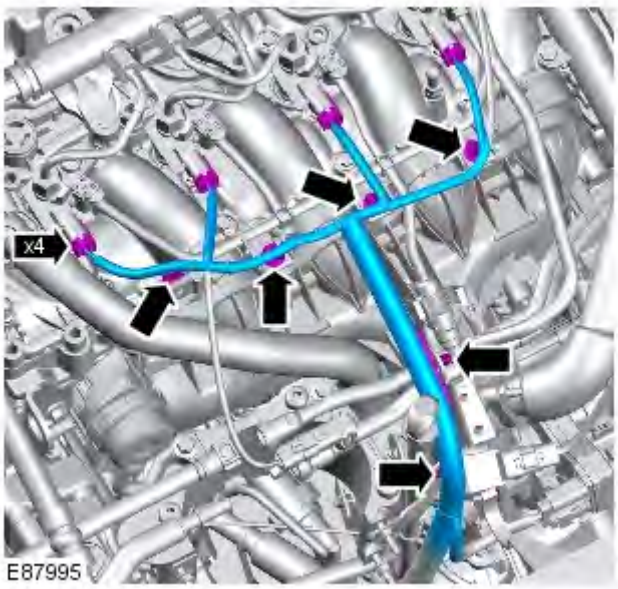

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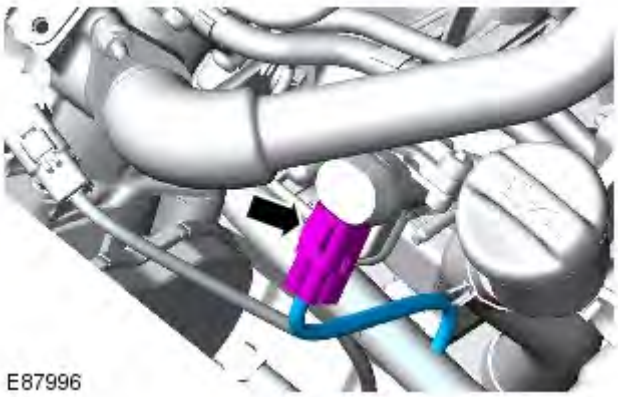

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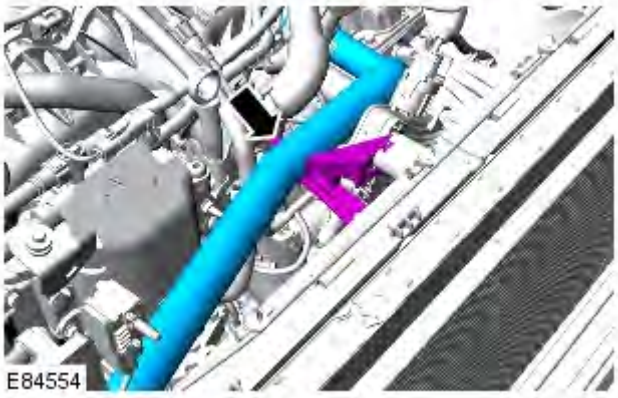

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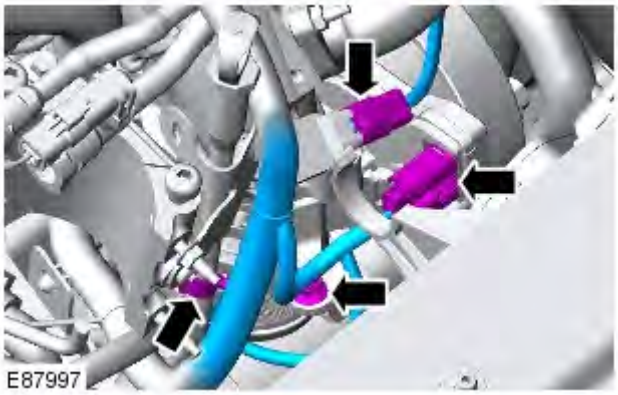

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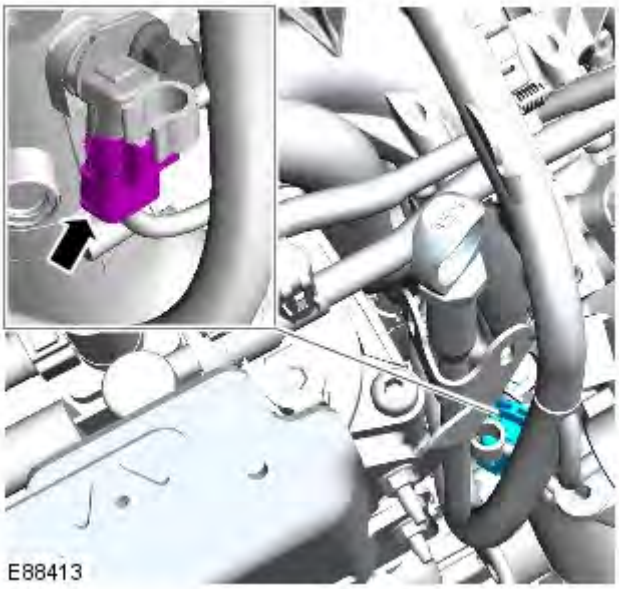

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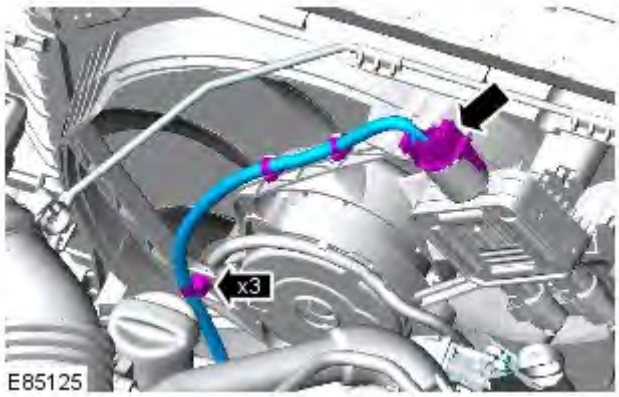
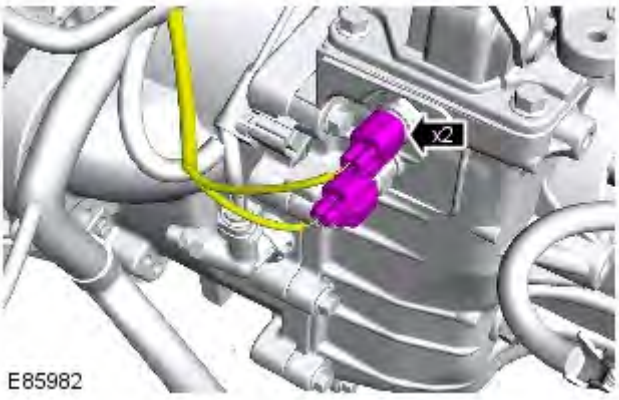


Vehicles with manual transmission

18.

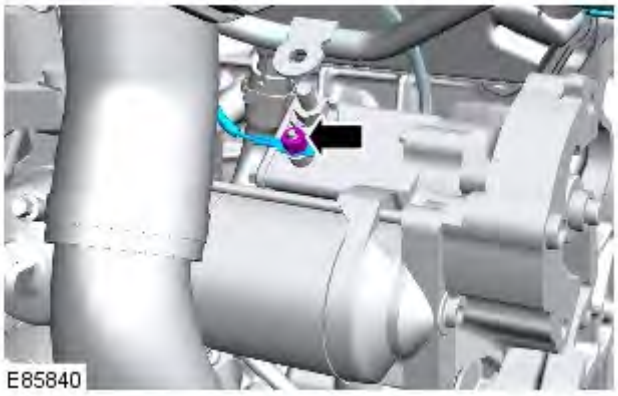


Vehicles with automatic transmission

19.

All vehicles

20. *Torque:* 6 Nm



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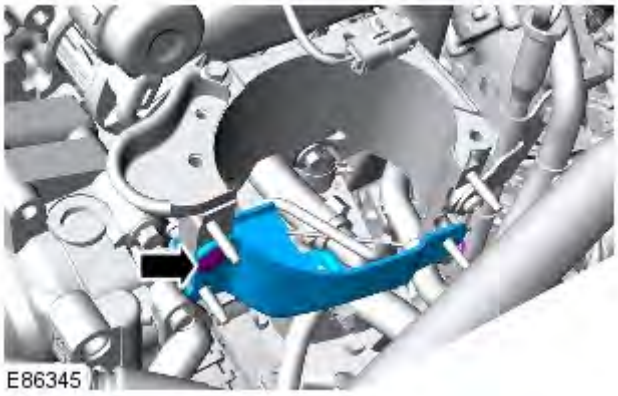

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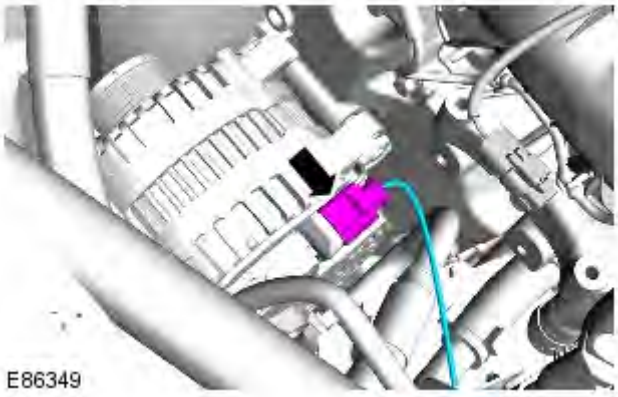

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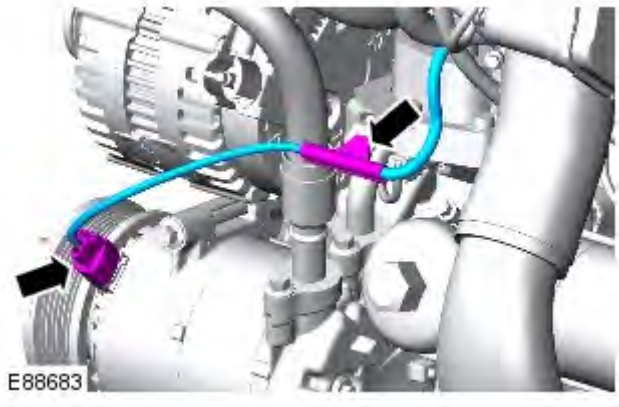

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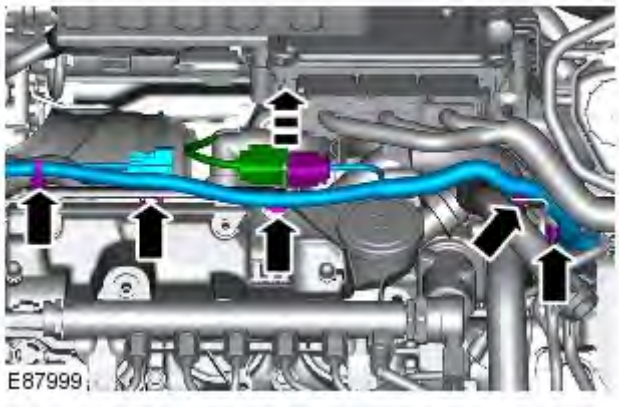

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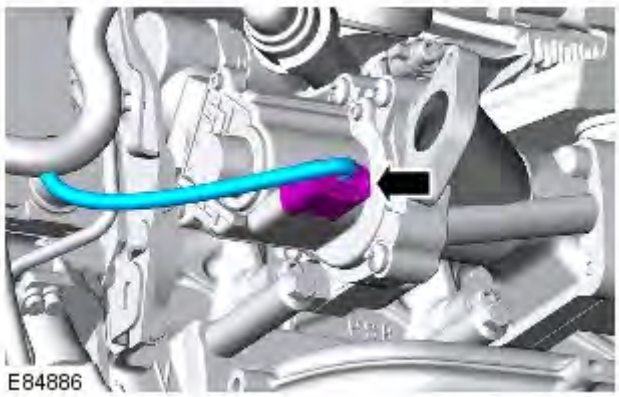

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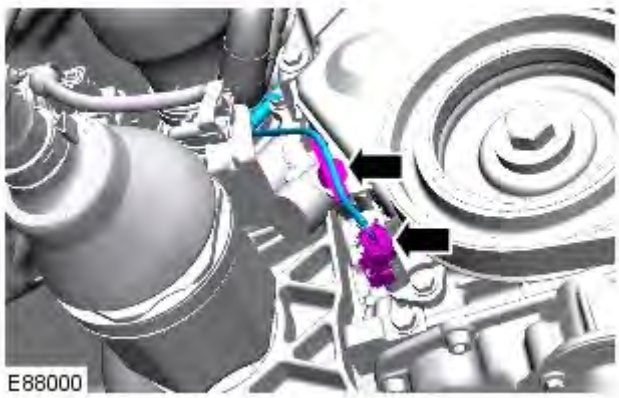

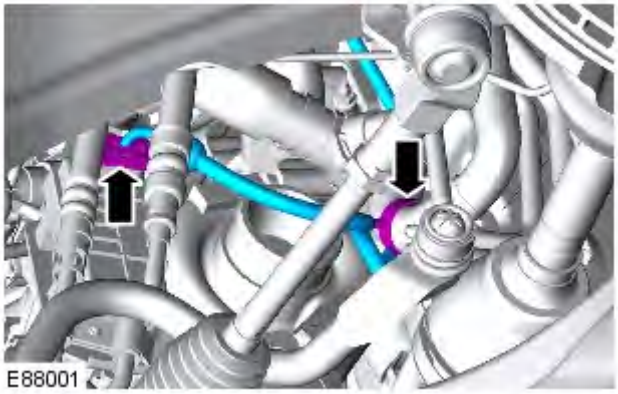

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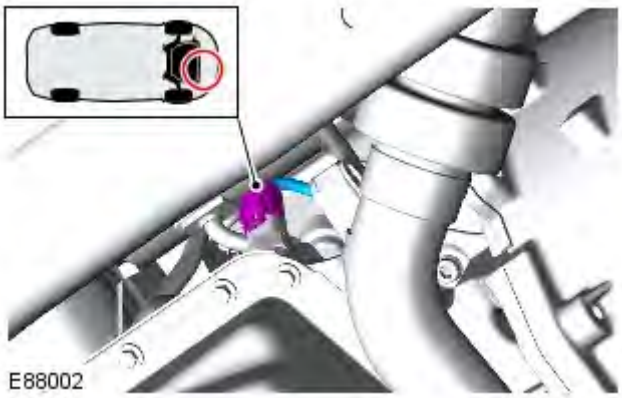

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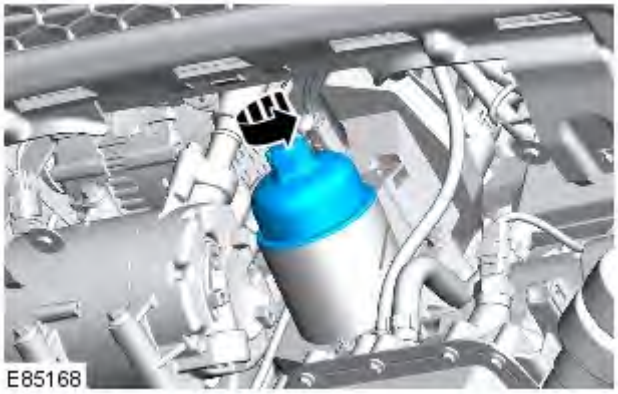
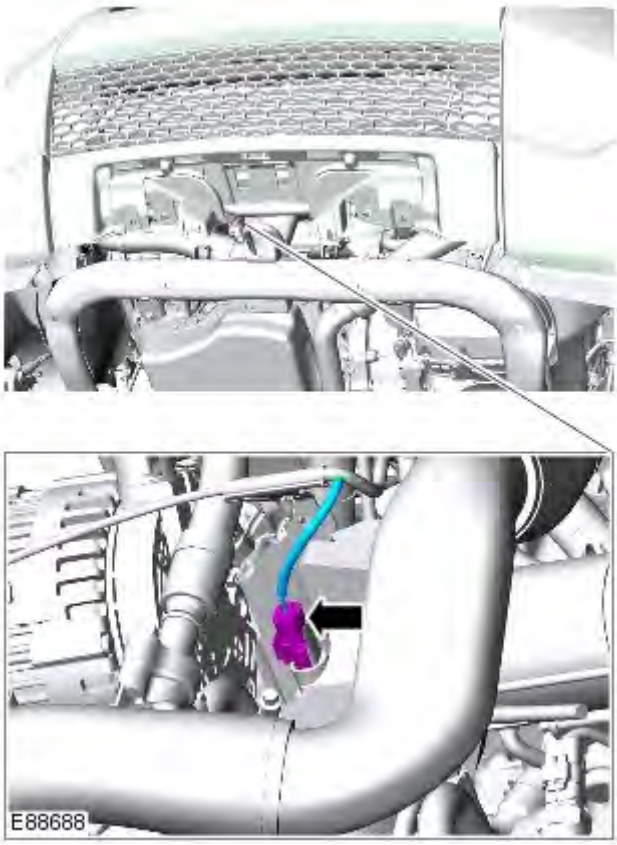


29. *Torque:* 25 Nm

30.



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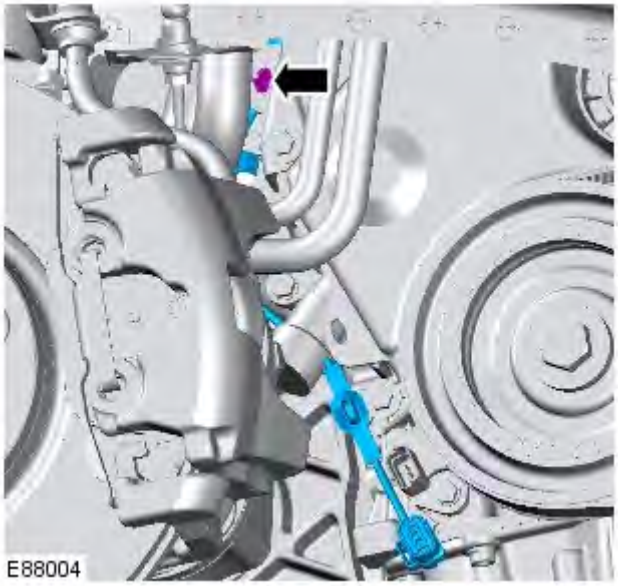

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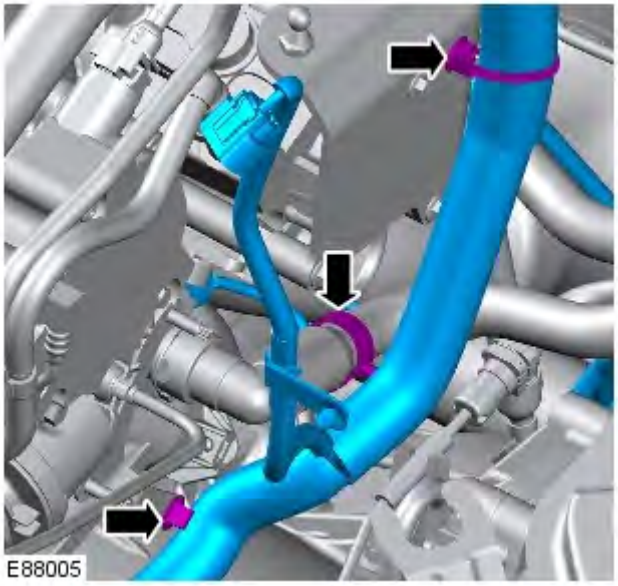

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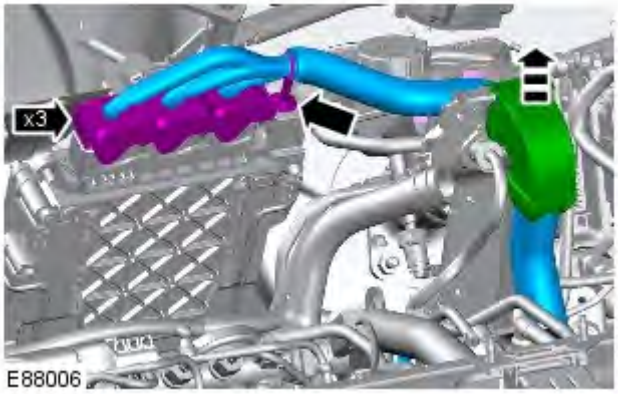

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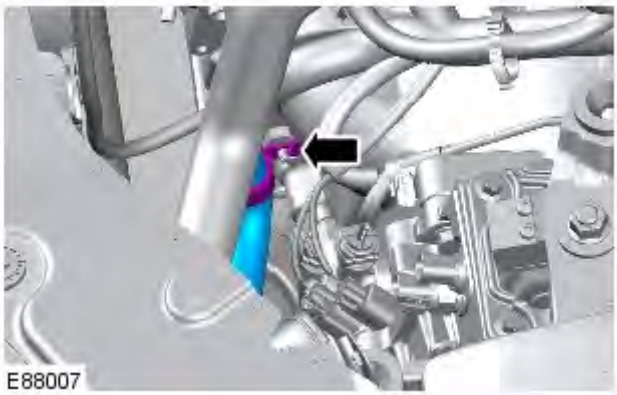
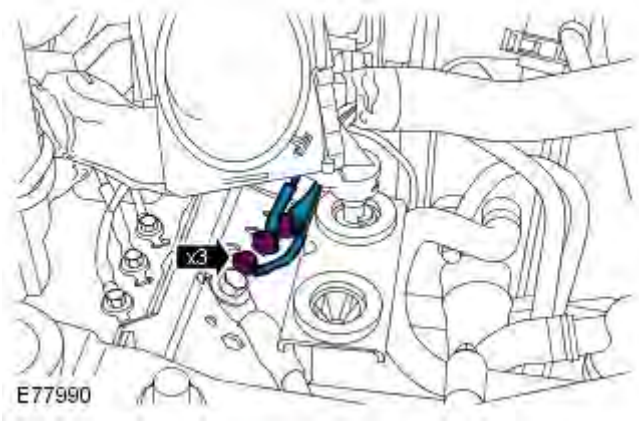
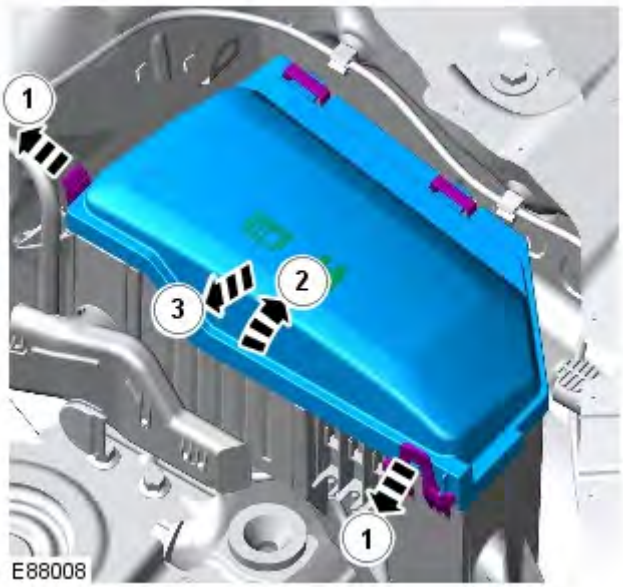




35. *Torque:* 10 Nm



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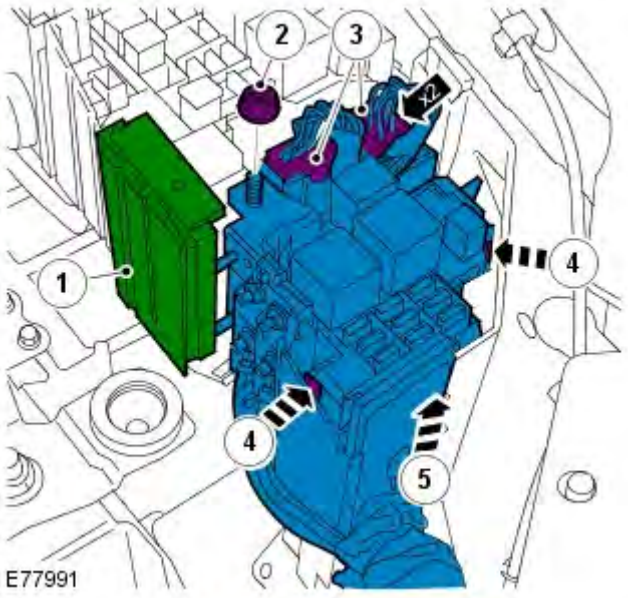


37. Release the wiring harness from the battery junction box.

    Torque: 10 Nm

38. Remove the engine wiring harness.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Anti-Theft - Active -

Torque Specifications

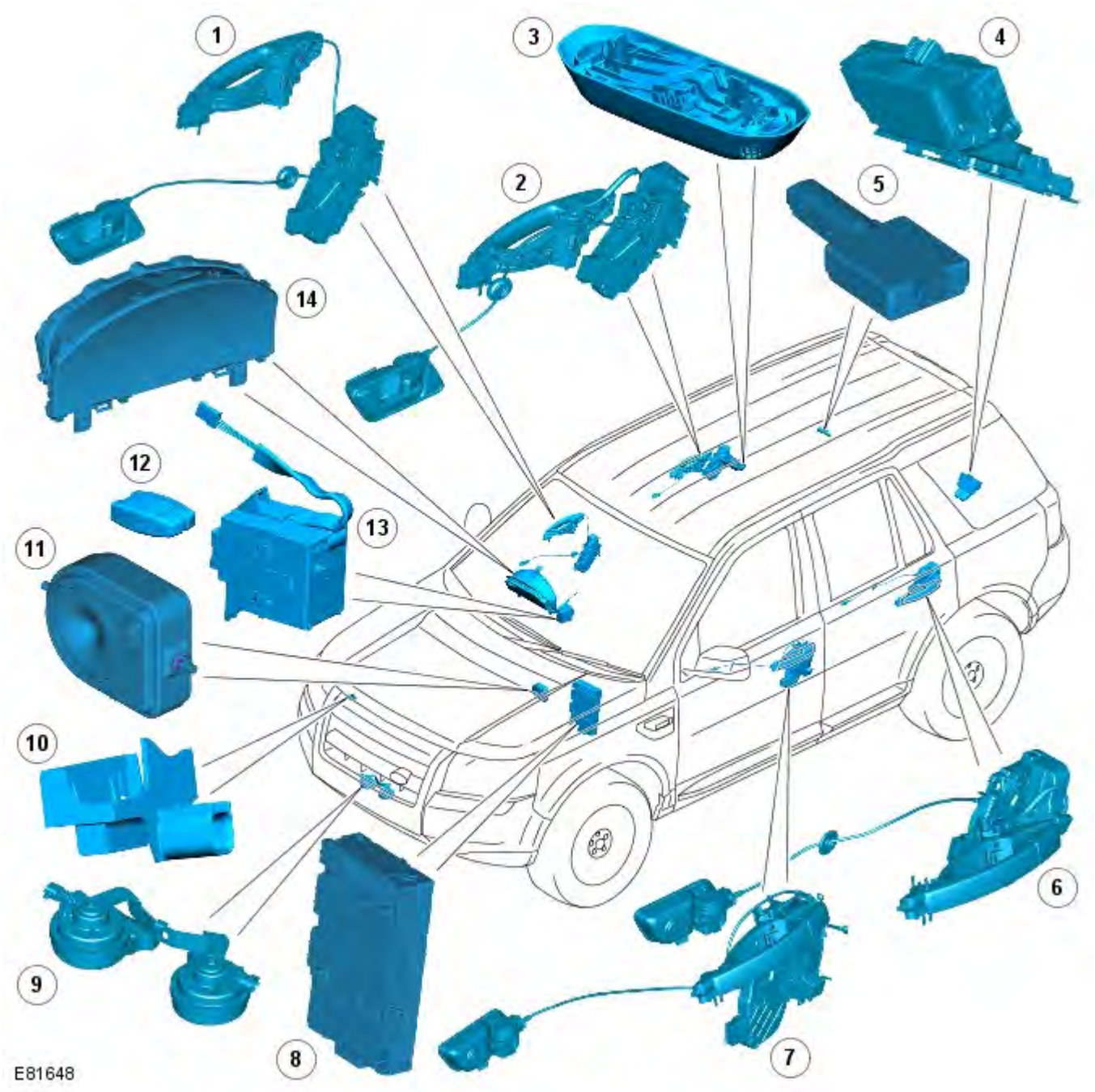
Description	Nm	lb-ft
Anti-theft alarm horn with integral battery	10	7
Hood switch	10	7

Published: 11-May-2011

Anti-Theft - Active - Anti-Theft - Active

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Right Hand (RH) front door latch microswitch
2	-	RH rear door latch microswitch
3	-	Intrusion detection module
4	-	Liftgate latch microswitch
5	-	Radio Frequency (RF) receiver
6	-	Left Hand (LH) rear door latch microswitch
7	-	LH front door latch microswitch
8	-	Central Junction Box (CJB)
9	-	Vehicle horns
10	-	Hood microswitch
11	-	Battery backed sounder (incorporates tilt sensor in certain markets)
12	-	Remote handset
13	-	Start control module
14	-	Instrument cluster - Alarm Light Emitting Diode (LED)

OVERVIEW

The active anti-theft system monitors the hinged panels for unauthorized opening. In some markets the anti-theft system also incorporates monitoring of the vehicle interior and vehicle tilt sensing.

The active anti-theft alarm system is controlled by the following body system control modules:

- CJB
- Left Hand (LH) and Right Hand (RH) front and rear door modules
- Instrument cluster.

The CJB is the main controller in the system. The CJB controls the following security functions, in addition to other vehicle functions:

- Locking, double locking and unlocking
- Monitoring of hinged panel microswitches and panel ajar states
- Intrusion detection module
- Battery backed sounder or vehicle horns
- Passive arming and disarming
- Panic alarm function
- Remote handset transponder reading
- Interior lighting.

Two levels of vehicle anti-theft alarm are available; perimeter mode monitors all opening panels and volumetric mode (if fitted) monitors the vehicle interior for intrusion and, in certain markets, it also incorporates a tilt sensor to monitor if the vehicle is being moved.

• NOTE: Volumetric mode and tilt sensing are not available in certain markets.

• NOTE: Volumetric mode is cancelled if the vehicle is locked with any window or roof opening panel not closed to avoid inadvertent alarm activation.

The remote handset provides the following functionality:

- Unlock (central unlock or single point entry)
- Lock and double lock
- Liftgate release
- Approach lighting
- Panic alarm.

The unlock and lock buttons also control a 'lazy' lock and unlock feature which will automatically close or open the windows with an extended press of the applicable button. This feature is only available in certain markets and is controlled in conjuction with the door modules.

WARNING: Never double lock the vehicle with any person or animal inside.

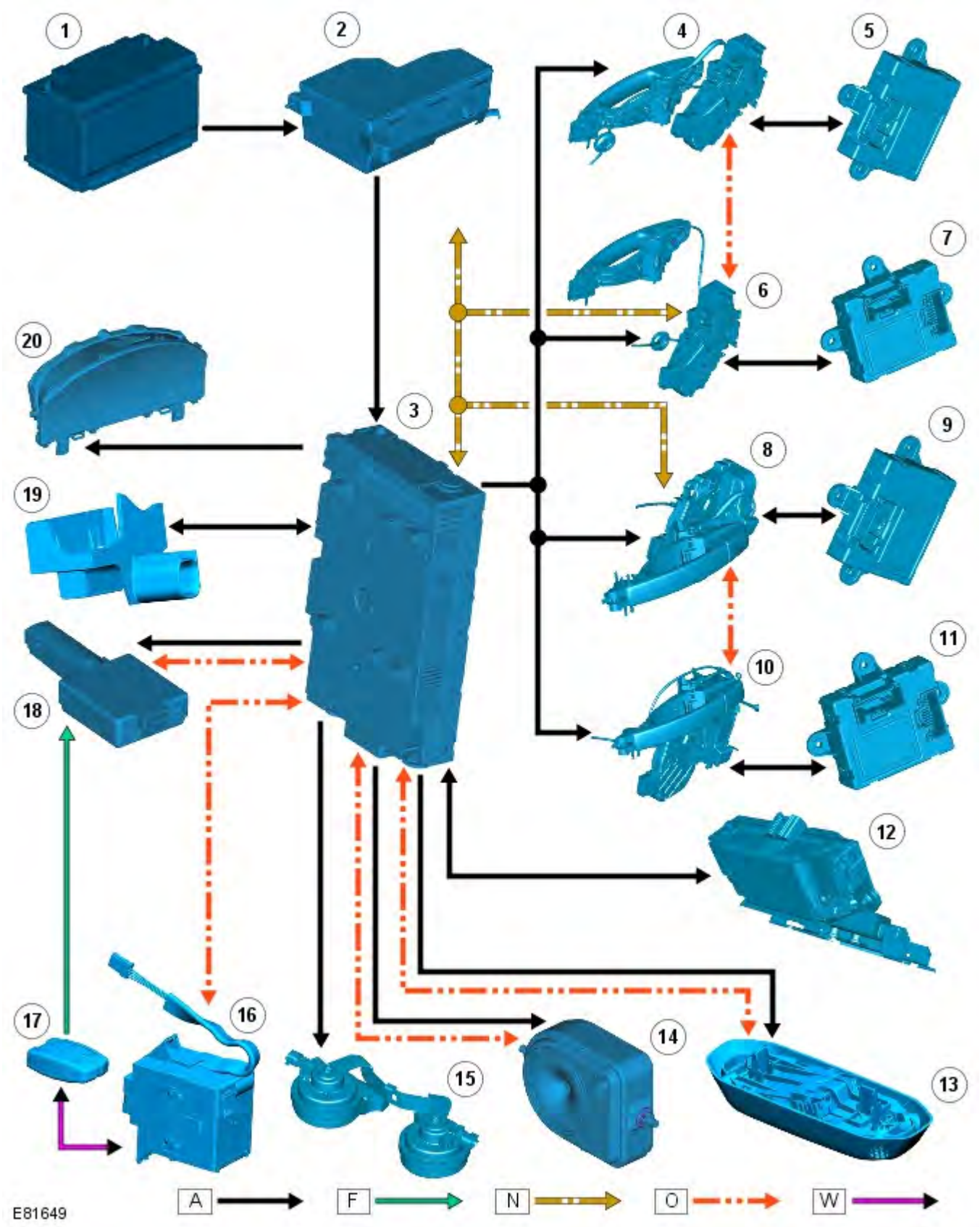
• NOTE: Double locking is only available in certain markets.

The remote handset contains an emergency access key. This can be used in the event of failure of the remote handset or the vehicle battery to unlock the vehicle. The LH door handle contains a concealed mechanical key barrel which can be used with the emergency key to access the vehicle. This will not disable the perimeter or interior alarm systems which will be activated when the door is opened. To cancel the alarm, the remote handset must be inserted in the slot in the start control module and the stop/start button must be pressed.

The remote handset is fitted with an integral vanadium lithium rechargeable battery. The battery is charged when it is inserted into the slot in the start control module.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **F** = RF Transmission; **N** = Medium Speed CAN bus; **O** = LIN bus; **W** = LF Transmission



Item	Part Number	Description
1	-	Battery
2	-	Battery junction box
3	-	CJB
4	-	RH rear door latch microswitch
5	-	RH rear door module
6	-	RH front door latch microswitch
7	-	RH front door module
8	-	LH rear door latch microswitch
9	-	LH rear door module
10	-	LH front door latch microswitch
11	-	LH front door module

12	-	Liftgate latch microswitch
13	-	Intrusion detection module
14	-	Battery backed sounder and tilt sensor (certain markets only) (if fitted)
15	-	Vehicle horns
16	-	Remote handset
17	-	RF receiver
18	-	Start control module
19	-	Hood microswitch
20	-	Instrument cluster alarm LED

DOOR MODULES

The door modules provide the interface between the door latch motors, the door and latch switches and the CJB. The door modules provide door microswitch status information and enable the door motors on request from the CJB.

The rear door modules are controlled via the front door modules on the Local Interconnect Network (LIN) bus. Additionally, the front door modules also control the exterior mirror functions.

CENTRAL JUNCTION BOX

The CJB controls the following functions:

- the horns
- the liftgate latch motor and microswitches (including the liftgate external release switch)
- the liftgate ajar switch
- the turn signal indicators
- fuel filler flap operation.

The CJB also has a connection to the Restraints Control Module (RCM) for automatic operation of the interior lights and the turn signal indicators in the event of an accident.

• NOTE: If the CJB is replaced, the new module will require configuring to the master car configuration using a Land Rover approved diagnostic system.

The CJB automatically arms and disarms the active anti-theft system when the vehicle is locked and unlocked after successful confirmation that a valid remote handset has been used.

INSTRUMENT CLUSTER

The instrument cluster controls the alarm indicator which is incorporated in the main display in the instrument cluster.

The instrument cluster also controls, in conjunction with the CJB, the Engine Control Module (ECM) and the Anti-lock Brake System (ABS) module, the engine immobilization. The ECM controls the engine crank and fuel functions and the ABS module controls the tilt function. The EMS and ABS module communicate to each other after the CJB processes the valid remote handset information.

Alarm Indicator

The alarm indicator is a Light Emitting Diode (LED) located in the instrument cluster. When the ignition is off, the indicator gives a visual indication of the active anti-theft system to show if the alarm system is set or unset.

When the ignition is on, the indicator provides a visual indication of the status of the passive anti-theft (engine immobilization) system. If the immobilization system is operating correctly, the LED will be illuminated for 3 seconds at ignition on and then extinguish.

If a fault exists in the immobilization system, the LED will be either permanently illuminated or flashing for 60 seconds. This indicates that a fault exists and a fault code has been recorded. After the 60 second period, the LED will flash at different frequencies which indicate the nature of the fault.

Item	Part Number	Description
1	-	Alarm indicator

Operation of the alarm indicator is controlled by the instrument cluster which varies the flash rate of the LED to indicate the system status of the alarm and the immobilization systems.

Alarm/Immobilization Status	Alarm Indicator Status	Alarm Indicator Function
UNSET	No flash	LED is off
SET - with perimeter alarm	Flashing	LED will flash twice quickly with a long interval between and is repeated 10 times. Slow 'active' flash then follows.
SET - with volumetric alarm	Flashing	LED will flash three times quickly with a long interval in between and is repeated 10 times. Slow 'active' flash then follows.
ACTIVE	Flashing	Slow flash once alarm is activated at a frequency of 100ms on and 200ms off.
UNSET - alarm activated during previous SET cycle	Flashing rapidly	LED will flash rapidly until the CJB receives an accessory power mode 4 signal.

VEHICLE HORNS

The vehicle horns are located in the front bumper armature. The horns are connected directly to the CJB which activates the horns when the alarm is triggered.

BATTERY BACKED SOUNDER (if fitted)

E84908

The battery backed sounder (or battery backed sounder with tilt function) is located in the LH rear corner of the engine compartment and is attached to the fire shield. The sounder is only fitted in certain markets.

On vehicles with a battery backed sounder, a tilt sensor can be incorporated which monitors the vehicle attitude. The CJB monitors the tilt sensor and can detect if the vehicle is being moved, towed or raised and activate the alarm. The type of battery backed sounder can be identified by a suffix change to the part number; sounders without a tilt sensor have the suffix 'A' and sounders with a tilt sensor have the suffix 'B'.

Operation of the sounder is controlled by the CJB on a LIN bus. The sounder is also connected with a permanent battery supply via the CJB. An integral, rechargeable battery powers the sounder if the vehicle battery supply from the CJB is interrupted.

INTRUSION DETECTION MODULE

E84909

The intrusion detection module is an optional fitment in some markets and is not available in other markets. The intrusion detection module comprises four sensors which allow the interior of the vehicle to be monitored. The module is located in a central position on the vehicle headliner.

The intrusion detection modules are activated with the volumetric mode which in turn is enabled when the vehicle is double locked. The vehicle can be locked and alarmed with the module deactivated if a pet is to be left in the vehicle for example, by single locking the active anti-theft system.

When volumetric mode is active, if the vehicle battery voltage falls to below 9 volts, the CJB will ignore any inputs from the module to prevent false alarm activation.

PRINCIPLES OF OPERATION

The CJB automatically arms and disarms the active anti-theft system when it operates the Central Locking System (CLS).

On vehicles without an intrusion detection module, only the perimeter mode is available to monitor the hinged panels and the validity of the remote handset.

When perimeter mode is active, the CJB monitors panel ajar switches located in the latch mechanisms of the front and rear doors and the liftgate. A separate hood ajar microswitch, located in RH hood latch mechanism in the engine compartment, monitors the hood status.

When volumetric mode is active, the CJB monitors the interior of the vehicle for movement using an intrusion detection module located in the centre of the headliner.

Arming

On vehicles without an intrusion detection module and a tilt sensor, the active anti-theft system is armed in the perimeter mode when the vehicle is either locked or double locked.

On vehicles fitted with an intrusion detection module, the system has 2 modes of operation; perimeter mode and volumetric mode.

Perimeter mode

Perimeter mode only monitors the hinged panels and validity of the remote handset in the start control module. Perimeter mode is activated by a single press of the lock button on the remote handset.

Volumetric Mode

Volumetric mode monitors the vehicle interior for intrusion. If the vehicle is fitted with a battery backed sounder, which incorporates a tilt sensor, the vehicle attitude is also monitored when volumetric mode is active. Volumetric mode is activated by a second press of the lock button on the remote handset. The second press of the button must occur within 3 seconds of the first press. The second press of the lock button also activates the perimeter mode double locking feature.

The CJB arms the active anti-theft system when it locks or double locks the vehicle, providing all the following conditions are met:

- All doors, liftgate and hood are closed
- The CJB is not in transit mode.

When the vehicle has successfully completed its locking routine, confirmation will be given by a single flash of the turn signal indicators to indicate the locked condition. If double locking is activated, then the confirmation will be given by a double flash of the turn signal indicators; one flash for locked and one long flash for double locked.

Mislock

If any doors, liftgate or hood is open when a lock or double lock request is received, the active anti-theft alarm system remains disarmed and the CJB generates a short mislock sound from the vehicle horns or battery backed sounder and the turn signal indicators will not flash. Each attempt to lock will be confirmed by an audible chime being emitted.

When the CJB arms the active anti-theft system, it first enables perimeter mode and monitors the status of the hinged panels. If the vehicle is fitted with a battery backed sounder, an arming signal is sent from the CJB to enable the sounder. If the vehicle is double locked and fitted with an intrusion detection module, the CJB then sends an arming signal to the module and the tilt sensor when double locked. The CJB ignores the signals from the intrusion detection module for the first 30 seconds to allow time for the vehicle interior to settle and prevent false alarm activation.

If the liftgate is opened via the remote handset, the intrusion detection module and the tilt sensor are inhibited until the liftgate is closed.

Disarming

The CJB will disarm the active anti-theft system to prevent false alarm activation under certain conditions as follows:

- When the active anti-theft system is armed in volumetric mode, if the vehicle battery voltage decreases to less than 9 volts, the CJB will disable the volumetric mode and remain in perimeter mode only. This prevents false alarm activation because the intrusion detection module cannot operate correctly below 9 volts.
- On vehicles fitted with a battery backed sounder, if the vehicle battery voltage decreases from 9.5 to 9 volts in more than a 30 minute period, the CJB de-activates the battery backed sounder and, if required, will use the vehicle horns to sound an audible alarm trigger warning. This prevents false alarm activation. At voltages below 9 volts, the CJB will not generate the 'heartbeat' signal to the battery backed sounder. The battery backed sounder interprets this as the CJB has been tampered with and activates its sounder. If the battery voltage subsequently rises to more than 9.5 volts, the CJB will re-arm the battery backed sounder.
- If the vehicle is unlocked using the unlock button on the remote handset and, within 60 seconds a hinged panel is not opened, the CJB automatically re-locks the vehicle and re-arms the active anti-theft system (if the 'auto re-lock' feature is enabled). This prevents leaving the vehicle unlocked and disarmed by accidental operation of the remote handset unlock button.

Alarm

When the alarm is triggered, the CJB activates audible and visual warnings. The audible warnings are produced by the vehicle's horns or the battery backed sounder. Visible indications are produced using the turn signal indicators.

The CJB activates the vehicle horns or battery backed sounder and the visual indications for 30 seconds. The activation is stopped for 5 seconds and, if the alarm trigger is still present, the CJB will cycle again for 30 seconds (60 seconds in certain markets). This will be repeated for up to a maximum of 10 cycles (3 cycles in certain markets) of 30 seconds (60 seconds in certain markets) for any one arming period. The CJB will de-activate the alarm if the 10 cycles (3 cycles in certain markets) have been completed and the alarm trigger is still present or until it receives a disarm signal.

• NOTE: If the battery backed sounder is triggered due to tamper detection, the visual indication using the turn signal indicators is not activated.

The alarm can be triggered by any of the hinged panels being opened, the intrusion detection module detects a movement inside the vehicle, the tilt sensor detects vehicle movement or an ignition tamper is detected (invalid remote handset).

Battery Backed Sounder

When the CJB arms the active anti-theft system, in either the perimeter mode or the volumetric mode, the CJB sends an arming signal to the battery backed sounder on the LIN bus. When the system is armed in the volumetric mode, the CJB also sends an arming signal to the tilt sensor (if fitted).

• NOTE: If a battery backed sounder is fitted, it is also armed with the perimeter mode lock request.

On receipt of the arming signals, the sounder and the tilt sensor respond with a status message. If the CJB does not receive the status signals within 12 seconds, the CJB assumes there is a fault and responds with a disarm signal to either the sounder and/or the tilt sensor and stores a related fault code. If the sounder is disarmed when the active anti-theft system is armed and the system is subsequently triggered, the CJB energizes the horn relay and uses the vehicle horns to sound the audible warning in place of the sounder.

When the sounder is armed, the CJB sends a periodic (heartbeat) signal to the sounder which prompts the sounder to monitor the vehicle battery supply and the LIN bus link with the CJB. The sounder will operate if:

- it receives an alarm signal from the CJB or the tilt sensor
- the power supply or the LIN bus link to the CJB is disrupted.

The tilt sensor measures the longitudinal and lateral angle of the vehicle over a range of ±16 degrees from the horizontal. When the active anti-theft system is armed in volumetric mode, the tilt sensor stores the current vehicle angles in its memory and monitors the tilt sensor readings. If the vehicle angle changes in either direction by more than the alarm limit, the tilt sensor activates the sounder.

If the alarm system is active and the battery or the battery backed sounder is disconnected, the sounder will operate without the visual indication of the turn signal indicators flashing.

Global Open/Close

The global open/close feature allows the user to fully raise/lower the windows with a single press of a remote handset button. The button must be pressed and held for more than 2 seconds. Either or both global open/close functions can be disabled using a Land Rover approved diagnostic system.

• NOTE: Remote global close is not available in certain markets, North American Specification (NAS) for example.

Single Point Entry

The single point entry feature only unlocks the driver's door and the liftgate, all other doors remain locked. A single press of the unlock button on the remote handset will unlock only the driver's door and the liftgate, a second press is required to unlock the remaining doors.

If the vehicle is double locked, the first press of the unlock button on the remote handset unlocks the driver's door and the liftgate. The remaining doors revert to the single locked state and can therefore be unlocked using the interior door handles, the remote handset unlock button or the unlock switch on the instrument panel switchpack.

Changing from central locking to single point entry can be carried out by pressing the lock and unlock buttons on the remote handset simultaneously. The turn signal indicators will flash to confirm that the function change has been performed.

Drive Away Locking

The drive away door locking feature locks the doors and the liftgate if they are unlocked when the vehicle reaches a certain speed.

On vehicles with automatic transmission, with all the doors, liftgate and hood closed and the gear selector not in 'P' Park or 'N' Neutral position, if the CJB detects, via a high speed CAN message from the Anti-lock Brake System (ABS) module, that the vehicle speed is more than 7 km/h (5 mph), the doors will automatically lock.

On vehicles with manual transmission, with all the doors, liftgate and hood closed, if the CJB detects, via a high speed CAN message from the ABS module, that the vehicle speed is more than 7 km/h (5 mph), the doors will automatically lock.

Remote Handset Additional Features

The remote handset has convenience buttons in addition to the lock and unlock buttons.

Panic Alarm

The panic alarm feature allows the user to activate the vehicle alarm system using the remote handset. The 'panic button', identified by a triangle symbol, can be pressed 3 times within 3 seconds or pressed and held for more than 3 seconds to activate the panic alarm.

Global Open/Close

A global open and close feature can be operated from the remote handset. This feature allows the vehicle windows to be opened/closed by a single press of the lock or unlock button. The button must be pressed and held for more than 2 seconds to activate the global open/close feature. The global open/close feature is not available in all markets.

Liftgate Release

A liftgate release button can pressed to unlock and release the liftgate latch only. This will operate with the vehicle locked and alarmed or unlocked. If the vehicle is locked and alarmed, when the liftgate release button is pressed, the liftgate can be opened without triggering the alarm system. When the liftgate is subsequently closed, the alarm will be re-activated.

Headlamp Convenience

A headlamp convenience button can be pressed to operate the headlamps to assist departure or approach to the vehicle. A single press of the button will operate the headlamps for approximately 25 seconds, after which time they will automatically turn off. A second press of the button will turn off the headlamps if the 25 second period has not been reached. Pressing the stop/start button within the 25 second period will also turn off the headlamp convenience feature.

Convenience mode

When the vehicle is unlocked using the unlock button on the remote handset, the vehicle's electrical system initiates convenience mode. The following systems become active:

- Memory - seat adjustment and mirror position
- Interior and exterior lighting
- Audio system
- Instrument cluster message centre
- Horn
- Cigar lighter/power socket.

Published: 11-May-2011

Anti-Theft - Active - Anti-Theft - Active

Diagnosis and Testing

The complexity of the electronics involved with the anti-theft system, and the multiplexed communication network which are connected to it, preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the manufacturer approved diagnostic system for detailed instructions on testing the anti-theft system.

The manufacturer approved diagnostic system systematically tests and analyses all functions and the various systems affected by it.

Where a fault is indicated, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged before installing a new component.

Published: 11-May-2011

Anti-Theft - Active - Anti-Theft Alarm Horn with Integral Battery

Removal and Installation

Removal

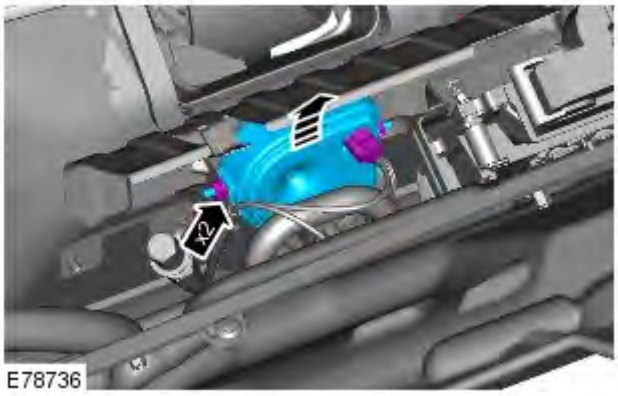
- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



3. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

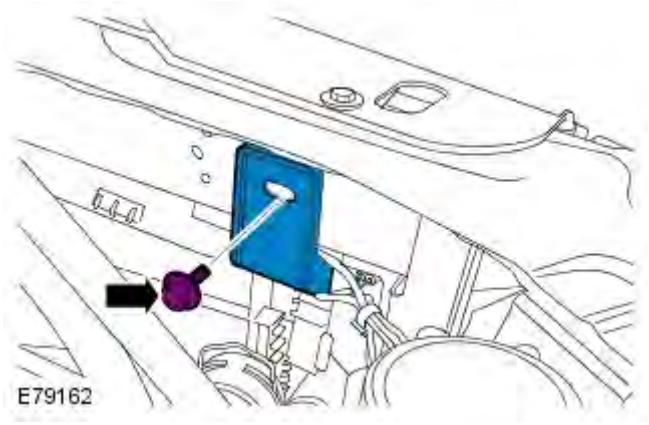
Published: 11-May-2011

Anti-Theft - Active - Hood Switch

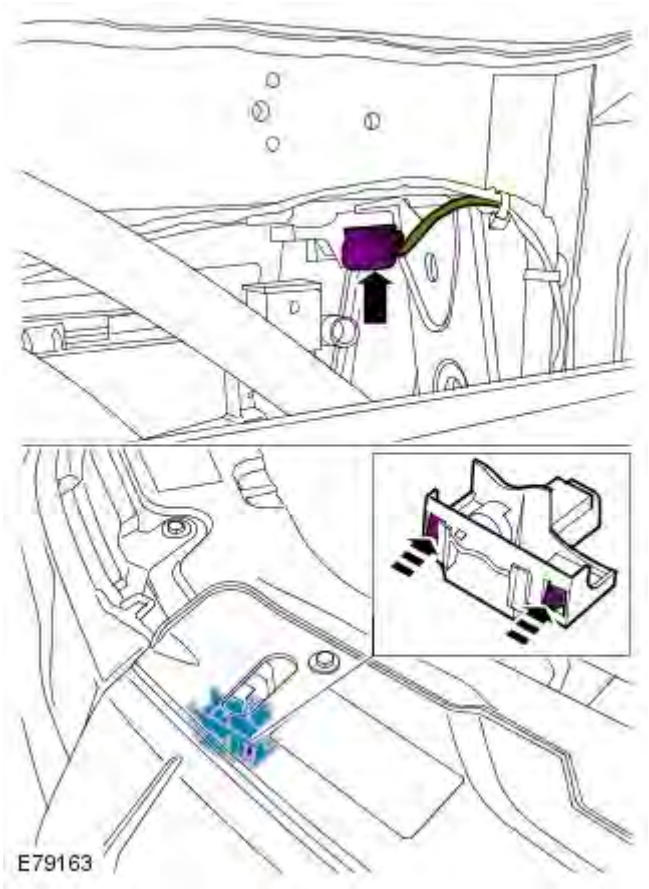
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 10 Nm



2.

Installation

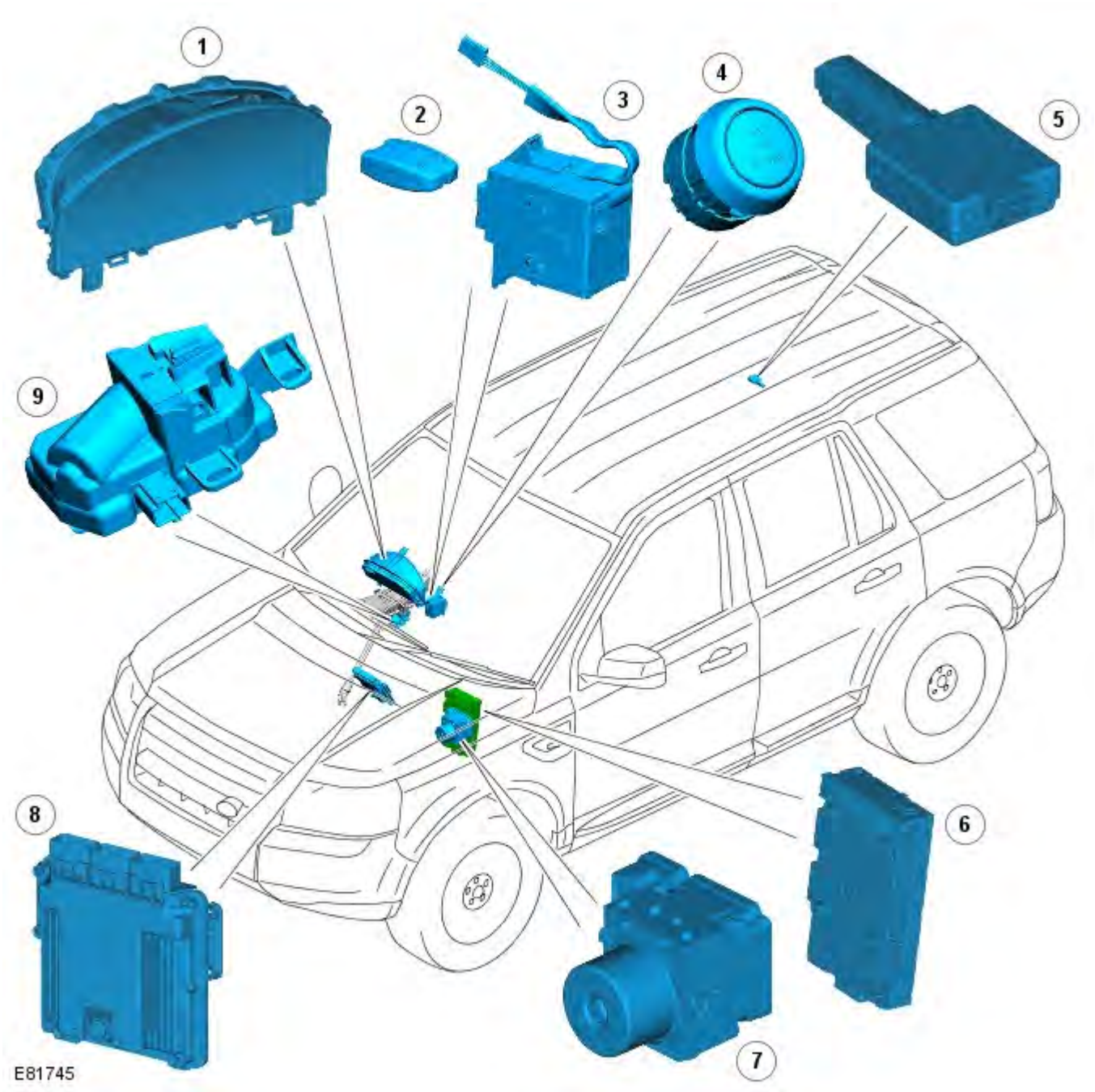
1. To install, reverse the removal procedure.

Published: 11-May-2011

Anti-Theft - Passive - Anti-Theft - Passive

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Instrument cluster
2	-	Remote handset
3	-	Start control module
4	-	Stop/Start switch
5	-	Radio Frequency (RF) receiver
6	-	Central Junction Box (CJB)
7	-	Anti-lock Brake System (ABS) module
8	-	Engine Control Module (ECM)
9	-	Electric steering column lock

OVERVIEW

The Passive Anti-Theft System (PATS - immobilization) provides a secure interface between the CJB , ECM and ABS module to prevent unauthorized starting of the vehicle. This is achieved by having uniquely coded remote handset and encoded data exchange between modules.

Unauthorized starting prevention is achieved by immobilization of the engine crank system, fuel system and ignition system.

The passive anti-theft system uses the following components:

- Remote handset transponder
- CJB
- ECM
- Start control module
- Instrument cluster
- ABS module
- Electric steering column lock (if enabled).

• NOTE: On North American Specification (NAS) vehicles, a running change was introduced during 2008 Model Year (MY) to disable the electric steering column lock. Under the change, the internal electronics (printed circuit board (PCB), motor, etc.) of the lock have been removed and the lock has been disabled in the car configuration file. The change is incorporated on VIN (vehicle identification number) 082896, 085531, 085622, 085685, 085832, 085891, 085942, 085987, 086049, 086081, 086123, 086178, 086276, 086287, 086309, 086363, 086383, 086389, 086398, 086403 and 091770 onwards.

The system is automatic and requires no input from the driver. The engine management system will only allow engine crank when an authorization data message is received from the CJB. The engine start system is initiated when the start/stop switch and the brake pedal (automatic transmission) or the clutch pedal (manual transmission) are pressed simultaneously.

The engine management system (ECM) will only allow engine crank, spark (petrol models only) and injector functions when the following conditions are met:

- A hardwired Park/Neutral signal is received from the Transmission Control Module (TCM) (automatic transmission only)
- A hardwired ignition signal is received from the CJB
- A hardwired crank request signal is received from the CJB
- Encrypted data exchange between the instrument cluster and the ECM is verified.

Before the CJB will send the hardwired ignition signal, it must satisfactorily complete the following:

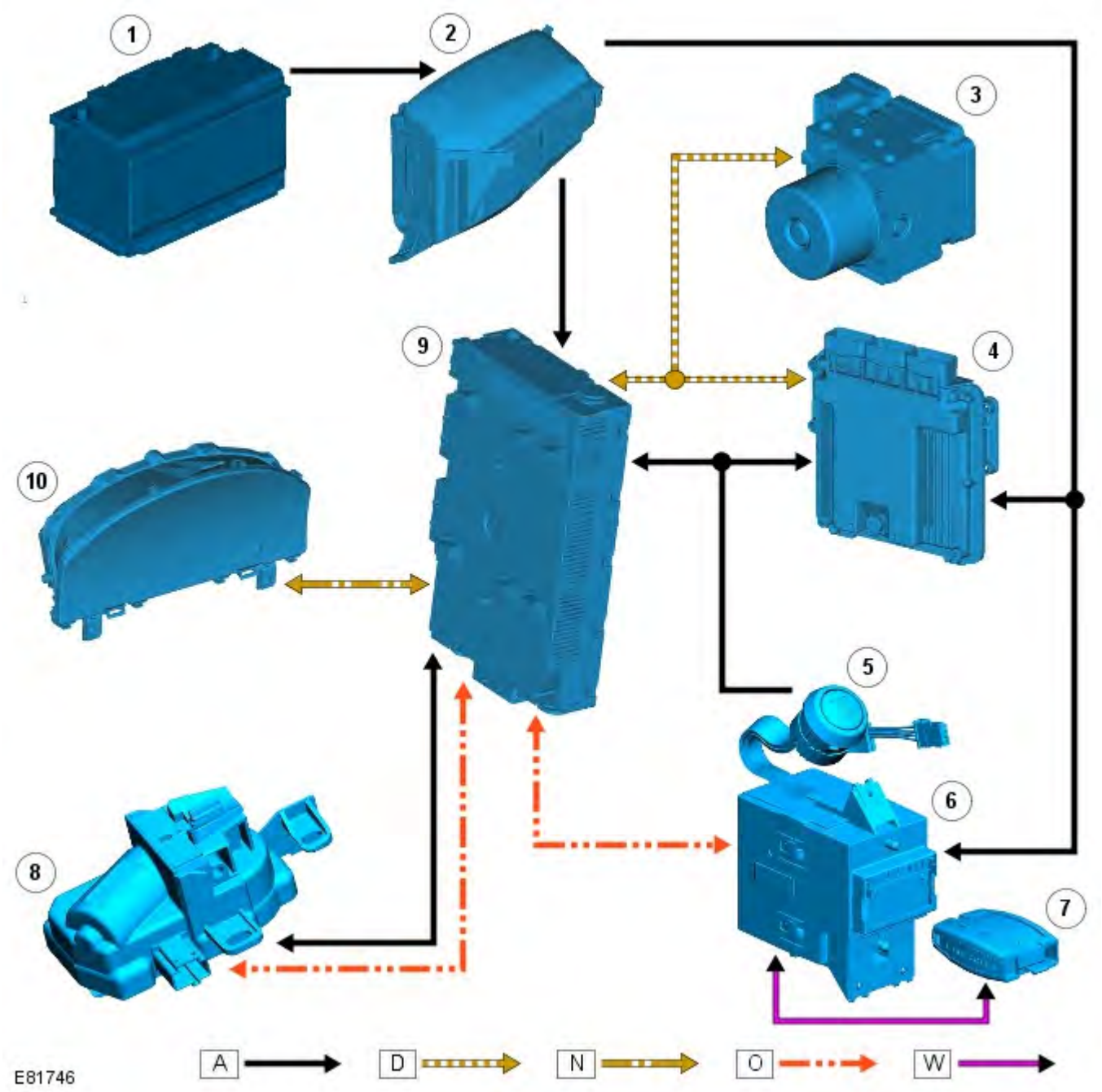
- Exchanged encrypted data with the start control module to validate the remote handset.

Additionally, before the CJB will send the hardwired crank request signal it must receive the following signals:

- Brake signal from the brake switch (automatic transmission) or clutch signal from the clutch switch (manual transmission)
- Hardwired transmission in Park (P) signal from the selector lever assembly (automatic transmission only).

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus; **O** = LIN bus; **W** = LF transmission



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box (BJB)
3	-	ABS module
4	-	ECM
5	-	Stop/Start switch
6	-	Start control module
7	-	Remote handset
8	-	Electric steering column lock (if enabled)
9	-	CJB
10	-	Instrument cluster

START CONTROL MODULE

The start control module is located in the instrument panel, adjacent to the steering column. The start control module is used as a primary method to authorize the remote handset.

The remote handset is inserted into the start control module slot with the key fob loop trailing. The start control module is motorized and will draw the remote handset into the slot once inserted.

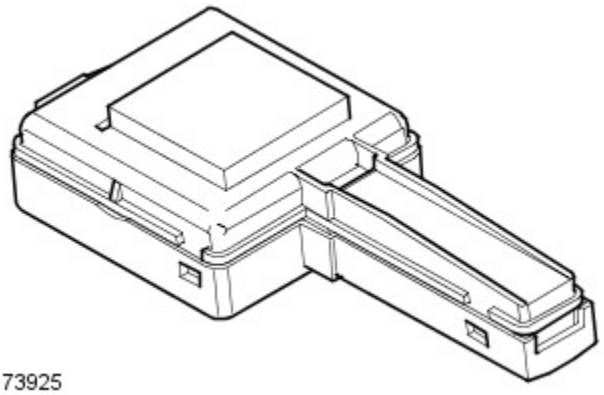
The start control module will then read the transponder within the remote handset and, if the transponder identification is valid, pass the identification data to the CJB to be processed.

Five seconds after the remote handset is inserted in the start control module, the module will start to charge the remote handset battery.

A message 'KEY IN' will be displayed if the remote handset is still in the start control module and the driver's door is

opened. The remote handset is removed from the start control module by gently pushing the remote handset into the start control module and releasing. The start control module motor will then drive the remote handset out from the slot as long as the ignition is off.

RF RECEIVER



The Radio Frequency (RF) antenna is located in a central position behind the head liner. The receiver is available in two variants; 315 MHz or 433 MHz depending on market requirements. Transmissions are received from the remote handset for key identification and remote lock/unlock requests or requests for operation of the additional driver convenience features.

PRINCIPLES OF OPERATION

The remote handset is validated via the start control module and the CJB. If the remote handset is valid the CJB initiates the unlocking of the electric steering column lock (if enabled). Once the electric steering column lock is unlocked and power has been removed, then the CJB enables the Fuel Pump Driver Module (FPDM) on petrol vehicles or the fuel pump relay on diesel vehicles.

The CJB also controls the engine crank request. On vehicles with automatic transmission, if the transmission selector lever is in the Park 'P' position and the driver presses the brake pedal or on manual transmission vehicles if the driver presses the clutch pedal and simultaneously presses the start/stop switch, the CJB interprets this as an engine crank request. Before the engine crank request is allowed, the CJB checks for the brake or clutch switch signal. If the signal is correct then the CJB sends a crank request signal to the ECM on the high speed Controller Area Network (CAN) bus.

If a replacement remote handset is required, then a Land Rover approved diagnostic system must be used to synchronize the remote handsets. If any module, which is involved in the remote handset authorization process, require replacement, a Land Rover approved diagnostic system procedure is also required to synchronize the replacement module into the system.

Published: 11-May-2011

Anti-Theft - Passive - Anti-Theft - Passive

Diagnosis and Testing

Principles of Operation

For a detailed description of the Passive Anti-Theft System (PATS), refer to the relevant Description and Operation section in the workshop manual.
REFER to: Anti-Theft - Passive (419-01B Anti-Theft - Passive, Description and Operation).

Inspection and Verification

The best method to confirm the correct operation of the Passive Anti-Theft System (PATS) is to check the LED (located in the center of the instrument panel). The LED should illuminate solid for 3 seconds, when the ignition status is set to ON, and then extinguish. This validates all PATS functions (i.e. the key transponder matches a stored key code, the challenge/response sequence between the respective modules was successful resulting in the EMS being enabled).

Ignition Fails to Operate

Check that the key is correctly inserted into the start control unit (SCU) and that it is the correct key for the vehicle (Key will be ejected from the SCU if it is not programmed or from another vehicle). If the vehicle is an automatic, ensure that the Park position is selected and if manual, ensure it is in the Neutral position.

Check that the start button circuit to the Central Junction Box (CJB) is not open circuit or short to ground.

Check that the CAN network is not malfunctioning, i.e. open circuit or short circuit. This would mean that the CJB, ECM and Instrument Cluster would be unable to communicate. Check these modules for related DTCs and refer to relevant DTC Index.

Engine Fails to Crank

The immobilizer status indication LED is displayed in the bottom left of the instrument pack. When the key is inserted into the SCU, the LED will be turned on for 3 seconds and then turned off. The LED will flash slowly (once every 2 seconds) if the vehicle is immobilised (transponder not approved). Additionally the diagnostic system should be used to check for Diagnostic Trouble Codes (DTCs) from the CJB, instrument cluster, ECM and the ABS module.

One potential occurrence for the vehicle failing to crank on an Automatic Transmission could be due to the Locked in park switch.

Check the Crank request circuit from the CJB to ECM for short circuit or open circuit.

Check the Starter Relay Circuit.

Check that the Steering Column Lock (SCL) is operating correctly. Inserting the key should drive the SCL to un-lock and steering wheel should move freely.

Check the CAN network is not malfunctioning, i.e. the CAN circuit is open or short circuit. This would mean that the CJB, instrument cluster, ECM or ABS module would not be able to communicate resulting in no challenge being made from the modules for the Immobilisation data.

Also on an Automatic, check the CAN network between the CJB and the Transmission Control Module (TCM). The CJB uses the "LockedInP" signal transmitted by the TCM to determine if the transmission is in Park before allowing crank, the CJB uses a value of 0x01, if the CJB sees a value less than this it will not allow crank, and key will not be ejected from SCU.

For a manual gearbox the clutch pedal has to be de-pressed, hence check the CAN network between the CJB and the ECM to ensure the clutch is depressed, ClutchPedalSwitch75pct = TRUE and ClutchPedalPressed2 = True. The Vehicle will not crank until these signals are set.

On an Automatic vehicle, check the CAN network between the ABS module and the CJB. The CJB uses a signal "BrakePedalActive" to determine if the brake pedal has been depressed in order to allow the engine to crank. The CJB uses a value = TRUE if the CJB does not receive this signal, it will not allow the crank request output.

Engine Cranks But Will Not Start

If the engine is cranking it means that the EMS has passed the authorisation required with the CJB. If this authorisation failed, the ECM would not engage the starter relay. This could be confirmed by verifying the LED in the left of the Instrument pack being illuminated for 3 seconds on Key insertion, or by reading DTCs from the CJB or the ECM.

In all cases of suspected non-start issues, the most logical failure modes should be eliminated first. i.e.

- 1. Check all relevant supplies and grounds to the relevant modules are ok.
- 2. Note any unusual behaviour from other systems/functionality.
- 3. Note any functions that are not operating as expected.

Fault Codes/DTCs

For the various PATS modes of operation/failures listed in the table, the CJB will store a DTC which will not be shown to the customer.

When the Key is inserted and ignition status ON is achieved, if the start authorisation passes, the LED in the bottom left of the instrument cluster will illuminate for 3 seconds then go off. If start authorisation fails, the LED will continue to flash every 2 seconds. Please see table below for a list of fault codes that will be stored under certain conditions. For additional information.
REFER to: Starting System (303-06A Starting System - I6 3.2L Petrol, Diagnosis and Testing) /

Electronic Engine Controls (303-14A Electronic Engine Controls - I6 3.2L Petrol, Diagnosis and Testing) / Electronic Engine Controls (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Diagnosis and Testing).

Mode of Operation/ Failure	When Logged	Ignition Status	DTC	Indication
Prove out	N/A	Transition from OFF to ON	N/A	3 Seconds of LED illumination
SCU internal failure	Key insert	Any	B102496	Warning message displayed
Lost communication with SCU (SCU no response)	Key insert	Any	B102487	Warning message displayed
SCU incorrect response	Key insert	Any	B102481	Warning message displayed
SCU not programmed	Key insert	Any	B102451	Warning message displayed
Key transponder no response	Key insert	Any	B102408	Warning message displayed
Transponder incorrect response	Key insert	Any	B102581	Warning message displayed
TP communication error	Key insert	Any	B102408	Warning message displayed
Number of keys programmed below minimum	Manufacturer/Dealer	Any	B10D800	No indication
Key not programmed	Manufacturer/Dealer	Any	B10D751	No indication
SCL not programmed	Manufacturer/Dealer	Transition from OFF to ON	B102651	Warning message displayed
Lost communication with ECM	N/A	Any	U010000	Warning message displayed

Published: 11-May-2011

Multifunction Electronic Modules -

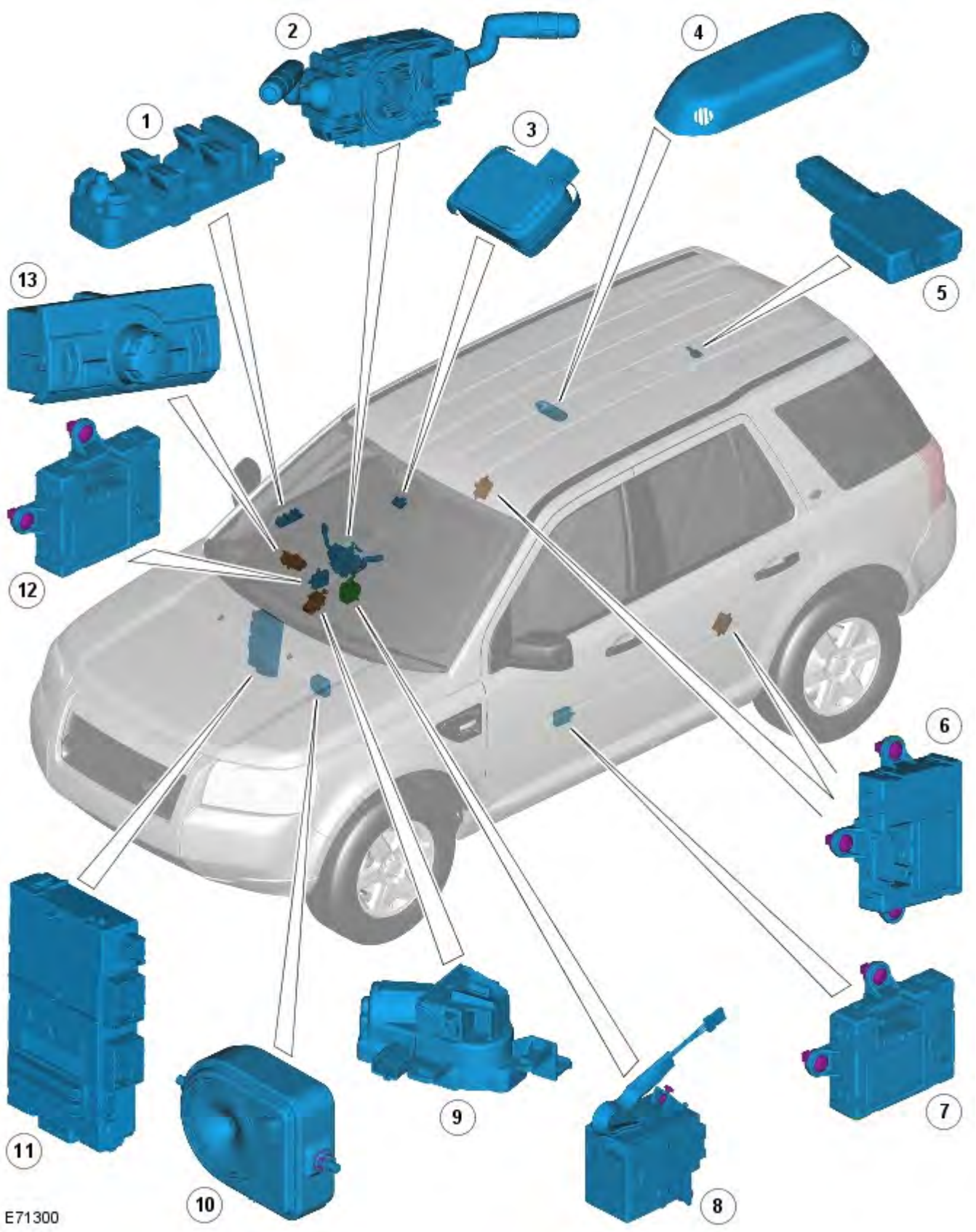
Torque Specifications

Description	Nm	lb-ft
Cellular phone antenna Torx screw	10	7
Front door module	1	1
Rear door module	1	1

Multifunction Electronic Modules - Module Controlled Functions

Description and Operation

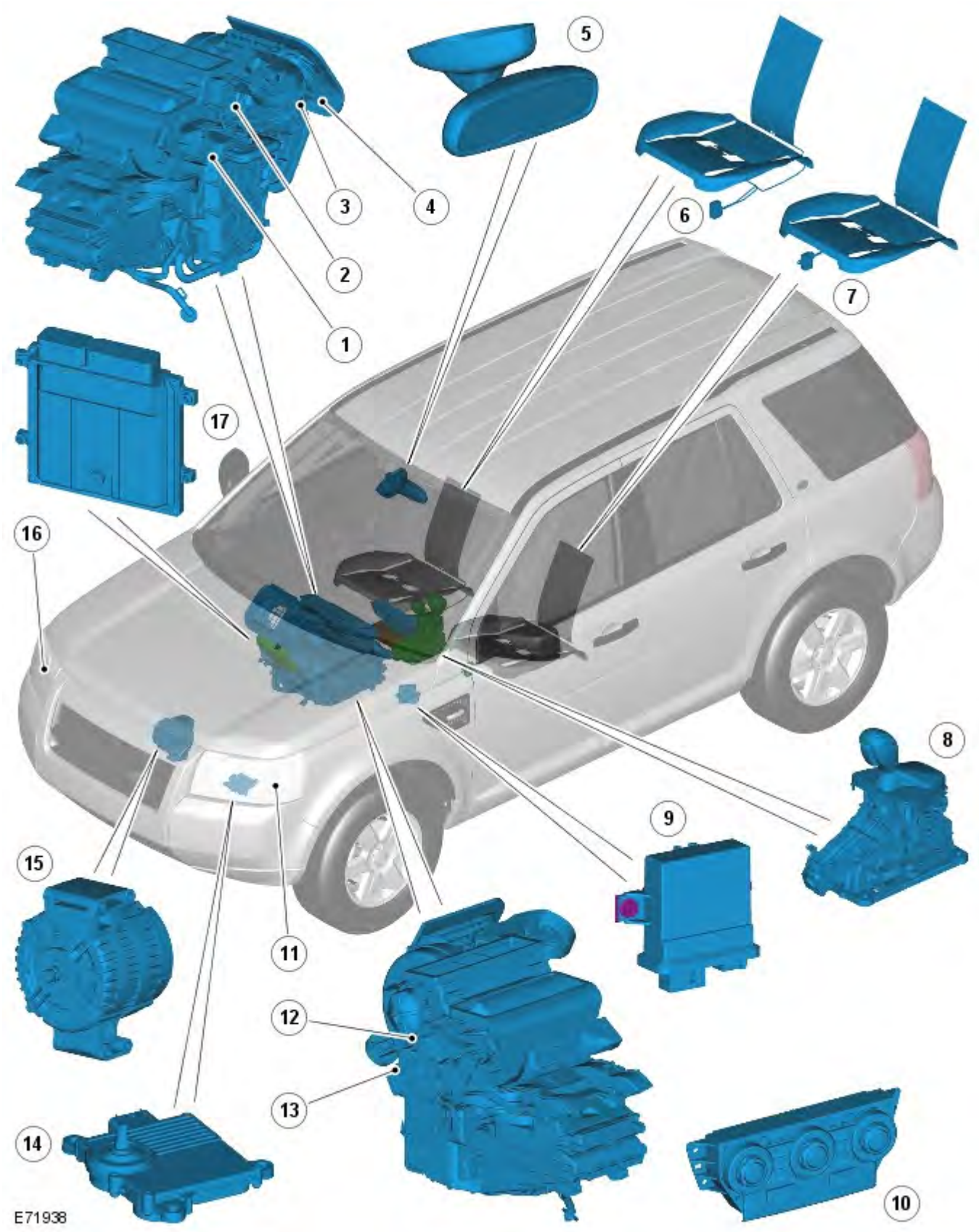
COMPONENT LOCATION - LIN BUS (SHEET 1 OF 2)



Item	Part Number	Description
1	-	Driver's door switchpack
2	-	Steering wheel module
3	-	Rain sensor
4	-	Volumetric sensor

5	-	RF receiver
6	-	Left Hand (LH) / Right Hand (RH) rear door modules
7	-	Passenger door module
8	-	Start control module
9	-	Electronic steering column lock
10	-	Battery Backed-Up Sounder (BBUS)
11	-	Central Junction Box (CJB)
12	-	Driver's door module
13	-	Light switch module

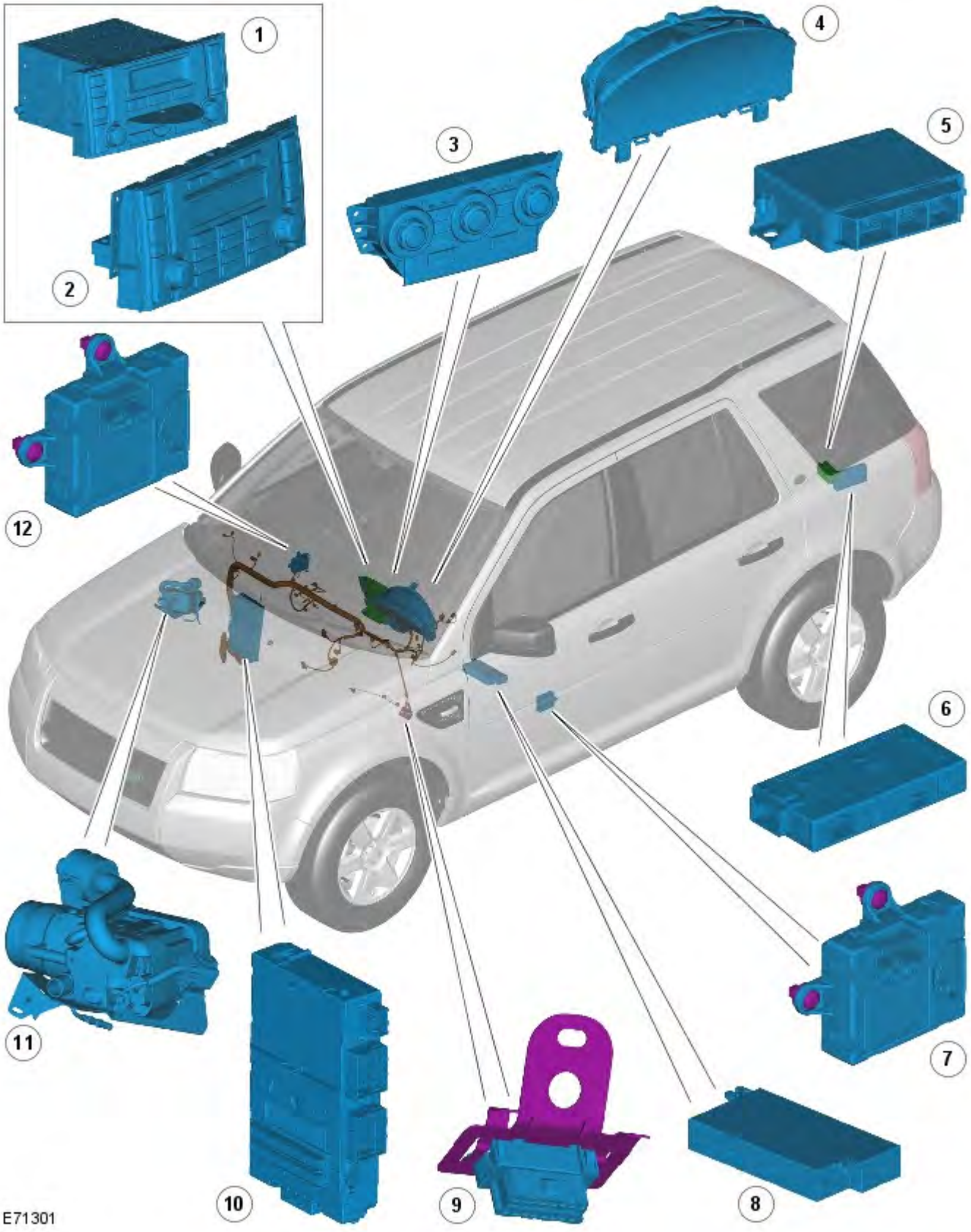
COMPONENT LOCATION - LIN BUS (SHEET 2 OF 2)



Item	Part Number	Description
1	-	Flap actuator module 1
2	-	Flap actuator module 2
3	-	Flap actuator module 3
4	-	Air quality sensor
5	-	Humidity sensor
6	-	RH seat heat module
7	-	LH seat heat module
8	-	Selector lever module
9	-	Headlamp levelling control module
10	-	Automatic Temperature Control (ATC) module
11	-	LH headlamp control unit
12	-	Flap actuator module 4
13	-	Flap actuator module 5
14	-	Transmission Control Module (TCM)
15	-	Generator control module
16	-	RH headlamp control unit
17	-	Engine Control Module (ECM)

COMPONENT LOCATION - MEDIUM SPEED CAN BUS

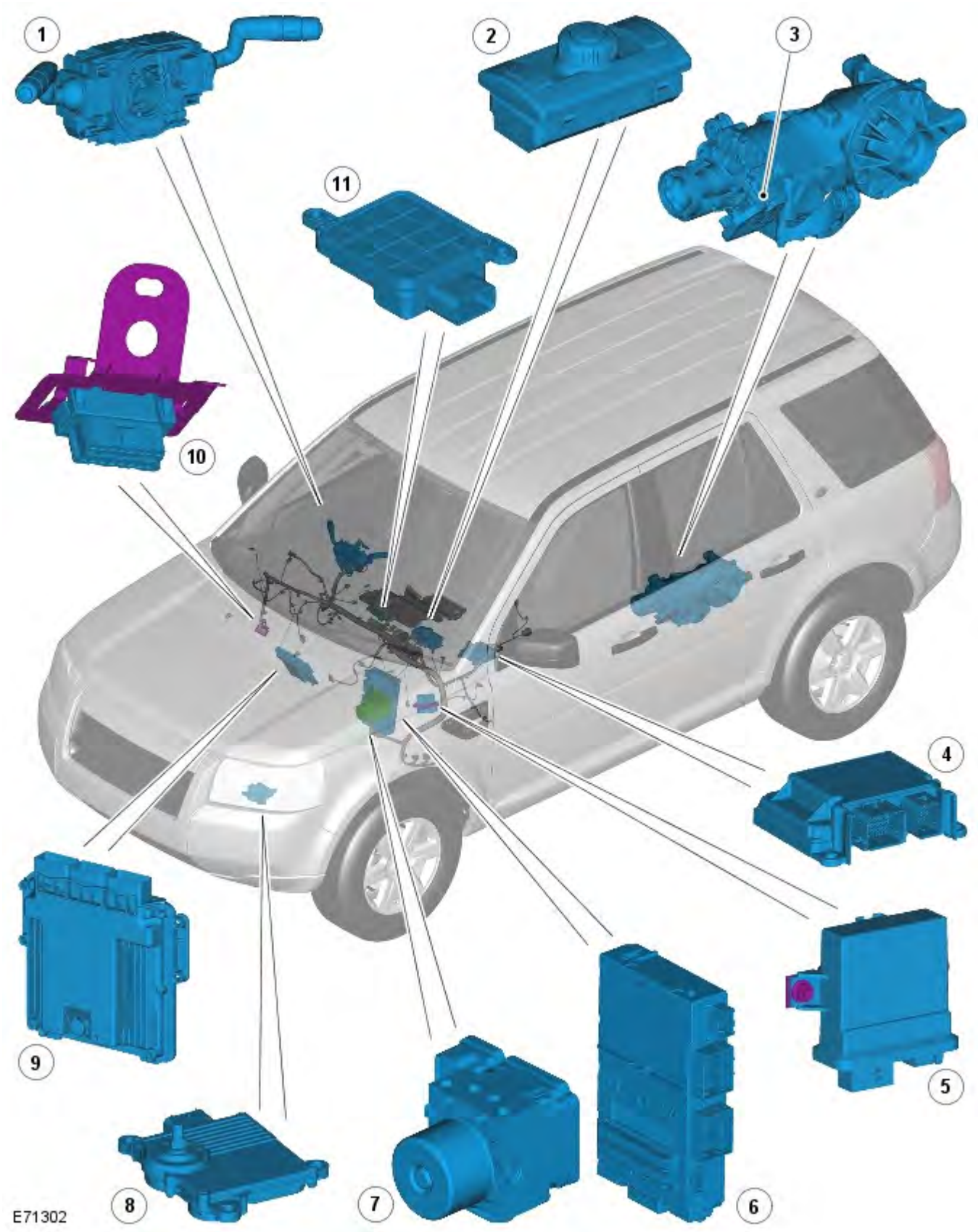
- NOTE: NOTE: Left hand drive vehicle shown



Item	Part Number	Description
1	-	Integrated Control Module (ICM) - Lo-Line audio system
2	-	Integrated Control Module (ICM) - Hi-Line audio system
3	-	ATC module
4	-	Instrument cluster
5	-	Parking aid module
6	-	Trailer module
7	-	Driver's door module
8	-	Seat memory module
9	-	Diagnostic socket
10	-	CJB
11	-	Fuel fired heater module

12	-	Passenger door module

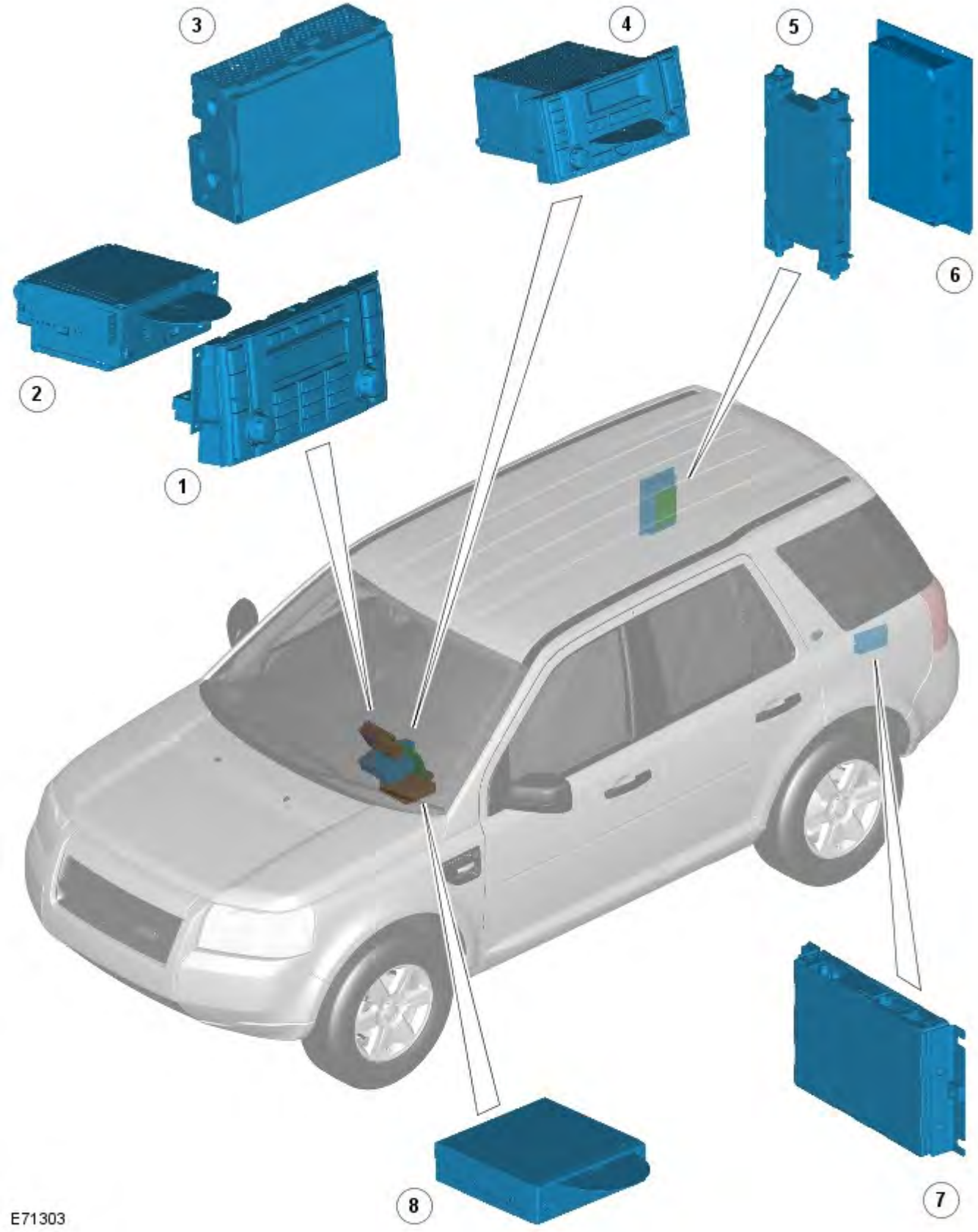
COMPONENT LOCATION - HIGH SPEED CAN BUS



Item	Part Number	Description
1	-	Steering angle sensor
2	-	Terrain Response control module
3	-	Electronic rear differential control module
4	-	Restraints Control Module (RCM)
5	-	Headlamp levelling control module
6	-	CJB
7	-	Anti-lock Brake System module

8	-	TCM
9	-	Engine Control Module (ECM)
10	-	Diagnostic socket
11	-	Occupant Classification Sensor (OCS - NAS only

COMPONENT LOCATION - MOST



Item	Part Number	Description
1	-	Integrated control Module (ICM) - Face plate
2	-	Integrated Head Unit (IHU) - Hi-Line

3	-	Touch Screen Display (TAD)
4	-	Integrated Head Unit (IHU) - Hi-Line
5	-	Bluetooth phone module
6	-	Amplifier/tuner
7	-	Digital Audio Broadcast (DAB) receiver
8	-	Navigation computer

OVERVIEW

The vehicle electrical system comprises a number of control modules which are interconnected via several network systems.

The following network systems are used on the vehicle:

- High Speed Controller Area Network bus
- Medium speed CAN bus
- Local Interconnect Network (LIN) bus
- Media Orientated Systems Transport (MOST) system.

The CJB is the 'gateway' for the network systems which allows information to be exchanged between networks.

The entertainment system components are connected on a fiber optic MOST system. The MOST system can send and receive information to/from the other network systems via a 'gateway' in the Integrated Control Module.

The following table shows each vehicle control module, the network system to which it is connected, its function and location in the vehicle.

Module	Network System	Function	Vehicle Location
CJB	High speed CAN bus	Controls body functions and power distribution	Passenger footwell, behind glovebox
Steering angle sensor	High speed CAN bus	Transmits steering positional information	Integral with the steering wheel clockspring
Diagnostic socket	High speed CAN bus	Allows the transfer of vehicle information using IDS or other diagnostic tool	Driver's footwell on underside of instrument panel
RCM	High speed CAN bus	Controls deployment of supplementary restraint components	Rear of centre console, below arm rest
TCM	High speed CAN bus	Controls automatic transmission operation	Mounted on the top of the transmission housing
ECM	High speed CAN bus	Controls engine management and fuel system operation	Mounted between the bulkheads in the engine compartment
ABS module	High speed CAN bus	Controls all aspects of the braking system	Mounted between the bulkheads on LH side of engine compartment
Headlamp levelling module	High speed CAN bus	Controls the dynamic headlamp levelling function	Passenger footwell, behind the glovebox
Occupant classification sensor (NAS only)	High speed CAN bus	Detects when a passenger is in the front passenger seat	Underside of passenger seat
Terrain Response module	High speed CAN bus	Controls the Terrain Response system using data from other vehicle systems	Integral with Terrain Response rotary control
Electronic differential control module	High speed CAN bus	Controls the operation of the electronic differential	Mounted on front of rear differential
CJB	Medium speed CAN bus	Controls body functions and power distribution	Passenger footwell, behind glovebox
Fuel fired heater module	Medium speed CAN bus	Controls operation of the fuel fired heater	Integrated with the ATC module
Diagnostic socket	Medium speed CAN bus	Allows the transfer of vehicle information using IDS or other diagnostic tool	Driver's footwell on underside of instrument panel
Passenger door module	Medium speed CAN bus	Controls window and locking functions	Mounted in passenger door
Parking aid module	Medium speed CAN bus	Controls parking aid system	Mounted on LH rear suspension turret
Seat memory module	Medium speed CAN bus	Controls driver seat positioning and also memory functions of other driver personalised functions	Under driver's seat
Trailer module	Medium speed CAN bus	Controls operation of trailer lamps and also informs CJB that trailer connected	LH side of luggage compartment, behind suspension turret
Instrument cluster/Driver Information Module	Medium speed CAN bus	Receives data from other systems to provide driver information	Instrument panel
Driver's door module	Medium speed CAN bus	Controls window and locking functions	Mounted in driver's door
ATC module	Medium speed CAN bus	Contains controls for the heating and air conditioning systems	Mounted in centre console

Module	Network System	Function	Vehicle Location
Integrated Control Module	Medium speed CAN bus	Contains controls for the entertainment system and gateway between audio system and other vehicle systems	Integral part of head unit, located in centre console
Integrated Head Unit (IHU)	Medium speed CAN bus	Contains controls for the entertainment system	Integral part of head unit, located in centre console
RH rear door module	LIN	Controls window and locking operation	Mounted in RH rear door
LH rear door module	LIN	Controls window and locking operation	Mounted in LH rear door
Generator	LIN	Provide load signal to ECM	Located in engine compartment. Location on engine dependent on engine fitment.
RH front seat heat module	LIN	Used by ATC to control seat heater temperature	Underside of seat
LH front seat heat module	LIN	Used by ATC to control seat heater temperature	Underside of seat
Air quality sensor	LIN	Measures air quality in the vehicle interior	Fitted to the heater assembly
Flap actuator module 1	LIN	Moves flaps within the heater assembly to direct air flow to different parts of the interior	Part of the heater assembly
Flap actuator module 2	LIN	Moves flaps within the heater assembly to direct air flow to different parts of the interior	Part of the heater assembly
Flap actuator module 3	LIN	Moves flaps within the heater assembly to direct air flow to different parts of the interior	Part of the heater assembly
Flap actuator module 4	LIN	Moves flaps within the heater assembly to direct air flow to different parts of the interior	Part of the heater assembly
Flap actuator module 5	LIN	Moves flaps within the heater assembly to direct air flow to different parts of the interior	Part of the heater assembly
Humidity sensor	LIN	Measures air quality in the vehicle interior	Integral with the interior rear view mirror
HVAC control module	LIN	Controls operation of the HVAC system functions	Integral with HVAC controls panel in centre console
Steering wheel module	LIN	Converts analogue signals from steering wheel switches into digital messages	Behind steering wheel clockspring
Battery backed sounder	LIN	Activated by CJB when alarm trigger is received	Mounted in a central position between the bulkheads in the engine compartment
Electric steering column lock	LIN	Controls the locking and unlocking of the steering column	On underside of steering column, under lower column shroud
CJB	LIN	Control body functions and power distribution	Passenger footwell, behind glovebox
Light switch module	LIN	Control of headlamp operation and levelling	Driver's side of instrument panel
Volumetric sensor	LIN	Detects movement in vehicle interior and activates anti-theft alarm system	In housing in centre of headlining
Rain sensor module	LIN	Detects moisture on the windshield	At top of windshield
Start control unit	LIN	Used to identify the remote handset - component of the keyless start system	In instrument panel, adjacent to the steering column
RF receiver	LIN	Receives RF transmissions from the TPMS system and the remote handset	Positioned adjacent to the rear interior lamp, behind the headlining
Headlamp levelling module	LIN	Controls the dynamic headlamp levelling functions	Passenger footwell, behind glovebox, integral with headlamp levelling module
RH headlamp	LIN	Provides positional information to the headlamp levelling module	Attached to the headlamp assembly
LH headlamp	LIN	Provides positional data to the headlamp levelling module	Attached to the headlamp assembly
Driver's window switch	LIN	Controls operation of the driver's window	Mounted in driver's door
Driver's door module	LIN	Controls window and locking functions	Mounted in driver's door
Passenger door module	LIN	Controls window and locking functions	Mounted in passenger door
Transmission selector lever module	LIN	Sends selector lever position to the TCM	Located below centre console
TCM	LIN	Receives selector lever position information to control transmission operation	Mounted on the top of the transmission housing
Integrated Control Module	MOST	Contains controls for the entertainment system and gateway between audio system and other vehicle systems	Integral part of head unit, located in centre console
Integrated Head Unit	MOST	Contains controls for the entertainment system	Integral part of head unit, located in centre console
Digital Audio Broadcast (DAB) receiver	MOST	Receives digital radio broadcasts	Mounted in LH side of the luggage compartment
Bluetooth phone module	MOST	Controls the operation of the Bluetooth phone system	Mounted in RH side of the luggage compartment
Amplifier/Tuner	MOST	Provides amplification for the entertainment systems and reception of radio RF broadcasts	Mounted in RH side of the luggage compartment
Navigation computer	MOST	Reads map data from a DVD to calculate and display visual route guidance information via the TAD and audible guidance via the amplifier to the driver	Below the IHU in the centre console

Module	Network System	Function	Vehicle Location
Touch Screen Display (TAD)	MOST	Provides the driver interface to the entertainment, navigation and driver personalisation functions	Above the IHU in the centre console

Published: 11-May-2011

Multifunction Electronic Modules - Multifunction Electronic Module

Diagnosis and Testing

Description and Operation

For a detailed description of the multifunction electronic control modules, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Module Controlled Functions (419-10 Multifunction Electronic Modules, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of electrical damage.

Visual Inspection

Electrical
• Fuse(s) • Electrical connector(s) • Wiring Harness

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

• NOTE: The DTC Index in this section shows information for DTCs that could be logged in the Driver Door Module (DDM) or Passenger Door Module (PDM). For diagnosis and testing information for: Driver Seat module.
REFER to: Seats (501-10 Seating, Diagnosis and Testing).
Information and Entertainment module.
REFER to: Information and Entertainment System (415-01 Information and Entertainment System, Diagnosis and Testing).

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B108F23	Cabin Lock/Unlock Switch	• Signal stuck low	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B109C15	Front Courtesy Light	• Short to power or open circuit	Refer to the electrical circuit diagrams and test front courtesy light circuit for short to power or open circuit
B109D11	Front Courtesy Light	• Short to ground	Refer to the electrical circuit diagrams and test front courtesy light circuit for short ground
B10EB11	Driver door double locking motor	• Short to ground	Refer to the electrical circuit diagrams and test driver door double locking motor circuit for short ground
B10EB15	Driver door double locking motor	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver door double locking motor circuit for short to power or open circuit
B10EC11	Passenger door double locking motor	• Short to ground	Refer to the electrical circuit diagrams and test passenger door double locking motor circuit for short ground
B10EC15	Passenger door double locking motor	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger door double locking motor circuit for short to power or open circuit

DTC	Description	Possible Cause	Action
B10ED11	Rear door driver side double locking motor	• Circuit short to ground	Refer to the electrical circuit diagrams and check rear door driver side double locking motor control circuit for short to ground
B10ED15	Rear door driver side double locking motor	• Circuit short to power or open	Refer to the electrical circuit diagrams and check rear door driver side double locking motor control circuit for short to power, open circuit
B10EE11	Rear door passenger side double locking motor	• Circuit short to ground	Refer to the electrical circuit diagrams and check rear door passenger side double locking motor control circuit for short to ground
B10EE15	Rear door passenger side double locking motor	• Circuit short to power or open	Refer to the electrical circuit diagrams and check rear door passenger side double locking motor control circuit for short to power, open circuit
B110811	Driver door central locking motor	• Short to ground	Refer to the electrical circuit diagrams and test driver door central locking motor circuit for short ground
B110815	Driver door central locking motor	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver door central locking motor circuit for short to power or open circuit
B110911	Passenger door central locking motor	• Short to ground	Refer to the electrical circuit diagrams and test passenger door central locking motor circuit for short ground
B110915	Passenger door central locking motor	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger door central locking motor circuit for short to power or open circuit
B110A11	Rear door driver side central locking motor	• Circuit short to ground	Refer to electrical circuit diagrams and check rear door driver side central locking motor control circuit for short to ground
B110A15	Rear door driver side central locking motor	• Circuit short to power or open	Refer to electrical circuit diagrams and check rear door driver side central locking motor control circuit for short to power, open circuit
B110B11	Rear door passenger side central locking motor	• Circuit short to ground	Refer to electrical circuit diagrams and check rear door passenger side central locking motor control circuit for short to ground
B110B15	Rear door passenger side central locking motor	• Circuit short to power or open	Refer to electrical circuit diagrams and check rear door passenger side central locking motor control circuit for short to power, open circuit
B116311	Left Mirror Heater Output short to ground	• Short to ground	Refer to the electrical circuit diagrams and test left mirror heater output circuit for short to ground
B116315	Left Mirror Heater Output short to power	• Short to power or open circuit	Refer to the electrical circuit diagrams and test left mirror heater output circuit for short to power or open circuit
B116411	Right Mirror Heater Output short to ground	• Short to ground	Refer to the electrical circuit diagrams and test right mirror heater output circuit for short to ground
B116415	Right Mirror Heater Output short to power	• Short to power or open circuit	Refer to the electrical circuit diagrams and test right mirror heater output circuit for short to power or open circuit
B116511	Left Front Puddle Lamp Output short to ground	• Short to ground	Refer to the electrical circuit diagrams and test left front puddle lamp output circuit for short to ground
B116515	Left Front Puddle Lamp Output open load or short to power	• Short to power or open circuit	Refer to the electrical circuit diagrams and test left front puddle lamp output circuit for short to power or open circuit
B116611	Right Front Puddle Lamp Output short to ground	• Short to ground	Refer to the electrical circuit diagrams and test right front puddle lamp output circuit for short to ground
B116615	Right Front Puddle Lamp Output open load or short to power	• Short to power or open circuit	Refer to the electrical circuit diagrams and test right front puddle lamp output circuit for short to power or open circuit
B117C07	Rear Power Window up	• Mechanical Failure	Check for mechanical failure of rear window mechanism
B117C72	Rear Power Window up	• Actuator Stuck Open	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117C73	Rear Power Window up	• Actuator Stuck Closed	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117C92	Rear Power Window up	• Performance or incorrect operation	Refer to electrical circuit diagrams and check power and ground supplies to rear door module
B117D72	Rear Power Window down	• Actuator Stuck Open	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117D73	Rear Power Window down	• Actuator Stuck Closed	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117E07	Front Power Window up	• Mechanical failure	Check for mechanical failure of front window mechanism

DTC	Description	Possible Cause	Action
B117E72	Front Power Window up	• Actuator stuck open	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117E73	Front Power Window up	• Actuator stuck closed	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F72	Front Power Window down	• Actuator stuck open	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F73	Front Power Window down	• Actuator stuck closed	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B118929	Front Window Position Sensor	• Signal invalid	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B118A29	Rear Window Position Sensor	• Signal invalid	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B11D183	LIN Bus Circuit "C"	• Value of signal protection calculation incorrect	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
B11D186	LIN Bus Circuit "C"	• Signal Invalid	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
B11D187	LIN Bus Circuit "C"	• Missing Message	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
B11F611	Driver Folding Mirror Motor	• Short To Ground	Refer to electrical circuit diagrams and check driver folding mirror motor for short to ground
B11F615	Driver Folding Mirror Motor	• Short to power or open	Refer to electrical circuit diagrams and check driver folding mirror motor for short to power, open circuit
B11F711	Passenger Folding Mirror Motor	• Short To Ground	Refer to electrical circuit diagrams and check passenger folding mirror motor for short to ground
B11F715	Passenger Folding Mirror Motor	• Short to power or open	Refer to electrical circuit diagrams and check passenger folding mirror motor for short to power, open circuit
B1A9411	Driver Mirror	• Short to ground	Refer to the electrical circuit diagrams and test driver mirror fold motor circuit for short to ground
B1A9415	Driver Mirror	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver mirror fold motor circuit for short to power or open circuit
B1A9511	Passenger Mirror	• Short to ground	Refer to the electrical circuit diagrams and test passenger mirror fold motor circuit for short to ground
B1A9515	Passenger Mirror	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger mirror fold motor circuit for short to power or open circuit
B1A9883	LIN Bus Circuit #1	• Value of signal protection calculation incorrect	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test LIN circuit between driver side rear door module and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
B1A9886	LIN Bus Circuit #1	• Signal Invalid	Refer to the electrical circuit diagrams and test LIN circuit between driver side rear door module and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
B1A9887	LIN Bus Circuit #1	• Missing Message	Refer to the electrical circuit diagrams and test LIN circuit between driver side rear door module and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).

DTC	Description	Possible Cause	Action
B1C0911	Driver Left/Right Mirror Motor Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver left/right mirror motor circuit for short to ground
B1C0915	Driver Left/Right Mirror Motor Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver left/right mirror motor circuit for short to power or open circuit
B1C1011	Driver Up/Down Mirror Motor Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver up/down mirror motor circuit for short to ground
B1C1015	Driver Up/Down Mirror Motor Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver up/down mirror motor circuit for short to power or open circuit
B1C1111	Passenger Left/Right Mirror Motor Circuit	• Short to ground	Refer to the electrical circuit diagrams and test passenger left/right mirror motor circuit for short to ground
B1C1115	Passenger Left/Right Mirror Motor Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger left/right mirror motor circuit for short to power or open circuit
B1C1211	Passenger Up/Down Mirror Motor Circuit	• Short to ground	Refer to the electrical circuit diagrams and test passenger up/down mirror motor circuit for short to ground
B1C1215	Passenger Up/Down Mirror Motor Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger up/down mirror motor circuit for short to power or open circuit
B1C1311	Driver Up/Down Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to ground
B1C1315	Driver Up/Down Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to power or open circuit
B1C1411	Driver Left/Right Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to ground
B1C1415	Driver Left/Right Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to power or open circuit
B1C1511	Passenger Up/Down Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to ground
B1C1515	Passenger Up/Down Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to power or open circuit
B1C1611	Passenger Left/Right Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to ground
B1C1615	Passenger Left/Right Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to power or open circuit
B1C3929	Key Lock Switch	• Signal invalid	Carry out the associated pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1B1411	Sensor Supply #1	• Short to ground	Refer to the electrical circuit diagrams and test front window sensor supply circuit for short to ground
C1B1415	Sensor Supply #1	• Short to power or open circuit	Refer to the electrical circuit diagrams and test front window sensor supply circuit for short to power or open circuit
C1B1511	Sensor Supply #2	• Short to ground	Refer to the electrical circuit diagrams and test rear window sensor supply circuit for short to ground
C1B1515	Sensor Supply #2	• Short to power or open circuit	Refer to the electrical circuit diagrams and test rear window sensor supply circuit for short to power or open circuit
U001000	Medium speed CAN communication Bus	• Medium speed CAN communication Bus	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost communication with CJB	• Logged when subscribed CAN message missing from CJB	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U020800	Lost communication With Driver Seat Module (DSM)	• Missing message	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	• Invalid configuration message is received	Re-configure the CJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the DDM/PDM, refer to the new module installation note at the top of the DTC Index
U200224	Switch	• Signal stuck high	Clear DTC and re-test. If DTC remains, install a new passenger side window switch
U200424	Auxiliary Switch Pack	• Signal stuck high	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
U201011	Switch illumination	• Circuit short to ground	Carry out CAN network tests using the manufacturer approved diagnostic system
U201012	Switch illumination	• Circuit short to power	Carry out CAN network tests using the manufacturer approved diagnostic system
U201208	Car Configuration Parameter(s)	• Bus signal/message failures	Cycle the ignition status and re-test. If DTC remains, re-configure the RJB using the manufacturer approved diagnostic system
U201324	Switch Pack	• Signal stuck high	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and re-test. If DTC remains, install a new driver side window switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
U201444	Control module hardware	• Data Memory Failure	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
U210000	Initial configuration not complete	• No sub type information	Re-configure the DDM/PDM using the manufacturer approved diagnostic system
U300049	Control module	• Internal electronic failure	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
U300255	Vehicle Identification Number (VIN)	• Not configured	Re-configure the relevant module as new using the manufacturer approved diagnostic system and re-test. If DTC remains install a new module, refer to the new module installation note at the top of the DTC Index
U300281	Vehicle Identification Number (VIN)	• Vehicle/component mis-match. Corrupt VIN data being transmitted, module previously installed to other vehicle	Install original module, check for DTCs and refer to relevant DTC Index
U300362	power voltage	• Mis-match of power voltage, of 2 volts or lower, between DDM/PDM and CJB	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Published: 11-May-2011

Multifunction Electronic Modules - Front Door Module (FDM)

Removal and Installation

Removal

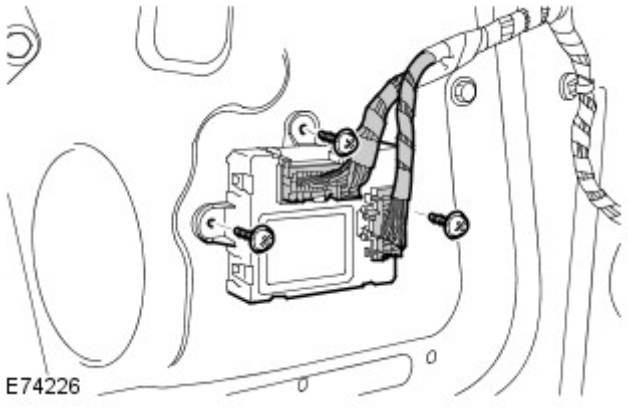
1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the front door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



Installation

1. To install, reverse the removal procedure.

2. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Multifunction Electronic Modules - Rear Door Module (RDM)

Removal and Installation

Removal

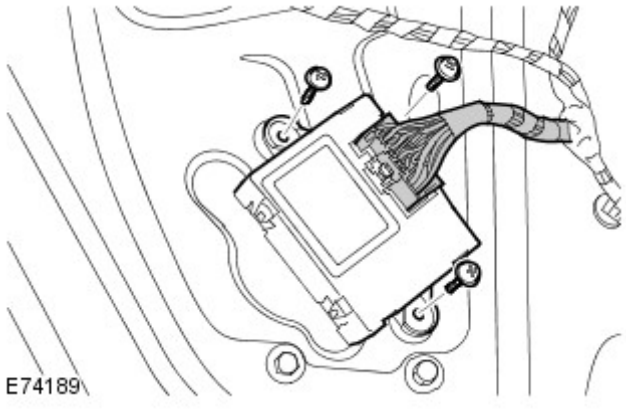
1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the rear door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



Installation

1. To install, reverse the removal procedure.

2. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Multifunction Electronic Modules - Driver Seat Module (DSM)

Removal and Installation

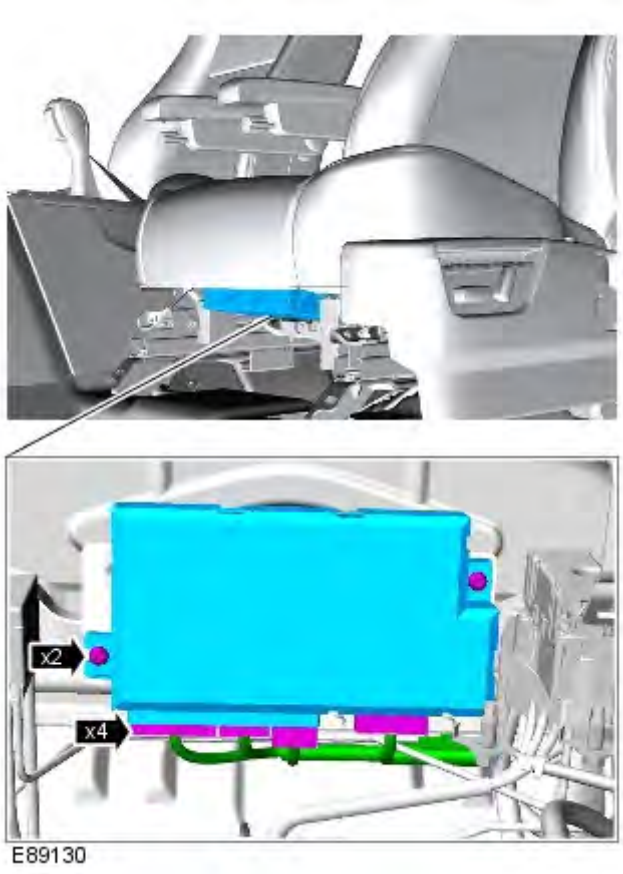
Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cover and disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. *Torque:* 7 Nm



Installation

1. To install, reverse the removal procedure.

2. Using the Land Rover approved diagnostic system, calibrate a new module.

Published: 11-May-2011

Front End Body Panels -

Torque Specifications

Description	Nm	lb-ft
Coldzone main panel screws	10	7
Engine undershield bolts	60	42
Fender splash shield	6	4
Front fender bolts	10	7
Hood hinge bolts	24	18
Hood latch panel bolts	24	18
Secondary bulkhead center panel	10	7

Published: 11-May-2011

Front End Body Panels -

Torque Specifications

Description	Nm	lb-ft
Coldzone main panel screws	10	7
Engine undershield bolts	60	42
Fender splash shield	6	4
Front fender bolts	10	7
Hood hinge bolts	24	18
Hood latch panel bolts	24	18
Secondary bulkhead center panel	10	7

Published: 11-May-2011

Front End Body Panels - Fender Splash Shield

Removal and Installation

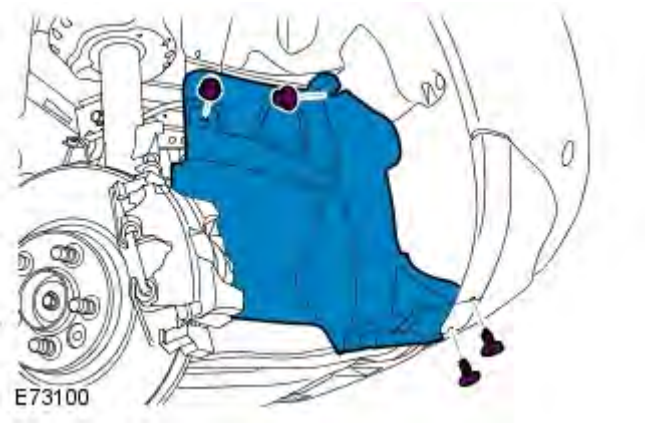
Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

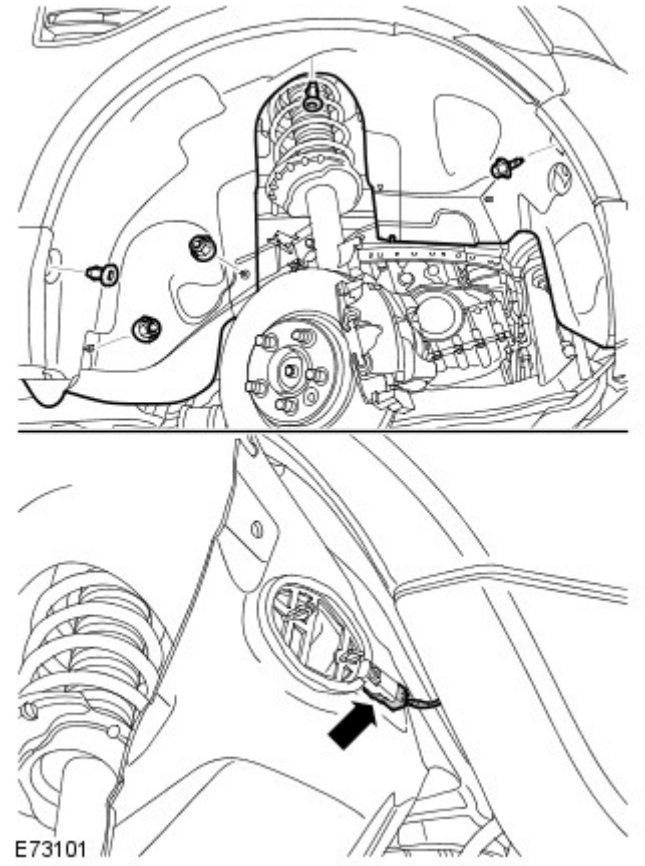
   Raise and support the vehicle.

2. Remove the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



3. Remove the fender splash shield extension panel.



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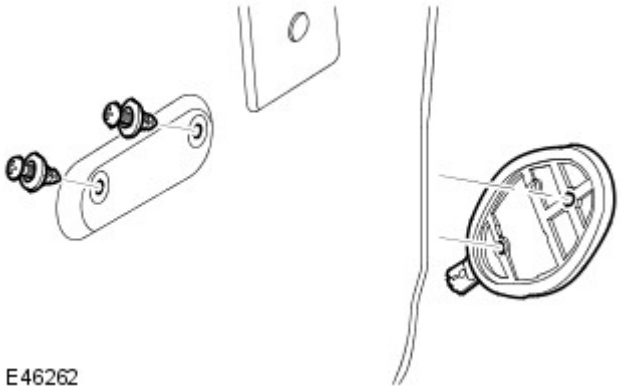


5. **5.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. Install the tire pressure antenna.
2. Install the fender splash shield and tighten the Torx screw to 6 Nm (4 lb.ft).
3. Install the fender splash shield extension panel.
4. Install the front wheel.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Front End Body Panels - Engine Undershield

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. *Torque:* 60 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Front End Body Panels - Secondary Bulkhead Center PanelI6 3.2L Petrol

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

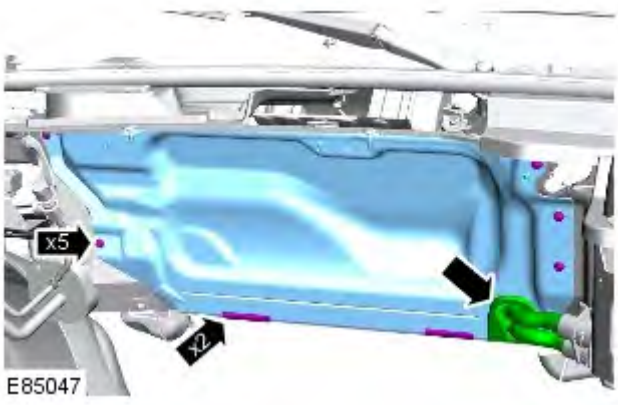
2. Remove the engine cover.

   Refer to: Engine Cover - I6 3.2L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the plenum chamber.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

4. Release the secondary bulkhead center panel pad.



5. *Torque:* 10 Nm

6.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Front End Body Panels - Secondary Bulkhead Center PanelTD4 2.2L Diesel

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

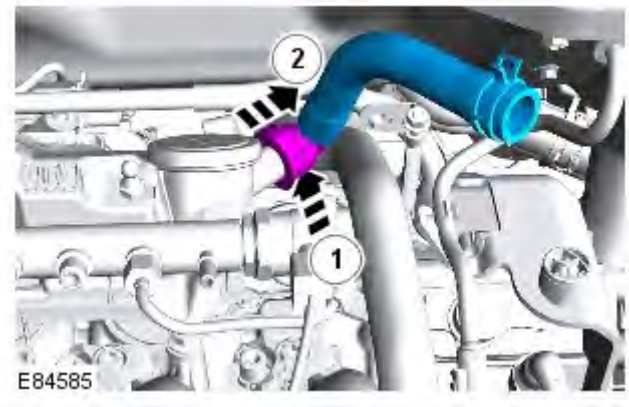
2. Remove the engine cover.

   Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the plenum chamber.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

4.



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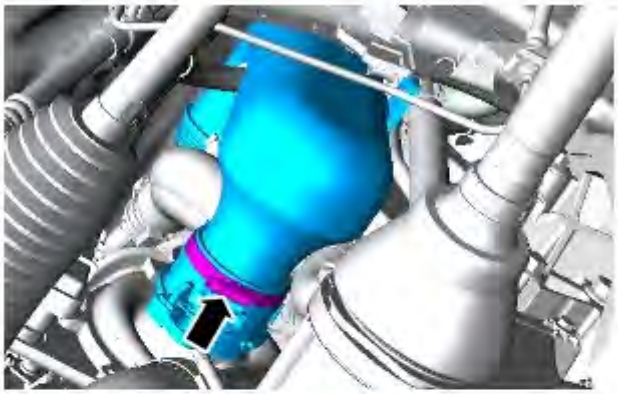
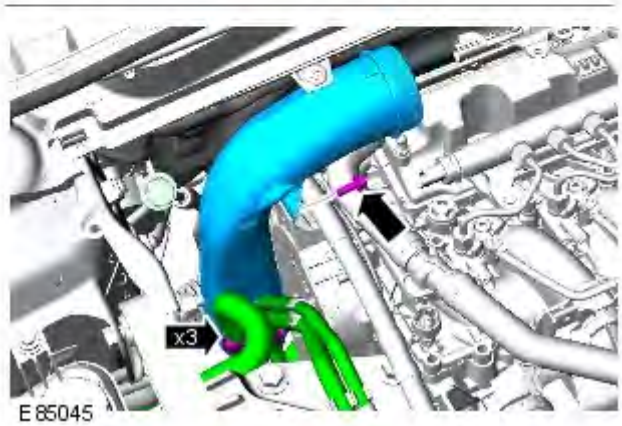
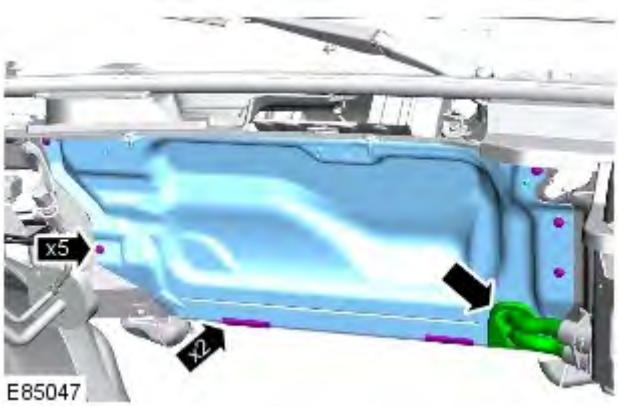




6. Release the secondary bulkhead center panel pad.

7. *Torque:* 10 Nm



8.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Front End Body Panels - Hood Latch Panel

Removal and Installation

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the headlamps.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

3. **3.** NOTE: Do not disassemble further if the component is removed for access only.

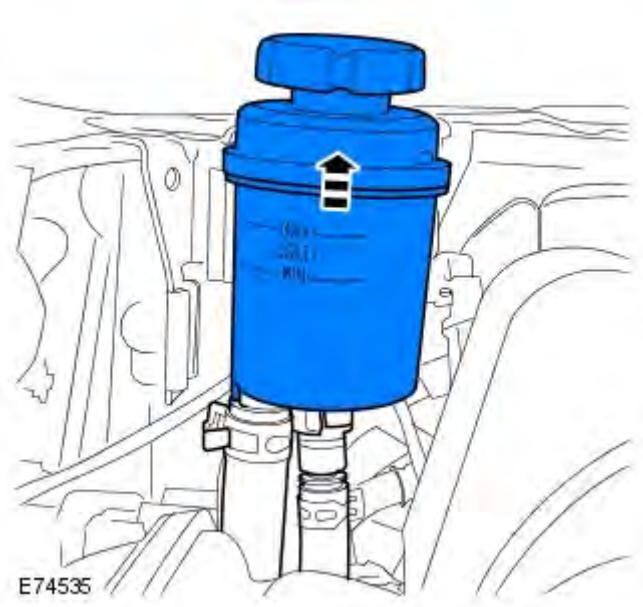
   Remove the front impact sensors.

   Refer to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).

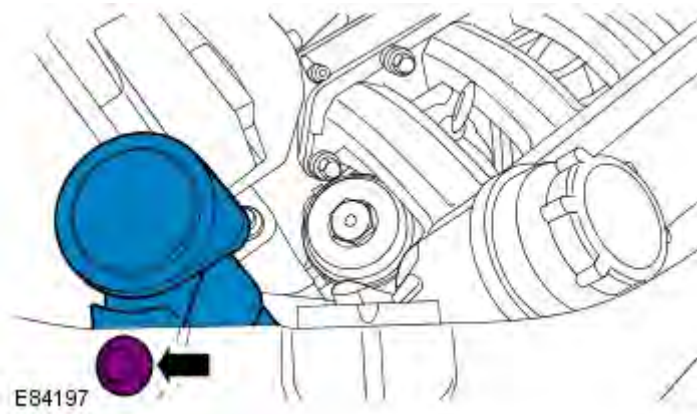
4. Remove the front fenders.

   Refer to: Fender (501-02 Front End Body Panels, Removal and Installation).

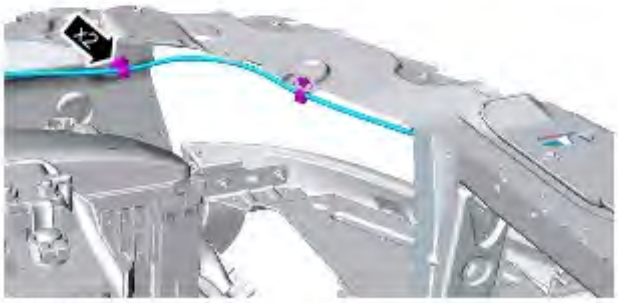
5. Release and tie aside the power steering reservoir.



6. Release the windshield washer reservoir filler neck.



7. Release the hood latches.



E84198

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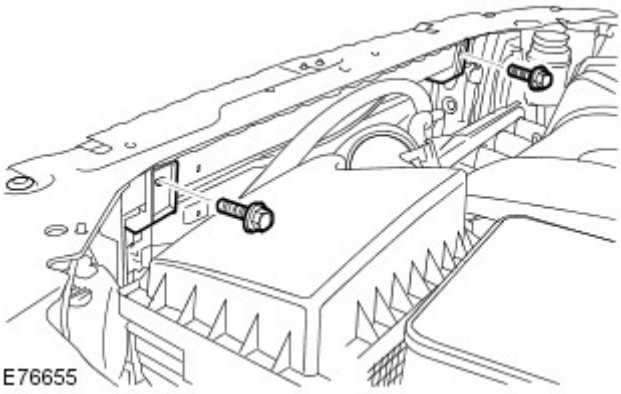

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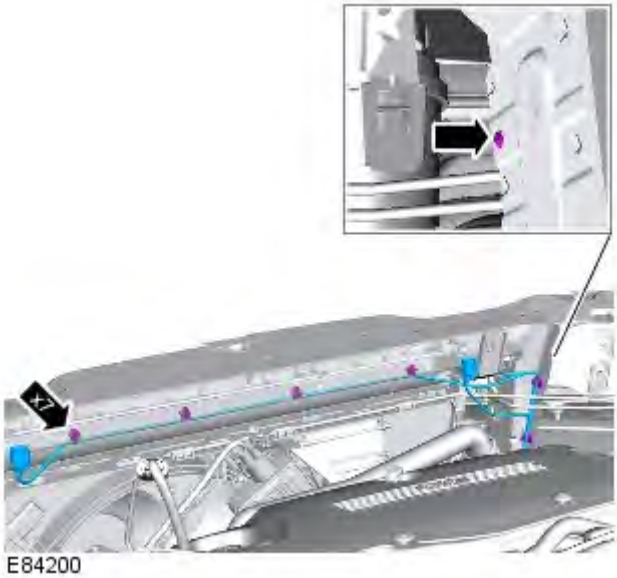
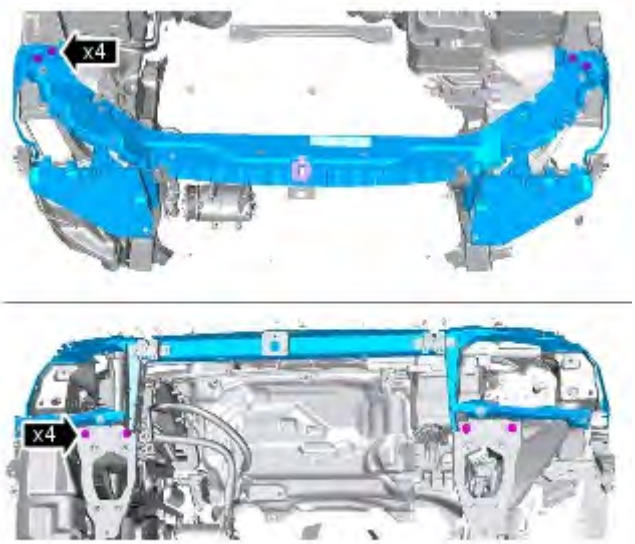


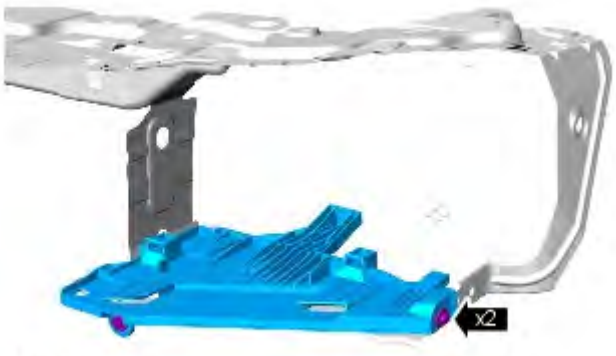
E84200

9. Release the harness.



E84201

10. **10.** WARNING: This step requires the aid of another technician.



E84203

11. **11.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. Install the headlamp brackets.

Torque: 6 Nm

2. **2.** WARNING: This step requires the aid of another technician.

   Install the hood latch panel.

   Torque: 24 Nm

3. Secure the electrical harness.

4. Install the radiator mountings.

   Torque: 6 Nm

5. Install the hood latches.

   Torque: 10 Nm

6. Install the windshield washer reservoir filler neck.

   Torque: 6 Nm

7. Install the power steering fluid reservoir.

8. Install the front impact sensors.

   Refer to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).

9. Install the front fenders.

   Refer to: Fender (501-02 Front End Body Panels, Removal and Installation).

10. Install the headlamps.

    Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

Published: 11-May-2011

Body Closures -

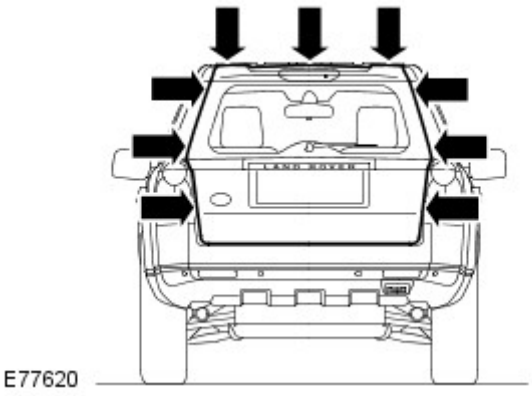
Torque Specifications

Description	Nm	lb-ft
Front door check strap	24	18
Front door hinge bolts	30	22
Hood hinges	24	18
Liftgate hinge bolts	24	18
Liftgate support strut spigot	24	18
Rear door check strap	24	18
Rear door hinge bolts	30	22

Published: 11-May-2011

Body Closures - Liftgate Alignment

General Procedures

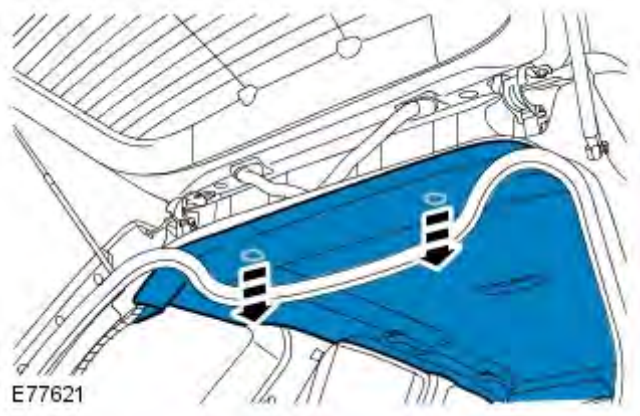


1. With the liftgate closed, check the alignment of the liftgate to the roof panel and bodyside panel. The liftgate should be central in its aperture.

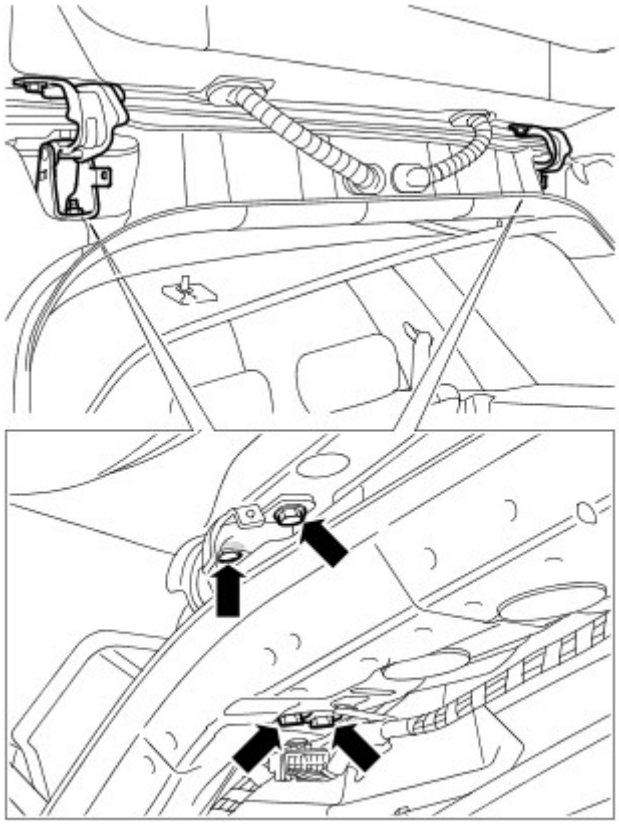
   Refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

2. Remove the D-pillar trim panels.

   Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. Release the rear of the headliner.



E77622

4. Loosen, but do not remove the liftgate hinge bolts.

5. Position the liftgate central to the aperture.

6. Tighten the liftgate hinge bolts.

   Torque: 24 Nm

7. Check for correct operation of the liftgate, and if necessary adjust the liftgate striker.

   Refer to: Liftgate Striker Adjustment (501-14 Handles, Locks, Latches and Entry Systems, General Procedures).

8. Attach the rear of the headliner.

9. Install the D-pillar trim panels.

   Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Body Closures - Front Door

Removal and Installation

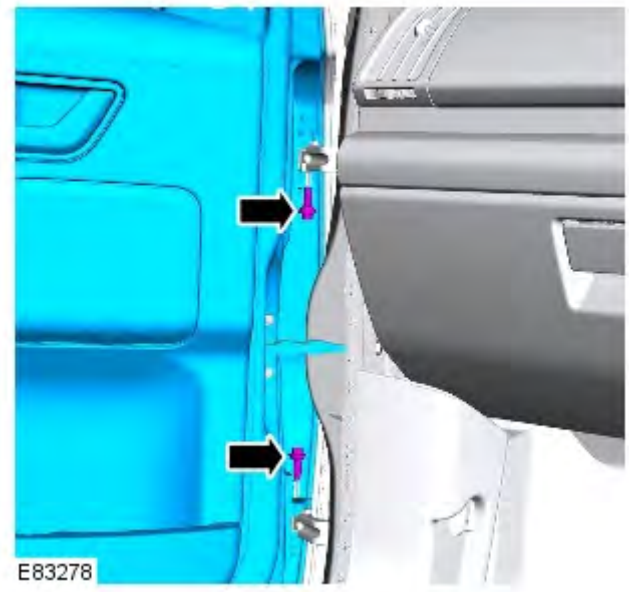
Removal

1. **1.** CAUTION: After switching off the ignition, wait for 2 minutes before disconnecting the battery. Failure to wait for 2 minutes will damage the navigation computer.

   Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

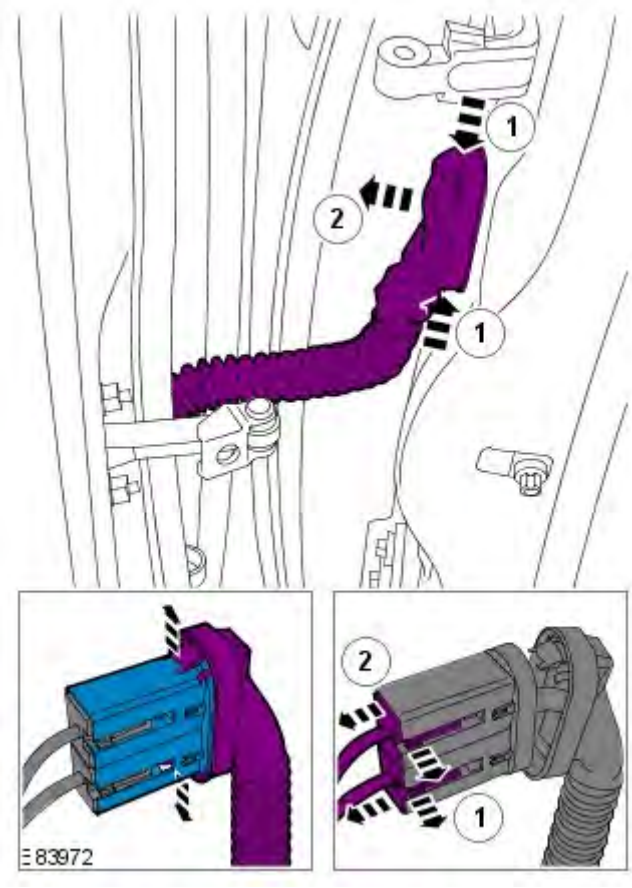
2.
   - *Torque:* 24 Nm



3. **3.** CAUTION: Protect the surrounding trim to avoid damage.

   • NOTE: This step requires the aid of another technician.

   - *Torque:* 30 Nm



4. **4.** NOTE: With assistance, support the door.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

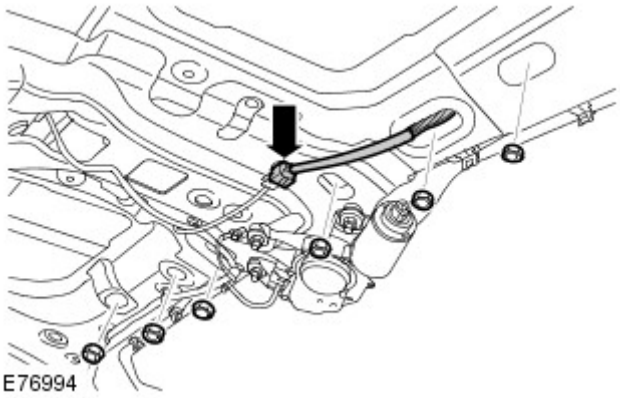
Body Closures - Power Liftgate Switch

Removal and Installation

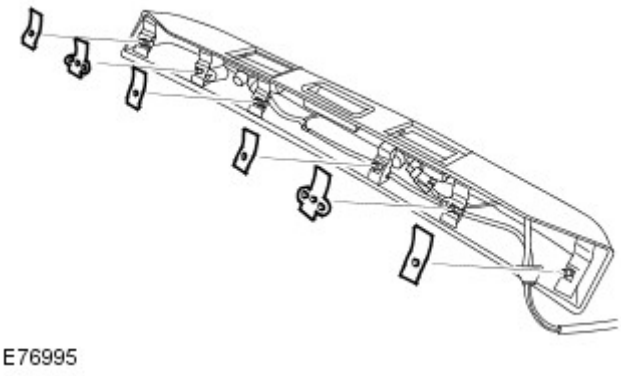
Removal

1. Remove the liftgate trim panel.

   Refer to: Liftgate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

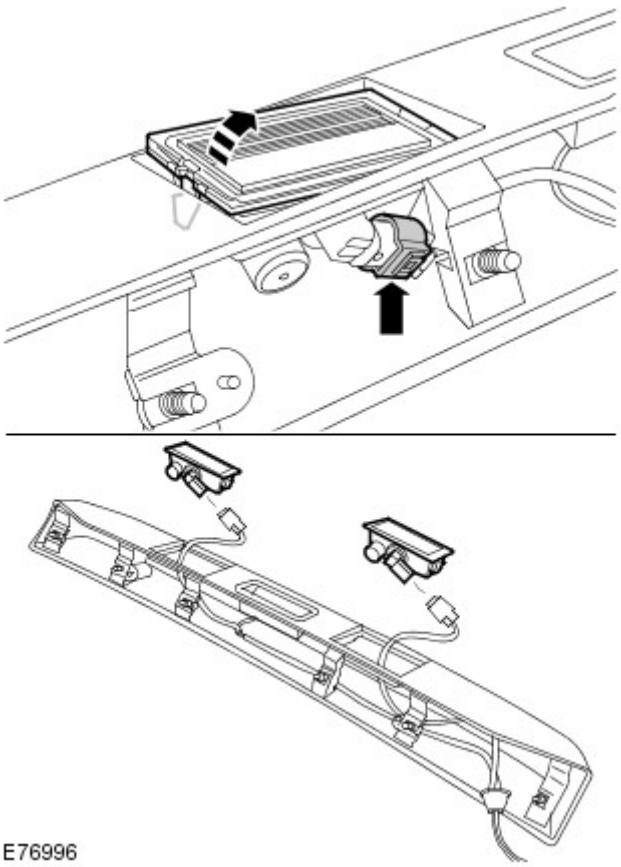

E76994

2. Remove the license plate lamp housing.

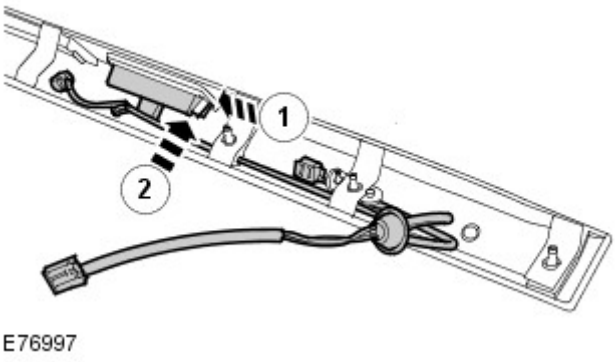

E76995

3. Remove and discard the 6 license plate housing gaskets.

4. Remove the license plate lamps.



5. Remove the power liftgate switch.



Installation

1. Install the power liftgate switch.
2. Install the license plate lamps.
3. Install the license plate housing and tighten the nuts.

   Torque: 5 Nm
4. Install the liftgate trim panel.

   Refer to: Liftgate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

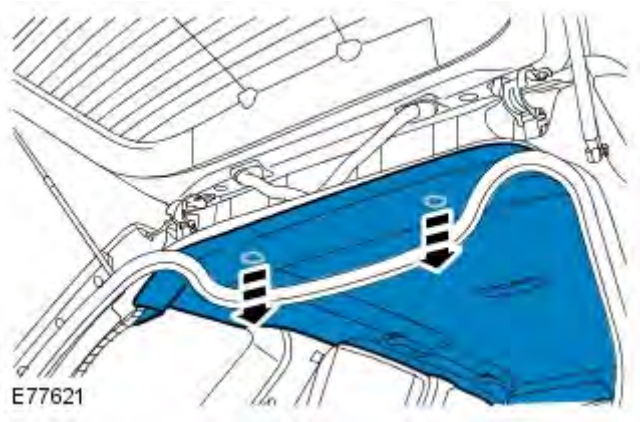
Body Closures - Liftgate

Removal and Installation

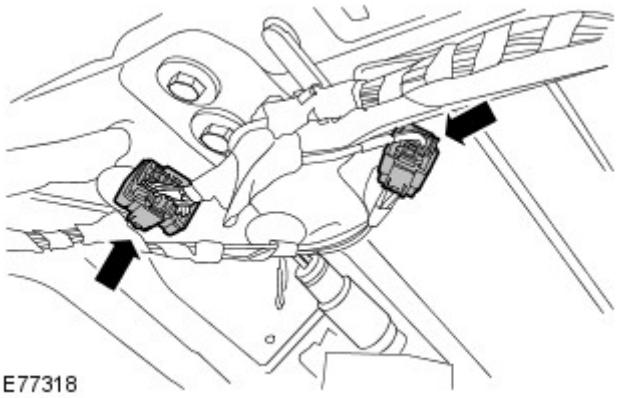
Removal

1. Remove the LH D-pillar upper trim panel.

   Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. Release the rear of the headliner.



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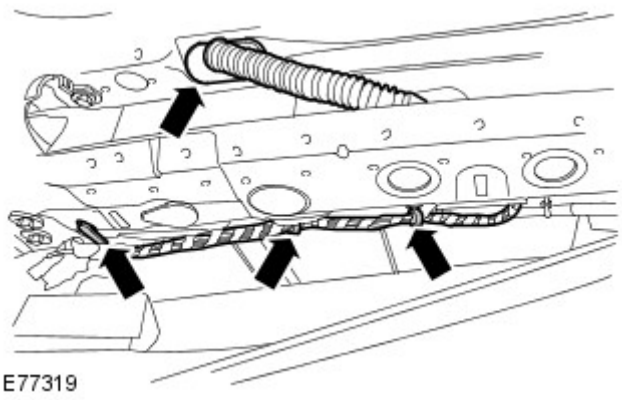
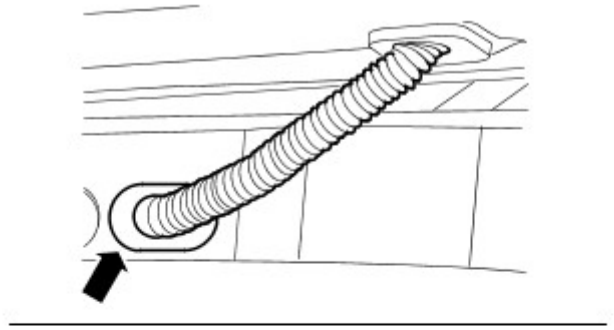
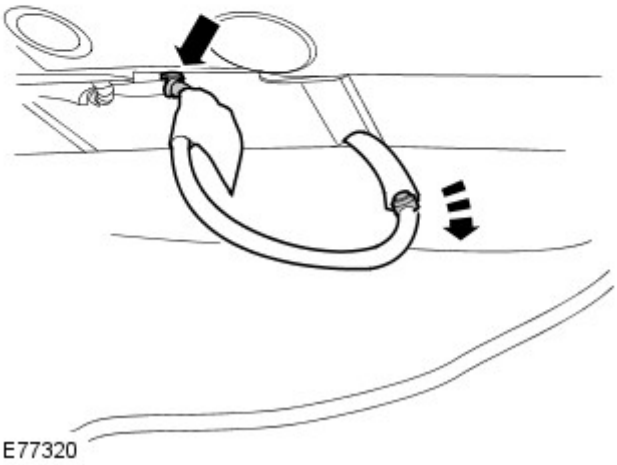
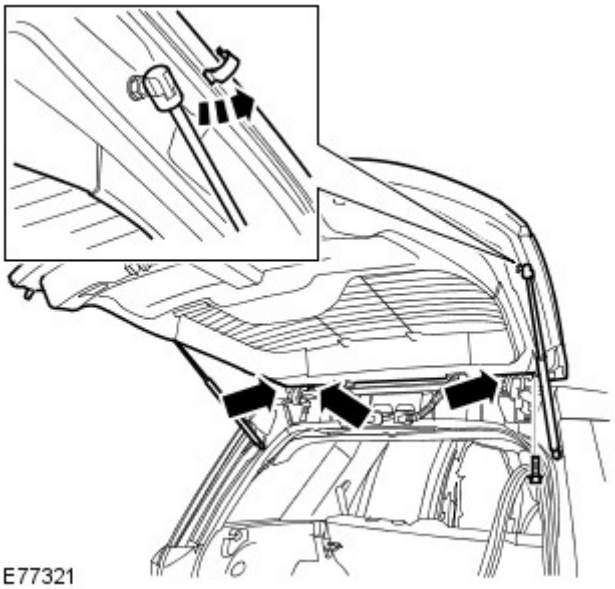


4. Release the liftgate wiring harness.

5.







6. **6.** WARNING: This step requires the aid of another technician.

   CAUTION: Mark the components to aid installation.

   Remove the liftgate.

Installation

1. **1.** WARNING: This step requires the aid of another technician.

   CAUTION: Make sure that the area around the component is clean and free of foreign material.

   Install the liftgate.

   Torque: 24 Nm

2. Connect the washer jet hose.

3. Attach the liftgate wiring harness.

4. Connect the liftgate wiring harness electrical connectors.

5. With the liftgate closed, check the alignment of the liftgate to the roof panel and bodyside panel. The liftgate should be central in its aperture.

6. Loosen, but do not remove the liftgate hinge bolts.

7. Position the liftgate central to the aperture.

8. Tighten the liftgate hinge bolts.

   Torque: 24 Nm

9. Attach the rear of the headliner.

10. Install the LH D-pillar upper trim panel.

    Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

11. Check for correct operation of the liftgate, and if necessary adjust the liftgate striker.

Published: 11-May-2011

Body Closures - Rear Door

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. *Torque:* 24 Nm

3. **3.** CAUTION: Protect the surrounding trim to avoid damage.

   • NOTE: This step requires the aid of another technician.

   Torque: 30 Nm

4.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Interior Trim and Ornamentation -

Torque Specifications

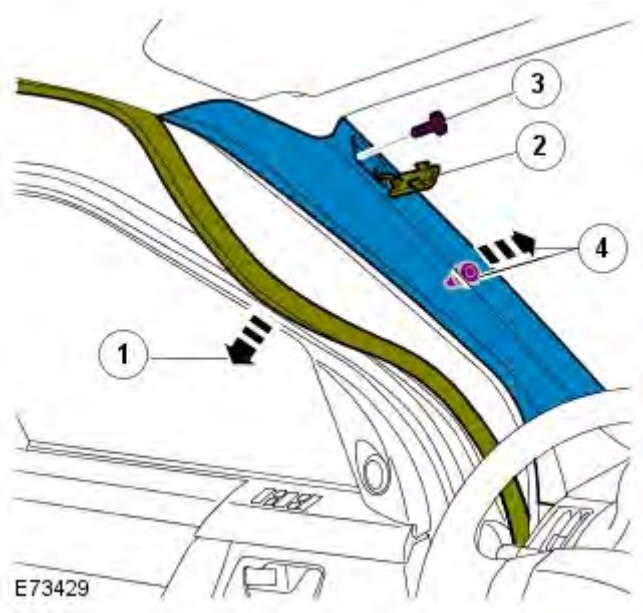
Description	Nm	lb-ft
A-pillar trim panel Torx screw	3	2
A-pillar airbag deflector bracket bolts	9	7
B-pillar trim panel upper Torx bolt	25	18
C-pillar upper trim panel Torx screw	3	2
Engine cover 2.2 Diesel	10	7
Liftgate trim panel	1	1
Loadspace securing ring	25	18
Passenger assist handles	2	1
Sunvisors	2	1

Published: 11-May-2011

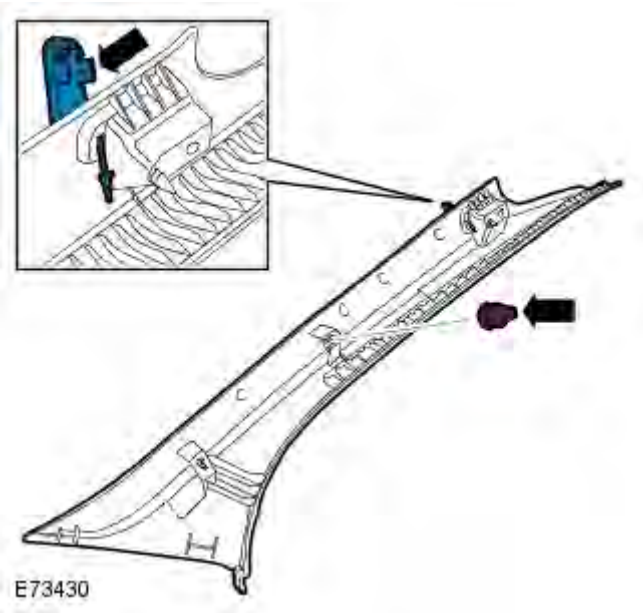
Interior Trim and Ornamentation - A-Pillar Trim Panel

Removal and Installation

Removal



1.



2. **2.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. **1.** CAUTION: The airbag tether is mounted under this component. Do not trap during installation.

   Install the A-pillar trim panel and tighten the new Torx screw to 3 Nm (2.2 lb.ft).

Published: 11-May-2011

Interior Trim and Ornamentation - B-Pillar Upper Trim Panel

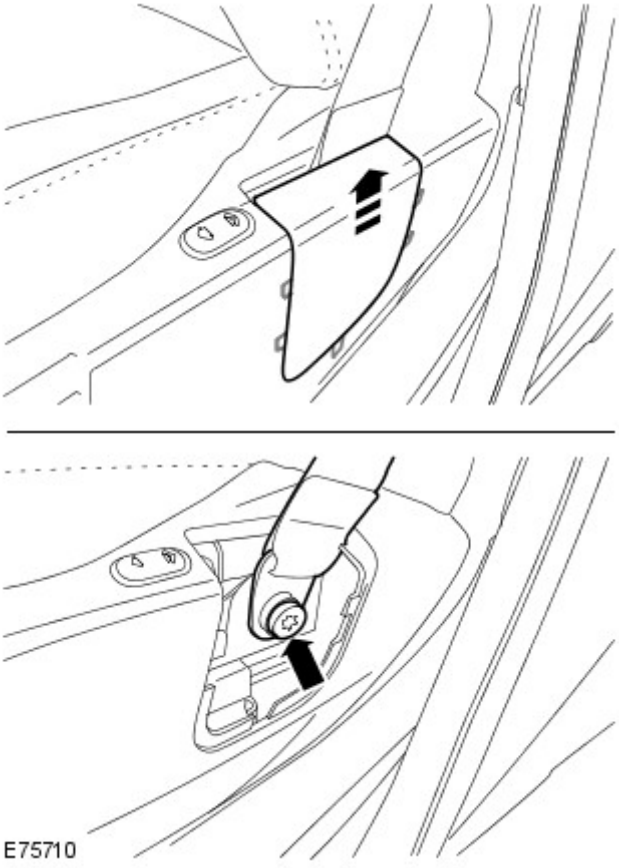
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the B-pillar lower trim panel.

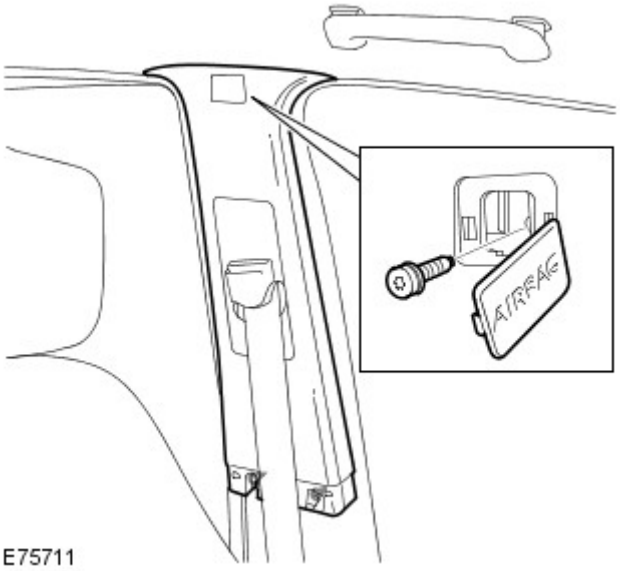
   Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

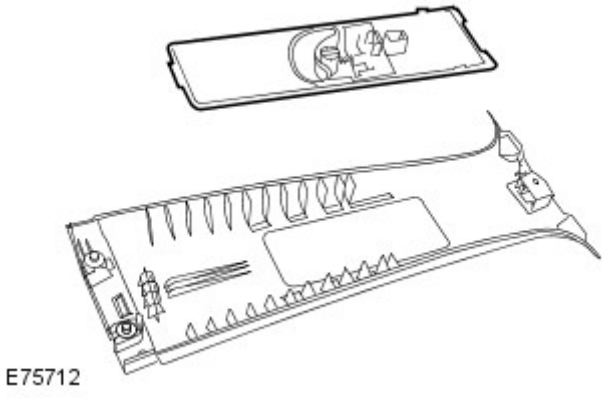


2. **2.** WARNING: Make sure that a new bolt is installed.

   Torque: 40 Nm

3. *Torque:* 25 Nm




E75712

4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

E75713

5.

Installation

1. To install, reverse the removal procedure.

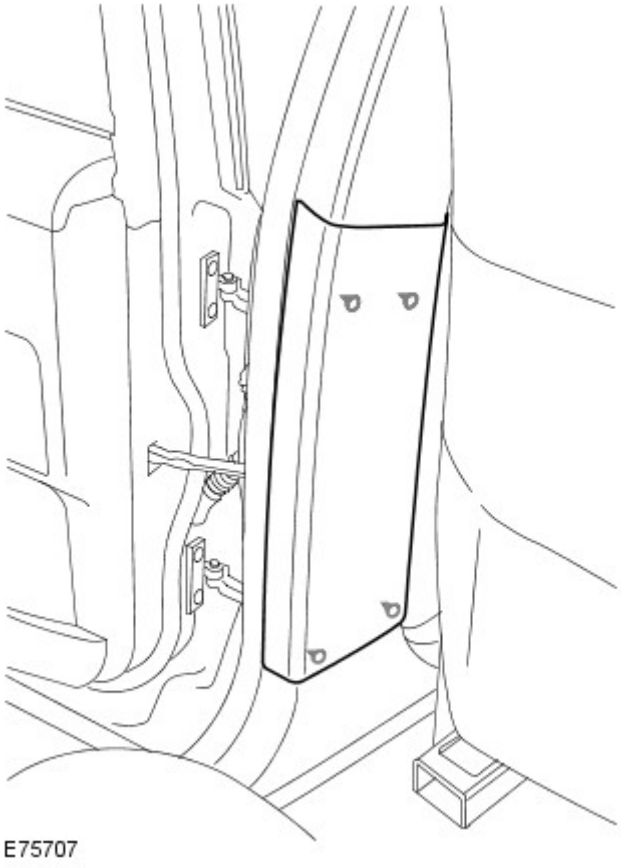
Published: 11-May-2011

Interior Trim and Ornamentation - B-Pillar Lower Trim Panel

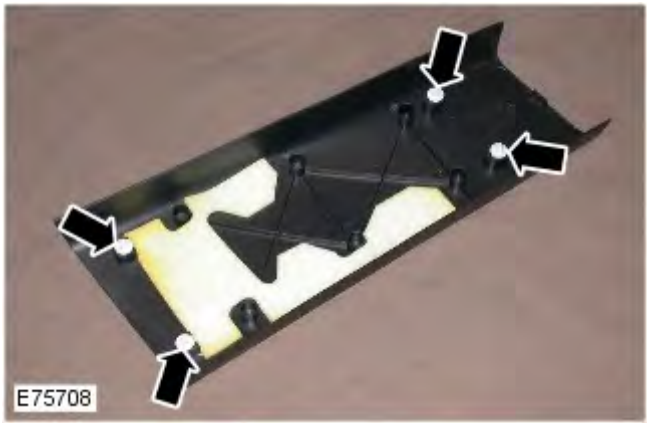
Removal and Installation

Removal

1.



2. **2.** NOTE: Do not disassemble any further if the component is removed for access only.



Installation

1. To install, reverse the removal procedure.

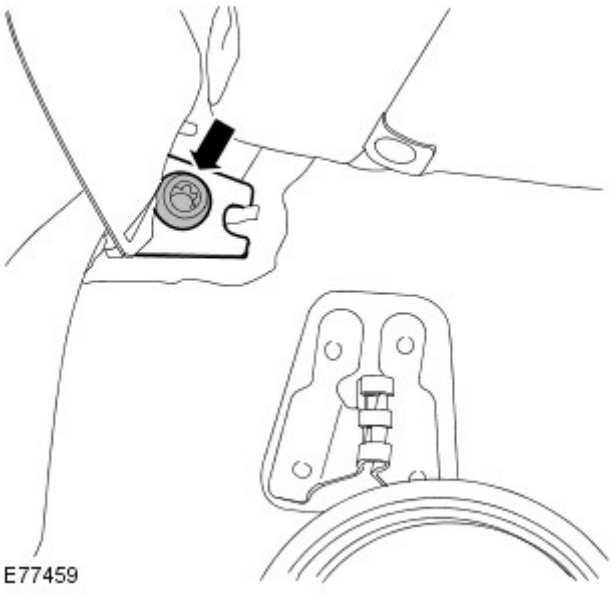
Published: 11-May-2011

Interior Trim and Ornamentation - C-Pillar Trim Panel

Removal and Installation

Removal

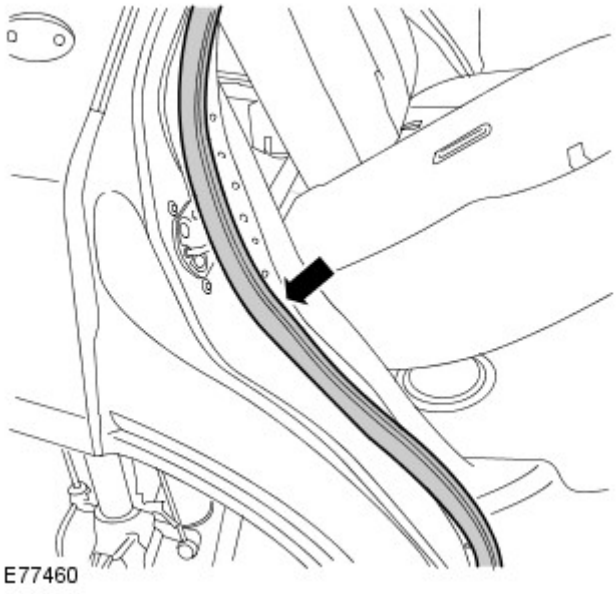
- NOTE: Removal steps in this procedure may contain installation details.



1. **1.** WARNING: Make sure that a new bolt is installed.

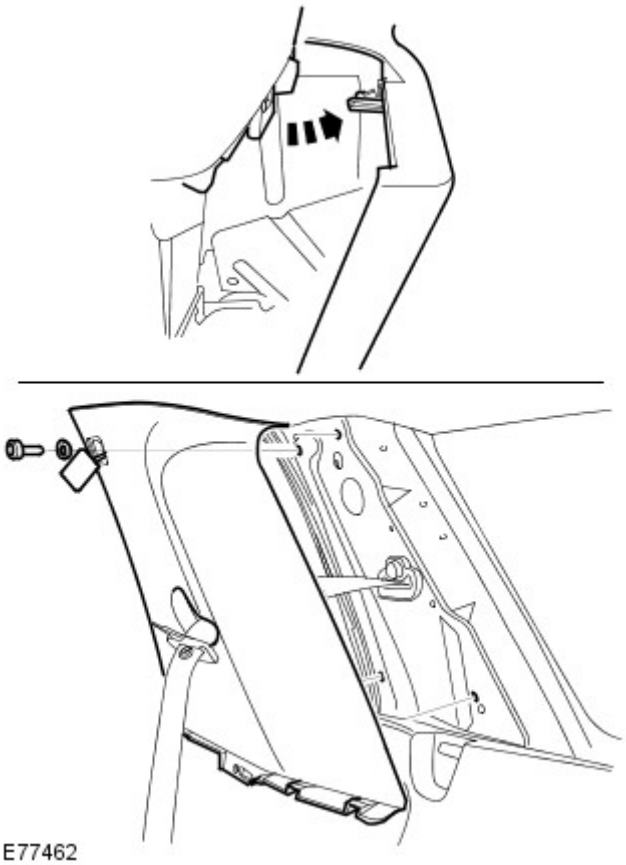
   Release the safety belt lower anchor.

   Torque: 40 Nm



2. Release the rear door seal.

3. Release the rear quarter trim panel.

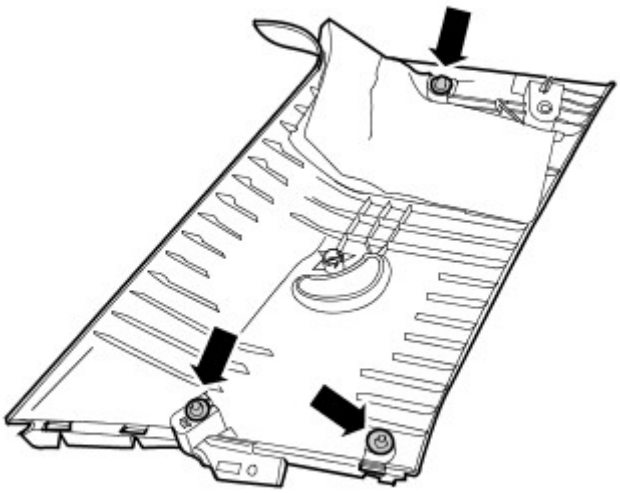


4. **4.** WARNING: Make sure that a new bolt is installed.

   Remove the C-pillar trim panel.

   Torque: 3 Nm

5. **5.** NOTE: Do not disassemble further if the component is removed for access only.



E77463

Installation

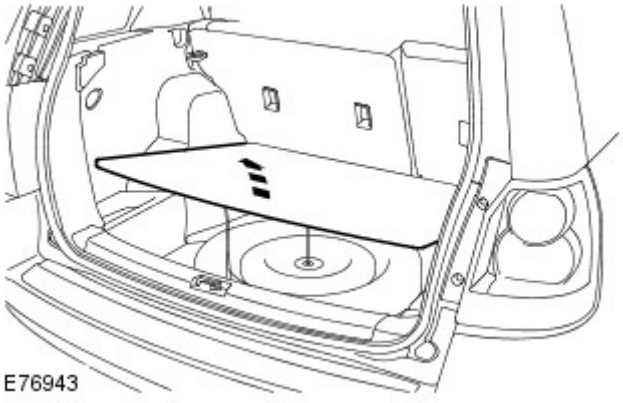
1. To install, reverse the removal procedure.

Published: 11-May-2011

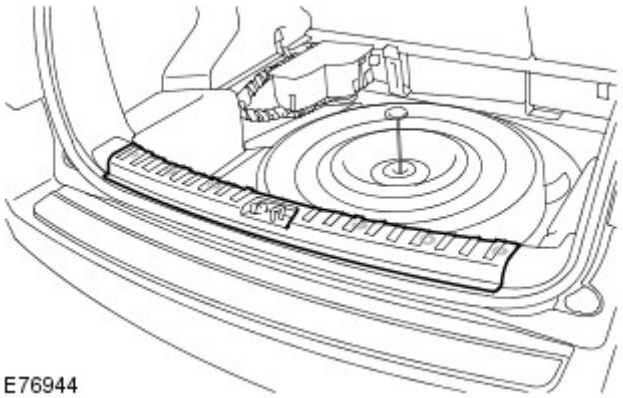
Interior Trim and Ornamentation - D-Pillar Trim Panel

Removal and Installation

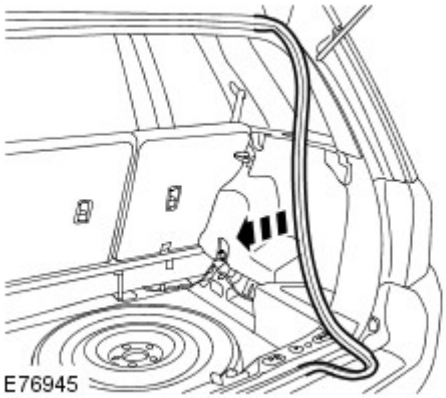
Removal



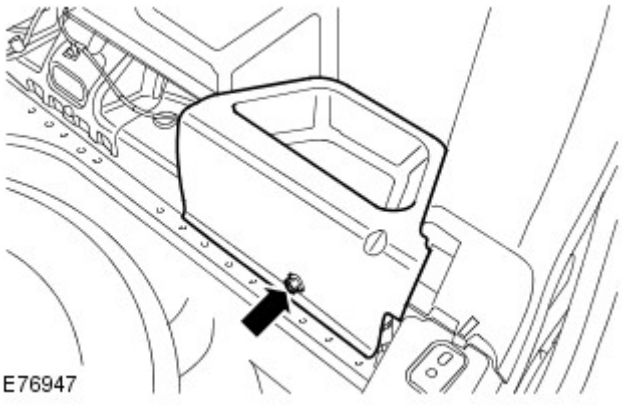
1. Remove the spare wheel cover.



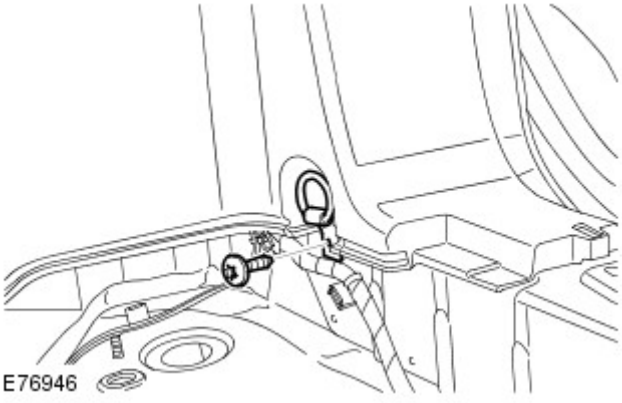
2. Remove the loadspace scuff plate.



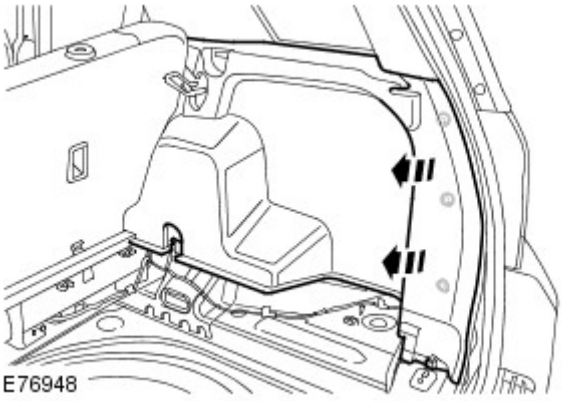
3. Release the liftgate seal.



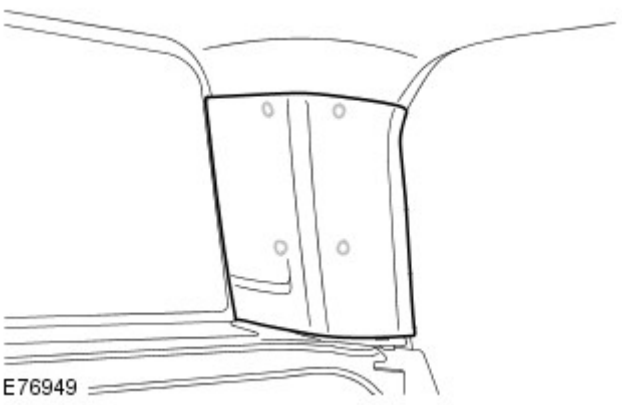
4. Remove the loadspace stowage tray.



5. Remove the loadspace securing ring.



6. Release the rear quarter trim panel.



7. Remove the D-pillar trim panel.

8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the speaker.

Installation

1. Install the speaker
2. Install the D-pillar trim panel.
3. Secure the rear quarter trim panel.
4. Install the loadspace securing ring and tighten the Torx screw.

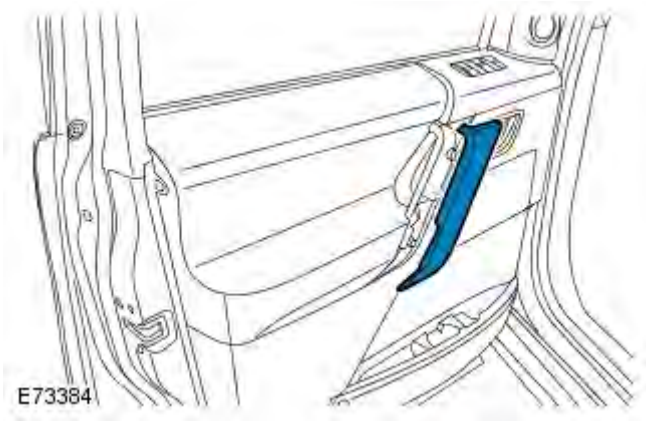
   Torque: 25 Nm
5. Install the loadspace stowage tray.
6. Attach the liftgate seal.
7. Install the loadspace scuff plate.
8. Install the spare wheel cover.

Published: 11-May-2011

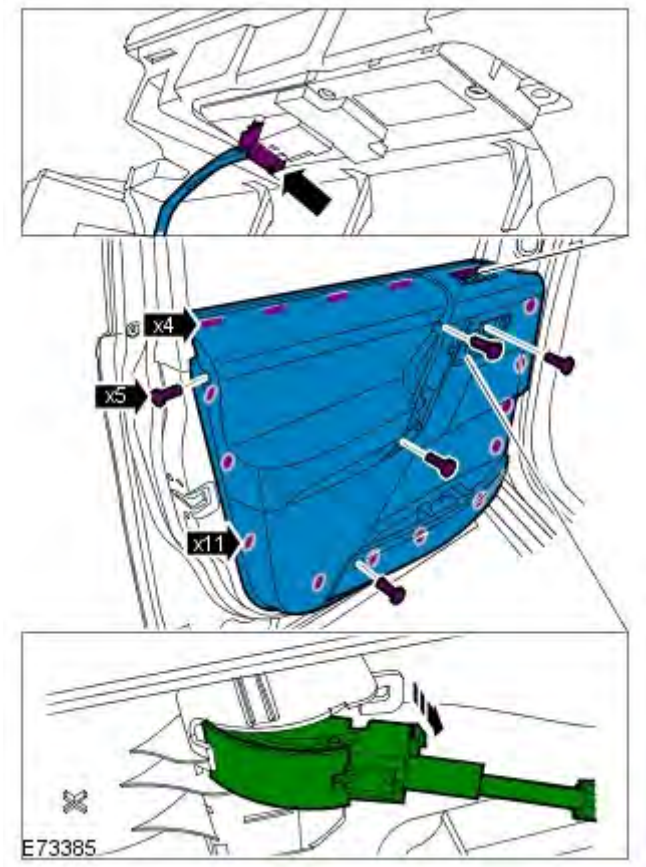
Interior Trim and Ornamentation - Front Door Trim Panel

Removal and Installation

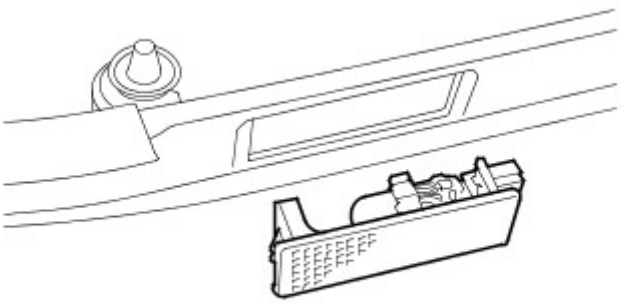
Removal



1. Remove the grab handle cover.



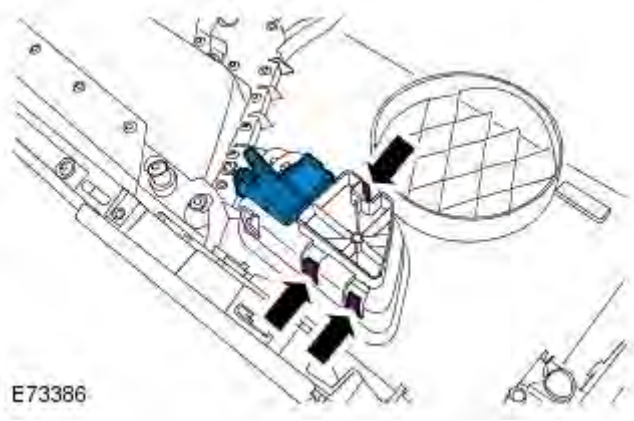
2. Remove the front door trim panel.



E43315

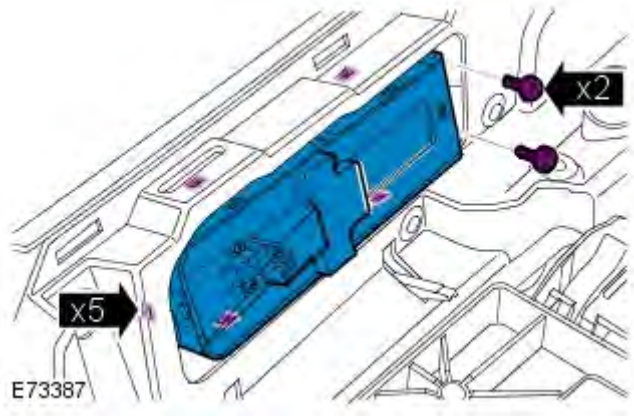
3. **3.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the puddle lamp.



E73386

4. Remove the front door latch remote control handle.



E73387

5. Remove the window control switch.

6. Remove the 11 clips.

Installation

1. Install the window control switch.
2. Install the front door latch remote control handle.
3. Install the puddle lamp.
4. Install the clips.
5. Install the front door trim panel.
6. Install the grab handle cover.

Published: 11-May-2011

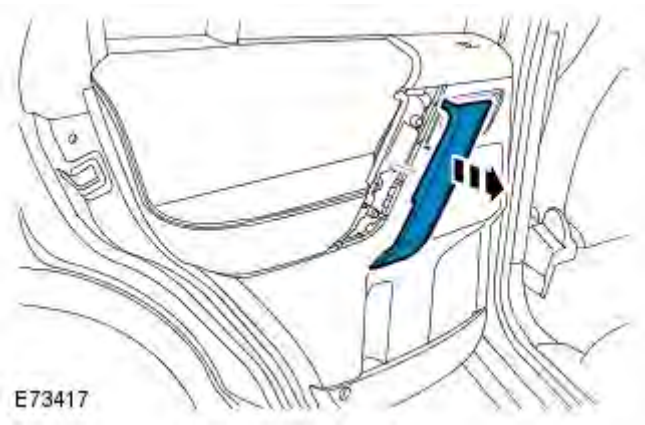
Interior Trim and Ornamentation - Rear Door Trim Panel

Removal and Installation

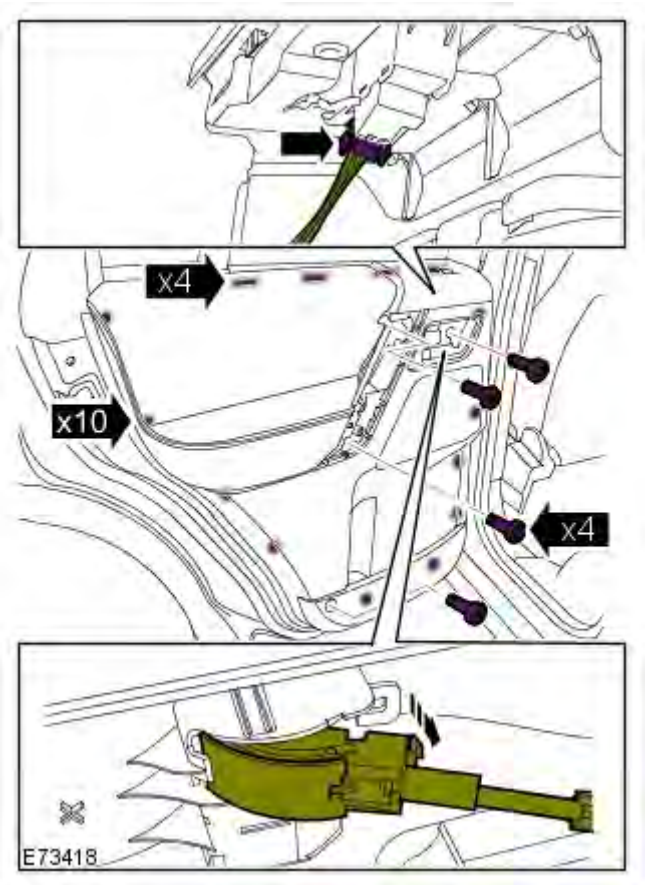
Removal

1. Disconnect the battery ground cable.

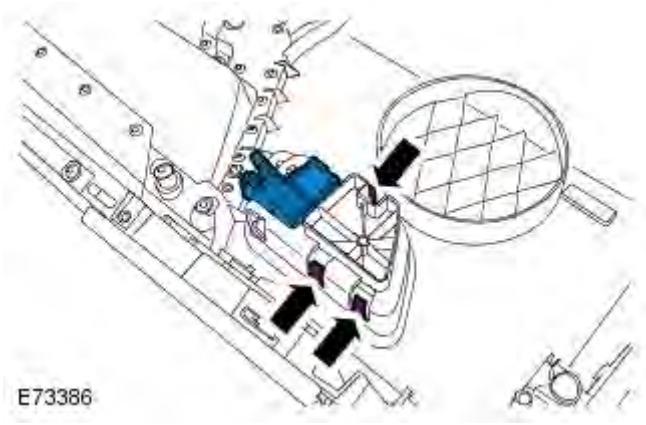
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).



2.

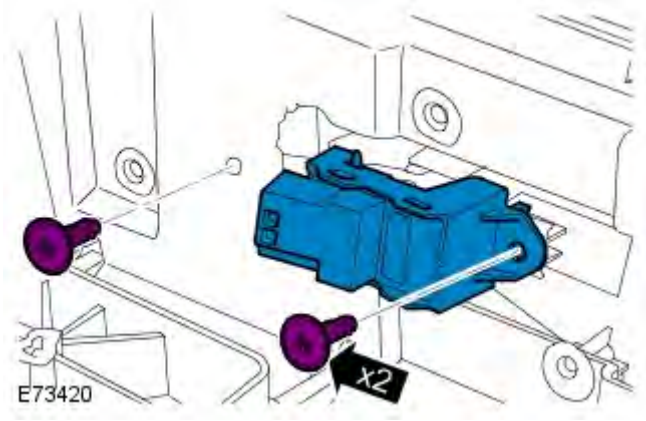


3. Remove the rear door trim panel.

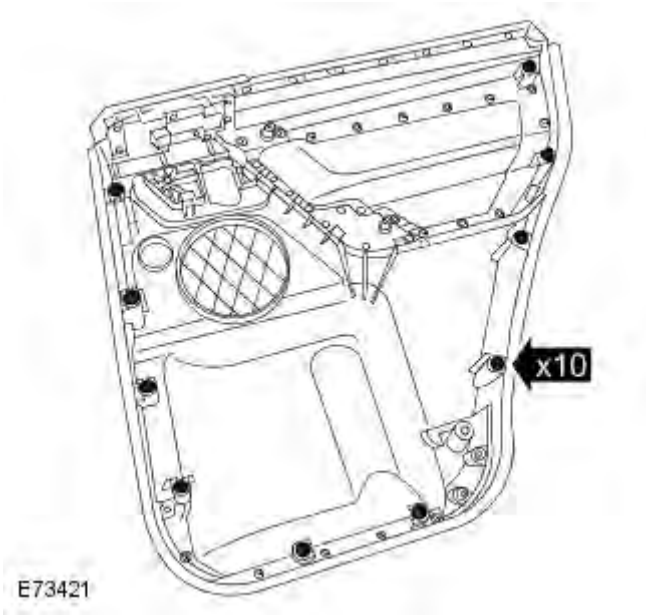


4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the rear door latch remote control handle.



5.



6.

Installation

1. Install the window control switch.
2. Install the rear door latch remote control handle.
3. Install the clips.
4. Install the rear door trim panel.

5. Install the grab handle cover.

6. Connect the battery ground cable.

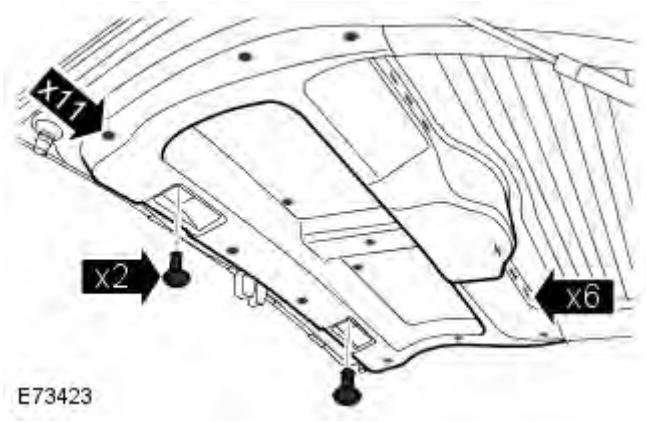
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

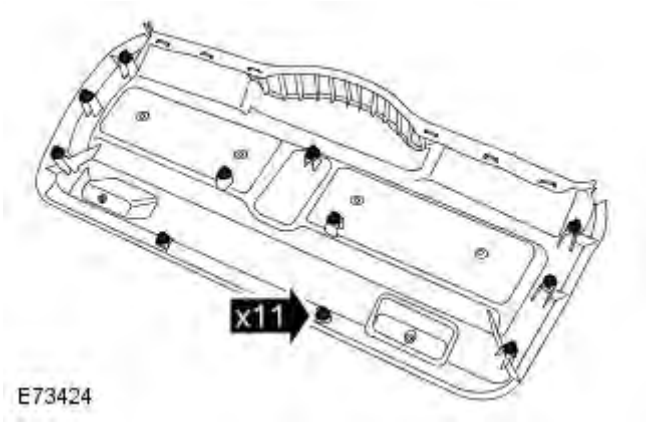
Interior Trim and Ornamentation - Liftgate Trim Panel

Removal and Installation

Removal



1.



2. **2.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Interior Trim and Ornamentation - HeadlinerVehicles Without: Tilting Roof Opening Panel

Removal and Installation

Removal

CAUTION: Make sure that the wiring harnesses are correctly located.

• NOTE: If a headliner is to be replaced, it is imperative that the washer hose and wiring harness are installed to their original positions. Failure to follow these instructions may impede the side air curtain module performance.

• NOTE: Note the position of the wiring harnesses to aid installation.

1. Remove both A-pillar trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove both B-pillar upper trim panels.

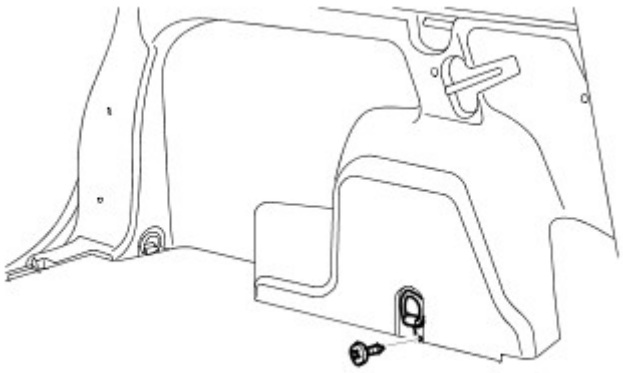
   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove both C-pillar trim panels.

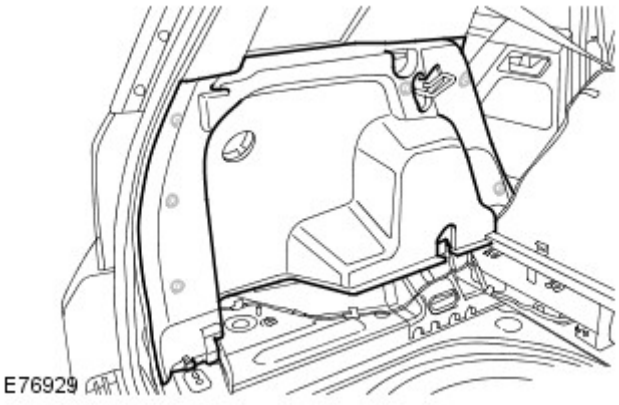
   Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Remove both D-pillar upper trim panels.

   Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).


E77860

5. Remove the loadspace securing ring.


E76929

6. Remove the rear quarter trim panel.

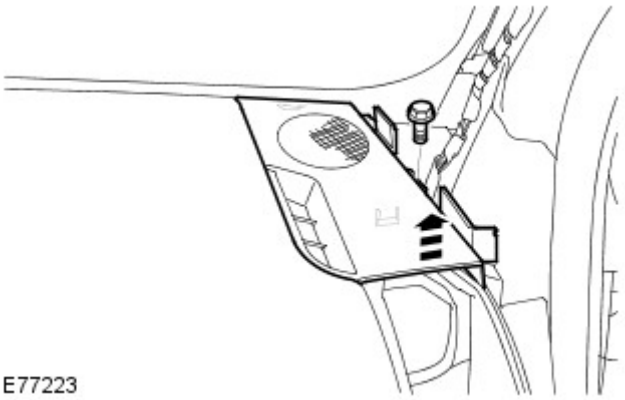
7. Remove the glove compartment.

   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

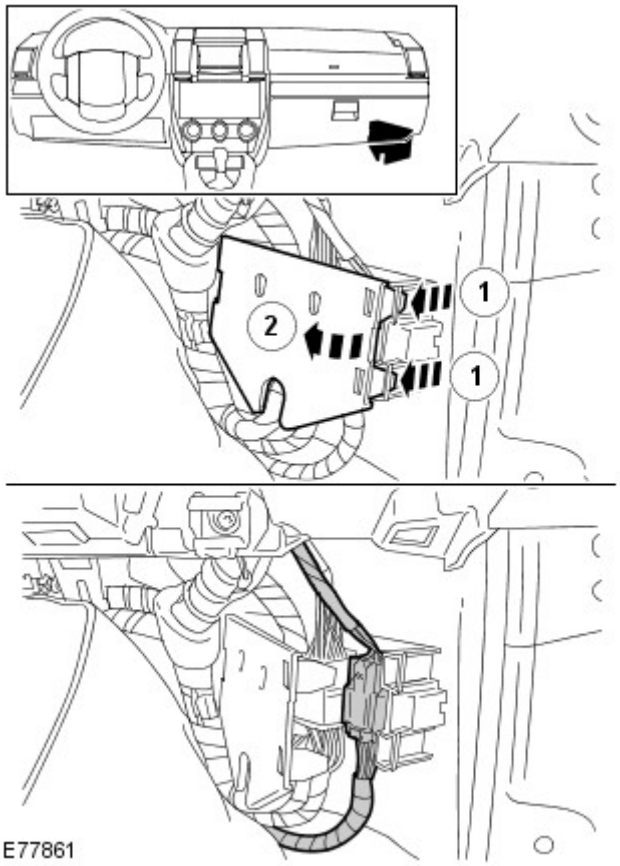
8. Passenger side: Remove the cowl side trim panel.

   Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

9. Passenger side: Remove the speaker grille.

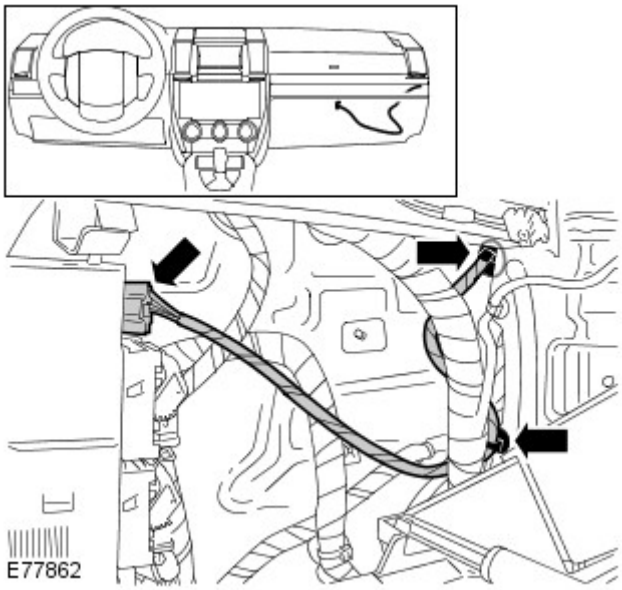

E77223

10.

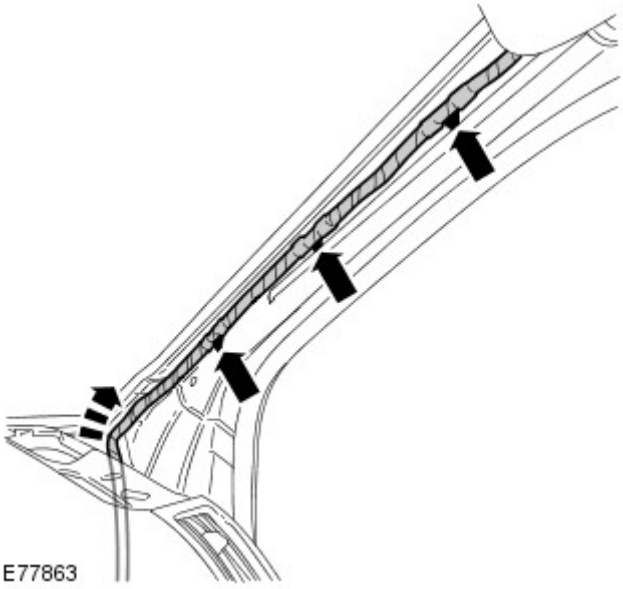


E77861

11.



12.



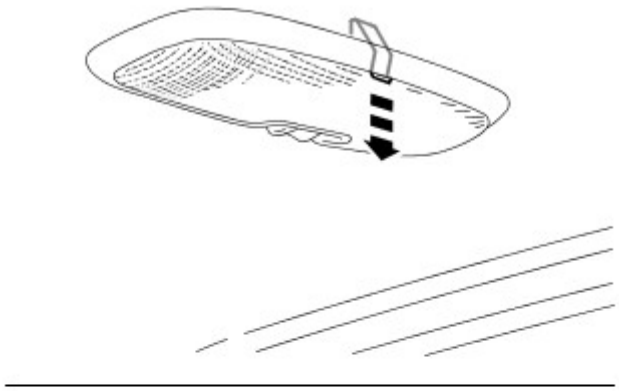
13. Remove the interior rear view mirror.

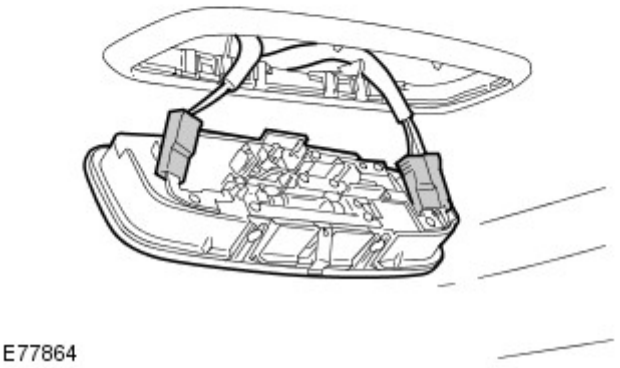
    Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

14. Remove the overhead console.

    Refer to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).

15. Remove the rear interior lamp.



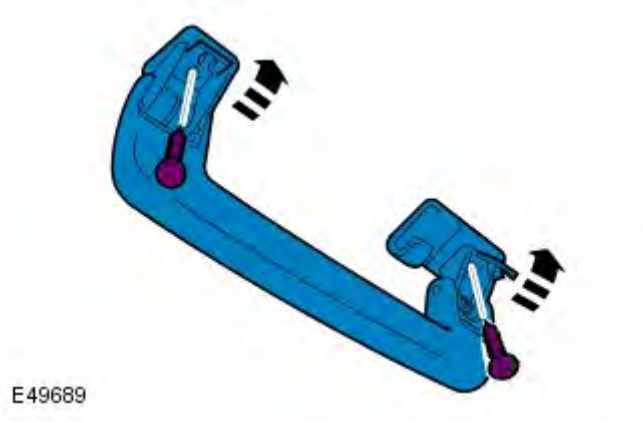


E77864

16. Remove both sun visors.

E77865

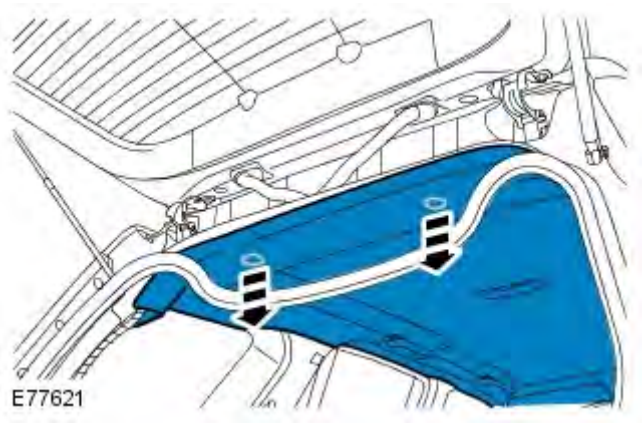
17. Remove the 4 passenger assist handles.



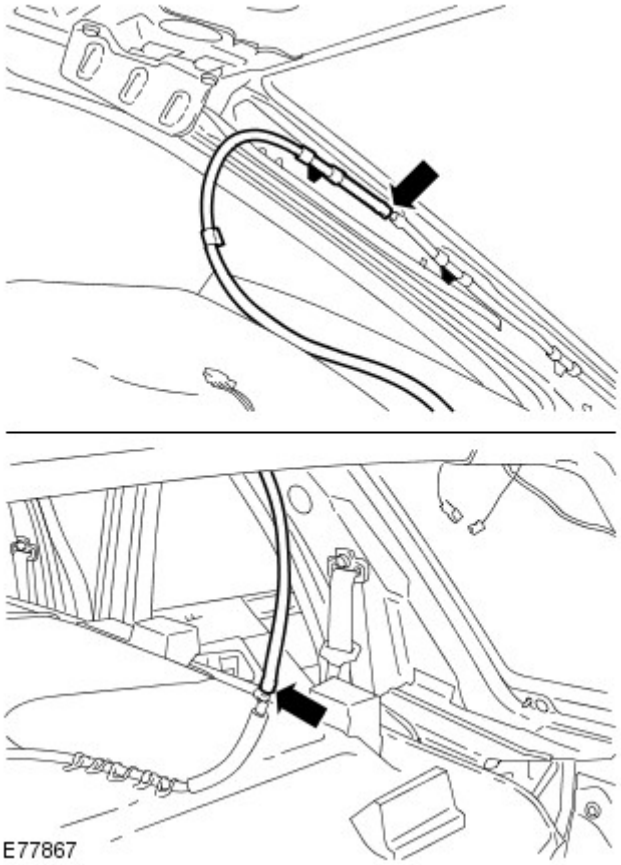
18. Position the front seats fully forward.

19. Position the rear seats fully forward.

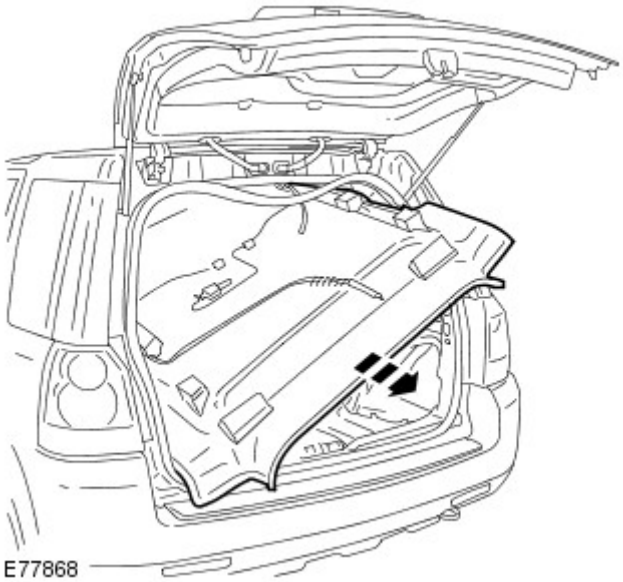
20. Release the rear of the headliner.



21. Release the front door seals.

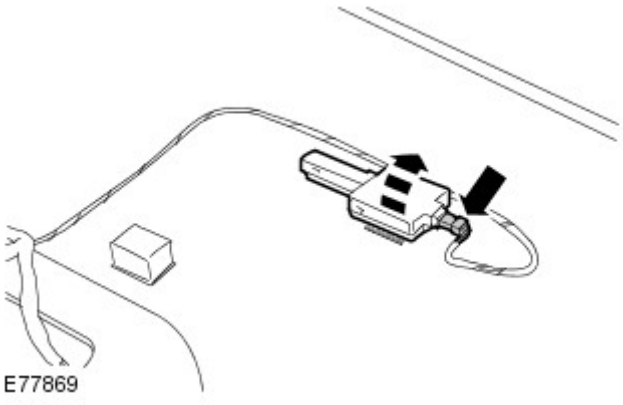


22. Disconnect the washer jet hose.



23. **23.** NOTE: This step requires the aid of another technician.

    Remove the headliner.

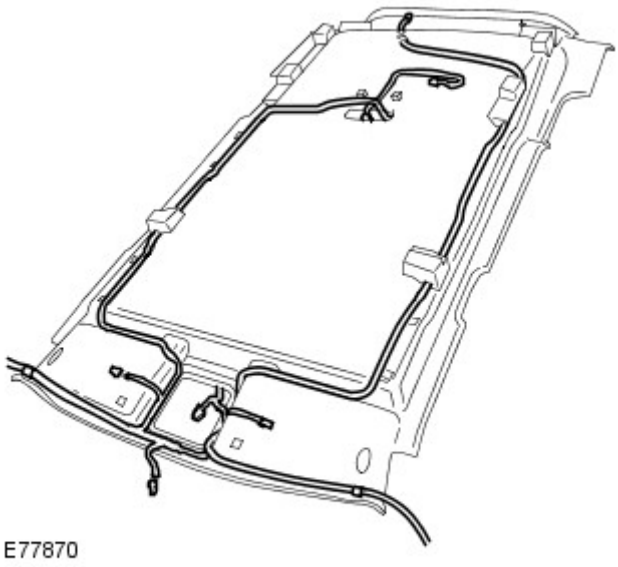

E77869

24. **24.** NOTE: Do not disassemble further if the component is removed for access only.

    Remove the tire pressure monitoring system receiver.

25. **25.** NOTE: Make sure that this component is installed to the noted removal position.

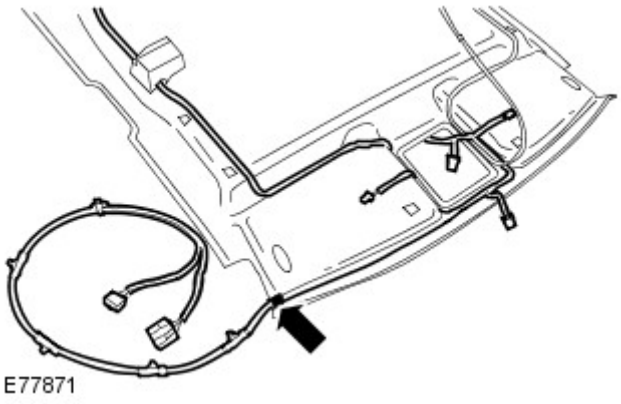
    Remove the washer jet hose.


E77870

26. **26.** NOTE: Note the position of the wiring harnesses to aid installation.

    Remove the headliner wiring harness.

Installation


E77871

1. **1.** CAUTION: Make sure that the wiring harnesses are correctly located.
   - Align the yellow tape on the wiring harness to the corner of the headliner.

2. Install the washer jet hose.

3. Install the tire pressure monitoring system receiver.

4. **4.** NOTE: This step requires the aid of another technician.

   Install the headliner.

5. Connect the washer jet hose.

6. Attach the front door seals.

7. Attach the rear of the headliner.

8. Reposition the rear seats.

9. Reposition the front seats.

10. Install the passenger assist handles.

11. Install the sun visors.

12. Install the rear interior lamp.

13. Install the overhead console.

    Refer to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).

14. Install the interior rear view mirror.

    Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

15. Connect the headliner wiring harness and secure the clips.

16. Install the speaker grille.

17. Install the cowl side trim panel.

    Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

18. Install the glove compartment.

    Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

19. Install the rear quarter trim panel.

20. Install the loadspace securing ring and tighten the Torx screw.

    Torque: 25 Nm

21. Install the D-pillar trim panels.

    Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

22. Install the C-pillar trim panels.

    Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

23. Install the B-pillar trim panels.

    Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

24. Install the A-pillar trim panels.

    Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Interior Trim and Ornamentation - HeadlinerVehicles With: Tilting Roof Opening Panel

Removal and Installation

Removal

CAUTION: Make sure that the wiring harnesses are correctly located.

• NOTE: If a headliner is to be replaced, it is imperative that the washer hose and wiring harness are installed to their original positions. Failure to follow these instructions may impede the side air curtain module performance.

• NOTE: Note the position of the wiring harnesses to aid installation.

1. Remove both A-pillar trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove both B-pillar upper trim panels.

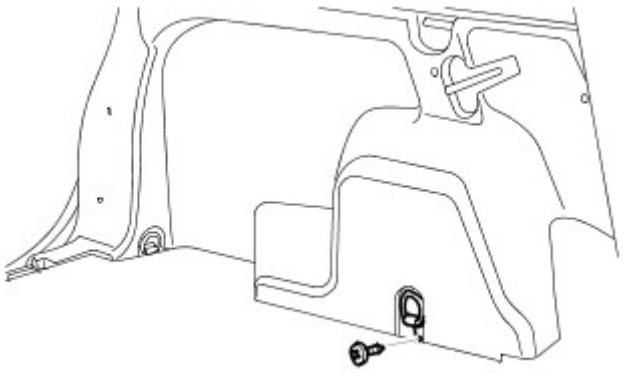
   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove both C-pillar trim panels.

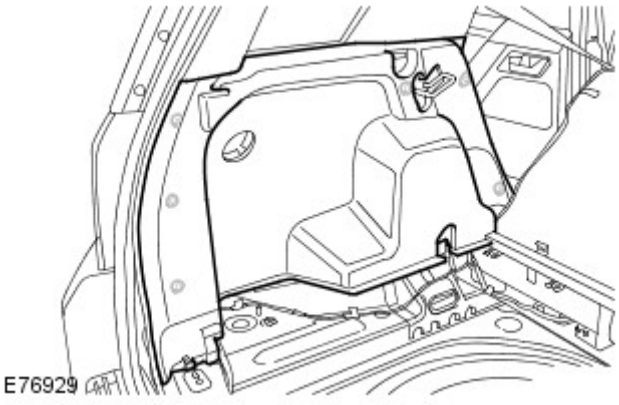
   Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Remove both D-pillar upper trim panels.

   Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).


E77860

5. Remove the loadspace securing ring.


E76929

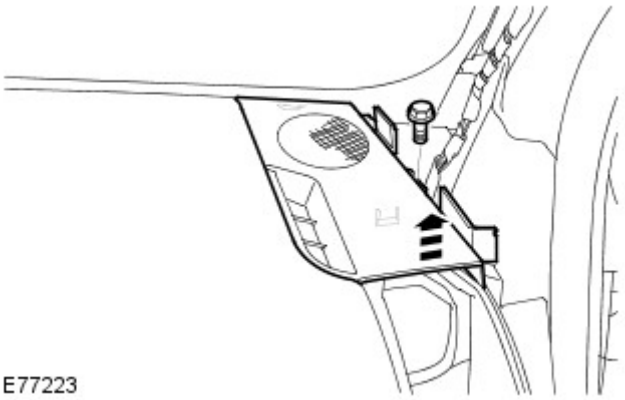
6. Remove the rear quarter trim panel.

7. Remove the glove compartment.

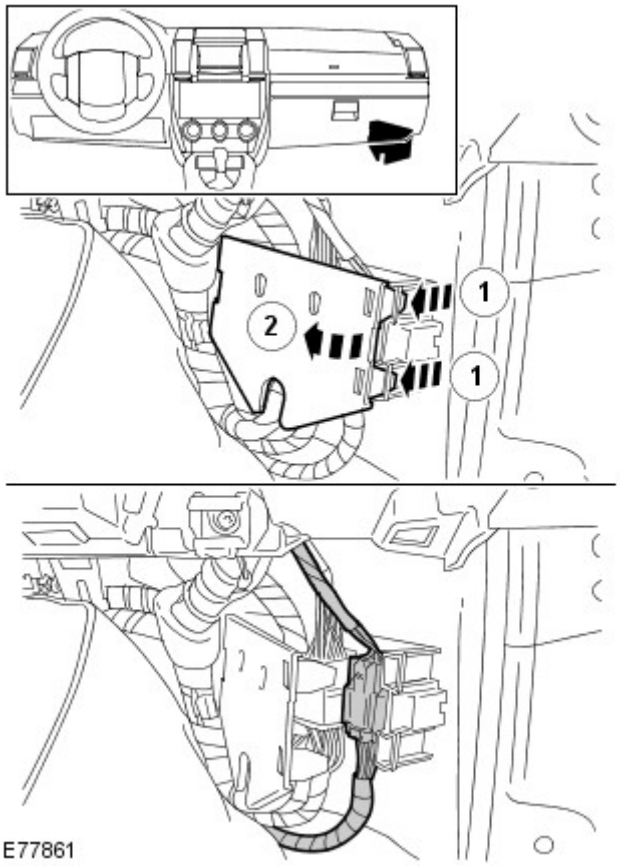
   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

8. Passenger side: Remove the cowl side trim panel.

   Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



9. Passenger side: Remove the speaker grille.



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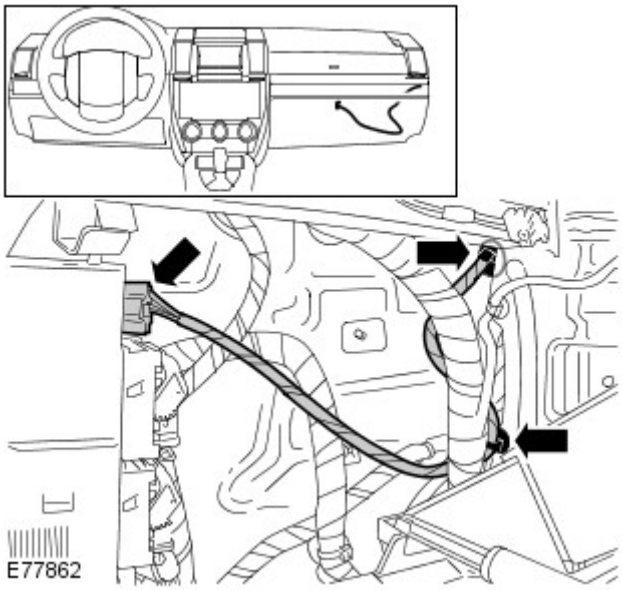

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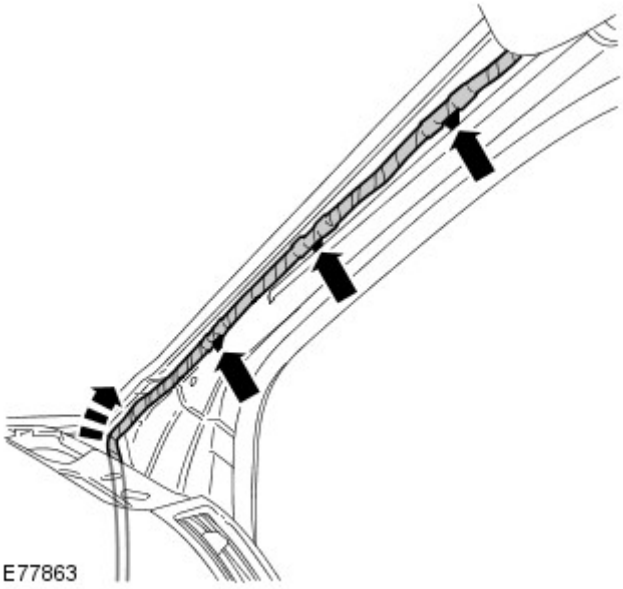


13. Remove the interior rear view mirror.

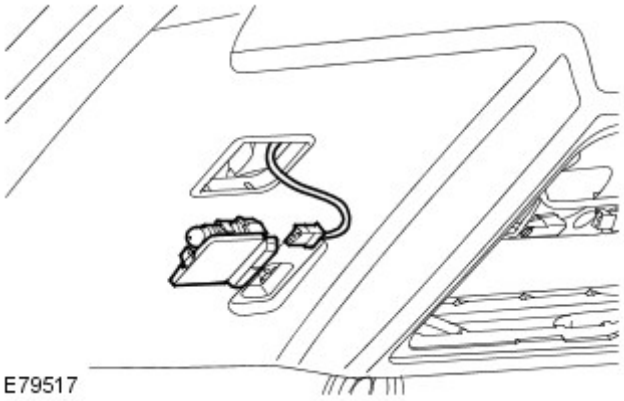
    Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

14. Remove both sun visors.

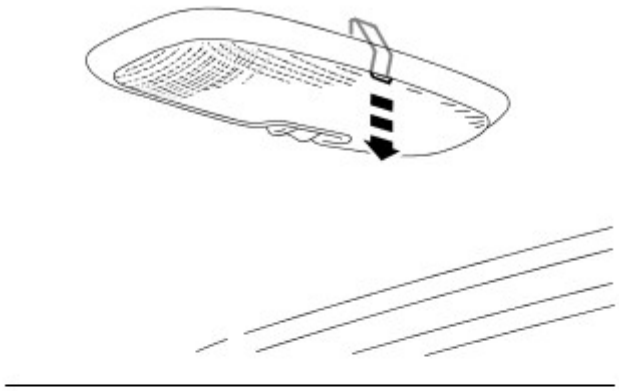
15. Remove the overhead console.

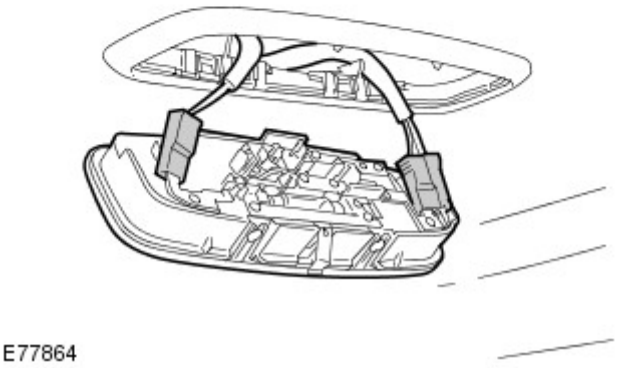
    Refer to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).

16. Remove both front interior lamps.



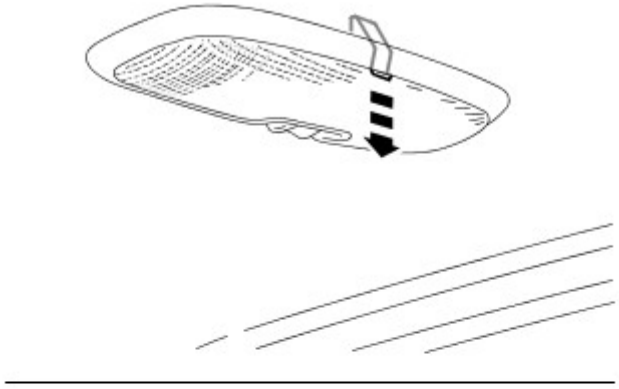
17. Remove the center interior lamp.

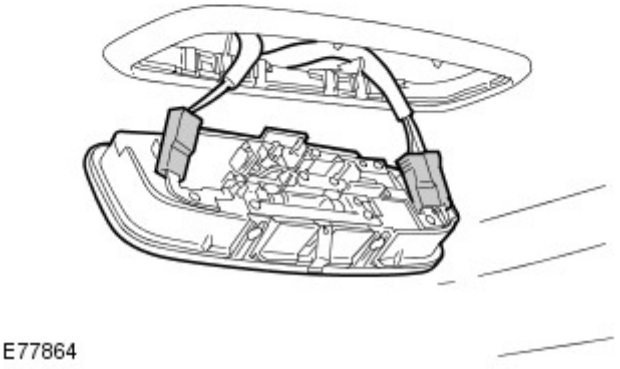




E77864

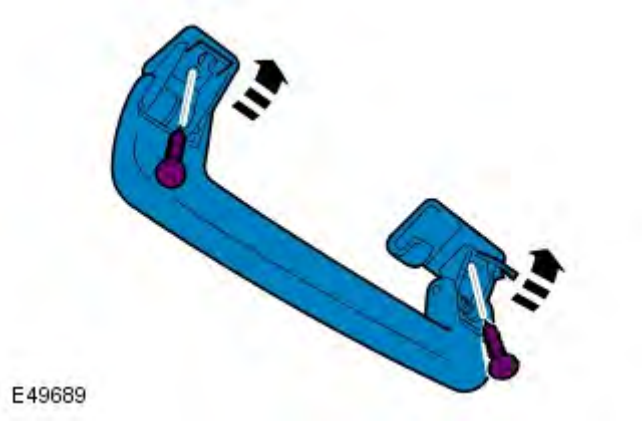
18. Remove the rear interior lamp.





E77864

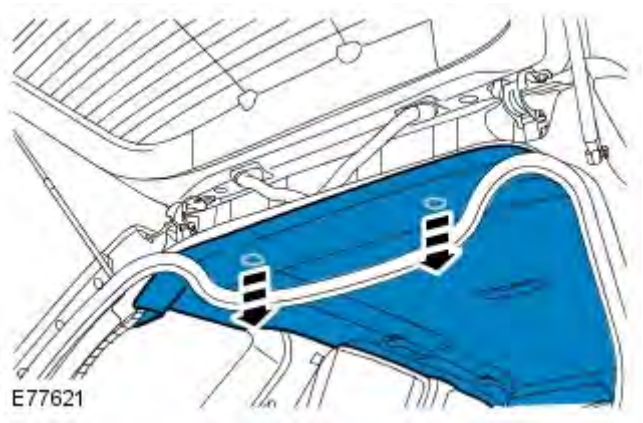
19. Remove the 4 passenger assist handles.



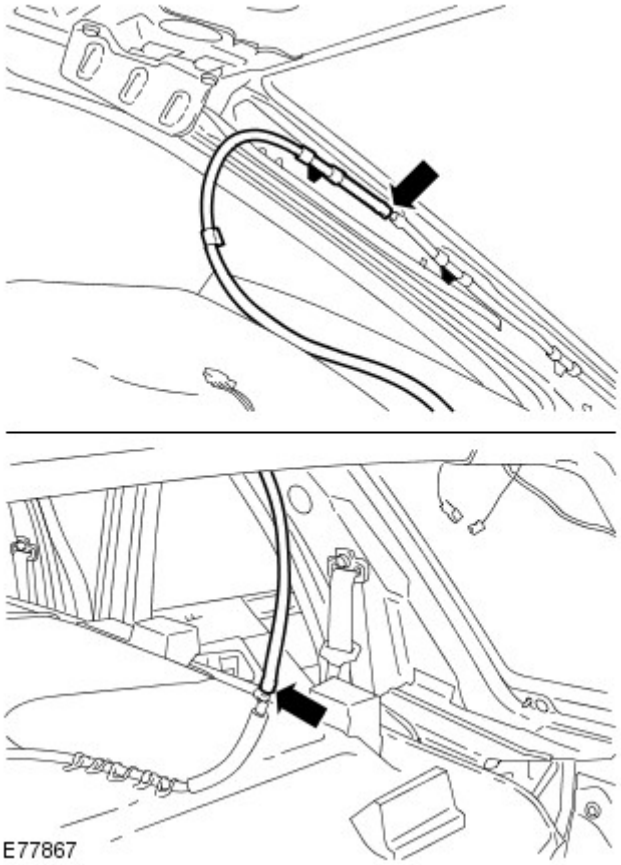
20. Position the front seats fully forward.

21. Position the rear seats fully forward.

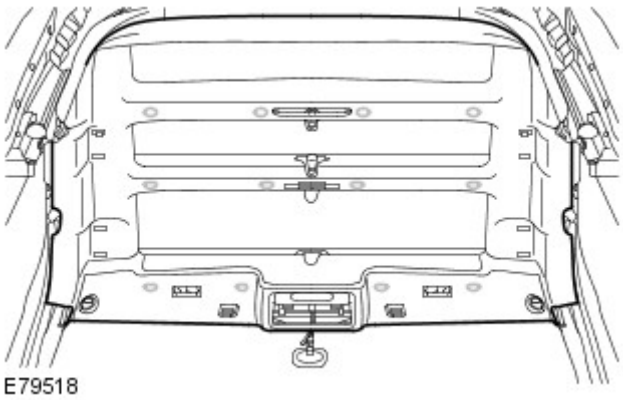
22. Release the rear of the headliner.



23. Release the front door seals.

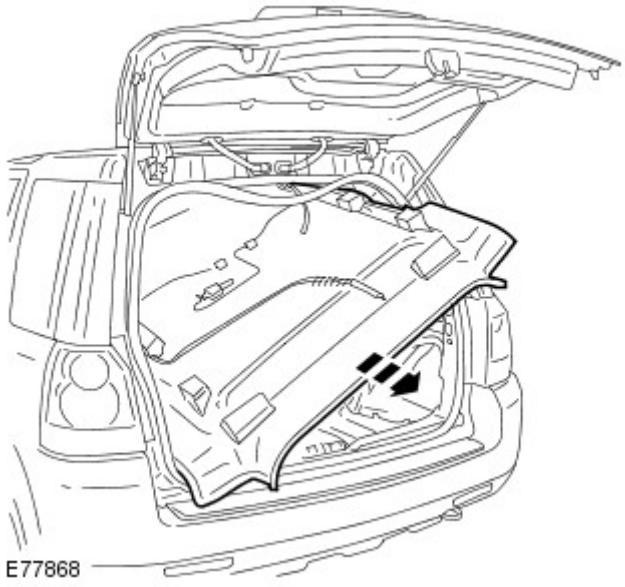


24. Disconnect the washer jet hose.



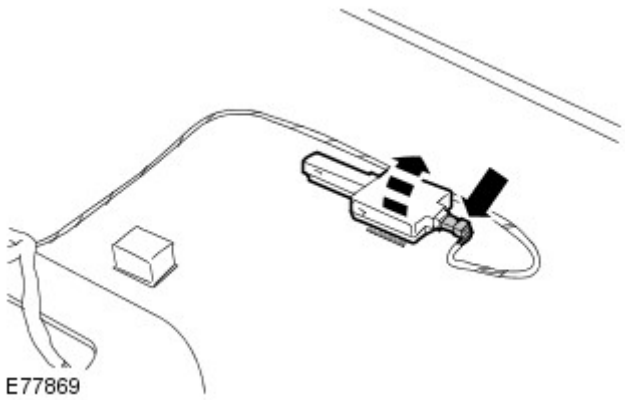
25. Release the headliner.

26. Disconnect the roof opening panel motor electrical connector.



27. **27.** NOTE: This step requires the aid of another technician.

    Remove the headliner.



28. **28.** NOTE: Do not disassemble further if the component is removed for access only.

    Remove the tire pressure monitoring system receiver.

29. **29.** NOTE: Make sure that this component is installed to the noted removal position.

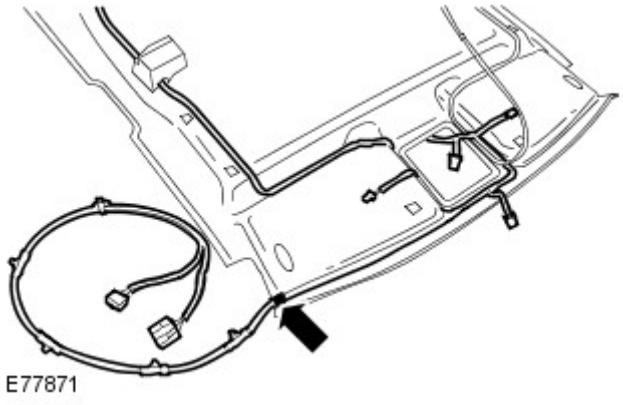
    Remove the washer jet hose.

30. Remove the 14 clips.

31. **31.** NOTE: Note the position of the wiring harnesses to aid installation.

    Remove the headliner wiring harness.

Installation



1. **1.** CAUTION: Make sure that the wiring harnesses are correctly located.
   - Align the yellow tape on the wiring harness to the corner of the headliner.
2. Install the clips.
3. Install the washer jet hose.
4. Install the tire pressure monitoring system receiver.
5. **5.** NOTE: This step requires the aid of another technician.

   Install the headliner.
6. Connect the roof opening panel motor electrical connector.
7. Connect the washer jet hose.
8. Attach the front door seals.
9. Attach the rear of the headliner.
10. Reposition the rear seats.
11. Reposition the front seats.
12. Install the passenger assist handles.
13. Install the rear interior lamp.
14. Install the center interior lamp.
15. Install the front interior lamps.
16. Install the overhead console.

    Refer to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).
17. Install the sun visors.
18. Install the interior rear view mirror.

    Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

19. Connect the headliner wiring harness and secure the clips.

20. Install the speaker grille.

21. Install the cowl side trim panel.

    Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

22. Install the glove compartment.

    Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

23. Install the rear quarter trim panel.

24. Install the loadspace securing ring and tighten the Torx screw.

    Torque: 25 Nm

25. Install the D-pillar trim panels.

    Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

26. Install the C-pillar trim panels.

    Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

27. Install the B-pillar trim panels.

    Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

28. Install the A-pillar trim panels.

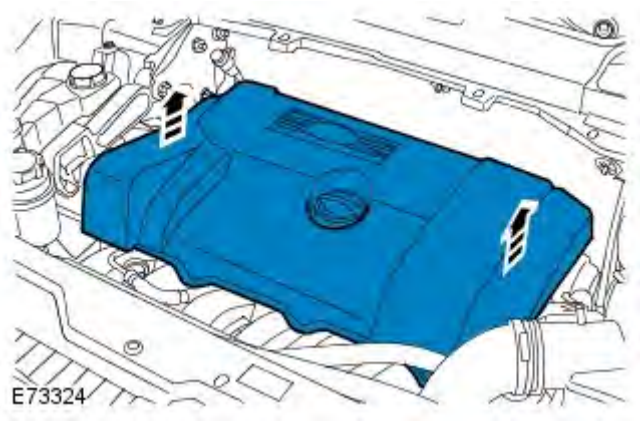
    Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Interior Trim and Ornamentation - Engine CoverI6 3.2L Petrol

Removal and Installation

Removal



1.

2. **2.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the 4 clips.

Installation

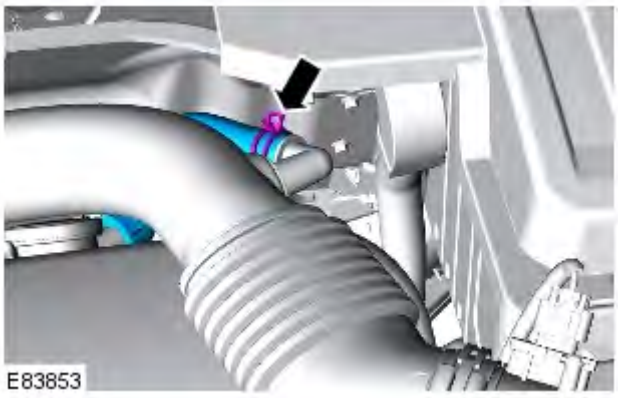
1. To install, reverse the removal procedure.

Published: 11-May-2011

Interior Trim and Ornamentation - Engine CoverTD4 2.2L Diesel

Removal and Installation

Removal

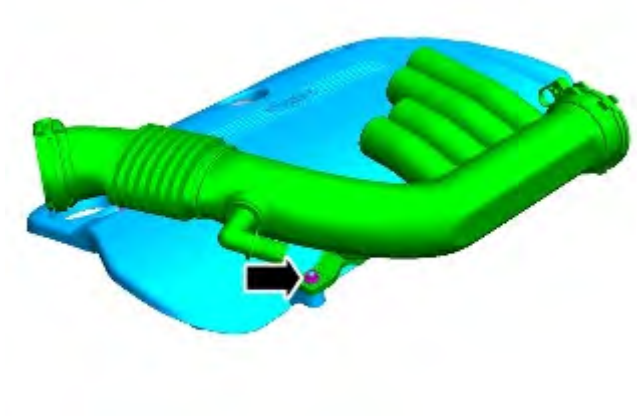


1.

2.

3. *Torque:* 10 Nm

4. *Torque:* 10 Nm



Installation

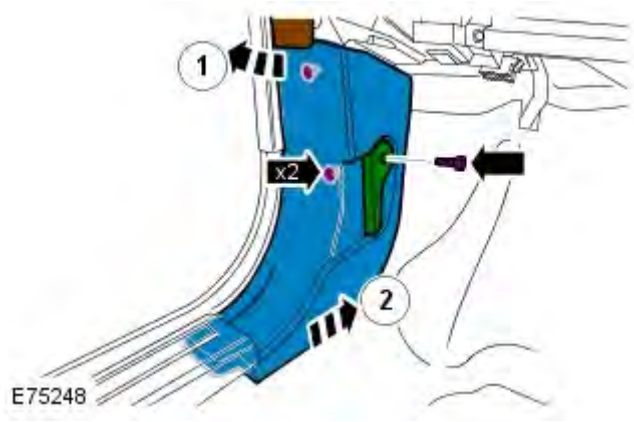
1. To install, reverse the removal procedure.

Published: 11-May-2011

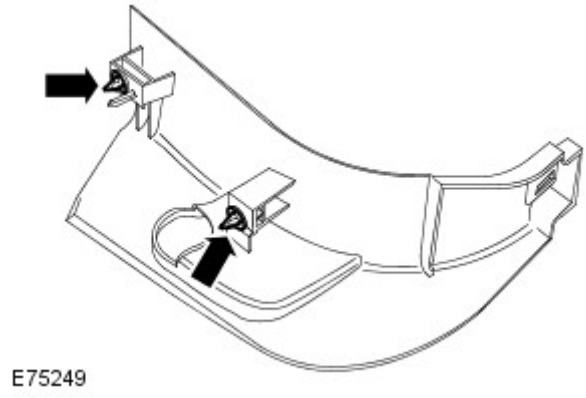
Interior Trim and Ornamentation - Cowl Side Trim Panel

Removal and Installation

Removal



1.



2. **2.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

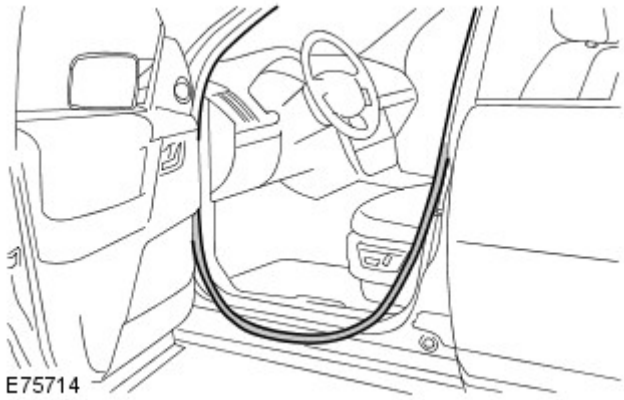
Interior Trim and Ornamentation - Front Scuff Plate Trim Panel

Removal and Installation

Removal

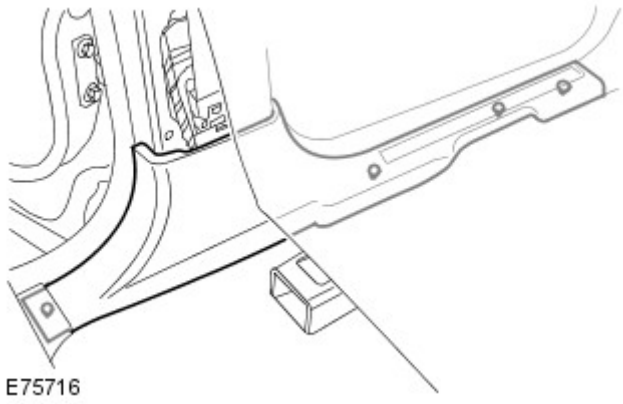
1. Remove the B-pillar lower trim panel.

   Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.

3.



4.

5. **5.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

2. Remove the B-pillar lower trim panel.

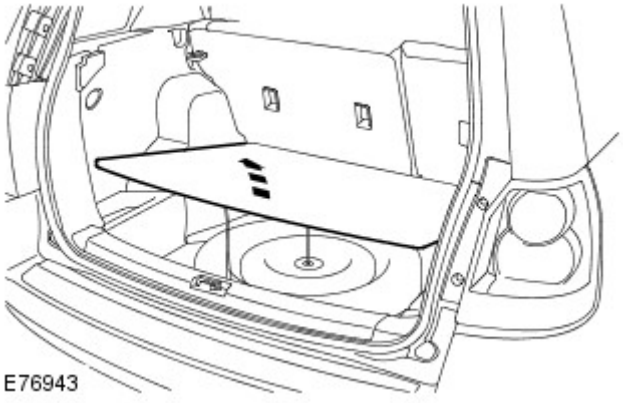
   Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

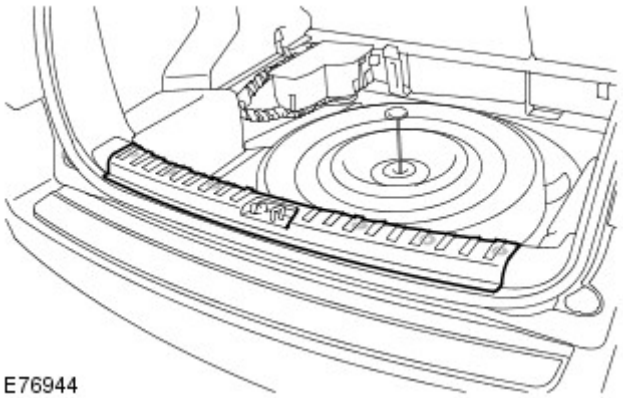
Interior Trim and Ornamentation - Rear Quarter Trim Panel

Removal and Installation

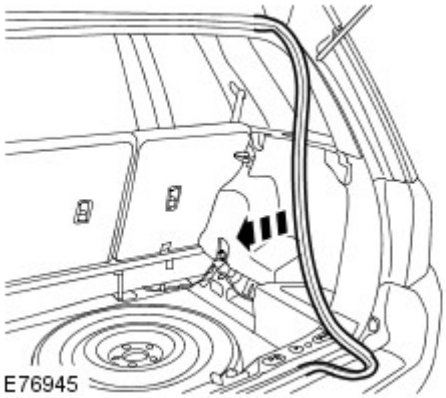
Removal



1.

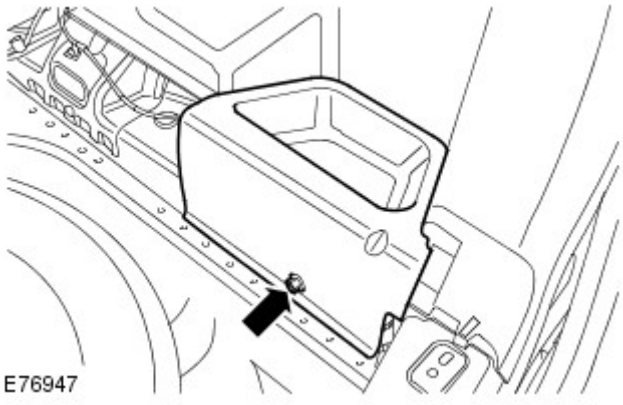


2. Remove the loadspace scuff plate.

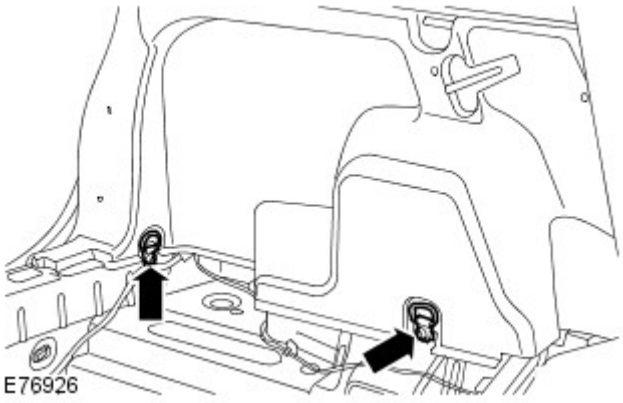


3. Release the liftgate seal.

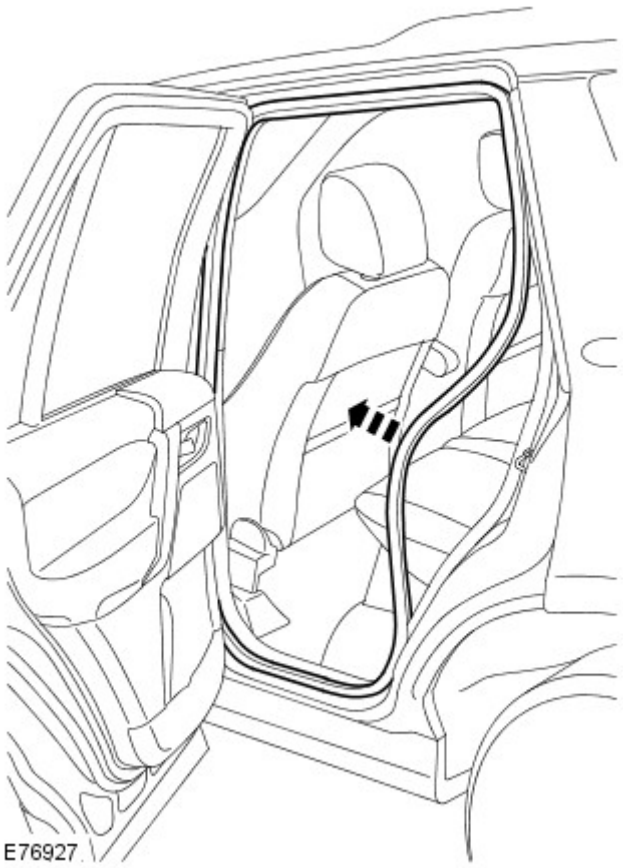
4.



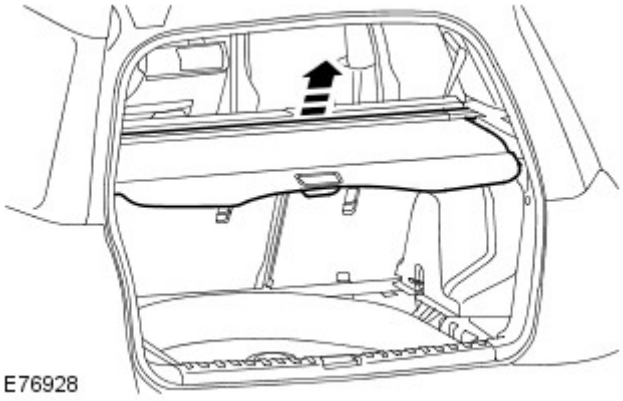
5.



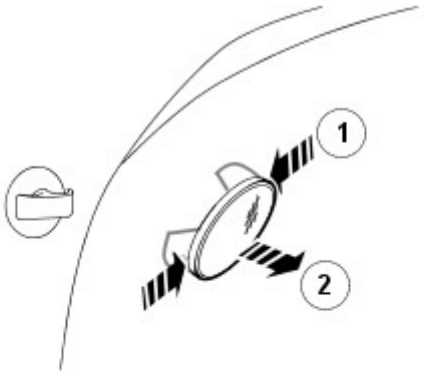
6. Release the rear door seal.

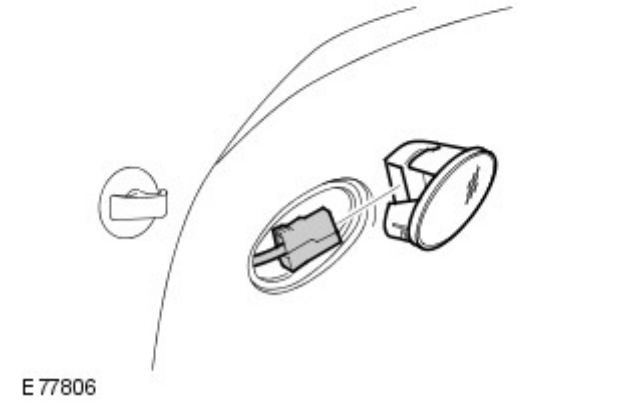


7.

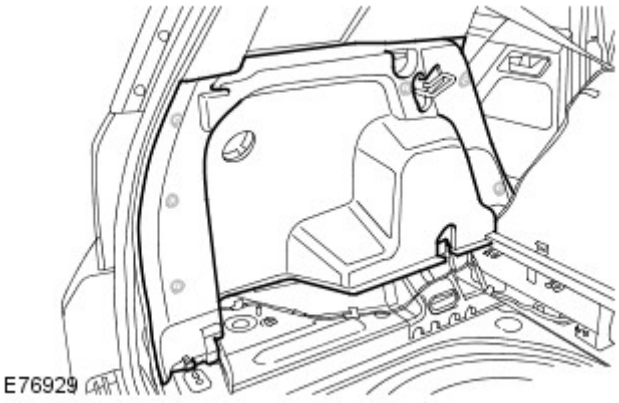


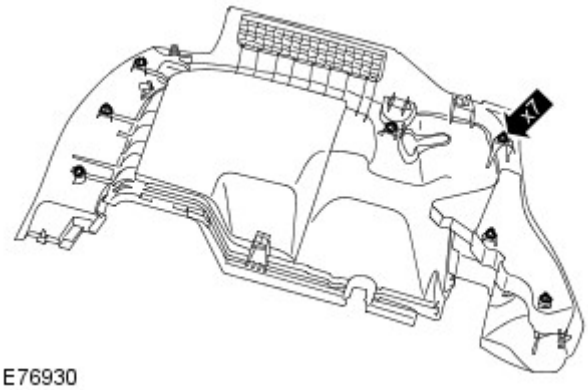
8. If installed, remove the loadspace lamp.





9. Remove the rear quarter trim panel.

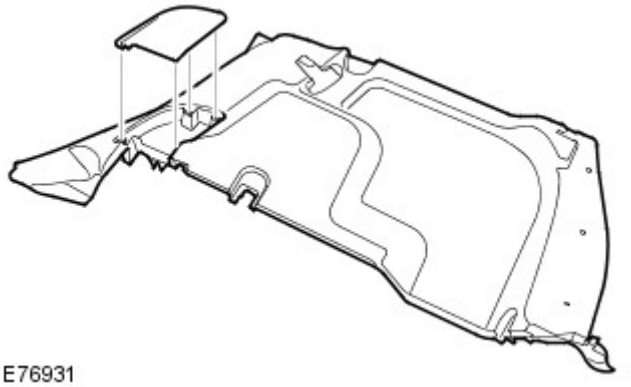




E76930

10. **10.** NOTE: Do not disassemble further if the component is removed for access only.

    Remove the 7 clips.


E76931

11. Remove the access cover.

Installation

1. Install the access cover.
2. Install the clips.
3. Install the rear quarter trim panel.
4. Install the loadspace lamp.
5. Install the loadspace roller blind.
6. Secure the rear door seal.
7. Install the loadspace securing ring and tighten the Torx screw.

   Torque: 25 Nm
8. Install the loadspace stowage tray.
9. Secure the liftgate seal.
10. Install the loadspace scuff plate.
11. Install the spare wheel cover.

Published: 11-May-2011

Exterior Trim and Ornamentation -

Torque Specifications

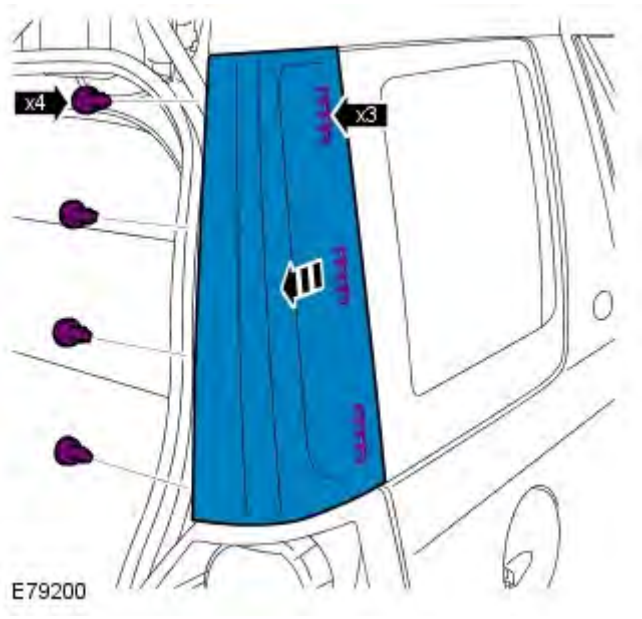
Description	Nm	lb-ft
Rear outer quarter panel moulding fixings	4	3

Published: 11-May-2011

Exterior Trim and Ornamentation - Rear Quarter Panel Moulding

Removal and Installation

Removal



1.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Rear View Mirrors -

Interior Rear View Mirror Types

Item	Land Rover Part No.
Prismatic / manual dipping mirror	6H52 17K695 AB
Electrochromatic mirror	6H52 17e678 AB
Electrochromatic mirror with Humidity sensor	6H52 17E678 BB

Torque Specifications

Description	Nm	lb-ft
Exterior mirror bolts	10	7

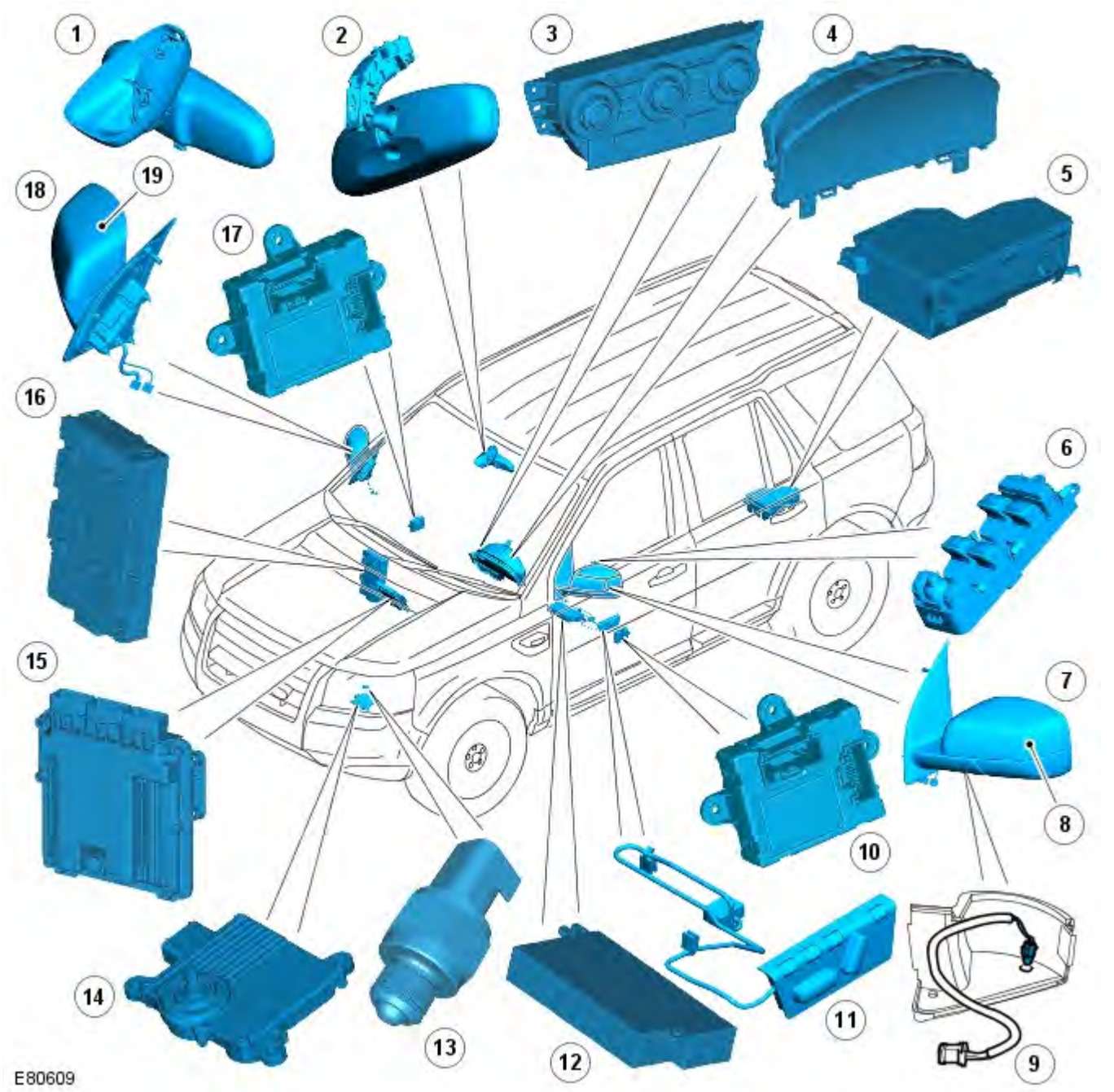
Published: 11-May-2011

Rear View Mirrors - Rear View Mirrors

Description and Operation

COMPONENT LOCATION

- NOTE: Left-Hand Drive (LHD) shown; Right-Hand Drive (RHD) similar.



Item	Part Number	Description
1	-	Manual dimming interior mirror
2	-	Automatic dimming interior mirror
3	-	Automatic Temperature Control (ATC) module
4	-	Instrument cluster
5	-	Auxiliary Junction Box (AJB)
6	-	Exterior mirror switch pack
7	-	Left-Hand (LH) exterior mirror
8	-	LH exterior mirror motor
9	-	Ambient air temperature sensor
10	-	LH door control module
11	-	Driver's memory seat switch pack
12	-	Driver's memory seat control module
13	-	Reverse gear switch - manual transmission
14	-	Transmission Control Module (TCM) - automatic transmission
15	-	Engine Control Module (ECM)

16	-	Central Junction Box (CJB)
17	-	Right-Hand (RH) door control module
18	-	RH exterior mirror
19	-	RH exterior mirror motor

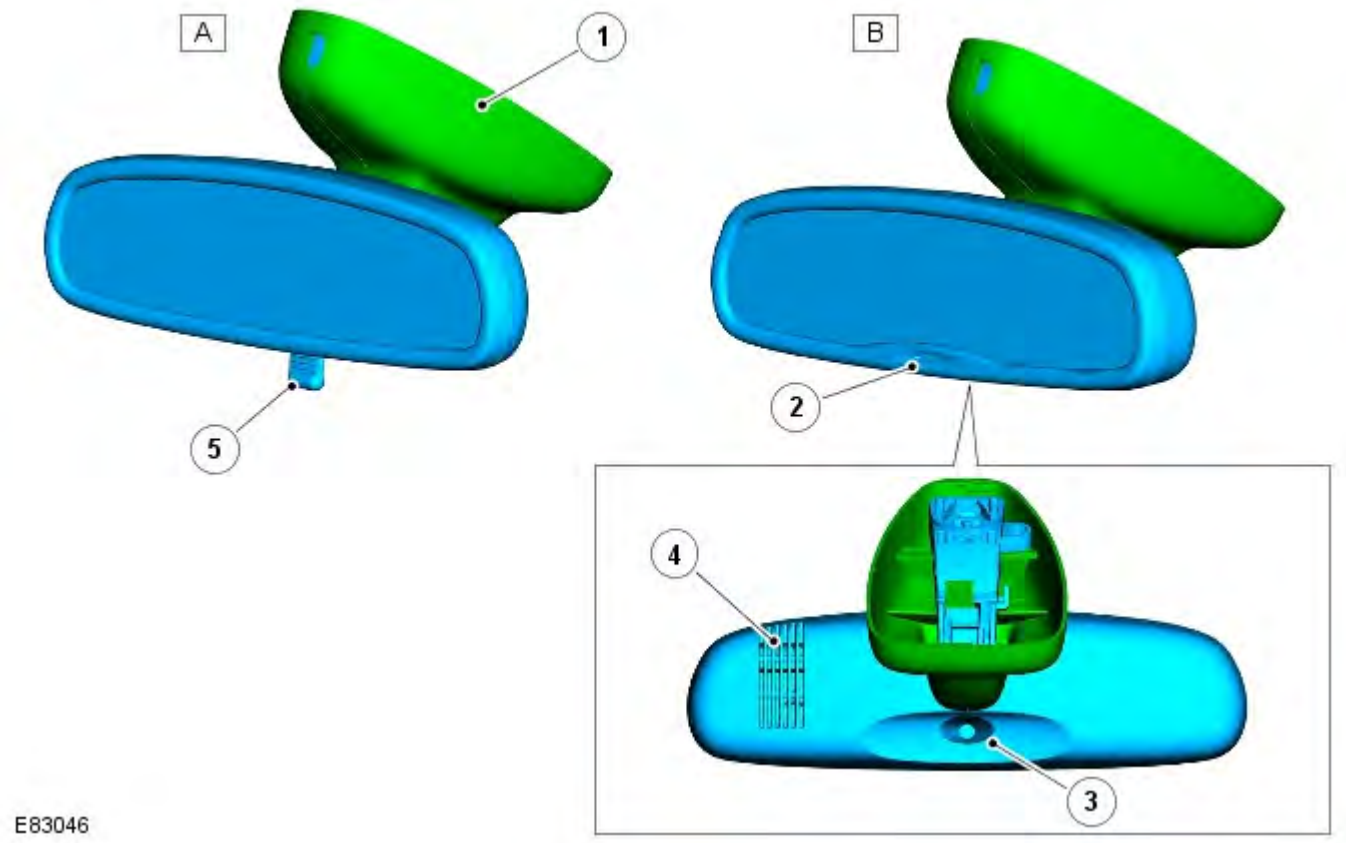
OVERVIEW

The rear view mirrors comprise an interior mirror mounted to the windshield, and an exterior mirror mounted on each front door cheater.

For Japanese specification vehicles, a driver proximity mirror is installed on the LH front corner of the hood.

The types of mirrors and associated operating functions installed depend on the specification and trim level of the vehicle.

INTERIOR MIRROR



Item	Part Number	Description
A	-	Manual dimming mirror
B	-	Automatic dimming mirror
1	-	Mirror stem cover (2 piece)
2	-	Rearward facing light sensor
3	-	Forward facing light sensor
4	-	Cabin humidity sensor
5	-	Manual dimming mirror lever

The interior rear view mirror is provided as a manual dimming or an electrically operated automatic dimming type. On certain vehicles, a cabin humidity sensor is incorporated in the electrically operated mirror casing.

Manual Dimming Mirror

The manual dimming mirror comprises a prismatic glass housed within a surrounding case that is attached with a ball joint connector to the mirror stem.

Manual dimming of the mirror is achieved using the lever mounted on the underside of the mirror body. Operating the lever will tilt the mirror head from the 'day' position to the 'night' position.

Automatic Dimming Mirror

The automatic dimming mirror comprises an electro-chromatic glass housed within a surrounding case that is attached with a ball joint connector to the mirror stem. The mirror stem incorporates an 8-pin electrical connector that is connected to the roof panel wiring harness. The wiring harness provides hardwired and a Local Interconnect Network (LIN) connection to the CJB.

Light sensors are mounted on the front and rear of the mirror surround case. The sensors control the automatic dimming feature to reduce glare from the headlights of following vehicles.

The automatic dimming function is permanently active when the ignition is in power mode 4 (Accessory) and power mode 6

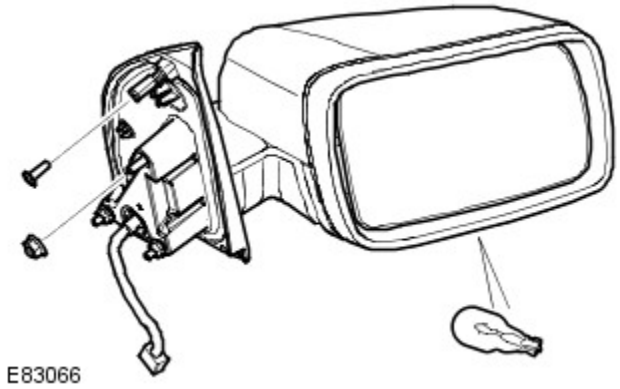
(Ignition). The forward facing light sensor monitors the ambient light level at the front of the vehicle; the rearward facing light sensor monitors the light level coming from the rear of the vehicle. When light from the rear of the vehicle exceeds the ambient light level from the front of the vehicle, the automatic dimming circuit darkens the interior mirror surface.

Automatic dimming is inhibited when reverse gear is selected to provide the driver with maximum vision. On vehicles with automatic transmission, the reverse gear signal is provided by the TCM via the high speed Controller Area Network (CAN) bus to the CJB. The CJB then provides a power feed to the mirror. On vehicles with manual transmission, the reverse gear signal is provided by a transmission switch that is hardwired to the CJB.

Cabin Humidity Sensor

Depending on the vehicle specification, the automatic dimming interior mirror may also incorporate a cabin humidity sensor. The cabin humidity sensor is located in the mirror rear casing near to the windshield, and provides the ATC module with information regarding the probability of windshield misting. This information is used to vary the automatic operation of the climate control system.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

EXTERIOR MIRRORS



Electrically operated and heated exterior mirrors are installed as standard. Depending on the specification and trim level of the vehicle, the following options are available:

- Power fold (switch pack operated feature) and auto fold (remote handset operated feature)
- Memory recall
- Reverse gear mirror dip
- Exterior mirror lamps.

The power fold/auto fold feature is available only when power fold mirrors are installed to the vehicle.

The auto fold and reverse gear mirror dip functions are not customer configurable, but may be enabled or disabled by the dealer using the Land Rover approved diagnostic system. The diagnostic system enables or disables either or both functions by setting the EEPROM contained within the instrument cluster.

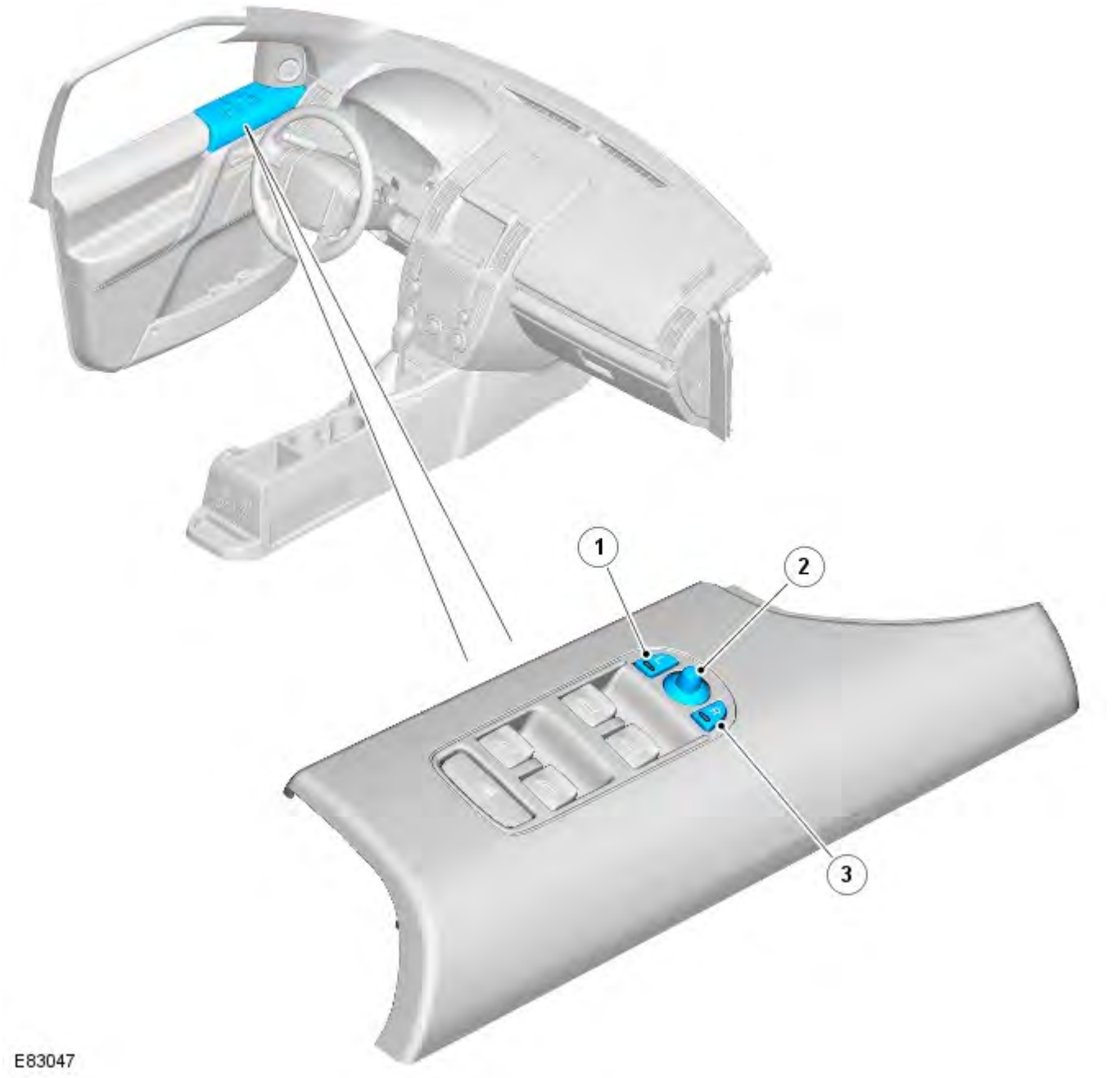
The LH door mirror incorporates an ambient air temperature sensor that is hardwired to the ECM. The ECM is connected to the CJB and other control modules via the high speed CAN bus. The sensor provides information to the ECM that is then transmitted on the medium speed CAN bus for use by other control modules. On vehicles installed with a high-line instrument cluster, the CJB transmits the temperature signal to the instrument cluster that provides a display of the ambient temperature to the driver.

For additional information, refer to:

> Electronic Engine Controls - 2.2L Diesel (303-14 Electronic Engine Controls - 2.2L Diesel, Description and Operation), Information and Message Center (413-08 Information and Message Center, Description and Operation).

The exterior mirror lamps are controlled by the interior lighting function.
For additional information, refer to: Interior Lighting (417-02 Interior Lighting, Description and Operation).

Exterior Mirror Adjustment



Item	Part Number	Description
1	-	LH exterior mirror select switch
2	-	4-way directional joystick
3	-	RH exterior mirror select switch

The door mirrors are controlled using a switch pack located on the driver's door. The switch pack contains 2 non-latching mirror select switches labeled '**L**' and '**R**' and a 4-way directional joystick. The switch pack is connected to the driver door control module via the LIN bus. The driver and front passenger door control modules are connected via the medium speed CAN bus. A hardwired connection between each door control module and the corresponding door mirror, provides the supply and ground paths for the mirror motors.

Each exterior door mirror incorporates 2 motors to control horizontal (left/right) and vertical (up/down) adjustments.

On vehicles installed with a driver's power operated memory seat and memory exterior mirrors, a potentiometer is incorporated within each mirror motor and is used to provide information regarding the actual motor positions. The current position and memory positions of each door mirror motor are maintained and stored within the corresponding door control module.

The memory exterior mirror positions are also monitored and stored within door control module memory when the reverse gear mirror dip function is used.

When reverse gear is selected, the door control modules store the current mirror positions and will then dip both the driver and passenger mirror glass to a default dip position. While reverse gear is selected it is possible to store a preferred dipped mirror position by adjusting the driver/passenger mirror glass to the desired position via the mirror switch pack. When the desired position is achieved using the switches, the new dip positions will be automatically stored by the door control modules when reverse gear is de-selected. Therefore when reverse gear is re-selected, the dip position recalled by the door control modules will be the new reverse gear mirror dip stored position. When reverse gear is deselected the mirror glass will automatically move to the previous stored position prior to reverse gear selection.

Reverse gear mirror dip is only available when memory mirrors are installed, and reverse gear mirror dip is enabled within the instrument cluster.

If the driver selects a memory recall function using the memory seat switch pack, the driver's memory seat and exterior memory mirrors are moved to a stored memory position.
For additional information, refer to: Seats (501-10 Seating, Description and Operation).

Mirror Power Fold and Auto Fold Feature

Exterior mirrors with the power fold/auto fold feature incorporate a motor located in the hinge of each exterior mirror arm. Operation of the power fold feature is achieved using the exterior mirror switch pack. Operation of the auto fold feature is achieved using the remote handset.

The power fold function is active when the ignition is in power mode 6 (Ignition).

Both exterior mirrors will power fold when the mirror switch pack '**L**' and '**R**' switches are pressed together. Pressing the switches again will unfold the mirrors.

When the instrument cluster is configured for the auto fold feature, the mirrors will fold in when the remote handset lock button is pressed. The mirrors will unfold when the vehicle is unlocked using the remote handset unlock button.

• NOTE: If the mirrors are folded in using the mirror switch pack (power fold) and the vehicle is then locked, subsequent unlocking of the vehicle will not unfold the mirrors.

When the remote handset unlock button is operated, the CJB recognizes the remote handset for that vehicle and acknowledges the request. The door control modules are connected directly to the AJB for power supply to the exterior mirror folding motors.

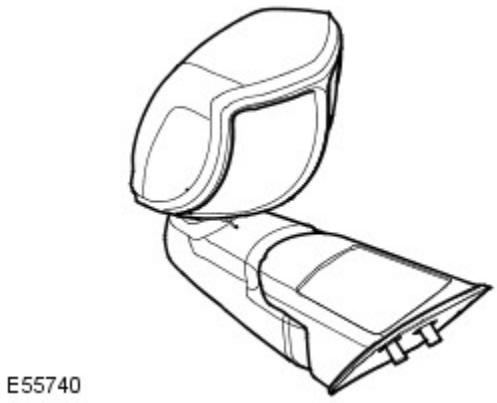
When the vehicle is locked the door control modules reverse the polarity of the mirror fold motor, power and ground connections to operate the mirrors in the opposite direction.

Exterior Mirror Heating

Exterior mirror heating is provided with heater elements bonded to the back of the mirror glass. Power supply for the mirror heating elements is provided by the corresponding driver or passenger door control module via the AJB.

The door control modules receive a power supply from the AJB, and are both connected on the medium speed CAN bus to the ATC module. A ground terminal from each door control module completes the circuit. The ATC module automatically controls the mirror heating function whenever the ignition is in power mode 4 (Accessory) and power mode 6 (Ignition).
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

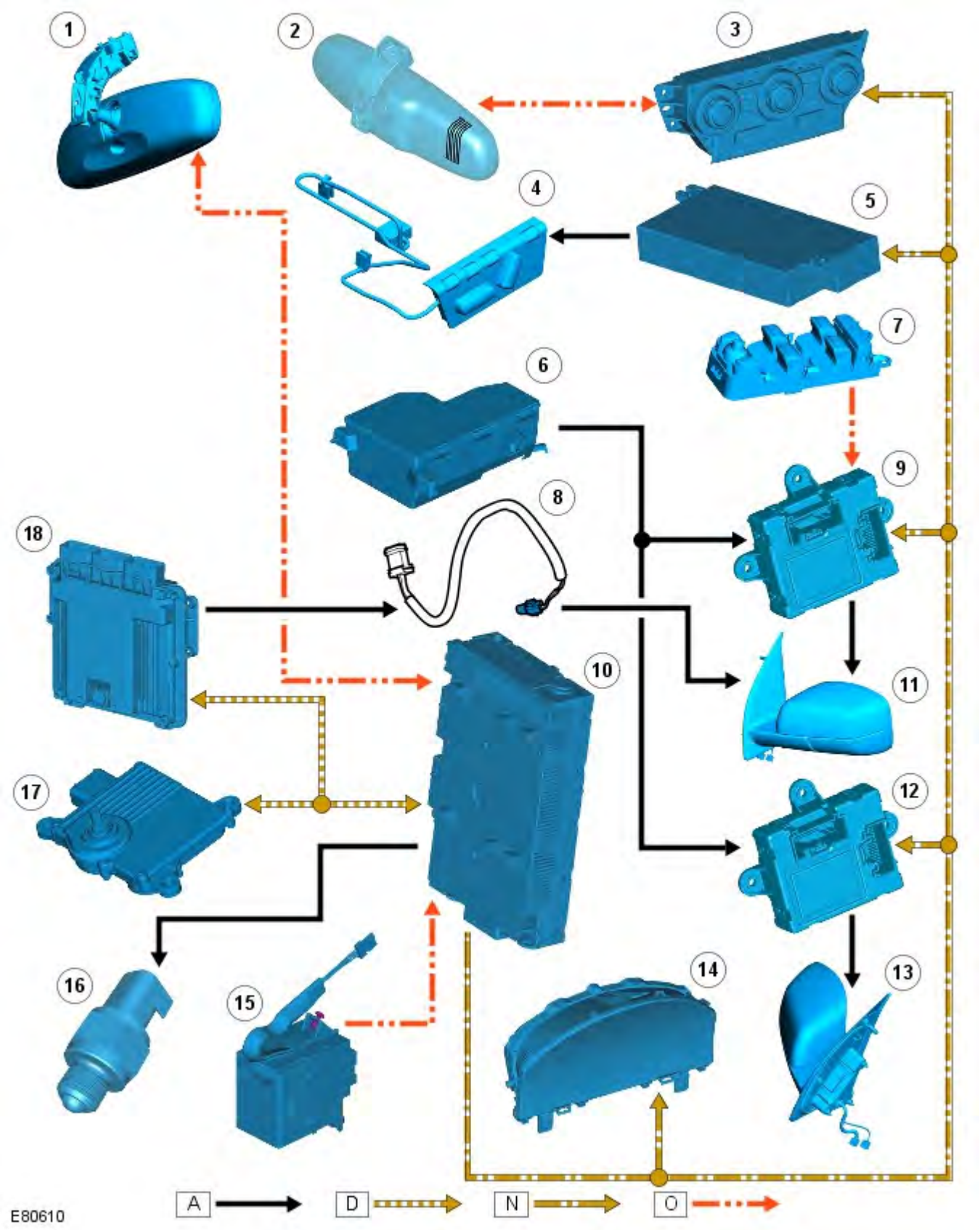
DRIVER PROXIMITY MIRROR (JAPANESE SPECIFICATION ONLY)



The proximity mirror allows the driver to view the 'blind spots' below the level of the hood when performing low speed maneuvering. The mirror is manufactured in plastic and comprises a lens housing attached to a pivot arm that is attached to the LH front corner of the hood. Two lenses in the housing provide coverage across the front and along the LH side of the vehicle. The mirror is manually adjusted in the horizontal plane only.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus; **O** = LIN bus.



Item	Part Number	Description
1	-	Automatic dimming interior mirror
2	-	Automatic dimming interior mirror (with ATC humidity sensor)
3	-	ATC module
4	-	Driver's memory seat switch pack
5	-	Driver's memory seat control module
6	-	AJB
7	-	Exterior mirror switch pack
8	-	Ambient air temperature sensor
9	-	LH door control module
10	-	CJB
11	-	LH exterior mirror

12	-	RH door control module
13	-	RH exterior mirror
14	-	Instrument cluster
15	-	Start control module
16	-	Reverse gear switch - manual transmission
17	-	TCM - automatic transmission
18	-	ECM

Published: 11-May-2011

Rear View Mirrors - Rear View Mirrors

Diagnosis and Testing

Principles of Operation

For a detailed description of the rear view mirror systems, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Condition, correct installation and security of rear view mirrors	• Fuses/relays (refer to electrical guide) • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connections

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
B116311	Left Mirror Heater Output short to ground	• Short to ground	Refer to the electrical circuit diagrams and test left mirror heater output circuit for short to ground
B116315	Left Mirror Heater Output short to power	• Short to power or open circuit	Refer to the electrical circuit diagrams and test left mirror heater output circuit for short to power or open circuit
B116411	Right Mirror Heater Output short to ground	• Short to ground	Refer to the electrical circuit diagrams and test right mirror heater output circuit for short to ground
B116415	Right Mirror Heater Output short to power	• Short to power or open circuit	Refer to the electrical circuit diagrams and test right mirror heater output circuit for short to power or open circuit
B1A9411	Driver Mirror	• Short to ground	Refer to the electrical circuit diagrams and test driver mirror fold motor circuit for short to ground
B1A9415	Driver Mirror	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver mirror fold motor circuit for short to power or open circuit
B1A9511	Passenger Mirror	• Short to ground	Refer to the electrical circuit diagrams and test passenger mirror fold motor circuit for short to ground
B1A9515	Passenger Mirror	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger mirror fold motor circuit for short to power or open circuit
B1C0911	Driver Left/Right Mirror Motor Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver left/right mirror motor circuit for short to ground
B1C0915	Driver Left/Right Mirror Motor Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver left/right mirror motor circuit for short to power or open circuit
B1C1011	Driver Up/Down Mirror Motor Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver up/down mirror motor circuit for short to ground

DTC	Description	Possible Causes	Action
B1C1015	Driver Up/Down Mirror Motor Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver up/down mirror motor circuit for short to power or open circuit
B1C1111	Passenger Left/Right Mirror Motor Circuit	• Short to ground	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1115	Passenger Left/Right Mirror Motor Circuit	• Short to power or open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1211	Passenger Up/Down Mirror Motor Circuit	• Short to ground	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1215	Passenger Up/Down Mirror Motor Circuit	• Short to power or open circuit	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1311	Driver Up/Down Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to ground
B1C1315	Driver Up/Down Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to power or open circuit
B1C1411	Driver Left/Right Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to ground
B1C1415	Driver Left/Right Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to power or open circuit
B1C1511	Passenger Up/Down Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to ground
B1C1515	Passenger Up/Down Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to power or open circuit
B1C1611	Passenger Left/Right Mirror Motor Feedback Circuit	• Short to ground	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to ground
B1C1615	Passenger Left/Right Mirror Motor Feedback Circuit	• Short to power or open circuit	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to power or open circuit

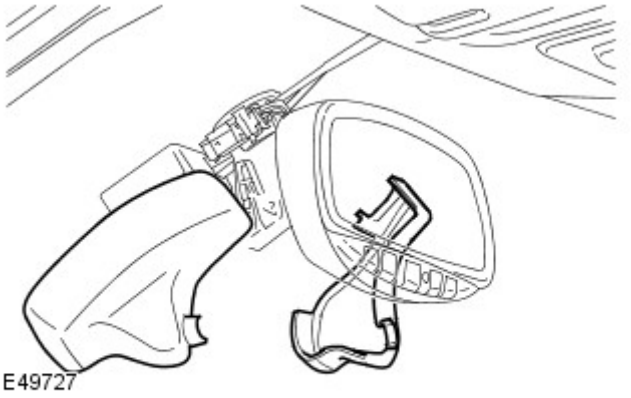
Published: 11-May-2011

Rear View Mirrors - Interior Rear View Mirror

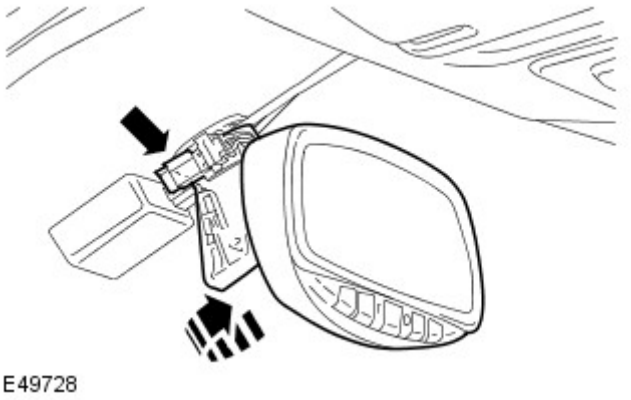
Removal and Installation

Removal

• NOTE: A humidty sensor is installed to certain derivatives. It is part of the interior rear view mirror and cannot be serviced separately.



1.



2.

- Disconnect the electrical connector.
- Rotate the mirror stem at its base to release from the windshield.

Installation

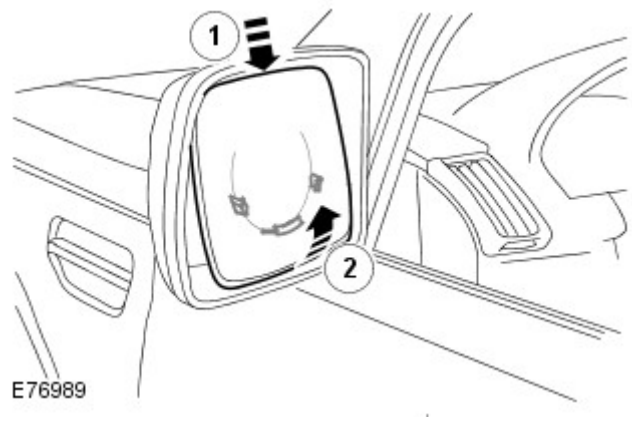
1. To install, reverse the removal procedure.

Published: 11-May-2011

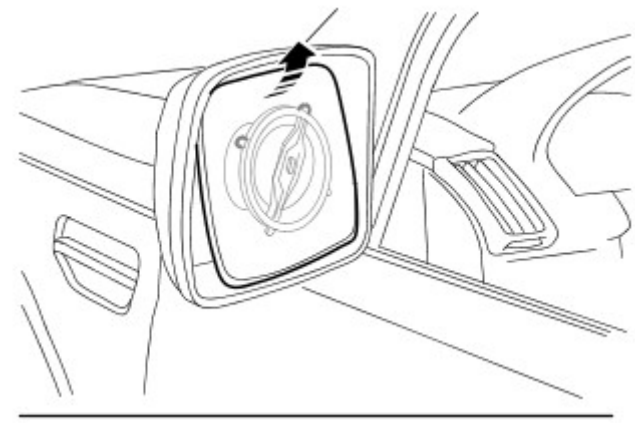
Rear View Mirrors - Exterior Mirror Glass

Removal and Installation

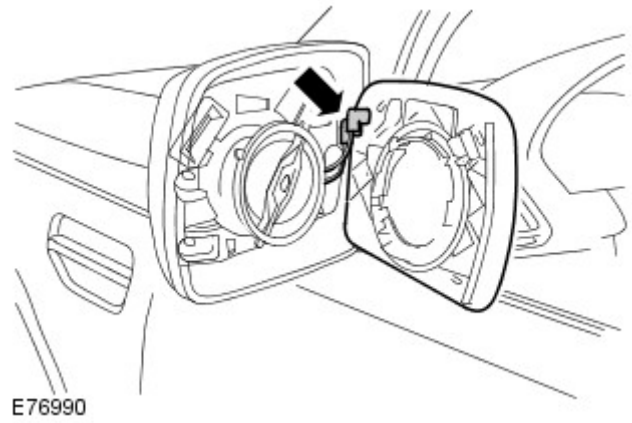
Removal



1. Release the exterior mirror glass.



2. Remove the exterior mirror glass.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Rear View Mirrors - Exterior Mirror

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

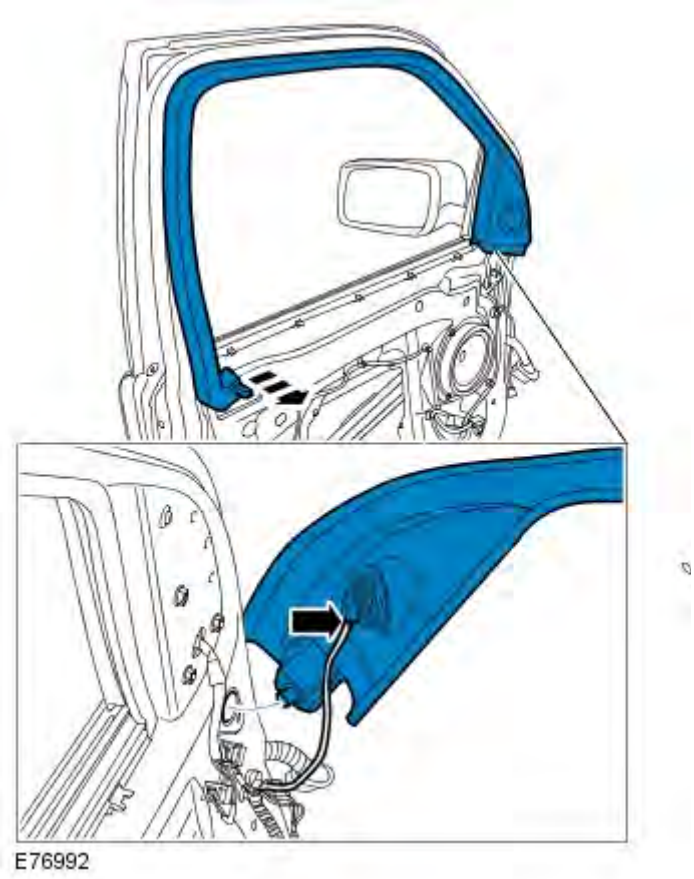
1. Lower the window glass.
2. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the front door trim panel.

   Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

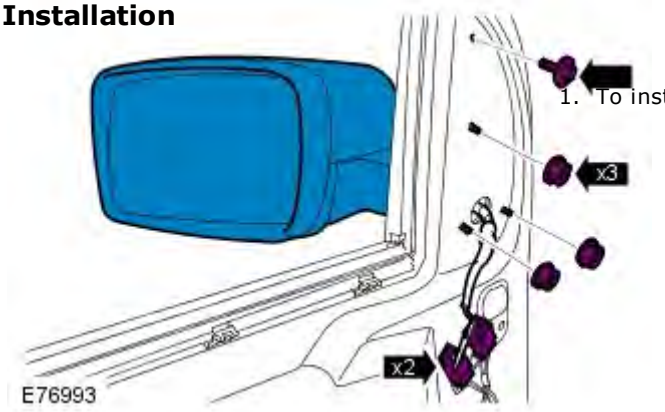
4. Remove the front door frame trim.



Installation

5.
   - *Torque:* 10 Nm

1. To install, reverse the removal procedure.



Published: 11-May-2011

Rear View Mirrors - Exterior Mirror Motor

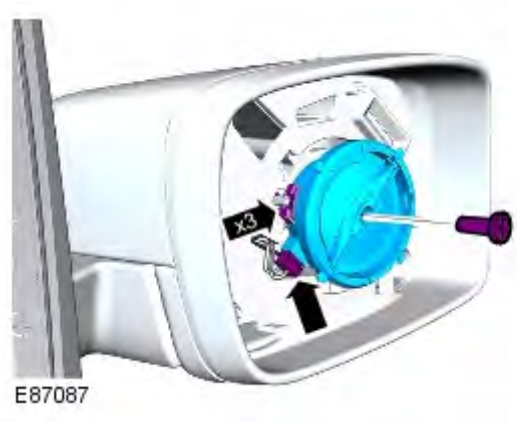
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the exterior mirror glass.

   Refer to: Exterior Mirror Glass (501-09 Rear View Mirrors, Removal and Installation).



2. *Torque:* 5 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Seating -

Torque Specifications

Description	Nm	lb-ft
Adaptor bracket - cushion frame screw	45	33
Cushion frame - pretensioner bolt	45	33
Front seat armrest Torx bolt	10	7
Front seat control switch screws	1	1
Front seat cushion bolts	25	18
Front seat tilt motor bolts	10	7
Heater mat control unit bracket screws	3	2
Front seat Torx bolts*	40	30
Front seat height adjustment motor nuts	25	18
Rear center seat belt attachment bolt	47	35
Rear seat cushion bolts	25	18
Rear seat outer pivot bolt	35	26
Rear seat latch attachment bolts	23	17
Seat module bracket Torx bolts	3	1
Squab frame to cushion frame	21	15
Squab frame - Side airbag nut	9	7
Track - Assembly adaptor bracket nuts	21	15
Track - Front and rear foot nuts	21	15

***New nuts/bolts must be fitted**

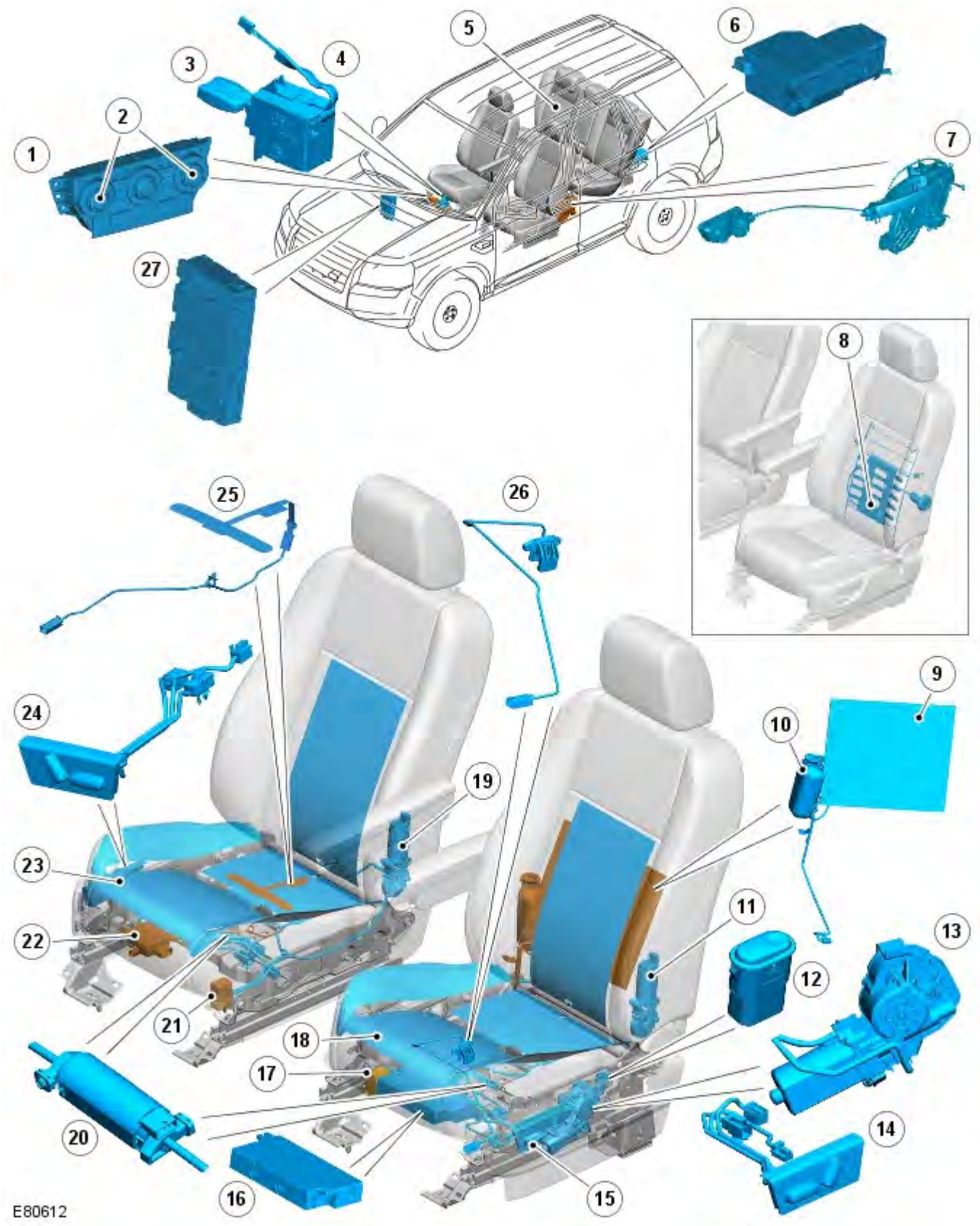
Published: 11-May-2011

Seating - Seats

Description and Operation

COMPONENT LOCATION

• NOTE: Left-Hand Drive (LHD) shown; Right-Hand Drive (RHD) similar.



Item	Part Number	Description
1	-	Automatic Temperature Control (ATC) module
2	-	Front seat heating control switches

3	-	Remote handset
4	-	Start control module
5	-	Rear passenger seats
6	-	Auxiliary Junction Box (AJB)
7	-	Driver's door latch and ajar switch
8	-	Driver's seat manual operated lumbar support
9	-	Power operated lumbar support air cells
10	-	Driver's seat power operated lumbar support motor
11	-	Driver's power operated seat squab recline motor
12	-	Power operated lumbar support switch
13	-	Driver's power operated seat height motor
14	-	Driver's power operated non-memory seat switch pack
15	-	Driver's power operated memory seat switch pack
16	-	Driver's power seat module (memory)
17	-	Driver's seat heating module
18	-	Driver's seat cushion/squab heating element
19	-	Passenger power operated seat squab recline motor
20	-	Driver's and passenger power operated seat slide motor
21	-	Passenger seat heating module
22	-	Passenger seat occupancy classification sensor
23	-	Passenger seat cushion/squab heating element
24	-	Passenger power operated seat non-memory switch pack
25	-	Passenger seat occupancy detection sensor
26	-	Driver's seat position sensor
27	-	Central Junction Box (CJB)

OVERVIEW

All vehicles, except those manufactured to North American Specification (NAS), are installed with manually operated front seats as standard. Options available include electrically power operated front seats without memory function, and an electrically power operated driver's seat with memory functionality. The front seats may also be provided with arm rests to improve driver and front passenger comfort.

NAS vehicles are installed with power operated front seats as standard. The front seats feature arm rests to improve driver and front passenger comfort. A driver's power operated seat with memory functionality is provided as an option for NAS vehicles.

Depending on vehicle specification and trim level, vehicles may also feature front heated seats and a lumbar support system. Lumbar support is provided as a manual or electrically operated system, and is only available for the driver's seat.

The rear seat is manufactured to the same specification for all vehicles, and is provided with ISOFIX child safety seat restraints.

All seats incorporate adjustable head restraints. Depending on the vehicle specification the seats are upholstered in either all cloth, cloth/leather/PVC, leather/PVC or all PVC finish.

FRONT SEAT CONSTRUCTION

The front seat base is manufactured from high strength steel extrusions designed to exceed current legal strength requirements. The seat base is molded to form an anti-submarine hollow that will retain the occupant in the seat during a front end collision. The seat backrest is manufactured from high strength steel and features a wire suspension system to provide increased comfort. The backrest is attached at both sides of the seat base with a high strength steel bracket and pivot.

The seat base and backrest are inlayed with formed sections of dual hardness, molded foam to form the seat squab and cushion. The seats are designed to provide support, comfort and an ergonomic position for the driver and passenger.

The driver and passenger front seats are provided with additional safety features. The front driver's seat is installed with a seat position sensor; the front passenger seat is installed with an occupancy classification system sensor (dependant on vehicle specification) and an occupancy detection system. Both the driver's and passenger seat safety features provide inputs to control the deployment of the air bags and seat belt pre-tensioners.
For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).

The front seat belt buckles are mounted integrally with the seats to provide increased anchorage and occupant restraint.
For additional information, refer to: Safety Belt System (501-20A Safety Belt System, Description and Operation).

MANUALLY OPERATED FRONT SEATS

E83152

Item	Part Number	Description
A	-	Driver's seat
B	-	Front passenger seat
1	-	Seat squab recline wheel
2	-	Seat height lever (driver's seat only)
3	-	Seat slide lever

The manually operated front seats provide a 4-way adjustable passenger seat with forward-rearward, incline-recline functions, and a 6-way adjustable driver's seat with forward-rearward, raise-lower and incline-recline functions. Operation of the seat adjustment levers will move the seat in the corresponding direction. For additional information on the manual seat controls, refer to the relevant section of the Owner's Handbook.

FRONT POWER OPERATED NON-MEMORY SEATS

Item	Part Number	Description
A	-	Driver's power operated non-memory seat
B	-	Front passenger power operated non-memory seat

The driver's non-memory seat is 6-way adjustable with forward-rearward, raise-lower and incline-recline functions; the passenger non-memory seat is 4-way adjustable with forward-rearward, incline-recline functions. Height adjustment is not required for the passenger seat.

Front Non-Memory Seat Switch Pack and Motors

Item	Part Number	Description
A	-	Driver's power operated non-memory seat
B	-	Front passenger power operated non-memory seat
1	-	Seat squab recline motor
2	-	Driver's seat height motor
3	-	Driver's power operated non-memory seat switch pack
4	-	Seat slide motor
5	-	Passenger power operated non-memory seat switch pack

Movement of the seat is achieved using the control switch pack located on the outboard side of the seat. The seat control switches directly operate the corresponding seat adjustment motors, mounted to the seat frame and backrest. For additional information on the power operated non-memory seat controls, refer to the relevant section of the Owner's Handbook.

The seat adjustment motors are a permanent magnet motor type, coupled to a rack and pinion assembly.

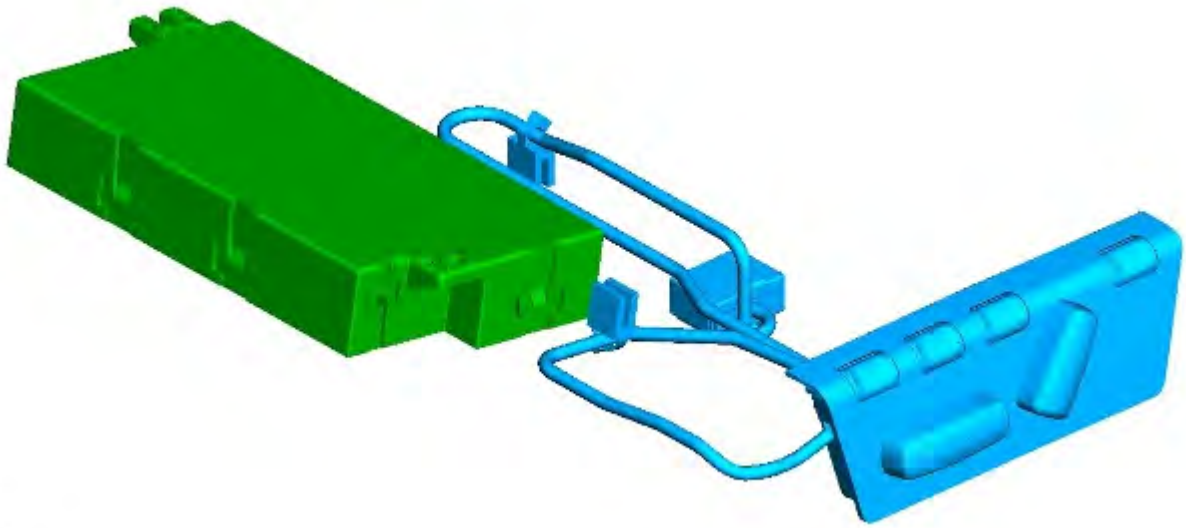
DRIVER'S POWER OPERATED MEMORY SEAT

E83155

Item	Part Number	Description
1	-	Driver's memory seat switch pack
2	-	Power seat module

The driver's power operated seat with memory is 6-way adjustable and comprises the same control components as the front non-memory seat. The seat incorporates a power seat module located under the seat frame that allows up to 3 memory positions for the seat to be stored and recalled. If memory exterior mirrors are installed, the power seat module also initiates movement of the exterior mirrors by transmitting a command signal to the front door control modules when the seat memory position is recalled. The front door control modules are used to store and recall the memory exterior mirror positions.
For additional information, refer to: Rear View Mirrors (501-09 Rear View Mirrors, Description and Operation).

Power Seat Module



E83156

The power seat module is connected in the wiring between the seat switch pack and seat adjustment motors. The module contains a non-volatile Electrically Erasable Programmable Read Only Memory (EEPROM).

The power seat module monitors the seat positions and stores information provided by the seat track Hall sensors. The Hall sensors are incorporated within the seat adjustment motors. All seat memory values and current seat motor positions are stored in the EEPROM.

In the event of a power loss, when power is restored the current motor positions are recalled from the EEPROM memory

and adopted as the current positions. This will allow the relative memory positions to be retained without any need to recalibrate the power seat module.

The power seat module is able to be 'flashed' for service updates or interrogated using the Land Rover approved diagnostic equipment.

Up to 3 different seat positions are able to be stored in the power seat module. Seat positions are stored in memory by pressing the memory button (**M**), and then 1 of the 3 memory store buttons (**1**, **2**, **3**) within 5 seconds. The memory buttons are located on the switch pack. The switch pack memory buttons allow the driver to control the memory storage and recall operations for the seat and exterior mirrors. The switch pack buttons are non-latching, momentary action switches.

On vehicles installed with a high-line instrument cluster and the ignition switched on, the seat position memory store commands are displayed in the message center and a single chime is sounded to confirm the new seat position is saved.

• NOTE: Low-line instrument clusters are not installed to vehicles equipped with a memory seat system.

For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation) / Information and Message Center (413-08 Information and Message Center, Description and Operation).

The power seat module provides the following driver selectable functions:

- Seat and exterior mirror memory recall
- Immediate seat adjustment.

For further operating details of the driver selectable functions, refer to the section 'Principles of Operation'.

The activity of the seat is automatically monitored by the power seat module. The module will react to motors that are not functioning correctly to an operation request, and will also aim to reduce power consumption during periods of inactivity.

The power seat module provides the following automatic monitoring functions:

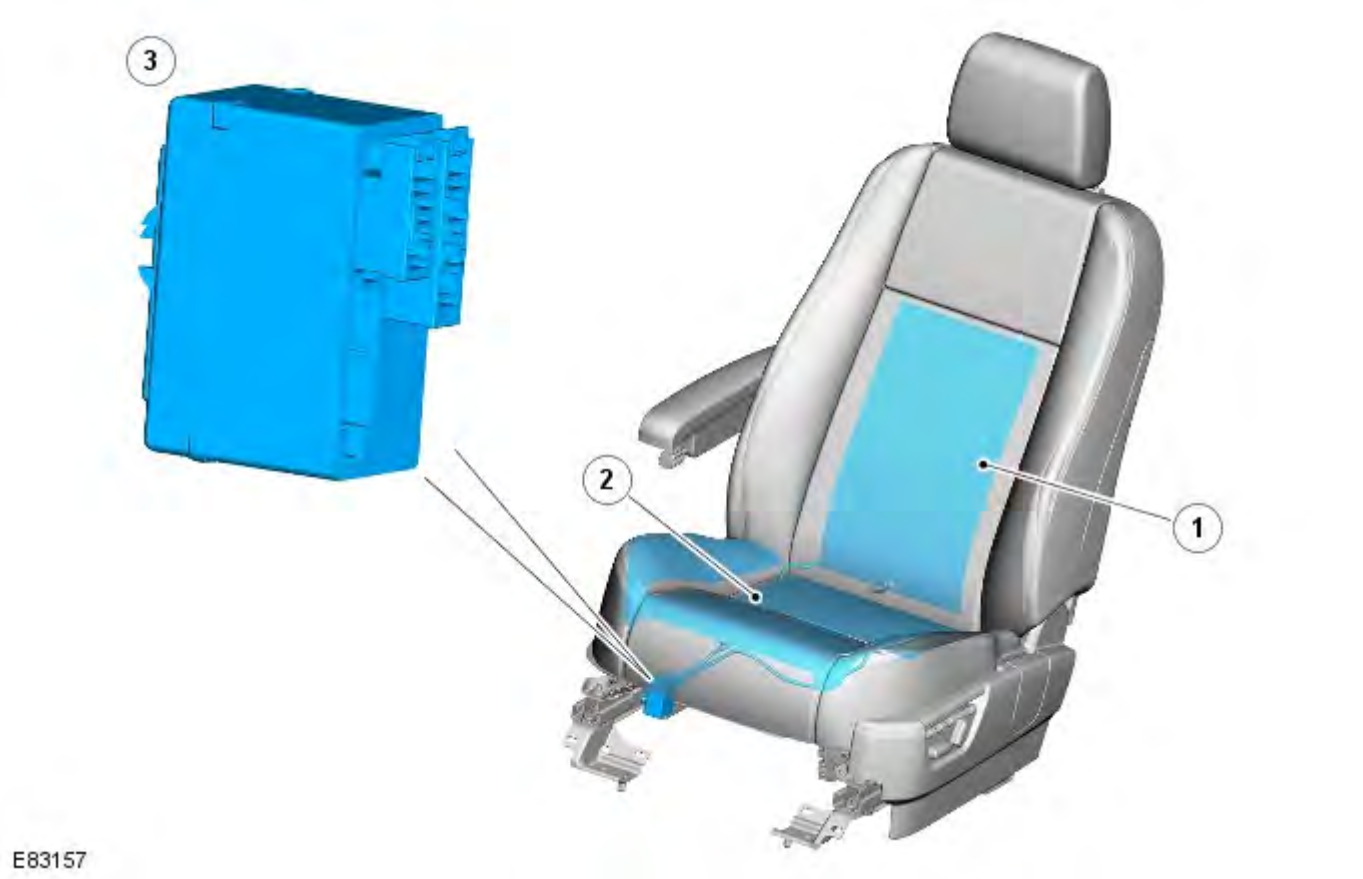
- Stall detection mode
- Sleep mode
- Battery monitor mode.

For further operating details of the automatic monitoring functions, refer to the section 'Principles of Operation'.

Calibration of Power Seat Module

If the power seat module is replaced in service, the replacement module must be calibrated using the Land Rover approved diagnostic equipment. The calibration routine is necessary for the power seat module to reset the seat datum values.

FRONT SEAT HEATING



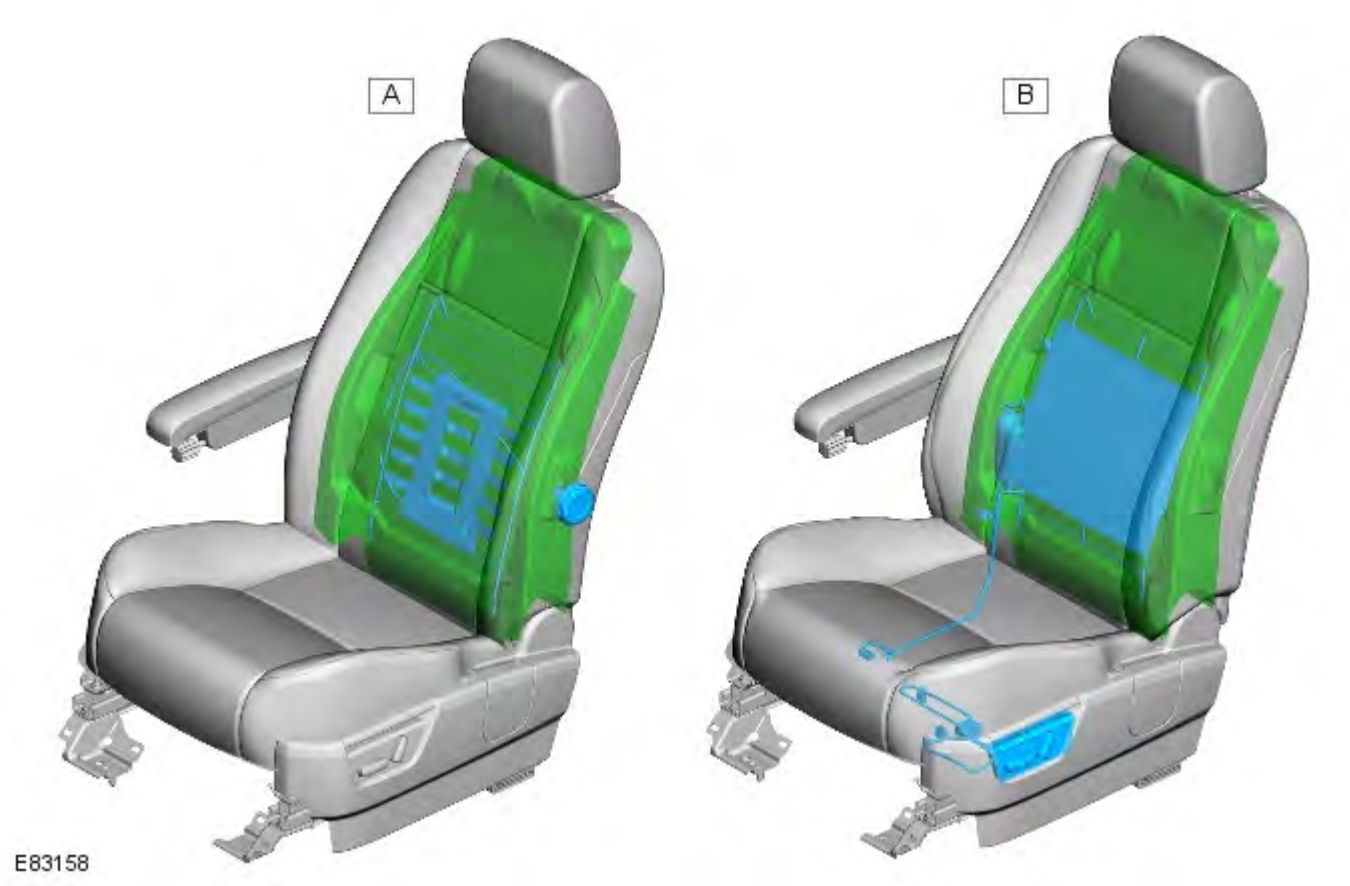
Item	Part Number	Description
1	-	Seat squab heating element
2	-	Seat cushion heating element

3	-	Seat heating module

Depending on vehicle specification, seat heating is available for both the manually operated and the power operated seats. A heating element is incorporated within each seat cushion and squab. A seat heating module and electrical wiring is located beneath each front seat.

The seat heating modules are connected on the LIN bus to the ATC, and are also hardwired to the AJB for the power supply. A ground terminal from each seat heating module completes the circuit.
For additional information, refer to: Control Components (412-01 Climate Control, Description and Operation).

LUMBAR SUPPORT



Item	Part Number	Description
A	-	Driver's seat manually operated lumbar support system
B	-	Driver's seat power operated lumbar support system

Depending on the vehicle specification, the driver's seat only may incorporate a manually operated or a power operated lumbar support system.

Manually Operated Lumbar Support

The manual adjust lumbar support system is operated by a hand-wheel located on the side of the backrest. The hand-wheel is connected with a cable to a flexible plate mounted behind the backrest squab. As the hand-wheel rotates, the plate is distorted and is forced to bow toward or away from the seat squab. The manual adjust system provides a high level of control over the increase in lumbar support.

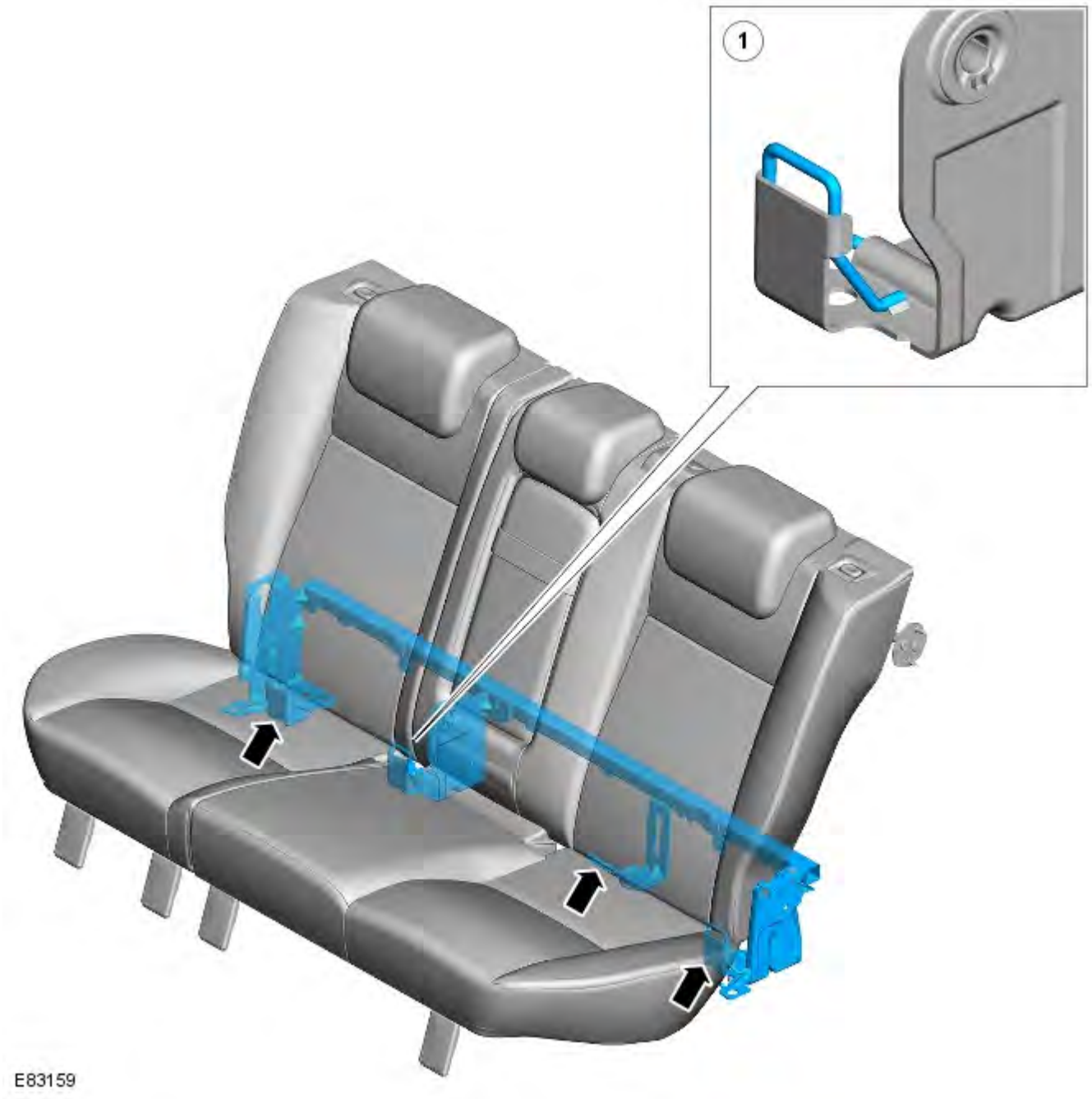
Power Operated Lumbar Support

The power operated lumbar support system features a single motor driven pump and air cells. The air cells are mounted behind the seat squab. The lumbar motor is controlled using the lumbar switch mounted to the seat frame. Operation of the lumbar switch will energize the lumbar motor, and drive the pump to inflate or deflate the air cells.

Power for the lumbar motor is supplied and controlled by the CJB, via a battery-saver timer relay to the lumbar control switch. The lumbar control switch directs the voltage via a hardwired connection to the lumbar motor.

Lumbar position is not stored within the power seat module.

REAR SEAT



Item	Part Number	Description
1	-	ISOFIX fastening points

The rear seat is a 60/40 split configuration, and is designed to fold in order to increase luggage capacity. Removal of the rear seat head rests will allow the seat to fold completely flat to the floor.

The rear seat is manufactured from 2 high strength steel extrusions that are joined at each end with a high strength steel bracket and pivot. The rear seat base is formed with an anti-submarine shelf that will retain the rear occupants in the seat during a front end collision.

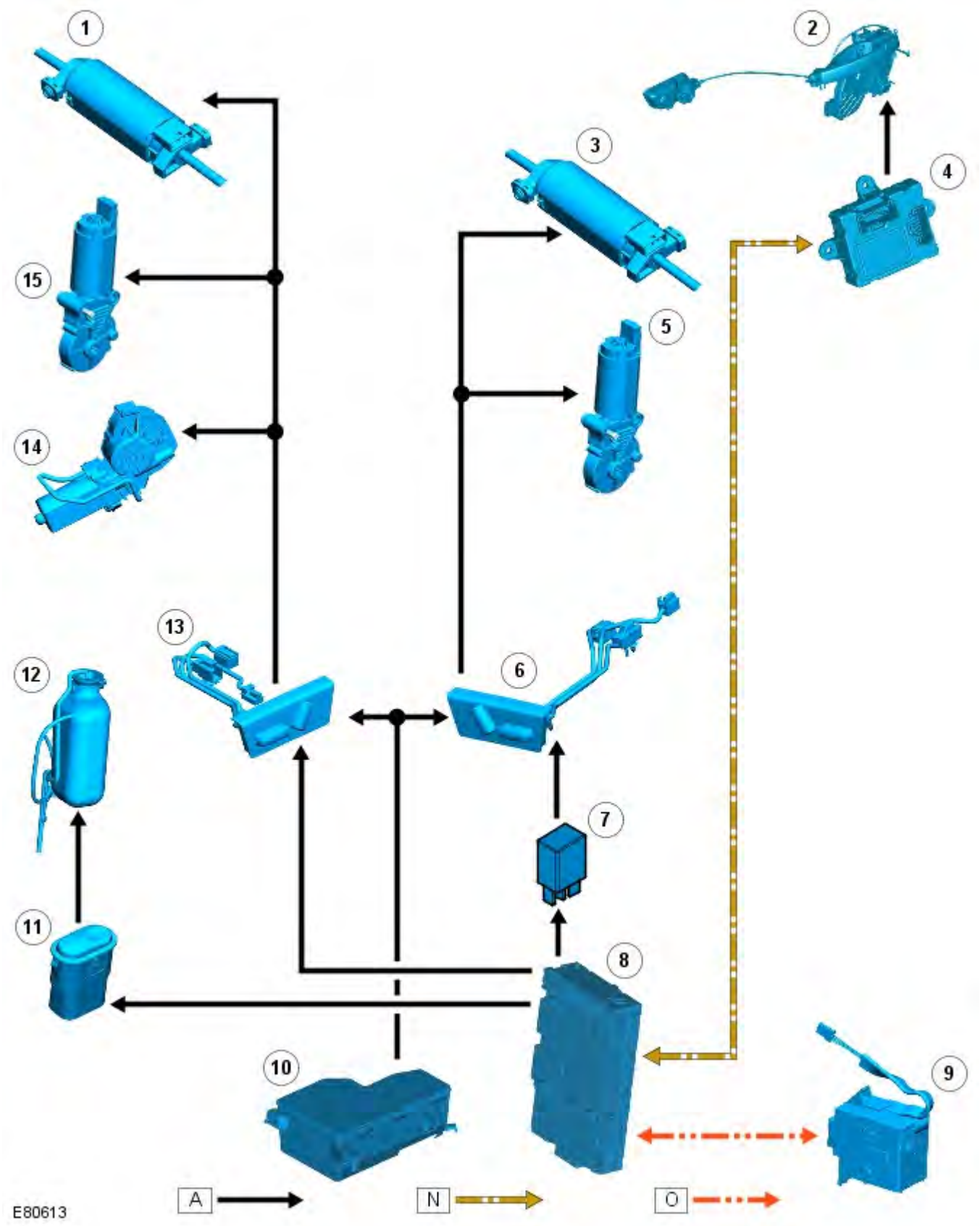
The seat base and backrest are inlayed with formed sections of dual hardness molded foam that form the seat squab and cushion. The seats provide excellent support and comfort for the rear occupants.

An injection molded armrest with stowage tray is mounted in the center of the backrest, and may be folded down from the rear seat when the center position is not occupied.

ISOFIX fastening points are manufactured on the rear seat frame and are provided for secure fastening of compatible child safety seats to the 2 outer seat positions. The ISOFIX fastenings provide the safest method of child safety seat restraint, as the child safety seat is not able to roll or become detached from the rear seat, even during severe vehicle maneuvers.

CONTROL DIAGRAM - FRONT POWER OPERATED NON-MEMORY SEATS (SHEET 1 OF 3)

• NOTE: **A** = Hardwired; **N** = Medium speed Controller Area Network (CAN) bus; **O** = LIN bus.

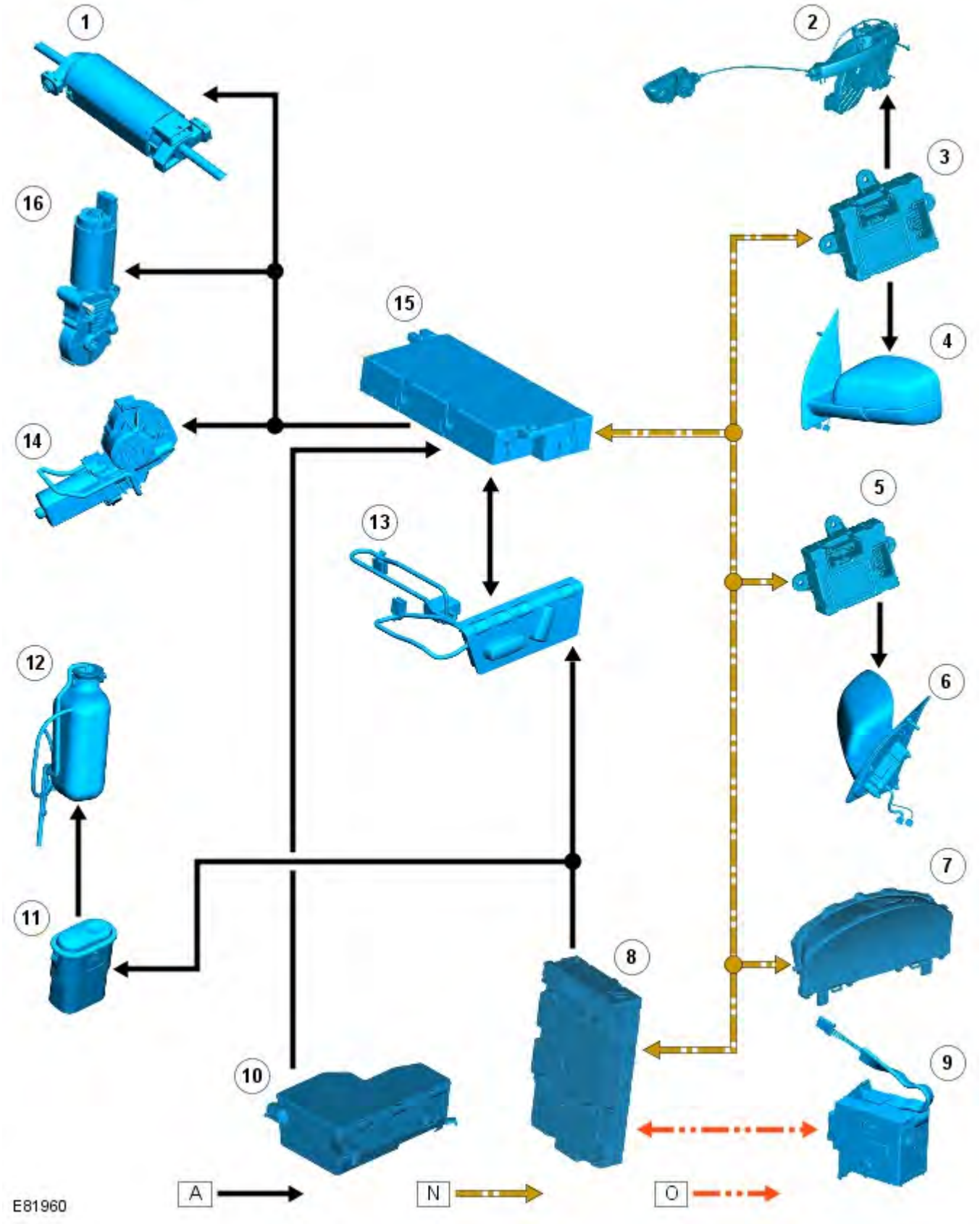


Item	Part Number	Description
1	-	Driver's power operated non-memory seat slide motor
2	-	Driver's door latch with ajar switch
3	-	Passenger power operated non-memory seat slide motor
4	-	Driver's door control module
5	-	Passenger power operated non-memory seat squab recline motor
6	-	Passenger power operated non-memory seat switch pack
7	-	Passenger seat relay
8	-	CJB with internal battery-saver timer relay
9	-	Start control module
10	-	AJB
11	-	Power operated lumbar support switch

12	-	Power operated lumbar support motor
13	-	Driver's power operated non-memory seat switch pack
14	-	Driver's power operated non-memory seat height motor
15	-	Driver's power operated non-memory seat squab recline motor

CONTROL DIAGRAM - DRIVER'S POWER OPERATED MEMORY SEAT (SHEET 2 OF 3)

• NOTE: **A** = Hardwired; **N** = Medium speed CAN bus; **O** = LIN bus.

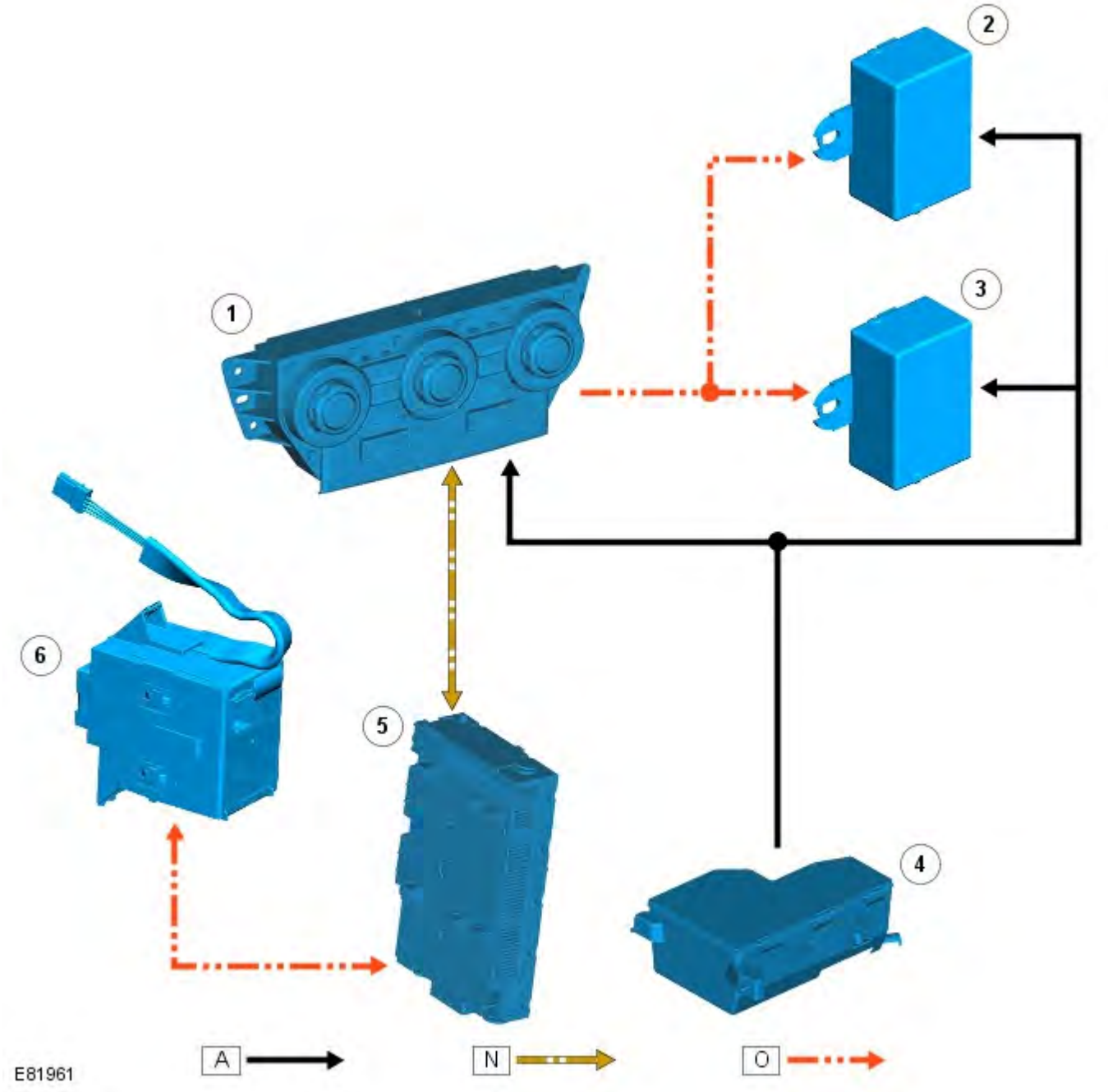


Item	Part Number	Description
1	-	Driver's power operated memory seat slide motor
2	-	Driver's door latch with ajar switch

3	-	Driver's door control module
4	-	LH exterior mirror
5	-	Passenger door control module
6	-	RH exterior mirror
7	-	Instrument cluster
8	-	CJB with battery-saver timer relay
9	-	Start control module
10	-	AJB
11	-	Power operated lumbar support switch
12	-	Power operated lumbar support motor
13	-	Driver's power operated memory seat switch pack
14	-	Driver's power operated memory seat height motor
15	-	Driver's power seat module
16	-	Driver's power operated memory seat squab recline motor

CONTROL DIAGRAM - FRONT SEAT HEATING (SHEET 3 OF 3)

• NOTE: **A** = Hardwired; **N** = Medium speed CAN bus; **O** = LIN bus.



Item	Part Number	Description
1	-	ATC module
2	-	Driver's seat heating module
3	-	Passenger seat heating module
4	-	AJB
5	-	CJB

6	-	Start control module

PRINCIPLES OF OPERATION

Front Power Operated Non-Memory Seats

The driver's non-memory seat will operate in all ignition power modes. The passenger non-memory seat will only operate when the ignition is in power mode 6 (Ignition).

Power for front passenger seat operation is supplied from the AJB via a passenger seat power relay to the passenger seat control switch pack. Power for the driver's seat operation is supplied directly from the AJB to the driver's seat control switch pack. The front passenger and driver seat power supplies are controlled by the CJB. The seat switch pack directs the voltage to the relevant seat adjustment motor when a seat control switch is pressed. Two pins within each of the seat switch packs control the seat motors. Both pins are normally connected to ground.

The driver and passenger switch packs are also connected in circuit with a battery-saver timer relay that is located in, and controlled by the CJB. The battery-saver timer relay allows operation of the driver and passenger seat controls for 10 minutes after the engine is switched off, and the ignition is then selected to an appropriate power mode. The 10 minute timer is reset if the appropriate ignition power mode is retained and the driver's door is opened or closed. The driver and passenger seat operation is inhibited immediately following central locking of the vehicle.

Operating a seat motor control switch applies voltage to one of the pins while the other pin remains connected to ground. Operating the seat motor control switch in the opposite direction reverses the power and ground connections to the motor, allowing the motor pinion to rotate in the opposite direction. In the event that a motor seizes or sticks, an internal thermal cut-out switch will trip to remove voltage from the motor.

Driver's Power Operated Memory Seat

The driver's memory seat will operate when the ignition is in power modes 4 (Accessory) and 6 (Ignition), and will not operate during power mode 9 (Engine crank).

Power for the driver's memory seat operation is supplied directly from the AJB to the power seat module. The memory seat switch pack is connected to the power seat module that controls the operation and memory position of the individual seat motors. The power seat module is connected on the medium speed CAN bus to the CJB and the front LH and RH door control modules.

The power seat module is also connected in circuit with a battery-saver timer relay that is located within, and controlled by the CJB. The battery-saver timer relay allows operation of the seat controls for 10 minutes after the engine is switched off, and the ignition is then selected to an appropriate power mode. The 10 minute timer is reset if the appropriate ignition power mode is retained and the driver's door is opened or closed. The driver's seat operation is inhibited immediately following central locking of the vehicle.

Requests for memory exterior mirror movements for a memory recall are transmitted on the medium speed CAN bus by the power seat module to the front door control modules. The front door control modules directly control the memory store and recall positions for the memory exterior mirrors.
For additional information, refer to: Rear View Mirrors (501-09 Rear View Mirrors, Description and Operation).

Power Seat Module

The power seat module features driver selectable functions, and automatic monitoring functions.

Driver Selectable Functions

- Seat and exterior mirror memory recall
- Immediate seat adjustment.

Seat and exterior mirror memory recall function

The memory recall function sets the driver's seat to a stored position, and is activated when a switch pack memory position button is pressed. When memory recall is initiated, only 2 seat adjustment motors will operate at any one time to limit the overall current consumption. To further minimize the current load as the motors energize, the initiation of each of the 2 operating motors is phased with a 10 millisecond delay. The cushion slide and backrest will move first, followed by the cushion height.

As soon as the seat switch pack memory position button is pressed, a message is transmitted by the power seat module on the medium speed CAN bus to the front door control modules. The door control modules then activate the memory recall positions for the exterior mirrors. The instrument cluster message center will display memory recall messages when a memory recall is activated.

The memory recall function operates with 2 separate modes; the operation of each mode is dependant on the vehicle status when the seat memory position button is pressed.

Memory recall operating modes:

- One-touch mode
- Proportional mode.

One-Touch Mode

When the vehicle is stationary and a switch pack memory position button is pressed, the memory recall function will operate in 'one-touch' mode. One touch mode allows the seat and exterior mirrors to immediately move to the requested stored memory position.

If a seat adjustment or memory position button is operated during memory recall 'one-touch' mode, the current memory recall will be cancelled and the seat (and exterior mirrors via the medium speed CAN bus) will immediately stop moving. The seat will then commence moving in the direction that corresponds to the pressed switch.

Memory recall is also immediately cancelled if the vehicle is driven from the stationary position before the seat has reached the requested memory position.

Proportional Mode

If the vehicle is already in motion when the switch pack memory position button is pressed, the memory recall function will operate in 'proportional' mode. Proportional mode recalls the seat (and exterior mirror) position for the duration that the memory switch is held in the pressed state. When the memory position button is released the memory recall will immediately stop, unless the seat has already reached the intended memory position.

In order to reach the intended stored memory position while the vehicle is moving, the memory position button must not be released until all seat, and exterior mirror movements are complete.

Immediate seat adjustment function

The immediate adjustment function is activated when a switch pack seat position switch (recline, slide or height) is operated.

Pressing any of the seat adjustment switches will initiate the corresponding direction motor to move the seat in that direction, until the switch is released. Only 2 seat motors will operate at any one time.

Automatic Monitoring Functions

The power seat module automatic monitoring functions are detailed as follows:

- Stall detection mode
- Sleep mode
- Battery monitor mode.

Stall detection mode

A seat motor is deemed to have stalled if there is no change in the input that is received from the corresponding feedback sensor for 200 milliseconds, while that axis is being driven.

If a stall condition is detected by the power seat module then the drive to that axis is cancelled for the remainder of that memory operation (memory recall), or until the switch is re-selected (immediate seat adjustment).

For all seat motor manual movements during an immediate seat adjustment function, when a motor is driven and a stall occurs the power seat module records and stores the stall position (soft stop) that the stall occurred. If movement occurs beyond the stored soft stop stall position, then the stall position is erased from the power seat module memory. This will always allow movement past a previously recorded stall position once movement has been registered beyond that position (i.e. by pressing the switch for longer than 2 seconds).

If the motor movement has stopped due to a motor stall (seat obstruction for example), once the obstruction is cleared then that axis may be activated again to move past the new soft stop stall position by re-selecting the appropriate switch and pressing for longer than 2 seconds. If the switch is not operated to move the seat past the new soft stop position, this position will remain stored in the power seat module memory as the full axis movement.

If motor movement has stopped due to loss of sensor feedback (sensor or wiring failure) then that axis may be activated again to move past the stall position by re-selecting the appropriate switch and pressing for longer than 2 seconds. This allows control of the motor to be maintained if sensor feedback is lost.

Upon re-selection of movement, if sensor pulses are detected then the motor will continue to be driven until the switch is released or another stall condition is detected. If sensor feedback is not detected then the motor is only driven for 0.5 second and then stops, until the switch is released and then pressed again for longer than 2 seconds, when a further 0.5 second of activation is permitted and so on. This is known as 'inch mode'.

If there is a failure with the medium speed CAN bus network, the seat will operate in 'inch mode'.

• NOTE: For diagnostic purposes, an indication of medium speed CAN bus disconnection is apparent if the seat is operating in 'inch mode' and either the seat control module, CJB or door control modules are not shown connected to the medium speed CAN bus.

Sleep mode

The power seat module features a sleep mode to reduce power consumption to the required minimum.

If the power seat module is being prevented from entering sleep mode due to motor movement, memory recall or switch pack operation, then the module will enter sleep mode when the current function has terminated.

• NOTE: In the case of a memory recall, all memory recall operations are carried out before the power seat module enters sleep mode, and not just the current motor movement.

The power seat module will exit sleep mode when any CAN bus activity is detected.

Battery monitor mode

The power seat module monitors the input power supply to make sure there is sufficient battery voltage available for engine cranking. If the battery voltage drops below 10.5 volts, then the power seat module ignores all requests for a memory recall until the battery voltage is greater than 11.0 volts.

If the battery voltage drops below 8.5 volts, then the power seat module ignores all requests for seat movement until the battery voltage is greater than 9.0 volts.

If the battery voltage is greater than 16.5 volts, then the power seat module ignores all requests for seat movement until the battery voltage drops below 16.0 volts.

Published: 11-May-2011

Seating - Seats

Diagnosis and Testing

Principles of Operation

For a detailed description of the seats, refer to the relevant Description and Operation section in the workshop manual. REFER to: Seats (501-10 Seating, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical/electrical damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Condition, correct installation and security of seat components and fixings	• Fuses • Harnesses for damage/corrosion • Electrical connectors • Damaged/corroded pins

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
No Driver seat movement from driver seat switch-pack (including no memory recall) and no passenger seat movement from passenger seat switch pack	• Comfort relay has de-activated which disables Driver seat and Passenger seat functions	Insert Key and press ignition ON. Check seat function from driver switch pack and passenger switch pack
No Driver seat movement from driver seat switch-pack (including no memory recall)	• Driver seat switch pack ground circuit - open circuit	Check SW Ground 1 connection between driver seat switch-pack and DSM for open circuit
One or more driver seat axis does not move from switch pack or a memory function does not operate correctly	• Seat switch stuck or seat switch pack/DSM connection short to power or ground	Check for the following DSM DTCs. B1B9424 Seat Height Up Switch. B1B9524 Seat Height Down Switch. B1B9624 Seat Slide Forward Switch. B1B9724 Seat Slide Backward Switch. B1C0024 Seat Recline Up Switch. B1C0124 Seat Recline Down Switch. B1C0224 Memory Store Switch. B1C0324 Memory #1 Switch. B1C0424 Memory #2 Switch. B1C0524 Memory #3 Switch. Check Driver seat switch pack for switch stuck condition or Driver seat switch pack/DSM connections for short to ground or power condition
Driver seat axis movement from switch-pack occurs in delayed inch mode (seat axis moves short distance when switch pressed for longer than 2 seconds and then stops. This could occur on ANY seat axis i.e. slide, height or squab)	• Motor Hall sensor on affected axis is not connected or not receiving expected signals	Check for the following DSM DTCs, B1B8731 Seat Height Motor Speed/Position Sensor. B1B8931 Seat Slide Motor Speed/Position Sensor. B1B9331 Seat Recline Motor Speed/Position Sensor. If present then check Hall sensor feedback connection(s) between seat motor(s) and seat module and also check Hall sensor Ground connections for affected axis. When hall sensor connection issue fixed press switch on affected axis for longer than 2 seconds. By keeping the switch pressed the axis movement should now operate for the duration of switch-press. Recalibrate affected seat
Driver seat axis movement from switch-pack occurs in inch mode. When any seat axis movement is requested from the seat switch pack the requested seat axis immediately moves a short distance then stops. This behaviour occurs for ALL seat axis movement (slide, height or squab) when requested. MS CAN communication not possible	• Vehicle has MS CAN issue	Carry out CAN network integrity tests using the manufacturer approved diagnostic system

Symptom	Possible Cause	Action
Driver Seat movement from switch-pack occurs in inch mode. When any seat axis movement is requested from the seat switch pack the requested seat axis immediately moves a short distance then stops. This behaviour occurs for ALL seat axis movement (slide, height or squab) when requested	• DSM is disconnected from the MS CAN bus	Check for Instrument Cluster DTC U020808 Lost Communication with Driver Seat Module. If this DTC is present then check the Driver Seat Module CAN bus connections
Driver seat movement from switch-pack occurs in inch mode. When any seat axis movement is requested from the seat switch pack the requested seat axis immediately moves a short distance then stops. This behaviour occurs for ALL seat axis movement (slide, height or squab,) when requested	• Driver Door Module (DDM) is disconnected from the CAN bus	Check for DSM DTC U019900 Lost Communication with DDM. If this DTC is present then check the DDM CAN bus connections

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Driver Seat Module (DSM) (100-00 General Information, Description and Operation).

Published: 26-Jul-2011

Seating - Heater Mats

Diagnosis and Testing

Principles of Operation

Heated seats incorporate heater elements in the cushion and the backrest of the seat. Each cushion heater element has a thermal sensor, which supplies a feedback temperature signal to the related seat heater module. The backrest heater elements do not have a thermal sensor, and are regulated at the same temperature as the cushion heater elements.

For a detailed description of the seat heater mat, refer to the relevant Description and Operation section in the workshop manual. REFER to: Seats (501-10, Description and Operation).

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual inspection

Mechanical	Electrical
• Seat heater switches condition and installation	• Fuses • Harnesses and connectors • Seat heater module • Seat heater switches • Seat heater mat

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the warranty policy and procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC Index

For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to section 100-00.

Seat Heater Mat Application Chart

• NOTE: To ensure an accurate resistance reading, calibrated test equipment **must be** used

Vehicle /Year	Cushion / Backrest	Heater Mat / NTC Resistor	Left Hand Drive		Right Hand Drive		Minimum Resistance	Maximum Resistance
			Passenger Side Connector / Pin	Driver Side Connector / Pin	Passenger Side Connector / Pin	Driver Side Connector / Pin	Ohms At 20°C ±10°C	Ohms At 20°C ±10°C
Discovery 3 2006	Cushion	Heater mat	C2950-1 and C2950-4	C0085-1 and C0085-4	C2950-1 and C2950-4	C0085-1 and C0085-4	0,75	1,0
		NTC resistor	C2950-2 and C2950-3	C0085-2 and C0085-3	C2950-2 and C2950-3	C0085-2 and C0085-3	4 000	10 000
	Backrest	Heater mat	connected in series	connected in series	connected in series	connected in series	0,44	0,59
Discovery 4 2010	Cushion	Heater mat	C3542-1 and C3542-4	C3542-1 and C3542-4	C3542-1 and C3542-4	C3542-1 and C3542-4	0,70	1,0
		NTC resistor	C3542-2 and C3542-3	C3542-2 and C3542-3	C3542-2 and C3542-3	C3542-2 and C3542-3	4 000	10 000
	Backrest	Heater mat	C3543-1 and C3543-2	C3543-1 and C3543-2	C3543-1 and C3543-2	C3543-1 and C3543-2	0,4	0,7
Range Rover Sport 2010	Cushion	Heater mat	C3542-1 and C3542-4	C3542-1 and C3542-4	C3542-1 and C3542-4	C3542-1 and C3542-4	0,93	1,25
		NTC resistor	C3542-2 and C3542-3	C3542-2 and C3542-3	C3542-2 and C3542-3	C3542-2 and C3542-3	4 000	10 000
	Backrest	Heater mat	C3543-1 and C3543-2	C3543-1 and C3543-2	C3543-1 and C3543-2	C3543-1 and C3543-2	0,43	0,6

Vehicle /Year	Cushion / Backrest	Heater Mat / NTC Resistor	Left Hand Drive		Right Hand Drive		Minimum Resistance	Maximum Resistance
			Passenger Side Connector / Pin	Driver Side Connector / Pin	Passenger Side Connector / Pin	Driver Side Connector / Pin	Ohms At 20°C ±10°C	Ohms At 20°C ±10°C
Freelander 2	Cushion	Heater mat	C3HS08C-1 and C3HS08C-4	C3HS03C-1 and C3HS03C-4	C3HS08C-1 and C3HS08C-4	C3HS03C-1 and C3HS03C-4	0,8	1,0
		NTC resistor	C3HS08C-2 and C3HS08C-3	C3HS03C-2 and C3HS03C-3	C3HS08C-2 and C3HS08C-3	C3HS03C-2 and C3HS03C-3	4 000	10 000
	Backrest	Heater mat	C3HS08B-1 and C3HS08B-2	C3HS03B-1 and C3HS03B-2	C3HS08B-1 and C3HS08B-2	C3HS03B-1 and C3HS03B-2	0,5	0,7

PINPOINT TEST A : SEAT HEATER MAT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FOR DTC'S	
	1 Where possible use the manufacturer approved diagnostic system to review any logged seat heater mat DTC's
	Were any seat heater mat DTC's logged? **Yes** Carry out the help text action for any logged DTC's. Clear the DTC and retest. If DTC's return follow the tests listed below GO to A2. **No** GO to A2.
A2: MANUAL CHECK	
• NOTE: On full power the seat should be hot to touch	
	1 If required operate the vehicle air conditioning on full for 10 minutes to reduce the in vehicle ambient temperature
	2 Operate the seat heater on full power
	Does the seat heater operate correctly? **Yes** Clear any stored DTC's and retest. If seat heater operation is correct no further action required **No** GO to A3.
A3: SHORT CIRCUIT TO GROUND	
	1 Refer to the electrical circuit diagrams and the seat heater mat application chart (see above) to identify the connector
	2 Disconnect the connector
	3 Refer to the electrical circuit diagrams and check the seat heater mat (heater circuit) and (thermal sensor circuit) for short circuit to ground
	Are either of the circuits short circuit to ground? **Yes** Repair the circuit or replace the seat heater mat as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Clear any stored DTC's and retest **No** GO to A4.
A4: CIRCUIT CONTINUITY TEST	
	1 Refer to the electrical circuit diagrams and check the seat heater mat (heater circuit) for circuit continuity
	Does the seat heater mat **heater circuit** pass the continuity test? **Yes** GO to A5. **No** Repair the circuit or replace the seat heater mat as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Clear any stored DTC's and retest
A5: POWER CONSUMPTION	
• NOTE: The seat heater power supply cycles on and off dependant on the seat and cabin temperature and may only switch on for 5 seconds in 30 seconds	
	1 Reconnect the connector
	2 Operate the vehicle air conditioning on full for 10 minutes to reduce the in vehicle ambient temperature
	3 Refer to the electrical circuit diagrams and check the seat heater mat (heater circuit) using a **current clamp**
	4 Operate the seat heater on full power
	5 Use the chart above to calculate typical value (V/R=I) (**Volts** divided by **Resistance** equals **Current in Amps**)
	6 Examples (12 volts / 0.5 ohms =24 amps) (12 volts / 1 ohms = 12 amps) (12 volts / 2 ohms = 6 amps)
	Does the seat heater mat consume the correct level of current? **Yes** Clear any stored DTC's and retest. If operation correct, no further action required **No** GO to A6.
A6: RESISTANCE CHECK	

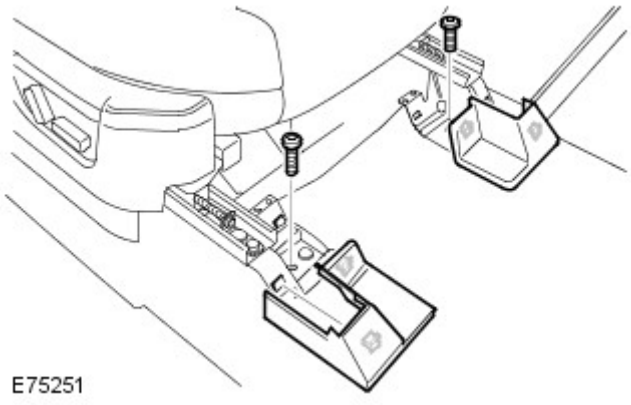
• NOTE: Ensure the multimeter used is calibrated and a resistance reading of **0** ohms is shown when the test leads are connected together, alternately subtract any resistance shown from the result	
• NOTE: The seat heater mat circuits should be checked at the seat heater module connector	
• NOTE: Refer to the electrical circuit diagrams and to confirm the total resistance of the circuit the cushion and backrest are connected in series	
	1 Refer to the electrical circuit diagrams and the seat heater mat application chart (see above) to identify the terminals
	2 Disconnect the connector
	3 Using a multimeter, carry out a resistance check of the seat heater mat **heater circuit** and the **NTC resistor circuit**. Record the results
	4 Compare the results to the chart (see above)
	Are the results within specification at the given ambient temperature? (tolerance +/- **0.5** Ohms) **Yes** Reconnect the connector. Clear any stored DTC's and retest. If customer concern or DTC's return refer to electrical circuit diagrams and investigate the power and ground supply circuits **No** Replace the seat heater mat as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Clear any stored DTC's and retest

Published: 11-May-2011

Seating - Front Seat

Removal and Installation

Removal



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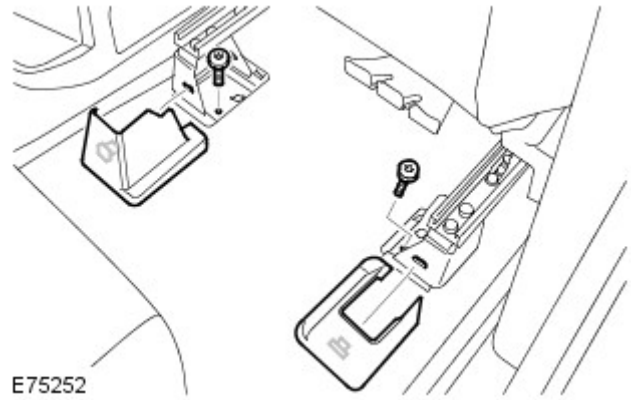

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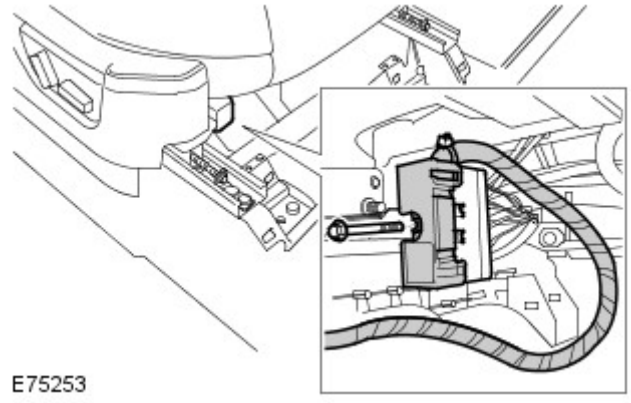


3. Disconnect the front seat harness electrical connectors.

Installation

1. Install the front seat using new bolts.

   Torque: 40 Nm

2. Connect the front seat harness electrical connectors.
3. Install the rear front seat base trim.
4. Install the front seat base trim.

Published: 11-May-2011

Seating - Front Seat Backrest Cover

Removal and Installation

Removal

• WARNINGS:

To avoid accidental deployment, the restraints control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.

Make sure that sufficient time has elapsed after disconnecting the battery ground cable(s), before commencing work on the supplemental restraint system (SRS). Failure to follow these instructions may result in personal injury.

• NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

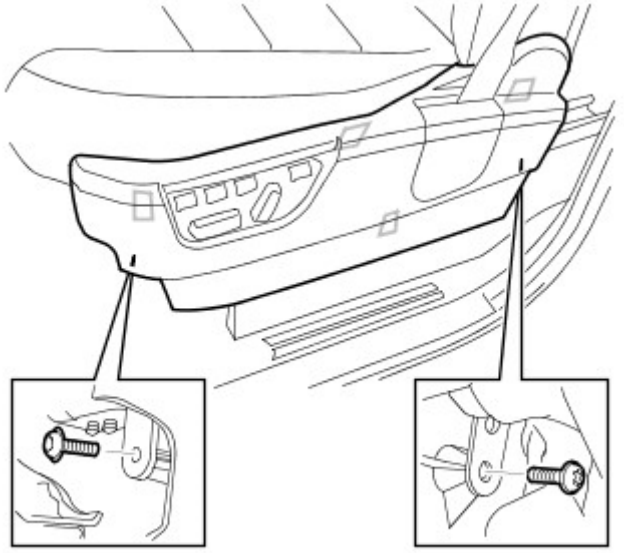
2. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the front safety belt buckle.

   Refer to: Front Safety Belt Buckle (501-20A Safety Belt System, Removal and Installation).

4.



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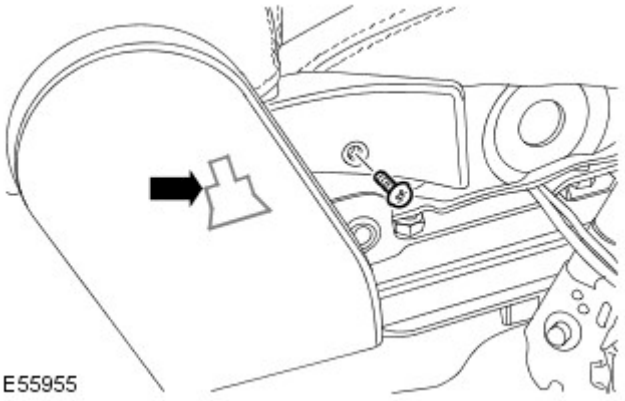

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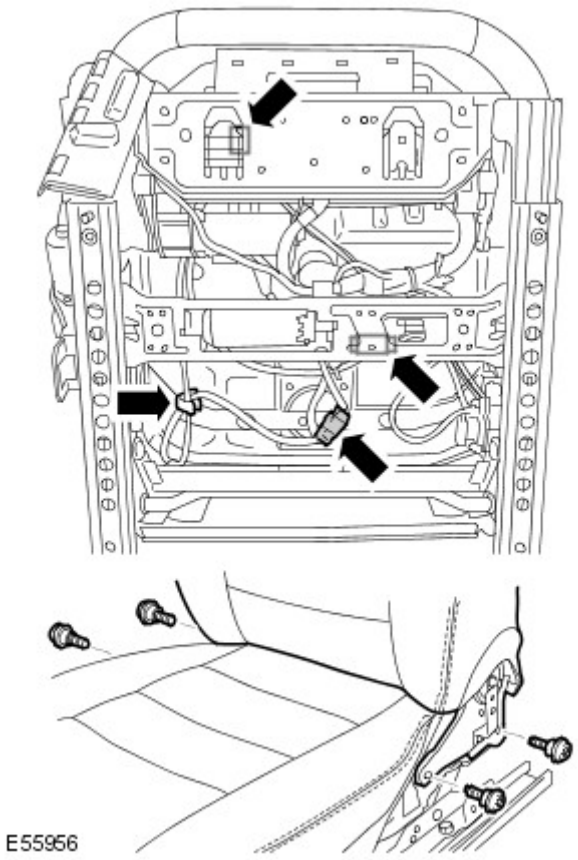
6. *Torque:* 25 Nm



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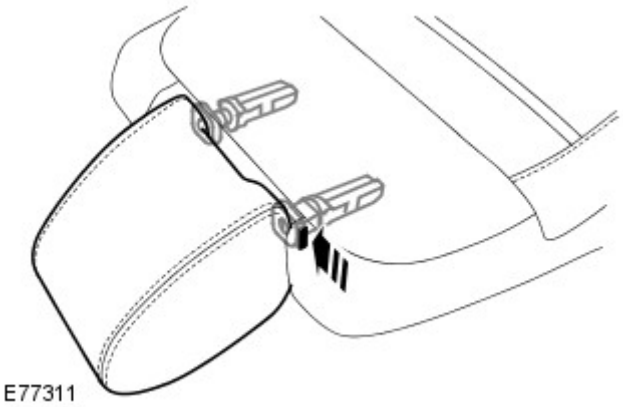
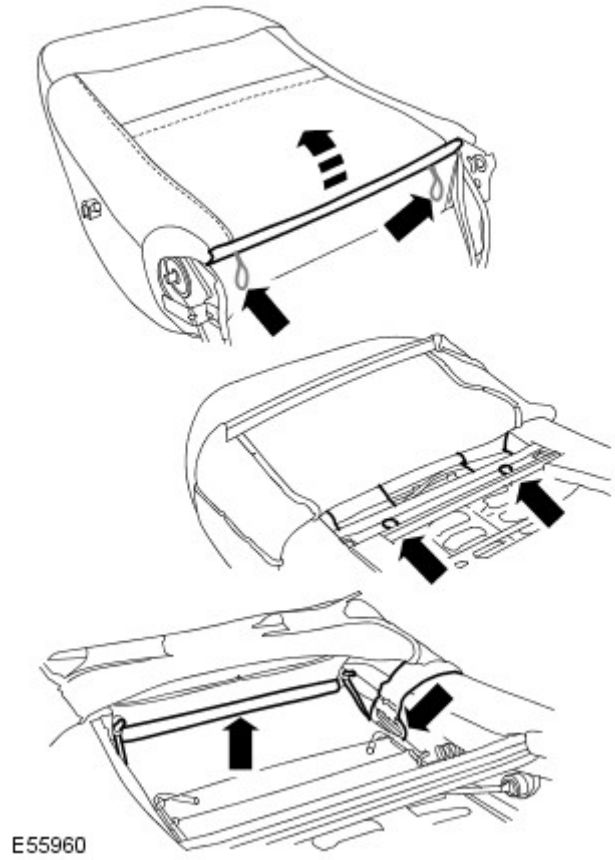


8. Remove the seat armrest.

   Refer to: Front Seat Armrest (501-10 Seating, Removal and Installation).

9.



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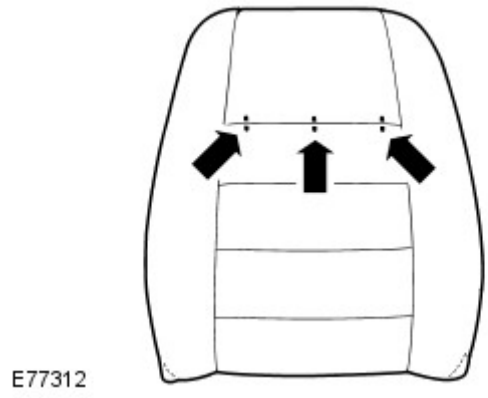


Installation

1. To install, reverse the removal procedure.

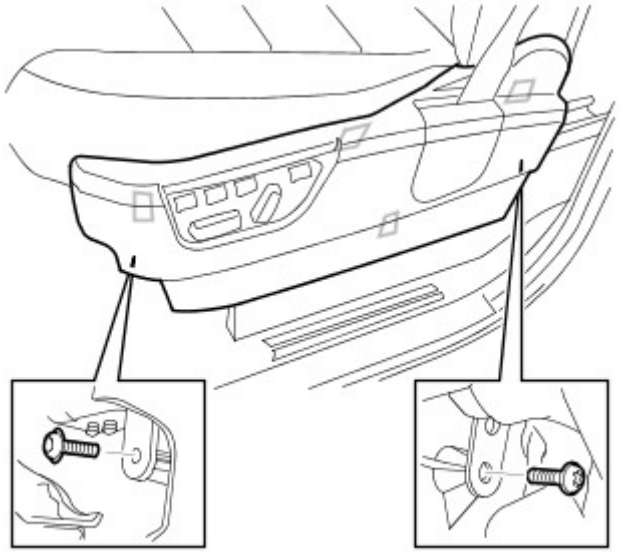
Published: 11-May-2011

Seating - Front Seat Control Switch

Removal and Installation

Removal

1.



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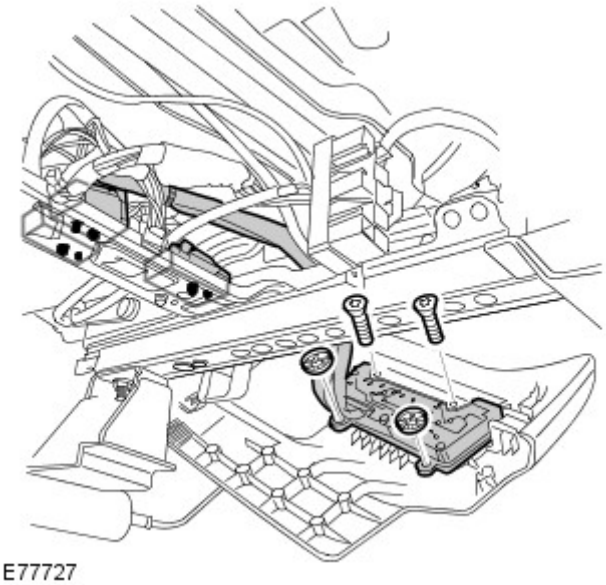


E77727

Installation

1. To install, reverse the removal procedure.

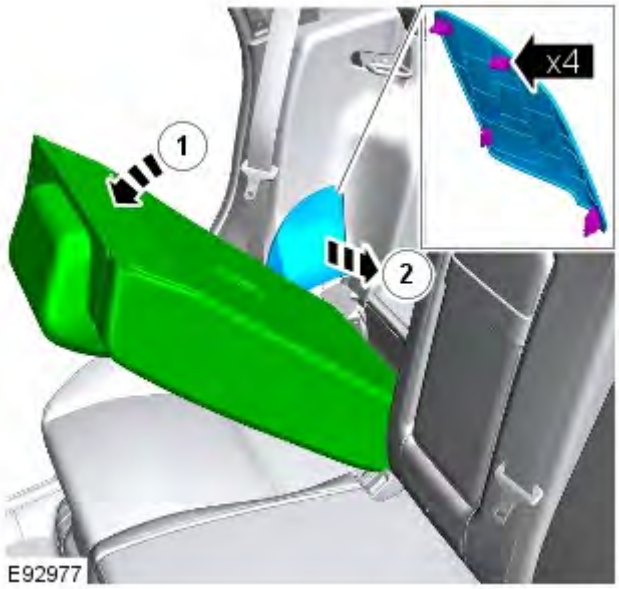
Published: 11-May-2011

Seating - Rear Seat Backrest Cover

Removal and Installation

Removal

• NOTE: This procedure covers the removal and installation of both rear seat backrests and the LH rear seat backrest cover. The RH rear seat backrest cover is similar. All notes and cautions must be followed strictly to avoid any chance of NVH or failure of the rear seat backrests.



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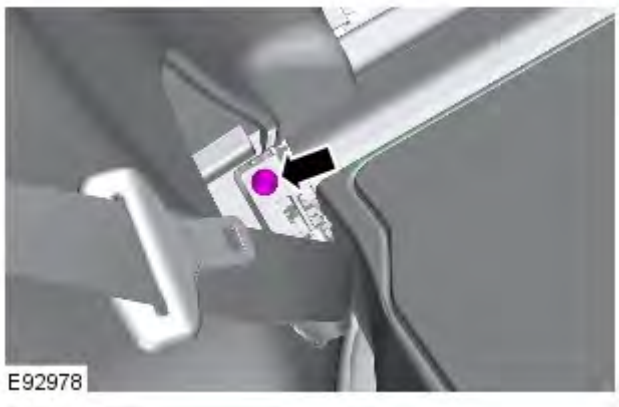

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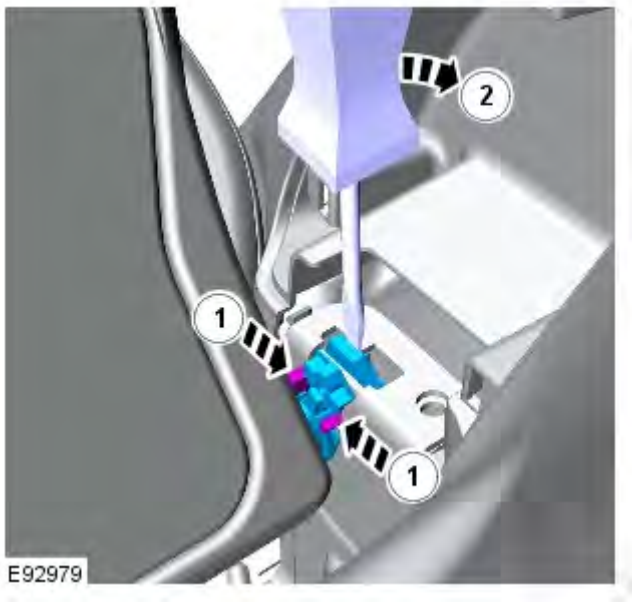
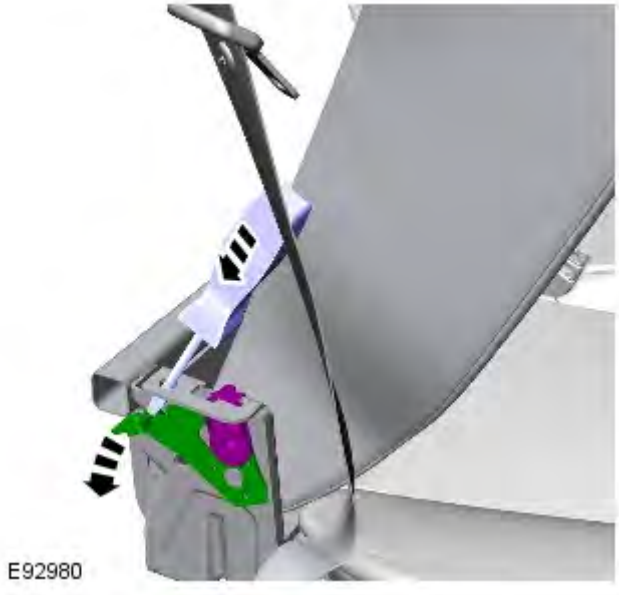
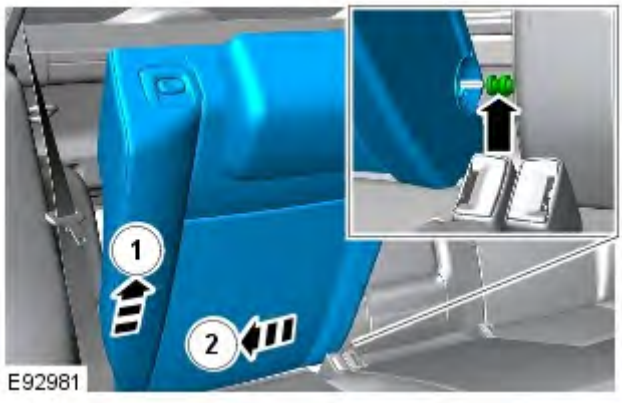


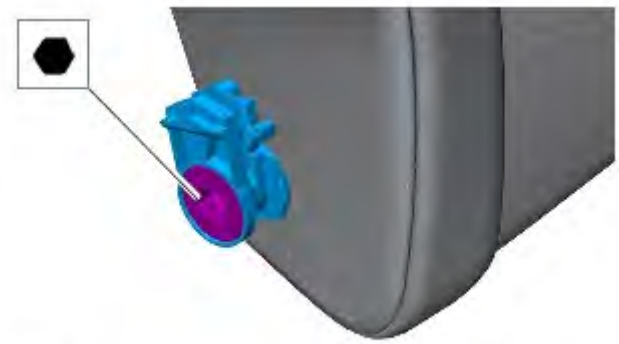
3. Release the RH rear seat backrest outer pivot pin bushing.



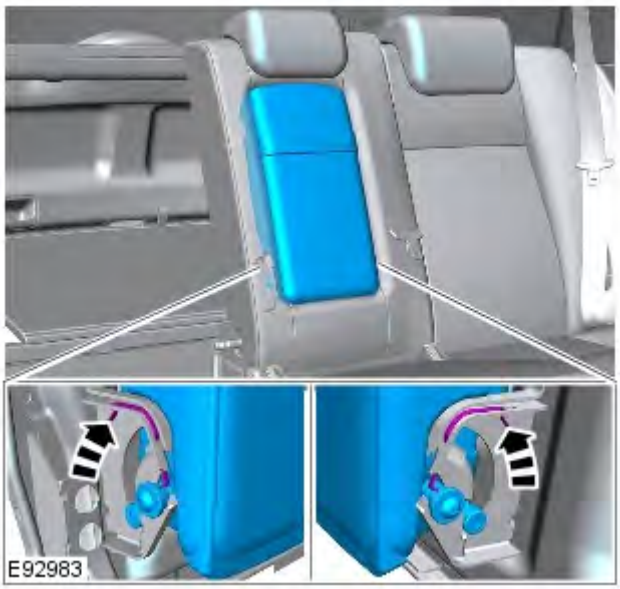
4. Using a screwdriver, release the outer pivot pin bushing locking arm.



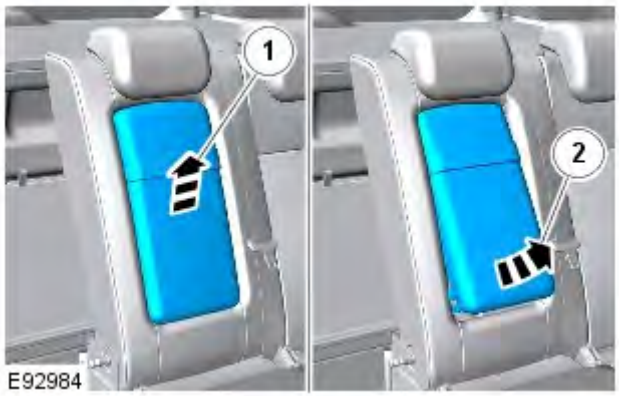
5. **5.** CAUTION: The left-hand rear seat backrest inner pivot pin has radial grooves. When removing the RH backrest from the LH backrest take care not to damage the RH backrest inner pivot bushing.
    - Release the RH rear seat backrest outer pivot pin bushing from the mounting bracket.
    - Release the RH rear seat backrest from the LH rear seat backrest.


E92982

6. Remove and discard the RH rear seat backrest outer pivot pin bushing.

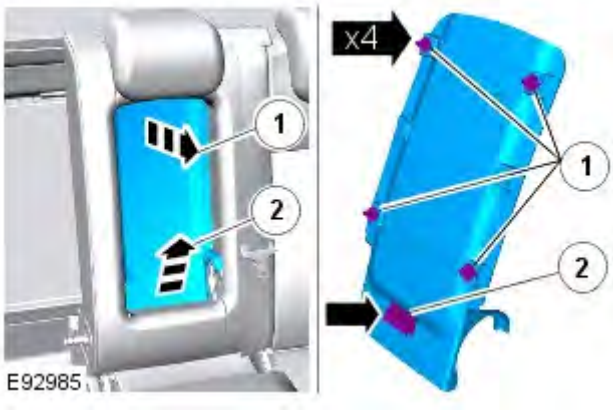

E92983

7.
- If installed, release the armrest.
- Remove and discard the armrest pivot bushing spring clips.



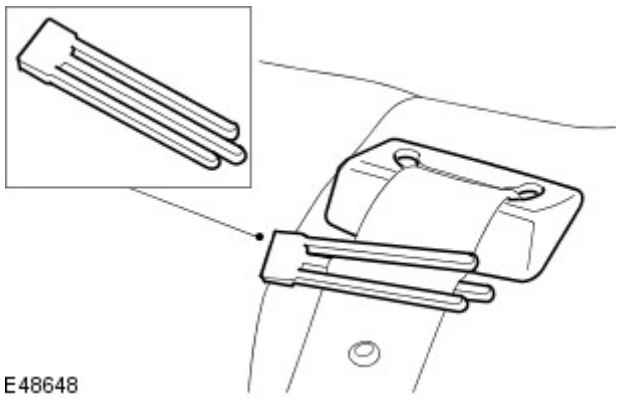
E92984

8.
- Slide the armrest upwards.
- Slide the armrest outwards.



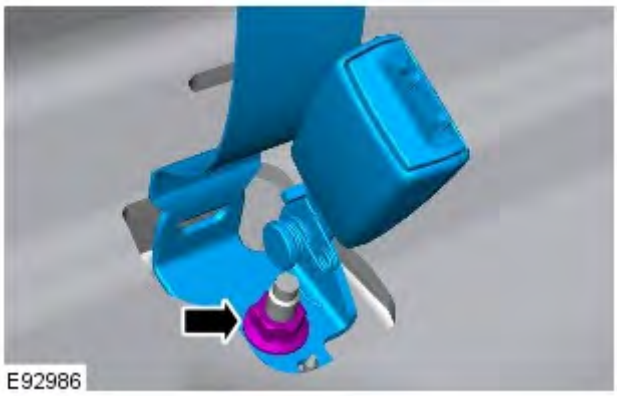
9.

- Remove the armrest backing plate.
- Remove and discard the 4 fir tree clips.



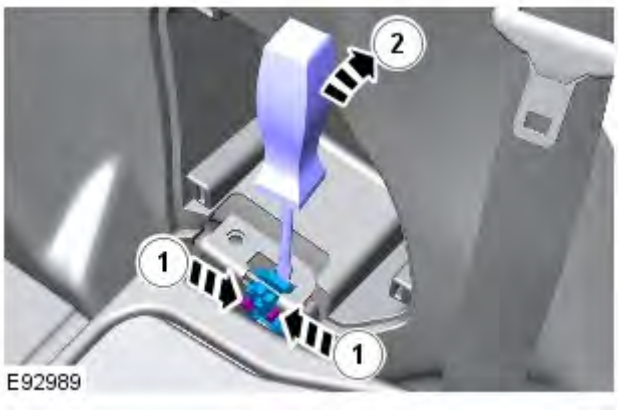
10. **10.** CAUTION: Make sure that a webbing retainer is installed at least 200 mm towards the rear center safety belt retractor from the webbing stop.

Install the safety belt webbing retainer.

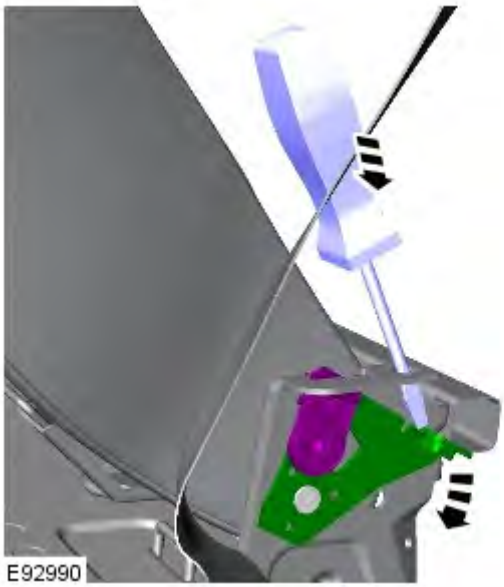


11. Remove the rear center safety belt lower anchor nut.

12.
13.



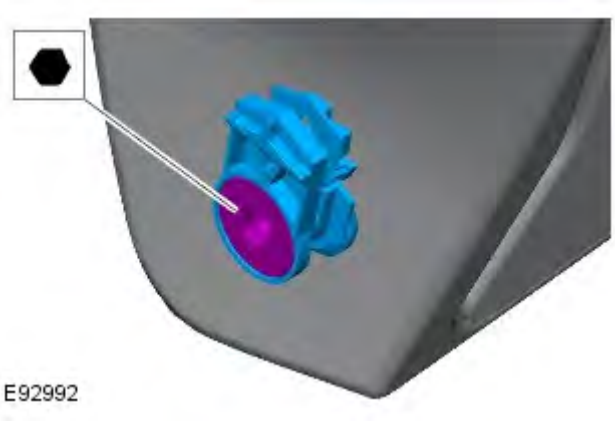
14. Release the LH rear seat backrest outer pivot pin bushing.



15. Using a screwdriver, release the outer pivot pin bushing locking arm.

16. **16.** CAUTION: The left-hand rear seat backrest inner pivot pin has radial grooves. Take care not to damage the center hinge pivot bushing.

- Release the LH rear seat backrest outer pivot pin bushing from the mounting bracket.
- Carefully slide the LH rear seat backrest inner pivot pin out of the center hinge pivot bushing.

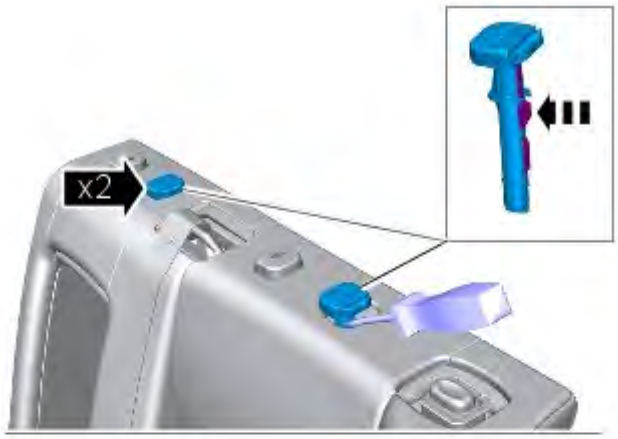


17. Remove and discard the LH rear seat backrest outer pivot pin bushing.

18.

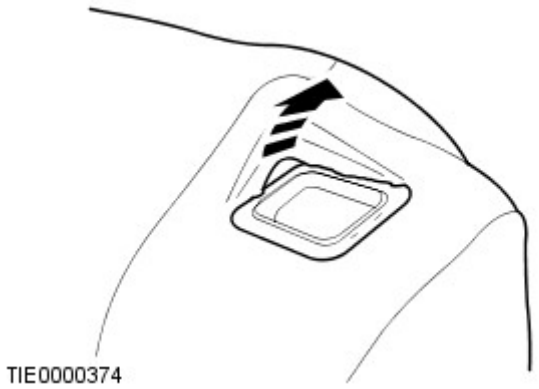
19. Remove the center safety belt trim panel.

20. Remove the rear seat backrest release button trim panel.

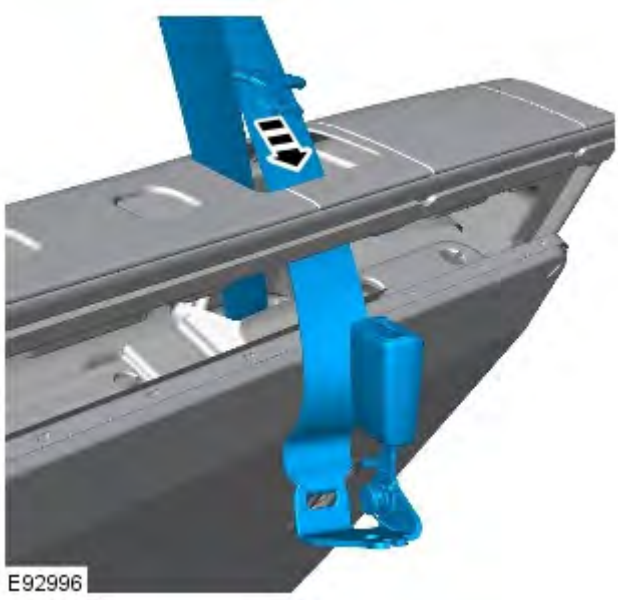


21. **21.** CAUTION: Make sure that the head restraint guide tube locking tang is fully depressed before removal.
    - Using a screwdriver, depress the locking tang.
    - Pull the guide tube upwards.
    - Remove and discard the head restraint guide tubes.

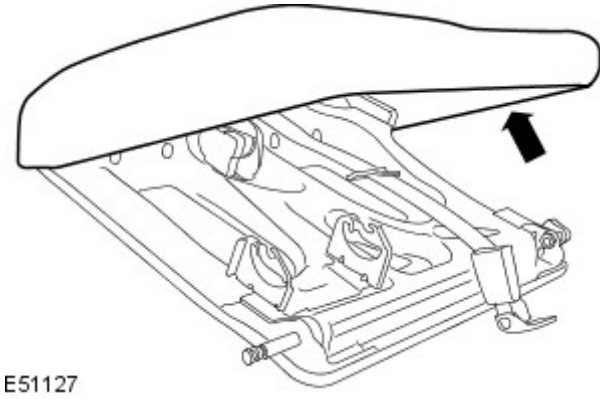
22. Release the rear seat backrest cover from the rear seat backrest frame.



23. Release the rear seat backrest cover and pad assembly from the rear seat backrest release button.



24. Release the rear center safety belt and lower anchor from the backrest cover.

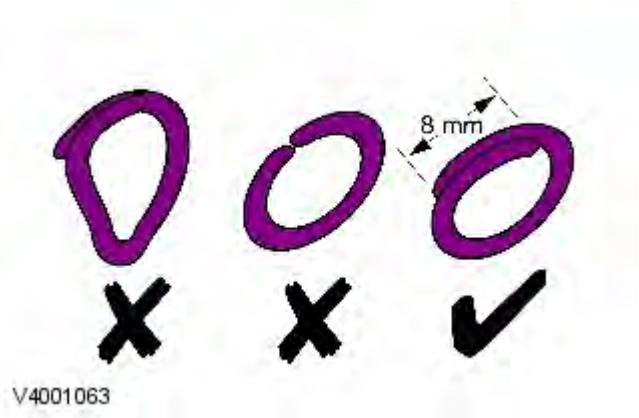


25. Remove the rear seat backrest cover and pad assembly.

26. Remove and discard the hog rings.

E93177

Installation



V4001063

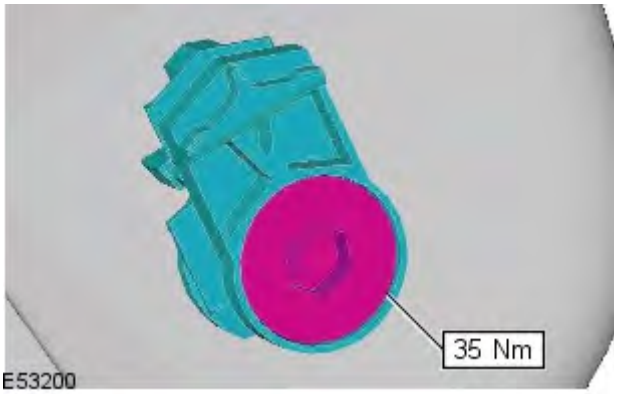
1. **1.** NOTE: If a replacement rear seat backrest cover is to be installed, cut out holes for the head restraint guide tubes and center safety belt trim panel. Use the existing rear seat backrest cover as a template. This also applies to the backrest squab foam.

   • NOTE: Use hog ring pliers to close the hog rings. Do not use any other tool. The hog rings must be closed to overlap as illustrated.

   • NOTE: Make sure that new hog rings are installed.

   Using hog ring pliers, install the 13 hog rings.

2. Guide the rear center safety belt and lower anchor through the backrest cover.
3. Install the rear seat backrest cover and pad assembly.
4. Secure the rear seat backrest cover and pad assembly around the rear seat backrest release button.
5. Secure the rear seat backrest cover to the rear seat backrest frame.
6. Install new head restraint guide tubes.
7. Install the rear seat backrest release button trim panel.
8. Install the center safety belt trim panel.
9. Install the head restraints.



10. Install a new LH rear seat backrest outer pivot pin bushing.

    Torque: 35 Nm

11. **11.** CAUTIONS:

    The center hinge pivot bushing must be replaced if excessive damage or wear is present.

    The left-hand rear seat backrest inner pivot pin has radial grooves. Take care not to damage the center hinge pivot bushing.

    - Install the LH rear seat backrest inner pivot pin to the center hinge pivot bushing.
    - Carefully lower the LH rear seat backrest outer pivot pin bushing into the mounting bracket.

12. Install a new bolt to the outer pivot pin bushing locking arm.

    Torque: 23 Nm

13. Install the LH rear quarter trim access panel.

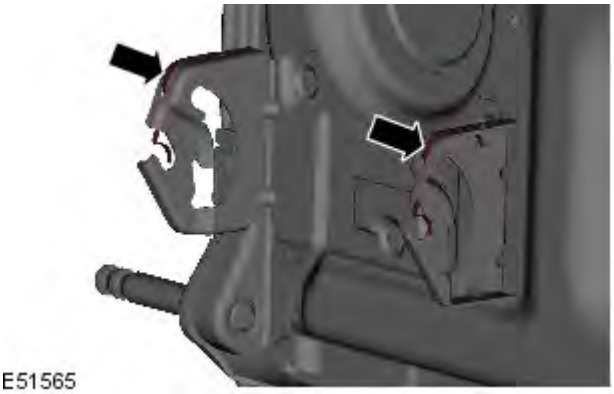
14. **14.** WARNING: Make sure that the safety belt anchor is correctly installed.

    Secure the rear center safety belt lower anchor.

    Torque: 40 Nm

15. **15.** CAUTION: Check for correct operation of the rear center safety belt retractor.

    Remove the safety belt webbing retainer.

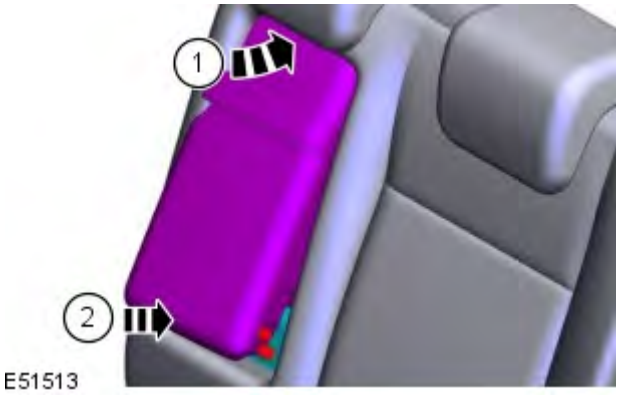


16. **16.** WARNING: New armrest pivot bushing spring clips must be installed. Failure to follow this instruction may result in personal injury.

    If installed with armrest, install new armrest pivot bushing spring clips.

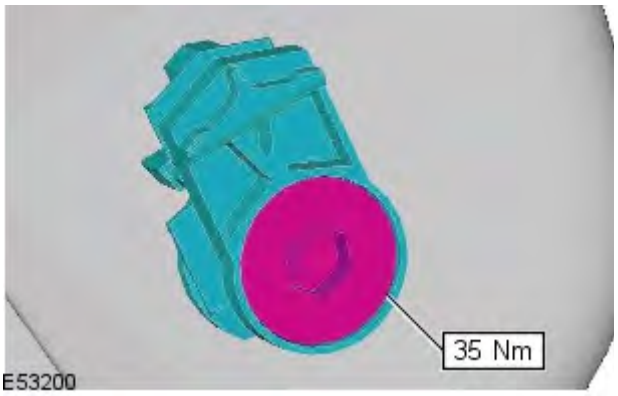
17.

    - Install 4 new fir tree clips to the armrest backing plate.
    - Install the armrest backing plate.



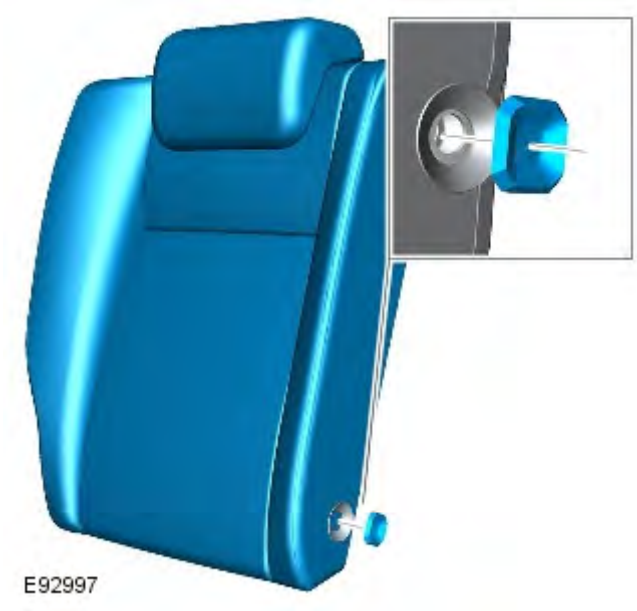
18. **18.** NOTE: Make sure that the armrest pivot bushing spring clips locate in the armrest pivot bushing grooves.

    Install the armrest.



19. Install a new RH rear seat backrest outer pivot pin bushing.

    Torque: 35 Nm



20. **20.** CAUTION: If the existing right-hand rear seat backrest is to be installed, the condition of the inner pivot bushing must be checked and a service pad installed. If excessive damage is present to the inner pivot bushing the right-hand rear seat backrest frame must be replaced.

    • NOTE: This step is not necessary if a new right-hand rear seat backrest is to be installed.

    Install the service pad to the RH rear seat backrest inner pivot bushing.

21. **21.** CAUTION: The left-hand rear seat backrest inner pivot pin has radial grooves. When installing the RH backrest, take care not to damage the inner pivot bushing.

    - Carefully guide the RH rear seat backrest inner pivot bushing onto the LH rear seat backrest inner pivot pin.
    - Carefully lower the RH rear seat backrest outer pivot pin bushing into the mounting bracket.

22. Install a new bolt to the outer pivot pin bushing locking arm.

    Torque: 23 Nm

23. Install the RH rear quarter trim access panel.

Published: 11-May-2011

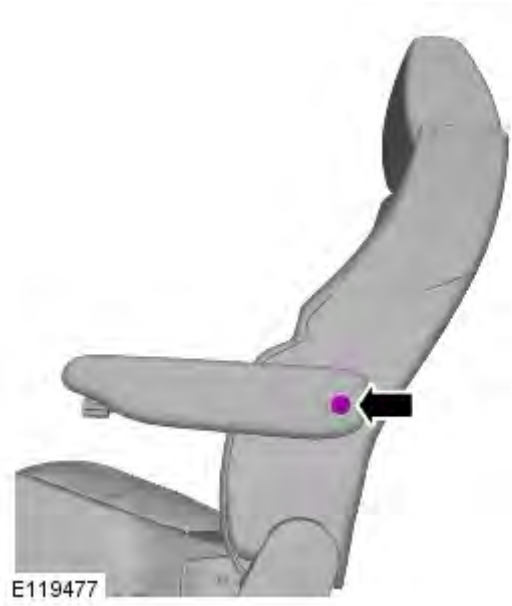
Seating - Front Seat Armrest

Removal and Installation

Removal

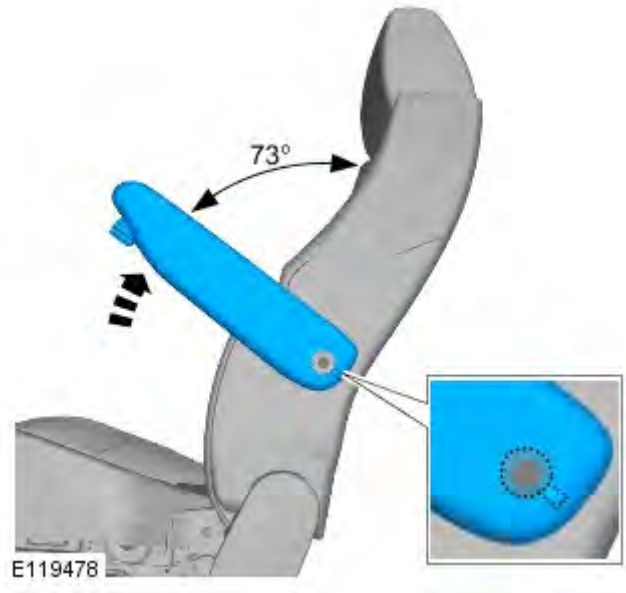
1.

- Remove the cover.



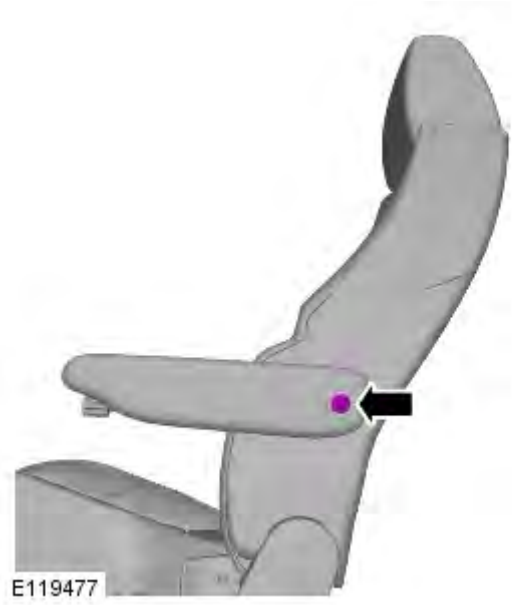
2.

- Remove the Torx bolt.



3. **3.** CAUTION: Make sure that the seat armrest slot is correctly aligned before removing the seat armrest. Failure to follow this instruction may result in damage to the vehicle.
    - Raise the seat armrest to the position shown.
    - Slide the seat armrest towards the centre of the vehicle.

Installation



1.
    - To install, reverse the removal procedure.
    - Tighten the Torx bolt to 10 Nm (7 lb.ft).

Published: 11-May-2011

Seating - Front Seat Armrest

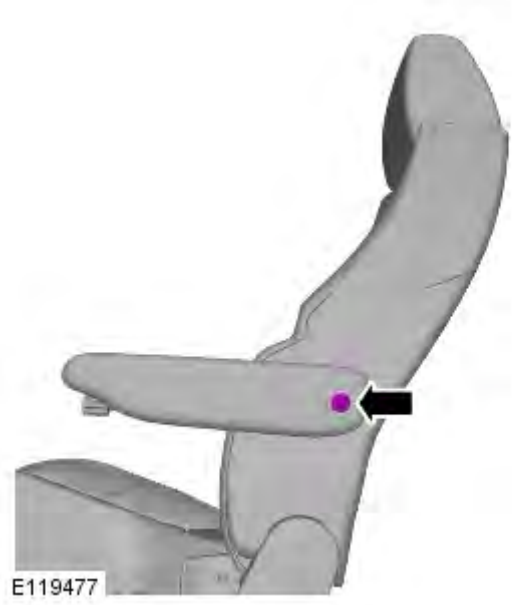
Removal and Installation

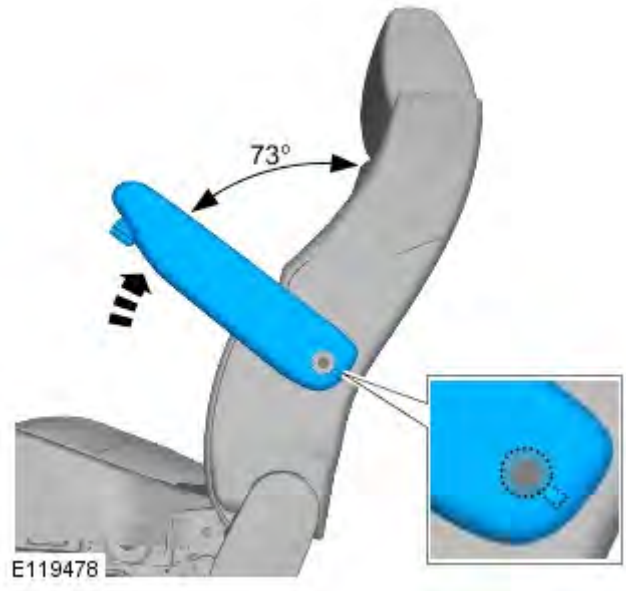
Removal

1. Raise the seat base for access.

2. Remove the cover.

3. Remove the Torx bolt.





4. CAUTION: Make sure that the seat armrest slot is correctly aligned before removing the seat armrest. Failure to follow this instruction may result in damage to the vehicle.

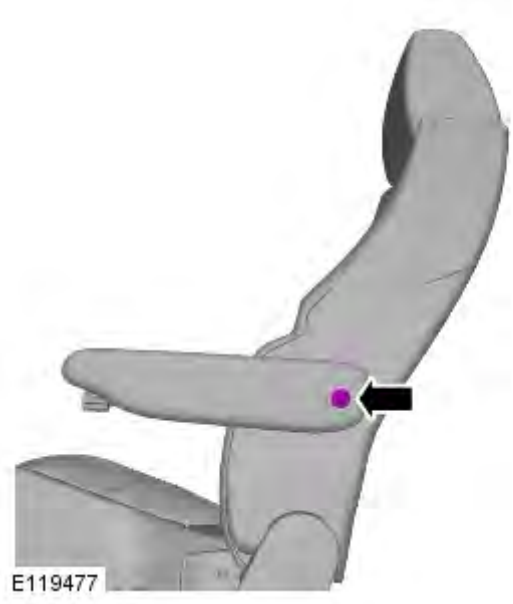
Remove the seat armrest.

- Raise the seat armrest to the position shown.
- Slide the seat armrest towards the centre of the vehicle.

Installation

1. To install, reverse the removal procedure.

- Tighten the Torx bolt to 10 Nm (7 lb.ft).



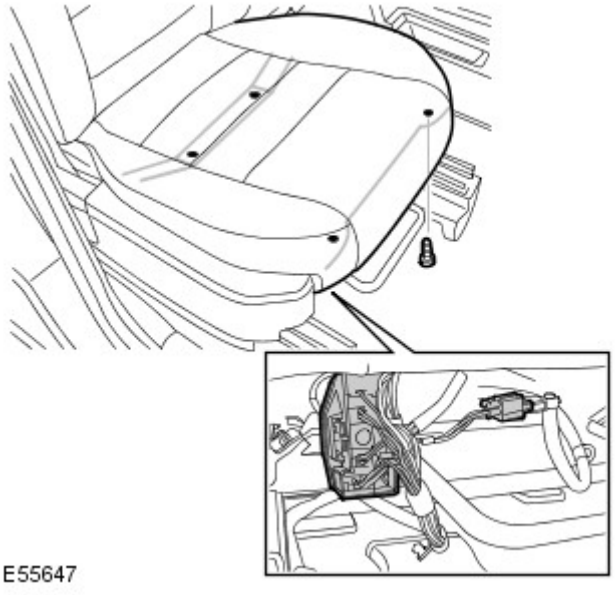
Published: 11-May-2011

Seating - Front Seat Cushion

Removal and Installation

Removal

• NOTE: In this procedure the cushion is removed as an assembly. There is a separate procedure showing removal of the cushion cover.



1. *Torque:* 25 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Seating - Front Seat Track

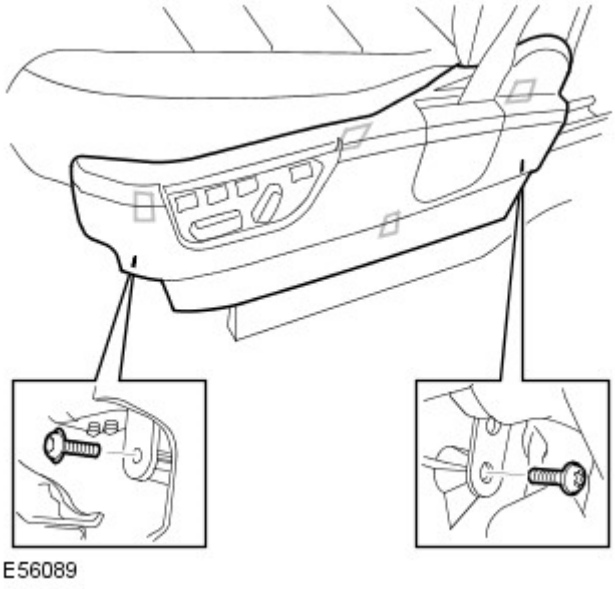
Removal and Installation

Removal

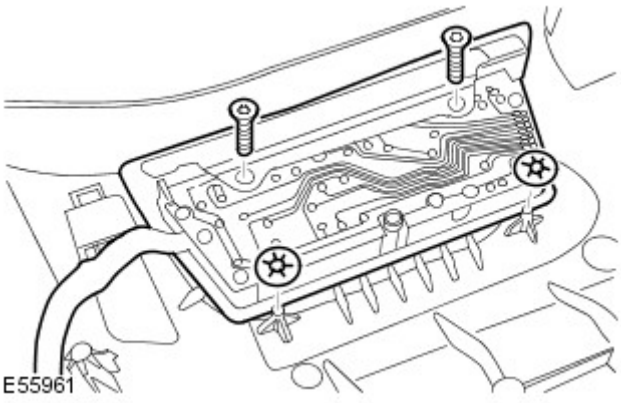
- NOTE: The front seat track motor is supplied as part of the front seat lower frame assembly.

1. Remove the front seat.
For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

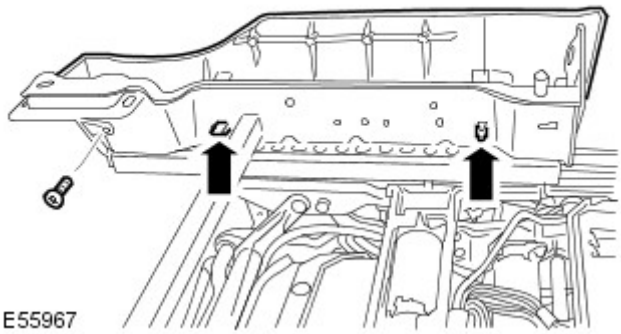
2.


E56089

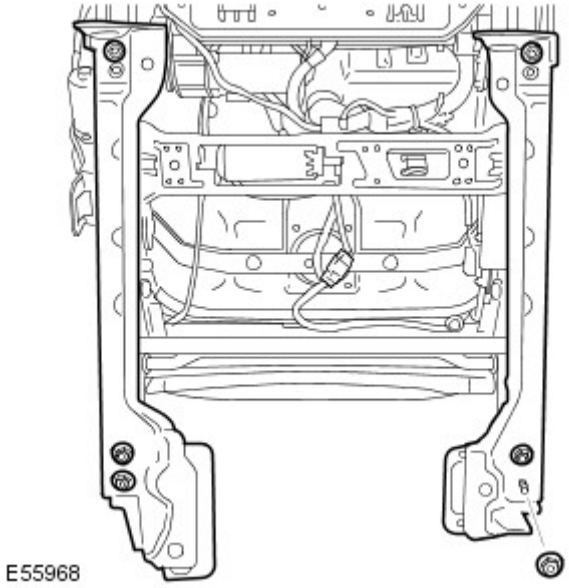
3. Release the seat control switch.


E55961

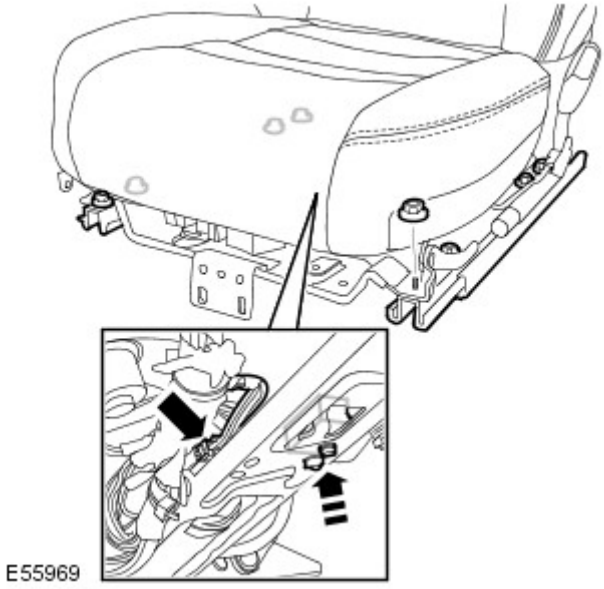
4.


E55967

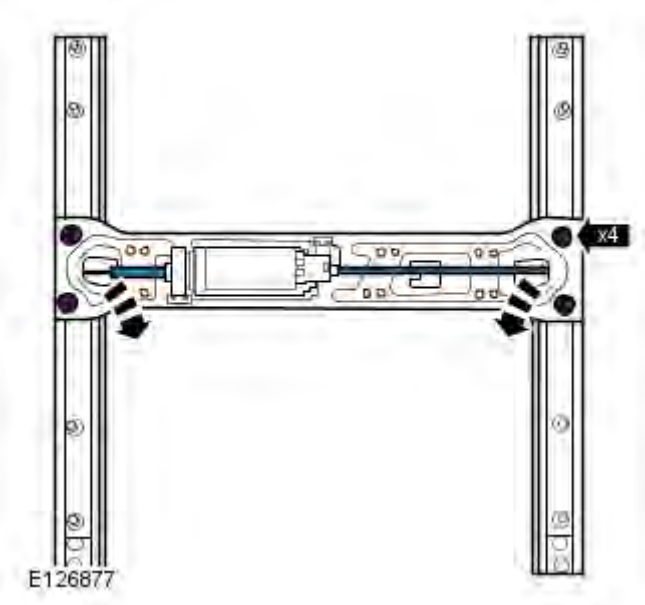
5. TORQUE: 25 Nm



6. TORQUE: 25 Nm



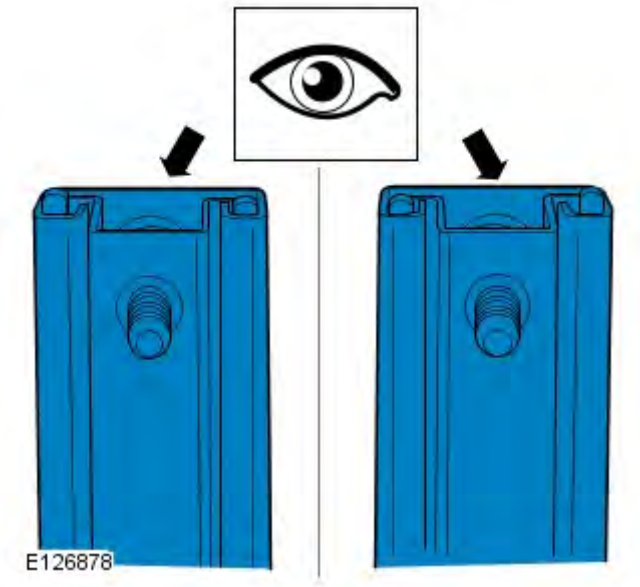
7. TORQUE: 10 Nm



8. NOTE: Do not disassemble further if the component is removed for access only.

Installation

1.



2. To install, reverse the removal procedure.

Published: 11-May-2011

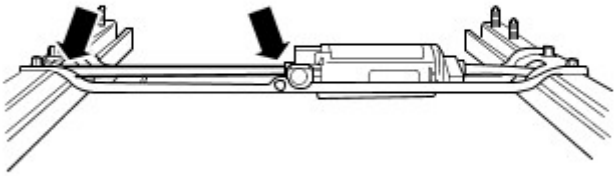
Seating - Front Seat Track Motor

Removal and Installation

Removal

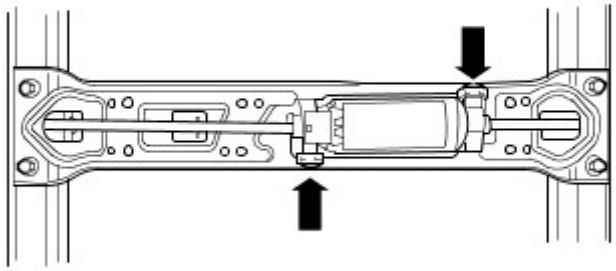
1. Raise the seat base for access.

2.
   - Remove the drive cable.
   - Disconnect the seat motor electrical connector.



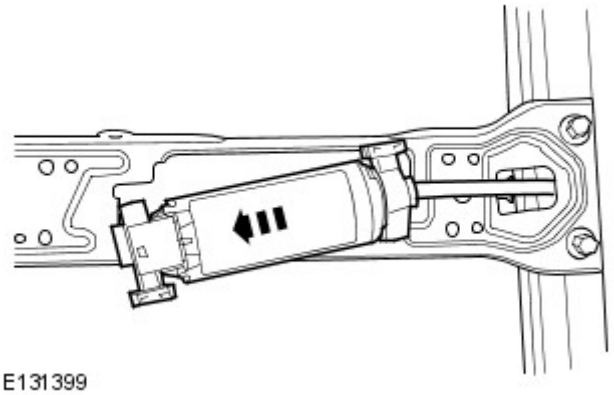
E131397

3. Remove the 2 clips.



E131398

4. Remove the front seat track motor.



E131399

Installation

1.
   - Install the front seat track motor.
   - Install the drive cable.
   - Install the 2 clips.

2.
   - Install the drive cable.
   - Connect the seat motor electrical connector.

Published: 11-May-2011

Seating - Front Seat Tilt Motor

Removal and Installation

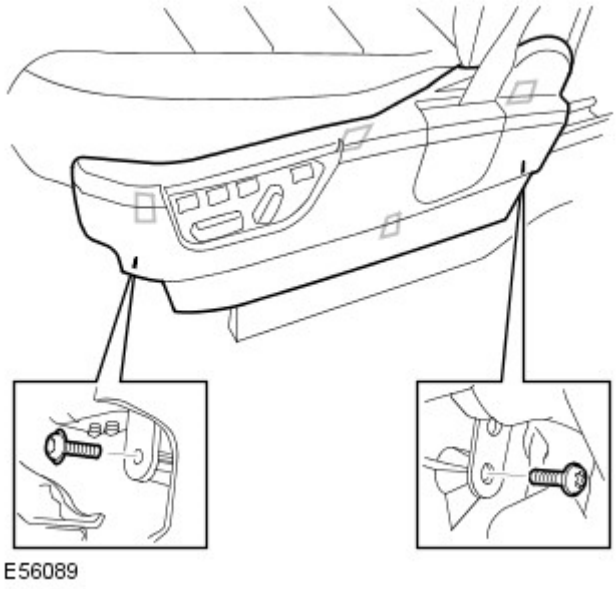
Removal

- NOTE: Removal steps in this procedure may contain installation details.

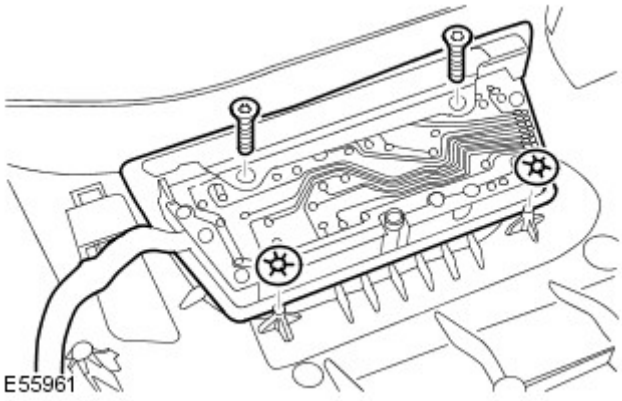
1. Remove the front seat.

   Refer to: Front Seat (501-10 Seating, Removal and Installation).

2.

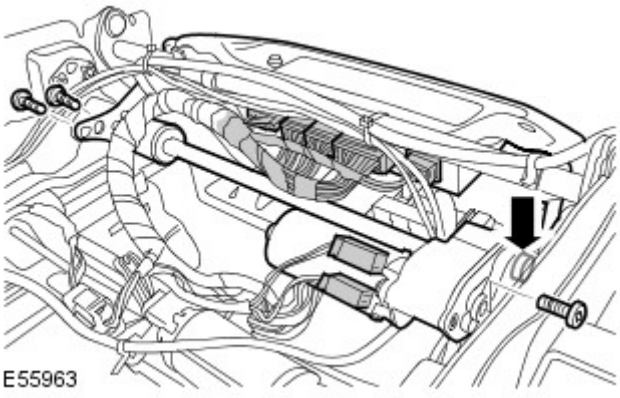


3.

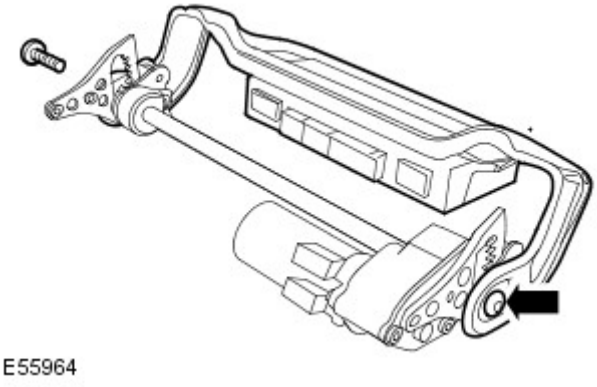


4. Remove the front seat cushion assembly.

   Refer to: Front Seat Cushion (501-10 Seating, Removal and Installation).



5. *Torque:* 10 Nm



6. **6.** NOTE: Do not disassemble further if the component is removed for access only.

   Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Seating - Front Seat Recliner Motor

Removal and Installation

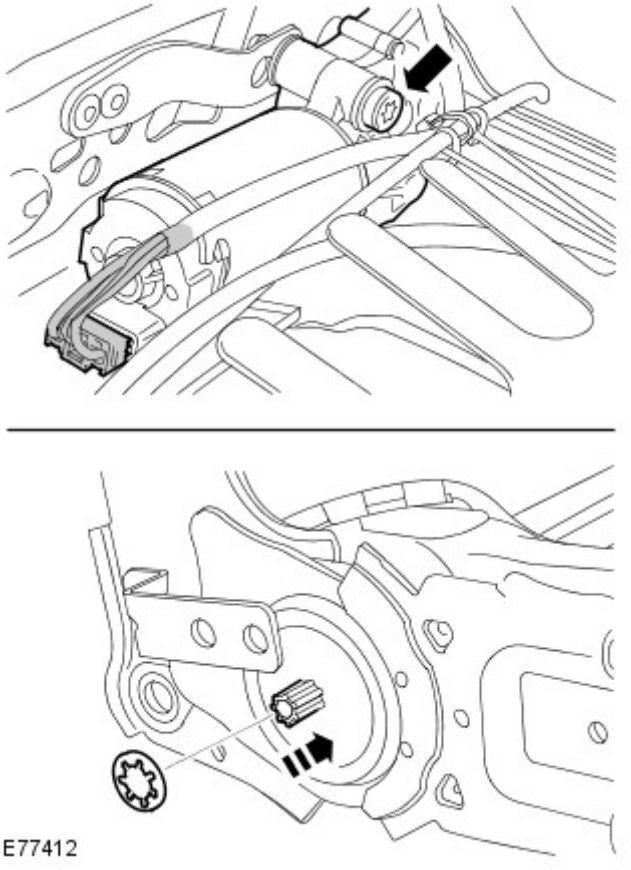
Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the front seat backrest cover.

   Refer to: Front Seat Backrest Cover (501-10 Seating, Removal and Installation).

2. Remove the front seat backrest pad.



3. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Seating - Front Seat Height Adjustment Motor

Removal and Installation

Removal

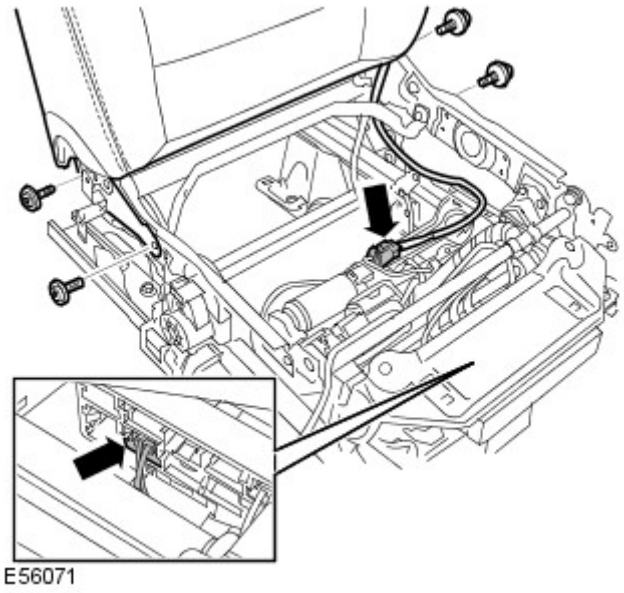
- NOTE: Front seat height adjustment motor is supplied as part of the front seat frame assembly.
- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the front safety belt buckle.

   Refer to: Front Safety Belt Buckle (501-20A Safety Belt System, Removal and Installation).

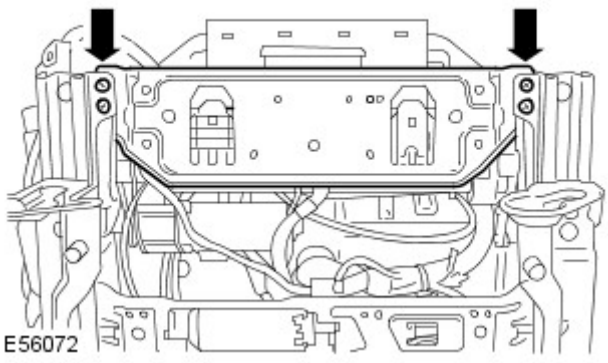
2. Remove the front seat cushion assembly.

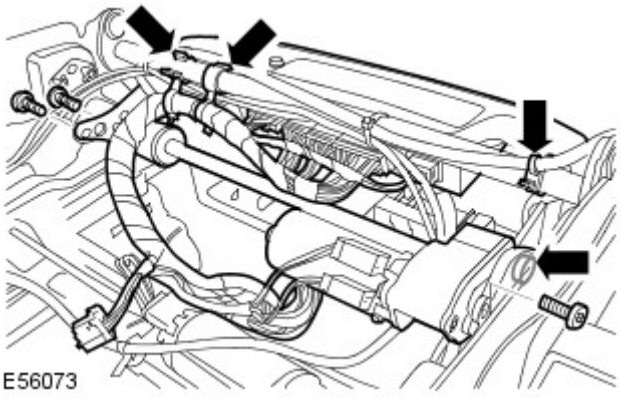
   Refer to: Front Seat Cushion (501-10 Seating, Removal and Installation).


E56071

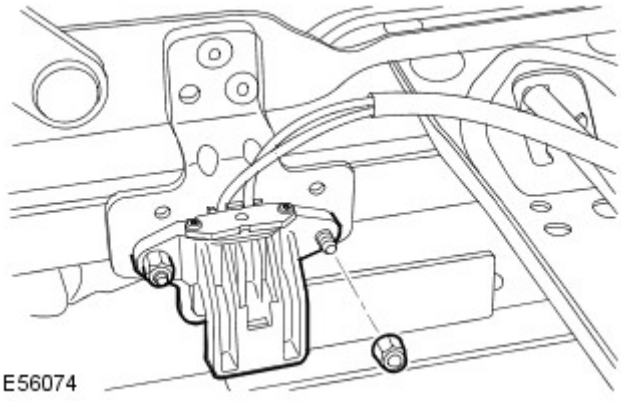
3. *Torque:* 25 Nm

4.

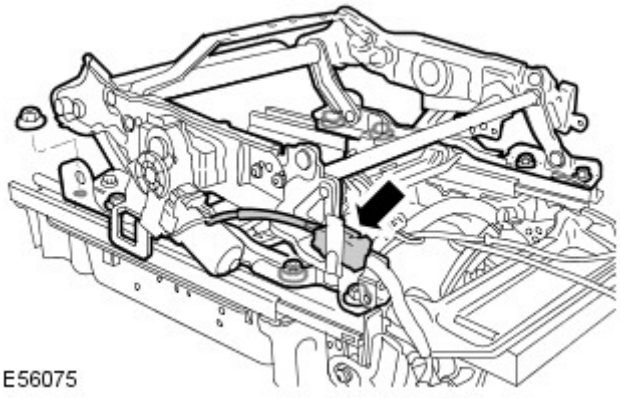

E56072



5. *Torque:* 10 Nm



6. *Torque:* 4 Nm



7. *Torque:* 25 Nm

Installation

1. To install, reverse the removal procedure.

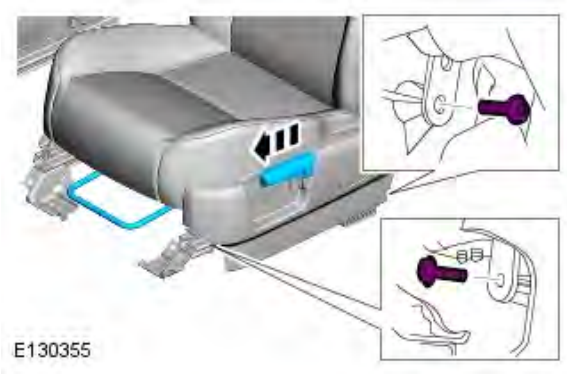
Published: 11-May-2011

Seating - Front Seat Manual Height Adjustment Lever

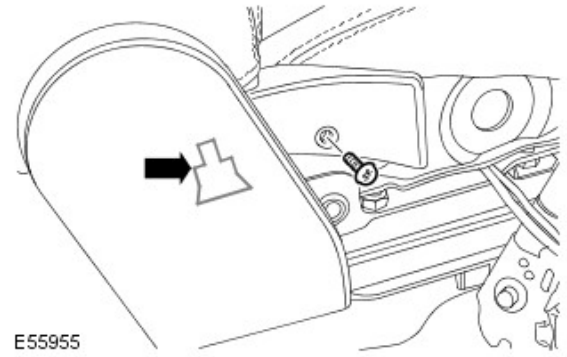
Removal and Installation

Removal

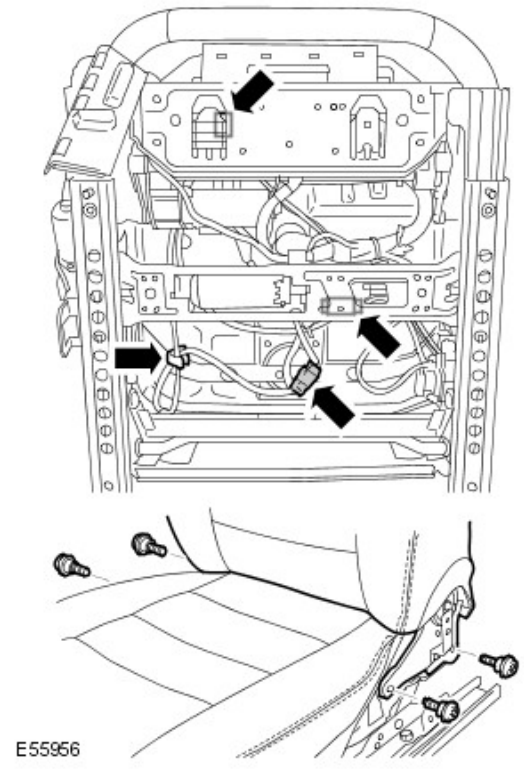
1. Remove the drivers side seat slides.
   For additional information, refer to: Front Seat Track (501-10 Seating, Removal and Installation).
2. Remove the front seat cushion base.
   For additional information, refer to: Front Seat Cushion (501-10 Seating, Removal and Installation).
3.



4.



5. TORQUE: 25 Nm



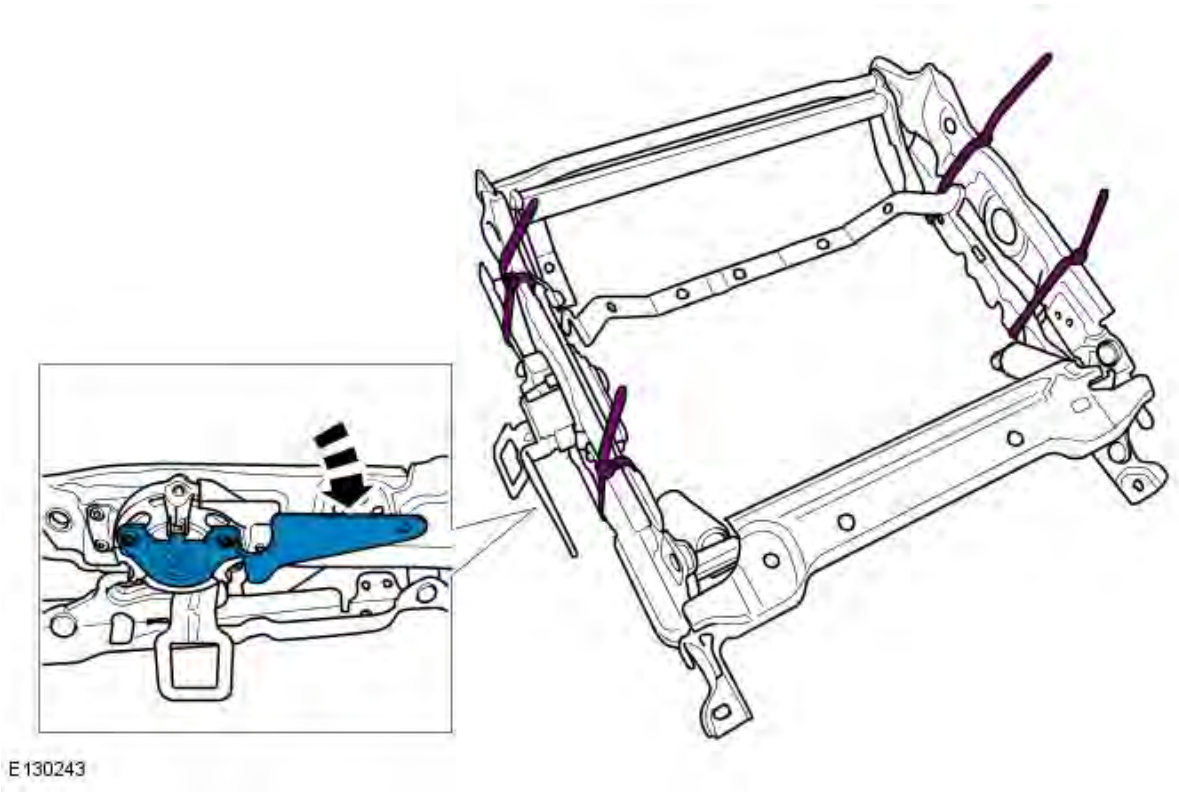
6. CAUTIONS:

Tie straps must be fitted, failure to follow this instruction may result in personal injury.

Failure to follow this instruction may cause damage to the vehicle.

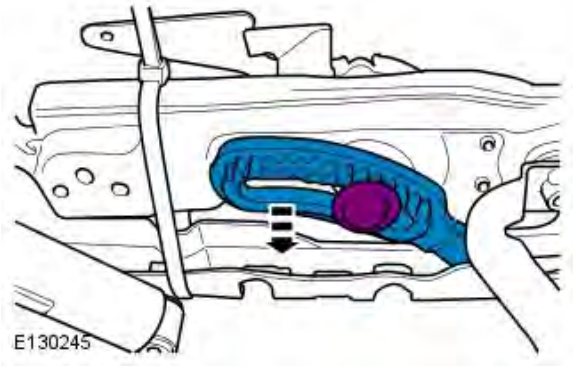
Secure the seat base using the 4 tie straps supplied, as shown.

- Using the seat height adjuster, lower the seat base to its lowest position.

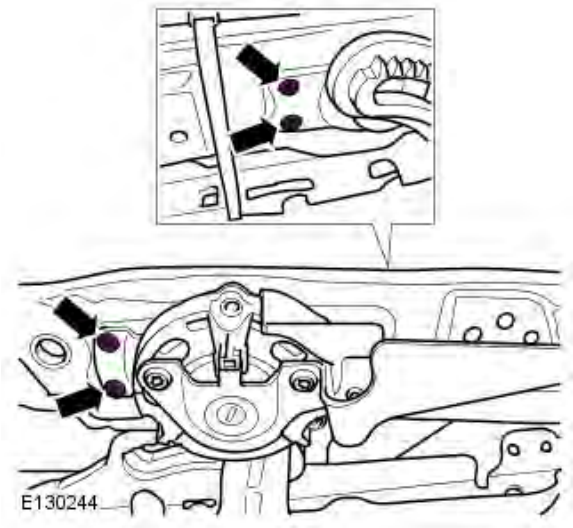


7. Release the arm from the height adjuster.

- Remove the Torx bolt.



8. Drill out the 4 rivets.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Seating - Front Seat Cushion Cover

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

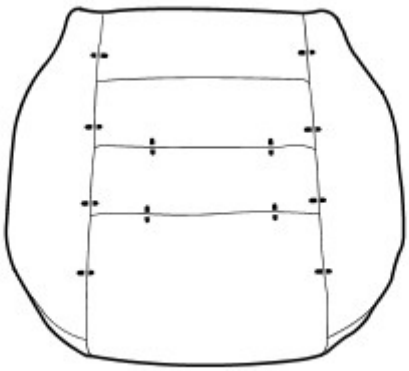
1. Remove the front seat cushion assembly.

   Refer to: Front Seat Cushion (501-10 Seating, Removal and Installation).

2.

E55966

3.



E56020

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

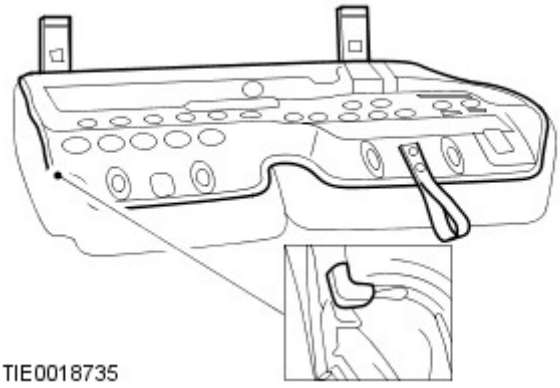
Seating - Rear Seat Cushion Cover

Removal and Installation

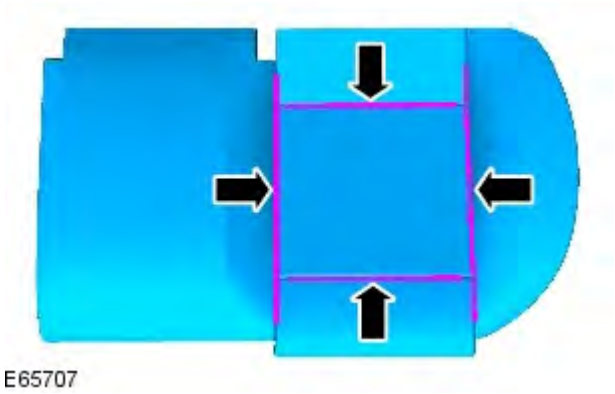
Removal

- NOTE: LH rear seat cushion cover shown, RH similar.
- NOTE: Removal steps in this procedure may contain installation details.

1.



2.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Seating - Front Seat Backrest Heater Mat

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

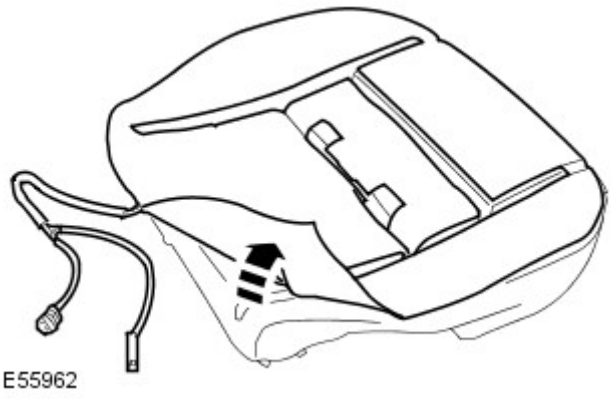
1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the front seat backrest cover.

   Refer to: Front Seat Backrest Cover (501-10 Seating, Removal and Installation).

3.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Seating - Front Seat Cushion Heater Mat

Removal and Installation

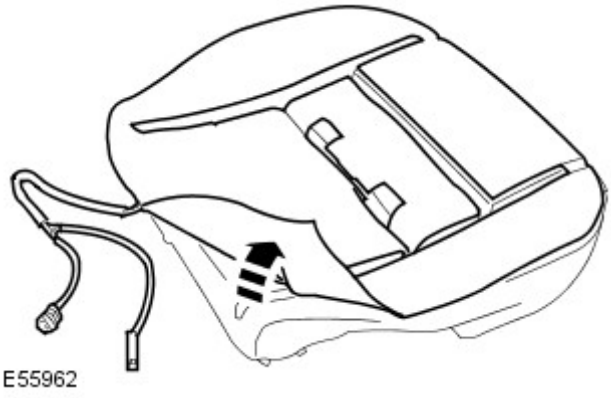
Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the front seat cushion cover.

   Refer to: Front Seat Cushion Cover (501-10 Seating, Removal and Installation).

2.



Installation

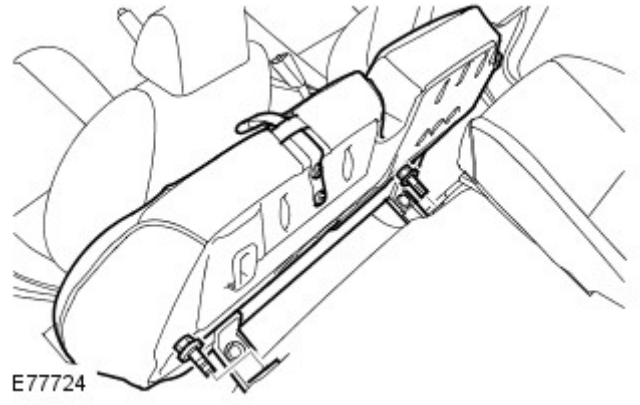
1. To install, reverse the removal procedure.

Published: 11-May-2011

Seating - Rear Seat Cushion

Removal and Installation

Removal



1. *Torque:* 25 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Seating - Lumbar Assembly

Removal and Installation

Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Make the SRS system safe.

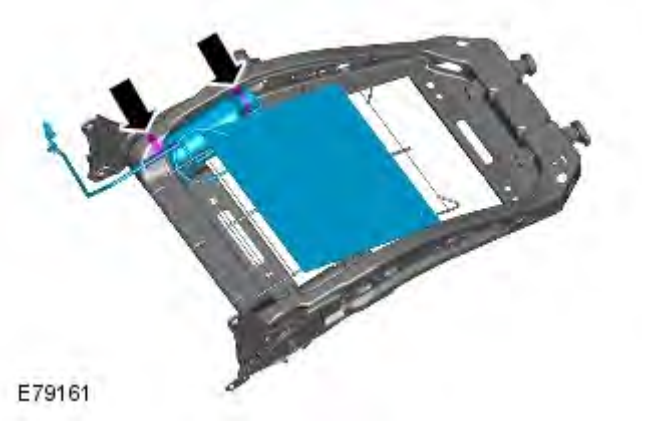
   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20, General Procedures).

3. Remove the front seat backrest cover.

   Refer to: Front Seat Backrest Cover (501-10 Seating, Removal and Installation).

4. Remove the front seat backrest pad.

5.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Glass, Frames and Mechanisms -

Torque Specifications

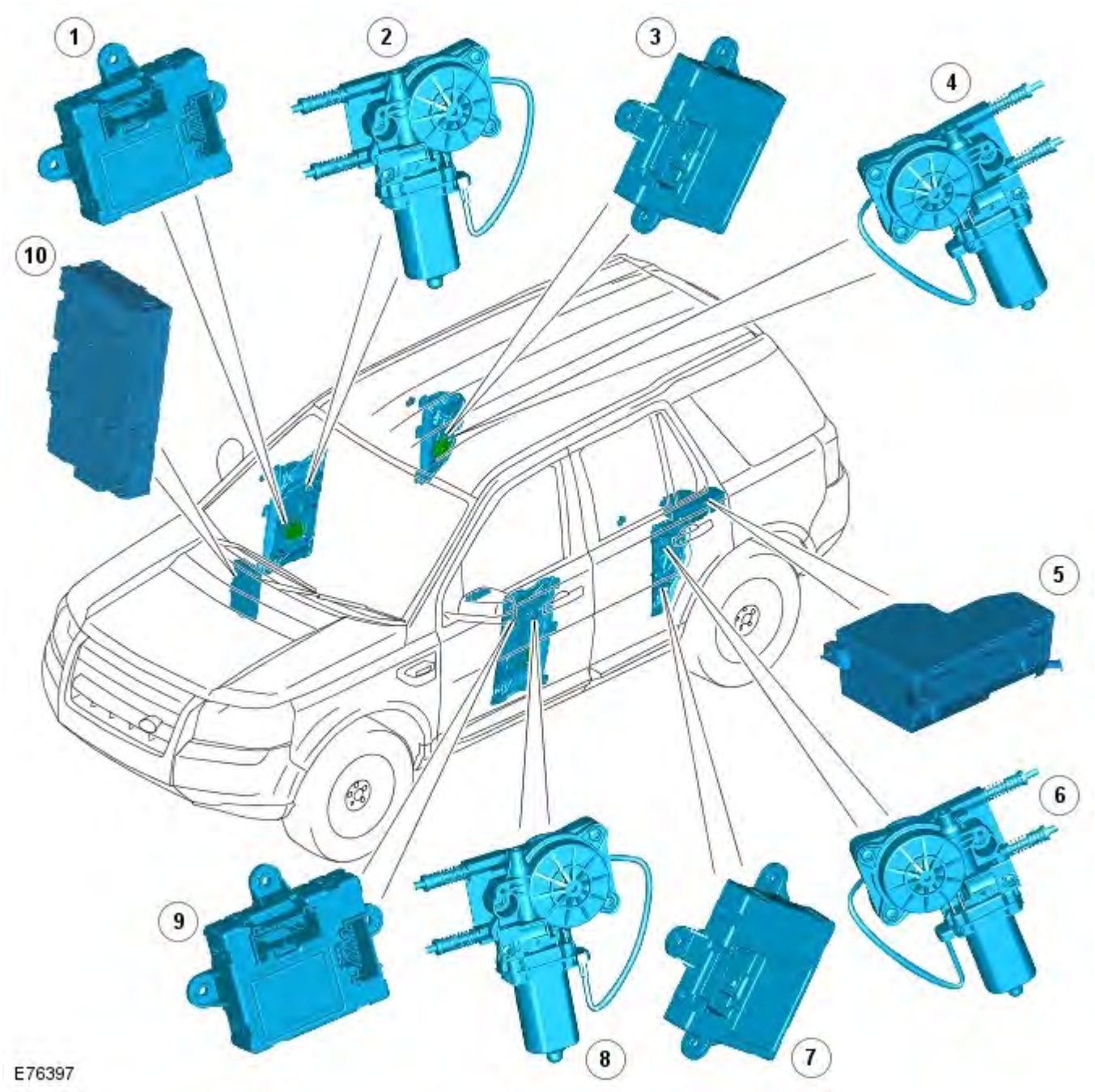
Description	Nm	lb-ft
Front door window glass guide channel bolt	10	7
Front door window motor and regulator to door nuts and bolts	10	7
Rear door window fixed glass Torx screw	5	4
Rear door window motor and regulator to door nuts and bolts	10	7

Published: 11-May-2011

Glass, Frames and Mechanisms - Glass, Frames and Mechanisms

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Passenger door module
2	-	Passenger door glass motor
3	-	Rear door module
4	-	Rear door glass motor
5	-	Auxiliary Junction Box (AJB)
6	-	Rear door glass motor
7	-	Rear door module
8	-	Driver door glass motor
9	-	Driver door module
10	-	Central Junction Box (CJB)

OVERVIEW

The laminated windshield is bonded and sealed to the body aperture using Polyurethane (PU) adhesive. Bonded to the inner surface of the windshield is the mounting boss for the interior mirror. Dependent on vehicle specification, the windshield may contain 2 heating elements between the windshield laminations.

The toughened rear screen is also bonded and sealed to the body aperture using PU adhesive. A single heating element is

printed on the inner surface of the rear screen.

Operation of the window lift system is controlled by the CJB in conjunction with the driver door module and the front passenger door module. The door modules are mounted on the regulators of their respective front windows. Door modules are also mounted on both rear window regulators, and communicate with the front door modules over the Local Interconnect Network (LIN) bus.

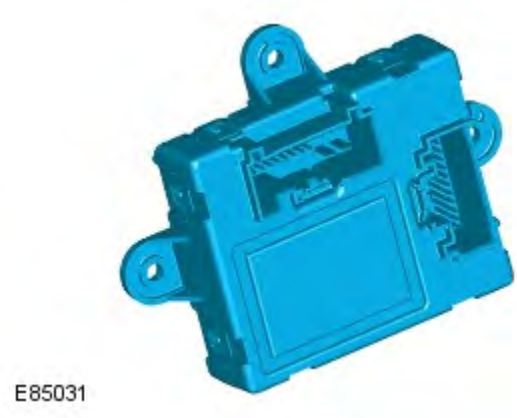
The window lift system features one shot up and down operation, plus an anti-trap feature for all door windows.

If the battery is disconnected, the window lift system will require calibrating on battery re-connection. To calibrate the system the following routine must be carried out.

With the ignition on:

- Fully close the door glass and release the switch.
- Re-apply the switch to close the door glass and hold for approximately 2 seconds.
- Fully open the door glass and release the switch.
- Re-apply the switch to open the door glass and hold for approximately 2 seconds.
- Repeat for all remaining windows.

DOOR MODULES



In addition to controlling the window lift system, the front door modules also control:

- Door locking.
  For additional information, refer to: Handles, Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).
- Door mirror adjustment and heating. For additional information, refer to:
  Rear View Mirrors (501-09 Rear View Mirrors, Description and Operation),
  Control Components (412-01 Climate Control, Description and Operation).
- Door mirror lamps.
  For additional information, refer to: Interior Lighting (417-02 Interior Lighting, Description and Operation).

The rear door modules control window lift and door locking only.

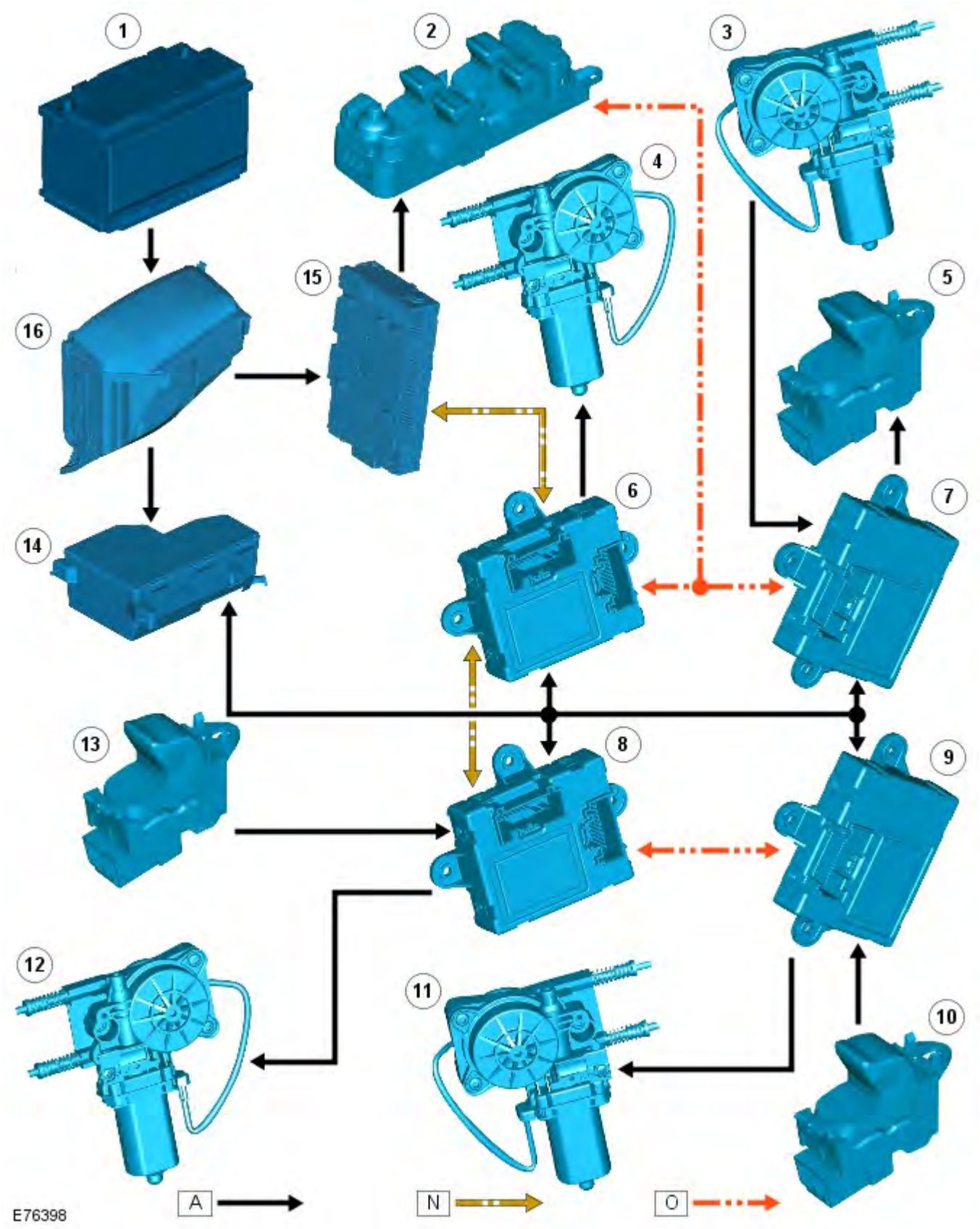
The door modules are color coded for position on the vehicle. The driver door module and both rear door modules are black. The passenger door module is gray. The electrical wiring harness connectors are also color coded to match the door modules.

• NOTE: Both rear door modules are identical.

If a front door module develops a fault, a Diagnostic Trouble Code (DTC) is stored in its memory. The DTC can be read using the Land Rover approved diagnostic system. If either of the rear door modules develop a fault, the DTC is stored in the respective front door module.
For additional information, refer to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **N** = Medium speed Controller Area Network (CAN) bus; **O** = LIN bus



Item	Part Number	Description
1	-	Battery
2	-	Driver door switch pack
3	-	Rear door glass motor
4	-	Driver door glass motor
5	-	Rear door window lift switch
6	-	Driver door module
7	-	Rear door module
8	-	Passenger door module
9	-	Rear door module
10	-	Rear door window lift switch
11	-	Rear door glass motor

12	-	Passenger door glass motor
13	-	Passenger door window lift switch
14	-	AJB
15	-	CJB
16	-	Battery Junction Box (BJB)

PRINCIPLES OF OPERATION

The CJB provides a power supply to the driver door switch pack when the vehicle is in power mode 6 (ignition on). Switch requests made using the driver door switch pack are then delivered to the driver door module over the LIN bus.

The driver door module interprets the request made using the switch pack and responds as follows:

- If the request is for drivers side rear window operation, a request is transmitted over the LIN bus to the driver side rear door module.
- If the request is for front passenger window operation, a request is transmitted over the medium speed CAN bus to the passenger door module.
- If the request is for passenger side rear window operation, a request is transmitted over the medium speed CAN bus to the passenger door module. This request is then forwarded over the LIN bus to the passenger side rear door module.

Door Glass Opening and Closing

Each door module provides 2 signal feeds to its window lift switch. When a switch request is made, a ground path is created on one of the lines via the door module. From this the door module can determine which direction of travel has been requested.

The door modules power the door glass motors on receipt of a switch request or a request for Global Closing (see below). The door modules provide feed and return paths to their respective motor, which can switch depending on the direction of travel requested.

The door glass motor assemblies also contain a Hall effect sensor. The Hall effect sensor allows the door module to determine the position of the door glass and if a motor stall condition has taken place.

Global Closing

The AJB provides a constant battery feed to the 4 door modules. This feed is used operate the 'Global Closing' feature. Global Closing allows all 4 windows to be closed using the Radio Frequency (RF) handset.

• NOTE: The roof opening panel is not part of the Global Closing feature.

The Global Closing feature is activated by pressing and holding the 'lock' button on the RF handset for 3 seconds. The request for Global Closing is provided to the CJB by the RF receiver. The CJB then transmits this request to the driver and passenger door modules over the medium speed CAN bus.

Initialization

When the vehicle is delivered from the factory the window lift system will operate slowly until it has been initialized. The initialization process should be carried out using the Pre-Delivery Inspection (PDI) feature contained within the Land Rover approved diagnostic system. For more information, refer to the PDI manual.

Similarly, if a door module is replaced, the new module will require initialization before handover to the customer. The initialization process for a new module is carried out using the 'New Module' feature contained within the Land Rover approved diagnostic system.

• NOTE: If a driver door or passenger door module is replaced, both will require initialization. This ensures both front controlling modules contain the same level of software.

Published: 11-May-2011

Glass, Frames and Mechanisms - Glass, Frames and Mechanisms

Diagnosis and Testing

Principles of Operation

For a detailed description of the glass, frames and mechanisms, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Window glass • Window regulator	• Fuses/relays (refer to electrical guide) • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connections

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B117C07	Rear Power Window up	• Mechanical Failure	Check for mechanical failure of rear window mechanism
B117C72	Rear Power Window up	• Actuator Stuck Open	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117C73	Rear Power Window up	• Actuator Stuck Closed	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117C92	Rear Power Window up	• Performance or incorrect operation	Refer to electrical circuit diagrams and check power and ground supplies to rear door module
B117D72	Rear Power Window down	• Actuator Stuck Open	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117D73	Rear Power Window down	• Actuator Stuck Closed	Clear DTC and re-test. If DTC returns, install a new rear door module, refer to the new module installation note at the top of the DTC Index
B117E07	Front Power Window up	• Mechanical failure	Check for mechanical failure of front window mechanism
B117E72	Front Power Window up	• Actuator stuck open	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117E73	Front Power Window up	• Actuator stuck closed	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F72	Front Power Window down	• Actuator stuck open	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index

DTC	Description	Possible Cause	Action
B117F73	Front Power Window down	• Actuator stuck closed	Clear DTC and re-test. If DTC returns, install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B118929	Front Window Position Sensor	• Signal invalid	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B118A29	Rear Window Position Sensor	• Signal invalid	Carry out pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B11D183	LIN Bus Circuit "C"	• Value of signal protection calculation incorrect	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
B11D186	LIN Bus Circuit "C"	• Signal Invalid	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
B11D187	LIN Bus Circuit "C"	• Missing Message	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
B1A9883	LIN Bus Circuit #1	• Value of signal protection calculation incorrect	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and test LIN circuit between driver side rear door module and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
B1A9886	LIN Bus Circuit #1	• Signal Invalid	Refer to the electrical circuit diagrams and test LIN circuit between driver side rear door module and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
B1A9887	LIN Bus Circuit #1	• Missing Message	Refer to the electrical circuit diagrams and test LIN circuit between driver side rear door module and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
C1B1411	Sensor Supply #1	• Short to ground	Refer to the electrical circuit diagrams and test front window sensor supply circuit for short to ground
C1B1415	Sensor Supply #1	• Short to power or open circuit	Refer to the electrical circuit diagrams and test front window sensor supply circuit for short to power or open circuit
C1B1511	Sensor Supply #2	• Short to ground	Refer to the electrical circuit diagrams and test rear window sensor supply circuit for short to ground
C1B1515	Sensor Supply #2	• Short to power or open circuit	Refer to the electrical circuit diagrams and test rear window sensor supply circuit for short to power or open circuit
U030000	Internal control module software incompatibility	• Invalid configuration message is received	Re-configure the CJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the DDM/PDM, refer to the new module installation note at the top of the DTC Index
U201324	Switch Pack	• Signal stuck high	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Clear DTC and re-test. If DTC remains, install a new driver side window switch pack. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
U201444	Control module hardware	• Data Memory Failure	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
U210000	Initial configuration not complete	• No sub type information	Re-configure the DDM/PDM using the manufacturer approved diagnostic system
U300049	Control module	• Internal electronic failure	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index

Published: 11-May-2011

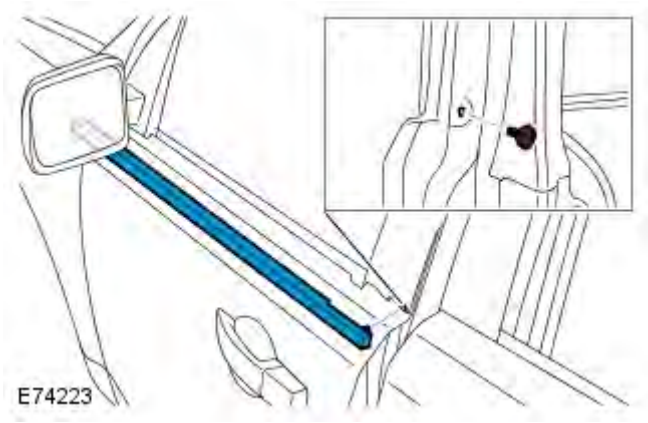
Glass, Frames and Mechanisms - Front Door Window Glass

Removal and Installation

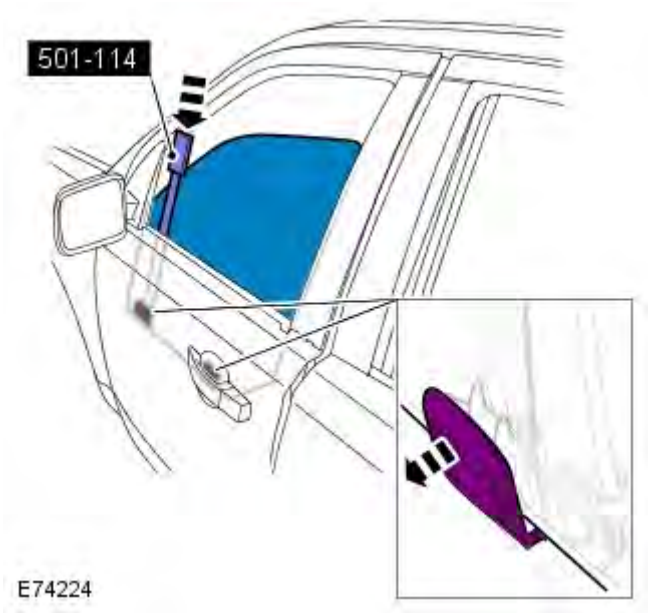
Special Tool(s)

	501-114 Release Lever, Door Glass

Removal

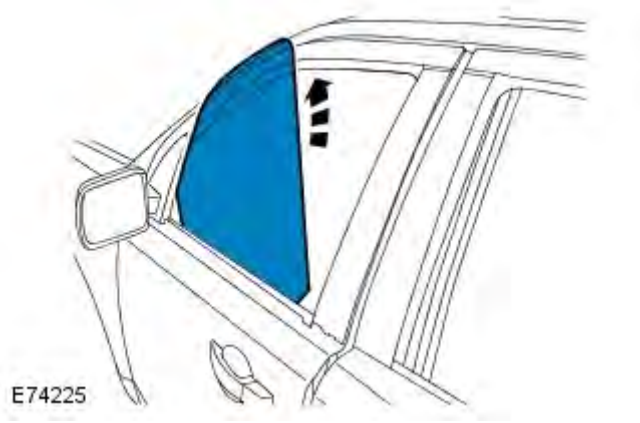


1.



2. Release the door window glass.

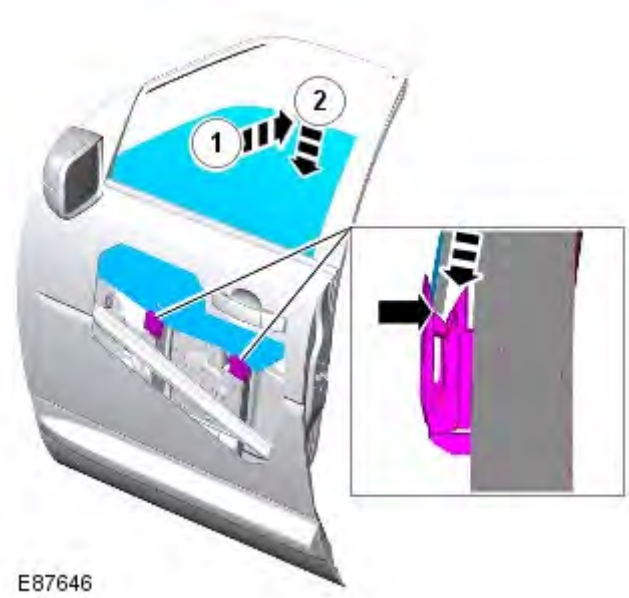
   Special Tool(s): 501-114



3.

Installation

1. To install, reverse the removal procedure.



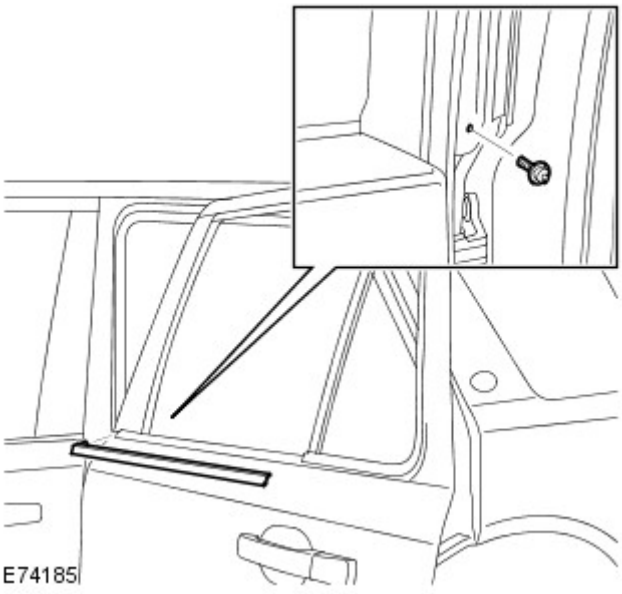
2. To secure the door glass to the door glass mechanism, lower the glass squarely to rest within the latches. With slight pressure applied to top of glass as shown, push the glass down to fully engage.

Published: 11-May-2011

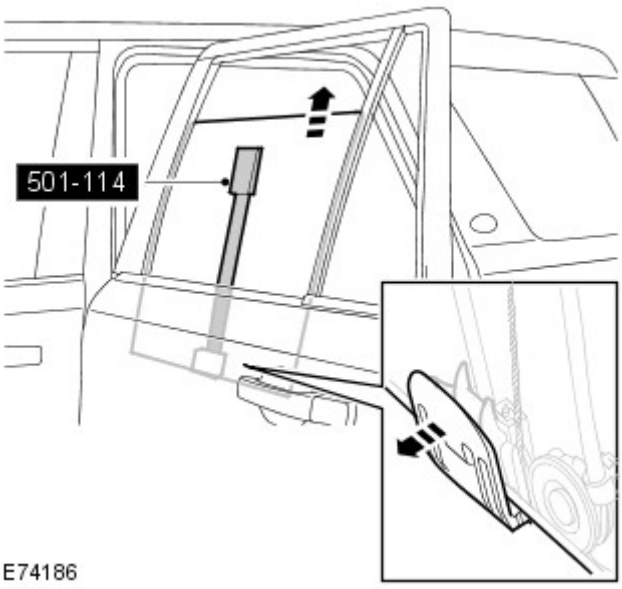
Glass, Frames and Mechanisms - Rear Door Window Glass

Removal and Installation

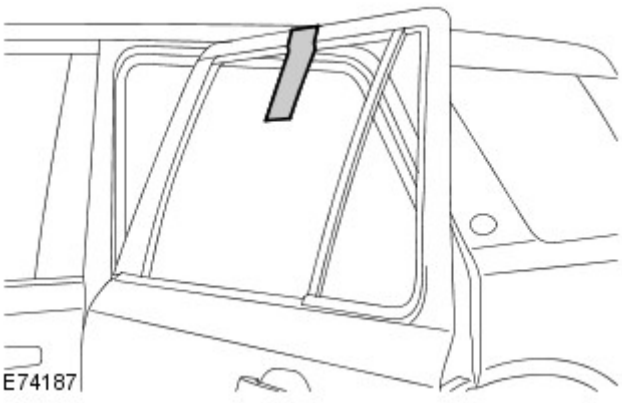
Removal



1. Carefully remove the outer waist seal.

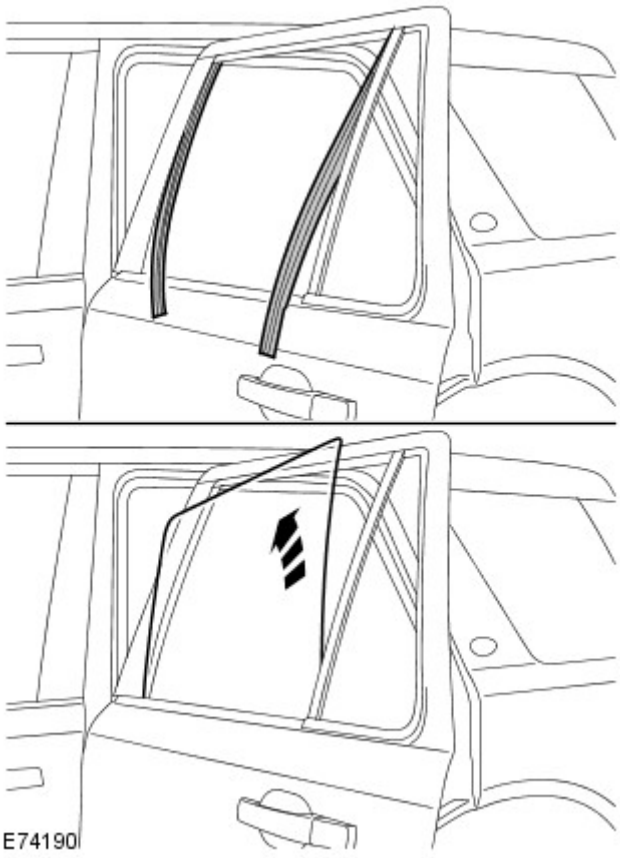


2.
- If possible, lower the window glass by approximately one third of its travel.
- Using the special tool, release the door window glass from the window lift mechanism and raise the glass to the top of the door frame.



3. Secure the glass to the top of the frame.

4. Lower the window lift mechanism.



5.
- Lower the door glass to the bottom of the door.
- Release the lining from both guide channels.

Installation

1.
- Install the rear door window glass.
- Install the guide channel lining.
- Secure the glass to the top of the frame.

2. Raise the window lift mechanism.

3. Secure the door window glass to the window lift mechanism.

4. Install the outer waist seal and secure with the Torx screw.

Published: 11-May-2011

Glass, Frames and Mechanisms - Rear Quarter Window Glass

Removal and Installation

Removal

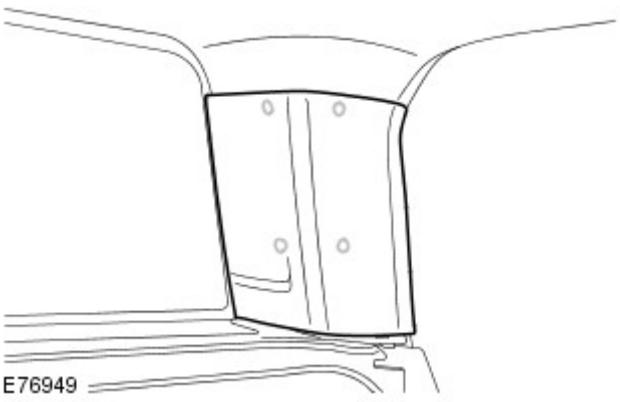
1. Remove the rear quarter trim panel.

   Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. **2.** WARNING: Make sure that a new bolt is installed.

   Remove the C-pillar trim panel.

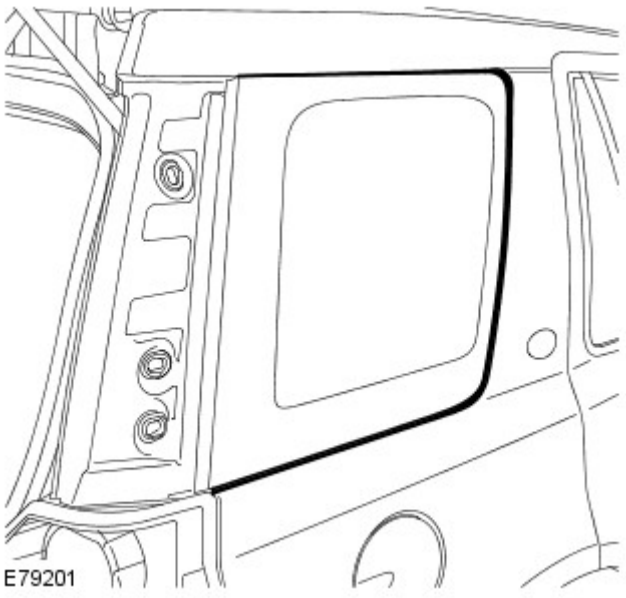
   Torque: 3 Nm



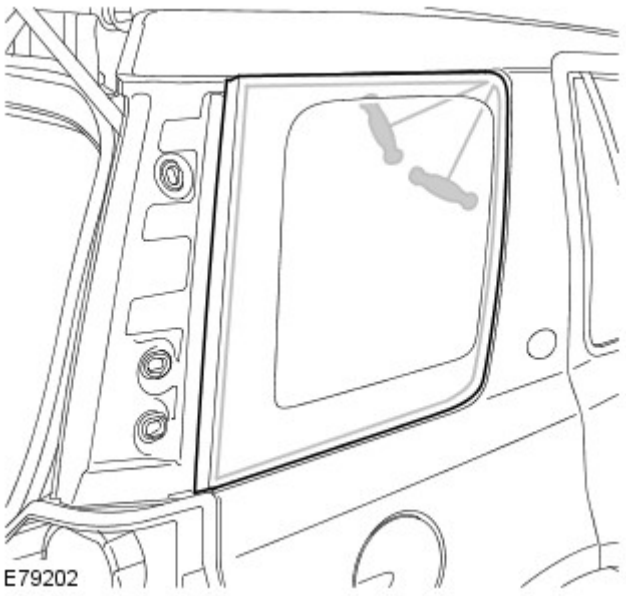
3. Remove the D-pillar trim panel.

4. Remove the rear quarter panel moulding.

   Refer to: Rear Quarter Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).



5. Cut the seal from the rear quarter glass.



6.
- Feed the glazing cutting wire around all the glass.
- Pull glazing wire through windshield sealant to the inside of the vehicle.

7. **7.** WARNING: Wear safety goggles and protective gloves.

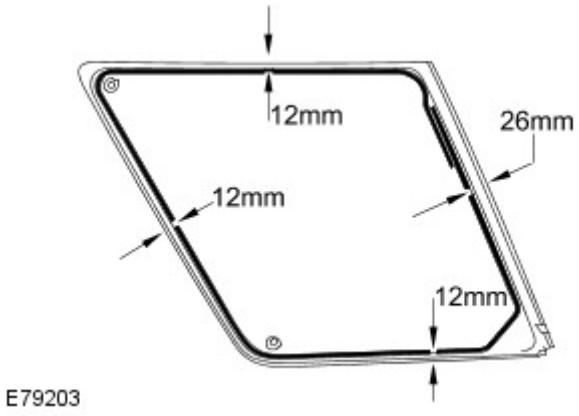
CAUTION: Protect the surrounding paintwork to avoid damage.

Use the glazing cutting wire to cut the sealant.

Installation

1. Apply etch primer to any bare metal.
2. Apply primer over the etch primer.
3. Apply glass primer to the sealant face on the rear quarter window glass and allow to cure.
4. Apply activator over the old sealant on the rear quarter window glass and allow to cure.

5.
- Fit a pre-cut nozzle to the sealer cartridge, remove the lid, shake out the crystals and fit the cartridge to the applicator gun.
- Modify the nozzle to achieve a bead section in the shape of a right angle triangle with a base of 8 mm and a vertical height of 12 mm.



6. Apply a continuous bead of sealant to the glass.

7.
- With assistance, install the window glass.
- Lightly press the window glass to seat the sealer.
- Secure the rear quarter window glass in position using tape.

8. Test the sealer for leaks, apply additional sealer if necessary. If water is used, allow sealer to dry before testing. Spray water around the glass and check for leaks. Mark any area that leaks. Dry the glass and sealer then apply additional sealer.

9. Install the rear quarter panel moulding.

   Refer to: Rear Quarter Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).

10. **10.** WARNING: Make sure that a new bolt is installed.

    Install the C-Pillar trim panel.

11. Install the D-pillar trim panel.

12. Install the rear quarter trim panel.

    Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Glass, Frames and Mechanisms - Liftgate Window Glass

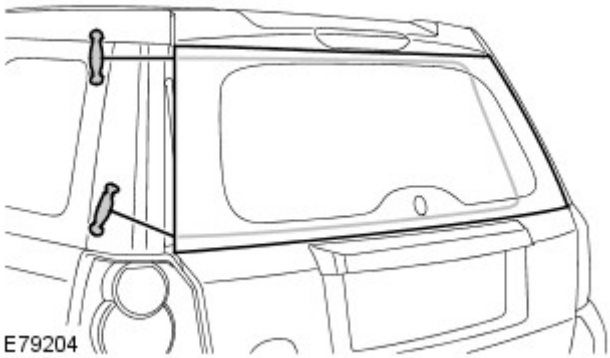
Removal and Installation

Removal

1. Remove the rear window wiper motor.

   Refer to: Rear Window Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

2. Disconnect the heated rear window electrical connectors.



3. Feed the glazing cutting wire around the glass.

4. **4.** WARNING: Wear safety goggles and protective gloves.

   CAUTION: Protect the surrounding paintwork to avoid damage.

   Use the glazing cutting wire to cut the sealant.

Installation

1. Apply etch primer to any bare metal.

2. Apply primer over the etch primer.

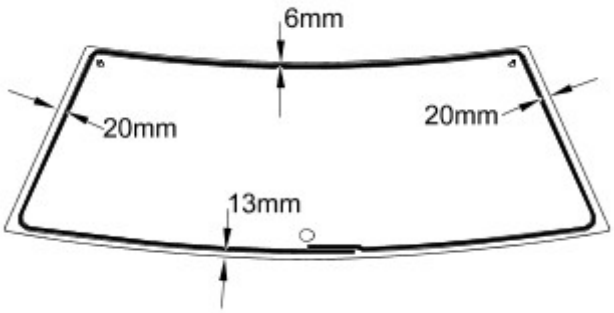
3. Apply glass primer to the sealant face on the liftgate window glass and allow to cure.

4. Apply activator over the old sealant on the liftgate window glass and allow to cure.

5.
   - Fit a pre-cut nozzle to the sealer cartridge, remove the lid,

shake out the crystals and fit the cartridge to the applicator gun.
- Modify the nozzle to achieve a bead section in the shape of a right angle triangle with a base of 8 mm and a vertical height of 12 mm.

6. Apply a continuous bead of sealant to the glass.



E79205

7.
- With assistance, install the window glass.
- Lightly press the window glass to seat the sealer.
- Secure the rear quarter window glass in position using tape.

8. Test the sealer for leaks, apply additional sealer if necessary. If water is used, allow sealer to dry before testing. Spray water around the glass and check for leaks. Mark any area that leaks. Dry the glass and sealer then apply additional sealer.

9. Connect the heated rear window electrical connectors.

10. Install the rear window wiper motor.

    Refer to: Rear Window Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

Published: 11-May-2011

Glass, Frames and Mechanisms - Windshield Glass

Removal and Installation

Removal

1. Remove the interior mirror.

   Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

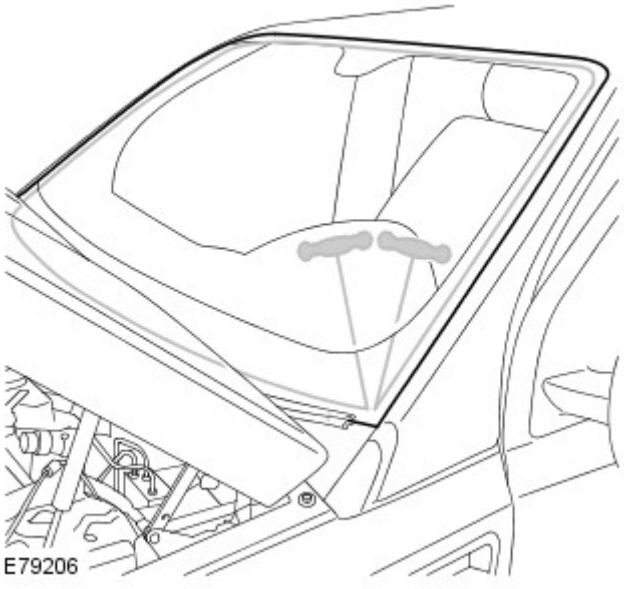
2. Remove the A-pillar trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

4. Disconnect the heated front screen electrical connectors, if installed.



5.
   - Feed the glazing cutting wire around the windshield under the waist seal.
   - Pull glazing wire through windshield sealant to the inside of the vehicle.

6. **6.** WARNING: Wear safety goggles and protective gloves.

   CAUTION: Protect the surrounding paintwork to avoid damage.

   From inside the vehicle, cut the windshield sealant using the glazing cutting wire.

Installation

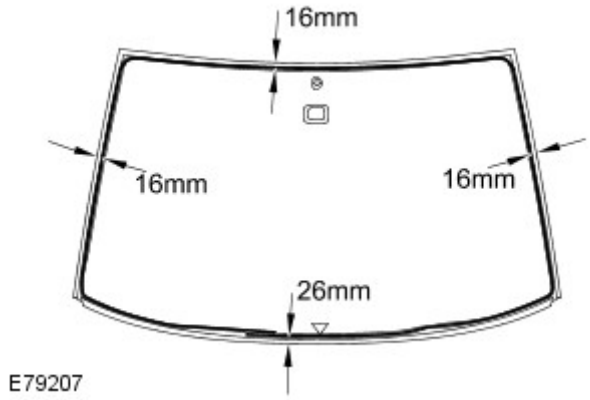
1. Apply etch primer to any bare metal.

2. Apply primer over the etch primer.

3. Apply glass primer to the sealant face on the windshield glass and allow to cure.

4. Apply activator over the old sealant on the windshield glass and allow to cure.

5.
   - Fit a pre-cut nozzle to the sealer cartridge, remove the lid, shake out the crystals and fit the cartridge to the applicator gun.
   - Modify the nozzle to achieve a bead section in the shape of a right angle triangle with a base of 8 mm and a vertical height of 12 mm.



6.
   - Apply a continuous bead of sealant to the windshield glass.

CAUTION: Make sure the heated front screen foil electrical connectors are tucked underneath the body plenum panel. This will avoid contact with the windscreen wiper arm linkage.

7.
   - With assistance, install the window glass.
   - Lightly press the window glass to seat the sealer.
   - Secure the windshield glass in position using tape.
   - Connect the heated front screen electrical connectors, if installed.

8.
   - Test the sealer for leaks, apply additional sealer if necessary. If water is used, allow sealer to dry before testing. Spray water around the glass and check for leaks. Mark any area that leaks. Dry the glass and sealer then apply additional sealer.

9. Install the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).

10. Install the A-pillar trim panels.

    Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

11. Install the interior mirror.

    Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

Published: 11-May-2011

Glass, Frames and Mechanisms - Front Door Window Regulator and Motor

Removal and Installation

Special Tool(s)

E54200	501-114 Release Lever, Door Glass

Removal

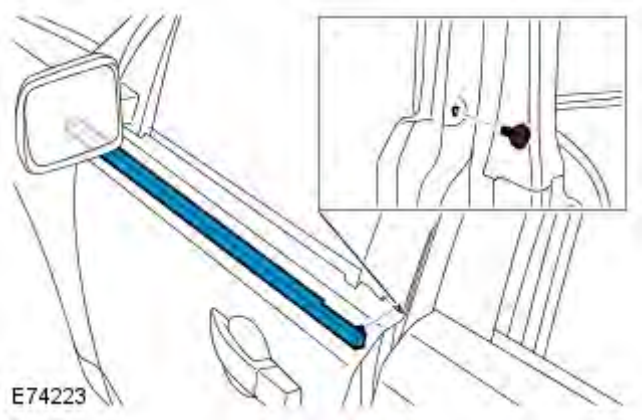
- NOTE: If possible, lower the window glass by approximately one third of its travel.

1. Disconnect the battery ground cable.

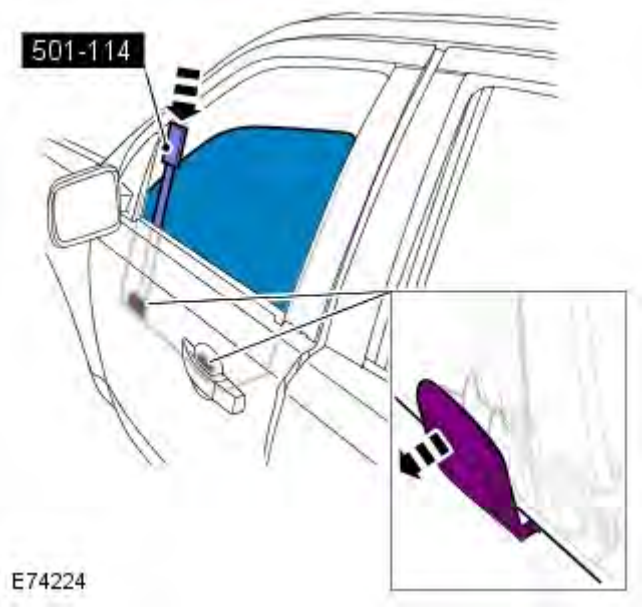
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the front door speaker.

   Refer to: Front Door Speaker (415-01 Information and Entertainment System, Removal and Installation).

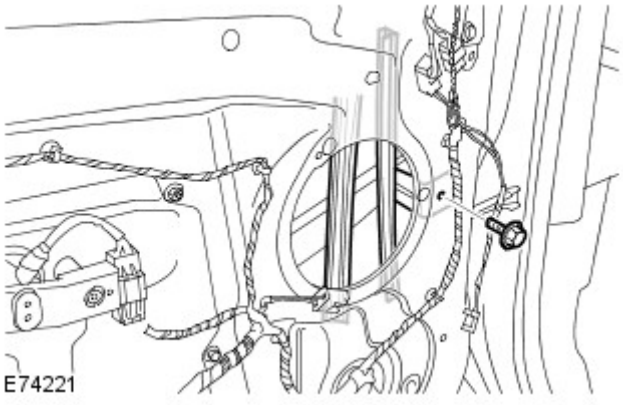


3. Carefully remove the outer waist seal.

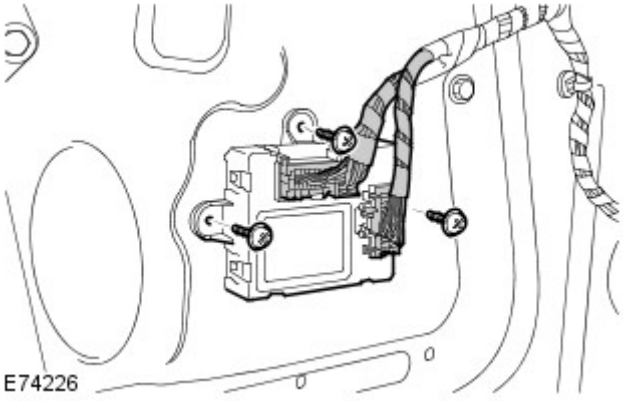


4. Release the door window glass from the window lift mechanism. Raise the glass and secure it to the top of the door frame.

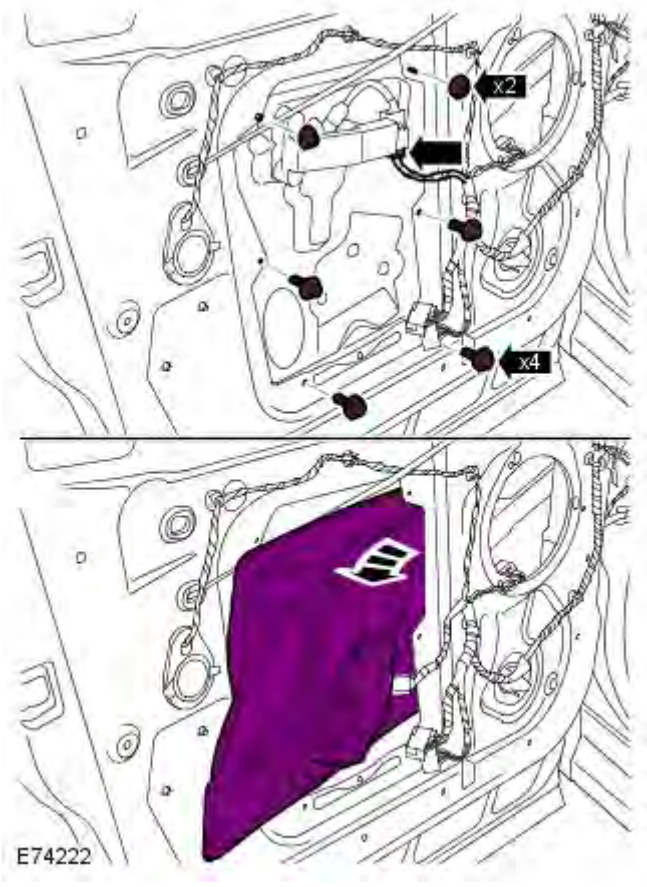
   Special Tool(s): 501-114



5. Remove the glass guide channel.



6. Remove the front door control module.



7. Remove the window motor and regulator assembly.

Installation

1. Install the window motor and regulator assembly. Tighten the nuts and the bolts.

Torque: 10 Nm

2. Install the door control module.

3. Install the glass guide channel and lining. Tighten the bolt.

   Torque: 10 Nm

4. Secure the door window glass to the window lift mechanism.

5. Install the outer waist seal and secure with the Torx screw.

6. Install the front door speaker.

   Refer to: Front Door Speaker (415-01 Information and Entertainment System, Removal and Installation).

7. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Glass, Frames and Mechanisms - Rear Door Window Regulator and Motor

Removal and Installation

Special Tool(s)

	501-114 Release Lever, Door Glass

Removal

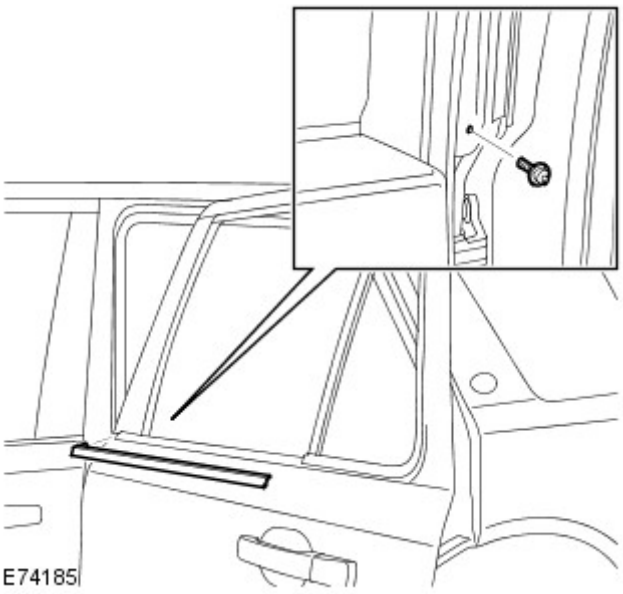
- NOTE: If possible, lower the window glass by approximately one third of its travel.

1. Disconnect the battery ground cable.

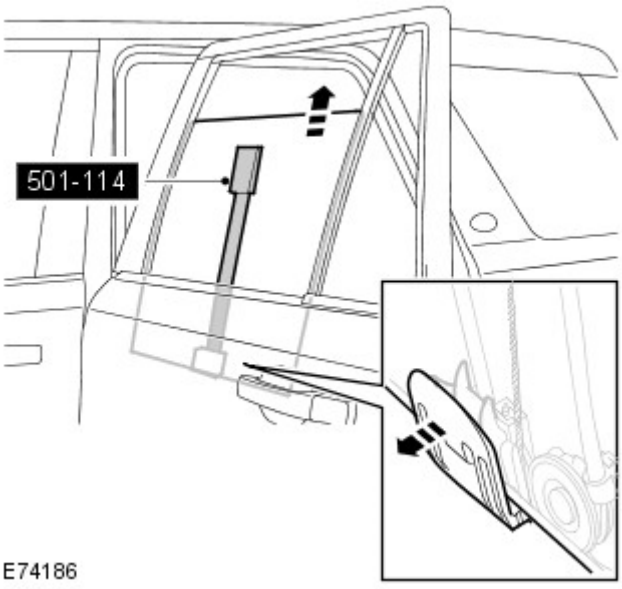
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the rear door module.

   Refer to: Rear Door Module (RDM) (419-10 Multifunction Electronic Modules, Removal and Installation).



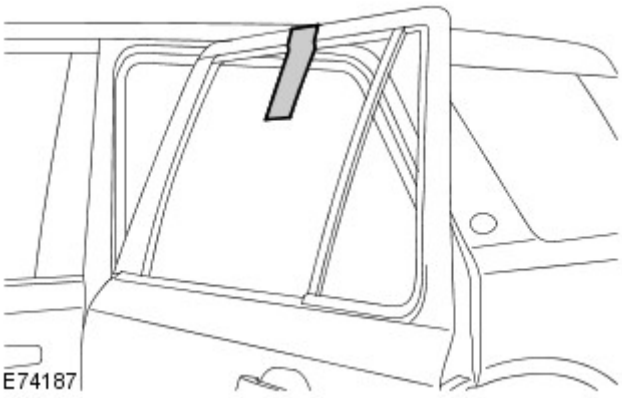
3. Carefully remove the outer waist seal.



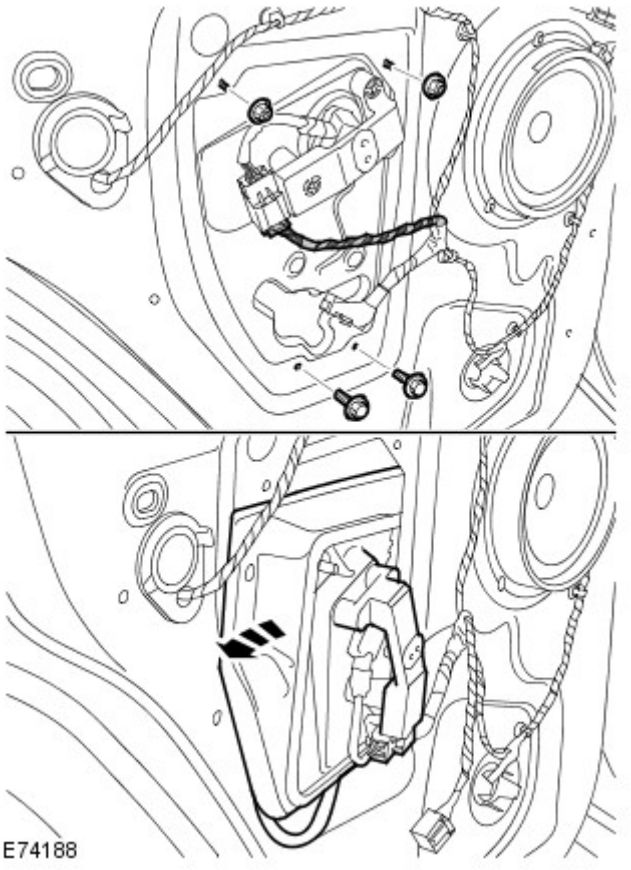
4.

- Release the door window glass from the window lift mechanism. Raise the glass and secure it to the top of the door frame.

  Special Tool(s): 501-114



5. Secure the glass to the top of the frame.



6.

- Remove the window motor and regulator assembly.
- Rotate the assembly within the door through 90 degrees and remove the upper edge from the aperture first.

Installation

1. Install the window motor and regulator assembly. Tighten the nuts and the bolts.

   Torque: 10 Nm

2. Secure the door window glass to the window lift mechanism.

3. Install the outer waist seal and secure with the Torx screw.

4. Install the rear door module.

   Refer to: Rear Door Module (RDM) (419-10 Multifunction Electronic Modules, Removal and Installation).

5. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Glass, Frames and Mechanisms - Driver Door Window Control Switch

Removal and Installation

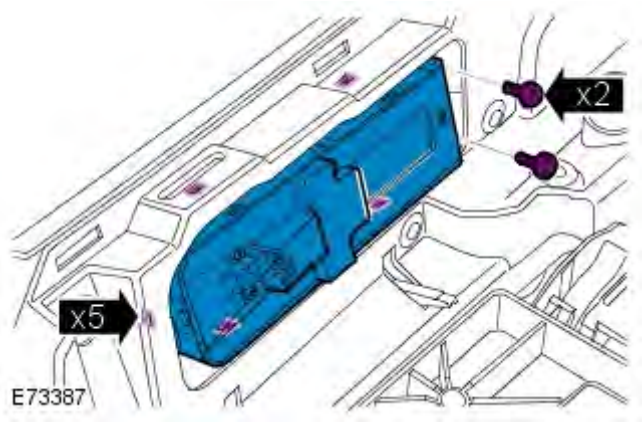
Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the front door trim panel.

   Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3.
   - Remove the 2 screws.
   - Release the 5 clips.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Glass, Frames and Mechanisms - Passenger Door Window Control Switch

Removal and Installation

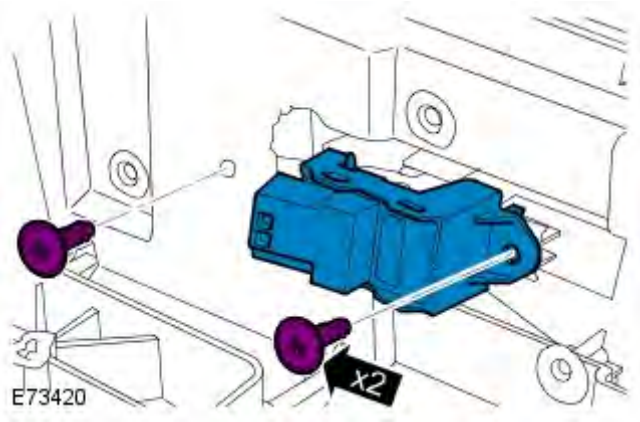
Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the rear door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Glass, Frames and Mechanisms - Rear Door Fixed Window Glass

Removal and Installation

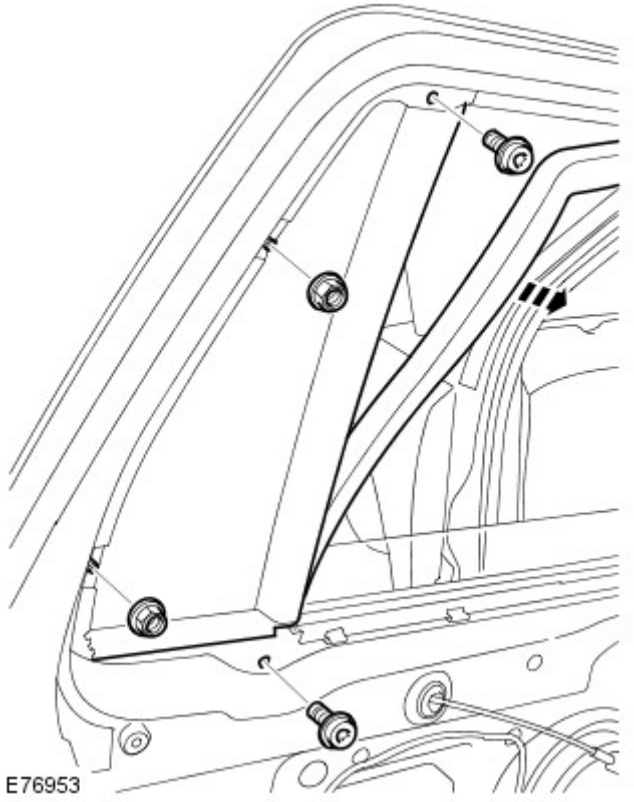
Removal

1. Lower the door glass to the bottom of the door.
2. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
3. Remove the rear door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Remove the rear door frame trim.



5.
   - Remove the 2 nuts.
   - Remove the 2 Torx screws.
   - Release the glass channel lining.

Installation

1. Install the rear door window fixed glass and tighten the nuts and Torx screws evenly.

   Torque: 5 Nm

2. Install the door frame trim.

3. Install the rear door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Instrument Panel and Console -

Torque Specifications

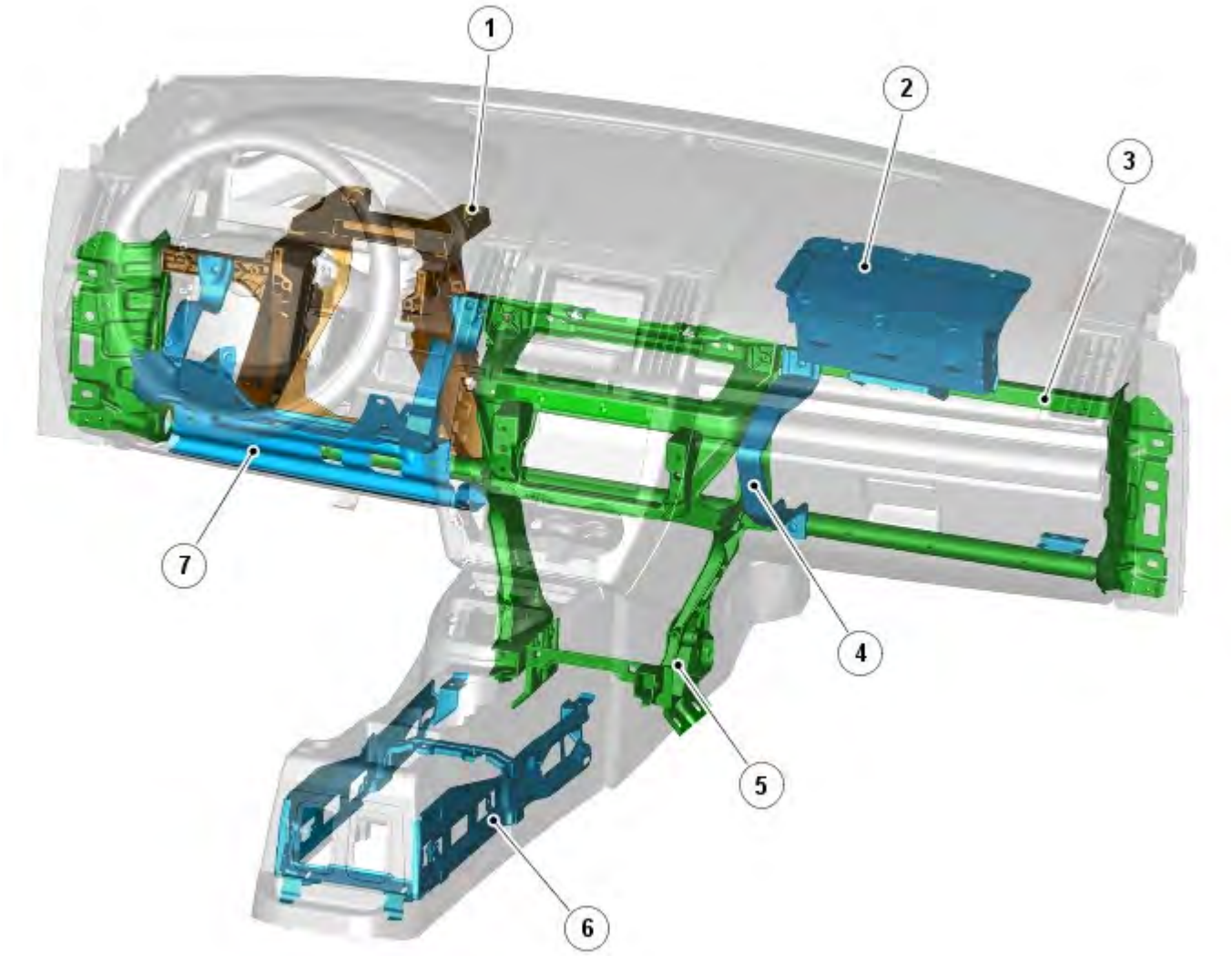
Description	Nm	lb-ft
Instrument panel:		
M8 Bolts	24	18
M12 Bolts	40	30
Instrument panel console switch	3	2
Instrument panel Torx bolts	3	2
ECM Bracket	10	7

Published: 11-May-2011

Instrument Panel and Console - Instrument Panel

Description and Operation

COMPONENT LOCATION



E76414

Item	Part Number	Description
1	-	Steering column mounting
2	-	Passenger air bag
3	-	Cross car beam
4	-	Passenger side energy absorbing bracket - North American Specification (NAS) vehicles only
5	-	Center console mounting
6	-	Floor console support
7	-	Driver side energy absorbing assembly

OVERVIEW

The instrument panel incorporates a tubular steel cross car beam. An energy absorbing assembly is bolted to the drivers side of the cross car beam. The energy absorbing assembly comprises 2 deformable brackets welded to a cross brace. NAS vehicles also feature a single energy absorbing bracket bolted to the passenger side of the cross car beam.

Secured to the center of the cross car beam is a cast magnesium structure which provides support and mounting points for the center console. Mounted on the driver side of the cross car beam is the steering column support, which is also manufactured from magnesium. The cross car beam also provides a mounting point for the dual stage passenger air bag. For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B

Supplemental Restraint System, Description and Operation).

The instrument panel consists of 2 plastic moldings (upper and lower) which are welded together to provide a single assembly. The instrument panel provides mounting points for various driver and passenger interfaces. Also contained within the instrument panel are the air distribution ducts, vents and registers.
For additional information, refer to: Air Distribution and Filtering (412-01 Climate Control, Description and Operation).

Published: 11-May-2011

Instrument Panel and Console - Instrument PanelTD4 2.2L Diesel

Removal and Installation

Removal

1. Make the SRS system safe.

   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20, General Procedures).

2. Remove the windshield wiper motor.

   Refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

3. Evacuate the A/C system.

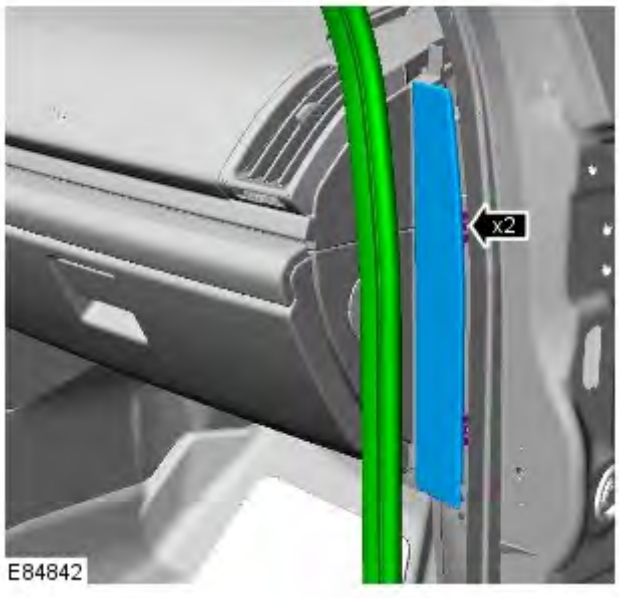
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

4. Remove both front door assemblies.

   Refer to: Front Door (501-03 Body Closures, Removal and Installation).

5. Remove both A-pillar upper trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



6. Remove the A-pillar center trim panels.

7. Release the forward edge of both scuff plate trim panels.

8. Remove both cowl side trim panels.

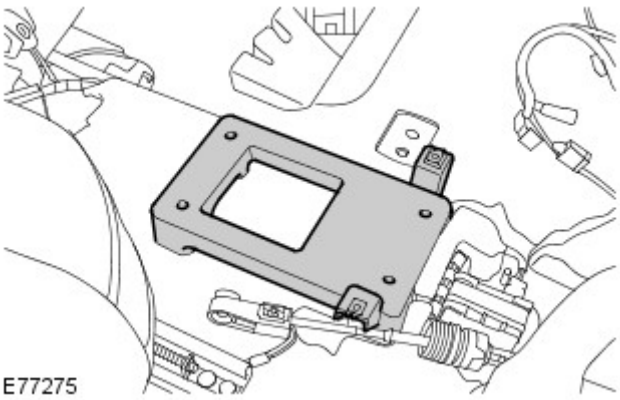
   Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

9. Remove the LH front seat.

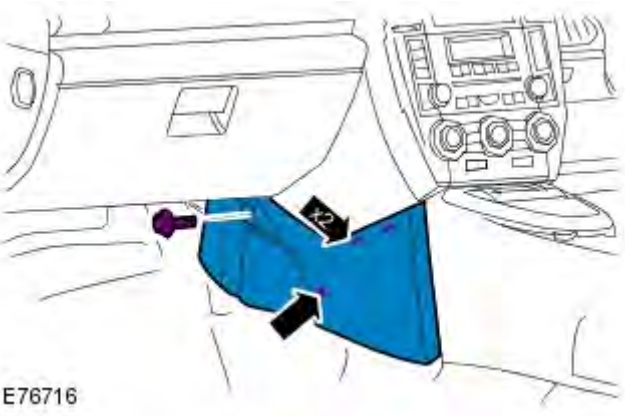
   Refer to: Front Seat (501-10 Seating, Removal and Installation).

10. Remove the transmission selector lever.

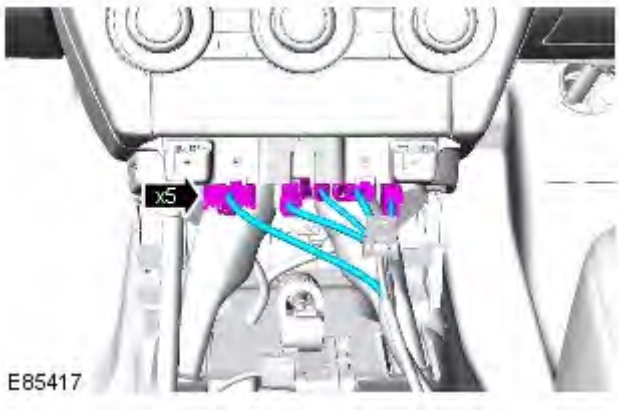
    Refer to: Selector Lever Assembly (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).



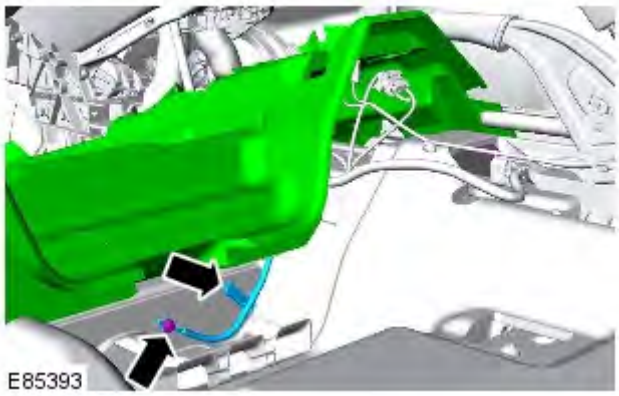
11.



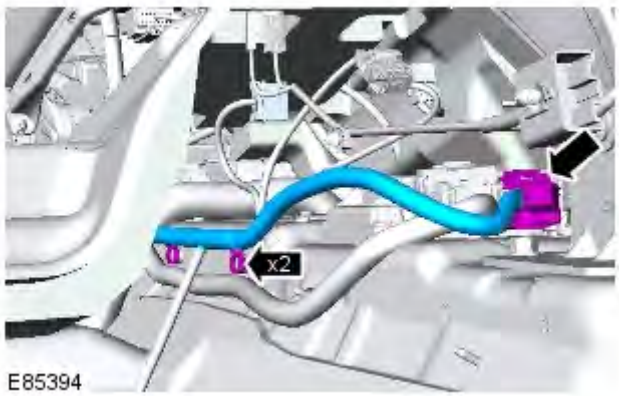
12. Remove both floor console extensions.



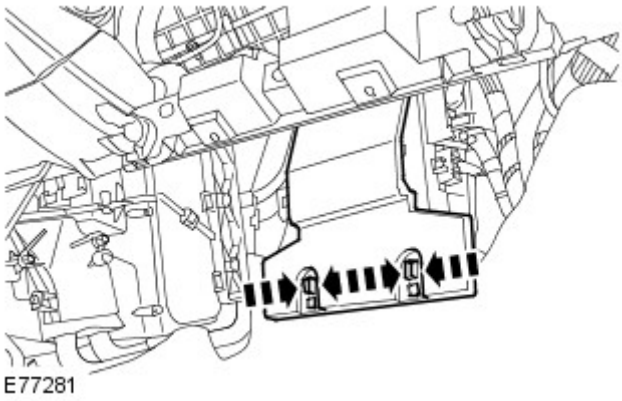
13. **13.** CAUTION: Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of more than 30 mm.



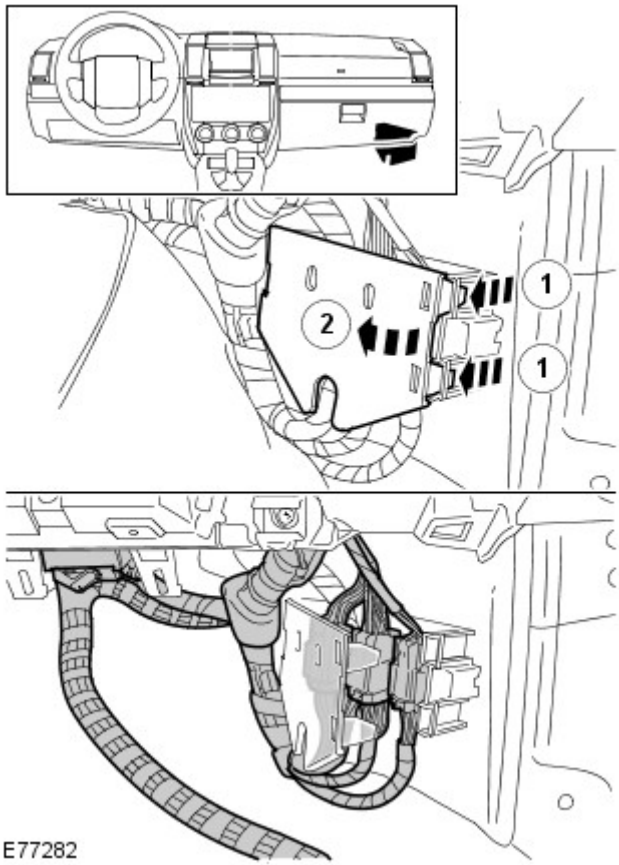
14. Release the earth lead.



15. Release the instrument panel harness from the transmission tunnel.

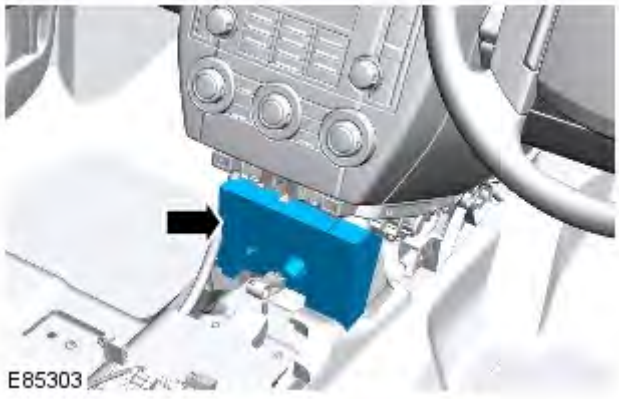


16. Remove the auxiliary junction box access cover.

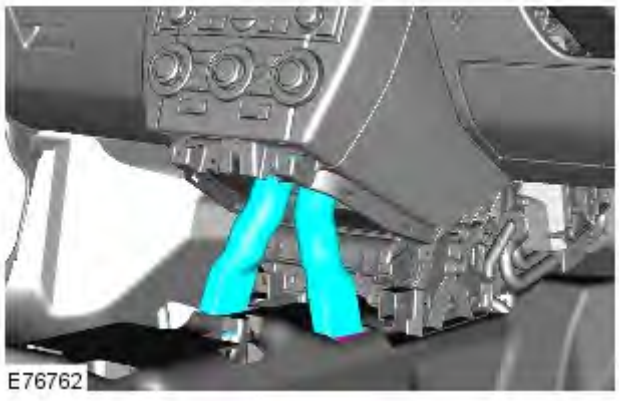


17. **17.** NOTE: LHD illustration shown, RHD is similar.

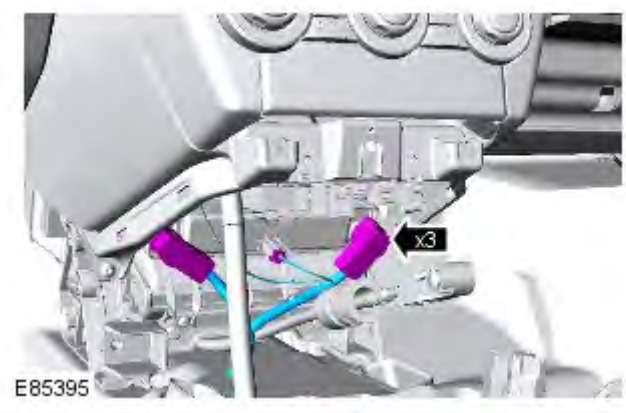
    Release the instrument panel wiring harness.



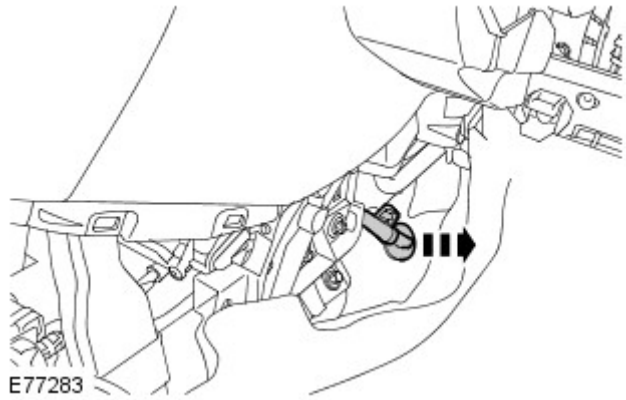
18.



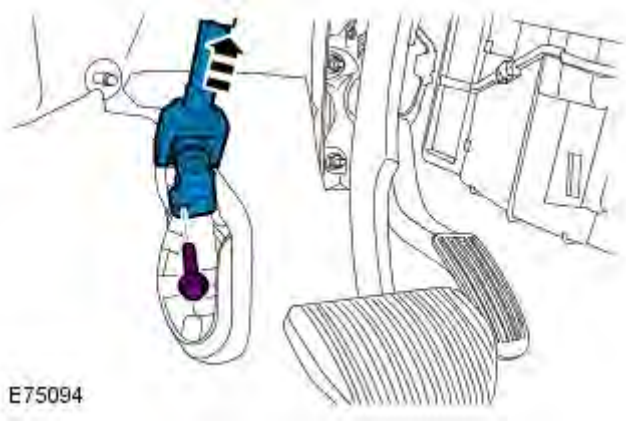
19. Remove both of the center, lower ducts from the heater housing.



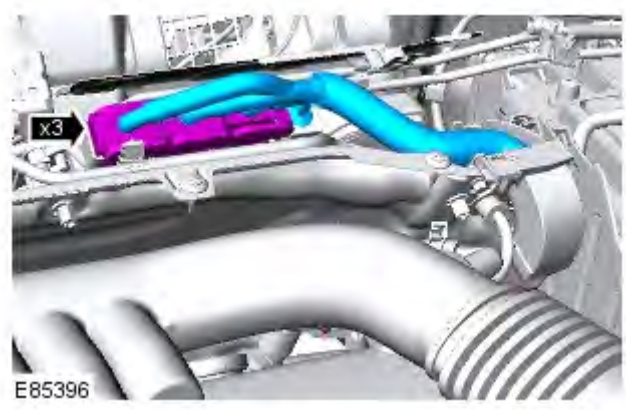
20. Disconnect the electric booster heater core.



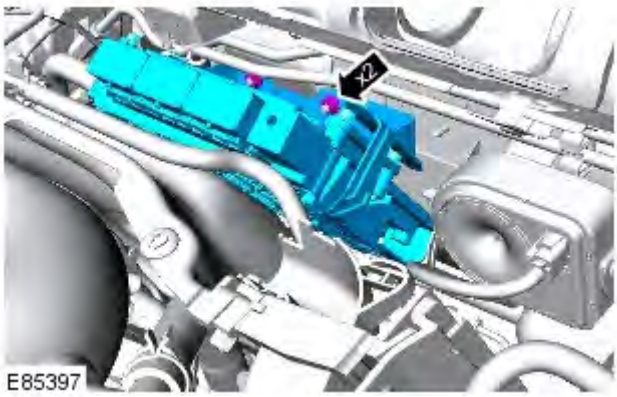
21. Disconnect the drain tube from the heater housing.



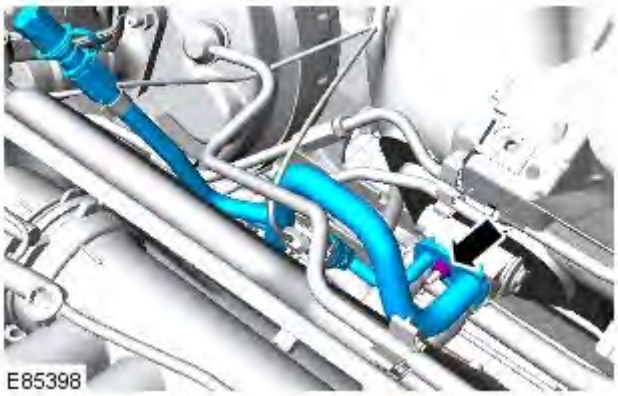
22. Disconnect the steering column lower shaft from the steering column.



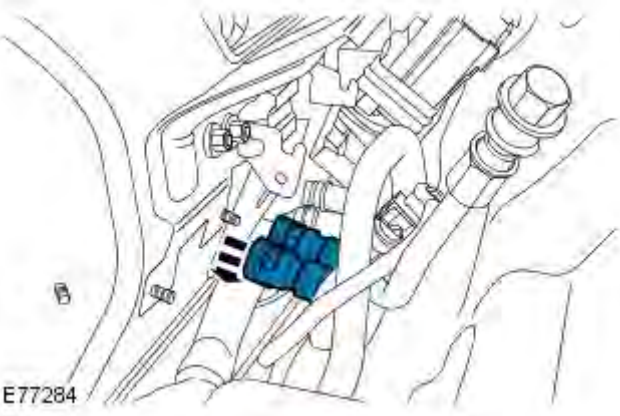
23. Disconnect the ECM electrical connectors.



24. Remove the ECM bracket assembly.



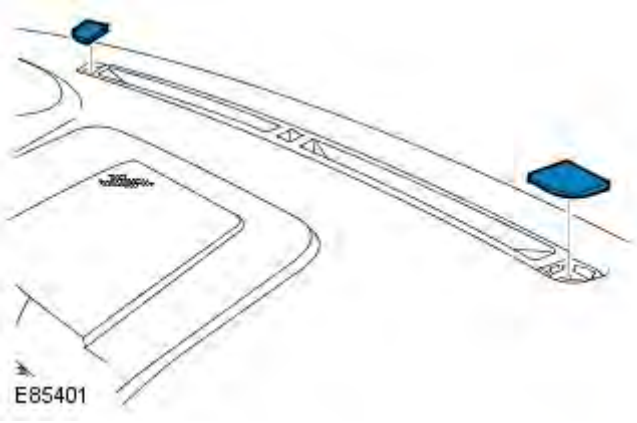
25. Disconnect the A/C pipes from the TXV.



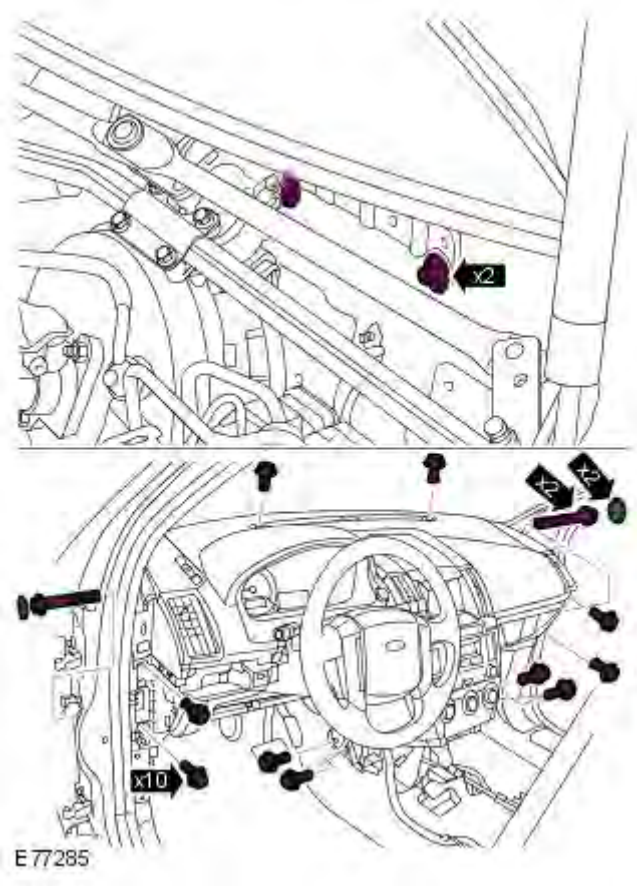
26.

- Clamp the hoses to minimize coolant loss.
- Rotate the outer ring counter-clockwise and disconnect the hose.

27.



28. Remove the windshield defroster outer finishers.



29.
- Remove the A-pillar bolt covers.
- Protect the surrounding bodywork and remove the 2 side fixing bolts.
- Remove the 10 bolts.
- Remove the 2 screws.
- Install protective covers to interior trim.
- With assistance, remove the instrument panel.

Installation

1.
- Install and tighten the M8 bolts.

  Torque: 24 Nm
- Install and tighten the M12 bolts.

  Torque: 40 Nm
- Install the 2 screws.
- Remove protective tape and covers.
- Install the bolt covers.

2. Install the windshield defroster outer finishers.

3. Install the heater housing bolt.

4. Install the heater core inlet and outlet hoses.

5. Remove the coolant hose clamps.

6. Connect the A/C pipes to the TXV and tighten the M6 nut.

   Torque: 10 Nm

7. Install the ECM bracket assembly and tighten the nuts.

   Torque: 10 Nm

8. Connect the ECM electrical connectors.

9. **9.** WARNING: Make sure that a new bolt is installed.

   Connect the steering column lower shaft and tighten the bolt.

   Torque: 25 Nm

10. Connect the drain tube to the heater housing.

11. Connect the electric booster heater core.

12. Install the center, lower ducts to the heater housing.

13. Install the NVH pad.

14. Install the instrument panel wiring harness.

15. Install the auxiliary junction box access cover.

16. Secure the instrument panel harness to the transmission tunnel.

17. Secure and tighten the earth lead.

    Torque: 10 Nm

18. Connect the body harness to the instrument panel.

19. Install the floor console extensions.

20. Install the selector lever mounting bracket.

21. Install the transmission selector lever.

    Refer to: Selector Lever Assembly (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).

22. Install the LH front seat.

    Refer to: Front Seat (501-10 Seating, Removal and Installation).

23. Install both cowl side trim panels.
24. Secure both scuff plate trim panels.

    Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

25. Install the engine cover.

26. Install both A-pillar upper trim panels.

    Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

27. Install both front door assemblies.

    Refer to: Front Door (501-03 Body Closures, Removal and Installation).

28. Recharge the A/C system.

    Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

29. Install the windshield wiper motor.

    Refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

30. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

31. Check and top-up the coolant.

Published: 11-May-2011

Instrument Panel and Console - Instrument PanelI6 3.2L Petrol

Removal and Installation

Removal

1. Make the SRS system safe.

   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20, General Procedures).

2. Remove the windshield wiper motor.

   Refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

3. Evacuate the A/C system.

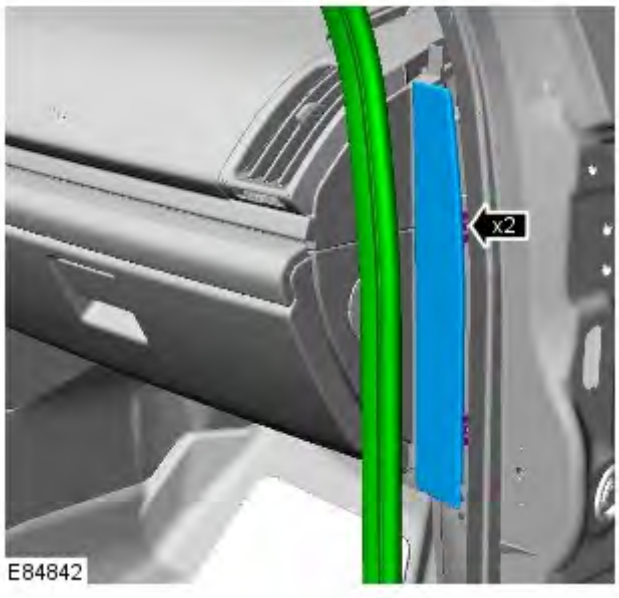
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

4. Remove both front door assemblies.

   Refer to: Front Door (501-03 Body Closures, Removal and Installation).

5. Remove both A-pillar upper trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



6. Remove the A-pillar center trim panels.

7. Release the forward edge of both scuff plate trim panels.

8. Remove both cowl side trim panels.

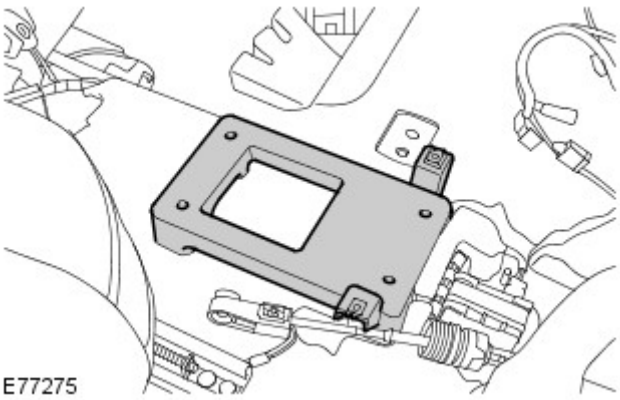
   Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

9. Remove the LH front seat.

   Refer to: Front Seat (501-10 Seating, Removal and Installation).

10. Remove the transmission selector lever.

    Refer to: Selector Lever Assembly (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).



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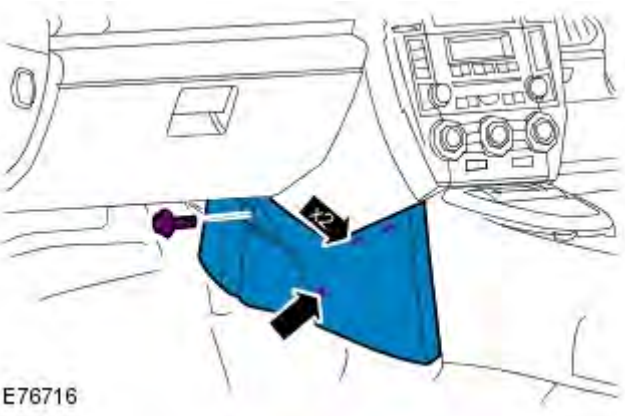
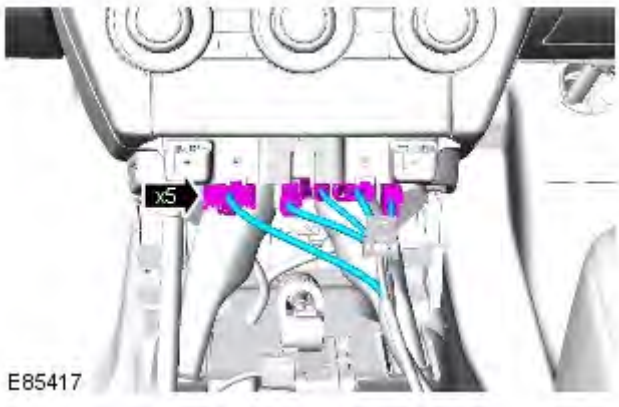
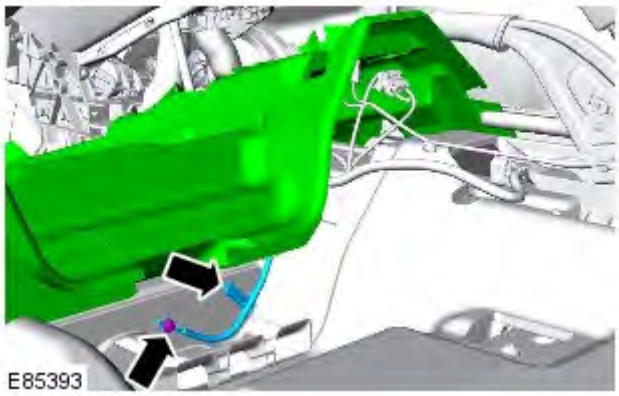


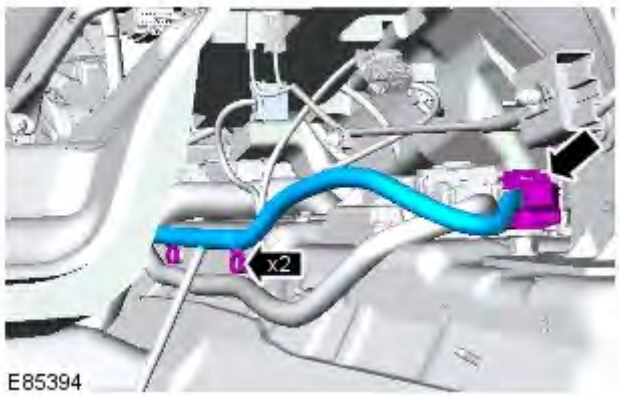
12. Remove both floor console extensions.



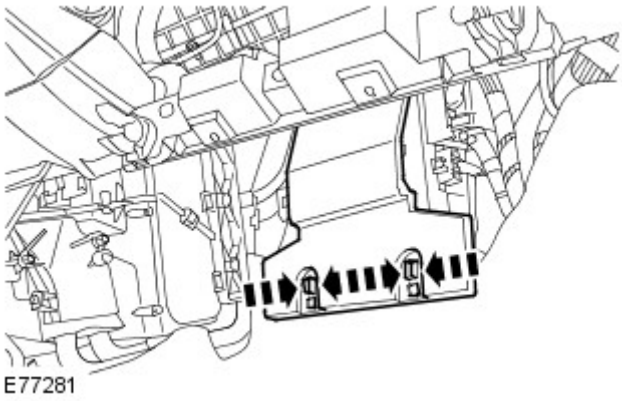
13. **13.** CAUTION: Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of more than 30 mm.



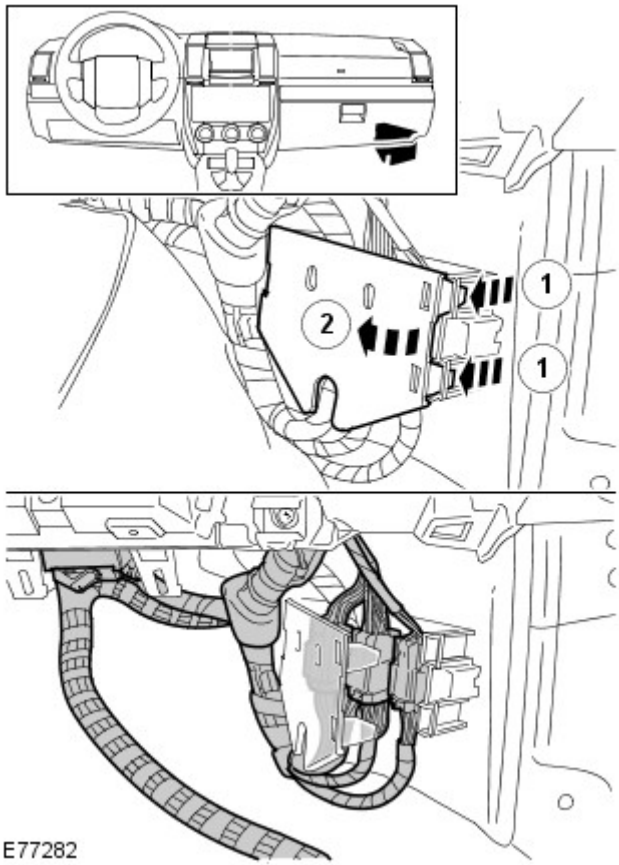
14. Release the earth lead.



15. Release the instrument panel harness from the transmission tunnel.

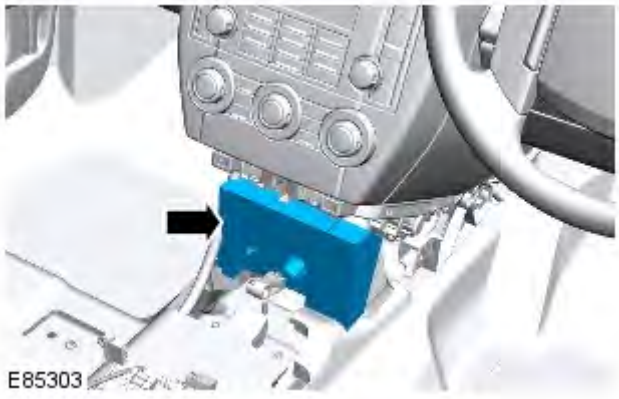


16. Remove the auxiliary junction box access cover.



17. **17.** NOTE: LHD illustration shown, RHD is similar.

    Release the instrument panel wiring harness.



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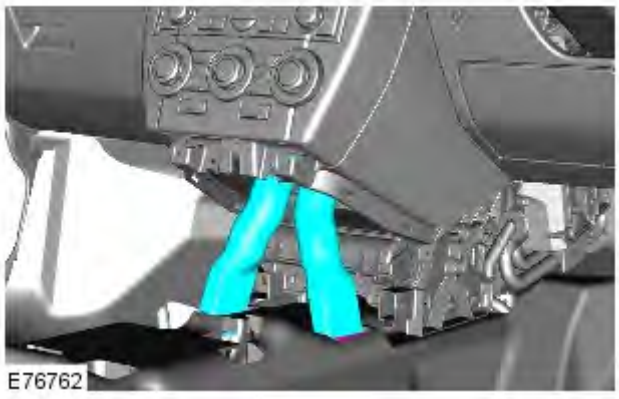
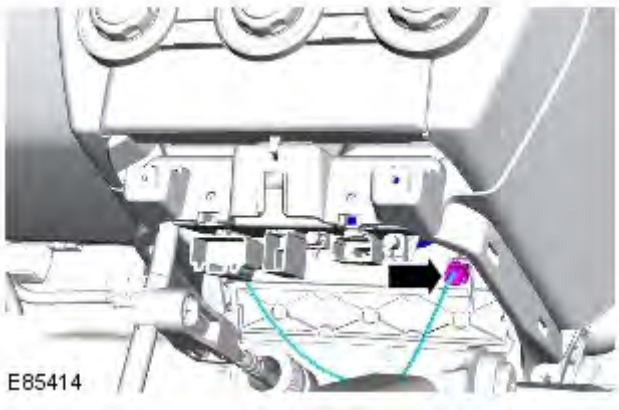


19. Remove both of the center, lower ducts from the heater housing.



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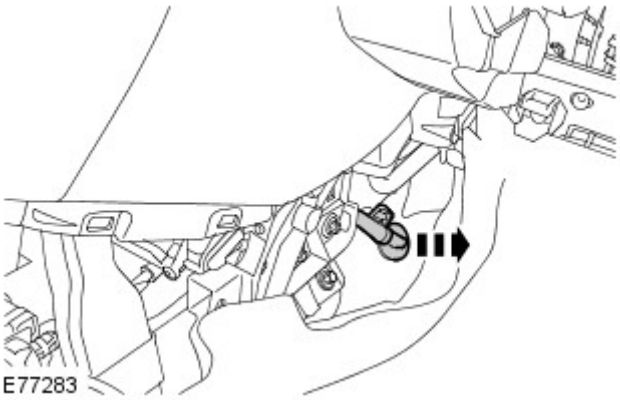
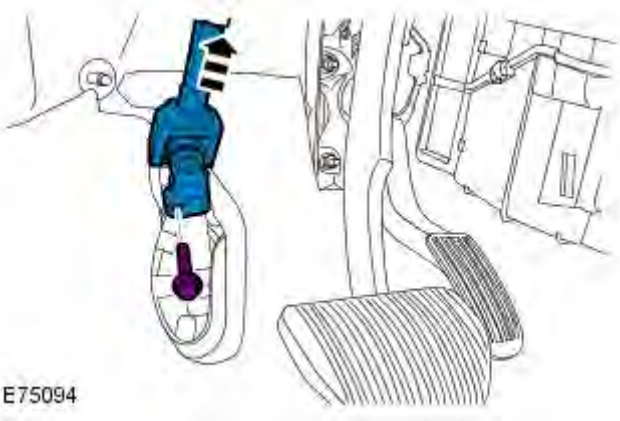
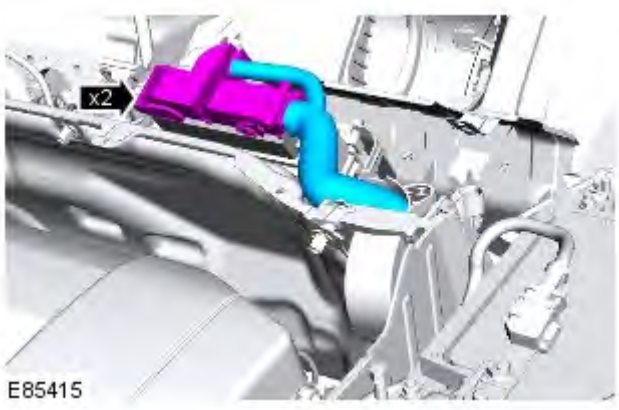


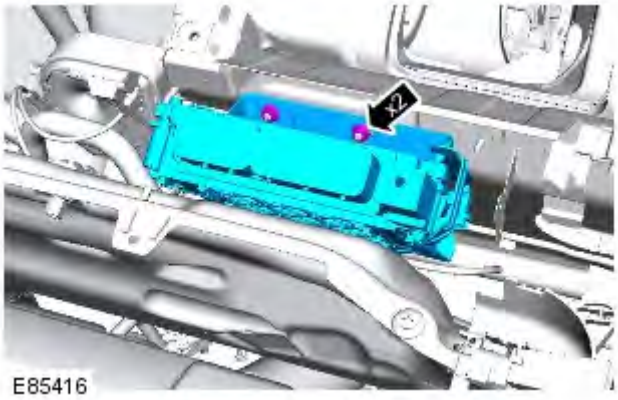
21. Disconnect the drain tube from the heater housing.



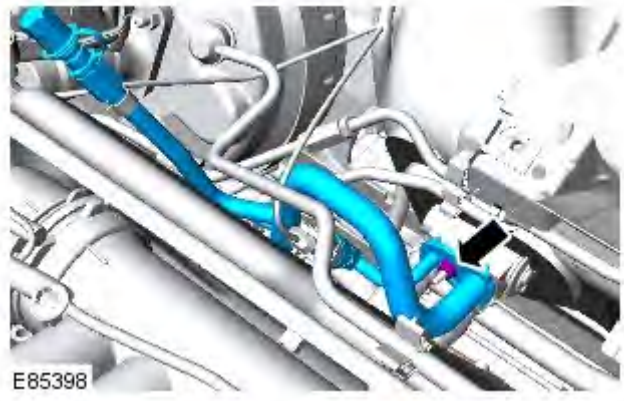
22. Disconnect the steering column lower shaft from the steering column.



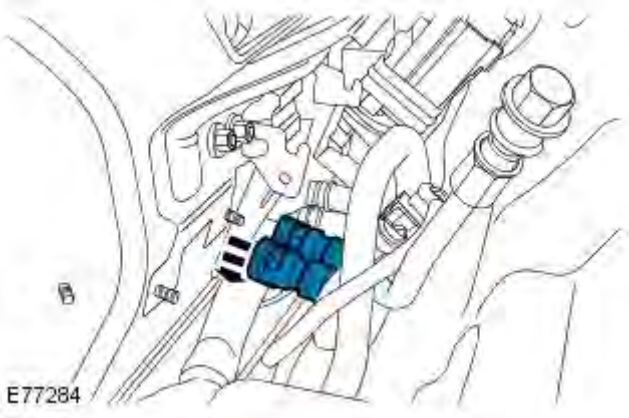
23. Disconnect the ECM electrical connectors.



24. Remove the ECM bracket assembly.



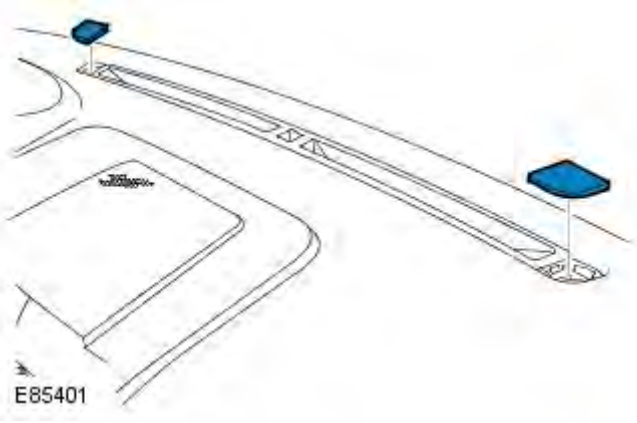
25. Disconnect the A/C pipes from the TXV.



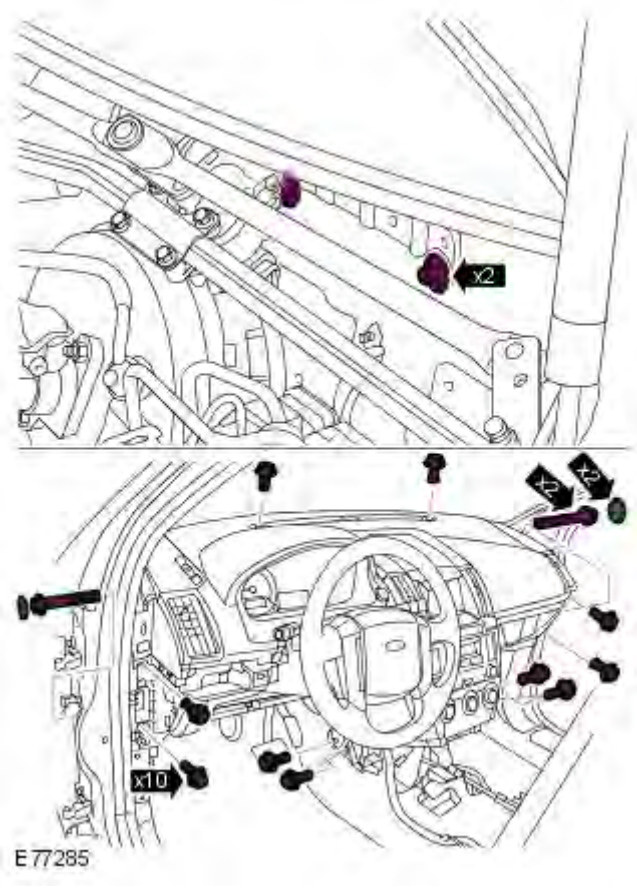
26.

- Clamp the hoses to minimize coolant loss.
- Rotate the outer ring counter-clockwise and disconnect the hose.

27.



28. Remove the windshield defroster outer finishers.



29.
- Remove the A-pillar bolt covers.
- Protect the surrounding bodywork and remove the 2 side fixing bolts.
- Remove the 10 bolts.
- Remove the 2 screws.
- Install protective covers to interior trim.
- With assistance, remove the instrument panel.

Installation

1.
- Install and tighten the M8 bolts.

Torque: 24 Nm
- Install and tighten the M12 bolts.

Torque: 40 Nm
- Install the 2 screws.
- Remove protective tape and covers.
- Install the bolt covers.

2. Install the windshield defroster outer finishers.

3. Install the heater housing bolt.

4. Install the heater core inlet and outlet hoses.

5. Remove the coolant hose clamps.

6. Connect the A/C pipes to the TXV and tighten the M6 nut.

   Torque: 10 Nm

7. Install the ECM bracket assembly and tighten the nuts.

   Torque: 10 Nm

8. Connect the ECM electrical connectors.

9. **9.** WARNING: Make sure that a new bolt is installed.

   Connect the steering column lower shaft and tighten the bolt.

   Torque: 25 Nm

10. Connect the drain tube to the heater housing.

11. Secure the redundant electric booster heater electrical connector.

12. Install the center, lower ducts to the heater housing.

13. Install the NVH pad.

14. Install the instrument panel wiring harness.

15. Install the auxiliary junction box access cover.

16. Secure the instrument panel harness to the transmission tunnel.

17. Secure and tighten the earth lead.

    Torque: 10 Nm

18. Connect the body harness to the instrument panel.

19. Install the floor console extensions.

20. Install the selector lever mounting bracket.

21. Install the transmission selector lever.

    Refer to: Selector Lever Assembly (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).

22. Install the LH front seat.

    Refer to: Front Seat (501-10 Seating, Removal and Installation).

23. Install both cowl side trim panels.
24. Secure both scuff plate trim panels.

    Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

25. Install the A-pillar lower trim panels.

26. Install both A-pillar upper trim panels.

    Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

27. Install both front door assemblies.

    Refer to: Front Door (501-03 Body Closures, Removal and Installation).

28. Recharge the A/C system.

    Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

29. Install the windshield wiper motor.

    Refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

30. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

31. Check and top-up the coolant.

Published: 11-May-2011

Instrument Panel and Console - Instrument Panel Upper Section

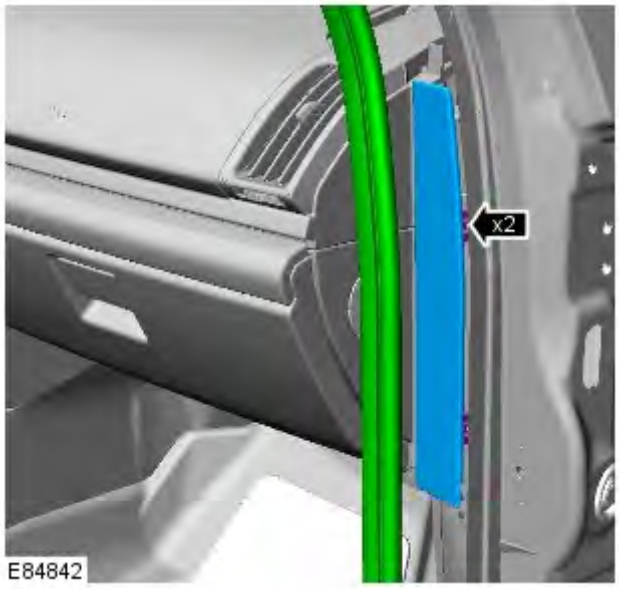
Removal and Installation

Removal

1. Make the SRS system safe.

2. Remove both A-pillar upper trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. Remove the A-pillar center trim panels.

4. Release the forward edge of both scuff plate trim panels.

5. Remove both cowl side trim panels.

   Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

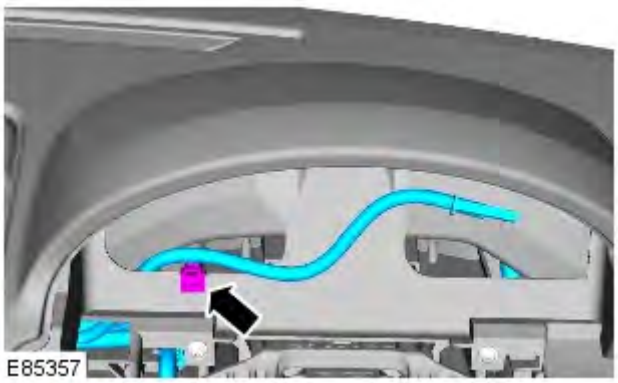
6. Remove the clockspring.

   Refer to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

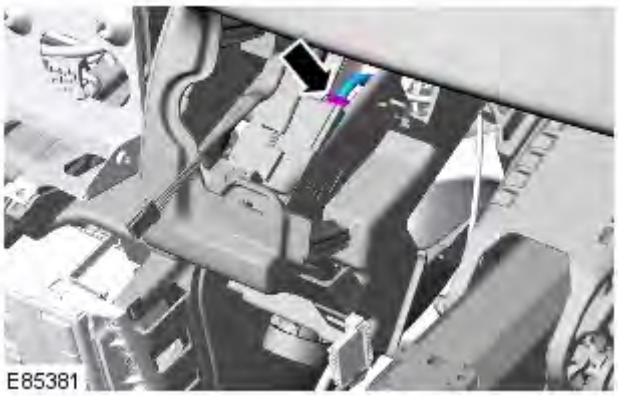
7. Remove the instrument cluster.

   Refer to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation).

8.

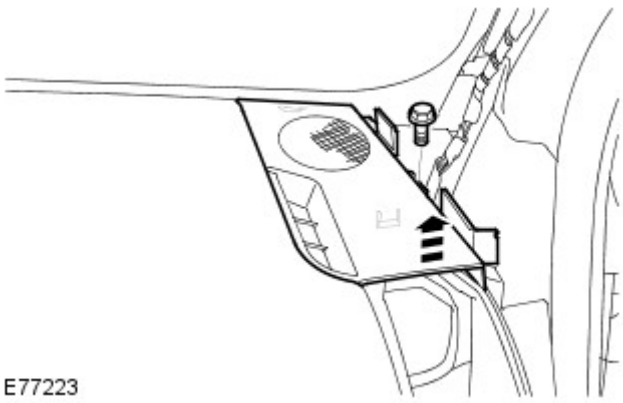


9. Disconnect the keyless start module electrical connector.

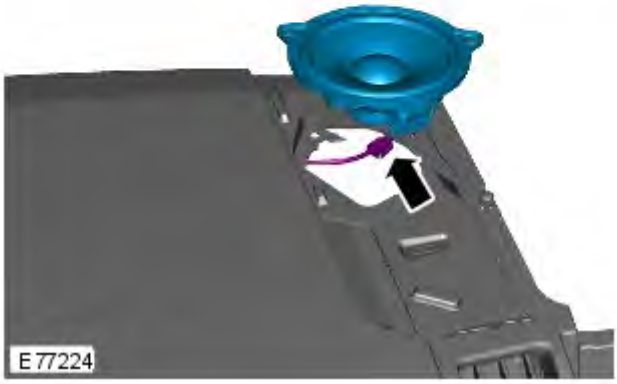


10. Disconnect the in-vehicle temperature sensor.

11. Remove both upper trim panels.



12. Remove both instrument panel speakers.



13. Remove both floor console extensions.

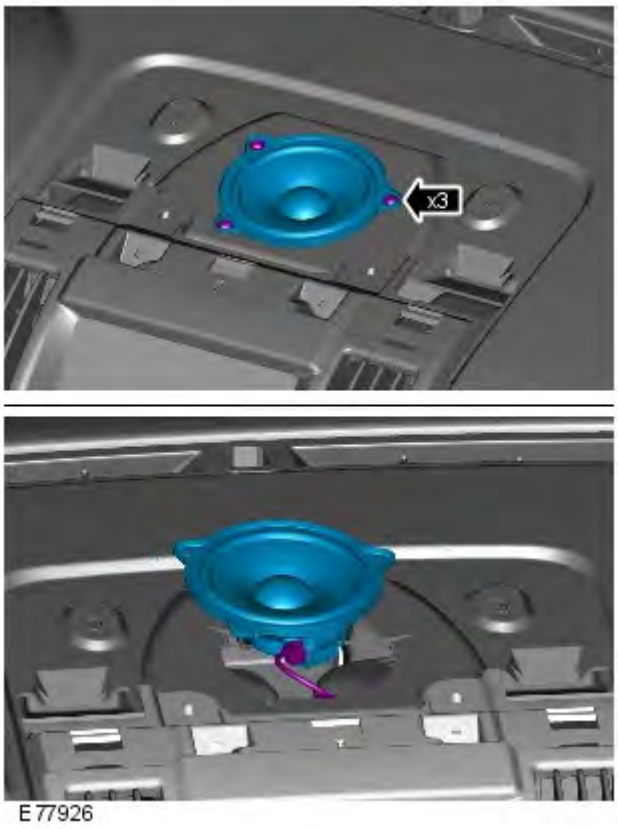
14. Remove the floor console.

    Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

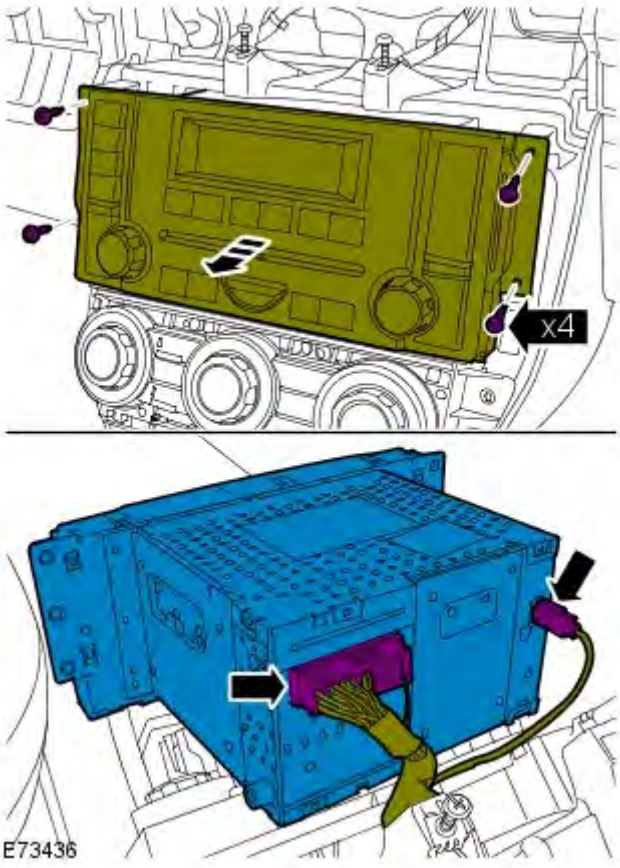
15. Remove the video display.

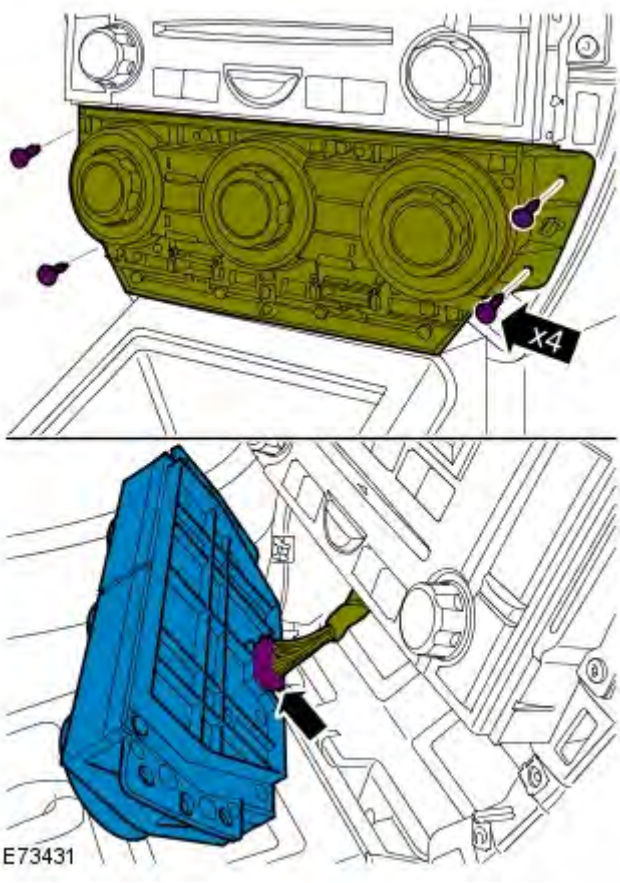
    Refer to: Video Display (415-01 Information and Entertainment System, Removal and Installation).

16. Remove the center speaker.

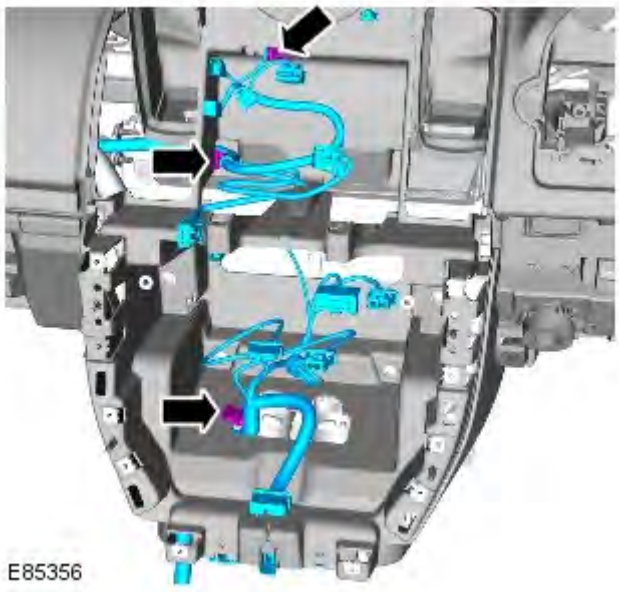


17. Remove the audio unit.



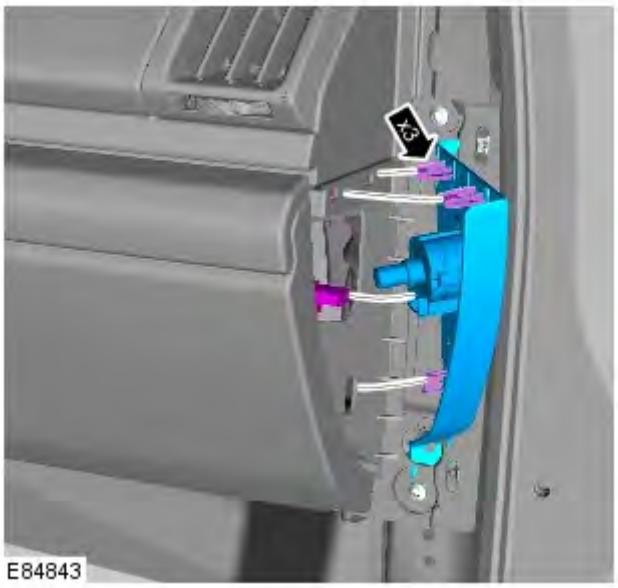


18. Remove the climate control assembly.



19.

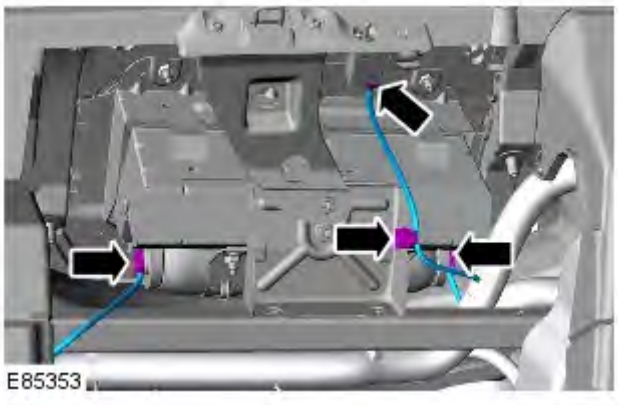
20.



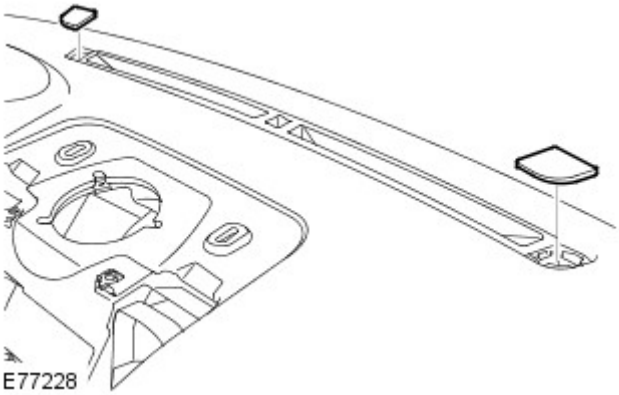
21. Remove the passenger side instrument panel end trim panel.

22. Remove the glove compartment.

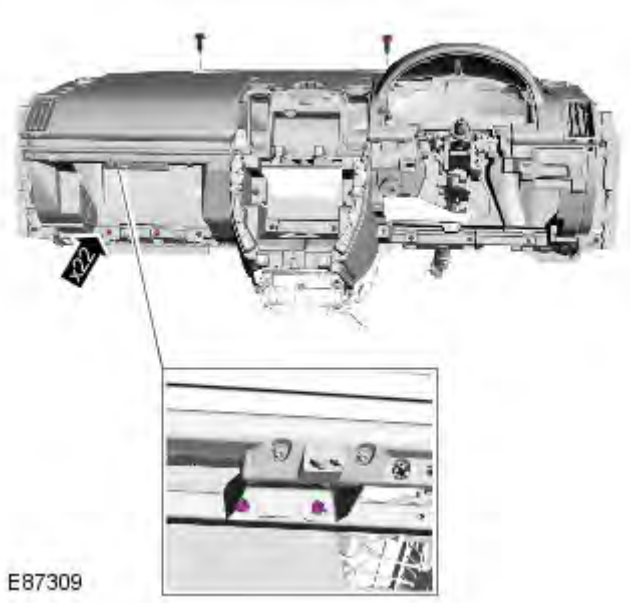
    Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).



23.

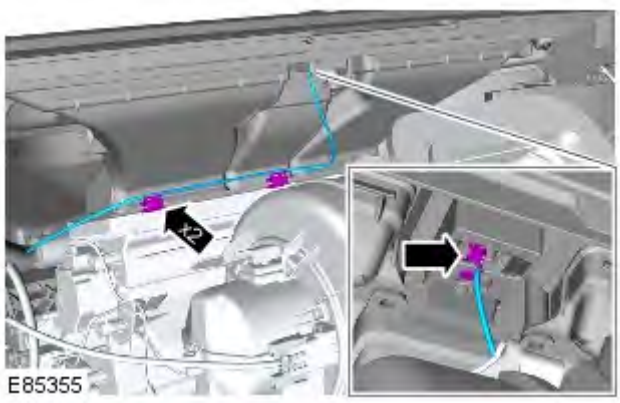


24. Remove the windshield defroster outer finishers.



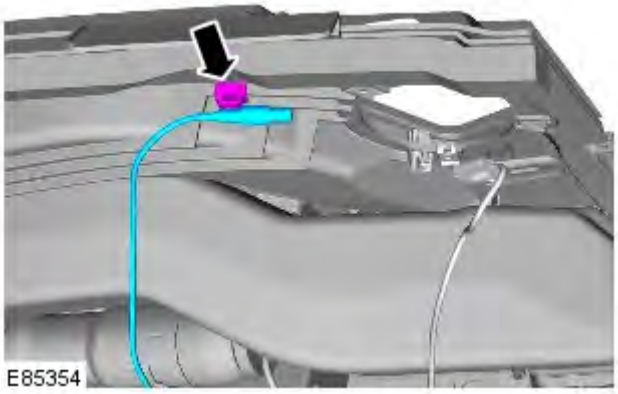
25. **25.** CAUTION: Protect the surrounding trim to avoid damage.

    With assistance, carefully release the instrument panel upper section.



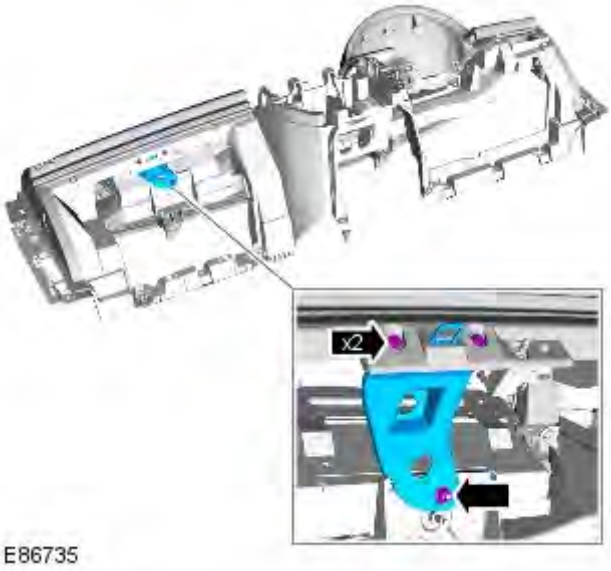
26.

27.



28. With assistance, remove the instrument panel upper section.

29. **29.** NOTE: Do not disassemble further if the component is removed for access only.



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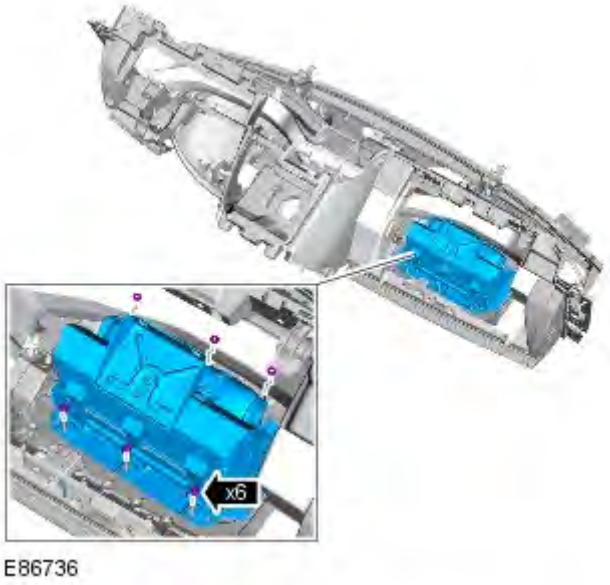
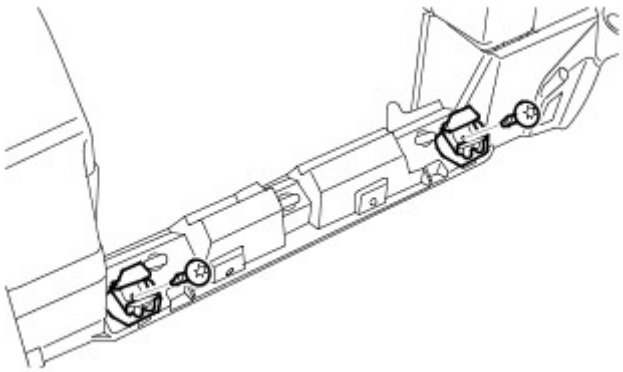


31.

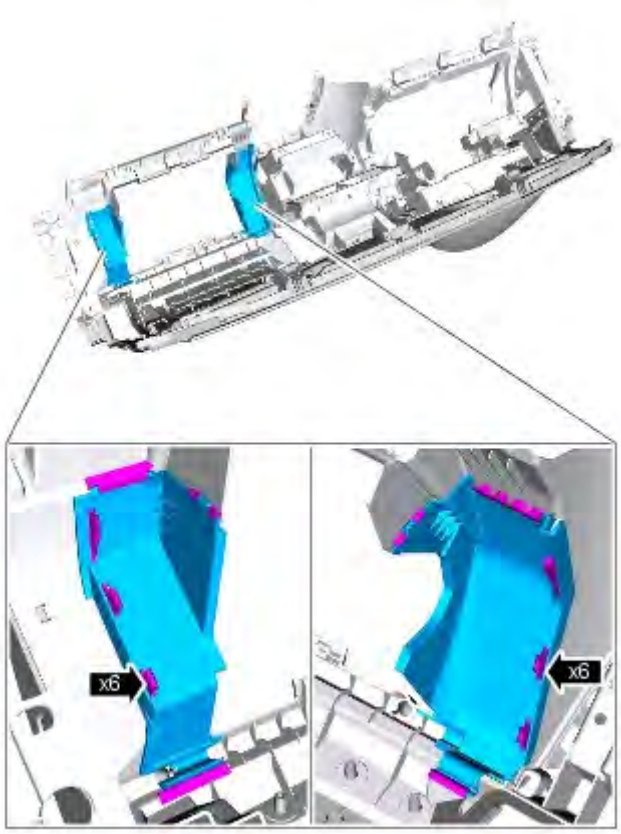
E86737



E77237

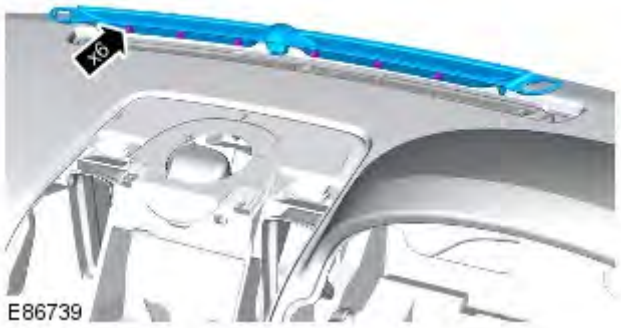
32. Remove the glove compartment lid hinges.

33. Remove the glove compartment support panels.



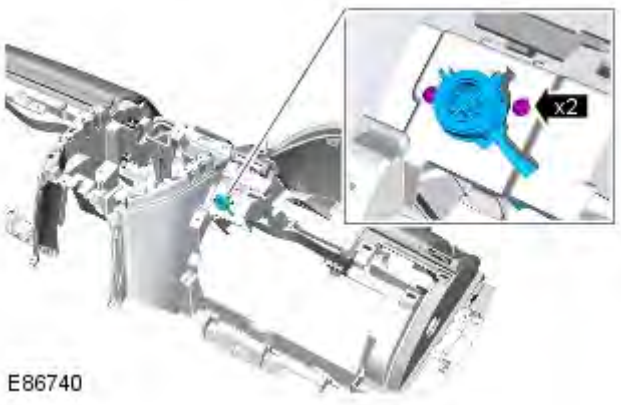
E86738

34. Remove the windshield defroster trim panel.

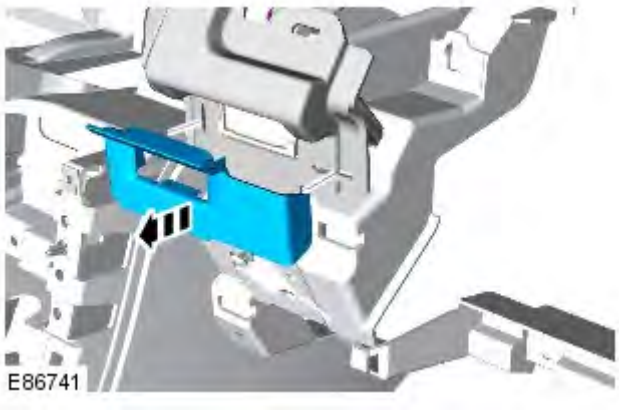


E86739

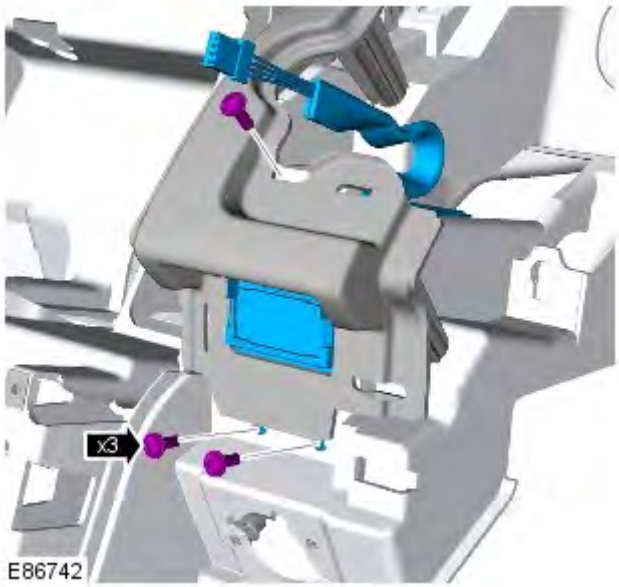
35. Remove the in-vehicle temperature sensor.



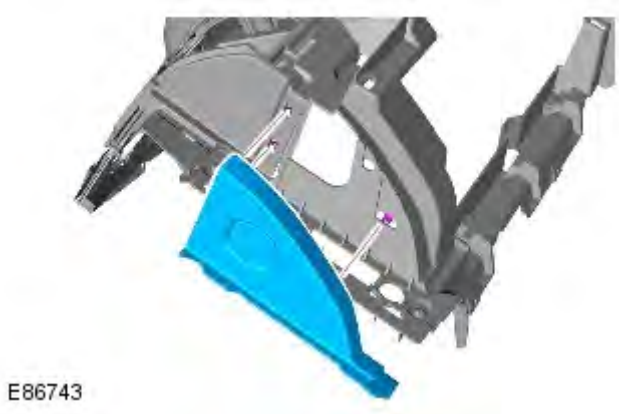
E86740



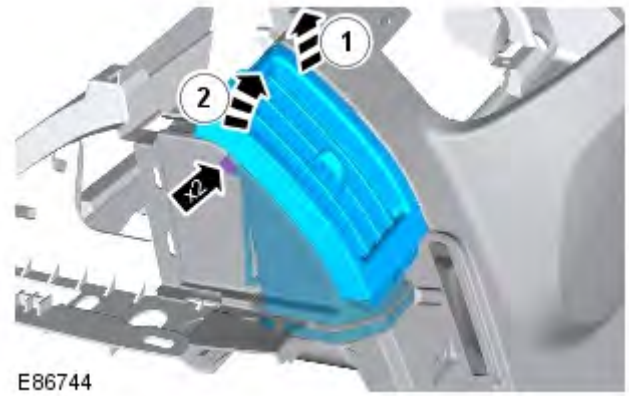
36. Remove the keyless start control module trim cover.



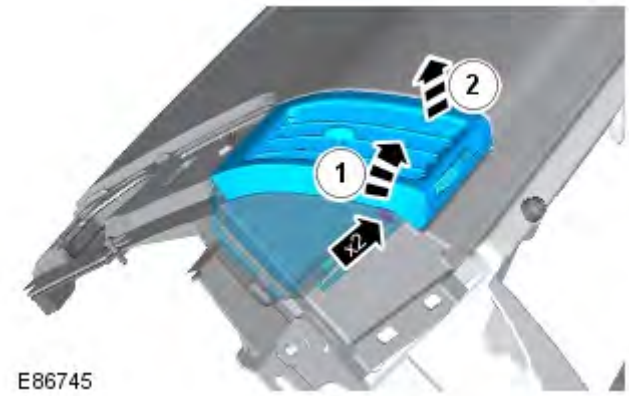
37. Remove the keyless start control module.



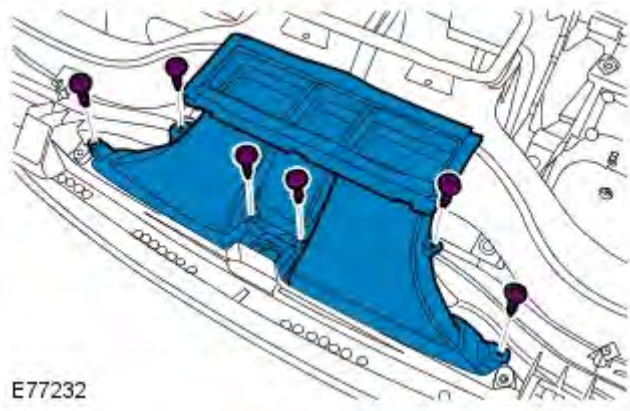
38.



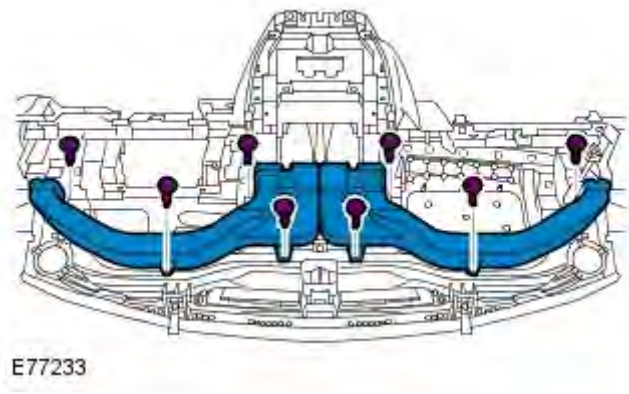
39. Remove the driver side register.



40. Remove the passenger side register.



41. Remove the windshield defroster duct.



42. Remove the register ducting.

43. Remove the remaining clips.

Installation

1. Install the clips.
2. Install the register ducting.
3. Install the windshield defroster duct.
4. Install the passenger side register.
5. Install the driver side register.
6. Install the driver side instrument panel end trim panel.
7. Install the keyless start control module.
8. Install the keyless start control module trim cover.
9. Install the in-vehicle temperature sensor.
10. Install the windshield defroster trim panel.
11. Install the glove compartment support panels.
12. Install the glove compartment lid hinges.
13. Install the glove compartment lamp.
14. Install the passenger air bag module.

    Torque: 10 Nm
15. Install the glove compartment striker reinforcement panel.
16. With assistance, install the instrument panel upper section.
17. Secure the wiring harness clip to the passenger side of the instrument panel upper section.
18. Secure the 2 wiring harness clips to the windshield defroster duct and connect the sunload sensor.
19. With assistance, secure the instrument panel upper section.
20. Install the windshield defroster outer finishers.
21. Connect the passenger air bag module electrical connectors.
22. Connect the glove compartment lamp electrical connector.
23. Secure the passenger air bag module and glove compartment lamp wiring harness.
24. Install the glove compartment.

Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

25. Install the passenger side instrument panel end trim panel.

26. Secure the wiring harness support bracket.

27. Secure the wiring harness to the center of the instrument panel upper section.

28. Install the climate control assembly.

29. Install the audio unit.

30. Install the center speaker.

31. Install the video display.

    Refer to: Video Display (415-01 Information and Entertainment System, Removal and Installation).

32. Install the floor console.

    Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

33. Install the floor console extensions.

34. Install both instrument panel speakers.

35. Install both upper trim panels.

36. Connect the in-vehicle temperature sensor electrical connector.

37. Connect the keyless start module electrical connector.

38. Secure the instrument cluster wiring harness clip.

39. Install the instrument cluster.

    Refer to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation).

40. Install the clockspring.

    Refer to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

41. Install both cowl side trim panels.

    Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

42. Secure both scuff plate trim panels.

43. Install the A-pillar center trim panels.

44. Install both A-pillar upper trim panels.

    Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

45. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

46. Return the steering column to its original position.

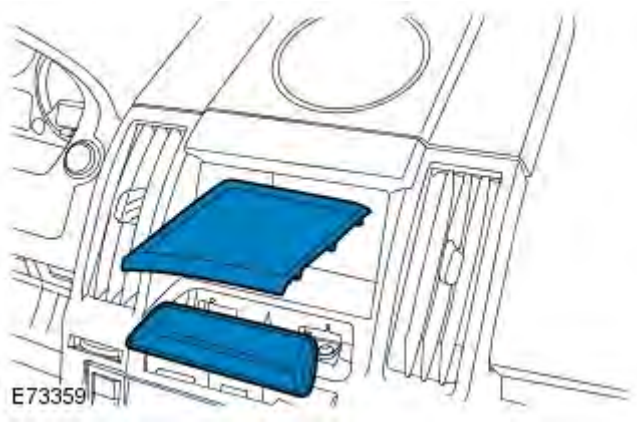
Published: 11-May-2011

Instrument Panel and Console - Instrument Panel Console

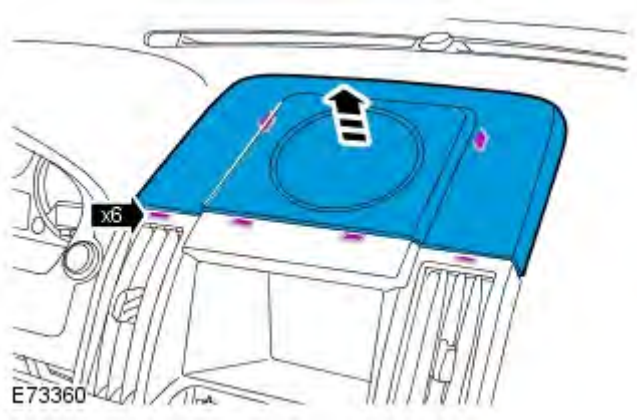
Removal and Installation

Removal

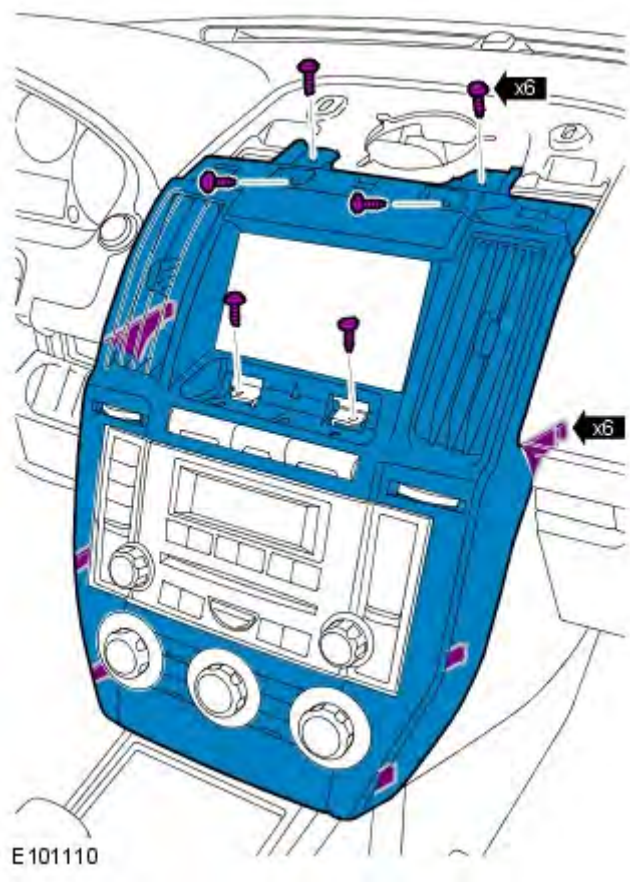
- NOTE: Removal steps in this procedure may contain installation details.



1. If equipped.

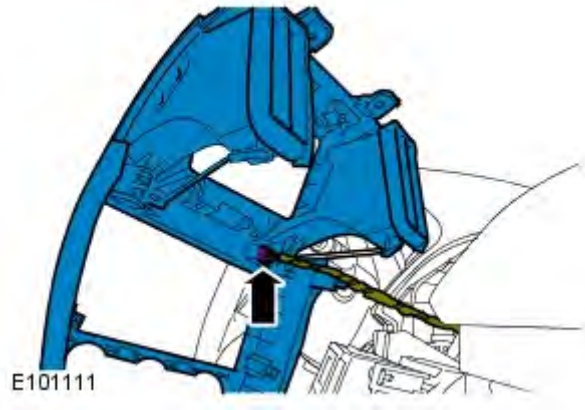


2.



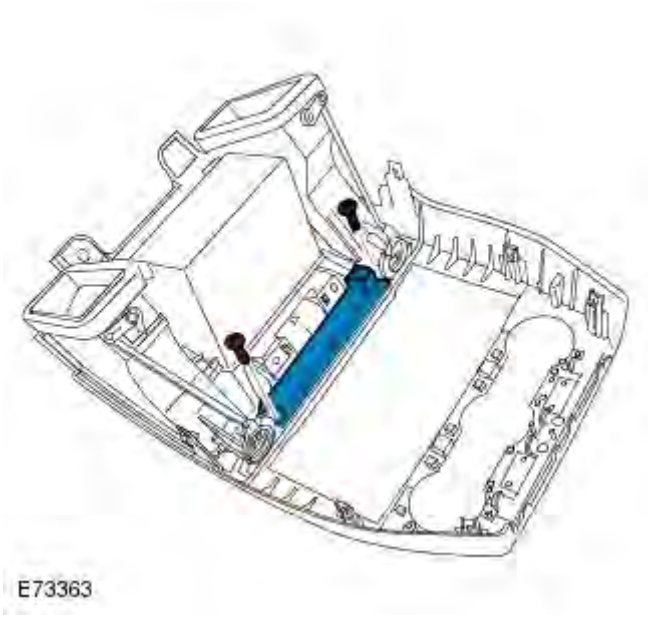
3. **3.** CAUTION: Protect the surrounding trim from damage when changing the component.

   Torque: 3 Nm



4.

5. **5.** NOTE: Do not disassemble further if the component is removed for access only.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Instrument Panel and Console - Floor Console

Removal and Installation

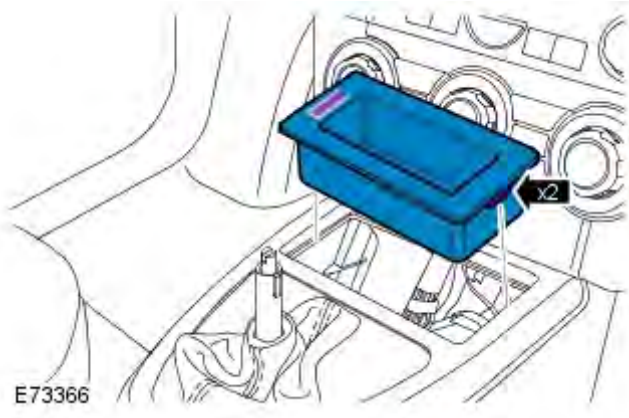
Removal

1. Remove the audio control switches.

   Refer to: Rear Auxiliary Audio Controls (415-01 Information and Entertainment System, Removal and Installation).

2. Remove the gear selector knob.

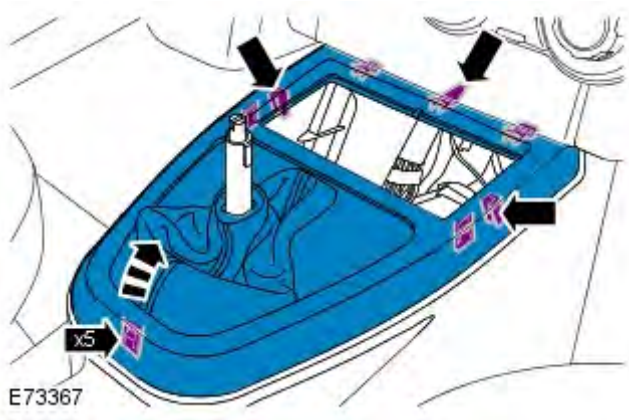
   Refer to: Selector Lever Knob (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).
   Refer to: Gearshift Lever Knob (308-06 Manual Transmission/Transaxle External Controls, Removal and Installation).



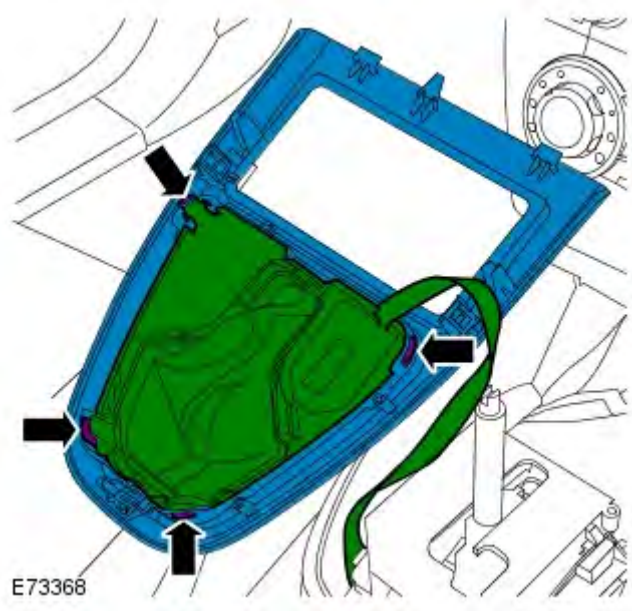
3. **Vehicles without terrain response:** Remove the stowage compartment tray.

4. **Vehicles with terrain response:** Remove the ride and handling optimization switch.

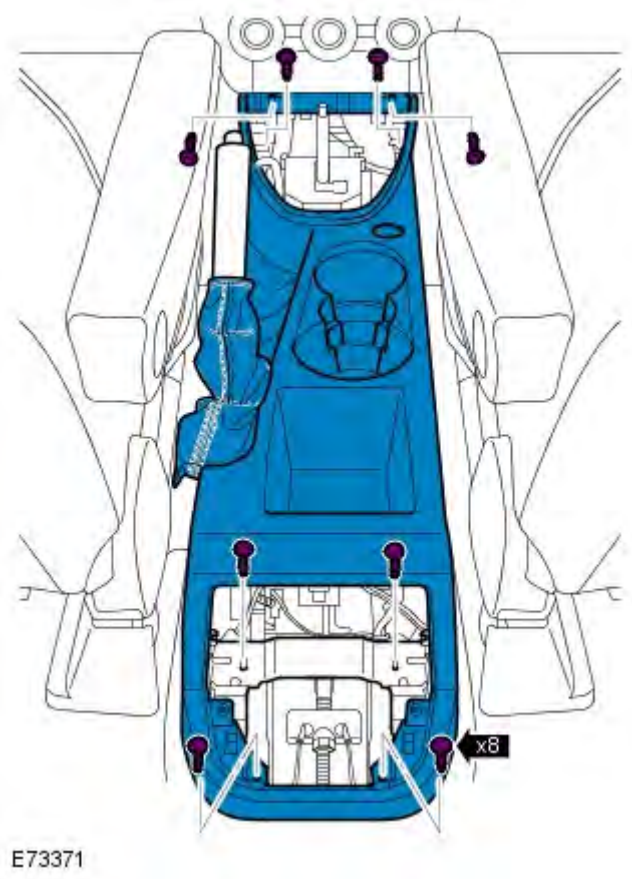
   Refer to: Ride and Handling Optimization Switch (204-06 Ride and Handling Optimization, Removal and Installation).



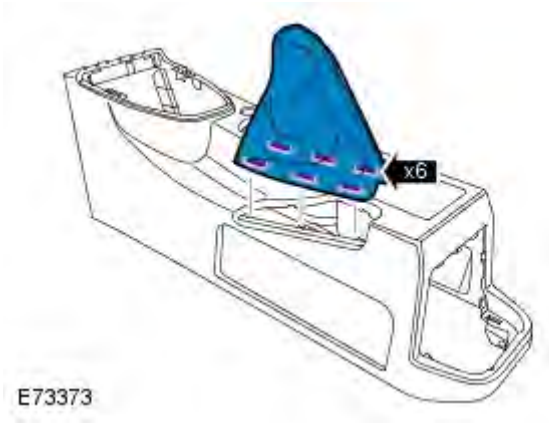
5. Release the gear selector cover.



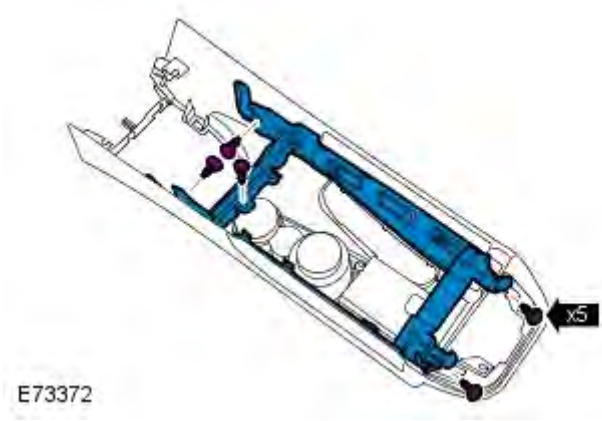
6. Remove the gear selector cover.



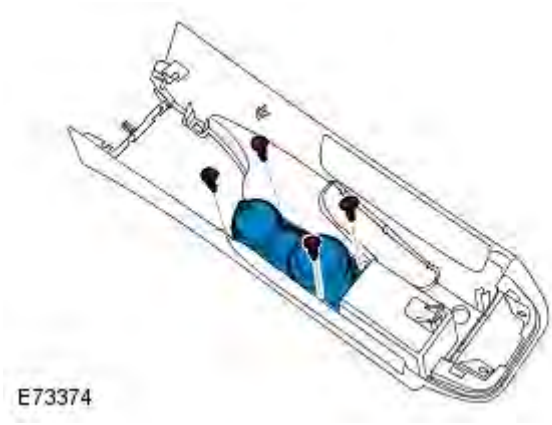
7. **7.** CAUTION: Protect the surrounding trim to avoid damage.
   - Apply the parking brake control to it's highest possible position.
   - Disconnect the auxiliary input socket electrical connector.
   - Remove the 8 screws.
   - Remove the floor console.



8. **8.** NOTE: Do not disassemble further if the component is removed for access only.



9.



10.

Installation

1. Install the cup holder.
2. Install the floor console bracket.
3. Install the parking brake control gaiter.
4. Install the floor console.
5. Install the gear selector cover.
6. Secure the gear selector cover.
7. **Vehicles with terrain response:** Install the ride and handling optimization switch.

Refer to: Ride and Handling Optimization Switch (204-06 Ride and Handling Optimization, Removal and Installation).

8. **Vehicles without terrain response:** Install the stowage compartment tray.

9. Install the gear selector knob.

   Refer to: Selector Lever Knob (307-05 Automatic Transmission/Transaxle External Controls, Removal and Installation).
   Refer to: Gearshift Lever Knob (308-06 Manual Transmission/Transaxle External Controls, Removal and Installation).

10. Install the audio control switches

    Refer to: Rear Auxiliary Audio Controls (415-01 Information and Entertainment System, Removal and Installation).

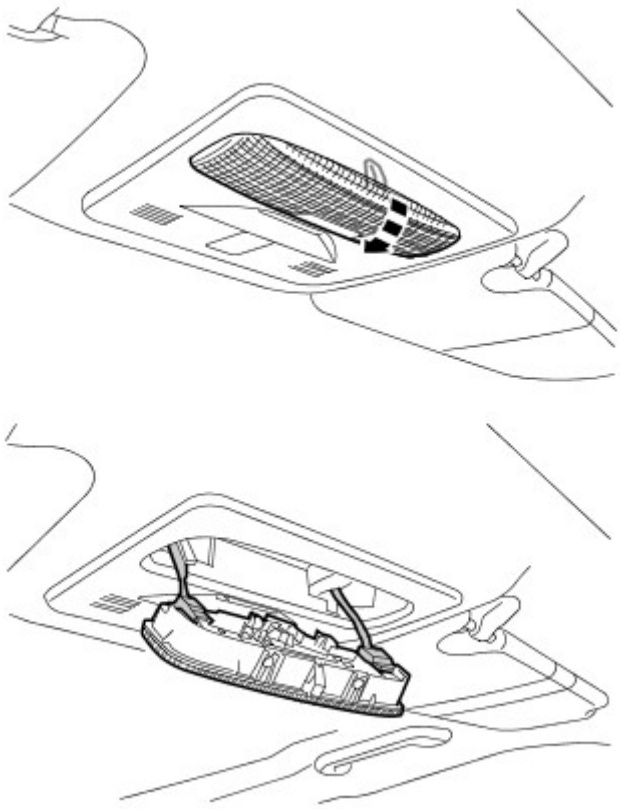
Published: 11-May-2011

Instrument Panel and Console - Overhead Console

Removal and Installation

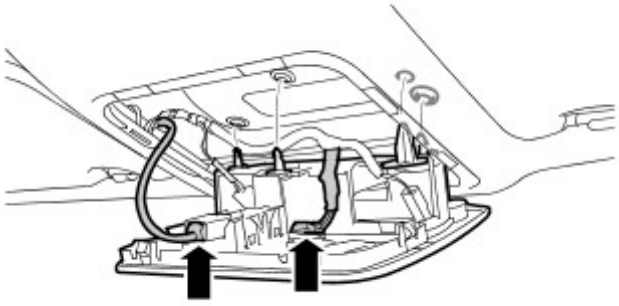
Removal

1.

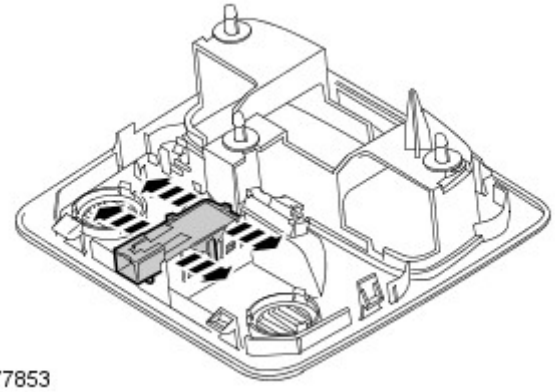


E77851

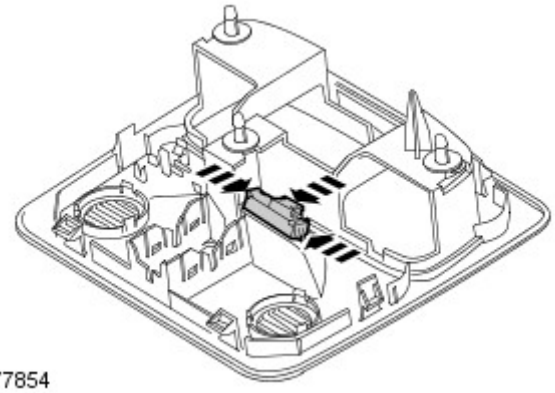
2.



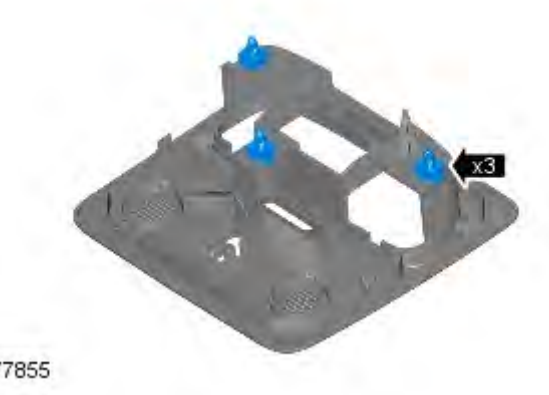
E77852


E77853

3. **3.** NOTE: Do not disassemble further if the component is removed for access only.


E77854

4. Remove the passenger air bag deactivation warning lamp.



E77855

5.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

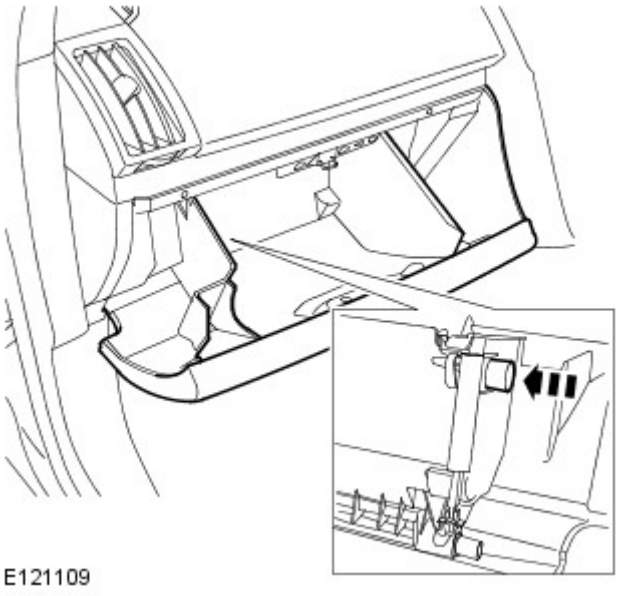
Instrument Panel and Console - Glove Compartment

Removal and Installation

Removal

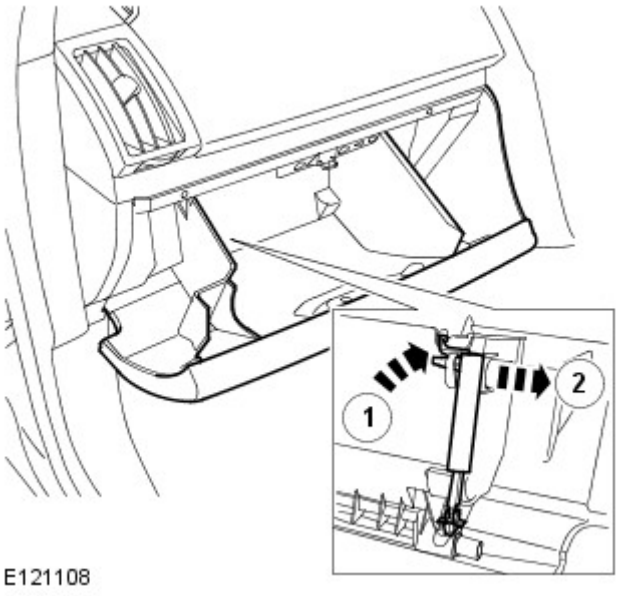
1. Position the front seat fully rearwards.

2. Open the glove compartment to the service condition.


E121109

3. **3.** CAUTION: Make sure that excessive force is not used to release the glove compartment. Failure to follow these instructions may result in damage to the vehicle.

   Release the glove compartment.



E121108

4. **4.** CAUTION: Make sure that excessive force is not used to release the glove compartment. Failure to follow these instructions may result in damage to the vehicle.

   Release the glove compartment damper.

5. Remove the glove compartment.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Handles, Locks, Latches and Entry Systems -

Torque Specifications

Description	Nm	lb-ft
Front door latch Torx screws	10	7
Hood latch interior release handle bolt	10	27
Hood latch to slam panel bolts	10	7
Hood safety hook bolts	10	7
Liftgate handle bolts	4	3
Liftgate latch Torx screws	20	15
Liftgate striker bolts	25	18
Rear door latch Torx screws	10	7

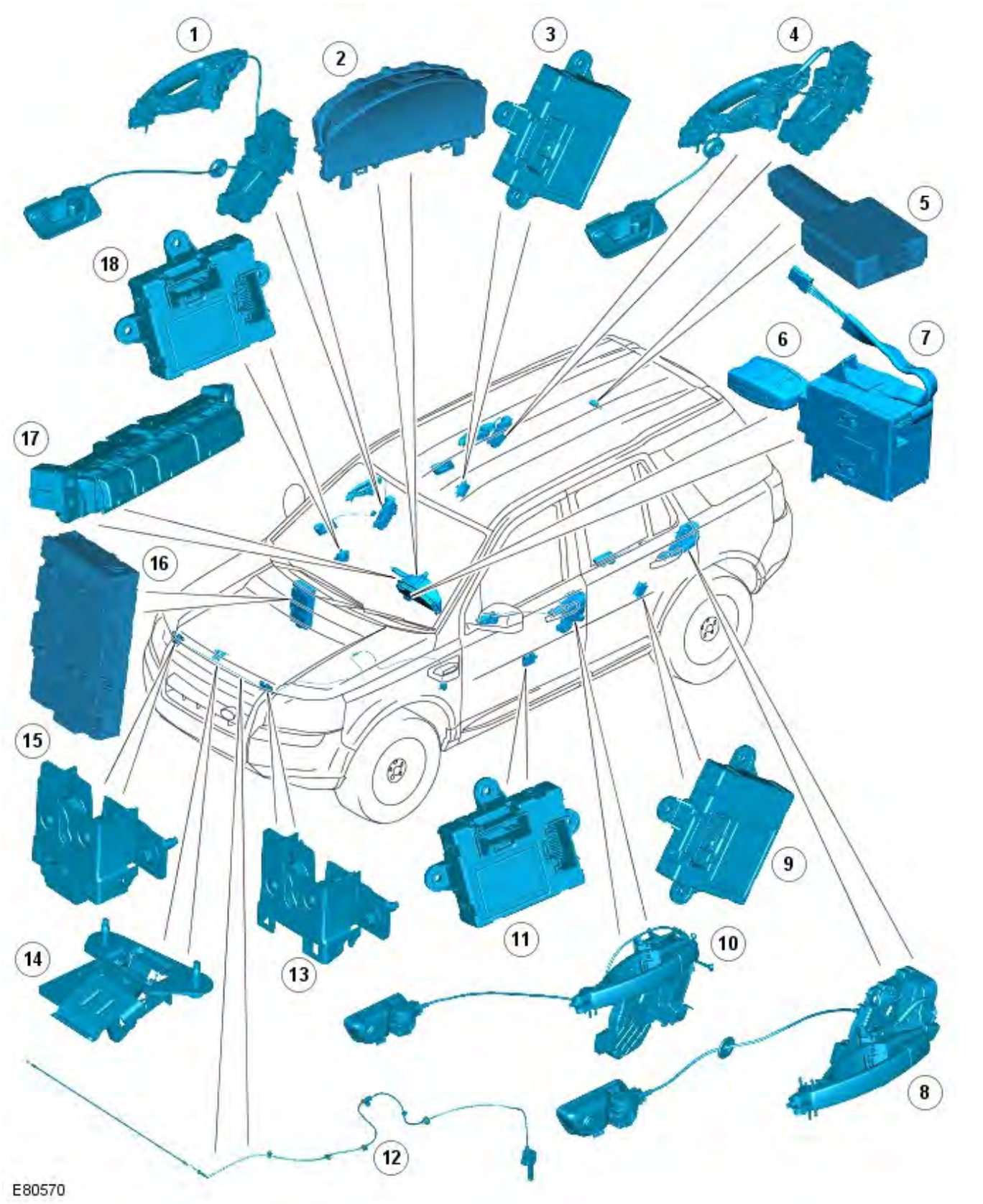
Published: 11-May-2011

Handles, Locks, Latches and Entry Systems - Handles, Locks, Latches and Entry Systems

Description and Operation

COMPONENT LOCATION (SHEET 1 OF 2)

• NOTE: Left-Hand Drive (LHD) shown; Right-Hand Drive (RHD) similar.

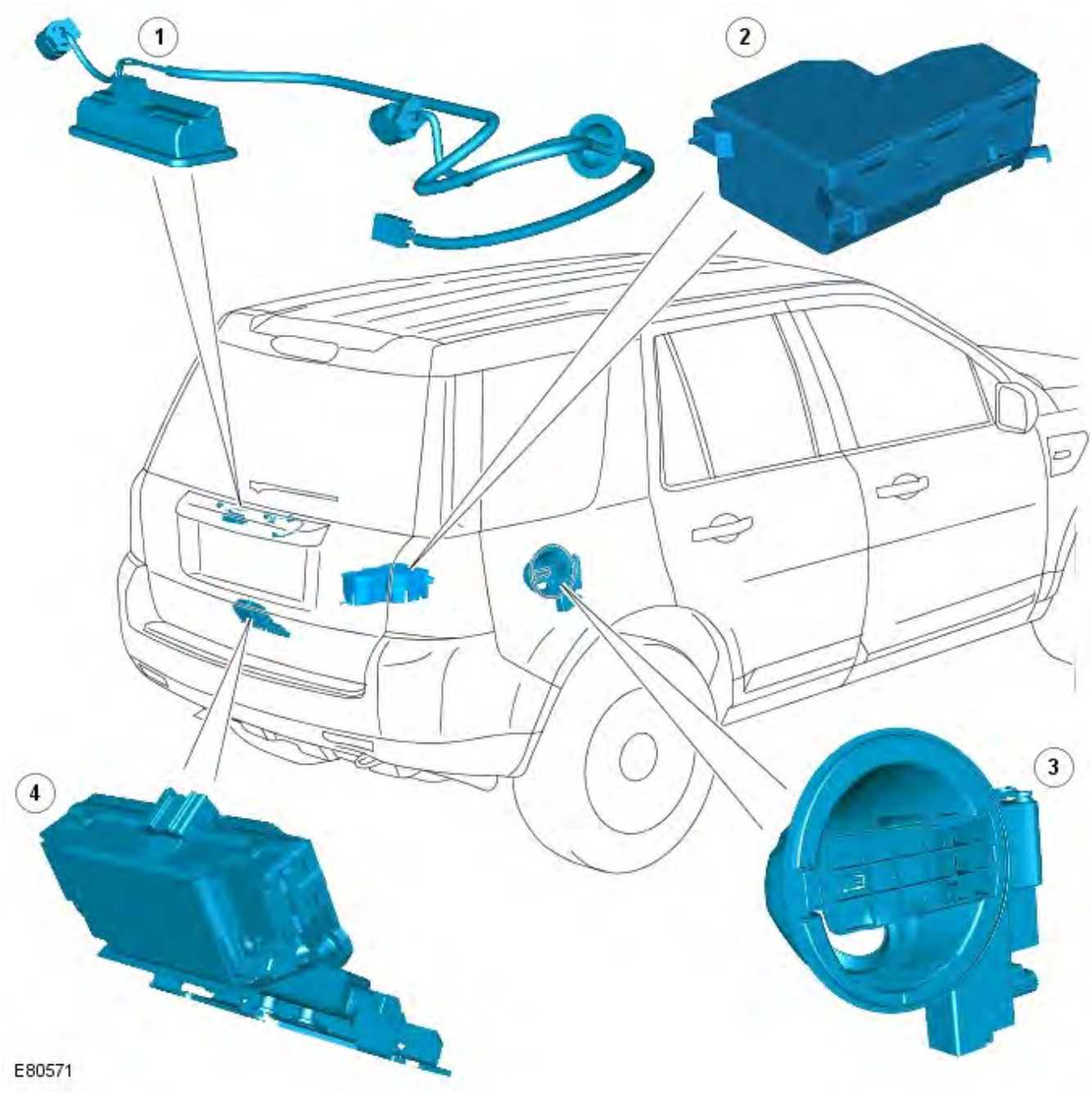


Item	Part Number	Description
1	-	Right-Hand (RH) front door handle and latch
2	-	Instrument cluster

3	-	RH rear door control module
4	-	RH rear door handle and latch
5	-	Radio Frequency (RF) receiver
6	-	Remote handset
7	-	Start control module
8	-	Left-Hand (LH) rear door handle and latch
9	-	LH rear door control module
10	-	LH front door handle and latch
11	-	LH front door control module
12	-	Hood release cable
13	-	LH hood latch
14	-	Hood safety hook
15	-	RH hood latch and ajar switch
16	-	Central Junction Box (CJB)
17	-	Instrument panel central locking switches
18	-	RH front door control module

COMPONENT LOCATION (SHEET 2 OF 2)

• NOTE: LHD shown; RHD similar.



Item	Part Number	Description
1	-	Liftgate release switch
2	-	Auxiliary Junction Box (AJB)
3	-	Fuel filler door actuator
4	-	Liftgate latch and ajar switch

OVERVIEW

All the vehicle hinged panels are secured by latches with mating strikers. The latches incorporate panel ajar switches that will inform the driver of an open access point.

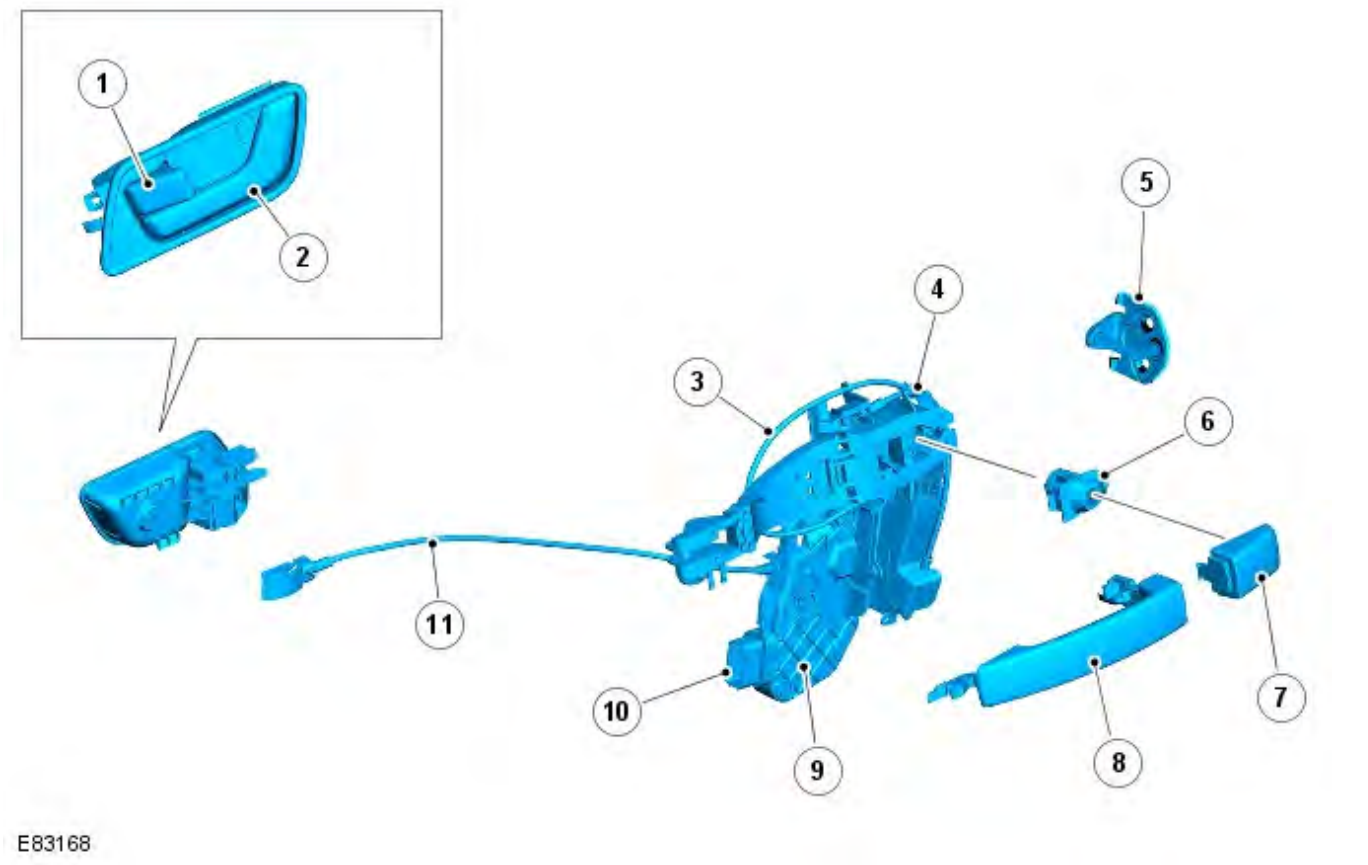
The central locking system is operated by either the remote handset, front door central locking buttons or the instrument panel central locking switches. The central locking system controls the automatic locking and unlocking of the vehicle entry points. The software used to control the central locking system is incorporated within the CJB.

The central locking system is also integrated with the interior lighting function. The interior lights and exterior mirror lamps are illuminated via the RF receiver and CJB following a valid unlock request from the remote handset.
For additional information, refer to: Interior Lighting (417-02 Interior Lighting, Description and Operation).

If configured by the dealer, the exterior door mirror power fold function is also operated by the central locking system.

A concealed mechanical door lock is provided in the front LH door exterior handle, and is used to gain access to the vehicle if the battery is discharged or the central locking system fails.

DOOR LATCHES



E83168

Item	Part Number	Description
1	-	Door interior lock/unlock button
2	-	Door interior release handle
3	-	Mechanical door lock release cable (front LH door only)
4	-	Door lock exterior release cable
5	-	Door striker
6	-	Emergency mechanical door lock (front LH door only)
7	-	Exterior door handle lock cover
8	-	Exterior door handle
9	-	Door latch
10	-	Electrical connection to door control module
11	-	Door lock interior release cable

The door latches are installed at the rear edge of each door and engage with corresponding strikers mounted to the 'B' and 'C' pillars. Each interior and exterior door handle is connected with a release cable to the corresponding door latch. In the front LH door a third release cable is connected between the door latch and the concealed emergency mechanical door lock.

Each door latch is a sealed unit that comprises the following:

- Lock motor
- Double lock motor (all except North American Specification (NAS), Japan and Gulf vehicles)
- Door ajar switch.

An electrical connector is incorporated in each door latch and provides the interface with the door control module, CJB, and AJB. The front door control modules are connected to the CJB on the medium speed Controller Area Network (CAN) bus; the rear door control modules are connected via the Local Interconnect Network (LIN) bus to the front door control modules. Power supply for the door latch lock and double lock motors is provided from the AJB.

The lock and double lock motors control the engagement of the door latches with the release cables to lock and unlock the vehicle. When the vehicle is locked, the lock motors disengage the door latches from the exterior release cables. When the vehicle is double locked, the double lock motors also disengage the door latches from the interior release cables. When the vehicle is subsequently unlocked, the interior and exterior release cables are re-engaged with the door latches.

All the door interior release handles incorporate a locking button. When a front door central locking button is pressed/pulled, all the vehicle doors will centrally lock/unlock. When a rear door locking button is pressed/pulled, the locking button will only lock/unlock the activated rear door.

When the door locking button is pressed, the interior release cable is pushed and causes the exterior release cable to be disengaged from the door latch. On the rear doors, pressing the locking button will also disengage the interior handle from the interior release cable.

When the door locking button is pulled away from the door, the door interior release handle is re-engaged with the interior release cable. As the interior release cable is re-engaged it is pulled, causing the door latch to re-engage with the exterior release cable.

Rear Door Child Locks

The rear door latches incorporate child locks that provide additional rear occupancy safety. The child locks are manually operated using the emergency key blade within the remote handset. Setting the child lock to the locked position will disengage the door latch interior release cable from the door latch, and prevent opening of the rear door using the interior release handle.

For further information on child locks, refer to the Owners Handbook.

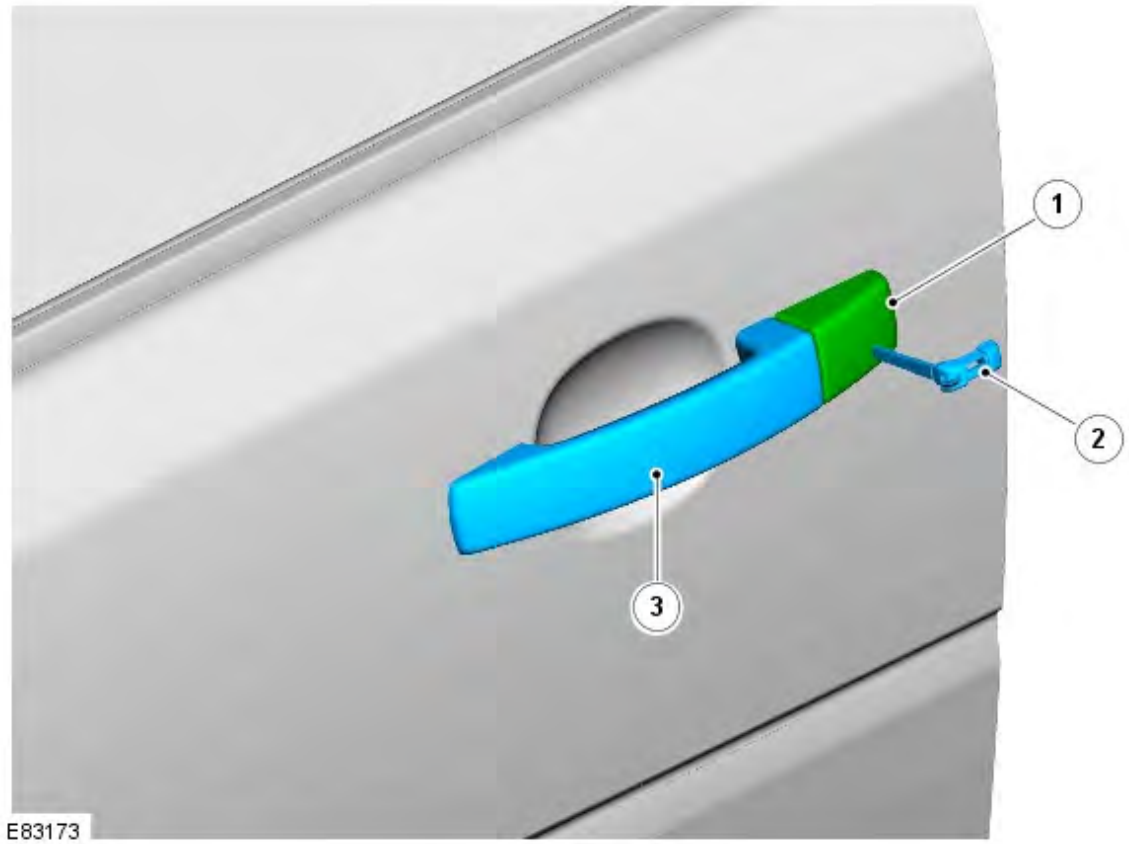
Door Ajar Switch

An ajar switch is installed in each door latch and is hardwired to the CJB. If the ignition is in power modes 4 (Accessory) or 6 (Ignition) and a door is opened or is not fully closed, the corresponding door ajar switch is opened to disconnect the ground from the CJB. A message is transmitted by the CJB via the medium speed CAN bus to the instrument cluster, to inform the driver that a door is ajar.

On vehicles with a low-line instrument cluster the door ajar symbol is illuminated.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).
On vehicles with a high-line instrument cluster, the door ajar symbol is illuminated and a message is also displayed in the message center.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

The door ajar switch is also integrated with the vehicle security system and is used as the detection device for unauthorized vehicle entry.
For additional information, refer to: Anti-Theft - Active (419-01A Anti-Theft - Active, Description and Operation).

Emergency Mechanical Door Lock



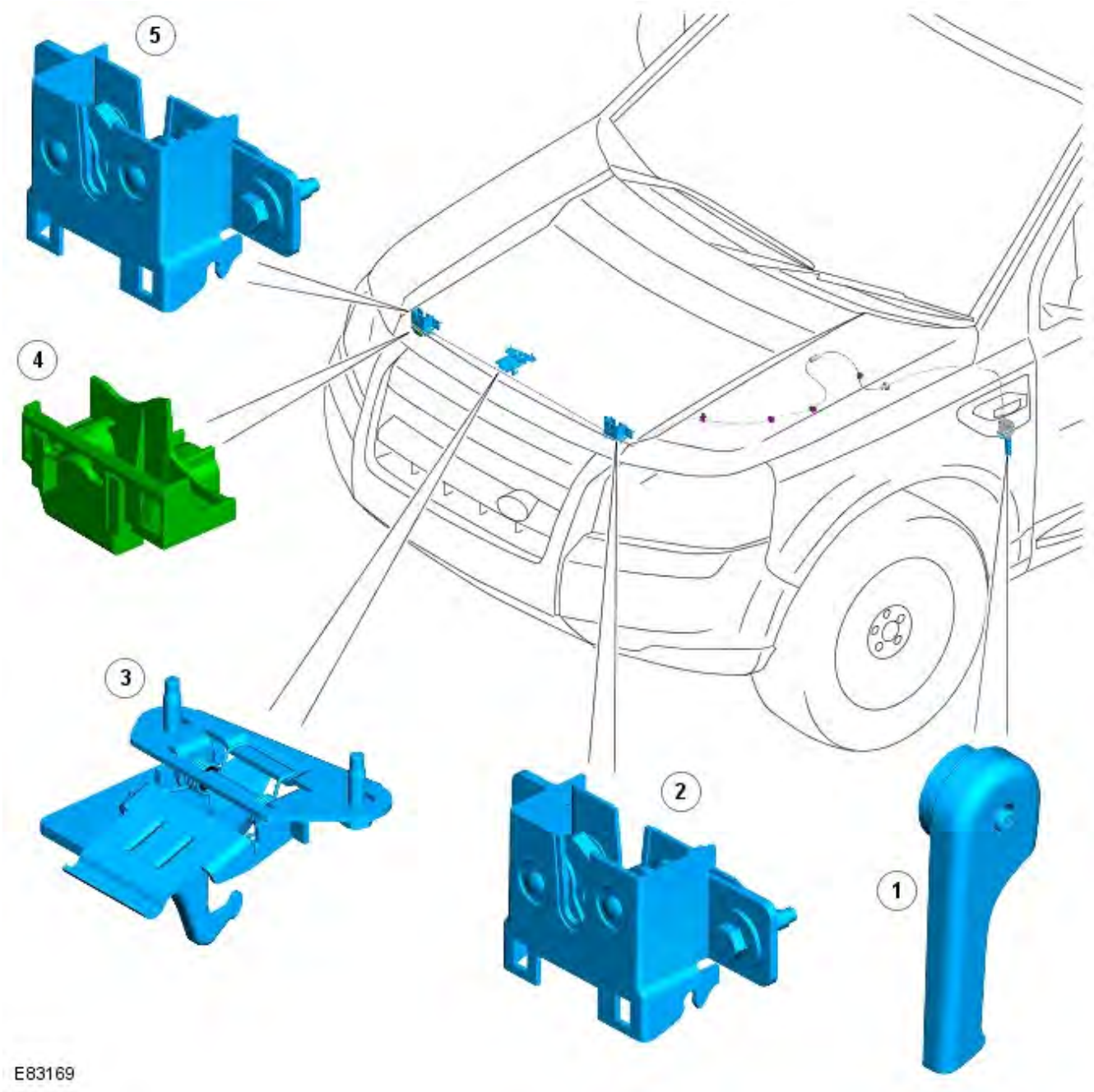
Item	Part Number	Description
1	-	Concealed mechanical lock

2	-	Emergency key blade
3	-	LH front door handle

The remote handset contains an emergency key blade, concealed in the key fob. The front LH exterior door handle incorporates a mechanical operated door lock that is concealed behind a removable plastic cover. The door lock allows the front LH door to be mechanically unlocked and locked using the emergency key blade in the event that the remote central locking operation fails, or a vehicle power failure occurs.

When the mechanical door lock is used the central locking system will not operate, and if already armed the vehicle alarm will sound when the door is opened. The vehicle is not able to be double locked, or the alarm system armed using the emergency key blade.

HOOD LATCHES



Item	Part Number	Description
1	-	Hood release handle
2	-	LH hood latch
3	-	Hood safety hook
4	-	Hood ajar switch
5	-	RH hood latch

The hood is secured in the closed position by 2 latches located on each side of the hood latch panel. The hood release lever is located below the instrument panel on the LH 'A' pillar and is connected with a cable to the hood latches. Operation of the hood release lever will open the 2 hood latches and release the hood.

A mechanically operated safety hook is installed at the front center of the hood. The safety hook prevents the hood from fully opening in the event that the hood latches are open, and the vehicle is in motion. The safety hook is spring operated to bias the hook to the latched position, and is formed with a lever plate. The lever must be pressed to release the safety hook from the mating latch plate when the hood is to be fully opened.

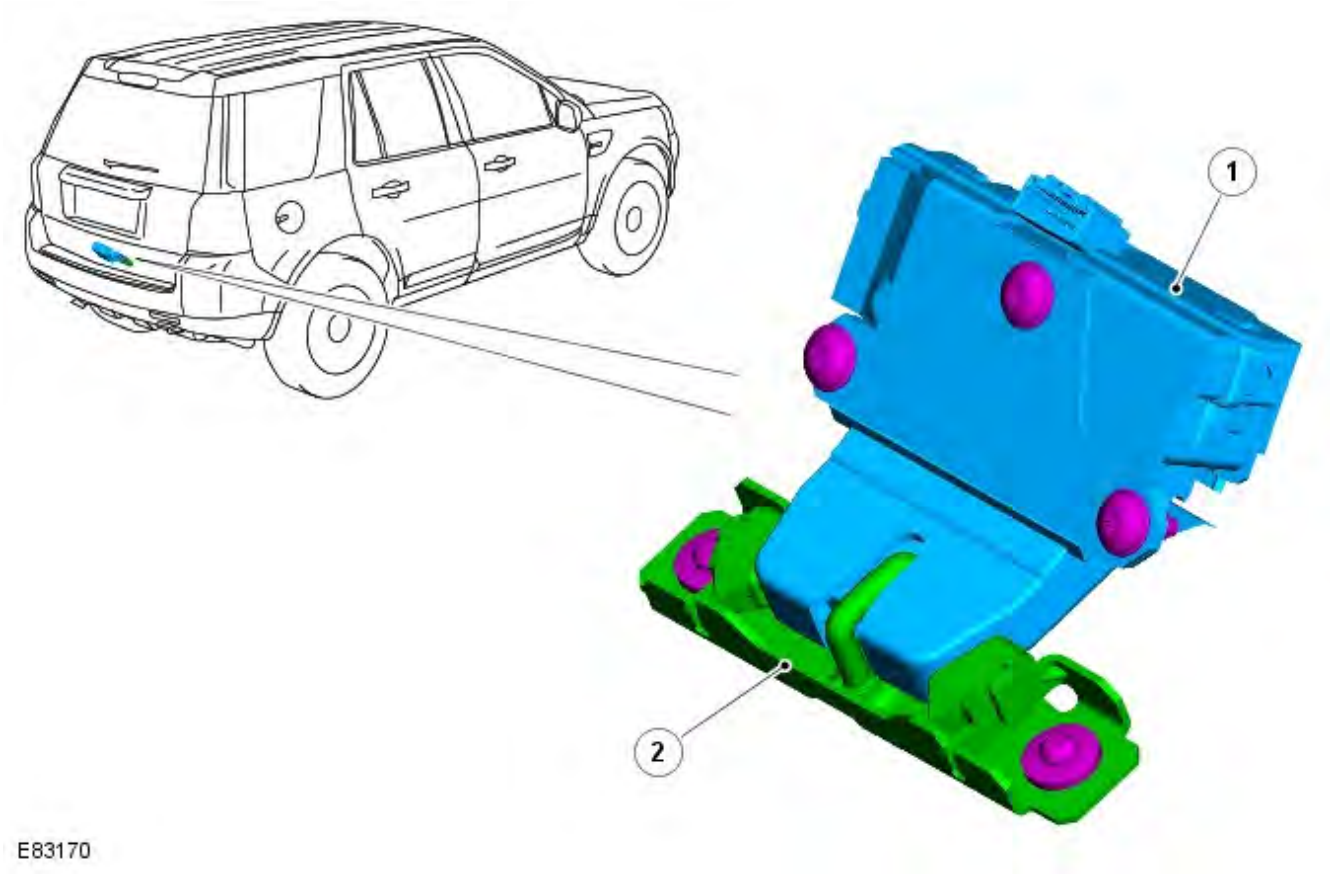
Hood Ajar Switch

The RH hood latch incorporates the hood ajar switch that is hardwired to the CJB. If the ignition is in power modes 4 (Accessory) or 6 (Ignition) and the hood is opened or is not fully closed, the hood ajar switch is opened to disconnect the ground from the CJB. A message is transmitted by the CJB via the medium speed CAN bus to the instrument cluster, to inform the driver that the hood is ajar.

On vehicles with a low-line instrument cluster the hood ajar symbol is illuminated.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).
On vehicles with a high-line instrument cluster, the hood ajar symbol is illuminated and a message is also displayed in the message center.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

The hood ajar switch is also integrated with the vehicle security system and is used as the detection device for unauthorized vehicle entry.
For additional information, refer to: Anti-Theft - Active (419-01A Anti-Theft - Active, Description and Operation).

LIFTGATE LATCH



E83170

Item	Part Number	Description
1	-	Liftgate latch
2	-	Liftgate striker

The liftgate latch is mounted at the bottom center of the liftgate interior body panel and is a fully electrically operated unit. The liftgate latch incorporates the liftgate lock motor, and receives a power supply via a hardwired connection from the CJB. A release microswitch is housed within a touch-pad that is located on the underside of the liftgate exterior handle.

The liftgate latch is released by the CJB when the vehicle is stationary and either the remote handset button is pressed, or the exterior handle touch-pad is applied. The liftgate latch is also released when the instrument panel central locking switches are simultaneously pressed for 3 seconds, and the vehicle speed is less than 8 km/h (5 mph).

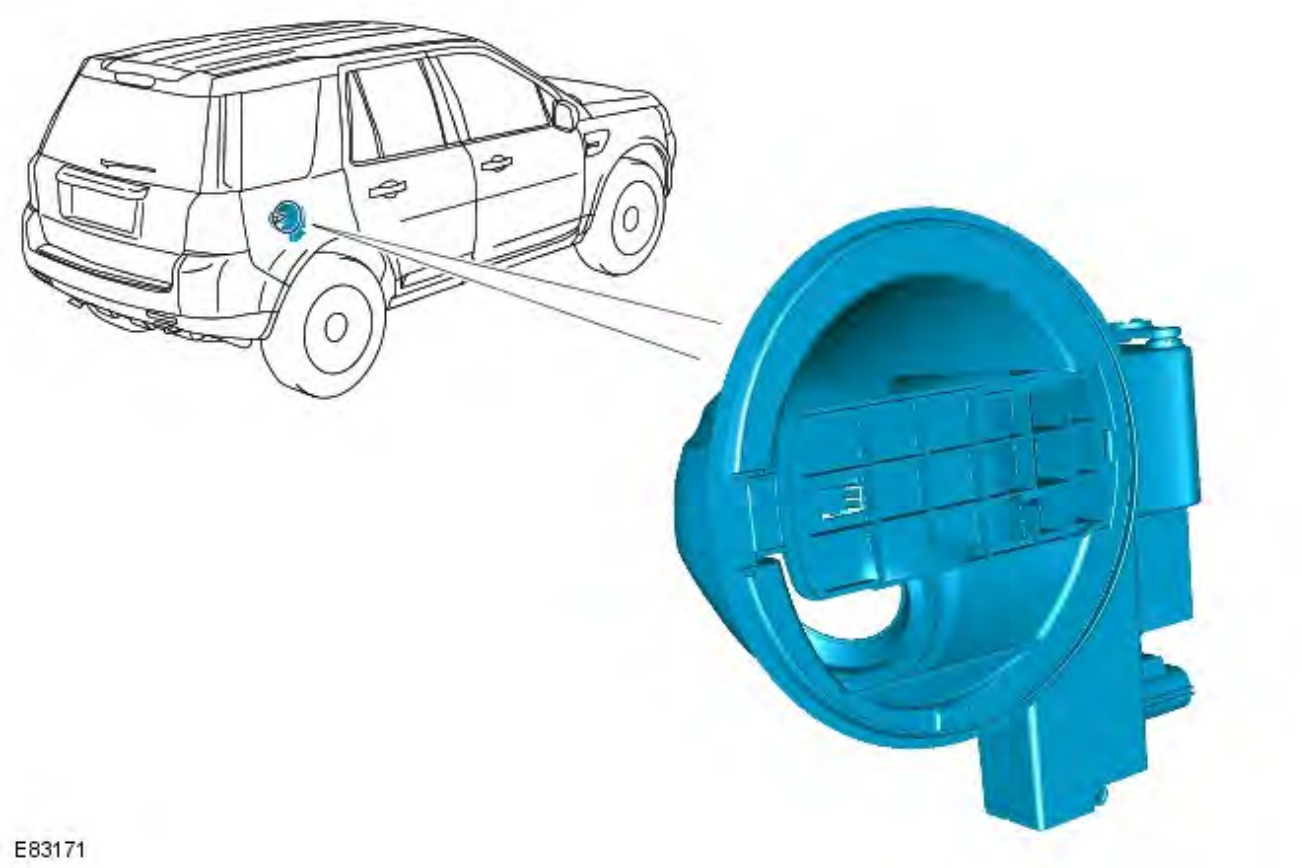
Liftgate Ajar Switch

The liftgate latch also incorporates the liftgate ajar switch that is hardwired to the CJB. If the ignition is in power modes 4 (Accessory) or 6 (Ignition) and the liftgate is opened or is not fully closed, the liftgate ajar switch is opened to disconnect the ground from the CJB. A message is transmitted by the CJB via the medium speed CAN bus to the instrument cluster, to inform the driver that the liftgate is ajar.

On vehicles with a low-line instrument cluster the liftgate ajar symbol is illuminated.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).
On vehicles with a high-line instrument cluster, the liftgate ajar symbol is illuminated and a message is also displayed in the message center.
For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

The liftgate ajar switch is also integrated with the vehicle security system and is used as the detection device for unauthorized vehicle entry.
For additional information, refer to: Anti-Theft - Active (419-01A Anti-Theft - Active, Description and Operation).

FUEL FILLER DOOR ACTUATOR



E83171

The fuel filler door is electrically locked and unlocked with an actuator and plastic pin. The actuator is located behind the fuel filler door housing, and operates the pin to engage or release a spigot on the door mounting hinge arm.

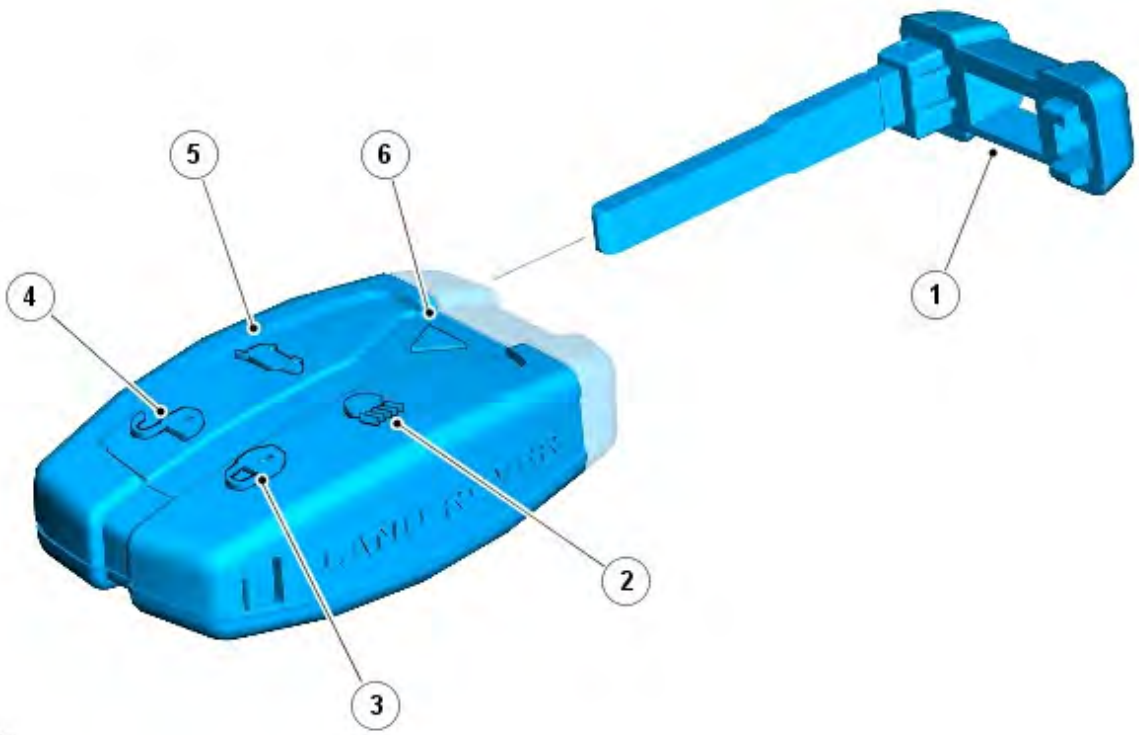
The fuel filler door actuator is hardwired to the CJB and is operated by the vehicle central locking system. The CJB reverses the polarity of the actuator power and ground connections, allowing the pin to move in both directions for locking and unlocking. When unlocked, the fuel filler door is manually opened to gain access to the fuel tank filler cap.

CENTRAL LOCKING SYSTEM CONTROLS

The central locking system provides the driver with control over the locking and unlocking of the vehicle entry points, from inside or outside the vehicle. Manual operation of the central locking system is achieved using the following:

- Remote handset and RF receiver
- Front door central locking button
- Instrument panel central locking switches.

Remote Handset



E83172

Item	Part Number	Description
1	-	Emergency key blade
2	-	Headlamp delay function button
3	-	Vehicle lock button
4	-	Vehicle unlock button
5	-	Liftgate unlock button
6	-	Panic alarm button

The remote handset is a sealed waterproof unit that contains a Printed Circuit Board (PCB), transponder and a rechargeable battery. The remote handset battery is charged whenever the remote handset is located in the start control unit, and the engine is running.

The remote handset contains an emergency key blade, concealed in the key fob. The emergency key blade is used to access the vehicle through the LH front door if the central locking system fails. The emergency key blade is also used to enable or disable the rear door child locks, and to disable the passenger airbag.
For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).

The remote handset is identical for all vehicle specifications, but differs in the preset frequency and power that the remote handset operates. The remote handset for each vehicle specification is identified by a suffix change to the base part number as follows:

Part No. Suffix	Operating Frequency	Vehicle Specification
A#	433 MHz	Europe and ROW (Rest Of World)
B#	315 MHz	NAS
C#	315 MHz low power	Japan and Korea

Each remote handset features a unique identification code that is programmed within the integral transponder. The RF signal produced by the remote handset contains the unique identification code and also a rolling code. During vehicle production, the unique identification codes of the valid remote handsets are programmed into the CJB, and the rolling codes are also synchronized with the CJB.

When the remote handset is operated, the CJB checks the unique identification and rolling code. The CJB will only respond if the RF signal produced is from a valid remote handset for the vehicle.
For additional information, refer to: Anti-Theft - Passive (419-01 Anti-Theft - Passive, Description and Operation).

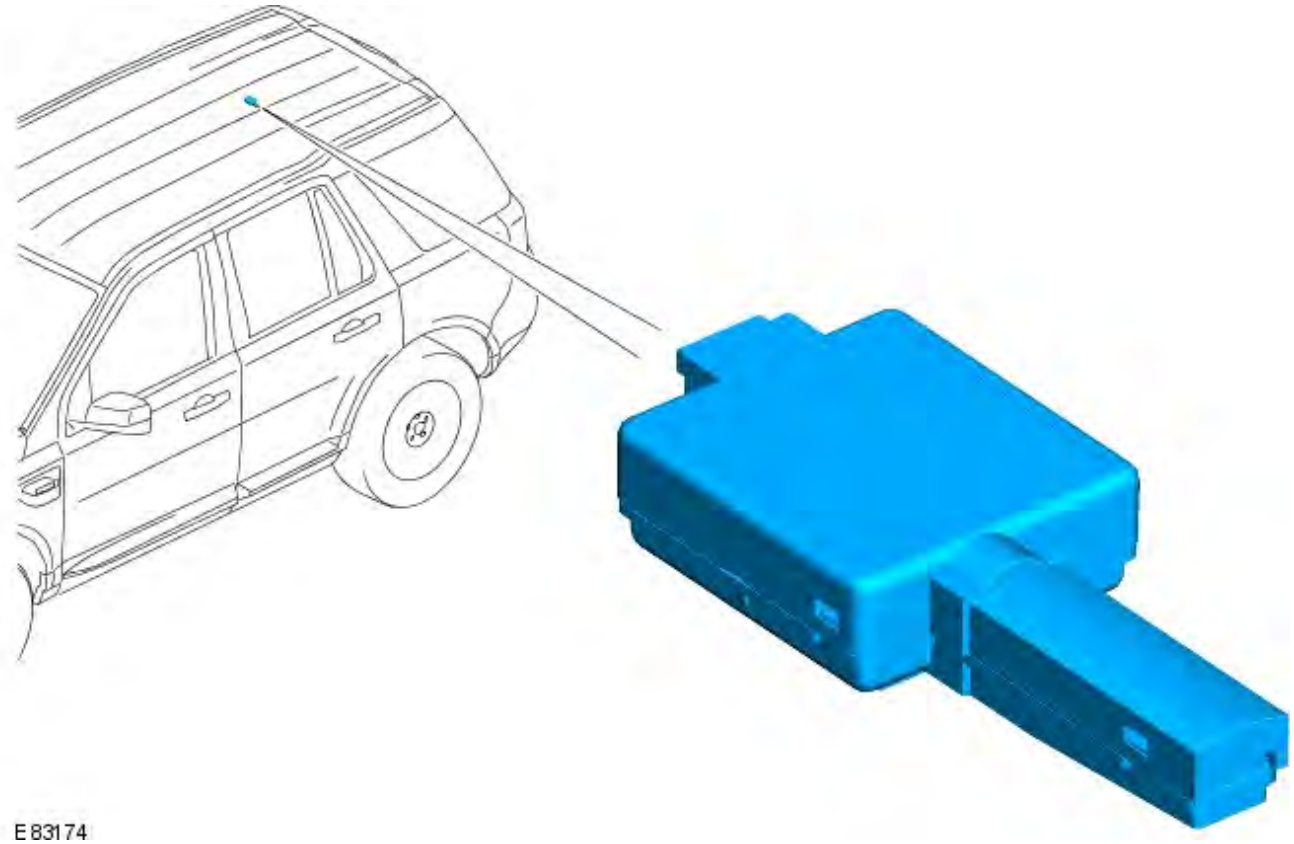
A total of 30 'slots' are available in the CJB software to allow for replacement, and the addition of remote handsets. In service, the Land Rover approved diagnostic system may be used to communicate with the CJB for the following:

- Identification of remote handset allocation within the CJB.
- Enabling of new remote handsets.
- Disabling of existing remote handsets.
- Re-enabling a previously disabled remote handset.

If the remote handset rolling code loses synchronization with the CJB, the remote handset functions will not operate. Synchronization between the remote handset and CJB is restored by starting the engine with the affected remote handset, and allowing the engine to run for a minimum of 6 minutes.

Additional buttons are located on the remote handset to provide convenience operation of the liftgate release, headlamp delay and panic alarm functions.

RF Receiver



The RF receiver is installed above the headlining, adjacent to the rear interior light. The receiver provides functionality for the remote central locking system, and is also used by the tire pressure monitoring system and interior lighting function.

For additional information, refer to:

Wheels and Tires (204-04 Wheels and Tires, Description and Operation),
Interior Lighting (417-02 Interior Lighting, Description and Operation).

The RF receiver is identical for all vehicle specifications, but differs in the preset frequency that the receiver operates. The RF receiver for each vehicle specification is identified by a suffix change to the base part number as follows:

Part No. Suffix	Operating Frequency	Vehicle Specification
A#	433 MHz	Europe and ROW
C#	315 MHz	NAS, Japan and Korea

The RF receiver converts the signals transmitted by the remote handset into digital messages, and then transmits the message via the LIN bus to the CJB.

A permanent power feed is supplied to the RF receiver by the CJB.

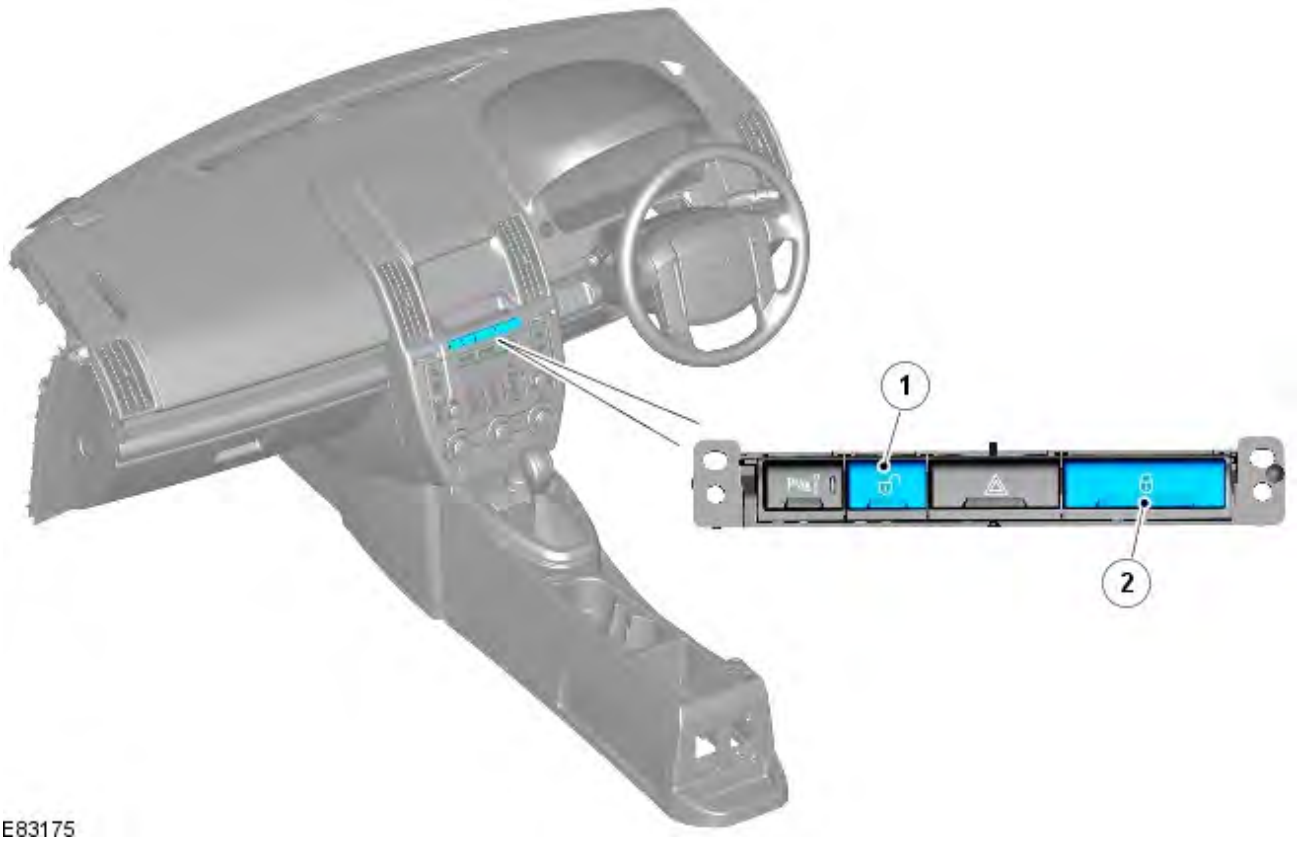
Front Door Central Locking Button

Both the front door interior locking buttons will activate the central locking function. When a front door central locking button is pressed/pulled, all the vehicle doors will centrally lock/unlock.

When a front door central locking button is pressed/pulled, the door control module on the activated door transmits the central lock/unlock request to the CJB. The CJB then transmits the central lock/unlock command to all the vehicle door control modules to lock/unlock all the vehicle doors.

The central locking feature using the front door central locking button is inhibited if either of the front doors is ajar. If a front door is ajar when a front door central locking button is pressed to lock the doors, the doors will lock and then instantly unlock.

Instrument Panel Central Locking Switches



E83175

Item	Part Number	Description
1	-	Interior CLS vehicle unlock switch
2	-	Interior CLS vehicle lock switch

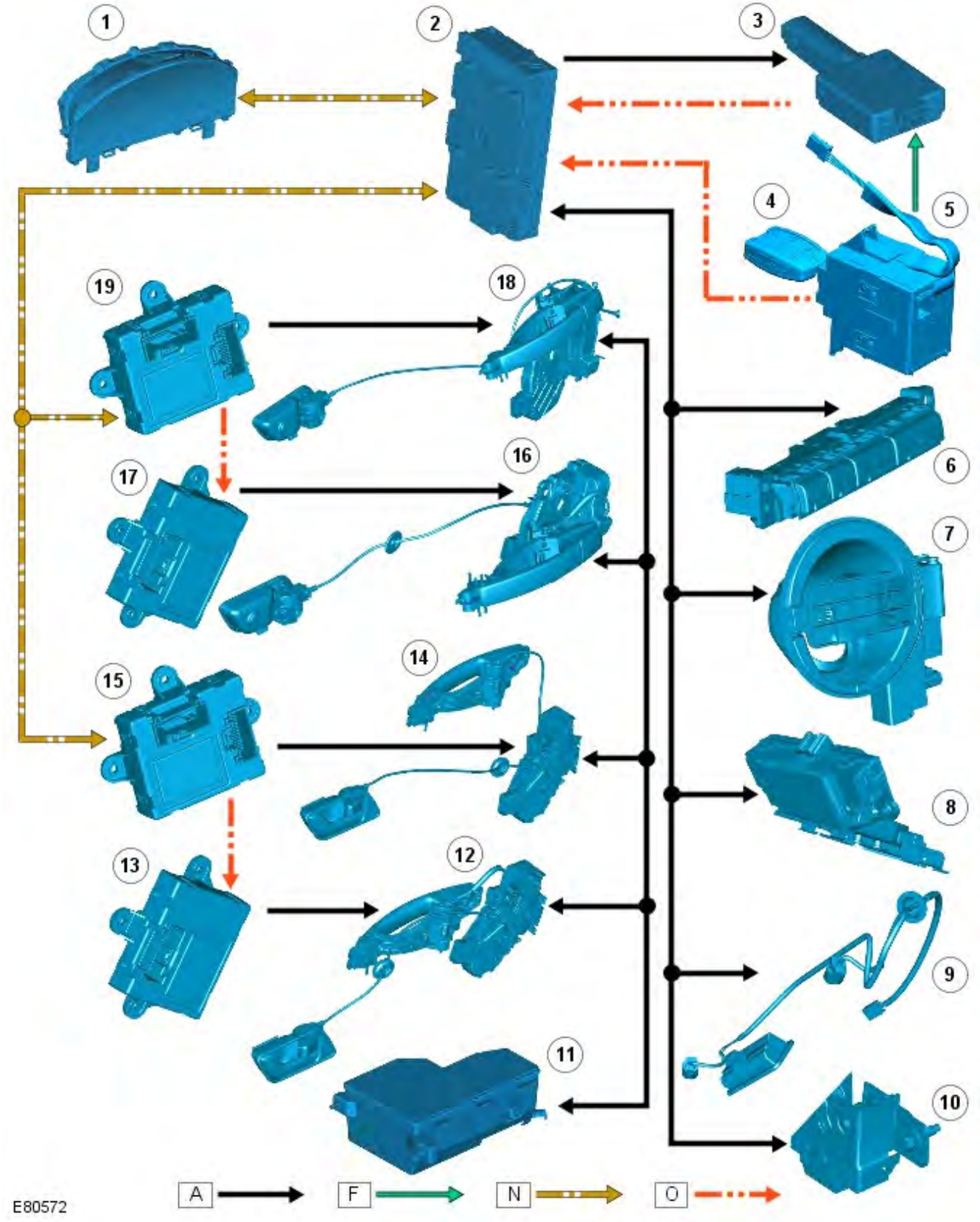
Interior lock and unlock switches are located in the instrument panel to provide manual control of the vehicle central locking system. The switches are non-latching and allow all the vehicle entry points to be centrally locked or unlocked from inside the vehicle.

When the instrument panel central lock or unlock switch is pressed, a ground is connected to the CJB that energizes the lock or unlock motor in the door latches, liftgate latch and the fuel filler door actuator. The doors will only respond to the central lock/unlock command when they are fully closed. If a door is ajar the central locking feature is inhibited.

The liftgate latch will release when the instrument panel central locking switches are simultaneously pressed for 3 seconds, and the vehicle speed is less than 8 km/h (5 mph).

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **F** = RF transmission; **N** = Medium speed CAN bus; **O** = LIN bus.



Item	Part Number	Description
1	-	Instrument cluster
2	-	CJB
3	-	RF receiver
4	-	Remote handset
5	-	Start control module
6	-	Instrument panel central locking switches
7	-	Fuel filler door actuator
8	-	Liftgate latch and ajar switch
9	-	Liftgate release switch
10	-	RH hood latch and ajar switch
11	-	AJB
12	-	RH rear door handle and latch

13	-	RH rear door control module
14	-	RH front door handle and latch
15	-	RH front door control module
16	-	LH rear door handle and latch
17	-	LH rear door control module
18	-	LH front door handle and latch
19	-	LH front door control module

PRINCIPLES OF OPERATION

Central Locking System - Manual Operation

The central locking system provides the option of 2 or 3 manual locking modes, dependent on the vehicle specification. The locking modes are activated using the instrument panel central locking switches, front door central lock/unlock buttons, or the remote handset lock/unlock buttons:

- Internally locked mode
- Externally locked mode
- Double locked mode (all except NAS, Japan and Gulf vehicles).

When the vehicle is externally locked, the CJB flashes the direction indicators once for 250 milliseconds. When the vehicle is double locked, the CJB flashes the direction indicators twice for 250 milliseconds with a 250 millisecond pause between flashes. When the vehicle is unlocked with the remote handset, the CJB flashes the direction indicator lamps twice for 250 milliseconds with a 250 millisecond pause between flashes.

The remote handset may be configured by the driver for single point entry or global entry, by simultaneously pressing the remote handset lock and unlock buttons for 4 seconds. The vehicle must initially be in an unlocked state and the remote handset recently removed from the start control module prior to the mode change. The direction indicators will flash twice for 250 milliseconds with a 250 millisecond pause between flashes to confirm the mode change. The vehicle will also lock and then unlock in the selected mode.

When single point entry is enabled, an unlock command from the remote handset will only unlock the driver's door, liftgate and the fuel filler door. To unlock the remaining entry points, a second unlock command from the remote handset or the instrument panel central unlock switch is required.

Additional options for speed dependent locking and automatic relocking modes may be configured by the dealer. All vehicles incorporate an automatically operated crash unlocking mode.

Internally Locked Mode

The internally locked mode is activated by a single press of the instrument panel central lock switch, or a single press of a front door central lock/unlock button. When in the internally locked mode:

- The exterior door release handles are disengaged from the door latches to prevent opening of the doors from outside the vehicle.
- The CJB disregards an open request from the liftgate exterior handle to prevent opening of the liftgate from outside the vehicle.
- The vehicle may be unlocked by either a single press of the instrument panel central unlock switch, pulling a front door central lock/unlock button, or a single press of the remote handset unlock button. The vehicle will also unlock if the driver or front passenger door is opened.

Externally Locked Mode

The externally locked mode is activated by a single press of the remote handset lock button. When in the externally locked mode:

- The exterior door release handles are disengaged from the door latches to prevent opening of the doors from outside the vehicle.
- The CJB disregards an open request from the liftgate exterior handle or the instrument panel central locking switches to prevent exterior opening of the liftgate and doors.
- The fuel filler door actuator is energized to lock the fuel filler door.
- The vehicle may be unlocked by a single press of the remote handset unlock button.

Double Locked Mode

The double locked mode is activated by pressing the remote handset lock button twice within 3 seconds. When in the double locked mode:

- The interior and exterior door release handles are disengaged from the door latches to prevent opening of the doors from inside or outside the vehicle.
- The fuel filler door actuator is energized to lock the fuel filler door.
- The CJB disregards an open request from the liftgate exterior handle and the instrument panel central locking switches, to prevent opening of the liftgate and doors.
- The vehicle may be unlocked with a single press of the remote handset unlock button.

For all UK, Europe and ROW specification vehicles, a single press of the remote handset lock button will externally lock the vehicle to disengage the exterior handles, and will arm the active anti-theft system.
For additional information, refer to: Anti-Theft - Active (419-01A Anti-Theft - Active, Description and Operation).

For NAS, Japan and Gulf specification vehicles, a single press of the remote handset lock button will externally lock the vehicle to disengage the exterior handles, and will arm the active and passive anti-theft system. For additional information, refer to:

Anti-Theft - Active (419-01A Anti-Theft - Active, Description and Operation),
Anti-Theft - Passive (419-01 Anti-Theft - Passive, Description and Operation).

For all vehicles except NAS, Japan and Gulf specifications, pressing the remote handset lock button twice within 3 seconds

will double lock the vehicle to disengage the interior and exterior handles, and will arm the active and passive anti-theft system. For additional information, refer to:

Anti-Theft - Active (419-01A Anti-Theft - Active, Description and Operation),
Anti-Theft - Passive (419-01 Anti-Theft - Passive, Description and Operation).

Central Locking System - Automatic Modes

The central locking system features automatic modes to control the vehicle entry points, and provide protection for the system components.

The central locking system incorporates the following automatic modes:

- Mislock mode
- Speed dependant locking mode (if programmed)
- Crash unlocking mode
- Repetition blocking mode
- Lockout protection mode
- Automatic relock mode (if programmed)
- Transport mode.

Mislock Mode

A mislock occurs if the CJB receives an external lock or double lock request when a hinged panel is ajar. To indicate a mislock the CJB sounds the horns to produce a 100 millisecond 'chirp'.

If a mislock occurs due to an external lock request when a hinged panel is ajar, the CJB will not carry out a lock request on any access points.

Speed Dependant Locking Mode

When speed dependant locking is enabled the CJB will internally lock all the doors when the vehicle speed exceeds 8 km/h (5 mph) with all the doors closed and the engine running. If the driver or front passenger door is opened and then closed, when the vehicle slows down or stops and then increases to more than 8 km/h (5 mph) again, the CJB will internally lock the doors.

Speed dependant locking may be enabled or disabled by the dealer using the Land Rover approved diagnostic system.

Crash Unlocking Mode

With the ignition in power mode 6 (Ignition), if a crash occurs that triggers deployment of the air bags, then the CJB will unlock all of the doors. The CJB is informed of the crash by a status message from the Restraints Control Module (RCM) on the medium speed CAN bus that changes from 'no crash' to 'crash'.

The central locking system will also perform crash unlocking mode if a 'no crash' status message is not received from the RCM every 500 milliseconds.
For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).

Repetition Blocking Mode

To protect the central locking system motors and actuators against system mis-use, the CJB incorporates repetition blocking to limit the maximum operating rate of each motor and actuator. The lock motor in each door latch also incorporates thermal protection.

Central Locking System Motor and Actuator Operating Parameters

Motor or Actuator	Current On Time (ms)	Maximum Operations (per minute)	Nominal Operating Current (A)	Stall Current (A)
Liftgate latch	600 ± 10	10	3.6 to 5.2	7.5
Fuel filler door	700 ± 10	5	2.7	8
Door double lock	100 to 110	10	0.28	1.14
Door lock	100 to 110	10	0.54	3.31

Lockout Protection Mode

The vehicle is not able to be locked using a front door central locking button or instrument panel central locking switch if any door is open.

If an internal lock request is received from either of the front door central locking buttons, the CJB will centrally lock the vehicle and then centrally unlock the vehicle if any door is open.

If a front door is open and the open door central locking button is pressed and held in the locked position, the open front door may remain in the locked state. When the open door is subsequently closed, the CJB will centrally unlock all doors.

Automatic Relock Mode

Automatic relock prevents accidental operation of the remote handset buttons that will unlock and disarm the vehicle.

When the central locking system is unlocked using the remote handset, and a door or liftgate is not opened or the remote handset is not placed in the start control unit within 1 minute, the CJB will automatically lock or double lock the vehicle again, depending on the previously locked mode.

Transport Mode

All new vehicles are delivered from the factory in transport mode. Transport mode replaces the traditional transit relay and inhibits a number of electrical systems and features to reduce quiescent drain from the battery during delivery. When the vehicle is in transport mode 'transp' is displayed in the instrument cluster odometer. Single point entry is enabled and global locking and unlocking using the remote handset is disabled.

The speed locking mode is also disabled, but crash unlocking mode remains enabled.

To remove the vehicle from transport mode, the Land Rover approved diagnostic system must be connected during the Pre-Delivery Inspection (PDI). For further information, refer to the PDI manual.

Published: 22-Nov-2011

Handles, Locks, Latches and Entry Systems - Locks, Latches and Entry Systems

Diagnosis and Testing

Principle of Operation

For a detailed description of the locks, latches and entry systems and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Handles, Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Incorrectly aligned door(s), hood or tailgate • Fuel filler door lock actuator • Hood release handle • Hood release cables • Hood latch(es) • Exterior door handle(s) • Interior door handle(s) • Cable(s) • Tailgate release switch • Rear window release switch	• Fuses • Wiring harness • Wiring connector(s) • Door lock actuator(s) • Remote transmitter (key-fob or smart key) • Central locking switches • Controller Area Network (CAN) circuits • Radio frequency (RF) receiver • Central junction box (CJB) • Loose or corroded connections

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

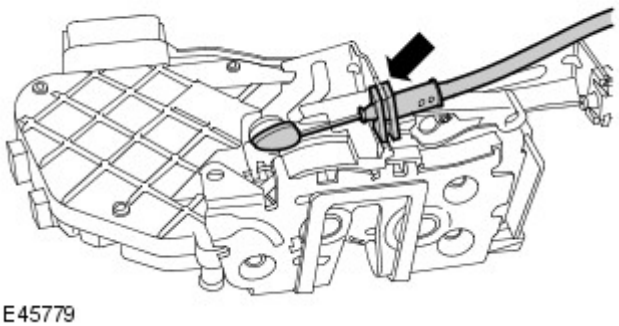
Symptom	Possible causes	Action
Door(s) will not open from outside	• Exterior door handle condition/installation • Exterior release cable disconnected from exterior door handle or door latch • Door latch failure	• Check the exterior door handle condition and installation • Check the condition and security of the exterior release cable • Check the operation of the latch GO to Pinpoint Test A.
Door(s) will not open from inside	• Child lock(s) engaged • Interior door handle condition/installation • Interior release cable disconnected from interior door handle or door latch • Door latch failure	• Check that the child locks are disengaged • Check the interior door handle condition and installation • Check the condition and security of the interior release cable • Check the operation of the latch. GO to Pinpoint Test A.
The message center indicates that the hood, the tailgate or a door is open when it appears to be closed Vehicle indicates a miss-lock when the hood, tailgate and doors appear to be closed	• Incorrect striker alignment/adjustment • Ajar switch circuit short circuit to ground • Ajar switch failure	• Check/adjust the strikers as necessary • Check for DTCs indicating an ajar switch fault. Refer to the DTC index
Fuel flap does not lock/unlock	• Fuel flap cable detached from body • Fuel flap actuator detached from mounting bracket • Fuel flap actuator disconnected • Fuel flap actuator failure	• Check the condition and installation of the fuel flap cable • Check the security of the fuel flap actuator and bracket • Check the security of the actuator electrical connector • Check for DTCs indicating a fuel flap actuator fault. Refer to the DTC index

Symptom	Possible causes	Action
Door latching and locking function test	• Door latch • Cable fault • Door handle • Door lock switch • Wiring harness • Central junction box (CJB)	• NOTE: **Complete the diagnostic steps below to confirm any concern prior replacing the component** • Check for relevant stored DTCs • Once any DTC related faults have been rectified continue with the diagnostic steps below • The first component that should be checked when experiencing locking or latching issues are the door latch release cables, then the door latch. These can be tested as a discrete components to confirm if the specific component is working as designed or is demonstrating a fault • **Single door will not open from the outside (but opens from the inside)**GO to Pinpoint Test A. • **Single Door Will Not Open From The Inside (but opens from the outside)**GO to Pinpoint Test B. • **Door Latching and Locking Function Test**GO to Pinpoint Test C. • **No lock / unlock function from key-fob**GO to Pinpoint Test E.
Latch mounted door ajar switch test	• Door latch • Wiring harness • Instrument cluster	• **Latch Mounted Door Ajar Switch Test**GO to Pinpoint Test D.
Vehicle electrical system test	• Fuses • Wiring harness • Wiring connector(s)	• **Vehicle Electrical System Test**GO to Pinpoint Test E. • Check for relevant stored DTCs • Refer to the electrical circuit diagrams to locate the fault • Carry out continuity test to confirm circuit integrity

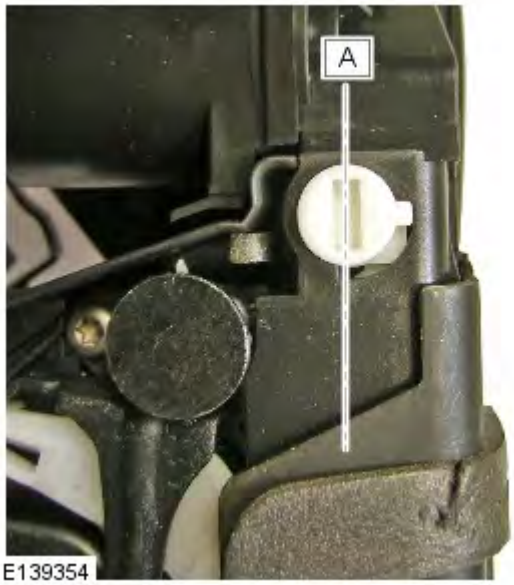
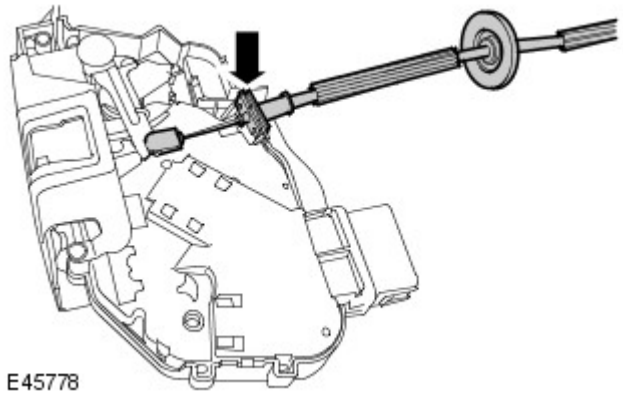
DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Body Control Module (BCM) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Driver/Passenger Door Module (DDM/PDM) (100-00 General Information, Description and Operation).

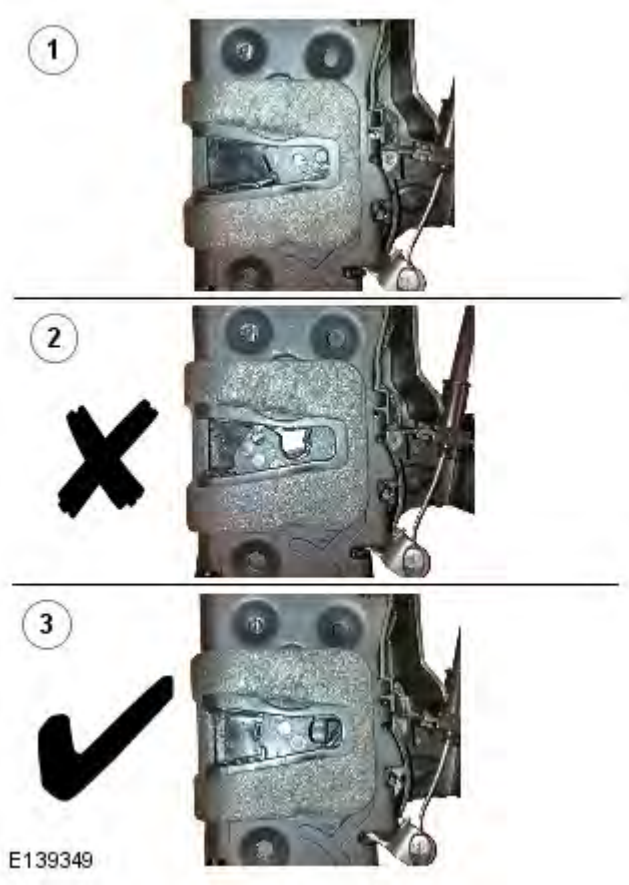
Pinpoint Test

PINPOINT TEST A : SINGLE DOOR WILL NOT OPEN FROM THE OUTSIDE (BUT OPENS FROM THE INSIDE)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE EXTERIOR DOOR RELEASE CABLE TO EXTERIOR DOOR HANDLE IS INSTALLED CORRECTLY	
	1 Remove the door trim panel as necessary. REFER to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) / Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
	2 Confirm the exterior door release cable is correctly installed to the exterior door handle
	Is the cable correctly installed? **Yes** GO to A2. **No** Connect the door release cable correctly. **If the cable is damaged, install a new door release cable**. Test the system for normal operation.
A2: CHECK THE EXTERIOR DOOR HANDLE RELEASE CONNECTION TO THE DOOR LATCH	
 E45779	1 Confirm the exterior door handle release connection to the door latch is installed correctly

	Is the exterior door handle release cable installed correctly? **Yes** GO to Pinpoint Test C. **No** Connect the door release cable correctly. **If the cable is damaged, install a new door release cable**. Test the system for normal operation.

PINPOINT TEST B : SINGLE DOOR WILL NOT OPEN FROM THE INSIDE (BUT OPENS FROM THE OUTSIDE)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE INTERIOR DOOR RELEASE CABLE TO INTERIOR DOOR HANDLE IS INSTALLED CORRECTLY	
 E139354	• NOTE: Figure A - Child lock off position shown 1 Make sure the child lock is disengaged (rear door only)
	2 Remove the door trim panel as necessary REFER to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) / Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation). 3 Confirm the interior door release cable is correctly installed to the interior door handle
	Is the cable correctly installed? **Yes** GO to B2. **No** Connect the door release cable correctly. **If the cable is damaged, install a new door release cable**. Test the system for normal operation
B2: CHECK THE INTERIOR DOOR HANDLE RELEASE CONNECTION TO THE DOOR LATCH	
 E45778	1 Confirm the interior door handle release connection to the door latch is installed correctly
	Is the interior door handle release cable installed correctly? **Yes** GO to Pinpoint Test C. **No** Connect the door release cable correctly. **If the cable is damaged, install a new door release cable**. Test the system for normal operation.

PINPOINT TEST C : DOOR LATCHING AND LOCKING FUNCTION TEST

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: DOOR LATCH TEST	
• NOTE: Test as a single component to ensure that the door latch is not replaced unnecessarily, when another component may be at fault	
	1 Remove door trim from door REFER to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) / Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
	2 Remove module plate / closing panel from door
	3 Remove latch module from door REFER to: (501-14 Handles, Locks, Latches and Entry Systems) Front Door Latch (Removal and Installation), Rear Door Latch (Removal and Installation).
	4 Inspect latch module for any visual damage
	5 **Disconnect** interior release bowden cable at door latch
	6 **Disconnect** exterior release bowden cable at door latch
	7 With the latch in hand, connect the electrical connector(s) to connect door latch to door harness
	• NOTE: **THE LATCH IS NOW READY TO TEST** 8 Close all vehicle doors except the door being investigated
	• NOTE: Figure 1 - Unlatched position shown • NOTE: Figure 2 - First safety latched position shown • NOTE: Figure 3 - Fully latched position shown • NOTE: **Test will not work if latch is only in first safety latch position** 9 Rotate latch claw (using a small screw driver or similar) to the fully latched position (Figure 3)

 E139350	• NOTE: Unlocked position shown 10 Confirm that the latch interior release lever is in the unlocked position as shown
 E139351	• NOTE: Locked position shown 11 Press the **lock** button on the key-fob or smart key
	Does the latch interior release lever move from the unlocked position to the locked position? **Yes** GO to C2. **No** If this is a repeat test and the vehicle electrical test section has been completed and confirmed that vehicle is working correctly, then replace the door latch. If replacing latch as part of a warranty claim, please quote reference code **LKINOP** in the technician comments section of the warranty claim

C2: TEST 1 DOOR LATCH

• NOTE: Locked position shown

1 With the latch in the locked state (i.e. the latch interior release lever is in the locked position), press the key-fob or smart key**unlock** button

Does the latch interior release lever move from the locked position to the unlocked position?

Yes

GO to C3.

No

GO to Pinpoint Test E. If pinpoint test E has been completed and confirmed that vehicle is correctly supplying signals to latch, then replace the door latch. If replacing latch as part of a warranty claim, please quote reference code **UNLKINOP** in the technician comments section of the warranty claim

C3: TEST 2 DOOR LATCH

• NOTE: Fully latched position shown

1 With the latch in its unlocked state, push the latch exterior release lever against its return spring, whilst simultaneously applying a light pressure to release the latch claw using a small screw driver or similar

Does the latch claw release?

Yes

GO to C4.

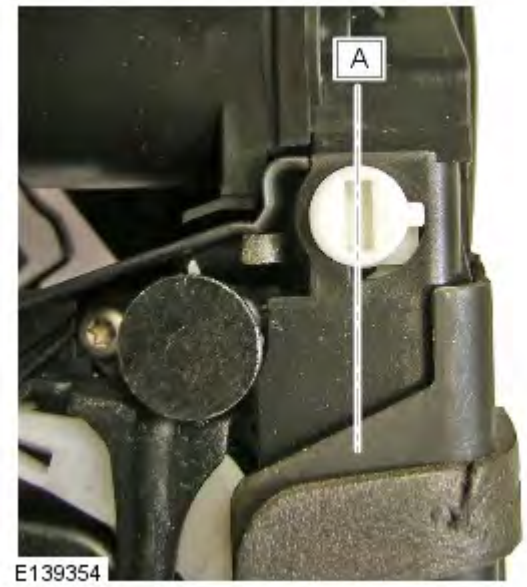
No

Repeat tests **C2** and **C3** to confirm the fault. GO to C2. If the repeat test has confirmed that the exterior release lever will not release the claw on an unlocked latch replace the door latch. If replacing latch as part of a warranty claim, please quote reference code **EXTINOP** in the technician comments section of the warranty claim

C4: TEST 3 DOOR LATCH

- NOTE: Fully latched position shown

1 Using a small screw driver or similar, rotate latch claw to the second fully latched position



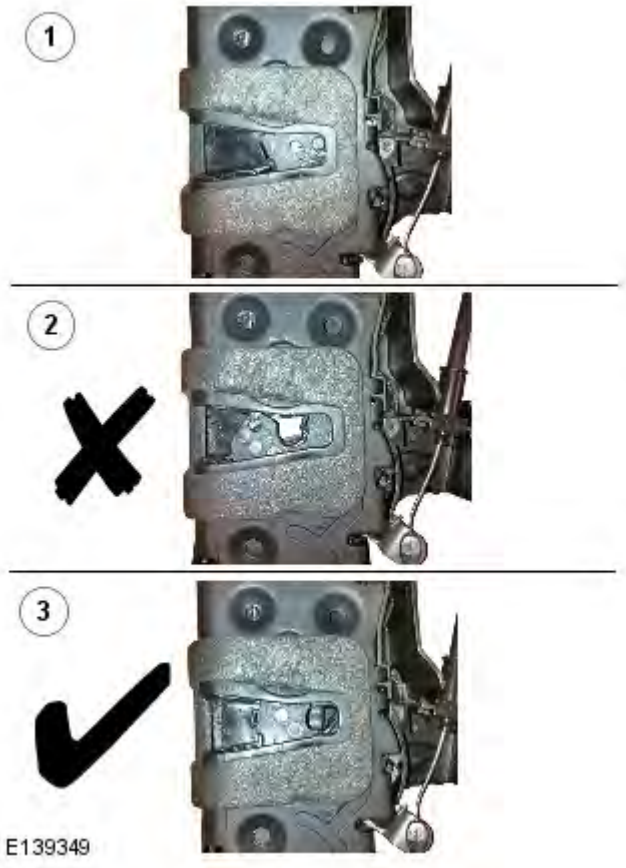
- NOTE: Figure A - Child lock off position shown

2 If testing a rear door latch, ensure that the child lock is turned to the off position

3 Confirm that the latch interior release lever is in the unlocked position as shown

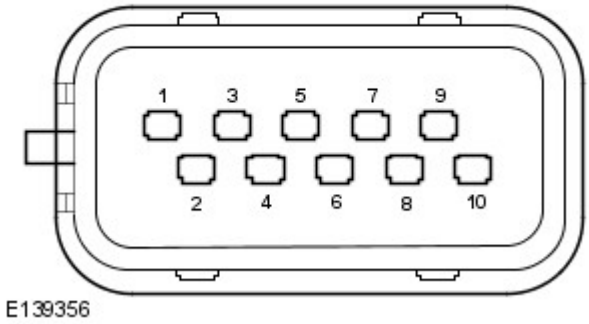
 E139355	4 Whilst the latch is still in its unlocked state, push the latch interior release lever against its return spring, whilst simultaneously applying a light pressure to release the latch claw using a small screw driver or similar
	Does the latch claw release **Yes** Latch has passed all tests to confirm its correct function. **DO NOT REPLACE LATCH** as part of any attempts to resolve any locking functionality issues. GO to Pinpoint Test E. To confirm vehicle electrical signal is received by the latch **No** Repeat this testGO to C4. If repeat test has confirmed that the interior release lever will not release the claw when the latch is in the unlocked state, then replace the latch. If replacing latch as part of a warranty claim, please quote reference code **INTINOP** in the technician comments section of the warranty claim

PINPOINT TEST D : LATCH MOUNTED DOOR AJAR SWITCH TEST	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: TEST 4 DOOR LATCH	
• NOTE: If a customer is complaining of issues relating to a door ajar signal e.g. door latch won't lock, or alarm system triggering (indicated via DTC's), there may be several components that generate the fault, including ● Door Latch ajar switch ● Alarm control module ● Central junction box ● Body wiring harness / connectors ● Door wiring harness / connectors	
• NOTE: To investigate the functioning of the door ajar switch contained within the door latch, to prove or eliminate the door latch mounted door ajar switch as the root cause, follow the process below. This will prevent the unnecessary replacement of a correctly functioning door latch	
	1 Remove door trim from door REFER to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) / Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
	2 Remove module plate / closing panel from door
	3 Remove latch module from door REFER to: (501-14 Handles, Locks, Latches and Entry Systems) Front Door Latch (Removal and Installation), Rear Door Latch (Removal and Installation).
	4 Inspect latch module for any visual damage



- NOTE: Figure 1 - Unlatched position shown
- NOTE: Figure 2 - First safety latched position shown
- NOTE: Test will not work if latch is only in first safety latch position

5 Using a small screw driver or similar, rotate latch claw to the second fully latched position (figure 3)



6 Carry out continuity test between terminals **1 and 4 (left side)** or **8 and 4 (right side)** with claw closed

Does the continuity test pass?

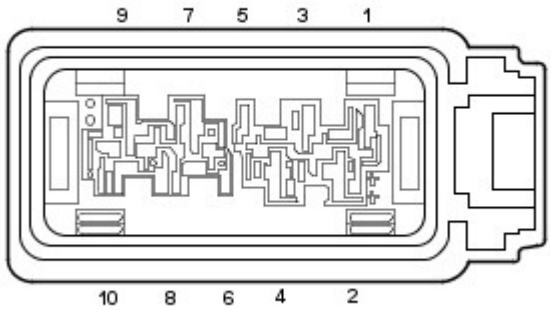
Yes

The latch ajar switch is working correctly. **Do not replace latch**. Investigate for fault elsewhere in vehicle system

No

Release latch claw and repeat test from step 5 to confirm result. If this is a repeat test and you are sure that the ajar switch does not provide continuity when fully latched. Replace the latch. If replacing latch as part of a warranty claim, please quote reference code **AJARINOP** in the technician comments section of the warranty claim

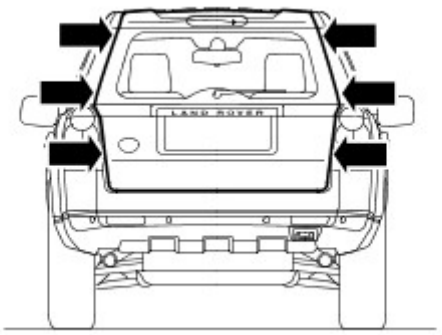
PINPOINT TEST E : VEHICLE ELECTRICAL SYSTEM TEST	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: TEST 5 LOCK COMMAND	

 E139357	1 Disconnect electrical connector from latch
	2 Close all vehicle doors apart from door being investigated, please note which door, left side or right side is under investigation
	3 Monitor the circuit for momentary power when locking the vehicle via the key-fob or smart key between terminals **1 and 10 left side** or **8 and 10 right side**
	Is there momentary power (for approx 8 seconds) between terminals **1 and 10 left side** or **8 and 10 right side** when locking the vehicle via the key-fob or smart key **Yes** The vehicle electrical system is locking correctly, providing the signal to the latch. GO to E2. **No** Refer to the electrical circuit diagrams and investigate why vehicle electrical system is not providing signals to the latch. Using the manufacturer approved diagnostic system check for logged DTCs to localize the fault
E2: TEST 6 UNLOCK COMMAND	
	1 Monitor the circuit for momentary power when unlocking the vehicle via the key-fob or smart key between terminals **1 and 9 left side** or **8 and 9 right side**
	Is there momentary power (for approx 8 seconds) between terminals **1 and 9 left side** and **8 and 9 right side** when unlocking the vehicle via the key-fob or smart key **Yes** The vehicle electrical system is unlocking correctly, providing the signal to the latch. Plug electrical connector back in to latch. Rebuild vehicle and check for correct operation **No** Refer to the electrical circuit diagrams and investigate why vehicle electrical system is not providing signals to the latch. Using the manufacturer approved diagnostic system check for logged DTCs to localize the fault

Published: 11-May-2011

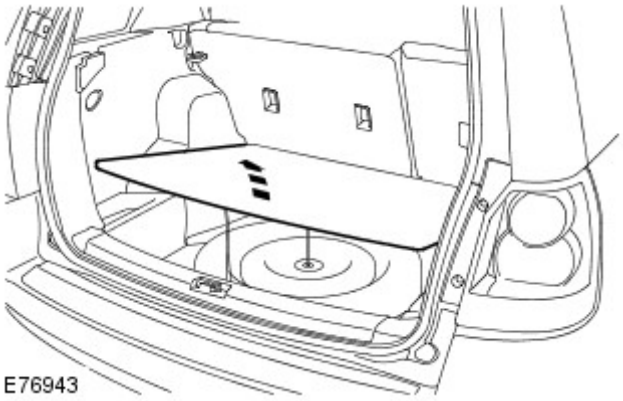
Handles, Locks, Latches and Entry Systems - Liftgate Striker Adjustment

General Procedures



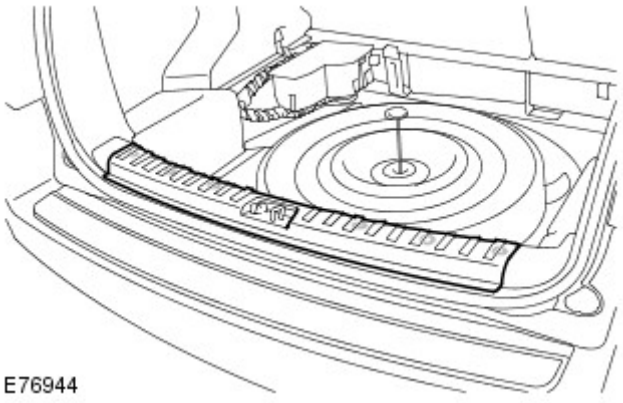
E77113

1. Check for an equal gap and alignment to the adjacent panels. If incorrect, follow the adjust procedure below.



E76943

2. Remove the spare wheel cover.



E76944

3. Remove the loadspace scuff plate.

E77114

4. Loosen the 2 liftgate striker bolts.

5. Close the liftgate and check for an equal gap and alignment to the adjacent panels.

6. Open the liftgate and tighten the liftgate striker bolts.

   Torque: 25 Nm

7. Install the loadspace scuff plate.

8. Install the spare wheel cover.

Published: 11-May-2011

Handles, Locks, Latches and Entry Systems - Front Door Latch

Removal and Installation

Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the window motor and regulator assembly.

   Refer to: Front Door Window Regulator and Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).

3. **3.** CAUTION: Release the exterior door handle and screw cover clips from inside the door.

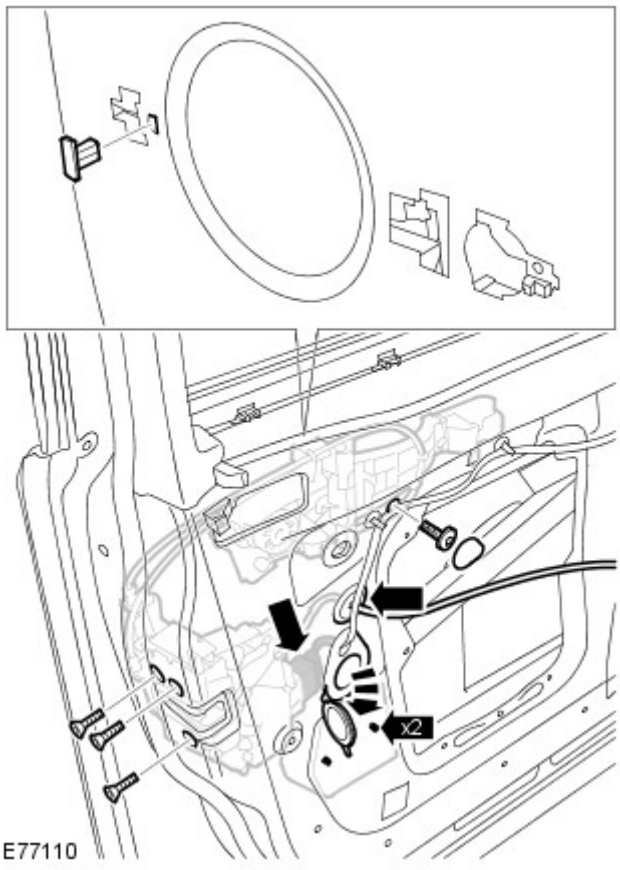
   Remove the front door exterior handle.

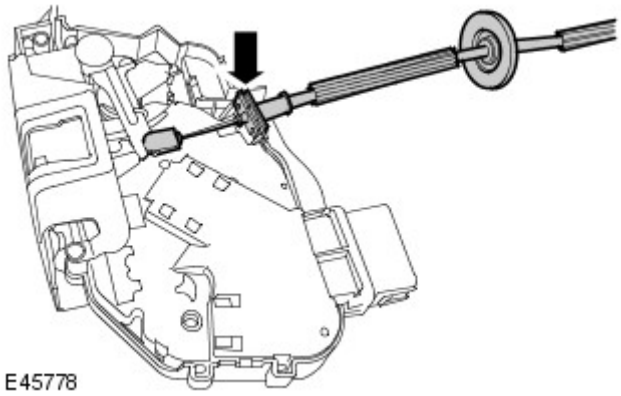
   Refer to: Exterior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

4. Release the remote control cable.

5. Release the door exterior handle mechanism.

6. Remove the front door latch assembly.

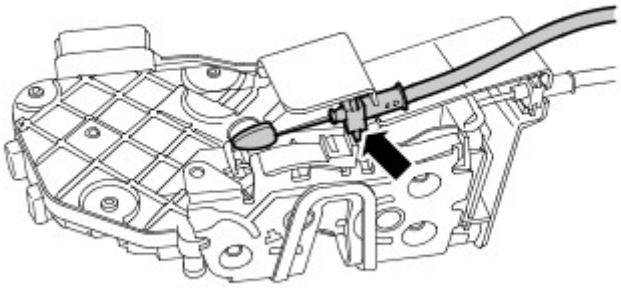



E45778

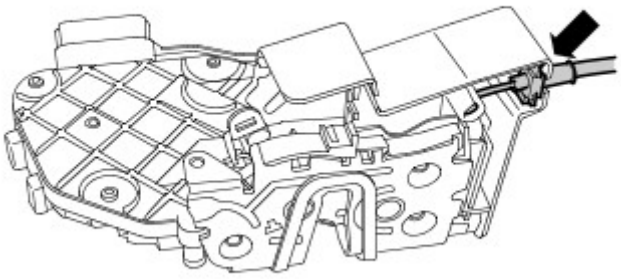
7. **7.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the door latch remote control cable.

8. Release the exterior door handle mechanism cable from the door latch.

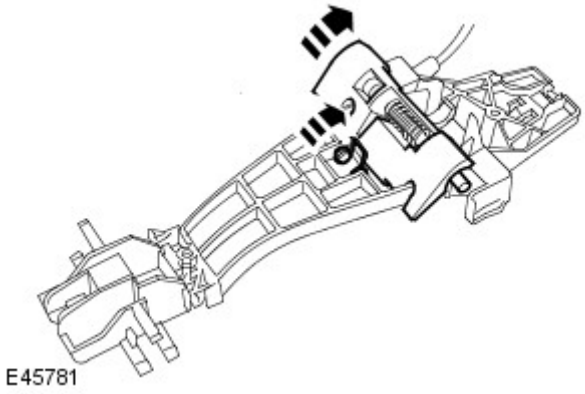

E77111

9. LH side: Release the door lock cylinder cable from the door latch.


E77112

Installation

1. LH side: Connect the door lock cylinder cable to the door latch.
2. Connect the door exterior handle mechanism cable to the door latch.
3. Install the remote control cable to the door latch.



4.
- Set the exterior handle mechanism.
- Rotate the lever.
- Engage the retaining tang.

5. Install the door latch and tighten the screws.

   Torque: 10 Nm

6. Install the door exterior handle mechanism.

7. Position the remote control cable to the door.

8. Install the front door exterior handle.

   Refer to: Exterior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

9. Install the window motor and regulator assembly.

   Refer to: Front Door Window Regulator and Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).

10. Connect the battery ground cable.

    Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Handles, Locks, Latches and Entry Systems - Rear Door Latch

Removal and Installation

Removal

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the window motor and regulator assembly.

   Refer to: Rear Door Window Regulator and Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).

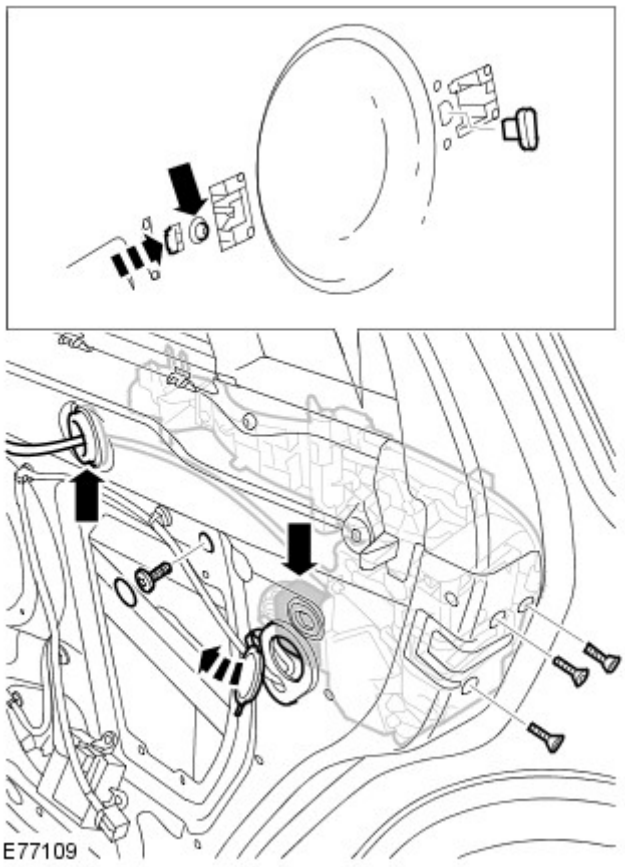
3. **3.** CAUTION: Release the exterior door handle and screw cover clips from inside the door.

   Remove the rear door exterior handle.

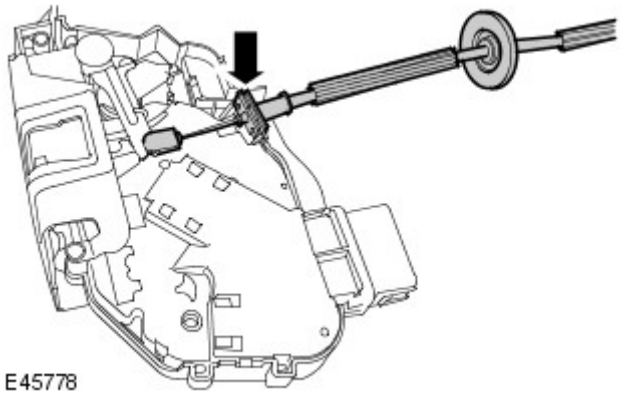
   Refer to: Exterior Rear Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

4. Release the remote control cable.

5. Release the door exterior handle mechanism.



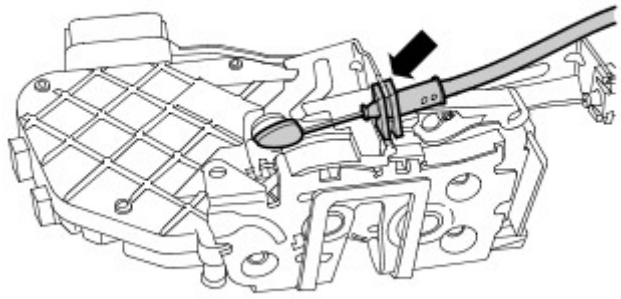
6. Remove the rear door latch assembly.


E45778

7. **7.** NOTE: Do not disassemble further if the component is removed for access only.

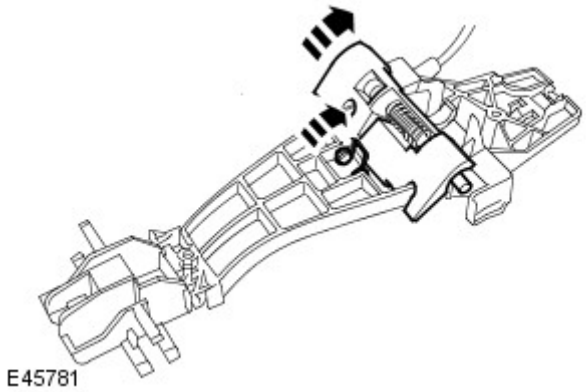
   Remove the door latch remote control cable.

8. Release the exterior door handle mechanism cable from the door latch.


E45779

Installation

1. Connect the door exterior handle mechanism cable to the door latch.
2. Install the remote control cable to the door latch.
3.
   - Set the exterior handle mechanism.
   - Rotate the lever.
   - Engage the retaining tang.


E45781

4. Install the door latch and tighten the screws.

   Torque: 10 Nm

5. Install the door exterior handle mechanism.
6. Position the remote control cable to the door.
7. Install the rear door exterior handle.

Refer to: Exterior Rear Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

8. Install the window motor and regulator assembly.

   Refer to: Rear Door Window Regulator and Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).

9. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

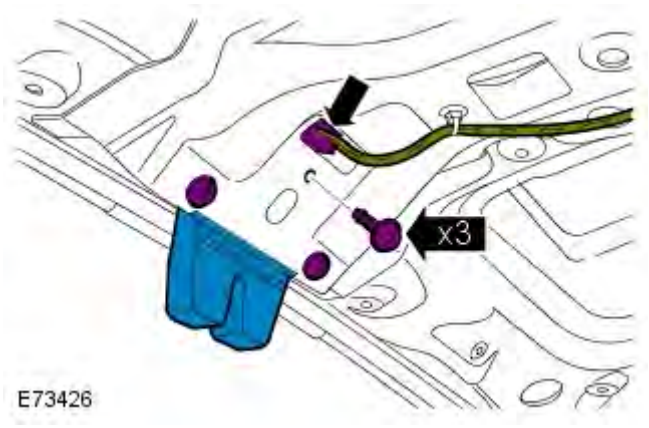
Handles, Locks, Latches and Entry Systems - Liftgate Latch

Removal and Installation

Removal

1. Remove the liftgate trim panel.

   Refer to: Liftgate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.
   - Torque: 25 Nm (18 lb.ft).

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Handles, Locks, Latches and Entry Systems - Exterior Front Door Handle

Removal and Installation

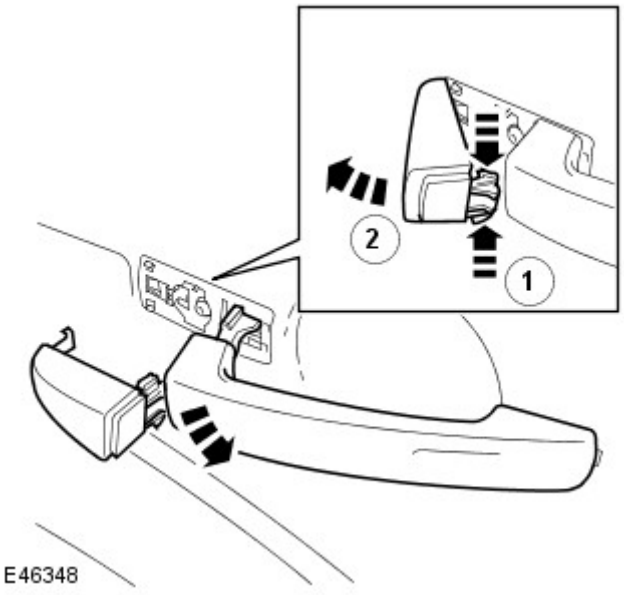
Removal

• NOTE: This procedure details removal and installation of both the LH and RH exterior front door handles.

• NOTE: If the exterior handle is to be removed in conjunction with additional door internal items, then it is recommended that the screw cover and exterior handle be released from the inside of the door.

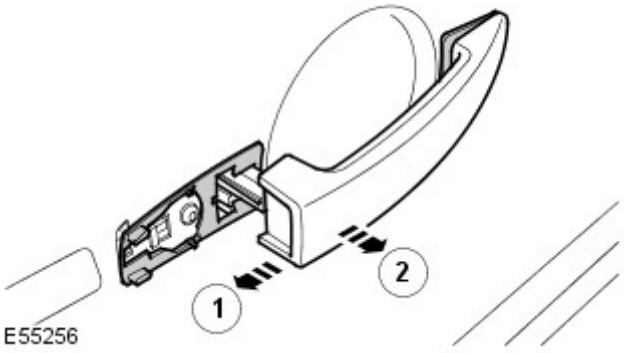
1. LH side: Remove the private lock.

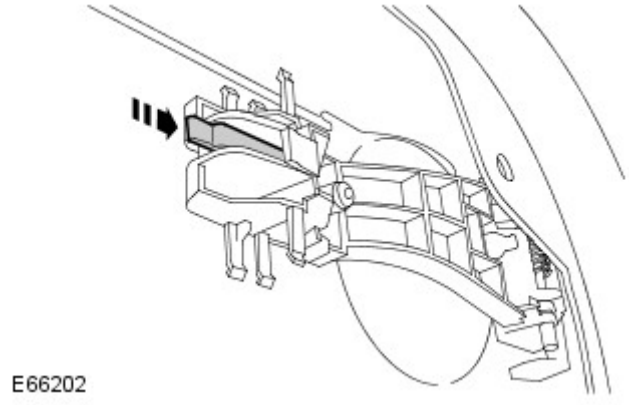
   Refer to: Door Lock Cylinder (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).



2. RH side: Release the 2 clips.

3. To remove the exterior front door handle, without removal of the door trim pad.

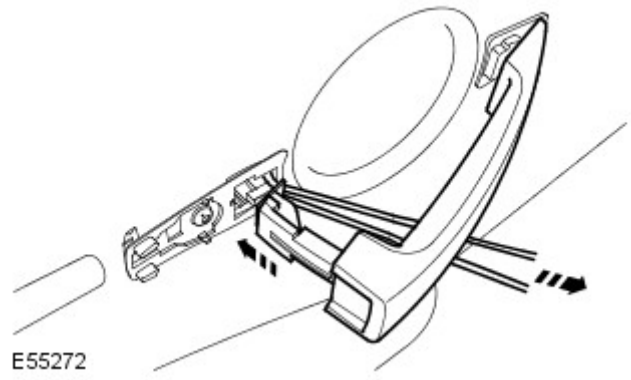




4. To remove the exterior front door handle, after removal of the door trim pad and regulator.

Installation

1. To install, reverse the removal procedure.



2. Use a length of cord to hold the lock lever against spring pressure, while engaging the outside handle.

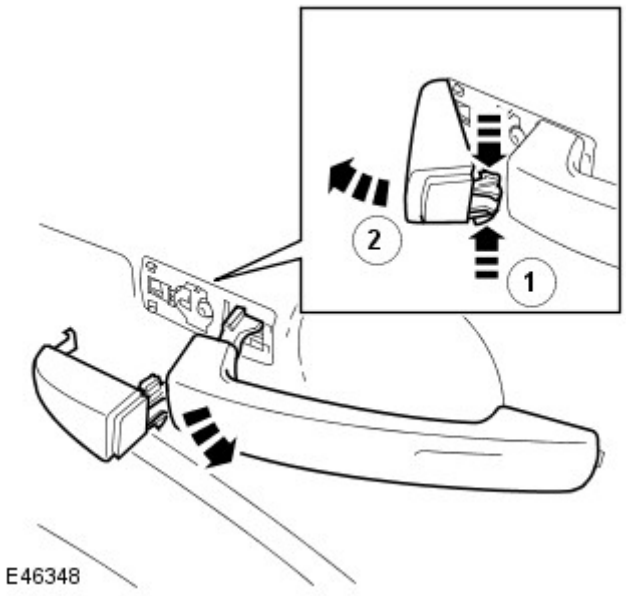
Published: 11-May-2011

Handles, Locks, Latches and Entry Systems - Exterior Rear Door Handle

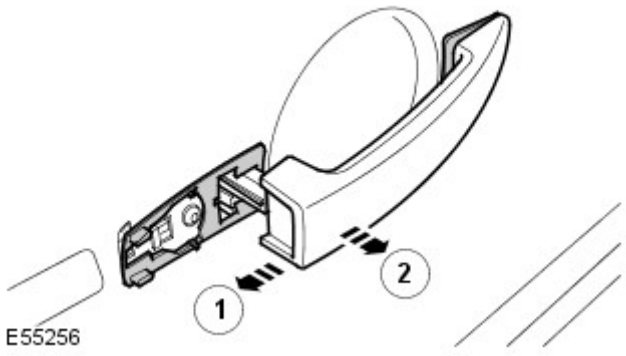
Removal and Installation

Removal

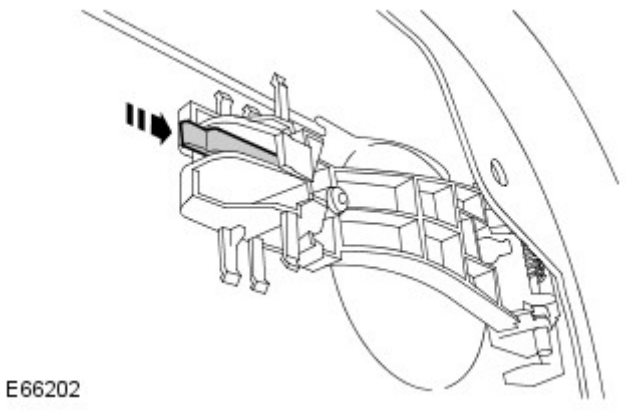
• NOTE: If the exterior handle is to be removed in conjunction with additional door internal items, then it is recommended that the screw cover and exterior handle be released from the inside of the door, after removal of the door trim pad, regulator and motor.



1.
- Release the 2 clips.



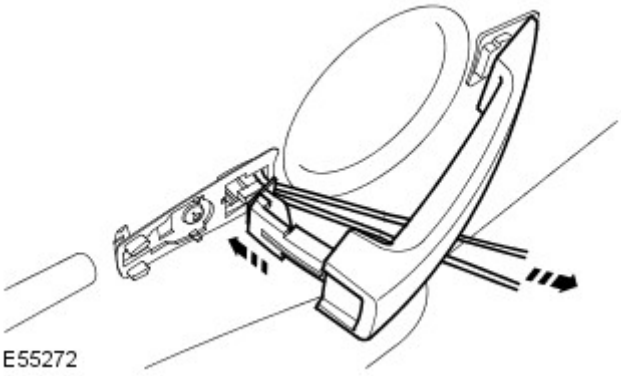
2. To remove the exterior rear door handle, without removal of the door trim pad.



3. To remove the exterior rear door handle, after removal of the door trim pad and regulator.

Installation

1. To install, reverse the removal procedure.



2. Use a length of cord to hold the lock lever against spring pressure, while engaging the outside handle.

Published: 11-May-2011

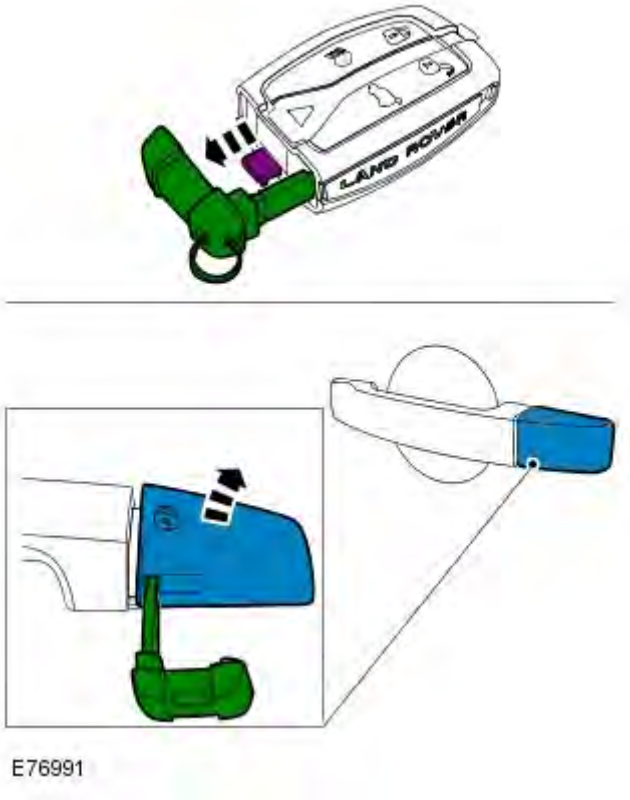
Handles, Locks, Latches and Entry Systems - Door Lock Cylinder

Removal and Installation

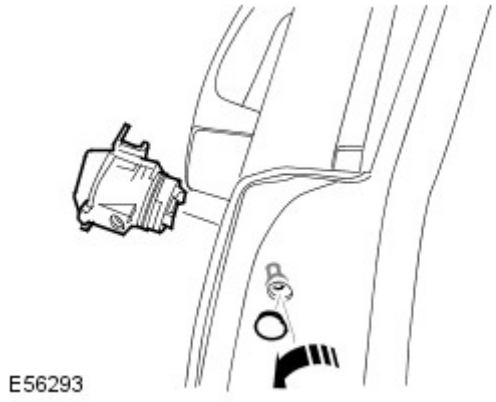
Removal

• NOTE: This procedure is for removal and installation of the door lock cylinder only. The ignition lock and door lock cylinders are replaced in sets.

1.



2. **2.** NOTE: Remove the screw sufficiently, only to release the component.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Wipers and Washers -

Capacities

Item	Capacity (liters/pints/US quarts)
Windscreen washer reservoir:	
With headlamp wash	5.8/10.2/6.1
Without headlamp wash	3.1/5.5/3.3

General Specification

Item	Specification
Front wiper motor	Valeo
Power washer pump make	Kautex Textron
Rain sensor	Bonded to inner surface of the windscreen behind the interior mirror
Rear wiper motor	Valeo

Torque Specifications

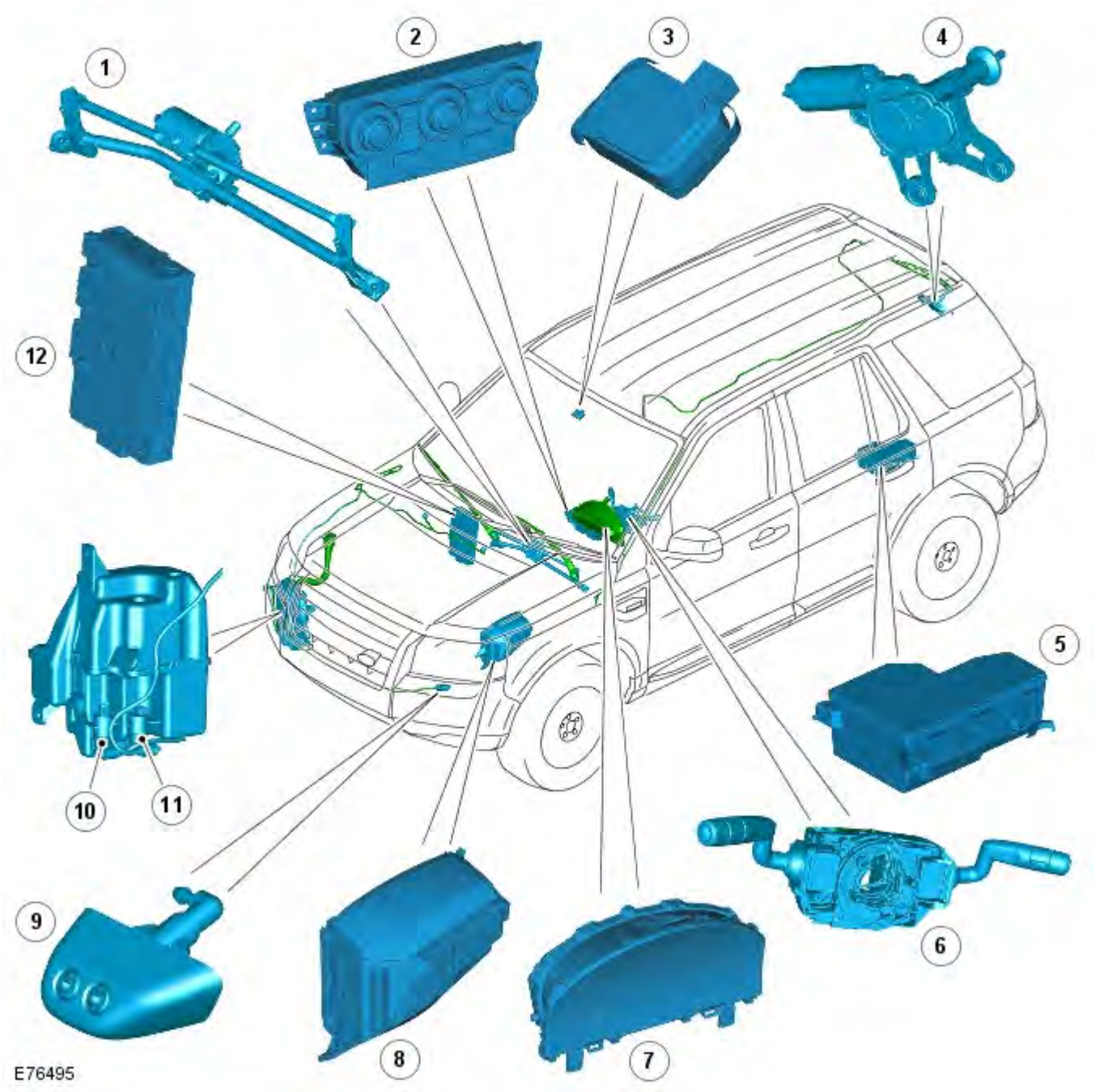
Description	NM	lb-ft
Front wiper arms to linkage nut	45	33
Rear window wiper motor nuts	10	7
Rear wiper arm to motor nut	7	5
Wiper linkage to body bolts	8	6
Washer reservoir and pump assembly to body bolts	6	4
Washer reservoir and pump assembly to bumper armature bolts	6	4
Washer reservoir filler neck support bolt	4	3
Windshield wiper motor bolts	10	7

Published: 11-May-2011

Wipers and Washers - Wipers and Washers

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Windshield wiper motor and linkage assembly
2	-	Automatic Temperature Control (ATC) module
3	-	Rain sensor (if fitted)
4	-	Rear screen wiper motor
5	-	Auxiliary Junction Box (AJB)
6	-	Right Hand (RH) steering column multi-function switch
7	-	Instrument cluster
8	-	Battery Junction Box (BJB)
9	-	Headlamp washer jets
10	-	Headlamp washer pump
11	-	Windshield and rear screen washer pump
12	-	Central Junction Box (CJB)

OVERVIEW

Windshield wiper and washer operation is controlled by the CJB in response to driver input and if fitted, signals from the rain sensor. The front wipers have 4 operational states:

- Flick wipe
- Intermittent/Auto (vehicles without/with rain sensor fitted)
- Slow wipe
- Fast wipe.

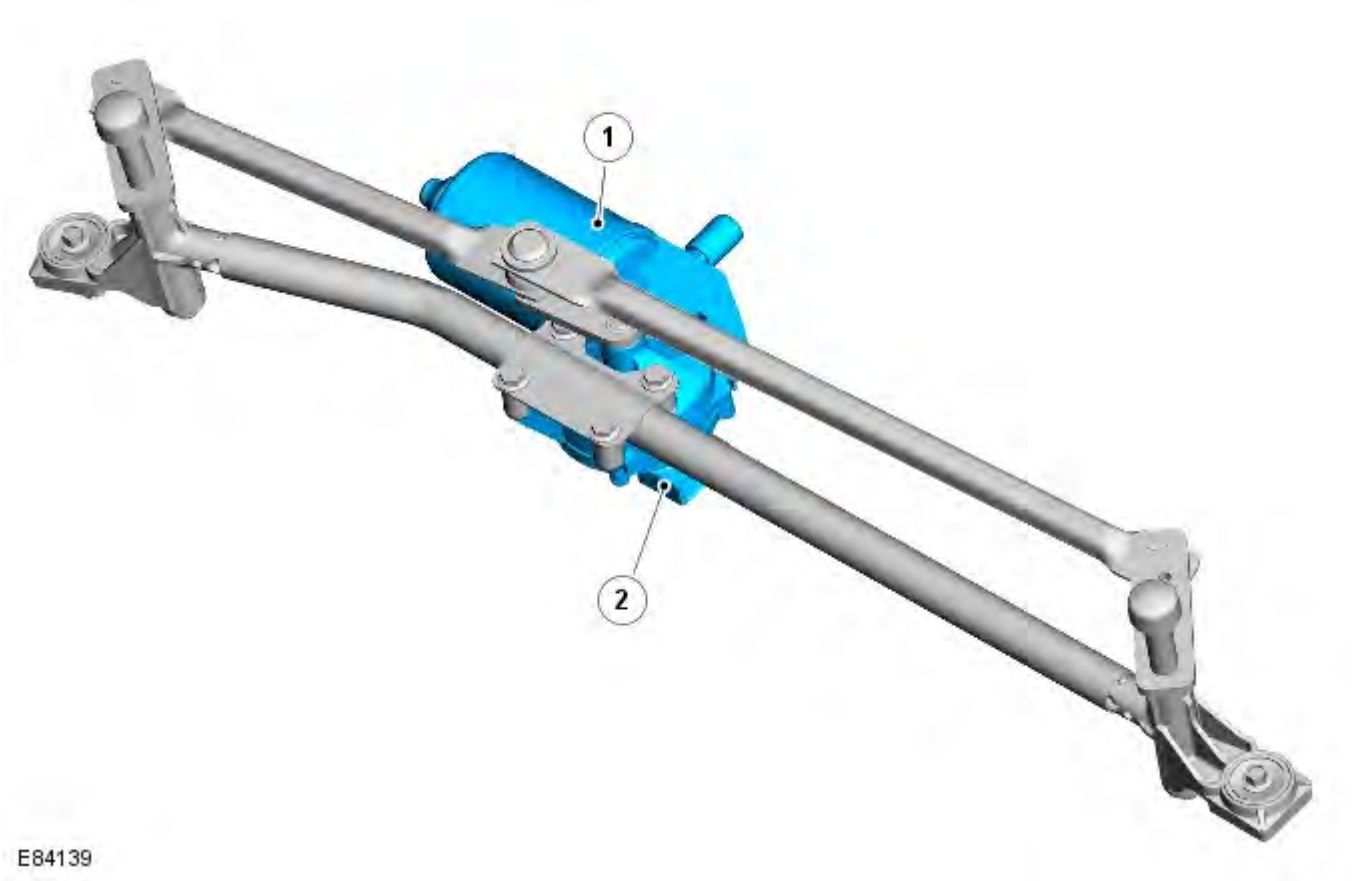
The 'Auto' function requires an input from the rain sensor. The rain sensor is mounted on the inner surface of the windshield and transmits an infra-red signal to determine the amount of water on the outer surface of the windshield. A value is then transmitted to the CJB over the Local Interconnect Network (LIN) bus.

The CJB also controls operation of the headlamp wash function. For more information, refer to 'Headlamp Washers' below.

The rear screen wiper system operates independently of the windshield wiper system and is controlled by the CJB on receipt of LIN bus messages from the RH steering column multi-function switch.

• NOTE: The windshield and rear screen washers utilize the same pump meaning only 1 wash function, either front or rear, can be performed at any one time.

WINDSHIELD WIPER MOTOR

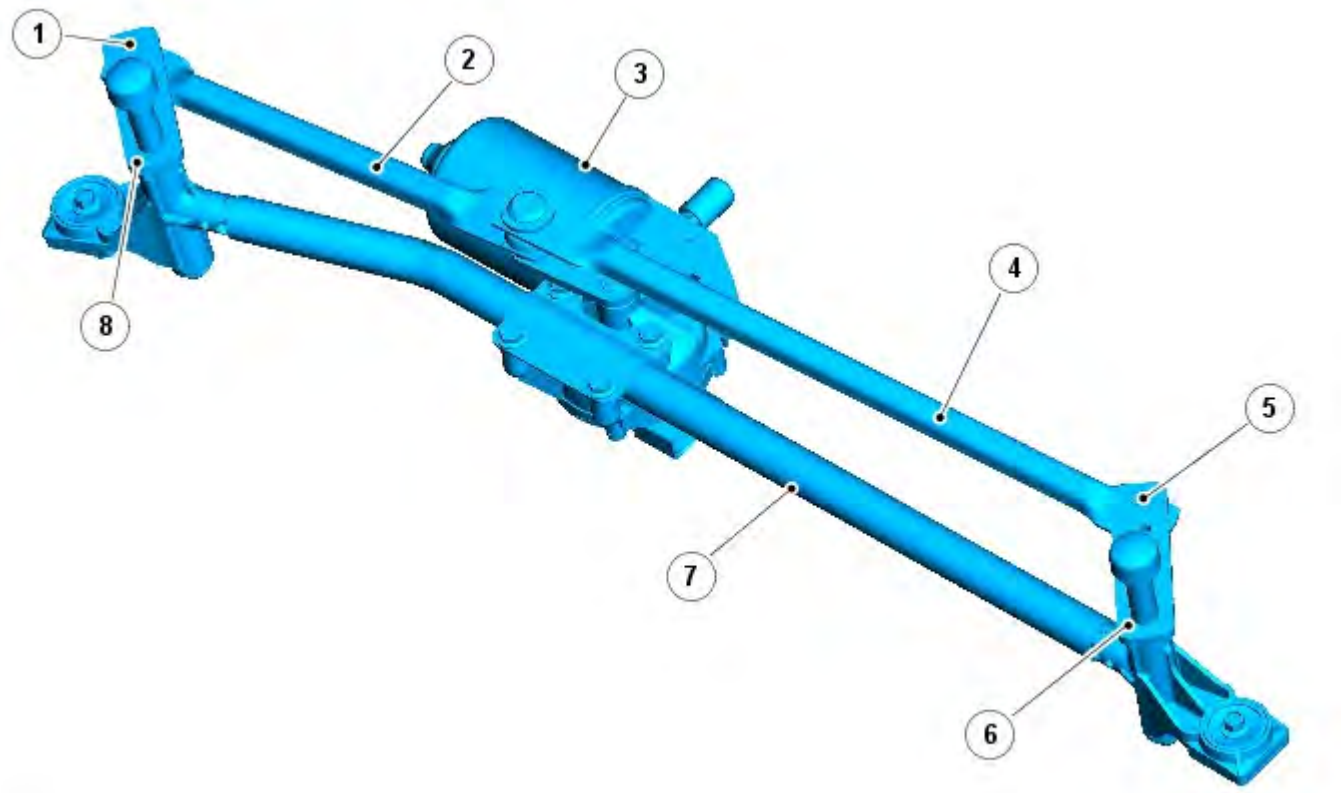


Item	Part Number	Description
1	-	Motor
2	-	Electrical connector

The windshield wiper motor drives a gear wheel via a worm drive attached to the motor spindle. The gear wheel has a central spigot which provides the attachment point for the motor crank. The motor crank attaches directly to the wiper linkage link rods and is secured by a single nut. The motor assembly and wiper linkage are a single component and must be removed or replaced as such.
For additional information, refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

The motor assembly is connected to the vehicle harness by a 4 pin electrical connector. The electrical connector provides 2 battery voltage feeds from the BJB, a wiper park feed from the CJB, and a ground path for the motor assembly.

WINDSHIELD WIPER LINKAGE



E84140

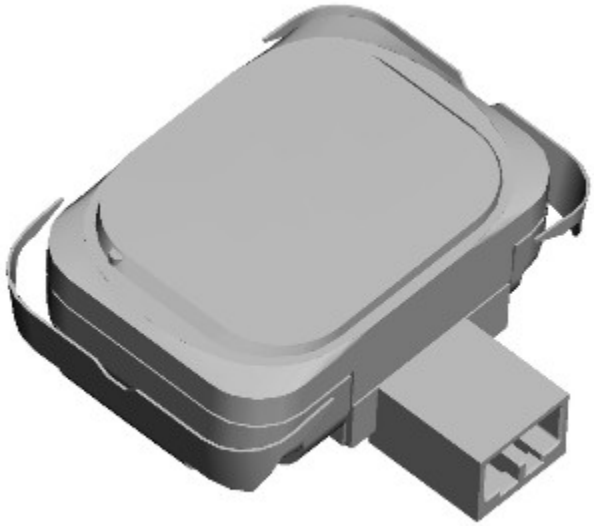
Item	Part Number	Description
1	-	RH crank
2	-	RH link rod
3	-	Windshield wiper motor
4	-	Left Hand (LH) link rod
5	-	LH pivot assembly
6	-	LH crank
7	-	Main tube
8	-	RH pivot housing

The windshield wiper linkage comprises a main tube with a pivot housing at each end. The windshield wiper motor is mounted centrally on the main tube and acts directly on a pair of link rods. The link rods convert the rotary motion of the motor into a linear, reciprocating motion.

The link rods are connected to the main tube via a crank at each end. The cranks convert the linear, reciprocating motion of the link rods into a rotary, reciprocating motion of the pivots. This translates to a reciprocating motion of the wiper blades across the windshield.

The windshield wiper linkage and motor assembly are a single component and must be removed or replaced as such. For additional information, refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

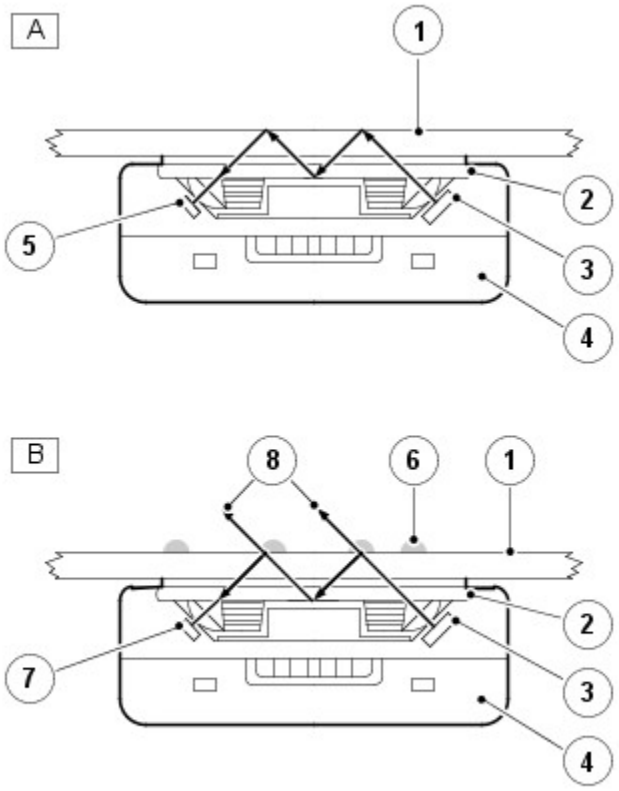
RAIN SENSOR



E84141

The rain sensor is located behind the interior mirror trim casing and sits in a bracket which is bonded to the inner surface of the windshield. The sensor contains a number of transmitter and receiver diodes which emit and receive infrared light. By comparing the received light signal against the known transmitted light signal, the rain sensor can determine the amount of water on the outer surface of the windshield.

• NOTE: **A** = Clean and dry windshield; **B** = Wet and dirty windshield



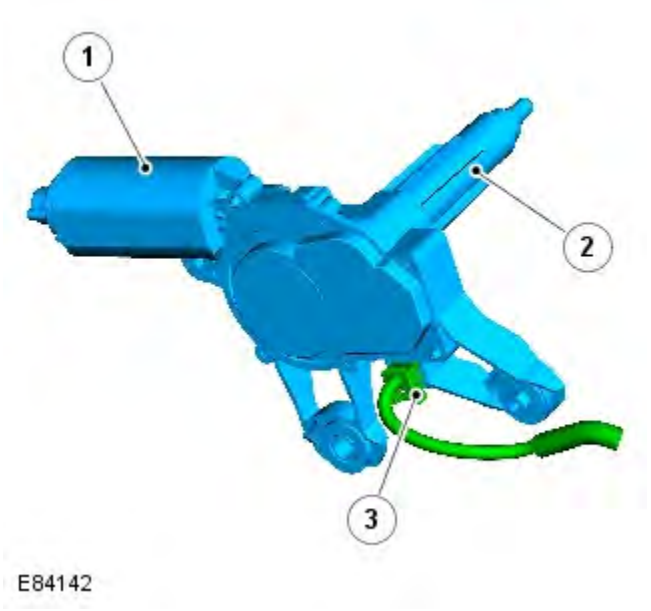
E43326

Item	Part Number	Description
1	-	Windshield outer surface
2	-	Optical element
3	-	Transmitter diodes (100% light transmitted)
4	-	Rain sensor
5	-	Receiver diodes (100% light received)
6	-	Water droplets/film
7	-	Receiver diodes (less than 100% light received)
8	-	Lost light

• NOTE: The rain sensor also contains a light sensor. The light sensor is used to control operation of the automatic headlamps function.
For additional information, refer to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

The rain sensor is connected to the vehicle harness by a 3 pin electrical connector. The electrical connector provides a power feed from the CJB, a LIN bus connection to the CJB and a ground path.

REAR SCREEN WIPER MOTOR



Item	Part Number	Description
1	-	Motor
2	-	Spindle
3	-	Electrical connector

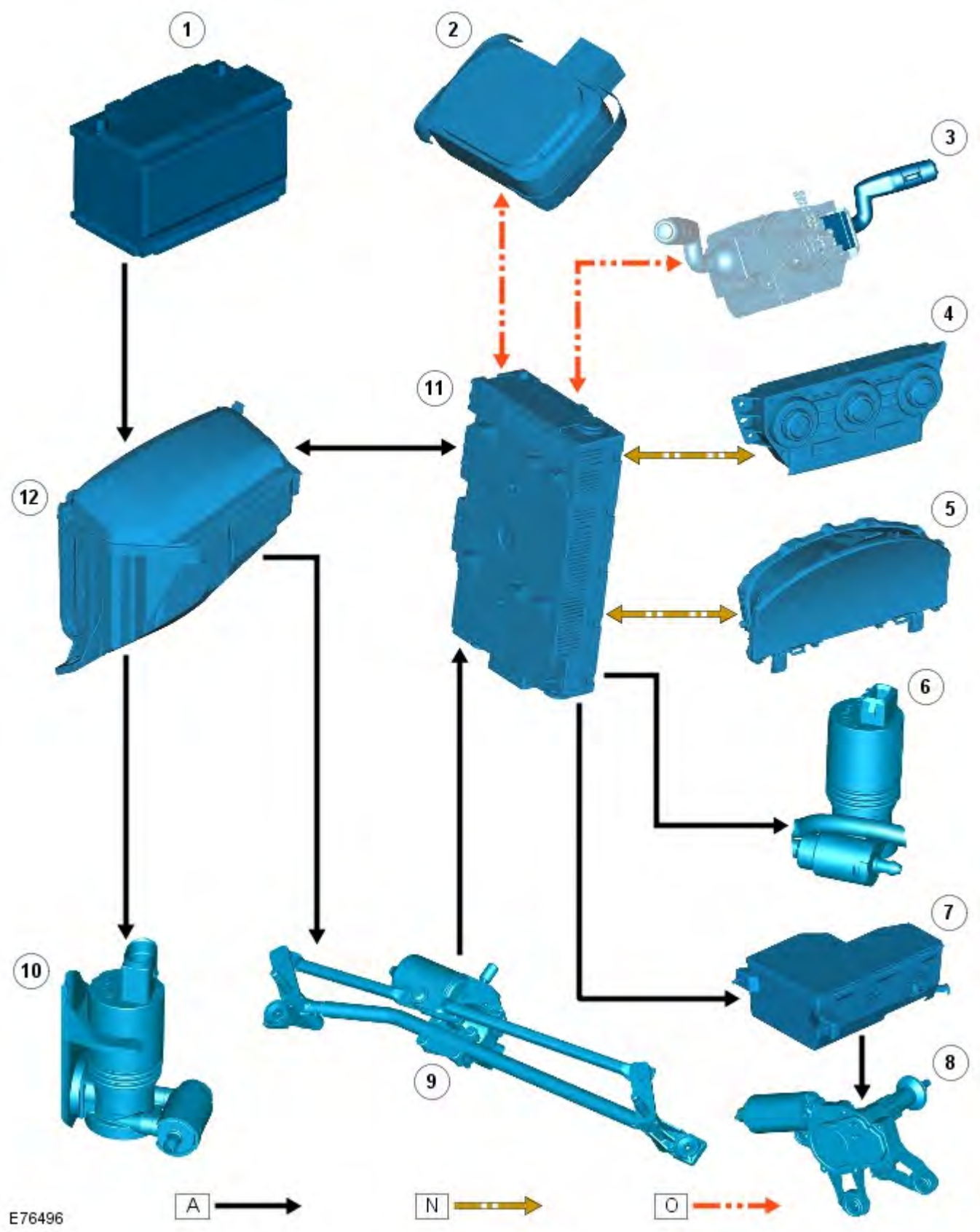
The single speed rear screen wiper motor is mounted on the inner surface of the liftgate and is secured by 3 bolts. Rubber bushes isolate the motor assembly from the body to help reduce the transmission of motor operating noise to the liftgate. The motor is located on a worm drive mechanism, which converts the rotary motion of the motor output spindle into the required arc for the rear wiper blade.

A 3 pin electrical connector is used to connect the rear screen wiper motor to the vehicle harness. The electrical connector provides a power feed to the motor from the AJB, a wiper park feed from the CJB, and a ground path.

The AJB contains the rear screen wiper relay. Operation of the relay is controlled by the CJB, which provides feed and ground paths according to logic contained within its software.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **N** = Medium speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1	-	Battery
2	-	Rain sensor
3	-	RH steering column multi-function switch
4	-	ATC module
5	-	Instrument cluster
6	-	Windshield and rear screen washer pump
7	-	AJB
8	-	Rear screen wiper motor
9	-	Windshield wiper motor
10	-	Headlamp washer pump
11	-	CJB

12	-	BJB

PRINCIPLES OF OPERATION

The wiper and washer system can operate in a number of different ways when the vehicle is in power mode 4 through 8. Requests from the RH steering column multi-function switch are transmitted over the LIN bus to the CJB, which is the main controller for the system.

Windshield Wiper Slow Wipe

On receiving a request for slow windshield wiper operation the CJB will energize relay 11 in the BJB. When energized, relay 11 provides a feed to the switch contacts of relay 8, which is also located in the CJB. Relay 8 is the fast/slow wipe relay. When slow wipe has been requested relay 8 remains de-energized, allowing a feed to flow across the relay switch contacts to the windshield wiper motor slow speed brush contacts.

Windshield Wiper Fast Wipe

On receiving a request for fast windshield wiper operation the CJB will energize relay 11 and relay 8 in the BJB. When energized, relay 11 provides a feed to the switch contacts of relay 8. The energized relay 8 provides a feed to the windshield wiper motor fast speed brush contacts.

Windshield Wiper Intermittent Wipe

On receiving a request for intermittent windshield wiper operation, the CJB will energize relay 11 in the BJB to operate the wipers at slow speed. Software contained within the CJB interprets the time delay requested and controls operation of relay 11 accordingly.

The intermittent wiper setting broadcast on the LIN bus to the CJB equates to the following time delays.

LIN Bus Signal	Time Delay (seconds)
1	22
2	15.5
3	9.5
4	6
5	3.5
6	1

In the event of a LIN bus failure between the CJB and the RH steering column multi-function switch, the CJB will default to 'Limp Home' mode (see below).

Windshield Wiper Automatic Wipe

On receiving a request for automatic windshield wiper operation, the CJB interprets LIN bus messages received from the rain sensor. The rain sensor provides LIN bus messages with values ranging from 0 to 7. A signal value of 0 is interpreted by the CJB as there being no water on the windshield.

A signal value from 1 to 5 is interpreted by the CJB as there being a small amount of water hitting the windshield. In this instance, the CJB initiates a slow wipe routine as detailed in the 'Windshield Wiper Slow Wipe' section above.

A signal value from 6 to 7 is interpreted by the CJB as there being a large amount of water hitting the windshield. In this instance, the CJB initiates a fast wipe routine as detailed in the 'Windshield Wiper Fast Wipe' section above.

Rain sensor sensitivity can be adjusted by turning the rotary control on the RH steering column multi-function switch to the required position. Six different sensitivity settings are available, which are broadcast over the LIN bus to the CJB.

• NOTE: The CJB will only change a fast wipe routine to a slow wipe routine if the rain sensor value is lower than 4.

Windshield Wiper Flick Wipe

On receiving a request for flick wipe operation the CJB will operate the windshield wipers as described in the 'Slow Wipe' section above until the request is removed.

Windshield Wiper Park

The windshield wiper park switch is integral with the windshield wiper motor. The park switch ensures the windshield wipers return to the park position if the windshield wiper request is cancelled mid-stroke.

The CJB is connected to one side of the park switch. The park switch contacts are open when the wipers are in any position except the park position. While the switch contacts are open, the CJB continues to energize relays 11 and 8 in the BJB, even if a LIN bus signal has been received from the RH steering column multi-function switch requested the wipers are stopped.

When the wipers reach the park position, the park switch contacts close and a ground path is created. When the CJB registers this ground path its software logic determines the wipers are in the park position and de-energizes relays 11 and 8 in the BJB.

Windshield Wiper Limp Home Mode

In the event of a LIN bus failure between the CJB and the RH steering column multi-function switch when the windshield wipers are active, the CJB will enter limp home mode. In limp home mode, the CJB will only power the windshield wipers at slow speed.

Windshield Wiper Service Position

The windshield wipers can be parked on the windshield to aid the fitment of new wiper blades. For more information, refer

to the 'Owners Handbook'.

Rear Screen Wiper

On receiving a request for rear screen wiper operation the CJB will energize relay RA2 in the AJB. When energized, relay RA2 provides a feed to the rear screen wiper motor. The rear screen wiper operates intermittently, with a delay between wipes of approximately 6 seconds. The CJB controls operation of relay RA2, and consequently rear screen wiper motor operation, accordingly.

The CJB also provides a feed to the rear screen wiper motor park switch. The park switch is integral with the rear screen wiper motor and ensures the wiper returns to the park position if the rear wiper request is cancelled mid-stroke. The park switch contacts are closed when the rear wiper is in any position except the park position. This allows the CJB to return the rear wiper to the park position when relay RA2 is de-energized.

The CJB will also power the rear screen wiper motor if reverse gear is selected while the windshield wiper function is active. On vehicles fitted with an automatic transmission, the reverse gear signal originates in the Transmission Control Module (TCM). The TCM broadcasts a reverse gear signal over the high speed CAN bus to the CJB, which responds by operating the rear wiper.

On vehicles fitted with a manual transmission, the reverse gear signal originates at the reverse gear switch. The reverse gear switch is hardwired to the CJB.

Windshield Washers

On receiving a request for windshield washer operation the CJB will energize the front washer control relay. This allows a battery voltage feed to flow to the washer pump. A ground path for the pump is provided by the de-energized rear washer control relay. Both washer control relays are integral with the CJB.

When windshield washer operation is requested, the windshield washers will operate. The CJB will delay wiper operation for 100 ms after the washer switch is pressed. If the switch is pressed for less than 100 ms, the CJB will not operate the wipers.

The CJB will power the windshield wipers for as long as washer operation is requested, although the washers will time out after 10 seconds. After the washer switch has been released, the CJB will operate the windshield wipers through 2 more wipe cycles.

Rear Screen Washer

On receiving a request for rear screen washer operation the CJB will energize the rear washer control relay. This allows a battery voltage feed to flow to the washer pump. A ground path for the pump is provided by the de-energized front washer control relay. Reversing the polarity of the pump (see 'Windshield Washers' above) allows washer fluid to be directed to the rear screen washer jet rather than the windshield washer jets. The rear screen washer jet is incorporated into the high mounted stop lamp.

The rear screen washer will operate for up to 10 seconds if continuously requested. When rear screen washer operation is requested, the rear screen wiper will operate continuously until the switch is released. After the switch has been released, or following 10 seconds of continuous operation, the CJB will operate the rear screen wiper through 2 or 3 more wipe cycles.

Headlamp Washers

When the vehicle enters ignition mode 4 (accessory) to 7 (engine running) the first windshield wash request greater than 100 ms will operate a headlamp power wash sequence. The CJB will then start a 10 minute timer. If 5 requests for windshield washer operation are made within this 10 minute window, the CJB will power the headlamp washers upon receiving the fifth request. When this occurs, the 10 minute timer is reset to 0.

If the CJB receives no windshield washer requests during a 10 minute window, the headlamp washers will operate on the first request received after the 10 minute window has elapsed. Again, once the headlamp washers have been operational, the CJB resets the timer to 0.

The headlamp washers will only operate when the headlamps are on. The CJB receives a 'lights on' signal from the light control module over the LIN bus.

When headlamp washer operation is required, the CJB energizes relay 9 in the BJB, allowing a battery voltage feed to power the headlamp washer pump. A ground path for the washer pump is provided by the de-energized relay 12, which is also located in the BJB. This sequence of events provides washer fluid to the headlamp 1 washer jets.

After this sequence the power supply to the pump is reversed. The CJB does this by de-energizing relay 9 and energizing relay 12. This allows the pump to provide washer fluid to the headlamp 2 washer jets. The sequence of events runs as follows:

- Power to headlamp 1 washer - 500 ms
- Delay to power headlamp 2 washer - 100 ms
- Power to headlamp 2 washer - 500 ms
- Delay (soak time) to power 1 headlamp washer - 700 ms
- Power to 1 headlamp washer - 500 ms
- Delay to power 2 headlamp washer - 100 ms
- Power to 2 headlamp washer - 500 ms

If there is less than 1 liter (0.26 US gallon) of washer fluid in the washer fluid reservoir, the CJB will suspend headlamp washer operation. The fluid level switch is hardwired to the CJB, which also transmits a low fluid signal to the instrument cluster over the medium speed CAN bus. For additional information, refer to:

Instrument Cluster (413-01 Instrument Cluster, Description and Operation),
Information and Message Center (413-08 Information and Message Center, Description and Operation).

Published: 11-May-2011

Wipers and Washers - Wipers and Washers

Diagnosis and Testing

Principles of Operation

For a detailed description of the wiper and washer systems, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Wiper blades • Wiper pivot arm shaft • Washer reservoir • Hose(s) • Washer jet(s)	• Fuses/relays (refer to electrical guide) • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connections

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B109512	Wiper On/Off Relay - circuit short to power	• Wiper On/Off relay circuit - short to power	Refer to electrical circuit diagrams and check wiper On/Off relay circuit for short to power
B109514	Wiper On/Off Relay - circuit short to ground or open	• Wiper On/Off relay circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check wiper On/Off relay circuit for short to ground, open circuit
B109612	Wiper High/Low Relay - circuit short to power	• Wiper High/Low relay circuit - short to power	Refer to electrical circuit diagrams and check wiper High/Low relay circuit for short to power
B109614	Wiper High/Low Relay - circuit short to ground or open	• Wiper High/Low relay circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check wiper High/Low relay circuit for short to ground, open circuit
B10AD04	Rain Sensor - System Internal Failure	• Internal sensor failure	Install a new rain sensor. REFER to: Rain Sensor (501-16 Wipers and Washers, Removal and Installation).
B10AD09	Rain Sensor - Component Failures	• Rain sensor incorrectly installed • Rain sensor internal failure	Check for correct installation of rain sensor. Install a new sensor as required. REFER to: Rain Sensor (501-16 Wipers and Washers, Removal and Installation).
B113188	Wiper Motor Module - Bus off	• Lost communications with wiper motor module	Carry out diagnostic strategy associated with this DTC using manufacturer approved diagnostic system
B1C8212	Headlamp Washer Relay Coil Circuit - circuit short to power	• Headlamp washer relay control circuit - short to power	Refer to electrical circuit diagrams and check headlamp washer relay control circuit for short to power

DTC	Description	Possible Cause	Action
B1C8214	Headlamp Washer Relay Coil Circuit - circuit short to ground or open	• Headlamp washer relay control circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check headlamp washer relay control circuit for short to ground, open circuit
C200412	Headlamp washer relay B - circuit short to power	• Headlamp washer relay B circuit - short to power	Refer to electrical circuit diagrams and check headlamp washer relay B circuit for short to power
C200414	Headlamp washer relay B - circuit short to ground or open	• Headlamp washer relay B circuit - short to ground, open circuit	Refer to electrical circuit diagrams and check headlamp washer relay B circuit for short to ground, open circuit
U023100	Lost Communication With Rain Sensing Module	• Lost communication with rain sensing module	Carry out the associated network test for this DTC using the manufacturer approved diagnostic system

Published: 11-May-2011

Wipers and Washers - Windshield Wiper Motor

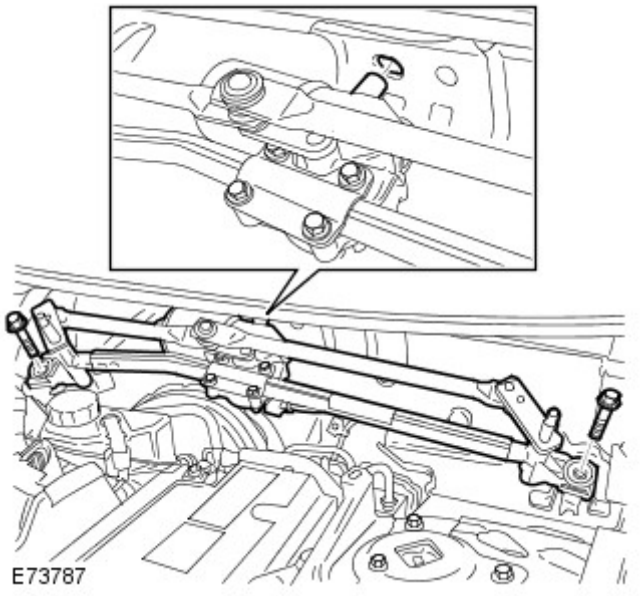
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Remove the plenum chamber panel.

   Refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).



2. Remove the windshield wiper motor.

   Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Wipers and Washers - Rear Window Wiper Motor

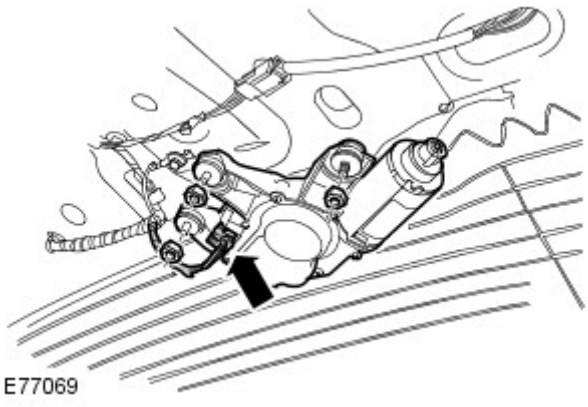
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

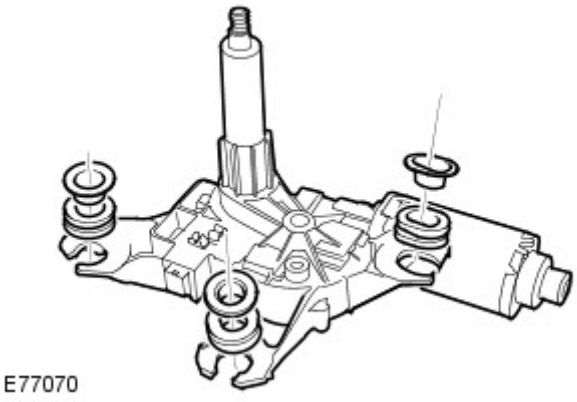
1. Remove the rear window wiper pivot arm.
2. Remove the liftgate trim panel.

   Refer to: Liftgate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. Remove the rear window wiper motor.

   Torque: 10 Nm



4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Wipers and Washers - Rain Sensor

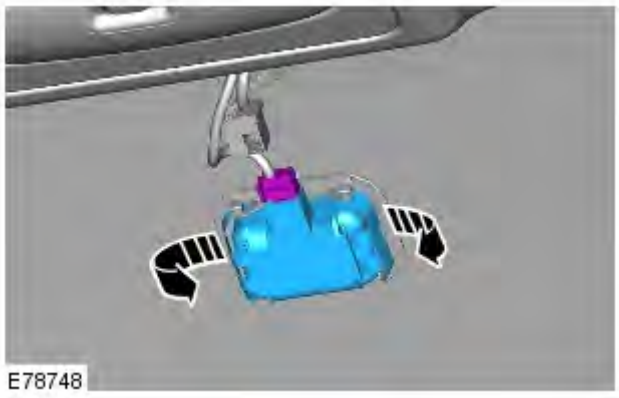
Removal and Installation

Removal

1. Remove the interior mirror.

   Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

2.



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Wipers and Washers - Headlamp Washer Jet

Removal and Installation

Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

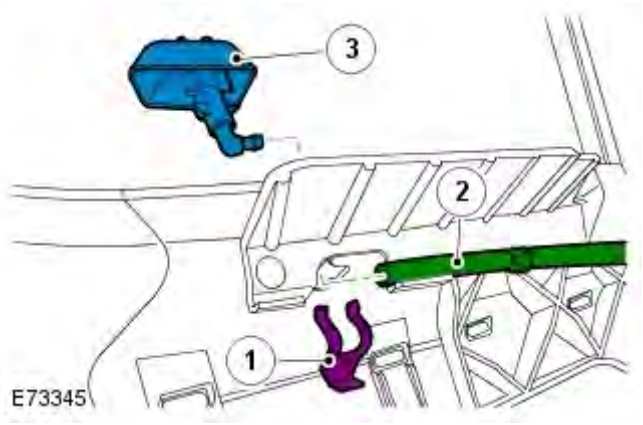
   Raise and support the vehicle.

2. Remove the front wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the front bumper cover.

   Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).



4.

Installation

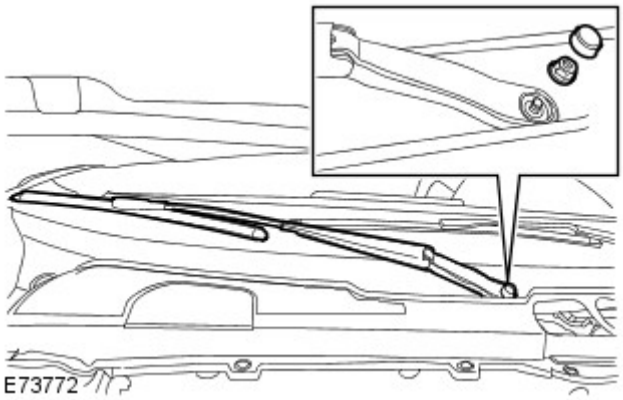
1. To install, reverse the removal procedure.

Published: 11-May-2011

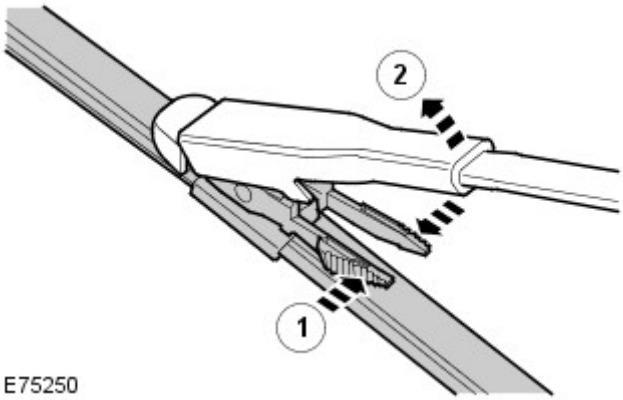
Wipers and Washers - Wiper Pivot Arm

Removal and Installation

Removal

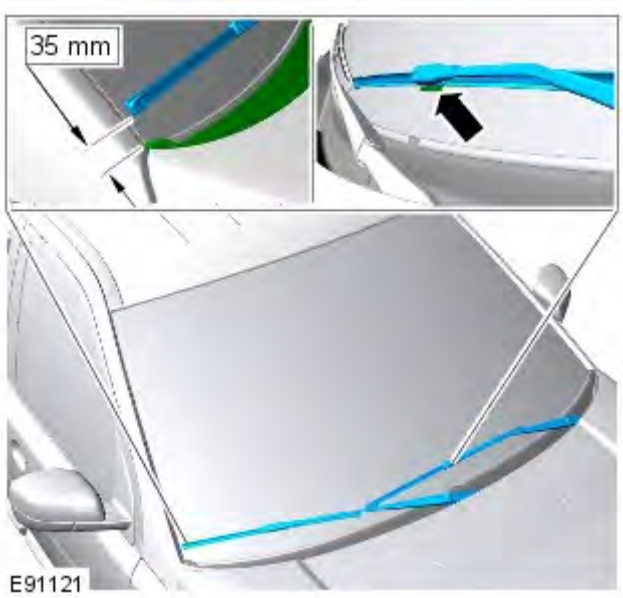


1.



2. **2.** NOTE: Do not disassemble further if the component is removed for access only.

Installation



1. *Torque:* 25 Nm

Published: 11-May-2011

Wipers and Washers - Windshield Washer Pump

Removal and Installation

Removal

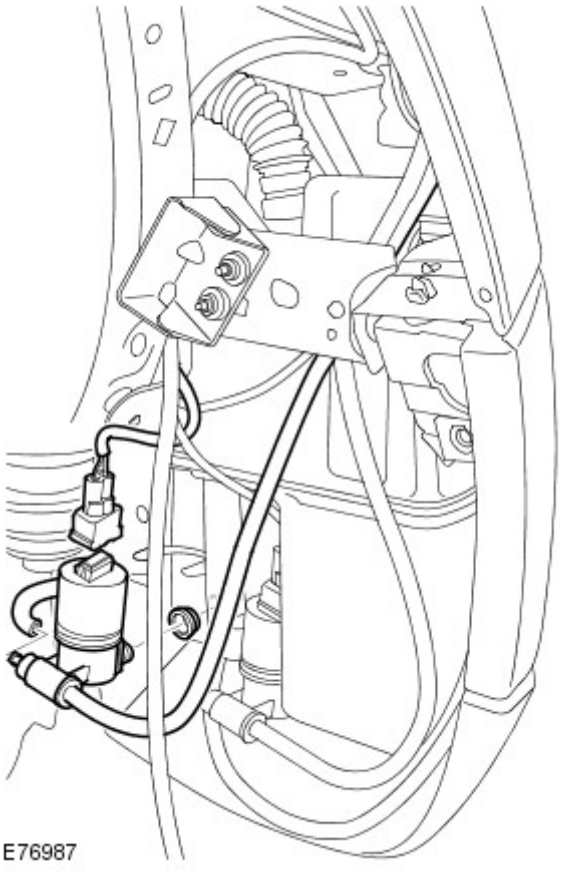
1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the RH fender splash shield.

   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

3. Drain the washer reservoir fluid.



4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the windshield washer pump.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Wipers and Washers - Windshield Washer Reservoir

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

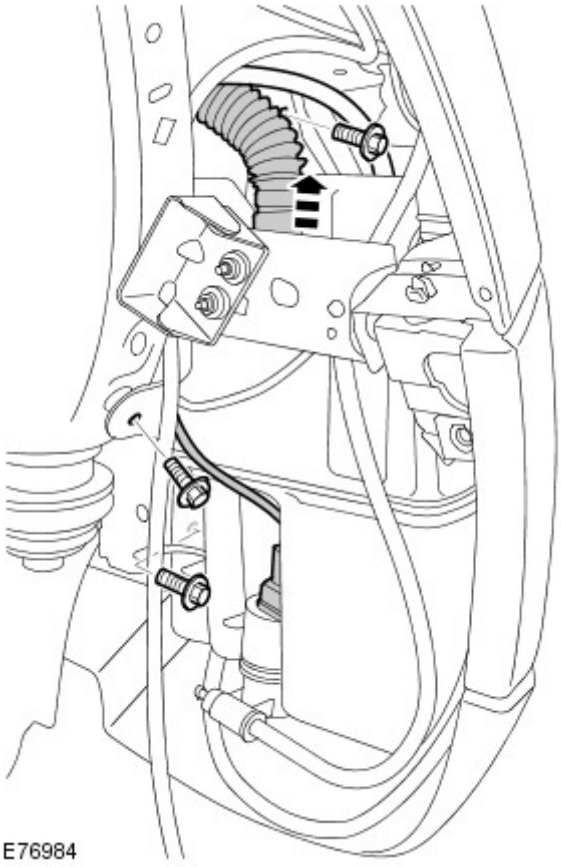
1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the RH fender splash shield.

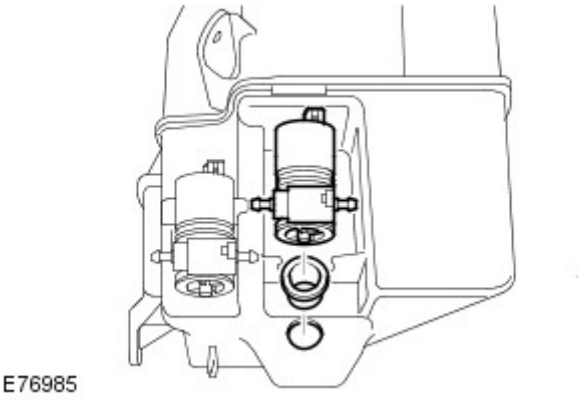
   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

3. Drain the washer reservoir fluid.



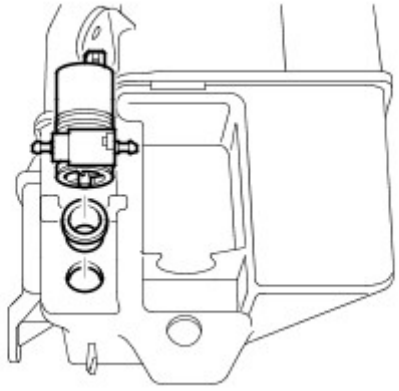
4. Remove the windshield washer reservoir.

   Torque: 6 Nm



5. **5.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the windshield washer pump.



E76986

6. Remove the headlamp washer pump.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Wipers and Washers - Headlamp Washer Pump

Removal and Installation

Removal

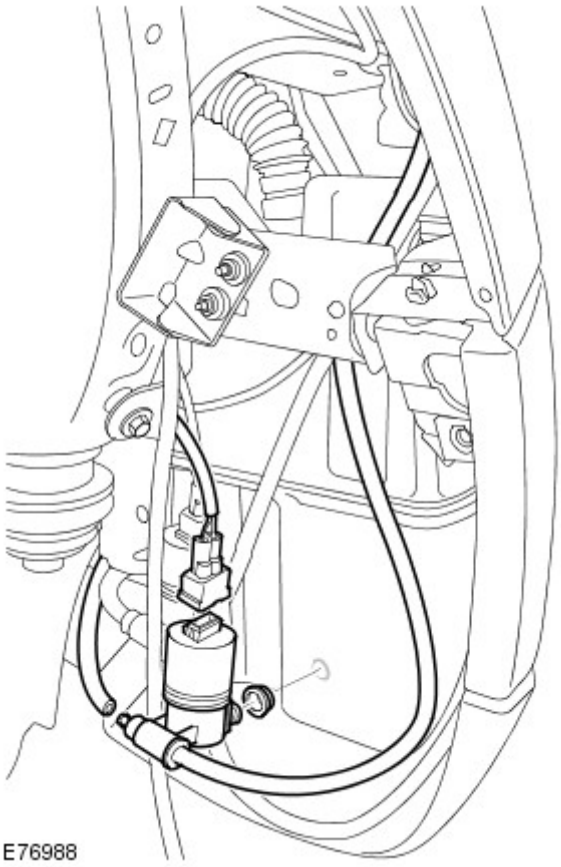
1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle.

2. Remove the RH fender splash shield.

   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

3. Drain the washer reservoir fluid.



4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the headlamp washer pump.

Installation

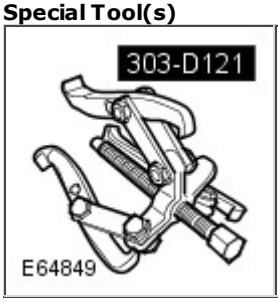
1. To install, reverse the removal procedure.

Published: 11-May-2011

Wipers and Washers - Rear Window Wiper Pivot Arm

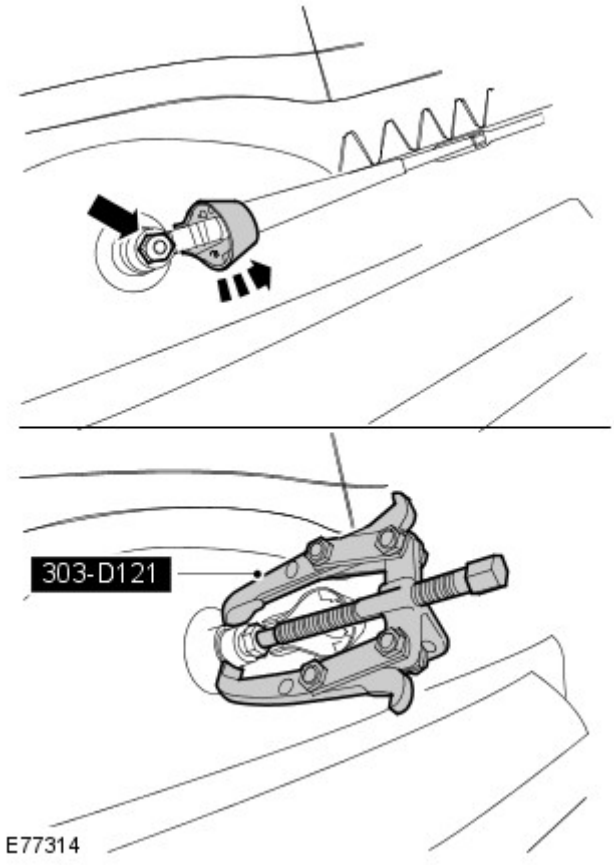
Removal and Installation

Special Tool(s)

	303-D121 Puller, General Purpose

Removal

- NOTE: Removal steps in this procedure may contain installation details.

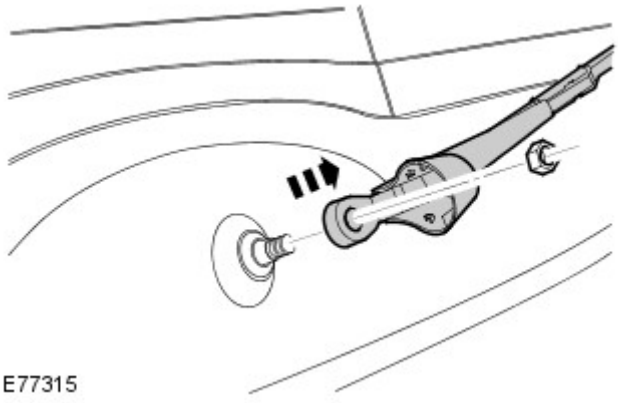


1. **1.** CAUTION: Make sure that these components are installed to the noted removal position.
   - Release the cover.
   - Loosen, but do not remove the nut.
   - Using the special tool, release the rear window wiper pivot arm.

   Special Tool(s): 303-D121

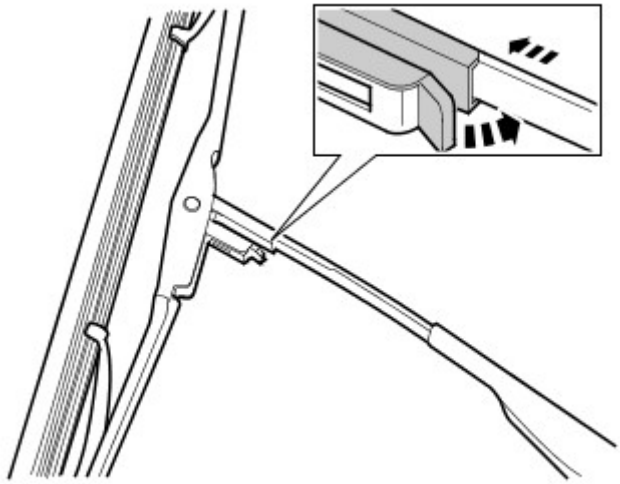
2. Remove the rear window wiper pivot arm nut.

   Torque: 7 Nm



E77315

3. Remove the rear window wiper pivot arm.

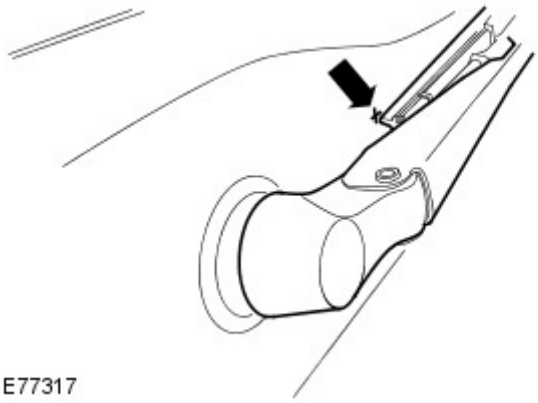


E77316

4. **4.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the rear window wiper blade.

Installation



E77317

1. **1.** CAUTION: Make sure that the component aligns with the installation mark.

   To install, reverse the removal procedure.

Published: 11-May-2011

Roof Opening Panel -

Torque Specifications

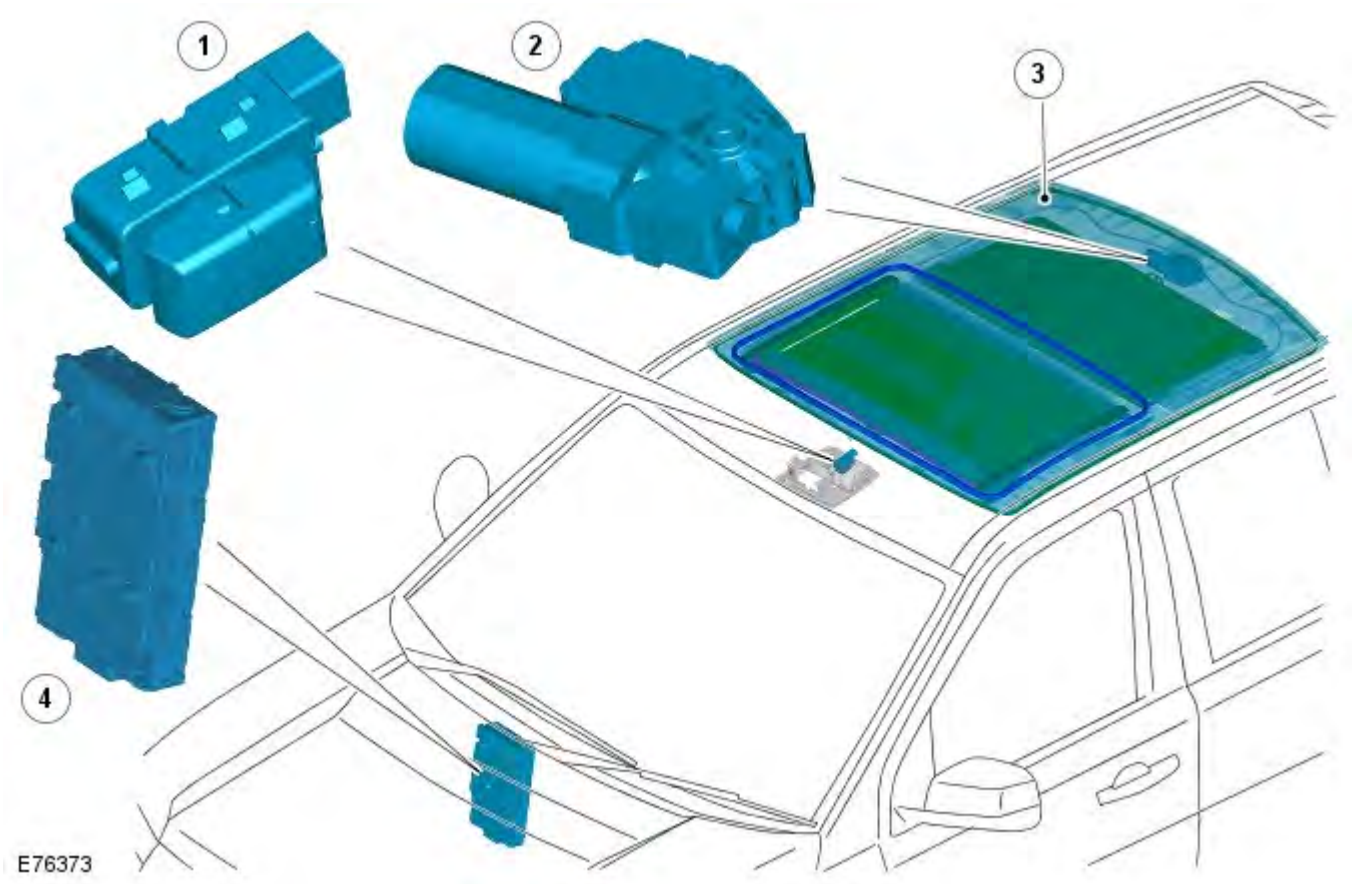
Description	Nm	lb-ft
Roof opening panel motor Torx screws	5	4
Roof opening panel alignment Torx screws	3	2
Roof opening panel bolts	3	2
Roof opening panel motor tether	4	4

Published: 11-May-2011

Roof Opening Panel - Roof Opening Panel

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Switch
2	-	Control unit/motor
3	-	Roof opening panel
4	-	Central Junction Box (CJB)

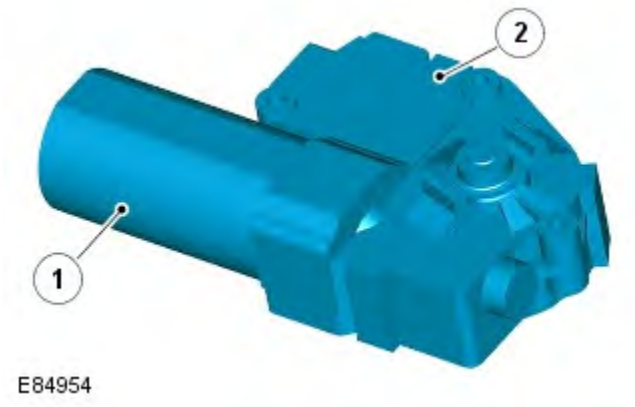
OVERVIEW

The roof opening panel is a double length glass unit, with the rear half being fixed in position.

The front half of the roof opening panel is electrically operated through a 2 way rocker switch located in the roof console. An electric motor, attached to the rear of the roof opening panel frame, drives the front glass panel to the tilt, open or closed position. The glass panel is operated by 2 cables, which are driven by the motor.

Operation of the roof opening panel is controlled by the roof opening panel control unit, which is integral with the motor. The control unit receives inputs from the CJB and the switch to control roof opening panel operation accordingly. The CJB also provides a vehicle speed signal to the control unit, which is used to calibrate the anti-trap feature.

CONTROL UNIT/MOTOR



Item	Part Number	Description
1	-	Motor
2	-	Control unit

The combined control unit and motor assembly is mounted behind the headlining, to the rear of the roof opening panel. The control unit uses inputs from the CJB and the roof opening panel switch to control operation of the motor.

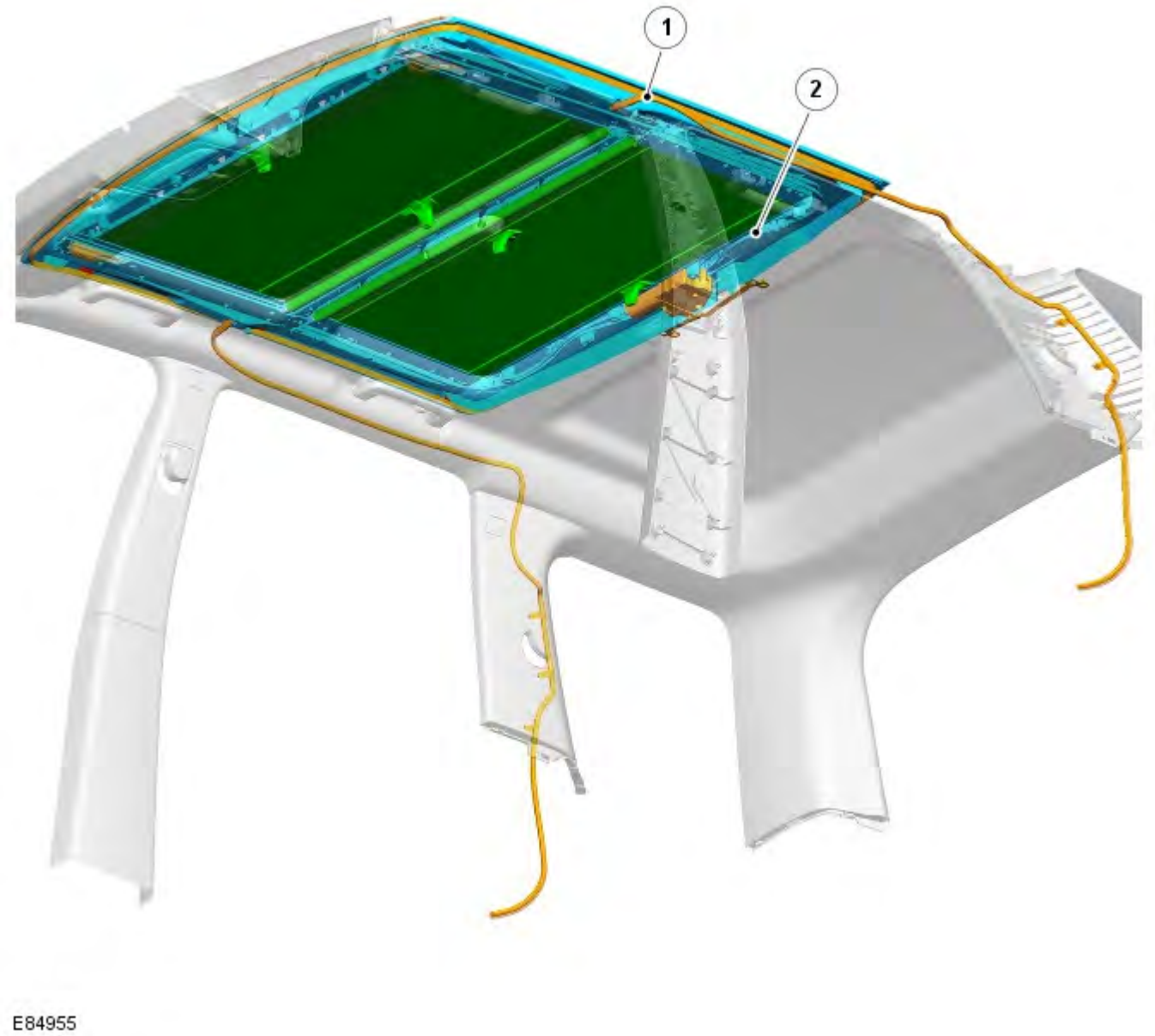
The end of the motor armature is formed as a worm drive, which drives a gear attached to the end of the motor assembly. The gear engages with helixed cables in the roof opening panel frame to form a rack and pinion drive.

The control unit incorporates a Hall effect sensor which is used to count the revolutions made by the motor armature. By counting the revolutions the control unit can accurately determine when the glass panel has reached its fully open, closed or tilt position by comparing the armature rotation value against values stored in its memory. The values are stored in the control unit's memory when the initialization routine has been carried out.

The control unit also monitors the temperature of the motor and will suspend operation if an overheat situation is likely to occur. The thermal protection function has 2 levels of operation.

- Level 1 - The control unit will only allow the roof opening panel to be closed
- Level 2 - All operation is suspended except 'Anti-Trap'.

ROOF OPENING PANEL



E84955

Item	Part Number	Description
1	-	Drain hose (2 off)
2	-	Helixed drive cable (2 off)

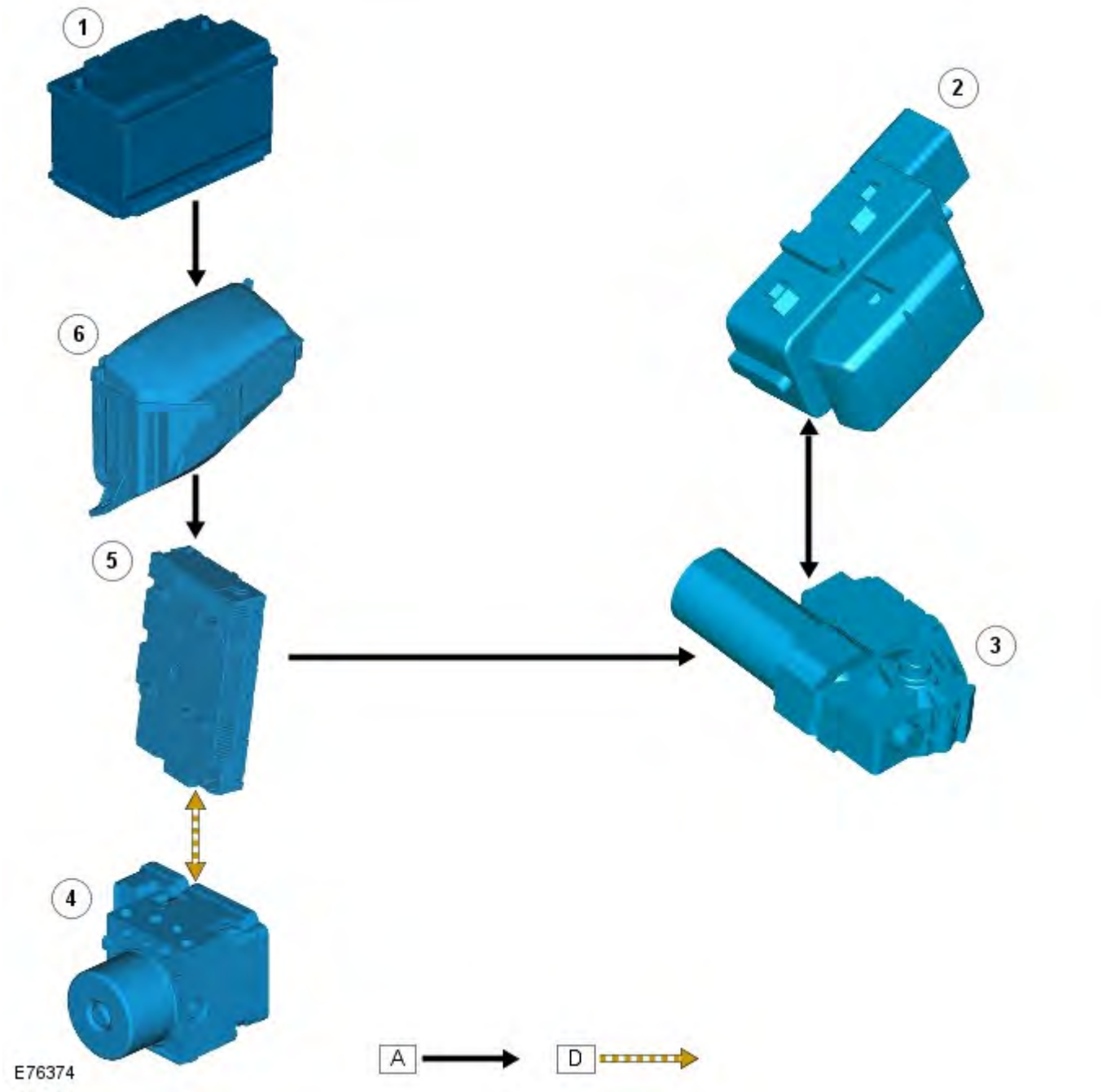
The roof opening panel is attached to the outside of the body side panels, the front roof panel and the rear roof panel with a Polyurethane (PU) adhesive. The roof panel comprises a plastic one piece frame housing 2 glass panels.

The rear glass panel is fixed in position and bonded to the roof opening panel frame using a PU adhesive. The forward glass panel is driven into position by a pair of helixed cables. The helixed cables are able to push or pull the forward glass panel into the required position.

The roof opening panel also contains 2 integral, manually operated sunblinds and 2 drain hoses. The drain hoses are connected to the center of the frame above the B pillars. The drain hoses run through the cant rails and down the C pillars to allow water collected in the frame to escape.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High speed Controller Area Network (CAN) bus



Item	Part Number	Description
1	-	Battery
2	-	Switch
3	-	Control unit/motor
4	-	Anti-lock Brake System (ABS) module
5	-	CJB
6	-	Battery Junction Box (BJB)

PRINCIPLES OF OPERATION

The roof opening panel will only operate when the vehicle is in power mode 6 (ignition on). Power is supplied to the roof opening panel control unit/motor by the CJB, which supplies both a permanent battery and ignition power supply. The CJB also provides a vehicle speed signal to the control unit.

For details on how to operate the roof opening panel, refer to the 'Owners Handbook'.

Switch Inputs

The roof opening panel rocker switch is mounted in the roof console and is provided 2 signal feeds by the control unit. When the switch is in the rest (central) position, both connections from the control unit are open circuit. When the switch is pressed to open the glass panel, the signal feed from pin 4 of the control unit electrical connector is provided a ground path through the switch contacts. When the switch is pressed to close the glass panel, the switch grounds the signal feed from pin 8 of the control unit electrical connector.

When tilt operation is requested, the switch grounds the signal feed from pin 8 of the control unit electrical connector as described for 'close' operation.

Anti-Trap

The roof opening panel motor is calibrated to detect a blockage that will prevent the glass panel from closing. The force required to close the glass panel on a stationary vehicle will not exceed approximately 100 Newtons (N). If this limit is reached, the control unit will power the motor in the opposite direction to reverse the position of the glass panel by 200 mm.

The control unit also monitors external forces which may increase the force required to close the glass panel. The control unit bases this figure on vehicle speed, rough road conditions, and extreme ambient air temperatures and may increase the maximum force applied by the motor to approximately 150 N if required.

Vehicle Speed Signal

The vehicle speed signal is used by the roof opening panel control unit to adjust the sensitivity of the anti-trap feature. This signal allows the control unit to take into account wind resistance when closing the roof opening panel at vehicle speeds higher than 2.5 mph (4 kph).

The vehicle speed signal originates in the ABS module, and is broadcast over the high speed CAN bus. The CJB converts the vehicle speed signal into a pulsed voltage signal for delivery to the control unit. This signal pulses at a rate of 8,000 pulses per mile (5,000 pulses per kilometer), and has a duty cycle of 50% on 50% off.

Calibration

If the battery is disconnected, or the power supply is interrupted, whilst the sunroof is partially open it will need to be recalibrated.

Once the battery is reconnected, or the power supply is restored, recalibrate the sunroof as follows:

- Switch the ignition on.
- With the sunroof closed, press and release the front of the switch. The sunroof will move to the tilted position ready for calibration.
- Press the front of the sunroof switch, and hold for twenty seconds.
- After twenty seconds the sunroof will begin to move. Keep the front of the switch pressed until the sunroof has fully opened, then closed.
- Once the open/close cycle has completed and the sunroof has stopped moving, release the switch.

The sunroof can now be operated as normal.

Published: 11-May-2011

Roof Opening Panel - Roof Opening Panel

Diagnosis and Testing

Principles of Operation

For a detailed description of the roof opening panel system, refer to the relevant Description and Operation section in the workshop manual. REFER to: Roof Opening Panel (501-17 Roof Opening Panel, Description and Operation).

Roof Opening Panel Diagnostic Symptom Chart

Symptom	Probable Cause	Action
Roof opening panel - noise during operation	• Noise produced during roof opening panel operation • Side acoustic seal(s) adrift or damaged • Front acoustic seal adrift or damaged • Glass seal adrift or damaged • Drip lip adrift or damaged • Air deflector adrift or damaged • Roof opening panel motor fault	GO to Pinpoint Test A.
One-touch operation - inoperative	• Loss of switch one-touch function • initialization required	GO to Pinpoint Test B.
Roof opening panel - inoperative	• Does not close • Does not open • Does not tilt • Jammed / stuck in one position • Roof opening panel motor fault	GO to Pinpoint Test C.
Roof opening panel - unnecessary bounce back	• Side acoustic seal(s) adrift or damaged • Front acoustic seal adrift or damaged • Glass seal adrift or damaged • Drip lip adrift or damaged • Air deflector adrift or damaged • Roof opening panel motor fault	• NOTE: Unnecessary bounce-back refers to the unintentional operation of the anti trap feature GO to Pinpoint Test D.
Roof opening panel - blind	• Noise produced during roof opening panel blind operation • Not latching • Not retracting • Handle adrift	GO to Pinpoint Test E.
Water ingress	• Drain tubes blocked • Seals adrift • Air deflector location	GO to Pinpoint Test F.
Wind noise	• Side acoustic seal(s) adrift or damaged • Front acoustic seal adrift or damaged • Glass seal adrift or damaged • Drip lip adrift or damaged • Air deflector adrift or damaged	GO to Pinpoint Test G.
Seals loose or adrift	• Side acoustic seal(s) adrift or damaged • Front acoustic seal adrift or damaged • Glass seal adrift or damaged • Drip lip adrift or damaged • Air deflector adrift or damaged	GO to Pinpoint Test H.

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Roof opening panel • Helixed drive cables • Switch • Roof opening panel motor	• Fuses/relays (refer to electrical guide) • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connections

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

• NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

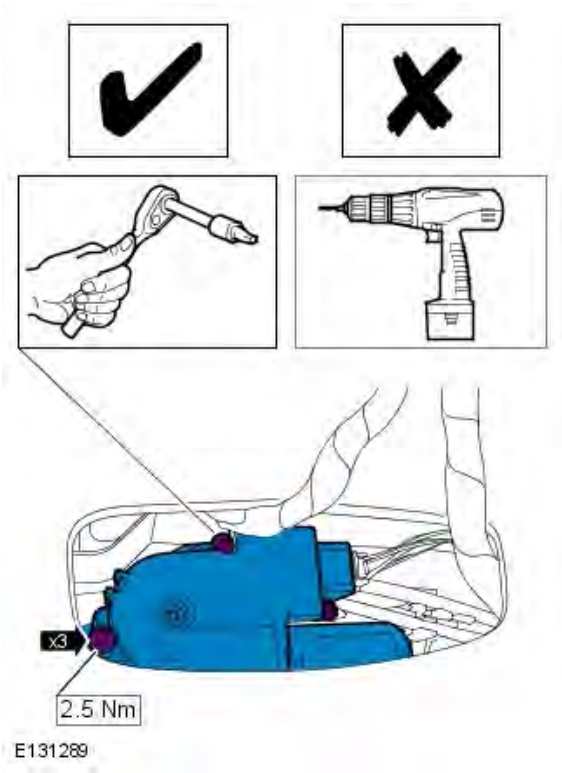
• NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

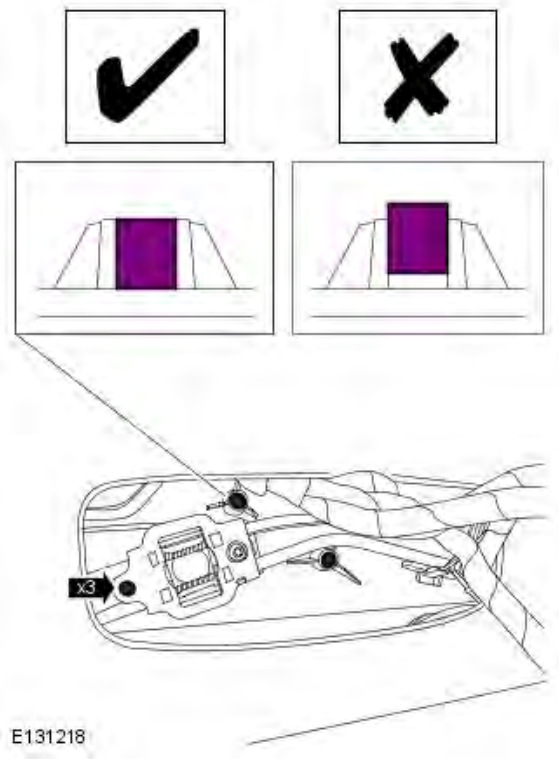
• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B10EF-12	Sunroof Speed Output - circuit short to power	• Roof opening panel motor speed output circuit short to power	Refer to electrical circuit diagrams and check the **(speed output)** circuit between the central junction box and the roof opening panel motor for short to power. Repair as required
B10EF-14	Sunroof Speed Output - circuit short to ground or open	• Roof opening panel motor speed output circuit short to ground or open circuit	Refer to electrical circuit diagrams and check the **(speed output)** circuit between the central junction box and the roof opening panel motor for short to ground or open circuit. Repair as required
B10F2-12	Sunroof control - circuit short to power	• Roof opening panel motor **(ACC)** circuit short to power	Refer to the electrical circuit diagrams and check the **(ACC)** circuit between the central junction box and the roof opening panel motor for circuit short to power. Repair as required
B10F2-14	Sunroof control - circuit short to ground or open	• Roof opening panel motor **(ACC)** circuit short to ground or open circuit	Refer to the electrical circuit diagrams and check the **(ACC)** circuit between the central junction box and the roof opening panel motor for circuit short to ground or open circuit. Repair as required
B113D-12	Sunroof Global Open/Close Control - circuit short to power	• Roof opening panel motor global open/close control circuit short to power	Refer to electrical circuit diagrams and check the **(global close)** circuit between the central junction box and the roof opening panel motor for circuit for short to power. Repair as required
B113D-14	Sunroof Global Open/Close Control - circuit short to ground or open	• Roof opening panel motor global open/close control circuit short to ground or open circuit	Refer to electrical circuit diagrams and check the **(global close)** circuit between the central junction box and the roof opening panel motor for circuit for short to ground or open circuit. Repair as required

Roof Opening Panel Diagnostic Pinpoint

PINPOINT TEST A : ROOF OPENING PANEL - NOISE DURING OPERATION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: MOTOR - NOISE DURING OPERATION	
• NOTE: These tests are to be carried out to determine the cause of the noise during roof opening panel operation.	
	1 Operate the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close) using the roof mounted switch.
	Is the roof opening panel motor noisy during operation when compared to another vehicle? **Yes** GO to A2. **No** GO to A4.
A2: MOTOR FIXING - SECURITY, LOCATION AND TORQUE	
	1 Access the roof opening panel motor.
	2 Check the roof opening panel motor is correctly located and securely installed.
	Is the roof opening panel motor correctly located and securely installed? **Yes** GO to A3. **No** Correctly locate and secure the roof opening panel motor. Check for correct roof opening panel operation. If the concern persists, GO to A1.
A3: MOTOR FIXINGS - HEXAGONAL MOTOR MOUNTING INSERTS	



1 Remove the roof opening panel motor from the roof opening panel and confirm the 3 brass hexagonal motor mounting inserts on the roof opening panel are correctly located and secure.
REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation).

Are the 3 brass hexagonal motor mounting inserts correctly located and securely installed?

Yes

Install a new roof opening panel motor.
REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation).

No

Replace the roof opening panel.
REFER to: Roof Opening Panel (501-17 Roof Opening Panel, Removal and Installation).

A4: AIR DEFLECTOR - NOISE

1 Operate the roof opening panel using the roof mounted switch to determine the cause of the noise during the roof opening panel operation.

Is the air deflector causing the noise during movement of the roof opening panel?

Yes

GO to A5.

No

GO to A6.

A5: AIR DEFLECTOR - ALIGNMENT

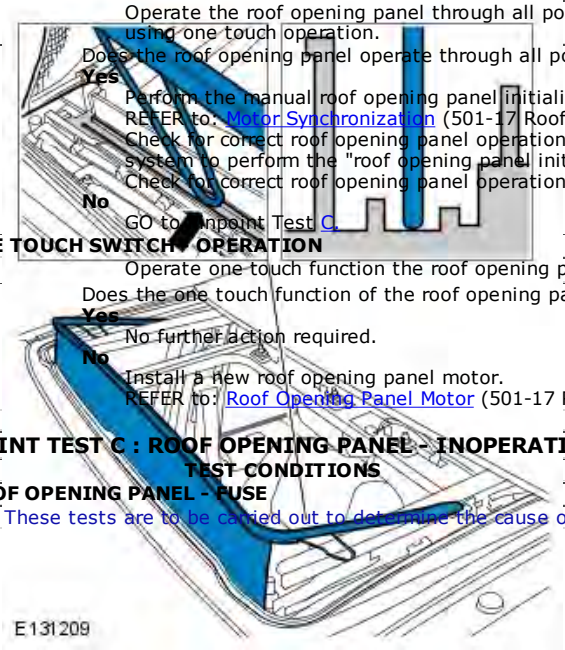
1 Check the alignment of the air deflector spring.

PINPOINT TEST B : ROOF OPENING PANEL - ONE TOUCH SWITCH OPERATION INOPERATIVE

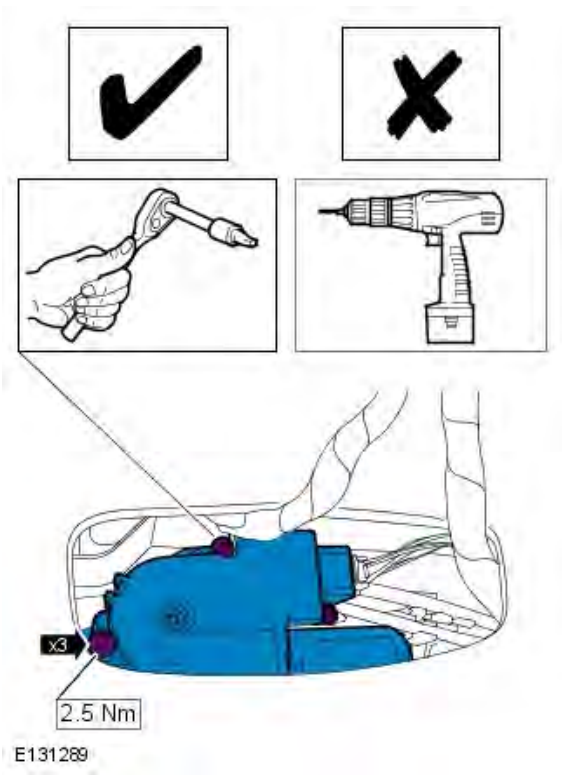
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: ROOF OPENING PANEL - OPERATION	
• NOTE: These tests are to be carried out to determine the cause of the loss of one touch operation.	
Operate the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close) without using one touch operation.	
Does the roof opening panel operate through all possible positions correctly?	
Yes	Perform the manual roof opening panel initialization procedure. REFER to: Motor Synchronization (501-17 Roof Opening Panel, General Procedures). Check for correct roof opening panel operation. If the concern persists, use the manufacturer approved diagnostic system to perform the "roof opening panel initialization procedure" Including "vehicle hard reset procedure as required". Check for correct roof opening panel operation. GO to B2.
No	GO to Pinpoint Test C.
B2: ONE TOUCH SWITCH OPERATION	
Operate one touch function the roof opening panel using the roof mounted switch.	
Does the one touch function of the roof opening panel switch operate correctly?	
Yes	No further action required.
No	Install a new roof opening panel motor. REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation).

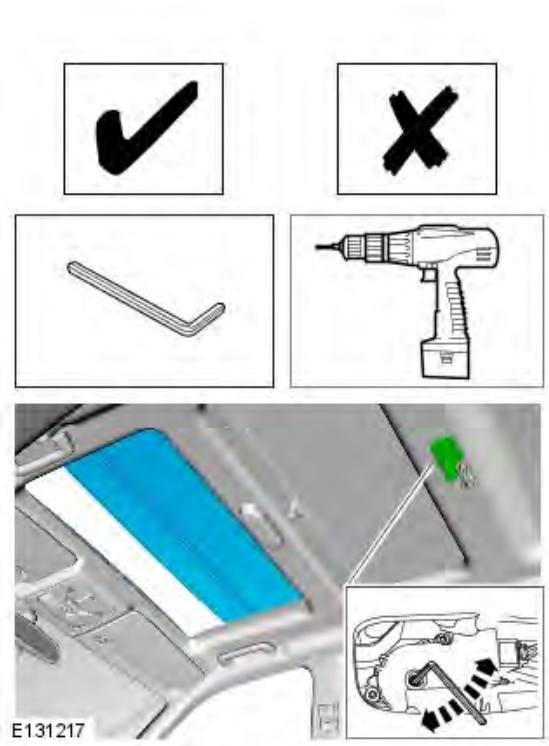
PINPOINT TEST C : ROOF OPENING PANEL - INOPERATIVE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: ROOF OPENING PANEL - FUSE	
• NOTE: These tests are to be carried out to determine the cause of the loss of roof opening panel functionality.	
	1 Refer to the electrical circuit diagrams and check the fused link to the roof opening panel motor.



	Is the fused link **(VBATT)** circuit to the roof opening panel motor intact? **Yes** GO to C2. **No** The fused link to the roof opening panel motor has failed. Refer to the electrical circuit diagrams and check the **(VBATT)** circuit between the fused link and the roof opening panel motor for short circuit to ground. Replace the fused link or repair the circuit as required. Check for correct roof opening panel operation.
C2: VEHICLE - AUTHORIZATION	
• NOTE: With the ignition state **ON** the authorization signal voltage is supplied on the **(ACC)** circuit of the roof opening panel motor, and should be greater than **7volts** when the roof panel authorization signal is **active** and less than **1volt** when the roof panel authorization signal is **inactive**.	
	1 Access the roof opening panel switch. REFER to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).
	2 Refer to the electrical circuit diagrams and check the **(ACC)** circuit to the roof opening panel motor for correct operation (see note above).
	Does the **(ACC)** circuit to the roof opening panel motor show the expected voltages? **Yes** GO to C3. **No** Confirm **DTC B10F2-14** (Sunroof control - circuit short to ground or open) has been stored, refer to the electrical circuit diagrams and check the **(ACC)** circuit between the central junction box and the roof opening panel motor for fault. Repair as required.If the DTC has not been stored, investigate the central junction box (ACC) circuit operation.
C3: ROOF OPENING PANEL - SWITCH CONNECTOR	
	1 Refer to the electrical circuit diagrams and check the roof opening panel switch terminals and housing for location and condition.
	Are the roof opening panel switch terminals and housing located correctly and in good condition? **Yes** GO to C4. **No** Correctly relocate or replace any roof opening panel switch connector terminals as required. Check for correct roof opening panel operation.
C4: ROOF OPENING PANEL - MOTOR CONNECTOR	
	1 Access the roof opening panel motor. REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation).
	2 Refer to the electrical circuit diagrams and check the roof opening panel motor terminals and housing for location and condition.
	Are the roof opening panel motor connector terminals and housing located correctly and in good condition? **Yes** GO to C5. **No** Correctly relocate or replace any roof opening panel motor connector terminals as required. Check for correct roof opening panel operation.
C5: SWITCH - CIRCUIT CHECK 1	
• NOTE: The roof opening panel motor gives a voltage out on the open and close circuits which is grounded when the switch is operated, this voltage should be greater than **7volts (switch inactive)** and less than **1volt (switch active)** with the ignition state switched to on.	
	1 Refer to the electrical circuit diagrams and locate the **open and close** circuits between the roof opening panel motor and the roof opening panel switch, monitor the voltage on each circuit as the switch is operated
	Do both **open and close** switch circuit voltages change from greater than **7volts** to less than **1volt** when the roof opening panel **open or close** switches are operated? **Yes** GO to C8. **No** GO to C6.
C6: SWITCH - CIRCUIT CHECK 2	
• NOTE: During the previous check, if the voltage remained high **(greater than 7volts)**, refer to the electrical circuit diagrams and check the switch circuit for fault.	
• NOTE: During the previous check, if the voltage remained low **(less than 1volt)**, refer to the electrical circuit diagrams and check the roof opening panel motor circuit for fault.	
	1 Refer to notes above.
	Did the voltage remain low **(less than 1volt)**? **Yes** GO to C7. **No** The voltage remained high **(above 7volts)** refer to the electrical circuit diagrams and check the roof opening panel switch circuit for fault.
C7: MOTOR SUPPLY - VOLTAGE	
	1 Refer to the electrical circuit diagrams and check the voltage between the power **(VBATT)** and ground **(GND)** circuits to the roof opening panel motor for battery supply voltage **(approx. 12volts)**.

	Do the **(VBATT)** and **(GND)** circuits to the roof opening panel motor have battery supply voltage? **Yes** GO to C8. **No** Check the **(VBATT)** and **(GND)** circuits to the roof opening panel motor for fault. Repair as required. Check for correct roof opening panel operation.
C8: MOTOR - FAILURE	
	1 Operate the roof opening panel using the roof mounted switch.
	When operating the roof opening panel using the roof mounted switch does the motor click? **Yes** GO to C9. **No** Replace the roof opening panel motor. REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation). Perform the manual roof opening panel initialization procedure. REFER to: Motor Synchronization (501-17 Roof Opening Panel, General Procedures). Check for correct roof opening panel operation.
C9: MOTOR TEST - REMOVED	
• NOTE: Ensure the roof opening panel motor weight is supported to avoid damage while any electrical connectors are attached.	
	1 Remove the 3 roof opening panel motor fixings, carefully lower the motor from the roof opening panel. REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation).
	2 Operate the roof opening panel switch.
	Does the roof opening panel motor operate? **Yes** GO to C11. **No** GO to C10.
C10: VEHICLE - HARD RESET	
	1 Reinstall the roof opening panel motor to the roof opening panel frame.
	2 Using the manufacturer approved diagnostic system carry out the vehicle hard reset procedure.
	3 Using the manufacturer approved diagnostic system perform the roof opening panel initialization procedure.
	4 Operate the one touch function of the roof opening panel using the roof mounted switch.
	Does the one touch function of the roof opening panel switch operate correctly? **Yes** No further action required. **No** Replace the roof opening panel motor. Using the manufacturer approved diagnostic system perform the roof opening panel initialization procedure. Check for correct roof opening panel operation.
C11: MANUAL - ROOF OPERATION	
	1 Reinstall the roof opening panel motor to the roof opening panel frame.



2 Manually operate the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close).

Can the roof opening panel be manually operated through all possible positions?

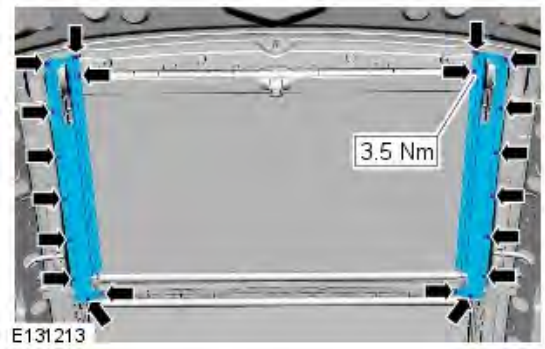
Yes

Contact dealer technical support.

No

GO to C12.

C12: GLASS PANEL - REMOVAL



1 Remove the glass panel from the roof opening panel. REFER to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation).

Can the glass panel be removed?

Yes

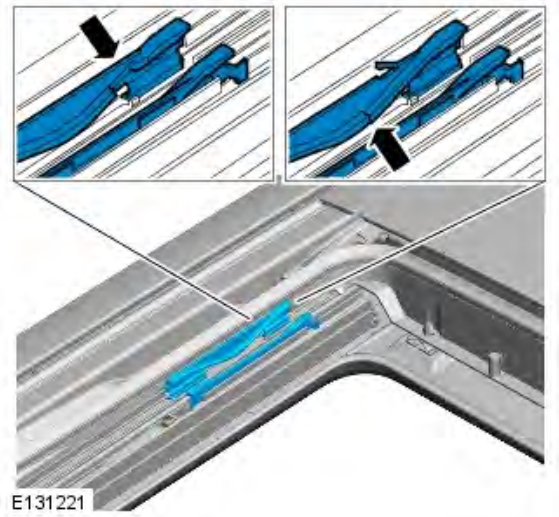
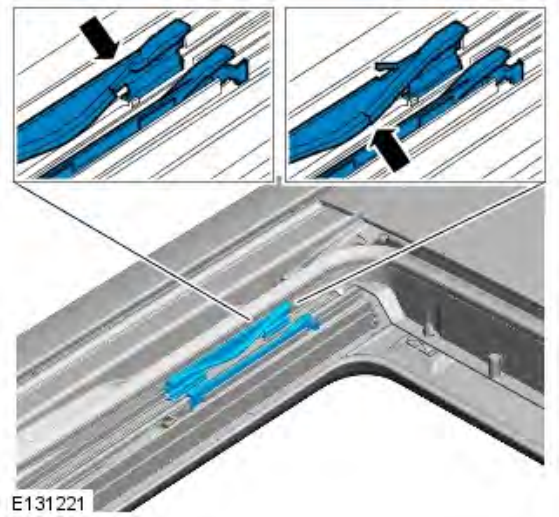
GO to C13.

No

If the glass panel can not be removed by the standard R&I procedure, remove the 20 machine screws that secure the glass panel guide(s), then push the glass panel outward, manually operate the roof opening panel to the glass (slide open) position and remove the front glass guide locators. Manually operate the roof opening panel to the closed position and remove the roof opening panel. If removal is not possible contact dealer technical support. GO to C13.

C13: GLASS PANEL REMOVED

1 Carry out visual and manual inspection of the rail(s) for debris.

	Are the rail(s) obstructed by debris? **Yes** Clear any obstruction from the rail(s). Refer to illustration E131215, prior to reassembly apply grease (KP 1N-30 or ISO-L-X-CDBE1) to the areas marked in black. GO to C14. **No** GO to C14.
C14: RAIL MOUNTED GUIDE BRACKETS - CONDITION	
 E131221	1 Carry out visual and manual inspection of the rail mounted guide brackets for cracks or damage (pieces broken).
	Are the rail mounted guide brackets cracked or damaged? **Yes** Replace the rail mounted guide bracket(s) as required. GO to C15. **No** Correctly re-assemble the rail mounted guide bracket(s). GO to C15.
C15: RAIL MOUNTED GUIDE BRACKETS - LOCATION	
 E131221	1 Carry out visual and manual inspection of the rail mounted guide brackets.
	2 Confirm that the rail mounted guide brackets are correctly located, with no movement in any direction.
	Are the rail mounted guide brackets correctly located, with no movement in any direction? **Yes** GO to C16. **No** Correctly re-assemble or if required replace the rail mounted guide bracket(s) as required. GO to C16.
C16: REAR SLIDERS - CONDITION AND LOCATION	

1 Carry out visual and manual inspection of the rear sliders and the connecting bar for damage (pieces broken) and correct location.

Are the rear sliders or connecting bar damaged / jammed?

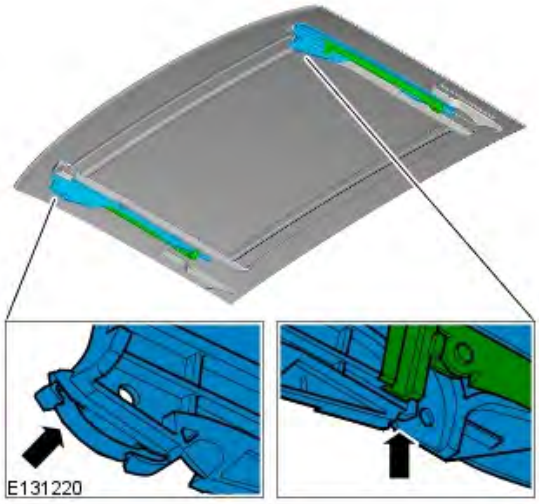
Yes

Replace the damaged rear slider(s) or connecting bar as required.

No

GO to C17.

C17: GLASS MOUNTED GUIDE BRACKETS



1 Visually inspect the glass mounted guide brackets on the glass panels for damage.

Are the glass mounted guide brackets damaged?

Yes

Install a new opening panel glass.
REFER to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation).

No

GO to C18.

C18: GLASS PANEL - REASSEMBLY

1 Install the rails using the 20 machine screws that secure the glass panel guide(s) if previously removed.

2 Re-assemble the glass panel onto the roof opening panel.
REFER to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation).

3 Perform the manual roof opening panel initialization procedure.
REFER to: Motor Synchronization (501-17 Roof Opening Panel, General Procedures).

4 Check for correct roof opening panel operation.

Does the roof opening panel operate correctly?

Yes

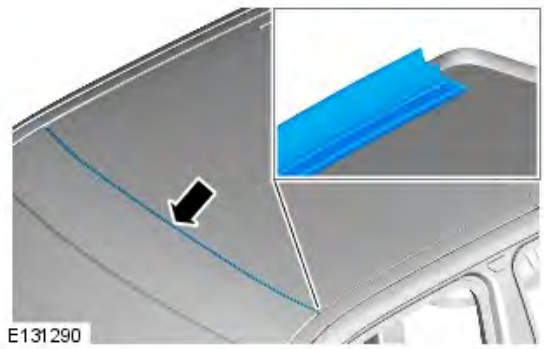
No further action required.

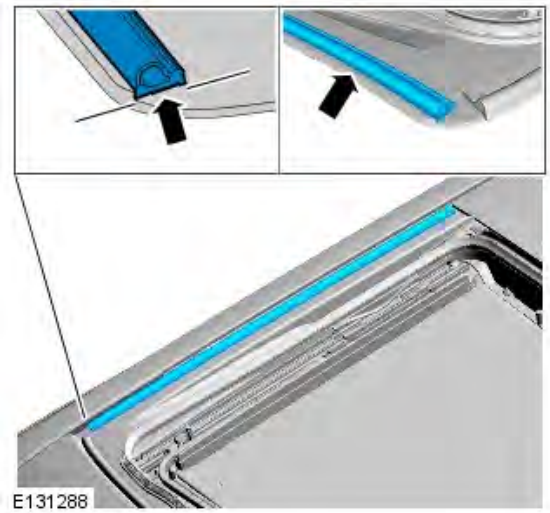
No

Contact dealer technical support.

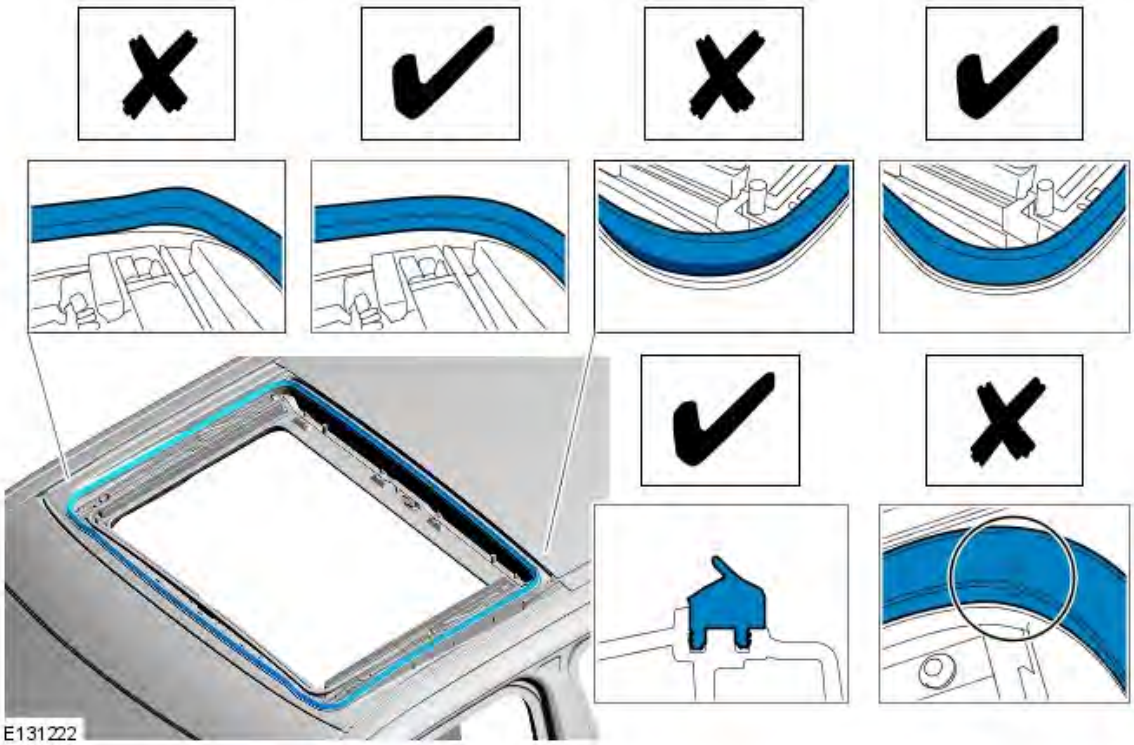
PINPOINT TEST D : ROOF OPENING PANEL - BOUNCE BACK

TEST CONDITIONS	DETAILS/RESULTS /ACTIONS
D1: INITIALIZATION	
• NOTE: These tests are to be carried out to determine the cause of the unnecessary roof opening panel bounce back.	
	1 Perform the manual roof opening panel initialization procedure.

	REFER to: Motor Synchronization (501-17 Roof Opening Panel, General Procedures).
	2 Operate the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close) using the roof mounted switch.
	3 Operate the roof opening panel one touch function five times in succession using the roof mounted switch.
	Does the roof opening panel operate correctly five times in succession? **Yes** No further action required. **No** GO to D2.
D2: INCORRECT SEAL LOCATION CAUSING BOUNCE-BACK	
	1 Visually inspect the location of the roof opening panel seals.
 E131290	2 Drip Lip
 E131286	3 Front Acoustic Seal • Vehicles built up to VIN 154971. • Vehicles built from VIN 154972.



4 Side Acoustic Seal



5 Aperture Seal

Are any of the seals causing the bounce back?

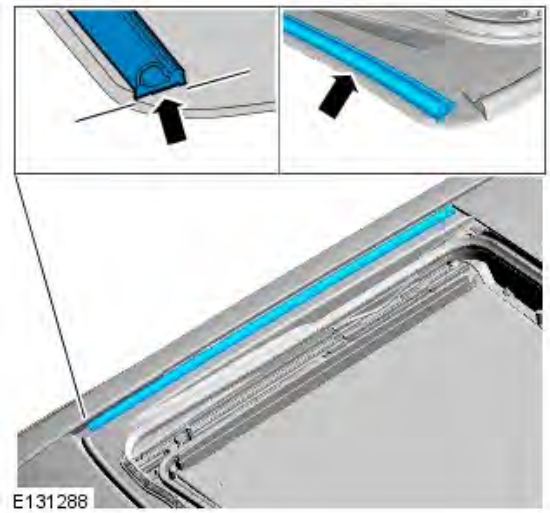
Yes

GO to D3.

No

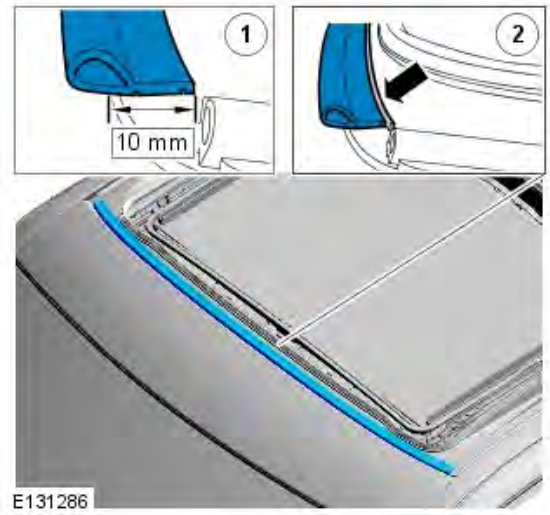
GO to D8.

D3: SIDE ACOUSTIC SEAL - LOCATION

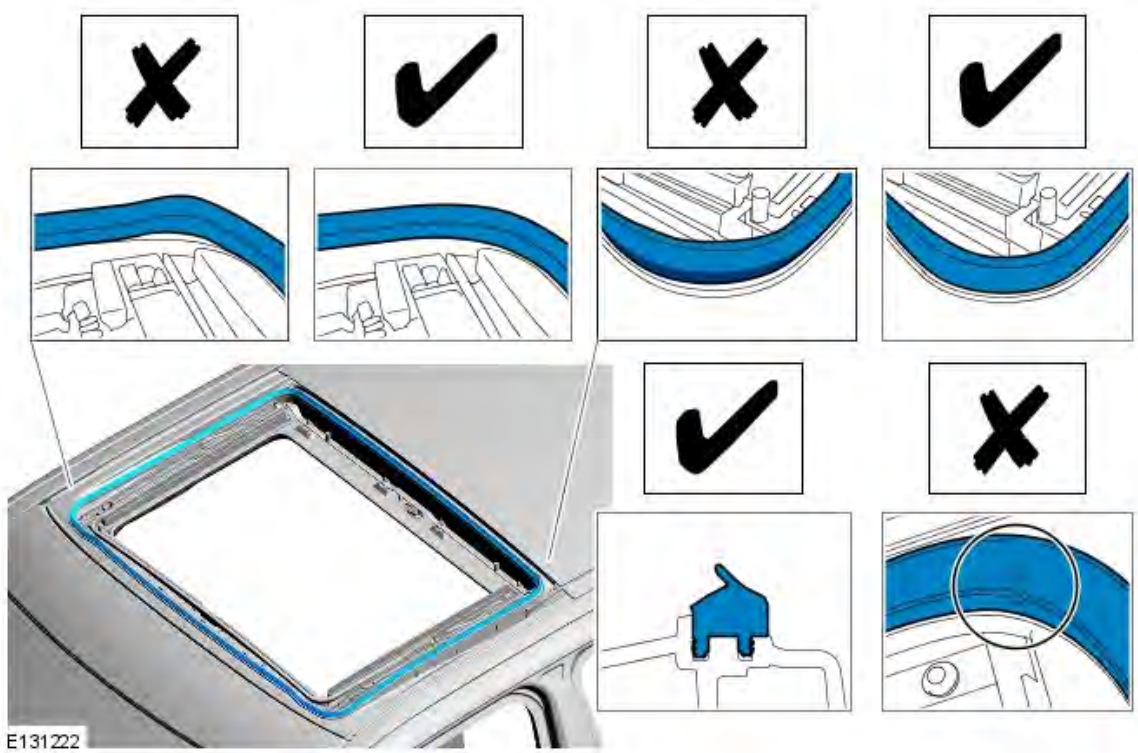
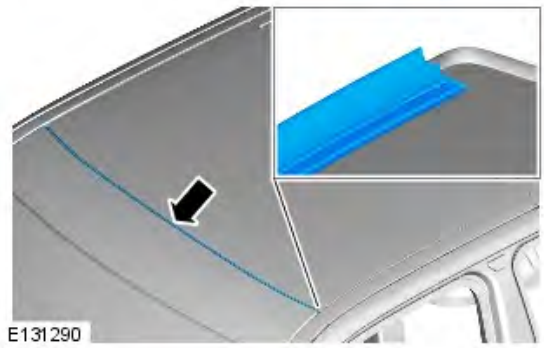


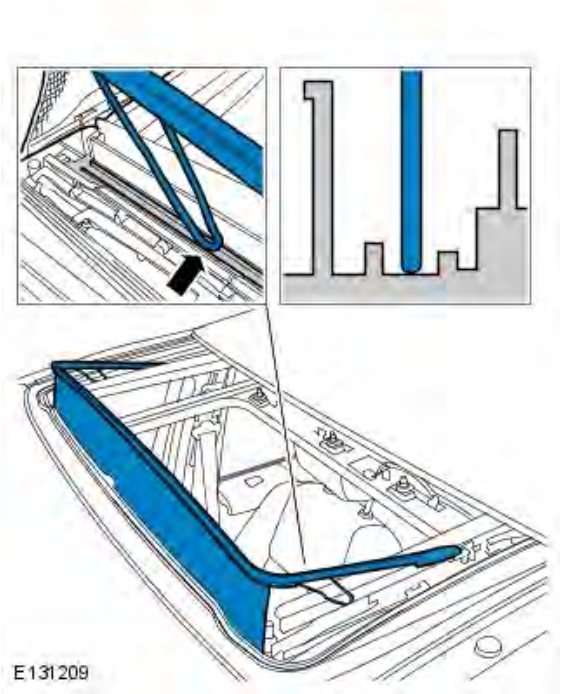
	1 Visually inspect the roof opening panel side acoustic seals.
	Is the bounce back caused by either of the roof opening panel side acoustic seals? **Yes** Replace the side acoustic seals. Clean all relevant surfaces then correctly position and bond the new side acoustic seals to the roof opening panel. GO to D4. **No** GO to D4.

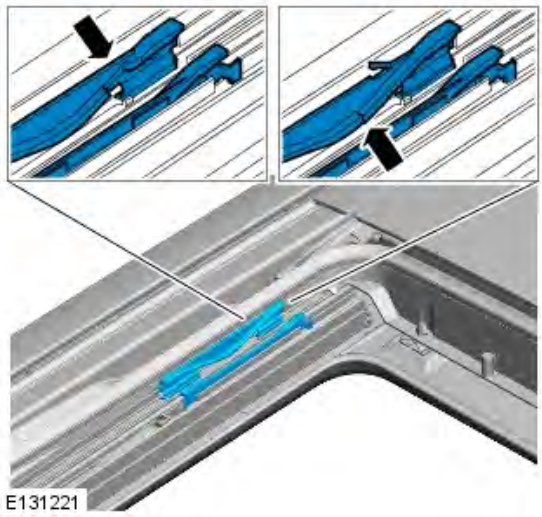
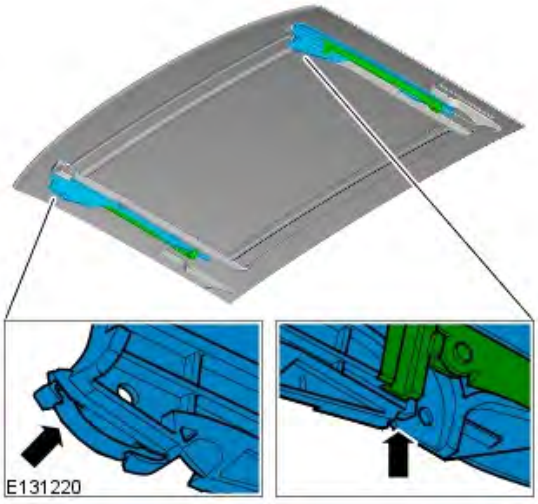
D4: FRONT ACOUSTIC SEAL - LOCATION



	1 Visually inspect the roof opening panel front acoustic seal. • Vehicles built up to VIN 154971. • Vehicles built from VIN 154972.
	Is the bounce back caused by the roof opening panel front acoustic seal? **Yes** Replace the front acoustic seal. Clean all relevant surfaces then correctly position and bond the front acoustic seal to the roof opening panel.

	GO to D5. **No** GO to D5.
D5: GLASS SEAL - LOCATION	
	1 Visually inspect the roof opening panel glass seal.
	Is the bounce back caused by the roof opening panel glass seal? **Yes** Install a new roof opening panel glass seal. REFER to: Roof Opening Panel Seal (501-17 Roof Opening Panel, Removal and Installation). GO to D6. **No** GO to D6.
D6: DRIP LIP ON THE GLASS PANEL - LOCATION	
	1 Visually inspect the roof opening panel glass drip lip.
	Is the bounce back caused by the roof opening panel glass drip lip? **Yes** Replace the glass panel (The drip lip is not a serviceable item). REFER to: Roof Opening Panel Glass (501-17 Roof Opening

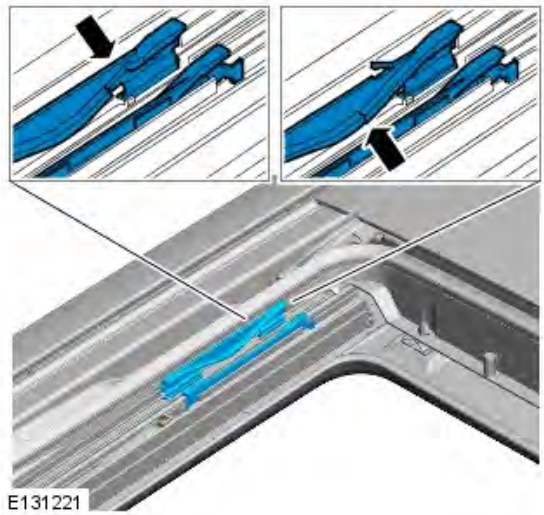
	Panel, Removal and Installation). GO to D7. **No** GO to D7.
D7: CORRECT OPERATION	
	1 Perform the manual roof opening panel initialization procedure. REFER to: Motor Synchronization (501-17 Roof Opening Panel, General Procedures). 2 Operate the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close) using the roof mounted switch. 3 Operate the roof opening panel one touch function five times in succession using the roof mounted switch.
	Does the roof opening panel operate correctly five times in succession? **Yes** No further action required. **No** GO to D8.
D8: AIR DEFLECTOR - LOCATION	
	1 Visually inspect the roof opening panel air deflector.
	
	Is the bounce back caused by the roof opening panel air deflector? **Yes** Correctly relocate and secure, or

	replace if required the roof opening panel air deflector. REFER to: Air Deflector (501-17 Roof Opening Panel, Removal and Installation). GO to D7. **No** GO to D9.
D9: GLASS PANEL - REMOVED	
	1 Carry out visual and manual inspection of the glass panel guides for debris.
	Are the guide(s) obstructed by debris? **Yes** Clear any obstruction from the glass panel guide(s).GO to D10. **No** GO to D10.
D10: GLASS MOUNTED GUIDE BRACKETS - CONDITION	
	1 Carry out visual and manual inspection of the glass mounted guide brackets for cracks or damage.
	Are the glass mounted guide brackets cracked or damaged? **Yes** Replace the glass panel (The guide brackets are non serviceable).GO to D11. **No** GO to D11.

D11: REAR SLIDERS - CONDITION

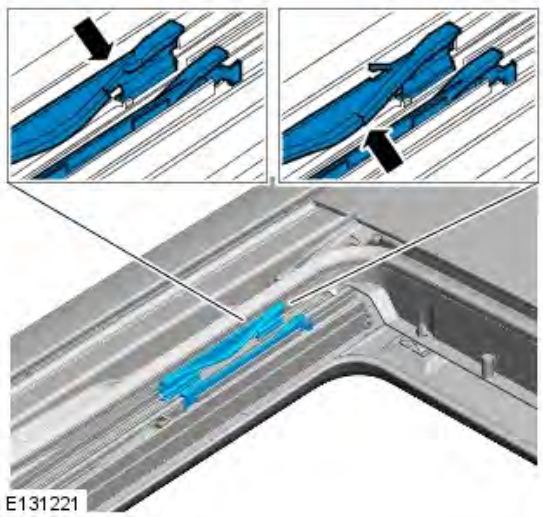
	1 Carry out visual and manual inspection of the rear sliders and the connecting bar for damage (pieces broken) and correct location.
	Are the rear sliders or connecting bar damaged / jammed? **Yes** Replace the damaged rear slider(s) or connecting bar as required. GO to D12. **No** GO to D12.

D12: RAIL MOUNTED GUIDE BRACKETS - CONDITION



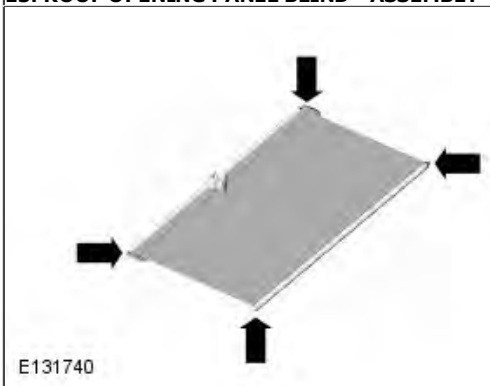
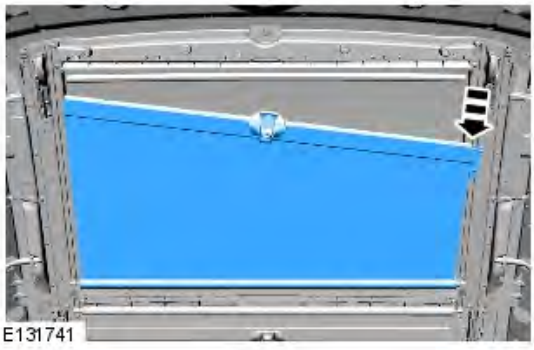
	1 Carry out visual and manual inspection of the rail mounted guide brackets for cracks or damage (pieces broken).
	Are the rail mounted guide brackets cracked or damaged? **Yes** Replace the rail mounted guide bracket(s) as required. GO to D13. **No** GO to D13.

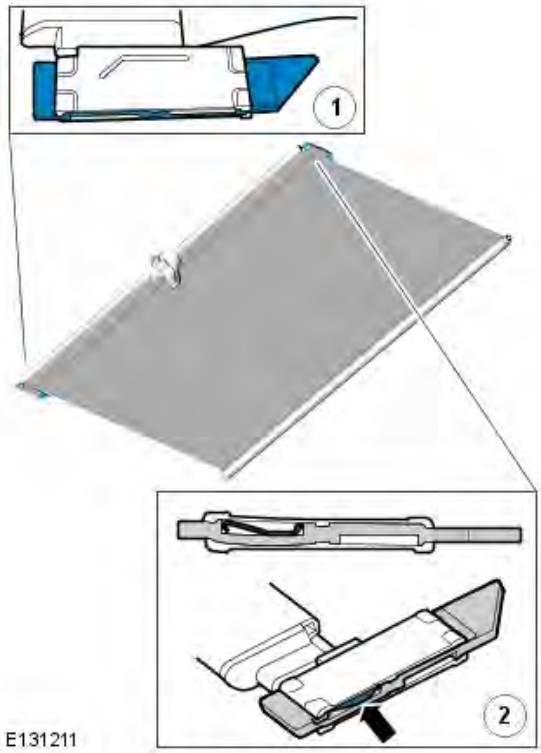
D13: RAIL MOUNTED GUIDE BRACKETS - LOCATION



	1 Carry out visual and manual inspection of the rail mounted guide brackets.
	2 Confirm that the rail mounted guide brackets are correctly located, with no movement in any direction.
	Are the rail mounted guide brackets correctly located, with no movement in any direction? **Yes** GO to D14. **No** Correctly re-assemble or if required replace the rail mounted guide bracket(s). GO to D14.
D14: GLASS PANEL - REASSEMBLY	
	1 Re-assemble the glass panel onto the roof opening panel.
	2 Perform the manual roof opening panel initialization procedure. REFER to: Motor Synchronization (501-17 Roof Opening Panel, General Procedures).
	3 Check for correct roof opening panel operation.
	Does the roof opening panel operate correctly? **Yes** No further action required. **No** Contact dealer technical support.

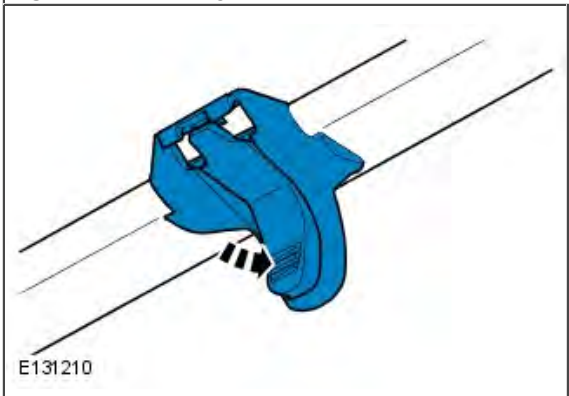
PINPOINT TEST E : ROOF OPENING PANEL BLIND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: ROOF OPENING PANEL BLIND - OPERATION	
• NOTE: These tests are to be carried out to determine the cause of the roof opening panel blind noisy operation, not latching or not retracting.	
	1 Operate the roof opening panel blind through all movements and latch to the frame.
	Does the roof opening panel blind operate through all movements and latch correctly? **Yes** GO to E2. **No**

	GO to E8.
E2: ROOF OPENING PANEL BLIND - NOISE DURING OPERATION	
	1 Operate the roof opening panel blind through all movements and latch to the frame.
	Is the roof opening panel blind noisy during operation when compared to another vehicle? **Yes** GO to E3. **No** GO to E8.
E3: ROOF OPENING PANEL BLIND - ASSEMBLY	
 E131740	1 Carry out visual checks of the roof opening panel blind assembly.
	2 Confirm the correct location of the mounting pins and the slide shoe(s).
	Are the mounting pins and the slide shoe(s) correctly located? **Yes** GO to E4. **No** Correctly reassemble the mounting pins or slide shoe(s). GO to E2.
E4: ROOF OPENING PANEL BLIND - SLIDE SHOES	
	1 Operate the roof opening panel blind through all movements and latch to the frame.
	2 Carry out visual, manual and audible checks of the roof opening panel blind assembly during operation.
	Is the noise caused by the slide shoe(s) in the guide(s)? **Yes** GO to E5. **No** GO to E7.
E5: SLIDESHOE / GUIDES - CONTAMINATION	
 E131741	1 Remove the leading edge of the roof opening panel blind, dismantle the slide shoe(s) from the guide(s).
	2 Inspect the guide(s) for debris.
	Are the guide(s) contaminated with debris? **Yes** Clear any debris from the guide(s). Reassemble the slide shoe(s) into the guide(s), Reinstall the roof opening panel blind. GO to E1. **No** GO to E6.
E6: SLIDE SHOE(S) / RUBBERS / SPRINGS - ASSEMBLY	

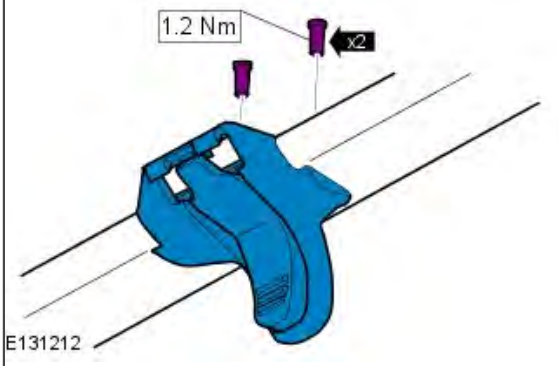


	1 Check that the slide shoe rubbers and springs are correctly assembled.
	Are the slide shoe rubbers and springs correctly assembled? **Yes** Replace the roof opening panel blind. GO to E7. **No** Correctly reassemble the slide shoe rubbers and springs into the slide shoes, reassemble the slide shoes into the guides. GO to E1.
E7: ROOF OPENING PANEL BLIND - MECHANISM NOISE	
	1 Operate the roof opening panel blind through all movements and latch to the frame.
	Is the noise caused by the roof opening panel blind mechanism? **Yes** Replace the roof opening panel blind. GO to E1. **No** GO to E1.
E8: ROOF OPENING PANEL BLIND - LATCH OPERATION	
	1 Operate the roof opening panel blind through all movements and latch correctly to the frame.
	Does the roof opening panel blind latch correctly? **Yes** GO to E9. **No** GO to E12.
E9: ROOF OPENING PANEL BLIND - RETRACTION	
	1 Operate the roof opening panel blind through all movements and then retract.
	Does the roof opening panel blind retract correctly? **Yes** GO to E1. **No** GO to E10.
E10: ROOF OPENING PANEL BLIND - REWIND PROCEDURE	
	1 Remove the roof opening panel blind from the roof opening panel. 2 Rewind the roof opening panel blinds mechanism referring to the roof opening panel blind rewind procedure in this procedure. 3 Reassemble the roof opening panel blind and reinstall.
	Could the rewind procedure be completed correctly? **Yes** GO to E11. **No** Replace the roof opening panel blind. GO to E1.
E11: ROOF OPENING PANEL BLIND - REINSTALL	
	1 Reinstall the roof opening panel blind to the roof opening panel. REFER to: Roof Opening Panel Blind (501-17 Roof Opening Panel, Removal and Installation). 2 Operate the roof opening panel blind through all movements and then retract.
	Does the roof opening panel blind retract correctly? **Yes** No further action required. **No** Replace the roof opening panel blind.
E12: VISUAL INSPECTION	
	1 Carry out visual inspection of the roof opening panel blind.
	Is the roof opening panel blind handle installed? **Yes** GO to E13. **No** Reinstall the roof opening panel blind handle. Check for correct operation.

E13: HANDLE REPLACEMENT



1 Blind (check)



2 Carry out visual inspection of the roof opening panel blind.

Is the roof opening panel blind handle damaged?

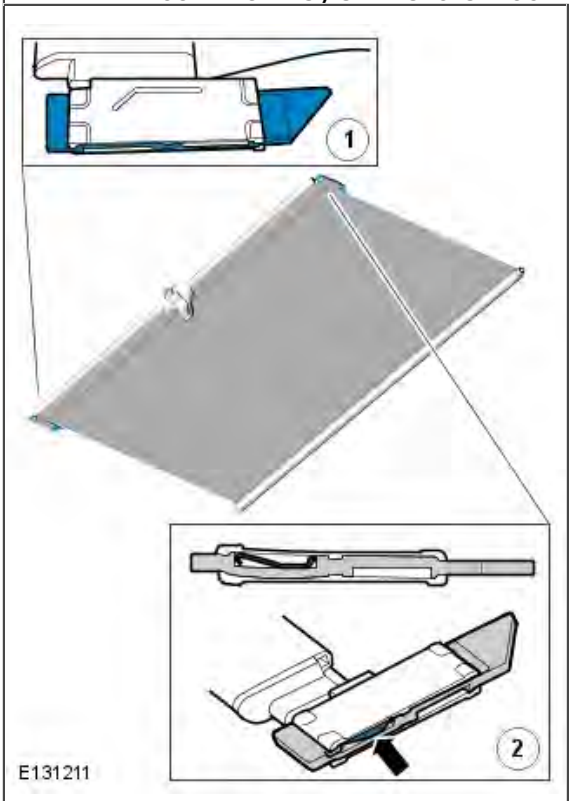
Yes

Replace the damaged roof opening panel blind handle. GO to E15.

No

GO to E14.

E14: BLIND - MOUNTING PINS / SLIDE SHOES - LOCATION



1 Carry out visual and manual inspection of the roof opening panel blind mounting pins and slide shoe(s).

Are the mounting pins and slide shoe(s) intact and correctly located?

Yes

GO to E15.

No

Correctly reassemble the mounting pins and slide shoe(s) reinstall the roof opening panel blind. Check for correct operation.

E15: ROOF OPENING PANEL BLIND - DAMAGED

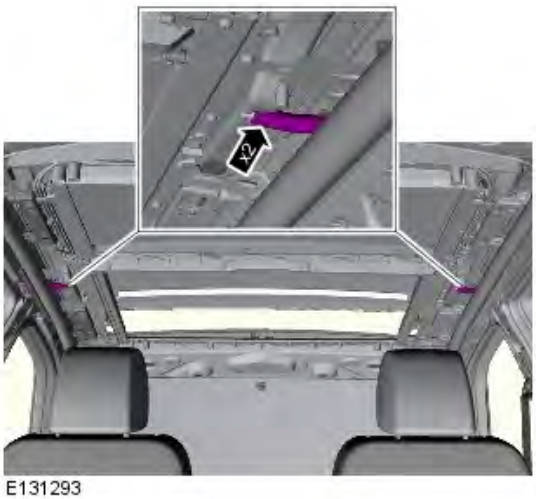
1 Carry out visual inspection of the roof opening panel blind.

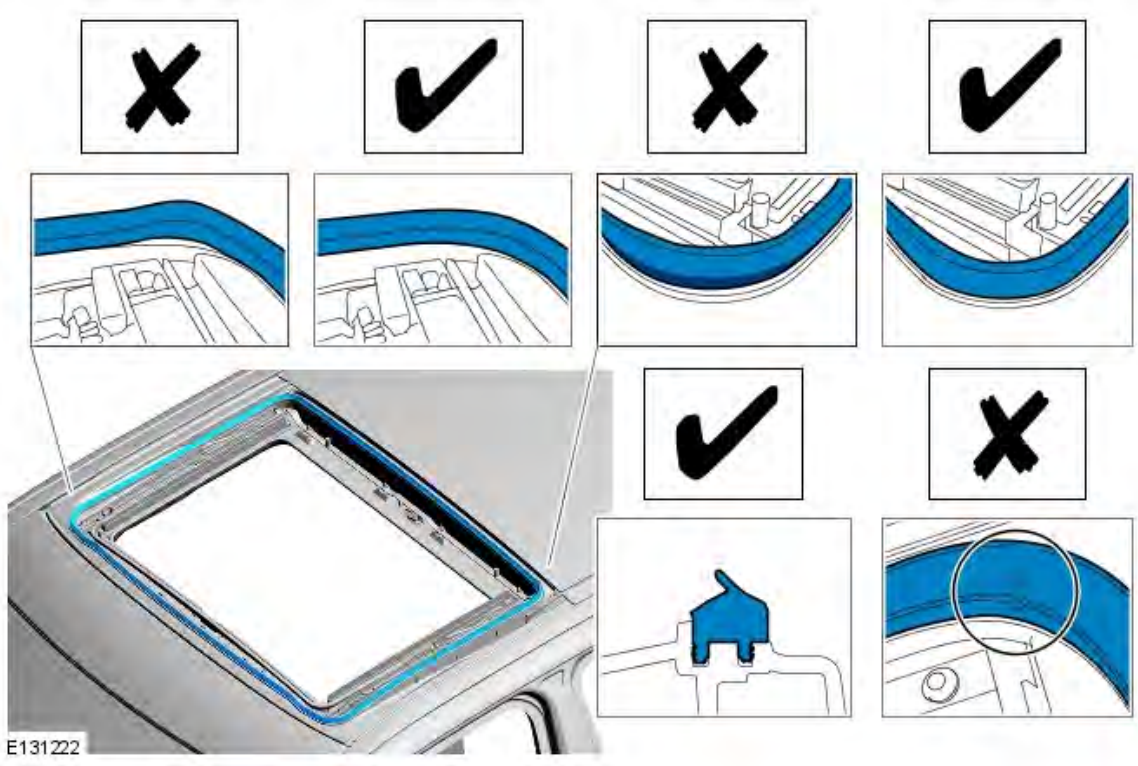
Is the roof opening panel blind beam miss-shaped in such a way that the handle latching feature is no longer in line with the frame latching feature?

Yes

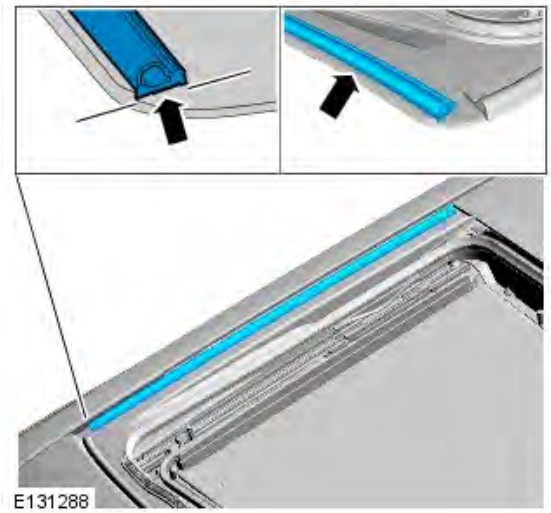
Replace the roof opening panel blind.

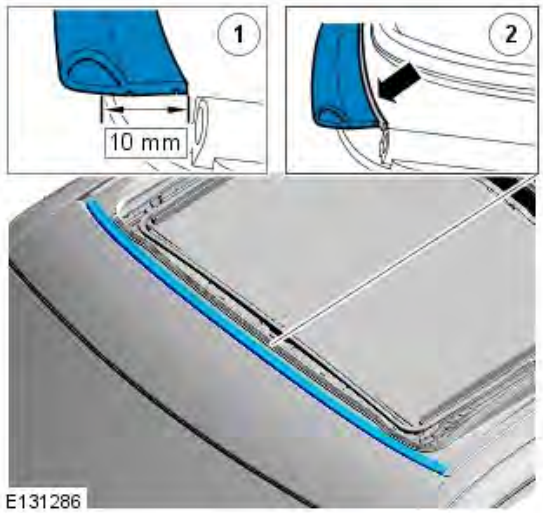
	No Contact dealer technical support.

PINPOINT TEST F : WATER INGRESS	
TEST CONDITIONS	**DETAILS/RESULTS /ACTIONS**
F1: DRAIN TUBE - INSPECTION	
• NOTE: These tests are to be carried out to determine the cause of the water ingress around the roof opening panel.	
• NOTE: Using the manufacturer approved process carry out a water leak test to locate the point of water ingress, often visual inspection of the suspect area including studying any water staining is the best method to pinpoint the water entry point.	
	1 Fully retract the roof opening panel.
	2 Carry out visually inspection of the roof opening panel water drain tube openings and confirm that they are not obstructed by debris.
	Are the water drain tubes obstructed by debris? **Yes** Remove any obstructions. **No** GO to F2.
F2: DRAIN TUBE - LOCATION	
 E131293	1 Gain access to the drain tubes at the roof opening panel stub. REFER to: Headliner - Vehicles With: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
	2 Ensure that the drain tubes are not kinked or twisted.
	3 Check that the drain tubes are correctly attached.
	Are the drain tubes correctly attached to the roof opening panel? **Yes** GO to F3. **No** Correctly reinstall the water drain tubes, ensure that there are no kinks or twists.
F3: AIR DEFLECTOR - FOLDED POSITION	
	1 Operate the roof opening panel using the roof mounted switch.
	During closing of the roof opening panel glass, does the wind deflector net fold forwards and become trapped between the glass panel and the glass

	seal? **Yes** Install a new wind deflector. REFER to: Air Deflector (501-17 Roof Opening Panel, Removal and Installation). **No** GO to F4.
F4: GLASS PANEL SEAL - LOCATION	
	1 Confirm that the roof opening panel, glass panel seal is correctly located, secure with no kinks.
	Is the roof opening panel glass panel seal correctly located and secure with no kinks. REFER to: Roof Opening Panel Seal (501-17 Roof Opening Panel, Removal and Installation). **Yes** GO to F5. **No** Install a new glass panel seal. REFER to: Roof Opening Panel Seal (501-17 Roof Opening Panel, Removal and Installation).
F5: ROOF OPENING - APERTURE	
• NOTE: The previous steps have confirmed that the route of the water ingress is not through the roof opening panel but through the bonded seal between the vehicle body the roof opening panel frame.	
	1 Carry out a water leak test of the bonded seal between the vehicle body the roof opening panel frame to locate the point of water ingress.
	Can the water ingress point be located on the bonded seal between the vehicle body the roof opening panel frame?

	Yes Using the manufacturer approved process apply sealer to the point of water ingress. **No** The water ingress point has not been located or the roof opening panel frame requires removal to enable a water tight seal to be established. **Contact dealer technical support**

PINPOINT TEST G : ROOF OPENING PANEL - WIND NOISE	
TEST CONDITIONS	**DETAILS/RESULTS /ACTIONS**
G1: ROOF OPENING PANEL - OPERATION	
• NOTE: These tests are to be carried out to determine the cause of the wind noise around the roof opening panel area.	
	1 Operate the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close) using the roof mounted switch.
	Does the roof opening panel operate correctly? **Yes** GO to G2. **No** GO to Pinpoint Test C.
G2: SIDE ACOUSTIC SEAL - LOCATION	
	1 Carry out a visual inspection of the side acoustic seals for location and security.
	Are the side acoustic seals correctly located and bonded to the roof opening panel frame? **Yes** GO to G3. **No** Correctly relocate and bond the side acoustic seals to the roof opening panel frame. GO to G3.
G3: FRONT ACOUSTIC SEAL - LOCATION	



1 Carry out a visual inspection of the front acoustic seals for location and security.

- Vehicles built up to VIN 154971.
- Vehicles built from VIN 154972.

Is the front acoustic seal correctly located and bonded to the roof opening panel frame?

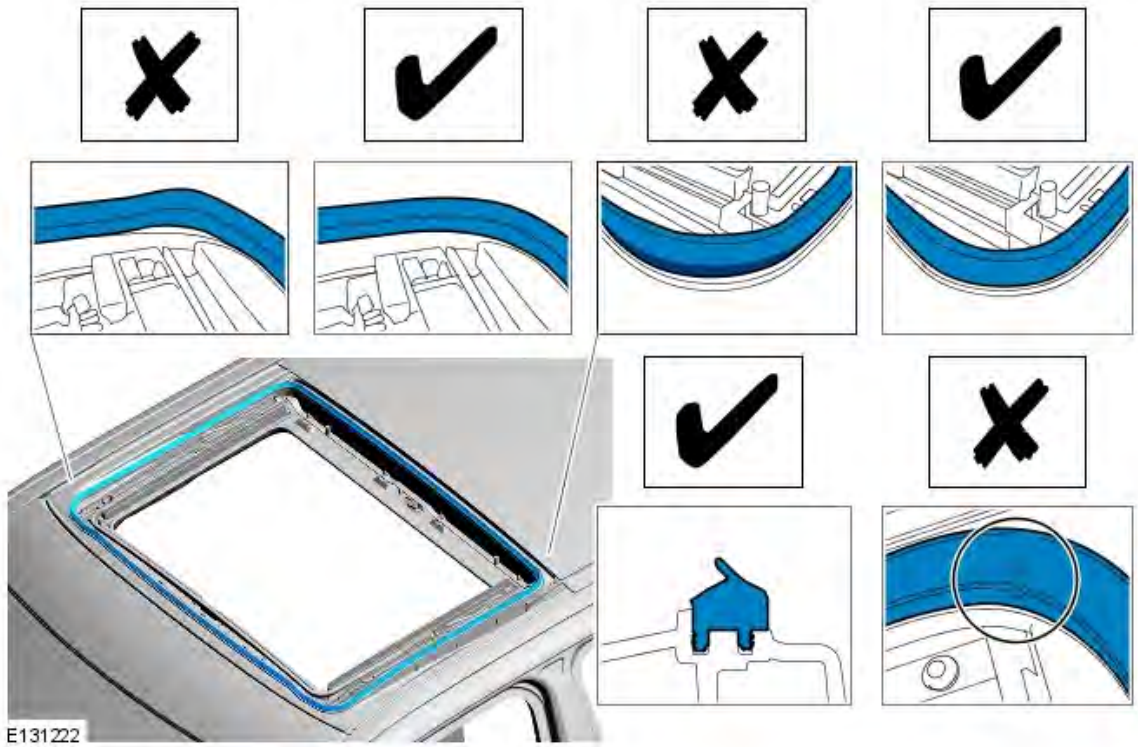
Yes

GO to G4.

No

Replace the front acoustic seal. Clean all relevant surfaces then correctly position and bond the front acoustic seal to the roof opening panel. GO to G4.

G4: GLASS SEAL - LOCATION



1 Carry out a visual inspection of the glass seal for location and security.

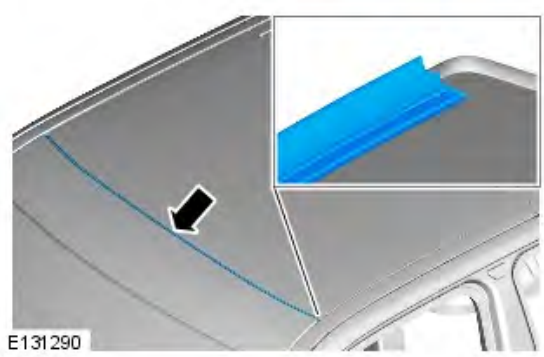
Is the glass seal correctly located and bonded to the roof opening panel frame?

Yes

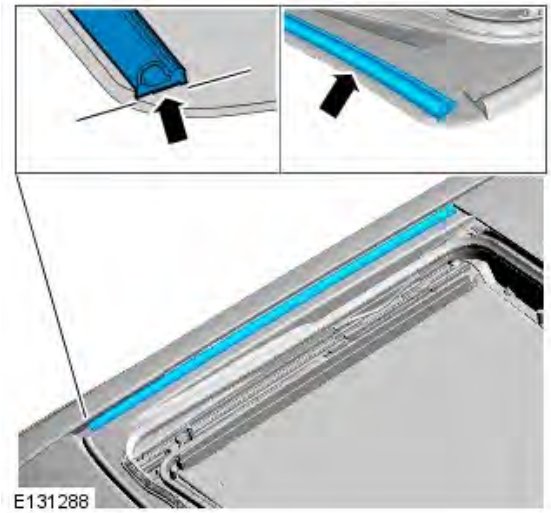
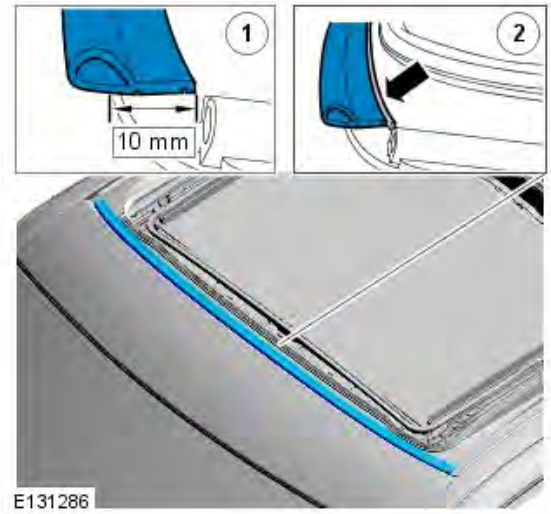
GO to G5.

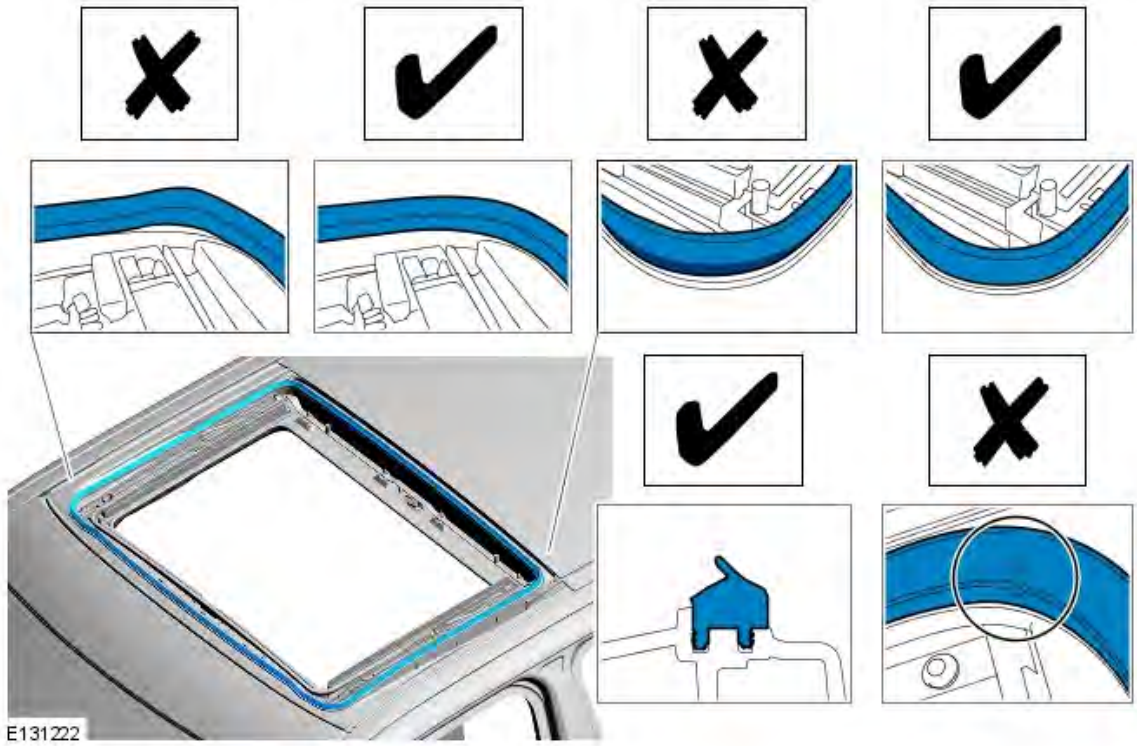
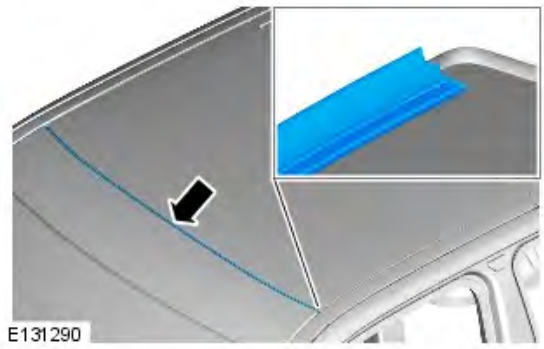
No

Replace the glass seal.

	Clean all relevant surfaces then correctly position and bond the glass seal to the roof opening panel. GO to G5.
G5: DRIP LIP - LOCATION	
	1 Carry out a visual inspection of the drip lip on the glass panel for location and security.
	Is the drip lip correctly located on the glass panel? **Yes** GO to G7. **No** Replace the glass panel (The drip lip is not a serviceable part). GO to G6.
G6: INITIALIZATION	
	1 Perform the manual roof opening panel initialization procedure. REFER to: Motor Synchronization (501-17 Roof Opening Panel, General Procedures).
	2 Operate the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close) using the roof mounted switch.
	3 Check the vehicle for wind noise from the roof opening panel.
	Is the wind noise still evident? **Yes** Contact dealer technical support. **No** No further action required.
G7: INITIALIZATION	
	1 Perform the manual roof opening panel initialization procedure. REFER to: Motor Synchronization (501-17 Roof Opening Panel, General Procedures).

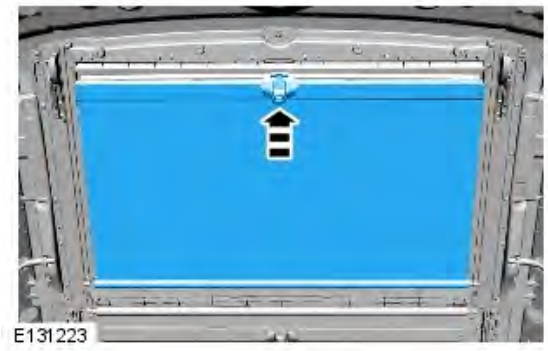
	2 Check the vehicle for wind noise from the roof opening panel.
	Is the wind noise still evident? **Yes** Contact dealer technical support. **No** No further action required.

PINPOINT TEST H : SEALS LOOSE OR ADRIFT	
TEST CONDITIONS	**DETAILS/RESULTS /ACTIONS**
H1: SIDE ACOUSTIC SEAL - LOCATION	
	1 Carry out a visual inspection of the side acoustic seals for location and security.
	Are the side acoustic seals correctly located and bonded to the roof opening panel frame? **Yes** GO to H2. **No** Correctly relocate and bond the side acoustic seals to the roof opening panel frame. GO to H2.
H2: FRONT ACOUSTIC SEAL - LOCATION	
	1 Carry out a visual inspection of the front acoustic seals for location and security. • Vehicles built up to VIN 154971. • Vehicles built from VIN 154972.
	Is the front acoustic seal correctly located and bonded to the roof opening panel frame?

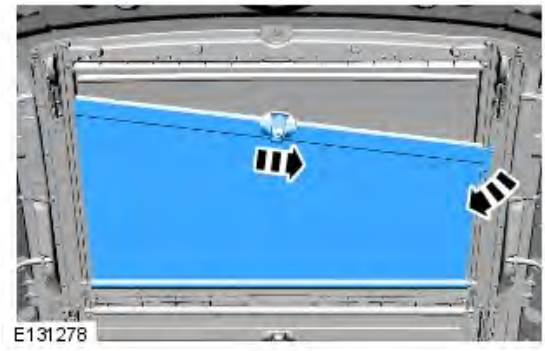
	Yes GO to H3. **No** Correctly relocate and bond the front acoustic seal to the roof opening panel frame. GO to H3.
H3: GLASS SEAL - LOCATION	
 	1 Carry out a visual inspection of the glass seal for location and security.
	Is the glass seal correctly located and bonded to the roof opening panel frame? **Yes** GO to H4. **No** Replace the glass seal and bond the four corners of the glass seal to the roof opening panel frame. GO to H4.
H4: DRIP LIP - LOCATION	
 	1 Carry out a visual inspection of the drip lip on the glass panel for location, condition and security.
	Is the drip lip correctly located on the glass panel and in good condition? **Yes** The drip lip is correctly located on the glass panel. No

	No	further action required. Replace the glass panel (The drip lip is not a serviceable part).

Roof opening panel blind rewind procedure - Vehicles built up to VIN 154971



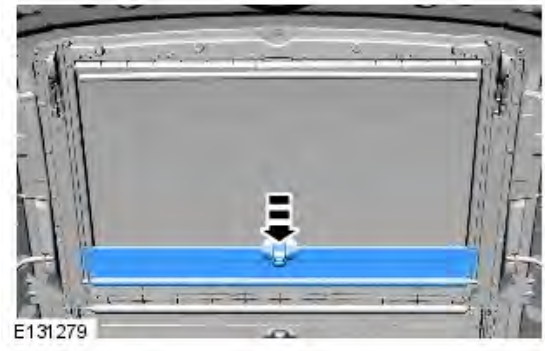
1. **1.** Close the roof opening panel blind (but do not latch the handle to the frame) .



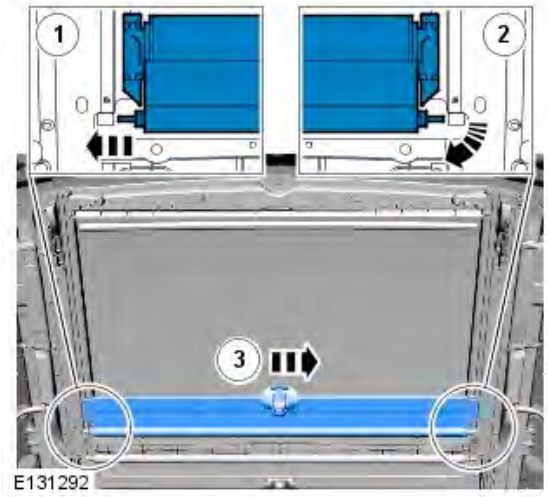
2. • NOTE: Rotate the roof opening panel in the directions illustrated.

   2. Release the roof opening panel blind from the runners.

   - Rotate the left-hand edge counter clockwise and release the right-hand edge from the frame.

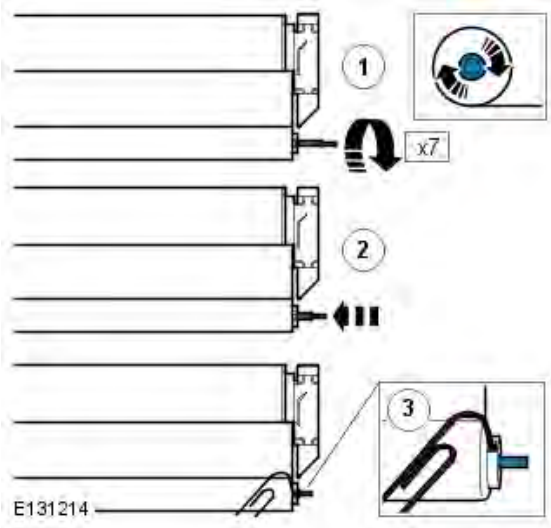


3. **3.** Open the roof opening panel blind.



4. **4.** Release the roof opening panel blind from the mounting bracket and remove the roof opening panel blind from the vehicle.

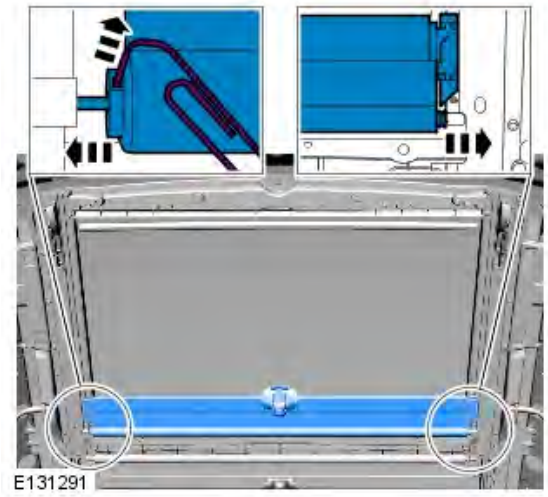
    1. Push the roof opening panel blind in to the frame to release the left-hand spring axle.
    2. Rotate the roof opening panel blind counter clockwise.
    3. Remove the roof opening panel blind.



5. • NOTE: The roof opening panel must be rewound 7 rotations.

    5. Rewind the roof opening panel.

    1. Using a suitable tool, hold and rotate the spring axle.
    2. Push the spring axle in to the roof opening panel blind and align the spring axle locking holes.
    3. Using suitable pin or paperclip (as illustrated), lock the spring axle.

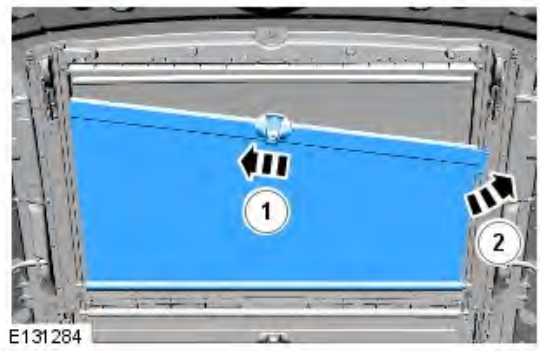


6. • NOTE: Make sure that the spring axle is correctly located into the roof opening panel frame.

    • NOTE: Make sure that the suitable pin or paperclip remains in place while installing the roof opening panel blind.

    6. Install the roof opening panel blind to the frame.

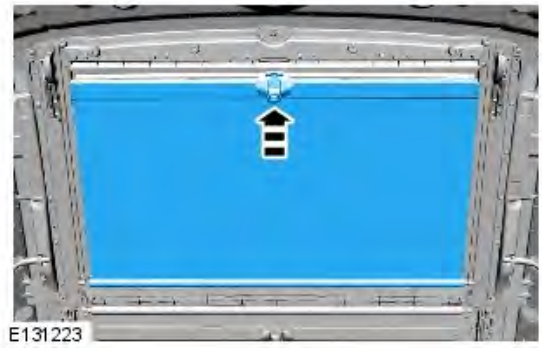
- Remove the suitable pin or paperclip from the roof opening panel blind once the roof opening panel has been correctly installed.



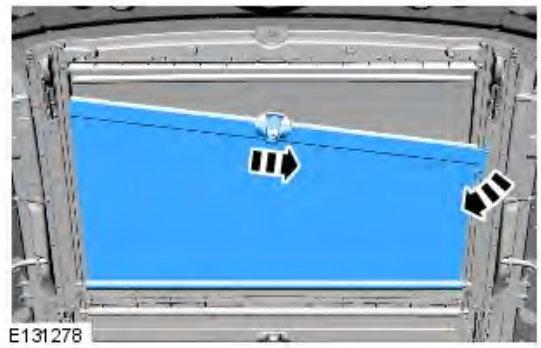
7. **7.** Install the roof opening panel blind sliders to the runners.
    1. Push the roof opening panel blind right-hand slider in to the runner.
    2. Install the left-hand slider clockwise to the runner.

8. **8.** Open the roof opening panel blind and check for correct operation.

Roof opening panel blind rewind procedure - Vehicles built from VIN 154972

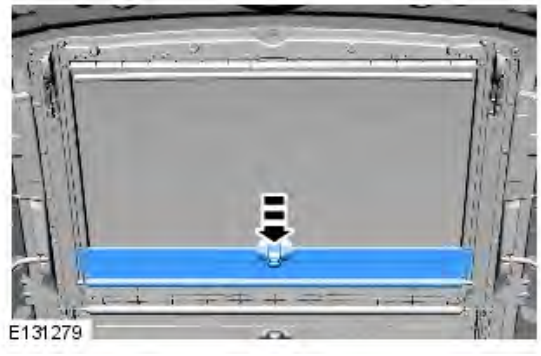


1. **1.** Close the roof opening panel blind.

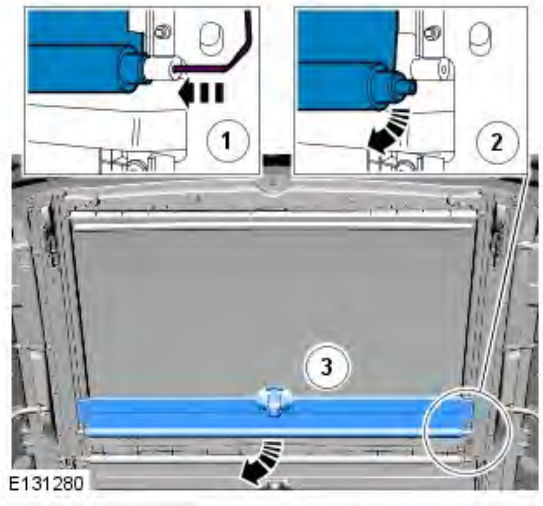


2. • NOTE: Rotate the roof opening panel in the directions illustrated.

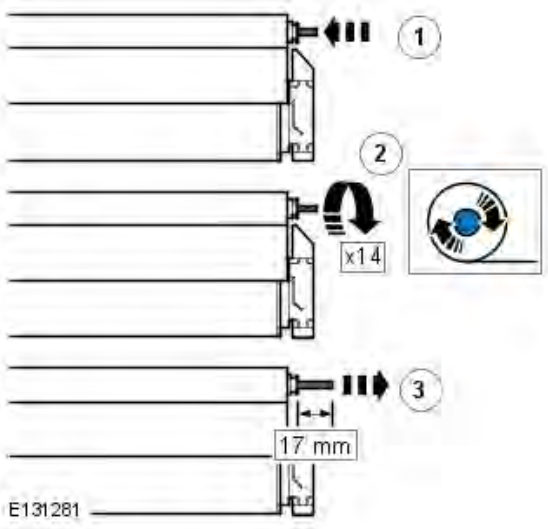
   2. Release the roof opening panel blind from the runners.
    - Rotate the left-hand edge counter clockwise and release the right-hand edge from the frame.



3. **3.** Open the roof opening panel blind.



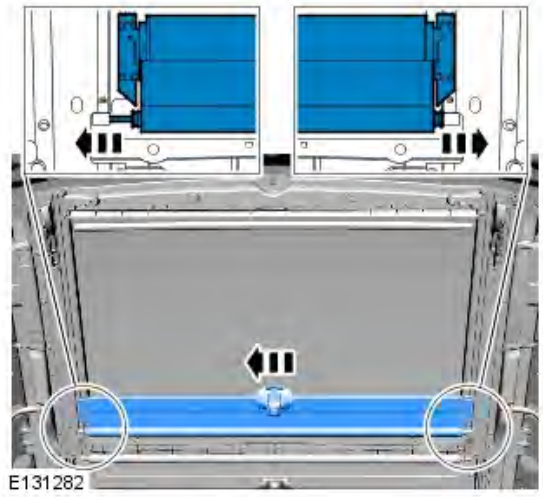
4. **4.** Using a suitable pin or paperclip (as illustrated), release the roof opening panel blind from the mounting bracket and remove the roof opening panel blind from the vehicle.



5. • NOTE: The roof opening panel must be rewound 14 rotations.

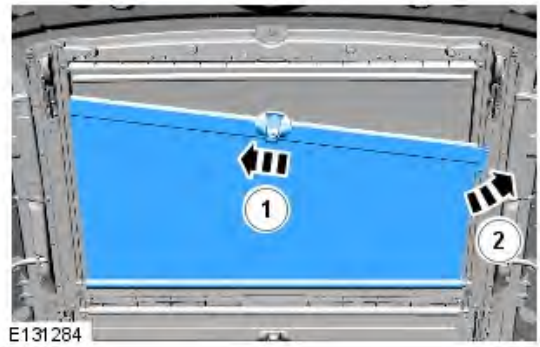
   5. Rewind the roof opening panel.

   1. Push the spring axle in to the roof opening panel blind.
   2. Using a suitable tool, hold and rotate the spring axle.
   3. Release the spring axle 17 mm from the roof opening panel blind once after the 14 rotations have been achieved.



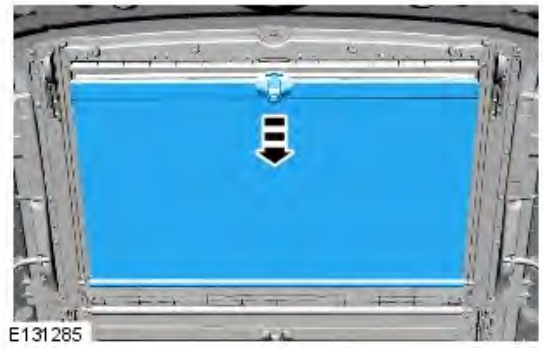
6. • NOTE: Make sure that the spring axle is correctly located into the roof opening panel frame.

   6. Install the roof opening panel blind to the frame.



7. **7.** Install the roof opening panel blind sliders to the runners.

   1. Push the roof opening panel blind right-hand slider in to the runner.
   2. Install the left-hand slider clockwise to the runner.



8. **8.** Open the roof opening panel blind and check for correct operation.

Published: 11-May-2011

Roof Opening Panel - Motor Synchronization

General Procedures

1.

- Set the ignition to the ON position.
- With the roof opening panel closed, press and hold the front of the roof opening panel switch until the roof opening panel has moved to the tilted open position.
- Release the roof opening panel switch.

2.

- Press the front of the roof opening panel switch.
- After 20 seconds the roof opening panel will begin to move.
- Keep the front of the roof opening panel switch pressed until the roof opening panel have fully opened, then closed.

3.

- Once the open/close cycle has completed and the roof opening panel has stopped moving, release the switch.
- The roof opening panel is now synchronized.
- The roof opening panel can now be operated as normal.

Published: 11-May-2011

Roof Opening Panel - Roof Opening Panel

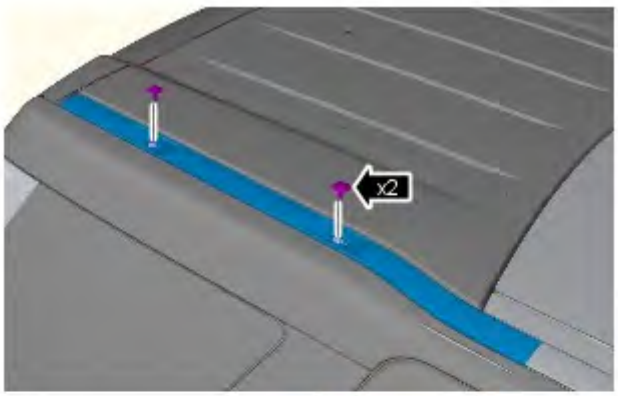
Removal and Installation

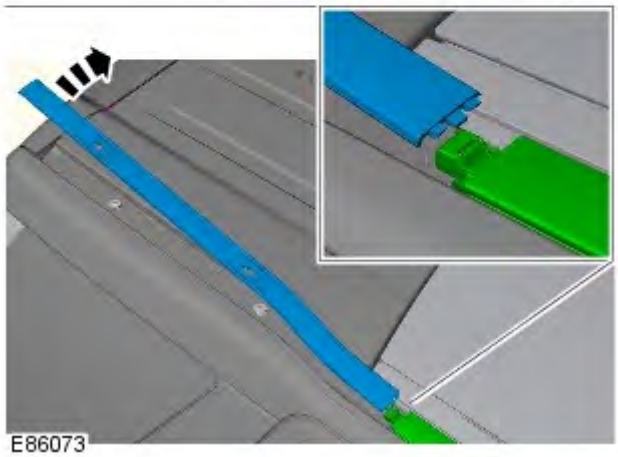
Removal

- CAUTIONS:

Protect the surrounding paintwork to avoid damage.

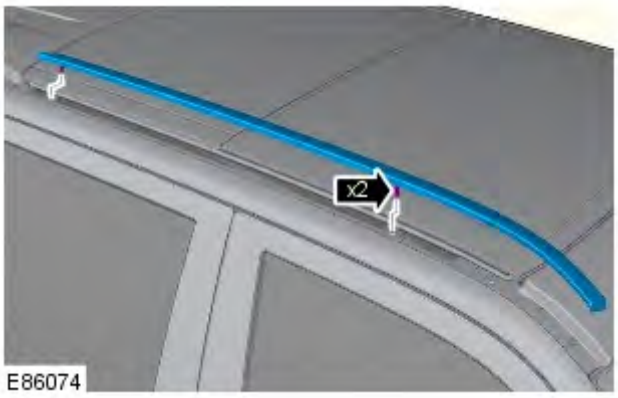
Protect the surrounding trim to avoid damage.





1.

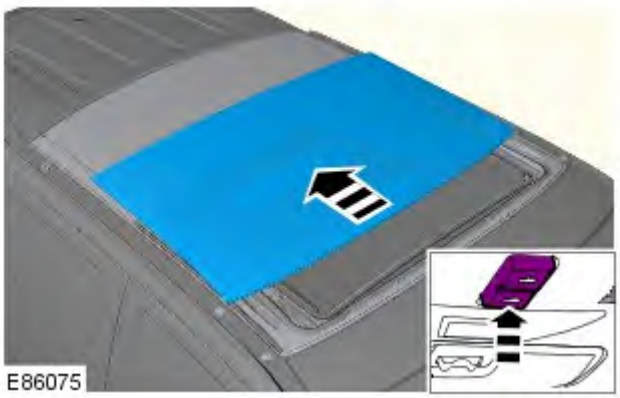
- Remove the rear section of the roof moulding.
- Remove the 2 clips.
- Working from the rear end, carefully release the moulding.



2.

- Remove the front section of the roof moulding.
- Working from the rear end, carefully release the moulding.
- Release the 2 clips.

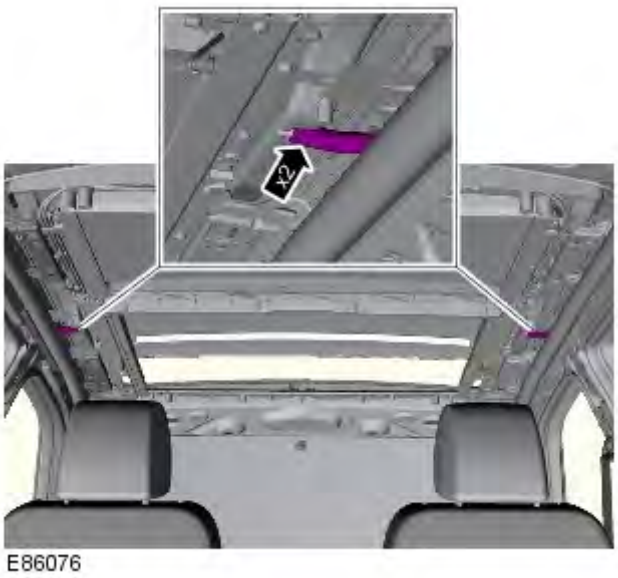
3. Repeat steps 1 and 2 for the other side.



4. Partially open the roof opening panel glass for access.

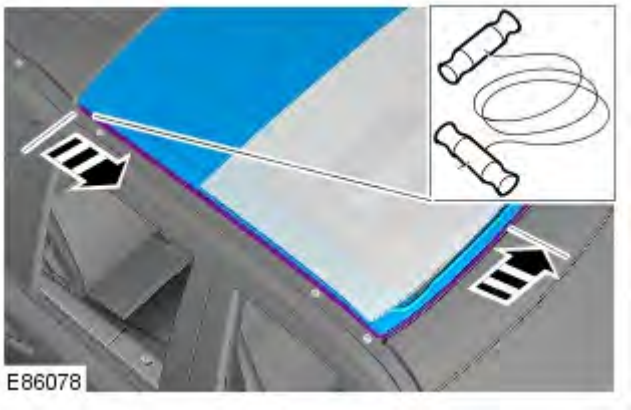
5. Remove the headliner.

   Refer to: Headliner - Vehicles With: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



6.
   - Disconnect the drain tubes.

7. Release the roof opening panel tethers.



8. **8.** WARNING: Wear safety goggles and protective gloves.

   • CAUTIONS:

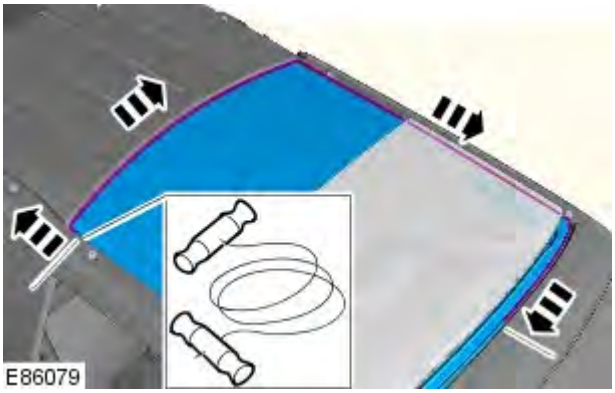
   Protect the surrounding paintwork to avoid damage.

   Protect the surrounding trim to avoid damage.

   If the original roof opening panel is to be installed, take care not to damage the locating pegs.

   • NOTE: This step requires the aid of another technician.

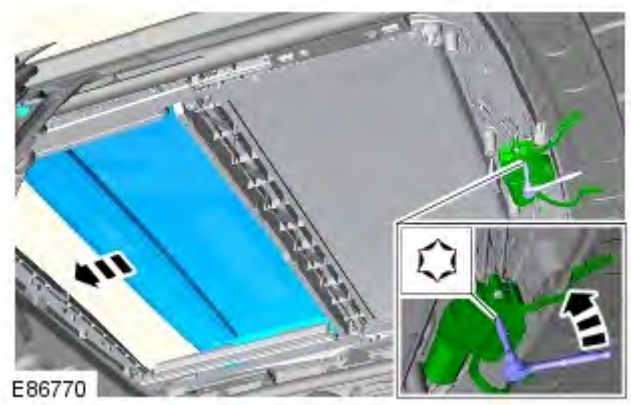
   - Feed the glazing wire through the roof opening panel sealant to the inside of the vehicle.
   - Working in a counter clockwise direction, cut the sealant upto the front locating peg.



9. **9.** CAUTION: If the original roof opening panel is to be installed, take care not to damage the locating pegs.

   • NOTE: This step requires the aid of another technician.

   - Working in a clockwise direction, cut the sealant upto the front locating peg.

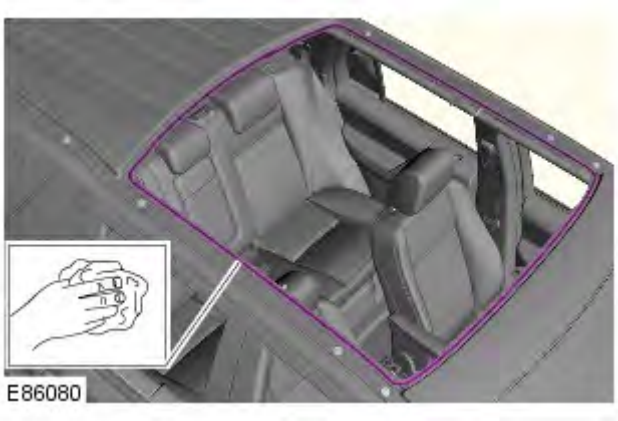


10. Close the roof opening panel glass.

11. **11.** CAUTION: Do not lift the roof opening panel by the blinds.

    • NOTE: This step requires the aid of another technician.

    With assistance, remove the roof opening panel assembly.

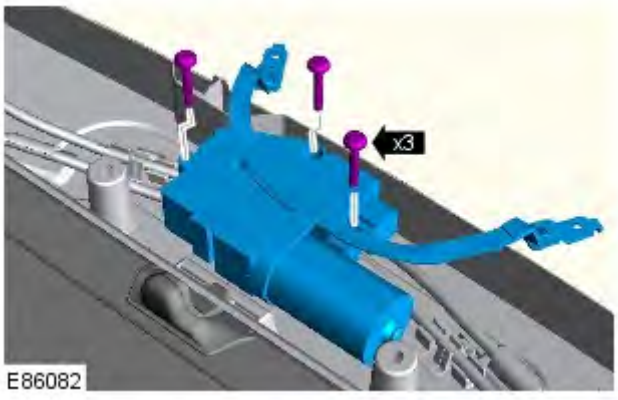


12.

- Carefully remove the sealant from the body to leave a smooth surface.

13. **13.** NOTE: Note the location of the rubber spacers.

- Remove the 12 rubber spacers.
- Carefully remove the sealant from the roof opening panel to leave a smooth surface.



14. **14.** NOTE: Do not disassemble further if the component is removed for access only.

Remove the roof opening panel motor.

Installation

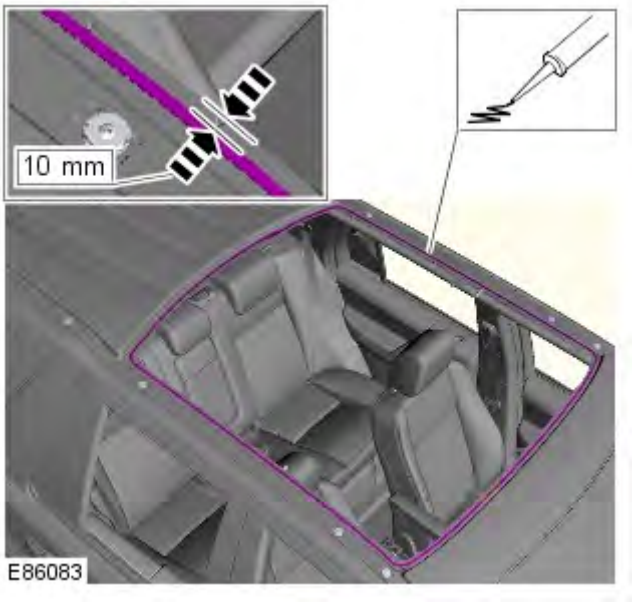
1. Install the roof opening panel motor.

   Torque: 2.5 Nm

2. **2.** CAUTION: Make sure that the surface is clean and free of foreign material.

   - Apply primer of the correct specification to the sealant face on the body and allow to cure.

3. **3.** CAUTION: Make sure that the surface is clean and free of foreign material.
   - Apply primer of the correct specification to the sealant face on the roof opening panel and allow to cure.
4.
   - Install new rubber spacers to the roof opening panel.
5.
   - Fit a pre-cut nozzle to the sealer cartridge, remove the lid, shake out the crystals and fit the cartridge to the applicator gun.
6.
   - Apply a continuous bead of sealant to the body.
   - Apply additional sealant to the body flanges.



7.
   - With assistance, install the roof opening panel assembly.
   - Lightly press the roof opening panel assembly to seat the sealant.
8.
   - Connect the drain tubes.
9.
   - Test the sealant for leaks, apply additional sealant if necessary. If water is used, allow sealant to dry before testing. Spray water around the roof opening panel assembly and check for leaks. Mark any area that leaks. Dry the assembly and sealant then apply additional sealant.
10. Secure the roof opening panel tethers.

    Torque: 4 Nm
11. Install the headliner.

    Refer to: Headliner - Vehicles With: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
12. **12.** CAUTIONS:

    Make sure that the surface is clean and free of foreign material.

Extreme cleanliness must be exercised when handling this component.

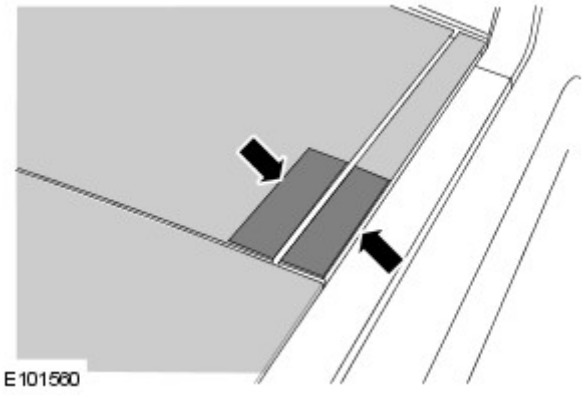
- Install the roof mouldings.
- Spirit wipe the body mating face.
- Remove the protective tape.
- Align the clips.
- Align and secure the mouldings.

Published: 11-May-2011

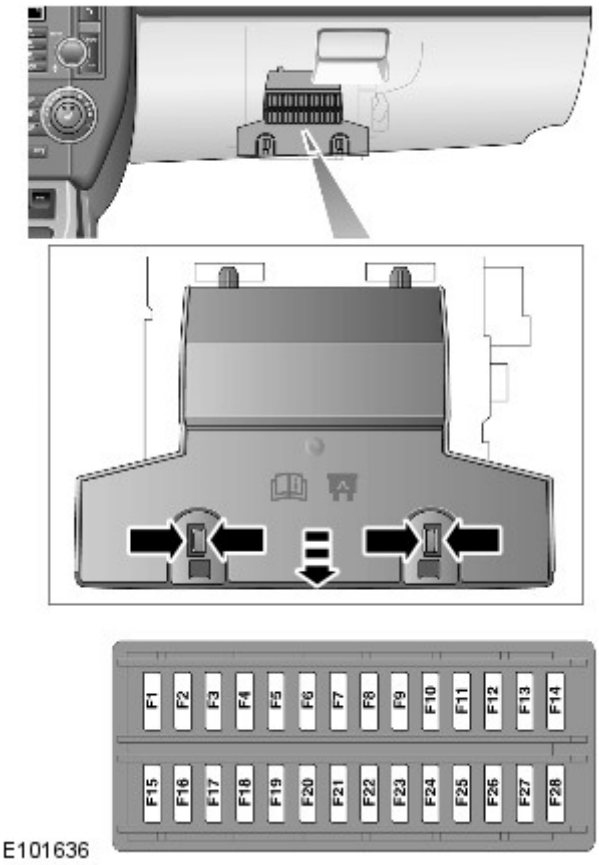
Roof Opening Panel - Roof Opening Panel Glass

Removal and Installation

Removal



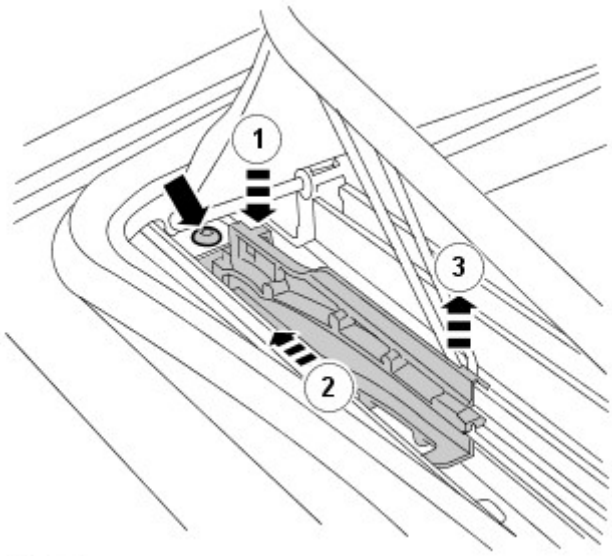
1. **1.** NOTE: Left-hand shown, right-hand similar.
   - Apply strips of masking tape to the front edge of the fixed rear glass to prevent damage when lifting the glass panel.



2. **2.** NOTE: This step requires the aid of another technician.
   - Disable the one-touch operation.
   - Open the roof panel, while the roof opening panel is moving remove fuse F10.
   - Replace fuse F10 and make sure the roof opening panel functions without the one-touch operation.

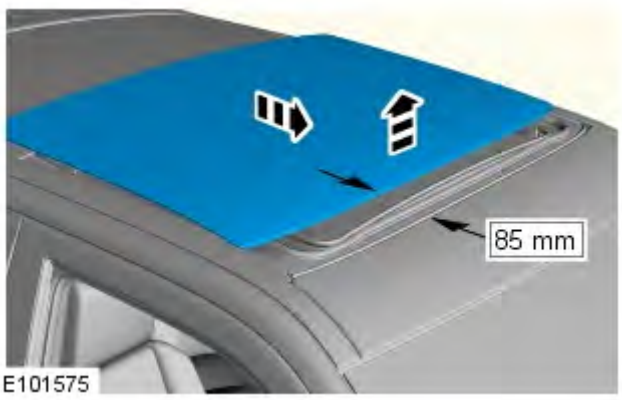
3. Open the roof opening panel blind.

4. Fully open the roof opening panel glass.



E101561

5. **5.** NOTE: Left-hand shown, right-hand similar.
   - Remove the roof opening panel glass guide locators.
   - Remove the Torx screw (TX15).
   - Apply pressure downwards (1) and slide forward (2) and then remove the guide locator (3).
   - Repeat the operation for the other side.

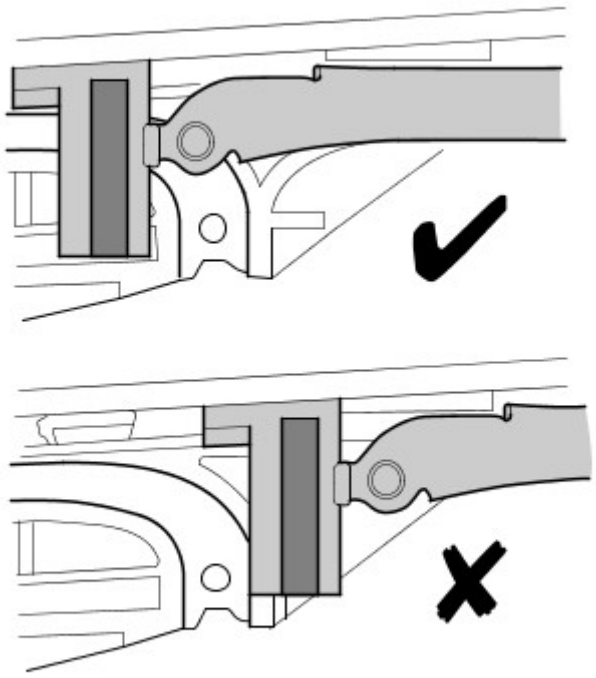


E101575

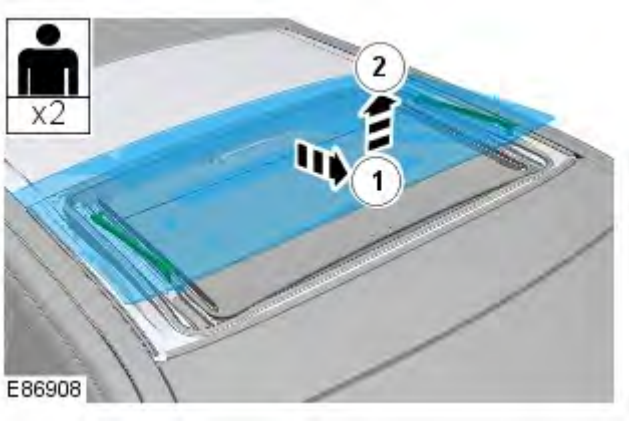
6. **6.** CAUTION: Do not raise the front end of the roof opening panel glass by more than 100 mm with the rear end located as damage may occur.

   • NOTE: This will release the front of the glass panel.
   - Close the roof opening panel glass to 85 mm and apply upwards pressure to release the front of the glass.

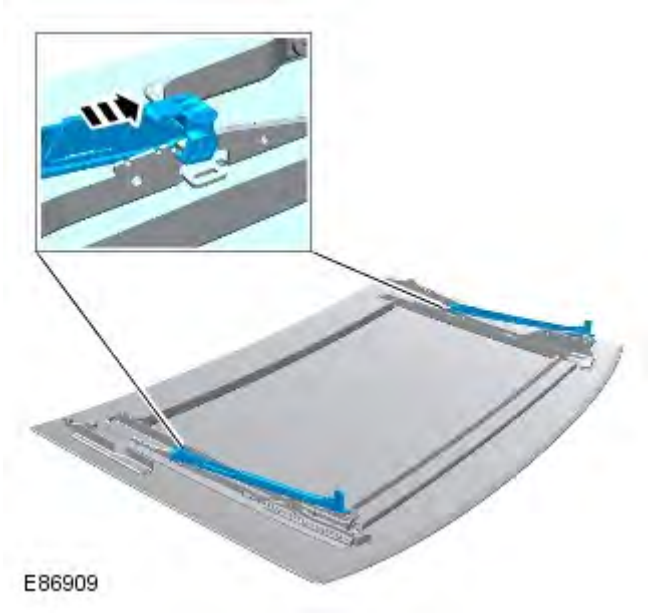
7. **7.** NOTE: Left-hand shown, right-hand similar.
    - Slide the connecting bars forward 20 mm.



E101562

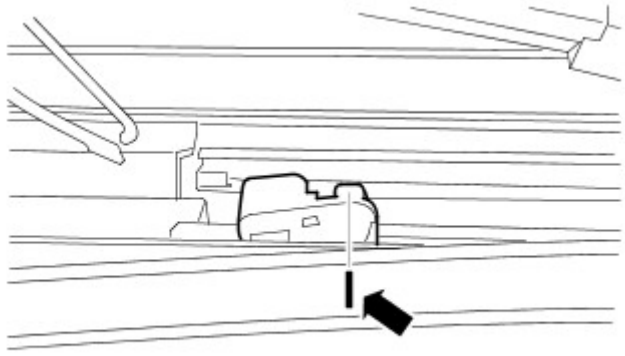


8. **8.** NOTE: This step requires the aid of another technician.
    - Remove the roof opening panel glass.



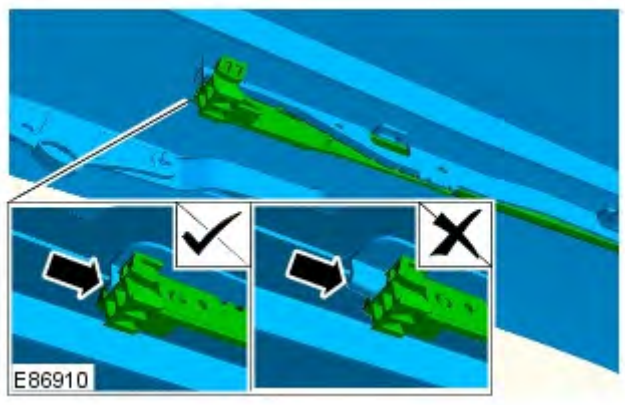
9. **9.** NOTE: Do not disassemble further if the component is removed for access only.
    - Remove the roof opening panel glass connecting bars.

Installation

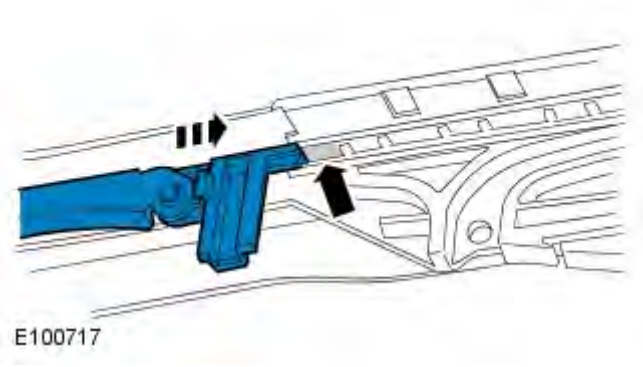


1. **1.** CAUTION: Make sure that the roof opening panel motor is not operated at any time until instructed.

    • NOTE: Left-hand shown, right-hand similar.
    - Using a non-permanent marker, mark the seal to show the roof opening panel glass driving slider position.

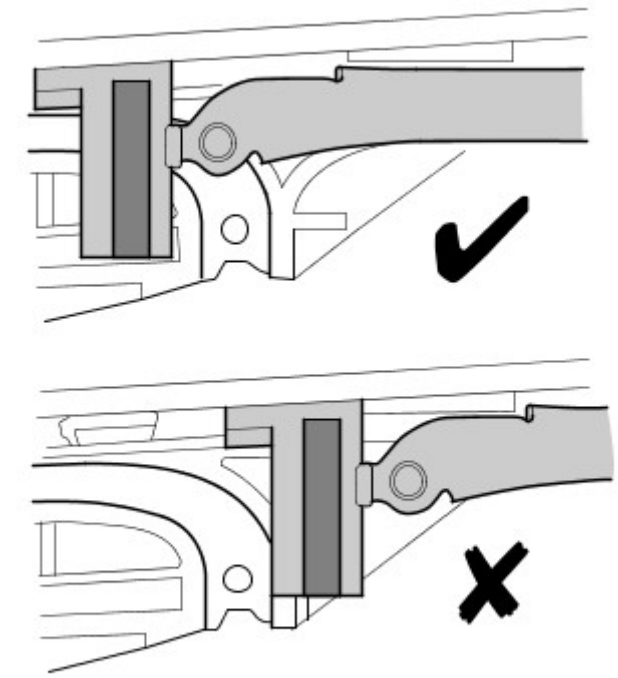


2. **2.** NOTE: This step is only required if previously removed.
    - Locate the connecting bar rear guide.



E100717

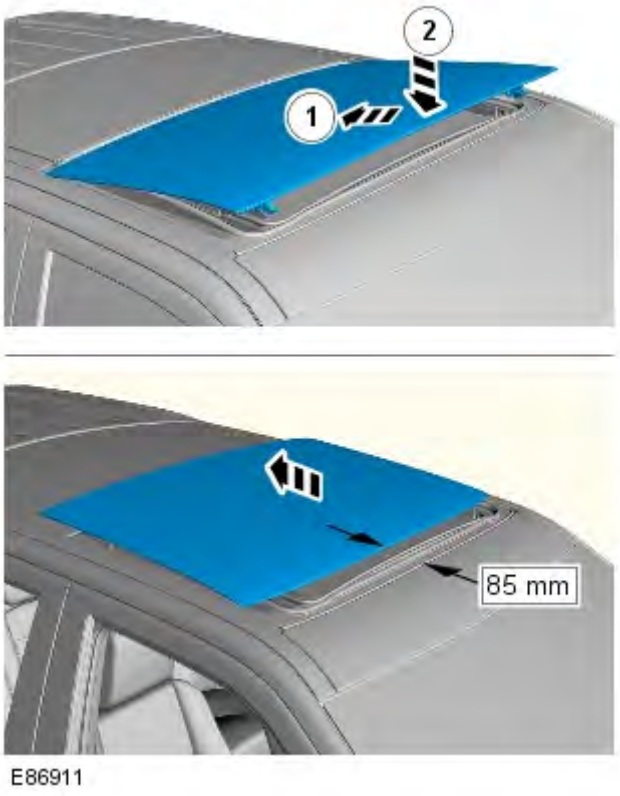
3. **3.** NOTE: This step is only required if previously removed.
   - Locate the connecting bar front guide.



E101562

4. **4.** NOTE: Left-hand shown, right-hand similar.

   • NOTE: This step is only required if previously removed.
   - Slide the connecting bars forward 20 mm.

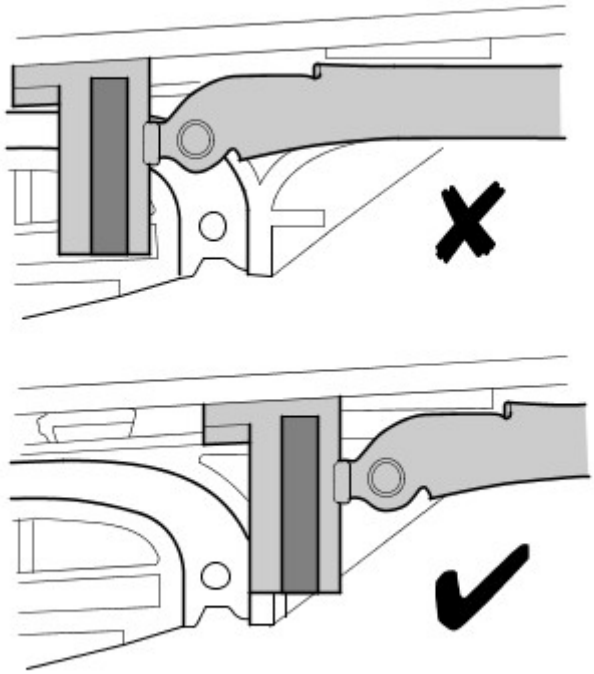


E86911

5. **5.** CAUTION: Do not raise the front end of the roof opening panel glass by more than 100 mm with the rear end located as damage may occur.

   • NOTE: This step requires the aid of another technician.

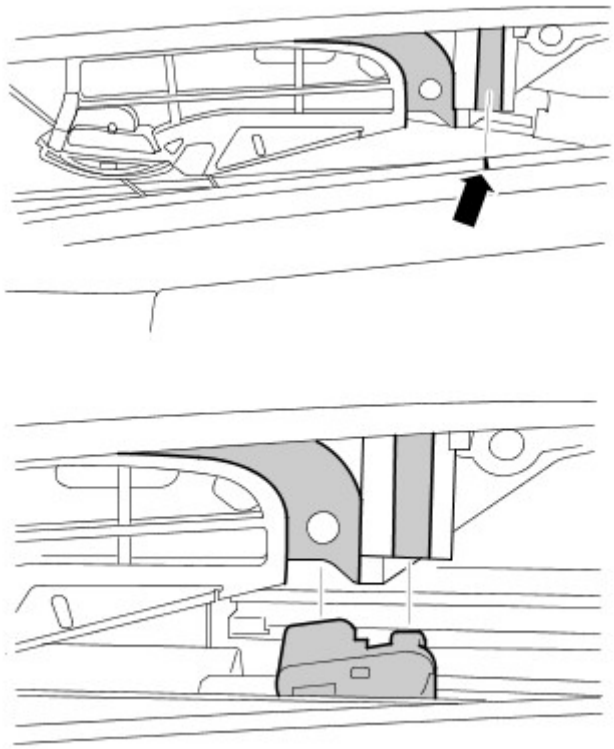
   - Align the rear runners to the roof opening panel channels.
   - Carefully slide the roof opening panel glass rearward, so that a 85 mm opening is achieved.



E101576

6. **6.** NOTE: Left-hand shown, right-hand similar.

   - Align the connecting bar with the roof opening panel guide.



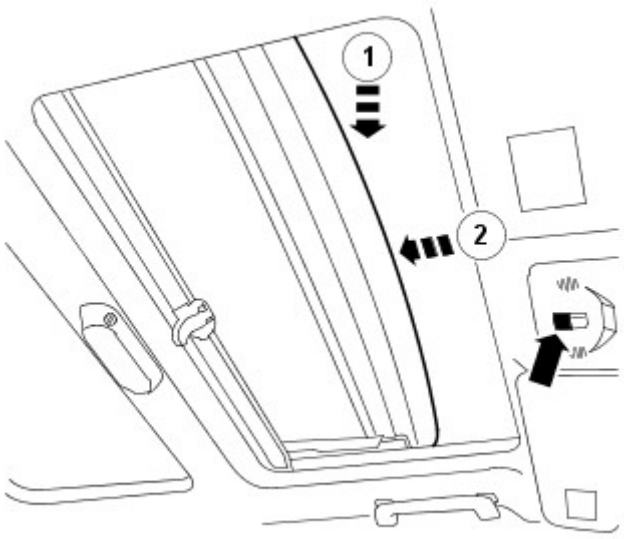
E102784

7. **7.** CAUTION: Damage will occur if the roof opening glass panel is not aligned correctly.

   • NOTE: This step requires the aid of another technician.

   • NOTE: Left-hand shown, right-hand similar.

   - Carefully align and locate the roof opening panel glass to the driving slider.
   - If resistance is encountered, realign the roof opening panel glass to the driving slider.

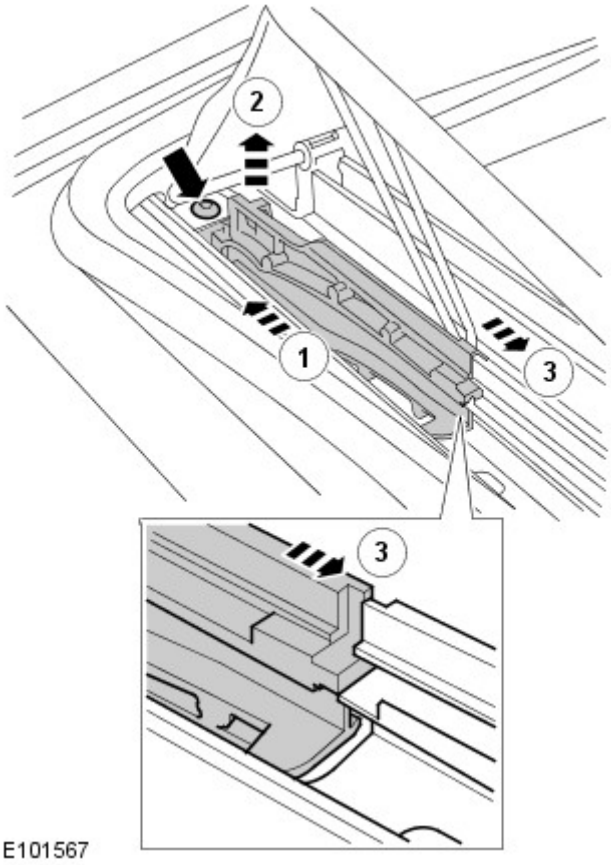


E100486

8. **8.** CAUTION: Do not apply downward pressure whilst operating the roof opening panel.

   • NOTE: A slight noise may be heard when the roof opening panel is operated for the first time.

   - Carefully retract the roof panel glass rearwards for 50 mm to make sure the roof panel glass is correctly located in the guide rails.
   - If the roof panel glass is correctly located, fully open the roof panel glass.



9.
- Install the panel glass guide locator.
- Locate the front of the guide locator (1) and raise upwards (2) and then locate onto the rail and slide forwards (3).
- Tighten the Torx screw to 2.5 Nm.
- Repeat procedure for the other side.

10. **10.** CAUTION: Make sure the net deflector folds protrude rearwards when closing the roof opening panel glass. If the net deflector is folded forwards water leakage from the roof panel may occur.
    - Close the roof opening panel glass.

11. Remove the protective tape.

12. Manually initialize the roof opening panel motor.

13.
    - Switch the ignition on.
    - Press the front leading edge of the roof opening panel switch and move the roof opening panel glass to the full tilt position.
    - Release the switch.
    - Press and hold the front leading edge of the switch.
    - After 20 seconds the roof opening panel glass will perform the following: stall in the tilt mode causing a noise, a full open and close cycle.
    - Do not release the switch until the roof opening panel glass has completed the above step.
    - Release the switch.
    - The roof panel will now operate one-touch open (tilt and fully open) and one-touch close (from the fully open position).
    - One touch close is inoperable from tilt.

14. Close the roof opening panel glass.

15. Close the roof opening panel blind.

Published: 11-May-2011

Roof Opening Panel - Roof Opening Panel Motor

Removal and Installation

Removal

• NOTE: It is possible to gain access to the roof opening panel motor by partially releasing the headliner, the motor is situated above the rear interior lamp.

1. Remove the interior mirror.

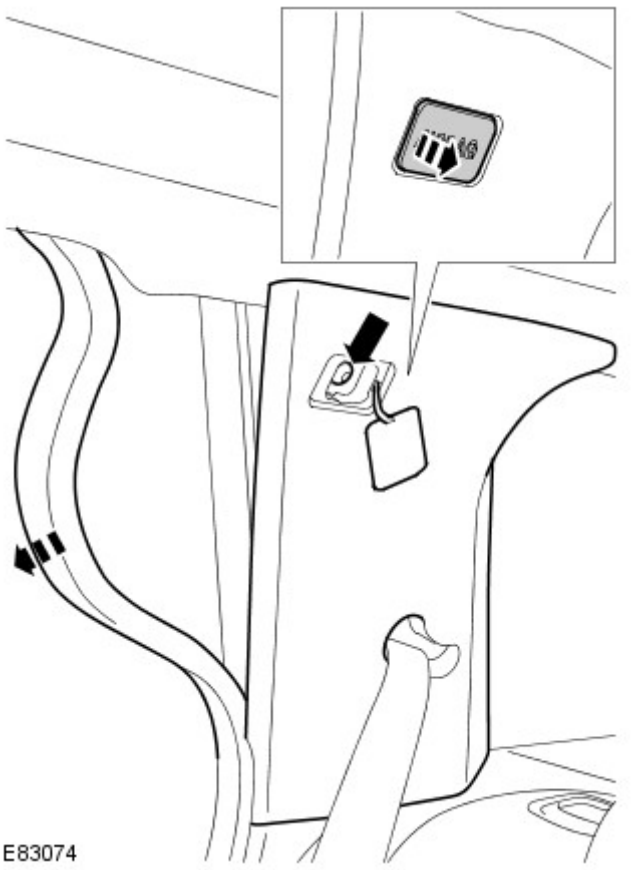
   Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

2. Remove both A-pillar trim panels.

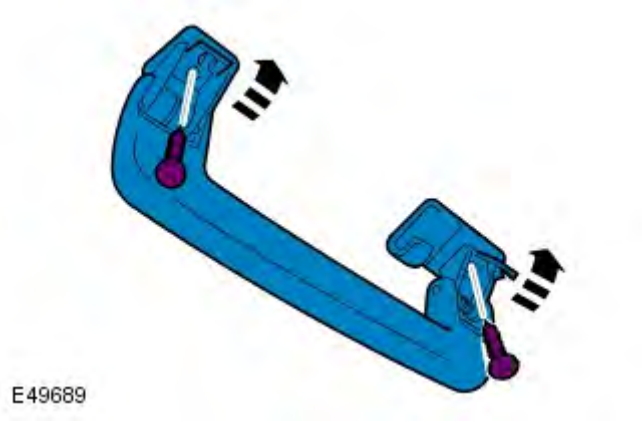
   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove both B-pillar upper trim panels.

   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

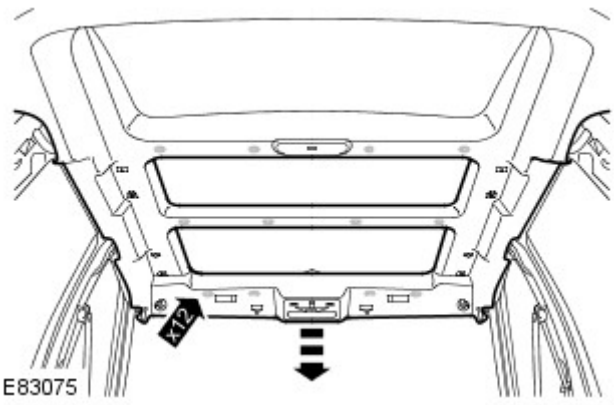


4. Carefully release both C-pillar upper trim panels.

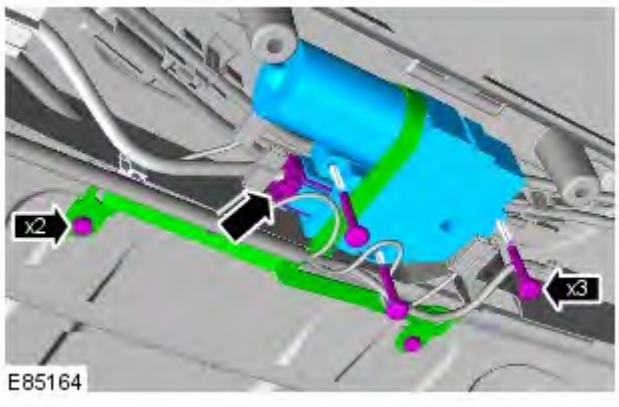


5. Remove the passenger assist handles.

6. Remove both sun visors.



7. With assistance starting from the front edge, carefully release the headliner for access. Support the headliner after release to prevent damage.



8. Remove the roof opening panel motor.

Installation

1. Install the roof opening panel motor.

   Torque: 2.5 Nm

2. Secure the roof opening panel motor tether.

   Torque: 4 Nm

3. Connect the roof opening panel motor electrical connector.

4. With assistance, carefully install the headliner.

5. Install the sun visors.

6. Install the passenger assist handles.

7. Install both C-pillar upper trim panels.

8. Install both B-pillar upper trim panels.

   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

9. Install both A-pillar upper trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

10. Install the interior mirror.

    Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

11. Manually initialize the roof opening panel motor.

12.
    - Switch the ignition on.
    - Press the front leading edge of the roof opening panel switch and move the roof opening panel glass to the full tilt position.
    - Release the switch.
    - Press and hold the front leading edge of the switch.
    - After 20 seconds the roof opening panel glass will perform the following: stall in the tilt mode causing a noise, a full

open and close cycle.
- Do not release the switch until the roof opening panel glass has completed the above step.
- Release the switch.
- The roof panel will now operate one-touch open (tilt and fully open) and one-touch close (from the fully open position).
- One touch close is inoperable from tilt.

Published: 11-May-2011

Roof Opening Panel - Air Deflector

Removal and Installation

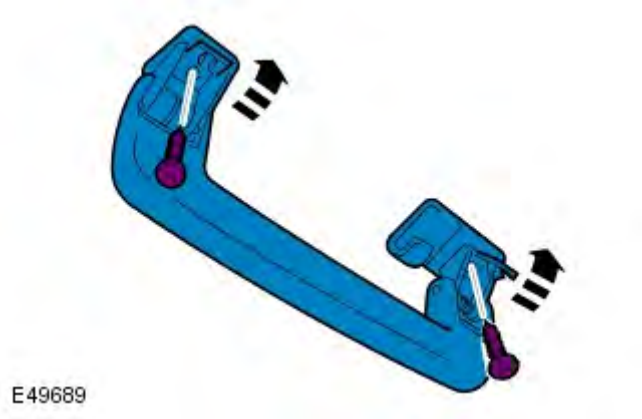
Removal

1. Open the roof opening panel.
2. Remove the interior mirror.

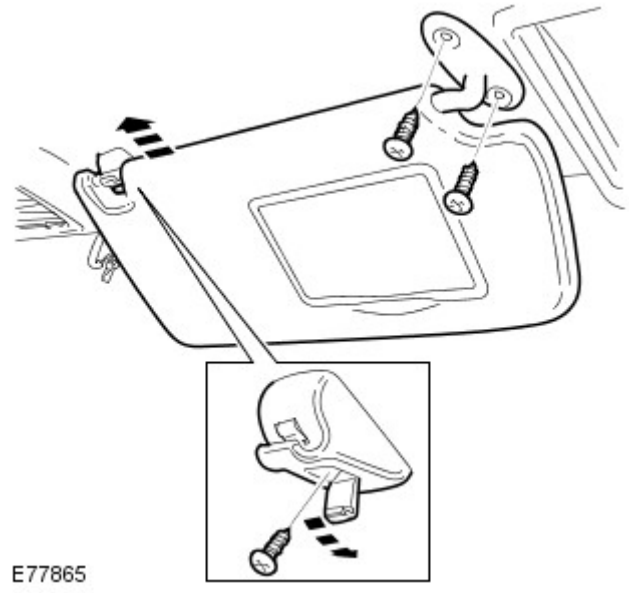
   Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).
3. Remove both A-pillar trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Remove both B-pillar upper trim panels.

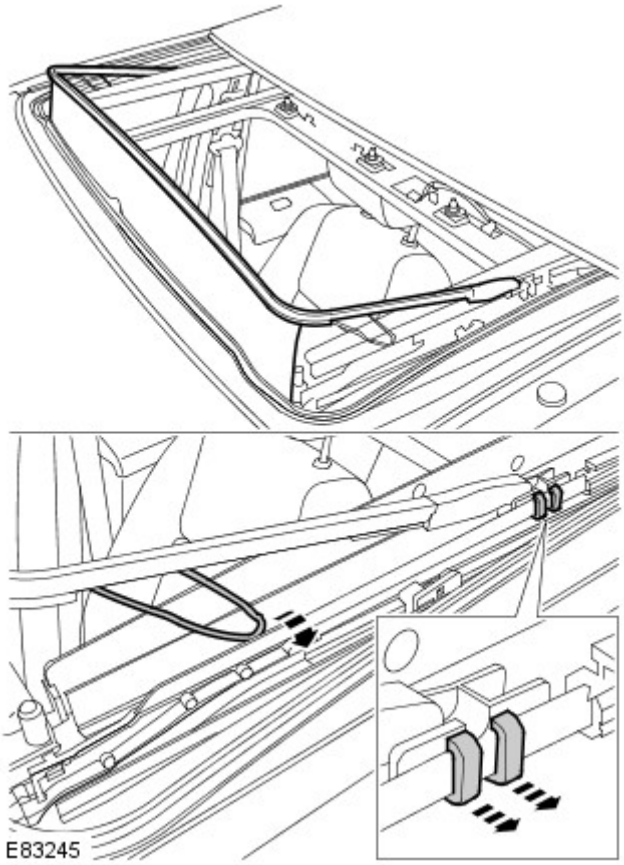
   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. Remove both front passenger assist handles.



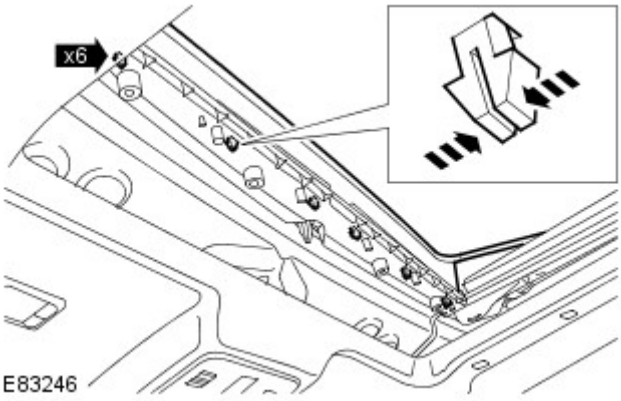
6. Remove both sun visors.



7. Starting from the front edge, carefully release the headliner for access.



8. **8.** CAUTION: Protect the surrounding paintwork to avoid damage.



9.

Installation

1. Install the air deflector.
2.
   - Install the hinge pivots to the air deflector.
   - Tension both springs.
   - Locate and secure the air deflector hinge pivots.
3. Carefully install the headliner.
4. Install the sun visors.
5. Install the passenger assist handles.
6. Install both B-pillar upper trim panels.

Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. Install both A-pillar upper trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

8. Install the interior mirror.

   Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

9. Manually check the operation of the air deflector.

Published: 11-May-2011

Roof Opening Panel - Roof Opening Panel Seal

Removal and Installation

Removal

1. Remove the roof opening panel glass.

   Refer to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation).

2. **2.** CAUTION: Note the fitted position of the component prior to removal.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Roof Opening Panel - Glass Roof Panel Blind

Removal and Installation

Removal

1. Remove both A-pillar trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove both B-pillar upper trim panels.

   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove both C-pillar trim panels.

   Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Remove both D-pillar upper trim panels.

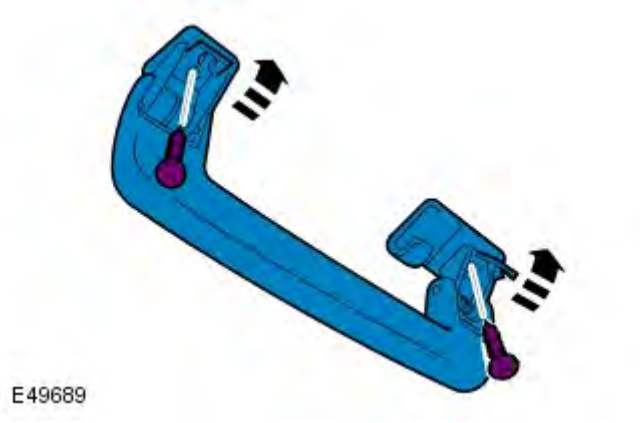
   Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

5. Remove the interior rear view mirror.

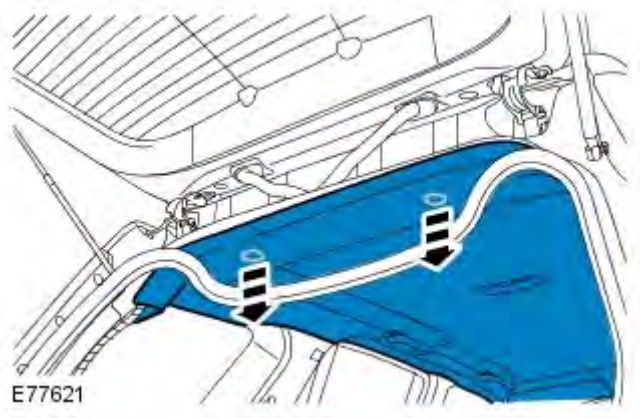
   Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

6. Remove both sun visors.

7. Remove the 4 passenger assist handles.

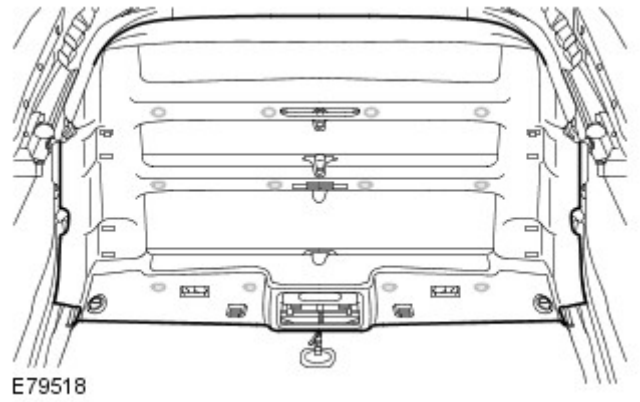


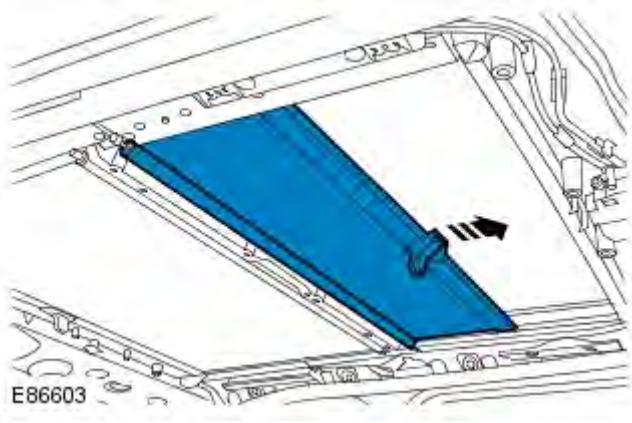
8. Release the rear of the headliner.



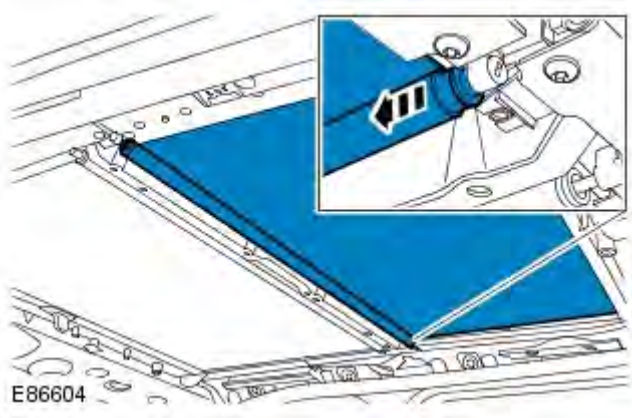
9. Release the front door seals.

10. Release the headliner.





11. Close the glass roof panel blind.

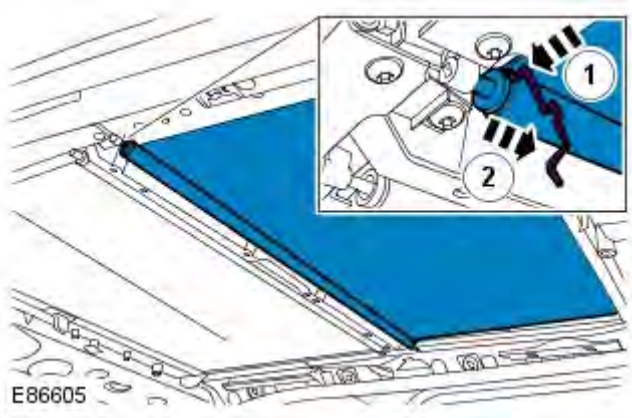


12. **12.** CAUTIONS:

⚠ Do not allow the glass roof panel blind tube to rotate.

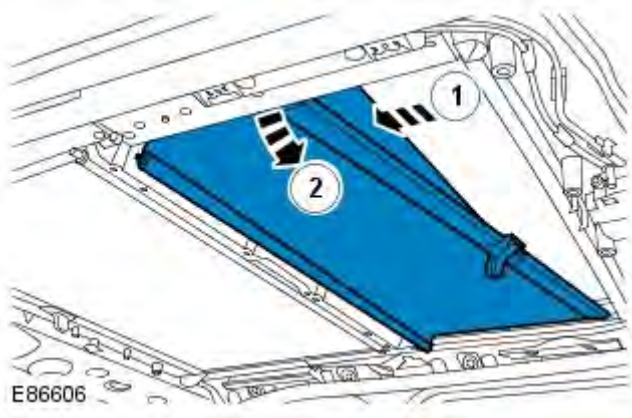
⚠ Do not release the metal pin from its locator until the locking pin is in place.

- Carefully slide the glass roof panel blind tube to the left.
- Release the plastic pin from its locator.



13.

- Using a suitable pin (1mm diameter), lock the glass roof panel blind.
- Release the metal pin from its locator.



14. Remove the glass roof panel blind.

Installation

1. Install the glass roof panel blind slider feet to the guides.

2. **2.** CAUTION: Do not allow the glass roof panel blind tube to rotate until the plastic pin is secure in its locator.
   - Secure the metal pin to its locator.
   - Remove the locking pin from the glass roof panel blind.

3.
   - Carefully slide the glass roof panel blind tube to the left.
   - Align and secure the plastic pin to its locator.

4. Open the glass roof panel blind.

5. Secure the headliner.

6. Attach the front door seals.

7. Attach the rear of the headliner.

8. Install the passenger assist handles.

9. Install the sun visors.

10. Install the interior rear view mirror.

    Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

11. Install the D-pillar trim panels.

    Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

12. Install the C-pillar trim panels.

    Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

13. Install the B-pillar trim panels.

    Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

14. Install the A-pillar trim panels.

    Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Roof Opening Panel - Roof Opening Panel Blind

Removal and Installation

Removal

1. Remove both A-pillar trim panels.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove both B-pillar upper trim panels.

   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove both C-pillar trim panels.

   Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Remove both D-pillar upper trim panels.

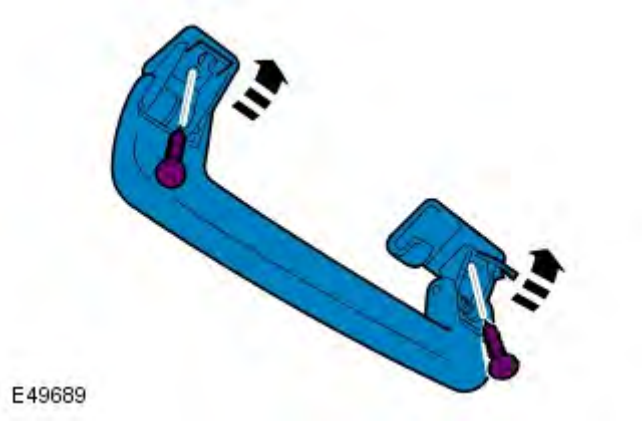
   Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

5. Remove the interior rear view mirror.

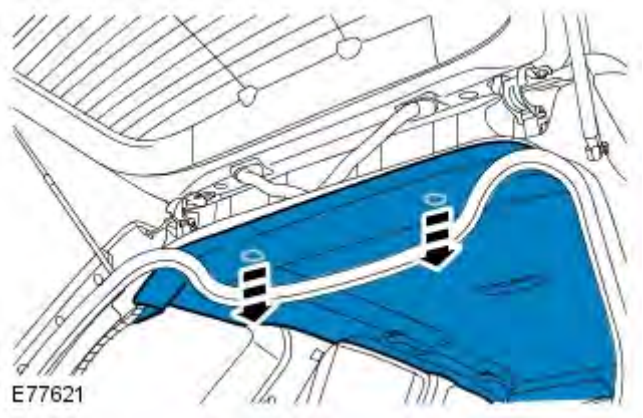
   Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).

6. Remove both sun visors.

7. Remove the 4 passenger assist handles.


E49689

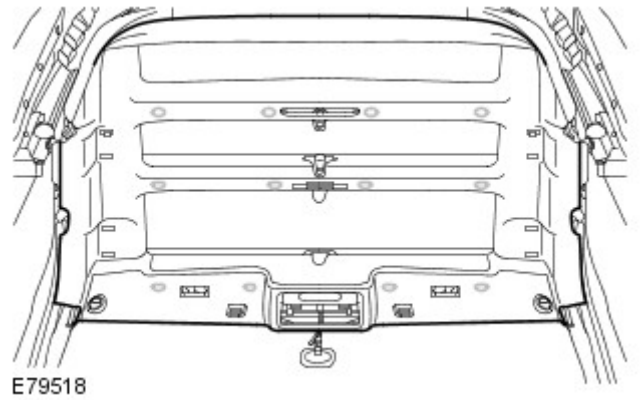
8. Release the rear of the headliner.

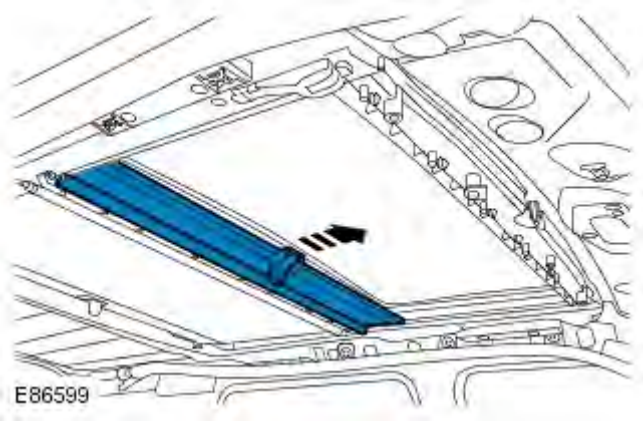

E77621

9. Release the front door seals.

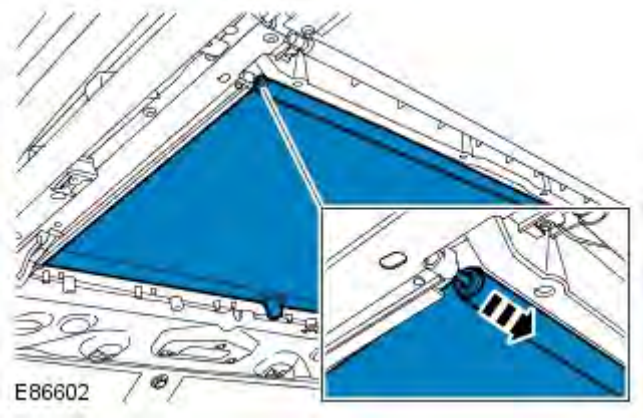
E77866

10. Release the headliner.


E79518



11. Close the roof opening panel blind.

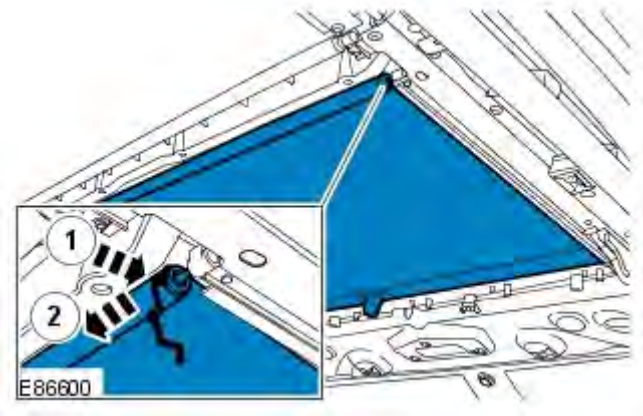


12. **12.** CAUTIONS:

⚠ Do not allow the roof opening panel blind tube to rotate.

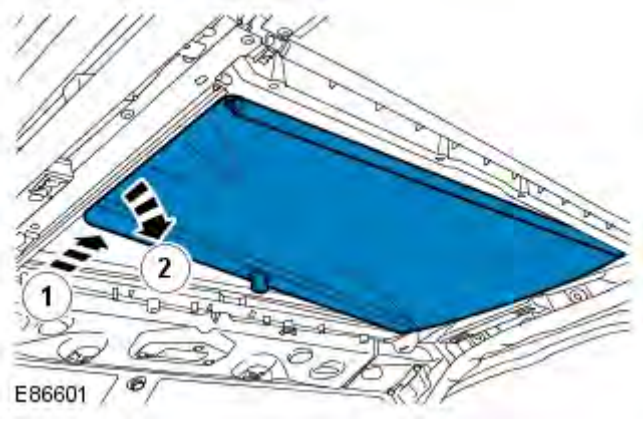
⚠ Do not release the metal pin from its locator until the locking pin is in place.

- Carefully slide the roof opening panel blind tube to the right.
- Release the plastic pin from its locator.



13.

- Using a suitable pin (1 mm diameter), lock the roof opening panel blind.
- Release the metal pin from its locator.



14. Remove the roof opening panel blind.

Installation

1. Install the roof opening panel blind slider feet to the guides.

2. **2.** CAUTION: Do not allow the roof opening panel blind tube to rotate until the plastic pin is secure in its locator.
    - Secure the metal pin to its locator.
    - Remove the locking pin from the roof opening panel blind.
3.
    - Carefully slide the roof opening panel blind tube to the right.
    - Align and secure the plastic pin to its locator.
4. Open the roof opening panel blind.
5. Secure the headliner.
6. Attach the front door seals.
7. Attach the rear of the headliner.
8. Install the passenger assist handles.
9. Install the sun visors.
10. Install the interior rear view mirror.

    Refer to: Interior Rear View Mirror (501-09 Rear View Mirrors, Removal and Installation).
11. Install the D-pillar trim panels.

    Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
12. Install the C-pillar trim panels.

    Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
13. Install the B-pillar trim panels.

    Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
14. Install the A-pillar trim panels.

    Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Published: 11-May-2011

Bumpers -

Product	Part Number
Rear bumper PDC sensor mounting adhesive	3M 8005B35

Torque Specifications

Description	Nm	lb-ft
Front bumper bolts to body	48	35
Front bumper cover fixing to fender bracket	4	3
Front bumper cover fixing to hood latch panel	3	2
Front bumper cover fixing to undertray	4	3
Rear bumper bolts to body	30	22
Rear bumper cover fixing behind lamp assembly	2	1
Rear bumper cover screws	2	1
Rear bumper cover to bracket bolts	4	3
Fender splash shield screws	2	1

Published: 11-May-2011

Bumpers - Front Bumper Cover

Removal and Installation

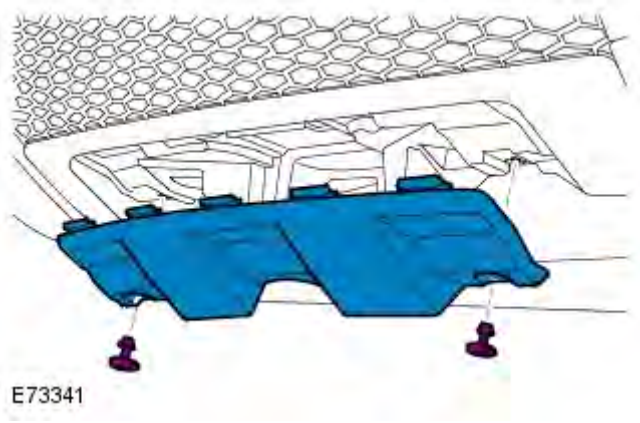
Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

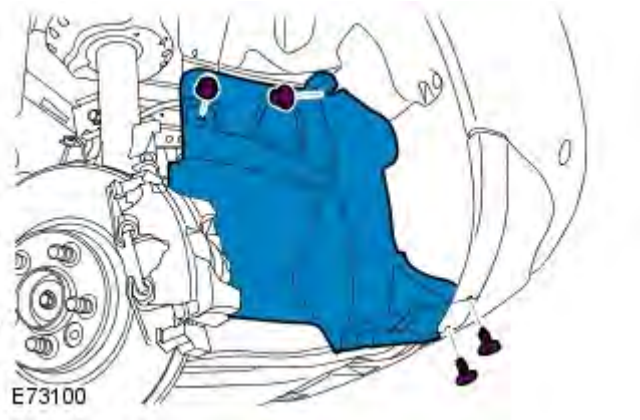
   Raise and support the vehicle.

2. Remove the front wheels and tires.

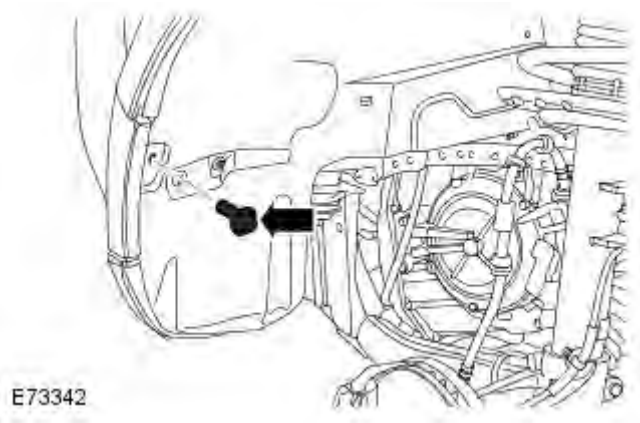
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



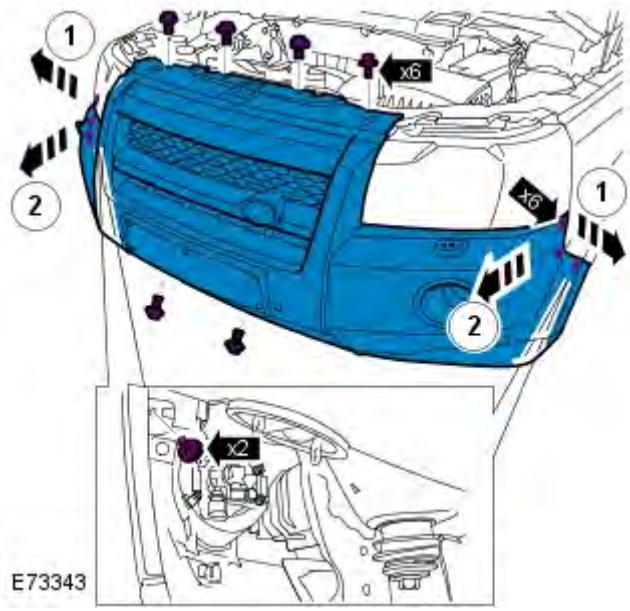
3. Remove the towing eye cover.



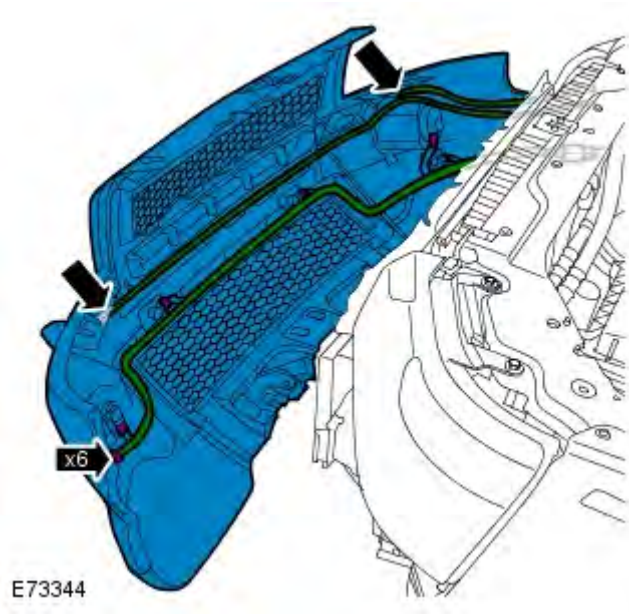
4. Remove the front RH and LH splash shields.



5. Release the front bumper cover from the RH and LH fender splash shields.

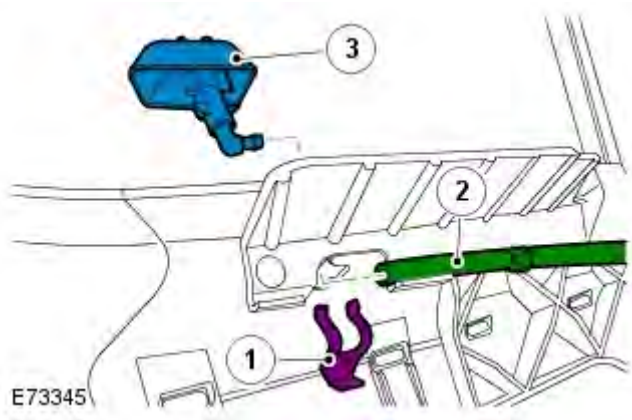


6. With assistance, release the front bumper cover.



7. **7.** NOTE: Some fluid spillage is inevitable during this operation.

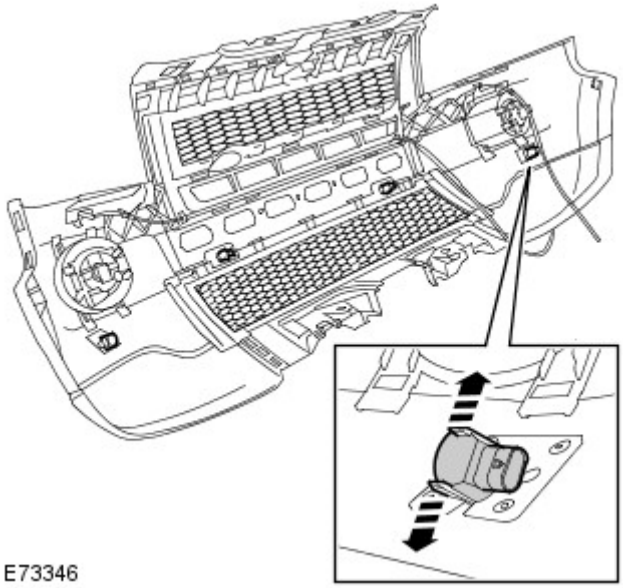
   With assistance, remove the front bumper cover.



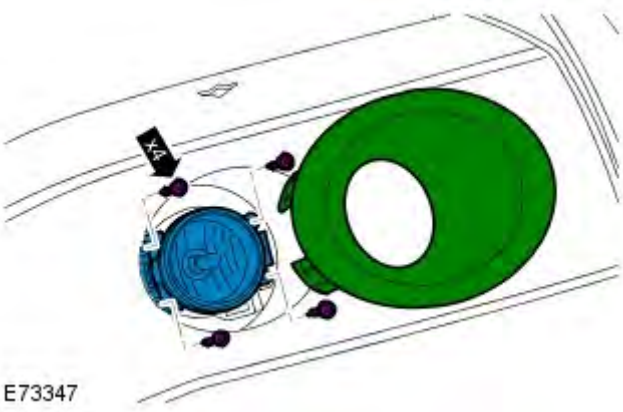
8. **8.** NOTE: Do not disassemble further if the component is removed for access only.

   Remove the 2 washer jets.

9. Remove the 4 parking aid sensors.


E73346

10. Remove the front fog lamps.

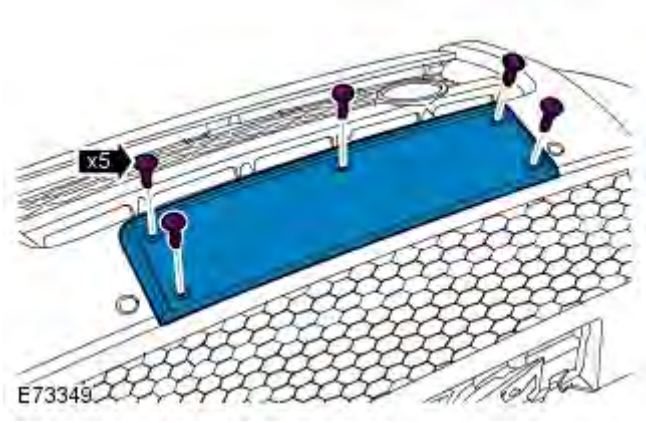


E73347

11. Carefully remove the decal.

E73348

12. If installed: Remove the license plate.



13. If installed: Remove the license plate panel.

Installation

1. If installed, install the license plate panel.
2. If installed, install the license plate.
3. Install the decal.
4. Install the front fog lamps.
5. Install the parking aid sensors.
6. Install the washer jets.
7. With assistance, install the front bumper cover and tighten the fixings to 10 Nm (7 lb.ft).
8. Install the splash shields.
9. Install the towing eye cover.

Published: 11-May-2011

Bumpers - Front Bumper

Removal and Installation

Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

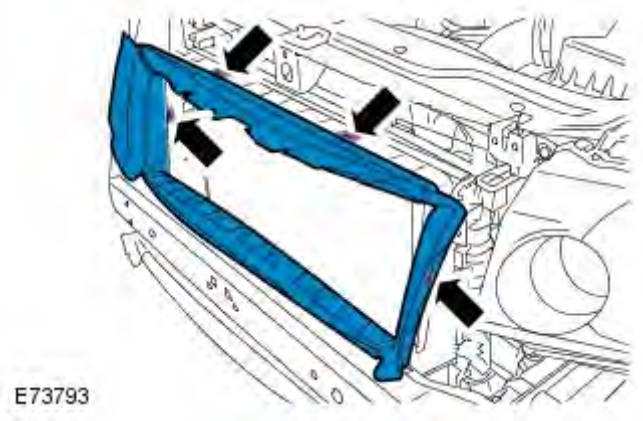
   Raise and support the vehicle.

2. Remove the front wheels and tires.

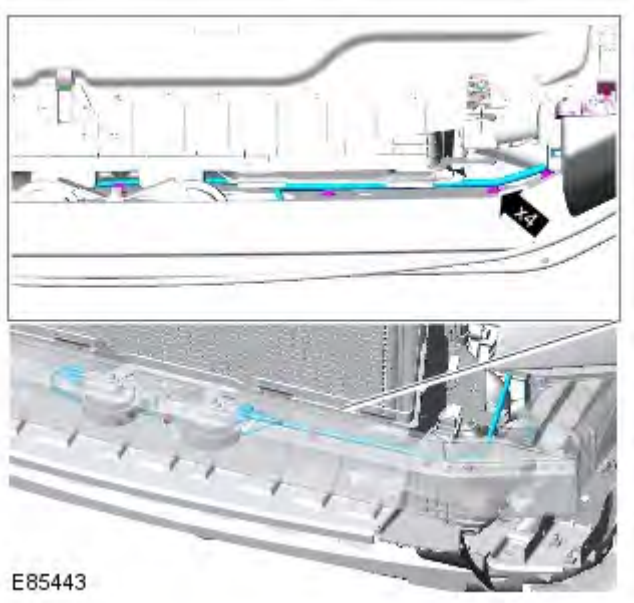
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the front bumper cover.

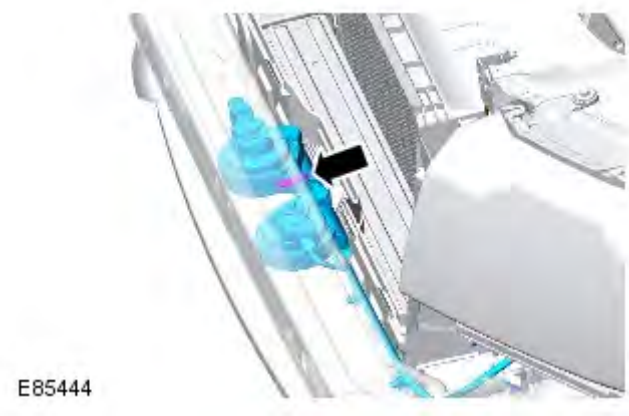
   Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).



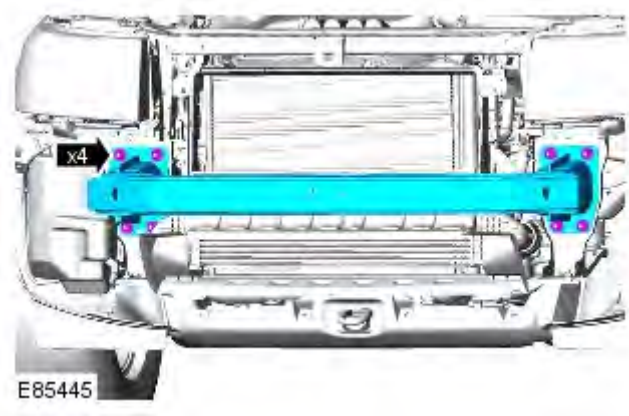
4.



5.



6.
- Tie the horns aside.
- *Torque:* 25 Nm



7. **7.** WARNING: This step requires the aid of another technician.

Torque: 48 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Bumpers - Rear Bumper Cover

Removal and Installation

Removal

- NOTE: New bumper covers are supplied without the four holes for the park distance control sensors.

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

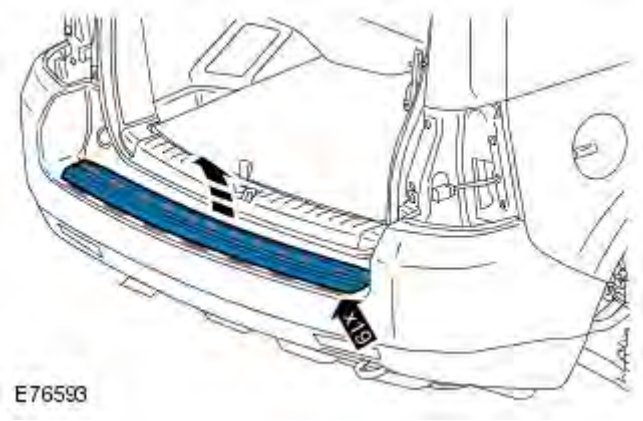
   Raise and support the vehicle.

2. Remove both rear wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the rear lamp assemblies.

   Refer to: Rear Lamp Assembly (417-01 Exterior Lighting, Removal and Installation).



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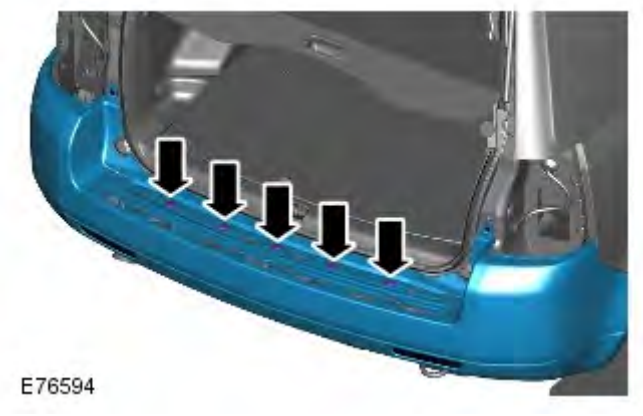
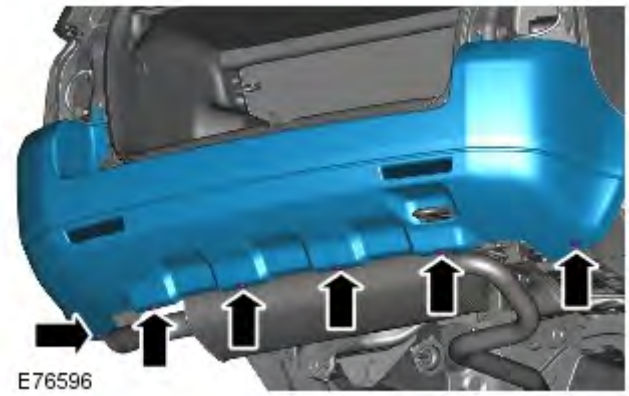


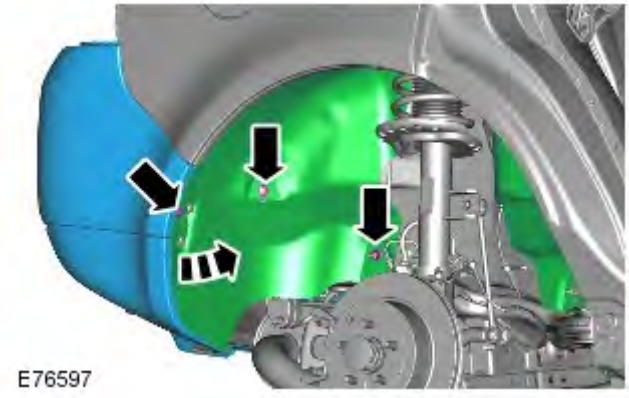
5.

E76595

6.

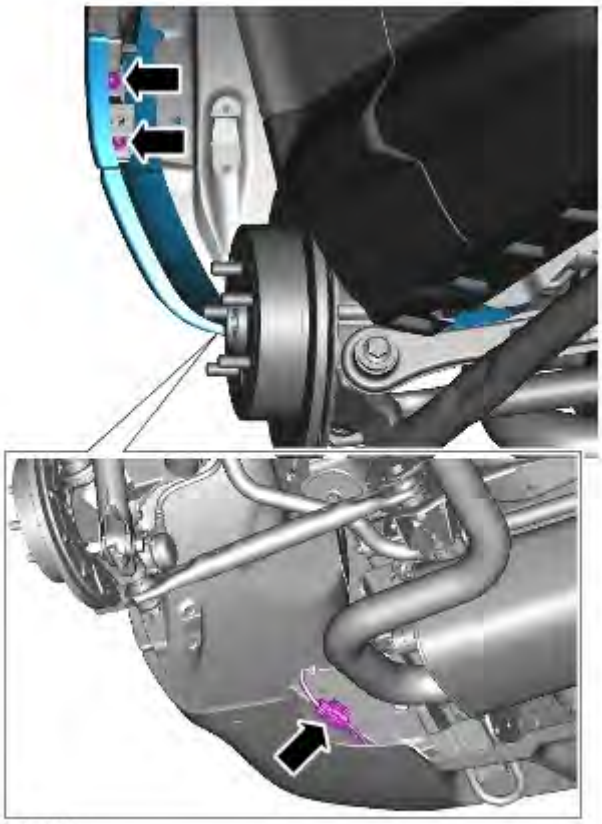

E76596

7.


E76597

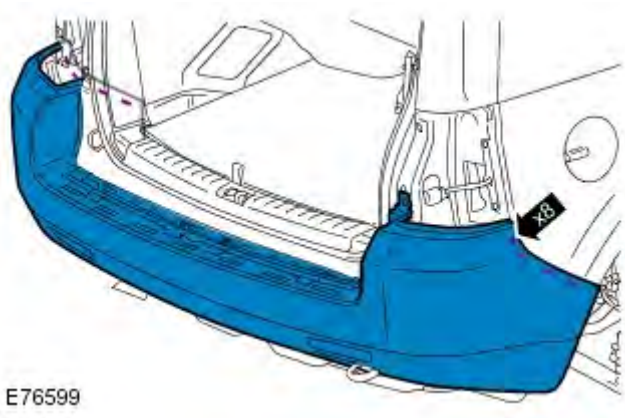
8.

- Release the rear lower edge of the rear fender splash shield.
- Repeat the above procedure for the other side.


E76598

9.

- If installed, disconnect the parking aid sensor wiring harness electrical connector.
- Repeat the above procedure for the other side.



E76599

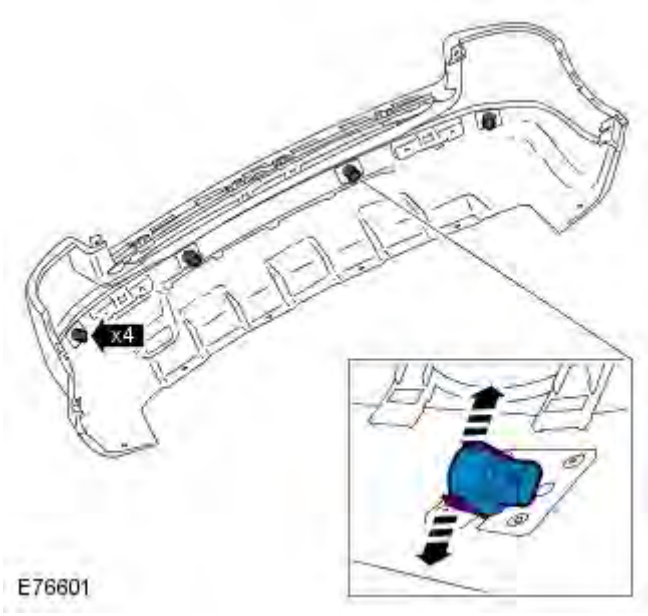
10.

E76600

11. **11.** NOTE: Do not disassemble further if the component is removed for access only.

If installed, remove the parking aid sensor wiring harness.

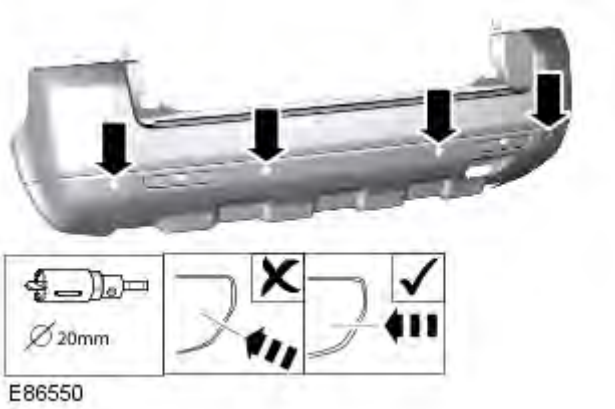
12. If installed, remove the 4 parking aid sensors.



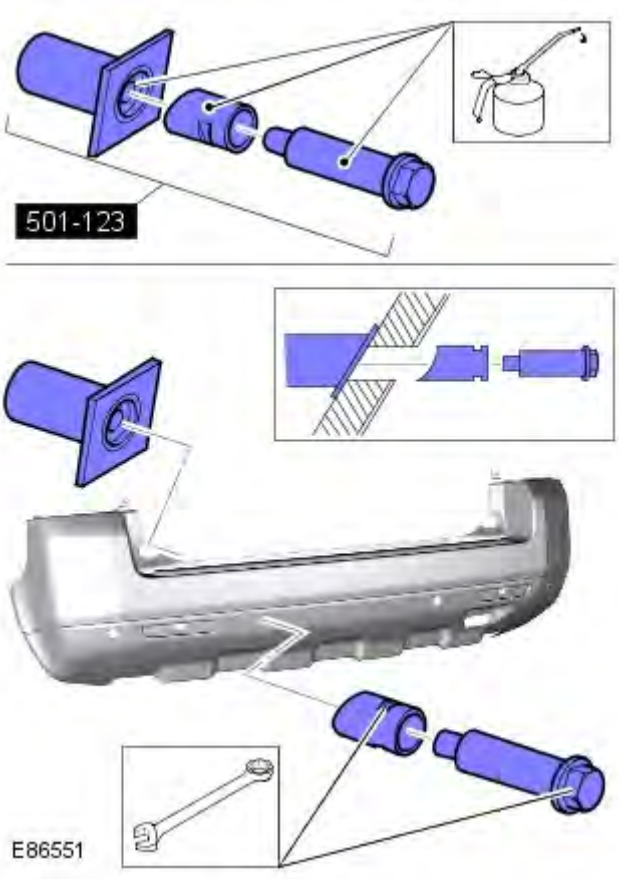
13.

Installation

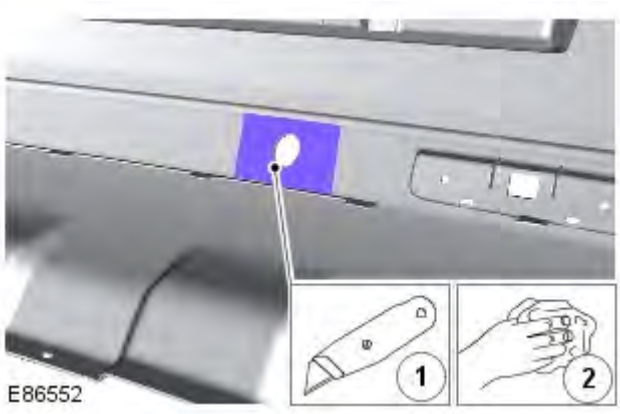
1.



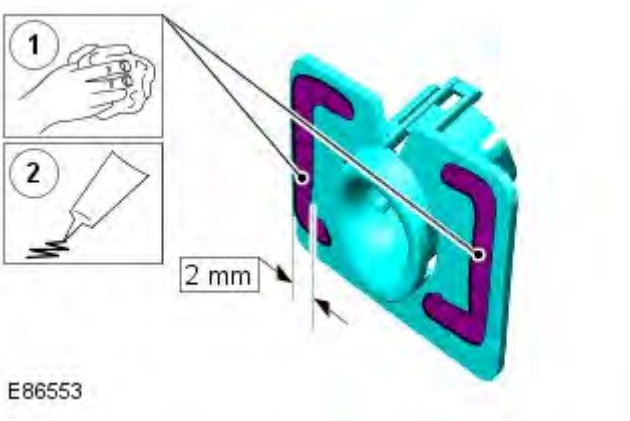
2.



3. **3.** CAUTION: Align the special tool cutting edge with the contour of the bumper cover. Make sure it does not rotate while cutting the hole.



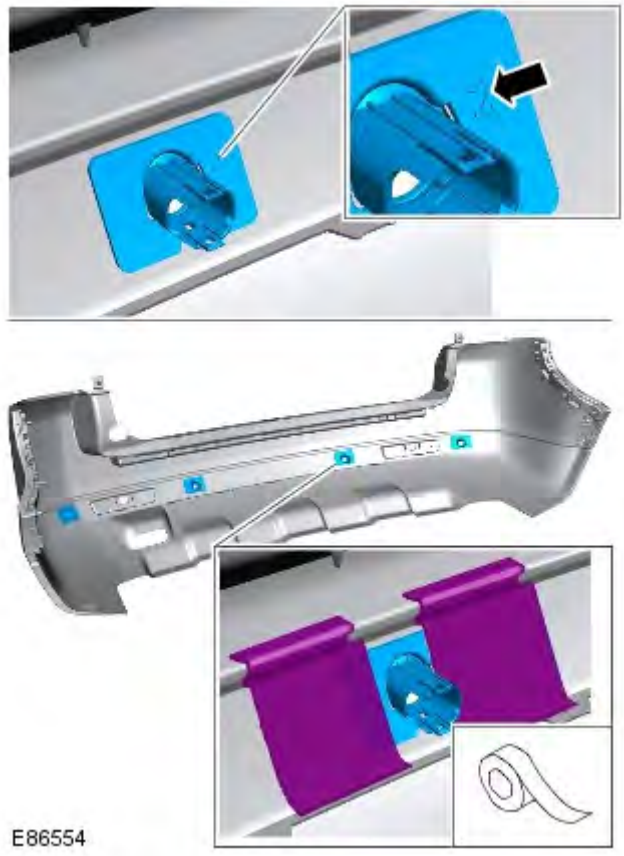
4.



5. **5.** CAUTION: To avoid excess adhesive being pushed through the cut bumper hole when fitting the trims, ensure the adhesive is applied as illustrated.

   For adhesive information, refer to the specification section.

   Refer to: Specifications (501-19 Bumpers, Specifications).



6. **6.** CAUTION: Allow adhesive to cure for 2 hours before proceeding to fit bumper.

7. Install the reflectors.
8. Install the parking aid sensors.
9. Install the parking aid sensor wiring harness.
10. Install the rear bumper cover.
11. Secure the fender splash shield.
12. Install the bumper cover trim panel.
13. Install the rear lamp assemblies.

    Refer to: Rear Lamp Assembly (417-01 Exterior Lighting, Removal and Installation).

14. Install the wheels and tires.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Bumpers - Rear Bumper

Removal and Installation

Removal

1. **1.** WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

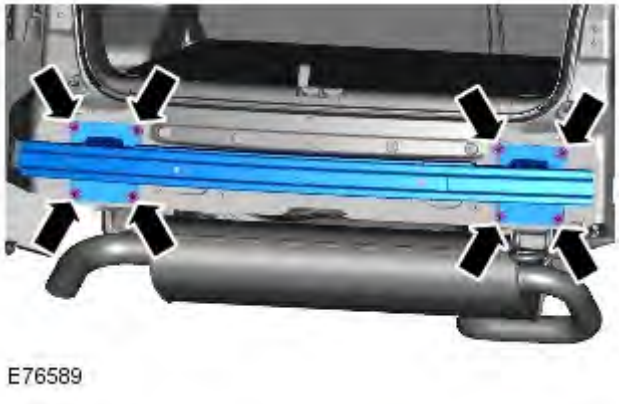
   Raise and support the vehicle.

2. Remove both rear wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the rear bumper cover.

   Refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).


E76589

4.

- WARNING: Make sure that new nuts are installed.

  Torque: 30 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Safety Belt System -

Torque Specifications

Description	Nm	lb-ft
Adjustable shoulder anchorage Torx bolts	25	18
Front safety belt buckle to seat Torx bolt	40	30
Front safety belt lower anchor Torx bolt*	40	30
Front safety belt retractor Torx bolt*	40	30
Front safety belt upper anchor Torx bolt*	40	30
Rear center safety belt buckle Torx bolt	55	41
Rear center safety belt lower anchor	55	41
Rear center safety belt retractor Torx bolt	35	26
Rear safety belt lower anchor	40	30
Rear safety belt upper anchor Torx bolt	40	30
Rear seatbelt retractor	40	30
Webbing guide	8	6

*** New nuts/bolts must be fitted**

Published: 11-May-2011

Safety Belt System - Safety Belt System

Description and Operation

COMPONENT LOCATION

E79395

Item	Part Number	Description
1	-	Front RH safety belt retractor
2	-	Front RH safety belt
3	-	Rear RH safety belt retractor
4	-	Rear RH safety belt
5	-	Rear safety belt buckles
6	-	Center safety belt and retractor
7	-	Rear LH safety belt
8	-	Rear LH safety belt retractor
9	-	Front LH safety belt
10	-	Front LH safety belt retractor
11	-	Front LH safety belt buckle
12	-	Front LH safety belt buckle

OVERVIEW

A 3 point safety belt is installed in all seating positions. Each seatbelt has emergency locking retractor functionality.

The emergency locking retractor function incorporates a lift shaft locking system with webbing sensor and car sensing

activating mechanisms. The webbing sensor activates the locking mechanism if the webbing is subjected to a sharp pull. The car sensor activates the locking system if the vehicle is subjected to sudden deceleration or severe tilt angle.

All row 1 driver and passenger emergency locking retractor incorporate an electrically activated webbing tension reducer (comfort device). This device is activated when the vehicle enters ignition mode 6 and insertion of the seatbelt tongue into the buckle.

All row 2 passengers and NAS front Passenger emergency locking retractors are enhanced with automatic locking retractors.

The automatic locking retractor allows webbing to be extracted to activate a ratchet device. This device allows webbing to be cinched tight to facilitate child seat fitment. With seatbelt webbing tensioned in automatic locking retractor mode the seatbelt is always locked.

A safety belt warning indicator is installed in the instrument cluster to remind the front seat occupants to fasten their safety belts. On North American Specification (NAS) vehicles, when the ignition mode is accessory/convenience, the warning indicator illuminates if the safety belt of an occupied front seat is not fastened. The warning indicator remains illuminated until the safety belt of each occupied front seat is fastened, or the ignition mode is off. In all markets except NAS, a belt minder function provides a more intrusive reminder to fasten the front safety belts.

Belt Minder Function

The belt minder function provides warnings to the driver if the appropriate front safety belts are not fastened when driving. The belt minder function is controlled by the instrument cluster using:

- High speed CAN (controller area network) bus messages, from the RCM (restraints control module) , to monitor the status of the front safety belts.
- An input from the occupant detection system to monitor the status of the front passenger seat.

When the ignition is switched to on, the instrument cluster illuminates the safety belt warning indicator until one of the front safety belts is fastened or the belt minder function is triggered. The belt minder function is triggered when the ignition switch is in accessory/convenience and the following conditions coexist:

- The belt minder function is enabled
- The vehicle is not in reverse
- Vehicle speed is 8 km/h (5 mph) or more
- The driver safety belt or, if the front passenger seat is occupied, the front passenger safety belt, is unfastened.

When the belt minder is triggered, the instrument cluster generates the following warnings for 10 seconds.

- Flashes the safety belt warning indicator at 2 Hz
- Sounds a repeating chime in sequence with the flashing safety belt warning indicator.

After 10 seconds, the repeating chime is discontinued and the safety belt warning indicator changes from flashing to continuously illuminated for 20 seconds. While the trigger conditions still coexist, the warnings are repeated every 30 seconds until one of the following occurs:

- 5 minutes has elapsed from when the warnings were first triggered
- The safety belt of each occupied front seat is fastened
- The ignition mode is position 0
- The vehicle speed decreases to 5 km/h (3 mph).

For non NAS vehicles the belt minder function can be enabled and disabled using the driver safety belt switch. The instrument cluster changes the state of the belt minder function if, within 60 seconds of first entering ignition mode II, the driver safety belt is fastened and unfastened nine times. Successful completion of the change is indicated by a single chime and the safety belt warning indicator flashing five times, at 2 Hz. The belt minder function can also be enabled and disabled using the reccomeneded Land Rover diagnostic tool.

Safety Belt Warning Indicator

E88662

SECOND ROW SAFETY BELTS

The retractor of each outboard second row safety belt is attached to the body immediately behind the D pillar. The webbing runs from the retractor, through an upper mounting on the D pillar, to an anchor point at the front of the related wheel arch.

The retractor for the center second row safety belt is installed in the top of the seat back. The webbing runs from the retractor, over the top of the seat, to an anchor point at the base of the seat frame.

The buckles for the second row safety belts are attached to the related seat frame.

Published: 21-Nov-2011

Safety Belt System - Safety Belt System

Diagnosis and Testing

Principle of Operation

For a detailed description of the safety belt system and operation, refer to the relevant description and operation section of the workshop manual REFER to: Safety Belt System (501-20A Safety Belt System, Description and Operation).

Safety Information

• WARNINGS:

To avoid accidental deployment the back-up power supply must be depleted before beginning any work on the SRS system or its components. Failure to follow this instruction may result in personal injury

Do not use a multimeter to probe an SRS module. It is possible for the power from the multimeter battery to trigger the activation of the module. Failure to follow this instruction may result in personal injury

• NOTE: Do not to use a cellular phone or to have a cellular phone in close proximity when working on the SRS system or components

Power supply depletion

Before beginning any work on the SRS system or related components:

1. **1.** Remove the ignition key
2. **2.** Disconnect the battery leads, ground first
3. **3.** Wait 2 minutes for the power circuit to discharge

There are comprehensive instructions on the correct procedures for SRS system repairs, refer to the relevant section of the workshop manual

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle

• NOTE: Check and rectify basic faults before beginning diagnostic routines including pinpoint tests

1. **1.** Verify the customer concern by operating the safety belt
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage

Visual Inspection

Mechanical	Electrical
• Check for the installation of non-standard accessories which may affect or obstruct the function of the safety belt system • Frayed or damaged webbing • Missing or damaged button stop • Pretensioner(s) Buckles/Stalks	• Fuses • Wiring harness fault • Correct engagement of electrical connectors • Loose or corroded connections • Warning lamp bulb(s) • Impact sensor(s) • Buckle sensor(s) • Pretensioner(s) • Belt tension sensor(s) • Restraints control module

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, carry out the test methods described below, alternatively check for diagnostic trouble codes and refer to the relevant diagnostic trouble code index

For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Restraints Control Module (RCM) (100-00 General Information, Description and Operation).

Symptom Chart for Safety Belt Rows 1, 2 and 3

Symptom	Possible Causes	Action
Safety belt jammed - Webbing tight	• Backlock effect-in action (webbing retracted quickly and came to sudden stop) • Safety belt retractor not installed correctly • Rear centre belt only. Mini-button (webbing travel limit stop) missing and seat squab has been moved	• GO to Pinpoint Test A. • GO to Pinpoint Test F. • GO to Pinpoint Test H. • See the automatic locking retractor description below

Symptom	Possible Causes	Action
	causing tight fit • Automatic locking retractor activated (clicking – during retraction only)	
Seat squab will not fold/jammed	• NOTE: Rear centre belt only • Mini-button (webbing travel limit stop) missing and seat squab has been moved causing excessive tension	• GO to Pinpoint Test H.
Safety belt jammed - Webbing loose	• Safety belt webbing trapped in seat • Safety belt retractor webbing guide loose • Twist in webbing • Interference in webbing routing • D-loop not rotating correctly	• GO to Pinpoint Test B. • GO to Pinpoint Test C. • GO to Pinpoint Test D. • GO to Pinpoint Test E. • GO to Pinpoint Test G.
Safety belt - Intermittent jamming	• Safety belt retractor not installed correctly	• GO to Pinpoint Test F.
Safety belt - Slow retraction	• Safety belt retractor webbing guide loose • Twist in safety belt webbing • Interference in webbing routing • Safety belt retractor not installed correctly • D-loop not rotating correctly • Foreign object/debris	• GO to Pinpoint Test C. • GO to Pinpoint Test D. • GO to Pinpoint Test E. • GO to Pinpoint Test F. • GO to Pinpoint Test G. • GO to Pinpoint Test E.
Safety belt - Not retracting	• Safety belt retractor webbing guide loose • Twist in safety belt webbing • D-loop not rotating correctly • Interference in webbing routing • Foreign object/debris	• GO to Pinpoint Test C. • GO to Pinpoint Test D. • GO to Pinpoint Test G. • GO to Pinpoint Test E. • GO to Pinpoint Test E.
Safety Belt - Not extracting	• Backlock effect-in action (webbing retracted quickly and came to sudden stop) • Safety belt retractor not installed correctly • Safety belt retractor webbing guide loose • Twist in safety belt webbing • D-loop not rotating correctly • Interference in webbing routing • Foreign object/debris • Automatic locking retractor activated (clicking – during retraction only)	• GO to Pinpoint Test A. • GO to Pinpoint Test F. • GO to Pinpoint Test C. • GO to Pinpoint Test D. • GO to Pinpoint Test G. • GO to Pinpoint Test E. • GO to Pinpoint Test E. • See the automatic locking retractor description below
Safety belt - Noisy during operation	• Automatic locking retractor activated (clicking–during retraction only) • Interference in webbing routing (rubbing)	• GO to Pinpoint Test B. • GO to Pinpoint Test E.
Safety belt buckle - Not latching / jammed	• Foreign object/debris	CAUTION: Do not insert any objects or tools into the buckle head • GO to Pinpoint Test I.

Inertia Reel Safety Belts

The vehicle is equipped with (two row one), (three row two), and (two row three (seven seat versions only)) inertia reel safety belts

These safety belts are **"dual sensitive"** which means that they have:

- **Car sense system - A vehicle motion sensor, which locks the safety belt webbing under braking, cornering, on steep hills and in adverse camber conditions, when parked on a steep incline or driveway or two wheels on a high curb**
- **Webb sense system - A webbing motion sensor, which locks when the safety belt webbing is extracted suddenly**

The safety belts in the following positions are equipped with an automatic locking retractor function:

Carline	Market	Seat position	Automatic Locking Retractor Installed	From Model Year
Defender (L316)	All	All	No	2007
Discovery / Range Rover Sport (L319/L320)	All	Driver	No	2008
Discovery / Range Rover Sport (L319/L320)	US	Passenger	Yes	2005
Discovery / Range Rover Sport (L319/L320)	All	Driver	No	2005
Discovery / Range Rover Sport (L319/L320)	ROW	Passenger	No	2005
Discovery (L319)	All	Row 2	Yes	2005
Discovery (L319)	All	Row 3	Yes	2005
Range Rover Sport (L320)	All	Row 2	Yes	2006
Freelander (L359)	All	Driver	No	2007
Freelander (L359)	ROW	Passenger	No	2007
Freelander (L359)	US	Passenger	Yes	2007
Freelander (L359)	ROW	Row 2	No	2007
Freelander (L359)	US	Row 2	Yes	2007

Carline	Market	Seat position	Automatic Locking Retractor Installed	From Model Year
Range Rover Evoque (L358)	All	Driver	No	2011
Range Rover Evoque (L358)	ROW	Passenger	No	2011
Range Rover Evoque (L358)	US	Passenger	Yes	2011
Range Rover Evoque (L358)	ROW	Row 2	No	2011
Range Rover Evoque (L358)	US	Row 2	Yes	2011
Range Rover (L322)	All	Driver	No	2003
Range Rover (L322)	ROW	Passenger	No	2003
Range Rover (L322)	US	Passenger	Yes	2003
Range Rover (L322)	ROW	Row 2	No	2003
Range Rover (L322)	US	Row 2	Yes	2003

The **automatic locking retractor function** is a feature to secure a child seat or heavy load to the seat

Activation	Deactivation
• NOTE: When automatic locking retractor is activated, no further webbing can be drawn from the safety belt retractor, prior to disengagement of the automatic locking. This can be mistaken as a jammed safety belt retractor Activated by total extraction of the webbing	Automatic locking retractor is deactivated by allowing the webbing to retract until the clicking stops (close to park position)
When activated the automatic locking retractor is identified by a clicking noise during webbing retraction	When deactivated the automatic locking retractor safety belt changes state, from a **static** safety belt to an **automatic** safety belt

Safety Belt Locking Test

With the vehicle stationary and on level ground take firm hold of the safety belt webbing (on the tongue side of the upper safety belt anchor) and withdraw sharply, **the retractor should lock**. Preventing further webbing release **(repeat this test 3 times)**. Any safety belt retractor which fails to lock **must not be used** and a **new safety belt must be installed**.

DTC Index

For a list of diagnostic trouble codes that could be logged on this vehicle, please refer to Section 100-00 or for removal and installation/description and operation see Section 501-20

Diagnostic Guide Inertia Reel Safety Belts

PINPOINT TEST A : BACKLOCK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: BACKLOCK	
	1 Visually inspect the condition of the suspect safety belt
	2 Draw a maximum of 20mm of the webbing from the safety belt retractor with moderate force. Then release the webbing
	3 Check for correct operation twice
	Does the webbing move freely then retract correctly? **Yes** No further action required **No** For first row safety belt GO to Pinpoint Test C. For second and third row safety belts GO to Pinpoint Test B.

PINPOINT TEST B : WEBBING-TRAPPED IN SEAT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: WEBBING-TRAPPED IN SEAT	
	1 Visually inspect the condition of the suspect safety belt
	2 Lift the seat base or release the seat backrest as required
	3 Free the trapped webbing, allow the webbing to retract **Note: If the automatic locking retractor is activated, allow the webbing to retract until the clicking stops**
	4 Check for correct operation **twice**
	Does the webbing move freely then retract correctly? **Yes** No further action required **No** GO to Pinpoint Test C.

PINPOINT TEST C : SAFETY BELT RETRACTOR-WEBBING GUIDE LOOSE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: SAFETY BELT RETRACTOR-WEBBING GUIDE LOOSE	
	1 Refer to 501-20 removal and installation section of the workshop manual, remove any trim panels required to expose the D loop (anchor point) and safety belt retractor
	2 Check the webbing is not trapped or twisted and is centrally located on the safety belt retractor spindle
	3 Attempt to withdraw the webbing from the safety belt retractor **NOTE: If the safety belt webbing is jammed, the automatic locking retractor could be engaged**
	4 To release the automatic locking retractor, manually wind the webbing onto the spindle until the automatic locking retractor deactivates (clicking stops)
	5 Fully extract webbing

	6	Confirm webbing guide location is correct , Confirm the fixing lugs are correctly located in the retractor frame
	7	Allow webbing to retract
	8	Check for correct operation **twice**
	Does the webbing move freely then retract correctly? **Yes** Refer to the 501-20 removal and installation section of the workshop manual, reinstall any trim panels, ensure there are no obstructions and the webbing does not catch or rub. No further action required **No** GO to Pinpoint Test D.	

PINPOINT TEST D : TWIST IN WEBBING		
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**	
D1: TWIST IN WEBBING		
	1	Refer to section 501-20 removal and installation section of the workshop manual, remove any trim panels required to expose the D loop (anchor point)
	2	Twist the webbing back the correct way in the loop
	3	Pass the twist through the pillar loop or escutcheon as required
	4	Check for correct operation **twice**
	Does the webbing move freely then retract correctly? **Yes** Refer to the 501-20 removal and installation section of the workshop manual, reinstall any trim panels, ensure there are no obstructions and the webbing does not catch or rub. No further action required **No** GO to Pinpoint Test E.	

PINPOINT TEST E : INTERFERENCE-WEBBING ROUTING		
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**	
E1: INTERFERENCE-WEBBING ROUTING		
	1	Refer to the 501-20 removal and installation section of the workshop manual, remove any trim panels required to expose the D loop (anchor point)
	2	Remove obstructions and foreign objects ensure the webbing does not catch or rub
	3	Confirm the safety belt does not contact the wiring harness
	4	Check for correct operation **twice**
	Does the webbing move freely then retract correctly? **Yes** Refer to the 501-20 removal and installation section of the workshop manual, reinstall any trim panels, ensure there are no obstructions and the webbing does not catch or rub. No further action required **No** GO to Pinpoint Test F.	

PINPOINT TEST F : SAFETY BELT RETRACTOR-INCORRECT INSTALLATION		
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**	
F1: SAFETY BELT RETRACTOR-INCORRECT INSTALLATION		
	1	Refer to the 501-20 removal and installation section of the workshop manual, remove any trim panels required to expose the D loop (anchor point) and the safety belt retractor
	2	Refer to the 501-20 removal and installation section of the workshop manual, correctly reinstall the safety belt retractor ensure that the locating "T bar" and "anti rotation pins" are correctly located
	3	Check for correct operation **twice**
	Does the webbing move freely then retract correctly? **Yes** Refer to the 501-20 removal and installation section of the workshop manual, reinstall any trim panels, ensure there are no obstructions and the webbing does not catch or rub. No further action required **No** Replace as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component	

PINPOINT TEST G : D-LOOP NOT ROTATING CORRECTLY		
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**	
G1: D-LOOP NOT ROTATING CORRECTLY		
	1	Refer to the 501-20 removal and installation section of the workshop manual, remove any trim panels required to expose the D loop (anchor point) and the safety belt retractor
	2	Ensure there are no obstructions and the webbing does not catch or rub, the D loop (anchor point) rotates correctly and if installed the confirm the height adjuster operates correctly
	3	Check for correct operation **twice**
	Does the webbing move freely then retract correctly? **Yes** Refer to the 501-20 removal and installation section of the workshop manual, reinstall any trim panels, ensure there are no obstructions and the webbing does not catch or rub. No further action required **No**	

	Replace as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

PINPOINT TEST H : MINI BUTTON-MISSING/DAMAGED	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: MINI BUTTON-MISSING/DAMAGED	
• NOTE: This test applies to the rear centre safety belt retractor installed in the **seat back**	
	1 Refer to the 501-20 removal and installation section of the workshop manual, remove the seat cushion and the plastic escutcheon at the top of the seat back (where the webbing exits to expose the lower anchor fixing point of the center safety belt)
	2 Remove the lower anchorage of the safety belt
	3 With the seat back correctly latched, allow up to 20mm webbing to retract, then extract the webbing
	Is the mini-button (webbing travel limit stop) correctly installed to the webbing and in good condition? **Yes** Feed the mini-button back through the plastic escutcheon if required. Correctly reinstall the escutcheon to the seat back, extract the webbing then allow to retract, ensure the mini-button comes to rest outside the escutcheon stop **No** Replace as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

PINPOINT TEST I : SAFETY BELT BUCKLE-NOT LATCHING/JAMMED	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: SAFETY BELT BUCKLE-NOT LATCHING/JAMMED	
CAUTION: Do not insert any objects or tools into the buckle head	
	1 Visually inspect the buckle head for evidence of damage. If damaged replace as required
	2 Depress the buckle release (red button) and **(Using a torch)** carry out visual inspection for any evidence of debris/material or foreign objects in the buckle head
	3 If required remove the pretensioner from the vehicle. Remove the seat. Remove the pretensioner from the seat frame
	4 **Do not insert any objects or tools buckle head** With the buckle removed invert and attempt to shake out any debris
	5 Attempt to latch the tongue in the buckle
	Does the seat belt buckle operate correctly **Yes** Reinstall any components, no further action required **No** Replace the pretensioner, Refer to section 501 20

Published: 11-May-2011

Safety Belt System - Front Safety Belt Retractor

Removal and Installation

Removal

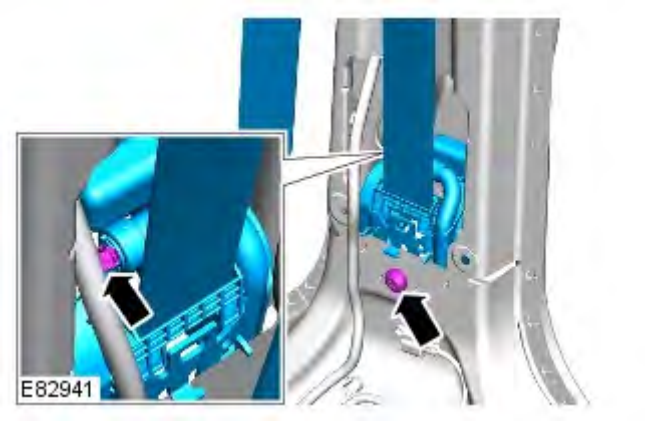
• NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20, General Procedures).

2. Remove the B-pillar upper trim panel.

   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. **3.** WARNING: Make sure that a new bolt is installed.

   Torque: 40 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Safety Belt System - Rear Safety Belt Retractor

Removal and Installation

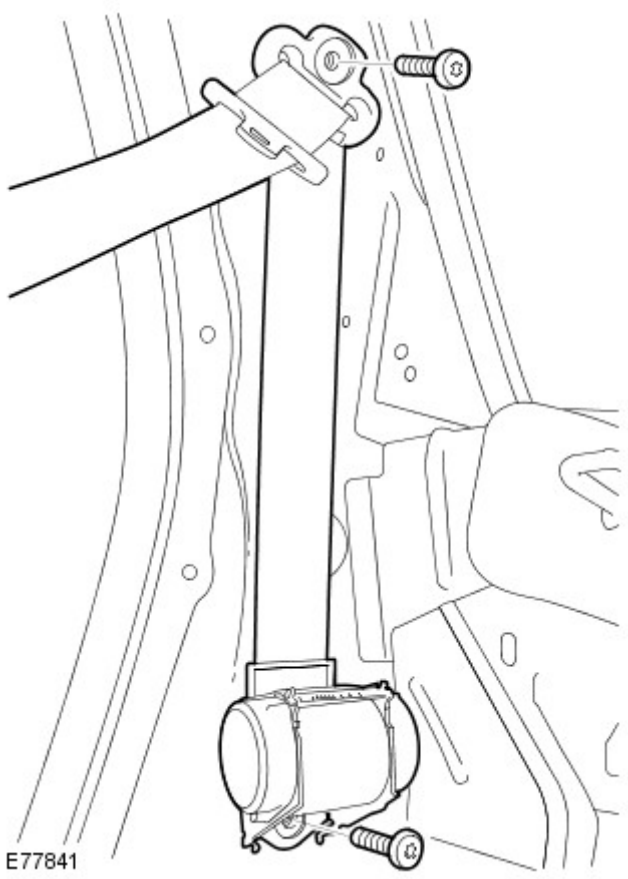
Removal

1. Remove the rear quarter trim panel.

   Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove the C-pillar upper trim panel.

   Refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. *Torque:* 40 Nm

Installation

1. To install, reverse the removal procedure.

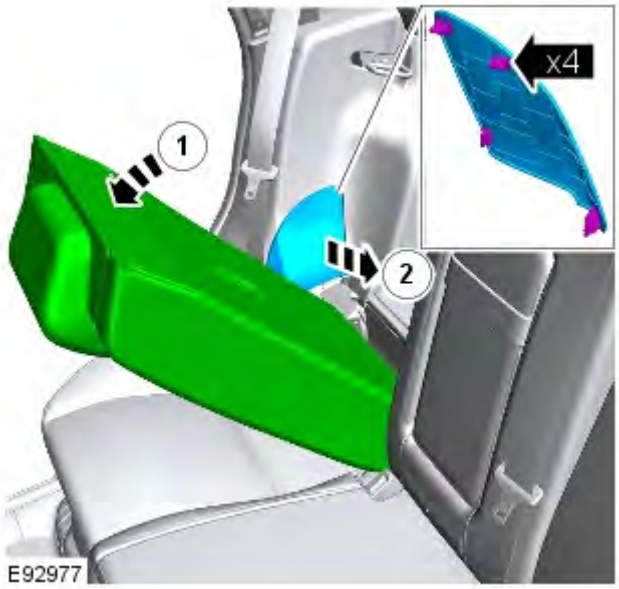
Published: 11-May-2011

Safety Belt System - Rear Center Safety Belt Retractor

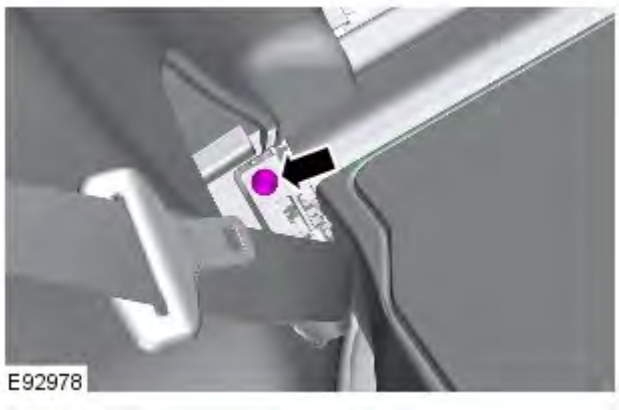
Removal and Installation

Removal

• NOTE: This procedure involves the removal and installation of both rear seat backrests and the LH rear seat backrest cover and pad assembly. All notes and cautions must be followed strictly to avoid any chance of NVH or failure of the rear seat backrests.



1.



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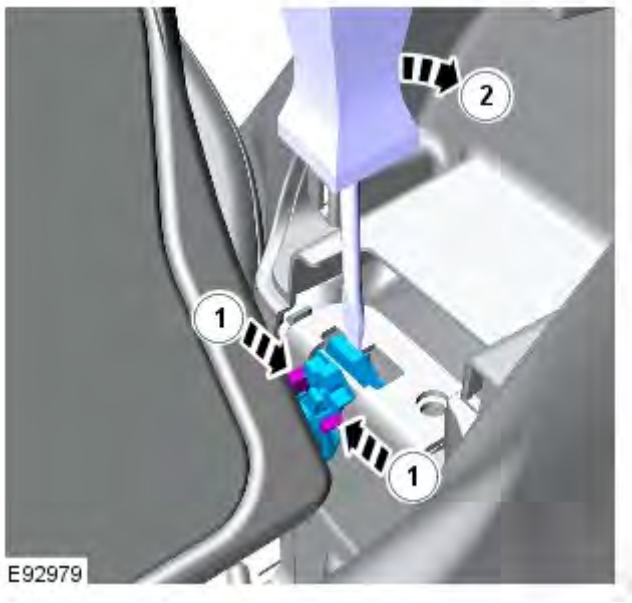
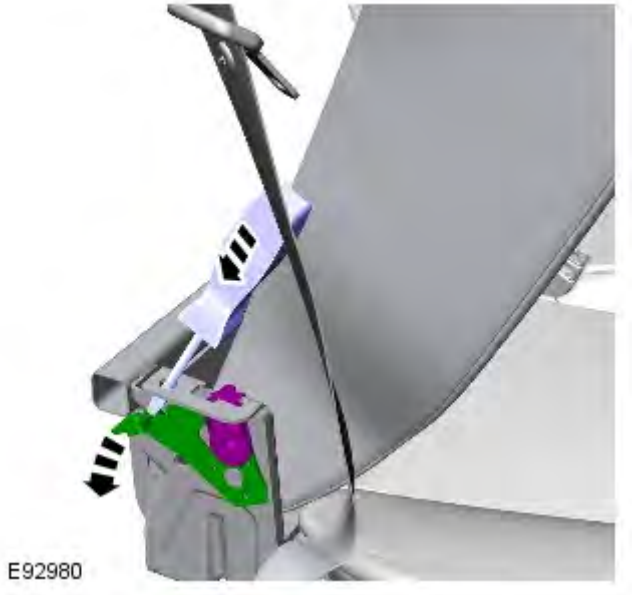
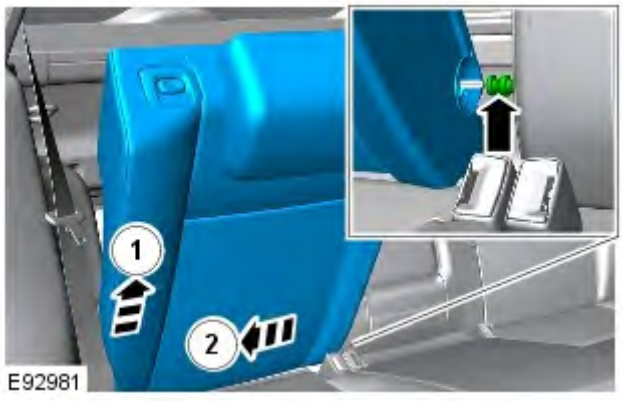


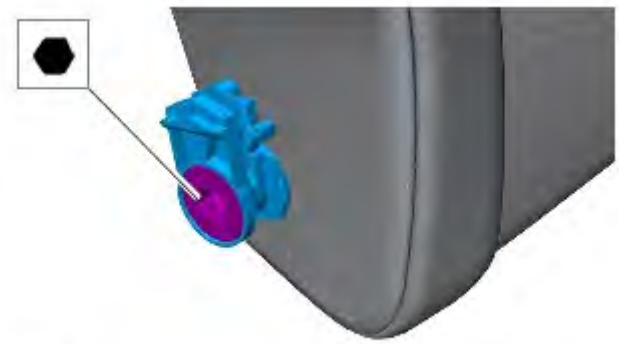
3. Release the RH rear seat backrest outer pivot pin bushing.



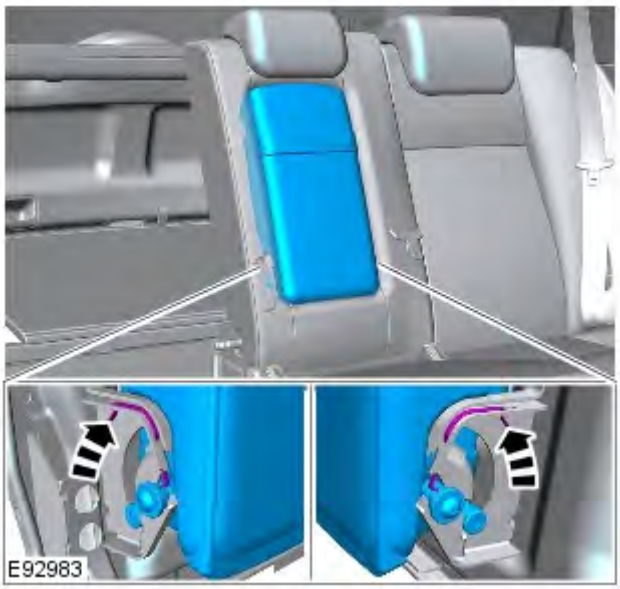
4. Using a screwdriver, release the outer pivot pin bushing locking arm.



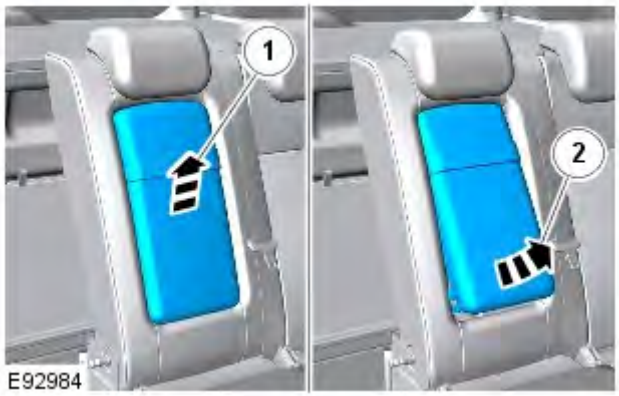
5. **5.** CAUTION: The left-hand rear seat backrest inner pivot pin has radial grooves. When removing the RH backrest from the LH backrest take care not to damage the RH backrest inner pivot bushing.
   - Release the RH rear seat backrest outer pivot pin bushing from the mounting bracket.
   - Release the RH rear seat backrest from the LH rear seat backrest.


E92982

6. Remove and discard the RH rear seat backrest outer pivot pin bushing.

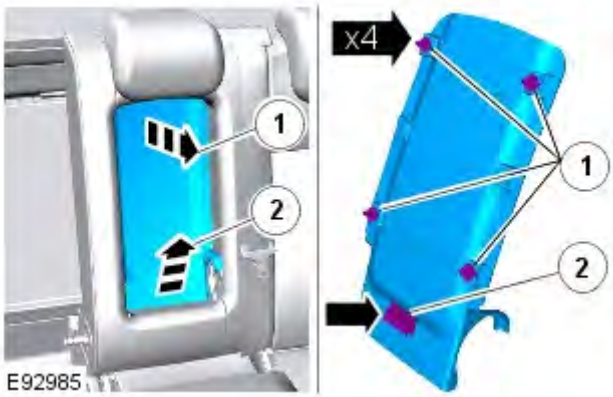

E92983

7.
- If installed, release the armrest.
- Remove and discard the armrest pivot bushing spring clips.



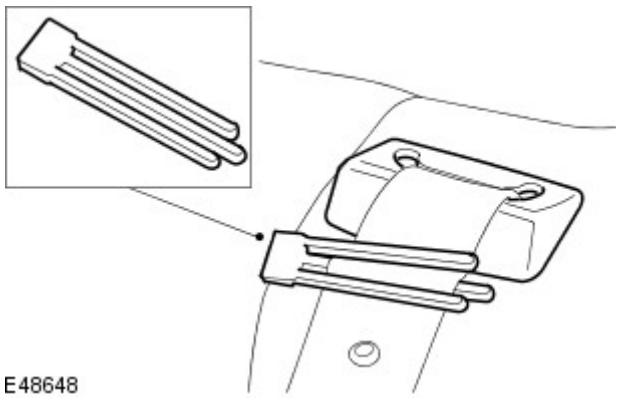
E92984

8.
- Slide the armrest upwards.
- Slide the armrest outwards.



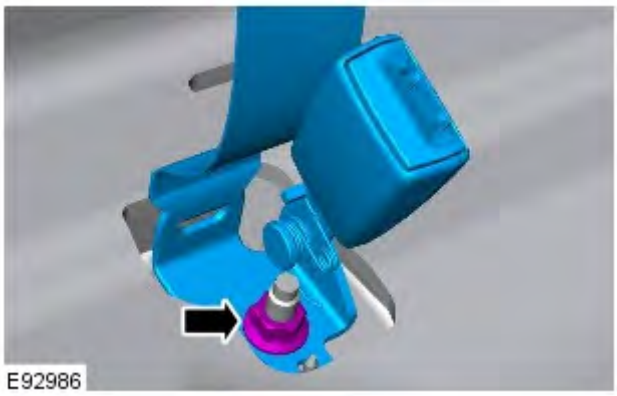
9.

- Remove the armrest backing plate.
- Remove and discard the 4 fir tree clips.



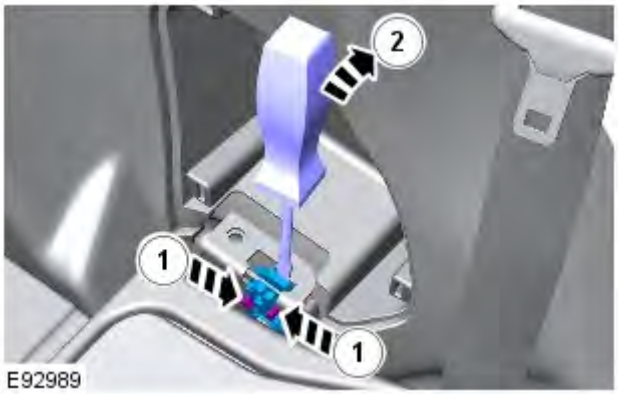
10. **10.** CAUTION: Make sure that a webbing retainer is installed at least 200 mm towards the rear center safety belt retractor from the webbing stop.

Install the safety belt webbing retainer.

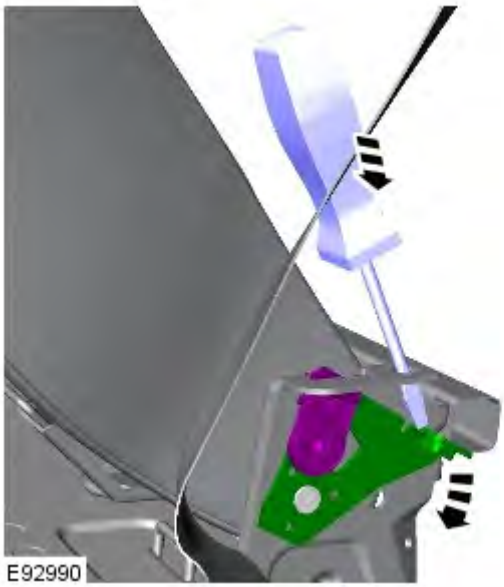


11. Remove the rear center safety belt lower anchor nut.

12.
13.



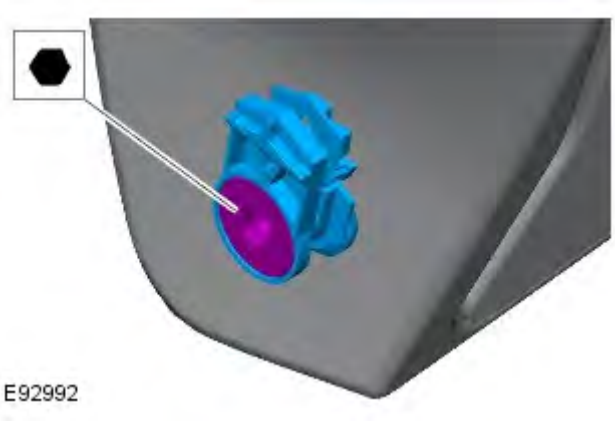
14. Release the LH rear seat backrest outer pivot pin bushing.



15. Using a screwdriver, release the outer pivot pin bushing locking arm.

16. **16.** CAUTION: The left-hand rear seat backrest inner pivot pin has radial grooves. Take care not to damage the center hinge pivot bushing.

- Release the LH rear seat backrest outer pivot pin bushing from the mounting bracket.
- Carefully slide the LH rear seat backrest inner pivot pin out of the center hinge pivot bushing.



17. Remove and discard the LH rear seat backrest outer pivot pin bushing.

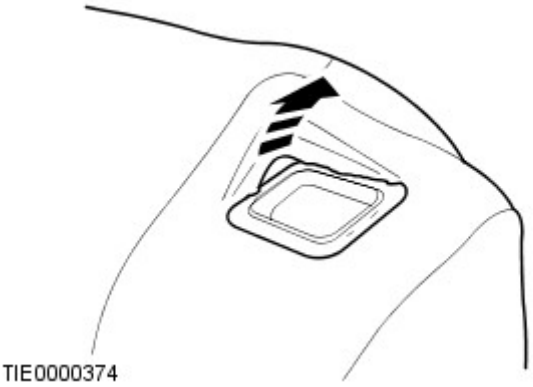
18.

19. Remove the center safety belt trim panel.

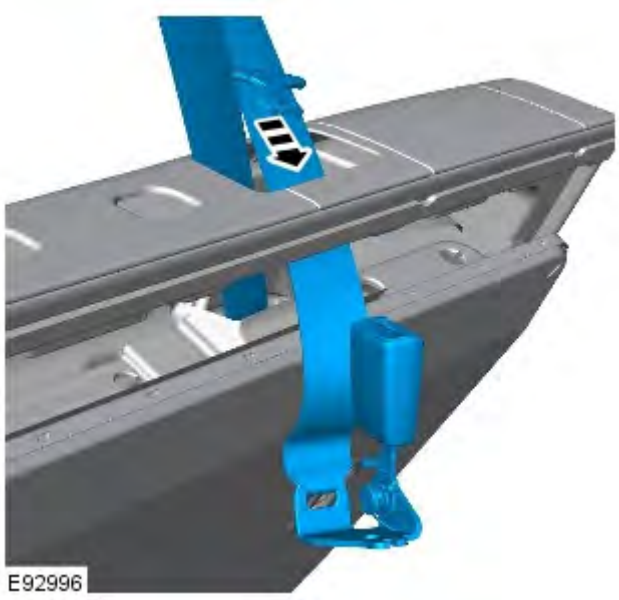
20. Remove the rear seat backrest release button trim panel.

21. **21.** CAUTION: Make sure that the head restraint guide tube locking tang is fully depressed before removal.
    - Using a screwdriver, depress the locking tang.
    - Pull the guide tube upwards.
    - Remove and discard the head restraint guide tubes.

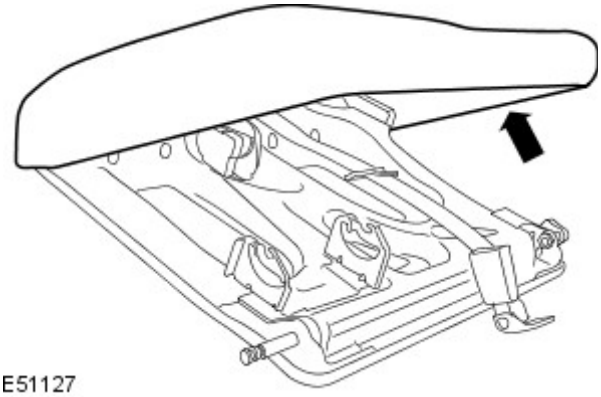
22. Release the rear seat backrest cover from the rear seat backrest frame.


TIE0000374

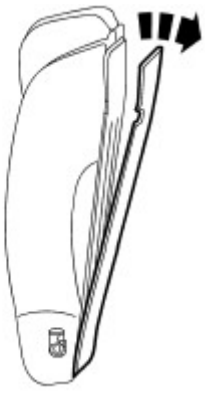
23. Release the rear seat backrest cover and pad assembly from the rear seat backrest release button.


E92996

24. Release the rear center safety belt and lower anchor from the backrest cover.

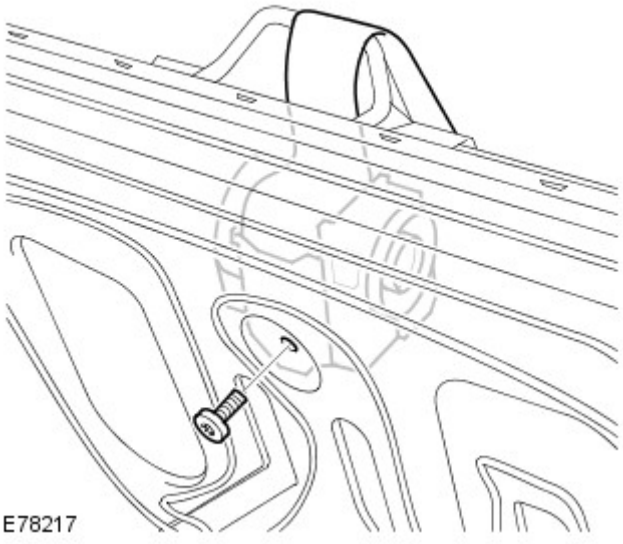

E51127

25. Remove the rear seat backrest cover and pad assembly.


E48926

26. Remove the carpet from the LH rear seat backrest.

27.
- Remove the rear center safety belt retractor Torx bolt.
- Release the locking tang.



Installation

1.
- Install the rear center safety belt retractor.
- Locate the tang of the rear center safety belt into the LH rear seat backrest frame.

2. Install the rear center safety belt retractor Torx bolt.

   Torque: 35 Nm

3. Install the carpet to the LH rear seat backrest.

4. Guide the rear center safety belt and lower anchor through the backrest cover.

5. Install the rear seat backrest cover and pad assembly.

6. Secure the rear seat backrest cover and pad assembly around the rear seat backrest release button.

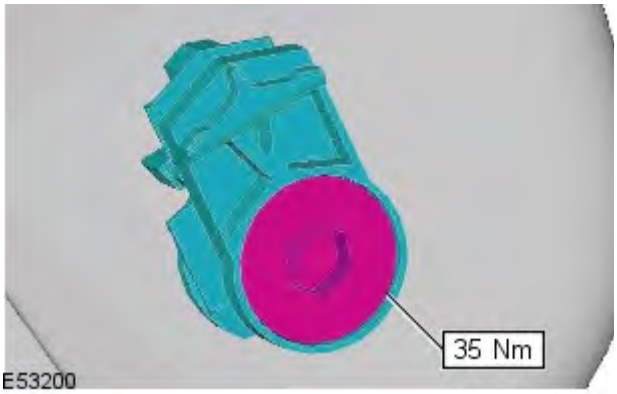
7. Secure the rear seat backrest cover to the rear seat backrest frame.

8. Install new head restraint guide tubes.

9. Install the rear seat backrest release button trim panel.

10. Install the center safety belt trim panel.

11. Install the head restraints.



12. Install a new LH rear seat backrest outer pivot pin bushing.

    Torque: 35 Nm

13. **13.** CAUTIONS:

    The center hinge pivot bushing must be replaced if excessive damage or wear is present.

    The left-hand rear seat backrest inner pivot pin has radial grooves. Take care not to damage the center hinge pivot bushing.

    - Install the LH rear seat backrest inner pivot pin to the center hinge pivot bushing.
    - Carefully lower the LH rear seat backrest outer pivot pin bushing into the mounting bracket.

14. Install a new bolt to the outer pivot pin bushing locking arm.

    Torque: 23 Nm

15. Install the LH rear quarter trim access panel.

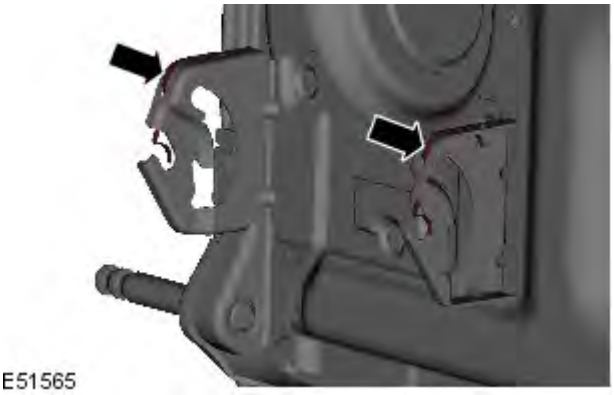
16. **16.** WARNING: Make sure that the safety belt anchor is correctly installed.

    Secure the rear center safety belt lower anchor.

    Torque: 40 Nm

17. **17.** CAUTION: Check for correct operation of the rear center safety belt retractor.

    Remove the safety belt webbing retainer.

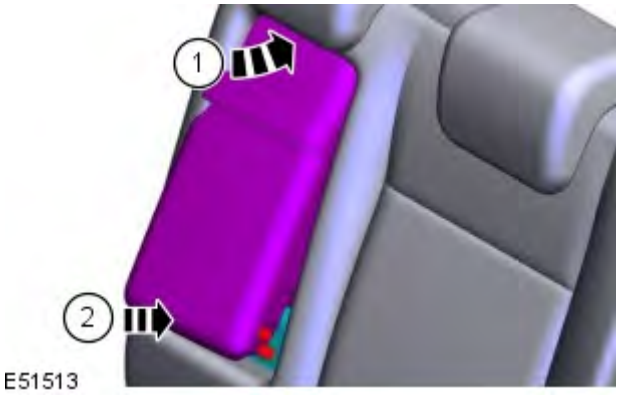


18. **18.** WARNING: New armrest pivot bushing spring clips must be installed. Failure to follow this instruction may result in personal injury.

    If installed with armrest, install new armrest pivot bushing spring clips.

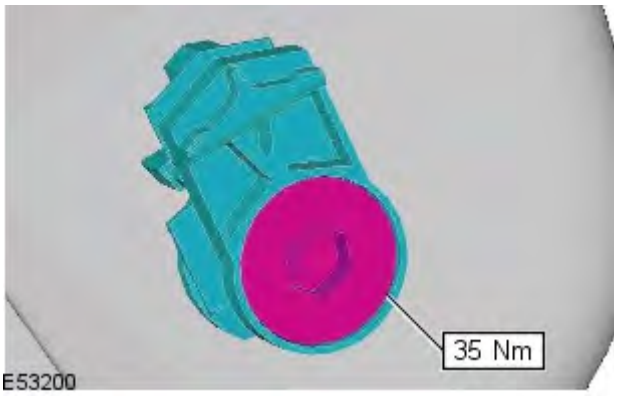
19.

    - Install 4 new fir tree clips to the armrest backing plate.
    - Install the armrest backing plate.



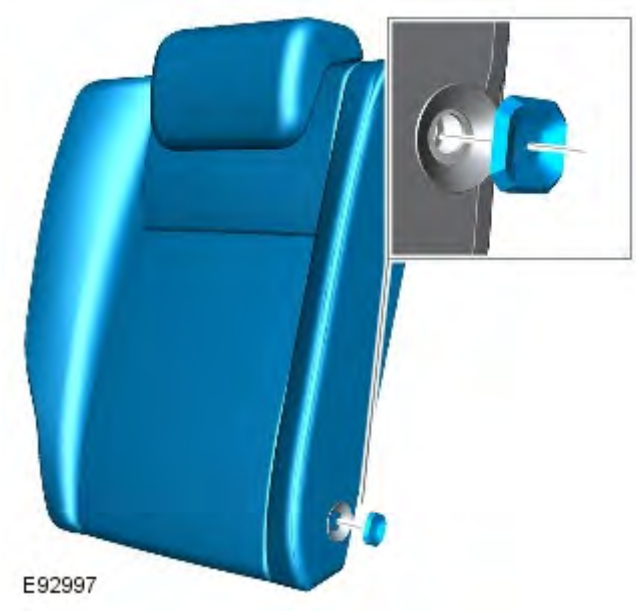
20. **20.** NOTE: Make sure that the armrest pivot bushing spring clips locate in the armrest pivot bushing grooves.

    Install the armrest.



21. Install a new RH rear seat backrest outer pivot pin bushing.

    Torque: 35 Nm



22. **22.** CAUTION: If the existing right-hand rear seat backrest is to be installed, the condition of the inner pivot bushing must be checked and a service pad installed. If excessive damage is present to the inner pivot bushing the right-hand rear seat backrest frame must be replaced.

    • NOTE: This step is not necessary if a new right-hand rear seat backrest is to be installed.

    Install the service pad to the RH rear seat backrest inner pivot bushing.

23. **23.** CAUTION: The left-hand rear seat backrest inner pivot pin has radial grooves. When installing the RH backrest, take care not to damage the inner pivot bushing.

    - Carefully guide the RH rear seat backrest inner pivot bushing onto the LH rear seat backrest inner pivot pin.
    - Carefully lower the RH rear seat backrest outer pivot pin bushing into the mounting bracket.

24. Install a new bolt to the outer pivot pin bushing locking arm.

    Torque: 23 Nm

25. Install the RH rear quarter trim access panel.

Published: 11-May-2011

Safety Belt System - Front Safety Belt Buckle

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

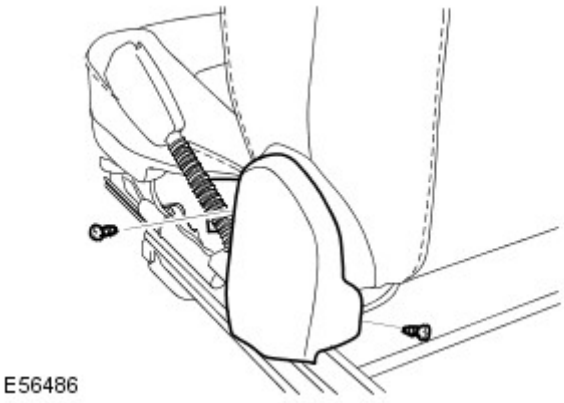
2. Make the SRS system safe.

   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20, General Procedures).

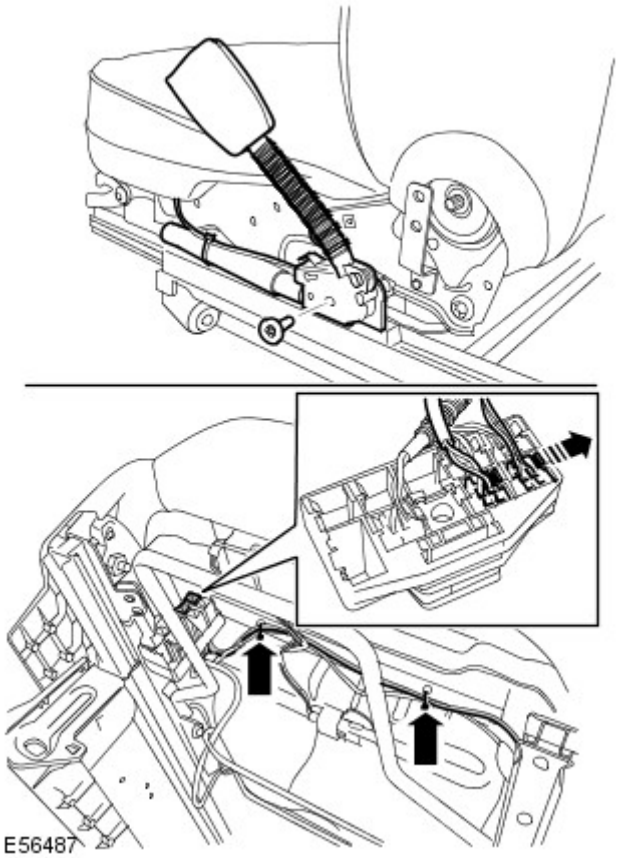
3. Remove the front seat.

   Refer to: Front Seat (501-10 Seating, Removal and Installation).

4.



5. *Torque:* 40 Nm



Installation

1. To install, reverse the removal procedure.

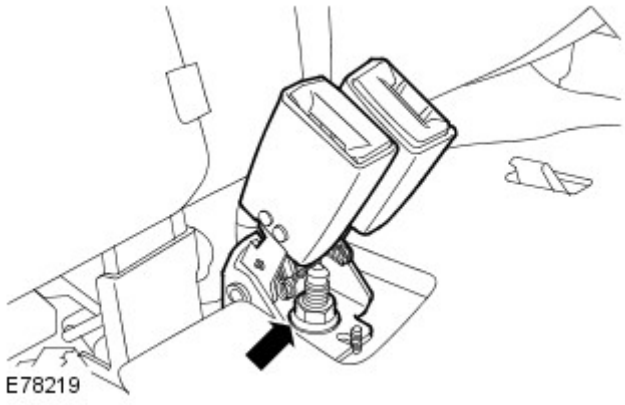
Published: 11-May-2011

Safety Belt System - Rear Safety Belt Buckle

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 55 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Supplemental Restraint System -

Torque Specifications

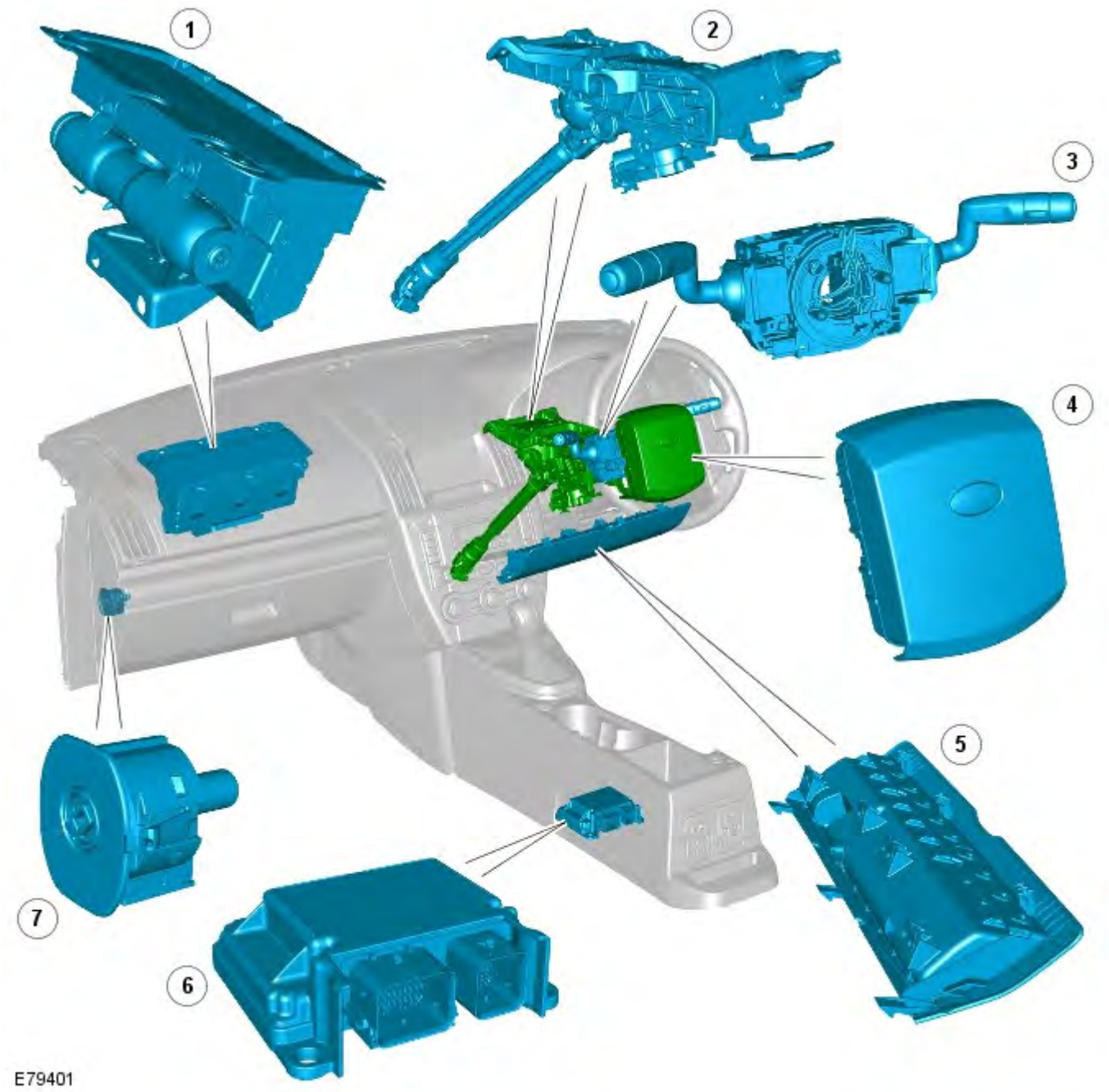
Description	Nm	lb-ft
B-pillar side impact sensor Torx screws	10	7
C-pillar side impact sensor Torx bolts	10	7
Driver lower air bag module	6	4
Front impact severity sensor Torx bolts	10	7
Passenger air bag module bracket Torx screws	7	5
Passenger air bag module nuts	10	7
Restraints control module (RCM) Torx screws	10	7
Side air bag module nuts	10	7
Side air curtain module Torx screws	10	7

Published: 11-May-2011

Supplemental Restraint System - Air Bag and Safety Belt Pretensioner
Supplemental Restraint System (SRS)

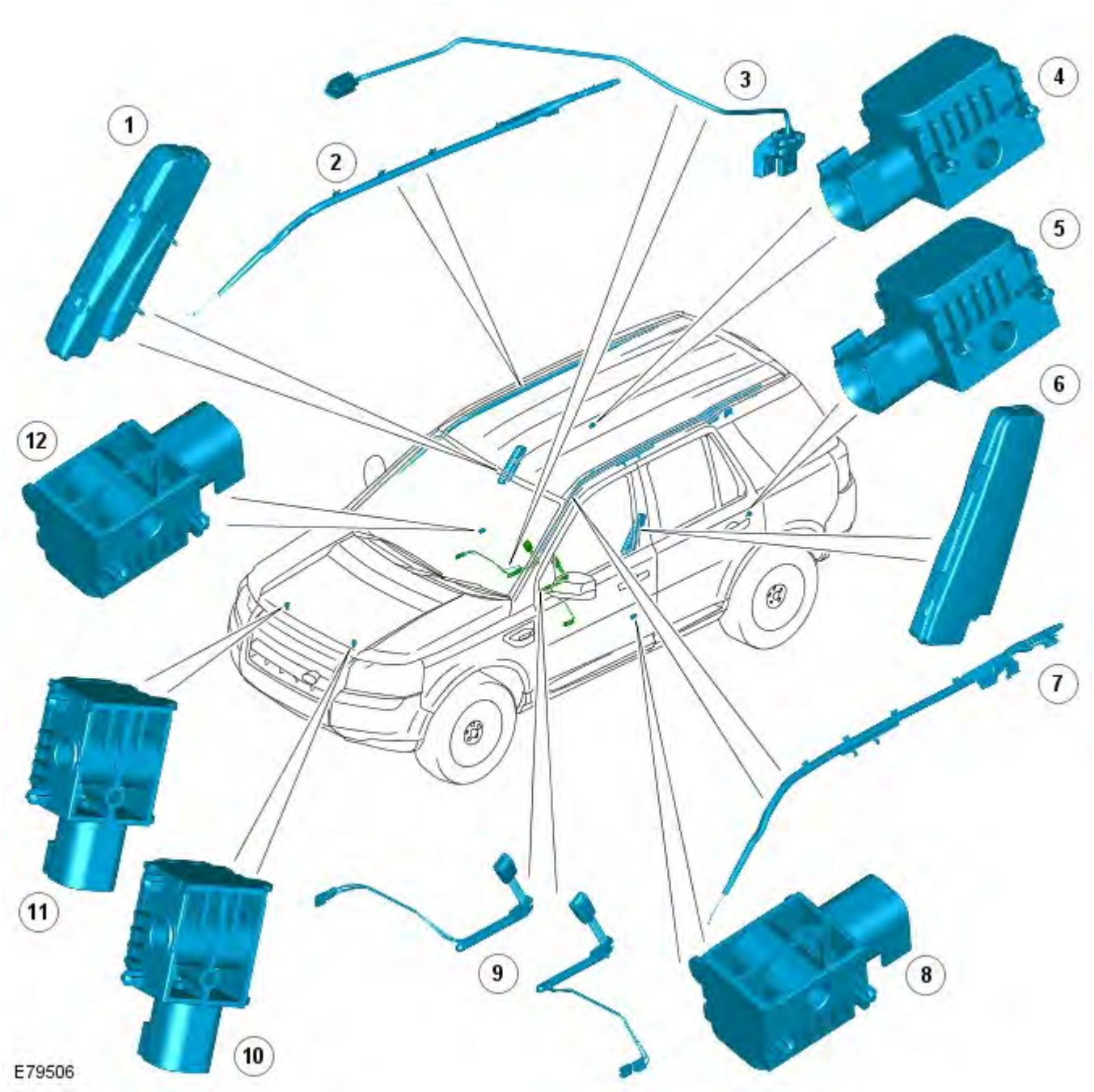
Description and Operation

COMPONENT LOCATION SHEET 1 OF 2



Item	Part Number	Description
1	-	Passenger air bag
2	-	Adaptive steering column
3	-	Clockspring
4	-	Driver air bag
5	-	Driver lower air bag
6	-	Restraints Control Module (RCM)
7	-	Passenger air bag deactivation switch

COMPONENT LOCATION SHEET 2 OF 2



Item	Part Number	Description
1	-	Side air bag
2	-	Side air curtain
3	-	Driver seat position sensor
4	-	Side impact sensor – C-pillar
5	-	Side impact sensor - C-pillar
6	-	Side air bag
7	-	Side air curtain
8	-	Side impact sensor - B-pillar
9	-	Safety belt pretensioners
10	-	Impact sensor - front
11	-	Impact sensor - front
12	-	Side impact sensor - B-pillar

OVERVIEW

WARNING: All pyrotechnic devices are dangerous. Before performing any procedures on any pyrotechnic device, read all information contained within the Standard Workshop Practices section of this manual.
For additional information, refer to: Standard Workshop Practices (100-00 General Information, Description and Operation). (100-00, Description and Operation).

The continued development of the Supplemental Restraint System (SRS) provides an improved overall level of crash protection for vehicle occupants. The system analyzes the occupancy scenario and crash severity before activating the appropriate safety devices to better protect a range of occupants in a variety of crash situations. Benefits of the system include:

- Optimization of the deployment restraint devices and the reduction in potential for air bag induced injuries.
- The significant reduction in passenger air bag deployments; particularly when passenger seats are unoccupied.

There are seven separate air bags, each designed with a specific protection function:

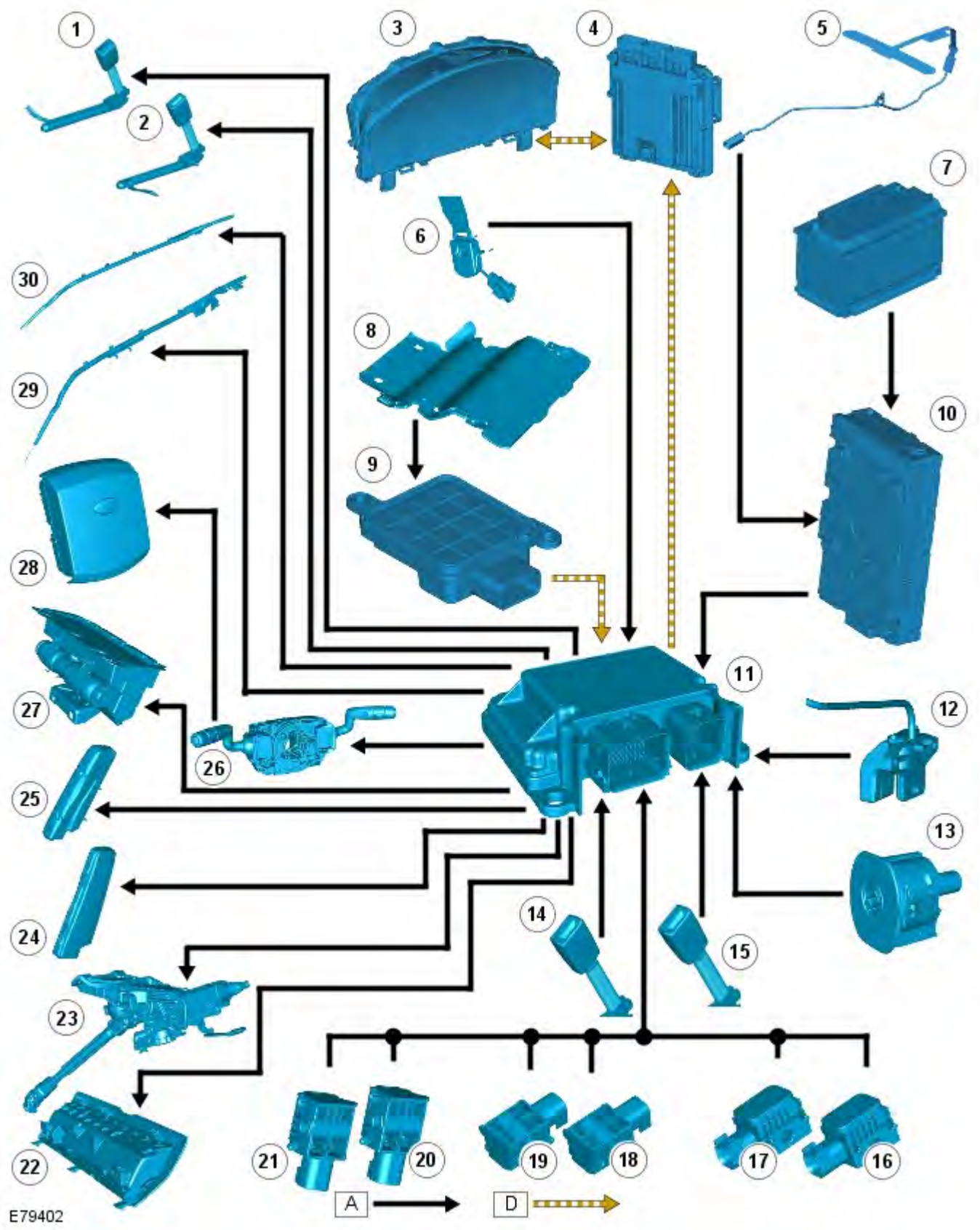
- Driver and front passenger air bags provide head and chest protection for front occupants.
- Driver and front passenger side air bags provide protection against side impact.
- Side air curtains provide protection against head impact and roll-over ejection for both front and rear occupants.
- A driver lower air bag provides protection to the driver's legs from the steering column support structures.

In order to support the SRS requirements, restraint control architecture is used comprising the following systems or components:

- All electronic front and side crash sensing and advanced restraints management.
- Driver air bag with twin stage inflator.
- Passenger air bag with twin stage inflator.
- Depending on market, a front passenger seat:
  - occupant classification sensing system, or
  - occupant detection sensing system.
- Safety belt buckle pretensioners.
- A seat position sensor on the driver seat.
- Depending on market; a pyrotechnic actuator fitted to the steering column to provide increased energy absorption.

CONTROL DIAGRAM

• NOTE: **A** = Hardwired; **D** = High speed controller area network (CAN) bus.



Item	Part Number	Description
1	-	Drivers safety belt pretensioner
2	-	Passenger safety belt pretensioner
3	-	Instrument cluster
4	-	Engine Control Module (ECM)
5	-	Belt-minder sensor – market specific
6	-	Safety belt tension sensor – market specific
7	-	Battery
8	-	Occupancy sensor
9	-	Occupancy sensor module
10	-	Central Junction Box (CJB)
11	-	Restraints Control Module (RCM)

12	-	Seat position sensor
13	-	Passenger air bag deactivation switch
14	-	Driver safety belt buckle switch
15	-	Passenger safety belt buckle switch
16	-	Impact sensor - left-hand front
17	-	Impact sensor - right-hand front
18	-	Side impact sensor - left-hand B-pillar
19	-	Side impact sensor - right-hand B-pillar
20	-	Side impact sensor - left-hand C-pillar
21	-	Side impact sensor - right-hand C-pillar
22	-	Driver lower air bag
23	-	Adaptive steering column
24	-	Side air bag – left-hand
25	-	Side air bag – right-hand
26	-	Clockspring
27	-	Passenger air bag
28	-	Driver air bag
29	-	Curtain air bag – left-hand
30	-	Curtain air bag – right-hand

PRINCIPLES OF OPERATION

Crash Sensing

Impact sensor

The impact sensors are installed in the front and both sides of the vehicle. When the ignition is switched on the Restraints Control Module (RCM), supplies power to the impact sensors which perform a self test. After satisfactory self test the impact sensors continually output 'digital acceleration' messages to the restraints control module. The use of multiple impact sensors provide shorter air bag trigger times through faster detection of lateral and longitudinal acceleration and also improves detection accuracy.

Each impact sensor incorporates an accelerometer and a microchip powered by a feed from the restraints control module. Acceleration is evaluated by the microchip and transmitted to the restraints control module, which then makes the decision on whether or not to activate the air bags and pretensioners.

If a fault is detected the relevant impact sensor sends a fault message, instead of the digital acceleration message, to the restraints control module. The RCM then stores a related fault code and illuminates the air bag warning indicator. Faults can be retrieved by the Land Rover approved diagnostic system from the RCM via the high-speed CAN.

Occupant Monitoring

There are two types of occupant monitoring systems fitted to vehicles:

1. **1.** NAS markets, have an **Occupant Classification Sensing System**.
2. **2.** Markets except NAS and Australia, have an **Occupant Detection Sensing System**.

1. Occupant Classification Sensing System

Item	Part Number	Description
1	-	Safety belt tension sensor
2	-	Occupancy sensor
3	-	Occupancy sensor module

In NAS markets where safety belt use is infrequent, additional technology is used to classify the occupant of the front passenger seat. The occupant classification sensing system provides seat load data to the Restraints Control Module (RCM).

The occupant classification system consists of:

- A pressure pad, installed under the cushion of the front passenger seat, which is connected to a pressure sensor.
- A safety belt tension sensor, integrated into the anchor point of the front passenger safety belt.
- An occupant classification module, installed under the front passenger seat.

The pressure pad is a silicone filled bladder. Any load on the pressure pad is detected by the pressure sensor. The safety belt tension sensor is a strain gauge which measures the load applied by the safety belt anchor to the anchor bolt. The sensor is located in the lower safety belt anchor point.

The occupancy sensor responds to weight changes on the passenger seat and provides an appropriate signal to the occupancy sensor module. In addition, the belt tension sensor provides a separate input to the occupancy sensor module. The module processes the input signals received from the sensors and forwards an appropriate signal to the RCM on the high-speed CAN.

The RCM monitors and processes the data from these and several other sensors, before making an air bag deployment decision. The system is designed to take account of several variables in addition to weight, including: inclination of the vehicle and exact position and structure of the weight on the seat.

This protects against inadvertent air bag deployment, for example, if the seat were occupied by an infant in a booster

seat, or an unrestrained but very lightweight adult, in both these cases the air bag would be disabled. The occupant classification sensing system forms part of a strategy to control passenger air bag deployment depending on the occupancy scenario.

The occupant classification system has four possible states:

- **Seat Empty:** the passenger air bag, passenger-side air bag and passenger safety belt buckle and pretensioner operation is disabled; the passenger air bag deactivation indicator is not illuminated.
- **Occupied Inhibit:** when the seat is occupied by a small person, the passenger air bag, passenger-side air bag and passenger safety belt buckle and pretensioner operation is disabled; the passenger air bag deactivation indicator is illuminated.
- **Occupied Allow:** when the seat is occupied by a large person; the passenger air bag and passenger-side air bag operation is enabled, the passenger air bag deactivation indicator is not illuminated. Passenger safety belt and pretensioner operation status depends on the safety belt buckle status:
  - active for buckled,
  - inactive for unbuckled.
- **Error:** if a system fault is detected; the passenger air bag is enabled to deploy at 'stage-1' only, refer to Air Bag Dual Stage Inflators below. Passenger-side air bag operation is also enabled; the passenger air bag deactivation indicator is not illuminated. Passenger safety belt and pretensioner operation status depends on the safety belt buckle status:
  - active for buckled,
  - inactive for unbuckled.

Occupancy Sensor Module

The occupancy sensor module is installed on the underside of the front passenger seat. The module supplies a power feed to the occupancy sensor and monitors the return voltage to determine if the seat is occupied or not. The result is transmitted to the RCM on the high-speed CAN. The occupancy sensor module also monitors for short and open circuits in the occupancy sensor. If it detects a fault, the occupancy sensor module transmits a fault message to the RCM.

Safety Belt Tension Sensor

The safety belt tension sensor is a strain-gauge type, encapsulated within the passenger safety belt anchor. The sensor converts the force applied to the safety belt into an electrical signal. In the event that a child-seat is installed onto the front passenger seat, the force applied to the passenger safety belt is reflected by the output signal from the sensor, which provides data to supplement that received from the occupancy sensor. The occupancy sensor module processes the input data and makes it available to the restraints control module, which then makes the necessary adjustments in respect of passenger air bag deployment.

2. Occupant Detection Sensing System

The belt-minder sensor and a safety belt buckle switch are used to warn the driver if the front passenger seat is occupied without the safety belt being engaged.

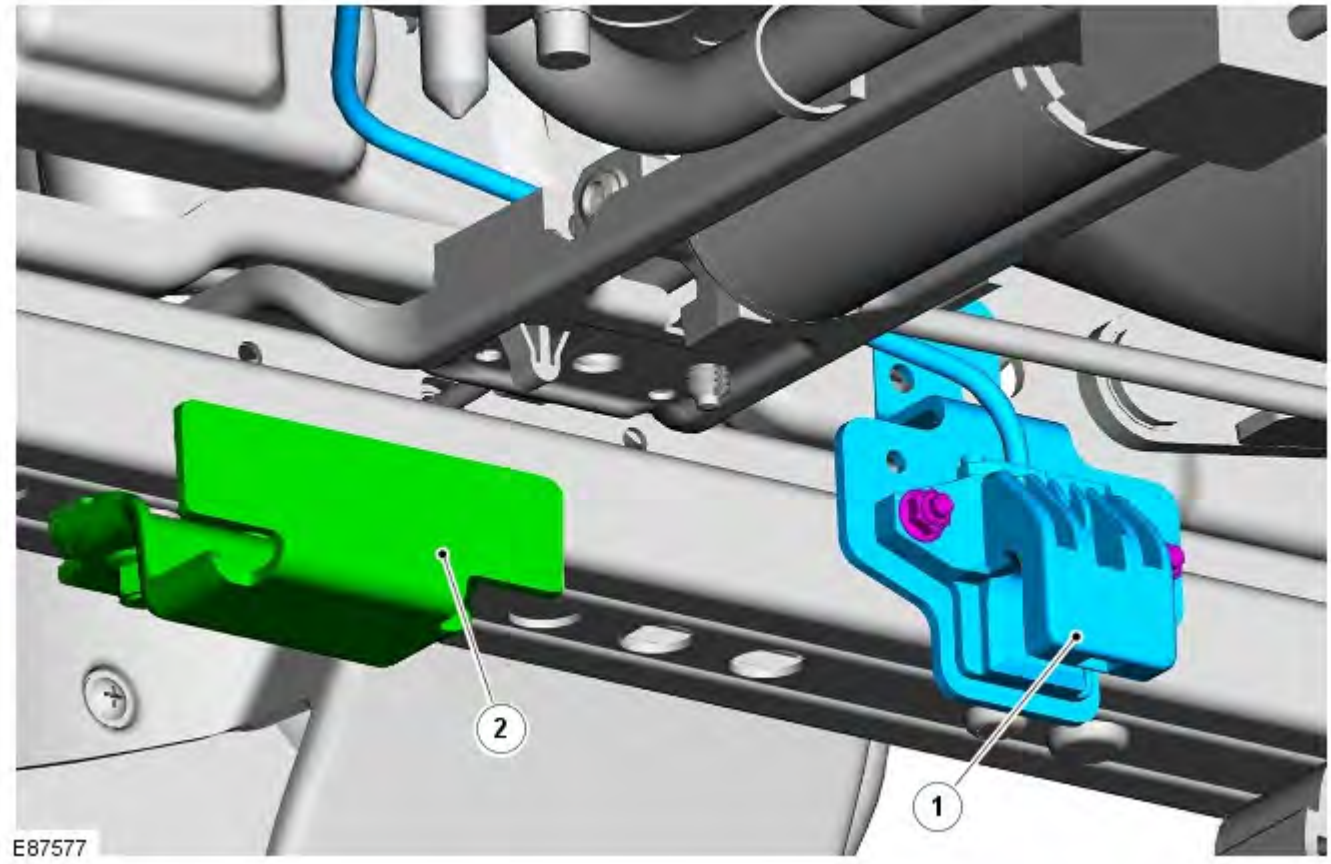
Belt Minder Sensor

The occupancy sensor is installed in the cushion of the front passenger seat between the foam padding and the cover. The sensor consists of a foil contact circuit, embedded in a plastic sheet. Weight on the sensor reduces the resistance of the circuit.

The safety belt buckle switch provides an output signal in response to the insertion of the safety belt tongue into the buckle. The output signal from the switch is used by the RCM to determine whether the front seat occupants are correctly restrained. The switch signal is used in conjunction with the belt minder sensor to ensure that air bag and safety belt deployment only occurs when the seat is occupied.

Driver Position Sensing System

Seat Position Sensor



Item	Part Number	Description
1	-	Seat position sensor
2	-	Target bracket

The seat position sensor, a 'Hall effect' type, is fitted to the underside of the driver's seat. The sensor is actuated by the target bracket attached to the seat slide. The disturbance caused when the target bracket passes the sensor creates an output signal for the RCM. On receipt of this signal, which indicates when the seat is forward of a defined point in its travel, the RCM disables the second stage output of the driver air bag; refer to air bags section.

Control and Processing

Restraints Control Module

Internally, the Restraints Control Module (RCM) has two areas that determine which elements of the restraint system are to be deployed:

Area 1 - Crash severity evaluation:

The first area evaluates crash severity by using data from the module's internal accelerometer, the front crash sensor and the safety-belt buckle sensor. Based on this data, the RCM decides which level of air bag deployment is required and forwards the information to the second area, the deployment handler.

Area 2 - Deployment handler:

The status of the seat position sensor, occupant classification sensing system and safety-belt buckle sensors are examined before a decision is made about which restraints should finally be deployed. For instance, if the occupant classification sensing system indicates that the passenger seat is empty, then no restraint deployment will take place on the passenger side, even if full deployment takes place for the driver.

An energy reserve in the RCM ensures there is always a minimum of 150 milliseconds of stored energy available if the power supply from the ignition switch is disrupted during a crash. The stored energy is sufficient to produce firing signals for the driver air bag, the passenger air bag and the safety belt pretensioners.

When the ignition is switched on the RCM performs cyclical monitoring of the system. If a fault is detected the RCM stores a related fault code and sends the signal to illuminate the air bag warning indicator. The faults can be retrieved by the Land Rover approved diagnostic system. If a fault that could cause a false fire signal is detected, the RCM disables the respective firing circuit, and keeps it disabled during a crash event.

Air Bags

Hybrid Inflator Technology

All air bags feature hybrid inflators, rather than the previously used solid pyrotechnic gas generators which use an explosion to generate the air bag charge directly. Hybrid inflators use a self-contained pyrotechnic device to heat a cylinder of compressed inert gas within the inflator. Above a calibrated pressure, this cylinder bursts and the gas is released into the fabric bag.

The benefits of hybrid inflators are cooler gas, hence lower bag surface temperatures, and the elimination of post-deployment effluent associated with solid pyrotechnic generators.

Dual Stage Inflators

Both the driver air bag and passenger air bag feature dual-stage inflators. Each air bag employs two separate inflators, fitted with independent squibs connected to the air bag. This allows air bag size, pressure and rate of rise in pressure to be optimized to suit the vehicle's structural characteristics as well as the severity of the actual impact.

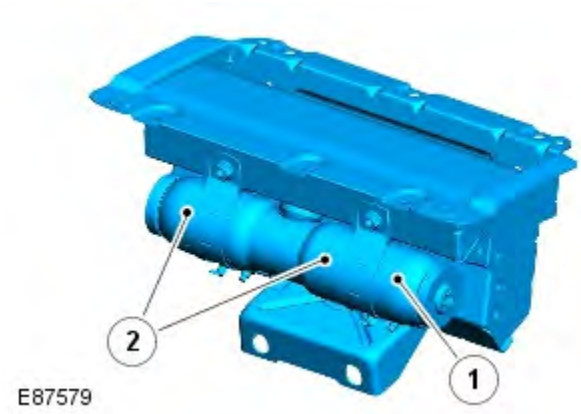
The restraint control module (RCM) monitors the severity of the collision, safety belt tension and proximity of the driver's seat to the steering wheel in order to determine the air bag deployment strategy:

- At relatively low speeds, or when smaller occupants are seated close to the steering wheel only the 'stage 1' inflator deploys; this inflates the air bag to about 70% of its capacity.
- At higher speed impacts both 'stage 1' and after a pre-set interval, 'stage 2' inflator deploys to achieve maximum air bag volume, unless the driver is dangerously close to the steering wheel.

Driver Air Bag

The driver air bag has a two stage inflator, with separate electrical connectors for each stage. Lines molded into the inner surface of the driver air-bag cover, provide weak points that split open in a controlled manner when the driver air bag deploys.

Passenger Air Bag



Item	Part Number	Description
1	-	Stage one – 70% air bag volume
2	-	Stage two – full air bag volume

The top of the passenger air bag is attached to a re-enforcement lid in the instrument panel. The reinforcement lid incorporates a single door that opens, splitting the instrument panel covering, when the air bag deploys. The air bag has a two stage inflator, with separate electrical connectors for each stage.

Passenger Air Bag Disable Switch

E87580

A key-operated passenger air bag disable switch is installed in specified markets. When the passenger air bag deactivation switch is operated, it changes a ground connection between two pins in the connectors of the RCM. A tell-tale warning light, located in the roof console near the interior rear view mirror is illuminated when the passenger air bag is disabled.

The passenger air bag disable switch is operated by the emergency key located in the remote control.

Passenger Air Bag Deactivation Indicator

E87592

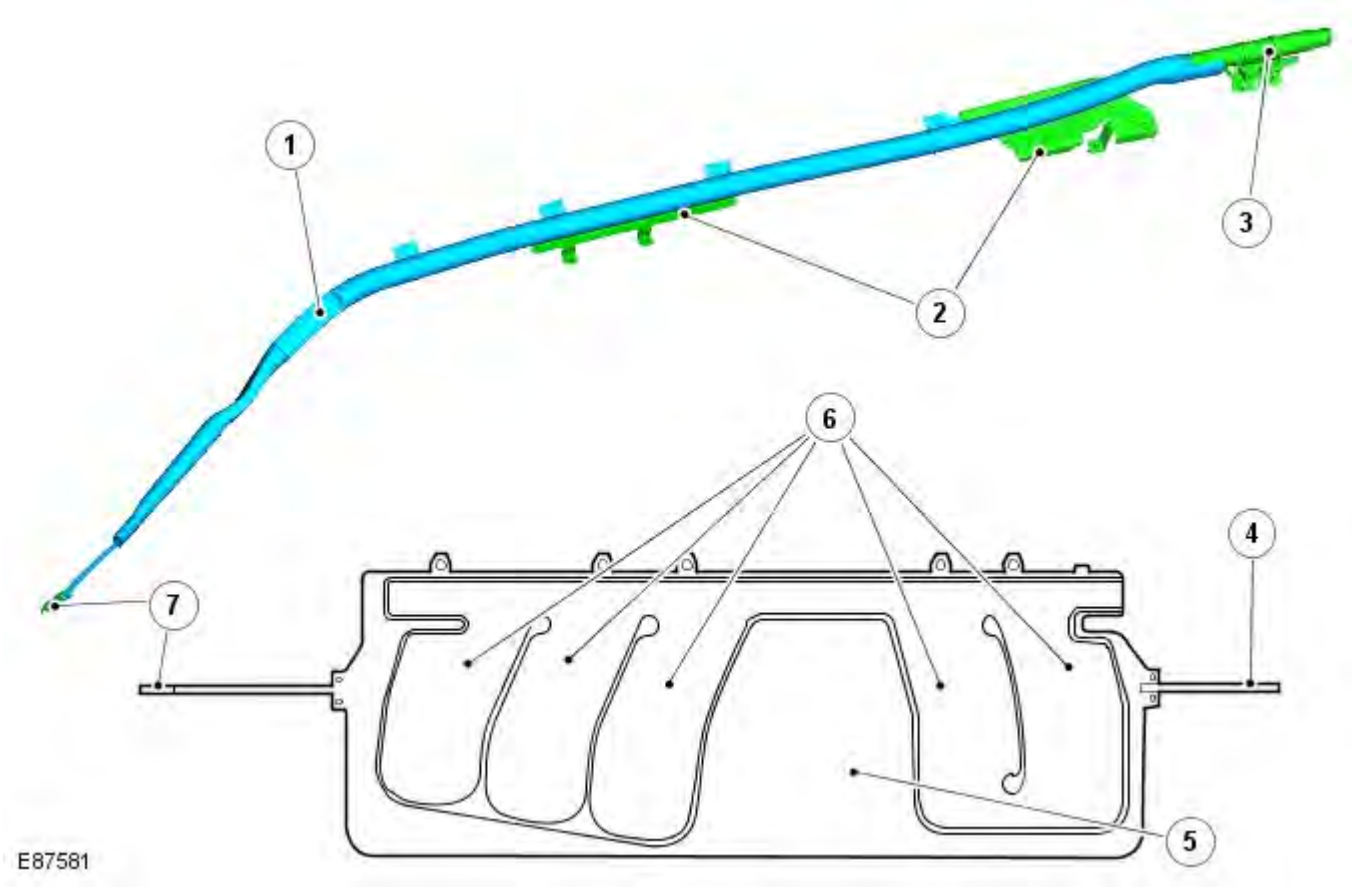
When the passenger air bag deactivation switch is selected to OFF, the RCM disables the passenger air bag and if the front passenger seat is occupied, illuminates the passenger air bag deactivation indicator.

Side Air Bags

A side air bag is attached to the outside of each front seat backrest frame, under the backrest cover.

The side air bags are handed and each consists of a molded plastic case which contains the folded air bag and the inflator. A cable connects the igniter of the inflator to a connector in the main seat harness connector block located under the front edge of the seat cushion. When the air bag deploys it forces the front edge of the molded plastic case apart and splits open the backrest cover.

Side Air Curtains



Item	Part Number	Description
1	-	Air curtain housing
2	-	Deployment ramps
3	-	Gas generator
4	-	Rear tether
5	-	Curtain
6	-	Air chambers
7	-	Front tether

Side air curtains protect against head injuries in a side impact, while also helping to ensure unrestrained occupants are not ejected through open or broken windows during a rollover event.

A single inflator mounted behind the rear seat passengers unfurls the curtain and fills five separate chambers to provide head protection cushions for occupants in side-impact and roll-over events. Steel ramps guarantee the curtain does not snag on the interior trim as it unfurls, while tethers at the front and rear of the curtain ensure the curtain is held taut.

The side air curtain deflation characteristics are deliberately slow to ensure it remains inflated throughout the duration of a vehicle rollover event.

Air Bag Warning Indicator

The air bag warning indicator consists of a red LED (light emitting diode) behind a SRS graphic in the instrument cluster.

Operation of the air bag warning indicator is controlled by a high-speed CAN bus message from the RCM to the instrument cluster. The RCM sends the signal to illuminate the air bag warning indicator if a fault is detected, and for approximately 6 seconds during the bulb check at the beginning of each ignition cycle.

Clockspring

The clockspring is installed on the steering column to provide the electrical interface between the vehicle's fixed wiring harness and the steering wheel. The clockspring provides connections for the driver air bag, horn and steering wheel switch packs.

Safety Belt Pretensioners

A pretensioner is integrated into each front safety belt buckle and attached to a bracket on the inboard side of the seat. The pretensioner pulls 80mm of slack from the safety belt through a cable system running parallel to the seat rail. This tightens the front safety belts during a collision to ensure the occupants are securely held in their seats.

Each pretensioner has a tube containing propellant and a piston. The piston is attached to a steel cable, the opposite end of which is attached to the safety belt buckle. A squib in the base of the tube provides an ignition source when triggered by a fire signal from the RCM. On receipt of a fire signal from the RCM, the squib ignites the propellant. The propellant produces nitrogen gas that rapidly expands to drive the piston along the tube, pulling the cable and drawing the buckle downwards.

Steering Column Pyrotechnic Device

NAS market vehicles; a pyrotechnic device is fitted to the steering column to provide increased energy absorption to a driver not wearing a safety belt. If the driver is wearing a safety belt and a crash situation occurs, the device is not activated. Refer to steering column section for further information.

Published: 11-May-2011

Supplemental Restraint System - Air Bag Supplemental Restraint System (SRS)

Diagnosis and Testing

Principles of Operation

For a detailed description of the air bag supplemental restraints system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).

Inspection and Verification

WARNING: TO AVOID ACCIDENTAL DEPLOYMENT AND POSSIBLE PERSONAL INJURY, THE BACKUP POWER SUPPLY MUST BE DEPLETED BEFORE REPAIRING OR REPLACING ANY AIR BAG SUPPLEMENTAL RESTRAINT SYSTEM (SRS) COMPONENTS. TO DEPLETE THE BACKUP POWER SUPPLY ENERGY, DISCONNECT THE BATTERY GROUND CABLE AND WAIT TWO MINUTES. FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN PERSONAL INJURY.

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

• NOTE: Given the legal implications of a restraints system failure, harness repairs to Air Bag module circuits are not acceptable. Where the text refers to "REPAIR the circuit", this will normally mean the replacement of a harness.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of damage.

Visual Inspection

Electrical
• Battery condition, state of charge • Make sure all electrical connector(s) are engaged correctly on the air bag circuits • Wiring harness • Air bag module(s) • Make sure the restraints control module (RCM) is correctly installed • Fuse(s) • Sensor(s) • Pretensioner(s) • Warning lamp bulb(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, check Restraints Control Module (RCM) and Occupancy Classification System (OCS) module for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Given the complexity of the system and the potential for damage/injury, the preferred method of diagnosis is via the Manufacturer approved diagnostic system.

If the Manufacturer approved diagnostic system is not available, use a scan tool to extract DTCs and refer to the DTC Index.

DTC Index

• NOTE: If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

• NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

• NOTE: When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

• NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

• NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Restraints Control Module (RCM) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Supplemental Restraint System - Restraints Control Module (RCM)

Removal and Installation

Removal

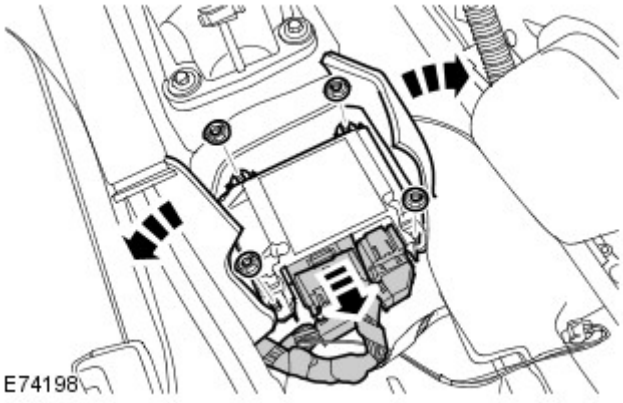
• NOTE: The RCM must be replaced after every time any SRS component has been deployed.

1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

2. Remove the floor console.

   Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).



3.
   - Cut the carpet for access.
   - Position the carpet aside for access.

4.
   - *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

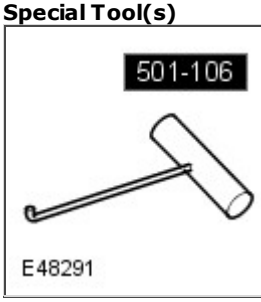
2. Using Land Rover approved diagnostic equipment, programme a new RCM.

Published: 11-May-2011

Supplemental Restraint System - Driver Air Bag Module

Removal and Installation

Special Tool(s)

	501-106 Remover, Driver Air Bag

Removal

1. Disconnect the battery ground cable.

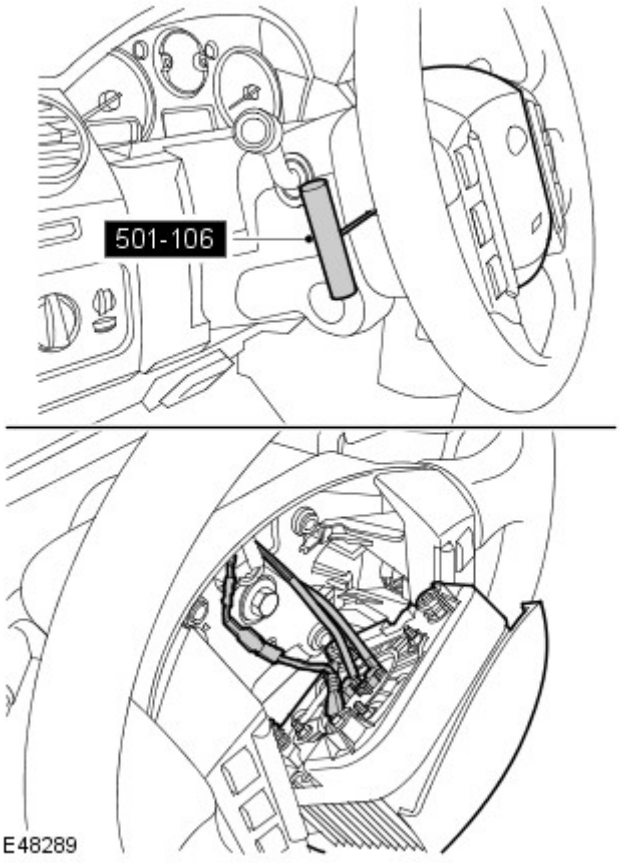
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

3.
   - Carefully release the 2 clips.
   - Using the special tool, remove the driver air bag module.

   Special Tool(s): 501-106



4. **4.** WARNING: Do not probe supplemental restraint system (SRS) electrical connectors.
   - Disconnect the 3 electrical connectors.

Installation

1. **1.** WARNINGS:

The SRS electrical connectors are unique. DO NOT force, or attempt to connect electrical connectors to the wrong sockets.

Driver air bag module installation can be confirmed by hearing 2 audible clicks, 1 for each spring. The module edges should also be flush with the steering wheel.

• NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

To install, reverse the removal procedure.

Published: 11-May-2011

Supplemental Restraint System - Driver Lower Air Bag Module

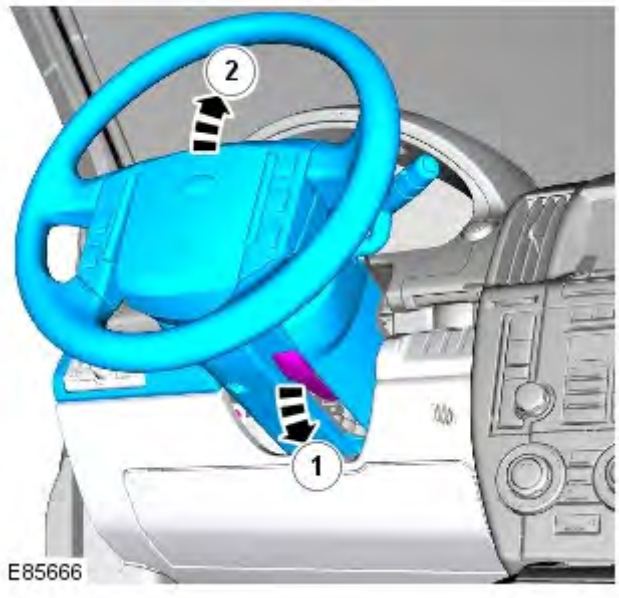
Removal and Installation

Removal

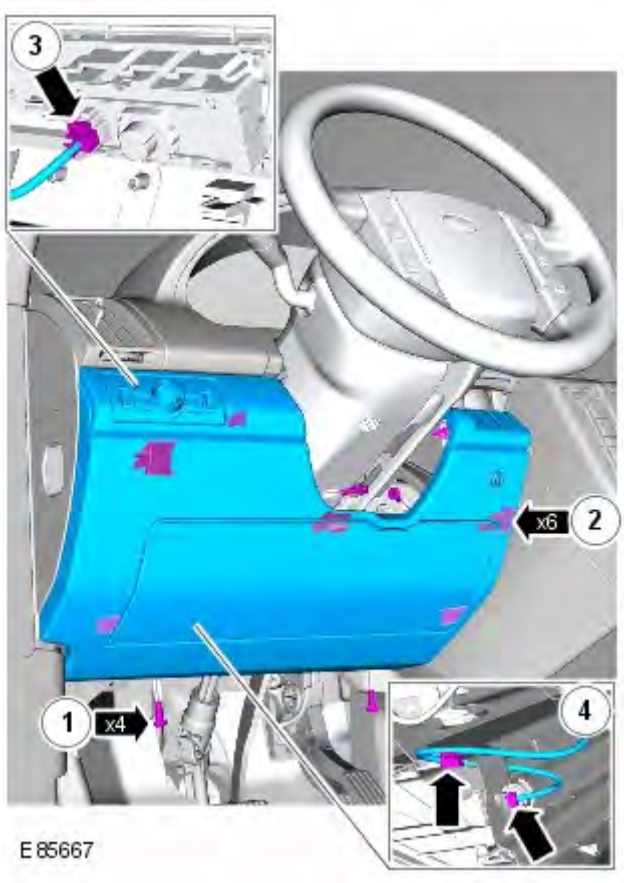
• NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

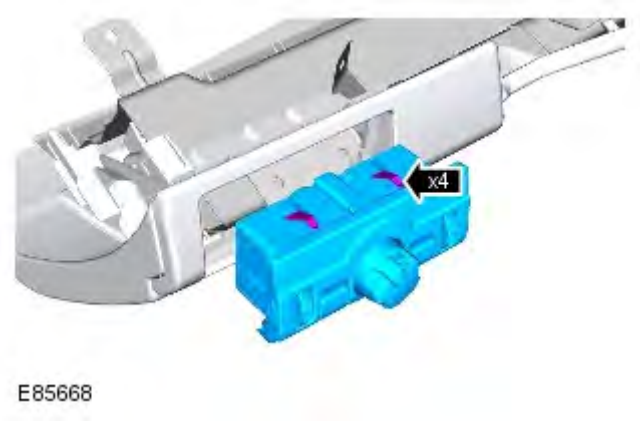


2. Release the steering column lever and raise the column for access.

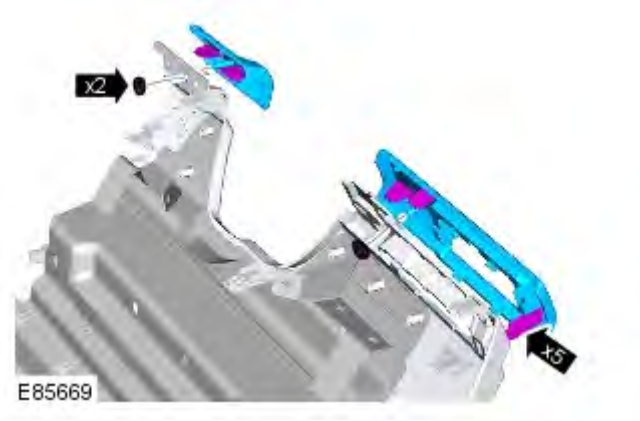


3. **3.** NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

   Torque: 6 Nm



4. **4.** NOTE: Do not disassemble further if the component is removed for access only.



5.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Supplemental Restraint System - Passenger Air Bag Module

Removal and Installation

Removal

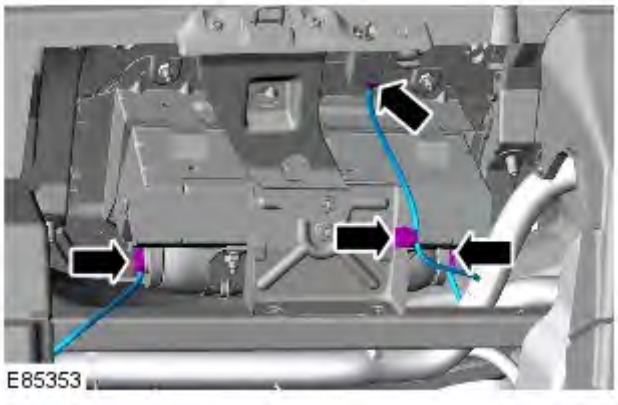
- NOTE: Removal steps in this procedure may contain installation details.

1. Make the SRS system safe.

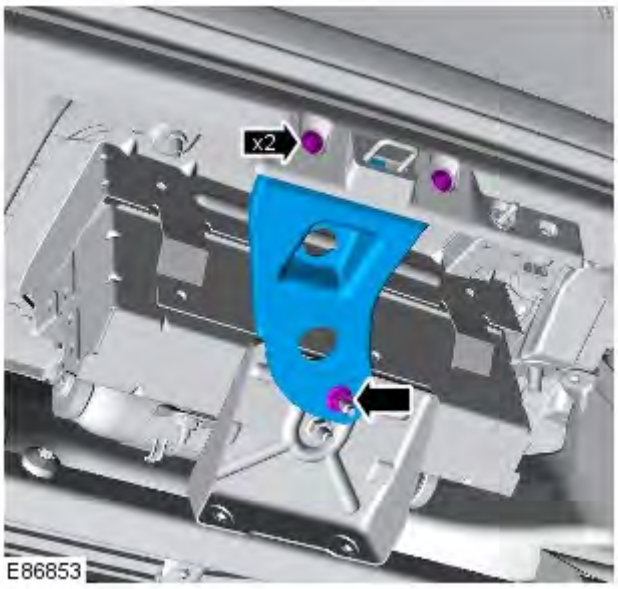
   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

2. Remove the glove compartment.

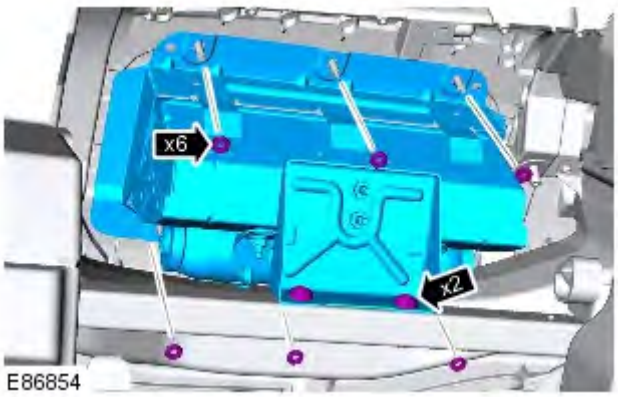
   Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).



3.

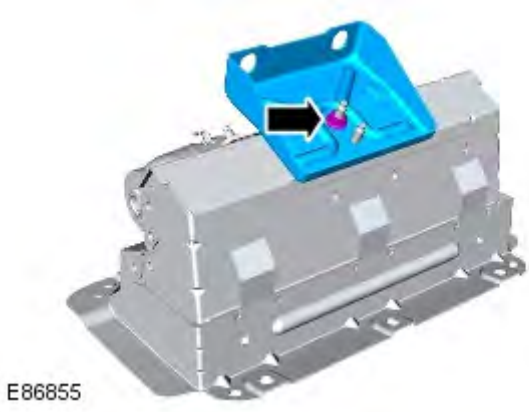


4.



5. **5.** NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

   Torque: 10 Nm



6. **6.** NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Supplemental Restraint System - Side Air Bag Module

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

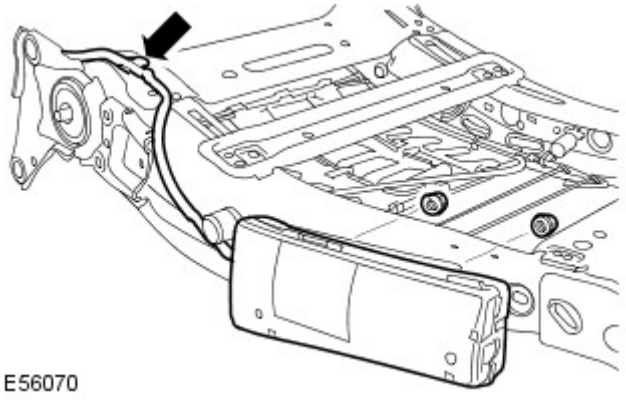
1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

2. Remove the front seat backrest cover.

   Refer to: Front Seat Backrest Cover (501-10 Seating, Removal and Installation).

3. Remove the front seat backrest pad.



4. **4.** WARNING: Do not probe supplemental restraint system (SRS) electrical connectors.

   Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Supplemental Restraint System - Side Air Curtain Module

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

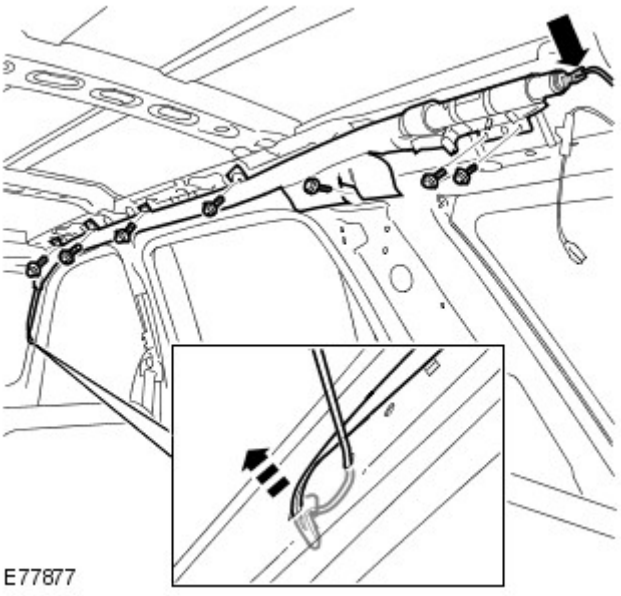
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the headliner.

   Refer to: Headliner - Vehicles Without: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
   Refer to: Headliner - Vehicles With: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



4. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Supplemental Restraint System - Passenger Air Bag Deactivation (PAD) Switch

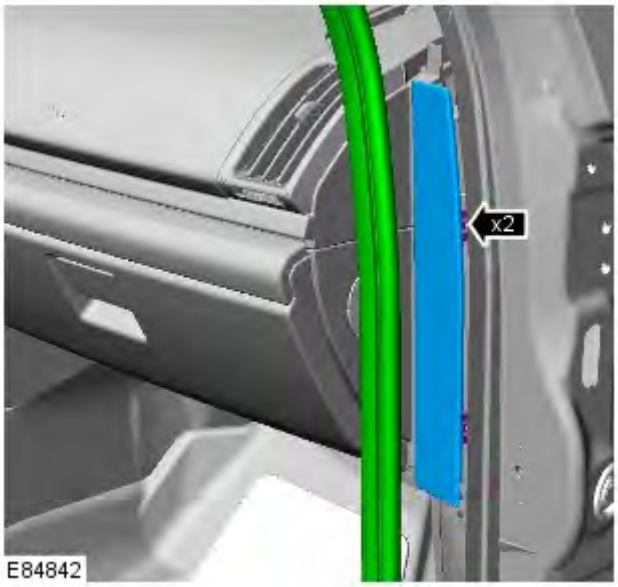
Removal and Installation

Removal

1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

2.



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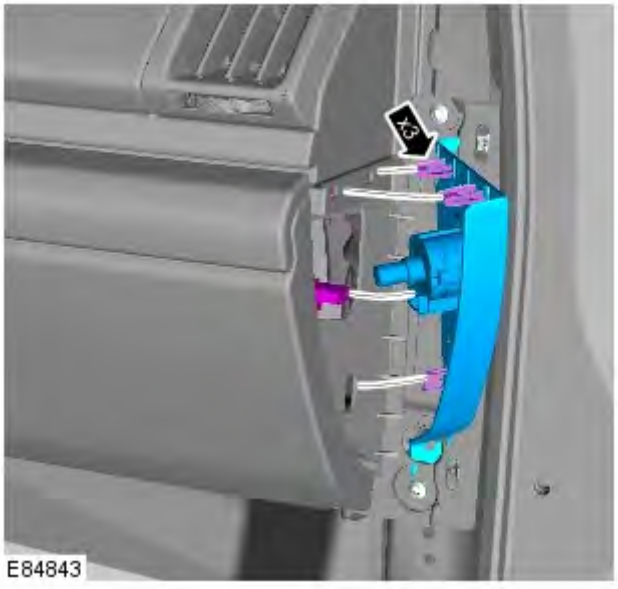

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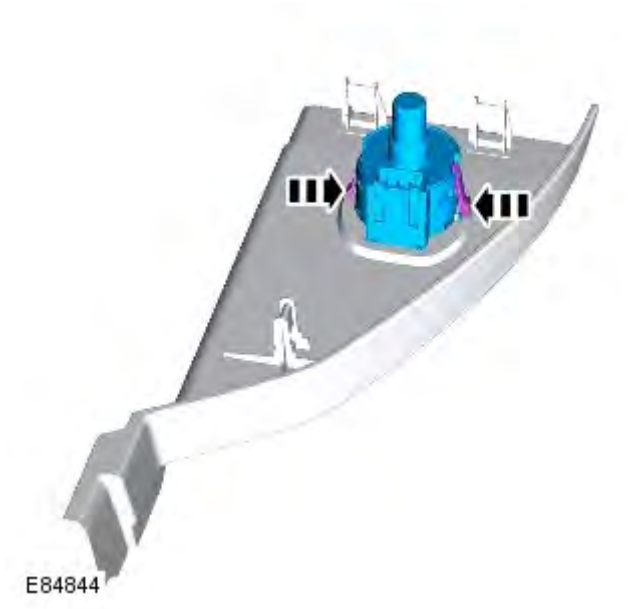


Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Supplemental Restraint System - Clockspring

Removal and Installation

Removal

1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

2. **2.** CAUTION: Make sure that the road wheels are in the straight ahead position.

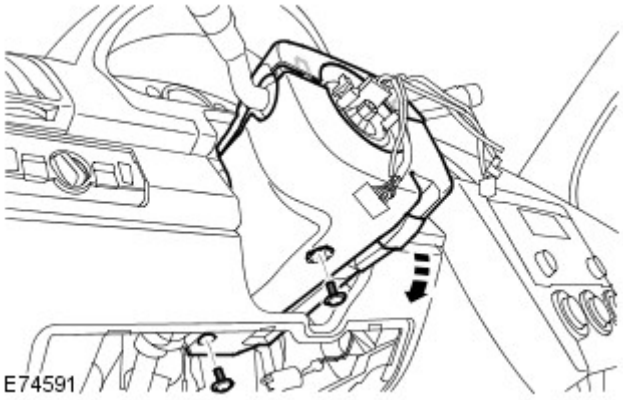
   Remove the steering wheel.

   Refer to: Steering Wheel (211-04 Steering Column, Removal and Installation).

3. Release the steering column adjustment lever.

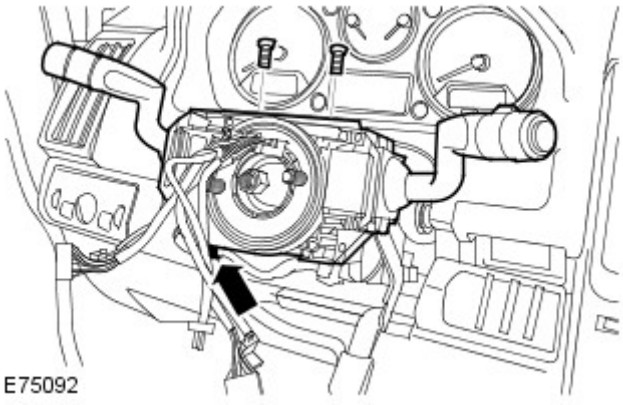
4. Remove the steering column upper cowl.

5. Remove the steering column lower cowl.



6. **6.** CAUTION: Make sure that the clockspring rotor does not rotate.

   Remove the clockspring.



Installation

1. **1.** CAUTION: Correct clockspring alignment can be found by viewing a yellow marker through the window situated on the clockspring face, at the 8 o'clock position. If the marker is not visible, carefully turn the clockspring fully clockwise. Turn the clockspring in a counterclockwise direction 3.25 turns. The yellow marker should now be in the central position.

   To install, reverse the removal procedure.

Published: 11-May-2011

Supplemental Restraint System - Occupant Classification Sensor

Removal and Installation

Removal

• NOTE: The occupant classification sensor is part of the passenger seat cushion. The sensor is only fitted to NAS models.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the front seat cushion cover.

   Refer to: Front Seat Cushion Cover (501-10 Seating, Removal and Installation).

Installation

1. Install the front seat cushion cover.

   Refer to: Front Seat Cushion Cover (501-10 Seating, Removal and Installation).

2. Connect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Using IDS, configure a new occupant classification sensor.

Published: 11-May-2011

Supplemental Restraint System - B-Pillar Side Impact Sensor

Removal and Installation

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

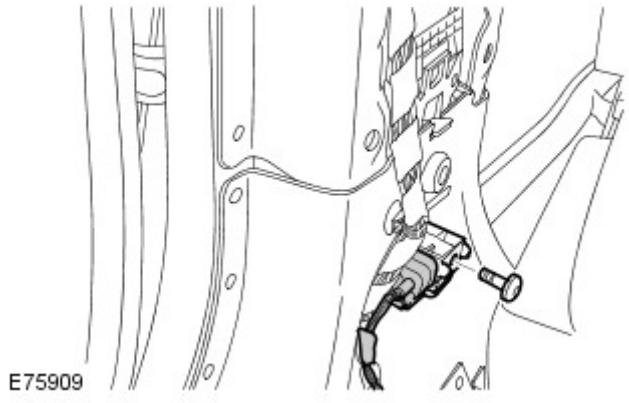
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the front scuff plate trim panel.

   Refer to: Front Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



4. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Supplemental Restraint System - C-Pillar Side Impact Sensor

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

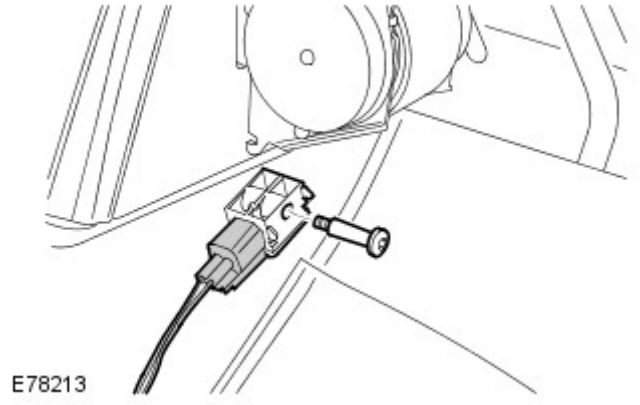
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the rear quarter trim panel.

   Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



4. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Supplemental Restraint System - Front Impact Severity Sensor

Removal and Installation

Removal

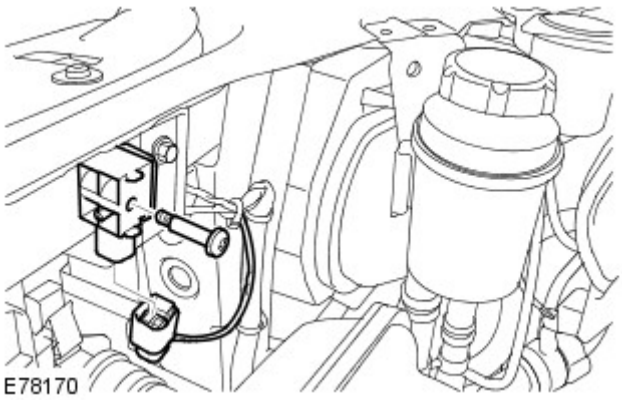
- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).



3. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Body Repairs - General Information - Body Repairs

Description and Operation

General Information

Introduction

The body plays a significant role in the increasing trend of ever more rapidly changing model variants. The different customer groups are strongly influenced by the design and shape of the body. At the same time the stability of the body plays the most important part in ensuring passenger and driver safety. Lightweight construction, alternative materials, composite materials, plastics and appropriate joining processes are all design features that characterise modern Land Rover vehicle bodies.

In terms of manufacturing technology, modern safety cell bodies can be produced almost without any problems. Land Rover guarantee high quality standards by ensuring that mechanical strength properties are tried and tested in numerous computer simulations, crash tests, by testing materials and by employing sophisticated manufacturing technologies. In the event of repairs it is vital that the production quality standards are upheld. This requires a well-equipped workshop, and places particular emphasis on the qualifications of the workshop technicians. Up-to-date knowledge of current manufacturing technologies and continuous training on new repair methods and techniques are vital for high-quality body repairs. The model-specific repair manuals and the general repair techniques provide valuable support when undertaking body repairs.

Always follow the repair instructions published in this manual. Failure to observe this instruction can result in serious impairment of vehicle safety. All specified safety requirements must be met after the work has been carried out.

Vehicle design

The body

The Freelander 2 body is manufactured like a conventional monocoque. Two monosides are welded to the floor, roof and bulkheads, creating a strong, single structure. Dual Phase (DP), and Bake Hardened (BH), steels are used in the side panel reinforcements. DP steel is also used for the rear of the front side member, for added strength in front and side impacts. The roof structure can accommodate a roof opening panel. When a sunroof is not fitted, the outer roof panel is a single large steel pressing with styled swages to add strength and prevent booming.

The safety of the driver and the passengers is paramount for every body design. There are two key safety aspects in the body:

- Safety passenger cell
- Crumple zones

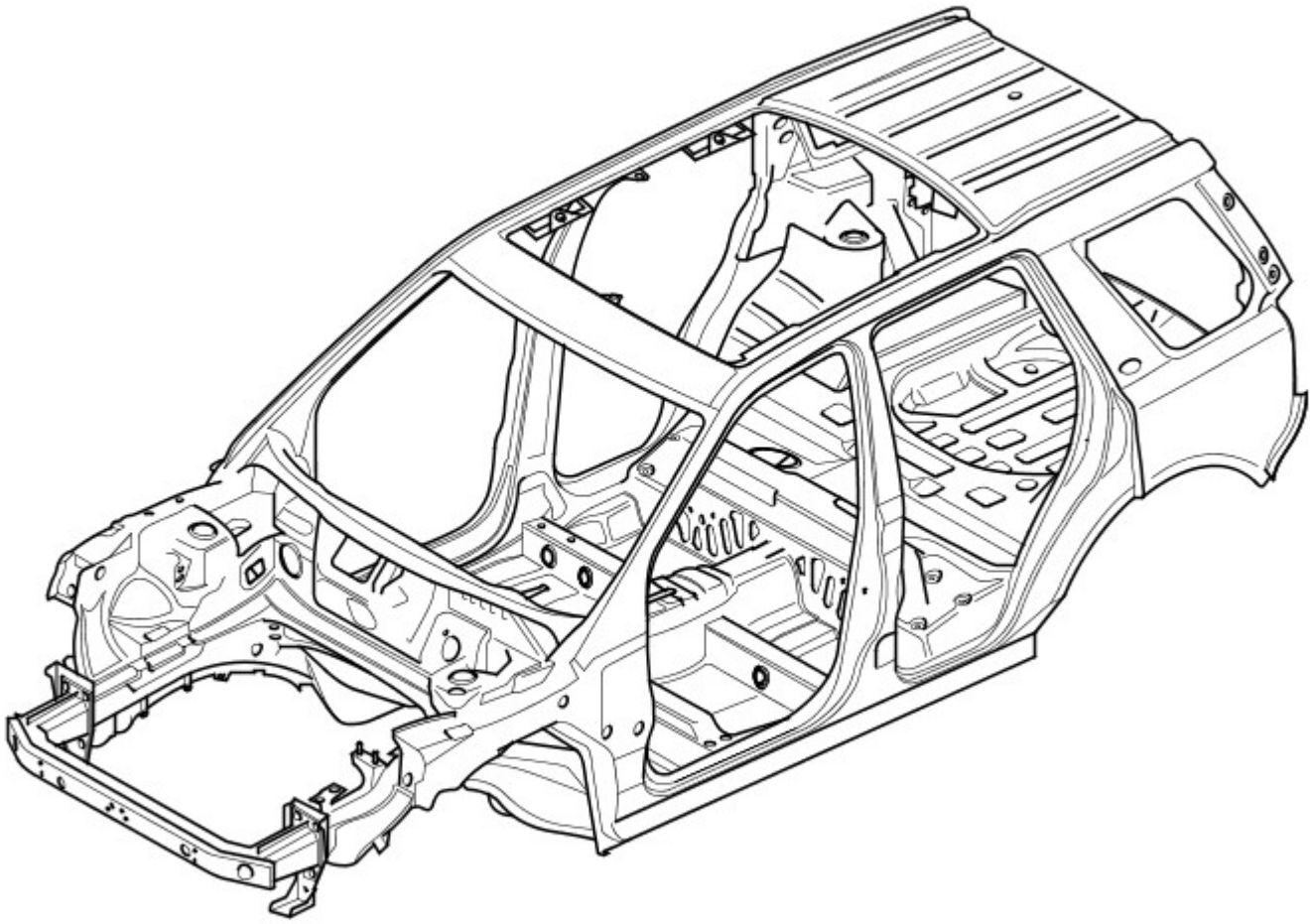
Safety passenger cell

- Stable pillars, rocker panel and door profiles.
- Side impact protection in the doors.
- Doors are designed to open even in the event of extreme deformation.

Crumple zone

- Dynamic absorption of deforming forces.
- Protection of the passenger cell.

Vehicle Design



E89233

Item	Part Number	Description
1		Bodyshell

High Strength Steels

Most modern vehicles are constructed from a number of different steels, partly to obtain an optimised body, (collision, safety, rigidity, fuel economy, etc).

Steels are divided into several groups according to their tensile and yield strength, that is to say the force necessary to bring about plastic deformation of the material.

Yield Summary

Yield is the strength at which the metal changes from elastic to plastic in behaviour, the point of no return.

Tensile Summary

Tensile strength is the breaking strength of a material when subjected to a tensile (stretching) force, the point of no return.

Dual Phase (DP) steel falls into both the VHSS and EHSS classifications, dependant on grade of DP.

Steel Type	Yield Strength
Mild Steel (MS)	Maximum Yield point up to 180 MPa
High Strength Steel (HSS)	Steel With a Yield Point up to 280 MPa
Very High Strength Steel (VHSS)	Steel With a Yield Point up to 380 MPa
Extra High Strength Steel (EHSS)	Steel With a Yield Point up to 800 MPa
Ultra High Strength Steel (UHSS)	Steel With a Yield Point greater than 800 MPa

Welding Ultra High Strength Steel

Ultra high strength steel requires welding equipment which can achieve the following equipment settings.

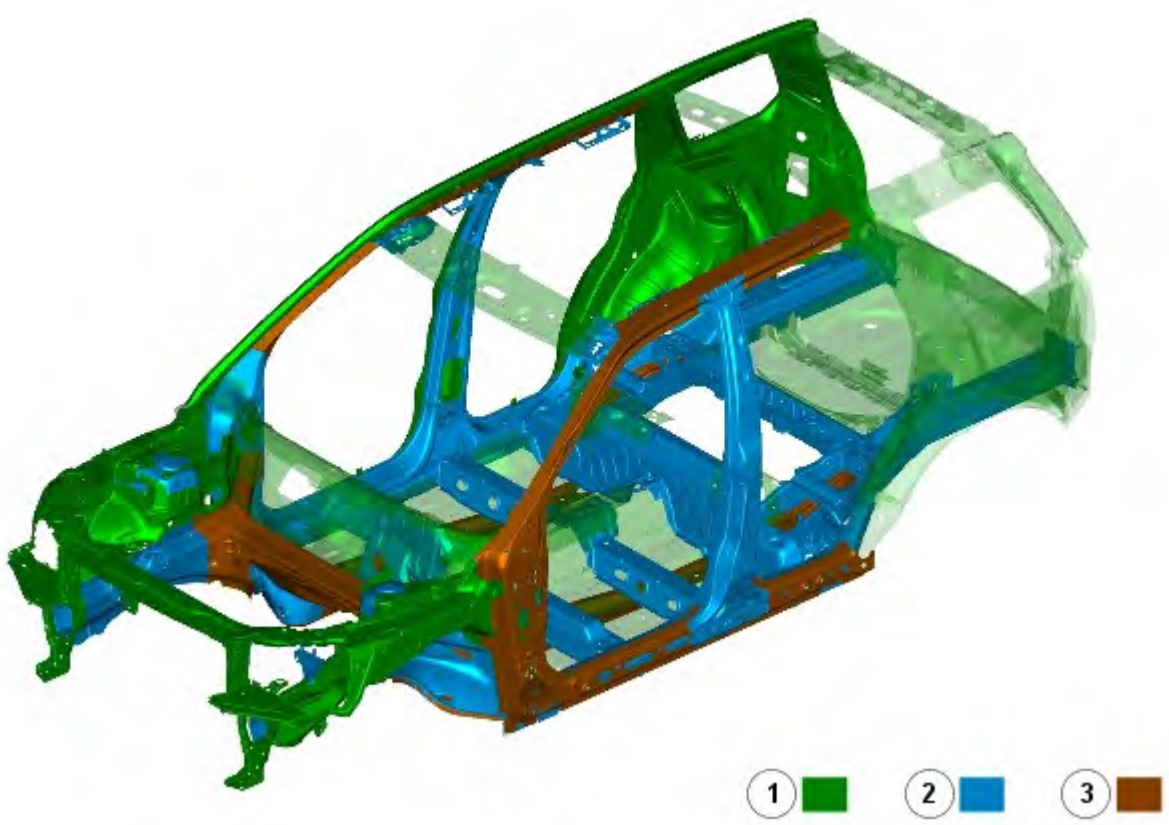
Spot Welding

Information to follow.

MIG Brazing

When mig-brazing use the following type of welder meeting the specifications shown: Fronius Trans Plus Synergic 2700 4 R/Z/AL MIG Welder, with CuSi3 (DIN 1733) 1.0mm filler wire with setting parameters 4, which is 92 Amps, Wire feed 4.6 m/min. Shielding gas L1 = pure Argon (DIN 439).

Steels used in body structure



E92284

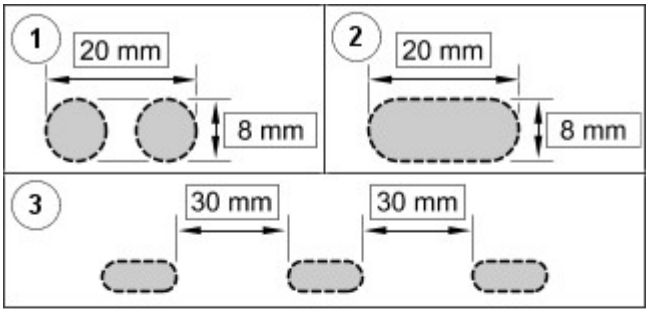
Item	Type of Steel
1	Soft Steel (SS)
2	High Strength Steel (HSS)
3	Extra High Strength Steel (EHSS)

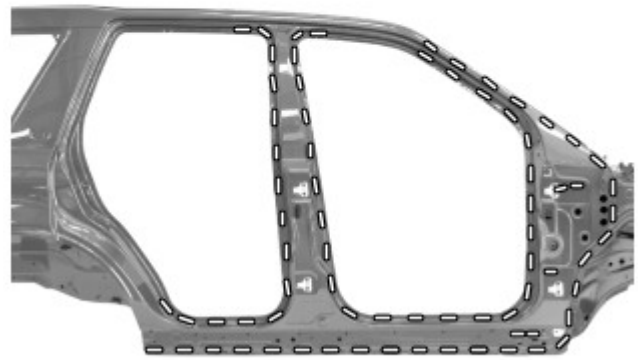
• NOTE: The addition of DP600 (EHSS), for the side panel reinforcement "ring frame", and the rear of the front side member, gives the body greater strength in a front or side impact.

• NOTE: When installing outer side panels, A-Pillar, B-Pillar, rocker panel, quarter panel, they must be slot brazed where they adjoin their inner, reinforcement, panels.

• NOTE: The size of the slots are to be 20mm x 8mm and 30mm apart. Slots should be installed in accordance with this spacing. Where this is not possible, due to the indents in the panel, the slot should be made in the location of the original spot weld.

Side panel





E89257

Item	Description
1	Drill 2 x 8mm holes to form basis of slot
2	Mill out to form 20mm x 8mm slot
3	Slots spaced at 30mm intervals

• NOTE: Mig brazing is carried out at a temperature of 650°C to 950°C. To avoid degradation of the ultra high strength steel material properties, the temperature must be below 950°C.

Mig braze the slot(s) using a Fronius Trans Plus Synergic 2700 4 R/Z/AL MIG Welder, with CuSi3 (DIN 1733) 1.0mm filler wire with setting parameters 4, which is 92 Amps, Wire feed 4.6 m/min. Shielding gas L1 = pure Argon (DIN 439).

Dress the surface of the weld cap (brazed slot) with 60/80 grit belt sanders.

Accident damage and diagnosis

General notes

- Exact diagnosis of the extent of the damage enables proper repair planning.
- All body repairs must be carried out in accordance with the guidelines in this Body Repair Manual.
- The stability and strength properties of the body must be taken into account during body repairs. The body has exact defined deformation patterns that must not be affected by any repair work.
- For instance, the crumple zones absorb the bulk of the impact energy. If any unprofessional repair techniques or methods are used in these areas then this can pose a fundamental threat to vehicle safety.

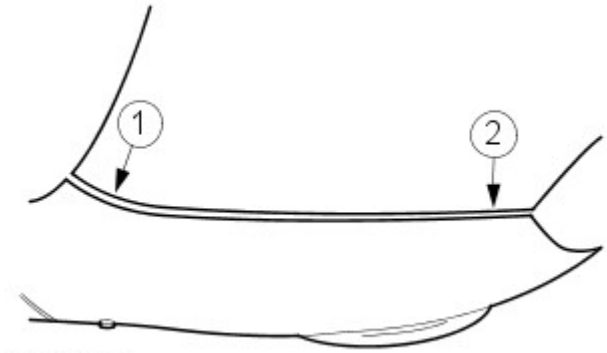
Hidden damage

- As well as looking at external indicators like flaked off paint, it is vital to check for hidden body damage or deformation that is not visible from the outside. Large attached parts like bumpers and inner fenders often need to be removed to allow accurate assessment of damage to underlying body parts.

Gap dimensions

Gap dimensions offer another alternative for diagnosis by visual inspection. If any changes or misaligned edges are apparent, then this usually indicates that the dimensions of the affected part are incorrect.

Changes in gap dimension



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Item	Part Number	Description
1	-	Gap too wide
2	-	Gap too small

Impact effects on the body

• NOTE: Vehicle components like drive shafts and trailer attachments transfer forces. If a vehicle is subjected to a rear impact then all connected body parts and mechanical components (e.g. transmission mountings) should be thoroughly checked. Electronic components should be checked to ensure that they still operate correctly.

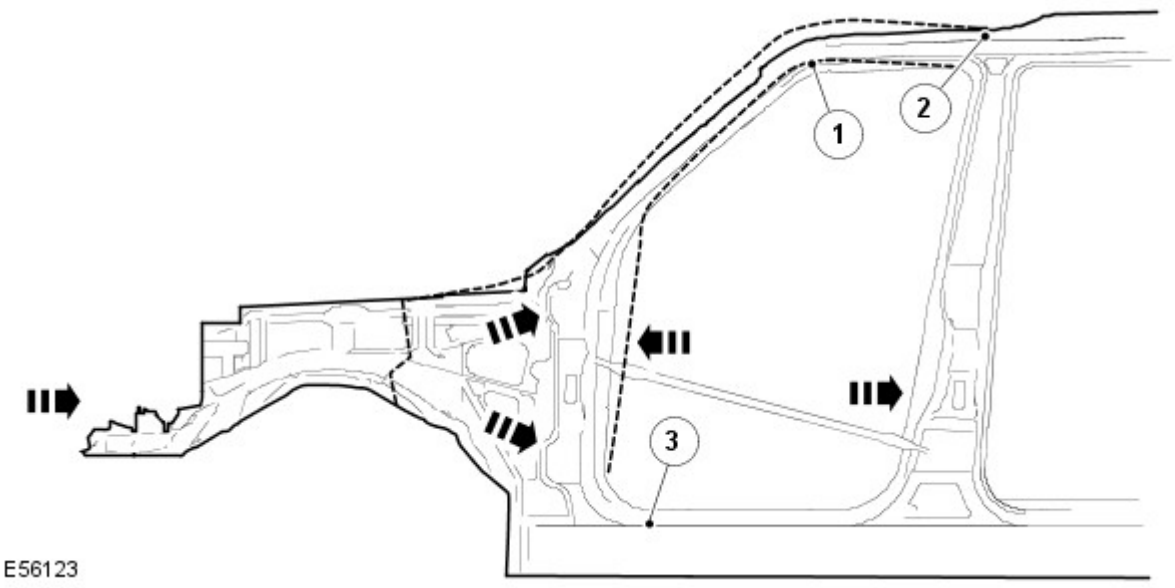
Furthermore it is possible to deduce the overall extent of damage from the direction and magnitude of the impact forces. This does however require extensive body-specific knowledge.

If, for instance, an impact occurs at the front left-hand side member, then the right-hand side member is usually also affected as a result of the rigid body-shell design (crossmember). Often the length of this side member will not have changed, but because of the rigid body-shell design it may have moved from its original position (often only by a very small amount). If any deviations are present this can usually be detected by checking the gap dimensions between door and fender or by checking for changes in dimension.

In the case of more severe impacts, the front part of the body cannot absorb all of the impact energy, and the passenger cell is also deformed. Here the impact energy is transferred via the side member to the A-pillar (see diagram). This results in deformations in the area of the roof and the door rocker panel.

The body reacts quite differently to side impacts where there is hardly any crumple zone. As the passenger cell is extremely stable, there are comparatively few local deformations at the site of the impact. However, the impact forces are transferred to the entire vehicle floor, which often results in so-called "banana damage", where the vehicle is bent into a banana shape.

Impact energy is transferred via the side member to the A-pillar



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Item	Part Number	Description
1	-	Deformation area - roof rail
2	-	Deformation area - roof
3	-	Deformation area - door rocker panel

Body measurements

Measuring options

- Comparison measurements can also be made on the outside of the body. Depending on the damage, comparison measurements and diagonal measurements can be carried out using compass, telescopic rod, tape measure or ruler.

- • NOTE: The same reference points must be chosen on both sides when checking for changed dimensions (e.g. bores, edges, beads/swage lines etc).

  All of the important external body dimensions are listed in Tolerance Checks.
  For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

- Measurements with a measuring/straightening jig.
- A measuring/straightening jig is required for accurate measurements of the body. The measuring systems are categorised by their means of operation:
- Mechanical measuring system.
- Optical measuring system.

Quick and accurate measuring results can be obtained using computerised measuring systems.

A minimum of three intact measuring points on the body are required for measurements of length, width and height dimensions.

In some cases this may mean making the measuring points accessible. All of these measuring systems can be used to make body measurements, provided all the equipment is available.

Planning a repair

The following decisions have to be made before the repairs are started:

- Does the vehicle need to be put on a straightening jig, or can it be straightened by other means?
- Does the body need to be measured?
- Do aggregates like engine or axles need to be removed?
- • NOTE: It is preferable to repair body parts rather than to renew them, as this keeps the complete body-shell intact.

  Which body parts need to be renewed?
- Which body parts can be repaired?

Obtaining spare parts

The availability of spare parts often determines how easily the body repairs can be carried out. The following procedure is recommended:

- Obtain all the data for the vehicle, including type, vehicle identification number, trim code, engine identification letters, initial registration etc.
- Establish all of the metal parts that need to be renewed.
- Establish all of the attached parts that need to be renewed, including small parts like rivets, clips etc.

Straightening repairs

WARNING: The use of heat when pulling to straighten body panels, (such as side members), is not recommended. Longitudinal pulling, (hot or cold), is also not recommended. A small amount of side to side pull is permissible, (cold).

When any type of pulling or straightening operation is performed it is important to observe for any movement in adjacent panels.

A panel must retain its strength and integrity, if there is any doubt the panel must be renewed.

Straightening repairs are often required to restore the body to its original shape after an accident. This can be done with:

- Alignment jigs.
- Universal straightening and measuring jigs.
- Welding jig system.

The following points must be followed to ensure that the repairs are carried out professionally and that all the dimensions are correct after the repairs have been carried out.

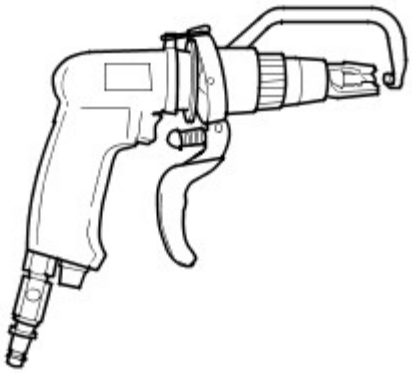
- Structure:
  - The repair sequence depends on the individual repair plan (taking any necessary disassembly work into account).
  - Clean the attachment areas.
  - Anchor the vehicle free of stress on the relevant system.
  - Support the aggregates to take strain off the body.
  - Decide on at least three measuring/mounting points that are undamaged and as far apart as possible (for basic adjustment).
  - Check the dimensions of the measuring/mounting points.
- Straightening:
  -
  • NOTE: Check dimensions and gaps continuously during straightening.

  A body is always straightened in the opposite direction to that of the impact. Always carry out straightening repairs with the complete body shell assembled (do not cut out any parts beforehand). Carry out the straightening work in several stages. This prevents the risk of over stretching or of welded joints tearing out. During the individual straightening steps, relieve tension by striking with an aluminium hammer while the part is subjected to a tensile load (in the area of pre-determined folding points, dents, welded joins etc.).
- Special features:
  - Ultra high strength steel cannot be straightened due to its brittleness and must always be replaced.

Cutting out body parts

Depending on how the parts are joined/connected, different tools are suitable for cutting/separating body parts.

Spot-weld mill



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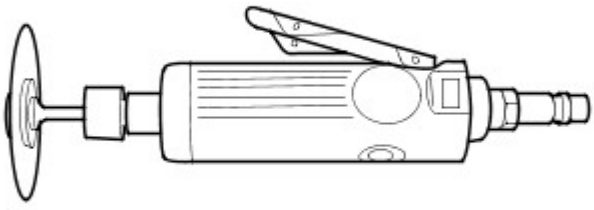
• NOTE: All other parts like interior equipment, window glass etc. must be protected against flying sparks.

• NOTE: Ensure that the milling depth is set correctly to prevent the remaining flange from being weakened.

Rod sander



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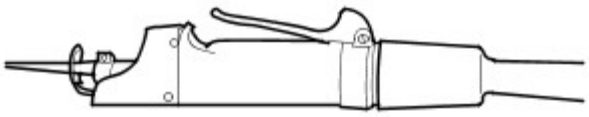
• NOTE: Wear protective clothing. Protect any vulnerable body or glass areas against flying sparks. Remove explosive materials from the vicinity.

Any spot welds that are inaccessible for the spot-weld mill (diameter > 8 mm) should be ground out using a rod sander. The same applies to MIG spot welds or seams.

Short stroke saw



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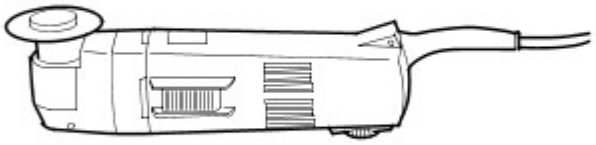
• NOTE: Underlying metal parts, wiring harnesses, hoses etc. must not be damaged - remove them beforehand if necessary.

Body saws are particularly versatile and are therefore very suitable for making severance cuts on body parts.

Reciprocating saw



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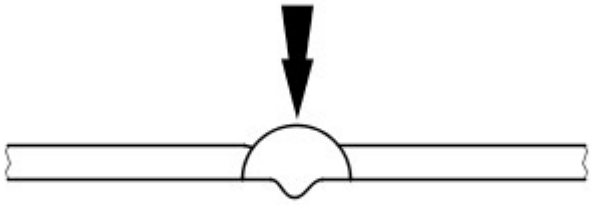
In addition to the short stroke saw, the reciprocating saw can be used. With this, it is possible to make narrow and straight cuts to an exact depth.

Carrying out the repairs

Butt joint



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• NOTE: The severance cut should always be kept as short as possible on sectional replacement. Only cut at the severance lines shown in the repair chapters.

Do not make any cuts near reinforcements or pre-determined folding lines.

- Prepare parts remaining on the vehicle/new parts.
  - Reshape the adjoining surface of any dented body parts that are to remain on the vehicle using a hammer and a counterhold (ensure that the old part matches the shape of the new part). Grind off left over spot welds or seams with an angle grinder.
  - Cut the new parts to shape.
  - If necessary punch or drill holes for mig plug welding.
  -
  • NOTE: Do not use a welding torch to remove paint residue (the heat could cause the metal to deform).

  Grind all joining flanges to bare metal on both sides. Do not use an angle grinder for this purpose (this could weaken the metal and damage the zinc layer). Suitable tools: rotating wire brush, belt sander or plastic disc.
  - Apply welding primer liberally to all weld flanges.
  - The primer must be well stirred before use.

• NOTE: When using aerosols, take care not to contaminate adjacent parts with spray mist.

Fit the new part.

- It must be ensured that the new part fits exactly to the specified dimensions. Suitable equipment:
  - Alignment jig.
  - Universal measuring system.
  - Jig system.
  - Ruler or tape measure.
  - Compass.
  - Frame dimensions can be found in the model-specific repair manuals.
- • NOTE: Any attached body parts that require accurate alignment and fitting must be incorporated in this step; for instance bumpers, seals, headlamps, rear lamps and lock assembly components. If this is not done carefully it may result in water leaks, wind noises and substantial follow-on work.

  Ensure that edges line up with adjacent parts and check that gaps are consistent (compare left and right-hand sides). Make sure that the shape of the vehicle is retained.

Secure the new part

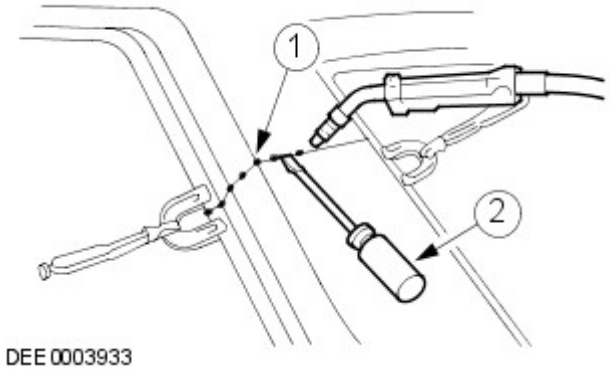
- • NOTE: The need for subsequent follow-on work can be significantly reduced if aligning and tack-welding are carried out with due care.

  Depending on accessibility the following methods for securing are available:

- Grip pliers (set of).
- Screw clamp (set of).
- Self-tapping screws.
- Tack welds.

- Use a staking tool or a screwdriver to ensure that the edges of sectional replacements of profiled parts line up. The edge is then tack welded to ensure that it lines up.

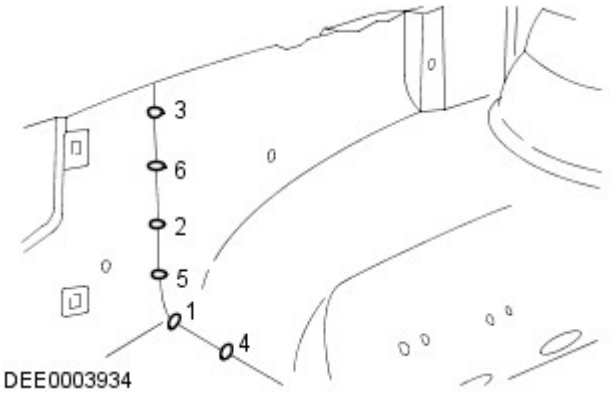
Aligning and tack weld



Item	Part Number	Description
1	-	Tack welds
2	-	Using a screwdriver to align

- Longer joins are usually tack welded to prevent the panel from warping. It is important to carry out the tack welds in the correct sequence (see diagram).
- Weld in the new part following the instructions in the repair manual.

Correct tack welding sequence



Follow on repairs/corrosion protection

- This step basically covers the following work:
  - Grinding welded seams.
  - Priming any bare metal.
  - Sealing welded seams.
  - Applying underbody protection.
  - Sticking damping matting in place.
  - Filling cavities with cavity wax.
  -
  • NOTE: See corrosion protection section for cavity wax application areas.

  Cavity wax (after painting).

Panel Beating

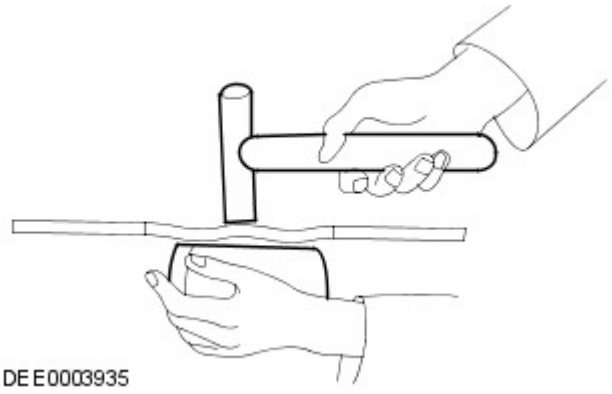
Fundamentals of panel beating

- Before carrying out any sectional replacements or complete replacements of body panels, always check carefully whether the damaged panel(s) can be rectified by panel beating.
- Panel beating is usually the easiest and most economical method of repairing a damaged panel.

Examples of applications of different panel beating techniques:

- Aluminium hammer and mallet.
  - Advantage: Low risk of over-stretching the panel.
  - Used for repairs of small dents on panels that are accessible from both sides.
  - These two panel beating tools are usually used for "finishing repairs".

Fine straightening with an aluminium hammer and a universal dolly



- Sliding hammer
  - If the damaged panel is only accessible from the outside, use a sliding hammer to pull it back into shape. The discs or studs needed to mount the sliding hammer are welded onto the bare surface. Dents in the panel can be flattened out using controlled application of the sliding hammer.

Heat-treatment of panels

- It is usually inevitable that some parts of the body panels show excess material as a result of mechanical strain. If there are any areas of excess material this will cause localised instabilities due to differences in tension. These localised instabilities can be stabilised by applying heat-treatment techniques.
- • NOTE: This does not apply to high-strength low alloy steel, ultra high strength steel and aluminium.

  Rule: Flattening panels by heat-treatment reduces the amount of excess material by more than they were originally stretched.

Different heat-treatment techniques.

• NOTE: Different heat-treatment techniques are used depending on the amount of excess material.

- Flattening using a flame.
  - A welding torch is used if the material excess extends over a larger area (torch size 0.5 - 1.0 mm). Use a soft flame.
  - The surface of the metal is briefly spot-heated and then immediately cooled with a wet sponge.
  - Requirement: Ability to handle a welding torch safely and knowledge of annealing colours of steel.
  - Advantage: No damage to the surface of the metal.
- Flattening using a flame, supported by hammer and counterhold.
  -
  • NOTE: The flattening effect is increased by speeding up the heating and cooling stages.

  If the material excess is concentrated, then the flattening effect can be increased after heating by carefully using an aluminium or wooden hammer.
  - Requirement: Ability to recognise material tension by feeling the surface that is to be flattened.
- Flattening using a carbon electrode.
  - If panel areas are only accessible from one side, or the panel is only slightly destabilised, then the preferred method is flattening using a carbon electrode.
  - Requirement: Bare metal surface.
  - Disadvantage: Scarring and hardening of the surface.
- Flattening using a copper electrode.
  - Small, sharp dents that face outwards can be worked on with a copper electrode.
- Flattening using a flame and body files.
  -
  • NOTE: When applied correctly, this method can be used with all the attached parts still in place (roof headlining, wiring harnesses etc.).

  Small, soft dents (only slight stretching): Working at the edges of the dent in an inward spiral pattern, the dent is heated with an oxyacetylene torch (torch size 1 - 2 mm, excess gas flame) to approx. 250° C.
  - Working rapidly with a body file extracts heat from the edge area until the dent is flattened. Preferably alternate between two files. This increases the amount of heat that can be extracted.

Safety measures

- The electronic control modules (ECM) fitted to vehicles make it advisable to follow suitable precautions prior to carrying out welding repair operations. Harsh conditions of heat and vibration may be generated during these operations which could cause damage to the modules. In particular, it is essential to follow the appropriate precautions when disconnecting or removing the airbag RCM.
- Do not allow electronic modules or lines to come into contact with the ground connection or the welding electrode.
- Seat belt anchorages are a safety critical. When making repairs in these areas, it is essential to follow design specifications. Note that extra strength low alloy steel may be used for seat belt anchorages. Where possible, the original production assembly should be used, complete with its seat belt anchorages, or the cut line should be so arranged that the original seat belt anchorage is not disturbed.
- All welds within 250mm (9.842) of seat belt anchorages must be carefully checked for weld quality, including spacing of spot welds.
- Remove the battery before carrying out welding work in its vicinity.
- Utmost care must be taken when welding near the fuel tank or other components that contain fuel. If the tank filler neck or a fuel line must be detached to allow access for welding work, then the fuel tank must be drained and removed.
- Never weld, on components of a filled air conditioning system. The same applies if there is a risk of the air conditioning system heating up.

- Connect the ground connection of the electrical welder directly to the part that is to be welded. Ensure that there are no electrically insulating parts between the ground connection and the welding point.
- Adjacent vehicle parts and adjacent vehicles must be shielded against flying sparks and heat.

Resistance spot welding

Where resistance spot welds have been used in production, they must be reproduced with new spot welds in replacement where possible. All such reproduction spot welds should be spaced 25 to 30mm apart.

Setting up the equipment and co-ordinating the welding parameters.

- Equipment:
  - Follow the equipment manufacturer's instructions for the equipment settings.
  - Select the correct electrode arms (as short as possible).
  - Align the electrode arms and tips exactly.
  - Electrode tips should be convex (rough shaping with a file, fine shaping with a sanding block).
- Body:
  - Ensure that the flanges to be joined lie perfectly flat to one another.
  - Prepare a bare metal joint surface (inside and outside).
- Notes on technique/method:
  - Carry out a test weld on a sample piece of the material coated in welding paste.
  - If any metal parts are located between the electrode arms then there will be a loss of induction and therefore power (adjust current setting).
  - The power needs to be adjusted for high-strength low alloy steel.
  - Repeated welding on old welding points often leads to poor quality welds.
  - Keep the electrode tips as near as possible to an angle of 90° to the contact surface.
  - Keep the pressure on the electrodes for a short period after finishing the weld.
  - The electrodes work best if their shape is convex. Clean the contact surface of the electrodes regularly.

Resistance spot welding panels where the total thickness is 3 mm or more

For all repairs to modern Land Rover vehicles, spot-welding equipment should be suitable for reliable welding of zinc-plated, high-strength and high-tensile steels in three or more layers, up to 5 mm total thickness. If these requirements are not fulfilled, plug welding must be used for safety reasons. The electrical specifications (current, resistance, heat) of the spot-welding equipment have different validity, depending upon the type of equipment. Therefore, it is essential that the manufacturer's instructions are observed with regard to the actual welding performance.

MIG/MAG welding

Setting up the equipment and co-ordinating the welding parameters.

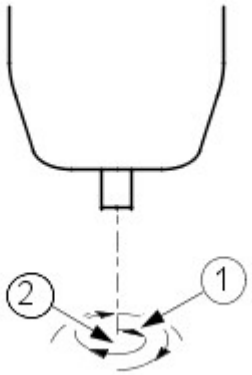
- Any joins that are MIG/MAG welded in production must also be MIG/MAG welded during repairs. Also during repairs, some resistance spot welds need to be replaced by plug welds.
- If access is difficult, or if a suitably powerful spot welder (see above) for total panel thicknesses of 3 mm or more is not available, resistance spot welding must be partially replaced by plug welding during repairs. In this case, the increased time needed and the correspondingly more demanding corrosion protection requirements, must be taken into account.
- Welding repairs can only be carried out properly if the equipment is set up correctly and all the welding parameters are co-ordinated.
- Equipment:
  - Set up the equipment as directed by the manufacturer.
  - The hoses must be untwisted.
  - The core must be free of abraded rod particles.
  - The gas and current nozzles must be free of slag and scale residue.
  - Pay attention to the quality of the welding rod and the throughput of gas.
- Body:
  - Ensure that the joint surface is perfect.
  - Prepare a bare metal joint surface.
  - Maintain the correct gaps (formation of roots).
- Notes on technique/method:
  -

  • NOTE: The increased application of heat during MIG welding destroys the welding primer/zinc layer over a much larger area than during resistance spot welding, as a result of which much more care needs to be taken when applying anti-corrosion protection afterwards.

  • NOTE: A test weld should always be carried out to ensure that the welded joint is not just a surface connection.

  Attach the ground cable right next to the welding point (ensure that good contact is made).
  - During plug welding start welding on the lower panel to ensure adequate penetration.

Plug welding



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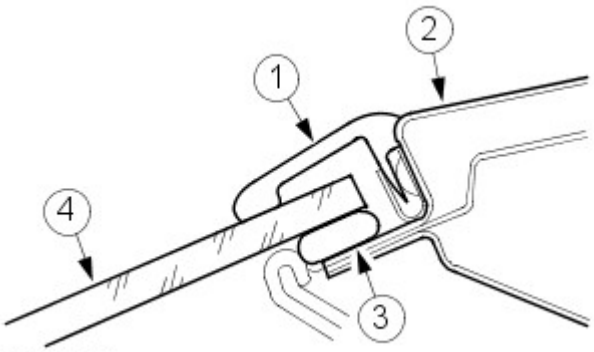
Item	Part Number	Description
1	-	Welding direction: circular pattern working from the inside outwards
2	-	Welding starting point: centre of hole on lower panel

Bonded glazing

- - The windscreen, side and rear windows are bonded directly onto the window frames on the body and liftgate.
  - The windows are bonded primarily for reasons of adhesive strength. Bonded glazing provides additional torsional stiffness to the body.

Adhesive bonding of bonded windows



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Item	Part Number	Description
1	-	Rubber strip
2	-	Window frame
3	-	Adhesive
4	-	Window glass

Removing and installing bonded windows

Safety measures

- The following safety measures must always be followed to prevent personal injury:
  - Wear protective gloves and arm protection.
  - Wear protective goggles.

Preparations

- Before cutting out a bonded window, undo and remove any attached parts in the cutting area that are at risk, e.g. trim panels and decorative strips, as well as all electrical connections.
- Mask any painted areas that are adjacent to the window.
- Cut off any surplus adhesive, as this makes it easier to cut out the window.
- Secure vertical windows against dropping out.

Cutting out the window

- Cut into the adhesive bead at easily accessible points using the cutting tool.
- Carefully guide the cutting tool around the window, cutting through the adhesive bead.
- Avoid touching the window frame and the body flange.
- Use cup suction tools to lift the cut-out window out of the window aperture.

General preparations for bonding

- Follow the manufacturer's instructions.
- Cut back the remaining adhesive bead on the metal flange to a residual height of about 1mm. Do not touch or clean the cut surface afterwards.
- Carefully rectify any paint damage (apply primer and top coat).
- Renew the window stops as necessary.

Bonding the window glass

- Apply an even bead of adhesive to the window or to the body flange.
- Insert the window glass into the window aperture and centre it (2 technicians required).
- Check the gaps.
- • NOTE: Open the windows and doors while the window is left to dry and do not move the vehicle (slamming doors creates excess pressure which could cause the window to become loose).

  Use adhesive tape to prevent the window from falling out or slipping.

Finishing operations

- Reconnect all electrical connections and check that the components operate correctly.
- Install the attached parts and check that the fit is accurate and secure.
  - Carry out a visual inspection to ensure that the gaps and joints are even.
- Thoroughly clean the window glass.

Protective equipment and safety at work

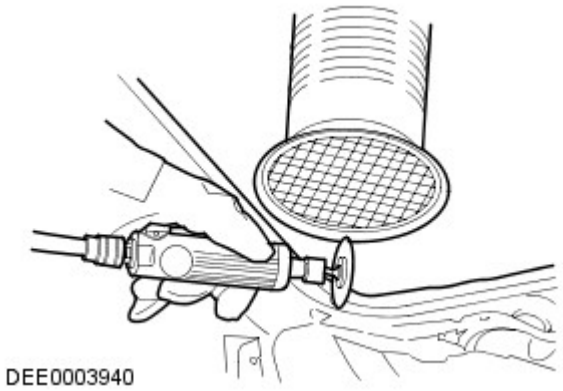
- Various safety measures and legal requirements must be met when carrying out repairs. All regulations relating to health and safety at work must be followed.

Welding safety precautions

- The following safety precautions must be observed to prevent the risk of personal injury:
  - Safety hood (face protection).
  - Welding shield.
  - Safety gloves.
  - Safety shoes.
  - Extraction unit for welding smoke.
- Welding should always be carried out in well ventilated areas. A fire extinguisher must also always be within reach.

General body repair safety measures

Extraction unit



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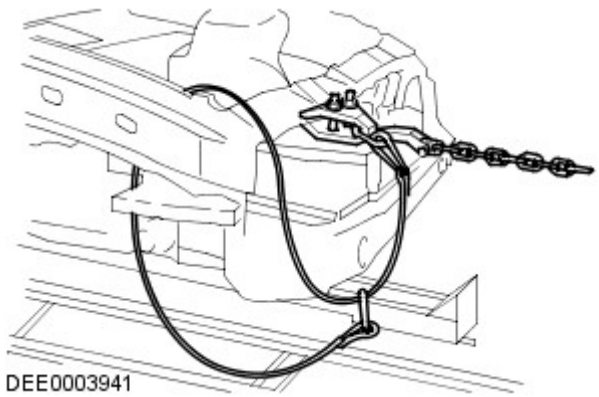
- Sealing compound, underbody protection etc. must not be burned off with a naked flame. This would produce toxic gases. If for instance PVC is burned, then gases containing hydrochloric acid are produced. For this reason a suitable extraction unit should always be used when performing grinding, welding or soldering work.
- Always ensure good ventilation when working with materials that contain solvents, wear breathing equipment and use an extraction unit.
- Ear defenders should always be worn when cutting, grinding or straightening metal, as the noise levels can reach or even exceed 85 - 90 dB(A).
- Take care not to look directly into any laser measuring systems, for instance used to measure the under body.
- When removing components from a vehicle mounted on a lifting ramp, watch out for a shift in its centre-of-gravity. When first placing the vehicle on the ramp, take into account that it may need to be secured against tipping over.
- Chains and chain clamps must be secured with safety ropes during straightening work.

Safety rope



DEE0003941

Published: 11-May-2011

Body Repairs - Corrosion Protection - Corrosion Protection

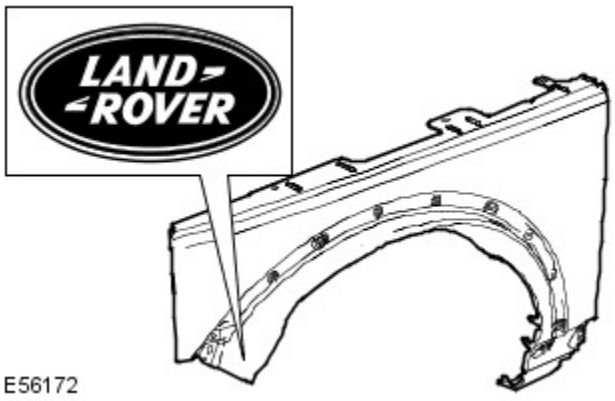
Description and Operation

General

The corrosion protection provided in production must be carefully maintained and/or reproduced during and after body repair work. It is only then that the long-term warranty against penetrative corrosion damage can be assured.

Only Land Rover original bodywork components and Land Rover approved repair materials (sealer, paint etc.) are to be used for bodywork repairs.

Land Rover Original Parts



All Land Rover bodywork components have a cathodic base coating. Individual bodywork components are zinc plated on one or both sides (in different areas depending on vehicle model).

Together with elastic paint coating, this guarantees an optimum, highly resistant protection against corrosion caused by the impact of small objects such as gravel.

• NOTE: If possible, the individual protective layers (zinc, cathodic base coat) on Land Rover bodywork components must not be damaged or destroyed by sanding or other mechanical operations.

If hairline cracks at "bodywork connection areas" appear after reshaping work (e.g. at door hinges), it must be ensured that the corrosion protection provided in production is recreated. The complete paint covering must be re-created if necessary. The same applies to reshaping work on heavily profiled bodywork components (e.g. floor pan). Renew or touch-up the paint coating, sealing beads and underbody protection as necessary.

After repair, any interior surfaces which are no longer visible or accessible must be primed before cavity wax is applied. To be certain of an even coating on inner surfaces, careful application of spray (twice, with drying time in-between) must be carried out throughout the whole cavity.

If bodywork panels are strongly heated during repair work, this will invariably result in damage to or even destruction of the applied corrosion protection material. The effectiveness of the cavity protection material is reduced if heating occurs. Reworking of the affected areas is therefore vital.

Welded areas should be made good before corrosion protection is applied.

The corrosion protection measures to be taken when bodywork components are renewed are described on the following pages.

Corrosion Protection of New Components

All new components must be inspected for transport or storage damage such as scratches or dents. The following operations may be necessary, depending on the extent of damage:

Undamaged New Component

- Do not grind the cathodic primer.
- Thoroughly clean with silicone remover and rub dry.

Slightly Damaged New Component

- Sand out scratches.
- Finely sand the surrounding surface.
- Thoroughly clean with silicone remover and rub dry.
- Apply corrosion protection primer to bare areas.

Damaged New Components (bumps and dents)

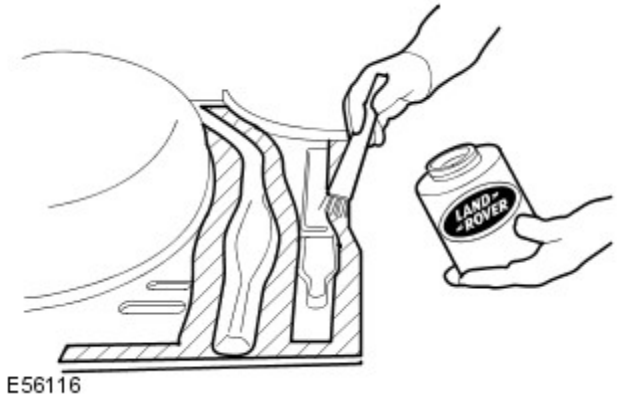
- Beat out the dented area and sand down to bare metal.
- Apply polyester filler (only onto bare metal).
- Apply filler.
- Lightly sand the whole component.
- Thoroughly clean with silicone remover and rub dry.
- Apply corrosion protection primer to bare areas.

The clinched flanges on the hood, doors, tailgate and liftgate must be sealed with clinched flange sealer, if this is not already applied.

Weld Components

Use a stripping disc to remove the cathodic primer on the inside and outside of the area to be welded. The stripped area should be kept as small as possible, retaining as much of the cathodic primer as possible, taking care not to damage the zinc coating.

Apply Welding Primer



• NOTE: The welding primer must be stirred well or shaken before application.

Clean the repair area thoroughly (silicone remover).

Apply welding primer evenly to all weld flanges (old and new components).

• NOTE: The welding primer must be allowed to dry before welding is carried out.

All weld beads must be ground down after all welding is completed, taking care not to weaken the material.

Any unevenness at the joint must be made good.

If necessary, spot weld missing weld studs into position.

The vehicle must be completely cleaned of sanding dust and metal swarf because of the danger of corrosion.

Clean and prime all internal areas and those to be sealed.

• NOTE: The primer must be dry before sealing mastic or underbody protection is applied. Do not use thinners when applying sealing mastic (the mastic will not dry).

Partial Renewal

The procedure to follow when partially renewing components is the same as described in the section "Welded Components".

The main difference when components are partially, rather than completely renewed, concerns the preparation of butt or lap joints.

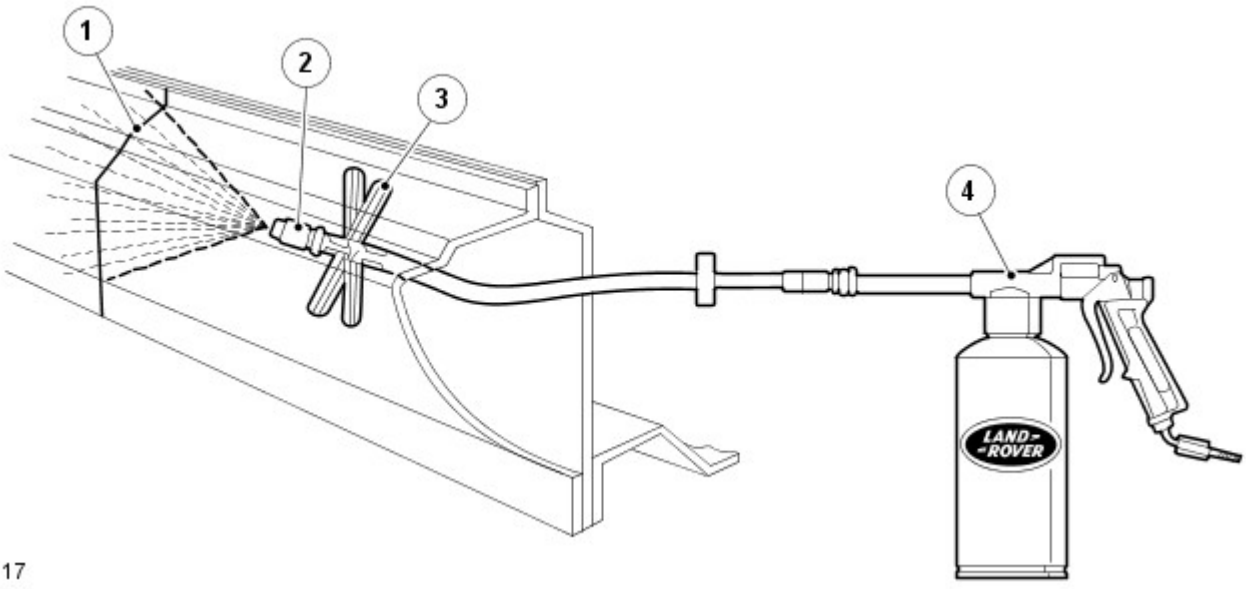
- When bodywork components are cut through, attention must be paid to the adequate removal of the paint and zinc coatings on inner areas. This specially applies to areas which are difficult to access internally.
- It is important for the weld quality that the inner area is bare metal. Zinc and paint residues in the weld area burn and cause serious hole formation during welding.
- If the zinc layer and the paint coating are not removed, the zinc and paint will burn during welding. The soot produced prevents satisfactory cavity protection.

Procedure

- The paint layer must be removed for a width of 30 mm from the line of the weld using a rotating tress wire brush.
- This operation must be carried out on both the new and the old parts of the bodywork.
- Depending on the bodywork component, a 10 mm width of the underlying zinc layer must also be removed along the weld line.

• NOTE: A flat scraper or a wire brush can be used instead of the rotating brush if the cavity is small. Do not use an angle grinder, which would weaken the structure.

Application of Cavity Wax Protection on a Door Rocker Panel After Partial Repair



E56117

Item	Part Number	Description
1	-	Weld bead
2	-	Spray head
3	-	Distance maintainer
4	-	Spray gun

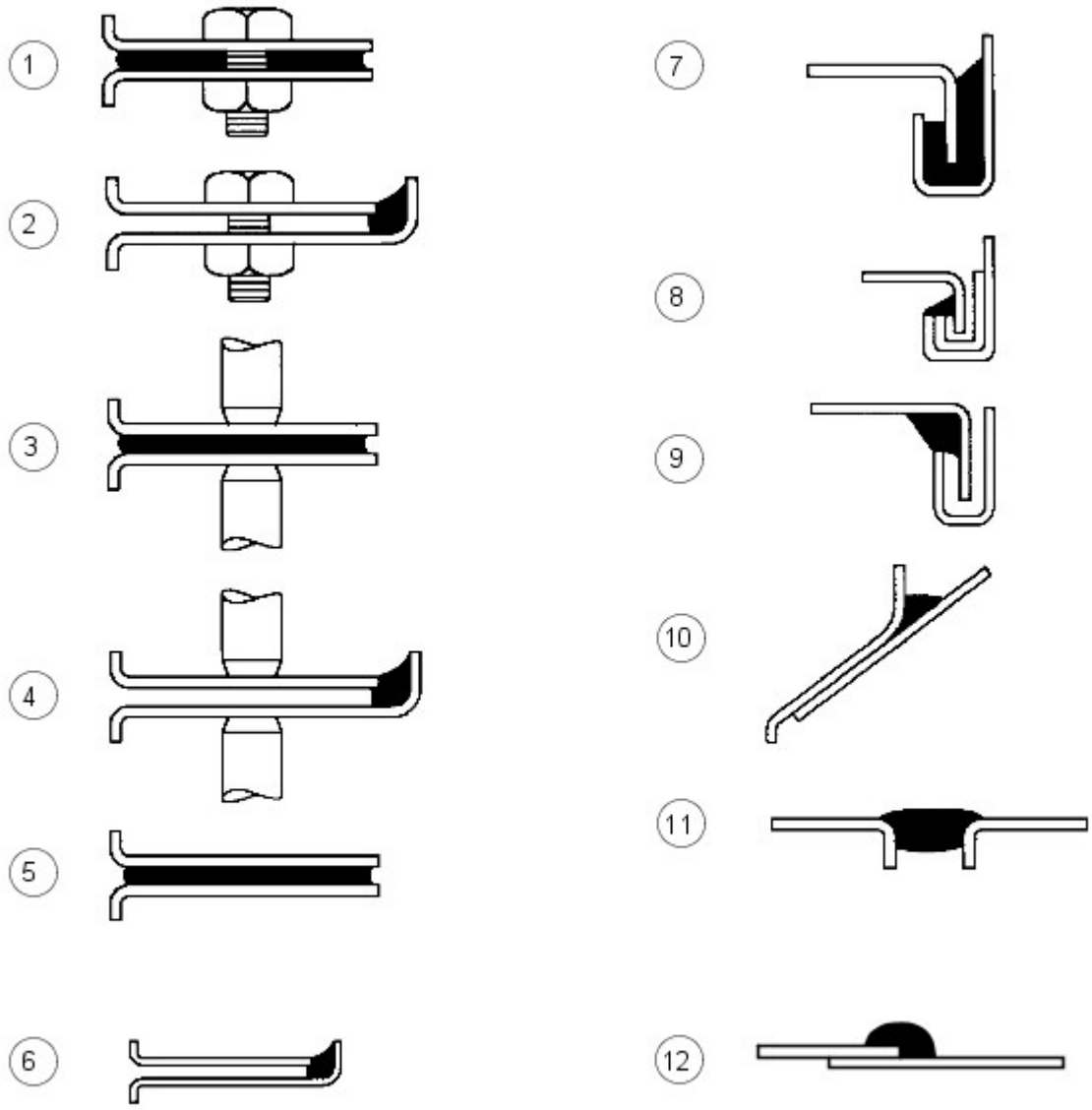
Classification of the different corrosion protection measures for dent removal

Corrosion Protection Method	Exterior Surfaces	Accessible Inner Surfaces	Inaccessible Inner Surfaces
Painting	X	X	
Cavity protection			X

Classification of Different Corrosion Protection Measures for Installation of New Components

Corrosion Protection Method	Weld Flanges Before Welding in Place (contact surfaces)	All Bare Sanded Areas	Weld Flange Area Accessible	Weld Flange Area Not Accessible
Welding primer	X			
Painting		X	X	
Clinched flange protection			X	
Cavity protection				X

Body Sealing Materials



E56018

Item	Part Number	Description
1	-	Between Panels - Bolted
2	-	Panel Edge Bolted
3	-	Between Panels - spot welded
4	-	Panel edges - spot welded
5	-	Between panels - bonded
6	-	Panel edges - bonded
7	-	Clinch joints - type A
8	-	Clinch joints - type B
9	-	Clinch joints - type C
10	-	Gaps between panels - type A
11	-	Gaps between panels - type B
12	-	Lap joint

Approved Service Materials For Repair

Description - Usage	Supplier	Product Number
Sealing	-	-
Polyurethane cartridge extruded seam sealer - grey - **this is not a weld through product**	3M	08684
Polyurethane cartridge extruded seam sealer - white - **this is not a weld through product**	3M	08689
Polyurethane cartridge extruded seam sealer - black - **this is not a weld through product**	3M	08694
Polyurethane sachet 310ml - grey - **this is not a weld through product**	3M	08782
Polyurethane sachet 310ml - white - **this is not a weld through product**	3M	08787
Polyurethane sachet 310ml - black - **this is not a weld through product**	3M	08789
Polyurethane sachet 600ml - grey - **this is not a weld through product**	3M	08783
Polyurethane sachet 600ml - white - **this is not a weld through product**	3M	08788

Description - Usage	Supplier	Product Number
Polyurethane sachet 600ml - black - **this is not a weld through product**	3M	08793
Sprayable seam sealer 2K polyurethane 150ml - grey	3M	08823
Sprayable seam sealer 2K polyurethane 250ml - grey	3M	08800
Sprayable seam sealer MS polymer grey	3M	08851
Super seam sealer can - grey	3M	08537
Super seam sealer - brush	3M	08540
Butyl cartridge highly flexible for joints greater than 3mm - grey	3M	08645
Terostat 9100 (1K PUR) adhesive sealant	Teroson	153.65B
Terostat 9100 (1K PUR) adhesive sealant	Teroson	112.72C
Terostat 9100 (1K PUR) adhesive sealant	Teroson	129.19S
Terostat 9200 (1K PUR) adhesive sealant - black	Teroson	120.20Q
Terostat 9200 (1K PUR) adhesive sealant - black	Teroson	120.25W
Terolan light vehicle body sealant	Teroson	128.60D
Terostat 9320 sprayable seam sealant - grey	Teroson	139.15A
Terostat 9320 sprayable seam sealant - black	Teroson	139.16B
Terostat 9320 sprayable seam sealant - ochre	Teroson	139.17C
Terolan special sealant brushable	Teroson	179.70H
Terostat II sprayable sealant band	Teroson	193.00D
Terostat VII round profile plastic sealing band	Teroson	112.46Z
Terostat IX putty	Teroson	157.86J
MS Polymer Sealing	-	-
MS Polymer caulkable sealer - white	3M	0855
Terostat 9120 (MS Polymer) adhesive sealant - white	Teroson	102.78X
Terostat 9120 (MS Polymer) adhesive sealant - black	Teroson	113.23H
Terostat 9120 (MS Polymer) adhesive sealant - black	Teroson	104.41R
Seam Sealing Light	-	-
Drip Chek clear	3M	08401
Drip Chek heavy	3M	08531
Silicone Sealant	-	-
Terostat 9140 silicone sealant - transparent	Teroson	140.08B
Terostat 9140 silicone sealant - black	Teroson	140.04X
Body Caulking	-	-
Body caulking	3M	08568
Structural Adhesive	-	-
Two component epoxy adhesive	3M	08122
Manual applicator gun	3M	08190
Panel Bonding Adhesive	-	-
Panel bonding adhesive + (nozzle 08193)	3M	08115
Requires manual applicator gun + nozzle	3M	08117
Tape and Film	-	-
Acrylic tape PT1100 double sided - 6mm x 40m	3M	80318
Acrylic tape PT1100 double sided -9mm x 20m	3M	80319
Acrylic tape PT1100 double sided 12mm x 20m	3M	80320
Acrylic tape PT1100 double sided 19mm x 20m	3M	80322
Acrylic tape PT1100 double sided 25mm x 20m	3M	80323
Polyolefin adhesion promoter	3M	05917
Abrasion resistance film	3M	08210
Abrasion resistance film	3M	08219
Sealing Tape and Primer	-	-
Terotape seam sealing tape 8mm x 6mm	Teroson	8164590
Terotape seam sealing tape 10mm x 16mm	Teroson	8164600
Terotape primer 420ml	Teroson	8164610
Cavity Wax	-	-
Body shultz coatings - black - 1L can	3M	08861
Body shultz coatings - black - 500ml aerosol	3M	08877
Inner cavity wax aerosol (transparent)	3M	08909
Inner cavity wax aerosol (amber)	3M	08901
Inner cavity wax 1L can (amber)	3M	08911
Inner cavity wax 1L can (transparent)	3M	08919
Inner cavity wax 10L drum (amber)	3M	08921
Inner cavity wax 10L drum (transparent)	3M	08929
Terotex HV 200 extra spray - 1L can	Teroson	176.48
Terotex HV 200 extra spray - 10L tin	Teroson	179.40A
Terotex HV 200 extra spray - 60L barrel	Teroson	170.96J
Terotex HV 400 1L can	Teroson	169.65Q
Terotex HV 400 10L tin	Teroson	169.76C
Terotex HV 400 60L barrel	Teroson	169.85M
Teroson cavity spray 500ml aerosol	Teroson	155.71A
Underbody Wax	-	-
Terotex wax black 1L can	Teroson	114.59F
Protective wax	Teroson	122.73Q
Underbody Coating	-	-
Bodyguard stonechip coating (textured) can - black	3M	08868
Bodyguard stonechip coating (textured) can - white	3M	08878
Bodyguard stonechip coating (textured) can - grey	3M	08879

Description - Usage	Supplier	Product Number
Bodyguard stonechip coating (flat) can - black	3M	08158
Bodyguard stonechip coating (flat) can - grey	3M	08159
Anti chip coating smooth - grey	3M	08886
Terotex record black 1L can	Teroson	122.48N
Terotex record light 1L can	Teroson	165.53S
Terotex anti chip compound light (UBC) 1L can	Teroson	191.08V
Terotex anti chip compound black (UBC) 1L can	Teroson	191.32V
Trim Adhesive	-	-
Auto adhesive - aerosol - clear (trim)	3M	08080
Auto adhesive - brushable - clear (trim)	3M	08150
Contact adhesive - aerosol - amber	3M	08090
Corrosion Protection	-	-
Zinc spray	3M	09113
Zinc spray	Teroson	158.18T
Anti Corrosive Agent	-	-
Terotex HV 350 1L can	Teroson	141.78L
Terotex HV 350 10L can	Teroson	160.02T
Terotex HV 350 60L barrel	Teroson	160.01S
Sound Deadening	-	-
Sound deadening sheets	3M	08840
Terodem SP 100 alu	Teroson	190.33
Terodem SP 200	Teroson	190.55M
Terodem SP 300 50 x 50	Teroson	145.28R
Terodem SP 300 100 x 50	Teroson	134.29X
Flexible Part Repair	-	-
Flexible part repair material (FPRM)	3M	05900
Adhesives / Thread Locking	-	-
Lock N Seal 243 thread locking	Loctite	13701
Lock N Seal 243 thread locking	Loctite	14131
Lock N Seal 243 thread locking	Loctite	25684
Stud N Bearing fit 271	Loctite	13704
Stud N Bearing fit 271	Loctite	14130
Stud N Bearing fit 271	Loctite	25685
Pipe sealant 577	Loctite	16604
Pipe sealant 577	Loctite	25689
Pipe sealant 55	Loctite	31899
Gasket	-	-
Multi gasket	Loctite	25688
Silicone copper	Loctite	19245
Silicone copper	Loctite	82046
Silicone 596 black	Loctite	19242
Silicone 596 black	Loctite	59875
3020 gasket adhesive	Loctite	31458
NVH Baffle	-	-
Sikabaffle 278	SIKA	

Approved Service Material Supplier - Contact Details

3M

- 3M United Kingdom PLC
- 3M Centre
- Cain Road
- Bracknell
- Berkshire
- RG12 8HT
- Telephone (01344) 858000
- www.3m.com

Cooper Pegler

- Burgess Hill
- Sussex
- RH 15 9LA
- Telephone (014446) 42526

Sika Ltd

- Watchmead
- Welwyn Garden City
- Hertfordshire
- AL7 1BQ
- Telephone (01707) 394444
- www.sika.co.uk

SATA Spray Equipment

- Minden Industrial equipment
- 16 Greyfriars Road
- Moreton Hall

- Bury St Edmunds
- Suffolk
- IP32 7DX
- Telephone (01284) 760791
- www.sata.com

Henkel Loctite Adhesives Limited

- Technologies House
- Wood Lane End
- Hemel Hempstead
- Hertfordshire
- HP2 4RQ
- Telephone (01442) 278000
- www.loctite.co.uk

Teroson

- Henkel Ltd
- Apollo Court
- 2 Bishops Square Business Park
- Hatfield
- Hertfordshire
- AL10 9EY
- Telephone (01707) 635000
- www.henkel.co.uk

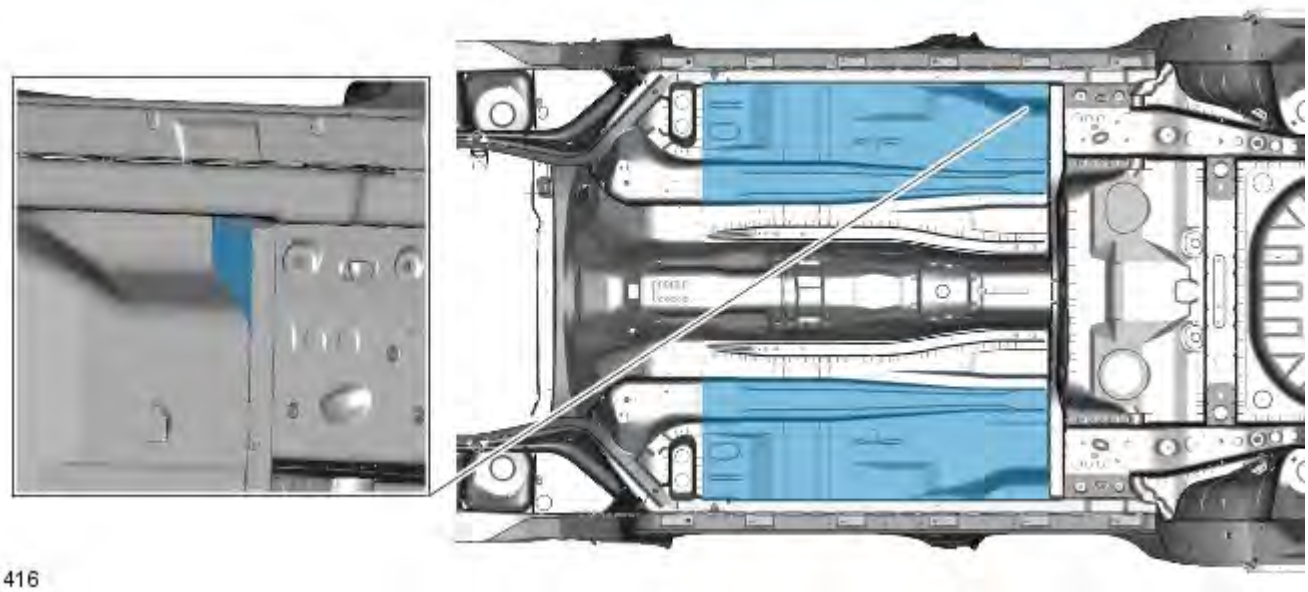
Underbody sealer

Under floor areas and the front part of the spare wheel well are treated with a plastisol PVC underbody sealer. This material is not suitable for re-treatment. When repairing areas of underbody sealer, strip the factory-applied underbody sealer back to a suitable break point. Ensure that a clean metal surface is exposed and that the edge of the existing adheres soundly to the panel.

Apply new underbody sealer between primer and surface paint operations. Apply seam sealer as necessary before application of underbody sealer. Ensure that blanking plugs and grommets in the floor pan (except those used for wax injection) are fitted before underbody sealer application. Refit any heat-fusible plugs which have been disturbed in repair with the aid of a hot air blower, or replace with rubber grommets

CAUTION: Ensure that suspension units, wheels, tires, power unit, drive shafts, exhaust and brakes (including all mounting points) are shielded prior to application of fresh underbody sealer.

Area of Underbody Sealer Application - Floor Pan



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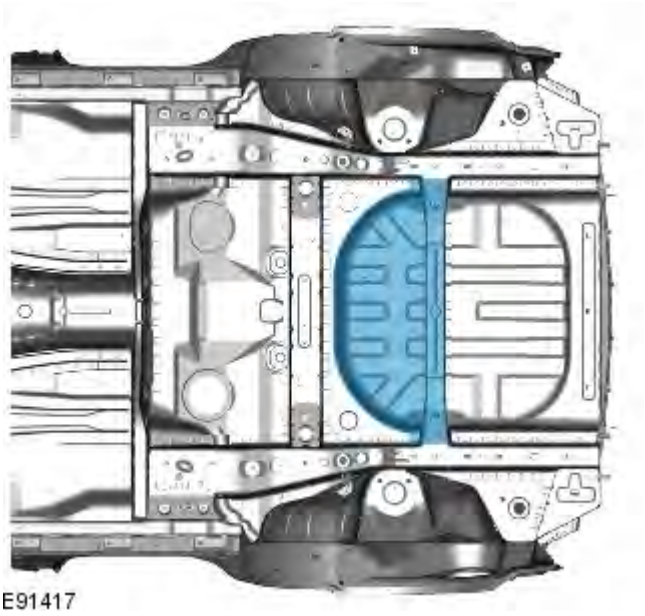
Area of Underbody Sealer Application - Spare Wheel Well



E91417

Precautions During Body Repairs and Handling

Take care when handling the vehicle in the workshop. Underbody sealers, seam sealers, underbody wax and body panels may be damaged if the vehicle is carelessly lifted.

Proprietary Anti-corrosion Treatments

The application of proprietary anti corrosion treatments in addition to the factory-applied treatment could invalidate the corrosion warranty and should be discouraged. This does not apply to approved, compatible, preservative waxes which may be applied on top of existing coatings.

Fitting Approved Accessories

When fitting accessories ensure that the vehicle corrosion protection is not affected, either by breaking the protective coating or by introducing a moisture trap.

Do not screw self-tapping screws directly into body panels. Fit suitable plastic inserts to the panel beforehand. Always ensure that the edges of holes drilled into panels, chassis members and other body parts are protected with a suitable zinc rich or acid etch primer, and follow with a protective wax coating brushed onto the surrounding area.

Do not attach painted metal surfaces of any accessory directly to the vehicle's bodywork unless suitably protected. Where metal surfaces are bolted together always interpose a suitable interface material such as weldable zinc rich primer, extruded strip, or zinc tape.

Steam Cleaning

Due to the high pressure/temperature generated by steam cleaning equipment, there is a risk that certain adhesives and corrosion prevention material may become softened or liquified.

Take care not to allow the steam jet to dwell on one area, and keep the nozzle at least 300mm from the panel surface.

CAUTION: Do not remove wax or lacquer from underbody areas during repairs.

Inspection During Maintenance Servicing

It is a requirement of the corrosion warranty that the vehicle is inspected for corrosion by a Land Rover Authorised Repairer during a routine service, to ensure that the factory-applied protection remains effective.

Rectify any bodywork damage or evidence of corrosion found during inspection as soon as is practicable, both to minimise the extent of the damage and to ensure the long term effectiveness of the factory-applied corrosion prevention treatment.

Underbody Protection Repairs

Whenever body repairs have been carried out, ensure that full sealing and corrosion protection treatments are reinstated. This applies both to the damaged areas and also to areas where protection has been indirectly impaired, as a result either of accident damage or repair operations.

Remove corrosion protection from the damaged areas before straightening or panel beating. This applies in particular to panels coated with wax, PVC underbody sealer, sound deadening pads etc.

CAUTION: Do not use oxy-acetylene to remove corrosion prevention material. Large volumes of fumes and gases are liberated by these materials when they burn.

The most common method of removal is by means of a hot air blower with an integral scraper. High temperatures can be generated with this equipment which may cause fumes. Take care during its use.

Structural Adhesive

CAUTION: When separating a joint with metal to metal adhesive, it is important to avoid distortion. Heat gradually until the bond weakens sufficiently to permit panel separation - do not apply excessive heat.

• NOTE: When spot welding through metal to metal adhesive, take particular care to adjust the equipment setting to ensure a suitable weld.

Metal to metal adhesive is applied to critical joint areas during factory assembly. The material used is a high temperature, heat cured, nitrile phenolic which serves to bond two metal surfaces and also to seal the joint against ingress of dust, moisture and fumes. This material is not suitable for service use and, during repair, should be substituted by an approved structural adhesive. For panel specific information and to identify the areas of structural adhesive application in repair, refer to the relevant sheet metal removal and installation procedure.

Expanding Foam Acoustic Seals

Expanding foam acoustic seals are used in various closed-sections of the body to improve vehicle refinement. The seals are installed during the vehicle body manufacture and expand during the paint process up to ten times original size, thus locking them into position. They are located such that they prevent noise accentuation along a section and reflect air borne noise away from the cabin.

The seals have spilt functionality depending on location. The seals located at the base of the body pillars have a primary function of preventing water ingress when wading. Their secondary function is to prevent noise and dust ingress.

The seal around the fuel filler has a primary function of preventing both fuel and water ingress. With a secondary function of preventing noise and dust ingress.

The remaining seals primary function is to prevent noise accentuation along a section and reflect air borne noise away from the cabin.

Another advantage of the seals is that they marginally increase the overall stiffness of the body and its structural performance in case of a crash.

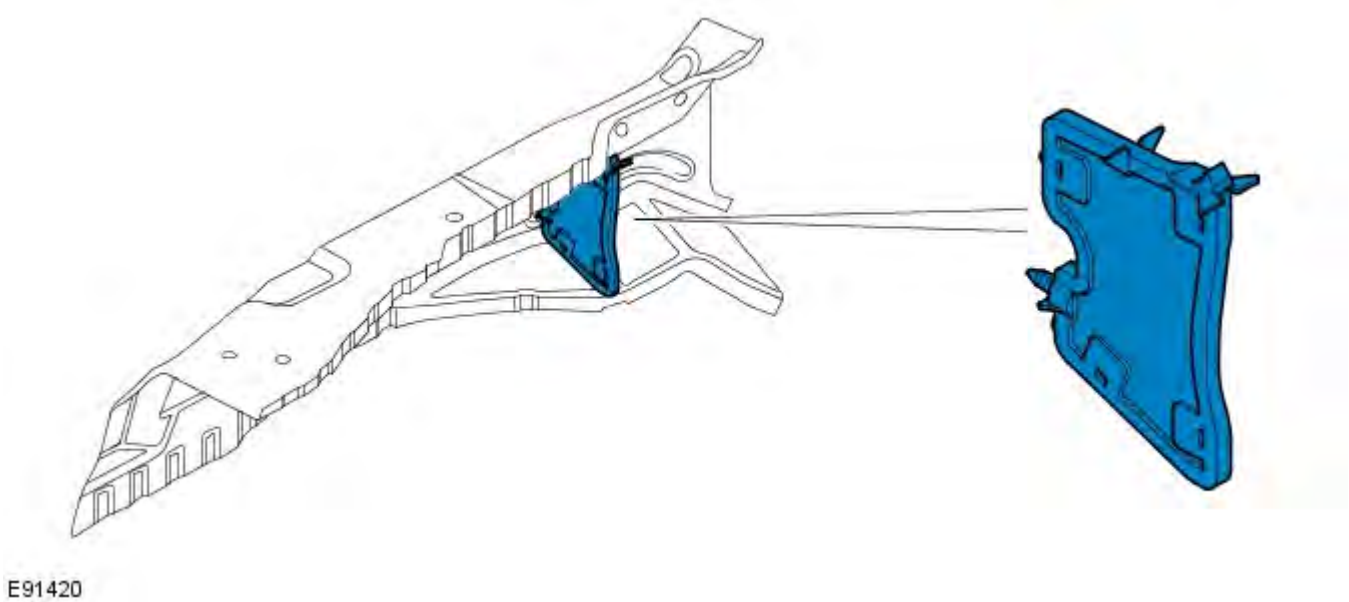
The seals are manufactured from an expandible polymer.

Replacing Expanding Foam Acoustic Seals

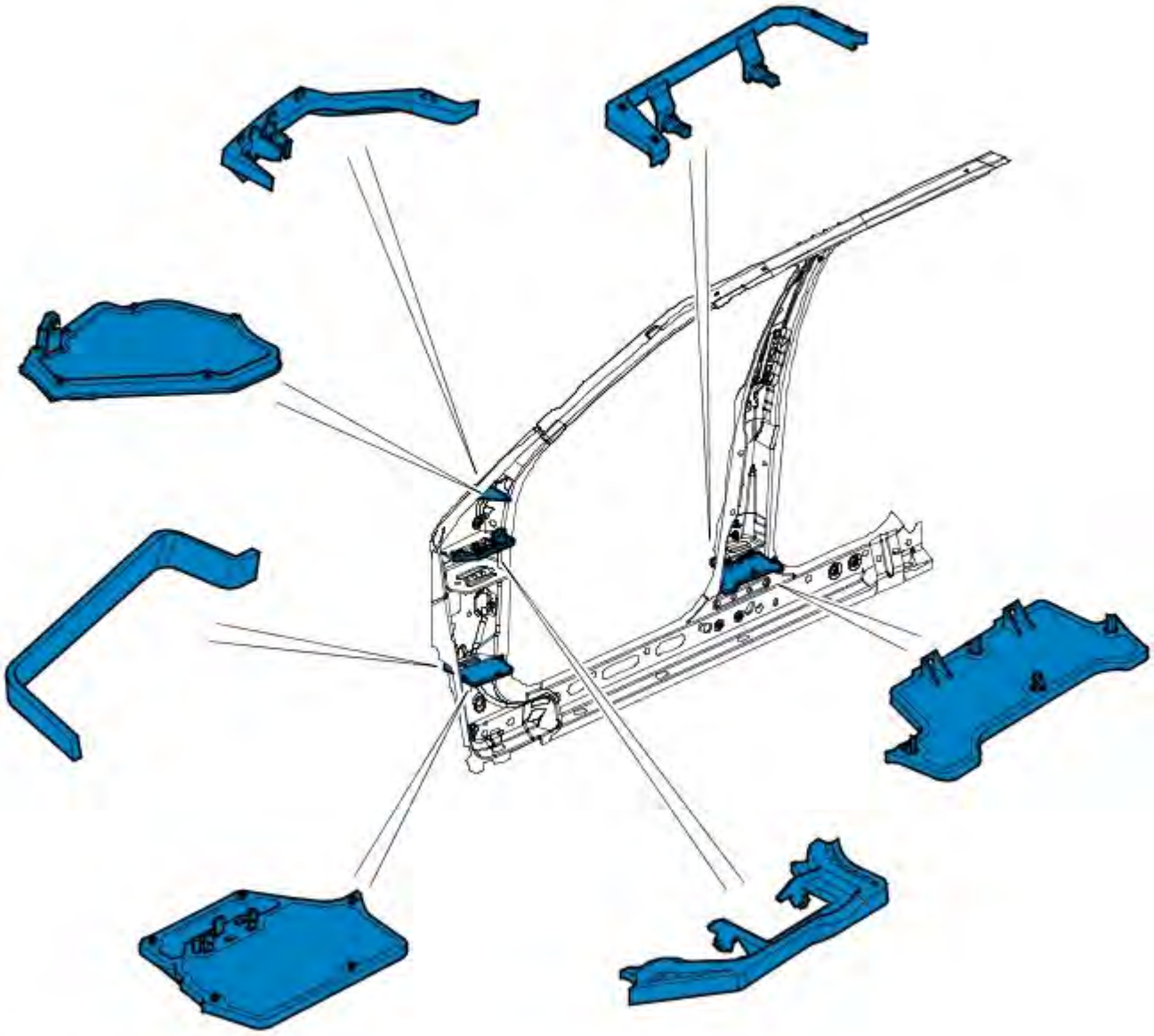
As paint oven temperatures used in a repair workshop are significantly lower than those that are used during manufacture of the vehicle, (the temperatures are not sufficient to expand the foam), a different process is required to replicate the foam in repair.

If a repair disturbs the expanding foam acoustic seal it must be reinstated. If access allows, (whether a new seal is fitted or the original is reused), acoustic foam should be injected after paint refinishing. If access is not possible, or it is not practical to apply expanding foam due to the nature of the repair, a suitable flexible PU sealer should be applied around the seal and the corresponding body panel/s prior to assembly. In all cases the application of foam / sealer should form a seal between the expanding foam acoustic seal and any adjacent panelwork.

Expanding Foam Acoustic Seals in the Fender Apron Upper Panel

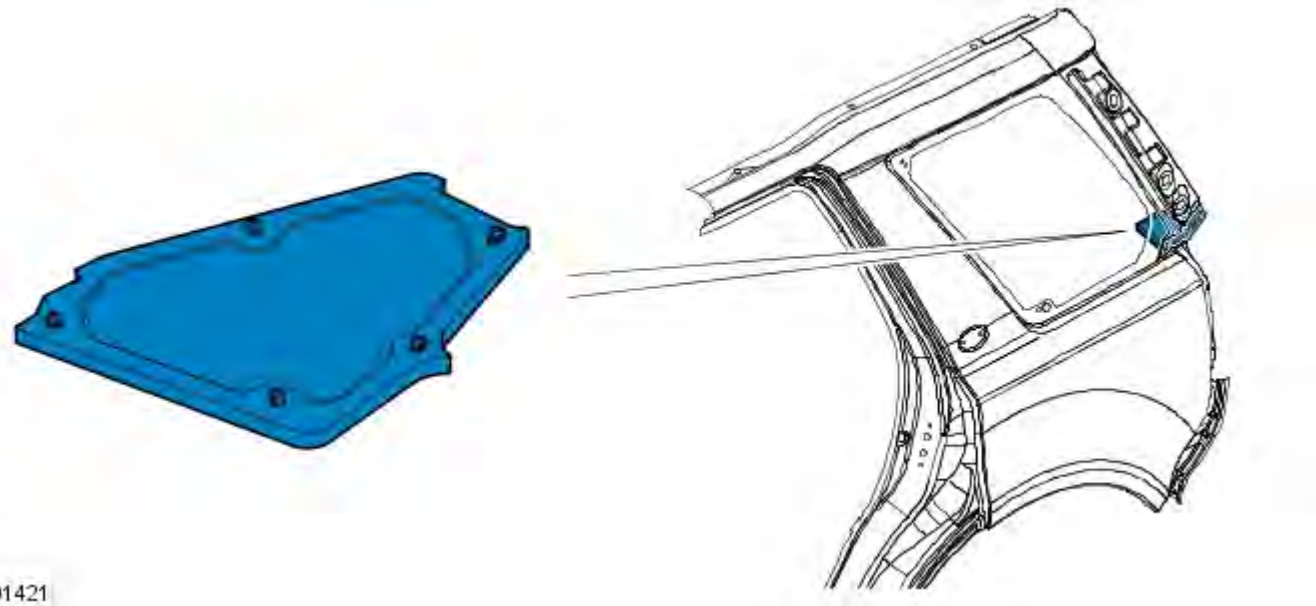


Expanding Foam Acoustic Seals in the Side Panel Reinforcement



E91419

Expanding Foam Acoustic Seals in the Quarter Panel



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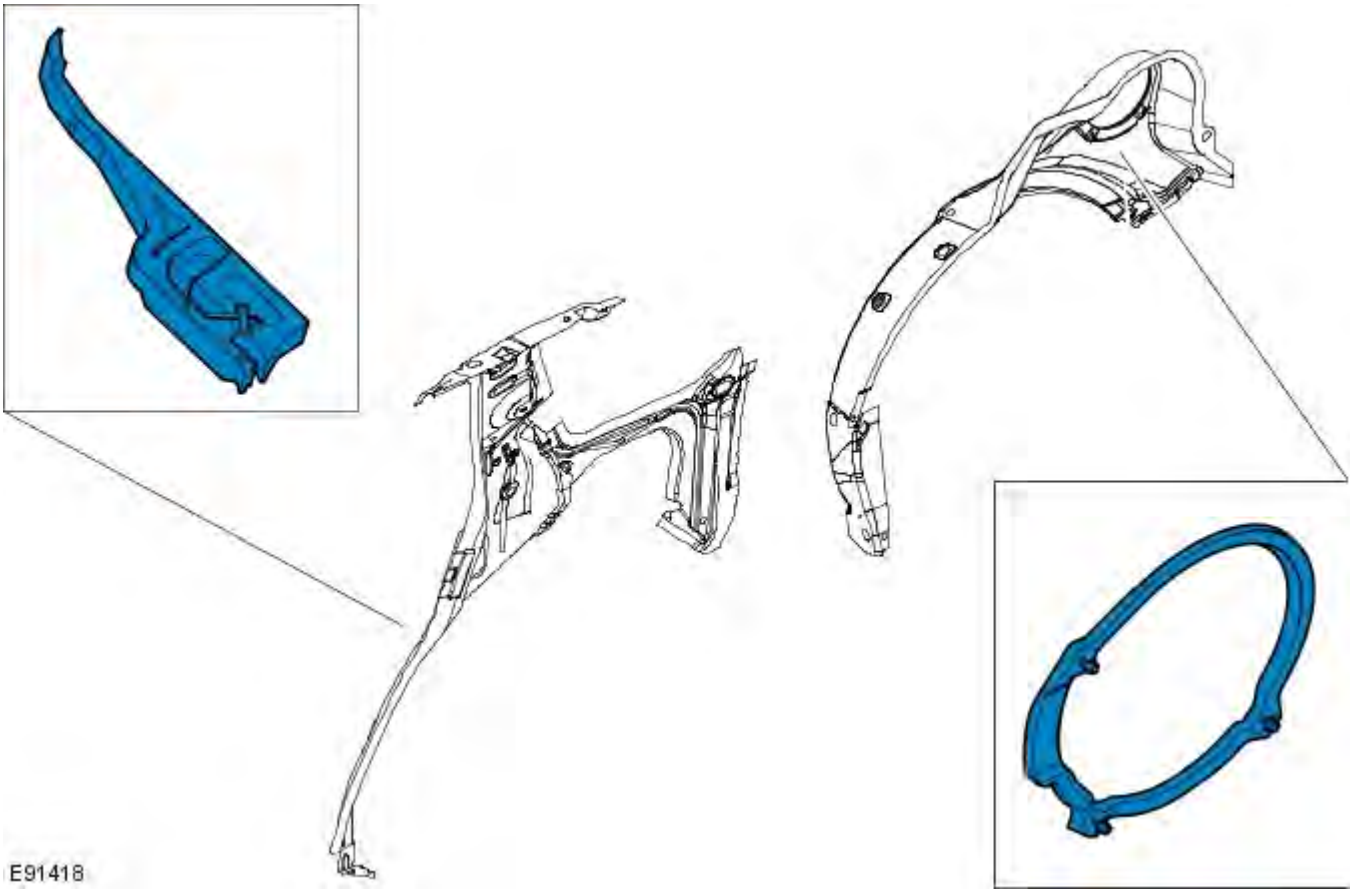
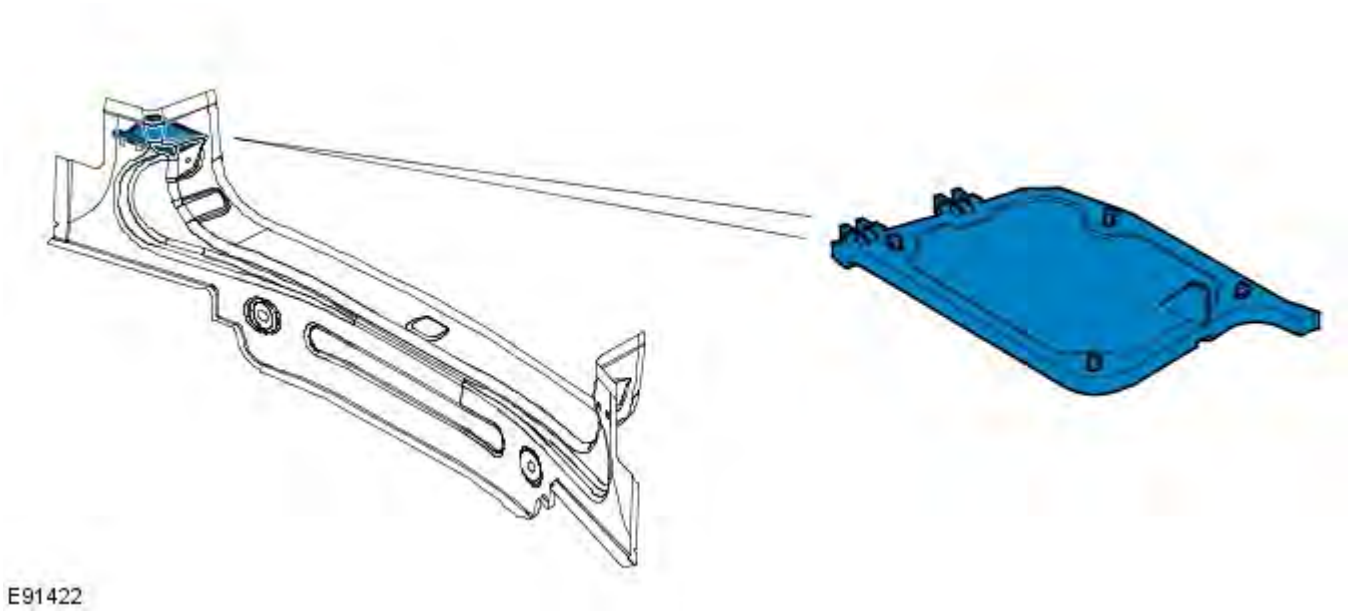
Expanding Foam Acoustic Seals in the Inner Quarter Panel and Wheelhouse



Expanding Foam Acoustic Seals in the Back Panel Inner



Seam Sealer

A heat cured, PVC based sealant is applied to specific joint seams during factory assembly. This material is not suitable for service use and during repair and should be substituted by an approved seam sealer.

• NOTE: Where seams are inaccessible following the reassembly or fitting of components, ensure that a paste-type seam sealer is applied to such seams. Certain seams also become inaccessible after the completion of panel repairs. In such instances apply seam sealer and paint before final assembly.

Apply seam sealers after the application of primer and before the application of top coat. The sealer must form a continuous bead, with the profile of the bead dependent on the type of seam. If the seam sealer is applied with a brush take particular care to maintain the required coverage of the seam.

Ensure that all accessible repair seams are sealed following a repair. Damage to a vehicle often flexes areas of the body remote from the impact. As a result the seam sealer in these areas may be disturbed by subsequent straightening and repair operations. Check all seams in the vicinity of the area undergoing repair for evidence of cracked seam sealer, then clean out as required and apply fresh seam sealer using the following procedure:

- Clean the affected seam and re-treat any exposed metal areas with a suitable etch phosphate primer.
- Treat affected area with an etch-acid primer.
- Apply appropriate seam sealer as necessary.
- apply appropriate colour coat (and under body sealer as applicable).

Provided access is adequate, apply seam sealer to both sides of a repair joint. Where access is limited to one side only, (e.g. box section), treat the affected box member with cavity wax.

Cavity Wax

After repairs, always re-treat these areas with an approved cavity wax. In addition, treat all interior surfaces which have been disturbed during repairs whether they have been treated in production or not. This includes all box members, cavities and door interiors.

Before wax injection, ensure that the cavity to be treated is free from any contamination or foreign matter. Where necessary, clear out any debris.

Ensure that cavity wax is applied after the final paint process and before refitting any trim components.

During application ensure that the wax covers all flanges and seam areas and that it is adequately applied to all repaired areas of both new and existing panels.

It should be noted that new panel assemblies and complete body shells are supplied without wax injection treatment. Ensure that such treatment is carried out after repairs.

Effective cavity wax protection is vital. Always observe the following points:

- Complete all paint refinish operations before wax application.
- Check the spray pattern of injection equipment.
- Mask all areas not to be waxed.
- Remove body fixings, such as seat belt retractors, if contamination is at all likely.
- Move door glasses to fully closed position before treating door interiors.
- Treat body areas normally covered by trim before refitting items.
- Check that body and door drain holes are clear after the protective wax has dried.
- Keep all equipment clean, especially wax injection nozzles.

Published: 11-May-2011

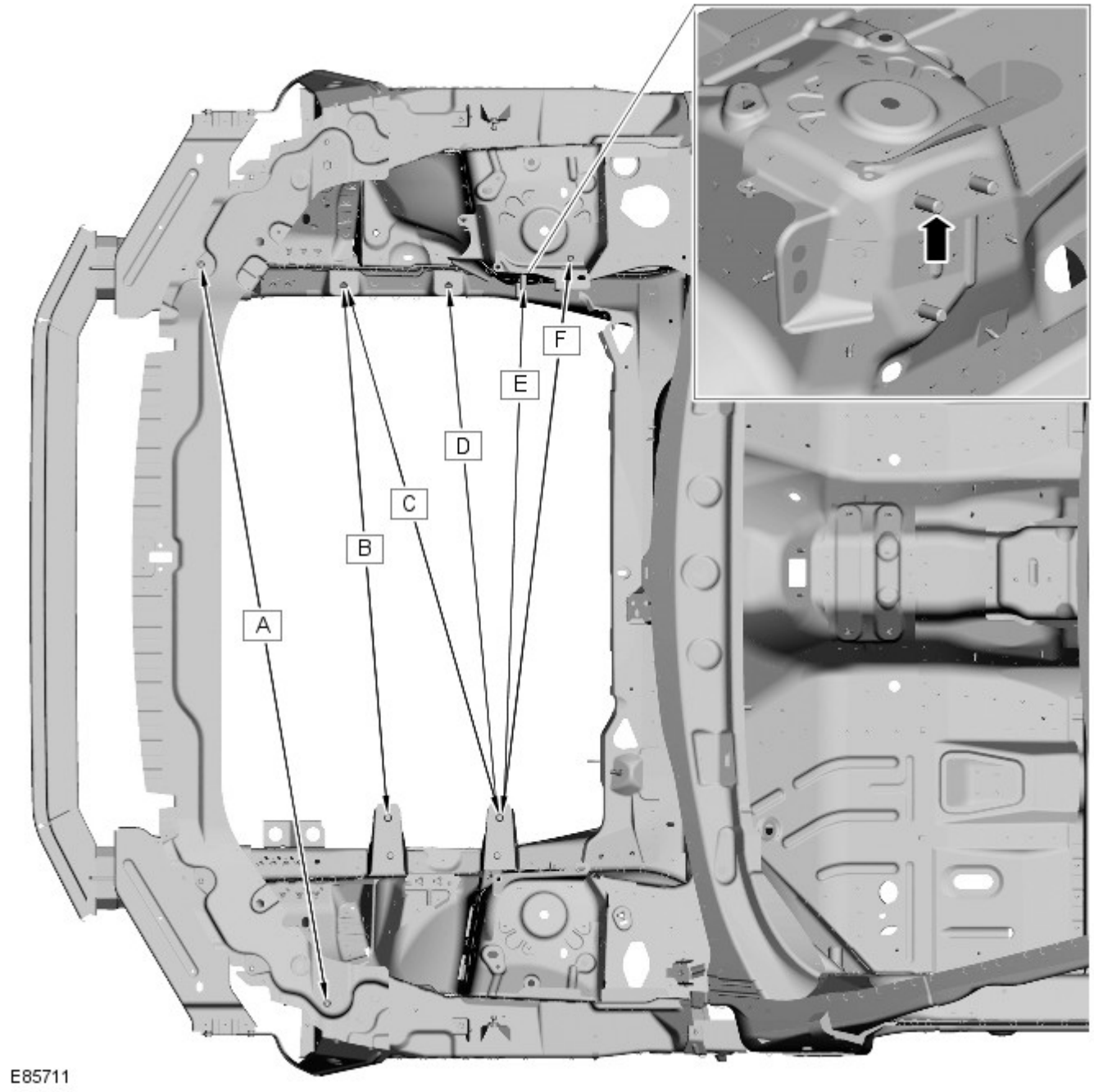
Body Repairs - Vehicle Specific Information and Tolerance Checks - Body and Frame

Description and Operation

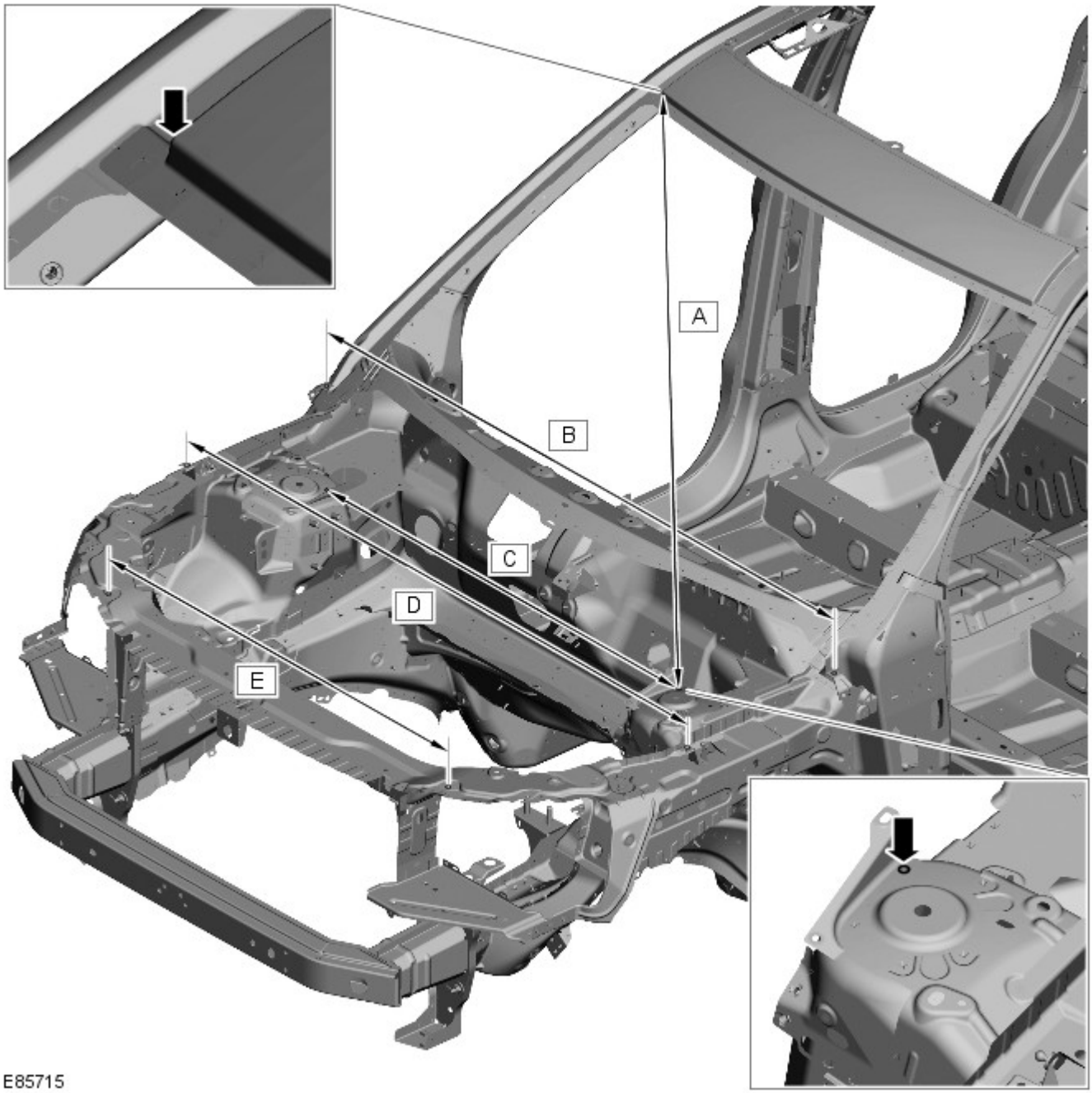
Front End Body Dimensions

• NOTE: All dimensions shown are in millimetres (mm).

• NOTE: Dimensions shown to holes, are always taken from/to the hole centre. They are also always to the body panel surface, not to the top of bolts or components.



Item	From	To	Dimension
A	Head lamp inboard fixing hole	Fender, forward fixing hole	1291.3
B	Transmission LH mounting, forward stud	Engine RH mounting forward fixing hole	922
C	Transmission LH mounting, rear stud	Engine RH mounting forward fixing hole	957.5
D	Transmission LH mounting, rear stud	Engine RH mounting middle fixing hole	922.3
E	Transmission LH mounting, rear stud	Engine RH mounting forward fixing top stud	924.8
F	Transmission LH mounting, rear stud	Damper mounting, rear hole	1025.4

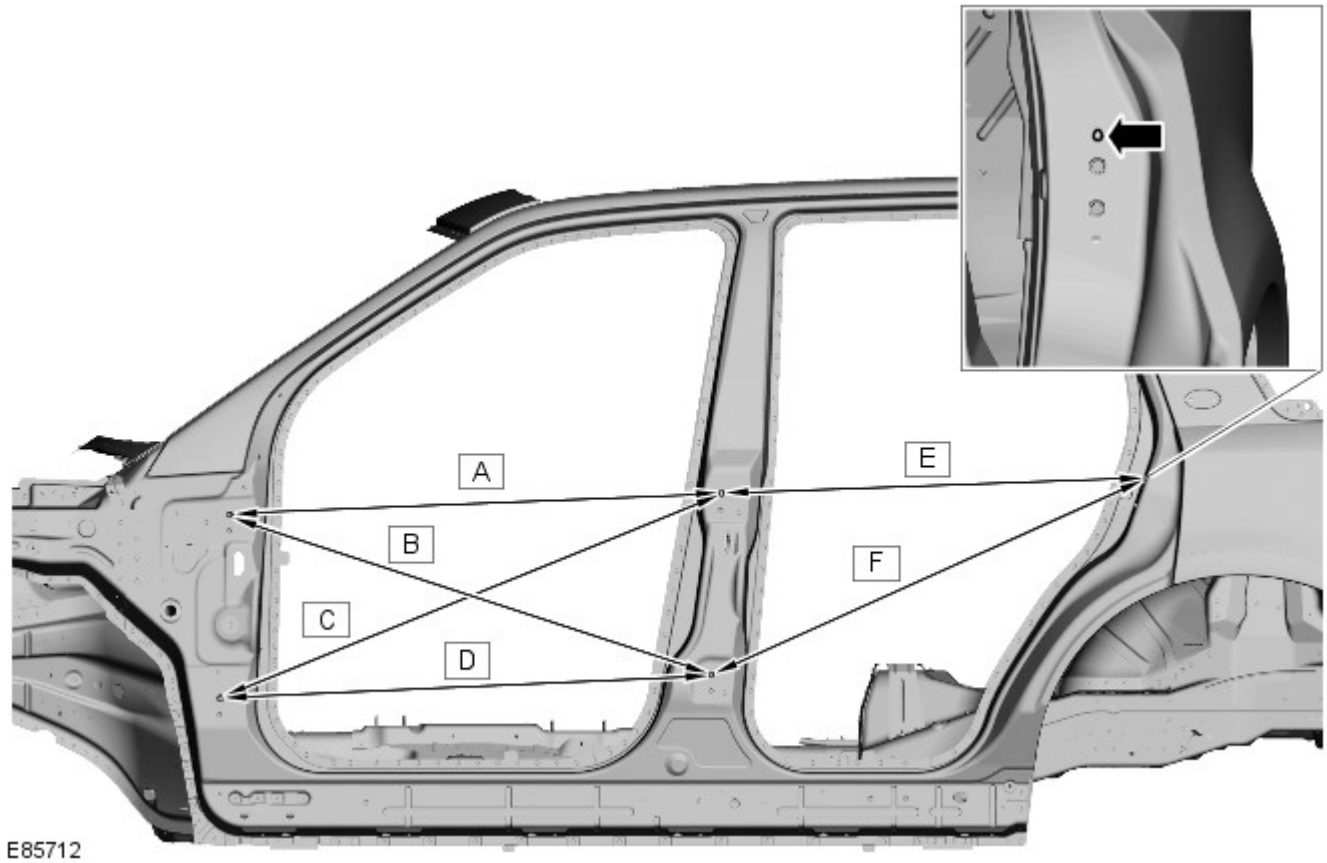


Item	From	To	Dimension
A	Damper mounting rear hole	Roof corner point	1597.25
B	RH Fender rear fixing hole	LH Fender rear fixing hole	1583.9
C	RH Damper mounting rear hole	LH Damper mounting rear hole	1136
D	RH Fender middle fixing hole	LH Fender middle fixing hole	1558.9
E	RH Headlamp top inboard fixing hole	LH Headlamp top inboard fixing hole	1061.5

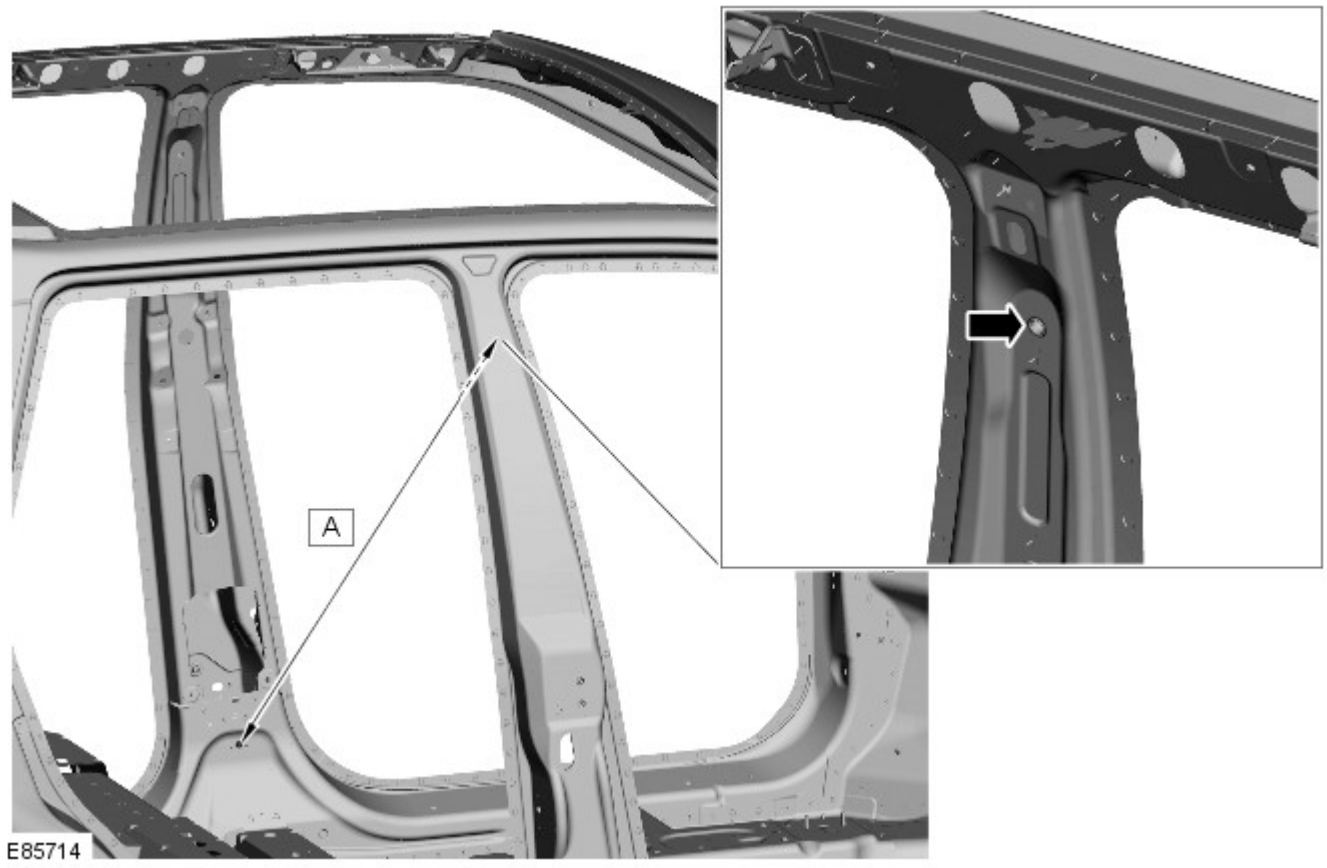
E85718

Item	From	To	Dimension
A	Bumper RH top inboard fixing hole	Bumper LH top inboard fixing hole	960
B	RH Valance extension panel tooling hole	LH Valance extension panel tooling hole	1533.7

Side Panel Dimensions

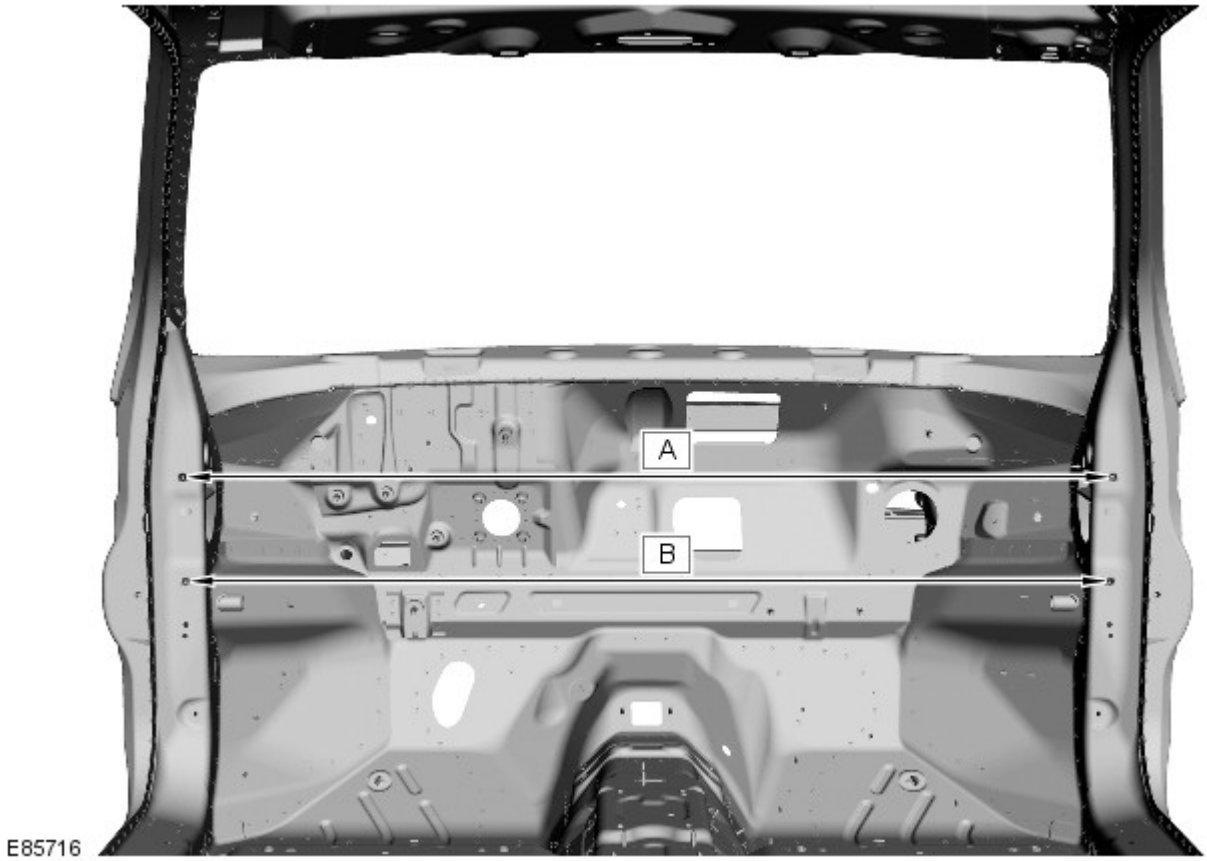


Item	From	To	Dimension
A	Front door top hinge fixing hole	Rear door top hinge fixing hole	1034.9
B	Front door top hinge fixing hole	Rear door bottom hinge, top fixing hole	1061.44
C	Front door bottom hinge, top fixing hole	Rear door top hinge fixing hole	1138.7
D	Front door bottom hinge, top fixing hole	Rear door bottom hinge, top fixing hole	1035.5
E	Rear door top hinge fixing hole	Rear door striker top fixing hole	1917.7
F	Rear door bottom hinge, top fixing hole	Rear door striker top fixing hole	983.8



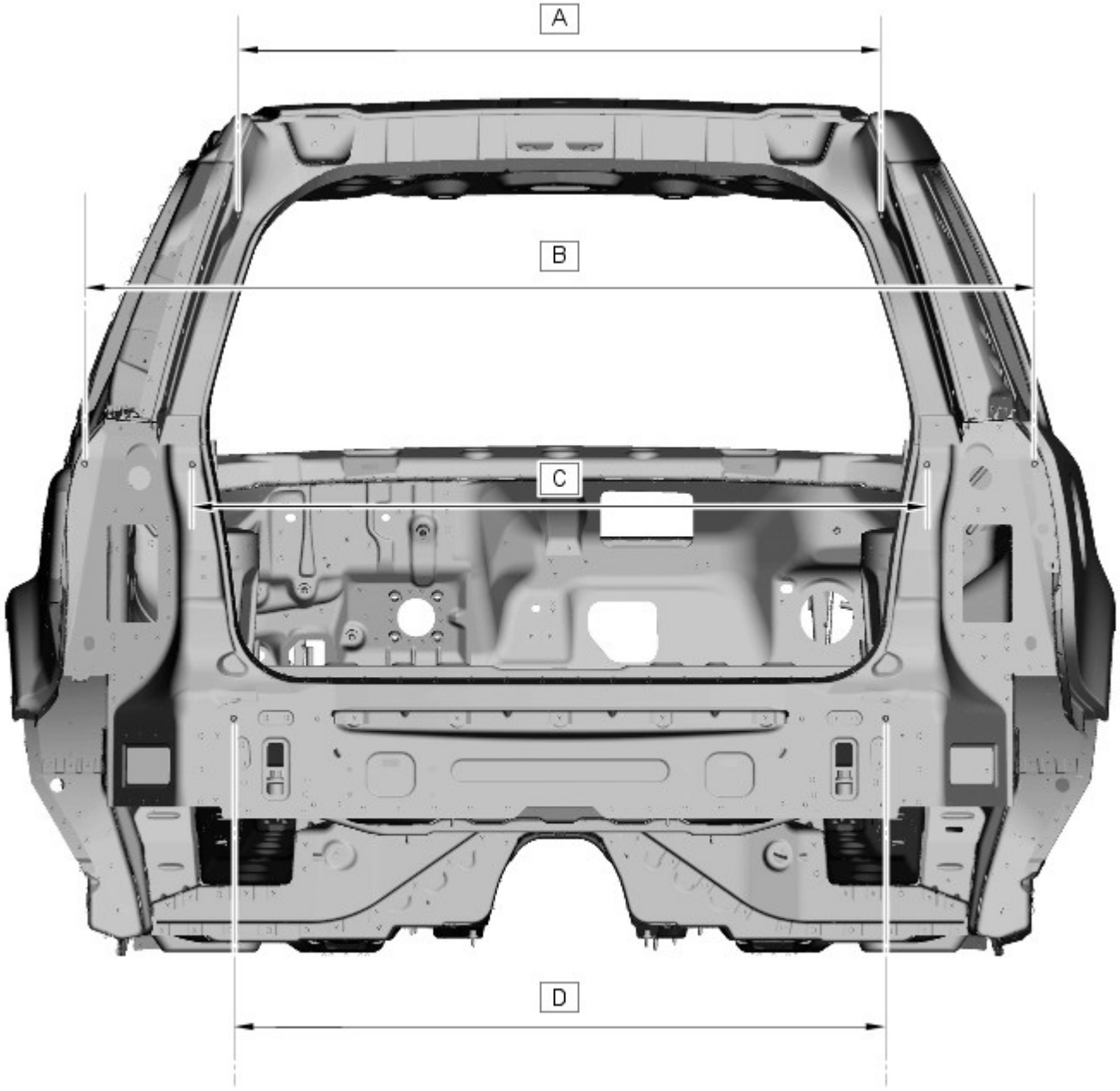
Item	From	To	Dimension

Item	From	To	Dimension
A	Front seat belt retractor fixing hole	Front seat belt anchorage fixing hole	1673.3



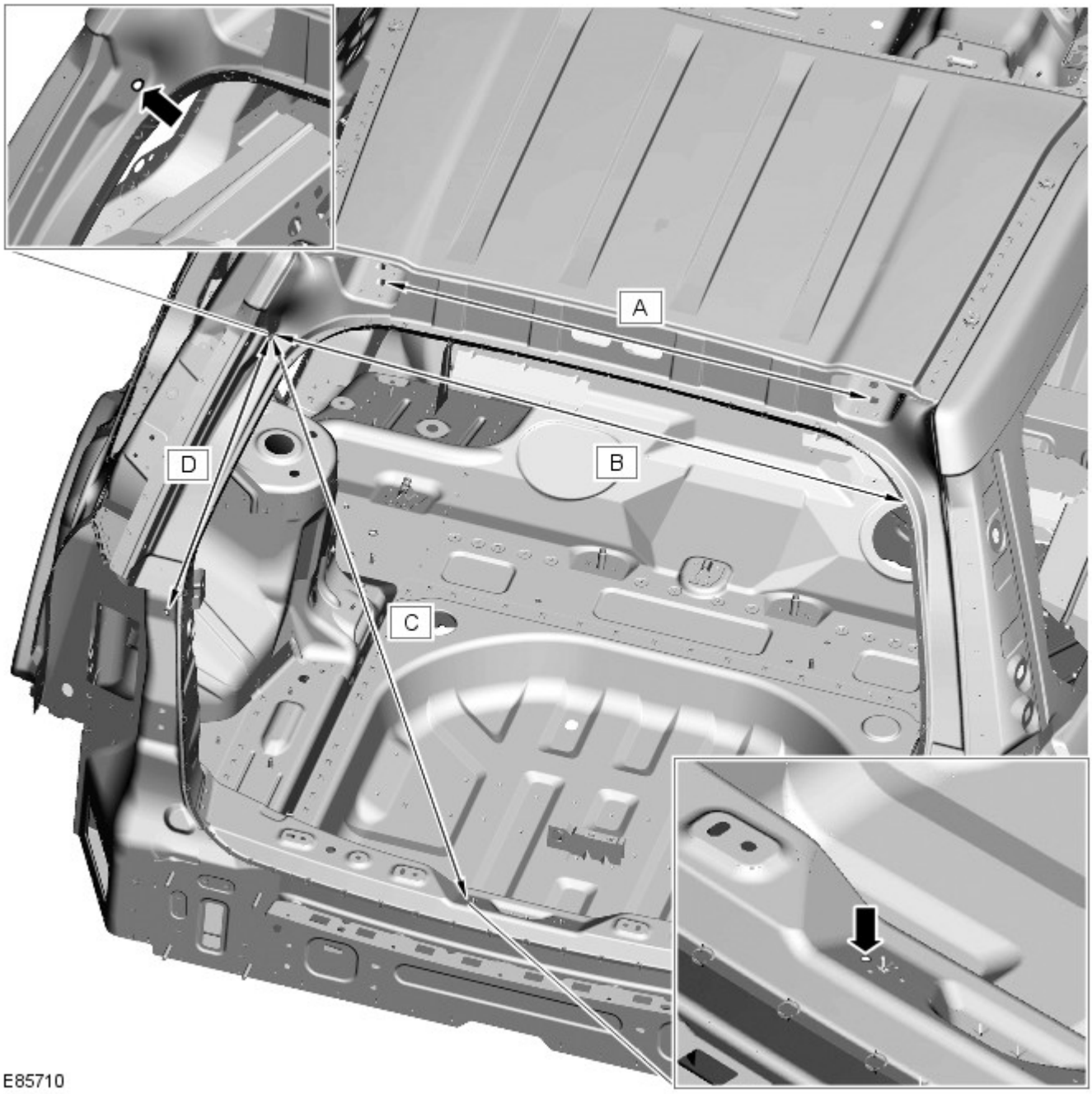
Item	From	To	Dimension
A	Instrument panel carrier RH top fixing hole	Instrument panel carrier LH top fixing hole	1447
B	Instrument panel carrier RH bottom fixing hole	Instrument panel carrier LH bottom fixing hole	1447

Rear End Body Dimensions



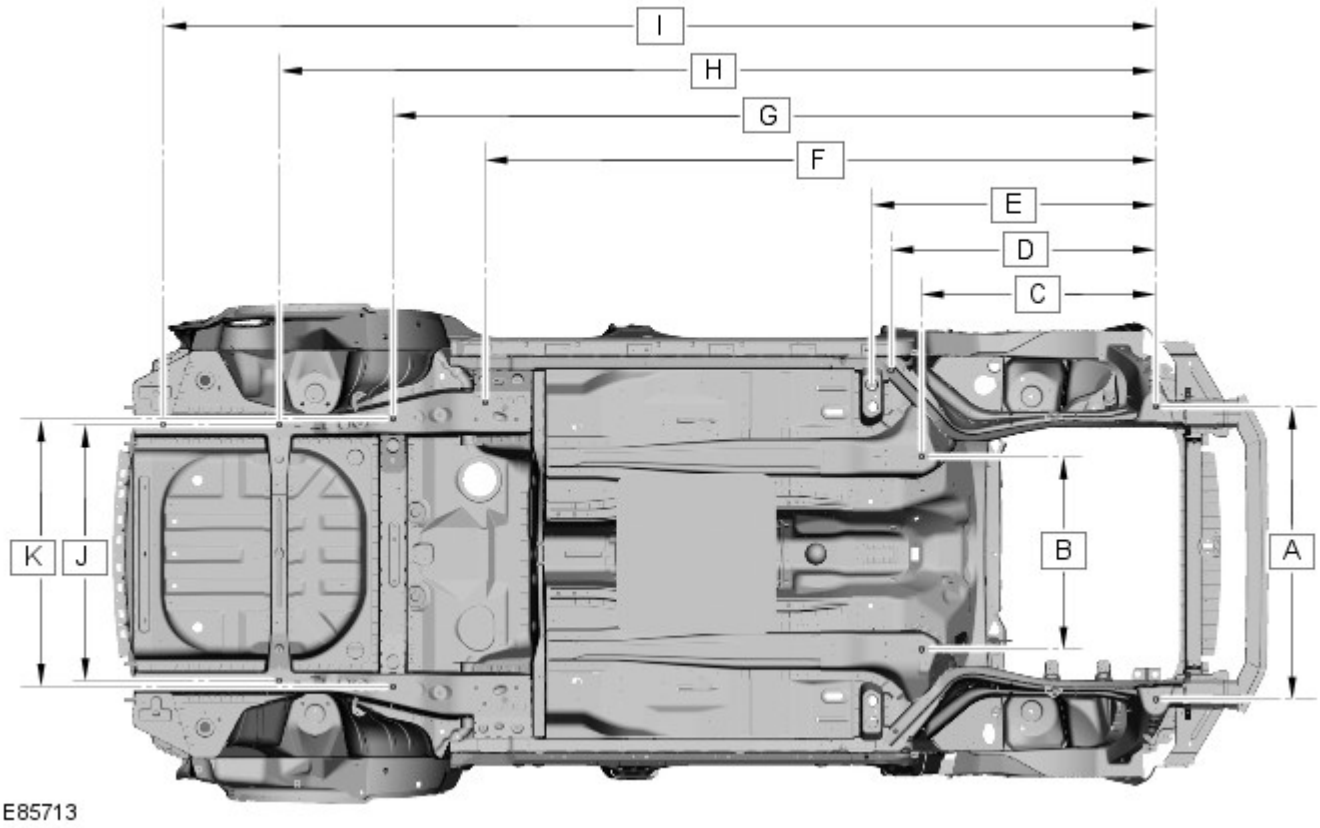
E85719

Item	From	To	Dimension
A	RH Gas strut spigot fixing hole	LH Gas strut spigot fixing hole	1086.6
B	RH Rear lamp location hole	LH Rear lamp location hole	1615.2
C	RH Rear lamp top fixing hole	LH Rear lamp top fixing hole	1241.8
D	Rear bumper RH outboard top fixing stud	Rear bumper LH outboard top fixing stud	1101.12

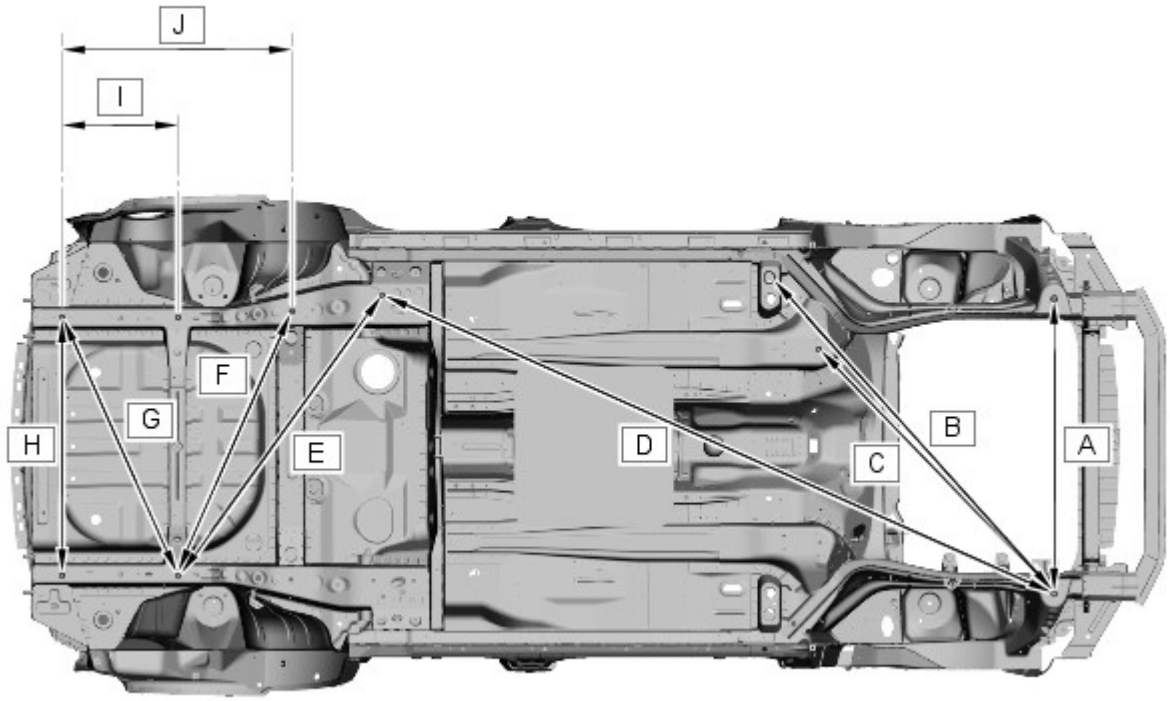


Item	From	To	Dimension
A	Liftgate LH inboard hinge fixing hole	Liftgate RH outboard hinge fixing hole	800
B	LH Gas strut spigot fixing hole	RH Gas strut spigot fixing hole	1086.6
C	LH Gas strut spigot fixing hole	Liftgate LH latch fixing hole	953
D	LH Gas strut spigot fixing hole	LH Rear lamp top fixing hole	475.9

Under Body Dimensions



Item	From	To	Dimension
A	Front subframe RH front fixing hole	Front subframe LH front fixing hole	1096
B	Front subframe RH rear fixing hole	Front subframe LH rear fixing hole	722
C	Front subframe front fixing hole	Front subframe rear fixing hole	880
D	Front subframe front fixing hole	Side member rear extension tooling hole	976.4
E	Front subframe front fixing hole	Main floor onboard tooling hole	1065.8
F	Front subframe front fixing hole	Trailing arm fixing hole	2517.6
G	Front subframe front fixing hole	Rear subframe front fixing hole	2862
H	Front subframe front fixing hole	Rear subframe rear fixing hole	3288.7
I	Front subframe front fixing hole	Rear towing eye rear fixing hole	3720
J	Rear subframe RH rear fixing hole	Rear subframe LH rear fixing hole	959.4
K	Rear subframe RH front fixing hole	Rear subframe LH front fixing hole	1000



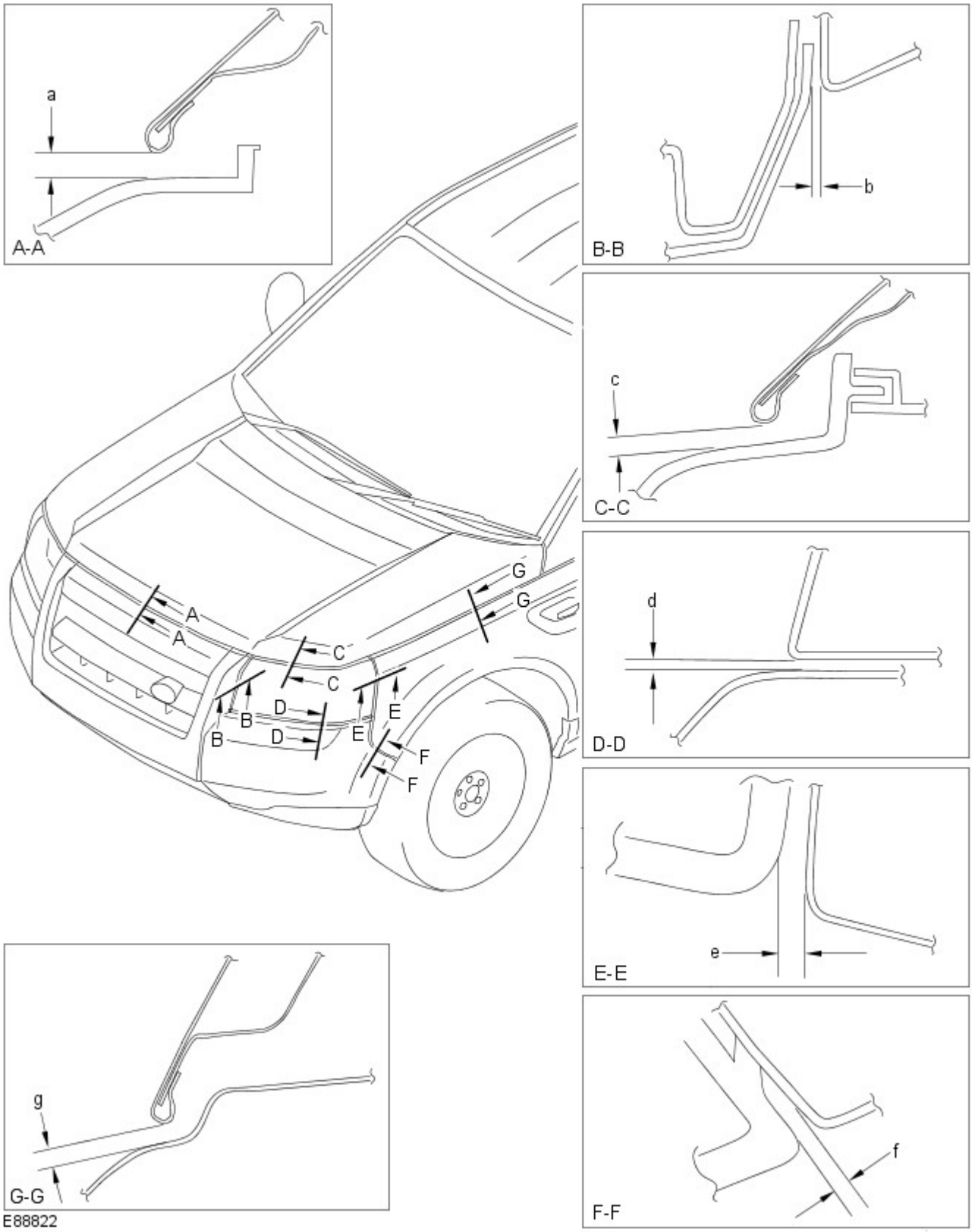
E85717

Item	From	To	Dimension
A	Front subframe RH front fixing hole	Front subframe LH front fixing hole	1096
B	Front subframe front fixing hole	Main floor onboard tooling hole	1606.2
C	Front subframe front fixing hole	Front subframe rear fixing hole	1287.6
D	Front subframe front fixing hole	Trailing arm fixing hole	2754.4
E	Rear subframe rear fixing hole	Trailing arm fixing hole	1302.2
F	Rear subframe rear fixing hole	Rear subframe front fixing hole	1071.2
G	Rear subframe rear fixing hole	Rear towing eye rear fixing hole	1051.9
H	Rear towing eye rear fixing hole	Rear towing eye rear fixing hole	959.4
I	Rear subframe rear fixing hole	Rear towing eye rear fixing hole	431.3
J	Rear subframe front fixing hole	Rear towing eye rear fixing hole	858

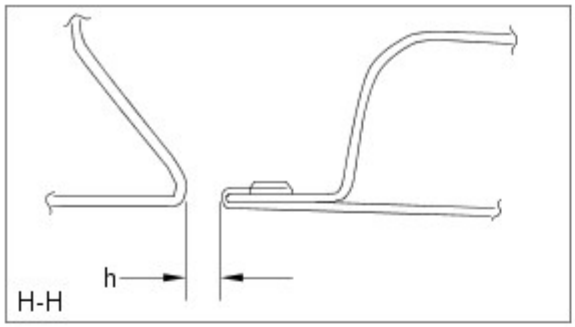
Gap and Profile measurements

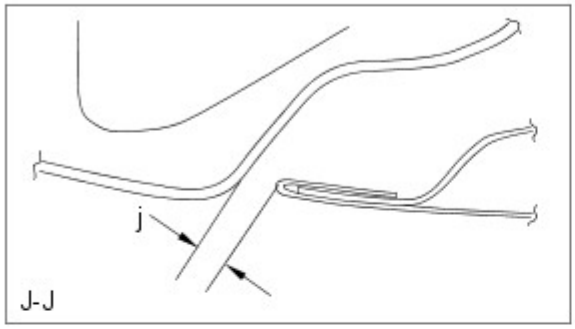
The following information is to be used as a guide to assist the technician in installing exterior body panels and trim items so as to achieve a correctly aligned and cosmetically acceptable vehicle.

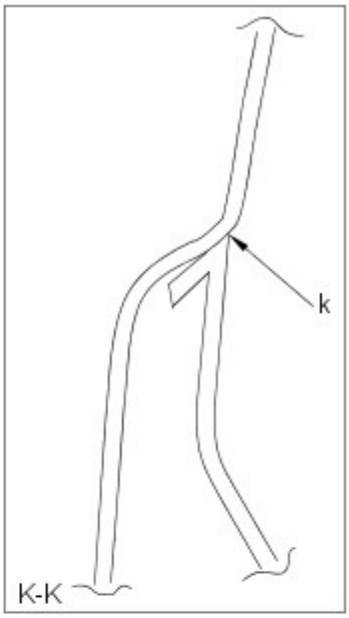
• NOTE: All dimensions shown are in millimetres (mm).

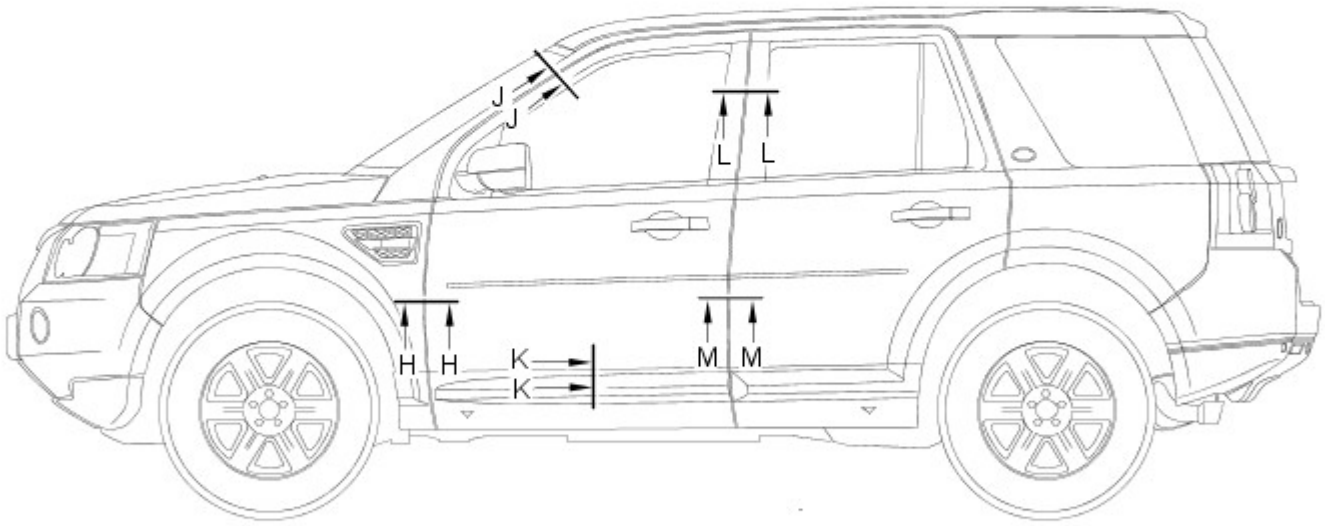


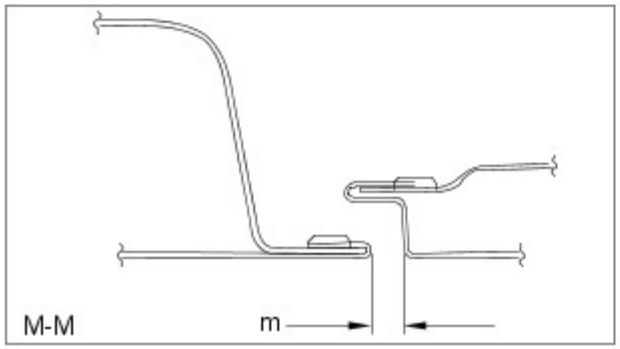
Section	Description	Gap	Profile
A-A	Hood to bumper cover gap	5.0 +2.0 -0.0	N/A
B-B	Front bumper cover to headlamp gap	5.0 ±2.5 (maximum taper 2.0)	N/A
C-C	Hood to headlamp gap	5.0 +2.0 -0.0	N/A
D-D	Headlamp to bumper cover	4.0 ±2.0	N/A
E-E	Fender to headlamp	3.0 ±1.0	1.0 ±1.5
F-F	Fender to bumper cover	2.0 +1.0 -0.0	1.5 ±1.0
G-G		5.0 ±1.7	N/A

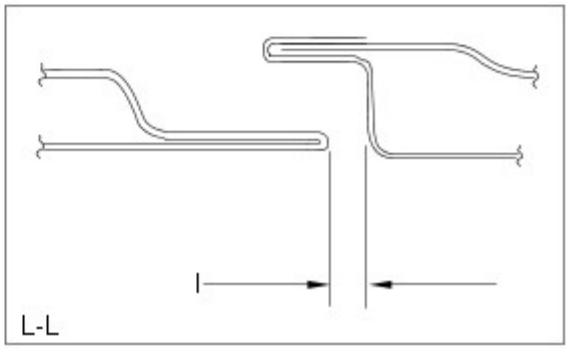






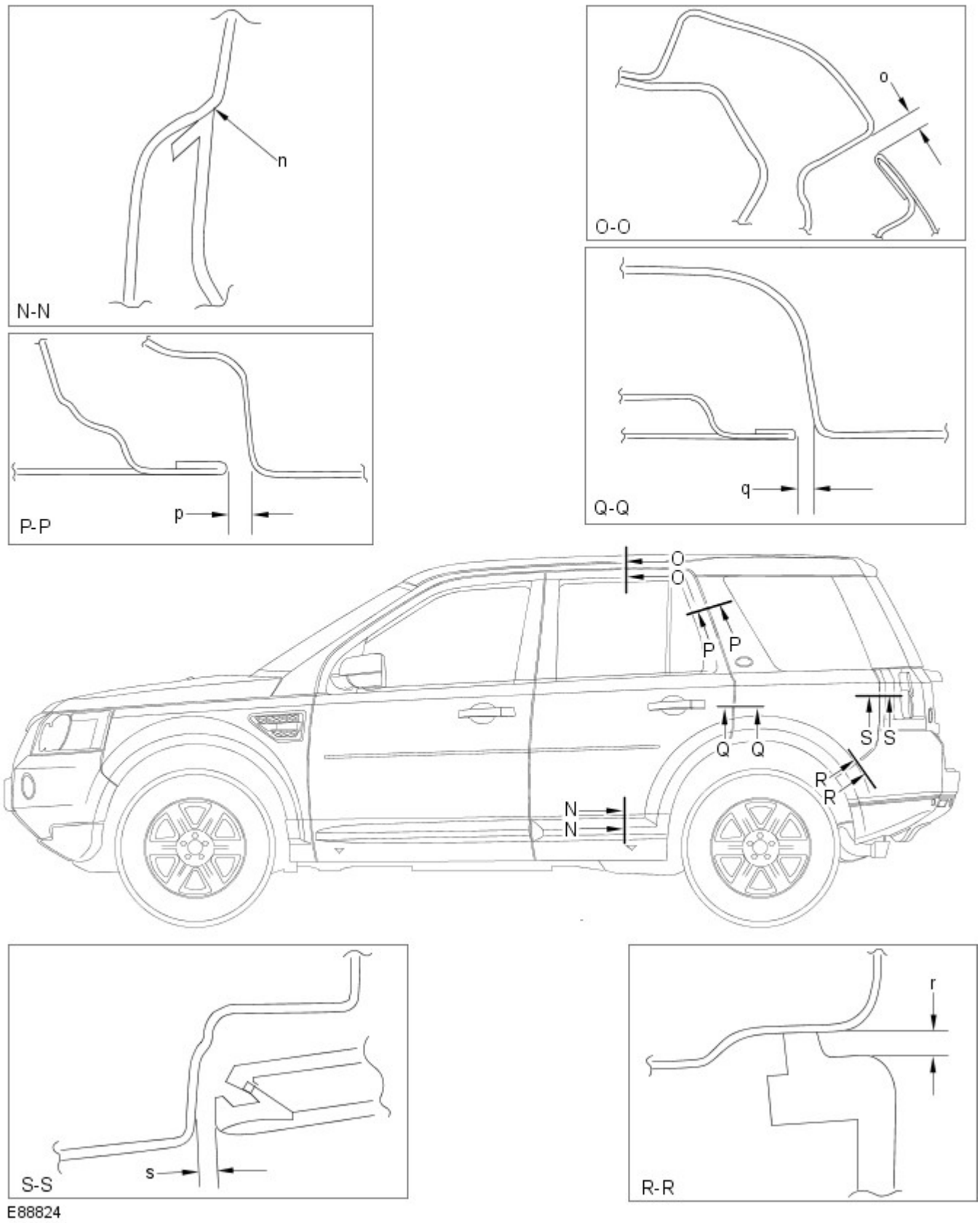






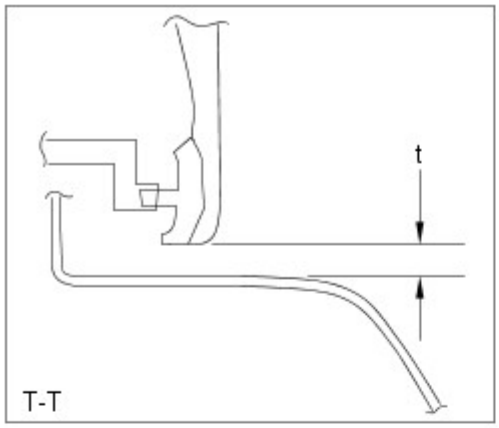
E88823

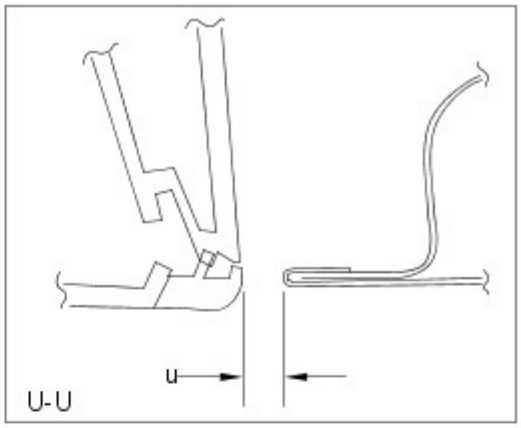
Section	Description	Gap	Profile
H-H	Fender to front door	5.0 ±1.0	0.7 ±1.0
J-J	Front door to A-Pillar	4.5 ±1.0	-2.5 ±1.2
K-K	Front door finisher to door	0.0 +1.0 -0.0	-2.0 ±1.0
L-L	Front door to rear door	5.0 ±1.0	0.8 ±1.0
M-M	Front door to rear door	5.0 ±1.0	1.0 ±1.0

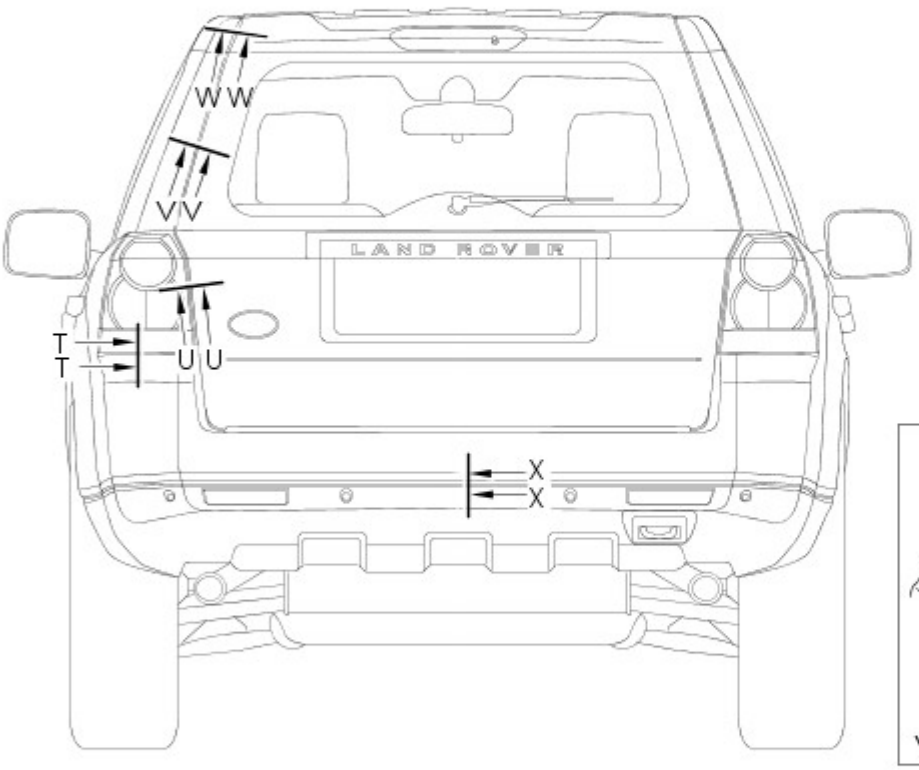


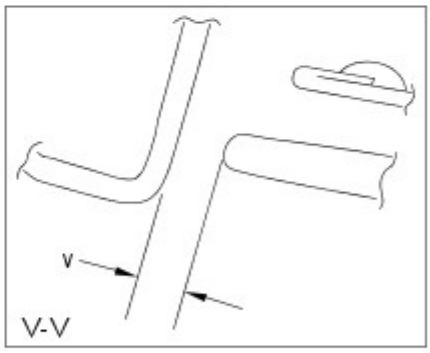
E88824

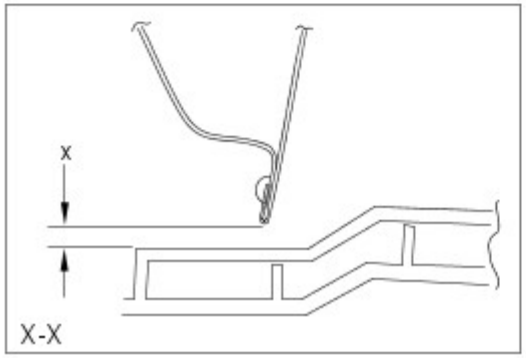
Section	Description	Gap	Profile
N-N	Rear door finisher to door	0.0 +1.0 -0.0	-2.0 ±1.0
O-O	Rear door to side panel	4.5 ±1.0	-2.5 ±1.2
P-P	Rear door to side panel	4.5 ±1.0	1.0 ±1.0
Q-Q	Rear door to side panel	5.0 ±1.0	0.5 ±0.5
R-R	Side panel to bumper cover	2.0 +1.0 -0.0	1.5 ±1.0
S-S	Side panel to rear lamp	3.0 ±1.5	1.0 ±1.2

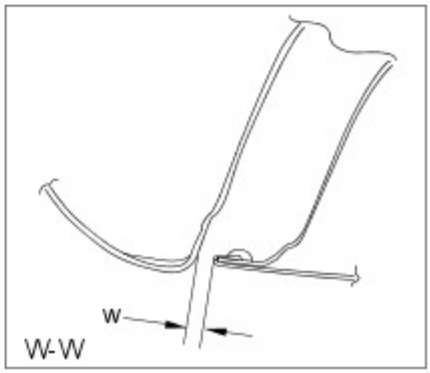












E88825

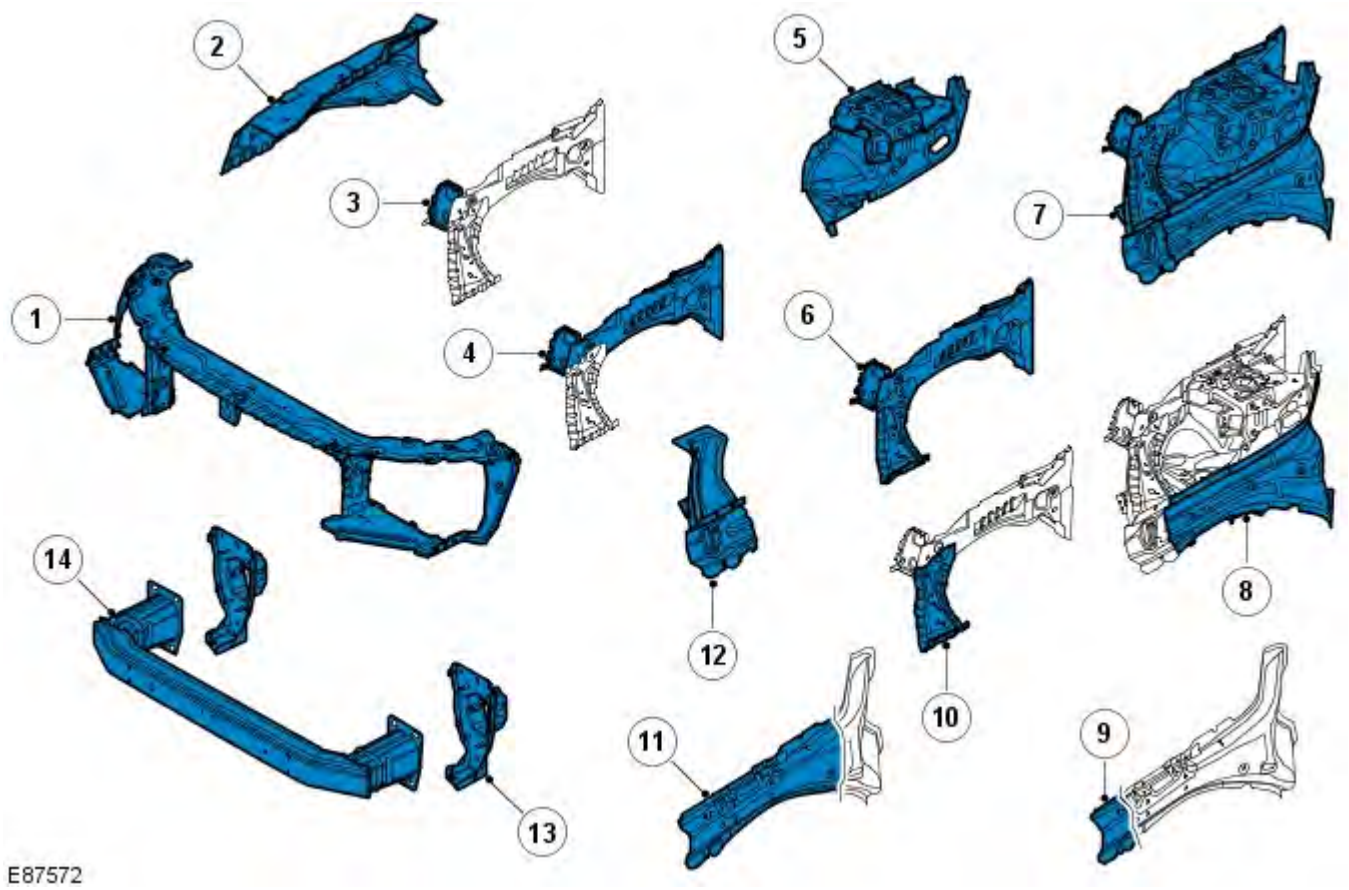
Section	Description	Gap	Profile
T-T	Rear lamp to bumper cover	3.0 ±2.0	N/A
U-U	Rear lamp to liftgate	5.0 ±1.5	3.0 ±1.3
V-V	D-Pillar trim panel to liftgate glass	5.0 ±2.0	2.5 ±1.3
W-W	Side panel to liftgate	5.0 ±1.5	2.0 ±1.5
X-X	Liftgate to bumper cover	6.0 ±2.7	N/A

Published: 11-May-2011

Front End Sheet Metal Repairs - Front End Sheet Metal

Description and Operation

Front end service panels



Item	Description
1	Hood latch panel
2	Fender apron upper panel
3	Fender apron panel front extension
4	Fender apron panel reinforcement
5	Suspension top mount
6	Fender apron panel
7	Front side member and suspension top mount assembly
8	Front side member closing panel
9	Front side member section
10	Fender apron lower panel
11	Front side member
12	Fender apron panel front reinforcement
13	Front bumper mounting
14	Front bumper

Time schedules, front end

The following schedules show the total time taken to replace single panels and also combinations of panels. The published times include the removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends to adjacent panels are not included). A corrosion protection time is included where appropriate.

The times were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only, based on new undamaged panels. Job allowances are not included, as a guide Thatcham recommend 0.3 hours to be added to single panel times and 0.5 hours to be added to combination times.

Single panel times

Panel Description	Times
Hood	**5.6**
Front bumper cover	**5.5**
Front fender	**5.5**
Hood latch panel	**6.2**
Engine and Suspension assembly remove and install	**8.5**
Instrument panel remove and install	**6.2**

Combination panel replacement times

Combination panel times

Panel Description	Times
Hood	
Front bumper cover	
Front bumper	
Hood latch panel	
Front fender	
Fender mounting bracket, (front)	
Total Time	**L/H 16.5** **R/H 16.5**

Combination panel times

Panel Description	Times
Hood	
Front bumper cover	
Front bumper	
Hood latch panel	
Front fender L/H and R/H	
Front fender mounting bracket, (front) L/H and R/H	
Total Time	**17.2**

Combination panel times

Panel Description	Times
Hood	
Front bumper cover	
Front bumper	
Hood latch panel	
Front fender	
Front fender mounting bracket, (front)	
Front bumper mounting	
Front side member	
Front side member and suspension top mount assembly	
Fender apron upper panel	
Engine and suspension assembly remove and install	
Instrument panel remove and install	
Total Time	**L/H 42.2** **R/H 43.6**

Combination panel times

Panel Description	Times
Hood	
Front bumper cover	
Front bumper	
Hood latch panel	
Front fender L/H and R/H	
Front fender mounting bracket, (front) L/H and R/H	
Front bumper mounting L/H and R/H	
Front side member L/H and R/H	
Front side member and suspension top mount assembly L/H and R/H	
Fender apron upper panel L/H and R/H	
Engine and suspension assembly remove and install	
Instrument panel remove and install	
Total Time	**57.6**

Combination panel times

Panel Description	Times
Hood	
Front bumper cover	
Front bumper	
Hood latch panel	
Front fender	
Front fender mounting bracket, (front)	
Front bumper mounting	
Front side member section	
Fender apron lower panel	
Fender apron panel front reinforcement	
Engine and suspension assembly remove and install	
Total Time	**L/H 29.9** **R/H 30.0**

Published: 11-May-2011

Front End Sheet Metal Repairs - Front Bumper Mounting

Removal and Installation

Removal

• NOTE: The front bumper mounting is serviced as a separate weld-on panel.

• NOTE: Due to the combined thickness of the panels, it is recommended that spot welds are replaced with MIG plug welds in this repair.

1. The front bumper mounting is replaced in conjunction with:

- Front bumper cover
- Front bumper
- Hood latch panel
- Both front fenders

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the hood latch panel.
For additional information, refer to: Hood Latch Panel (501-27, Removal and Installation).

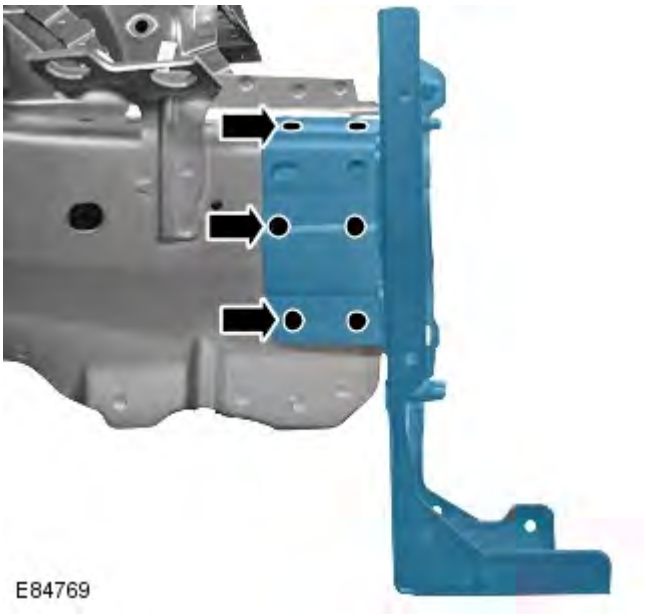
4. Remove the radiator cooling pack.
For additional information, refer to: Radiator (303-03A Engine Cooling - I6 3.2L Petrol, Removal and Installation).

5. LH Side: Remove the air intake pipe.

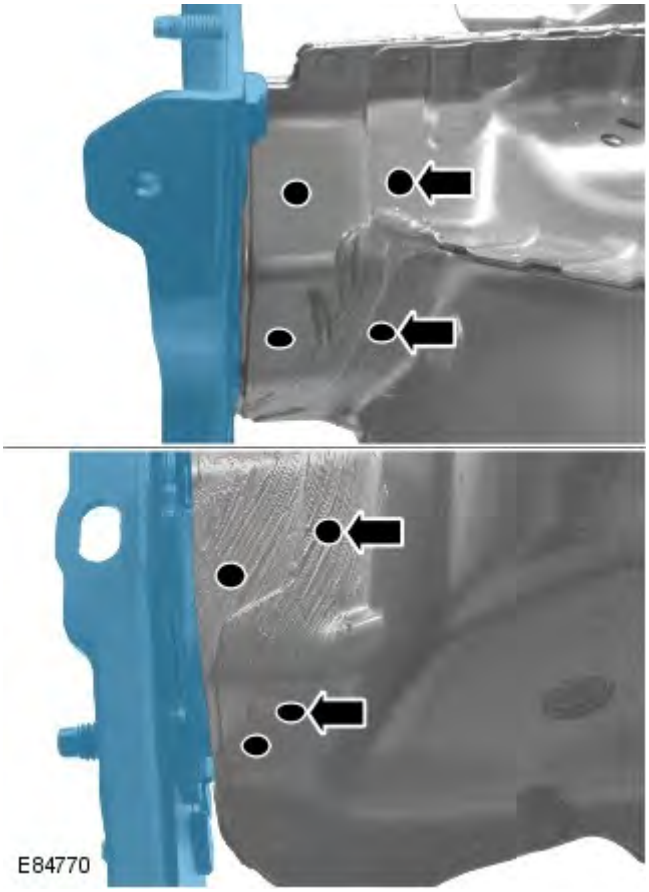
6. RH Side: Remove the windshield washer reservoir.
For additional information, refer to: Windshield Washer Reservoir (501-16 Wipers and Washers, Removal and Installation).

7. Release and lay aside the wiring harness.

8. Mill out the spot welds.



9. Mill out the spot welds.



10. Separate the joints and remove the panel.

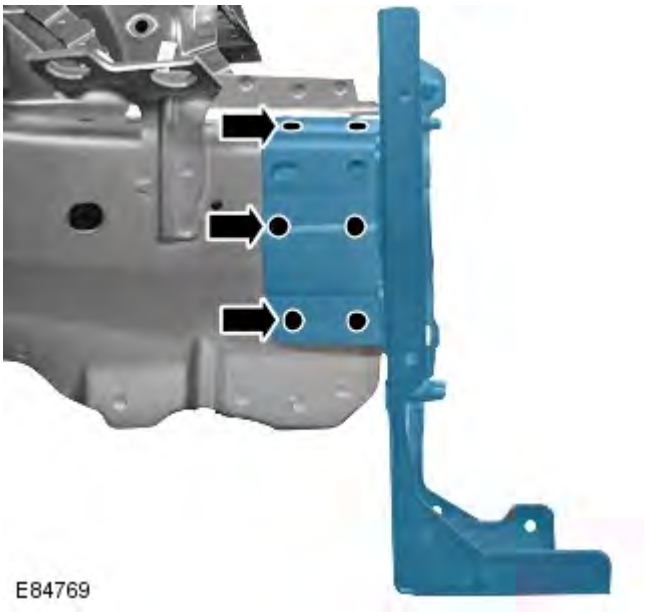
Installation

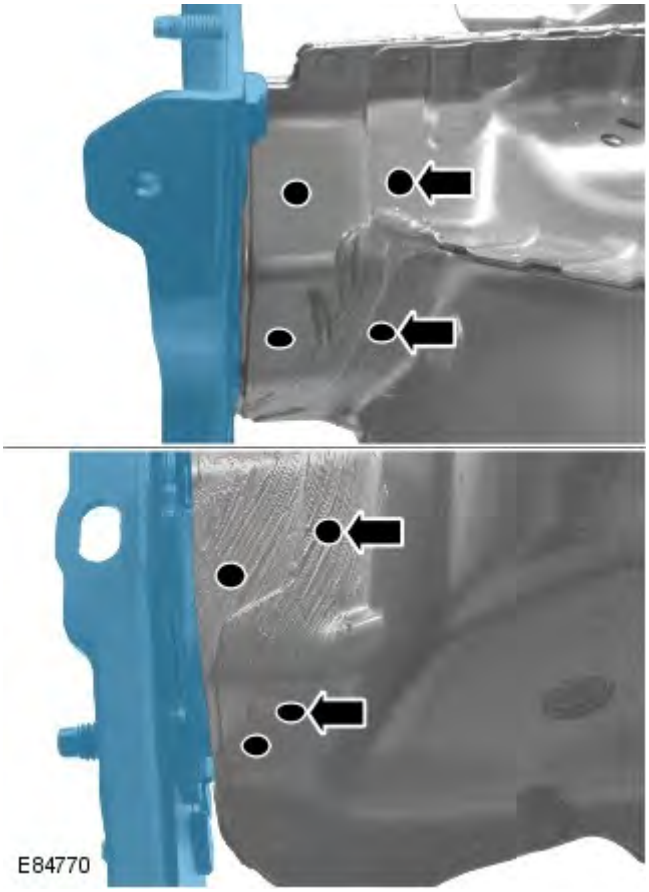
1. Prepare the old and new panel joint surfaces.

2. Drill holes in the new panel ready for plug welding.

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. Plug weld to the front side member.





5. Plug weld to the front side member closing panel.

6. Dress all welded joints.

7. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Front Side Member and Suspension Top Mount Assembly

Removal and Installation

Removal

• NOTE: The front side member and suspension top mount assembly is an assembly of the front side member closing panel, fender apron panel reinforcement, fender apron panel front extension, fender apron lower panel, front side member and fender apron panel and the suspension top mount.

• NOTE: The service panel is not fully welded.

• NOTE: The panel is serviced less its weld studs

1. The front side member and suspension top mount assembly is replaced in conjunction with:

- Front bumper cover
- Front bumper armature
- Hood latch panel
- Both front fenders
- Front bumper mounting
- Fender apron upper panel
- Front side member

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) /
Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the front side member.
For additional information, refer to: Front Side Member (501-27 Front End Sheet Metal Repairs, Removal and Installation).

4. Remove the fender apron upper panel.
For additional information, refer to: Fender Apron Upper Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).

5. Remove the instrument panel.
For additional information, refer to: Instrument Panel - TD4 2.2L Diesel (501-12 Instrument Panel and Console, Removal and Installation).

6. Remove the rocker panel inner trim.

7. Remove the B-pillar lower trim.
For additional information, refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

8. Release and lay aside the front carpet section.

9. Release and lay aside the insulating material at the outer bulkhead.

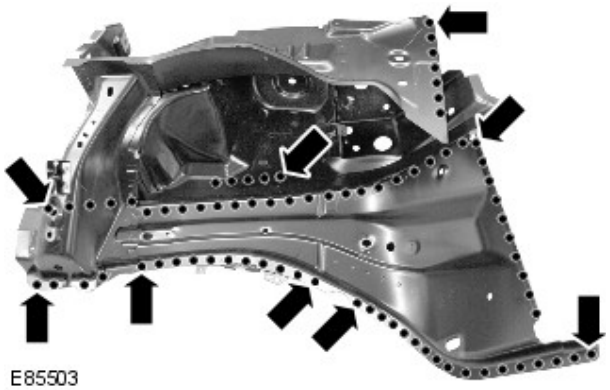
10. LH Side: Remove the hood release handle.

11. RH Side: Remove the brake booster.
For additional information, refer to: Brake Booster (206-07 Power Brake Actuation, Removal and Installation).

12. RH Side: Remove the pedal box.

13. Release and lay aside the wiring harnesses at the a-pillar, bulkhead and side member.

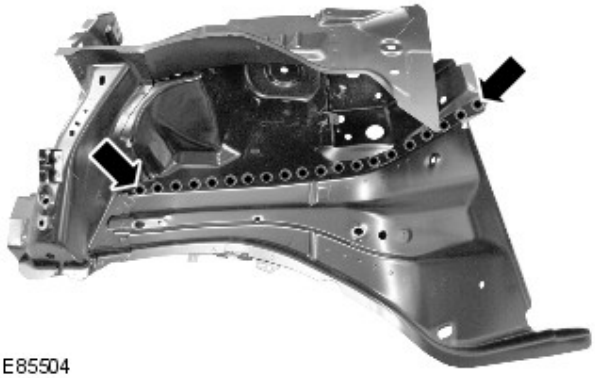
14. Mill out the spot welds.


E85503

15. Separate the joints and remove the old panel.

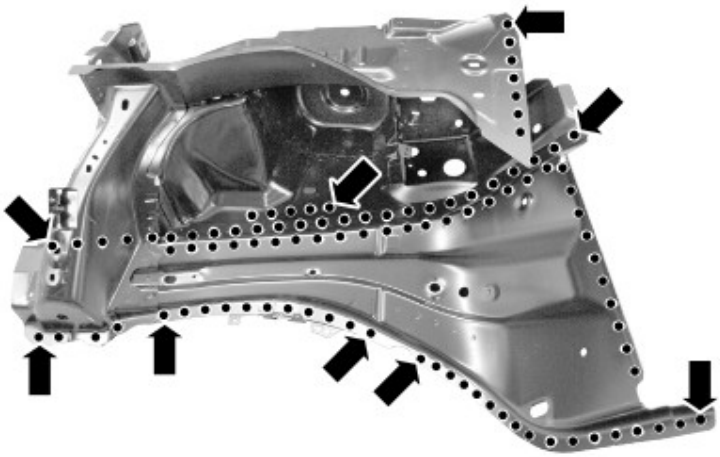
Installation

1. Prepare the new panel in the areas where it is not fully welded and MIG plug weld these areas.



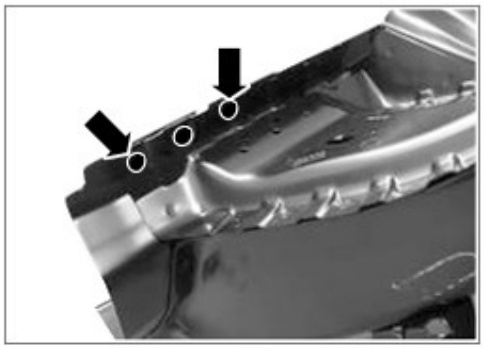
E85504

2. Prepare the old and new panel joint surfaces.



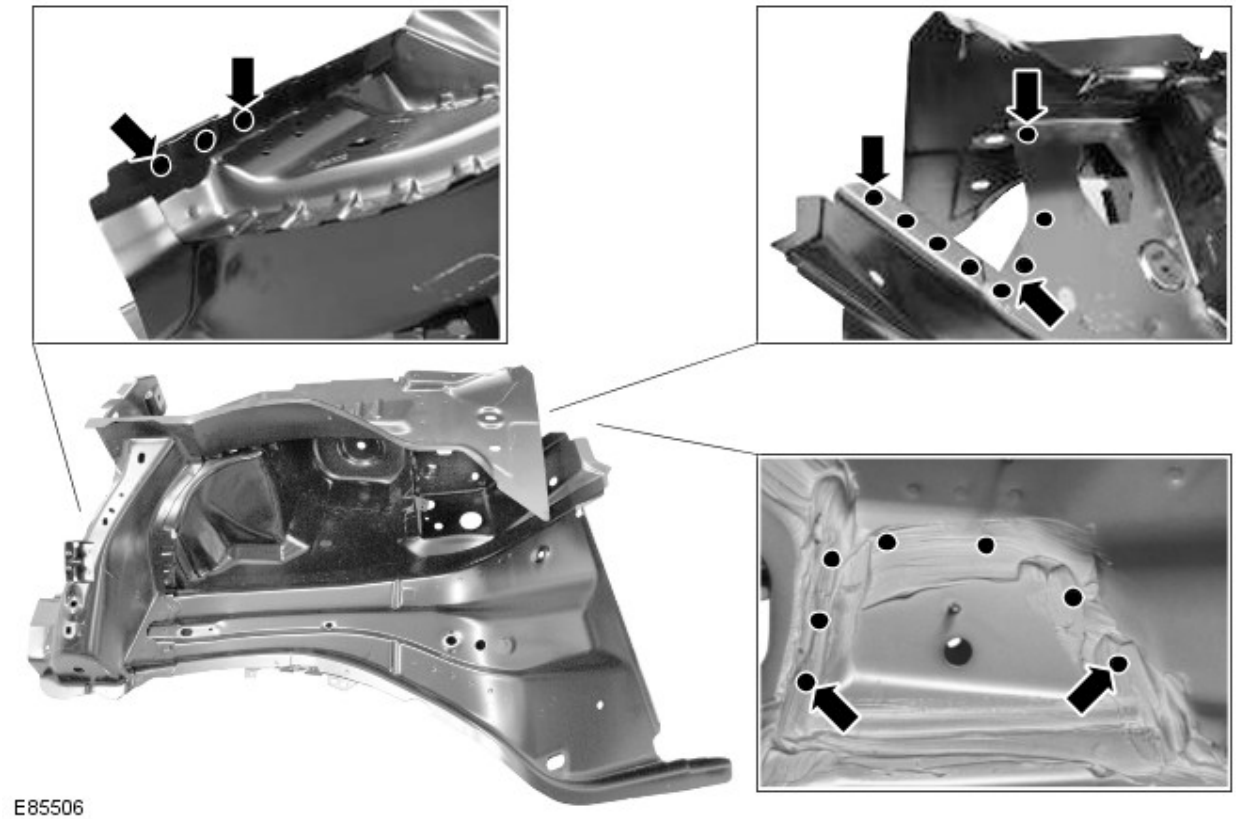
E85505

3. Drill holes in the new panel ready for MIG plug welding



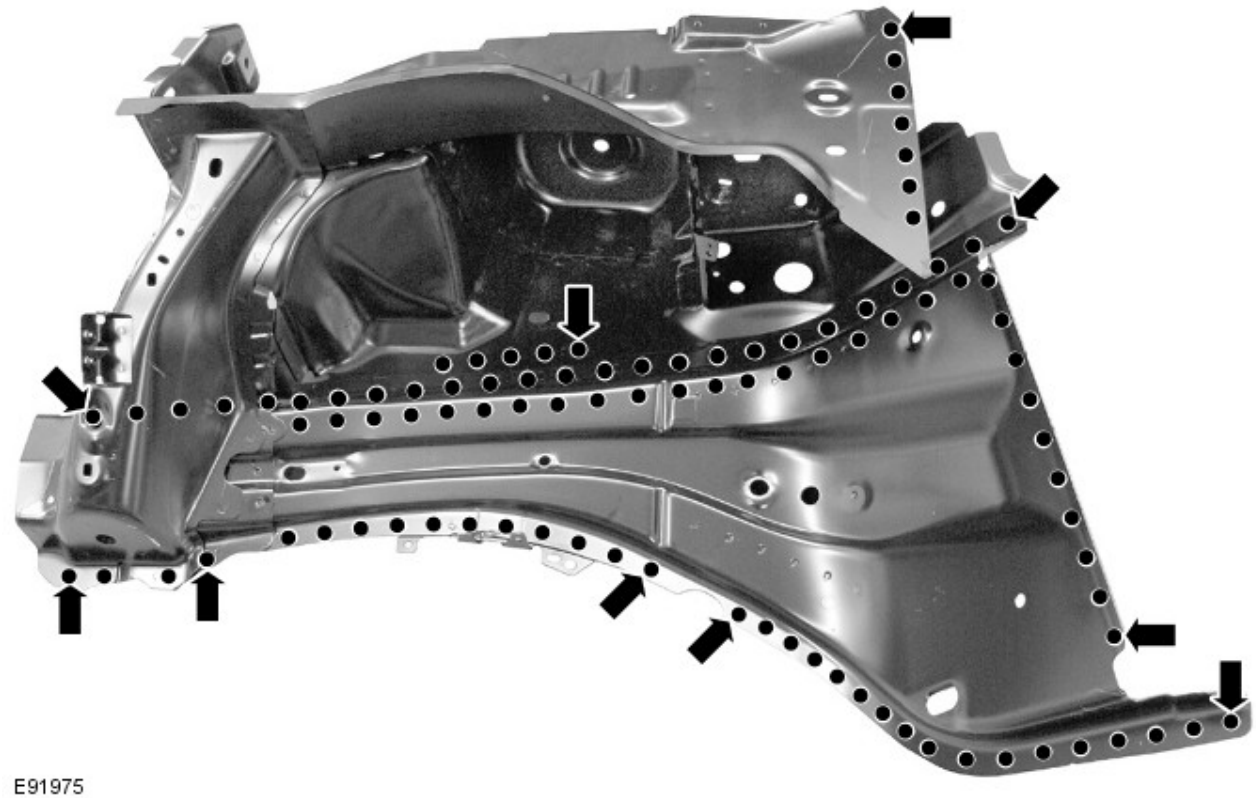
4. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

5. MIG Plug weld.



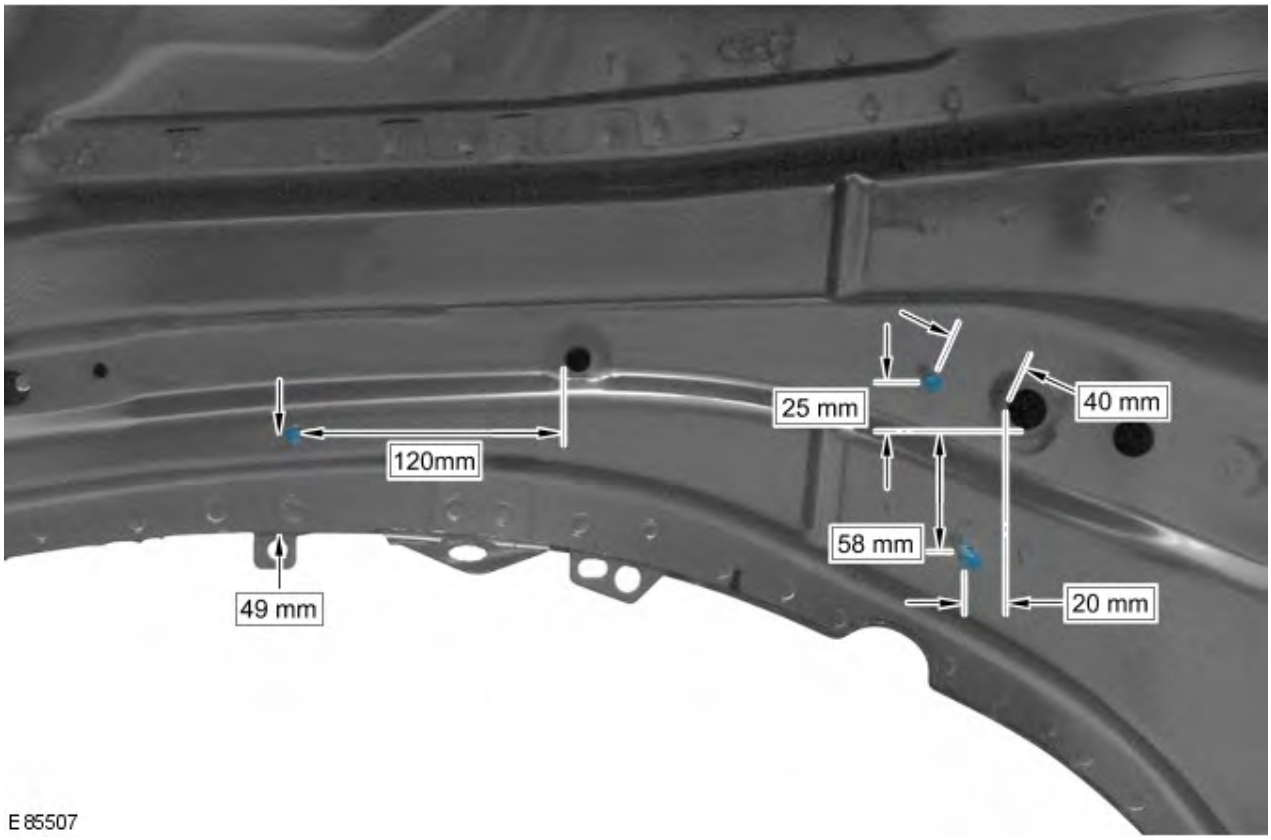
E85506

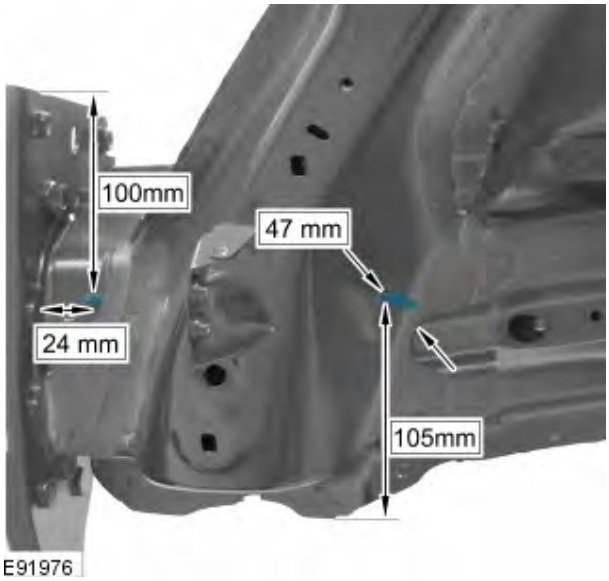
6. MIG Plug weld.



E91975

7. Install weld studs.





8. Install weld studs.

9. Dress all welded joints.

10. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Front Side Member

Removal and Installation

• NOTE: The front side member is serviced as a separate weld on panel. This procedure is to fit a long section cut from the service panel, discarding the rear part.

• NOTE: The service panel is not fully welded.

• NOTE: The section must be made at least 20mm forward of the laser weld.

1. The front side member is replaced in conjunction with:

- Front bumper cover
- Front bumper
- Hood latch panel
- Both front fenders
- Front bumper mounting
- Front side member closing panel
- Fender apron panel front reinforcement
- Fender apron lower panel

• NOTE: It is also necessary to remove the engine and suspension as an assembly.

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the front side member closing panel.
For additional information, refer to: Front Side Member Closing Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).

4. Remove the radiator cooling pack.
For additional information, refer to: Radiator (303-03A Engine Cooling - I6 3.2L Petrol, Removal and Installation).

5. Remove the engine and front suspension as an assembly.

6. Release and lay aside the brake pipe.

7. LH Side: Release the battery junction box and position aside.

8. LH Side: Remove the air intake pipe.

9. LH Side: Release and lay aside the brake pipe at the side member.

10. LH Side: Remove the anti-Lock brake system (ABS) Module.
For additional information, refer to: Anti-Lock Brake System (ABS) Module (206-09A Anti-Lock Control, Removal and Installation).

11. RH Side: Remove the windshield washer reservoir.
For additional information, refer to: Windshield Washer Reservoir (501-16 Wipers and Washers, Removal and Installation).

12. RH Side: Remove the engine mounting bracket.
For additional information, refer to: Engine Mount RH (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).

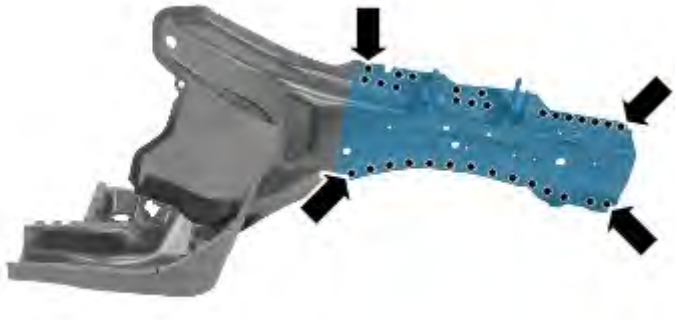
13. RH Side: Remove the fender apron brake pipes.

14. RH Side: Remove the fender apron A/C pipe.

15. Release and lay aside the insulating material at the bulkhead.

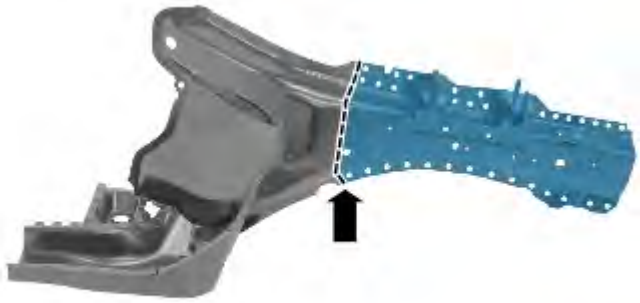
16. Release and lay aside the wiring harness.

17. Mill out the spot welds.



E84785

18. Saw cut the old panel at the point illustrated. The cut should be made at least 20mm forward of the laser weld.



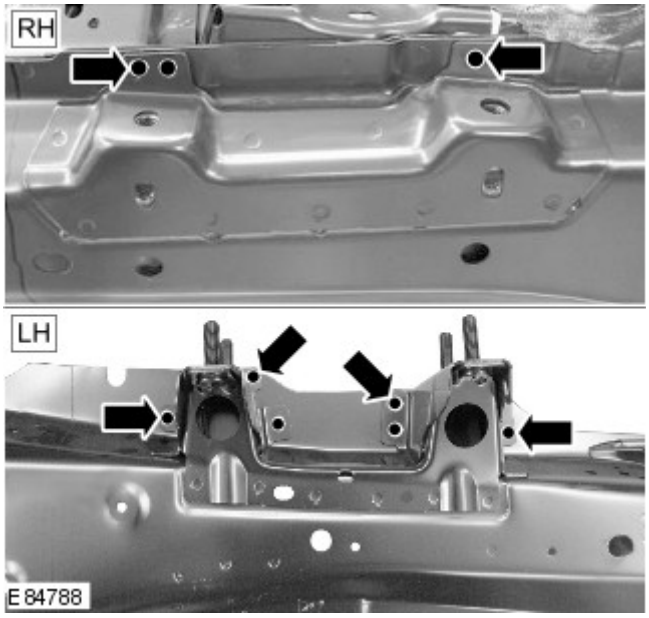
E84786

19. Separate the joints and remove the old panel.

Installation

1. Saw cut the new section from the service panel.

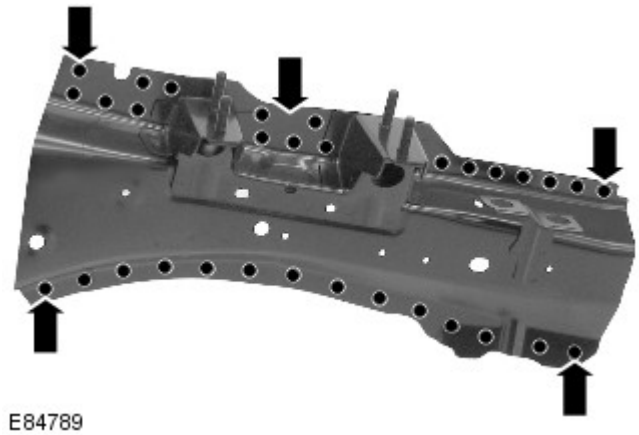
E84787



2. Prepare and MIG plug weld the new panel in the areas illustrated, where it is not fully welded.

3. Prepare the old and new panel joint surfaces.

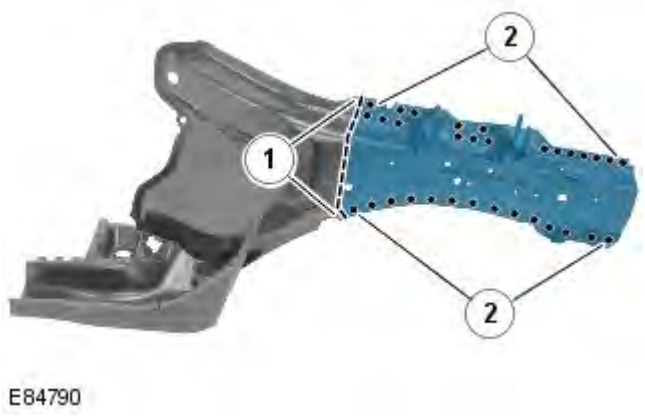
4. Drill holes in the new panel ready for MIG plug welding.



5. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

6. With panels clamped into position:

1. Tack weld the butt joint.
2. MIG plug weld.



7. Dress the tack welds.

8. MIG weld the butt joint.

E84791

9. Dress all welded joints.

10. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Suspension Top Mount

Removal and Installation

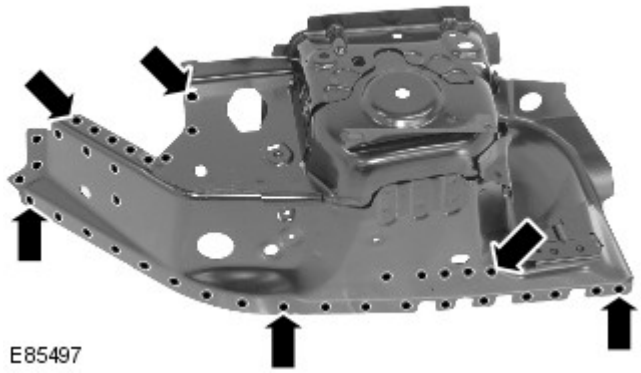
Removal

- NOTE: The suspension top mount is serviced as a separate weld-on panel.
- NOTE: The service panel is not fully welded.
- NOTE: The panel is serviced less its weld studs

1. The suspension top mount is replaced in conjunction with:
   - Front bumper cover
   - Front bumper armature
   - Hood
   - Hood latch panel
   - Both front fenders
   - Fender apron upper panel
   - Fender apron panel
   - Instrument panel

- NOTE: It is also necessary to remove the engine and suspension as an assembly.

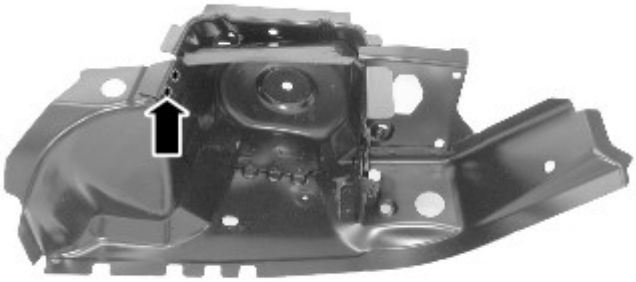
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the fender apron panel.
   For additional information, refer to: Fender Apron Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).
4. Remove the instrument panel.
   For additional information, refer to: Instrument Panel - TD4 2.2L Diesel (501-12 Instrument Panel and Console, Removal and Installation).
5. Remove the rocker panel inner trim panel.
6. Remove the B-pillar lower trim panel.
   For additional information, refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. Remove the engine and front suspension as an assembly.
8. RH Side: Remove the pedal box.
9. RH Side: Remove the brake master cylinder.
   For additional information, refer to: Brake Master Cylinder (206-06 Hydraulic Brake Actuation, Removal and Installation).
10. Release and lay aside the carpet and insulating material at the inner bulkhead.
11. Release and lay aside the wiring harness.
12. Mill out the spot welds.



13. Separate the joints and remove the old panel.

Installation

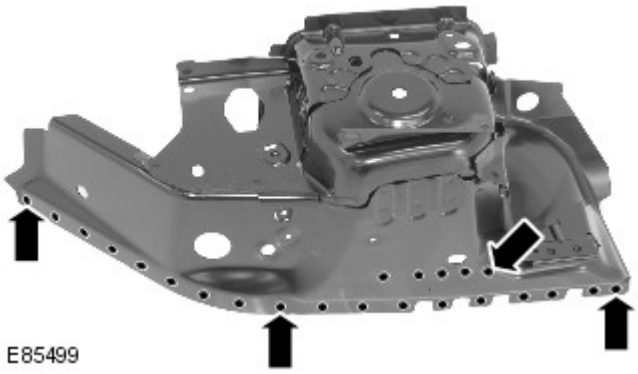
1. Prepare and MIG plug weld the new panel in the area illustrated, where it is not fully welded.



E85498

2. Prepare the old and new panel joint surfaces.

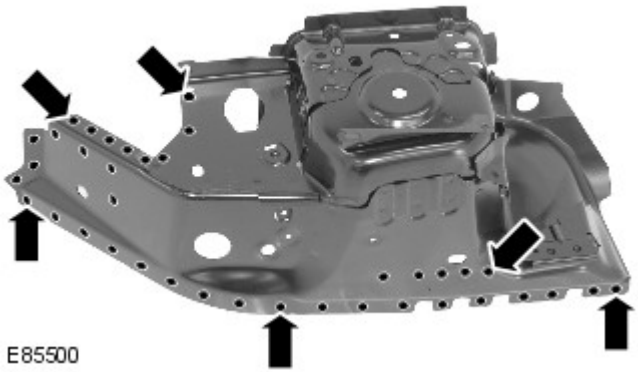
3. Drill holes in the new panel ready for MIG plug welding.



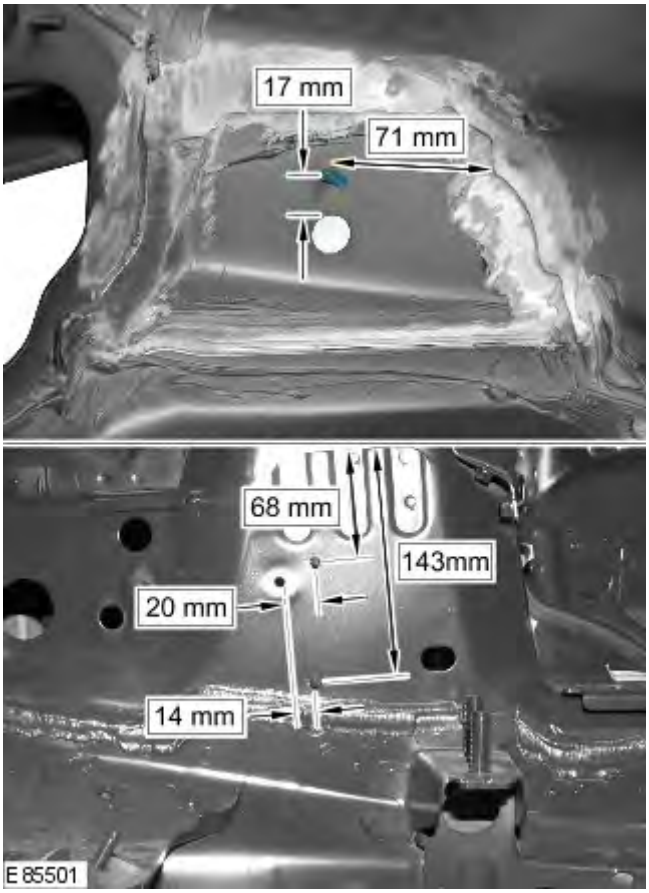
E85499

4. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

5. MIG Plug weld.



E85500



6. Install weld studs.

7. Dress all welded joints.

8. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Front Side Member Section

Removal and Installation

Removal

• NOTE: The front side member section is cut from the front side member service panel.

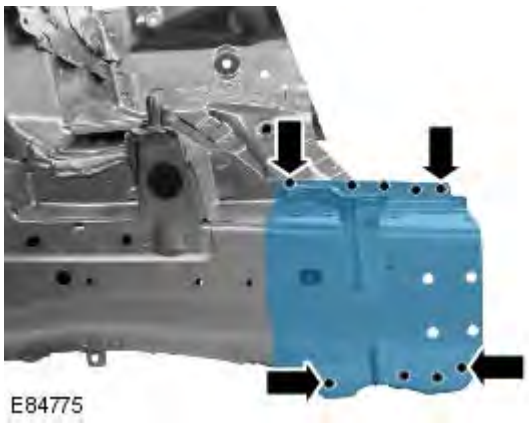
• NOTE: The RH section is slightly shorter than the LH due to the location of the engine mounting.

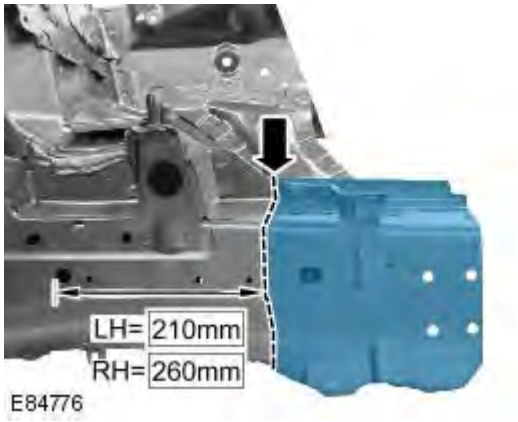
• NOTE: Due to the combined thickness of the panels, it is recommended that spot welds are replaced with MIG plug welds in this repair.

1. The front side member section is replaced in conjunction with:
   - Front bumper cover
   - Front bumper armature
   - Hood latch panel
   - Both front fenders
   - Front bumper mounting

• NOTE: It is also necessary to remove the engine and suspension as an assembly.

2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the front bumper mounting.
   For additional information, refer to: Front Bumper Mounting (501-27 Front End Sheet Metal Repairs, Removal and Installation).
4. Remove the radiator cooling pack.
   For additional information, refer to: Radiator (303-03A Engine Cooling - I6 3.2L Petrol, Removal and Installation).
5. Remove the engine and front suspension as an assembly.
6. LH Side: Remove the air intake pipe.
7. LH Side: Release the battery junction box and position aside.
8. RH Side: Remove the windshield washer reservoir.
   For additional information, refer to: Windshield Washer Reservoir (501-16 Wipers and Washers, Removal and Installation).
9. Release and lay aside the wiring harness.
10. Mill out the spot welds.



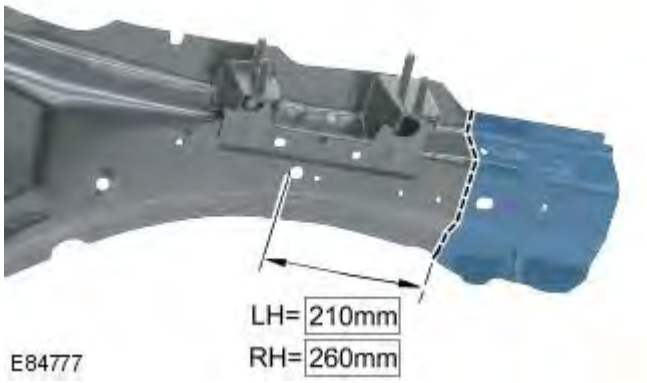


11. Saw cut the old panel at the point illustrated.

12. Separate the joints and remove the old panel.

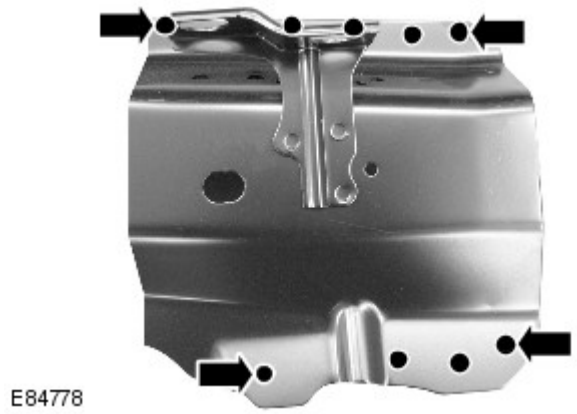
Installation

1. Saw cut the new section from the service panel, ensure the cut is made to align with the cut in the old panel.

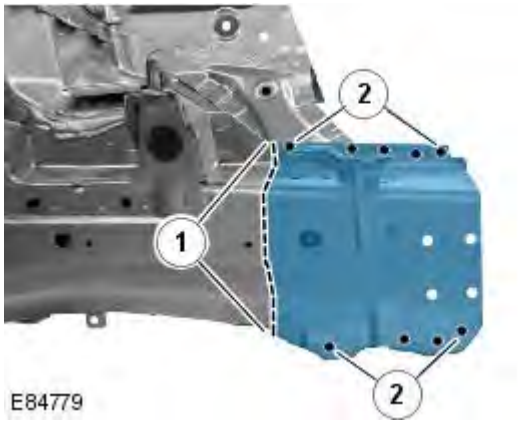


2. Prepare the old and new panel joint surfaces.

3. Drill holes in the new panel ready for MIG plug welding.



4. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

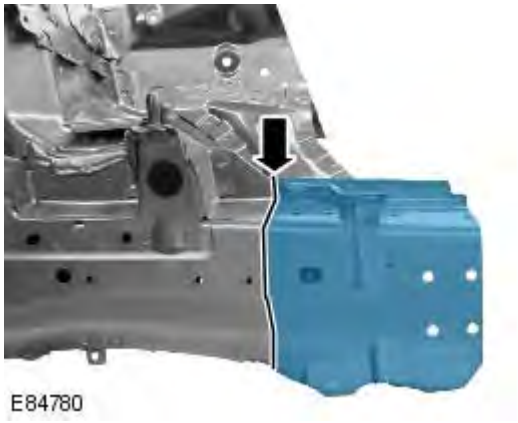


5. With panels clamped into position:

1. Tack weld the butt joint.
2. MIG plug weld.

6. Dress the tack welds.

7. MIG weld the butt joint.



8. Dress all welded joints.

9. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Fender Apron Panel

Removal and Installation

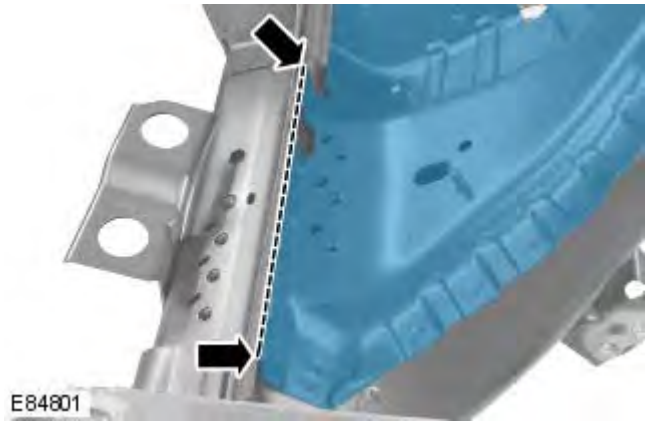
Removal

• NOTE: The fender apron panel is serviced as a separate weld-on panel. It is an assembly of the fender apron panel reinforcement, fender apron lower panel and fender apron panel front extension.

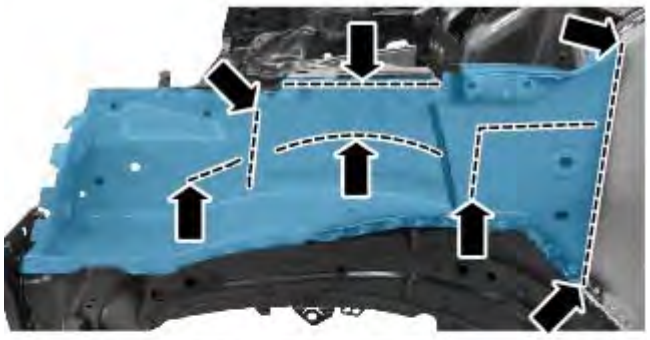
• NOTE: The panel is serviced less its weld studs

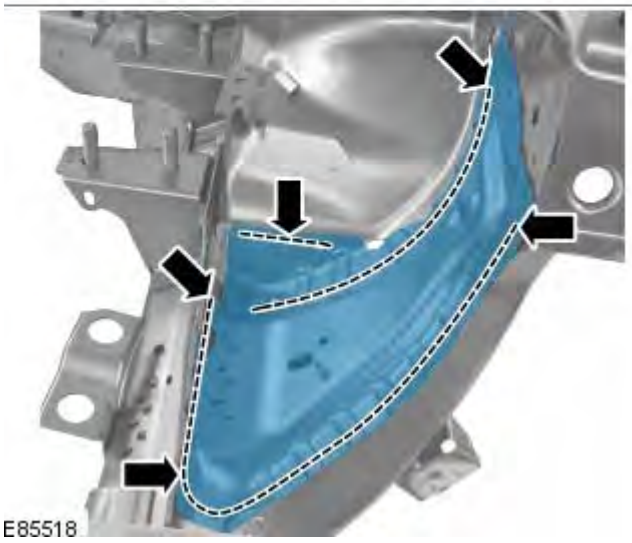
1. The fender apron panel is replaced in conjunction with:
   - Front bumper cover
   - Hood latch panel
   - Both front fenders
   - Fender apron upper panel
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the fender apron upper panel.
   For additional information, refer to: Fender Apron Upper Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).
4. LH Side: Remove the air cleaner.
   For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - I6 3.2L Petrol, Removal and Installation).
5. LH Side: Remove the air intake pipe.
6. LH Side: Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
7. LH Side: Remove the engine lower support insulator.
   For additional information, refer to: Engine Lower Support Insulator (303-01A Engine - I6 3.2L Petrol, Removal and Installation).
8. LH Side: Release the battery junction box and position aside.
9. RH Side: Drain the cooling system.
   For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - I6 3.2L Petrol, General Procedures).
10. RH Side: Evacuate the A/C system.
    For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
11. RH Side: Remove the power steering reservoir.
    For additional information, refer to: Power Steering Fluid Reservoir (211-02 Power Steering, Removal and Installation).
12. RH Side: Release the coolant expansion tank and position aside.
13. RH Side: Remove the engine mounting bracket.
    For additional information, refer to: Engine Mount RH (303-01A Engine - I6 3.2L Petrol, Removal and Installation).
14. RH Side: Remove the windshield washer reservoir.
    For additional information, refer to: Windshield Washer Reservoir (501-16 Wipers and Washers, Removal and Installation).
15. RH Side: Remove the fender apron A/C pipes.
16. Remove the shock absorber and spring assembly.
    For additional information, refer to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation).
17. Release and lay aside the wiring harness.

18. Use a belt sander to remove 5 x spot welds.



19. Mill out the remaining spot welds.



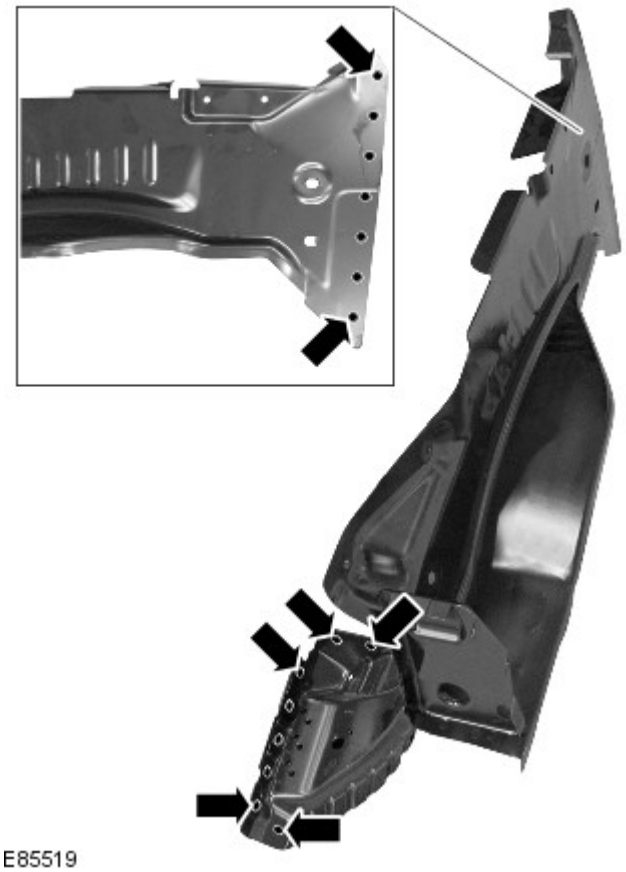


20. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.

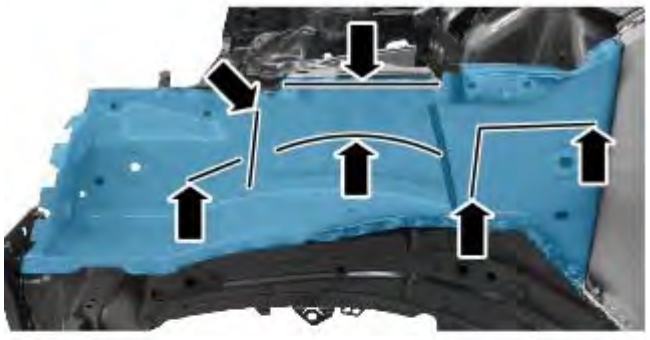
2. Drill holes in the new panel ready for MIG plug welding.

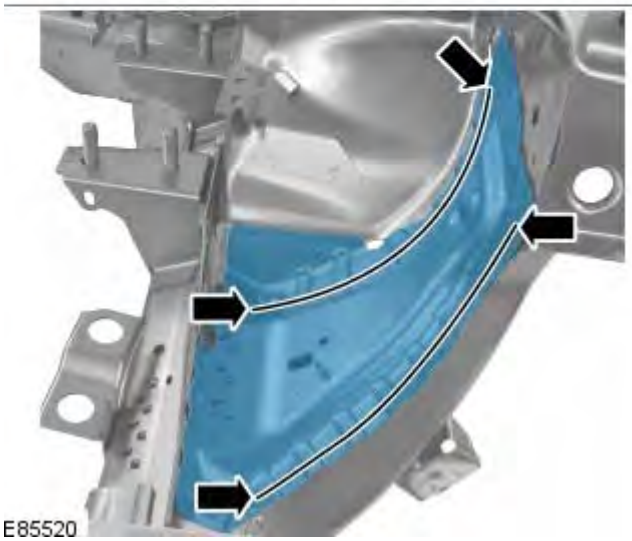


E85519

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

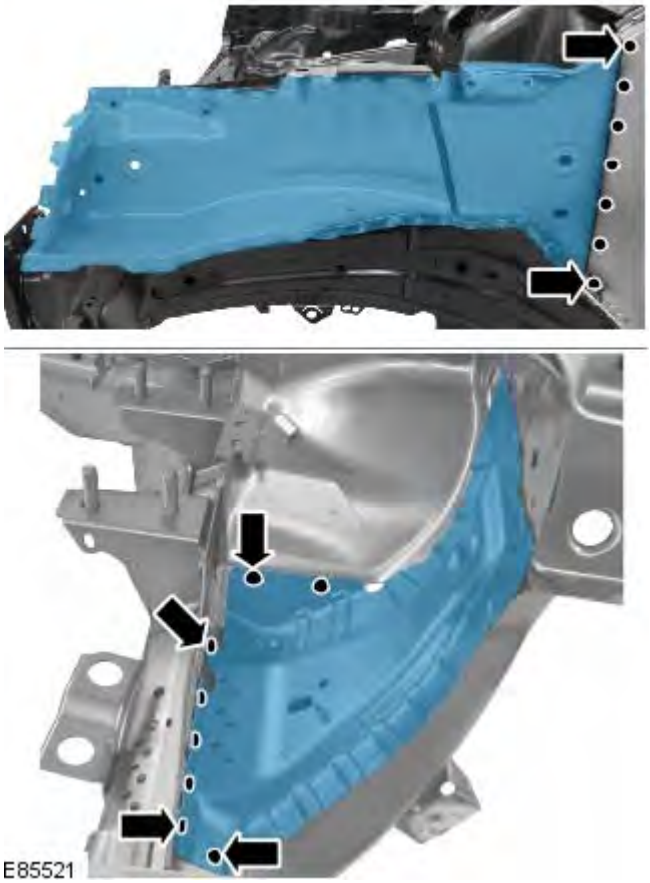
4. Spot weld.



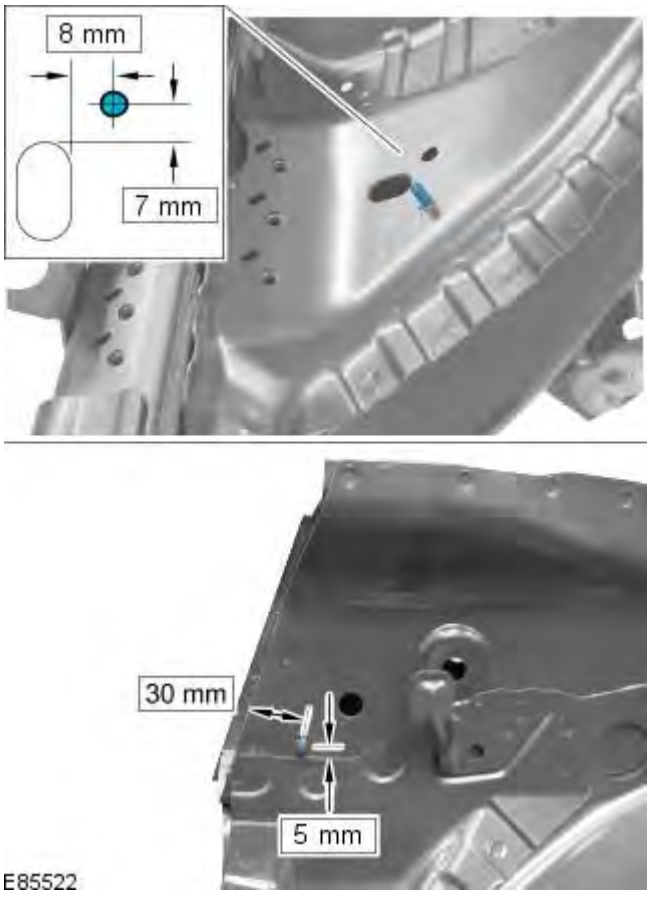


E85520

5. MIG Plug weld.



6. Install weld studs.



7. Dress all welded joints.

8. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Fender Apron Panel Reinforcement

Removal and Installation

Removal

• NOTE: The fender apron panel reinforcement has to be unpicked from the fender apron panel service panel, it is not available separately.

• NOTE: The RH panel is serviced less its weld studs

1. The fender apron panel reinforcement is replaced in conjunction with:
   - Front bumper cover
   - Hood latch panel
   - Both front fenders
   - Fender apron upper panel
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the fender apron upper panel.
   For additional information, refer to: Fender Apron Upper Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).
4. Remove the front shock absorber.
   For additional information, refer to: Front Shock Absorber (204-01 Front Suspension, Removal and Installation).
5. LH Side: Remove the engine support insulator.
   For additional information, refer to: Engine Upper Support Insulator (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).
6. LH Side: Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
7. LH Side: Remove the air intake pipe.
8. LH Side: Release the battery junction box and position aside.
9. RH Side: Remove the windshield washer reservoir.
   For additional information, refer to: Windshield Washer Reservoir (501-16 Wipers and Washers, Removal and Installation).
10. RH Side: Remove the engine mounting bracket.
    For additional information, refer to: Engine Mount RH (303-01B Engine - TD4 2.2L Diesel, Removal and Installation).
11. RH Side: Release the coolant expansion tank and lay it aside.
12. RH Side: Evacuate the A/C system.
    For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
13. RH Side: Remove the fender apron A/C pipes.
14. RH Side: Release and lay aside the insulating material at the bulkhead.
15. Release and lay aside the wiring harness.

16. Mill out the spot welds.

E85488

17. Separate the joints and remove the old panel.

Installation

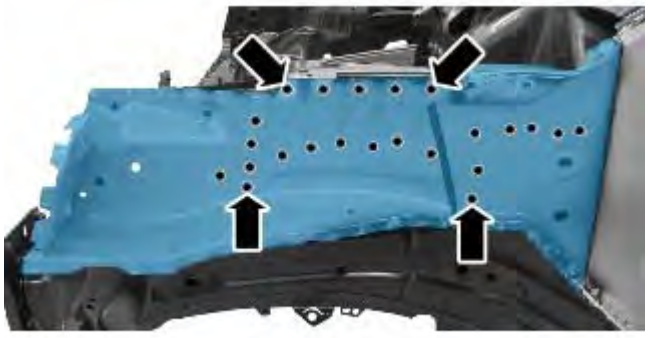
1. Prepare the old and new panel joint surfaces.

2. Drill holes in the new panel ready for MIG plug welding.

E85489

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. Spot weld.

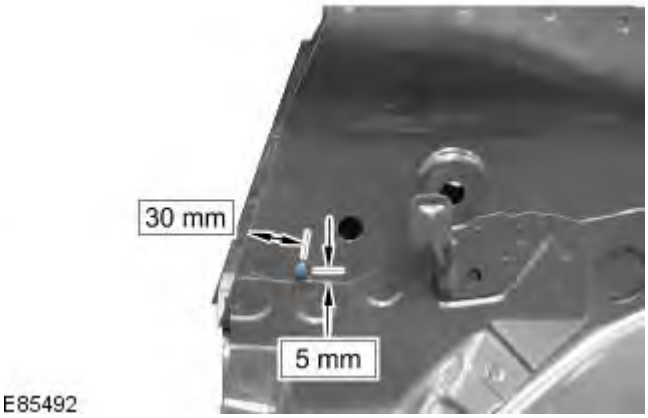


E85559

5. MIG Plug weld.

E85490

6. Install weld studs.



E85492

7. Dress all welded joints.

8. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Fender Apron Panel Front Extension

Removal and Installation

Removal

• NOTE: The fender apron panel front extension has to be unpicked from the fender apron panel, it is not serviced separately.

1. The fender apron panel front extension is replaced in conjunction with:
   - Front bumper cover
   - Hood latch panel
   - Both front fenders
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the hood latch panel.
   For additional information, refer to: Hood Latch Panel (501-27, Removal and Installation).
4. Mill out the spot welds.

5. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.
2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.
3. Spot weld at the points illustrated.

4. Dress all welded joints.
5. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Fender Apron Lower Panel

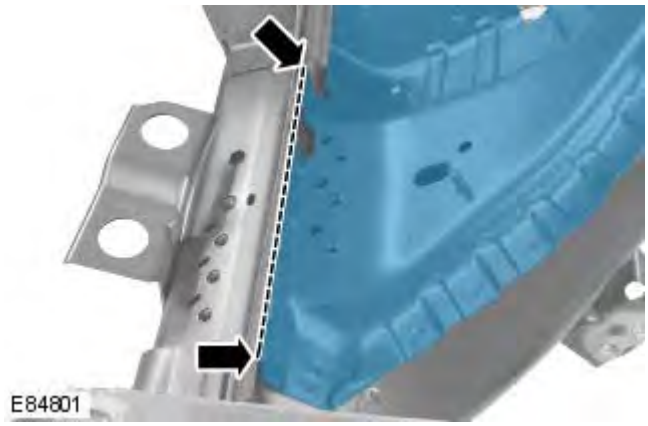
Removal and Installation

Removal

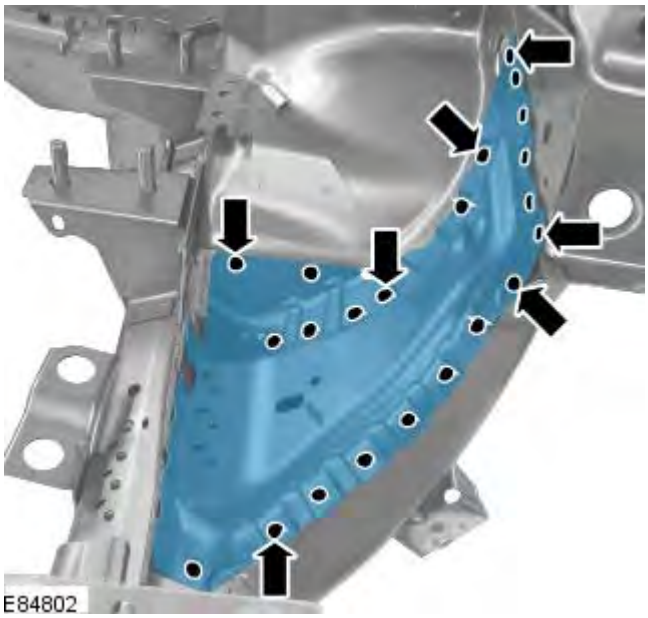
• NOTE: The fender apron lower panel is to be removed from the fender apron panel service panel; it is not available separately.

• NOTE: The panel is serviced less its weld studs

1. The fender apron lower panel is replaced in conjunction with:
   - Front bumper cover
   - Hood latch panel
   - Both front fenders
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the hood latch panel.
   For additional information, refer to: Hood Latch Panel (501-27, Removal and Installation).
4. Use a belt sander to sand down the spot welds in the area illustrated.



5. Mill out the remaining spot welds.



6. Separate the joints and remove the old panel.

Installation

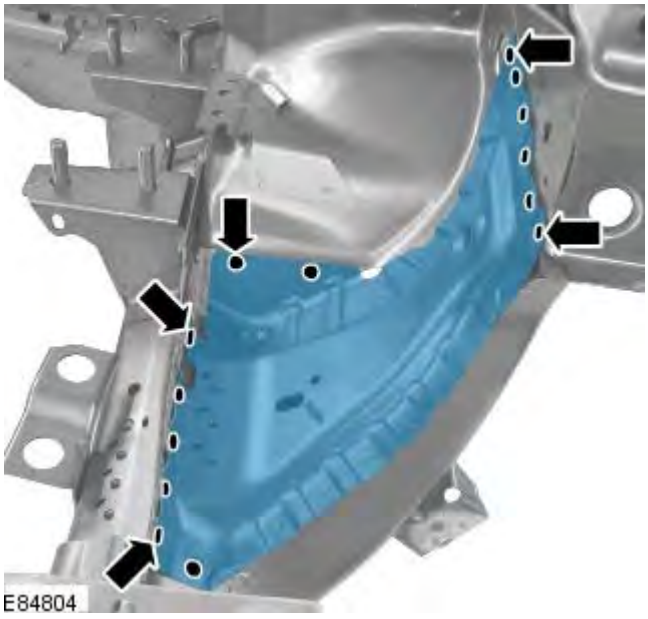
1. Prepare the old and new panel joint surfaces.

2. Drill holes in the new panel ready for MIG plug welding.

E84803

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

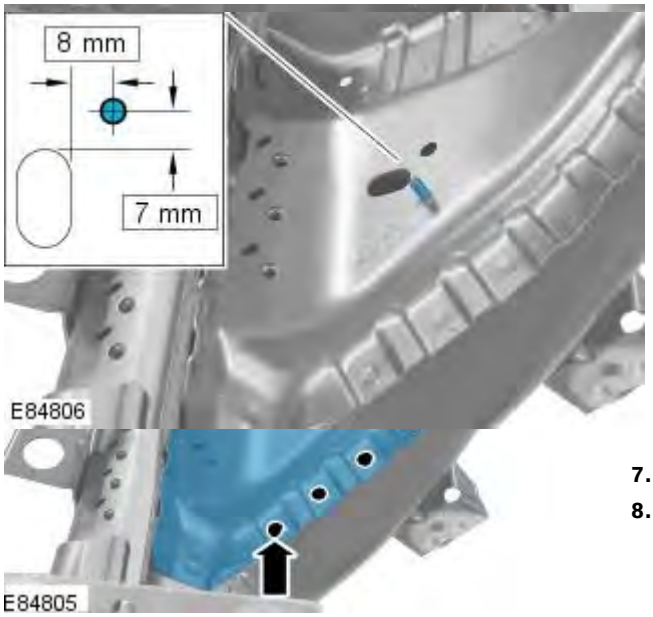
4. MIG Plug weld.



E84804

5. Spot weld.

6. Install weld stud.



E84806

E84805

7. Dress all welded joints.

8. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Fender Apron Upper Panel

Removal and Installation

Removal

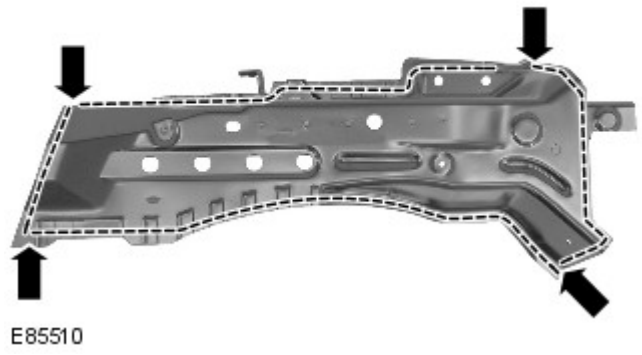
• NOTE: The fender apron upper panel is serviced as a separate weld-on panel.

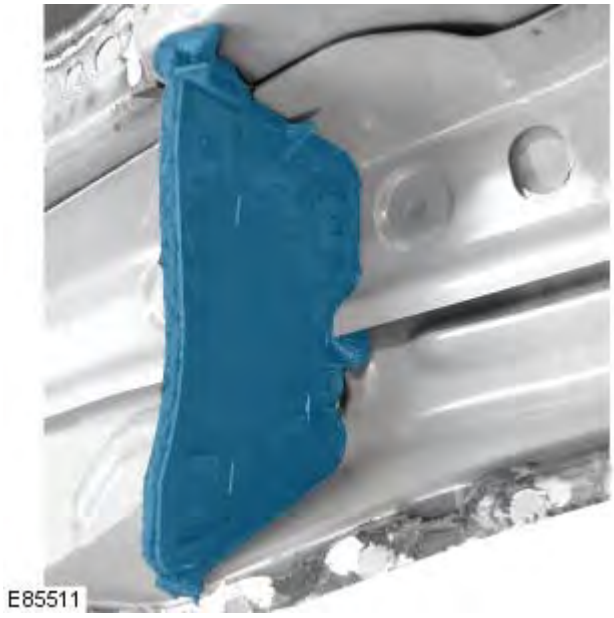
• NOTE: The service panel is not fully welded.

• NOTE: There is an NVH element attached inside this panel, it is not serviced on the new panel. Therefore, if damaged, a new element will be required.

1. The fender apron upper panel is replaced in conjunction with:
   - Front bumper cover
   - Hood
   - Hood latch panel
   - Both front fenders
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the hood latch panel.
   For additional information, refer to: Hood Latch Panel (501-27, Removal and Installation).
4. Remove the hood.
5. Remove the plenum chamber panel.
   For additional information, refer to: Plenum Chamber (412-01 Climate Control, Removal and Installation).
6. LH Side: Remove the air intake pipe.
7. RH Side: Release and lay aside the wiring harness.
8. Remove the hood hinge, 2 x 13mm headed bolts.

9. Mill out the spot welds.

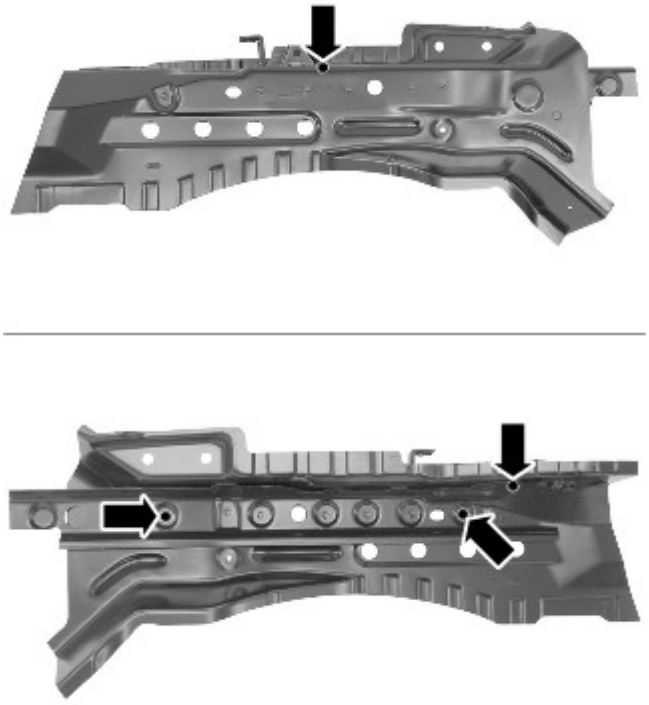



E85511

10. Separate the joints and remove the old panel, including its NVH element.

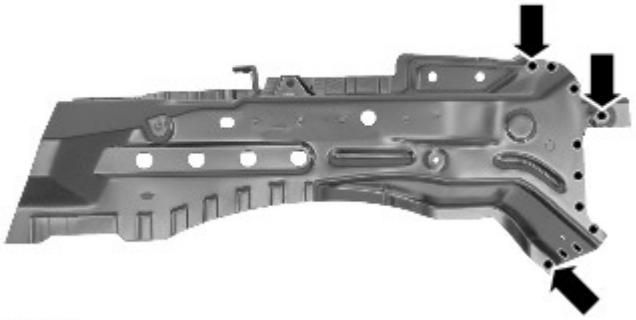
Installation

1. Prepare and spot weld the new panel in the areas illustrated, where it is not fully welded.


E85512

2. Prepare the old and new panel joint surfaces.

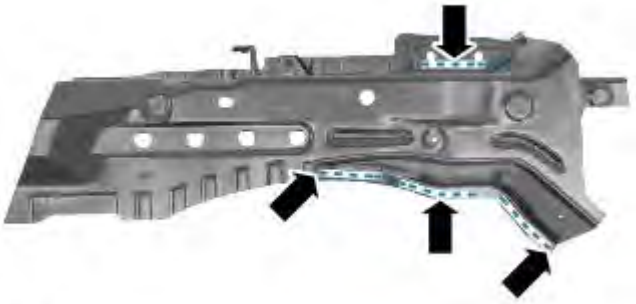
3. Drill holes in the new panel ready for MIG plug welding.



E85513

4. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

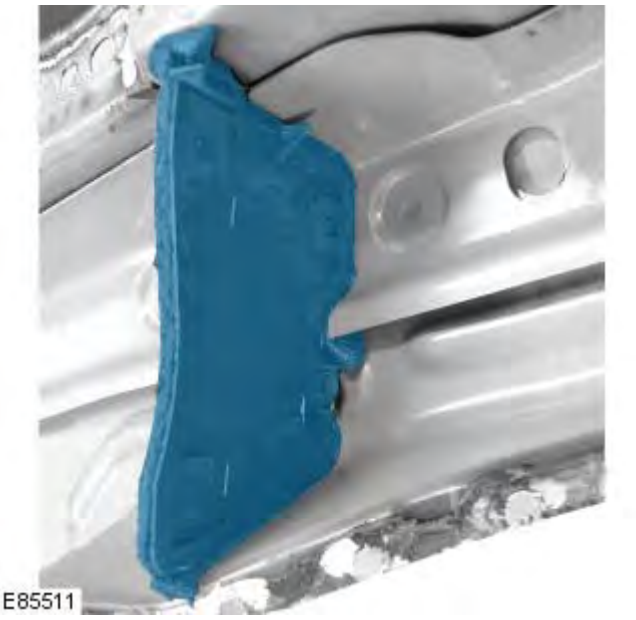
5. Remove the panel and apply adhesive to the areas illustrated.



E85514

6. If necessary, renew the NVH element.

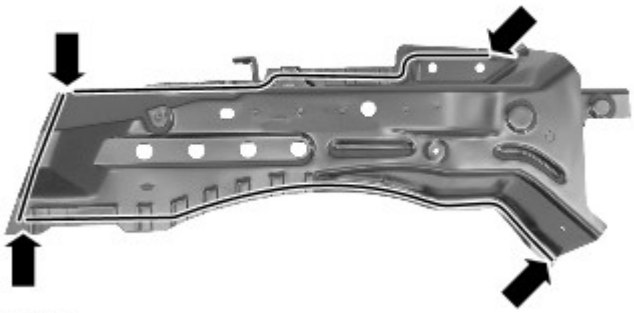
7. Apply sealer adhesive to the NVH element.



E85511

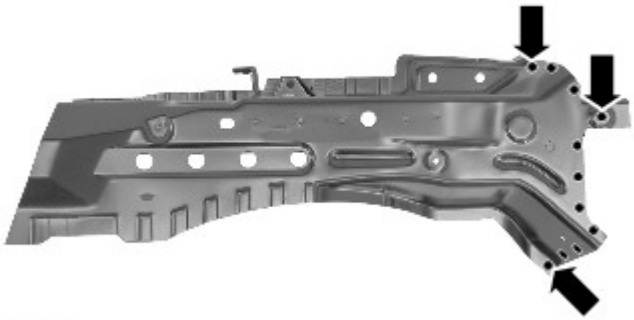
8. Offer up the new panel and clamp into position.

9. Spot weld at the points illustrated.



E85515

10. MIG Plug weld.



E85516

11. Dress all welded joints.

12. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Front Side Member Closing Panel

Removal and Installation

Removal

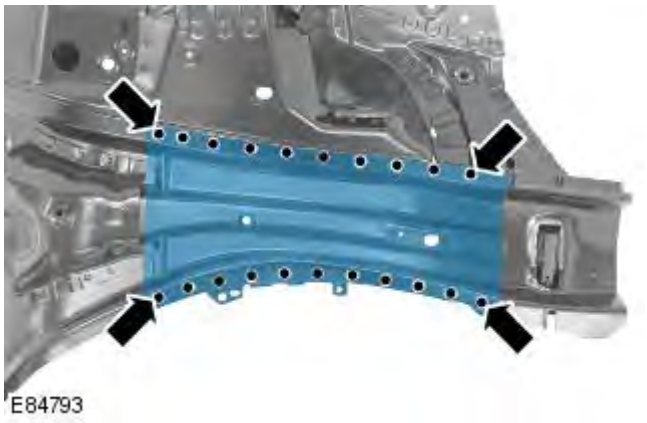
• NOTE: The front side member closing panel must be unpicked from the front side member and suspension top mount assembly, it is not serviced separately.

• NOTE: The panel is serviced less its weld studs

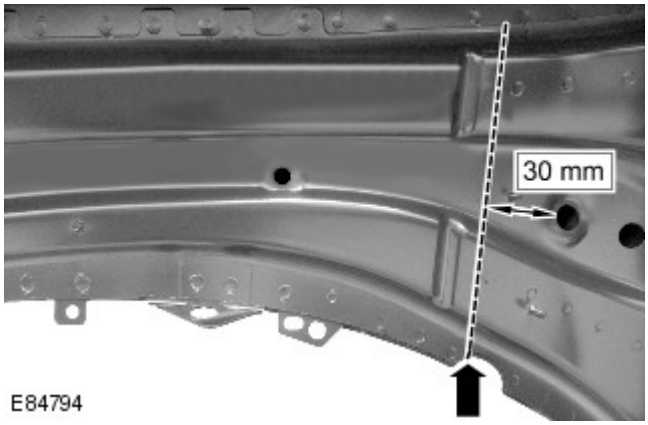
1. The front side member closing panel is replaced in conjunction with:
   - Front bumper cover
   - Front bumper
   - Hood latch panel
   - Both front fenders
   - Front bumper mounting
   - Fender apron lower panel
   - Fender apron panel front reinforcement
   - Front side member

• NOTE: It is also necessary to remove the engine and suspension as an assembly.

2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the front side member.
   For additional information, refer to: Front Side Member (501-27 Front End Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.

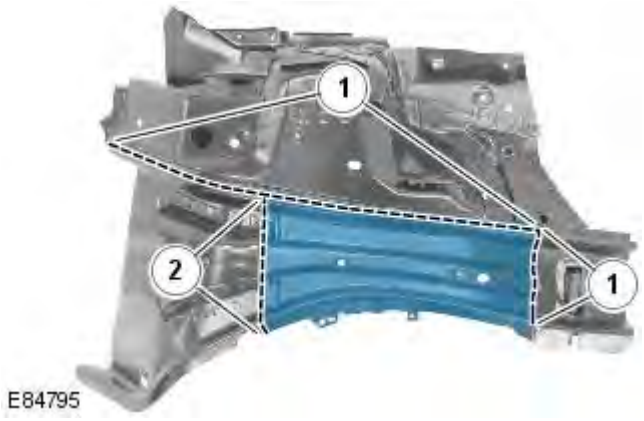


5. Saw cut the old panel at the point illustrated.



6. Separate the joints and remove the old panel.

Installation



E84795

1. Remove the panel from the service panel.

1. Mill out the spot welds.
2. Saw cut, ensuring the cut aligns with the one already made on the vehicle.

2. Prepare the old and new panel joint surfaces.

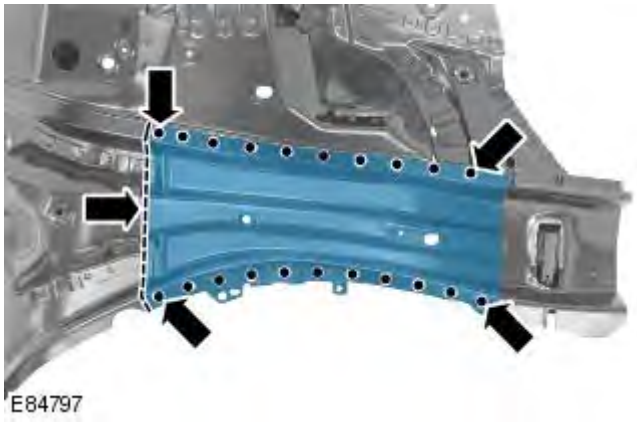
3. Drill holes in the new panel ready for MIG plug welding.

E84796

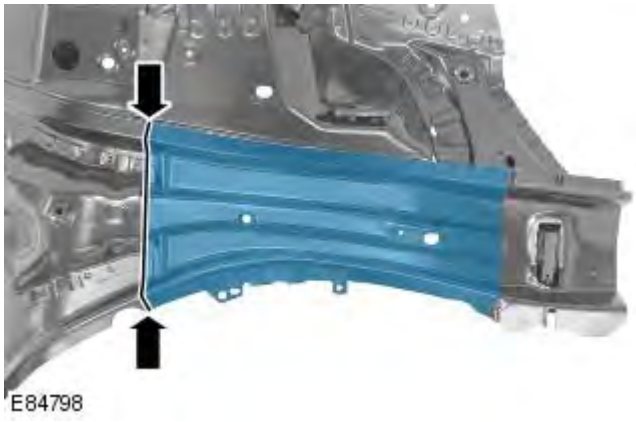
4. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

5. With panels clamped into position:

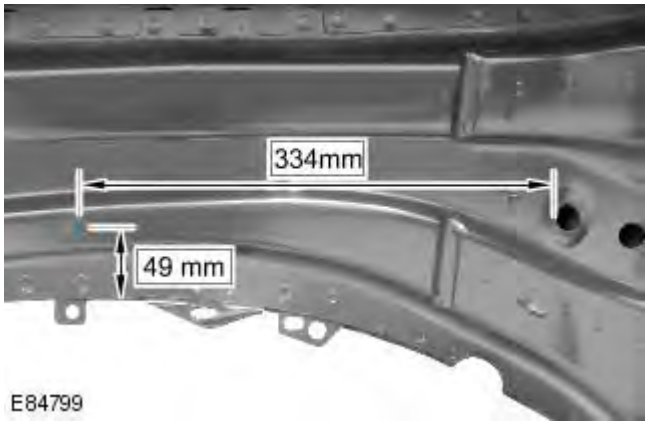
1. Tack weld the butt joint.
2. MIG plug weld.


E84797

6. Dress the tack welds.


E84798

7. MIG weld the butt joint.



E84799

8. Install weld stud.

9. Dress all welded joints.

10. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Front End Sheet Metal Repairs - Fender Apron Panel Front Reinforcement

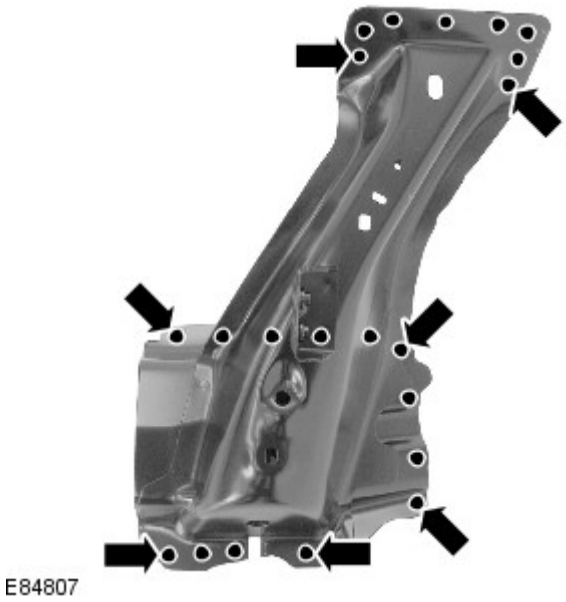
Removal and Installation

Removal

• NOTE: The fender apron panel front reinforcement has to be removed from the fender apron panel service panel; it is not available as a separate panel.

• NOTE: The panel is serviced less its weld studs

1. The front side member and fender apron panel is replaced in conjunction with:
   - Front bumper cover
   - Front bumper
   - Hood
   - Hood latch panel
   - Both front fenders
   - Fender apron lower panel
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the fender apron lower panel.
   For additional information, refer to: Fender Apron Lower Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.



E84807

5. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.

2. Drill holes in the new panel ready for MIG plug welding.

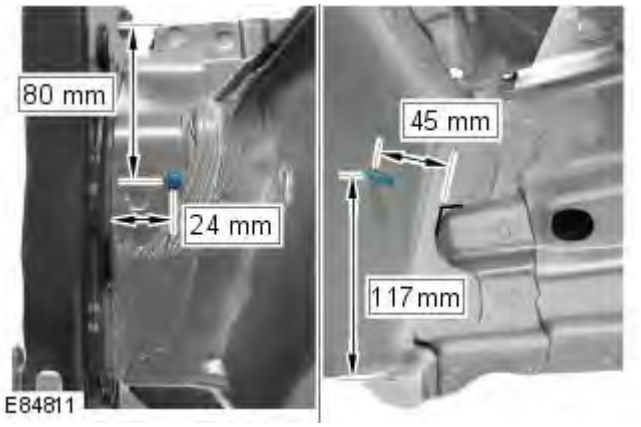
E84807

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step. If not, rectify and recheck before proceeding.

4. MIG Plug weld.

E84807

5. Install weld studs.



E84811

6. Dress all welded joints.

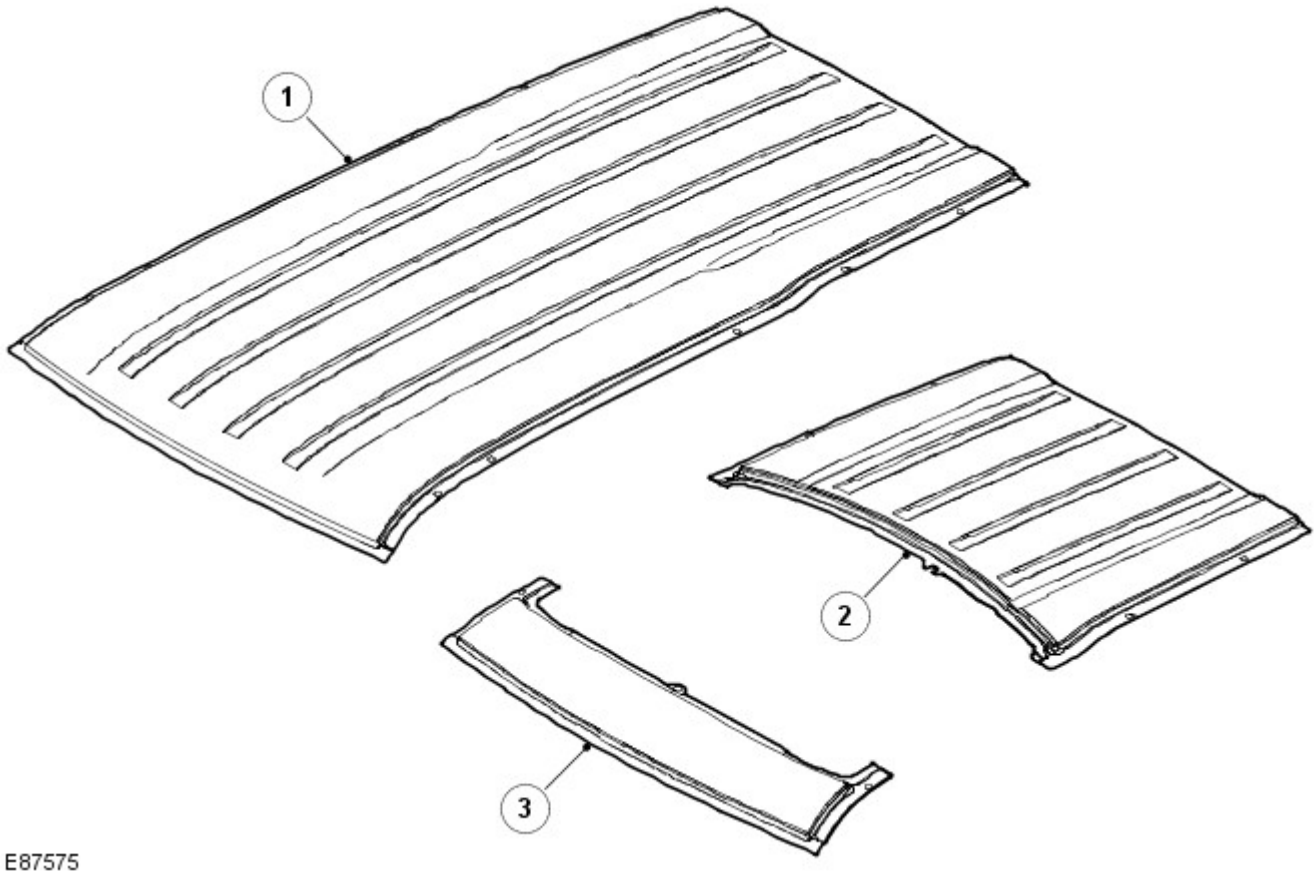
7. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Roof Sheet Metal Repairs - Roof

Description and Operation

Roof service panels



E87575

Item	Description
1	Roof panel
2	Roof rear panel
3	Roof front panel

Time schedules, roof panels

The following times relate to the replacement of the roof panels as single panels. The published times include the removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends to adjacent panels are not included). A corrosion protection time is included where appropriate.

The times were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only, based on new undamaged panels. Job allowances are not included, as a guide Thatcham recommend 0.3 hours to be added to single panel times.

Single panel times

Panel Description	Times
Roof panel	**20.3**
Roof rear panel	**16.4**
Roof front panel	**14.4**

Published: 11-May-2011

Roof Sheet Metal Repairs - Roof PanelVehicles Without: Sliding Roof Opening Panel

Removal and Installation

Removal

• NOTE: The roof is serviced as a separate weld on panel, less its reinforcements.

• NOTE: Along the RH and LH sides of the panel, spot welds should be installed adjacent to the originals and not in the same locations.

1. The roof panel is replaced in conjunction with:
   - Liftgate
   - Windshield
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Disconnect both battery cables.
4. Remove the liftgate.
   For additional information, refer to: Liftgate (501-03 Body Closures, Removal and Installation).
5. Remove the windshield glass.
   For additional information, refer to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
6. Remove both front seats.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).
7. Remove the rear seat.
8. Remove both side air curtain modules.
   For additional information, refer to: Side Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).
9. Remove both front safety belt retractors.
   For additional information, refer to: Front Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).
10. Remove both rear safety belt retractors.
    For additional information, refer to: Rear Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).
11. Release and lay aside the wiring harness.

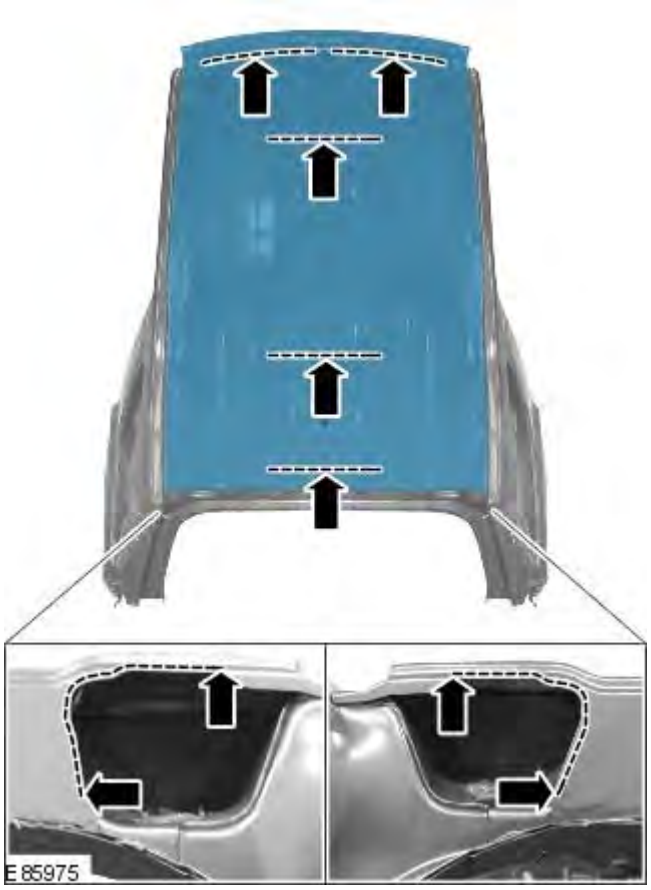
12. Remove 10 21mm headed bolts.

E85973

13. Mill out the spot welds.

E85974

14. Cut through the adhesive to separate the reinforcements from the roof panel.

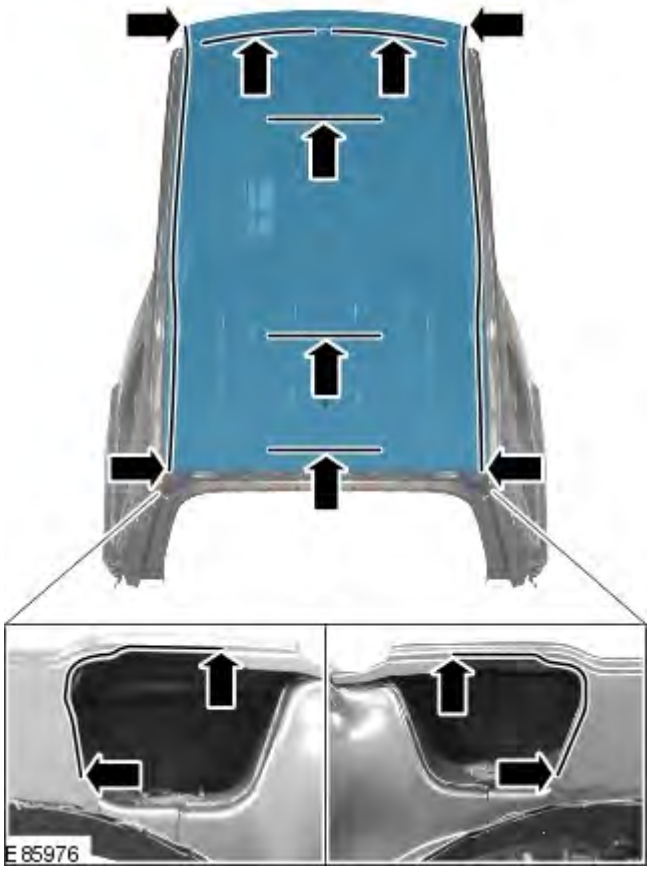


15. Separate the remaining joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.

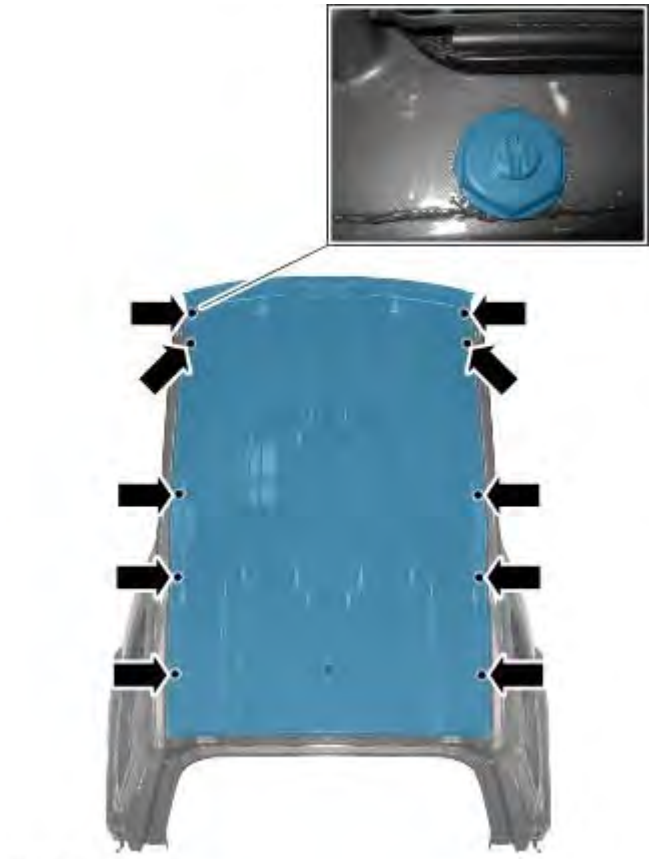
2. Apply adhesive, in the areas illustrated.



3. Offer up the new panel and clamp into position. Check

alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. Install 10 21mm bolts.



E85977

5. NOTE: Along the RH and LH sides of the panel, spot welds should be installed adjacent to the originals and not in the same locations.

Spot weld.

E85978

6. Dress all welded joints.

7. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Roof Sheet Metal Repairs - Roof Front PanelVehicles With: Sliding Roof Opening Panel

Removal and Installation

Removal

• NOTE: The roof front panel is serviced as a separate weld-on panel.

1. The roof front panel is replaced in conjunction with:
   - Windshield
   - Roof opening panel
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Disconnect both battery cables.
4. Remove the windshield glass.
   For additional information, refer to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
5. Remove both front seats.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).
6. Remove the roof opening panel.
   For additional information, refer to: Roof Opening Panel (501-17 Roof Opening Panel, Removal and Installation).
7. Remove both side air curtain modules.
   For additional information, refer to: Side Air Curtain Module (501-20B Supplemental Restraint System, Removal and Installation).
8. Remove both front safety belt retractors.
   For additional information, refer to: Front Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).
9. Remove both rear safety belt retractors.
   For additional information, refer to: Rear Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).
10. Release and lay aside the wiring harness.
11. Remove 2 21mm headed bolts, 1 each side.

12. Mill out the spot welds.

13. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.

2. Apply adhesive, in the areas illustrated.

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. Install 2 21mm bolts.

5. Spot weld.

6. Dress all welded joints.

7. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Roof Sheet Metal Repairs - Roof Rear PanelVehicles With: Sliding Roof Opening Panel

Removal and Installation

Removal

• NOTE: The roof rear panel is serviced as a separate weld-on panel, less its reinforcements.

• NOTE: Along the RH and LH sides of the panel, spot welds should be installed adjacent to the originals and not in the same locations.

1. The roof rear panel is replaced in conjunction with:

- Liftgate
- Roof opening panel

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Disconnect both battery cables.

4. Remove the liftgate.
For additional information, refer to: Liftgate (501-03 Body Closures, Removal and Installation).

5. Remove both front seats.
For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

6. Remove the rear seat.

7. Remove the roof opening panel.
For additional information, refer to: Roof Opening Panel (501-17 Roof Opening Panel, Removal and Installation).

8. Remove both side air curtain modules.
For additional information, refer to: Side Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

9. Remove both front safety belt retractors.
For additional information, refer to: Front Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).

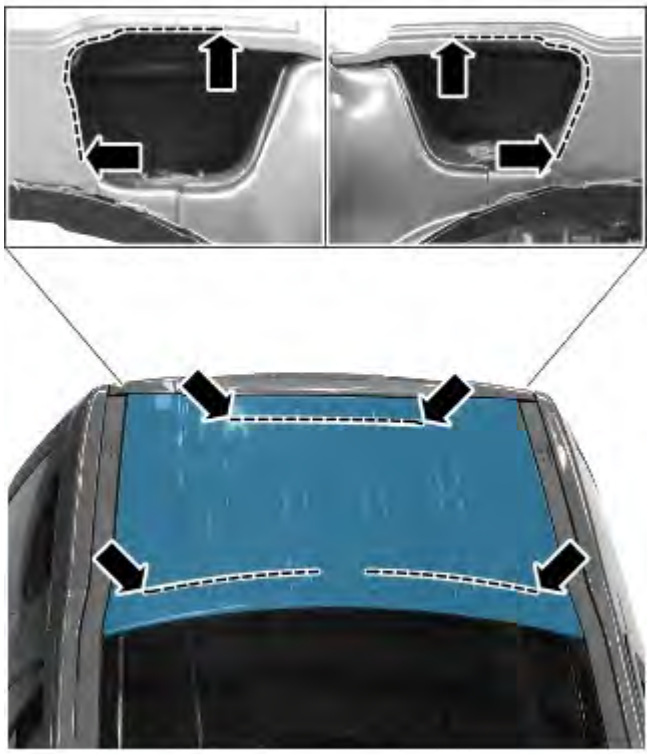
10. Remove both rear safety belt retractors.
For additional information, refer to: Rear Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).

11. Release and lay aside the wiring harness.

12. Remove 4 21mm headed bolts, 2 each side.

13. Mill out the spot welds.

14. Cut through the adhesive to separate the reinforcements from the roof rear panel.

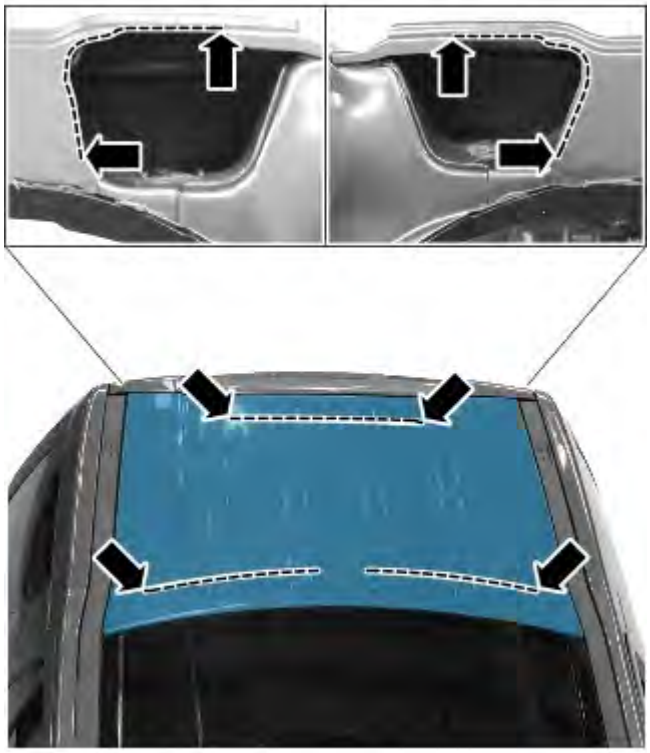


15. Separate the remaining joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.

2. Apply adhesive, in the areas illustrated.



E87465

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. Install 4 21mm bolts.

E87467

5. NOTE: Along the RH and LH sides of the panel, spot welds should be installed adjacent to the originals and not in the same locations.

Spot weld.

E87469

6. Dress all welded joints.

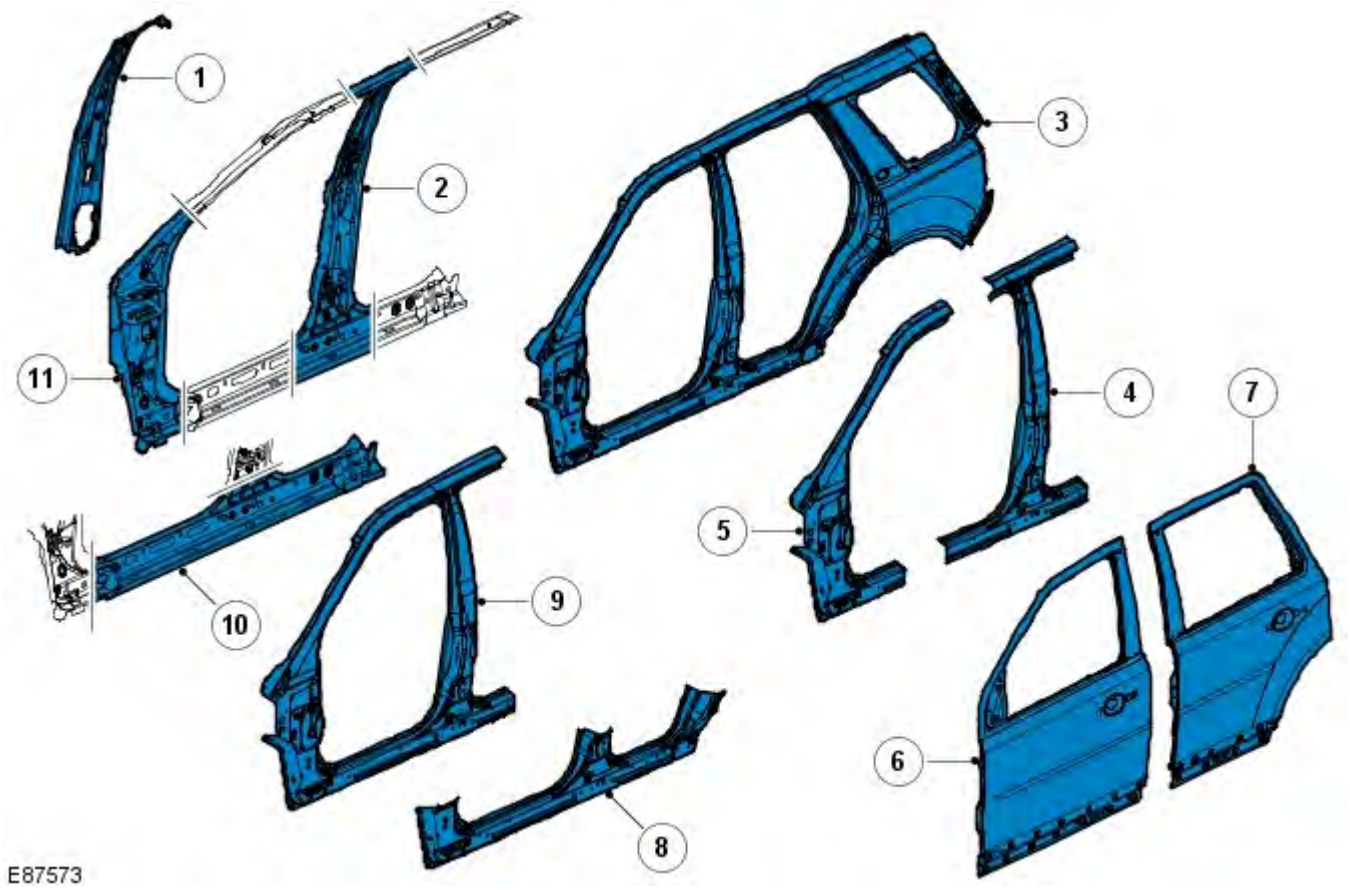
7. The installation of associated panels and mechanical

Published: 11-May-2011

Side Panel Sheet Metal Repairs - Side Panel Sheet Metal

Description and Operation

Side service panels



Item	Description
1	B-Pillar inner panel
2	B-Pillar reinforcement
3	Side panel
4	B-Pillar outer panel
5	A-Pillar outer panel
6	Front door
7	Rear door
8	Rocker panel
9	Side panel front section
10	Rocker panel inner reinforcement
11	A-Pillar reinforcement

paragraph

Time schedules, side panels

The following schedules show the total time taken to replace single panels and also combinations of panels. The published times include the removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends to adjacent panels are not included). A corrosion protection time is included where appropriate.

The times were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only, based on new undamaged panels. Job allowances are not included, as a guide Thatcham recommend 0.3 hours to be added to single panel times and 0.5 hours to be added to combination times.

Single panel times

Panel Description	Times
Front fender	**5.5**
Door front	**6.9**
Door rear	**6.6**
Rocker panel	**L/H 22.8** **R/H 22.7**
Quarter panel	**L/H 22.9** **R/H 24.1**
Instrument panel remove and install	**6.2**
Headliner remove and install	**3.3**
Windshield glass remove and install	**1.9**

Combination panel replacement times

Combination panel times

Panel Description	Times
Door front	
Front fender	
Total Time	**L / H 8.9** **R / H 8.9**

Combination panel times

Panel Description	Times
Door rear	
Quarter panel	
Headliner remove and install	
Total Time	**L / H 27.0** **R / H 28.3**

Combination panel times

Panel Description	Times
Door front	
Door rear	
B-Pillar outer panel	
B-Pillar reinforcement	
B-Pillar inner panel	
Headliner remove and install	
Total Time	**L / H 39.0** **R / H 39.2**

Combination panel times

Panel Description	Times
Door front	
Door rear	
Front fender	
Quarter panel	
Headliner remove and install	
Total Time	**L / H 32.2** **R / H 33.5**

Combination panel times

Panel Description	Times
Door front	
Front fender	
A-Pillar outer panel	
A-Pillar reinforcement	
Instrument panel remove and Install	
Headliner remove and Install	
Windshield glass remove and Install	
Total Time	**L / H 37.2** **R / H 37.5**

Published: 11-May-2011

Side Panel Sheet Metal Repairs - Side Panel

Removal and Installation

Removal

CAUTION: The side panel must be MIG slot brazed to its reinforcement, which contains DP600, (Dual Phase steel). **MIG plug welds / spot welds, must not be used.**

• NOTE: The side panel is serviced as a separate weld on panel, serviced less the fender mounting bracket, which is serviced separately.

• NOTE: There are NVH elements attached inside this panel, they are not serviced on the new panel. If damaged, new element/s will be required.

1. The side panel is replaced in conjunction with:

- Front bumper cover
- Front fender
- Hood
- Front door
- Rear door
- Quarter glass
- Instrument panel
- Windshield glass
- Headliner
- Rear bumper cover

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) /
Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the hood.

4. Remove the front fender.

5. Remove the front door.
For additional information, refer to: Front Door (501-03 Body Closures, Removal and Installation).

6. Remove the rear door.
For additional information, refer to: Rear Door (501-03 Body Closures, Removal and Installation).

7. Remove the headliner.
For additional information, refer to: Headliner - Vehicles Without: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) /
Headliner - Vehicles With: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

8. Remove the instrument panel.
For additional information, refer to: Instrument Panel - TD4 2.2L Diesel (501-12 Instrument Panel and Console, Removal and Installation).

9. Remove the windshield glass.
For additional information, refer to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).

10. Remove the rear quarter glass.
For additional information, refer to: Rear Quarter Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).

11. Remove the rear bumper cover.
For additional information, refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).

12. Remove the upper and lower door hinges from the A-Pillar, 4 x bolts.

13. Remove the upper and lower door hinges from the B-Pillar, 4 x bolts.

14. Remove the front door striker from the B-Pillar.

15. Remove the rear door striker from the C-Pillar.

16. Remove the roof moulding, front and rear sections.

17. Remove the side air curtain module.
For additional information, refer to: Side Air Curtain Module (501-20B Supplemental Restraint System, Removal and

Installation).

18. Remove the front seat.
For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

19. Remove the floor console.
For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

20. Remove the RH & LH rocker panel inner trims.

21. Remove the rear seat cushion.
For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).

22. Remove the rear carpet section.

23. Remove the B-Pillar side impact sensor.
For additional information, refer to: B-Pillar Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation).

24. Remove the front safety belt retractor.
For additional information, refer to: Front Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).

25. Remove the rear safety belt retractor.
For additional information, refer to: Rear Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).

26. Release and lay aside the front carpet section.

27. Remove the rear carpet section.

28. Remove the front wheel and tire. LINK

29. Remove the rear wheel and tire.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

30. Remove the rocker panel outer moulding.

31. Remove the liftgate aperture weatherseal.

32. Remove the forced air extraction grille.

33. Release and lay aside the insulating material at the inner bulkhead.

34. Release and lay aside the insulating material at the inner quarter panel.

35. Release and lay aside the wiring harnesses at the A-Pillar, B-Pillar and rocker panel.

36. Release and lay aside the wiring harness along the inner quarter panel and back panel.

37. Release and lay aside the insulating material at the inner quarter panel.

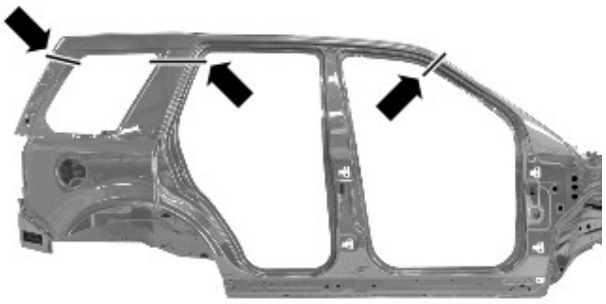
38. RH side: Drain the fuel tank.
For additional information, refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

39. RH side: Remove the fuel tank filler pipe.
For additional information, refer to: Fuel Tank Filler Pipe (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).

40. Remove the fender mounting bracket:

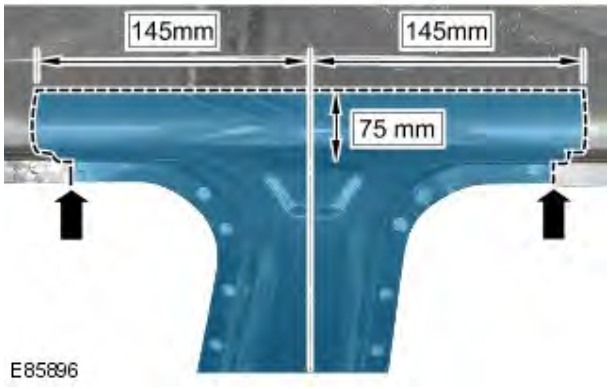
- Mill out 3 spot welds. If not re-using the mounting the upper spot weld does not have to be removed.
- Separate the mounting from the A-Pillar.
- Retain the mounting if it is being reused, if not, discard.

41. Saw cut the old panel at the A-Pillar and rear quarter panel, using the new panel for reference, ensuring that the new panel overlaps the panel remaining on the vehicle.



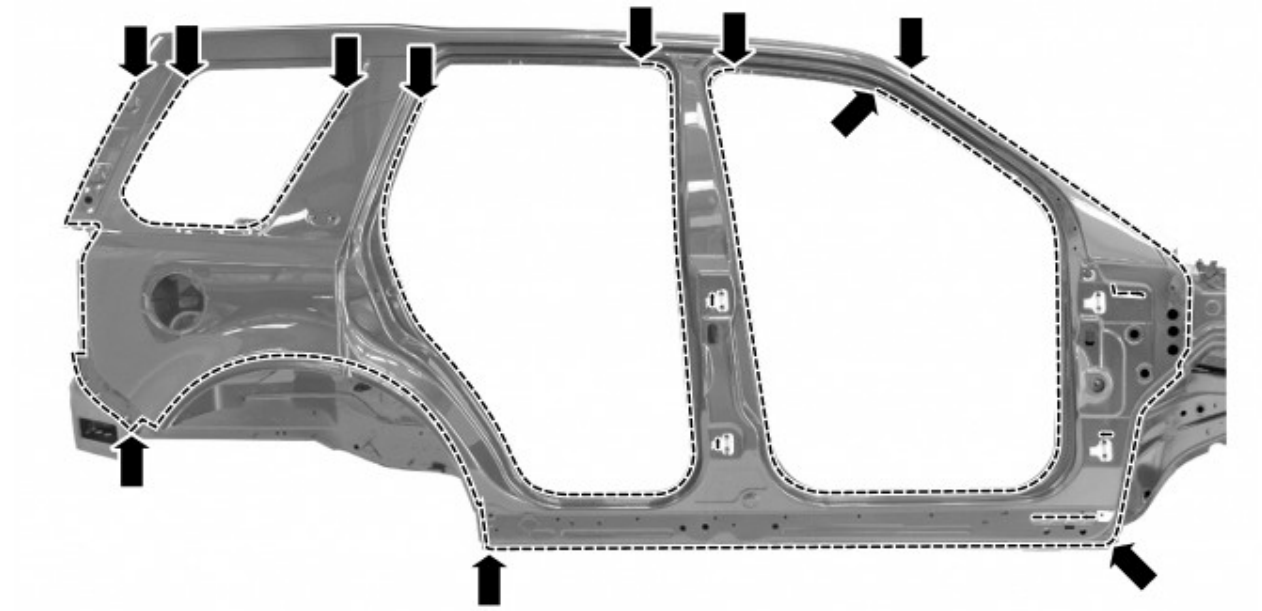
E89254

42. Saw cut the old panel at the B-Pillar, as illustrated, observe the measurements to allow access to the B-Pillar reinforcement.



E85896

43. Mill out the spot welds.

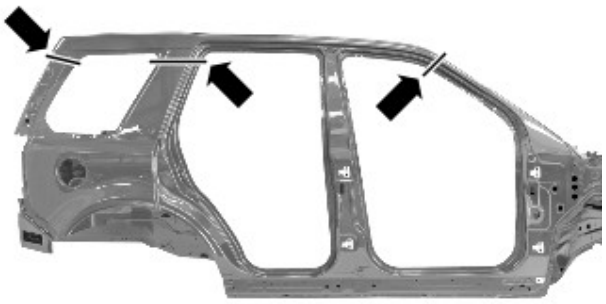


E89258

44. Separate the joints and remove the old panel, also releasing the NVH elements.

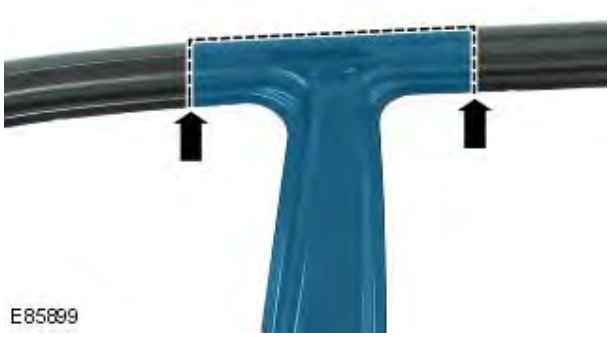
Installation

1. Offer up and align the new panel and clamp into position, overlapping the old panel remaining on the vehicle. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.



E89254

2. Saw cut the new and old panels at the A-Pillar and rear quarter panel, ensuring that the new panel overlaps the panel remaining on the vehicle.



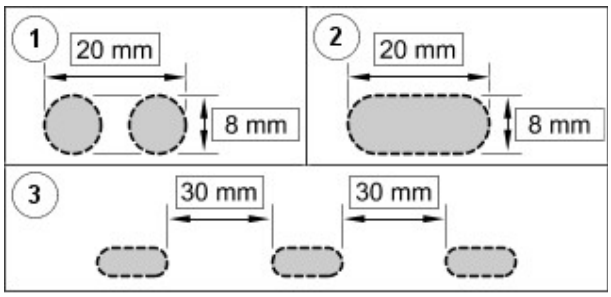
E85899

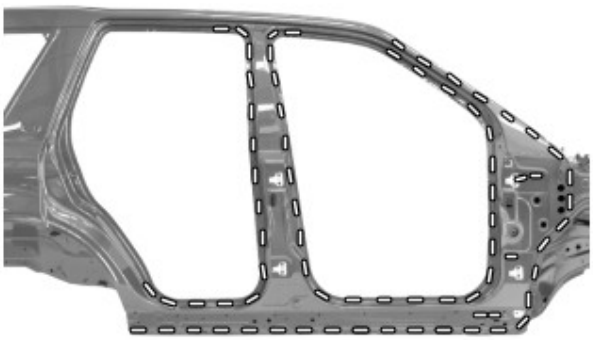
3. Saw cut through the new and old panels at the B-Pillar, where the MIG butt joint is to be made.

4. Remove the new panel and the old remnants.

5. NOTE: MIG slots should be installed in accordance with the spacing shown in the illustration. Where this is not possible, due to the indents in the panel, the slot should be made in the location of the original spot weld.

Cut slots in the new panel ready for MIG brazing.





E89257

6. Drill holes in the new panel ready for MIG plug welding.

E85934

7. Prepare the old and new panel joint surfaces.

8. If necessary, renew the NVH element/s.

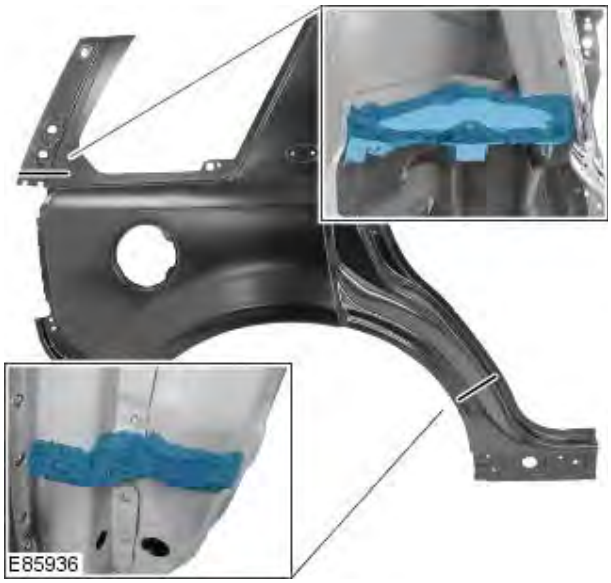
9. Apply sealer adhesive to the NVH element at the A-Pillar.

E85530

10. Apply sealer adhesive to the NVH element at the B-Pillar.

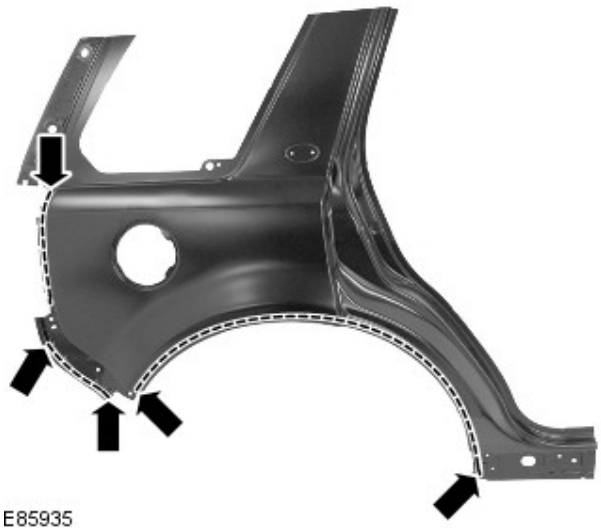
E85901

11. Apply sealer adhesive to the NVH elements at the quarter panel.



12. Apply adhesive to the A-Pillar as illustrated.

13. Apply adhesive to the quarter panel as illustrated.



14. Offer up the new panel and clamp into position.

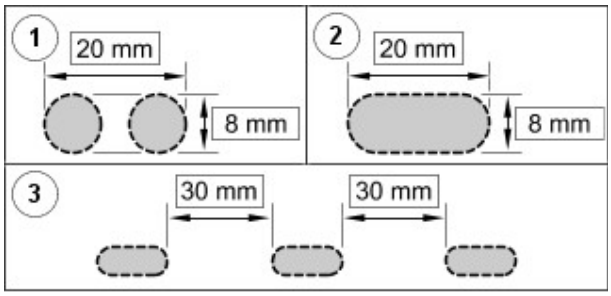
15. Tack weld the butt joints.

16. MIG plug weld.

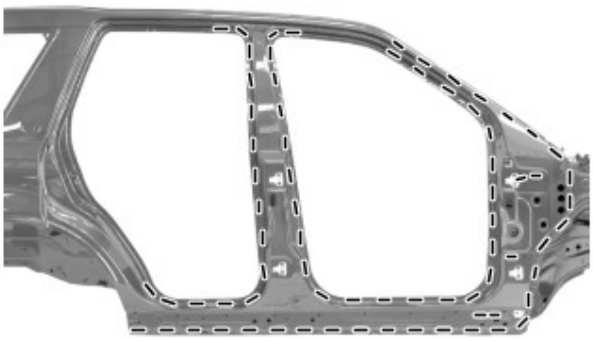
E85938

17. Spot weld.

E85937



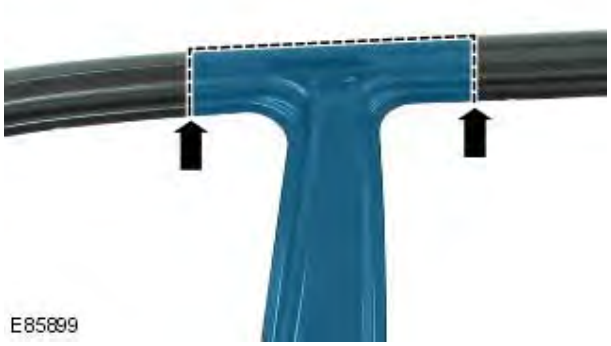
18. MIG braze the slots.



E89253

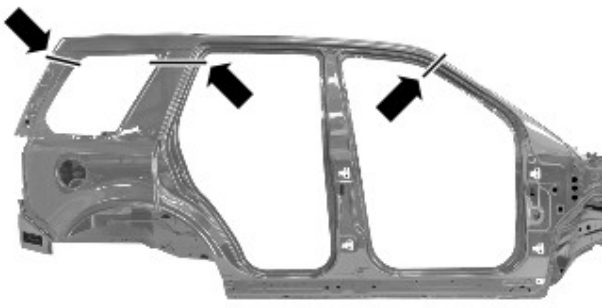
19. Dress the tack welds.

20. MIG weld the butt joint at the upper B-Pillar.



E85899

21. MIG weld the butt joints at the A-Pillar and quarter panel.



E89254

22. Dress all welded joints.

23. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Side Panel Sheet Metal Repairs - Side Panel Front Section

Removal and Installation

Removal

CAUTION: The side panel front section must be MIG slot brazed to its reinforcement, which contains DP600, (Dual Phase steel). **MIG plug welds / spot welds, must not be used.**

• NOTE: The side panel front section is serviced as a separate weld on panel, serviced less the fender mounting bracket, which is serviced separately.

• NOTE: There are NVH elements attached inside this panel, they are not serviced on the new panel. If damaged, new element/s will be required.

1. The side panel front section is replaced in conjunction with:

- Front bumper cover
- Front fender
- Hood
- Front door
- Rear door
- Instrument panel
- Windshield glass
- Headliner

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) /
Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the hood.

4. Remove the front fender.

5. Remove the front door.
For additional information, refer to: Front Door (501-03 Body Closures, Removal and Installation).

6. Remove the rear door.
For additional information, refer to: Rear Door (501-03 Body Closures, Removal and Installation).

7. Remove the headliner.
For additional information, refer to: Headliner - Vehicles Without: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) /
Headliner - Vehicles With: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

8. Remove the instrument panel.
For additional information, refer to: Instrument Panel - TD4 2.2L Diesel (501-12 Instrument Panel and Console, Removal and Installation).

9. Remove the windshield glass.
For additional information, refer to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).

10. Remove the upper and lower door hinges from the A-Pillar, 4 x bolts.

11. Remove the upper and lower door hinges from the B-Pillar, 4 x bolts.

12. Remove the front door striker from the B-Pillar.

13. Remove the side air curtain module.
For additional information, refer to: Side Air Curtain Module (501-20B Supplemental Restraint System, Removal and Installation).

14. Remove the rear seat cushion.
For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).

15. Remove the RH & LH rocker panel inner trims.

16. Remove the B-Pillar side impact sensor.
For additional information, refer to: B-Pillar Side Impact Sensor

(501-20B Supplemental Restraint System, Removal and Installation).

17. Remove the front safety belt retractor.
For additional information, refer to: Front Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).

18. Release and lay aside the front carpet section.

19. Remove the rear carpet section.

20. Remove the roof moulding, front and rear sections.

21. Remove the front wheel and tire.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

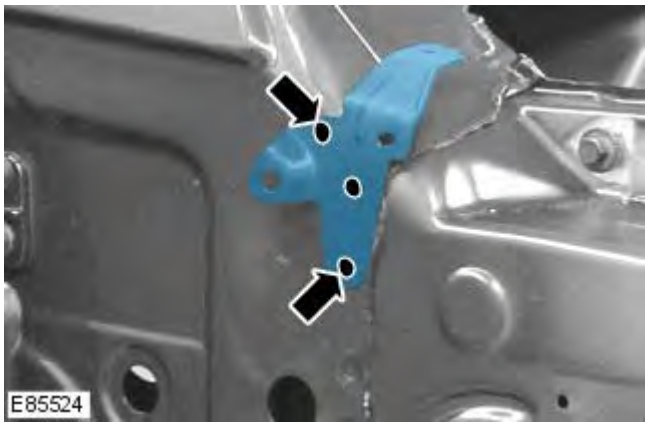
22. Remove the rocker panel outer moulding.

23. Release and lay aside the insulating material at the inner bulkhead.

24. Release and lay aside the wiring harnesses at the A-Pillar, B-Pillar and rocker panel.

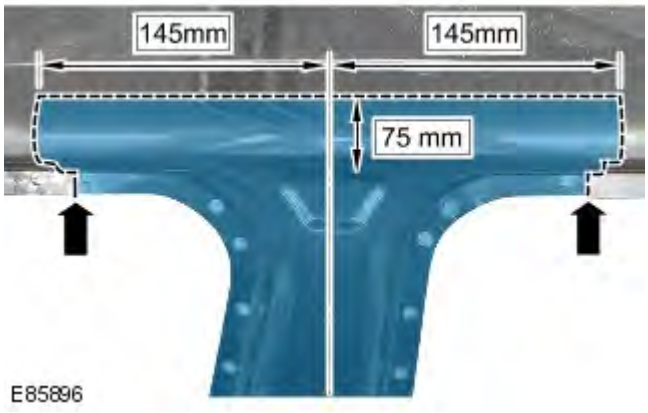
25. Remove the fender mounting bracket:

- Mill out 3 spot welds. If not re-using the mounting the upper spot weld does not have to be removed.
- Separate the mounting from the A-Pillar.
- Retain the mounting if it is being reused, if not, discard.



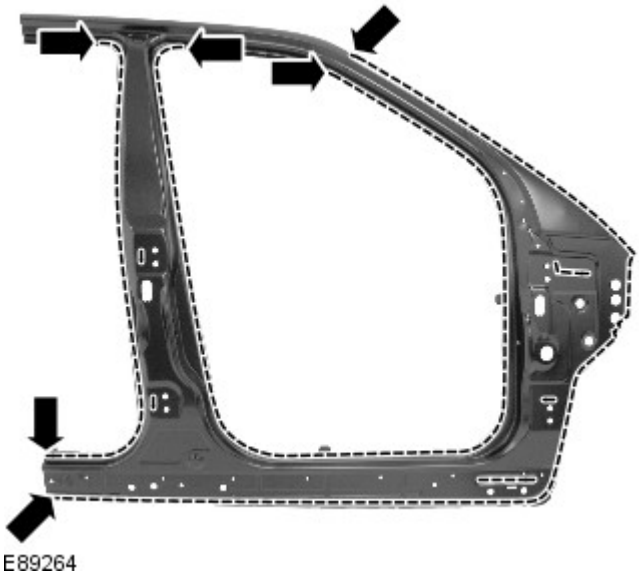
26. Saw cut the old panel at the A-Pillar and rocker panel, using the new panel for reference, ensuring that the new panel overlaps the panel remaining on the vehicle.

E89260



27. Saw cut the old panel at the B-Pillar, as illustrated, observe the measurements to allow access to the B-Pillar reinforcement.

28. Mill out the spot welds.



29. Separate the joints and remove the old panel, also releasing the NVH elements.

Installation

1. Offer up and align the new panel and clamp into position, overlapping the old panel remaining on the vehicle. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

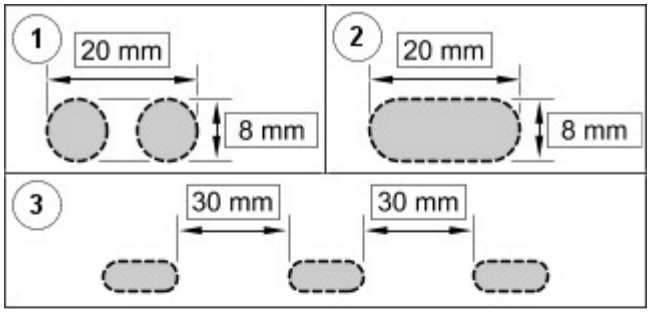
2. Saw cut through the new and old panels at the rocker panel and A-Pillar, where the MIG butt joints are to be made.

3. Saw cut through the new and old panels at the B-Pillar, where the MIG butt joint is to be made.

4. Remove the new panel and the old remnants.

5. NOTE: MIG slots should be installed in accordance with the spacing shown in the illustration. Where this is not possible, due to the indents in the panel, the slot should be made in the location of the original spot weld.

Cut slots in the new panel ready for MIG brazing.



6. Prepare the old and new panel joint surfaces.

7. If necessary, renew the NVH element/s.

8. Apply sealer adhesive to the NVH element at the A-Pillar.

E85530

9. Apply sealer adhesive to the NVH element at the B-Pillar.

E85901

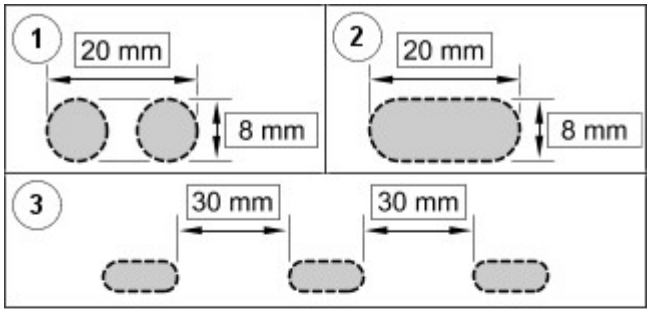
10. Apply adhesive to the A-Pillar as illustrated.

E85529

11. Offer up the new panel and clamp into position.

12. Tack weld the butt joints.

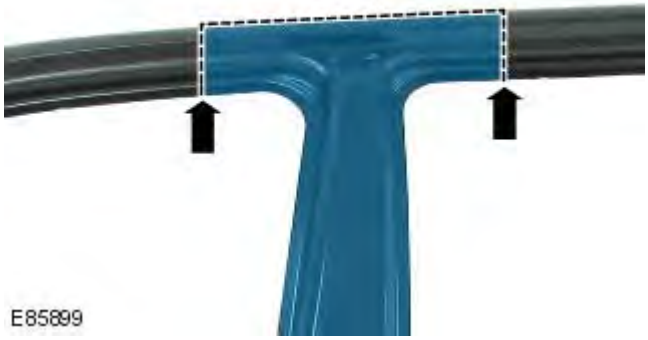
13. MIG braze the slots.



E89265

14. Dress the tack welds.

15. MIG weld the butt joint at the upper B-Pillar.



E85899

16. MIG weld the butt joints at the A-Pillar and rocker panel.

E89260

17. Dress all welded joints.

18. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Side Panel Sheet Metal Repairs - A-Pillar Outer Panel

Removal and Installation

Removal

CAUTION: The A-Pillar outer panel must be MIG slot brazed to the reinforcement, which is DP600, (Dual Phase steel). **MIG plug welds / spot welds, must not be used.**

• NOTE: The A-Pillar outer panel is serviced as a separate weld-on panel. The fender mounting bracket is serviced separately.

• NOTE: There are NVH elements attached inside this panel; they are not serviced on the new panel. If damaged, new element(s) will be required.

1. The A-Pillar outer panel is replaced in conjunction with:

- Front bumper cover
- Hood
- Front fender
- Front door
- Instrument panel
- Windshield glass
- Headliner

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the hood.

4. Remove the front fender.

5. Remove the front door.
For additional information, refer to: Front Door (501-03 Body Closures, Removal and Installation).

6. Remove the headliner.
For additional information, refer to: Headliner - Vehicles Without: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) / Headliner - Vehicles With: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. Remove the instrument panel.
For additional information, refer to: Instrument Panel - TD4 2.2L Diesel (501-12 Instrument Panel and Console, Removal and Installation).

8. Remove the windshield glass.
For additional information, refer to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).

9. Remove the upper and lower door hinges from the pillar, 4 x bolts.

10. Remove the rocker panel inner trim.

11. Remove the side air curtain module.
For additional information, refer to: Side Air Curtain Module (501-20B Supplemental Restraint System, Removal and Installation).

12. Remove the front wheel and tire.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

13. Remove the rocker panel outer moulding.

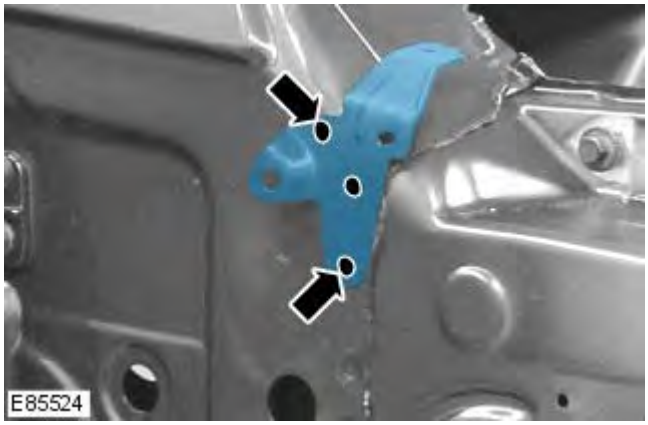
14. Release and lay aside the front carpet section.

15. Remove the rear carpet section.

16. Remove the roof moulding, front and rear sections.

17. Release and lay aside the wiring harness along the A-Pillar inner and inner rocker panel.

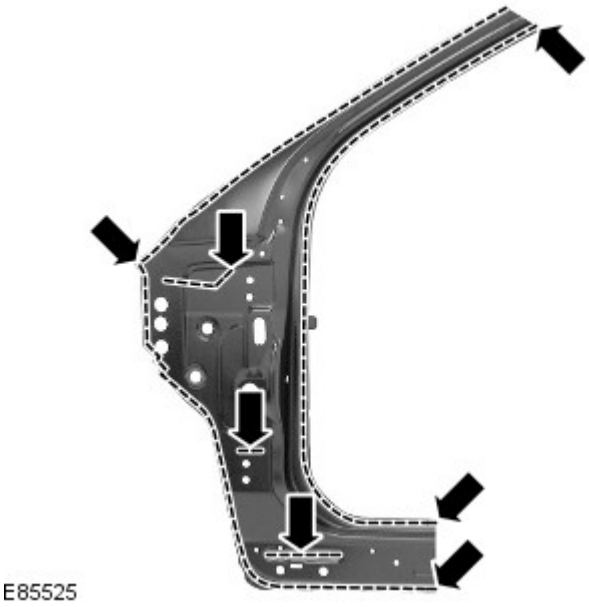
18. Release and lay aside the insulating material at the inner bulkhead.



19. Remove the fender mounting bracket:

- Mill out 3 spot welds. If not re-using the mounting the upper spot weld does not have to be removed.
- Separate the mounting from the A-Pillar.
- Retain the mounting if it is being reused, if not, discard.

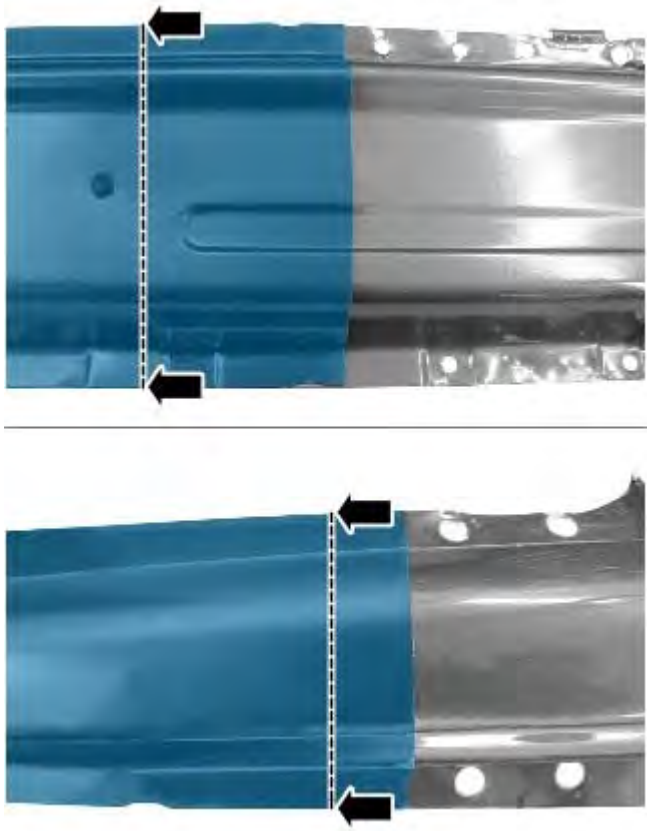
20. Saw cut the old panel at the points illustrated, using the new panel for reference, ensuring that the new panel overlaps the panel remaining on the vehicle.



21. Mill out the spot welds.

22. Separate the joints and remove the old panel, also releasing the NVH element.

Installation

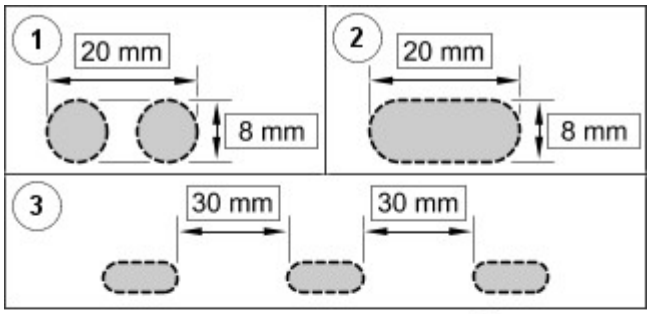


E85527

1. Offer up and align the new panel and clamp into position, overlapping the old panel remaining on the vehicle. Saw cut through the new and old panels at the points where the MIG butt joints are to be made.

2. Remove the new panel and the old remnants.

3. Prepare the old and new panel joint surfaces.



4. NOTE: MIG slots should be installed in accordance with the spacing shown in the illustration. Where this is not possible, due to the indents in the panel, the slot should be made in the location of the original spot weld.

Cut slots in the new panel ready for MIG brazing.

E89224

5. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

6. Remove the new panel.

7. Apply adhesive to the areas illustrated.

E85529

8. If necessary, renew the NVH element.

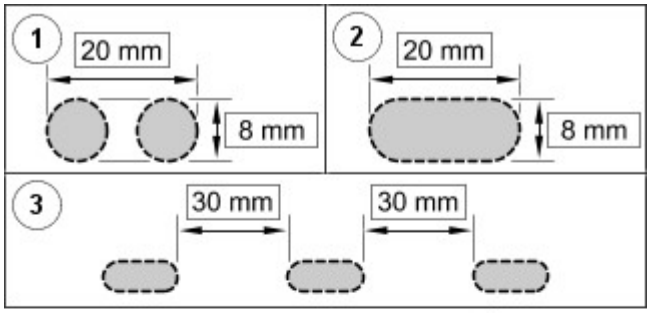
9. Apply sealer adhesive to the NVH element.

E85530

10. Offer up the new panel and clamp into position.

11. Tack weld the butt joints.

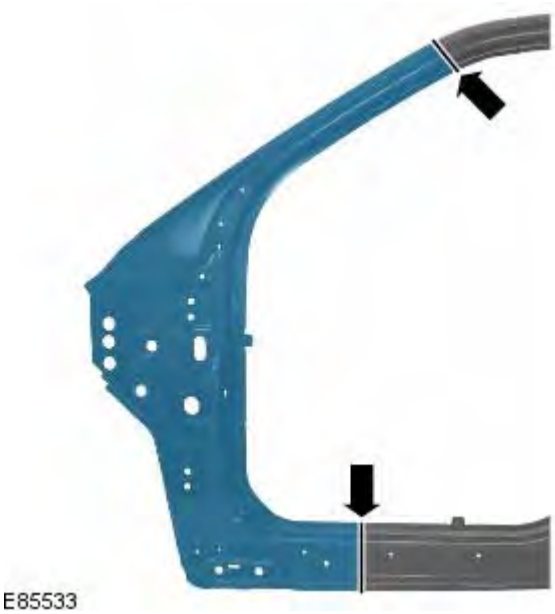
12. MIG braze the slots.



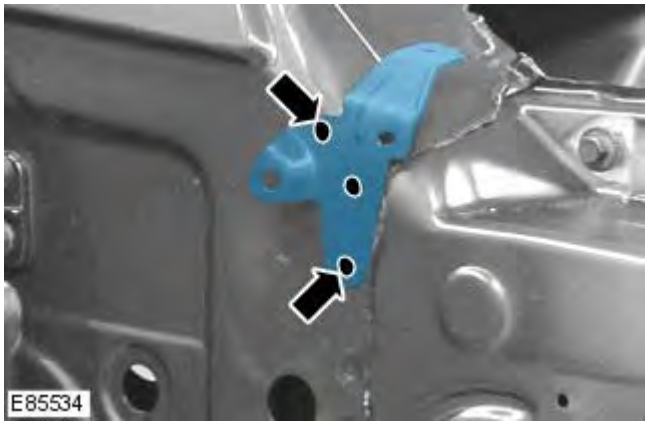
E85531

13. Dress the tack welds.

14. MIG weld the butt joint.



E85533



15. Install the fender mounting bracket, using the fender for alignment.

16. Dress all welded joints.

17. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Side Panel Sheet Metal Repairs - A-Pillar Reinforcement

Removal and Installation

Removal

• CAUTIONS:

The A-Pillar reinforcement is DP600, (Dual Phase steel) and must be MIG plug welded to the inner. **Spot welds must not be used.**

Ensure that all welded joints are suitably sealed and waterproofed, particularly in the areas where the original panel adhesive / sealer cannot be replicated. Where necessary, seal the joints prior to the fitment of outer panels.

• NOTE: The A-Pillar reinforcement is unpicked from the side panel reinforcement 'ring-frame', it is not serviced separately.

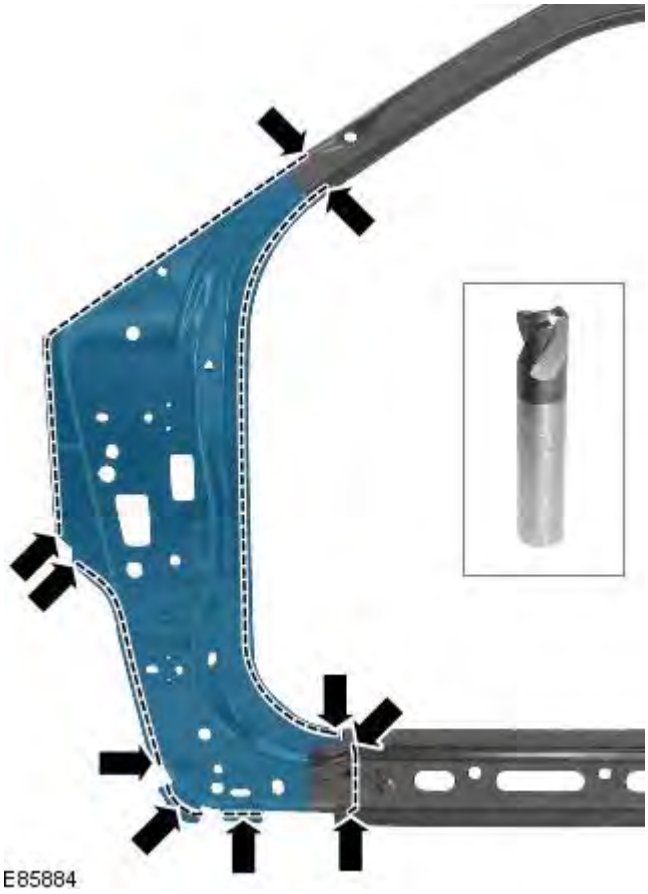
• NOTE: There are NVH elements attached inside this panel, they are not serviced on the new panel. If damaged, new element/s will be required.

1. The A-Pillar reinforcement is replaced in conjunction with:

- Front bumper cover
- Front fender
- Front door
- Instrument panel
- Windshield glass
- A-Pillar outer panel

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the A-Pillar outer panel.
For additional information, refer to: A-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).

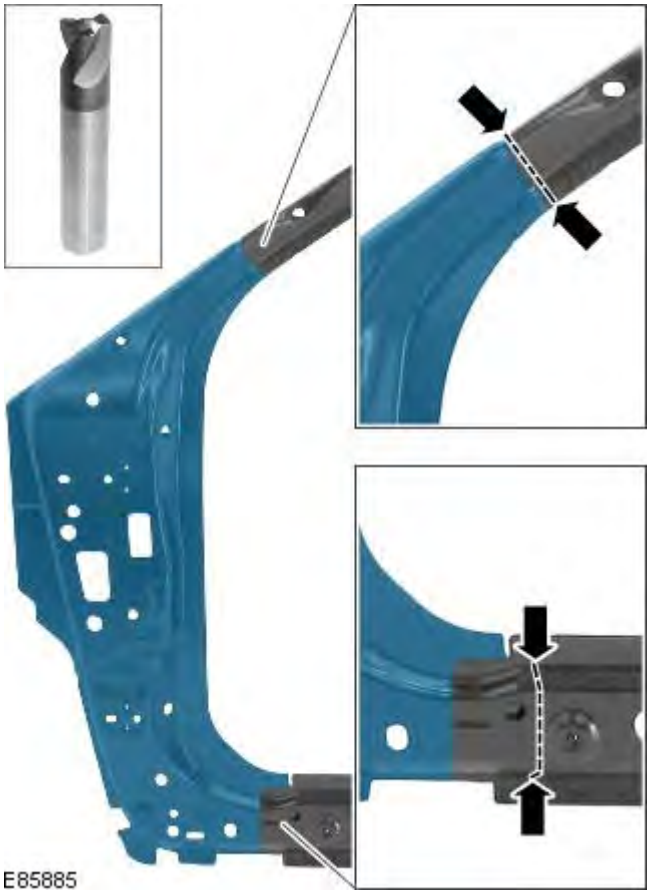


4. NOTE: Where possible, holes should be drilled through the A-Pillar reinforcement and the A-Pillar inner panel, (note that the reinforcement panel is DP600, (Dual Phase), steel and a HSS drill bit will be required). This enables MIG plug welds to be installed through the inner panel, where possible.

Mill out the spot welds, it will be necessary to use a HSS spot weld drill bit.

5. Separate the joints and remove the old panel, also releasing the NVH element.

Installation



1. Remove the A-Pillar reinforcement part from the ring-frame service panel. Mill out the spot welds using a HSS spot weld drill bit.

2. Drill the holes, not already made on removal, ready for MIG plug welding.

E89228

3. Prepare the old and new panel joint surfaces.

4. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

5. Remove the new panel.

6. If necessary, renew the NVH element.

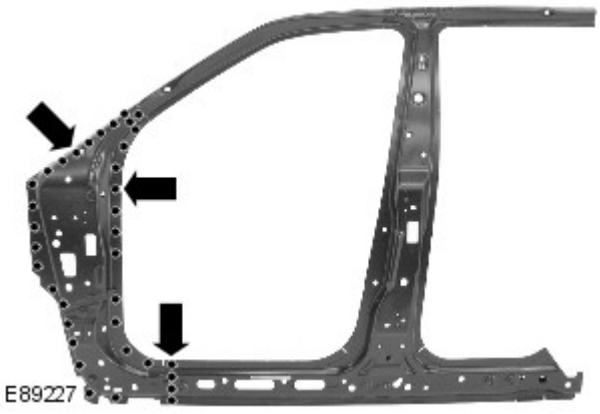
7. Apply sealer adhesive to the NVH element.

E85888

8. Offer up the new panel and clamp into position.

9. NOTE: MIG plug welds should be installed in the locations of the original spot welds and where possible, should be installed through the A-Pillar inner.

MIG plug weld.



E89227

10. Dress all welded joints.
11. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Side Panel Sheet Metal Repairs - B-Pillar Outer Panel

Removal and Installation

Removal

CAUTION: The B-Pillar outer panel must be MIG slot brazed to the B-Pillar reinforcement, which is BH300, (Bake Hardened steel) and the rocker panel inner reinforcement, which is DP600, (Dual Phase steel). **MIG plug welds / spot welds, must not be used.**

• NOTE: The B-Pillar outer panel is serviced as a separate weld-on panel.

• NOTE: There is an NVH element attached inside this panel, it is not serviced on the new panel. If damaged, a new element will be required.

• NOTE: If the B-Pillar outer is replaced without the B-Pillar reinforcement, the upper section butt joint can be made lower down the pillar if required.

1. The B-Pillar outer panel is replaced in conjunction with:

- Front door
- Rear door
- Headliner

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the front door.
For additional information, refer to: Front Door (501-03 Body Closures, Removal and Installation).

4. Remove the rear door.
For additional information, refer to: Rear Door (501-03 Body Closures, Removal and Installation).

5. Remove the upper and lower door hinges from the B-Pillar, 4 x bolts.

6. Remove the front door striker from the B-Pillar.

7. Remove the front seat.
For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

8. Remove the rear seat cushion.
For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).

9. Remove the front safety belt retractor.
For additional information, refer to: Front Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).

10. Remove the headliner.
For additional information, refer to: Headliner - Vehicles Without: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) / Headliner - Vehicles With: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

11. Remove the RH & LH rocker panel inner trims.

12. Remove the B-Pillar side impact sensor.
For additional information, refer to: B-Pillar Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation).

13. Remove the side air curtain module.
For additional information, refer to: Side Air Curtain Module (501-20B Supplemental Restraint System, Removal and Installation).

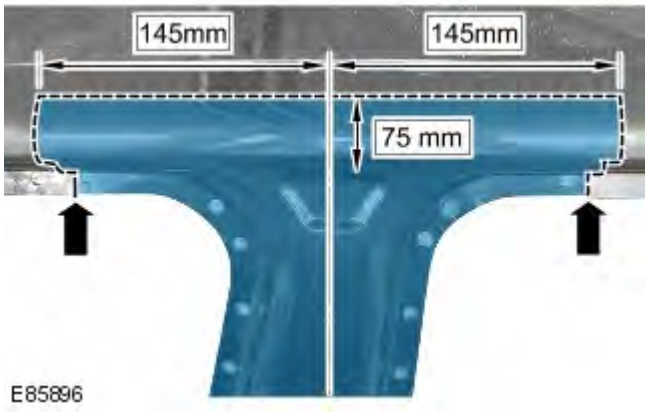
14. Remove the roof moulding, front and rear sections.

15. Remove the rocker panel outer moulding.

16. Release and lay aside the front carpet section.

17. Remove the rear carpet section.

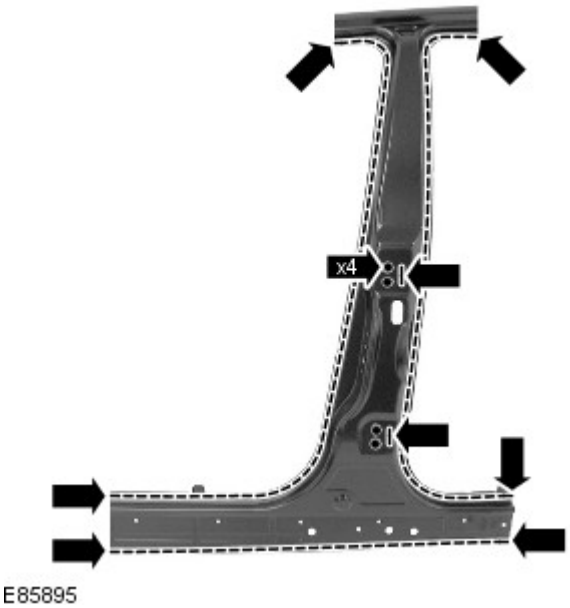
18. Release and lay aside the wiring harness along the B-Pillar inner and inner rocker panel.



19. Saw cut the old panel as illustrated, observe the measurements to allow access to the B-Pillar reinforcement.

20. Saw cut the old panel at its joints with the rocker panel, ensuring there is an allowance for the new panel to overlap, use the new panel for reference.

21. Mill out the spot welds.

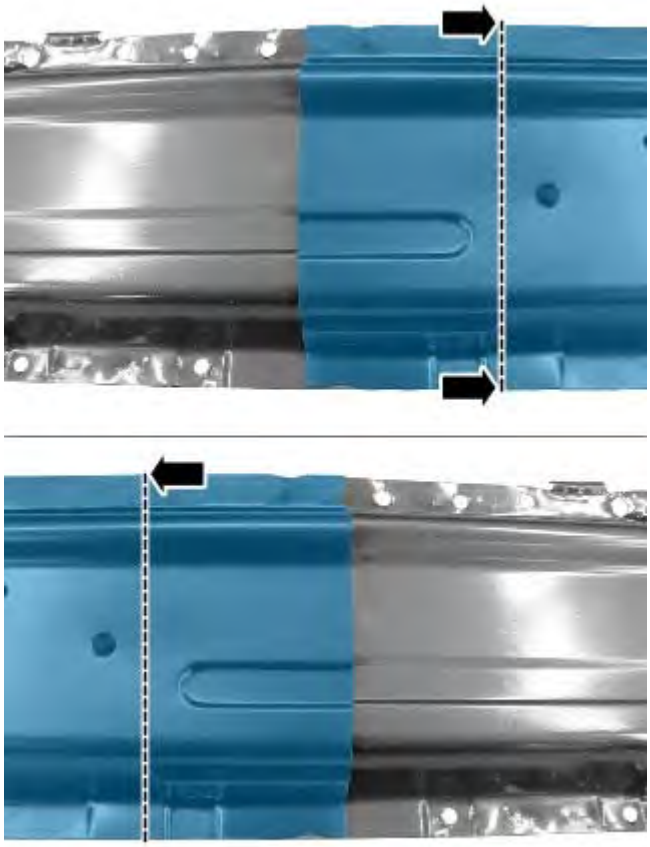


22. Separate the joints and remove the old panel, also releasing the NVH element.

Installation

1. Offer up and align the new panel and clamp into position, overlapping the old panel remaining on the vehicle.

2. Saw cut through the new and old panels at the rocker panel, where the MIG butt joints are to be made.

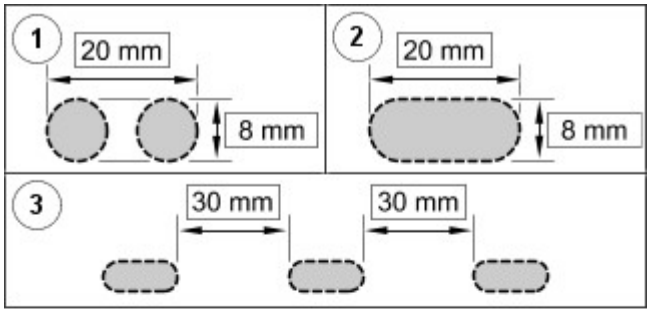


E85898

3. Saw cut through the new and old panels at the upper joint, where the MIG butt joint is to be made.

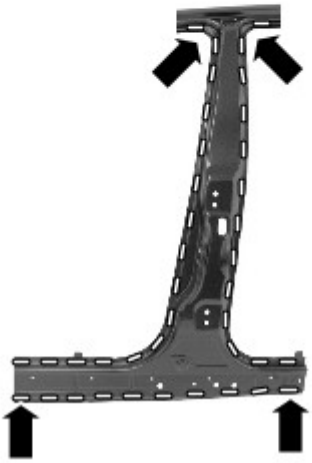
E85899

4. Remove the new panel and the old remnants.



5. NOTE: MIG slots should be installed in accordance with the spacing shown in the illustration. Where this is not possible, due to the indents in the panel, the slot should be made in the location of the original spot weld.

Cut slots in the new panel ready for MIG brazing.



E89230

6. Prepare the old and new panel joint surfaces.

7. If necessary, renew the NVH element.

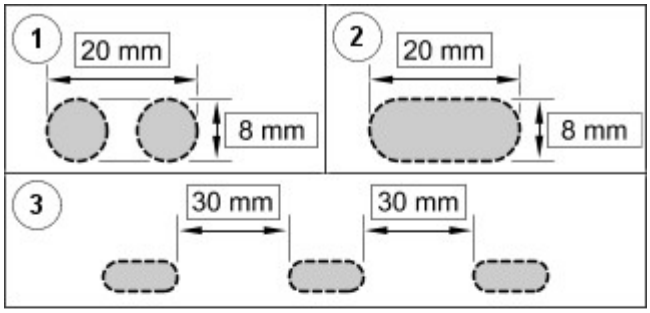
8. Apply sealer adhesive to the NVH element.

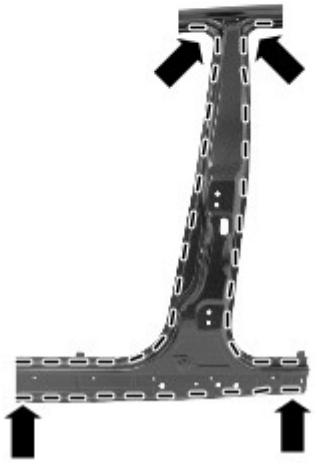
E85901

9. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

10. Tack weld the butt joints.

11. MIG braze the slots.





E89229

12. Dress the tack welds.

13. MIG weld the butt joints.

E85903

14. Dress all welded joints.

15. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Side Panel Sheet Metal Repairs - B-Pillar Reinforcement

Removal and Installation

Removal

• CAUTIONS:

The B-Pillar reinforcement is BH300, (Bake Hardened steel). It must be MIG plug welded to the B-Pillar inner, the rocker panel inner reinforcement and the cantrail reinforcement. **Spot welds must not be used.**

Ensure that all welded joints are suitably sealed and waterproofed, particularly in the areas where the original panel adhesive / sealer cannot be replicated. Where necessary, seal the joints prior to the fitment of outer panels.

• NOTE: The B-Pillar reinforcement is unpicked from the side panel reinforcement, 'ring-frame', it is not serviced separately.

• NOTE: There is a NVH element located between the B-Pillar reinforcement and the B-Pillar inner.

1. The B-Pillar reinforcement is replaced in conjunction with:

- Front door
- Rear door
- Headlining
- B-Pillar outer panel

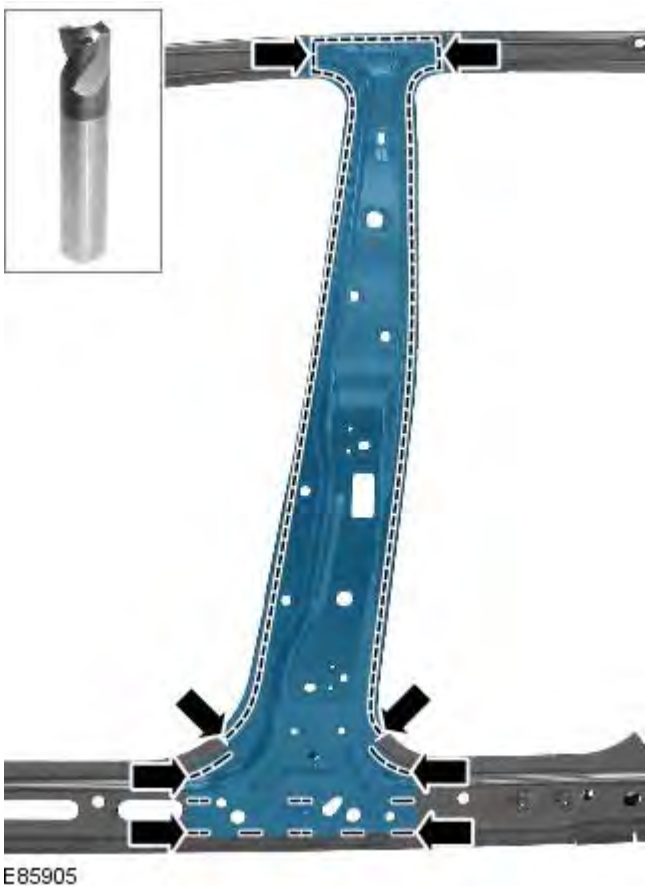
2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the B-Pillar outer panel.
For additional information, refer to: B-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).

4. NOTE: It will be necessary to use a HSS spot weld drill bit on the A-Pillar upper / cantrail and rocker panel areas.

• NOTE: Holes should be drilled through the B-Pillar reinforcement and the B-Pillar inner panel at the door apertures. This enables MIG plug welds to be installed through the inner panel.

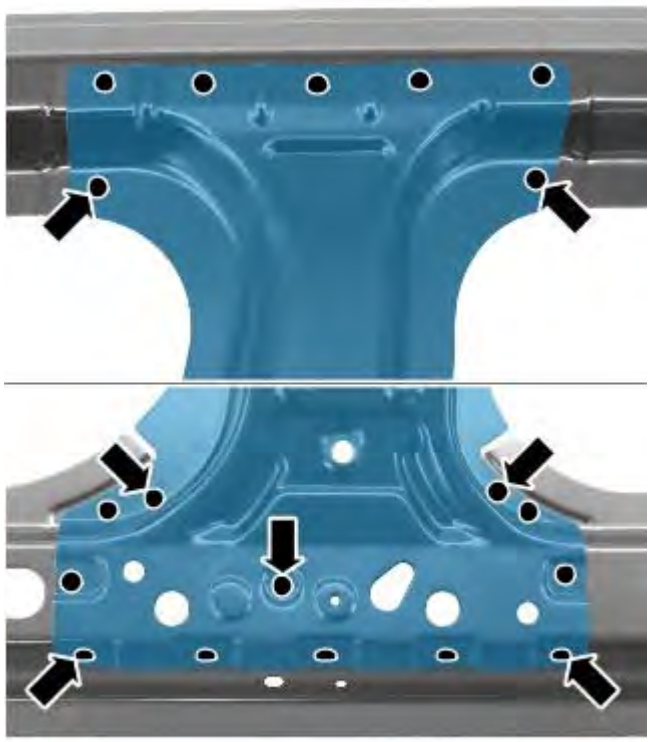
Mill out the spot welds.


E85905

5. Separate the joints and remove the old panel, also releasing the NVH element.

Installation

1. Remove the B-Pillar reinforcement part from the ring frame service panel. Mill out the spot welds using a HSS spot weld drill bit.



E85906

2. Prepare the old and new panel joint surfaces.

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

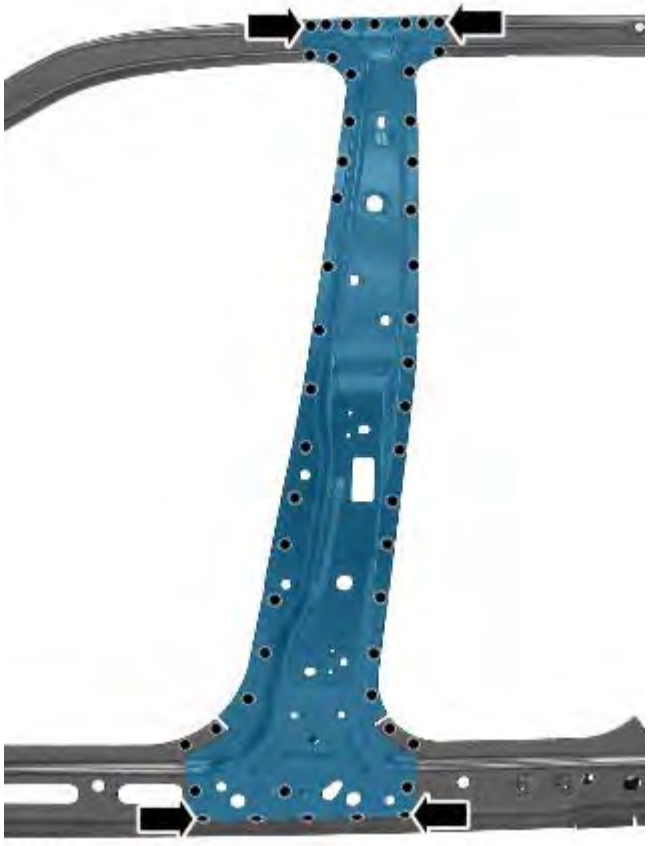
4. Remove the new panel.

5. If necessary, renew the NVH element.

6. Apply sealer adhesive to the NVH element.

E85909

7. Offer up the new panel and clamp into position.


E89232

8. NOTE: Holes for MIG plugs would be created during the old panel removal and separation of the service panel.

• NOTE: MIG plug welds should be installed through the inner panel at the door apertures.

MIG plug weld.

9. Dress all welded joints.

10. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Side Panel Sheet Metal Repairs - B-Pillar Inner Panel

Removal and Installation

Removal

• NOTE: The B-Pillar inner panel is serviced as a separate weld-on panel.

1. The B-Pillar reinforcement is replaced in conjunction with:
   - Front door
   - Rear door
   - Headlining
   - B-Pillar outer panel
   - B-Pillar reinforcement
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the B-Pillar reinforcement.
   For additional information, refer to: B-Pillar Reinforcement (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.

5. Separate the joints and remove the panel.

Installation

1. Prepare the old and new panel joint surfaces.

2. Drill holes in the new panel ready for MIG plug welding.

E85893

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step. If not, rectify and recheck before proceeding.

4. MIG plug weld.

E85892

5. Dress all welded joints.

6. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Side Panel Sheet Metal Repairs - Rocker Panel Inner Reinforcement

Removal and Installation

Removal

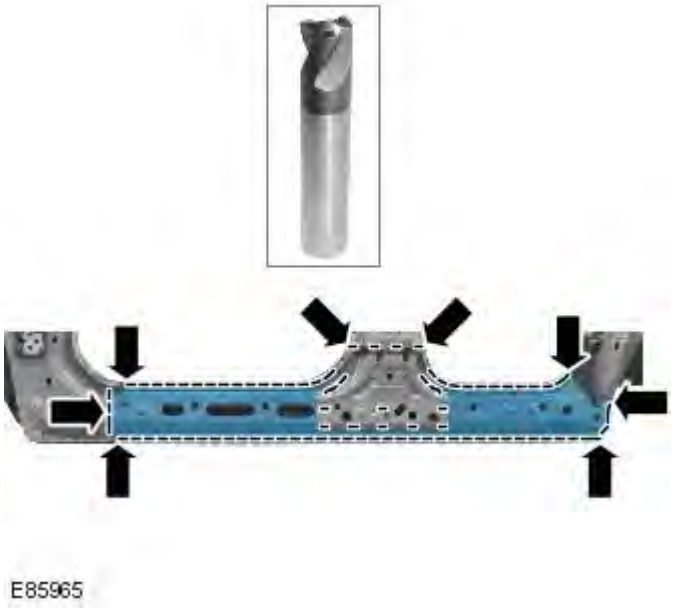
• CAUTIONS:

The rocker panel inner reinforcement is DP600, (Dual Phase steel) and must be MIG plug welded to the inner. **Spot welds must not be used.**

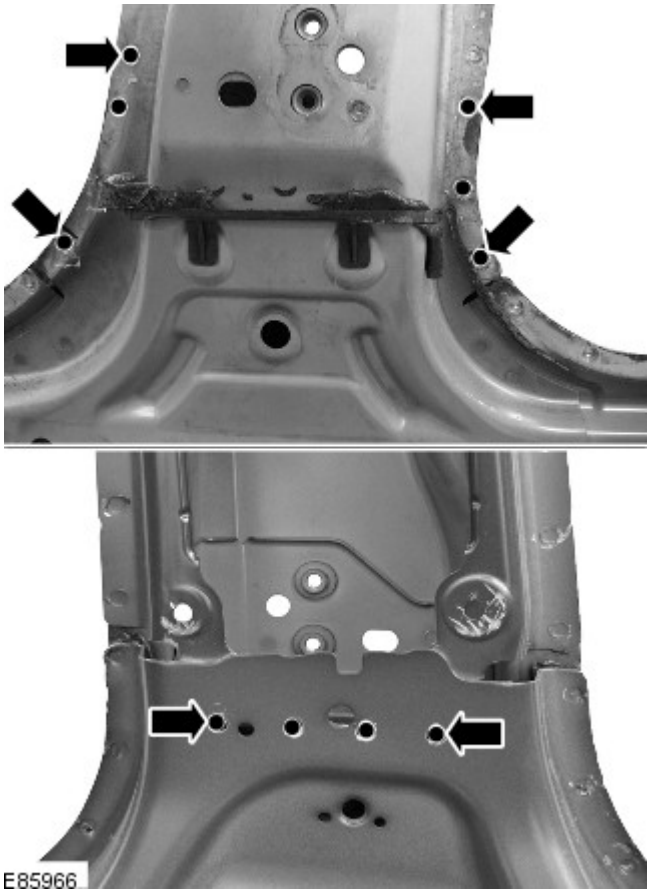
Ensure that all welded joints are suitably sealed and waterproofed, particularly in the areas where the original panel adhesive / sealer cannot be replicated. Where necessary, seal the joints prior to the fitment of outer panels.

• NOTE: The rocker panel inner reinforcement is unpicked from the side panel reinforcement 'ring-frame', it is not serviced separately.

1. The rocker panel inner reinforcement is replaced in conjunction with:
   - Front bumper cover
   - Front fender
   - Front door
   - Rear door
   - Rocker panel
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the rocker panel.
   For additional information, refer to: Rocker Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds, it will be necessary to use a HSS spot weld drill bit.



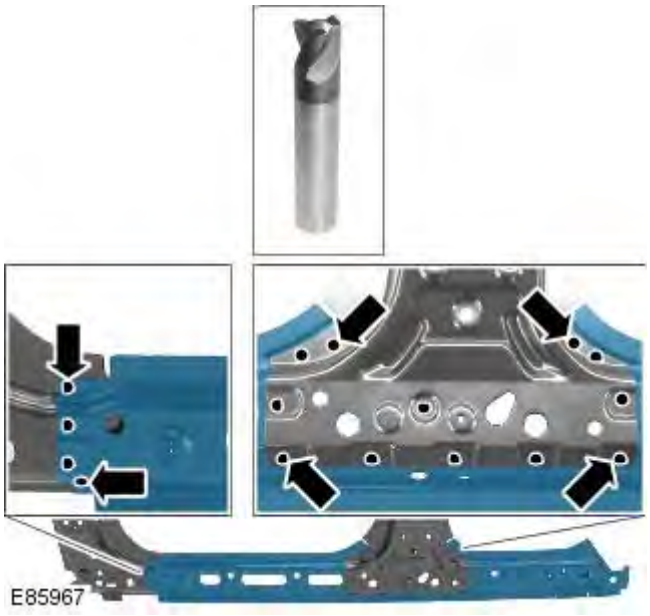
E85965



5. If the B-Pillar reinforcement has not been removed it will be necessary to release it.
   - Mill out spot welds.
   - Separate this joint and ease the B-Pillar reinforcement forward to allow the rocker panel inner reinforcement to be removed.

6. Separate the joints and remove the old panel.

Installation

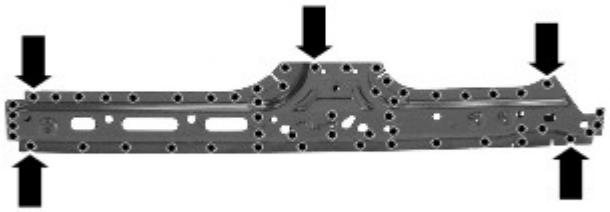


1. Remove the rocker panel reinforcement part from the side panel reinforcement 'ring-frame', service panel. Mill out the spot welds using a HSS spot weld drill bit.

2. Prepare the old and new panel joint surfaces.
3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. NOTE: Holes for MIG plugs would be created during the old panel removal and separation of the service panel.

• NOTE: MIG plug welds should be installed in the locations of the original spot welds and where possible, should be installed through the rocker panel inner.



E89243

MIG plug weld.

5. Dress all welded joints.

6. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Side Panel Sheet Metal Repairs - Rocker Panel

Removal and Installation

Removal

CAUTION: The rocker panel must be MIG slot brazed to the rocker panel inner reinforcement, which is DP600, (Dual Phase steel). **MIG plug welds / spot welds must not be used.**

• NOTE: The rocker panel is serviced as a separate weld-on panel.

1. The rocker panel is replaced in conjunction with:
   - Front bumper cover
   - Front fender
   - Front door
   - Rear door
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the fender.
4. Remove the front door.
   For additional information, refer to: Front Door (501-03 Body Closures, Removal and Installation).
5. Remove the rear door.
   For additional information, refer to: Rear Door (501-03 Body Closures, Removal and Installation).
6. Remove the front road wheel.
   For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
7. Remove the rear road wheel.
   For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
8. LH side: Remove the hood release handle.
9. Remove the front seat.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).
10. Remove the floor console.
    For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).
11. Remove the front door aperture weatherseal.
12. Remove the rear door aperture weatherseal.
13. Remove the cowl side trim panel.
    For additional information, refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
14. Remove the B-Pillar upper trim.
    For additional information, refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
15. Remove the RH & LH B-Pillar lower trims.
    For additional information, refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
16. Remove the rear quarter trim panel.
    For additional information, refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
17. Remove the RH & LH rocker panel inner trims.
18. Remove the rocker panel outer moulding.
19. Remove the back panel inner trim.
20. Remove the rear seat cushion.
    For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).
21. Remove the front safety belt retractor.

For additional information, refer to: Front Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).

22. Remove the rear carpet section.

23. Release and lay aside the front carpet section.

24. Remove the B-Pillar side impact sensor.
For additional information, refer to: B-Pillar Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation).

25. Remove the C-Pillar side impact sensor.
For additional information, refer to: C-Pillar Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation).

26. Release and lay aside the bulkhead inner insulation.

27. Release and lay aside the wiring harness along the inner rocker panel.

28. Saw cut the old panel at its joints with the A-Pillar, B-Pillar and quarter panel, ensuring there is an allowance for the new panel to overlap. Use the new panel for reference.

E85959

29. Mill out the spot welds.

E85958

30. Separate the joints and remove the old panel.

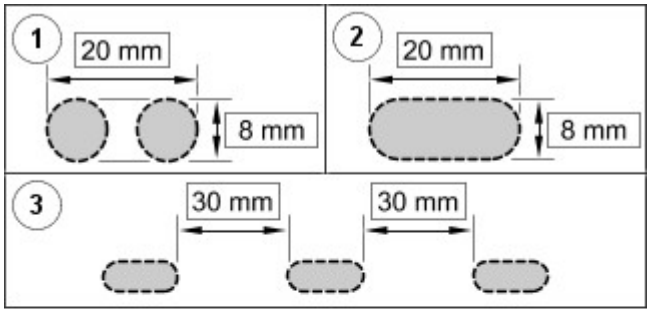
Installation

1. Offer up and align the new panel and clamp into position, overlapping the old panel remaining on the vehicle.

2. Saw cut through the new and old panels at the A-Pillar, B-Pillar and quarter panel, where the MIG butt joints are to be made.

E85959

3. Remove the new panel and the old remnants.



4. NOTE: MIG slots should be installed in accordance with the spacing shown in the illustration. Where this is not possible, due to the indents in the panel, the slot should be made in the location of the original spot weld.

Cut slots in the new panel ready for MIG brazing.

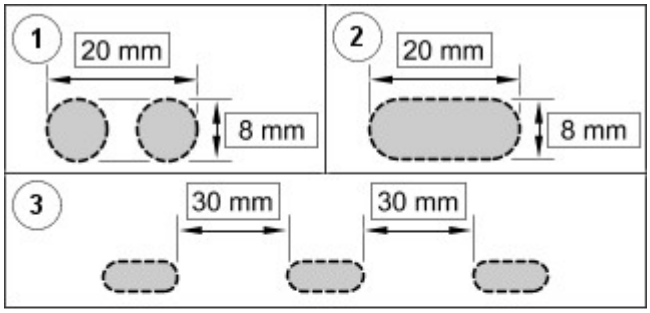
E89242

5. Prepare the old and new panel joint surfaces.

6. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

7. Tack weld the butt joints.

8. MIG braze the slots.



E89241

9. Dress the tack welds.

10. MIG weld the butt joints.

E85963

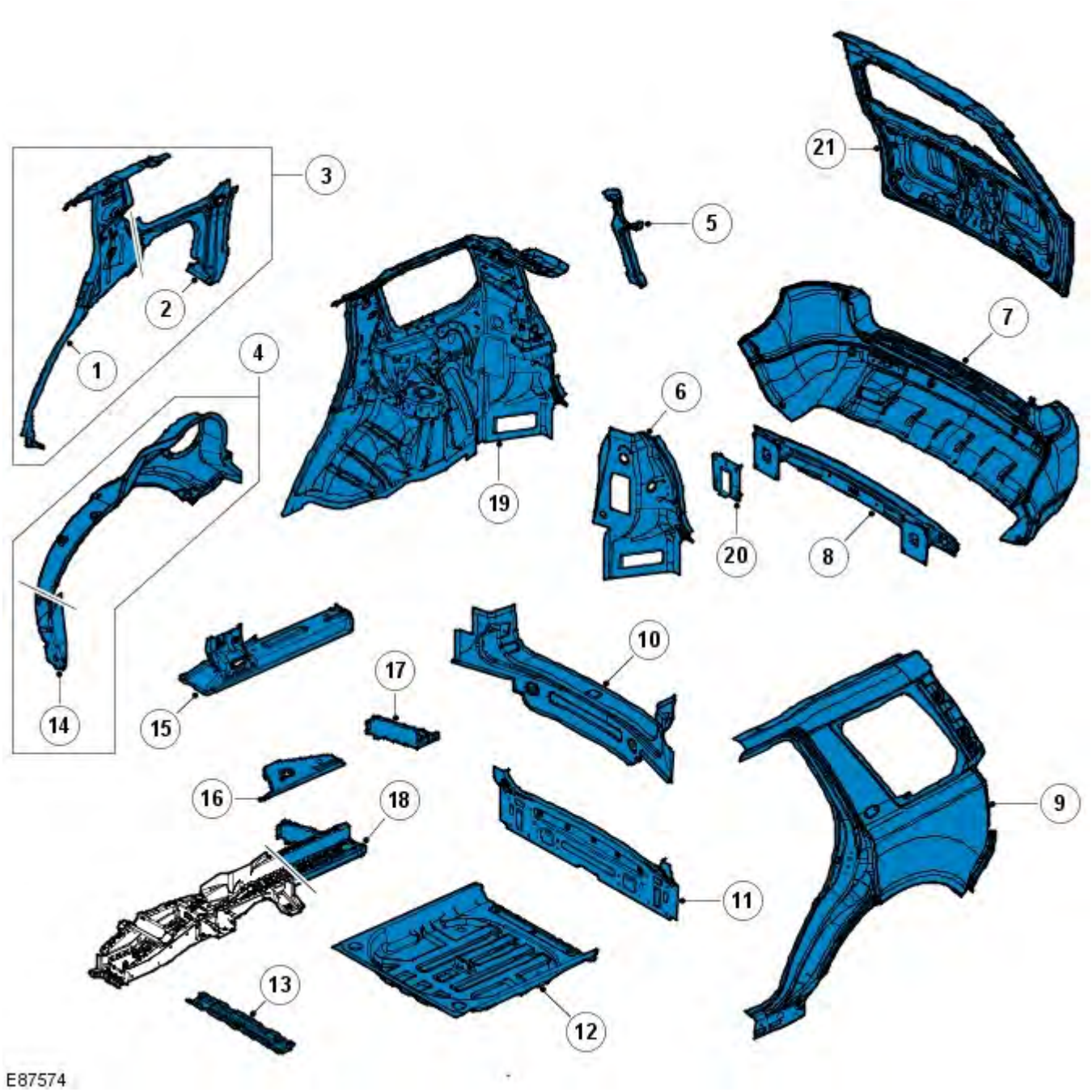
11. Dress all welded joints.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Rear End Sheet Metal

Description and Operation

Rear end service panels



Item	Description
1	Inner quarter panel front
2	Inner quarter panel rear
3	Inner quarter panel
4	Rear wheelhouse outer
5	Water drain panel section
6	Rear lamp mounting panel
7	Rear bumper cover
8	Rear bumper
9	Quarter panel
10	Back panel assembly
11	Back panel
12	Spare wheel well
13	Rear crossmember
14	Rear wheelhouse front extension
15	Rear side member closing panel
16	Rear side member upper side extension
17	Rear side member lower side extension
18	Rear side member section

Item	Description
19	Inner quarter panel and wheelhouse
20	Rear bumper mounting
21	Liftgate

Time schedules, rear end

The following schedules show the total time taken to replace single panels and also combinations of panels. The published times include the removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends to adjacent panels are not included). A corrosion protection time is included where appropriate.

The times were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only, based on new undamaged panels. Job allowances are not included, as a guide Thatcham recommend 0.3 hours to be added to single panel times and 0.5 hours to be added to combination times.

Single panel times

Panel Description	Times
Rear bumper cover	**5.1**
Liftgate	**6.9**
Rear lamp mounting panel	**L/H 8.5** **R/H 8.6**
Back panel	**14.6**
Quarter panel	**L/H 22.9** **R/H 24.1**
Headliner remove and install	**3.3**
Liftgate screen remove and install	**1.4**
Rear suspension assembly remove and install	**4.0**
Fuel tank remove and install	**2.5**

Combination panel replacement times

Combination panel times

Panel Description	Times
Rear bumper cover	
Rear bumper	
Liftgate	
Rear lamp mounting panel	
Back panel	
Quarter panel	
Headliner remove and install	
Liftgate screen remove and install	
Total Time	**L/H 44.3** **R/H 45.3**

Combination panel times

Panel Description	Times
Rear bumper cover	
Rear bumper	
Liftgate	
Rear lamp mounting panel L/H and R/H	
Back panel	
Inner back panel assembly	
Quarter panel L/H and R/H	
Headliner remove and install	
Liftgate screen remove and install	
Total Time	**62.5**

Combination panel times

Panel Description	Times
Rear bumper cover	
Rear bumper	
Liftgate	
Back panel	
Inner back panel assembly	
Quarter panel	
Spare wheel well	
Rear crossmember	
Rear bumper mounting	
Rear side member section	
Rear side member closing panel	
Rear side member upper side extension	
Water drain panel section	
Inner quarter panel and wheelarch	
Headliner remove and install	
Liftgate screen remove and install	
Fuel tank remove and install	
Rear suspension assembly remove and install	
Total Time	**L/H 69.6** **R/H 70.3**

Combination panel times

Panel Description	Times
Rear bumper cover	
Rear bumper	
Liftgate	
Back panel	
Inner back panel assembly	
Quarter panel L/H and R/H	
Spare wheel well	
Rear crossmember	
Rear bumper mounting L/H and R/H	
Rear side member section L/H and R/H	
Rear side member closing panel L/H and R/H	
Rear side member upper side extension L/H and R/H	
Water drain panel section L/H and R/H	
Inner quarter panel and wheelarch L/H and R/H	
Headliner remove and install	
Liftgate screen remove and install	
Fuel tank remove and install	
Rear suspension assembly remove and install	
Total Time	**95.9**

Combination panel times

Panel Description	Times
Rear bumper cover	
Rear bumper	
Liftgate	
Back panel	
Inner back panel assembly	
Rear lamp mounting panel	
Spare wheel well	
Rear bumper mounting	
Rear side member section	
Rear side member closing panel	
Rear side member upper side extension	
Liftgate screen remove and install	
Fuel tank remove and install	
Rear suspension assembly remove and install	
Total Time	**L/H 47.1** **R/H 47.1**

Combination panel times

Panel Description	Times
Rear bumper cover	
Rear bumper	
Liftgate	
Back panel	
Inner back panel assembly	
Rear lamp mounting panels L/H and R/H	
Spare wheel well	
Rear crossmember	
Rear bumper mounting L/H and R/H	
Liftgate screen remove and install	
Fuel tank remove and install	
Rear suspension assembly remove and install	
Total Time	**43.9**

Published: 11-May-2011

Rear End Sheet Metal Repairs - Quarter Panel

Removal and Installation

Removal

CAUTION: The quarter panel must be MIG slot brazed to the rocker panel inner reinforcement, which is DP600, (Dual Phase steel). **MIG plug welds / spot welds must not be used in this area.**

• NOTE: The quarter panel is serviced as a separate weld-on panel.

• NOTE: There are NVH elements inside this panel, they are not serviced on the new panel. If damaged, a new element will be required.

1. The quarter panel is replaced in conjunction with:

- Rear bumper cover
- Rear door
- Quarter glass
- Headliner

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the rear bumper cover.
For additional information, refer to: Rear Bumper (501-19 Bumpers, Removal and Installation).

4. Remove the rear door.
For additional information, refer to: Rear Door (501-03 Body Closures, Removal and Installation).

5. Remove the headliner.
For additional information, refer to: Headliner - Vehicles Without: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) / Headliner - Vehicles With: Tilting Roof Opening Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

6. Remove the rear door striker from the C-Pillar.

7. Remove the roof moulding, front and rear sections.

8. Remove the side air curtain module.
For additional information, refer to: Side Air Curtain Module (501-20B Supplemental Restraint System, Removal and Installation).

9. Remove the rear quarter glass.
For additional information, refer to: Rear Quarter Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).

10. Remove the front seat.
For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

11. Remove the floor console.
For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

12. Remove the RH & LH rocker panel inner trims.

13. Remove the rear seat cushion.
For additional information, refer to: Rear Seat Cushion (501-10 Seating, Removal and Installation).

14. Remove the rear carpet section.

15. Remove the rear safety belt retractor.
For additional information, refer to: Rear Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).

16. Remove the liftgate aperture weatherseal.

17. Remove the forced air extraction grille.

18. Remove the rear wheel and tire.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

19. Remove the rocker panel outer moulding.

20. Release and lay aside the wiring harness along the inner

quarter panel and back panel.

21. Release and lay aside the insulating material at the inner quarter panel.

22. RH side: Drain the fuel tank.
For additional information, refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

23. RH side: Remove the fuel tank filler pipe.
For additional information, refer to: Fuel Tank Filler Pipe (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).

24. Saw cut the old panel at the points illustrated, using the new panel for reference, ensuring that the new panel overlaps.

E85932

25. Mill out the spot welds.

E85931

26. Separate the joints and remove the old panel, also releasing the NVH elements and the fuel filler on the RH.

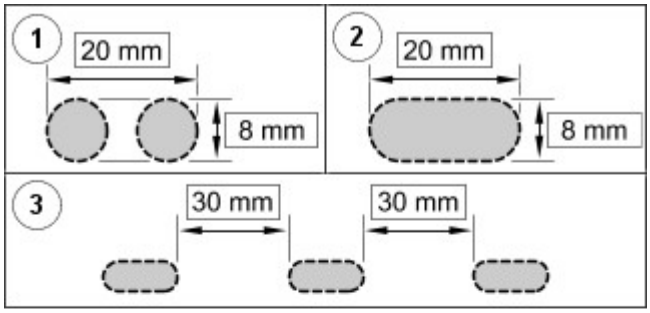
Installation

1. Offer up and align the new panel and clamp into position, overlapping the old panel. Saw cut the new and old panels at the points where the MIG butt joints are to be made.

E85933

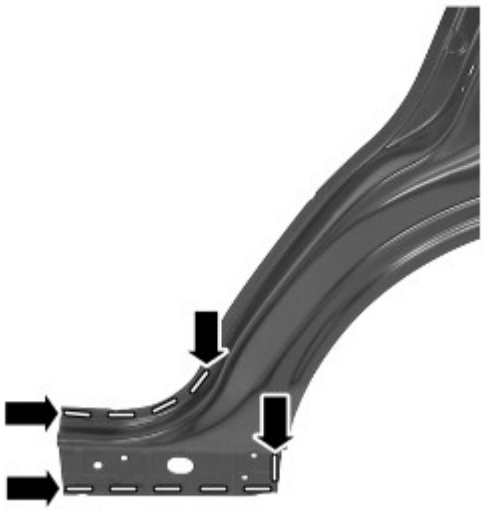
2. Remove the new panel and the old remnants.
3. Prepare the old and new panel joint surfaces.
4. Drill holes in the new panel ready for MIG plug welding.

E85934



5. NOTE: MIG slots should be installed in accordance with the spacing shown in the illustration. Where this is not possible, due to the indents in the panel, the slot should be made in the location of the original spot weld.

Cut slots in the new panel ready for MIG brazing.

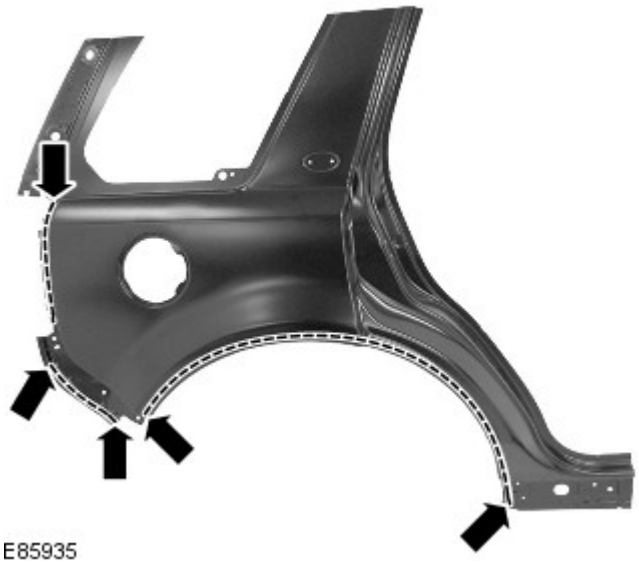


E89240

6. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

7. Remove the new panel.

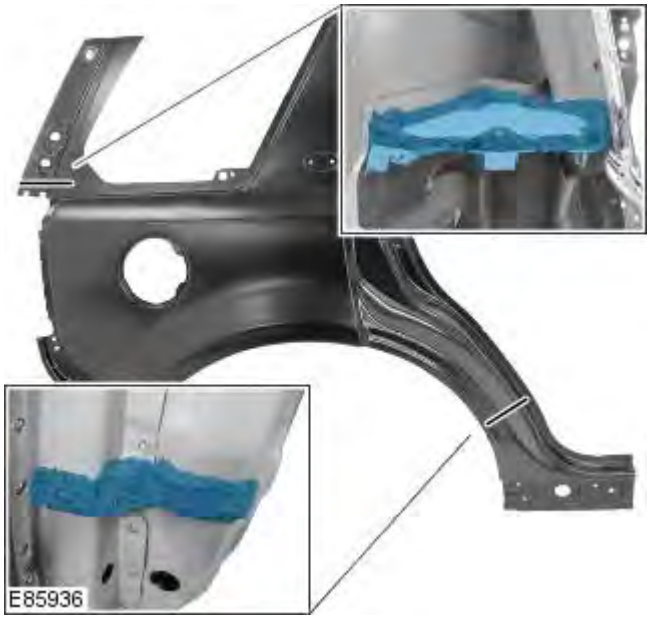
8. Apply adhesive to the areas illustrated.



E85935

9. If necessary, renew the NVH element/s.

10. Apply sealer adhesive to the NVH elements.



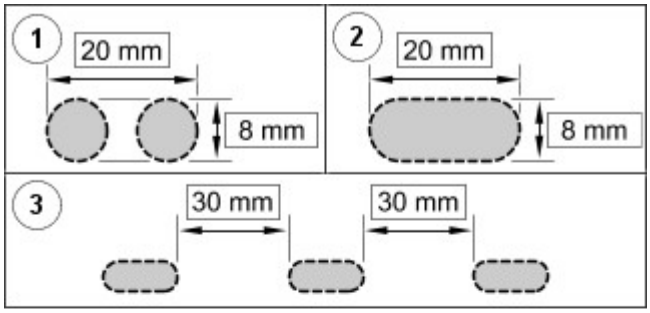
11. Offer up the new panel and clamp into position.

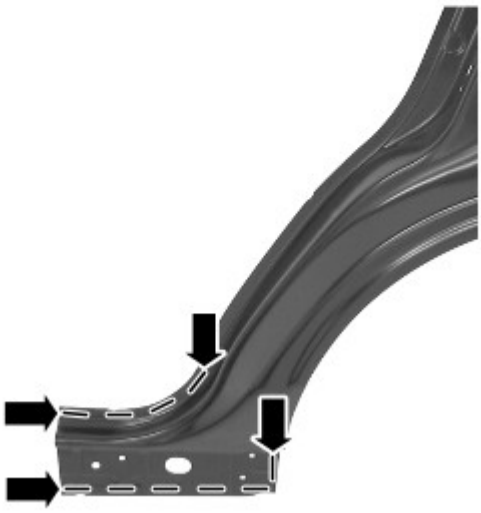
12. Tack weld the butt joints.

13. Spot weld.

14. MIG plug weld.

15. MIG braze the slots.





E89239

16. Dress the tack welds.

17. MIG weld the butt joint.

E85939

18. Dress all welded joints.

19. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Rear Side Member Section

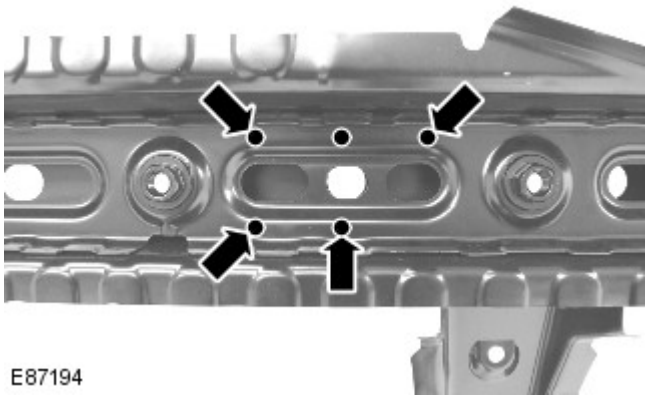
Removal and Installation

Removal

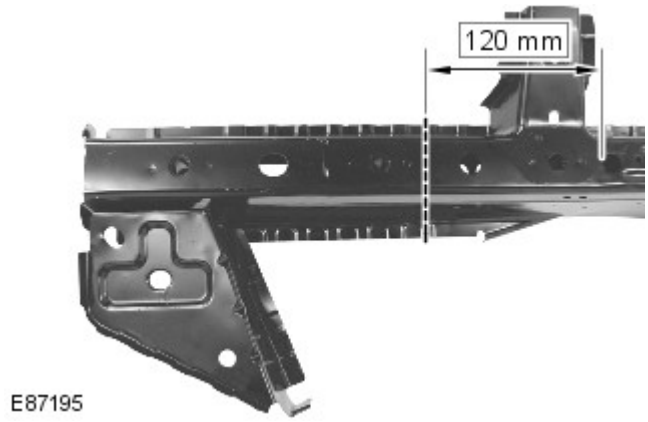
• NOTE: The rear side member section is cut from the rear side member service panel. The section is approximately 410mm in length and is serviced with the rear side member lower extension.

• NOTE: It is necessary to remove the spare wheel well to allow access to the rear side member section.

1. The rear side member section is replaced in conjunction with:
   - Rear bumper cover
   - Rear bumper armature
   - Back panel
   - Rear bumper mounting
   - Inner back panel assembly
   - Rear side member closing panel.
   - Spare wheel well
   - Fuel tank
   - Rear subframe and suspension assembly
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the rear side member closing panel.
   For additional information, refer to: Rear Side Member Closing Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Remove the rear subframe / suspension as an assembly.
   For additional information, refer to: Rear Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
5. Remove the fuel tank.
   For additional information, refer to: Fuel Tank (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).
6. Mill out the spot welds.



7. Saw cut the old panel at the point illustrated.



E87195

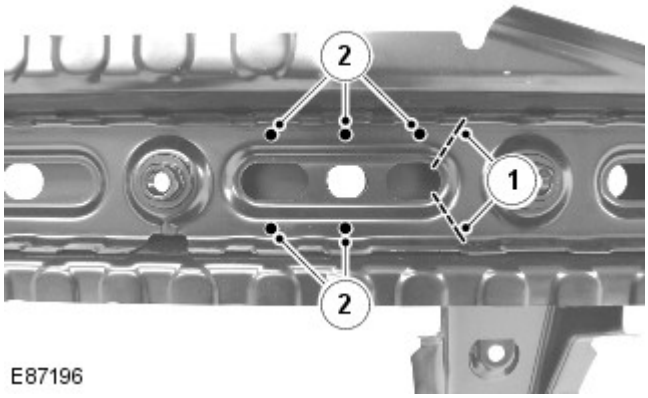
8. Separate the joints and remove the old panel.

Installation

1. NOTE: Ensure there is a 50mm minimum stagger between the old side member and the new reinforcement section cuts.

Remove a section of reinforcement from the old panel:

1. Saw cut the reinforcement at the point illustrated, do not cut through the side member.
2. Mill out 5 spot welds.
3. Separate and remove the reinforcement remnant.

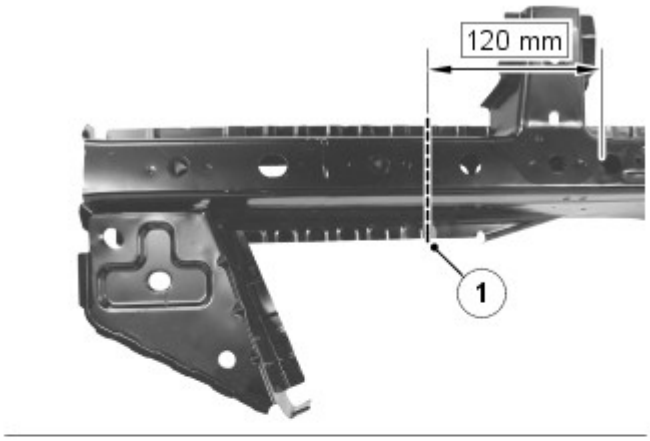


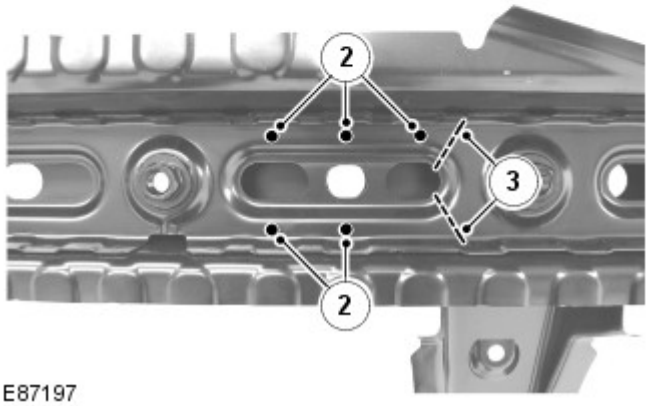
E87196

2. NOTE: Ensure there is a 50mm minimum stagger between the old side member and the new reinforcement section cuts.

Remove the rear side member section from the service panel:

1. Saw cut the side member at the point illustrated, do not cut through the reinforcement.
2. Mill out 5 spot welds.
3. Saw cut the reinforcement at the point illustrated.
4. Separate and remove the side member section.

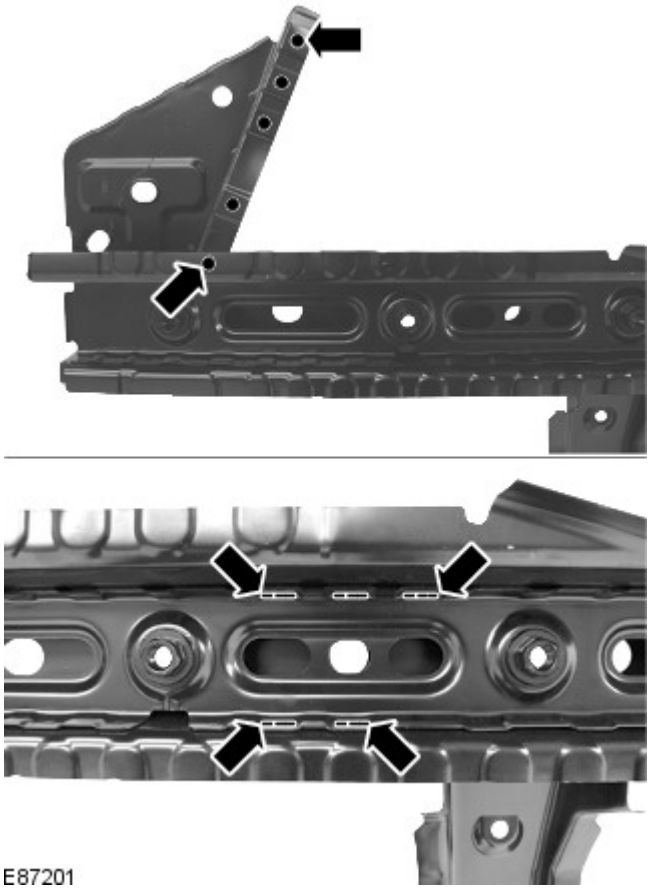




E87197

3. Prepare the old and new panel joint surfaces.

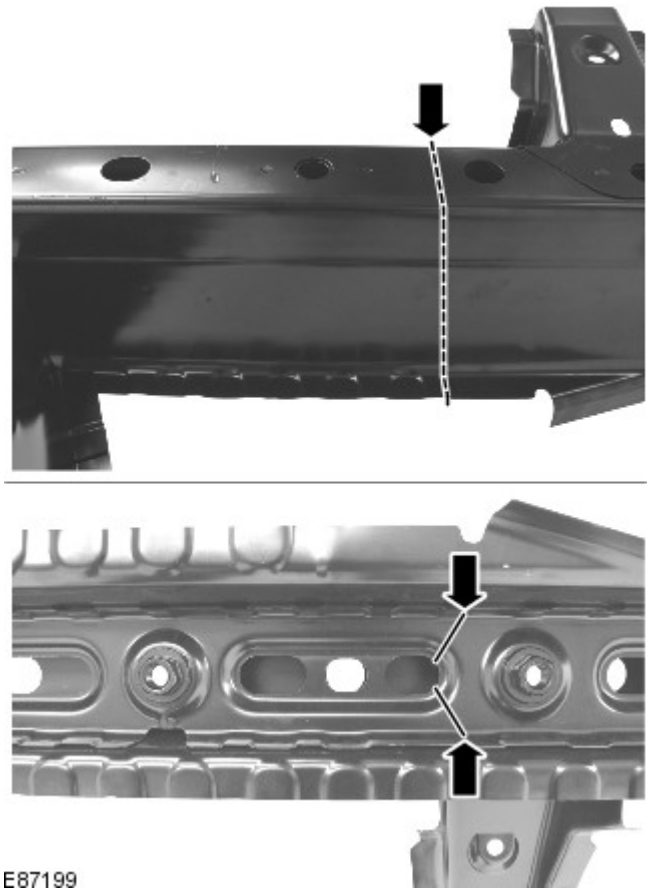
4. Drill holes in the new panel ready for MIG plug welding.



E87201

5. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

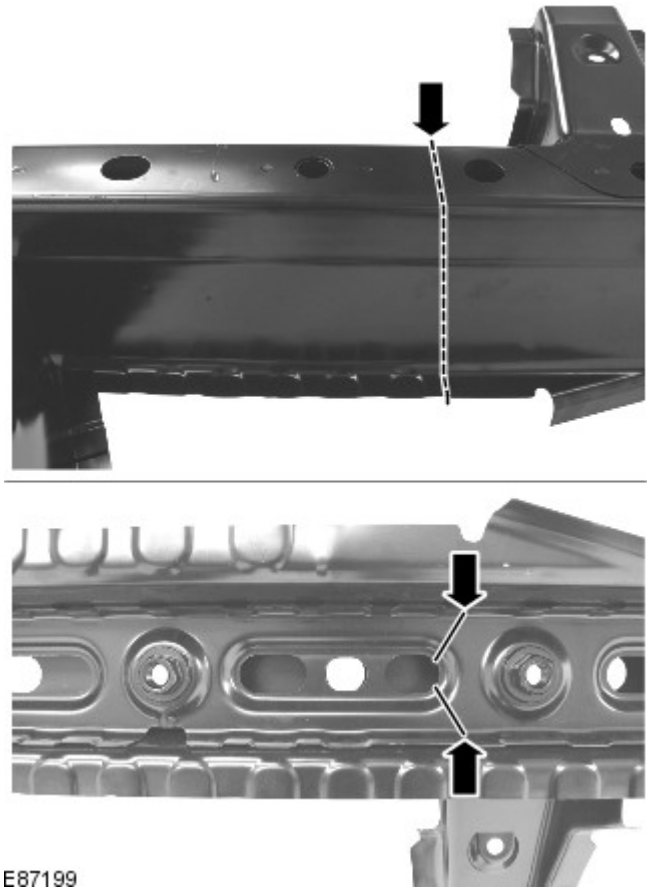
6. With panels clamped into position, tack weld the butt joints.



E87199

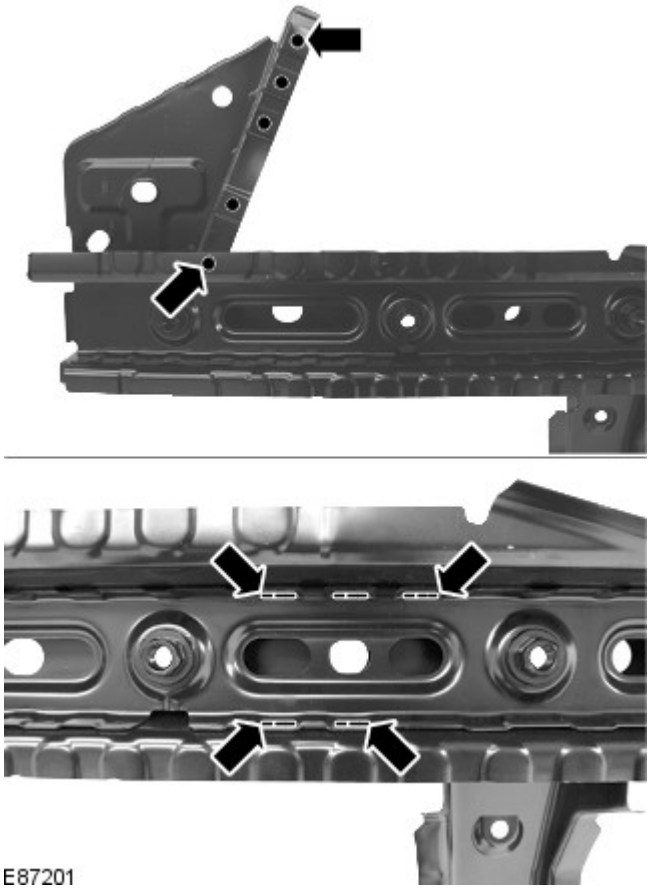
7. Dress the tack welds.

8. MIG weld the butt joints.



E87199

9. MIG plug weld.



E87201

10. Dress all welded joints.

11. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

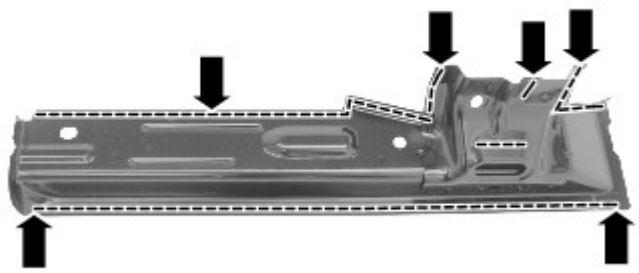
Rear End Sheet Metal Repairs - Rear Side Member Closing Panel

Removal and Installation

Removal

- NOTE: The rear side member closing panel is serviced as a separate weld-on panel.
- NOTE: The panel is serviced less its weld studs.
- NOTE: It is necessary to remove the spare wheel well to allow access to the rear side member closing panel.

1. The rear side member closing panel is replaced in conjunction with:
   - Rear bumper cover
   - Rear bumper armature
   - Back panel
   - Rear bumper mounting
   - Inner back panel assembly
   - Rear side member section
   - Spare wheel well
   - Fuel tank
   - Rear subframe and suspension assembly
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the rear side member section.
   For additional information, refer to: Rear Side Member Section (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Remove the rear subframe / suspension as an assembly.
   For additional information, refer to: Rear Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
5. Remove the fuel tank.
   For additional information, refer to: Fuel Tank (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation).
6. Mill out the spot welds.



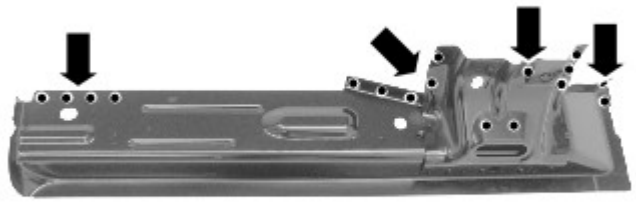
E87203

7. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.

2. Drill hole in the new panel ready for MIG plug welding.



E87204

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

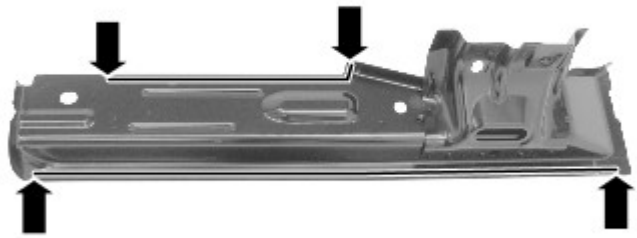
4. Remove the new panel.

5. Apply adhesive to the areas illustrated.

E87205

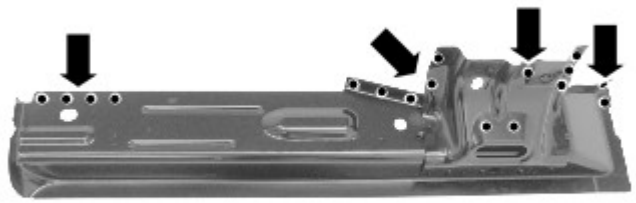
6. Offer up the new panel and clamp into position.

7. Spot weld.



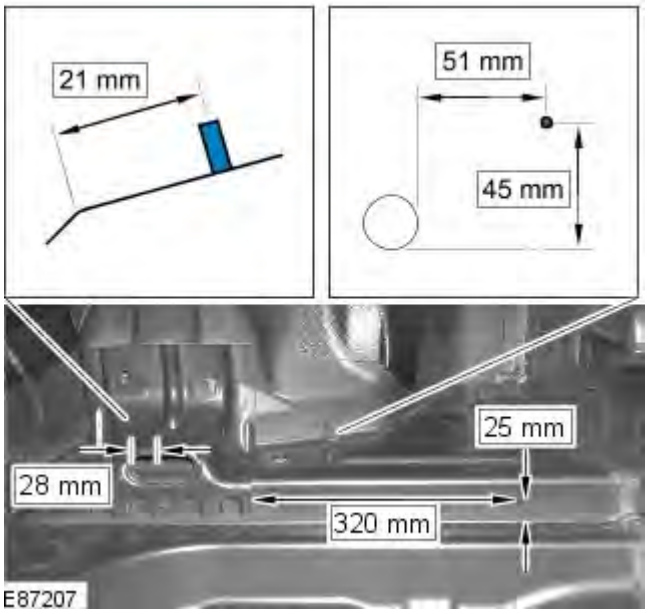
E87206

8. MIG plug weld.



E87204

9. Install weld studs.



10. Dress all welded joints.

11. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Spare Wheel Well

Removal and Installation

Removal

• NOTE: The spare wheel well is serviced as a separate weld on panel, it includes the spare wheel retaining bracket but not the crossmember.

• NOTE: The panel is serviced less its weld studs

1. The spare wheel well is replaced in conjunction with:

- Rear bumper cover
- Rear bumper
- Back panel
- Back panel assembly
- Fuel tank
- Rear subframe and suspension assembly

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the back panel assembly.
For additional information, refer to: Back Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).

4. Remove the rear subframe and suspension as an assembly.

5. Remove the fuel tank.
For additional information, refer to: Fuel Tank (310-01A Fuel Tank and Lines - I6 3.2L Petrol, Removal and Installation) / Fuel Tank (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

6. Remove the rear seat.

7. Remove the RH and LH rocker panel inner trims.

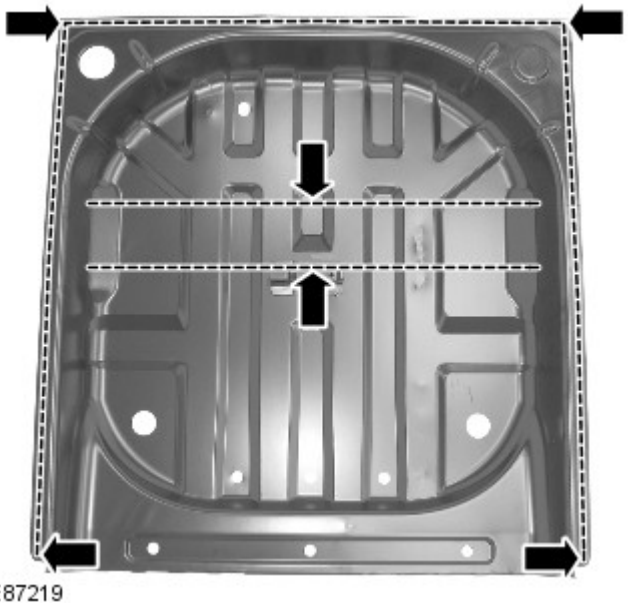
8. Remove the RH and LH rear quarter panel mouldings.
For additional information, refer to: Rear Quarter Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).

9. Release and lay aside the carpet.

10. Remove the RH and LH brake pipes.

11. Release and lay aside the wiring harnesses at the floor panel and inner quarter panels.

12. Mill out the spot welds.



E87219

13. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.

2. Drill holes in the new panel ready for MIG plug welding.

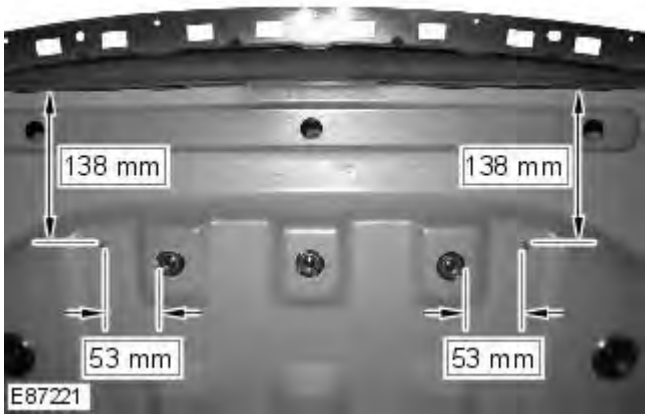
E87220

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. MIG plug weld.

E87220

5. Install weld studs.



6. Dress all welded joints.

7. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

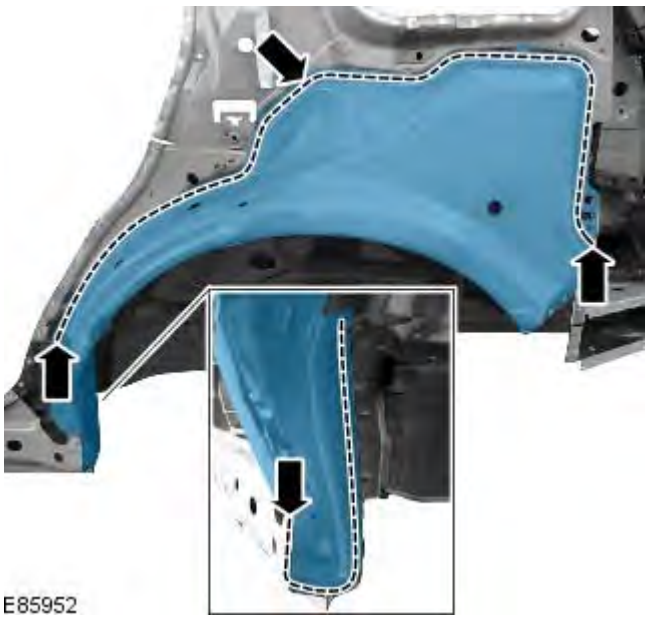
Rear End Sheet Metal Repairs - Rear Wheelhouse Outer

Removal and Installation

Removal

• NOTE: The rear wheelhouse outer is serviced as a separate weld-on panel.

1. The rear wheelhouse outer is replaced in conjunction with:
   - Rear bumper cover
   - Quarter panel
   - Rear door
   - Quarter glass
   - Inner quarter panel
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the inner quarter panel.
   For additional information, refer to: Inner Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.

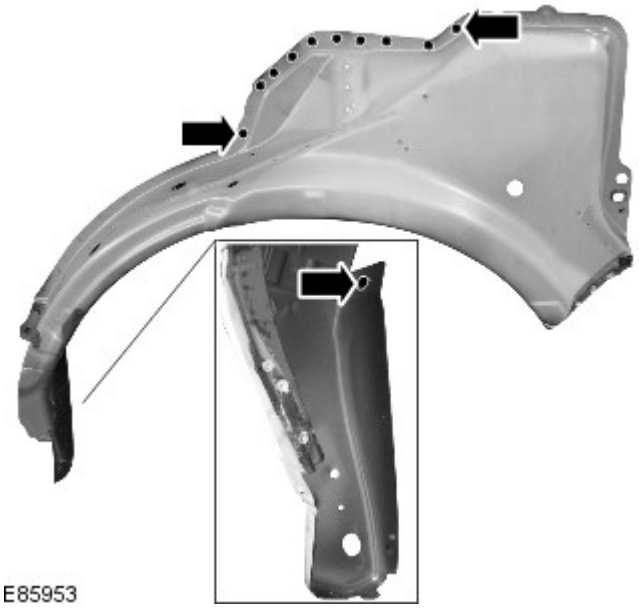


5. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.

2. Drill holes in the new panel ready for MIG plug welding.



E85953

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step. If not, rectify and recheck before proceeding.

4. Remove the new panel.

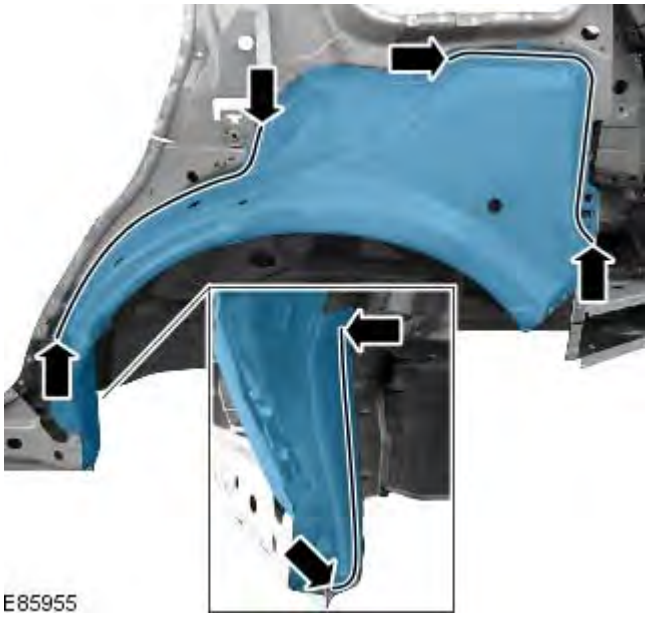
5. Apply adhesive to the areas illustrated.

E85954

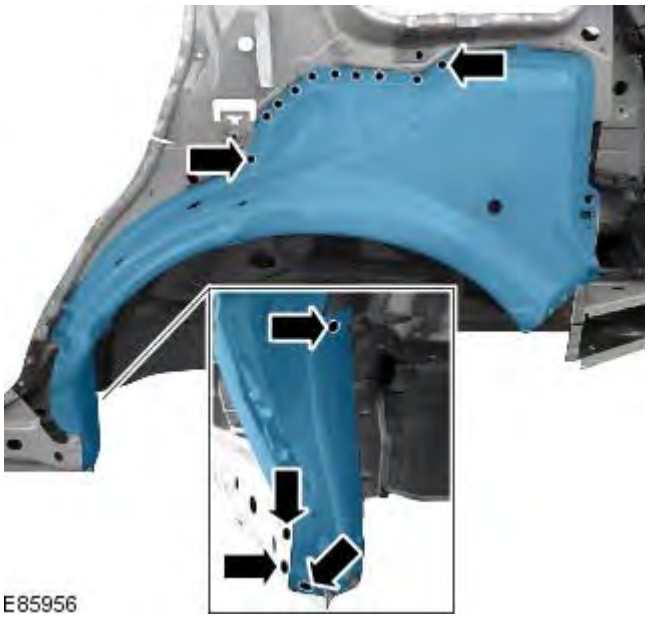
6. Offer up the new panel and clamp into position.

7. Tack weld the butt joints.

8. Spot weld.



9. MIG plug weld.



10. Dress all welded joints.

11. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

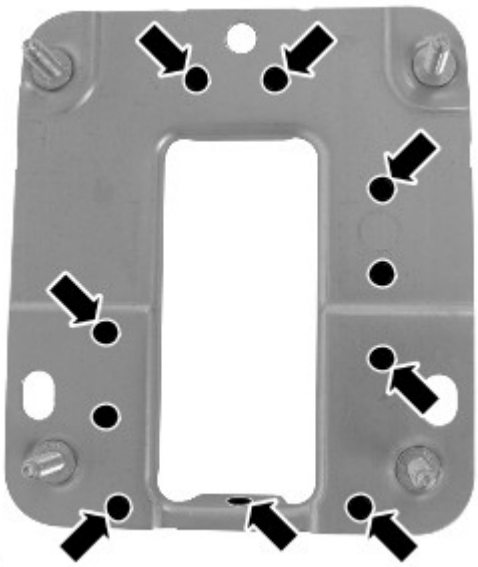
Rear End Sheet Metal Repairs - Rear Bumper Mounting

Removal and Installation

Removal

• NOTE: The rear bumper mounting is serviced as a separate weld-on panel.

1. The rear bumper mounting is replaced in conjunction with:
   - Rear bumper cover
   - Rear bumper armature
   - Back panel
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the back panel.
   For additional information, refer to: Back Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.



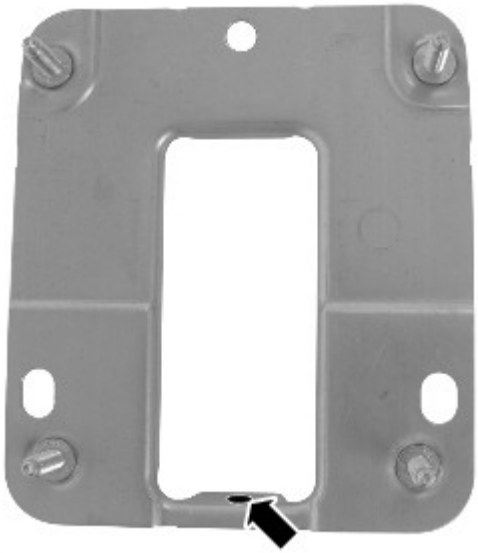
E87215

5. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.

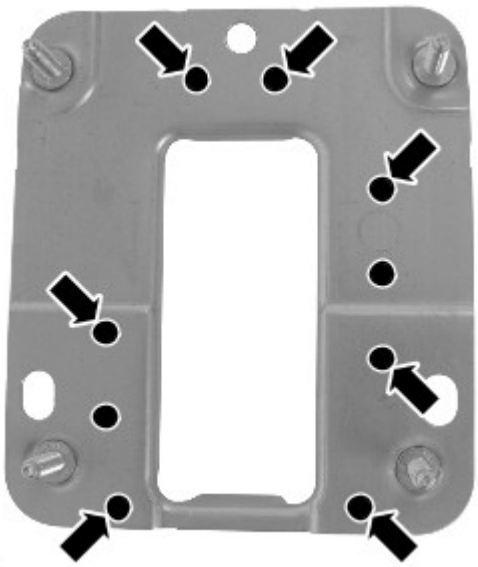
2. Drill hole in the new panel ready for MIG plug welding.



E87216

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. Spot weld.

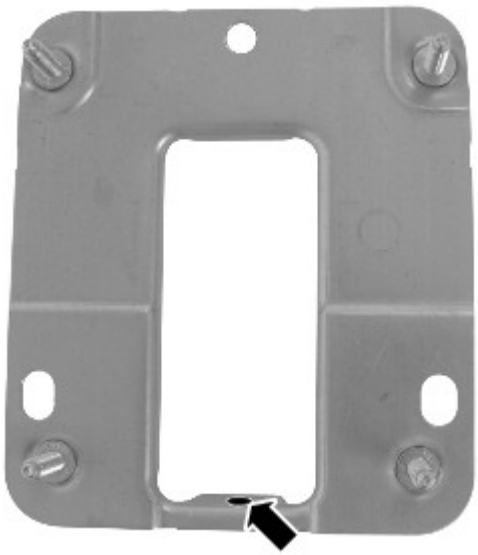


E87217

5. MIG plug weld.

6. Dress all welded joints.

7. The installation of associated panels and mechanical components is the reverse of removal.



E87216

Published: 11-May-2011

Rear End Sheet Metal Repairs - Back Panel

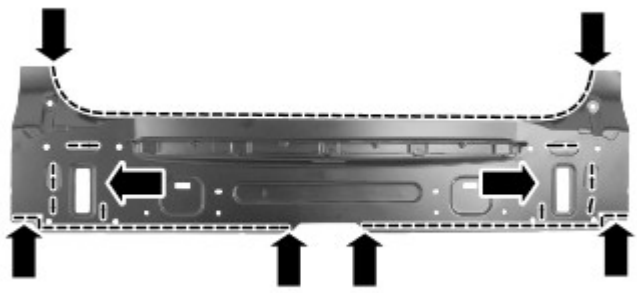
Removal and Installation

Removal

• NOTE: The back panel is serviced as a separate weld-on panel, it includes the bumper retaining bracket.

• NOTE: It is necessary to remove sections of both rear lamp mounting panels to enable removal and refitment of the back panel, (unless the back panel is being replaced in conjunction with a rear lamp mounting panel).

1. The back panel is replaced in conjunction with:
   - Rear bumper cover
   - Rear bumper
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the rear bumper.
   For additional information, refer to: Rear Bumper (501-19 Bumpers, Removal and Installation).
4. Remove the RH and LH bumper retainer guides.
5. Remove the liftgate aperture weatherseal.
6. Remove the back panel trim.
7. Remove the RH and LH quarter panel inner trims.
   For additional information, refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
8. Remove the RH and LH forced air extraction grilles.
9. Remove the spare road wheel.
10. Remove the subwoofer amplifier.
    For additional information, refer to: Subwoofer Amplifier (415-01 Information and Entertainment System, Removal and Installation).
11. Remove the exhaust assembly.
    For additional information, refer to: Exhaust System (309-00A Exhaust System - I6 3.2L Petrol, Removal and Installation).
12. Remove the floor panel exhaust heat shield.
13. Remove the RH and LH road wheels.
    For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
14. Release and lay aside the insulating material at the back panel.
15. Release and lay aside the back panel wiring harness.
16. Saw cut each rear lamp mounting panel, as illustrated.
17. Separate the joints and remove the rear lamp mounting panel sections, **retain the sections for refitment.**
18. Drill out the spot welds.
19. Mill out the spot welds.



E87177

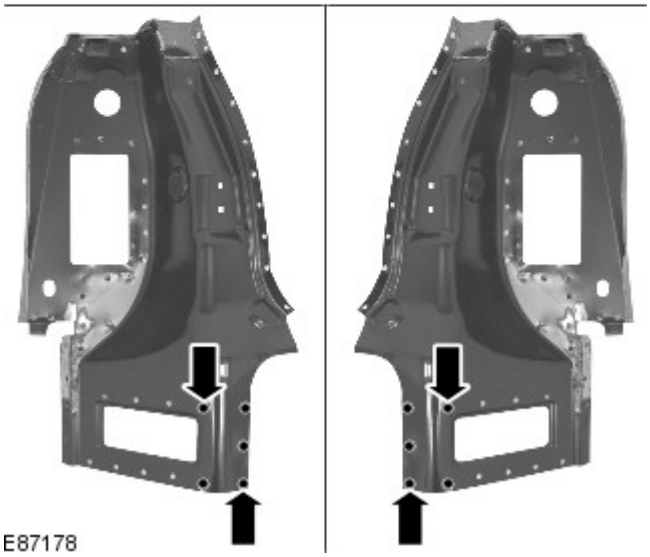
E87176

20. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces, including the rear lamp mounting panel sections.

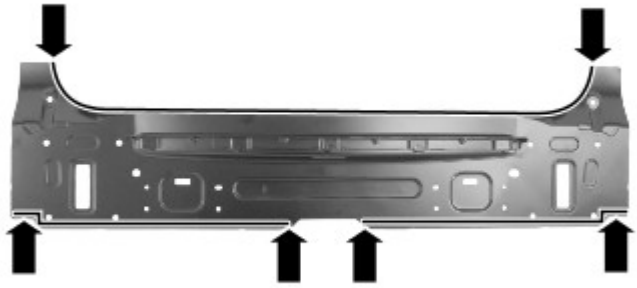
2. Drill holes in the new panel ready for MIG plug welding.



E87178

3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. Spot weld.

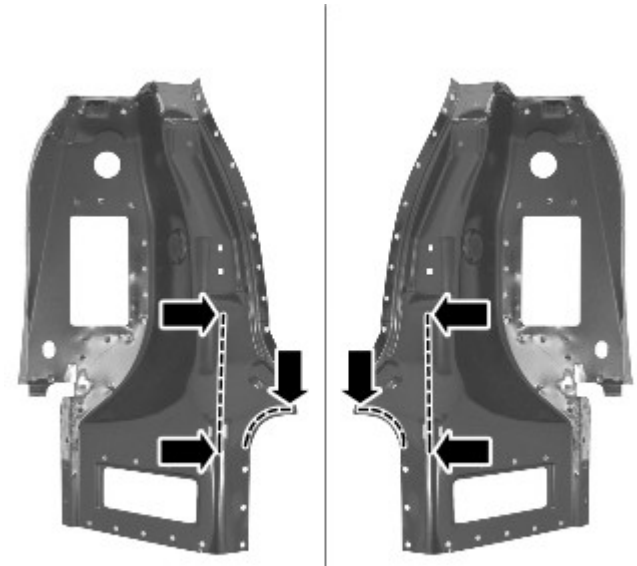


E87179

5. MIG plug weld.

E87180

6. Apply adhesive to the rear lamp mounting panel sections at the points illustrated.

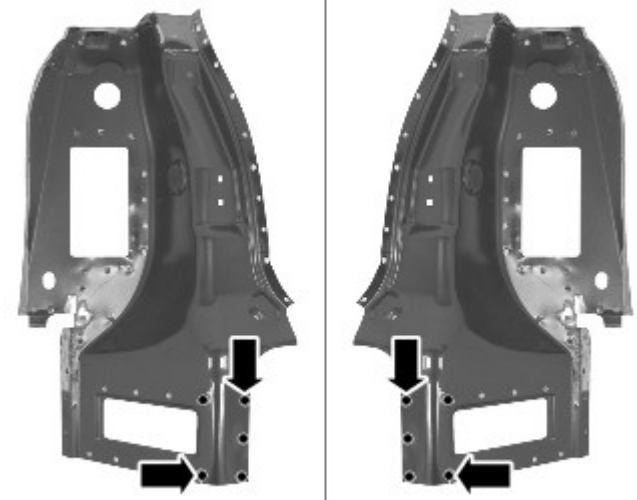


E87181

7. Offer up the rear lamp mounting panel sections and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

8. Tack weld the butt joints.

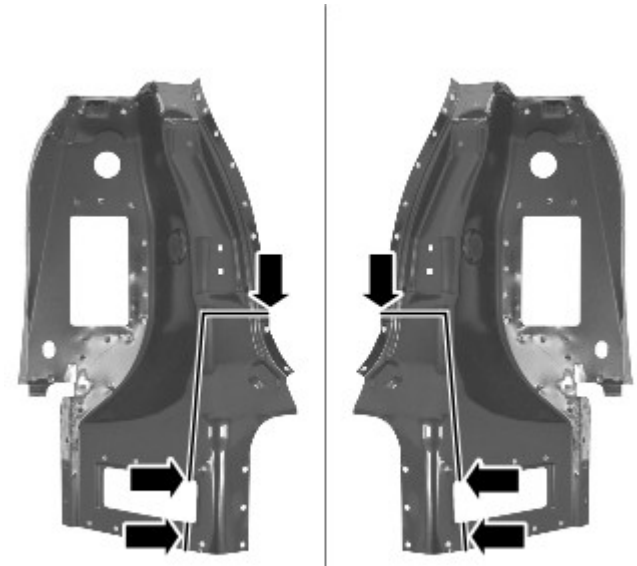
9. MIG plug weld.



E87183

10. Dress the tack welds.

11. MIG weld the butt joint.



E87184

12. Dress all welded joints.

13. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Rear Crossmember

Removal and Installation

Removal

- NOTE: The rear crossmember is serviced as a separate weld-on panel.
- NOTE: The panel is serviced less its weld studs.

1. The rear crossmember is replaced in conjunction with:
   - Rear bumper cover
   - Rear bumper armature
   - Back panel
   - Inner back panel assembly
   - Spare wheel well
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the spare wheel well.
   For additional information, refer to: Spare Wheel Well (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.

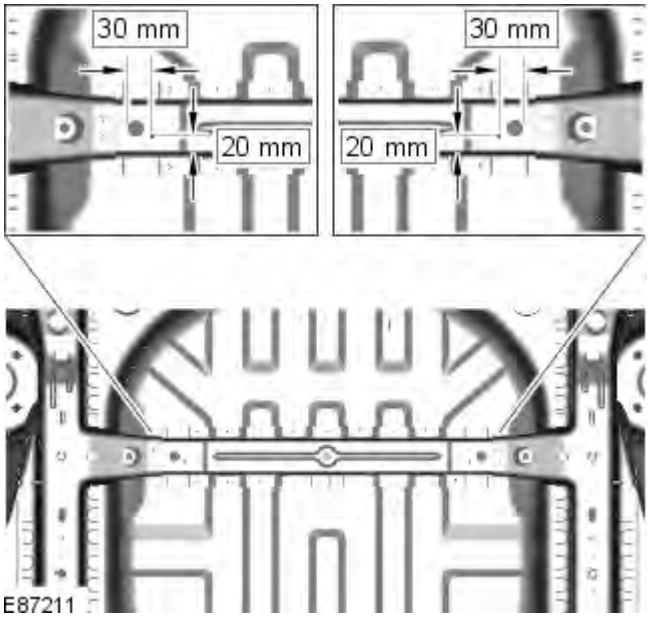
E87209

5. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.
2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.
3. Spot weld.

E87210



4. Install weld studs.

5. Dress all welded joints.

6. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Rear Side Member Lower Side Extension

Removal and Installation

Removal

• NOTE: The rear side member lower side extension is serviced as a separate weld-on panel, it is also serviced as part of the rear side member.

1. The rear side member lower side extension is replaced in conjunction with:
   - Rear bumper cover
   - Rear bumper armature
   - Rear lamp mounting panel
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the rear lamp mounting panel.
   For additional information, refer to: Rear Lamp Mounting Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.

5. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.
2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.
3. MIG plug weld.

4. Dress all welded joints.
5. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Rear Lamp Mounting Panel

Removal and Installation

Removal

• NOTE: The rear lamp mounting panel is serviced as a separate weld-on panel.

• NOTE: There are NVH elements attached to the old panel, they are not serviced on the new panel. If damaged, new elements will be required.

1. The rear lamp mounting panel is replaced in conjunction with:

- Rear bumper cover
- Rear bumper armature

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the rear bumper.
For additional information, refer to: Rear Bumper (501-19 Bumpers, Removal and Installation).

4. Disconnect both battery cables.

5. Remove the D-Pillar trim panel.
For additional information, refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

6. Remove the rear wheel and tire.

7. Remove the rear quarter window moulding.

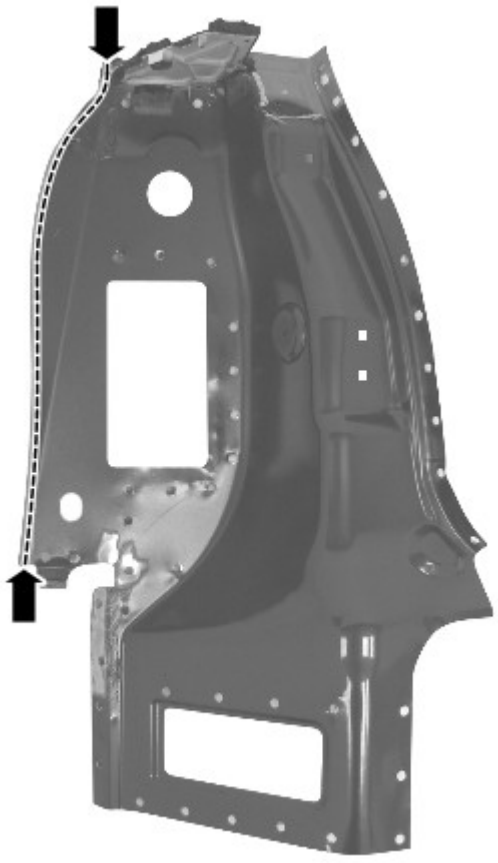
8. Remove the loadspace trim panel.

9. Remove the forced air extraction grille.

10. Release the insulating material and lay aside.

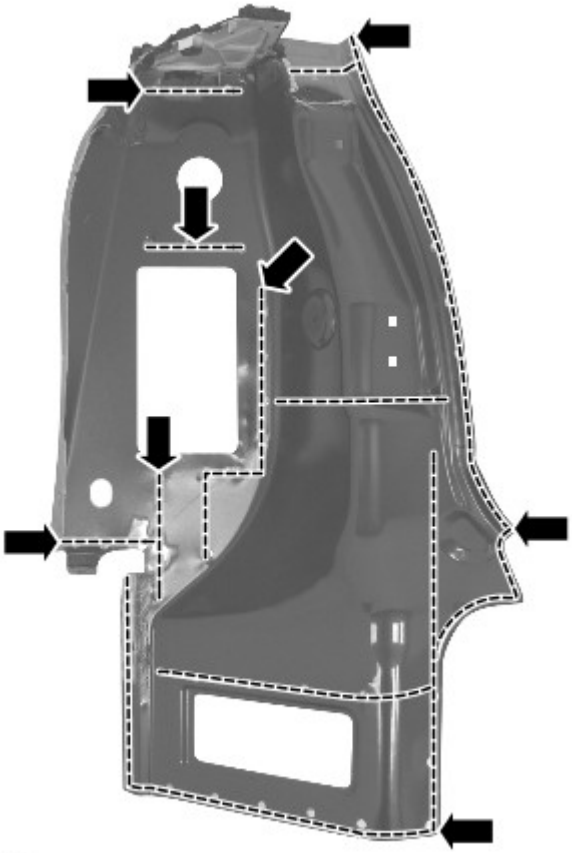
11. Release and lay aside the wiring harness.

12. Use a belt sander to sand down the spot welds in the area illustrated.



E87186

13. Mill out the remaining spot welds.



E87187

14. Separate the joints and remove the old panel, also releasing the NVH elements.

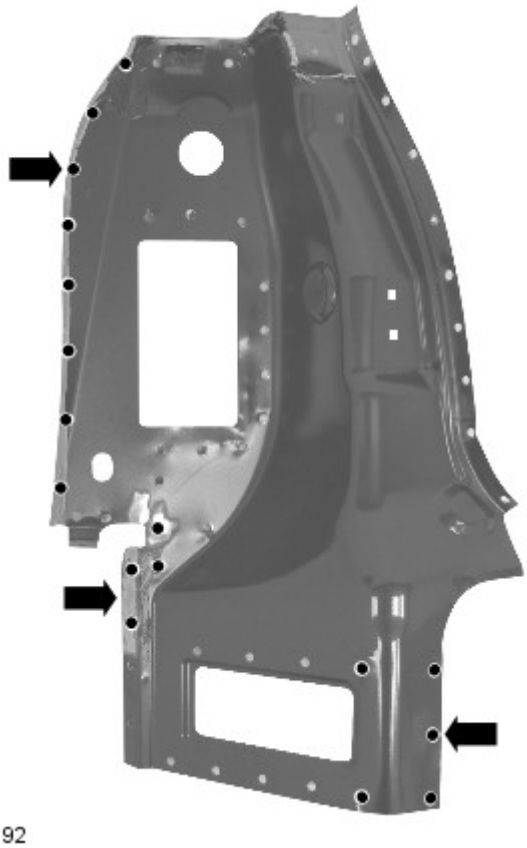
Installation

1. Prepare the old and new panel joint surfaces, including the rear lamp mounting panel sections.

2. Drill holes in the new panel ready for MIG plug welding.

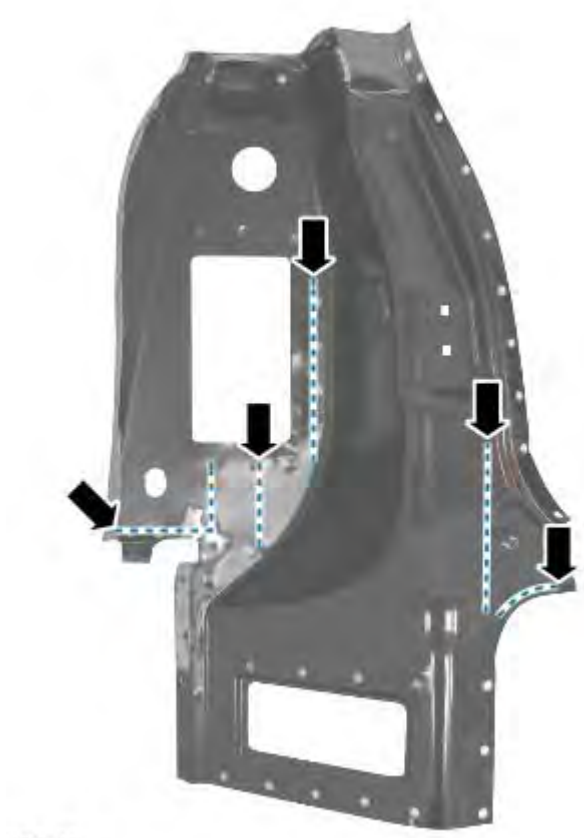
3. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

4. Remove the new panel.



E87192

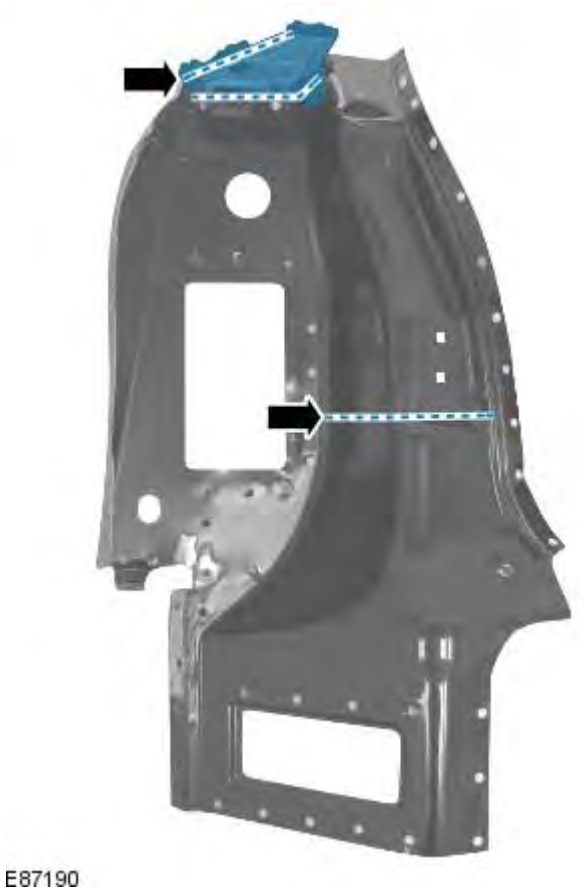
5. Apply adhesive to the areas illustrated.



E87189

6. If necessary, renew the NVH elements.

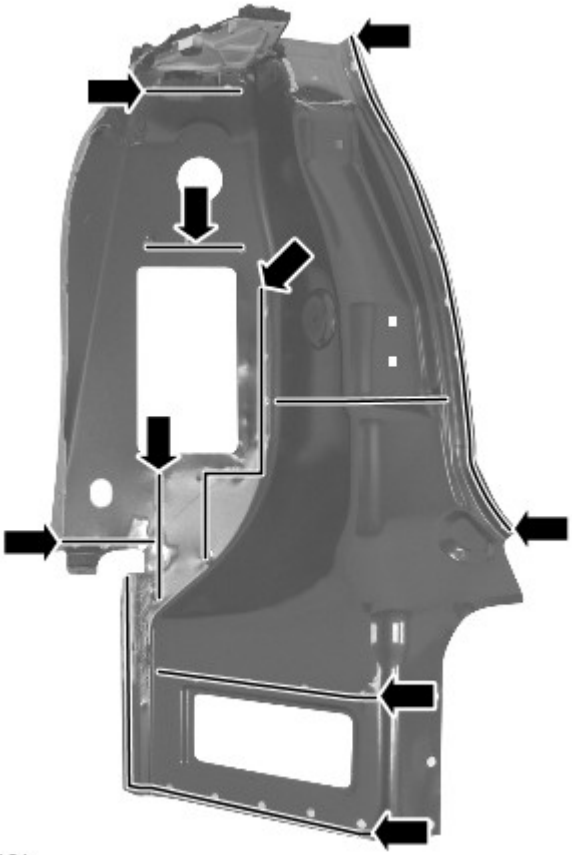
7. Apply sealer adhesive to the NVH elements.



E87190

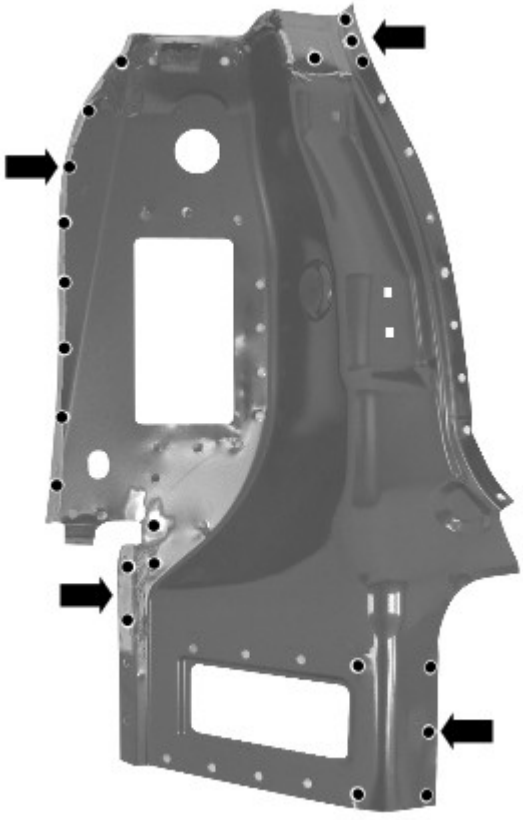
8. Offer up the new panel and clamp into position.

9. Spot weld.



E87191

10. MIG plug weld.



E87188

11. Dress all welded joints.

12. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Water Drain Panel Section

Removal and Installation

Removal

• NOTE: The water drain panel section is cut from the water drain panel, which is a separate weld-on panel.

1. The water drain panel section is replaced in conjunction with:

- Rear bumper cover
- Rear bumper armature
- Liftgate
- Quarter panel
- Rear lamp mounting panel

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the quarter panel.
For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).

4. Remove the rear lamp mounting panel.
For additional information, refer to: Rear Lamp Mounting Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).

5. Mill out the spot welds.

E87454

E87455

6. Saw cut the old panel at the point illustrated, using the new panel for reference, ensuring that the new panel overlaps.

7. Separate the joints and remove the old panel.

Installation

1. Offer up and align the new panel and clamp into position, overlapping the old panel. Saw cut the new and old panels at the point where the MIG butt joint is to be made.
2. Remove the new panel and the old remnants.
3. Prepare the old and new panel joint surfaces.
4. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

5. Tack weld the butt joint.

E87455

6. Spot weld.

E87456

7. Dress the tack welds.

8. MIG weld the butt joint.

E87457

9. Dress all welded joints.

10. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Rear Wheelhouse Front Extension

Removal and Installation

Removal

• NOTE: The rear wheelhouse front extension is to be unpicked from the rear wheelhouse outer service panel.

1. The rear wheelhouse front extension is replaced in conjunction with:
   - Rear bumper cover
   - Quarter panel
   - Rear door
   - Quarter glass
   - Inner quarter panel
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the inner quarter panel.
   For additional information, refer to: Inner Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.

5. Separate the joints and remove the old panel.

Installation

E85947

1. Remove the rear wheelhouse front extension from the wheelhouse outer service panel.

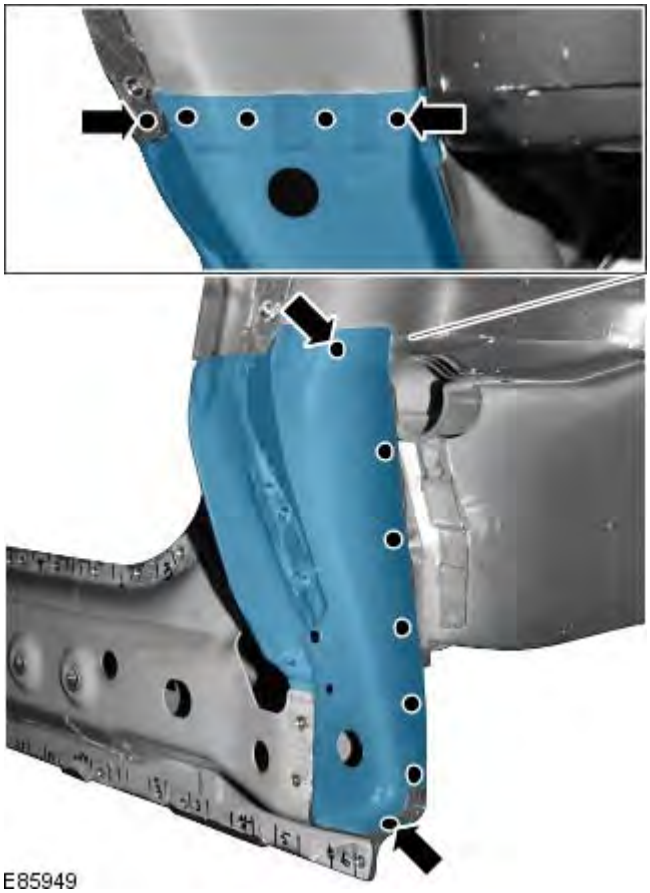
2. Prepare the old and new panel joint surfaces.

3. Drill holes in the new panel ready for MIG plug welding.

E85948

4. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

5. Spot weld.



E85949

6. MIG plug weld.

E85950

7. Dress all welded joints.

8. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Inner Quarter Panel

Removal and Installation

Removal

• NOTE: The inner quarter panel is serviced as a separate weld-on panel.

• NOTE: There is a NVH element on this panel, it is not serviced on the new panel. If damaged, a new element will be required.

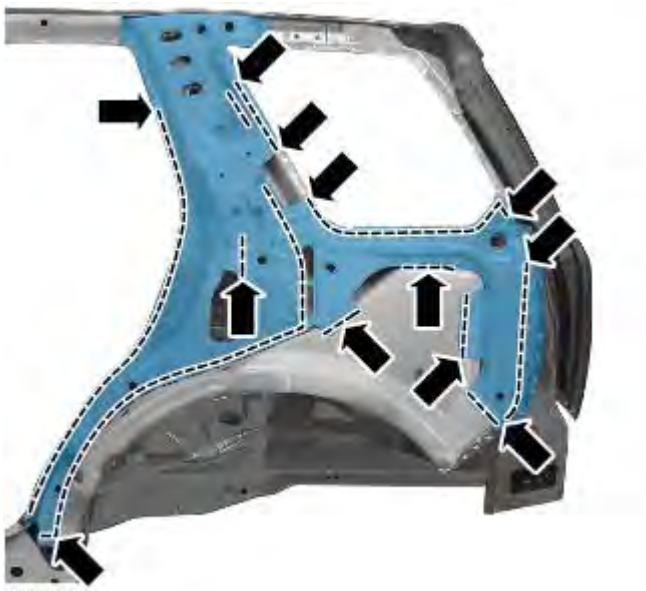
1. The inner quarter panel is replaced in conjunction with:

- Rear bumper cover
- Quarter panel
- Rear door
- Quarter glass

2. For additional information relating to this repair procedure please see the following:
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).

3. Remove the quarter panel.
For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).

4. Mill out the spot welds.



E85922

E85923

5. Saw cut the old panel at the point illustrated, using the new panel for reference, ensuring that the new panel overlaps.

6. Separate the joints and remove the old panel, also releasing the NVH element.

Installation

E85924

1. Offer up and align the new panel and clamp into position, overlapping the old panel. Saw cut through the new and old panels at the point where the MIG butt joint is to be made.

2. Remove the new panel and the old remnants.
3. Prepare the old and new panel joint surfaces.

4. Drill holes in the new panel ready for MIG plug welding.

E85925

5. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.

6. Remove the new panel.

7. If necessary, renew the NVH element.

8. Apply sealer adhesive to the NVH element.

E85926

9. Offer up the new panel and clamp into position.

10. Tack weld the butt joint.

11. Spot weld.

E85927

12. MIG plug weld.

E85928

13. Dress the tack welds.

14. MIG weld the butt joint.

E85929

15. Dress all welded joints.

16. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Front Inner Quarter Panel

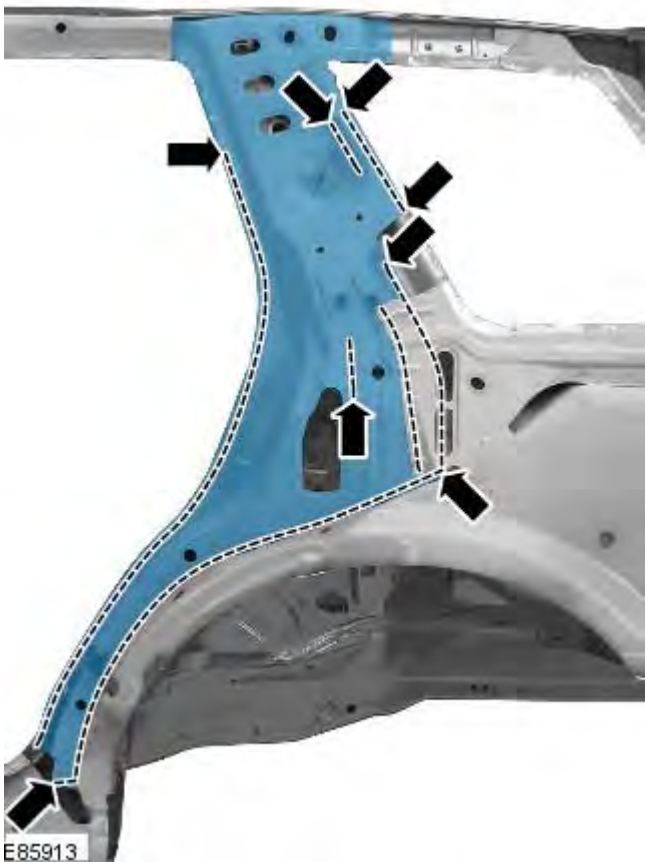
Removal and Installation

Removal

• NOTE: The front inner quarter panel is to be unpicked from the inner quarter panel, it is not serviced separately.

• NOTE: There is a NVH element on this panel, it is not serviced on the new panel. If damaged, a new element will be required.

1. The front inner quarter panel is replaced in conjunction with:
   - Rear bumper cover
   - Quarter panel
   - Rear door
   - Quarter glass
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the quarter panel.
   For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.



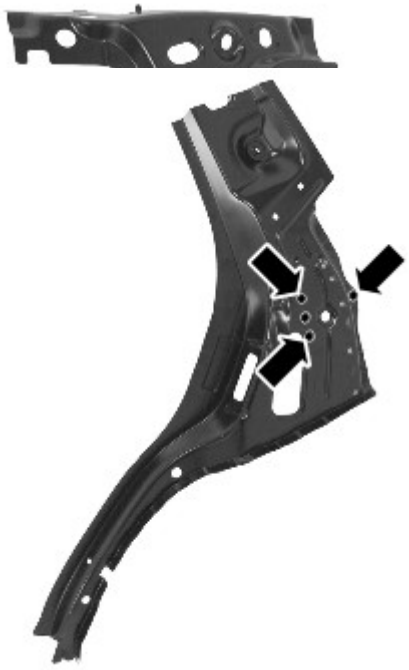
5. Saw cut the old panel at the point illustrated, using the new panel for reference, ensuring that the new panel overlaps.

E85914

6. Separate the joints and remove the old panel, also releasing the NVH element.

Installation

1. Remove the front inner quarter panel from the inner quarter service panel, mill out 5 spot welds.
2. Offer up and align the new panel and clamp into position, overlapping the old panel. Saw cut through the new and old panels at the point where the MIG butt joint is to be made.
3. Remove the new panel and the old remnants.
4. Prepare the old and new panel joint surfaces.
5. Drill holes in the new panel ready for MIG plug welding.


E85916

E85915

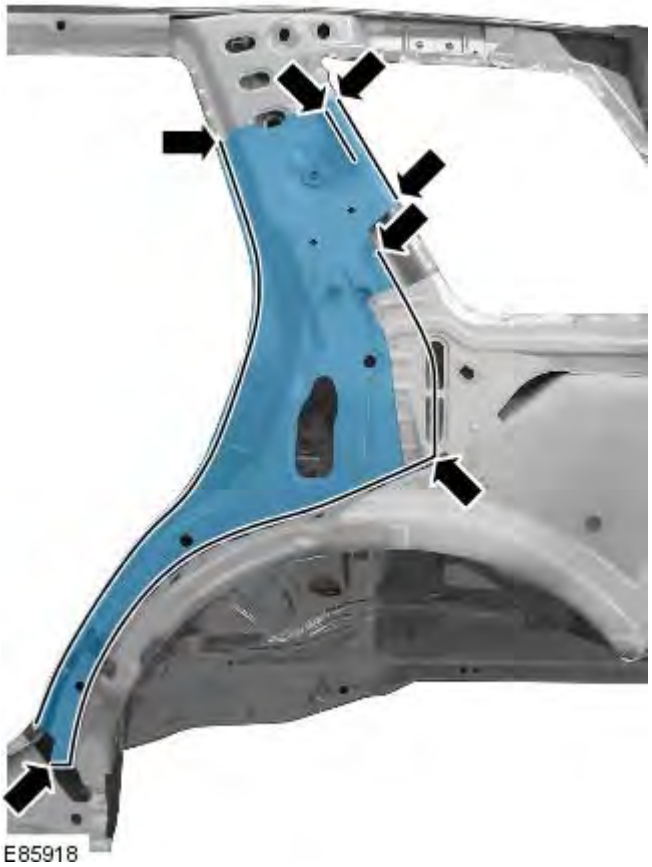
6. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.
7. Remove the new panel.
8. If necessary, renew the NVH element.

9. Apply sealer adhesive to the NVH element.

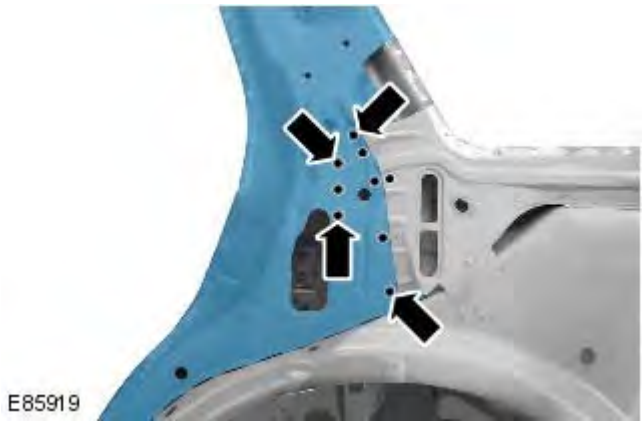
10. Offer up the new panel and clamp into position.

11. Tack weld the butt joint.

12. Spot weld.

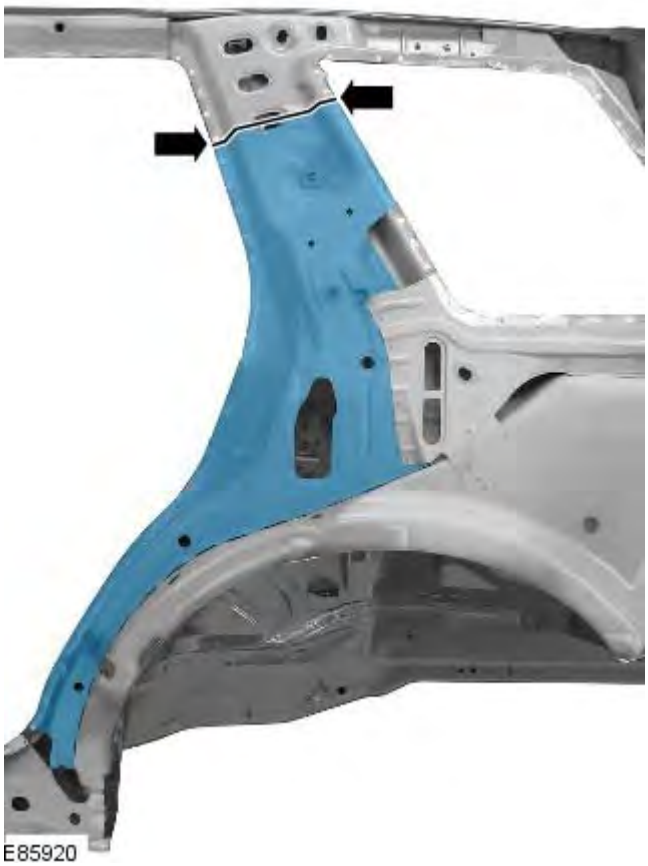


13. MIG plug weld.



14. Dress the tack welds.

15. MIG weld the butt joint.



16. Dress all welded joints.

17. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

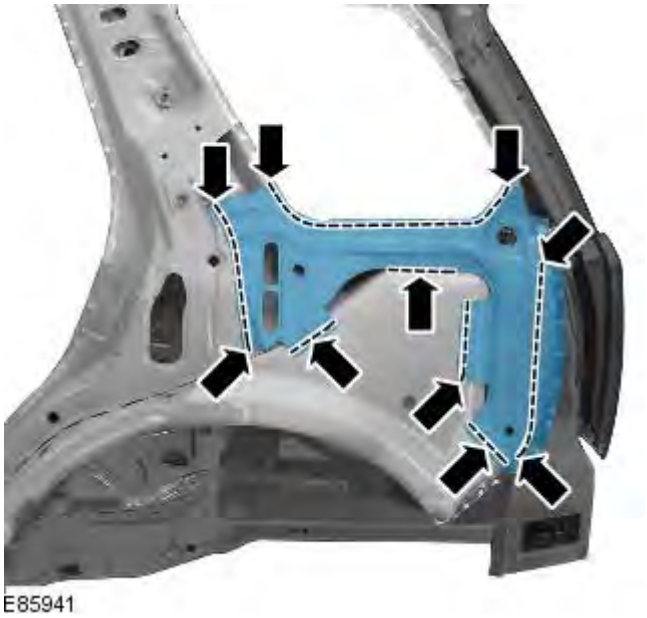
Rear End Sheet Metal Repairs - Rear Inner Quarter Panel

Removal and Installation

Removal

• NOTE: The rear inner quarter panel is to be unpicked from the inner quarter panel, it is not serviced separately.

1. The rear inner quarter panel is replaced in conjunction with:
   - Rear bumper cover
   - Quarter panel
   - Rear door
   - Quarter glass
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the quarter panel.
   For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.



E85941

5. Separate the joints and remove the old panel, also releasing the NVH element.

Installation

1. Remove the rear inner quarter panel from the inner quarter service panel, mill out 5 spot welds.
2. Prepare the old and new panel joint surfaces.
3. Drill holes in the new panel ready for MIG plug welding.

E85942

4. Spot weld.

E85943

5. MIG plug weld.

E85944

6. Dress all welded joints.

7. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Inner Quarter Panel and Wheelhouse

Removal and Installation

Removal

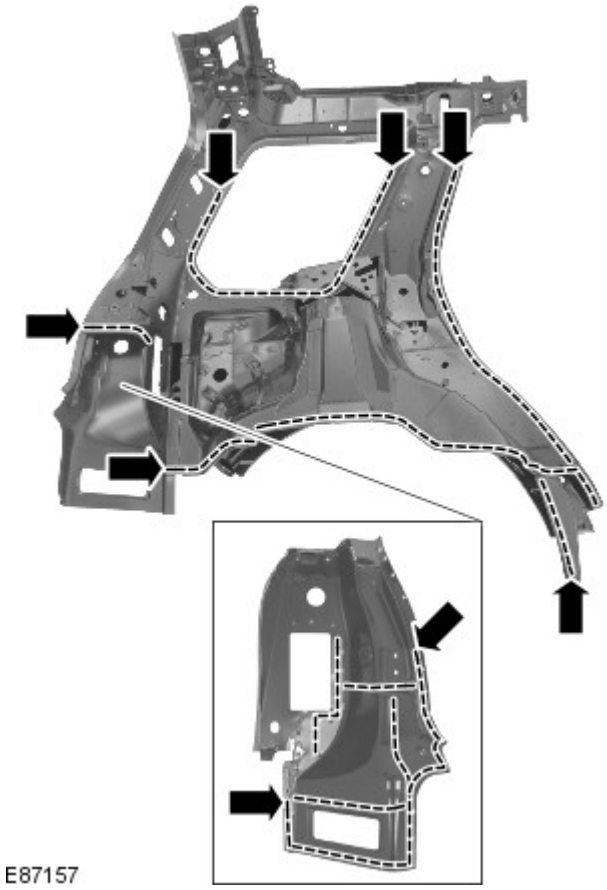
• NOTE: The inner quarter panel and wheelhouse is an assembly of the inner quarter panel, rear wheelhouse inner, rear wheelhouse outer and the rear lamp mounting panel.

• NOTE: The service panel is not fully welded.

• NOTE: The panel is sectioned to avoid disturbing the roof panel.

1. The inner quarter panel and wheelhouse is replaced in conjunction with:
   - Rear bumper cover
   - Rear bumper
   - Quarter panel
   - Rear door
   - Quarter glass
   - Rear subframe and suspension assembly
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the quarter panel.
   For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Remove the rear subframe / suspension as an assembly.
5. Remove the brake pipe.
6. RH Only: Release and lay aside the fuel vent hose.
7. Remove the rear seat backrest.
   For additional information, refer to: Front Seat Backrest Heater Mat (501-10 Seating, Removal and Installation).
8. Release and lay aside the wiring harness.

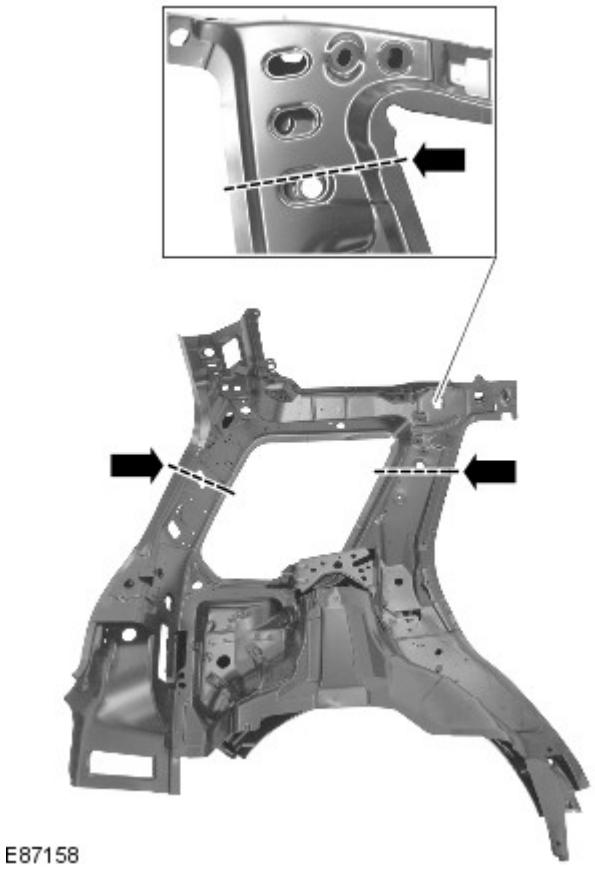
9. Mill out the spot welds.



E87157

10. NOTE: Ensure there is a 50mm minimum stagger between the butt joints.

Saw cut the old panel at the points illustrated, using the new panel for reference, ensuring that the new panel overlaps.

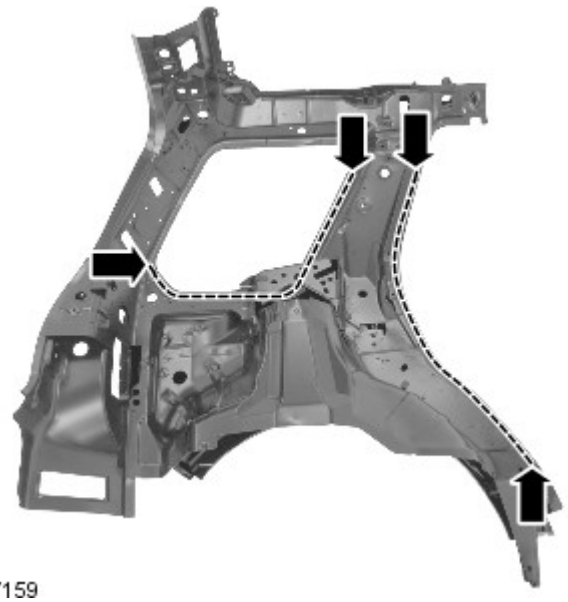


E87158

11. Separate the joints and remove the old panel, also releasing the NVH elements.

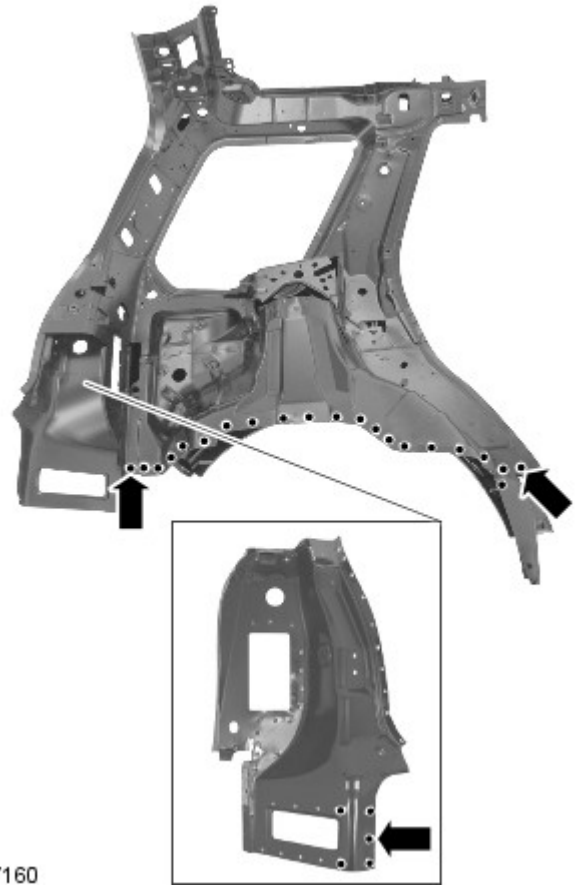
Installation

1. Prepare the new panel in the areas where it is not fully welded and spot weld.



E87159

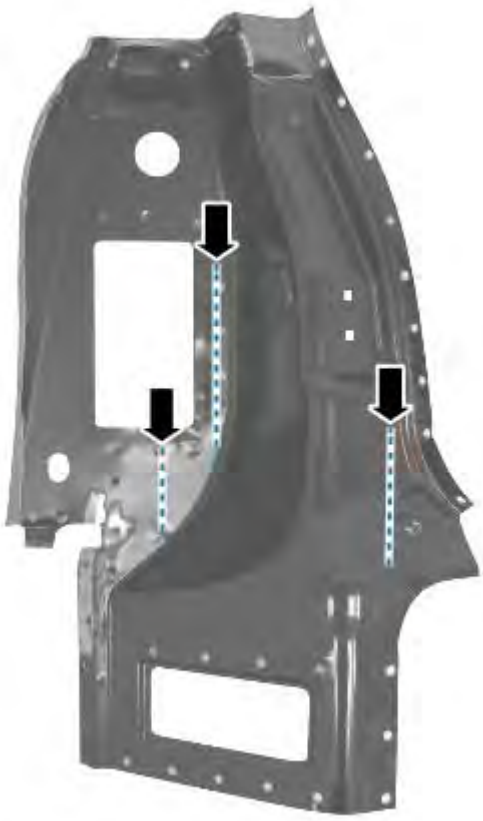
2. Prepare the old and new panel joint surfaces.
3. Drill holes in the new panel ready for MIG plug welding.



E87160

4. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.
5. Remove the new panel.

6. Apply adhesive to the areas illustrated.



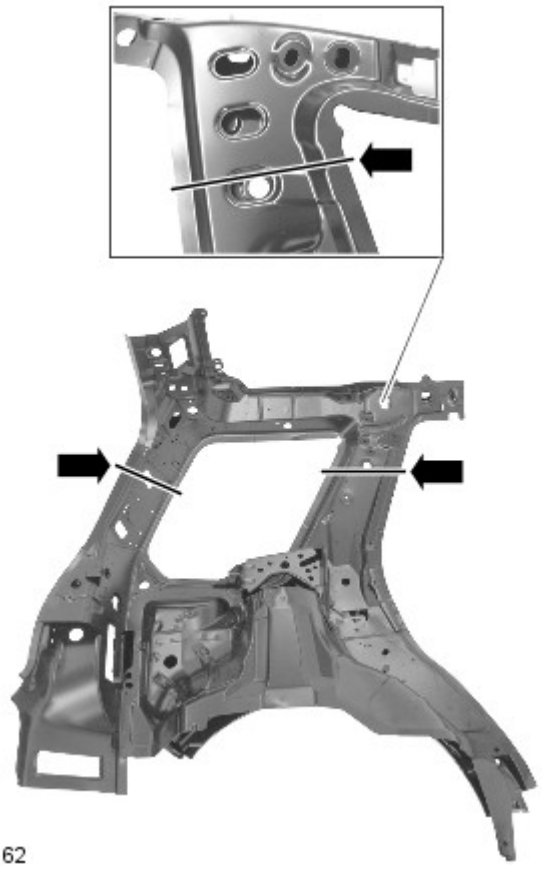
E87161

7. If necessary, renew the NVH element(s).

8. Apply sealer adhesive to the NVH elements.

9. Offer up the new panel and clamp into position.

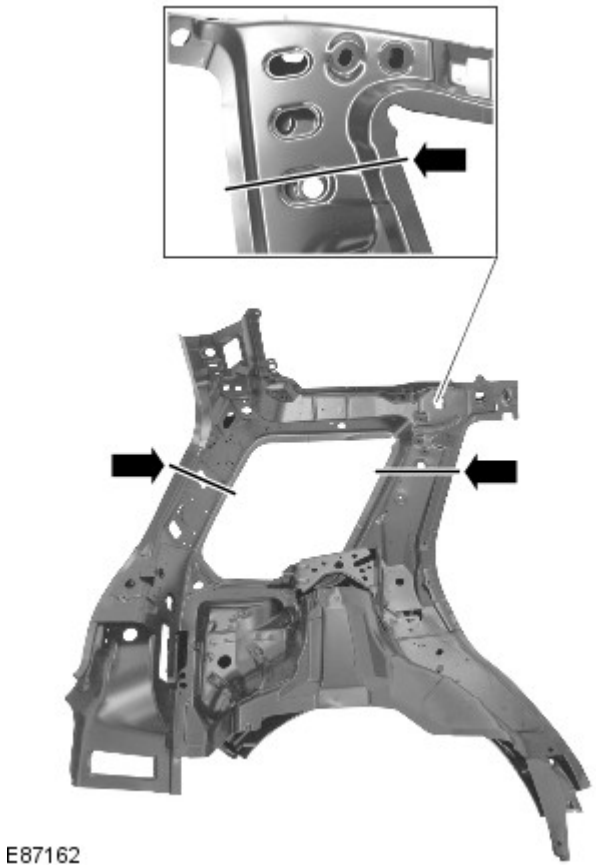
10. With panels clamped into position, tack weld the butt joints.



E87162

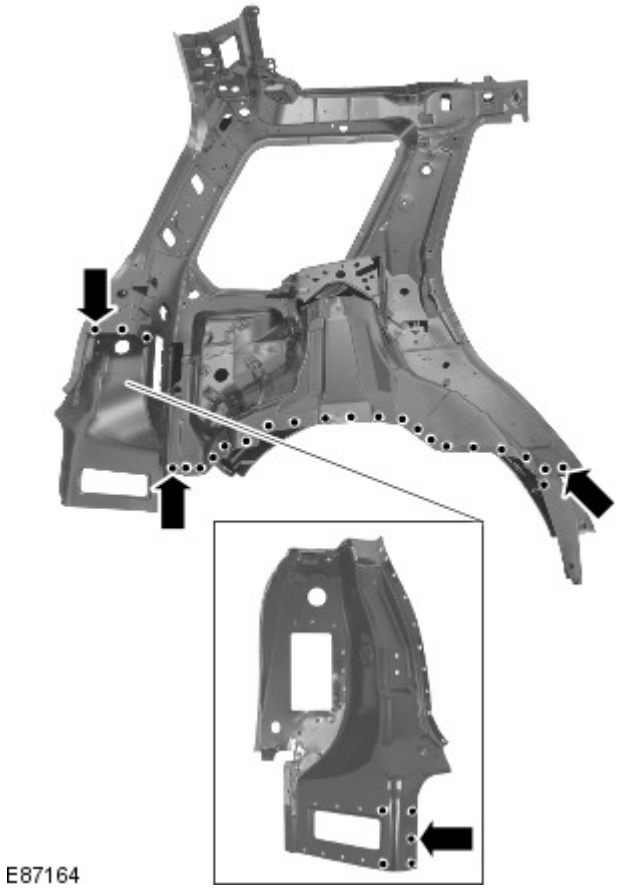
11. Dress the tack welds.

12. MIG weld the butt joints.



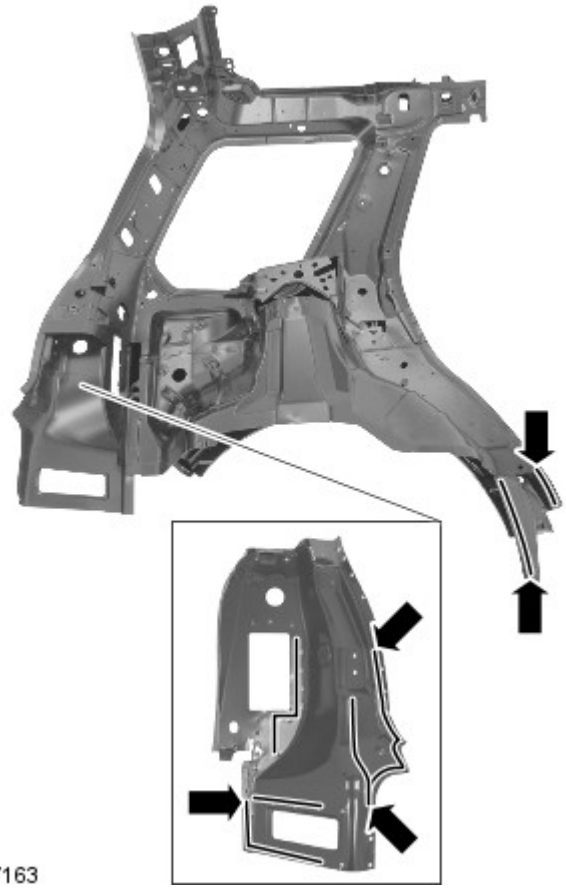
E87162

13. MIG plug weld.



E87164

14. Spot weld.



E87163

15. Dress all welded joints.

16. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Inner Back Panel Assembly

Removal and Installation

Removal

• NOTE: The inner back panel assembly is serviced as a separate weld-on panel.

• NOTE: The panel is serviced less its weld studs.

• NOTE: There are NVH elements attached to the panel, they are not serviced on the new panel. If damaged, new elements will be required.

• NOTE: It is necessary to remove the back panel and both rear lamp mounting panels to enable removal and refitment of the inner back panel.

1. The inner back panel assembly is replaced in conjunction with:
   - Rear bumper cover
   - Rear bumper armature
   - Back panel
   - Both rear lamp mounting panels
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove both rear lamp mounting panels.
   For additional information, refer to: Rear Lamp Mounting Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Remove the back panel.
   For additional information, refer to: Back Panel Assembly (501-30, Removal and Installation).
5. Saw cut the old panel, at the points illustrated, to aid access to spot welds.

E87166

6. Mill out the spot welds.

E87167

7. Separate the joints and remove the old panel, also releasing the NVH elements.

Installation

1. Prepare the old and new panel joint surfaces.
2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.
3. Remove the new panel.
4. Apply adhesive to the areas illustrated.

E87170

5. If necessary, renew the NVH elements.
6. Apply sealer adhesive to the NVH elements.

E87171

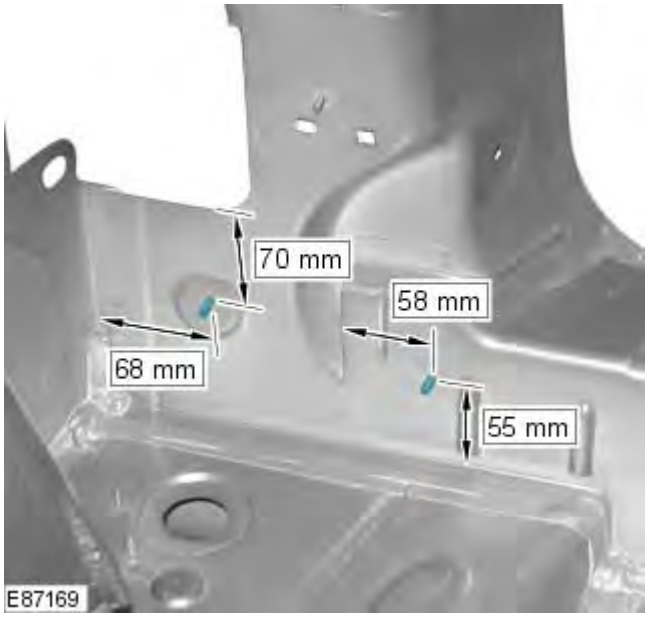
7. Offer up the new panel and clamp into position.
8. Spot weld.

E87168

9. MIG plug weld.

E87172

10. Install weld studs.



11. Dress all welded joints.

12. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Rear End Sheet Metal Repairs - Rear Side Member Upper Side Extension

Removal and Installation

Removal

• NOTE: The rear side member upper side extension is serviced as a separate weld on panel, it is also serviced on the rear side member.

• NOTE: The panel is serviced less its weld studs.

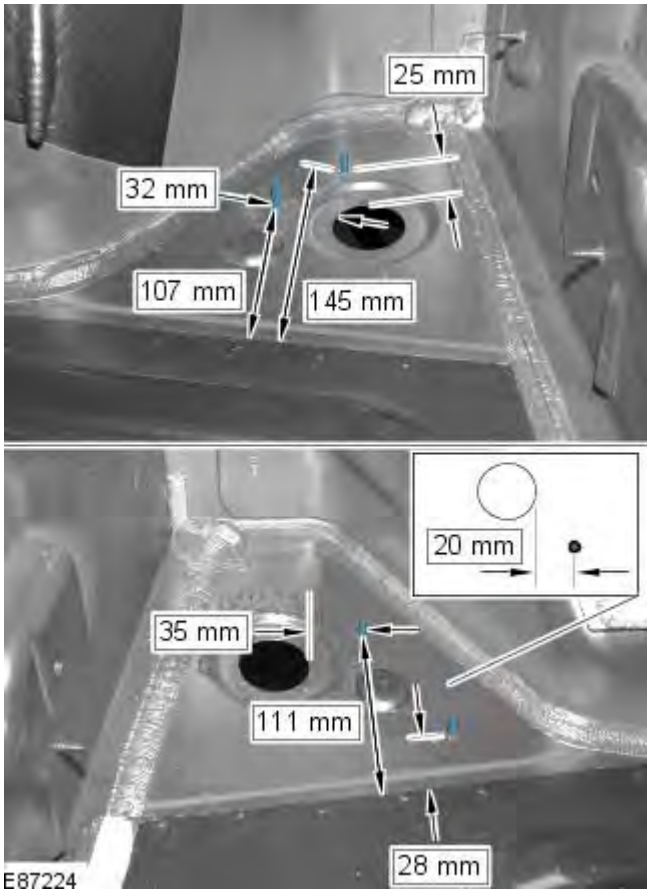
1. The rear side member upper side extension is replaced in conjunction with:
   - Rear bumper cover
   - Rear bumper armature
   - Rear lamp mounting panel
   - Rear side member lower side extension
2. For additional information relating to this repair procedure please see the following:
   For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation) / Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the rear side member lower side extension.
   For additional information, refer to: Rear Side Member Lower Side Extension (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
4. Mill out the spot welds.

5. Separate the joints and remove the old panel.

Installation

1. Prepare the old and new panel joint surfaces.
2. Offer up the new panel and clamp into position. Check alignment, if correct, proceed to next step, if not, rectify and recheck before proceeding.
3. MIG plug weld.

4. Install weld studs.



5. Dress all welded joints.

6. The installation of associated panels and mechanical components is the reverse of removal.

Published: 11-May-2011

Uni-Body, Subframe and Mounting System -

Description	Nm	lb-ft
Front subframe to body bolts*	140 + 240°	103 + 240°
Front subframe cross brace bolts*	45	33
Rear subframe bolts*	175	129
Trailing arm to body bracket bolts*	110	81

*** New nuts/bolts must be fitted**

Published: 11-May-2011

Uni-Body, Subframe and Mounting System - Front Subframe

Removal and Installation

Special Tool(s)

	211-316 Separator, Ball Joint
	502-012 Alignment Pins, Subframe

General Equipment

Powertrain Jack

Removal

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Siphon the fluid from the power steering reservoir.

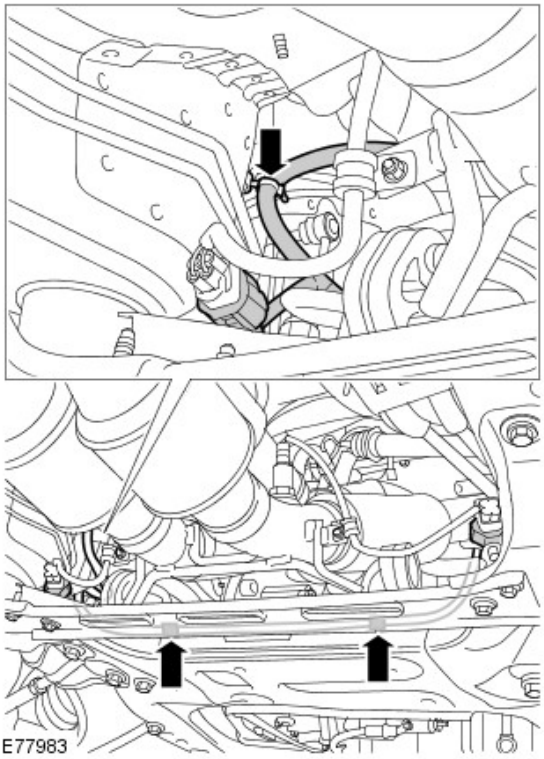
3. Remove the front road wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

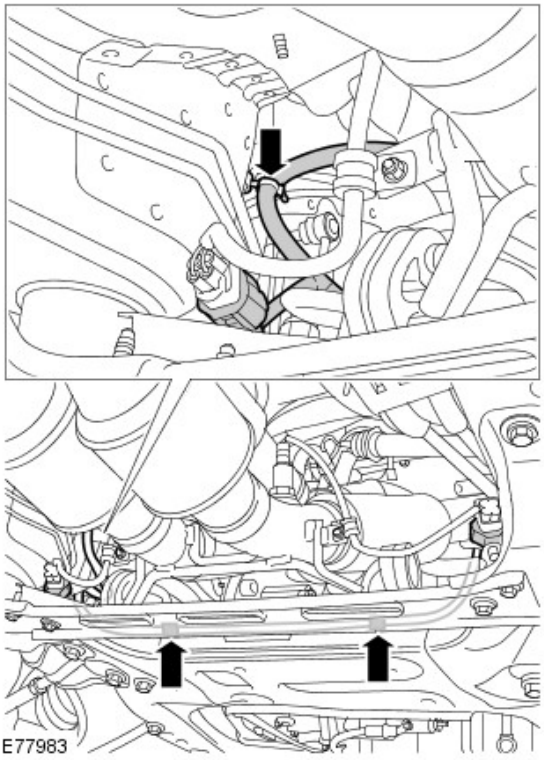
4. Remove the engine undershield.

   Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

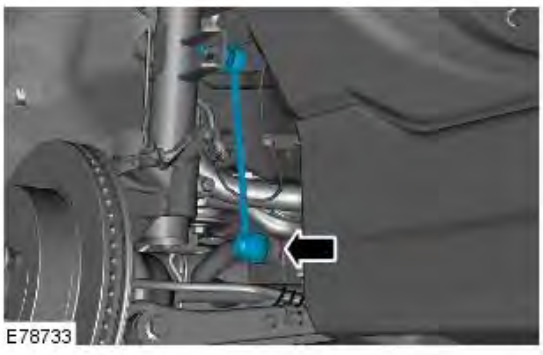
5. Disconnect the LH catalyst monitor sensor electrical connector.



6. Disconnect the RH catalyst monitor sensor electrical connector.

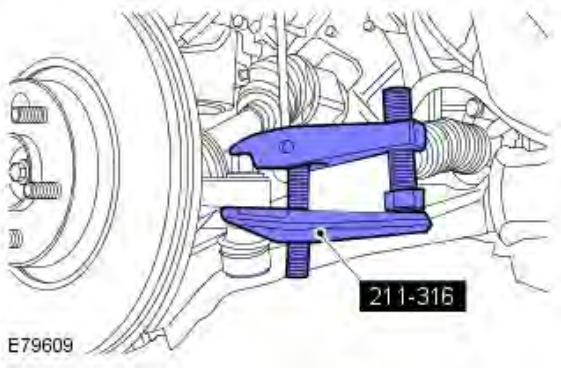


7. Release the catalyst monitor sensor wiring harness.



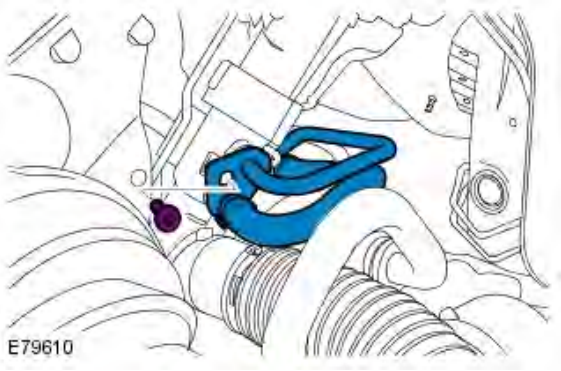
8. **8.** CAUTION: Make sure that the ball joint ball does not rotate.

Disconnect both front stabilizer bar links from the lower suspension arm.



9. Using the special tool, release the LH and RH tie-rod end ball joints.

   Special Tool(s): 211-316

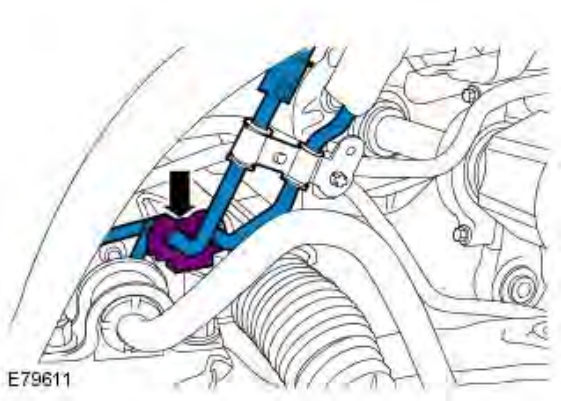


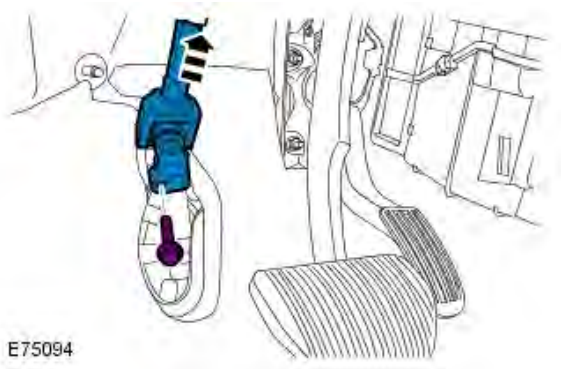
10. **10.** CAUTION: Be prepared to collect escaping fluids.

    • NOTE: Make sure that all openings are sealed.

    Disconnect the pressure lines from the power steering gear.

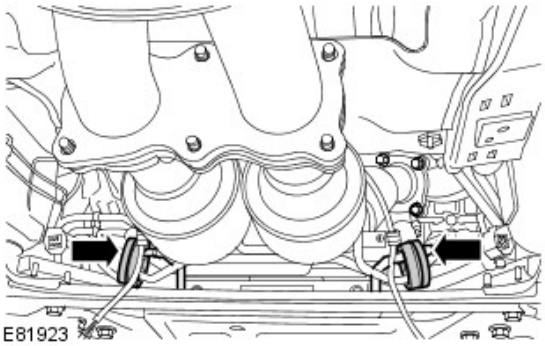
11. Release the PAS lines.



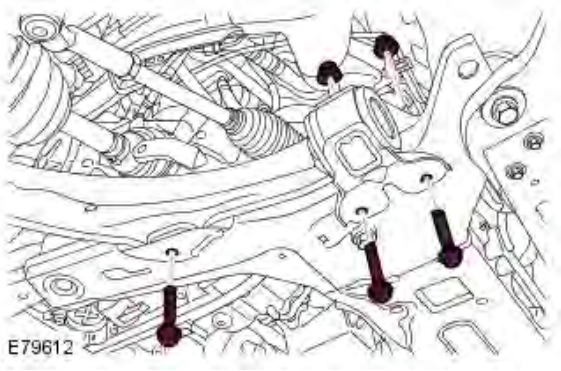


12. **12.** WARNING: Make sure that a new steering column flexible coupling bolt is installed.

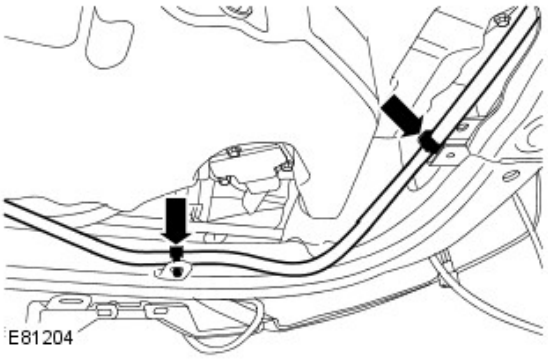
    Disconnect the lower steering column from the steering gear.



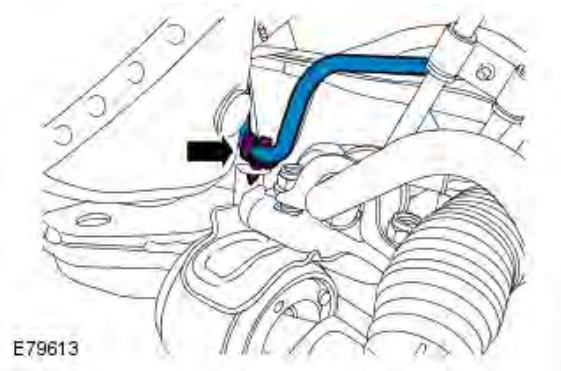
13. Release the downpipe catalytic converters.



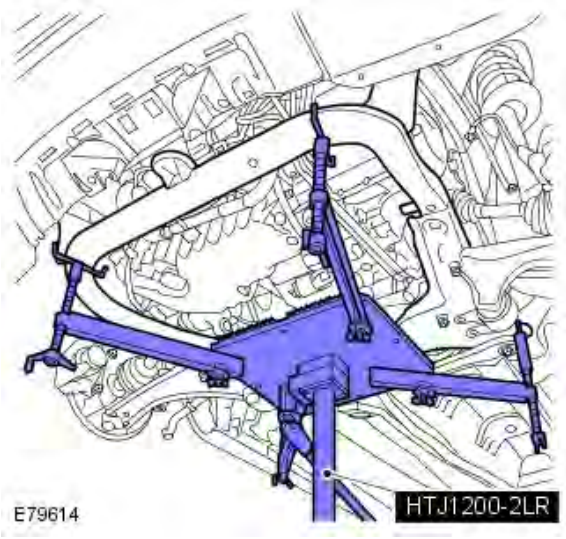
14. Release the LH and RH lower suspension arms.



15. Release the purge line from the subframe.

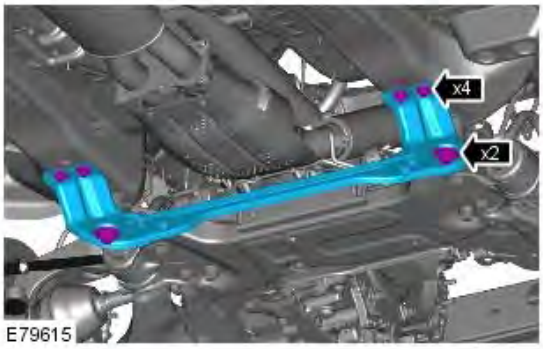


16. Release the fuel line.



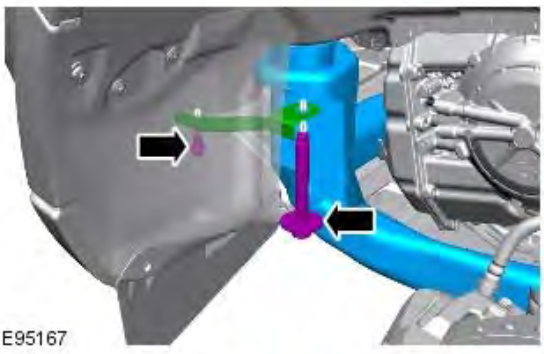
17. Support the subframe.

    General Equipment: Powertrain Jack



18. **18.** CAUTION: Make sure that new subframe bolts are installed.

    Remove the front subframe cross-brace.



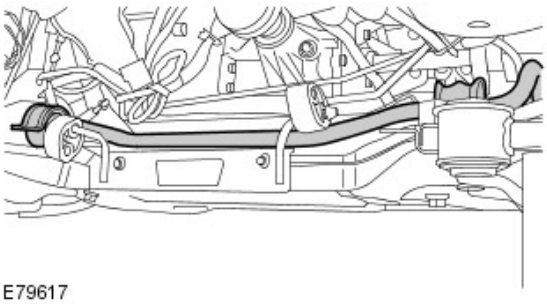
19. **19.** CAUTIONS:

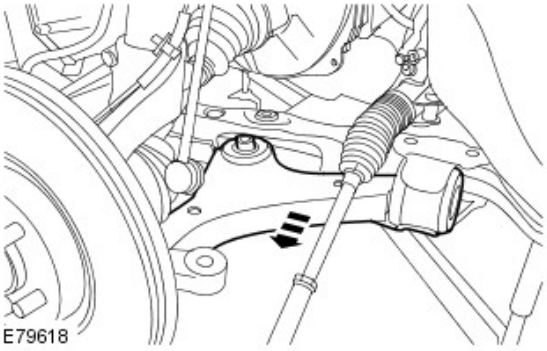
    Mark the components to aid installation.

    Make sure that new subframe bolts are installed.

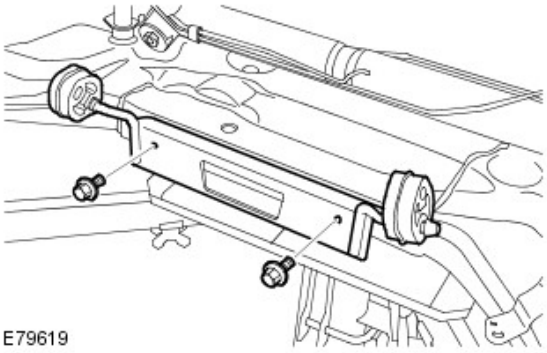
    Lower the front subframe assembly.

20. Remove the stabilizer bar.



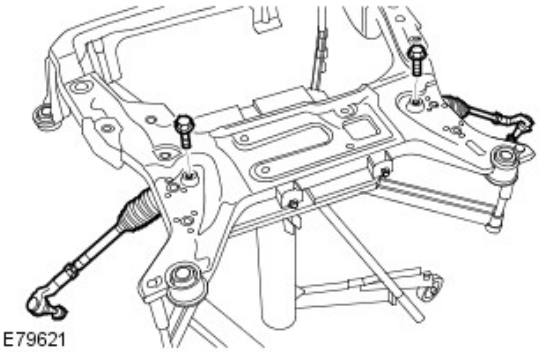


21. Release the LH and RH suspension arms, as the subframe is lowered, and tie them aside.



22. **22.** NOTE: Do not disassemble further if the component is removed for access only.

    Remove the catalyst support bracket.



23. Remove the steering gear.

Installation

1. Install the steering gear.

   Torque: 105 Nm

2. Using the special tool, support the subframe.

3. **3.** CAUTION: Install all the bolts finger tight before final tightening.

   Raise the front subframe to allow installation of the suspension arms and the bolts.

4. Install the LH and RH suspension arms as the subframe is raised.

5. Install the stabilizer bar.

6. **6.** CAUTION: Make sure that new bolts are installed.

   Install the subframe cross-brace.

   Torque: 45 Nm

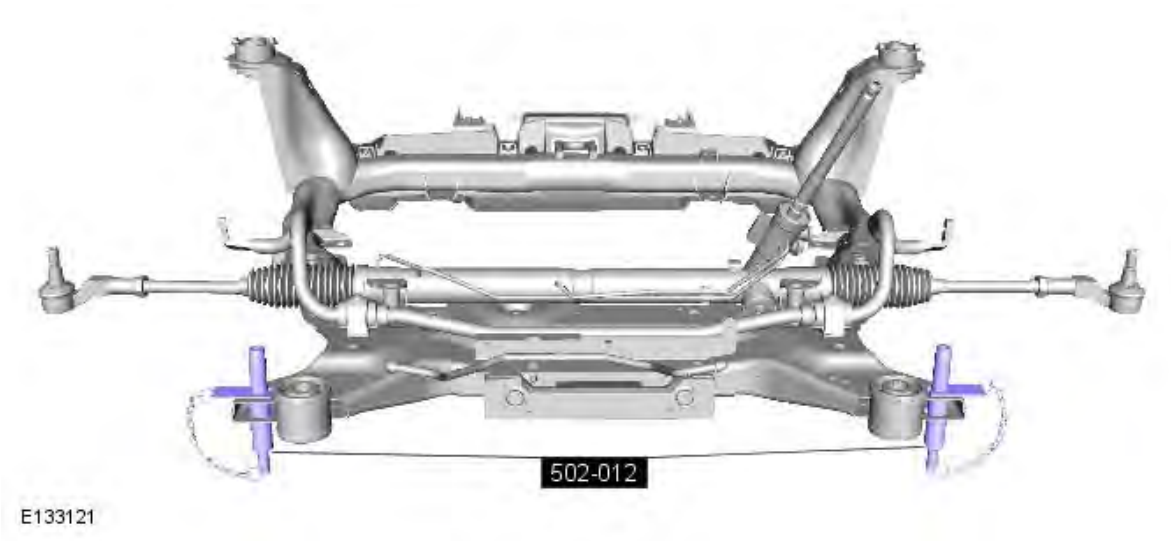
7. **7.** CAUTION: Make sure that new bolts are installed.

- Install the 2 support brackets.

  Torque: 25 Nm

8. Install the front subframe.

   Special Tool(s): 502-012
   Torque:
   Stage 1: 140 Nm
   Stage 2: 240°

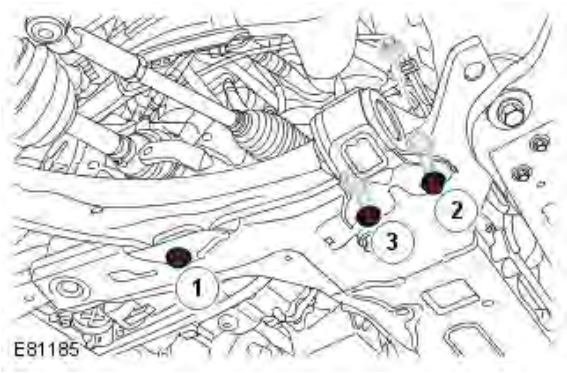


9. Install the catalyst support bracket.

   Torque: 10 Nm

10. Install the fuel line.

11. Install the purge line.



12.
- Tighten bolt 1.

  Torque:
  Stage 1:140 Nm
  Stage 2:45°
- Tighten bolt 2 to

  Torque: 175 Nm
- Tighten bolt 3 to

  Torque: 175 Nm

13. Secure the catalytic converters.

14. **14.** WARNING: Make sure that new nuts are installed.

    Connect the LH and RH tie-rod end ball joints.

    Torque: 105 Nm

15. Connect the steering gear pressure lines.

    Torque: 25 Nm

16. **16.** WARNING: Make sure that new nuts are installed.

    CAUTION: Make sure that the ball joint ball does not rotate.

    Install the stabilizer link bar to the lower suspension arm, and tighten to 55 Nm (41 lb.ft)

17. Secure the electrical harness.

18. **18.** WARNING: Make sure that a new steering column flexible coupling bolt is installed.

    Connect the steering column to the steering gear.

    Torque: 25 Nm

19. Connect and secure the catalyst monitor sensor electrical connectors.

20. Install the 2 subframe mounting bolts and remove the jack.

21. Install the engine undershield.

    Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

22. Install the wheels and tires.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

23. Refill and bleed the power steering.

    Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

24. Using only four wheel alignment equipment approved by Land Rover, check and adjust the wheel alignment.

Published: 11-May-2011

Uni-Body, Subframe and Mounting System - Front Subframe Front Bushing

Removal and Installation

Special Tool(s)

E75373	204-598 Hydraulic Cylinder 10t
E73708	204-598-01 Remover/Installer, Subframe Bushing Guide

Removal

1. Remove the cover and disconnect the battery ground cable.

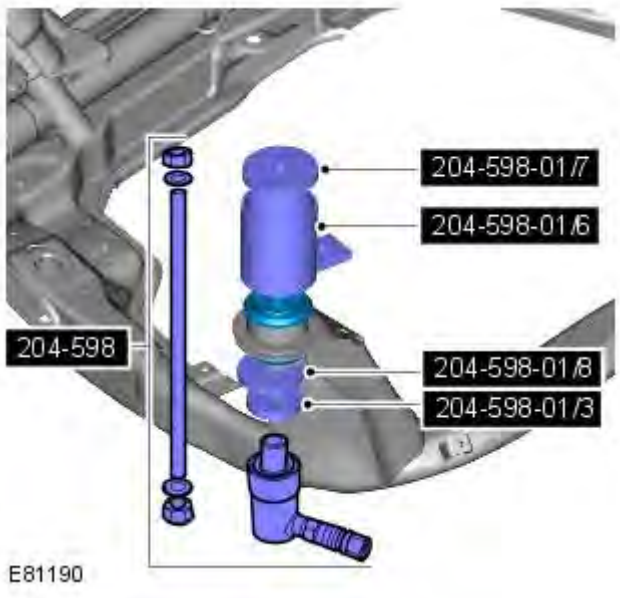
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the front subframe assembly.

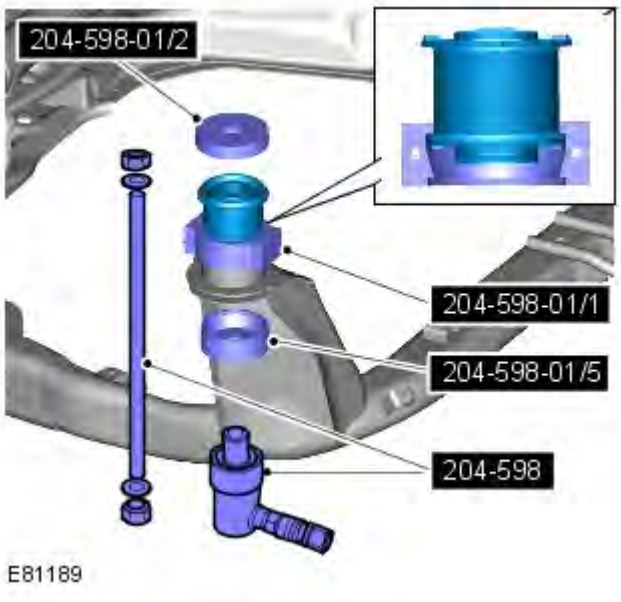
   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



4. **4.** CAUTION: Mark the components to aid installation.
   - Remove the bushing.

     Special Tool(s): 204-598, 204-598-01
   - Special tool 204-598-01/8 is used to start the bushing removal process, and must be removed after the bushing has released, as it will not pass through the sub-frame bushing aperture.

Installation



1. **1.** CAUTION: Make sure that the component aligns with the installation mark.

   Install the bushing.

   Special Tool(s): 204-598, 204-598-01

2. Install the front subframe.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

3. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Uni-Body, Subframe and Mounting System - Front Subframe Rear Bushing

Removal and Installation

Special Tool(s)

E75373	204-598 Hydraulic Cylinder 10t
E73708	204-598-01 Remover/Installer, Subframe Bushing Guide

Removal

1. Remove the cover and disconnect the battery ground cable.

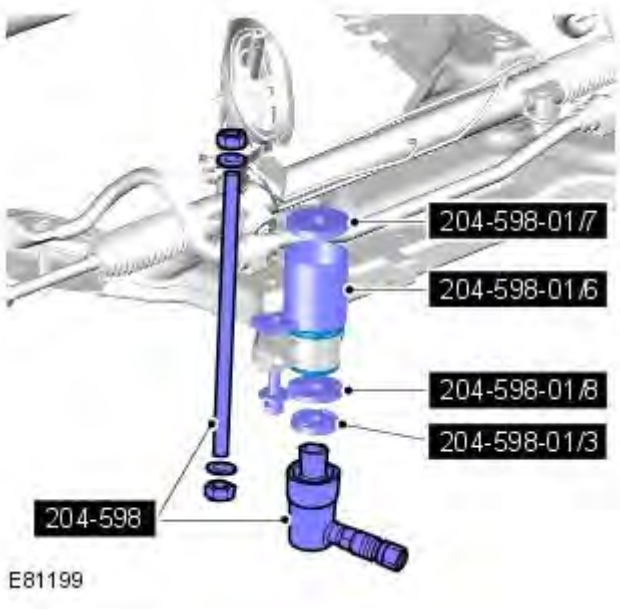
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. **2.** WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Remove the front subframe assembly.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



4. **4.** CAUTION: Mark the components to aid installation.
   - Special tool 204-598-01/8 is used to start the bushing removal process, and must be removed after the bushing has released, as it will not pass through the sub-frame bushing aperture.
   - Remove the bushing.

   Special Tool(s): 204-598, 204-598-01

Installation

1. **1.** CAUTION: Make sure that the component aligns with the installation mark.

   Install the bushing.

   Special Tool(s): 204-598, 204-598-01

2. Install the front subframe.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

3. Connect the battery ground cable and install the cover.

   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Published: 11-May-2011

Uni-Body, Subframe and Mounting System - Rear Subframe

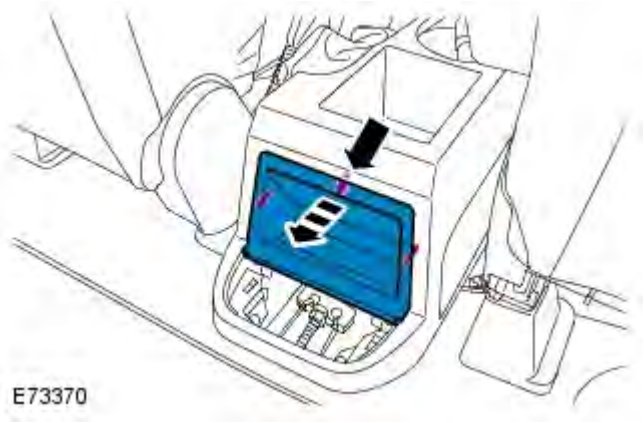
Removal and Installation

General Equipment

Powertrain Jack

Removal

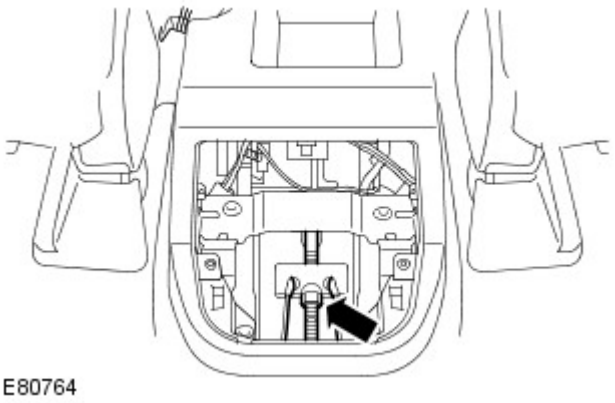
1.



2. Remove the stowage compartment.

3. **3.** NOTE: Use an additional wrench to prevent the component from rotating.

   Remove the adjusting nut and disconnect the front parking brake cable.

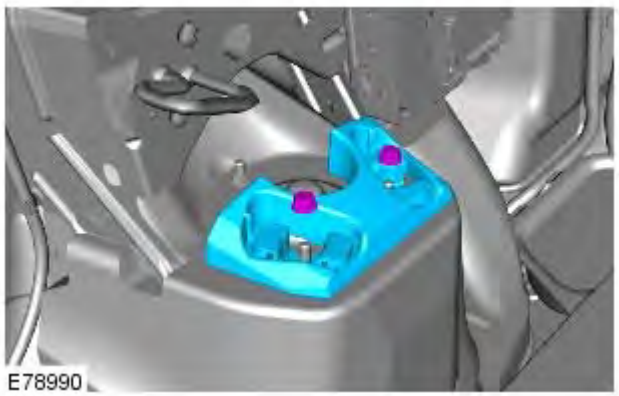


4. Release the rear parking brake cables and remove the compensator.

5. Remove the rear quarter trim panels.

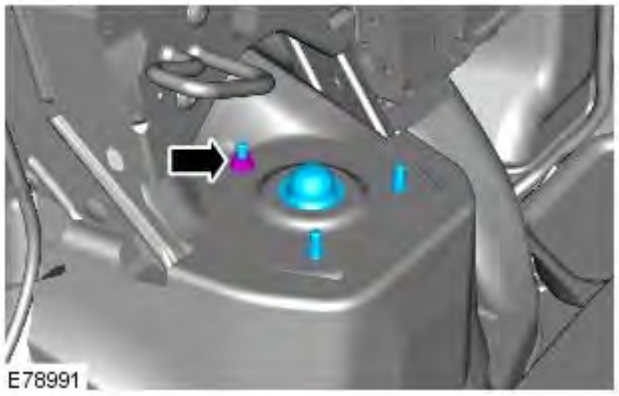
   Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

6.



7. Repeat the above procedure on the opposite hand.

8.



9. Repeat the above procedure on the opposite hand.

10. **10.** WARNING: Make sure to support the vehicle with axle stands.

    Raise and support the vehicle.

11. Remove both rear wheels and tires.

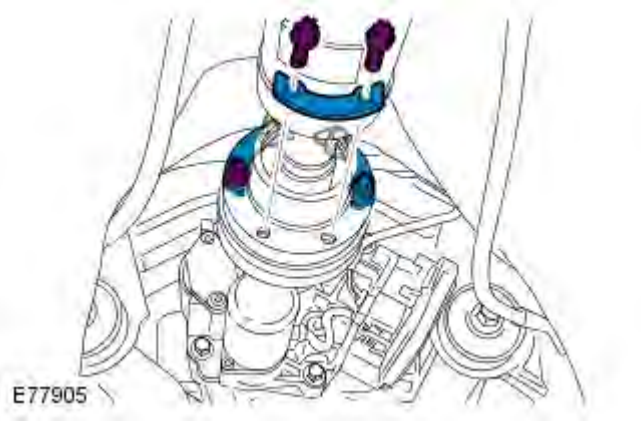
    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

12. If installed, remove the rear suspension height sensor.

    Refer to: Rear Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation).

13. Remove the rear muffler.

    Refer to: Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

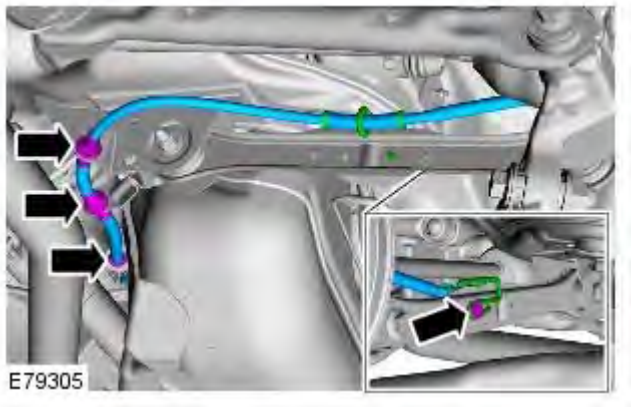


14. **14.** CAUTIONS:

⚠ Mark the position of the driveshaft flange in relation to the drive pinion flange.

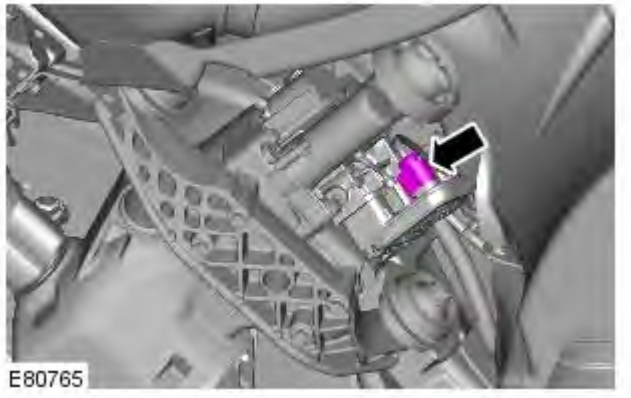
⚠ To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

Discard the bolts.



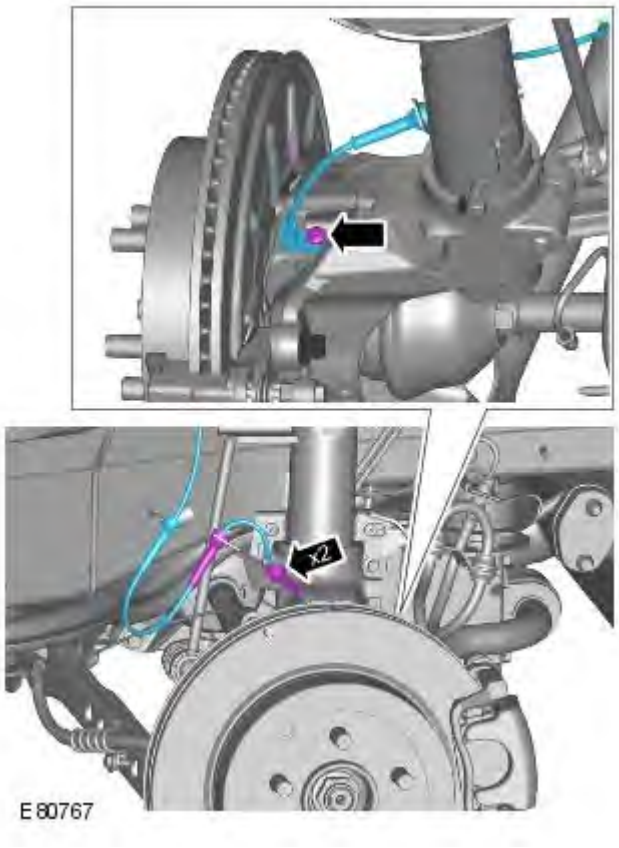
15.

16. Repeat the above procedure on the opposite hand.

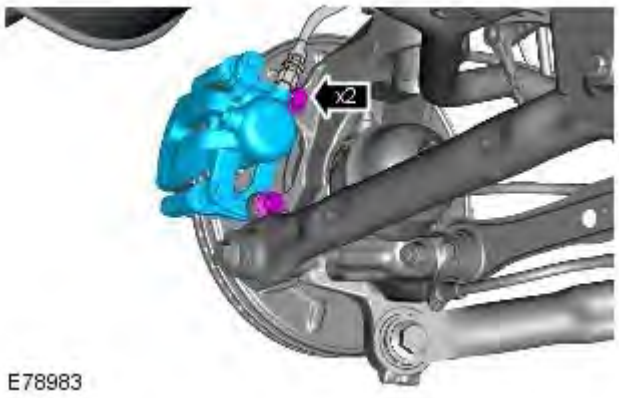


17.

18.



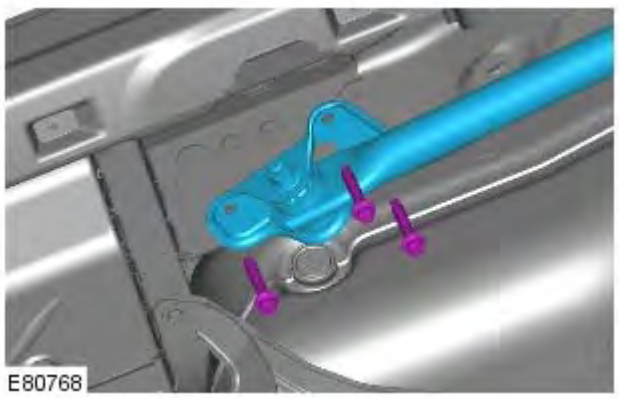
19. Repeat the above procedure on the opposite hand.



20. **20.** CAUTION: Make sure that no load is placed on the brake hose.

    Tie the rear brake caliper aside.

21. Repeat the above procedure on the opposite hand.



22. **22.** CAUTION: Make sure the bushing(s) or isolator(s), are not strained or left unsupported during this procedure.

    Release the trailing arm to body bracket.

23. Repeat the above procedure on the opposite hand.

24. Support the subframe.

General Equipment: Powertrain Jack

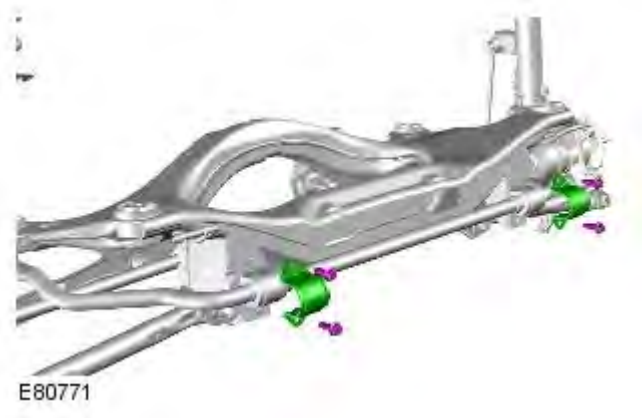
25.

26. Carefully lower the subframe for access to the differential breather lines.

27.

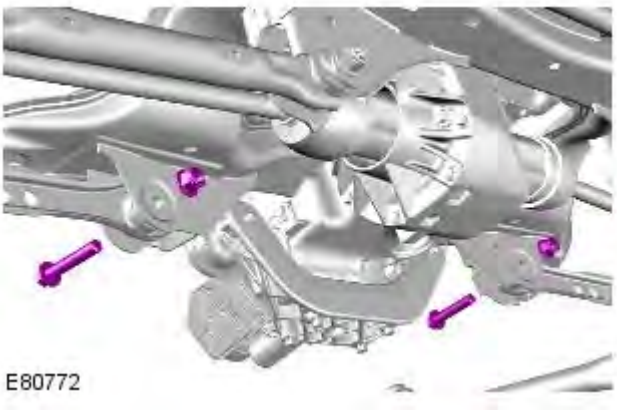
28. **28.** CAUTION: Make sure that no components catch.

With assistance, remove the rear subframe assembly.



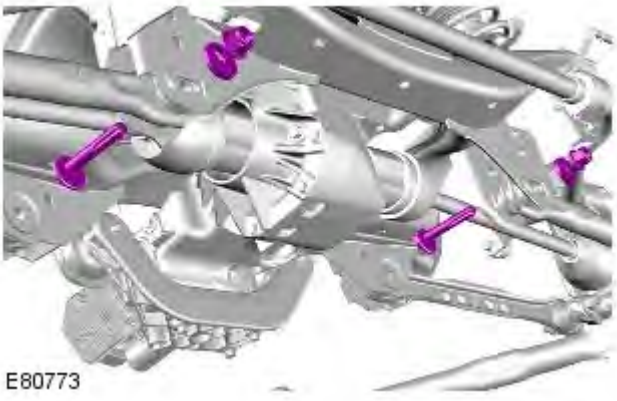
29. **29.** NOTE: Do not disassemble further if the component is removed for access only.

30.



E80772

31.



E80773

32. Discard the bolts.

E80774

33. Discard the bolts.

E80775

34. With assistance, remove the rear subframe.

Installation

1. **1.** CAUTION: Make sure that new bolts are installed.
    - Clean the component mating faces.
    - With assistance, install the subframe.
    - With assistance, align and secure the differential.
    - Tighten the rear bolts.

      Torque: 110 Nm
    - Tighten the front bolts.

      Torque: 175 Nm

2. **2.** CAUTION: Make sure that new bolts are installed.

   Align the suspension arms to the subframe and install the bolts, do not fully tighten at this stage.

3. Using the special tool, support the subframe.

4. Connect the transmission breather lines.

5. **5.** CAUTIONS:

   Make sure that no components catch.

   Make sure that new bolts are installed.

   With assistance, position the subframe to the body and tighten the bolts.

   Torque: 175 Nm

6. **6.** CAUTION: Make sure that new bolts are installed.

   Install the stabilizer clamp bolts, but do not tighten fully at this stage.

7. Connect the Active On-demand Coupling module electrical connector.

8. Remove the powertrain jack.

   General Equipment: Powertrain Jack

9. **9.** CAUTION: Make sure that new bolts are installed.

   Install the trailing arm to body brackets.

   Torque: 110 Nm

10. **10.** CAUTION: Make sure that the brake hose is not twisted and is correctly located.
    - Clean the component mating faces.
    - Install the brake caliper anchor plate.

      Torque: 110 Nm
    - Repeat the above procedure for the other side.

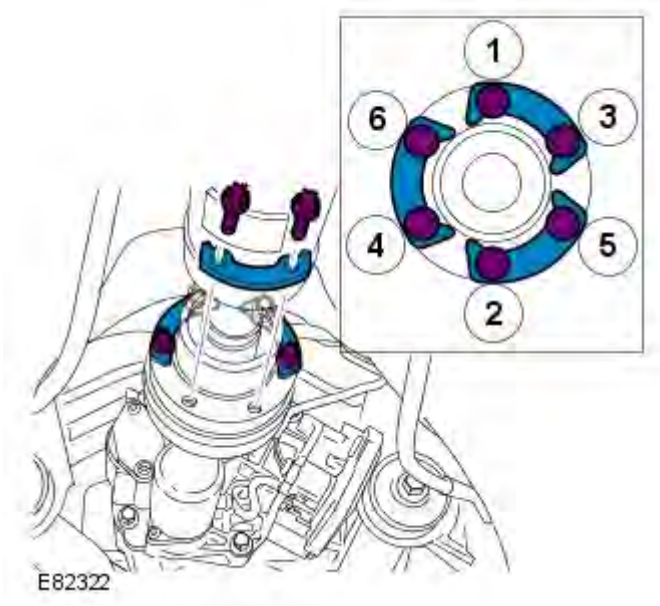
11.
    - Secure the wheel speed sensor and lead.

Torque: 5 Nm
- Secure the lead in the clips.
- Repeat the above procedure for the other side.

12. LH side: Connect the ride height sensor electrical connector.

13.
- Position and secure the rear shock absorbers.
- Install both mass dampers.

Torque: 25 Nm
- Repeat the above procedure for the other side.



14. **14.** CAUTION: Make sure that new bolts are installed.
    - Clean the component mating faces.
    - Connect the driveshaft to the rear flange.

    Torque: 40 Nm

15. Install the parking brake cables to the guide tubes.

16. Connect the parking brake cables.

17. Adjust the parking brake.

    Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

18. Install the rear muffler.

    Refer to: Exhaust System (309-00B Exhaust System - TD4 2.2L Diesel, Removal and Installation).

19. Install the rear quarter trim panels.

    Refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

20. Install the rear suspension height sensor.

    Refer to: Rear Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation).

21. Install the wheels and tires.

    Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

22. **22.** CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

    Tighten the stabilizer bar clamp bolts.

    Torque: 60 Nm

23. **23.** CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

    - Tighten the supsension arms to the subframe.

      Torque: 175 Nm
    - During installation, do not tighten the nuts and bolts until the 4 wheel alignment procedure has been carried out.

24. Carry out a complete vehicle geometry check and adjustment.

Published: 11-May-2011

Uni-Body, Subframe and Mounting System - Rear Subframe Front Bushing

Removal and Installation

Special Tool(s)

E75373	204-598 Hydraulic Cylinder 10t
E73708	204-598-01 Remover/Installer, Subframe Bushing Guide

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

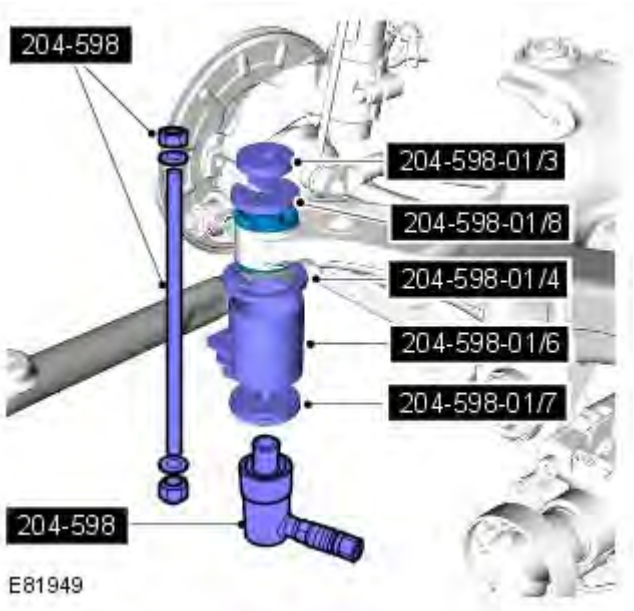
   Raise and support the vehicle.

2. Remove both rear wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the rear subframe assembly for access.

   Refer to: Rear Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



4. **4.** CAUTIONS:

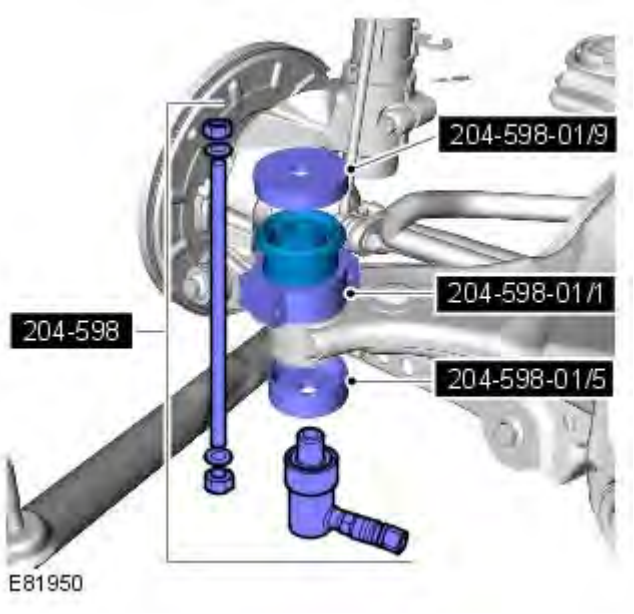
   Mark the components to aid installation.

   Special tool 204-598-01/8 is used to start the bushing removal process, and must be removed after the bushing has released, as it will not pass through the subframe bushing aperture.

   Remove the bushing.

   Special Tool(s): 204-598, 204-598-01

Installation



1. **1.** CAUTIONS:

   Make sure the correct special tool is used to install the bushings to the correct depth.

   Make sure that the installation marks are aligned.

   Install the bushing.

   Special Tool(s): 204-598, 204-598-01

2. Install the rear subframe assembly.

   Refer to: Rear Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

3. Install the wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Published: 11-May-2011

Uni-Body, Subframe and Mounting System - Rear Subframe Rear Bushing

Removal and Installation

Special Tool(s)

E75373	204-598 Hydraulic Cylinder 10t
E73708	204-598-01 Remover/Installer, Subframe Bushing Guide

Removal

• NOTE: Removal steps in this procedure may contain installation details.

1. **1.** WARNING: Make sure to support the vehicle with axle stands.

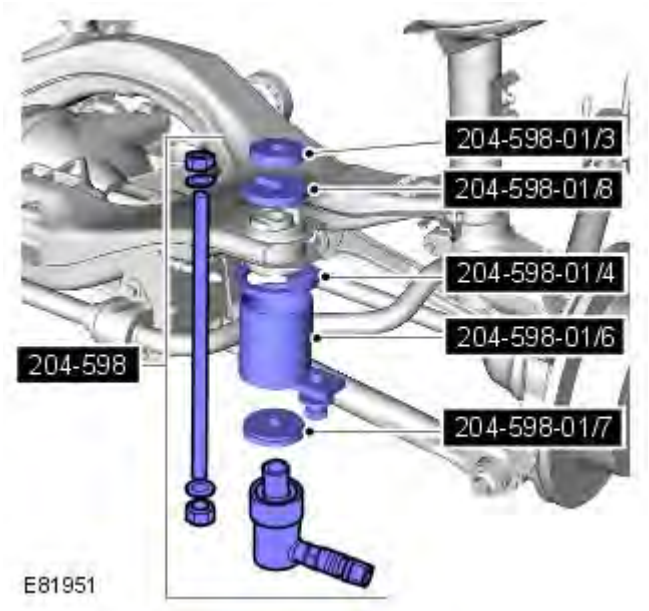
   Raise and support the vehicle.

2. Remove both rear wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

3. Remove the rear subframe assembly for access.

   Refer to: Rear Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



4. **4.** CAUTIONS:

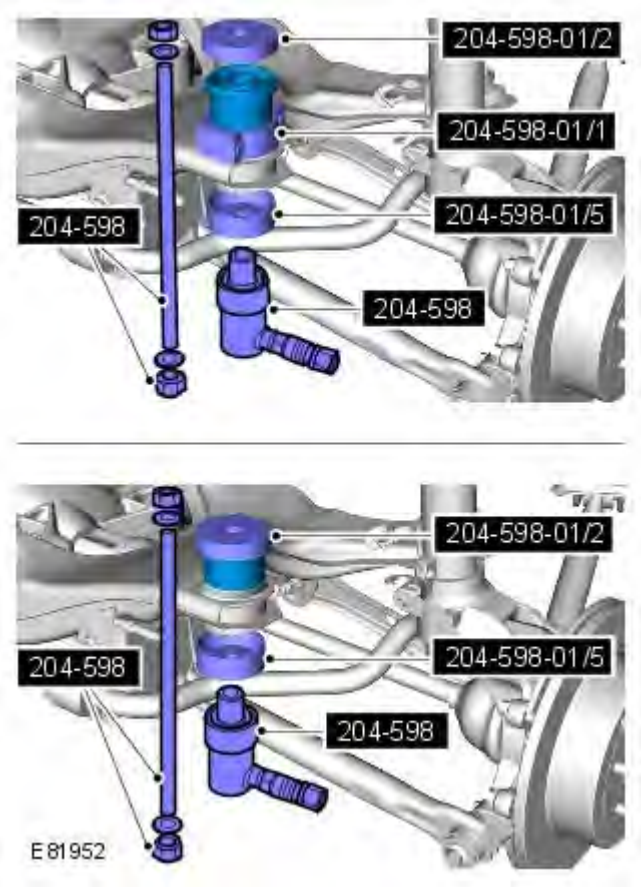
   Mark the components to aid installation.

   Special tool 204-598-01/8 is used to start the bushing removal process, and must be removed after the bushing has released, as it will not pass through the subframe bushing aperture.

   Remove the bushing.

   Special Tool(s): 204-598-01

Installation



1. **1.** CAUTIONS:

   Make sure the correct special tool is used to install the bushings to the correct depth.

   Make sure that the installation marks are aligned.

   Install the bushing.

   Special Tool(s): 204-598, 204-598-01

2. Install the rear subframe assembly.

   Refer to: Rear Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

3. Install the wheels and tires.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

FREELANDER 2

OWNER MANUAL

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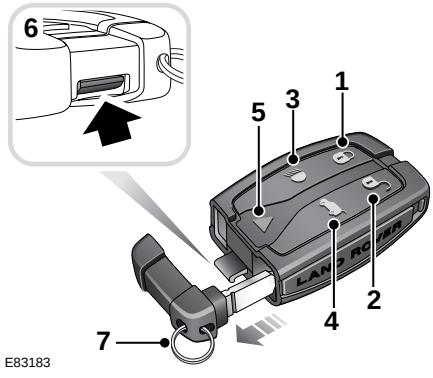
QUICK START

Remote control



1. Lock button.

   Press once to lock the vehicle and arm the alarm. Press twice within three seconds to double lock the vehicle. Press and hold to close the door windows (Global closing).

2. Unlock button.

   Press once to disarm the alarm, unlock the driver's door and unlock the luggage compartment. Press again to unlock the passenger doors. Press and hold to open the door windows (Global opening).

3. Approach lighting button.

   Press once to switch the headlamps, position lamps, and license plate lamps on for a short period. Press again to switch off. See **APPROACH LAMPS** (page 76).

4. Tailgate release.

   Press to release the tailgate.

5. Panic alarm.

   Press twice in three seconds, or press and hold for two seconds, to activate the **panic alarm**. After five seconds, press and hold the button again to cancel the alarm.

6. Press the release tab on the remote control to release the emergency key blade.

7. Pull the keyring attachment to remove the key blade.

Single point entry

This is a security feature that unlocks only the driver's door, fuel filler flap, and tailgate. It can be disabled on individual remote controls by unlocking the vehicle then simultaneously pressing and holding the lock and unlock buttons for three seconds. The vehicle will lock and then unlock in the currently selected mode and the hazard warning lights will flash twice to confirm the change.

You can now unlock all doors with a single press. Repeating the procedure will re-enable Single point entry.

Further information is available within the main body of the handbook. See **USING THE REMOTE CONTROL** (page 41).

Engine starting

The **START STOP ENGINE** button **2** is only operational when a recognised remote control is inserted into the starter control unit **1** (buttons facing upwards).

When inserted, the remote control will latch into the starter control unit. To remove, press the remote control to unlatch and release.

Remote control unit removal
Press the remote control to unlatch and release from the starter control unit. Remove by gripping the sides of the remote control.

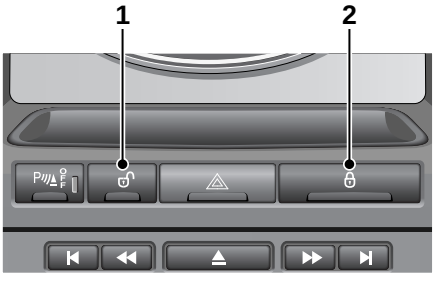
Ignition only

- Press and hold the **START STOP ENGINE** button for a short period, to switch on the ignition.
- Pressing the button again will switch off the ignition.

Engine start/stop

- For automatic transmission vehicles, with the gear selector in **P** (park) or **N** (neutral) and the brake pedal depressed, press and release the **START STOP ENGINE** button to start the engine.
- For manual transmission vehicles, depress the clutch pedal and press and release the **START STOP ENGINE** button to start the engine.
- Press the button again to stop the engine and switch off the ignition.

Master lock and unlock switches

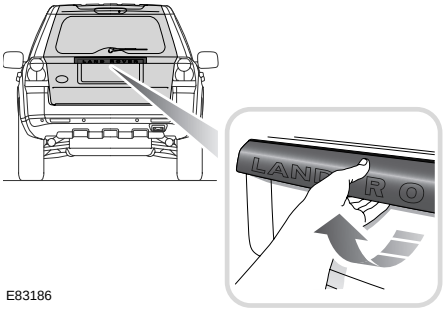


E83185

1. Press and hold to unlock all doors and tailgate.
2. Press and hold to lock all doors and tailgate.

Press both **1** and **2** to release the tailgate.

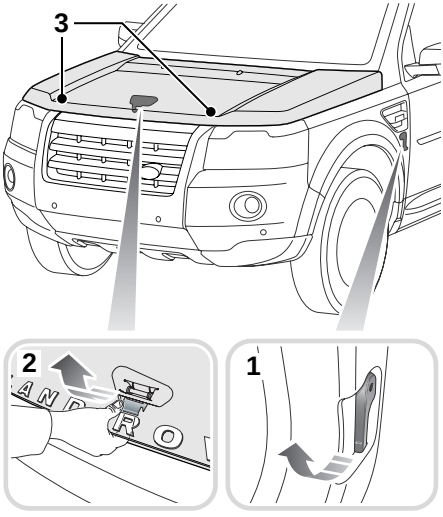
Tailgate



E83186

With the vehicle unlocked, press the release switch on the underside of the exterior handle and pull to open.

Bonnet



E83187

Opening

Pull the bonnet release lever **1**.

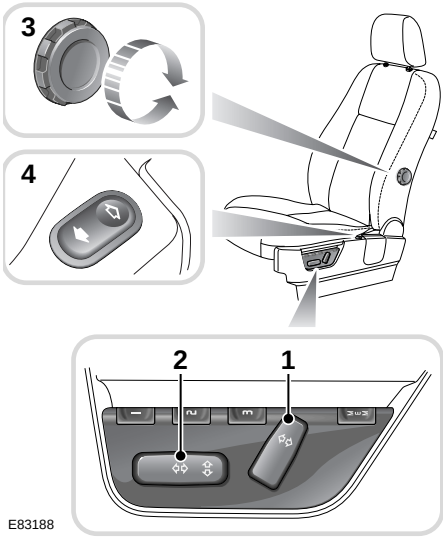
Lift the bonnet safety catch lever **2**, and raise the bonnet.

Closing

Lower the bonnet until the safety catch engages. Using both hands, press the bonnet down until the catches click.

Check that both catches **3** are engaged by trying to lift the front edge of the bonnet.

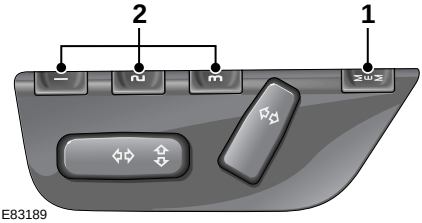
Power operated seat adjustment



1. Backrest adjustment switch.
2. Seat forward/backwards and cushion height control switch.
3. Lower backrest lumbar support handwheel (non-memory seats).
4. Lower backrest lumbar support switch (driver's side memory seat only).

Wherever possible the seats should be adjusted with the engine running. In addition, the seats have an active period that is initiated when the driver's door is opened and closed or the remote control is removed from the docking port.

Driving position memory



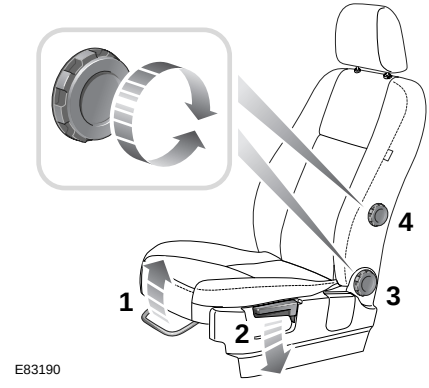
Once you have adjusted the power operated driver's seat and exterior mirrors for your ideal driving position, the vehicle can memorise these settings for future use.

To operate the windows and door mirrors, the remote control must be in the docking port and the ignition on.

1. Press the memory store button to activate the memory function.
2. Press one of the preset buttons within five seconds to memorise the current settings. **MEMORY STORED** will be displayed on the message centre accompanied by an audible chime to confirm the settings have been memorised.

Operating note
A seat position will only be memorised during the five second active period. Any existing settings will be over-written when programming a memory position.

Manual seat adjustment

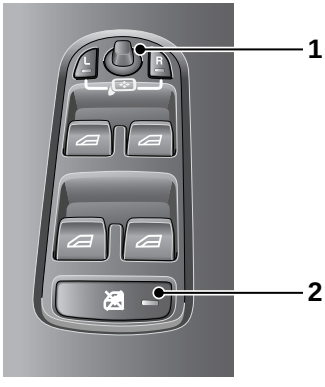


E83190

1. Forward/backward adjustment.
2. Height adjustment.
3. Backrest adjustment.
4. Lumbar adjustment.

Windows and Door mirrors

To operate the windows and door mirrors, the remote control must be in the docking port and the ignition on.



E83191

Windows

- To open a window, press and hold the respective switch.
- To close the window, pull and hold the switch.

Window movement can be stopped at any time by releasing the switch.

The windows have a one touch facility that allows them to be fully opened or closed with a single operation of the switch. Press or pull the switch and release. Movement can be stopped by briefly pressing the switch again.

Press switch **2** to inhibit the operation of the rear window switches.

Resonance with lowered windows
If a resonance/booming sound occurs when a window is open, lowering an adjacent window about 25 mm (1 inch) will eliminate the condition.

Door mirror adjustment

To adjust the mirrors, press the **L** (Left) or **R** (Right) button to select the appropriate mirror. Move the control knob **1** in any direction to adjust the position of the mirror glass.

Power fold mirrors

The mirrors can be electrically folded towards the door for better clearance/protection.

Press the **L** and **R** buttons simultaneously to fold/unfold the mirrors.

The mirrors may also fold automatically when the vehicle is locked, and unfold when the vehicle is unlocked.

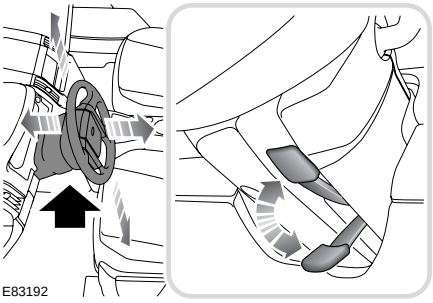
Reverse automatic mirror dip

When reverse gear is selected, the door mirrors will dip.

The dip position of the door mirrors can be personalised. See **ELECTRIC EXTERIOR MIRRORS** (page 95).

This feature can be disabled or enabled by a Land Rover Dealer/Authorised Repairer.

Steering column adjustment

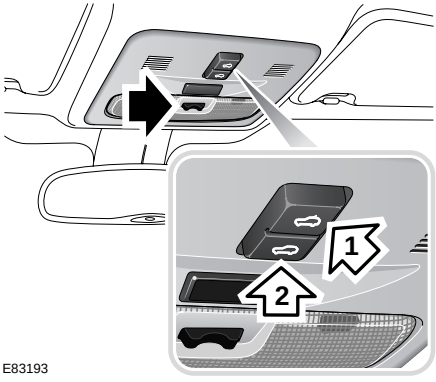


1. Move the lever located under the steering wheel fully downward.
2. Adjust the height and reach of the steering wheel to the desired position.
3. Move the lever fully up to lock the position of the wheel.

Steering column lock

The vehicle has an electronic steering column lock that is deactivated when the remote control is inserted in the docking port.

Overhead console



Courtesy lamps

The front and rear courtesy lamps will operate in conjunction with the vehicle being unlocked/locked or when a door is opened.

The courtesy lamps can be manually switched on or off by the lamp switch (arrowed in the illustration). When the switch is in the centre position, the lamps operate in automatic mode.

Panoramic sunroof

To tilt the sunroof:

1. Press and release the front of the switch **2** to open the sunroof to the tilt position.

To open the sunroof:

1. Press and release the rear of the switch **1** to fully open the sunroof.

To close the sunroof:

1. From the fully open position, press and release the front of the switch **2**.
2. From the tilted position, press and hold the rear of the switch **1**.

If the sunroof is moving, it can be stopped by pressing the switch again.

Operating note
The sunroof can only be operated with the ignition on.

Seat belts and Child restraints

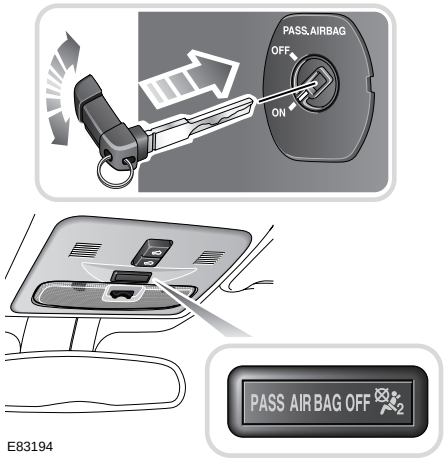
A warning indicator on the instrument pack will illuminate to alert you that the driver's or front passenger's seat belt is unbuckled.

Child seats

It is important to remember that the child's weight, rather than age, determines the type of seat that is required. See **CHILD SEATS** (page 64).

Recommended child seat
Land Rover strongly recommend the use of ISOFIX child seats. ISOFIX child seats can only be fitted in the rear outer seating positions.

Passenger airbag deactivation



E83194

WARNING
Do not use a child restraint on a seat protected by an operational airbag in front of it. There is a risk of death or serious injury when the airbag deploys.

If it becomes necessary to fit a child restraint on the front passenger seat, the passenger airbag must be deactivated.

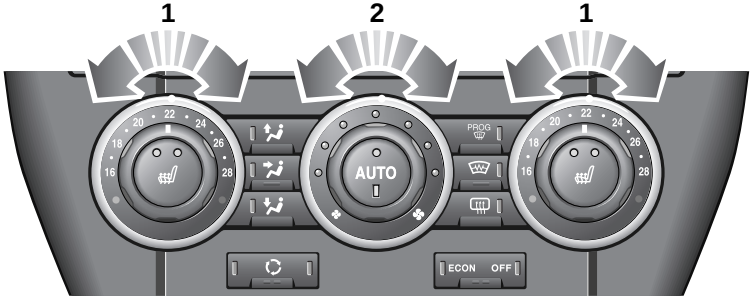
To deactivate the airbag, open the front passenger door and use the starter key to turn the **PASS AIRBAG** switch (located on the end of the facia) to the **OFF** position.

With the airbag deactivated, the status indicator, located on the overhead console, will illuminate whenever the ignition is on.

Operating note
When an adult is seated in the front passenger seat, ensure the **PASS AIRBAG** switch is turned to the **ON** position.

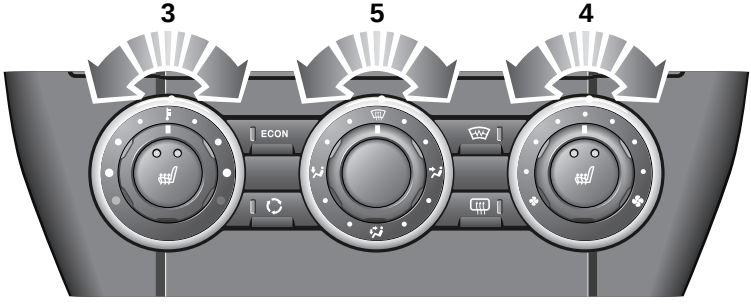
Heating and ventilation

Automatic system



E83195

Manual system



E83196

These are the primary functions of the heating and ventilation system. Dependent upon specification, the control panel may differ from those shown.

Air conditioning

Air conditioning is an integral part of the heating and ventilation system, providing cooled and dehumidified air for occupant comfort. The dry airflow is effective in preventing misting of windows and is also beneficial at low external temperatures.

Air conditioning is automatically switched on and controlled whenever the system is not operating in **ECON** mode.

External water deposits
The air conditioning system removes moisture from the air and deposits excess water beneath the vehicle. Puddles may form, but this is no cause for concern.

Auto mode (Automatic systems)

Press **AUTO** to select automatic operation of the system, both LEDs in the switch will illuminate.

The system will adjust the heat output, blower speed, air intake and airflow distribution to maintain the selected temperature(s) and reduce misting without further adjustments.

The air distribution and blower controls can be operated to override the automatic settings. This will extinguish the appropriate LED in the **AUTO** control.

Recommended mode
Select **AUTO** as the normal operating mode. This will help prevent window misting and odours from the climate control system.

Temperature selection (Automatic system)

Rotate the control **1** to adjust the temperature for the respective side of the passenger compartment.

Operating note
On the automatic system, it is not possible to achieve a temperature differential of more than 4°C (7°F) between the left and right.

Blower speed (Automatic systems)

Rotate the blower control **2** to adjust airflow through the vents. LEDs will illuminate to indicate which of the eight possible speeds is currently selected.

Air distribution control (Automatic systems)

Press to select the desired distribution setting. An LED will illuminate in the switch.

Front screen and side window vents

Face level vents

Foot level vents

More than one setting can be selected to achieve the desired distribution.

Off (Automatic systems)

Press to switch the system off. An LED will illuminate in the switch to show this condition.

Press again to return the system to its previous operating mode. The system will also be reactivated by using the **AUTO**, blower speed, air distribution or defrost controls.

Defrost mode (Automatic systems)

Press to remove frost or heavy misting from the front screen. The system will automatically adjust the blower output for maximum clearing, in addition the front and rear screen heaters will be activated.

Press again to switch off defrost mode. The screen heaters will remain on.

Heated screens

Press to operate. An LED in the switch will illuminate whilst operating.

The heaters will automatically switch off after a preset interval.

Air recirculation

Press once to activate air recirculation. An LED will illuminate in the switch. Press again to return to fresh air intake.

Economy mode

Press to put the system into economy mode. An LED will illuminate in the switch to show this condition.

In economy mode air conditioning is switched off. This reduces the load on the engine, thereby improving fuel consumption.

Seat heaters

Press the relevant button to operate the required seat heater at high level. Both LEDs will illuminate.

Press a second time to heat the seat at a lower level. One LED will extinguish.

Press a third time to switch off.

Temperature selection (Manual system)

Rotate the control **3** to adjust the air temperature entering the passenger compartment.

Blower speed (Manual system)

Rotate the blower control **4** to adjust airflow through the vents. As the control is adjusted, LEDs will illuminate to indicate which of the eight possible speeds is currently selected.

Air distribution control (Manual system)

Rotate the control **5** to achieve the desired air distribution setting.

Front screen and side window vents

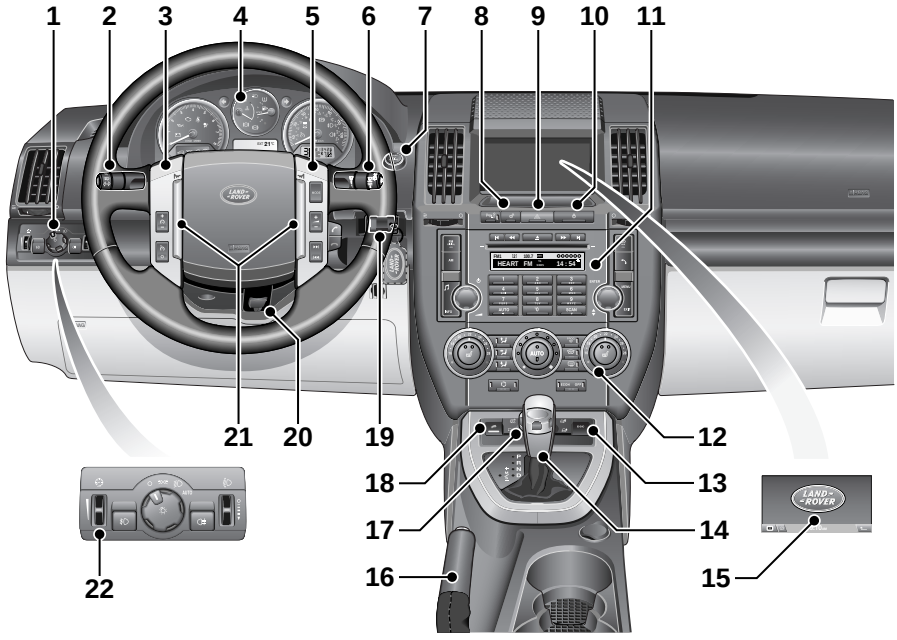
Face level vents

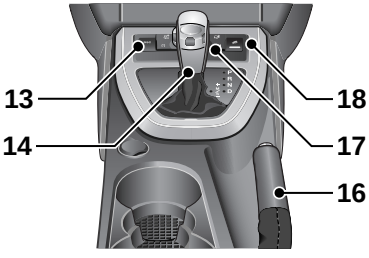
Foot level vents

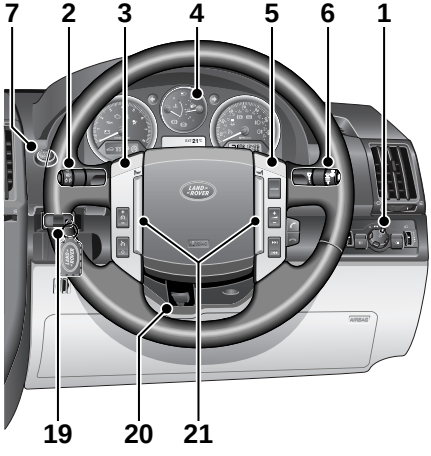
Foot and face level vents

Note: *It is possible to distribute air to two areas simultaneously. For example; to distribute air to both the windscreen and the foot vents set the rotary control (**5**) to a point between the windscreen and foot vent symbols.*

Facia



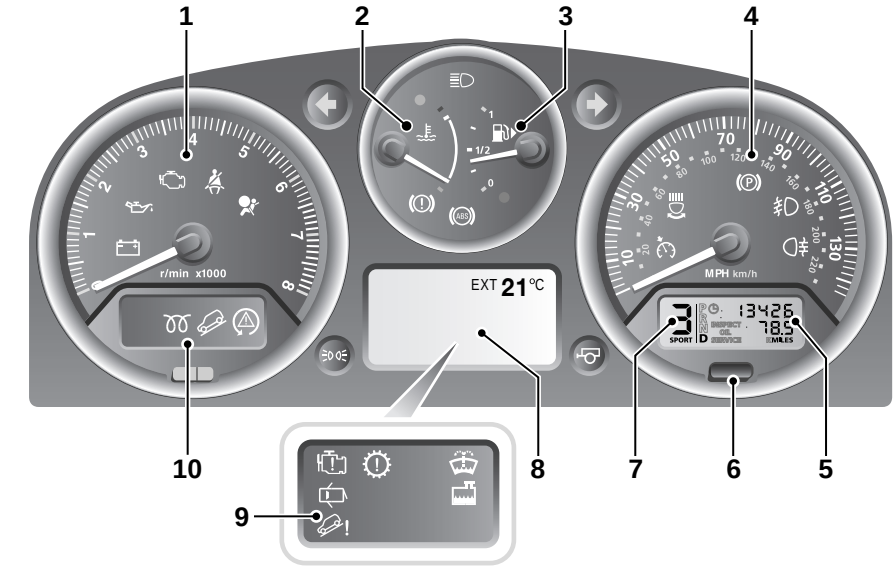




E83197

1. Exterior lamps master switch
2. Direction indicators/headlamps/trip computer switch
3. Cruise control switches
4. Instrument pack
5. Audio/telephone switches
6. Washer/wiper switch
7. Start stop engine button
8. Master unlock switch
9. Hazard warning switch
10. Master lock switch
11. Audio unit
12. Heater/air conditioning controls
13. Dynamic Stability Control (DSC) switch
14. Gear selector
15. Touch screen
16. Parking brake
17. Terrain Response control switch
18. Hill Descent Control (HDC) switch
19. Starter control unit
20. Steering column adjustment lever
21. Horn switches
22. Facia illumination dimmer control

Instrument pack



E83375

1. Tachometer
2. Temperature gauge
3. Fuel gauge
4. Speedometer
5. Total distance (odometer) and trip recorder
6. Trip recorder reset switch
7. Gear selector mode and position display
8. Main message centre
9. Warning indicators panel
10. Tachometer indicators panel

Tachometer

Indicates engine speed in revolutions per minute (x 1 000). In normal driving conditions the engine is most fuel efficient between 2 000 and 3 000 rev/min.

Temperature gauge

At normal operating temperature, the pointer is positioned midway between the red and blue segments of the gauge (the precise position will vary according to climatic conditions).

E80509

If the pointer moves into the red segment and the red warning indicator (arrowed) illuminates, severe engine damage could occur (under these circumstances the air conditioning may switch off and engine performance may reduce to minimise engine load).

If the engine overheats, stop the vehicle as soon as safety permits. Switch the engine off and allow it to cool down. If the problem reoccurs, seek qualified assistance before continuing.

Fuel gauge

CAUTION

Never allow your vehicle to run out of fuel as the resultant misfire may destroy the catalytic converter.

When the ignition is on the pointer quickly rises to show the level of fuel in the tank.

E80510

When the amber low fuel warning indicator (arrowed) illuminates, the remaining fuel should give a range of 80 km (50 miles). The small arrow alongside the fuel pump symbol indicates the side of the vehicle on which the fuel filler is located.

Total distance (odometer) and trip recorder

Indicates the total distance travelled, and also shows the most recent individual journey distance.

Trip recorder reset switch

With the ignition on, press to reset the trip recorder back to zero.

Selected gear display

Displays the currently selected gear and operating mode.

Warning indicators (attention)

If any of the following illuminates whilst driving a fault has been detected. Refer to the individual pages given below for further information.

Battery charge indicator. See **GENERAL DRIVING POINTS** (page 128).

Low oil pressure. See **GENERAL DRIVING POINTS** (page 128).

Parking brake. See **PARKING BRAKE** (page 124).

Brake systems. See **PRINCIPLE OF OPERATION** (page 123).

Anti-lock braking system. See **HINTS ON DRIVING WITH ABS** (page 123).

Airbag system. See **AIRBAG WARNING LAMP** (page 61).

Engine management system. See **REDUCED ENGINE PERFORMANCE** (page 128).

Engine. See **REDUCED ENGINE PERFORMANCE** (page 128).

Transmission. See **MANUAL TRANSMISSION** (page 118).

Hill Descent Control (HDC). See **PRINCIPLE OF OPERATION** (page 136).

Low engine coolant level. See **ENGINE COOLANT CHECK** (page 163).

Dynamic Stability Control (DSC). See **PRINCIPLE OF OPERATION** (page 140).

Adaptive front lighting system. See **ADAPTIVE FRONT LIGHTING SYSTEM (AFS)** (page 74).

Warning indicators (information)

The following will illuminate during normal driving to indicate that a particular system or feature is operating.

Seat belt reminder. See **SEAT BELT REMINDER** (page 55).

Door open. See **LOCKING AND UNLOCKING** (page 44).

Low screen washer level. See **WASHER FLUID CHECK** (page 167).

Diesel glow plugs active. See **STARTING A DIESEL ENGINE** (page 115).

Hill Descent Control (HDC) active. See **PRINCIPLE OF OPERATION** (page 136).

Cruise control active. See **USING CRUISE CONTROL** (page 130).

Direction indicator. See **DIRECTION INDICATORS** (page 75).

Trailer direction indicator. See **TOWING A TRAILER** (page 150).

Side lamps on. See **LIGHTING CONTROL** (page 72).

Headlamp high beam on. See **LIGHTING CONTROL** (page 72).

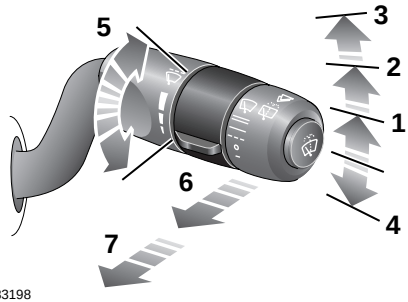
Rear fog lamps on. See **REAR FOG LAMPS** (page 73).

Front fog lamps on. See **FRONT FOG LAMPS** (page 72).

Diesel particulate filter warnings

If either of the messages **DPF FULL** or **DPF FULL VISIT DEALER** are displayed, you must resolve the problem as soon as possible. See **DIESEL PARTICULATE FILTER (DPF)** (page 116).

Wipers and washers



E83198

Windscreen wipers

1. Intermittent wipe/rain sensor
2. Low speed wipe
3. High speed wipe
4. Single wipe - pull down and release to operate
5. Rotate control to adjust speed of intermittent wipe or sensitivity of rain sensor

Windscreen washer

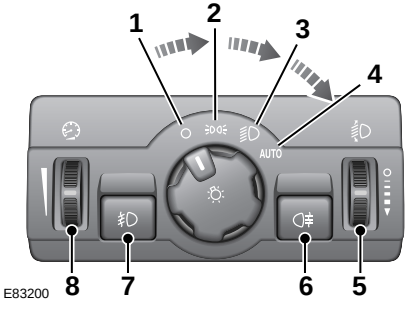
Push the button on the end of the lever to operate the windscreen washer.

Rear wiper and washer

Pull the lever to position **6** for intermittent operation of the rear wiper. Pull and hold the lever in position **7** to operate the rear washer and wiper.

Exterior lighting

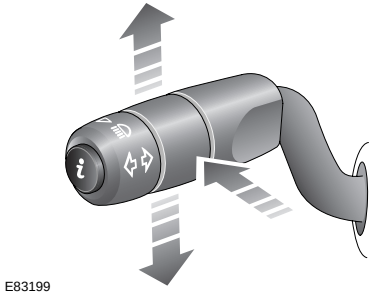
Exterior lamps master switch



E83200

1. Exterior lamps off
2. Side lamps
3. Headlamps
4. Autolamps
   - With the switch in **AUTO** and the engine running or ignition on, a sensor monitors the exterior light levels and will automatically switch the side lamps and dipped headlamps on and off as required.
5. Headlamp levelling control (Halogen headlamps)
6. Rear fog lamps
7. Front fog lamps
8. Facia illumination dimmer control

Direction indicators and headlamp high beam



E83199

Move the lever up or down to activate the direction indicators.

Moving the lever up or down against spring pressure and then releasing will flash the indicators three times. Useful for lane changing.

Push the lever away from you to select headlamp high beam. A warning indicator will illuminate on the instrument pack.

To flash the headlamps, pull the lever towards the steering wheel and then release.

Gearshift interlocks

Park

The remote control must be inserted in the docking port, the footbrake applied and the selector release button pressed before the gear selector can be moved from **P** (Park).

Neutral

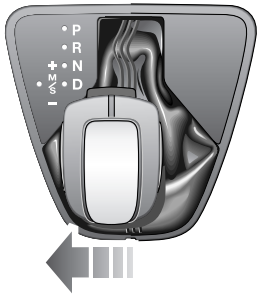
If the vehicle remains stationary with **N** (Neutral) selected, the selector lever will lock into the **N** position after 3 seconds.

Press the selector release button and apply the footbrake to move the selector lever from **N**.

Automatic transmission

Sports mode

Operating note
If Terrain Response is fitted, Sports mode is only available when the **General** program is selected.



E83201

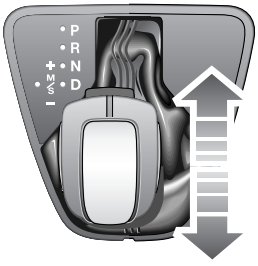
In Sports mode, automatic gear changing is maintained but the gearshift changes are modified to improve performance.

To select Sports mode, move the gear selector from the **D** position towards the left-hand side of the vehicle.

The word **SPORT** will appear on the instrument pack display and the LED in the gear selector surround will illuminate.

CommandShift™

CommandShift gear selection can be used as an alternative to automatic gear selection and is particularly effective when rapid acceleration or engine braking are required.

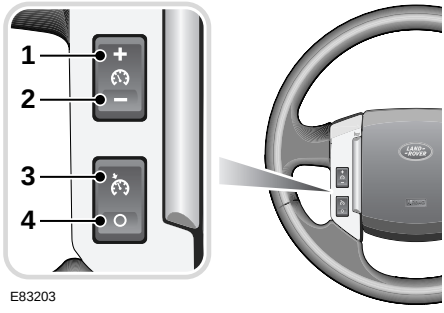


E83202

- Select Sports mode. The transmission will automatically select the gear most appropriate to the vehicle's road speed and accelerator position.
- Moving the selector lever forward (**+**) or backwards (**-**) and then releasing will manually select a higher or lower gear (when available). The message **TRANSMISSION COMMANDSHIFT SELECTED** will appear in the message centre.
- Subsequent gear selections will display the selected gear on the instrument pack display.
- To deselect CommandShift mode, move the selector lever back to the **D** position.

Cruise control

Cruise control enables the driver to maintain a constant road speed without using the accelerator pedal.

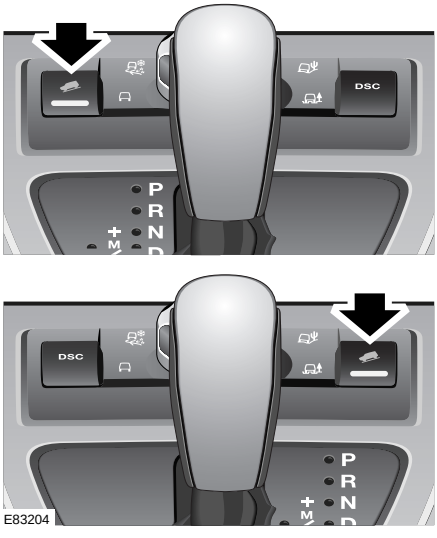


E83203

1. **SET + :** to set a road speed or increase the speed in 2 km/h (1 mph) steps when cruise control is operating.
2. **SET - :** to set a road speed or decrease the speed in 2 km/h (1 mph) steps when cruise control is operating.
3. **RESUME:** resumes the SET speed retained in memory.
4. **CANCEL:** cancels cruise control but retains the set speed in memory.

Operating note
Cruise control will automatically **disengage** when the **brake/clutch pedal** is used or when the vehicle speed falls below 30 km/h (18 mph).

Hill Descent Control (HDC)



E83204

HDC operates in conjunction with the anti-lock braking system to provide greater control in off-road situations particularly when descending severe gradients.

Press the switch (arrowed in illustration) to select HDC. HDC can be selected at speeds below 80 km/h (50 mph) but will not be fully active until the vehicle speed reduces below 50 km/h (30 mph), confirmed by a continuously illuminated HDC indicator in the instrument pack. Press the switch again to deselect HDC.

Terrain Response system

E83205

The Terrain Response system, if fitted, is always active and cannot be switched off. When the vehicle is started the system will normally start in the **General** program.

Manual selection of a special program, by rotating the knob, will provide benefits in how the vehicle can be driven over different surfaces or terrains by automatically adjusting the vehicle's drive and suspension systems.

It is recommended that a special program be engaged whenever driving conditions could become difficult, and cancelled once the conditions for use are no longer present.

General

Suitable for surfaces that match typical road surfaces.

Grass-Gravel-Snow

Suitable for surfaces which are firm but have a slippery surface, e.g. grass, snow, loose gravel, pebbles, or icy conditions. If the gravel is deep, the Sand program may be more beneficial.

Mud-Ruts

Suitable for soft, muddy, uneven or deeply rutted ground.

Sand

Suitable for soft, predominantly dry, yielding sandy ground, e.g. sand dunes and deserts. If the sand is damp or wet the Mud-Ruts program may be more beneficial.

Wading
When wading through water, select the program suitable for the surface beneath the water. The maximum depth of water should not exceed 500 mm (19.7 inches).

Parking aid

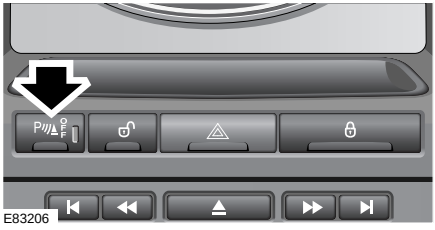
With the ignition on, the front and rear parking sensors are activated whenever reverse gear is selected. A short confirmation tone will sound after one second.

If an obstruction is detected by the sensors, an intermittent tone will sound (higher pitch for objects detected by the front sensors). As the vehicle moves closer to the obstruction the intermittent tone increases in frequency.

When the distance between the sensor and the obstruction is less than approximately 30 cm (1 foot) the tone becomes continuous.

The parking aid is automatically switched off when the vehicle's forward speed exceeds 16 km/h (10 mph).

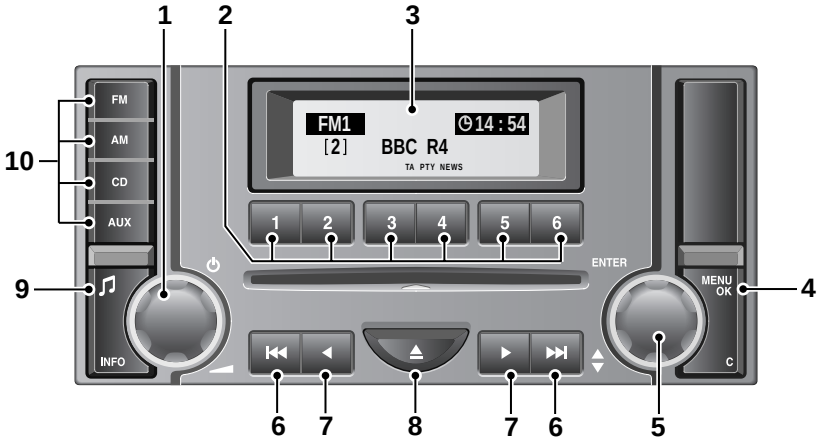
Front parking aid - manual operation



When driving into a limited space, the front parking aid can be manually activated by pressing the switch on the facia. The switch will illuminate and a short confirmation tone will sound.

Audio system

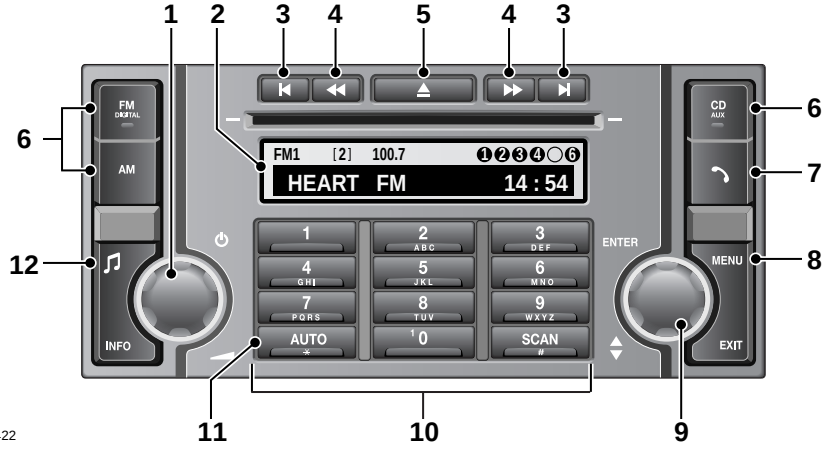
Standard audio



E84421

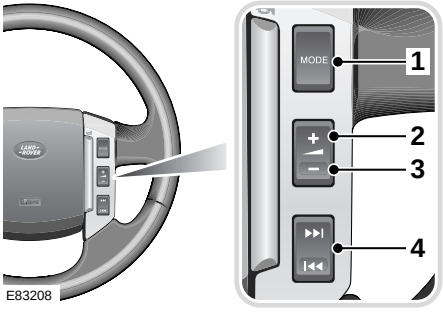
1. Press to switch audio unit on or off and rotate to adjust the volume.
2. Press appropriate number to select required preset radio station or disc from autochanger.
3. Display screen.
4. Press to access the audio unit menu.
5. Rotate to scroll through menu options or adjust settings. Press to select a menu item or confirm a change.
6. Press to automatically search for a radio station or select a track on a CD.
7. Press to manually search for a radio station or to search in a CD track
8. Press to eject the currently selected CD.
9. Press button repeatedly to scroll through the sound settings options. With the desired sound setting selected, rotate control **1** to adjust. Confirm new setting by pressing button **9**.
10. Press the appropriate mode button to select FM, AM, CD or AUX.

Premium audio



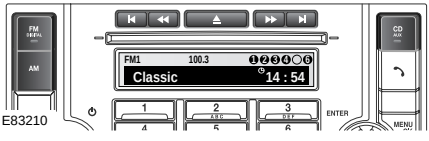
1. Press to switch audio unit on or off and rotate to adjust the volume.
2. Display screen.
3. Press to automatically search for a radio station or select a track on a CD.
4. Press to manually search for a radio station or to search in a CD track
5. Press to eject the currently selected CD.
6. Press the appropriate mode button to select FM, AM or CD.
   - Press and release the FM button to change between FM1, FM2, DAB1 and DAB2.
   - Press and hold the CD button to change between CD and AUX input.
7. Telephone button.
8. Press to access the audio unit menu.
9. Rotate to scroll through menu options or radio presets. Press to select a menu item or confirm a change.
10. Press appropriate number to select required preset radio station or disc from autochanger.
11. Press and hold to automatically store radio stations. Press and release to access the autostored stations.
12. Press button repeatedly to scroll through the sound settings options. With the desired sound setting selected, rotate control **1** to adjust. Confirm new setting by pressing button **12**.

Steering wheel controls



1. Press to switch between Radio, CD, or AUX.
2. Press to increase volume.
3. Press to decrease volume.
4. Press and release to scroll through preset radio stations or CD tracks. Press and hold for two seconds to search up or down for the next radio station/CD track.

Radio operation



Press either the **FM** or **AM** button to select the required waveband. Repeated presses of either button will scroll through the FM and AM waveband memory options.

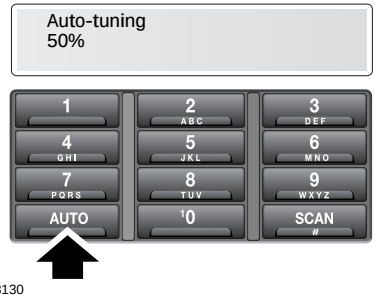
Storing radio stations

To automatically store radio stations, press and hold either the **FM** or **AM** button on standard audio units or the **AUTO** button on premium audio units. The stations will be stored under the preset numbers in the selected waveband.

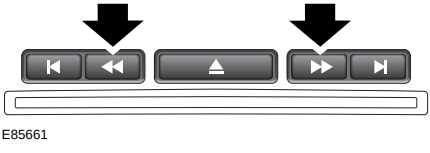
To recall a preset station, press and release one of the numbered preset buttons.

A selection of radio presets can be stored manually. See **STATION PRESET BUTTONS** (page 226).

DAB radio



On the premium audio unit, press and release the **FM** button repeatedly until either **DAB1** or **DAB2** is displayed. To automatically tune all the available digital radio channels, press and hold the **AUTO** button.



Use the channel search buttons to scroll through the list of available channels. When you find a channel you want to store, press and hold a numbered preset button.

E88124

Some channels can contain subchannels. If subchannels are available, an arrow icon is displayed. To access a subchannel, press and hold one of the channel search buttons. Press and release the channel search button repeatedly to scroll through the available subchannels. See **CHANNEL OPTIONS** (page 236).

CD OPERATION

Compatible disc types
The use of discs with paper labels or double-sided dual format discs (CD/DVD) should be avoided as they could become jammed.

Depending on specification, your audio unit will feature either a single-slot CD player or an integral 6-disc autochanger.

Single CD player

Insert a disc, label side up, into the player. The disc will load and start to play.

To end CD playback, briefly press one of the other mode buttons (FM or AM). Playback will resume when the CD button is pressed again.

To eject the disc, press the eject button. When prompted, remove the disc from the CD slot.

CD autochanger

Loading CDs

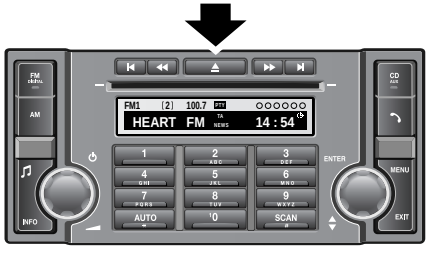
To insert a single disc, press the **CD** button then one of the number buttons (**1** to **6**). When prompted by the information display, insert the disc, label side up. The autochanger will load the CD in the selected position.

Playing CDs

When in CD mode, press the appropriate CD number (**1** to **6**) to start playing the selected disc. Playback commences and progresses sequentially through all of the loaded discs.

Playback can be paused by briefly pressing one of the other mode buttons (**FM** or **AM**). Playback will resume when the **CD** button is pressed again.

Ejecting CDs



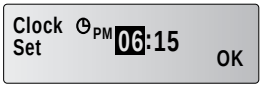
E83211

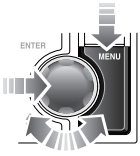
To eject a single disc, select the required disc by pressing one of the number buttons **1** to **6** and then press the eject button.

To eject all loaded discs, press and hold the eject button, the discs will be ejected one at a time. Remove disc only when the display shows the message **Remove Disc**.

Clock setting

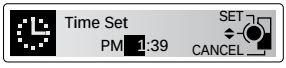
Standard audio

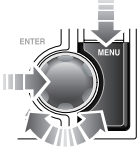




E84423

Premium audio





E84424

1. Switch on the audio system, by pressing the volume rotary control.
2. Press the MENU button to access the function menu.
3. Rotate the control to select Clock and press to confirm selection.
4. On standard audio units, rotate the control to select Set and press to confirm selection.
5. Rotate the control to adjust the hour and minutes. Press the control to confirm setting after each action. On premium audio units, the time mode (12 or 24 hr) can also be set from this menu.
6. Once the time has been set, on standard audio units, OK will be highlighted. Press the rotary control to accept the settings. Press the EXIT button on premium audio units to cancel and return to the menu.

Telephone - Bluetooth system

Mobile phones with Bluetooth capability can communicate with the vehicle's inbuilt telephone feature. You must pair your Bluetooth mobile phone with the vehicle's system before use.

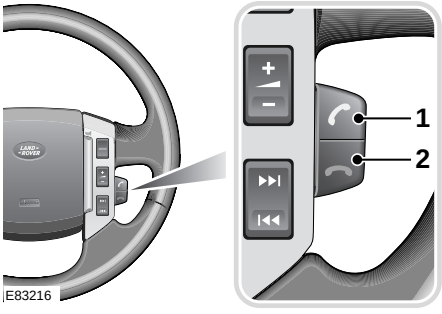
Mobile phone compatibility
Not all phones are fully compatible with the Land Rover system. For the latest list of compatible phones and software versions, please refer to **www.ownerinfo.landrover.com**. Alternatively consult your Land Rover Dealer/Authorised Repairer.

Pairing a phone to the vehicle's system

1. With the ignition on, press the telephone mode button on the audio unit.
2. When prompted, press the **ENTER** control to confirm that you want to pair a telephone to the system.
3. The system will ask you to check that your Bluetooth function on your telephone is enabled. Press the **ENTER** control to confirm. The system will then search for your telephone.
4. After the search is completed, the detected telephones will be listed. Rotate the **ENTER** control to scroll through the list and press to select the correct telephone.
5. The audio unit will then display a Bluetooth access code number. Enter this number into your telephone. The telephone will now pair to the system.
6. If the pairing fails, a message will appear on the audio unit display. Press the **ENTER** control to retry or press the **EXIT** button and restart the process.
7. To cancel the pairing process, press and hold the telephone button on the audio unit.

Operating note
If more than one paired Bluetooth phone is in range, the system will automatically select the last phone used in Bluetooth mode.

Making a call



1. With a paired handset, press the telephone mode button on the audio unit.
2. Enter the required telephone number using the numeric keypad.
3. Press and release the **ENTER** control or operate the answer call switch **1** on the steering wheel to send.

Receiving a call

To answer an incoming call, press and release the **ENTER** control on the audio unit, or operate the answer call switch **1** on the steering wheel controls.

To end, or reject an incoming call, press and release the **EXIT** button or operate the end call switch **2** on the steering wheel controls.

FILLING STATION INFORMATION

Fuel filler flap

Fuel filler flap location

A small arrow on the fuel gauge indicates which side of the vehicle the fuel filler flap is located.

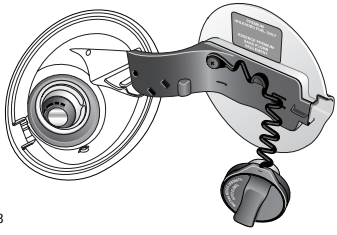
Fuel filler flap opening

E83217

With the vehicle unlocked, pull the flap (as arrowed in the illustration) to open.

Operating note
The fuel filler flap will not open if the vehicle is locked.

Refuelling



E83218

The filler cap is secured to the vehicle by a strap. For your convenience, a holder is provided, on the fuel filler flap, to hook the strap over while refuelling.

After refuelling, tighten the filler cap until it clicks three times.

Fuel tank capacity

Model	Litres	Gallons
Petrol engine	70	15.4
Diesel engine	68	14.9

Fuel specification

CAUTIONS

Land Rover petrol engines are not fitted with equipment necessary for use of fuels containing more than 10 percent ethanol.

Do not use E85 fuels (85 percent ethanol content). If E85 fuels are used, serious engine and fuel system damage will occur.

The correct fuel specification for your vehicle is shown on the inside of the fuel filler flap. See **TECHNICAL SPECIFICATIONS** (page 146).

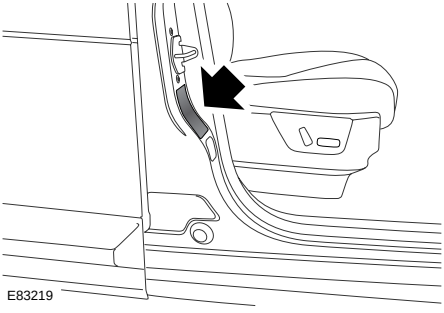
Incorrect fuelling

CAUTION

If the fuel tank is accidentally filled with the wrong type of fuel, it is essential that the engine is not started and you seek qualified assistance.

Tyre pressures

Tyre pressure label



The correct tyre pressures are shown on a label attached to the driver's door pillar.

Engine oil specification

Model	Specification
Petrol engine	Use only 0W-30 engine oil, meeting ACEA A5 or B5 specification.
Diesel engine	Use only 5W-30 oil meeting Ford 913-B specification.

LAND ROVER RECOMMENDS

Castrol

Engine coolant specification

Top-up to the upper level indicator mark. Use only a 50% mix of water and Texaco XLC antifreeze. See **ENGINE COOLANT CHECK** (page 163).

SYMBOLS GLOSSARY

Warnings

WARNING

Safety warnings are included in this handbook. These indicate either a procedure which must be followed precisely, or information that should be considered with great care in order to avoid the possibility of personal injury.

Cautions

CAUTION

Cautions are included in this handbook. These indicate either a procedure which must be followed precisely, or information that should be considered with great care in order to avoid the possibility of damage to your vehicle.

Symbols

This recycling symbol identifies those items that must be disposed of safely in order to prevent unnecessary damage to the environment.

This symbol identifies those features that can be adjusted, disabled or enabled by a Land Rover Dealer/Authorised Repairer.

LABEL LOCATIONS

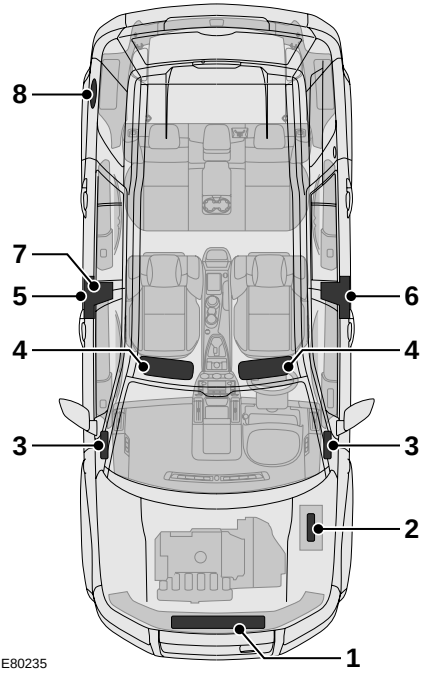
Warning labels attached to your vehicle bearing this symbol mean: Do not touch or adjust components until you have read the relevant instructions in the handbook.

Labels showing this symbol indicate that the ignition system utilises very high voltages. Do not touch any ignition components while the starter switch is turned on.

Warning labels

Labels are attached to your vehicle at several positions. These are applied to draw your attention to important subjects, e.g. tyre pressures, tow bar use, airbags, roll-over risk, engine compartment hazards, etc.

Additional information labels may also be found at these locations.



1. Bonnet locking platform - Air conditioning label
2. Top face of battery - Battery warning symbols
3. End of facia (passenger side) - Passenger airbag label
4. Sun visor - Airbag label, Vehicle handling label
5. Base of right-hand B pillar - Tyre pressure label, Airbag warning label
6. Left-hand B pillar - Airbag warning label, Vehicle Identification Number label
7. Right-hand B pillar - Vehicle Identification Number label (China)
8. Inner face of fuel filler flap - Fuel specification label

It is important that you are familiar with these subjects to ensure that your vehicle and its features are used safely. Using the index at the back of this handbook, refer to the relevant topic for more information.

HEALTH AND SAFETY

WARNINGS

Your vehicle has a higher ground clearance and hence, a higher centre of gravity than ordinary passenger cars, to enable the vehicle to perform in a wide variety of off-road applications. An advantage of the higher ground clearance is a better view of the road allowing you to anticipate problems.

The vehicle is not designed for cornering at the same speed as conventional passenger cars any more than a low-slung sports car is designed to perform satisfactorily under off-road conditions. If at all possible, avoid sharp turns or abrupt manoeuvres. As with other vehicles of this type, failure to operate the vehicle correctly may result in loss of control or vehicle roll-over.

The vehicle should not be parked over long dry grass or other combustible material, particularly during dry weather. As the heat generated by the exhaust and emission control systems may be sufficient to start a fire.

Before exiting the vehicle ensure that **P** park is selected and the park brake applied. When exiting the vehicle ensure that the remote control is removed from the vehicle.

DATA RECORDING

Service data recording

Service data recorders in your vehicle are capable of collecting and storing diagnostic information about your vehicle. This potentially includes information about the performance or status of various systems and modules in the vehicle such as engine, throttle, steering or brakes.

In order to properly diagnose and service your vehicle, Land Rover and service and repair facilities may access vehicle diagnostic information through a direct connection to your vehicle.

Event data recording

Event data recorders are capable of collecting and storing data during a crash or near-crash event. The recorded information may assist in the investigation of such an event. The modules may record information about both the vehicle and the occupants, potentially including information such as:

- How various systems in your vehicle were operating.
- Whether or not the driver and passenger seat belts were buckled.
- How far, if at all, the driver was depressing the accelerator and/or the brake pedal.
- How fast the vehicle was travelling.
- Where the driver was positioning the steering wheel.

To access this information special equipment must be connected directly to the recording modules. Land Rover do not access event data recorder information without obtaining consent, unless pursuant to court order or where required by law enforcement, other government authorities or third parties acting with lawful authority.

Other parties may seek to access the information independently of Land Rover.

DISABILITY MODIFICATIONS

Occupants with disabilities which may require modification of the vehicle must contact a Land Rover Dealer/Authorised Repairer before any modifications are made.

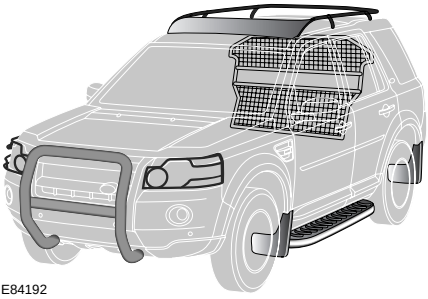
PARTS AND ACCESSORIES

WARNINGS

The fitting of non-approved parts and accessories, or the carrying out of non-approved alterations or conversions, may be dangerous and could affect the safety of the vehicle and occupants and also invalidate the terms and conditions of the vehicle warranty.

Land Rover will not accept any liability for death, personal injury or damage to property which may occur as a direct result of fitment of non-approved accessories or the carrying out of non-approved conversions to Land Rover vehicles.

Land Rover strongly advise against making any modifications to the suspension or steering system. This could seriously affect the handling and stability of the vehicle leading to loss of control or roll-over.



E84192

The vehicle has been designed, built and tested to cope with a variety of off-road driving conditions, some of which can place the severest possible demands on control systems and components. As such, fitting replacement parts and accessories that have been developed and tested to the same stringent standards as the original components will safeguard the continued reliability, safety and performance of your vehicle.

To augment the vehicle's already impressive performance, a comprehensive range of Land Rover approved spare parts and accessories is available, enabling the vehicle to fulfil a wide variety of roles, and enhancing and protecting the vehicle in the many tasks to which it can be applied.

Land Rover parts are the only parts built to original equipment specifications and approved by Land Rover designers; this means that every single part and accessory has been rigorously tested by the same engineering team that designed and built the vehicle and can therefore be guaranteed for twelve months with unlimited mileage.

A full list and description of all accessories is available from your Land Rover Dealer/ Authorised Repairer.

Electrical equipment

WARNING

It is extremely hazardous to fit or replace parts or accessories, the installation of which requires the dismantling of, or addition to, either the electrical or fuel systems.

Always consult a Land Rover Dealer/ Authorised Repairer before fitting any accessory.

Fitting inferior quality parts or accessories, may be dangerous and could invalidate the vehicle warranty.

It is recommended that you always consult a Land Rover Dealer/Authorised Repairer for advice regarding the approval, suitability, installation and use of any parts or accessories before fitting.

Airbag system

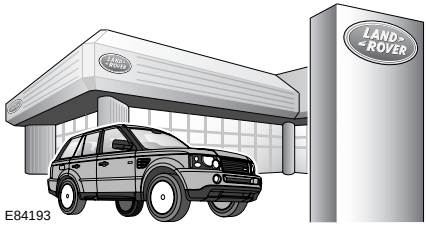
WARNING

The components that make up the airbag system are sensitive to electrical or physical interference, either of which could easily damage the system and cause inadvertent operation or a malfunction of the airbag module.

To prevent malfunction of the airbag system always consult a Land Rover Dealer/ Authorised Repairer before fitting any of the following:

- Electronic equipment such as a mobile phone, two-way radio or in-car entertainment system.
- Accessories attached to the front of the vehicle.
- Any modification to the front of the vehicle.
- Any modification involving the removal or repair of any wiring or component in the vicinity of any of the airbag system components, including the steering wheel, steering column, instrument or facia panels.
- Any modification to the facia panels or steering wheel.

After-sales service



E84193

The After Sales Parts service is of paramount importance, both in the UK and across the world. In the UK there are over 100 authorised Land Rover Dealers/Authorised Repairers, all computer linked for rapid ordering of parts and accessories.

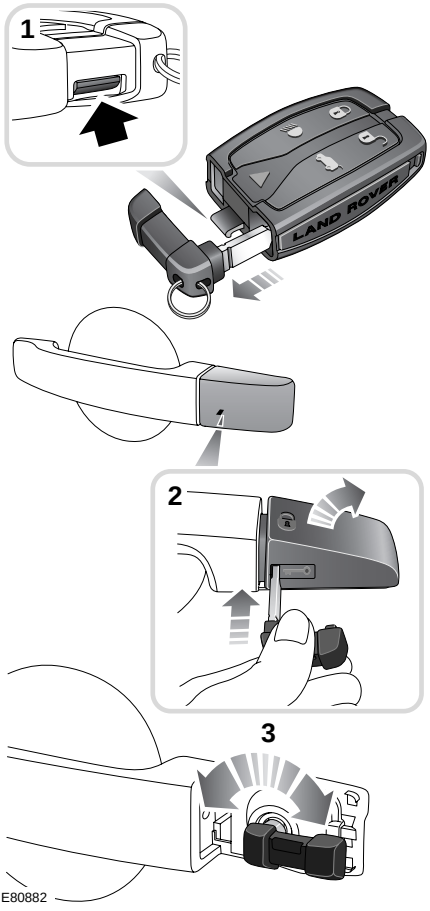
In addition, with franchised representation in over 100 countries worldwide, Land Rover are able to support your vehicle wherever you go.

Travelling abroad

In certain countries, it is a legal requirement to fit parts made to the vehicle manufacturers' specification.

Owners should ensure that any parts or accessories fitted to the vehicle while travelling abroad will also conform to the legal requirements of their own country when they return home.

USING THE KEY



1. Press the release tab and pull out the key blade.
2. Use the key blade to remove the door lock cover.
3. Insert the key into the lock and rotate to unlock.

Note: *When the door is opened the alarm will begin to sound. To silence the alarm, insert the remote into the start control unit.*

GENERAL INFORMATION ON RADIO FREQUENCIES

Note: *The radio frequency used by your remote control may be used by other devices. For example: amateur radios, medical equipment, wireless headphones, or other remote control devices. This may cause the frequency to be jammed, and prevent your remote control from operating correctly.*

Environmental conditions can affect the operation of remote controls and the operating range may vary considerably depending on the vehicle's location.

USING THE REMOTE CONTROL

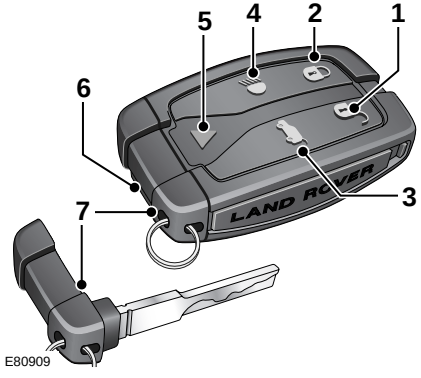
Remote control

WARNING

Never leave the remote control in the vehicle if children or animals are also left in the vehicle. The vehicle's systems and remote control functions could be operated, which may result in injury.

Note: *The operational range of the remote control will vary considerably depending on atmospheric conditions and interference from other transmitting devices.*

The vehicle is supplied with two remote controls, but up to six can be programmed to the vehicle at any one time.



1. Unlock.
2. Lock.
3. Tailgate release.
4. Approach lighting.
5. Emergency alarm.
6. Key blade release tab.
7. Key blade.

Unlocking

Press briefly to unlock the vehicle, and deactivate the alarm. The hazard warning lamps will flash twice to indicate that the vehicle is unlocked and the alarm has been deactivated. The interior lamps will illuminate to assist entry to the vehicle.

Note: *The fuel filler flap can only be opened when the vehicle is unlocked.*

Single/Multi-point entry

When you press the unlock button your vehicle will unlock in one of two ways:

1. Unlock the driver's door, fuel filler flap, and tailgate only. A second press is required to unlock the remaining doors.
2. Unlock all doors, fuel filler flap, and the tailgate.

This security feature unlocks only the driver's door and tailgate. It can be disabled on individual remote controls by unlocking the vehicle then simultaneously pressing and holding the lock and unlock buttons for three seconds. The vehicle will lock and then unlock in the currently selected mode and the hazard warning lights will flash twice to confirm the change. You can now unlock all doors with a single press. Repeating the procedure will re-enable Single point entry.

Global opening

Press and hold the unlock button for three seconds to unlock the vehicle and open all of the windows.

Single and double locking

The vehicle can be locked in two ways.

Single locking

Single locking secures the vehicle and prevents the doors being opened from outside of the vehicle. The doors can be unlocked and opened from inside the vehicle.

Double locking

WARNING

Never double lock the vehicle with people, children, or pets inside. In the event of an emergency they would be unable to escape, and the emergency services would be unable to release them quickly.

Double locking secures the vehicle and prevents the doors being opened from inside or outside of the vehicle. The doors can not be unlocked or opened from inside the vehicle.

This provides additional security if the vehicle is left unattended. The vehicle cannot be opened by breaking a window and operating the door locks from inside the vehicle.

Locking

Press briefly to single lock the vehicle, and partially activate the alarm. The hazard warning lamps will flash to indicate that the vehicle is locked. A second press within three seconds will double lock the vehicle and fully arm the alarm. The hazard warning lamps will flash again to indicate the enhanced lock/alarm state.

Note: *The fuel filler flap can only be opened when the vehicle is unlocked.*

Global closing

WARNING

Ensure that no children, pets, or obstructions are in any open aperture before operating global closing. Safety mechanisms are in place to prevent serious injury, however, injuries can still occur.

Press and hold the lock button for three seconds to single lock the vehicle, fully arm the alarm, and close all of the windows.

Note: *For safety reasons, the sunroof does not close automatically. It should be closed in the normal way before exiting the vehicle.*

Automatic relocking

If a door, or the tailgate, are not opened within one minute of unlocking the vehicle, doors will lock again automatically.

Approach lighting

When approaching the vehicle during darkness press to switch on the approach illumination. Press again to turn the approach lamps off.

The approach illumination period set at the factory is thirty seconds. This can be configured by a Land Rover Dealer/Authorised Repairer to provide illumination lasting between Zero and 120 seconds.

Tailgate

Press briefly to release the tailgate.

Emergency alarm

Press and hold for three seconds, or press twice within three seconds, to activate the horn and the hazard lamps.

Once active for more than five seconds the alarm can be cancelled by pressing the button and holding for three seconds, or pressing twice within three seconds.

Note: *The horn and hazard lamps will switch off automatically after two minutes and forty five seconds.*

Remote battery

The remote control batteries are recharged when the remote is docked and the engine is running. For this reason it is recommended that each remote is used periodically. This will ensure that the batteries are kept charged and ready for use.

LOCKING AND UNLOCKING

WARNING

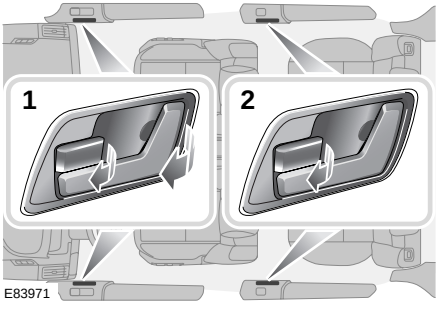
Never double lock the vehicle with people, children or pets inside. In the event of an emergency they would be unable to escape, and the emergency services would be unable to release them quickly.

Drive-away locking

The vehicle can be configured by a Land Rover Dealer/Authorised Repairer to lock automatically when in motion. Contact your Dealer/Authorised Repairer for further information.

Locking and unlocking from inside the vehicle

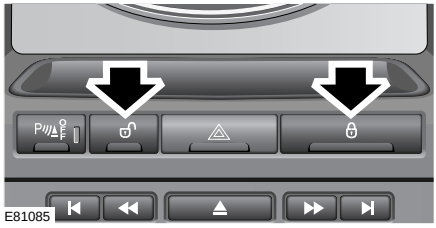
Door buttons and levers



1. The front doors can be unlocked using the door buttons, or unlocked and opened using the lever.
2. The rear doors are unlocked using the door buttons. If the doors are locked, operating the lever will have no effect.

Note: *For information on operating the child safety locks. See* ***CHILD SAFETY LOCKS*** *(page 69).*

Facia buttons



To lock or unlock the vehicle press the respective button on the facia. This will lock, or unlock, all doors and the tailgate.

Note: *Pressing and holding both buttons simultaneously for three seconds will release the tailgate.*

Mis-lock

If one of the doors, the bonnet, or the tailgate are not shut fully the horn will emit a single tone. The vehicle will not fully lock until the door, bonnet, and tailgate are fully closed.

ARMING THE ALARM

The engine is automatically immobilised when the remote control is removed from the starter control unit. The alarm system is automatically armed when the remote lock button is pressed. The hazard lamps will flash to indicate that the alarm is armed.

Full alarm

To set full alarm protection ensure that all the windows and the sunroof are closed. Then press the lock button twice within three seconds. The hazard warning lights will flash twice to confirm the alarm state.

Once fully armed the alarm will sound if :-

- the bonnet, tailgate, or a door are opened.
- movement is detected within the vehicle interior.
- a window, front or rear windscreen, or sunroof glass are broken.
- the vehicle is raised or tilted.
- the vehicle battery is disconnected.
- an attempt is made to disconnect the alarm siren.

Note: *If the alarm is armed and a window or the sunroof are left open the alarm will sound due to movement of air currents.*

Partial alarm

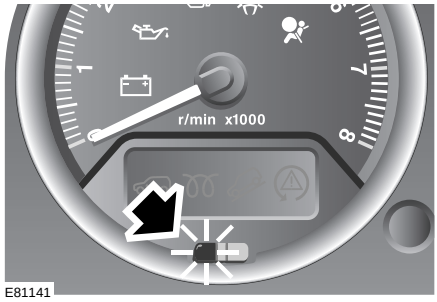
To set partial alarm protection, briefly press the lock button once. The hazard warning lights will flash once to confirm the alarm state.

Once partially armed the alarm will sound if :-

- the bonnet, tailgate, or a door are opened.
- the vehicle battery is disconnected.
- an attempt is made to disconnect the alarm siren.

Note: *This setting should be used in circumstances such as travelling on a ferry, when pets are to be left in the vehicle, when a window must be left open etc*

Alarm indicator



The alarm status is displayed by the indicator.

- Indicator off - alarm disarmed.
- Indicator flashes once per second - alarm is armed and engine immobilised.
- Indicator flashes rapidly - the alarm has been triggered.

Note: *The alarm status indicator will flash rapidly when the alarm has been disarmed, but the remote has not been docked.*

DISARMING THE ALARM

When the vehicle is unlocked using the remote control, the alarm is automatically disabled. The hazard lamps will flash twice to indicate that the alarm is disabled.

Disarming when the unlock button fails to work

If, when pressed, the unlock button fails to operate the vehicle can still be unlocked and the alarm disabled. To unlock the vehicle :-

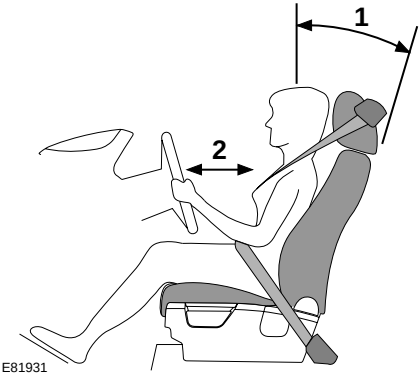
1. Unlock the drivers door using the key blade.
2. Dock the remote control.

Note: *When the drivers door is unlocked using the key, the alarm will sound until the remote is docked.*

Deactivating the alarm when triggered

If the alarm has been triggered it can be deactivated by pressing the remote unlock button, or by docking the remote control.

SITTING IN THE CORRECT POSITION



WARNING

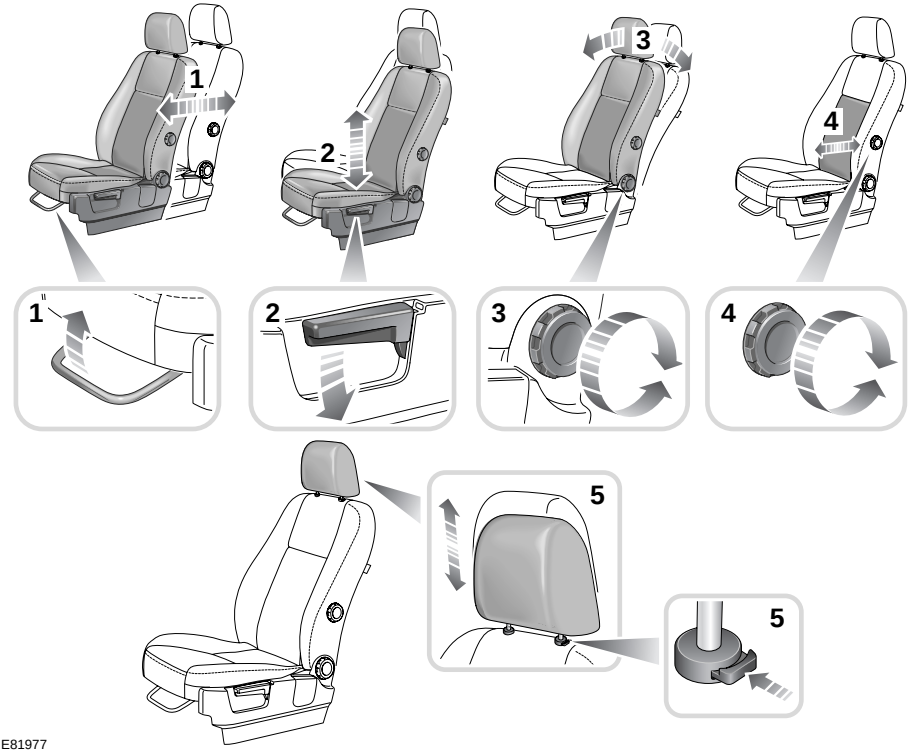
Do not adjust the seat while the vehicle is moving. Doing so could cause loss of vehicle control and personal injury.

The seat, head restraint, seat belt and airbags, all contribute to the protection of the user. Correct use of these components will give you greater protection, therefore you should observe the following points:

1. Sit in an upright position with the base of your spine as far back as possible and the seatback reclined no more than 30 degrees.
2. Do not move the driver's seat too close to the steering wheel. Ideally, a minimum distance of 254 mm (10 inches) is recommended between the breastbone and the steering wheel airbag cover. Hold the steering wheel in the correct position with your arms slightly bent.

- Adjust the head restraint so that it's highest point is level with the top of your head.
- Position the seatbelt so that it is mid-way between your neck and your shoulder. Fit the strap tightly across your hips, not across your stomach.
- Ensure that your driving position is comfortable, and enables you to maintain full control of the vehicle.

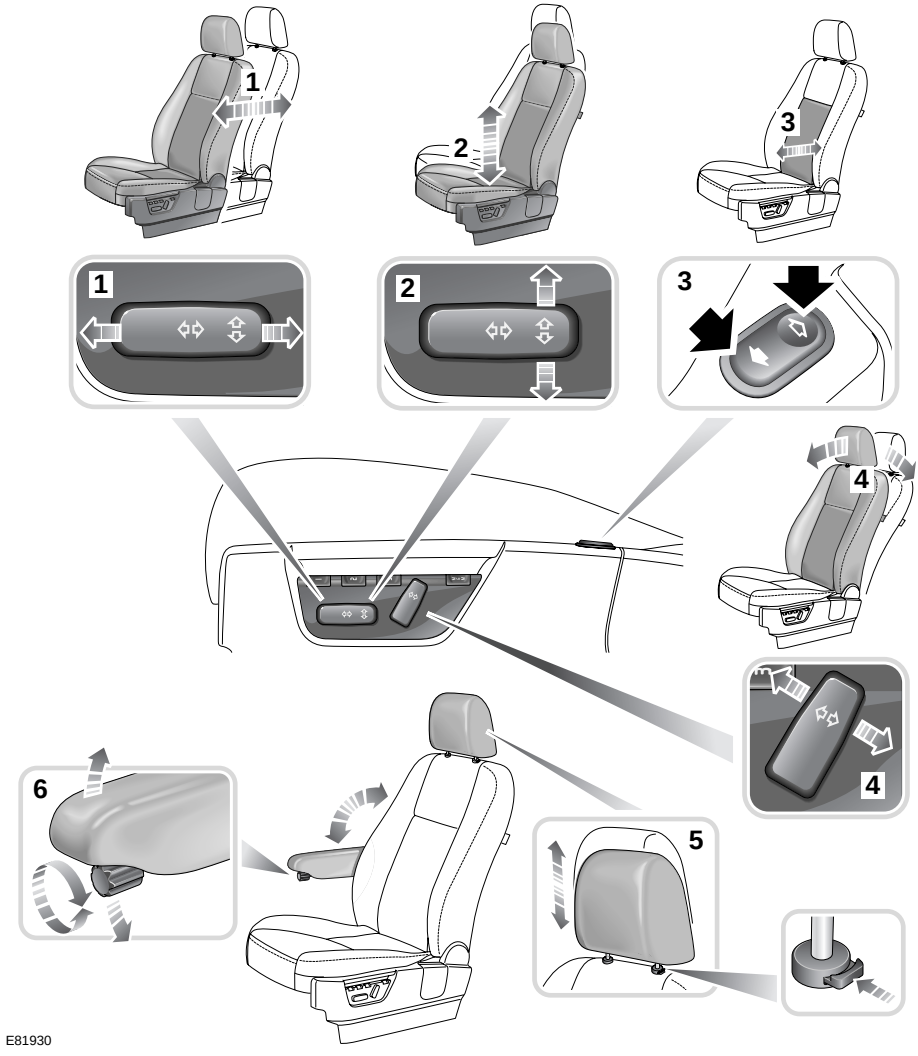
MANUAL SEATS



E81977

1. Fore and aft adjustment.
2. Height adjustment.
3. Seat back angle adjustment.
4. Lumbar support adjustment.
5. Head restraint height adjustment.

ELECTRIC SEATS

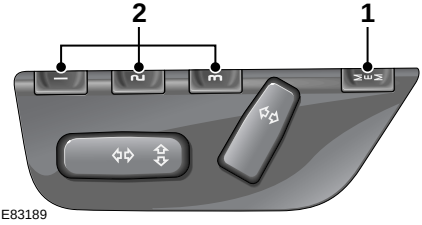


E81930

1. Fore and aft adjustment.
2. Height adjustment.
3. Lumbar support adjustment.
4. Seat back angle adjustment.
5. Head restraint height adjustment.
6. Armrest height adjustment.

To adjust the seats, the remote control must be inserted in the starter control unit and the ignition on. On those vehicles equipped with the memory driver's seat, the seat has a 10 minute active period, initiated when the driver's door is opened/closed or the remote control is removed from the starter control unit.

Driving position memory



E83189

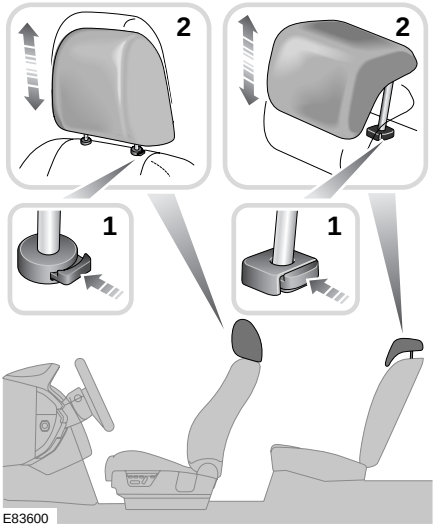
Once you have adjusted the power operated driver's seat and exterior mirrors for your ideal driving position, the vehicle can memorise these settings for future use.

1. Press the memory store button to activate the memory function.
2. Press one of the preset buttons within five seconds to memorise the current settings. **MEMORY STORED** will be displayed on the message centre accompanied by an audible chime to confirm the settings have been memorised.

A seat position will only be memorised during the five second active period.

Any existing settings will be over-written when programming a memory position.

HEAD RESTRAINTS



WARNINGS

Head restraints are designed to support the head, not the back of the neck. The restraint must be positioned correctly to restrain rearward movement of the head in a collision. An incorrectly adjusted head restraint increases the risk of death or serious injury in the event of a collision.

Adjust the head restraint so that the top of the head restraint is above the centre line of the head. An incorrectly adjusted head restraint increases the risk of death or serious injury in the event of a collision. See **SITTING IN THE CORRECT POSITION** (page 47).

Do not drive, or carry passengers with the head restraints removed from occupied seats. The absence of a correctly adjusted head restraint increases the risk of death or serious injury in the event of a collision.

WARNINGS

Never adjust the head restraints while the vehicle is in motion. An incorrectly adjusted head restraint increases the risk of death or serious injury in the event of a collision.

1. Press the locking collar to release the head restraint.
2. Whilst pressing the locking collar, move the head restraint up or down to the required position.

REAR SEATS

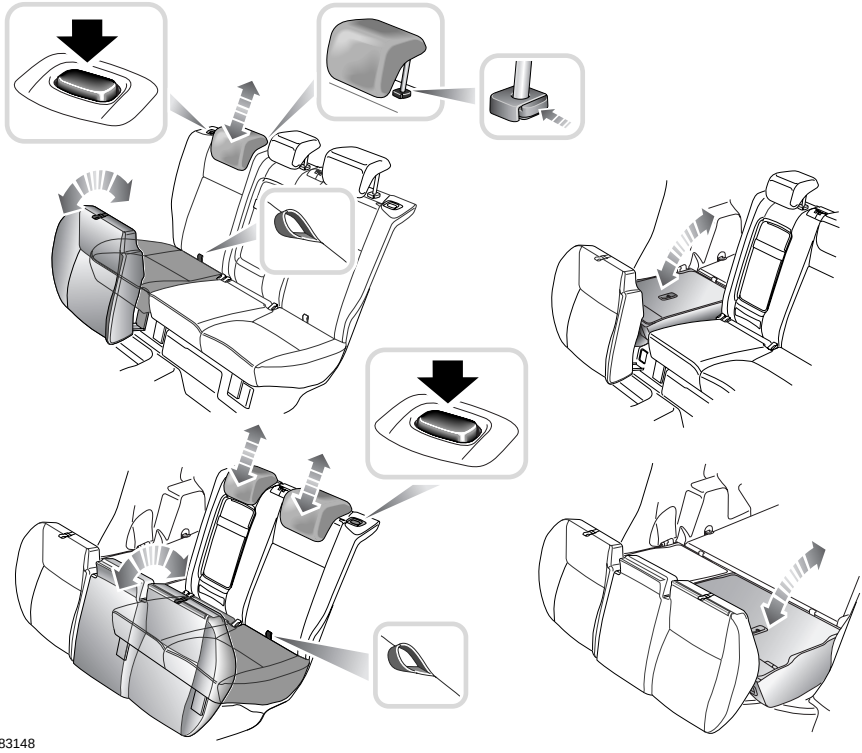
WARNINGS

Always ensure that objects carried within the vehicle are secured properly. Unsecured items can cause death or serious injury in the event of an impact or sudden manoeuvre.

Never allow passengers to travel in the load space under any circumstances. All vehicle occupants should be seated correctly, and wear a seat belt at all times when the vehicle is in motion. Failure to do so will greatly increase the risk of death and serious injury in the event of an accident or heavy braking.

The split fold rear seat can be folded completely to accommodate large loads, or partially to accommodate large loads, and still retain seating for passengers.

Folding the rear seats



E83148

1. Using the loop provided at the back of the seat base, pull the back of the seat base up and forward.
2. Fully lower the head restraints.
3. Press the seat back release button, and fold the seat back fully forward.
4. If required, repeat the process for the second seat section.

Note: *To achieve a completely flat load floor it will be necessary to completely remove the rear head restraints.*

WARNING

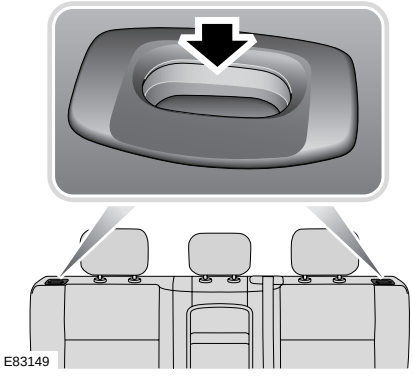
Ensure that if the rear head rests are removed they are stored securely. Never leave them loose in the vehicle, as they can cause serious injury or death in the event of an accident, heavy braking, or sudden manoeuvres.

Raising the rear seats

The process for raising the rear seat is the reverse of folding.

WARNING

Ensure that when the seat back is raised the locking mechanism is fully engaged. Failure to do so can increase the risk of death or serious injury in the event of an accident or sudden manoeuvre or heavy braking.



When the seat back has been raised fully, and is locked into position, the release button will pop-up.

Note: *The red warning section will only be visible if the seat back has not been locked into position.*

HEATED SEATS

Note: *To prevent the battery from becoming discharged the seat heaters will only operate when the engine is running.*

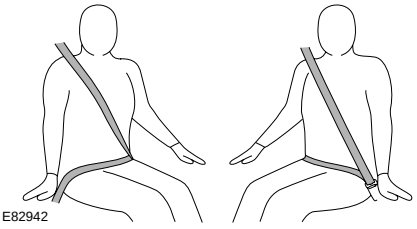
The seat heaters will maintain a factory set temperature, and have two levels of operation, high, and low. There are two indicators in each switch, if both are on the setting is high, if only one is on the setting is low.

To operate:-

1. Press once to turn on to high.
2. Press again to change the setting to low.
3. Press a third time to switch off.

PRINCIPLE OF OPERATION

Seat belts



WARNINGS

Seat belts are designed to bear upon the bony structure of the body, and should be worn low across the front of the pelvis, or the pelvis chest and shoulders, as applicable; wearing the lap section of the belt across the abdominal area must be avoided.

Seat belts should be adjusted as firmly as possible, consistent with comfort, to provide the protection for which they have been designed. A slack belt will greatly reduce the protection afforded to the wearer.

Care should be taken to avoid contamination of the webbing with polishes, oils and chemicals, and particularly battery acid. Cleaning may safely be carried out using mild soap and water.

The belt should be replaced if webbing becomes frayed, contaminated or damaged.

It is essential to replace the entire assembly after it has been worn in a severe impact even if damage to the assembly is not obvious.

Belts should not be worn with the straps twisted.

WARNINGS

Do not carry hard, fragile, or sharp items between your person and the seat belt. In an impact the pressure from the seat belt on such items can cause them to break, which in turn may cause death or serious injuries.

Each belt assembly must only be used by one occupant; it is dangerous to put a belt around a child being carried on the occupant's lap.

The occupants of the front seats should not travel with the seat back at more than 30 degrees from upright. Doing so will reduce the protection afforded by the seat belt.

Seat belt safety

WARNINGS

Seat belts should be worn by all vehicle occupants, for every journey no matter how short. failure to do so will greatly increase the risk of death or serious injury in the event of an accident.

No modifications or additions should be made which prevent the seat belt mechanism from taking up slack, or prevent the seat belt being adjusted to remove slack. A slack seat belt offers a greatly reduced level of occupant protection in an impact.

If any damage, wear, cuts, defects, or impaired operation are noted with the seat belts, the vehicle should be taken to a Land Rover Dealer/Authorised repairer for immediate attention. Do not use the vehicle if the seat belts cannot be operated correctly.

When using seat belts to restrain items other than occupants, take care to ensure that the belts are not damaged, or exposed to sharp edges.

WARNINGS

Care must be taken to avoid contaminating the seat belt webbing, and seat belt mechanisms with any chemicals, liquids, grit, dirt, or cleaning products. If the seat belts do become contaminated they should be replaced immediately. Contaminated seat belts my not operate correctly in an impact and cannot be relied upon.

Seat belt checks

Note: *If the vehicle is parked on an incline, the seat belt mechanism may lock. This is not a fault, and the belt should be gently eased out from the upper anchorage.*

The seat belts should be inspected regularly to check for fraying, cuts, or wear to the webbing, and the condition and security of the mechanism, buckles, adjusters, and mounting points.

Checks

- With the seat belt fastened, give the webbing near the buckle a quick upward pull. The buckle must remain securely locked.
- With the seat belt unfastened, unreel the seat belt to the limit of its travel. Check that it unreels smoothly with no snatches or snags. Allow the belt to fully retract, again checking for smooth operation.
- Partially unreel the seat belt, then hold the tongue plate and give a quick forward pull. The mechanism must lock and prevent any further unreeling.

If any of the seat belts fail to meet those criteria, immediately contact you Land Rover Dealer/Authorised Repairer.

SEAT BELT REMINDER

If the driver's seat belt is not fastened when the vehicle is in motion, a chime will be heard and the seat belt warning indicator will illuminate. The warning chime and indicator will also be activated if the front passenger seat is occupied without the seat belt being fastened.

Note: *Objects placed on the front passenger seat may activate the seat belt reminder warning chime and indicator. It is recommended that any objects placed on the front passenger seat are secured using the seat belt.*

FASTENING THE SEAT BELTS

E82905

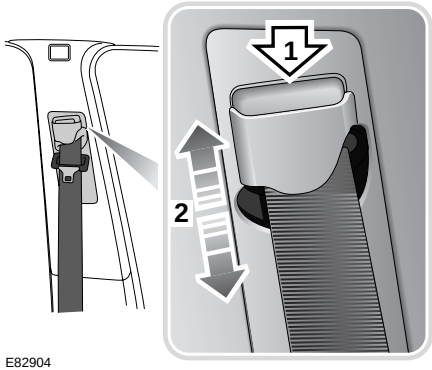
1. Draw the belt out smoothly, ensure that the belt height, the seat, and your position on the seat are correct. The belt should lay flat across the pelvis, chest, and mid-point of the collar bone between the neck and shoulder.
2. With the seat belt correctly positioned, place the metal tongue into the buckle nearest to you. Press it in until a click is heard.

Releasing the seat belts

Note: *When releasing the seat belt it is advisable to hold the belt before pressing the release button. This will prevent the belt from retracting too quickly.*

To release the seat belt, press the red button.

SEAT BELT HEIGHT ADJUSTMENT



E82904

WARNING

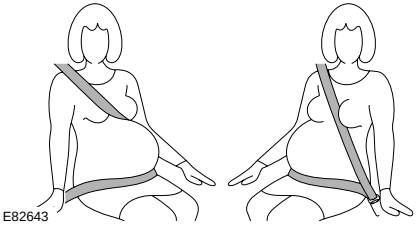
Correct seat belt adjustment is essential for safety and comfort. Ensure that the height is correctly adjusted and the mechanism is locked in place before driving the vehicle. Do not attempt to adjust the seat belt height once the vehicle is in motion. Doing so may cause you to loose control of the vehicle, or incorrectly adjust the seat belt.

1. Press to release the catch.
2. With the catch depressed move the mechanism slide up or down to the required height. Ensure that the locking mechanism has engaged.

When correctly positioned the seat belt should cross the collar bone at the mid-point between the neck and end of your shoulder.

Where possible, rear seat passengers should adjust their seating position to achieve the same seat belt position.

USING SEAT BELTS DURING PREGNANCY



WARNINGS

Position the seat belt correctly for the safety of the mother and unborn child. Never wear just the lap strap, and never sit on the lap strap whilst using just the shoulder strap. Both of these actions are extremely dangerous, and may increase your risk of serious injury in the event of an accident or during emergency braking.

Never place anything between you and the seat belt in an attempt to cushion the impact in the event of an accident. It can be dangerous, and will reduce the effectiveness of the seat belt in preventing injury.

Position the lap strap comfortably across the hips beneath the abdomen. Place the diagonal part of the seat belt between the breasts and to the side of the abdomen. Ensure that the seat belt is not slack or twisted.

PRINCIPLE OF OPERATION

Introduction

In the event of a collision the airbag control unit monitors the rate of deceleration caused by the collision. This information is then used to determine whether airbags should be deployed.

Airbag deployment is dependent on the rate at which the passenger compartment changes speed following the collision. The circumstances affecting different collisions (vehicle speed, angle of impact, type and size of object hit, etc) vary considerably, and will affect the rate of deceleration accordingly.

The Supplementary Restraint System (SRS) components include :-

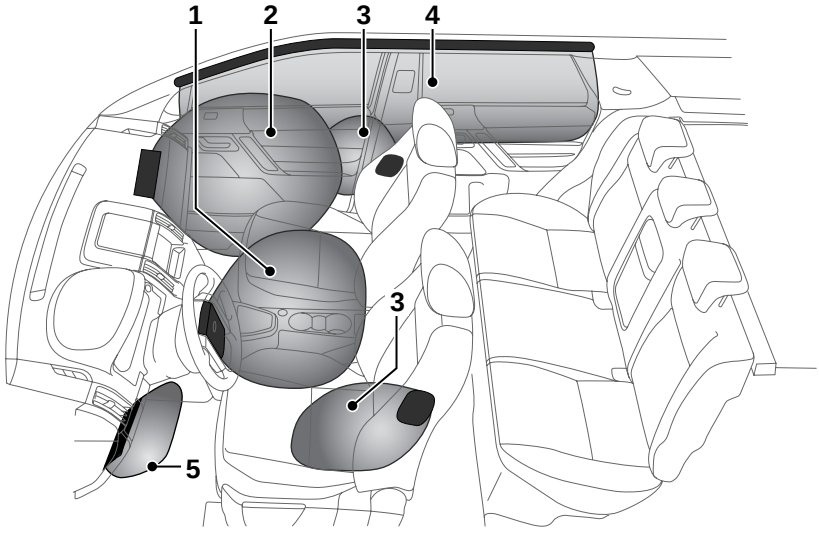
- SRS warning indicator.
- Rotary coupler.
- Airbag modules.
- Seat belt pre-tensioners.
- Airbag diagnostic control unit.
- Crash sensors.
- Airbag wiring harnesses.
- Seat occupancy sensor.

Note: *The SRS is not designed to operate as a result of:*

- Rear impacts.
- Minor front impacts.
- Minor side impacts.
- Heavy braking.
- Driving over bumps and pot holes.

Therefore, it follows that considerable superficial damage to the vehicle can occur without causing the airbags to deploy.

Airbags



E82660

1. Driver's airbag.
2. Front passenger airbag.
3. Seat mounted side airbags.
4. Curtain airbags.
5. Knee-bolster airbag.

WARNINGS

High speed impacts may cause serious injury or death irrespective of safety features fitted to a vehicle. Always drive with caution and consideration for the vehicle's characteristics, road and weather conditions, and do not exceed any speed limits in force.

Seat belts should be worn at all times, by the driver and passengers in all seating positions. The airbag SRS cannot provide protection in some types of impact. Under these circumstances the only protection will be provided by a correctly worn seat belt.

WARNINGS

Airbags inflate at high speeds, and can cause injuries. To minimise the risk of injury, ensure that all vehicle occupants wear correctly positioned seat belts, sit correctly in the seats, and position the seats as far back as practical.

Ensure that a gap is maintained between the side of the vehicle, and the head and torso. This will enable unobstructed inflation of the curtain, and seat mounted side airbags.

Airbag inflation takes place instantaneously, and cannot protect against the effects of secondary impacts. Under these circumstances the only protection will be provided by a correctly worn seat belt.

WARNINGS

Phone systems should only be installed by qualified persons familiar with the operation of, and requirements for, vehicles fitted with SRS. If you are in any doubt, seek advice from your Land Rover Dealer/Authorised repairer.

Note: *The location points of airbags fitted to the vehicle are marked by the word AIRBAG embossed into the trim.*

Always contact your Land Rover Dealer/Authorised repairer if :-

- An airbag inflates.
- The front or sides of the vehicle are damaged.
- Any part of the SRS shows signs of cracking or damage, including trim covering airbags.

Airbag operation

WARNINGS

For the airbags to operate correctly the roof lining and door post trims must be in good condition, correctly fitted, and free from obstruction. Any damage, wear, or incorrect fitment should be referred to your Land Rover Dealer/Authorised repairer as soon as possible for examination and repair.

Do not allow passengers to obstruct the operation of the airbags by placing any part of their person, or any objects, in contact with, or close to, an airbag module. Airbags deploy at very high speeds, and can cause serious injury or death if objects or occupants are within the area of deployment.

Airbags cannot deploy correctly if they are obstructed. Examples of obstructions are :-

- Any part of an occupants body in contact with, or close to, an airbag cover.
- Objects placed on, or close to, an airbag cover.
- Clothing, sun screens, or other material hanging from grab handles.
- Clothing, cushions, or other material, covering seat mounted airbags.
- Seat covers which are not approved by Land Rover, or specifically designed for use with seat mounted airbags.

This list is not exhaustive, and it remains the responsibility of the driver and passengers to ensure that the airbags are not obstructed in any way.

Deployment and deflation

In the event of a collision the airbag control system monitors the rate, and direction of deceleration. If required to supplement the seat belts, airbags will be deployed as appropriate.

Front airbags

The front passenger's, and driver's airbags are able to deploy in two stages depending on the severity of the frontal impact. In a severe impact the airbags inflate fully to offer maximum protection. In a lesser impact full deployment is not required, so the airbags are partially inflated.

Side and curtain airbags

Side and curtain airbags are designed to offer increased protection for the torso and head in a side impact. The curtain airbags deflate at a slower rate than the front, or side airbags to afford greater protection from serious head injuries.

Airbag deployment effects

WARNINGS

When an airbag inflates a fine powder is released. This is normal, and not an indication of a malfunction. However, the powder may cause irritation to the skin, and should be throughly flushed from eyes, and any cuts or abrasions.

After inflation some airbag components are at high temperatures. To prevent injury, do no touch the airbag components until they have cooled.

In order to react with sufficient speed, airbags are deployed by an explosive charge. Consequently airbag deployment is accompanied by a very loud noise which may cause discomfort and temporary loss of hearing.

AIRBAG WARNING LAMP

The airbag warning indicator is mounted in the instrument pack, and will illuminate as a bulb check when the ignition is turned on.

If any of the following warning indicator conditions occur, the vehicle should be checked by your Land Rover Dealer/Authorised repairer immediately.

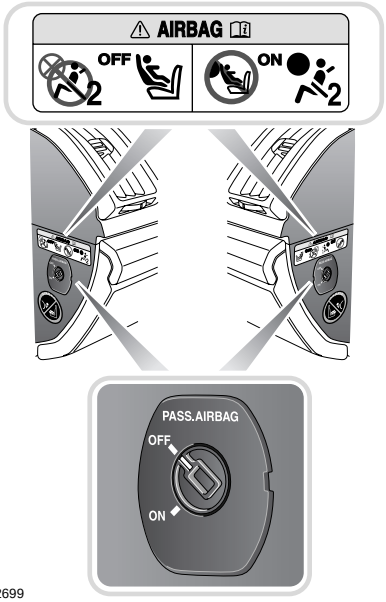
- The warning indicator fails to illuminate when the ignition is turned on.
- The warning indicator fails to extinguish within six seconds of the ignition being turned on.
- The warning indicator illuminates at any time other than the bulb check, when the ignition is turned on.

WARNING

If the warning indicator signals that a fault is present in the system, do not use a child restraint on the front passenger seat. Doing so will increase the risk of death or serious injury to the child.

DISABLING THE PASSENGER AIRBAG

Note: *The passenger airbag should be disabled only when a rearward facing child restraint if fitted to the front passenger seat.*



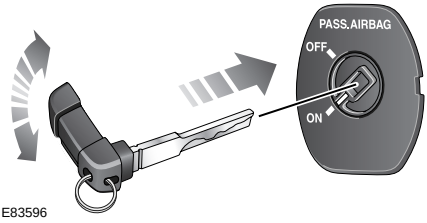
E82699

WARNINGS

Crash test data and statistics, show that the safest place for a child to be restrained, is in a child seat correctly fitted to the vehicle's rear seat.

Do not use a child restraint on a seat protected by an operational airbag in front of it. Doing so presents a high risk of death or serious injury to the child in the event of an accident.

Do not fit a child restraint to the front passenger seat if the SRS warning light illuminates continuously with the ignition on.



E83596

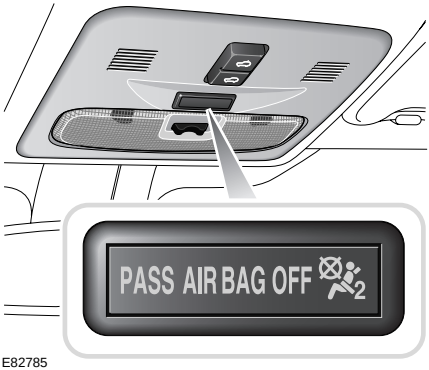
To disable the passenger airbag :-

1. Remove the emergency key from the remote control. See **USING THE KEY** (page 40).
2. Insert the end of the key blade into the slot in the switch and rotate the switch to the off position.

WARNING

As soon as the child seat is removed from the front passenger seat the airbag must be turned on. Failure to do so will put any front seat passengers at greater risk of death or serious injury in the event of a frontal impact.

Operational status indicator



E82785

WARNING

When checking the operational status of the front passenger airbag, ensure that the ignition is switched on.

The passenger airbag operational status indicator illuminates yellow when the airbag has been disabled.

Note: *The indicator will only illuminate when the ignition is turned on, or the engine is running.*

AIRBAG SERVICE INFORMATION

WARNINGS

Do not attempt to service, repair, replace, modify, or tamper with, any part of the SRS. This includes wiring or components in the vicinity of SRS components. Doing so may cause the system to trigger, or render the system inoperative, either of which may result in death or serious injuries.

Do not use any electrical test equipment, or devices in the vicinity of SRS components or wiring. Doing so may cause the system to trigger, or render the system inoperative, either of which may result in death or serious injuries.

All of the following operations should only be carried out by a Land Rover Dealer/Authorised Repairer, or suitably qualified person :-

- Removal or repair of any wiring or component in the vicinity of any SRS components.
- Installation of electrical, or electronic, equipment and accessories.
- Modification to the front or sides of the vehicle exterior.
- Attachment of accessories to the front or sides of the vehicle.

CHILD SEATS

WARNINGS

Do not use a child restraint on a seat with an operational airbag in front of it. There is a risk of death or serious injury when the airbag deploys.

Crash statistics show that children are safest when properly restrained on the rear seat.

Do not use a forward facing child seat until the child using it is above the minimum weight of 9 kg (20 lb.) and able to sit up unaided. Up to the age of two, a child's spine and neck are not sufficiently developed to avoid injury in a frontal impact.

Do not allow a baby or infant to be held or carried on the lap. The force of a crash can increase effective body weight by as much as thirty times, making it impossible to hold onto the child. Children typically require the use of a booster seat appropriate to their age and size, thereby enabling the seat belts to be properly fitted, reducing the risk of injury in a crash. Children could be endangered in a crash if their child restraints are not properly secured in the vehicle.

Do not use a child seat that hooks over the seat back. This type of seat cannot be satisfactorily secured and is unlikely to be safe for your child.

It is very important for all infants and children under 12 years of age to be restrained in a suitable child safety seat appropriate to their age and size.

If it is essential that a child travels in the front passenger seat, Land Rover recommends that the following preparations are made before fitting the child restraint.

- Disable the front passenger airbag. See **DISABLING THE PASSENGER AIRBAG** (page 62).
- Adjust the front passenger seat fully rearwards.
- Adjust the lumbar support to its minimum support position.
- Adjust the seat cushion to its highest position. If cushion rake adjustment is possible, adjust it to its lowest position.
- Adjust the seat belt adjustable upper anchorage to its lowest position.

WARNING

Original text according to ECE R94. 01. Extreme hazard! Do not use a rearward facing child restraint on a seat protected by an operational airbag in front of it!

E79258

This symbol is affixed to the end of the facia on the passenger side. Its purpose is to warn against the use of a rear facing child seat when the front passenger airbag is fitted and operational.

Child restraint check list

Every time a child travels in the vehicle observe the following :-

- Use appropriate child restraints.
- Carefully follow the restraint system manufacturers instructions.
- Adjust the harnesses for every child on every trip.
- Ensure that all slack is removed from the adult seatbelt.
- Always attach the top tether when installing an ISOFIX seat.
- Always check the security of the child restraint. See **ISOFIX ANCHOR POINTS** (page 67).
- Do not dress a child in bulky clothing, or place any objects/padding between the child and the restraint.
- Regularly check the fit and condition of child restraints. If the fit is poor, or wear/damage is visible replace the restraint immediately.
- Set a good example - always wear your seat belt.

Child safety seating and positions

Mass group.	0 = Up to 10 kg (22 lb).	0+ = Up to 13 kg (29 lb).	I = 9-18 kg (20-40 lb).	II = 15-25 kg (40-67 lb).	III = 25-36 kg (67-80 lb).
Seating positions.					
Front passenger. *	UF*	UF*	U*	U*	U*
Rear outboard.	U	U	U	U	U
Rear centre.	U	U	U	U	U

- U = Suitable for universal category restraints approved for this mass group.
- UF = Suitable for Forward-facing universal category restraints approved for this mass group.

* Always ensure that the passenger airbag has been disabled before using a child restraint in this seating position. The seat back needs to be adjusted to the fully upright position. See **DISABLING THE PASSENGER AIRBAG** (page 62).

CAUTION

Information given within the table is correct at the time of going to press. However, availability of child restraints may change. Please consult your Land Rover Dealer/Authorised Repairer for the latest recommendation.

Note: *The legislation which governs how and where children should be carried when travelling in a vehicle, is subject to change. It is the responsibility of the driver to comply with all regulations in force.*

BOOSTER CUSHIONS

In a situation where a child is too large to fit into a child safety seat, but is still too small to safely fit the three point belt properly, a booster seat is recommended for maximum safety. Follow the manufacturer's instructions for fitting and use, then adjust the seat belt to suit.

ISOFIX ANCHOR POINTS

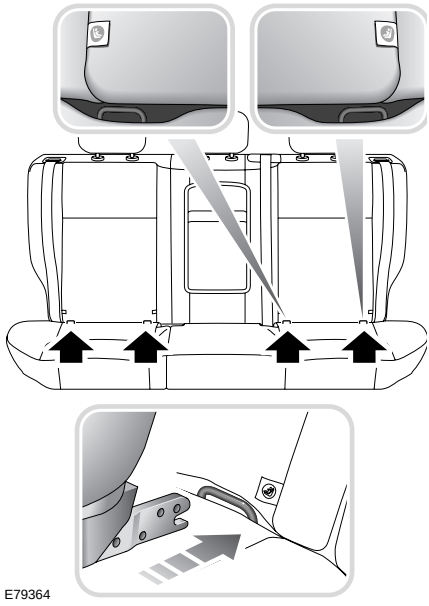
WARNINGS

Do not attempt to fit ISOFIX restraints to the centre seating position. The anchor bars are not designed to hold an ISOFIX restraint in this position.

If the restraint is not correctly anchored, there is a significant risk of injury to the child in the event of a collision or emergency braking.

Child restraint anchorages are designed to withstand only loads imposed by correctly fitted child restraints. Under no circumstances are they to be used for adult seat belts, harnesses, or for attaching other items or equipment to the vehicle.

If removing a head restraint in order to fit a child restraint, always secure the head restraint when storing it. If left loose in the vehicle it may cause death or serious injury during sudden braking or an impact.



E79364

Both of the outer seat positions on the rear seat are equipped to accept ISOFIX restraints.

This symbol is shown on a label sewn into the seats to indicate the position of the ISOFIX lower anchorages.

ISOFIX child seats

Mass group	Size classes	Fixtures	Rear outboard seats
Carrycot	F/G	ISO L1/L2	X
0 = Up to 10 kg (26.8 lb)	E	ISO R1	IL*
0+ = Up to 13 kg (34.8 lb)	C/D/E	ISO R1/R2/R3	IL*
I = 9 to 18 kg (24 to 48 lb)	C/D A/B1/B	ISO R2/R3 ISO F2/F2X/F3	IL* IUF
II = 15 to 25 kg (40.2 to 67 lb)	-	N/A	N/A
III = 22 to 36 kg (59 to 96.5 lb)	-	N/A	N/A

- IUF = Suitable for ISOFIX forward child restraint systems of universal category approved for use in the mass group.
- IL = These ISOFIX child restraint systems are of the specific vehicle, restricted, or semi-universal categories.
- * = Child seats suitable for use in these locations are Britax Cosy-Tot, and Römer Baby Safe ISOFIX.

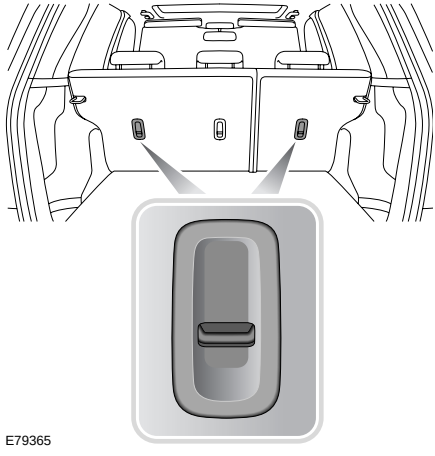
Installing an ISOFIX child seat

To install an ISOFIX child seat :-

1. Raise or remove the head restraint.
2. Lift the velcro flap to expose the ISOFIX locking mechanism.
3. Slide the child seat into the locking mechanism.
4. Test the security of the child restraint. To do this attempt to pull the restraint away from the vehicle seat and twist the restraint from side to side. Even if the restraint appears secure you should still check the anchor points visually to ensure correct attachment.

Note: *Always ensure that if an upper tether is provided, it is fitted and tightened correctly.*

Tether anchorages


E79365

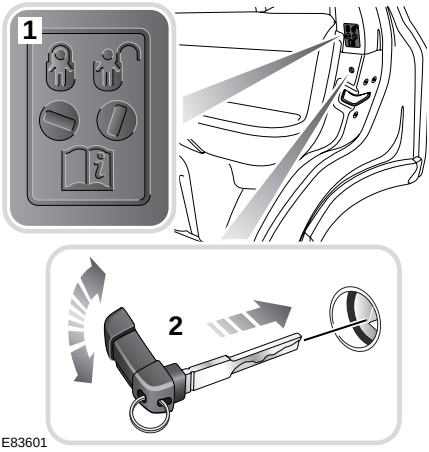
WARNING

Child restraint anchorages are designed to withstand only those loads imposed by correctly fitted child restraints. Under no circumstances are they to be used for adult seat belts, harnesses or for attaching other equipment or items to the vehicle.

Tether anchorages are provided at each rear outboard seating position.

Note: *A tether anchorage is provided for the centre seat position, but should only be used when a non- ISOFIX child seat with a tether is used in this seating position.*

CHILD SAFETY LOCKS



Child safety locks are fitted to the rear doors to allow you to prevent accidental opening of the doors when the vehicle is in motion.

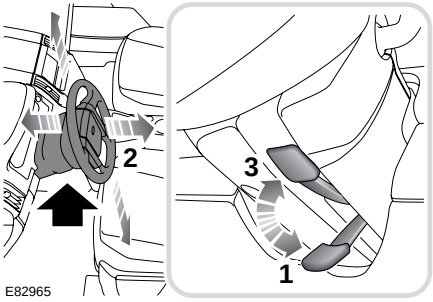
If children are to be carried in the rear seat positions, it is recommended that the rear door interior handles are disabled.

Note: *For convenience the rear door interior handles should be re-enabled when carrying adult passengers in the rear seat positions.*

To change the child lock settings :-

1. Open the door to access the child safety lock.
2. Insert the emergency key into the slot, and rotate a quarter of a turn to enable, or disable the interior door handle as required.

ADJUSTING THE STEERING WHEEL



WARNINGS

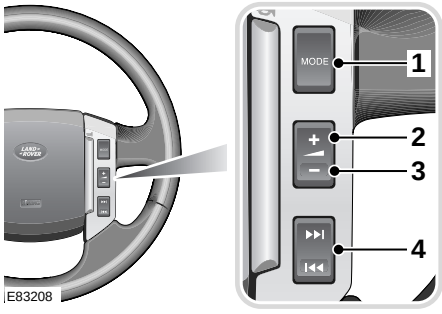
Never adjust the steering wheel position whilst the vehicle is in motion. Doing so will reduce control of the vehicle, and may cause unpredictable steering movements.

After adjusting the steering wheel position, ensure that the locking lever is returned to the fully up position. Failure to do so will reduce control of the vehicle, and may cause unpredictable steering movements.

To adjust the steering wheel :-

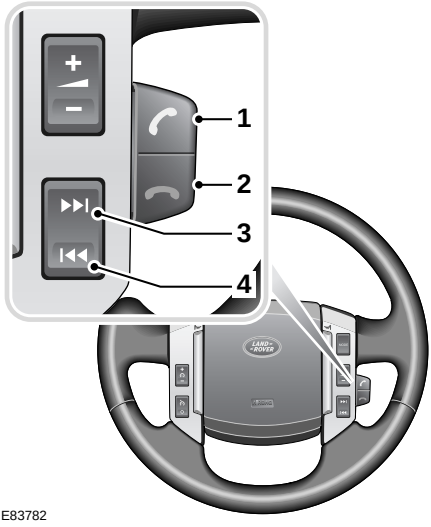
1. Release the locking mechanism by pulling the lever down.
2. Adjust the steering wheel to the desired position.
3. Push the locking lever back up, and ensure that it's fully home.

AUDIO CONTROL



1. Press to switch between radio, CD, or AUX.
2. Press to increase volume.
3. Press to decrease volume.
4. Press and release to scroll through preset radio stations or CD tracks. Press to search up or down for the next or previous radio station/CD track.

Audio control using the telephone buttons



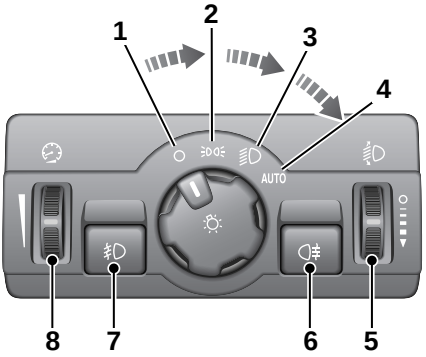
E83782

When the telephone system is inoperative the telephone controls on the steering wheel can be used to operate the audio system.

1. Operates as a menu control. Press to enter or confirm menus selections.
2. Operates as an exit control. press to return to the previous screen or menu.
3. Operates as forward motion of the rotary control. Press to scroll forward through menu items.
4. Operates as backward motion of the rotary control. Press to scroll back through menu items.

LIGHTING CONTROL

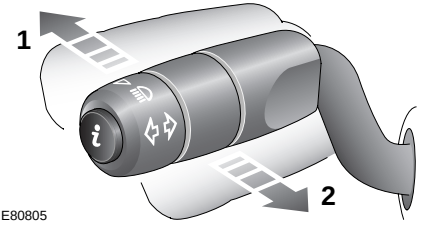
Main switch panel



E80804

1. Headlamps/side lamps off.
2. Side lamps on.
3. Headlamp dipped beam on.
4. Autolamps on.
5. Headlamp levelling control.
6. Rear fog lamps on/off.
7. Front fog lamps on/off.
8. Facia illumination dimmer control.

Main beam



E80805

1. When the headlamp dipped beams are switched on, push the indicator stalk to change to full beam.
2. To flash the headlamps at anytime, briefly pull the indicator stalk and release it.

When the headlamp main beam is on, the main beam warning indicator will illuminate.

Note: *Do not use main beam where it may dazzle other road users.*

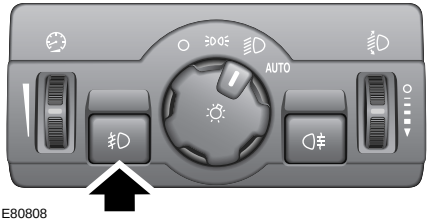
Headlamp courtesy delay

This feature enables the driver to keep the area in front of the vehicle illuminated for a short period after the vehicle has been locked.

1. Switch off the ignition.
2. Pull the indicator stalk (main beam flash) towards the steering wheel, and exit the vehicle as normal.

The headlamps will remain on for thirty seconds. The length of time that the headlamps remain on, can be adjusted by your Land Rover Dealer/Authorised Repairer.

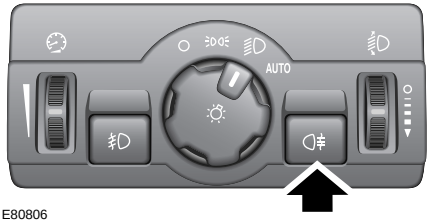
FRONT FOG LAMPS



E80808

Front fog lamps will only operate when headlamp dipped beam, or Auto lamps are selected. Press the front fog lamp button to switch on, press again to switch off.

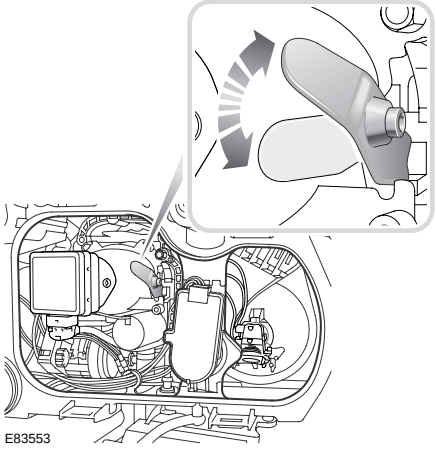
REAR FOG LAMPS



E80806

Rear fog lamps will only operate when headlamp dipped beam, or Auto lamps are selected. Press the rear fog lamp button to switch on, press again to switch off.

ADJUSTING THE HEADLAMPS



E83553

Note: *The headlamps must be removed in order to change the beam pattern. See* ***CHANGING A BULB*** *(page 77).*

The tourist lever allows you to adjust the headlamps to the correct beam pattern for driving in countries where vehicles drive on the left, or the right.

When new, the lever will be set to the correct position for the country in which the vehicle is sold. To change the pattern for driving on the other side of the road, move the lever to the opposite position.

Note: *When changing the beam pattern using the lever, ensure that you change the lever position on both headlamps.*

HEADLAMP LEVELLING

Halogen headlamps

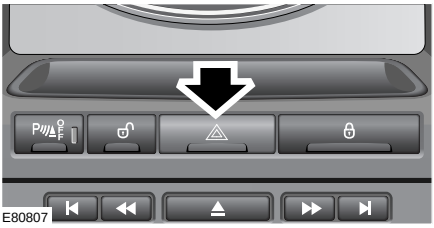
Use the headlamp levelling control to account for vehicle loading changes.

Vehicle load	Switch position
Driver only	0
Driver and front seat passenger	0
Driver and passengers in all seats	1
Maximum gross vehicle weight	2
Maximum rear axle load	2.5

Xenon headlamps

Headlamp levelling is adjusted automatically if Xenon headlamps are fitted.

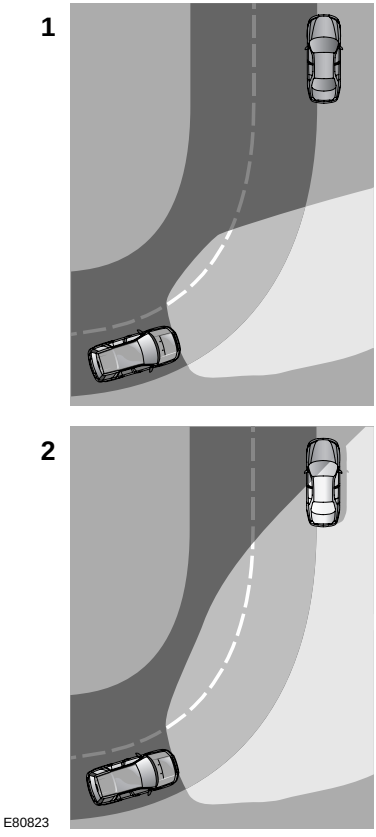
HAZARD WARNING FLASHERS



Press the switch to turn the hazard warning lamps on. When the hazard warning lamps are operating, the indicator warning lamps will flash in time with the hazard warning lamps.

Note: *Hazard warning lamps can be used when the ignition is on or off.*

ADAPTIVE FRONT LIGHTING SYSTEM (AFS)



1. Vehicle without AFS.

2. Vehicle with AFS.

When cornering using dipped beam, AFS will adjust the headlamp beams to provide improved illumination in the direction of travel.

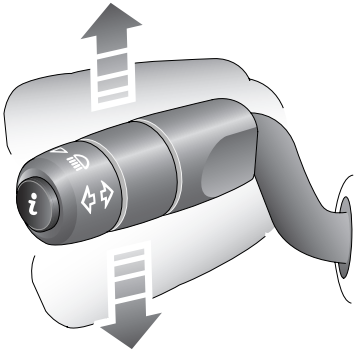
AFS is deactivated when :-

- reverse gear is selected.
- the vehicle is stationary.
- daylight running lamps are on.

If a system fault is detected the headlamps will attempt to move to the central position, and remain stationary. The AFS warning indicator will illuminate to indicate that a fault is present.

If the warning indicator illuminates, contact your Land Rover Dealer/Authorised Repairer as soon as possible.

DIRECTION INDICATORS

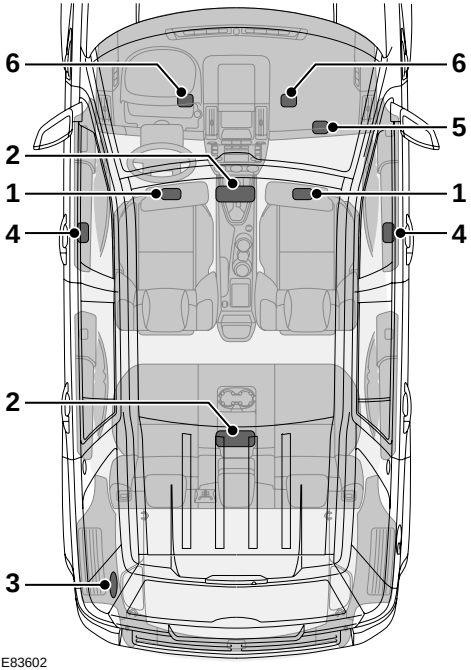


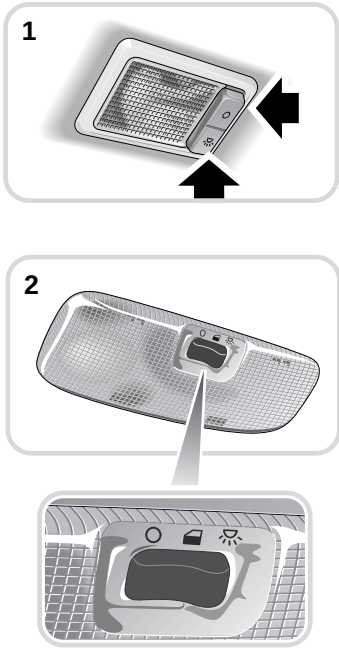
E80822

The direction indicators are operated using the indicator stalk. Move the stalk up or down, to indicate turning right or left.

The indicators will operate three times if the stalk is briefly pushed up or down.

INTERIOR LAMPS





1. Sun visor lamps. Switch on or off as required using the switch.
2. Map reading/interior lamps. The switch allows them to be turned on, off, or set to operate when the doors are opened.
3. Luggage compartment lamp. Automatically illuminates when the doors are opened.
4. Puddle lamps. Automatically illuminate when the doors are opened.
5. Glove box lamp. Automatically illuminates when the glove box is opened.
6. Footwell lamps. Automatically illuminate when the doors are opened.

APPROACH LAMPS

The approach lamp feature turns on the parking lamps, indicator lamps, door mirror lamps, number plate lamps, interior lamps, and puddle lamps remotely. This feature is activated with the remote control. See **USING THE REMOTE CONTROL** (page 41).

The length of time which the lights remain on can be adjusted by your Land Rover Dealer/Authorised Repairer.

CHANGING A BULB

General information

CAUTION

Alway replace bulbs with the correct type and specification. If you are in any doubt contact your Land Rover Dealer/Authorised Repairer for advice.

Note: *In certain territories it is a legal requirement to carry spare bulbs. A replacement bulb kit is available as an approved accessory from your Land Rover Dealer/Authorised Repairer.*

Halogen bulbs

Halogen bulbs are used for main beam, dipped beam, and front fog lamps. Take care not to touch the glass part of the bulb with your fingers; always use a cloth to handle the bulb. If necessary use methylated spirits to remove finger prints.

Xenon lamps

WARNINGS

Replacement or maintenance of Xenon lamps should only be carried out by suitably qualified personnel.

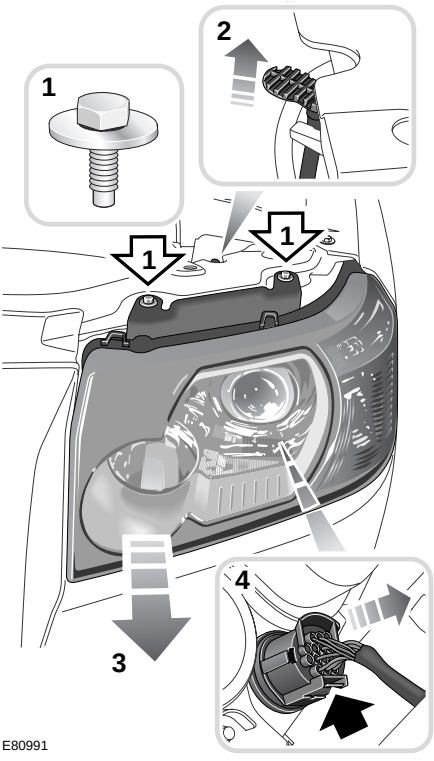
High voltage is required to ignite the gas and metal vapour which are used to power Xenon lamps. Contact with this voltage can cause serious injuries.

Bi-Xenon lamp units operate at a very high temperature. Ensure that the lamp units have cooled before attempting to touch them.

Xenon lamp units contain Mercury which is highly toxic, and can be extremely harmful.

Seek advice about the correct disposal of Bi-Xenon lamp units from a Land Rover Dealer/Authorised Repairer, or your local authority.

Removing the headlamp unit



In order to change a headlamp unit bulb, you must first remove the headlamp unit.

To remove the headlamp unit :-

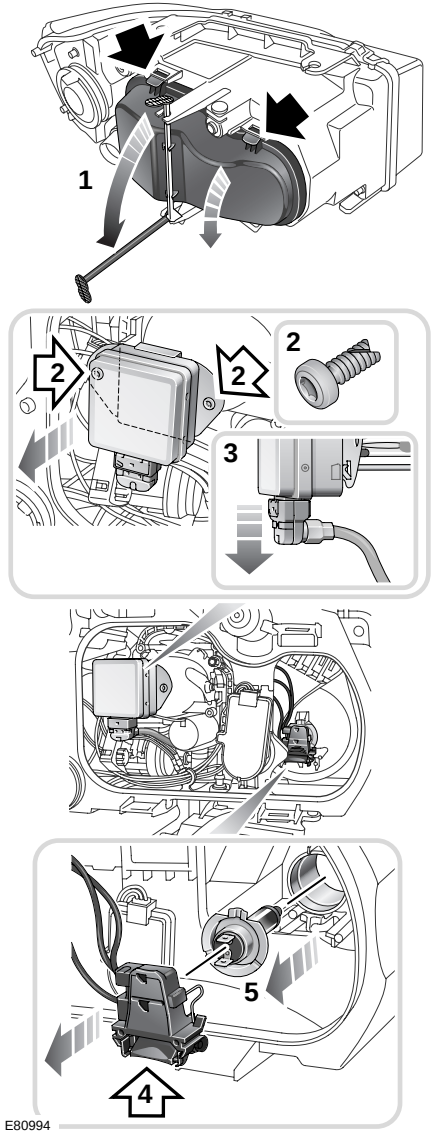
1. Undo and remove the two retaining bolts.
2. Pull up the locking lever to release the headlamp unit.
3. Pull the headlamp unit forward sufficiently to allow access to the rear of the unit.
4. Disconnect the electrical plug from the back of the headlamp by pressing in the locking tab and pulling the connector out.

CAUTION

Do not place the lamp unit face down on hard or abrasive surfaces. Doing so may scratch the surface of the lens.

Headlamp unit bulbs

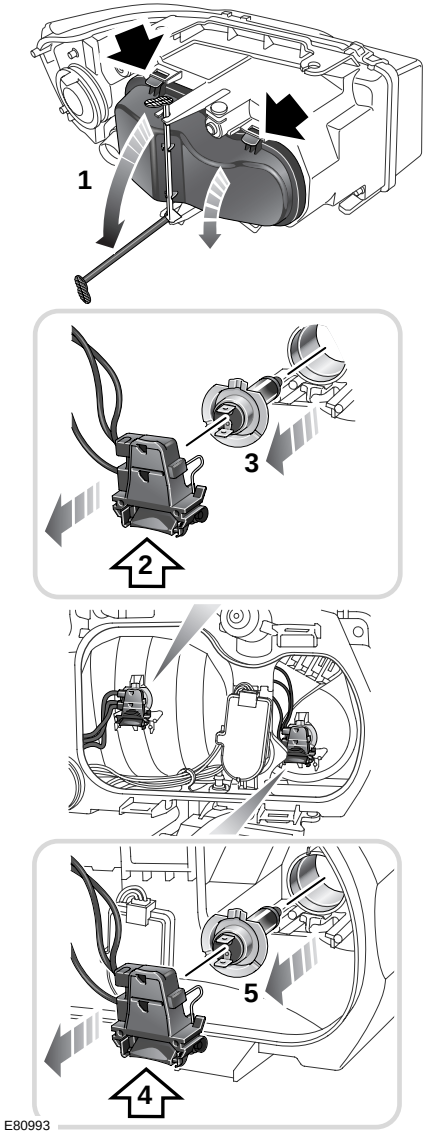
Xenon dipped/main beam with supplementary halogen main beam



With the headlamp unit removed :-

1. Unclip the locking lever, press down the two tabs and remove the cover.
2. Undo the two retaining screws and remove the Xenon unit.
3. Remove the electrical connection from the Xenon unit.
4. Pull the halogen main beam electrical connector off of the supplementary halogen main beam bulb.
5. Unclip the halogen bulb and remove it from the unit.

Halogen dipped and main beam

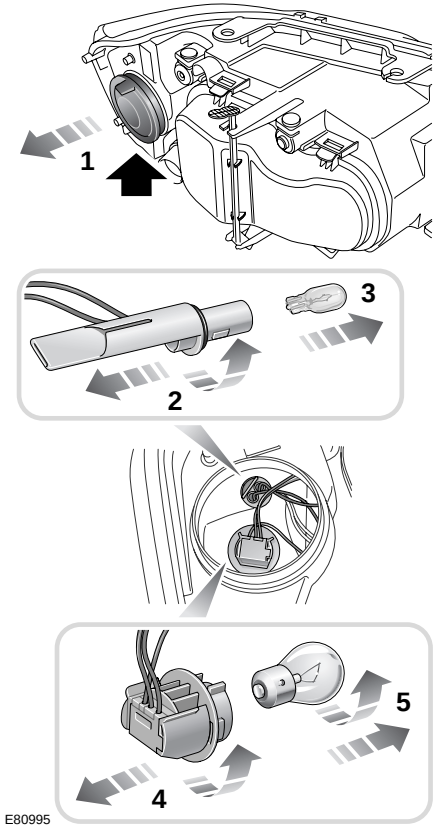


E80993

With the headlamp unit removed :-

1. Unclip the locking lever, press down the two tabs, and remove the cover.
2. Pull the halogen dipped beam electrical connector off of the bulb.
3. Unclip the bulb and remove it from the unit.
4. Pull the halogen main beam electrical connector off of the bulb.
5. Unclip the bulb and remove it from the unit.

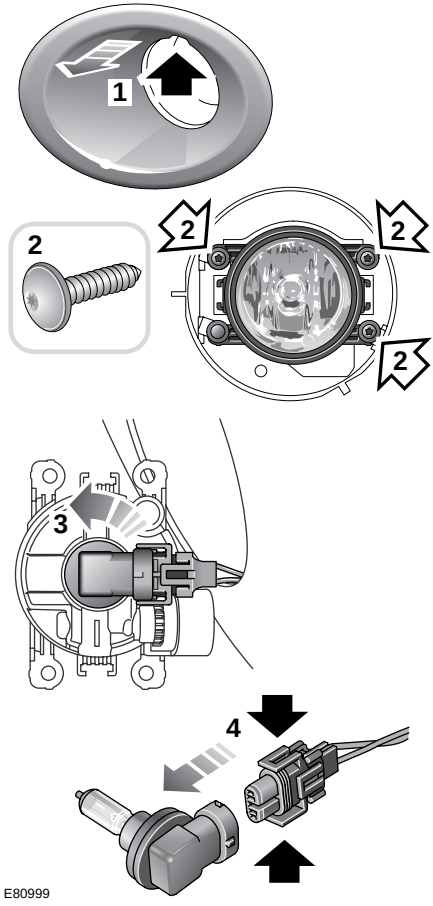
Side lamp and indicator bulbs



With the headlamp unit removed :-

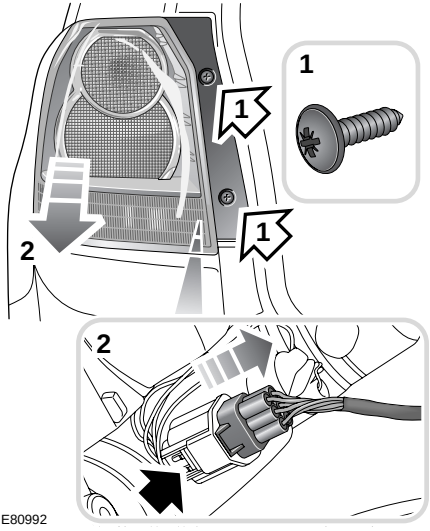
1. Remove cover.
2. Twist the side lamp bulb holder and remove it from the lamp unit.
3. Pull the bulb out of the holder.
4. Twist the indicator bulb holder, and remove it from the lamp unit.
5. Press the bulb into the holder, then twist it and remove from the holder.

Front fog lamp



1. Remove the trim from the fog lamp.
2. Undo the three retaining screws, and remove the lamp unit.
3. Rotate the bulb holder (anti-clockwise) and remove from the lamp unit.
4. Press the two clips together, and remove the electrical connection.

Removing the rear lamp unit



In order to change a rear lamp unit bulb, you must first remove the rear lamp.

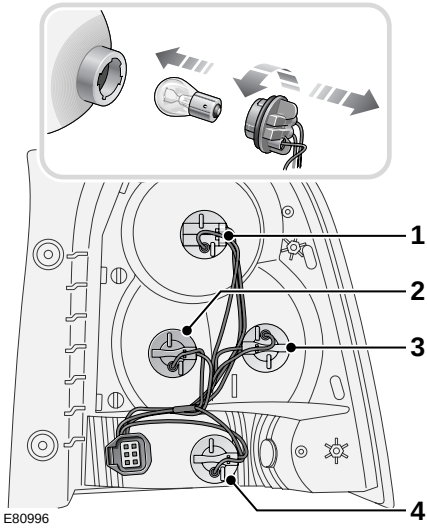
To remove the rear lamp :-

1. Undo, and remove the two retaining screws.
2. Remove the lamp unit and disconnect the electrical connection.

CAUTION

Do not place the lamp unit face down on hard or abrasive surfaces. Doing so may scratch the surface of the lens.

Rear lamp bulbs

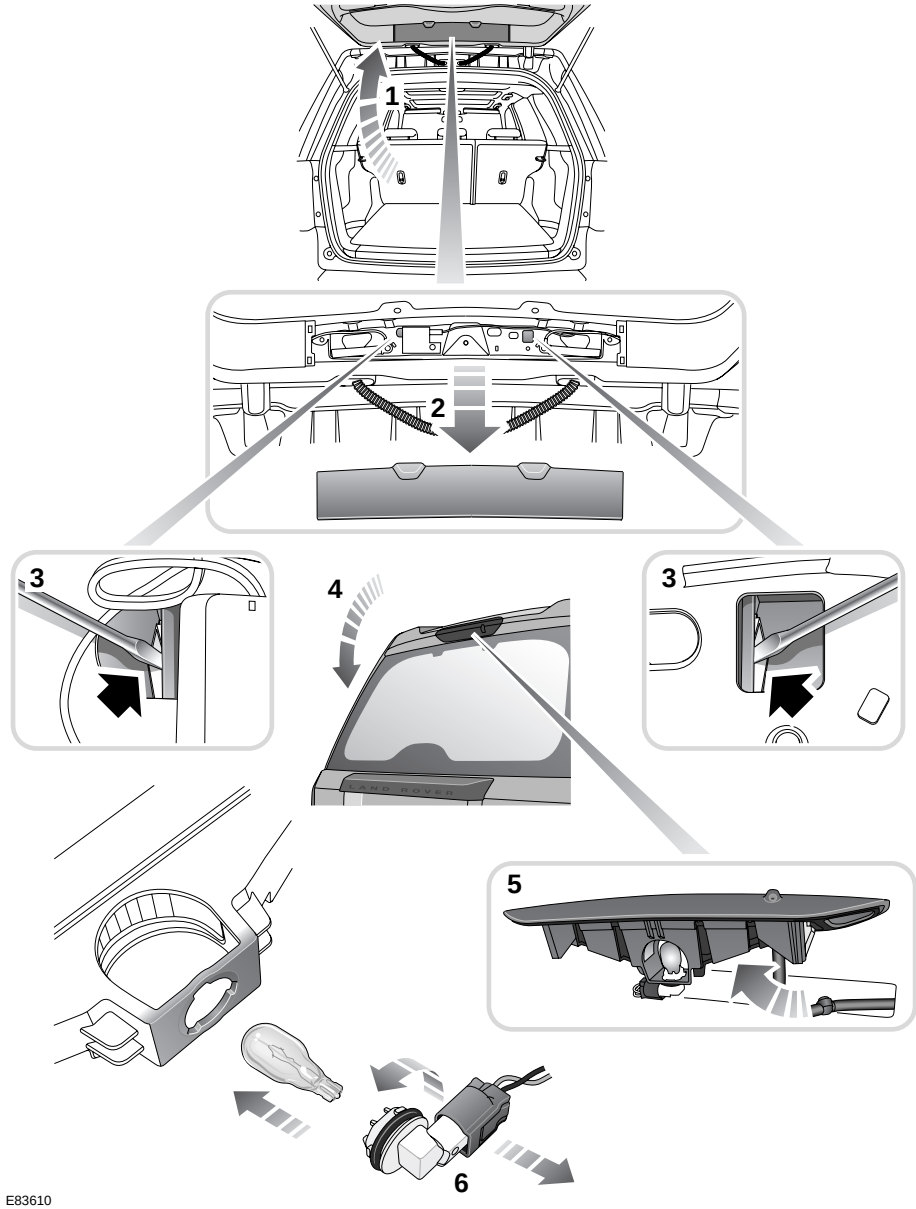


1. Stop/tail lamp.
2. Direction indicator.
3. Reverse lamp.
4. Rear fog lamp.

All of the rear lamp bulbs are removed in the same way.

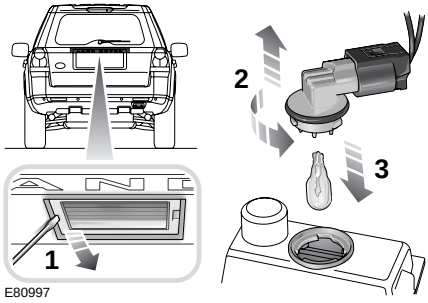
- Rotate the bulb holder (anti-clockwise) and remove from the lamp unit.
- Press the bulb into the holder, rotate it, and remove from holder.

High level brake lamp



1. Open the tailgate.
2. Remove the interior trim cover.
3. Using a suitable implement, press in the retaining clips.
4. Close the tailgate.
5. Remove the lamp unit from the tailgate.
6. Rotate the bulb holder and remove it from the lamp unit, then pull the bulb out of the holder.

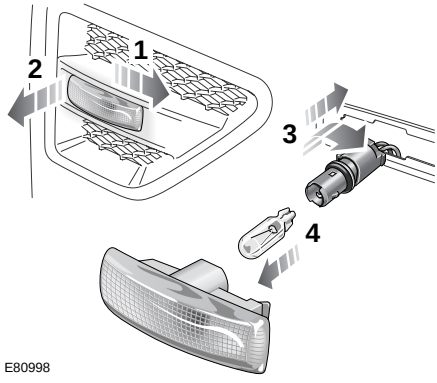
Number plate lamp bulb



E80997

1. Using a suitable tool, lever out the side of the lamp unit and remove it from the tailgate.
2. Rotate the bulb holder and remove it from the lamp.
3. the bulb from the holder.

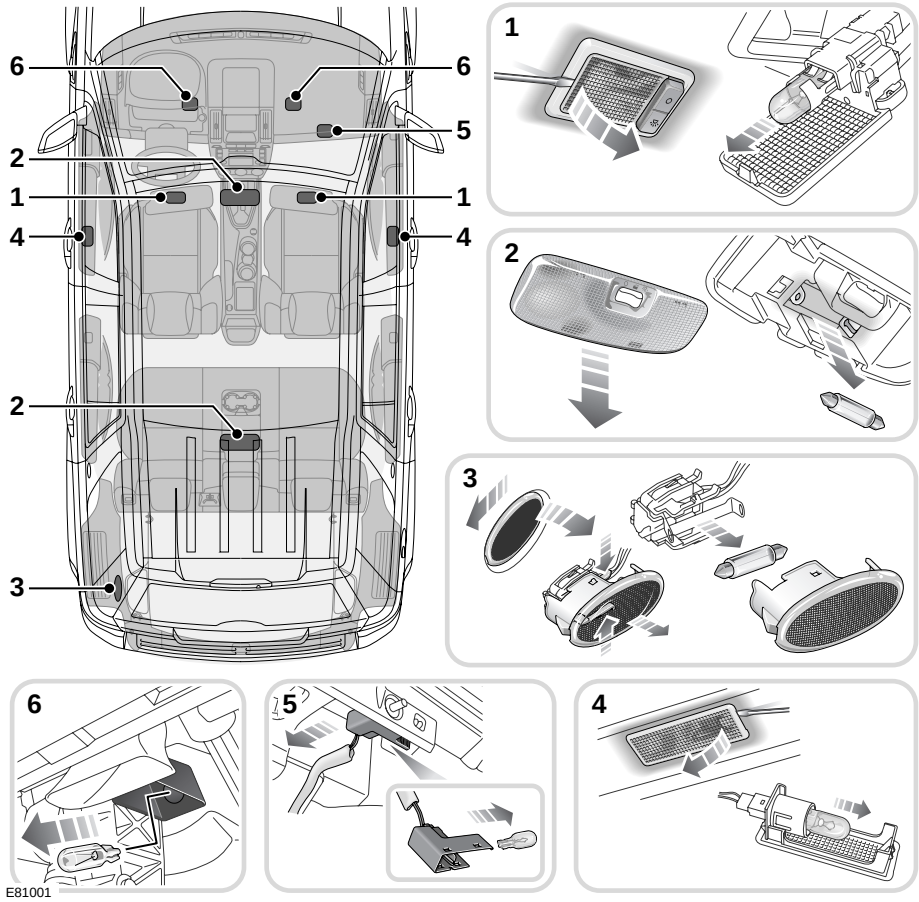
Side repeater lamp



E80998

1. Slide the lens forward and lift the rear edge.
2. Remove the lamp unit.
3. Rotate the bulb holder and remove from the lamp unit.
4. Pull the bulb out of the holder.

Interior lamp bulbs



1. Sun visor lamps.
2. Map/reading lamps.
3. Luggage compartment lamp.
4. Puddle lamps.
5. Glove box lamp.
6. Footwell lamps.

To access and replace the lamp bulbs follow the directions given in the illustration.

BULB SPECIFICATION CHART

CAUTION

Before attempting to replace a bulb, ensure that both the affected lamp, and the vehicle's ignition, are turned off. If the circuit is live a short circuit can occur which may damage the vehicle's electrical system.

Lamp	Specification	Power (Watts)
Halogen headlamp (Dip and Main beam).	H7	55
Xenon headlamp (Dip and Main beam).	D1S	35
Front side lamps.	W5W	5
Front direction indicators.	PY21W	21
Rear direction indicators.	PY21W	21
Front fog lamps.	H11	55
Side repeater lamps.	W5W	5
Reverse lamps.	P21W	21
Rear fog lamps.	P21W	21
Stop/tail lamps.	P21/5W	21/5
High mounted stop lamp	W16W	16
Number plate lamps.	W5W	5
Puddle lamps.	W5W	5
Interior lamps.	W5W	5
Luggage/footwell lamps.	W5W	5
Luggage/tailgate lamps.	W5W	5
Glovebox lamp.	W5W	5
Vanity mirror lamp.	W5W	5

WINDSCREEN WIPERS

CAUTIONS

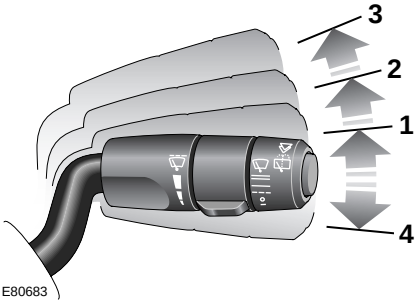
Do not operate the windscreen wipers on a dry screen. The drag on the wiper mechanism may cause damage.

In freezing, or very hot conditions ensure that the wipers have not stuck to the windscreen before operating. The drag on the wiper mechanism may cause damage.

Remove any snow, ice, or frost, from the windscreen, around the wiper arms and blades, and the screen scuttle before operating the wipers. Snow and ice can cause damage to the wiper mechanism if left uncleared.

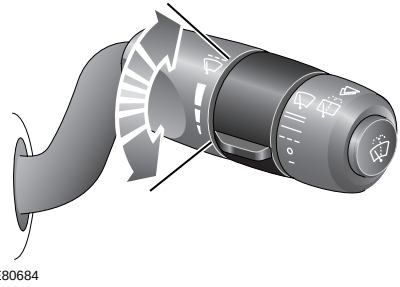
Note: *If the wiper blades do become stuck, or jammed, an electronic cut-out may temporarily halt the operation of the wipers. If this happens, switch off the wipers and the ignition. Clear any obstructions, and free the wiper blades before attempting to switch on the ignition.*

Wiper operation



1. Rain sensor/intermittent variable delay.
2. Low speed wipe.
3. High speed wipe.
4. Single wipe, pull down and release to operate.

Intermittent variable delay



The interval in between wipes can be adjusted to suit the conditions. Rotate the control upwards to increase the time between wipes, and down to decrease the time between wipes.

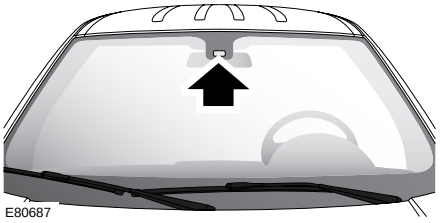
Speed-dependent mode

If the vehicle's speed drops below 2 km/h (1.2 mph) with the wipers operating, the wiper frequency automatically reduces. The wipers will switch to the next lowest speed. When the vehicle's speed increases to over 8 km/h (5 mph), the original wiper speed setting is restored automatically.

RAIN SENSOR

CAUTION

Ensure that the wipers are switched off before entering a car wash. If the rain sensitive wipers operate during the car washing process damage may occur to the wiper mechanism.

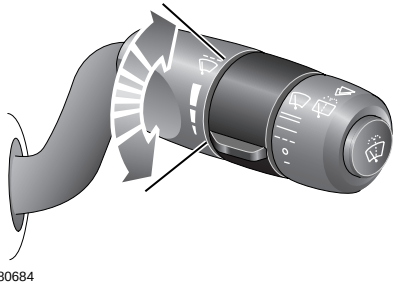

E80687

The rain sensor is able to detect the presence and amount of rain/dirt/snow on the windscreen.

Operation

To use the rain sensitive wipers, move the wiper stalk to position **1** rain sensor/intermittent variable delay.

Adjusting the sensitivity


E80684

Rotate the control upwards to increase the sensitivity, and down to reduce the sensitivity.

If the sensor detects constant rain the wipers will operate continuously.

WINDSCREEN WASHERS

WARNING

Some screenwash products are flammable, do not allow screenwash to come into contact with sources of ignition.

CAUTION

Only screenwash products which are approved for automotive use should be used, and only in accordance with the manufacturers instructions.

E80679

To operate the windscreen wash press the button on the end of the wiper stalk. When the button is released, the wipers will complete two additional strokes, and then park.

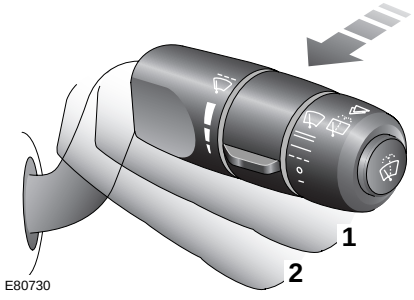
HEADLAMP WASHERS

Headlamp power wash operates automatically with the windscreen wash, and will only operate if the headlamps are switched on and there is sufficient washer fluid in the reservoir.

Headlamp wash operates with every fifth operation of the screen washers, or if ten minutes have elapsed since the last operation of the screen washers, they will operate again immediately.

Note: *The headlamps are washed alternately to prevent the washer fluid from reducing the light output for both headlamps at the same time.*

REAR WINDOW WIPER AND WASHERS



1. Intermittent wiper operation.
2. Wash wipe.

Wiper

Pull the wiper stalk back to position 1 to turn on the rear screen wiper. The wipe interval is set to six seconds.

Wash/wipe

Pull the wiper stalk to position 2 and hold it there for as long as the wash is required. The wiper will operate at the same time, and carry out two additional wiper sweeps when the lever is released.

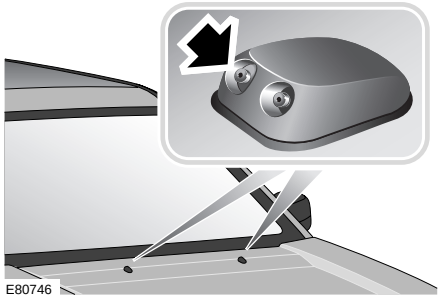
Reversing

If reverse gear is selected while the front wipers are operating, the rear wiper will begin automatically and continue as long as reverse gear is selected.

If the rain sensor is operating the front wipers and reverse gear is selected, the rear wiper will operate automatically.

ADJUSTING THE WINDSCREEN WASHER JETS

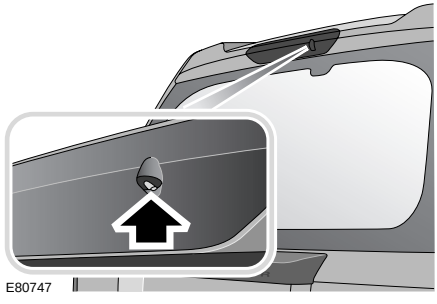
Front



If it is necessary to adjust the direction of the front washer jets, insert the end of a needle into the jet and gently reposition it.

Note: *Direct the water jet towards the centre of the windscreen. Take into account that when the vehicle is moving at speed the air flow over the bonnet will lower the jet.*

Rear



The rear washer jet is set at the factory, and cannot be adjusted.

Blocked jets

WARNING

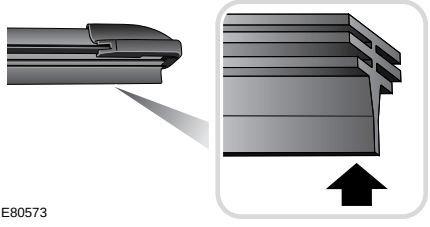
Do not operate the washer jets during adjustment. Windscreen washer fluid may cause irritation to the eyes and skin. Alway read and observe the washer fluid manufacturers instructions.

If a washer jet becomes blocked, use a thin strand of wire to unblock the jet by inserting the wire into the jet. Ensure that the wire is completely removed after unblocking.

CHECKING THE WIPER BLADES

WARNING

Only use cleaning products which have been approved for use on automotive glass and rubber. Inappropriate products can cause smearing, and increase glare.



E80573

The wiping edge of the blades should be checked, and cleaned periodically. Check the blade rubber for cracks, splits, and roughness. If any damage, wear, or roughness is detected the blade should be replaced immediately to prevent damage to the glass.

Clean the blade edge by wiping with a soft cloth or sponge, using warm soapy water.

CHANGING THE WIPER BLADES

CAUTIONS

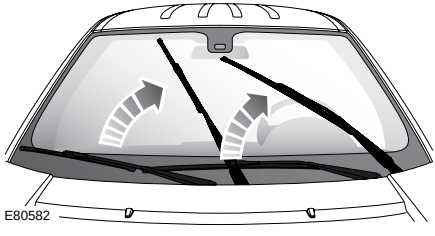
When checking or changing the wiper blades, they can be set to the service position, or parked normally.

The wipers will return to their normal parked position when the ignition is turned on. To prevent damage to the mechanism ensure that they are returned to their position against the windscreen, and that there are no obstructions, ice, or snow present on the windscreen.

Service position

CAUTION

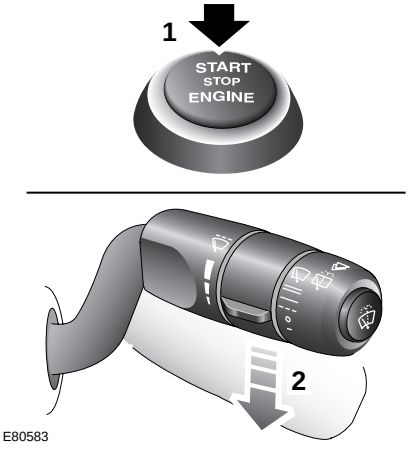
If the wipers are set to the service position and left there overnight during frosty conditions, do not switch the ignition on until the wipers have been freed from frost/ice. The wipers will try to park when the ignition is switched on. If they are frozen to the screen when this occurs then this may cause damage to the mechanism.



E80582

The windscreen wiper service position allows the wipers to be parked in a more accessible position. This makes it easier to change wiper blades, or free the wipers from frost/ice.

Setting the wipers



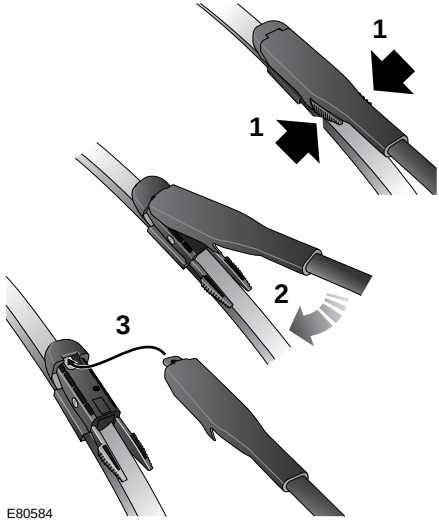
E80583

1. Switch off the ignition.
2. Within three seconds of switching off the ignition pull the wiper stalk down to the single wipe position. Hold the stalk in this position briefly, and release it.

Changing the front wiper blades

CAUTION

Only fit the correct length and type of wiper blade. Failure to do so may cause damage to the wiper system, it may also affect the operation of the rain sensor.



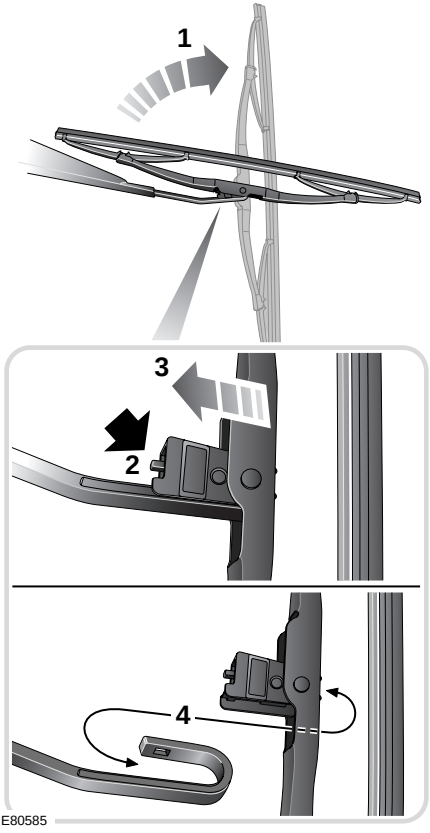
E80584

Having set the wipers to the service position, lift the wiper blade clear of the windscreen. The removal procedure for the wiper blade is as follows :-

1. Push the clips together on the underside of the wiper mounting.
2. Rotate the clips and blade away from the wiper mounting.
3. Slide the wiper blade off of the wiper arm.

To fit the new blade, follow the removal procedure in reverse.

Changing the rear wiper blades



Lift the wiper blade clear of the windscreen. The removal procedure for the wiper blade is as follows :-

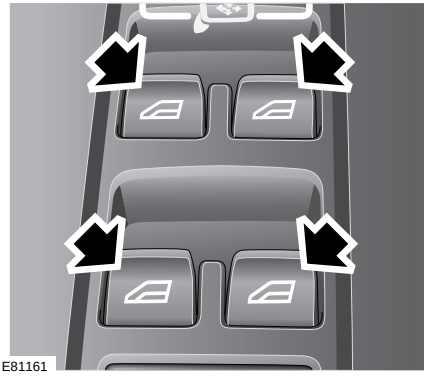
1. Rotate the wiper blade to gain access to the retaining clip.
2. Press in the retaining clip on the underside of the mounting.
3. Slide blade down the wiper arm and clear of the mounting.
4. Move the blade sideways and lift it clear of the wiper arm.

To fit the new blade, follow the removal procedure in reverse.

ELECTRIC WINDOWS

WARNING

All of the windows have an anti-trap protection system. However, before closing a window care must be taken to ensure that none of the occupants have any part of their body in a position where it could be trapped. Even with an anti-trap system serious injury or death can occur.



With the ignition on, or engine running, press the switch down to lower the window, pull it up to raise the window. Release the switch at any point to stop window movement.

The windows will operate for five minutes after the engine is switched off, as long as the doors are not opened.

One shot operation

WARNING

Ensure that you remove the remote control when leaving occupants in the vehicle. This will prevent unsupervised operation of the windows, which may result in injury.

All four windows have one-shot operation. Briefly pull the switch up and release, the window will continue to raise until fully closed. Briefly press the switch down and release, the window will continue to lower until fully open. Pressing or pulling the switch again will stop the window.

Overriding anti-trap protection

Anti-trap protection will stop window movement if an obstruction or resistance is detected. Check the window and it's aperture and remove any obstructions, ice, etc. If it is still necessary to raise the window, the override procedure is as follows :-

1. Attempt to close the window, anti-trap will prevent closure and lower the window slightly.
2. Within ten seconds attempt to raise the window again, anti-trap will prevent closure and lower the window slightly.
3. Attempt to close the window for a third time, this time hold the switch in the close position. The window will raise whilst the switch is held. Hold until closed.

Note: *If this procedure fails to remove the blockage, the window operation may need to be reset.*

Window reset

The windows will need to be reset if the battery is disconnected, becomes discharged, or power supply is interrupted.

Reset as follows :-

1. Close the window fully.
2. Release the switch, then lift it to the close position and hold for two seconds.
3. Open the window fully.
4. Release the switch, then push it to the open position and hold for two seconds.
5. Lift and release the switch to operate the one touch function.
6. Repeat the procedure on each window.

Window isolator

E81162

WARNING

If children are carried in the rear seats, the isolator switch should be used to prevent operation of the windows. If the windows are operated by young children there is a risk of serious injury or death.

To prevent operation of the rear windows, press the inhibitor switch. To allow passengers control of the windows, press the switch again.

EXTERIOR MIRRORS

Note: *Depending on the type of lens used, distances may be difficult to judge accurately when only using the mirrors.*

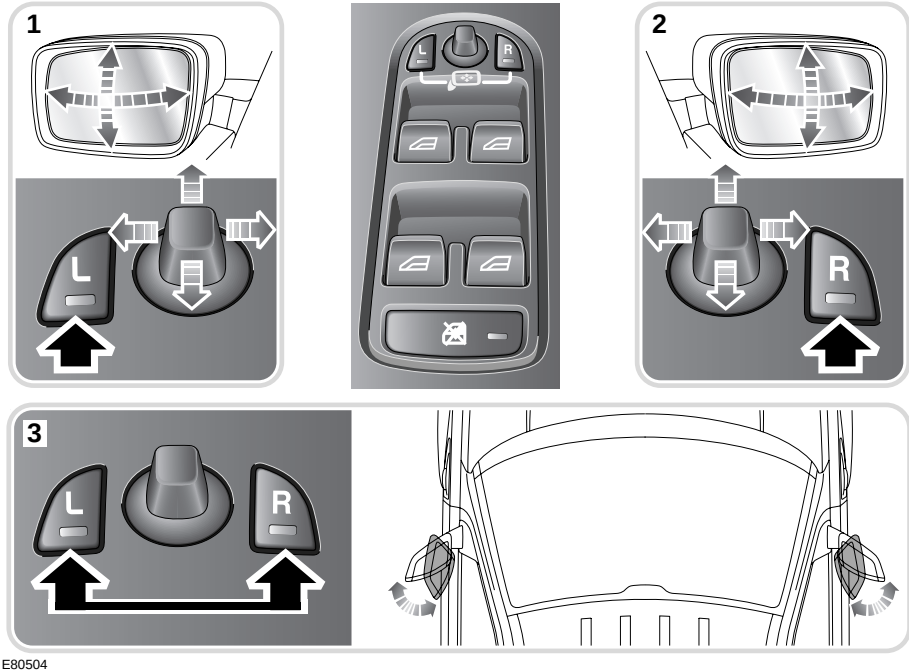
Proximity mirror (Japan only)

E83691

Rotate the mirror as required to give the best view of the areas in front of and beside the vehicle.

ELECTRIC EXTERIOR MIRRORS

Adjusting and folding



E80504

1. Left mirror adjustment.
2. Right mirror adjustment.
3. Powerfold.

Adjusting

1. Press the left or right mirror button as required. The green tell-tale light will illuminate in the button to indicate that it has been selected.
2. Move the toggle switch to adjust the mirror as required.

Folding

To fold the mirrors back press both left and right buttons at the same time. To unfold the mirrors, press both left and right buttons again.

Note: *If the mirrors are folded manually, or knocked into the folded position accidentally, the mirror head will be loose. To re-engage the mechanism, fold, then unfold the mirrors using the switches.*

The system is protected by a thermal cut-out which will temporarily disable the powerfold feature if the switches are operated repeatedly. If the cut-out operates when the mirrors are folded, they can be unfolded manually.

Powerfold will only operate if the vehicle is stationary, or travelling at 20 km/h (12 mph) or less.

Automatic folding

The mirrors can be configured by your land Rover Dealer/Authorised repairer to automatically fold when the vehicle is locked, and unfold when it is unlocked.

Note: *If the mirrors were folded using the switches, they will not unfold when the vehicle is unlocked.*

Mirror dip when reversing

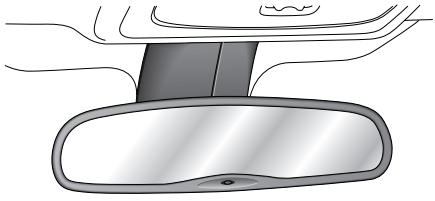
When reverse gear is selected the driver and passenger door mirrors are automatically adjusted to provide an improved viewing angle for reversing.

The exact dipped position can be adjusted when the mirrors are dipped. The next time reverse is selected, the newly adjusted position will be selected.

When the gear selector is moved out of reverse, the mirrors will return to their previous position.

INTERIOR MIRROR

Auto dimming



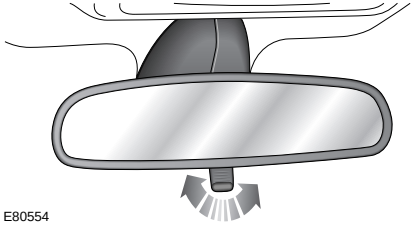
E80553

The interior mirror dimming is adjusted automatically according to the amount of ambient light when the ignition is on. If reverse gear is selected, the automatic dimming feature is turned off to allow maximum visibility for reversing.

Note: *If the mirror becomes detached from the windscreen it should be reattached by a Land Rover Dealer/Authorised Repairer.*

Note: *If the rear screen is obscured, or the light falling on the mirror is reduced by an obstruction, the automatic dimming feature may not operate correctly.*

Manual dimming

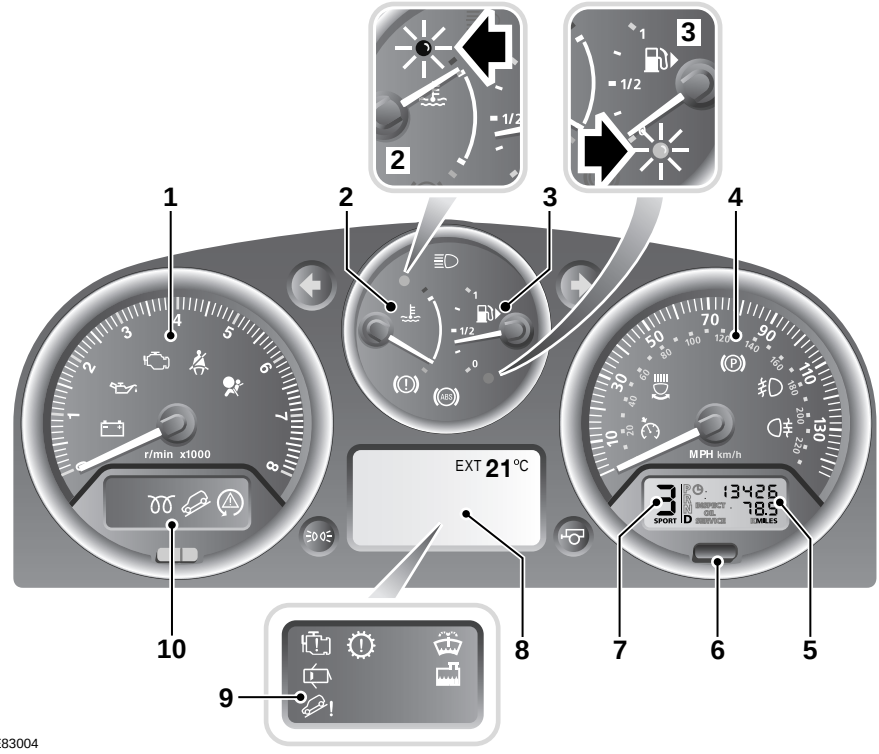


E80554

To dim the light levels reflected by the mirror, push the lever forward. To return it to normal light levels, pull the lever back.

INSTRUMENT PANEL OVERVIEW

Instrument panel



E83004

1. Tachometer.
2. Temperature gauge.
3. Fuel gauge.
4. Speedometer.
5. Odometer and trip recorder.
6. Trip recorder reset button.
7. Gear selector mode and position display.
8. Main message centre.
9. Warning indicator panel (fitted in place of main message centre).
10. Warning indicator panel.

Tachometer

Indicates engine speed in revolutions per minute (RPM) x 1000.

Temperature gauge

CAUTION

Serious engine damage can occur if the vehicle is driven whilst the engine is overheating.

If the pointer moves onto the red line and the red warning indicator illuminates severe engine damage can occur.

If the engine overheats, stop the vehicle as soon as safety permits. Switch the engine off and allow it to cool down. If the problem reoccurs, seek qualified assistance before continuing.

Note: *If engine temperature rises to the point where overheating may occur, there may be a noticeable reduction in engine power, and the air conditioning may cease operation. This is a normal operating strategy to reduce load on the engine and assist with cooling.*

Fuel gauge

CAUTION

Never allow the vehicle to run out of fuel. The resulting mis-fire may cause serious damage to the catalytic convertor.

Once the fuel level has dropped to the point where the range is approximately 80 km (50 miles) the low fuel warning indicator will illuminate.

As a reminder for the location of the fuel filler, there is an arrow next to the fuel pump symbol which points to the relevant side of the vehicle.

Speedometer

Indicates road speed.

Odometer

Indicates the total distance which the vehicle has travelled.

Trip recorder

Indicates the distance travelled since the last reset, and can be used to measure the distance of individual journeys.

Trip recorder reset button

Resets the distance shown on the trip recorder to zero.

Note: *Once the trip recorder has been reset to zero, the previously recorded distance will be lost.*

Gear selector mode and positiondisplay

Displays the currently selected gear on vehicle's fitted with automatic transmission.

Main message centre

Displays warning, and information messages. See **INFORMATION MESSAGES** (page 99).

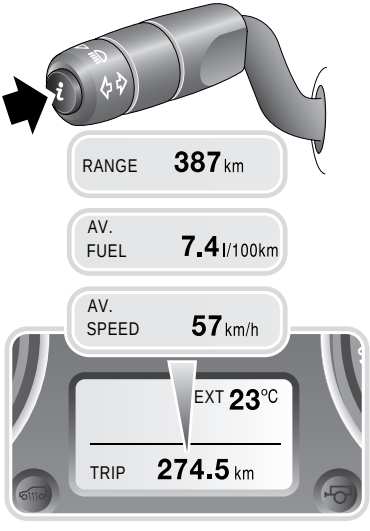
Warning indicator panel (fitted in place of main message centre)

If a main message centre is not fitted, the warning indicator panel will provide system status information.

Warning indicator panel

The warning indicator panel will provide system status information.

TRIP COMPUTER



E83070

A short press (two seconds or less) or a series of short presses of the **i** button will change the trip computer display.

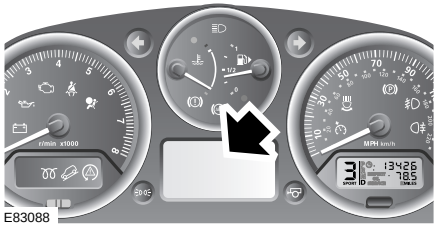
The options available are :-

- Approximate maximum range on current fuel.
- Average fuel consumption.
- Average speed.
- Review active warning messages.
- Blank trip computer screen (displays outside temperature).
- Trip distance.

To reset the trip distance recorder to zero, press and hold the **i** button for two seconds.

INFORMATION MESSAGES

Main message centre



E83088

The main message centre is used to convey information, warnings, and critical warning messages to the driver.

Critical warning messages

CAUTION

Do not ignore critical warning messages, take appropriate action immediately. Failure to do so may result in serious damage to the vehicle.

Critical warning messages are accompanied by an audible warning, and the message text may have the handbook symbol next to it. These messages are displayed continuously whilst the ignition is on.

Warnings and information messages

CAUTION

Do not ignore warning messages, take appropriate action as soon as possible. Failure to do so may result in serious damage to the vehicle.

When displayed, warning messages are accompanied by an audible warning. These messages are displayed for approximately twenty seconds. The warning messages will be displayed when applicable, and also when the ignition is turned on, and off.

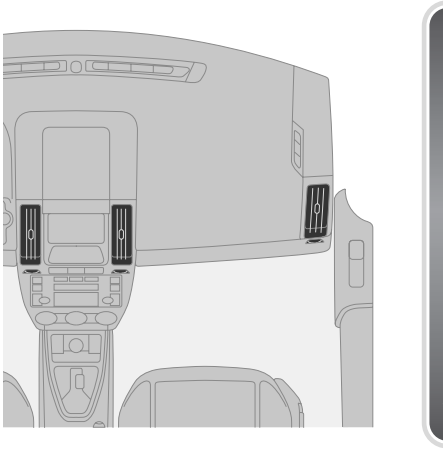
If the **i** symbol is displayed, there are current warning messages waiting to be reviewed. To review the warning messages press the **i** button repeatedly until the list of messages is displayed. The message centre will then cycle through the messages until the **i** button is pressed again.

Note: *Messages are displayed in order of importance, with critical warning messages being the highest priority.*

Messages

For information regarding the individual messages, their meanings, and any action required, please refer to the relevant section within this handbook.

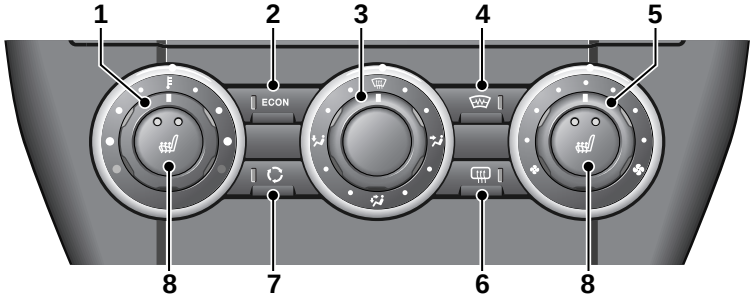
AIR VENTS



Adjust the direction and volume of air flow to suit your requirements.

MANUAL CLIMATE CONTROL

Controls



E81418

1. Temperature control, rotate to adjust.
2. Economy mode, press to switch on/off.
3. Air distribution, rotate to direct air flow.
4. Heated front screen, press to switch on/off.
5. Blower speed, rotate to change blower speed.
6. Heated rear screen, press to switch on/off.
7. Recirculation, press to switch on/off.
8. Seat heaters, press to switch on/off. Press once to turn on high, twice to turn on low, and a third time to turn off.

Note: *The amber tell-tale indicators in the switches will illuminate when the function is selected.*

Economy mode (2)

When selected economy mode will achieve the lowest possible temperature without using the air conditioning system. This reduces power consumption and improves fuel economy.

Air distribution (3)

Rotate the control to set the air distribution to the required points.

Note: *In low temperatures it is advisable to close the centre face level vent, and direct air flow from the outer face level vents towards the side windows. This will help to keep the windows clear of ice.*

Note: *It is possible to distribute air to two areas simultaneously. For example; to distribute air to both the windscreen and the foot vents set the rotary control (**5**) to a point between the windscreen and foot vent symbols.*

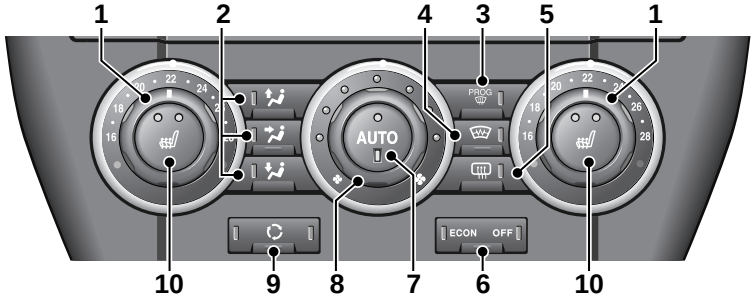
Recirculation (7)

When selected, the air is recirculated inside the vehicle. This helps to maintain a high or low temperature, and is useful for preventing fumes from entering the vehicle.

Note: *Prolonged use at low temperatures may cause the windows to mist.*

AUTOMATIC CLIMATE CONTROL

Controls



E81419

1. Left and right temperature controls, rotate to adjust.
2. Air distribution, press to select direction of air flow. More than one direction may be selected if required.
3. Defrost program, press to switch on/off.
4. Heated front screen, press to switch on/off.
5. Heated rear screen, press to switch on/off.
6. Economy mode, press to switch on/off.
7. AUTO mode, press to select fully automatic operation.
8. Blower speed, rotate to change blower speed.
9. Recirculation, press to switch on/off.
10. Seat heaters, press to switch on/off. Press once to turn on high, twice to turn on low, and a third time to turn off.

Note: *The amber tell-tale lights in the switches will illuminate when the function is selected.*

Air distribution (2)

Press the relevant button to set the air distribution to the required points. Screen, face, or floor. It is possible to select more than one option by pressing the required combination of buttons.

Note: *In low temperatures it is advisable to close the centre face level vent, and direct air flow from the outer face level vents towards the side windows. This will help to keep the windows clear of ice.*

Economy mode (6)

When selected economy mode will achieve the lowest possible temperature without using the air conditioning system. This reduces power consumption and improves fuel economy.

Auto mode (7)

When the Auto function is selected, you have the opportunity to select a fully automatic operation, or manually adjust the fan speed and the direction of air flow. All other adjustments which are necessary to maintain the temperature that you have selected are made automatically by the climate control system.

There are two tell-tale indicators on the Auto button. The round indicator represents the blower control, and the rectangular indicator the air distribution control. In fully automatic mode both indicators illuminate, the round indicator will extinguish if the blower speed is changed manually, and the rectangular indicator extinguishes if the air distribution is changed manually.

To resume fully automatic operation at any time, press the Auto button.

Recirculation (9)

When selected, the air is recirculated inside the vehicle. This helps to maintain a high or low temperature, and is useful for preventing fumes from entering the vehicle.

A single brief press will select recirculation for four minutes. The system will then revert to fresh air intake to prevent misting.

Pressing and holding the button will select recirculation until it is switched off. This state is indicated by three flashes of the tell-tale lamp in the switch.

Note: *Prolonged use at low temperatures may cause the windows to mist.*

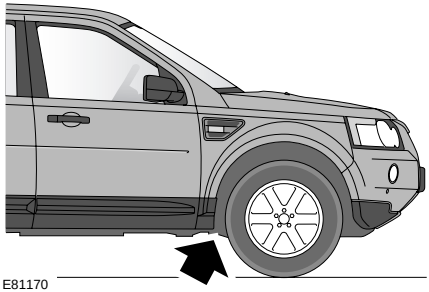
HEATED WINDOWS AND MIRRORS

The heated windscreen is switched on by briefly pressing the switch (4).

Note: *The operation of the heated mirrors is fully automatic, and requires no driver intervention.*

AUXILIARY HEATER

Your vehicle may be fitted with an auxiliary heater which is powered by fuel drawn from the vehicle's tank. The heater only operates at low ambient temperatures, and is fully automatic.



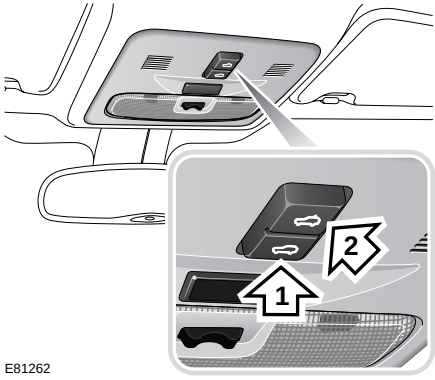
When the heater is operating exhaust fumes from the heater may be visible exiting from the front underside. This is normal, and not a cause for concern.

ELECTRIC SUNROOF

WARNING

Extreme care must be taken to ensure that none of the occupants have any part of their body in a position where it could be trapped by the panoramic sunroof when closing. Although an anti-trap mechanism is fitted, serious injuries can occur.

Operation



E81262

1. Front switch, closes or tilts the sunroof.
2. Rear switch, fully opens or closes the sunroof.

The panoramic sunroof can only be operated with the ignition on.

Tilt

With the roof closed, press and release the front of the switch. The sunroof will move to the tilted position automatically. It can be stopped at any point by pressing the button again.

Fully open

With the sunroof closed, press and release the rear of the switch. The sunroof will move to the fully open position automatically. It can be stopped at any point by pressing the button again.

Close

- From the fully open position, press and release the front of the switch. The roof will return to the closed position automatically.
- From the tilted position, press and hold the rear of the switch. Keep the switch pressed until the roof is fully closed.

Anti-trap mechanism

WARNING

The anti-trap mechanism does not operate when closing the roof from the tilted position. The sunroof can cause serious injury should a body part become trapped. Always ensure that the sunroof is free from obstructions before closing.

If the sunroof encounters resistance when closing it will stop, and then open slightly. This is to prevent serious injury or damage to the mechanism.

Override

CAUTION

Wherever possible remove any snow, ice, dirt, leaves etc. from the sunroof mechanism before closing. Failure to do so may damage the sunroof mechanism.

The anti-trap mechanism can be overridden to allow the roof to be closed when movement is restricted by dirt or ice. To override the anti-trap mechanism, press and hold the front of the switch until the roof reaches the closed position.

Calibration

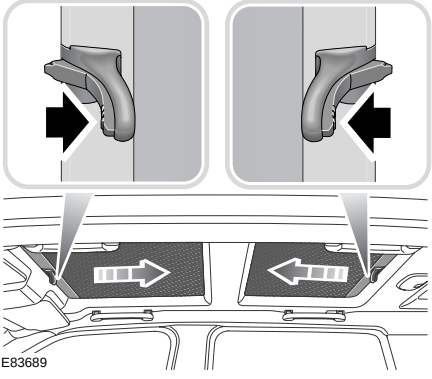
If the battery is disconnected, or the power supply is interrupted, whilst the sunroof is partially open it will need to be recalibrated.

Once the battery is reconnected, or the power supply is restored, recalibrate the sunroof as follows :-

1. Switch the ignition on.
2. Press the front of the sunroof switch, and hold for twenty seconds.
3. After twenty seconds the sunroof will begin to move. Keep the front of the switch pressed until the sunroof has fully opened, then closed.
4. Once the open/close cycle has completed and the sunroof has stopped moving, release the switch.

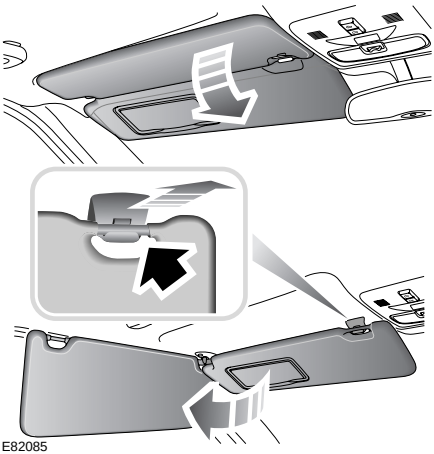
The sunroof can now be operated as normal.

Sunroof blinds



When opening the sunroof blinds, hold the catch firmly, then press the catch release button and allow the sunroof blind to open smoothly.

SUN VISORS

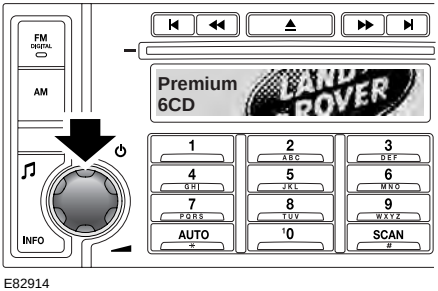


E82085

CLOCK

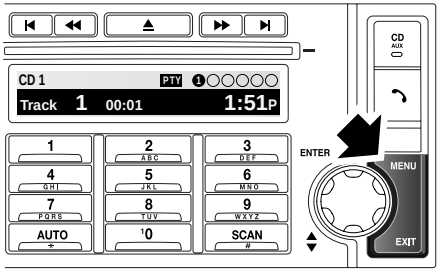
The clock is set through the audio system.

Setting the clock - Premium audio



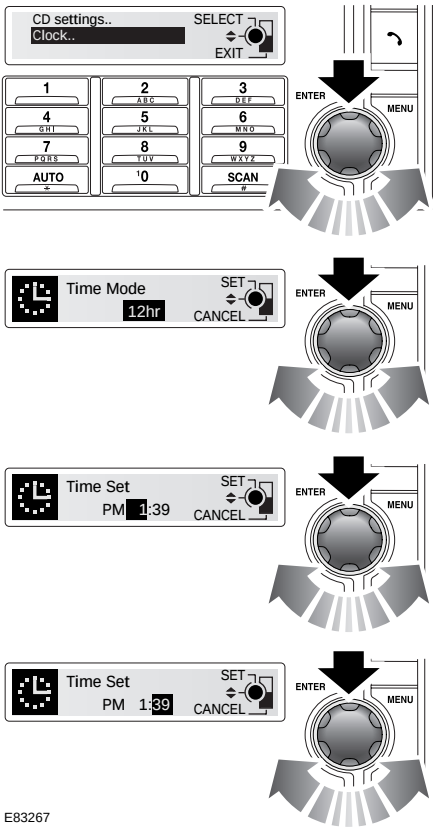
E82914

1. Switch on the audio system, by pressing the volume rotary control.



E82981

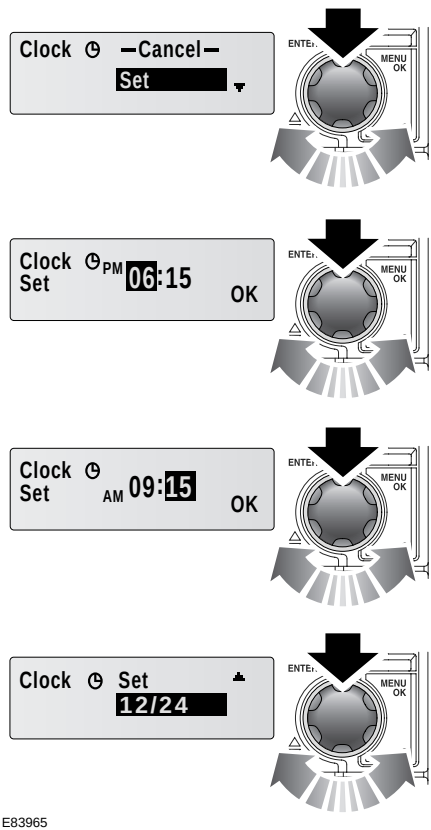
2. Press the **MENU** button to access the function menu.



E83267

3. Rotate the control to select **Clock** and press to confirm selection.
4. Use the rotary control to adjust the **Time Mode** (12 or 24 hr), press to confirm selection.
5. Use the rotary control to adjust the **hour** displayed, press to confirm selection.
6. Use the rotary control to adjust the **minutes** displayed, press to confirm selection.
7. Press the **EXIT** button to cancel and to return to the menu.

Setting the clock - Standard audio



E83965

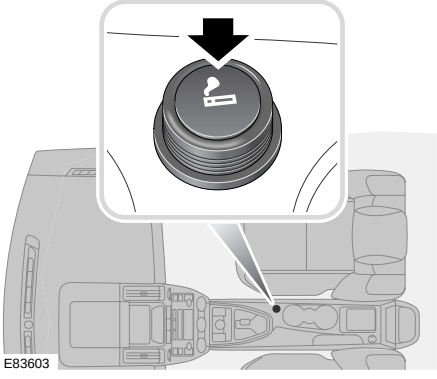
1. Switch on the audio system, by pressing the volume rotary control.
2. Press the **MENU** button to access the function menu.
3. Rotate the control to select **Clock** and press to confirm selection.
4. Rotate the control to select **Set** and press to confirm selection.
5. Use the rotary control to adjust the **hour** and press to confirm selection.

6. Use the rotary control to adjust the **minutes** and press to confirm selection.
7. Once the time has been set, **OK** will be highlighted. Press the rotary control to accept the settings.

Set 12/24 hour display

1. With the audio unit switched on, press the **MENU** button to access the function menu.
2. Rotate the control to select **Clock** and press to confirm selection.
3. Rotate the control to select **12/24** and press to confirm selection.
4. Use the rotary control to select **12hr** or **24hr** and press to confirm selection.

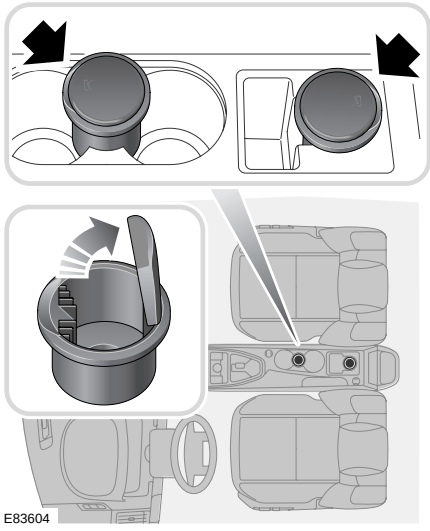
CIGAR LIGHTER



With the ignition on, and/or the engine running, press in the centre of the cigar lighter. When the cigar lighter element has reached the correct temperature it will partially eject and can be withdrawn for use.

After use push the lighter back into the first position.

ASHTRAY

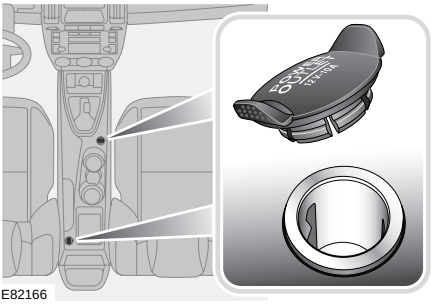


WARNING

Do not use the ashtrays for disposing of waste paper, or other combustible items. The resulting fire may cause death or serious injury.

To empty the ashtrays fully open the lid, then pull the ashtray upwards to remove.

AUXILIARY POWER SOCKETS



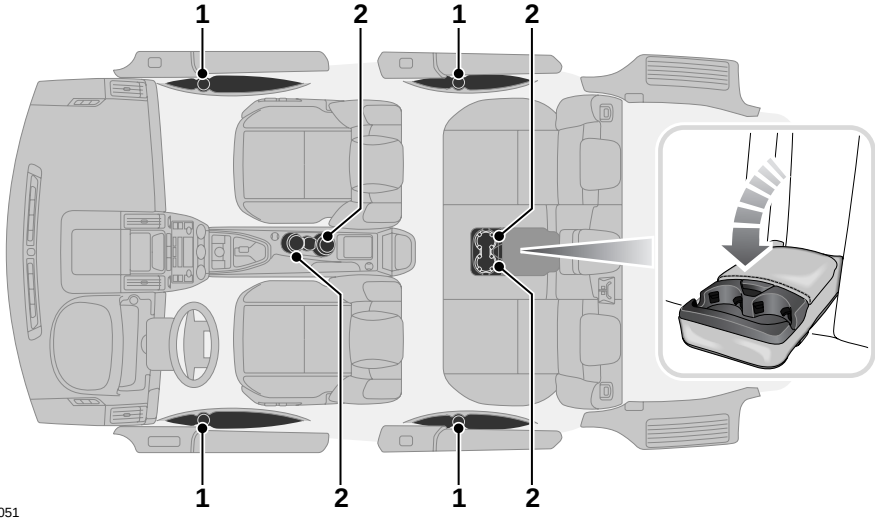
E82166

CAUTIONS

Only Land Rover approved accessories should be plugged into the power sockets. Using any other equipment may damage the vehicle's electrical system. If you are in any doubt contact a Land Rover Dealer/Authorised Repairer.

The engine should be running when using accessories for long periods. Failure to do so can discharge the battery.

CUP HOLDERS



E82051

1. Bottle holders.

2. Cup holders.

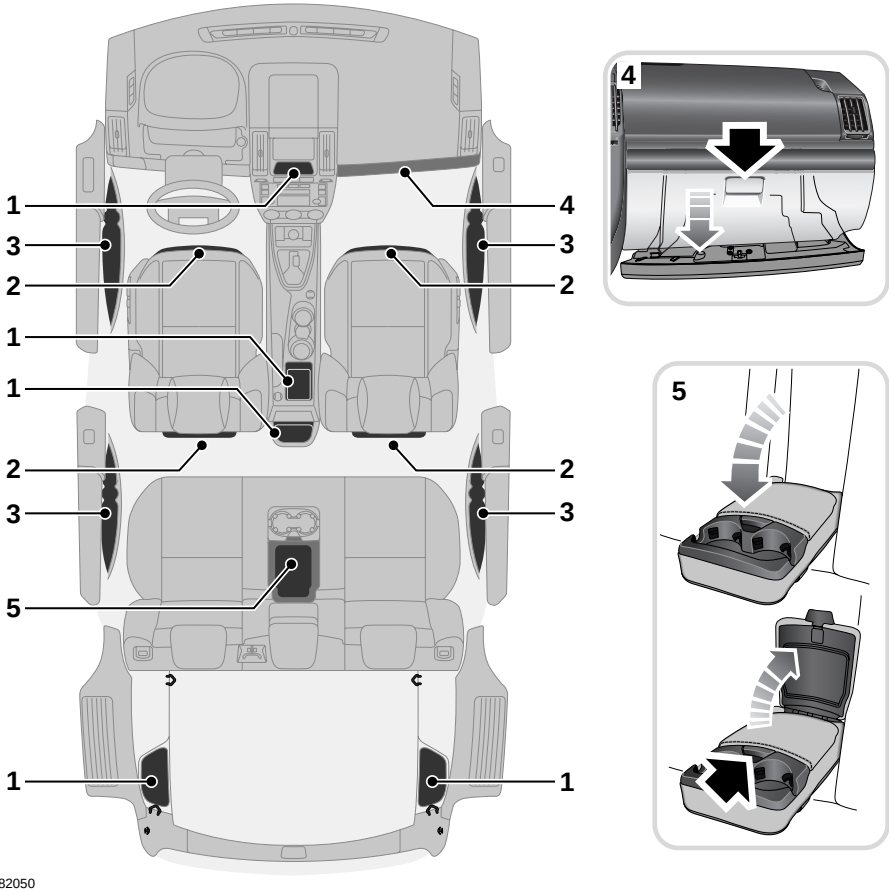
WARNINGS

The cup and bottle holders should only be used for soft containers. Containers which are hard (cans, metal, ceramic, hard plastic etc.) can cause serious injury if the vehicle is involved in an accident, sudden manoeuvre or braking.

Do not carry open drinks containers. Hot liquids can cause serious injury when spilled and may damage the vehicle.

Do not drink, or use the drinks holders when driving. Doing so would break concentration, which may result in loss of control.

STORAGE COMPARTMENTS



E82050

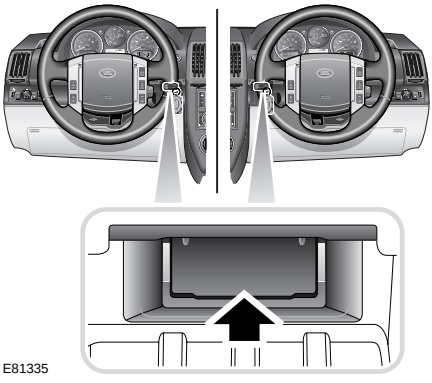
1. Coin/trinket trays.
2. Map pockets.
3. Storage compartments.
4. Glove box.
5. Rear armrest storage compartment.

WARNING

Ensure that any items stored in the vehicle are secure and cannot move. If the vehicle is involved in an accident, or subject to sudden braking or direction change, loose items can cause serious injury.

GENERAL INFORMATION

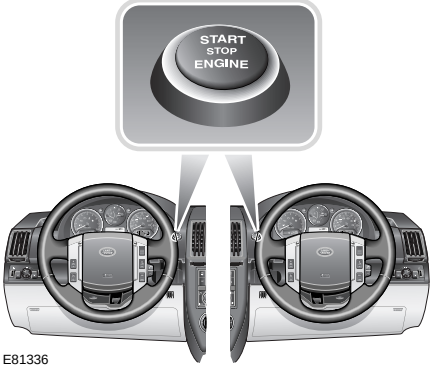
Docking the remote



E81335

Before the engine can be started, the remote control will need to be docked.

Start/Stop button



E81336

The start/stop button is used to start or stop the engine, or to turn on the ignition without starting the engine.

Switching on the ignition

To turn on the ignition without starting the engine press the start/stop button and hold until the warning indicators illuminate, then release the button.

STARTING A PETROL ENGINE

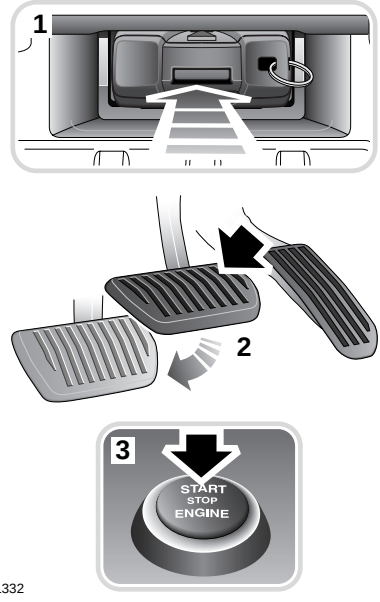
Starting

WARNING

Never start the engine, or leave it running, when the vehicle is in an enclosed space. Exhaust gasses are poisonous and can cause unconsciousness and death if inhaled.

CAUTION

If the engine fails to start, do not continue cranking as this will discharge the battery. It may also damage the catalytic convertor due to unburnt fuel passing through the exhaust.

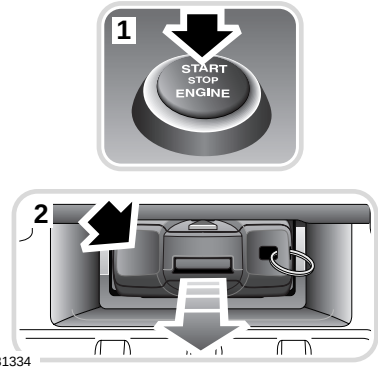


E81332

1. Insert the remote control into the docking port and press to latch.
2. Press the brake pedal.
3. With the brake pedal depressed briefly press and release the start button. The engine will crank automatically until it starts.

Stopping the engine

Before stopping the engine, ensure that the vehicle is parked safely with the park brake applied.



E81334

1. Select **P** (Park) and press the Start/Stop button.
2. Press the remote to unlatch it, then remove it from the docking port by gripping the sides. Do not pull the remote out using the keyring attachment as this may remove only the emergency key.

***Note: P** (Park) must be selected before the remote can be removed.*

STARTING A DIESEL ENGINE

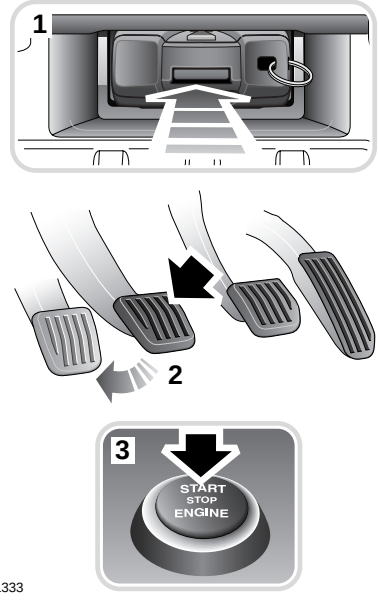
WARNING

Never start the engine, or leave it running, when the vehicle is in an enclosed space. Exhaust gasses are poisonous and can cause unconsciousness and illness if inhaled.

CAUTION

If the engine fails to start, do not continue cranking as this will discharge the battery.

Manual transmission

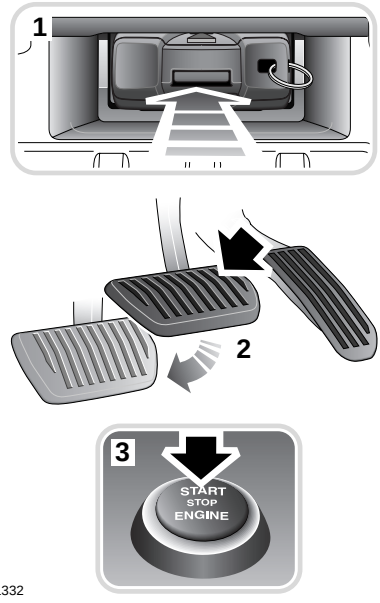


E81333

Note: *Do not press the accelerator pedal when starting the engine.*

1. Insert the remote control into the docking port and press to latch.
2. Press the clutch pedal.
3. With the clutch pedal depressed briefly press and release the start button. There will be a brief delay whilst the glow plugs warm up, then the engine will crank automatically until it starts.

Automatic transmission



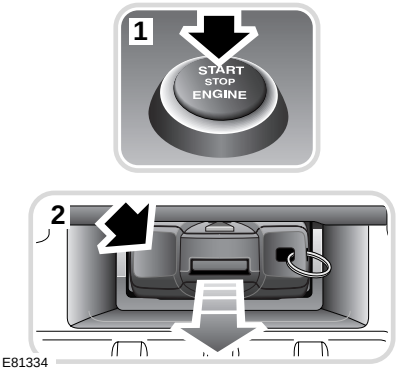
E81332

Note: *Do not press the accelerator pedal when starting the engine.*

1. Insert the remote control into the docking port and press to latch.
2. Press the brake pedal.
3. With the brake pedal depressed briefly press and release the start button. There will be a brief delay whilst the glow plugs warm up, then the engine will crank automatically until it starts.

Stopping the engine

Before stopping the engine, ensure that the vehicle is parked safely with the park brake applied.



1. Select **P** (Park) and press the Start/Stop button.
2. Press the remote to unlatch it, then remove it from the docking port by gripping the sides. Do not pull the remote out using the keyring attachment as this will only remove the emergency key.

DIESEL PARTICULATE FILTER (DPF)

The Diesel Particulate Filter (DPF) forms part of the emissions reduction system fitted to Land Rover vehicles. The DPF will remove a high proportion of the harmful carbon microspheres (soot) before they leave the exhaust. It achieves this by filtering out the particles, which are then stored until they are burnt away and the filter is emptied.

Regeneration

CAUTION

The regeneration procedure produces high temperatures in the DPF. Heat can be felt radiating from beneath the vehicle, which is normal and not a cause for concern. However, the vehicle should not be parked over combustible material, particularly during dry weather. The heat generated could be sufficient to start a fire when in close proximity to combustible material such as long dry grass, paper etc.

Unlike a normal filter which requires periodic replacement, the DPF has been designed to regenerate, or clean itself to maintain operating efficiency. The regeneration process takes place automatically in most cases. However, some unfavourable driving conditions mean that the regeneration process must be initiated deliberately by the driver.

Regeneration procedure

If **DPF FULL** along with the handbook symbol appears in the message centre, carry out the following procedure.

Note: *At all times during this procedure you should observe all relevant speed limits, laws, and regulations. Always take account of traffic and weather conditions, and drive with consideration for other road users.*

1. Drive the vehicle until the engine reaches normal operating temperature. The engine should not be left idling to achieve working temperature.
2. Drive the vehicle for a further twenty minutes, keeping the road speed above 48 km/h (30 mph).
3. If regeneration is successful the warning light, or message, will extinguish. If they do not repeat the process.

Note: *If the warning indicator or message fails to extinguish after following the regeneration process three times, contact your Land Rover Dealer/Authorised Repairer for assistance.*

Warning indicators and messages

CAUTION

Failure to take the appropriate action when a warning indicator or message appears may result in damage to the engine, DPF system, increased vehicle emissions, and costly repairs.

If regeneration cannot be achieved automatically by the system, due to short journeys for example, the driver will be notified via a warning indicator, or message.

DPF FULL

If this message appears the driver should carry out the DPF regeneration procedure as soon as possible.

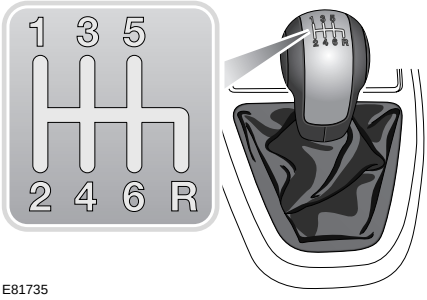
DPF FULL VISIT DEALER

If this message appears the vehicle should be taken to your Land Rover Dealer/Authorised Repairer as soon as possible.

MANUAL TRANSMISSION

CAUTION

Selection of reverse gear is prevented when the vehicle is travelling in excess of 24 km/h (15 mph). Never attempt to engage reverse gear whilst the vehicle is in forward motion. This may result in serious transmission damage and costly repairs.



E81735

The gear lever is spring loaded, and when in neutral sits between third and forth gear positions. Extra pressure will be required to move across to reverse.

AUTOMATIC TRANSMISSION

WARNING

Park (P) should be engaged when the vehicle is stationary. The vehicle can move unexpectedly with any other gear position selected, which may result in death or serious injuries to people or animals outside of the vehicle.

CAUTIONS

Never select the Park (P) position whilst the vehicle is in motion. Doing so may cause serious damage to the transmission.

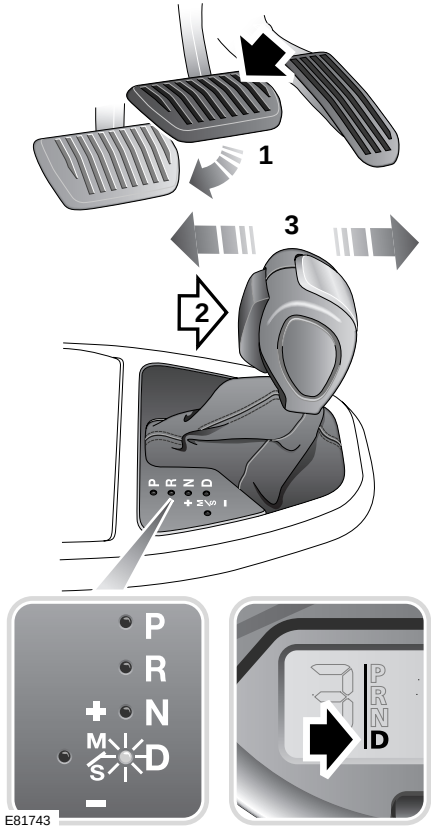
Never select the Reverse (R) position whilst the vehicle is in forward motion. Doing so may cause serious damage to the transmission.

Never select a forward gear whilst the vehicle is in rearward motion. Doing so may cause serious damage to the transmission.

Do not rev the engine or allow it to run above normal idle speed while selecting D or R, or while the vehicle is stationary with any gear selected.

Do not allow the vehicle to remain stationary for any length of time with a gear selected and the engine running. Always select P or N if the engine is to idle for a prolonged period.

Automatic mode



To select Drive (D) when the vehicle is stationary :-

1. Apply the footbrake.
2. Press the gear selector release button.
3. Move the gear selector to Drive (D).

When in D the transmission will automatically select the most appropriate gear for the current driving conditions.

Note: *If pressure is applied to the selector lever before the foot brake is applied, any gear selected may not be available irrespective of the lever position. In this situation, remove pressure from the selector lever, ensure that the footbrake is applied and select the required gear.*

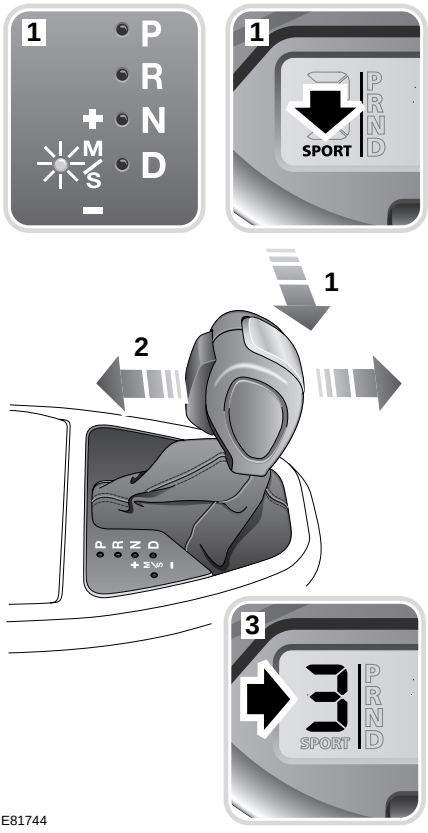
Note: *When a gear is selected the vehicle may begin to move as soon as the foot brake is released.*

Kick-down

When D is selected, and the accelerator pedal is depressed fully the transmission will downshift to the lowest appropriate gear. Once the accelerator pedal is returned to a normal driving position the transmission will upshift to the highest appropriate gear.

Note: *Kick-down operation will vary according to road speed, current gear in use and accelerator movement.*

Sport mode and CommandShift™



E81744

1. To select sport mode, move the selector lever from **D** to **SPORT**.
2. To use CommandShift, move the selector lever forward to move up a gear, and back to move down a gear.

Sport mode

When sport mode is selected (**1**) **SPORT** will be displayed in the message centre, and the selector indicator will illuminate.

To return to automatic mode move the selector lever back to the Drive (D) position. The **D** on the selector display will illuminate to confirm that automatic mode has been selected.

CommandShift™

When using CommandShift the selected gear is displayed in the message centre (**3**).

Moving away from a stand still can be achieved using either first or second gear. This may prove useful for certain terrain, using second gear for pulling away on snow for example.

Note: *In order to protect the engine, the transmission will automatically change up to prevent over-revving, or down if the engine is labouring.*

Note: *When in CommandShift, if the vehicle comes to a complete stop the transmission will remain in second gear. First gear can be selected manually if required.*

Electronic gear change strategies

In automatic, or sport modes (not available in CommandShift) the gear change points will be adapted to suit driving conditions.

Hill ascent, towing, and high altitude

The lower gears are selected, and maintained for longer than usual. This helps overcome the loss of momentum when towing, or ascending hills. It also helps overcome the loss of engine torque when the vehicle is operating at high altitudes.

Hill descent

With HDC selected in either automatic, or sport modes, a low gear will be selected and maintained to provide maximum engine braking.

High temperatures

In circumstances where engine and transmission temperatures are raised to very high levels, the gear change strategy will alter to provide maximum cooling efficiency.

Transmission fault

In the unlikely event that a fault develops within the transmission system, **F** will be displayed in the gear position display and a warning message will appear in the message centre. A limited range of gears will be available, and you should seek qualified assistance immediately.

TECHNICAL SPECIFICATIONS

Transmission fluids and capacities

Transmission unit	Fluid specification	Fluid capacity
Automatic gearbox	Esso JWS3309	7 litres (12.3 pints)
Manual gearbox	Castrol MTF 97309	1.9 litres (3.3 pints)
Power transfer unit	Castrol BOT118	0.75 litres (1.3 pints)
Haldex coupling	STAT OIL SL01-301	0.65 litres (1.1 pints)
Rear differential	Castrol EPX	0.7 litres (1.2 pints)

PRINCIPLE OF OPERATION

WARNINGS

Do not rest your foot on the brake pedal whilst the vehicle is in motion. This may cause a light application of the brakes, which can result in overheating, reduced brake performance, and excessive brake wear.

Never allow the vehicle to coast (freewheel) with the engine turned off. The engine must be running to provide full braking assistance. The brakes will still function with the engine off, but far more pressure will be required to operate them.

If the red brake warning indicator illuminates, safely bring the vehicle to a stop, as quickly as possible. Seek qualified assistance before proceeding.

Never place non-approved floor matting or any other obstructions under the brake pedal. This restricts pedal travel and braking efficiency.

Brake pads

Brake pads require a period of bedding in when new. Drive with extra caution for the first 800 km (500 miles) to avoid then need for heavy braking.

Wet conditions

Driving through heavy rain or water can have an adverse effect on braking efficiency. Under those circumstances it is recommended that you lightly apply the brakes intermittently to dry the brakes.

HINTS ON DRIVING WITH ABS

WARNINGS

ABS cannot overcome the physical limitations of braking distance. Nor can it overcome the lack of grip on a road surface, aquaplaning on water for example.

Braking distance is increased on a slippery surface. This applies to all vehicles, even those fitted with ABS.

The driver should not be tempted to take risks when driving, in the hope that ABS will correct errors of judgement. In all cases it remains the driver's responsibility to drive with due care and attention, paying particular attention to the effects of speed, weather, road conditions etc.

ABS (Anti-Lock Braking System) allows maximum brake pressure, and thus maximum braking efficiency, to be applied, and prevents the road wheels locking. This allows the driver to retain steering control during heavy braking under most road conditions.

During emergency braking conditions ABS constantly monitors the speed of each wheel. ABS varies the brake pressure to individual wheels, according to the grip available. The constant alteration of brake pressure can be felt as a pulsing sensation through the brake pedal. This is not a cause for concern, as it is designed to demonstrate to the driver that ABS is operating.

ABS warning indicator

If this amber warning indicator illuminates, drive with extra caution, avoid heavy braking where possible, and seek qualified assistance as soon as possible.

ABS and off-road driving

ABS will operate when driving off-road, however it may be unwise to rely on it's assistance under some conditions.

Stopping distances will be increased when travelling over rough, or bumpy terrain.

Soft surfaces

On soft or deep surfaces such as powdery snow, sand, or gravel, the braking distance required will be increased. This is because the natural action of a locked wheel (which cannot happen when ABS is operating) is to form a wedge of surface material in front of the wheel, which reduces the stopping distance.

Steep slopes

If the vehicle is stationary on a steep, slippery slope, it may begin to slide even with the brakes applied. This is because without wheel rotation the ABS cannot determine vehicle movement.

To counteract this, briefly release the brakes to allow some wheel rotation. Then re-apply the brakes to allow ABS to gain control.

Emergency Brake Assist (EBA)

If the driver rapidly applies the brakes, EBA automatically boosts the braking force to it's maximum in order to bring the vehicle to a halt as quickly as possible. If the driver applies the brakes slowly, but conditions mean that ABS operates on the front wheels, EBA will increase the braking force in order to apply ABS control to the rear wheels.

EBA stops operating as soon as the brake pedal is released.

A fault with the EBA system is indicated by the red brake warning indicator illuminating.

Electronic Brake Distribution (EBD)

EBD controls the balance of braking forces supplied to the front and rear wheels, in order to maintain maximum braking efficiency.

If the vehicle has a light load (only the driver in the vehicle for example) the EBD will reduce the braking force applied to the rear wheels. If the vehicle is heavily laden then EBD will increase the braking force to the rear wheels.

A fault with the EBD system is indicated by the red brake warning indicator illuminating.

PARKING BRAKE

Parking on a slope

Facing uphill

If the vehicle is parked facing uphill, select first gear (manual gearbox), or Park (automatic gearbox), and turn the steering wheel so that the front wheels face away from the kerb.

Facing downhill

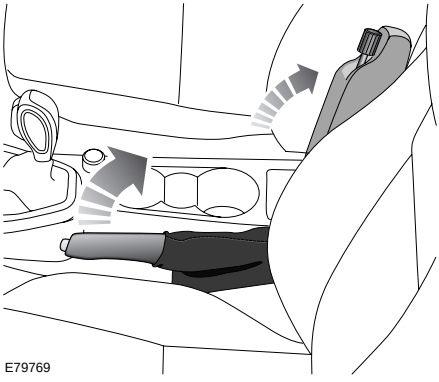
If the vehicle is parked facing downhill, select reverse gear (manual gearbox), or Park (automatic gearbox), and turn the steering wheel so that the front wheels face towards the kerb.

Applying the parking brake

WARNING

Ensure that the parking brake is applied fully before releasing the parking brake lever.

Note: *The front seat armrest may obstruct the operation of the parking brake for some drivers. If this is the case, lift the seat armrest before applying the parking brake.*



1. Firmly apply the foot brake.
2. Pull the parking brake lever upwards until the parking brake is applied.

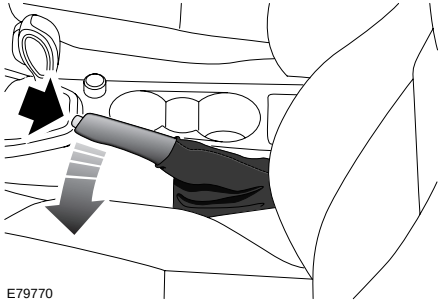
When the parking brake is applied the warning indicator will illuminate.

Note: *Do not press the parking brake release button when applying the parking brake.*

Releasing the parking brake

WARNING

Ensure that the foot brake is applied before releasing the parking brake.

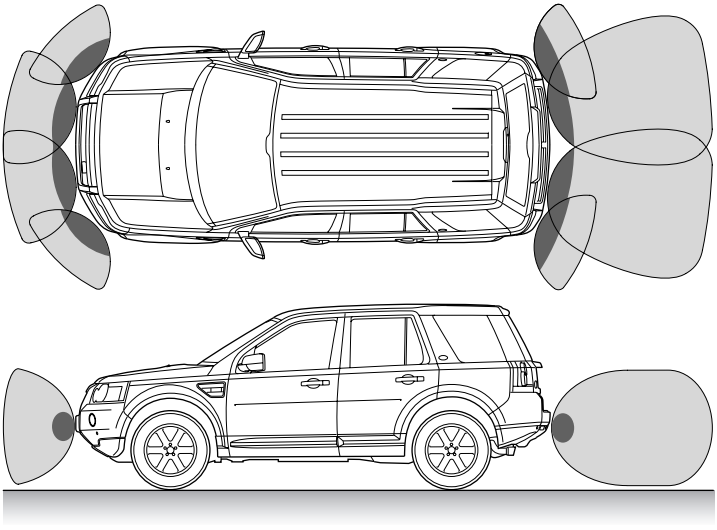


1. Firmly apply the foot brake.
2. Press the parking brake lever release button.
3. With the button pressed, lower the parking brake lever to its lowest position.

When the parking brake is released the warning indicator will extinguish.

PRINCIPLE OF OPERATION

Park Distance Control (PDC) provides the driver with information on most obstructions, and their distance from the vehicle, when manoeuvring. PDC does this by using four ultrasonic sensors on each bumper.



E79871

1. When objects are detected at this range the PDC will emit a pulse tone which increases in frequency as the vehicle gets closer to the object.
2. When objects are sensed within this range, approximately 30 centimetres (12 inches) the tone becomes continuous.

USING THE PARKING AID

WARNING

Parking aids may not detect moving objects such as children and animals until they are dangerously close. Always use extreme caution when manoeuvring.

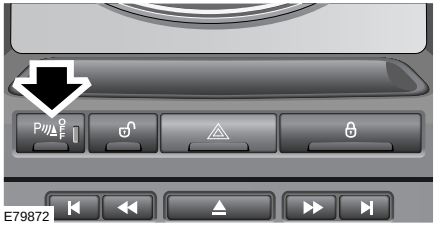
CAUTIONS

Parking aids are for guidance only, and are not intended to replace the driver's visual checks for obstructions when manoeuvring.

PDC sensors may not detect some obstructions. Obstructions such as narrow posts, small objects close to the ground, and some objects with dark non-reflective surfaces for example.

Systems which use the same frequency band as the front PDC sensors may cause irregular tones to be emitted.

PDC activation



Front PDC is activated by pressing the PDC button a short confirmation tone will be heard, and the tell-tale will illuminate. The front sensors will remain active as long as the vehicle's speed does not exceed 16 km/h (10 mph).

If reverse gear is selected, front and rear sensors are activated.

In vehicles fitted with automatic transmission, selecting neutral from reverse will keep front and rear sensors active.

Front PDC deactivation

The PDC system can be deactivated by pressing the PDC switch.

Towing

The rear sensors are automatically disabled when a trailer is connected.

Sensor care

CAUTION

When washing the vehicle do not aim high pressure water jets directly at the sensors. Do not use abrasive materials or hard/sharp objects to clean the sensors. Only use approved vehicle shampoo.

The sensors should be kept clean to maintain accuracy and performance.

System fault

If a system fault is detected, a long high-pitched tone will sound, and the switch indicator lamp will flash. Contact your Land Rover Dealer/Authorised Repairer as soon as possible.

GENERAL DRIVING POINTS

Battery charging - red

Illuminates as a bulb check when the ignition is turned on and extinguishes once the engine is running. If it remains on, or illuminates whilst driving, a fault with the battery charging system is indicated. Seek qualified assistance urgently.

Low oil pressure - red

Illuminates as a bulb check when the ignition is turned on and extinguishes when the engine is started. If the indicator remains on, flashes on and off, or illuminates whilst driving, stop the vehicle as soon as safety permits and switch off the engine immediately. Seek qualified assistance before driving. Always check the oil level when this indicator illuminates.

REDUCED ENGINE PERFORMANCE

Engine management system (EMS) fault

Illuminates amber in the instrument pack when the engine management system detects a serious fault - reduced performance may be experienced. Avoid high speeds and consult your Land Rover Dealer/Authorised Repairer as soon as possible.

Check engine - petrol models only

Illuminates amber in the instrument pack as a bulb and system check when the starter switch is turned on and extinguishes as soon as the engine is started. Illumination at any other time indicates that the emission performance of the engine management system is impaired - seek qualified assistance. If the indicator flashes while driving, immediately reduce engine power to avoid catalytic converter damage.

RUNNING-IN

The engine, gearbox, tyres, and brakes need time to bed-in. During the first 800 km (500 miles) it is essential that the vehicle is driven with consideration for the running-in process. During the running in period the following advice should be followed.

- Limit the engine speed to a maximum of 3000 rpm, and the road speed to a maximum of 110 km/h (68 mph).
- Do not use full accelerator pedal travel, and use the gears to avoid over-revving or labouring the engine.
- Do not use sport mode during the running in period.
- Avoid rapid acceleration or heavy braking wherever possible.
- Ensure that servicing is carried out on time, and follow any advice regarding use in arduous conditions.

Note: *The advice given for running in will aid fuel economy, and should be adopted as general driving practice even after the running in period.*

ECONOMICAL DRIVING

There are two main factors which influence fuel economy, the way the vehicle is driven, and maintenance.

Driving tips for economy

- Avoid unnecessary journeys, especially short stop-start trips.
- Accelerate smoothly and gently from a stand still.
- Use the gears to avoid labouring, or over-revving the engine.
- Allow time to brake gently and smoothly.
- Be aware of traffic and road conditions ahead, and take action in time to avoid hard braking or acceleration.
- When stationary apply the park brake, and select neutral.
- Turn off the air conditioning when not needed.

Maintenance and fuel economy

Regular servicing by a Land Rover Dealer/Approved repairer, along with regular checks by the driver are essential for vehicle longevity and fuel economy.

The condition of the engine (oils, filters, spark plugs, settings etc) tyre pressures, and wheel alignment, will all have a bearing on fuel economy. For this reason it is essential that the vehicle is checked regularly by the driver, and serviced by an approved Land Rover Dealer/Authorised Repairer at the correct intervals.

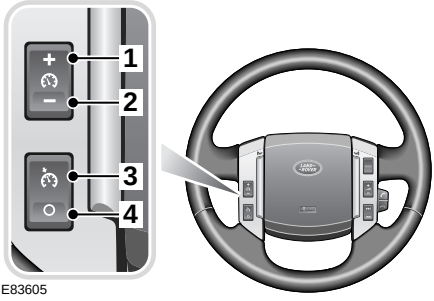
Note: *If you are in any doubt about the maintenance requirements, intervals, or checks required, contact your Land Rover Dealer/Authorised repairer for advice.*

Cruise control

PRINCIPLE OF OPERATION

Cruise control enables the driver to maintain a constant road speed without using the accelerator pedal. This is particularly useful for motorway cruising, or for any journey where a constant speed can be maintained for a lengthy period.

USING CRUISE CONTROL



E83605

1. Set target speed, or increase speed.
2. Decrease speed.
3. Resume set speed.
4. Cancels cruise control operation without erasing memorised speed.

Note: *Cruise control is not available in HDC, or when a Terrain Response special program has been selected.*

Note: *Do not use cruise control in traffic conditions where a constant speed cannot easily be maintained.*

Note: *Do not use cruise control on winding roads, or in slippery conditions.*

Note: *Do not use cruise control when driving off-road.*

Note: *Do not use cruise control with* ***SPORT*** *mode selected.*

Engaging cruise control

Note: *Cruise control can only be engaged at speeds in excess of 30 km/h (18 mph).*

Accelerate until the desired speed is reached, then press the + switch to set the vehicle speed into the system's memory. Cruise control will now maintain that speed.

The cruise control warning indicator will illuminate to confirm cruise control is operational. Speed can be increased using the accelerator pedal as normal, to overtake for example. As soon as the accelerator pedal is released, the vehicle speed will return to the set cruising speed.

Note: *If the accelerator pedal is pressed for more than 60 seconds, cruise control will be cancelled.*

Suspending cruise control

Cruise control can be suspended by a single press of the cancel switch. The warning indicator will extinguish when cruise control is cancelled.

Cruise control will also be suspended if the brake pedal is pressed, the gear selector is moved to N, or if HDC or DSC are activated.

To resume cruise control operation at the previously set speed, press the resume switch.

Note: *The set speed will not be erased by pressing the cancel switch. The set speed can only be erased by switching off the ignition.*

Reducing the cruise speed

To reduce cruising speed, press and hold the — switch. Release the switch when the desired speed is reached, the new speed will be set and maintained.

The set speed can be reduced incrementally by tapping the — switch. Each press of the switch will decrease the speed by 1 km/h or 1 mph depending on which scale is in use.

Increasing the cruise speed

CAUTION

When setting the cruise control to the speed limit it is important to remember that it is possible for the vehicle speed to increase when travelling downhill. This may result in the vehicle speed exceeding the speed limit.

Press and hold the + switch to increase speed. Release the switch when the desired speed is reached, the new speed will be set and maintained.

The speed can be increased incrementally by tapping the **+** switch. Each press of the switch will increase the speed by 2 km/h (1 mph).

Speed can also be increased using the accelerator. When the desired speed is reached press the **+** switch to set and maintain the new speed.

PRINCIPLE OF OPERATION

The Terrain Response System provides an opportunity for the driver to feed back terrain information to the vehicle by choosing a general setting or one of three special programs. It then uses that information to optimise the vehicle's systems for improved traction and driveability. It does this by bringing together vehicle drive control systems which usually operate individually.

The drive systems optimised by the Terrain Response System are :-

- Engine management.
- Gearbox management.
- Intelligent coupling control.
- Dynamic stability, traction and Hill Descent controls.

The system will provide a variable accelerator pedal response, ranging from very cautious for slippery conditions (where a large pedal movement has only a small effect on engine power) to very responsive (where engine power is allowed to rise more quickly).

Note: *Changing from one special program to another will introduce noticeably different responses. For example, the engine revs produced by the current accelerator pedal position, may increase or decrease in the new program.*

To familiarise yourself and get the best from the system you should try out the programs in circumstances which are safe for you and other road users.

Terrain response has been designed to benefit the driver no matter what their level of off-road driving experience. The system will aid those with less experience, and enhance the skills of those with more experience.

USING TERRAIN RESPONSE

Note: *The Terrain Response System is designed to be engaged before crossing difficult terrain. Do not wait until control has been lost before using the special programs.*

When the vehicle is started, the Terrain Response System will be in its General program. The General program will allow the vehicle to operate capably in most conditions, as some of the sub-systems will react to the conditions where appropriate. When conditions change, and more difficult conditions are encountered, the appropriate special program should be selected.

Before driving off-road

Before venturing off-road it is absolutely essential that inexperienced drivers become fully familiar with the vehicle's controls. In particular, CommandShift, Hill Descent Control (HDC), and the Terrain Response system.

Basic information and off-road driving techniques can be found in the off-road driving handbook available on-line at **http://www.ownerinfo.landrover.com**

Off-road driver training should be undertaken by anyone intending to drive off-road. Training is available at your nearest Land Rover Experience centre. More details can be found at **http://www.landroverexperience.com**

Driver override options

All systems will be set to their optimum parameters for the conditions reflected in the choice of special program. However, if required, Hill Descent control can be operated independently. See **USING HDC** (page 137). If it has not been automatically selected by the special program, it may be engaged as required. Conversely, if it has been selected, but is not required, it may be turned off.

The HDC status will be displayed on the message centre whether it is engaged or disengaged by the system, or the driver. Use of HDC in special programs may prompt additional driving advice, and warnings to be displayed on the message centre.

Although Dynamic Stability Control is automatically engaged when a special program is selected, it can be turned off if required See **USING TRACTION CONTROL** (page 139).

Automatic gear selection can be overridden by using the CommandShift function.

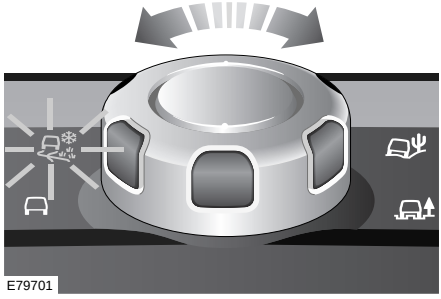
Terrain Response operation

E79700

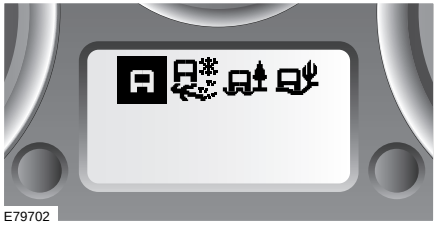
A rotary control just in front of the gear lever is used to select the required special program. When the selector reaches the end of the selection range in either direction it can be rotated further, but it has no effect.

In addition to the general program, there are three special programs.

- Grass/Gravel/Snow (also used for ice).
- Mud/Ruts.
- Sand.


E79701

When the starter button is pressed, the indicators around the rotary control are illuminated. The active program is highlighted in amber, and the program icon is displayed in the message centre.



E79702

The special programs remain active for six hours after the ignition is turned off. If the ignition is turned on again within six hours the program will remain active. After six hours the general program is automatically selected.

General program

This program is compatible with all on and off-road conditions. If not already active, it should be selected before driving on surfaces which are similar to a hard road surface. Dry cobbles, tarmac, dry wooden planks, etc. all fall into this category.

This program should be selected once the need for a special program has passed. Once the special program has been deselected, all of the vehicle systems will return to their normal settings except HDC. HDC will remain active if it was selected manually.

Grass-Gravel-Snow

This program should be used where a firm surface is covered with loose, or slippery material. Surfaces covered in water, ice, slime, grass, gravel, shale, pebbles, or a thin coating of sand for example.

Note: *For deep gravel it is recommended that the Sand program is selected.*

In slippery conditions, it may be beneficial to pull away in a higher gear than usual.

For information on the fitment and use of snow chains. See **USING SNOW CHAINS** (page 192).

For information on the fitment and use of winter tyres. See **USING WINTER TYRES** (page 183).

Note: *If the vehicle is unable to gain traction in deep snow, switching DSC off may help. DSC should be switched on again as soon as the difficulty is overcome. See* ***USING TRACTION CONTROL*** *(page 139).*

Mud-Ruts

This program should be used for crossing terrain that is muddy, rutted, soft, or uneven.

Sand

This program should be used for terrain which is predominantly soft dry sand, or deep gravel.

Note: *If the vehicle is unable to gain traction in extremely soft, dry sand, switching DSC off may help. DSC should be switched on again as soon as the difficulty is overcome. See* ***USING TRACTION CONTROL*** *(page 139).*

If the sand to be crossed is damp/wet, and sufficiently deep to cause the wheels to sink into the surface, the Mud-Ruts program should be used.

System difficulties

Note: *Selection of an inappropriate special program will not endanger the driver, nor will it immediately damage the vehicle. However, if continued, use of an incorrect program will impair the vehicle's response to the terrain, and can reduce the durability of the drive systems.*

If the system becomes partially inoperable for any reason, it may not be possible to select special programs. A warning will be given when selection of a special program is attempted. If the Terrain response system becomes totally inoperable, all of the program indicators will be switched off, and the message centre will display the relevant message.

If a participating vehicle system becomes temporarily inoperable, the General program will be automatically selected. Once the system returns to normal operation, the previously active program will be re-activated unless the ignition has been turned off in the mean time.

Terrain response messages

Messages relating to the terrain response system are displayed on the message centre. See **INFORMATION MESSAGES** (page 99).

Most of the messages that appear will be for information only, and require no driver intervention, **SAND PROGRAM SELECTED** for example.

Messages that require driver intervention are shown in the following table.

Message	Meaning	What to do?
PROGRAM CHANGE IN PROGRESS	Conditions exist which temporarily prevent selection of a new program.	If conditions change within 60 seconds, the chosen program will be activated. If the message is prompted by electronic coupling overheat the delay will be longer. A separate message will also be displayed.
SYSTEM FAULT SPECIAL PROGRAMS NOT AVAILABLE	A fault exists which renders the Terrain Response programs unavailable.	Use extreme caution if travelling off road, and seek qualified assistance immediately.
RECOMMEND COMMAND SHIFT FOR DEEP SOFT SAND	In extreme sand conditions, it may be beneficial to select Command Shift to improve driver control.	Select Command Shift if required.

Hill descent control (HDC)

PRINCIPLE OF OPERATION

HDC operates in conjunction with ABS to provide greater control when off-road, particularly when descending steep slopes. HDC operation is fully automatic when engaged.

During a hill descent when driving off-road, engine braking is used to control the speed of descent. If engine braking alone is insufficient to control the vehicle's speed, HDC will slow the vehicle using the braking system. HDC will control the descent speed relative to the gear selected and accelerator position.

If the vehicle is fitted with a manual transmission, HDC should only be used in first, or reverse gears. If the vehicle is fitted with an automatic transmission, HDC should only be used in **D**, **R**, or CommandShift **1**. When in **D** the vehicle will select the most appropriate gear.

Note: *HDC is automatically selected by some of the Terrain response special programs.*

Gradient release control (GRC)

With HDC activated, if the vehicle is stopped on a slope using the footbrake, GRC will become active. When the footbrake is released GRC will automatically delay the brake release to allow take up of drive, and build up of engine torque. The brakes will then gradually release to allow the vehicle to move smoothly away under the control of HDC.

GRC operates in forward and reverse, and requires no driver intervention.

Before driving off-road

Before venturing off-road it is absolutely essential that inexperienced drivers become fully familiar with the vehicle's controls. In particular, CommandShift, Hill Descent Control (HDC), and the Terrain Response system.

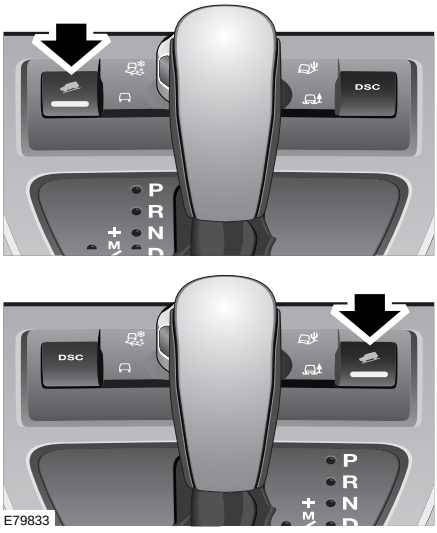
Basic information and off-road driving techniques can be found in the off-road driving handbook available on-line at **http://www.ownerinfo.landrover.com**

Off-road driver training should be undertaken by anyone intending to drive off-road. Training is available at your nearest Land Rover Experience centre. More details can be found at **http://www.landroverexperience.com**

Hill descent control (HDC)

USING HDC

Selecting HDC



E79833

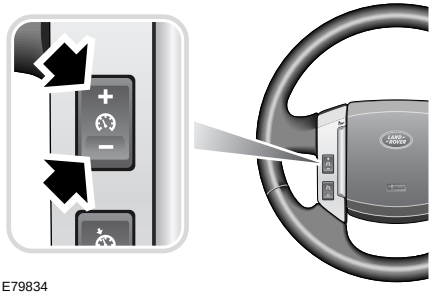
HDC can be selected at speeds below 80 km/h (50 mph). To select HDC, press and release the HDC on/off switch.

The green HDC indicator will illuminate continuously at speeds below 50 km/h (30 mph) to indicate that HDC is fully active.

If the vehicle speed exceeds 80 km/h (50 mph) HDC will disengage, and the HDC indicator will extinguish.

If HDC has been selected, and the vehicle speed rises above 50 km/h (30 mph) HDC is suspended, and the HDC indicator will flash. A message will appear in the message centre to confirm the suspension of HDC.

HDC operation


E79834

With HDC engaged, the speed of descent can be altered using the cruise control steering wheel switches. **+** increases the speed, and **—** decreases the speed.

To increase speed press, and hold, the **+** switch until the desired speed is achieved. When the switch is released, the speed will be maintained.

To decrease speed press, and hold, the **—** switch until the desired speed is achieved. When the switch is released, the speed will be maintained.

To increase or decrease speed gradually, tap the **+** or **—** switch as required. Each tap of the switch will increase, or decrease the speed in increments of 0.5 km/h (0.3 mph). The accelerator pedal can also be used to increase speed, up to the threshold in each gear.

Note: *Each gear has a pre-determined minimum speed.*

Descent speed will only increase on a slope steep enough to provide additional momentum. Therefore, use of the ***+*** *switch on a gentle slope may not increase the speed.*

When using HDC in vehicles fitted with a manual transmission, depressing the clutch pedal will prevent HDC from controlling the speed of descent.

If the brake pedal is depressed, HDC will be overridden and the brakes will operate as normal. When the brake pedal is released, HDC will resume control of the descent.

If HDC is switched off during a descent, HDC assistance will fade out gradually. This is to prevent loss of control if HDC is switched off in error. HDC will resume control when switched back on if assistance is still required, but at the speed the vehicle is travelling when the pedal is released.

When driving off-road HDC can be permanently selected, but it will only provide assistance when the speed parameters are met.

Warning messages

WARNING

Do not attempt a steep descent if HDC is inoperative, or warning messages are displayed.

Brake temperature

In extreme circumstances, the HDC system may cause brake temperatures to exceed their pre-set limits. If this occurs the warning message **HDC TEMPORARILY NOT AVAILABLE SYSTEM COOLING** will be displayed in the message centre. HDC will then fade out and become temporarily inactive.

If the vehicle is not fitted with a message centre, then the amber HDC warning indicator will flash.

HDC will remain unavailable until the brakes reach an acceptable temperature. Once the brakes have reached an acceptable temperature, the message will disappear (or the warning indicator will extinguish) and HDC will, if required, resume operation.

System fault

If a fault is detected in the HDC system, **HDC FAULT SYSTEM NOT AVAILABLE** will appear in the message centre.

If the vehicle is not fitted with a message centre the amber HDC warning indicator will illuminate.

If the fault is detected whilst the system is operating HDC assistance will fade out.

If a fault is detected, contact you Land Rover Dealer/Authorised Repairer as soon as possible.

USING TRACTION CONTROL

Electronic Traction Control (ETC)

ETC operates in conjunction with Dynamic Stability Control (DSC) and is designed to assist when one, or more, wheels have lost traction.

If a wheel looses traction, ETC will operate the brake on that wheel until it regains traction.

Warning indicator

If a fault is detected within the ETC system the warning indicator will illuminate.

Before driving off-road

Before venturing off-road it is absolutely essential that inexperienced drivers become fully familiar with the vehicle's controls. In particular, CommandShift, Hill Descent Control (HDC), and the Terrain Response system.

Basic information and off-road driving techniques can be found in the off-road driving handbook available on-line at **http://www.ownerinfo.landrover.com**

Off-road driver training should be undertaken by anyone intending to drive off-road. Training is available at your nearest Land Rover Experience centre. More details can be found at **http://www.landroverexperience.com**

PRINCIPLE OF OPERATION

Dynamic Stability Control (DSC)

WARNING

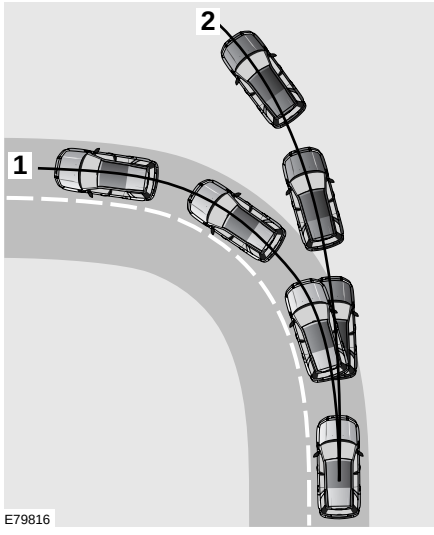
DSC is unable to compensate for driver errors.

It is the driver's responsibility to drive with due care and attention, in a manner which is safe for their vehicle, it's occupants, and other road users.

DSC has two main functions.

Firstly, if a wheel, or wheels, loose traction when accelerating, it enhances Traction Control by reducing engine torque, and applying braking force to individual wheels. This further improves the vehicle's ability to pull away on slippery, or loose surfaces, and reduces the likelihood of wheel spin when cornering.

Secondly, DSC will apply braking force to individual wheels in order to maintain vehicle stability when cornering, changing lanes suddenly, or manoeuvring in an emergency. This will help to keep the vehicle on the driver's intended path, rather than over, or under steering.



1. Vehicle fitted with DSC.
2. Vehicle without DSC.

Roll stability control (RSC)

WARNING

No electronic system can remove the need for safe driving practice. RSC can help to maintain control of the vehicle. It cannot regain control of the vehicle if it has been lost, or overcome driver errors. Always drive with due consideration for the prevailing road and weather conditions.

RSC works in conjunction with DSC to try and prevent vehicle roll-over. If the system senses that the vehicle is approaching roll-over it will reduce engine power and use the ABS system to reduce the chance of roll-over.

USING STABILITY CONTROL

DSC

DSC is activated automatically each time the engine is started, and is automatically selected by some of the Terrain Response Special programs.

Note: *In the majority of driving situations, and particularly on-road, it is recommended that you do not turn DSC off.*

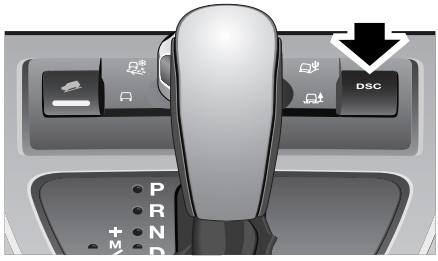
Deactivating DSC

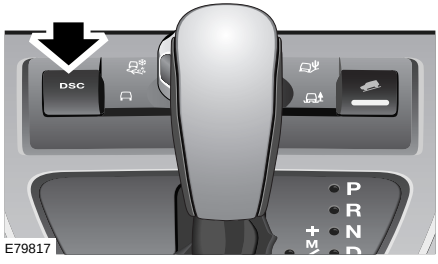
CAUTION

Driving with DSC deactivated puts additional loads on the brakes. Wherever possible, drive with DSC activated.

In some driving conditions it may prove helpful to deactivate DSC to improve traction. These conditions include :-

- Rocking the vehicle out of a hollow.
- Rocking the vehicle out when the wheels have sunk into the surface.
- Pulling away in deep snow, or a loose surface.
- Driving along deep ruts.
- Driving through deep mud.





To deactivate DSC, press, and briefly hold, the DSC button. The DSC warning indicator will illuminate continuously as a reminder that DSC is deactivated.

Note: *Deactivating DSC will have no effect upon the operation of Traction Control.*

Reactivating DSC

DSC is reactivated by :-

- pressing, and briefly holding the DSC button.
- starting the engine.
- selecting a new Terrain Response special program.

DSC system fault

If a fault is detected the DSC warning lamp will illuminate continuously when DSC has not been deactivated.

SAFETY PRECAUTIONS

WARNINGS

Petroleum gasses are highly flammable, have a low flash point, and are explosive, especially in confined spaces. Avoid exposing the gasses to any potential sources of ignition as the resulting fire and explosion may cause serious injuries and/or death.

Only use containers specifically designed for carrying fuel, and alway remove them from the vehicle to fill them. Failure to do so may result in spillage, and cause a fire.

Switch off the engine when refuelling, as it is both a source of extreme temperatures, and electrical sparks. The resulting fire and explosion may cause serious injury and death.

Switch off any personal electronic devices such as mobile phones, or music players. They have the potential to cause electrical sparks. The resulting fire and explosion may cause serious injury and death.

Do not smoke, use a naked flame, or cause sparks. The resulting fire and explosion may cause serious injury and death.

Do not overfill the fuel tank. Overfilling may cause spillage when the vehicle is driven. Spillage may also occur if the fuel expands in high ambient temperatures.

FUEL QUALITY

Petrol engined vehicles

CAUTIONS

Do not use leaded fuels, lead substitutes, or fuel additives. Doing so can cause damage to the engine, fuel, and emission control systems.

Only use high quality petrol, as using lower quality fuels can cause damage to the engine, fuel, and emission control systems.

Fuel system cleaning agents should not be used, unless approved by Land Rover. Unapproved products may be harmful to fuel system components on your vehicle.

Octane rating

The minimum octane rating for fuel used is 91 RON. The vehicle will run on lower ratings, but it may cause pronounced engine knock or pinking. If the pinking is severe it can cause damage to the engine, fuel, and emission control systems.

Note: *Occasional, light, engine knock experienced while accelerating or climbing hills is acceptable.*

Alternative fuels for petrol engines

Ethanol

CAUTIONS

This vehicle is not suitable for use with fuels containing more than 10% Ethanol.

Do not use E85 fuels (85% Ethanol content). Equipment necessary for the use of fuels containing more than 10% Ethanol is not fitted to this vehicle. If E85 fuels are used, serious engine and fuels system damage will occur.

Fuels containing up to 10% Ethanol (grain alcohol) may be used. Ensure that the fuel has octane ratings no lower than those recommended for unleaded fuel. Most drivers will not notice any operating difference with fuel containing Ethanol. If a difference is detected, the use of conventional unleaded fuel should be resumed.

Methanol

Some fuels contain Methanol (Methyl or wood alcohol). If you use fuels containing Methanol the fuels must also contain co-solvents and corrosion inhibitors for Methanol. Also, do not use fuels which contain more than 3% Methanol even if they contain co-solvents and corrosion inhibitors. Fuel system damage or vehicle performance problems resulting from the use of such fuels is not the responsibility of Land Rover, and may not be covered under the warranty.

CAUTION

Wherever possible avoid using fuel containing Methanol.

Methyl Tertiary Butyl Ether (MTBE)

Unleaded fuel containing an oxygenate known as MTBE can be used provided that the ratio of MTBE to conventional fuel does not exceed 15%. MTBE is an Ether based compound derived from Petroleum, which has been specified by several refiners as the substance to enhance the Octane rating of fuel.

Reformulated gasoline

Several petroleum companies have announced the availability of reformulated fuels. These fuels are specially formulated to further reduce vehicle emissions. Land Rover fully supports all efforts to protect and maintain ambient air quality, and encourages the use of reformulated gasoline where available.

Diesel engined vehicles

Note: *Land Rover vehicle's are capable of running with up to a 5% blend of bio-diesel in accordance with European Standard EN590.*

Sulphur content

The Sulphur content of diesel used in Land Rover vehicles should not exceed 0.3%.

In some countries diesel will contain higher levers of Sulphur, which will require reduced service intervals to reduce the effects on engine components. If in doubt contact a local Land Rover Dealer/Authorised Repairer for advice.

RUNNING OUT OF FUEL

CAUTION

Avoid running out of fuel. Doing so can cause damage to the vehicle's engine, fuel, and emission control systems.

Note: *If the vehicle does run out of fuel, a minimum of 4 litres (0.8 gallons) will be required to restart the engine. The vehicle will need to be driven 1.6-5 km (1-3 miles) in order to reset the engine management and monitoring systems.*

Note: *If the vehicle does run out of fuel, seeking qualified assistance is advisable.*

FUEL CUT-OFF

The fuel system cut-off forms part of the Supplementary Restraint System (SRS) fitted to your vehicle. Following an impact, and depending on the severity, the fuel pump may be switched off.

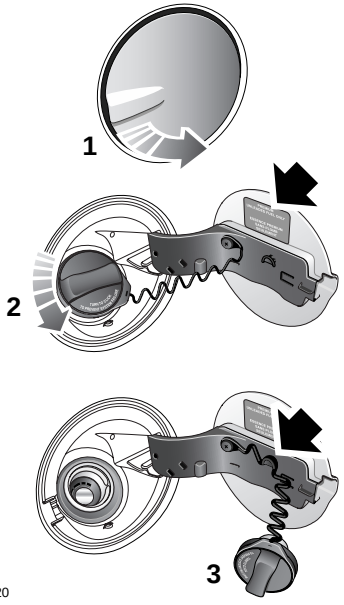
Resetting the fuel cut-off

WARNING

The fuel cut-off should never be reset if you can smell fuel, or a leak can be seen. Doing so can lead to a fire which may cause personal injury or death.

1. Switch the ignition off and wait for one minute.
2. Turn the ignition on for 30 seconds.
3. Check the vehicle thoroughly for fuel leaks. If a leak is detected switch the ignition off immediately.
   - Do not start the vehicle if a leak is present. Seek qualified advice, and have the vehicle recovered.
4. If no leaks are detected, start the vehicle.

FUEL FILLER FLAP



The fuel filler flap is located on the right-hand side of the vehicle, at the rear.

1. Ensure that the vehicle is fully unlocked, and pull the fuel filler flap open.
2. Twist the cap anti-clockwise to undo.
   - Ensure that you read, understand, and fully comply with all warnings and instructions given on the label affixed to the inside of the fuel filler flap.
3. Use the retaining clip to keep the filler cap out of the way whilst fuelling.

WARNINGS

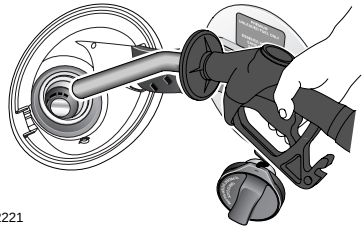
Open the fuel filler cap slowly and allow the pressure to release before fully removing the cap to avoid fuel spillage due to rapid expansion.

WARNINGS

Take note of all warnings and instructions given on the label affixed to the inside of the filler flap. Failure to do so may result in injury or death.

REFUELLING

Fuel filler



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WARNINGS

When refuelling ensure that all windows, doors, and sunroof are fully closed, particularly if young children or animals are in the vehicle. Fuel vapour contains harmful chemical compounds, some of which may cause cancer.

Do not attempt to fill the tank to its maximum capacity. If the vehicle is to be parked on a slope, in direct sunlight, or high ambient temperature, expansion of the fuel could cause spillage. Filling station pumps are equipped with automatic cut-off sensing to avoid fuel spillage. Fill the tank slowly until the filler nozzle automatically cuts-off the supply. Do not attempt to fill the tank beyond this point.

CAUTIONS

Ensure that you check the fuel pump information carefully to ensure that you are putting the correct fuel into the vehicle. Filling a vehicle with the incorrect fuel can cause serious engine and fuel system damage.

If the vehicle is filled with incorrect fuel it is essential that you seek qualified assistance before you start the engine. Running the engine can cause serious engine and fuel system damage.

Note: *Filling station pumps used for diesel commercial vehicles deliver fuel at a higher rate than normal. The higher fill rate can cause premature cut-off, and may cause fuel spillage. Therefore it is recommended that only standard light vehicle pumps are used.*

TECHNICAL SPECIFICATIONS

Fuel consumption

Fuel consumption figures

Variant	Urban	Extra-urban	Combined	CO2 emissions
	l/100 km (mpg)	l/100 km (mpg)	l/100 km (mpg)	g/km
Petrol	15.8 l/100 km (17.9 mpg)	8.6 l/100 km (33 mpg)	11.2 l/100 km (25.2 mpg)	265 g/km
Diesel Manual gearbox	9.2 l/100 km (30.6 mpg)	6.2 l/100 km (45.5 mpg)	7.5 l/100 km (37.7 mpg)	194 g/km

Fuel specification

Petrol	Diesel
91-98 RON	EN 590

For additional information on fuel consumption figures and exhaust emissions, visit the Vehicle Certification Agency (VCA) website at **http://www.vcacarfueldata.org.uk/**.

GENERAL INFORMATION

Weights and load capacities

Note: *It is the driver's responsibility to ensure that the maximum weights are not exceeded, and that the load is distributed correctly within the vehicle.*

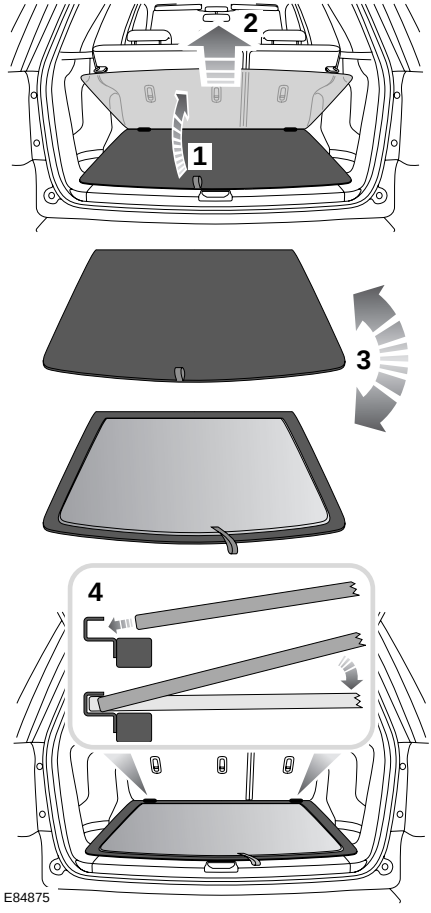
Information and values for the maximum weights can be found in the Weights section. See **WEIGHTS** (page 212).

Loadspace floor

WARNING

When removing or replacing the loadspace floor take care that your hands and fingers are placed so that they do not become trapped between the floor and vehicle. Ensure that children are kept at a safe distance to avoid accidental injury.

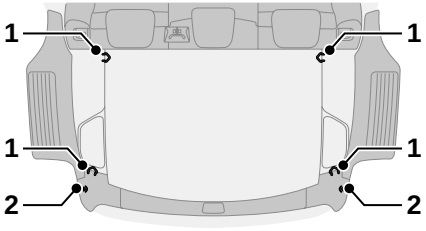
The loadspace floor is reversible to prevent damage/staining of the carpet when transporting muddy boots or wet dogs for example.

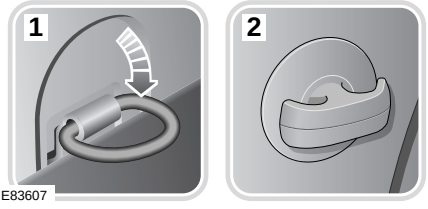


To reverse the loadspace floor :-

1. Raise the loadspace floor.
2. Pull the floor towards the rear of the vehicle, and remove it from the vehicle.
3. Turn the floor over so that the required surface is uppermost.
4. Insert the forward edge of the floor into the retaining channel, and lower the floor into position.

LUGGAGE ANCHOR POINTS





WARNINGS

All items carried in the luggage area should be properly secured. Loose items can cause serious injury or death in the event of an accident or sudden manoeuvre.

Do not use the bag hooks to secure heavy items. Items which are not properly secured can cause serious injury or death during an accident or sudden manoeuvre.

1. Load securing rings.
   - Four load securing rings are provided in the rear luggage area to assist in safely securing items carried.
2. Bag hooks.
   - A bag hook is provided on each side of the load area. These should be used to secure relatively light items such as shopping bags.

Note: *A range of approved luggage retention accessories are available from your Land Rover Dealer/Authorised Repairer.*

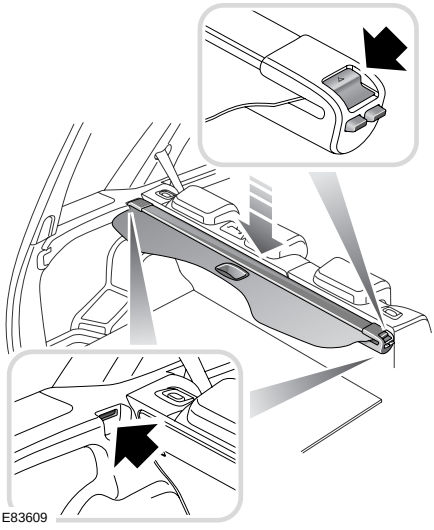
Reversible floor

The luggage compartment floor has been designed with two load surfaces. A carpeted side, which can be used in the normal way, and a hard, wipe clean surface. The hard surface can be used when transporting items which are wet, dirty, or may damage the carpeted surface.

To change between the two surfaces simply remove the floor panel and reinstall it with the required surface facing upwards.

LUGGAGE COVERS

Fitting the luggage cover



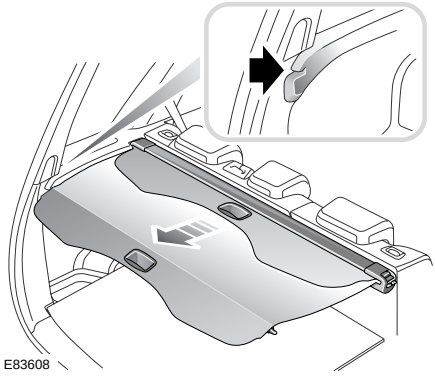
WARNING

When fitting the luggage cover ensure that the location pegs on the left-hand side are fully engaged, and the release button on the right-hand side is fully home. Failure to do so may allow the luggage cover to move during an accident or sudden manoeuvre.

1. Insert the location peg on the left-hand end of the luggage cover into the slot.
2. Lower the right-hand end into position by pulling back the release button.
3. Ensure that when the cover is in position the release button returns to its engaged position.

Reverse the installation procedure to remove the luggage cover.

Operating the luggage cover



WARNING

Never place objects on top of the luggage cover. During an accident or sudden manoeuvre loose objects can cause serious injury or death.

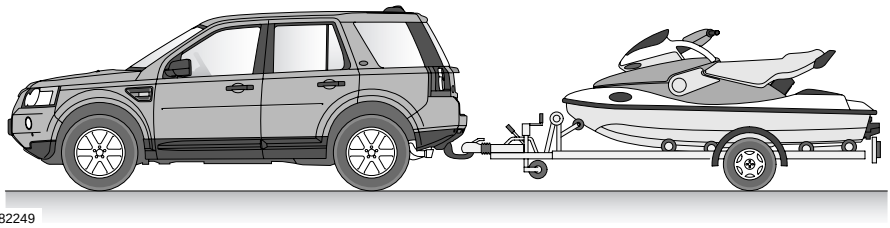
CAUTIONS

When retracting the cover, ensure that no items are on top of the cover. Items left on top of the cover, paper or fabrics for example, may be drawn into the mechanism and cause it to jam.

If the cover is damaged in any way, it should not be used. The damaged area may prevent the cover from operating correctly.

1. Pull the luggage cover blind towards the rear of the vehicle.
2. Engage the end pegs into the recesses provided in the luggage space side trims.

TOWING A TRAILER



WARNINGS

Never exceed the maximum weights for either the vehicle, or the trailer. Doing so can cause accelerated wear and damage to the vehicle. It can also adversely affect vehicle stability and braking, which in turn can lead to loss of control and increased braking distance resulting in a rollover or crash.

To preserve handling and stability, only fit Land Rover approved towing accessories.

Never use towing eyes, or lashing points to tow a trailer. They have not been designed for this purpose, and doing so may cause them to fail resulting in injury or death.

Note: *It is the driver's responsibility to ensure that the towing vehicle, and the trailer are being used correctly, and in accordance with manufacturers recommendations and any applicable legislation.*

Trailer electrical connection

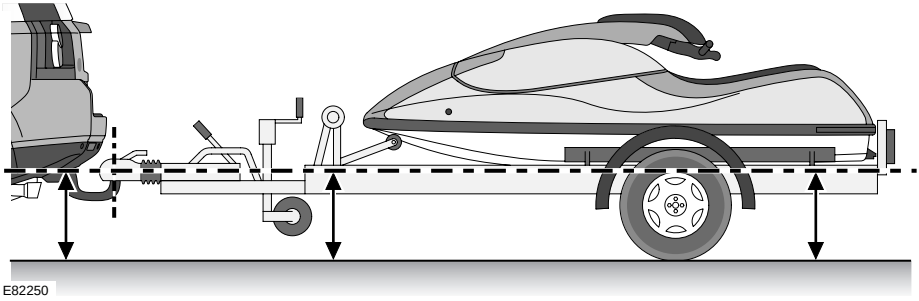
CAUTION

Only connect approved electrical circuits, which are in good condition to the trailer socket. Connecting incorrect, or faulty circuits may seriously damage the vehicle's electrical circuits.

Note: *The rear parking sensors are automatically disabled when the trailer electrical connection is made.*

The vehicle's electrical system has been designed to support all towing requirements, and comply with legal requirements for the specific territory in which the vehicle is first sold.

LEVELLING



To maintain vehicle stability, it is essential that the trailer is loaded so that it remains parallel to the ground. This is particularly important when towing twin axled trailers.

ESSENTIAL TOWING CHECKS

- The trailer should be parallel to the ground when loaded.
- When calculating the laden weight of the trailer remember to include the weight of the trailer, plus the weight of the load.
- If the load can be divided between the vehicle and trailer, loading more weight into the vehicle will generally improve stability. Do not exceed the vehicle's weight limits. See **WEIGHTS** (page 212).
- Ensure that all applicable regulations and legislation are complied with when loading and towing a trailer.
- Increase rear tyre pressures of the towing vehicle to those for maximum vehicle loading conditions. See **WEIGHTS** (page 212).
- Ensure trailer tyre pressures are set to trailer manufacturer's recommendations.
- If the vehicle is loaded to maximum Gross Vehicle Weight (GVW) the nose weight is limited to 150 kg (330 lbs).
- If it is necessary to increase the nose weight, up to a maximum of 250 kg (550 lbs) the vehicle load should be reduced accordingly. This ensures that the GVW, and maximum rear axle load are not exceeded.
- Ensure that a suitable breakaway cable or secondary coupling is used. Refer to the trailer manufacturer's instructions for guidance.
- Ensure that the tow ball is secure.
- Check the operation of all trailer lights.

WARNING

Do not loop the breakaway cable over the tow ball as it may slide off.

RECOMMENDED TOWING WEIGHTS

Maximum permissible towing weights	On-road	Off-road
Unbraked trailers	750 kg (1650 lbs)	750 kg (1650 lbs)
Trailers with overrun brakes	2000 kg (4400 lbs)	750 kg (1650 lbs)
Nose weight	150 kg (330 lbs)	150 kg (330 lbs)

WARNING

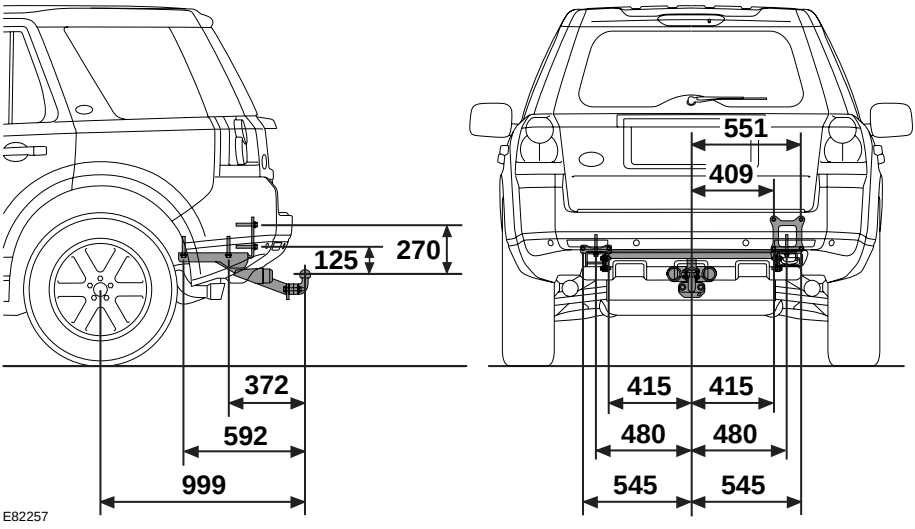
Do not exceed the Gross Vehicle Weight (GVW), maximum rear axle weight, maximum trailer weight, or nose weight. Exceeding any of these limits could cause instability and loss of control. See **WEIGHTS** (page 212).

Note: *When towing the maximum permissible gross vehicle weight can be increased by a maximum of 100 kg (220 lbs) provided that the road speed is limited to 100 km/h (60 mph).*

Note: *When calculating rear axle loading, remember that the trailer nose weight, the load in the vehicle's luggage area, weight on the roof rack, and the weight of rear seat passengers must all be added together.*

TOW BAR

Tow bar dimensions and mounting points



Note: *Dimensions given are in millimetres.*

CLEANING THE ALLOY WHEELS

CAUTION

Do not use non-approved, or acid based wheel cleaners. These can damage the wheel coating which may lead to corrosion of the wheel rims.

Wash the wheels with soap and water, this should be done more frequently when the wheels are exposed to heavy dirt deposits, salt, clay etc. If you are unsure how often to clean the wheels in particular conditions, seek advice from your Land Rover Dealer/Authorised Repairer.

Land Rover approved wheel cleaner should be used to remove heavy soiling.

CLEANING THE EXTERIOR

E79400

CAUTIONS

Some high pressure cleaning systems are sufficiently powerful to penetrate door/window seals, and damage trim and door locks. Never aim the water jet directly at the engine air intake, heater air intakes, body seals (doors, sunroof, windows etc) or at any components which may be damaged (lights, mirrors, exterior trim etc).

CAUTIONS

Do not use a power wash system in the engine bay area as it may damage fragile components, electrical systems etc.

Ensure that you read and comply with all warnings and instructions supplied with any cleaning products.

Never use cleaning products which are not approved for use on vehicles.

Washing the vehicle

CAUTION

Substances which are corrosive, such as bird droppings, tree resin, dead insects, tar spots, road salt, and industrial fall out, can damage the vehicle's paintwork. Any such deposits should be removed as soon as possible to prevent damage to the vehicle's paintwork.

Remove heavy deposits of mud and dirt with a hose before washing the vehicle.

Wash the vehicle frequently using a sponge and generous quantities of cold or luke warm water containing a suitable car shampoo. Rinse thoroughly, and dry with a chamois leather, or synthetic substitute.

Removing tar spots

Use white spirit to remove tar spots and stubborn grease stains from paintwork. Ensure that after using white spirit, the area is washed immediately with soapy water to remove all traces of spirit.

Underbody maintenance

Corrosive materials used on highways to control snow and ice, as well as accumulations from off-road driving or wading in salt water, can collect on the vehicle's underbody. If these materials are not removed accelerated corrosion can occur. Regularly flush the underbody with plain water, and pay particular attention to areas where mud and debris collect.

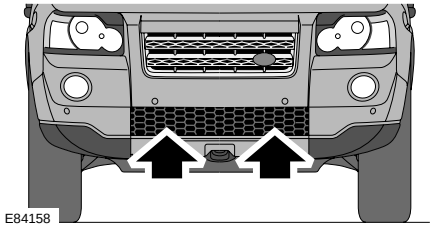
If damage or corrosion are detected, have the vehicle checked by a Land Rover Dealer/Authorised Repairer as soon as possible.

Glass and mirrors

The rear screen, and mirror glass' should only be cleaned using soapy water and a soft cloth. This will avoid damaging the reflective surface of the mirror, and the heating elements and antenna in the rear screen.

Never use abrasive cleaning products, or metal ice scrapers on the mirrors or the front/rear screens.

Cleaning after off-road driving



CAUTION

Ensure that the areas around air intakes and the front grille are clean and clear of debris. Pay particular attention to the lower grille and radiator. Failure to do so may cause the engine to overheat, leading to severe engine damage.

Ensure that the vehicle underside is cleaned as soon as possible after driving off-road. Further information on cleaning after off-road use is available in the off-road driving handbook. This can be found on-line at **http://www.ownerinfo.landrover.com**.

CLEANING THE INTERIOR

WARNING

Ensure that you read all of the information and instructions for use provided with cleaning products. Some products contain substances that are harmful and can cause health problems if used incorrectly.

CAUTION

Some products, if used incorrectly can cause damage to the interior surfaces of the vehicle.

Plastic and cloth

WARNING

Do not polish the instrument panel. Polished surfaces are reflective, and may interfere with the drivers view.

Clean plastic or cloth faced surfaces with warm water and non-detergent soap. Then wipe clean with a soft cloth.

Leather

CAUTIONS

Only use cleaning products specifically designed for use on leather. Do not use chemical, alcohol, or abrasive materials, as they will cause rapid deterioration of the leather. The use of products which are not approved will invalidate your warranty.

CAUTIONS

If you are in any doubt as to which products to use, consult your Land Rover Dealer/Approved repairer.

Leather should be cleaned and protected at least every six months.

Land Rover recommend the use of leather cleaning kit BAC500490. Use only in accordance with the instructions.

Note: *Some materials/fabrics are prone to dye transfer, which can cause unsightly discolouration of lighter coloured leathers. Affected areas should be cleaned and re-protected as soon as possible.*

Carpets and fabrics

Only clean with a dilute solution of an approved upholstery cleaner. It is advisable to test all cleaners on a concealed area before use.

Instrument pack, clock, and audio equipment

Only use a soft dry cloth to clean the instrument pack, clock, and audio equipment. Do not use cleaning fluids or sprays.

Seat belts

WARNING

Do not allow any water, cleaning products, or fabric from cloths to enter the seat belt mechanism. Any substance which enters the mechanism may affect the performance of the seat belt in an impact.

Extend the seat belts fully, then use warm water and a non-detergent soap to clean. Allow the seat belts to dry naturally whilst fully extended.

Note: *Whilst cleaning the seat belt, take the opportunity to examine the webbing for damage/wear. Any wear or damage should be reported to, and rectified by, a Land Rover Dealer/Approved repairer.*

Airbag module covers

WARNINGS

Airbag covers should only be cleaned using a slightly dampened cloth, and a small amount of upholstery cleaner.

Do not allow the airbag covers, or surrounding areas, to become contaminated with liquids. Any substance which enters the mechanism can prevent correct deployment of an airbag during an impact.

REPAIRING MINOR PAINT DAMAGE

Regularly inspect the paintwork for damage. Any stone chips, fractures, or deep scratches, in the paint/bodywork should be repaired promptly. Bare metal will corrode quickly, and if left untreated can result in expensive repairs.

Minor chips and scratches can be touched up using materials and advice available from a Land Rover Dealer/Authorised Repairer. Larger areas of damage will require professional repair, and you should consult a Land Rover Dealer/Authorised Repairer.

GENERAL INFORMATION

Regular systematic maintenance is the key to ensuring the continued reliability and efficiency of your vehicle.

Maintenance is the owner's responsibility and you must ensure that owner maintenance operations, oil services, inspections and brake fluid and coolant changes are carried out when required and according to the manufacturer's recommendations.

The routine maintenance requirements for your vehicle are shown in the Service Portfolio book. Most of this necessary workshop maintenance requires specialised knowledge and equipment, and should preferably be entrusted to a Land Rover Dealer/Authorised Repairer.

Service intervals

On vehicles fitted with a message centre, an upcoming service interval will be notified to the driver in one of two ways. As a distance left to travel, or a number of days remaining. Once the distance or time are exceeded the display will show a negative value (-) to indicate that a service is overdue.

When the ignition is turned on the Odometer display will show the service information for five seconds.

E86516

1. Distance to service.
2. Distance by which service is overdue.

E86517

1. Number of days to service.
2. Number of days by which service is overdue.

One or both types of service interval (distance and time) may be displayed. For example, if an engine oil service is due based on mileage, and a brake fluid change is due based on time, both distance and time countdowns will display.

Service Portfolio

The Service Portfolio book includes a Service Record section, which enables a record to be kept of all the servicing and inspections that are carried out on the vehicle. This section of the book also has an area for brake fluid changes to be recorded.

Ensure your service provider signs and stamps the book after each service and inspection.

Owner Maintenance

CAUTION

Any significant or sudden drop in fluid levels, or uneven tyre wear, should be reported to a qualified technician without delay.

In addition to the routine maintenance, a number of simple checks must be carried out more frequently. Advice is given on the pages that follow.

Daily checks

- Operation of lamps, horn, direction indicators, wipers, washers and warning indicators.
- Operation of seat belts and brakes.
- Look for fluid deposits underneath the vehicle that might indicate a leak.

Weekly checks

- Engine oil level. See **ENGINE OIL CHECK** (page 162).
- Engine coolant check. See **ENGINE COOLANT CHECK** (page 163).
- Brake/clutch fluid level. See **BRAKE AND CLUTCH FLUID CHECK** (page 165).
- Power steering fluid level. See **POWER STEERING FLUID CHECK** (page 166).
- Screen washer fluid level. See **WASHER FLUID CHECK** (page 167).
- Tyre pressures and condition.
- Operate air conditioning.

Note: *The engine oil level should be checked more frequently if the vehicle is driven for prolonged periods at high speeds.*

Driving in arduous conditions

When a vehicle is operated in extremely arduous conditions, more frequent attention must be paid to servicing requirements.

For example, if your vehicle experiences deep wading conditions, even daily servicing could be necessary to ensure the continued safe and reliable operation of the vehicle.

Arduous driving conditions include:

- Driving in dusty and/or sandy conditions.
- Driving on rough and/or muddy roads and/or wading.
- Driving in extremely hot conditions.
- Towing a trailer or driving in mountainous conditions.

Contact a Land Rover Dealer/Authorised Repairer for advice.

Emission control

Your vehicle is fitted with various items of emission and evaporative control equipment, designed to meet specific territorial requirements. You should be aware that unauthorised replacement, modification or tampering with this equipment by an owner or repair shop, may be unlawful and subject to legal penalties.

In addition, engine settings must not be tampered with. These have been established to ensure that your vehicle complies with stringent exhaust emission regulations. Incorrect engine settings may adversely affect exhaust emissions, engine performance and fuel consumption. They may also cause high temperatures, which will result in damage to the catalytic converter and the vehicle.

Road testing dynamometers (rolling roads)

Because your vehicle is equipped with anti-lock brakes and four wheel drive, it is essential that any dynamometer testing is carried out only by a qualified person, familiar with the dynamometer testing and safety procedures practised by Land Rover Dealers/Authorised Repairers.

Safety in the garage

WARNINGS

If the vehicle has been driven recently, do not touch exhaust and cooling system components until the engine has cooled.

Never leave the engine running in an unventilated area - exhaust gases are poisonous and extremely dangerous.

Do not work beneath the vehicle with the wheel changing jack as the only means of support.

Keep your hands and clothing away from drive belts and pulleys.

Remove metal wrist bands and jewellery, before working in the engine compartment.

Do not touch electrical leads or components while the engine is running, or with the starter switch turned on.

WARNINGS

Do not allow tools or metal parts of the vehicle to make contact with the battery leads or terminals.

Fuel system

WARNINGS

Under no circumstances should any part of the fuel system be dismantled or replaced by anyone other than a suitably qualified vehicle technician. Failure to comply with this instruction, may result in fuel spillage with a consequent serious risk of fire.

Ensure sparks and naked lights are kept away from the engine compartment.

Wear protective clothing, including, where practicable, gloves made from an impervious material.

Poisonous fluids

Fluids used in motor vehicles are poisonous and should not be consumed or brought into contact with open wounds. These include; battery acid, antifreeze, brake, clutch and power steering fluid, petrol, diesel, engine oil and windscreen washer additives.

For your own safety, always read and obey all instructions printed on labels and containers.

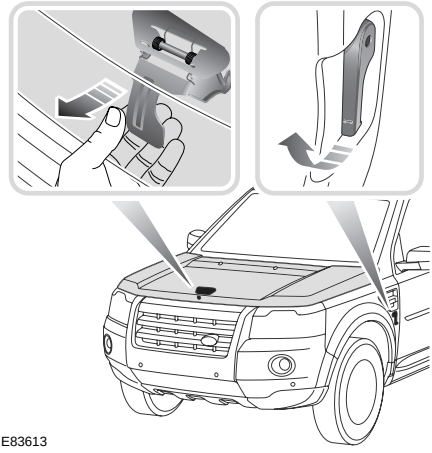
Used engine oil

Prolonged contact with engine oil may cause serious skin disorders, including dermatitis and cancer of the skin. Always wash thoroughly after contact.

It is illegal to pollute drains, water courses or soil. Use authorised waste disposal sites to dispose of used oil and toxic chemicals.

OPENING AND CLOSING THE BONNET

Opening the bonnet



E83613

1. Pull the bonnet release handle located on the left-hand side of the vehicle.
2. Lift the bonnet safety catch lever located below the centre point of the words LAND ROVER, and raise the bonnet.

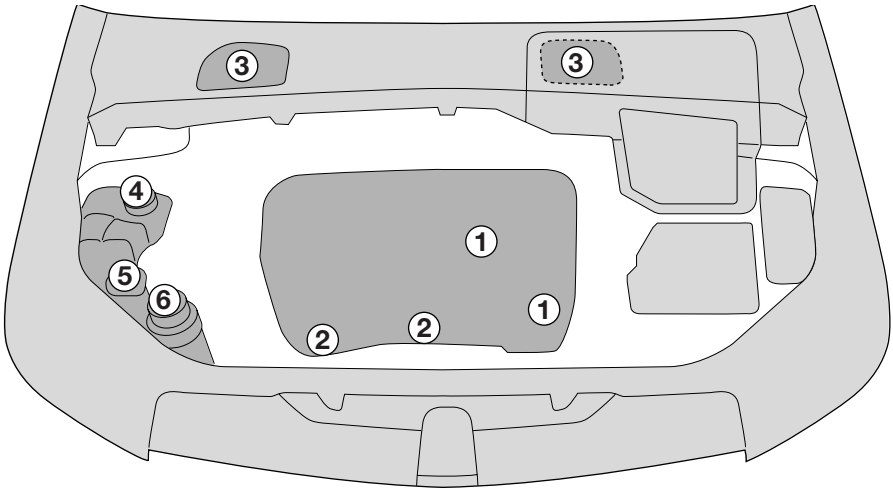
Closing the bonnet

WARNING

Do not drive with the bonnet retained by the safety catch alone.

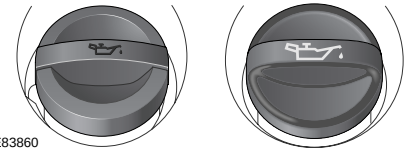
1. Lower the bonnet until the safety catch engages. Using both hands, press the bonnet down until the catches click.
2. Check that both catches are fully engaged by attempting to lift the front edge of the bonnet. This should be free from all movement.

ENGINE COMPARTMENT OVERVIEW



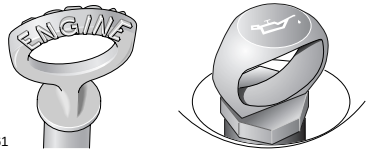
E83614

1. Engine oil filler caps (Black)



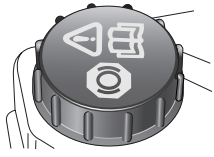
E83860

2. Engine oil dipsticks (Yellow)



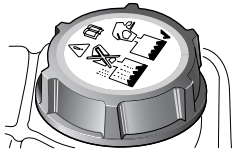
E83861

3. Brake fluid reservoir cap (Black)



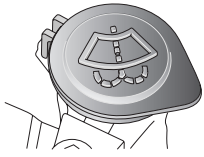
E83862

4. Coolant reservoir cap (Black)



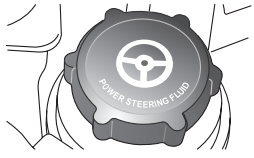
E83863

5. Washer fluid reservoir cap (Blue)



E83864

6. Power steering fluid reservoir cap (Black)



E83865

WARNINGS

While working in the engine compartment, always observe the safety precautions listed under Safety in the garage. See **GENERAL INFORMATION** (page 157).

Do not drive the vehicle if there is a possibility that leaked fluid will come into contact with a hot surface, such as the exhaust. A resulting fire may cause death or serious injury.

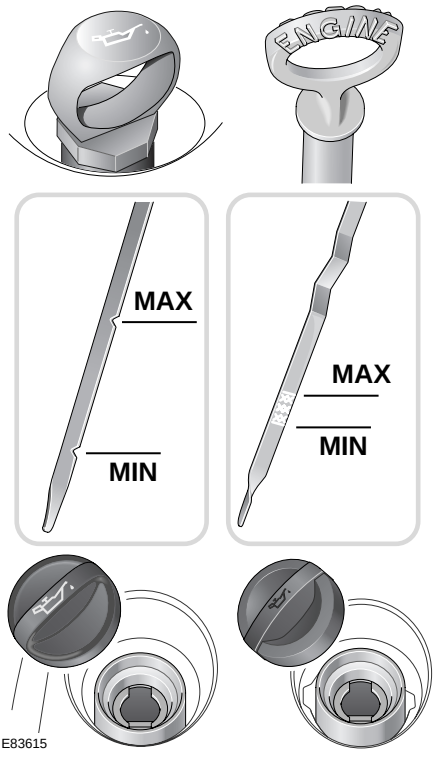
ENGINE OIL CHECK

The oil consumption of an engine is influenced by many factors. Under high loads an engine will consume more oil than usual. Diesel engines consume slightly more oil than petrol engines.

Check the oil level weekly, when the engine is cold and with the vehicle resting on level ground.

Checking the oil level

Note: *If it is necessary to check the oil level when the engine is hot, switch off the engine and let the vehicle stand for five minutes to allow the oil to drain back into the sump. Do not start the engine.*



1. Withdraw the dipstick and wipe the blade clean with a lint free cloth.
2. Fully re-insert the dipstick and withdraw again to check the oil level. Never allow the oil level to fall below the lower mark or notch on the dipstick.

As a general guide, if the level on the dipstick:

- Is nearer to the upper mark or notch than the lower, add no oil.
- Is nearer to the lower mark or notch than the upper, add half a litre (one pint) of oil.
- Is below the lower mark or notch, add one litre (two pints) of oil and re-check the level after a further five minutes.

Topping up the oil

CAUTIONS

Your vehicle warranty may be invalidated if damage is caused by using oil that does not meet the required specification.

Failure to use an oil that meets the required specification could cause excessive engine wear, a build up of sludge and deposits, and increase pollution. It could also lead to engine failure.

Overfilling with oil could result in severe engine damage. Oil should be added in small quantities and the level re-checked to ensure that the engine is not overfilled.

1. Unscrew the oil filler cap.
2. Add oil to maintain the level between the **MIN** and **MAX** marks or notches on the dipstick. Clean up any oil spilled during topping-up.
3. Check the oil level again after 5 minutes.

It is essential to use the correct specification oil, and to ensure it is suitable for the climatic conditions in which the vehicle is to be operated.

Note: *The approximate quantity of oil required to raise the level from **MIN** to **MAX** on the dipstick is 0.8 litres (1.4 pints) - petrol models or 1.5 litres (2.6 pints) - diesel models.*

Engine oil specification

Model	Specification
Petrol engine	Use only 0W-30 engine oil, meeting ACEA A5 or B5 specification.
Diesel engine	Use only 5W-30 oil meeting Ford 913-B specification.

Land Rover recommends Castrol oils.

ENGINE COOLANT CHECK

If the quantity of fluid in the coolant reservoir drops below the recommended level, an amber warning indicator in the instrument pack will illuminate. Stop the vehicle and check the coolant level.

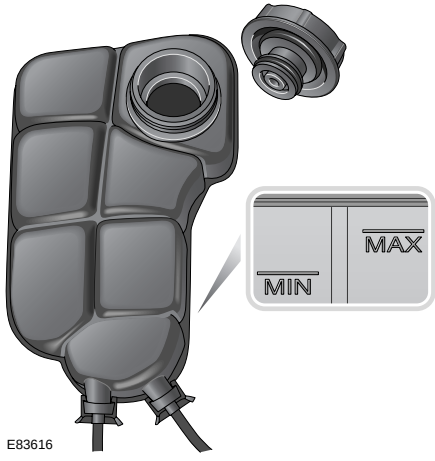
On vehicles with a message centre, the message **LOW COOLANT LEVEL** or **COOLING SYSTEM FAULT MONITOR GAUGE** will be displayed in place of the warning indicator.

Checking the coolant level

CAUTION

Running the engine without coolant will cause serious engine damage.

The coolant level in the expansion tank should be checked at least weekly (more frequently in high mileage or arduous operating conditions). Always check the level when the system is cold.



Ensure the coolant level is maintained between the level indicator marks located on the side of the expansion tank.

If the level has fallen appreciably, suspect leakage or overheating and arrange for the vehicle to be examined by a qualified technician.

Topping up the coolant

WARNINGS

Never remove the filler cap when the engine is hot - escaping steam or scalding water could cause serious personal injury.

Avoid spilling antifreeze onto a hot engine - a fire may result.

Unscrew the filler cap slowly, allowing the pressure to escape before removing completely.

CAUTION

When travelling in territories where the water supply contains salt, always ensure you carry a supply of fresh (rain or distilled) water. Topping up with salt water will cause serious engine damage.

Top-up to the upper level indicator mark located on the side of the expansion tank. Use only a 50% mix of water and Texaco XLC antifreeze.

Note: *In an emergency - and only if the approved antifreeze is unavailable - top-up the cooling system with clean water, but be aware of the resultant reduction in frost protection. Do not top-up or refill with conventional antifreeze formulations. If in doubt consult a qualified technician.*

Ensure the cap is tightened fully after top-up is completed by turning the cap until the ratchet cap clicks.

Antifreeze

WARNINGS

Antifreeze is poisonous and can be fatal if swallowed - keep containers sealed and out of the reach of children. If accidental consumption is suspected, seek medical attention immediately.

If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water.

CAUTIONS

The use of non-approved antifreeze will have an adverse effect on the engine cooling system and therefore engine durability.

Antifreeze will damage painted surfaces; soak up any spillage with an absorbent cloth immediately and wash the area with a mixture of car shampoo and water.

Antifreeze contains important corrosion inhibitors. The antifreeze content of the coolant must be maintained at 50% ± 5% all year round (not just in cold conditions). To ensure that the anti-corrosion properties of the coolant are retained, the antifreeze content should be checked once a year and completely renewed every ten years, regardless of distance travelled. Failure to do so may cause corrosion of the radiator and engine components.

The specific gravity of a 50% antifreeze solution at 20°C (68°F) is 1.068 and protects against frost down to -40°C (-40°F).

BRAKE AND CLUTCH FLUID CHECK

WARNINGS

Brake fluid is highly toxic - keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately.

If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water.

Take care not to spill the fluid onto a hot engine - a fire may result.

Do not drive the vehicle with the fluid level below the **MIN** mark.

If the quantity of fluid in the brake/clutch reservoir drops below the recommended level, a red warning indicator in the instrument pack will illuminate or the message **CHECK BRAKE FLUID** will be displayed in the message centre.

Note: *If the warning indicator illuminates, or the message is displayed while the vehicle is being driven, stop the vehicle as soon as safety permits by gently applying the brakes.*

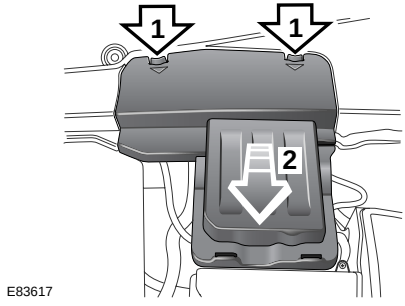
Check and top-up the fluid level if necessary.

Checking the fluid level

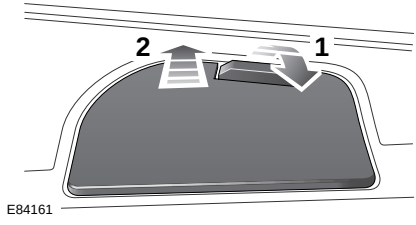
WARNING

Seek qualified assistance immediately if brake pedal travel is unusually long or if there is any significant loss of brake fluid. Driving under such conditions could result in extended stopping distances or complete brake failure.

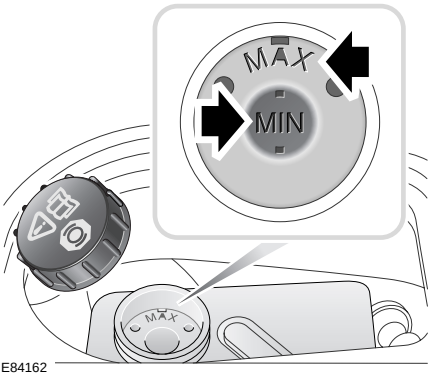
With the vehicle on level ground, check the fluid level at least every week (more frequently in high mileage or arduous operating conditions).



1. Release the two catches and lift the rear of the cover.
2. Slide the cover forward and lift it off completely.



1. Release the catch.
2. Remove the cover.



3. Clean the filler cap before removing to prevent dirt from entering the reservoir.
4. Remove the filler cap.
5. The brake fluid level should be between the **MIN** and the **MAX** marks.

The fluid level may drop slightly during normal use as a result of brake pad wear but should not be allowed to drop below the **MIN** mark.

Topping up the fluid

CAUTIONS

Brake fluid will damage painted surfaces. Soak up any spillage with an absorbent cloth immediately and wash the area with a mixture of car shampoo and water.

Only use new fluid from an airtight container (fluid from opened containers or fluid previously bled from the system will have absorbed moisture, which will adversely affect performance, and must not be used).

1. Top-up the reservoir to the **MAX** mark using Shell DOT4 ESL brake fluid. If Shell DOT4 ESL is not available, a low viscosity DOT4 brake fluid that meets ISO 4925 class 6 and Land Rover LRES22BF03 requirements may be used.
2. Replace the cap.
3. Fit the reservoir cover in the reverse order of removal.

POWER STEERING FLUID CHECK

WARNINGS

Power steering fluid is highly toxic. Keep containers sealed and out of reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately.

If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water.

Checking the fluid level

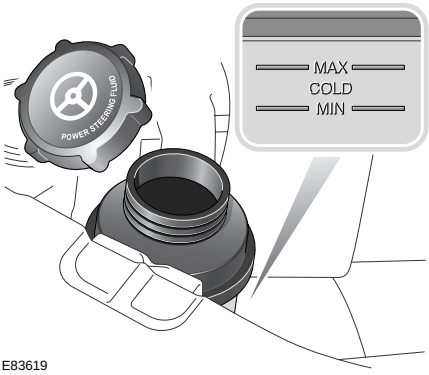
CAUTIONS

The engine must not be started if the fluid level has dropped below the **MIN** mark. Severe damage to the steering pump could result.

Seek qualified assistance immediately if there is a noticeable drop in the fluid level. Severe damage to the steering pump could result.

If fluid loss is slow, the reservoir may be topped-up to the upper level mark to enable the vehicle to be driven to a repair facility for examination. However, it is recommended that you seek qualified assistance before driving the vehicle.

Check and top-up the fluid with the vehicle on level ground, engine switched off, and the system cold. Ensure that the steering wheel is not turned after stopping the engine.



E83619

The level of fluid can be seen through the translucent body of the reservoir.

The fluid level should be between the **MIN** and the **MAX** marks.

Topping up the fluid

CAUTIONS

Power steering fluid will damage painted surfaces. Soak up any spillage with an absorbent cloth immediately and wash the area with a mixture of car shampoo and water.

Do not fill the reservoir above the **MAX** mark.

1. Clean the filler cap before removing to prevent dirt from entering the reservoir.
2. Remove filler cap.
3. Using Pentosin CHF202 fluid, top-up the reservoir until the fluid level is between the **MIN** and **MAX** marks.
4. Replace filler cap.

WASHER FLUID CHECK

WARNINGS

Some screen washer products are inflammable, particularly if high or undiluted concentrations are exposed to sparking. Do not allow screen washer fluid to come into contact with naked flames or sources of ignition.

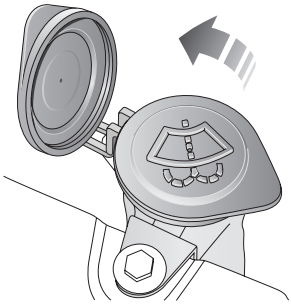
If the vehicle is operated in temperatures below 4°C (40°F), use a washer fluid with frost protection. In cold weather, failure to use a washer fluid with frost protection, could result in impaired vision and increase the risk of a vehicle crash.

CAUTIONS

Do not use an antifreeze or vinegar/water solution in the washer reservoir - antifreeze will damage painted surfaces, while vinegar can damage the windscreen washer pump.

Body panels may suffer discolouration as a result of screen washer fluid spillage. Take care to avoid spillage, particularly if an undiluted or high concentration is being used. If spillage occurs, wash the affected area immediately with water.

If the quantity of fluid remaining in the washer reservoir drops to less than one litre, an amber warning indicator in the instrument pack will illuminate or the message **LOW WASHER FLUID** will be displayed in the message centre.


E83620

The washer reservoir supplies both front and rear screen washer jets and headlamp washer jets.

Check and top-up the reservoir level at least every week. Always top-up with screen washer fluid to prevent freezing.

Operate the washer switches periodically to check that the nozzles are clear and properly directed.

Topping up the fluid

1. Clean the filler cap before removing to prevent dirt from entering the reservoir.
2. Remove filler cap.
3. Top-up the reservoir until the fluid is visible in the filler neck.
4. Replace filler cap.

Washer reservoir capacity

- Models without headlamp wash - 3.1 litres (5.45 pints).
- Models with headlamp wash - 5.8 litres (10.2 pints).

TECHNICAL SPECIFICATIONS

Lubricants and fluids

Part	Variant	Specification
Engine oil	Diesel vehicles	SAE 5W-30 meeting Ford 913-B specification.
Engine oil	Petrol vehicles	SAE 0W-30 meeting ACEA A5 or B5 specification.
Main gearbox oil	Manual transmission	Castrol MTF 97309
Main gearbox oil	Automatic transmission	Esso JWS3309US
Power transfer unit fluid	Diesel vehicles	Castrol BOT119
Power transfer unit fluid	Petrol vehicles	Castrol BOT118
Rear differential oil	All vehicles	Castrol EPX
Rear differential on demand coupler fluid	All vehicles	STAT OIL SL01-301
Power steering fluid	All vehicles	Pentosin CHF202 PAS fluid
Brake fluid	All vehicles	Shell DOT4 ESL [1]
Screen washer	All vehicles	Screen wash with frost protection
Coolant	All vehicles	50% mixture of Texaco XLC antifreeze and water.

[1] If Shell DOT4 ESL is not available, a low viscosity DOT4 brake fluid that meets ISO 4925 class 6 and Land Rover LRES22BF03 requirements may be used.

Capacities

Item	Variant	Capacity
Fuel tank	Diesel vehicles	68 litres (15 gallons)
	Petrol vehicles	70 litres (15.4 gallons)
Engine oil refill and filter change	Diesel vehicles	5.86 litres (10.31 pints)
	Petrol vehicles	7.7 litres (13.55 pints)
Engine oil **MIN** to **MAX** on dipstick	Diesel vehicles	1.5 litres (2.64 pints)
	Petrol vehicles	0.8 litres (1.4 pints)
Manual gearbox	All vehicles	2.0 litres (3.52 pints)
Automatic gearbox	All vehicles	7 litres (12.32 pints)
Power transfer unit	All vehicles	0.75 litres (1.32 pints)
Rear differential	All vehicles	0.7 litres (1.23 pints)
Rear differential coupling unit	All vehicles	0.65 litres (1.14 pints)
Washer reservoir	With headlamp wash	5.8 litres (10.2 pints)
Washer reservoir	Without headlamp wash	3.1 litres (5.45 pints)
Cooling system (fill from dry)	All vehicles	8.0 litres (14.07 pints)

The quoted capacities are approximate and provided as a guide only. All oil levels must be checked using the dipstick or level plugs as applicable.

BATTERY WARNING SYMBOLS

Do not allow any naked flames, or other sources of ignition near the battery as the battery may emit explosive gasses.

Ensure that when working near, or handling the battery, suitable eye protection is worn. This will reduce the risk of eye damage caused by acid splashes.

To prevent risk of injury, do not allow children near the battery.

Be aware that the battery may emit explosive gasses.

The battery contains acid which is extremely corrosive, and toxic.

BATTERY CARE

WARNINGS

Do not allow the battery electrolyte (fluid) come into contact with your skin or eyes. It is both corrosive and toxic, and the resulting injuries can be severe. If any electrolyte does come into contact with your skin or eyes, immediately rinse the affected area with clean, cold water. Immediate medical advice will be required.

If battery electrolyte comes into contact with your skin and/or clothes you should remove the affected clothing and flush the skin with copious amounts of water. Seek medical assistance immediately.

If battery electrolyte comes into contact with your eyes, flush with copious amounts of clean cold water. Seek medical assistance immediately, and continue to flush with water.

If swallowed, battery electrolyte can be fatal. If electrolyte is swallowed seek medical assistance immediately.

Do not connect any 12 volt equipment directly to the battery terminals. Doing so may cause a spark, which can result in an explosion.

The cell plugs and vent pipe must be in place at all times when the battery is connected to the vehicle. Ensure that the vent pipe is clear of obstructions and not kinked. Failure to do so may cause a pressure build up in the battery, resulting in an explosion.

Do not expose the battery to a naked flame or spark as the battery produces explosive, flammable gas.

Never jump start (boost) or charge, a frozen battery. Doing so can result in an explosion.

Vehicle battery

WARNINGS

Remove all metal jewellery before working on, or near, the battery, and never allow metal tools or vehicle components to come into contact with the battery terminals. Metal objects can cause sparks, and/or short circuits, resulting in an explosion.

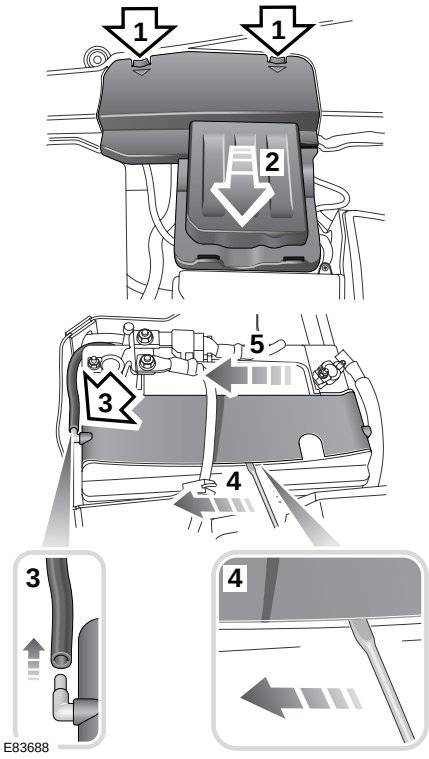
Do not allow the battery posts or terminals to come into contact with your skin. They contain lead, and lead compounds which are toxic. Always wash your hands thoroughly after handling the battery.

CAUTION

Do not allow battery electrolyte to come into contact with fabrics or painted surfaces. If battery electrolyte comes into contact with any surface, the surface should be washed down immediately with copious amounts of clean water. Battery electrolyte is both corrosive and toxic, and can damage a wide range of materials if left.

Your vehicle is fitted with a low maintenance battery.

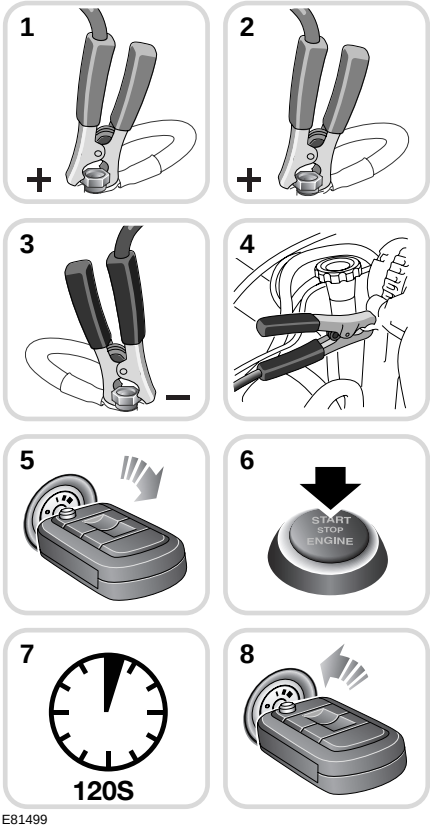
In hot climates more frequent checks of the battery electrolyte level and condition are required. If necessary, the battery cells can be topped up using distilled water.



1. Press the clips to release the back of the cover.
2. Slide the cover forward, and lift it off.
3. Disconnect the vent tube.
4. Prise up the inner cover using a screw driver blade or similar blunt implement. Run the screwdriver forward to release the inner cover edge.
5. Slide the inner cover out under the battery cable.

USING BOOSTER CABLES

Note: *Before connecting booster cables ensure that the battery connections on the disabled vehicle are correct, and that all electrical equipment has been switched off.*



E81499

1. Connect one end of the positive booster cable to the positive terminal on the donor vehicle's battery.
2. Connect the other end of the positive booster cable to the positive terminal on the disabled vehicle's battery.
3. Connect one end of the negative booster cable to the negative terminal on the donor vehicle's battery.
4. Connect the other end of the negative booster cable to a suitable earth point on the disabled vehicle. The earth point should be at least 0.5 metres (20 inches) away from the battery, and as far as possible from any fuel or brake pipes.
   - Check that all cables are clear of any moving components, and that all four connections are secure.
5. Start the engine of the donor vehicle, and allow it to idle for a few minutes.
6. Start the engine of the disabled vehicle.
7. Allow both vehicles to idle for two minutes.
8. Switch off the donor vehicle.

Disconnecting the cables

WARNING

To avoid serious injury use extreme caution when removing the booster cables as the engine will be running on the previously disabled vehicle. This means that you will be working close to components which are moving at high speed, carry high voltage, or may be hot.

Note: *Do not switch any electrical equipment on until after the cables have been disconnected.*

The engine should be running on the previously disabled vehicle, and the engine switched off on the donor vehicle. Disconnect the booster cables in the exact reverse order of that used for connection.

CHARGING THE VEHICLE BATTERY

WARNINGS

Ensure that the charger used is of the correct type and rating for the battery. Using an unsuitable charger may damage the battery, and could cause the battery to explode.

Always charge the battery in a well ventilated area away from any naked flames, sparks or other ignition sources. During charging the battery can produce a highly explosive and flammable gas.

CAUTIONS

The battery must be disconnected and removed from the vehicle before charging. Failure to do so could result in damage to the vehicle's electrical system.

Always follow the instructions supplied with the battery charger. Failure to do so may result in damage to the battery.

1. Disconnect the battery and remove it from the vehicle.
2. Connect the battery charger in accordance with the charger manufacturer's instructions.
3. Once the charge is complete switch off the power to the charger.
4. Disconnect the charger cables from the battery.
5. Allow the battery to stand for an hour before connecting to the vehicle. This will allow any explosive gasses to dissipate, and reduce the risk of explosion.

CHANGING THE VEHICLE BATTERY

Disconnecting

WARNINGS

Use caution when lifting the battery out of, or into, the vehicle. It is heavy, and may cause injury when lifting, or if dropped.

Do not tip the battery when lifting or moving as tilting the battery more than 45 degrees may damage the battery, and may cause the electrolyte to leak out. Battery electrolyte is highly corrosive, and toxic.

CAUTIONS

Do not rest the battery on any part of the vehicle as it may cause damage due to it's weight.

Do not run the engine with the battery disconnected. Doing so may damage the charging system.

1. Ensure that all electrical circuits are switched off, all windows are closed, and the alarm is disarmed.
2. Remove the remote control from the vehicle and wait two minutes to allow the systems to power down fully.
3. Undo the negative clamp, and lift the cable and clamp clear of the battery terminal.
4. Undo the positive clamp, and lift the cable and clamp clear of the battery terminal.
5. Undo the battery clamp and lift the battery clear of the vehicle.

Effects of disconnecting

Disconnecting the battery can affect a number of vehicle systems, especially if there is insufficient battery power prior to disconnection. For example, the alarm may trigger depending on it's state when the battery was disconnected. If the alarm does sound, use the remote control in the normal way to disarm the security system. The windows may need resetting to enable the one-shot feature to operate correctly. See **ELECTRIC WINDOWS** (page 93).

Replacement batteries

WARNING

Only fit a battery of the correct type and rating. Fitting an incorrect battery may result in a fire, or damage to the electrical system. If you are in any doubt when fitting a battery seek qualified assistance.

Battery disposal

Note: *Used batteries must be disposed of correctly as they contain a number of harmful substances. Seek advice on disposal from your Land Rover Dealer/Authorised Repairer, and/or your local authority.*

Refitting

WARNING

When refitting the battery ensure that no metal objects, or vehicle components, come into contact with the battery terminals. Metal objects can cause a spark or short circuit, both of which may result in an explosion.

CAUTIONS

Ensure that when fitting a battery to the vehicle, the terminals and battery clamps are clean, and lightly coated with petroleum jelly. This will ensure good electrical connections are made, and help to prevent corrosion.

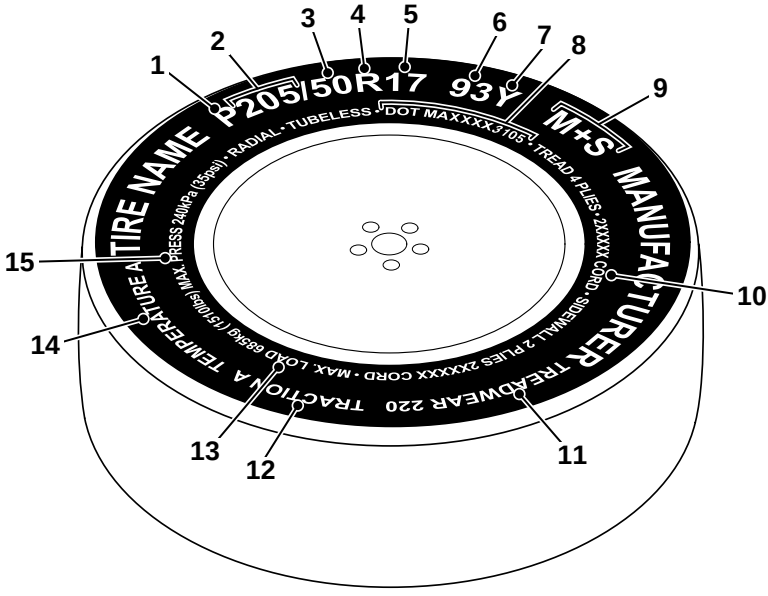
Always follow the battery manufacturers instructions. Failure to do so may result in damage to the vehicle and/or the electrical system.

A new battery should be supplied with plastic terminal covers. Leave the covers in place when fitting the battery, and remove them one at a time to fit the battery cable clamps.

Refitting is an exact reversal of the removal procedure. If you are in any doubt about fitting a battery seek qualified assistance before attempting to fit the battery.

GENERAL INFORMATION

Tyre markings



E80640

1. P indicates that the tyre is for passenger vehicle use.
2. The width of the tyre from sidewall edge to sidewall edge in millimetres.
3. The aspect ratio, also known as the profile, gives the sidewall height as a percentage of the tread width. So, if the tread width is 205 mm, and the aspect ratio is 50, the sidewall height will be 102 mm.
4. R indicates that the tyre is of Radial ply construction.
5. The diameter of the wheel rim given in inches.
6. The load index for the tyre. This index is not always shown.
7. The speed rating denotes the maximum speed at which the tyre should be used for extended periods. †
8. Tyre manufacturing standard information, which can be used for tyre recalls and other checking processes. Most of this information relates to the manufacturer, place of manufacture etc. The last four numbers are the date of manufacture. For example, if the number was 3106, the tyre was made in the 31st week of 2006.
9. M+S or M/S indicates that the tyre has been designed with some capability for mud and snow.

10. The number of plies in both the tread area, and the sidewall area, indicates how many layers of rubber coated material make up the structure of the tyre. Information is also provided on the type of materials used.
11. Wear rate indicator. A tyre rated at 400 for example, will last twice as long as a tyre rated at 200.
12. The traction rating grades a tyres performance when stopping on a wet road surface. The higher the grade the better the braking performance. The grades from highest to lowest are, AA, A, B, and C.
13. The maximum load which can be carried by the tyre.
14. Heat resistance grading. The tyre's resistance to heat is grade A, B, or C, with A indicating the greatest resistance to heat. This grading is provided for a correctly inflated tyre, which is being used within its speed and loading limits.
15. The maximum inflation pressure for the tyre. This pressure should not be used for normal driving. See **TECHNICAL SPECIFICATIONS** (page 194).

† Speed ratings

Rating	Speed kmh (mph)
Q	160 (99)
R	170 (106)
S	180 (112)
T	190 (118)
U	200 (124)
H	210 (130)
V	240 (149)
W	270 (168)
Y	300 (186)

TYRE CARE

WARNINGS

Defective tyres are dangerous. Do not drive the vehicle if a tyre is damaged, excessively worn, or incorrectly inflated. Doing so may lead to premature tyre failure.

Avoid contaminating the tyres with vehicle fluids as they may cause damage to the tyre.

Avoid spinning the wheels. The forces released can damage the structure of the tyre, and cause it to fail. Doing so may lead to premature tyre failure.

If wheel spin is unavoidable due to a loss of traction (in deep snow for example) do not exceed the 50 km/h (30 mph) point on the speedometer. Doing so may lead to premature tyre failure.

Note: *Tyre condition should be checked after the vehicle has been used off-road. As soon as the vehicle returns to a normal, hard, road surface stop the vehicle and check for damage to the tyres.*

All of the vehicle's tyres (including the spare) should be checked regularly for damage, wear and distortion. If you are in any doubt about the condition of a tyre, have it checked immediately by a tyre repair centre, or your Land Rover Dealer/Authorised repairer.

Tyre wear

Good driving practise will improve the mileage you obtain from your tyres, and avoid unnecessary damage.

- Always ensure that the tyre pressures are correctly adjusted.
- Always observe the posted speed limits, and advisory speeds for bends.
- Avoid pulling away quickly, or hard acceleration.
- Avoid making fast turns or braking sharply.
- Wherever possible, avoid potholes, or obstacles on the road.
- Do not drive up kerbs, or rub the tyres against them when parking.

Wear indicators

WARNING

Wear indicators show the minimum tread depth recommended by the manufacturers. Tyres which have worn to this point will have reduced grip and poor water displacement characteristics.

CAUTION

If tread wear is uneven across a tyre, or the tyre wears excessively, the vehicle should be checked by your Land Rover Dealer/Authorised Repairer as soon as possible.

E80236

When the tread has worn down to approximately 2 mm, wear indicators start to appear at the surface of the tread pattern. This produces a continuous band of rubber across the tread as a visual indicator.

To maintain performance and grip the tyre must be replaced as soon as the wear indicator becomes visible. Sooner, if legislation requires replacement at a greater tread depth.

Note: *Tread depth should be checked regularly, in some case more frequently than the service intervals. For advice on checking tyres contact your Land Rover Dealer/Authorised repairer, or a tyre dealer.*

Age degradation

Tyres degrade over time due to the effects of ultraviolet light, extreme temperatures, high loads, and environmental conditions. It is recommended that tyres are replaced at least every six years, but they may require replacement more frequently.

Land Rover recommends that even if unused, the spare tyre be replaced at the same time as the four road tyres.

Punctured tyres

WARNING

Do not drive the vehicle with a punctured tyre. Even if the punctured tyre has not deflated, it is unsafe to use as the tyre may deflate suddenly at any time. See **TYRE REPAIR KIT** (page 187).

Tyre checks

Not all punctures result in the tyre deflating immediately. Therefore, it is important to check the tyres for damage and foreign objects, regularly.

When driving, if a sudden vibration, or change to the vehicle's handling is noticed, reduce speed immediately. Do not brake hard, or make any sudden manoeuvres or direction changes. Drive slowly to an area off of the main highway and stop the vehicle.

Note: *Driving the vehicle to a safe area may cause damage to the punctured tyre, but occupant safety is far more important.*

Inspect the tyres for signs of punctures, damage, or under inflation. If any damage or deformity is detected, the tyre should be replaced. If a spare tyre is not available, then the vehicle should be recovered to a tyre repair centre, or Land Rover Dealer/Approved repairer.

Note: *The tyres should be checked immediately after any off-road use, and prior to using the vehicle on a public highway.*

Replacement tyres

WARNINGS

Do not fit cross-ply tyres.

Do not fit tubed tyres.

Do not swap tyres around the vehicle. Tyres bed in to the specific characteristics of each wheel position. Swapping them around may affect the vehicle's handling and traction.

Always fit replacement tyres of the same type, and wherever possible of the same make and tread pattern.

WARNINGS

Replacement wheels should be genuine Land Rover parts. This will maintain the designed driving characteristics both on and off road.

If the use of tyres not recommended by Land Rover is unavoidable, ensure that you read, and fully comply with the tyre manufacturers instructions. Failure to do so may lead to tyre failure due to incorrect fitment or use.

Ideally, tyres should be replaced in sets of four. If this is not possible, replace the tyres in pairs (front and rear). When tyres are replaced, the wheels should always be re-balanced, and alignment checked.

The correct tyre specification for your vehicle can be found on the tyre information label.

Directional tyres

Directional tyres are designed to operate correctly when rotating forwards (when the vehicle is travelling forwards).

Typical direction indicators

E80237

Tyre pressures

WARNINGS

Never drive your vehicle if the tyre pressures are incorrect. Under-inflation causes excessive flexing and uneven tyre wear. This can lead to sudden tyre failure. Over-inflation causes a harsh ride, uneven tyre wear and poor handling.

Pressure checks should only be carried out when the tyres are cold, and the vehicle has been stationary for more than three hours. A hot tyre at or below recommended cold inflation pressure is dangerously under-inflated.

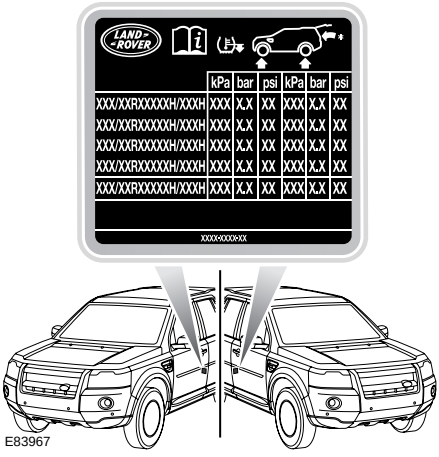
If the vehicle has been parked in strong sunlight, or used in high ambient temperatures do not reduce the tyre pressures. move the vehicle into the shade and allow the tyres to cool before re-checking the pressures.

Tyre pressures (including the spare) should be checked at least once a week with normal on-road use, but should be checked daily if the vehicle is used off-road. Always check the tyre pressures before setting off on a long journey.

Use a reliable gauge to check the pressures when the tyres are cold. Driving as short a distance as 3 km (1 mile) can warm the tyres up sufficiently to affect the tyre pressures.

If it is necessary to check tyre pressures when the tyres are warm, you should expect the pressures to have increased by up to 30 - 40 kpa (0.3 - 0.4 bar) (4 - 6 lbf/in^2). Do not reduce the tyre pressures to the cold inflation pressure under these circumstances. Allow the tyres to cool fully before adjusting the pressures.

Checking the tyre pressures



1. Tyre information label position on a left-hand drive vehicle.
2. Tyre information label position on a right-hand drive vehicle.

WARNING

Tyre pressures should be checked regularly using an accurate pressure gauge, when the tyres are cold. Failure to properly maintain your tyre pressures could increase the risk of tyre failure resulting in loss of vehicle control and personal injury.

The following procedure should be used to check and adjust the tyres pressures.

1. Remove the valve cap.
2. Firmly attach a tyre pressure gauge/inflator to the valve.
3. Read the tyre pressure from the gauge, and add air if required.
4. If air is added to the tyre, remove the gauge and re-attach it before reading the pressure. Failure to do so may result in an inaccurate reading.
5. If the tyre pressure is too high, remove the gauge and allow air out of the tyre by pressing the centre of the valve. Refit the gauge to the valve and check the pressure.
6. Repeat the process adding or removing air as required until the correct tyre pressure is reached.
7. Refit the valve cap.

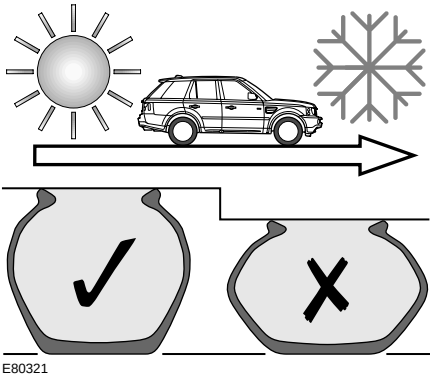
Note: *It is an offence in certain countries to drive a vehicle with incorrect tyre pressures.*

Note: *It is the driver's responsibility to ensure that the tyre pressures are correct.*

Tyre valves

Keep the valve caps screwed down firmly to prevent water or dirt entering the valve. Check the valves for leaks when checking the tyre pressures.

Pressure compensation for ambient temperature changes



E80321

If the ambient temperature drops, the tyre pressures will decrease, which may cause under inflation. This should be borne in mind when travelling to, or through, areas of lower temperature.

Under inflation causes the tyre side wall height to reduce, which in turn results in uneven tyre wear, and a risk of tyre failure.

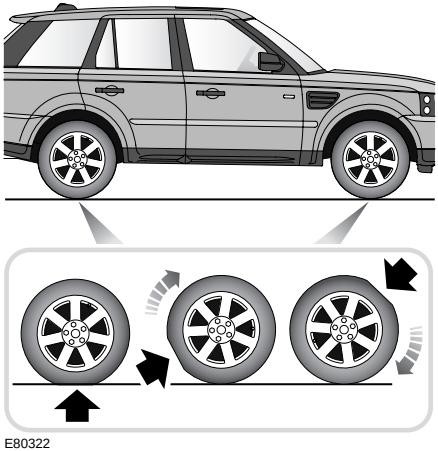
Tyre pressures may be adjusted before setting off on a journey to, or through, areas of low temperature. Alternatively, the tyre pressures can be adjusted when low temperature areas are reached.

Note: *If the tyre pressures are to be adjusted in the lower temperature area, the vehicle should be left standing for at least one hour prior to adjustment.*

Tyre pressures should be increased by 0.14 bar/14 kPa (2 lbf/in²) for each 10 °C (20 °F) temperature decrease.

Flat spots

If the vehicle is stationary for a long period when the ambient temperature is high, the tyres may form flat spots. When the vehicle is driven these flat spots will cause a vibration which will steadily disappear as the tyres warm up and regain their original shape.



E80322

In order to minimise flat spotting, the tyre pressures can be increased.

Tyre pressures should be increased by 0.14 bar/14 kPa (2 lbf/in²) for each 10 °C (20 °F) temperature increase above 20 °C (68 °F).

Long term storage

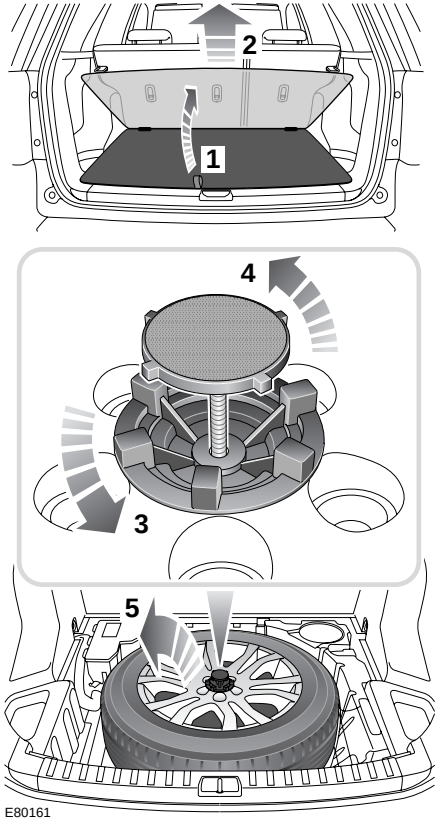
Flat spotting can be minimised during long term storage by increasing the tyre pressures to the maximum indicated on the tyre sidewall.

Note: *The tyre pressures should be reduced to the correct pressure before the vehicle is driven.*

USING WINTER TYRES

If winter tyres are fitted to the vehicle, the tyre manufacturers instructions should be followed. Pay particular attention to instructions regarding the maximum speed that the vehicle can be driven, and the correct pressures for the tyres.

CHANGING A ROAD WHEEL



E80161

To access the spare wheel and tool kit :-

1. Lift the floor panel.
2. Pull the floor panel towards the rear of the vehicle and remove it from the vehicle.
3. Slacken the spare wheel locking ring.
4. Undo and remove the retaining bolt.
5. Remove the spare wheel.
6. Remove the tool kit.

WARNINGS

The spare wheel is heavy and if handled incorrectly may cause injury. Use extreme caution when lifting or manoeuvring the wheels.

Always secure the spare wheel, or the removed wheel, in the correct position using the retaining bolt. Failure to do so may cause the spare wheel to move in the event of a sudden manouevre or accident, leading to death or serious injury.

Ensure that the floor panel is placed where it cannot fall and cause injury when it is removed from the vehicle.

When removing or replacing the floor panel ensure that fingers and hands are kept clear. Failure to do so may result in crush injuries.

Note: *When replacing the spare wheel ensure that the retaining bolt is screwed fully home before tightening the clamping ring.*

Wheel changing safety

Before raising the vehicle, or changing a wheel ensure that you read, and comply with the following warnings.

WARNINGS

Always find a safe place to stop, off of the highway and away from traffic.

Ensure that the vehicle is on firm level ground.

Disconnect trailer/caravan from vehicle.

Switch on the hazard warning lamps.

Ensure that all passengers, and animals, are out of the vehicle, and in a safe place away from the highway.

Place a warning triangle at a suitable distance behind the vehicle, facing towards oncoming traffic.

Ensure that the front wheels are in the straight ahead position, and engage the steering lock.

Apply the parking brake, and engage Park in vehicles fitted with an automatic transmission.

Apply the parking brake, and engage 1st or reverse gear in vehicles fitted with a manual transmission.

Ensure that the jack is on firm level ground.

Never place anything between the jack and the ground, or the jack and the vehicle.

Always chock the wheels using suitable wheel chocks. Place the chocks on both sides of the wheel diagonally opposite the wheel to be changed.

WARNINGS

If jacking the vehicle on a slight slope is unavoidable, place the chocks on the downhill side of the two opposite wheels.

Take care when lifting the spare wheel, and removing the punctured wheel. The wheels are heavy, and can cause injuries if not handled correctly.

Remove the spare wheel prior to jacking the vehicle. To avoid destabilising the vehicle when raised.

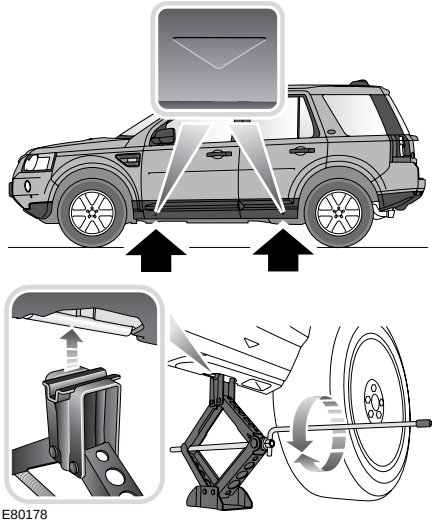
Take care when loosening the wheel nuts. The wheel brace may slip off if not properly attached, and the wheel nuts may give way suddenly. Either unexpected movement may cause an injury.

Positioning the jack

WARNINGS

Never work beneath the vehicle, or place any part of your body beneath the vehicle with the jack as the only means of support. Always use suitable vehicle support stands which are approved for the weight of the vehicle.

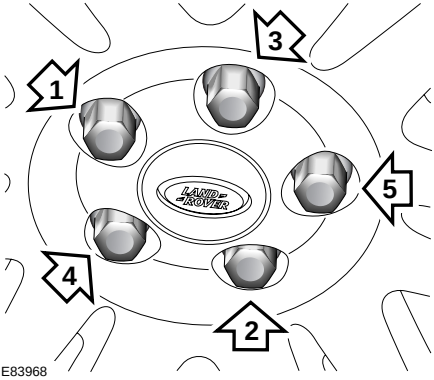
Ensure that the jack is correctly located onto the jacking point.



E80178

1. Read and observe the warnings in **Wheel changing safety**.
2. Loosen the wheel nuts half a turn (anti-clockwise).
3. Position the jack beneath the relevant jacking point.
4. Raise the vehicle using the jack with a slow steady operation. Avoid rapid, jerky actions as they may cause the vehicle/jack to become unstable.
5. Remove the wheel nuts and place them together where they cannot roll away.
6. Remove the wheel and place to one side. Do not lay the wheel on it's face, as this may damage the finish.
7. Re-fit the wheel nuts, and lightly tighten them. Ensure that the wheel is making contact with the hub evenly.
8. Ensure that the space under the vehicle is clear of obstructions, and lower the vehicle slowly and smoothly.
9. With all wheels on the ground and the jack removed, fully tighten the wheel nuts. The wheel nuts should be tightened in sequence to the correct torque of 133 Nm (98 lb.ft).
10. If an alloy spare wheel is to be fitted, using a suitable blunt tool, knock the centre cap out of the removed wheel. Using hand pressure only, press the centre cap into the newly fitted spare.
11. Check and adjust the tyre pressure as soon as possible.

Wheel nut tightening sequence



With all wheels on the ground and the jack removed, fully tighten the wheel nuts in the sequence shown to 133 Nm (98 lb.ft).

Note: *If it is not possible to torque the wheel nuts when a wheel is replaced, the wheel nuts should be set to the correct torque as soon as possible.*

Temporary spare wheel

WARNINGS

Please note the temporary spare warning label affixed to the wheel, and adhere to the instructions. Failure to comply with the instructions may result in incorrect use of the temporary spare wheel. Which may in turn cause vehicle instability and/or tyre failure.

Drive with caution while the temporary spare wheel is fitted, and ensure that an original size wheel and tyre are fitted as soon as possible.

Do not fit more than one temporary spare wheel.

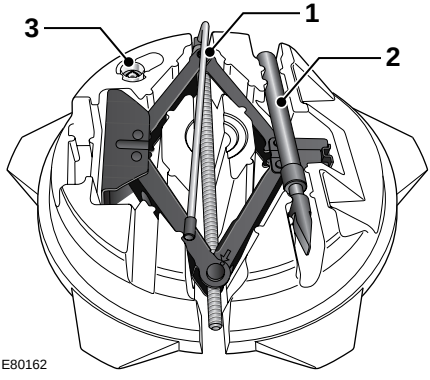
Do not exceed 80 km/h (50 mph) while the temporary spare wheel is fitted.

WARNINGS

DSC must be switched on while the temporary spare wheel is in use.

Tool kit

Tool kit contents



1. Jack.
2. Wheel brace.
3. Locking wheel nut adapter.

WARNING

After use the tool kit should be returned to the under floor storage area, and correctly stowed. Do not leave the tool kit, or it's components, loose in the storage area as they can prove hazardous during an impact or sudden manoeuvre.

Note: *The jack requires occasional maintenance. Examine the jack for wear, damage, or corrosion, and lubricate the moving parts.*

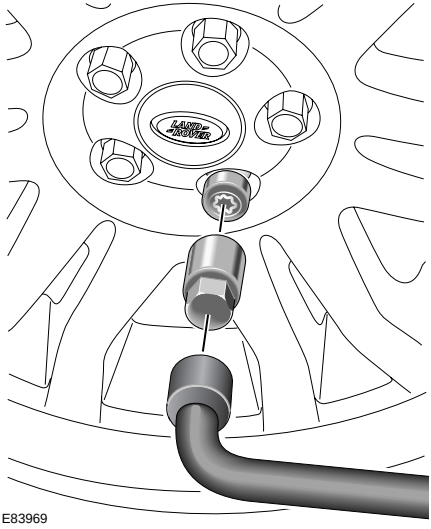
Locking wheel nuts

Locking wheel nuts can only be removed using the special adapter provided in the tool kit.

Note: *When the vehicle is first supplied the adapter may be stored in the glove compartment. It should be removed and stored in the tool kit as soon as possible.*

Note: *A code number is stamped onto the underside of the adapter. This number must be recorded on the security card supplied with the literature pack. If a replacement adapter is required you will be asked to quote this number. The security card must be kept safe, but should not be kept with the vehicle.*

Releasing locking wheel nuts



1. Insert the wheel nut adapter into the locking wheel nut ensuring that it is fully engaged.
2. Using the wheel brace, unscrew the wheel nut and adapter.

Note: *After use store the wheel nut adapter correctly in the tool kit.*

TYRE REPAIR KIT

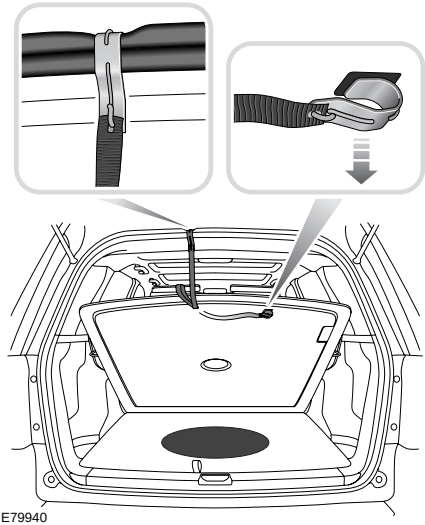
WARNINGS

⚠ To ensure vehicle safety, it is essential that you read and understand the following information. Failure to follow the instructions given here may lead to serious tyre damage, and may result in death or serious injury.

⚠ If you are in any doubt regarding your ability to carry out the instructions, contact your Land Rover Dealer/Approved repairer before attempting the repair.

Your vehicle may not be equipped with a spare tyre. If this is the case, in it's place you will find a Land Rover tyre repair kit. The Land Rover tyre repair kit can be used to repair one tyre, and it is essential that you read the following guide before attempting to repair a tyre.

The Land Rover tyre repair kit seals most punctures caused by nails, or similar items, with a maximum diameter of 6 mm (1/4 inch).


E79940

The tyre repair kit is located in the rear underfloor storage compartment.

Note: *The sealant used in the tyre repair kit has a shelf life, and the expiry date is shown on the top of the bottle. Ensure that the bottle is replaced before the expiry date.*

Land Rover tyre repair kit safety information

WARNINGS

Some tyre damage may only be partially sealed, or may not seal at all, depending on the amount and type of damage. Any loss of tyre pressure can seriously affect vehicle safety.

Do not use the tyre repair kit if the tyre has been damaged by driving while under inflated.

Only use the tyre repair kit to seal damage located within the tyre tread area.

WARNINGS

Do not use the tyre repair kit to seal damage to the tyre sidewall.

Do not exceed 80 km/h (50 mph) when a repaired tyre is fitted to the vehicle.

The maximum distance that should be driven when a repaired tyre is fitted, is 200km (125 miles).

When a repaired tyre is fitted, drive with caution and avoid sudden braking or steering manoeuvres.

Only use the tyre repair kit for the vehicle with which it was supplied.

Do not use the tyre repair kit for any other purpose than tyre repair.

Never leave the tyre repair kit unattended when in use.

Only use the tyre repair kit within the -30 °C to +70 °C temperature range.

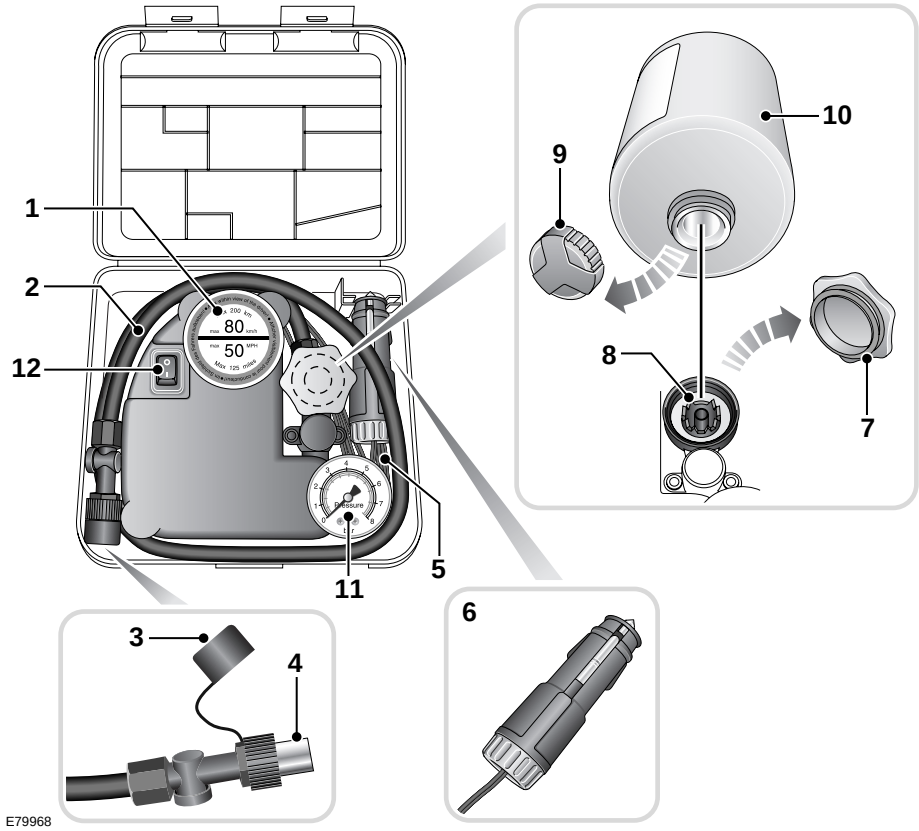
Alway keep children and animals at a safe distance from the tyre repair kit when in use.

Do not stand directly beside the compressor when it is operating.

Check the tyre sidewall prior to inflation. If any cracks, damage, or deformities are apparent do not inflate the tyre.

Watch the tyre sidewall during inflation. If any cracks, damage, or deformities are apparent switch off the compressor, and deflate the tyre.

Land Rover tyre repair kit



1. Maximum speed label. 80 km/h (50 mph).
2. Tyre inflation hose.
3. Inflation hose protective cap.
4. Inflation hose connector.
5. Compressor power cable.
6. Power cable connector.
7. Sealant bottle receiver cap (orange).
8. Sealant bottle receiver.
9. Sealant bottle cap.
10. Sealant bottle.
11. Tyre pressure gauge.
12. Compressor on/off switch. (I = on. 0 = off.)

Using the Land Rover tyre repair kit

WARNINGS

Avoid skin contact with the sealant which contains natural rubber latex.

Do not unscrew the sealant bottle from the receiver until it is empty, as sealant will leak out.

If the tyre inflation pressure does not reach 1.8 bar (26 lb/in²) within seven minutes, the tyre may have suffered excessive damage. A temporary repair will not be possible, and the vehicle should not be driven until the tyre has been replaced.

CAUTIONS

Before attempting a tyre repair, ensure that the vehicle is parked safely, as far away from passing traffic as possible.

Ensure that the parking brake is applied, and P is selected if an automatic transmission is fitted.

Do not attempt to remove foreign objects such as nails, screws, etc from the tyre.

Always run the engine when using the compressor, unless the vehicle is in an enclosed, or poorly ventilated space.

To prevent overheating do not operate the compressor continuously for longer than ten minutes.

Note: *All vehicle drivers and occupants should be made aware that a temporary repair has been made to a tyre fitted to the vehicle. They should also be made aware of the special driving conditions imposed when using a repaired tyre.*

Repair procedure

1. Open the tyre repair kit and peel off the maximum speed label. Attach the label to the facia in the driver's field of view. Take care not to obstruct any of the instruments or warning lights.
2. Uncoil the compressor power cable and the inflation hose.
3. Unscrew the orange cap from the sealant bottle receiver, and the sealant bottle cap.
4. Screw the sealant bottle into the receiver (clockwise) until tight.
   - Screwing the bottle onto the receiver will pierce the bottle's seal. Do not unscrew a full, or partly used bottle from the receiver. Doing so will result in the sealant leaking from the bottle.
5. Remove the valve cap from the damaged tyre.
6. Remove the protective cap from the inflation hose, and connect the inflation hose to the tyre valve. Ensure that the hose is screwed on firmly.
7. Ensure that the compressor switch is in the off (**O**) position.
8. Insert the power cable connector into an auxiliary power socket. See **AUXILIARY POWER SOCKETS** (page 110).
9. Unless the vehicle is in an enclosed or poorly ventilated area, start the engine.
10. Set the compressor switch to the on (**I**) position.
11. Inflate the tyre to a minimum of 1.8 bar (26 lb/in²) and a maximum of 3.5 bar (51 lb/in²).†

12. During the inflation, switch the compressor off briefly to check the tyre pressure using the gauge mounted on the compressor.
    - It should not take longer than seven minutes to inflate the tyre. If after seven minutes the tyre has not reached the minimum pressure, the tyre should not be used.
13. Once the tyre has been inflated switch off the compressor. If desired the engine may be turned off after the compressor has been turned off.
14. Remove the power connector from the auxiliary power socket.
15. Remove the inflation hose from the tyre valve by unscrewing it as quickly as possible (anti-clockwise).
16. Replace the inflation hose protective cap, and the tyre valve cap.
17. Do not remove the sealant bottle from the receiver.
18. Ensure that the tyre repair kit (including the bottle, and receiver caps) are placed securely in the vehicle. You will need to use the kit to check the tyre pressure after 3km (2 miles) so ensure they are easily accessible.
19. Immediately drive the vehicle for 3 km (2 miles) to allow the sealant to coat the inner surface of the tyre and form a seal at the puncture.

†When pumping the sealant through the tyre valve, the pressure may rise up to 6 bar (87 lb/in²). The pressure will drop again after approximately 30 seconds.

Checking the tyre pressure after a repair

WARNINGS

When driving the vehicle, if you experience vibrations, abnormal steering, or noises, reduce speed immediately. Drive with extreme caution and reduced speed to the first safe place to stop the vehicle. Visually examine the tyre, and check it's pressure. If there are any signs of damage or deformity to the tyre, or the tyre pressure is below 1.3 bar (19 lb/in²) do not continue driving.

Consult a tyre repair centre, or your Land Rover Dealer/Authorised repairer for advice concerning the replacement of a tyre after using a tyre repair kit.

1. Drive the vehicle for 3 km (2 miles) then stop in a safe place. Carry out a visual examination of the tyres condition.
2. Remove the protective cap from the inflation hose.
3. Screw the inflation hose connector firmly onto the tyre valve.
4. Read the tyre pressure from the gauge.
5. If the pressure of the sealant filled tyre is above 1.3 bar (19 lb/in²) adjust the pressure to the correct value. See **TECHNICAL SPECIFICATIONS** (page 194).
6. Ensure that the compressor switch is in the off position (**O**), and insert the power cable connector into an auxiliary power socket. See **AUXILIARY POWER SOCKETS** (page 110).
7. If the vehicle is in a well ventilated area, start the engine.
8. Switch on the compressor (**I**), and inflate the tyre to the correct pressure.

9. To check the tyre pressure turn off the compressor then read the pressure from the gauge.
10. When the compressor is off, if the tyre pressure is too high, release the required amount of pressure using the pressure relief valve.
11. Once the tyre is inflated to the correct pressure, switch off the compressor and remove the power plug from the auxiliary socket.
12. Unscrew the inflation hose connector from the tyre valve, replace the tyre valve cap and the inflation hose connector protective cap.
13. Do not remove the sealant bottle from the receiver.
14. Ensure that the tyre repair kit (including the bottle, and receiver caps) are placed securely in the vehicle.
15. Drive to the nearest tyre repair centre, or Land Rover Dealer/Authorised repairer for a replacement tyre to be fitted. Ensure that you make the repair centre aware that the tyre repair kit has been used before the tyre is removed.
16. Both the tyre inflation hose, and the sealant bottle should be replaced once a new tyre has been fitted.

Only sealant bottles which are completely empty should be disposed of with normal household waste. Sealant bottles which contain some sealant, and the tyre inflation hose, should be disposed of by a tyre specialist, or your Land Rover Dealer/Authorised repairer in compliance with local waste disposal regulations.

USING SNOW CHAINS

WARNING

Only use traction devices in heavy snow conditions, on hard road surfaces.

Dynamic Stability Control (DSC) must be switched off when using traction devices. DSC limits wheel spin which is required to maintain traction in deep snow conditions.

Never exceed 50 km/h (30 mph) when traction devices are fitted.

Never fit traction devices to a temporary use spare wheel.

Land Rover approved traction devices may be used to improve traction on a hard road surface in heavy snow conditions. They should not be used in off-road conditions.

If it becomes necessary to fit traction devices, the following points should be observed:-

- Single sided Spike-spyder traction devices can only be fitted to the front wheels of vehicles fitted with 17 or 18 inch diameter wheels.
  - The wheels and tyres fitted must conform to the specifications of the original equipment.
- No traction devices should be fitted to the rear wheels.
- Only Land Rover approved traction devices should be used on the vehicle. Only Land Rover approved traction devices have been tested to ensure that they do not cause damage to the vehicle. Contact your Land Rover Dealer/Authorised repairer for information.
- Always read, understand, and follow the snow chain manufacturer's instructions. Pay particular attention to the maximum speed, and fitting instructions.

- Avoid tyre/vehicle damage by removing the traction devices as soon as the conditions allow.

TYRE GLOSSARY

Terms used

lbf/in² or psi

Pounds per square inch, an imperial unit of measure for pressure.

kPa

Kilo Pascal, a metric unit of measure for pressure.

Cold tyre pressure

The air pressure in a tyre which has been standing in excess of three hours, or driven for less than one mile.

Maximum inflation pressure

The maximum pressure to which the tyre should be inflated. This pressure is given on the tyre side wall in lbf/in² (psi) and kPa.

Note: *This pressure is the maximum allowed by the tyre manufacturer. It is not the pressure recommended for use.* *See* ***TECHNICAL SPECIFICATIONS*** *(page 194).*

Kerb weight

The weight of a standard vehicle, including a full tank of fuel, any optional equipment fitted, and with the correct coolant and oil levels.

Gross vehicle weight

The maximum permissible weight of a vehicle with driver, passengers, load, luggage, equipment, and towbar load.

Accessory weight

The combined weight (in excess of those items replaced) of items available as factory installed equipment.

Production options weight

The combined weight of options installed which weigh in excess of 1.4 kg (3 lb) more than the standard items that they replaced, and are not already considered in kerb or accessory weights. Items such as heavy duty brakes, high capacity battery, special trim etc.

Vehicle capacity weight

The number of seats multiplied by 68 kg (150 lb) plus the rated amount of load/luggage.

Maximum loaded vehicle weight

The sum of kerb weight, accessory weight, vehicle capacity weight, plus any production option weights.

Rim

The metal support for a tyre, or tyre and tube, upon which the tyre beads are seated.

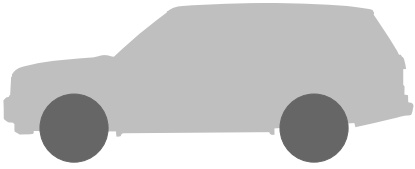
Bead

The inner edge of a tyre that is shaped to fit to the rim and form an air tight seal. The bead is constructed of steel wires which are wrapped, or reinforced, by the ply cords.

TECHNICAL SPECIFICATIONS

Wheel size	Tyre size	Speed rating
8.0J x 18	235/60 R 18	V
7.5J x 17	235/65 R 17	V
6.5J x 16	215/75 R 16	H

Accessory wheels and tyres



1 _____ **2** _____

3 _____

_____

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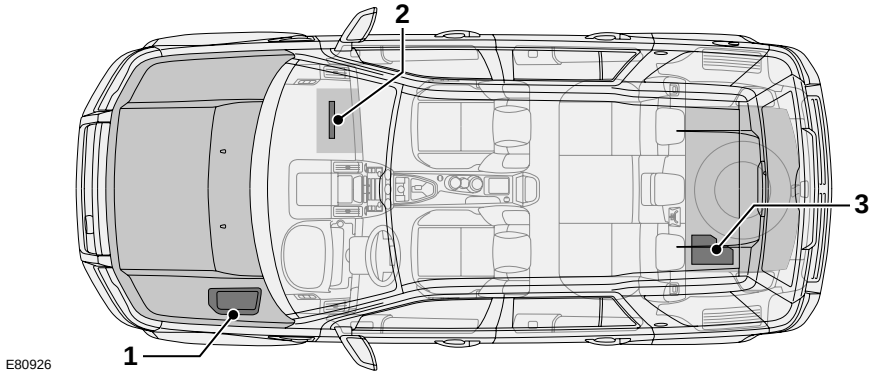
Note: *Use the diagram above to record accessory wheel and tyre information.*

1. Front tyre pressure.
2. Rear tyre pressure.
3. Wheel and tyre information (size, speed rating, etc).

WARNING

Contact your Land Rover dealer before fitting any accessory wheels and tyres. Your Land Rover dealer will be able to offer guidance regarding the correct accessories. Fitting incorrect wheel/tyre combinations can seriously affect the ride and handling of your vehicle. In extreme cases this may lead to loss of control of the vehicle.

FUSE BOX LOCATIONS



1. Engine compartment fuse box.
2. Passenger compartment fuse box.
3. Luggage compartment fuse box.

CHANGING A FUSE

CAUTIONS

Fit Land Rover approved replacement fuses of the same rating and type, or fuses of matching specification. Using an incorrect fuse may result in damage to the vehicle's electrical system, and can result in a fire.

If the replacement fuse blows after installation the system should be checked by your Land Rover Dealer/Authorised Repairer.

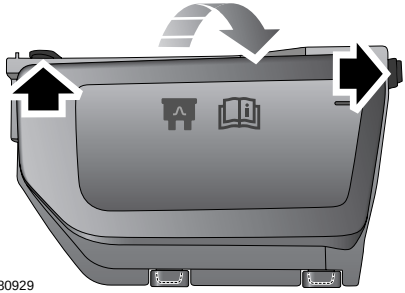
Note: *Land Rover recommend that owners do not remove or replace relays. It is recommended that you seek qualified assistance in the event of a relay failure.*

Always switch off the ignition, and the affected electrical circuit before replacing a fuse.

FUSE SPECIFICATION CHART

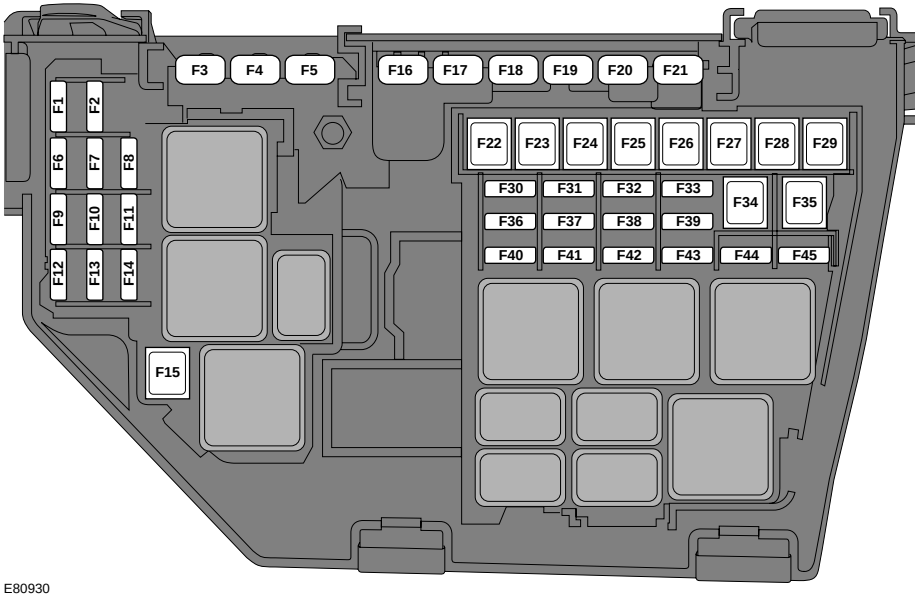
Engine compartment fuse box

Accessing fuses



E80929

Fuse positions and specifications



E80930

Fuses

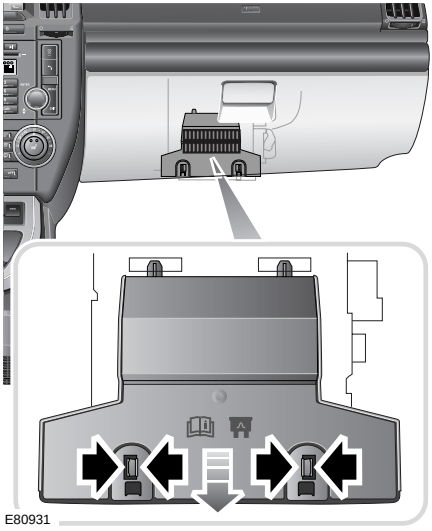
Fuse number	Rating (Amps)	Fuse colour	Circuits protected
F1	5	tan	Glow plugs
F2	15	blue	Automatic transmission
F3	80	-	Cooling fans
F4	60	-	Glow plugs
F5	-	-	-
F6 (Diesel)	10	red	Engine management
F6 (Petrol)	15	blue	Engine management
F7	5	tan	Relays
F8 (Diesel)	10	red	Engine management
F8 (Petrol)	15	blue	Engine management
F9 (Diesel)	10	red	Engine management
F9 (Petrol)	15	blue	Engine management
F10 (Petrol)	10	red	Engine management
F11 (Diesel)	10	red	Engine management
F11 (Petrol)	10	red	Engine management
F12 (Diesel)	10	red	Engine management
F12 (Petrol)	20	yellow	Engine management
F13	15	blue	Air Conditioning
F14 (Diesel)	15	blue	Engine management
F15	40	green	Starter motor
F16 (Diesel)	100	-	Diesel PTC heater
F17	60	-	Passenger compartment fuse box supply
F18	60	-	Passenger compartment fuse box supply
F19	60	-	Luggage compartment fuse box supply
F20	60	-	Luggage compartment fuse box supply
F21	60	-	Luggage compartment fuse box supply - Audio unit
F22	30	pink	Windscreen wipers
F23	-	-	-

Fuses

Fuse number	Rating (Amps)	Fuse colour	Circuits protected
F24	30	pink	Headlamp washers
F25	30	pink	ABS
F26	40	green	ABS
F27	-	-	-
F28	40	green	Heater blower
F29	-	-	-
F30	-	-	-
F31	15	blue	Horns
F32	20	yellow	Diesel auxiliary heater
F33	5	tan	Relays
F34	40	green	Heated windscreen(LH)
F35	40	green	Heated windscreen (RH)
F36	-	-	-
F37	10	red	Heated washer jets
F38	10	red	AFS (RH lamp motors)
F39	10	red	Climate control
F40	-	-	-
F41	20	yellow	Passenger compartment fuse box supply
F42	15	blue	Engine management
F43	5	tan	Headlamp levelling control - AFS
F44	10	red	AFS (LH lamp motors)
F45	15	blue	Cigar lighter

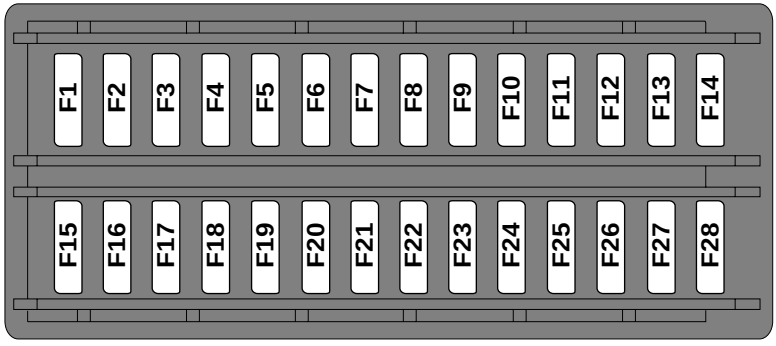
Passenger compartment fuse box

Accessing fuses



E80931

Fuse positions and specifications



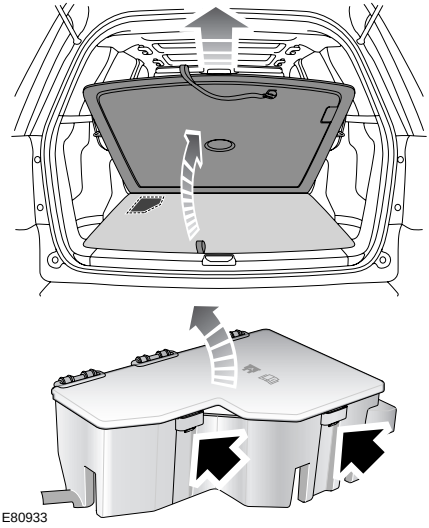
E80932

Fuses

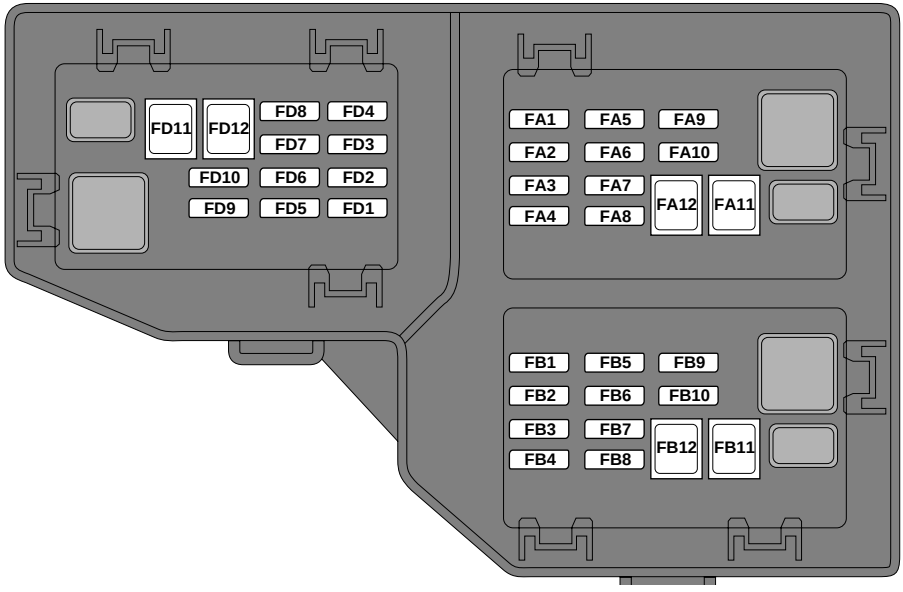
Fuse number	Rating (Amps)	Fuse colour	Circuits protected
F1	5	tan	Rain sensor
F2	10	red	SRS
F3	5	tan	ABS
F4	5	tan	Instrument pack - Accelerator pedal - Light Switch Module
F5	-	-	-
F6	15	blue	Audio unit
F7	7.5	brown	Steering wheel controls
F8	5	tan	Instrument pack
F9	15	blue	Headlamp main beam
F10	15	blue	Sunroof
F11	7.5	brown	Reverse lights and interior mirror dip
F12	-	-	-
F13	15	blue	Front fog lamps
F14	15	blue	Screen wash
F15	-	-	-
F16	-	-	-
F17	7.5	brown	Interior lighting
F18	-	-	-
F19	5	tan	Electric seat adjustment
F20	15	blue	Rear wiper
F21	5	tan	Alarm
F22	20	yellow	Fuel pump
F23	20	yellow	Steering column lock
F24	-	-	-
F25	10	red	Tailgate - Fuel filler flap
F26	5	tan	Diagnostic socket and alarm
F27	5	tan	Start button and climate control
F28	5	tan	Brake lights

Luggage compartment fuse box

Accessing fuses



Fuse positions and specifications



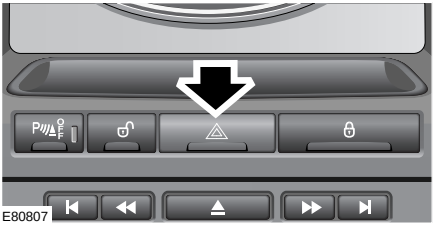
Fuses

Fuse number	Rating (Amps)	Fuse colour	Circuits protected
FA1	25	clear	Driver door controls
FA2	25	clear	Passenger door controls
FA3	25	clear	Rear left door controls
FA4	25	clear	Rear right door controls
FA5	-	-	-
FA6	15	blue	Rear accessory socket
FA7	30	green	Heated rear screen
FA8	-	-	-
FA9	15	blue	Trailer power
FA10	30	green	Driver electric seat
FA11	40	green	Trailer power
FA12	-	-	-
FB1	10	red	Park distance control
FB2	-	-	-
FB3	15	blue	Driver's seat heater
FB4	15	blue	Front passenger's seat heater
FB5	15	blue	Caravan fridge
FB6	15	blue	Electronic centre differential
FB7	-	-	-
FB8	-	-	-
FB9	30	green	Passenger electric seat
FB10	-	-	-
FB11	-	-	-
FB12	-	-	-
FD1	10	red	Audio system and touch screen
FD2	-	-	-
FD3	10	red	DAB
FD4	5	tan	Bluetooth telephone
FD5	-	-	-
FD6	10	red	Audio unit

Fuses

Fuse number	Rating (Amps)	Fuse colour	Circuits protected
FD7	-	-	-
FD8	-	-	-
FD9	30	green	Audio amplifier
FD10	-	-	-
FD11	-	-	-
FD12	-	-	-

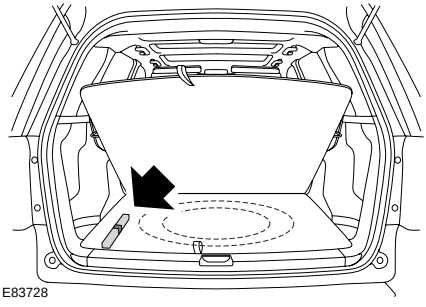
HAZARD WARNING FLASHERS



If the vehicle is stationary in an unsafe location, or may cause a hazard to other road users, switch on the hazard warning flashers. Press the switch to turn the hazard warning lamps on.

Note: *Hazard warning lamps can be used when the ignition is on or off.*

WARNING TRIANGLE



1. The warning triangle is located on the left-hand side of the under-floor storage area.

DRIVING AFTER A COLLISION

Before starting or driving

WARNING

If the vehicle is involved in a collision it should be checked by a Land Rover Dealer/Authorised repairer, or suitably qualified persons before starting or driving.

If the vehicle has been involved in an accident it should be checked thoroughly before attempting to start the engine or drive the vehicle.

Check for :-

- Fuel leaks.
- Fluid leaks.
- Battery damage.
- Damage to wiring.
- Damage to lights.
- Damage to steering, suspension, wheels or tyres.
- Sharp or protruding bodywork.
- Operation of doors and locks.
- Condition and operation of seat belts and SRS components.
- Condition of child seats and their mounting/attachment points.

Note: *This list is not exhaustive.*

Resetting the fuel cut-off

WARNING

The fuel cut-off should never be reset if you can smell fuel, or a leak can be seen. Doing so can lead to a fire which may cause personal injury or death.

The fuel system cut-off forms part of the Safety and Restraint System (SRS) fitted to your vehicle. Following an impact, and depending on the severity, the fuel pump may be switched off.

1. Switch the ignition off, and wait for one minute.
2. Turn the ignition on for 30 seconds.
3. Check the vehicle thoroughly for fuel leaks. If a leak is detected switch the ignition off immediately.
   - The vehicle must not be started if a leak is present. Seek qualified advice, and have the vehicle recovered.
4. If no leaks are detected, start the vehicle.

When driving

When driving a vehicle which has been involved in a collision use caution and pay extra attention to the operation of the vehicle. If any changes in vehicle operation after the collision are noted when compared to it's operation before the collision, do not continue to drive the vehicle. Stop the vehicle as soon as it is safe to do so, and have the vehicle recovered.

Pay particular attention to changes in :-

- Steering.
- Braking.
- Unusual noises.
- Warning lights or messages displayed.
- Problems with electrical systems.

INSPECTING SAFETY SYSTEM COMPONENTS

Following a collision the seat belt and Supplementary Restraint System components should be inspected for damage and/or deformity. The inspection and any subsequent repair work should only be carried out by a Land Rover Dealer/Authorised Repairer, or other suitably qualified persons.

Components which require inspection include :-

- Seat belt webbing and mechanisms.
- Seat belt pre-tensioners.
- Airbag covers and modules.
- Seat frames and mounting points.
- Child seats.
- Child seat anchor points.

Note: *This list is not exhaustive.*

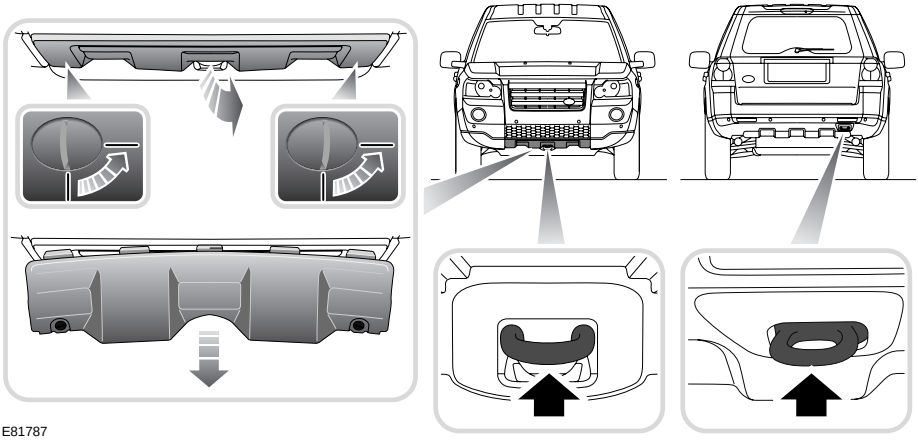
In addition to the physical items checked the electronic control system and it's associated wiring should also be checked thoroughly. This process will include a diagnostic check which can only be carried out by a Land Rover Dealer/Authorised repairer or suitably qualified and equipped persons.

WARNING

It is not recommended that the vehicle be driven or used until all of the occupant protection systems have been checked.

TOWING POINTS

Front and rear towing eyes



E81787

WARNINGS

The towing eyes at the front and rear of the vehicle are designed for on-road recovery only. If they are used for any other purpose it may result in vehicle damage and serious injury.

Never use the towing eyes to tow a trailer, caravan etc. Doing so may result in vehicle damage and serious injury.

CAUTION

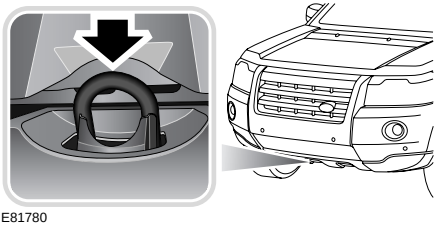
Remove the front towing eye cover before driving off-road to prevent damage or loss.

LASHING POINTS

WARNING

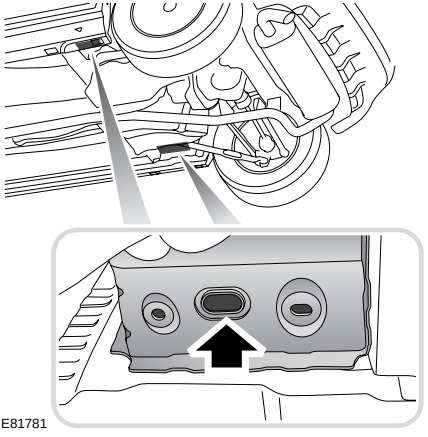
The front and rear lashing points must only be used for securing the vehicle during transportation. Use for any other purpose may result in damage to the vehicle, and serious injury.

Front



E81780

Rear



E81781

TRANSPORTING THE VEHICLE

The recommended method for recovery/transportation or the vehicle is on a transporter or trailer designed for that purpose.

Ensure that transportation is carried out by suitably qualified persons, and that the vehicle is secured correctly.

TOWING THE VEHICLE ON FOUR WHEELS

WARNINGS

Ensure that the remote control remains docked whilst the vehicle is being towed. Removing the remote control will engage the steering lock, which will prevent the vehicle from steering correctly.

If the engine cannot be run whilst the vehicle is being towed, there will be no power assistance for the steering or brakes. This will result in greater effort being required to steer or slow the vehicle, and greatly increased stopping distances.

CAUTIONS

The vehicle should only be towed in a forward direction with all four wheels on the ground. Towing in a reverse direction with two wheels on the ground will result in serious damage to the transmission.

The vehicle should only be towed for a maximum of 80 km (50 miles), at a maximum speed of 80 km/h (50 mph). Towing for a greater distance, or at a higher speed may result in serious damage to the transmission.

Note: *The recommended recovery method is to raise all four wheels.*

Towing procedure

1. The vehicle should be parked on firm level ground, with the park brake on, and the gear selector in P if an automatic gearbox is fitted.
2. Secure the towing attachment from the recovery vehicle to the front towing eye. See **TOWING POINTS** (page 207).
3. Dock the remote control, and switch on the ignition. See **GENERAL INFORMATION** (page 113).

CAUTION

Leaving the ignition switched on for extended periods will cause the battery to drain.

4. Apply the foot brake, and select neutral.
5. With the footbrake still applied, release the park brake.
6. The vehicle can now be towed a maximum of 80 km (50 miles) at a maximum speed of 80 kmh (50 mph).
7. Upon arrival at the destination, ensure wherever possible that the vehicle is parked on firm level ground.
8. Apply the park brake, and place the selector lever into the **P** (park) position.
9. Switch off the ignition, and remove the remote control.

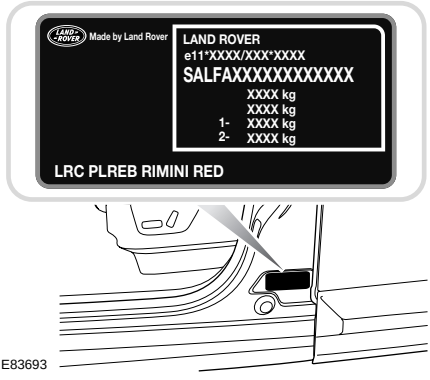
WARNING

Use extreme caution when detaching towing equipment. Vehicle movement is possible which can result in serious injuries.

10. Remove the towing attachment from the towing eye.

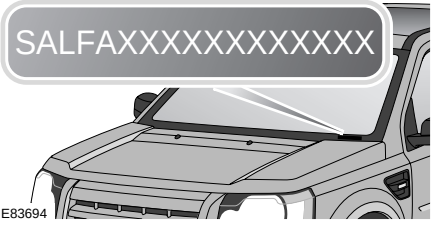
Vehicle identification

VEHICLE IDENTIFICATION PLATE



The Vehicle Identification Number (VIN) and recommended maximum vehicle weights, are stamped on a plate rivetted to the lock side of the left-hand (right hand in China) front door aperture at the bottom. VIN should match the VIN recorded in the Service Portfolio, and the VIN visible through the front windscreen.

VEHICLE IDENTIFICATION NUMBER (VIN)



As a deterrent to thieves, and to assist the Police, the VIN is stamped on a plate which is visible through the lowest part of the left side of the windscreen.

Note: *If you need to communicate with a Land Rover Dealer/Authorised repairer, you may be asked to quote the VIN number.*

VEHICLE BUILD DATE PLATE

This is the calendar month and year in which the body and power train assemblies were conjoined and the vehicle was driven from the production line.

The vehicle built date is shown on a the tyre pressure label attached to the right-hand 'B' post.

ENGINE SPECIFICATIONS

Data	Petrol
Number of cylinders	6
Displacement cc's	3192
Firing order	1-5-3-6-2-4
Compression ratio	10.8:1
Power output kW (PS)	171 (233) at 6300 rpm
Maximum torque Nm	317 at 3200 rpm

Data	Diesel	Diesel with DPF
Number of cylinders	4	4
Displacement cc's	2179	2179
Firing order	1-3-4-2	1-3-4-2
Compression ratio	16.5:1	16.5:1
Power output kW (PS)	118 (160) at 4000 rpm Belgium 110 (150) at 4000 rpm	112 (152) at 4000 rpm Belgium 110 (150) at 4000 rpm
Maximum torque Nm	400 at 2000 rpm	400 at 2000 rpm

WEIGHTS

Variant	Approximate unladen weight[1]	Gross Vehicle Weight (GVW)[2]	Gross Train Weight[3]
Petrol	1825 kg 4020 lbs	2505 kg 5520 lbs	4505 kg 9930 lbs
Diesel	1820 kg 4010 lbs	2505 kg 5520 lbs	4505 kg 9935 lbs

[1] This figure includes the tool kit, all fluids to the correct levels, and spare wheel, but excludes the driver and passengers.

[2] The maximum permissible weight of the vehicle including passengers and load.

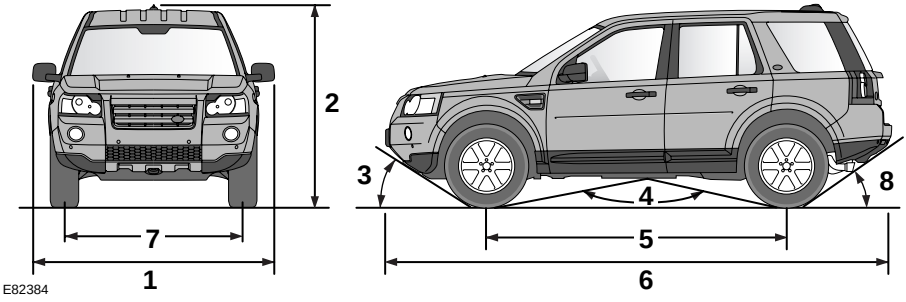
[3] The maximum permissible weight of the vehicle and braked trailer including their respective loads.

Variant	Maximum front axle load[1]	Maximum rear axle load[1]	Maximum roof rack load[2]	Maximum payload
Petrol and Diesel	1310 kg 2885 lbs	1360 kg 2995 lbs	75 kg 165 lbs	500 kg 1100 lbs

Note: *[1] The front and rear axle maximum loads can not be reached simultaneously as this will exceed the GVW limit.*

[2] This figure includes the weight of the roof rack.

DIMENSIONS



Item	Description	mm/inches	Degrees
1	Width	2180/85.7	-
1	Width with mirrors folded	2005/78.8	-
2	Maximum height (inc roof rails)	1820/71.6	-
3	Approach angle	-	31°
4	Breakover angle	-	157°
5	Wheelbase	2660/104.7	-
6	Length excluding number plate plinth	4500/177.1	-
7	Track - front	1601/63	-
7	Track - rear	1614/63.5	-
8	Departure angle without tow hitch	-	34°
8	Departure angle with detachable tow ball	-	18°
-	Turning circle (kerb to kerb)	11.3m/37.1ft	-
-	Maximum wading depth	500/19.7	-

Wheel alignment data (China only)

Wheel alignment - front	Wheel alignment - rear	Camber - front	Camber - rear	Castor - front and rear
+0.30°	+0.46°	-0.5°	-1.95°	Non-adjustable

Clutch and brake pedal travel (China only)

The clutch and brake pedal travel are set at the factory and non-adjustable.

Declarations of conformity

Declaration of Conformity appropriate to the Directive 1999/5/EC (R&TTE)
Annex IV

Visteon Deutschland GmbH
.....
Manufacturer,

Notified Body consulted: **Phoenix Test-Lab, Königswinkel 10, D-32825 Blomberg**
ID-Number of Notified Body: **0700**

declare under our responsibility that the product: **RKE Transmitter**

Type: **TXREL**

☐ Telecommunications Terminal Equipment ☒ Radio Equipment

Remote Keyless Entry System Transmitter **1**
Intended Purpose Equipment Class

complies with the appropriate essential requirements of the Article 3 of the R&TTE and the other relevant provisions, when used for its intended purpose.

Health and Safety requirements contained in Article 3 (1) a)

EN 60 950: 2001 Information technology equipment – Safety – Part 1: General Requirements.
EN 50 371: 2002, Generic standard to demonstrate the compliance of low power electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (10 MHz – 300 GHz) – General public.

Protection requirements with respect to electromagnetic compatibility Article 3 (1) b)

EN 301 489-01 V.1.4.1: 08/2002, Electromagnetic Compatibility and radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements.
EN 301 489-03 V.1.4.1: 08/2002, Electromagnetic Compatibility and radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz.

Means of the efficient use of the radio frequency spectrum

☒ Air interface specification of the radio path contained in Article 3(2)

EN 300 220-3 V1.1.1: 09/2000, Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices (SRD); Radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW; Part 3: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive.

Address:

Visteon Deutschland GmbH
Visteonstrasse 4 - 10
50170 Kerpen
Germany
URL: http://www.visteon.com/europe

Roland Greff
Vice President Visteon Deutschland GmbH

CE 0700

E84189

SIEMENS VDO
Automotive

SiemensVDO Automotive AG ·P.O. Box 10 09 43 ·D-93009 Regensburg

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Fax	+49(0)941/790-136699
E-Mail	dagmar.kolar@siemens.com
Internet	www.siemensvdo.de
Our Ref.	Doc_5WK49096.doc
Date.	03/08/2005

Declaration of Conformity in accordance with Directive 1999/5/EC (R&TTE Directive)

Manufacturer:	Siemens VDO Automotive AG Body & Chassis Electronics
Address:	Dep. SV C BC P2 RF TG Siemensstrasse 12 D-93049 Regensburg Germany
Product type designation:	5WK4 9096
Intended use:	Radio frequency receiver used in vehicle locking/unlocking systems

The product mentioned above complies with the essential requirements and other relevant provisions of Directive 1999/5/EC, when used for its intended purpose:

Health and safety pursuant to §3.1.a:	*Applied standard(s):* EN 60950:2000
Electromagnetic compatibility pursuant to § 3.1.b:	*Applied standard(s):* EN 301 489-1,-3: V1.4.1 (2002-08)
Efficient use of spectrum pursuant to § 3.2:	*Applied standard(s):* EN 300 220-1: V1.3.1 (2000-09)

The following marking applies to the above mentioned product:

CE

Siemens VDO Automotive AG

Regensburg, 2005-08-03

i.V. .....
Jean-Francois Tarabbia
Executive Vice President
Body and Chassis Electronics Operations

i.V. .....
Dr. Martin Fischer
Vice President
Wireless Products and Modules

E84190

Declaration of Conformity appropriate to the Directive 1999/5/EC (R&TTE)
Annex IV

Visteon Deutschland GmbH
.....
Manufacturer,

Notified Body consulted: **Cetecom ICT Services GmbH, Untertürkheimer Strasse 6-10, D-66117 Saarbrücken**
ID-Number of Notified Body: **0682**

declare under our responsibility that the product: **Immobiliser System Transceiver**

Type: **PATS XCVR** Start Control Unit

☐ Telecommunications Terminal Equipment ☒ Radio Equipment

Immobiliser System Transceiver 1
.....
Intended Purpose Equipment Class

complies with the appropriate essential requirements of the Article 3 of the R&TTE and the other relevant provisions, when used for its intended purpose.

Health and Safety requirements contained in Article 3 (1) a)

EN 60 950: 2001 Information technology equipment – Safety –
EN 50 371: 2002, Generic standard to demonstrate the compliance of low power electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (10 MHz – 300 GHz) – General public.

Protection requirements with respect to electromagnetic compatibility Article 3 (1) b)

EN 301 489-03 V.1.4.1: 08/2002, Electromagnetic Compatibility and radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services, Part 3: Specific conditions for Short Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz.

Means of the efficient use of the radio frequency spectrum

☒ Air interface specification of the radio path contained in Article 3(2)

EN 300 330-1 V1.3.2: 12/2002 and **EN 300 330-2 V1.1.1**: 06/2001, Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Part 1: Technical characteristics and test methods and Part 2: Harmonized EN under article 3.2 of the R&TTE Directive.

Address:

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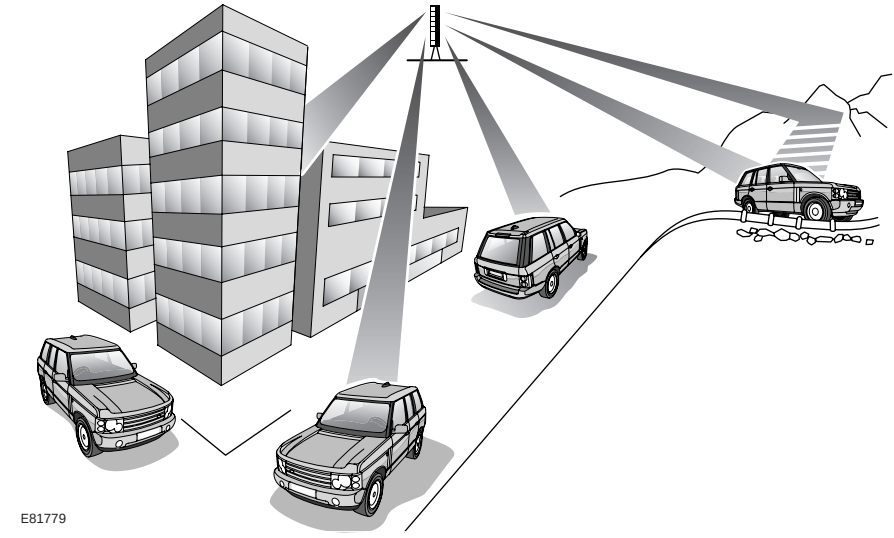
URL: http://www.visteon.com/europe

Roland Greff
Vice President Visteon Deutschland GmbH

CE 0682

E84303

RADIO RECEPTION



E81779

Some interference is to be expected from time to time during a journey. Occasionally it may be necessary to retune the audio unit to offset the effects of moving from one transmitter area to another.

While Radio Data System (RDS) automatic retuning helps to reduce the effects of signal changes, some manual retuning may still be required (especially for local stations) in areas of weak reception.

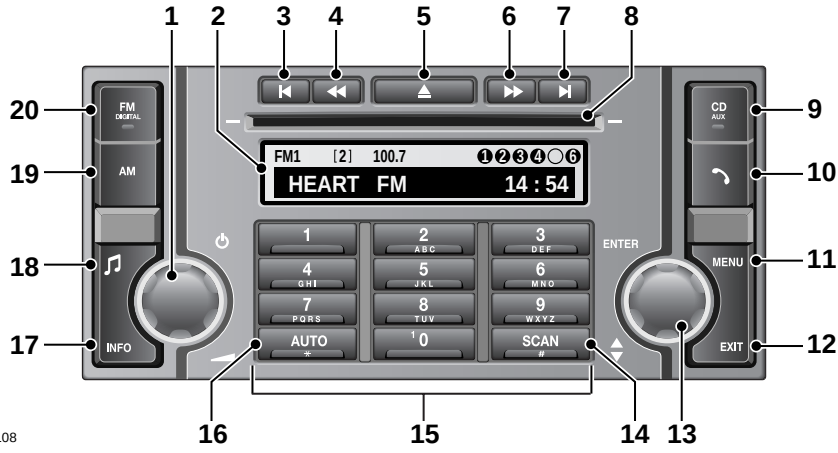
FM Signals travel in a straight line so large obstacles, such as tall buildings, can shield the vehicle from the signal, causing distortion or loss of reception (known as dead spots).

Distortion can also occur if FM signals received directly from the transmitter, mix with signals deflected by obstructions such as mountains, hills and tall buildings. This is known as multi-path distortion.

Note: *Although distortion, interference and lack of signal clarity are sometimes attributed to a fault in the radio, this is rarely the case.*

AUDIO UNIT OVERVIEW

Premium audio overview



1. On or off and volume control
   - Press to switch on or off
   - Rotate to adjust volume
2. Information display screen
3. Rearward search or previous track button
   - Radio station automatic rearward search
   - Compact disc previous track or beginning of track
4. Manual tuning or review button
   - Radio station manual rearward search
   - Compact disc rearward search (review)
5. Compact disc eject button
6. Manual tuning or cue button
   - Radio station manual forward search
   - Compact disc forward search (cue)
7. Forward search or next track button
   - Radio station automatic forward search
   - Compact disc next track
8. Compact disc slot
9. Compact disc player or AUX mode button
10. Telephone mode button
11. Audio MENU button:
    - FM settings
    - Clock
    - CD settings
    - Random
    - AUX settings
12. EXIT button
13. Audio MENU control
    - Rotate to scroll through options
    - Press to enable or disable the function
14. SCAN button
    - Press during CD play to listen to the first 10 seconds of each track
15. Input keypad
16. AUTO button
    - Press to automatically store radio stations

17. INFO button
- Press and release for traffic announcements
- Press and hold for news announcements

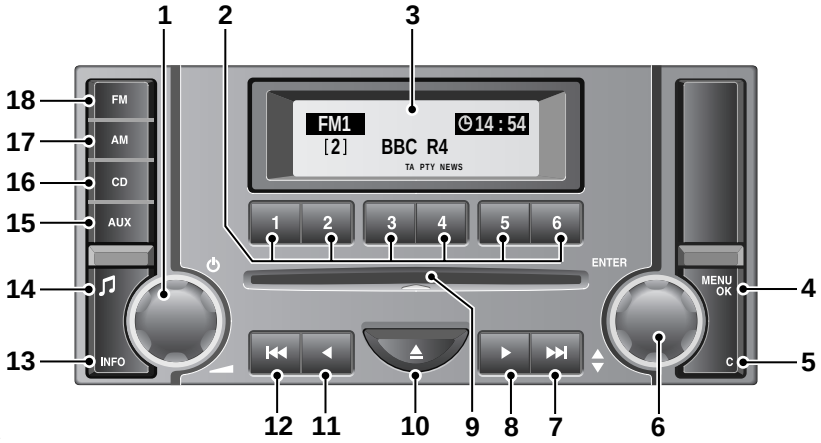
18. Tone and volume settings button
- Press and release for tone settings menu
- Press and hold for volume settings menu

19. AM waveband button

20. FM waveband button

Audio unit overview

Standard audio overview

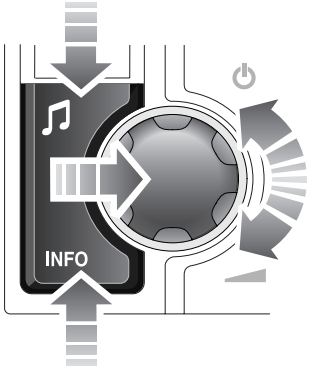


E83107

1. On or off and volume control
   - Press to switch on or off
   - Rotate to adjust volume
2. Radio station presets or CD disc selection
3. Information display screen
4. Audio MENU button:
   - Access
   - Save
   - Close
5. Exit or Cancel button
6. Audio menu control
   - Rotate to scroll through options
   - Press to enable or disable the function
7. Forward search or next track button
   - Radio station automatic forward search
   - Compact disc forward search
8. Manual tuning or cue button
   - Radio station manual forward search
   - Compact disc forward search (cue)
9. Compact disc slot
10. Compact disc eject button
11. Manual tuning or review button
    - Radio station manual rearward search
    - Compact disc rearward search (review)
12. Rearward search or previous track button
    - Radio station automatic rearward search
    - Compact disc previous track or beginning of track
13. INFO button
    - Press and release for traffic announcements
    - Press and hold for news announcements
14. Tone and volume settings button
    - Press and release for tone settings menu
    - Press and hold for volume settings menu
15. Auxiliary input mode button
16. Compact disc player mode button
17. AM waveband button
18. FM waveband button

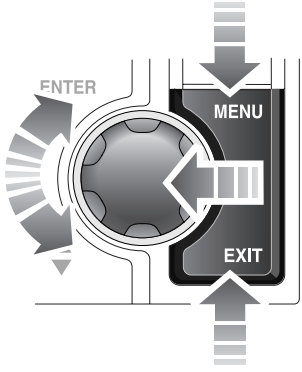
Audio unit overview

Basic audio functions



E83955

- Press rotary control to switch audio unit on or off.
- Rotate control to adjust volume or to adjust menu settings levels.
- Press and release tone button to access the tone settings menu.
- Press and hold tone button to access the volume settings menu.
- Press and release **INFO** button to activate or deactivate the traffic announcements (TA) function.
- Press and hold **INFO** button to activate or deactivate the news broadcasts function.



E83956

- Press **MENU** button to access various audio menus.
- Rotate control to scroll through menu items.
- Press rotary control to enter or confirm menu selection.
- Press and release **EXIT** button (**C** button on standard audio units) to go back to the previous screen.
- Press and hold **EXIT** button (**C** button on standard audio units) to return to main display.

ON OR OFF CONTROL

Press the on or off control to switch the audio unit on. Press again to switch off.

VOLUME CONTROL

Rotate the volume control to increase or decrease the audio unit volume. The volume can be set between **0** and **35**.

When the audio unit is turned on, the previously set volume level will be implemented.

Note: *The standard audio unit can be used with the engine off, but the maximum volume level will be restricted.*

Automatic Volume Control (AVC)

The AVC feature adjusts the volume level to compensate for the changes in road noise as the vehicle speed increases or decreases.

Note: *The AVC setting represents the volume increase and not the volume level.*

If the AVC level is set to **Off**, there will be no volume increase. With a low level setting, the volume increase at speed will be minimal. If a high level setting is used, there will be a noticeable increase of volume at speed.

The AVC setting required will depend upon the expected speed and the expected road conditions.

Use the following procedure to set the AVC level.

1. Press and hold the tone button to access the volume settings menu.
2. Press the tone button repeatedly until **AVC Level** is displayed.
3. Rotate the volume control to select the required AVC setting.

Reset volume settings

The following procedure will reset all of the volume settings to the original factory values.

1. Press and hold the tone button to access the volume settings menu.
2. Repeatedly press the tone button to scroll through the menu until the **Reset volume settings** message is displayed.
3. Rotate the volume control to highlight **YES** or **NO** as required.
4. On premium audio units, press the tone button to confirm your choice and exit the menu. On standard audio units, your choice is confirmed by pressing the **MENU** button.

AUDIO CONTROL

Depending on the specification of the audio system fitted to your vehicle, the following audio control settings are available from the tone menu.

Surround sound settings

1. Press and release the tone button to display the current surround sound setting.
2. Rotate the volume control to highlight **3 Channel** or **Stereo** as required.

Bass response adjustment

1. Press the tone button repeatedly until the current **Bass** setting is displayed.
2. Rotate the volume control to increase or decrease the level.

Treble response adjustment

1. Press the tone button repeatedly until the current **Treble** setting is displayed.
2. Rotate the volume control to increase or decrease the level.

Balance adjustment

1. Press the tone button repeatedly until the current **Balance** setting is displayed.
2. Rotate the volume control to adjust sound level to the right or left.

Fader adjustment

1. Press the tone button repeatedly until the current **Fader** setting is displayed.
2. Rotate the volume control to adjust the sound level to the front or rear.

Subwoofer settings

1. Press the tone button repeatedly until the current **Subwoofer** setting is displayed.
2. Rotate the volume control to increase or decrease the setting.

Centre speaker settings

1. Press the tone button repeatedly until the current **Centre** setting is displayed.
2. Rotate the volume control to increase or decrease the setting.

Resetting tone values

Use the following procedure to return the tone settings to the factory defaults.

1. Press the tone button repeatedly until the **Reset tone settings** message is displayed.
2. Rotate the volume control to highlight **YES** or **NO** as required.
3. On premium audio units, press the tone button to confirm your choice. On standard audio units, use the **MENU** button.

All settings will be reset to the neutral (central) value.

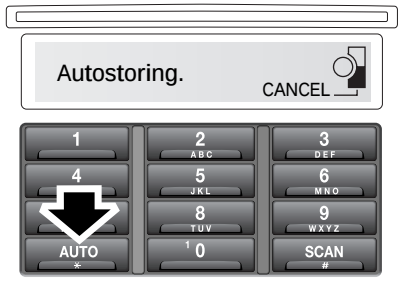
WAVEBAND BUTTON

To select the FM waveband, press and release the **FM** button. Repeated presses will scroll between **FM1** and **FM2**. On standard audio units **FMa** is also available. The selection will be shown in the top left-hand corner of the information display.

To select the AM waveband, press and release the **AM** button. The selection will be shown in the top left-hand corner of the information display. On standard audio units, repeated presses of the **AM** button will scroll through **MW1**, **MWa**, **LW1** and **LWa**.

AUTOSTORE CONTROL

Autostoring radio stations - Premium audio



E82933

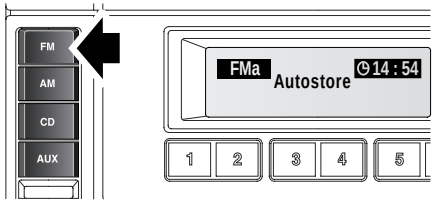
To autostore stations on premium audio units, select the required waveband, then press and hold the **AUTO** button for three seconds. **Autostoring** will be shown in the information display and the stations will be stored under the preset numbers in the order in which they are found.

To access the autostored stations, press and release the **AUTO** button. **FMA** or **AMA** will be displayed, depending on the selected waveband.

To recall an autostored station, press and release the required preset number.

To exit the selected autostore waveband, press and release the **AUTO** button.

Autostoring radio stations - Standard audio



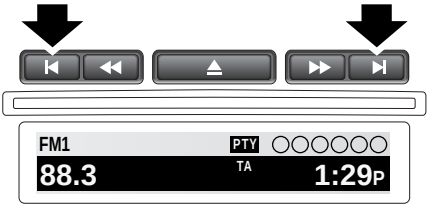
E83959

To autostore stations on standard audio units, select the required waveband, then press and hold the relevant waveband button for three seconds. **Autostore** will be shown in the information display and the stations will be stored under the preset numbers in the order in which they are found.

To recall an autostored station, press and release the required preset number.

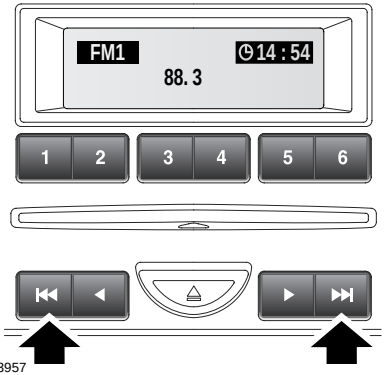
STATION PRESET BUTTONS

Premium audio



E82929

Standard audio

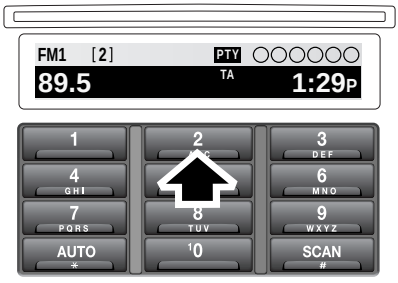


E83957

To store a station, press either of the search buttons to find the next available station. Having tuned to the desired station, press and hold the preset number under which you would like the station stored.

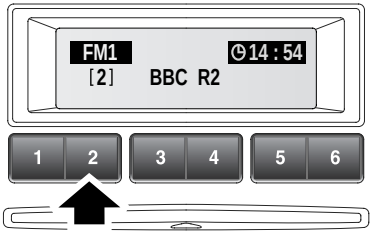
The audio output will be muted when the button is pressed, and dependent on specification, accompanied by the message **Station stored.**

Premium audio



E82930

Standard audio



E83958

To access the stored stations, press and release the required preset number.

TRAFFIC INFORMATION CONTROL

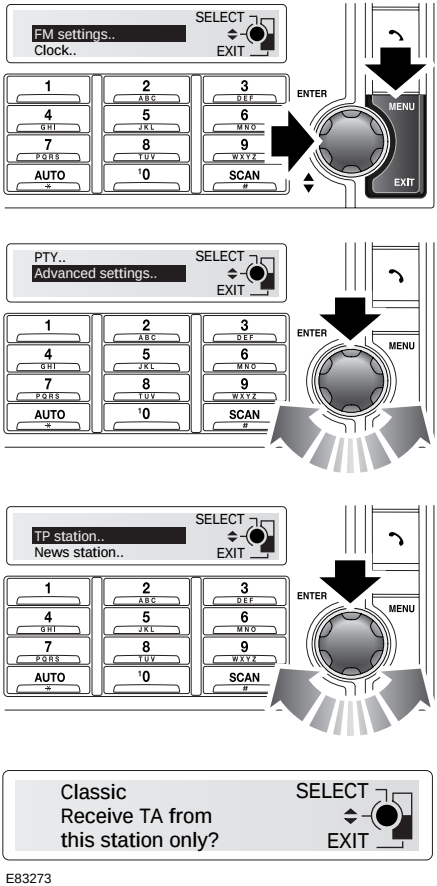
The Traffic Announcement (TA) feature detects the presence of local travel announcements, providing information on local conditions. As soon as a traffic announcement is received, radio reception or CD play is interrupted. At the end of the traffic announcement, radio or CD play will resume.

Press and release the **INFO** button to switch **TA** on or off.

To cancel an announcement, briefly press the **EXIT or C** button.

Traffic Programme (TP) preference

With the Traffic Announcement (TA) feature enabled, any announcement received by the system will interrupt normal radio reception or CD play. The TP preference feature on premium audio units allows the system to receive only traffic announcements from a particular station.



E83273

1. With the preferred station selected, press the **MENU** button.
2. Use the rotary control to select **FM Settings** and press to confirm.
3. Use the rotary control to highlight **Advanced settings** and press to select.

Note: *The* ***Advanced settings*** *menu is not available while the vehicle is moving.*

4. Rotate the control until **TP station** is selected and press to confirm selection.
5. When the station name or frequency is displayed along with the message **Receive TA from this station only?**, press the rotary control to confirm.

RADIO DATA SYSTEM (RDS)

Your audio system is equipped with RDS (Radio Data System), which enables the audio unit to receive extra information with the normal radio signals.

On the FM waveband, RDS enables the audio to receive traffic and news information broadcasts. RDS also allows the audio unit to automatically retune to stations that are linked to the same network.

Note: *Not all FM radio stations broadcast RDS. If a non-RDS station is selected, RDS features will not be available.*

Selecting RDS

On standard audio units, RDS can be enabled or disabled, according to preference. The following procedure explains how to switch RDS on or off.

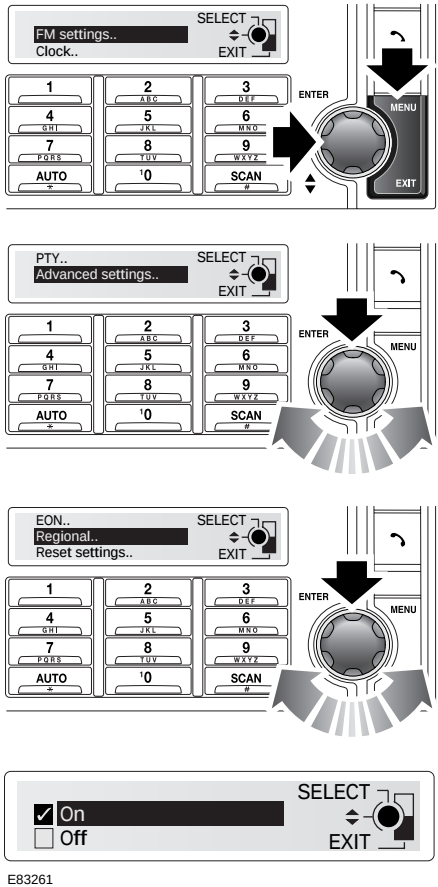
1. With **FM1**, **FM2** or **FMa** selected, press the **MENU** button to display the menu.
2. Using the rotary control, select **RDS** from the menu. **ON** or **OFF** will be displayed, dependent on status.
3. Press the rotary control to change status.

The RDS status will be displayed briefly on the information screen.

REGIONAL MODE (REG)

As you drive into different radio reception areas, the Radio Data System (RDS) automatically retunes the radio to the strongest signal. Regional mode is an RDS feature which stops the system from tuning to another local radio station with a stronger signal. With this feature enabled, your selected local radio station will remain tuned.

Regional mode - Premium audio



E83261

1. With **FM1**, **FM2** or **FMA** selected, press the **MENU** button.
2. Use the rotary control to select **FM Settings** and press to confirm selection.
3. Use the rotary control to select **Advanced settings** from the menu and press to confirm selection.

Note: *The* ***Advanced settings*** *menu is not available while the vehicle is moving.*

4. From the next menu select **Regional** and press to confirm selection.
5. To enable Regional mode, rotate the control until **On** is selected and press to confirm selection.

Regional mode - Standard audio

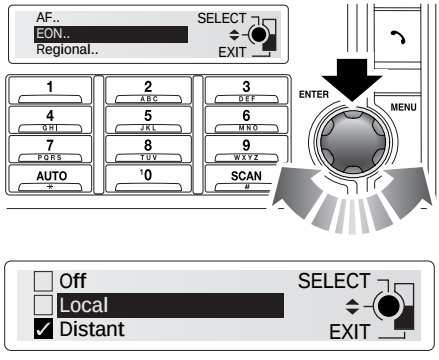
1. With **FM1**, **FM2** or **FMa** selected, press the **MENU** button to display the menu.
2. Using the rotary control, select **Regional** from the menu. **ON** or **OFF** will be displayed, dependent on status.
3. Press the rotary control to change status.

The regional status will be displayed briefly on the information screen.

ENHANCED OTHER NETWORK (RDS-EON)

The Enhanced Other Network (EON) feature will tune to any radio station of the same station network as the one that you are listening to, once the signal gets weak.

Either local or distant networks can be selected by the EON feature.



E83263

1. With **FM1**, **FM2** or **FMA** selected, press the **MENU** button.
2. Use the rotary control to select **FM Settings** and press to select.
3. Use the rotary control to select **Advanced settings** and press to confirm selection.

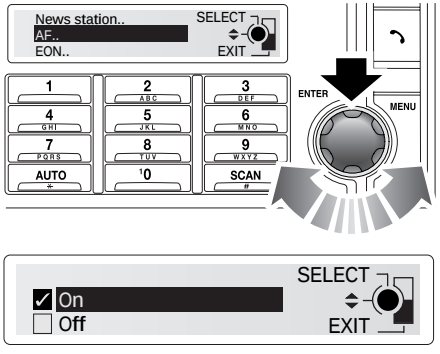
Note: *The* ***Advanced settings*** *menu is not available while the vehicle is moving.*

4. Use the rotary control to select **EON** and press to confirm selection.
5. To enable or disable the EON mode, rotate the control to select **Off, Local** or **Distant** and press to confirm selection.

ALTERNATIVE FREQUENCIES

As the Radio Data System (RDS) receives information about the frequencies being used by nearby transmitters, it can choose the strongest signal for the selected station. With the Alternative Frequencies (AF) feature enabled, you will not need to retune the radio as you drive between different transmitter areas.

Alternative Frequency (AF) - Premium audio



E83262

1. With **FM1**, **FM2** or **FMA** selected, press the **MENU** button.
2. Use the rotary control to select **FM Settings** and press to select.
3. Use the rotary control to select **Advanced settings** and press to confirm selection.

Note: *The **Advanced settings** menu is not available while the vehicle is moving.*

4. Use the rotary control to select **AF** and press to confirm selection.
5. To enable AF mode, rotate the control until **On** is highlighted and press to confirm selection.

Alternative Frequency (AF) - Standard audio

1. With **FM1**, **FM2** or **FMa** selected, press the **MENU** button to display the menu.
2. Using the rotary control, select **AF Switch** from the menu. **ON** or **OFF** will be displayed, dependent on status.
3. Press the rotary control to change status.

The AF switch status will be displayed briefly on the information screen.

NEWS BROADCASTS

The news broadcasts feature detects the presence of local news. As soon as a news broadcast is received, radio reception or CD play is interrupted. At the end of the news broadcast, radio or CD play will resume.

Press and hold the **INFO** button to switch news announcements on or off.

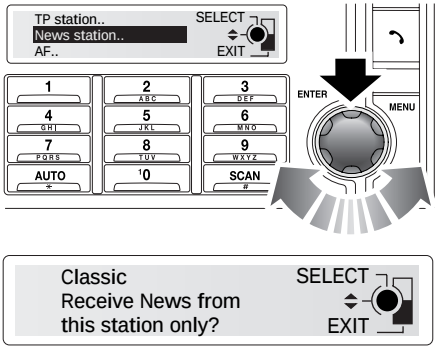
Note: *Both traffic and news information can be selected at the same time. However, the audio unit will always give priority to traffic information.*

To cancel an announcement, press and release the **EXIT or C** button.

Note: *Cancelling an announcement in this way will not prevent further announcements when they become available.*

News station preference

With the news feature enabled, any announcement received by the system will interrupt normal radio reception or CD play. The news station preference feature allows the premium audio system to only receive news announcements from a particular station.



E83266

1. With the preferred news station selected, press the **MENU** button.

2. Use the rotary control to select **FM Settings** and press to confirm.
3. Use the rotary control to highlight **Advanced settings** and press to select.

Note: *The* ***Advanced settings*** *menu is not available while the vehicle is moving.*

4. Rotate the control until **News station** is selected and press to confirm selection.
5. When the station name or frequency is displayed along with the message **Receive news from this station only?**, press the rotary control to confirm.

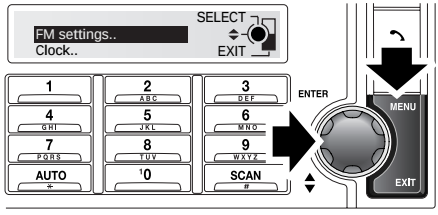
PRIORITY PROGRAMME TYPE (PTY)

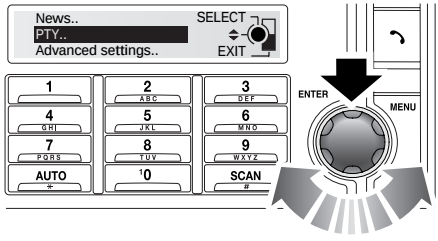
The RDS (Radio Data System) allows programmes to be categorised by the broadcast type (rock music, current affairs, news, etc).

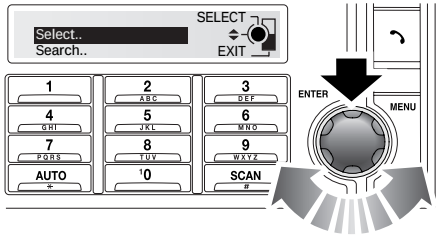
This in turn allows you to search for a station by choosing the type of broadcast that you wish to listen to.

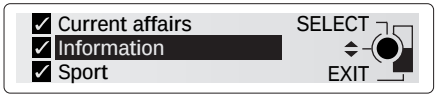
PTY selection - Premium audio

The type of programme searched for by the PTY feature can be selected from the PTY selection list.









E83736

1. Press the **Menu** button to enter the menu.
2. Press the rotary control to select **FM settings**.
3. Use the rotary control to scroll through the menu until **PTY** is highlighted, then press the rotary control.
4. Use the rotary control to scroll through the menu until **Select** is highlighted, then press the rotary control.

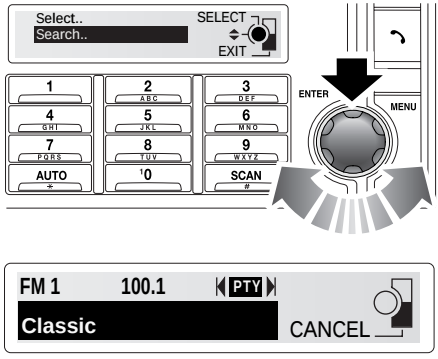
5. Having entered the **PTY** select menu, use the rotary control to scroll through the programme types until your choice is highlighted.
6. Press the rotary control to select or deselect the programme type(s) required.
7. Press the **EXIT** button to return to the **PTY** menu.

PTY programme types

1. News
2. Current affairs
3. Information
4. Sport
5. Education
6. Drama
7. Culture
8. Science
9. Varied speech
10. Pop music
11. Rock music
12. Easy listening
13. Light classic
14. Serious classic
15. Other music
16. Weather
17. Finance
18. Childrens
19. Social affairs
20. Religion
21. Phone in
22. Travel and touring
23. Leisure and hobby
24. Jazz music
25. Country music
26. National music
27. Oldies music
28. Folk music
29. Documentary

PTY search - Premium audio

1. Press the **Menu** button to enter the menu.
2. Press the rotary control to select **FM settings**.
3. Use the rotary control to scroll through the menu until **PTY** is highlighted, then press the rotary control.

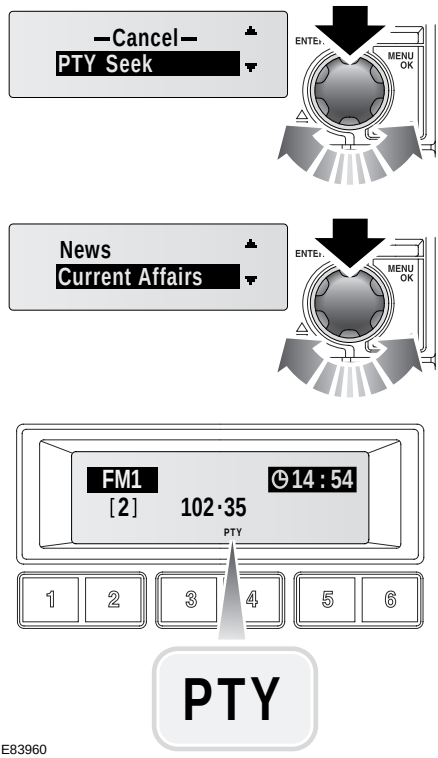


E83106

4. Use the rotary control to scroll through the menu until **Search** is highlighted, then press the rotary control. The audio system will then search for all pre-selected programme types.
5. To abort a **PTY** search, press the **EXIT** button.

Once the search is complete, **PTY** will be displayed on the screen with the station information. To skip to the next or previously stored PTY station, press the forward or rearward search arrow button.

PTY seek - Standard audio



E83960

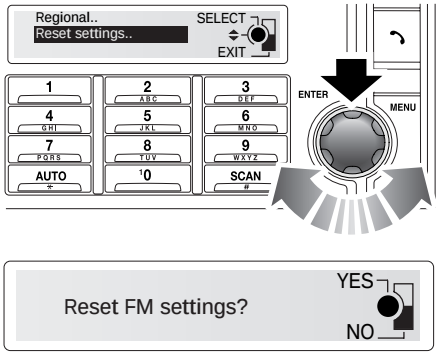
1. Press the **Menu** button to enter the menu.
2. Use the rotary control to scroll through the menu until **PTY Seek** is highlighted, then press the rotary control.
3. Use the rotary control to scroll through the programme types until your choice is highlighted.
4. Press the rotary control to start searching for the selected programme type.

Once a matching station is found, it will continue to play. If you wish to continue searching, press the search up or down buttons within 30 seconds.

To abort PTY seek, press the **C** button.

RESETTING THE AUDIO UNIT

It is possible to reset the RDS settings on the premium audio unit to the default values in one operation.



E83537

1. With the preferred news station selected, press the **MENU** button.
2. Use the rotary control to select **FM Settings** and press to confirm.
3. Use the rotary control to highlight **Advanced settings** and press to select.

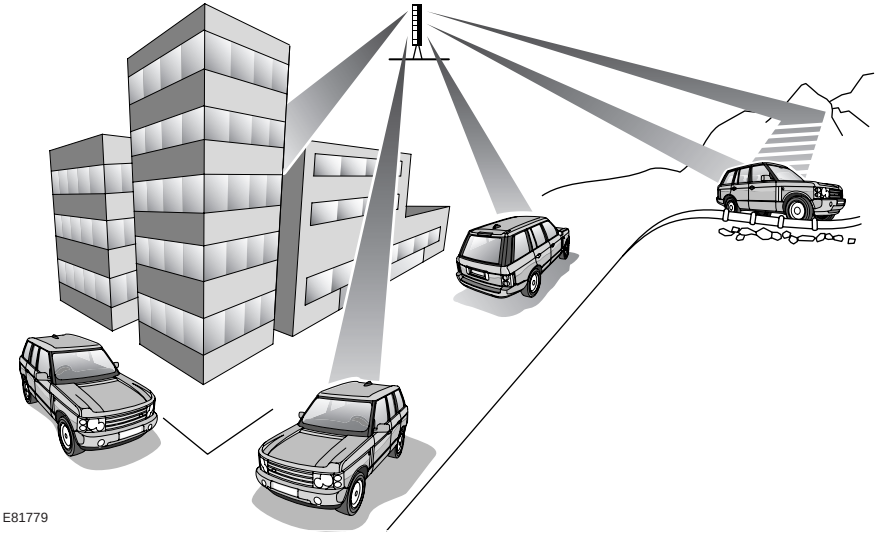
Note: *The* ***Advanced settings*** *menu is not available while the vehicle is moving.*

4. Rotate the control until **Reset settings** is selected and press to confirm selection.
5. When the message **Reset FM settings?** appears, press the rotary control to confirm, or the **EXIT** button to cancel.

Digital audio broadcasting

GENERAL INFORMATION

Digital radio reception



Digital audio broadcasting (DAB) provides a clear signal with minimal interference, hiss or fading. After a channel (or station) has been tuned and stored, you do not need to retune.

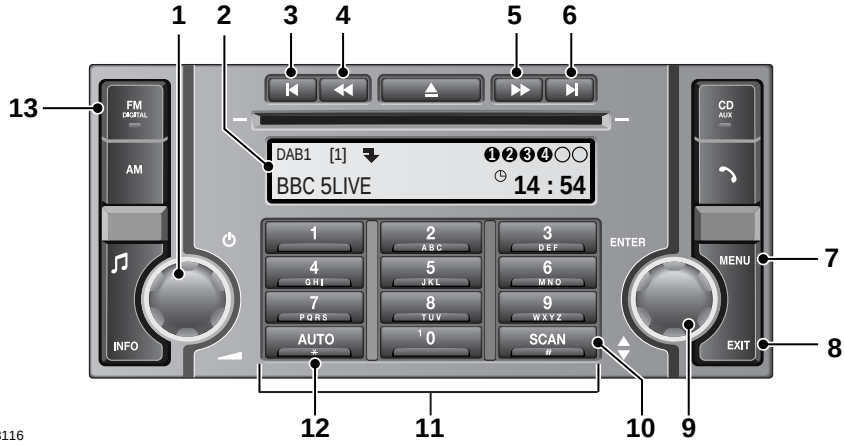
Radio signals travel in a straight line so large obstacles, such as tall buildings, can shield the vehicle from the signal, causing temporary loss of reception (known as dead spots).

Digital radio is transmitted from regional terrestrial transmitters. Some local digital radio channels are not available outside the range of a transmitter. If you want to listen to new local channels as you move around the country, you will need to use the auto-tune function (AUTO) to build new channel lists.

Digital radio channels are organised into groups called ensembles (also known as multiplexes). Some individual channels may also provide a number of subchannels. For example, if several sports events are being held simultaneously, the channel may temporarily choose to broadcast each different event on a separate subchannel.

Digital audio broadcasting

AUDIO CONTROLS

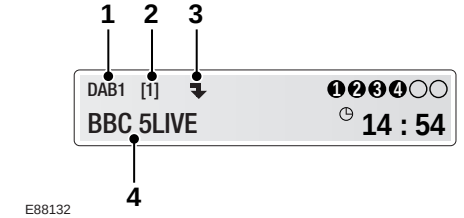


1. On/off and volume control
2. Information display screen
3. Ensemble search down
   - Press and release to find previous digital ensemble
   - Press and hold to display a list all available ensembles
4. Channel search down
   - Press and release to find previous digital channel
   - Press and hold to access subchannels (if available), then press and release to find previous subchannel
5. Channel search up
   - Press and release to find the next digital channel
   - Press and hold to access subchannels (if available), then press and release to find next subchannel
6. Ensemble search up
   - Press and hold to find the next digital ensemble
   - Press and hold to display a list of all available ensembles
7. MENU button
8. EXIT button
   - Press and hold to save changes and exit the menu
   - Press and release to move up to the previous menu
9. Menu control
   - Rotate to scroll through a menu and highlight menu options
   - Press to select menu options
10. SCAN button
    - Press to listen to an eight-second broadcast of each channel in sequence, press again to select a channel
11. Keypad buttons. Preset store and recall
12. AUTO button
    - Press and hold to start automatic tuning of available ensembles and channels

13. FM/DIGITAL button

- Press and release to select the next available radio source FM1, FM2, DAB1, DAB2

DISPLAY OPTIONS



1. Digital source indicator

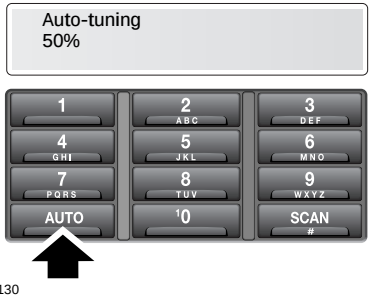
2. Preset number for current channel

3. Subchannel indicator (or **SubCh** if a subchannel is being received)

4. Channel name

Note: *The display can also show ensemble or programme type (PTY) information if you have selected one of these options via the menu. See* ***SETTINGS*** *(page 240).*

CHANNEL AUTOMATIC TUNING



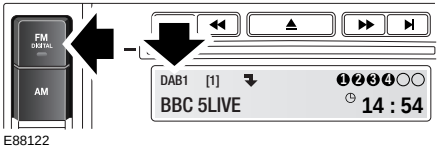
Note: *When you first use your DAB radio, you will be unable to listen to any digital stations until you have used the auto-tune function.*

Press and hold the **AUTO** button to start automatic tuning and build a list of all the digital ensembles and channels available in the region you are located.

While automatic tuning is running, the message **Auto-tuning** will be displayed along with a percentage complete. When tuning is complete, the first channel found will start playing.

To update the list of local channels when you move to a different region, press and hold the **AUTO** button again.

CHANNEL OPTIONS

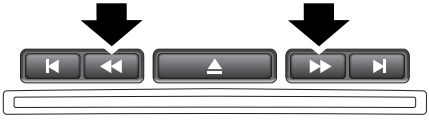


To receive digital broadcasts, press and release the **FM/DIGITAL** button repeatedly to toggle between the **FM1**, **FM2**, **DAB1** and **DAB2** sources. Choose either DAB1 or DAB2 to receive digital broadcasts. The channel that was last played on your chosen digital source will be selected for playback automatically.

Note: *If this is the first time you have used DAB, before you can select a channel, you need to build a list of available channels using the auto-tune function. See* ***CHANNEL AUTOMATIC TUNING*** *(page 236).*

Digital radio channels are organised into groups called ensembles and some individual channels may provide a number of subchannels. You can search for channels, subchannels or ensembles to find the digital broadcast you require.

Selecting a channel



E85661

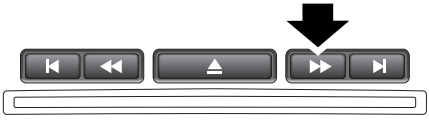
Press and release one of the channel search buttons to select the next available digital channel. The up (>>) button selects the next channel, the down (<<) button selects the previous channel.

Note: *If the next or previous channel is in a different ensemble, then there will be a short pause before the channel is located. The message* ***Please wait…*** *is displayed on the screen.*

Selecting a subchannel

E88124

If subchannels are available under the channel you have selected, the subchannel arrow icon is displayed.



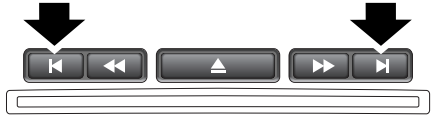
E88125

Press and hold either of the channel search buttons to access a list of subchannels. Then, to find the next subchannel, press and release the channel search button.

If more than one subchannel is available, press and release the channel search button repeatedly to scroll through the list. To return to the main channel, press and hold one of the channel search buttons. You can also search subchannels from the settings menu. See **SETTINGS** (page 240).

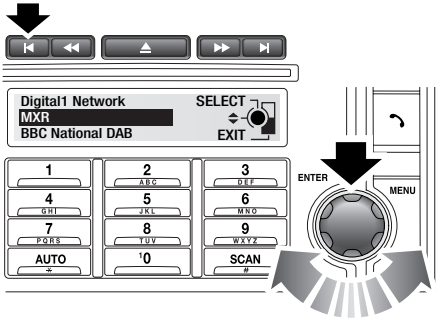
Note: *when you select and play a subchannel, the arrow icon is replaced by* ***SubCh*** *on the display screen.*

Selecting an ensemble



E85662

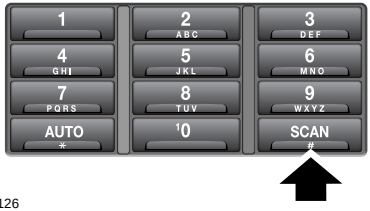
Press and release the ensemble search buttons to find the next available ensemble. The up (>|) button finds the next ensemble, the down (|<) button finds the previous ensemble. After a few seconds wait the first channel in the ensemble you have selected will play.



E88123

Press and hold an ensemble search button to display a list of all available ensembles. Rotate the menu control to scroll through the ensemble list and press it to select one and display a list of channels in that ensemble.

Scanning channels



E88126

You can use the scan function to listen to a short broadcast of each available channel in turn before selecting the one you prefer.

Press and release the **SCAN** button to start the channel scan and play the first channel. After eight seconds, the scan moves to the next channel and so on. After the last channel in an ensemble, the first channel in the next ensemble is played. To stop the scan and play the current channel, press the SCAN button again or press the Exit button.

Note: *Subchannels are not included in scanning.*

Signal availability

E88127

If the digital radio signal is lost or the system takes time to tune in to a channel, then the display screen will show the message **No reception**.

The problem may be caused by a temporary problem, such as buildings or trees blocking the signal, or it might be a problem with the broadcast service operator. Try tuning to an alternative channel and return later to see if the problem has been resolved. If you are unable to tune to any other channels, switch off the audio unit and then try again.

PRESET BUTTONS

Storing channels as presets

E88128

You can store up to twenty digital channels (ten each on **DAB1** and **DAB2**) using the numbered preset buttons.

1. Search for and start playing the channel you want to preset.

2. Press and hold the preset button (for about two seconds) on which you want to store the current channel. Audio output is muted for a further two seconds while the channel is stored and a confirmation message is displayed.
3. Repeat steps 1 and 2 for each channel that you want to store as a preset.

Note: *You cannot store a subchannel as a preset. If you try to store a subchannel, you will store the channel to which the subchannel belongs.*

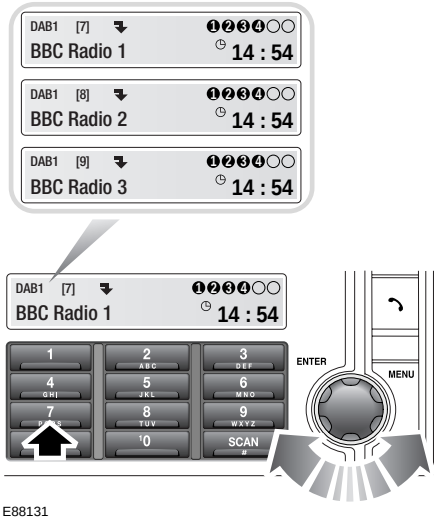
Recalling a preset channel

E88129

Make sure that you have selected the appropriate digital source (**DAB1** or **DAB2**) and then press and release the preset button you require. The channel you have selected will start to play automatically.

Note: *If you try to recall a channel that has previously been stored as a preset but is now unavailable or invalid, the message* ***No channel found*** *is displayed. You must choose another channel.*

Scrolling through presets

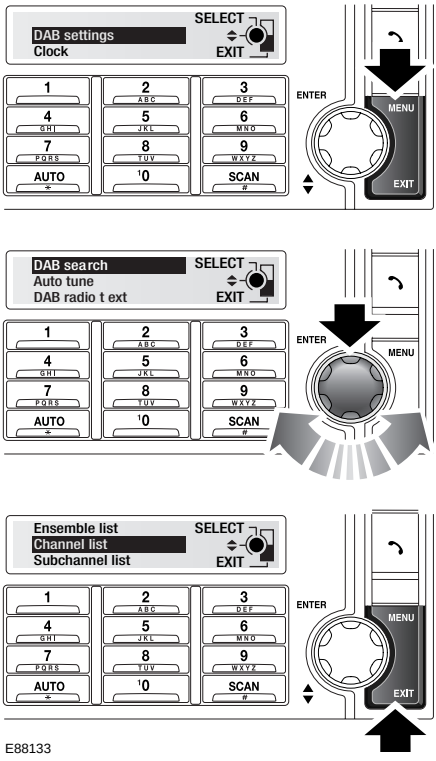


E88131

Rotate the menu control to scroll through all available presets for the current digital source (**DAB1** or **DAB2**). When you stop rotating, the selected channel will start to play automatically after a few seconds.

Note: *If you are listening to a subchannel, then rotating the menu control will return you to, and then scroll through, the channel preset list.*

SETTINGS



A number of different functions are available from the DAB settings menu. Follow the procedure below to access the menu.

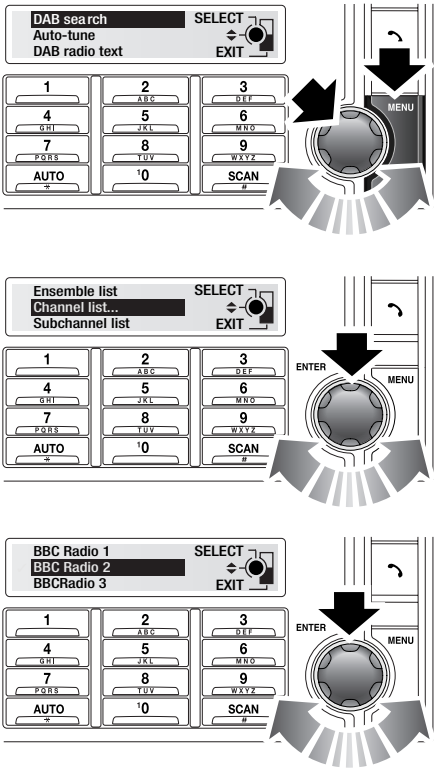
1. While you are using either the DAB1 or DAB2 source, press and release the **MENU** button.
2. Press and release the menu control to select **DAB settings**.
3. Rotate the menu control to scroll through, and highlight, the menu options displayed.
4. Press and hold the **EXIT** button to save any changes you have made and return to normal audio mode.

Note: *To navigate up to a previous menu level, press and release the* ***EXIT*** *button.*

Note: *If you have pressed the* ***MENU*** *button once but take no action for ten seconds, the system will exit the menu automatically.*

DAB search

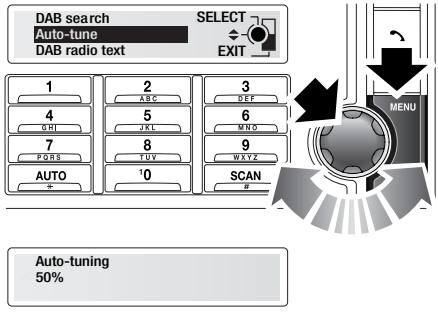
To find a specific broadcast, use the **DAB search** menu. You can scroll through, and choose from, complete lists of ensembles, channels, subchannels or programme type (PTY) categories.



E88134

1. From the **DAB settings** menu, choose **DAB search**.
2. Press and release the menu control to view the following options: **Ensemble list** to view a list of all ensembles and the channels within each ensemble-; **Channel list** to view a list of all available channels. **Subchannel list** to view a list of all subchannels (if available) under the channel currently playing **PTY** to list all PTY categories (News, Sport, Talk etc.) and the channels within each category.
3. Rotate the menu control to scroll through the list, then press and release the menu control to choose from a list.

Auto-tune



E88135

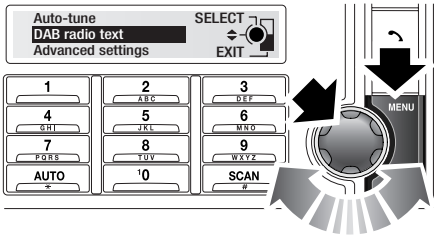
Auto-tune builds a list of all the available digital channels for the region you are in. See **CHANNEL AUTOMATIC TUNING** (page 236).

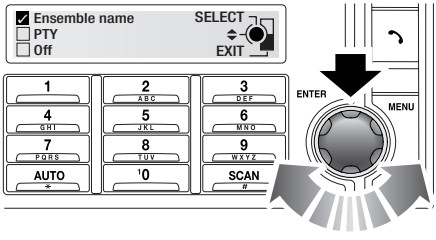
From the **DAB settings** menu, choose **Auto-tune** to start. The message **Auto-tuning…** is displayed along with a percentage to indicate progress.

Note: *You can also press and hold the* ***AUTO*** *button to start auto-tuning.*

DAB radio text

You can change the type of information that is displayed on the screen when a channel or subchannel is playing.



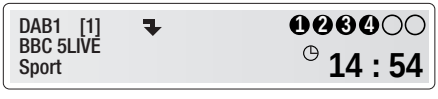


E88136

From the **DAB settings** menu, choose **DAB radio text**. Rotate the menu control and press to select one of the following:

E88137

- **Ensemble name** to display the name of the ensemble to which the current channel belongs.



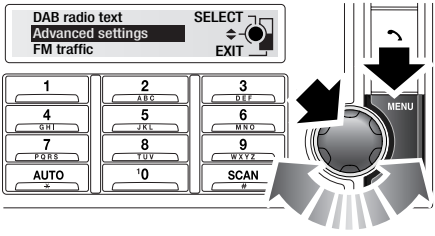
E88138

- **PTY** to display the name of the ensemble to which the current channel belongs.

E88139

- **Off** to display only the channel name.

Advanced settings

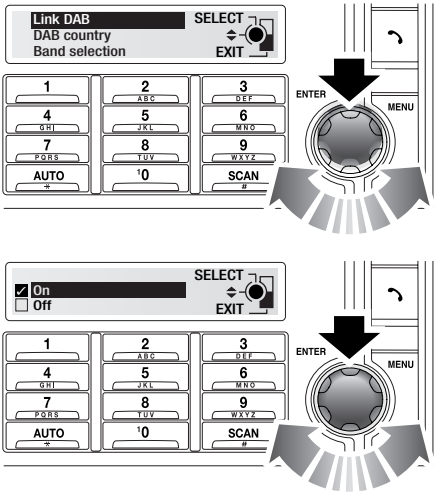


E89492

From the **DAB settings** menu, choose **Advanced settings**. Use the menu control to navigate the menu options below.

Link DAB

Some DAB channels are broadcast in a number of different ensembles. For example, some national channels may broadcast a number of regional variations of the same channel under different ensembles.

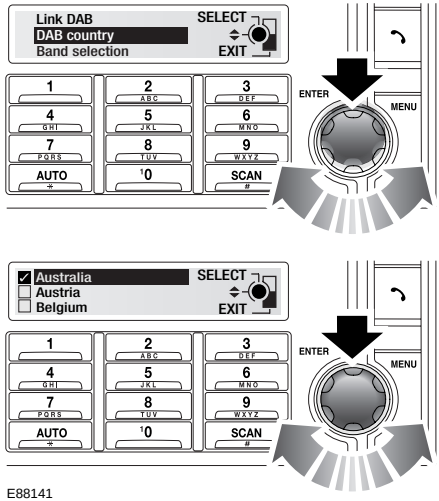


E88140

If the **Link DAB** setting is switched on and the signal strength for a channel falls below an acceptable level, the audio unit will automatically search other available ensembles for a channel with the same name.

If an alternative local channel is found, then the message **Switching ensemble** is displayed and the new channel is played automatically after few seconds. If the channel is not found after a few seconds, the message **No signal** is displayed.

DAB country



E88141

If you move the vehicle to a different country, you can change **DAB country** setting to make sure that the audio unit gives the best possible reception and sound quality. Rotate the menu control to highlight the new country in the list. Press and release the menu control to check the box next to the selected country.

Note: *When you change the DAB country, the audio unit automatically starts auto-tuning. See* ***CHANNEL AUTOMATIC TUNING*** *(page 236).*

Band selection

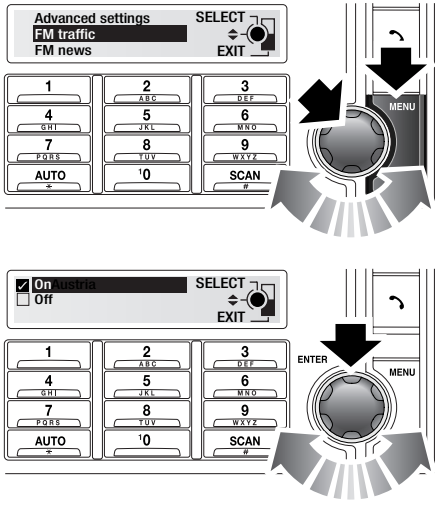
Different regions or countries may use different digital bands to broadcast DAB channels. If you know the band(s) required then you can choose from the **Band selection** menu. The available bands are:

- LBand
- BandIII
- LBand & BandIII
- LBandCanada
- LBandCan & BandIII

Reset DAB settings

If you want to reset the DAB settings to the manufacturer's defaults, use the menu control to choose the **Reset DAB settings** menu option. Press the menu control again to confirm the reset.

FM traffic and news



E88142

The FM traffic function detects the presence of local travel announcements, while the FM news function detects local news announcements. As soon as an announcement is received, radio reception or CD play is interrupted. At the end of the announcement, radio or CD play will resume. You can use this menu option to turn announcements on or off.

From the **DAB settings** menu, choose **FM traffic** or **FM news** and then press and release the menu control to select either **On** or **Off**. To cancel a traffic or news announcement and return to the digital channel, press and release the **EXIT** button. Cancelling an announcement temporarily will not prevent further announcements from broadcasting when they become available.

Note:

Both traffic and news information can be selected at the same time. However, the audio unit will always give priority to traffic information.

Note:

Traffic and news announcements are not currently available from DAB services, so the audio unit switches to an FM channel just for the duration of the announcement, so there may be some temporary loss of sound quality.

LOADING COMPACT DISCS

CAUTION

Do not force the disc into the slot.

Note: *Some music CD manufacturers are using data encryption to copy-protect their recordings and prevent the production of counterfeit copies. These CDs differ from the internationally agreed CD audio standard, RedBook, a standard that serves as the operating basis for all CD players and changers. Copy-protected CDs may fail to play in your CD changer or may be played subject to various limitations, e.g. sound quality may be impaired. If you do experience a problem, try the CD in other players before contacting the CD vendor.*

CAUTION

Do not use discs with paper labels, Dual Discs or DVDPlus discs. The front loading CD player may load and play this type of disc, however, it is likely that the disc will not eject and will block the CD mechanism. Such damage to a CD player will not be covered under warranty.

Loading a CD - Single disc player

To insert a disc into the player, make sure that the label side of the disc is facing upwards and present the disc to the slot. Ease the disc into the slot until the mechanism takes over and draws the disc in fully.

Loading a CD - Six disc player

Press the **CD** mode button, then press the numbered button of the position in which the compact disc is to be stored (**1** to **6**).

Make sure that the label side of the disc is facing upwards then, when prompted, partially insert the disc. The player mechanism will draw the disc in automatically and the disc number will appear on the display.

Note: *If there is a problem with a disc that has been loaded (inserted upside down, wrong format etc.),* ***Disc unreadable*** *or* ***Disc error*** *will appear in the information display, and the disc will be ejected. If the problem can be corrected (disc upside down for example), then re-insert the disc in the correct manner. If the problem cannot be rectified, do not re-insert the disc.*

There will be a pause while the player reads information from the disc, then play will start at the first track.

To load another CD, press another numbered button (**1** to **6**) and repeat the loading procedure.

Note: *The six circles in the top right-hand side of the information display of the premium unit, represent the six available CD positions. As soon as a CD is loaded, its number will appear in the circle.*

Load all

This feature is only available on the standard audio, six disc CD player.

1. Press and hold the **CD** button until **Load All** appears on the display.
2. When prompted, partially insert the first disc. The player mechanism will draw the disc in automatically.
3. When prompted, continue to insert discs until all six discs have been loaded. When fully loaded, the CD player will commence playing CD1.

EJECTING COMPACT DISCS

It is only possible to eject a single disc, if it is currently selected or playing.

To eject a disc, press and release the eject button. A confirmation message will be shown on the information display. After a short pause, the disc will be presented. The disc should then be removed.

Note: *If the disc is not removed from the slot within fifteen seconds, it will be drawn back into the player.*

EJECTING MULTIPLE COMPACT DISCS

All the discs loaded in the player can be ejected in sequence. To eject all of the discs, press and hold the eject button. A confirmation message will be shown on the information display. After a short pause, the first disc will be presented. The disc should then be removed.

The discs will be ejected one at a time with a short pause in between each.

To stop the process, press any CD number button (**1** to **6**).

COMPACT DISC SELECTION

To select one of the loaded discs, briefly press the disc number required (**1** to **6**). If the position selected does not contain a disc, there will be a pause and a message will appear on the information display.

Once a disc has been inserted, there will be a pause while the player reads the disc information. Playback will then begin at the start of track one.

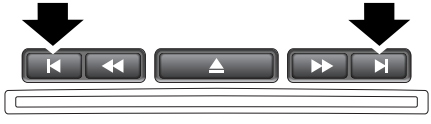
COMPACT DISC PLAYBACK

To start compact disc playback, briefly press the **CD** mode button, followed by the disc number required. If no disc number is selected, playback will begin at one of two places:

- If the discs have not been removed since their last use, playback will begin from the point at which it was stopped previously.
- If the discs have not been used since they were inserted, playback will begin at the start of the first loaded disc.

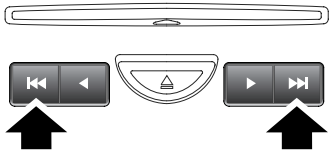
TRACK SELECTION

Premium audio



E83962

Standard audio



E83961

To return to the start of a track, or skip to the next track during playback, press and release the appropriate button.

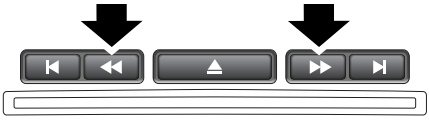
COMPACT DISC PAUSE

To pause or stop compact disc playback, briefly press one of the other mode buttons, **AM** or **FM** for example. Press the **CD** button to continue playback.

On premium audio units, CD play will also pause when the volume is turned down to **0**. Play will resume when the volume is turned back up.

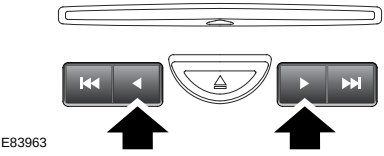
FAST FORWARD/REVERSE

Premium audio



E83964

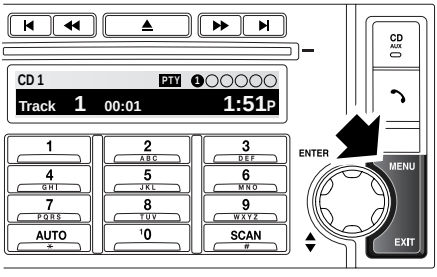
Standard audio



E83963

To search forwards or backwards through the current track, press and hold the relevant search button.

COMPACT DISC FUNCTION MENU



E82981

Depending on the specification of the audio unit, the following extra functions are available using the compact disc function menu:

- Random
- CD text
- CD scan
- Repeat
- TA
- News

Select compact disc mode, then briefly press the **MENU** button. Use the rotary control to select **CD settings**. Press the rotary control to confirm selection. Use the rotary control to select the required function and press to confirm selection. Rotate the control to enable or disable the function.

COMPACT DISC DISPLAY OPTIONS

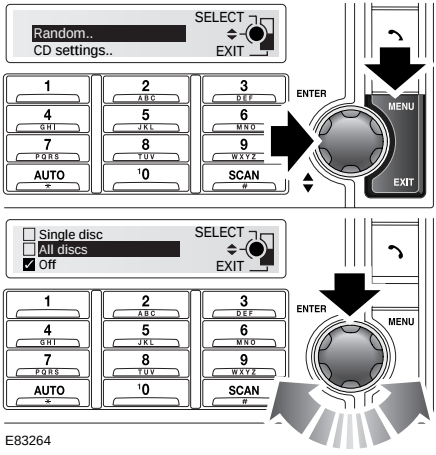
Some compact discs, including MP3 files, have information which can be displayed on the premium audio display screen. Instead of the track number, it is possible to view the track title with the CD text function enabled.

To enable or disable the CD text function, select compact disc mode, then briefly press the **MENU** button. Use the rotary control to highlight **CD settings** and press to confirm selection. Using the rotary control, select **CD TEXT** from the menu. Rotate the control to select **On** or **Off** and press to confirm selection.

SHUFFLE/RANDOM

Random alters the playback sequence for the loaded discs. The tracks are selected randomly by the player.

Random selection - Premium audio



E83264

1. Press the **Menu** button to access the menu.
2. Use the rotary control to select **Random** and press to confirm selection.
3. From the following menu, use the rotary control to select **Off**, **All discs** or **Single disc**. Press the control to confirm selection. Press the **EXIT** button to return to the previous menu.

Note: *When **All discs** is selected, the system will ignore MP3 discs and only play standard audio discs.*

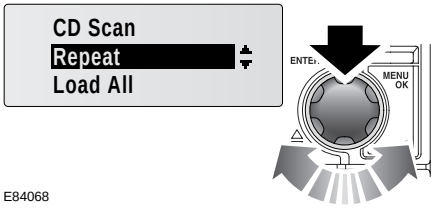
Random selection - Standard audio

1. Press the **Menu** button to access the menu.
2. Use the rotary control to select **Random**.
3. Press the rotary control to enable or disable the function as required.

REPEAT COMPACT DISC TRACKS

Repeat allows the current track to play repeatedly until it is stopped or cancelled.

Note: *This feature is only available on standard audio units.*



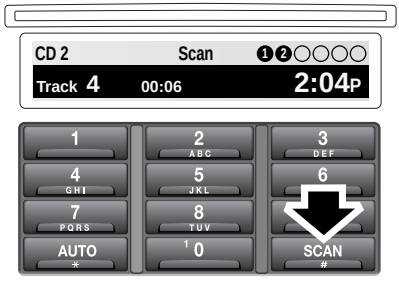
E84068

1. Press the **MENU** button to view the menu.
2. Use the rotary control to select **Repeat** and press the control to enable the function.
3. To disable the function, rotate the menu control to select **Repeat** and press the control. Pressing the **C** button, the next track or previous track buttons will also disable the function.

COMPACT DISC TRACK SCANNING

Compact disc track scan allows you to sample the music on a compact disc. This feature plays the first ten seconds of each track in numerical order. Play will then begin at the start of track one.

CD scan - Premium audio



E82983

Press the **SCAN** button to enable this function.

To disable the function, and to continue the currently playing track, press the **SCAN** or **EXIT** button again.

Note: *While in CD scan mode, pressing the previous track button will resume normal play at the current track. Pressing the next track button will move to the next track and resume normal play.*

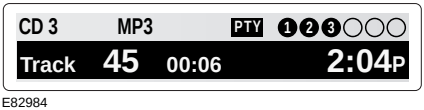
CD Scan - Standard audio

1. Press the **MENU** button to access the functions menu.
2. Use the rotary control to select **CD Scan**.
3. Press the rotary control to enable or disable the function.

Note: *While in CD scan mode, pressing the previous track button will resume normal play at the current track. Pressing the next track button will move to the next track and resume normal play.*

MP3 FILE PLAYBACK

Note: *Standard audio units do not have the facility to play MP3 files.*

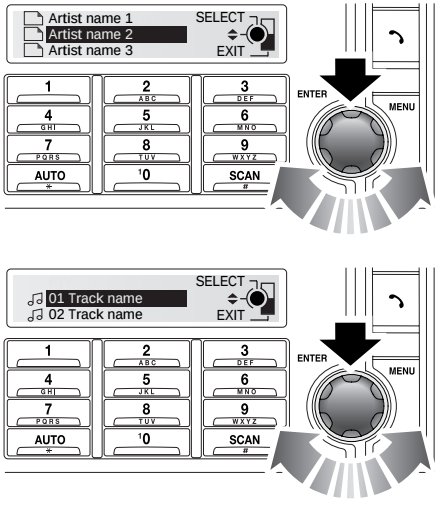


E82984

When a data disc (containing MP3 encrypted music data) is inserted into the compact disc slot, **MP3** will appear at the top of the display.

The disc will play the tracks in the order they appear on the disc.

All folder information is ignored and the tracks are numbered as they are ordered.



E83753

If you wish to navigate through folders to select specific tracks, press the rotary control to access the file structure. Use the rotary control to highlight the required folder or track and press to select.

If an MP3 recording is made with a compression rate lower than 128k some Digital Signal Processing (DSP) functionality may be lost.

To make sure that the best sound quality is achieved the instructions or information provided with the recording software should be read carefully and adhered to.

AUXILIARY INPUT (AUX IN) SOCKET

WARNINGS

Make sure that any auxiliary devices are stored securely while the vehicle is in motion. Any loose objects can present a serious hazard during sudden manoeuvres, emergency braking or an accident.

Do not place any item connected to the auxiliary input socket or the auxiliary power socket on the vehicle's seats, carpets, or other upholstery. The heat generated by these devices may cause damage to the upholstery, or in extreme cases, a vehicle fire.

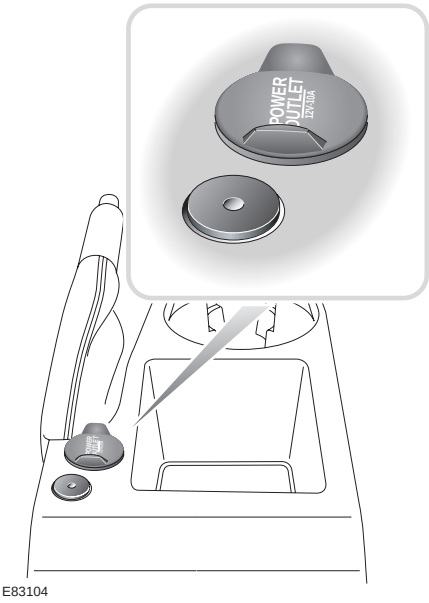
Do not leave any auxiliary input devices connected while the vehicle is left unattended. There is a risk of heat damage or fire, in addition to the risk of theft.

CAUTION

Read the manufacturer's instructions for any device before it is connected to the vehicle's audio system. Keep to any instructions about connection and operation and make sure that the device is suitable. Failure to do so may result in damage to the vehicle's audio system or the auxiliary device.

AUX (Auxiliary Input) mode allows extra equipment to be connected to the vehicle's audio system. Items such as a personal stereo, MP3 player, hand-held navigation unit etc., can be plugged in to the vehicle's audio system.

Note: *The volume levels and sound quality available from devices connected to the auxiliary inputs may vary widely. If the connected audio device is equipped with a line out socket as well as a headphone socket, the line out socket should be used.*



E83104

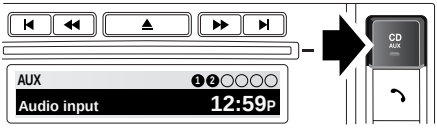
The auxiliary connector is situated at the rear of the centre console.

Auxiliary audio devices are connected via the 3.5 mm stereo jack socket.

The auxiliary power socket, situated next to the auxiliary input connector, can be used to power or charge any suitable device.

Auxiliary input (AUX IN) socket

Auxiliary mode



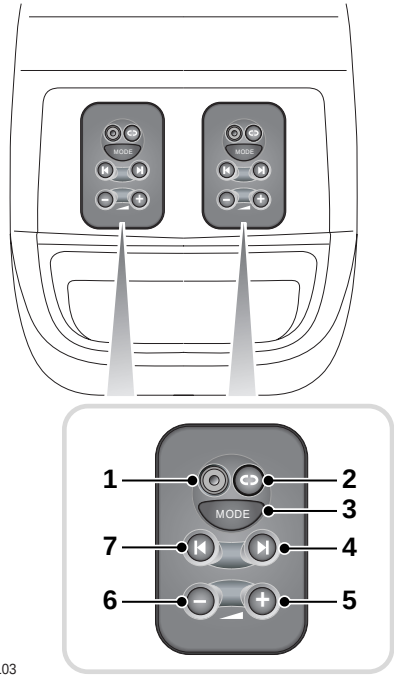
E83265

To listen to an auxiliary input source, connect the device and press and hold the **CD or AUX** button on premium audio units. On standard audio units, press and release the **AUX** button. The unit will playback audio via the 3.5 mm stereo jack socket.

Alternatively, repeatedly press the **MODE** button on the steering wheel or the rear audio controls until **AUX** is selected.

REAR SEAT CONTROLS

The rear seat control panels, located on the rear of the centre console, provides control of the audio system to the rear seat passengers.



E83103

1. 3.5 mm headphone socket
2. CD select
   - During CD play, press and release to select the next CD.
3. Mode control
   - Repeatedly press to scroll through FM, AM, CD and AUX modes.
4. Search up
   - During radio play, press to search up the frequency band for the next station with a good signal strength.
   - During CD play, press and release to start the next track.
   - During CD play, press and hold to search forward through the track being played. Release button to stop search.
5. Volume increase
   - Press to increase headphone volume
6. Volume decrease
   - Press to decrease headphone volume
7. Search down
   - During radio play, press to search down the frequency band for the next station with a good signal strength.
   - During CD play, press and release to start the current track again. A second press will start the previous track.
   - During CD play, press and hold to search back through the track being played. Release button to stop search.

With the starter switch in position **I** or **II**, the rear seat controls can operate, regardless of whether the audio system is switched on or not. The play and selection features of the audio system will be available at the rear seat controls. However, the output can only be heard through the headphones.

If rear seat passengers are listening to the same source as the front seat passengers, only the volume can be adjusted at the rear seat controls.

For example, if a music CD is playing on the audio unit, rear seat passengers can listen to that music and adjust the volume to suit their requirement. No other functions will be available.

If however, the audio unit is switched to another source, e.g. radio, all CD related rear seat controls become operable. If the audio source is subsequently switched back to CD, the rear seat controls will again be limited to volume control only.

The same logic applies to radio functions.

Adjustments can be made to other functions of the audio system.

For example, if a music CD is selected on the audio unit, radio can be selected and controlled using the rear seat controls. All radio related rear seat controls become operable.

HEADPHONES

Note: *Only headphones compatible with a 3.5 mm jack plug socket can be used. To obtain optimum sound quality, use headphones with an impedance of 32 ohms.*

Note: *When the headphones are not connected, the rear seat controls remain operational. It is still possible to select CD, while the radio is playing on the audio unit. CD play will remain operational until the mode control is pressed again.*

Note: *The mode in use when the starter key is removed will resume if the starter switch is turned on again (position **I** or **II**) within two minutes. If the starter switch is turned off for longer than two minutes **AUX** mode will be selected when the starter switch is next turned on. For example, if a CD is playing when the key is removed, play will restart when the starter switch is next turned to position **I**, or the engine is started, whether the headphones are in use or not.*

Note: *Adjusting the volume on the audio unit, does not alter the headphone volume. The volume of each controller can be adjusted independently.*

GENERAL INFORMATION

WARNINGS

Using the telephone near the car: do not telephone inside a garage or near an open car bonnet. The air may contain fuel vapours and the telephone could produce sparks and start a fire.

Unusual ambient conditions: Switch off the telephone in areas where high explosives are being used. High frequency remote controls could be interfered with and cause an explosion. Switch off your telephone in areas with a high explosion risk. This includes filling stations, fuel storage areas or chemical factories, as well as places where the air contains fuel vapour, chemicals or metal dust. The telephone might possibly produce sparks and cause a fire or explosion.

Medical equipment: The functioning of cardiac pacemakers or hearing aids may be impaired when the phone is in use. Check with a doctor or manufacturer whether any such devices you or your passengers are using are sufficiently protected against high-frequency energy.

Always stow your mobile phone securely. In an accident loose items can cause injury.

Note: *The vehicle telephone system is designed to function with a wide variety of Bluetooth telephones. As these telephones have a wide range of audio and echo performance characteristics, it may take a few seconds for the vehicle telephone system to adapt and deliver optimum audio performance. It may be necessary to reduce the in-vehicle volume slightly to fully optimise audio performance and reduce echo.*

Note: *The vehicle's Bluetooth telephone system can be used with an appropriate Bluetooth-equipped mobile telephone.*

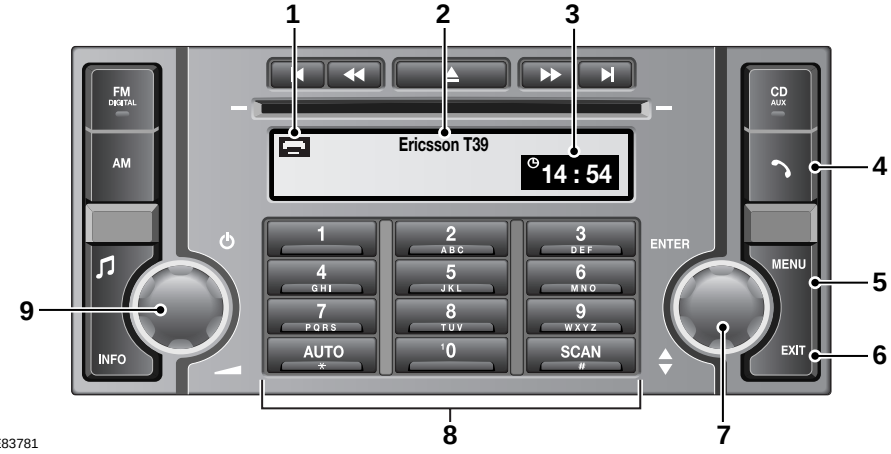
Note: *Please refer to your Land Rover Dealer/Authorised Repairer for a list of compatible telephones.*

Telephone networks

The Telephone network standard allows you to use your telephone in many countries.

However, telephone reception may be poor or unavailable in remote regions. This may be due to the inadequate power of the transmitter, which results in a weak signal or incomplete coverage.

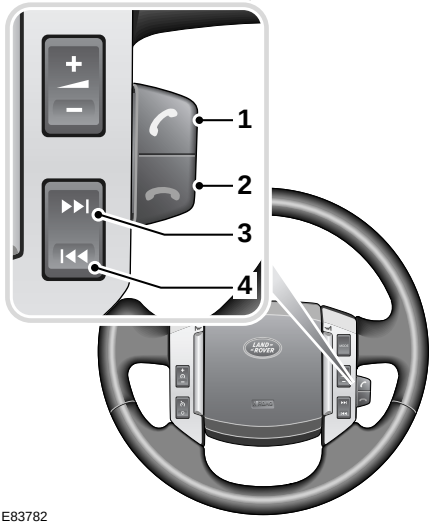
TELEPHONE CONTROLS



E83781

1. Call status icon
   - Indicates whether the telephone is in use.
2. Paired telephone name
   - The name of the telephone which is paired to the vehicle system.
3. Clock
4. Telephone mode button
   - Press to enable operation of telephone. (Press and hold to switch telephone operation off).
5. **MENU** button
   - Press to enter the telephone main menu.
6. **EXIT** button
   - Press to exit a menu or to delete entered numbers.
7. **ENTER** button
   - Rotate to select menu options. Press to confirm selections.
8. Keypad
   - Use to enter numbers. Also used to select phonebook letters.
9. On or off or volume button
   - Rotate (when in Ring Volume menu) to adjust the ring volume.

Telephone controls - Steering wheel



E83782

1. Answer call or dial switch
   - Pull the switch towards the steering wheel to answer an incoming call, or to view the list of the last 10 dialled numbers (if the audio unit is in telephone mode). A second pull of the switch will dial the highlighted number. Pull and hold the switch (for approximately two seconds) to activate voice tag dialling. See **TELEPHONE VOICE CONTROL** (page 270).
2. End or reject call switch
   - Pull the switch towards the steering wheel to end the current call or reject an incoming call.
3. Menu next button
   - Press to scroll down through a menu.
4. Menu previous button
   - Press to scroll up through a menu.
5. To leave the menu press the **EXIT** button.

BLUETOOTH SETUP

Before you can use your telephone with your vehicle it must be paired to the vehicle telephone system.

When pairing a Bluetooth telephone with the vehicle system make sure that the telephone is switched on, Bluetooth is enabled and discoverable, its battery is fully charged and the telephone User's Handbook is available.

Note: *A maximum of five pairings can be made to the vehicle, but only one telephone can be used at any time.*

Pairing a telephone to the system

Your Bluetooth mobile telephone pairing or discovery process will also be described in your mobile telephone User's Handbook.

1. Make sure the telephone to be paired is within 10 metres (30 feet) of the vehicle.
2. With the vehicle ignition on, press the telephone mode button on the audio unit. The system will search for the last connected telephone. If a telephone is not detected, the system will ask if you want to pair. Briefly press the **ENTER** button. If you do not want to pair a telephone, press the **EXIT** button.
3. The audio unit display will show a message to make sure that your Bluetooth telephone is switched on. Briefly press the **ENTER** button. The system will then start a search for your telephone.
4. After the search is completed, a list of all telephones found will be displayed on the audio unit screen. If more than one telephone is found, rotate the **ENTER** button to move up or down the list to select your telephone and then press the **ENTER** button.

5. The audio unit will now display a Bluetooth access code number which must be entered into your telephone.
6. A message on the audio unit display will confirm the system is connecting with your telephone. When it is successfully connected, the telephone will be paired and connected with the vehicle and can now be used with the vehicle telephone system.
7. If the pairing fails, a message will appear on the audio unit display; press the **ENTER** button to retry or press the **EXIT** button and restart the process.
8. The last connected telephone will be available for use when the system and telephone are switched on again.
9. If you wish to pair additional telephones, repeat the process.

Adding or changing a telephone

1. Select the telephone main menu. See **TELEPHONE SETUP** (page 258).
2. Select **Bluetooth**, then select the option to **change a telephone**.
3. **Add new phone** will appear at the top of the list. Repeat the procedure for pairing a telephone to the system.

If the maximum number of telephones are already paired to the system, a message will be displayed and you are given the option to remove one. This must be carried out before a new telephone can be paired.

Removing a telephone from the system

1. Select the telephone main menu. See **TELEPHONE SETUP** (page 258).
2. Select **Bluetooth**, then select the option to **remove a telephone**.
3. Select a telephone by rotating the **ENTER** button, highlight the telephone to be removed then press the **ENTER** button. A confirmation message to remove a telephone will appear on the audio unit display, press the **ENTER** button.
4. The **remove telephone** screen will be displayed, and if no further telephones are to be removed, press the **EXIT** button.

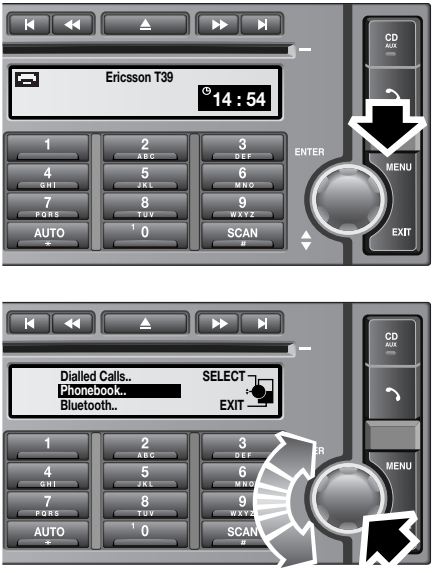
Loss of Bluetooth link

If the link between the telephone and the vehicle is lost, you have the choice to reconnect or to exit from the telephone system. To reconnect press the **ENTER** button. There will be a short delay whilst the connection is established and then your telephone name will be shown in the display.

Alternatively, press the **EXIT** button if you do not wish to reconnect your telephone.

TELEPHONE SETUP

Telephone main menu



E83808

Press the **MENU** button then rotate the **ENTER** button to select from:

- Missed calls
- Received calls
- Dialled calls
- Phonebook
  - See **PHONEBOOK** (page 266).
- Bluetooth
  - See **BLUETOOTH SETUP** (page 256).
- Phone settings
- Clock
  - See **CLOCK** (page 107).

Press the **ENTER** button to confirm your selection.

Missed calls

The audio unit display will list the numbers of the last 10 calls which have been missed. These are displayed in chronological order, with the last number missed first and highlighted.

Note: *Some mobile telephones reverse the missed call list, which results in the last missed call number being at the bottom of the list, rather than the top.*

Rotate the **ENTER** button to select the number, then press again or operate the answer call switch on the steering wheel to dial the number.

If there are no entries, an empty list is shown, press **EXIT** to return to the phone view.

Note: *When viewing missed calls, do not rotate the volume button as this will result in your highlighted selection returning to the first entry in the list, irrespective of your previously highlighted position.*

Received calls

The audio unit display will list the numbers of the last 10 calls which have been received. These are displayed in chronological order, with the last number received first and highlighted.

Note: *Some mobile telephones reverse the received call list, which results in the last received call number being at the bottom of the list, rather than the top.*

Rotate the **ENTER** button to select the number, then press again or operate the answer call switch on the steering wheel to dial the number.

If there are no entries, an empty list is shown, press **EXIT** to return to the phone view.

Note: *When viewing received calls, do not rotate the volume button as this will result in your highlighted selection returning to the first entry in the list, irrespective of your previously highlighted position.*

Dialled calls

The audio unit display will list the numbers of the last 10 calls which have been dialled. These are displayed in chronological order, with the last number dialled first and highlighted.

Note: *Some mobile telephones reverse the dialled call list, which results in the last dialled call number being at the bottom of the list, rather than the top.*

The dialled calls list can also be accessed by pressing the **ENTER** button, when telephone mode is selected.

Rotate the **ENTER** button to select the number. Then to dial the number, press **ENTER** again, or operate the answer call switch on the steering wheel.

If there are no entries, an empty list is shown, press **EXIT** to return to the phone view.

Note: *When viewing dialled calls, do not press the volume button as this will take you back to the radio or CD.*

Phone settings

Select **Call options** from the **Phone Settings** menu, and press the **ENTER** button.

Call options

E83809

This feature is used to turn the automatic answer facility on or off and also to enter the voice mail number.

Rotate the **ENTER** button to highlight **Automatic answer** and press the **ENTER** button. Select **On** and press the **ENTER** button again.

When automatic answer is on, all incoming calls are answered automatically and when the mode is off you must accept the call or press **EXIT** to reject.

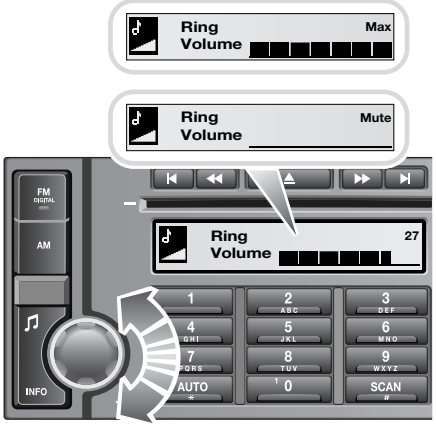
To enter a voice mail number, rotate the **ENTER** button to highlight **Voicemail number** and press the **ENTER** button. Enter your voice mail number on the keypad and press the **ENTER** button again.

Use the **EXIT** button to delete an incorrect number.

Sounds and alerts

E83810

Selecting sounds and alerts gives you the choice to alter the ring tone and the ring volume.



E83811

To select the ring volume, rotate the **ENTER** button to highlight **Ring volume** and then press the **ENTER** button to select. Now by rotating the **On or off or volume** button you can change the ring volume.

Note: *If the ring volume is not changed, the ring tone will sound for eight seconds. If the ring volume is changed, the ring tone will return to the menu two seconds after the change has been made.*

*This only applies to the **Car ring tones**. If **Mobile ring tone** is selected, no ring tone will be played. When **Mobile ring tone** has been selected, the volume can only be changed when there is an incoming call, i.e. ringing.*

E83812

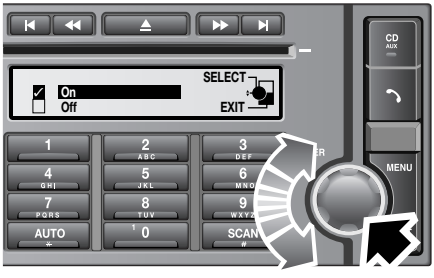
Select ring tone by rotating the **ENTER** button to highlight **Ring tone** and then press the **ENTER** button to select. Rotate the **ENTER** button to select one of the four alternative ring tones, or use the mobile telephone ring tone. Once you have selected a ring tone, press the **ENTER** button to hear the selected ring tone.

Note: *This only applies to the **Car ring tones**. If **Mobile ring tone** is selected, no ring tone will be played. When **Mobile ring tone** has been selected, the volume can only be changed when there is an incoming call, i.e. ringing.*

Another brief press of the **ENTER** button will store the tone. If you press the **EXIT** button the tone will not be stored and the ring tone menu will remain visible. Press the **EXIT** button again to return to the main menu or to the function previously selected.

Note: *Not all mobile telephones support* ***Mobile ring tone****, in this case it will not be possible to select and store the* ***Mobile ring tone*** *setting in the vehicle system.*

Autocopy phonebook



E83813

This feature allows you to choose whether or not your phone book is automatically updated every time you connect your telephone to the vehicle system. If **On** is selected and your telephone has the capability, the vehicle phone book will be updated the next time the telephone is connected to the vehicle. If **Off** is selected the phone book will not be downloaded to the vehicle system. See **PHONEBOOK** (page 266).

Press the **ENTER** button after making your selection. Pressing the **EXIT** button will return you to the previous screen. To return to the telephone main display, press and hold the **EXIT** button.

USING THE TELEPHONE

Selecting telephone mode

Switch on the ignition. If your telephone is switched on and previously paired or connected with the system, you can select the vehicle telephone system.

E83788

Briefly press the telephone mode button (arrowed). Visual confirmation of telephone operation is given via the display.

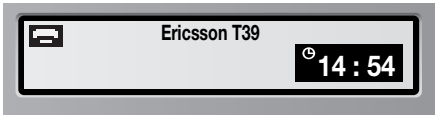
If a telephone is not paired to your vehicle system, **No paired Phone** and **Do you want to pair?** is displayed. See **BLUETOOTH SETUP** (page 256).

To exit telephone mode, press one of the audio system mode buttons, i.e. **FM**, **AM** or **CD or AUX**.

Telephone display

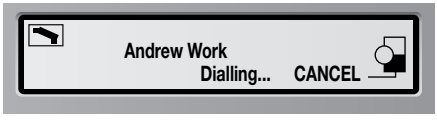
There are four different call status screens:

No call



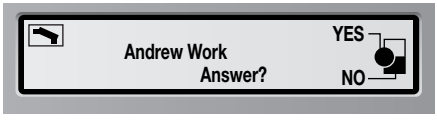
E83789

Dialling



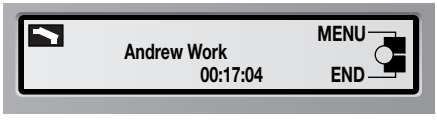
E83790

Incoming call



E83791

Call in progress



E83792

Making telephone calls

Dialling a number manually

E83793

Enter the telephone number to be dialled, using the vehicle keypad. The digits of the number appear in the display.

To pause during number entry, press and hold the **AUTO** key. A ***** symbol will appear in the display.

The international dial symbol + can be entered by pressing and holding the **0** (zero) key.

When the telephone number has been entered, briefly press the **ENTER** button or operate the answer call switch on the steering wheel to dial the number (**Dialling** appears in the display supported by ringing tones). A successful connection is shown on the display.

Note: *To cancel a call at any time, press the* ***EXIT*** *button or operate the end call button on the steering wheel.*

Correcting or deleting numbers

E83795

If an incorrect digit is entered, press the **EXIT** button (arrowed) to delete the last digit, then enter the correct digit.

Press and hold the **EXIT** button (for approximately two seconds) to delete all entered digits.

Multiple choice dialling

If the number you have dialled has an automated voice that requests another number, for a different area or department, use the keypad to enter that number.

Last number redial

The last number dialled can be redialled using the answer call switch on the steering wheel. If telephone mode is active, pull and release the switch. The number will appear in the audio unit display. Pull and release the answer call switch for a second time and the number will be dialled.

If telephone mode is not active, press the telephone mode button to enter telephone mode.

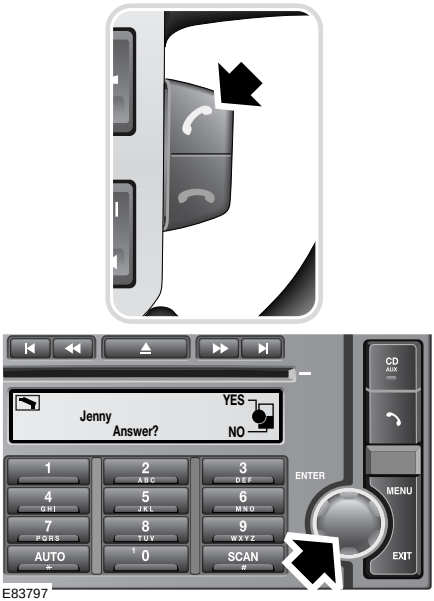
Note: *Some mobile telephones reverse the last dialled number list, which results in the last dialled number being at the bottom of the list, rather than the top.*

Ending telephone calls

E83796

To end a telephone call, press the **EXIT** button or operate the end call switch on the steering wheel.

Receiving telephone calls



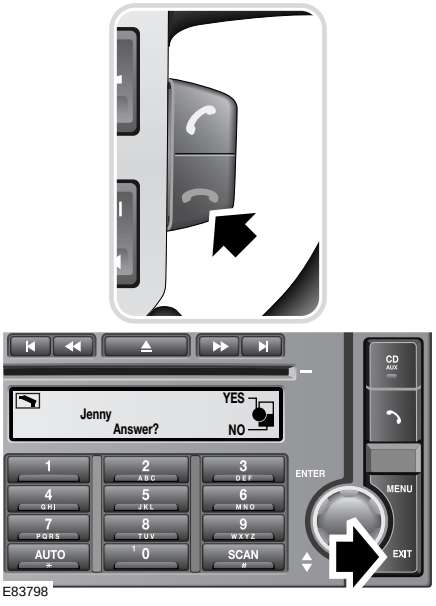
E83797

When a call is received, the number or caller ID (if entered into the phone book) will appear in the audio unit display.

If the audio or a CD was in use before the telephone call then that function will resume at the end of the phone call. A CD will continue playing from the point at which it was paused by the telephone call. The telephone display will be visible for the duration of the call.

The call can be answered in two ways:

- Operate the answer call switch on the steering wheel (arrowed in inset).
- Briefly press the **ENTER** button (arrowed).



E83798

If automatic answer is switched on, the call is accepted automatically. If automatic answer is switched off, and you do nothing, the vehicle system will operate as your mobile telephone would operate, i.e. go to voice mail or continue ringing.

Note: *The automatic answer feature can be switched on or off. See* ***TELEPHONE SETUP*** *(page 258).*

When the call is accepted, the display shows that the call is in progress and the duration of the call in minutes and seconds.

Rejecting an incoming call

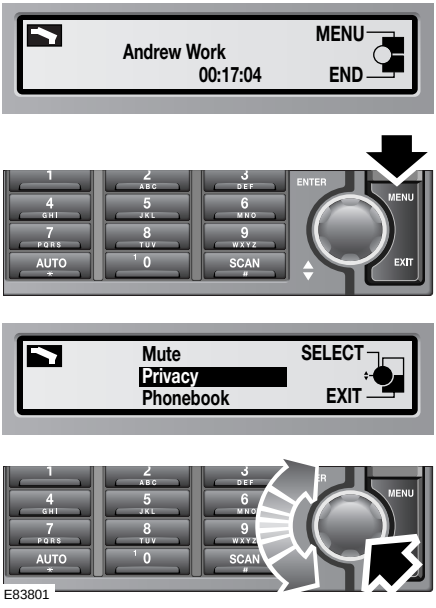
To reject a call without answering, briefly press the **EXIT** button or operate the end call switch on the steering wheel.

Telephone in-call menu

A number of settings can be made while a call is in progress. These are:

- muting the call
- privacy call
- accessing the phonebook.

When the call is ended the in-call settings return to their default values.



To enter the in-call menu, press the **MENU** button and then rotate the **ENTER** button to highlight the required option. Press the **ENTER** button to select.

Mute the call

Select **Mute** and press the **ENTER** button, this will prevent the caller from hearing any conversation in the vehicle.

Select **Mute Off** and press the **ENTER** button to resume your telephone conversation.

Privacy mode

Select **Privacy** and press the **ENTER** button, this will transfer the call to the mobile telephone preventing the vehicle occupants from listening in to your received conversation.

Select **Hands Free** and press the **ENTER** button when you wish to return to using the vehicle system.

Note: *Some mobile telephones may end the call or lose the Bluetooth connection when transferring between Privacy and Hands Free modes.*

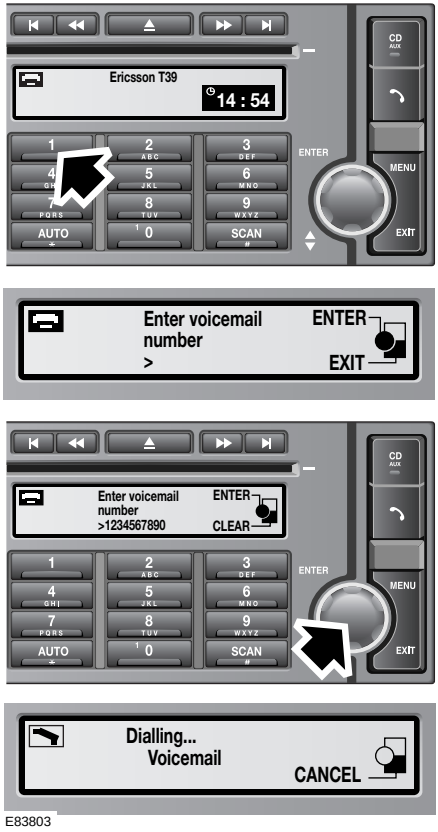
Phone book

You can access your phone book during a telephone conversation if you need to find a particular number.

Select **Phonebook** and press the **ENTER** button.

Press the **EXIT** button to return to your telephone conversation.

Voice mail



E83803

Voice mail may be set up by your service provider and can be used by the vehicle system.

Before voice mail can be used in the vehicle system, the voice mail number needs to be entered. See **TELEPHONE SETUP** (page 258).

E83804

You can access your voice mail when the mobile telephone is switched on, the voice mail number has been stored in the vehicle system and the vehicle system is in telephone mode. Press and hold the number **1** key on the keypad. This will send a message to the mobile telephone to dial the voice mail number.

You can also access voice mail by using **Call options** in the **Phone Settings** menu. See **TELEPHONE SETUP** (page 258).

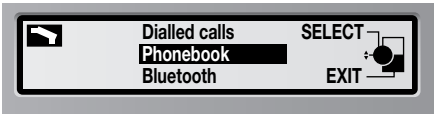
The audio unit display will indicate when voice mail is empty.

PHONEBOOK

When your telephone is next connected to the vehicle and autocopy phonebook is set to **On**, your phonebook is downloaded automatically to the vehicle system, provided your telephone has the capability. See **TELEPHONE SETUP** (page 258).

Note: *If there is a communication problem with the telephone or the telephone does not support this feature, the message* ***Phonebook is empty*** *will be displayed, and the phonebook will not be downloaded.*

Once downloaded, the phonebook can be accessed through the telephone main menu.



E83805

1. Press the **MENU** button to access the telephone main menu.
2. Rotate the **ENTER** button to highlight **Phonebook** and press the **ENTER** button again to select.

Note: *To exit the phonebook without selecting an entry, press the* ***EXIT*** *button.*

Phonebook menu

Rotate the **ENTER** button to select one of the following options:

- Search Phonebook
- Copy from Phone
- Erase car entry
- Erase car Ph.book

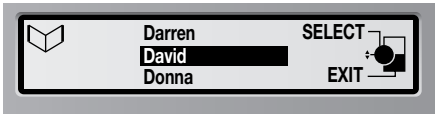
Press **ENTER** to confirm your selection.

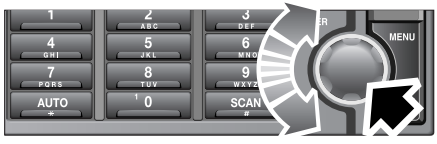
Search Phonebook

Note: *When viewing the phonebook, do not rotate the volume button as this will result in your highlighted selection returning to the first entry in the phonebook, irrespective of your previously highlighted position.*

The following methods can be used to search the phonebook:

- browsing
- alphabetic search
- quick search



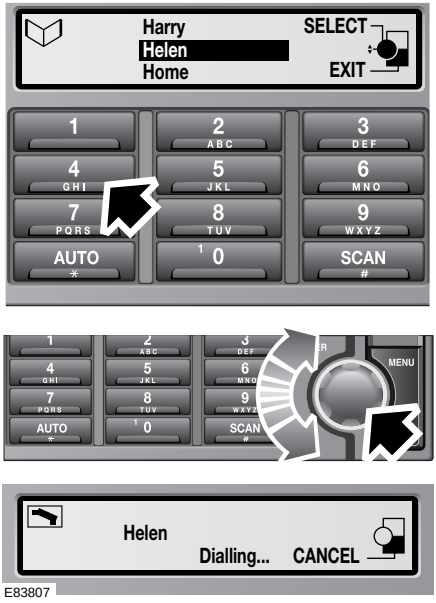


E83806

Browsing the phonebook

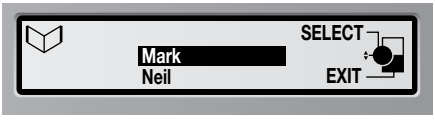
1. With phonebook displayed, rotate the **ENTER** button clockwise, or operate the menu next button on the steering wheel to scroll down the phonebook. To scroll up the phonebook, rotate the **ENTER** button counterclockwise or press the menu previous button on the steering wheel.
2. Once the chosen phonebook entry is highlighted, press the **ENTER** button, or operate the answer call switch on the steering wheel, to dial the number.

3. If an entry was selected by mistake, either operate the end call switch on the steering wheel, or press the **EXIT** button to cancel dialling.



Alphabetical search

1. With the phonebook displayed, press the appropriate key the corresponding number of times according to the initial letter of the entry.
   - For example; if the initial letter of the required phonebook entry is **H**, press the **4** key on the keypad twice. The display will now show all entries beginning with the letter **H**.
2. If there are a large number of entries beginning with the letter **H**, the second and subsequent characters of the name can be added by repeatedly pressing the relevant key until the character appears in the audio unit display.
   - For example; if the required phonebook entry is **Helen**, press the **4** key on the keypad twice the **2** key on the keypad twice, and the **5** key on the keypad three times. The display will now show all entries beginning with **Hel**.
3. Once the chosen phonebook entry is highlighted, press the **ENTER** button, or operate the answer call switch on the steering wheel, to dial the number.



E83840

Quick search

1. To find a specific number from your phonebook without accessing the phonebook, while in telephone mode, press and hold a key (between **2-9**) which corresponds to the first letter of the name.
   - For example; if the initial letter of the required phonebook entry is an **M**, press and hold the **6** key of the keypad. The phonebook will open at the selected point.
2. If there are a large number of entries beginning with letter **M**, the second and subsequent characters of the name can be added by repeatedly pressing the relevant key until the character appears in the audio unit display.
   - For example; if the required phonebook entry is **Mark**, press the **2** key on the keypad once and the **7** key on the keypad three times. The display will now show all entries beginning with **Mar**.
3. Once the chosen phonebook entry is highlighted, press the **ENTER** button, or operate the answer call switch on the steering wheel to dial the number.

Copy from phone

If the phonebook in the vehicle system does not match that of the mobile telephone (and your mobile telephone supports this feature), the following procedure will allow you to resynchronise.

Note: *The vehicle system phonebook allows 750 entries to be downloaded. If your mobile telephone contains more than this, the mobile telephone will send these in memory location order. Which means that your telephone phonebook may not always match the vehicle system.*

1. Enter the phonebook menu and select **Copy from Ph. book**. Press the **ENTER** button to confirm.
2. If successful, **Phonebook downloading to the car is in progress** will appear on the display.
3. On completion of the download, the display will return to the telephone main menu.

If the phonebook download is not supported, the message **Phonebook download is not supported by this phone** will appear in the display.

Erase car entry

Once a phonebook has been downloaded, individual entries can be erased from the vehicle system, not from the mobile telephone.

Note: *If Autocopy phonebook is switched on, the next time the telephone is connected to the vehicle system, the mobile telephone's phonebook will be sent to the vehicle. This may result in your previously deleted entry being re-instated in the vehicle system phonebook.*

1. Enter the phonebook menu and select **Erase car entry**.
2. Press the **ENTER** button to confirm.
3. Rotate the **ENTER** button to select the entry you wish to erase and press the **ENTER** button.
4. A confirmation message will appear on the display. Press the **ENTER** button to erase the entry or press the **EXIT** button to retain the entry and return to the menu.

Erase car Ph. book

Once a phonebook has been downloaded, it can be erased from the vehicle system, not from the mobile telephone.

Note: *If Autocopy phonebook is switched on, the next time the telephone is connected to the vehicle system, the mobile telephone's phonebook will be sent to the vehicle. This may result in your previously deleted phonebook being re-instated in the vehicle system.*

1. Enter the phonebook menu and select **Erase car Ph. book**. Press the **ENTER** button.
2. A confirmation message will appear on the display. Press the **ENTER** button to erase the phonebook or press the **EXIT** button to retain the phonebook and return to the menu.

TELEPHONE VOICE CONTROL

E83802

The vehicle system is able to use any voice tags which are stored in the mobile telephone.

Note: *Voice tags are stored via the mobile telephone and should be set up without the mobile telephone connected to the vehicle.*

1. Press and hold the **ENTER** button, or pull and hold the answer call switch on the steering wheel to access voice tag dialling.
2. The phone display will show that voice tag dialling is in progress and, after an audible prompt from your mobile telephone, you should recite the name that you want to call.
3. A message on the audio unit display will confirm your voice tag and the number is then dialled.
4. If the name you requested is not recognised then you will be informed.
5. Press the **EXIT** button to cancel voice tag dialling.

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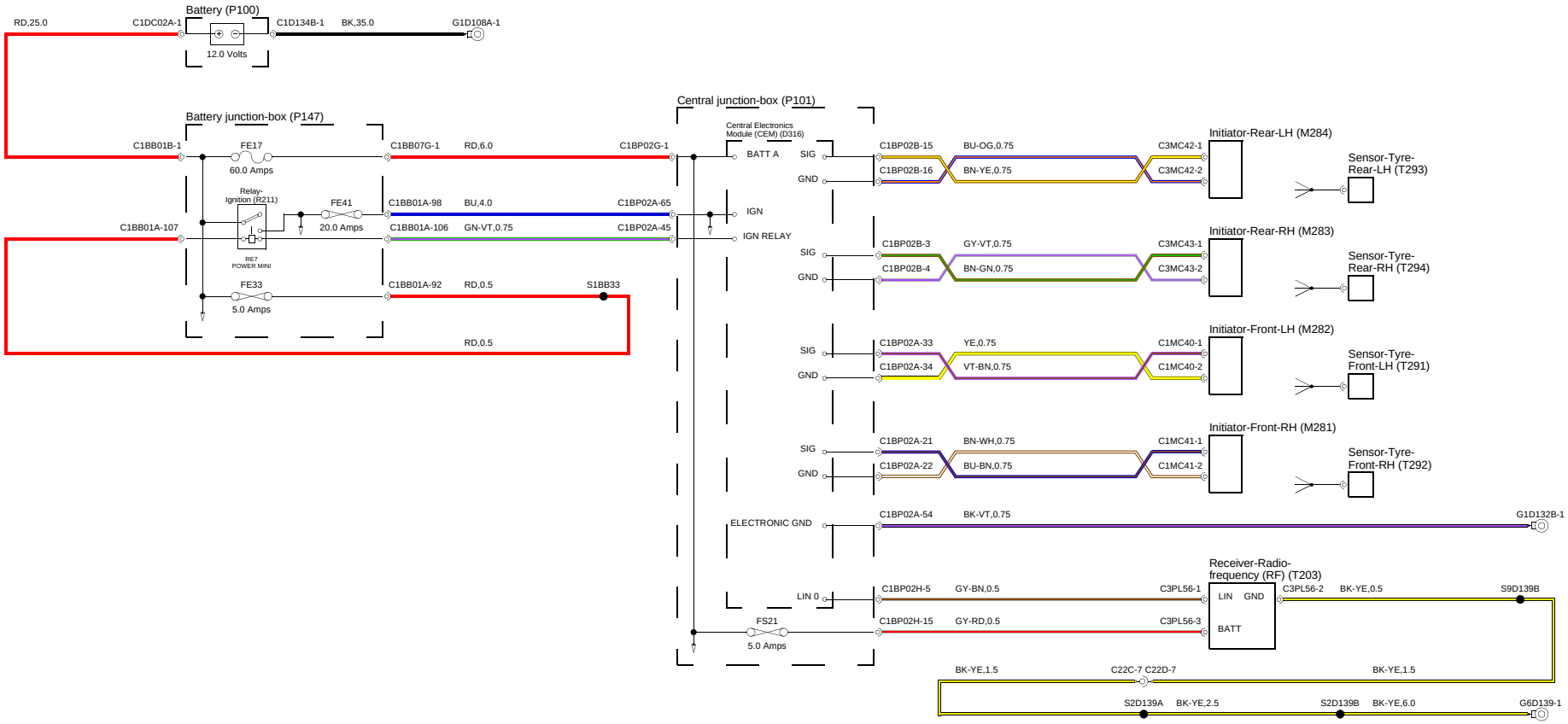
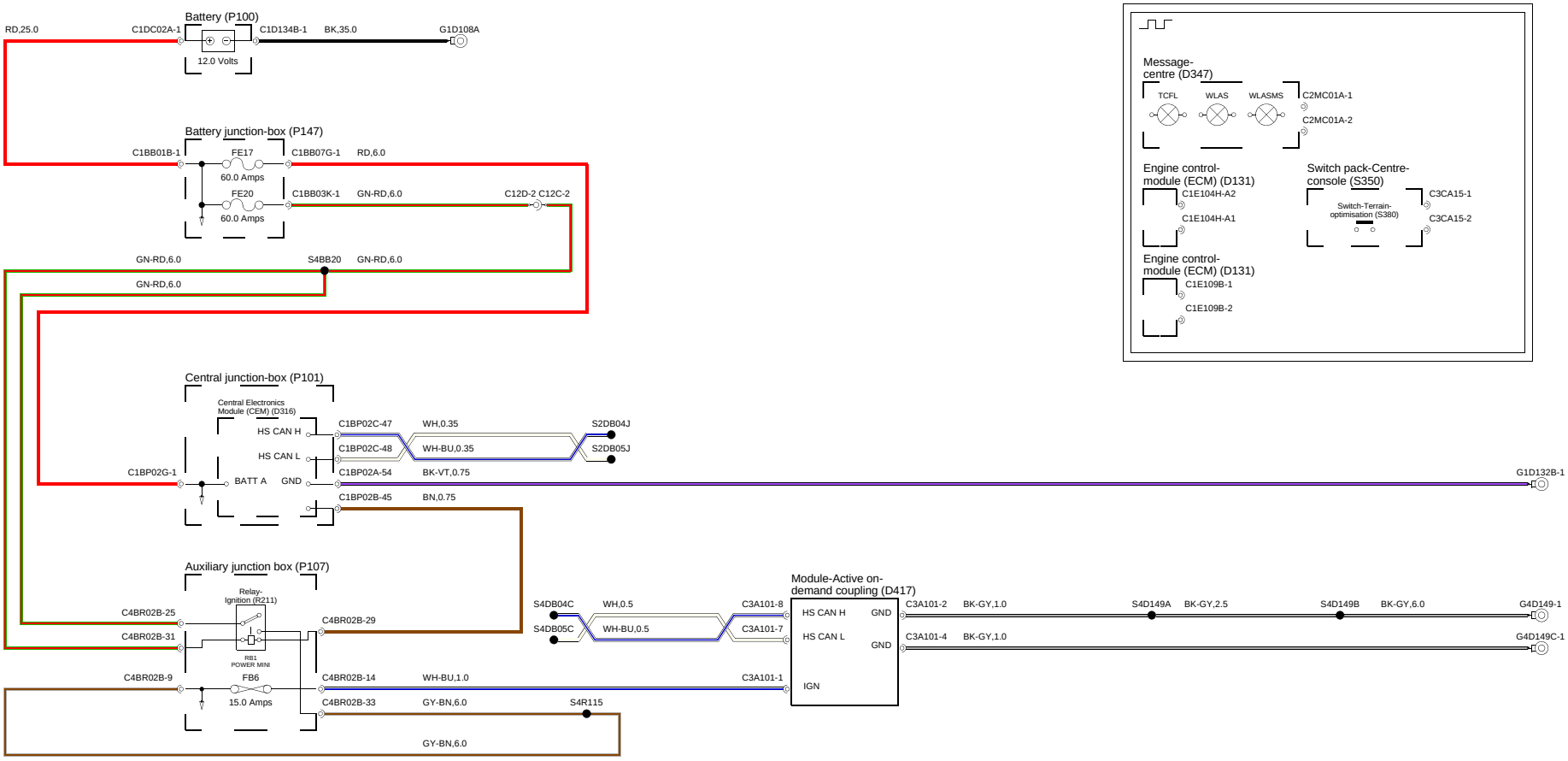
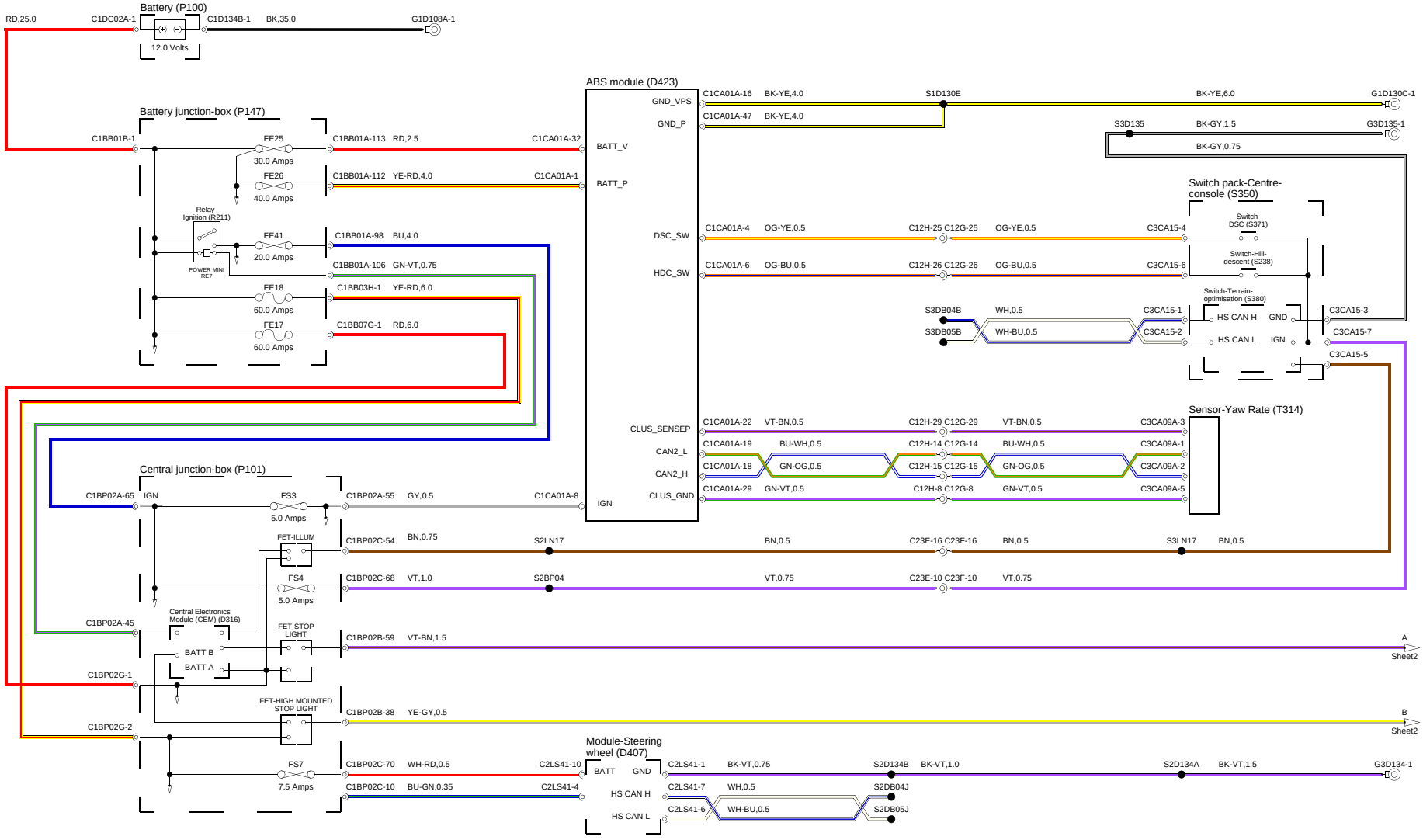
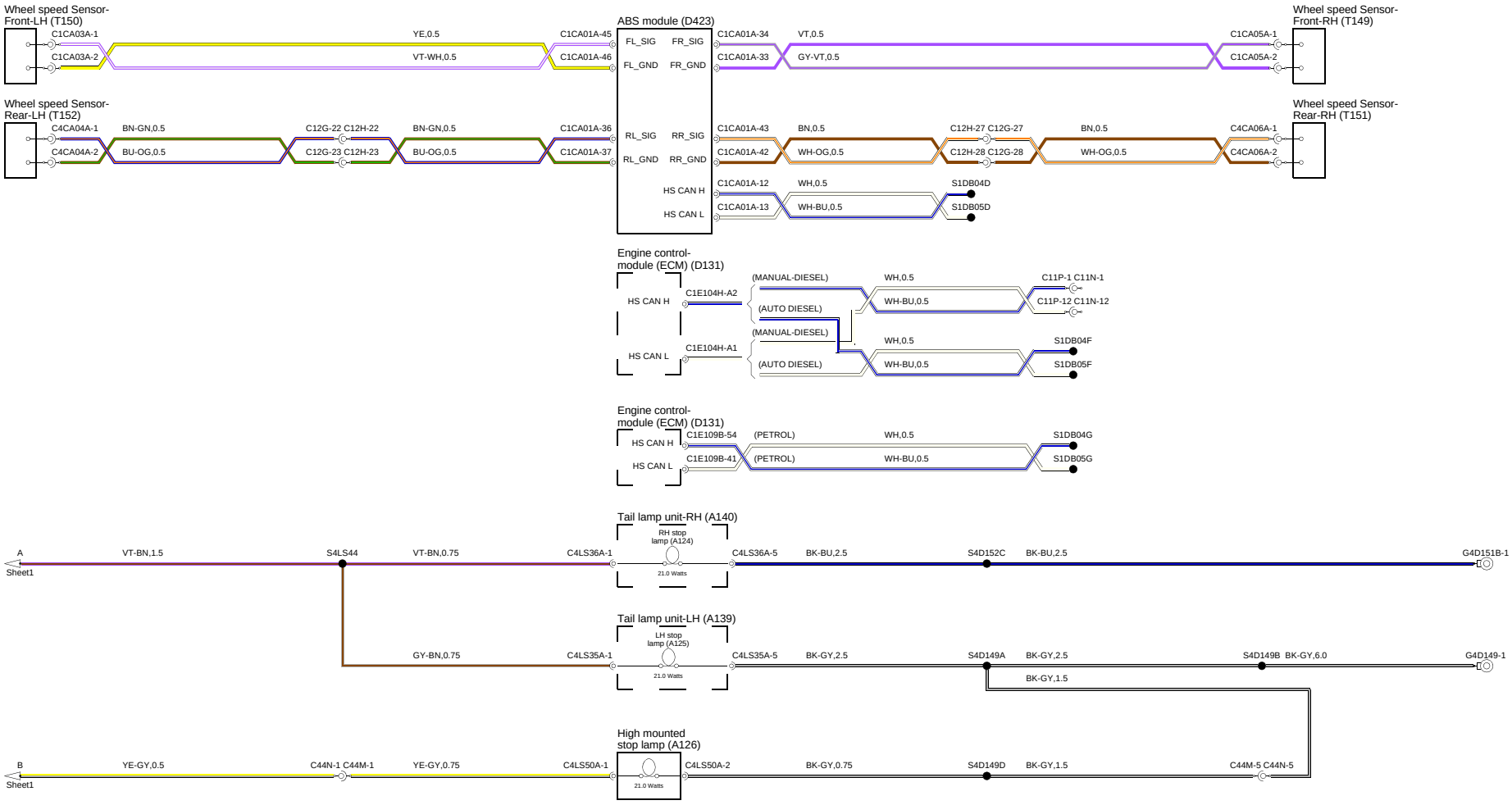
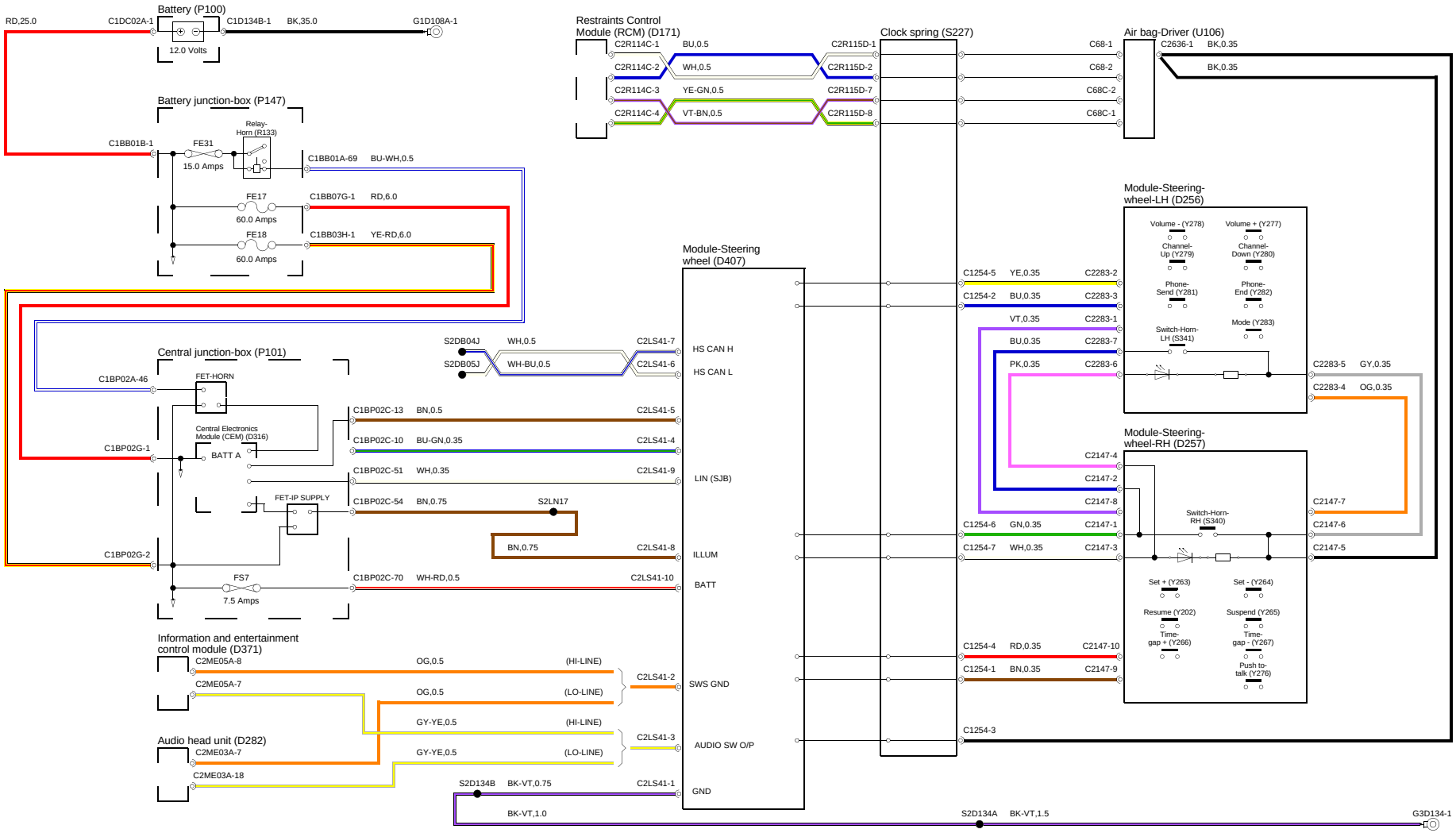
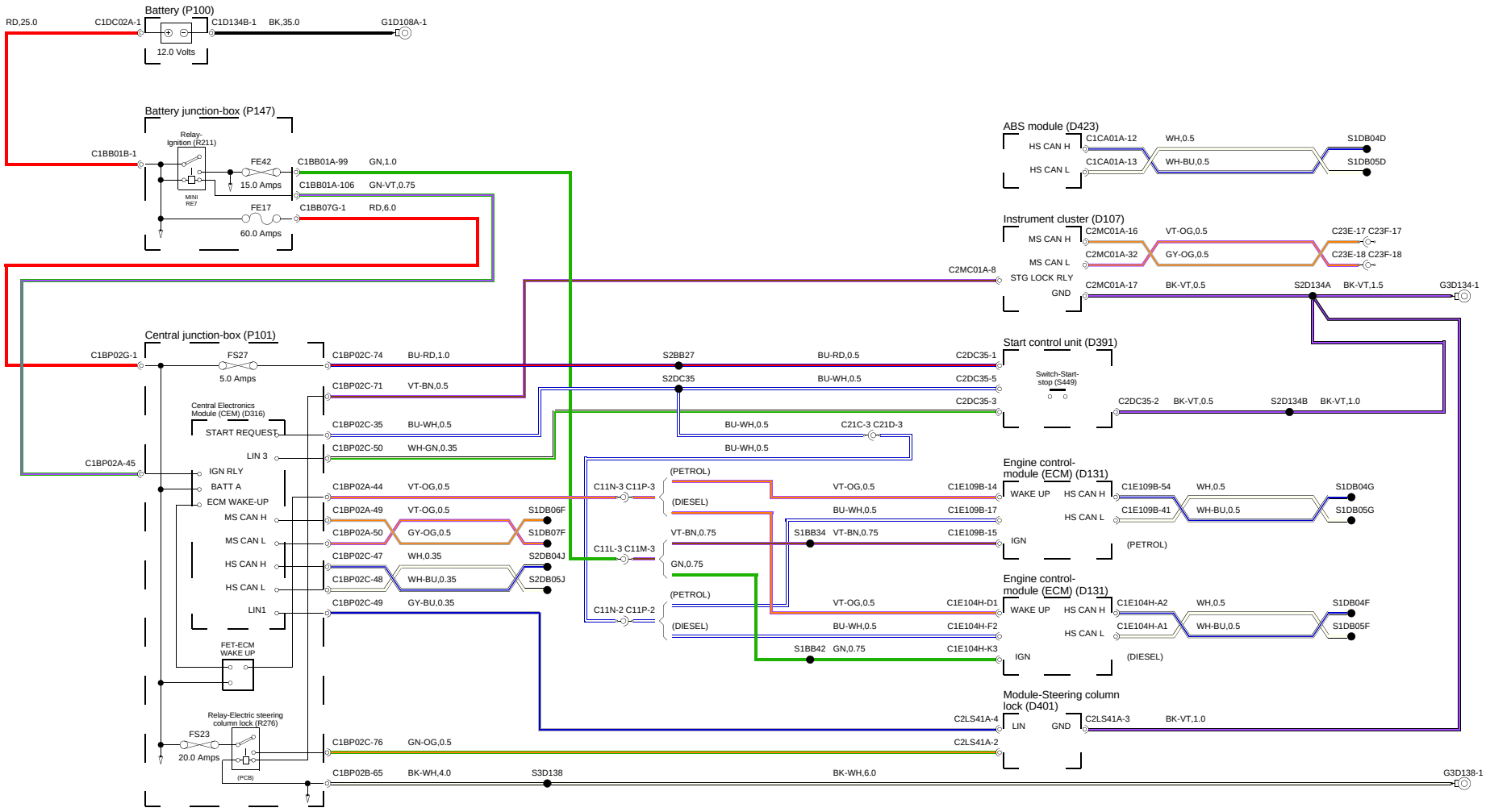

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
C1BP02G-1
Relay-Ignition (R211)
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BP02A-65
C1BB01A-107
C1BB01A-106
GN-VT,0.75
C1BP02A-45
RE7 POWER MINI
FE33
5.0 Amps
C1BB01A-92
RD,0.5
S1BB33
RD,0.5
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
BATT A
IGN
IGN RELAY
SIG
GND
C1BP02B-15
BU-OG,0.75
C3MC42-1
C1BP02B-16
BN-YE,0.75
C3MC42-2
Initiator-Rear-LH (M284)
Sensor-Tyre-Rear-LH (T293)
C1BP02B-3
GY-VT,0.75
C3MC43-1
C1BP02B-4
BN-GN,0.75
C3MC43-2
Initiator-Rear-RH (M283)
Sensor-Tyre-Rear-RH (T294)
C1BP02A-33
YE,0.75
C1MC40-1
C1BP02A-34
VT-BN,0.75
C1MC40-2
Initiator-Front-LH (M282)
Sensor-Tyre-Front-LH (T291)
C1BP02A-21
BN-WH,0.75
C1MC41-1
C1BP02A-22
BU-BN,0.75
C1MC41-2
Initiator-Front-RH (M281)
Sensor-Tyre-Front-RH (T292)
ELECTRONIC GND
C1BP02A-54
BK-VT,0.75
G1D132B-1
Receiver-Radio-frequency (RF) (T203)
LIN 0
C1BP02H-5
GY-BN,0.5
C3PL56-1
LIN
GND
BATT
C3PL56-2
BK-YE,0.5
S9D139B
FS21
5.0 Amps
C1BP02H-15
GY-RD,0.5
C3PL56-3
BK-YE,1.5
C22C-7 C22D-7
BK-YE,1.5
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1

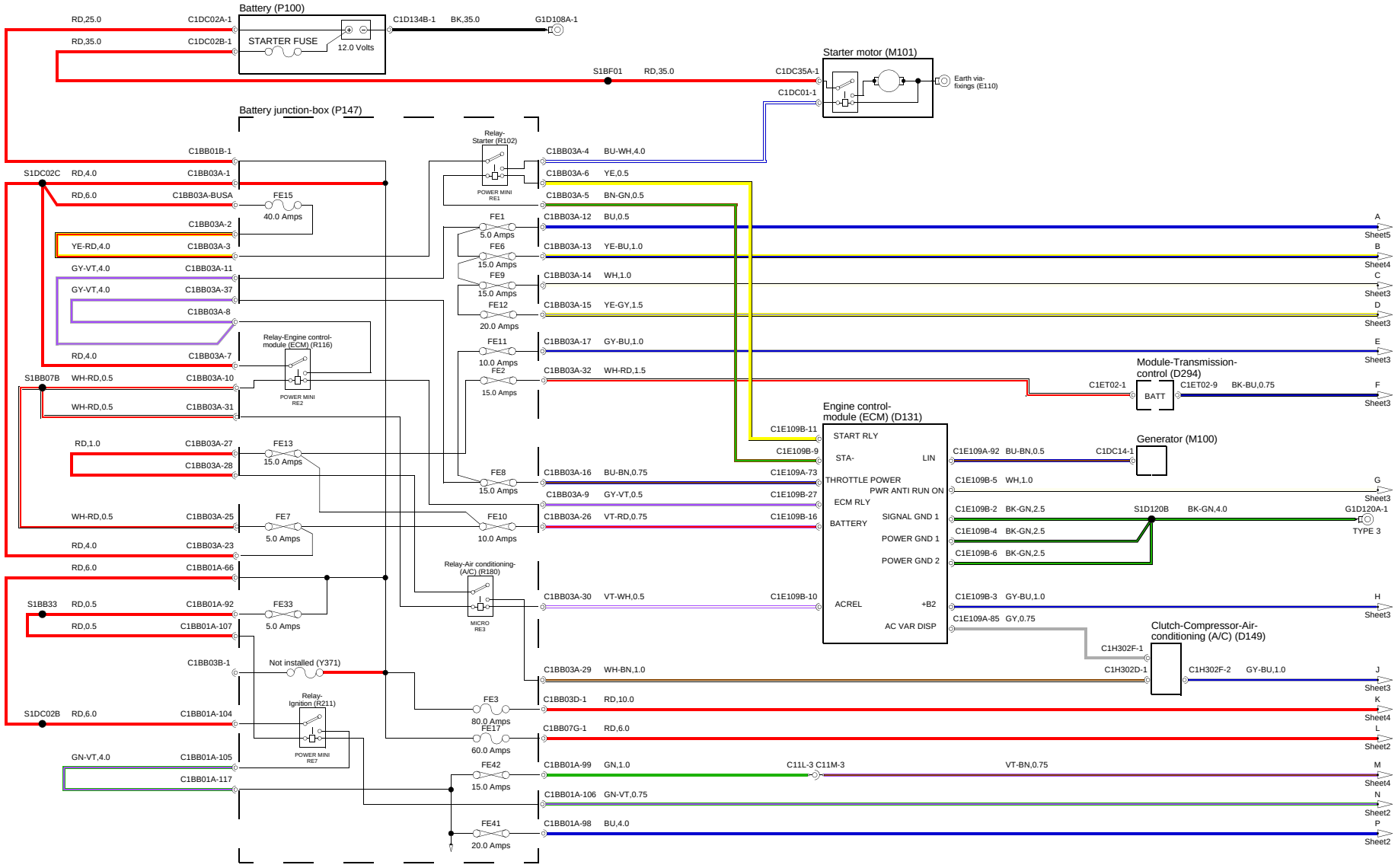

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
FE20
C1BB03K-1
GN-RD,6.0
C12D-2 C12C-2
60.0 Amps
GN-RD,6.0
S4BB20
GN-RD,6.0
GN-RD,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
HS CAN H
HS CAN L
C1BP02C-47
WH,0.35
S2DB04J
C1BP02C-48
WH-BU,0.35
S2DB05J
C1BP02G-1
BATT A
GND
C1BP02A-54
BK-VT,0.75
G1D132B-1
C1BP02B-45
BN,0.75
Auxiliary junction box (P107)
Relay-Ignition (R211)
C4BR02B-25
C4BR02B-29
C4BR02B-31
RB1 POWER MINI
C4BR02B-9
FB6
15.0 Amps
C4BR02B-14
WH-BU,1.0
C4BR02B-33
GY-BN,6.0
S4R115
GY-BN,6.0
S4DB04C
WH,0.5
C3A101-8
S4DB05C
WH-BU,0.5
C3A101-7
Module-Active on-demand coupling (D417)
HS CAN H
HS CAN L
IGN
GND
GND
C3A101-1
C3A101-2
BK-GY,1.0
S4D149A
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
C3A101-4
BK-GY,1.0
G4D149C-1
Message-centre (D347)
TCFL
WLAS
WLASMS
C2MC01A-1
C2MC01A-2
Engine control-module (ECM) (D131)
C1E104H-A2
C1E104H-A1
Switch pack-Centre-console (S350)
Switch-Terrain-optimisation (S380)
C3CA15-1
C3CA15-2
Engine control-module (ECM) (D131)
C1E109B-1
C1E109B-2

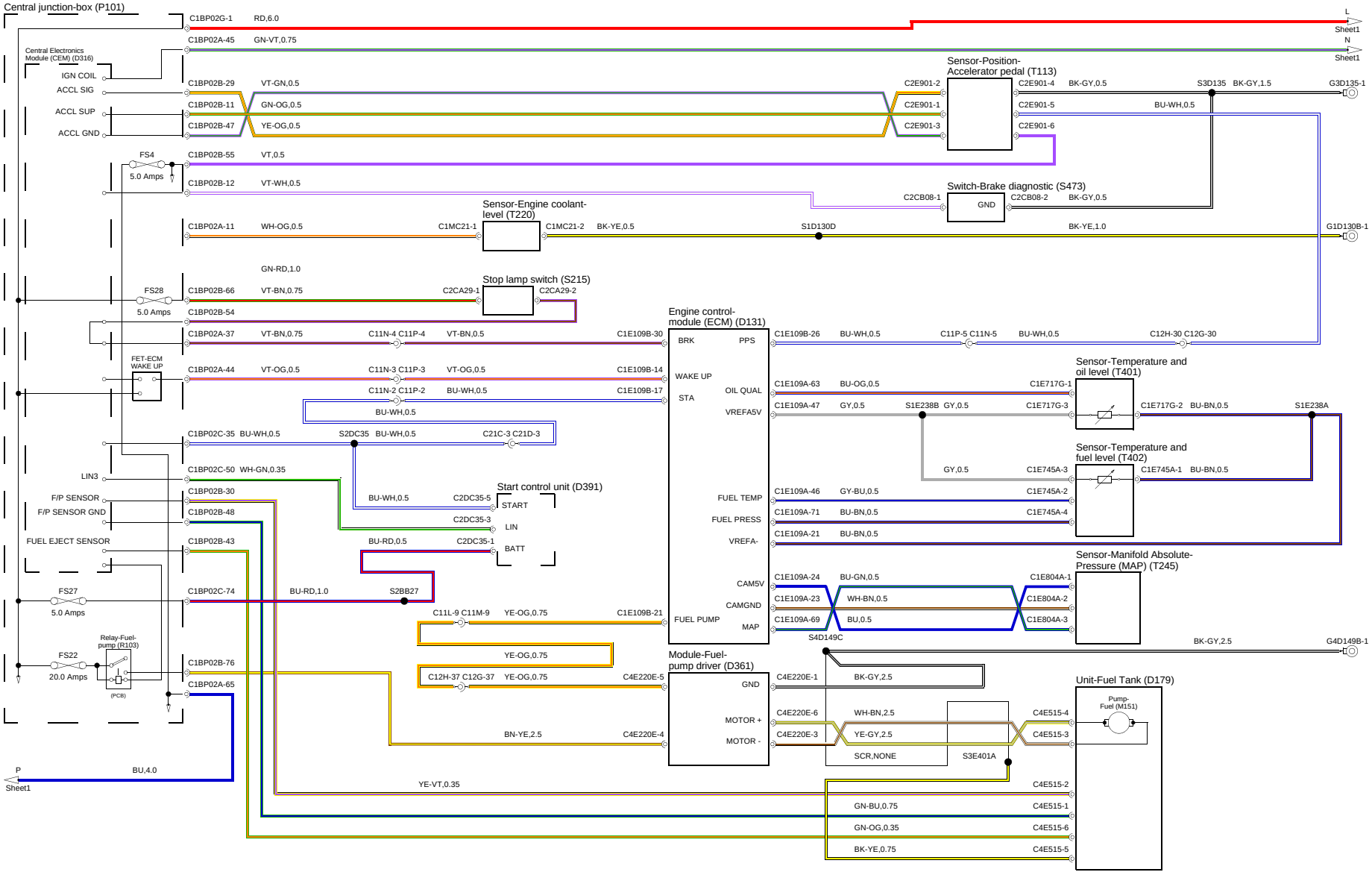

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
ABS module (D423)
GND_VPS
GND_P
BATT_V
BATT_P
DSC_SW
HDC_SW
CLUS_SENSEP
CAN2_L
CAN2_H
CLUS_GND
IGN
C1CA01A-16
BK-YE,4.0
S1D130E
BK-YE,6.0
G1D130C-1
C1CA01A-47
BK-YE,4.0
S3D135
BK-GY,1.5
G3D135-1
BK-GY,0.75
Switch pack-Centre-console (S350)
Switch-DSC (S371)
Switch-Hill-descent (S238)
Switch-Terrain-optimisation (S380)
C1CA01A-4
OG-YE,0.5
C12H-25 C12G-25
OG-YE,0.5
C3CA15-4
C1CA01A-6
OG-BU,0.5
C12H-26 C12G-26
OG-BU,0.5
C3CA15-6
S3DB04B
WH,0.5
C3CA15-1
S3DB05B
WH-BU,0.5
C3CA15-2
HS CAN H
HS CAN L
GND
IGN
C3CA15-3
C3CA15-7
C3CA15-5
Sensor-Yaw Rate (T314)
C1CA01A-22
VT-BN,0.5
C12H-29 C12G-29
VT-BN,0.5
C3CA09A-3
C1CA01A-19
BU-WH,0.5
C12H-14 C12G-14
BU-WH,0.5
C3CA09A-1
C1CA01A-18
GN-OG,0.5
C12H-15 C12G-15
GN-OG,0.5
C3CA09A-2
C1CA01A-29
GN-VT,0.5
C12H-8 C12G-8
GN-VT,0.5
C3CA09A-5
Battery junction-box (P147)
C1BB01B-1
FE25
30.0 Amps
C1BB01A-113
RD,2.5
C1CA01A-32
FE26
40.0 Amps
C1BB01A-112
YE-RD,4.0
C1CA01A-1
Relay-Ignition (R211)
POWER MINI RE7
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BB01A-106
GN-VT,0.75
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0
FE17
60.0 Amps
C1BB07G-1
RD,6.0
Central junction-box (P101)
C1BP02A-65
IGN
FS3
5.0 Amps
C1BP02A-55
GY,0.5
C1CA01A-8
FET-ILLUM
C1BP02C-54
BN,0.75
S2LN17
BN,0.5
C23E-16 C23F-16
BN,0.5
S3LN17
BN,0.5
FS4
5.0 Amps
C1BP02C-68
VT,1.0
S2BP04
VT,0.75
C23E-10 C23F-10
VT,0.75
C1BP02A-45
Central Electronics Module (CEM) (D316)
BATT B
BATT A
C1BP02G-1
FET-STOP LIGHT
C1BP02B-59
VT-BN,1.5
A
Sheet2
FET-HIGH MOUNTED STOP LIGHT
C1BP02G-2
C1BP02B-38
YE-GY,0.5
B
Sheet2
Module-Steering wheel (D407)
BATT
GND
HS CAN H
HS CAN L
FS7
7.5 Amps
C1BP02C-70
WH-RD,0.5
C2LS41-10
C1BP02C-10
BU-GN,0.35
C2LS41-4
C2LS41-1
BK-VT,0.75
S2D134B
BK-VT,1.0
S2D134A
BK-VT,1.5
G3D134-1
C2LS41-7
WH,0.5
S2DB04J
C2LS41-6
WH-BU,0.5
S2DB05J

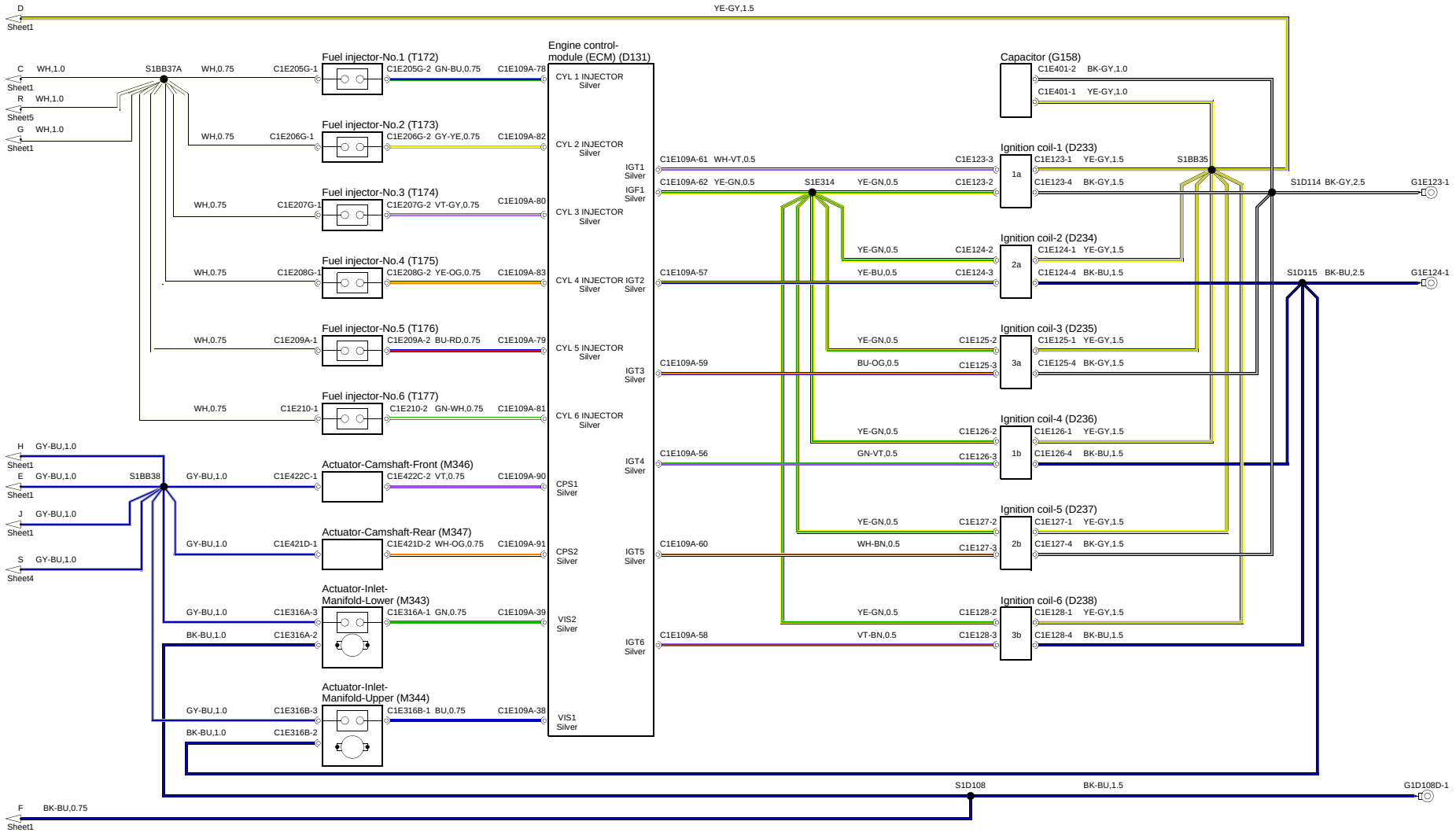

Wheel speed Sensor-
Front-LH (T150)
C1CA03A-1
C1CA03A-2
YE,0.5
VT-WH,0.5
C1CA01A-45
C1CA01A-46
ABS module (D423)
FL_SIG
FR_SIG
FL_GND
FR_GND
C1CA01A-34
C1CA01A-33
VT,0.5
GY-VT,0.5
C1CA05A-1
C1CA05A-2
Wheel speed Sensor-
Front-RH (T149)
Wheel speed Sensor-
Rear-LH (T152)
C4CA04A-1
C4CA04A-2
BN-GN,0.5
BU-OG,0.5
C12G-22 C12H-22
C12G-23 C12H-23
BN-GN,0.5
BU-OG,0.5
C1CA01A-36
C1CA01A-37
RL_SIG
RR_SIG
RL_GND
RR_GND
C1CA01A-43
C1CA01A-42
BN,0.5
WH-OG,0.5
C12H-27 C12G-27
C12H-28 C12G-28
BN,0.5
WH-OG,0.5
C4CA06A-1
C4CA06A-2
Wheel speed Sensor-
Rear-RH (T151)
HS CAN H
HS CAN L
C1CA01A-12
C1CA01A-13
WH,0.5
WH-BU,0.5
S1DB04D
S1DB05D
Engine control-
module (ECM) (D131)
HS CAN H
HS CAN L
C1E104H-A2
C1E104H-A1
(MANUAL-DIESEL)
(AUTO DIESEL)
WH,0.5
WH-BU,0.5
C11P-1 C11N-1
C11P-12 C11N-12
S1DB04F
S1DB05F
Engine control-
module (ECM) (D131)
HS CAN H
HS CAN L
C1E109B-54
C1E109B-41
(PETROL)
WH,0.5
WH-BU,0.5
S1DB04G
S1DB05G
Tail lamp unit-RH (A140)
RH stop
lamp (A124)
21.0 Watts
A
Sheet1
VT-BN,1.5
S4LS44
VT-BN,0.75
C4LS36A-1
C4LS36A-5
BK-BU,2.5
S4D152C
BK-BU,2.5
G4D151B-1
Tail lamp unit-LH (A139)
LH stop
lamp (A125)
21.0 Watts
GY-BN,0.75
C4LS35A-1
C4LS35A-5
BK-GY,2.5
S4D149A
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
BK-GY,1.5
High mounted
stop lamp (A126)
21.0 Watts
B
Sheet1
YE-GY,0.5
C44N-1 C44M-1
YE-GY,0.75
C4LS50A-1
C4LS50A-2
BK-GY,0.75
S4D149D
BK-GY,1.5
C44M-5 C44N-5

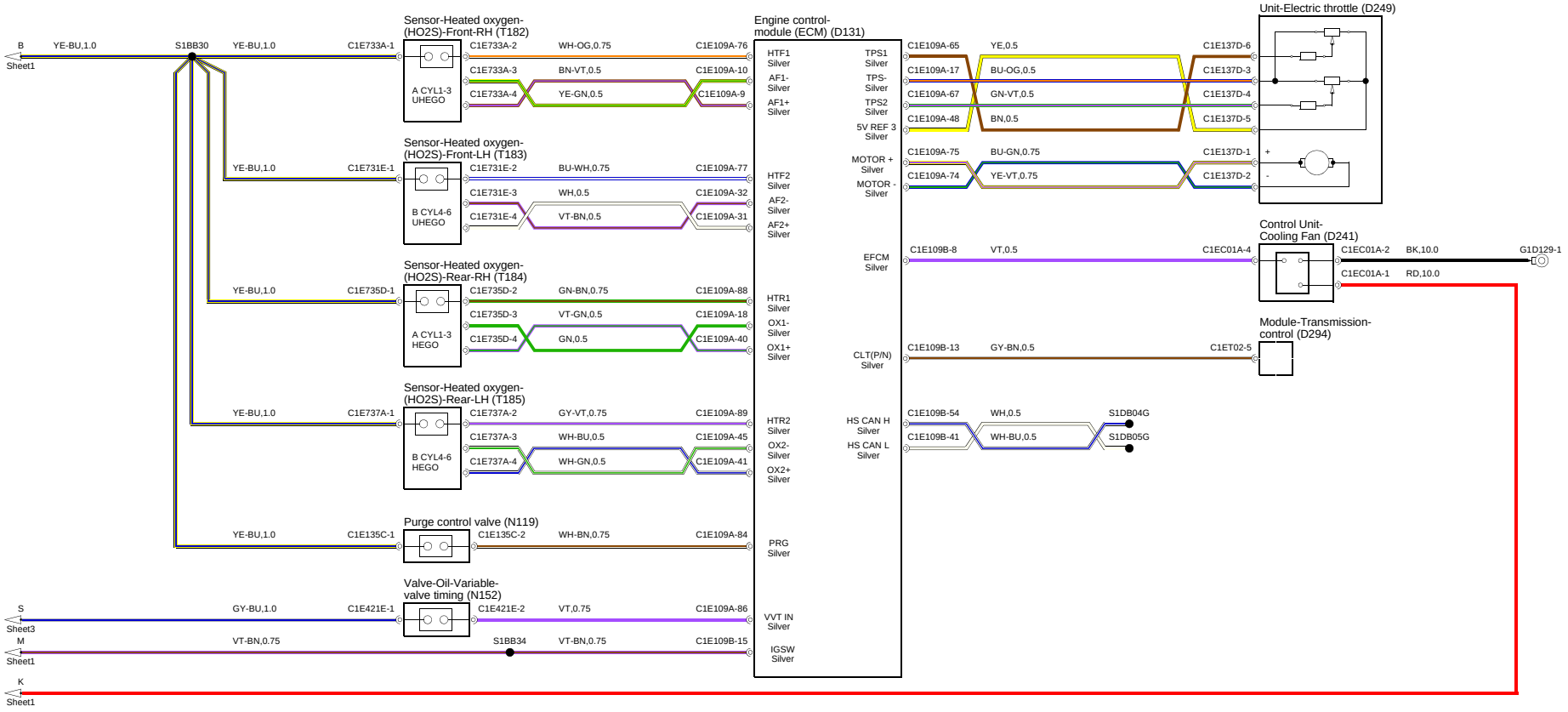

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE31
15.0 Amps
Relay-Horn (R133)
C1BB01A-69
BU-WH,0.5
FE17
60.0 Amps
C1BB07G-1
RD,6.0
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0
Central junction-box (P101)
C1BP02A-46
FET-HORN
C1BP02G-1
Central Electronics Module (CEM) (D316)
BATT A
FET-IP SUPPLY
C1BP02G-2
FS7
7.5 Amps
C1BP02C-13
BN,0.5
C1BP02C-10
BU-GN,0.35
C1BP02C-51
WH,0.35
C1BP02C-54
BN,0.75
S2LN17
BN,0.75
C1BP02C-70
WH-RD,0.5
Information and entertainment control module (D371)
C2ME05A-8
OG,0.5
(HI-LINE)
C2ME05A-7
OG,0.5
(LO-LINE)
GY-YE,0.5
(HI-LINE)
Audio head unit (D282)
C2ME03A-7
GY-YE,0.5
(LO-LINE)
C2ME03A-18
S2DB04J
WH,0.5
S2DB05J
WH-BU,0.5
Restraints Control Module (RCM) (D171)
C2R114C-1
BU,0.5
C2R114C-2
WH,0.5
C2R114C-3
YE-GN,0.5
C2R114C-4
VT-BN,0.5
C2R115D-1
C2R115D-2
C2R115D-7
C2R115D-8
Clock spring (S227)
C68-1
C68-2
C68C-2
C68C-1
Air bag-Driver (U106)
C2636-1
BK,0.35
BK,0.35
Module-Steering wheel (D407)
HS CAN H
HS CAN L
LIN (SJB)
ILLUM
BATT
SWS GND
AUDIO SW O/P
GND
C2LS41-7
C2LS41-6
C2LS41-5
C2LS41-4
C2LS41-9
C2LS41-8
C2LS41-10
C2LS41-2
C2LS41-3
C2LS41-1
S2D134B
BK-VT,0.75
BK-VT,1.0
S2D134A
BK-VT,1.5
G3D134-1
C1254-5
YE,0.35
C2283-2
C1254-2
BU,0.35
C2283-3
VT,0.35
C2283-1
BU,0.35
C2283-7
PK,0.35
C2283-6
C1254-6
GN,0.35
C2147-1
C1254-7
WH,0.35
C2147-3
C1254-4
RD,0.35
C2147-10
C1254-1
BN,0.35
C2147-9
C1254-3
Module-Steering-wheel-LH (D256)
Volume - (Y278)
Volume + (Y277)
Channel-Up (Y279)
Channel-Down (Y280)
Phone-Send (Y281)
Phone-End (Y282)
Mode (Y283)
Switch-Horn-LH (S341)
C2283-5
GY,0.35
C2283-4
OG,0.35
Module-Steering-wheel-RH (D257)
C2147-4
C2147-2
C2147-8
Switch-Horn-RH (S340)
C2147-7
C2147-6
C2147-5
Set + (Y263)
Set - (Y264)
Resume (Y202)
Suspend (Y265)
Time-gap + (Y266)
Time-gap - (Y267)
Push to-talk (Y276)

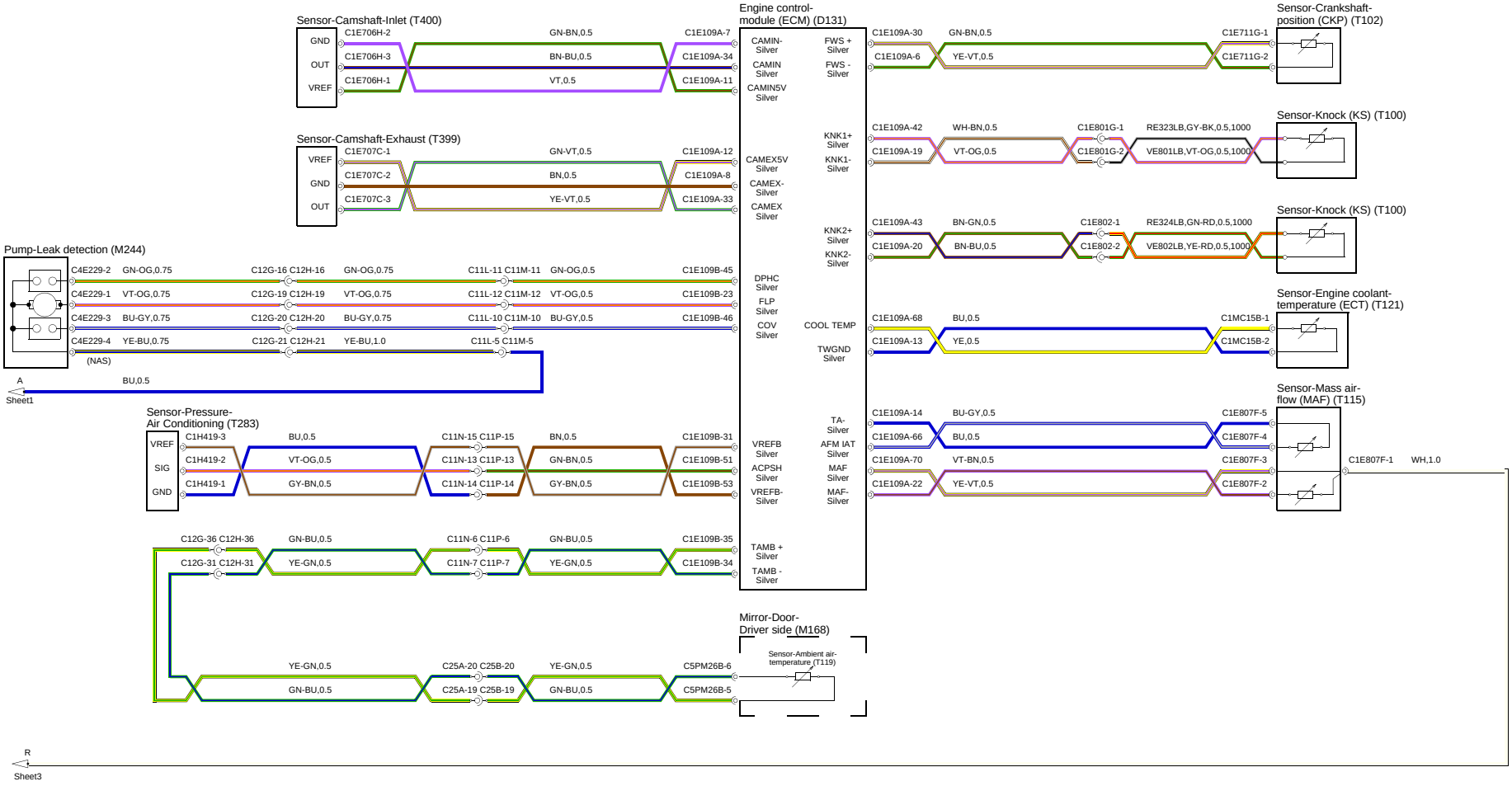

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
Relay-Ignition (R211)
C1BB01B-1
FE42
15.0 Amps
C1BB01A-99
GN,1.0
C1BB01A-106
GN-VT,0.75
MINI RE7
FE17
60.0 Amps
C1BB07G-1
RD,6.0
C2MC01A-8
Central junction-box (P101)
C1BP02G-1
FS27
5.0 Amps
C1BP02C-74
BU-RD,1.0
C1BP02C-71
VT-BN,0.5
Central Electronics Module (CEM) (D316)
START REQUEST
C1BP02C-35
BU-WH,0.5
LIN 3
C1BP02C-50
WH-GN,0.35
C1BP02A-45
IGN RLY
BATT A
ECM WAKE-UP
C1BP02A-44
VT-OG,0.5
MS CAN H
C1BP02A-49
VT-OG,0.5
S1DB06F
MS CAN L
C1BP02A-50
GY-OG,0.5
S1DB07F
HS CAN H
C1BP02C-47
WH,0.35
S2DB04J
HS CAN L
C1BP02C-48
WH-BU,0.35
S2DB05J
LIN1
C1BP02C-49
GY-BU,0.35
FET-ECM WAKE UP
Relay-Electric steering column lock (R276)
FS23
20.0 Amps
(PCB)
C1BP02C-76
GN-OG,0.5
C1BP02B-65
BK-WH,4.0
S3D138
BK-WH,6.0
G3D138-1
S2BB27
BU-RD,0.5
C2DC35-1
S2DC35
BU-WH,0.5
C2DC35-5
C2DC35-3
BU-WH,0.5
C21C-3 C21D-3
BU-WH,0.5
C11N-3 C11P-3
(PETROL)
(DIESEL)
C11L-3 C11M-3
VT-BN,0.75
GN,0.75
C11N-2 C11P-2
(PETROL)
(DIESEL)
S1BB34
VT-BN,0.75
S1BB42
GN,0.75
ABS module (D423)
HS CAN H
C1CA01A-12
WH,0.5
S1DB04D
HS CAN L
C1CA01A-13
WH-BU,0.5
S1DB05D
Instrument cluster (D107)
MS CAN H
C2MC01A-16
VT-OG,0.5
C23E-17 C23F-17
MS CAN L
C2MC01A-32
GY-OG,0.5
C23E-18 C23F-18
STG LOCK RLY
GND
C2MC01A-17
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
Start control unit (D391)
Switch-Start-stop (S449)
C2DC35-2
BK-VT,0.5
S2D134B
BK-VT,1.0
Engine control-module (ECM) (D131)
WAKE UP
IGN
C1E109B-14
VT-OG,0.5
C1E109B-17
BU-WH,0.5
C1E109B-15
VT-BN,0.75
HS CAN H
C1E109B-54
WH,0.5
S1DB04G
HS CAN L
C1E109B-41
WH-BU,0.5
S1DB05G
(PETROL)
Engine control-module (ECM) (D131)
WAKE UP
IGN
C1E104H-D1
VT-OG,0.5
C1E104H-F2
BU-WH,0.5
C1E104H-K3
HS CAN H
C1E104H-A2
WH,0.5
S1DB04F
HS CAN L
C1E104H-A1
WH-BU,0.5
S1DB05F
(DIESEL)
Module-Steering column lock (D401)
LIN
GND
C2LS41A-4
C2LS41A-3
BK-VT,1.0
C2LS41A-2

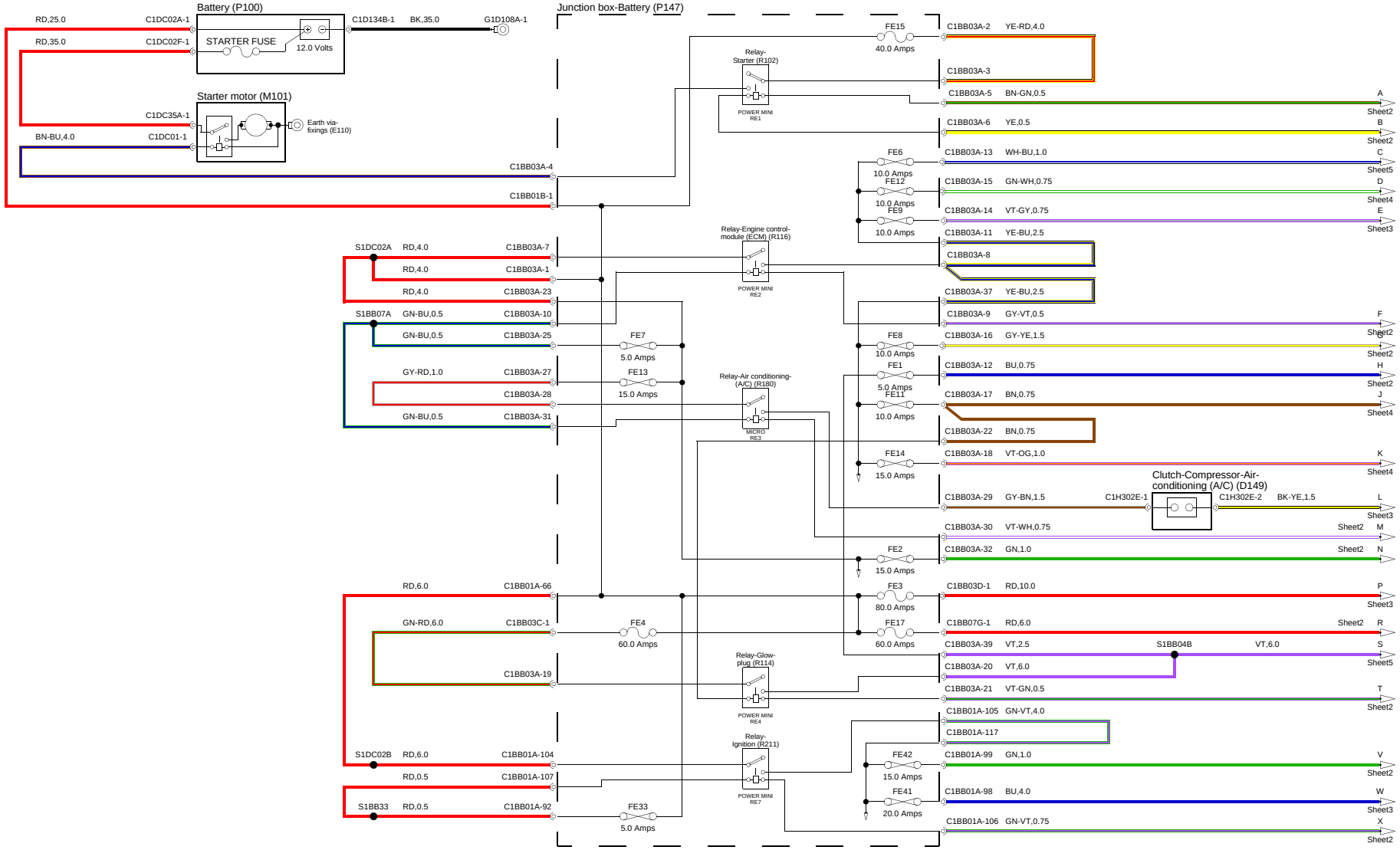

Battery (P100)
STARTER FUSE
12.0 Volts
Starter motor (M101)
Earth via-fixings (E110)
Battery junction-box (P147)
Relay-Starter (R102)
Relay-Engine control-module (ECM) (R116)
Relay-Air conditioning-(A/C) (R180)
Relay-Ignition (R211)
Not installed (Y371)
Engine control-module (ECM) (D131)
START RLY
STA-
LIN
THROTTLE POWER
PWR ANTI RUN ON
ECM RLY
BATTERY
SIGNAL GND 1
POWER GND 1
POWER GND 2
ACREL
+B2
AC VAR DISP
Module-Transmission-control (D294)
BATT
Generator (M100)
Clutch-Compressor-Air-conditioning (A/C) (D149)
TYPE 3

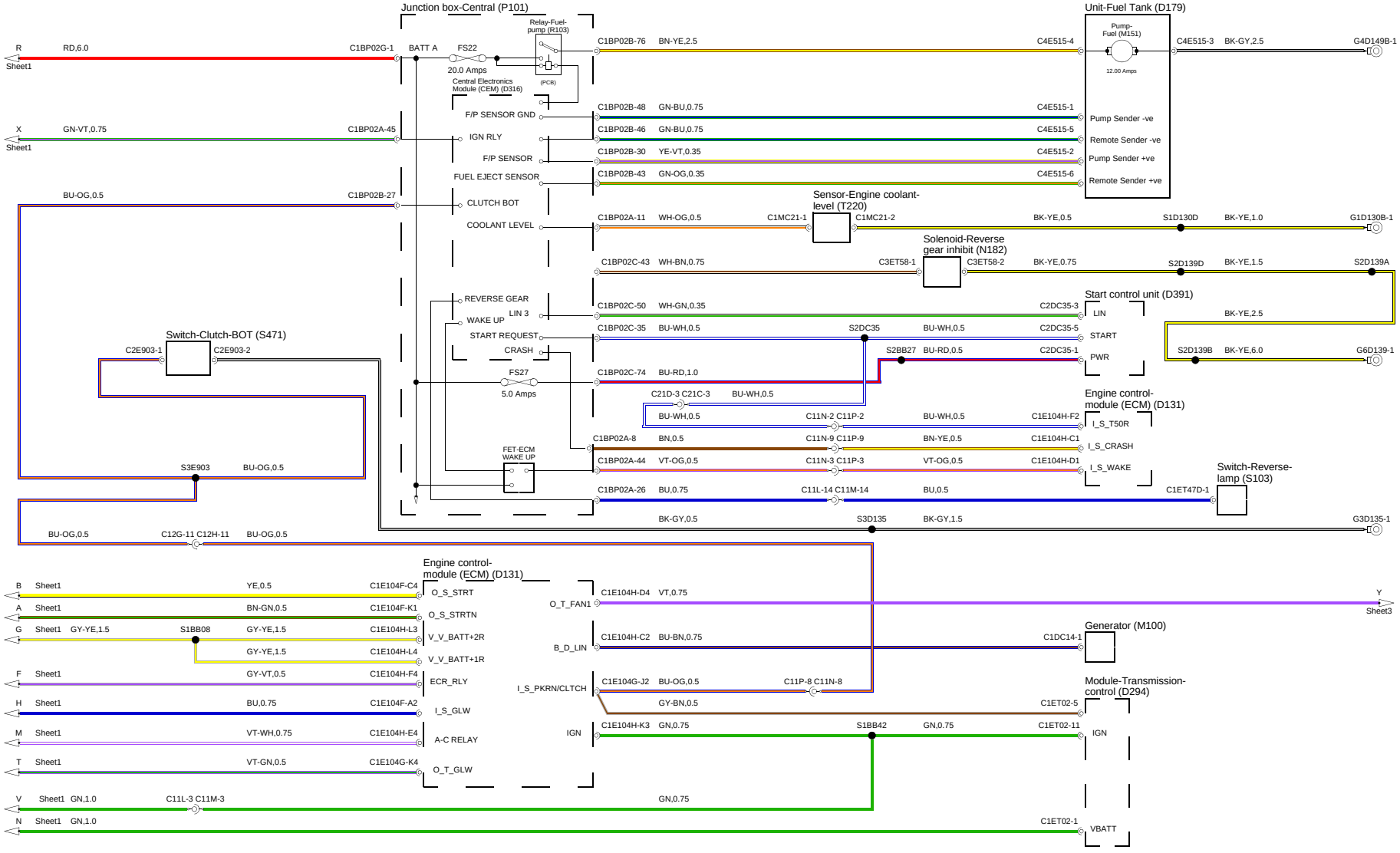

Central junction-box (P101)
C1BP02G-1 RD,6.0
L
Sheet1
C1BP02A-45 GN-VT,0.75
N
Sheet1
Central Electronics Module (CEM) (D316)
IGN COIL
ACCL SIG
ACCL SUP
ACCL GND
C1BP02B-29 VT-GN,0.5
C1BP02B-11 GN-OG,0.5
C1BP02B-47 YE-OG,0.5
Sensor-Position-Accelerator pedal (T113)
C2E901-2
C2E901-1
C2E901-3
C2E901-4 BK-GY,0.5
C2E901-5
C2E901-6
S3D135 BK-GY,1.5
G3D135-1
BU-WH,0.5
FS4
5.0 Amps
C1BP02B-55 VT,0.5
C1BP02B-12 VT-WH,0.5
Switch-Brake diagnostic (S473)
C2CB08-1
GND
C2CB08-2 BK-GY,0.5
Sensor-Engine coolant-level (T220)
C1BP02A-11 WH-OG,0.5
C1MC21-1
C1MC21-2 BK-YE,0.5
S1D130D
BK-YE,1.0
G1D130B-1
GN-RD,1.0
FS28
5.0 Amps
C1BP02B-66 VT-BN,0.75
C2CA29-1
Stop lamp switch (S215)
C2CA29-2
C1BP02B-54
Engine control-module (ECM) (D131)
C1BP02A-37 VT-BN,0.75
C11N-4 C11P-4 VT-BN,0.5
C1E109B-30
BRK
PPS
C1E109B-26 BU-WH,0.5
C11P-5 C11N-5 BU-WH,0.5
C12H-30 C12G-30
FET-ECM WAKE UP
C1BP02A-44 VT-OG,0.5
C11N-3 C11P-3 VT-OG,0.5
C1E109B-14
WAKE UP
STA
OIL QUAL
C11N-2 C11P-2 BU-WH,0.5
C1E109B-17
BU-WH,0.5
VREFA5V
C1E109A-63 BU-OG,0.5
C1E717G-1
Sensor-Temperature and oil level (T401)
C1E109A-47 GY,0.5
S1E238B GY,0.5
C1E717G-3
C1E717G-2 BU-BN,0.5
S1E238A
C1BP02C-35 BU-WH,0.5
S2DC35 BU-WH,0.5
C21C-3 C21D-3
GY,0.5
C1E745A-3
Sensor-Temperature and fuel level (T402)
C1E745A-1 BU-BN,0.5
LIN3
C1BP02C-50 WH-GN,0.35
F/P SENSOR
C1BP02B-30
F/P SENSOR GND
C1BP02B-48
Start control unit (D391)
BU-WH,0.5
C2DC35-5
START
C2DC35-3
LIN
BATT
FUEL TEMP
FUEL PRESS
VREFA-
C1E109A-46 GY-BU,0.5
C1E109A-71 BU-BN,0.5
C1E109A-21 BU-BN,0.5
C1E745A-2
C1E745A-4
FUEL EJECT SENSOR
C1BP02B-43
BU-RD,0.5
C2DC35-1
FS27
5.0 Amps
C1BP02C-74
BU-RD,1.0
S2BB27
CAM5V
CAMGND
FUEL PUMP
MAP
C1E109A-24 BU-GN,0.5
C1E109A-23 WH-BN,0.5
C1E109A-69 BU,0.5
C1E804A-1
C1E804A-2
C1E804A-3
Sensor-Manifold Absolute-Pressure (MAP) (T245)
S4D149C
BK-GY,2.5
G4D149B-1
C11L-9 C11M-9 YE-OG,0.75
C1E109B-21
YE-OG,0.75
Relay-Fuel-pump (R103)
FS22
20.0 Amps
(PCB)
C1BP02B-76
C1BP02A-65
Module-Fuel-pump driver (D361)
C12H-37 C12G-37 YE-OG,0.75
C4E220E-5
GND
MOTOR +
MOTOR -
C4E220E-1 BK-GY,2.5
C4E220E-6 WH-BN,2.5
C4E220E-3 YE-GY,2.5
SCR,NONE
S3E401A
C4E515-4
C4E515-3
Unit-Fuel Tank (D179)
Pump-Fuel (M151)
BN-YE,2.5
C4E220E-4
P
Sheet1
BU,4.0
YE-VT,0.35
C4E515-2
GN-BU,0.75
C4E515-1
GN-OG,0.35
C4E515-6
BK-YE,0.75
C4E515-5

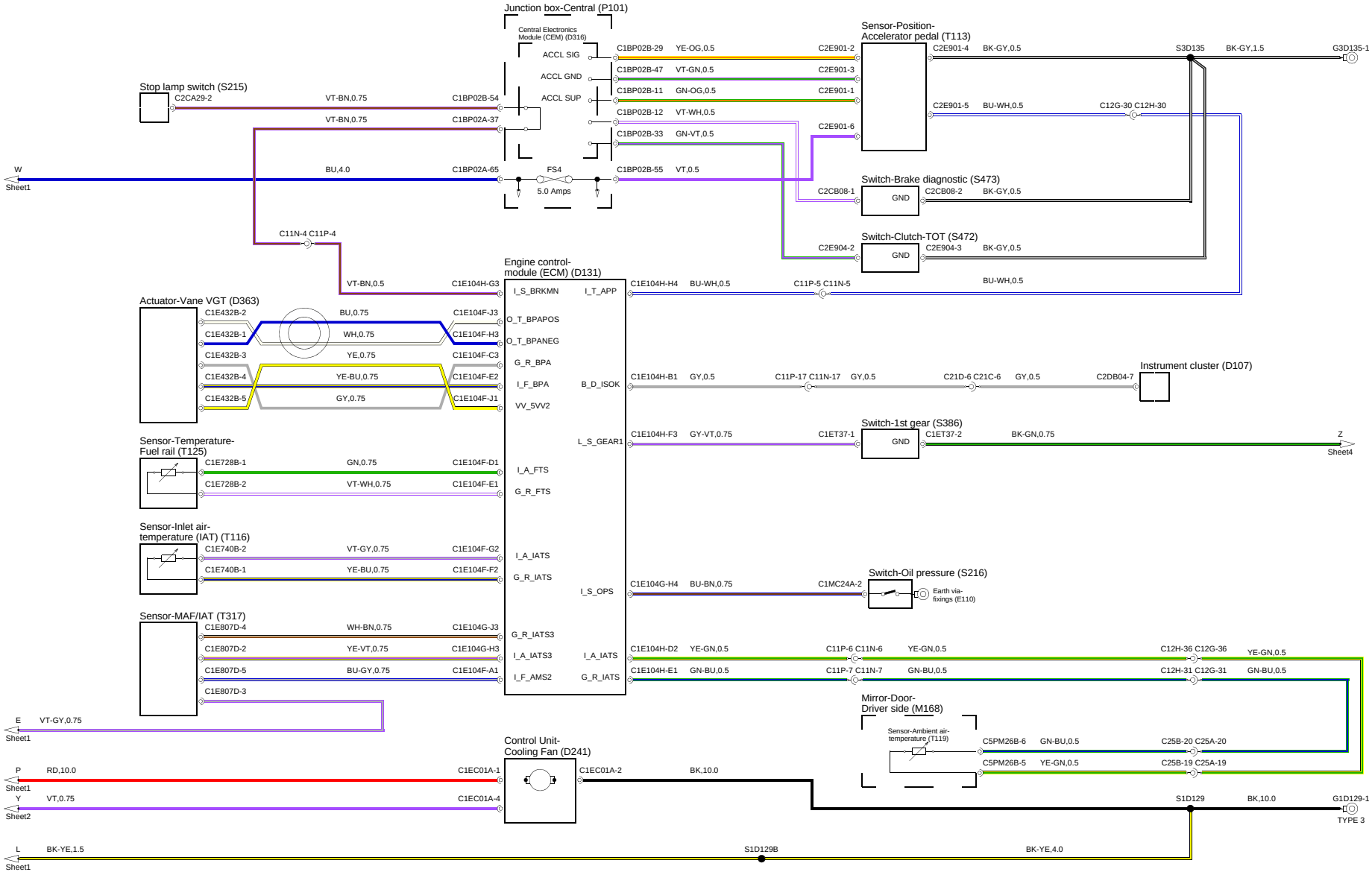

D
Sheet1
YE-GY,1.5
C WH,1.0
Sheet1
S1BB37A
WH,0.75
C1E205G-1
Fuel injector-No.1 (T172)
C1E205G-2 GN-BU,0.75
C1E109A-78
CYL 1 INJECTOR Silver
R WH,1.0
Sheet5
G WH,1.0
Sheet1
WH,0.75
C1E206G-1
Fuel injector-No.2 (T173)
C1E206G-2 GY-YE,0.75
C1E109A-82
CYL 2 INJECTOR Silver
WH,0.75
C1E207G-1
Fuel injector-No.3 (T174)
C1E207G-2 VT-GY,0.75
C1E109A-80
CYL 3 INJECTOR Silver
WH,0.75
C1E208G-1
Fuel injector-No.4 (T175)
C1E208G-2 YE-OG,0.75
C1E109A-83
CYL 4 INJECTOR Silver
WH,0.75
C1E209A-1
Fuel injector-No.5 (T176)
C1E209A-2 BU-RD,0.75
C1E109A-79
CYL 5 INJECTOR Silver
WH,0.75
C1E210-1
Fuel injector-No.6 (T177)
C1E210-2 GN-WH,0.75
C1E109A-81
CYL 6 INJECTOR Silver
Engine control-module (ECM) (D131)
IGT1 Silver
IGF1 Silver
IGT2 Silver
IGT3 Silver
IGT4 Silver
IGT5 Silver
IGT6 Silver
CPS1 Silver
CPS2 Silver
VIS2 Silver
VIS1 Silver
H GY-BU,1.0
Sheet1
E GY-BU,1.0
Sheet1
S1BB38
GY-BU,1.0
C1E422C-1
Actuator-Camshaft-Front (M346)
C1E422C-2 VT,0.75
C1E109A-90
J GY-BU,1.0
Sheet1
GY-BU,1.0
C1E421D-1
Actuator-Camshaft-Rear (M347)
C1E421D-2 WH-OG,0.75
C1E109A-91
S GY-BU,1.0
Sheet4
GY-BU,1.0
C1E316A-3
Actuator-Inlet-Manifold-Lower (M343)
C1E316A-1 GN,0.75
C1E109A-39
BK-BU,1.0
C1E316A-2
GY-BU,1.0
C1E316B-3
Actuator-Inlet-Manifold-Upper (M344)
C1E316B-1 BU,0.75
C1E109A-38
BK-BU,1.0
C1E316B-2
F BK-BU,0.75
Sheet1
Capacitor (G158)
C1E401-2 BK-GY,1.0
C1E401-1 YE-GY,1.0
C1E109A-61 WH-VT,0.5
C1E109A-62 YE-GN,0.5
S1E314
Ignition coil-1 (D233)
C1E123-3
C1E123-2
1a
C1E123-1 YE-GY,1.5
C1E123-4 BK-GY,1.5
S1BB35
S1D114 BK-GY,2.5
G1E123-1
YE-GN,0.5
C1E124-2
Ignition coil-2 (D234)
C1E109A-57
YE-BU,0.5
C1E124-3
2a
C1E124-1 YE-GY,1.5
C1E124-4 BK-BU,1.5
S1D115 BK-BU,2.5
G1E124-1
YE-GN,0.5
C1E125-2
Ignition coil-3 (D235)
C1E109A-59
BU-OG,0.5
C1E125-3
3a
C1E125-1 YE-GY,1.5
C1E125-4 BK-GY,1.5
YE-GN,0.5
C1E126-2
Ignition coil-4 (D236)
C1E109A-56
GN-VT,0.5
C1E126-3
1b
C1E126-1 YE-GY,1.5
C1E126-4 BK-BU,1.5
YE-GN,0.5
C1E127-2
Ignition coil-5 (D237)
C1E109A-60
WH-BN,0.5
C1E127-3
2b
C1E127-1 YE-GY,1.5
C1E127-4 BK-GY,1.5
YE-GN,0.5
C1E128-2
Ignition coil-6 (D238)
C1E109A-58
VT-BN,0.5
C1E128-3
3b
C1E128-1 YE-GY,1.5
C1E128-4 BK-BU,1.5
S1D108
BK-BU,1.5
G1D108D-1

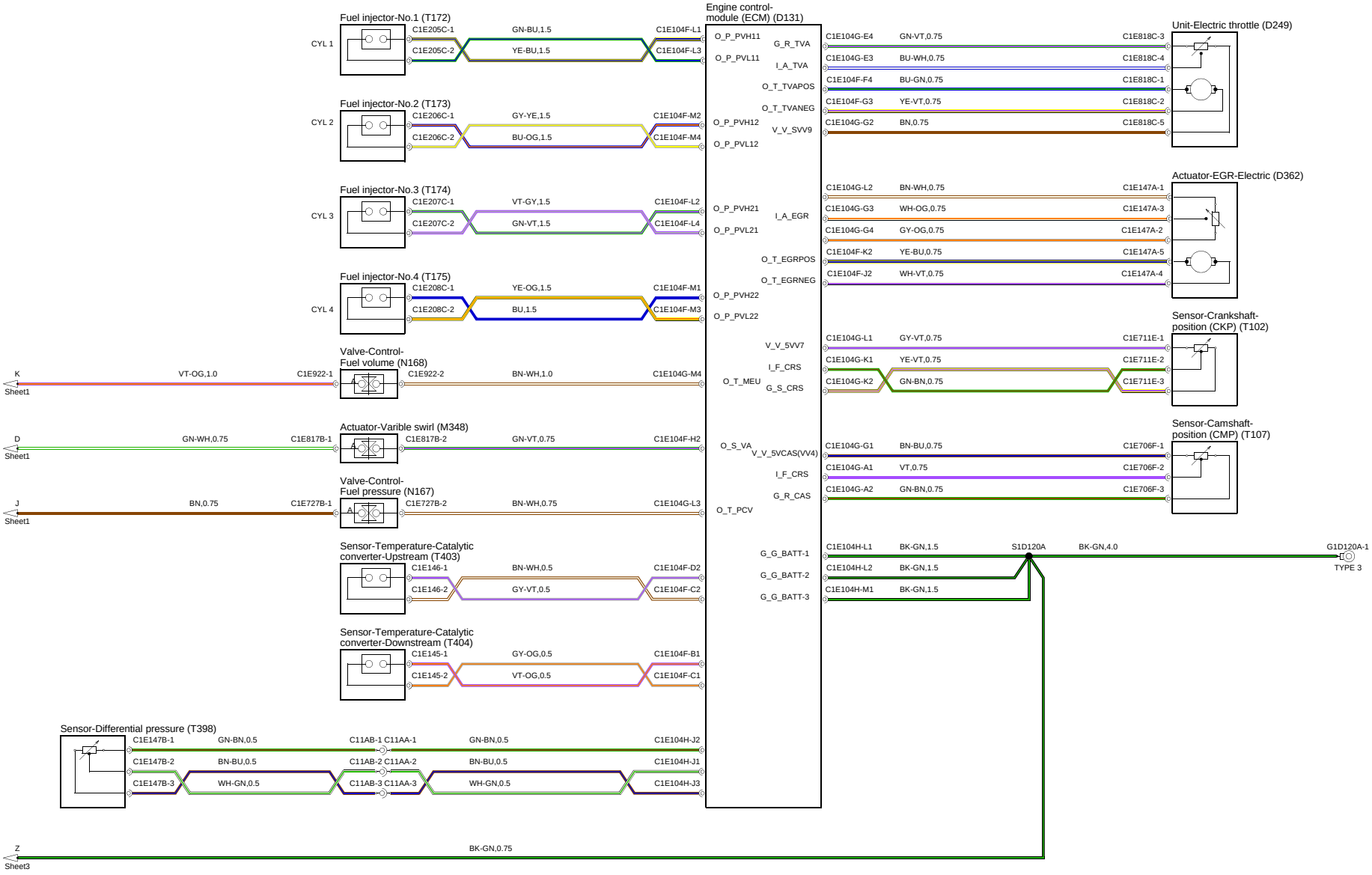

Sensor-Heated oxygen-(HO2S)-Front-RH (T182)
Sensor-Heated oxygen-(HO2S)-Front-LH (T183)
Sensor-Heated oxygen-(HO2S)-Rear-RH (T184)
Sensor-Heated oxygen-(HO2S)-Rear-LH (T185)
Purge control valve (N119)
Valve-Oil-Variable-valve timing (N152)
Engine control-module (ECM) (D131)
Unit-Electric throttle (D249)
Control Unit-Cooling Fan (D241)
Module-Transmission-control (D294)
A CYL1-3 UHEGO
B CYL4-6 UHEGO
A CYL1-3 HEGO
B CYL4-6 HEGO
S1BB30
S1BB34
G1D129-1
S1DB04G
S1DB05G
Sheet1
Sheet3

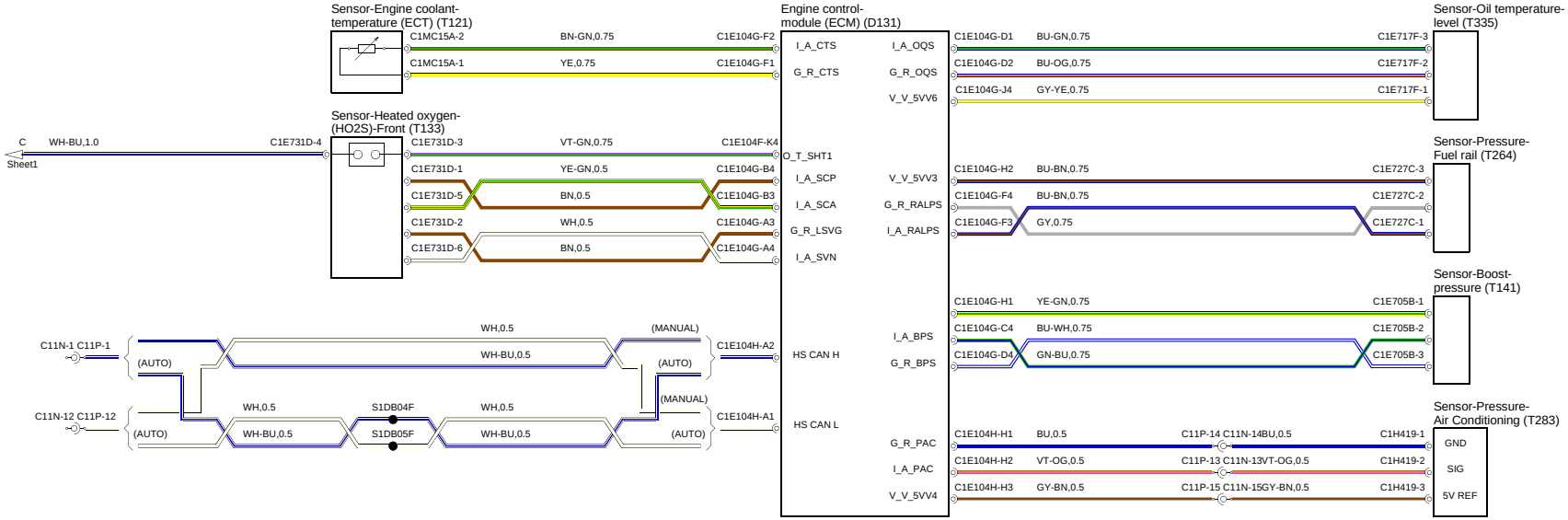

Sensor-Camshaft-Inlet (T400)
GND
OUT
VREF
C1E706H-2
C1E706H-3
C1E706H-1
GN-BN,0.5
BN-BU,0.5
VT,0.5
C1E109A-7
C1E109A-34
C1E109A-11
Sensor-Camshaft-Exhaust (T399)
VREF
GND
OUT
C1E707C-1
C1E707C-2
C1E707C-3
GN-VT,0.5
BN,0.5
YE-VT,0.5
C1E109A-12
C1E109A-8
C1E109A-33
Pump-Leak detection (M244)
C4E229-2 GN-OG,0.75
C4E229-1 VT-OG,0.75
C4E229-3 BU-GY,0.75
C4E229-4 YE-BU,0.75
(NAS)
C12G-16 C12H-16 GN-OG,0.75
C12G-19 C12H-19 VT-OG,0.75
C12G-20 C12H-20 BU-GY,0.75
C12G-21 C12H-21 YE-BU,1.0
C11L-11 C11M-11 GN-OG,0.5
C11L-12 C11M-12 VT-OG,0.5
C11L-10 C11M-10 BU-GY,0.5
C11L-5 C11M-5
C1E109B-45
C1E109B-23
C1E109B-46
A
Sheet1
BU,0.5
Sensor-Pressure-Air Conditioning (T283)
VREF
SIG
GND
C1H419-3
C1H419-2
C1H419-1
BU,0.5
VT-OG,0.5
GY-BN,0.5
C11N-15 C11P-15
C11N-13 C11P-13
C11N-14 C11P-14
BN,0.5
GN-BN,0.5
GY-BN,0.5
C1E109B-31
C1E109B-51
C1E109B-53
C12G-36 C12H-36 GN-BU,0.5
C12G-31 C12H-31 YE-GN,0.5
C11N-6 C11P-6 GN-BU,0.5
C11N-7 C11P-7 YE-GN,0.5
C1E109B-35
C1E109B-34
YE-GN,0.5
GN-BU,0.5
C25A-20 C25B-20 YE-GN,0.5
C25A-19 C25B-19 GN-BU,0.5
C5PM26B-6
C5PM26B-5
Engine control-module (ECM) (D131)
CAMIN- Silver
CAMIN Silver
CAMIN5V Silver
CAMEX5V Silver
CAMEX- Silver
CAMEX Silver
DPHC Silver
FLP Silver
COV Silver
VREFB Silver
ACPSH Silver
VREFB- Silver
TAMB + Silver
TAMB - Silver
FWS + Silver
FWS - Silver
KNK1+ Silver
KNK1- Silver
KNK2+ Silver
KNK2- Silver
COOL TEMP
TWGND Silver
TA- Silver
AFM IAT Silver
MAF Silver
MAF- Silver
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
R
Sheet3
C1E109A-30 GN-BN,0.5 C1E711G-1
C1E109A-6 YE-VT,0.5 C1E711G-2
Sensor-Crankshaft-position (CKP) (T102)
C1E109A-42 WH-BN,0.5 C1E801G-1 RE323LB,GY-BK,0.5,1000
C1E109A-19 VT-OG,0.5 C1E801G-2 VE801LB,VT-OG,0.5,1000
Sensor-Knock (KS) (T100)
C1E109A-43 BN-GN,0.5 C1E802-1 RE324LB,GN-RD,0.5,1000
C1E109A-20 BN-BU,0.5 C1E802-2 VE802LB,YE-RD,0.5,1000
Sensor-Knock (KS) (T100)
C1E109A-68 BU,0.5 C1MC15B-1
C1E109A-13 YE,0.5 C1MC15B-2
Sensor-Engine coolant-temperature (ECT) (T121)
C1E109A-14 BU-GY,0.5 C1E807F-5
C1E109A-66 BU,0.5 C1E807F-4
C1E109A-70 VT-BN,0.5 C1E807F-3
C1E109A-22 YE-VT,0.5 C1E807F-2
Sensor-Mass air-flow (MAF) (T115)
C1E807F-1 WH,1.0


Battery (P100)
RD,25.0
C1DC02A-1
RD,35.0
C1DC02F-1
STARTER FUSE
12.0 Volts
C1D134B-1
BK,35.0
G1D108A-1
Starter motor (M101)
C1DC35A-1
BN-BU,4.0
C1DC01-1
Earth via-fixings (E110)
Junction box-Battery (P147)
C1BB03A-4
C1BB01B-1
Relay-Starter (R102)
POWER MINI RE1
Relay-Engine control-module (ECM) (R116)
POWER MINI RE2
Relay-Air conditioning-(A/C) (R180)
MICRO RE3
Relay-Glow-plug (R114)
POWER MINI RE4
Relay-Ignition (R211)
POWER MINI RE7
S1DC02A
RD,4.0
C1BB03A-7
C1BB03A-1
C1BB03A-23
S1BB07A
GN-BU,0.5
C1BB03A-10
C1BB03A-25
GY-RD,1.0
C1BB03A-27
C1BB03A-28
C1BB03A-31
S1DC02B
RD,6.0
C1BB01A-104
RD,0.5
C1BB01A-107
S1BB33
C1BB01A-92
RD,6.0
C1BB01A-66
GN-RD,6.0
C1BB03C-1
C1BB03A-19
FE15
40.0 Amps
FE6
10.0 Amps
FE12
10.0 Amps
FE9
10.0 Amps
FE7
5.0 Amps
FE13
15.0 Amps
FE8
10.0 Amps
FE1
5.0 Amps
FE11
10.0 Amps
FE14
15.0 Amps
FE2
15.0 Amps
FE3
80.0 Amps
FE4
60.0 Amps
FE17
60.0 Amps
FE42
15.0 Amps
FE41
20.0 Amps
FE33
5.0 Amps
C1BB03A-2 YE-RD,4.0
C1BB03A-3
C1BB03A-5 BN-GN,0.5
C1BB03A-6 YE,0.5
C1BB03A-13 WH-BU,1.0
C1BB03A-15 GN-WH,0.75
C1BB03A-14 VT-GY,0.75
C1BB03A-11 YE-BU,2.5
C1BB03A-8
C1BB03A-37 YE-BU,2.5
C1BB03A-9 GY-VT,0.5
C1BB03A-16 GY-YE,1.5
C1BB03A-12 BU,0.75
C1BB03A-17 BN,0.75
C1BB03A-22 BN,0.75
C1BB03A-18 VT-OG,1.0
C1BB03A-29 GY-BN,1.5
C1BB03A-30 VT-WH,0.75
C1BB03A-32 GN,1.0
C1BB03D-1 RD,10.0
C1BB07G-1 RD,6.0
C1BB03A-39 VT,2.5
C1BB03A-20 VT,6.0
C1BB03A-21 VT-GN,0.5
C1BB01A-105 GN-VT,4.0
C1BB01A-117
C1BB01A-99 GN,1.0
C1BB01A-98 BU,4.0
C1BB01A-106 GN-VT,0.75
Clutch-Compressor-Air-conditioning (A/C) (D149)
C1H302E-1
C1H302E-2
BK-YE,1.5
S1BB04B
VT,6.0
A Sheet2
B Sheet2
C Sheet5
D Sheet4
E Sheet3
F Sheet2
G Sheet2
H Sheet2
J Sheet4
K Sheet4
L Sheet3
M Sheet2
N Sheet2
P Sheet3
R Sheet2
S Sheet5
T Sheet2
V Sheet2
W Sheet3
X Sheet2

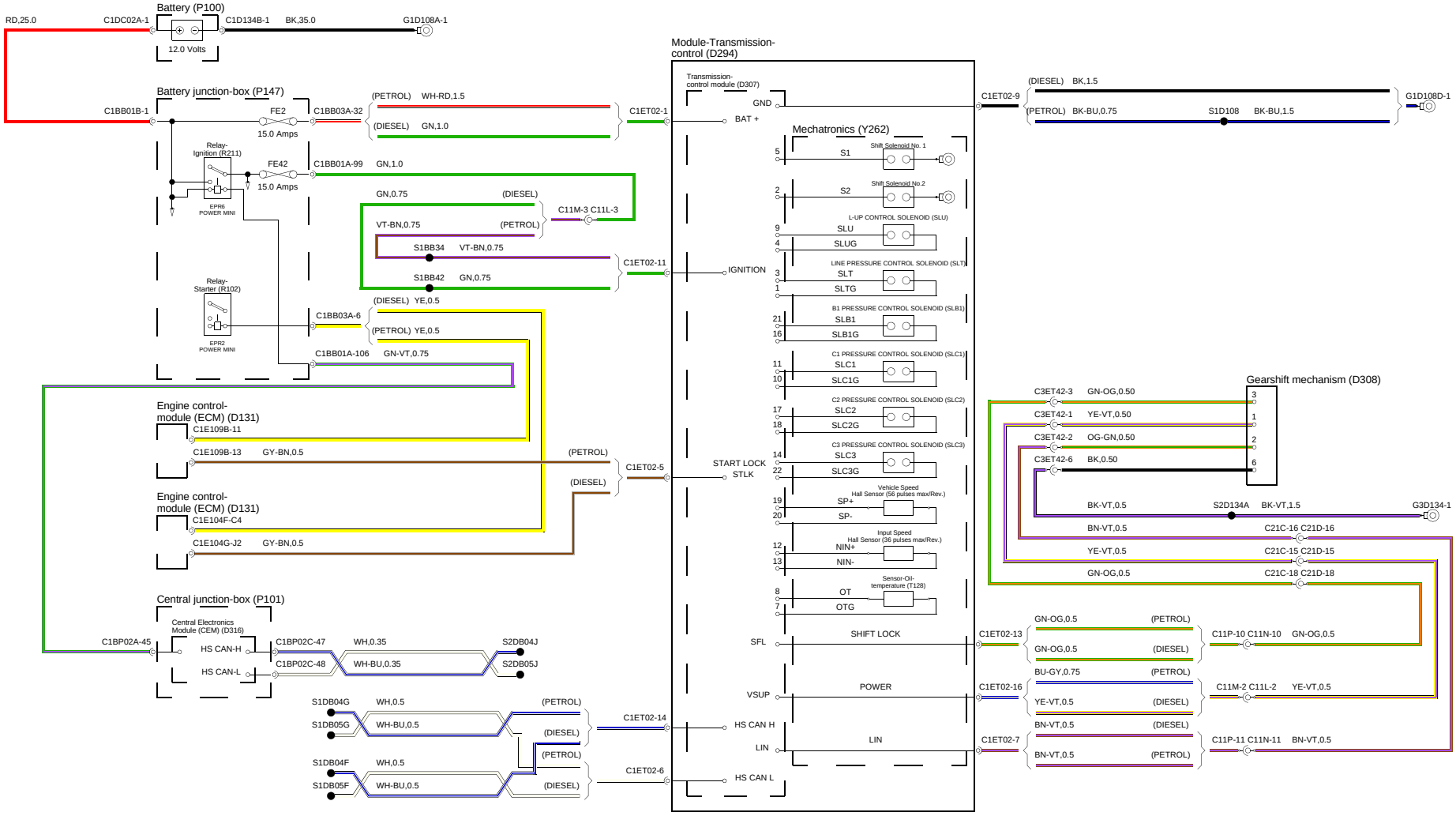

Junction box-Central (P101)
Relay-Fuel-pump (R103)
(PCB)
Central Electronics Module (CEM) (D316)
BATT A
FS22
20.0 Amps
F/P SENSOR GND
IGN RLY
F/P SENSOR
FUEL EJECT SENSOR
CLUTCH BOT
COOLANT LEVEL
REVERSE GEAR
LIN 3
WAKE UP
START REQUEST
CRASH
FS27
5.0 Amps
FET-ECM WAKE UP
Unit-Fuel Tank (D179)
Pump-Fuel (M151)
12.00 Amps
Pump Sender -ve
Remote Sender -ve
Pump Sender +ve
Remote Sender +ve
Sensor-Engine coolant-level (T220)
Solenoid-Reverse gear inhibit (N182)
Start control unit (D391)
LIN
START
PWR
Switch-Clutch-BOT (S471)
Engine control-module (ECM) (D131)
I_S_T50R
I_S_CRASH
I_S_WAKE
Switch-Reverse-lamp (S103)
S3E903
S1BB08
S1BB42
S2DC35
S2BB27
S2D139B
S2D139D
S3D135
Generator (M100)
Module-Transmission-control (D294)
O_S_STRT
O_S_STRTN
V_V_BATT+2R
V_V_BATT+1R
ECR_RLY
I_S_GLW
A-C RELAY
O_T_GLW
O_T_FAN1
B_D_LIN
I_S_PKRN/CLTCH
IGN
VBATT
Sheet1
Sheet3

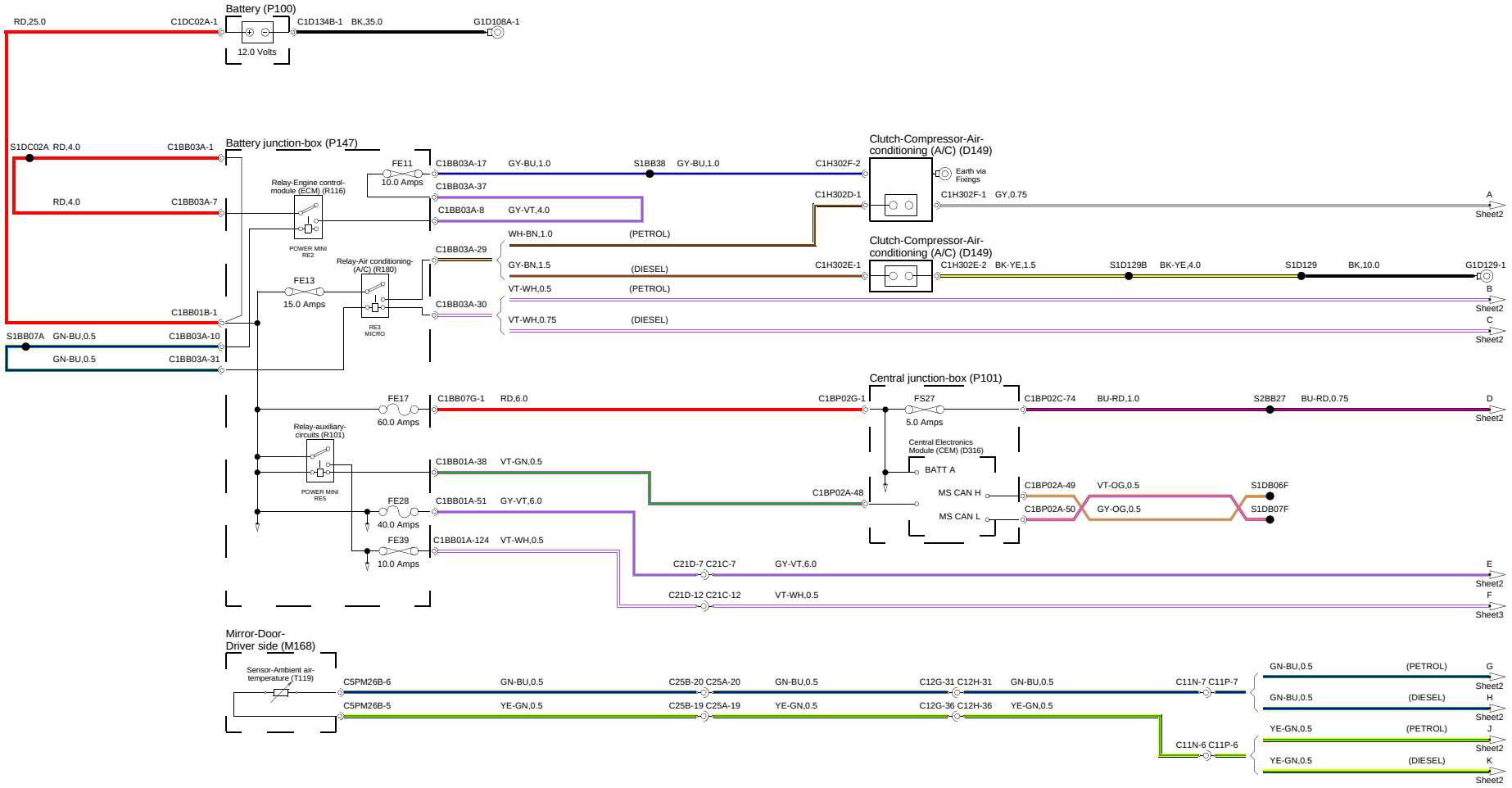

Junction box-Central (P101)
Central Electronics Module (CEM) (D316)
ACCL SIG
ACCL GND
ACCL SUP
C1BP02B-29 YE-OG,0.5 C2E901-2
C1BP02B-47 VT-GN,0.5 C2E901-3
C1BP02B-11 GN-OG,0.5 C2E901-1
C1BP02B-12 VT-WH,0.5
C1BP02B-33 GN-VT,0.5
C2E901-6
Sensor-Position-Accelerator pedal (T113)
C2E901-4 BK-GY,0.5 S3D135 BK-GY,1.5 G3D135-1
C2E901-5 BU-WH,0.5 C12G-30 C12H-30
Stop lamp switch (S215)
C2CA29-2 VT-BN,0.75 C1BP02B-54
VT-BN,0.75 C1BP02A-37
W Sheet1 BU,4.0 C1BP02A-65
FS4 5.0 Amps
C1BP02B-55 VT,0.5
Switch-Brake diagnostic (S473)
C2CB08-1 GND C2CB08-2 BK-GY,0.5
Switch-Clutch-TOT (S472)
C2E904-2 GND C2E904-3 BK-GY,0.5
C11N-4 C11P-4
VT-BN,0.5 C1E104H-G3
Engine control-module (ECM) (D131)
I_S_BRKMN I_T_APP
C1E104H-H4 BU-WH,0.5 C11P-5 C11N-5
BU-WH,0.5
Actuator-Vane VGT (D363)
C1E432B-2 BU,0.75 C1E104F-J3 O_T_BPAPOS
C1E432B-1 WH,0.75 C1E104H-H3 O_T_BPANEG
C1E432B-3 YE,0.75 C1E104F-C3 G_R_BPA
C1E432B-4 YE-BU,0.75 C1E104F-E2 I_F_BPA
C1E432B-5 GY,0.75 C1E104F-J1 VV_5VV2
B_D_ISOK
C1E104H-B1 GY,0.5 C11P-17 C11N-17 GY,0.5 C21D-6 C21C-6 GY,0.5 C2DB04-7
Instrument cluster (D107)
Switch-1st gear (S386)
L_S_GEAR1
C1E104H-F3 GY-VT,0.75 C1ET37-1 GND C1ET37-2 BK-GN,0.75 Z Sheet4
Sensor-Temperature-Fuel rail (T125)
C1E728B-1 GN,0.75 C1E104F-D1 I_A_FTS
C1E728B-2 VT-WH,0.75 C1E104F-E1 G_R_FTS
Sensor-Inlet air-temperature (IAT) (T116)
C1E740B-2 VT-GY,0.75 C1E104F-G2 I_A_IATS
C1E740B-1 YE-BU,0.75 C1E104F-F2 G_R_IATS
I_S_OPS
C1E104G-H4 BU-BN,0.75 C1MC24A-2
Switch-Oil pressure (S216)
Earth via-fixings (E110)
Sensor-MAF/IAT (T317)
C1E807D-4 WH-BN,0.75 C1E104G-J3 G_R_IATS3
C1E807D-2 YE-VT,0.75 C1E104G-H3 I_A_IATS3 I_A_IATS
C1E807D-5 BU-GY,0.75 C1E104F-A1 I_F_AMS2 G_R_IATS
C1E807D-3
C1E104H-D2 YE-GN,0.5 C11P-6 C11N-6 YE-GN,0.5 C12H-36 C12G-36 YE-GN,0.5
C1E104H-E1 GN-BU,0.5 C11P-7 C11N-7 GN-BU,0.5 C12H-31 C12G-31 GN-BU,0.5
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
C5PM26B-6 GN-BU,0.5 C25B-20 C25A-20
C5PM26B-5 YE-GN,0.5 C25B-19 C25A-19
E Sheet1 VT-GY,0.75
Control Unit-Cooling Fan (D241)
P Sheet1 RD,10.0 C1EC01A-1
Y Sheet2 VT,0.75 C1EC01A-4
C1EC01A-2 BK,10.0
S1D129 BK,10.0 G1D129-1 TYPE 3
L Sheet1 BK-YE,1.5 S1D129B BK-YE,4.0

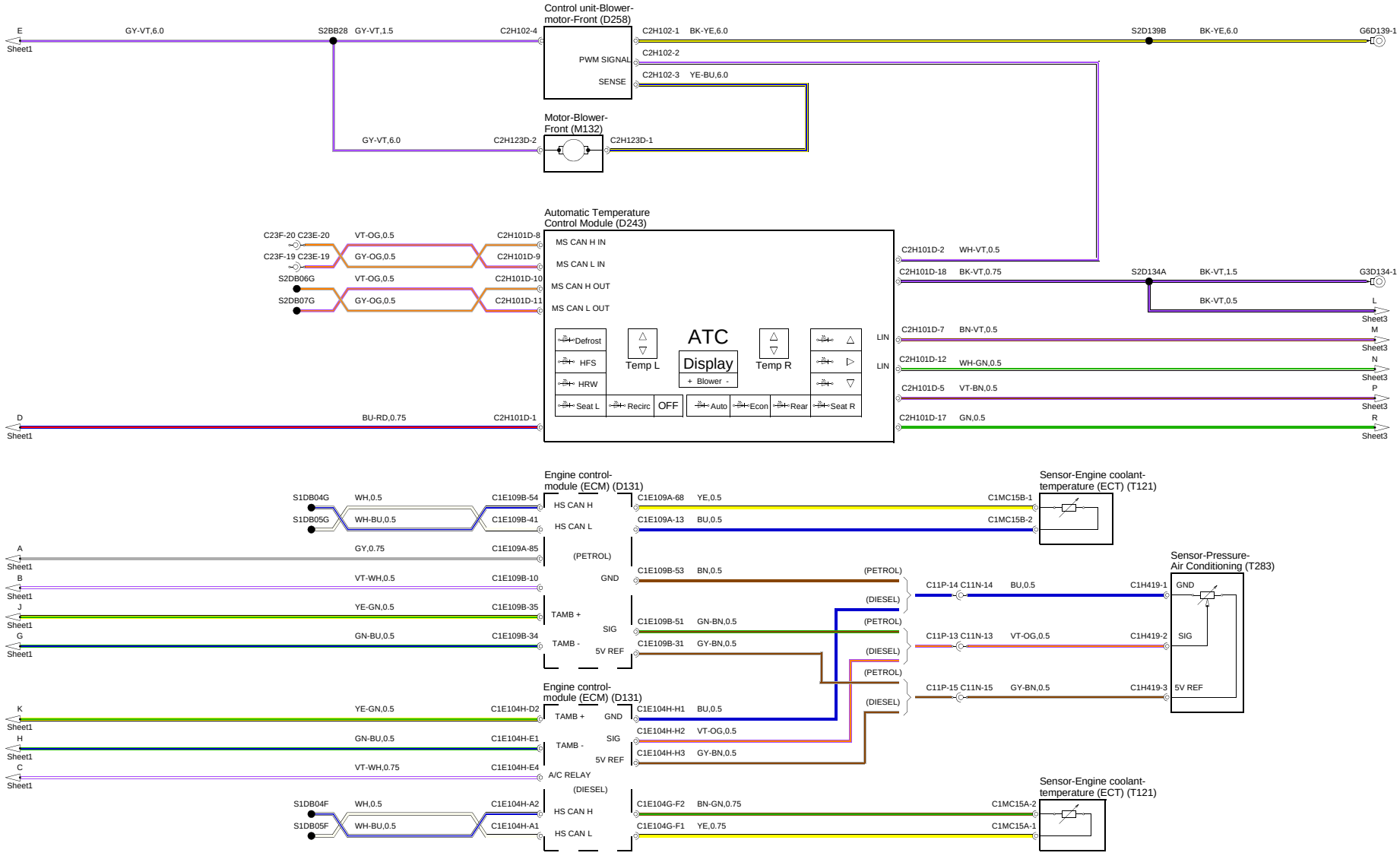

Fuel injector-No.1 (T172)
CYL 1
C1E205C-1
C1E205C-2
GN-BU,1.5
YE-BU,1.5
C1E104F-L1
C1E104F-L3
Fuel injector-No.2 (T173)
CYL 2
C1E206C-1
C1E206C-2
GY-YE,1.5
BU-OG,1.5
C1E104F-M2
C1E104F-M4
Fuel injector-No.3 (T174)
CYL 3
C1E207C-1
C1E207C-2
VT-GY,1.5
GN-VT,1.5
C1E104F-L2
C1E104F-L4
Fuel injector-No.4 (T175)
CYL 4
C1E208C-1
C1E208C-2
YE-OG,1.5
BU,1.5
C1E104F-M1
C1E104F-M3
Valve-Control-
Fuel volume (N168)
K
Sheet1
VT-OG,1.0
C1E922-1
C1E922-2
BN-WH,1.0
C1E104G-M4
Actuator-Varible swirl (M348)
D
Sheet1
GN-WH,0.75
C1E817B-1
C1E817B-2
GN-VT,0.75
C1E104F-H2
Valve-Control-
Fuel pressure (N167)
J
Sheet1
BN,0.75
C1E727B-1
C1E727B-2
BN-WH,0.75
C1E104G-L3
Sensor-Temperature-Catalytic
converter-Upstream (T403)
C1E146-1
C1E146-2
BN-WH,0.5
GY-VT,0.5
C1E104F-D2
C1E104F-C2
Sensor-Temperature-Catalytic
converter-Downstream (T404)
C1E145-1
C1E145-2
GY-OG,0.5
VT-OG,0.5
C1E104F-B1
C1E104F-C1
Sensor-Differential pressure (T398)
C1E147B-1
C1E147B-2
C1E147B-3
GN-BN,0.5
BN-BU,0.5
WH-GN,0.5
C11AB-1 C11AA-1
C11AB-2 C11AA-2
C11AB-3 C11AA-3
C1E104H-J2
C1E104H-J1
C1E104H-J3
Engine control-
module (ECM) (D131)
O_P_PVH11
O_P_PVL11
O_P_PVH12
O_P_PVL12
O_P_PVH21
O_P_PVL21
O_P_PVH22
O_P_PVL22
G_R_TVA
I_A_TVA
O_T_TVAPOS
O_T_TVANEG
V_V_SVV9
I_A_EGR
O_T_EGRPOS
O_T_EGRNEG
V_V_5VV7
I_F_CRS
O_T_MEU
G_S_CRS
O_S_VA
V_V_5VCAS(VV4)
I_F_CRS
G_R_CAS
O_T_PCV
G_G_BATT-1
G_G_BATT-2
G_G_BATT-3
Unit-Electric throttle (D249)
C1E104G-E4
C1E104G-E3
C1E104F-F4
C1E104F-G3
C1E104G-G2
GN-VT,0.75
BU-WH,0.75
BU-GN,0.75
YE-VT,0.75
BN,0.75
C1E818C-3
C1E818C-4
C1E818C-1
C1E818C-2
C1E818C-5
Actuator-EGR-Electric (D362)
C1E104G-L2
C1E104G-G3
C1E104G-G4
C1E104F-K2
C1E104F-J2
BN-WH,0.75
WH-OG,0.75
GY-OG,0.75
YE-BU,0.75
WH-VT,0.75
C1E147A-1
C1E147A-3
C1E147A-2
C1E147A-5
C1E147A-4
Sensor-Crankshaft-
position (CKP) (T102)
C1E104G-L1
C1E104G-K1
C1E104G-K2
GY-VT,0.75
YE-VT,0.75
GN-BN,0.75
C1E711E-1
C1E711E-2
C1E711E-3
Sensor-Camshaft-
position (CMP) (T107)
C1E104G-G1
C1E104G-A1
C1E104G-A2
BN-BU,0.75
VT,0.75
GN-BN,0.75
C1E706F-1
C1E706F-2
C1E706F-3
C1E104H-L1
C1E104H-L2
C1E104H-M1
BK-GN,1.5
S1D120A
BK-GN,4.0
G1D120A-1
TYPE 3
Z
Sheet3
BK-GN,0.75

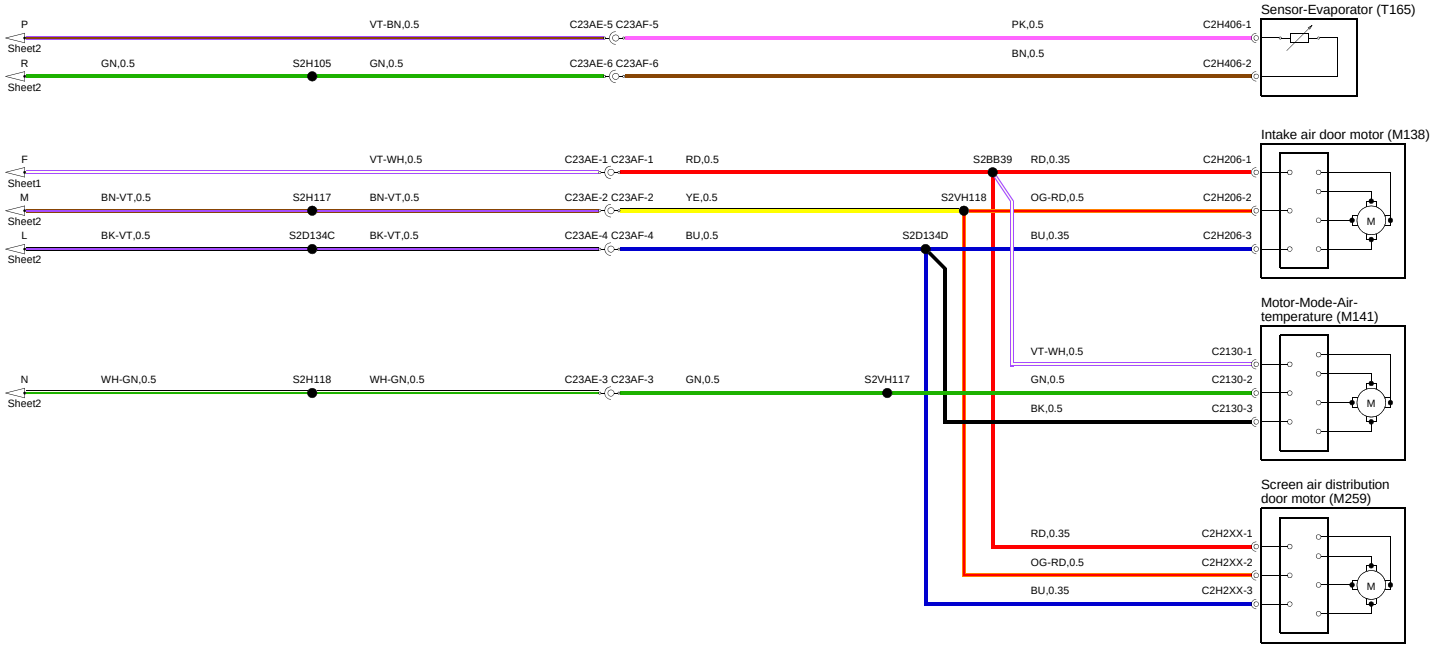

Sensor-Engine coolant-temperature (ECT) (T121)
C1MC15A-2
BN-GN,0.75
C1E104G-F2
C1MC15A-1
YE,0.75
C1E104G-F1
Engine control-module (ECM) (D131)
I_A_CTS
G_R_CTS
I_A_OQS
G_R_OQS
V_V_5VV6
C1E104G-D1
BU-GN,0.75
C1E717F-3
C1E104G-D2
BU-OG,0.75
C1E717F-2
C1E104G-J4
GY-YE,0.75
C1E717F-1
Sensor-Oil temperature-level (T335)
Sensor-Heated oxygen-(HO2S)-Front (T133)
C
WH-BU,1.0
C1E731D-4
Sheet1
C1E731D-3
VT-GN,0.75
C1E104F-K4
O_T_SHT1
C1E731D-1
YE-GN,0.5
C1E104G-B4
C1E731D-5
BN,0.5
C1E104G-B3
C1E731D-2
WH,0.5
C1E104G-A3
C1E731D-6
BN,0.5
C1E104G-A4
I_A_SCP
I_A_SCA
G_R_LSVG
I_A_SVN
V_V_5VV3
G_R_RALPS
I_A_RALPS
C1E104G-H2
BU-BN,0.75
C1E727C-3
C1E104G-F4
BU-BN,0.75
C1E727C-2
C1E104G-F3
GY,0.75
C1E727C-1
Sensor-Pressure-Fuel rail (T264)
C1E104G-H1
YE-GN,0.75
C1E705B-1
C1E104G-C4
BU-WH,0.75
C1E705B-2
C1E104G-D4
GN-BU,0.75
C1E705B-3
Sensor-Boost-pressure (T141)
C11N-1 C11P-1
(AUTO)
WH,0.5
WH-BU,0.5
(MANUAL)
(AUTO)
C1E104H-A2
HS CAN H
I_A_BPS
G_R_BPS
C11N-12 C11P-12
(AUTO)
WH,0.5
WH-BU,0.5
S1DB04F
S1DB05F
WH,0.5
WH-BU,0.5
(MANUAL)
(AUTO)
C1E104H-A1
HS CAN L
G_R_PAC
I_A_PAC
V_V_5VV4
C1E104H-H1
BU,0.5
C11P-14 C11N-14BU,0.5
C1H419-1
C1E104H-H2
VT-OG,0.5
C11P-13 C11N-13VT-OG,0.5
C1H419-2
C1E104H-H3
GY-BN,0.5
C11P-15 C11N-15GY-BN,0.5
C1H419-3
Sensor-Pressure-Air Conditioning (T283)
GND
SIG
5V REF

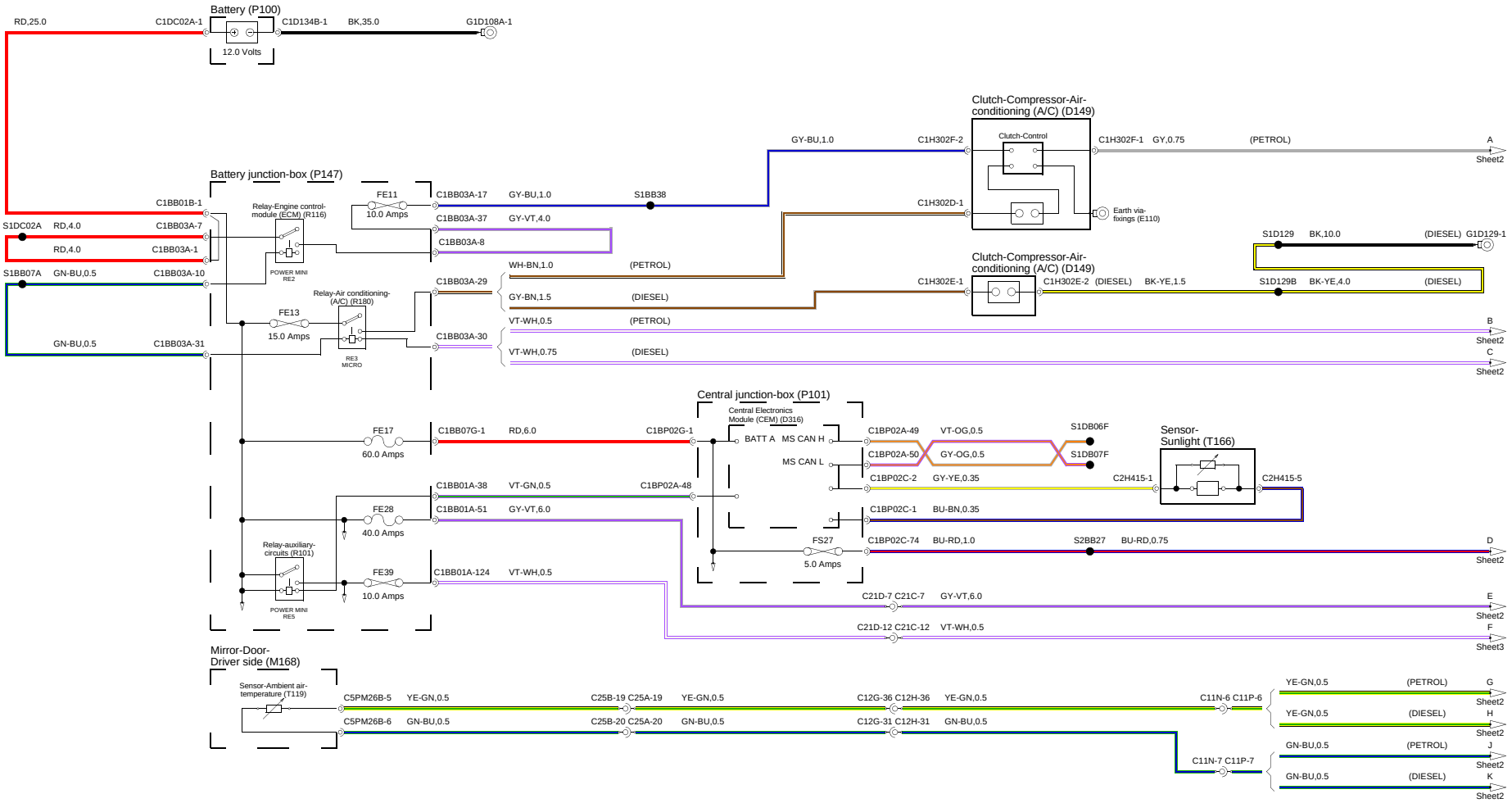
S
VT,6.0
Sheet1
S1BB04A
VT,2.5
C11X-1 C11Y-1
VT,2.5D
C1E243-1
Glow plug (T171)
1
Earth via-fixings (E110)
VT,2.5
C11X-2 C11Y-2
VT,2.5D
C1E244-1
Glow plug (T171)
2
Earth via-fixings (E110)
VT,2.5
C11X-3 C11Y-3
VT,2.5D
C1E245-1
Glow plug (T171)
3
Earth via-fixings (E110)
VT,2.5
C11X-4 C11Y-4
VT,2.5D
C1E246-1
Glow plug (T171)
4
Earth via-fixings (E110)

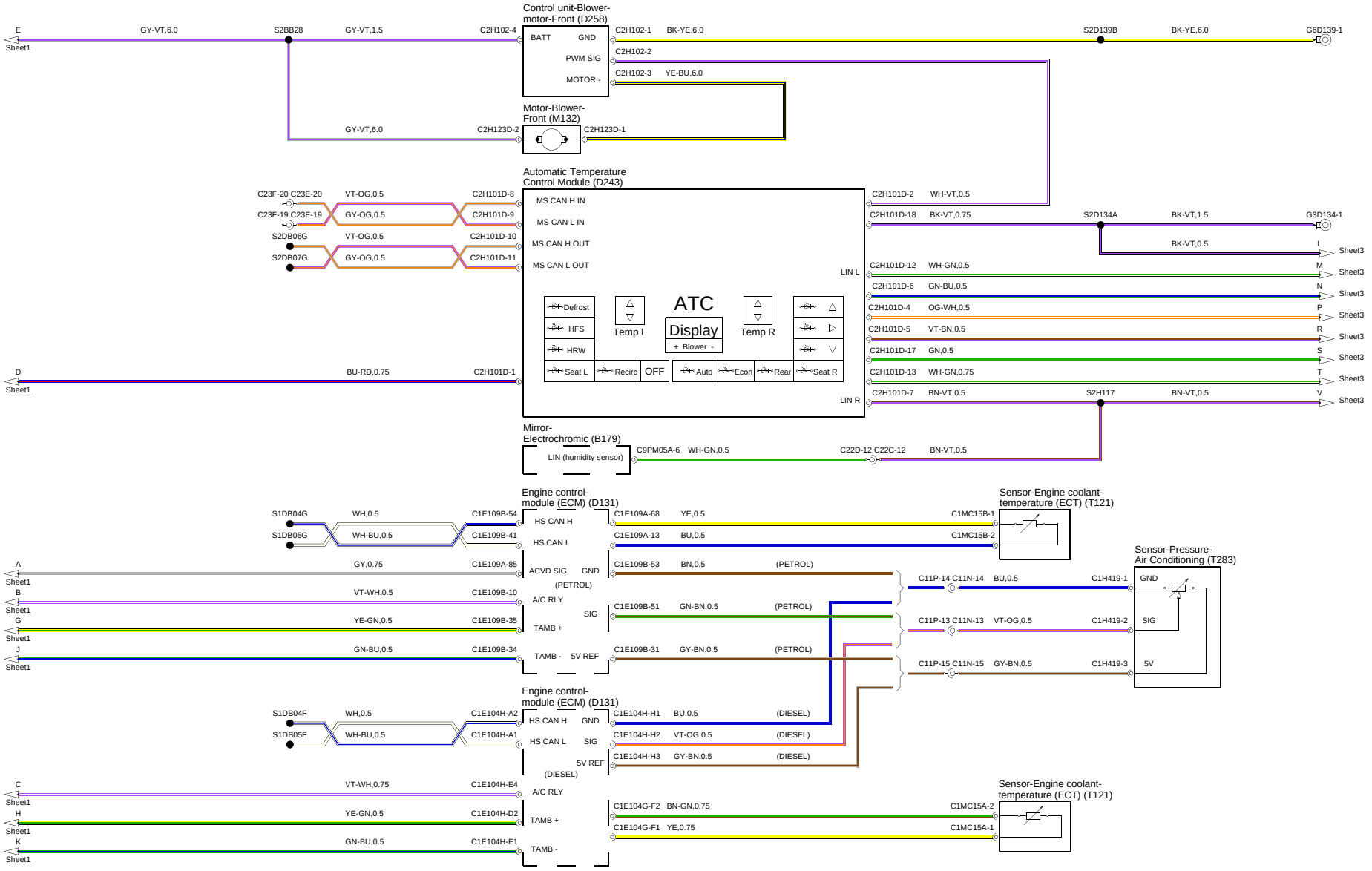

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE2
15.0 Amps
C1BB03A-32
(PETROL) WH-RD,1.5
(DIESEL) GN,1.0
C1ET02-1
Relay-Ignition (R211)
FE42
15.0 Amps
C1BB01A-99 GN,1.0
EPR6 POWER MINI
GN,0.75 (DIESEL)
VT-BN,0.75 (PETROL)
C11M-3 C11L-3
S1BB34 VT-BN,0.75
S1BB42 GN,0.75
C1ET02-11
Relay-Starter (R102)
EPR2 POWER MINI
C1BB03A-6
(DIESEL) YE,0.5
(PETROL) YE,0.5
C1BB01A-106 GN-VT,0.75
Engine control-module (ECM) (D131)
C1E109B-11
C1E109B-13 GY-BN,0.5
(PETROL)
(DIESEL)
C1ET02-5
Engine control-module (ECM) (D131)
C1E104F-C4
C1E104G-J2 GY-BN,0.5
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
C1BP02A-45
HS CAN-H
HS CAN-L
C1BP02C-47 WH,0.35
C1BP02C-48 WH-BU,0.35
S2DB04J
S2DB05J
S1DB04G WH,0.5
S1DB05G WH-BU,0.5
S1DB04F WH,0.5
S1DB05F WH-BU,0.5
(PETROL)
(DIESEL)
C1ET02-14
C1ET02-6
Module-Transmission-control (D294)
Transmission-control module (D307)
GND
BAT +
IGNITION
START LOCK
STLK
SFL
VSUP
HS CAN H
LIN
HS CAN L
Mechatronics (Y262)
S1
Shift Solenoid No. 1
S2
Shift Solenoid No.2
L-UP CONTROL SOLENOID (SLU)
SLU
SLUG
LINE PRESSURE CONTROL SOLENOID (SLT)
SLT
SLTG
B1 PRESSURE CONTROL SOLENOID (SLB1)
SLB1
SLB1G
C1 PRESSURE CONTROL SOLENOID (SLC1)
SLC1
SLC1G
C2 PRESSURE CONTROL SOLENOID (SLC2)
SLC2
SLC2G
C3 PRESSURE CONTROL SOLENOID (SLC3)
SLC3
SLC3G
Vehicle Speed Hall Sensor (56 pulses max/Rev.)
SP+
SP-
Input Speed Hall Sensor (36 pulses max/Rev.)
NIN+
NIN-
Sensor-Oil-temperature (T128)
OT
OTG
SHIFT LOCK
POWER
LIN
C1ET02-9
(DIESEL) BK,1.5
(PETROL) BK-BU,0.75
S1D108
BK-BU,1.5
G1D108D-1
Gearshift mechanism (D308)
C3ET42-3 GN-OG,0.50
C3ET42-1 YE-VT,0.50
C3ET42-2 OG-GN,0.50
C3ET42-6 BK,0.50
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
BN-VT,0.5
C21C-16 C21D-16
YE-VT,0.5
C21C-15 C21D-15
GN-OG,0.5
C21C-18 C21D-18
C1ET02-13
GN-OG,0.5 (PETROL)
GN-OG,0.5 (DIESEL)
C11P-10 C11N-10 GN-OG,0.5
C1ET02-16
BU-GY,0.75 (PETROL)
YE-VT,0.5 (DIESEL)
C11M-2 C11L-2 YE-VT,0.5
C1ET02-7
BN-VT,0.5 (DIESEL)
BN-VT,0.5 (PETROL)
C11P-11 C11N-11 BN-VT,0.5

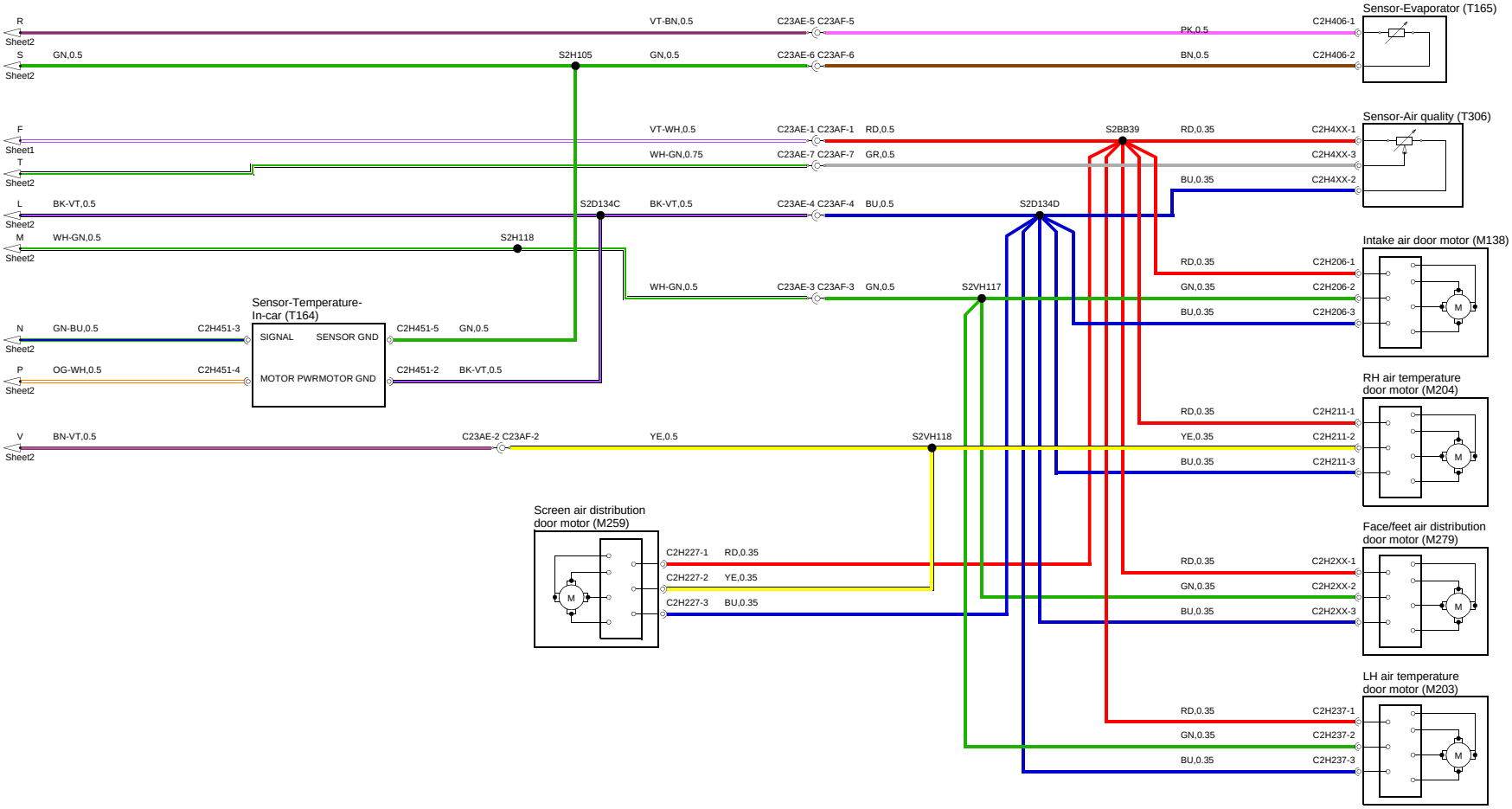

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1 BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
S1DC02A RD,4.0
C1BB03A-1
RD,4.0
C1BB03A-7
C1BB01B-1
S1BB07A GN-BU,0.5
C1BB03A-10
GN-BU,0.5
C1BB03A-31
FE11
10.0 Amps
C1BB03A-17 GY-BU,1.0
S1BB38 GY-BU,1.0
C1H302F-2
C1BB03A-37
C1BB03A-8 GY-VT,4.0
C1H302D-1
Relay-Engine control-module (ECM) (R116)
POWER MINI RE2
Clutch-Compressor-Air-conditioning (A/C) (D149)
Earth via Fixings
C1H302F-1 GY,0.75
A
Sheet2
WH-BN,1.0 (PETROL)
C1BB03A-29
GY-BN,1.5 (DIESEL)
C1H302E-1
Relay-Air conditioning-(A/C) (R180)
FE13
15.0 Amps
RE3 MICRO
VT-WH,0.5 (PETROL)
C1BB03A-30
VT-WH,0.75 (DIESEL)
Clutch-Compressor-Air-conditioning (A/C) (D149)
C1H302E-2 BK-YE,1.5
S1D129B BK-YE,4.0
S1D129 BK,10.0
G1D129-1
B
Sheet2
C
Sheet2
Central junction-box (P101)
FE17
60.0 Amps
C1BB07G-1 RD,6.0
C1BP02G-1
FS27
5.0 Amps
C1BP02C-74 BU-RD,1.0
S2BB27 BU-RD,0.75
D
Sheet2
Relay-auxiliary-circuits (R101)
POWER MINI RE5
C1BB01A-38 VT-GN,0.5
Central Electronics Module (CEM) (D316)
BATT A
C1BP02A-48
MS CAN H
MS CAN L
C1BP02A-49 VT-OG,0.5
C1BP02A-50 GY-OG,0.5
S1DB06F
S1DB07F
FE28
40.0 Amps
C1BB01A-51 GY-VT,6.0
FE39
10.0 Amps
C1BB01A-124 VT-WH,0.5
C21D-7 C21C-7 GY-VT,6.0
E
Sheet2
C21D-12 C21C-12 VT-WH,0.5
F
Sheet3
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
C5PM26B-6 GN-BU,0.5 C25B-20 C25A-20 GN-BU,0.5 C12G-31 C12H-31 GN-BU,0.5 C11N-7 C11P-7
C5PM26B-5 YE-GN,0.5 C25B-19 C25A-19 YE-GN,0.5 C12G-36 C12H-36 YE-GN,0.5
C11N-6 C11P-6
GN-BU,0.5 (PETROL) G
Sheet2
GN-BU,0.5 (DIESEL) H
Sheet2
YE-GN,0.5 (PETROL) J
Sheet2
YE-GN,0.5 (DIESEL) K
Sheet2

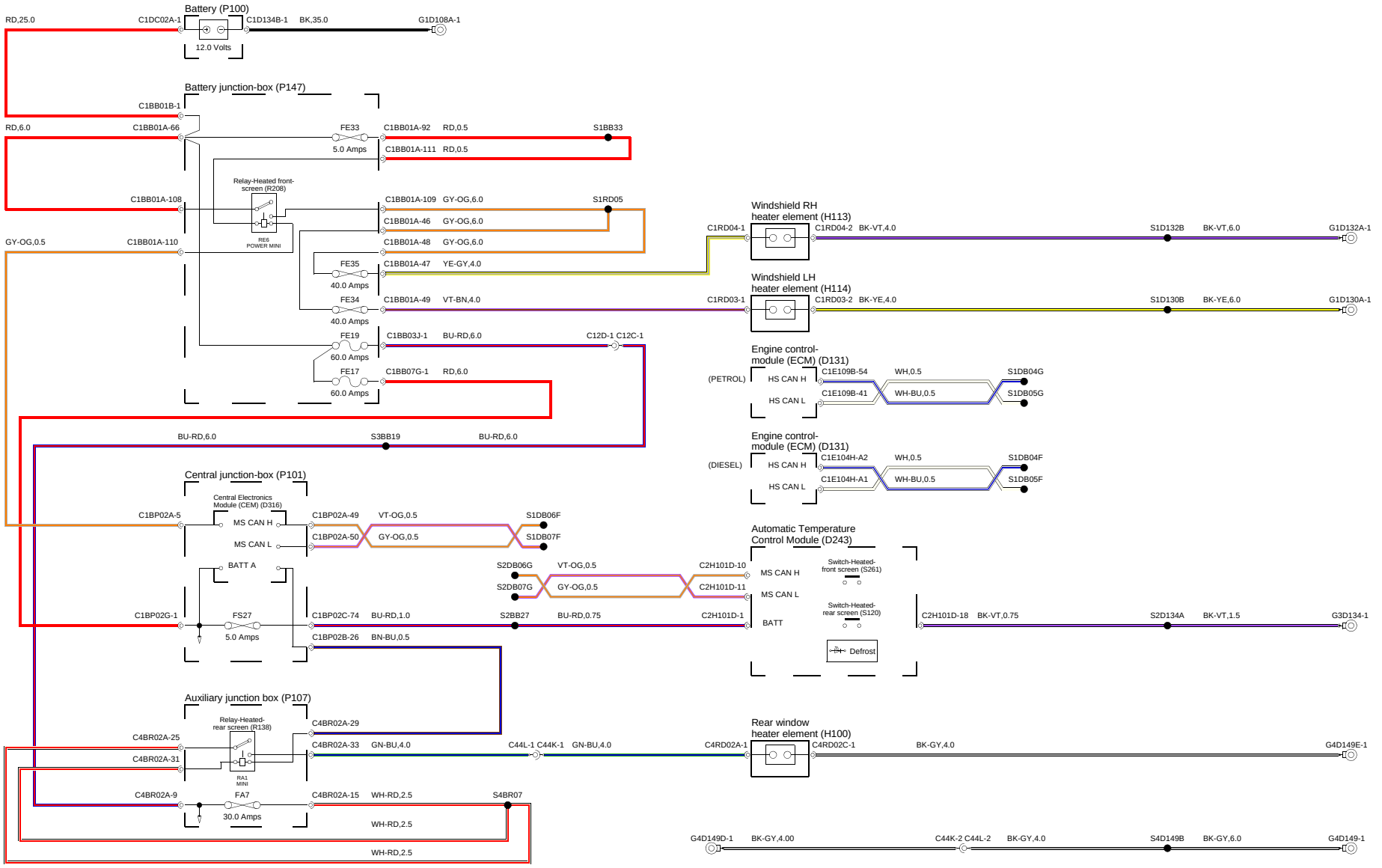

Control unit-Blower-motor-Front (D258)
PWM SIGNAL
SENSE
Motor-Blower-Front (M132)
Automatic Temperature Control Module (D243)
MS CAN H IN
MS CAN L IN
MS CAN H OUT
MS CAN L OUT
ATC
Display
Temp L
Temp R
Defrost
HFS
HRW
Seat L
Recirc
OFF
Auto
Econ
Rear
Seat R
Engine control-module (ECM) (D131)
HS CAN H
HS CAN L
(PETROL)
GND
TAMB +
TAMB -
SIG
5V REF
A/C RELAY
(DIESEL)
Sensor-Engine coolant-temperature (ECT) (T121)
Sensor-Pressure-Air Conditioning (T283)
Sheet1
Sheet3

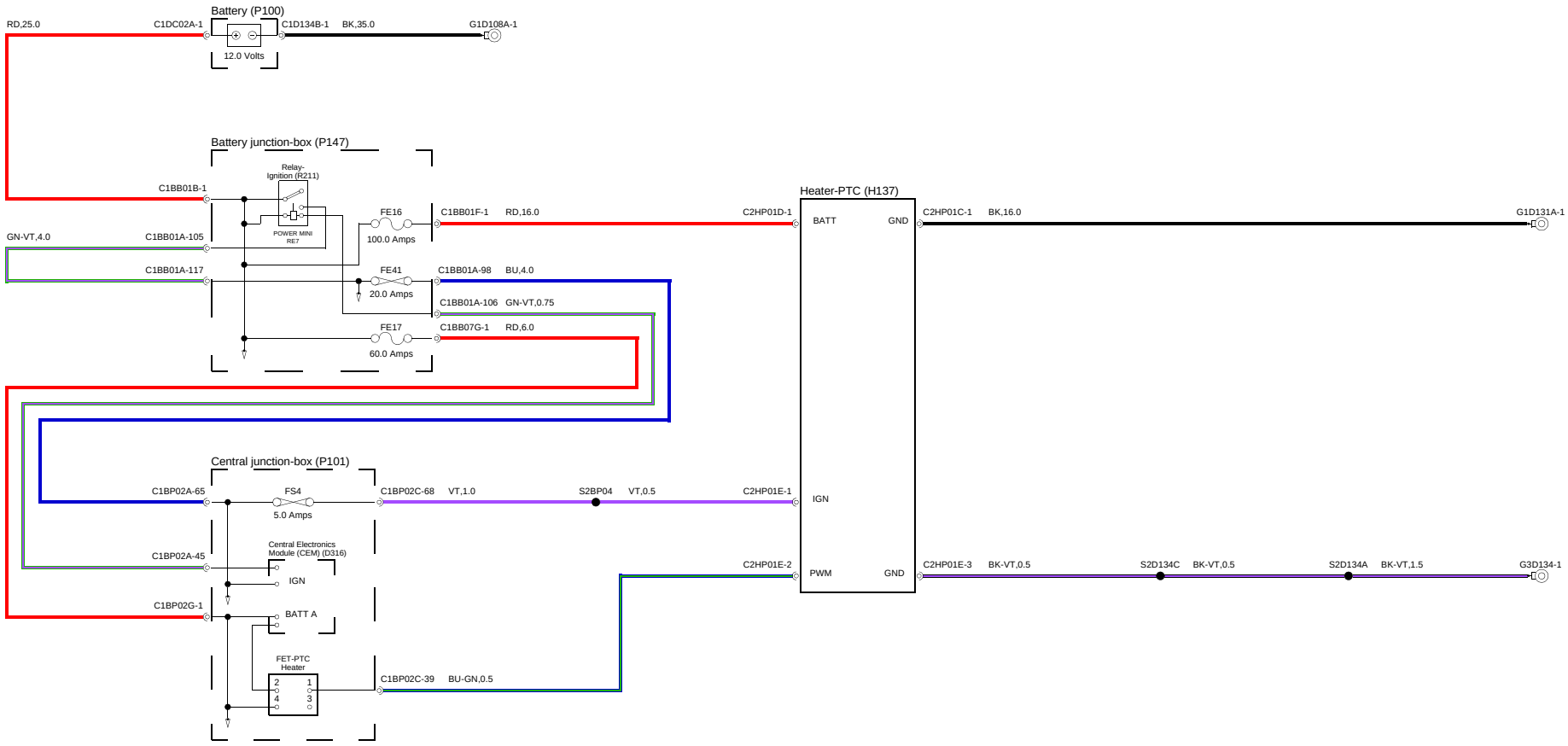

P
Sheet2
VT-BN,0.5
C23AE-5 C23AF-5
PK,0.5
C2H406-1
Sensor-Evaporator (T165)
BN,0.5
R
Sheet2
GN,0.5
S2H105
GN,0.5
C23AE-6 C23AF-6
C2H406-2
F
Sheet1
VT-WH,0.5
C23AE-1 C23AF-1
RD,0.5
S2BB39
RD,0.35
C2H206-1
Intake air door motor (M138)
M
Sheet2
BN-VT,0.5
S2H117
BN-VT,0.5
C23AE-2 C23AF-2
YE,0.5
S2VH118
OG-RD,0.5
C2H206-2
L
Sheet2
BK-VT,0.5
S2D134C
BK-VT,0.5
C23AE-4 C23AF-4
BU,0.5
S2D134D
BU,0.35
C2H206-3
Motor-Mode-Air-temperature (M141)
VT-WH,0.5
C2130-1
N
Sheet2
WH-GN,0.5
S2H118
WH-GN,0.5
C23AE-3 C23AF-3
GN,0.5
S2VH117
GN,0.5
C2130-2
BK,0.5
C2130-3
Screen air distribution door motor (M259)
RD,0.35
C2H2XX-1
OG-RD,0.5
C2H2XX-2
BU,0.35
C2H2XX-3
M

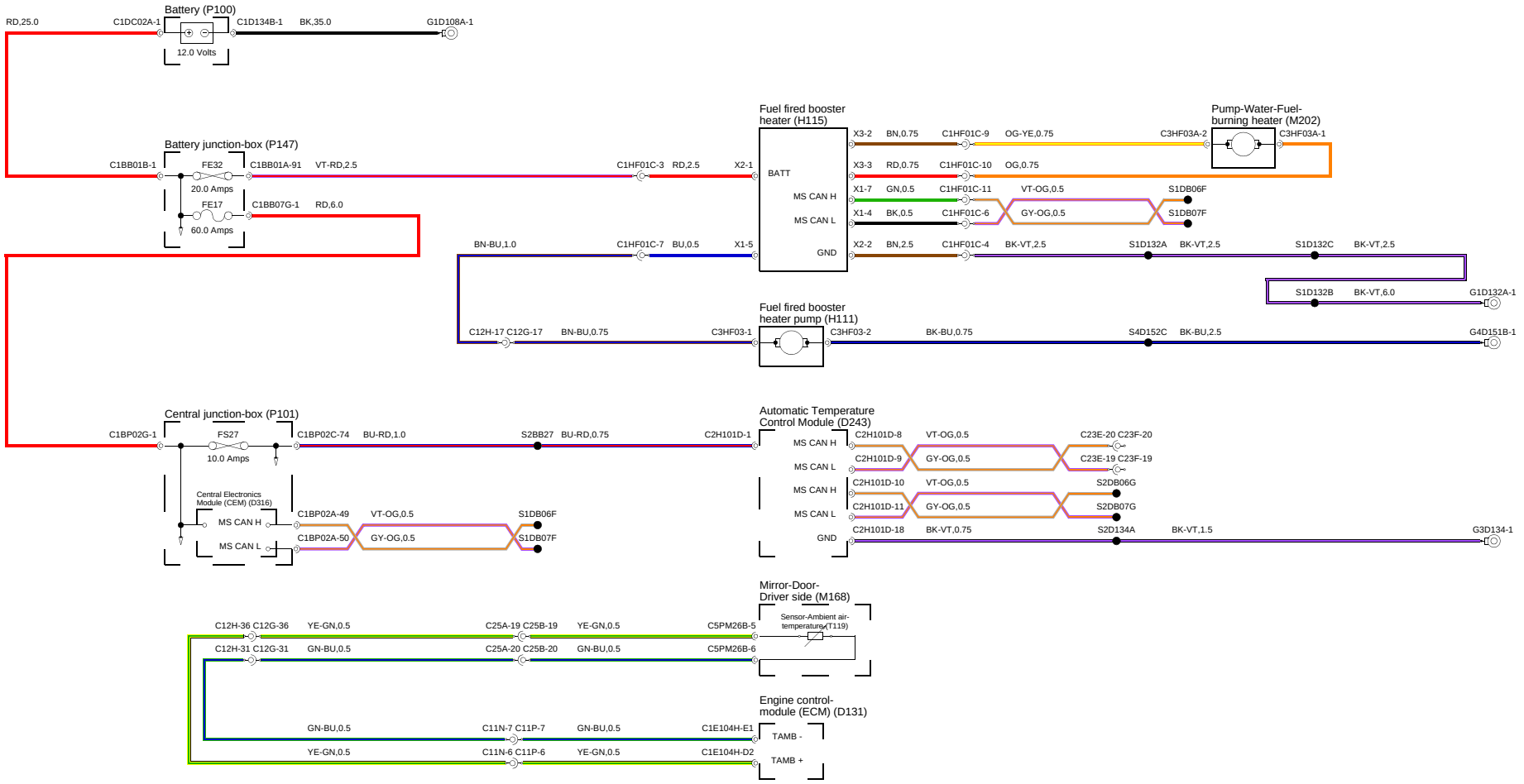

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
S1DC02A
RD,4.0
C1BB03A-7
RD,4.0
C1BB03A-1
S1BB07A
GN-BU,0.5
C1BB03A-10
GN-BU,0.5
C1BB03A-31
Relay-Engine control-module (ECM) (R116)
POWER MINI RE2
FE11
10.0 Amps
C1BB03A-17
GY-BU,1.0
S1BB38
C1BB03A-37
GY-VT,4.0
C1BB03A-8
Relay-Air conditioning-(A/C) (R180)
RE3 MICRO
FE13
15.0 Amps
C1BB03A-29
C1BB03A-30
GY-BU,1.0
C1H302F-2
Clutch-Compressor-Air-conditioning (A/C) (D149)
Clutch-Control
C1H302F-1
GY,0.75
(PETROL)
A
Sheet2
C1H302D-1
Earth via-fixings (E110)
WH-BN,1.0
(PETROL)
GY-BN,1.5
(DIESEL)
C1H302E-1
C1H302E-2
(DIESEL)
BK-YE,1.5
S1D129
BK,10.0
(DIESEL)
G1D129-1
S1D129B
BK-YE,4.0
(DIESEL)
VT-WH,0.5
(PETROL)
VT-WH,0.75
(DIESEL)
B
Sheet2
C
Sheet2
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
FE17
60.0 Amps
C1BB07G-1
RD,6.0
C1BP02G-1
BATT A
MS CAN H
MS CAN L
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
C1BP02C-2
GY-YE,0.35
C1BP02C-1
BU-BN,0.35
Sensor-Sunlight (T166)
C2H415-1
C2H415-5
C1BB01A-38
VT-GN,0.5
C1BP02A-48
FE28
40.0 Amps
C1BB01A-51
GY-VT,6.0
Relay-auxiliary-circuits (R101)
POWER MINI RE5
FE39
10.0 Amps
C1BB01A-124
VT-WH,0.5
FS27
5.0 Amps
C1BP02C-74
BU-RD,1.0
S2BB27
BU-RD,0.75
D
Sheet2
C21D-7 C21C-7
GY-VT,6.0
E
Sheet2
C21D-12 C21C-12
VT-WH,0.5
F
Sheet3
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
C5PM26B-5
YE-GN,0.5
C25B-19 C25A-19
YE-GN,0.5
C12G-36 C12H-36
YE-GN,0.5
C11N-6 C11P-6
YE-GN,0.5
(PETROL)
G
Sheet2
YE-GN,0.5
(DIESEL)
H
Sheet2
C5PM26B-6
GN-BU,0.5
C25B-20 C25A-20
GN-BU,0.5
C12G-31 C12H-31
GN-BU,0.5
C11N-7 C11P-7
GN-BU,0.5
(PETROL)
J
Sheet2
GN-BU,0.5
(DIESEL)
K
Sheet2

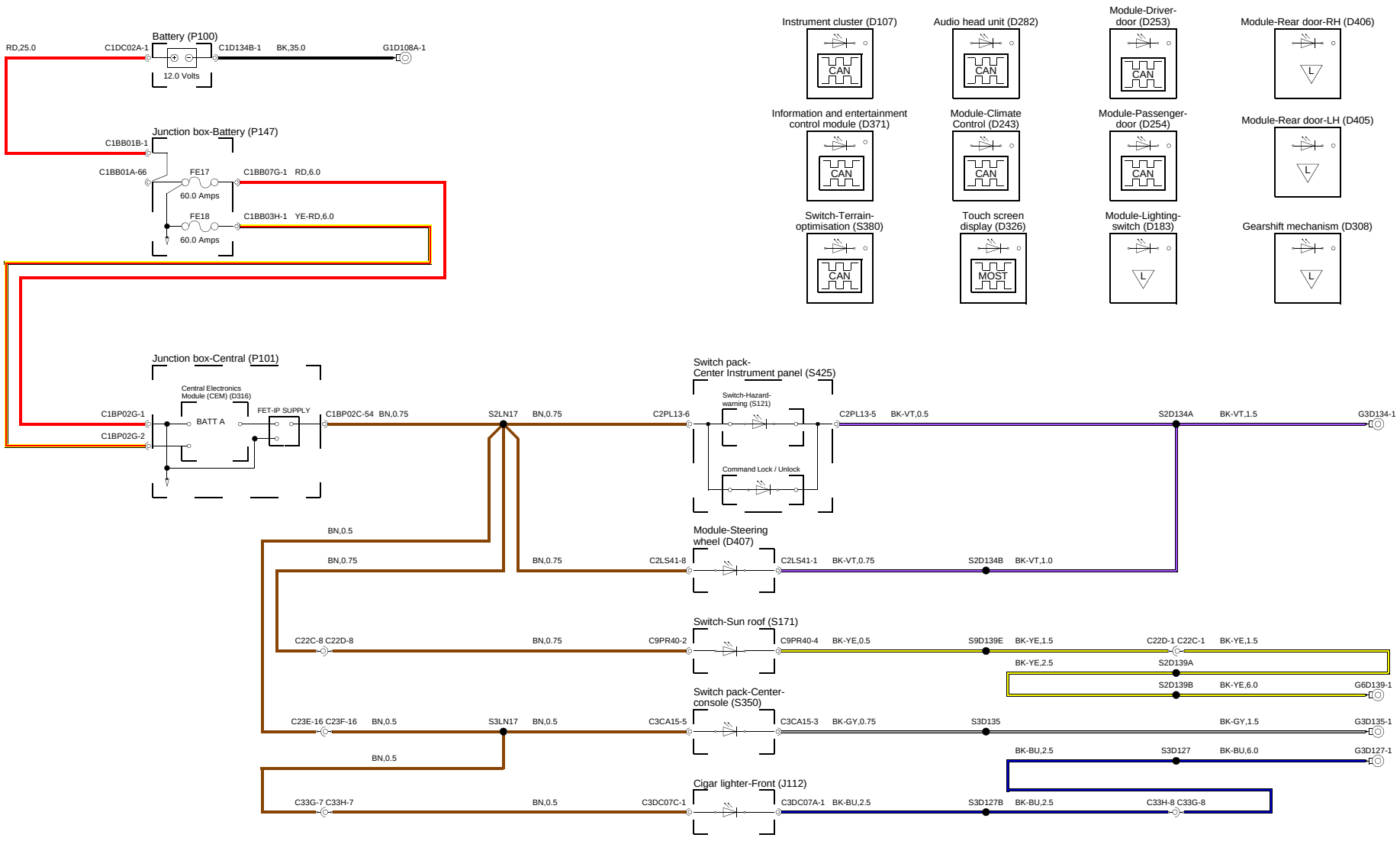

Control unit-Blower-motor-Front (D258)
BATT
GND
PWM SIG
MOTOR -
Motor-Blower-Front (M132)
Automatic Temperature Control Module (D243)
MS CAN H IN
MS CAN L IN
MS CAN H OUT
MS CAN L OUT
LIN L
LIN R
Defrost
HFS
HRW
Seat L
Recirc
OFF
Auto
Econ
Rear
Seat R
Temp L
Temp R
ATC
Display
+ Blower -
Mirror-Electrochromic (B179)
LIN (humidity sensor)
Engine control-module (ECM) (D131)
HS CAN H
HS CAN L
ACVD SIG
GND
A/C RLY
SIG
TAMB +
TAMB -
5V REF
(PETROL)
Engine control-module (ECM) (D131)
HS CAN H
GND
HS CAN L
SIG
5V REF
(DIESEL)
A/C RLY
TAMB +
TAMB -
Sensor-Engine coolant-temperature (ECT) (T121)
Sensor-Pressure-Air Conditioning (T283)
GND
SIG
5V
Sensor-Engine coolant-temperature (ECT) (T121)

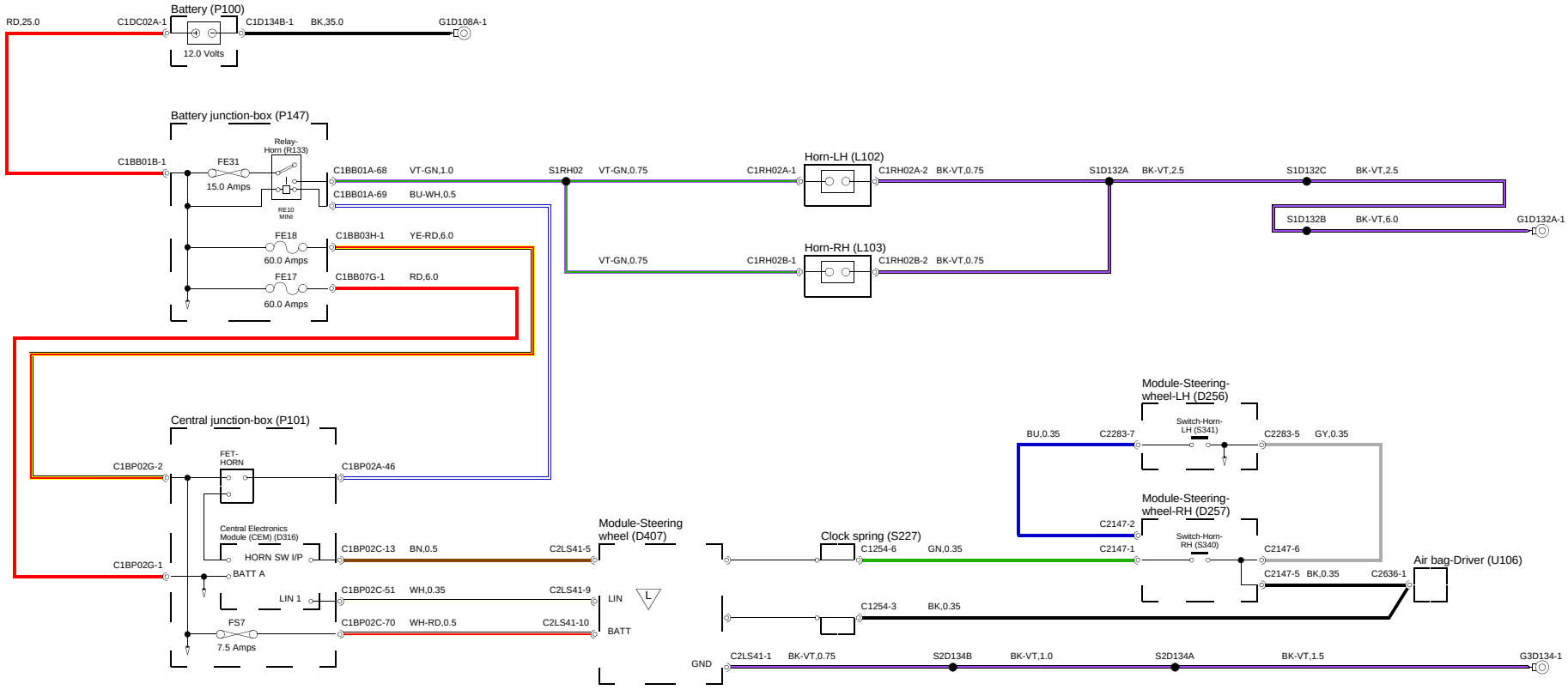

R
Sheet2
VT-BN,0.5
C23AE-5 C23AF-5
PK,0.5
C2H406-1
Sensor-Evaporator (T165)
S
Sheet2
GN,0.5
S2H105
GN,0.5
C23AE-6 C23AF-6
BN,0.5
C2H406-2
F
Sheet1
VT-WH,0.5
C23AE-1 C23AF-1
RD,0.5
S2BB39
RD,0.35
C2H4XX-1
Sensor-Air quality (T306)
T
Sheet2
WH-GN,0.75
C23AF-7 C23AF-7
GR,0.5
C2H4XX-3
BU,0.35
C2H4XX-2
L
Sheet2
BK-VT,0.5
S2D134C
BK-VT,0.5
C23AE-4 C23AF-4
BU,0.5
S2D134D
M
Sheet2
WH-GN,0.5
S2H118
WH-GN,0.5
C23AE-3 C23AF-3
GN,0.5
S2VH117
RD,0.35
C2H206-1
Intake air door motor (M138)
GN,0.35
C2H206-2
BU,0.35
C2H206-3
Sensor-Temperature-
In-car (T164)
N
Sheet2
GN-BU,0.5
C2H451-3
SIGNAL
SENSOR GND
C2H451-5
GN,0.5
P
Sheet2
OG-WH,0.5
C2H451-4
MOTOR PWR
MOTOR GND
C2H451-2
BK-VT,0.5
V
Sheet2
BN-VT,0.5
C23AE-2 C23AF-2
YE,0.5
S2VH118
RD,0.35
C2H211-1
RH air temperature
door motor (M204)
YE,0.35
C2H211-2
BU,0.35
C2H211-3
Screen air distribution
door motor (M259)
C2H227-1
RD,0.35
C2H227-2
YE,0.35
C2H227-3
BU,0.35
RD,0.35
C2H2XX-1
Face/feet air distribution
door motor (M279)
GN,0.35
C2H2XX-2
BU,0.35
C2H2XX-3
RD,0.35
C2H237-1
LH air temperature
door motor (M203)
GN,0.35
C2H237-2
BU,0.35
C2H237-3

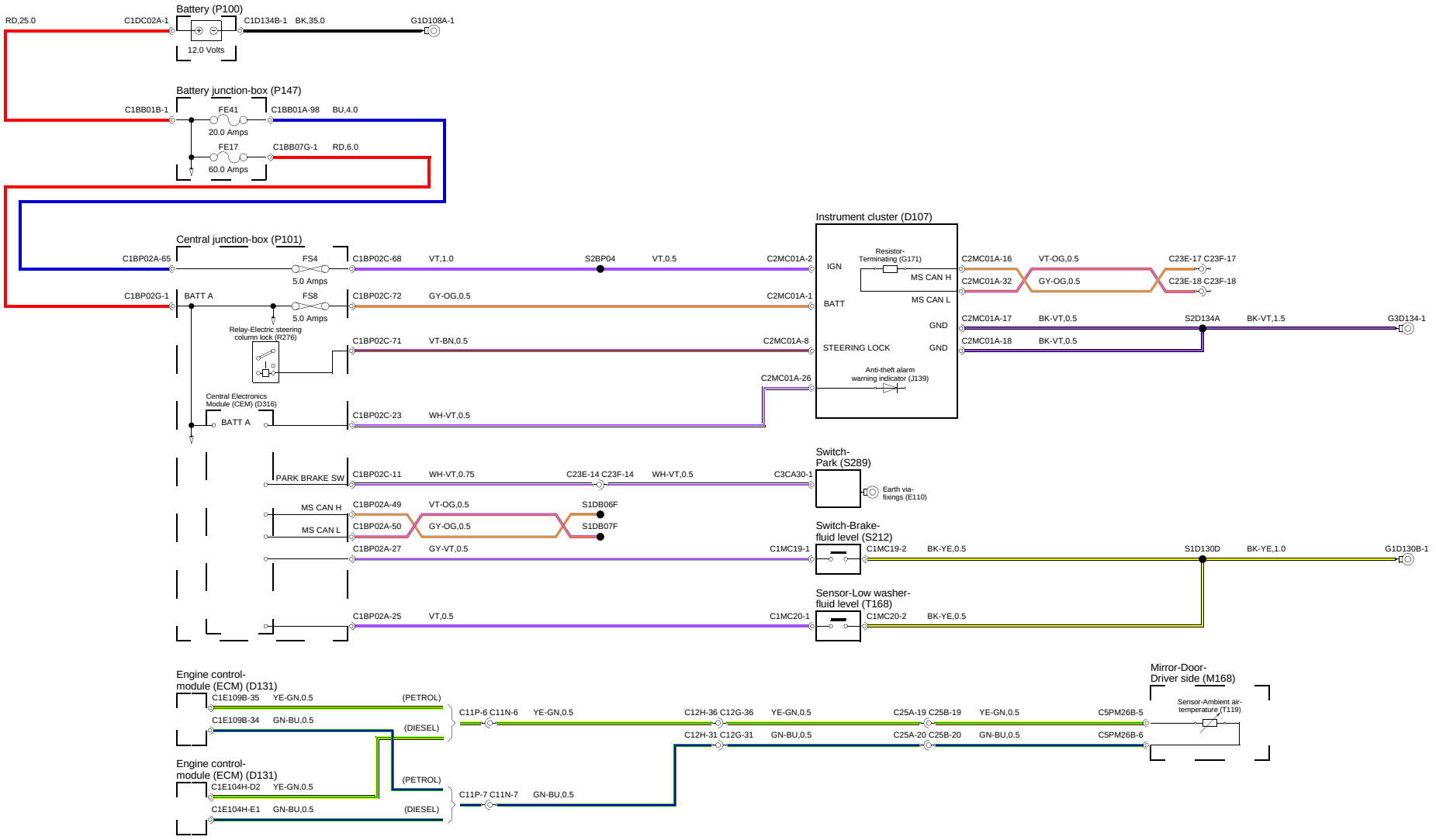

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
RD,6.0
C1BB01A-66
FE33
5.0 Amps
C1BB01A-92
RD,0.5
S1BB33
C1BB01A-111
RD,0.5
Relay-Heated front-screen (R208)
C1BB01A-108
C1BB01A-109
GY-OG,6.0
S1RD05
C1BB01A-46
GY-OG,6.0
GY-OG,0.5
C1BB01A-110
RE6 POWER MINI
C1BB01A-48
GY-OG,6.0
FE35
40.0 Amps
C1BB01A-47
YE-GY,4.0
FE34
40.0 Amps
C1BB01A-49
VT-BN,4.0
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
BU-RD,6.0
S3BB19
BU-RD,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
C1BP02A-5
MS CAN H
MS CAN L
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
BATT A
C1BP02G-1
FS27
5.0 Amps
C1BP02C-74
BU-RD,1.0
C1BP02B-26
BN-BU,0.5
Auxiliary junction box (P107)
Relay-Heated-rear screen (R138)
C4BR02A-29
C4BR02A-25
C4BR02A-31
C4BR02A-33
GN-BU,4.0
RA1 MINI
C4BR02A-9
FA7
30.0 Amps
C4BR02A-15
WH-RD,2.5
S4BR07
WH-RD,2.5
WH-RD,2.5
Windshield RH heater element (H113)
C1RD04-1
C1RD04-2
BK-VT,4.0
S1D132B
BK-VT,6.0
G1D132A-1
Windshield LH heater element (H114)
C1RD03-1
C1RD03-2
BK-YE,4.0
S1D130B
BK-YE,6.0
G1D130A-1
Engine control-module (ECM) (D131)
(PETROL)
HS CAN H
HS CAN L
C1E109B-54
WH,0.5
S1DB04G
C1E109B-41
WH-BU,0.5
S1DB05G
Engine control-module (ECM) (D131)
(DIESEL)
HS CAN H
HS CAN L
C1E104H-A2
WH,0.5
S1DB04F
C1E104H-A1
WH-BU,0.5
S1DB05F
Automatic Temperature Control Module (D243)
S2DB06G
VT-OG,0.5
C2H101D-10
MS CAN H
S2DB07G
GY-OG,0.5
C2H101D-11
MS CAN L
Switch-Heated-front screen (S261)
Switch-Heated-rear screen (S120)
S2BB27
BU-RD,0.75
C2H101D-1
BATT
C2H101D-18
BK-VT,0.75
S2D134A
BK-VT,1.5
G3D134-1
Defrost
Rear window heater element (H100)
C4RD02A-1
C4RD02C-1
BK-GY,4.0
G4D149E-1
C44L-1 C44K-1
GN-BU,4.0
G4D149D-1
BK-GY,4.00
C44K-2 C44L-2
BK-GY,4.0
S4D149B
BK-GY,6.0
G4D149-1

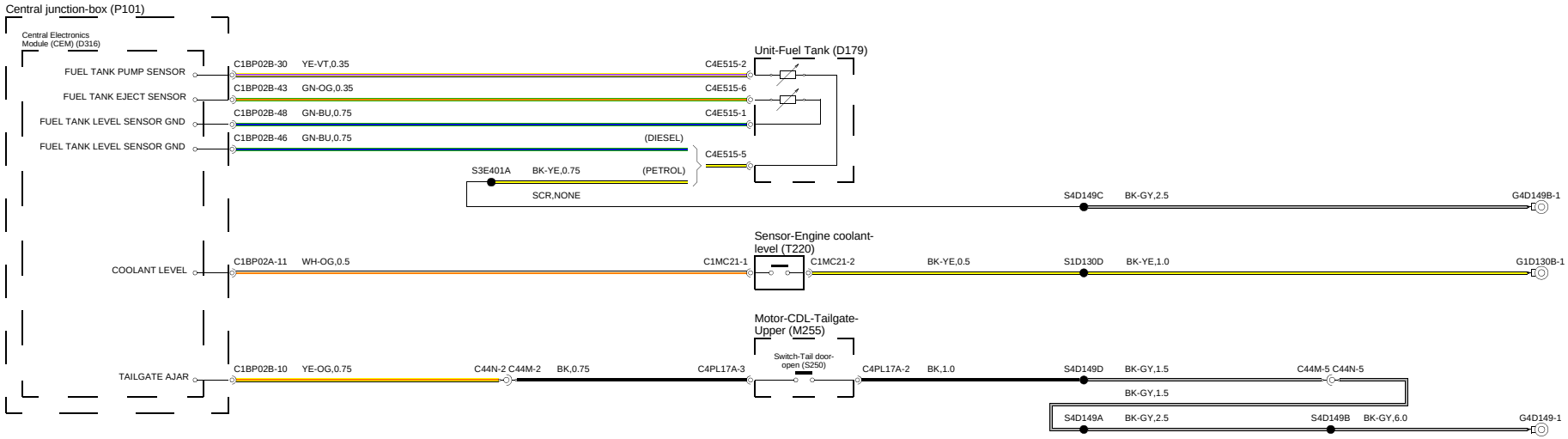

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
Relay-
Ignition (R211)
POWER MINI
RE7
C1BB01B-1
GN-VT,4.0
C1BB01A-105
C1BB01A-117
FE16
100.0 Amps
C1BB01F-1
RD,16.0
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BB01A-106
GN-VT,0.75
FE17
60.0 Amps
C1BB07G-1
RD,6.0
Heater-PTC (H137)
C2HP01D-1
BATT
GND
C2HP01C-1
BK,16.0
G1D131A-1
Central junction-box (P101)
C1BP02A-65
FS4
5.0 Amps
C1BP02C-68
VT,1.0
S2BP04
VT,0.5
C2HP01E-1
IGN
C1BP02A-45
Central Electronics
Module (CEM) (D316)
IGN
C2HP01E-2
PWM
GND
C2HP01E-3
BK-VT,0.5
S2D134C
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
C1BP02G-1
BATT A
FET-PTC
Heater
2
1
4
3
C1BP02C-39
BU-GN,0.5

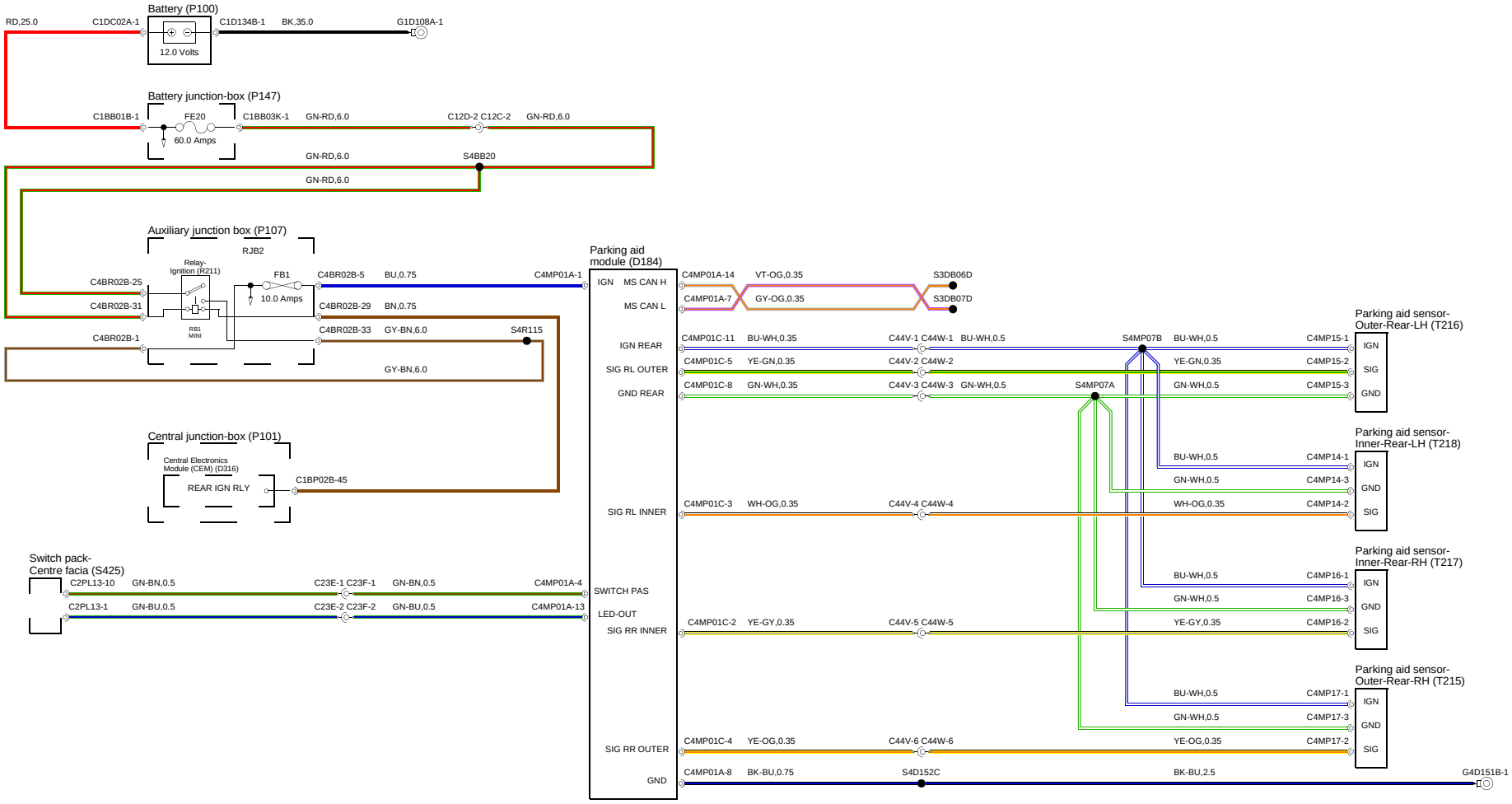

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE32
C1BB01A-91
VT-RD,2.5
20.0 Amps
FE17
C1BB07G-1
RD,6.0
60.0 Amps
Fuel fired booster heater (H115)
BATT
MS CAN H
MS CAN L
GND
C1HF01C-3
RD,2.5
X2-1
X3-2
BN,0.75
C1HF01C-9
OG-YE,0.75
C3HF03A-2
X3-3
RD,0.75
C1HF01C-10
OG,0.75
X1-7
GN,0.5
C1HF01C-11
VT-OG,0.5
S1DB06F
X1-4
BK,0.5
C1HF01C-6
GY-OG,0.5
S1DB07F
X2-2
BN,2.5
C1HF01C-4
BK-VT,2.5
S1D132A
S1D132C
S1D132B
BK-VT,6.0
G1D132A-1
Pump-Water-Fuel-burning heater (M202)
C3HF03A-1
BN-BU,1.0
C1HF01C-7
BU,0.5
X1-5
Fuel fired booster heater pump (H111)
C12H-17 C12G-17
BN-BU,0.75
C3HF03-1
C3HF03-2
BK-BU,0.75
S4D152C
BK-BU,2.5
G4D151B-1
Central junction-box (P101)
C1BP02G-1
FS27
10.0 Amps
C1BP02C-74
BU-RD,1.0
S2BB27
BU-RD,0.75
C2H101D-1
Central Electronics Module (CEM) (D316)
MS CAN H
MS CAN L
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
Automatic Temperature Control Module (D243)
MS CAN H
MS CAN L
MS CAN H
MS CAN L
GND
C2H101D-8
VT-OG,0.5
C23E-20 C23F-20
C2H101D-9
GY-OG,0.5
C23E-19 C23F-19
C2H101D-10
VT-OG,0.5
S2DB06G
C2H101D-11
GY-OG,0.5
S2DB07G
C2H101D-18
BK-VT,0.75
S2D134A
BK-VT,1.5
G3D134-1
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
C12H-36 C12G-36
YE-GN,0.5
C25A-19 C25B-19
YE-GN,0.5
C5PM26B-5
C12H-31 C12G-31
GN-BU,0.5
C25A-20 C25B-20
GN-BU,0.5
C5PM26B-6
Engine control-module (ECM) (D131)
TAMB -
TAMB +
GN-BU,0.5
C11N-7 C11P-7
GN-BU,0.5
C1E104H-E1
YE-GN,0.5
C11N-6 C11P-6
YE-GN,0.5
C1E104H-D2

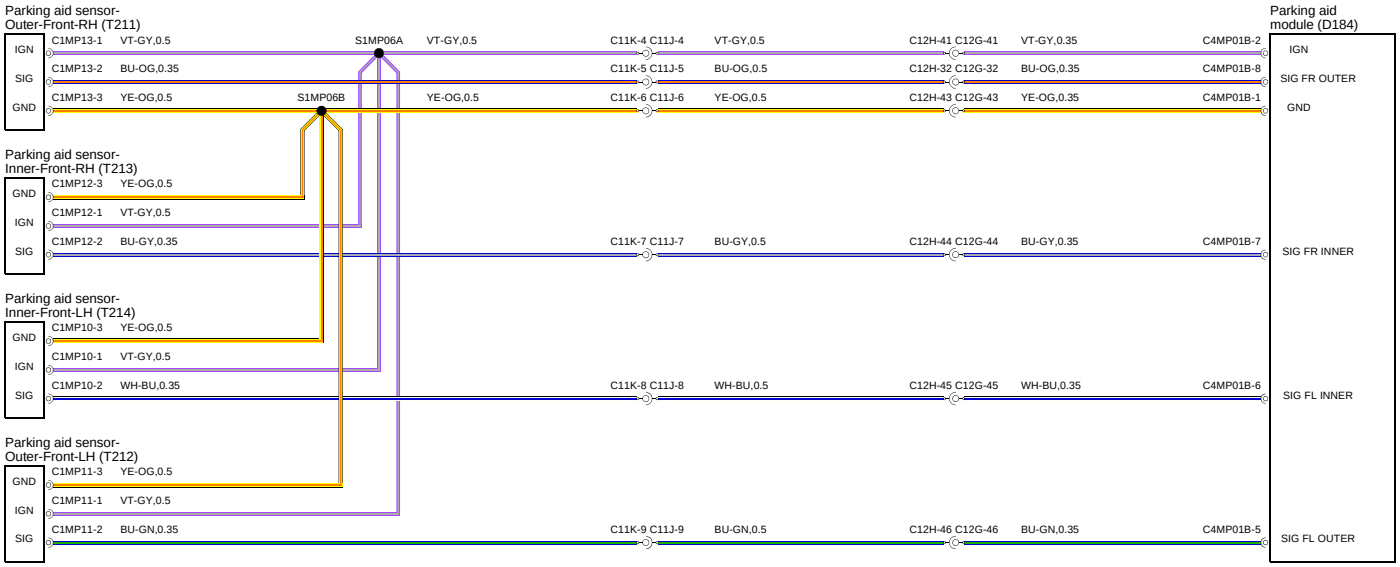

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Junction box-Battery (P147)
C1BB01B-1
C1BB01A-66
FE17
C1BB07G-1
RD,6.0
60.0 Amps
FE18
C1BB03H-1
YE-RD,6.0
60.0 Amps
Instrument cluster (D107)
Audio head unit (D282)
Module-Driver-door (D253)
Module-Rear door-RH (D406)
Information and entertainment control module (D371)
Module-Climate Control (D243)
Module-Passenger-door (D254)
Module-Rear door-LH (D405)
Switch-Terrain-optimisation (S380)
Touch screen display (D326)
Module-Lighting-switch (D183)
Gearshift mechanism (D308)
CAN
MOST
L
Junction box-Central (P101)
Central Electronics Module (CEM) (D316)
C1BP02G-1
C1BP02G-2
BATT A
FET-IP SUPPLY
C1BP02C-54
BN,0.75
S2LN17
C2PL13-6
Switch pack-Center Instrument panel (S425)
Switch-Hazard-warning (S121)
Command Lock / Unlock
C2PL13-5
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
BN,0.5
Module-Steering wheel (D407)
C2LS41-8
C2LS41-1
BK-VT,0.75
S2D134B
BK-VT,1.0
Switch-Sun roof (S171)
C22C-8
C22D-8
C9PR40-2
C9PR40-4
BK-YE,0.5
S9D139E
BK-YE,1.5
C22D-1
C22C-1
BK-YE,2.5
S2D139A
S2D139B
BK-YE,6.0
G6D139-1
Switch pack-Center-console (S350)
C23E-16
C23F-16
C3CA15-5
C3CA15-3
BK-GY,0.75
S3D135
BK-GY,1.5
G3D135-1
S3LN17
BK-BU,2.5
S3D127
BK-BU,6.0
G3D127-1
Cigar lighter-Front (J112)
C33G-7
C33H-7
C3DC07C-1
C3DC07A-1
BK-BU,2.5
S3D127B
C33H-8
C33G-8

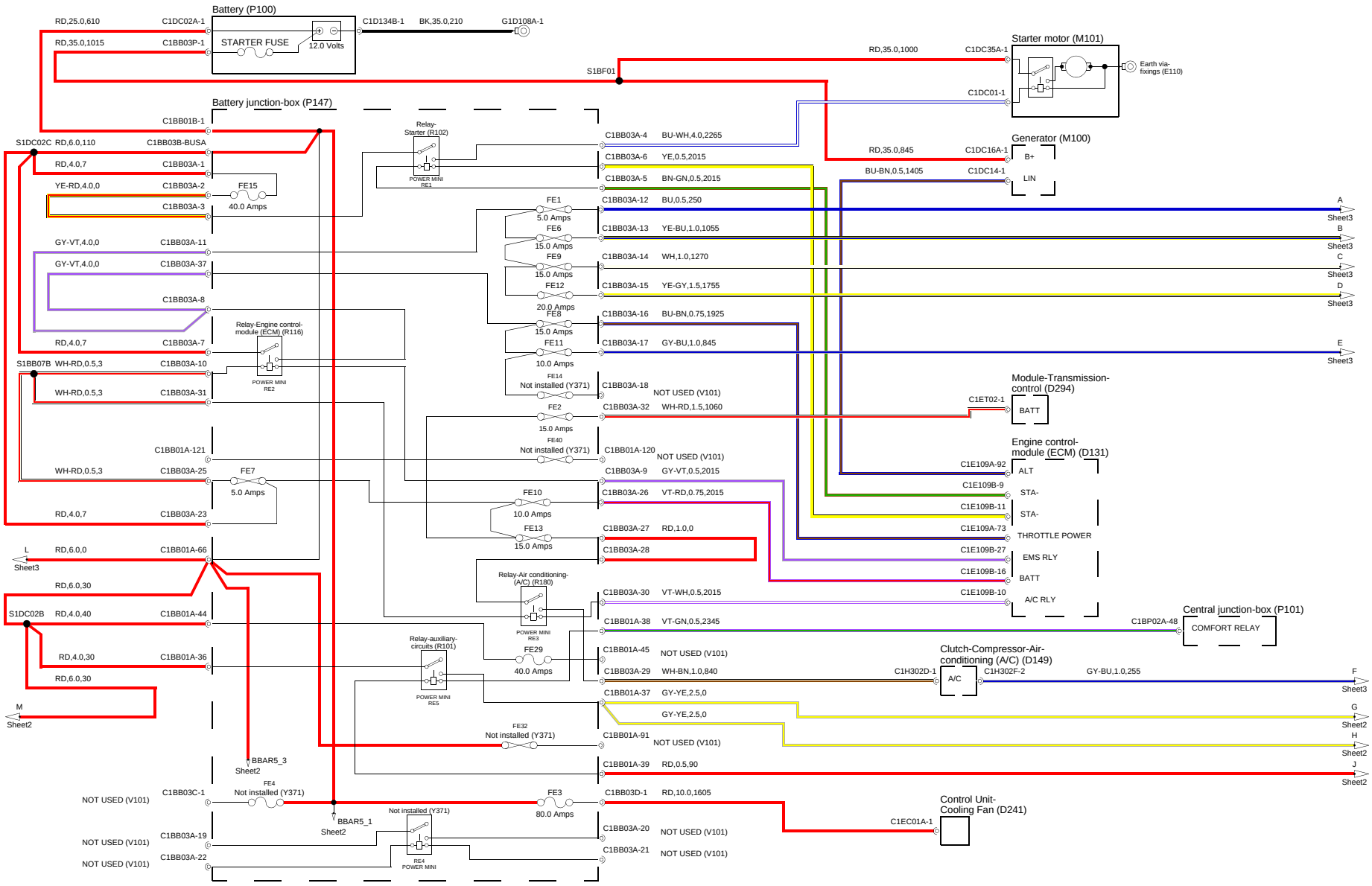

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE31
15.0 Amps
Relay-Horn (R133)
RE10 MINI
C1BB01A-68
VT-GN,1.0
C1BB01A-69
BU-WH,0.5
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0
FE17
60.0 Amps
C1BB07G-1
RD,6.0
S1RH02
VT-GN,0.75
C1RH02A-1
Horn-LH (L102)
C1RH02A-2
BK-VT,0.75
S1D132A
BK-VT,2.5
S1D132C
BK-VT,2.5
S1D132B
BK-VT,6.0
G1D132A-1
VT-GN,0.75
C1RH02B-1
Horn-RH (L103)
C1RH02B-2
BK-VT,0.75
Central junction-box (P101)
C1BP02G-2
FET-HORN
C1BP02A-46
C1BP02G-1
Central Electronics Module (CEM) (D316)
HORN SW I/P
BATT A
LIN 1
FS7
7.5 Amps
C1BP02C-13
BN,0.5
C2LS41-5
C1BP02C-51
WH,0.35
C2LS41-9
C1BP02C-70
WH-RD,0.5
C2LS41-10
Module-Steering wheel (D407)
LIN
BATT
GND
Clock spring (S227)
C1254-6
GN,0.35
C1254-3
BK,0.35
C2LS41-1
BK-VT,0.75
S2D134B
BK-VT,1.0
S2D134A
BK-VT,1.5
G3D134-1
Module-Steering-wheel-LH (D256)
Switch-Horn-LH (S341)
BU,0.35
C2283-7
C2283-5
GY,0.35
Module-Steering-wheel-RH (D257)
Switch-Horn-RH (S340)
C2147-2
C2147-1
C2147-6
C2147-5
BK,0.35
C2636-1
Air bag-Driver (U106)

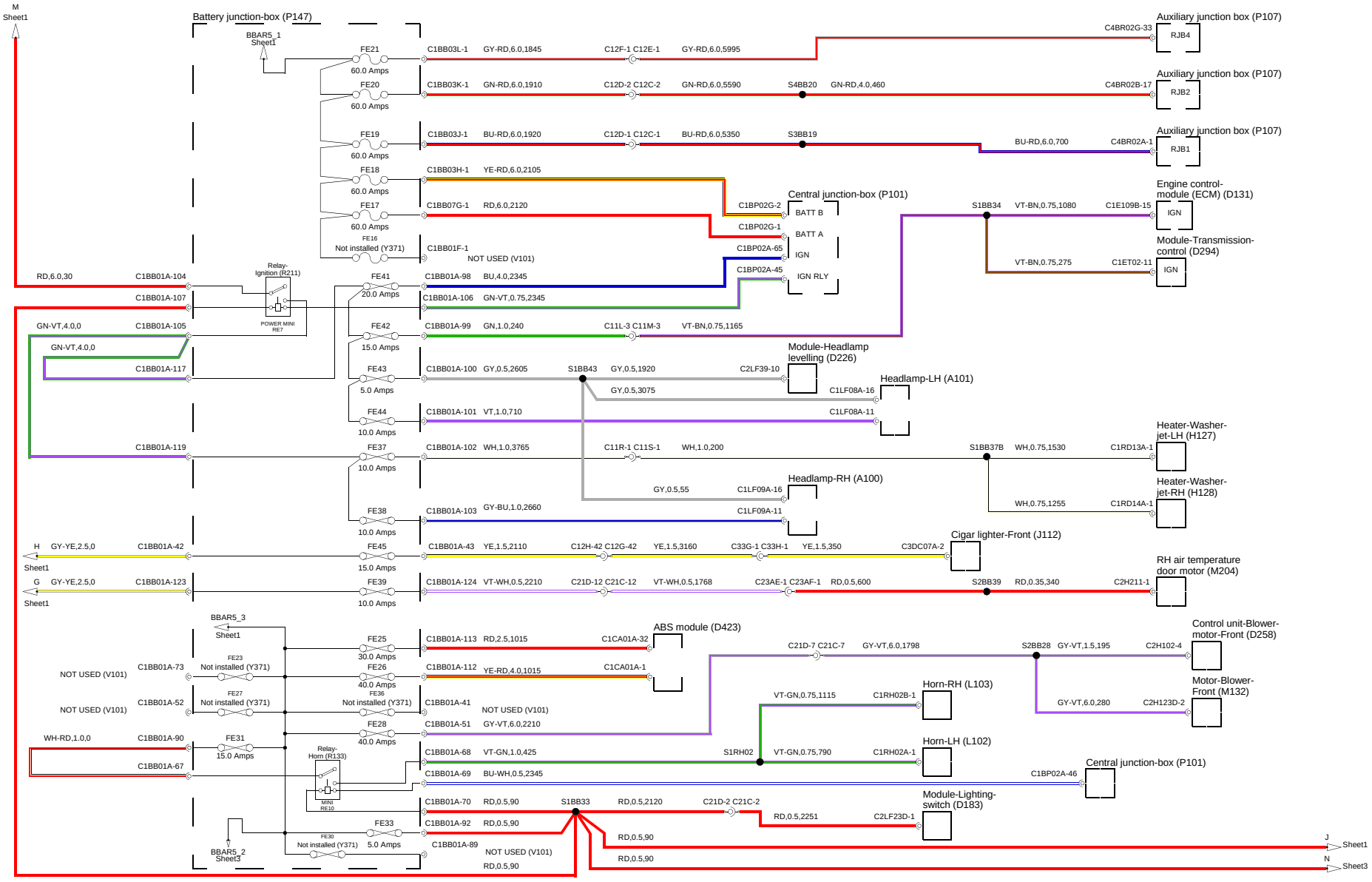

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1 BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE41
C1BB01A-98 BU,4.0
20.0 Amps
FE17
C1BB07G-1 RD,6.0
60.0 Amps
Central junction-box (P101)
C1BP02A-65
FS4
5.0 Amps
C1BP02C-68 VT,1.0
S2BP04
VT,0.5
C2MC01A-2
C1BP02G-1
BATT A
FS8
5.0 Amps
C1BP02C-72 GY-OG,0.5
C2MC01A-1
Relay-Electric steering column lock (R276)
C1BP02C-71 VT-BN,0.5
C2MC01A-8
C2MC01A-26
Central Electronics Module (CEM) (D316)
BATT A
C1BP02C-23 WH-VT,0.5
Instrument cluster (D107)
IGN
BATT
STEERING LOCK
Resistor-Terminating (G171)
MS CAN H
MS CAN L
GND
GND
Anti-theft alarm warning indicator (J139)
C2MC01A-16 VT-OG,0.5
C23E-17 C23F-17
C2MC01A-32 GY-OG,0.5
C23E-18 C23F-18
C2MC01A-17 BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
C2MC01A-18 BK-VT,0.5
PARK BRAKE SW
C1BP02C-11 WH-VT,0.75
C23E-14 C23F-14
WH-VT,0.5
C3CA30-1
Switch-Park (S289)
Earth via-fixings (E110)
MS CAN H
MS CAN L
C1BP02A-49 VT-OG,0.5
C1BP02A-50 GY-OG,0.5
S1DB06F
S1DB07F
C1BP02A-27 GY-VT,0.5
C1MC19-1
C1MC19-2 BK-YE,0.5
Switch-Brake-fluid level (S212)
S1D130D
BK-YE,1.0
G1D130B-1
C1BP02A-25 VT,0.5
C1MC20-1
C1MC20-2 BK-YE,0.5
Sensor-Low washer-fluid level (T168)
Engine control-module (ECM) (D131)
C1E109B-35 YE-GN,0.5
(PETROL)
C1E109B-34 GN-BU,0.5
(DIESEL)
C11P-6 C11N-6 YE-GN,0.5
C12H-36 C12G-36 YE-GN,0.5
C25A-19 C25B-19 YE-GN,0.5
C5PM26B-5
C12H-31 C12G-31 GN-BU,0.5
C25A-20 C25B-20 GN-BU,0.5
C5PM26B-6
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
Engine control-module (ECM) (D131)
C1E104H-D2 YE-GN,0.5
(PETROL)
C1E104H-E1 GN-BU,0.5
(DIESEL)
C11P-7 C11N-7 GN-BU,0.5

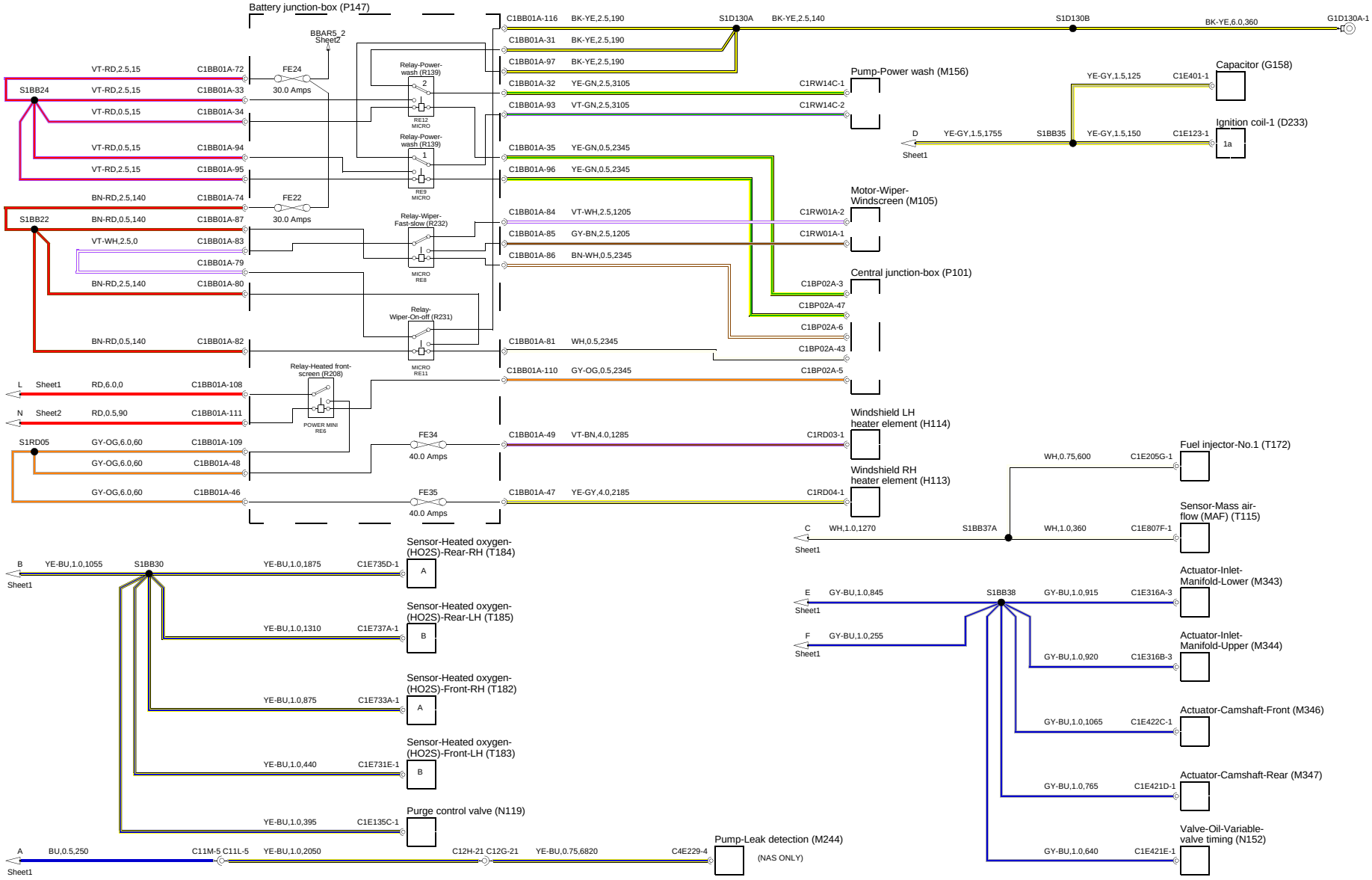

Central junction-box (P101)
Central Electronics Module (CEM) (D316)
FUEL TANK PUMP SENSOR
FUEL TANK EJECT SENSOR
FUEL TANK LEVEL SENSOR GND
FUEL TANK LEVEL SENSOR GND
C1BP02B-30 YE-VT,0.35
C1BP02B-43 GN-OG,0.35
C1BP02B-48 GN-BU,0.75
C1BP02B-46 GN-BU,0.75
Unit-Fuel Tank (D179)
C4E515-2
C4E515-6
C4E515-1
(DIESEL)
C4E515-5
S3E401A BK-YE,0.75 (PETROL)
SCR,NONE
S4D149C BK-GY,2.5
G4D149B-1
Sensor-Engine coolant-level (T220)
COOLANT LEVEL
C1BP02A-11 WH-OG,0.5
C1MC21-1
C1MC21-2
BK-YE,0.5
S1D130D
BK-YE,1.0
G1D130B-1
Motor-CDL-Tailgate-Upper (M255)
TAILGATE AJAR
C1BP02B-10 YE-OG,0.75
C44N-2 C44M-2 BK,0.75
C4PL17A-3
Switch-Tail door-open (S250)
C4PL17A-2 BK,1.0
S4D149D BK-GY,1.5
C44M-5 C44N-5
BK-GY,1.5
S4D149A BK-GY,2.5
S4D149B BK-GY,6.0
G4D149-1

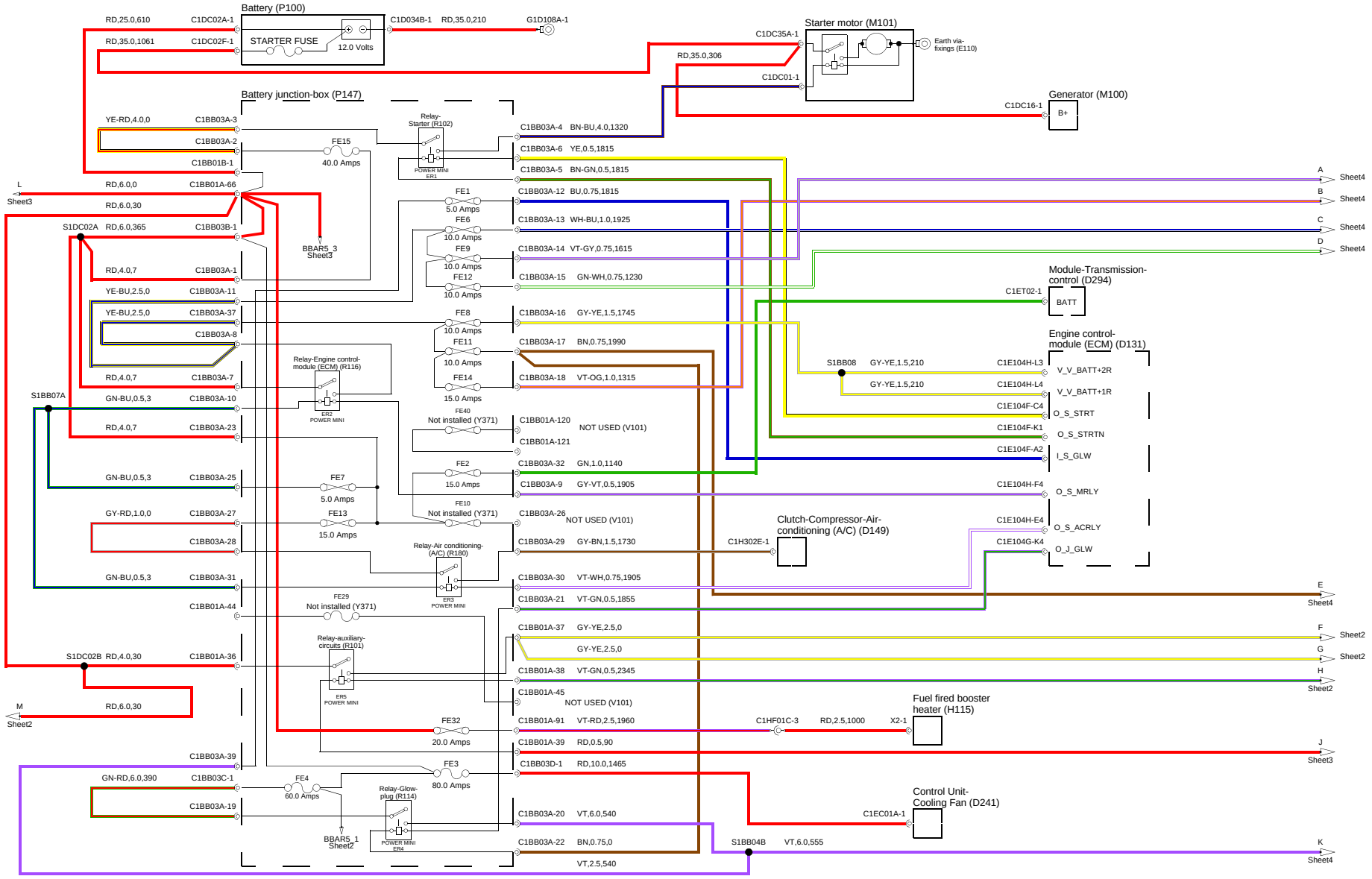

Battery (P100)
RD,25.0
C1DC02A-1
12.0 Volts
C1D134B-1
BK,35.0
G1D108A-1
Battery junction-box (P147)
C1BB01B-1
FE20
60.0 Amps
C1BB03K-1
GN-RD,6.0
C12D-2 C12C-2
GN-RD,6.0
GN-RD,6.0
S4BB20
GN-RD,6.0
Auxiliary junction box (P107)
RJB2
Relay-Ignition (R211)
RB1 MINI
FB1
10.0 Amps
C4BR02B-25
C4BR02B-31
C4BR02B-5
BU,0.75
C4MP01A-1
C4BR02B-29
BN,0.75
C4BR02B-33
GY-BN,6.0
S4R115
C4BR02B-1
GY-BN,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
REAR IGN RLY
C1BP02B-45
Switch pack-Centre facia (S425)
C2PL13-10
GN-BN,0.5
C23E-1 C23F-1
GN-BN,0.5
C4MP01A-4
C2PL13-1
GN-BU,0.5
C23E-2 C23F-2
GN-BU,0.5
C4MP01A-13
Parking aid module (D184)
IGN
MS CAN H
MS CAN L
IGN REAR
SIG RL OUTER
GND REAR
SIG RL INNER
SWITCH PAS
LED-OUT
SIG RR INNER
SIG RR OUTER
GND
C4MP01A-14
VT-OG,0.35
S3DB06D
C4MP01A-7
GY-OG,0.35
S3DB07D
C4MP01C-11
BU-WH,0.35
C44V-1 C44W-1
BU-WH,0.5
S4MP07B
BU-WH,0.5
C4MP15-1
C4MP01C-5
YE-GN,0.35
C44V-2 C44W-2
YE-GN,0.35
C4MP15-2
C4MP01C-8
GN-WH,0.35
C44V-3 C44W-3
GN-WH,0.5
S4MP07A
GN-WH,0.5
C4MP15-3
Parking aid sensor-Outer-Rear-LH (T216)
IGN
SIG
GND
BU-WH,0.5
C4MP14-1
GN-WH,0.5
C4MP14-3
Parking aid sensor-Inner-Rear-LH (T218)
IGN
GND
SIG
C4MP01C-3
WH-OG,0.35
C44V-4 C44W-4
WH-OG,0.35
C4MP14-2
BU-WH,0.5
C4MP16-1
GN-WH,0.5
C4MP16-3
Parking aid sensor-Inner-Rear-RH (T217)
IGN
GND
SIG
C4MP01C-2
YE-GY,0.35
C44V-5 C44W-5
YE-GY,0.35
C4MP16-2
BU-WH,0.5
C4MP17-1
GN-WH,0.5
C4MP17-3
Parking aid sensor-Outer-Rear-RH (T215)
IGN
GND
SIG
C4MP01C-4
YE-OG,0.35
C44V-6 C44W-6
YE-OG,0.35
C4MP17-2
C4MP01A-8
BK-BU,0.75
S4D152C
BK-BU,2.5
G4D151B-1

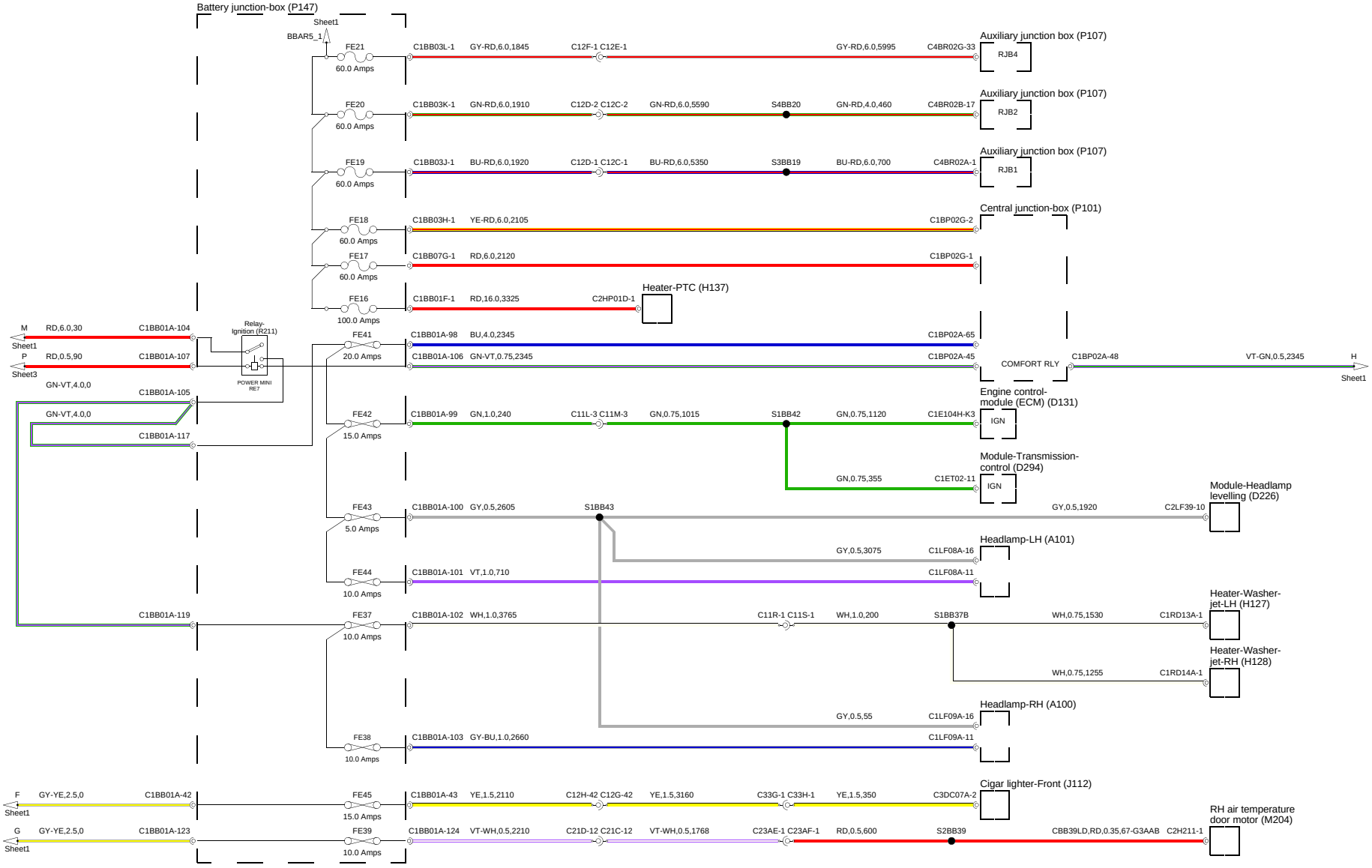

Parking aid sensor-
Outer-Front-RH (T211)
IGN
SIG
GND
C1MP13-1 VT-GY,0.5
C1MP13-2 BU-OG,0.35
C1MP13-3 YE-OG,0.5
S1MP06A
S1MP06B
VT-GY,0.5
YE-OG,0.5
C11K-4 C11J-4
C11K-5 C11J-5
C11K-6 C11J-6
VT-GY,0.5
BU-OG,0.5
YE-OG,0.5
C12H-41 C12G-41
C12H-32 C12G-32
C12H-43 C12G-43
VT-GY,0.35
BU-OG,0.35
YE-OG,0.35
C4MP01B-2
C4MP01B-8
C4MP01B-1
Parking aid
module (D184)
IGN
SIG FR OUTER
GND
Parking aid sensor-
Inner-Front-RH (T213)
GND
IGN
SIG
C1MP12-3 YE-OG,0.5
C1MP12-1 VT-GY,0.5
C1MP12-2 BU-GY,0.35
C11K-7 C11J-7
BU-GY,0.5
C12H-44 C12G-44
BU-GY,0.35
C4MP01B-7
SIG FR INNER
Parking aid sensor-
Inner-Front-LH (T214)
GND
IGN
SIG
C1MP10-3 YE-OG,0.5
C1MP10-1 VT-GY,0.5
C1MP10-2 WH-BU,0.35
C11K-8 C11J-8
WH-BU,0.5
C12H-45 C12G-45
WH-BU,0.35
C4MP01B-6
SIG FL INNER
Parking aid sensor-
Outer-Front-LH (T212)
GND
IGN
SIG
C1MP11-3 YE-OG,0.5
C1MP11-1 VT-GY,0.5
C1MP11-2 BU-GN,0.35
C11K-9 C11J-9
BU-GN,0.5
C12H-46 C12G-46
BU-GN,0.35
C4MP01B-5
SIG FL OUTER

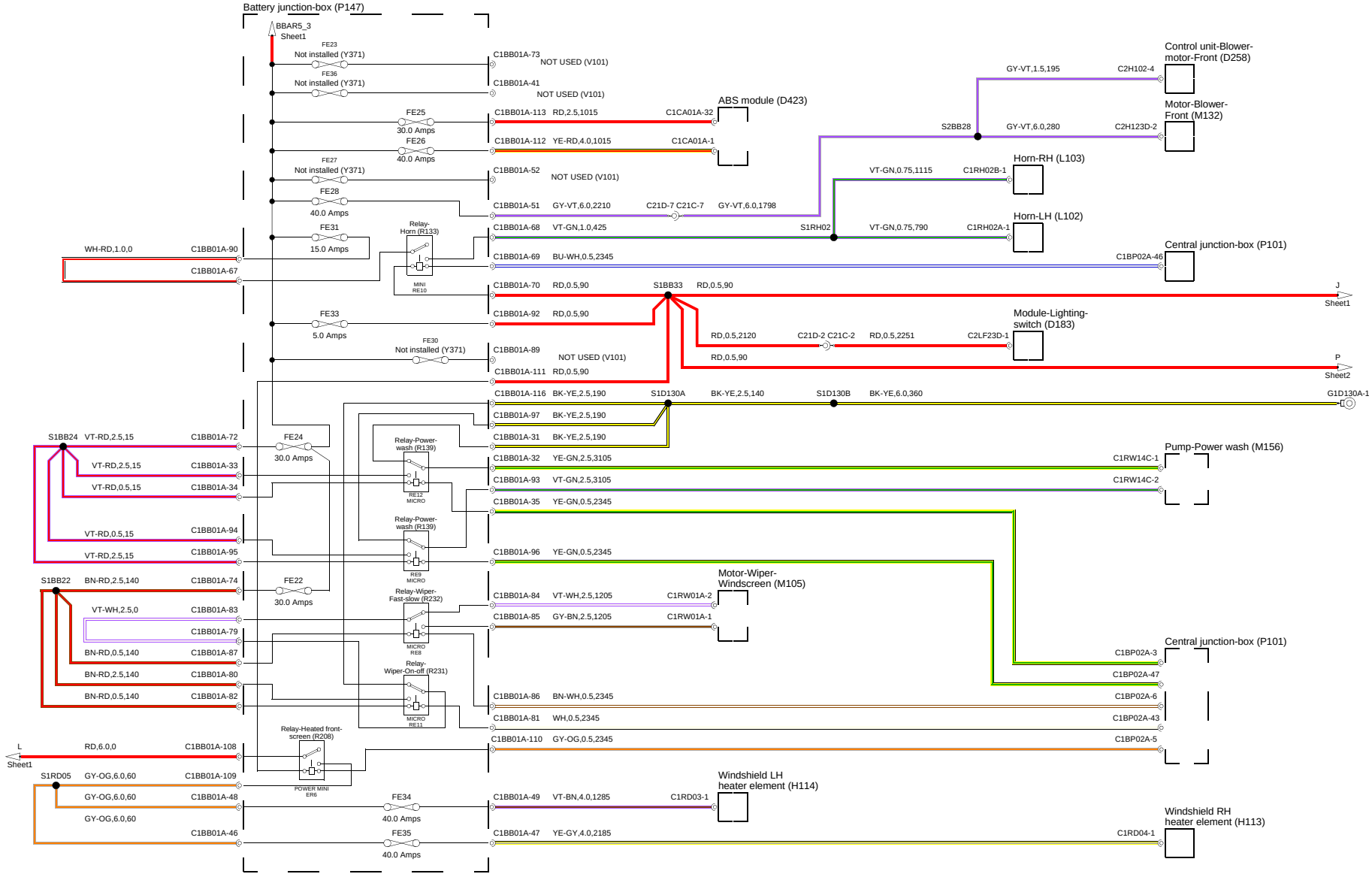

Battery (P100)
STARTER FUSE
12.0 Volts
Battery junction-box (P147)
Starter motor (M101)
Earth via-fixings (E110)
Generator (M100)
B+
LIN
Relay-Starter (R102)
POWER MINI RE1
Relay-Engine control-module (ECM) (R116)
POWER MINI RE2
Relay-Air conditioning-(A/C) (R180)
POWER MINI RE3
Relay-auxiliary-circuits (R101)
POWER MINI RE5
RE4 POWER MINI
Module-Transmission-control (D294)
BATT
Engine control-module (ECM) (D131)
ALT
STA-
THROTTLE POWER
EMS RLY
BATT
A/C RLY
Central junction-box (P101)
COMFORT RELAY
Clutch-Compressor-Air-conditioning (A/C) (D149)
A/C
Control Unit-Cooling Fan (D241)
NOT USED (V101)
Not installed (Y371)
5.0 Amps
15.0 Amps
20.0 Amps
10.0 Amps
40.0 Amps
80.0 Amps
FE1
FE2
FE3
FE4
FE6
FE7
FE8
FE9
FE10
FE11
FE12
FE13
FE14
FE15
FE29
FE32
FE40
BBAR5_1
BBAR5_3
Sheet2
Sheet3

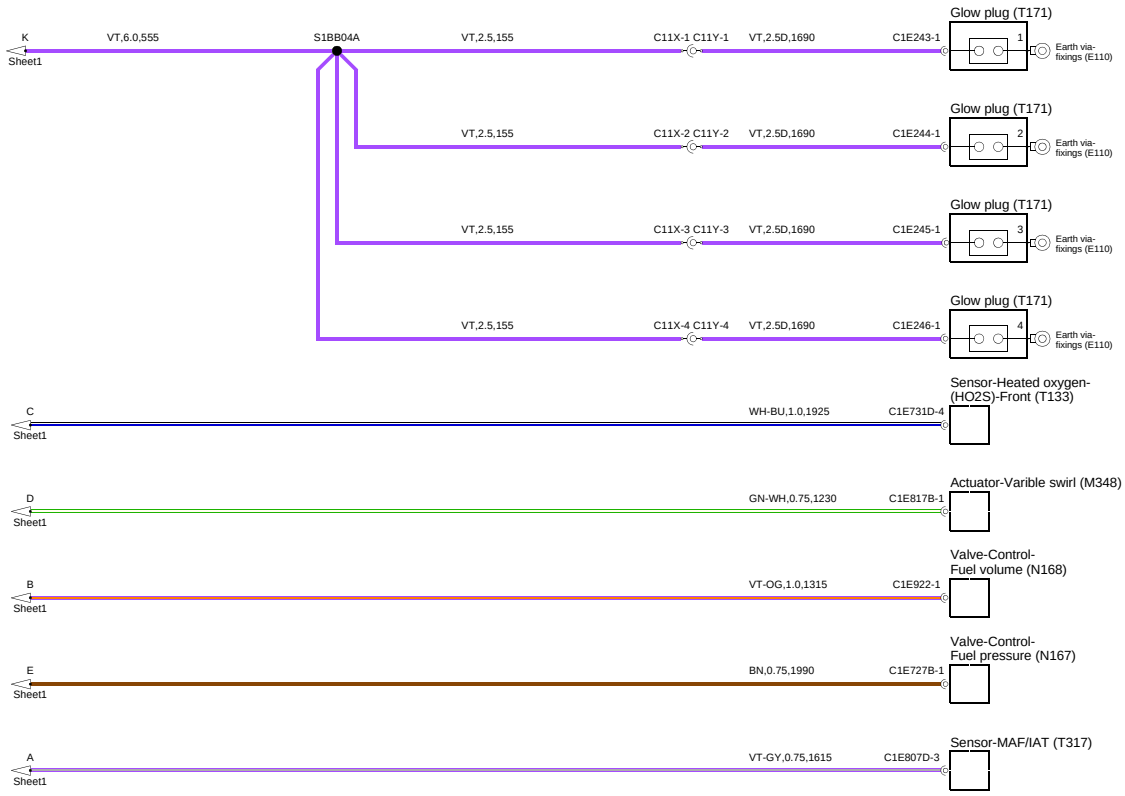

M
Sheet1
Battery junction-box (P147)
BBAR5_1
Sheet1
FE21
60.0 Amps
C1BB03L-1
GY-RD,6.0,1845
C12F-1 C12E-1
GY-RD,6.0,5995
C4BR02G-33
Auxiliary junction box (P107)
RJB4
FE20
60.0 Amps
C1BB03K-1
GN-RD,6.0,1910
C12D-2 C12C-2
GN-RD,6.0,5590
S4BB20
GN-RD,4.0,460
C4BR02B-17
Auxiliary junction box (P107)
RJB2
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0,1920
C12D-1 C12C-1
BU-RD,6.0,5350
S3BB19
BU-RD,6.0,700
C4BR02A-1
Auxiliary junction box (P107)
RJB1
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0,2105
FE17
60.0 Amps
C1BB07G-1
RD,6.0,2120
Central junction-box (P101)
C1BP02G-2
BATT B
C1BP02G-1
BATT A
C1BP02A-65
IGN
C1BP02A-45
IGN RLY
S1BB34
VT-BN,0.75,1080
C1E109B-15
IGN
Engine control-module (ECM) (D131)
VT-BN,0.75,275
C1ET02-11
IGN
Module-Transmission-control (D294)
FE16
Not installed (Y371)
C1BB01F-1
NOT USED (V101)
RD,6.0,30
C1BB01A-104
Relay-Ignition (R211)
POWER MINI RE7
C1BB01A-107
FE41
20.0 Amps
C1BB01A-98
BU,4.0,2345
C1BB01A-106
GN-VT,0.75,2345
GN-VT,4.0,0
C1BB01A-105
FE42
15.0 Amps
C1BB01A-99
GN,1.0,240
C11L-3 C11M-3
VT-BN,0.75,1165
GN-VT,4.0,0
C1BB01A-117
FE43
5.0 Amps
C1BB01A-100
GY,0.5,2605
S1BB43
GY,0.5,1920
C2LF39-10
Module-Headlamp levelling (D226)
GY,0.5,3075
C1LF08A-16
Headlamp-LH (A101)
FE44
10.0 Amps
C1BB01A-101
VT,1.0,710
C1LF08A-11
C1BB01A-119
FE37
10.0 Amps
C1BB01A-102
WH,1.0,3765
C11R-1 C11S-1
WH,1.0,200
S1BB37B
WH,0.75,1530
C1RD13A-1
Heater-Washer-jet-LH (H127)
GY,0.5,55
C1LF09A-16
Headlamp-RH (A100)
WH,0.75,1255
C1RD14A-1
Heater-Washer-jet-RH (H128)
FE38
10.0 Amps
C1BB01A-103
GY-BU,1.0,2660
C1LF09A-11
H
GY-YE,2.5,0
C1BB01A-42
Sheet1
FE45
15.0 Amps
C1BB01A-43
YE,1.5,2110
C12H-42 C12G-42
YE,1.5,3160
C33G-1 C33H-1
YE,1.5,350
C3DC07A-2
Cigar lighter-Front (J112)
G
GY-YE,2.5,0
C1BB01A-123
Sheet1
FE39
10.0 Amps
C1BB01A-124
VT-WH,0.5,2210
C21D-12 C21C-12
VT-WH,0.5,1768
C23AE-1 C23AF-1
RD,0.5,600
S2BB39
RD,0.35,340
C2H211-1
RH air temperature door motor (M204)
BBAR5_3
Sheet1
FE25
30.0 Amps
C1BB01A-113
RD,2.5,1015
C1CA01A-32
ABS module (D423)
C21D-7 C21C-7
GY-VT,6.0,1798
S2BB28
GY-VT,1.5,195
C2H102-4
Control unit-Blower-motor-Front (D258)
FE23
Not installed (Y371)
NOT USED (V101)
C1BB01A-73
FE26
40.0 Amps
C1BB01A-112
YE-RD,4.0,1015
C1CA01A-1
FE27
Not installed (Y371)
NOT USED (V101)
C1BB01A-52
FE36
Not installed (Y371)
C1BB01A-41
NOT USED (V101)
VT-GN,0.75,1115
C1RH02B-1
Horn-RH (L103)
GY-VT,6.0,280
C2H123D-2
Motor-Blower-Front (M132)
FE28
40.0 Amps
C1BB01A-51
GY-VT,6.0,2210
WH-RD,1.0,0
C1BB01A-90
FE31
15.0 Amps
C1BB01A-67
Relay-Horn (R133)
MINI RE10
C1BB01A-68
VT-GN,1.0,425
S1RH02
VT-GN,0.75,790
C1RH02A-1
Horn-LH (L102)
C1BB01A-69
BU-WH,0.5,2345
C1BP02A-46
Central junction-box (P101)
C1BB01A-70
RD,0.5,90
S1BB33
RD,0.5,2120
C21D-2 C21C-2
RD,0.5,2251
C2LF23D-1
Module-Lighting-switch (D183)
FE33
5.0 Amps
C1BB01A-92
RD,0.5,90
FE30
Not installed (Y371)
C1BB01A-89
NOT USED (V101)
RD,0.5,90
BBAR5_2
Sheet3
RD,0.5,90
J
Sheet1
RD,0.5,90
N
Sheet3

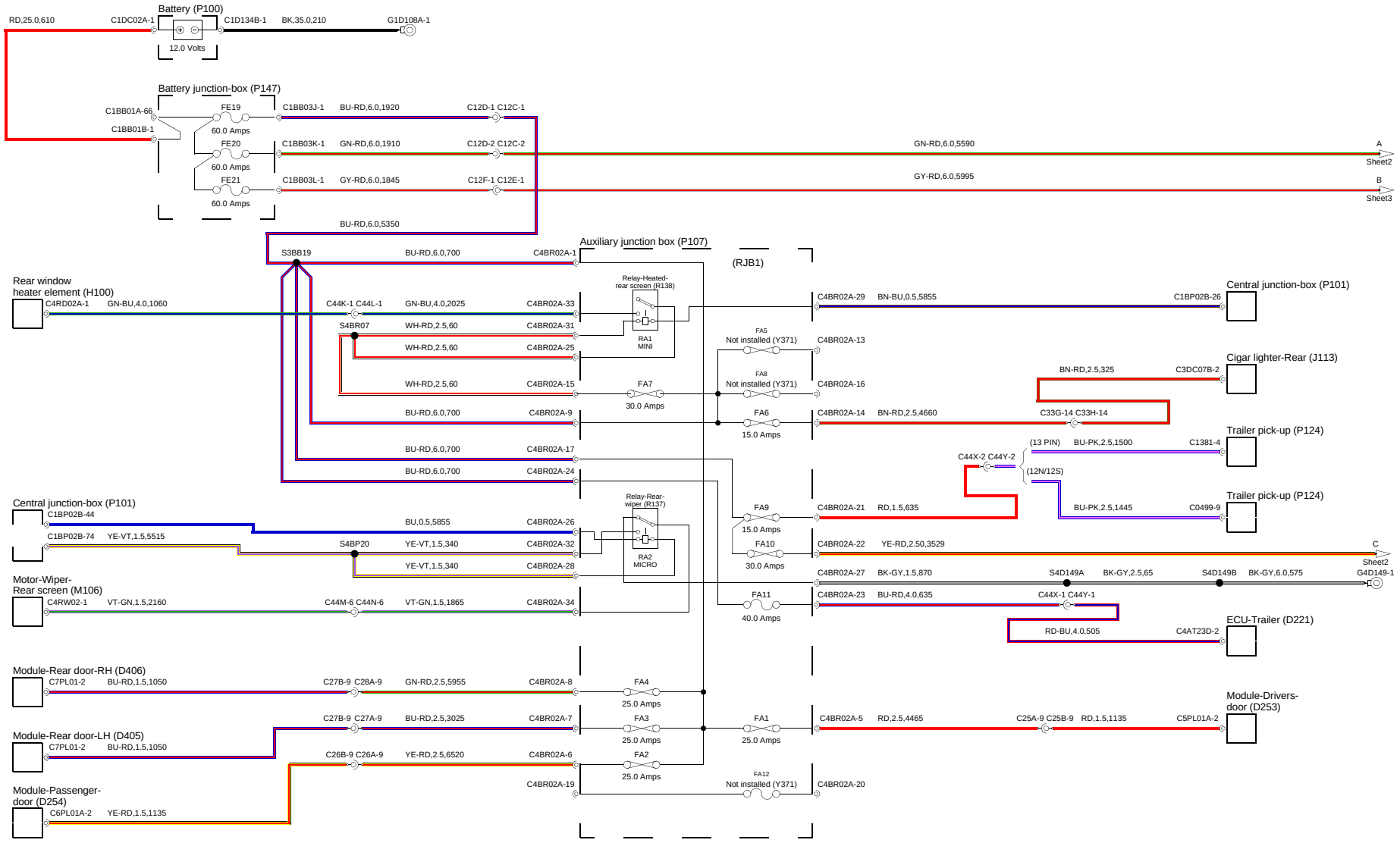

Battery junction-box (P147)
BBAR5_2
Sheet2
S1BB24
VT-RD,2.5,15
C1BB01A-72
FE24
30.0 Amps
VT-RD,2.5,15
C1BB01A-33
VT-RD,0.5,15
C1BB01A-34
VT-RD,0.5,15
C1BB01A-94
VT-RD,2.5,15
C1BB01A-95
S1BB22
BN-RD,2.5,140
C1BB01A-74
FE22
30.0 Amps
BN-RD,0.5,140
C1BB01A-87
VT-WH,2.5,0
C1BB01A-83
C1BB01A-79
BN-RD,2.5,140
C1BB01A-80
BN-RD,0.5,140
C1BB01A-82
L
Sheet1
RD,6.0,0
C1BB01A-108
N
Sheet2
RD,0.5,90
C1BB01A-111
S1RD05
GY-OG,6.0,60
C1BB01A-109
GY-OG,6.0,60
C1BB01A-48
GY-OG,6.0,60
C1BB01A-46
FE34
40.0 Amps
FE35
40.0 Amps
Relay-Power-wash (R139)
RE12 MICRO
Relay-Power-wash (R139)
RE9 MICRO
Relay-Wiper-Fast-slow (R232)
MICRO RE8
Relay-Wiper-On-off (R231)
MICRO RE11
Relay-Heated front-screen (R208)
POWER MINI RE6
C1BB01A-116
BK-YE,2.5,190
S1D130A
BK-YE,2.5,140
S1D130B
BK-YE,6.0,360
G1D130A-1
C1BB01A-31
BK-YE,2.5,190
C1BB01A-97
BK-YE,2.5,190
C1BB01A-32
YE-GN,2.5,3105
C1RW14C-1
Pump-Power wash (M156)
C1BB01A-93
VT-GN,2.5,3105
C1RW14C-2
C1BB01A-35
YE-GN,0.5,2345
C1BB01A-96
YE-GN,0.5,2345
C1BB01A-84
VT-WH,2.5,1205
C1RW01A-2
Motor-Wiper-Windscreen (M105)
C1BB01A-85
GY-BN,2.5,1205
C1RW01A-1
C1BB01A-86
BN-WH,0.5,2345
C1BP02A-3
Central junction-box (P101)
C1BP02A-47
C1BP02A-6
C1BP02A-43
C1BB01A-81
WH,0.5,2345
C1BB01A-110
GY-OG,0.5,2345
C1BP02A-5
C1BB01A-49
VT-BN,4.0,1285
C1RD03-1
Windshield LH heater element (H114)
C1BB01A-47
YE-GY,4.0,2185
C1RD04-1
Windshield RH heater element (H113)
D
Sheet1
YE-GY,1.5,1755
S1BB35
YE-GY,1.5,125
C1E401-1
Capacitor (G158)
YE-GY,1.5,150
C1E123-1
Ignition coil-1 (D233)
1a
C
Sheet1
WH,1.0,1270
S1BB37A
WH,0.75,600
C1E205G-1
Fuel injector-No.1 (T172)
WH,1.0,360
C1E807F-1
Sensor-Mass air-flow (MAF) (T115)
B
Sheet1
YE-BU,1.0,1055
S1BB30
YE-BU,1.0,1875
C1E735D-1
Sensor-Heated oxygen-(HO2S)-Rear-RH (T184)
YE-BU,1.0,1310
C1E737A-1
Sensor-Heated oxygen-(HO2S)-Rear-LH (T185)
YE-BU,1.0,875
C1E733A-1
Sensor-Heated oxygen-(HO2S)-Front-RH (T182)
YE-BU,1.0,440
C1E731E-1
Sensor-Heated oxygen-(HO2S)-Front-LH (T183)
YE-BU,1.0,395
C1E1135C-1
Purge control valve (N119)
A
Sheet1
BU,0.5,250
C11M-5 C11L-5
YE-BU,1.0,2050
C12H-21 C12G-21
YE-BU,0.75,6820
C4E229-4
Pump-Leak detection (M244)
(NAS ONLY)
E
Sheet1
GY-BU,1.0,845
S1BB38
GY-BU,1.0,915
C1E316A-3
Actuator-Inlet-Manifold-Lower (M343)
F
Sheet1
GY-BU,1.0,255
GY-BU,1.0,920
C1E316B-3
Actuator-Inlet-Manifold-Upper (M344)
GY-BU,1.0,1065
C1E422C-1
Actuator-Camshaft-Front (M346)
GY-BU,1.0,765
C1E421D-1
Actuator-Camshaft-Rear (M347)
GY-BU,1.0,640
C1E421E-1
Valve-Oil-Variable-valve timing (N152)

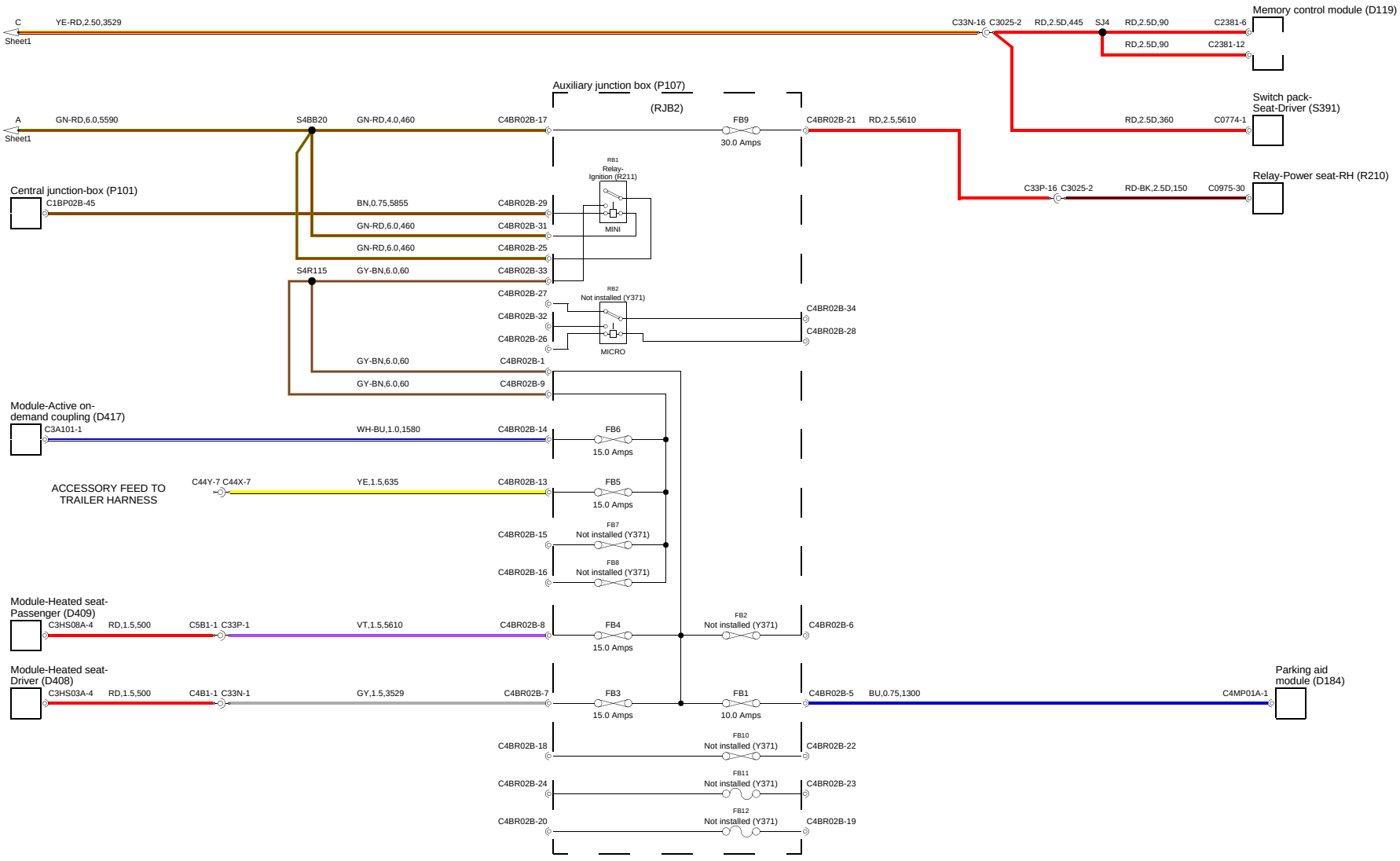

Battery (P100)
STARTER FUSE
12.0 Volts
Starter motor (M101)
Earth via-fixings (E110)
Generator (M100)
B+
Battery junction-box (P147)
Relay-Starter (R102)
Relay-Engine control-module (ECM) (R116)
Relay-Air conditioning-(A/C) (R180)
Relay-auxiliary-circuits (R101)
Relay-Glow-plug (R114)
Module-Transmission-control (D294)
BATT
Engine control-module (ECM) (D131)
V_V_BATT+2R
V_V_BATT+1R
O_S_STRT
O_S_STRTN
I_S_GLW
O_S_MRLY
O_S_ACRLY
O_J_GLW
Clutch-Compressor-Air-conditioning (A/C) (D149)
Fuel fired booster heater (H115)
Control Unit-Cooling Fan (D241)
NOT USED (V101)
Not installed (Y371)
FE1 5.0 Amps
FE2 15.0 Amps
FE3 80.0 Amps
FE4 60.0 Amps
FE6 10.0 Amps
FE7 5.0 Amps
FE8 10.0 Amps
FE9 10.0 Amps
FE11 10.0 Amps
FE12 10.0 Amps
FE13 15.0 Amps
FE14 15.0 Amps
FE15 40.0 Amps
FE29 Not installed (Y371)
FE32 20.0 Amps
FE40 Not installed (Y371)
BBAR5_3 Sheet3
BBAR5_1 Sheet2

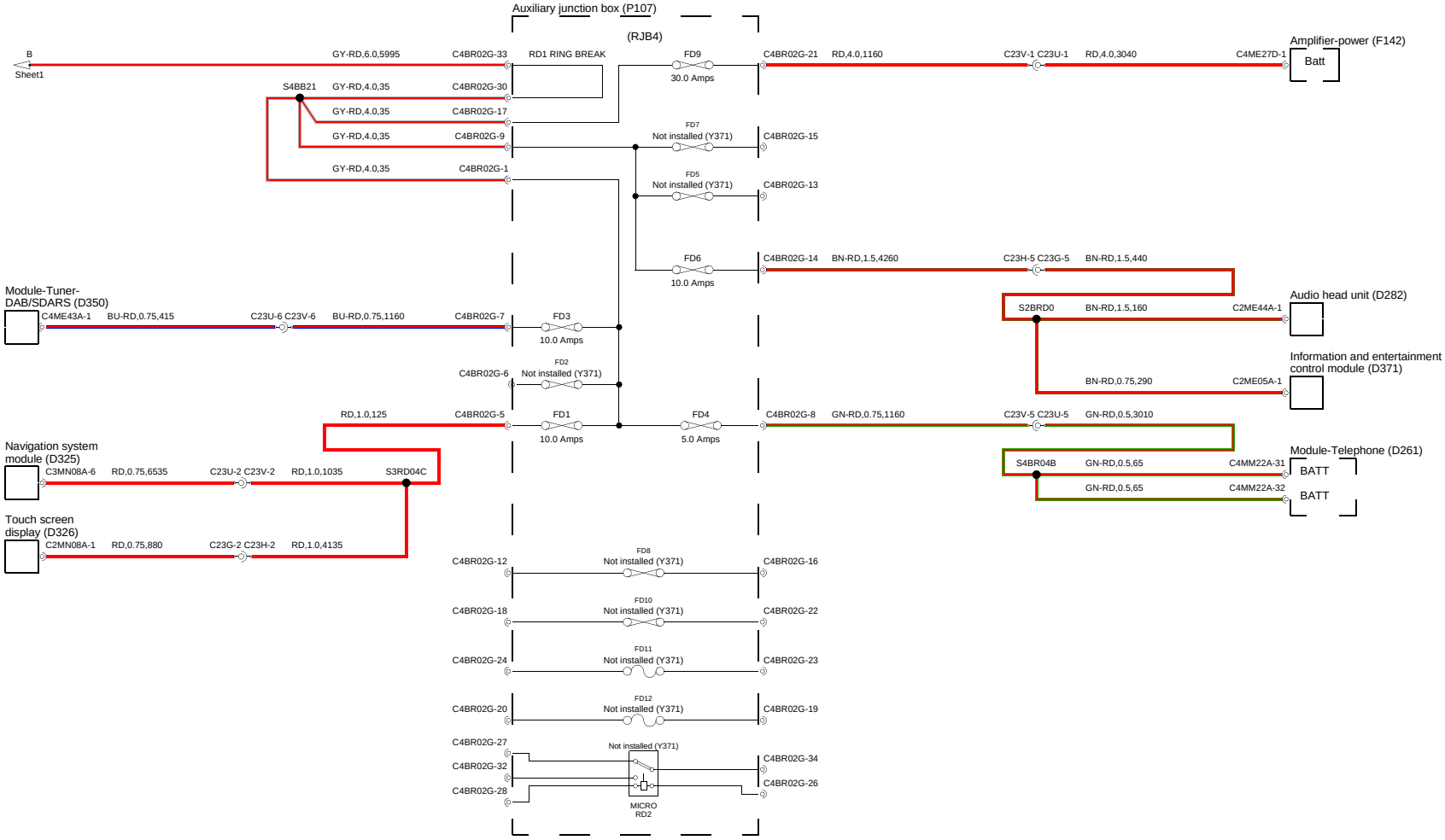

Battery junction-box (P147)
Sheet1
BBAR5_1
FE21
60.0 Amps
C1BB03L-1
GY-RD,6.0,1845
C12F-1 C12E-1
GY-RD,6.0,5995
C4BR02G-33
Auxiliary junction box (P107)
RJB4
FE20
60.0 Amps
C1BB03K-1
GN-RD,6.0,1910
C12D-2 C12C-2
GN-RD,6.0,5590
S4BB20
GN-RD,4.0,460
C4BR02B-17
Auxiliary junction box (P107)
RJB2
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0,1920
C12D-1 C12C-1
BU-RD,6.0,5350
S3BB19
BU-RD,6.0,700
C4BR02A-1
Auxiliary junction box (P107)
RJB1
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0,2105
C1BP02G-2
Central junction-box (P101)
FE17
60.0 Amps
C1BB07G-1
RD,6.0,2120
C1BP02G-1
FE16
100.0 Amps
C1BB01F-1
RD,16.0,3325
C2HP01D-1
Heater-PTC (H137)
M
RD,6.0,30
C1BB01A-104
Sheet1
P
RD,0.5,90
C1BB01A-107
Sheet3
GN-VT,4.0,0
Relay-Ignition (R211)
POWER MINI RE7
C1BB01A-105
GN-VT,4.0,0
C1BB01A-117
FE41
20.0 Amps
C1BB01A-98
BU,4.0,2345
C1BP02A-65
C1BB01A-106
GN-VT,0.75,2345
C1BP02A-45
COMFORT RLY
C1BP02A-48
VT-GN,0.5,2345
H
Sheet1
FE42
15.0 Amps
C1BB01A-99
GN,1.0,240
C11L-3 C11M-3
GN,0.75,1015
S1BB42
GN,0.75,1120
C1E104H-K3
Engine control-module (ECM) (D131)
IGN
GN,0.75,355
C1ET02-11
Module-Transmission-control (D294)
IGN
FE43
5.0 Amps
C1BB01A-100
GY,0.5,2605
S1BB43
GY,0.5,1920
C2LF39-10
Module-Headlamp levelling (D226)
GY,0.5,3075
C1LF08A-16
Headlamp-LH (A101)
FE44
10.0 Amps
C1BB01A-101
VT,1.0,710
C1LF08A-11
C1BB01A-119
FE37
10.0 Amps
C1BB01A-102
WH,1.0,3765
C11R-1 C11S-1
WH,1.0,200
S1BB37B
WH,0.75,1530
C1RD13A-1
Heater-Washer-jet-LH (H127)
WH,0.75,1255
C1RD14A-1
Heater-Washer-jet-RH (H128)
GY,0.5,55
C1LF09A-16
Headlamp-RH (A100)
FE38
10.0 Amps
C1BB01A-103
GY-BU,1.0,2660
C1LF09A-11
F
GY-YE,2.5,0
C1BB01A-42
Sheet1
FE45
15.0 Amps
C1BB01A-43
YE,1.5,2110
C12H-42 C12G-42
YE,1.5,3160
C33G-1 C33H-1
YE,1.5,350
C3DC07A-2
Cigar lighter-Front (J112)
G
GY-YE,2.5,0
C1BB01A-123
Sheet1
FE39
10.0 Amps
C1BB01A-124
VT-WH,0.5,2210
C21D-12 C21C-12
VT-WH,0.5,1768
C23AE-1 C23AF-1
RD,0.5,600
S2BB39
CBB39LD,RD,0.35,67-G3AAB
C2H211-1
RH air temperature door motor (M204)

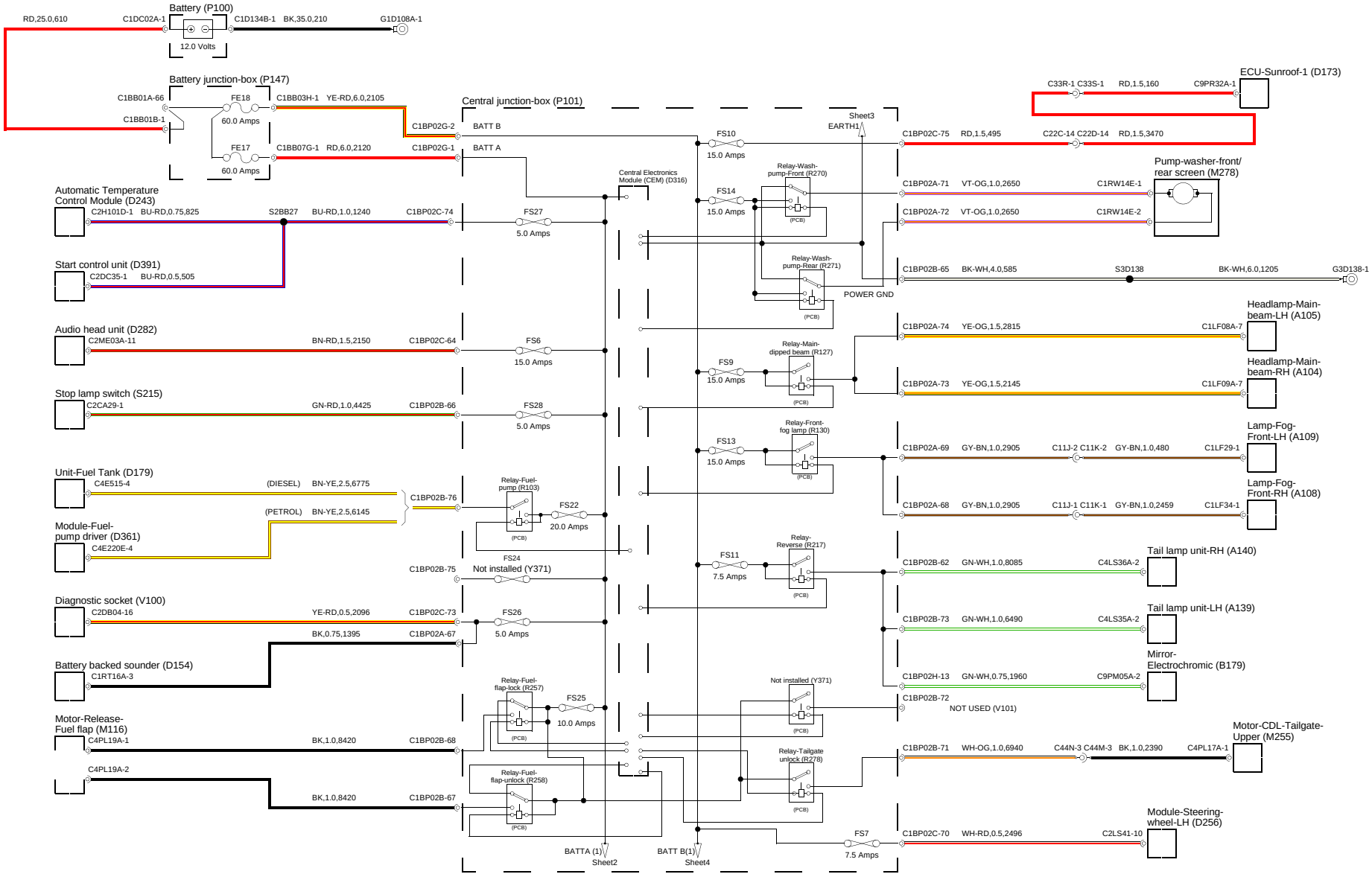

Battery junction-box (P147)
BBAR5_3
Sheet1
FE23
Not installed (Y371)
FE36
Not installed (Y371)
FE25
30.0 Amps
FE26
40.0 Amps
FE27
Not installed (Y371)
FE28
40.0 Amps
FE31
15.0 Amps
FE33
5.0 Amps
FE30
Not installed (Y371)
FE24
30.0 Amps
FE22
30.0 Amps
FE34
40.0 Amps
FE35
40.0 Amps
Relay-Horn (R133)
MINI RE10
Relay-Power-wash (R139)
RE12 MICRO
Relay-Power-wash (R139)
RE9 MICRO
Relay-Wiper-Fast-slow (R232)
MICRO RE8
Relay-Wiper-On-off (R231)
MICRO RE11
Relay-Heated front-screen (R208)
POWER MINI ER6
C1BB01A-73 NOT USED (V101)
C1BB01A-41 NOT USED (V101)
C1BB01A-113 RD,2.5,1015 C1CA01A-32
C1BB01A-112 YE-RD,4.0,1015 C1CA01A-1
C1BB01A-52 NOT USED (V101)
C1BB01A-51 GY-VT,6.0,2210 C21D-7 C21C-7 GY-VT,6.0,1798
C1BB01A-68 VT-GN,1.0,425 S1RH02 VT-GN,0.75,790 C1RH02A-1
C1BB01A-69 BU-WH,0.5,2345 C1BP02A-46
C1BB01A-70 RD,0.5,90 S1BB33 RD,0.5,90
C1BB01A-92 RD,0.5,90
C1BB01A-89 NOT USED (V101)
C1BB01A-111 RD,0.5,90
C1BB01A-116 BK-YE,2.5,190 S1D130A BK-YE,2.5,140 S1D130B BK-YE,6.0,360 G1D130A-1
C1BB01A-97 BK-YE,2.5,190
C1BB01A-31 BK-YE,2.5,190
C1BB01A-32 YE-GN,2.5,3105 C1RW14C-1
C1BB01A-93 VT-GN,2.5,3105 C1RW14C-2
C1BB01A-35 YE-GN,0.5,2345
C1BB01A-96 YE-GN,0.5,2345
C1BB01A-84 VT-WH,2.5,1205 C1RW01A-2
C1BB01A-85 GY-BN,2.5,1205 C1RW01A-1
C1BB01A-86 BN-WH,0.5,2345 C1BP02A-6
C1BB01A-81 WH,0.5,2345 C1BP02A-43
C1BB01A-110 GY-OG,0.5,2345 C1BP02A-5
C1BB01A-49 VT-BN,4.0,1285 C1RD03-1
C1BB01A-47 YE-GY,4.0,2185 C1RD04-1
C1BB01A-90
C1BB01A-67
C1BB01A-72
C1BB01A-33
C1BB01A-34
C1BB01A-94
C1BB01A-95
C1BB01A-74
C1BB01A-83
C1BB01A-79
C1BB01A-87
C1BB01A-80
C1BB01A-82
C1BB01A-108
C1BB01A-109
C1BB01A-48
C1BB01A-46
C1BP02A-3
C1BP02A-47
C1BP02A-6
C1BP02A-43
C1BP02A-5
S1BB24 VT-RD,2.5,15
VT-RD,2.5,15
VT-RD,0.5,15
VT-RD,0.5,15
VT-RD,2.5,15
S1BB22 BN-RD,2.5,140
VT-WH,2.5,0
BN-RD,0.5,140
BN-RD,2.5,140
BN-RD,0.5,140
L Sheet1 RD,6.0,0
S1RD05 GY-OG,6.0,60
GY-OG,6.0,60
GY-OG,6.0,60
S1BB33 RD,0.5,2120 C21D-2 C21C-2 RD,0.5,2251 C2LF23D-1
RD,0.5,90
J Sheet1
P Sheet2
ABS module (D423)
Control unit-Blower-motor-Front (D258)
GY-VT,1.5,195 C2H102-4
S2BB28 GY-VT,6.0,280 C2H123D-2
Motor-Blower-Front (M132)
Horn-RH (L103)
VT-GN,0.75,1115 C1RH02B-1
Horn-LH (L102)
Central junction-box (P101)
Module-Lighting-switch (D183)
Pump-Power wash (M156)
Motor-Wiper-Windscreen (M105)
Central junction-box (P101)
Windshield LH heater element (H114)
Windshield RH heater element (H113)

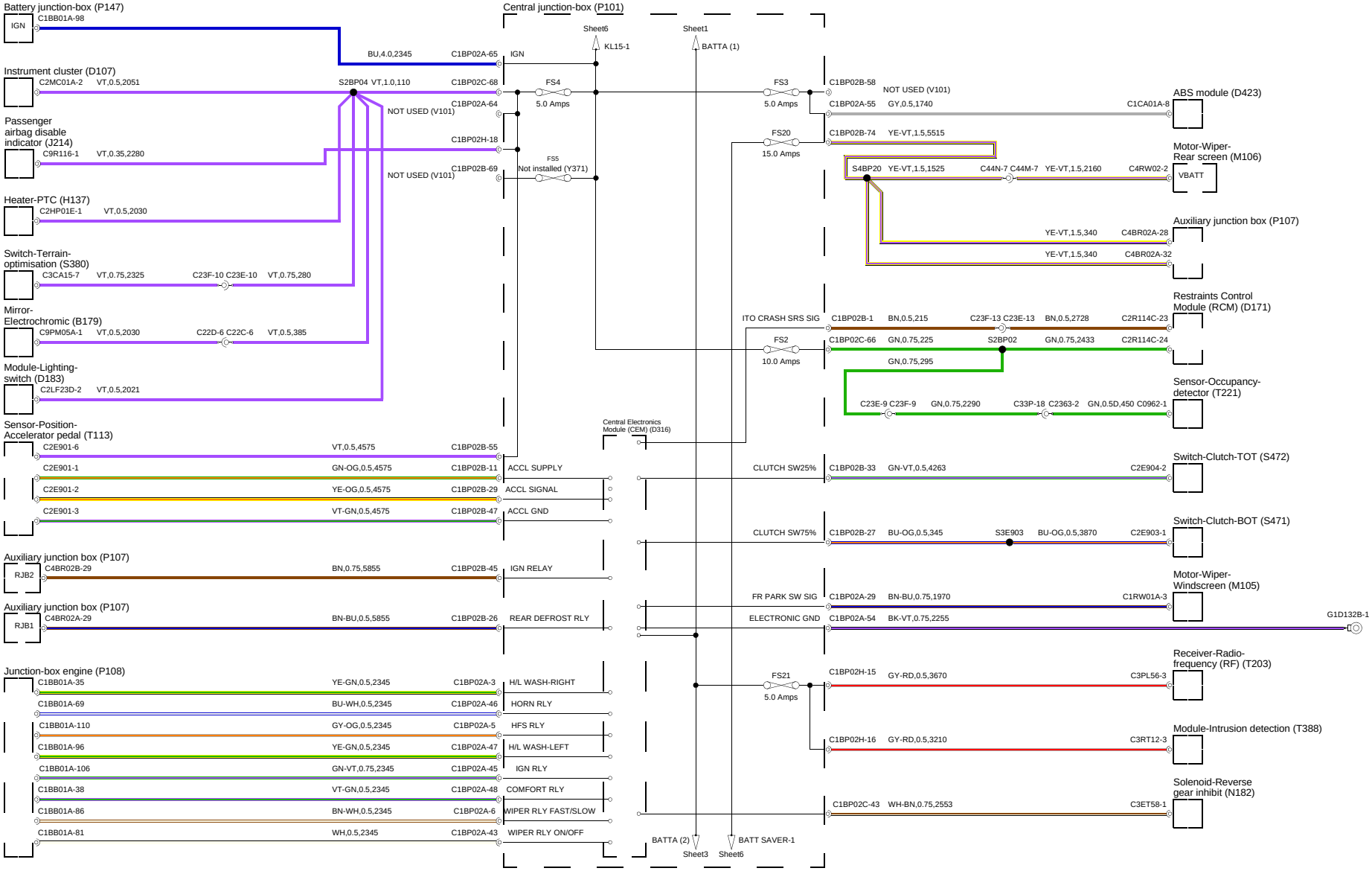

K
Sheet1
VT,6.0,555
S1BB04A
VT,2.5,155
C11X-1 C11Y-1
VT,2.5D,1690
C1E243-1
Glow plug (T171)
1
Earth via-fixings (E110)
VT,2.5,155
C11X-2 C11Y-2
VT,2.5D,1690
C1E244-1
Glow plug (T171)
2
Earth via-fixings (E110)
VT,2.5,155
C11X-3 C11Y-3
VT,2.5D,1690
C1E245-1
Glow plug (T171)
3
Earth via-fixings (E110)
VT,2.5,155
C11X-4 C11Y-4
VT,2.5D,1690
C1E246-1
Glow plug (T171)
4
Earth via-fixings (E110)
C
Sheet1
WH-BU,1.0,1925
C1E731D-4
Sensor-Heated oxygen-(HO2S)-Front (T133)
D
Sheet1
GN-WH,0.75,1230
C1E817B-1
Actuator-Varible swirl (M348)
B
Sheet1
VT-OG,1.0,1315
C1E922-1
Valve-Control-Fuel volume (N168)
E
Sheet1
BN,0.75,1990
C1E727B-1
Valve-Control-Fuel pressure (N167)
A
Sheet1
VT-GY,0.75,1615
C1E807D-3
Sensor-MAF/IAT (T317)

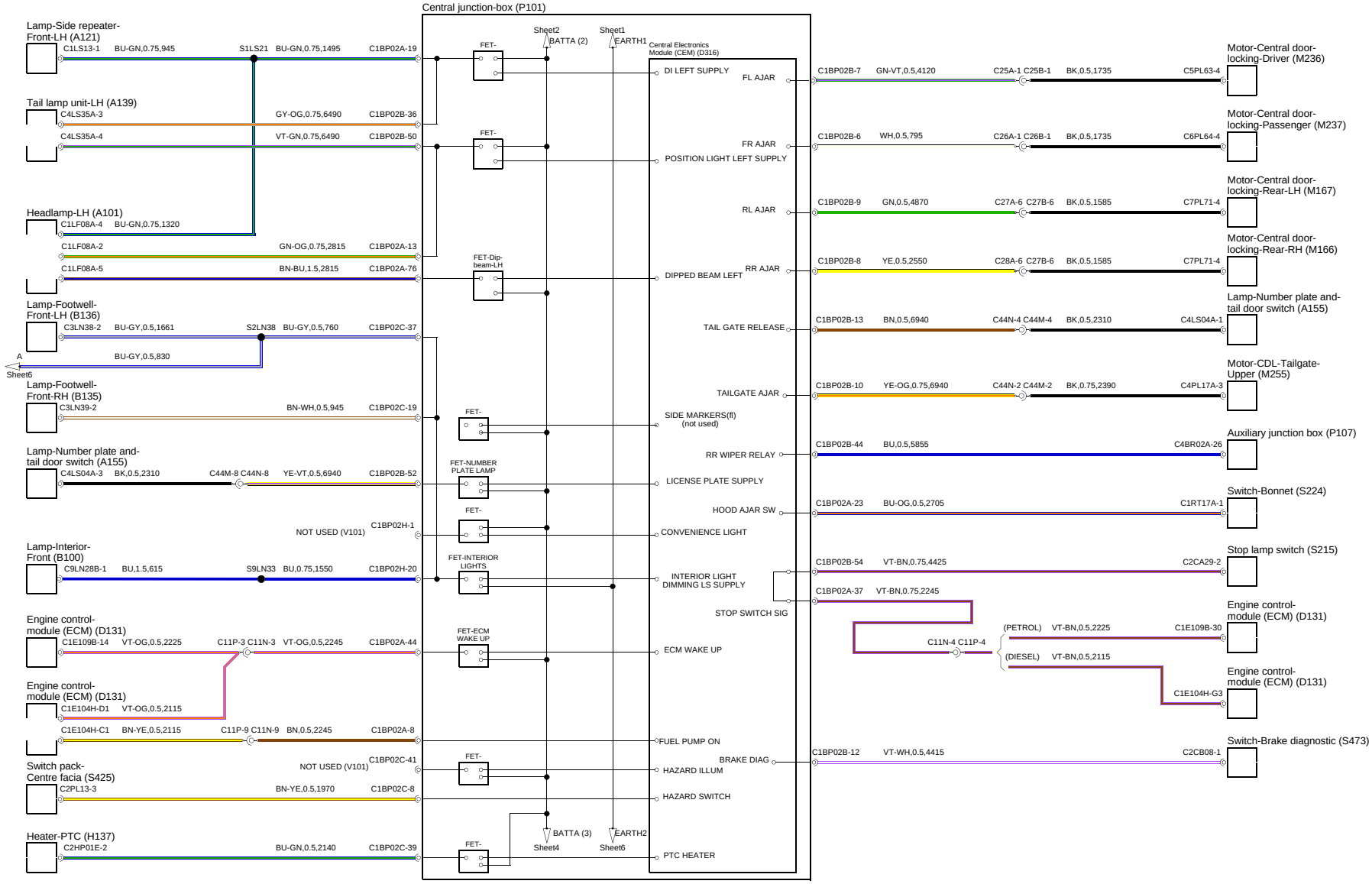

Battery (P100)
RD,25.0,610
C1DC02A-1
C1D134B-1
BK,35.0,210
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01A-66
C1BB01B-1
FE19
60.0 Amps
FE20
60.0 Amps
FE21
60.0 Amps
C1BB03J-1
BU-RD,6.0,1920
C12D-1 C12C-1
C1BB03K-1
GN-RD,6.0,1910
C12D-2 C12C-2
C1BB03L-1
GY-RD,6.0,1845
C12F-1 C12E-1
GN-RD,6.0,5590
A
Sheet2
GY-RD,6.0,5995
B
Sheet3
BU-RD,6.0,5350
Auxiliary junction box (P107)
(RJB1)
S3BB19
BU-RD,6.0,700
C4BR02A-1
Rear window heater element (H100)
C4RD02A-1
GN-BU,4.0,1060
C44K-1 C44L-1
GN-BU,4.0,2025
C4BR02A-33
Relay-Heated-rear screen (R138)
RA1 MINI
S4BR07
WH-RD,2.5,60
C4BR02A-31
C4BR02A-25
C4BR02A-15
FA7
30.0 Amps
BU-RD,6.0,700
C4BR02A-9
BU-RD,6.0,700
C4BR02A-17
BU-RD,6.0,700
C4BR02A-24
Central junction-box (P101)
C1BP02B-44
C1BP02B-74
YE-VT,1.5,5515
BU,0.5,5855
C4BR02A-26
S4BP20
YE-VT,1.5,340
C4BR02A-32
C4BR02A-28
Relay-Rear-wiper (R137)
RA2 MICRO
Motor-Wiper-Rear screen (M106)
C4RW02-1
VT-GN,1.5,2160
C44M-6 C44N-6
VT-GN,1.5,1865
C4BR02A-34
Module-Rear door-RH (D406)
C7PL01-2
BU-RD,1.5,1050
C27B-9 C28A-9
GN-RD,2.5,5955
C4BR02A-8
FA4
25.0 Amps
Module-Rear door-LH (D405)
C27B-9 C27A-9
BU-RD,2.5,3025
C4BR02A-7
FA3
25.0 Amps
C26B-9 C26A-9
YE-RD,2.5,6520
C4BR02A-6
FA2
25.0 Amps
Module-Passenger-door (D254)
C6PL01A-2
YE-RD,1.5,1135
C4BR02A-19
FA5
Not installed (Y371)
C4BR02A-13
FA8
Not installed (Y371)
C4BR02A-16
FA6
15.0 Amps
C4BR02A-14
BN-RD,2.5,4660
C33G-14 C33H-14
FA9
15.0 Amps
C4BR02A-21
RD,1.5,635
FA10
30.0 Amps
C4BR02A-22
YE-RD,2.50,3529
C
Sheet2
C4BR02A-27
BK-GY,1.5,870
S4D149A
BK-GY,2.5,65
S4D149B
BK-GY,6.0,575
G4D149-1
FA11
40.0 Amps
C4BR02A-23
BU-RD,4.0,635
C44X-1 C44Y-1
FA1
25.0 Amps
C4BR02A-5
RD,2.5,4465
C25A-9 C25B-9
RD,1.5,1135
C5PL01A-2
FA12
Not installed (Y371)
C4BR02A-20
Central junction-box (P101)
C1BP02B-26
BN-BU,0.5,5855
Cigar lighter-Rear (J113)
C3DC07B-2
BN-RD,2.5,325
Trailer pick-up (P124)
C1381-4
(13 PIN)
BU-PK,2.5,1500
C44X-2 C44Y-2
(12N/12S)
Trailer pick-up (P124)
C0499-9
BU-PK,2.5,1445
ECU-Trailer (D221)
C4AT23D-2
RD-BU,4.0,505
Module-Drivers-door (D253)

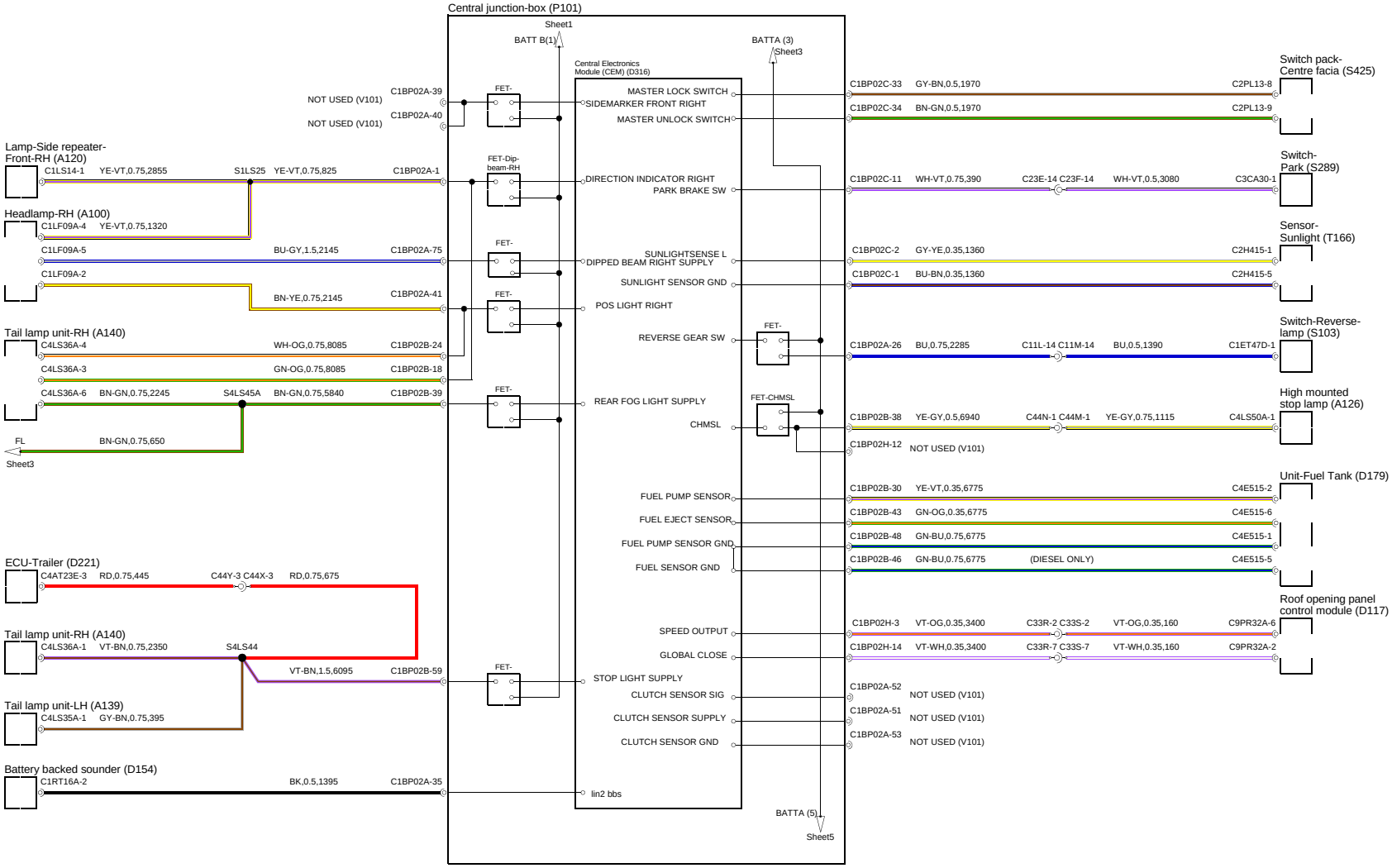

Memory control module (D119)
C YE-RD,2.50,3529 Sheet1
C33N-16 C3025-2 RD,2.5D,445 SJ4 RD,2.5D,90 C2381-6
RD,2.5D,90 C2381-12
Auxiliary junction box (P107)
(RJB2)
A GN-RD,6.0,5590 Sheet1
S4BB20 GN-RD,4.0,460 C4BR02B-17
FB9 30.0 Amps
C4BR02B-21 RD,2.5,5610
Switch pack-Seat-Driver (S391)
RD,2.5D,360 C0774-1
RB1 Relay-Ignition (R211) MINI
Central junction-box (P101)
C1BP02B-45 BN,0.75,5855 C4BR02B-29
GN-RD,6.0,460 C4BR02B-31
GN-RD,6.0,460 C4BR02B-25
C33P-16 C3025-2 RD-BK,2.5D,150 C0975-30
Relay-Power seat-RH (R210)
S4R115 GY-BN,6.0,60 C4BR02B-33
C4BR02B-27
RB2 Not installed (Y371) MICRO
C4BR02B-32
C4BR02B-26
C4BR02B-34
C4BR02B-28
GY-BN,6.0,60 C4BR02B-1
GY-BN,6.0,60 C4BR02B-9
Module-Active on-demand coupling (D417)
C3A101-1 WH-BU,1.0,1580 C4BR02B-14
FB6 15.0 Amps
ACCESSORY FEED TO TRAILER HARNESS
C44Y-7 C44X-7 YE,1.5,635 C4BR02B-13
FB5 15.0 Amps
C4BR02B-15
FB7 Not installed (Y371)
C4BR02B-16
FB8 Not installed (Y371)
Module-Heated seat-Passenger (D409)
C3HS08A-4 RD,1.5,500 C5B1-1 C33P-1 VT,1.5,5610 C4BR02B-8
FB4 15.0 Amps
FB2 Not installed (Y371)
C4BR02B-6
Module-Heated seat-Driver (D408)
C3HS03A-4 RD,1.5,500 C4B1-1 C33N-1 GY,1.5,3529 C4BR02B-7
FB3 15.0 Amps
FB1 10.0 Amps
C4BR02B-5 BU,0.75,1300
C4MP01A-1
Parking aid module (D184)
C4BR02B-18
FB10 Not installed (Y371)
C4BR02B-22
C4BR02B-24
FB11 Not installed (Y371)
C4BR02B-23
C4BR02B-20
FB12 Not installed (Y371)
C4BR02B-19

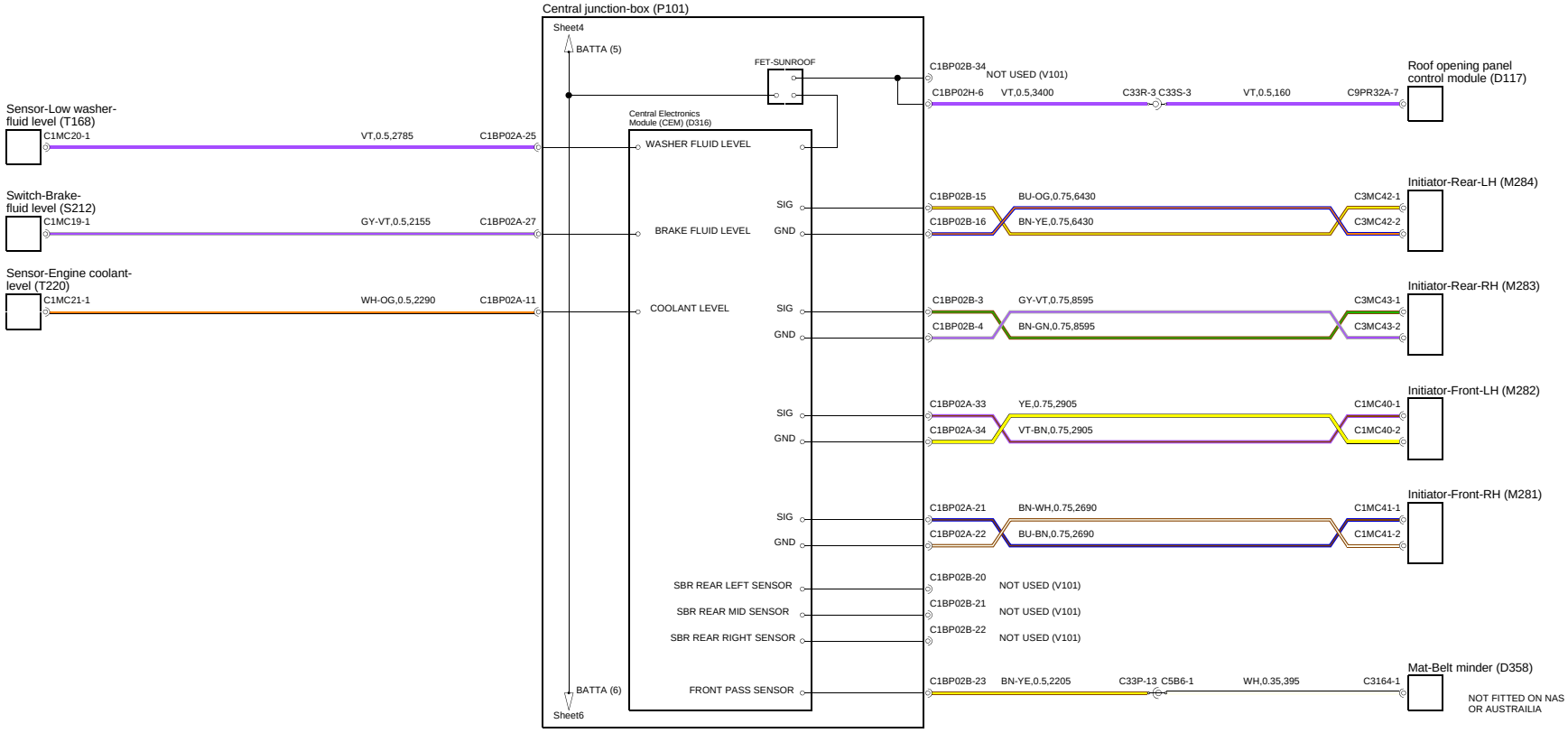

Auxiliary junction box (P107)
(RJB4)
B
Sheet1
GY-RD,6.0,5995
C4BR02G-33
RD1 RING BREAK
FD9
30.0 Amps
C4BR02G-21
RD,4.0,1160
C23V-1 C23U-1
RD,4.0,3040
C4ME27D-1
Amplifier-power (F142)
Batt
S4BB21
GY-RD,4.0,35
C4BR02G-30
GY-RD,4.0,35
C4BR02G-17
FD7
Not installed (Y371)
GY-RD,4.0,35
C4BR02G-9
C4BR02G-15
GY-RD,4.0,35
C4BR02G-1
FD5
Not installed (Y371)
C4BR02G-13
FD6
10.0 Amps
C4BR02G-14
BN-RD,1.5,4260
C23H-5 C23G-5
BN-RD,1.5,440
Module-Tuner-
DAB/SDARS (D350)
C4ME43A-1
BU-RD,0.75,415
C23U-6 C23V-6
BU-RD,0.75,1160
C4BR02G-7
FD3
10.0 Amps
S2BRD0
BN-RD,1.5,160
C2ME44A-1
Audio head unit (D282)
FD2
C4BR02G-6
Not installed (Y371)
BN-RD,0.75,290
C2ME05A-1
Information and entertainment
control module (D371)
RD,1.0,125
C4BR02G-5
FD1
10.0 Amps
FD4
5.0 Amps
C4BR02G-8
GN-RD,0.75,1160
C23V-5 C23U-5
GN-RD,0.5,3010
Navigation system
module (D325)
C3MN08A-6
RD,0.75,6535
C23U-2 C23V-2
RD,1.0,1035
S3RD04C
S4BR04B
GN-RD,0.5,65
C4MM22A-31
BATT
GN-RD,0.5,65
C4MM22A-32
BATT
Module-Telephone (D261)
Touch screen
display (D326)
C2MN08A-1
RD,0.75,880
C23G-2 C23H-2
RD,1.0,4135
FD8
Not installed (Y371)
C4BR02G-12
C4BR02G-16
FD10
Not installed (Y371)
C4BR02G-18
C4BR02G-22
FD11
Not installed (Y371)
C4BR02G-24
C4BR02G-23
FD12
Not installed (Y371)
C4BR02G-20
C4BR02G-19
C4BR02G-27
Not installed (Y371)
C4BR02G-32
C4BR02G-34
C4BR02G-28
C4BR02G-26
MICRO
RD2

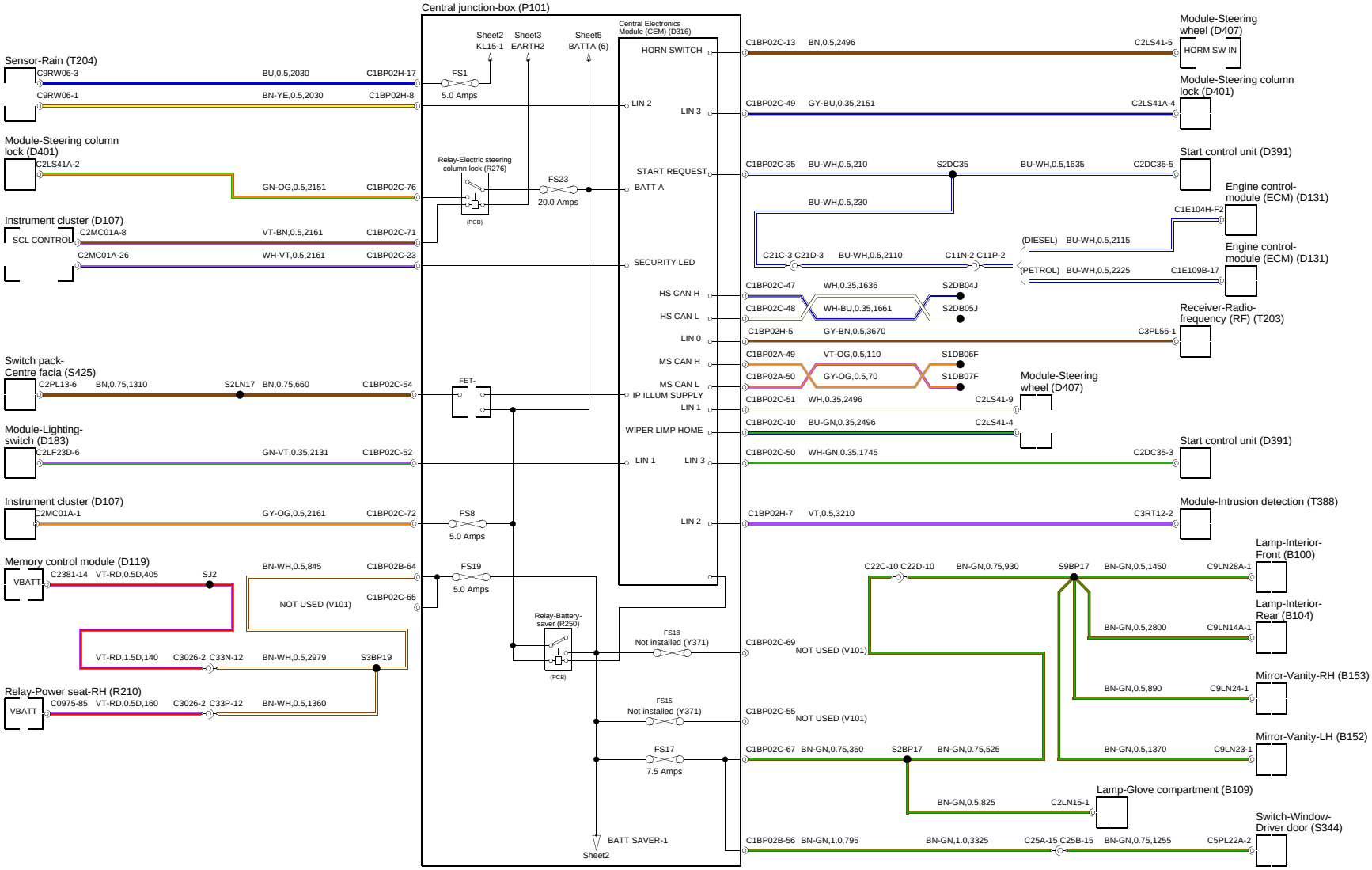

Battery (P100)
RD,25.0,610
C1DC02A-1
C1D134B-1 BK,35.0,210
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01A-66
C1BB01B-1
FE18
60.0 Amps
FE17
60.0 Amps
C1BB03H-1 YE-RD,6.0,2105
C1BB07G-1 RD,6.0,2120
C1BP02G-2
C1BP02G-1
Central junction-box (P101)
BATT B
BATT A
Central Electronics Module (CEM) (D316)
Sheet3
EARTH1
ECU-Sunroof-1 (D173)
C33R-1 C33S-1 RD,1.5,160 C9PR32A-1
C1BP02C-75 RD,1.5,495 C22C-14 C22D-14 RD,1.5,3470
Automatic Temperature Control Module (D243)
C2H101D-1 BU-RD,0.75,825 S2BB27 BU-RD,1.0,1240 C1BP02C-74
Start control unit (D391)
C2DC35-1 BU-RD,0.5,505
Audio head unit (D282)
C2ME03A-11 BN-RD,1.5,2150 C1BP02C-64
Stop lamp switch (S215)
C2CA29-1 GN-RD,1.0,4425 C1BP02B-66
Unit-Fuel Tank (D179)
C4E515-4 (DIESEL) BN-YE,2.5,6775
(PETROL) BN-YE,2.5,6145
C1BP02B-76
Module-Fuel-pump driver (D361)
C4E220E-4
Diagnostic socket (V100)
C2DB04-16 YE-RD,0.5,2096 C1BP02C-73
BK,0.75,1395 C1BP02A-67
Battery backed sounder (D154)
C1RT16A-3
Motor-Release-Fuel flap (M116)
C4PL19A-1 BK,1.0,8420 C1BP02B-68
C4PL19A-2 BK,1.0,8420 C1BP02B-67
FS27 5.0 Amps
FS6 15.0 Amps
FS28 5.0 Amps
FS22 20.0 Amps
FS24 Not installed (Y371)
FS26 5.0 Amps
FS25 10.0 Amps
FS10 15.0 Amps
FS14 15.0 Amps
FS9 15.0 Amps
FS13 15.0 Amps
FS11 7.5 Amps
FS7 7.5 Amps
Relay-Wash-pump-Front (R270)
Relay-Wash-pump-Rear (R271)
Relay-Main-dipped beam (R127)
Relay-Front-fog lamp (R130)
Relay-Reverse (R217)
Relay-Fuel-pump (R103)
Relay-Fuel-flap-lock (R257)
Relay-Fuel-flap-unlock (R258)
Relay-Tailgate unlock (R278)
(PCB)
Not installed (Y371)
NOT USED (V101)
POWER GND
Pump-washer-front/rear screen (M278)
C1BP02A-71 VT-OG,1.0,2650 C1RW14E-1
C1BP02A-72 VT-OG,1.0,2650 C1RW14E-2
C1BP02B-65 BK-WH,4.0,585 S3D138 BK-WH,6.0,1205 G3D138-1
Headlamp-Main-beam-LH (A105)
C1BP02A-74 YE-OG,1.5,2815 C1LF08A-7
Headlamp-Main-beam-RH (A104)
C1BP02A-73 YE-OG,1.5,2145 C1LF09A-7
Lamp-Fog-Front-LH (A109)
C1BP02A-69 GY-BN,1.0,2905 C11J-2 C11K-2 GY-BN,1.0,480 C1LF29-1
Lamp-Fog-Front-RH (A108)
C1BP02A-68 GY-BN,1.0,2905 C11J-1 C11K-1 GY-BN,1.0,2459 C1LF34-1
Tail lamp unit-RH (A140)
C1BP02B-62 GN-WH,1.0,8085 C4LS36A-2
Tail lamp unit-LH (A139)
C1BP02B-73 GN-WH,1.0,6490 C4LS35A-2
Mirror-Electrochromic (B179)
C1BP02H-13 GN-WH,0.75,1960 C9PM05A-2
C1BP02B-72
Motor-CDL-Tailgate-Upper (M255)
C1BP02B-71 WH-OG,1.0,6940 C44N-3 C44M-3 BK,1.0,2390 C4PL17A-1
Module-Steering-wheel-LH (D256)
C1BP02C-70 WH-RD,0.5,2496 C2LS41-10
BATTA (1)
Sheet2
BATT B(1)
Sheet4

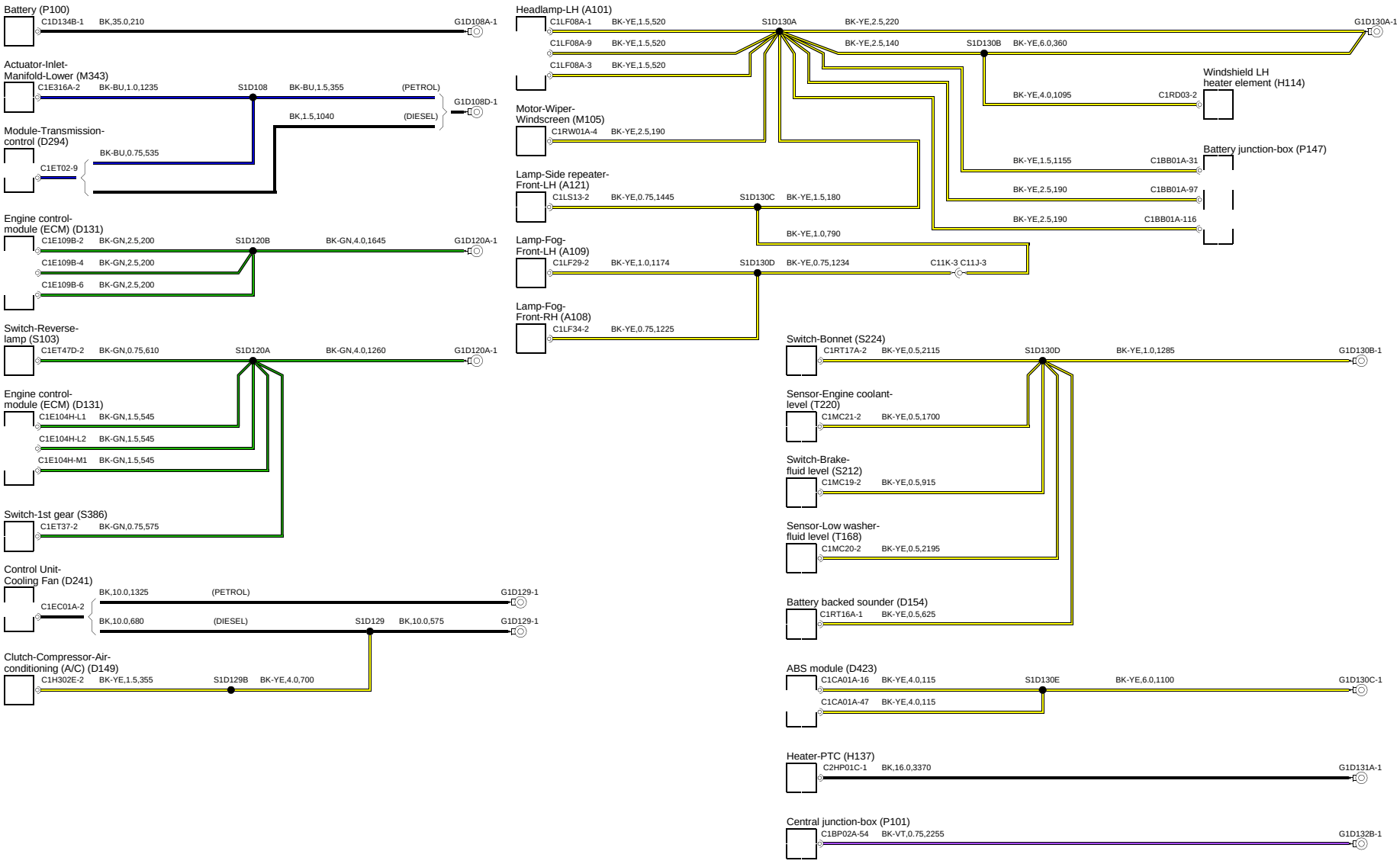

Battery junction-box (P147)
IGN
C1BB01A-98
Instrument cluster (D107)
C2MC01A-2 VT,0.5,2051
Passenger airbag disable indicator (J214)
C9R116-1 VT,0.35,2280
Heater-PTC (H137)
C2HP01E-1 VT,0.5,2030
Switch-Terrain-optimisation (S380)
C3CA15-7 VT,0.75,2325 C23F-10 C23E-10 VT,0.75,280
Mirror-Electrochromic (B179)
C9PM05A-1 VT,0.5,2030 C22D-6 C22C-6 VT,0.5,385
Module-Lighting-switch (D183)
C2LF23D-2 VT,0.5,2021
Sensor-Position-Accelerator pedal (T113)
C2E901-6 VT,0.5,4575 C1BP02B-55
C2E901-1 GN-OG,0.5,4575 C1BP02B-11 ACCL SUPPLY
C2E901-2 YE-OG,0.5,4575 C1BP02B-29 ACCL SIGNAL
C2E901-3 VT-GN,0.5,4575 C1BP02B-47 ACCL GND
Auxiliary junction box (P107)
RJB2 C4BR02B-29 BN,0.75,5855 C1BP02B-45 IGN RELAY
Auxiliary junction box (P107)
RJB1 C4BR02A-29 BN-BU,0.5,5855 C1BP02B-26 REAR DEFROST RLY
Junction-box engine (P108)
C1BB01A-35 YE-GN,0.5,2345 C1BP02A-3 H/L WASH-RIGHT
C1BB01A-69 BU-WH,0.5,2345 C1BP02A-46 HORN RLY
C1BB01A-110 GY-OG,0.5,2345 C1BP02A-5 HFS RLY
C1BB01A-96 YE-GN,0.5,2345 C1BP02A-47 H/L WASH-LEFT
C1BB01A-106 GN-VT,0.75,2345 C1BP02A-45 IGN RLY
C1BB01A-38 VT-GN,0.5,2345 C1BP02A-48 COMFORT RLY
C1BB01A-86 BN-WH,0.5,2345 C1BP02A-6 WIPER RLY FAST/SLOW
C1BB01A-81 WH,0.5,2345 C1BP02A-43 WIPER RLY ON/OFF
Central junction-box (P101)
Sheet6 KL15-1
Sheet1 BATTA (1)
BU,4.0,2345 C1BP02A-65 IGN
S2BP04 VT,1.0,110 C1BP02C-68
FS4 5.0 Amps
C1BP02A-64
NOT USED (V101)
C1BP02H-18
FS5 Not installed (Y371)
C1BP02B-69
NOT USED (V101)
Central Electronics Module (CEM) (D316)
FS3 5.0 Amps
C1BP02B-58
NOT USED (V101)
C1BP02A-55 GY,0.5,1740
C1CA01A-8
ABS module (D423)
FS20 15.0 Amps
C1BP02B-74 YE-VT,1.5,5515
S4BP20 YE-VT,1.5,1525 C44N-7 C44M-7 YE-VT,1.5,2160 C4RW02-2
VBATT
Motor-Wiper-Rear screen (M106)
YE-VT,1.5,340 C4BR02A-28
YE-VT,1.5,340 C4BR02A-32
Auxiliary junction box (P107)
ITO CRASH SRS SIG C1BP02B-1 BN,0.5,215 C23F-13 C23E-13 BN,0.5,2728 C2R114C-23
FS2 10.0 Amps
C1BP02C-66 GN,0.75,225 S2BP02 GN,0.75,2433 C2R114C-24
GN,0.75,295
Restraints Control Module (RCM) (D171)
C23E-9 C23F-9 GN,0.75,2290 C33P-18 C2363-2 GN,0.5D,450 C0962-1
Sensor-Occupancy-detector (T221)
CLUTCH SW25% C1BP02B-33 GN-VT,0.5,4263 C2E904-2
Switch-Clutch-TOT (S472)
CLUTCH SW75% C1BP02B-27 BU-OG,0.5,345 S3E903 BU-OG,0.5,3870 C2E903-1
Switch-Clutch-BOT (S471)
FR PARK SW SIG C1BP02A-29 BN-BU,0.75,1970 C1RW01A-3
ELECTRONIC GND C1BP02A-54 BK-VT,0.75,2255 G1D132B-1
Motor-Wiper-Windscreen (M105)
FS21 5.0 Amps
C1BP02H-15 GY-RD,0.5,3670 C3PL56-3
Receiver-Radio-frequency (RF) (T203)
C1BP02H-16 GY-RD,0.5,3210 C3RT12-3
Module-Intrusion detection (T388)
C1BP02C-43 WH-BN,0.75,2553 C3ET58-1
Solenoid-Reverse gear inhibit (N182)
BATTA (2) Sheet3
BATT SAVER-1 Sheet6

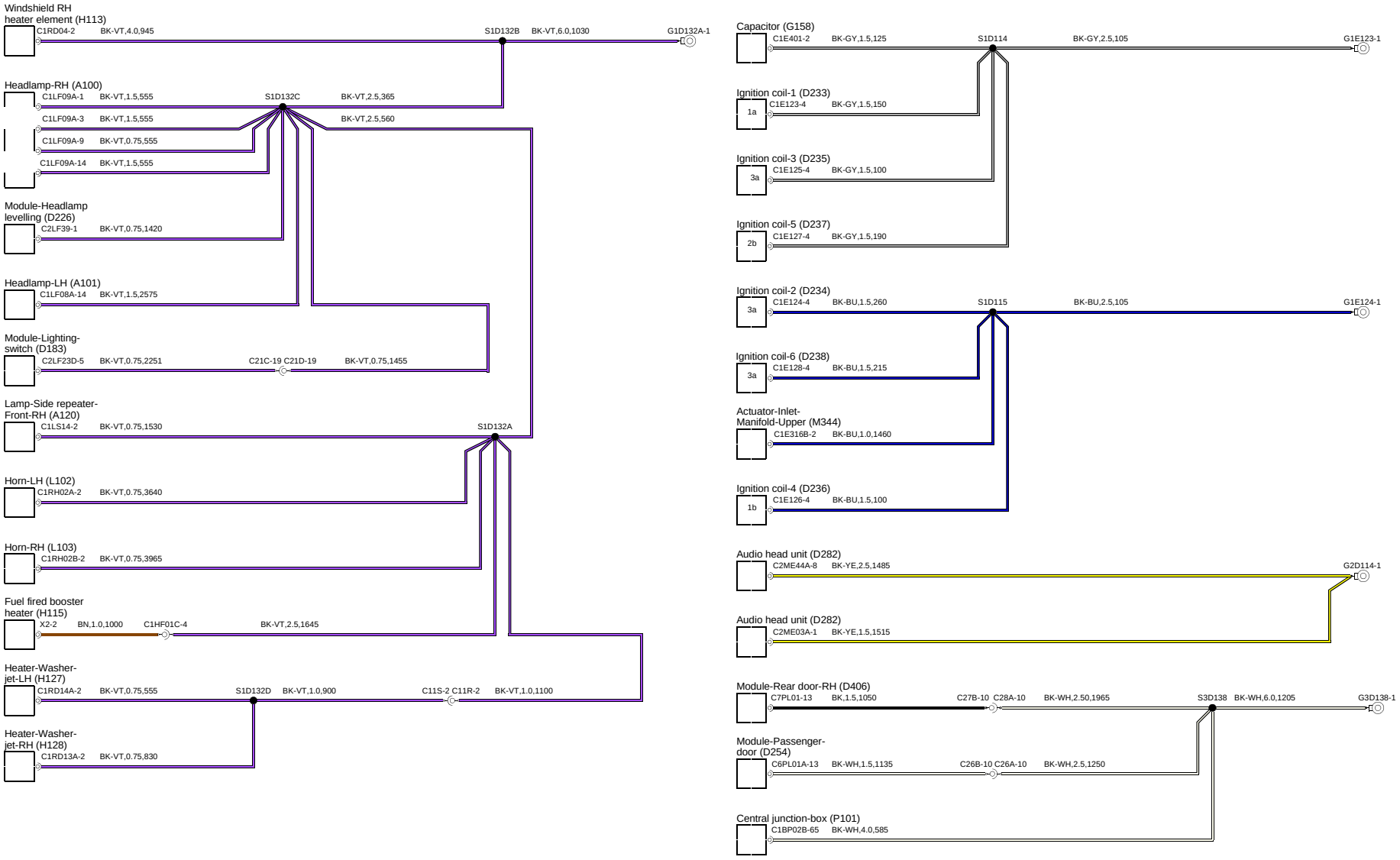

Central junction-box (P101)
Central Electronics Module (CEM) (D316)
Lamp-Side repeater-Front-LH (A121)
C1LS13-1 BU-GN,0.75,945
S1LS21 BU-GN,0.75,1495
C1BP02A-19
Tail lamp unit-LH (A139)
C4LS35A-3 GY-OG,0.75,6490 C1BP02B-36
C4LS35A-4 VT-GN,0.75,6490 C1BP02B-50
Headlamp-LH (A101)
C1LF08A-4 BU-GN,0.75,1320
C1LF08A-2 GN-OG,0.75,2815 C1BP02A-13
C1LF08A-5 BN-BU,1.5,2815 C1BP02A-76
Lamp-Footwell-Front-LH (B136)
C3LN38-2 BU-GY,0.5,1661
S2LN38 BU-GY,0.5,760 C1BP02C-37
A
BU-GY,0.5,830
Sheet6
Lamp-Footwell-Front-RH (B135)
C3LN39-2 BN-WH,0.5,945 C1BP02C-19
Lamp-Number plate and-tail door switch (A155)
C4LS04A-3 BK,0.5,2310
C44M-8 C44N-8 YE-VT,0.5,6940 C1BP02B-52
Lamp-Interior-Front (B100)
C9LN28B-1 BU,1.5,615
S9LN33 BU,0.75,1550 C1BP02H-20
Engine control-module (ECM) (D131)
C1E109B-14 VT-OG,0.5,2225
C11P-3 C11N-3 VT-OG,0.5,2245 C1BP02A-44
Engine control-module (ECM) (D131)
C1E104H-D1 VT-OG,0.5,2115
C1E104H-C1 BN-YE,0.5,2115
C11P-9 C11N-9 BN,0.5,2245 C1BP02A-8
Switch pack-Centre facia (S425)
C2PL13-3 BN-YE,0.5,1970 C1BP02C-8
Heater-PTC (H137)
C2HP01E-2 BU-GN,0.5,2140 C1BP02C-39
FET-
FET-Dip-beam-LH
FET-NUMBER PLATE LAMP
FET-INTERIOR LIGHTS
FET-ECM WAKE UP
Sheet2 BATTA (2)
Sheet1 EARTH1
BATTA (3) Sheet4
EARTH2 Sheet6
C1BP02H-1 NOT USED (V101)
C1BP02C-41 NOT USED (V101)
DI LEFT SUPPLY
POSITION LIGHT LEFT SUPPLY
DIPPED BEAM LEFT
SIDE MARKERS(fl) (not used)
LICENSE PLATE SUPPLY
CONVENIENCE LIGHT
INTERIOR LIGHT DIMMING LS SUPPLY
ECM WAKE UP
FUEL PUMP ON
HAZARD ILLUM
HAZARD SWITCH
PTC HEATER
FL AJAR
FR AJAR
RL AJAR
RR AJAR
TAIL GATE RELEASE
TAILGATE AJAR
RR WIPER RELAY
HOOD AJAR SW
STOP SWITCH SIG
BRAKE DIAG
C1BP02B-7 GN-VT,0.5,4120 C25A-1 C25B-1 BK,0.5,1735 C5PL63-4
Motor-Central door-locking-Driver (M236)
C1BP02B-6 WH,0.5,795 C26A-1 C26B-1 BK,0.5,1735 C6PL64-4
Motor-Central door-locking-Passenger (M237)
C1BP02B-9 GN,0.5,4870 C27A-6 C27B-6 BK,0.5,1585 C7PL71-4
Motor-Central door-locking-Rear-LH (M167)
C1BP02B-8 YE,0.5,2550 C28A-6 C27B-6 BK,0.5,1585 C7PL71-4
Motor-Central door-locking-Rear-RH (M166)
C1BP02B-13 BN,0.5,6940 C44N-4 C44M-4 BK,0.5,2310 C4LS04A-1
Lamp-Number plate and-tail door switch (A155)
C1BP02B-10 YE-OG,0.75,6940 C44N-2 C44M-2 BK,0.75,2390 C4PL17A-3
Motor-CDL-Tailgate-Upper (M255)
C1BP02B-44 BU,0.5,5855 C4BR02A-26
Auxiliary junction box (P107)
C1BP02A-23 BU-OG,0.5,2705 C1RT17A-1
Switch-Bonnet (S224)
C1BP02B-54 VT-BN,0.75,4425 C2CA29-2
Stop lamp switch (S215)
C1BP02A-37 VT-BN,0.75,2245
C11N-4 C11P-4
(PETROL) VT-BN,0.5,2225 C1E109B-30
Engine control-module (ECM) (D131)
(DIESEL) VT-BN,0.5,2115 C1E104H-G3
Engine control-module (ECM) (D131)
C1BP02B-12 VT-WH,0.5,4415 C2CB08-1
Switch-Brake diagnostic (S473)

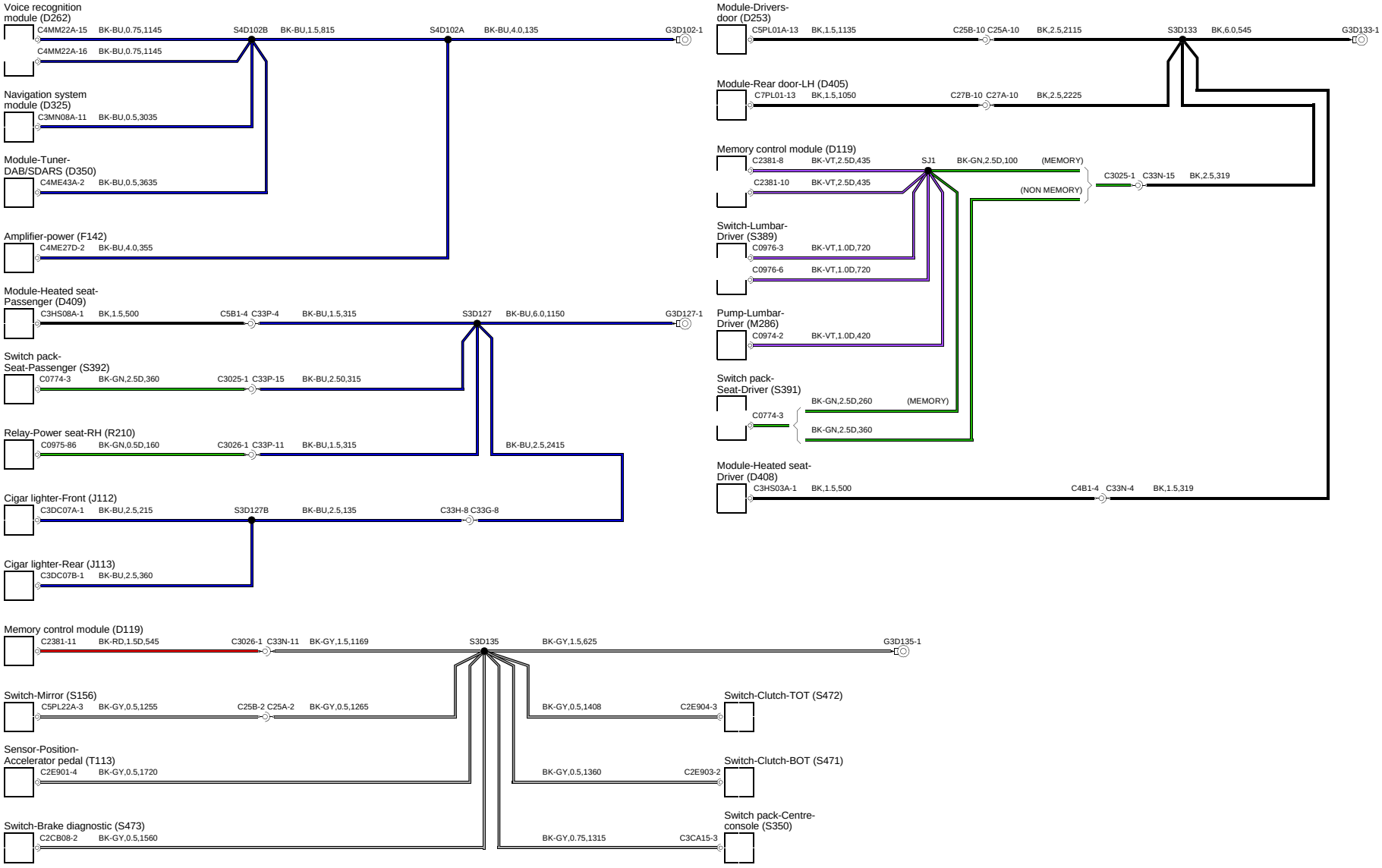

Central junction-box (P101)
Sheet1
BATT B(1)
BATTA (3)
Sheet3
Central Electronics Module (CEM) (D316)
NOT USED (V101)
C1BP02A-39
NOT USED (V101)
C1BP02A-40
FET-
MASTER LOCK SWITCH
SIDEMARKER FRONT RIGHT
MASTER UNLOCK SWITCH
C1BP02C-33 GY-BN,0.5,1970 C2PL13-8
C1BP02C-34 BN-GN,0.5,1970 C2PL13-9
Switch pack-Centre facia (S425)
Lamp-Side repeater-Front-RH (A120)
C1LS14-1 YE-VT,0.75,2855 S1LS25 YE-VT,0.75,825 C1BP02A-1
FET-Dip-beam-RH
DIRECTION INDICATOR RIGHT
PARK BRAKE SW
C1BP02C-11 WH-VT,0.75,390 C23E-14 C23F-14 WH-VT,0.5,3080 C3CA30-1
Switch-Park (S289)
Headlamp-RH (A100)
C1LF09A-4 YE-VT,0.75,1320
C1LF09A-5 BU-GY,1.5,2145 C1BP02A-75
FET-
SUNLIGHTSENSE L
DIPPED BEAM RIGHT SUPPLY
SUNLIGHT SENSOR GND
C1BP02C-2 GY-YE,0.35,1360 C2H415-1
C1BP02C-1 BU-BN,0.35,1360 C2H415-5
Sensor-Sunlight (T166)
C1LF09A-2
BN-YE,0.75,2145 C1BP02A-41
FET-
POS LIGHT RIGHT
Tail lamp unit-RH (A140)
C4LS36A-4 WH-OG,0.75,8085 C1BP02B-24
C4LS36A-3 GN-OG,0.75,8085 C1BP02B-18
C4LS36A-6 BN-GN,0.75,2245 S4LS45A BN-GN,0.75,5840 C1BP02B-39
FET-
REVERSE GEAR SW
C1BP02A-26 BU,0.75,2285 C11L-14 C11M-14 BU,0.5,1390 C1ET47D-1
Switch-Reverse-lamp (S103)
FL
BN-GN,0.75,650
Sheet3
FET-CHMSL
REAR FOG LIGHT SUPPLY
CHMSL
C1BP02B-38 YE-GY,0.5,6940 C44N-1 C44M-1 YE-GY,0.75,1115 C4LS50A-1
C1BP02H-12 NOT USED (V101)
High mounted stop lamp (A126)
FUEL PUMP SENSOR
FUEL EJECT SENSOR
FUEL PUMP SENSOR GND
FUEL SENSOR GND
C1BP02B-30 YE-VT,0.35,6775 C4E515-2
C1BP02B-43 GN-OG,0.35,6775 C4E515-6
C1BP02B-48 GN-BU,0.75,6775 C4E515-1
C1BP02B-46 GN-BU,0.75,6775 (DIESEL ONLY) C4E515-5
Unit-Fuel Tank (D179)
ECU-Trailer (D221)
C4AT23E-3 RD,0.75,445 C44Y-3 C44X-3 RD,0.75,675
Tail lamp unit-RH (A140)
C4LS36A-1 VT-BN,0.75,2350 S4LS44
VT-BN,1.5,6095 C1BP02B-59
FET-
SPEED OUTPUT
GLOBAL CLOSE
STOP LIGHT SUPPLY
C1BP02H-3 VT-OG,0.35,3400 C33R-2 C33S-2 VT-OG,0.35,160 C9PR32A-6
C1BP02H-14 VT-WH,0.35,3400 C33R-7 C33S-7 VT-WH,0.35,160 C9PR32A-2
Roof opening panel control module (D117)
Tail lamp unit-LH (A139)
C4LS35A-1 GY-BN,0.75,395
CLUTCH SENSOR SIG
CLUTCH SENSOR SUPPLY
CLUTCH SENSOR GND
C1BP02A-52 NOT USED (V101)
C1BP02A-51 NOT USED (V101)
C1BP02A-53 NOT USED (V101)
Battery backed sounder (D154)
C1RT16A-2 BK,0.5,1395 C1BP02A-35
lin2 bbs
BATTA (5)
Sheet5

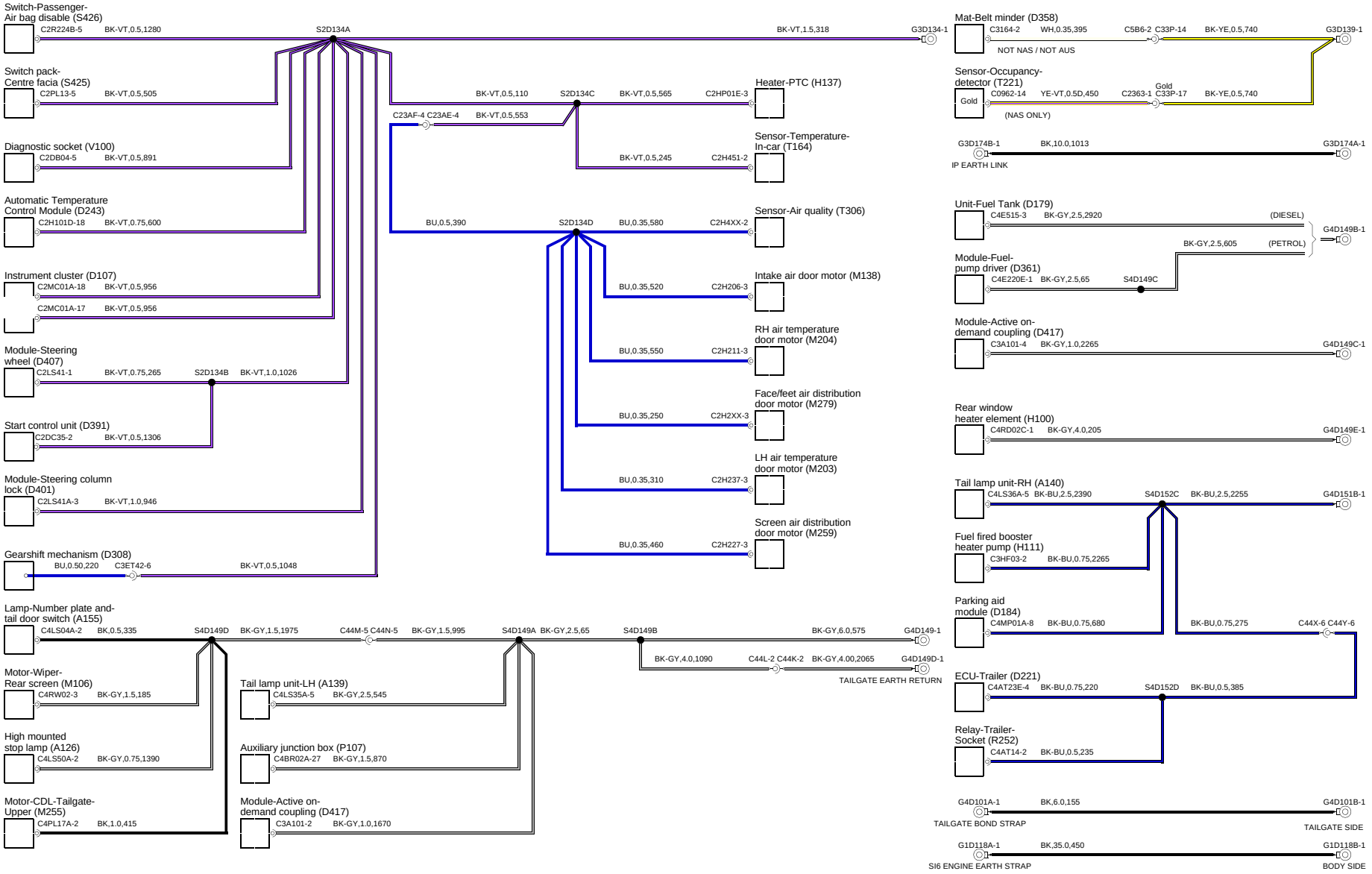

Central junction-box (P101)
Sheet4
BATTA (5)
FET-SUNROOF
Central Electronics Module (CEM) (D316)
Sensor-Low washer-fluid level (T168)
C1MC20-1
VT,0.5,2785
C1BP02A-25
WASHER FLUID LEVEL
Switch-Brake-fluid level (S212)
C1MC19-1
GY-VT,0.5,2155
C1BP02A-27
BRAKE FLUID LEVEL
SIG
GND
Sensor-Engine coolant-level (T220)
C1MC21-1
WH-OG,0.5,2290
C1BP02A-11
COOLANT LEVEL
SIG
GND
SIG
GND
SIG
GND
SBR REAR LEFT SENSOR
SBR REAR MID SENSOR
SBR REAR RIGHT SENSOR
BATTA (6)
FRONT PASS SENSOR
Sheet6
C1BP02B-34
NOT USED (V101)
C1BP02H-6
VT,0.5,3400
C33R-3 C33S-3
VT,0.5,160
C9PR32A-7
Roof opening panel control module (D117)
C1BP02B-15
BU-OG,0.75,6430
C3MC42-1
C1BP02B-16
BN-YE,0.75,6430
C3MC42-2
Initiator-Rear-LH (M284)
C1BP02B-3
GY-VT,0.75,8595
C3MC43-1
C1BP02B-4
BN-GN,0.75,8595
C3MC43-2
Initiator-Rear-RH (M283)
C1BP02A-33
YE,0.75,2905
C1MC40-1
C1BP02A-34
VT-BN,0.75,2905
C1MC40-2
Initiator-Front-LH (M282)
C1BP02A-21
BN-WH,0.75,2690
C1MC41-1
C1BP02A-22
BU-BN,0.75,2690
C1MC41-2
Initiator-Front-RH (M281)
C1BP02B-20
NOT USED (V101)
C1BP02B-21
NOT USED (V101)
C1BP02B-22
NOT USED (V101)
C1BP02B-23
BN-YE,0.5,2205
C33P-13 C5B6-1
WH,0.35,395
C3164-1
Mat-Belt minder (D358)
NOT FITTED ON NAS OR AUSTRAILIA

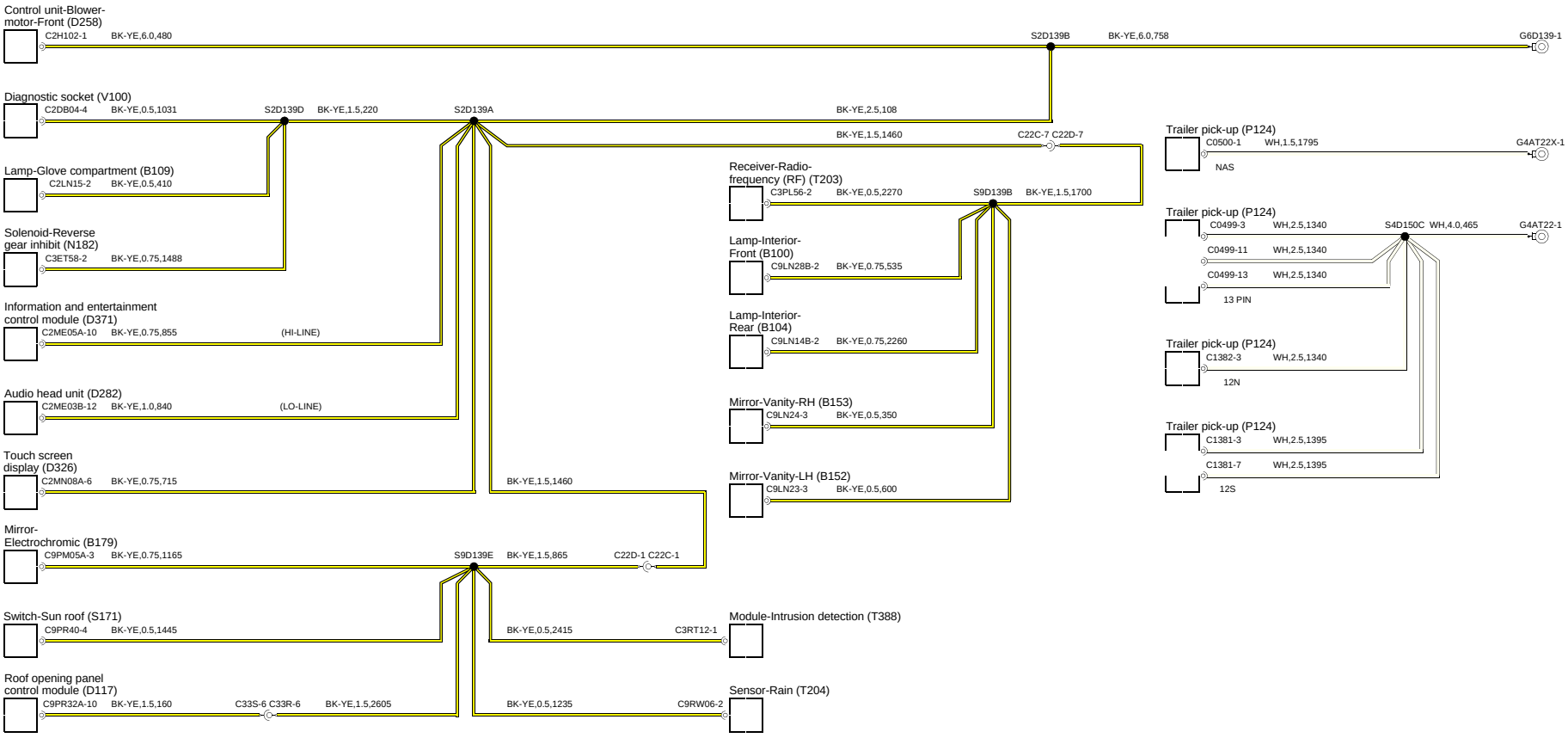

Central junction-box (P101)
Central Electronics Module (CEM) (D316)
Sheet2 KL15-1
Sheet3 EARTH2
Sheet5 BATTA (6)
Sensor-Rain (T204)
C9RW06-3 BU,0.5,2030 C1BP02H-17
C9RW06-1 BN-YE,0.5,2030 C1BP02H-8
FS1 5.0 Amps
Module-Steering column lock (D401)
C2LS41A-2 GN-OG,0.5,2151 C1BP02C-76
Relay-Electric steering column lock (R276)
FS23 20.0 Amps
(PCB)
Instrument cluster (D107)
SCL CONTROL
C2MC01A-8 VT-BN,0.5,2161 C1BP02C-71
C2MC01A-26 WH-VT,0.5,2161 C1BP02C-23
Switch pack-Centre facia (S425)
C2PL13-6 BN,0.75,1310 S2LN17 BN,0.75,660 C1BP02C-54
FET-
Module-Lighting-switch (D183)
C2LF23D-6 GN-VT,0.35,2131 C1BP02C-52
Instrument cluster (D107)
C2MC01A-1 GY-OG,0.5,2161 C1BP02C-72
FS8 5.0 Amps
Memory control module (D119)
VBATT
C2381-14 VT-RD,0.5D,405 SJ2
BN-WH,0.5,845 C1BP02B-64
FS19 5.0 Amps
NOT USED (V101) C1BP02C-65
VT-RD,1.5D,140 C3026-2 C33N-12 BN-WH,0.5,2979 S3BP19
Relay-Battery-saver (R250)
(PCB)
Relay-Power seat-RH (R210)
VBATT
C0975-85 VT-RD,0.5D,160 C3026-2 C33P-12 BN-WH,0.5,1360
HORN SWITCH
LIN 2
LIN 3
START REQUEST
BATT A
SECURITY LED
HS CAN H
HS CAN L
LIN 0
MS CAN H
MS CAN L
IP ILLUM SUPPLY
LIN 1
WIPER LIMP HOME
LIN 1
LIN 3
LIN 2
FS18 Not installed (Y371)
FS15 Not installed (Y371)
FS17 7.5 Amps
BATT SAVER-1
Sheet2
C1BP02C-13 BN,0.5,2496 C2LS41-5
Module-Steering wheel (D407)
HORM SW IN
C1BP02C-49 GY-BU,0.35,2151 C2LS41A-4
Module-Steering column lock (D401)
C1BP02C-35 BU-WH,0.5,210 S2DC35 BU-WH,0.5,1635 C2DC35-5
Start control unit (D391)
BU-WH,0.5,230
C1E104H-F2
Engine control-module (ECM) (D131)
C21C-3 C21D-3 BU-WH,0.5,2110 C11N-2 C11P-2
(DIESEL) BU-WH,0.5,2115
(PETROL) BU-WH,0.5,2225 C1E109B-17
Engine control-module (ECM) (D131)
C1BP02C-47 WH,0.35,1636 S2DB04J
C1BP02C-48 WH-BU,0.35,1661 S2DB05J
C1BP02H-5 GY-BN,0.5,3670 C3PL56-1
Receiver-Radio-frequency (RF) (T203)
C1BP02A-49 VT-OG,0.5,110 S1DB06F
C1BP02A-50 GY-OG,0.5,70 S1DB07F
C1BP02C-51 WH,0.35,2496 C2LS41-9
Module-Steering wheel (D407)
C1BP02C-10 BU-GN,0.35,2496 C2LS41-4
C1BP02C-50 WH-GN,0.35,1745 C2DC35-3
Start control unit (D391)
C1BP02H-7 VT,0.5,3210 C3RT12-2
Module-Intrusion detection (T388)
C22C-10 C22D-10 BN-GN,0.75,930 S9BP17 BN-GN,0.5,1450 C9LN28A-1
Lamp-Interior-Front (B100)
BN-GN,0.5,2800 C9LN14A-1
Lamp-Interior-Rear (B104)
C1BP02C-69 NOT USED (V101)
BN-GN,0.5,890 C9LN24-1
Mirror-Vanity-RH (B153)
C1BP02C-55 NOT USED (V101)
C1BP02C-67 BN-GN,0.75,350 S2BP17 BN-GN,0.75,525
BN-GN,0.5,1370 C9LN23-1
Mirror-Vanity-LH (B152)
BN-GN,0.5,825 C2LN15-1
Lamp-Glove compartment (B109)
C1BP02B-56 BN-GN,1.0,795 BN-GN,1.0,3325 C25A-15 C25B-15 BN-GN,0.75,1255 C5PL22A-2
Switch-Window-Driver door (S344)

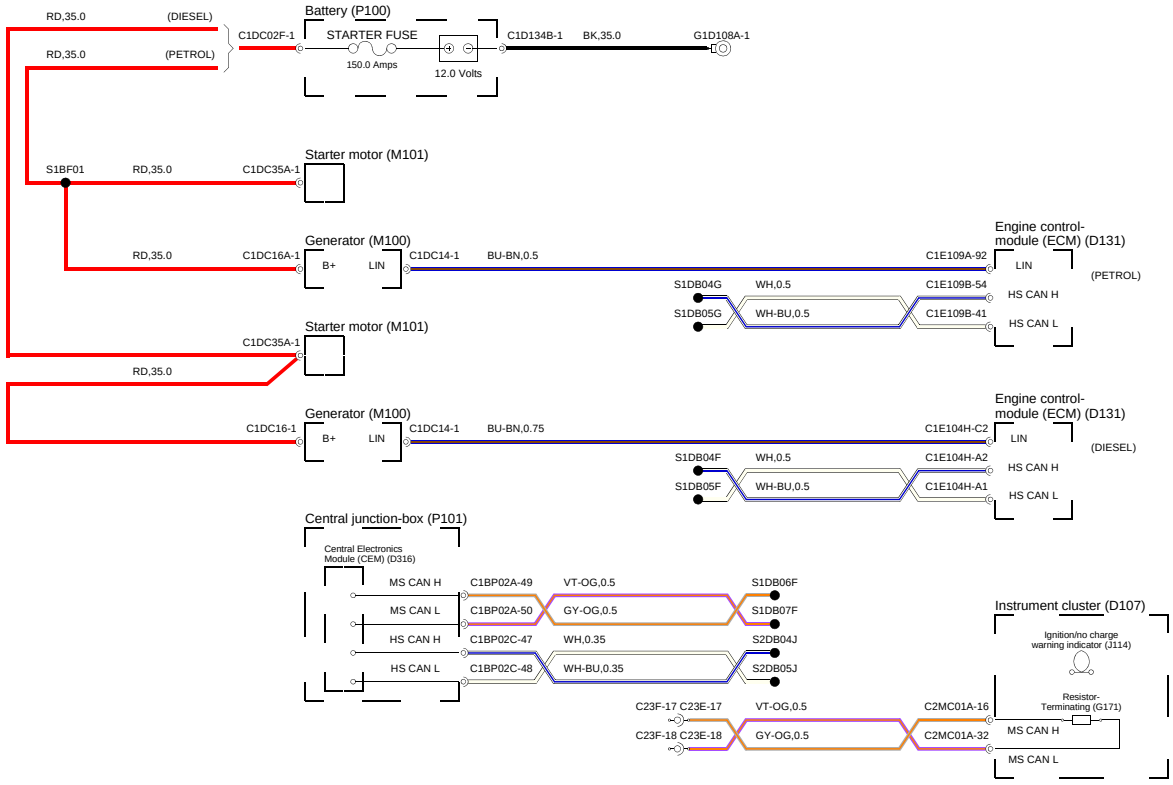

Battery (P100)
C1D134B-1 BK,35.0,210 G1D108A-1
Actuator-Inlet-Manifold-Lower (M343)
C1E316A-2 BK-BU,1.0,1235 S1D108 BK-BU,1.5,355 (PETROL)
BK,1.5,1040 (DIESEL)
G1D108D-1
Module-Transmission-control (D294)
C1ET02-9 BK-BU,0.75,535
Engine control-module (ECM) (D131)
C1E109B-2 BK-GN,2.5,200 S1D120B BK-GN,4.0,1645 G1D120A-1
C1E109B-4 BK-GN,2.5,200
C1E109B-6 BK-GN,2.5,200
Switch-Reverse-lamp (S103)
C1ET47D-2 BK-GN,0.75,610 S1D120A BK-GN,4.0,1260 G1D120A-1
Engine control-module (ECM) (D131)
C1E104H-L1 BK-GN,1.5,545
C1E104H-L2 BK-GN,1.5,545
C1E104H-M1 BK-GN,1.5,545
Switch-1st gear (S386)
C1ET37-2 BK-GN,0.75,575
Control Unit-Cooling Fan (D241)
C1EC01A-2 BK,10.0,1325 (PETROL) G1D129-1
BK,10.0,680 (DIESEL) S1D129 BK,10.0,575 G1D129-1
Clutch-Compressor-Air-conditioning (A/C) (D149)
C1H302E-2 BK-YE,1.5,355 S1D129B BK-YE,4.0,700
Headlamp-LH (A101)
C1LF08A-1 BK-YE,1.5,520 S1D130A BK-YE,2.5,220 G1D130A-1
C1LF08A-9 BK-YE,1.5,520 BK-YE,2.5,140 S1D130B BK-YE,6.0,360
C1LF08A-3 BK-YE,1.5,520
Windshield LH heater element (H114)
BK-YE,4.0,1095 C1RD03-2
Motor-Wiper-Windscreen (M105)
C1RW01A-4 BK-YE,2.5,190
Battery junction-box (P147)
BK-YE,1.5,1155 C1BB01A-31
BK-YE,2.5,190 C1BB01A-97
BK-YE,2.5,190 C1BB01A-116
Lamp-Side repeater-Front-LH (A121)
C1LS13-2 BK-YE,0.75,1445 S1D130C BK-YE,1.5,180
BK-YE,1.0,790
Lamp-Fog-Front-LH (A109)
C1LF29-2 BK-YE,1.0,1174 S1D130D BK-YE,0.75,1234 C11K-3 C11J-3
Lamp-Fog-Front-RH (A108)
C1LF34-2 BK-YE,0.75,1225
Switch-Bonnet (S224)
C1RT17A-2 BK-YE,0.5,2115 S1D130D BK-YE,1.0,1285 G1D130B-1
Sensor-Engine coolant-level (T220)
C1MC21-2 BK-YE,0.5,1700
Switch-Brake-fluid level (S212)
C1MC19-2 BK-YE,0.5,915
Sensor-Low washer-fluid level (T168)
C1MC20-2 BK-YE,0.5,2195
Battery backed sounder (D154)
C1RT16A-1 BK-YE,0.5,625
ABS module (D423)
C1CA01A-16 BK-YE,4.0,115 S1D130E BK-YE,6.0,1100 G1D130C-1
C1CA01A-47 BK-YE,4.0,115
Heater-PTC (H137)
C2HP01C-1 BK,16.0,3370 G1D131A-1
Central junction-box (P101)
C1BP02A-54 BK-VT,0.75,2255 G1D132B-1

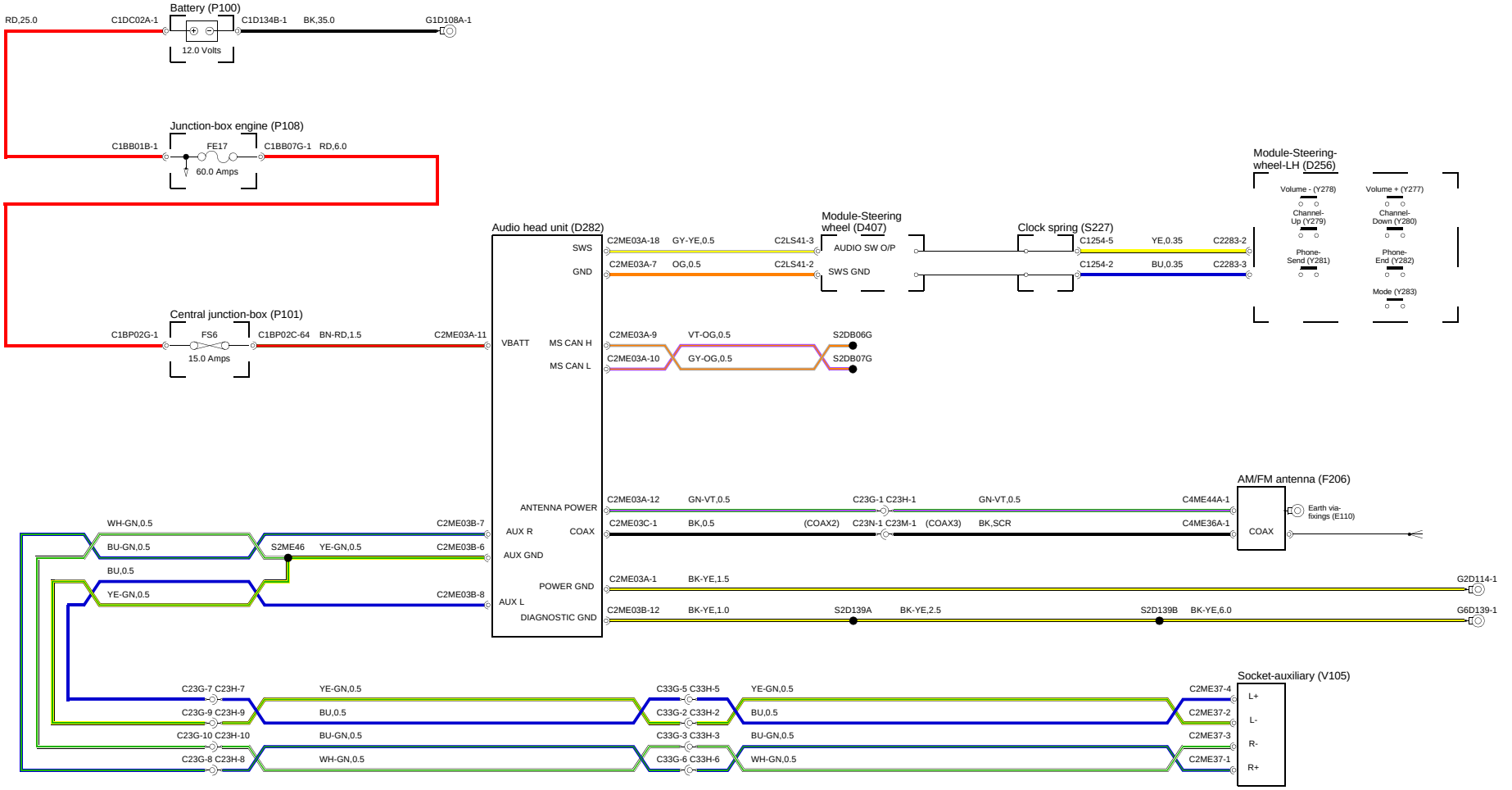

Windshield RH heater element (H113)
C1RD04-2 BK-VT,4.0,945 S1D132B BK-VT,6.0,1030 G1D132A-1
Headlamp-RH (A100)
C1LF09A-1 BK-VT,1.5,555 S1D132C BK-VT,2.5,365
C1LF09A-3 BK-VT,1.5,555 BK-VT,2.5,560
C1LF09A-9 BK-VT,0.75,555
C1LF09A-14 BK-VT,1.5,555
Module-Headlamp levelling (D226)
C2LF39-1 BK-VT,0.75,1420
Headlamp-LH (A101)
C1LF08A-14 BK-VT,1.5,2575
Module-Lighting-switch (D183)
C2LF23D-5 BK-VT,0.75,2251 C21C-19 C21D-19 BK-VT,0.75,1455
Lamp-Side repeater-Front-RH (A120)
C1LS14-2 BK-VT,0.75,1530 S1D132A
Horn-LH (L102)
C1RH02A-2 BK-VT,0.75,3640
Horn-RH (L103)
C1RH02B-2 BK-VT,0.75,3965
Fuel fired booster heater (H115)
X2-2 BN,1.0,1000 C1HF01C-4 BK-VT,2.5,1645
Heater-Washer-jet-LH (H127)
C1RD14A-2 BK-VT,0.75,555 S1D132D BK-VT,1.0,900 C11S-2 C11R-2 BK-VT,1.0,1100
Heater-Washer-jet-RH (H128)
C1RD13A-2 BK-VT,0.75,830
Capacitor (G158)
C1E401-2 BK-GY,1.5,125 S1D114 BK-GY,2.5,105 G1E123-1
Ignition coil-1 (D233)
1a C1E123-4 BK-GY,1.5,150
Ignition coil-3 (D235)
3a C1E125-4 BK-GY,1.5,100
Ignition coil-5 (D237)
2b C1E127-4 BK-GY,1.5,190
Ignition coil-2 (D234)
3a C1E124-4 BK-BU,1.5,260 S1D115 BK-BU,2.5,105 G1E124-1
Ignition coil-6 (D238)
3a C1E128-4 BK-BU,1.5,215
Actuator-Inlet-Manifold-Upper (M344)
C1E316B-2 BK-BU,1.0,1460
Ignition coil-4 (D236)
1b C1E126-4 BK-BU,1.5,100
Audio head unit (D282)
C2ME44A-8 BK-YE,2.5,1485 G2D114-1
Audio head unit (D282)
C2ME03A-1 BK-YE,1.5,1515
Module-Rear door-RH (D406)
C7PL01-13 BK,1.5,1050 C27B-10 C28A-10 BK-WH,2.50,1965 S3D138 BK-WH,6.0,1205 G3D138-1
Module-Passenger-door (D254)
C6PL01A-13 BK-WH,1.5,1135 C26B-10 C26A-10 BK-WH,2.5,1250
Central junction-box (P101)
C1BP02B-65 BK-WH,4.0,585

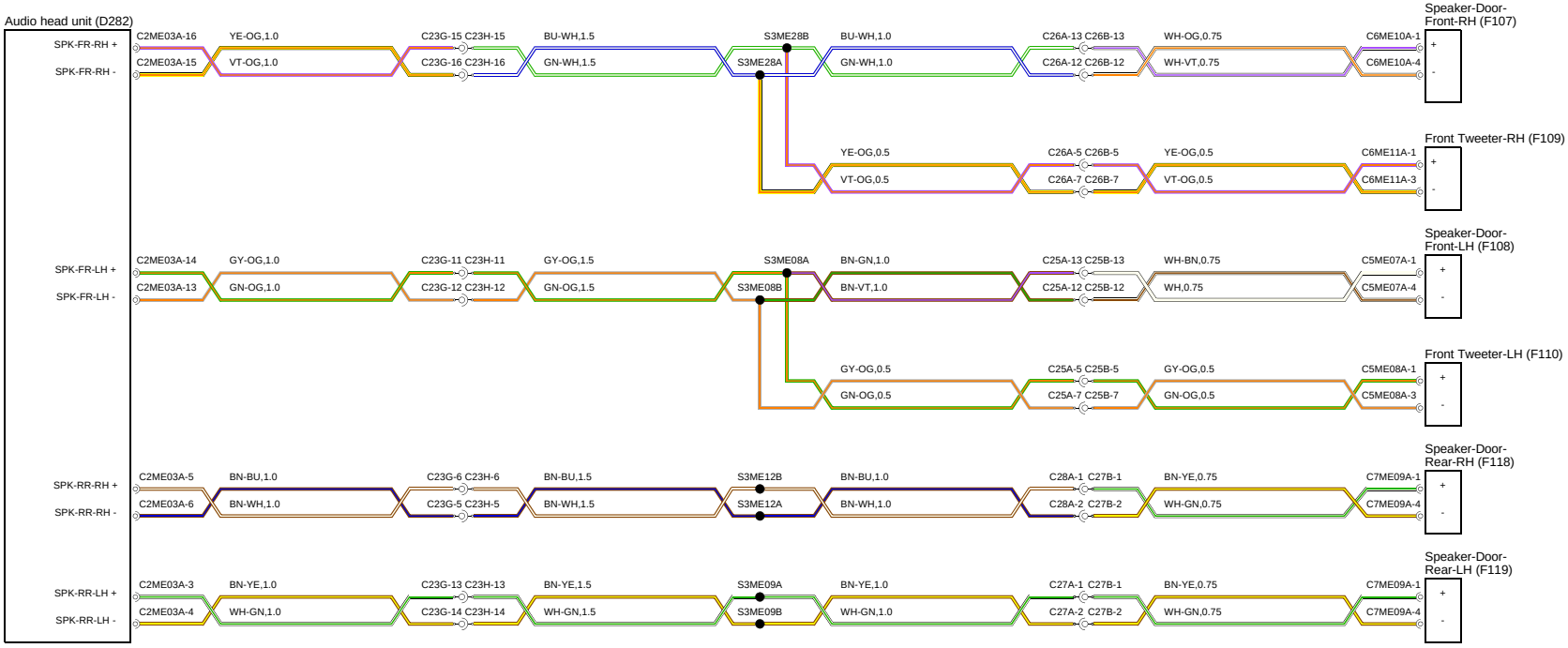

Voice recognition module (D262)
C4MM22A-15 BK-BU,0.75,1145
S4D102B BK-BU,1.5,815
S4D102A BK-BU,4.0,135
G3D102-1
C4MM22A-16 BK-BU,0.75,1145
Navigation system module (D325)
C3MN08A-11 BK-BU,0.5,3035
Module-Tuner-DAB/SDARS (D350)
C4ME43A-2 BK-BU,0.5,3635
Amplifier-power (F142)
C4ME27D-2 BK-BU,4.0,355
Module-Heated seat-Passenger (D409)
C3HS08A-1 BK,1.5,500
C5B1-4 C33P-4 BK-BU,1.5,315
S3D127 BK-BU,6.0,1150
G3D127-1
Switch pack-Seat-Passenger (S392)
C0774-3 BK-GN,2.5D,360
C3025-1 C33P-15 BK-BU,2.50,315
Relay-Power seat-RH (R210)
C0975-86 BK-GN,0.5D,160
C3026-1 C33P-11 BK-BU,1.5,315
BK-BU,2.5,2415
Cigar lighter-Front (J112)
C3DC07A-1 BK-BU,2.5,215
S3D127B BK-BU,2.5,135
C33H-8 C33G-8
Cigar lighter-Rear (J113)
C3DC07B-1 BK-BU,2.5,360
Module-Drivers-door (D253)
C5PL01A-13 BK,1.5,1135
C25B-10 C25A-10 BK,2.5,2115
S3D133 BK,6.0,545
G3D133-1
Module-Rear door-LH (D405)
C7PL01-13 BK,1.5,1050
C27B-10 C27A-10 BK,2.5,2225
Memory control module (D119)
C2381-8 BK-VT,2.5D,435
SJ1 BK-GN,2.5D,100 (MEMORY)
C2381-10 BK-VT,2.5D,435
(NON MEMORY)
C3025-1 C33N-15 BK,2.5,319
Switch-Lumbar-Driver (S389)
C0976-3 BK-VT,1.0D,720
C0976-6 BK-VT,1.0D,720
Pump-Lumbar-Driver (M286)
C0974-2 BK-VT,1.0D,420
Switch pack-Seat-Driver (S391)
C0774-3
BK-GN,2.5D,260 (MEMORY)
BK-GN,2.5D,360
Module-Heated seat-Driver (D408)
C3HS03A-1 BK,1.5,500
C4B1-4 C33N-4 BK,1.5,319
Memory control module (D119)
C2381-11 BK-RD,1.5D,545
C3026-1 C33N-11 BK-GY,1.5,1169
S3D135 BK-GY,1.5,625
G3D135-1
Switch-Mirror (S156)
C5PL22A-3 BK-GY,0.5,1255
C25B-2 C25A-2 BK-GY,0.5,1265
BK-GY,0.5,1408
C2E904-3
Switch-Clutch-TOT (S472)
Sensor-Position-Accelerator pedal (T113)
C2E901-4 BK-GY,0.5,1720
BK-GY,0.5,1360
C2E903-2
Switch-Clutch-BOT (S471)
Switch-Brake diagnostic (S473)
C2CB08-2 BK-GY,0.5,1560
BK-GY,0.75,1315
C3CA15-3
Switch pack-Centre-console (S350)

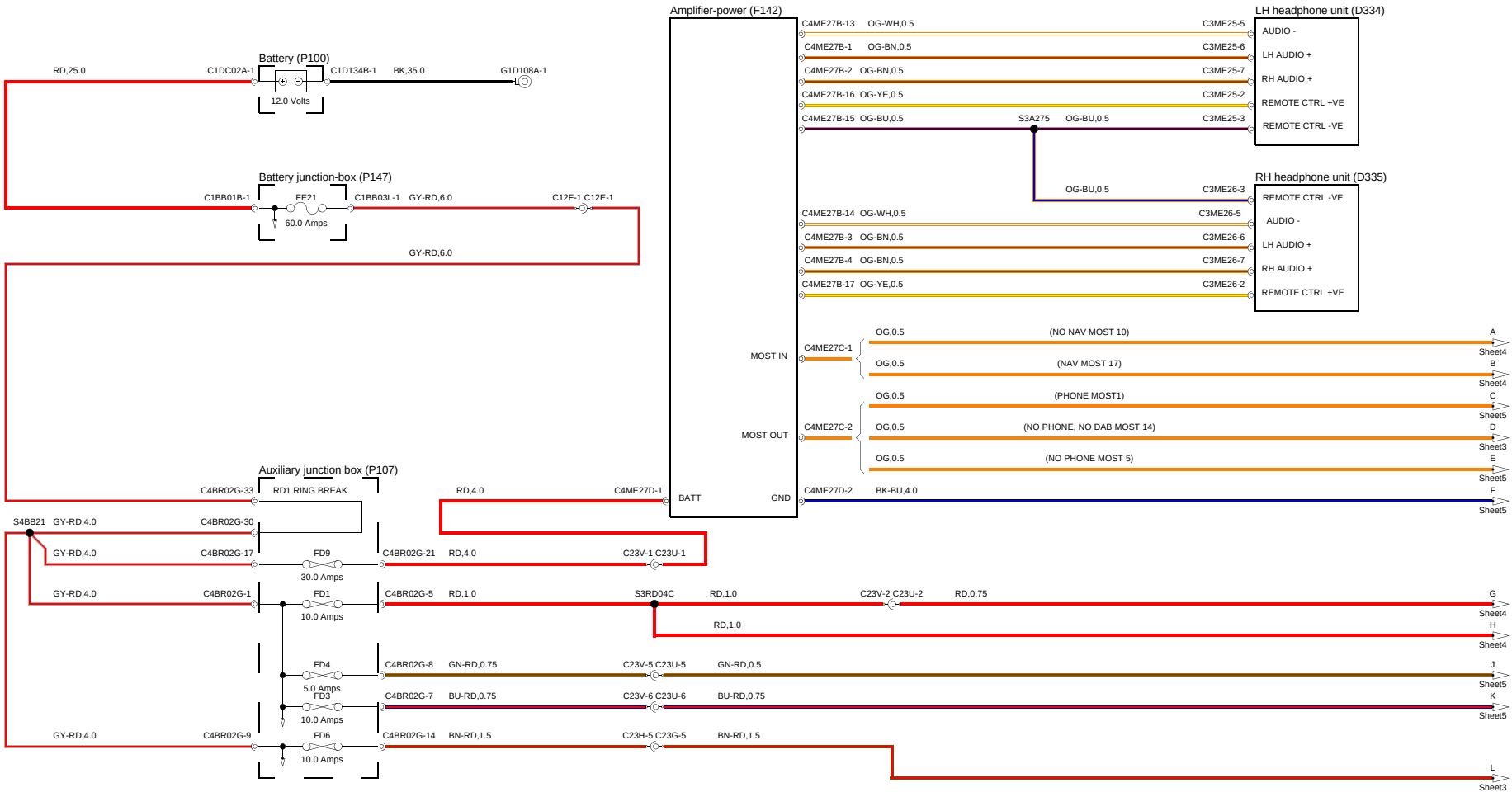

Switch-Passenger-Air bag disable (S426)
C2R224B-5 BK-VT,0.5,1280 S2D134A BK-VT,1.5,318 G3D134-1
Switch pack-Centre facia (S425)
C2PL13-5 BK-VT,0.5,505
Diagnostic socket (V100)
C2DB04-5 BK-VT,0.5,891
Automatic Temperature Control Module (D243)
C2H101D-18 BK-VT,0.75,600
Instrument cluster (D107)
C2MC01A-18 BK-VT,0.5,956
C2MC01A-17 BK-VT,0.5,956
Module-Steering wheel (D407)
C2LS41-1 BK-VT,0.75,265 S2D134B BK-VT,1.0,1026
Start control unit (D391)
C2DC35-2 BK-VT,0.5,1306
Module-Steering column lock (D401)
C2LS41A-3 BK-VT,1.0,946
Gearshift mechanism (D308)
BU,0.50,220 C3ET42-6 BK-VT,0.5,1048
BK-VT,0.5,110 S2D134C BK-VT,0.5,565 C2HP01E-3
Heater-PTC (H137)
C23AF-4 C23AE-4 BK-VT,0.5,553
BK-VT,0.5,245 C2H451-2
Sensor-Temperature-In-car (T164)
BU,0.5,390 S2D134D BU,0.35,580 C2H4XX-2
Sensor-Air quality (T306)
BU,0.35,520 C2H206-3
Intake air door motor (M138)
BU,0.35,550 C2H211-3
RH air temperature door motor (M204)
BU,0.35,250 C2H2XX-3
Face/feet air distribution door motor (M279)
BU,0.35,310 C2H237-3
LH air temperature door motor (M203)
BU,0.35,460 C2H227-3
Screen air distribution door motor (M259)
Lamp-Number plate and-tail door switch (A155)
C4LS04A-2 BK,0.5,335 S4D149D BK-GY,1.5,1975 C44M-5 C44N-5 BK-GY,1.5,995 S4D149A BK-GY,2.5,65 S4D149B BK-GY,6.0,575 G4D149-1
BK-GY,4.0,1090 C44L-2 C44K-2 BK-GY,4.00,2065 G4D149D-1
TAILGATE EARTH RETURN
Motor-Wiper-Rear screen (M106)
C4RW02-3 BK-GY,1.5,185
High mounted stop lamp (A126)
C4LS50A-2 BK-GY,0.75,1390
Motor-CDL-Tailgate-Upper (M255)
C4PL17A-2 BK,1.0,415
Tail lamp unit-LH (A139)
C4LS35A-5 BK-GY,2.5,545
Auxiliary junction box (P107)
C4BR02A-27 BK-GY,1.5,870
Module-Active on-demand coupling (D417)
C3A101-2 BK-GY,1.0,1670
Mat-Belt minder (D358)
C3164-2 WH,0.35,395 C5B6-2 C33P-14 BK-YE,0.5,740 G3D139-1
NOT NAS / NOT AUS
Sensor-Occupancy-detector (T221)
Gold C0962-14 YE-VT,0.5D,450 C2363-1 Gold C33P-17 BK-YE,0.5,740
(NAS ONLY)
G3D174B-1 BK,10.0,1013 G3D174A-1
IP EARTH LINK
Unit-Fuel Tank (D179)
C4E515-3 BK-GY,2.5,2920 (DIESEL)
BK-GY,2.5,605 (PETROL)
G4D149B-1
Module-Fuel-pump driver (D361)
C4E220E-1 BK-GY,2.5,65 S4D149C
Module-Active on-demand coupling (D417)
C3A101-4 BK-GY,1.0,2265 G4D149C-1
Rear window heater element (H100)
C4RD02C-1 BK-GY,4.0,205 G4D149E-1
Tail lamp unit-RH (A140)
C4LS36A-5 BK-BU,2.5,2390 S4D152C BK-BU,2.5,2255 G4D151B-1
Fuel fired booster heater pump (H111)
C3HF03-2 BK-BU,0.75,2265
Parking aid module (D184)
C4MP01A-8 BK-BU,0.75,680 BK-BU,0.75,275 C44X-6 C44Y-6
ECU-Trailer (D221)
C4AT23E-4 BK-BU,0.75,220 S4D152D BK-BU,0.5,385
Relay-Trailer-Socket (R252)
C4AT14-2 BK-BU,0.5,235
G4D101A-1 BK,6.0,155 G4D101B-1
TAILGATE BOND STRAP
TAILGATE SIDE
G1D118A-1 BK,35.0,450 G1D118B-1
SI6 ENGINE EARTH STRAP
BODY SIDE

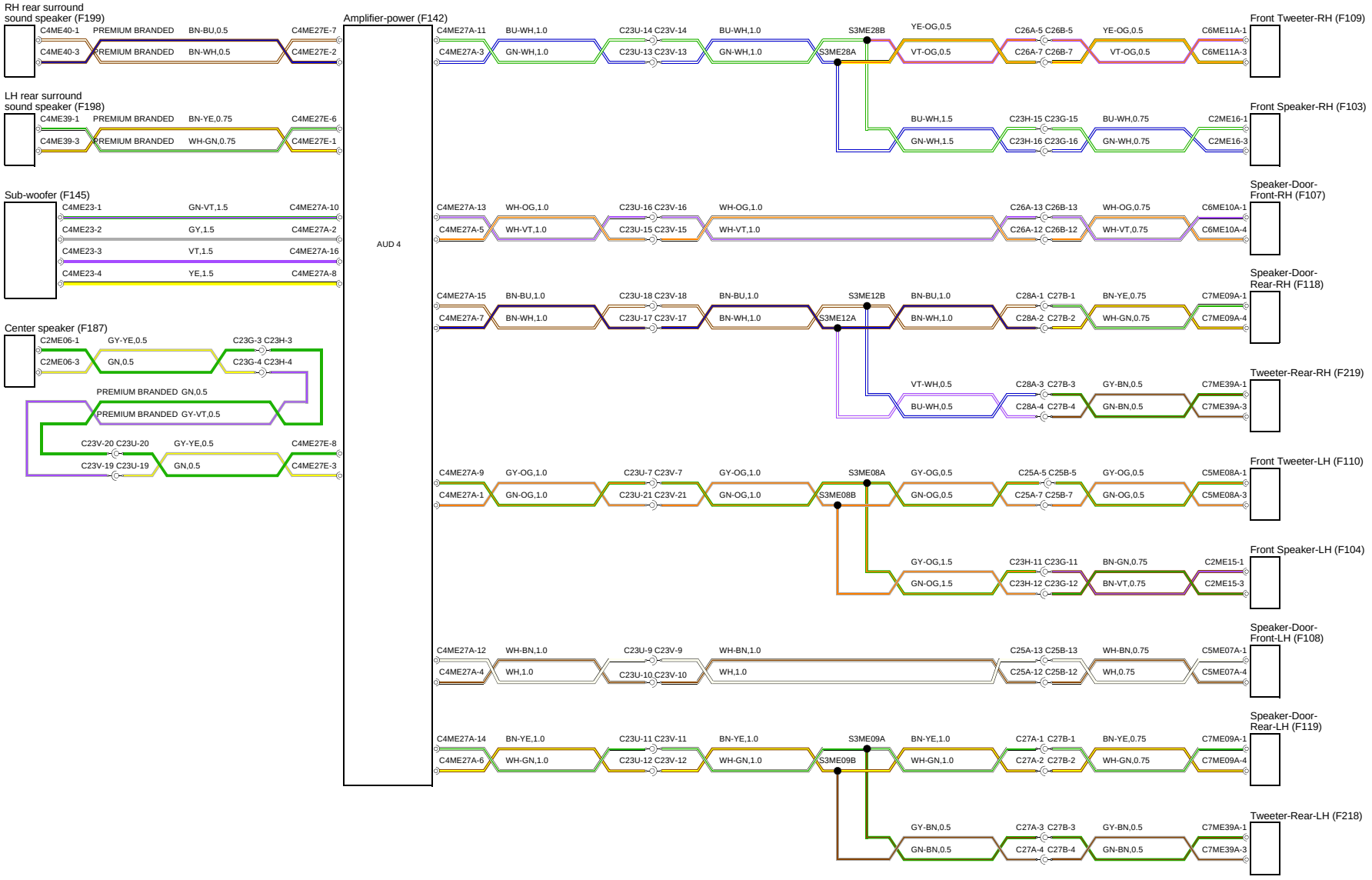

Control unit-Blower-motor-Front (D258)
C2H102-1 BK-YE,6.0,480
S2D139B BK-YE,6.0,758 G6D139-1
Diagnostic socket (V100)
C2DB04-4 BK-YE,0.5,1031 S2D139D BK-YE,1.5,220 S2D139A
BK-YE,2.5,108
BK-YE,1.5,1460 C22C-7 C22D-7
Lamp-Glove compartment (B109)
C2LN15-2 BK-YE,0.5,410
Solenoid-Reverse gear inhibit (N182)
C3ET58-2 BK-YE,0.75,1488
Information and entertainment control module (D371)
C2ME05A-10 BK-YE,0.75,855 (HI-LINE)
Audio head unit (D282)
C2ME03B-12 BK-YE,1.0,840 (LO-LINE)
Touch screen display (D326)
C2MN08A-6 BK-YE,0.75,715
BK-YE,1.5,1460
Mirror-Electrochromic (B179)
C9PM05A-3 BK-YE,0.75,1165 S9D139E BK-YE,1.5,865 C22D-1 C22C-1
Switch-Sun roof (S171)
C9PR40-4 BK-YE,0.5,1445
BK-YE,0.5,2415 C3RT12-1
Module-Intrusion detection (T388)
Roof opening panel control module (D117)
C9PR32A-10 BK-YE,1.5,160 C33S-6 C33R-6 BK-YE,1.5,2605
BK-YE,0.5,1235 C9RW06-2
Sensor-Rain (T204)
Receiver-Radio-frequency (RF) (T203)
C3PL56-2 BK-YE,0.5,2270 S9D139B BK-YE,1.5,1700
Lamp-Interior-Front (B100)
C9LN28B-2 BK-YE,0.75,535
Lamp-Interior-Rear (B104)
C9LN14B-2 BK-YE,0.75,2260
Mirror-Vanity-RH (B153)
C9LN24-3 BK-YE,0.5,350
Mirror-Vanity-LH (B152)
C9LN23-3 BK-YE,0.5,600
Trailer pick-up (P124)
C0500-1 WH,1.5,1795 G4AT22X-1
NAS
Trailer pick-up (P124)
C0499-3 WH,2.5,1340 S4D150C WH,4.0,465 G4AT22-1
C0499-11 WH,2.5,1340
C0499-13 WH,2.5,1340
13 PIN
Trailer pick-up (P124)
C1382-3 WH,2.5,1340
12N
Trailer pick-up (P124)
C1381-3 WH,2.5,1395
C1381-7 WH,2.5,1395
12S

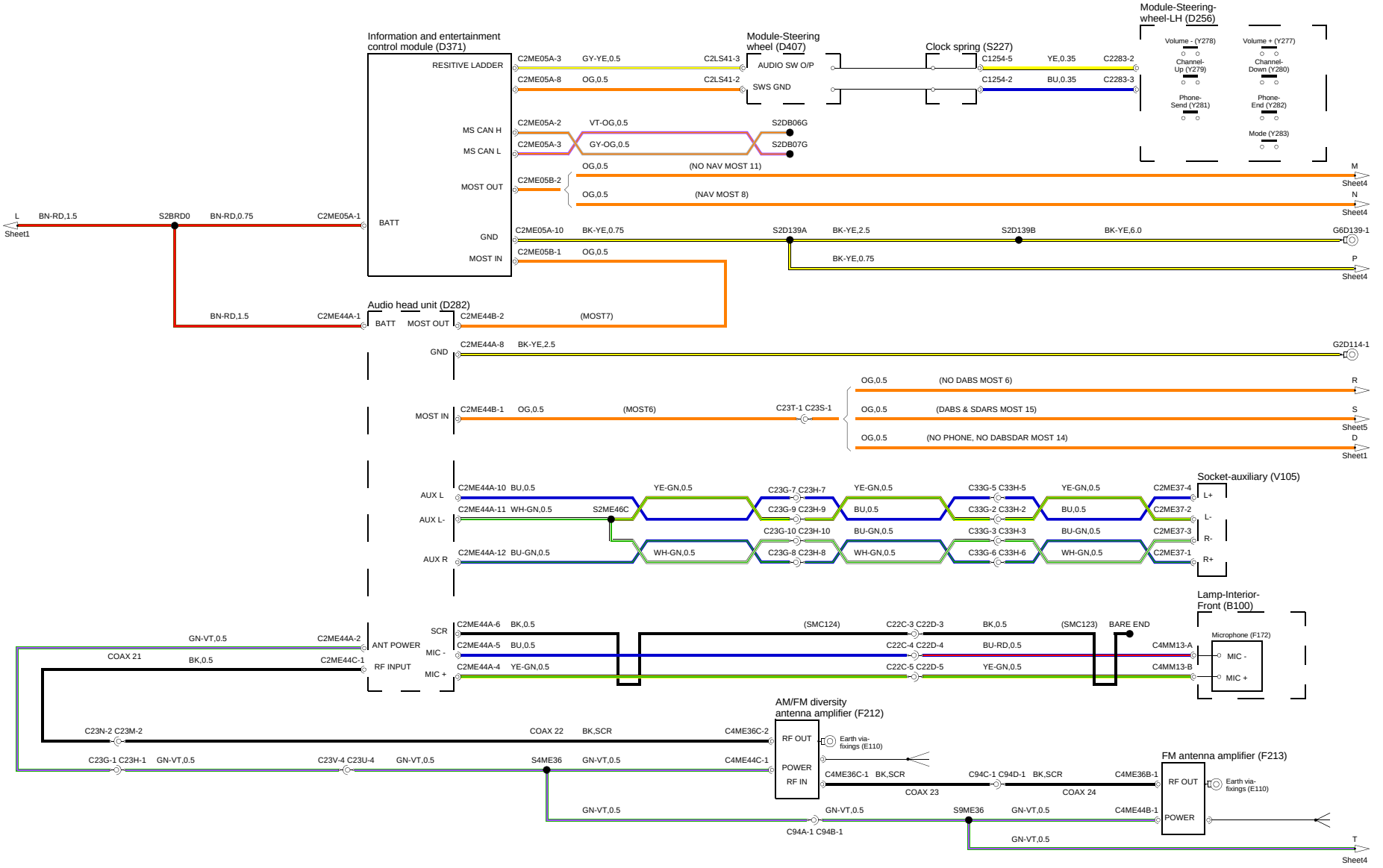

Battery (P100)
RD,35.0 (DIESEL)
RD,35.0 (PETROL)
C1DC02F-1
STARTER FUSE
150.0 Amps
12.0 Volts
C1D134B-1
BK,35.0
G1D108A-1
Starter motor (M101)
S1BF01
RD,35.0
C1DC35A-1
Generator (M100)
C1DC16A-1
B+
LIN
C1DC14-1
BU-BN,0.5
C1E109A-92
Engine control-module (ECM) (D131)
LIN
(PETROL)
S1DB04G
WH,0.5
C1E109B-54
HS CAN H
S1DB05G
WH-BU,0.5
C1E109B-41
HS CAN L
Starter motor (M101)
C1DC35A-1
RD,35.0
Generator (M100)
C1DC16-1
B+
LIN
C1DC14-1
BU-BN,0.75
C1E104H-C2
Engine control-module (ECM) (D131)
LIN
(DIESEL)
S1DB04F
WH,0.5
C1E104H-A2
HS CAN H
S1DB05F
WH-BU,0.5
C1E104H-A1
HS CAN L
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
MS CAN H
C1BP02A-49
VT-OG,0.5
S1DB06F
MS CAN L
C1BP02A-50
GY-OG,0.5
S1DB07F
HS CAN H
C1BP02C-47
WH,0.35
S2DB04J
HS CAN L
C1BP02C-48
WH-BU,0.35
S2DB05J
Instrument cluster (D107)
Ignition/no charge warning indicator (J114)
Resistor-Terminating (G171)
C23F-17 C23E-17
VT-OG,0.5
C2MC01A-16
MS CAN H
C23F-18 C23E-18
GY-OG,0.5
C2MC01A-32
MS CAN L

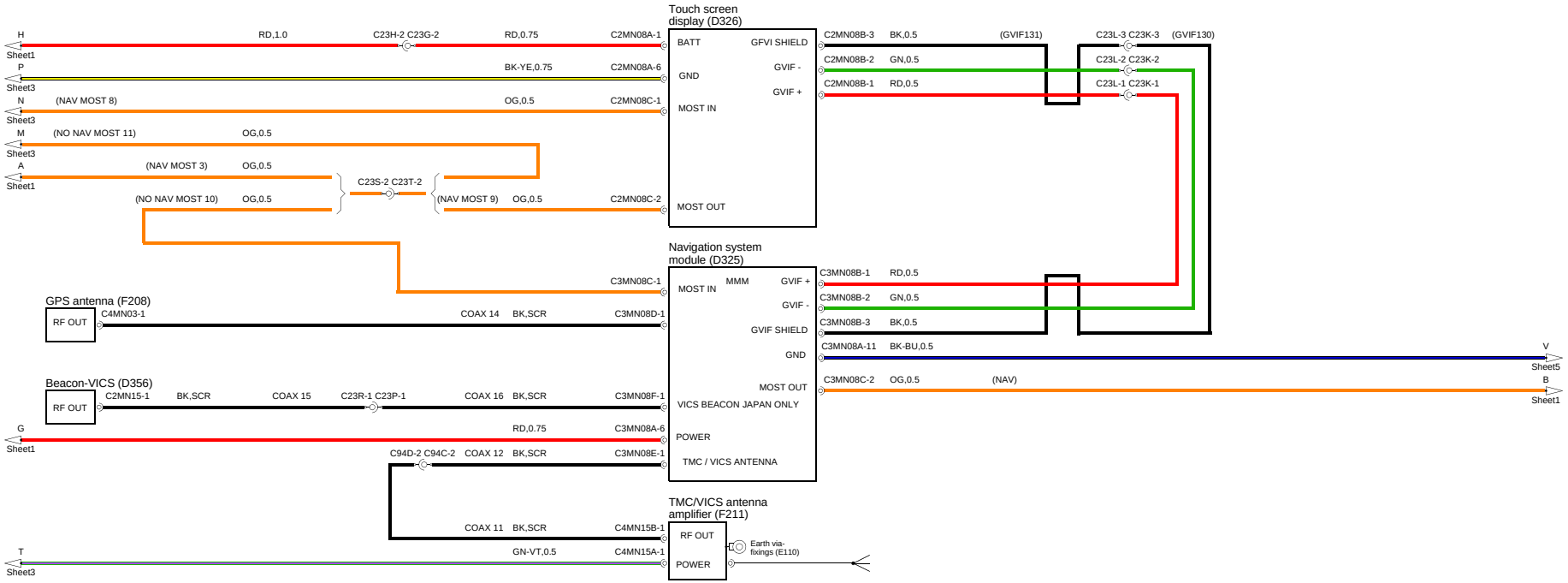

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Junction-box engine (P108)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
Central junction-box (P101)
C1BP02G-1
FS6
C1BP02C-64
BN-RD,1.5
C2ME03A-11
15.0 Amps
Audio head unit (D282)
SWS
GND
VBATT
MS CAN H
MS CAN L
ANTENNA POWER
AUX R
COAX
AUX GND
POWER GND
AUX L
DIAGNOSTIC GND
Module-Steering wheel (D407)
AUDIO SW O/P
SWS GND
Clock spring (S227)
Module-Steering-wheel-LH (D256)
Volume - (Y278)
Volume + (Y277)
Channel-Up (Y279)
Channel-Down (Y280)
Phone-Send (Y281)
Phone-End (Y282)
Mode (Y283)
C2ME03A-18
GY-YE,0.5
C2LS41-3
C2ME03A-7
OG,0.5
C2LS41-2
C1254-5
YE,0.35
C2283-2
C1254-2
BU,0.35
C2283-3
C2ME03A-9
VT-OG,0.5
S2DB06G
C2ME03A-10
GY-OG,0.5
S2DB07G
AM/FM antenna (F206)
C2ME03A-12
GN-VT,0.5
C23G-1 C23H-1
C4ME44A-1
C2ME03C-1
BK,0.5
(COAX2)
C23N-1 C23M-1
(COAX3)
BK,SCR
C4ME36A-1
Earth via fixings (E110)
WH-GN,0.5
C2ME03B-7
BU-GN,0.5
S2ME46
YE-GN,0.5
C2ME03B-6
BU,0.5
YE-GN,0.5
C2ME03B-8
C2ME03A-1
BK-YE,1.5
G2D114-1
C2ME03B-12
BK-YE,1.0
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
Socket-auxiliary (V105)
C23G-7 C23H-7
YE-GN,0.5
C33G-5 C33H-5
C2ME37-4
C23G-9 C23H-9
BU,0.5
C33G-2 C33H-2
C2ME37-2
C23G-10 C23H-10
BU-GN,0.5
C33G-3 C33H-3
C2ME37-3
C23G-8 C23H-8
WH-GN,0.5
C33G-6 C33H-6
C2ME37-1
L+
L-
R-
R+

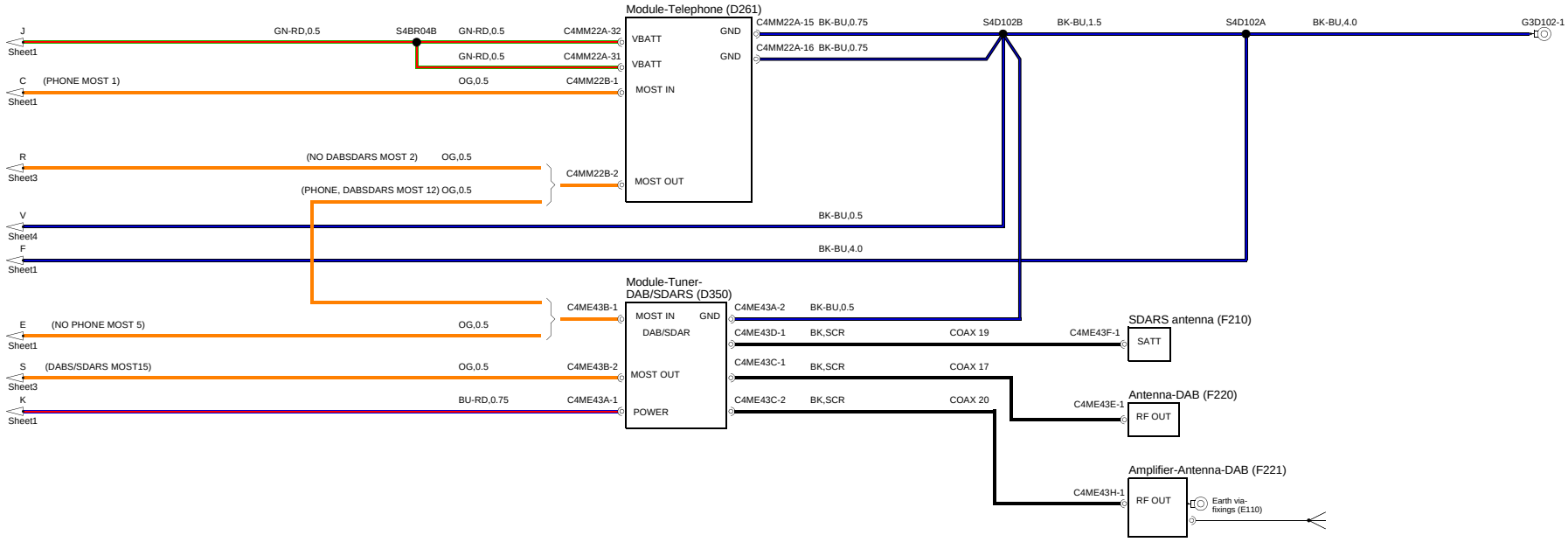

Audio head unit (D282)
SPK-FR-RH +
SPK-FR-RH -
C2ME03A-16
C2ME03A-15
YE-OG,1.0
VT-OG,1.0
C23G-15 C23H-15
C23G-16 C23H-16
BU-WH,1.5
GN-WH,1.5
S3ME28B
S3ME28A
BU-WH,1.0
GN-WH,1.0
C26A-13 C26B-13
C26A-12 C26B-12
WH-OG,0.75
WH-VT,0.75
C6ME10A-1
C6ME10A-4
Speaker-Door-Front-RH (F107)
YE-OG,0.5
VT-OG,0.5
C26A-5 C26B-5
C26A-7 C26B-7
YE-OG,0.5
VT-OG,0.5
C6ME11A-1
C6ME11A-3
Front Tweeter-RH (F109)
SPK-FR-LH +
SPK-FR-LH -
C2ME03A-14
C2ME03A-13
GY-OG,1.0
GN-OG,1.0
C23G-11 C23H-11
C23G-12 C23H-12
GY-OG,1.5
GN-OG,1.5
S3ME08A
S3ME08B
BN-GN,1.0
BN-VT,1.0
C25A-13 C25B-13
C25A-12 C25B-12
WH-BN,0.75
WH,0.75
C5ME07A-1
C5ME07A-4
Speaker-Door-Front-LH (F108)
GY-OG,0.5
GN-OG,0.5
C25A-5 C25B-5
C25A-7 C25B-7
GY-OG,0.5
GN-OG,0.5
C5ME08A-1
C5ME08A-3
Front Tweeter-LH (F110)
SPK-RR-RH +
SPK-RR-RH -
C2ME03A-5
C2ME03A-6
BN-BU,1.0
BN-WH,1.0
C23G-6 C23H-6
C23G-5 C23H-5
BN-BU,1.5
BN-WH,1.5
S3ME12B
S3ME12A
BN-BU,1.0
BN-WH,1.0
C28A-1 C27B-1
C28A-2 C27B-2
BN-YE,0.75
WH-GN,0.75
C7ME09A-1
C7ME09A-4
Speaker-Door-Rear-RH (F118)
SPK-RR-LH +
SPK-RR-LH -
C2ME03A-3
C2ME03A-4
BN-YE,1.0
WH-GN,1.0
C23G-13 C23H-13
C23G-14 C23H-14
BN-YE,1.5
WH-GN,1.5
S3ME09A
S3ME09B
BN-YE,1.0
WH-GN,1.0
C27A-1 C27B-1
C27A-2 C27B-2
BN-YE,0.75
WH-GN,0.75
C7ME09A-1
C7ME09A-4
Speaker-Door-Rear-LH (F119)

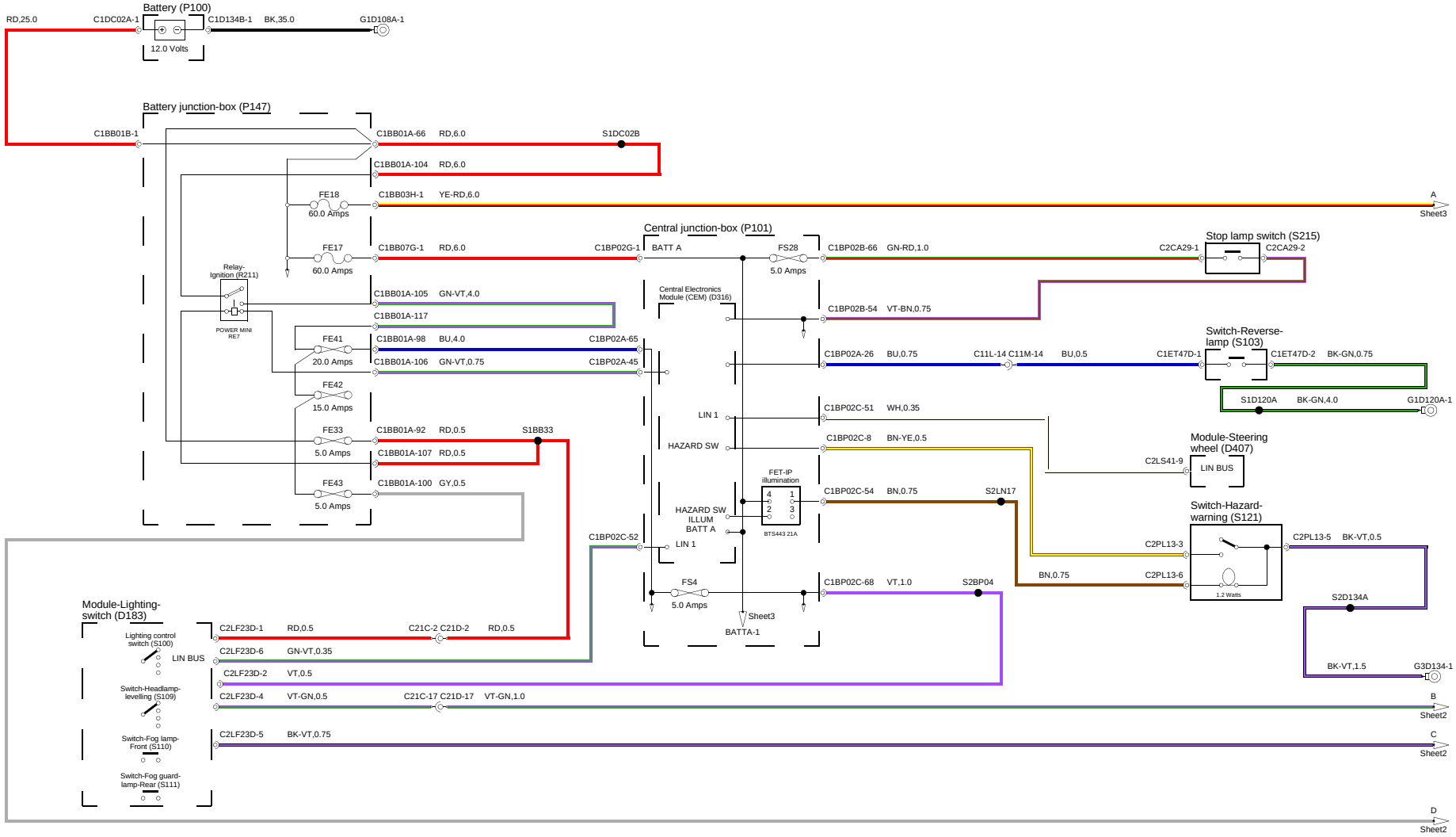

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE21
C1BB03L-1
GY-RD,6.0
C12F-1 C12E-1
60.0 Amps
GY-RD,6.0
Amplifier-power (F142)
C4ME27B-13 OG-WH,0.5
C4ME27B-1 OG-BN,0.5
C4ME27B-2 OG-BN,0.5
C4ME27B-16 OG-YE,0.5
C4ME27B-15 OG-BU,0.5
S3A275
OG-BU,0.5
C3ME25-5
C3ME25-6
C3ME25-7
C3ME25-2
C3ME25-3
LH headphone unit (D334)
AUDIO -
LH AUDIO +
RH AUDIO +
REMOTE CTRL +VE
REMOTE CTRL -VE
OG-BU,0.5
C3ME26-3
RH headphone unit (D335)
REMOTE CTRL -VE
C4ME27B-14 OG-WH,0.5
C4ME27B-3 OG-BN,0.5
C4ME27B-4 OG-BN,0.5
C4ME27B-17 OG-YE,0.5
C3ME26-5
C3ME26-6
C3ME26-7
C3ME26-2
AUDIO -
LH AUDIO +
RH AUDIO +
REMOTE CTRL +VE
MOST IN
C4ME27C-1
OG,0.5
(NO NAV MOST 10)
A
Sheet4
OG,0.5
(NAV MOST 17)
B
Sheet4
MOST OUT
C4ME27C-2
OG,0.5
(PHONE MOST1)
C
Sheet5
OG,0.5
(NO PHONE, NO DAB MOST 14)
D
Sheet3
OG,0.5
(NO PHONE MOST 5)
E
Sheet5
BATT
GND
C4ME27D-1
C4ME27D-2
BK-BU,4.0
F
Sheet5
Auxiliary junction box (P107)
C4BR02G-33
RD1 RING BREAK
RD,4.0
C4ME27D-1
S4BB21 GY-RD,4.0
C4BR02G-30
GY-RD,4.0
C4BR02G-17
FD9
30.0 Amps
C4BR02G-21
RD,4.0
C23V-1 C23U-1
GY-RD,4.0
C4BR02G-1
FD1
10.0 Amps
C4BR02G-5
RD,1.0
S3RD04C
RD,1.0
C23V-2 C23U-2
RD,0.75
G
Sheet4
RD,1.0
H
Sheet4
FD4
5.0 Amps
C4BR02G-8
GN-RD,0.75
C23V-5 C23U-5
GN-RD,0.5
J
Sheet5
FD3
10.0 Amps
C4BR02G-7
BU-RD,0.75
C23V-6 C23U-6
BU-RD,0.75
K
Sheet5
GY-RD,4.0
C4BR02G-9
FD6
10.0 Amps
C4BR02G-14
BN-RD,1.5
C23H-5 C23G-5
BN-RD,1.5
L
Sheet3

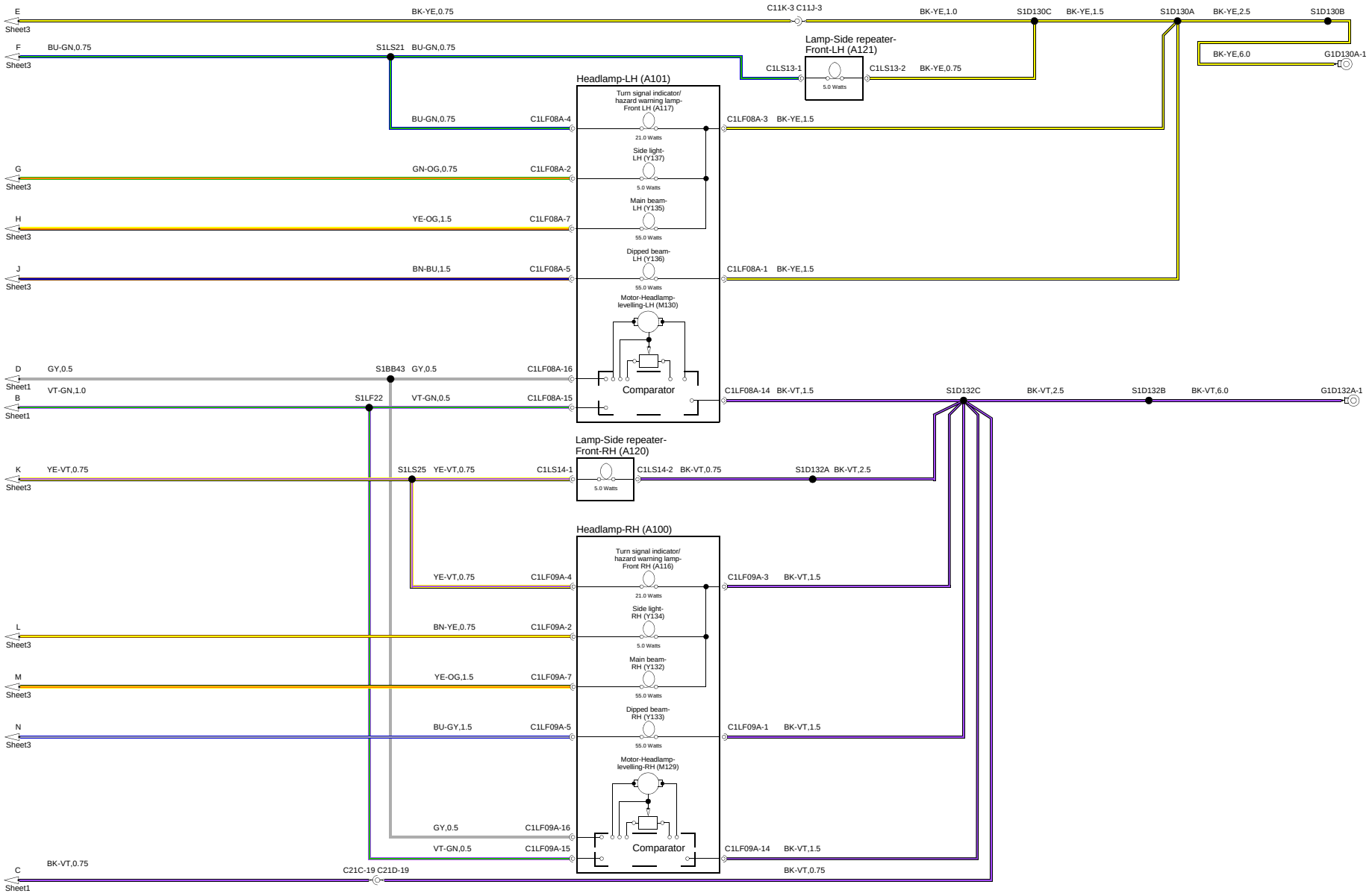

RH rear surround sound speaker (F199)
C4ME40-1 PREMIUM BRANDED BN-BU,0.5 C4ME27E-7
C4ME40-3 PREMIUM BRANDED BN-WH,0.5 C4ME27E-2
LH rear surround sound speaker (F198)
C4ME39-1 PREMIUM BRANDED BN-YE,0.75 C4ME27E-6
C4ME39-3 PREMIUM BRANDED WH-GN,0.75 C4ME27E-1
Sub-woofer (F145)
C4ME23-1 GN-VT,1.5 C4ME27A-10
C4ME23-2 GY,1.5 C4ME27A-2
C4ME23-3 VT,1.5 C4ME27A-16
C4ME23-4 YE,1.5 C4ME27A-8
Center speaker (F187)
C2ME06-1 GY-YE,0.5 C23G-3 C23H-3
C2ME06-3 GN,0.5 C23G-4 C23H-4
PREMIUM BRANDED GN,0.5
PREMIUM BRANDED GY-VT,0.5
C23V-20 C23U-20 GY-YE,0.5 C4ME27E-8
C23V-19 C23U-19 GN,0.5 C4ME27E-3
Amplifier-power (F142)
AUD 4
C4ME27A-11 BU-WH,1.0 C23U-14 C23V-14 BU-WH,1.0 S3ME28B YE-OG,0.5 C26A-5 C26B-5 YE-OG,0.5 C6ME11A-1
C4ME27A-3 GN-WH,1.0 C23U-13 C23V-13 GN-WH,1.0 S3ME28A VT-OG,0.5 C26A-7 C26B-7 VT-OG,0.5 C6ME11A-3
Front Tweeter-RH (F109)
BU-WH,1.5 C23H-15 C23G-15 BU-WH,0.75 C2ME16-1
GN-WH,1.5 C23H-16 C23G-16 GN-WH,0.75 C2ME16-3
Front Speaker-RH (F103)
C4ME27A-13 WH-OG,1.0 C23U-16 C23V-16 WH-OG,1.0 C26A-13 C26B-13 WH-OG,0.75 C6ME10A-1
C4ME27A-5 WH-VT,1.0 C23U-15 C23V-15 WH-VT,1.0 C26A-12 C26B-12 WH-VT,0.75 C6ME10A-4
Speaker-Door-Front-RH (F107)
C4ME27A-15 BN-BU,1.0 C23U-18 C23V-18 BN-BU,1.0 S3ME12B BN-BU,1.0 C28A-1 C27B-1 BN-YE,0.75 C7ME09A-1
C4ME27A-7 BN-WH,1.0 C23U-17 C23V-17 BN-WH,1.0 S3ME12A BN-WH,1.0 C28A-2 C27B-2 WH-GN,0.75 C7ME09A-4
Speaker-Door-Rear-RH (F118)
VT-WH,0.5 C28A-3 C27B-3 GY-BN,0.5 C7ME39A-1
BU-WH,0.5 C28A-4 C27B-4 GN-BN,0.5 C7ME39A-3
Tweeter-Rear-RH (F219)
C4ME27A-9 GY-OG,1.0 C23U-7 C23V-7 GY-OG,1.0 S3ME08A GY-OG,0.5 C25A-5 C25B-5 GY-OG,0.5 C5ME08A-1
C4ME27A-1 GN-OG,1.0 C23U-21 C23V-21 GN-OG,1.0 S3ME08B GN-OG,0.5 C25A-7 C25B-7 GN-OG,0.5 C5ME08A-3
Front Tweeter-LH (F110)
GY-OG,1.5 C23H-11 C23G-11 BN-GN,0.75 C2ME15-1
GN-OG,1.5 C23H-12 C23G-12 BN-VT,0.75 C2ME15-3
Front Speaker-LH (F104)
C4ME27A-12 WH-BN,1.0 C23U-9 C23V-9 WH-BN,1.0 C25A-13 C25B-13 WH-BN,0.75 C5ME07A-1
C4ME27A-4 WH,1.0 C23U-10 C23V-10 WH,1.0 C25A-12 C25B-12 WH,0.75 C5ME07A-4
Speaker-Door-Front-LH (F108)
C4ME27A-14 BN-YE,1.0 C23U-11 C23V-11 BN-YE,1.0 S3ME09A BN-YE,1.0 C27A-1 C27B-1 BN-YE,0.75 C7ME09A-1
C4ME27A-6 WH-GN,1.0 C23U-12 C23V-12 WH-GN,1.0 S3ME09B WH-GN,1.0 C27A-2 C27B-2 WH-GN,0.75 C7ME09A-4
Speaker-Door-Rear-LH (F119)
GY-BN,0.5 C27A-3 C27B-3 GY-BN,0.5 C7ME39A-1
GN-BN,0.5 C27A-4 C27B-4 GN-BN,0.5 C7ME39A-3
Tweeter-Rear-LH (F218)

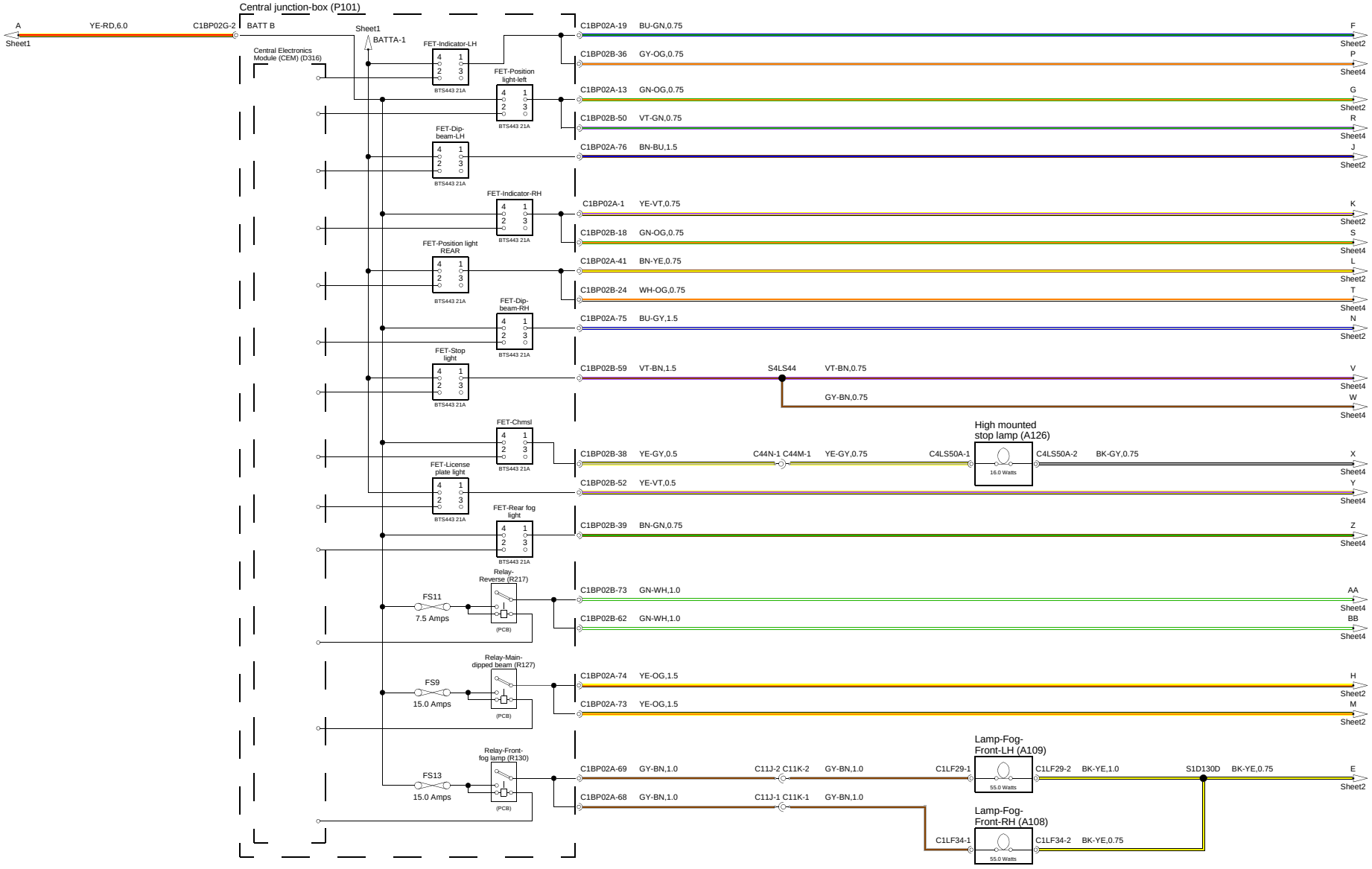

Information and entertainment control module (D371)
RESITIVE LADDER
MS CAN H
MS CAN L
MOST OUT
BATT
GND
MOST IN
Module-Steering wheel (D407)
AUDIO SW O/P
SWS GND
Clock spring (S227)
Module-Steering-wheel-LH (D256)
Volume - (Y278)
Volume + (Y277)
Channel-Up (Y279)
Channel-Down (Y280)
Phone-Send (Y281)
Phone-End (Y282)
Mode (Y283)
C2ME05A-3 GY-YE,0.5 C2LS41-3
C2ME05A-8 OG,0.5 C2LS41-2
C1254-5 YE,0.35 C2283-2
C1254-2 BU,0.35 C2283-3
C2ME05A-2 VT-OG,0.5 S2DB06G
C2ME05A-3 GY-OG,0.5 S2DB07G
C2ME05B-2
OG,0.5 (NO NAV MOST 11) M Sheet4
OG,0.5 (NAV MOST 8) N Sheet4
L BN-RD,1.5 S2BRD0 BN-RD,0.75 C2ME05A-1 Sheet1
C2ME05A-10 BK-YE,0.75 S2D139A BK-YE,2.5 S2D139B BK-YE,6.0 G6D139-1
BK-YE,0.75 P Sheet4
C2ME05B-1 OG,0.5
Audio head unit (D282)
BN-RD,1.5 C2ME44A-1 BATT MOST OUT C2ME44B-2 (MOST7)
GND C2ME44A-8 BK-YE,2.5 G2D114-1
MOST IN C2ME44B-1 OG,0.5 (MOST6) C23T-1 C23S-1
OG,0.5 (NO DABS MOST 6) R
OG,0.5 (DABS & SDARS MOST 15) S Sheet5
OG,0.5 (NO PHONE, NO DABSDAR MOST 14) D Sheet1
Socket-auxiliary (V105)
AUX L C2ME44A-10 BU,0.5 YE-GN,0.5 C23G-7 C23H-7 YE-GN,0.5 C33G-5 C33H-5 YE-GN,0.5 C2ME37-4 L+
AUX L- C2ME44A-11 WH-GN,0.5 S2ME46C YE-GN,0.5 C23G-9 C23H-9 BU,0.5 C33G-2 C33H-2 BU,0.5 C2ME37-2 L-
C23G-10 C23H-10 BU-GN,0.5 C33G-3 C33H-3 BU-GN,0.5 C2ME37-3 R-
AUX R C2ME44A-12 BU-GN,0.5 WH-GN,0.5 C23G-8 C23H-8 WH-GN,0.5 C33G-6 C33H-6 WH-GN,0.5 C2ME37-1 R+
Lamp-Interior-Front (B100)
SCR C2ME44A-6 BK,0.5 (SMC124) C22C-3 C22D-3 BK,0.5 (SMC123) BARE END
MIC - C2ME44A-5 BU,0.5 C22C-4 C22D-4 BU-RD,0.5 C4MM13-A
MIC + C2ME44A-4 YE-GN,0.5 C22C-5 C22D-5 YE-GN,0.5 C4MM13-B
Microphone (F172)
MIC -
MIC +
GN-VT,0.5 C2ME44A-2 ANT POWER
COAX 21 BK,0.5 C2ME44C-1 RF INPUT
AM/FM diversity antenna amplifier (F212)
C23N-2 C23M-2 COAX 22 BK,SCR C4ME36C-2
RF OUT
Earth via-fixings (E110)
C23G-1 C23H-1 GN-VT,0.5 C23V-4 C23U-4 GN-VT,0.5 S4ME36 GN-VT,0.5 C4ME44C-1
POWER
RF IN
C4ME36C-1 BK,SCR COAX 23 C94C-1 C94D-1 BK,SCR COAX 24 C4ME36B-1
FM antenna amplifier (F213)
RF OUT
Earth via-fixings (E110)
GN-VT,0.5 GN-VT,0.5 C94A-1 C94B-1 S9ME36 GN-VT,0.5 C4ME44B-1
POWER
GN-VT,0.5 T Sheet4

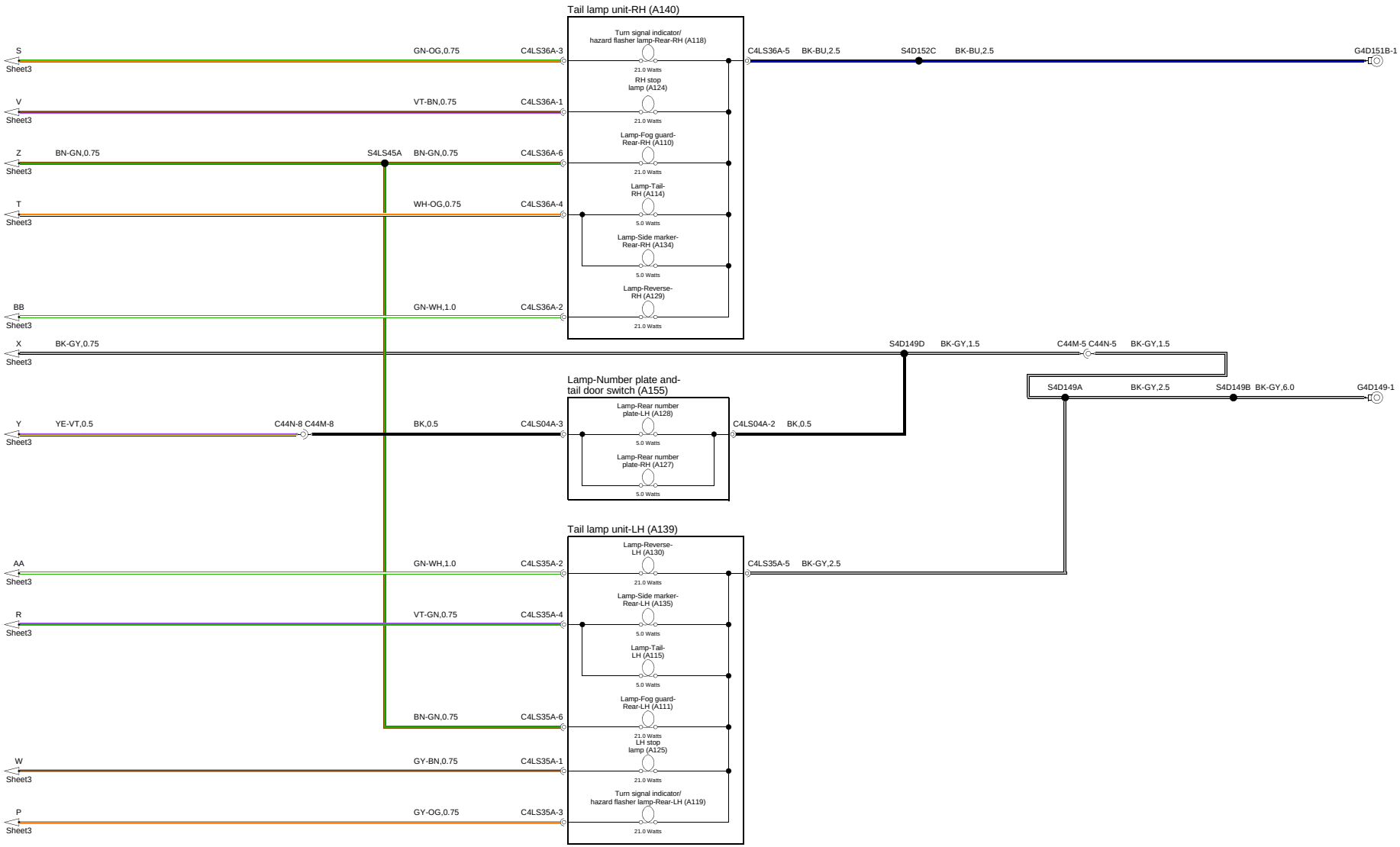

Touch screen display (D326)
BATT
GFVI SHIELD
GND
GVIF -
GVIF +
MOST IN
MOST OUT
Navigation system module (D325)
MOST IN
MMM
GVIF +
GVIF -
GVIF SHIELD
GND
MOST OUT
VICS BEACON JAPAN ONLY
POWER
TMC / VICS ANTENNA
GPS antenna (F208)
RF OUT
Beacon-VICS (D356)
RF OUT
TMC/VICS antenna amplifier (F211)
RF OUT
POWER
Earth via-fixings (E110)
H
Sheet1
P
Sheet3
N
Sheet3
M
Sheet3
A
Sheet1
G
Sheet1
T
Sheet3
V
Sheet5
B
Sheet1
RD,1.0
C23H-2 C23G-2
RD,0.75
C2MN08A-1
BK-YE,0.75
C2MN08A-6
(NAV MOST 8)
OG,0.5
C2MN08C-1
(NO NAV MOST 11)
OG,0.5
(NAV MOST 3)
OG,0.5
C23S-2 C23T-2
(NO NAV MOST 10)
OG,0.5
(NAV MOST 9)
OG,0.5
C2MN08C-2
C3MN08C-1
C4MN03-1
COAX 14
BK,SCR
C3MN08D-1
C2MN15-1
BK,SCR
COAX 15
C23R-1 C23P-1
COAX 16
BK,SCR
C3MN08F-1
RD,0.75
C3MN08A-6
C94D-2 C94C-2
COAX 12
BK,SCR
C3MN08E-1
COAX 11
BK,SCR
C4MN15B-1
GN-VT,0.5
C4MN15A-1
C2MN08B-3
BK,0.5
(GVIF131)
C23L-3 C23K-3
(GVIF130)
C2MN08B-2
GN,0.5
C23L-2 C23K-2
C2MN08B-1
RD,0.5
C23L-1 C23K-1
C3MN08B-1
RD,0.5
C3MN08B-2
GN,0.5
C3MN08B-3
BK,0.5
C3MN08A-11
BK-BU,0.5
C3MN08C-2
OG,0.5
(NAV)

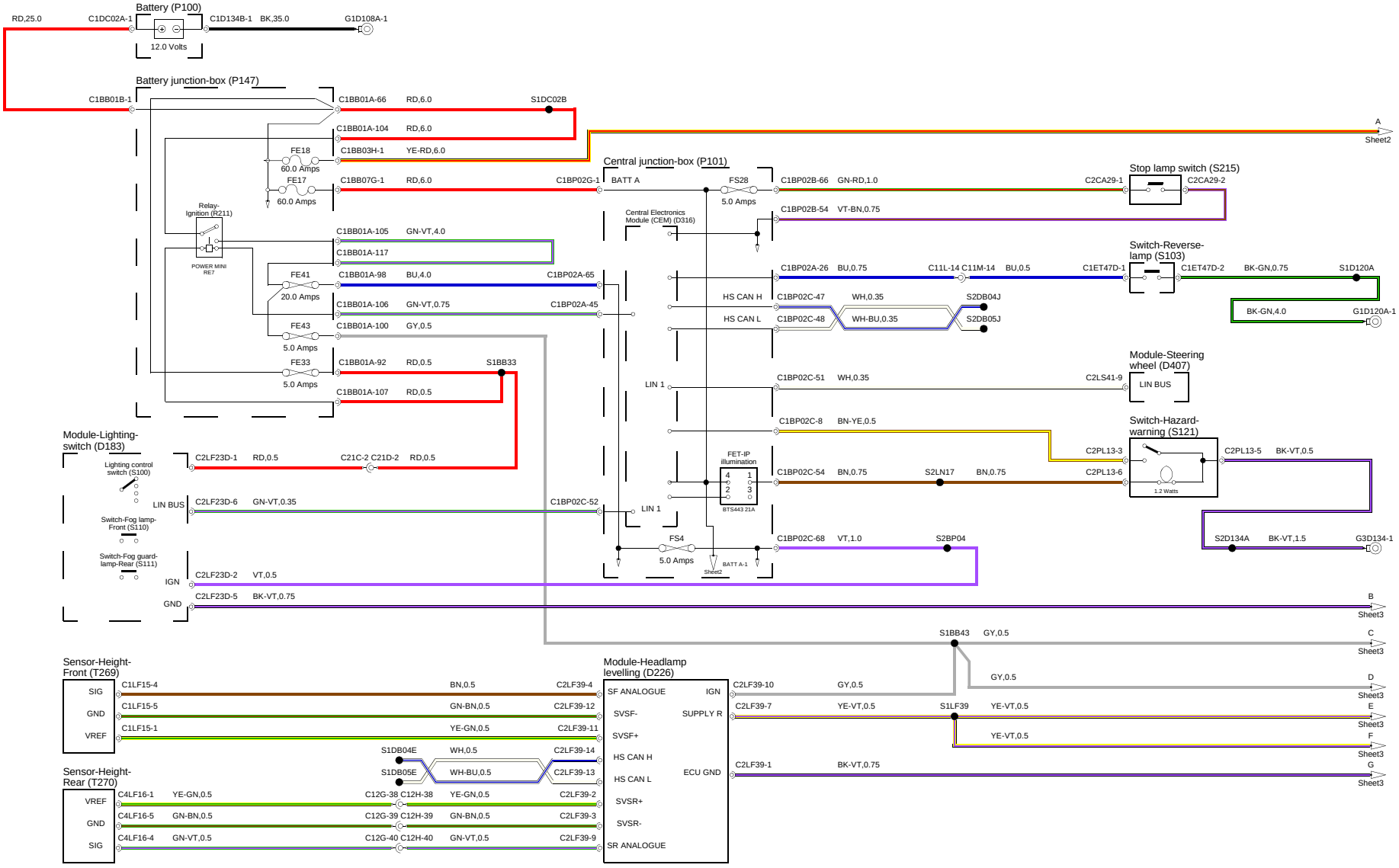

Module-Telephone (D261)
J
Sheet1
GN-RD,0.5
S4BR04B
GN-RD,0.5
C4MM22A-32
GN-RD,0.5
C4MM22A-31
VBATT
VBATT
GND
GND
C4MM22A-15 BK-BU,0.75
C4MM22A-16 BK-BU,0.75
S4D102B
BK-BU,1.5
S4D102A
BK-BU,4.0
G3D102-1
C (PHONE MOST 1)
Sheet1
OG,0.5
C4MM22B-1
MOST IN
R
Sheet3
(NO DABSDARS MOST 2) OG,0.5
C4MM22B-2
MOST OUT
(PHONE, DABSDARS MOST 12) OG,0.5
V
Sheet4
BK-BU,0.5
F
Sheet1
BK-BU,4.0
Module-Tuner-
DAB/SDARS (D350)
C4ME43B-1
MOST IN
GND
DAB/SDAR
C4ME43A-2
BK-BU,0.5
E (NO PHONE MOST 5)
Sheet1
OG,0.5
C4ME43D-1
BK,SCR
COAX 19
C4ME43F-1
SATT
SDARS antenna (F210)
S (DABS/SDARS MOST15)
Sheet3
OG,0.5
C4ME43B-2
MOST OUT
C4ME43C-1
BK,SCR
COAX 17
K
Sheet1
BU-RD,0.75
C4ME43A-1
POWER
C4ME43C-2
BK,SCR
COAX 20
C4ME43E-1
RF OUT
Antenna-DAB (F220)
Amplifier-Antenna-DAB (F221)
C4ME43H-1
RF OUT
Earth via-
fixings (E110)

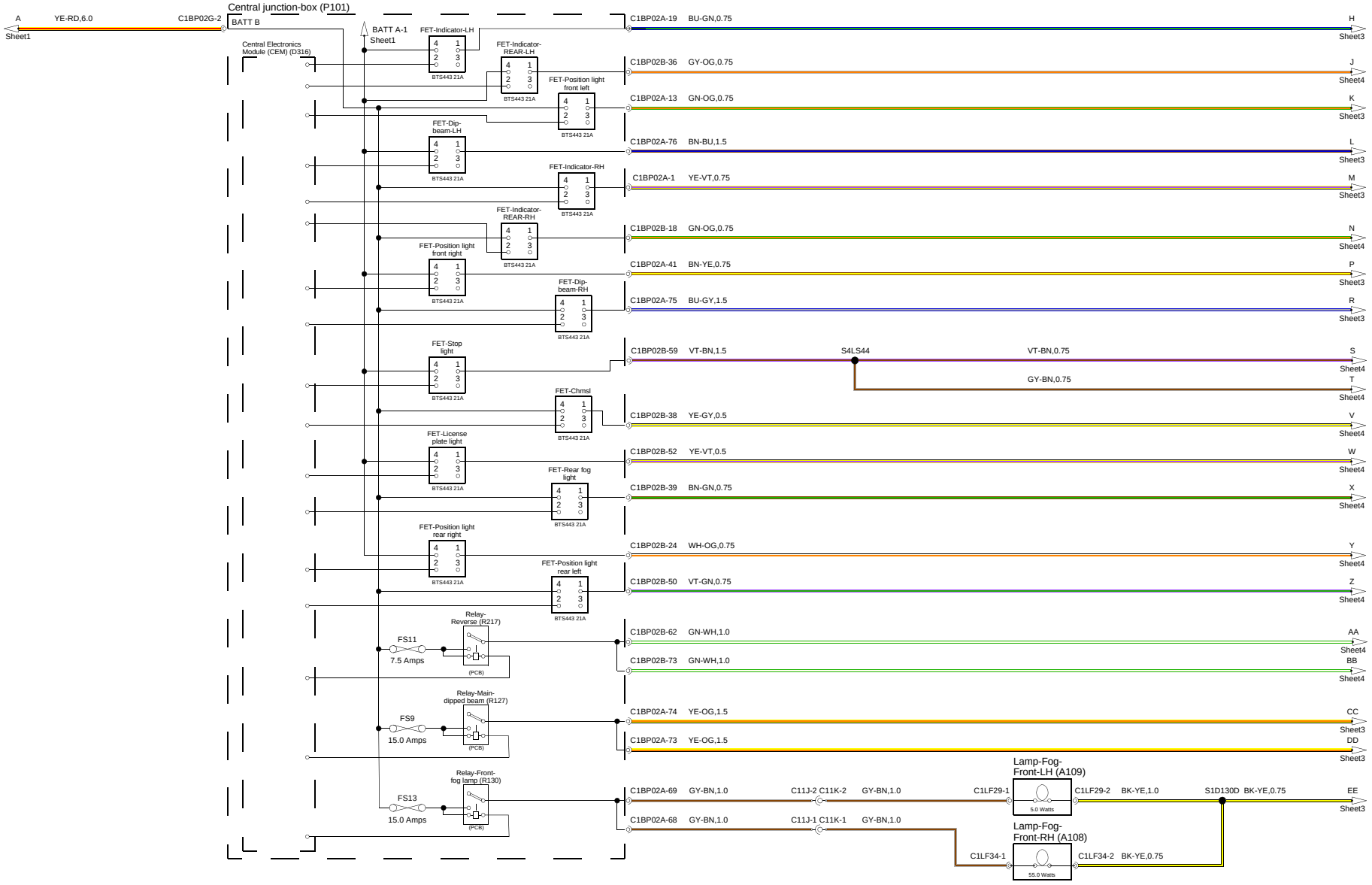

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
C1BB01A-66
RD,6.0
S1DC02B
C1BB01A-104
RD,6.0
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0
A
Sheet3
Central junction-box (P101)
FE17
60.0 Amps
C1BB07G-1
RD,6.0
C1BP02G-1
BATT A
FS28
5.0 Amps
C1BP02B-66
GN-RD,1.0
C2CA29-1
C2CA29-2
Stop lamp switch (S215)
Relay-Ignition (R211)
POWER MINI RE7
C1BB01A-105
GN-VT,4.0
C1BB01A-117
Central Electronics Module (CEM) (D316)
C1BP02B-54
VT-BN,0.75
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BP02A-65
C1BB01A-106
GN-VT,0.75
C1BP02A-45
C1BP02A-26
BU,0.75
C11L-14
C11M-14
BU,0.5
C1ET47D-1
C1ET47D-2
BK-GN,0.75
Switch-Reverse-lamp (S103)
S1D120A
BK-GN,4.0
G1D120A-1
FE42
15.0 Amps
LIN 1
C1BP02C-51
WH,0.35
FE33
5.0 Amps
C1BB01A-92
RD,0.5
S1BB33
C1BB01A-107
RD,0.5
HAZARD SW
C1BP02C-8
BN-YE,0.5
C2LS41-9
LIN BUS
Module-Steering wheel (D407)
FE43
5.0 Amps
C1BB01A-100
GY,0.5
FET-IP illumination
BTS443 21A
C1BP02C-54
BN,0.75
S2LN17
HAZARD SW ILLUM BATT A
C1BP02C-52
LIN 1
C2PL13-3
C2PL13-5
BK-VT,0.5
Switch-Hazard-warning (S121)
1.2 Watts
FS4
5.0 Amps
C1BP02C-68
VT,1.0
S2BP04
BN,0.75
C2PL13-6
S2D134A
Sheet3
BATTA-1
Module-Lighting-switch (D183)
Lighting control switch (S100)
LIN BUS
C2LF23D-1
RD,0.5
C21C-2
C21D-2
RD,0.5
C2LF23D-6
GN-VT,0.35
C2LF23D-2
VT,0.5
BK-VT,1.5
G3D134-1
Switch-Headlamp-levelling (S109)
C2LF23D-4
VT-GN,0.5
C21C-17
C21D-17
VT-GN,1.0
B
Sheet2
Switch-Fog lamp-Front (S110)
C2LF23D-5
BK-VT,0.75
C
Sheet2
Switch-Fog guard-lamp-Rear (S111)
D
Sheet2

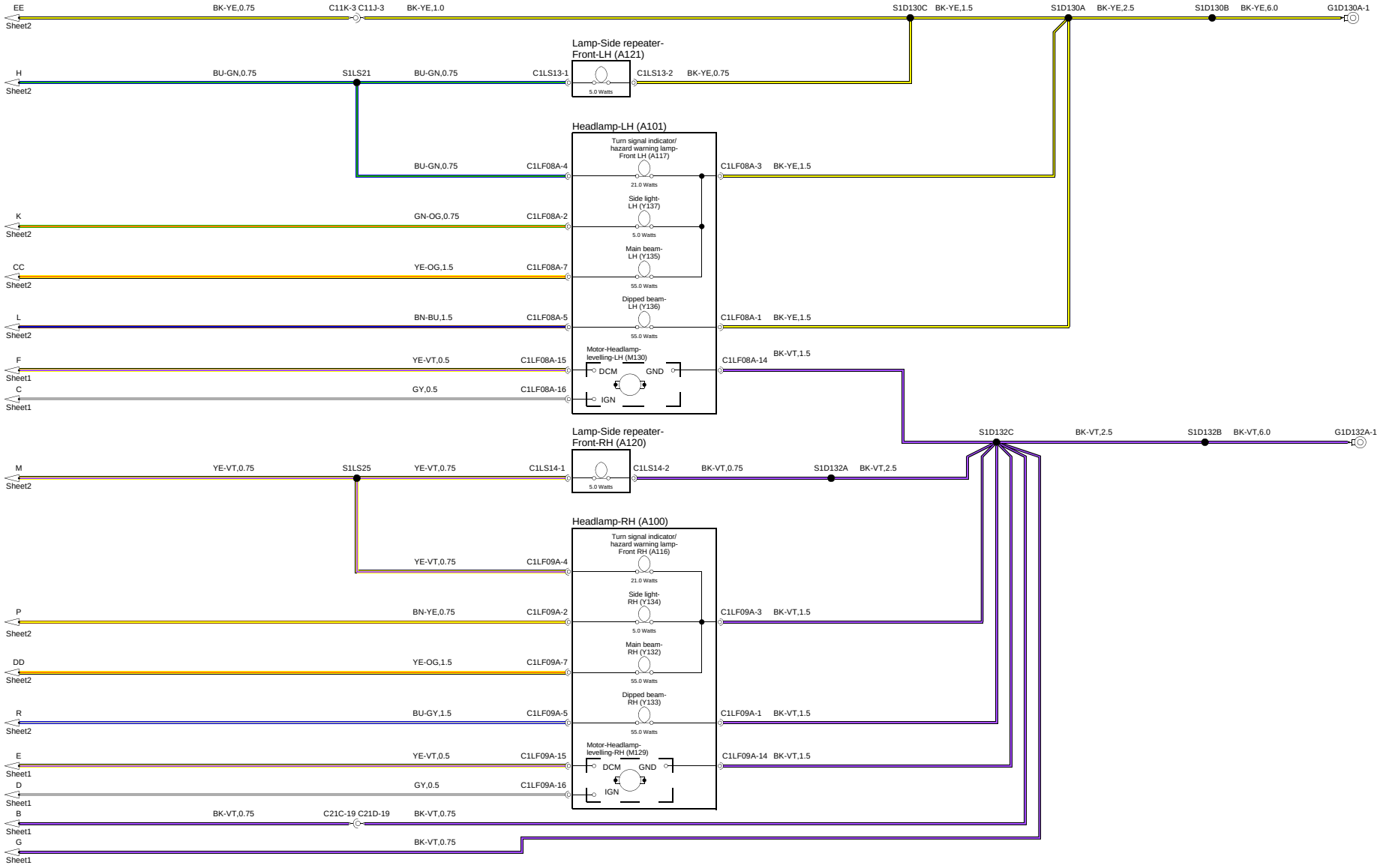

E
Sheet3
BK-YE,0.75
C11K-3 C11J-3
BK-YE,1.0
S1D130C
BK-YE,1.5
S1D130A
BK-YE,2.5
S1D130B
BK-YE,6.0
G1D130A-1
F
Sheet3
BU-GN,0.75
S1LS21
BU-GN,0.75
Lamp-Side repeater-Front-LH (A121)
C1LS13-1
C1LS13-2
BK-YE,0.75
5.0 Watts
Headlamp-LH (A101)
Turn signal indicator/hazard warning lamp-Front LH (A117)
21.0 Watts
BU-GN,0.75
C1LF08A-4
C1LF08A-3
BK-YE,1.5
Side light-LH (Y137)
5.0 Watts
G
Sheet3
GN-OG,0.75
C1LF08A-2
Main beam-LH (Y135)
55.0 Watts
H
Sheet3
YE-OG,1.5
C1LF08A-7
Dipped beam-LH (Y136)
55.0 Watts
J
Sheet3
BN-BU,1.5
C1LF08A-5
C1LF08A-1
BK-YE,1.5
Motor-Headlamp-levelling-LH (M130)
D
Sheet1
GY,0.5
S1BB43
GY,0.5
C1LF08A-16
B
Sheet1
VT-GN,1.0
S1LF22
VT-GN,0.5
C1LF08A-15
Comparator
C1LF08A-14
BK-VT,1.5
S1D132C
BK-VT,2.5
S1D132B
BK-VT,6.0
G1D132A-1
Lamp-Side repeater-Front-RH (A120)
K
Sheet3
YE-VT,0.75
S1LS25
YE-VT,0.75
C1LS14-1
C1LS14-2
BK-VT,0.75
S1D132A
BK-VT,2.5
5.0 Watts
Headlamp-RH (A100)
Turn signal indicator/hazard warning lamp-Front RH (A116)
YE-VT,0.75
C1LF09A-4
C1LF09A-3
BK-VT,1.5
21.0 Watts
Side light-RH (Y134)
L
Sheet3
BN-YE,0.75
C1LF09A-2
5.0 Watts
Main beam-RH (Y132)
M
Sheet3
YE-OG,1.5
C1LF09A-7
55.0 Watts
Dipped beam-RH (Y133)
N
Sheet3
BU-GY,1.5
C1LF09A-5
C1LF09A-1
BK-VT,1.5
55.0 Watts
Motor-Headlamp-levelling-RH (M129)
GY,0.5
C1LF09A-16
VT-GN,0.5
C1LF09A-15
Comparator
C1LF09A-14
BK-VT,1.5
C
Sheet1
BK-VT,0.75
C21C-19 C21D-19
BK-VT,0.75

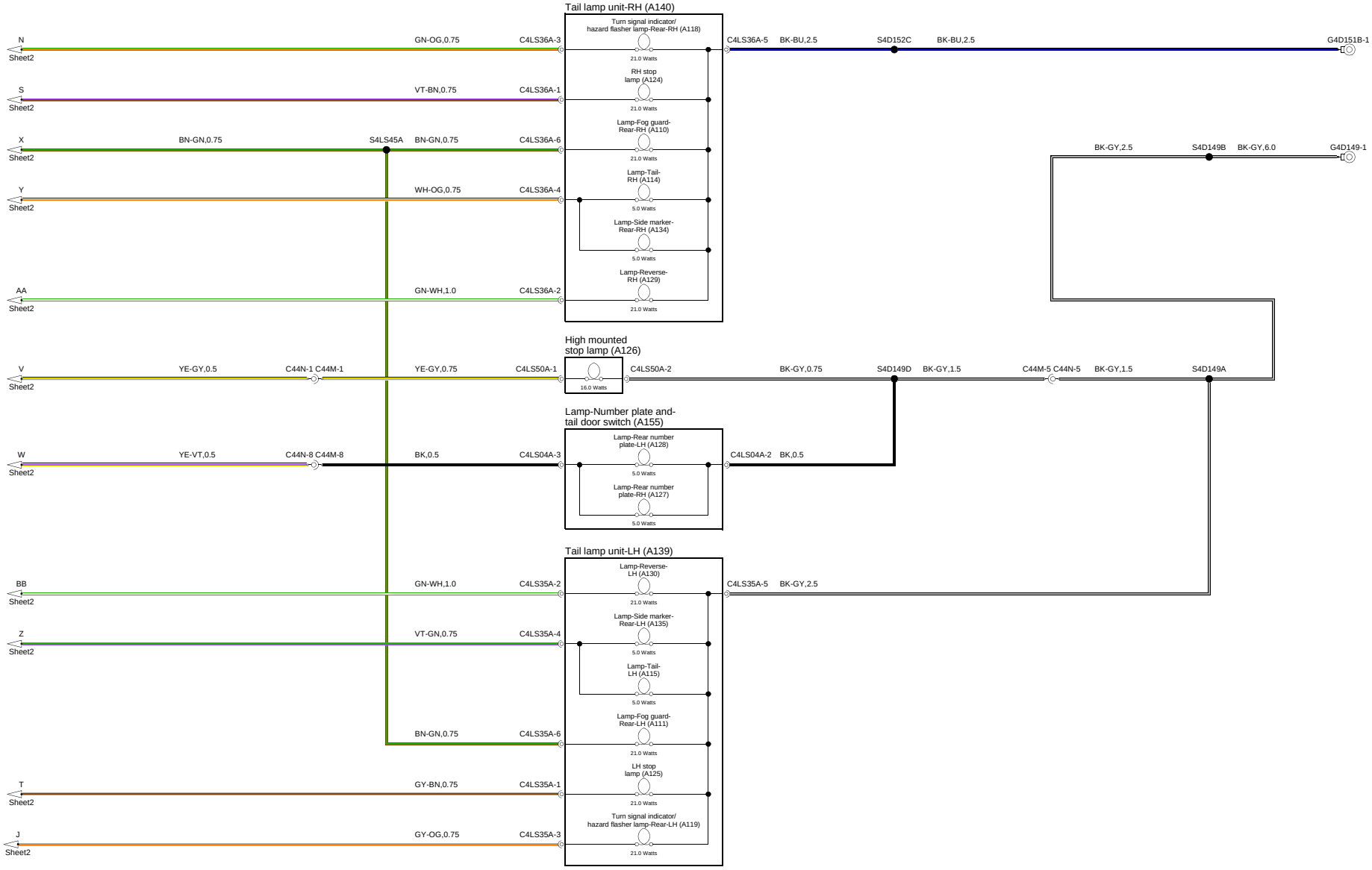

Central junction-box (P101)
A
YE-RD,6.0
C1BP02G-2
BATT B
Sheet1
BATTA-1
Central Electronics Module (CEM) (D316)
FET-Indicator-LH
FET-Position light-left
FET-Dip-beam-LH
FET-Indicator-RH
FET-Position light REAR
FET-Dip-beam-RH
FET-Stop light
FET-Chmsl
FET-License plate light
FET-Rear fog light
BTS443 21A
Relay-Reverse (R217)
FS11
7.5 Amps
Relay-Main-dipped beam (R127)
FS9
15.0 Amps
Relay-Front-fog lamp (R130)
FS13
15.0 Amps
(PCB)
C1BP02A-19 BU-GN,0.75
C1BP02B-36 GY-OG,0.75
C1BP02A-13 GN-OG,0.75
C1BP02B-50 VT-GN,0.75
C1BP02A-76 BN-BU,1.5
C1BP02A-1 YE-VT,0.75
C1BP02B-18 GN-OG,0.75
C1BP02A-41 BN-YE,0.75
C1BP02B-24 WH-OG,0.75
C1BP02A-75 BU-GY,1.5
C1BP02B-59 VT-BN,1.5
S4LS44
VT-BN,0.75
GY-BN,0.75
C1BP02B-38 YE-GY,0.5
C44N-1 C44M-1 YE-GY,0.75
C4LS50A-1
High mounted stop lamp (A126)
16.0 Watts
C4LS50A-2 BK-GY,0.75
C1BP02B-52 YE-VT,0.5
C1BP02B-39 BN-GN,0.75
C1BP02B-73 GN-WH,1.0
C1BP02B-62 GN-WH,1.0
C1BP02A-74 YE-OG,1.5
C1BP02A-73 YE-OG,1.5
C1BP02A-69 GY-BN,1.0
C11J-2 C11K-2 GY-BN,1.0
C1LF29-1
Lamp-Fog-Front-LH (A109)
55.0 Watts
C1LF29-2 BK-YE,1.0
S1D130D BK-YE,0.75
C1BP02A-68 GY-BN,1.0
C11J-1 C11K-1 GY-BN,1.0
C1LF34-1
Lamp-Fog-Front-RH (A108)
C1LF34-2 BK-YE,0.75
Sheet2
Sheet4

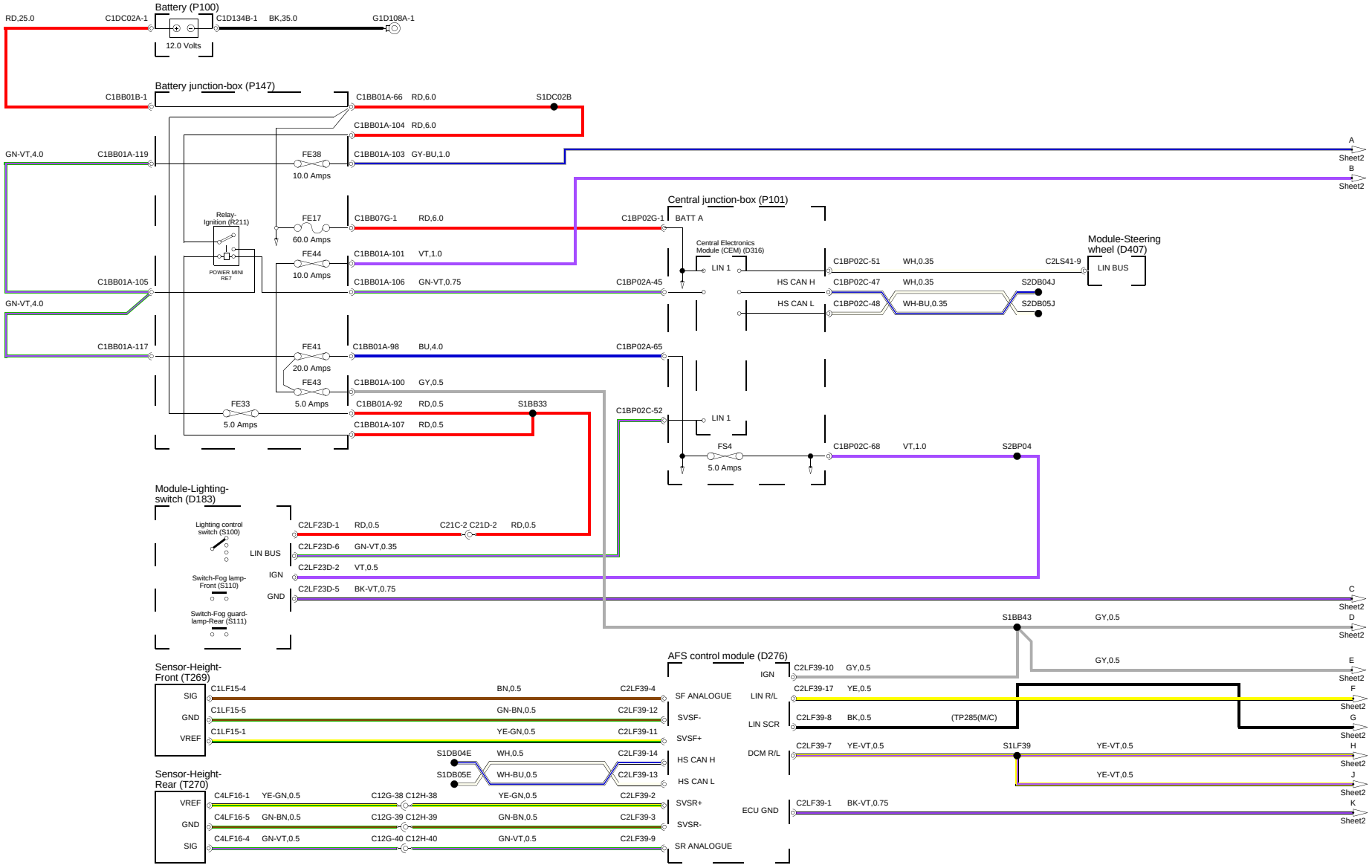

Tail lamp unit-RH (A140)
Turn signal indicator/ hazard flasher lamp-Rear-RH (A118)
RH stop lamp (A124)
Lamp-Fog guard-Rear-RH (A110)
Lamp-Tail-RH (A114)
Lamp-Side marker-Rear-RH (A134)
Lamp-Reverse-RH (A129)
21.0 Watts
5.0 Watts
S
Sheet3
GN-OG,0.75
C4LS36A-3
C4LS36A-5
BK-BU,2.5
S4D152C
BK-BU,2.5
G4D151B-1
V
VT-BN,0.75
C4LS36A-1
Z
BN-GN,0.75
S4LS45A
BN-GN,0.75
C4LS36A-6
T
WH-OG,0.75
C4LS36A-4
BB
GN-WH,1.0
C4LS36A-2
X
BK-GY,0.75
S4D149D
BK-GY,1.5
C44M-5 C44N-5
BK-GY,1.5
S4D149A
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
Lamp-Number plate and-tail door switch (A155)
Lamp-Rear number plate-LH (A128)
Lamp-Rear number plate-RH (A127)
Y
YE-VT,0.5
C44N-8 C44M-8
BK,0.5
C4LS04A-3
C4LS04A-2
BK,0.5
Tail lamp unit-LH (A139)
Lamp-Reverse-LH (A130)
Lamp-Side marker-Rear-LH (A135)
Lamp-Tail-LH (A115)
Lamp-Fog guard-Rear-LH (A111)
LH stop lamp (A125)
Turn signal indicator/ hazard flasher lamp-Rear-LH (A119)
AA
GN-WH,1.0
C4LS35A-2
C4LS35A-5
BK-GY,2.5
R
VT-GN,0.75
C4LS35A-4
BN-GN,0.75
C4LS35A-6
W
GY-BN,0.75
C4LS35A-1
P
GY-OG,0.75
C4LS35A-3

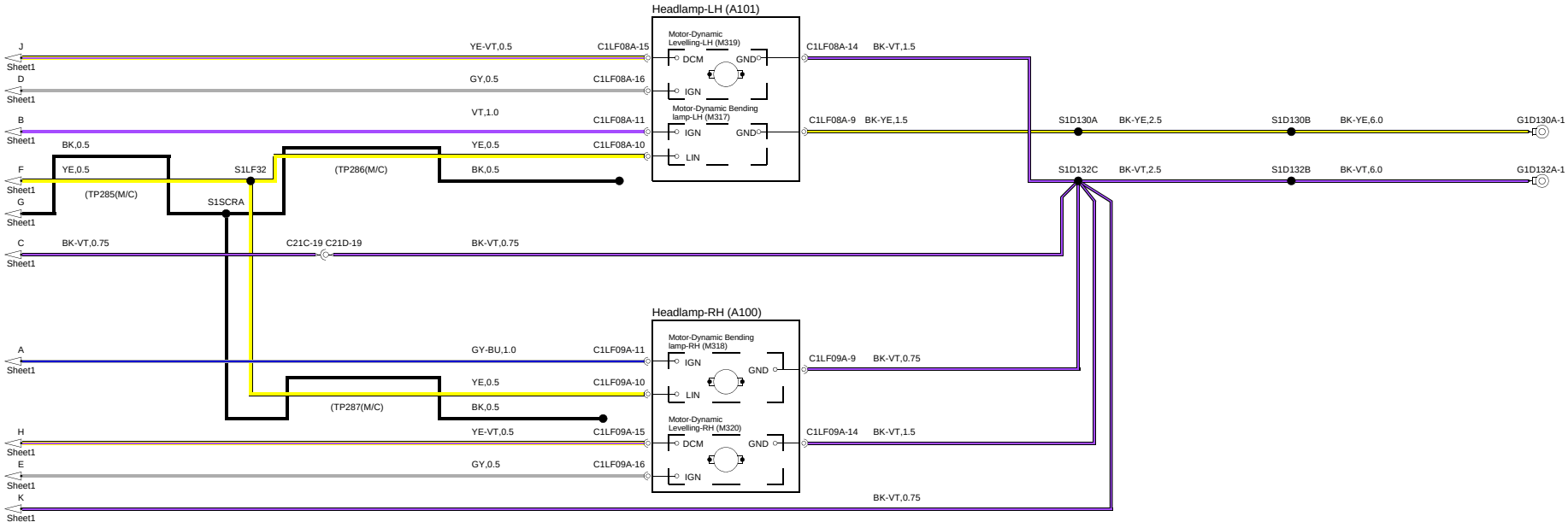

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1 BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
C1BB01A-66 RD,6.0
S1DC02B
C1BB01A-104 RD,6.0
FE18
60.0 Amps
C1BB03H-1 YE-RD,6.0
FE17
60.0 Amps
C1BB07G-1 RD,6.0
C1BP02G-1
Central junction-box (P101)
BATT A
FS28
5.0 Amps
C1BP02B-66 GN-RD,1.0
C2CA29-1
Stop lamp switch (S215)
C2CA29-2
C1BP02B-54 VT-BN,0.75
A
Sheet2
Relay-Ignition (R211)
POWER MINI RE7
C1BB01A-105 GN-VT,4.0
C1BB01A-117
Central Electronics Module (CEM) (D316)
Switch-Reverse-lamp (S103)
FE41
20.0 Amps
C1BB01A-98 BU,4.0
C1BP02A-65
C1BP02A-26 BU,0.75
C11L-14 C11M-14 BU,0.5
C1ET47D-1
C1ET47D-2 BK-GN,0.75
S1D120A
C1BB01A-106 GN-VT,0.75
C1BP02A-45
HS CAN H
C1BP02C-47 WH,0.35
S2DB04J
HS CAN L
C1BP02C-48 WH-BU,0.35
S2DB05J
BK-GN,4.0
G1D120A-1
FE43
5.0 Amps
C1BB01A-100 GY,0.5
FE33
5.0 Amps
C1BB01A-92 RD,0.5
S1BB33
C1BB01A-107 RD,0.5
Module-Steering wheel (D407)
LIN 1
C1BP02C-51 WH,0.35
C2LS41-9
LIN BUS
C1BP02C-8 BN-YE,0.5
Switch-Hazard-warning (S121)
Module-Lighting-switch (D183)
C2LF23D-1 RD,0.5
C21C-2 C21D-2 RD,0.5
C2PL13-3
C2PL13-5 BK-VT,0.5
Lighting control switch (S100)
FET-IP illumination
C1BP02C-54 BN,0.75
S2LN17
BN,0.75
C2PL13-6
1.2 Watts
LIN BUS
C2LF23D-6 GN-VT,0.35
C1BP02C-52
LIN 1
BTS443 21A
Switch-Fog lamp-Front (S110)
S2D134A BK-VT,1.5
G3D134-1
Switch-Fog guard-lamp-Rear (S111)
FS4
5.0 Amps
C1BP02C-68 VT,1.0
S2BP04
BATT A-1
Sheet2
IGN
C2LF23D-2 VT,0.5
GND
C2LF23D-5 BK-VT,0.75
B
Sheet3
S1BB43 GY,0.5
C
Sheet3
Sensor-Height-Front (T269)
Module-Headlamp levelling (D226)
SIG
C1LF15-4
BN,0.5
C2LF39-4
SF ANALOGUE
IGN
C2LF39-10
GY,0.5
GY,0.5
D
Sheet3
GND
C1LF15-5
GN-BN,0.5
C2LF39-12
SVSF-
SUPPLY R
C2LF39-7
YE-VT,0.5
S1LF39
YE-VT,0.5
E
Sheet3
VREF
C1LF15-1
YE-GN,0.5
C2LF39-11
SVSF+
YE-VT,0.5
F
Sheet3
S1DB04E
WH,0.5
C2LF39-14
HS CAN H
S1DB05E
WH-BU,0.5
C2LF39-13
HS CAN L
ECU GND
C2LF39-1
BK-VT,0.75
G
Sheet3
Sensor-Height-Rear (T270)
SVSR+
SVSR-
VREF
C4LF16-1 YE-GN,0.5
C12G-38 C12H-38 YE-GN,0.5
C2LF39-2
GND
C4LF16-5 GN-BN,0.5
C12G-39 C12H-39 GN-BN,0.5
C2LF39-3
SIG
C4LF16-4 GN-VT,0.5
C12G-40 C12H-40 GN-VT,0.5
C2LF39-9
SR ANALOGUE

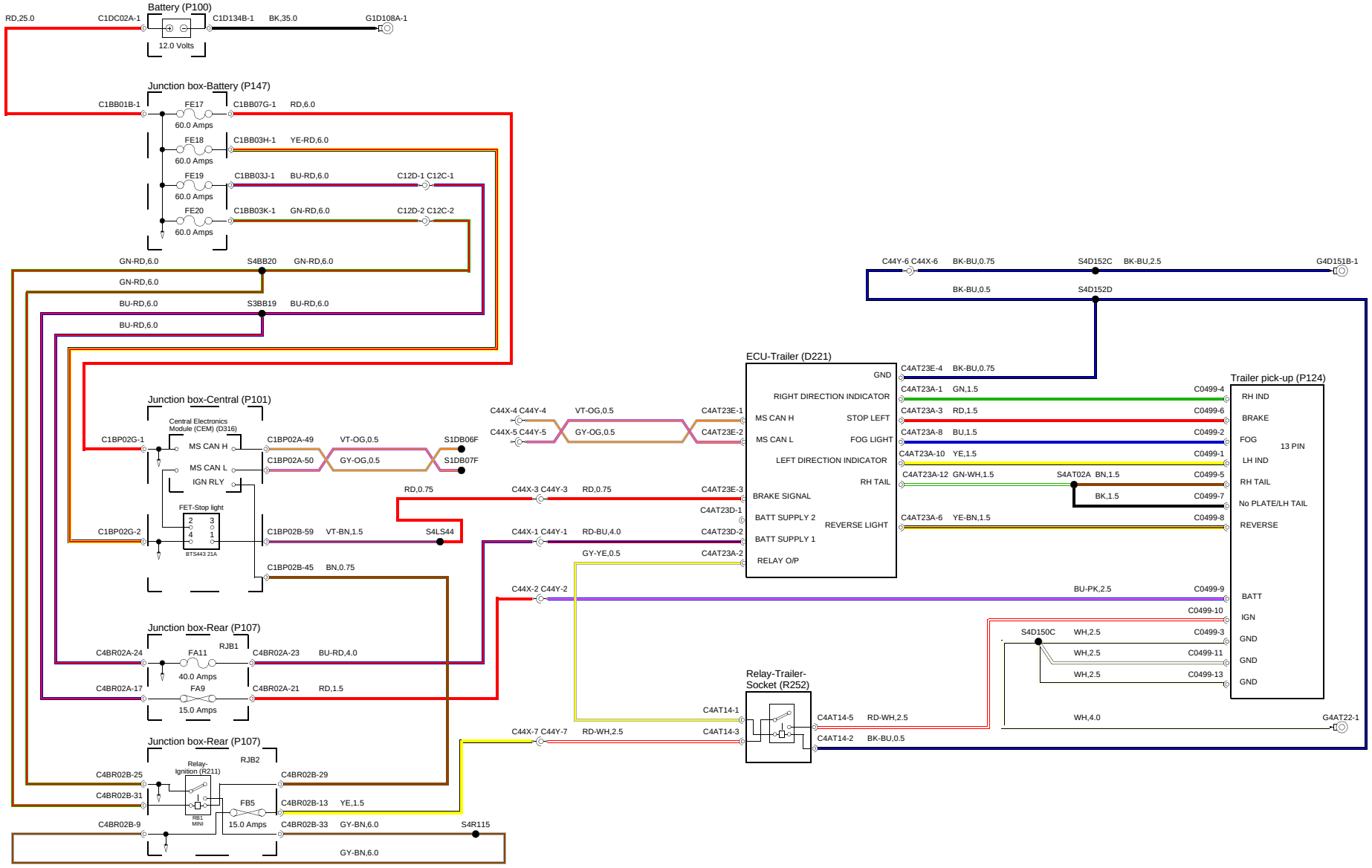

Central junction-box (P101)
A
YE-RD,6.0
C1BP02G-2
BATT B
Sheet1
BATT A-1
Sheet1
Central Electronics Module (CEM) (D316)
FET-Indicator-LH
FET-Indicator-REAR-LH
FET-Position light front left
FET-Dip-beam-LH
FET-Indicator-RH
FET-Indicator-REAR-RH
FET-Position light front right
FET-Dip-beam-RH
FET-Stop light
FET-Chmsl
FET-License plate light
FET-Rear fog light
FET-Position light rear right
FET-Position light rear left
BTS443 21A
Relay-Reverse (R217)
FS11
7.5 Amps
Relay-Main-dipped beam (R127)
FS9
15.0 Amps
Relay-Front-fog lamp (R130)
FS13
15.0 Amps
(PCB)
C1BP02A-19 BU-GN,0.75 H Sheet3
C1BP02B-36 GY-OG,0.75 J Sheet4
C1BP02A-13 GN-OG,0.75 K Sheet3
C1BP02A-76 BN-BU,1.5 L Sheet3
C1BP02A-1 YE-VT,0.75 M Sheet3
C1BP02B-18 GN-OG,0.75 N Sheet4
C1BP02A-41 BN-YE,0.75 P Sheet3
C1BP02A-75 BU-GY,1.5 R Sheet3
C1BP02B-59 VT-BN,1.5 S4LS44 VT-BN,0.75 S Sheet4
GY-BN,0.75 T Sheet4
C1BP02B-38 YE-GY,0.5 V Sheet4
C1BP02B-52 YE-VT,0.5 W Sheet4
C1BP02B-39 BN-GN,0.75 X Sheet4
C1BP02B-24 WH-OG,0.75 Y Sheet4
C1BP02B-50 VT-GN,0.75 Z Sheet4
C1BP02B-62 GN-WH,1.0 AA Sheet4
C1BP02B-73 GN-WH,1.0 BB Sheet4
C1BP02A-74 YE-OG,1.5 CC Sheet3
C1BP02A-73 YE-OG,1.5 DD Sheet3
C1BP02A-69 GY-BN,1.0 C11J-2 C11K-2 GY-BN,1.0 C1LF29-1
Lamp-Fog-Front-LH (A109)
5.0 Watts
C1LF29-2 BK-YE,1.0 S1D130D BK-YE,0.75 EE Sheet3
C1BP02A-68 GY-BN,1.0 C11J-1 C11K-1 GY-BN,1.0 C1LF34-1
Lamp-Fog-Front-RH (A108)
55.0 Watts
C1LF34-2 BK-YE,0.75

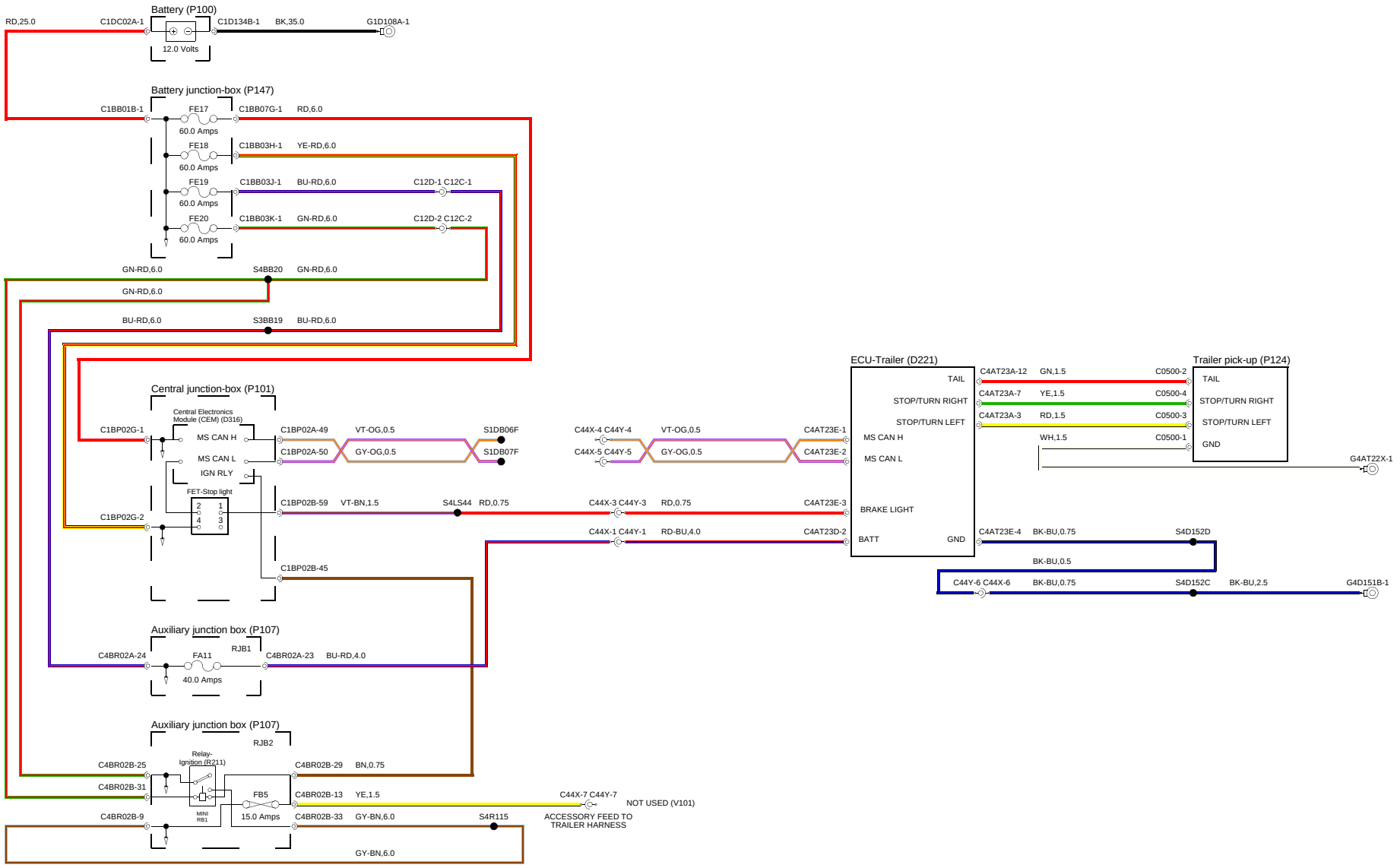

EE
BK-YE,0.75
C11K-3 C11J-3
BK-YE,1.0
S1D130C
BK-YE,1.5
S1D130A
BK-YE,2.5
S1D130B
BK-YE,6.0
G1D130A-1
Sheet2
Lamp-Side repeater-Front-LH (A121)
H
BU-GN,0.75
S1LS21
BU-GN,0.75
C1LS13-1
C1LS13-2
BK-YE,0.75
5.0 Watts
Headlamp-LH (A101)
Turn signal indicator/hazard warning lamp-Front LH (A117)
BU-GN,0.75
C1LF08A-4
C1LF08A-3
BK-YE,1.5
21.0 Watts
Side light-LH (Y137)
K
GN-OG,0.75
C1LF08A-2
5.0 Watts
Main beam-LH (Y135)
CC
YE-OG,1.5
C1LF08A-7
55.0 Watts
Dipped beam-LH (Y136)
L
BN-BU,1.5
C1LF08A-5
C1LF08A-1
BK-YE,1.5
Motor-Headlamp-levelling-LH (M130)
F
YE-VT,0.5
C1LF08A-15
C1LF08A-14
BK-VT,1.5
DCM
GND
C
GY,0.5
C1LF08A-16
IGN
Sheet1
Lamp-Side repeater-Front-RH (A120)
S1D132C
BK-VT,2.5
S1D132B
BK-VT,6.0
G1D132A-1
M
YE-VT,0.75
S1LS25
YE-VT,0.75
C1LS14-1
C1LS14-2
BK-VT,0.75
S1D132A
BK-VT,2.5
Headlamp-RH (A100)
Turn signal indicator/hazard warning lamp-Front RH (A116)
YE-VT,0.75
C1LF09A-4
P
BN-YE,0.75
C1LF09A-2
C1LF09A-3
BK-VT,1.5
Side light-RH (Y134)
Main beam-RH (Y132)
DD
YE-OG,1.5
C1LF09A-7
Dipped beam-RH (Y133)
R
BU-GY,1.5
C1LF09A-5
C1LF09A-1
BK-VT,1.5
Motor-Headlamp-levelling-RH (M129)
E
YE-VT,0.5
C1LF09A-15
C1LF09A-14
BK-VT,1.5
D
GY,0.5
C1LF09A-16
B
BK-VT,0.75
C21C-19 C21D-19
BK-VT,0.75
G
BK-VT,0.75

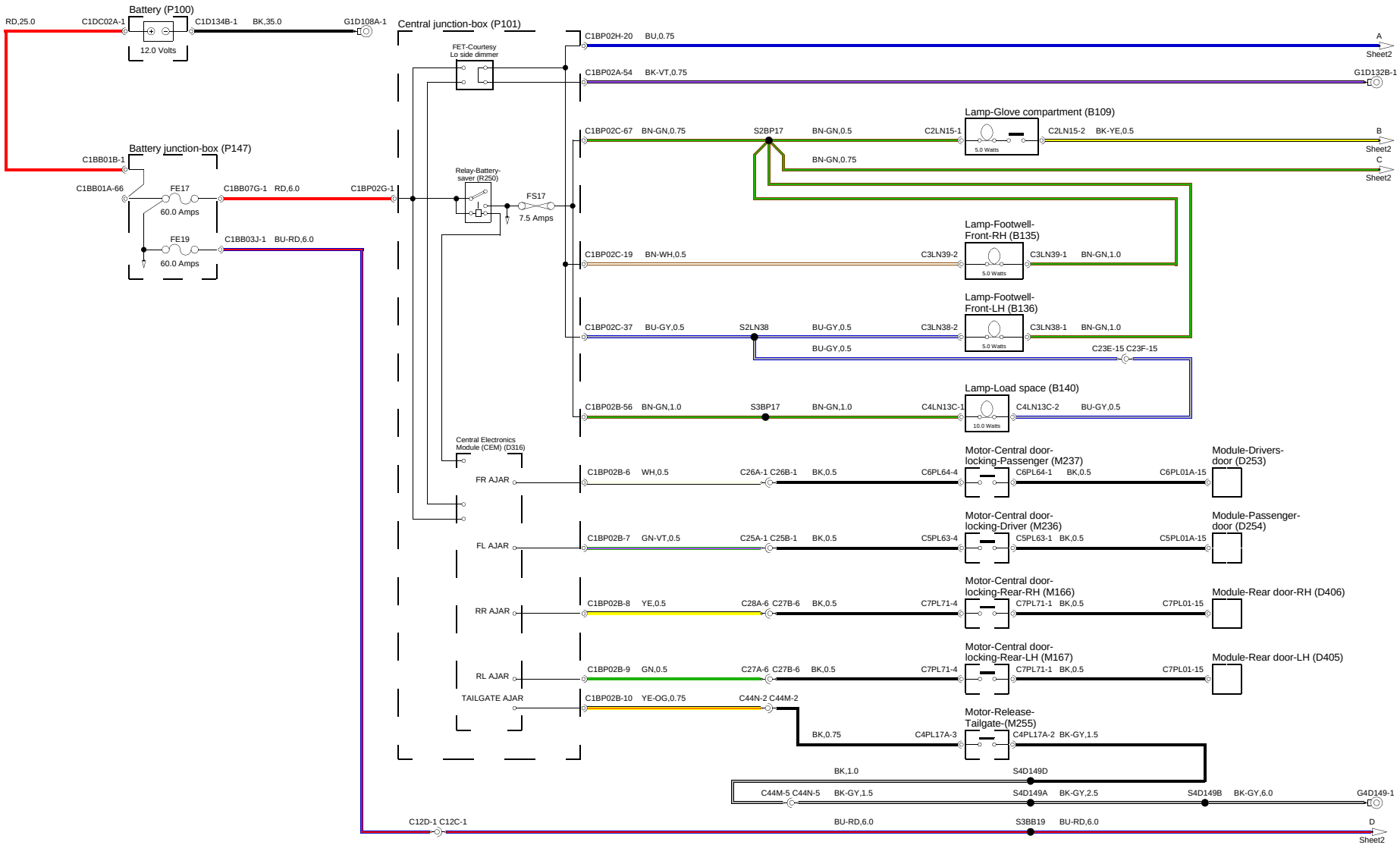

Tail lamp unit-RH (A140)
Turn signal indicator/ hazard flasher lamp-Rear-RH (A118)
21.0 Watts
RH stop lamp (A124)
21.0 Watts
Lamp-Fog guard-Rear-RH (A110)
21.0 Watts
Lamp-Tail-RH (A114)
5.0 Watts
Lamp-Side marker-Rear-RH (A134)
5.0 Watts
Lamp-Reverse-RH (A129)
21.0 Watts
N
S
X
Y
AA
Sheet2
GN-OG,0.75
C4LS36A-3
VT-BN,0.75
C4LS36A-1
BN-GN,0.75
S4LS45A
BN-GN,0.75
C4LS36A-6
WH-OG,0.75
C4LS36A-4
GN-WH,1.0
C4LS36A-2
C4LS36A-5
BK-BU,2.5
S4D152C
BK-BU,2.5
G4D151B-1
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
High mounted stop lamp (A126)
16.0 Watts
V
Sheet2
YE-GY,0.5
C44N-1 C44M-1
YE-GY,0.75
C4LS50A-1
C4LS50A-2
BK-GY,0.75
S4D149D
BK-GY,1.5
C44M-5 C44N-5
BK-GY,1.5
S4D149A
Lamp-Number plate and-tail door switch (A155)
Lamp-Rear number plate-LH (A128)
5.0 Watts
Lamp-Rear number plate-RH (A127)
5.0 Watts
W
Sheet2
YE-VT,0.5
C44N-8 C44M-8
BK,0.5
C4LS04A-3
C4LS04A-2
BK,0.5
Tail lamp unit-LH (A139)
Lamp-Reverse-LH (A130)
21.0 Watts
Lamp-Side marker-Rear-LH (A135)
5.0 Watts
Lamp-Tail-LH (A115)
5.0 Watts
Lamp-Fog guard-Rear-LH (A111)
21.0 Watts
LH stop lamp (A125)
21.0 Watts
Turn signal indicator/ hazard flasher lamp-Rear-LH (A119)
21.0 Watts
BB
Z
T
J
Sheet2
GN-WH,1.0
C4LS35A-2
VT-GN,0.75
C4LS35A-4
BN-GN,0.75
C4LS35A-6
GY-BN,0.75
C4LS35A-1
GY-OG,0.75
C4LS35A-3
C4LS35A-5
BK-GY,2.5

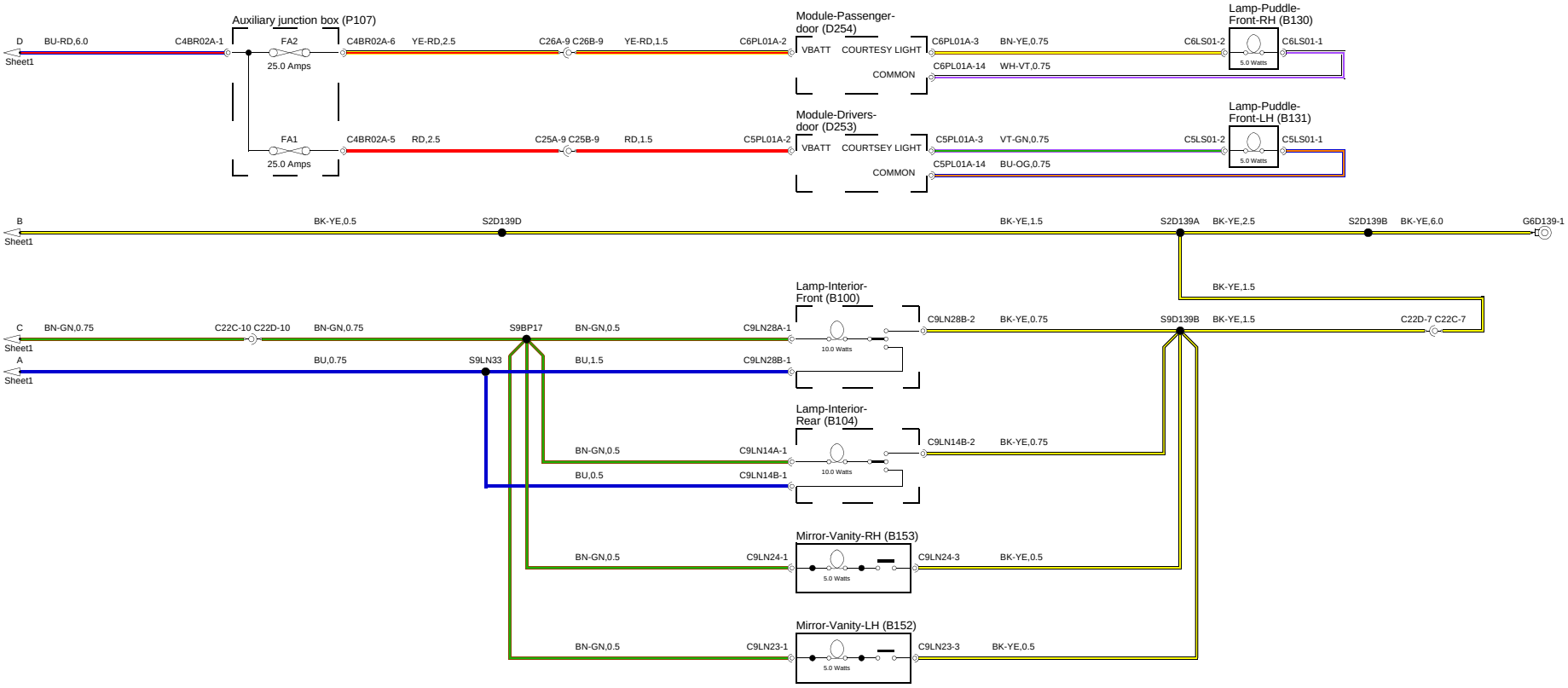

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
C1BB01A-66
RD,6.0
S1DC02B
C1BB01A-104
RD,6.0
GN-VT,4.0
C1BB01A-119
FE38
10.0 Amps
C1BB01A-103
GY-BU,1.0
A
Sheet2
B
Sheet2
Central junction-box (P101)
Relay-Ignition (R211)
POWER MINI RE7
FE17
60.0 Amps
C1BB07G-1
RD,6.0
C1BP02G-1
BATT A
FE44
10.0 Amps
C1BB01A-101
VT,1.0
Central Electronics Module (CEM) (D316)
LIN 1
C1BP02C-51
WH,0.35
C2LS41-9
LIN BUS
Module-Steering wheel (D407)
C1BB01A-105
C1BB01A-106
GN-VT,0.75
C1BP02A-45
HS CAN H
C1BP02C-47
WH,0.35
S2DB04J
GN-VT,4.0
HS CAN L
C1BP02C-48
WH-BU,0.35
S2DB05J
C1BB01A-117
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BP02A-65
FE43
5.0 Amps
C1BB01A-100
GY,0.5
FE33
5.0 Amps
C1BB01A-92
RD,0.5
S1BB33
C1BP02C-52
LIN 1
5.0 Amps
C1BB01A-107
RD,0.5
FS4
C1BP02C-68
VT,1.0
S2BP04
Module-Lighting-switch (D183)
Lighting control switch (S100)
C2LF23D-1
RD,0.5
C21C-2 C21D-2
RD,0.5
LIN BUS
C2LF23D-6
GN-VT,0.35
IGN
C2LF23D-2
VT,0.5
Switch-Fog lamp-Front (S110)
GND
C2LF23D-5
BK-VT,0.75
C
Sheet2
Switch-Fog guard-lamp-Rear (S111)
S1BB43
GY,0.5
D
Sheet2
AFS control module (D276)
GY,0.5
E
Sheet2
Sensor-Height-Front (T269)
IGN
C2LF39-10
GY,0.5
SIG
C1LF15-4
BN,0.5
C2LF39-4
SF ANALOGUE
LIN R/L
C2LF39-17
YE,0.5
F
Sheet2
GND
C1LF15-5
GN-BN,0.5
C2LF39-12
SVSF-
LIN SCR
C2LF39-8
BK,0.5
(TP285(M/C)
G
Sheet2
VREF
C1LF15-1
YE-GN,0.5
C2LF39-11
SVSF+
DCM R/L
C2LF39-7
YE-VT,0.5
S1LF39
YE-VT,0.5
H
Sheet2
S1DB04E
WH,0.5
C2LF39-14
HS CAN H
YE-VT,0.5
J
Sheet2
S1DB05E
WH-BU,0.5
C2LF39-13
HS CAN L
Sensor-Height-Rear (T270)
VREF
C4LF16-1
YE-GN,0.5
C12G-38 C12H-38
YE-GN,0.5
C2LF39-2
SVSR+
ECU GND
C2LF39-1
BK-VT,0.75
K
Sheet2
GND
C4LF16-5
GN-BN,0.5
C12G-39 C12H-39
GN-BN,0.5
C2LF39-3
SVSR-
SIG
C4LF16-4
GN-VT,0.5
C12G-40 C12H-40
GN-VT,0.5
C2LF39-9
SR ANALOGUE

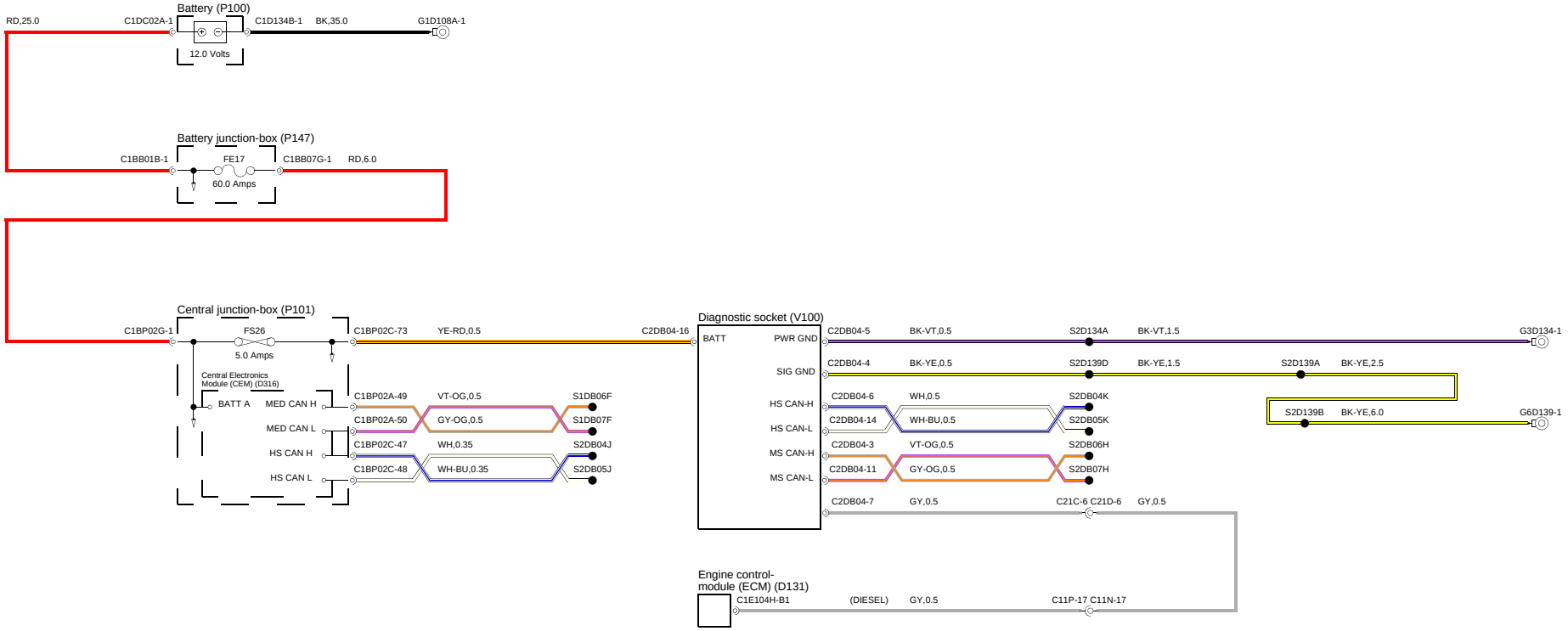

Headlamp-LH (A101)
Motor-Dynamic Levelling-LH (M319)
DCM
GND
IGN
Motor-Dynamic Bending lamp-LH (M317)
IGN
GND
LIN
J
Sheet1
D
Sheet1
B
Sheet1
F
Sheet1
G
Sheet1
C
Sheet1
YE-VT,0.5
C1LF08A-15
GY,0.5
C1LF08A-16
VT,1.0
C1LF08A-11
YE,0.5
C1LF08A-10
BK,0.5
YE,0.5
(TP285(M/C)
S1LF32
S1SCRA
(TP286(M/C)
BK,0.5
BK-VT,0.75
C21C-19 C21D-19
BK-VT,0.75
C1LF08A-14
BK-VT,1.5
C1LF08A-9
BK-YE,1.5
S1D130A
BK-YE,2.5
S1D130B
BK-YE,6.0
G1D130A-1
S1D132C
BK-VT,2.5
S1D132B
BK-VT,6.0
G1D132A-1
Headlamp-RH (A100)
Motor-Dynamic Bending lamp-RH (M318)
IGN
GND
LIN
Motor-Dynamic Levelling-RH (M320)
DCM
GND
IGN
A
Sheet1
H
Sheet1
E
Sheet1
K
Sheet1
GY-BU,1.0
C1LF09A-11
YE,0.5
C1LF09A-10
(TP287(M/C)
BK,0.5
YE-VT,0.5
C1LF09A-15
GY,0.5
C1LF09A-16
BK-VT,0.75
C1LF09A-9
BK-VT,0.75
C1LF09A-14
BK-VT,1.5

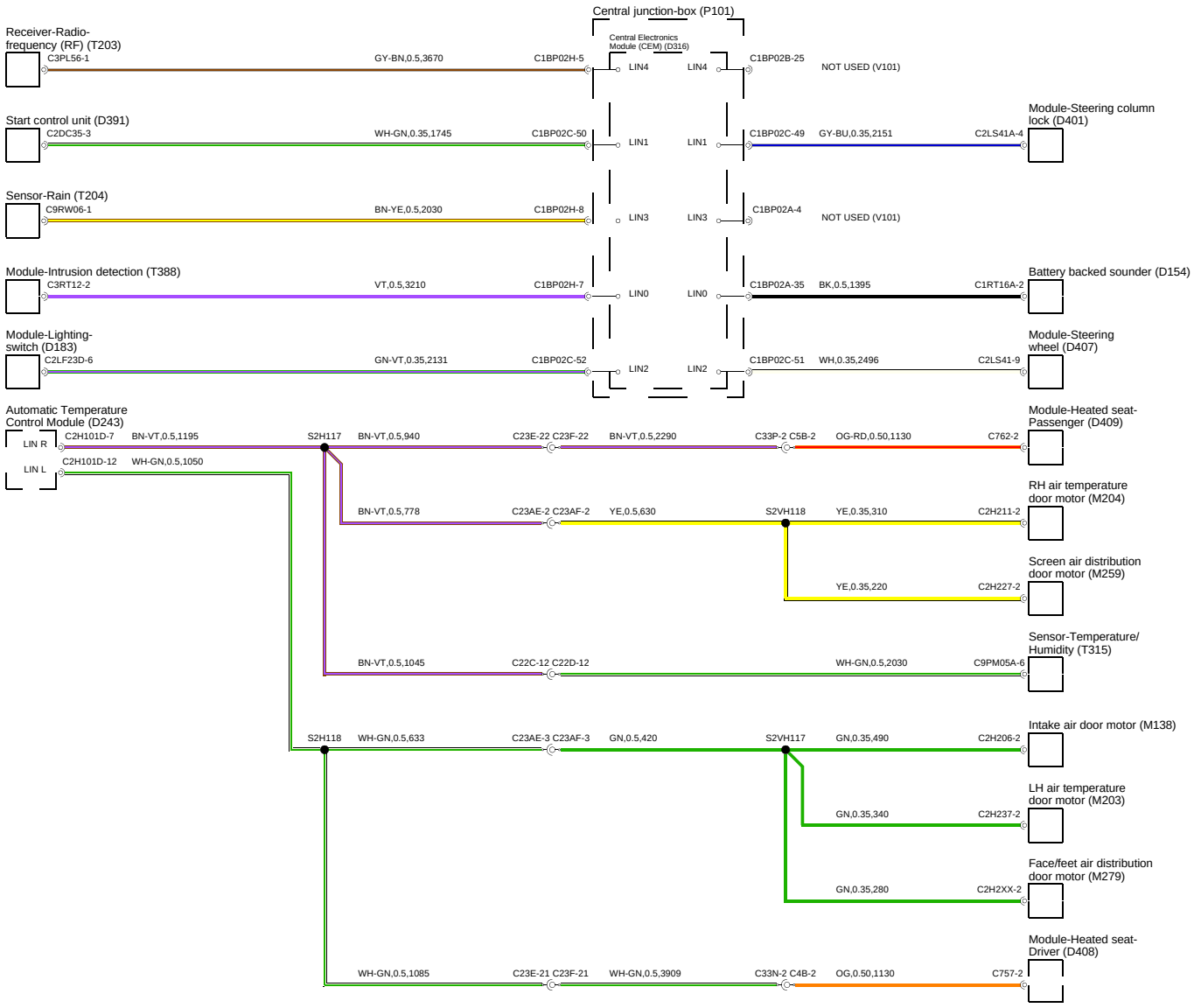

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Junction box-Battery (P147)
C1BB01B-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
FE18
C1BB03H-1
YE-RD,6.0
FE19
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
FE20
C1BB03K-1
GN-RD,6.0
C12D-2 C12C-2
GN-RD,6.0
S4BB20
BU-RD,6.0
S3BB19
Junction box-Central (P101)
Central Electronics Module (CEM) (D316)
C1BP02G-1
MS CAN H
MS CAN L
IGN RLY
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
FET-Stop light
C1BP02G-2
C1BP02B-59
VT-BN,1.5
S4LS44
C1BP02B-45
BN,0.75
RD,0.75
Junction box-Rear (P107)
RJB1
C4BR02A-24
FA11
40.0 Amps
C4BR02A-23
BU-RD,4.0
C4BR02A-17
FA9
15.0 Amps
C4BR02A-21
RD,1.5
Junction box-Rear (P107)
RJB2
Relay-Ignition (R211)
C4BR02B-25
C4BR02B-31
C4BR02B-29
FB5
C4BR02B-13
YE,1.5
C4BR02B-9
15.0 Amps
C4BR02B-33
GY-BN,6.0
S4R115
GY-BN,6.0
C44X-4 C44Y-4
C44X-5 C44Y-5
C4AT23E-1
C4AT23E-2
C44X-3 C44Y-3
C4AT23E-3
C4AT23D-1
C44X-1 C44Y-1
RD-BU,4.0
C4AT23D-2
GY-YE,0.5
C4AT23A-2
C44X-2 C44Y-2
C44X-7 C44Y-7
RD-WH,2.5
C4AT14-1
C4AT14-3
ECU-Trailer (D221)
GND
RIGHT DIRECTION INDICATOR
MS CAN H
STOP LEFT
MS CAN L
FOG LIGHT
LEFT DIRECTION INDICATOR
RH TAIL
BRAKE SIGNAL
BATT SUPPLY 2
REVERSE LIGHT
BATT SUPPLY 1
RELAY O/P
C4AT23E-4
BK-BU,0.75
C4AT23A-1
GN,1.5
C4AT23A-3
RD,1.5
C4AT23A-8
BU,1.5
C4AT23A-10
YE,1.5
C4AT23A-12
GN-WH,1.5
C4AT23A-6
YE-BN,1.5
Relay-Trailer-Socket (R252)
C4AT14-5
RD-WH,2.5
C4AT14-2
BK-BU,0.5
C4Y-6 C44X-6
BK-BU,0.75
S4D152C
BK-BU,2.5
G4D151B-1
BK-BU,0.5
S4D152D
S4A02A
BN,1.5
BK,1.5
BU-PK,2.5
S4D150C
WH,2.5
WH,4.0
G4AT22-1
Trailer pick-up (P124)
13 PIN
RH IND
BRAKE
FOG
LH IND
RH TAIL
No PLATE/LH TAIL
REVERSE
BATT
IGN
GND
C0499-4
C0499-6
C0499-2
C0499-1
C0499-5
C0499-7
C0499-8
C0499-9
C0499-10
C0499-3
C0499-11
C0499-13

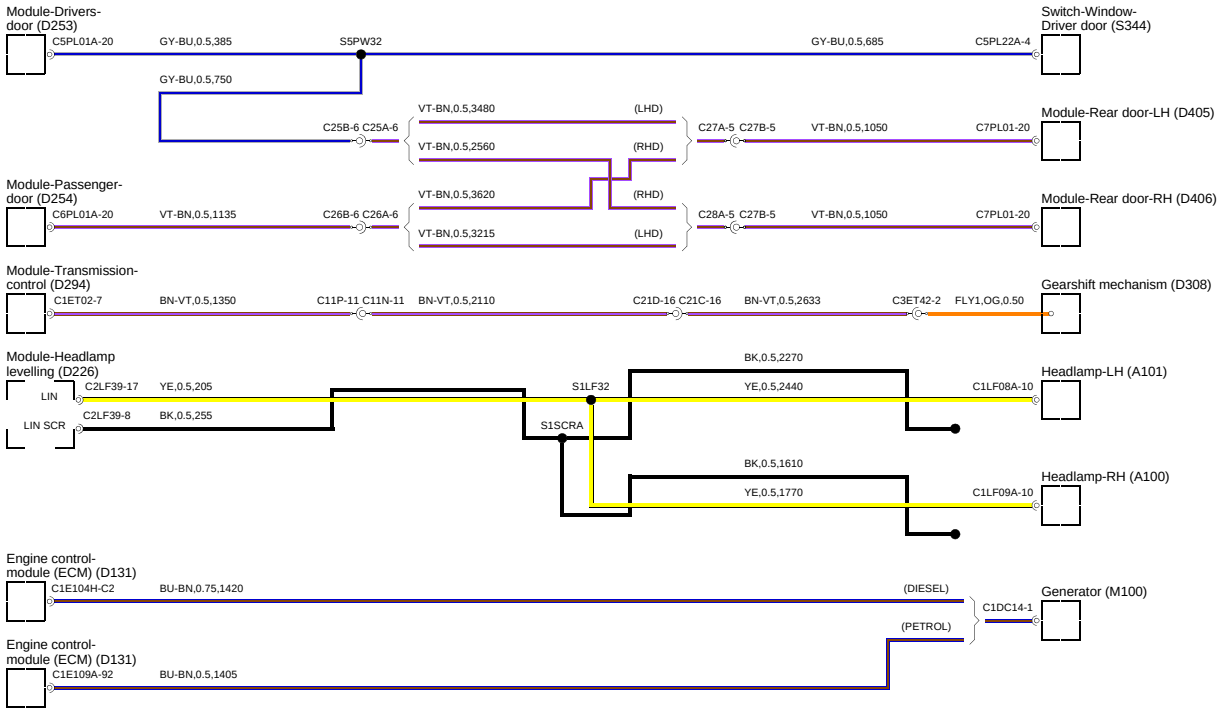

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
FE20
60.0 Amps
C1BB03K-1
GN-RD,6.0
C12D-2 C12C-2
GN-RD,6.0
S4BB20
GN-RD,6.0
GN-RD,6.0
BU-RD,6.0
S3BB19
BU-RD,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
C1BP02G-1
MS CAN H
MS CAN L
IGN RLY
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
FET-Stop light
C1BP02G-2
C1BP02B-59
VT-BN,1.5
S4LS44
RD,0.75
C1BP02B-45
C44X-4 C44Y-4
VT-OG,0.5
C4AT23E-1
C44X-5 C44Y-5
GY-OG,0.5
C4AT23E-2
C44X-3 C44Y-3
RD,0.75
C4AT23E-3
C44X-1 C44Y-1
RD-BU,4.0
C4AT23D-2
ECU-Trailer (D221)
TAIL
STOP/TURN RIGHT
STOP/TURN LEFT
MS CAN H
MS CAN L
BRAKE LIGHT
BATT
GND
C4AT23E-4
BK-BU,0.75
S4D152D
BK-BU,0.5
C44Y-6 C44X-6
BK-BU,0.75
S4D152C
BK-BU,2.5
G4D151B-1
C4AT23A-12
GN,1.5
C0500-2
C4AT23A-7
YE,1.5
C0500-4
C4AT23A-3
RD,1.5
C0500-3
WH,1.5
C0500-1
Trailer pick-up (P124)
TAIL
STOP/TURN RIGHT
STOP/TURN LEFT
GND
G4AT22X-1
Auxiliary junction box (P107)
RJB1
C4BR02A-24
FA11
40.0 Amps
C4BR02A-23
BU-RD,4.0
Auxiliary junction box (P107)
RJB2
C4BR02B-25
Relay-Ignition (R211)
C4BR02B-31
C4BR02B-29
BN,0.75
FB5
15.0 Amps
C4BR02B-13
YE,1.5
C44X-7 C44Y-7
NOT USED (V101)
C4BR02B-9
MINI RB1
C4BR02B-33
GY-BN,6.0
S4R115
ACCESSORY FEED TO TRAILER HARNESS
GY-BN,6.0

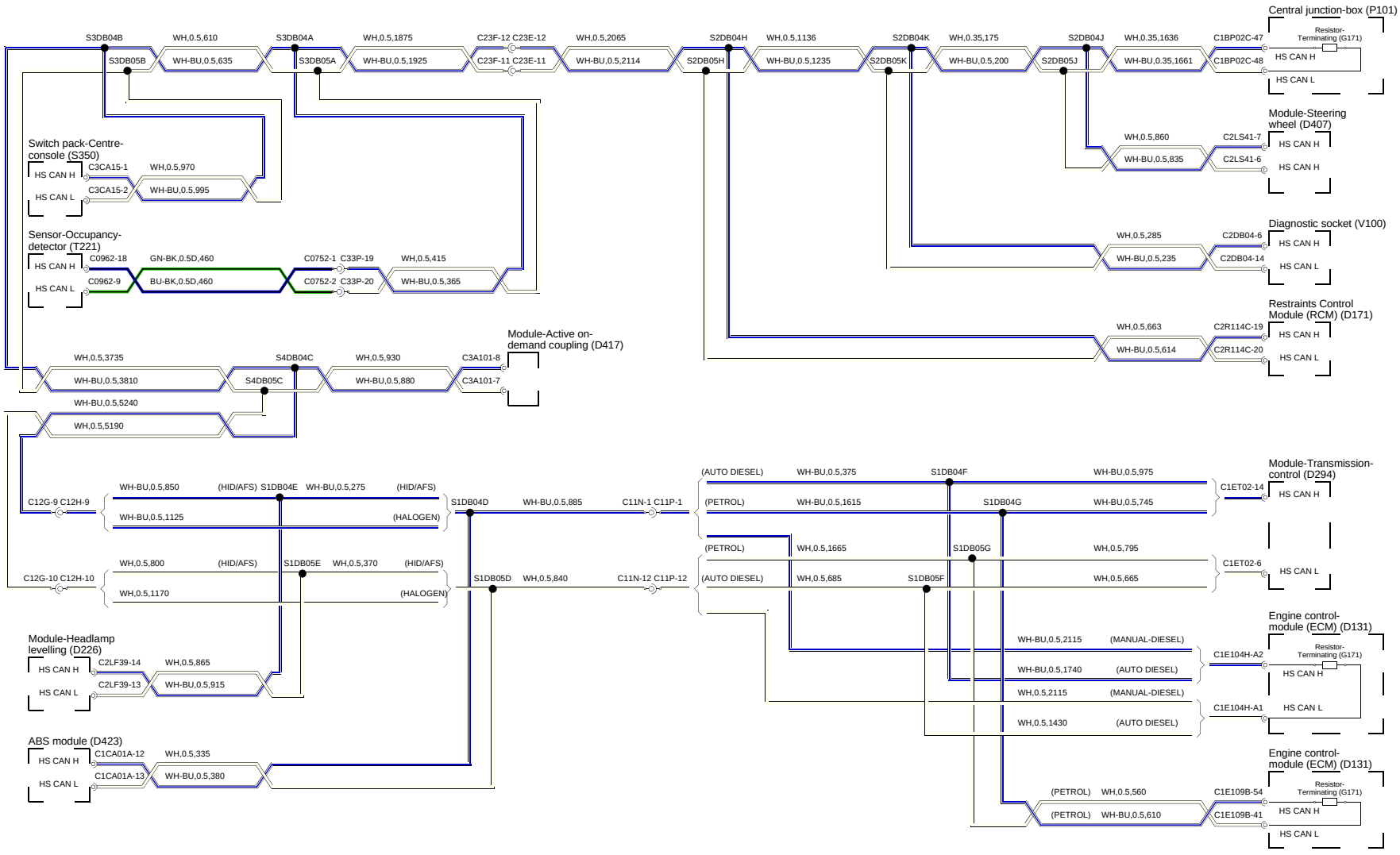

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Central junction-box (P101)
FET-Courtesy Lo side dimmer
Battery junction-box (P147)
C1BB01B-1
C1BB01A-66
FE17
C1BB07G-1
RD,6.0
C1BP02G-1
60.0 Amps
FE19
C1BB03J-1
BU-RD,6.0
60.0 Amps
Relay-Battery-saver (R250)
FS17
7.5 Amps
Central Electronics Module (CEM) (D316)
FR AJAR
FL AJAR
RR AJAR
RL AJAR
TAILGATE AJAR
C1BP02H-20 BU,0.75
A
Sheet2
C1BP02A-54 BK-VT,0.75
G1D132B-1
Lamp-Glove compartment (B109)
C1BP02C-67 BN-GN,0.75
S2BP17
BN-GN,0.5
C2LN15-1
5.0 Watts
C2LN15-2 BK-YE,0.5
B
Sheet2
BN-GN,0.75
C
Sheet2
Lamp-Footwell-Front-RH (B135)
C1BP02C-19 BN-WH,0.5
C3LN39-2
5.0 Watts
C3LN39-1 BN-GN,1.0
Lamp-Footwell-Front-LH (B136)
C1BP02C-37 BU-GY,0.5
S2LN38
BU-GY,0.5
C3LN38-2
5.0 Watts
C3LN38-1 BN-GN,1.0
BU-GY,0.5
C23E-15 C23F-15
Lamp-Load space (B140)
C1BP02B-56 BN-GN,1.0
S3BP17
BN-GN,1.0
C4LN13C-1
10.0 Watts
C4LN13C-2 BU-GY,0.5
C1BP02B-6 WH,0.5
C26A-1 C26B-1
BK,0.5
C6PL64-4
Motor-Central door-locking-Passenger (M237)
C6PL64-1 BK,0.5
C6PL01A-15
Module-Drivers-door (D253)
C1BP02B-7 GN-VT,0.5
C25A-1 C25B-1
BK,0.5
C5PL63-4
Motor-Central door-locking-Driver (M236)
C5PL63-1 BK,0.5
C5PL01A-15
Module-Passenger-door (D254)
C1BP02B-8 YE,0.5
C28A-6 C27B-6
BK,0.5
C7PL71-4
Motor-Central door-locking-Rear-RH (M166)
C7PL71-1 BK,0.5
C7PL01-15
Module-Rear door-RH (D406)
C1BP02B-9 GN,0.5
C27A-6 C27B-6
BK,0.5
C7PL71-4
Motor-Central door-locking-Rear-LH (M167)
C7PL71-1 BK,0.5
C7PL01-15
Module-Rear door-LH (D405)
C1BP02B-10 YE-OG,0.75
C44N-2 C44M-2
Motor-Release-Tailgate-(M255)
BK,0.75
C4PL17A-3
C4PL17A-2 BK-GY,1.5
BK,1.0
S4D149D
C44M-5 C44N-5
BK-GY,1.5
S4D149A
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
C12D-1 C12C-1
BU-RD,6.0
S3BB19
BU-RD,6.0
D
Sheet2

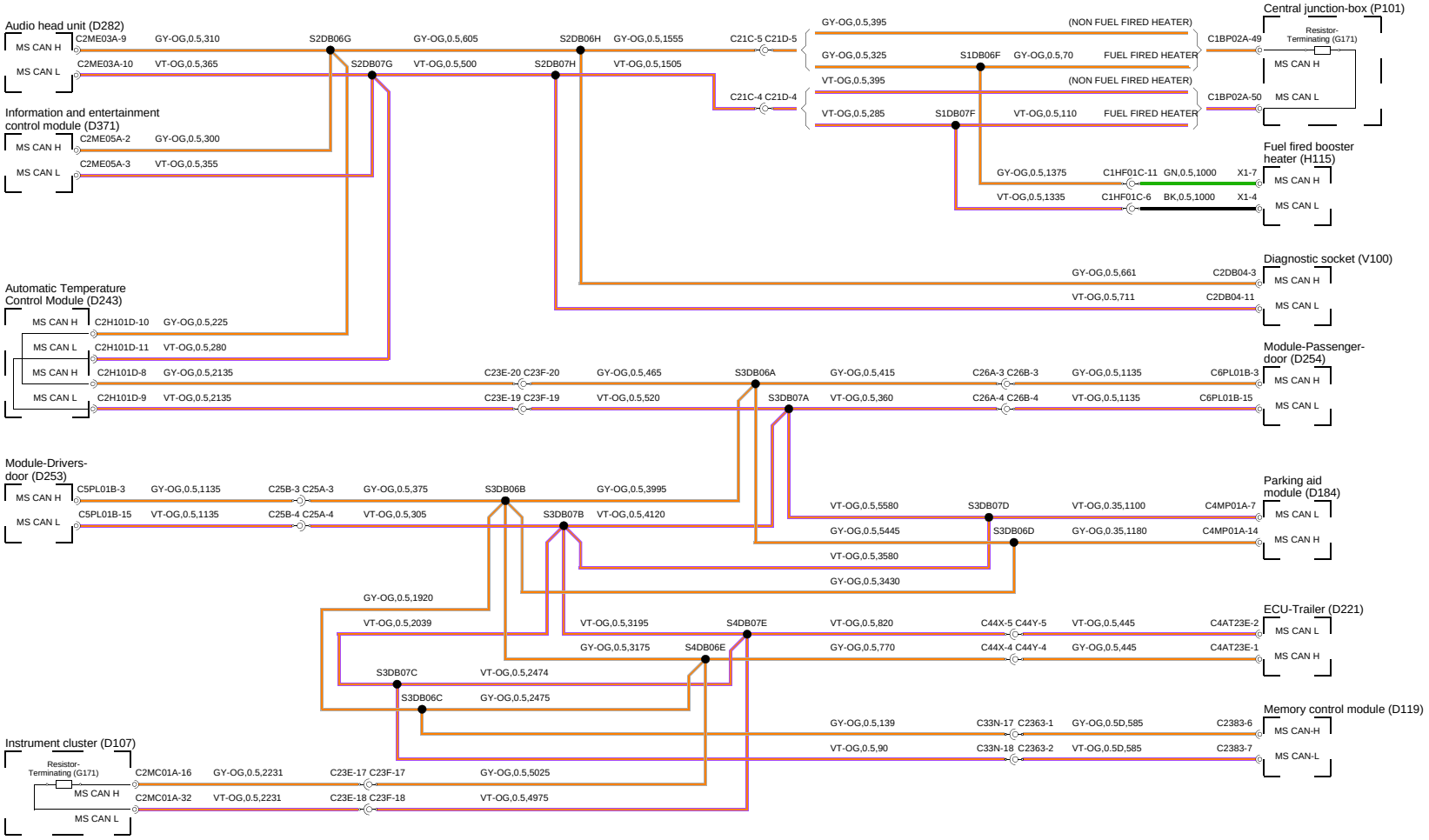

Auxiliary junction box (P107)
D
BU-RD,6.0
C4BR02A-1
FA2
25.0 Amps
C4BR02A-6
YE-RD,2.5
C26A-9 C26B-9
YE-RD,1.5
C6PL01A-2
Sheet1
Module-Passenger-door (D254)
VBATT
COURTESY LIGHT
C6PL01A-3
BN-YE,0.75
C6LS01-2
Lamp-Puddle-Front-RH (B130)
5.0 Watts
C6LS01-1
COMMON
C6PL01A-14
WH-VT,0.75
FA1
25.0 Amps
C4BR02A-5
RD,2.5
C25A-9 C25B-9
RD,1.5
C5PL01A-2
Module-Drivers-door (D253)
VBATT
COURTESY LIGHT
C5PL01A-3
VT-GN,0.75
C5LS01-2
Lamp-Puddle-Front-LH (B131)
5.0 Watts
C5LS01-1
COMMON
C5PL01A-14
BU-OG,0.75
B
Sheet1
BK-YE,0.5
S2D139D
BK-YE,1.5
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
BK-YE,1.5
Lamp-Interior-Front (B100)
C
BN-GN,0.75
C22C-10 C22D-10
BN-GN,0.75
S9BP17
BN-GN,0.5
C9LN28A-1
10.0 Watts
C9LN28B-2
BK-YE,0.75
S9D139B
BK-YE,1.5
C22D-7 C22C-7
A
BU,0.75
S9LN33
BU,1.5
C9LN28B-1
Lamp-Interior-Rear (B104)
BN-GN,0.5
C9LN14A-1
10.0 Watts
C9LN14B-2
BK-YE,0.75
BU,0.5
C9LN14B-1
Mirror-Vanity-RH (B153)
BN-GN,0.5
C9LN24-1
5.0 Watts
C9LN24-3
BK-YE,0.5
Mirror-Vanity-LH (B152)
BN-GN,0.5
C9LN23-1
5.0 Watts
C9LN23-3
BK-YE,0.5

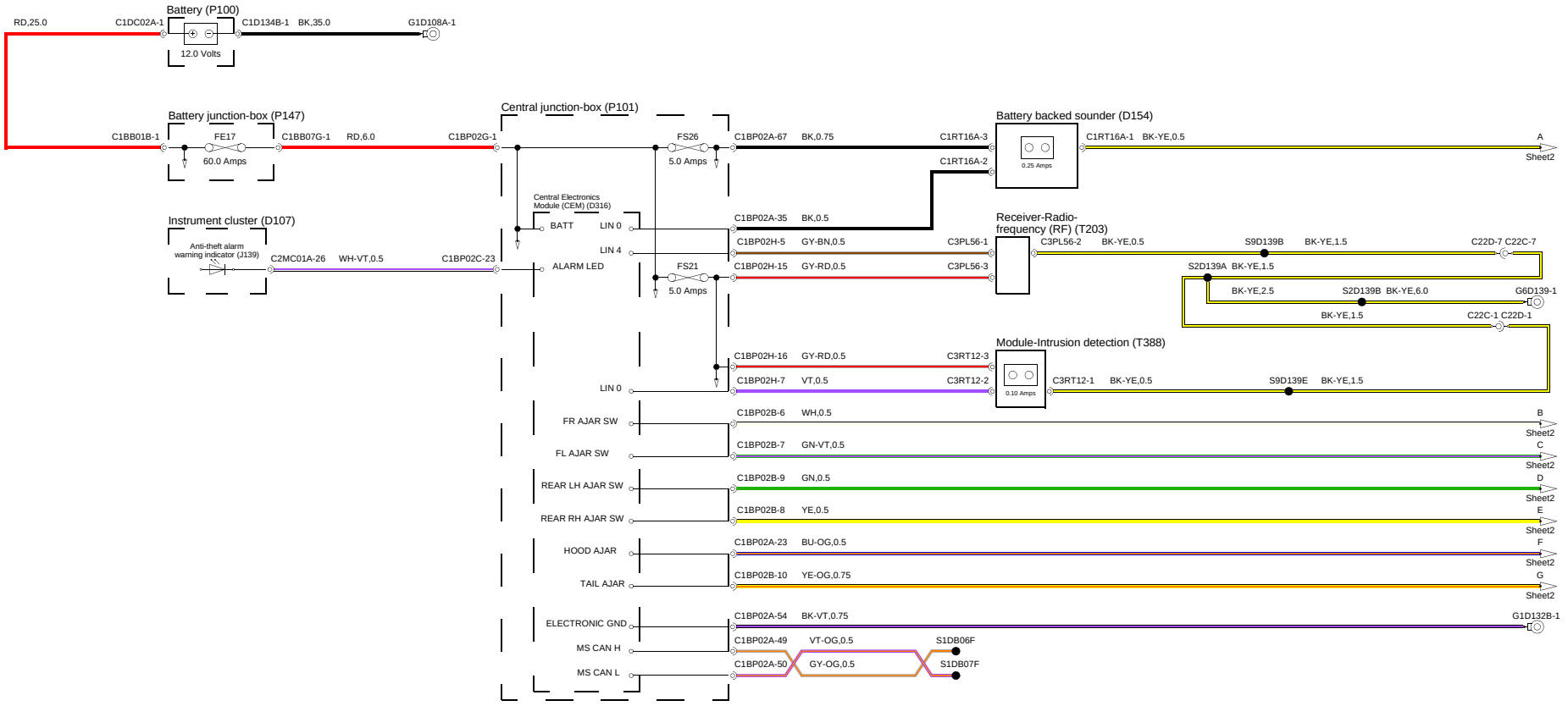

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
Central junction-box (P101)
C1BP02G-1
FS26
5.0 Amps
C1BP02C-73
YE-RD,0.5
C2DB04-16
Central Electronics Module (CEM) (D316)
BATT A
MED CAN H
MED CAN L
HS CAN H
HS CAN L
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
C1BP02C-47
WH,0.35
S2DB04J
C1BP02C-48
WH-BU,0.35
S2DB05J
Diagnostic socket (V100)
BATT
PWR GND
SIG GND
HS CAN-H
HS CAN-L
MS CAN-H
MS CAN-L
C2DB04-5
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
C2DB04-4
BK-YE,0.5
S2D139D
BK-YE,1.5
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
C2DB04-6
WH,0.5
S2DB04K
C2DB04-14
WH-BU,0.5
S2DB05K
C2DB04-3
VT-OG,0.5
S2DB06H
C2DB04-11
GY-OG,0.5
S2DB07H
C2DB04-7
GY,0.5
C21C-6 C21D-6
GY,0.5
Engine control-module (ECM) (D131)
C1E104H-B1
(DIESEL)
GY,0.5
C11P-17 C11N-17

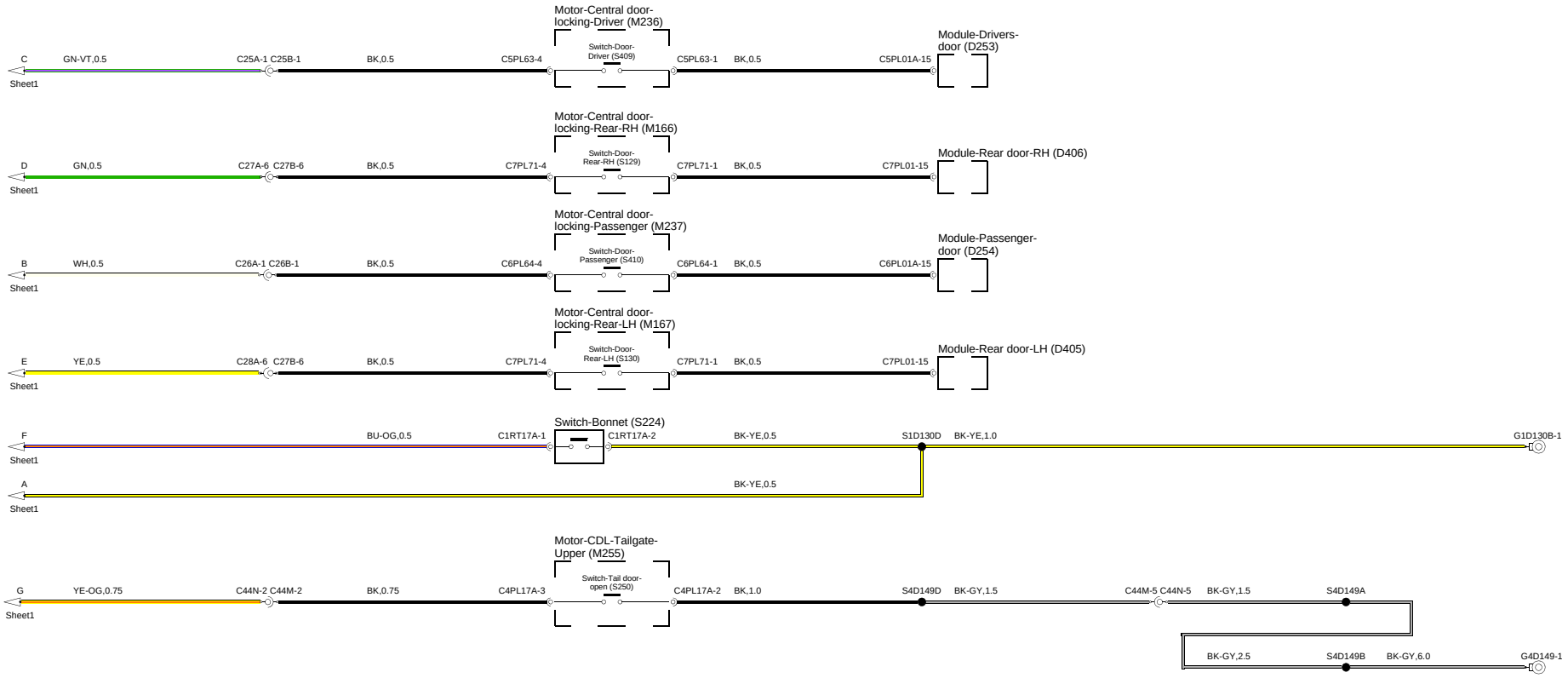

Central junction-box (P101)
Central Electronics Module (CEM) (D316)
Receiver-Radio-frequency (RF) (T203)
C3PL56-1
GY-BN,0.5,3670
C1BP02H-5
LIN4
LIN4
C1BP02B-25
NOT USED (V101)
Start control unit (D391)
C2DC35-3
WH-GN,0.35,1745
C1BP02C-50
LIN1
LIN1
C1BP02C-49
GY-BU,0.35,2151
C2LS41A-4
Module-Steering column lock (D401)
Sensor-Rain (T204)
C9RW06-1
BN-YE,0.5,2030
C1BP02H-8
LIN3
LIN3
C1BP02A-4
NOT USED (V101)
Module-Intrusion detection (T388)
C3RT12-2
VT,0.5,3210
C1BP02H-7
LIN0
LIN0
C1BP02A-35
BK,0.5,1395
C1RT16A-2
Battery backed sounder (D154)
Module-Lighting-switch (D183)
C2LF23D-6
GN-VT,0.35,2131
C1BP02C-52
LIN2
LIN2
C1BP02C-51
WH,0.35,2496
C2LS41-9
Module-Steering wheel (D407)
Automatic Temperature Control Module (D243)
LIN R
C2H101D-7
BN-VT,0.5,1195
S2H117
BN-VT,0.5,940
C23E-22 C23F-22
BN-VT,0.5,2290
C33P-2 C5B-2
OG-RD,0.50,1130
C762-2
Module-Heated seat-Passenger (D409)
LIN L
C2H101D-12
WH-GN,0.5,1050
BN-VT,0.5,778
C23AE-2 C23AF-2
YE,0.5,630
S2VH118
YE,0.35,310
C2H211-2
RH air temperature door motor (M204)
YE,0.35,220
C2H227-2
Screen air distribution door motor (M259)
BN-VT,0.5,1045
C22C-12 C22D-12
WH-GN,0.5,2030
C9PM05A-6
Sensor-Temperature/Humidity (T315)
S2H118
WH-GN,0.5,633
C23AE-3 C23AF-3
GN,0.5,420
S2VH117
GN,0.35,490
C2H206-2
Intake air door motor (M138)
GN,0.35,340
C2H237-2
LH air temperature door motor (M203)
GN,0.35,280
C2H2XX-2
Face/feet air distribution door motor (M279)
WH-GN,0.5,1085
C23E-21 C23F-21
WH-GN,0.5,3909
C33N-2 C4B-2
OG,0.50,1130
C757-2
Module-Heated seat-Driver (D408)

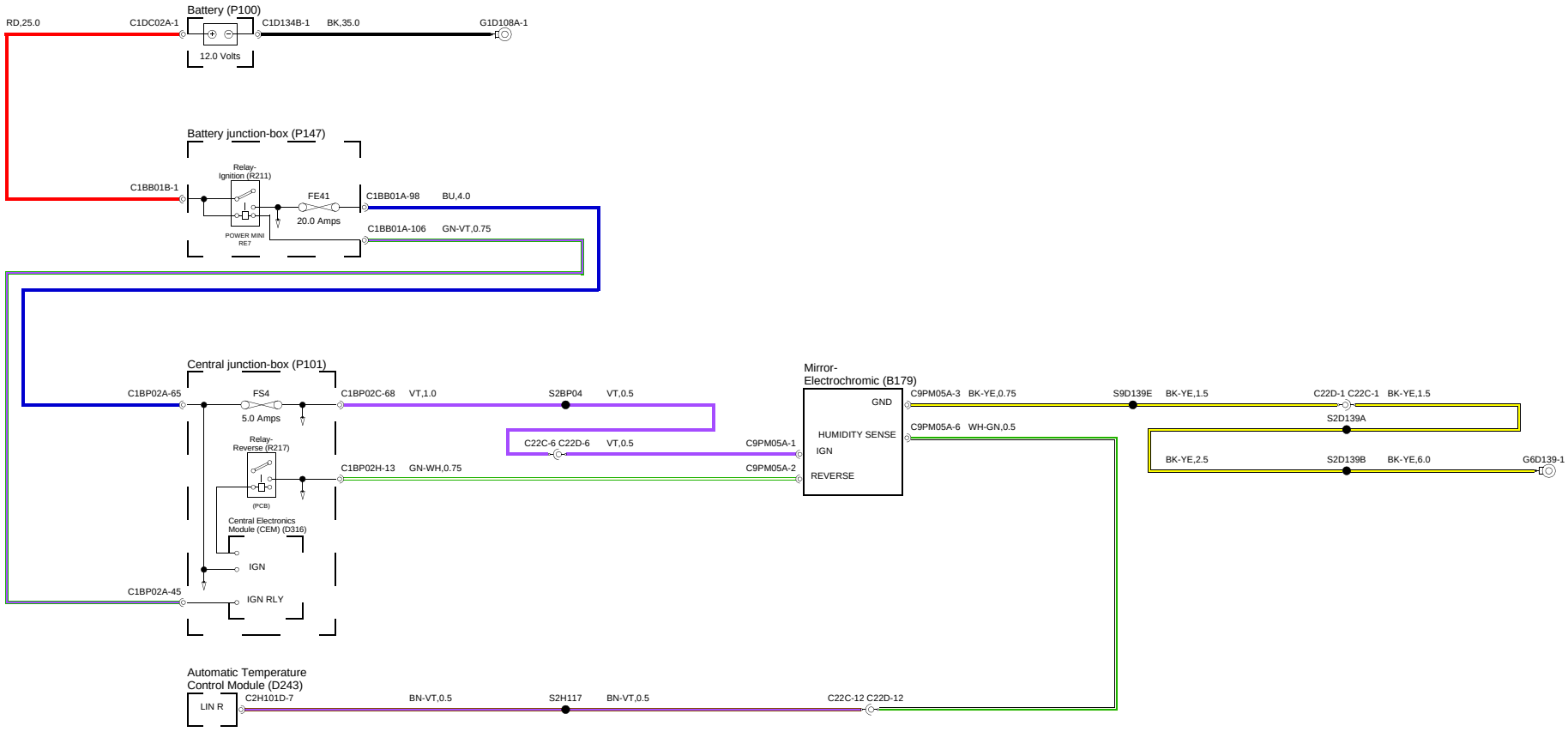

Module-Drivers-door (D253)
C5PL01A-20
GY-BU,0.5,385
S5PW32
GY-BU,0.5,685
C5PL22A-4
Switch-Window-Driver door (S344)
GY-BU,0.5,750
VT-BN,0.5,3480
(LHD)
C25B-6 C25A-6
C27A-5 C27B-5
VT-BN,0.5,1050
C7PL01-20
Module-Rear door-LH (D405)
VT-BN,0.5,2560
(RHD)
Module-Passenger-door (D254)
C6PL01A-20
VT-BN,0.5,1135
C26B-6 C26A-6
VT-BN,0.5,3620
(RHD)
C28A-5 C27B-5
VT-BN,0.5,1050
C7PL01-20
Module-Rear door-RH (D406)
VT-BN,0.5,3215
(LHD)
Module-Transmission-control (D294)
C1ET02-7
BN-VT,0.5,1350
C11P-11 C11N-11
BN-VT,0.5,2110
C21D-16 C21C-16
BN-VT,0.5,2633
C3ET42-2
FLY1,OG,0.50
Gearshift mechanism (D308)
Module-Headlamp levelling (D226)
LIN
C2LF39-17
YE,0.5,205
S1LF32
BK,0.5,2270
YE,0.5,2440
C1LF08A-10
Headlamp-LH (A101)
LIN SCR
C2LF39-8
BK,0.5,255
S1SCRA
BK,0.5,1610
YE,0.5,1770
C1LF09A-10
Headlamp-RH (A100)
Engine control-module (ECM) (D131)
C1E104H-C2
BU-BN,0.75,1420
(DIESEL)
(PETROL)
C1DC14-1
Generator (M100)
Engine control-module (ECM) (D131)
C1E109A-92
BU-BN,0.5,1405

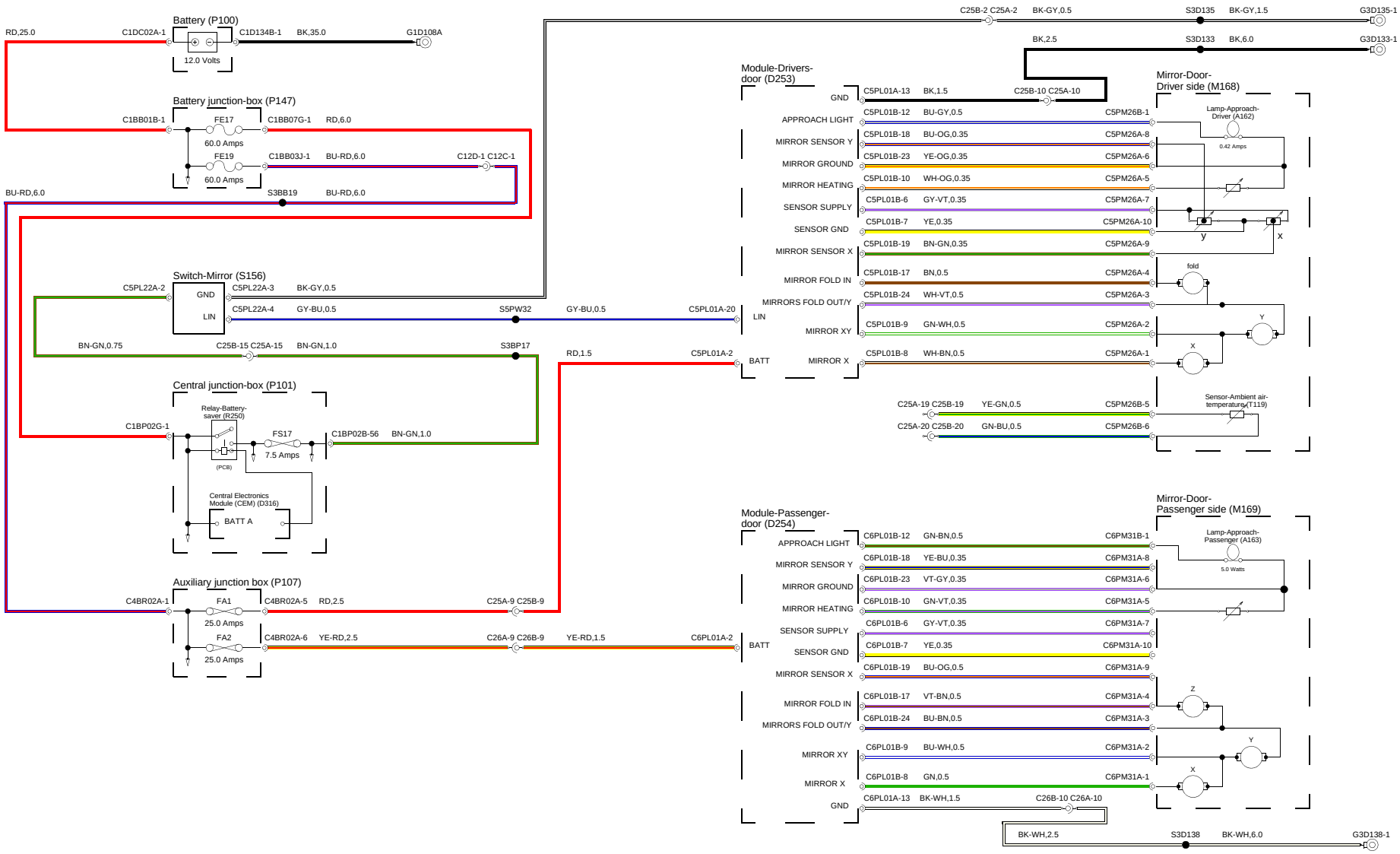

Central junction-box (P101)
S3DB04B WH,0.5,610 S3DB04A WH,0.5,1875 C23F-12 C23E-12 WH,0.5,2065 S2DB04H WH,0.5,1136 S2DB04K WH,0.35,175 S2DB04J WH,0.35,1636 C1BP02C-47
S3DB05B WH-BU,0.5,635 S3DB05A WH-BU,0.5,1925 C23F-11 C23E-11 WH-BU,0.5,2114 S2DB05H WH-BU,0.5,1235 S2DB05K WH-BU,0.5,200 S2DB05J WH-BU,0.35,1661 C1BP02C-48
Resistor-Terminating (G171)
HS CAN H
HS CAN L
Switch pack-Centre-console (S350)
HS CAN H C3CA15-1 WH,0.5,970
HS CAN L C3CA15-2 WH-BU,0.5,995
Module-Steering wheel (D407)
WH,0.5,860 C2LS41-7
WH-BU,0.5,835 C2LS41-6
HS CAN H
HS CAN H
Sensor-Occupancy-detector (T221)
HS CAN H C0962-18 GN-BK,0.5D,460 C0752-1 C33P-19 WH,0.5,415
HS CAN L C0962-9 BU-BK,0.5D,460 C0752-2 C33P-20 WH-BU,0.5,365
Diagnostic socket (V100)
WH,0.5,285 C2DB04-6
WH-BU,0.5,235 C2DB04-14
HS CAN H
HS CAN L
Restraints Control Module (RCM) (D171)
WH,0.5,663 C2R114C-19
WH-BU,0.5,614 C2R114C-20
HS CAN H
HS CAN L
Module-Active on-demand coupling (D417)
WH,0.5,3735 S4DB04C WH,0.5,930 C3A101-8
WH-BU,0.5,3810 S4DB05C WH-BU,0.5,880 C3A101-7
WH-BU,0.5,5240
WH,0.5,5190
Module-Transmission-control (D294)
(AUTO DIESEL) WH-BU,0.5,375 S1DB04F WH-BU,0.5,975 C1ET02-14
(PETROL) WH-BU,0.5,1615 S1DB04G WH-BU,0.5,745
HS CAN H
C12G-9 C12H-9 WH-BU,0.5,850 (HID/AFS) S1DB04E WH-BU,0.5,275 (HID/AFS)
WH-BU,0.5,1125 (HALOGEN)
S1DB04D WH-BU,0.5,885 C11N-1 C11P-1
(PETROL) WH,0.5,1665 S1DB05G WH,0.5,795 C1ET02-6
(AUTO DIESEL) WH,0.5,685 S1DB05F WH,0.5,665
HS CAN L
C12G-10 C12H-10 WH,0.5,800 (HID/AFS) S1DB05E WH,0.5,370 (HID/AFS)
WH,0.5,1170 (HALOGEN)
S1DB05D WH,0.5,840 C11N-12 C11P-12
Engine control-module (ECM) (D131)
WH-BU,0.5,2115 (MANUAL-DIESEL) C1E104H-A2
WH-BU,0.5,1740 (AUTO DIESEL)
WH,0.5,2115 (MANUAL-DIESEL) C1E104H-A1
WH,0.5,1430 (AUTO DIESEL)
Resistor-Terminating (G171)
HS CAN H
HS CAN L
Module-Headlamp levelling (D226)
HS CAN H C2LF39-14 WH,0.5,865
HS CAN L C2LF39-13 WH-BU,0.5,915
ABS module (D423)
HS CAN H C1CA01A-12 WH,0.5,335
HS CAN L C1CA01A-13 WH-BU,0.5,380
Engine control-module (ECM) (D131)
(PETROL) WH,0.5,560 C1E109B-54
(PETROL) WH-BU,0.5,610 C1E109B-41
Resistor-Terminating (G171)
HS CAN H
HS CAN L

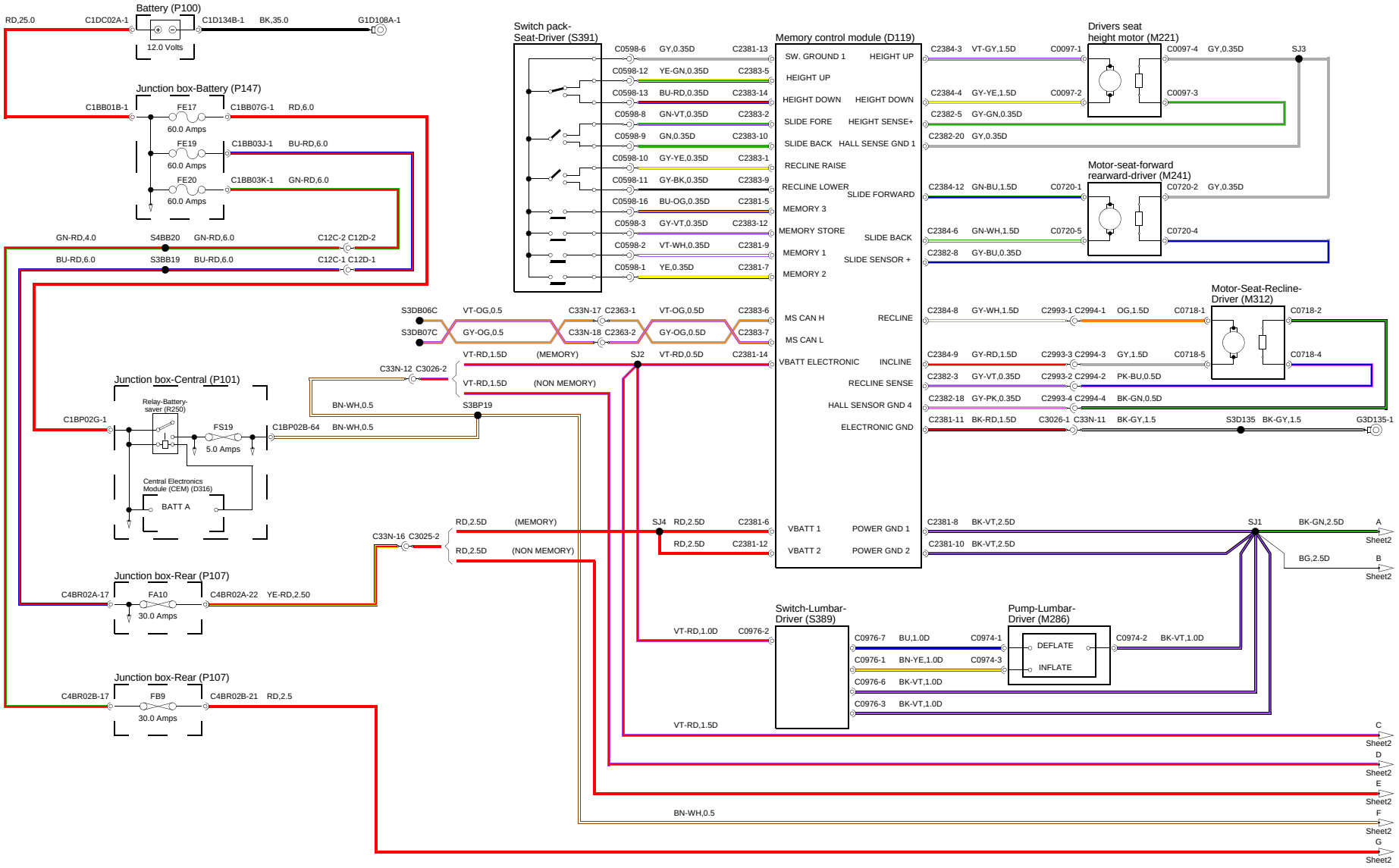

Audio head unit (D282)
MS CAN H
MS CAN L
C2ME03A-9
C2ME03A-10
GY-OG,0.5,310
VT-OG,0.5,365
S2DB06G
S2DB07G
GY-OG,0.5,605
VT-OG,0.5,500
S2DB06H
S2DB07H
GY-OG,0.5,1555
VT-OG,0.5,1505
C21C-5 C21D-5
C21C-4 C21D-4
GY-OG,0.5,395
GY-OG,0.5,325
VT-OG,0.5,395
VT-OG,0.5,285
(NON FUEL FIRED HEATER)
FUEL FIRED HEATER
S1DB06F
S1DB07F
GY-OG,0.5,70
VT-OG,0.5,110
C1BP02A-49
C1BP02A-50
Central junction-box (P101)
Resistor-Terminating (G171)
MS CAN H
MS CAN L
Information and entertainment control module (D371)
C2ME05A-2
C2ME05A-3
GY-OG,0.5,300
VT-OG,0.5,355
Fuel fired booster heater (H115)
GY-OG,0.5,1375
VT-OG,0.5,1335
C1HF01C-11
C1HF01C-6
GN,0.5,1000
BK,0.5,1000
X1-7
X1-4
Diagnostic socket (V100)
GY-OG,0.5,661
VT-OG,0.5,711
C2DB04-3
C2DB04-11
Automatic Temperature Control Module (D243)
C2H101D-10
C2H101D-11
C2H101D-8
C2H101D-9
GY-OG,0.5,225
VT-OG,0.5,280
GY-OG,0.5,2135
VT-OG,0.5,2135
C23E-20 C23F-20
C23E-19 C23F-19
GY-OG,0.5,465
VT-OG,0.5,520
S3DB06A
S3DB07A
GY-OG,0.5,415
VT-OG,0.5,360
C26A-3 C26B-3
C26A-4 C26B-4
GY-OG,0.5,1135
VT-OG,0.5,1135
C6PL01B-3
C6PL01B-15
Module-Passenger-door (D254)
Module-Drivers-door (D253)
C5PL01B-3
C5PL01B-15
GY-OG,0.5,1135
VT-OG,0.5,1135
C25B-3 C25A-3
C25B-4 C25A-4
GY-OG,0.5,375
VT-OG,0.5,305
S3DB06B
S3DB07B
GY-OG,0.5,3995
VT-OG,0.5,4120
VT-OG,0.5,5580
GY-OG,0.5,5445
VT-OG,0.5,3580
GY-OG,0.5,3430
S3DB07D
S3DB06D
VT-OG,0.35,1100
GY-OG,0.35,1180
C4MP01A-7
C4MP01A-14
Parking aid module (D184)
GY-OG,0.5,1920
VT-OG,0.5,2039
VT-OG,0.5,3195
GY-OG,0.5,3175
S4DB07E
S4DB06E
VT-OG,0.5,820
GY-OG,0.5,770
C44X-5 C44Y-5
C44X-4 C44Y-4
GY-OG,0.5,445
C4AT23E-2
C4AT23E-1
ECU-Trailer (D221)
S3DB07C
S3DB06C
VT-OG,0.5,2474
GY-OG,0.5,2475
GY-OG,0.5,139
VT-OG,0.5,90
C33N-17 C2363-1
C33N-18 C2363-2
GY-OG,0.5D,585
VT-OG,0.5D,585
C2383-6
C2383-7
Memory control module (D119)
MS CAN-H
MS CAN-L
Instrument cluster (D107)
Resistor-Terminating (G171)
C2MC01A-16
C2MC01A-32
GY-OG,0.5,2231
VT-OG,0.5,2231
C23E-17 C23F-17
C23E-18 C23F-18
GY-OG,0.5,5025
VT-OG,0.5,4975

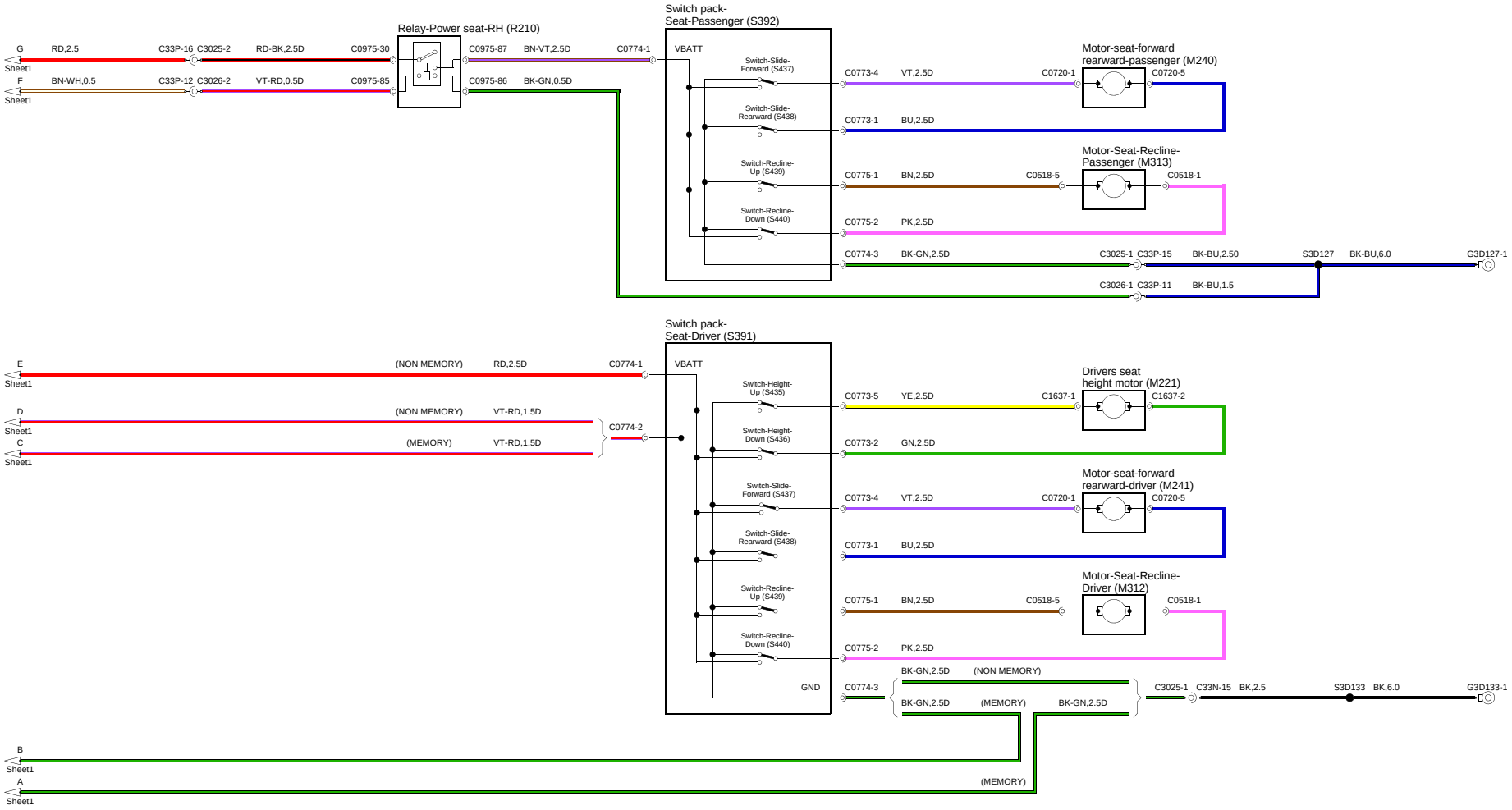

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1 BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
60.0 Amps
C1BB07G-1 RD,6.0
C1BP02G-1
Central junction-box (P101)
FS26
5.0 Amps
C1BP02A-67 BK,0.75
C1RT16A-3
C1RT16A-2
Battery backed sounder (D154)
0.25 Amps
C1RT16A-1 BK-YE,0.5
A
Sheet2
Instrument cluster (D107)
Anti-theft alarm warning indicator (J139)
C2MC01A-26 WH-VT,0.5
C1BP02C-23
Central Electronics Module (CEM) (D316)
BATT
LIN 0
LIN 4
ALARM LED
C1BP02A-35 BK,0.5
C1BP02H-5 GY-BN,0.5
C3PL56-1
C1BP02H-15 GY-RD,0.5
C3PL56-3
FS21
5.0 Amps
Receiver-Radio-frequency (RF) (T203)
C3PL56-2 BK-YE,0.5
S9D139B BK-YE,1.5
C22D-7 C22C-7
S2D139A BK-YE,1.5
BK-YE,2.5
S2D139B BK-YE,6.0
G6D139-1
BK-YE,1.5
C22C-1 C22D-1
Module-Intrusion detection (T388)
0.10 Amps
C1BP02H-16 GY-RD,0.5
C3RT12-3
C1BP02H-7 VT,0.5
C3RT12-2
C3RT12-1 BK-YE,0.5
S9D139E BK-YE,1.5
LIN 0
FR AJAR SW
C1BP02B-6 WH,0.5
B
Sheet2
FL AJAR SW
C1BP02B-7 GN-VT,0.5
C
Sheet2
REAR LH AJAR SW
C1BP02B-9 GN,0.5
D
Sheet2
REAR RH AJAR SW
C1BP02B-8 YE,0.5
E
Sheet2
HOOD AJAR
C1BP02A-23 BU-OG,0.5
F
Sheet2
TAIL AJAR
C1BP02B-10 YE-OG,0.75
G
Sheet2
ELECTRONIC GND
C1BP02A-54 BK-VT,0.75
G1D132B-1
MS CAN H
C1BP02A-49 VT-OG,0.5
S1DB06F
MS CAN L
C1BP02A-50 GY-OG,0.5
S1DB07F

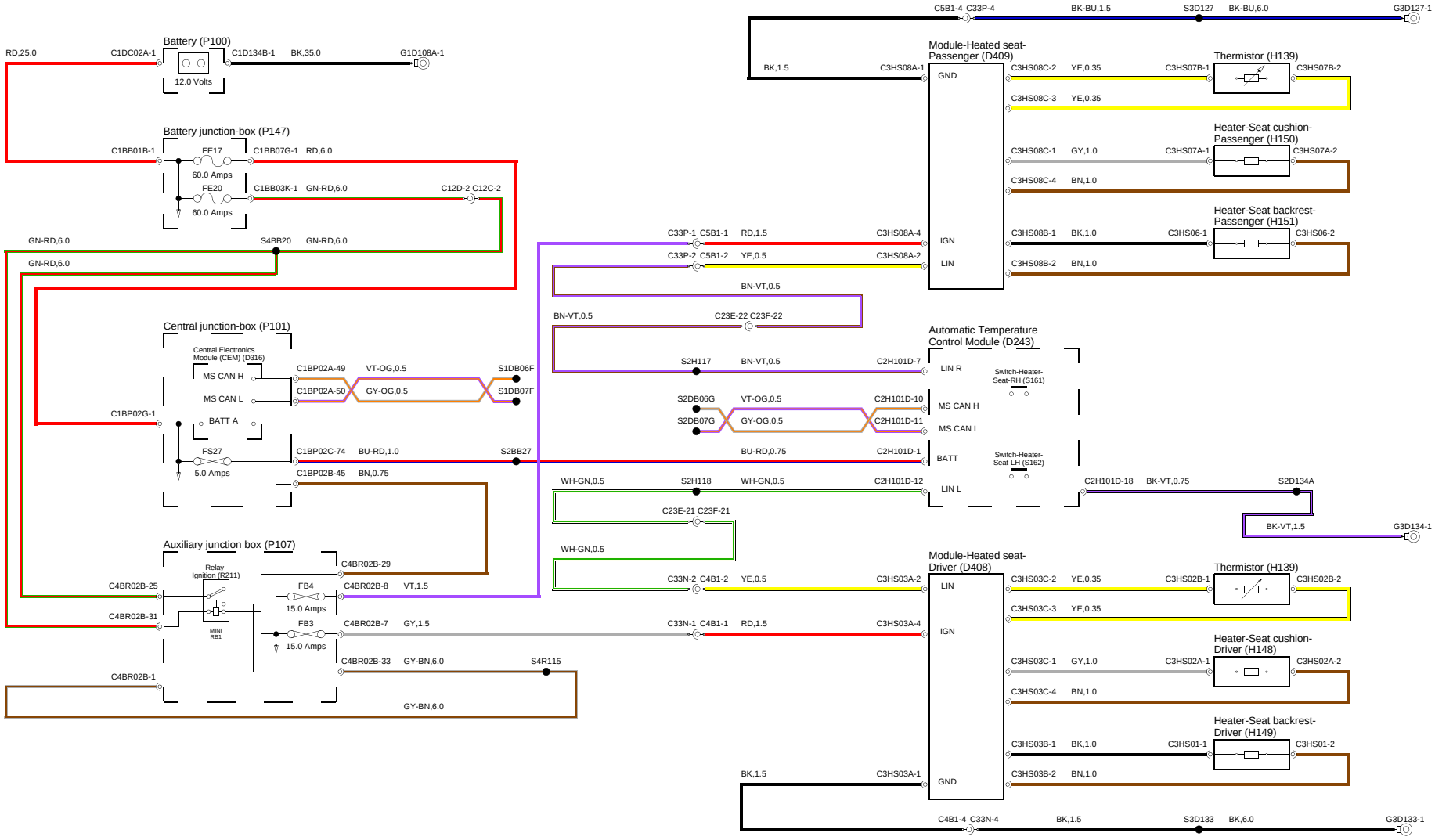

Motor-Central door-locking-Driver (M236)
C
GN-VT,0.5
C25A-1 C25B-1
BK,0.5
C5PL63-4
Switch-Door-Driver (S409)
C5PL63-1
BK,0.5
C5PL01A-15
Module-Drivers-door (D253)
Sheet1
Motor-Central door-locking-Rear-RH (M166)
D
GN,0.5
C27A-6 C27B-6
BK,0.5
C7PL71-4
Switch-Door-Rear-RH (S129)
C7PL71-1
BK,0.5
C7PL01-15
Module-Rear door-RH (D406)
Sheet1
Motor-Central door-locking-Passenger (M237)
B
WH,0.5
C26A-1 C26B-1
BK,0.5
C6PL64-4
Switch-Door-Passenger (S410)
C6PL64-1
BK,0.5
C6PL01A-15
Module-Passenger-door (D254)
Sheet1
Motor-Central door-locking-Rear-LH (M167)
E
YE,0.5
C28A-6 C27B-6
BK,0.5
C7PL71-4
Switch-Door-Rear-LH (S130)
C7PL71-1
BK,0.5
C7PL01-15
Module-Rear door-LH (D405)
Sheet1
Switch-Bonnet (S224)
F
BU-OG,0.5
C1RT17A-1
C1RT17A-2
BK-YE,0.5
S1D130D
BK-YE,1.0
G1D130B-1
Sheet1
A
BK-YE,0.5
Sheet1
Motor-CDL-Tailgate-Upper (M255)
G
YE-OG,0.75
C44N-2 C44M-2
BK,0.75
C4PL17A-3
Switch-Tail door-open (S250)
C4PL17A-2
BK,1.0
S4D149D
BK-GY,1.5
C44M-5 C44N-5
BK-GY,1.5
S4D149A
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
Sheet1

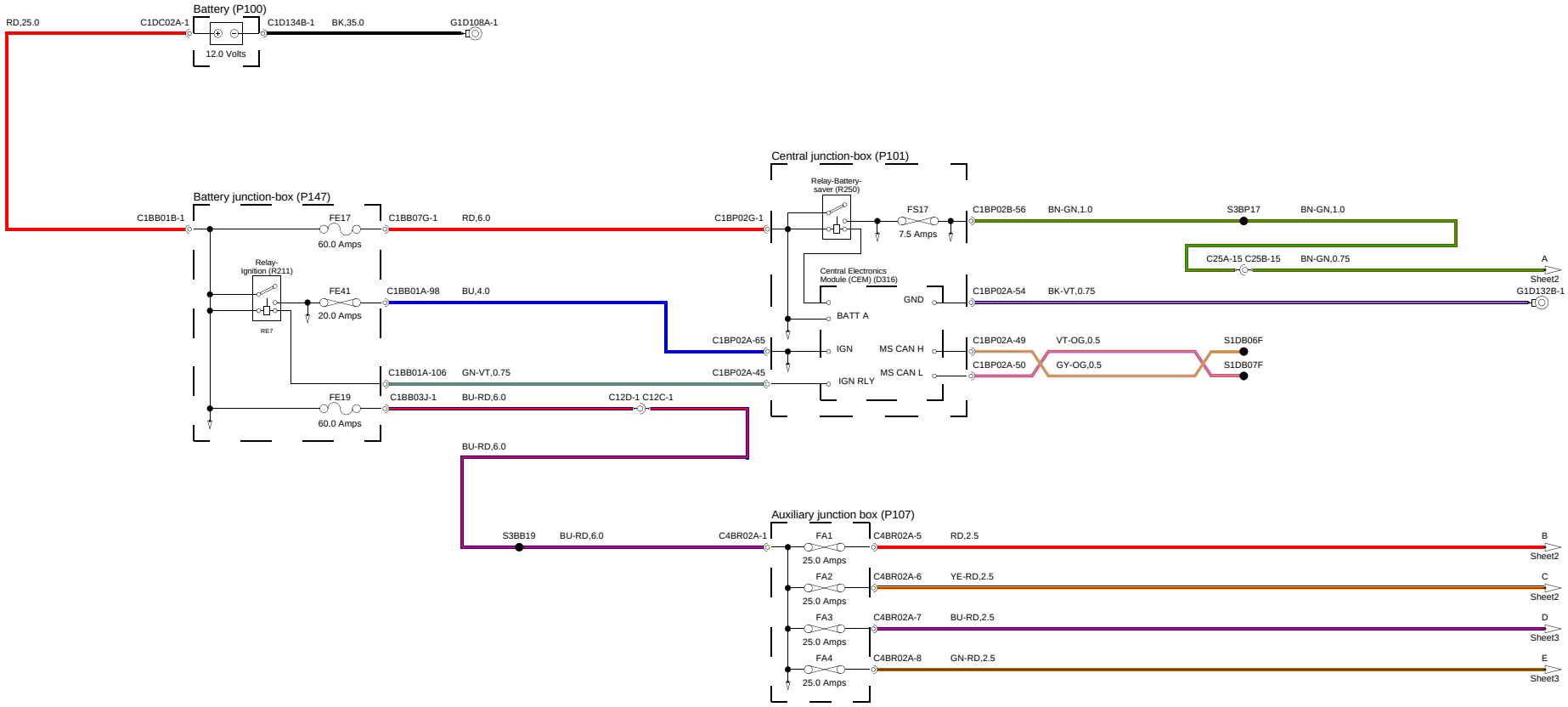

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
Relay-
Ignition (R211)
C1BB01B-1
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BB01A-106
GN-VT,0.75
POWER MINI
RE7
Central junction-box (P101)
C1BP02A-65
FS4
5.0 Amps
C1BP02C-68
VT,1.0
S2BP04
VT,0.5
Relay-
Reverse (R217)
C1BP02H-13
GN-WH,0.75
(PCB)
Central Electronics
Module (CEM) (D316)
IGN
C1BP02A-45
IGN RLY
Mirror-
Electrochromic (B179)
GND
HUMIDITY SENSE
IGN
REVERSE
C22C-6 C22D-6
VT,0.5
C9PM05A-1
C9PM05A-2
C9PM05A-3
BK-YE,0.75
S9D139E
BK-YE,1.5
C22D-1 C22C-1
BK-YE,1.5
S2D139A
C9PM05A-6
WH-GN,0.5
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
Automatic Temperature
Control Module (D243)
LIN R
C2H101D-7
BN-VT,0.5
S2H117
BN-VT,0.5
C22C-12 C22D-12

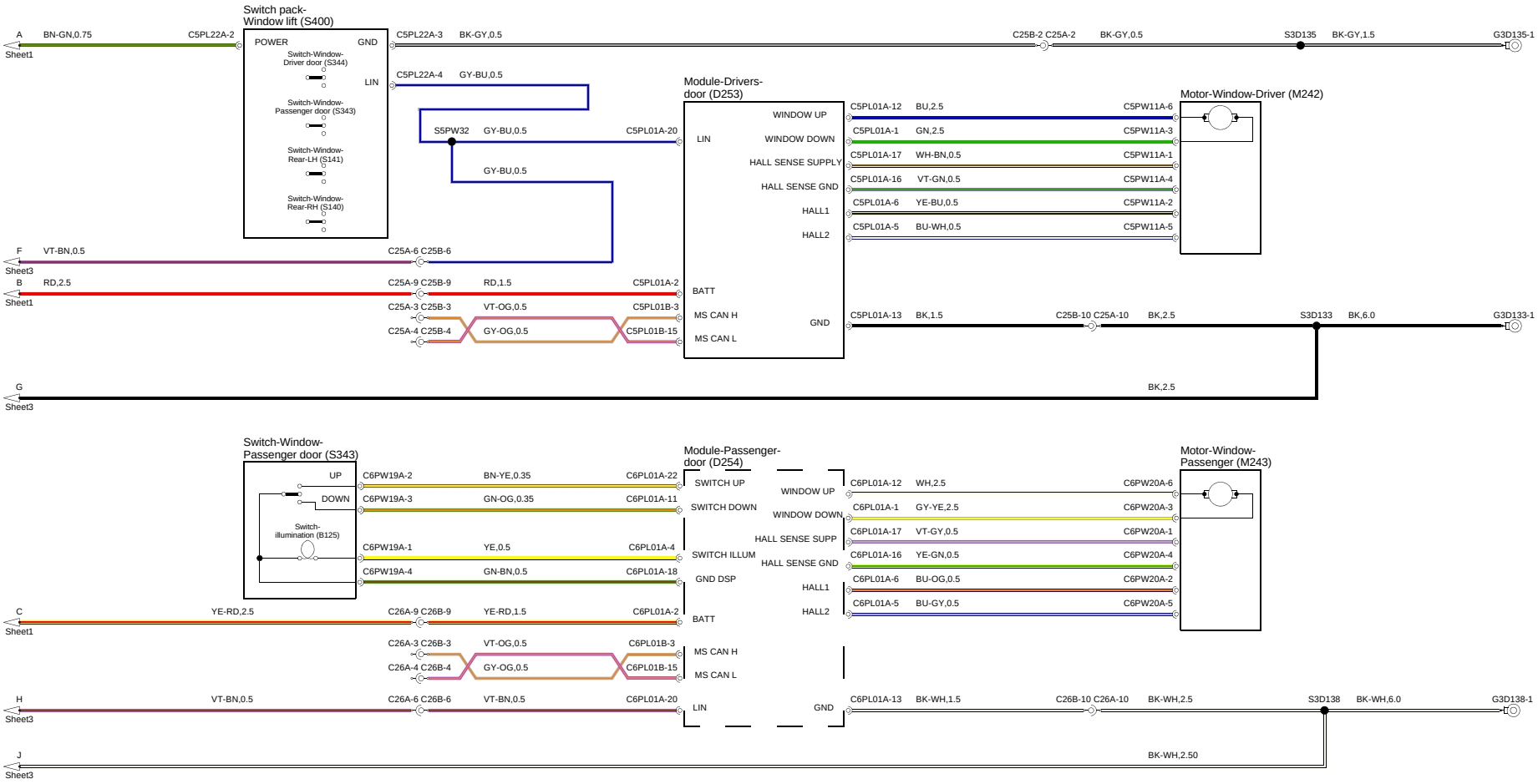

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
FE19
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
60.0 Amps
BU-RD,6.0
S3BB19
BU-RD,6.0
Switch-Mirror (S156)
C5PL22A-2
GND
C5PL22A-3
BK-GY,0.5
LIN
C5PL22A-4
GY-BU,0.5
S5PW32
GY-BU,0.5
C5PL01A-20
BN-GN,0.75
C25B-15 C25A-15
BN-GN,1.0
S3BP17
Central junction-box (P101)
Relay-Battery-saver (R250)
C1BP02G-1
FS17
7.5 Amps
C1BP02B-56
BN-GN,1.0
(PCB)
Central Electronics Module (CEM) (D316)
BATT A
Auxiliary junction box (P107)
C4BR02A-1
FA1
C4BR02A-5
RD,2.5
C25A-9 C25B-9
25.0 Amps
FA2
C4BR02A-6
YE-RD,2.5
C26A-9 C26B-9
YE-RD,1.5
C6PL01A-2
25.0 Amps
RD,1.5
C5PL01A-2
C25B-2 C25A-2
BK-GY,0.5
S3D135
BK-GY,1.5
G3D135-1
BK,2.5
S3D133
BK,6.0
G3D133-1
Module-Drivers-door (D253)
GND
C5PL01A-13
BK,1.5
C25B-10 C25A-10
APPROACH LIGHT
C5PL01B-12
BU-GY,0.5
C5PM26B-1
MIRROR SENSOR Y
C5PL01B-18
BU-OG,0.35
C5PM26A-8
MIRROR GROUND
C5PL01B-23
YE-OG,0.35
C5PM26A-6
MIRROR HEATING
C5PL01B-10
WH-OG,0.35
C5PM26A-5
SENSOR SUPPLY
C5PL01B-6
GY-VT,0.35
C5PM26A-7
SENSOR GND
C5PL01B-7
YE,0.35
C5PM26A-10
MIRROR SENSOR X
C5PL01B-19
BN-GN,0.35
C5PM26A-9
MIRROR FOLD IN
C5PL01B-17
BN,0.5
C5PM26A-4
MIRRORS FOLD OUT/Y
C5PL01B-24
WH-VT,0.5
C5PM26A-3
LIN
MIRROR XY
C5PL01B-9
GN-WH,0.5
C5PM26A-2
BATT
MIRROR X
C5PL01B-8
WH-BN,0.5
C5PM26A-1
Mirror-Door-Driver side (M168)
Lamp-Approach-Driver (A162)
0.42 Amps
fold
y
x
Y
X
C25A-19 C25B-19
YE-GN,0.5
C5PM26B-5
C25A-20 C25B-20
GN-BU,0.5
C5PM26B-6
Sensor-Ambient air-temperature (T119)
Module-Passenger-door (D254)
APPROACH LIGHT
C6PL01B-12
GN-BN,0.5
C6PM31B-1
MIRROR SENSOR Y
C6PL01B-18
YE-BU,0.35
C6PM31A-8
MIRROR GROUND
C6PL01B-23
VT-GY,0.35
C6PM31A-6
MIRROR HEATING
C6PL01B-10
GN-VT,0.35
C6PM31A-5
SENSOR SUPPLY
C6PL01B-6
GY-VT,0.35
C6PM31A-7
BATT
SENSOR GND
C6PL01B-7
YE,0.35
C6PM31A-10
MIRROR SENSOR X
C6PL01B-19
BU-OG,0.5
C6PM31A-9
MIRROR FOLD IN
C6PL01B-17
VT-BN,0.5
C6PM31A-4
MIRRORS FOLD OUT/Y
C6PL01B-24
BU-BN,0.5
C6PM31A-3
MIRROR XY
C6PL01B-9
BU-WH,0.5
C6PM31A-2
MIRROR X
C6PL01B-8
GN,0.5
C6PM31A-1
GND
C6PL01A-13
BK-WH,1.5
C26B-10 C26A-10
Mirror-Door-Passenger side (M169)
Lamp-Approach-Passenger (A163)
5.0 Watts
Z
Y
X
BK-WH,2.5
S3D138
BK-WH,6.0
G3D138-1

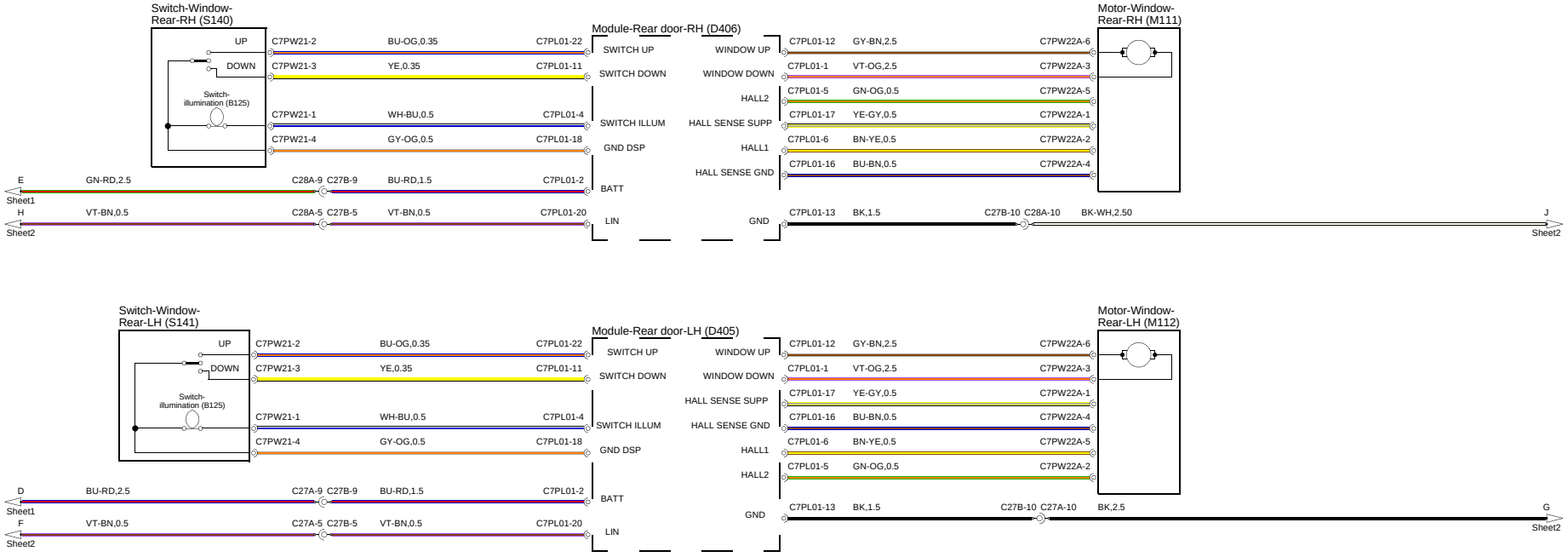

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Junction box-Battery (P147)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
FE19
C1BB03J-1
BU-RD,6.0
60.0 Amps
FE20
C1BB03K-1
GN-RD,6.0
60.0 Amps
GN-RD,4.0
S4BB20
GN-RD,6.0
C12C-2 C12D-2
BU-RD,6.0
S3BB19
BU-RD,6.0
C12C-1 C12D-1
Switch pack-Seat-Driver (S391)
C0598-6 GY,0.35D C2381-13
C0598-12 YE-GN,0.35D C2383-5
C0598-13 BU-RD,0.35D C2383-14
C0598-8 GN-VT,0.35D C2383-2
C0598-9 GN,0.35D C2383-10
C0598-10 GY-YE,0.35D C2383-1
C0598-11 GY-BK,0.35D C2383-9
C0598-16 BU-OG,0.35D C2381-5
C0598-3 GY-VT,0.35D C2383-12
C0598-2 VT-WH,0.35D C2381-9
C0598-1 YE,0.35D C2381-7
Memory control module (D119)
SW. GROUND 1
HEIGHT UP
HEIGHT UP
HEIGHT DOWN
HEIGHT DOWN
SLIDE FORE
HEIGHT SENSE+
SLIDE BACK
HALL SENSE GND 1
RECLINE RAISE
RECLINE LOWER
SLIDE FORWARD
MEMORY 3
MEMORY STORE
SLIDE BACK
MEMORY 1
SLIDE SENSOR +
MEMORY 2
MS CAN H
RECLINE
MS CAN L
VBATT ELECTRONIC
INCLINE
RECLINE SENSE
HALL SENSOR GND 4
ELECTRONIC GND
VBATT 1
POWER GND 1
VBATT 2
POWER GND 2
Drivers seat height motor (M221)
C2384-3 VT-GY,1.5D C0097-1
C0097-4 GY,0.35D SJ3
C2384-4 GY-YE,1.5D C0097-2
C0097-3
C2382-5 GY-GN,0.35D
C2382-20 GY,0.35D
Motor-seat-forward rearward-driver (M241)
C2384-12 GN-BU,1.5D C0720-1
C0720-2 GY,0.35D
C2384-6 GN-WH,1.5D C0720-5
C0720-4
C2382-8 GY-BU,0.35D
Motor-Seat-Recline-Driver (M312)
C2384-8 GY-WH,1.5D C2993-1 C2994-1 OG,1.5D C0718-1
C0718-2
C2384-9 GY-RD,1.5D C2993-3 C2994-3 GY,1.5D C0718-5
C0718-4
C2382-3 GY-VT,0.35D C2993-2 C2994-2 PK-BU,0.5D
C2382-18 GY-PK,0.35D C2993-4 C2994-4 BK-GN,0.5D
C2381-11 BK-RD,1.5D C3026-1 C33N-11 BK-GY,1.5
S3D135 BK-GY,1.5
G3D135-1
S3DB06C VT-OG,0.5 C33N-17 C2363-1 VT-OG,0.5D C2383-6
S3DB07C GY-OG,0.5 C33N-18 C2363-2 GY-OG,0.5D C2383-7
VT-RD,1.5D (MEMORY) SJ2 VT-RD,0.5D C2381-14
C33N-12 C3026-2
VT-RD,1.5D (NON MEMORY)
BN-WH,0.5
S3BP19
Junction box-Central (P101)
Relay-Battery-saver (R250)
C1BP02G-1
FS19
5.0 Amps
C1BP02B-64 BN-WH,0.5
Central Electronics Module (CEM) (D316)
BATT A
RD,2.5D (MEMORY)
SJ4 RD,2.5D C2381-6
C33N-16 C3025-2
RD,2.5D (NON MEMORY)
RD,2.5D C2381-12
C2381-8 BK-VT,2.5D
SJ1 BK-GN,2.5D A Sheet2
C2381-10 BK-VT,2.5D
BG,2.5D B Sheet2
Junction box-Rear (P107)
C4BR02A-17
FA10
C4BR02A-22 YE-RD,2.50
30.0 Amps
Switch-Lumbar-Driver (S389)
VT-RD,1.0D C0976-2
C0976-7 BU,1.0D C0974-1
C0976-1 BN-YE,1.0D C0974-3
C0976-6 BK-VT,1.0D
C0976-3 BK-VT,1.0D
Pump-Lumbar-Driver (M286)
DEFLATE
INFLATE
C0974-2 BK-VT,1.0D
Junction box-Rear (P107)
C4BR02B-17
FB9
C4BR02B-21 RD,2.5
30.0 Amps
VT-RD,1.5D
C Sheet2
D Sheet2
E Sheet2
BN-WH,0.5
F Sheet2
G Sheet2

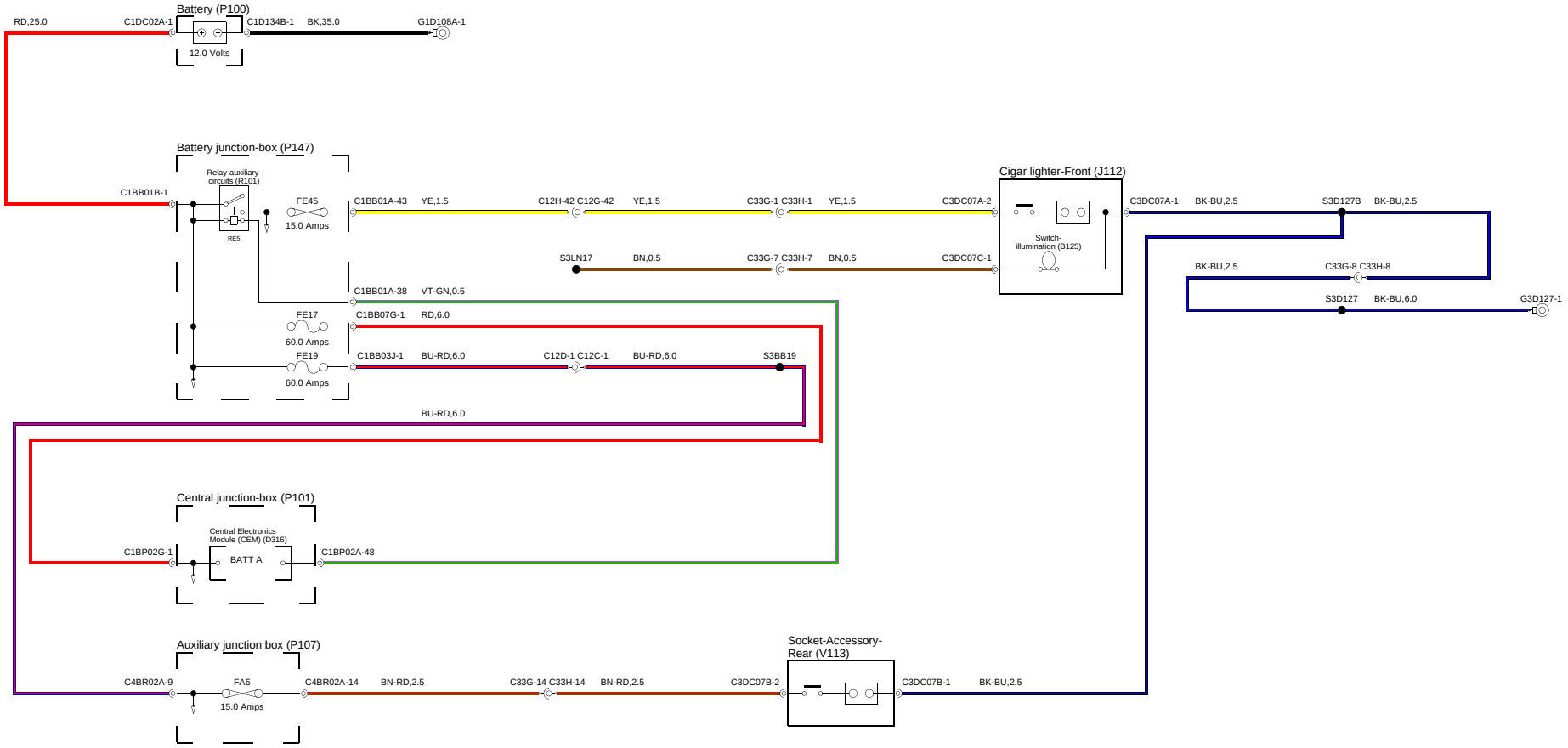

Relay-Power seat-RH (R210)
Switch pack-
Seat-Passenger (S392)
G
RD,2.5
C33P-16
C3025-2
RD-BK,2.5D
C0975-30
C0975-87
BN-VT,2.5D
C0774-1
Sheet1
F
BN-WH,0.5
C33P-12
C3026-2
VT-RD,0.5D
C0975-85
C0975-86
BK-GN,0.5D
Sheet1
VBATT
Switch-Slide-
Forward (S437)
Switch-Slide-
Rearward (S438)
Switch-Recline-
Up (S439)
Switch-Recline-
Down (S440)
C0773-4
VT,2.5D
C0720-1
C0720-5
Motor-seat-forward
rearward-passenger (M240)
C0773-1
BU,2.5D
C0775-1
BN,2.5D
C0518-5
C0518-1
Motor-Seat-Recline-
Passenger (M313)
C0775-2
PK,2.5D
C0774-3
BK-GN,2.5D
C3025-1
C33P-15
BK-BU,2.50
S3D127
BK-BU,6.0
G3D127-1
C3026-1
C33P-11
BK-BU,1.5
Switch pack-
Seat-Driver (S391)
E
(NON MEMORY)
RD,2.5
C0774-1
Sheet1
D
(NON MEMORY)
VT-RD,1.5D
Sheet1
C
(MEMORY)
VT-RD,1.5D
Sheet1
C0774-2
VBATT
Switch-Height-
Up (S435)
Switch-Height-
Down (S436)
Switch-Slide-
Forward (S437)
Switch-Slide-
Rearward (S438)
Switch-Recline-
Up (S439)
Switch-Recline-
Down (S440)
GND
C0773-5
YE,2.5D
C1637-1
C1637-2
Drivers seat
height motor (M221)
C0773-2
GN,2.5D
C0773-4
VT,2.5D
C0720-1
C0720-5
Motor-seat-forward
rearward-driver (M241)
C0773-1
BU,2.5D
C0775-1
BN,2.5D
C0518-5
C0518-1
Motor-Seat-Recline-
Driver (M312)
C0775-2
PK,2.5D
C0774-3
BK-GN,2.5D
(NON MEMORY)
BK-GN,2.5D
(MEMORY)
BK-GN,2.5D
C3025-1
C33N-15
BK,2.5
S3D133
BK,6.0
G3D133-1
B
Sheet1
A
Sheet1
(MEMORY)

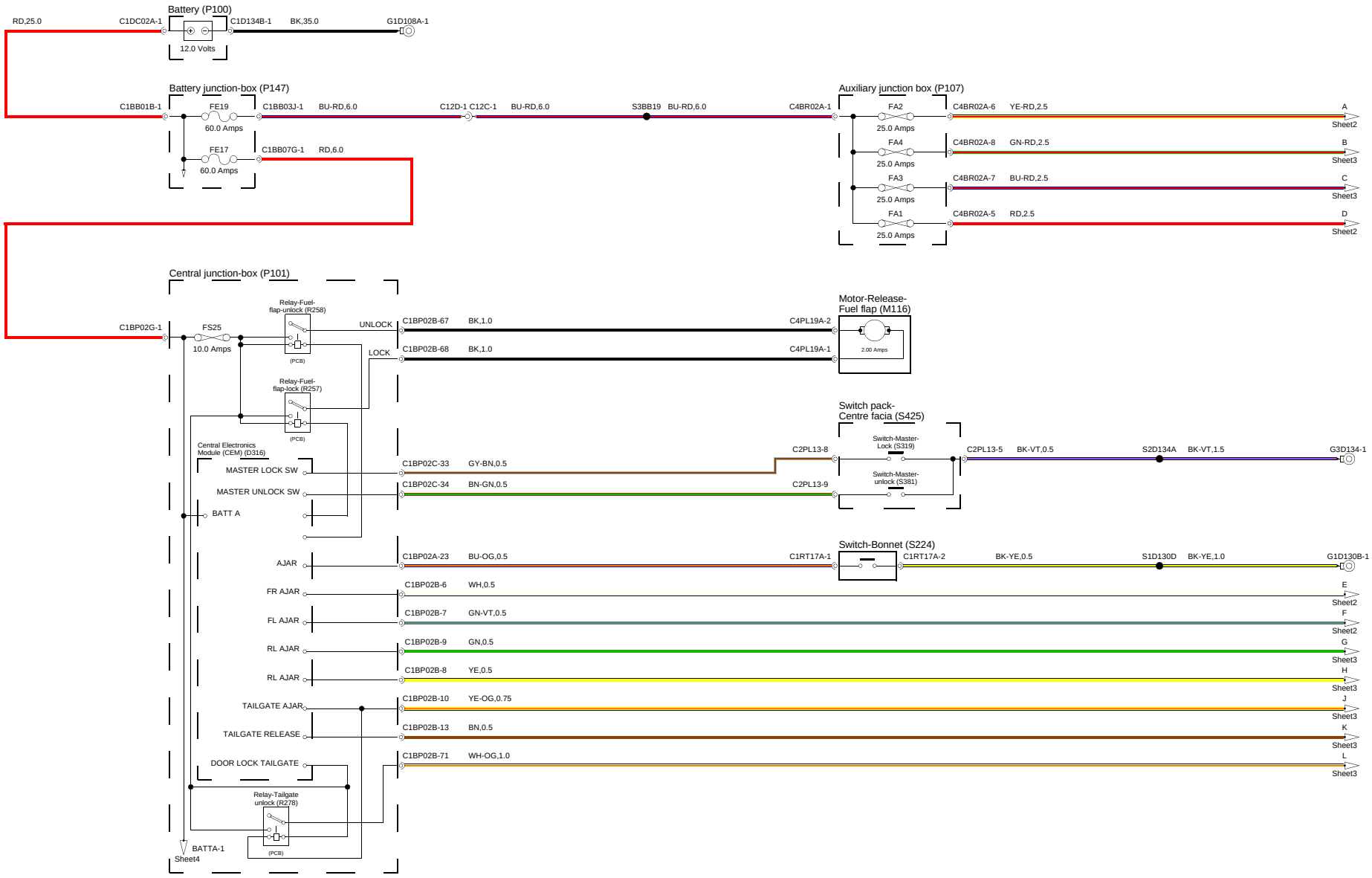

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
FE20
C1BB03K-1
GN-RD,6.0
C12D-2 C12C-2
60.0 Amps
GN-RD,6.0
S4BB20
GN-RD,6.0
GN-RD,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
MS CAN H
MS CAN L
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
C1BP02G-1
BATT A
FS27
5.0 Amps
C1BP02C-74
BU-RD,1.0
S2BB27
C1BP02B-45
BN,0.75
Auxiliary junction box (P107)
Relay-Ignition (R211)
MINI RB1
C4BR02B-29
C4BR02B-25
FB4
15.0 Amps
C4BR02B-8
VT,1.5
C4BR02B-31
FB3
15.0 Amps
C4BR02B-7
GY,1.5
C4BR02B-33
GY-BN,6.0
S4R115
C4BR02B-1
GY-BN,6.0
C5B1-4 C33P-4
BK-BU,1.5
S3D127
BK-BU,6.0
G3D127-1
Module-Heated seat-Passenger (D409)
BK,1.5
C3HS08A-1
GND
C3HS08C-2
YE,0.35
C3HS07B-1
Thermistor (H139)
C3HS07B-2
C3HS08C-3
YE,0.35
Heater-Seat cushion-Passenger (H150)
C3HS08C-1
GY,1.0
C3HS07A-1
C3HS07A-2
C3HS08C-4
BN,1.0
Heater-Seat backrest-Passenger (H151)
C33P-1 C5B1-1
RD,1.5
C3HS08A-4
IGN
C3HS08B-1
BK,1.0
C3HS06-1
C3HS06-2
C33P-2 C5B1-2
YE,0.5
C3HS08A-2
LIN
C3HS08B-2
BN,1.0
BN-VT,0.5
BN-VT,0.5
C23E-22 C23F-22
Automatic Temperature Control Module (D243)
S2H117
BN-VT,0.5
C2H101D-7
LIN R
Switch-Heater-Seat-RH (S161)
S2DB06G
VT-OG,0.5
C2H101D-10
MS CAN H
S2DB07G
GY-OG,0.5
C2H101D-11
MS CAN L
BU-RD,0.75
C2H101D-1
BATT
Switch-Heater-Seat-LH (S162)
WH-GN,0.5
S2H118
WH-GN,0.5
C2H101D-12
LIN L
C2H101D-18
BK-VT,0.75
S2D134A
BK-VT,1.5
G3D134-1
C23E-21 C23F-21
WH-GN,0.5
Module-Heated seat-Driver (D408)
C33N-2 C4B1-2
YE,0.5
C3HS03A-2
LIN
C3HS03C-2
YE,0.35
C3HS02B-1
Thermistor (H139)
C3HS02B-2
C3HS03C-3
YE,0.35
C33N-1 C4B1-1
RD,1.5
C3HS03A-4
IGN
Heater-Seat cushion-Driver (H148)
C3HS03C-1
GY,1.0
C3HS02A-1
C3HS02A-2
C3HS03C-4
BN,1.0
Heater-Seat backrest-Driver (H149)
C3HS03B-1
BK,1.0
C3HS01-1
C3HS01-2
C3HS03B-2
BN,1.0
BK,1.5
C3HS03A-1
GND
C4B1-4 C33N-4
BK,1.5
S3D133
BK,6.0
G3D133-1

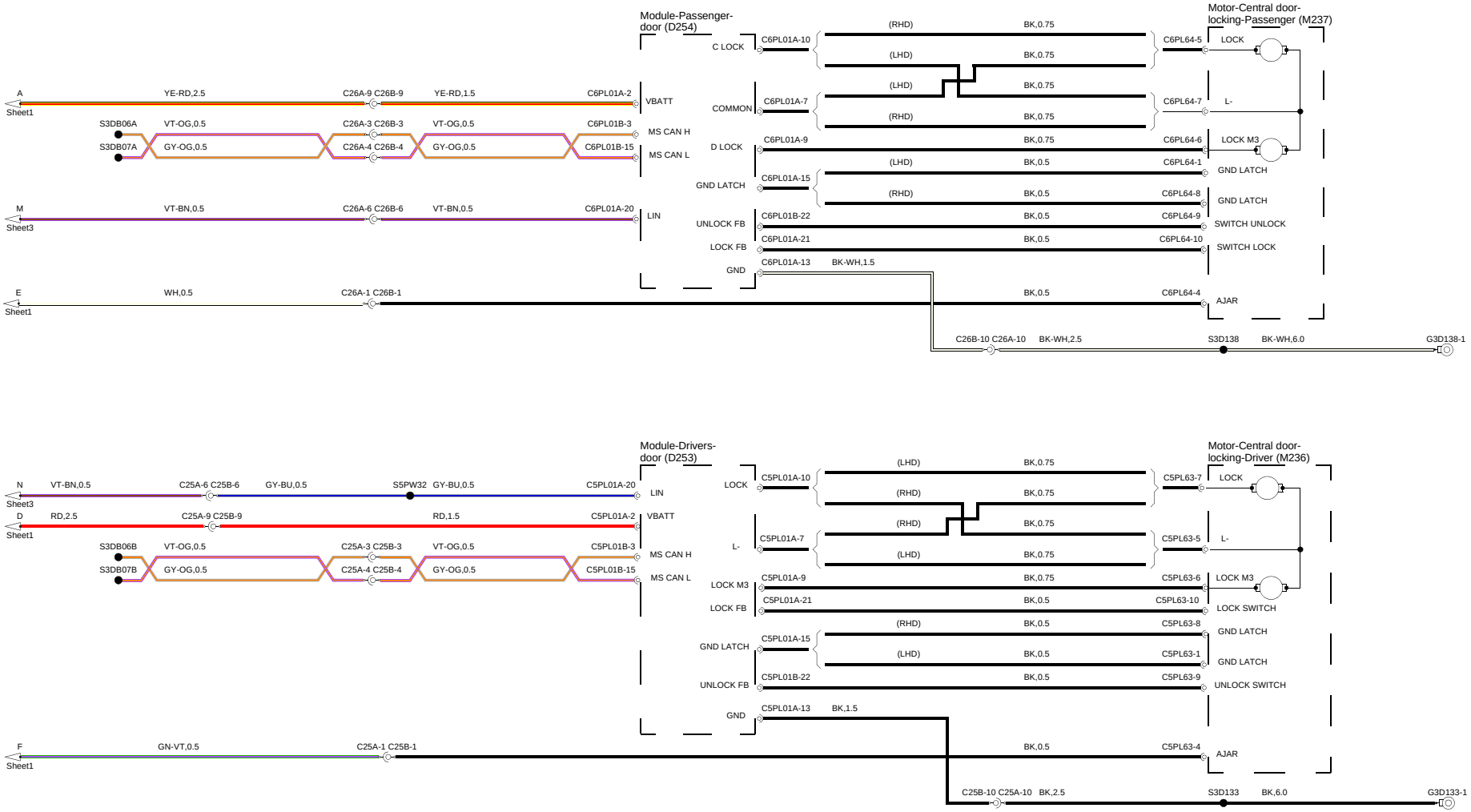

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Central junction-box (P101)
Battery junction-box (P147)
Relay-Battery-saver (R250)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
C1BP02G-1
60.0 Amps
FS17
7.5 Amps
C1BP02B-56
BN-GN,1.0
S3BP17
BN-GN,1.0
C25A-15 C25B-15
BN-GN,0.75
A
Sheet2
Relay-Ignition (R211)
RE7
FE41
C1BB01A-98
BU,4.0
20.0 Amps
Central Electronics Module (CEM) (D316)
GND
C1BP02A-54
BK-VT,0.75
G1D132B-1
BATT A
C1BP02A-65
IGN
MS CAN H
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
C1BB01A-106
GN-VT,0.75
C1BP02A-45
IGN RLY
MS CAN L
FE19
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
60.0 Amps
BU-RD,6.0
Auxiliary junction box (P107)
S3BB19
BU-RD,6.0
C4BR02A-1
FA1
C4BR02A-5
RD,2.5
B
Sheet2
25.0 Amps
FA2
C4BR02A-6
YE-RD,2.5
C
Sheet2
25.0 Amps
FA3
C4BR02A-7
BU-RD,2.5
D
Sheet3
25.0 Amps
FA4
C4BR02A-8
GN-RD,2.5
E
Sheet3
25.0 Amps

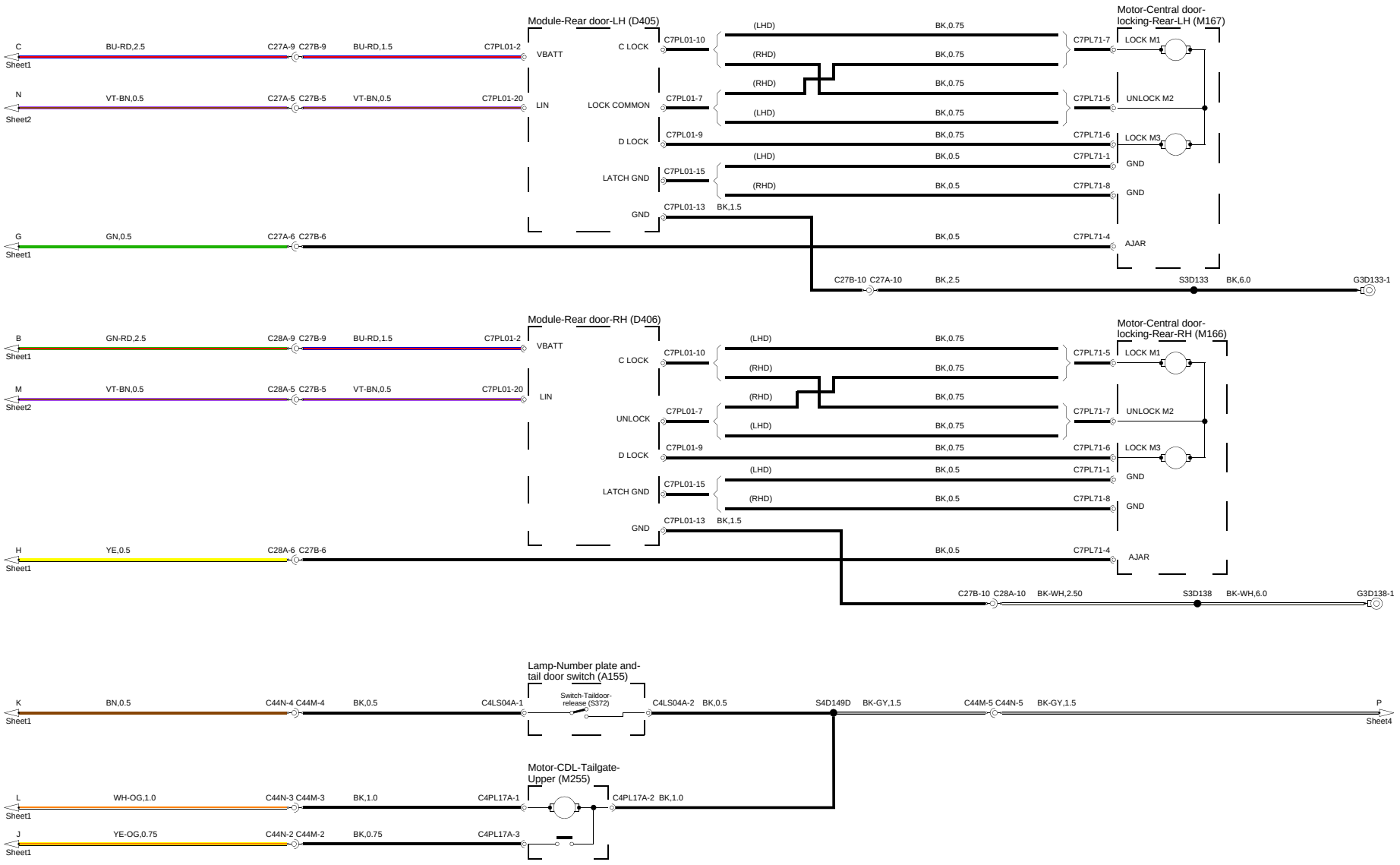

Switch pack-
Window lift (S400)
POWER
GND
Switch-Window-
Driver door (S344)
LIN
Switch-Window-
Passenger door (S343)
Switch-Window-
Rear-LH (S141)
Switch-Window-
Rear-RH (S140)
Module-Drivers-
door (D253)
WINDOW UP
WINDOW DOWN
HALL SENSE SUPPLY
HALL SENSE GND
HALL1
HALL2
BATT
MS CAN H
MS CAN L
GND
Motor-Window-Driver (M242)
Switch-Window-
Passenger door (S343)
UP
DOWN
Switch-
illumination (B125)
Module-Passenger-
door (D254)
SWITCH UP
SWITCH DOWN
SWITCH ILLUM
GND DSP
HALL SENSE SUPP
Motor-Window-
Passenger (M243)
A BN-GN,0.75 C5PL22A-2
C5PL22A-3 BK-GY,0.5
C25B-2 C25A-2 BK-GY,0.5
S3D135 BK-GY,1.5
G3D135-1
C5PL22A-4 GY-BU,0.5
S5PW32 GY-BU,0.5
C5PL01A-20
GY-BU,0.5
C5PL01A-12 BU,2.5
C5PW11A-6
C5PL01A-1 GN,2.5
C5PW11A-3
C5PL01A-17 WH-BN,0.5
C5PW11A-1
C5PL01A-16 VT-GN,0.5
C5PW11A-4
C5PL01A-6 YE-BU,0.5
C5PW11A-2
C5PL01A-5 BU-WH,0.5
C5PW11A-5
F VT-BN,0.5
C25A-6 C25B-6
B RD,2.5
C25A-9 C25B-9 RD,1.5
C5PL01A-2
C25A-3 C25B-3 VT-OG,0.5
C5PL01B-3
C25A-4 C25B-4 GY-OG,0.5
C5PL01B-15
C5PL01A-13 BK,1.5
C25B-10 C25A-10 BK,2.5
S3D133 BK,6.0
G3D133-1
G
BK,2.5
C6PW19A-2 BN-YE,0.35
C6PL01A-22
C6PW19A-3 GN-OG,0.35
C6PL01A-11
C6PW19A-1 YE,0.5
C6PL01A-4
C6PW19A-4 GN-BN,0.5
C6PL01A-18
C6PL01A-12 WH,2.5
C6PW20A-6
C6PL01A-1 GY-YE,2.5
C6PW20A-3
C6PL01A-17 VT-GY,0.5
C6PW20A-1
C6PL01A-16 YE-GN,0.5
C6PW20A-4
C6PL01A-6 BU-OG,0.5
C6PW20A-2
C6PL01A-5 BU-GY,0.5
C6PW20A-5
C YE-RD,2.5
C26A-9 C26B-9 YE-RD,1.5
C6PL01A-2
C26A-3 C26B-3 VT-OG,0.5
C6PL01B-3
C26A-4 C26B-4 GY-OG,0.5
C6PL01B-15
H VT-BN,0.5
C26A-6 C26B-6 VT-BN,0.5
C6PL01A-20
C6PL01A-13 BK-WH,1.5
C26B-10 C26A-10 BK-WH,2.5
S3D138 BK-WH,6.0
G3D138-1
J
BK-WH,2.50
Sheet1
Sheet3

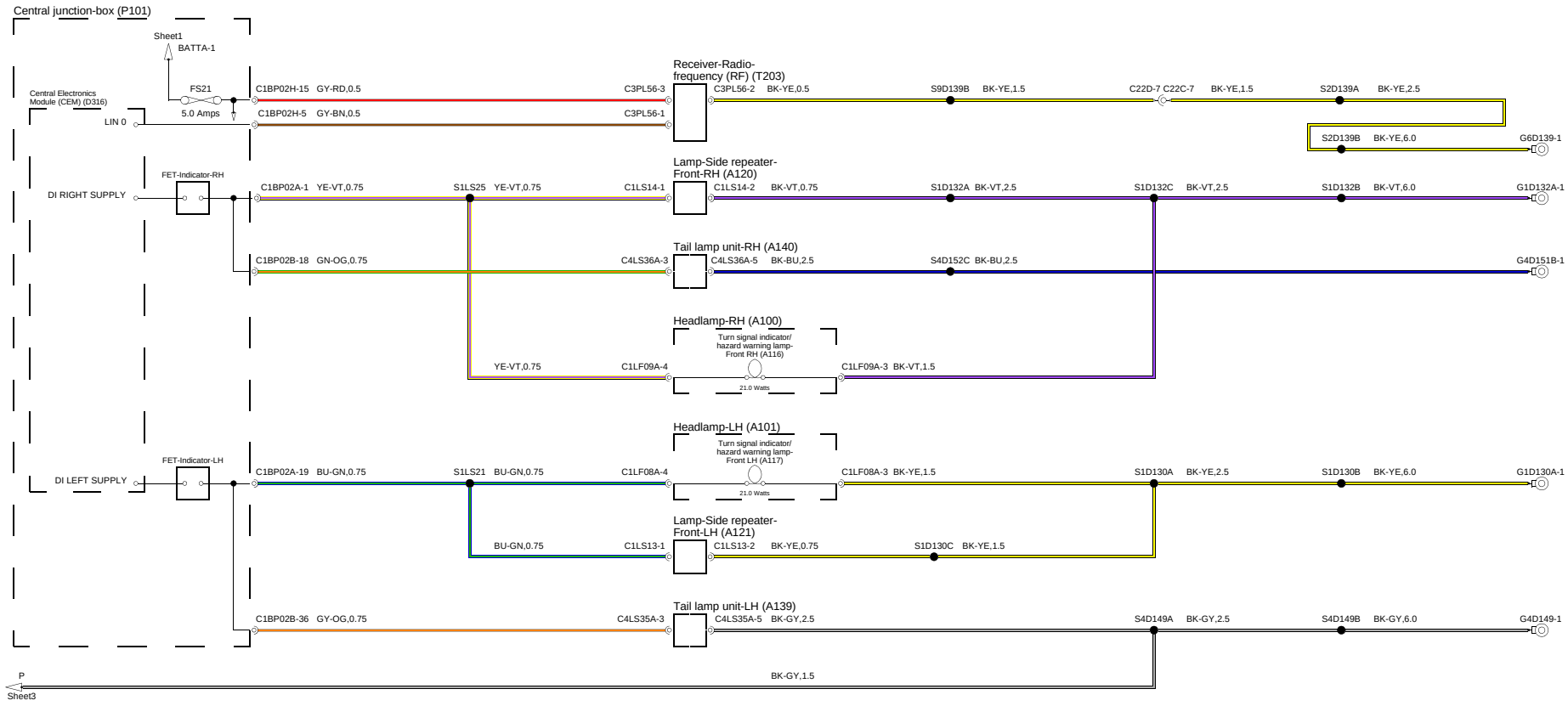

Switch-Window-Rear-RH (S140)
UP
DOWN
Switch-illumination (B125)
C7PW21-2
BU-OG,0.35
C7PL01-22
SWITCH UP
C7PW21-3
YE,0.35
C7PL01-11
SWITCH DOWN
C7PW21-1
WH-BU,0.5
C7PL01-4
SWITCH ILLUM
C7PW21-4
GY-OG,0.5
C7PL01-18
GND DSP
E
GN-RD,2.5
C28A-9
C27B-9
BU-RD,1.5
C7PL01-2
BATT
Sheet1
H
VT-BN,0.5
C28A-5
C27B-5
VT-BN,0.5
C7PL01-20
LIN
Sheet2
Module-Rear door-RH (D406)
WINDOW UP
C7PL01-12
GY-BN,2.5
C7PW22A-6
WINDOW DOWN
C7PL01-1
VT-OG,2.5
C7PW22A-3
HALL2
C7PL01-5
GN-OG,0.5
C7PW22A-5
HALL SENSE SUPP
C7PL01-17
YE-GY,0.5
C7PW22A-1
HALL1
C7PL01-6
BN-YE,0.5
C7PW22A-2
HALL SENSE GND
C7PL01-16
BU-BN,0.5
C7PW22A-4
GND
C7PL01-13
BK,1.5
C27B-10
C28A-10
BK-WH,2.50
J
Sheet2
Motor-Window-Rear-RH (M111)
Switch-Window-Rear-LH (S141)
UP
DOWN
Switch-illumination (B125)
C7PW21-2
BU-OG,0.35
C7PL01-22
SWITCH UP
C7PW21-3
YE,0.35
C7PL01-11
SWITCH DOWN
C7PW21-1
WH-BU,0.5
C7PL01-4
SWITCH ILLUM
C7PW21-4
GY-OG,0.5
C7PL01-18
GND DSP
D
BU-RD,2.5
C27A-9
C27B-9
BU-RD,1.5
C7PL01-2
BATT
Sheet1
F
VT-BN,0.5
C27A-5
C27B-5
VT-BN,0.5
C7PL01-20
LIN
Sheet2
Module-Rear door-LH (D405)
WINDOW UP
C7PL01-12
GY-BN,2.5
C7PW22A-6
WINDOW DOWN
C7PL01-1
VT-OG,2.5
C7PW22A-3
HALL SENSE SUPP
C7PL01-17
YE-GY,0.5
C7PW22A-1
HALL SENSE GND
C7PL01-16
BU-BN,0.5
C7PW22A-4
HALL1
C7PL01-6
BN-YE,0.5
C7PW22A-5
HALL2
C7PL01-5
GN-OG,0.5
C7PW22A-2
GND
C7PL01-13
BK,1.5
C27B-10
C27A-10
BK,2.5
G
Sheet2
Motor-Window-Rear-LH (M112)

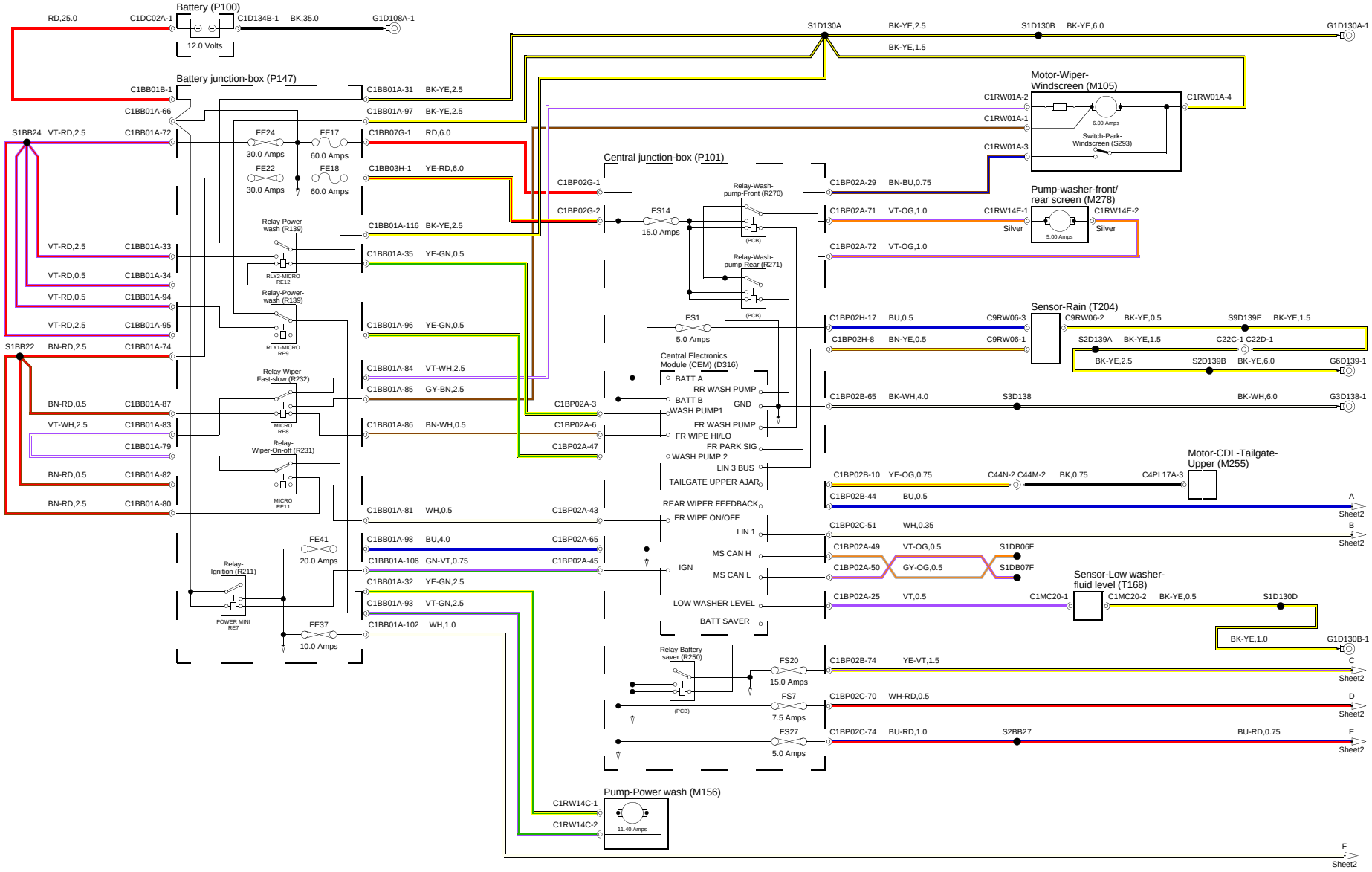

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
Relay-auxiliary-circuits (R101)
C1BB01B-1
RES
FE45
15.0 Amps
C1BB01A-43
YE,1.5
C12H-42 C12G-42
YE,1.5
C33G-1 C33H-1
YE,1.5
C3DC07A-2
Cigar lighter-Front (J112)
C3DC07A-1
BK-BU,2.5
S3D127B
BK-BU,2.5
Switch-illumination (B125)
S3LN17
BN,0.5
C33G-7 C33H-7
BN,0.5
C3DC07C-1
BK-BU,2.5
C33G-8 C33H-8
S3D127
BK-BU,6.0
G3D127-1
C1BB01A-38
VT-GN,0.5
FE17
60.0 Amps
C1BB07G-1
RD,6.0
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
BU-RD,6.0
S3BB19
BU-RD,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
C1BP02G-1
BATT A
C1BP02A-48
Auxiliary junction box (P107)
Socket-Accessory-Rear (V113)
C4BR02A-9
FA6
15.0 Amps
C4BR02A-14
BN-RD,2.5
C33G-14 C33H-14
BN-RD,2.5
C3DC07B-2
C3DC07B-1
BK-BU,2.5

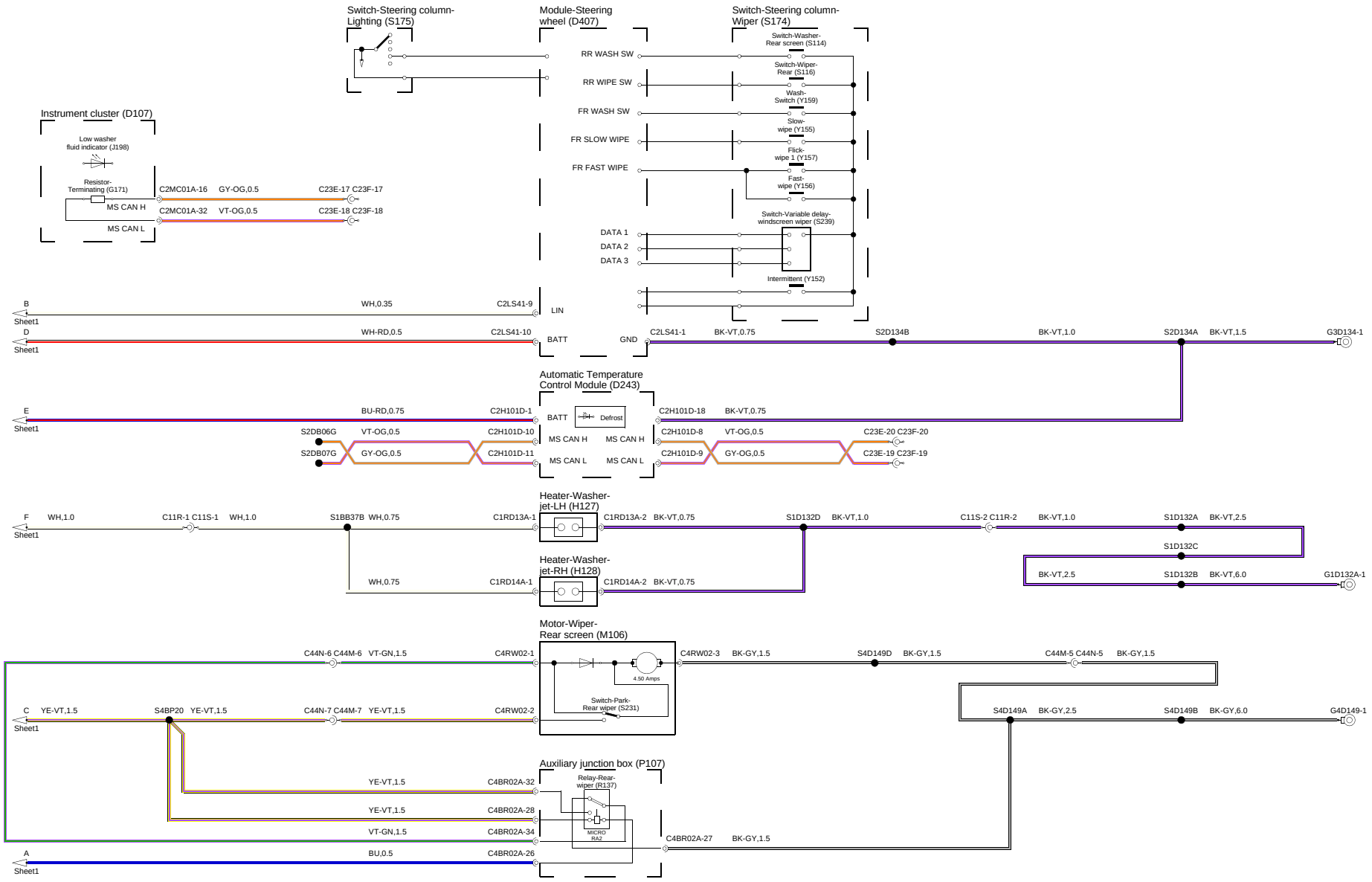

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
BU-RD,6.0
S3BB19
BU-RD,6.0
C4BR02A-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
Auxiliary junction box (P107)
FA2
25.0 Amps
C4BR02A-6
YE-RD,2.5
A
Sheet2
FA4
25.0 Amps
C4BR02A-8
GN-RD,2.5
B
Sheet3
FA3
25.0 Amps
C4BR02A-7
BU-RD,2.5
C
Sheet3
FA1
25.0 Amps
C4BR02A-5
RD,2.5
D
Sheet2
Central junction-box (P101)
C1BP02G-1
FS25
10.0 Amps
Relay-Fuel-flap-unlock (R258)
(PCB)
UNLOCK
C1BP02B-67
BK,1.0
C4PL19A-2
LOCK
C1BP02B-68
BK,1.0
C4PL19A-1
Motor-Release-Fuel flap (M116)
2.00 Amps
Relay-Fuel-flap-lock (R257)
(PCB)
Central Electronics Module (CEM) (D316)
MASTER LOCK SW
MASTER UNLOCK SW
BATT A
Switch pack-Centre facia (S425)
C2PL13-8
Switch-Master-Lock (S319)
C2PL13-5
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
Switch-Master-unlock (S381)
C2PL13-9
C1BP02C-33
GY-BN,0.5
C1BP02C-34
BN-GN,0.5
Switch-Bonnet (S224)
AJAR
C1BP02A-23
BU-OG,0.5
C1RT17A-1
C1RT17A-2
BK-YE,0.5
S1D130D
BK-YE,1.0
G1D130B-1
FR AJAR
C1BP02B-6
WH,0.5
E
Sheet2
FL AJAR
C1BP02B-7
GN-VT,0.5
F
Sheet2
RL AJAR
C1BP02B-9
GN,0.5
G
Sheet3
RL AJAR
C1BP02B-8
YE,0.5
H
Sheet3
TAILGATE AJAR
C1BP02B-10
YE-OG,0.75
J
Sheet3
TAILGATE RELEASE
C1BP02B-13
BN,0.5
K
Sheet3
DOOR LOCK TAILGATE
C1BP02B-71
WH-OG,1.0
L
Sheet3
Relay-Tailgate unlock (R278)
(PCB)
BATTA-1
Sheet4

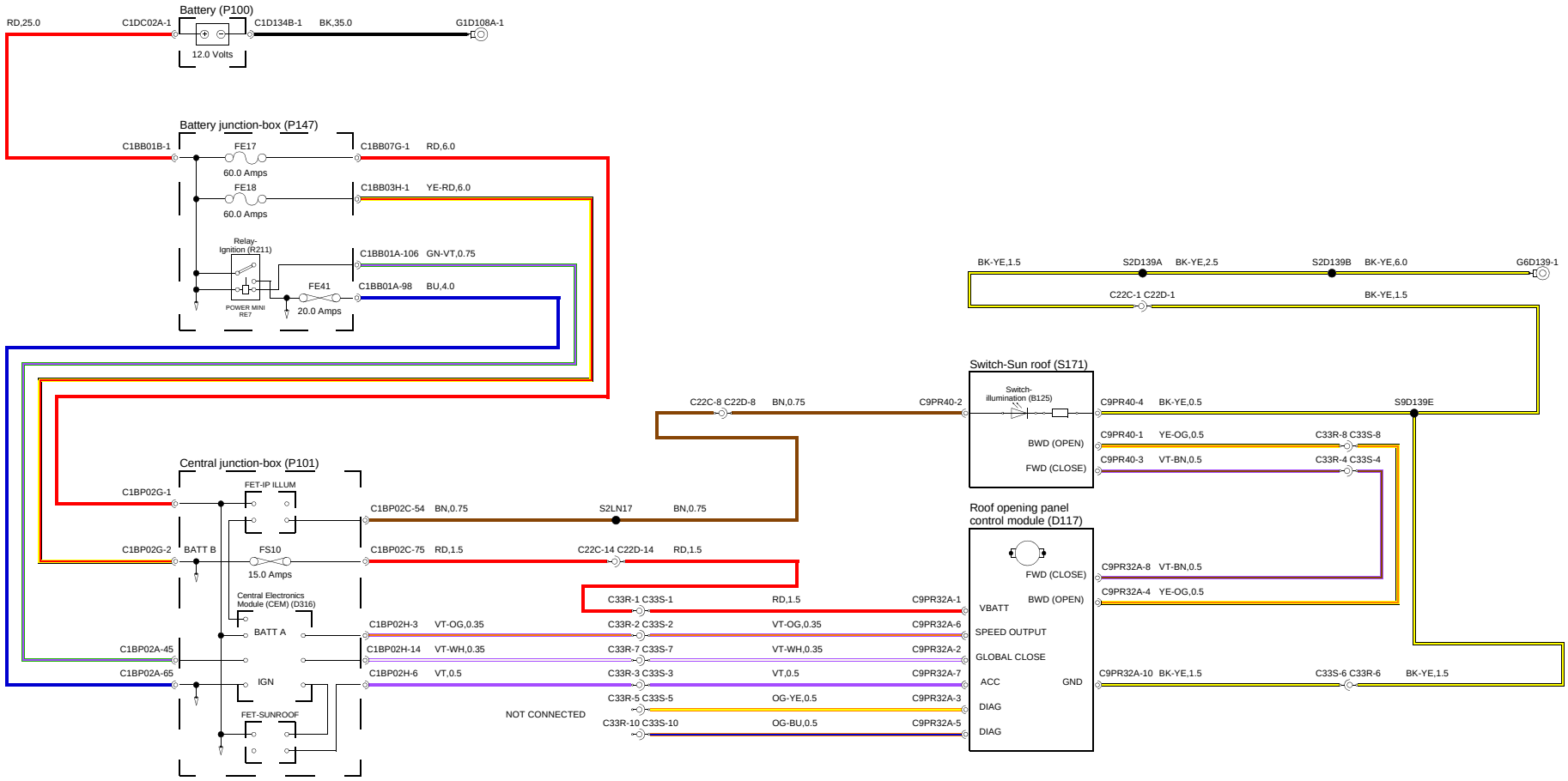

Module-Passenger-door (D254)
Motor-Central door-locking-Passenger (M237)
A
YE-RD,2.5
C26A-9 C26B-9
YE-RD,1.5
C6PL01A-2
Sheet1
VBATT
S3DB06A
VT-OG,0.5
C26A-3 C26B-3
VT-OG,0.5
C6PL01B-3
MS CAN H
S3DB07A
GY-OG,0.5
C26A-4 C26B-4
GY-OG,0.5
C6PL01B-15
MS CAN L
M
VT-BN,0.5
C26A-6 C26B-6
VT-BN,0.5
C6PL01A-20
Sheet3
LIN
E
WH,0.5
C26A-1 C26B-1
Sheet1
C LOCK
C6PL01A-10
(RHD)
BK,0.75
(LHD)
BK,0.75
C6PL64-5
LOCK
COMMON
C6PL01A-7
(LHD)
BK,0.75
(RHD)
BK,0.75
C6PL64-7
L-
D LOCK
C6PL01A-9
BK,0.75
C6PL64-6
LOCK M3
GND LATCH
C6PL01A-15
(LHD)
BK,0.5
C6PL64-1
GND LATCH
(RHD)
BK,0.5
C6PL64-8
GND LATCH
UNLOCK FB
C6PL01B-22
BK,0.5
C6PL64-9
SWITCH UNLOCK
LOCK FB
C6PL01A-21
BK,0.5
C6PL64-10
SWITCH LOCK
GND
C6PL01A-13
BK-WH,1.5
BK,0.5
C6PL64-4
AJAR
C26B-10 C26A-10
BK-WH,2.5
S3D138
BK-WH,6.0
G3D138-1
Module-Drivers-door (D253)
Motor-Central door-locking-Driver (M236)
N
VT-BN,0.5
C25A-6 C25B-6
GY-BU,0.5
S5PW32
GY-BU,0.5
C5PL01A-20
Sheet3
LIN
D
RD,2.5
C25A-9 C25B-9
RD,1.5
C5PL01A-2
Sheet1
VBATT
S3DB06B
VT-OG,0.5
C25A-3 C25B-3
VT-OG,0.5
C5PL01B-3
MS CAN H
S3DB07B
GY-OG,0.5
C25A-4 C25B-4
GY-OG,0.5
C5PL01B-15
MS CAN L
F
GN-VT,0.5
C25A-1 C25B-1
Sheet1
LOCK
C5PL01A-10
(LHD)
BK,0.75
(RHD)
BK,0.75
C5PL63-7
LOCK
L-
C5PL01A-7
(RHD)
BK,0.75
(LHD)
BK,0.75
C5PL63-5
L-
LOCK M3
C5PL01A-9
BK,0.75
C5PL63-6
LOCK M3
LOCK FB
C5PL01A-21
BK,0.5
C5PL63-10
LOCK SWITCH
GND LATCH
C5PL01A-15
(RHD)
BK,0.5
C5PL63-8
GND LATCH
(LHD)
BK,0.5
C5PL63-1
GND LATCH
UNLOCK FB
C5PL01B-22
BK,0.5
C5PL63-9
UNLOCK SWITCH
GND
C5PL01A-13
BK,1.5
BK,0.5
C5PL63-4
AJAR
C25B-10 C25A-10
BK,2.5
S3D133
BK,6.0
G3D133-1

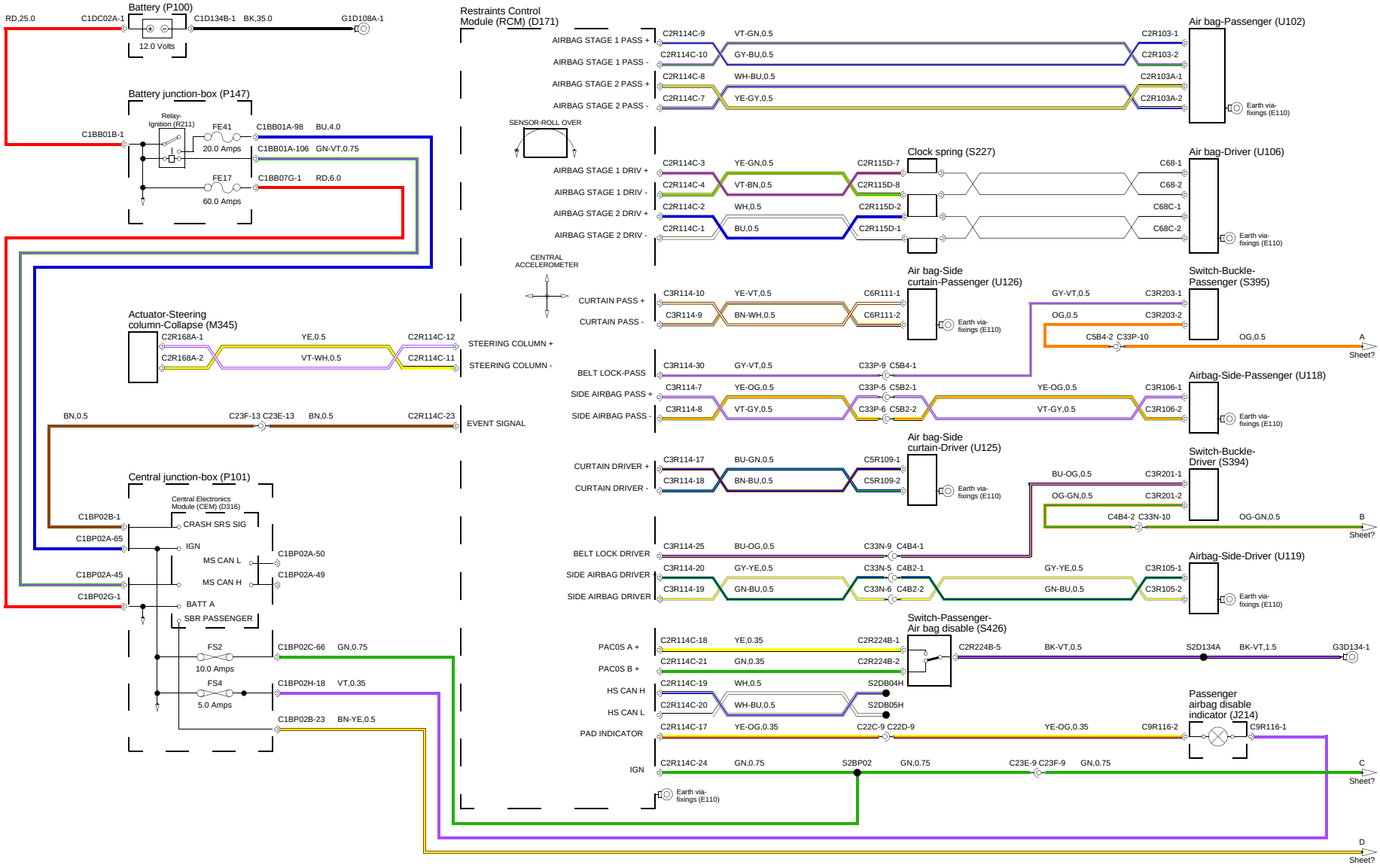

Module-Rear door-LH (D405)
Motor-Central door-locking-Rear-LH (M167)
C
BU-RD,2.5
C27A-9 C27B-9
BU-RD,1.5
C7PL01-2
VBATT
Sheet1
N
VT-BN,0.5
C27A-5 C27B-5
VT-BN,0.5
C7PL01-20
LIN
Sheet2
G
GN,0.5
C27A-6 C27B-6
Sheet1
C LOCK
C7PL01-10
LOCK COMMON
C7PL01-7
D LOCK
C7PL01-9
LATCH GND
C7PL01-15
GND
C7PL01-13
BK,1.5
(LHD)
(RHD)
BK,0.75
BK,0.5
C7PL71-7
C7PL71-5
C7PL71-6
C7PL71-1
C7PL71-8
C7PL71-4
LOCK M1
UNLOCK M2
LOCK M3
GND
AJAR
C27B-10 C27A-10
BK,2.5
S3D133
BK,6.0
G3D133-1
Module-Rear door-RH (D406)
Motor-Central door-locking-Rear-RH (M166)
B
GN-RD,2.5
C28A-9 C27B-9
BU-RD,1.5
C7PL01-2
VBATT
Sheet1
M
VT-BN,0.5
C28A-5 C27B-5
VT-BN,0.5
C7PL01-20
LIN
Sheet2
H
YE,0.5
C28A-6 C27B-6
Sheet1
C LOCK
C7PL01-10
UNLOCK
C7PL01-7
D LOCK
C7PL01-9
LATCH GND
C7PL01-15
GND
C7PL01-13
BK,1.5
(LHD)
(RHD)
BK,0.75
BK,0.5
C7PL71-5
C7PL71-7
C7PL71-6
C7PL71-1
C7PL71-8
C7PL71-4
LOCK M1
UNLOCK M2
LOCK M3
GND
AJAR
C27B-10 C28A-10
BK-WH,2.50
S3D138
BK-WH,6.0
G3D138-1
Lamp-Number plate and-tail door switch (A155)
K
BN,0.5
C44N-4 C44M-4
BK,0.5
C4LS04A-1
Switch-Taildoor-release (S372)
C4LS04A-2
BK,0.5
S4D149D
BK-GY,1.5
C44M-5 C44N-5
BK-GY,1.5
P
Sheet1
Sheet4
Motor-CDL-Tailgate-Upper (M255)
L
WH-OG,1.0
C44N-3 C44M-3
BK,1.0
C4PL17A-1
C4PL17A-2
BK,1.0
Sheet1
J
YE-OG,0.75
C44N-2 C44M-2
BK,0.75
C4PL17A-3
Sheet1

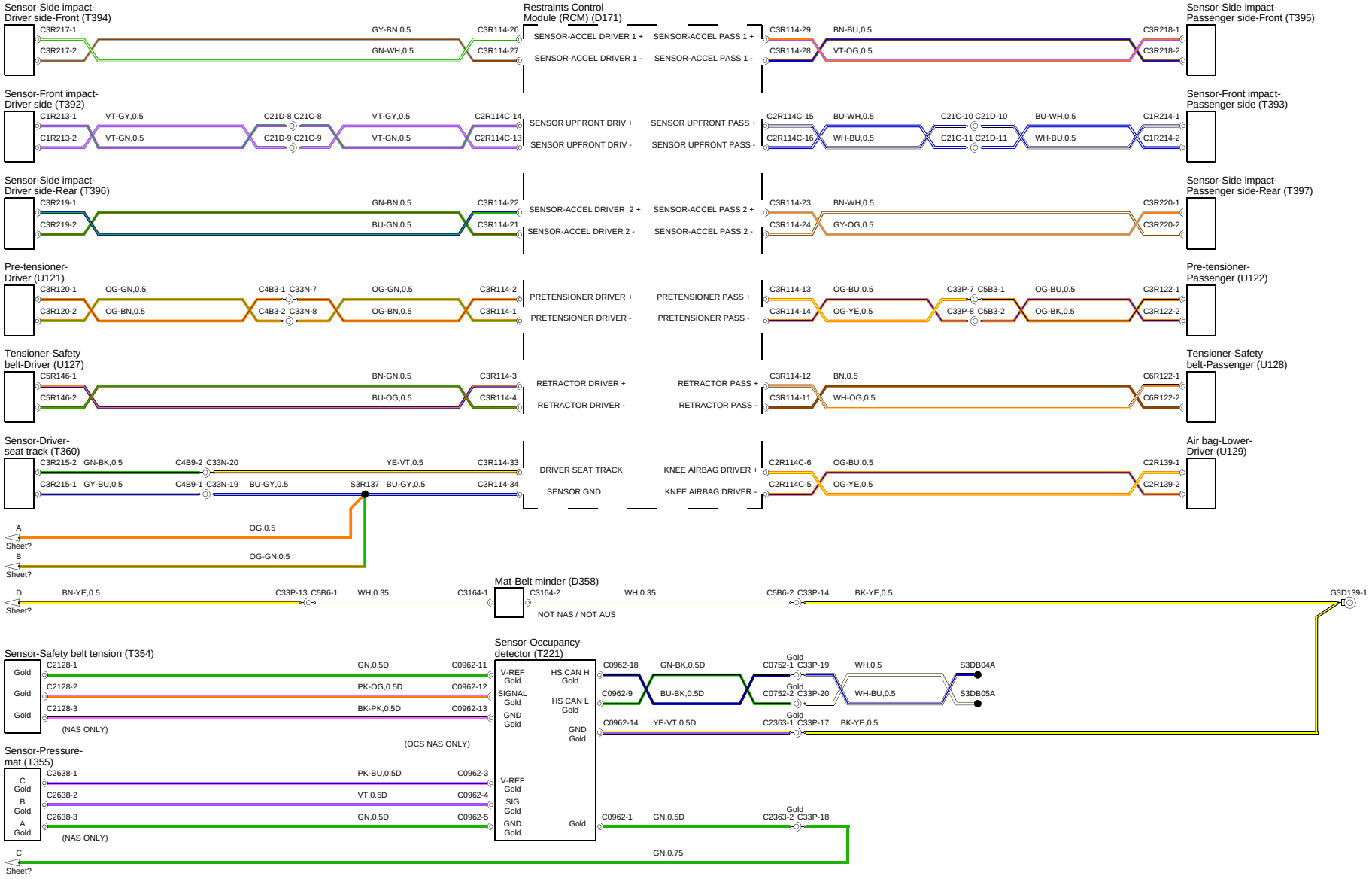

Central junction-box (P101)
Sheet1
BATTA-1
Central Electronics Module (CEM) (D316)
FS21
5.0 Amps
LIN 0
C1BP02H-15 GY-RD,0.5
C1BP02H-5 GY-BN,0.5
C3PL56-3
C3PL56-1
Receiver-Radio-frequency (RF) (T203)
C3PL56-2 BK-YE,0.5
S9D139B BK-YE,1.5
C22D-7 C22C-7 BK-YE,1.5
S2D139A BK-YE,2.5
S2D139B BK-YE,6.0
G6D139-1
FET-Indicator-RH
DI RIGHT SUPPLY
C1BP02A-1 YE-VT,0.75
S1LS25 YE-VT,0.75
C1LS14-1
Lamp-Side repeater-Front-RH (A120)
C1LS14-2 BK-VT,0.75
S1D132A BK-VT,2.5
S1D132C BK-VT,2.5
S1D132B BK-VT,6.0
G1D132A-1
C1BP02B-18 GN-OG,0.75
C4LS36A-3
Tail lamp unit-RH (A140)
C4LS36A-5 BK-BU,2.5
S4D152C BK-BU,2.5
G4D151B-1
Headlamp-RH (A100)
Turn signal indicator/ hazard warning lamp-Front RH (A116)
YE-VT,0.75
C1LF09A-4
21.0 Watts
C1LF09A-3 BK-VT,1.5
Headlamp-LH (A101)
Turn signal indicator/ hazard warning lamp-Front LH (A117)
FET-Indicator-LH
DI LEFT SUPPLY
C1BP02A-19 BU-GN,0.75
S1LS21 BU-GN,0.75
C1LF08A-4
C1LF08A-3 BK-YE,1.5
S1D130A BK-YE,2.5
S1D130B BK-YE,6.0
G1D130A-1
Lamp-Side repeater-Front-LH (A121)
BU-GN,0.75
C1LS13-1
C1LS13-2 BK-YE,0.75
S1D130C BK-YE,1.5
C1BP02B-36 GY-OG,0.75
C4LS35A-3
Tail lamp unit-LH (A139)
C4LS35A-5 BK-GY,2.5
S4D149A BK-GY,2.5
S4D149B BK-GY,6.0
G4D149-1
P
Sheet3
BK-GY,1.5


Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1 BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
C1BB01A-66
S1BB24 VT-RD,2.5
C1BB01A-72
FE24
30.0 Amps
FE17
60.0 Amps
FE22
30.0 Amps
FE18
60.0 Amps
C1BB01A-31 BK-YE,2.5
C1BB01A-97 BK-YE,2.5
C1BB07G-1 RD,6.0
C1BB03H-1 YE-RD,6.0
C1BB01A-116 BK-YE,2.5
C1BB01A-35 YE-GN,0.5
C1BB01A-96 YE-GN,0.5
C1BB01A-84 VT-WH,2.5
C1BB01A-85 GY-BN,2.5
C1BB01A-86 BN-WH,0.5
C1BB01A-81 WH,0.5
C1BB01A-98 BU,4.0
C1BB01A-106 GN-VT,0.75
C1BB01A-32 YE-GN,2.5
C1BB01A-93 VT-GN,2.5
C1BB01A-102 WH,1.0
Relay-Power-wash (R139)
RLY2-MICRO RE12
Relay-Power-wash (R139)
RLY1-MICRO RE9
Relay-Wiper-Fast-slow (R232)
MICRO RE8
Relay-Wiper-On-off (R231)
MICRO RE11
Relay-Ignition (R211)
POWER MINI RE7
FE41
20.0 Amps
FE37
10.0 Amps
VT-RD,2.5 C1BB01A-33
VT-RD,0.5 C1BB01A-34
VT-RD,0.5 C1BB01A-94
VT-RD,2.5 C1BB01A-95
S1BB22 BN-RD,2.5 C1BB01A-74
BN-RD,0.5 C1BB01A-87
VT-WH,2.5 C1BB01A-83
C1BB01A-79
BN-RD,0.5 C1BB01A-82
BN-RD,2.5 C1BB01A-80
S1D130A BK-YE,2.5
BK-YE,1.5
S1D130B BK-YE,6.0
G1D130A-1
Motor-Wiper-Windscreen (M105)
C1RW01A-2
C1RW01A-1
C1RW01A-3
C1RW01A-4
6.00 Amps
Switch-Park-Windscreen (S293)
Central junction-box (P101)
C1BP02G-1
C1BP02G-2
FS14
15.0 Amps
Relay-Wash-pump-Front (R270)
(PCB)
Relay-Wash-pump-Rear (R271)
(PCB)
FS1
5.0 Amps
Central Electronics Module (CEM) (D316)
BATT A
BATT B
WASH PUMP1
FR WIPE HI/LO
WASH PUMP 2
LIN 3 BUS
TAILGATE UPPER AJAR
REAR WIPER FEEDBACK
FR WIPE ON/OFF
LIN 1
MS CAN H
IGN
MS CAN L
LOW WASHER LEVEL
BATT SAVER
RR WASH PUMP
GND
FR WASH PUMP
FR PARK SIG
Relay-Battery-saver (R250)
(PCB)
FS20
15.0 Amps
FS7
7.5 Amps
FS27
5.0 Amps
C1BP02A-3
C1BP02A-6
C1BP02A-47
C1BP02A-43
C1BP02A-65
C1BP02A-45
C1BP02A-29 BN-BU,0.75
C1BP02A-71 VT-OG,1.0
C1BP02A-72 VT-OG,1.0
Pump-washer-front/rear screen (M278)
C1RW14E-1
C1RW14E-2
Silver
Silver
5.00 Amps
Sensor-Rain (T204)
C1BP02H-17 BU,0.5
C1BP02H-8 BN-YE,0.5
C9RW06-3
C9RW06-1
C9RW06-2 BK-YE,0.5
S9D139E BK-YE,1.5
S2D139A BK-YE,1.5
C22C-1 C22D-1
BK-YE,2.5
S2D139B BK-YE,6.0
G6D139-1
C1BP02B-65 BK-WH,4.0
S3D138
BK-WH,6.0
G3D138-1
Motor-CDL-Tailgate-Upper (M255)
C1BP02B-10 YE-OG,0.75
C44N-2 C44M-2 BK,0.75
C4PL17A-3
C1BP02B-44 BU,0.5
A
Sheet2
C1BP02C-51 WH,0.35
B
Sheet2
C1BP02A-49 VT-OG,0.5
S1DB06F
C1BP02A-50 GY-OG,0.5
S1DB07F
Sensor-Low washer-fluid level (T168)
C1BP02A-25 VT,0.5
C1MC20-1
C1MC20-2 BK-YE,0.5
S1D130D
BK-YE,1.0
G1D130B-1
C1BP02B-74 YE-VT,1.5
C
Sheet2
C1BP02C-70 WH-RD,0.5
D
Sheet2
C1BP02C-74 BU-RD,1.0
S2BB27
BU-RD,0.75
E
Sheet2
Pump-Power wash (M156)
C1RW14C-1
C1RW14C-2
11.40 Amps
F
Sheet2

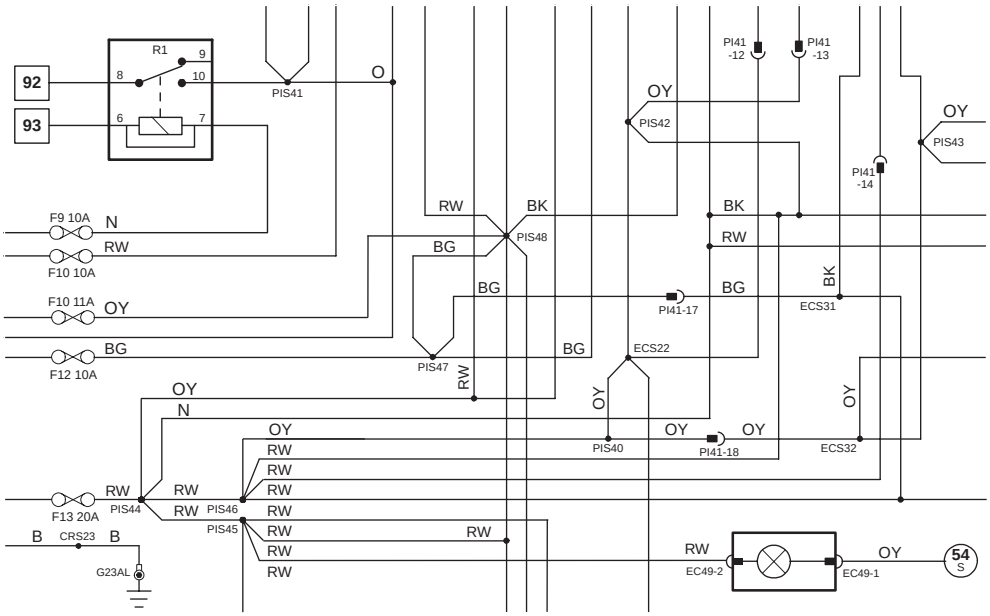

Switch-Steering column-
Lighting (S175)
Module-Steering
wheel (D407)
Switch-Steering column-
Wiper (S174)
Switch-Washer-
Rear screen (S114)
RR WASH SW
Switch-Wiper-
Rear (S116)
RR WIPE SW
Wash-
Switch (Y159)
FR WASH SW
Slow-
wipe (Y155)
FR SLOW WIPE
Flick-
wipe 1 (Y157)
FR FAST WIPE
Fast-
wipe (Y156)
Switch-Variable delay-
windscreen wiper (S239)
DATA 1
DATA 2
DATA 3
Intermittent (Y152)
Instrument cluster (D107)
Low washer
fluid indicator (J198)
Resistor-
Terminating (G171)
MS CAN H
MS CAN L
C2MC01A-16 GY-OG,0.5 C23E-17 C23F-17
C2MC01A-32 VT-OG,0.5 C23E-18 C23F-18
B
Sheet1
WH,0.35
C2LS41-9
LIN
D
Sheet1
WH-RD,0.5
C2LS41-10
BATT
GND
C2LS41-1
BK-VT,0.75
S2D134B
BK-VT,1.0
S2D134A
BK-VT,1.5
G3D134-1
Automatic Temperature
Control Module (D243)
E
Sheet1
BU-RD,0.75
C2H101D-1
BATT
Defrost
C2H101D-18
BK-VT,0.75
S2DB06G
VT-OG,0.5
C2H101D-10
MS CAN H
MS CAN H
C2H101D-8
VT-OG,0.5
C23E-20 C23F-20
S2DB07G
GY-OG,0.5
C2H101D-11
MS CAN L
MS CAN L
C2H101D-9
GY-OG,0.5
C23E-19 C23F-19
Heater-Washer-
jet-LH (H127)
F
Sheet1
WH,1.0
C11R-1 C11S-1
WH,1.0
S1BB37B
WH,0.75
C1RD13A-1
C1RD13A-2
BK-VT,0.75
S1D132D
BK-VT,1.0
C11S-2 C11R-2
BK-VT,1.0
S1D132A
BK-VT,2.5
S1D132C
Heater-Washer-
jet-RH (H128)
WH,0.75
C1RD14A-1
C1RD14A-2
BK-VT,0.75
BK-VT,2.5
S1D132B
BK-VT,6.0
G1D132A-1
Motor-Wiper-
Rear screen (M106)
C44N-6 C44M-6
VT-GN,1.5
C4RW02-1
4.50 Amps
Switch-Park-
Rear wiper (S231)
C4RW02-3
BK-GY,1.5
S4D149D
BK-GY,1.5
C44M-5 C44N-5
BK-GY,1.5
C
Sheet1
YE-VT,1.5
S4BP20
YE-VT,1.5
C44N-7 C44M-7
YE-VT,1.5
C4RW02-2
S4D149A
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
Auxiliary junction box (P107)
Relay-Rear-
wiper (R137)
MICRO
RA2
YE-VT,1.5
C4BR02A-32
YE-VT,1.5
C4BR02A-28
VT-GN,1.5
C4BR02A-34
C4BR02A-27
BK-GY,1.5
A
Sheet1
BU,0.5
C4BR02A-26


Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0
Relay-Ignition (R211)
POWER MINI RE7
C1BB01A-106
GN-VT,0.75
FE41
20.0 Amps
C1BB01A-98
BU,4.0
BK-YE,1.5
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
C22C-1 C22D-1
BK-YE,1.5
Switch-Sun roof (S171)
Switch-illumination (B125)
C22C-8 C22D-8
BN,0.75
C9PR40-2
C9PR40-4
BK-YE,0.5
S9D139E
C9PR40-1
YE-OG,0.5
C33R-8 C33S-8
BWD (OPEN)
C9PR40-3
VT-BN,0.5
C33R-4 C33S-4
FWD (CLOSE)
Central junction-box (P101)
C1BP02G-1
FET-IP ILLUM
C1BP02C-54
BN,0.75
S2LN17
BN,0.75
C1BP02G-2
BATT B
FS10
15.0 Amps
C1BP02C-75
RD,1.5
C22C-14 C22D-14
RD,1.5
Roof opening panel control module (D117)
Central Electronics Module (CEM) (D316)
BATT A
C1BP02A-45
C1BP02H-3
VT-OG,0.35
C33R-1 C33S-1
RD,1.5
C9PR32A-1
C33R-2 C33S-2
VT-OG,0.35
C9PR32A-6
C1BP02H-14
VT-WH,0.35
C33R-7 C33S-7
VT-WH,0.35
C9PR32A-2
C1BP02A-65
IGN
C1BP02H-6
VT,0.5
C33R-3 C33S-3
VT,0.5
C9PR32A-7
FET-SUNROOF
NOT CONNECTED
C33R-5 C33S-5
OG-YE,0.5
C9PR32A-3
C33R-10 C33S-10
OG-BU,0.5
C9PR32A-5
FWD (CLOSE)
BWD (OPEN)
VBATT
SPEED OUTPUT
GLOBAL CLOSE
ACC
GND
DIAG
DIAG
C9PR32A-8
VT-BN,0.5
C9PR32A-4
YE-OG,0.5
C9PR32A-10
BK-YE,1.5
C33S-6 C33R-6
BK-YE,1.5


Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
Relay-Ignition (R211)
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BB01A-106
GN-VT,0.75
FE17
60.0 Amps
C1BB07G-1
RD,6.0
Restraints Control Module (RCM) (D171)
AIRBAG STAGE 1 PASS +
AIRBAG STAGE 1 PASS -
AIRBAG STAGE 2 PASS +
AIRBAG STAGE 2 PASS -
C2R114C-9
VT-GN,0.5
C2R114C-10
GY-BU,0.5
C2R114C-8
WH-BU,0.5
C2R114C-7
YE-GY,0.5
C2R103-1
C2R103-2
C2R103A-1
C2R103A-2
Air bag-Passenger (U102)
Earth via-fixings (E110)
SENSOR-ROLL OVER
Clock spring (S227)
AIRBAG STAGE 1 DRIV +
AIRBAG STAGE 1 DRIV -
AIRBAG STAGE 2 DRIV +
AIRBAG STAGE 2 DRIV -
C2R114C-3
YE-GN,0.5
C2R115D-7
C2R114C-4
VT-BN,0.5
C2R115D-8
C2R114C-2
WH,0.5
C2R115D-2
C2R114C-1
BU,0.5
C2R115D-1
C68-1
C68-2
C68C-1
C68C-2
Air bag-Driver (U106)
CENTRAL ACCELEROMETER
Air bag-Side curtain-Passenger (U126)
CURTAIN PASS +
CURTAIN PASS -
C3R114-10
YE-VT,0.5
C3R114-9
BN-WH,0.5
C6R111-1
C6R111-2
Switch-Buckle-Passenger (S395)
GY-VT,0.5
C3R203-1
OG,0.5
C3R203-2
C5B4-2 C33P-10
OG,0.5
A
Sheet?
Actuator-Steering column-Collapse (M345)
C2R168A-1
C2R168A-2
YE,0.5
VT-WH,0.5
C2R114C-12
C2R114C-11
STEERING COLUMN +
STEERING COLUMN -
BELT LOCK-PASS
C3R114-30
GY-VT,0.5
C33P-9 C5B4-1
SIDE AIRBAG PASS +
SIDE AIRBAG PASS -
C3R114-7
YE-OG,0.5
C3R114-8
VT-GY,0.5
C33P-5 C5B2-1
C33P-6 C5B2-2
YE-OG,0.5
VT-GY,0.5
C3R106-1
C3R106-2
Airbag-Side-Passenger (U118)
BN,0.5
C23F-13 C23E-13
BN,0.5
C2R114C-23
EVENT SIGNAL
Air bag-Side curtain-Driver (U125)
CURTAIN DRIVER +
CURTAIN DRIVER -
C3R114-17
BU-GN,0.5
C3R114-18
BN-BU,0.5
C5R109-1
C5R109-2
Switch-Buckle-Driver (S394)
BU-OG,0.5
C3R201-1
OG-GN,0.5
C3R201-2
C4B4-2 C33N-10
OG-GN,0.5
B
Sheet?
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
C1BP02B-1
CRASH SRS SIG
C1BP02A-65
IGN
C1BP02A-45
MS CAN L
MS CAN H
C1BP02A-50
C1BP02A-49
C1BP02G-1
BATT A
SBR PASSENGER
BELT LOCK DRIVER
C3R114-25
BU-OG,0.5
C33N-9 C4B4-1
SIDE AIRBAG DRIVER +
SIDE AIRBAG DRIVER -
C3R114-20
GY-YE,0.5
C3R114-19
GN-BU,0.5
C33N-5 C4B2-1
C33N-6 C4B2-2
GY-YE,0.5
GN-BU,0.5
C3R105-1
C3R105-2
Airbag-Side-Driver (U119)
Switch-Passenger-Air bag disable (S426)
PAC0S A +
PAC0S B +
HS CAN H
HS CAN L
C2R114C-18
YE,0.35
C2R114C-21
GN,0.35
C2R114C-19
WH,0.5
C2R114C-20
WH-BU,0.5
C2R224B-1
C2R224B-2
S2DB04H
S2DB05H
C2R224B-5
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
FS2
10.0 Amps
FS4
5.0 Amps
C1BP02C-66
GN,0.75
C1BP02H-18
VT,0.35
C1BP02B-23
BN-YE,0.5
PAD INDICATOR
C2R114C-17
YE-OG,0.35
C22C-9 C22D-9
YE-OG,0.35
C9R116-2
C9R116-1
Passenger airbag disable indicator (J214)
IGN
C2R114C-24
GN,0.75
S2BP02
GN,0.75
C23E-9 C23F-9
GN,0.75
C
Sheet?
D
Sheet?
Earth via-fixings (E110)


Sensor-Side impact-Driver side-Front (T394)
C3R217-1
C3R217-2
GY-BN,0.5
GN-WH,0.5
C3R114-26
C3R114-27
Restraints Control Module (RCM) (D171)
SENSOR-ACCEL DRIVER 1 +
SENSOR-ACCEL DRIVER 1 -
SENSOR-ACCEL PASS 1 +
SENSOR-ACCEL PASS 1 -
C3R114-29
C3R114-28
BN-BU,0.5
VT-OG,0.5
C3R218-1
C3R218-2
Sensor-Side impact-Passenger side-Front (T395)
Sensor-Front impact-Driver side (T392)
C1R213-1
C1R213-2
VT-GY,0.5
VT-GN,0.5
C21D-8 C21C-8
C21D-9 C21C-9
VT-GY,0.5
VT-GN,0.5
C2R114C-14
C2R114C-13
SENSOR UPFRONT DRIV +
SENSOR UPFRONT DRIV -
SENSOR UPFRONT PASS +
SENSOR UPFRONT PASS -
C2R114C-15
C2R114C-16
BU-WH,0.5
WH-BU,0.5
C21C-10 C21D-10
C21C-11 C21D-11
BU-WH,0.5
WH-BU,0.5
C1R214-1
C1R214-2
Sensor-Front impact-Passenger side (T393)
Sensor-Side impact-Driver side-Rear (T396)
C3R219-1
C3R219-2
GN-BN,0.5
BU-GN,0.5
C3R114-22
C3R114-21
SENSOR-ACCEL DRIVER 2 +
SENSOR-ACCEL DRIVER 2 -
SENSOR-ACCEL PASS 2 +
SENSOR-ACCEL PASS 2 -
C3R114-23
C3R114-24
BN-WH,0.5
GY-OG,0.5
C3R220-1
C3R220-2
Sensor-Side impact-Passenger side-Rear (T397)
Pre-tensioner-Driver (U121)
C3R120-1
C3R120-2
OG-GN,0.5
OG-BN,0.5
C4B3-1 C33N-7
C4B3-2 C33N-8
OG-GN,0.5
OG-BN,0.5
C3R114-2
C3R114-1
PRETENSIONER DRIVER +
PRETENSIONER DRIVER -
PRETENSIONER PASS +
PRETENSIONER PASS -
C3R114-13
C3R114-14
OG-BU,0.5
OG-YE,0.5
C33P-7 C5B3-1
C33P-8 C5B3-2
OG-BU,0.5
OG-BK,0.5
C3R122-1
C3R122-2
Pre-tensioner-Passenger (U122)
Tensioner-Safety belt-Driver (U127)
C5R146-1
C5R146-2
BN-GN,0.5
BU-OG,0.5
C3R114-3
C3R114-4
RETRACTOR DRIVER +
RETRACTOR DRIVER -
RETRACTOR PASS +
RETRACTOR PASS -
C3R114-12
C3R114-11
BN,0.5
WH-OG,0.5
C6R122-1
C6R122-2
Tensioner-Safety belt-Passenger (U128)
Sensor-Driver-seat track (T360)
C3R215-2
C3R215-1
GN-BK,0.5
GY-BU,0.5
C4B9-2 C33N-20
C4B9-1 C33N-19
YE-VT,0.5
BU-GY,0.5
S3R137
BU-GY,0.5
C3R114-33
C3R114-34
DRIVER SEAT TRACK
SENSOR GND
KNEE AIRBAG DRIVER +
KNEE AIRBAG DRIVER -
C2R114C-6
C2R114C-5
OG-BU,0.5
OG-YE,0.5
C2R139-1
C2R139-2
Air bag-Lower-Driver (U129)
A
OG,0.5
Sheet?
B
OG-GN,0.5
Sheet?
Mat-Belt minder (D358)
D
BN-YE,0.5
C33P-13 C5B6-1
WH,0.35
C3164-1
C3164-2
WH,0.35
C5B6-2 C33P-14
BK-YE,0.5
G3D139-1
NOT NAS / NOT AUS
Sheet?
Sensor-Safety belt tension (T354)
Gold
C2128-1
C2128-2
C2128-3
GN,0.5D
PK-OG,0.5D
BK-PK,0.5D
C0962-11
C0962-12
C0962-13
(NAS ONLY)
Sensor-Occupancy-detector (T221)
V-REF Gold
SIGNAL Gold
GND Gold
HS CAN H Gold
HS CAN L Gold
GND Gold
C0962-18
C0962-9
C0962-14
GN-BK,0.5D
BU-BK,0.5D
YE-VT,0.5D
Gold
C0752-1 C33P-19
C0752-2 C33P-20
C2363-1 C33P-17
WH,0.5
WH-BU,0.5
BK-YE,0.5
S3DB04A
S3DB05A
(OCS NAS ONLY)
Sensor-Pressure-mat (T355)
C
B
A
Gold
C2638-1
C2638-2
C2638-3
PK-BU,0.5D
VT,0.5D
GN,0.5D
C0962-3
C0962-4
C0962-5
(NAS ONLY)
V-REF Gold
SIG Gold
GND Gold
Gold
C0962-1
GN,0.5D
C2363-2 C33P-18
GN,0.75
C
Sheet?

Electrical Wiring Diagrams



Freelander 2 - LR2

VIN: 000201 onwards

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Abbreviation	Description
ABS	Anti-lock braking system
AFS	Adaptive front lighting system
AUTO	Automatic transmission
CAN	Controller area network
DSC	Dynamic stability control
D4	Diesel engine - Straight-four
DV6	Diesel engine - V6
DV8	Diesel engine - V8
EGR	Exhaust gas recirculation
FET	Field effect transistor
GPS	Global positioning system
HS CAN	High speed controller area network bus
PV6	Petrol engine - V6
PV8	Petrol engine - V8
PV8NA	Naturally aspirated engine - V8
PV8SC	Super charged engine - V8
LH	Left-hand
LIN	Local interconnect network
MAF/IAT	Mass air flow / intake air temperature
MS CAN	Medium speed controller area network bus
NAS	North American specification
PDC	Park distance control
RH	Right-hand
TPMS	Tire pressure monitoring system
TSD	Touch screen display

USING THIS PUBLICATION

Health and safety

Always follow health and safety guidelines, specifically those detailed in the Workshop Manual.

Using this publication

The information provided in this publication is for use only by competent, qualified auto-electricians. Good product knowledge is assumed, as well as the ability to access and use recommended test equipment and other reference material provided.

Test equipment and other reference material

The information in this publication should be used in conjunction with the recommended test equipment; refer to Workshop Manual. Other reference material includes: Technical Service Bulletins (TSB) and the Workshop Manual.

The Electrical Reference Library (ERL) may also prove useful since it provides detailed connector information.

Battery disconnection and reconnection

It is imperative that any information relating to battery disconnection and reconnection is followed; refer to the appropriate sections in the Workshop Manual.

Fault Diagnosis

Always use the recommended test equipment for correct and reliable fault diagnosis, refer to the Workshop Manual.

Harness Repair

Repairs should only be undertaken for connectors where a Service Repair Kit is available; refer to the appropriate Electrical Reference Library (ERL).
Note: Fibre Optic circuits cannot be repaired; refer to the Workshop Manual.

Section numbering

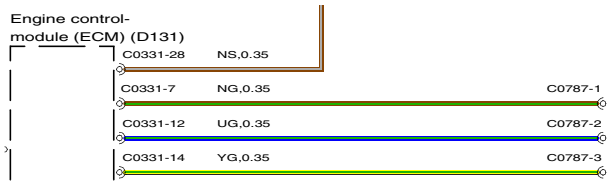
The sections in this publication are ordered to match the Global Outline numbering system as found in the current Workshop Manual. The Power and Ground distribution circuits can be found under section 414-01, BATTERY, MOUNTING AND CABLES.
Note: Where circuit diagrams show more than one sub-system, the circuit will be located in the section that carries the first-named sub-system, for example: Starting and Charging will be located under section 303-06 Starting System, since 'Starting' is the first-named sub-system.

Circuit sheet numbering

The figures in brackets to the left of the page number indicate a circuit sheet number and the total number of sheets per circuit, for example (01 / 05) represents sheet 1 of 5.

Understanding the circuit diagrams

Components



After each component description, a translation code is displayed in brackets, for example: Starter relay (R102), Engine control-module (ECM)(D131). The codes can be ignored.
Note: A dotted outline indicates that the component identified is not shown in its entirety.

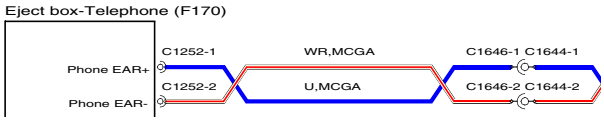
Connectors

Connectors and header joints are identified by their corresponding connector number with a numbered suffix to indicate the pin-out detail of the wire, i.e. C0292-1 identifies connector 292, pin number 1. Wire insulation colours are listed in a table at the end of this section. Where wires have a predominant colour with a secondary colour tracer, the main colour is identified first, i.e. WH-BK - white with a black tracer.

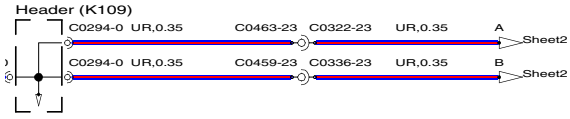
Wire length (Power and Ground Distribution only)

The wire length (in millimetres) is displayed after the colour and cross sectional area; for example, SR,0.35,480. In this example, the figure, 480 indicates the approximate position of the harness splice is 480mm from connector C2335.

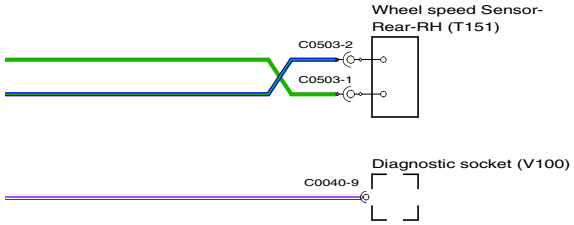
Line Types



Crossed wires as illustrated above show an example of how a twisted pair of wires may be represented on the circuits.



The arrows illustrated above show an example of the page break symbols, identifying that the circuit continues at the corresponding letter on the sheet number indicated.



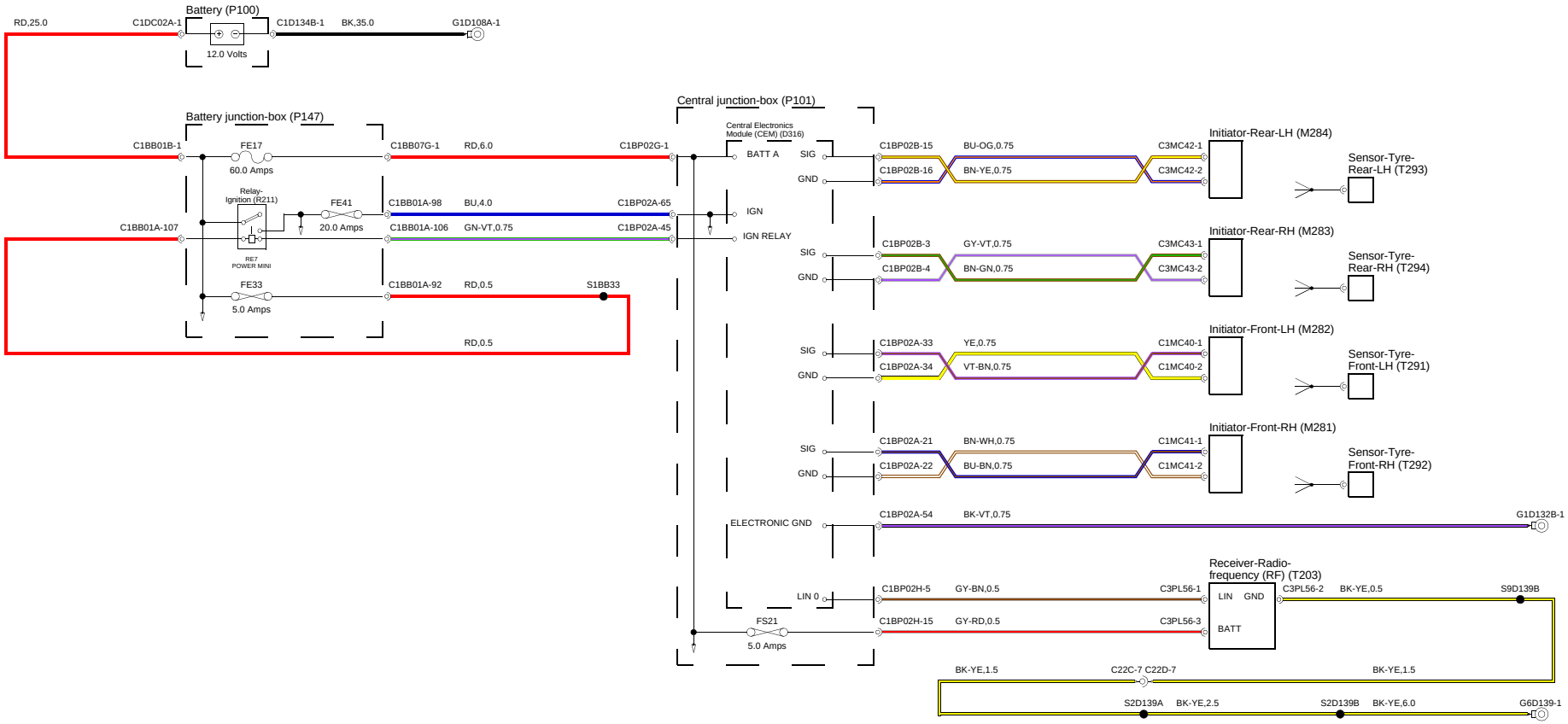
The cup and ball symbol represents the male and female halves of connector. Most connectors plug directly into a component but some are wired directly to the component using a ‘flylead’ as with C503 above.

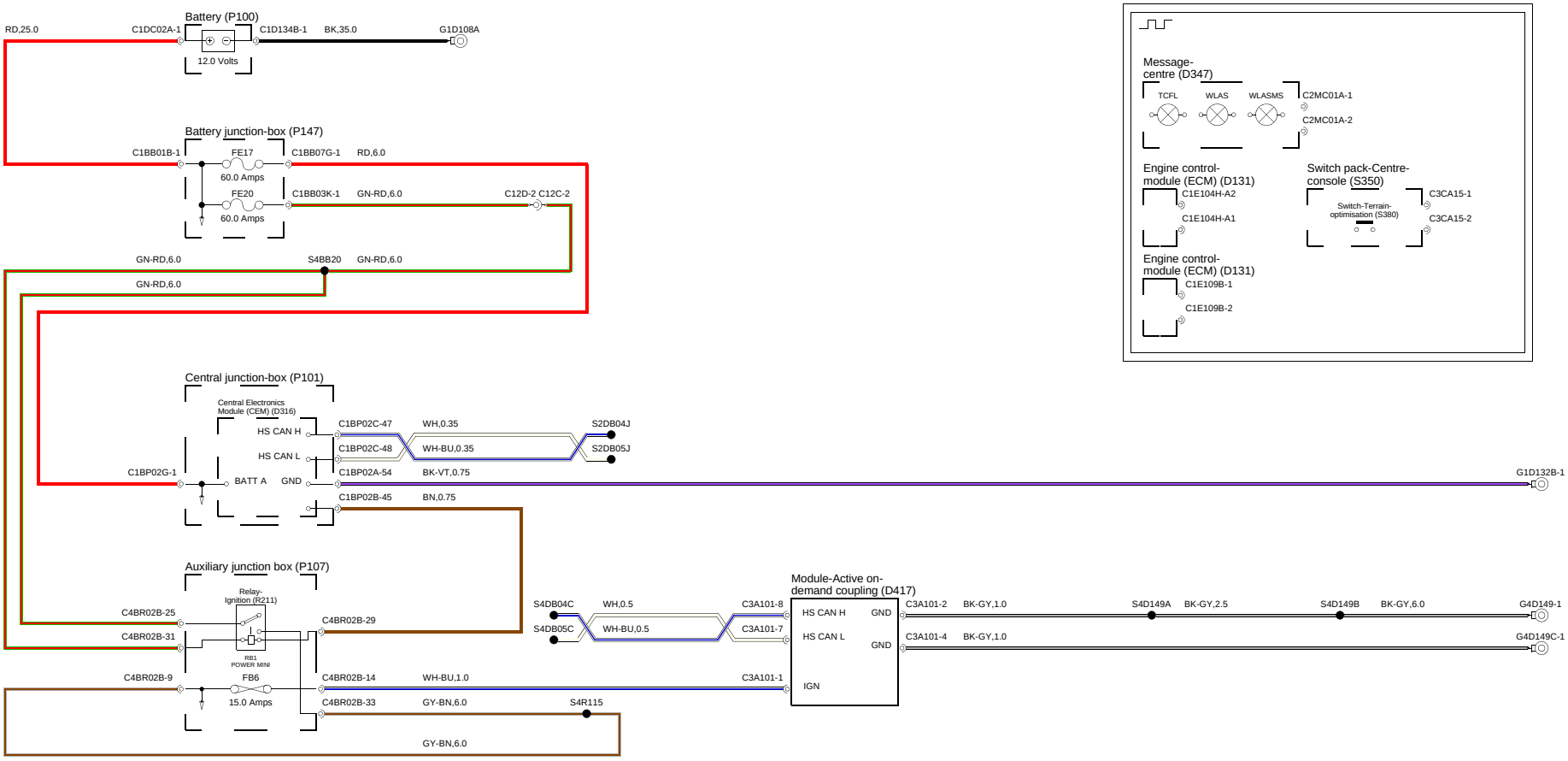
Ground points

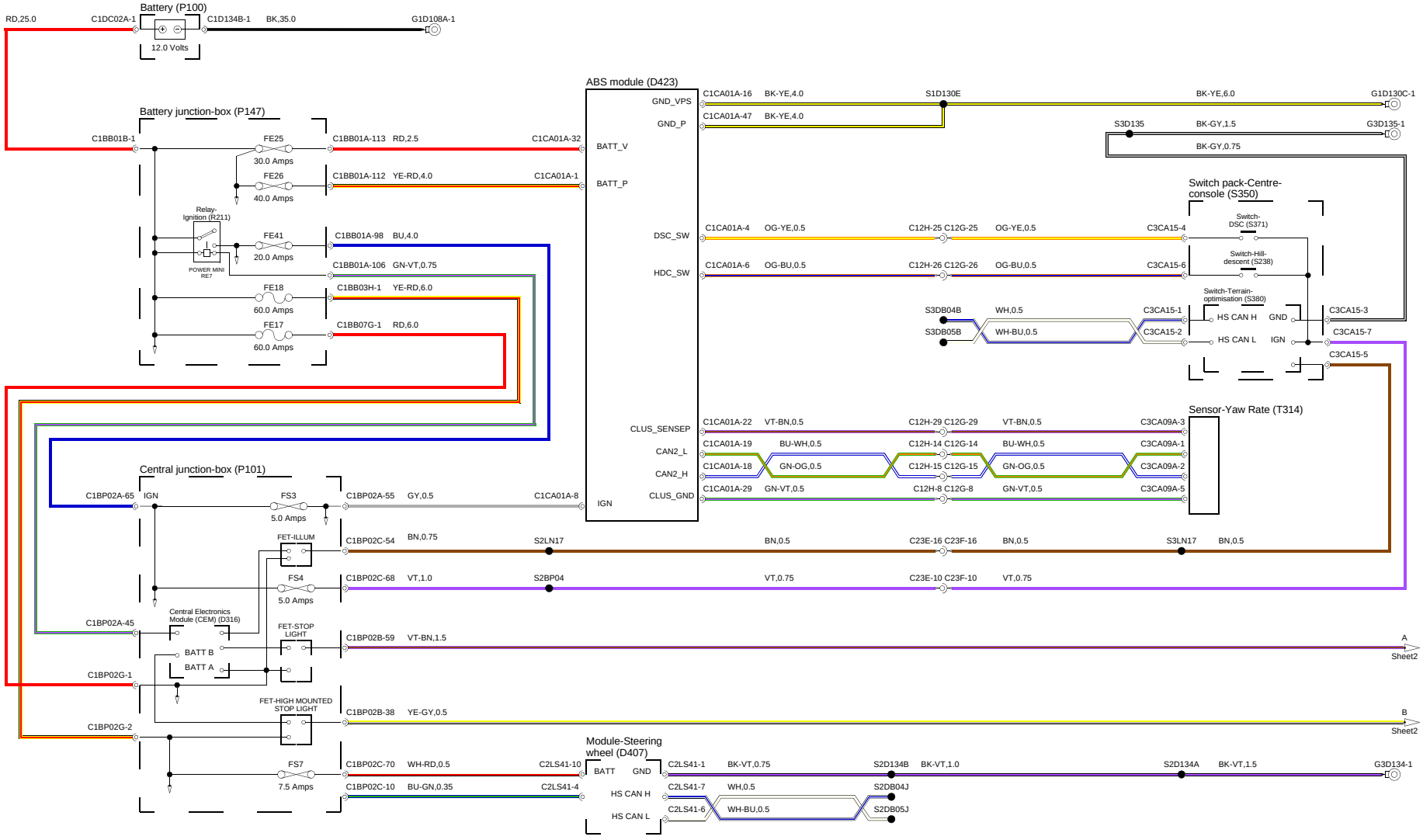
Ground points are identified with an eyelet symbol and a connector number, except where components are grounded through its fixings, when only the eyelet is shown.

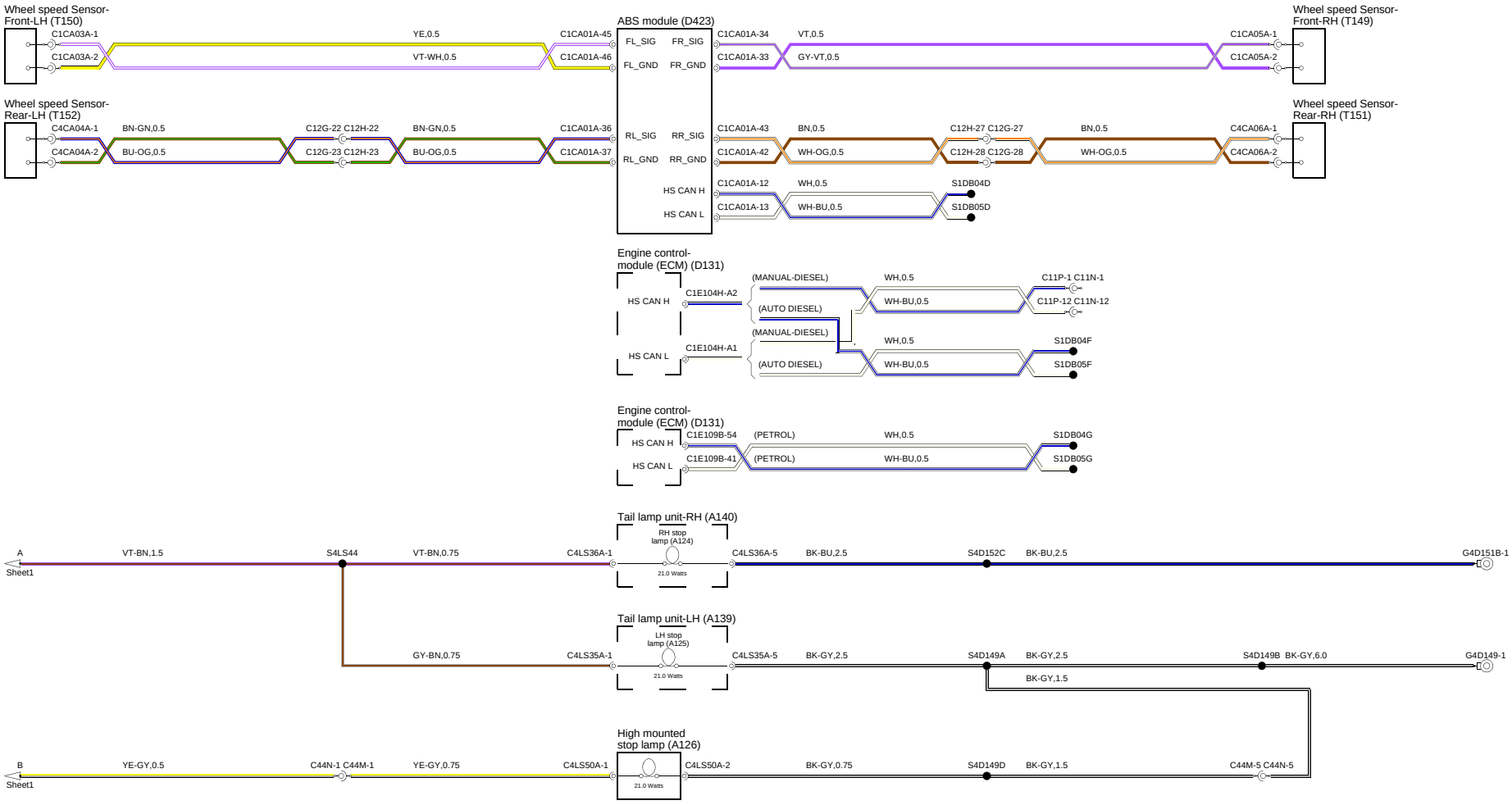
Colour Codes

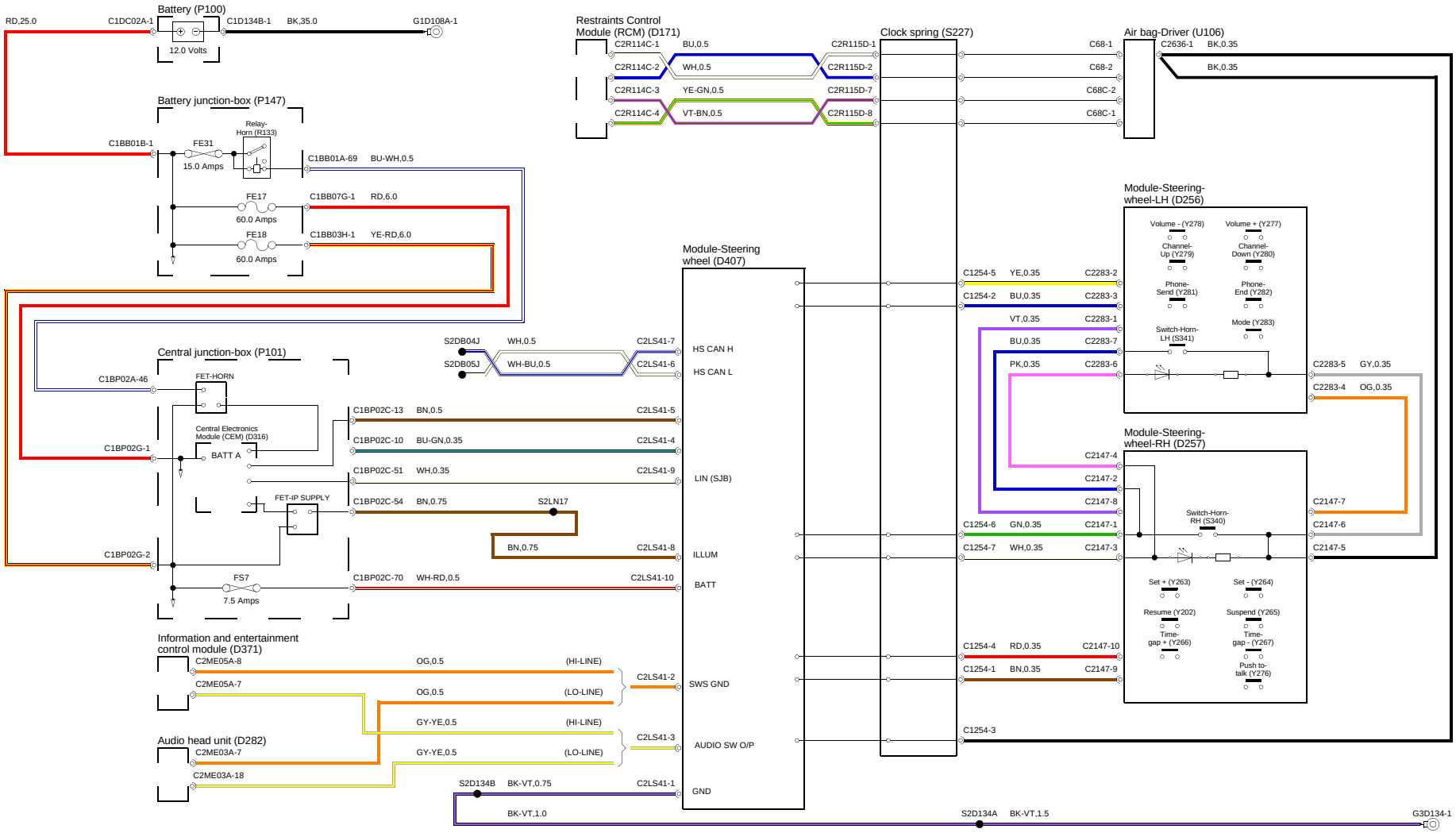
CODE	COLOUR
BK	BLACK
GN	GREEN
BN	BROWN
OG	ORANGE
VT	PURPLE
RD	RED
GY	GREY
BU	BLUE
WH	WHITE
PK	PINK
YE	YELLOW

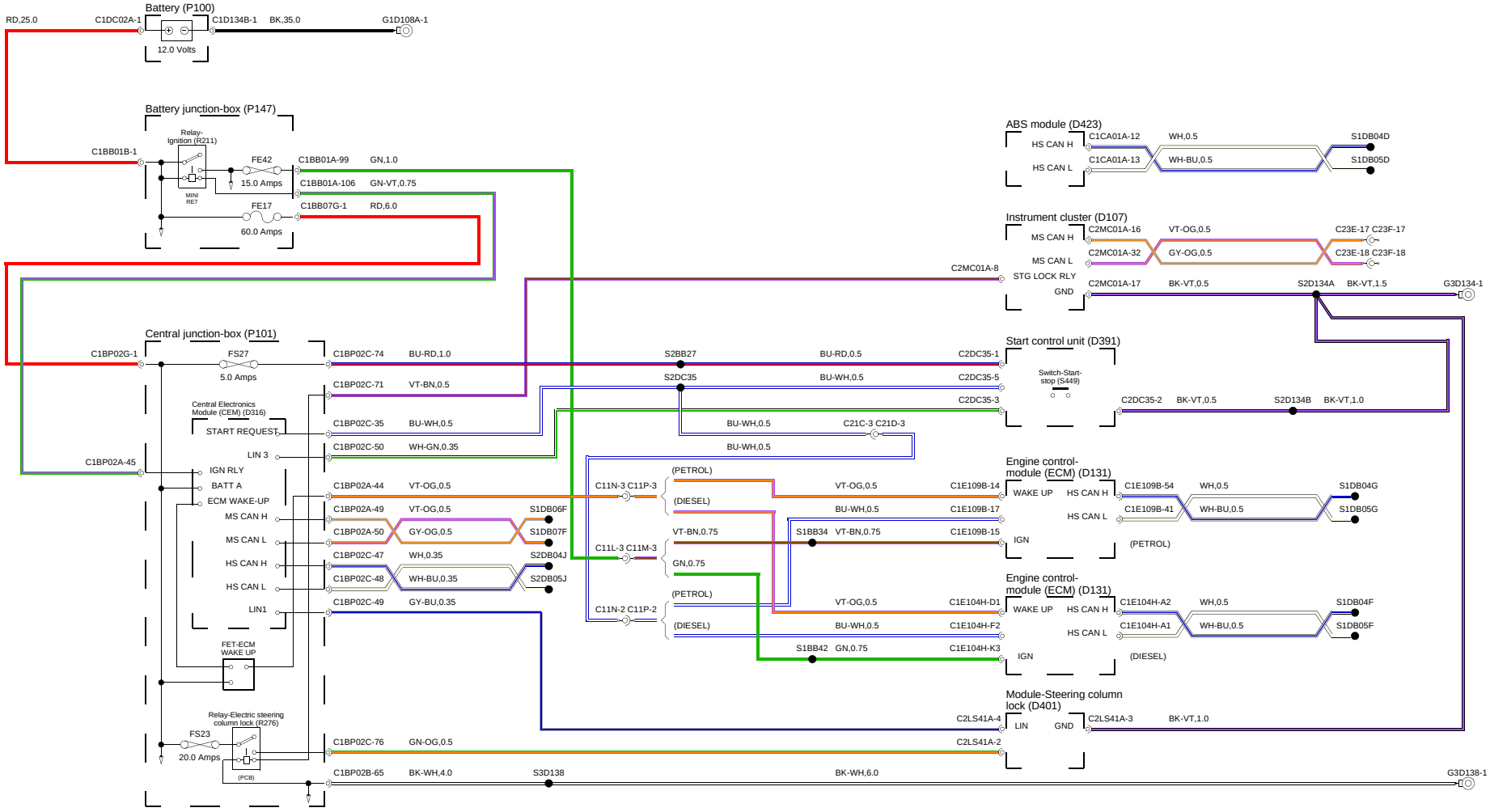

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
C1BP02G-1
Relay-Ignition (R211)
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BP02A-65
C1BB01A-107
C1BB01A-106
GN-VT,0.75
C1BP02A-45
RE7 POWER MINI
FE33
5.0 Amps
C1BB01A-92
RD,0.5
S1BB33
RD,0.5
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
BATT A
IGN
IGN RELAY
SIG
GND
C1BP02B-15
BU-OG,0.75
C3MC42-1
C1BP02B-16
BN-YE,0.75
C3MC42-2
Initiator-Rear-LH (M284)
Sensor-Tyre-Rear-LH (T293)
C1BP02B-3
GY-VT,0.75
C3MC43-1
C1BP02B-4
BN-GN,0.75
C3MC43-2
Initiator-Rear-RH (M283)
Sensor-Tyre-Rear-RH (T294)
C1BP02A-33
YE,0.75
C1MC40-1
C1BP02A-34
VT-BN,0.75
C1MC40-2
Initiator-Front-LH (M282)
Sensor-Tyre-Front-LH (T291)
C1BP02A-21
BN-WH,0.75
C1MC41-1
C1BP02A-22
BU-BN,0.75
C1MC41-2
Initiator-Front-RH (M281)
Sensor-Tyre-Front-RH (T292)
ELECTRONIC GND
C1BP02A-54
BK-VT,0.75
G1D132B-1
Receiver-Radio-frequency (RF) (T203)
LIN 0
C1BP02H-5
GY-BN,0.5
C3PL56-1
LIN
GND
BATT
C3PL56-2
BK-YE,0.5
S9D139B
FS21
5.0 Amps
C1BP02H-15
GY-RD,0.5
C3PL56-3
BK-YE,1.5
C22C-7 C22D-7
BK-YE,1.5
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1

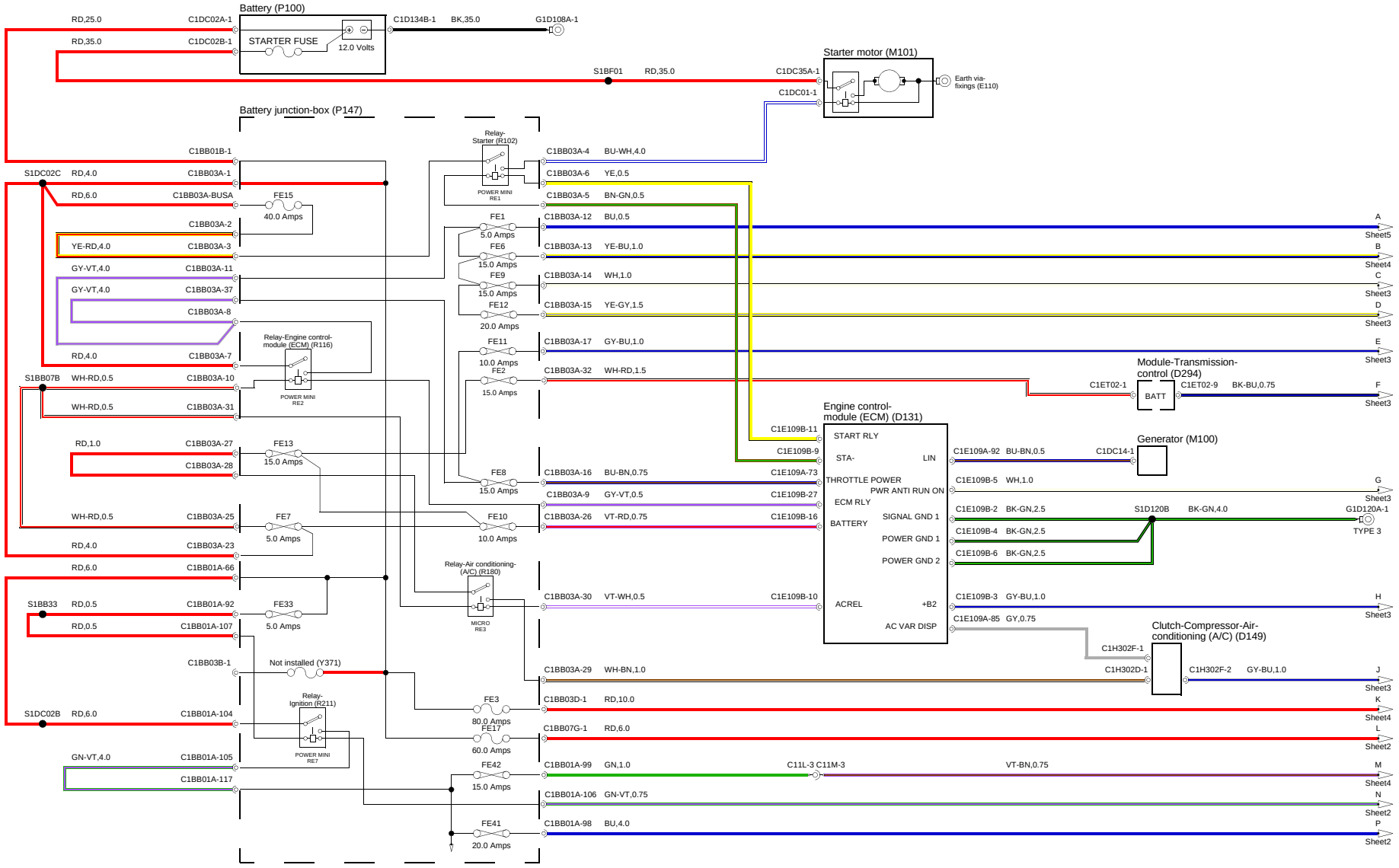

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
FE20
C1BB03K-1
GN-RD,6.0
C12D-2 C12C-2
60.0 Amps
GN-RD,6.0
S4BB20
GN-RD,6.0
GN-RD,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
HS CAN H
HS CAN L
C1BP02C-47
WH,0.35
S2DB04J
C1BP02C-48
WH-BU,0.35
S2DB05J
C1BP02G-1
BATT A
GND
C1BP02A-54
BK-VT,0.75
G1D132B-1
C1BP02B-45
BN,0.75
Auxiliary junction box (P107)
Relay-Ignition (R211)
C4BR02B-25
C4BR02B-29
C4BR02B-31
RB1 POWER MINI
C4BR02B-9
FB6
15.0 Amps
C4BR02B-14
WH-BU,1.0
C4BR02B-33
GY-BN,6.0
S4R115
GY-BN,6.0
S4DB04C
WH,0.5
S4DB05C
WH-BU,0.5
C3A101-8
C3A101-7
C3A101-1
Module-Active on-demand coupling (D417)
HS CAN H
HS CAN L
IGN
GND
GND
C3A101-2
BK-GY,1.0
S4D149A
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
C3A101-4
BK-GY,1.0
G4D149C-1
Message-centre (D347)
TCFL
WLAS
WLASMS
C2MC01A-1
C2MC01A-2
Engine control-module (ECM) (D131)
C1E104H-A2
C1E104H-A1
Switch pack-Centre-console (S350)
Switch-Terrain-optimisation (S380)
C3CA15-1
C3CA15-2
Engine control-module (ECM) (D131)
C1E109B-1
C1E109B-2

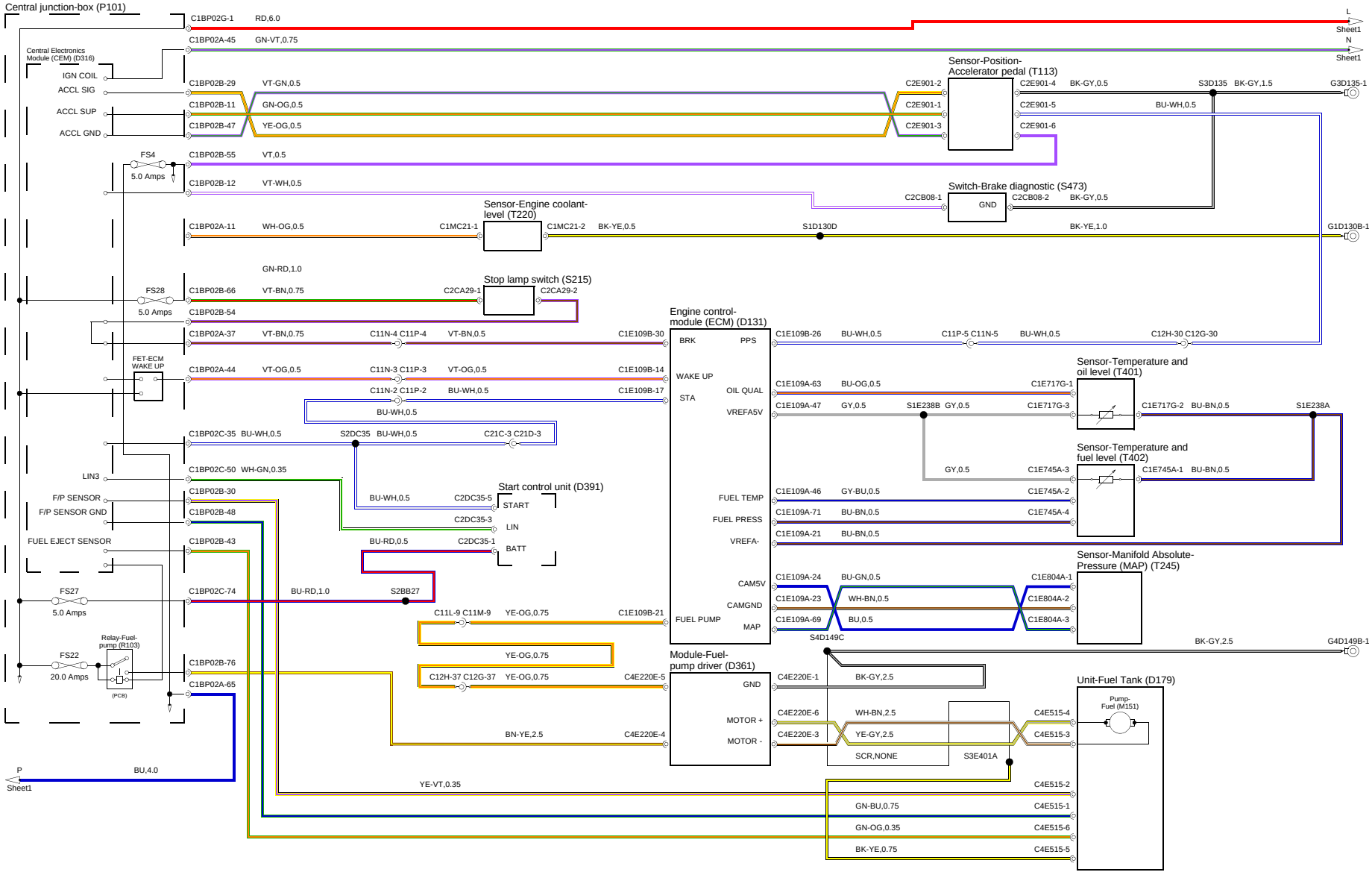

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
ABS module (D423)
GND_VPS
GND_P
BATT_V
BATT_P
DSC_SW
HDC_SW
CLUS_SENSEP
CAN2_L
CAN2_H
CLUS_GND
IGN
C1CA01A-16
BK-YE,4.0
S1D130E
BK-YE,6.0
G1D130C-1
C1CA01A-47
BK-YE,4.0
S3D135
BK-GY,1.5
G3D135-1
BK-GY,0.75
Switch pack-Centre-console (S350)
Switch-DSC (S371)
Switch-Hill-descent (S238)
Switch-Terrain-optimisation (S380)
HS CAN H
HS CAN L
GND
IGN
C1CA01A-4
OG-YE,0.5
C12H-25 C12G-25
OG-YE,0.5
C3CA15-4
C1CA01A-6
OG-BU,0.5
C12H-26 C12G-26
OG-BU,0.5
C3CA15-6
S3DB04B
WH,0.5
C3CA15-1
S3DB05B
WH-BU,0.5
C3CA15-2
C3CA15-3
C3CA15-7
C3CA15-5
Sensor-Yaw Rate (T314)
C1CA01A-22
VT-BN,0.5
C12H-29 C12G-29
VT-BN,0.5
C3CA09A-3
C1CA01A-19
BU-WH,0.5
C12H-14 C12G-14
BU-WH,0.5
C3CA09A-1
C1CA01A-18
GN-OG,0.5
C12H-15 C12G-15
GN-OG,0.5
C3CA09A-2
C1CA01A-29
GN-VT,0.5
C12H-8 C12G-8
GN-VT,0.5
C3CA09A-5
Battery junction-box (P147)
C1BB01B-1
FE25
30.0 Amps
C1BB01A-113
RD,2.5
C1CA01A-32
FE26
40.0 Amps
C1BB01A-112
YE-RD,4.0
C1CA01A-1
Relay-Ignition (R211)
POWER MINI RE7
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BB01A-106
GN-VT,0.75
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0
FE17
60.0 Amps
C1BB07G-1
RD,6.0
Central junction-box (P101)
C1BP02A-65
IGN
FS3
5.0 Amps
C1BP02A-55
GY,0.5
C1CA01A-8
FET-ILLUM
C1BP02C-54
BN,0.75
S2LN17
BN,0.5
C23E-16 C23F-16
BN,0.5
S3LN17
BN,0.5
FS4
5.0 Amps
C1BP02C-68
VT,1.0
S2BP04
VT,0.75
C23E-10 C23F-10
VT,0.75
Central Electronics Module (CEM) (D316)
C1BP02A-45
BATT B
BATT A
C1BP02G-1
FET-STOP LIGHT
C1BP02B-59
VT-BN,1.5
A
Sheet2
FET-HIGH MOUNTED STOP LIGHT
C1BP02G-2
C1BP02B-38
YE-GY,0.5
B
Sheet2
FS7
7.5 Amps
C1BP02C-70
WH-RD,0.5
C2LS41-10
C1BP02C-10
BU-GN,0.35
C2LS41-4
Module-Steering wheel (D407)
BATT
GND
HS CAN H
HS CAN L
C2LS41-1
BK-VT,0.75
S2D134B
BK-VT,1.0
S2D134A
BK-VT,1.5
G3D134-1
C2LS41-7
WH,0.5
S2DB04J
C2LS41-6
WH-BU,0.5
S2DB05J

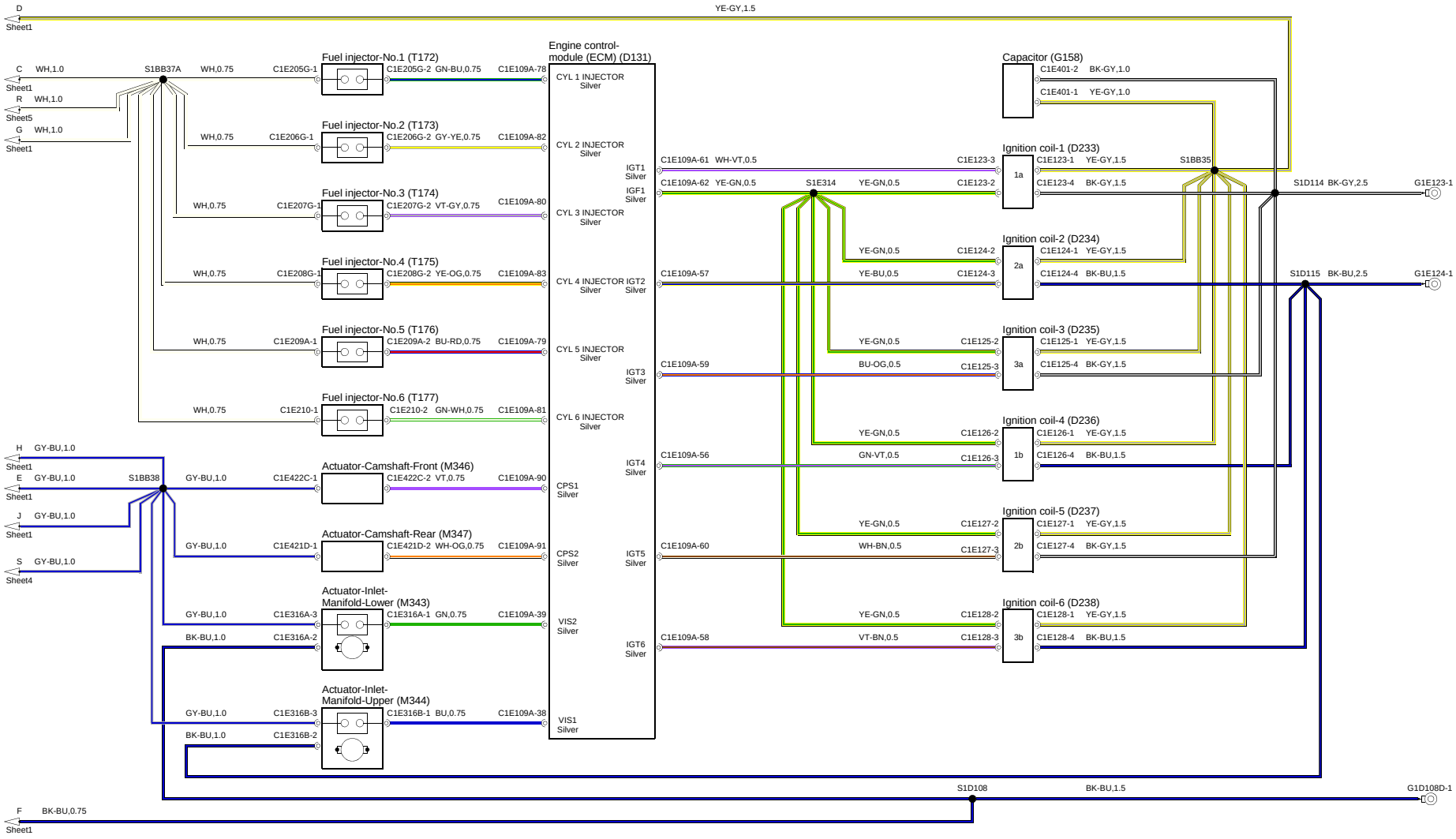

Wheel speed Sensor-Front-LH (T150)
C1CA03A-1
C1CA03A-2
YE,0.5
VT-WH,0.5
C1CA01A-45
C1CA01A-46
ABS module (D423)
FL_SIG
FR_SIG
FL_GND
FR_GND
C1CA01A-34
C1CA01A-33
VT,0.5
GY-VT,0.5
C1CA05A-1
C1CA05A-2
Wheel speed Sensor-Front-RH (T149)
Wheel speed Sensor-Rear-LH (T152)
C4CA04A-1
C4CA04A-2
BN-GN,0.5
BU-OG,0.5
C12G-22 C12H-22
C12G-23 C12H-23
BN-GN,0.5
BU-OG,0.5
C1CA01A-36
C1CA01A-37
RL_SIG
RR_SIG
RL_GND
RR_GND
C1CA01A-43
C1CA01A-42
BN,0.5
WH-OG,0.5
C12H-27 C12G-27
C12H-28 C12G-28
BN,0.5
WH-OG,0.5
C4CA06A-1
C4CA06A-2
Wheel speed Sensor-Rear-RH (T151)
HS CAN H
HS CAN L
C1CA01A-12
C1CA01A-13
WH,0.5
WH-BU,0.5
S1DB04D
S1DB05D
Engine control-module (ECM) (D131)
HS CAN H
HS CAN L
C1E104H-A2
C1E104H-A1
(MANUAL-DIESEL)
(AUTO DIESEL)
WH,0.5
WH-BU,0.5
C11P-1 C11N-1
C11P-12 C11N-12
S1DB04F
S1DB05F
Engine control-module (ECM) (D131)
HS CAN H
HS CAN L
C1E109B-54
C1E109B-41
(PETROL)
WH,0.5
WH-BU,0.5
S1DB04G
S1DB05G
Tail lamp unit-RH (A140)
RH stop lamp (A124)
21.0 Watts
A
Sheet1
VT-BN,1.5
S4LS44
VT-BN,0.75
C4LS36A-1
C4LS36A-5
BK-BU,2.5
S4D152C
BK-BU,2.5
G4D151B-1
Tail lamp unit-LH (A139)
LH stop lamp (A125)
21.0 Watts
GY-BN,0.75
C4LS35A-1
C4LS35A-5
BK-GY,2.5
S4D149A
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
BK-GY,1.5
High mounted stop lamp (A126)
21.0 Watts
B
Sheet1
YE-GY,0.5
C44N-1 C44M-1
YE-GY,0.75
C4LS50A-1
C4LS50A-2
BK-GY,0.75
S4D149D
BK-GY,1.5
C44M-5 C44N-5

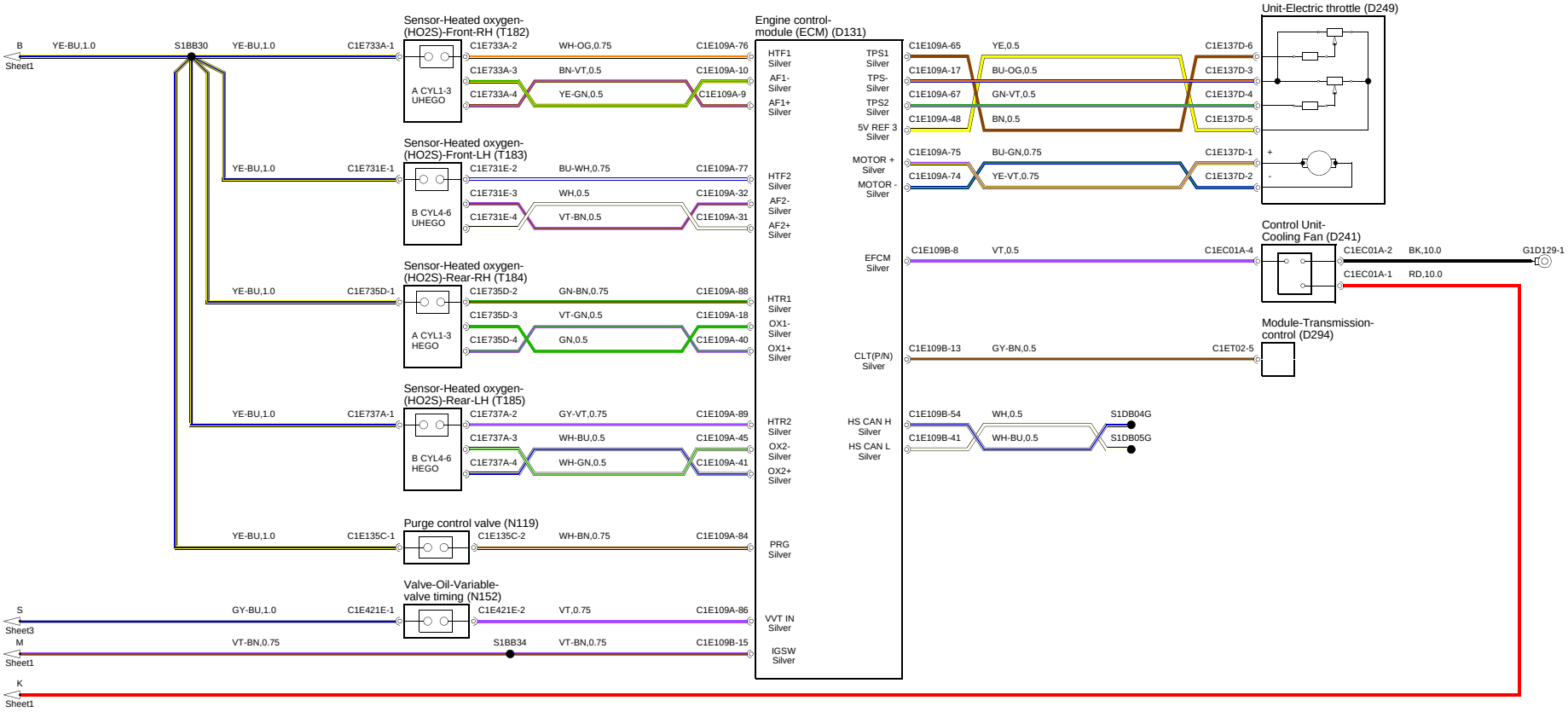

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE31
15.0 Amps
Relay-Horn (R133)
C1BB01A-69
BU-WH,0.5
FE17
60.0 Amps
C1BB07G-1
RD,6.0
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0
Central junction-box (P101)
C1BP02A-46
FET-HORN
Central Electronics Module (CEM) (D316)
C1BP02G-1
BATT A
FET-IP SUPPLY
C1BP02G-2
FS7
7.5 Amps
C1BP02C-13
BN,0.5
C1BP02C-10
BU-GN,0.35
C1BP02C-51
WH,0.35
C1BP02C-54
BN,0.75
S2LN17
BN,0.75
C1BP02C-70
WH-RD,0.5
Information and entertainment control module (D371)
C2ME05A-8
OG,0.5
(HI-LINE)
C2ME05A-7
OG,0.5
(LO-LINE)
GY-YE,0.5
(HI-LINE)
Audio head unit (D282)
C2ME03A-7
GY-YE,0.5
(LO-LINE)
C2ME03A-18
S2D134B
BK-VT,0.75
BK-VT,1.0
S2D134A
BK-VT,1.5
G3D134-1
S2DB04J
WH,0.5
S2DB05J
WH-BU,0.5
C2LS41-7
HS CAN H
C2LS41-6
HS CAN L
C2LS41-5
C2LS41-4
C2LS41-9
LIN (SJB)
C2LS41-8
ILLUM
C2LS41-10
BATT
C2LS41-2
SWS GND
C2LS41-3
AUDIO SW O/P
C2LS41-1
GND
Restraints Control Module (RCM) (D171)
C2R114C-1
BU,0.5
C2R114C-2
WH,0.5
C2R114C-3
YE-GN,0.5
C2R114C-4
VT-BN,0.5
C2R115D-1
C2R115D-2
C2R115D-7
C2R115D-8
Clock spring (S227)
C68-1
C68-2
C68C-2
C68C-1
Air bag-Driver (U106)
C2636-1
BK,0.35
BK,0.35
Module-Steering wheel (D407)
C1254-5
YE,0.35
C2283-2
C1254-2
BU,0.35
C2283-3
VT,0.35
C2283-1
BU,0.35
C2283-7
PK,0.35
C2283-6
C1254-6
GN,0.35
C2147-1
C1254-7
WH,0.35
C2147-3
C1254-4
RD,0.35
C2147-10
C1254-1
BN,0.35
C2147-9
C1254-3
Module-Steering-wheel-LH (D256)
Volume - (Y278)
Volume + (Y277)
Channel-Up (Y279)
Channel-Down (Y280)
Phone-Send (Y281)
Phone-End (Y282)
Mode (Y283)
Switch-Horn-LH (S341)
C2283-5
GY,0.35
C2283-4
OG,0.35
Module-Steering-wheel-RH (D257)
C2147-4
C2147-2
C2147-8
Switch-Horn-RH (S340)
C2147-7
C2147-6
C2147-5
Set + (Y263)
Set - (Y264)
Resume (Y202)
Suspend (Y265)
Time-gap + (Y266)
Time-gap - (Y267)
Push to-talk (Y276)

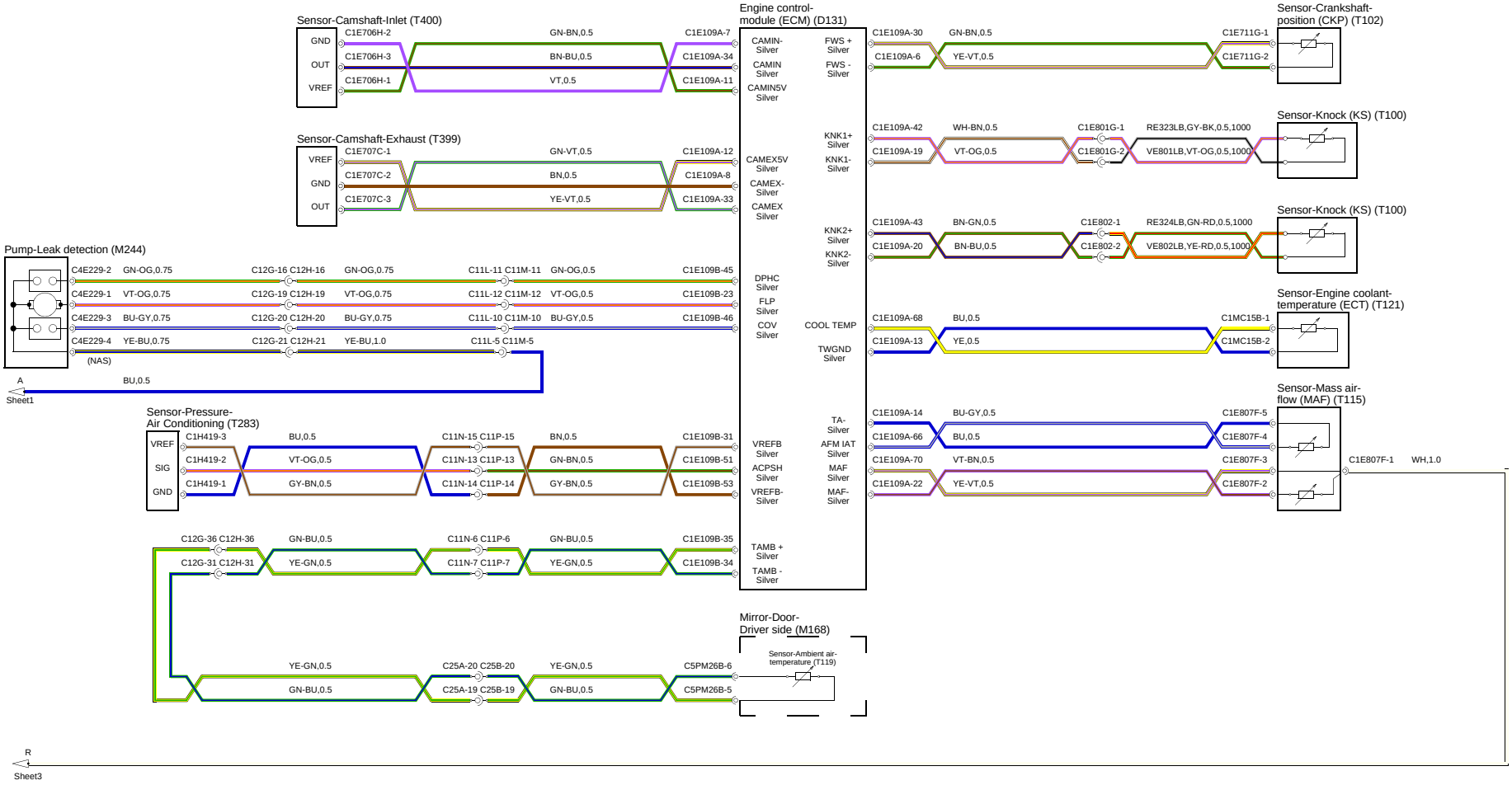

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
Relay-Ignition (R211)
C1BB01B-1
FE42
15.0 Amps
C1BB01A-99
GN,1.0
C1BB01A-106
GN-VT,0.75
MINI RE7
FE17
60.0 Amps
C1BB07G-1
RD,6.0
Central junction-box (P101)
C1BP02G-1
FS27
5.0 Amps
C1BP02C-74
BU-RD,1.0
C1BP02C-71
VT-BN,0.5
Central Electronics Module (CEM) (D316)
START REQUEST
C1BP02C-35
BU-WH,0.5
LIN 3
C1BP02C-50
WH-GN,0.35
C1BP02A-45
IGN RLY
BATT A
ECM WAKE-UP
C1BP02A-44
VT-OG,0.5
MS CAN H
C1BP02A-49
VT-OG,0.5
S1DB06F
MS CAN L
C1BP02A-50
GY-OG,0.5
S1DB07F
HS CAN H
C1BP02C-47
WH,0.35
S2DB04J
HS CAN L
C1BP02C-48
WH-BU,0.35
S2DB05J
LIN1
C1BP02C-49
GY-BU,0.35
FET-ECM WAKE UP
Relay-Electric steering column lock (R276)
FS23
20.0 Amps
(PCB)
C1BP02C-76
GN-OG,0.5
C1BP02B-65
BK-WH,4.0
S3D138
BK-WH,6.0
G3D138-1
S2BB27
BU-RD,0.5
C2DC35-1
S2DC35
BU-WH,0.5
C2DC35-5
C2DC35-3
BU-WH,0.5
C21C-3 C21D-3
BU-WH,0.5
C11N-3 C11P-3
(PETROL)
(DIESEL)
C11L-3 C11M-3
VT-BN,0.75
GN,0.75
C11N-2 C11P-2
(PETROL)
(DIESEL)
S1BB34
VT-BN,0.75
S1BB42
GN,0.75
C2MC01A-8
ABS module (D423)
HS CAN H
C1CA01A-12
WH,0.5
S1DB04D
HS CAN L
C1CA01A-13
WH-BU,0.5
S1DB05D
Instrument cluster (D107)
MS CAN H
C2MC01A-16
VT-OG,0.5
C23E-17 C23F-17
MS CAN L
C2MC01A-32
GY-OG,0.5
C23E-18 C23F-18
STG LOCK RLY
GND
C2MC01A-17
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
Start control unit (D391)
Switch-Start-stop (S449)
C2DC35-2
BK-VT,0.5
S2D134B
BK-VT,1.0
Engine control-module (ECM) (D131)
WAKE UP
IGN
C1E109B-14
VT-OG,0.5
C1E109B-17
BU-WH,0.5
C1E109B-15
VT-BN,0.75
HS CAN H
C1E109B-54
WH,0.5
S1DB04G
HS CAN L
C1E109B-41
WH-BU,0.5
S1DB05G
(PETROL)
Engine control-module (ECM) (D131)
WAKE UP
IGN
C1E104H-D1
VT-OG,0.5
C1E104H-F2
BU-WH,0.5
C1E104H-K3
HS CAN H
C1E104H-A2
WH,0.5
S1DB04F
HS CAN L
C1E104H-A1
WH-BU,0.5
S1DB05F
(DIESEL)
Module-Steering column lock (D401)
LIN
GND
C2LS41A-4
C2LS41A-2
C2LS41A-3
BK-VT,1.0

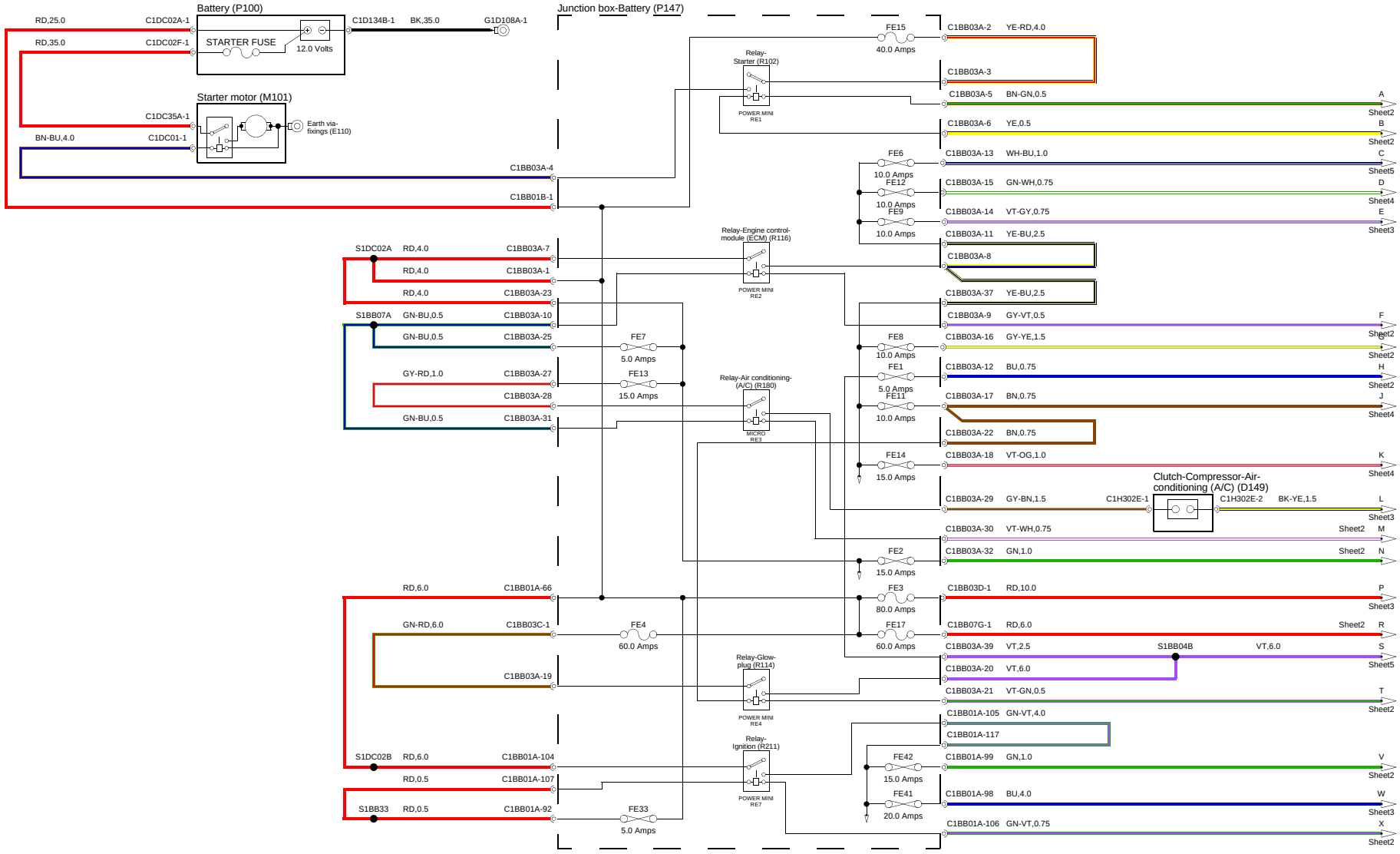

Battery (P100)
STARTER FUSE
12.0 Volts
Starter motor (M101)
Earth via-fixings (E110)
Battery junction-box (P147)
Relay-Starter (R102)
POWER MINI RE1
Relay-Engine control-module (ECM) (R116)
POWER MINI RE2
Relay-Air conditioning-(A/C) (R180)
MICRO RE3
Relay-Ignition (R211)
POWER MINI RE7
Not installed (Y371)
Engine control-module (ECM) (D131)
START RLY
STA-
LIN
THROTTLE POWER
PWR ANTI RUN ON
ECM RLY
SIGNAL GND 1
BATTERY
POWER GND 1
POWER GND 2
ACREL
+B2
AC VAR DISP
Module-Transmission-control (D294)
BATT
Generator (M100)
Clutch-Compressor-Air-conditioning (A/C) (D149)
TYPE 3
RD,25.0
C1DC02A-1
RD,35.0
C1DC02B-1
C1D134B-1
BK,35.0
G1D108A-1
S1BF01
RD,35.0
C1DC35A-1
C1DC01-1
S1DC02C
RD,4.0
RD,6.0
C1BB03A-BUSA
FE15
40.0 Amps
YE-RD,4.0
GY-VT,4.0
S1BB07B
WH-RD,0.5
RD,1.0
S1BB33
RD,0.5
S1DC02B
GN-VT,4.0
C1BB01B-1
C1BB03A-1
C1BB03A-2
C1BB03A-3
C1BB03A-11
C1BB03A-37
C1BB03A-8
C1BB03A-7
C1BB03A-10
C1BB03A-31
C1BB03A-27
C1BB03A-28
C1BB03A-25
C1BB03A-23
C1BB01A-66
C1BB01A-92
C1BB01A-107
C1BB03B-1
C1BB01A-104
C1BB01A-105
C1BB01A-117
FE1
5.0 Amps
FE6
15.0 Amps
FE9
15.0 Amps
FE12
20.0 Amps
FE11
10.0 Amps
FE2
15.0 Amps
FE13
15.0 Amps
FE8
15.0 Amps
FE7
5.0 Amps
FE10
10.0 Amps
FE33
5.0 Amps
FE3
80.0 Amps
FE17
60.0 Amps
FE42
15.0 Amps
FE41
20.0 Amps
C1BB03A-4 BU-WH,4.0
C1BB03A-6 YE,0.5
C1BB03A-5 BN-GN,0.5
C1BB03A-12 BU,0.5
C1BB03A-13 YE-BU,1.0
C1BB03A-14 WH,1.0
C1BB03A-15 YE-GY,1.5
C1BB03A-17 GY-BU,1.0
C1BB03A-32 WH-RD,1.5
C1BB03A-16 BU-BN,0.75
C1BB03A-9 GY-VT,0.5
C1BB03A-26 VT-RD,0.75
C1BB03A-30 VT-WH,0.5
C1BB03A-29 WH-BN,1.0
C1BB03D-1 RD,10.0
C1BB07G-1 RD,6.0
C1BB01A-99 GN,1.0
C1BB01A-106 GN-VT,0.75
C1BB01A-98 BU,4.0
C11L-3 C11M-3
VT-BN,0.75
C1E109B-11
C1E109B-9
C1E109A-73
C1E109B-27
C1E109B-16
C1E109B-10
C1E109A-92 BU-BN,0.5
C1E109B-5 WH,1.0
C1E109B-2 BK-GN,2.5
C1E109B-4 BK-GN,2.5
C1E109B-6 BK-GN,2.5
C1E109B-3 GY-BU,1.0
C1E109A-85 GY,0.75
C1DC14-1
C1ET02-1
C1ET02-9 BK-BU,0.75
S1D120B
BK-GN,4.0
G1D120A-1
C1H302F-1
C1H302D-1
C1H302F-2 GY-BU,1.0
A Sheet5
B Sheet4
C Sheet3
D Sheet3
E Sheet3
F Sheet3
G Sheet3
H Sheet3
J Sheet3
K Sheet4
L Sheet2
M Sheet4
N Sheet2
P Sheet2

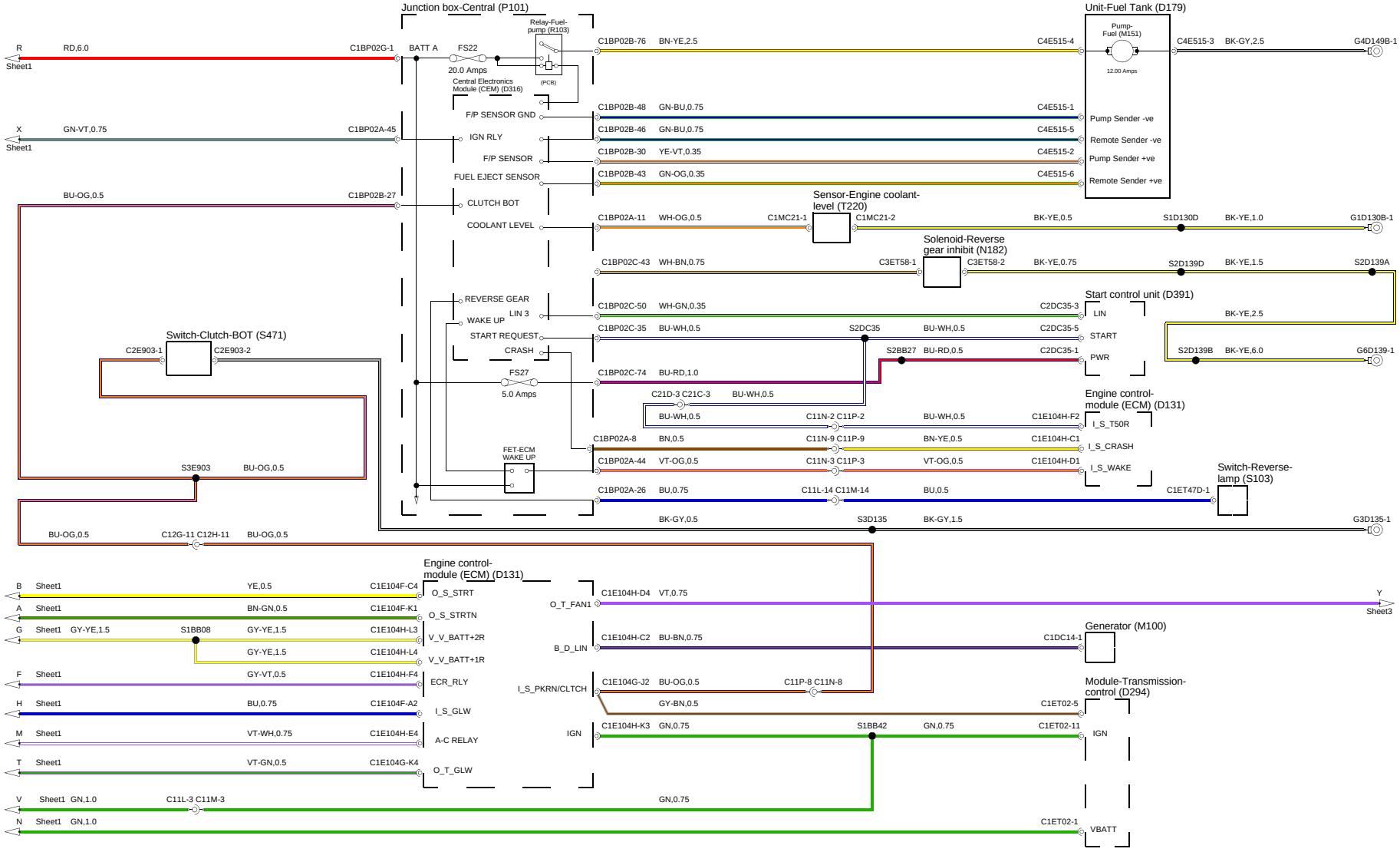

Central junction-box (P101)
C1BP02G-1 RD,6.0
C1BP02A-45 GN-VT,0.75
Central Electronics Module (CEM) (D316)
IGN COIL
ACCL SIG
ACCL SUP
ACCL GND
C1BP02B-29 VT-GN,0.5
C1BP02B-11 GN-OG,0.5
C1BP02B-47 YE-OG,0.5
Sensor-Position-Accelerator pedal (T113)
C2E901-2
C2E901-1
C2E901-3
C2E901-4 BK-GY,0.5
C2E901-5
C2E901-6
S3D135 BK-GY,1.5
BU-WH,0.5
G3D135-1
FS4
5.0 Amps
C1BP02B-55 VT,0.5
C1BP02B-12 VT-WH,0.5
Switch-Brake diagnostic (S473)
C2CB08-1
GND
C2CB08-2 BK-GY,0.5
Sensor-Engine coolant-level (T220)
C1BP02A-11 WH-OG,0.5
C1MC21-1
C1MC21-2 BK-YE,0.5
S1D130D
BK-YE,1.0
G1D130B-1
GN-RD,1.0
Stop lamp switch (S215)
FS28
5.0 Amps
C1BP02B-66 VT-BN,0.75
C2CA29-1
C2CA29-2
C1BP02B-54
Engine control-module (ECM) (D131)
C1BP02A-37 VT-BN,0.75
C11N-4 C11P-4 VT-BN,0.5
C1E109B-30
C1E109B-26 BU-WH,0.5
C11P-5 C11N-5 BU-WH,0.5
C12H-30 C12G-30
FET-ECM WAKE UP
C1BP02A-44 VT-OG,0.5
C11N-3 C11P-3 VT-OG,0.5
C1E109B-14
C11N-2 C11P-2 BU-WH,0.5
C1E109B-17
BU-WH,0.5
BRK
PPS
WAKE UP
OIL QUAL
STA
VREFA5V
Sensor-Temperature and oil level (T401)
C1E109A-63 BU-OG,0.5
C1E717G-1
C1E109A-47 GY,0.5
S1E238B GY,0.5
C1E717G-3
C1E717G-2 BU-BN,0.5
S1E238A
C1BP02C-35 BU-WH,0.5
S2DC35 BU-WH,0.5
C21C-3 C21D-3
Sensor-Temperature and fuel level (T402)
GY,0.5
C1E745A-3
C1E745A-1 BU-BN,0.5
LIN3
C1BP02C-50 WH-GN,0.35
Start control unit (D391)
BU-WH,0.5
C2DC35-5
START
C2DC35-3
LIN
F/P SENSOR
F/P SENSOR GND
C1BP02B-30
C1BP02B-48
FUEL TEMP
FUEL PRESS
VREFA-
C1E109A-46 GY-BU,0.5
C1E745A-2
C1E109A-71 BU-BN,0.5
C1E745A-4
C1E109A-21 BU-BN,0.5
FUEL EJECT SENSOR
C1BP02B-43
BU-RD,0.5
C2DC35-1
BATT
Sensor-Manifold Absolute-Pressure (MAP) (T245)
FS27
5.0 Amps
C1BP02C-74
BU-RD,1.0
S2BB27
CAM5V
CAMGND
FUEL PUMP
MAP
C1E109A-24 BU-GN,0.5
C1E804A-1
C1E109A-23 WH-BN,0.5
C1E804A-2
C1E109A-69 BU,0.5
C1E804A-3
S4D149C
C11L-9 C11M-9 YE-OG,0.75
C1E109B-21
BK-GY,2.5
G4D149B-1
YE-OG,0.75
Relay-Fuel-pump (R103)
FS22
20.0 Amps
(PCB)
C1BP02B-76
C1BP02A-65
Module-Fuel-pump driver (D361)
C12H-37 C12G-37 YE-OG,0.75
C4E220E-5
C4E220E-1 BK-GY,2.5
GND
MOTOR +
MOTOR -
C4E220E-6 WH-BN,2.5
C4E220E-3 YE-GY,2.5
SCR,NONE
S3E401A
C4E515-4
C4E515-3
Unit-Fuel Tank (D179)
Pump-Fuel (M151)
BN-YE,2.5
C4E220E-4
P
Sheet1
BU,4.0
YE-VT,0.35
C4E515-2
GN-BU,0.75
C4E515-1
GN-OG,0.35
C4E515-6
BK-YE,0.75
C4E515-5
L
Sheet1
N
Sheet1

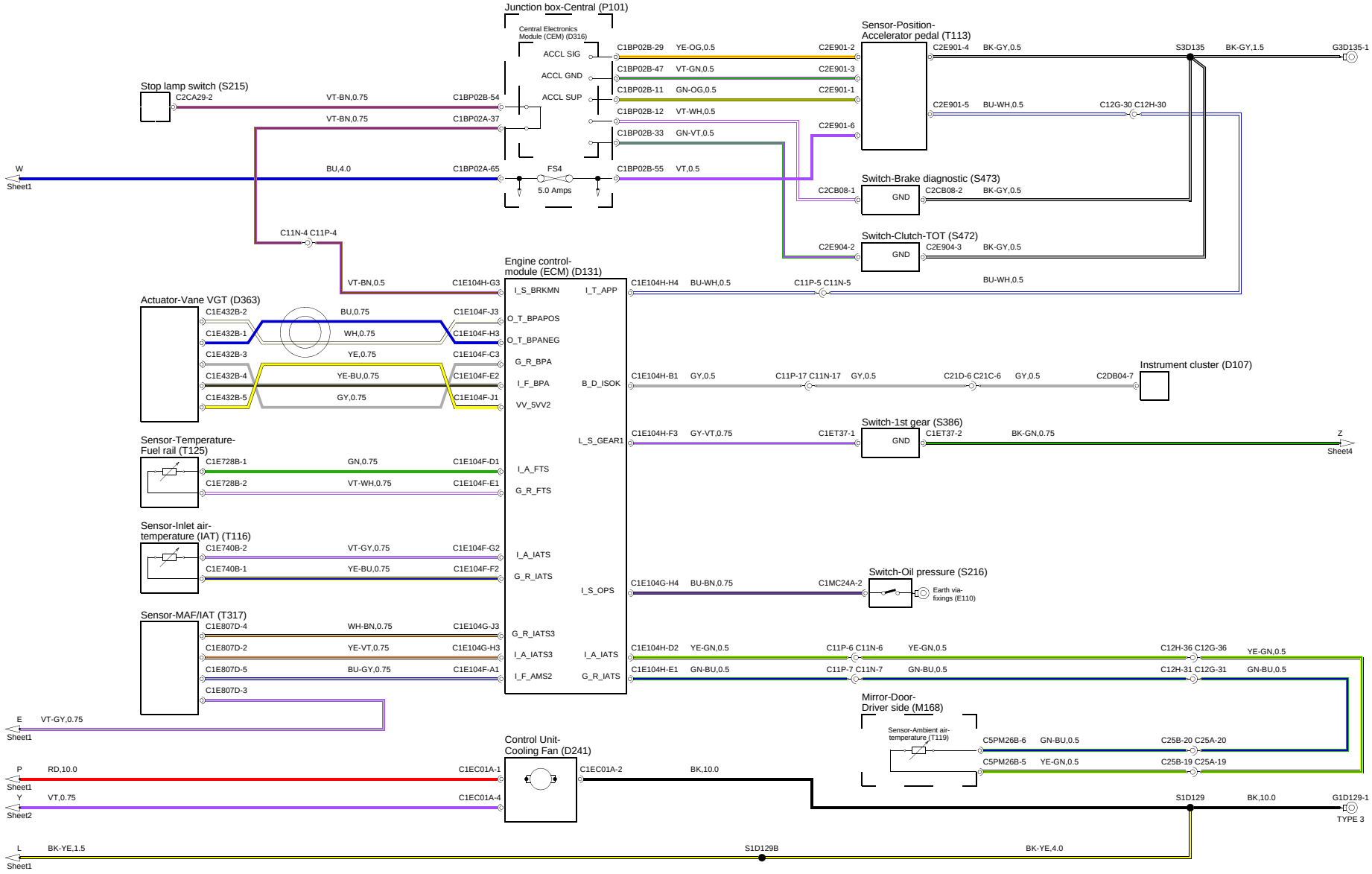

D
Sheet1
YE-GY,1.5
Engine control-module (ECM) (D131)
C WH,1.0
Sheet1
S1BB37A
WH,0.75
C1E205G-1
Fuel injector-No.1 (T172)
C1E205G-2 GN-BU,0.75
C1E109A-78
CYL 1 INJECTOR Silver
R WH,1.0
Sheet5
G WH,1.0
Sheet1
WH,0.75
C1E206G-1
Fuel injector-No.2 (T173)
C1E206G-2 GY-YE,0.75
C1E109A-82
CYL 2 INJECTOR Silver
WH,0.75
C1E207G-1
Fuel injector-No.3 (T174)
C1E207G-2 VT-GY,0.75
C1E109A-80
CYL 3 INJECTOR Silver
WH,0.75
C1E208G-1
Fuel injector-No.4 (T175)
C1E208G-2 YE-OG,0.75
C1E109A-83
CYL 4 INJECTOR Silver
WH,0.75
C1E209A-1
Fuel injector-No.5 (T176)
C1E209A-2 BU-RD,0.75
C1E109A-79
CYL 5 INJECTOR Silver
WH,0.75
C1E210-1
Fuel injector-No.6 (T177)
C1E210-2 GN-WH,0.75
C1E109A-81
CYL 6 INJECTOR Silver
H GY-BU,1.0
Sheet1
E GY-BU,1.0
Sheet1
S1BB38
GY-BU,1.0
C1E422C-1
Actuator-Camshaft-Front (M346)
C1E422C-2 VT,0.75
C1E109A-90
CPS1 Silver
J GY-BU,1.0
Sheet1
S GY-BU,1.0
Sheet4
GY-BU,1.0
C1E421D-1
Actuator-Camshaft-Rear (M347)
C1E421D-2 WH-OG,0.75
C1E109A-91
CPS2 Silver
GY-BU,1.0
C1E316A-3
Actuator-Inlet-Manifold-Lower (M343)
C1E316A-1 GN,0.75
C1E109A-39
VIS2 Silver
BK-BU,1.0
C1E316A-2
GY-BU,1.0
C1E316B-3
Actuator-Inlet-Manifold-Upper (M344)
C1E316B-1 BU,0.75
C1E109A-38
VIS1 Silver
BK-BU,1.0
C1E316B-2
F BK-BU,0.75
Sheet1
IGT1 Silver
IGF1 Silver
IGT2 Silver
IGT3 Silver
IGT4 Silver
IGT5 Silver
IGT6 Silver
Capacitor (G158)
C1E401-2 BK-GY,1.0
C1E401-1 YE-GY,1.0
C1E109A-61 WH-VT,0.5
C1E123-3
Ignition coil-1 (D233)
C1E123-1 YE-GY,1.5
C1E123-4 BK-GY,1.5
1a
S1BB35
S1D114 BK-GY,2.5
G1E123-1
C1E109A-62 YE-GN,0.5
S1E314
YE-GN,0.5
C1E123-2
YE-GN,0.5
C1E124-2
Ignition coil-2 (D234)
C1E124-1 YE-GY,1.5
C1E124-4 BK-BU,1.5
2a
S1D115 BK-BU,2.5
G1E124-1
C1E109A-57
YE-BU,0.5
C1E124-3
YE-GN,0.5
C1E125-2
Ignition coil-3 (D235)
C1E125-1 YE-GY,1.5
C1E125-4 BK-GY,1.5
3a
C1E109A-59
BU-OG,0.5
C1E125-3
YE-GN,0.5
C1E126-2
Ignition coil-4 (D236)
C1E126-1 YE-GY,1.5
C1E126-4 BK-BU,1.5
1b
C1E109A-56
GN-VT,0.5
C1E126-3
YE-GN,0.5
C1E127-2
Ignition coil-5 (D237)
C1E127-1 YE-GY,1.5
C1E127-4 BK-GY,1.5
2b
C1E109A-60
WH-BN,0.5
C1E127-3
YE-GN,0.5
C1E128-2
Ignition coil-6 (D238)
C1E128-1 YE-GY,1.5
C1E128-4 BK-BU,1.5
3b
C1E109A-58
VT-BN,0.5
C1E128-3
S1D108
BK-BU,1.5
G1D108D-1

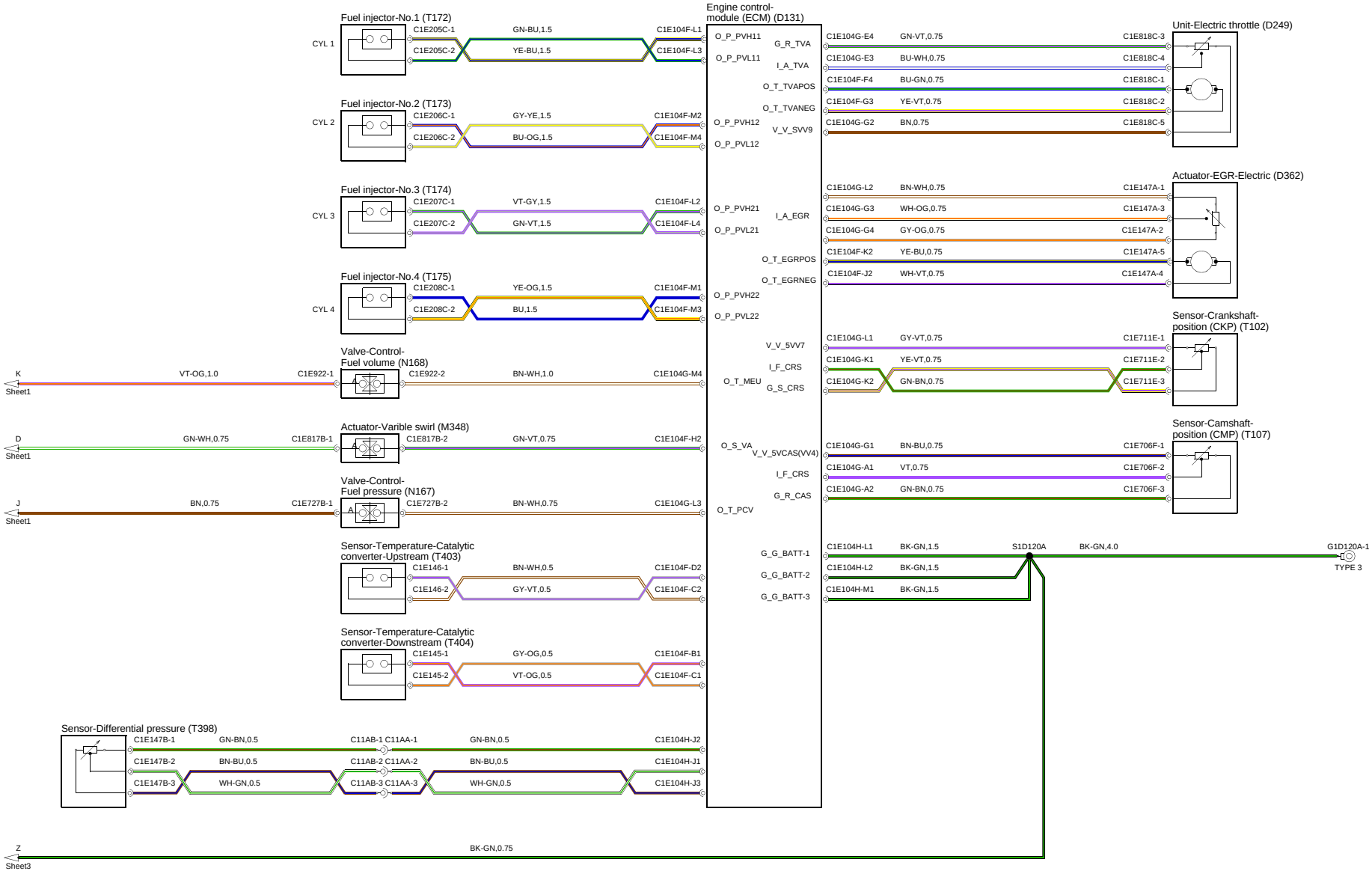

Sensor-Heated oxygen-(HO2S)-Front-RH (T182)
Sensor-Heated oxygen-(HO2S)-Front-LH (T183)
Sensor-Heated oxygen-(HO2S)-Rear-RH (T184)
Sensor-Heated oxygen-(HO2S)-Rear-LH (T185)
Purge control valve (N119)
Valve-Oil-Variable-valve timing (N152)
Engine control-module (ECM) (D131)
Unit-Electric throttle (D249)
Control Unit-Cooling Fan (D241)
Module-Transmission-control (D294)
A CYL1-3 UHEGO
B CYL4-6 UHEGO
A CYL1-3 HEGO
B CYL4-6 HEGO
B
Sheet1
S
Sheet3
M
Sheet1
K
Sheet1
S1BB30
S1BB34
YE-BU,1.0
GY-BU,1.0
VT-BN,0.75
C1E733A-1
C1E731E-1
C1E735D-1
C1E737A-1
C1E135C-1
C1E421E-1
C1E733A-2
C1E733A-3
C1E733A-4
C1E731E-2
C1E731E-3
C1E731E-4
C1E735D-2
C1E735D-3
C1E735D-4
C1E737A-2
C1E737A-3
C1E737A-4
C1E135C-2
C1E421E-2
WH-OG,0.75
BN-VT,0.5
YE-GN,0.5
BU-WH,0.75
WH,0.5
VT-BN,0.5
GN-BN,0.75
VT-GN,0.5
GN,0.5
GY-VT,0.75
WH-BU,0.5
WH-GN,0.5
WH-BN,0.75
VT,0.75
VT-BN,0.75
C1E109A-76
C1E109A-10
C1E109A-9
C1E109A-77
C1E109A-32
C1E109A-31
C1E109A-88
C1E109A-18
C1E109A-40
C1E109A-89
C1E109A-45
C1E109A-41
C1E109A-84
C1E109A-86
C1E109B-15
HTF1 Silver
AF1- Silver
AF1+ Silver
HTF2 Silver
AF2- Silver
AF2+ Silver
HTR1 Silver
OX1- Silver
OX1+ Silver
HTR2 Silver
OX2- Silver
OX2+ Silver
PRG Silver
VVT IN Silver
IGSW Silver
TPS1 Silver
TPS- Silver
TPS2 Silver
5V REF 3 Silver
MOTOR + Silver
MOTOR - Silver
EFCM Silver
CLT(P/N) Silver
HS CAN H Silver
HS CAN L Silver
C1E109A-65
C1E109A-17
C1E109A-67
C1E109A-48
C1E109A-75
C1E109A-74
C1E109B-8
C1E109B-13
C1E109B-54
C1E109B-41
YE,0.5
BU-OG,0.5
GN-VT,0.5
BN,0.5
BU-GN,0.75
YE-VT,0.75
VT,0.5
GY-BN,0.5
WH,0.5
WH-BU,0.5
C1E137D-6
C1E137D-3
C1E137D-4
C1E137D-5
C1E137D-1
C1E137D-2
C1EC01A-4
C1ET02-5
S1DB04G
S1DB05G
C1EC01A-2
C1EC01A-1
BK,10.0
RD,10.0
G1D129-1

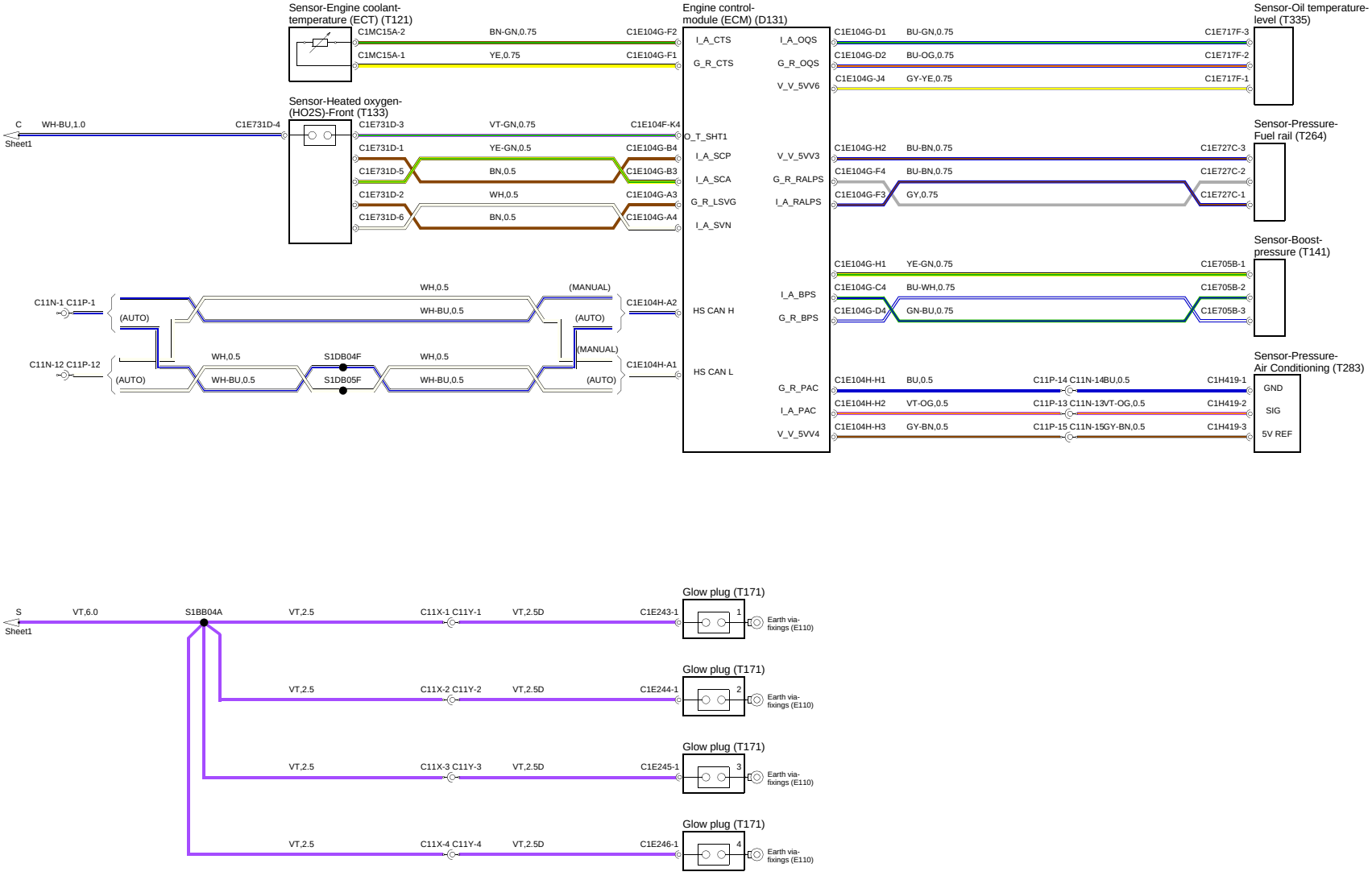

Sensor-Camshaft-Inlet (T400)
GND
OUT
VREF
C1E706H-2
C1E706H-3
C1E706H-1
GN-BN,0.5
BN-BU,0.5
VT,0.5
C1E109A-7
C1E109A-34
C1E109A-11
Sensor-Camshaft-Exhaust (T399)
VREF
GND
OUT
C1E707C-1
C1E707C-2
C1E707C-3
GN-VT,0.5
BN,0.5
YE-VT,0.5
C1E109A-12
C1E109A-8
C1E109A-33
Pump-Leak detection (M244)
C4E229-2 GN-OG,0.75
C4E229-1 VT-OG,0.75
C4E229-3 BU-GY,0.75
C4E229-4 YE-BU,0.75
(NAS)
C12G-16 C12H-16 GN-OG,0.75
C12G-19 C12H-19 VT-OG,0.75
C12G-20 C12H-20 BU-GY,0.75
C12G-21 C12H-21 YE-BU,1.0
C11L-11 C11M-11 GN-OG,0.5
C11L-12 C11M-12 VT-OG,0.5
C11L-10 C11M-10 BU-GY,0.5
C11L-5 C11M-5
C1E109B-45
C1E109B-23
C1E109B-46
A
Sheet1
BU,0.5
Sensor-Pressure-Air Conditioning (T283)
VREF
SIG
GND
C1H419-3
C1H419-2
C1H419-1
BU,0.5
VT-OG,0.5
GY-BN,0.5
C11N-15 C11P-15 BN,0.5
C11N-13 C11P-13 GN-BN,0.5
C11N-14 C11P-14 GY-BN,0.5
C1E109B-31
C1E109B-51
C1E109B-53
C12G-36 C12H-36 GN-BU,0.5
C12G-31 C12H-31 YE-GN,0.5
C11N-6 C11P-6 GN-BU,0.5
C11N-7 C11P-7 YE-GN,0.5
C1E109B-35
C1E109B-34
YE-GN,0.5
GN-BU,0.5
C25A-20 C25B-20 YE-GN,0.5
C25A-19 C25B-19 GN-BU,0.5
C5PM26B-6
C5PM26B-5
Engine control-module (ECM) (D131)
CAMIN-Silver
CAMIN Silver
CAMIN5V Silver
CAMEX5V Silver
CAMEX- Silver
CAMEX Silver
DPHC Silver
FLP Silver
COV Silver
VREFB Silver
ACPSH Silver
VREFB- Silver
TAMB + Silver
TAMB - Silver
FWS + Silver
FWS - Silver
KNK1+ Silver
KNK1- Silver
KNK2+ Silver
KNK2- Silver
COOL TEMP
TWGND Silver
TA- Silver
AFM IAT Silver
MAF Silver
MAF- Silver
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
R
Sheet3
Sensor-Crankshaft-position (CKP) (T102)
C1E109A-30 GN-BN,0.5
C1E109A-6 YE-VT,0.5
C1E711G-1
C1E711G-2
Sensor-Knock (KS) (T100)
C1E109A-42 WH-BN,0.5
C1E109A-19 VT-OG,0.5
C1E801G-1 RE323LB,GY-BK,0.5,1000
C1E801G-2 VE801LB,VT-OG,0.5,1000
Sensor-Knock (KS) (T100)
C1E109A-43 BN-GN,0.5
C1E109A-20 BN-BU,0.5
C1E802-1 RE324LB,GN-RD,0.5,1000
C1E802-2 VE802LB,YE-RD,0.5,1000
Sensor-Engine coolant-temperature (ECT) (T121)
C1E109A-68 BU,0.5
C1E109A-13 YE,0.5
C1MC15B-1
C1MC15B-2
Sensor-Mass air-flow (MAF) (T115)
C1E109A-14 BU-GY,0.5
C1E109A-66 BU,0.5
C1E109A-70 VT-BN,0.5
C1E109A-22 YE-VT,0.5
C1E807F-5
C1E807F-4
C1E807F-3
C1E807F-2
C1E807F-1 WH,1.0

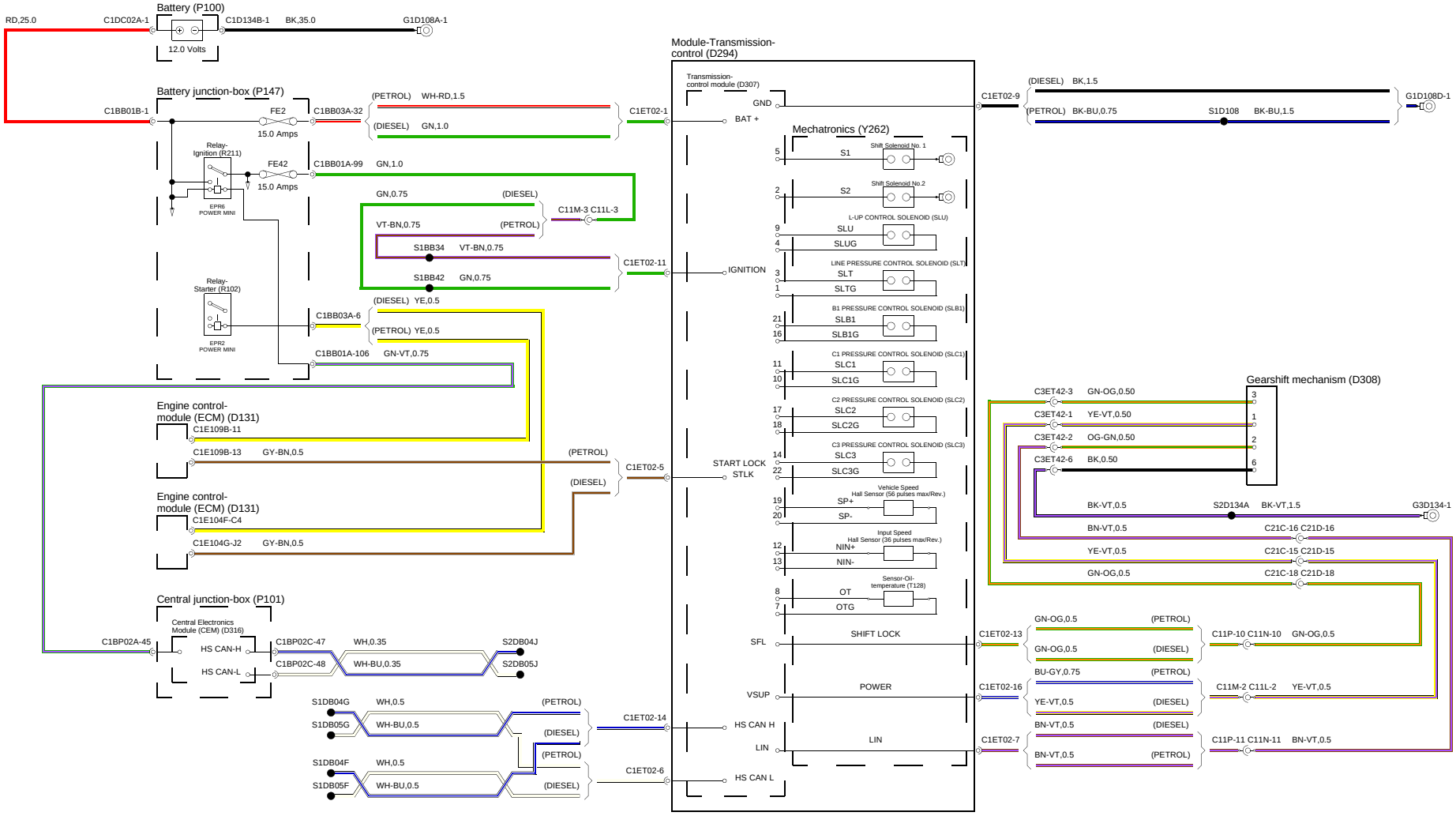

Battery (P100)
RD,25.0
C1DC02A-1
RD,35.0
C1DC02F-1
STARTER FUSE
12.0 Volts
C1D134B-1
BK,35.0
G1D108A-1
Starter motor (M101)
C1DC35A-1
BN-BU,4.0
C1DC01-1
Earth via-fixings (E110)
Junction box-Battery (P147)
C1BB03A-4
C1BB01B-1
Relay-Starter (R102)
POWER MINI RE1
Relay-Engine control-module (ECM) (R116)
POWER MINI RE2
Relay-Air conditioning-(A/C) (R180)
MICRO RE3
Relay-Glow-plug (R114)
POWER MINI RE4
Relay-Ignition (R211)
POWER MINI RE7
S1DC02A RD,4.0 C1BB03A-7
RD,4.0 C1BB03A-1
RD,4.0 C1BB03A-23
S1BB07A GN-BU,0.5 C1BB03A-10
GN-BU,0.5 C1BB03A-25
GY-RD,1.0 C1BB03A-27
C1BB03A-28
GN-BU,0.5 C1BB03A-31
RD,6.0 C1BB01A-66
GN-RD,6.0 C1BB03C-1
C1BB03A-19
S1DC02B RD,6.0 C1BB01A-104
RD,0.5 C1BB01A-107
S1BB33 RD,0.5 C1BB01A-92
FE7 5.0 Amps
FE13 15.0 Amps
FE4 60.0 Amps
FE33 5.0 Amps
FE15 40.0 Amps
FE6 10.0 Amps
FE12 10.0 Amps
FE9 10.0 Amps
FE8 10.0 Amps
FE1 5.0 Amps
FE11 10.0 Amps
FE14 15.0 Amps
FE2 15.0 Amps
FE3 80.0 Amps
FE17 60.0 Amps
FE42 15.0 Amps
FE41 20.0 Amps
C1BB03A-2 YE-RD,4.0
C1BB03A-3
C1BB03A-5 BN-GN,0.5
C1BB03A-6 YE,0.5
C1BB03A-13 WH-BU,1.0
C1BB03A-15 GN-WH,0.75
C1BB03A-14 VT-GY,0.75
C1BB03A-11 YE-BU,2.5
C1BB03A-8
C1BB03A-37 YE-BU,2.5
C1BB03A-9 GY-VT,0.5
C1BB03A-16 GY-YE,1.5
C1BB03A-12 BU,0.75
C1BB03A-17 BN,0.75
C1BB03A-22 BN,0.75
C1BB03A-18 VT-OG,1.0
C1BB03A-29 GY-BN,1.5
C1BB03A-30 VT-WH,0.75
C1BB03A-32 GN,1.0
C1BB03D-1 RD,10.0
C1BB07G-1 RD,6.0
C1BB03A-39 VT,2.5
C1BB03A-20 VT,6.0
C1BB03A-21 VT-GN,0.5
C1BB01A-105 GN-VT,4.0
C1BB01A-117
C1BB01A-99 GN,1.0
C1BB01A-98 BU,4.0
C1BB01A-106 GN-VT,0.75
Clutch-Compressor-Air-conditioning (A/C) (D149)
C1H302E-1
C1H302E-2
BK-YE,1.5
S1BB04B
VT,6.0
A Sheet2
B Sheet2
C Sheet5
D Sheet4
E Sheet3
F Sheet2
G Sheet2
H Sheet2
J Sheet4
K Sheet4
L Sheet3
M Sheet2
N Sheet2
P Sheet3
R Sheet2
S Sheet5
T Sheet2
V Sheet2
W Sheet3
X Sheet2

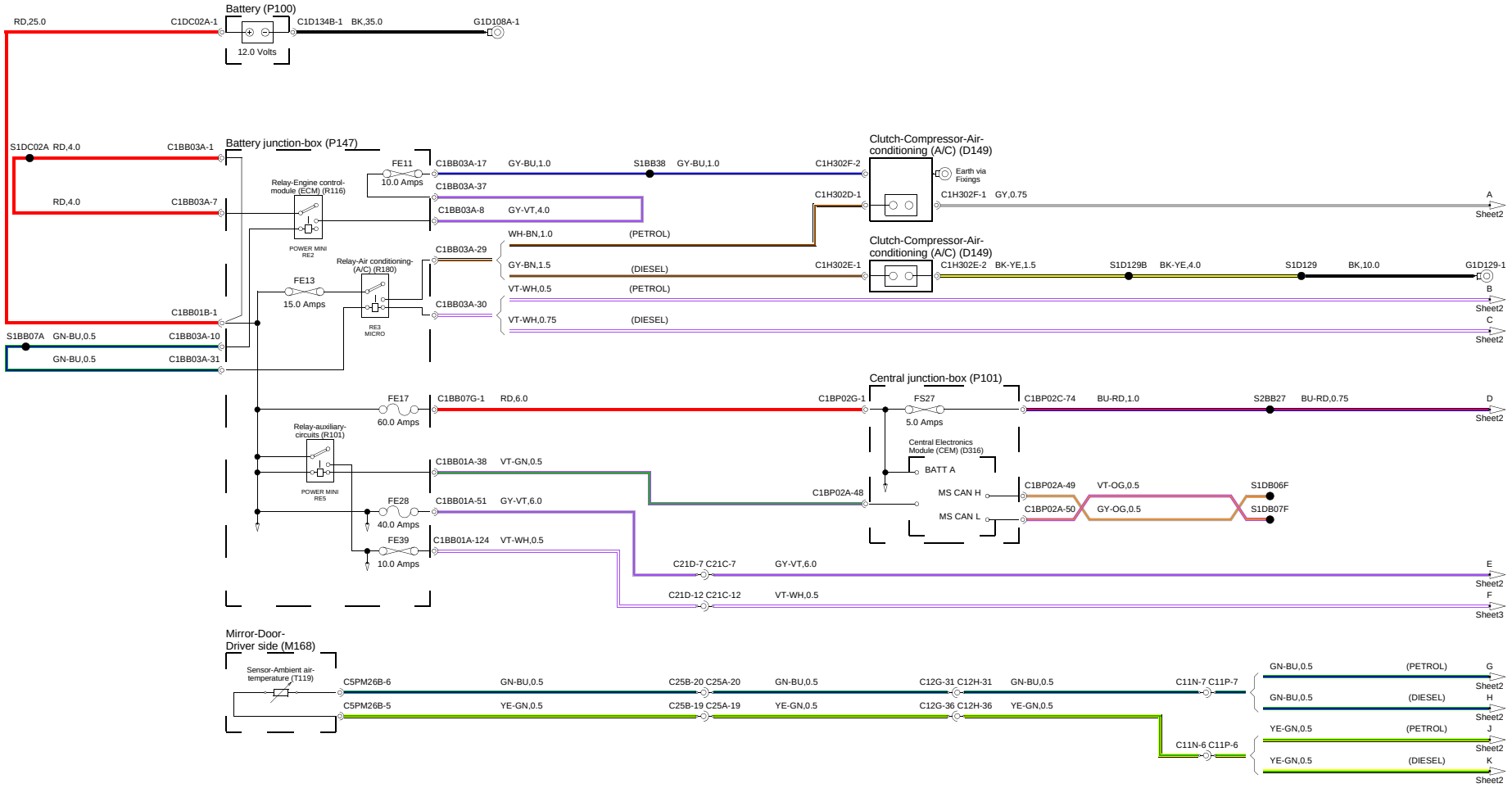

Junction box-Central (P101)
Relay-Fuel-pump (R103)
(PCB)
Central Electronics Module (CEM) (D316)
Unit-Fuel Tank (D179)
Pump-Fuel (M151)
12.00 Amps
Sensor-Engine coolant-level (T220)
Solenoid-Reverse gear inhibit (N182)
Start control unit (D391)
Switch-Clutch-BOT (S471)
Engine control-module (ECM) (D131)
Switch-Reverse-lamp (S103)
Generator (M100)
Module-Transmission-control (D294)
R RD,6.0 Sheet1
C1BP02G-1 BATT A FS22
20.0 Amps
C1BP02B-76 BN-YE,2.5 C4E515-4
C4E515-3 BK-GY,2.5 G4D149B-1
X GN-VT,0.75 Sheet1
C1BP02A-45 IGN RLY
C1BP02B-48 GN-BU,0.75 C4E515-1 Pump Sender -ve
C1BP02B-46 GN-BU,0.75 C4E515-5 Remote Sender -ve
C1BP02B-30 YE-VT,0.35 C4E515-2 Pump Sender +ve
C1BP02B-43 GN-OG,0.35 C4E515-6 Remote Sender +ve
F/P SENSOR GND
F/P SENSOR
FUEL EJECT SENSOR
BU-OG,0.5 C1BP02B-27 CLUTCH BOT
COOLANT LEVEL
C1BP02A-11 WH-OG,0.5 C1MC21-1 C1MC21-2 BK-YE,0.5 S1D130D BK-YE,1.0 G1D130B-1
C1BP02C-43 WH-BN,0.75 C3ET58-1 C3ET58-2 BK-YE,0.75 S2D139D BK-YE,1.5 S2D139A
REVERSE GEAR
WAKE UP
START REQUEST
CRASH
LIN 3
C1BP02C-50 WH-GN,0.35 C2DC35-3 LIN
C1BP02C-35 BU-WH,0.5 S2DC35 BU-WH,0.5 C2DC35-5 START
S2BB27 BU-RD,0.5 C2DC35-1 PWR
BK-YE,2.5
S2D139B BK-YE,6.0 G6D139-1
C2E903-1 C2E903-2
FS27
5.0 Amps
C1BP02C-74 BU-RD,1.0
C21D-3 C21C-3 BU-WH,0.5
BU-WH,0.5 C11N-2 C11P-2 BU-WH,0.5 C1E104H-F2 I_S_T50R
C1BP02A-8 BN,0.5 C11N-9 C11P-9 BN-YE,0.5 C1E104H-C1 I_S_CRASH
C1BP02A-44 VT-OG,0.5 C11N-3 C11P-3 VT-OG,0.5 C1E104H-D1 I_S_WAKE
FET-ECM WAKE UP
S3E903 BU-OG,0.5
C1BP02A-26 BU,0.75 C11L-14 C11M-14 BU,0.5 C1ET47D-1
BK-GY,0.5 S3D135 BK-GY,1.5 G3D135-1
BU-OG,0.5 C12G-11 C12H-11 BU-OG,0.5
B Sheet1 YE,0.5 C1E104F-C4 O_S_STRT
A Sheet1 BN-GN,0.5 C1E104F-K1 O_S_STRTN
G Sheet1 GY-YE,1.5 S1BB08 GY-YE,1.5 C1E104H-L3 V_V_BATT+2R
GY-YE,1.5 C1E104H-L4 V_V_BATT+1R
F Sheet1 GY-VT,0.5 C1E104H-F4 ECR_RLY
H Sheet1 BU,0.75 C1E104F-A2 I_S_GLW
M Sheet1 VT-WH,0.75 C1E104H-E4 A-C RELAY
T Sheet1 VT-GN,0.5 C1E104G-K4 O_T_GLW
O_T_FAN1 C1E104H-D4 VT,0.75 Y Sheet3
B_D_LIN C1E104H-C2 BU-BN,0.75 C1DC14-1
I_S_PKRN/CLTCH C1E104G-J2 BU-OG,0.5 C11P-8 C11N-8
GY-BN,0.5 C1ET02-5
IGN C1E104H-K3 GN,0.75 S1BB42 GN,0.75 C1ET02-11 IGN
V Sheet1 GN,1.0 C11L-3 C11M-3 GN,0.75
N Sheet1 GN,1.0 C1ET02-1 VBATT

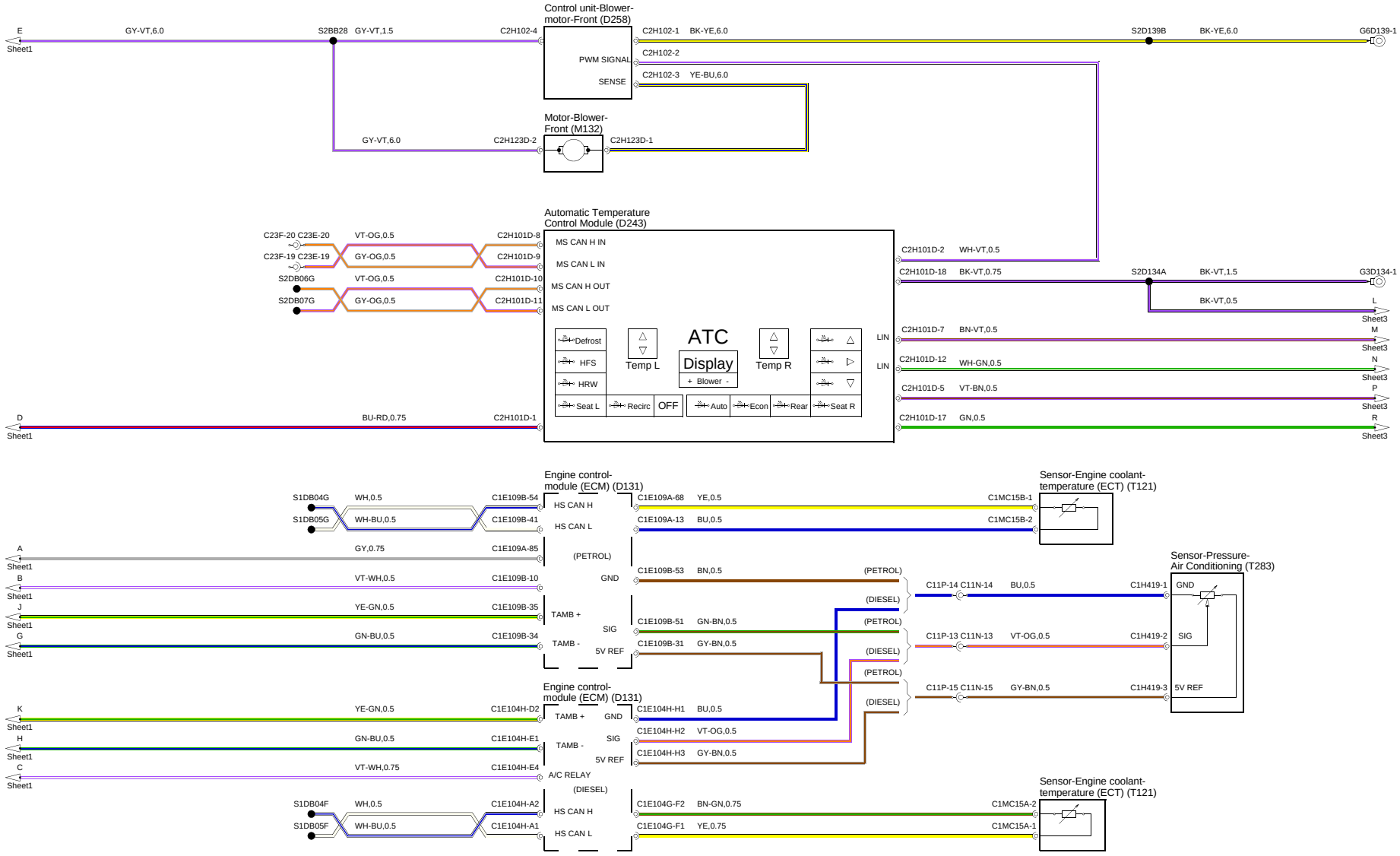

Junction box-Central (P101)
Central Electronics Module (CEM) (D316)
ACCL SIG
ACCL GND
ACCL SUP
C1BP02B-29 YE-OG,0.5 C2E901-2
C1BP02B-47 VT-GN,0.5 C2E901-3
C1BP02B-11 GN-OG,0.5 C2E901-1
C1BP02B-12 VT-WH,0.5
C1BP02B-33 GN-VT,0.5
C1BP02B-55 VT,0.5
FS4
5.0 Amps
Sensor-Position-Accelerator pedal (T113)
C2E901-4 BK-GY,0.5 S3D135 BK-GY,1.5 G3D135-1
C2E901-5 BU-WH,0.5 C12G-30 C12H-30
C2E901-6
Stop lamp switch (S215)
C2CA29-2 VT-BN,0.75 C1BP02B-54
VT-BN,0.75 C1BP02A-37
W Sheet1 BU,4.0 C1BP02A-65
C11N-4 C11P-4
Switch-Brake diagnostic (S473)
C2CB08-1 GND C2CB08-2 BK-GY,0.5
Switch-Clutch-TOT (S472)
C2E904-2 GND C2E904-3 BK-GY,0.5
Engine control-module (ECM) (D131)
VT-BN,0.5 C1E104H-G3
C1E104H-H4 BU-WH,0.5 C11P-5 C11N-5
BU-WH,0.5
I_S_BRKMN I_T_APP
Actuator-Vane VGT (D363)
C1E432B-2 BU,0.75 C1E104F-J3 O_T_BPAPOS
C1E432B-1 WH,0.75 C1E104F-H3 O_T_BPANEG
C1E432B-3 YE,0.75 C1E104F-C3 G_R_BPA
C1E432B-4 YE-BU,0.75 C1E104F-E2 I_F_BPA
C1E432B-5 GY,0.75 C1E104F-J1 VV_5VV2
Instrument cluster (D107)
C1E104H-B1 GY,0.5 C11P-17 C11N-17 GY,0.5 C21D-6 C21C-6 GY,0.5 C2DB04-7
B_D_ISOK
Switch-1st gear (S386)
C1E104H-F3 GY-VT,0.75 C1ET37-1 GND C1ET37-2 BK-GN,0.75 Z Sheet4
L_S_GEAR1
Sensor-Temperature-Fuel rail (T125)
C1E728B-1 GN,0.75 C1E104F-D1 I_A_FTS
C1E728B-2 VT-WH,0.75 C1E104F-E1 G_R_FTS
Sensor-Inlet air-temperature (IAT) (T116)
C1E740B-2 VT-GY,0.75 C1E104F-G2 I_A_IATS
C1E740B-1 YE-BU,0.75 C1E104F-F2 G_R_IATS
Switch-Oil pressure (S216)
C1E104G-H4 BU-BN,0.75 C1MC24A-2
Earth via-fixings (E110)
I_S_OPS
Sensor-MAF/IAT (T317)
C1E807D-4 WH-BN,0.75 C1E104G-J3 G_R_IATS3
C1E807D-2 YE-VT,0.75 C1E104G-H3 I_A_IATS3
C1E807D-5 BU-GY,0.75 C1E104F-A1 I_F_AMS2
C1E807D-3
C1E104H-D2 YE-GN,0.5 C11P-6 C11N-6 YE-GN,0.5 C12H-36 C12G-36 YE-GN,0.5
C1E104H-E1 GN-BU,0.5 C11P-7 C11N-7 GN-BU,0.5 C12H-31 C12G-31 GN-BU,0.5
I_A_IATS
G_R_IATS
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
C5PM26B-6 GN-BU,0.5 C25B-20 C25A-20
C5PM26B-5 YE-GN,0.5 C25B-19 C25A-19
E Sheet1 VT-GY,0.75
Control Unit-Cooling Fan (D241)
P Sheet1 RD,10.0 C1EC01A-1
Y Sheet2 VT,0.75 C1EC01A-4
C1EC01A-2 BK,10.0
S1D129 BK,10.0 G1D129-1 TYPE 3
L Sheet1 BK-YE,1.5 S1D129B BK-YE,4.0

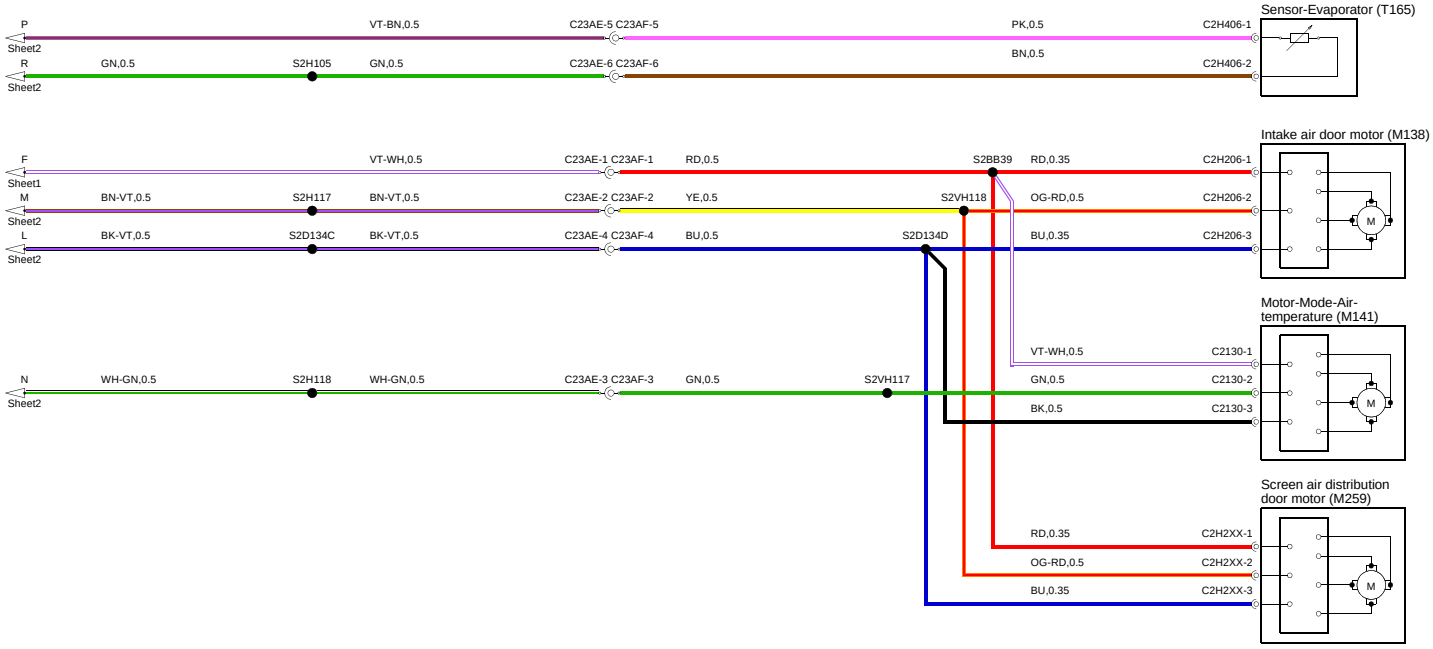

Fuel injector-No.1 (T172)
CYL 1
C1E205C-1
C1E205C-2
GN-BU,1.5
YE-BU,1.5
C1E104F-L1
C1E104F-L3
Fuel injector-No.2 (T173)
CYL 2
C1E206C-1
C1E206C-2
GY-YE,1.5
BU-OG,1.5
C1E104F-M2
C1E104F-M4
Fuel injector-No.3 (T174)
CYL 3
C1E207C-1
C1E207C-2
VT-GY,1.5
GN-VT,1.5
C1E104F-L2
C1E104F-L4
Fuel injector-No.4 (T175)
CYL 4
C1E208C-1
C1E208C-2
YE-OG,1.5
BU,1.5
C1E104F-M1
C1E104F-M3
Valve-Control-
Fuel volume (N168)
K
Sheet1
VT-OG,1.0
C1E922-1
C1E922-2
BN-WH,1.0
C1E104G-M4
Actuator-Varible swirl (M348)
D
Sheet1
GN-WH,0.75
C1E817B-1
C1E817B-2
GN-VT,0.75
C1E104F-H2
Valve-Control-
Fuel pressure (N167)
J
Sheet1
BN,0.75
C1E727B-1
C1E727B-2
BN-WH,0.75
C1E104G-L3
Sensor-Temperature-Catalytic
converter-Upstream (T403)
C1E146-1
C1E146-2
BN-WH,0.5
GY-VT,0.5
C1E104F-D2
C1E104F-C2
Sensor-Temperature-Catalytic
converter-Downstream (T404)
C1E145-1
C1E145-2
GY-OG,0.5
VT-OG,0.5
C1E104F-B1
C1E104F-C1
Sensor-Differential pressure (T398)
C1E147B-1
C1E147B-2
C1E147B-3
GN-BN,0.5
BN-BU,0.5
WH-GN,0.5
C11AB-1 C11AA-1
C11AB-2 C11AA-2
C11AB-3 C11AA-3
GN-BN,0.5
BN-BU,0.5
WH-GN,0.5
C1E104H-J2
C1E104H-J1
C1E104H-J3
Z
Sheet3
BK-GN,0.75
Engine control-
module (ECM) (D131)
O_P_PVH11
O_P_PVL11
O_P_PVH12
O_P_PVL12
O_P_PVH21
O_P_PVL21
O_P_PVH22
O_P_PVL22
G_R_TVA
I_A_TVA
O_T_TVAPOS
O_T_TVANEG
V_V_SVV9
I_A_EGR
O_T_EGRPOS
O_T_EGRNEG
V_V_5VV7
I_F_CRS
O_T_MEU
G_S_CRS
O_S_VA
V_V_5VCAS(VV4)
I_F_CRS
G_R_CAS
O_T_PCV
G_G_BATT-1
G_G_BATT-2
G_G_BATT-3
Unit-Electric throttle (D249)
C1E104G-E4
C1E104G-E3
C1E104F-F4
C1E104F-G3
C1E104G-G2
GN-VT,0.75
BU-WH,0.75
BU-GN,0.75
YE-VT,0.75
BN,0.75
C1E818C-3
C1E818C-4
C1E818C-1
C1E818C-2
C1E818C-5
Actuator-EGR-Electric (D362)
C1E104G-L2
C1E104G-G3
C1E104G-G4
C1E104F-K2
C1E104F-J2
BN-WH,0.75
WH-OG,0.75
GY-OG,0.75
YE-BU,0.75
WH-VT,0.75
C1E147A-1
C1E147A-3
C1E147A-2
C1E147A-5
C1E147A-4
Sensor-Crankshaft-
position (CKP) (T102)
C1E104G-L1
C1E104G-K1
C1E104G-K2
GY-VT,0.75
YE-VT,0.75
GN-BN,0.75
C1E711E-1
C1E711E-2
C1E711E-3
Sensor-Camshaft-
position (CMP) (T107)
C1E104G-G1
C1E104G-A1
C1E104G-A2
BN-BU,0.75
VT,0.75
GN-BN,0.75
C1E706F-1
C1E706F-2
C1E706F-3
C1E104H-L1
C1E104H-L2
C1E104H-M1
BK-GN,1.5
BK-GN,1.5
BK-GN,1.5
S1D120A
BK-GN,4.0
G1D120A-1
TYPE 3

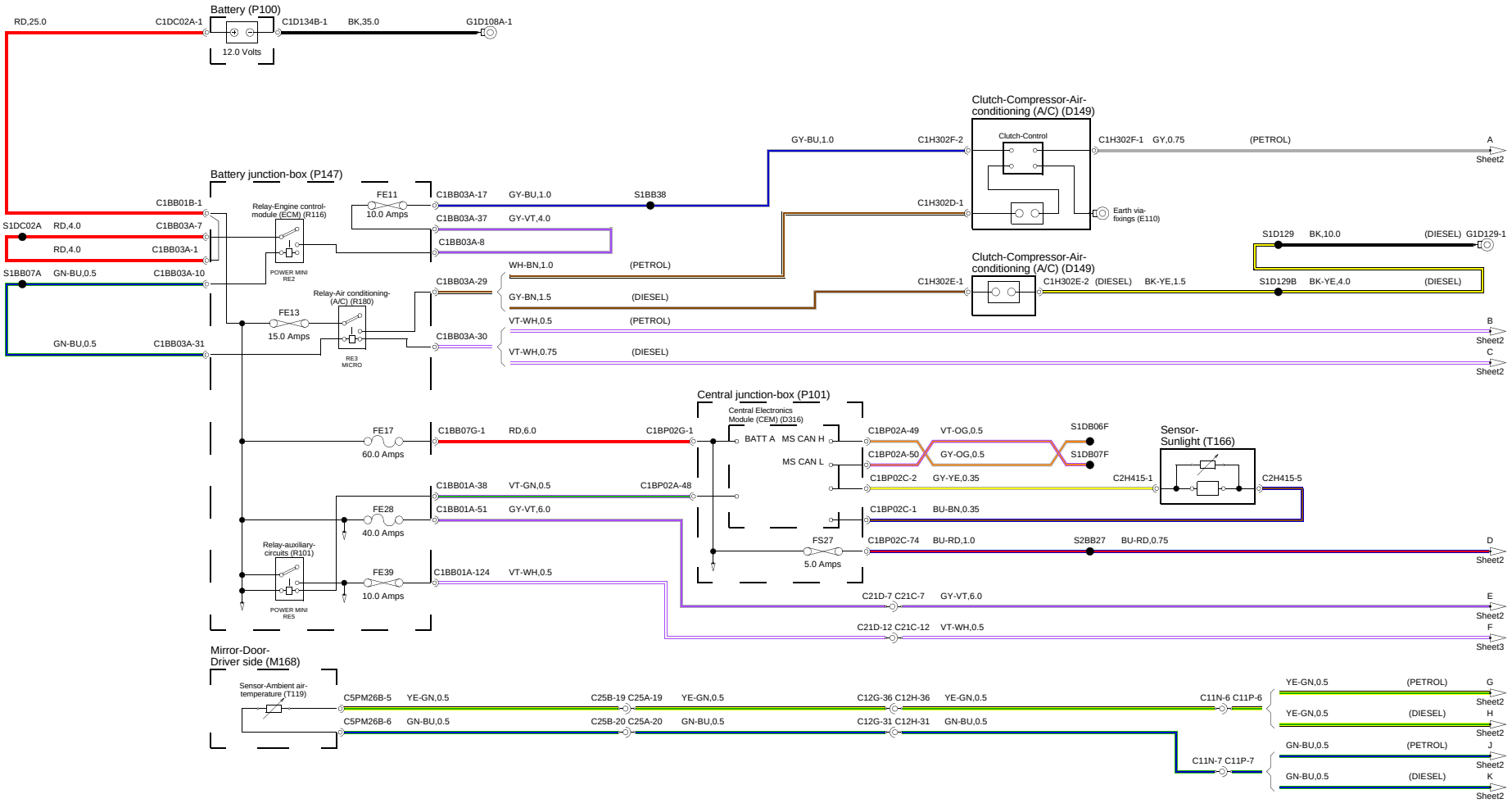

Sensor-Engine coolant-temperature (ECT) (T121)
C1MC15A-2
BN-GN,0.75
C1E104G-F2
C1MC15A-1
YE,0.75
C1E104G-F1
Sensor-Heated oxygen-(HO2S)-Front (T133)
C
WH-BU,1.0
C1E731D-4
Sheet1
C1E731D-3
VT-GN,0.75
C1E104F-K4
C1E731D-1
YE-GN,0.5
C1E104G-B4
C1E731D-5
BN,0.5
C1E104G-B3
C1E731D-2
WH,0.5
C1E104G-A3
C1E731D-6
BN,0.5
C1E104G-A4
Engine control-module (ECM) (D131)
I_A_CTS
G_R_CTS
O_T_SHT1
I_A_SCP
I_A_SCA
G_R_LSVG
I_A_SVN
HS CAN H
HS CAN L
I_A_OQS
G_R_OQS
V_V_5VV6
V_V_5VV3
G_R_RALPS
I_A_RALPS
I_A_BPS
G_R_BPS
G_R_PAC
I_A_PAC
V_V_5VV4
C1E104G-D1
BU-GN,0.75
C1E717F-3
C1E104G-D2
BU-OG,0.75
C1E717F-2
C1E104G-J4
GY-YE,0.75
C1E717F-1
Sensor-Oil temperature-level (T335)
C1E104G-H2
BU-BN,0.75
C1E727C-3
C1E104G-F4
BU-BN,0.75
C1E727C-2
C1E104G-F3
GY,0.75
C1E727C-1
Sensor-Pressure-Fuel rail (T264)
C1E104G-H1
YE-GN,0.75
C1E705B-1
C1E104G-C4
BU-WH,0.75
C1E705B-2
C1E104G-D4
GN-BU,0.75
C1E705B-3
Sensor-Boost-pressure (T141)
C11N-1 C11P-1
(AUTO)
WH,0.5
WH-BU,0.5
(MANUAL)
C1E104H-A2
C11N-12 C11P-12
(AUTO)
WH,0.5
WH-BU,0.5
S1DB04F
S1DB05F
WH,0.5
WH-BU,0.5
(MANUAL)
(AUTO)
C1E104H-A1
C1E104H-H1
BU,0.5
C11P-14
C11N-14
BU,0.5
C1H419-1
C1E104H-H2
VT-OG,0.5
C11P-13
C11N-13
VT-OG,0.5
C1H419-2
C1E104H-H3
GY-BN,0.5
C11P-15
C11N-15
GY-BN,0.5
C1H419-3
Sensor-Pressure-Air Conditioning (T283)
GND
SIG
5V REF
S
VT,6.0
Sheet1
S1BB04A
VT,2.5
C11X-1 C11Y-1
VT,2.5D
C1E243-1
Glow plug (T171)
1
Earth via-fixings (E110)
VT,2.5
C11X-2 C11Y-2
VT,2.5D
C1E244-1
Glow plug (T171)
2
Earth via-fixings (E110)
VT,2.5
C11X-3 C11Y-3
VT,2.5D
C1E245-1
Glow plug (T171)
3
Earth via-fixings (E110)
VT,2.5
C11X-4 C11Y-4
VT,2.5D
C1E246-1
Glow plug (T171)
4
Earth via-fixings (E110)

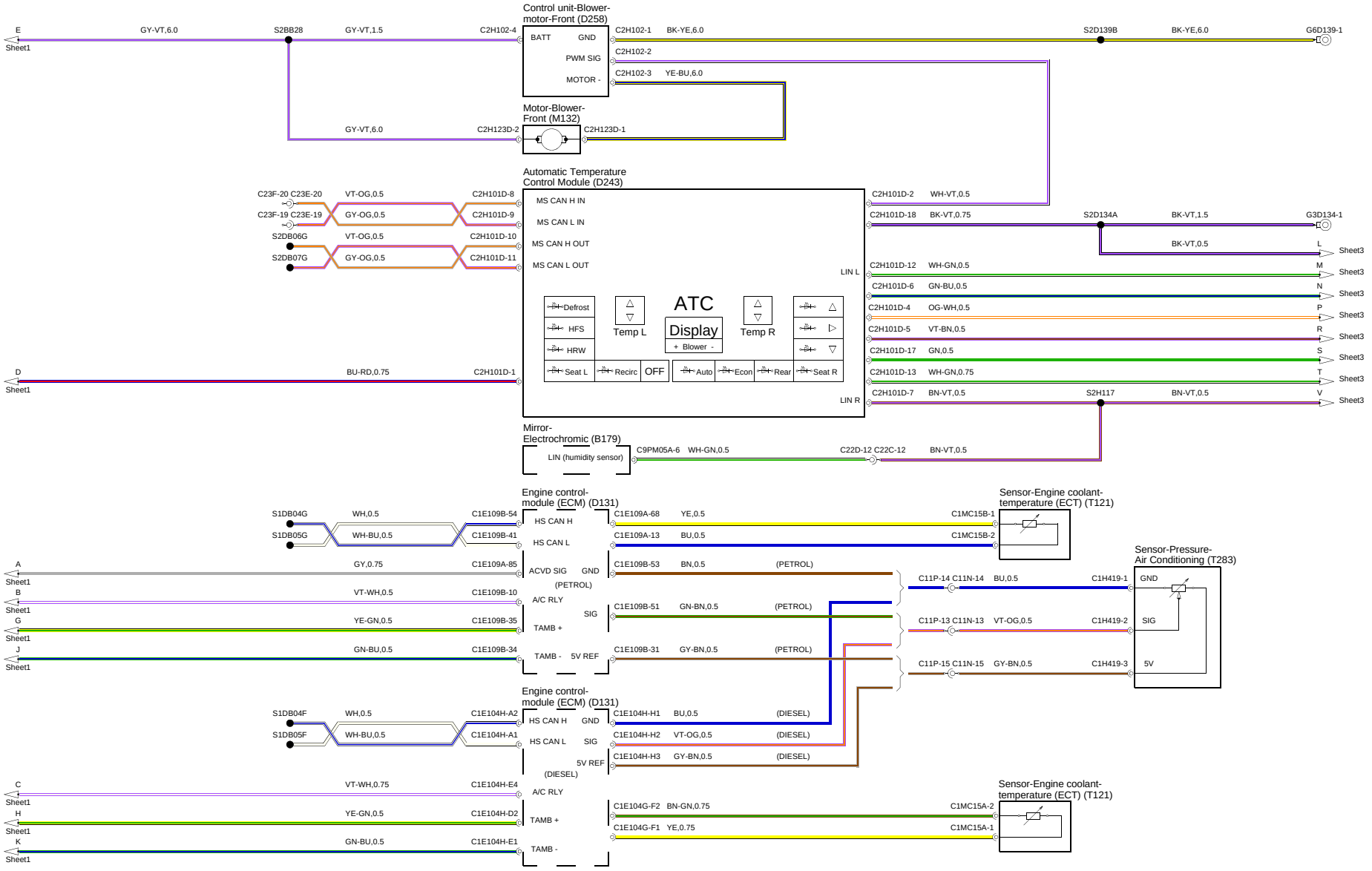

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE2
15.0 Amps
C1BB03A-32
(PETROL) WH-RD,1.5
(DIESEL) GN,1.0
C1ET02-1
Relay-Ignition (R211)
FE42
15.0 Amps
C1BB01A-99 GN,1.0
EPR6 POWER MINI
GN,0.75 (DIESEL)
VT-BN,0.75 (PETROL)
C11M-3 C11L-3
S1BB34 VT-BN,0.75
S1BB42 GN,0.75
C1ET02-11
Relay-Starter (R102)
EPR2 POWER MINI
C1BB03A-6
(DIESEL) YE,0.5
(PETROL) YE,0.5
C1BB01A-106 GN-VT,0.75
Engine control-module (ECM) (D131)
C1E109B-11
C1E109B-13 GY-BN,0.5
(PETROL)
(DIESEL)
C1ET02-5
Engine control-module (ECM) (D131)
C1E104F-C4
C1E104G-J2 GY-BN,0.5
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
C1BP02A-45
HS CAN-H
HS CAN-L
C1BP02C-47 WH,0.35
C1BP02C-48 WH-BU,0.35
S2DB04J
S2DB05J
S1DB04G WH,0.5
S1DB05G WH-BU,0.5
S1DB04F WH,0.5
S1DB05F WH-BU,0.5
(PETROL)
(DIESEL)
C1ET02-14
C1ET02-6
Module-Transmission-control (D294)
Transmission-control module (D307)
GND
BAT +
IGNITION
START LOCK STLK
SFL
VSUP
HS CAN H
LIN
HS CAN L
Mechatronics (Y262)
S1 Shift Solenoid No. 1
S2 Shift Solenoid No.2
SLU L-UP CONTROL SOLENOID (SLU)
SLUG
SLT LINE PRESSURE CONTROL SOLENOID (SLT)
SLTG
SLB1 B1 PRESSURE CONTROL SOLENOID (SLB1)
SLB1G
SLC1 C1 PRESSURE CONTROL SOLENOID (SLC1)
SLC1G
SLC2 C2 PRESSURE CONTROL SOLENOID (SLC2)
SLC2G
SLC3 C3 PRESSURE CONTROL SOLENOID (SLC3)
SLC3G
SP+ Vehicle Speed Hall Sensor (56 pulses max/Rev.)
SP-
NIN+ Input Speed Hall Sensor (36 pulses max/Rev.)
NIN-
OT Sensor-Oil-temperature (T128)
OTG
SHIFT LOCK
POWER
LIN
C1ET02-9
(DIESEL) BK,1.5
(PETROL) BK-BU,0.75
S1D108
BK-BU,1.5
G1D108D-1
Gearshift mechanism (D308)
C3ET42-3 GN-OG,0.50
C3ET42-1 YE-VT,0.50
C3ET42-2 OG-GN,0.50
C3ET42-6 BK,0.50
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
BN-VT,0.5
C21C-16 C21D-16
YE-VT,0.5
C21C-15 C21D-15
GN-OG,0.5
C21C-18 C21D-18
C1ET02-13
GN-OG,0.5 (PETROL)
GN-OG,0.5 (DIESEL)
C11P-10 C11N-10 GN-OG,0.5
C1ET02-16
BU-GY,0.75 (PETROL)
YE-VT,0.5 (DIESEL)
C11M-2 C11L-2 YE-VT,0.5
C1ET02-7
BN-VT,0.5 (DIESEL)
BN-VT,0.5 (PETROL)
C11P-11 C11N-11 BN-VT,0.5

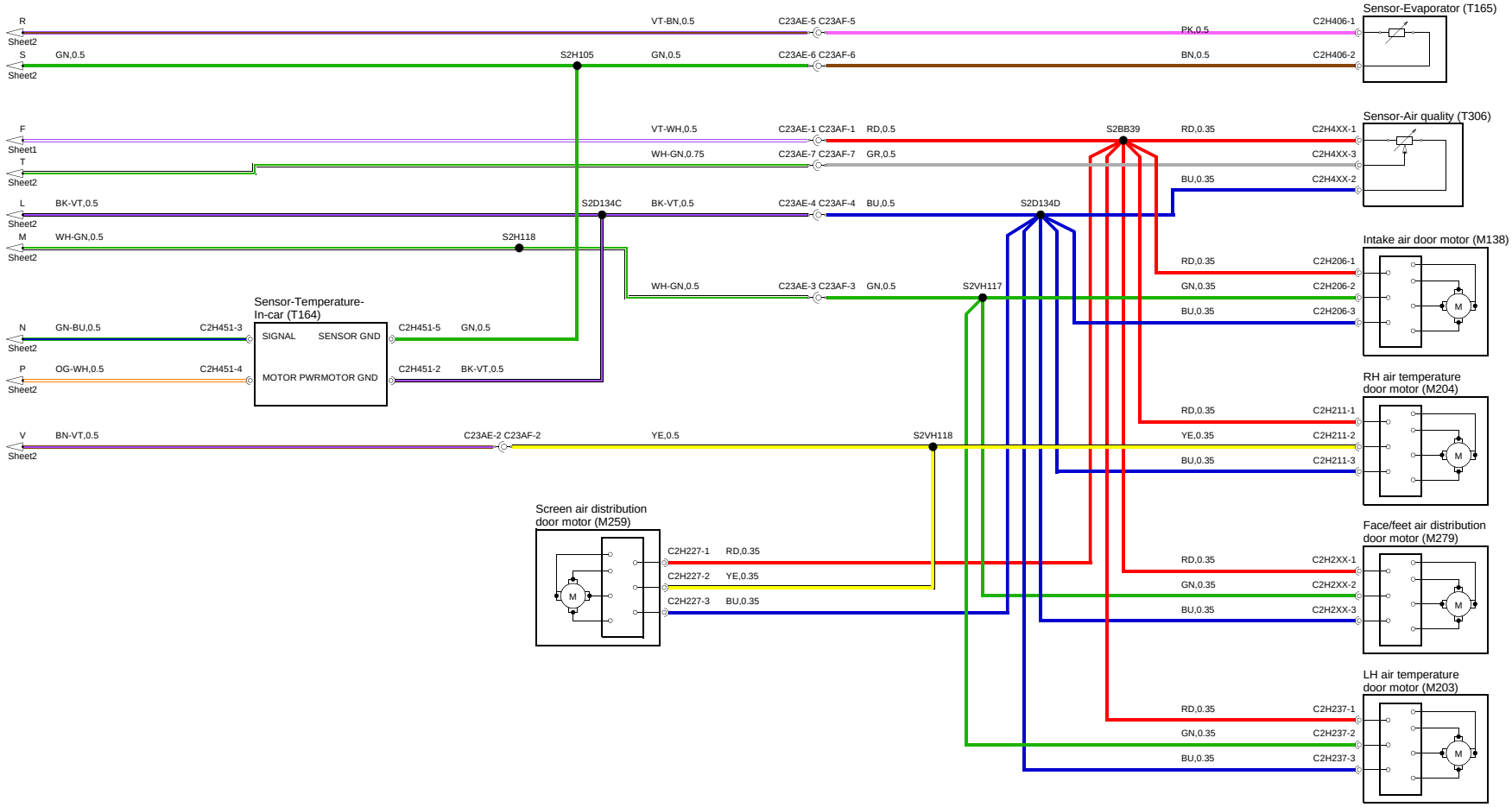

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1 BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
S1DC02A RD,4.0
C1BB03A-1
RD,4.0
C1BB03A-7
C1BB01B-1
S1BB07A GN-BU,0.5
C1BB03A-10
GN-BU,0.5
C1BB03A-31
FE11
10.0 Amps
C1BB03A-17 GY-BU,1.0
S1BB38 GY-BU,1.0
C1H302F-2
C1BB03A-37
C1BB03A-8 GY-VT,4.0
C1H302D-1
Relay-Engine control-module (ECM) (R116)
POWER MINI RE2
Clutch-Compressor-Air-conditioning (A/C) (D149)
Earth via Fixings
C1H302F-1 GY,0.75
A
Sheet2
WH-BN,1.0 (PETROL)
C1BB03A-29
GY-BN,1.5 (DIESEL)
C1H302E-1
Relay-Air conditioning-(A/C) (R180)
FE13
15.0 Amps
RE3 MICRO
VT-WH,0.5 (PETROL)
C1BB03A-30
VT-WH,0.75 (DIESEL)
Clutch-Compressor-Air-conditioning (A/C) (D149)
C1H302E-2 BK-YE,1.5
S1D129B BK-YE,4.0
S1D129 BK,10.0
G1D129-1
B
Sheet2
C
Sheet2
Central junction-box (P101)
FE17
60.0 Amps
C1BB07G-1 RD,6.0
C1BP02G-1
FS27
5.0 Amps
C1BP02C-74 BU-RD,1.0
S2BB27 BU-RD,0.75
D
Sheet2
Relay-auxiliary-circuits (R101)
POWER MINI RE5
C1BB01A-38 VT-GN,0.5
Central Electronics Module (CEM) (D316)
BATT A
C1BP02A-48
MS CAN H
MS CAN L
C1BP02A-49 VT-OG,0.5
C1BP02A-50 GY-OG,0.5
S1DB06F
S1DB07F
FE28
40.0 Amps
C1BB01A-51 GY-VT,6.0
FE39
10.0 Amps
C1BB01A-124 VT-WH,0.5
C21D-7 C21C-7 GY-VT,6.0
E
Sheet2
C21D-12 C21C-12 VT-WH,0.5
F
Sheet3
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
C5PM26B-6 GN-BU,0.5 C25B-20 C25A-20 GN-BU,0.5 C12G-31 C12H-31 GN-BU,0.5 C11N-7 C11P-7
C5PM26B-5 YE-GN,0.5 C25B-19 C25A-19 YE-GN,0.5 C12G-36 C12H-36 YE-GN,0.5
C11N-6 C11P-6
GN-BU,0.5 (PETROL) G Sheet2
GN-BU,0.5 (DIESEL) H Sheet2
YE-GN,0.5 (PETROL) J Sheet2
YE-GN,0.5 (DIESEL) K Sheet2

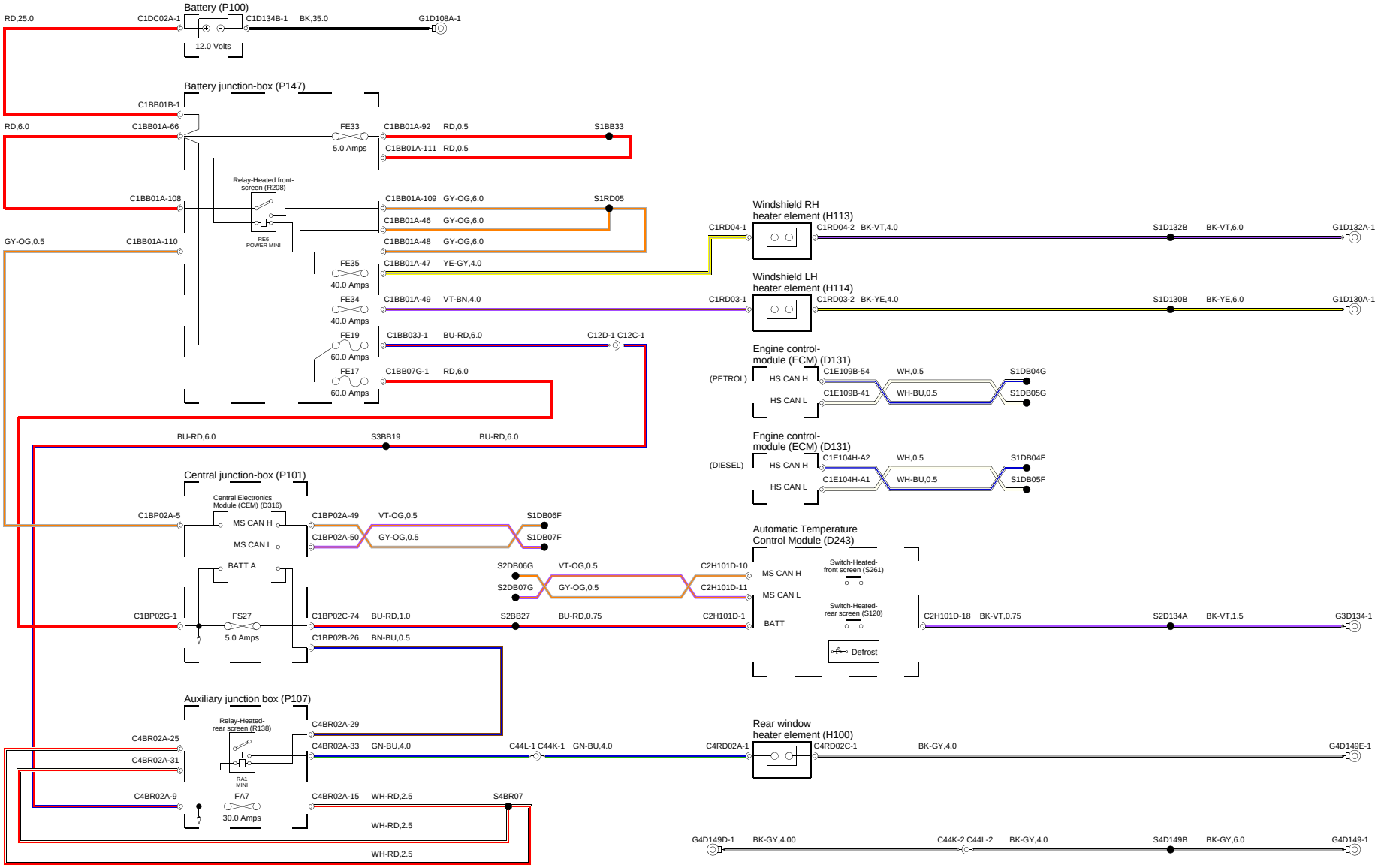

Control unit-Blower-motor-Front (D258)
PWM SIGNAL
SENSE
Motor-Blower-Front (M132)
Automatic Temperature Control Module (D243)
MS CAN H IN
MS CAN L IN
MS CAN H OUT
MS CAN L OUT
ATC
Display
+ Blower -
Temp L
Temp R
Defrost
HFS
HRW
Seat L
Recirc
OFF
Auto
Econ
Rear
Seat R
Engine control-module (ECM) (D131)
HS CAN H
HS CAN L
(PETROL)
GND
TAMB +
TAMB -
SIG
5V REF
A/C RELAY
(DIESEL)
Sensor-Engine coolant-temperature (ECT) (T121)
Sensor-Pressure-Air Conditioning (T283)

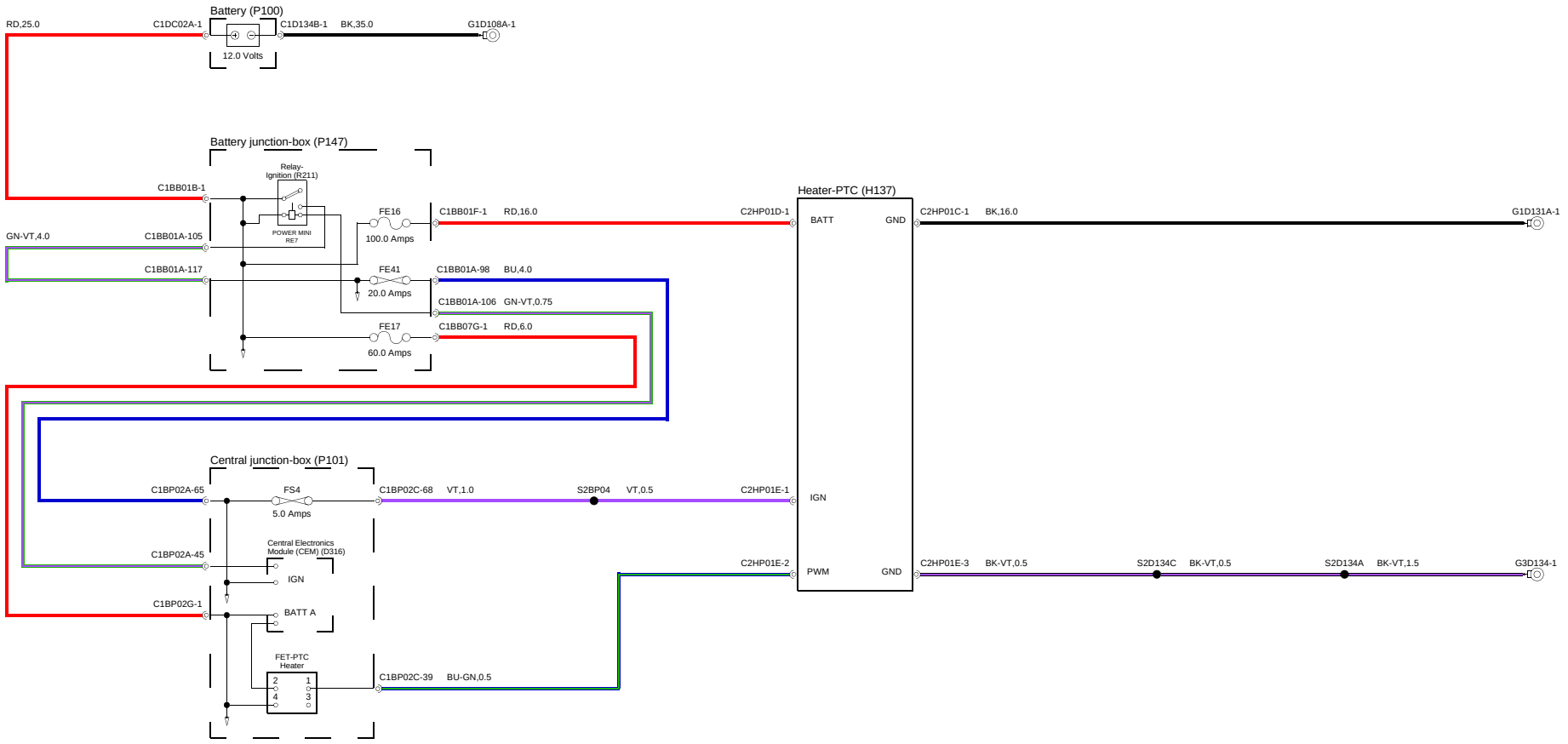

P
Sheet2
VT-BN,0.5
C23AE-5 C23AF-5
PK,0.5
C2H406-1
Sensor-Evaporator (T165)
BN,0.5
R
Sheet2
GN,0.5
S2H105
GN,0.5
C23AE-6 C23AF-6
C2H406-2
F
Sheet1
VT-WH,0.5
C23AE-1 C23AF-1
RD,0.5
S2BB39
RD,0.35
C2H206-1
Intake air door motor (M138)
M
Sheet2
BN-VT,0.5
S2H117
BN-VT,0.5
C23AE-2 C23AF-2
YE,0.5
S2VH118
OG-RD,0.5
C2H206-2
L
Sheet2
BK-VT,0.5
S2D134C
BK-VT,0.5
C23AE-4 C23AF-4
BU,0.5
S2D134D
BU,0.35
C2H206-3
Motor-Mode-Air-temperature (M141)
VT-WH,0.5
C2130-1
N
Sheet2
WH-GN,0.5
S2H118
WH-GN,0.5
C23AE-3 C23AF-3
GN,0.5
S2VH117
GN,0.5
C2130-2
BK,0.5
C2130-3
Screen air distribution door motor (M259)
RD,0.35
C2H2XX-1
OG-RD,0.5
C2H2XX-2
BU,0.35
C2H2XX-3
M

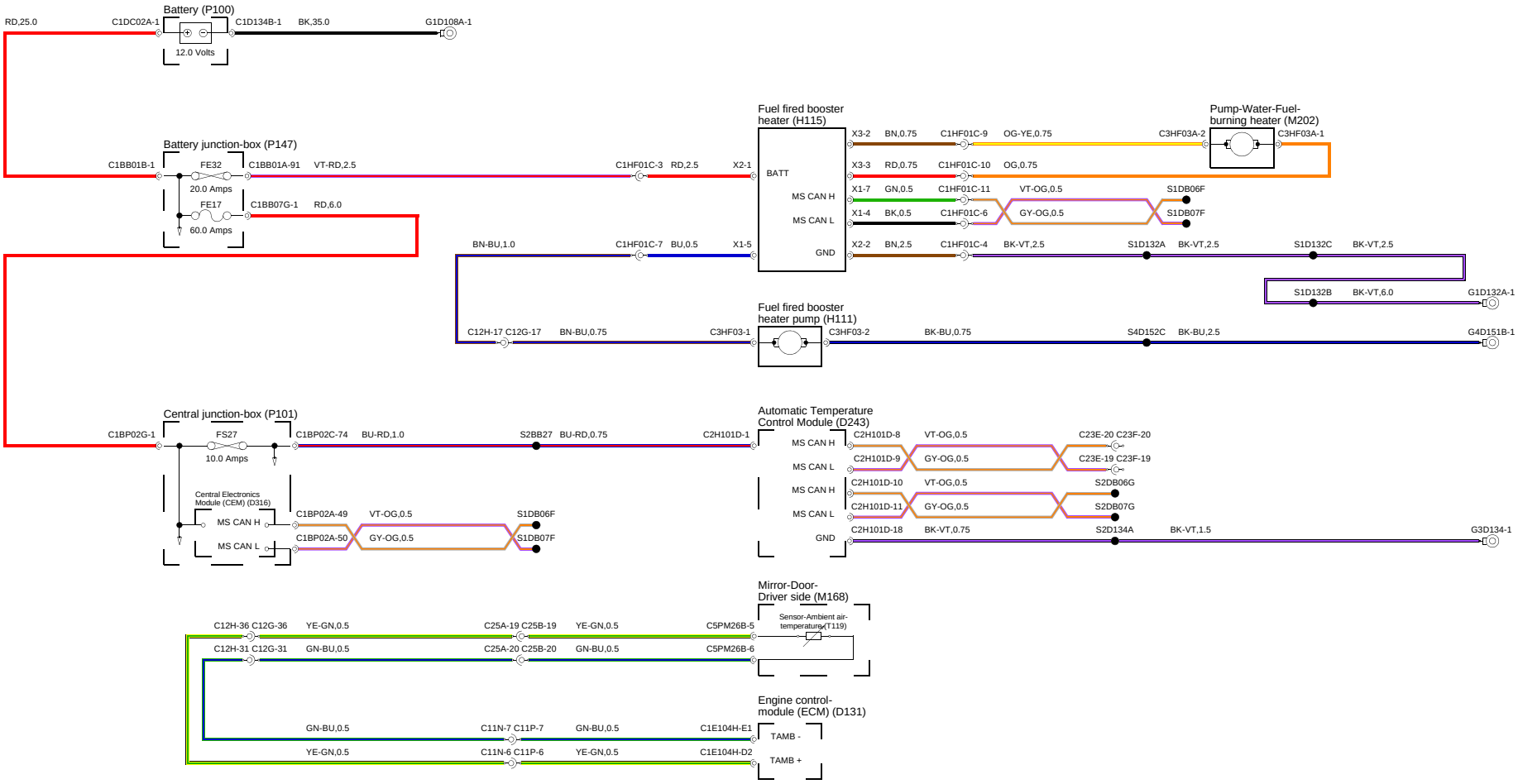

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
S1DC02A
RD,4.0
C1BB03A-7
RD,4.0
C1BB03A-1
S1BB07A
GN-BU,0.5
C1BB03A-10
GN-BU,0.5
C1BB03A-31
Relay-Engine control-module (ECM) (R116)
POWER MINI RE2
FE11
10.0 Amps
C1BB03A-17
GY-BU,1.0
S1BB38
C1BB03A-37
GY-VT,4.0
C1BB03A-8
Relay-Air conditioning-(A/C) (R180)
RE3 MICRO
FE13
15.0 Amps
C1BB03A-29
WH-BN,1.0
(PETROL)
GY-BN,1.5
(DIESEL)
C1BB03A-30
VT-WH,0.5
(PETROL)
VT-WH,0.75
(DIESEL)
GY-BU,1.0
C1H302F-2
Clutch-Control
Clutch-Compressor-Air-conditioning (A/C) (D149)
C1H302F-1
GY,0.75
(PETROL)
A
Sheet2
C1H302D-1
Earth via-fixings (E110)
C1H302E-1
C1H302E-2
(DIESEL)
BK-YE,1.5
S1D129
BK,10.0
(DIESEL)
G1D129-1
S1D129B
BK-YE,4.0
(DIESEL)
B
Sheet2
C
Sheet2
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
FE17
60.0 Amps
C1BB07G-1
RD,6.0
C1BP02G-1
BATT A
MS CAN H
MS CAN L
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
C1BP02C-2
GY-YE,0.35
C2H415-1
Sensor-Sunlight (T166)
C2H415-5
C1BP02C-1
BU-BN,0.35
C1BB01A-38
VT-GN,0.5
C1BP02A-48
FE28
40.0 Amps
C1BB01A-51
GY-VT,6.0
Relay-auxiliary-circuits (R101)
POWER MINI RE5
FE39
10.0 Amps
C1BB01A-124
VT-WH,0.5
FS27
5.0 Amps
C1BP02C-74
BU-RD,1.0
S2BB27
BU-RD,0.75
D
Sheet2
C21D-7 C21C-7
GY-VT,6.0
E
Sheet2
C21D-12 C21C-12
VT-WH,0.5
F
Sheet3
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
C5PM26B-5
YE-GN,0.5
C25B-19 C25A-19
YE-GN,0.5
C12G-36 C12H-36
YE-GN,0.5
C11N-6 C11P-6
YE-GN,0.5
(PETROL)
G
Sheet2
YE-GN,0.5
(DIESEL)
H
Sheet2
C5PM26B-6
GN-BU,0.5
C25B-20 C25A-20
GN-BU,0.5
C12G-31 C12H-31
GN-BU,0.5
C11N-7 C11P-7
GN-BU,0.5
(PETROL)
J
Sheet2
GN-BU,0.5
(DIESEL)
K
Sheet2

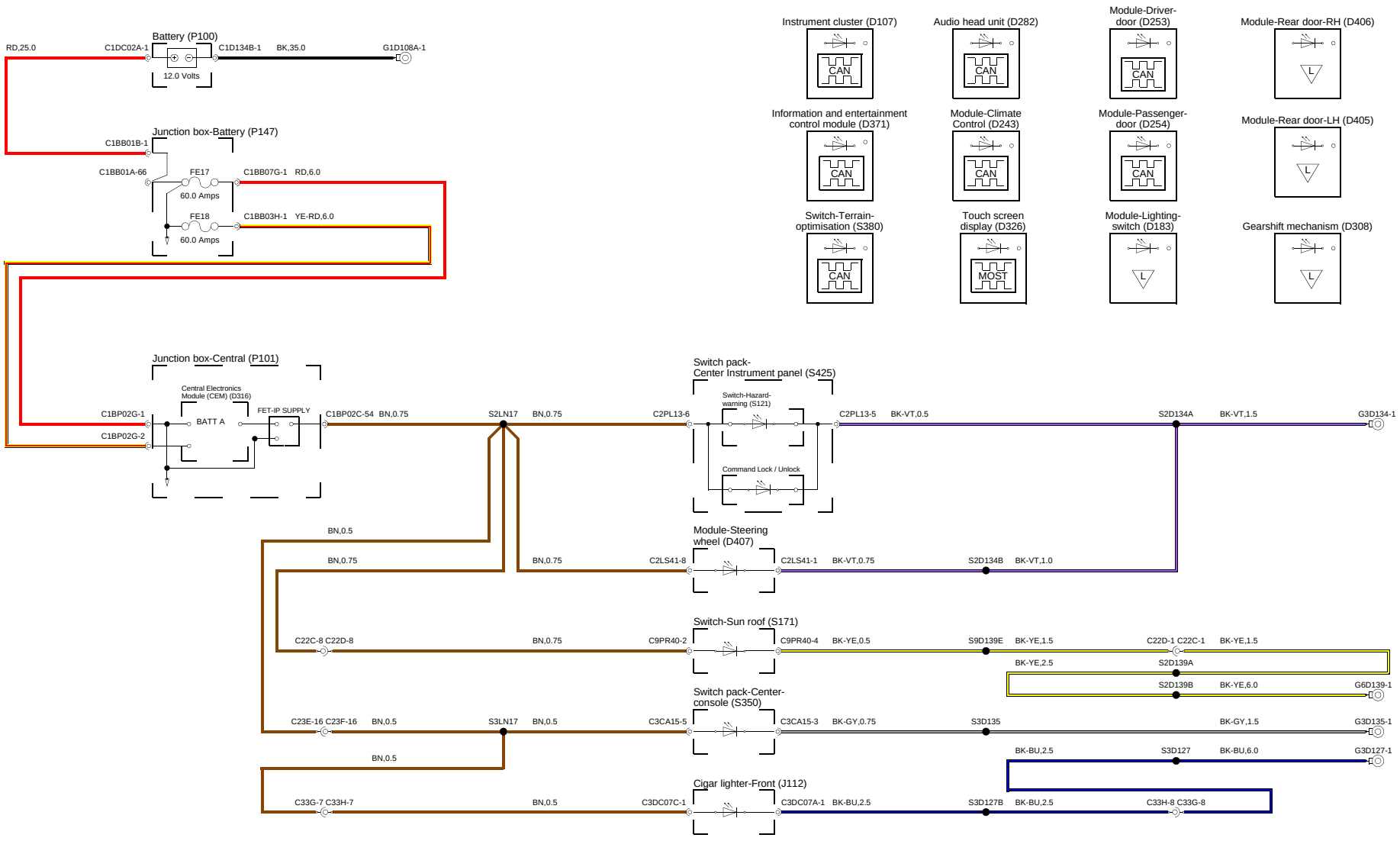

Control unit-Blower-motor-Front (D258)
BATT
GND
PWM SIG
MOTOR -
Motor-Blower-Front (M132)
Automatic Temperature Control Module (D243)
MS CAN H IN
MS CAN L IN
MS CAN H OUT
MS CAN L OUT
LIN L
LIN R
Defrost
HFS
HRW
Seat L
Recirc
OFF
Auto
Econ
Rear
Seat R
Temp L
Temp R
ATC
Display
+ Blower -
Mirror-Electrochromic (B179)
LIN (humidity sensor)
Engine control-module (ECM) (D131)
HS CAN H
HS CAN L
ACVD SIG
GND
A/C RLY
SIG
TAMB +
TAMB -
5V REF
(PETROL)
(DIESEL)
Sensor-Engine coolant-temperature (ECT) (T121)
Sensor-Pressure-Air Conditioning (T283)
Sheet1
Sheet3

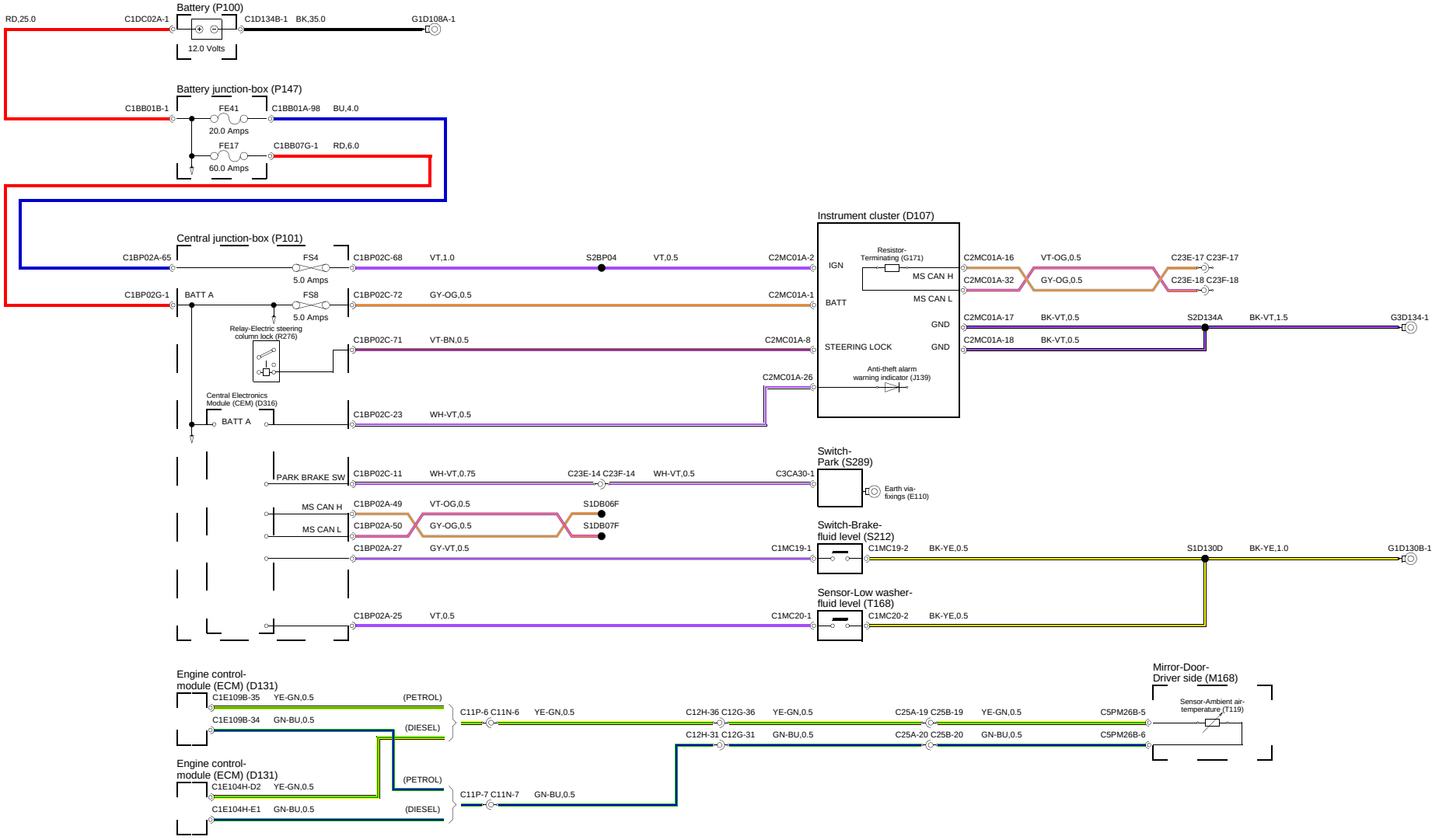

R
Sheet2
VT-BN,0.5
C23AE-5 C23AF-5
PK,0.5
C2H406-1
Sensor-Evaporator (T165)
S
Sheet2
GN,0.5
S2H105
GN,0.5
C23AE-6 C23AF-6
BN,0.5
C2H406-2
F
Sheet1
VT-WH,0.5
C23AE-1 C23AF-1
RD,0.5
S2BB39
RD,0.35
C2H4XX-1
Sensor-Air quality (T306)
T
Sheet2
WH-GN,0.75
C23AF-7 GR,0.5
C2H4XX-3
BU,0.35
C2H4XX-2
L
Sheet2
BK-VT,0.5
S2D134C
BK-VT,0.5
C23AE-4 C23AF-4
BU,0.5
S2D134D
M
Sheet2
WH-GN,0.5
S2H118
WH-GN,0.5
C23AE-3 C23AF-3
GN,0.5
S2VH117
RD,0.35
C2H206-1
Intake air door motor (M138)
GN,0.35
C2H206-2
BU,0.35
C2H206-3
Sensor-Temperature-
In-car (T164)
N
Sheet2
GN-BU,0.5
C2H451-3
SIGNAL
SENSOR GND
C2H451-5
GN,0.5
P
Sheet2
OG-WH,0.5
C2H451-4
MOTOR PWR
MOTOR GND
C2H451-2
BK-VT,0.5
RD,0.35
C2H211-1
RH air temperature
door motor (M204)
YE,0.35
C2H211-2
BU,0.35
C2H211-3
V
Sheet2
BN-VT,0.5
C23AE-2 C23AF-2
YE,0.5
S2VH118
Screen air distribution
door motor (M259)
C2H227-1
RD,0.35
C2H227-2
YE,0.35
C2H227-3
BU,0.35
RD,0.35
C2H2XX-1
Face/feet air distribution
door motor (M279)
GN,0.35
C2H2XX-2
BU,0.35
C2H2XX-3
RD,0.35
C2H237-1
LH air temperature
door motor (M203)
GN,0.35
C2H237-2
BU,0.35
C2H237-3

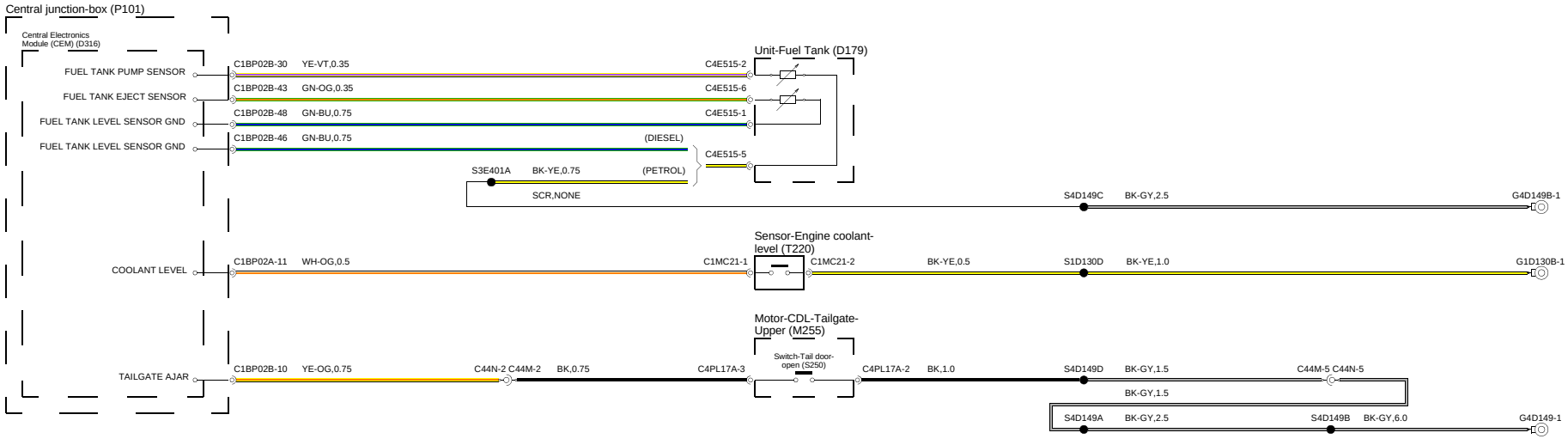

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
RD,6.0
C1BB01A-66
FE33
5.0 Amps
C1BB01A-92
RD,0.5
S1BB33
C1BB01A-111
RD,0.5
Relay-Heated front-screen (R208)
C1BB01A-108
C1BB01A-109
GY-OG,6.0
S1RD05
C1BB01A-46
GY-OG,6.0
GY-OG,0.5
C1BB01A-110
RE6 POWER MINI
C1BB01A-48
GY-OG,6.0
FE35
40.0 Amps
C1BB01A-47
YE-GY,4.0
FE34
40.0 Amps
C1BB01A-49
VT-BN,4.0
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
BU-RD,6.0
S3BB19
BU-RD,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
C1BP02A-5
MS CAN H
MS CAN L
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
BATT A
C1BP02G-1
FS27
5.0 Amps
C1BP02C-74
BU-RD,1.0
C1BP02B-26
BN-BU,0.5
Auxiliary junction box (P107)
Relay-Heated-rear screen (R138)
C4BR02A-25
C4BR02A-31
RA1 MINI
C4BR02A-29
C4BR02A-33
GN-BU,4.0
C4BR02A-9
FA7
30.0 Amps
C4BR02A-15
WH-RD,2.5
S4BR07
WH-RD,2.5
WH-RD,2.5
Windshield RH heater element (H113)
C1RD04-1
C1RD04-2
BK-VT,4.0
S1D132B
BK-VT,6.0
G1D132A-1
Windshield LH heater element (H114)
C1RD03-1
C1RD03-2
BK-YE,4.0
S1D130B
BK-YE,6.0
G1D130A-1
Engine control-module (ECM) (D131)
(PETROL)
HS CAN H
HS CAN L
C1E109B-54
WH,0.5
S1DB04G
C1E109B-41
WH-BU,0.5
S1DB05G
Engine control-module (ECM) (D131)
(DIESEL)
HS CAN H
HS CAN L
C1E104H-A2
WH,0.5
S1DB04F
C1E104H-A1
WH-BU,0.5
S1DB05F
S2DB06G
VT-OG,0.5
S2DB07G
GY-OG,0.5
Automatic Temperature Control Module (D243)
C2H101D-10
C2H101D-11
MS CAN H
MS CAN L
BATT
Switch-Heated-front screen (S261)
Switch-Heated-rear screen (S120)
Defrost
S2BB27
BU-RD,0.75
C2H101D-1
C2H101D-18
BK-VT,0.75
S2D134A
BK-VT,1.5
G3D134-1
C44L-1 C44K-1
GN-BU,4.0
Rear window heater element (H100)
C4RD02A-1
C4RD02C-1
BK-GY,4.0
G4D149E-1
G4D149D-1
BK-GY,4.00
C44K-2 C44L-2
BK-GY,4.0
S4D149B
BK-GY,6.0
G4D149-1

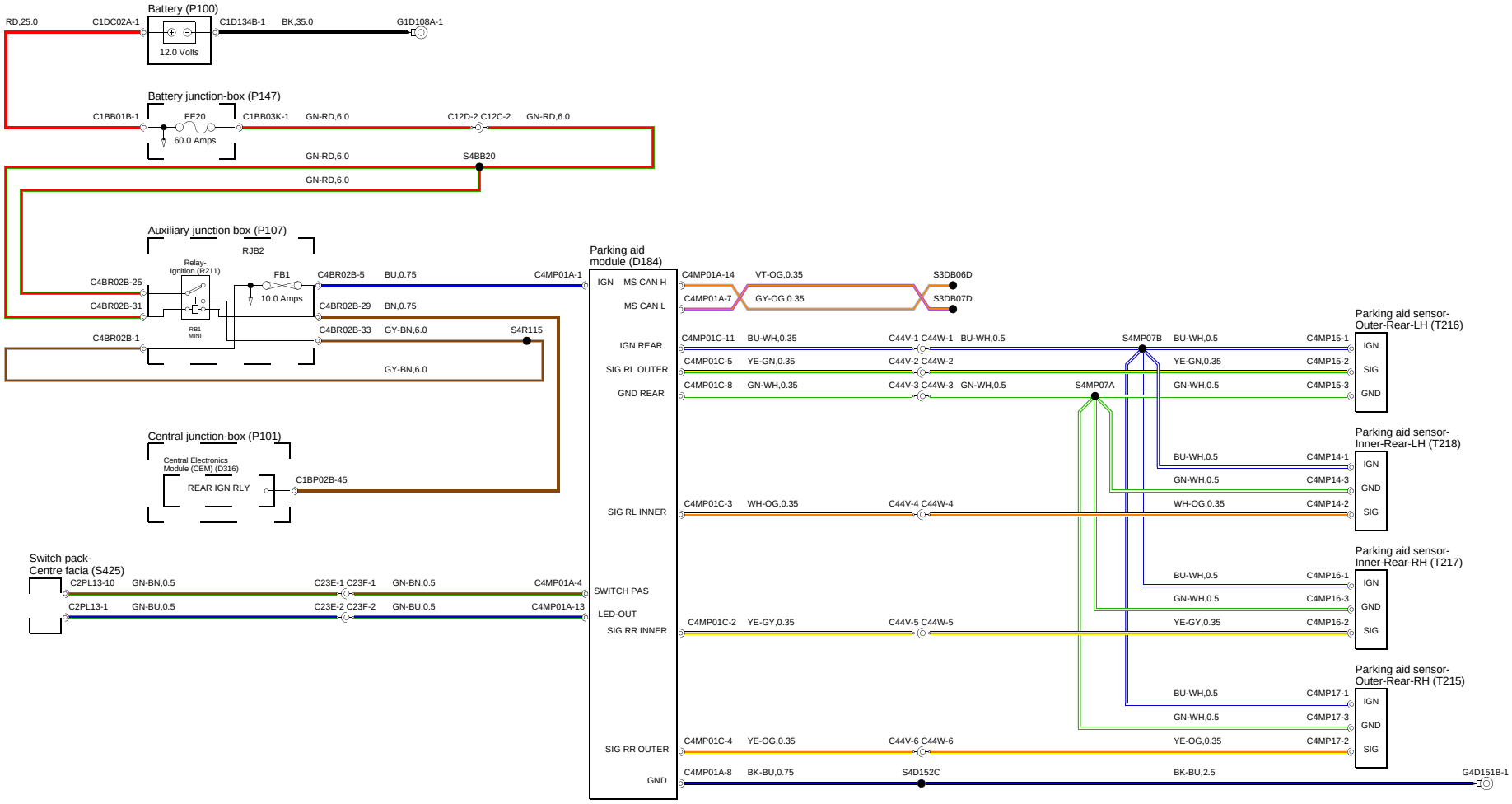

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
Relay-Ignition (R211)
POWER MINI RE7
C1BB01B-1
GN-VT,4.0
C1BB01A-105
C1BB01A-117
FE16
100.0 Amps
C1BB01F-1
RD,16.0
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BB01A-106
GN-VT,0.75
FE17
60.0 Amps
C1BB07G-1
RD,6.0
Heater-PTC (H137)
C2HP01D-1
BATT
GND
C2HP01C-1
BK,16.0
G1D131A-1
Central junction-box (P101)
C1BP02A-65
FS4
5.0 Amps
C1BP02C-68
VT,1.0
S2BP04
VT,0.5
C2HP01E-1
IGN
C1BP02A-45
Central Electronics Module (CEM) (D316)
IGN
C2HP01E-2
PWM
GND
C2HP01E-3
BK-VT,0.5
S2D134C
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
C1BP02G-1
BATT A
FET-PTC Heater
2
1
4
3
C1BP02C-39
BU-GN,0.5

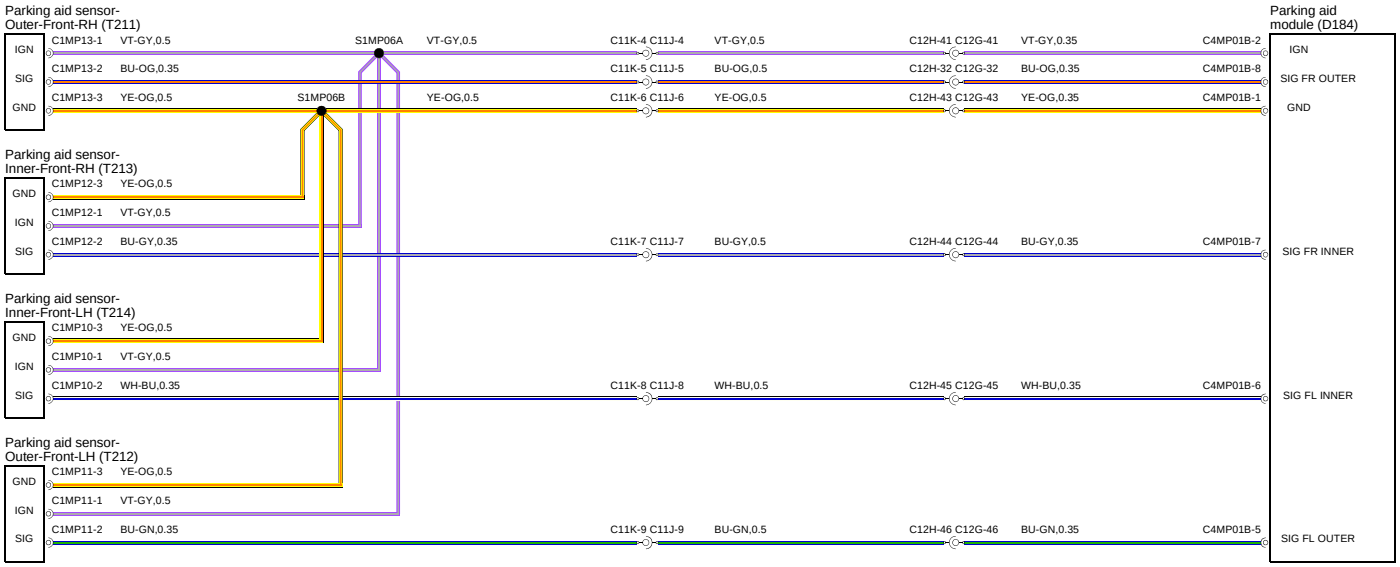

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE32
C1BB01A-91
VT-RD,2.5
20.0 Amps
FE17
C1BB07G-1
RD,6.0
60.0 Amps
C1HF01C-3
RD,2.5
X2-1
Fuel fired booster heater (H115)
BATT
MS CAN H
MS CAN L
GND
X3-2
BN,0.75
C1HF01C-9
OG-YE,0.75
C3HF03A-2
Pump-Water-Fuel-burning heater (M202)
C3HF03A-1
X3-3
RD,0.75
C1HF01C-10
OG,0.75
X1-7
GN,0.5
C1HF01C-11
VT-OG,0.5
S1DB06F
X1-4
BK,0.5
C1HF01C-6
GY-OG,0.5
S1DB07F
BN-BU,1.0
C1HF01C-7
BU,0.5
X1-5
X2-2
BN,2.5
C1HF01C-4
BK-VT,2.5
S1D132A
S1D132C
S1D132B
BK-VT,6.0
G1D132A-1
Fuel fired booster heater pump (H111)
C12H-17 C12G-17
BN-BU,0.75
C3HF03-1
C3HF03-2
BK-BU,0.75
S4D152C
G4D151B-1
Central junction-box (P101)
C1BP02G-1
FS27
10.0 Amps
C1BP02C-74
BU-RD,1.0
S2BB27
BU-RD,0.75
C2H101D-1
Central Electronics Module (CEM) (D316)
C1BP02A-49
VT-OG,0.5
C1BP02A-50
GY-OG,0.5
Automatic Temperature Control Module (D243)
C2H101D-8
C23E-20 C23F-20
C2H101D-9
C23E-19 C23F-19
C2H101D-10
S2DB06G
C2H101D-11
S2DB07G
C2H101D-18
S2D134A
BK-VT,1.5
G3D134-1
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
C12H-36 C12G-36
YE-GN,0.5
C25A-19 C25B-19
C5PM26B-5
C12H-31 C12G-31
GN-BU,0.5
C25A-20 C25B-20
C5PM26B-6
Engine control-module (ECM) (D131)
C11N-7 C11P-7
C1E104H-E1
TAMB -
C11N-6 C11P-6
C1E104H-D2
TAMB +

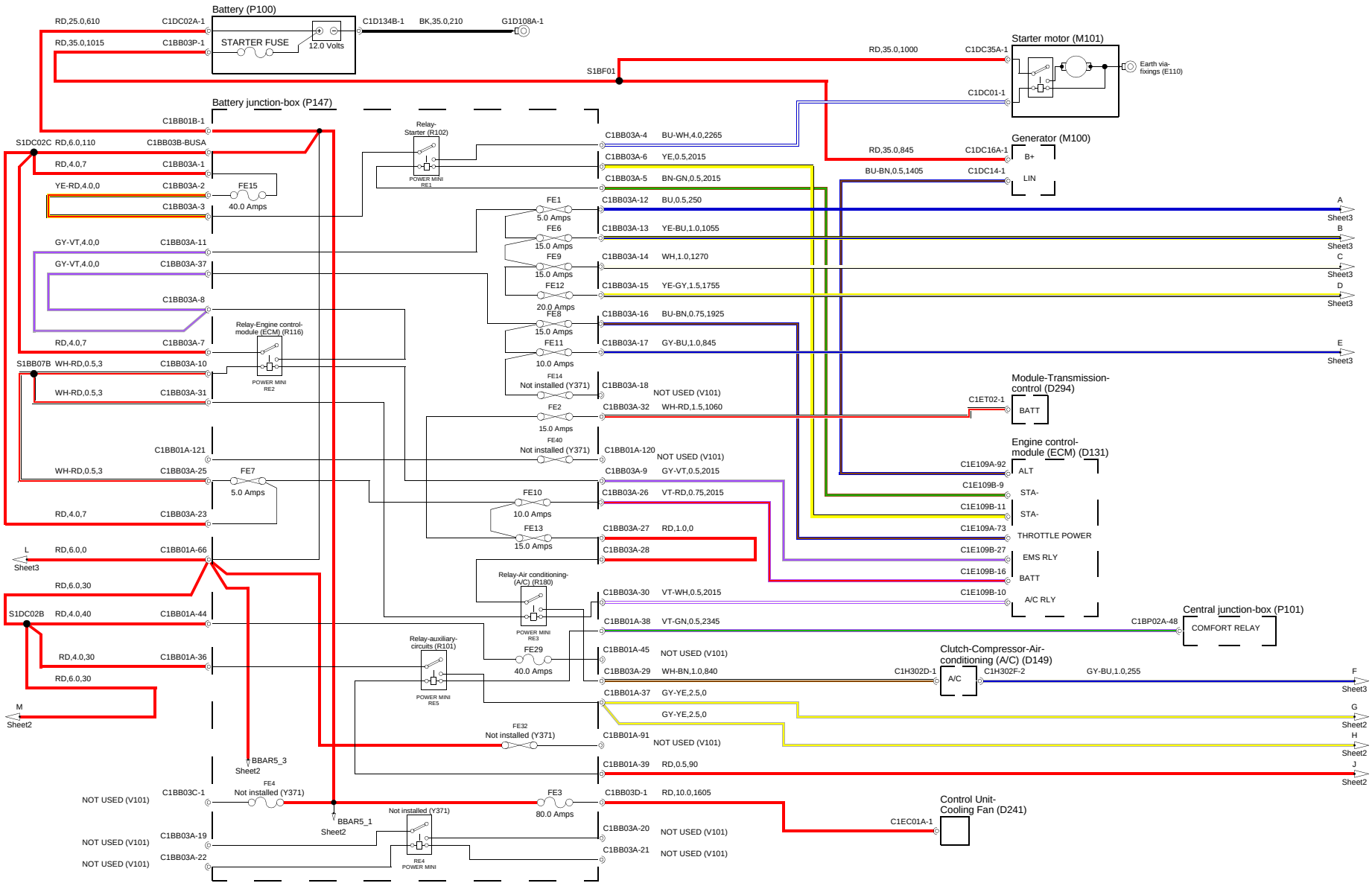

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Junction box-Battery (P147)
C1BB01B-1
C1BB01A-66
FE17
C1BB07G-1
RD,6.0
60.0 Amps
FE18
C1BB03H-1
YE-RD,6.0
60.0 Amps
Instrument cluster (D107)
Audio head unit (D282)
Module-Driver-door (D253)
Module-Rear door-RH (D406)
Information and entertainment control module (D371)
Module-Climate Control (D243)
Module-Passenger-door (D254)
Module-Rear door-LH (D405)
Switch-Terrain-optimisation (S380)
Touch screen display (D326)
Module-Lighting-switch (D183)
Gearshift mechanism (D308)
CAN
MOST
L
Junction box-Central (P101)
Central Electronics Module (CEM) (D316)
C1BP02G-1
C1BP02G-2
BATT A
FET-IP SUPPLY
C1BP02C-54
BN,0.75
S2LN17
Switch pack-Center Instrument panel (S425)
Switch-Hazard-warning (S121)
Command Lock / Unlock
C2PL13-6
C2PL13-5
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
Module-Steering wheel (D407)
C2LS41-8
C2LS41-1
BK-VT,0.75
S2D134B
BK-VT,1.0
Switch-Sun roof (S171)
C22C-8
C22D-8
C9PR40-2
C9PR40-4
BK-YE,0.5
S9D139E
BK-YE,1.5
C22D-1
C22C-1
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
Switch pack-Center-console (S350)
C23E-16
C23F-16
BN,0.5
S3LN17
C3CA15-5
C3CA15-3
BK-GY,0.75
S3D135
BK-GY,1.5
G3D135-1
BK-BU,2.5
S3D127
BK-BU,6.0
G3D127-1
Cigar lighter-Front (J112)
C33G-7
C33H-7
C3DC07C-1
C3DC07A-1
S3D127B
C33H-8
C33G-8

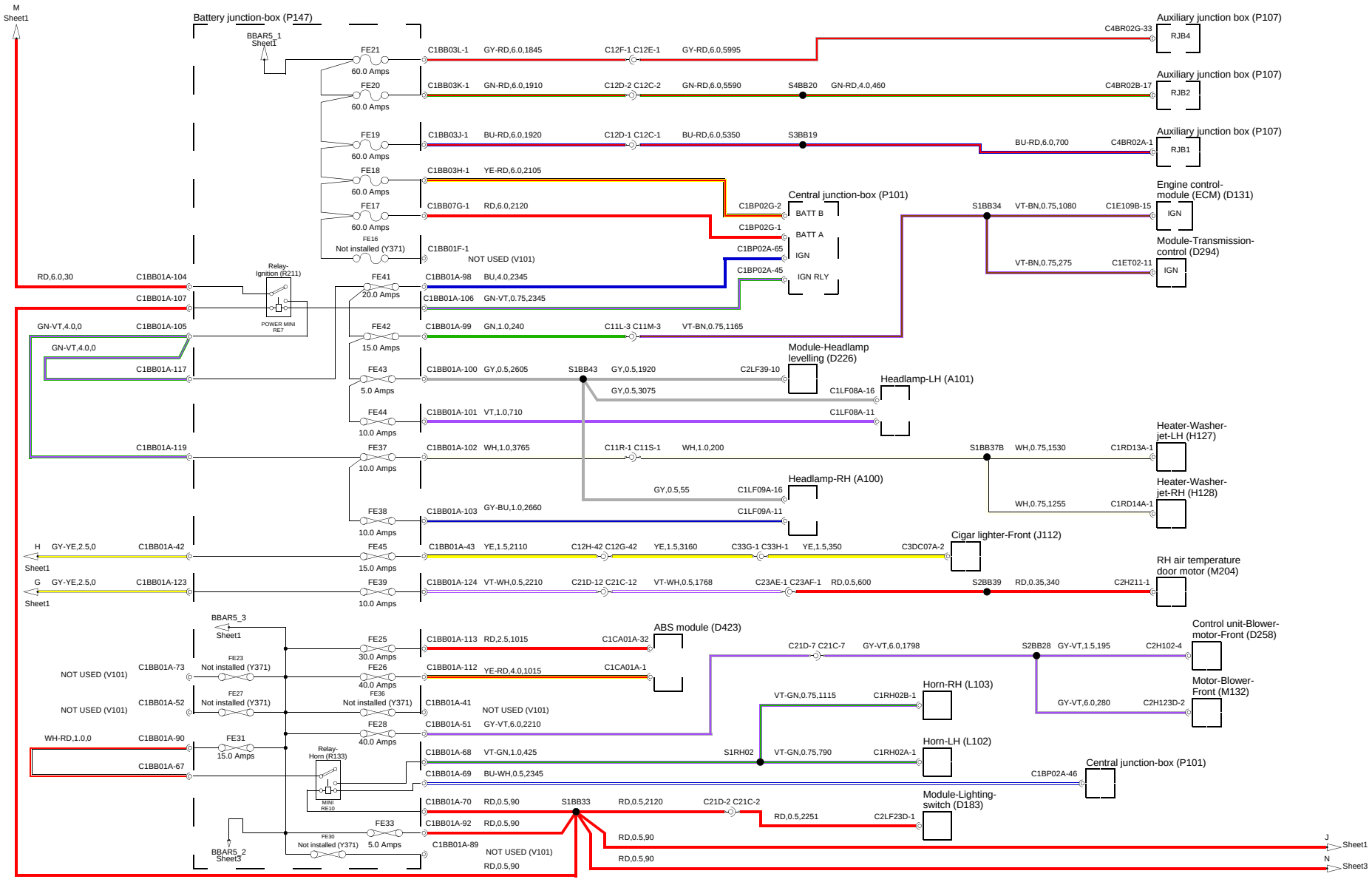

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1 BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE41
C1BB01A-98 BU,4.0
20.0 Amps
FE17
C1BB07G-1 RD,6.0
60.0 Amps
Central junction-box (P101)
C1BP02A-65
FS4
5.0 Amps
C1BP02C-68 VT,1.0
S2BP04
VT,0.5
C2MC01A-2
C1BP02G-1
BATT A
FS8
5.0 Amps
C1BP02C-72 GY-OG,0.5
C2MC01A-1
Relay-Electric steering column lock (R276)
C1BP02C-71 VT-BN,0.5
C2MC01A-8
C2MC01A-26
Central Electronics Module (CEM) (D316)
BATT A
C1BP02C-23 WH-VT,0.5
Instrument cluster (D107)
IGN
BATT
STEERING LOCK
Resistor-Terminating (G171)
MS CAN H
MS CAN L
GND
GND
Anti-theft alarm warning indicator (J139)
C2MC01A-16 VT-OG,0.5
C23E-17 C23F-17
C2MC01A-32 GY-OG,0.5
C23E-18 C23F-18
C2MC01A-17 BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
C2MC01A-18 BK-VT,0.5
PARK BRAKE SW
C1BP02C-11 WH-VT,0.75
C23E-14 C23F-14
WH-VT,0.5
C3CA30-1
Switch-Park (S289)
Earth via-fixings (E110)
MS CAN H
MS CAN L
C1BP02A-49 VT-OG,0.5
C1BP02A-50 GY-OG,0.5
S1DB06F
S1DB07F
C1BP02A-27 GY-VT,0.5
C1MC19-1
C1MC19-2 BK-YE,0.5
Switch-Brake-fluid level (S212)
S1D130D
BK-YE,1.0
G1D130B-1
C1BP02A-25 VT,0.5
C1MC20-1
C1MC20-2 BK-YE,0.5
Sensor-Low washer-fluid level (T168)
Engine control-module (ECM) (D131)
C1E109B-35 YE-GN,0.5
(PETROL)
C1E109B-34 GN-BU,0.5
(DIESEL)
C11P-6 C11N-6 YE-GN,0.5
C12H-36 C12G-36 YE-GN,0.5
C25A-19 C25B-19 YE-GN,0.5
C5PM26B-5
C12H-31 C12G-31 GN-BU,0.5
C25A-20 C25B-20 GN-BU,0.5
C5PM26B-6
Mirror-Door-Driver side (M168)
Sensor-Ambient air-temperature (T119)
Engine control-module (ECM) (D131)
C1E104H-D2 YE-GN,0.5
(PETROL)
C1E104H-E1 GN-BU,0.5
(DIESEL)
C11P-7 C11N-7 GN-BU,0.5

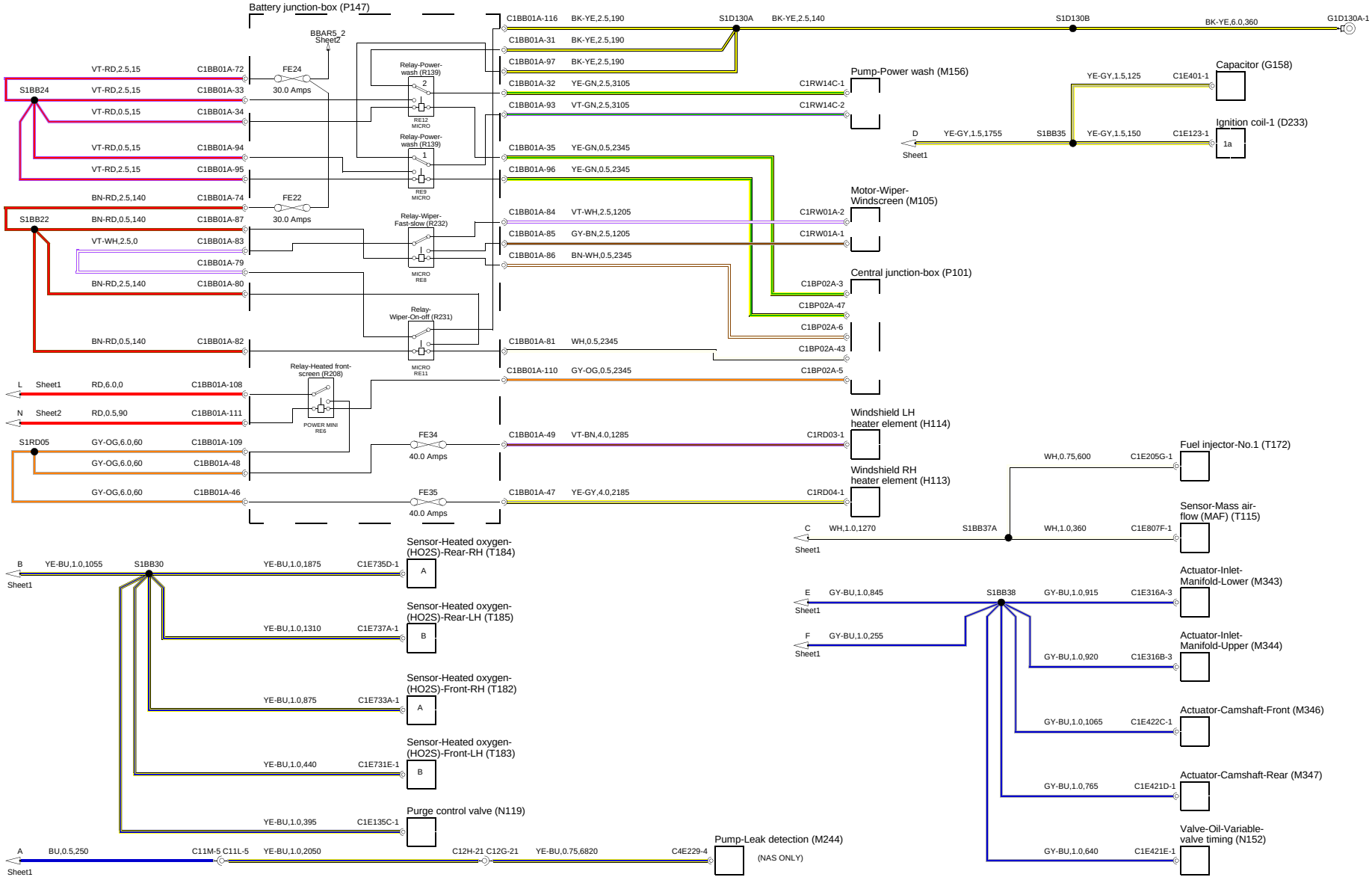

Central junction-box (P101)
Central Electronics Module (CEM) (D316)
FUEL TANK PUMP SENSOR
FUEL TANK EJECT SENSOR
FUEL TANK LEVEL SENSOR GND
FUEL TANK LEVEL SENSOR GND
C1BP02B-30 YE-VT,0.35
C1BP02B-43 GN-OG,0.35
C1BP02B-48 GN-BU,0.75
C1BP02B-46 GN-BU,0.75
(DIESEL)
(PETROL)
SCR,NONE
S3E401A BK-YE,0.75
C4E515-2
C4E515-6
C4E515-1
C4E515-5
Unit-Fuel Tank (D179)
S4D149C BK-GY,2.5
G4D149B-1
COOLANT LEVEL
C1BP02A-11 WH-OG,0.5
C1MC21-1
C1MC21-2 BK-YE,0.5
S1D130D BK-YE,1.0
G1D130B-1
Sensor-Engine coolant-level (T220)
TAILGATE AJAR
C1BP02B-10 YE-OG,0.75
C44N-2 C44M-2 BK,0.75
C4PL17A-3
Switch-Tail door-open (S250)
C4PL17A-2 BK,1.0
S4D149D BK-GY,1.5
C44M-5 C44N-5
BK-GY,1.5
S4D149A BK-GY,2.5
S4D149B BK-GY,6.0
G4D149-1
Motor-CDL-Tailgate-Upper (M255)

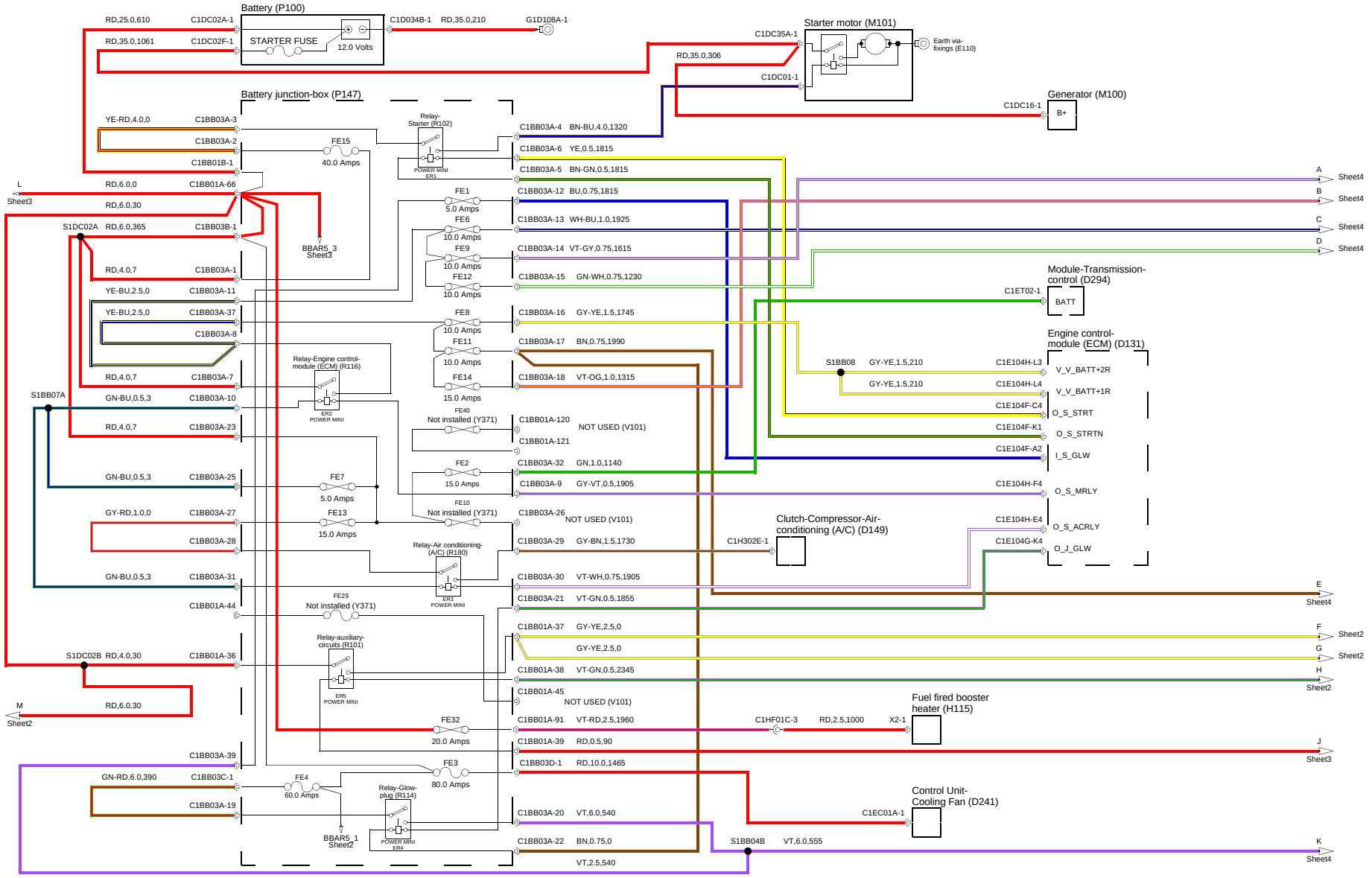

Battery (P100)
RD,25.0
C1DC02A-1
12.0 Volts
C1D134B-1
BK,35.0
G1D108A-1
Battery junction-box (P147)
C1BB01B-1
FE20
60.0 Amps
C1BB03K-1
GN-RD,6.0
C12D-2 C12C-2
GN-RD,6.0
GN-RD,6.0
S4BB20
GN-RD,6.0
Auxiliary junction box (P107)
RJB2
Relay-Ignition (R211)
RB1 MINI
FB1
10.0 Amps
C4BR02B-25
C4BR02B-31
C4BR02B-1
C4BR02B-5
BU,0.75
C4MP01A-1
C4BR02B-29
BN,0.75
C4BR02B-33
GY-BN,6.0
S4R115
GY-BN,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
REAR IGN RLY
C1BP02B-45
Switch pack-Centre facia (S425)
C2PL13-10
GN-BN,0.5
C23E-1 C23F-1
GN-BN,0.5
C4MP01A-4
C2PL13-1
GN-BU,0.5
C23E-2 C23F-2
GN-BU,0.5
C4MP01A-13
Parking aid module (D184)
IGN
MS CAN H
MS CAN L
IGN REAR
SIG RL OUTER
GND REAR
SIG RL INNER
SWITCH PAS
LED-OUT
SIG RR INNER
SIG RR OUTER
GND
C4MP01A-14
VT-OG,0.35
S3DB06D
C4MP01A-7
GY-OG,0.35
S3DB07D
C4MP01C-11
BU-WH,0.35
C44V-1 C44W-1
BU-WH,0.5
S4MP07B
BU-WH,0.5
C4MP15-1
C4MP01C-5
YE-GN,0.35
C44V-2 C44W-2
YE-GN,0.35
C4MP15-2
C4MP01C-8
GN-WH,0.35
C44V-3 C44W-3
GN-WH,0.5
S4MP07A
GN-WH,0.5
C4MP15-3
Parking aid sensor-Outer-Rear-LH (T216)
IGN
SIG
GND
BU-WH,0.5
C4MP14-1
GN-WH,0.5
C4MP14-3
Parking aid sensor-Inner-Rear-LH (T218)
IGN
GND
SIG
C4MP01C-3
WH-OG,0.35
C44V-4 C44W-4
WH-OG,0.35
C4MP14-2
BU-WH,0.5
C4MP16-1
GN-WH,0.5
C4MP16-3
Parking aid sensor-Inner-Rear-RH (T217)
IGN
GND
SIG
C4MP01C-2
YE-GY,0.35
C44V-5 C44W-5
YE-GY,0.35
C4MP16-2
BU-WH,0.5
C4MP17-1
GN-WH,0.5
C4MP17-3
Parking aid sensor-Outer-Rear-RH (T215)
IGN
GND
SIG
C4MP01C-4
YE-OG,0.35
C44V-6 C44W-6
YE-OG,0.35
C4MP17-2
C4MP01A-8
BK-BU,0.75
S4D152C
BK-BU,2.5
G4D151B-1

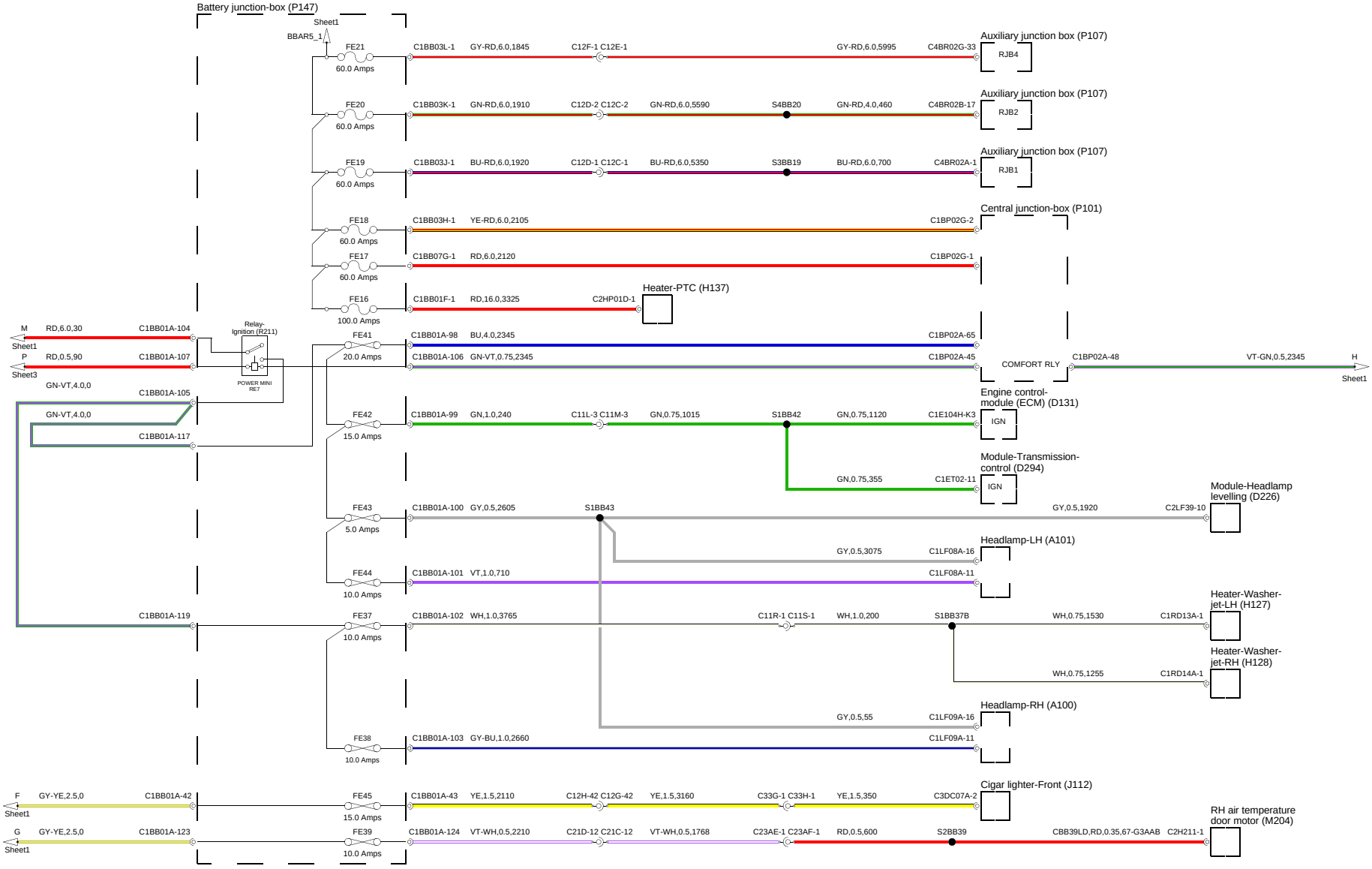

Parking aid sensor-
Outer-Front-RH (T211)
IGN
SIG
GND
C1MP13-1 VT-GY,0.5
C1MP13-2 BU-OG,0.35
C1MP13-3 YE-OG,0.5
S1MP06A
S1MP06B
VT-GY,0.5
YE-OG,0.5
C11K-4 C11J-4
C11K-5 C11J-5
C11K-6 C11J-6
VT-GY,0.5
BU-OG,0.5
YE-OG,0.5
C12H-41 C12G-41
C12H-32 C12G-32
C12H-43 C12G-43
VT-GY,0.35
BU-OG,0.35
YE-OG,0.35
C4MP01B-2
C4MP01B-8
C4MP01B-1
Parking aid
module (D184)
IGN
SIG FR OUTER
GND
Parking aid sensor-
Inner-Front-RH (T213)
GND
IGN
SIG
C1MP12-3 YE-OG,0.5
C1MP12-1 VT-GY,0.5
C1MP12-2 BU-GY,0.35
C11K-7 C11J-7
BU-GY,0.5
C12H-44 C12G-44
BU-GY,0.35
C4MP01B-7
SIG FR INNER
Parking aid sensor-
Inner-Front-LH (T214)
GND
IGN
SIG
C1MP10-3 YE-OG,0.5
C1MP10-1 VT-GY,0.5
C1MP10-2 WH-BU,0.35
C11K-8 C11J-8
WH-BU,0.5
C12H-45 C12G-45
WH-BU,0.35
C4MP01B-6
SIG FL INNER
Parking aid sensor-
Outer-Front-LH (T212)
GND
IGN
SIG
C1MP11-3 YE-OG,0.5
C1MP11-1 VT-GY,0.5
C1MP11-2 BU-GN,0.35
C11K-9 C11J-9
BU-GN,0.5
C12H-46 C12G-46
BU-GN,0.35
C4MP01B-5
SIG FL OUTER

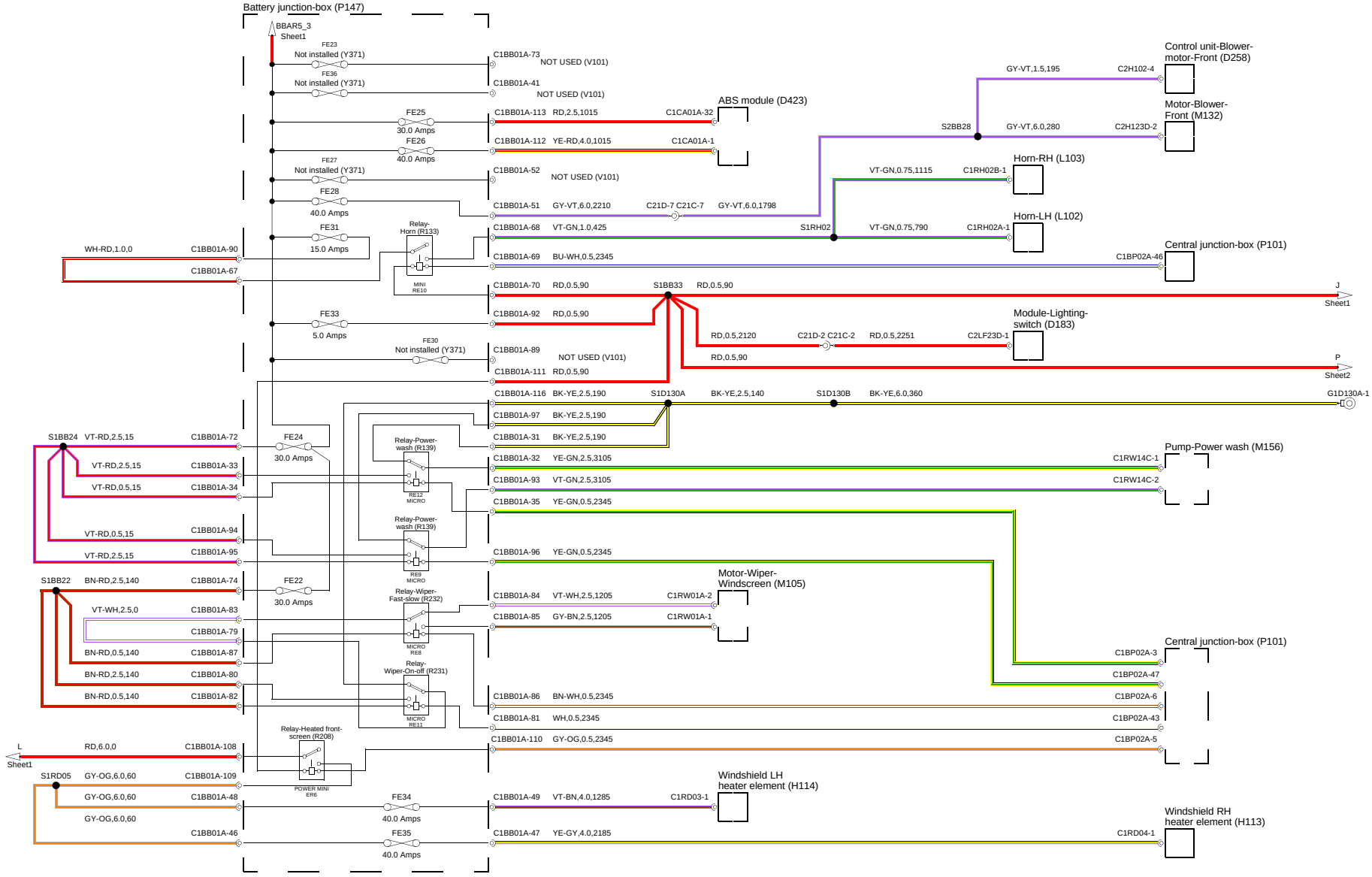

Battery (P100)
STARTER FUSE
12.0 Volts
Battery junction-box (P147)
Starter motor (M101)
Earth via-fixings (E110)
Generator (M100)
B+
LIN
Relay-Starter (R102)
POWER MINI RE1
Relay-Engine control-module (ECM) (R116)
POWER MINI RE2
Relay-Air conditioning-(A/C) (R180)
POWER MINI RE3
Relay-auxiliary-circuits (R101)
POWER MINI RE5
POWER MINI RE4
Module-Transmission-control (D294)
BATT
Engine control-module (ECM) (D131)
ALT
STA-
STA-
THROTTLE POWER
EMS RLY
BATT
A/C RLY
Central junction-box (P101)
COMFORT RELAY
Clutch-Compressor-Air-conditioning (A/C) (D149)
A/C
Control Unit-Cooling Fan (D241)
NOT USED (V101)
Not installed (Y371)

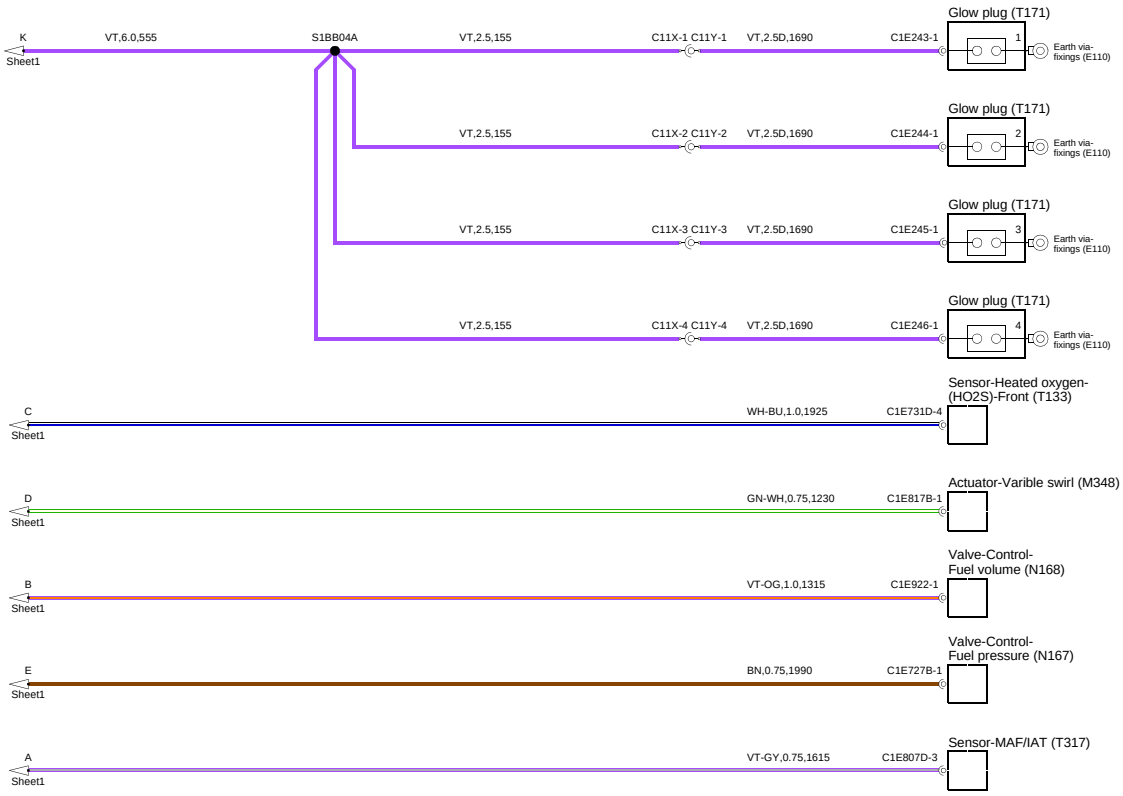

Battery junction-box (P147)
BBAR5_1
Sheet1
FE21
60.0 Amps
FE20
60.0 Amps
FE19
60.0 Amps
FE18
60.0 Amps
FE17
60.0 Amps
FE16
Not installed (Y371)
C1BB03L-1 GY-RD,6.0,1845 C12F-1 C12E-1 GY-RD,6.0,5995
C1BB03K-1 GN-RD,6.0,1910 C12D-2 C12C-2 GN-RD,6.0,5590 S4BB20 GN-RD,4.0,460
C1BB03J-1 BU-RD,6.0,1920 C12D-1 C12C-1 BU-RD,6.0,5350 S3BB19
C1BB03H-1 YE-RD,6.0,2105
C1BB07G-1 RD,6.0,2120
C1BB01F-1
NOT USED (V101)
Auxiliary junction box (P107)
C4BR02G-33
RJB4
Auxiliary junction box (P107)
C4BR02B-17
RJB2
Auxiliary junction box (P107)
BU-RD,6.0,700
C4BR02A-1
RJB1
Central junction-box (P101)
C1BP02G-2
BATT B
C1BP02G-1
BATT A
C1BP02A-65
IGN
C1BP02A-45
IGN RLY
Engine control-module (ECM) (D131)
S1BB34 VT-BN,0.75,1080 C1E109B-15
IGN
Module-Transmission-control (D294)
VT-BN,0.75,275 C1ET02-11
IGN
RD,6.0,30
C1BB01A-104
C1BB01A-107
Relay-Ignition (R211)
POWER MINI RE7
GN-VT,4.0,0
C1BB01A-105
GN-VT,4.0,0
C1BB01A-117
C1BB01A-119
FE41
20.0 Amps
FE42
15.0 Amps
FE43
5.0 Amps
FE44
10.0 Amps
FE37
10.0 Amps
FE38
10.0 Amps
C1BB01A-98 BU,4.0,2345
C1BB01A-106 GN-VT,0.75,2345
C1BB01A-99 GN,1.0,240 C11L-3 C11M-3 VT-BN,0.75,1165
C1BB01A-100 GY,0.5,2605 S1BB43 GY,0.5,1920 C2LF39-10
GY,0.5,3075 C1LF08A-16
C1BB01A-101 VT,1.0,710 C1LF08A-11
C1BB01A-102 WH,1.0,3765 C11R-1 C11S-1 WH,1.0,200 S1BB37B WH,0.75,1530 C1RD13A-1
GY,0.5,55 C1LF09A-16
C1BB01A-103 GY-BU,1.0,2660 C1LF09A-11
WH,0.75,1255 C1RD14A-1
Module-Headlamp levelling (D226)
Headlamp-LH (A101)
Heater-Washer-jet-LH (H127)
Headlamp-RH (A100)
Heater-Washer-jet-RH (H128)
H GY-YE,2.5,0 C1BB01A-42
Sheet1
FE45
15.0 Amps
C1BB01A-43 YE,1.5,2110 C12H-42 C12G-42 YE,1.5,3160 C33G-1 C33H-1 YE,1.5,350 C3DC07A-2
Cigar lighter-Front (J112)
G GY-YE,2.5,0 C1BB01A-123
Sheet1
FE39
10.0 Amps
C1BB01A-124 VT-WH,0.5,2210 C21D-12 C21C-12 VT-WH,0.5,1768 C23AE-1 C23AF-1 RD,0.5,600 S2BB39 RD,0.35,340 C2H211-1
RH air temperature door motor (M204)
BBAR5_3
Sheet1
FE25
30.0 Amps
FE23
Not installed (Y371)
FE26
40.0 Amps
FE27
Not installed (Y371)
FE36
Not installed (Y371)
FE28
40.0 Amps
FE31
15.0 Amps
C1BB01A-113 RD,2.5,1015 C1CA01A-32
ABS module (D423)
C1BB01A-73
NOT USED (V101)
C1BB01A-112 YE-RD,4.0,1015 C1CA01A-1
C1BB01A-52
NOT USED (V101)
C1BB01A-41
NOT USED (V101)
C1BB01A-51 GY-VT,6.0,2210
C21D-7 C21C-7 GY-VT,6.0,1798 S2BB28 GY-VT,1.5,195 C2H102-4
Control unit-Blower-motor-Front (D258)
VT-GN,0.75,1115 C1RH02B-1
Horn-RH (L103)
GY-VT,6.0,280 C2H123D-2
Motor-Blower-Front (M132)
WH-RD,1.0,0
C1BB01A-90
C1BB01A-67
Relay-Horn (R133)
MINI RE10
C1BB01A-68 VT-GN,1.0,425 S1RH02 VT-GN,0.75,790 C1RH02A-1
Horn-LH (L102)
C1BB01A-69 BU-WH,0.5,2345 C1BP02A-46
Central junction-box (P101)
C1BB01A-70 RD,0.5,90 S1BB33 RD,0.5,2120 C21D-2 C21C-2
RD,0.5,2251 C2LF23D-1
Module-Lighting-switch (D183)
C1BB01A-92 RD,0.5,90
FE33
5.0 Amps
FE30
Not installed (Y371)
BBAR5_2
Sheet3
C1BB01A-89
NOT USED (V101)
RD,0.5,90
RD,0.5,90
RD,0.5,90
J
Sheet1
N
Sheet3

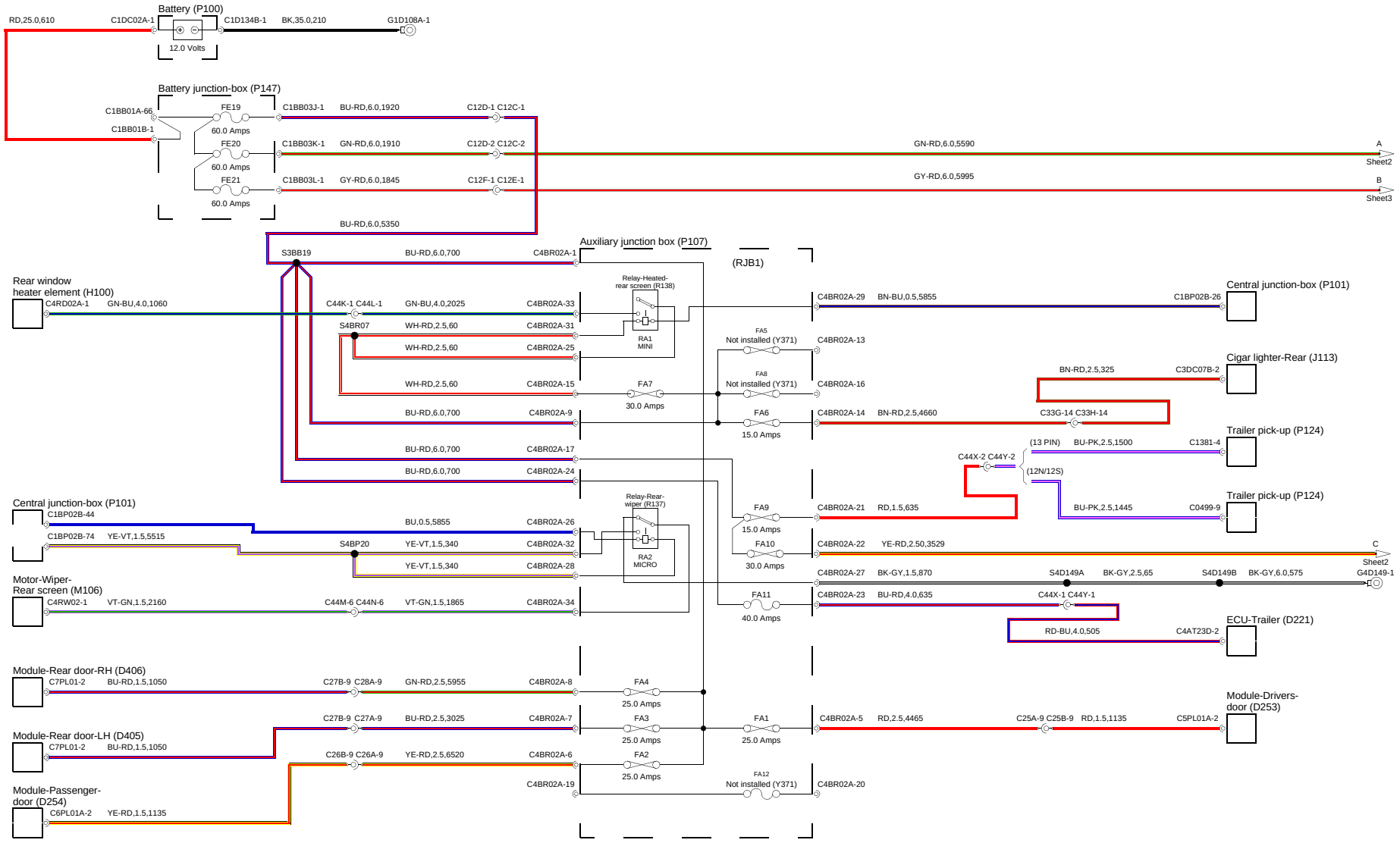

Battery junction-box (P147)
BBAR5_2
Sheet2
VT-RD,2.5,15
C1BB01A-72
FE24
30.0 Amps
S1BB24
VT-RD,2.5,15
C1BB01A-33
VT-RD,0.5,15
C1BB01A-34
VT-RD,0.5,15
C1BB01A-94
VT-RD,2.5,15
C1BB01A-95
BN-RD,2.5,140
C1BB01A-74
FE22
30.0 Amps
S1BB22
BN-RD,0.5,140
C1BB01A-87
VT-WH,2.5,0
C1BB01A-83
C1BB01A-79
BN-RD,2.5,140
C1BB01A-80
BN-RD,0.5,140
C1BB01A-82
L
Sheet1
RD,6.0,0
C1BB01A-108
N
Sheet2
RD,0.5,90
C1BB01A-111
S1RD05
GY-OG,6.0,60
C1BB01A-109
GY-OG,6.0,60
C1BB01A-48
GY-OG,6.0,60
C1BB01A-46
FE34
40.0 Amps
FE35
40.0 Amps
Relay-Power-wash (R139)
RE12 MICRO
Relay-Power-wash (R139)
RE9 MICRO
Relay-Wiper-Fast-slow (R232)
MICRO RE8
Relay-Wiper-On-off (R231)
MICRO RE11
Relay-Heated front-screen (R208)
POWER MINI RE6
C1BB01A-116
BK-YE,2.5,190
S1D130A
BK-YE,2.5,140
S1D130B
BK-YE,6.0,360
G1D130A-1
C1BB01A-31
BK-YE,2.5,190
C1BB01A-97
BK-YE,2.5,190
C1BB01A-32
YE-GN,2.5,3105
C1RW14C-1
Pump-Power wash (M156)
C1BB01A-93
VT-GN,2.5,3105
C1RW14C-2
C1BB01A-35
YE-GN,0.5,2345
C1BB01A-96
YE-GN,0.5,2345
C1BB01A-84
VT-WH,2.5,1205
C1RW01A-2
Motor-Wiper-Windscreen (M105)
C1BB01A-85
GY-BN,2.5,1205
C1RW01A-1
C1BB01A-86
BN-WH,0.5,2345
C1BP02A-3
Central junction-box (P101)
C1BP02A-47
C1BP02A-6
C1BP02A-43
C1BB01A-81
WH,0.5,2345
C1BB01A-110
GY-OG,0.5,2345
C1BP02A-5
C1BB01A-49
VT-BN,4.0,1285
C1RD03-1
Windshield LH heater element (H114)
C1BB01A-47
YE-GY,4.0,2185
C1RD04-1
Windshield RH heater element (H113)
D
Sheet1
YE-GY,1.5,1755
S1BB35
YE-GY,1.5,125
C1E401-1
Capacitor (G158)
YE-GY,1.5,150
C1E123-1
Ignition coil-1 (D233)
1a
C
Sheet1
WH,1.0,1270
S1BB37A
WH,0.75,600
C1E205G-1
Fuel injector-No.1 (T172)
WH,1.0,360
C1E807F-1
Sensor-Mass air-flow (MAF) (T115)
B
Sheet1
YE-BU,1.0,1055
S1BB30
YE-BU,1.0,1875
C1E735D-1
Sensor-Heated oxygen-(HO2S)-Rear-RH (T184)
YE-BU,1.0,1310
C1E737A-1
Sensor-Heated oxygen-(HO2S)-Rear-LH (T185)
YE-BU,1.0,875
C1E733A-1
Sensor-Heated oxygen-(HO2S)-Front-RH (T182)
YE-BU,1.0,440
C1E731E-1
Sensor-Heated oxygen-(HO2S)-Front-LH (T183)
YE-BU,1.0,395
C1E1135C-1
Purge control valve (N119)
A
Sheet1
BU,0.5,250
C11M-5 C11L-5
YE-BU,1.0,2050
C12H-21 C12G-21
YE-BU,0.75,6820
C4E229-4
Pump-Leak detection (M244)
(NAS ONLY)
E
Sheet1
GY-BU,1.0,845
S1BB38
GY-BU,1.0,915
C1E316A-3
Actuator-Inlet-Manifold-Lower (M343)
F
Sheet1
GY-BU,1.0,255
GY-BU,1.0,920
C1E316B-3
Actuator-Inlet-Manifold-Upper (M344)
GY-BU,1.0,1065
C1E422C-1
Actuator-Camshaft-Front (M346)
GY-BU,1.0,765
C1E421D-1
Actuator-Camshaft-Rear (M347)
GY-BU,1.0,640
C1E421E-1
Valve-Oil-Variable-valve timing (N152)

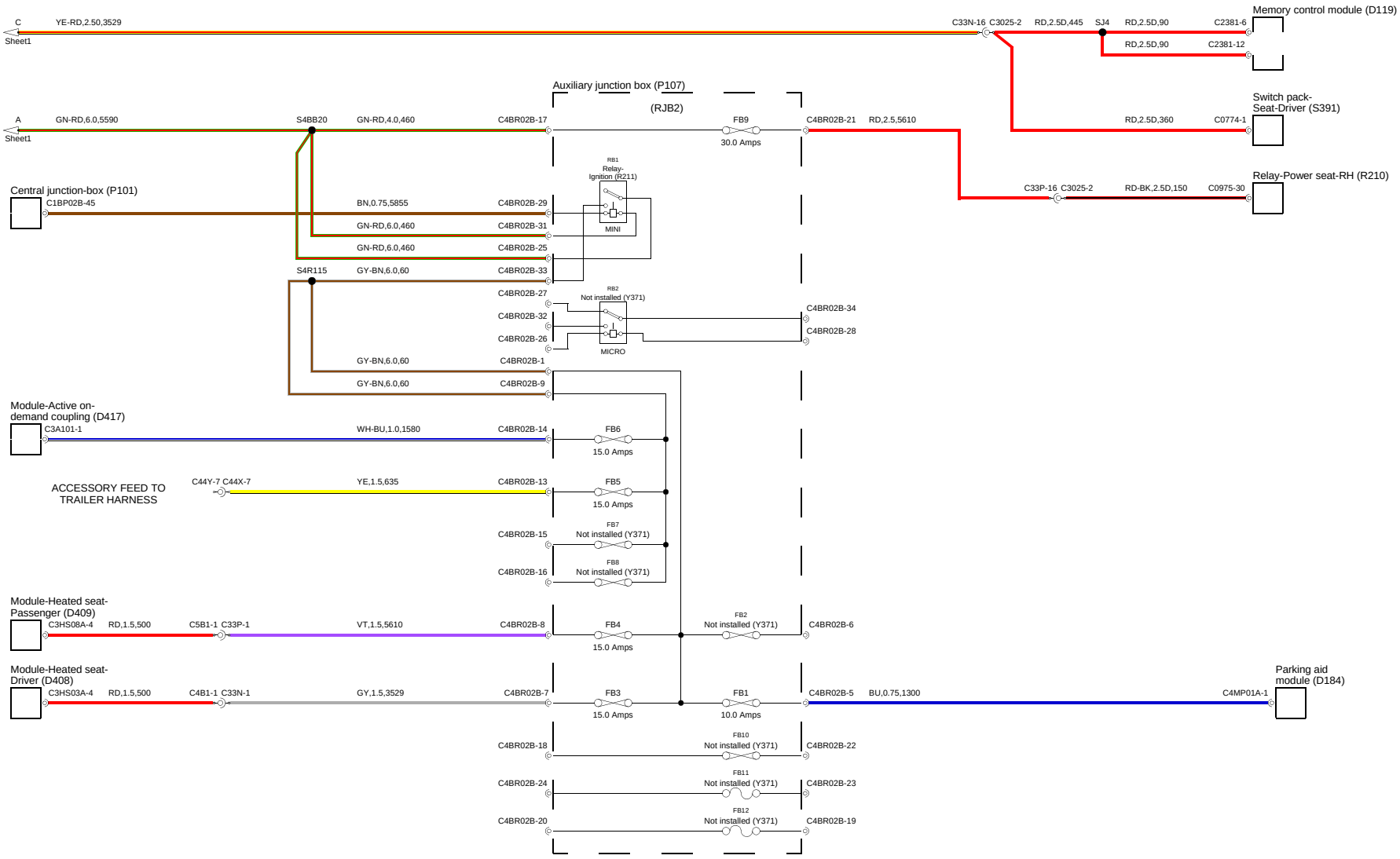

Battery (P100)
STARTER FUSE
12.0 Volts
Starter motor (M101)
Earth via-fixings (E110)
Generator (M100)
B+
Battery junction-box (P147)
Relay-Starter (R102)
Relay-Engine control-module (ECM) (R116)
Relay-Air conditioning-(A/C) (R180)
Relay-auxiliary-circuits (R101)
Relay-Glow-plug (R114)
Module-Transmission-control (D294)
BATT
Engine control-module (ECM) (D131)
V_V_BATT+2R
V_V_BATT+1R
O_S_STRT
O_S_STRTN
I_S_GLW
O_S_MRLY
O_S_ACRLY
O_J_GLW
Clutch-Compressor-Air-conditioning (A/C) (D149)
Fuel fired booster heater (H115)
Control Unit-Cooling Fan (D241)
NOT USED (V101)
Not installed (Y371)
S1DC02A
S1DC02B
S1BB07A
S1BB08
S1BB04B
BBAR5_3
BBAR5_1

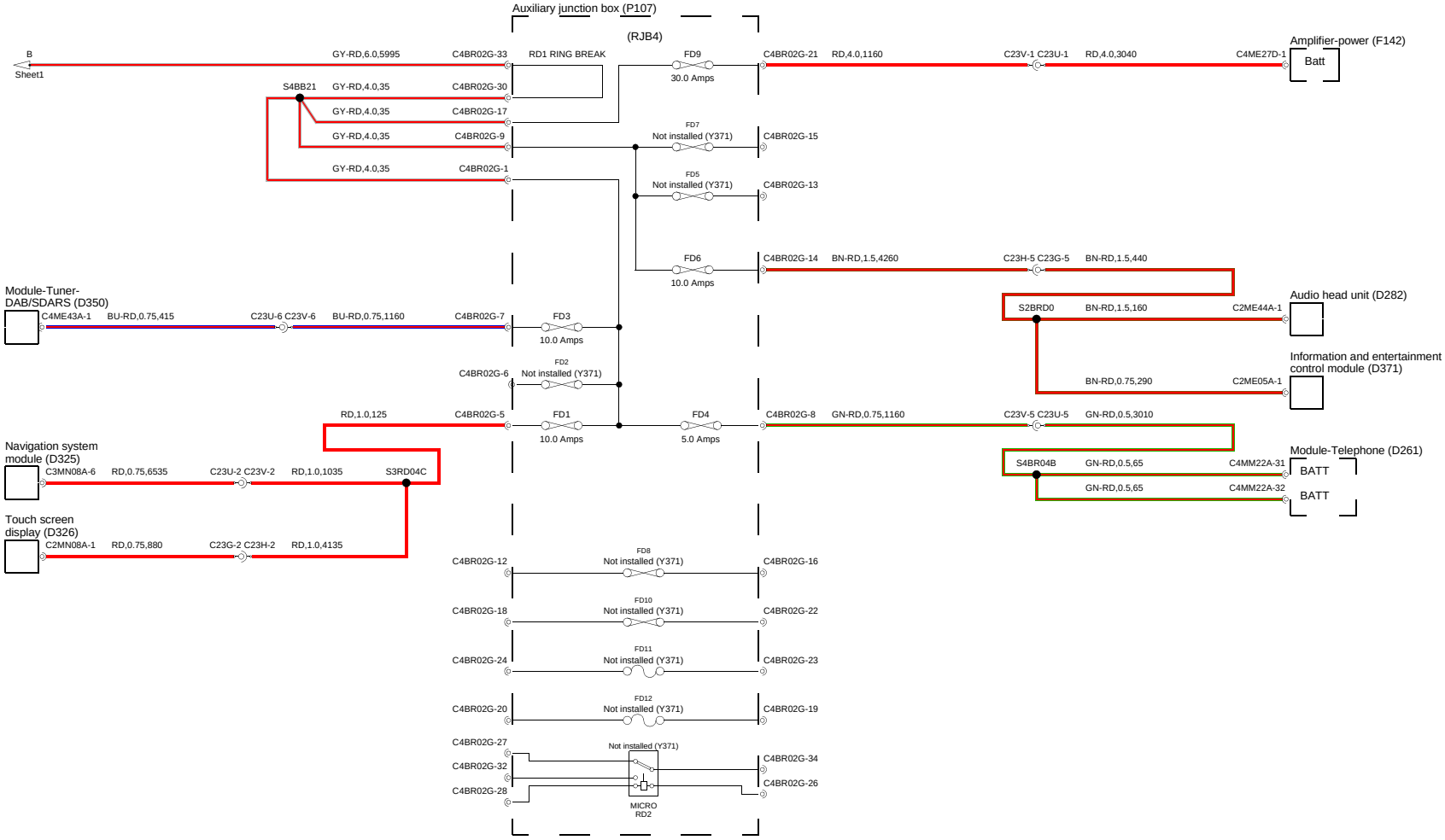

Battery junction-box (P147)
Sheet1
BBAR5_1
FE21
60.0 Amps
C1BB03L-1
GY-RD,6.0,1845
C12F-1 C12E-1
GY-RD,6.0,5995
C4BR02G-33
Auxiliary junction box (P107)
RJB4
FE20
60.0 Amps
C1BB03K-1
GN-RD,6.0,1910
C12D-2 C12C-2
GN-RD,6.0,5590
S4BB20
GN-RD,4.0,460
C4BR02B-17
Auxiliary junction box (P107)
RJB2
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0,1920
C12D-1 C12C-1
BU-RD,6.0,5350
S3BB19
BU-RD,6.0,700
C4BR02A-1
Auxiliary junction box (P107)
RJB1
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0,2105
C1BP02G-2
Central junction-box (P101)
FE17
60.0 Amps
C1BB07G-1
RD,6.0,2120
C1BP02G-1
FE16
100.0 Amps
C1BB01F-1
RD,16.0,3325
C2HP01D-1
Heater-PTC (H137)
M
RD,6.0,30
C1BB01A-104
Sheet1
P
RD,0.5,90
C1BB01A-107
Sheet3
Relay-Ignition (R211)
POWER MINI RE7
GN-VT,4.0,0
C1BB01A-105
GN-VT,4.0,0
C1BB01A-117
FE41
20.0 Amps
C1BB01A-98
BU,4.0,2345
C1BP02A-65
C1BB01A-106
GN-VT,0.75,2345
C1BP02A-45
COMFORT RLY
C1BP02A-48
VT-GN,0.5,2345
H
Sheet1
FE42
15.0 Amps
C1BB01A-99
GN,1.0,240
C11L-3 C11M-3
GN,0.75,1015
S1BB42
GN,0.75,1120
C1E104H-K3
Engine control-module (ECM) (D131)
IGN
GN,0.75,355
C1ET02-11
Module-Transmission-control (D294)
IGN
FE43
5.0 Amps
C1BB01A-100
GY,0.5,2605
S1BB43
GY,0.5,1920
C2LF39-10
Module-Headlamp levelling (D226)
GY,0.5,3075
C1LF08A-16
Headlamp-LH (A101)
FE44
10.0 Amps
C1BB01A-101
VT,1.0,710
C1LF08A-11
C1BB01A-119
FE37
10.0 Amps
C1BB01A-102
WH,1.0,3765
C11R-1 C11S-1
WH,1.0,200
S1BB37B
WH,0.75,1530
C1RD13A-1
Heater-Washer-jet-LH (H127)
WH,0.75,1255
C1RD14A-1
Heater-Washer-jet-RH (H128)
GY,0.5,55
C1LF09A-16
Headlamp-RH (A100)
FE38
10.0 Amps
C1BB01A-103
GY-BU,1.0,2660
C1LF09A-11
F
GY-YE,2.5,0
C1BB01A-42
Sheet1
FE45
15.0 Amps
C1BB01A-43
YE,1.5,2110
C12H-42 C12G-42
YE,1.5,3160
C33G-1 C33H-1
YE,1.5,350
C3DC07A-2
Cigar lighter-Front (J112)
G
GY-YE,2.5,0
C1BB01A-123
Sheet1
FE39
10.0 Amps
C1BB01A-124
VT-WH,0.5,2210
C21D-12 C21C-12
VT-WH,0.5,1768
C23AE-1 C23AF-1
RD,0.5,600
S2BB39
CBB39LD,RD,0.35,67-G3AAB
C2H211-1
RH air temperature door motor (M204)

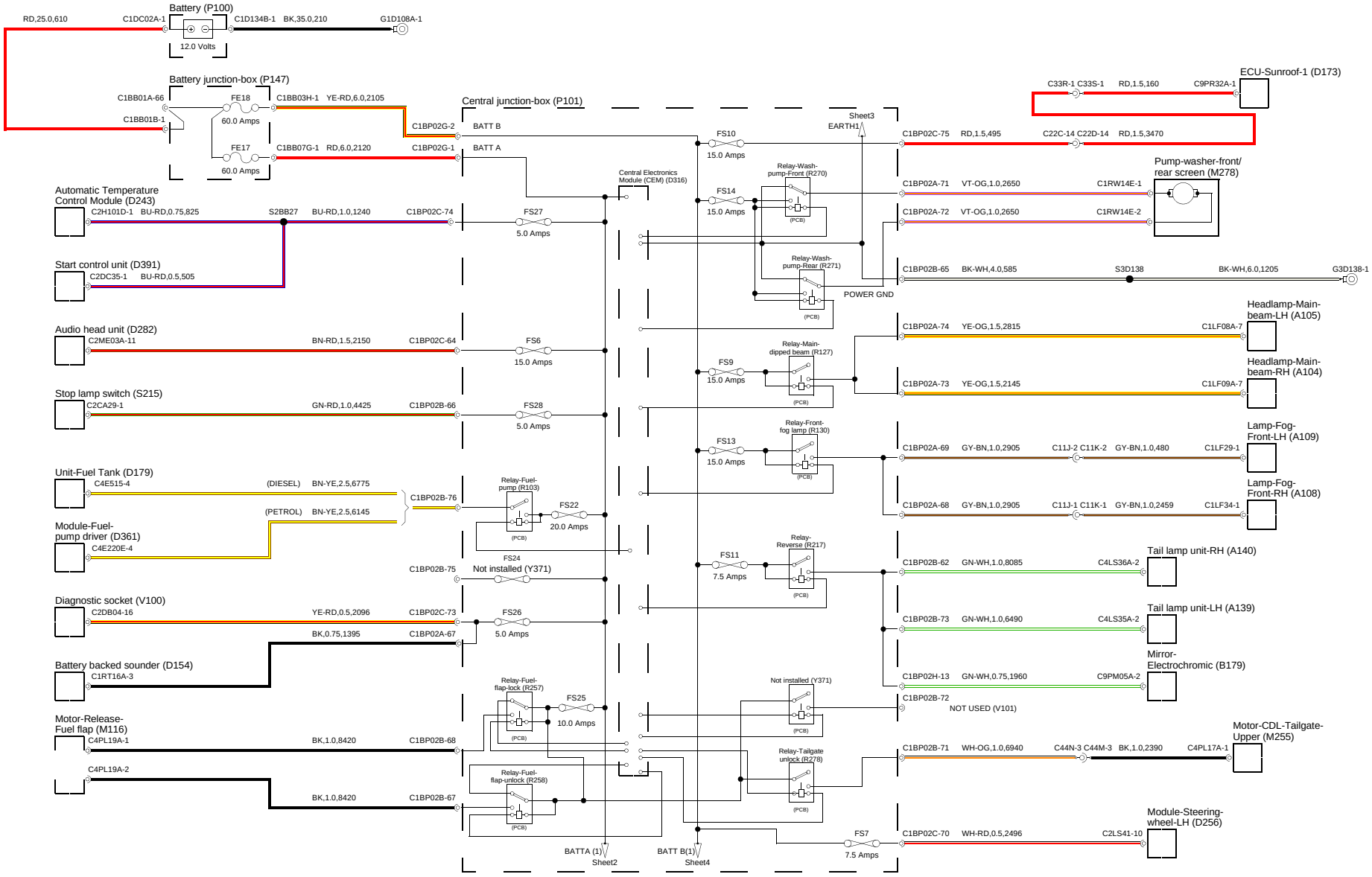

Battery junction-box (P147)
BBAR5_3
Sheet1
FE23
Not installed (Y371)
FE36
Not installed (Y371)
FE25
30.0 Amps
FE26
40.0 Amps
FE27
Not installed (Y371)
FE28
40.0 Amps
FE31
15.0 Amps
FE33
5.0 Amps
FE30
Not installed (Y371)
FE24
30.0 Amps
FE22
30.0 Amps
FE34
40.0 Amps
FE35
40.0 Amps
Relay-Horn (R133)
MINI RE10
Relay-Power-wash (R139)
RE12 MICRO
Relay-Power-wash (R139)
RE9 MICRO
Relay-Wiper-Fast-slow (R232)
MICRO RE8
Relay-Wiper-On-off (R231)
MICRO RE11
Relay-Heated front-screen (R208)
POWER MINI ER6
C1BB01A-73 NOT USED (V101)
C1BB01A-41 NOT USED (V101)
C1BB01A-113 RD,2.5,1015 C1CA01A-32
C1BB01A-112 YE-RD,4.0,1015 C1CA01A-1
C1BB01A-52 NOT USED (V101)
C1BB01A-51 GY-VT,6.0,2210 C21D-7 C21C-7 GY-VT,6.0,1798
C1BB01A-68 VT-GN,1.0,425 S1RH02 VT-GN,0.75,790 C1RH02A-1
C1BB01A-69 BU-WH,0.5,2345 C1BP02A-46
C1BB01A-70 RD,0.5,90 S1BB33 RD,0.5,90
C1BB01A-92 RD,0.5,90
C1BB01A-89 NOT USED (V101)
C1BB01A-111 RD,0.5,90
C1BB01A-116 BK-YE,2.5,190 S1D130A BK-YE,2.5,140 S1D130B BK-YE,6.0,360 G1D130A-1
C1BB01A-97 BK-YE,2.5,190
C1BB01A-31 BK-YE,2.5,190
C1BB01A-32 YE-GN,2.5,3105 C1RW14C-1
C1BB01A-93 VT-GN,2.5,3105 C1RW14C-2
C1BB01A-35 YE-GN,0.5,2345
C1BB01A-96 YE-GN,0.5,2345
C1BB01A-84 VT-WH,2.5,1205 C1RW01A-2
C1BB01A-85 GY-BN,2.5,1205 C1RW01A-1
C1BB01A-86 BN-WH,0.5,2345 C1BP02A-6
C1BB01A-81 WH,0.5,2345 C1BP02A-43
C1BB01A-110 GY-OG,0.5,2345 C1BP02A-5
C1BB01A-49 VT-BN,4.0,1285 C1RD03-1
C1BB01A-47 YE-GY,4.0,2185 C1RD04-1
C1BB01A-90
C1BB01A-67
C1BB01A-72
C1BB01A-33
C1BB01A-34
C1BB01A-94
C1BB01A-95
C1BB01A-74
C1BB01A-83
C1BB01A-79
C1BB01A-87
C1BB01A-80
C1BB01A-82
C1BB01A-108
C1BB01A-109
C1BB01A-48
C1BB01A-46
C1BP02A-3
C1BP02A-47
ABS module (D423)
Control unit-Blower-motor-Front (D258)
GY-VT,1.5,195 C2H102-4
Motor-Blower-Front (M132)
S2BB28 GY-VT,6.0,280 C2H123D-2
Horn-RH (L103)
VT-GN,0.75,1115 C1RH02B-1
Horn-LH (L102)
Central junction-box (P101)
J Sheet1
Module-Lighting-switch (D183)
RD,0.5,2120 C21D-2 C21C-2 RD,0.5,2251 C2LF23D-1
RD,0.5,90
P Sheet2
Pump-Power wash (M156)
Motor-Wiper-Windscreen (M105)
Central junction-box (P101)
Windshield LH heater element (H114)
Windshield RH heater element (H113)
S1BB24 VT-RD,2.5,15
VT-RD,2.5,15
VT-RD,0.5,15
VT-RD,0.5,15
VT-RD,2.5,15
S1BB22 BN-RD,2.5,140
VT-WH,2.5,0
BN-RD,0.5,140
BN-RD,2.5,140
BN-RD,0.5,140
L Sheet1 RD,6.0,0
S1RD05 GY-OG,6.0,60
GY-OG,6.0,60
GY-OG,6.0,60

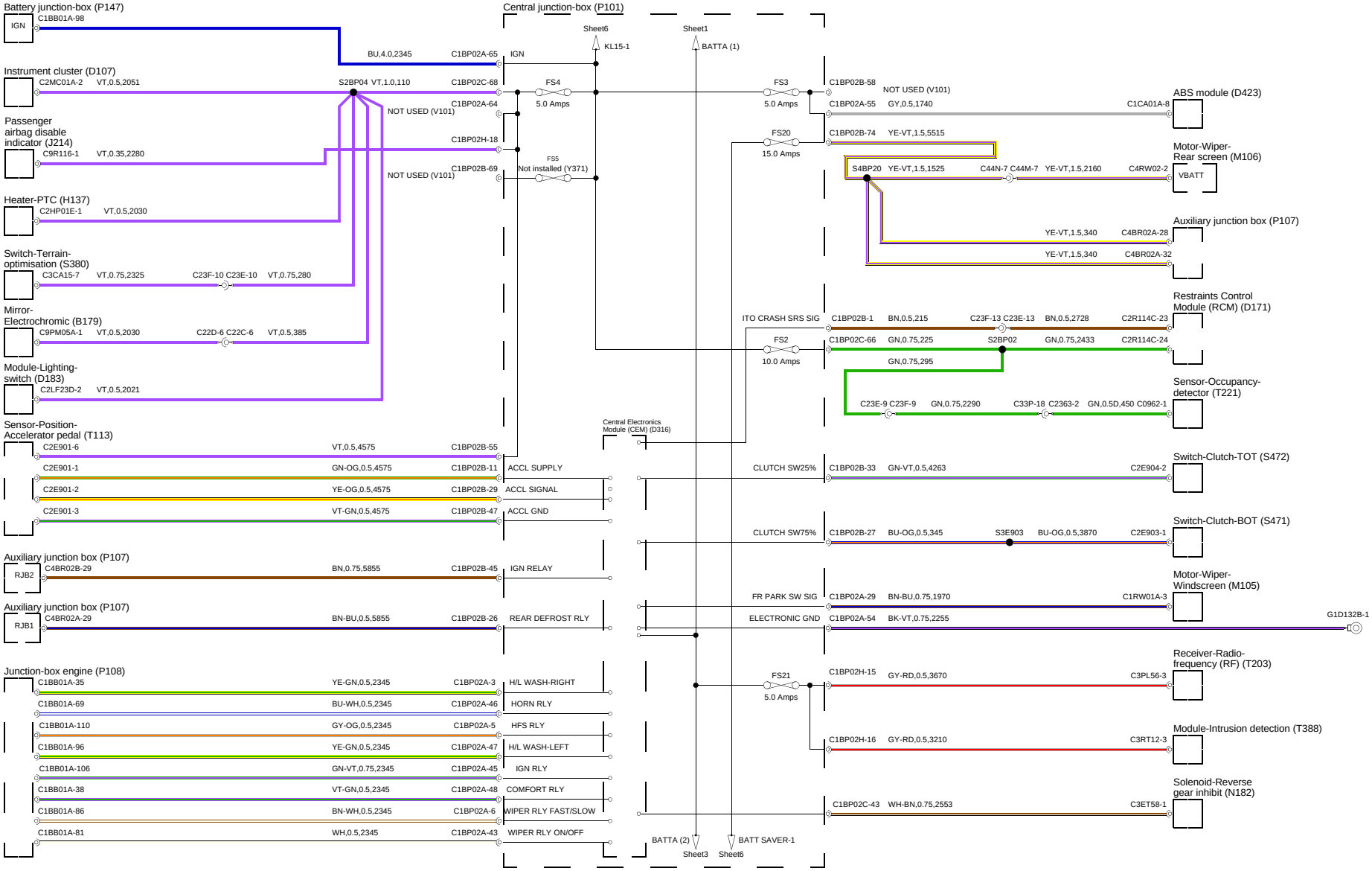

Glow plug (T171)
K
VT,6.0,555
S1BB04A
VT,2.5,155
C11X-1 C11Y-1
VT,2.5D,1690
C1E243-1
1
Earth via-fixings (E110)
Sheet1
Glow plug (T171)
VT,2.5,155
C11X-2 C11Y-2
VT,2.5D,1690
C1E244-1
2
Earth via-fixings (E110)
Glow plug (T171)
VT,2.5,155
C11X-3 C11Y-3
VT,2.5D,1690
C1E245-1
3
Earth via-fixings (E110)
Glow plug (T171)
VT,2.5,155
C11X-4 C11Y-4
VT,2.5D,1690
C1E246-1
4
Earth via-fixings (E110)
Sensor-Heated oxygen-(HO2S)-Front (T133)
C
WH-BU,1.0,1925
C1E731D-4
Sheet1
Actuator-Varible swirl (M348)
D
GN-WH,0.75,1230
C1E817B-1
Sheet1
Valve-Control-Fuel volume (N168)
B
VT-OG,1.0,1315
C1E922-1
Sheet1
Valve-Control-Fuel pressure (N167)
E
BN,0.75,1990
C1E727B-1
Sheet1
Sensor-MAF/IAT (T317)
A
VT-GY,0.75,1615
C1E807D-3
Sheet1

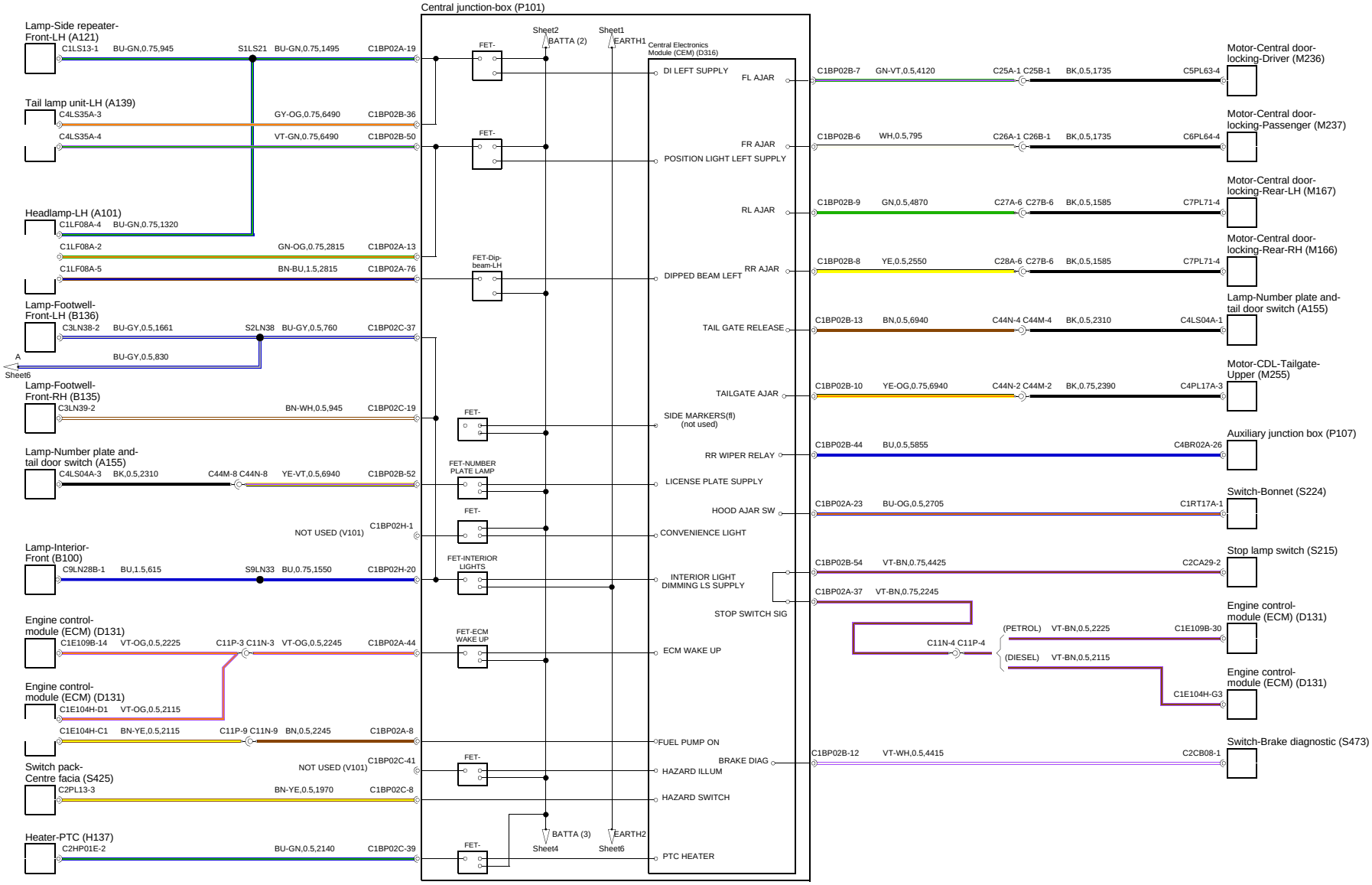

Battery (P100)
RD,25.0,610
C1DC02A-1
C1D134B-1
BK,35.0,210
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01A-66
C1BB01B-1
FE19
60.0 Amps
FE20
60.0 Amps
FE21
60.0 Amps
C1BB03J-1
BU-RD,6.0,1920
C12D-1 C12C-1
C1BB03K-1
GN-RD,6.0,1910
C12D-2 C12C-2
C1BB03L-1
GY-RD,6.0,1845
C12F-1 C12E-1
GN-RD,6.0,5590
A
Sheet2
GY-RD,6.0,5995
B
Sheet3
BU-RD,6.0,5350
Auxiliary junction box (P107)
(RJB1)
S3BB19
BU-RD,6.0,700
C4BR02A-1
Rear window heater element (H100)
C4RD02A-1
GN-BU,4.0,1060
C44K-1 C44L-1
GN-BU,4.0,2025
C4BR02A-33
Relay-Heated-rear screen (R138)
RA1 MINI
S4BR07
WH-RD,2.5,60
C4BR02A-31
C4BR02A-25
C4BR02A-15
FA7
30.0 Amps
C4BR02A-9
BU-RD,6.0,700
C4BR02A-17
C4BR02A-24
Central junction-box (P101)
C1BP02B-44
C1BP02B-74
YE-VT,1.5,5515
BU,0.5,5855
C4BR02A-26
S4BP20
YE-VT,1.5,340
C4BR02A-32
C4BR02A-28
Relay-Rear-wiper (R137)
RA2 MICRO
Motor-Wiper-Rear screen (M106)
C4RW02-1
VT-GN,1.5,2160
C44M-6 C44N-6
VT-GN,1.5,1865
C4BR02A-34
Module-Rear door-RH (D406)
C7PL01-2
BU-RD,1.5,1050
C27B-9 C28A-9
GN-RD,2.5,5955
C4BR02A-8
FA4
25.0 Amps
Module-Rear door-LH (D405)
C27B-9 C27A-9
BU-RD,2.5,3025
C4BR02A-7
FA3
25.0 Amps
Module-Passenger-door (D254)
C26B-9 C26A-9
YE-RD,2.5,6520
C4BR02A-6
FA2
25.0 Amps
C4BR02A-19
FA12
Not installed (Y371)
C4BR02A-20
FA5
Not installed (Y371)
C4BR02A-13
FA8
Not installed (Y371)
C4BR02A-16
FA6
15.0 Amps
C4BR02A-14
BN-RD,2.5,4660
C33G-14 C33H-14
FA9
15.0 Amps
C4BR02A-21
RD,1.5,635
FA10
30.0 Amps
C4BR02A-22
YE-RD,2.50,3529
C
Sheet2
C4BR02A-27
BK-GY,1.5,870
S4D149A
BK-GY,2.5,65
S4D149B
BK-GY,6.0,575
G4D149-1
FA11
40.0 Amps
C4BR02A-23
BU-RD,4.0,635
C44X-1 C44Y-1
RD-BU,4.0,505
C4AT23D-2
ECU-Trailer (D221)
C4BR02A-5
RD,2.5,4465
C25A-9 C25B-9
RD,1.5,1135
C5PL01A-2
Module-Drivers-door (D253)
Central junction-box (P101)
C1BP02B-26
BN-BU,0.5,5855
Cigar lighter-Rear (J113)
BN-RD,2.5,325
C3DC07B-2
Trailer pick-up (P124)
C44X-2 C44Y-2
(13 PIN)
BU-PK,2.5,1500
C1381-4
(12N/12S)
Trailer pick-up (P124)
BU-PK,2.5,1445
C0499-9

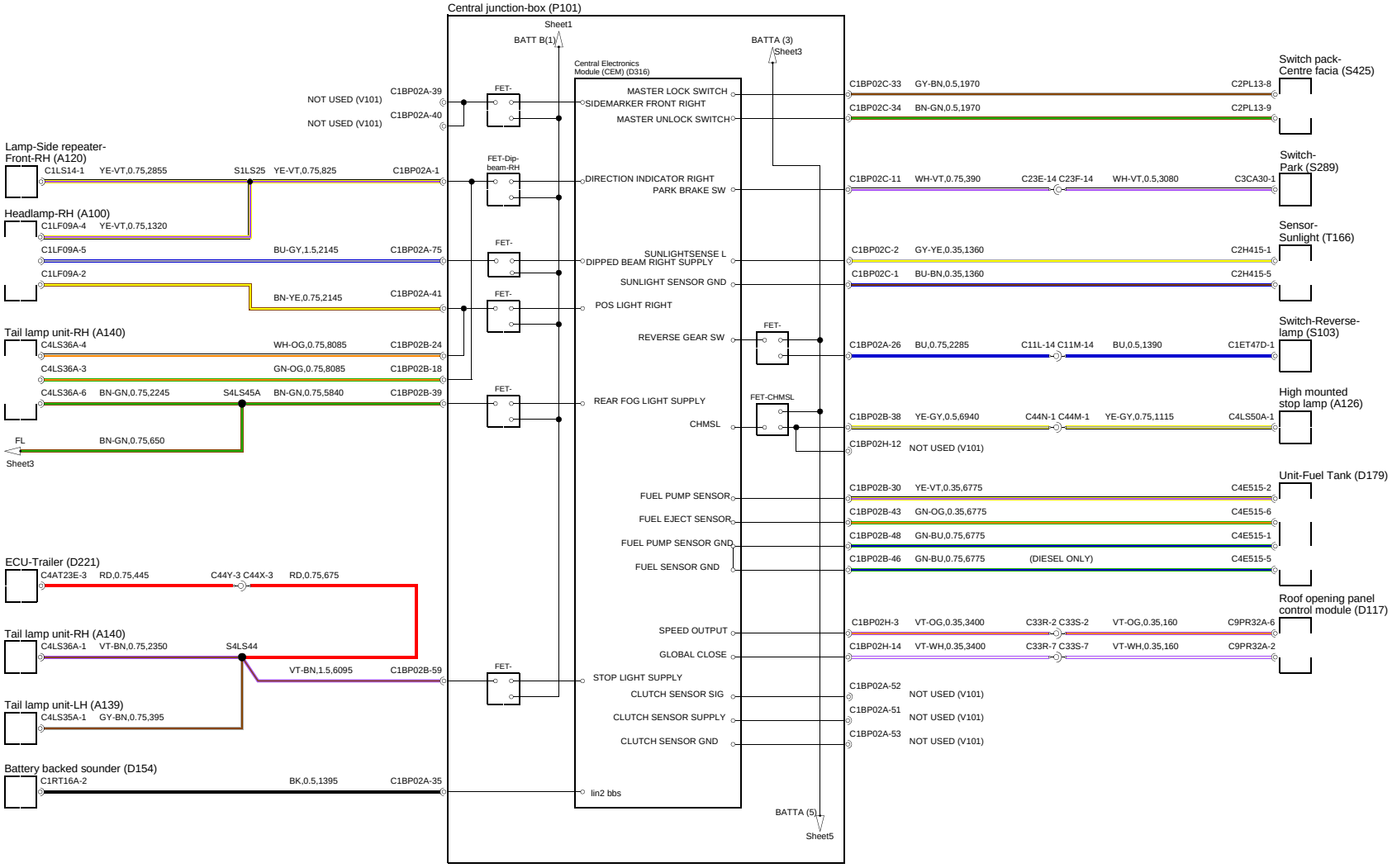

C
YE-RD,2.50,3529
Sheet1
C33N-16 C3025-2
RD,2.5D,445
SJ4
RD,2.5D,90
C2381-6
RD,2.5D,90
C2381-12
Memory control module (D119)
Auxiliary junction box (P107)
(RJB2)
A
GN-RD,6.0,5590
Sheet1
S4BB20
GN-RD,4.0,460
C4BR02B-17
FB9
30.0 Amps
C4BR02B-21
RD,2.5,5610
RD,2.5D,360
C0774-1
Switch pack-
Seat-Driver (S391)
RB1
Relay-
Ignition (R211)
MINI
Central junction-box (P101)
C1BP02B-45
BN,0.75,5855
C4BR02B-29
GN-RD,6.0,460
C4BR02B-31
GN-RD,6.0,460
C4BR02B-25
C33P-16 C3025-2
RD-BK,2.5D,150
C0975-30
Relay-Power seat-RH (R210)
S4R115
GY-BN,6.0,60
C4BR02B-33
RB2
Not installed (Y371)
C4BR02B-27
C4BR02B-32
C4BR02B-26
C4BR02B-34
C4BR02B-28
MICRO
GY-BN,6.0,60
C4BR02B-1
GY-BN,6.0,60
C4BR02B-9
Module-Active on-
demand coupling (D417)
C3A101-1
WH-BU,1.0,1580
C4BR02B-14
FB6
15.0 Amps
ACCESSORY FEED TO
TRAILER HARNESS
C44Y-7 C44X-7
YE,1.5,635
C4BR02B-13
FB5
15.0 Amps
C4BR02B-15
FB7
Not installed (Y371)
C4BR02B-16
FB8
Not installed (Y371)
Module-Heated seat-
Passenger (D409)
C3HS08A-4
RD,1.5,500
C5B1-1 C33P-1
VT,1.5,5610
C4BR02B-8
FB4
15.0 Amps
FB2
Not installed (Y371)
C4BR02B-6
Module-Heated seat-
Driver (D408)
C3HS03A-4
RD,1.5,500
C4B1-1 C33N-1
GY,1.5,3529
C4BR02B-7
FB3
15.0 Amps
FB1
10.0 Amps
C4BR02B-5
BU,0.75,1300
C4MP01A-1
Parking aid
module (D184)
C4BR02B-18
FB10
Not installed (Y371)
C4BR02B-22
C4BR02B-24
FB11
Not installed (Y371)
C4BR02B-23
C4BR02B-20
FB12
Not installed (Y371)
C4BR02B-19

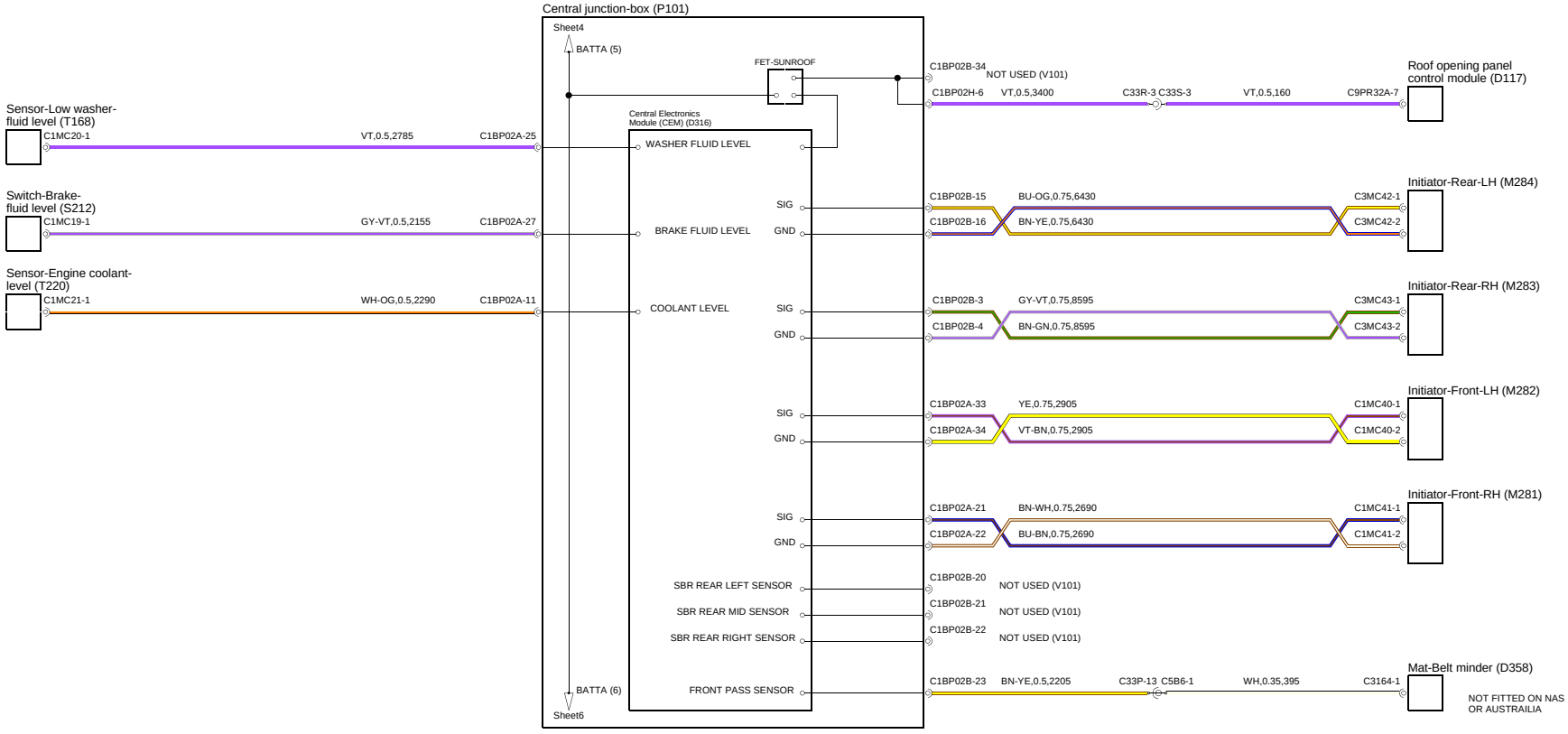

Auxiliary junction box (P107)
(RJB4)
B
Sheet1
GY-RD,6.0,5995
C4BR02G-33
RD1 RING BREAK
FD9
30.0 Amps
C4BR02G-21
RD,4.0,1160
C23V-1 C23U-1
RD,4.0,3040
C4ME27D-1
Amplifier-power (F142)
Batt
S4BB21
GY-RD,4.0,35
C4BR02G-30
GY-RD,4.0,35
C4BR02G-17
FD7
Not installed (Y371)
GY-RD,4.0,35
C4BR02G-9
C4BR02G-15
GY-RD,4.0,35
C4BR02G-1
FD5
Not installed (Y371)
C4BR02G-13
FD6
10.0 Amps
C4BR02G-14
BN-RD,1.5,4260
C23H-5 C23G-5
BN-RD,1.5,440
Module-Tuner-
DAB/SDARS (D350)
C4ME43A-1
BU-RD,0.75,415
C23U-6 C23V-6
BU-RD,0.75,1160
C4BR02G-7
FD3
10.0 Amps
S2BRD0
BN-RD,1.5,160
C2ME44A-1
Audio head unit (D282)
FD2
C4BR02G-6
Not installed (Y371)
BN-RD,0.75,290
C2ME05A-1
Information and entertainment
control module (D371)
RD,1.0,125
C4BR02G-5
FD1
10.0 Amps
FD4
5.0 Amps
C4BR02G-8
GN-RD,0.75,1160
C23V-5 C23U-5
GN-RD,0.5,3010
Navigation system
module (D325)
C3MN08A-6
RD,0.75,6535
C23U-2 C23V-2
RD,1.0,1035
S3RD04C
S4BR04B
GN-RD,0.5,65
C4MM22A-31
BATT
GN-RD,0.5,65
C4MM22A-32
BATT
Module-Telephone (D261)
Touch screen
display (D326)
C2MN08A-1
RD,0.75,880
C23G-2 C23H-2
RD,1.0,4135
FD8
Not installed (Y371)
C4BR02G-12
C4BR02G-16
FD10
Not installed (Y371)
C4BR02G-18
C4BR02G-22
FD11
Not installed (Y371)
C4BR02G-24
C4BR02G-23
FD12
Not installed (Y371)
C4BR02G-20
C4BR02G-19
C4BR02G-27
Not installed (Y371)
C4BR02G-32
C4BR02G-34
C4BR02G-28
C4BR02G-26
MICRO
RD2

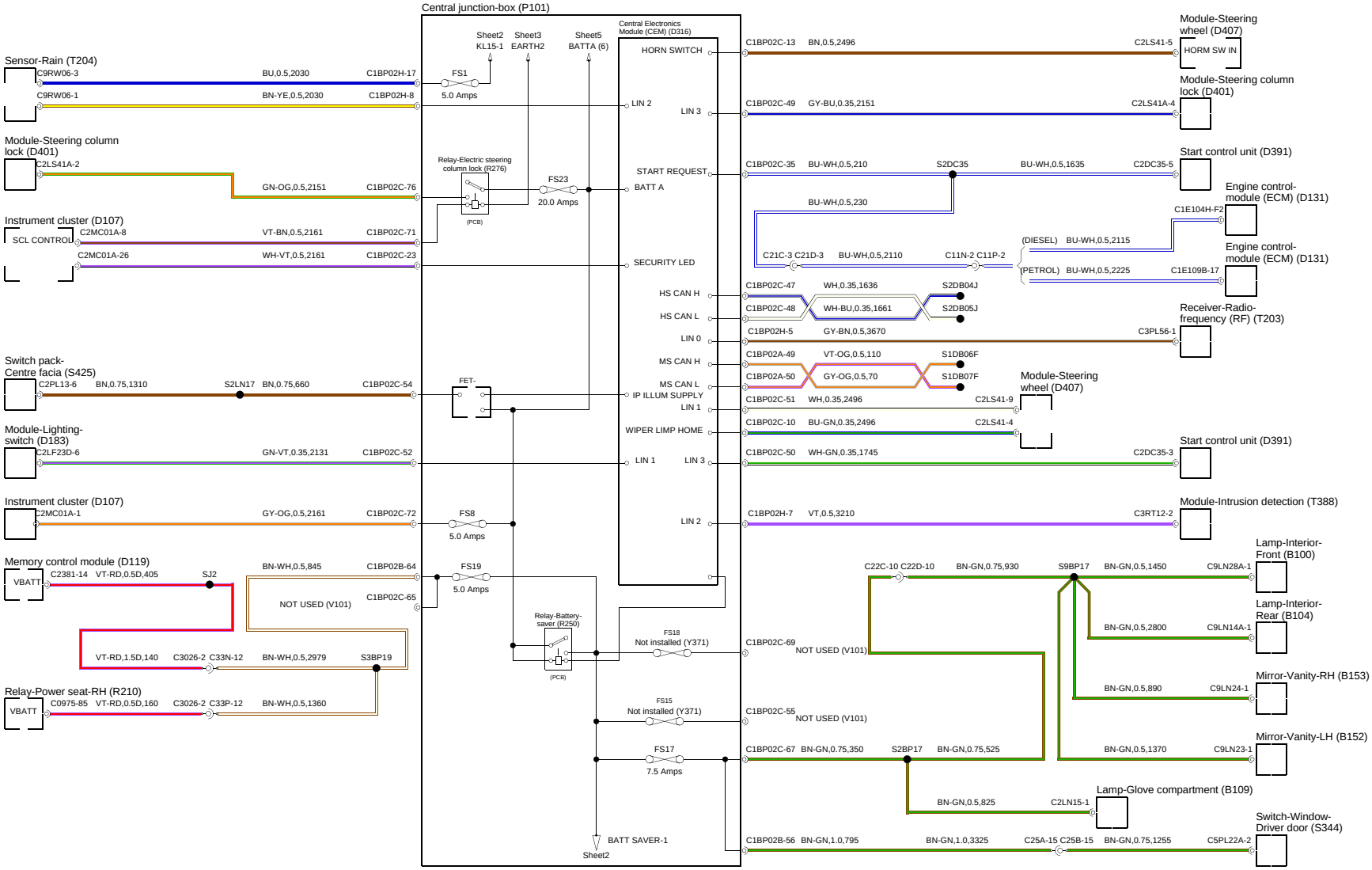

Battery (P100)
RD,25.0,610
C1DC02A-1
C1D134B-1 BK,35.0,210
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01A-66
C1BB01B-1
FE18
60.0 Amps
FE17
60.0 Amps
C1BB03H-1 YE-RD,6.0,2105
C1BB07G-1 RD,6.0,2120
C1BP02G-2
C1BP02G-1
Central junction-box (P101)
BATT B
BATT A
Central Electronics Module (CEM) (D316)
Automatic Temperature Control Module (D243)
C2H101D-1 BU-RD,0.75,825
S2BB27
BU-RD,1.0,1240
C1BP02C-74
FS27
5.0 Amps
Start control unit (D391)
C2DC35-1 BU-RD,0.5,505
Audio head unit (D282)
C2ME03A-11
BN-RD,1.5,2150
C1BP02C-64
FS6
15.0 Amps
Stop lamp switch (S215)
C2CA29-1
GN-RD,1.0,4425
C1BP02B-66
FS28
5.0 Amps
Unit-Fuel Tank (D179)
C4E515-4
(DIESEL) BN-YE,2.5,6775
(PETROL) BN-YE,2.5,6145
C1BP02B-76
Relay-Fuel-pump (R103)
FS22
20.0 Amps
Module-Fuel-pump driver (D361)
C4E220E-4
FS24
Not installed (Y371)
C1BP02B-75
Diagnostic socket (V100)
C2DB04-16
YE-RD,0.5,2096
C1BP02C-73
FS26
5.0 Amps
BK,0.75,1395
C1BP02A-67
Battery backed sounder (D154)
C1RT16A-3
Relay-Fuel-flap-lock (R257)
FS25
10.0 Amps
Motor-Release-Fuel flap (M116)
C4PL19A-1
BK,1.0,8420
C1BP02B-68
C4PL19A-2
Relay-Fuel-flap-unlock (R258)
BK,1.0,8420
C1BP02B-67
BATTA (1)
Sheet2
BATT B(1)
Sheet4
FS10
15.0 Amps
FS14
15.0 Amps
Relay-Wash-pump-Front (R270)
Relay-Wash-pump-Rear (R271)
(PCB)
Sheet3
EARTH1
POWER GND
FS9
15.0 Amps
Relay-Main-dipped beam (R127)
FS13
15.0 Amps
Relay-Front-fog lamp (R130)
FS11
7.5 Amps
Relay-Reverse (R217)
Relay-Tailgate unlock (R278)
Not installed (Y371)
FS7
7.5 Amps
C33R-1 C33S-1 RD,1.5,160 C9PR32A-1
ECU-Sunroof-1 (D173)
C1BP02C-75 RD,1.5,495 C22C-14 C22D-14 RD,1.5,3470
C1BP02A-71 VT-OG,1.0,2650 C1RW14E-1
C1BP02A-72 VT-OG,1.0,2650 C1RW14E-2
Pump-washer-front/rear screen (M278)
C1BP02B-65 BK-WH,4.0,585 S3D138 BK-WH,6.0,1205 G3D138-1
C1BP02A-74 YE-OG,1.5,2815 C1LF08A-7
Headlamp-Main-beam-LH (A105)
C1BP02A-73 YE-OG,1.5,2145 C1LF09A-7
Headlamp-Main-beam-RH (A104)
C1BP02A-69 GY-BN,1.0,2905 C11J-2 C11K-2 GY-BN,1.0,480 C1LF29-1
Lamp-Fog-Front-LH (A109)
C1BP02A-68 GY-BN,1.0,2905 C11J-1 C11K-1 GY-BN,1.0,2459 C1LF34-1
Lamp-Fog-Front-RH (A108)
C1BP02B-62 GN-WH,1.0,8085 C4LS36A-2
Tail lamp unit-RH (A140)
C1BP02B-73 GN-WH,1.0,6490 C4LS35A-2
Tail lamp unit-LH (A139)
C1BP02H-13 GN-WH,0.75,1960 C9PM05A-2
Mirror-Electrochromic (B179)
C1BP02B-72
NOT USED (V101)
C1BP02B-71 WH-OG,1.0,6940 C44N-3 C44M-3 BK,1.0,2390 C4PL17A-1
Motor-CDL-Tailgate-Upper (M255)
C1BP02C-70 WH-RD,0.5,2496 C2LS41-10
Module-Steering-wheel-LH (D256)

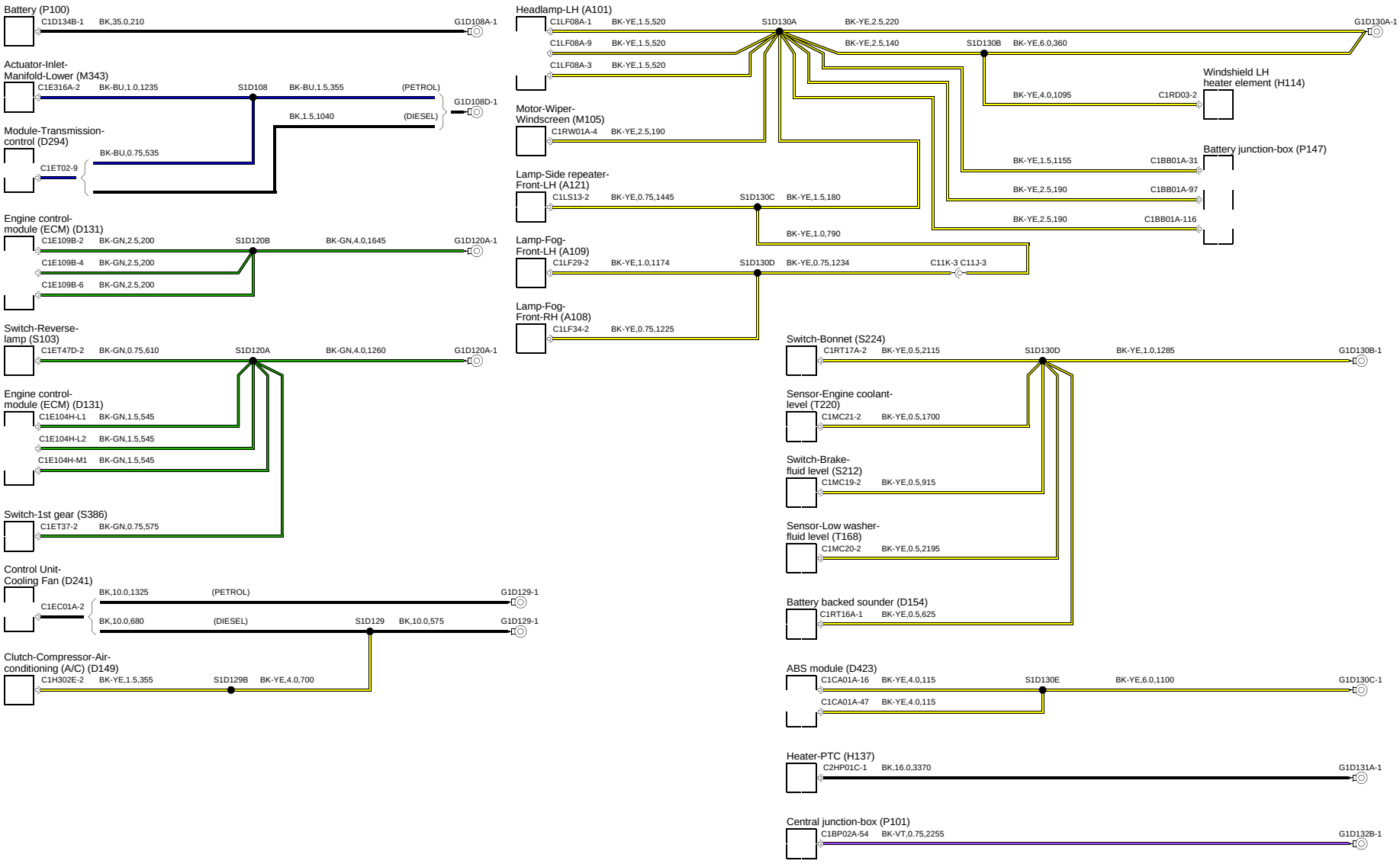

Battery junction-box (P147)
IGN
C1BB01A-98
Instrument cluster (D107)
C2MC01A-2 VT,0.5,2051
Passenger airbag disable indicator (J214)
C9R116-1 VT,0.35,2280
Heater-PTC (H137)
C2HP01E-1 VT,0.5,2030
Switch-Terrain-optimisation (S380)
C3CA15-7 VT,0.75,2325
C23F-10 C23E-10 VT,0.75,280
Mirror-Electrochromic (B179)
C9PM05A-1 VT,0.5,2030
C22D-6 C22C-6 VT,0.5,385
Module-Lighting-switch (D183)
C2LF23D-2 VT,0.5,2021
Sensor-Position-Accelerator pedal (T113)
C2E901-6 VT,0.5,4575
C2E901-1 GN-OG,0.5,4575
C2E901-2 YE-OG,0.5,4575
C2E901-3 VT-GN,0.5,4575
Auxiliary junction box (P107)
RJB2
C4BR02B-29 BN,0.75,5855
Auxiliary junction box (P107)
RJB1
C4BR02A-29 BN-BU,0.5,5855
Junction-box engine (P108)
C1BB01A-35 YE-GN,0.5,2345
C1BB01A-69 BU-WH,0.5,2345
C1BB01A-110 GY-OG,0.5,2345
C1BB01A-96 YE-GN,0.5,2345
C1BB01A-106 GN-VT,0.75,2345
C1BB01A-38 VT-GN,0.5,2345
C1BB01A-86 BN-WH,0.5,2345
C1BB01A-81 WH,0.5,2345
Central junction-box (P101)
Sheet6
KL15-1
Sheet1
BATTA (1)
BU,4.0,2345 C1BP02A-65 IGN
S2BP04 VT,1.0,110 C1BP02C-68
FS4
5.0 Amps
C1BP02A-64
NOT USED (V101)
C1BP02H-18
FS5
Not installed (Y371)
C1BP02B-69
NOT USED (V101)
C1BP02B-55
C1BP02B-11 ACCL SUPPLY
C1BP02B-29 ACCL SIGNAL
C1BP02B-47 ACCL GND
C1BP02B-45 IGN RELAY
C1BP02B-26 REAR DEFROST RLY
C1BP02A-3 H/L WASH-RIGHT
C1BP02A-46 HORN RLY
C1BP02A-5 HFS RLY
C1BP02A-47 H/L WASH-LEFT
C1BP02A-45 IGN RLY
C1BP02A-48 COMFORT RLY
C1BP02A-6 WIPER RLY FAST/SLOW
C1BP02A-43 WIPER RLY ON/OFF
Central Electronics Module (CEM) (D316)
BATTA (2)
Sheet3
BATT SAVER-1
Sheet6
FS3
5.0 Amps
C1BP02B-58
NOT USED (V101)
C1BP02A-55 GY,0.5,1740
C1CA01A-8
ABS module (D423)
FS20
15.0 Amps
C1BP02B-74 YE-VT,1.5,5515
S4BP20 YE-VT,1.5,1525
C44N-7 C44M-7 YE-VT,1.5,2160
C4RW02-2
VBATT
Motor-Wiper-Rear screen (M106)
YE-VT,1.5,340 C4BR02A-28
YE-VT,1.5,340 C4BR02A-32
Auxiliary junction box (P107)
ITO CRASH SRS SIG
C1BP02B-1 BN,0.5,215
C23F-13 C23E-13 BN,0.5,2728
C2R114C-23
FS2
10.0 Amps
C1BP02C-66 GN,0.75,225
S2BP02
GN,0.75,2433
C2R114C-24
GN,0.75,295
C23E-9 C23F-9 GN,0.75,2290
C33P-18 C2363-2 GN,0.5D,450 C0962-1
Restraints Control Module (RCM) (D171)
Sensor-Occupancy-detector (T221)
CLUTCH SW25%
C1BP02B-33 GN-VT,0.5,4263
C2E904-2
Switch-Clutch-TOT (S472)
CLUTCH SW75%
C1BP02B-27 BU-OG,0.5,345
S3E903
BU-OG,0.5,3870
C2E903-1
Switch-Clutch-BOT (S471)
FR PARK SW SIG
C1BP02A-29 BN-BU,0.75,1970
C1RW01A-3
ELECTRONIC GND
C1BP02A-54 BK-VT,0.75,2255
G1D132B-1
Motor-Wiper-Windscreen (M105)
FS21
5.0 Amps
C1BP02H-15 GY-RD,0.5,3670
C3PL56-3
Receiver-Radio-frequency (RF) (T203)
C1BP02H-16 GY-RD,0.5,3210
C3RT12-3
Module-Intrusion detection (T388)
C1BP02C-43 WH-BN,0.75,2553
C3ET58-1
Solenoid-Reverse gear inhibit (N182)

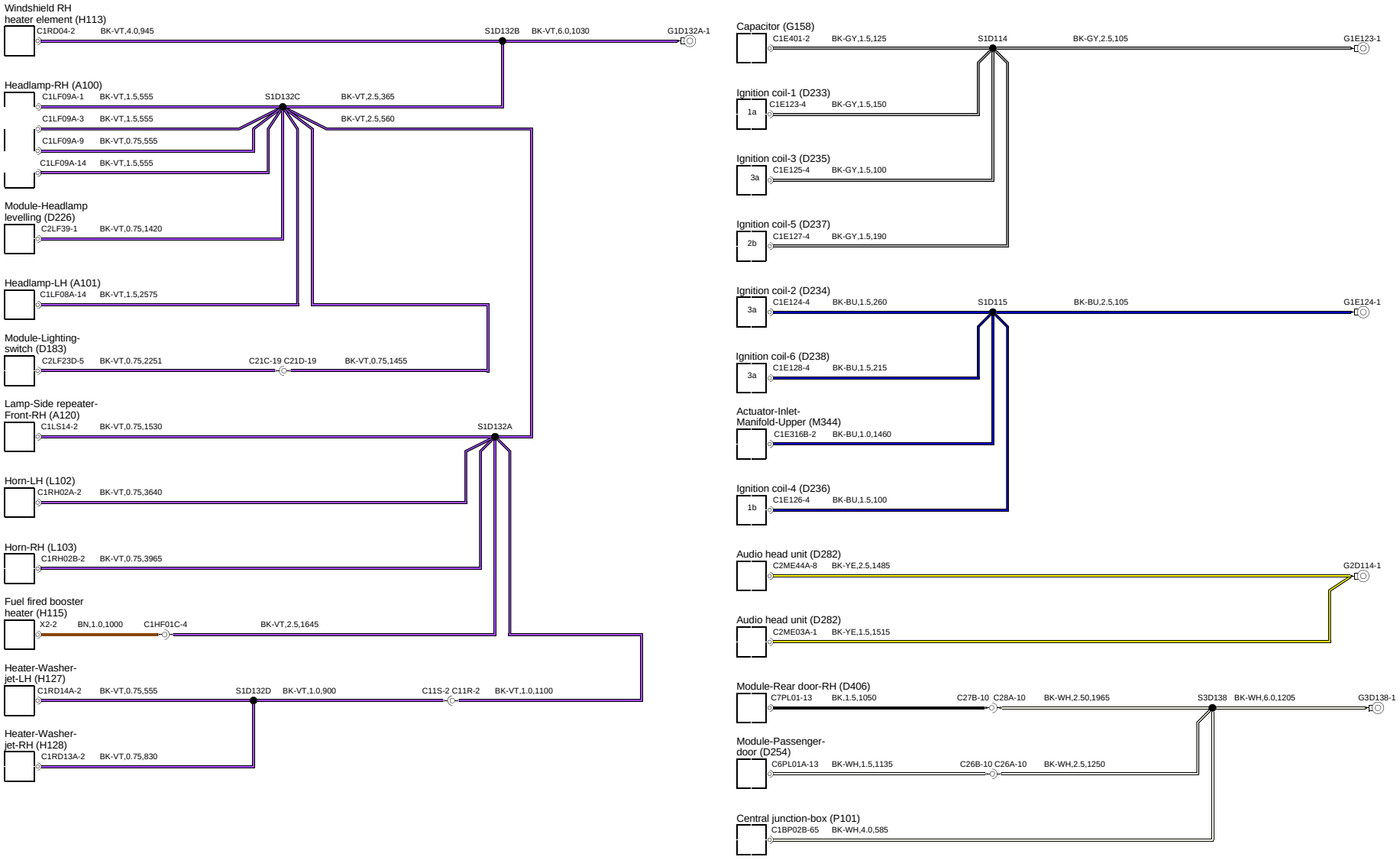

Central junction-box (P101)
Lamp-Side repeater-Front-LH (A121)
C1LS13-1 BU-GN,0.75,945
S1LS21 BU-GN,0.75,1495
C1BP02A-19
Tail lamp unit-LH (A139)
C4LS35A-3 GY-OG,0.75,6490 C1BP02B-36
C4LS35A-4 VT-GN,0.75,6490 C1BP02B-50
Headlamp-LH (A101)
C1LF08A-4 BU-GN,0.75,1320
C1LF08A-2 GN-OG,0.75,2815 C1BP02A-13
C1LF08A-5 BN-BU,1.5,2815 C1BP02A-76
Lamp-Footwell-Front-LH (B136)
C3LN38-2 BU-GY,0.5,1661
S2LN38 BU-GY,0.5,760 C1BP02C-37
A
BU-GY,0.5,830
Sheet6
Lamp-Footwell-Front-RH (B135)
C3LN39-2 BN-WH,0.5,945 C1BP02C-19
Lamp-Number plate and-tail door switch (A155)
C4LS04A-3 BK,0.5,2310
C44M-8 C44N-8 YE-VT,0.5,6940 C1BP02B-52
NOT USED (V101)
C1BP02H-1
Lamp-Interior-Front (B100)
C9LN28B-1 BU,1.5,615
S9LN33 BU,0.75,1550 C1BP02H-20
Engine control-module (ECM) (D131)
C1E109B-14 VT-OG,0.5,2225
C11P-3 C11N-3 VT-OG,0.5,2245 C1BP02A-44
Engine control-module (ECM) (D131)
C1E104H-D1 VT-OG,0.5,2115
C1E104H-C1 BN-YE,0.5,2115
C11P-9 C11N-9 BN,0.5,2245 C1BP02A-8
Switch pack-Centre facia (S425)
NOT USED (V101)
C1BP02C-41
C2PL13-3 BN-YE,0.5,1970 C1BP02C-8
Heater-PTC (H137)
C2HP01E-2 BU-GN,0.5,2140 C1BP02C-39
FET-
FET-Dip-beam-LH
FET-NUMBER PLATE LAMP
FET-INTERIOR LIGHTS
FET-ECM WAKE UP
Sheet2 BATTA (2)
Sheet1 EARTH1
Central Electronics Module (CEM) (D316)
DI LEFT SUPPLY
POSITION LIGHT LEFT SUPPLY
DIPPED BEAM LEFT
SIDE MARKERS(fl) (not used)
LICENSE PLATE SUPPLY
CONVENIENCE LIGHT
INTERIOR LIGHT DIMMING LS SUPPLY
ECM WAKE UP
FUEL PUMP ON
HAZARD ILLUM
HAZARD SWITCH
PTC HEATER
BATTA (3) Sheet4
EARTH2 Sheet6
FL AJAR
FR AJAR
RL AJAR
RR AJAR
TAIL GATE RELEASE
TAILGATE AJAR
RR WIPER RELAY
HOOD AJAR SW
STOP SWITCH SIG
BRAKE DIAG
C1BP02B-7 GN-VT,0.5,4120 C25A-1 C25B-1 BK,0.5,1735 C5PL63-4
Motor-Central door-locking-Driver (M236)
C1BP02B-6 WH,0.5,795 C26A-1 C26B-1 BK,0.5,1735 C6PL64-4
Motor-Central door-locking-Passenger (M237)
C1BP02B-9 GN,0.5,4870 C27A-6 C27B-6 BK,0.5,1585 C7PL71-4
Motor-Central door-locking-Rear-LH (M167)
C1BP02B-8 YE,0.5,2550 C28A-6 C27B-6 BK,0.5,1585 C7PL71-4
Motor-Central door-locking-Rear-RH (M166)
C1BP02B-13 BN,0.5,6940 C44N-4 C44M-4 BK,0.5,2310 C4LS04A-1
Lamp-Number plate and-tail door switch (A155)
C1BP02B-10 YE-OG,0.75,6940 C44N-2 C44M-2 BK,0.75,2390 C4PL17A-3
Motor-CDL-Tailgate-Upper (M255)
C1BP02B-44 BU,0.5,5855 C4BR02A-26
Auxiliary junction box (P107)
C1BP02A-23 BU-OG,0.5,2705 C1RT17A-1
Switch-Bonnet (S224)
C1BP02B-54 VT-BN,0.75,4425 C2CA29-2
Stop lamp switch (S215)
C1BP02A-37 VT-BN,0.75,2245
C11N-4 C11P-4
(PETROL) VT-BN,0.5,2225 C1E109B-30
Engine control-module (ECM) (D131)
(DIESEL) VT-BN,0.5,2115
C1E104H-G3
Engine control-module (ECM) (D131)
C1BP02B-12 VT-WH,0.5,4415 C2CB08-1
Switch-Brake diagnostic (S473)

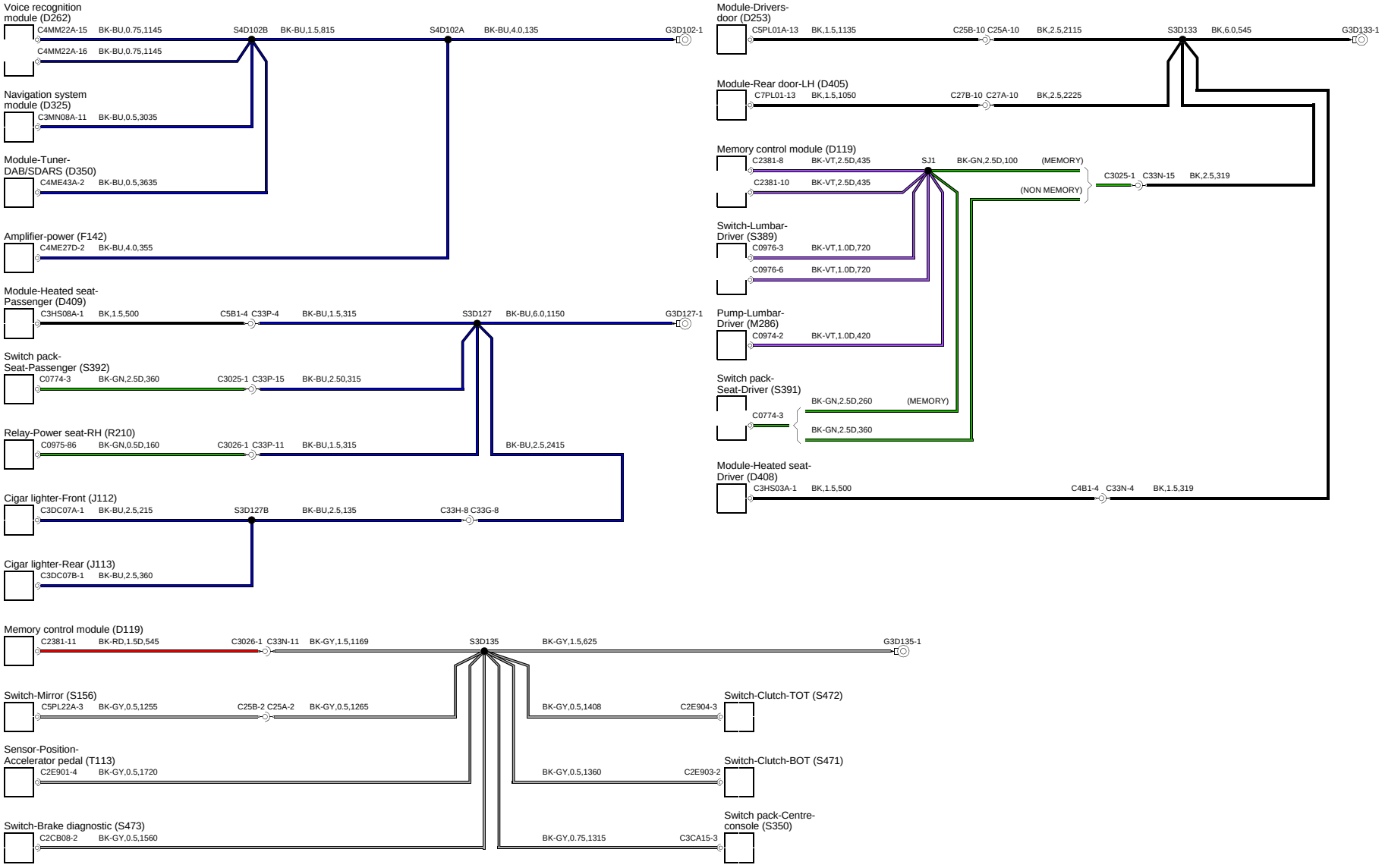

Central junction-box (P101)
Sheet1
BATT B(1)
BATTA (3)
Sheet3
Central Electronics Module (CEM) (D316)
NOT USED (V101)
C1BP02A-39
NOT USED (V101)
C1BP02A-40
FET-
MASTER LOCK SWITCH
SIDEMARKER FRONT RIGHT
MASTER UNLOCK SWITCH
C1BP02C-33 GY-BN,0.5,1970 C2PL13-8
C1BP02C-34 BN-GN,0.5,1970 C2PL13-9
Switch pack-Centre facia (S425)
Lamp-Side repeater-Front-RH (A120)
C1LS14-1 YE-VT,0.75,2855 S1LS25 YE-VT,0.75,825 C1BP02A-1
FET-Dip-beam-RH
DIRECTION INDICATOR RIGHT
PARK BRAKE SW
C1BP02C-11 WH-VT,0.75,390 C23E-14 C23F-14 WH-VT,0.5,3080 C3CA30-1
Switch-Park (S289)
Headlamp-RH (A100)
C1LF09A-4 YE-VT,0.75,1320
C1LF09A-5 BU-GY,1.5,2145 C1BP02A-75
FET-
SUNLIGHTSENSE L
DIPPED BEAM RIGHT SUPPLY
SUNLIGHT SENSOR GND
C1BP02C-2 GY-YE,0.35,1360 C2H415-1
C1BP02C-1 BU-BN,0.35,1360 C2H415-5
Sensor-Sunlight (T166)
C1LF09A-2
BN-YE,0.75,2145 C1BP02A-41
FET-
POS LIGHT RIGHT
Tail lamp unit-RH (A140)
C4LS36A-4 WH-OG,0.75,8085 C1BP02B-24
C4LS36A-3 GN-OG,0.75,8085 C1BP02B-18
C4LS36A-6 BN-GN,0.75,2245 S4LS45A BN-GN,0.75,5840 C1BP02B-39
FET-
REVERSE GEAR SW
C1BP02A-26 BU,0.75,2285 C11L-14 C11M-14 BU,0.5,1390 C1ET47D-1
Switch-Reverse-lamp (S103)
FL
BN-GN,0.75,650
Sheet3
FET-CHMSL
REAR FOG LIGHT SUPPLY
CHMSL
C1BP02B-38 YE-GY,0.5,6940 C44N-1 C44M-1 YE-GY,0.75,1115 C4LS50A-1
C1BP02H-12 NOT USED (V101)
High mounted stop lamp (A126)
FUEL PUMP SENSOR
FUEL EJECT SENSOR
FUEL PUMP SENSOR GND
FUEL SENSOR GND
C1BP02B-30 YE-VT,0.35,6775 C4E515-2
C1BP02B-43 GN-OG,0.35,6775 C4E515-6
C1BP02B-48 GN-BU,0.75,6775 C4E515-1
C1BP02B-46 GN-BU,0.75,6775 (DIESEL ONLY) C4E515-5
Unit-Fuel Tank (D179)
ECU-Trailer (D221)
C4AT23E-3 RD,0.75,445 C44Y-3 C44X-3 RD,0.75,675
SPEED OUTPUT
GLOBAL CLOSE
C1BP02H-3 VT-OG,0.35,3400 C33R-2 C33S-2 VT-OG,0.35,160 C9PR32A-6
C1BP02H-14 VT-WH,0.35,3400 C33R-7 C33S-7 VT-WH,0.35,160 C9PR32A-2
Roof opening panel control module (D117)
Tail lamp unit-RH (A140)
C4LS36A-1 VT-BN,0.75,2350 S4LS44
VT-BN,1.5,6095 C1BP02B-59
FET-
STOP LIGHT SUPPLY
CLUTCH SENSOR SIG
CLUTCH SENSOR SUPPLY
CLUTCH SENSOR GND
C1BP02A-52 NOT USED (V101)
C1BP02A-51 NOT USED (V101)
C1BP02A-53 NOT USED (V101)
Tail lamp unit-LH (A139)
C4LS35A-1 GY-BN,0.75,395
Battery backed sounder (D154)
C1RT16A-2 BK,0.5,1395 C1BP02A-35
lin2 bbs
BATTA (5)
Sheet5

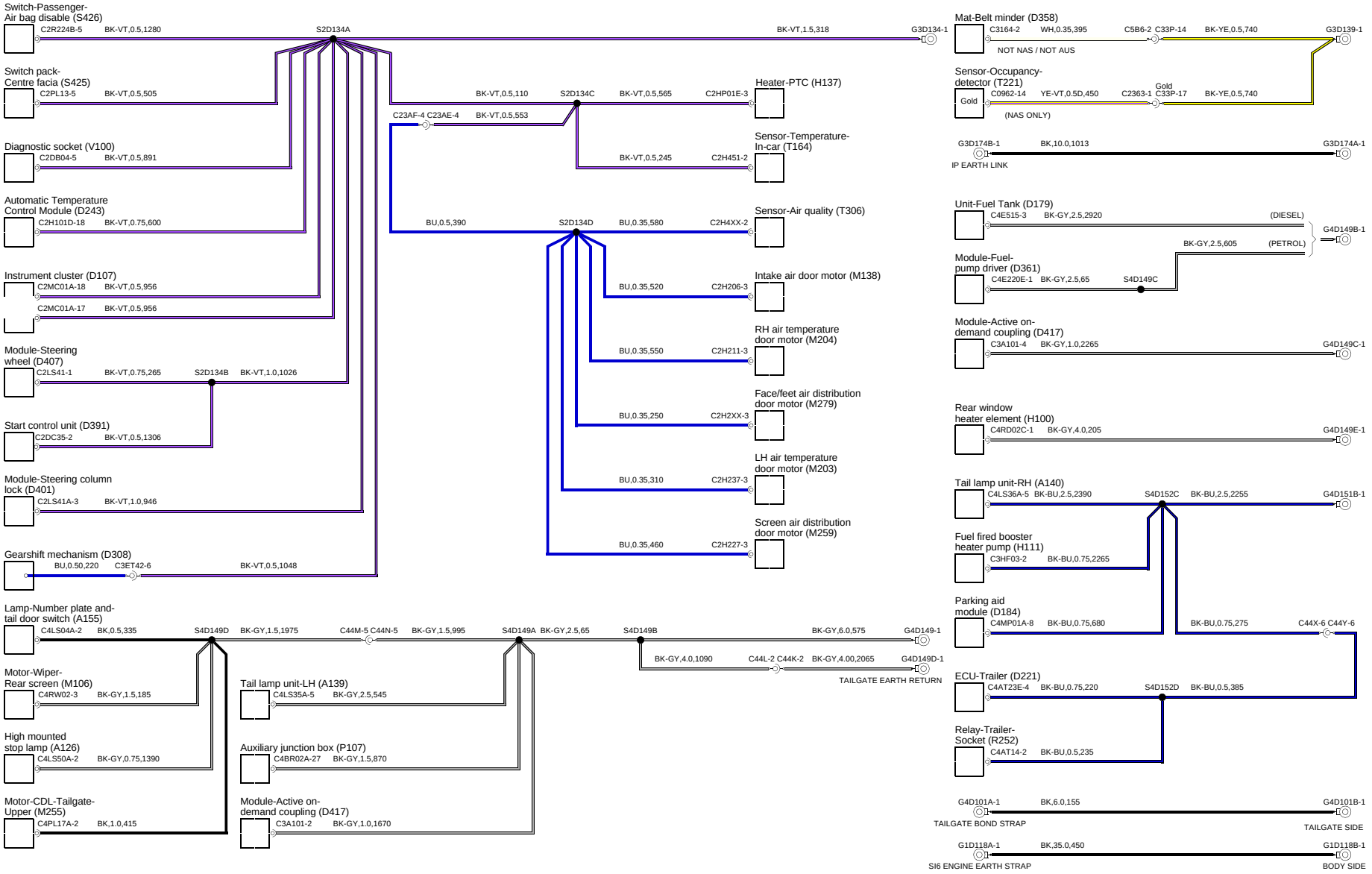

Central junction-box (P101)
Sheet4
BATTA (5)
FET-SUNROOF
Central Electronics Module (CEM) (D316)
Sensor-Low washer-fluid level (T168)
C1MC20-1
VT,0.5,2785
C1BP02A-25
WASHER FLUID LEVEL
Switch-Brake-fluid level (S212)
C1MC19-1
GY-VT,0.5,2155
C1BP02A-27
BRAKE FLUID LEVEL
SIG
GND
Sensor-Engine coolant-level (T220)
C1MC21-1
WH-OG,0.5,2290
C1BP02A-11
COOLANT LEVEL
SIG
GND
SIG
GND
SIG
GND
SBR REAR LEFT SENSOR
SBR REAR MID SENSOR
SBR REAR RIGHT SENSOR
BATTA (6)
FRONT PASS SENSOR
Sheet6
C1BP02B-34
NOT USED (V101)
C1BP02H-6
VT,0.5,3400
C33R-3 C33S-3
VT,0.5,160
C9PR32A-7
Roof opening panel control module (D117)
C1BP02B-15
BU-OG,0.75,6430
C3MC42-1
C1BP02B-16
BN-YE,0.75,6430
C3MC42-2
Initiator-Rear-LH (M284)
C1BP02B-3
GY-VT,0.75,8595
C3MC43-1
C1BP02B-4
BN-GN,0.75,8595
C3MC43-2
Initiator-Rear-RH (M283)
C1BP02A-33
YE,0.75,2905
C1MC40-1
C1BP02A-34
VT-BN,0.75,2905
C1MC40-2
Initiator-Front-LH (M282)
C1BP02A-21
BN-WH,0.75,2690
C1MC41-1
C1BP02A-22
BU-BN,0.75,2690
C1MC41-2
Initiator-Front-RH (M281)
C1BP02B-20
NOT USED (V101)
C1BP02B-21
NOT USED (V101)
C1BP02B-22
NOT USED (V101)
C1BP02B-23
BN-YE,0.5,2205
C33P-13 C5B6-1
WH,0.35,395
C3164-1
Mat-Belt minder (D358)
NOT FITTED ON NAS OR AUSTRAILIA

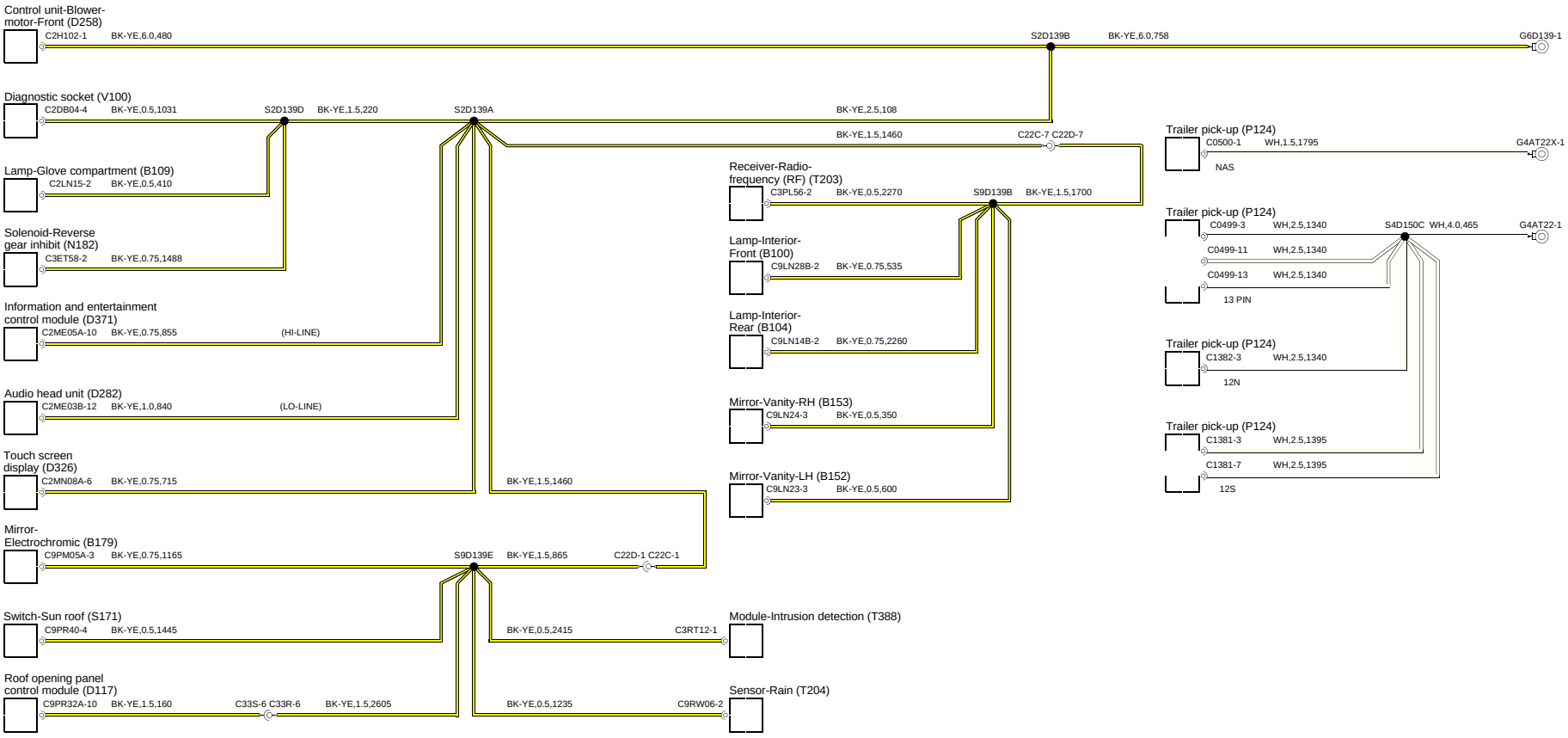

Central junction-box (P101)
Central Electronics Module (CEM) (D316)
Sheet2 KL15-1
Sheet3 EARTH2
Sheet5 BATTA (6)
Sensor-Rain (T204)
C9RW06-3 BU,0.5,2030 C1BP02H-17
C9RW06-1 BN-YE,0.5,2030 C1BP02H-8
FS1 5.0 Amps
Module-Steering column lock (D401)
C2LS41A-2 GN-OG,0.5,2151 C1BP02C-76
Relay-Electric steering column lock (R276)
FS23 20.0 Amps
(PCB)
Instrument cluster (D107)
SCL CONTROL
C2MC01A-8 VT-BN,0.5,2161 C1BP02C-71
C2MC01A-26 WH-VT,0.5,2161 C1BP02C-23
Switch pack-Centre facia (S425)
C2PL13-6 BN,0.75,1310 S2LN17 BN,0.75,660 C1BP02C-54
FET-
Module-Lighting-switch (D183)
C2LF23D-6 GN-VT,0.35,2131 C1BP02C-52
Instrument cluster (D107)
C2MC01A-1 GY-OG,0.5,2161 C1BP02C-72
FS8 5.0 Amps
Memory control module (D119)
VBATT
C2381-14 VT-RD,0.5D,405 SJ2
BN-WH,0.5,845 C1BP02B-64
FS19 5.0 Amps
NOT USED (V101) C1BP02C-65
VT-RD,1.5D,140 C3026-2 C33N-12 BN-WH,0.5,2979 S3BP19
Relay-Battery-saver (R250)
(PCB)
Relay-Power seat-RH (R210)
VBATT
C0975-85 VT-RD,0.5D,160 C3026-2 C33P-12 BN-WH,0.5,1360
HORN SWITCH
LIN 2
LIN 3
START REQUEST
BATT A
SECURITY LED
HS CAN H
HS CAN L
LIN 0
MS CAN H
MS CAN L
IP ILLUM SUPPLY
LIN 1
WIPER LIMP HOME
LIN 1
LIN 3
LIN 2
FS18 Not installed (Y371)
C1BP02C-69 NOT USED (V101)
FS15 Not installed (Y371)
C1BP02C-55 NOT USED (V101)
FS17 7.5 Amps
BATT SAVER-1
Sheet2
C1BP02C-13 BN,0.5,2496 C2LS41-5
Module-Steering wheel (D407)
HORM SW IN
C1BP02C-49 GY-BU,0.35,2151 C2LS41A-4
Module-Steering column lock (D401)
C1BP02C-35 BU-WH,0.5,210 S2DC35 BU-WH,0.5,1635 C2DC35-5
Start control unit (D391)
BU-WH,0.5,230
C1E104H-F2
Engine control-module (ECM) (D131)
C21C-3 C21D-3 BU-WH,0.5,2110 C11N-2 C11P-2
(DIESEL) BU-WH,0.5,2115
(PETROL) BU-WH,0.5,2225 C1E109B-17
Engine control-module (ECM) (D131)
C1BP02C-47 WH,0.35,1636 S2DB04J
C1BP02C-48 WH-BU,0.35,1661 S2DB05J
C1BP02H-5 GY-BN,0.5,3670 C3PL56-1
Receiver-Radio-frequency (RF) (T203)
C1BP02A-49 VT-OG,0.5,110 S1DB06F
C1BP02A-50 GY-OG,0.5,70 S1DB07F
C1BP02C-51 WH,0.35,2496 C2LS41-9
Module-Steering wheel (D407)
C1BP02C-10 BU-GN,0.35,2496 C2LS41-4
C1BP02C-50 WH-GN,0.35,1745 C2DC35-3
Start control unit (D391)
C1BP02H-7 VT,0.5,3210 C3RT12-2
Module-Intrusion detection (T388)
C22C-10 C22D-10 BN-GN,0.75,930 S9BP17 BN-GN,0.5,1450 C9LN28A-1
Lamp-Interior-Front (B100)
BN-GN,0.5,2800 C9LN14A-1
Lamp-Interior-Rear (B104)
BN-GN,0.5,890 C9LN24-1
Mirror-Vanity-RH (B153)
C1BP02C-67 BN-GN,0.75,350 S2BP17 BN-GN,0.75,525
BN-GN,0.5,1370 C9LN23-1
Mirror-Vanity-LH (B152)
BN-GN,0.5,825 C2LN15-1
Lamp-Glove compartment (B109)
C1BP02B-56 BN-GN,1.0,795 BN-GN,1.0,3325 C25A-15 C25B-15 BN-GN,0.75,1255 C5PL22A-2
Switch-Window-Driver door (S344)

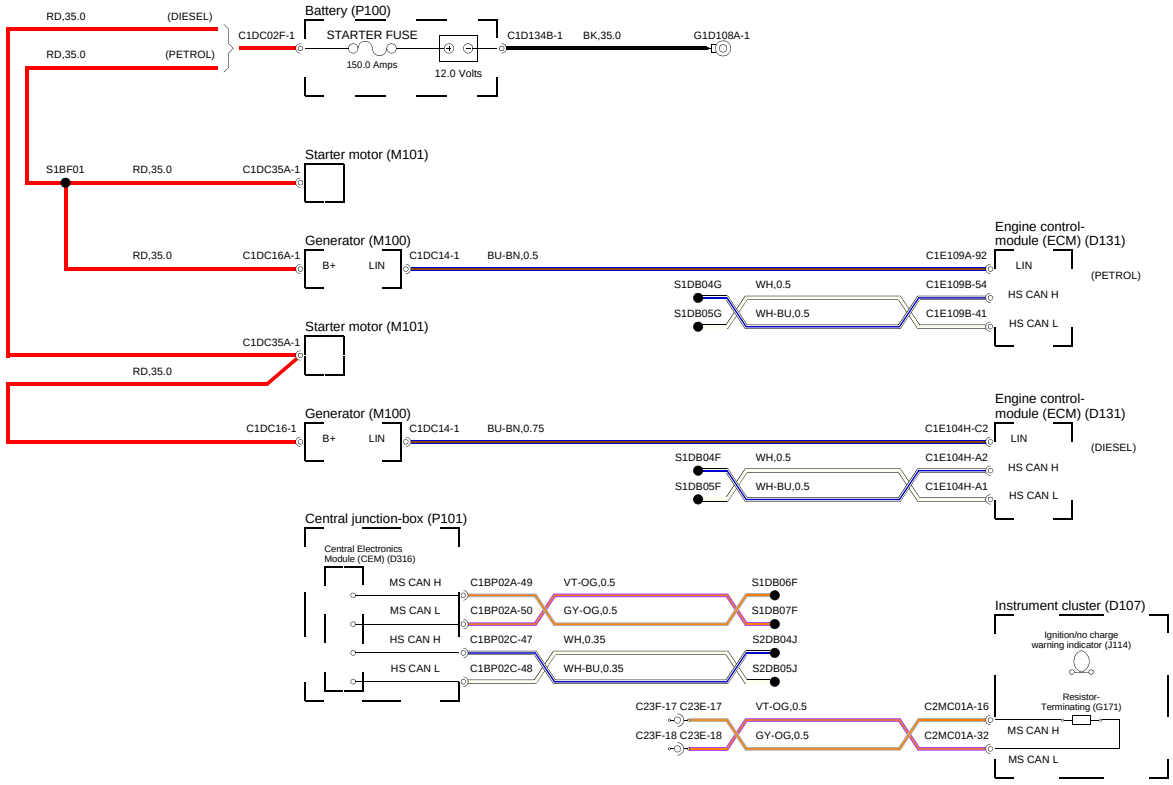

Battery (P100)
C1D134B-1 BK,35.0,210 G1D108A-1
Actuator-Inlet-Manifold-Lower (M343)
C1E316A-2 BK-BU,1.0,1235 S1D108 BK-BU,1.5,355 (PETROL)
BK,1.5,1040 (DIESEL)
G1D108D-1
Module-Transmission-control (D294)
C1ET02-9 BK-BU,0.75,535
Engine control-module (ECM) (D131)
C1E109B-2 BK-GN,2.5,200 S1D120B BK-GN,4.0,1645 G1D120A-1
C1E109B-4 BK-GN,2.5,200
C1E109B-6 BK-GN,2.5,200
Switch-Reverse-lamp (S103)
C1ET47D-2 BK-GN,0.75,610 S1D120A BK-GN,4.0,1260 G1D120A-1
Engine control-module (ECM) (D131)
C1E104H-L1 BK-GN,1.5,545
C1E104H-L2 BK-GN,1.5,545
C1E104H-M1 BK-GN,1.5,545
Switch-1st gear (S386)
C1ET37-2 BK-GN,0.75,575
Control Unit-Cooling Fan (D241)
C1EC01A-2 BK,10.0,1325 (PETROL) G1D129-1
BK,10.0,680 (DIESEL) S1D129 BK,10.0,575 G1D129-1
Clutch-Compressor-Air-conditioning (A/C) (D149)
C1H302E-2 BK-YE,1.5,355 S1D129B BK-YE,4.0,700
Headlamp-LH (A101)
C1LF08A-1 BK-YE,1.5,520 S1D130A BK-YE,2.5,220 G1D130A-1
C1LF08A-9 BK-YE,1.5,520 BK-YE,2.5,140 S1D130B BK-YE,6.0,360
C1LF08A-3 BK-YE,1.5,520
Windshield LH heater element (H114)
BK-YE,4.0,1095 C1RD03-2
Motor-Wiper-Windscreen (M105)
C1RW01A-4 BK-YE,2.5,190
Battery junction-box (P147)
BK-YE,1.5,1155 C1BB01A-31
BK-YE,2.5,190 C1BB01A-97
BK-YE,2.5,190 C1BB01A-116
Lamp-Side repeater-Front-LH (A121)
C1LS13-2 BK-YE,0.75,1445 S1D130C BK-YE,1.5,180
BK-YE,1.0,790
Lamp-Fog-Front-LH (A109)
C1LF29-2 BK-YE,1.0,1174 S1D130D BK-YE,0.75,1234 C11K-3 C11J-3
Lamp-Fog-Front-RH (A108)
C1LF34-2 BK-YE,0.75,1225
Switch-Bonnet (S224)
C1RT17A-2 BK-YE,0.5,2115 S1D130D BK-YE,1.0,1285 G1D130B-1
Sensor-Engine coolant-level (T220)
C1MC21-2 BK-YE,0.5,1700
Switch-Brake-fluid level (S212)
C1MC19-2 BK-YE,0.5,915
Sensor-Low washer-fluid level (T168)
C1MC20-2 BK-YE,0.5,2195
Battery backed sounder (D154)
C1RT16A-1 BK-YE,0.5,625
ABS module (D423)
C1CA01A-16 BK-YE,4.0,115 S1D130E BK-YE,6.0,1100 G1D130C-1
C1CA01A-47 BK-YE,4.0,115
Heater-PTC (H137)
C2HP01C-1 BK,16.0,3370 G1D131A-1
Central junction-box (P101)
C1BP02A-54 BK-VT,0.75,2255 G1D132B-1

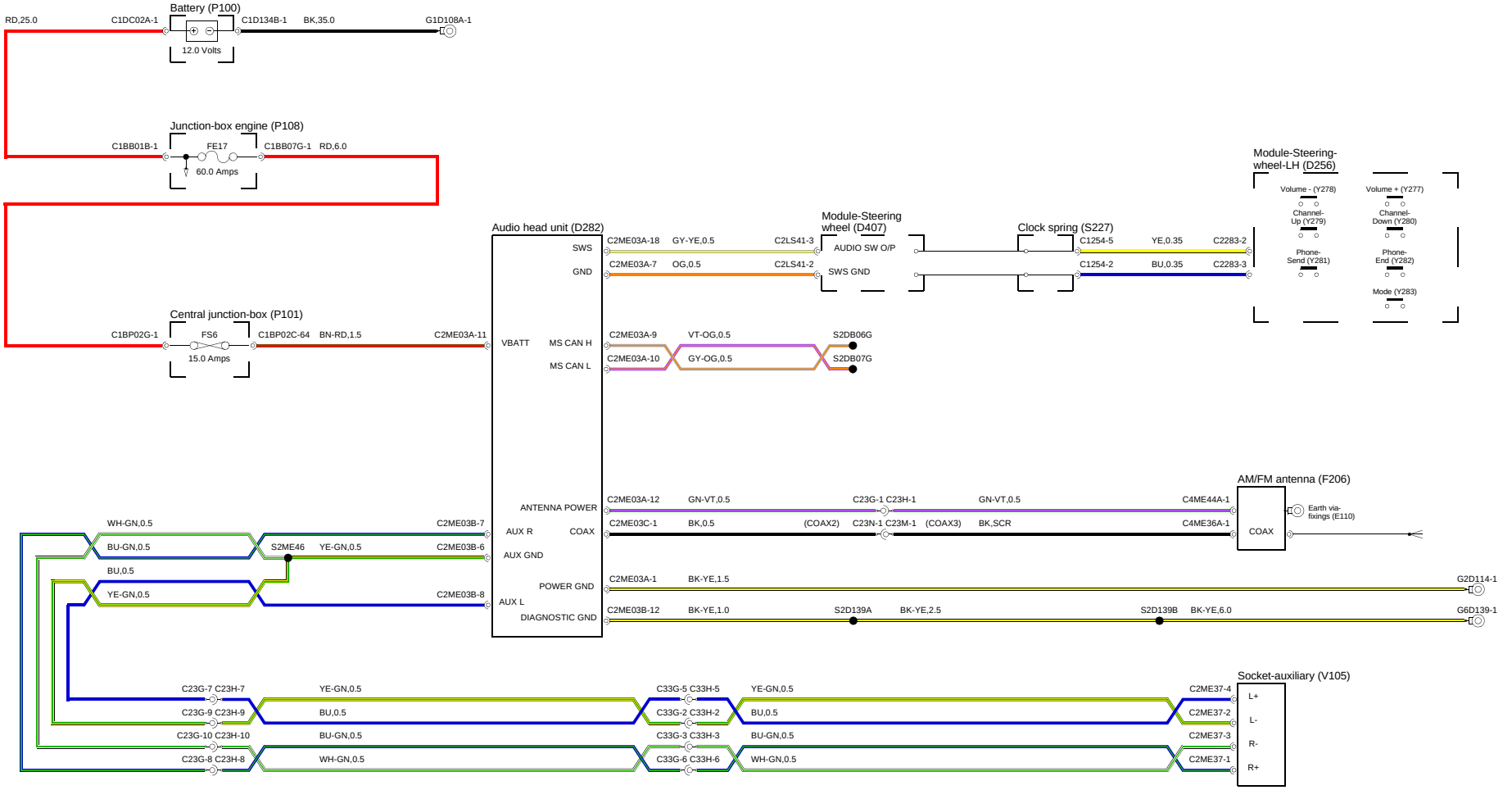

Windshield RH heater element (H113)
C1RD04-2 BK-VT,4.0,945 S1D132B BK-VT,6.0,1030 G1D132A-1
Headlamp-RH (A100)
C1LF09A-1 BK-VT,1.5,555 S1D132C BK-VT,2.5,365
C1LF09A-3 BK-VT,1.5,555 BK-VT,2.5,560
C1LF09A-9 BK-VT,0.75,555
C1LF09A-14 BK-VT,1.5,555
Module-Headlamp levelling (D226)
C2LF39-1 BK-VT,0.75,1420
Headlamp-LH (A101)
C1LF08A-14 BK-VT,1.5,2575
Module-Lighting-switch (D183)
C2LF23D-5 BK-VT,0.75,2251 C21C-19 C21D-19 BK-VT,0.75,1455
Lamp-Side repeater-Front-RH (A120)
C1LS14-2 BK-VT,0.75,1530 S1D132A
Horn-LH (L102)
C1RH02A-2 BK-VT,0.75,3640
Horn-RH (L103)
C1RH02B-2 BK-VT,0.75,3965
Fuel fired booster heater (H115)
X2-2 BN,1.0,1000 C1HF01C-4 BK-VT,2.5,1645
Heater-Washer-jet-LH (H127)
C1RD14A-2 BK-VT,0.75,555 S1D132D BK-VT,1.0,900 C11S-2 C11R-2 BK-VT,1.0,1100
Heater-Washer-jet-RH (H128)
C1RD13A-2 BK-VT,0.75,830
Capacitor (G158)
C1E401-2 BK-GY,1.5,125 S1D114 BK-GY,2.5,105 G1E123-1
Ignition coil-1 (D233)
1a C1E123-4 BK-GY,1.5,150
Ignition coil-3 (D235)
3a C1E125-4 BK-GY,1.5,100
Ignition coil-5 (D237)
2b C1E127-4 BK-GY,1.5,190
Ignition coil-2 (D234)
3a C1E124-4 BK-BU,1.5,260 S1D115 BK-BU,2.5,105 G1E124-1
Ignition coil-6 (D238)
3a C1E128-4 BK-BU,1.5,215
Actuator-Inlet-Manifold-Upper (M344)
C1E316B-2 BK-BU,1.0,1460
Ignition coil-4 (D236)
1b C1E126-4 BK-BU,1.5,100
Audio head unit (D282)
C2ME44A-8 BK-YE,2.5,1485 G2D114-1
Audio head unit (D282)
C2ME03A-1 BK-YE,1.5,1515
Module-Rear door-RH (D406)
C7PL01-13 BK,1.5,1050 C27B-10 C28A-10 BK-WH,2.50,1965 S3D138 BK-WH,6.0,1205 G3D138-1
Module-Passenger-door (D254)
C6PL01A-13 BK-WH,1.5,1135 C26B-10 C26A-10 BK-WH,2.5,1250
Central junction-box (P101)
C1BP02B-65 BK-WH,4.0,585

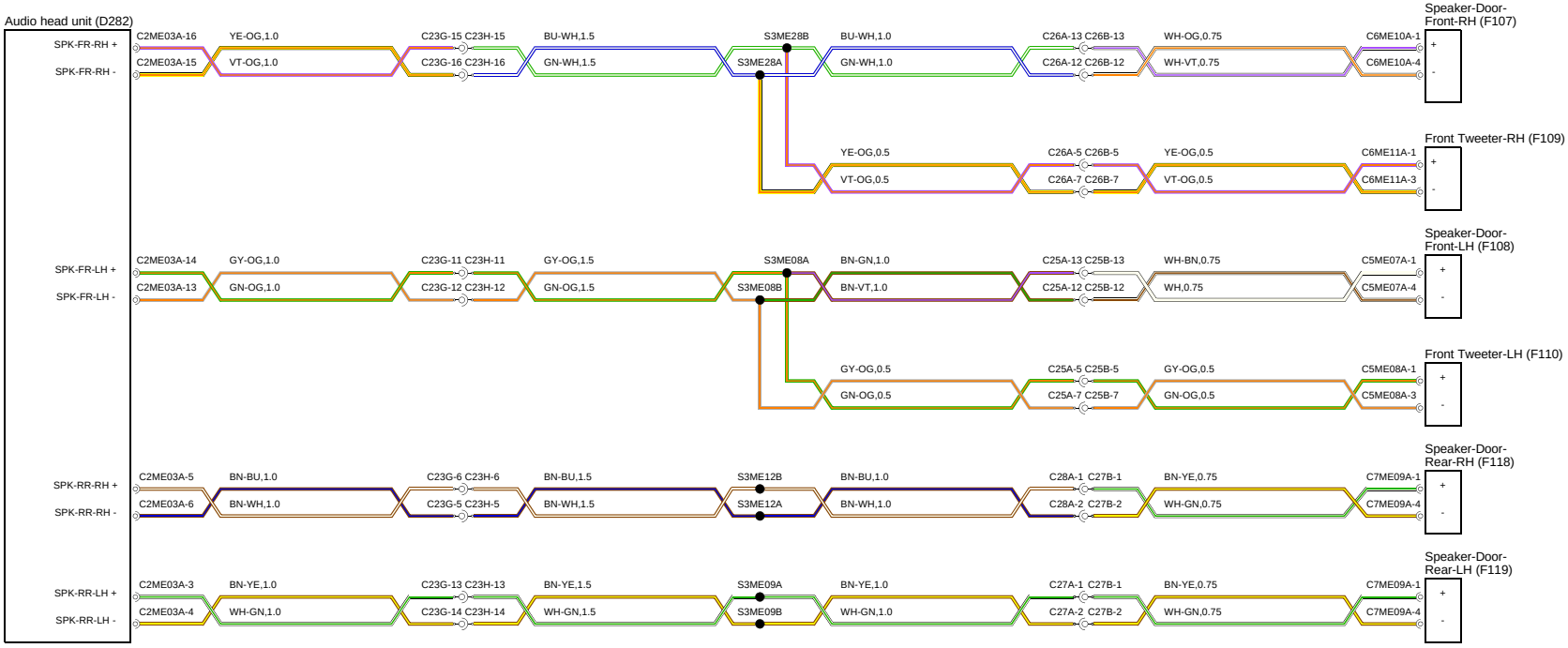

Voice recognition module (D262)
C4MM22A-15 BK-BU,0.75,1145
S4D102B BK-BU,1.5,815
S4D102A BK-BU,4.0,135
G3D102-1
C4MM22A-16 BK-BU,0.75,1145
Navigation system module (D325)
C3MN08A-11 BK-BU,0.5,3035
Module-Tuner-DAB/SDARS (D350)
C4ME43A-2 BK-BU,0.5,3635
Amplifier-power (F142)
C4ME27D-2 BK-BU,4.0,355
Module-Heated seat-Passenger (D409)
C3HS08A-1 BK,1.5,500
C5B1-4 C33P-4 BK-BU,1.5,315
S3D127 BK-BU,6.0,1150
G3D127-1
Switch pack-Seat-Passenger (S392)
C0774-3 BK-GN,2.5D,360
C3025-1 C33P-15 BK-BU,2.50,315
Relay-Power seat-RH (R210)
C0975-86 BK-GN,0.5D,160
C3026-1 C33P-11 BK-BU,1.5,315
BK-BU,2.5,2415
Cigar lighter-Front (J112)
C3DC07A-1 BK-BU,2.5,215
S3D127B BK-BU,2.5,135
C33H-8 C33G-8
Cigar lighter-Rear (J113)
C3DC07B-1 BK-BU,2.5,360
Module-Drivers-door (D253)
C5PL01A-13 BK,1.5,1135
C25B-10 C25A-10 BK,2.5,2115
S3D133 BK,6.0,545
G3D133-1
Module-Rear door-LH (D405)
C7PL01-13 BK,1.5,1050
C27B-10 C27A-10 BK,2.5,2225
Memory control module (D119)
C2381-8 BK-VT,2.5D,435
SJ1 BK-GN,2.5D,100 (MEMORY)
C3025-1 C33N-15 BK,2.5,319
C2381-10 BK-VT,2.5D,435
(NON MEMORY)
Switch-Lumbar-Driver (S389)
C0976-3 BK-VT,1.0D,720
C0976-6 BK-VT,1.0D,720
Pump-Lumbar-Driver (M286)
C0974-2 BK-VT,1.0D,420
Switch pack-Seat-Driver (S391)
C0774-3
BK-GN,2.5D,260 (MEMORY)
BK-GN,2.5D,360
Module-Heated seat-Driver (D408)
C3HS03A-1 BK,1.5,500
C4B1-4 C33N-4 BK,1.5,319
Memory control module (D119)
C2381-11 BK-RD,1.5D,545
C3026-1 C33N-11 BK-GY,1.5,1169
S3D135 BK-GY,1.5,625
G3D135-1
Switch-Mirror (S156)
C5PL22A-3 BK-GY,0.5,1255
C25B-2 C25A-2 BK-GY,0.5,1265
BK-GY,0.5,1408
C2E904-3
Switch-Clutch-TOT (S472)
Sensor-Position-Accelerator pedal (T113)
C2E901-4 BK-GY,0.5,1720
BK-GY,0.5,1360
C2E903-2
Switch-Clutch-BOT (S471)
Switch-Brake diagnostic (S473)
C2CB08-2 BK-GY,0.5,1560
BK-GY,0.75,1315
C3CA15-3
Switch pack-Centre-console (S350)

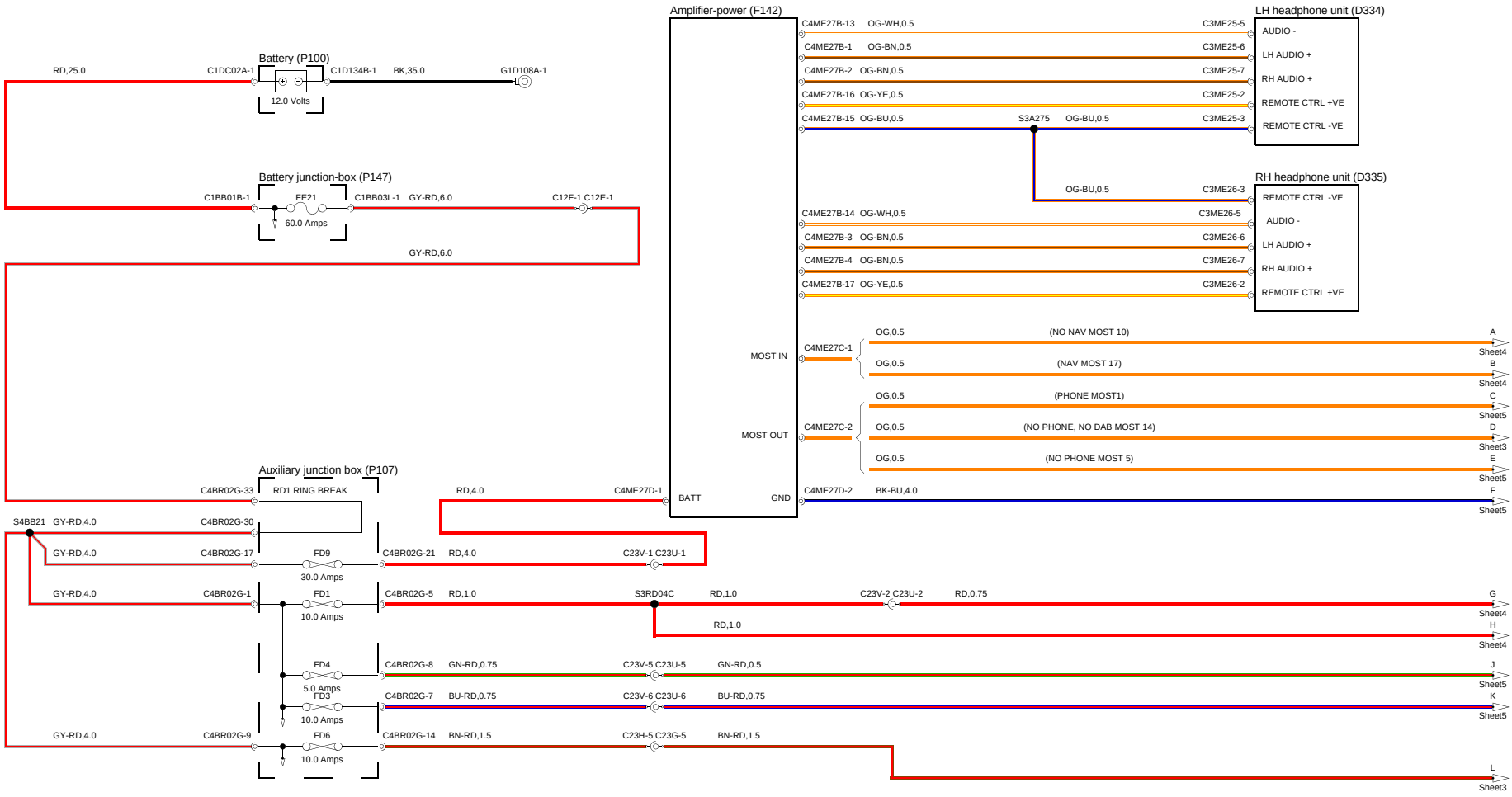

Switch-Passenger-Air bag disable (S426)
C2R224B-5 BK-VT,0.5,1280 S2D134A BK-VT,1.5,318 G3D134-1
Switch pack-Centre facia (S425)
C2PL13-5 BK-VT,0.5,505
Diagnostic socket (V100)
C2DB04-5 BK-VT,0.5,891
Automatic Temperature Control Module (D243)
C2H101D-18 BK-VT,0.75,600
Instrument cluster (D107)
C2MC01A-18 BK-VT,0.5,956
C2MC01A-17 BK-VT,0.5,956
Module-Steering wheel (D407)
C2LS41-1 BK-VT,0.75,265 S2D134B BK-VT,1.0,1026
Start control unit (D391)
C2DC35-2 BK-VT,0.5,1306
Module-Steering column lock (D401)
C2LS41A-3 BK-VT,1.0,946
Gearshift mechanism (D308)
BU,0.50,220 C3ET42-6 BK-VT,0.5,1048
BK-VT,0.5,110 S2D134C BK-VT,0.5,565 C2HP01E-3
Heater-PTC (H137)
C23AF-4 C23AE-4 BK-VT,0.5,553
BK-VT,0.5,245 C2H451-2
Sensor-Temperature-In-car (T164)
BU,0.5,390 S2D134D BU,0.35,580 C2H4XX-2
Sensor-Air quality (T306)
BU,0.35,520 C2H206-3
Intake air door motor (M138)
BU,0.35,550 C2H211-3
RH air temperature door motor (M204)
BU,0.35,250 C2H2XX-3
Face/feet air distribution door motor (M279)
BU,0.35,310 C2H237-3
LH air temperature door motor (M203)
BU,0.35,460 C2H227-3
Screen air distribution door motor (M259)
Lamp-Number plate and-tail door switch (A155)
C4LS04A-2 BK,0.5,335 S4D149D BK-GY,1.5,1975 C44M-5 C44N-5 BK-GY,1.5,995 S4D149A BK-GY,2.5,65 S4D149B BK-GY,6.0,575 G4D149-1
BK-GY,4.0,1090 C44L-2 C44K-2 BK-GY,4.00,2065 G4D149D-1
TAILGATE EARTH RETURN
Motor-Wiper-Rear screen (M106)
C4RW02-3 BK-GY,1.5,185
High mounted stop lamp (A126)
C4LS50A-2 BK-GY,0.75,1390
Motor-CDL-Tailgate-Upper (M255)
C4PL17A-2 BK,1.0,415
Tail lamp unit-LH (A139)
C4LS35A-5 BK-GY,2.5,545
Auxiliary junction box (P107)
C4BR02A-27 BK-GY,1.5,870
Module-Active on-demand coupling (D417)
C3A101-2 BK-GY,1.0,1670
Mat-Belt minder (D358)
C3164-2 WH,0.35,395 C5B6-2 C33P-14 BK-YE,0.5,740 G3D139-1
NOT NAS / NOT AUS
Sensor-Occupancy-detector (T221)
Gold C0962-14 YE-VT,0.5D,450 C2363-1 Gold C33P-17 BK-YE,0.5,740
(NAS ONLY)
G3D174B-1 BK,10.0,1013 G3D174A-1
IP EARTH LINK
Unit-Fuel Tank (D179)
C4E515-3 BK-GY,2.5,2920 (DIESEL)
BK-GY,2.5,605 (PETROL)
G4D149B-1
Module-Fuel-pump driver (D361)
C4E220E-1 BK-GY,2.5,65 S4D149C
Module-Active on-demand coupling (D417)
C3A101-4 BK-GY,1.0,2265 G4D149C-1
Rear window heater element (H100)
C4RD02C-1 BK-GY,4.0,205 G4D149E-1
Tail lamp unit-RH (A140)
C4LS36A-5 BK-BU,2.5,2390 S4D152C BK-BU,2.5,2255 G4D151B-1
Fuel fired booster heater pump (H111)
C3HF03-2 BK-BU,0.75,2265
Parking aid module (D184)
C4MP01A-8 BK-BU,0.75,680 BK-BU,0.75,275 C44X-6 C44Y-6
ECU-Trailer (D221)
C4AT23E-4 BK-BU,0.75,220 S4D152D BK-BU,0.5,385
Relay-Trailer-Socket (R252)
C4AT14-2 BK-BU,0.5,235
G4D101A-1 BK,6.0,155 G4D101B-1
TAILGATE BOND STRAP
TAILGATE SIDE
G1D118A-1 BK,35.0,450 G1D118B-1
SI6 ENGINE EARTH STRAP
BODY SIDE

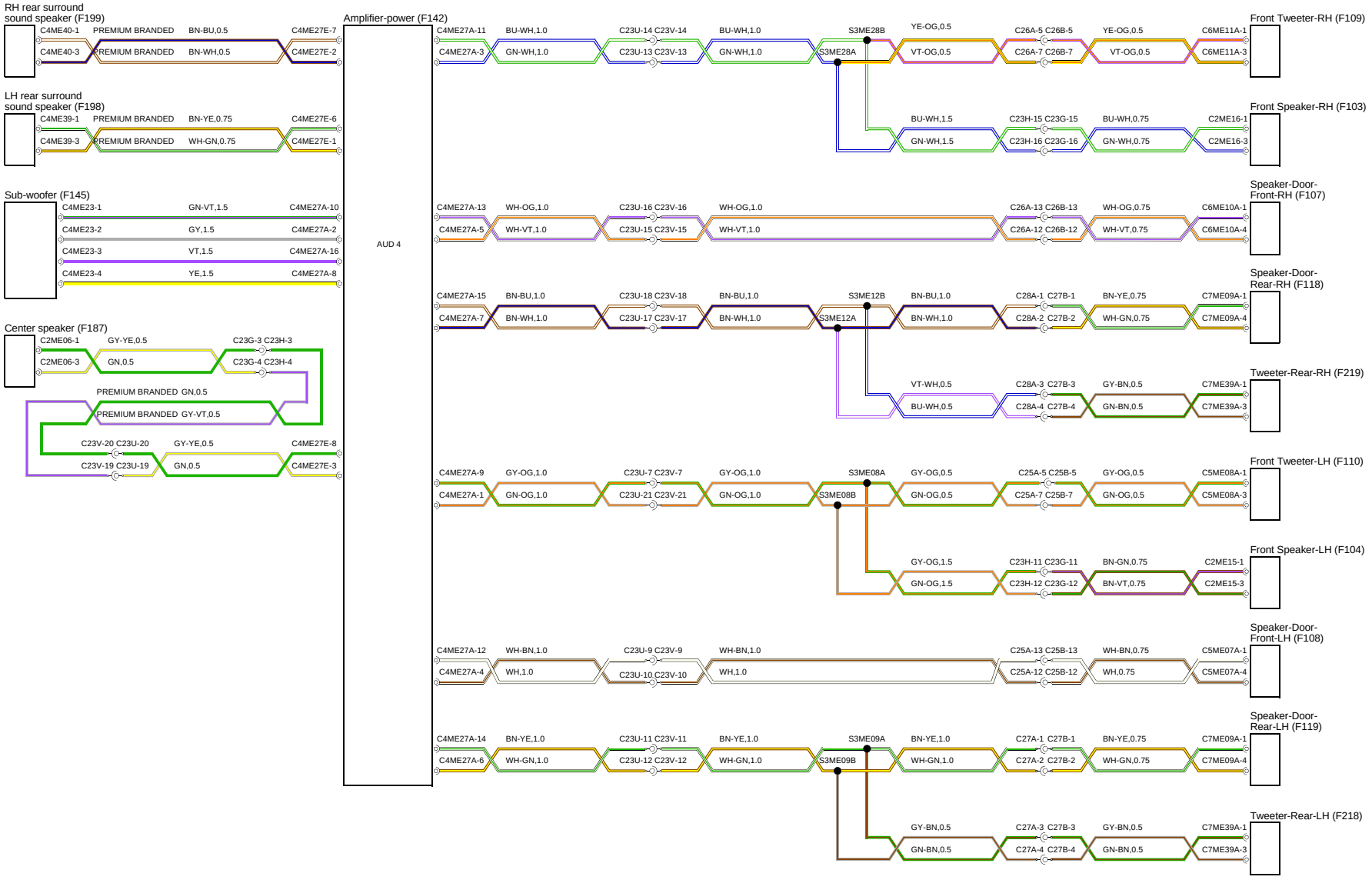

Control unit-Blower-motor-Front (D258)
C2H102-1 BK-YE,6.0,480
S2D139B BK-YE,6.0,758 G6D139-1
Diagnostic socket (V100)
C2DB04-4 BK-YE,0.5,1031 S2D139D BK-YE,1.5,220 S2D139A
BK-YE,2.5,108
BK-YE,1.5,1460 C22C-7 C22D-7
Lamp-Glove compartment (B109)
C2LN15-2 BK-YE,0.5,410
Solenoid-Reverse gear inhibit (N182)
C3ET58-2 BK-YE,0.75,1488
Information and entertainment control module (D371)
C2ME05A-10 BK-YE,0.75,855 (HI-LINE)
Audio head unit (D282)
C2ME03B-12 BK-YE,1.0,840 (LO-LINE)
Touch screen display (D326)
C2MN08A-6 BK-YE,0.75,715
BK-YE,1.5,1460
Mirror-Electrochromic (B179)
C9PM05A-3 BK-YE,0.75,1165 S9D139E BK-YE,1.5,865 C22D-1 C22C-1
Switch-Sun roof (S171)
C9PR40-4 BK-YE,0.5,1445
BK-YE,0.5,2415 C3RT12-1
Module-Intrusion detection (T388)
Roof opening panel control module (D117)
C9PR32A-10 BK-YE,1.5,160 C33S-6 C33R-6 BK-YE,1.5,2605
BK-YE,0.5,1235 C9RW06-2
Sensor-Rain (T204)
Receiver-Radio-frequency (RF) (T203)
C3PL56-2 BK-YE,0.5,2270 S9D139B BK-YE,1.5,1700
Lamp-Interior-Front (B100)
C9LN28B-2 BK-YE,0.75,535
Lamp-Interior-Rear (B104)
C9LN14B-2 BK-YE,0.75,2260
Mirror-Vanity-RH (B153)
C9LN24-3 BK-YE,0.5,350
Mirror-Vanity-LH (B152)
C9LN23-3 BK-YE,0.5,600
Trailer pick-up (P124)
C0500-1 WH,1.5,1795 G4AT22X-1
NAS
Trailer pick-up (P124)
C0499-3 WH,2.5,1340 S4D150C WH,4.0,465 G4AT22-1
C0499-11 WH,2.5,1340
C0499-13 WH,2.5,1340
13 PIN
Trailer pick-up (P124)
C1382-3 WH,2.5,1340
12N
Trailer pick-up (P124)
C1381-3 WH,2.5,1395
C1381-7 WH,2.5,1395
12S

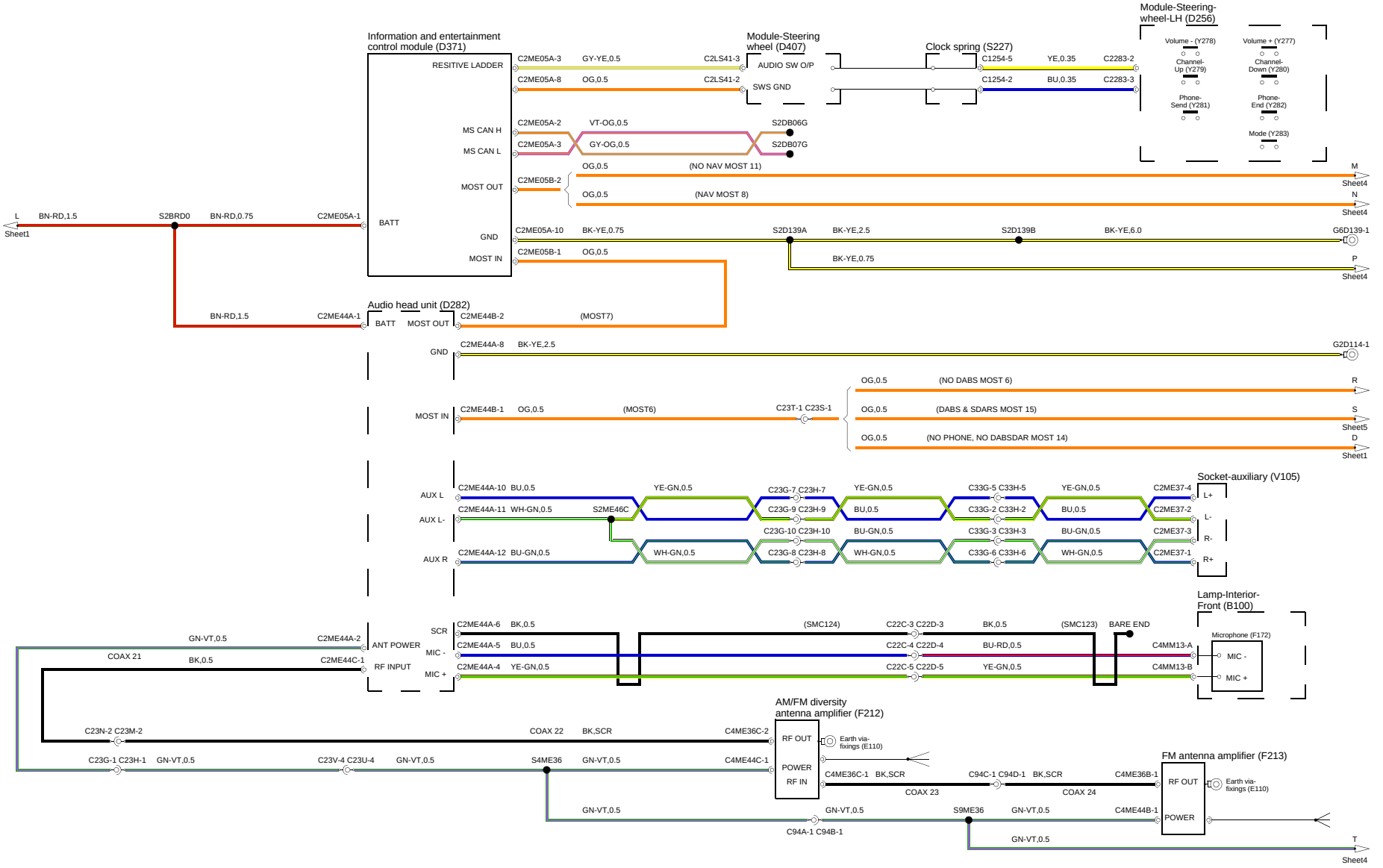

Battery (P100)
RD,35.0 (DIESEL)
RD,35.0 (PETROL)
C1DC02F-1
STARTER FUSE
150.0 Amps
12.0 Volts
C1D134B-1
BK,35.0
G1D108A-1
Starter motor (M101)
S1BF01
RD,35.0
C1DC35A-1
Generator (M100)
C1DC16A-1
B+
LIN
C1DC14-1
BU-BN,0.5
C1E109A-92
Engine control-module (ECM) (D131)
LIN
(PETROL)
S1DB04G
WH,0.5
C1E109B-54
HS CAN H
S1DB05G
WH-BU,0.5
C1E109B-41
HS CAN L
Starter motor (M101)
C1DC35A-1
RD,35.0
Generator (M100)
C1DC16-1
B+
LIN
C1DC14-1
BU-BN,0.75
C1E104H-C2
Engine control-module (ECM) (D131)
LIN
(DIESEL)
S1DB04F
WH,0.5
C1E104H-A2
HS CAN H
S1DB05F
WH-BU,0.5
C1E104H-A1
HS CAN L
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
MS CAN H
C1BP02A-49
VT-OG,0.5
S1DB06F
MS CAN L
C1BP02A-50
GY-OG,0.5
S1DB07F
HS CAN H
C1BP02C-47
WH,0.35
S2DB04J
HS CAN L
C1BP02C-48
WH-BU,0.35
S2DB05J
Instrument cluster (D107)
Ignition/no charge warning indicator (J114)
Resistor-Terminating (G171)
C23F-17 C23E-17
VT-OG,0.5
C2MC01A-16
MS CAN H
C23F-18 C23E-18
GY-OG,0.5
C2MC01A-32
MS CAN L

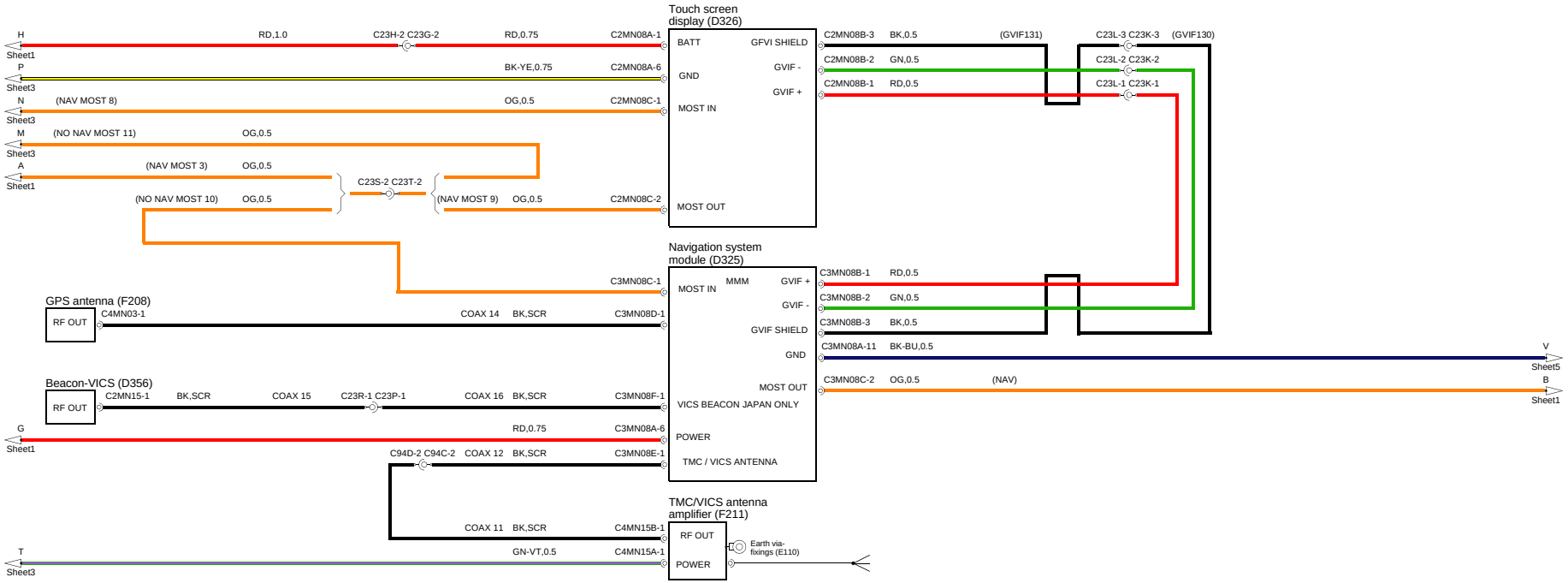

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Junction-box engine (P108)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
Central junction-box (P101)
C1BP02G-1
FS6
C1BP02C-64
BN-RD,1.5
C2ME03A-11
15.0 Amps
Audio head unit (D282)
SWS
GND
VBATT
MS CAN H
MS CAN L
ANTENNA POWER
AUX R
COAX
AUX GND
POWER GND
AUX L
DIAGNOSTIC GND
Module-Steering wheel (D407)
AUDIO SW O/P
SWS GND
Clock spring (S227)
Module-Steering-wheel-LH (D256)
Volume - (Y278)
Volume + (Y277)
Channel-Up (Y279)
Channel-Down (Y280)
Phone-Send (Y281)
Phone-End (Y282)
Mode (Y283)
C2ME03A-18
GY-YE,0.5
C2LS41-3
C2ME03A-7
OG,0.5
C2LS41-2
C1254-5
YE,0.35
C2283-2
C1254-2
BU,0.35
C2283-3
C2ME03A-9
VT-OG,0.5
S2DB06G
C2ME03A-10
GY-OG,0.5
S2DB07G
AM/FM antenna (F206)
C2ME03A-12
GN-VT,0.5
C23G-1 C23H-1
C4ME44A-1
C2ME03C-1
BK,0.5
(COAX2)
C23N-1 C23M-1
(COAX3)
BK,SCR
C4ME36A-1
COAX
Earth via fixings (E110)
WH-GN,0.5
C2ME03B-7
BU-GN,0.5
S2ME46
YE-GN,0.5
C2ME03B-6
BU,0.5
YE-GN,0.5
C2ME03B-8
C2ME03A-1
BK-YE,1.5
G2D114-1
C2ME03B-12
BK-YE,1.0
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
Socket-auxiliary (V105)
C23G-7 C23H-7
YE-GN,0.5
C33G-5 C33H-5
C2ME37-4
L+
C23G-9 C23H-9
BU,0.5
C33G-2 C33H-2
C2ME37-2
L-
C23G-10 C23H-10
BU-GN,0.5
C33G-3 C33H-3
C2ME37-3
R-
C23G-8 C23H-8
WH-GN,0.5
C33G-6 C33H-6
C2ME37-1
R+

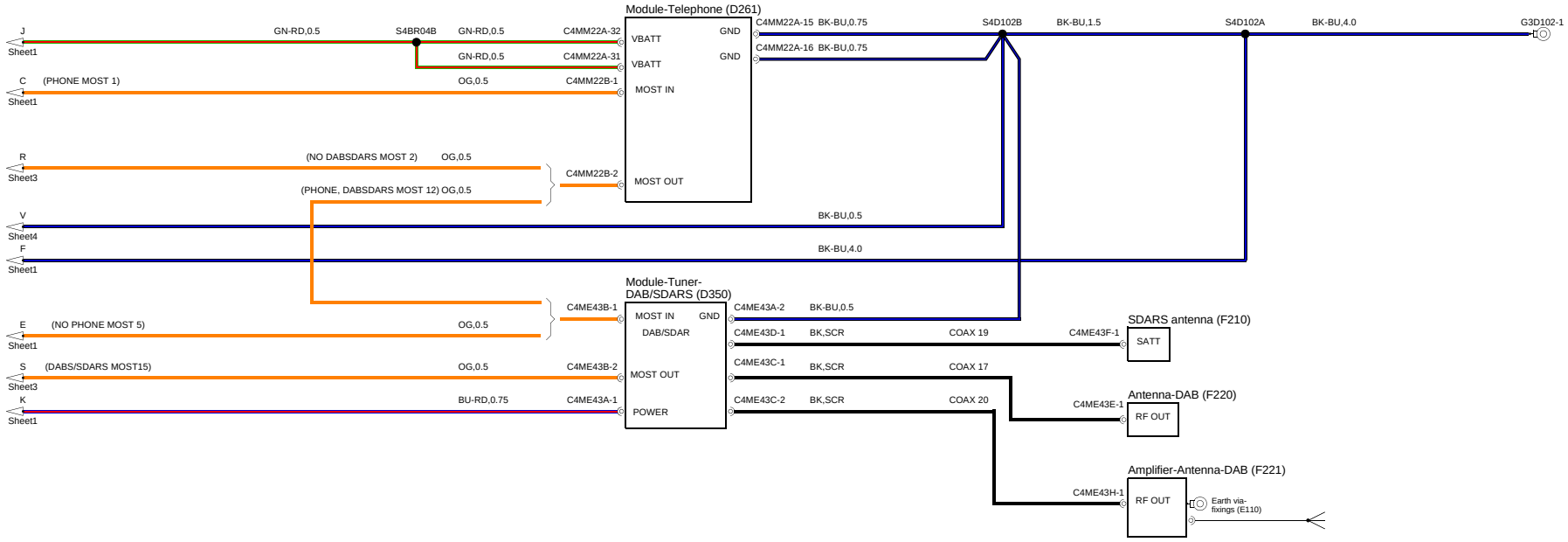

Audio head unit (D282)
SPK-FR-RH +
SPK-FR-RH -
C2ME03A-16
C2ME03A-15
YE-OG,1.0
VT-OG,1.0
C23G-15 C23H-15
C23G-16 C23H-16
BU-WH,1.5
GN-WH,1.5
S3ME28B
S3ME28A
BU-WH,1.0
GN-WH,1.0
C26A-13 C26B-13
C26A-12 C26B-12
WH-OG,0.75
WH-VT,0.75
C6ME10A-1
C6ME10A-4
Speaker-Door-Front-RH (F107)
YE-OG,0.5
VT-OG,0.5
C26A-5 C26B-5
C26A-7 C26B-7
YE-OG,0.5
VT-OG,0.5
C6ME11A-1
C6ME11A-3
Front Tweeter-RH (F109)
SPK-FR-LH +
SPK-FR-LH -
C2ME03A-14
C2ME03A-13
GY-OG,1.0
GN-OG,1.0
C23G-11 C23H-11
C23G-12 C23H-12
GY-OG,1.5
GN-OG,1.5
S3ME08A
S3ME08B
BN-GN,1.0
BN-VT,1.0
C25A-13 C25B-13
C25A-12 C25B-12
WH-BN,0.75
WH,0.75
C5ME07A-1
C5ME07A-4
Speaker-Door-Front-LH (F108)
GY-OG,0.5
GN-OG,0.5
C25A-5 C25B-5
C25A-7 C25B-7
GY-OG,0.5
GN-OG,0.5
C5ME08A-1
C5ME08A-3
Front Tweeter-LH (F110)
SPK-RR-RH +
SPK-RR-RH -
C2ME03A-5
C2ME03A-6
BN-BU,1.0
BN-WH,1.0
C23G-6 C23H-6
C23G-5 C23H-5
BN-BU,1.5
BN-WH,1.5
S3ME12B
S3ME12A
BN-BU,1.0
BN-WH,1.0
C28A-1 C27B-1
C28A-2 C27B-2
BN-YE,0.75
WH-GN,0.75
C7ME09A-1
C7ME09A-4
Speaker-Door-Rear-RH (F118)
SPK-RR-LH +
SPK-RR-LH -
C2ME03A-3
C2ME03A-4
BN-YE,1.0
WH-GN,1.0
C23G-13 C23H-13
C23G-14 C23H-14
BN-YE,1.5
WH-GN,1.5
S3ME09A
S3ME09B
BN-YE,1.0
WH-GN,1.0
C27A-1 C27B-1
C27A-2 C27B-2
BN-YE,0.75
WH-GN,0.75
C7ME09A-1
C7ME09A-4
Speaker-Door-Rear-LH (F119)

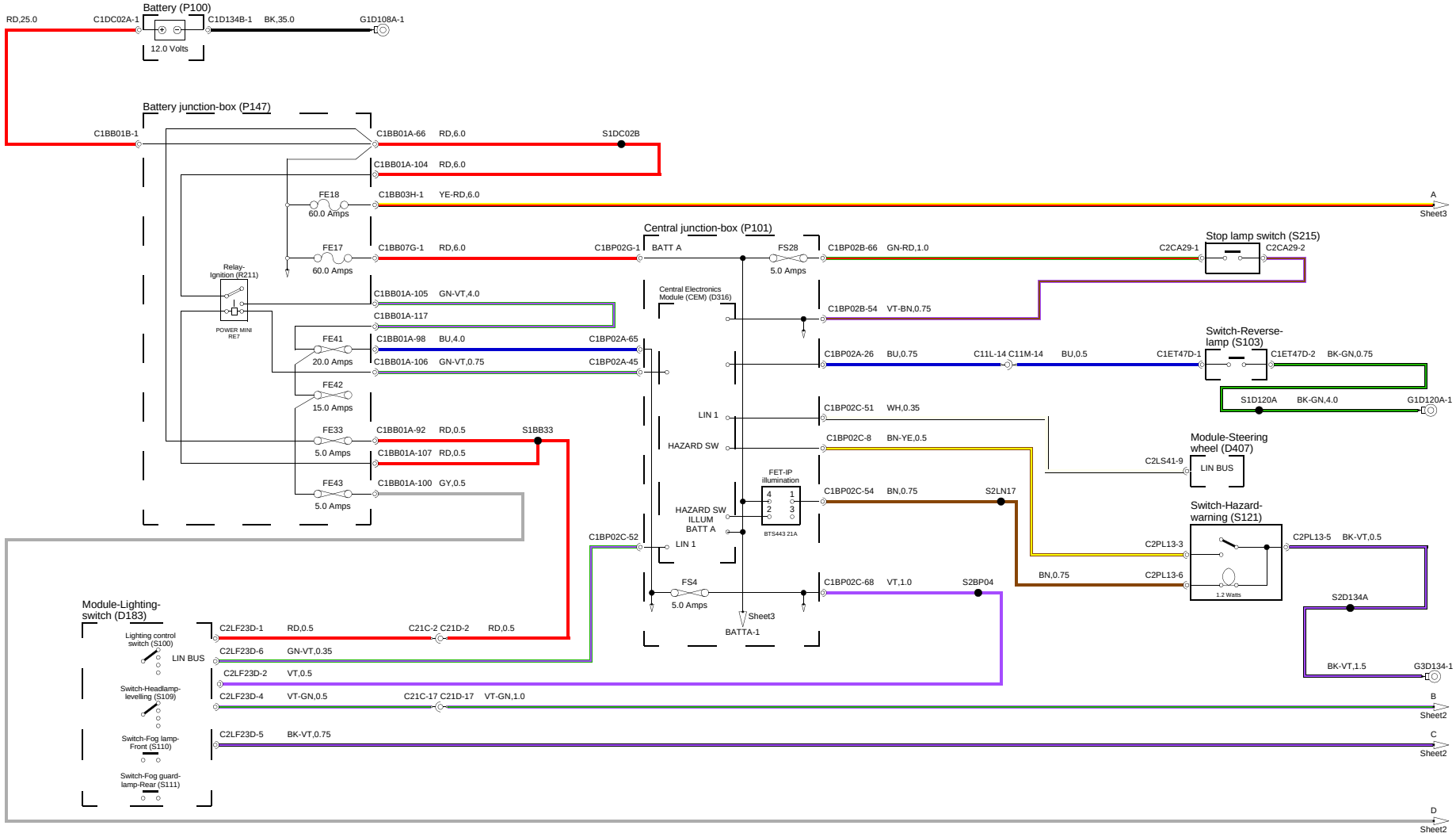

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE21
C1BB03L-1
GY-RD,6.0
C12F-1 C12E-1
60.0 Amps
GY-RD,6.0
Auxiliary junction box (P107)
C4BR02G-33
RD1 RING BREAK
RD,4.0
C4ME27D-1
S4BB21
GY-RD,4.0
C4BR02G-30
GY-RD,4.0
C4BR02G-17
FD9
30.0 Amps
C4BR02G-21
RD,4.0
C23V-1 C23U-1
GY-RD,4.0
C4BR02G-1
FD1
10.0 Amps
C4BR02G-5
RD,1.0
S3RD04C
RD,1.0
C23V-2 C23U-2
RD,0.75
G
Sheet4
RD,1.0
H
Sheet4
FD4
5.0 Amps
C4BR02G-8
GN-RD,0.75
C23V-5 C23U-5
GN-RD,0.5
J
Sheet5
FD3
10.0 Amps
C4BR02G-7
BU-RD,0.75
C23V-6 C23U-6
BU-RD,0.75
K
Sheet5
GY-RD,4.0
C4BR02G-9
FD6
10.0 Amps
C4BR02G-14
BN-RD,1.5
C23H-5 C23G-5
BN-RD,1.5
L
Sheet3
Amplifier-power (F142)
BATT
GND
C4ME27D-2
BK-BU,4.0
F
Sheet5
MOST IN
C4ME27C-1
OG,0.5
(NO NAV MOST 10)
A
Sheet4
OG,0.5
(NAV MOST 17)
B
Sheet4
MOST OUT
C4ME27C-2
OG,0.5
(PHONE MOST1)
C
Sheet5
OG,0.5
(NO PHONE, NO DAB MOST 14)
D
Sheet3
OG,0.5
(NO PHONE MOST 5)
E
Sheet5
C4ME27B-13 OG-WH,0.5
C3ME25-5
C4ME27B-1 OG-BN,0.5
C3ME25-6
C4ME27B-2 OG-BN,0.5
C3ME25-7
C4ME27B-16 OG-YE,0.5
C3ME25-2
C4ME27B-15 OG-BU,0.5
S3A275
OG-BU,0.5
C3ME25-3
LH headphone unit (D334)
AUDIO -
LH AUDIO +
RH AUDIO +
REMOTE CTRL +VE
REMOTE CTRL -VE
OG-BU,0.5
C3ME26-3
C4ME27B-14 OG-WH,0.5
C3ME26-5
C4ME27B-3 OG-BN,0.5
C3ME26-6
C4ME27B-4 OG-BN,0.5
C3ME26-7
C4ME27B-17 OG-YE,0.5
C3ME26-2
RH headphone unit (D335)
REMOTE CTRL -VE
AUDIO -
LH AUDIO +
RH AUDIO +
REMOTE CTRL +VE

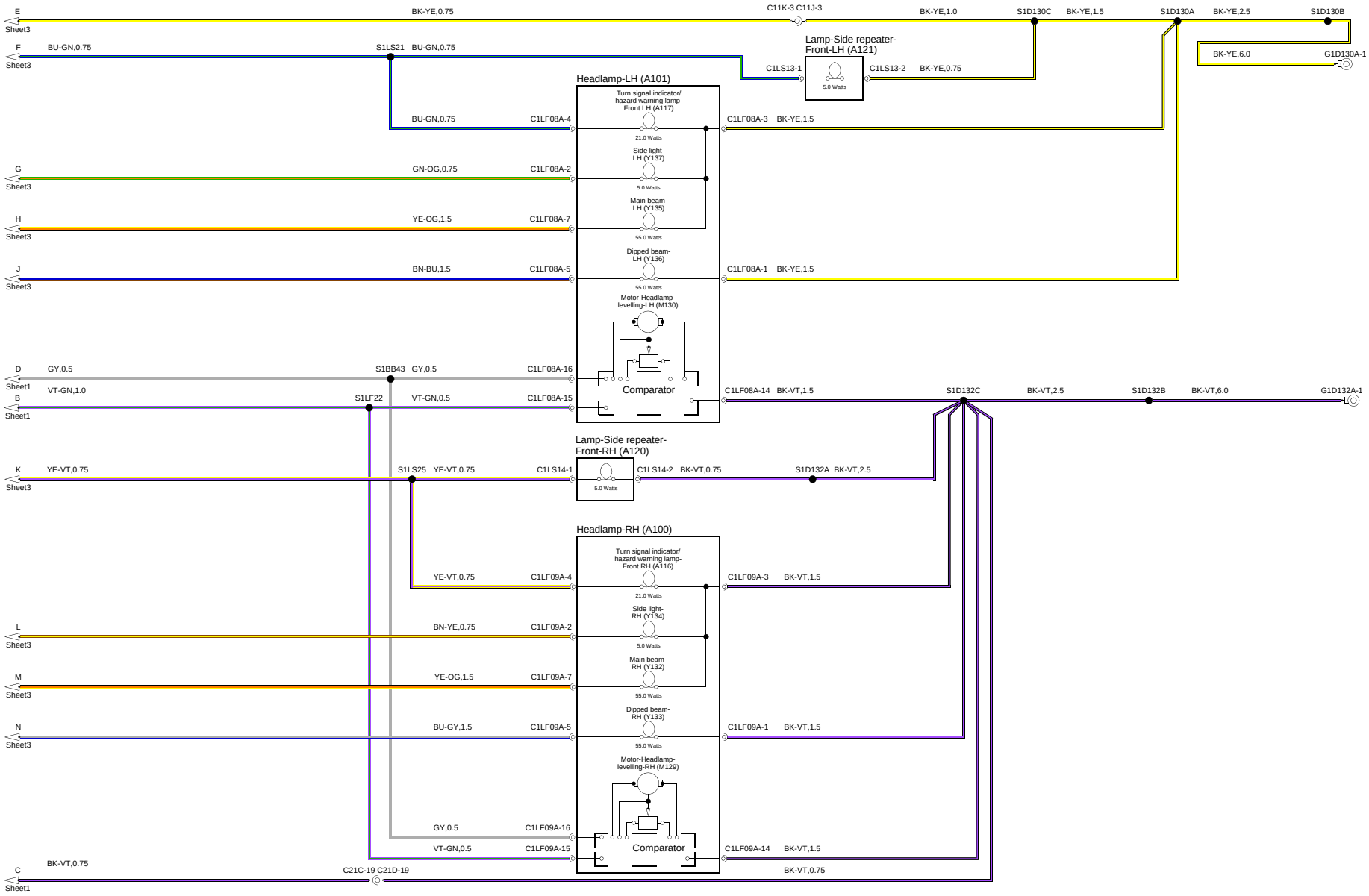

RH rear surround sound speaker (F199)
C4ME40-1 PREMIUM BRANDED BN-BU,0.5 C4ME27E-7
C4ME40-3 PREMIUM BRANDED BN-WH,0.5 C4ME27E-2
LH rear surround sound speaker (F198)
C4ME39-1 PREMIUM BRANDED BN-YE,0.75 C4ME27E-6
C4ME39-3 PREMIUM BRANDED WH-GN,0.75 C4ME27E-1
Sub-woofer (F145)
C4ME23-1 GN-VT,1.5 C4ME27A-10
C4ME23-2 GY,1.5 C4ME27A-2
C4ME23-3 VT,1.5 C4ME27A-16
C4ME23-4 YE,1.5 C4ME27A-8
Center speaker (F187)
C2ME06-1 GY-YE,0.5 C23G-3 C23H-3
C2ME06-3 GN,0.5 C23G-4 C23H-4
PREMIUM BRANDED GN,0.5
PREMIUM BRANDED GY-VT,0.5
C23V-20 C23U-20 GY-YE,0.5 C4ME27E-8
C23V-19 C23U-19 GN,0.5 C4ME27E-3
Amplifier-power (F142)
AUD 4
C4ME27A-11 BU-WH,1.0 C23U-14 C23V-14 BU-WH,1.0 S3ME28B YE-OG,0.5 C26A-5 C26B-5 YE-OG,0.5 C6ME11A-1
C4ME27A-3 GN-WH,1.0 C23U-13 C23V-13 GN-WH,1.0 S3ME28A VT-OG,0.5 C26A-7 C26B-7 VT-OG,0.5 C6ME11A-3
Front Tweeter-RH (F109)
BU-WH,1.5 C23H-15 C23G-15 BU-WH,0.75 C2ME16-1
GN-WH,1.5 C23H-16 C23G-16 GN-WH,0.75 C2ME16-3
Front Speaker-RH (F103)
C4ME27A-13 WH-OG,1.0 C23U-16 C23V-16 WH-OG,1.0 C26A-13 C26B-13 WH-OG,0.75 C6ME10A-1
C4ME27A-5 WH-VT,1.0 C23U-15 C23V-15 WH-VT,1.0 C26A-12 C26B-12 WH-VT,0.75 C6ME10A-4
Speaker-Door-Front-RH (F107)
C4ME27A-15 BN-BU,1.0 C23U-18 C23V-18 BN-BU,1.0 S3ME12B BN-BU,1.0 C28A-1 C27B-1 BN-YE,0.75 C7ME09A-1
C4ME27A-7 BN-WH,1.0 C23U-17 C23V-17 BN-WH,1.0 S3ME12A BN-WH,1.0 C28A-2 C27B-2 WH-GN,0.75 C7ME09A-4
Speaker-Door-Rear-RH (F118)
VT-WH,0.5 C28A-3 C27B-3 GY-BN,0.5 C7ME39A-1
BU-WH,0.5 C28A-4 C27B-4 GN-BN,0.5 C7ME39A-3
Tweeter-Rear-RH (F219)
C4ME27A-9 GY-OG,1.0 C23U-7 C23V-7 GY-OG,1.0 S3ME08A GY-OG,0.5 C25A-5 C25B-5 GY-OG,0.5 C5ME08A-1
C4ME27A-1 GN-OG,1.0 C23U-21 C23V-21 GN-OG,1.0 S3ME08B GN-OG,0.5 C25A-7 C25B-7 GN-OG,0.5 C5ME08A-3
Front Tweeter-LH (F110)
GY-OG,1.5 C23H-11 C23G-11 BN-GN,0.75 C2ME15-1
GN-OG,1.5 C23H-12 C23G-12 BN-VT,0.75 C2ME15-3
Front Speaker-LH (F104)
C4ME27A-12 WH-BN,1.0 C23U-9 C23V-9 WH-BN,1.0 C25A-13 C25B-13 WH-BN,0.75 C5ME07A-1
C4ME27A-4 WH,1.0 C23U-10 C23V-10 WH,1.0 C25A-12 C25B-12 WH,0.75 C5ME07A-4
Speaker-Door-Front-LH (F108)
C4ME27A-14 BN-YE,1.0 C23U-11 C23V-11 BN-YE,1.0 S3ME09A BN-YE,1.0 C27A-1 C27B-1 BN-YE,0.75 C7ME09A-1
C4ME27A-6 WH-GN,1.0 C23U-12 C23V-12 WH-GN,1.0 S3ME09B WH-GN,1.0 C27A-2 C27B-2 WH-GN,0.75 C7ME09A-4
Speaker-Door-Rear-LH (F119)
GY-BN,0.5 C27A-3 C27B-3 GY-BN,0.5 C7ME39A-1
GN-BN,0.5 C27A-4 C27B-4 GN-BN,0.5 C7ME39A-3
Tweeter-Rear-LH (F218)

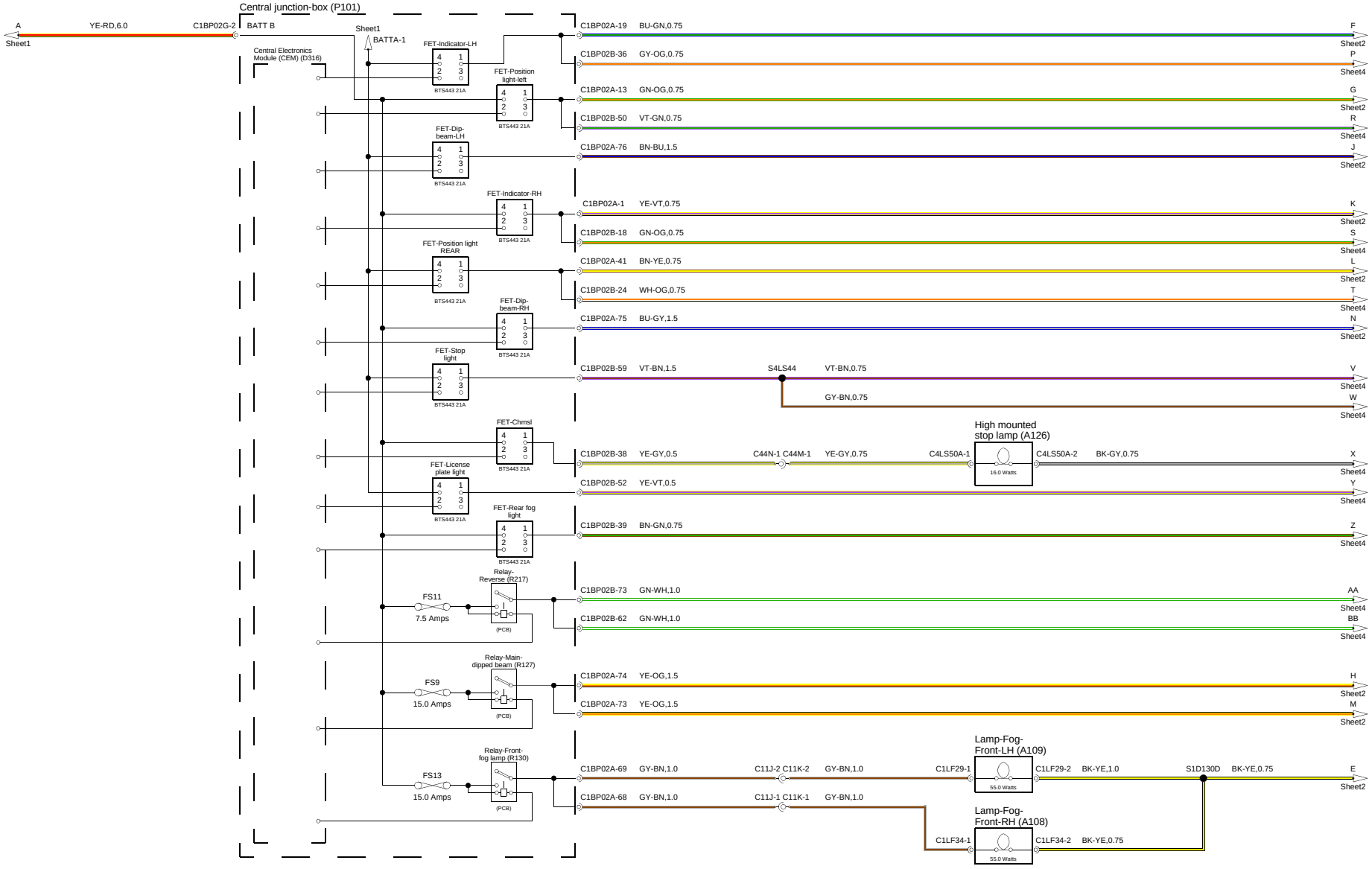

Information and entertainment control module (D371)
RESITIVE LADDER
MS CAN H
MS CAN L
MOST OUT
BATT
GND
MOST IN
Module-Steering wheel (D407)
AUDIO SW O/P
SWS GND
Clock spring (S227)
Module-Steering-wheel-LH (D256)
Volume - (Y278)
Volume + (Y277)
Channel-Up (Y279)
Channel-Down (Y280)
Phone-Send (Y281)
Phone-End (Y282)
Mode (Y283)
C2ME05A-3 GY-YE,0.5 C2LS41-3
C2ME05A-8 OG,0.5 C2LS41-2
C1254-5 YE,0.35 C2283-2
C1254-2 BU,0.35 C2283-3
C2ME05A-2 VT-OG,0.5 S2DB06G
C2ME05A-3 GY-OG,0.5 S2DB07G
C2ME05B-2
OG,0.5 (NO NAV MOST 11) M Sheet4
OG,0.5 (NAV MOST 8) N Sheet4
L BN-RD,1.5 S2BRD0 BN-RD,0.75 C2ME05A-1 Sheet1
C2ME05A-10 BK-YE,0.75 S2D139A BK-YE,2.5 S2D139B BK-YE,6.0 G6D139-1
BK-YE,0.75 P Sheet4
C2ME05B-1 OG,0.5
Audio head unit (D282)
BN-RD,1.5 C2ME44A-1 BATT MOST OUT C2ME44B-2 (MOST7)
GND C2ME44A-8 BK-YE,2.5 G2D114-1
MOST IN C2ME44B-1 OG,0.5 (MOST6) C23T-1 C23S-1
OG,0.5 (NO DABS MOST 6) R
OG,0.5 (DABS & SDARS MOST 15) S Sheet5
OG,0.5 (NO PHONE, NO DABSDAR MOST 14) D Sheet1
Socket-auxiliary (V105)
AUX L C2ME44A-10 BU,0.5 YE-GN,0.5 C23G-7 C23H-7 YE-GN,0.5 C33G-5 C33H-5 YE-GN,0.5 C2ME37-4 L+
AUX L- C2ME44A-11 WH-GN,0.5 S2ME46C YE-GN,0.5 C23G-9 C23H-9 BU,0.5 C33G-2 C33H-2 BU,0.5 C2ME37-2 L-
C23G-10 C23H-10 BU-GN,0.5 C33G-3 C33H-3 BU-GN,0.5 C2ME37-3 R-
AUX R C2ME44A-12 BU-GN,0.5 WH-GN,0.5 C23G-8 C23H-8 WH-GN,0.5 C33G-6 C33H-6 WH-GN,0.5 C2ME37-1 R+
Lamp-Interior-Front (B100)
SCR C2ME44A-6 BK,0.5 (SMC124) C22C-3 C22D-3 BK,0.5 (SMC123) BARE END
MIC - C2ME44A-5 BU,0.5 C22C-4 C22D-4 BU-RD,0.5 C4MM13-A
MIC + C2ME44A-4 YE-GN,0.5 C22C-5 C22D-5 YE-GN,0.5 C4MM13-B
Microphone (F172)
MIC -
MIC +
GN-VT,0.5 C2ME44A-2 ANT POWER
COAX 21 BK,0.5 C2ME44C-1 RF INPUT
AM/FM diversity antenna amplifier (F212)
C23N-2 C23M-2 COAX 22 BK,SCR C4ME36C-2
RF OUT
Earth via-fixings (E110)
C23G-1 C23H-1 GN-VT,0.5 C23V-4 C23U-4 GN-VT,0.5 S4ME36 GN-VT,0.5 C4ME44C-1
POWER
RF IN
C4ME36C-1 BK,SCR COAX 23 C94C-1 C94D-1 BK,SCR COAX 24 C4ME36B-1
FM antenna amplifier (F213)
RF OUT
Earth via-fixings (E110)
GN-VT,0.5 GN-VT,0.5 C94A-1 C94B-1 S9ME36 GN-VT,0.5 C4ME44B-1
POWER
GN-VT,0.5 T Sheet4

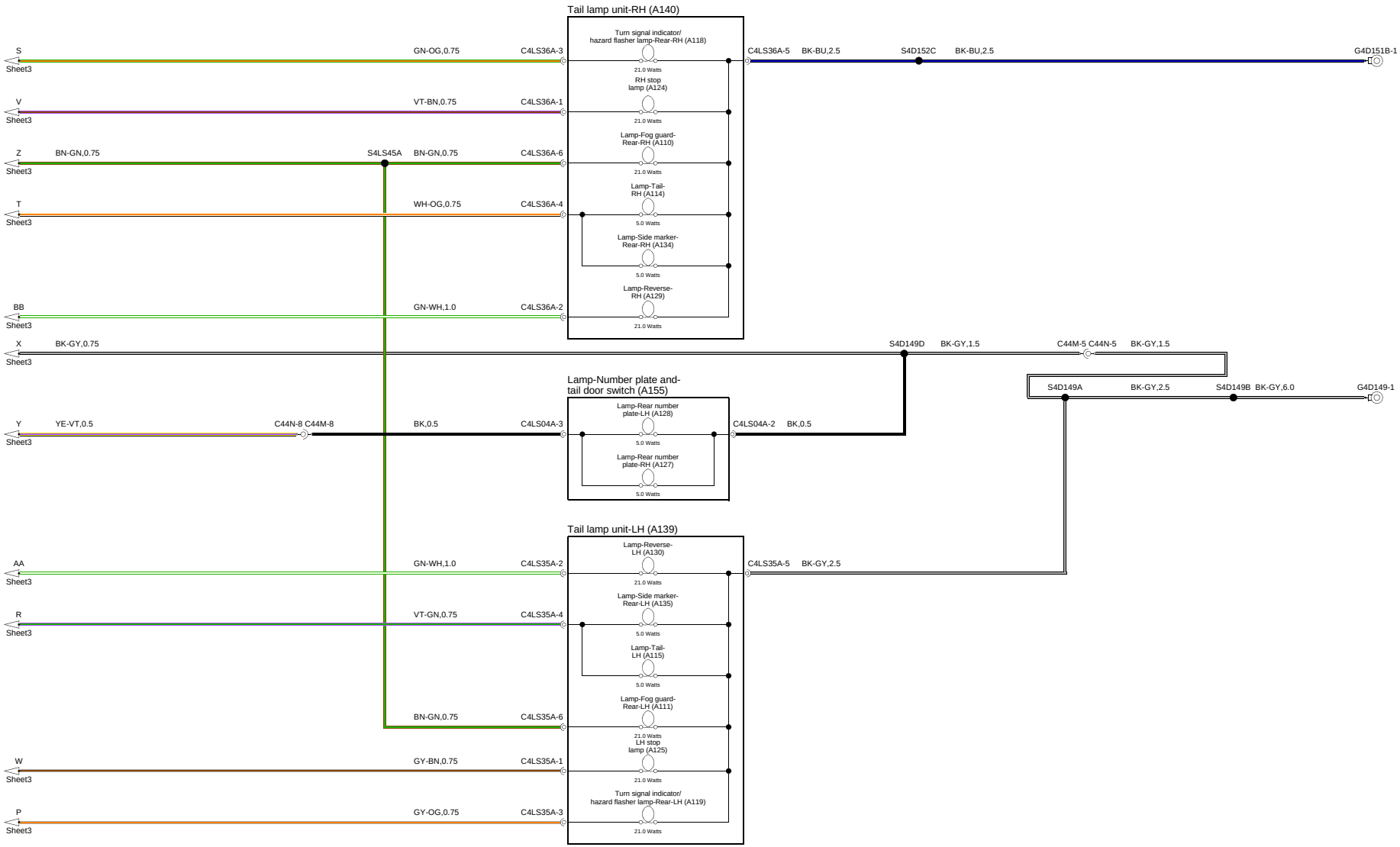

Touch screen display (D326)
BATT
GFVI SHIELD
GND
GVIF -
GVIF +
MOST IN
MOST OUT
Navigation system module (D325)
MOST IN
MMM
GVIF +
GVIF -
GVIF SHIELD
GND
MOST OUT
VICS BEACON JAPAN ONLY
POWER
TMC / VICS ANTENNA
GPS antenna (F208)
RF OUT
Beacon-VICS (D356)
RF OUT
TMC/VICS antenna amplifier (F211)
RF OUT
POWER
Earth via-fixings (E110)
H
Sheet1
P
Sheet3
N
Sheet3
M
Sheet3
A
Sheet1
G
Sheet1
T
Sheet3
V
Sheet5
B
Sheet1
RD,1.0
C23H-2 C23G-2
RD,0.75
C2MN08A-1
BK-YE,0.75
C2MN08A-6
(NAV MOST 8)
OG,0.5
C2MN08C-1
(NO NAV MOST 11)
OG,0.5
(NAV MOST 3)
OG,0.5
C23S-2 C23T-2
(NO NAV MOST 10)
OG,0.5
(NAV MOST 9)
OG,0.5
C2MN08C-2
C3MN08C-1
C4MN03-1
COAX 14
BK,SCR
C3MN08D-1
C2MN15-1
BK,SCR
COAX 15
C23R-1 C23P-1
COAX 16
BK,SCR
C3MN08F-1
RD,0.75
C3MN08A-6
C94D-2 C94C-2
COAX 12
BK,SCR
C3MN08E-1
COAX 11
BK,SCR
C4MN15B-1
GN-VT,0.5
C4MN15A-1
C2MN08B-3
BK,0.5
(GVIF131)
C23L-3 C23K-3
(GVIF130)
C2MN08B-2
GN,0.5
C23L-2 C23K-2
C2MN08B-1
RD,0.5
C23L-1 C23K-1
C3MN08B-1
RD,0.5
C3MN08B-2
GN,0.5
C3MN08B-3
BK,0.5
C3MN08A-11
BK-BU,0.5
C3MN08C-2
OG,0.5
(NAV)

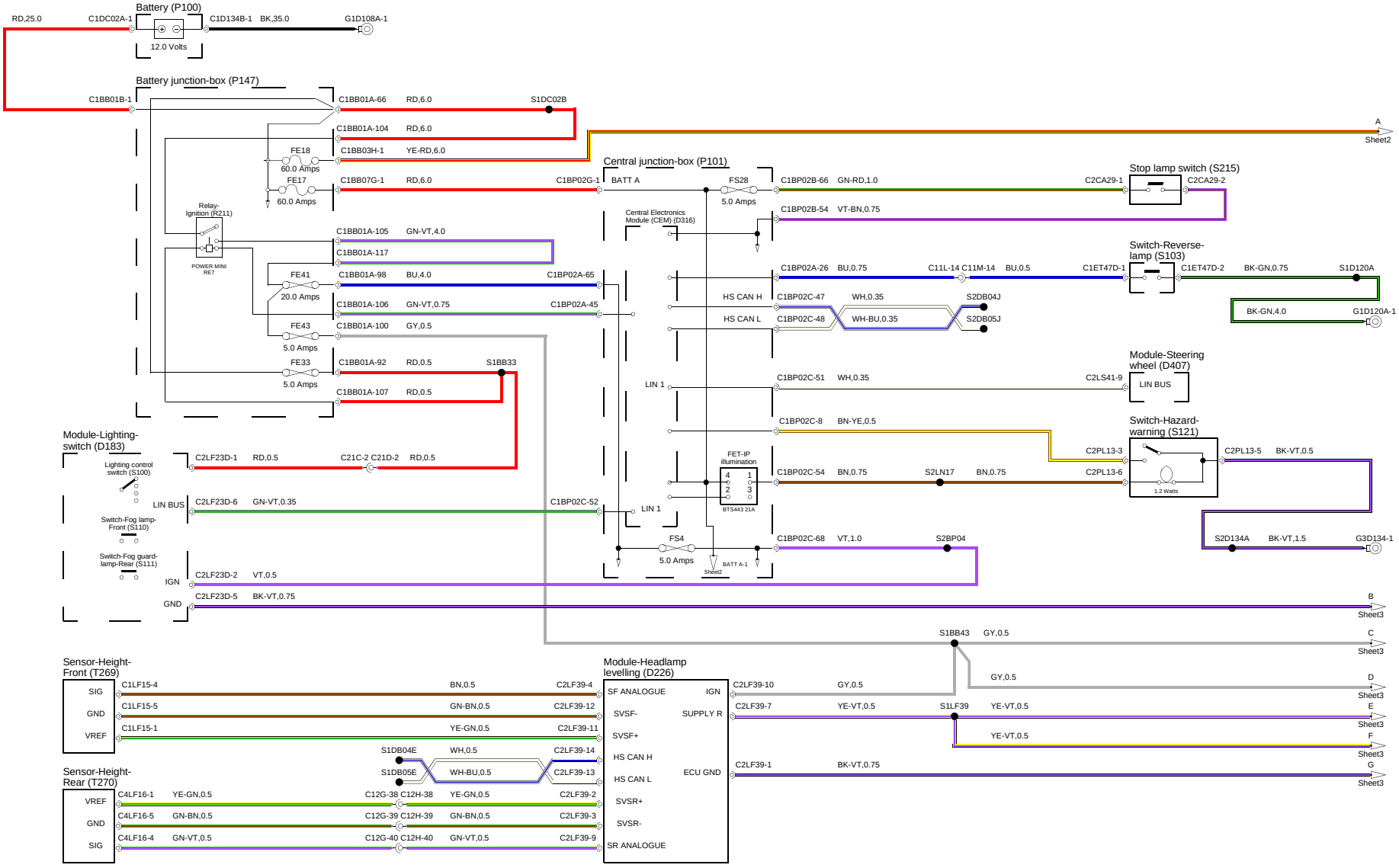

Module-Telephone (D261)
J
Sheet1
GN-RD,0.5
S4BR04B
GN-RD,0.5
C4MM22A-32
GN-RD,0.5
C4MM22A-31
VBATT
VBATT
GND
GND
C4MM22A-15 BK-BU,0.75
C4MM22A-16 BK-BU,0.75
S4D102B
BK-BU,1.5
S4D102A
BK-BU,4.0
G3D102-1
C
Sheet1
(PHONE MOST 1)
OG,0.5
C4MM22B-1
MOST IN
R
Sheet3
(NO DABSDARS MOST 2)
OG,0.5
C4MM22B-2
(PHONE, DABSDARS MOST 12) OG,0.5
MOST OUT
V
Sheet4
BK-BU,0.5
F
Sheet1
BK-BU,4.0
Module-Tuner-
DAB/SDARS (D350)
C4ME43B-1
E
Sheet1
(NO PHONE MOST 5)
OG,0.5
MOST IN
GND
DAB/SDAR
C4ME43A-2
BK-BU,0.5
C4ME43D-1
BK,SCR
COAX 19
C4ME43F-1
SDARS antenna (F210)
SATT
S
Sheet3
(DABS/SDARS MOST15)
OG,0.5
C4ME43B-2
MOST OUT
C4ME43C-1
BK,SCR
COAX 17
K
Sheet1
BU-RD,0.75
C4ME43A-1
POWER
C4ME43C-2
BK,SCR
COAX 20
C4ME43E-1
Antenna-DAB (F220)
RF OUT
Amplifier-Antenna-DAB (F221)
C4ME43H-1
RF OUT
Earth via-
fixings (E110)

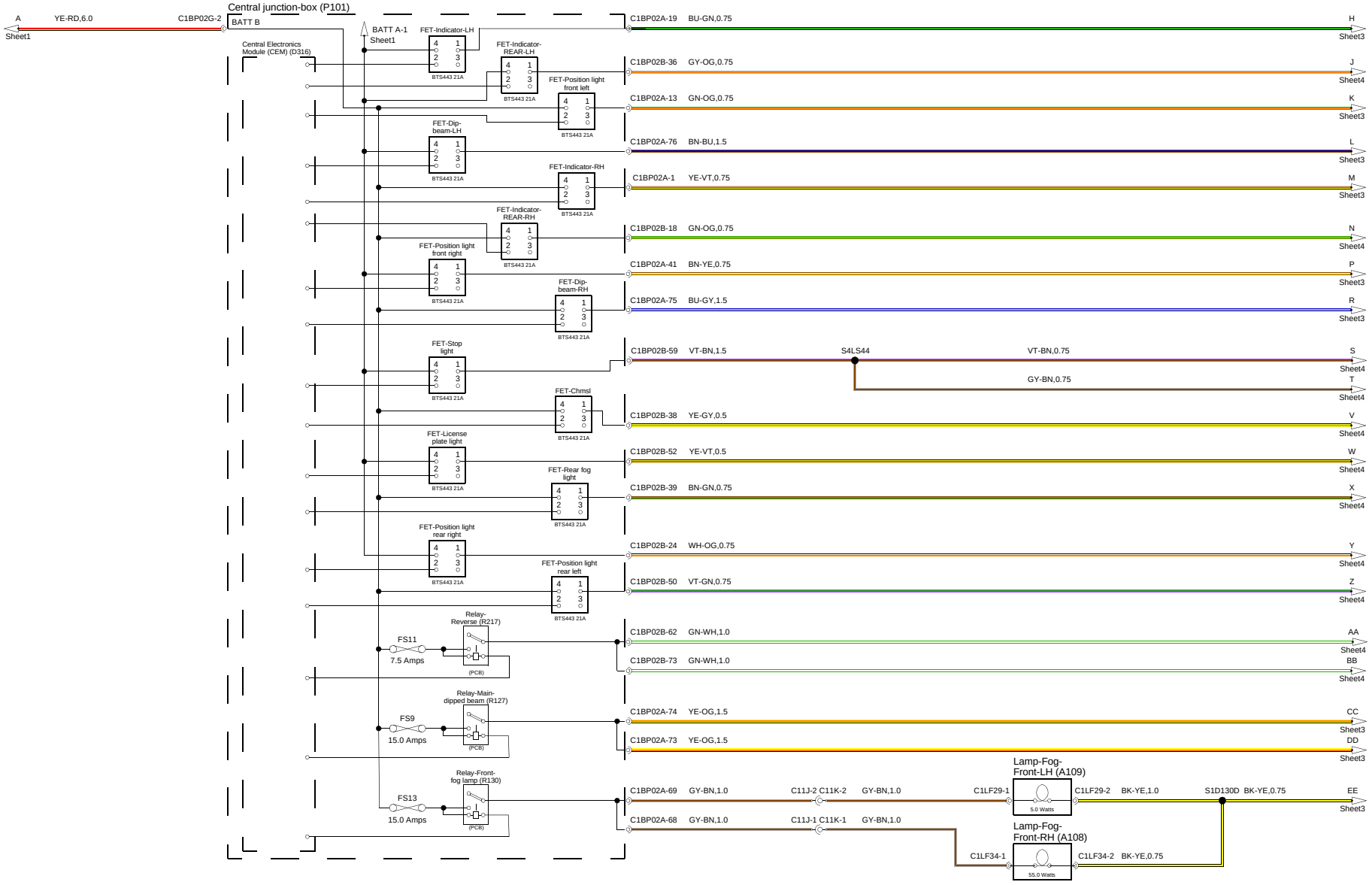

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
C1BB01A-66
RD,6.0
S1DC02B
C1BB01A-104
RD,6.0
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0
A
Sheet3
Central junction-box (P101)
FE17
60.0 Amps
C1BB07G-1
RD,6.0
C1BP02G-1
BATT A
FS28
5.0 Amps
C1BP02B-66
GN-RD,1.0
C2CA29-1
Stop lamp switch (S215)
C2CA29-2
Relay-Ignition (R211)
POWER MINI RE7
C1BB01A-105
GN-VT,4.0
C1BB01A-117
Central Electronics Module (CEM) (D316)
C1BP02B-54
VT-BN,0.75
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BP02A-65
C1BB01A-106
GN-VT,0.75
C1BP02A-45
C1BP02A-26
BU,0.75
C11L-14
C11M-14
BU,0.5
C1ET47D-1
Switch-Reverse-lamp (S103)
C1ET47D-2
BK-GN,0.75
S1D120A
BK-GN,4.0
G1D120A-1
FE42
15.0 Amps
LIN 1
C1BP02C-51
WH,0.35
FE33
5.0 Amps
C1BB01A-92
RD,0.5
S1BB33
C1BB01A-107
RD,0.5
HAZARD SW
C1BP02C-8
BN-YE,0.5
Module-Steering wheel (D407)
C2LS41-9
LIN BUS
FE43
5.0 Amps
C1BB01A-100
GY,0.5
FET-IP illumination
BTS443 21A
C1BP02C-54
BN,0.75
S2LN17
HAZARD SW ILLUM BATT A
Switch-Hazard-warning (S121)
C1BP02C-52
LIN 1
C2PL13-3
C2PL13-5
BK-VT,0.5
FS4
5.0 Amps
C1BP02C-68
VT,1.0
S2BP04
BN,0.75
C2PL13-6
1.2 Watts
Sheet3
BATTA-1
S2D134A
Module-Lighting-switch (D183)
C2LF23D-1
RD,0.5
C21C-2
C21D-2
RD,0.5
Lighting control switch (S100)
LIN BUS
C2LF23D-6
GN-VT,0.35
C2LF23D-2
VT,0.5
BK-VT,1.5
G3D134-1
Switch-Headlamp-levelling (S109)
C2LF23D-4
VT-GN,0.5
C21C-17
C21D-17
VT-GN,1.0
B
Sheet2
Switch-Fog lamp-Front (S110)
C2LF23D-5
BK-VT,0.75
C
Sheet2
Switch-Fog guard-lamp-Rear (S111)
D
Sheet2

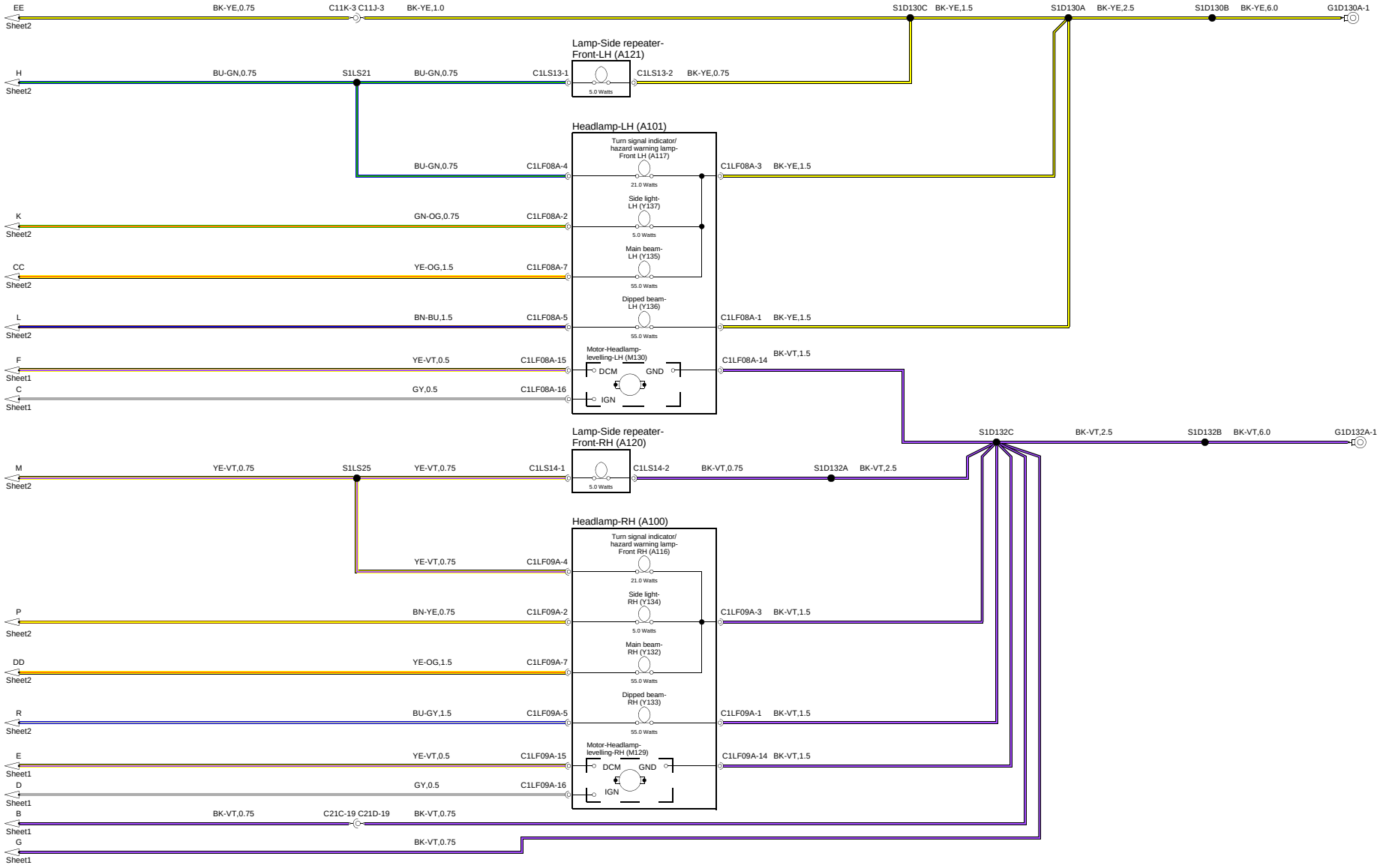

E
Sheet3
BK-YE,0.75
C11K-3 C11J-3
BK-YE,1.0
S1D130C
BK-YE,1.5
S1D130A
BK-YE,2.5
S1D130B
BK-YE,6.0
G1D130A-1
F
Sheet3
BU-GN,0.75
S1LS21
BU-GN,0.75
Lamp-Side repeater-Front-LH (A121)
C1LS13-1
C1LS13-2
BK-YE,0.75
5.0 Watts
Headlamp-LH (A101)
Turn signal indicator/hazard warning lamp-Front LH (A117)
21.0 Watts
BU-GN,0.75
C1LF08A-4
C1LF08A-3
BK-YE,1.5
Side light-LH (Y137)
5.0 Watts
G
Sheet3
GN-OG,0.75
C1LF08A-2
Main beam-LH (Y135)
55.0 Watts
H
Sheet3
YE-OG,1.5
C1LF08A-7
Dipped beam-LH (Y136)
55.0 Watts
J
Sheet3
BN-BU,1.5
C1LF08A-5
C1LF08A-1
BK-YE,1.5
Motor-Headlamp-levelling-LH (M130)
D
Sheet1
GY,0.5
S1BB43
GY,0.5
C1LF08A-16
B
Sheet1
VT-GN,1.0
S1LF22
VT-GN,0.5
C1LF08A-15
Comparator
C1LF08A-14
BK-VT,1.5
S1D132C
BK-VT,2.5
S1D132B
BK-VT,6.0
G1D132A-1
Lamp-Side repeater-Front-RH (A120)
K
Sheet3
YE-VT,0.75
S1LS25
YE-VT,0.75
C1LS14-1
C1LS14-2
BK-VT,0.75
S1D132A
BK-VT,2.5
5.0 Watts
Headlamp-RH (A100)
Turn signal indicator/hazard warning lamp-Front RH (A116)
YE-VT,0.75
C1LF09A-4
C1LF09A-3
BK-VT,1.5
21.0 Watts
Side light-RH (Y134)
L
Sheet3
BN-YE,0.75
C1LF09A-2
5.0 Watts
Main beam-RH (Y132)
M
Sheet3
YE-OG,1.5
C1LF09A-7
55.0 Watts
Dipped beam-RH (Y133)
N
Sheet3
BU-GY,1.5
C1LF09A-5
C1LF09A-1
BK-VT,1.5
55.0 Watts
Motor-Headlamp-levelling-RH (M129)
GY,0.5
C1LF09A-16
VT-GN,0.5
C1LF09A-15
Comparator
C1LF09A-14
BK-VT,1.5
C
Sheet1
BK-VT,0.75
C21C-19 C21D-19
BK-VT,0.75

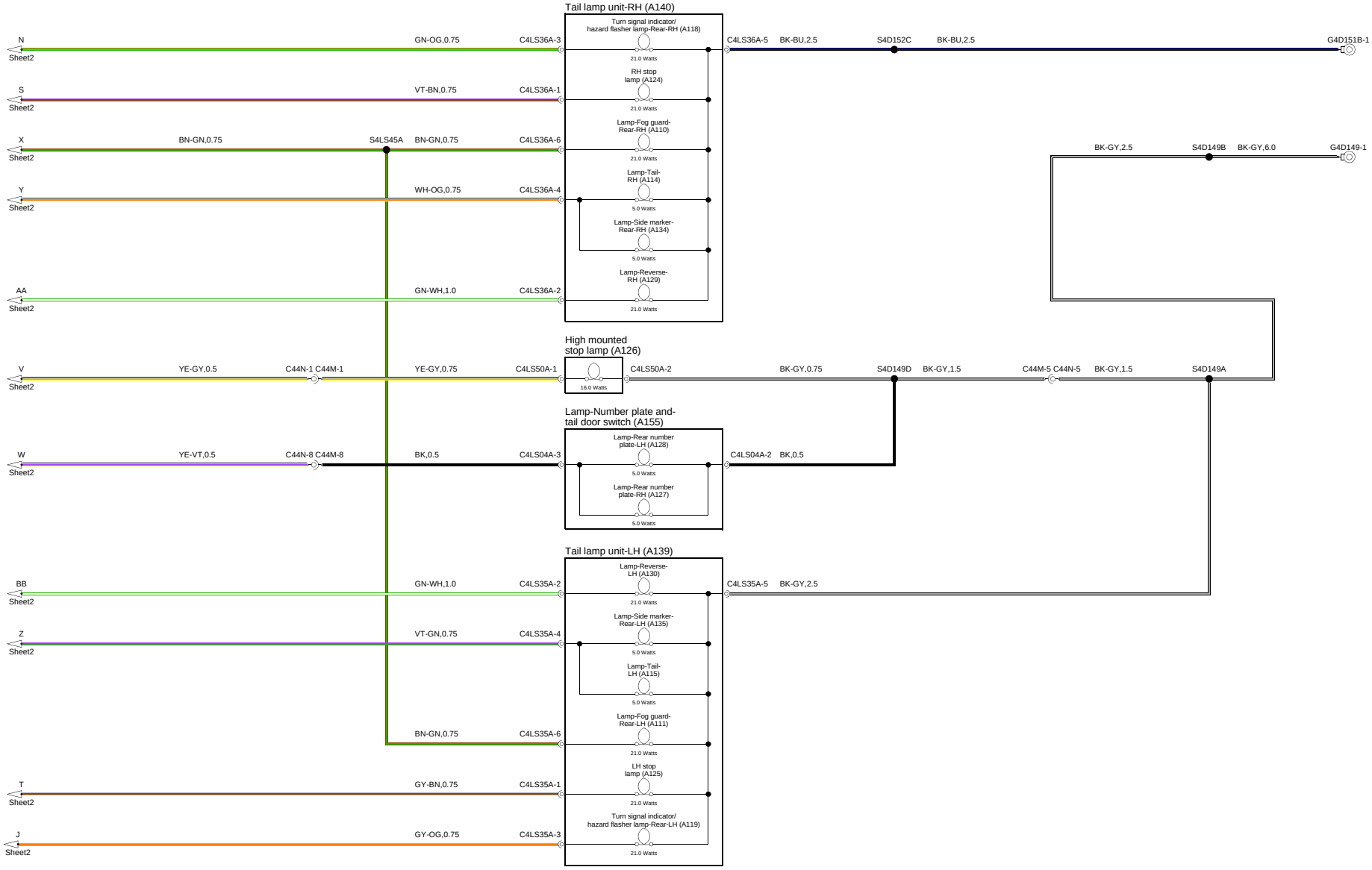

Central junction-box (P101)
A
YE-RD,6.0
C1BP02G-2
BATT B
Sheet1
BATTA-1
Central Electronics Module (CEM) (D316)
FET-Indicator-LH
FET-Position light-left
FET-Dip-beam-LH
FET-Indicator-RH
FET-Position light REAR
FET-Dip-beam-RH
FET-Stop light
FET-Chmsl
FET-License plate light
FET-Rear fog light
BTS443 21A
Relay-Reverse (R217)
FS11
7.5 Amps
Relay-Main-dipped beam (R127)
FS9
15.0 Amps
Relay-Front-fog lamp (R130)
FS13
15.0 Amps
(PCB)
C1BP02A-19 BU-GN,0.75
C1BP02B-36 GY-OG,0.75
C1BP02A-13 GN-OG,0.75
C1BP02B-50 VT-GN,0.75
C1BP02A-76 BN-BU,1.5
C1BP02A-1 YE-VT,0.75
C1BP02B-18 GN-OG,0.75
C1BP02A-41 BN-YE,0.75
C1BP02B-24 WH-OG,0.75
C1BP02A-75 BU-GY,1.5
C1BP02B-59 VT-BN,1.5
S4LS44
VT-BN,0.75
GY-BN,0.75
C1BP02B-38 YE-GY,0.5
C44N-1 C44M-1 YE-GY,0.75
C4LS50A-1
High mounted stop lamp (A126)
16.0 Watts
C4LS50A-2 BK-GY,0.75
C1BP02B-52 YE-VT,0.5
C1BP02B-39 BN-GN,0.75
C1BP02B-73 GN-WH,1.0
C1BP02B-62 GN-WH,1.0
C1BP02A-74 YE-OG,1.5
C1BP02A-73 YE-OG,1.5
C1BP02A-69 GY-BN,1.0
C11J-2 C11K-2 GY-BN,1.0
C1LF29-1
Lamp-Fog-Front-LH (A109)
55.0 Watts
C1LF29-2 BK-YE,1.0
S1D130D BK-YE,0.75
C1BP02A-68 GY-BN,1.0
C11J-1 C11K-1 GY-BN,1.0
C1LF34-1
Lamp-Fog-Front-RH (A108)
C1LF34-2 BK-YE,0.75
Sheet2
Sheet4

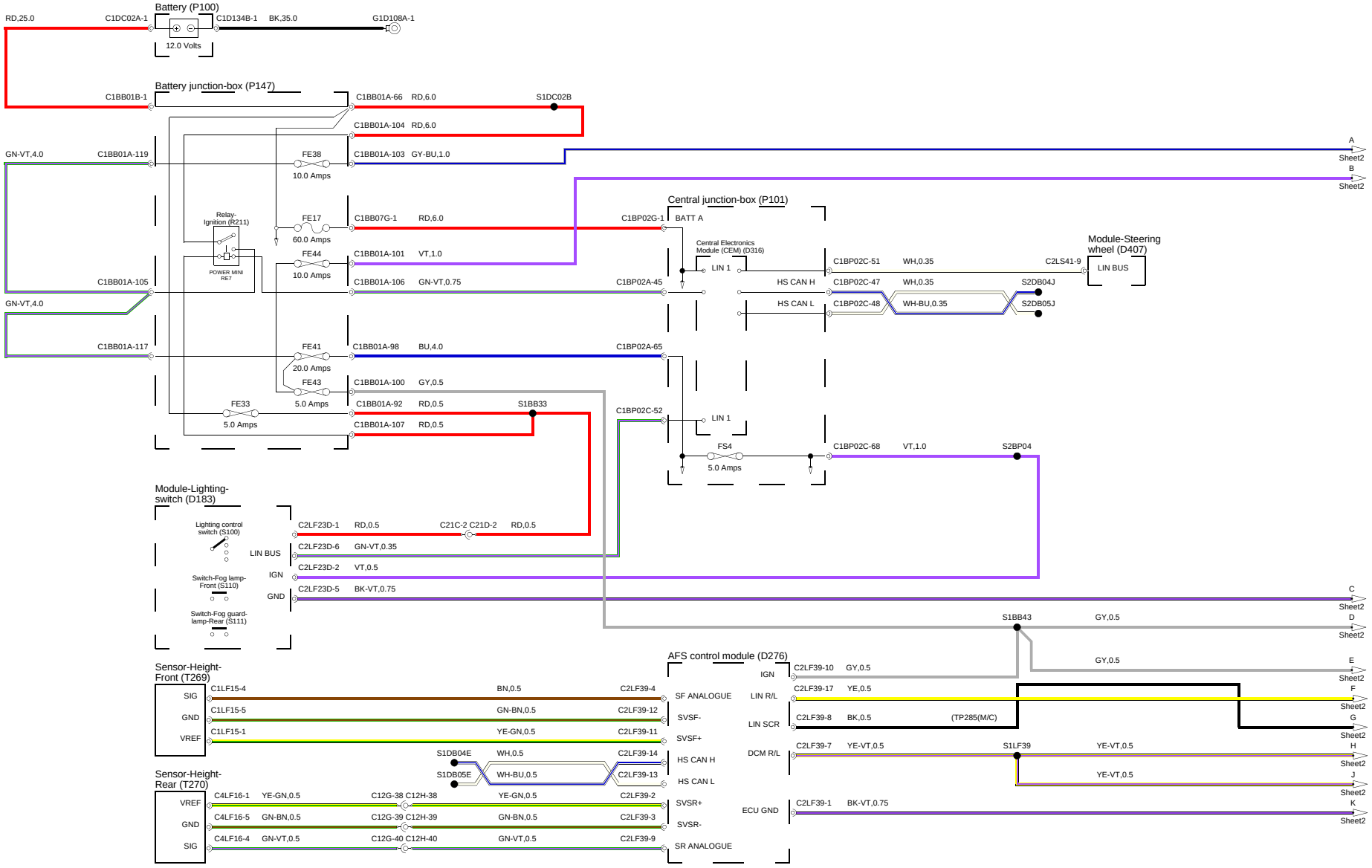

Tail lamp unit-RH (A140)
Turn signal indicator/ hazard flasher lamp-Rear-RH (A118)
RH stop lamp (A124)
Lamp-Fog guard-Rear-RH (A110)
Lamp-Tail-RH (A114)
Lamp-Side marker-Rear-RH (A134)
Lamp-Reverse-RH (A129)
21.0 Watts
5.0 Watts
S
Sheet3
GN-OG,0.75
C4LS36A-3
C4LS36A-5
BK-BU,2.5
S4D152C
BK-BU,2.5
G4D151B-1
V
VT-BN,0.75
C4LS36A-1
Z
BN-GN,0.75
S4LS45A
BN-GN,0.75
C4LS36A-6
T
WH-OG,0.75
C4LS36A-4
BB
GN-WH,1.0
C4LS36A-2
X
BK-GY,0.75
S4D149D
BK-GY,1.5
C44M-5 C44N-5
BK-GY,1.5
S4D149A
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
Lamp-Number plate and-tail door switch (A155)
Lamp-Rear number plate-LH (A128)
Lamp-Rear number plate-RH (A127)
Y
YE-VT,0.5
C44N-8 C44M-8
BK,0.5
C4LS04A-3
C4LS04A-2
BK,0.5
Tail lamp unit-LH (A139)
Lamp-Reverse-LH (A130)
Lamp-Side marker-Rear-LH (A135)
Lamp-Tail-LH (A115)
Lamp-Fog guard-Rear-LH (A111)
LH stop lamp (A125)
Turn signal indicator/ hazard flasher lamp-Rear-LH (A119)
AA
GN-WH,1.0
C4LS35A-2
C4LS35A-5
BK-GY,2.5
R
VT-GN,0.75
C4LS35A-4
BN-GN,0.75
C4LS35A-6
W
GY-BN,0.75
C4LS35A-1
P
GY-OG,0.75
C4LS35A-3

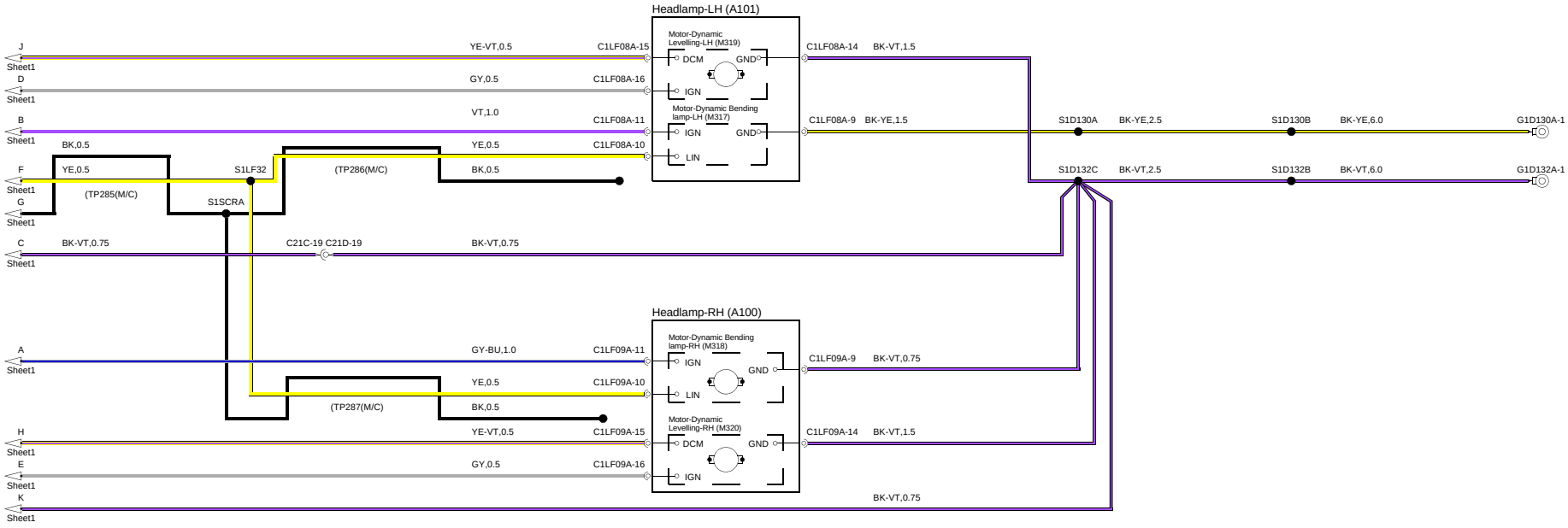

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1 BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
C1BB01A-66 RD,6.0
S1DC02B
C1BB01A-104 RD,6.0
FE18
60.0 Amps
C1BB03H-1 YE-RD,6.0
FE17
60.0 Amps
C1BB07G-1 RD,6.0
C1BP02G-1
Central junction-box (P101)
BATT A
FS28
5.0 Amps
C1BP02B-66 GN-RD,1.0
C2CA29-1
Stop lamp switch (S215)
C2CA29-2
C1BP02B-54 VT-BN,0.75
A
Sheet2
Relay-Ignition (R211)
POWER MINI RE7
C1BB01A-105 GN-VT,4.0
C1BB01A-117
Central Electronics Module (CEM) (D316)
FE41
20.0 Amps
C1BB01A-98 BU,4.0
C1BP02A-65
C1BB01A-106 GN-VT,0.75
C1BP02A-45
FE43
5.0 Amps
C1BB01A-100 GY,0.5
FE33
5.0 Amps
C1BB01A-92 RD,0.5
S1BB33
C1BB01A-107 RD,0.5
C1BP02A-26 BU,0.75
C11L-14 C11M-14 BU,0.5
C1ET47D-1
Switch-Reverse-lamp (S103)
C1ET47D-2
BK-GN,0.75
S1D120A
BK-GN,4.0
G1D120A-1
HS CAN H
C1BP02C-47 WH,0.35
S2DB04J
HS CAN L
C1BP02C-48 WH-BU,0.35
S2DB05J
LIN 1
C1BP02C-51 WH,0.35
C2LS41-9
Module-Steering wheel (D407)
LIN BUS
C1BP02C-8 BN-YE,0.5
Switch-Hazard-warning (S121)
C2PL13-3
C2PL13-5 BK-VT,0.5
FET-IP illumination
BTS443 21A
C1BP02C-54 BN,0.75
S2LN17
BN,0.75
C2PL13-6
1.2 Watts
S2D134A BK-VT,1.5
G3D134-1
Module-Lighting-switch (D183)
Lighting control switch (S100)
C2LF23D-1 RD,0.5
C21C-2 C21D-2 RD,0.5
LIN BUS
C2LF23D-6 GN-VT,0.35
C1BP02C-52
Switch-Fog lamp-Front (S110)
Switch-Fog guard-lamp-Rear (S111)
FS4
5.0 Amps
BATT A-1
Sheet2
C1BP02C-68 VT,1.0
S2BP04
IGN
C2LF23D-2 VT,0.5
GND
C2LF23D-5 BK-VT,0.75
B
Sheet3
S1BB43 GY,0.5
C
Sheet3
Sensor-Height-Front (T269)
SIG
GND
VREF
C1LF15-4
BN,0.5
C2LF39-4
C1LF15-5
GN-BN,0.5
C2LF39-12
C1LF15-1
YE-GN,0.5
C2LF39-11
Module-Headlamp levelling (D226)
SF ANALOGUE
SVSF-
SVSF+
HS CAN H
HS CAN L
SVSR+
SVSR-
SR ANALOGUE
IGN
SUPPLY R
ECU GND
C2LF39-10 GY,0.5
GY,0.5
D
Sheet3
C2LF39-7 YE-VT,0.5
S1LF39
YE-VT,0.5
E
Sheet3
YE-VT,0.5
F
Sheet3
C2LF39-1 BK-VT,0.75
G
Sheet3
S1DB04E WH,0.5
C2LF39-14
S1DB05E WH-BU,0.5
C2LF39-13
Sensor-Height-Rear (T270)
VREF
GND
SIG
C4LF16-1 YE-GN,0.5
C12G-38 C12H-38 YE-GN,0.5
C2LF39-2
C4LF16-5 GN-BN,0.5
C12G-39 C12H-39 GN-BN,0.5
C2LF39-3
C4LF16-4 GN-VT,0.5
C12G-40 C12H-40 GN-VT,0.5
C2LF39-9

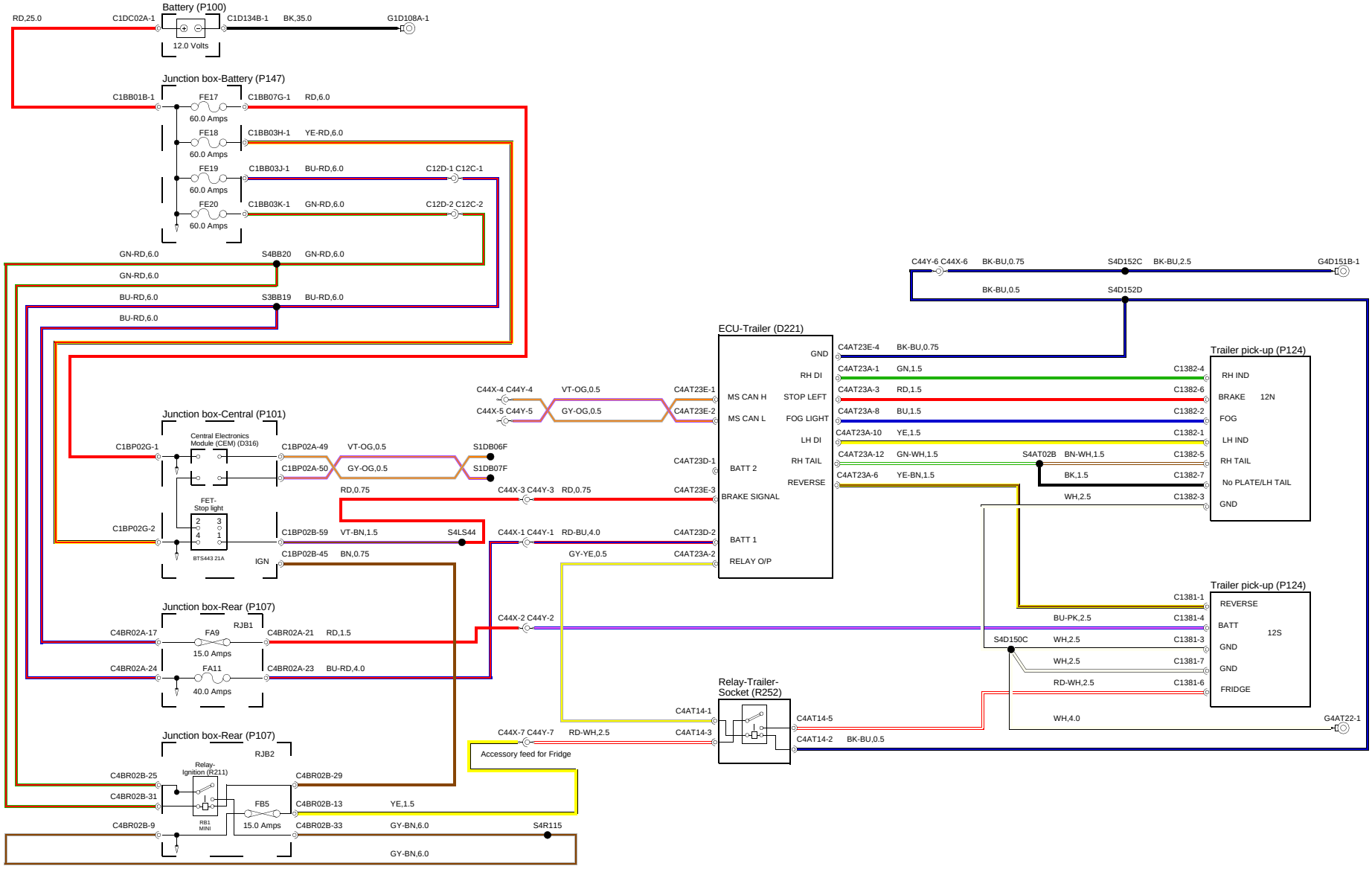

Central junction-box (P101)
A
YE-RD,6.0
C1BP02G-2
BATT B
Sheet1
Central Electronics Module (CEM) (D316)
BATT A-1
Sheet1
FET-Indicator-LH
FET-Indicator-REAR-LH
FET-Position light front left
FET-Dip-beam-LH
FET-Indicator-RH
FET-Indicator-REAR-RH
FET-Position light front right
FET-Dip-beam-RH
FET-Stop light
FET-Chmsl
FET-License plate light
FET-Rear fog light
FET-Position light rear right
FET-Position light rear left
BTS443 21A
Relay-Reverse (R217)
FS11
7.5 Amps
Relay-Main-dipped beam (R127)
FS9
15.0 Amps
Relay-Front-fog lamp (R130)
FS13
15.0 Amps
(PCB)
C1BP02A-19 BU-GN,0.75 H Sheet3
C1BP02B-36 GY-OG,0.75 J Sheet4
C1BP02A-13 GN-OG,0.75 K Sheet3
C1BP02A-76 BN-BU,1.5 L Sheet3
C1BP02A-1 YE-VT,0.75 M Sheet3
C1BP02B-18 GN-OG,0.75 N Sheet4
C1BP02A-41 BN-YE,0.75 P Sheet3
C1BP02A-75 BU-GY,1.5 R Sheet3
C1BP02B-59 VT-BN,1.5 S4LS44 VT-BN,0.75 S Sheet4
GY-BN,0.75 T Sheet4
C1BP02B-38 YE-GY,0.5 V Sheet4
C1BP02B-52 YE-VT,0.5 W Sheet4
C1BP02B-39 BN-GN,0.75 X Sheet4
C1BP02B-24 WH-OG,0.75 Y Sheet4
C1BP02B-50 VT-GN,0.75 Z Sheet4
C1BP02B-62 GN-WH,1.0 AA Sheet4
C1BP02B-73 GN-WH,1.0 BB Sheet4
C1BP02A-74 YE-OG,1.5 CC Sheet3
C1BP02A-73 YE-OG,1.5 DD Sheet3
C1BP02A-69 GY-BN,1.0 C11J-2 C11K-2 GY-BN,1.0 C1LF29-1
Lamp-Fog-Front-LH (A109)
5.0 Watts
C1LF29-2 BK-YE,1.0 S1D130D BK-YE,0.75 EE Sheet3
C1BP02A-68 GY-BN,1.0 C11J-1 C11K-1 GY-BN,1.0 C1LF34-1
Lamp-Fog-Front-RH (A108)
55.0 Watts
C1LF34-2 BK-YE,0.75

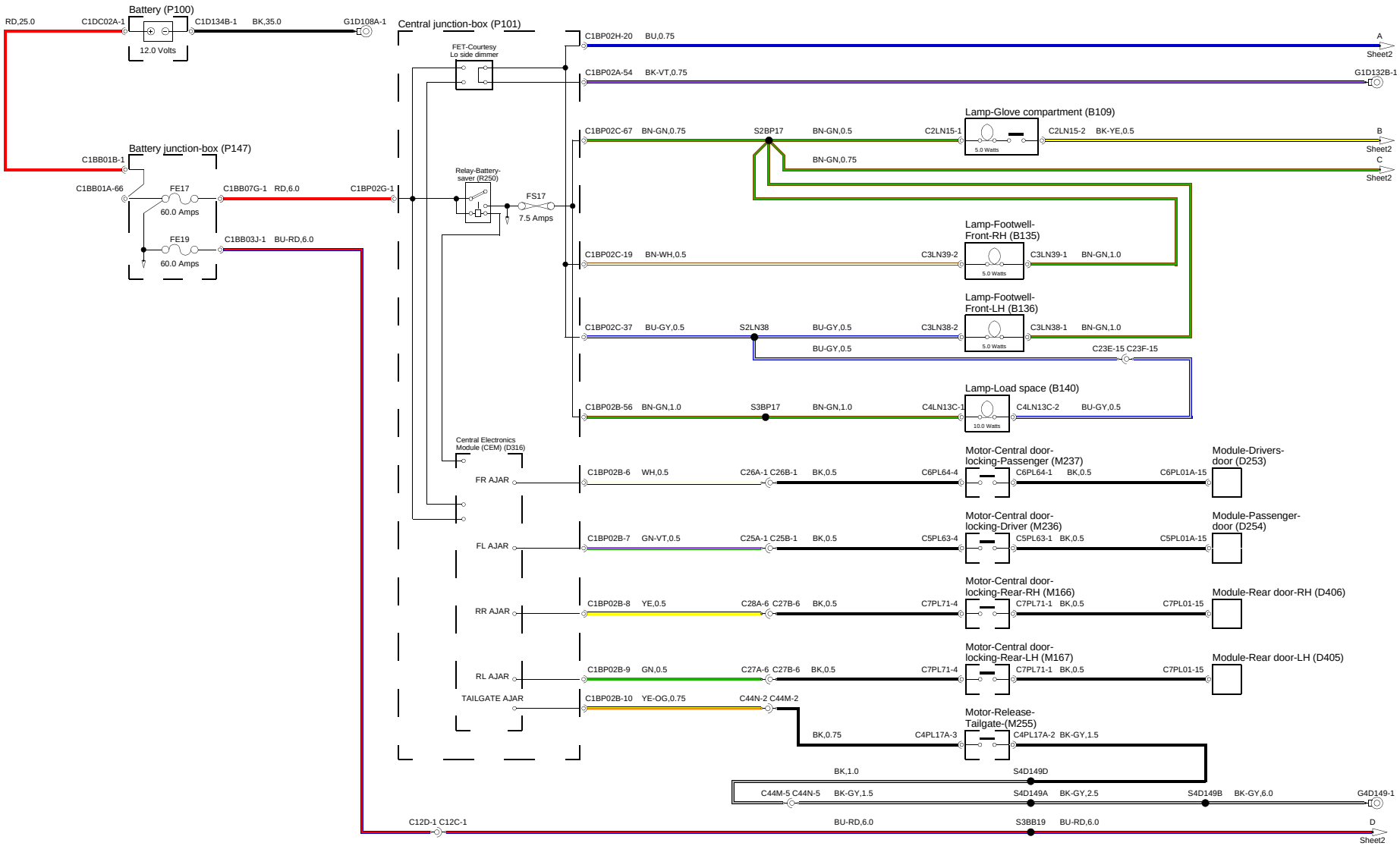

EE
BK-YE,0.75
C11K-3 C11J-3
BK-YE,1.0
S1D130C
BK-YE,1.5
S1D130A
BK-YE,2.5
S1D130B
BK-YE,6.0
G1D130A-1
Sheet2
Lamp-Side repeater-Front-LH (A121)
H
BU-GN,0.75
S1LS21
BU-GN,0.75
C1LS13-1
C1LS13-2
BK-YE,0.75
5.0 Watts
Headlamp-LH (A101)
Turn signal indicator/hazard warning lamp-Front LH (A117)
BU-GN,0.75
C1LF08A-4
C1LF08A-3
BK-YE,1.5
21.0 Watts
Side light-LH (Y137)
K
GN-OG,0.75
C1LF08A-2
5.0 Watts
Main beam-LH (Y135)
CC
YE-OG,1.5
C1LF08A-7
55.0 Watts
Dipped beam-LH (Y136)
L
BN-BU,1.5
C1LF08A-5
C1LF08A-1
BK-YE,1.5
55.0 Watts
Motor-Headlamp-levelling-LH (M130)
F
YE-VT,0.5
C1LF08A-15
C1LF08A-14
BK-VT,1.5
DCM
GND
C
GY,0.5
C1LF08A-16
IGN
Sheet1
S1D132C
BK-VT,2.5
S1D132B
BK-VT,6.0
G1D132A-1
Lamp-Side repeater-Front-RH (A120)
M
YE-VT,0.75
S1LS25
YE-VT,0.75
C1LS14-1
C1LS14-2
BK-VT,0.75
S1D132A
BK-VT,2.5
5.0 Watts
Headlamp-RH (A100)
Turn signal indicator/hazard warning lamp-Front RH (A116)
YE-VT,0.75
C1LF09A-4
21.0 Watts
Side light-RH (Y134)
P
BN-YE,0.75
C1LF09A-2
C1LF09A-3
BK-VT,1.5
5.0 Watts
Main beam-RH (Y132)
DD
YE-OG,1.5
C1LF09A-7
55.0 Watts
Dipped beam-RH (Y133)
R
BU-GY,1.5
C1LF09A-5
C1LF09A-1
BK-VT,1.5
55.0 Watts
Motor-Headlamp-levelling-RH (M129)
E
YE-VT,0.5
C1LF09A-15
C1LF09A-14
BK-VT,1.5
DCM
GND
D
GY,0.5
C1LF09A-16
IGN
B
BK-VT,0.75
C21C-19 C21D-19
BK-VT,0.75
G
BK-VT,0.75

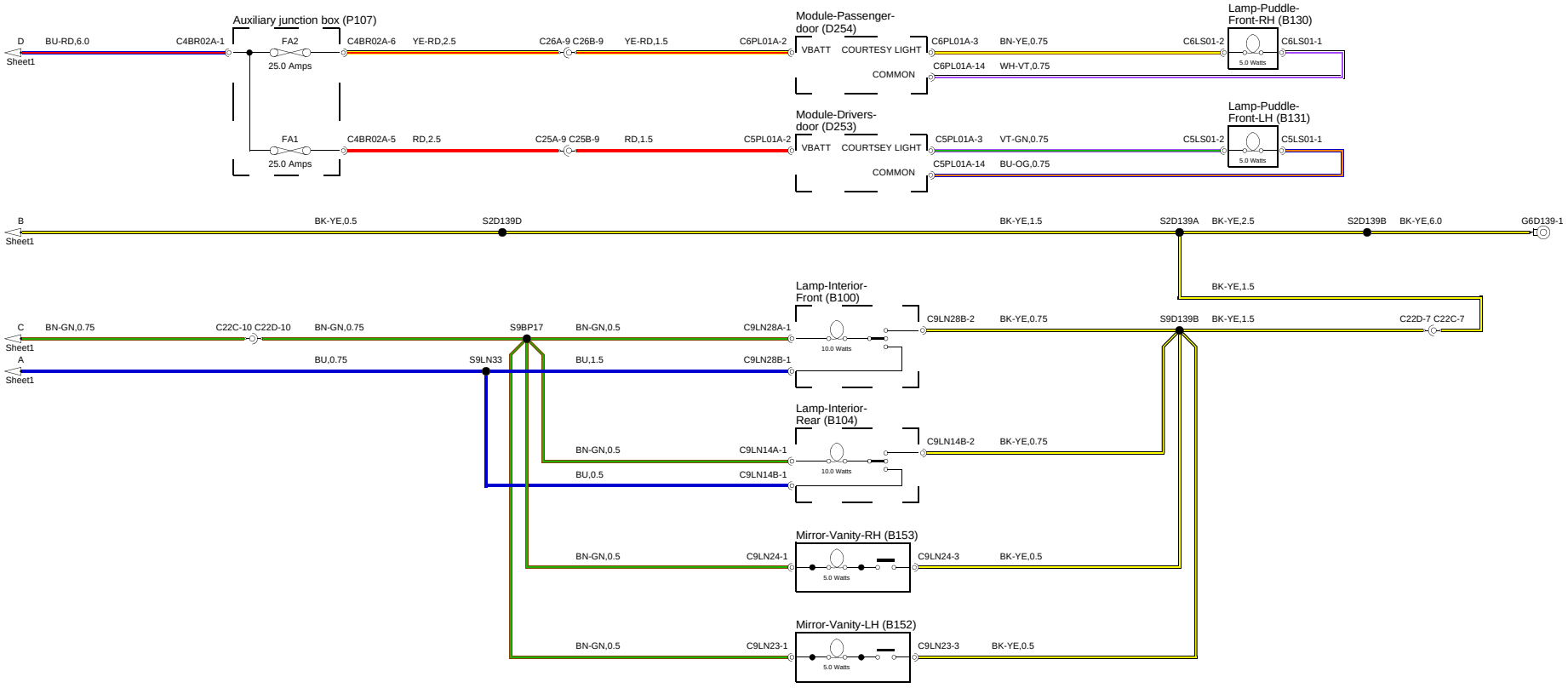

Tail lamp unit-RH (A140)
Turn signal indicator/ hazard flasher lamp-Rear-RH (A118)
21.0 Watts
RH stop lamp (A124)
21.0 Watts
Lamp-Fog guard-Rear-RH (A110)
21.0 Watts
Lamp-Tail-RH (A114)
5.0 Watts
Lamp-Side marker-Rear-RH (A134)
5.0 Watts
Lamp-Reverse-RH (A129)
21.0 Watts
N
S
X
Y
AA
Sheet2
GN-OG,0.75
C4LS36A-3
VT-BN,0.75
C4LS36A-1
BN-GN,0.75
S4LS45A
BN-GN,0.75
C4LS36A-6
WH-OG,0.75
C4LS36A-4
GN-WH,1.0
C4LS36A-2
C4LS36A-5
BK-BU,2.5
S4D152C
BK-BU,2.5
G4D151B-1
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
High mounted stop lamp (A126)
16.0 Watts
V
Sheet2
YE-GY,0.5
C44N-1 C44M-1
YE-GY,0.75
C4LS50A-1
C4LS50A-2
BK-GY,0.75
S4D149D
BK-GY,1.5
C44M-5 C44N-5
BK-GY,1.5
S4D149A
Lamp-Number plate and-tail door switch (A155)
Lamp-Rear number plate-LH (A128)
5.0 Watts
Lamp-Rear number plate-RH (A127)
5.0 Watts
W
Sheet2
YE-VT,0.5
C44N-8 C44M-8
BK,0.5
C4LS04A-3
C4LS04A-2
BK,0.5
Tail lamp unit-LH (A139)
Lamp-Reverse-LH (A130)
21.0 Watts
Lamp-Side marker-Rear-LH (A135)
5.0 Watts
Lamp-Tail-LH (A115)
5.0 Watts
Lamp-Fog guard-Rear-LH (A111)
21.0 Watts
LH stop lamp (A125)
21.0 Watts
Turn signal indicator/ hazard flasher lamp-Rear-LH (A119)
21.0 Watts
BB
Z
T
J
Sheet2
GN-WH,1.0
C4LS35A-2
VT-GN,0.75
C4LS35A-4
BN-GN,0.75
C4LS35A-6
GY-BN,0.75
C4LS35A-1
GY-OG,0.75
C4LS35A-3
C4LS35A-5
BK-GY,2.5

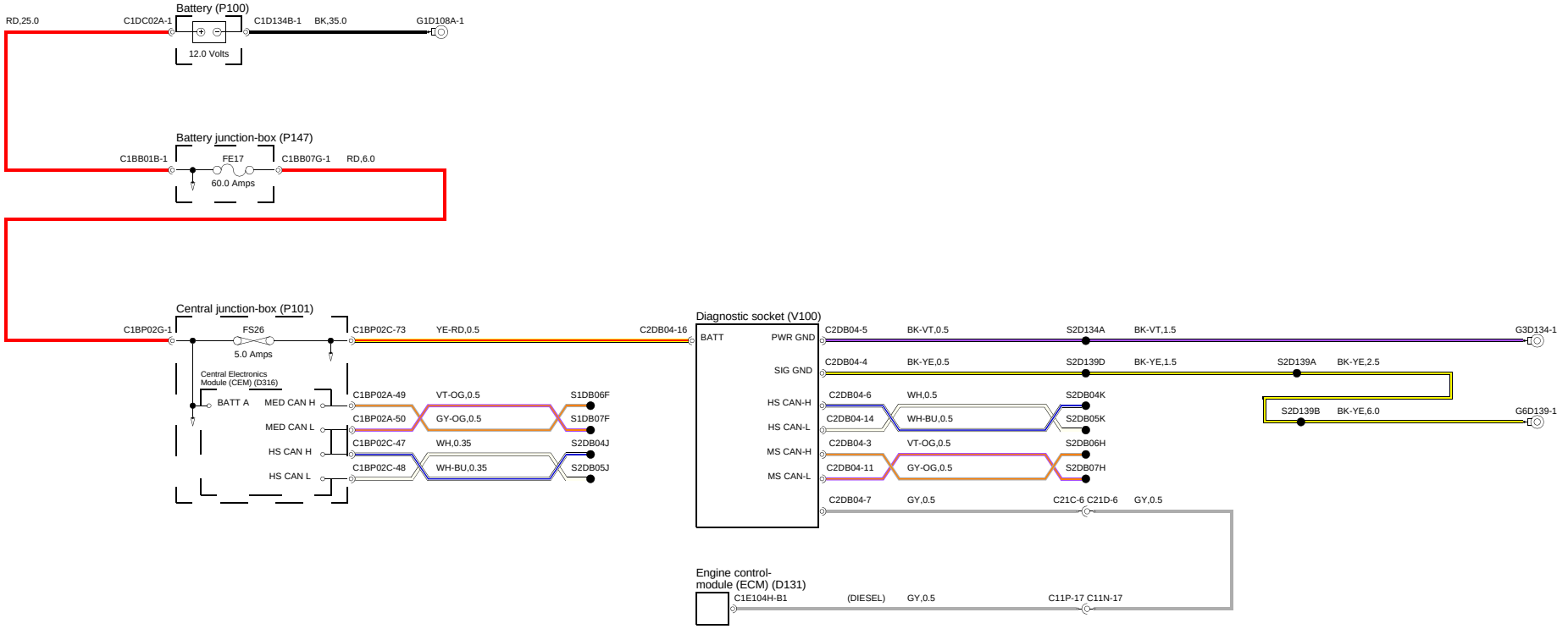

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
C1BB01A-66
RD,6.0
S1DC02B
C1BB01A-104
RD,6.0
GN-VT,4.0
C1BB01A-119
FE38
10.0 Amps
C1BB01A-103
GY-BU,1.0
A
Sheet2
B
Sheet2
Central junction-box (P101)
Relay-Ignition (R211)
POWER MINI RE7
FE17
60.0 Amps
C1BB07G-1
RD,6.0
C1BP02G-1
BATT A
FE44
10.0 Amps
C1BB01A-101
VT,1.0
Central Electronics Module (CEM) (D316)
LIN 1
C1BP02C-51
WH,0.35
C2LS41-9
LIN BUS
Module-Steering wheel (D407)
C1BB01A-105
C1BB01A-106
GN-VT,0.75
C1BP02A-45
HS CAN H
C1BP02C-47
WH,0.35
S2DB04J
GN-VT,4.0
HS CAN L
C1BP02C-48
WH-BU,0.35
S2DB05J
C1BB01A-117
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BP02A-65
FE43
5.0 Amps
C1BB01A-100
GY,0.5
FE33
5.0 Amps
C1BB01A-92
RD,0.5
S1BB33
C1BP02C-52
LIN 1
C1BB01A-107
RD,0.5
FS4
5.0 Amps
C1BP02C-68
VT,1.0
S2BP04
Module-Lighting-switch (D183)
Lighting control switch (S100)
C2LF23D-1
RD,0.5
C21C-2 C21D-2
RD,0.5
LIN BUS
C2LF23D-6
GN-VT,0.35
IGN
C2LF23D-2
VT,0.5
Switch-Fog lamp-Front (S110)
GND
C2LF23D-5
BK-VT,0.75
C
Sheet2
Switch-Fog guard-lamp-Rear (S111)
S1BB43
GY,0.5
D
Sheet2
AFS control module (D276)
GY,0.5
E
Sheet2
Sensor-Height-Front (T269)
IGN
C2LF39-10
GY,0.5
SIG
C1LF15-4
BN,0.5
C2LF39-4
SF ANALOGUE
LIN R/L
C2LF39-17
YE,0.5
F
Sheet2
GND
C1LF15-5
GN-BN,0.5
C2LF39-12
SVSF-
LIN SCR
C2LF39-8
BK,0.5
(TP285(M/C)
G
Sheet2
VREF
C1LF15-1
YE-GN,0.5
C2LF39-11
SVSF+
DCM R/L
C2LF39-7
YE-VT,0.5
S1LF39
YE-VT,0.5
H
Sheet2
S1DB04E
WH,0.5
C2LF39-14
HS CAN H
YE-VT,0.5
J
Sheet2
S1DB05E
WH-BU,0.5
C2LF39-13
HS CAN L
Sensor-Height-Rear (T270)
ECU GND
C2LF39-1
BK-VT,0.75
K
Sheet2
VREF
C4LF16-1
YE-GN,0.5
C12G-38 C12H-38
YE-GN,0.5
C2LF39-2
SVSR+
GND
C4LF16-5
GN-BN,0.5
C12G-39 C12H-39
GN-BN,0.5
C2LF39-3
SVSR-
SIG
C4LF16-4
GN-VT,0.5
C12G-40 C12H-40
GN-VT,0.5
C2LF39-9
SR ANALOGUE

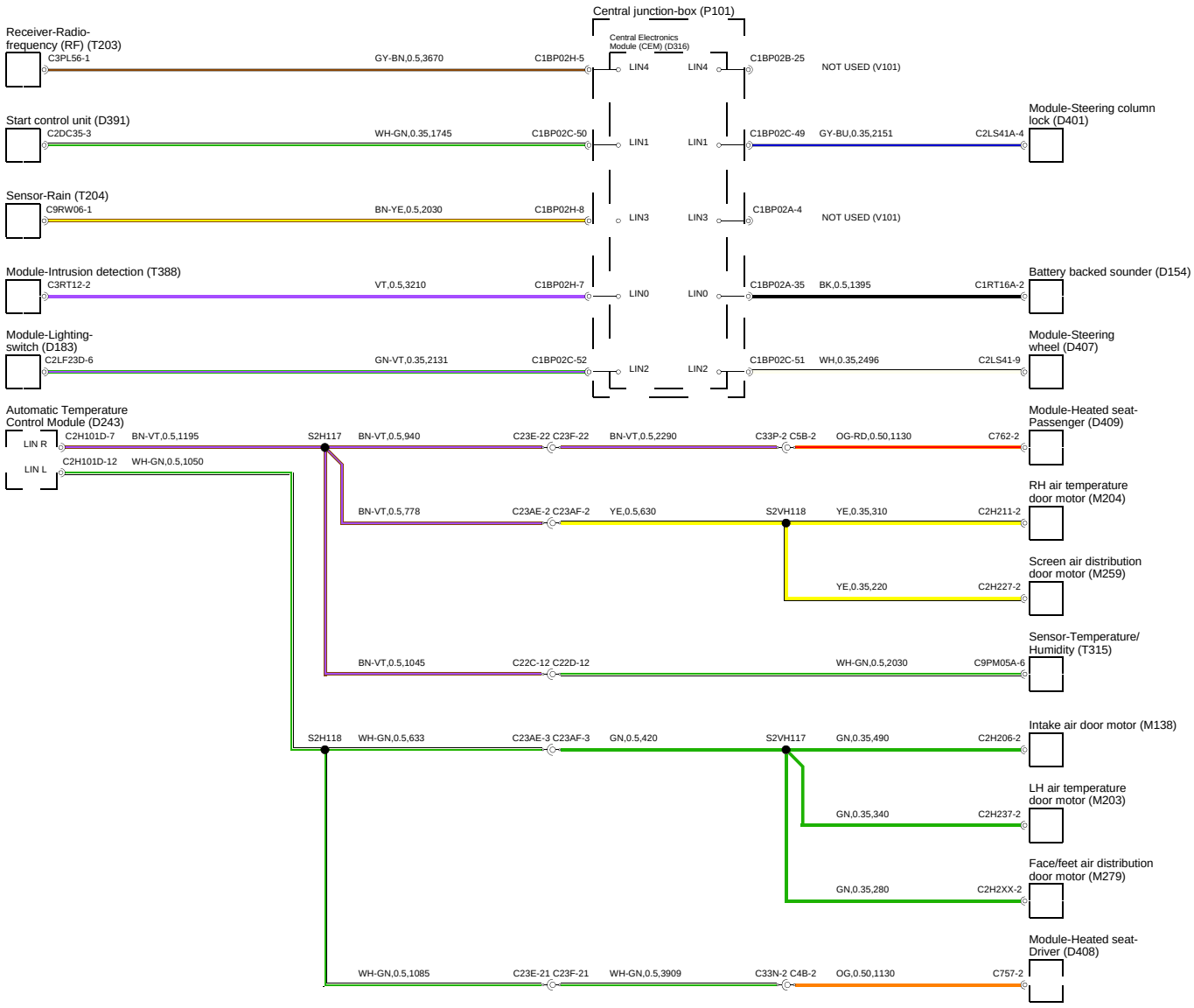

Headlamp-LH (A101)
Motor-Dynamic Levelling-LH (M319)
DCM
GND
IGN
Motor-Dynamic Bending lamp-LH (M317)
IGN
GND
LIN
J
Sheet1
D
Sheet1
B
Sheet1
F
Sheet1
G
Sheet1
C
Sheet1
YE-VT,0.5
GY,0.5
VT,1.0
YE,0.5
BK,0.5
YE,0.5
(TP285(M/C)
BK,0.5
S1LF32
S1SCRA
(TP286(M/C)
BK-VT,0.75
C21C-19 C21D-19
BK-VT,0.75
C1LF08A-15
C1LF08A-16
C1LF08A-11
C1LF08A-10
C1LF08A-14
BK-VT,1.5
C1LF08A-9
BK-YE,1.5
S1D130A
BK-YE,2.5
S1D130B
BK-YE,6.0
G1D130A-1
S1D132C
BK-VT,2.5
S1D132B
BK-VT,6.0
G1D132A-1
Headlamp-RH (A100)
Motor-Dynamic Bending lamp-RH (M318)
IGN
GND
LIN
Motor-Dynamic Levelling-RH (M320)
DCM
GND
IGN
A
Sheet1
H
Sheet1
E
Sheet1
K
Sheet1
GY-BU,1.0
YE,0.5
(TP287(M/C)
BK,0.5
YE-VT,0.5
GY,0.5
BK-VT,0.75
C1LF09A-11
C1LF09A-10
C1LF09A-15
C1LF09A-16
C1LF09A-9
BK-VT,0.75
C1LF09A-14
BK-VT,1.5

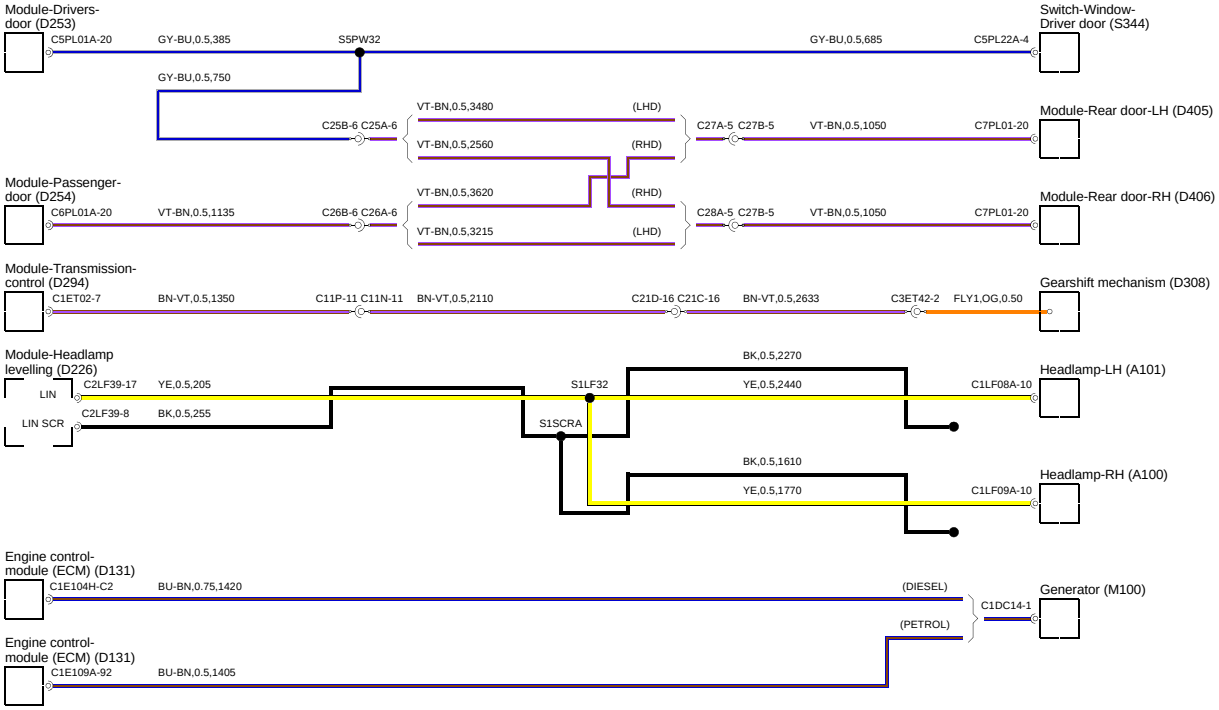

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Junction box-Battery (P147)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
FE18
C1BB03H-1
YE-RD,6.0
FE19
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
FE20
C1BB03K-1
GN-RD,6.0
C12D-2 C12C-2
GN-RD,6.0
S4BB20
GN-RD,6.0
BU-RD,6.0
S3BB19
BU-RD,6.0
C44Y-6 C44X-6
BK-BU,0.75
S4D152C
BK-BU,2.5
G4D151B-1
BK-BU,0.5
S4D152D
ECU-Trailer (D221)
GND
RH DI
MS CAN H
STOP LEFT
MS CAN L
FOG LIGHT
LH DI
BATT 2
RH TAIL
REVERSE
BRAKE SIGNAL
BATT 1
RELAY O/P
C4AT23E-4
BK-BU,0.75
C4AT23A-1
GN,1.5
C4AT23A-3
RD,1.5
C4AT23A-8
BU,1.5
C4AT23A-10
YE,1.5
C4AT23A-12
GN-WH,1.5
C4AT23A-6
YE-BN,1.5
C4AT23E-1
C4AT23E-2
C4AT23D-1
C4AT23E-3
C4AT23D-2
C4AT23A-2
C44X-4 C44Y-4
VT-OG,0.5
C44X-5 C44Y-5
GY-OG,0.5
C44X-3 C44Y-3
RD,0.75
C44X-1 C44Y-1
RD-BU,4.0
GY-YE,0.5
Trailer pick-up (P124)
RH IND
BRAKE
12N
FOG
LH IND
RH TAIL
No PLATE/LH TAIL
GND
C1382-4
C1382-6
C1382-2
C1382-1
C1382-5
C1382-7
C1382-3
S4AT02B
BN-WH,1.5
BK,1.5
WH,2.5
Junction box-Central (P101)
C1BP02G-1
Central Electronics Module (CEM) (D316)
C1BP02A-49
VT-OG,0.5
C1BP02A-50
GY-OG,0.5
S1DB06F
S1DB07F
C1BP02G-2
FET-Stop light
BTS443 21A
C1BP02B-59
VT-BN,1.5
S4LS44
C1BP02B-45
BN,0.75
IGN
Junction box-Rear (P107)
RJB1
C4BR02A-17
FA9
C4BR02A-21
RD,1.5
15.0 Amps
C4BR02A-24
FA11
C4BR02A-23
BU-RD,4.0
40.0 Amps
C44X-2 C44Y-2
Trailer pick-up (P124)
REVERSE
BATT
12S
GND
GND
FRIDGE
C1381-1
C1381-4
C1381-3
C1381-7
C1381-6
BU-PK,2.5
S4D150C
WH,2.5
WH,2.5
RD-WH,2.5
Relay-Trailer-Socket (R252)
C4AT14-1
C4AT14-5
C4AT14-3
C4AT14-2
BK-BU,0.5
WH,4.0
G4AT22-1
C44X-7 C44Y-7
RD-WH,2.5
Accessory feed for Fridge
Junction box-Rear (P107)
RJB2
Relay-Ignition (R211)
C4BR02B-25
C4BR02B-29
C4BR02B-31
FB5
C4BR02B-13
YE,1.5
RB1 MINI
15.0 Amps
C4BR02B-9
C4BR02B-33
GY-BN,6.0
S4R115
GY-BN,6.0

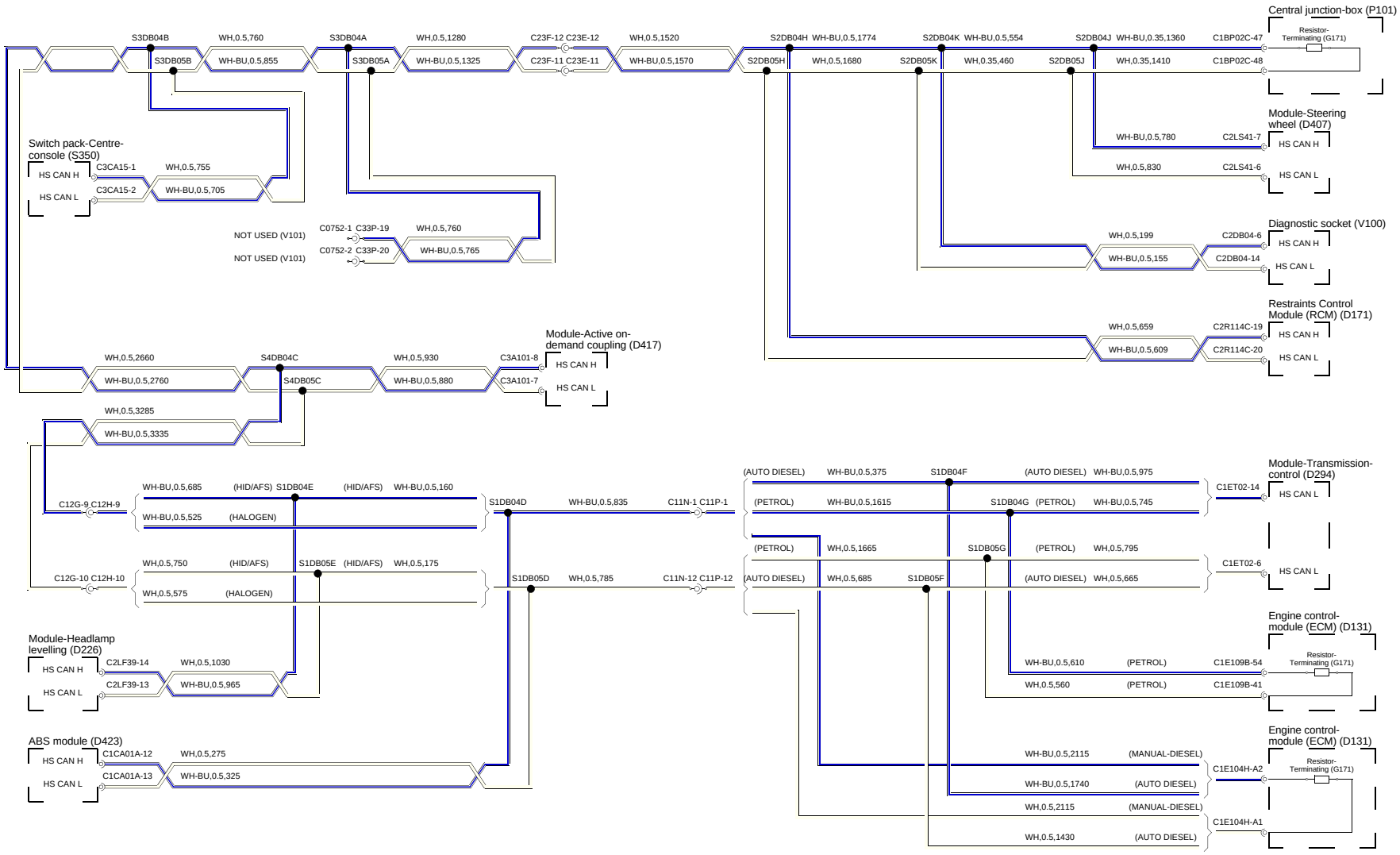

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Central junction-box (P101)
FET-Courtesy Lo side dimmer
Battery junction-box (P147)
C1BB01B-1
C1BB01A-66
FE17
60.0 Amps
C1BB07G-1
RD,6.0
C1BP02G-1
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0
Relay-Battery-saver (R250)
FS17
7.5 Amps
Central Electronics Module (CEM) (D316)
FR AJAR
FL AJAR
RR AJAR
RL AJAR
TAILGATE AJAR
C1BP02H-20
BU,0.75
A
Sheet2
C1BP02A-54
BK-VT,0.75
G1D132B-1
Lamp-Glove compartment (B109)
C1BP02C-67
BN-GN,0.75
S2BP17
BN-GN,0.5
C2LN15-1
5.0 Watts
C2LN15-2
BK-YE,0.5
B
Sheet2
BN-GN,0.75
C
Sheet2
Lamp-Footwell-Front-RH (B135)
C1BP02C-19
BN-WH,0.5
C3LN39-2
5.0 Watts
C3LN39-1
BN-GN,1.0
Lamp-Footwell-Front-LH (B136)
C1BP02C-37
BU-GY,0.5
S2LN38
BU-GY,0.5
C3LN38-2
5.0 Watts
C3LN38-1
BN-GN,1.0
BU-GY,0.5
C23E-15 C23F-15
Lamp-Load space (B140)
C1BP02B-56
BN-GN,1.0
S3BP17
BN-GN,1.0
C4LN13C-1
10.0 Watts
C4LN13C-2
BU-GY,0.5
C1BP02B-6
WH,0.5
C26A-1 C26B-1
BK,0.5
Motor-Central door-locking-Passenger (M237)
C6PL64-4
C6PL64-1
BK,0.5
C6PL01A-15
Module-Drivers-door (D253)
C1BP02B-7
GN-VT,0.5
C25A-1 C25B-1
BK,0.5
Motor-Central door-locking-Driver (M236)
C5PL63-4
C5PL63-1
BK,0.5
C5PL01A-15
Module-Passenger-door (D254)
C1BP02B-8
YE,0.5
C28A-6 C27B-6
BK,0.5
Motor-Central door-locking-Rear-RH (M166)
C7PL71-4
C7PL71-1
BK,0.5
C7PL01-15
Module-Rear door-RH (D406)
C1BP02B-9
GN,0.5
C27A-6 C27B-6
BK,0.5
Motor-Central door-locking-Rear-LH (M167)
C7PL71-4
C7PL71-1
BK,0.5
C7PL01-15
Module-Rear door-LH (D405)
C1BP02B-10
YE-OG,0.75
C44N-2 C44M-2
Motor-Release-Tailgate-(M255)
BK,0.75
C4PL17A-3
C4PL17A-2
BK-GY,1.5
BK,1.0
S4D149D
C44M-5 C44N-5
BK-GY,1.5
S4D149A
BK-GY,2.5
S4D149B
BK-GY,6.0
G4D149-1
C12D-1 C12C-1
BU-RD,6.0
S3BB19
BU-RD,6.0
D
Sheet2

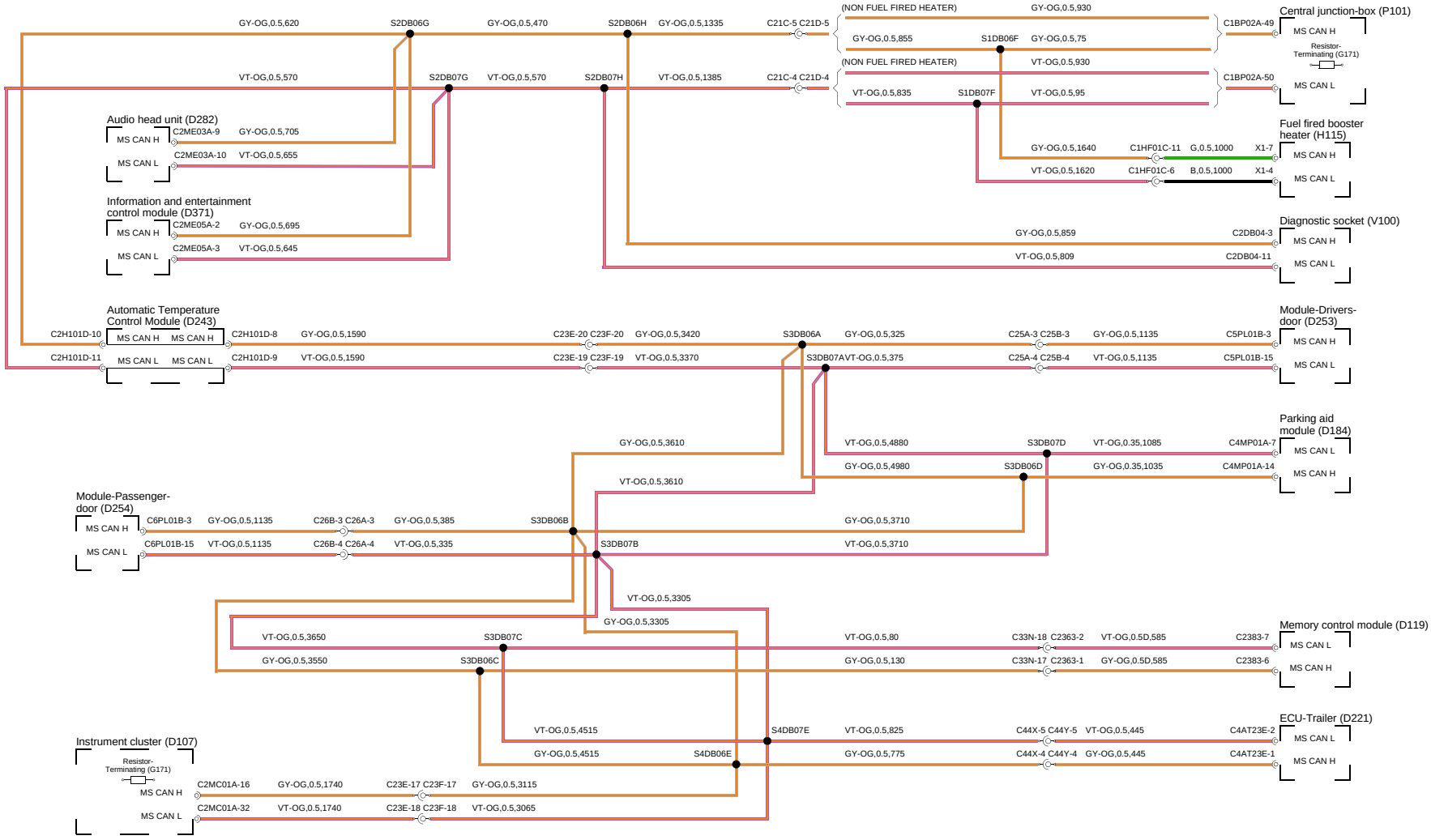

Auxiliary junction box (P107)
D
BU-RD,6.0
C4BR02A-1
FA2
25.0 Amps
C4BR02A-6
YE-RD,2.5
C26A-9 C26B-9
YE-RD,1.5
C6PL01A-2
Sheet1
FA1
25.0 Amps
C4BR02A-5
RD,2.5
C25A-9 C25B-9
RD,1.5
C5PL01A-2
Module-Passenger-door (D254)
VBATT
COURTESY LIGHT
COMMON
C6PL01A-3
BN-YE,0.75
C6PL01A-14
WH-VT,0.75
C6LS01-2
Lamp-Puddle-Front-RH (B130)
5.0 Watts
C6LS01-1
Module-Drivers-door (D253)
VBATT
COURTESY LIGHT
COMMON
C5PL01A-3
VT-GN,0.75
C5PL01A-14
BU-OG,0.75
C5LS01-2
Lamp-Puddle-Front-LH (B131)
5.0 Watts
C5LS01-1
B
Sheet1
BK-YE,0.5
S2D139D
BK-YE,1.5
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
BK-YE,1.5
Lamp-Interior-Front (B100)
C
BN-GN,0.75
C22C-10 C22D-10
BN-GN,0.75
S9BP17
BN-GN,0.5
C9LN28A-1
10.0 Watts
C9LN28B-2
BK-YE,0.75
S9D139B
BK-YE,1.5
C22D-7 C22C-7
A
BU,0.75
S9LN33
BU,1.5
C9LN28B-1
Lamp-Interior-Rear (B104)
BN-GN,0.5
C9LN14A-1
10.0 Watts
C9LN14B-2
BK-YE,0.75
BU,0.5
C9LN14B-1
Mirror-Vanity-RH (B153)
BN-GN,0.5
C9LN24-1
5.0 Watts
C9LN24-3
BK-YE,0.5
Mirror-Vanity-LH (B152)
BN-GN,0.5
C9LN23-1
5.0 Watts
C9LN23-3
BK-YE,0.5

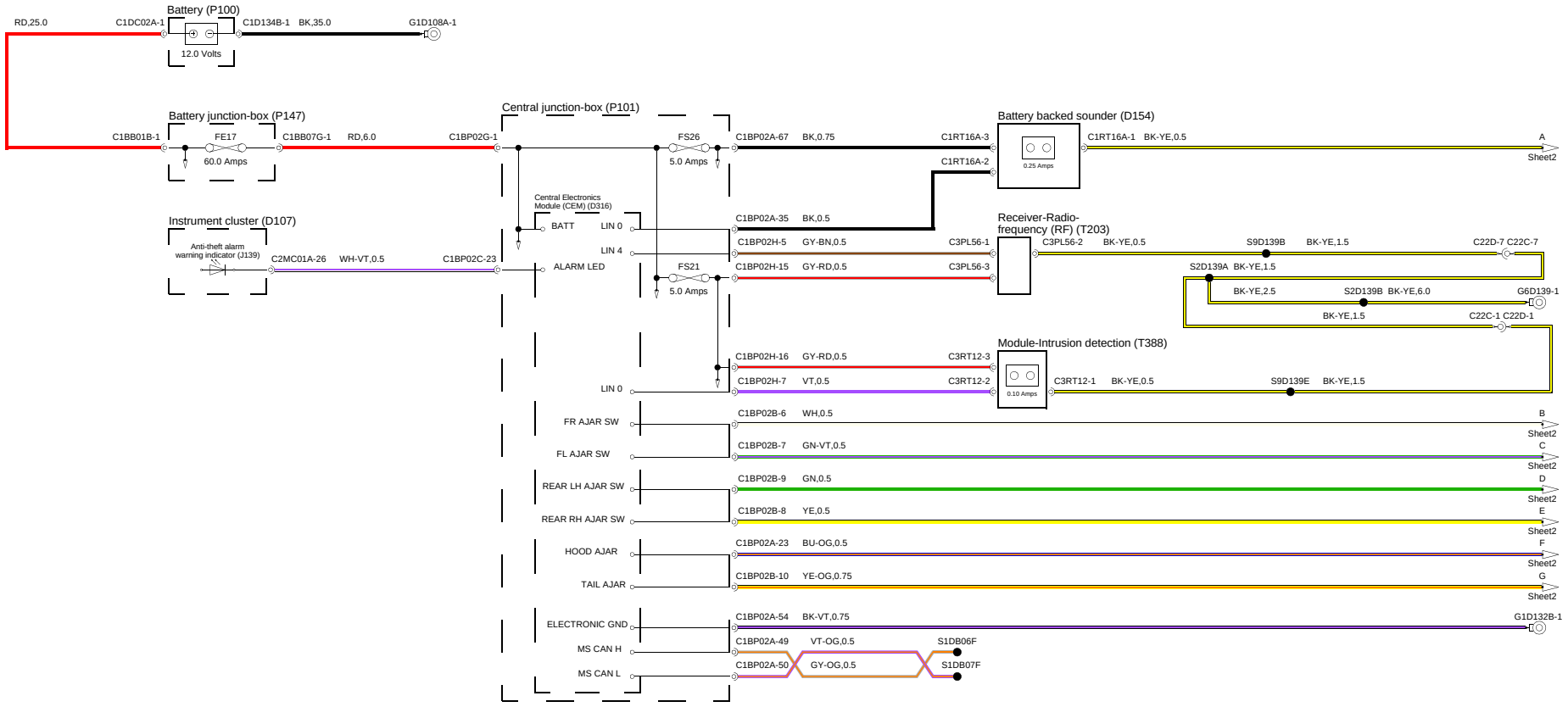

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
Central junction-box (P101)
C1BP02G-1
FS26
5.0 Amps
C1BP02C-73
YE-RD,0.5
C2DB04-16
Central Electronics Module (CEM) (D316)
BATT A
MED CAN H
MED CAN L
HS CAN H
HS CAN L
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
C1BP02C-47
WH,0.35
S2DB04J
C1BP02C-48
WH-BU,0.35
S2DB05J
Diagnostic socket (V100)
BATT
PWR GND
SIG GND
HS CAN-H
HS CAN-L
MS CAN-H
MS CAN-L
C2DB04-5
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
C2DB04-4
BK-YE,0.5
S2D139D
BK-YE,1.5
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
C2DB04-6
WH,0.5
S2DB04K
C2DB04-14
WH-BU,0.5
S2DB05K
C2DB04-3
VT-OG,0.5
S2DB06H
C2DB04-11
GY-OG,0.5
S2DB07H
C2DB04-7
GY,0.5
C21C-6
C21D-6
GY,0.5
Engine control-module (ECM) (D131)
C1E104H-B1
(DIESEL)
GY,0.5
C11P-17
C11N-17

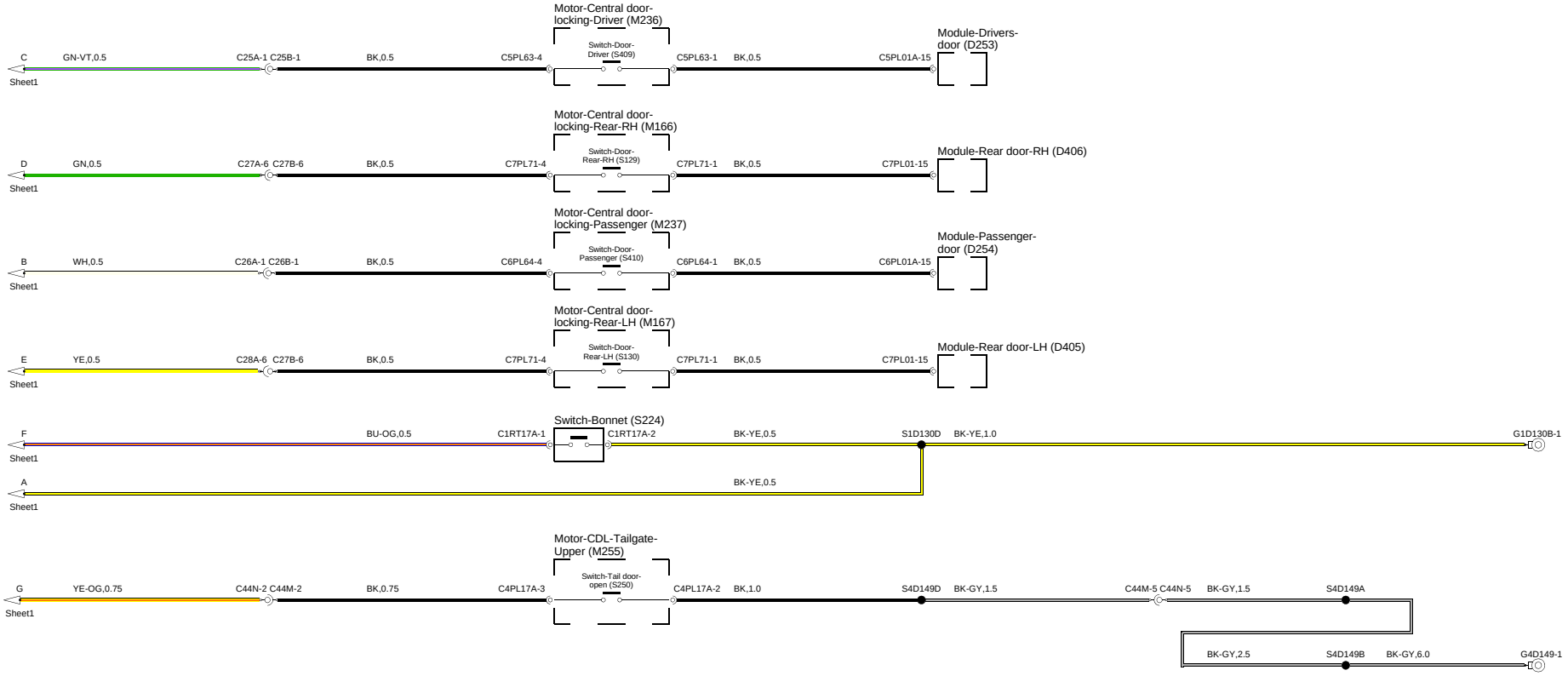

Central junction-box (P101)
Central Electronics Module (CEM) (D316)
Receiver-Radio-frequency (RF) (T203)
C3PL56-1
GY-BN,0.5,3670
C1BP02H-5
LIN4
LIN4
C1BP02B-25
NOT USED (V101)
Start control unit (D391)
C2DC35-3
WH-GN,0.35,1745
C1BP02C-50
LIN1
LIN1
C1BP02C-49
GY-BU,0.35,2151
C2LS41A-4
Module-Steering column lock (D401)
Sensor-Rain (T204)
C9RW06-1
BN-YE,0.5,2030
C1BP02H-8
LIN3
LIN3
C1BP02A-4
NOT USED (V101)
Module-Intrusion detection (T388)
C3RT12-2
VT,0.5,3210
C1BP02H-7
LIN0
LIN0
C1BP02A-35
BK,0.5,1395
C1RT16A-2
Battery backed sounder (D154)
Module-Lighting-switch (D183)
C2LF23D-6
GN-VT,0.35,2131
C1BP02C-52
LIN2
LIN2
C1BP02C-51
WH,0.35,2496
C2LS41-9
Module-Steering wheel (D407)
Automatic Temperature Control Module (D243)
LIN R
LIN L
C2H101D-7
BN-VT,0.5,1195
C2H101D-12
WH-GN,0.5,1050
S2H117
BN-VT,0.5,940
C23E-22 C23F-22
BN-VT,0.5,2290
C33P-2 C5B-2
OG-RD,0.50,1130
C762-2
Module-Heated seat-Passenger (D409)
BN-VT,0.5,778
C23AE-2 C23AF-2
YE,0.5,630
S2VH118
YE,0.35,310
C2H211-2
RH air temperature door motor (M204)
YE,0.35,220
C2H227-2
Screen air distribution door motor (M259)
BN-VT,0.5,1045
C22C-12 C22D-12
WH-GN,0.5,2030
C9PM05A-6
Sensor-Temperature/ Humidity (T315)
S2H118
WH-GN,0.5,633
C23AE-3 C23AF-3
GN,0.5,420
S2VH117
GN,0.35,490
C2H206-2
Intake air door motor (M138)
GN,0.35,340
C2H237-2
LH air temperature door motor (M203)
GN,0.35,280
C2H2XX-2
Face/feet air distribution door motor (M279)
WH-GN,0.5,1085
C23E-21 C23F-21
WH-GN,0.5,3909
C33N-2 C4B-2
OG,0.50,1130
C757-2
Module-Heated seat-Driver (D408)

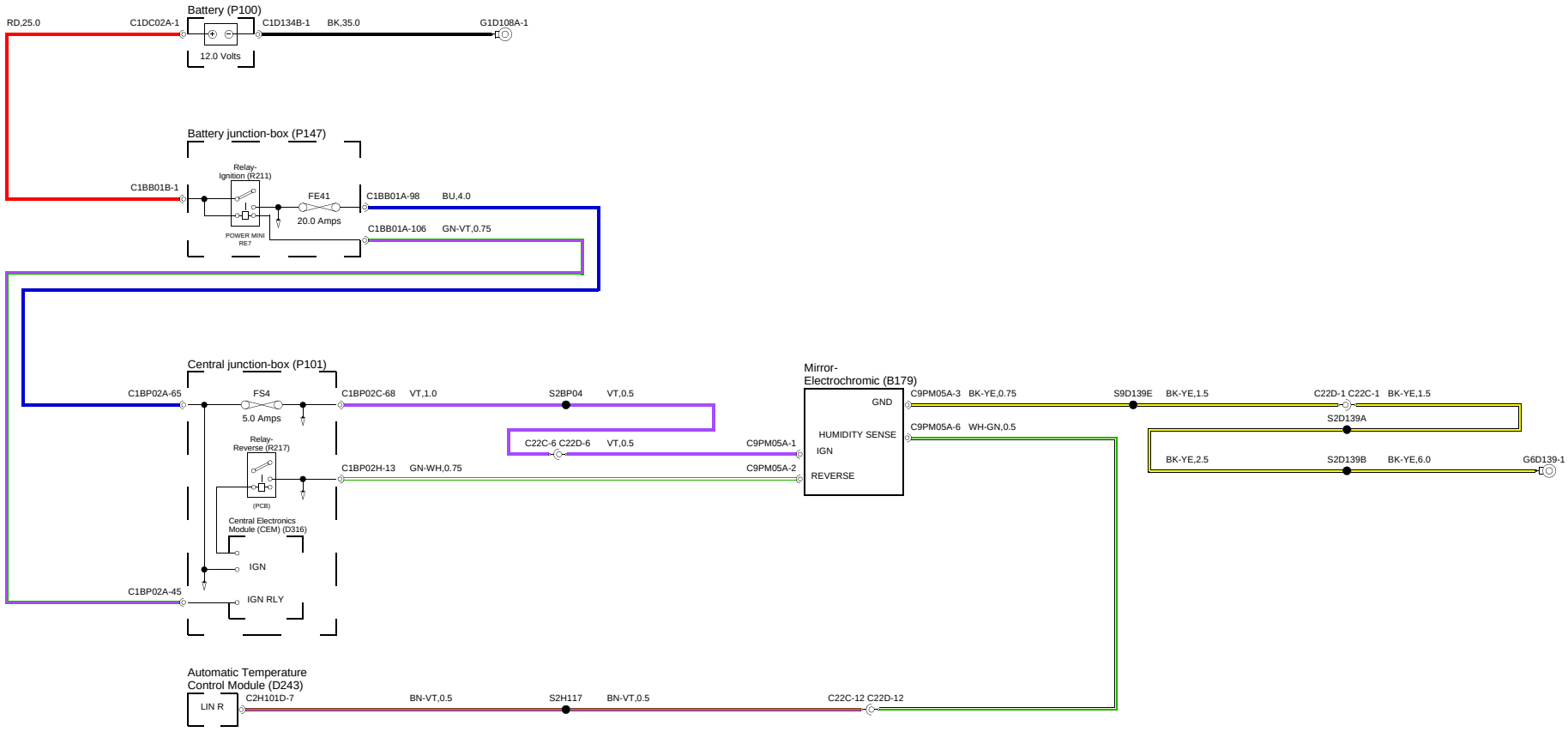

Module-Drivers-door (D253)
C5PL01A-20
GY-BU,0.5,385
S5PW32
GY-BU,0.5,685
C5PL22A-4
Switch-Window-Driver door (S344)
GY-BU,0.5,750
VT-BN,0.5,3480
(LHD)
C25B-6 C25A-6
C27A-5 C27B-5
VT-BN,0.5,1050
C7PL01-20
Module-Rear door-LH (D405)
VT-BN,0.5,2560
(RHD)
Module-Passenger-door (D254)
C6PL01A-20
VT-BN,0.5,1135
C26B-6 C26A-6
VT-BN,0.5,3620
(RHD)
C28A-5 C27B-5
VT-BN,0.5,1050
C7PL01-20
Module-Rear door-RH (D406)
VT-BN,0.5,3215
(LHD)
Module-Transmission-control (D294)
C1ET02-7
BN-VT,0.5,1350
C11P-11 C11N-11
BN-VT,0.5,2110
C21D-16 C21C-16
BN-VT,0.5,2633
C3ET42-2
FLY1,OG,0.50
Gearshift mechanism (D308)
Module-Headlamp levelling (D226)
LIN
C2LF39-17
YE,0.5,205
S1LF32
BK,0.5,2270
YE,0.5,2440
C1LF08A-10
Headlamp-LH (A101)
LIN SCR
C2LF39-8
BK,0.5,255
S1SCRA
BK,0.5,1610
YE,0.5,1770
C1LF09A-10
Headlamp-RH (A100)
Engine control-module (ECM) (D131)
C1E104H-C2
BU-BN,0.75,1420
(DIESEL)
C1DC14-1
Generator (M100)
(PETROL)
Engine control-module (ECM) (D131)
C1E109A-92
BU-BN,0.5,1405

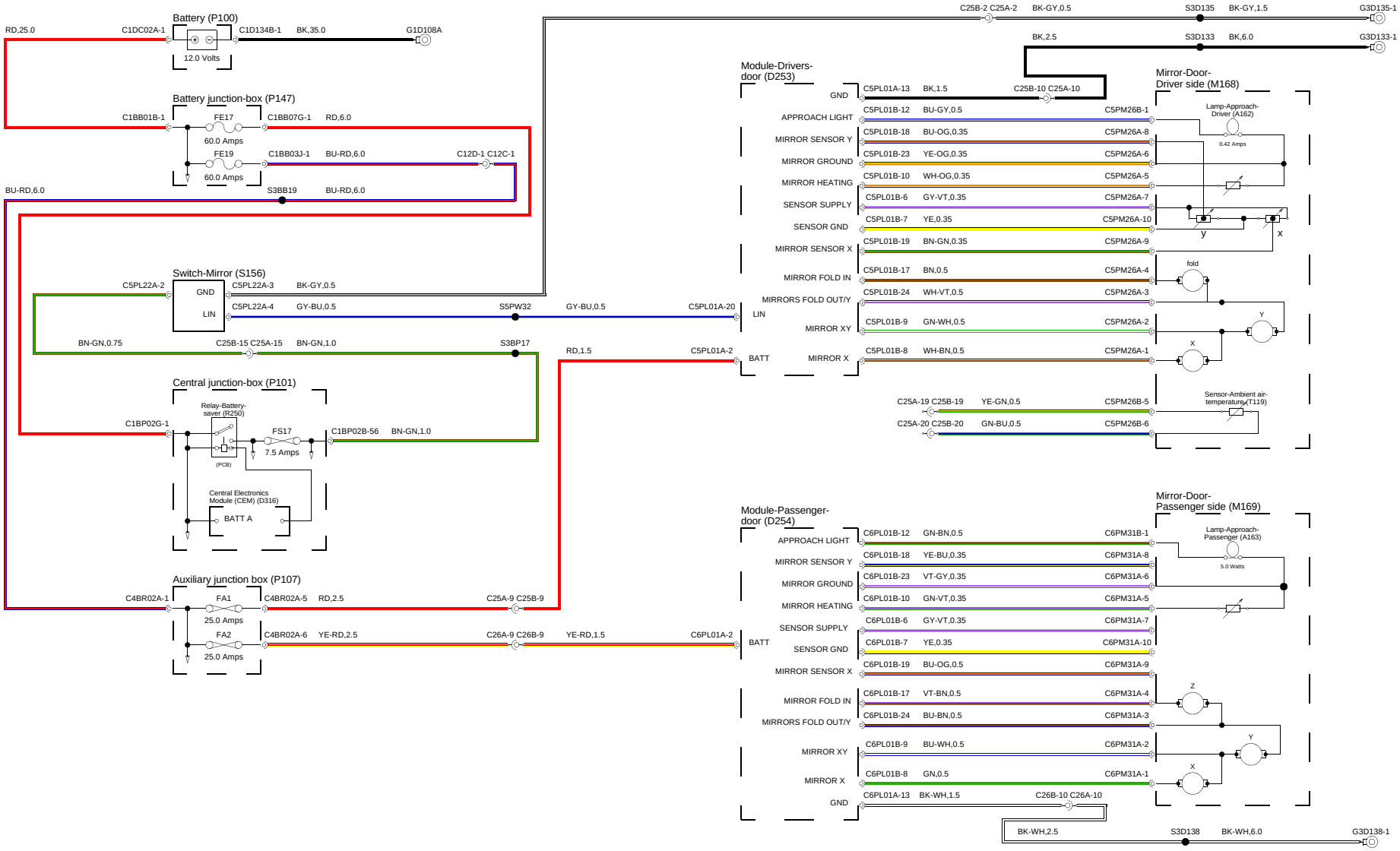

Central junction-box (P101)
S3DB04B WH,0.5,760 S3DB04A WH,0.5,1280 C23F-12 C23E-12 WH,0.5,1520 S2DB04H WH-BU,0.5,1774 S2DB04K WH-BU,0.5,554 S2DB04J WH-BU,0.35,1360 C1BP02C-47
S3DB05B WH-BU,0.5,855 S3DB05A WH-BU,0.5,1325 C23F-11 C23E-11 WH-BU,0.5,1570 S2DB05H WH,0.5,1680 S2DB05K WH,0.35,460 S2DB05J WH,0.35,1410 C1BP02C-48
Resistor-Terminating (G171)
Module-Steering wheel (D407)
WH-BU,0.5,780 C2LS41-7 HS CAN H
WH,0.5,830 C2LS41-6 HS CAN L
Switch pack-Centre-console (S350)
HS CAN H C3CA15-1 WH,0.5,755
HS CAN L C3CA15-2 WH-BU,0.5,705
NOT USED (V101)
NOT USED (V101)
C0752-1 C33P-19 WH,0.5,760
C0752-2 C33P-20 WH-BU,0.5,765
Diagnostic socket (V100)
WH,0.5,199 C2DB04-6 HS CAN H
WH-BU,0.5,155 C2DB04-14 HS CAN L
Restraints Control Module (RCM) (D171)
WH,0.5,659 C2R114C-19 HS CAN H
WH-BU,0.5,609 C2R114C-20 HS CAN L
Module-Active on-demand coupling (D417)
WH,0.5,2660 S4DB04C WH,0.5,930 C3A101-8 HS CAN H
WH-BU,0.5,2760 S4DB05C WH-BU,0.5,880 C3A101-7 HS CAN L
WH,0.5,3285
WH-BU,0.5,3335
Module-Transmission-control (D294)
(AUTO DIESEL) WH-BU,0.5,375 S1DB04F (AUTO DIESEL) WH-BU,0.5,975 C1ET02-14 HS CAN L
(PETROL) WH-BU,0.5,1615 S1DB04G (PETROL) WH-BU,0.5,745
WH-BU,0.5,685 (HID/AFS) S1DB04E (HID/AFS) WH-BU,0.5,160
C12G-9 C12H-9
WH-BU,0.5,525 (HALOGEN)
S1DB04D WH-BU,0.5,835 C11N-1 C11P-1
(PETROL) WH,0.5,1665 S1DB05G (PETROL) WH,0.5,795 C1ET02-6 HS CAN L
(AUTO DIESEL) WH,0.5,685 S1DB05F (AUTO DIESEL) WH,0.5,665
WH,0.5,750 (HID/AFS) S1DB05E (HID/AFS) WH,0.5,175
C12G-10 C12H-10
WH,0.5,575 (HALOGEN)
S1DB05D WH,0.5,785 C11N-12 C11P-12
Engine control-module (ECM) (D131)
WH-BU,0.5,610 (PETROL) C1E109B-54
WH,0.5,560 (PETROL) C1E109B-41
Resistor-Terminating (G171)
Module-Headlamp levelling (D226)
HS CAN H C2LF39-14 WH,0.5,1030
HS CAN L C2LF39-13 WH-BU,0.5,965
Engine control-module (ECM) (D131)
WH-BU,0.5,2115 (MANUAL-DIESEL)
WH-BU,0.5,1740 (AUTO DIESEL) C1E104H-A2
WH,0.5,2115 (MANUAL-DIESEL)
WH,0.5,1430 (AUTO DIESEL) C1E104H-A1
Resistor-Terminating (G171)
ABS module (D423)
HS CAN H C1CA01A-12 WH,0.5,275
HS CAN L C1CA01A-13 WH-BU,0.5,325

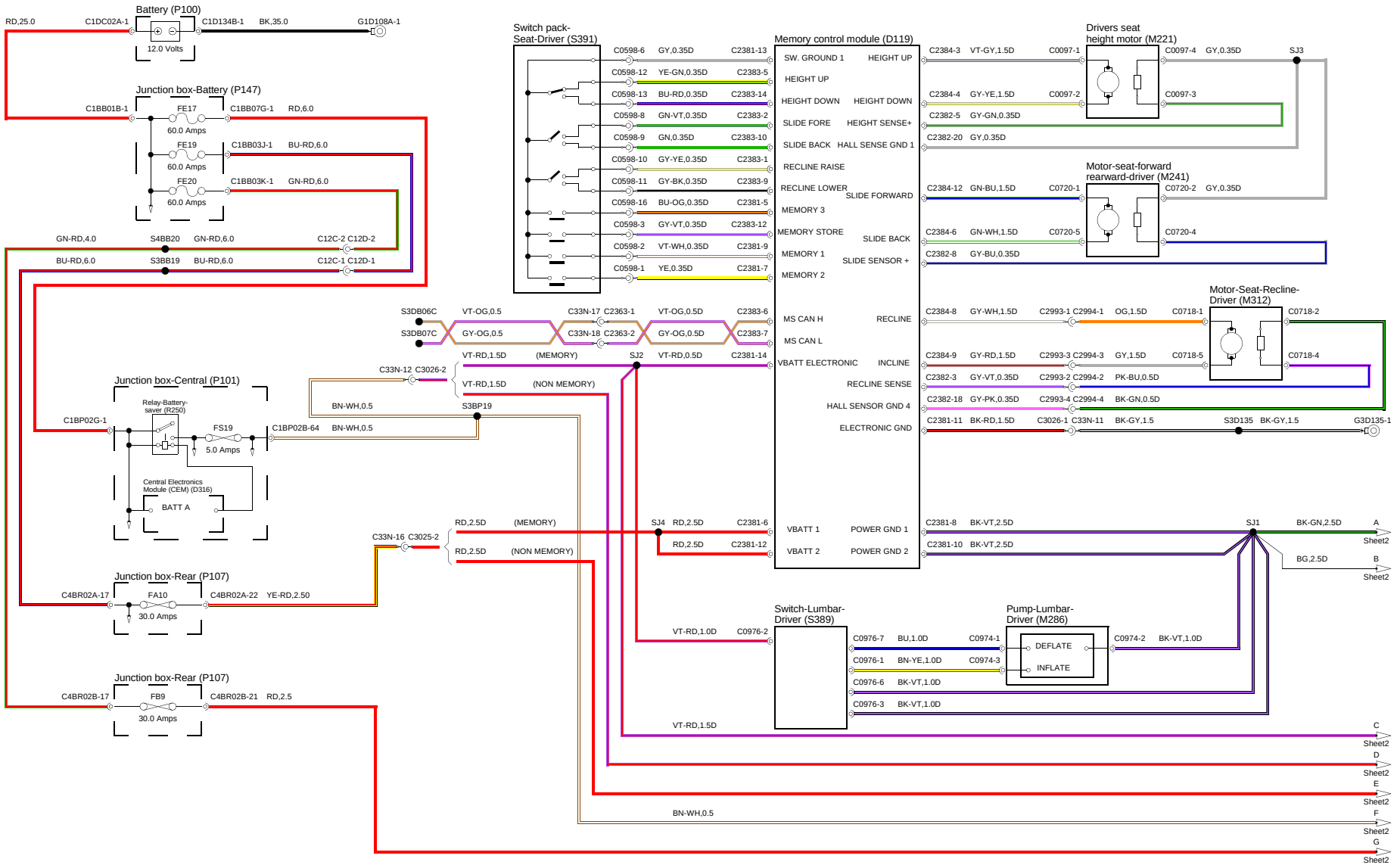

Central junction-box (P101)
MS CAN H
Resistor-Terminating (G171)
MS CAN L
(NON FUEL FIRED HEATER)
GY-OG,0.5,930
GY-OG,0.5,620
S2DB06G
GY-OG,0.5,470
S2DB06H
GY-OG,0.5,1335
C21C-5 C21D-5
GY-OG,0.5,855
S1DB06F
GY-OG,0.5,75
C1BP02A-49
(NON FUEL FIRED HEATER)
VT-OG,0.5,930
VT-OG,0.5,570
S2DB07G
VT-OG,0.5,570
S2DB07H
VT-OG,0.5,1385
C21C-4 C21D-4
VT-OG,0.5,835
S1DB07F
VT-OG,0.5,95
C1BP02A-50
Audio head unit (D282)
MS CAN H
C2ME03A-9
GY-OG,0.5,705
MS CAN L
C2ME03A-10
VT-OG,0.5,655
Fuel fired booster heater (H115)
GY-OG,0.5,1640
C1HF01C-11
G,0.5,1000
X1-7
MS CAN H
VT-OG,0.5,1620
C1HF01C-6
B,0.5,1000
X1-4
MS CAN L
Information and entertainment control module (D371)
MS CAN H
C2ME05A-2
GY-OG,0.5,695
MS CAN L
C2ME05A-3
VT-OG,0.5,645
Diagnostic socket (V100)
GY-OG,0.5,859
C2DB04-3
MS CAN H
VT-OG,0.5,809
C2DB04-11
MS CAN L
Automatic Temperature Control Module (D243)
C2H101D-10
MS CAN H
MS CAN H
C2H101D-8
GY-OG,0.5,1590
C23E-20 C23F-20
GY-OG,0.5,3420
S3DB06A
GY-OG,0.5,325
C25A-3 C25B-3
GY-OG,0.5,1135
C5PL01B-3
Module-Drivers-door (D253)
MS CAN H
C2H101D-11
MS CAN L
MS CAN L
C2H101D-9
VT-OG,0.5,1590
C23E-19 C23F-19
VT-OG,0.5,3370
S3DB07A
VT-OG,0.5,375
C25A-4 C25B-4
VT-OG,0.5,1135
C5PL01B-15
MS CAN L
Parking aid module (D184)
GY-OG,0.5,3610
VT-OG,0.5,4880
S3DB07D
VT-OG,0.35,1085
C4MP01A-7
MS CAN L
GY-OG,0.5,4980
S3DB06D
GY-OG,0.35,1035
C4MP01A-14
MS CAN H
VT-OG,0.5,3610
Module-Passenger-door (D254)
MS CAN H
C6PL01B-3
GY-OG,0.5,1135
C26B-3 C26A-3
GY-OG,0.5,385
S3DB06B
GY-OG,0.5,3710
MS CAN L
C6PL01B-15
VT-OG,0.5,1135
C26B-4 C26A-4
VT-OG,0.5,335
S3DB07B
VT-OG,0.5,3710
VT-OG,0.5,3305
GY-OG,0.5,3305
Memory control module (D119)
VT-OG,0.5,3650
S3DB07C
VT-OG,0.5,80
C33N-18 C2363-2
VT-OG,0.5D,585
C2383-7
MS CAN L
GY-OG,0.5,3550
S3DB06C
GY-OG,0.5,130
C33N-17 C2363-1
GY-OG,0.5D,585
C2383-6
MS CAN H
ECU-Trailer (D221)
VT-OG,0.5,4515
S4DB07E
VT-OG,0.5,825
C44X-5 C44Y-5
VT-OG,0.5,445
C4AT23E-2
MS CAN L
GY-OG,0.5,4515
S4DB06E
GY-OG,0.5,775
C44X-4 C44Y-4
GY-OG,0.5,445
C4AT23E-1
MS CAN H
Instrument cluster (D107)
Resistor-Terminating (G171)
MS CAN H
C2MC01A-16
GY-OG,0.5,1740
C23E-17 C23F-17
GY-OG,0.5,3115
MS CAN L
C2MC01A-32
VT-OG,0.5,1740
C23E-18 C23F-18
VT-OG,0.5,3065

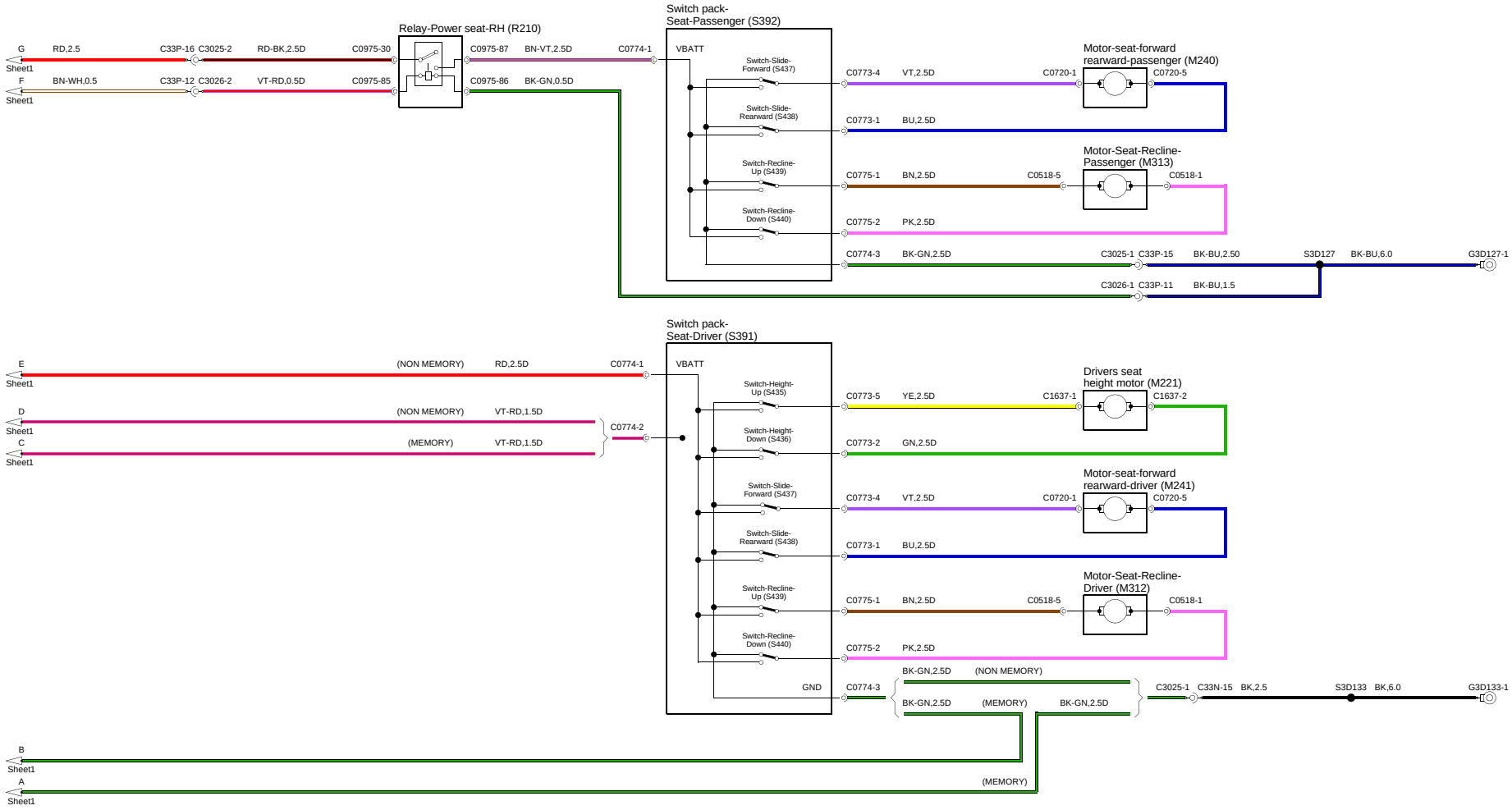

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1 BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
60.0 Amps
C1BB07G-1 RD,6.0
C1BP02G-1
Central junction-box (P101)
FS26
5.0 Amps
C1BP02A-67 BK,0.75
C1RT16A-3
C1RT16A-2
Battery backed sounder (D154)
0.25 Amps
C1RT16A-1 BK-YE,0.5
A
Sheet2
Instrument cluster (D107)
Anti-theft alarm warning indicator (J139)
C2MC01A-26 WH-VT,0.5
C1BP02C-23
Central Electronics Module (CEM) (D316)
BATT
LIN 0
LIN 4
ALARM LED
C1BP02A-35 BK,0.5
C1BP02H-5 GY-BN,0.5
C3PL56-1
C1BP02H-15 GY-RD,0.5
C3PL56-3
FS21
5.0 Amps
Receiver-Radio-frequency (RF) (T203)
C3PL56-2 BK-YE,0.5
S9D139B BK-YE,1.5
C22D-7 C22C-7
S2D139A BK-YE,1.5
BK-YE,2.5
S2D139B BK-YE,6.0
G6D139-1
BK-YE,1.5
C22C-1 C22D-1
Module-Intrusion detection (T388)
C1BP02H-16 GY-RD,0.5
C3RT12-3
C1BP02H-7 VT,0.5
C3RT12-2
0.10 Amps
C3RT12-1 BK-YE,0.5
S9D139E BK-YE,1.5
LIN 0
FR AJAR SW
C1BP02B-6 WH,0.5
B
Sheet2
FL AJAR SW
C1BP02B-7 GN-VT,0.5
C
Sheet2
REAR LH AJAR SW
C1BP02B-9 GN,0.5
D
Sheet2
REAR RH AJAR SW
C1BP02B-8 YE,0.5
E
Sheet2
HOOD AJAR
C1BP02A-23 BU-OG,0.5
F
Sheet2
TAIL AJAR
C1BP02B-10 YE-OG,0.75
G
Sheet2
ELECTRONIC GND
C1BP02A-54 BK-VT,0.75
G1D132B-1
MS CAN H
C1BP02A-49 VT-OG,0.5
S1DB06F
MS CAN L
C1BP02A-50 GY-OG,0.5
S1DB07F

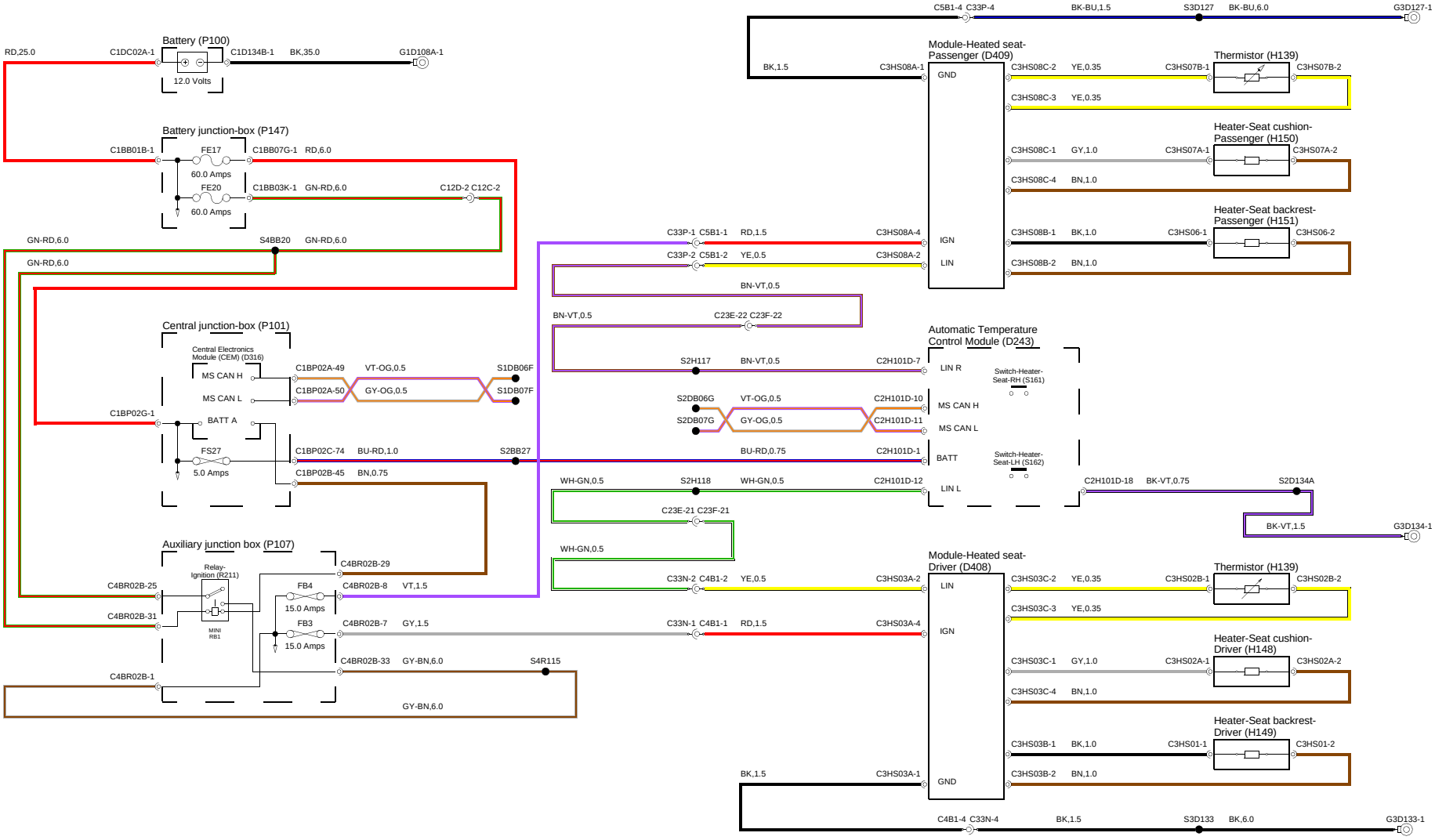

Motor-Central door-locking-Driver (M236)
Switch-Door-Driver (S409)
Module-Drivers-door (D253)
C GN-VT,0.5 C25A-1 C25B-1 BK,0.5 C5PL63-4 C5PL63-1 BK,0.5 C5PL01A-15
Sheet1
Motor-Central door-locking-Rear-RH (M166)
Switch-Door-Rear-RH (S129)
Module-Rear door-RH (D406)
D GN,0.5 C27A-6 C27B-6 BK,0.5 C7PL71-4 C7PL71-1 BK,0.5 C7PL01-15
Sheet1
Motor-Central door-locking-Passenger (M237)
Switch-Door-Passenger (S410)
Module-Passenger-door (D254)
B WH,0.5 C26A-1 C26B-1 BK,0.5 C6PL64-4 C6PL64-1 BK,0.5 C6PL01A-15
Sheet1
Motor-Central door-locking-Rear-LH (M167)
Switch-Door-Rear-LH (S130)
Module-Rear door-LH (D405)
E YE,0.5 C28A-6 C27B-6 BK,0.5 C7PL71-4 C7PL71-1 BK,0.5 C7PL01-15
Sheet1
Switch-Bonnet (S224)
F BU-OG,0.5 C1RT17A-1 C1RT17A-2 BK-YE,0.5 S1D130D BK-YE,1.0 G1D130B-1
Sheet1
A BK-YE,0.5
Sheet1
Motor-CDL-Tailgate-Upper (M255)
Switch-Tail door-open (S250)
G YE-OG,0.75 C44N-2 C44M-2 BK,0.75 C4PL17A-3 C4PL17A-2 BK,1.0 S4D149D BK-GY,1.5 C44M-5 C44N-5 BK-GY,1.5 S4D149A
Sheet1
BK-GY,2.5 S4D149B BK-GY,6.0 G4D149-1

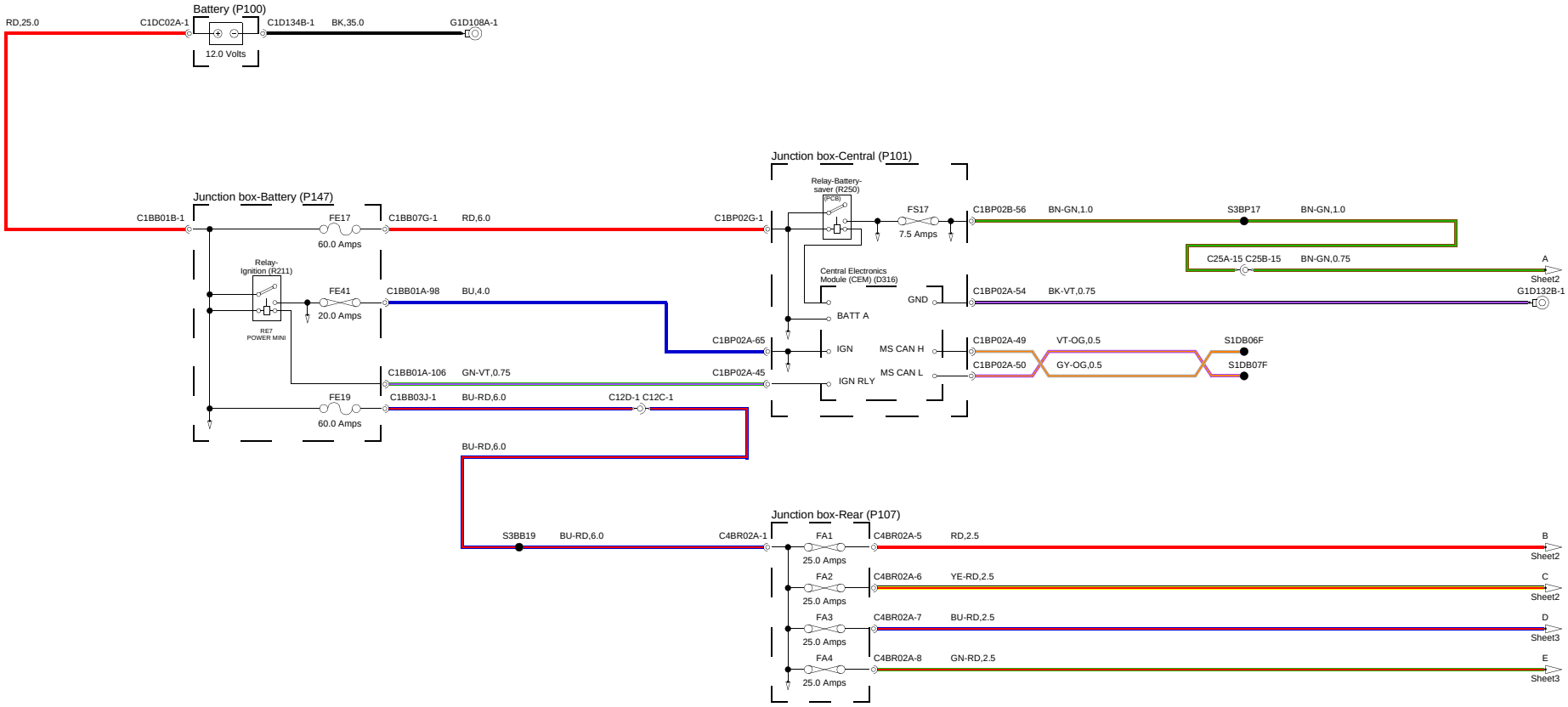

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
Relay-
Ignition (R211)
C1BB01B-1
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BB01A-106
GN-VT,0.75
POWER MINI
RE7
Central junction-box (P101)
C1BP02A-65
FS4
5.0 Amps
C1BP02C-68
VT,1.0
S2BP04
VT,0.5
Relay-
Reverse (R217)
C1BP02H-13
GN-WH,0.75
(PCB)
Central Electronics
Module (CEM) (D316)
IGN
C1BP02A-45
IGN RLY
Mirror-
Electrochromic (B179)
GND
HUMIDITY SENSE
IGN
REVERSE
C22C-6 C22D-6
VT,0.5
C9PM05A-1
C9PM05A-2
C9PM05A-3
BK-YE,0.75
S9D139E
BK-YE,1.5
C22D-1 C22C-1
BK-YE,1.5
S2D139A
C9PM05A-6
WH-GN,0.5
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
Automatic Temperature
Control Module (D243)
LIN R
C2H101D-7
BN-VT,0.5
S2H117
BN-VT,0.5
C22C-12 C22D-12

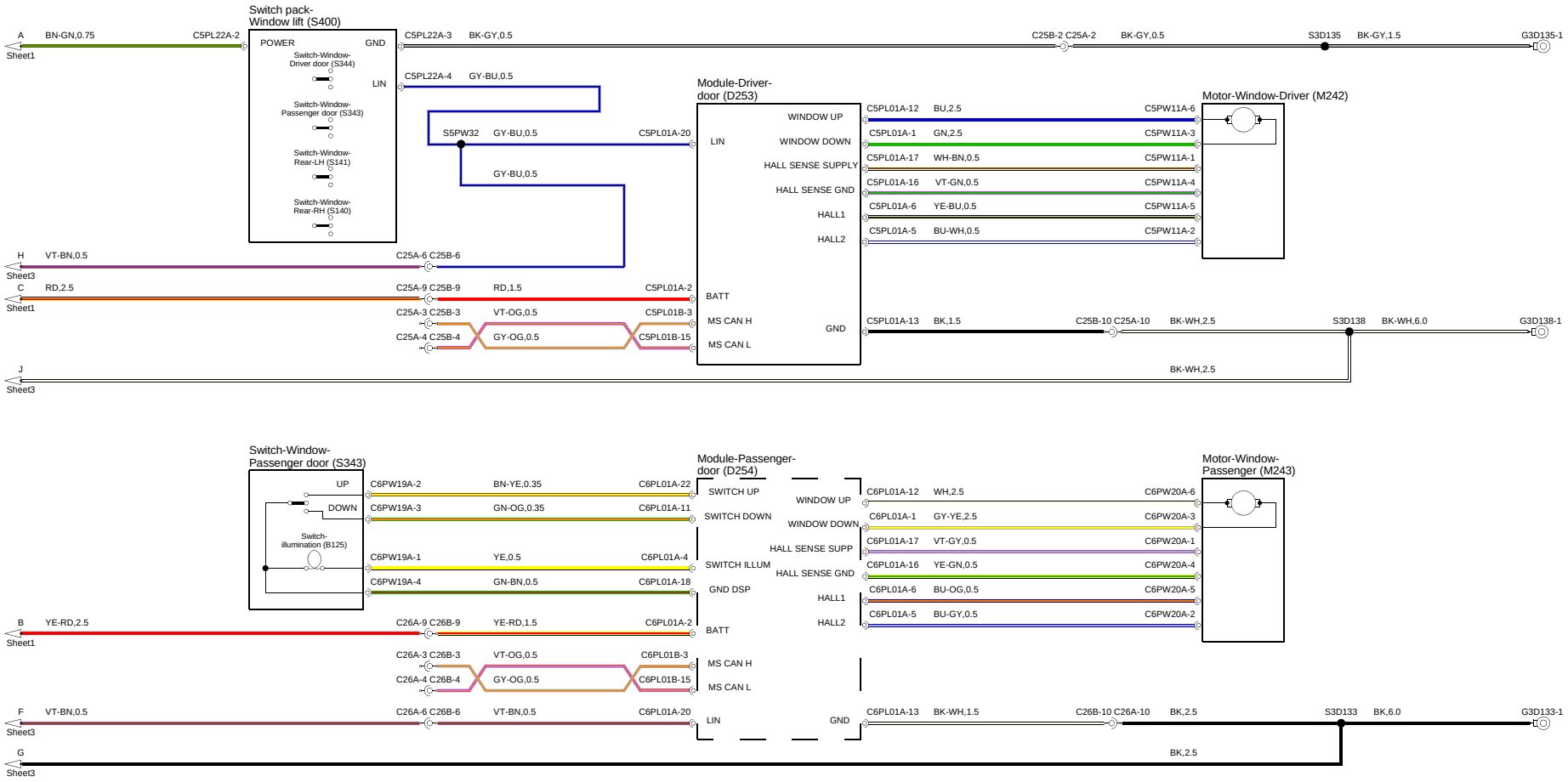

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
FE19
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
60.0 Amps
BU-RD,6.0
S3BB19
BU-RD,6.0
Switch-Mirror (S156)
C5PL22A-2
GND
C5PL22A-3
BK-GY,0.5
LIN
C5PL22A-4
GY-BU,0.5
S5PW32
GY-BU,0.5
C5PL01A-20
BN-GN,0.75
C25B-15 C25A-15
BN-GN,1.0
S3BP17
RD,1.5
C5PL01A-2
Central junction-box (P101)
Relay-Battery-saver (R250)
C1BP02G-1
FS17
7.5 Amps
C1BP02B-56
BN-GN,1.0
(PCB)
Central Electronics Module (CEM) (D316)
BATT A
Auxiliary junction box (P107)
C4BR02A-1
FA1
C4BR02A-5
RD,2.5
C25A-9 C25B-9
25.0 Amps
FA2
C4BR02A-6
YE-RD,2.5
C26A-9 C26B-9
YE-RD,1.5
C6PL01A-2
25.0 Amps
C25B-2 C25A-2
BK-GY,0.5
S3D135
BK-GY,1.5
G3D135-1
BK,2.5
S3D133
BK,6.0
G3D133-1
Module-Drivers-door (D253)
GND
C5PL01A-13
BK,1.5
C25B-10 C25A-10
APPROACH LIGHT
C5PL01B-12
BU-GY,0.5
C5PM26B-1
MIRROR SENSOR Y
C5PL01B-18
BU-OG,0.35
C5PM26A-8
MIRROR GROUND
C5PL01B-23
YE-OG,0.35
C5PM26A-6
MIRROR HEATING
C5PL01B-10
WH-OG,0.35
C5PM26A-5
SENSOR SUPPLY
C5PL01B-6
GY-VT,0.35
C5PM26A-7
SENSOR GND
C5PL01B-7
YE,0.35
C5PM26A-10
MIRROR SENSOR X
C5PL01B-19
BN-GN,0.35
C5PM26A-9
MIRROR FOLD IN
C5PL01B-17
BN,0.5
C5PM26A-4
MIRRORS FOLD OUT/Y
C5PL01B-24
WH-VT,0.5
C5PM26A-3
LIN
MIRROR XY
C5PL01B-9
GN-WH,0.5
C5PM26A-2
BATT
MIRROR X
C5PL01B-8
WH-BN,0.5
C5PM26A-1
C25A-19 C25B-19
YE-GN,0.5
C5PM26B-5
C25A-20 C25B-20
GN-BU,0.5
C5PM26B-6
Mirror-Door-Driver side (M168)
Lamp-Approach-Driver (A162)
0.42 Amps
y
x
fold
Y
X
Sensor-Ambient air-temperature (T119)
Module-Passenger-door (D254)
APPROACH LIGHT
C6PL01B-12
GN-BN,0.5
C6PM31B-1
MIRROR SENSOR Y
C6PL01B-18
YE-BU,0.35
C6PM31A-8
MIRROR GROUND
C6PL01B-23
VT-GY,0.35
C6PM31A-6
MIRROR HEATING
C6PL01B-10
GN-VT,0.35
C6PM31A-5
SENSOR SUPPLY
C6PL01B-6
GY-VT,0.35
C6PM31A-7
BATT
SENSOR GND
C6PL01B-7
YE,0.35
C6PM31A-10
MIRROR SENSOR X
C6PL01B-19
BU-OG,0.5
C6PM31A-9
MIRROR FOLD IN
C6PL01B-17
VT-BN,0.5
C6PM31A-4
MIRRORS FOLD OUT/Y
C6PL01B-24
BU-BN,0.5
C6PM31A-3
MIRROR XY
C6PL01B-9
BU-WH,0.5
C6PM31A-2
MIRROR X
C6PL01B-8
GN,0.5
C6PM31A-1
GND
C6PL01A-13
BK-WH,1.5
C26B-10 C26A-10
BK-WH,2.5
S3D138
BK-WH,6.0
G3D138-1
Mirror-Door-Passenger side (M169)
Lamp-Approach-Passenger (A163)
5.0 Watts
Z
Y
X

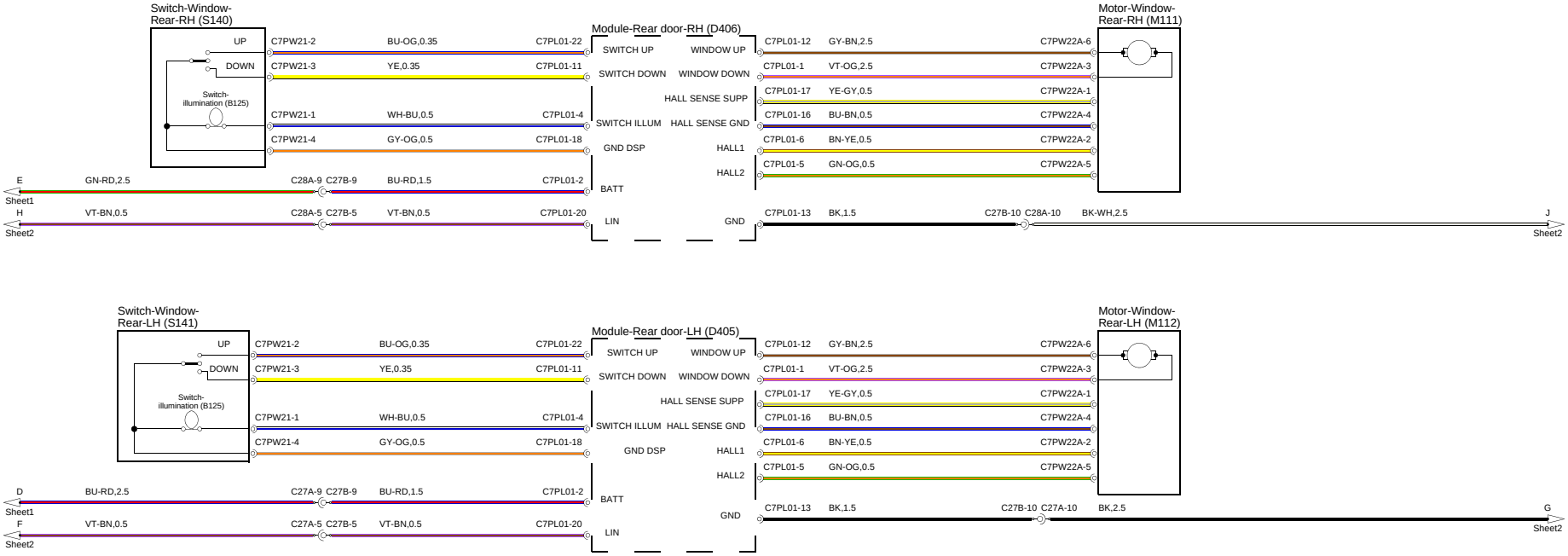

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Junction box-Battery (P147)
C1BB01B-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
FE19
C1BB03J-1
BU-RD,6.0
FE20
C1BB03K-1
GN-RD,6.0
GN-RD,4.0
S4BB20
C12C-2 C12D-2
BU-RD,6.0
S3BB19
C12C-1 C12D-1
Switch pack-Seat-Driver (S391)
Memory control module (D119)
SW. GROUND 1
HEIGHT UP
HEIGHT DOWN
SLIDE FORE
SLIDE BACK
RECLINE RAISE
RECLINE LOWER
MEMORY 3
MEMORY STORE
MEMORY 1
MEMORY 2
SLIDE FORWARD
SLIDE BACK
SLIDE SENSOR +
HALL SENSE GND 1
HEIGHT SENSE+
C0598-6 GY,0.35D C2381-13
C0598-12 YE-GN,0.35D C2383-5
C0598-13 BU-RD,0.35D C2383-14
C0598-8 GN-VT,0.35D C2383-2
C0598-9 GN,0.35D C2383-10
C0598-10 GY-YE,0.35D C2383-1
C0598-11 GY-BK,0.35D C2383-9
C0598-16 BU-OG,0.35D C2381-5
C0598-3 GY-VT,0.35D C2383-12
C0598-2 VT-WH,0.35D C2381-9
C0598-1 YE,0.35D C2381-7
Drivers seat height motor (M221)
C2384-3 VT-GY,1.5D C0097-1
C0097-4 GY,0.35D SJ3
C2384-4 GY-YE,1.5D C0097-2
C0097-3
C2382-5 GY-GN,0.35D
C2382-20 GY,0.35D
Motor-seat-forward rearward-driver (M241)
C2384-12 GN-BU,1.5D C0720-1
C0720-2 GY,0.35D
C2384-6 GN-WH,1.5D C0720-5
C0720-4
C2382-8 GY-BU,0.35D
Motor-Seat-Recline-Driver (M312)
S3DB06C VT-OG,0.5
S3DB07C GY-OG,0.5
C33N-17 C2363-1 VT-OG,0.5D C2383-6
C33N-18 C2363-2 GY-OG,0.5D C2383-7
MS CAN H
MS CAN L
RECLINE
C2384-8 GY-WH,1.5D C2993-1 C2994-1 OG,1.5D C0718-1
C0718-2
C2384-9 GY-RD,1.5D C2993-3 C2994-3 GY,1.5D C0718-5
C0718-4
C2382-3 GY-VT,0.35D C2993-2 C2994-2 PK-BU,0.5D
C2382-18 GY-PK,0.35D C2993-4 C2994-4 BK-GN,0.5D
C2381-11 BK-RD,1.5D C3026-1 C33N-11 BK-GY,1.5
S3D135 BK-GY,1.5
G3D135-1
VT-RD,1.5D (MEMORY) SJ2 VT-RD,0.5D C2381-14
C33N-12 C3026-2
VT-RD,1.5D (NON MEMORY)
BN-WH,0.5
S3BP19
VBATT ELECTRONIC
INCLINE
RECLINE SENSE
HALL SENSOR GND 4
ELECTRONIC GND
Junction box-Central (P101)
Relay-Battery-saver (R250)
C1BP02G-1
FS19
5.0 Amps
C1BP02B-64 BN-WH,0.5
Central Electronics Module (CEM) (D316)
BATT A
RD,2.5D (MEMORY)
C33N-16 C3025-2
RD,2.5D (NON MEMORY)
SJ4 RD,2.5D C2381-6
RD,2.5D C2381-12
VBATT 1
VBATT 2
POWER GND 1
POWER GND 2
C2381-8 BK-VT,2.5D
C2381-10 BK-VT,2.5D
SJ1
BK-GN,2.5D
A
Sheet2
BG,2.5D
B
Sheet2
Junction box-Rear (P107)
C4BR02A-17
FA10
30.0 Amps
C4BR02A-22 YE-RD,2.50
Switch-Lumbar-Driver (S389)
Pump-Lumbar-Driver (M286)
VT-RD,1.0D C0976-2
C0976-7 BU,1.0D C0974-1
C0976-1 BN-YE,1.0D C0974-3
C0976-6 BK-VT,1.0D
C0976-3 BK-VT,1.0D
DEFLATE
INFLATE
C0974-2 BK-VT,1.0D
Junction box-Rear (P107)
C4BR02B-17
FB9
30.0 Amps
C4BR02B-21 RD,2.5
VT-RD,1.5D
C
Sheet2
D
Sheet2
E
Sheet2
BN-WH,0.5
F
Sheet2
G
Sheet2

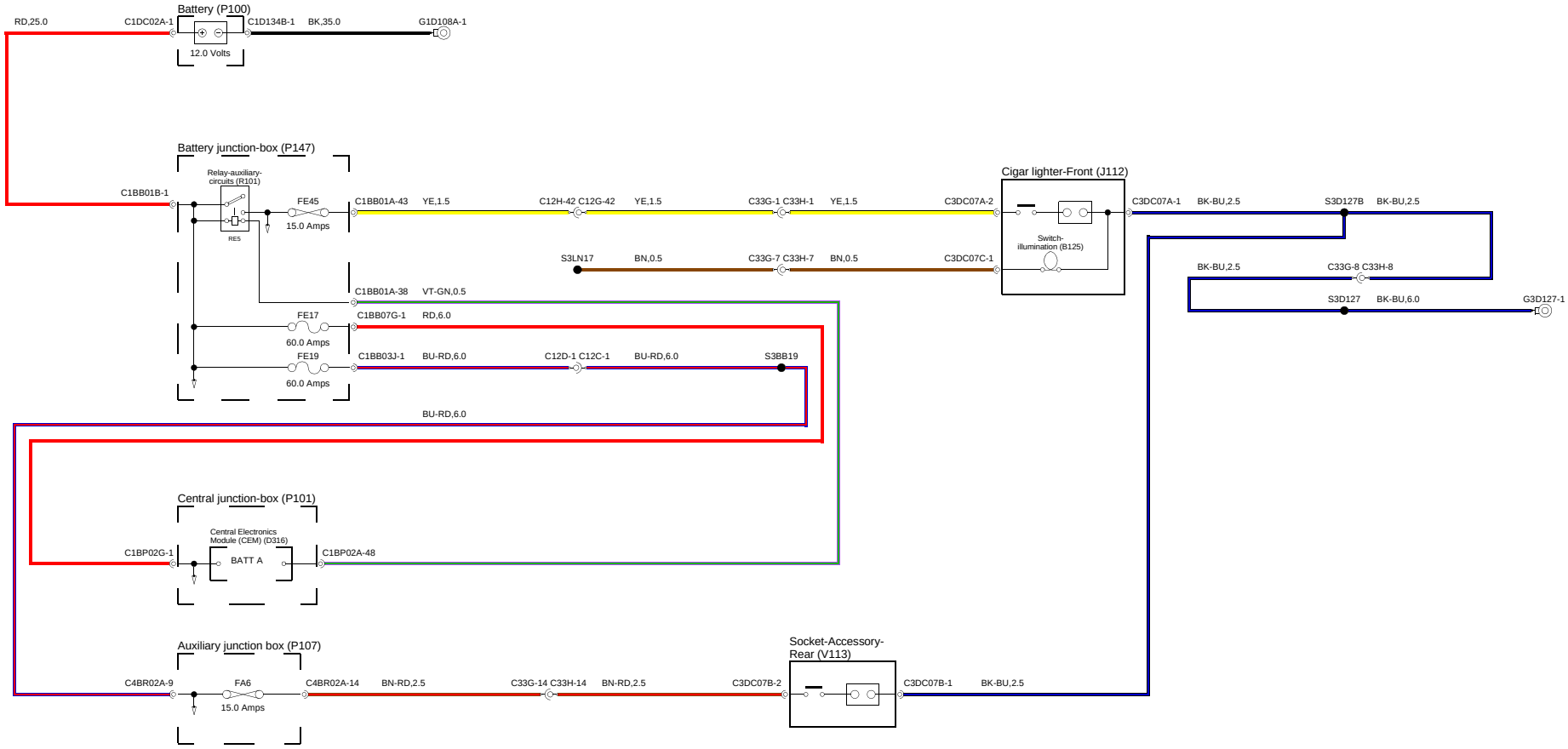

Relay-Power seat-RH (R210)
Switch pack-
Seat-Passenger (S392)
G RD,2.5 C33P-16 C3025-2 RD-BK,2.5 C0975-30
Sheet1
F BN-WH,0.5 C33P-12 C3026-2 VT-RD,0.5D C0975-85
Sheet1
C0975-87 BN-VT,2.5D C0774-1
C0975-86 BK-GN,0.5D
VBATT
Switch-Slide-
Forward (S437)
Switch-Slide-
Rearward (S438)
Switch-Recline-
Up (S439)
Switch-Recline-
Down (S440)
C0773-4 VT,2.5D C0720-1
C0773-1 BU,2.5D
C0775-1 BN,2.5D C0518-5
C0775-2 PK,2.5D
C0774-3 BK-GN,2.5D
Motor-seat-forward
rearward-passenger (M240)
C0720-5
Motor-Seat-Recline-
Passenger (M313)
C0518-1
C3025-1 C33P-15 BK-BU,2.50 S3D127 BK-BU,6.0 G3D127-1
C3026-1 C33P-11 BK-BU,1.5
Switch pack-
Seat-Driver (S391)
E (NON MEMORY) RD,2.5D C0774-1
Sheet1
D (NON MEMORY) VT-RD,1.5D
Sheet1
C (MEMORY) VT-RD,1.5D
Sheet1
C0774-2
VBATT
Switch-Height-
Up (S435)
Switch-Height-
Down (S436)
Switch-Slide-
Forward (S437)
Switch-Slide-
Rearward (S438)
Switch-Recline-
Up (S439)
Switch-Recline-
Down (S440)
GND
C0773-5 YE,2.5D C1637-1
C0773-2 GN,2.5D
C0773-4 VT,2.5D C0720-1
C0773-1 BU,2.5D
C0775-1 BN,2.5D C0518-5
C0775-2 PK,2.5D
C0774-3
Drivers seat
height motor (M221)
C1637-2
Motor-seat-forward
rearward-driver (M241)
C0720-5
Motor-Seat-Recline-
Driver (M312)
C0518-1
BK-GN,2.5D (NON MEMORY)
BK-GN,2.5D (MEMORY) BK-GN,2.5D
C3025-1 C33N-15 BK,2.5 S3D133 BK,6.0 G3D133-1
B
Sheet1
A
Sheet1
(MEMORY)

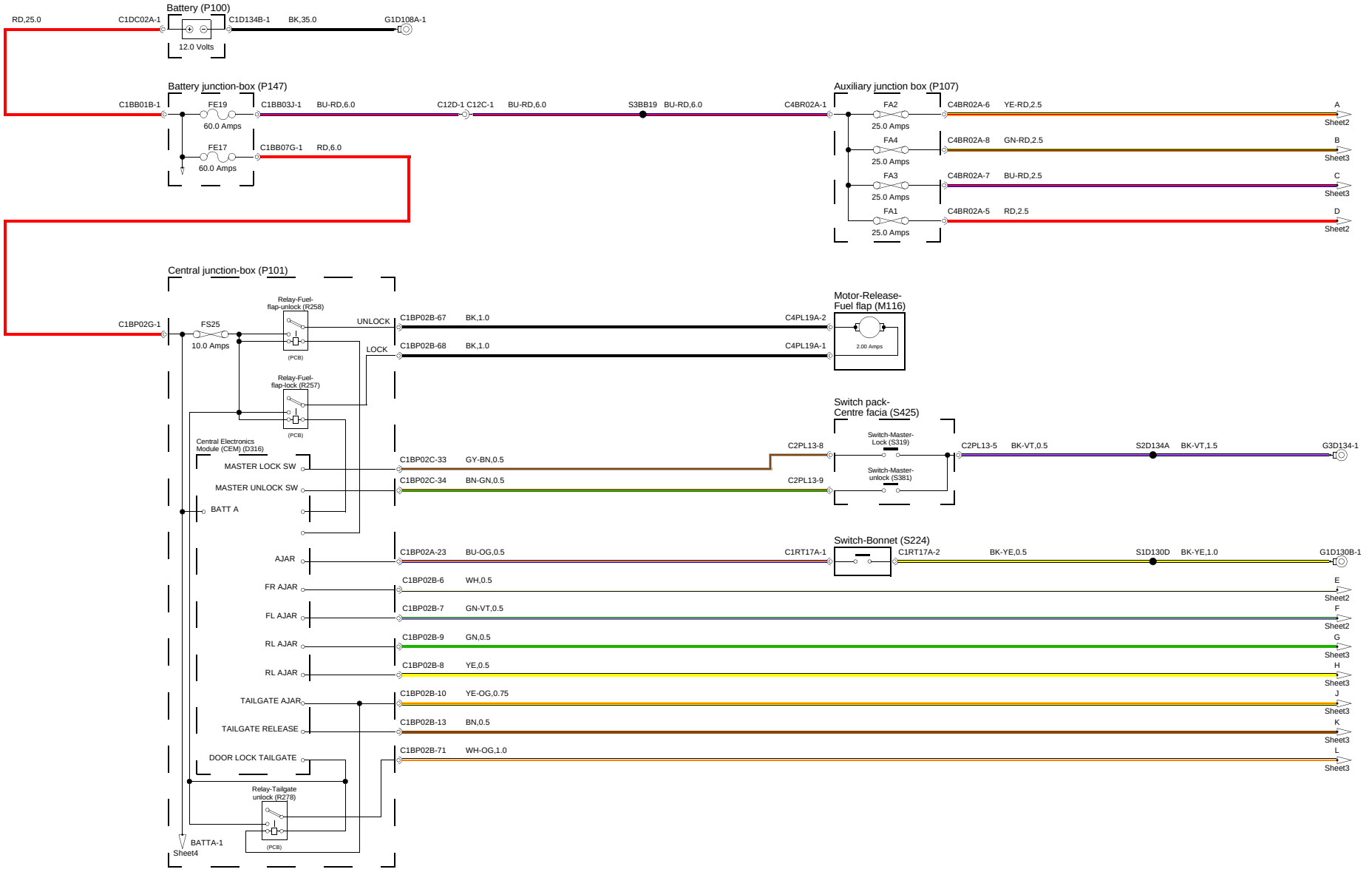

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
C1BB07G-1
RD,6.0
60.0 Amps
FE20
C1BB03K-1
GN-RD,6.0
C12D-2 C12C-2
60.0 Amps
GN-RD,6.0
S4BB20
GN-RD,6.0
GN-RD,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
MS CAN H
MS CAN L
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
C1BP02G-1
BATT A
FS27
5.0 Amps
C1BP02C-74
BU-RD,1.0
S2BB27
C1BP02B-45
BN,0.75
Auxiliary junction box (P107)
Relay-Ignition (R211)
MINI RB1
C4BR02B-29
C4BR02B-25
FB4
15.0 Amps
C4BR02B-8
VT,1.5
C4BR02B-31
FB3
15.0 Amps
C4BR02B-7
GY,1.5
C4BR02B-33
GY-BN,6.0
S4R115
C4BR02B-1
GY-BN,6.0
C5B1-4 C33P-4
BK-BU,1.5
S3D127
BK-BU,6.0
G3D127-1
Module-Heated seat-Passenger (D409)
BK,1.5
C3HS08A-1
GND
C3HS08A-4
IGN
C33P-1 C5B1-1
RD,1.5
C3HS08A-2
LIN
C33P-2 C5B1-2
YE,0.5
BN-VT,0.5
BN-VT,0.5
C23E-22 C23F-22
Thermistor (H139)
C3HS08C-2
YE,0.35
C3HS07B-1
C3HS07B-2
C3HS08C-3
YE,0.35
Heater-Seat cushion-Passenger (H150)
C3HS08C-1
GY,1.0
C3HS07A-1
C3HS07A-2
C3HS08C-4
BN,1.0
Heater-Seat backrest-Passenger (H151)
C3HS08B-1
BK,1.0
C3HS06-1
C3HS06-2
C3HS08B-2
BN,1.0
Automatic Temperature Control Module (D243)
S2H117
BN-VT,0.5
C2H101D-7
LIN R
Switch-Heater-Seat-RH (S161)
S2DB06G
VT-OG,0.5
C2H101D-10
MS CAN H
S2DB07G
GY-OG,0.5
C2H101D-11
MS CAN L
BU-RD,0.75
C2H101D-1
BATT
Switch-Heater-Seat-LH (S162)
WH-GN,0.5
S2H118
WH-GN,0.5
C2H101D-12
LIN L
C23E-21 C23F-21
WH-GN,0.5
C2H101D-18
BK-VT,0.75
S2D134A
BK-VT,1.5
G3D134-1
Module-Heated seat-Driver (D408)
C33N-2 C4B1-2
YE,0.5
C3HS03A-2
LIN
C33N-1 C4B1-1
RD,1.5
C3HS03A-4
IGN
BK,1.5
C3HS03A-1
GND
Thermistor (H139)
C3HS03C-2
YE,0.35
C3HS02B-1
C3HS02B-2
C3HS03C-3
YE,0.35
Heater-Seat cushion-Driver (H148)
C3HS03C-1
GY,1.0
C3HS02A-1
C3HS02A-2
C3HS03C-4
BN,1.0
Heater-Seat backrest-Driver (H149)
C3HS03B-1
BK,1.0
C3HS01-1
C3HS01-2
C3HS03B-2
BN,1.0
C4B1-4 C33N-4
BK,1.5
S3D133
BK,6.0
G3D133-1

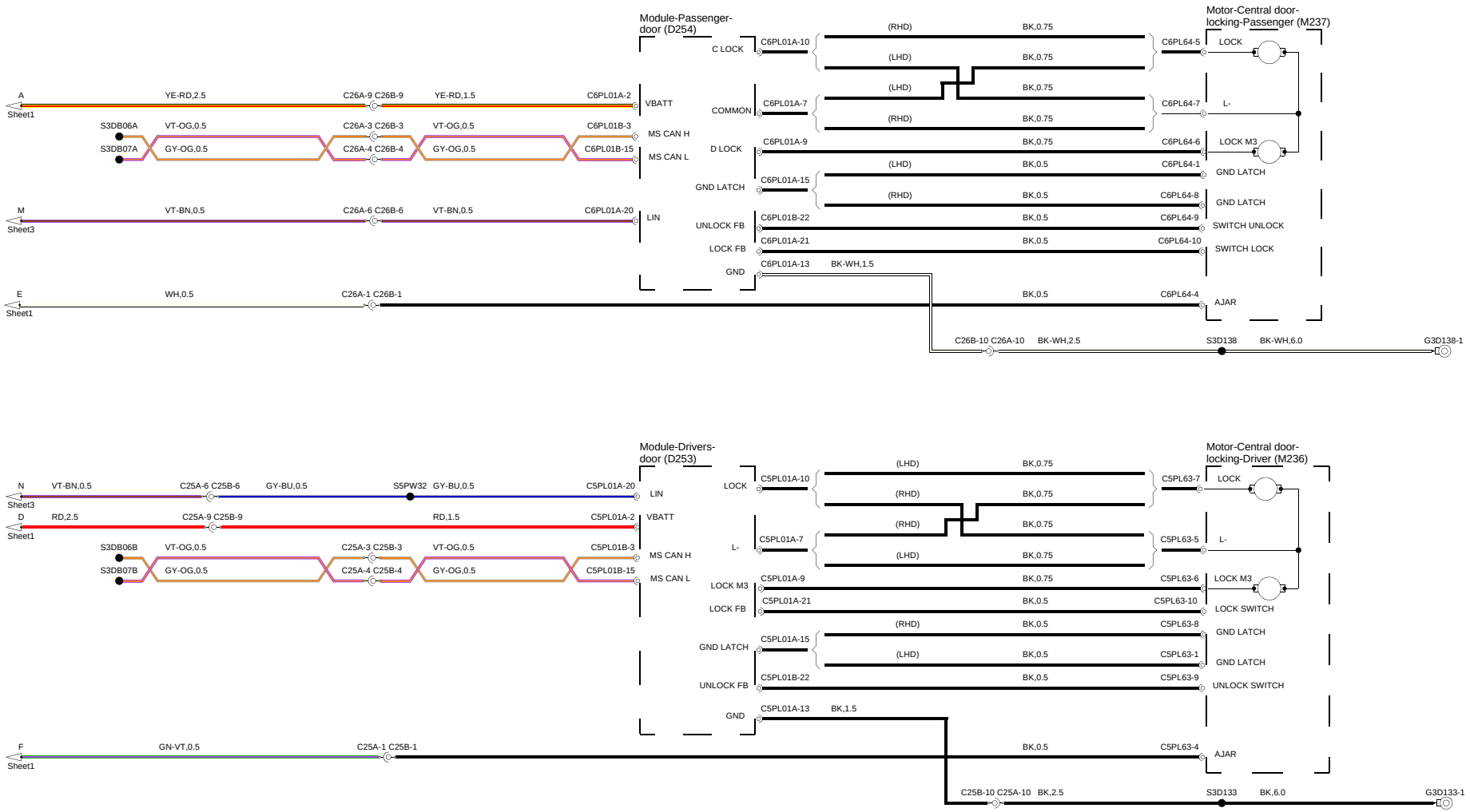

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Junction box-Battery (P147)
C1BB01B-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
Relay-Ignition (R211)
RE7 POWER MINI
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BB01A-106
GN-VT,0.75
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
Junction box-Central (P101)
Relay-Battery-saver (R250)
(PCB)
C1BP02G-1
FS17
7.5 Amps
C1BP02B-56
BN-GN,1.0
S3BP17
BN-GN,1.0
C25A-15 C25B-15
BN-GN,0.75
A
Sheet2
Central Electronics Module (CEM) (D316)
GND
C1BP02A-54
BK-VT,0.75
G1D132B-1
BATT A
C1BP02A-65
IGN
MS CAN H
C1BP02A-49
VT-OG,0.5
S1DB06F
C1BP02A-50
GY-OG,0.5
S1DB07F
C1BP02A-45
IGN RLY
MS CAN L
BU-RD,6.0
Junction box-Rear (P107)
S3BB19
BU-RD,6.0
C4BR02A-1
FA1
25.0 Amps
C4BR02A-5
RD,2.5
B
Sheet2
FA2
25.0 Amps
C4BR02A-6
YE-RD,2.5
C
Sheet2
FA3
25.0 Amps
C4BR02A-7
BU-RD,2.5
D
Sheet3
FA4
25.0 Amps
C4BR02A-8
GN-RD,2.5
E
Sheet3

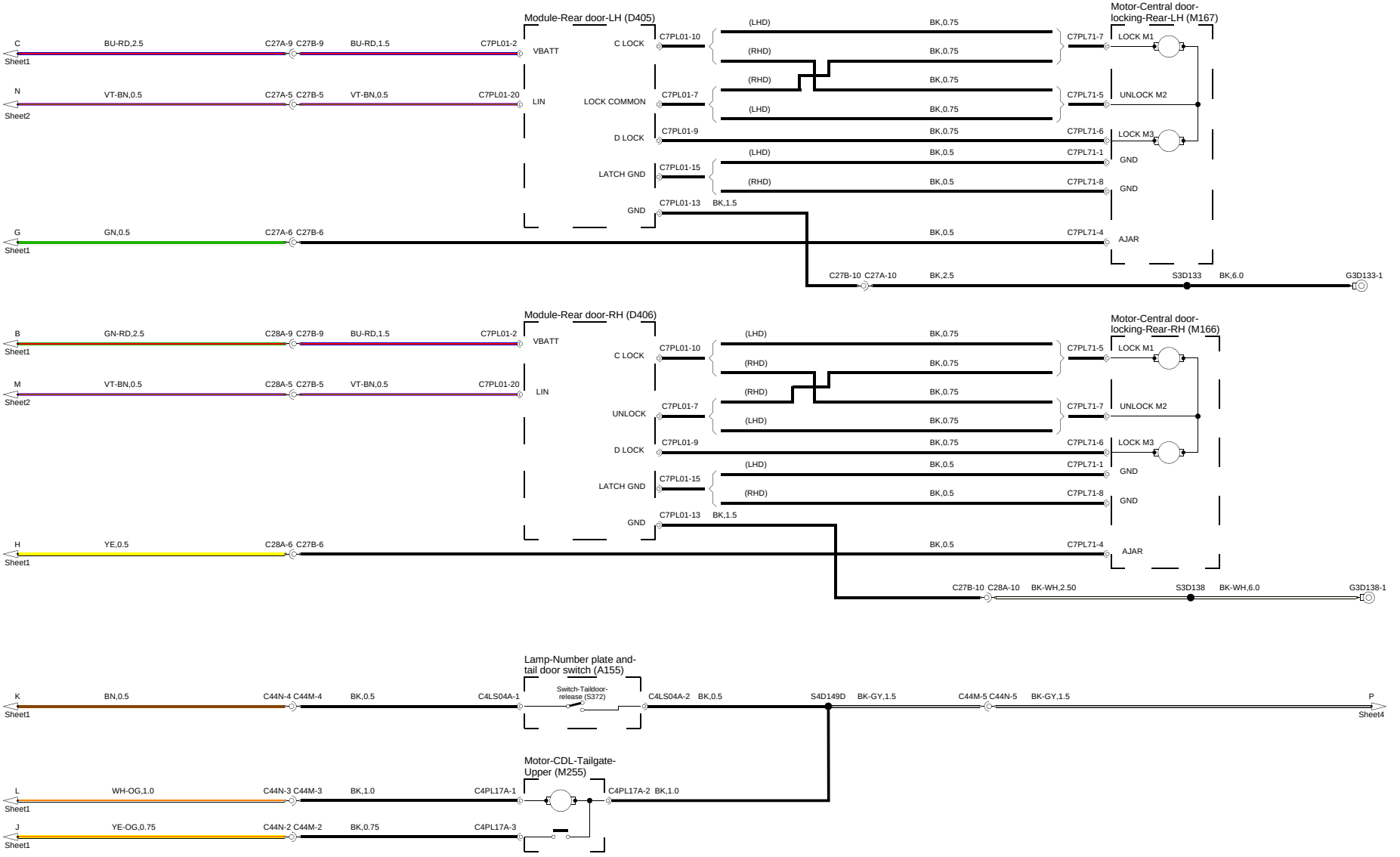

Switch pack-
Window lift (S400)
POWER
GND
LIN
Switch-Window-
Driver door (S344)
Switch-Window-
Passenger door (S343)
Switch-Window-
Rear-LH (S141)
Switch-Window-
Rear-RH (S140)
Module-Driver-
door (D253)
WINDOW UP
WINDOW DOWN
HALL SENSE SUPPLY
HALL SENSE GND
HALL1
HALL2
BATT
MS CAN H
MS CAN L
GND
Motor-Window-Driver (M242)
Switch-Window-
Passenger door (S343)
UP
DOWN
Switch-
illumination (B125)
Module-Passenger-
door (D254)
SWITCH UP
SWITCH DOWN
SWITCH ILLUM
GND DSP
Motor-Window-
Passenger (M243)
A BN-GN,0.75 C5PL22A-2
C5PL22A-3 BK-GY,0.5
C25B-2 C25A-2 BK-GY,0.5
S3D135 BK-GY,1.5 G3D135-1
C5PL22A-4 GY-BU,0.5
S5PW32 GY-BU,0.5 C5PL01A-20
GY-BU,0.5
C5PL01A-12 BU,2.5 C5PW11A-6
C5PL01A-1 GN,2.5 C5PW11A-3
C5PL01A-17 WH-BN,0.5 C5PW11A-1
C5PL01A-16 VT-GN,0.5 C5PW11A-4
C5PL01A-6 YE-BU,0.5 C5PW11A-5
C5PL01A-5 BU-WH,0.5 C5PW11A-2
H VT-BN,0.5 C25A-6 C25B-6
C RD,2.5 C25A-9 C25B-9 RD,1.5 C5PL01A-2
C25A-3 C25B-3 VT-OG,0.5 C5PL01B-3
C25A-4 C25B-4 GY-OG,0.5 C5PL01B-15
C5PL01A-13 BK,1.5 C25B-10 C25A-10 BK-WH,2.5
S3D138 BK-WH,6.0 G3D138-1
J BK-WH,2.5
Sheet1
Sheet3
C6PW19A-2 BN-YE,0.35 C6PL01A-22
C6PW19A-3 GN-OG,0.35 C6PL01A-11
C6PW19A-1 YE,0.5 C6PL01A-4
C6PW19A-4 GN-BN,0.5 C6PL01A-18
C6PL01A-12 WH,2.5 C6PW20A-6
C6PL01A-1 GY-YE,2.5 C6PW20A-3
C6PL01A-17 VT-GY,0.5 C6PW20A-1
C6PL01A-16 YE-GN,0.5 C6PW20A-4
C6PL01A-6 BU-OG,0.5 C6PW20A-5
C6PL01A-5 BU-GY,0.5 C6PW20A-2
B YE-RD,2.5 C26A-9 C26B-9 YE-RD,1.5 C6PL01A-2
C26A-3 C26B-3 VT-OG,0.5 C6PL01B-3
C26A-4 C26B-4 GY-OG,0.5 C6PL01B-15
F VT-BN,0.5 C26A-6 C26B-6 VT-BN,0.5 C6PL01A-20
C6PL01A-13 BK-WH,1.5 C26B-10 C26A-10 BK,2.5
S3D133 BK,6.0 G3D133-1
G BK,2.5
Sheet1
Sheet3

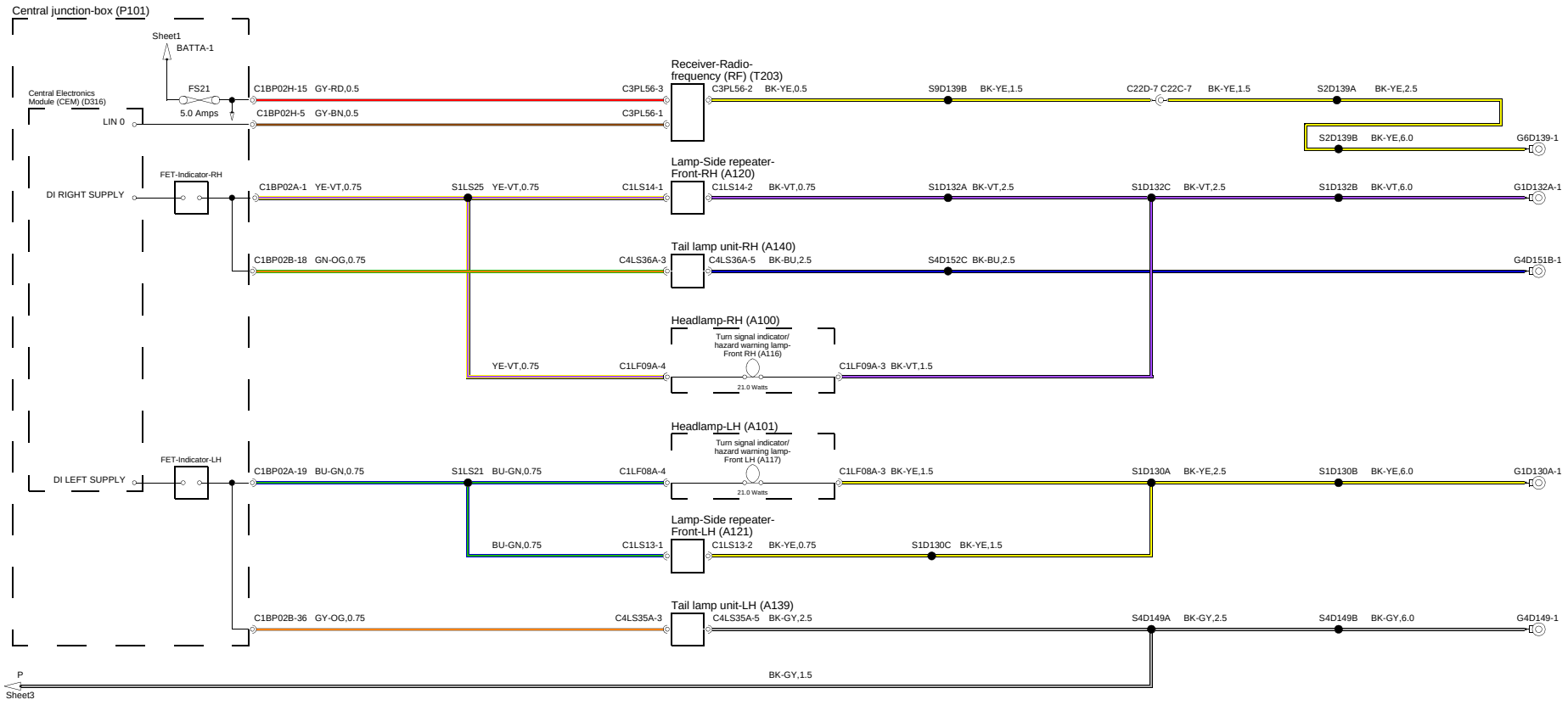

Switch-Window-Rear-RH (S140)
UP
DOWN
Switch-illumination (B125)
C7PW21-2
BU-OG,0.35
C7PL01-22
C7PW21-3
YE,0.35
C7PL01-11
C7PW21-1
WH-BU,0.5
C7PL01-4
C7PW21-4
GY-OG,0.5
C7PL01-18
Module-Rear door-RH (D406)
SWITCH UP
WINDOW UP
SWITCH DOWN
WINDOW DOWN
HALL SENSE SUPP
SWITCH ILLUM
HALL SENSE GND
GND DSP
HALL1
HALL2
BATT
LIN
GND
Motor-Window-Rear-RH (M111)
C7PL01-12
GY-BN,2.5
C7PW22A-6
C7PL01-1
VT-OG,2.5
C7PW22A-3
C7PL01-17
YE-GY,0.5
C7PW22A-1
C7PL01-16
BU-BN,0.5
C7PW22A-4
C7PL01-6
BN-YE,0.5
C7PW22A-2
C7PL01-5
GN-OG,0.5
C7PW22A-5
E
GN-RD,2.5
C28A-9
C27B-9
BU-RD,1.5
C7PL01-2
Sheet1
H
VT-BN,0.5
C28A-5
C27B-5
VT-BN,0.5
C7PL01-20
Sheet2
C7PL01-13
BK,1.5
C27B-10
C28A-10
BK-WH,2.5
J
Sheet2
Switch-Window-Rear-LH (S141)
UP
DOWN
Switch-illumination (B125)
C7PW21-2
BU-OG,0.35
C7PL01-22
C7PW21-3
YE,0.35
C7PL01-11
C7PW21-1
WH-BU,0.5
C7PL01-4
C7PW21-4
GY-OG,0.5
C7PL01-18
Module-Rear door-LH (D405)
SWITCH UP
WINDOW UP
SWITCH DOWN
WINDOW DOWN
HALL SENSE SUPP
SWITCH ILLUM
HALL SENSE GND
GND DSP
HALL1
HALL2
BATT
LIN
GND
Motor-Window-Rear-LH (M112)
C7PL01-12
GY-BN,2.5
C7PW22A-6
C7PL01-1
VT-OG,2.5
C7PW22A-3
C7PL01-17
YE-GY,0.5
C7PW22A-1
C7PL01-16
BU-BN,0.5
C7PW22A-4
C7PL01-6
BN-YE,0.5
C7PW22A-2
C7PL01-5
GN-OG,0.5
C7PW22A-5
D
BU-RD,2.5
C27A-9
C27B-9
BU-RD,1.5
C7PL01-2
Sheet1
F
VT-BN,0.5
C27A-5
C27B-5
VT-BN,0.5
C7PL01-20
Sheet2
C7PL01-13
BK,1.5
C27B-10
C27A-10
BK,2.5
G
Sheet2

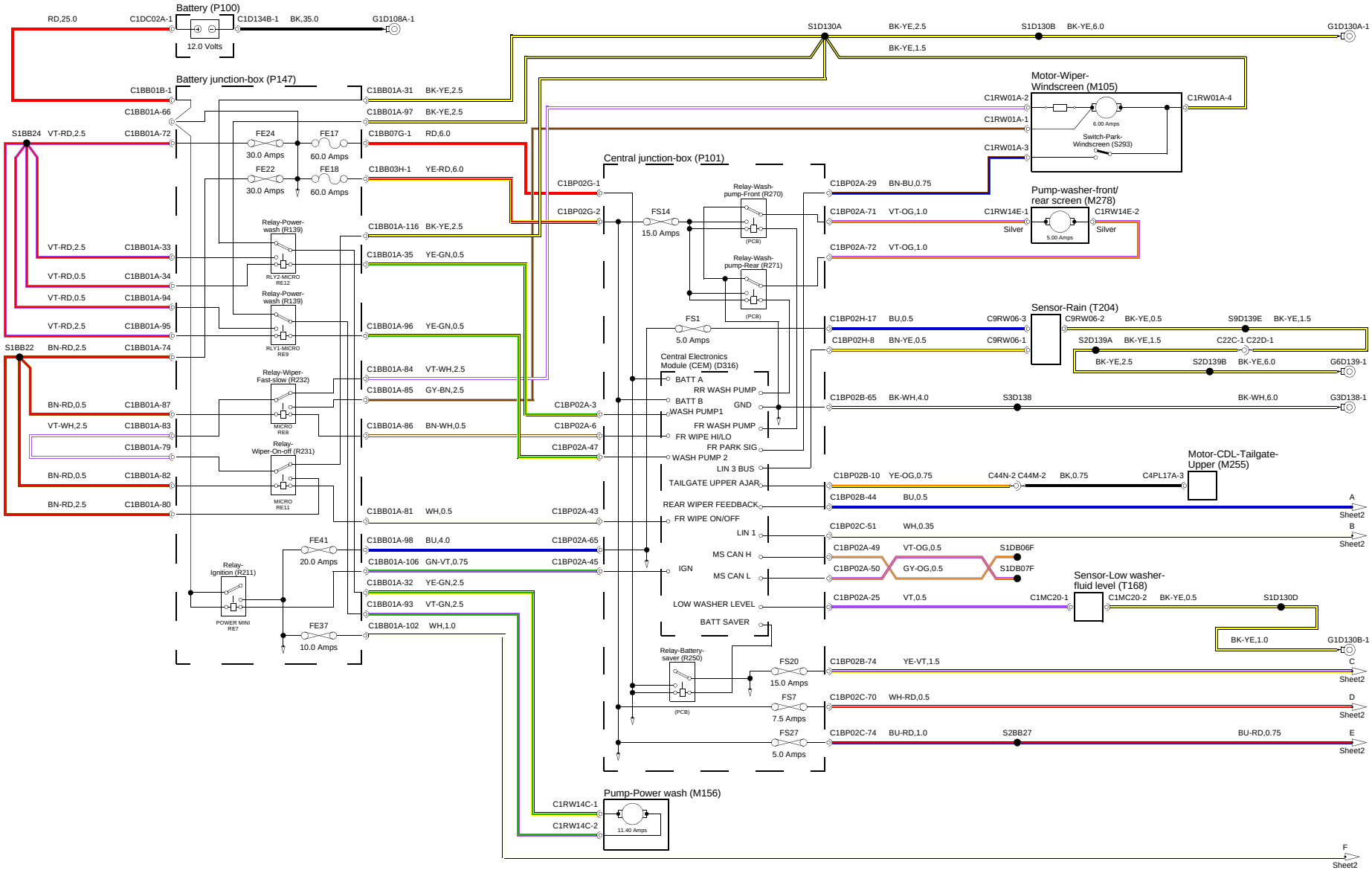

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
Relay-auxiliary-circuits (R101)
C1BB01B-1
RE5
FE45
15.0 Amps
C1BB01A-43
YE,1.5
C12H-42 C12G-42
YE,1.5
C33G-1 C33H-1
YE,1.5
C3DC07A-2
Cigar lighter-Front (J112)
C3DC07A-1
BK-BU,2.5
S3D127B
BK-BU,2.5
Switch-illumination (B125)
S3LN17
BN,0.5
C33G-7 C33H-7
BN,0.5
C3DC07C-1
BK-BU,2.5
C33G-8 C33H-8
S3D127
BK-BU,6.0
G3D127-1
C1BB01A-38
VT-GN,0.5
FE17
60.0 Amps
C1BB07G-1
RD,6.0
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0
C12D-1 C12C-1
BU-RD,6.0
S3BB19
BU-RD,6.0
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
C1BP02G-1
BATT A
C1BP02A-48
Auxiliary junction box (P107)
C4BR02A-9
FA6
15.0 Amps
C4BR02A-14
BN-RD,2.5
C33G-14 C33H-14
BN-RD,2.5
C3DC07B-2
Socket-Accessory-Rear (V113)
C3DC07B-1
BK-BU,2.5

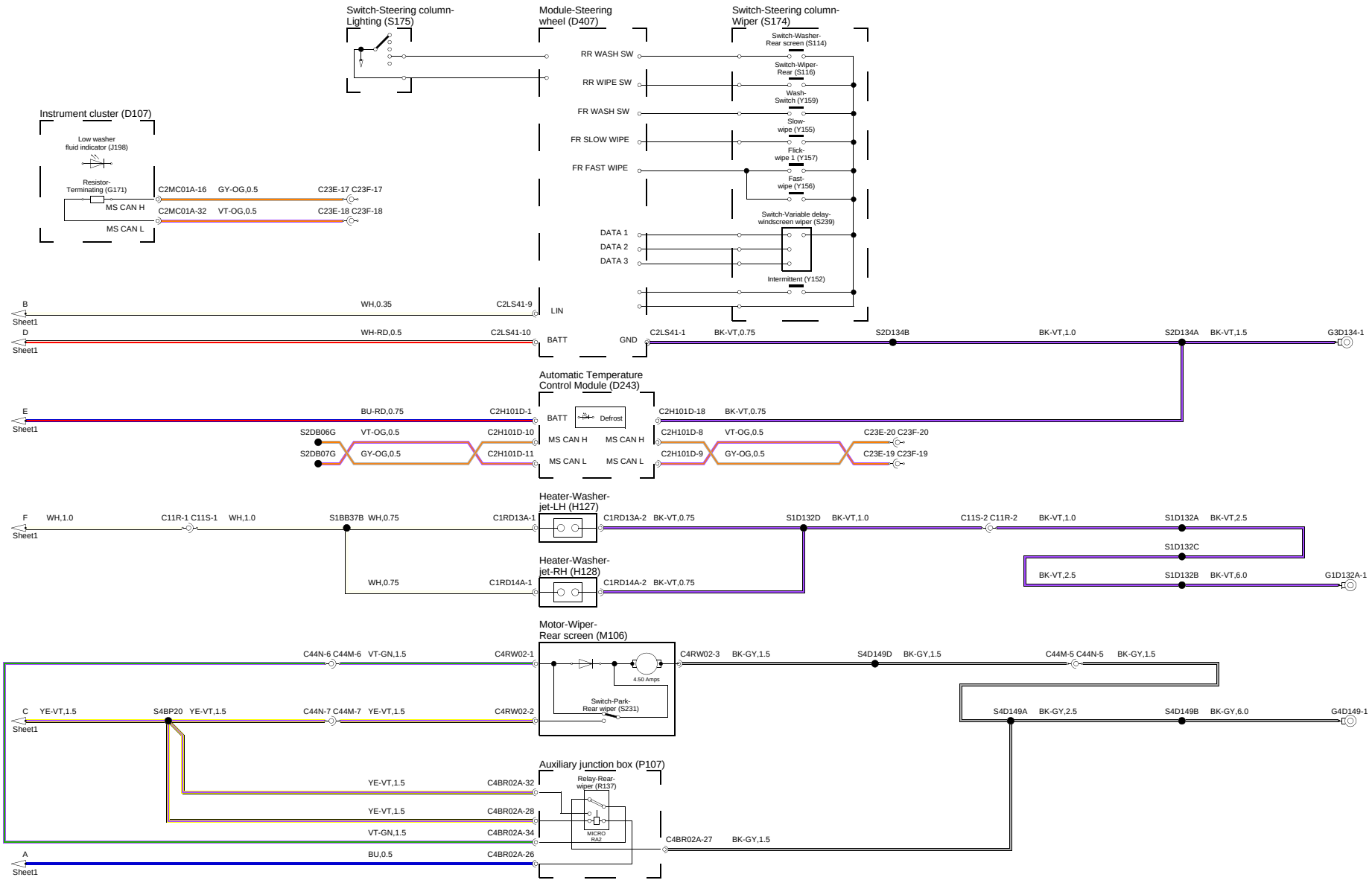

Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE19
60.0 Amps
C1BB03J-1
BU-RD,6.0
C12D-1
C12C-1
BU-RD,6.0
S3BB19
BU-RD,6.0
C4BR02A-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
Auxiliary junction box (P107)
FA2
25.0 Amps
C4BR02A-6
YE-RD,2.5
A
Sheet2
FA4
25.0 Amps
C4BR02A-8
GN-RD,2.5
B
Sheet3
FA3
25.0 Amps
C4BR02A-7
BU-RD,2.5
C
Sheet3
FA1
25.0 Amps
C4BR02A-5
RD,2.5
D
Sheet2
Central junction-box (P101)
C1BP02G-1
FS25
10.0 Amps
Relay-Fuel-flap-unlock (R258)
(PCB)
UNLOCK
LOCK
C1BP02B-67
BK,1.0
C4PL19A-2
C1BP02B-68
BK,1.0
C4PL19A-1
Motor-Release-Fuel flap (M116)
2.00 Amps
Relay-Fuel-flap-lock (R257)
(PCB)
Central Electronics Module (CEM) (D316)
MASTER LOCK SW
MASTER UNLOCK SW
BATT A
Switch pack-Centre facia (S425)
C2PL13-8
Switch-Master-Lock (S319)
C2PL13-5
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
Switch-Master-unlock (S381)
C2PL13-9
C1BP02C-33
GY-BN,0.5
C1BP02C-34
BN-GN,0.5
Switch-Bonnet (S224)
AJAR
C1BP02A-23
BU-OG,0.5
C1RT17A-1
C1RT17A-2
BK-YE,0.5
S1D130D
BK-YE,1.0
G1D130B-1
FR AJAR
C1BP02B-6
WH,0.5
E
Sheet2
FL AJAR
C1BP02B-7
GN-VT,0.5
F
Sheet2
RL AJAR
C1BP02B-9
GN,0.5
G
Sheet3
RL AJAR
C1BP02B-8
YE,0.5
H
Sheet3
TAILGATE AJAR
C1BP02B-10
YE-OG,0.75
J
Sheet3
TAILGATE RELEASE
C1BP02B-13
BN,0.5
K
Sheet3
DOOR LOCK TAILGATE
C1BP02B-71
WH-OG,1.0
L
Sheet3
Relay-Tailgate unlock (R278)
(PCB)
BATTA-1
Sheet4

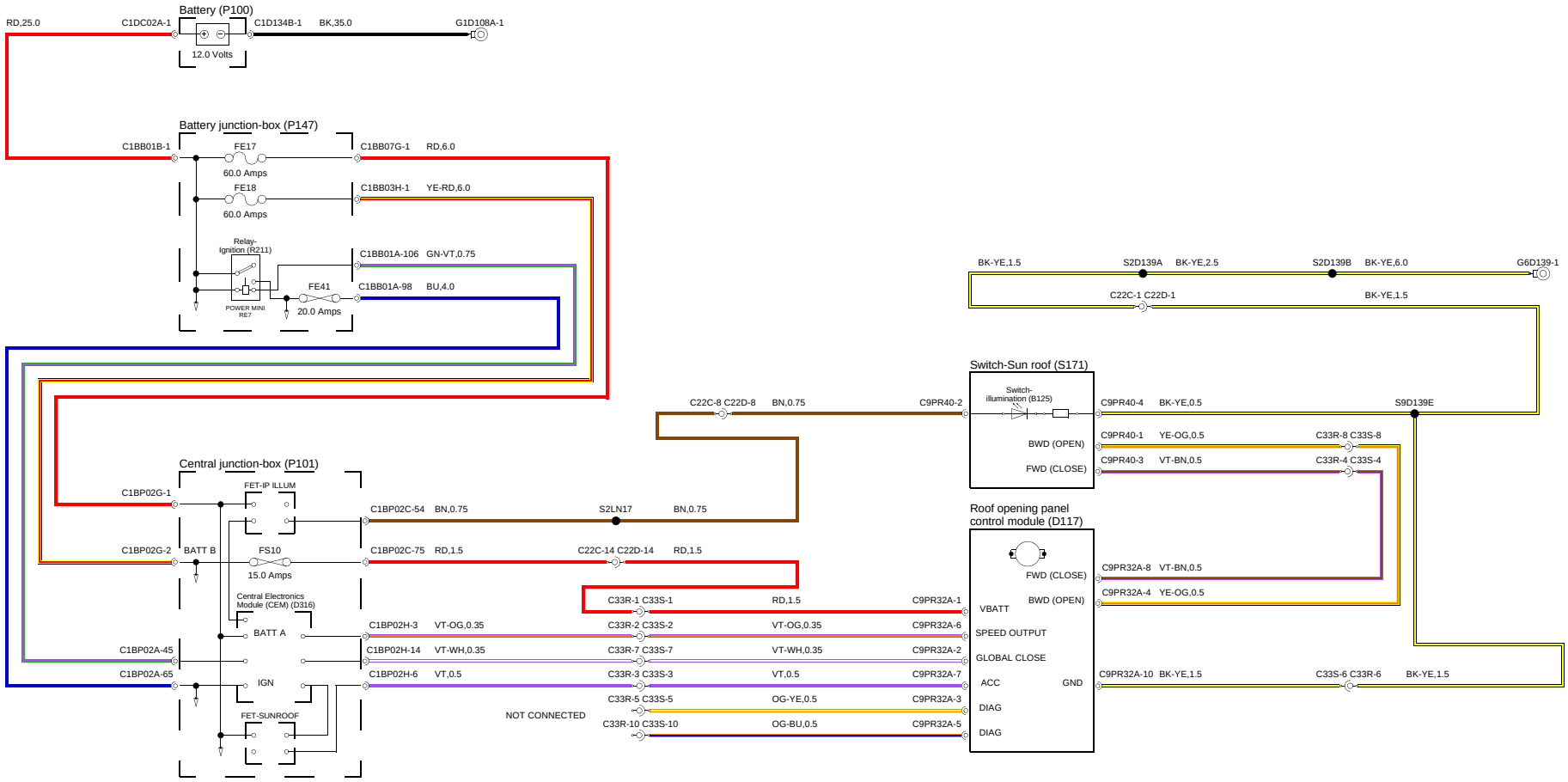

Module-Passenger-door (D254)
Motor-Central door-locking-Passenger (M237)
A
Sheet1
YE-RD,2.5
C26A-9 C26B-9
YE-RD,1.5
C6PL01A-2
VBATT
S3DB06A
S3DB07A
VT-OG,0.5
GY-OG,0.5
C26A-3 C26B-3
C26A-4 C26B-4
VT-OG,0.5
GY-OG,0.5
C6PL01B-3
C6PL01B-15
MS CAN H
MS CAN L
M
Sheet3
VT-BN,0.5
C26A-6 C26B-6
VT-BN,0.5
C6PL01A-20
LIN
E
Sheet1
WH,0.5
C26A-1 C26B-1
C LOCK
C6PL01A-10
(RHD)
BK,0.75
(LHD)
BK,0.75
C6PL64-5
LOCK
COMMON
C6PL01A-7
(LHD)
BK,0.75
(RHD)
BK,0.75
C6PL64-7
L-
D LOCK
C6PL01A-9
BK,0.75
C6PL64-6
LOCK M3
GND LATCH
C6PL01A-15
(LHD)
BK,0.5
C6PL64-1
GND LATCH
(RHD)
BK,0.5
C6PL64-8
GND LATCH
UNLOCK FB
C6PL01B-22
BK,0.5
C6PL64-9
SWITCH UNLOCK
LOCK FB
C6PL01A-21
BK,0.5
C6PL64-10
SWITCH LOCK
GND
C6PL01A-13
BK-WH,1.5
BK,0.5
C6PL64-4
AJAR
C26B-10 C26A-10
BK-WH,2.5
S3D138
BK-WH,6.0
G3D138-1
Module-Drivers-door (D253)
Motor-Central door-locking-Driver (M236)
N
Sheet3
VT-BN,0.5
C25A-6 C25B-6
GY-BU,0.5
S5PW32
GY-BU,0.5
C5PL01A-20
LIN
D
Sheet1
RD,2.5
C25A-9 C25B-9
RD,1.5
C5PL01A-2
VBATT
S3DB06B
S3DB07B
VT-OG,0.5
GY-OG,0.5
C25A-3 C25B-3
C25A-4 C25B-4
VT-OG,0.5
GY-OG,0.5
C5PL01B-3
C5PL01B-15
MS CAN H
MS CAN L
F
Sheet1
GN-VT,0.5
C25A-1 C25B-1
LOCK
C5PL01A-10
(LHD)
BK,0.75
(RHD)
BK,0.75
C5PL63-7
LOCK
L-
C5PL01A-7
(RHD)
BK,0.75
(LHD)
BK,0.75
C5PL63-5
L-
LOCK M3
C5PL01A-9
BK,0.75
C5PL63-6
LOCK M3
LOCK FB
C5PL01A-21
BK,0.5
C5PL63-10
LOCK SWITCH
GND LATCH
C5PL01A-15
(RHD)
BK,0.5
C5PL63-8
GND LATCH
(LHD)
BK,0.5
C5PL63-1
GND LATCH
UNLOCK FB
C5PL01B-22
BK,0.5
C5PL63-9
UNLOCK SWITCH
GND
C5PL01A-13
BK,1.5
BK,0.5
C5PL63-4
AJAR
C25B-10 C25A-10
BK,2.5
S3D133
BK,6.0
G3D133-1

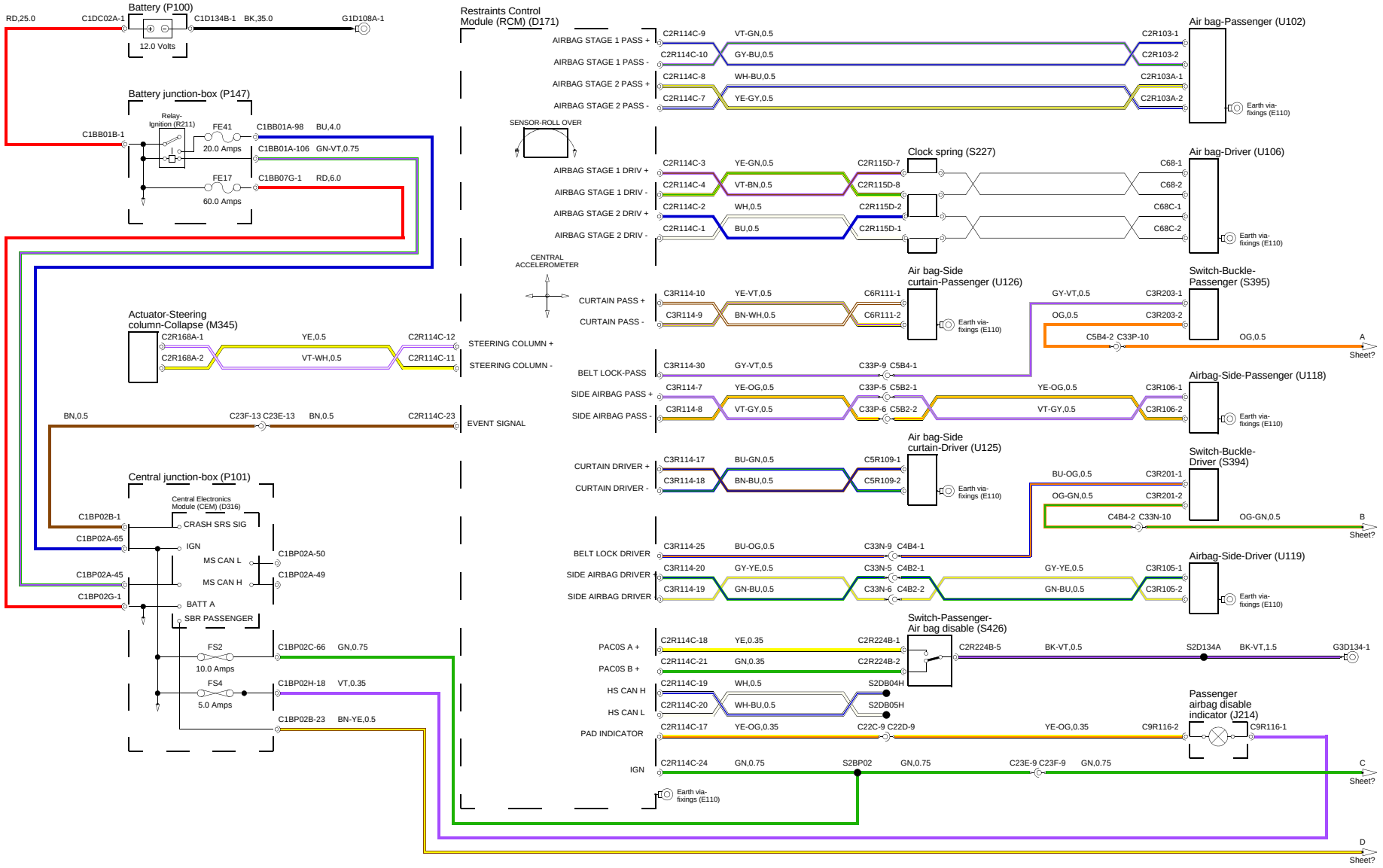

Module-Rear door-LH (D405)
Motor-Central door-locking-Rear-LH (M167)
C BU-RD,2.5 C27A-9 C27B-9 BU-RD,1.5 C7PL01-2 VBATT
Sheet1
N VT-BN,0.5 C27A-5 C27B-5 VT-BN,0.5 C7PL01-20 LIN
Sheet2
G GN,0.5 C27A-6 C27B-6
Sheet1
C LOCK
LOCK COMMON
D LOCK
LATCH GND
GND
C7PL01-10
C7PL01-7
C7PL01-9
C7PL01-15
C7PL01-13 BK,1.5
(LHD)
(RHD)
BK,0.75
BK,0.5
C7PL71-7
C7PL71-5
C7PL71-6
C7PL71-1
C7PL71-8
C7PL71-4
LOCK M1
UNLOCK M2
LOCK M3
GND
AJAR
C27B-10 C27A-10 BK,2.5 S3D133 BK,6.0 G3D133-1
Module-Rear door-RH (D406)
Motor-Central door-locking-Rear-RH (M166)
B GN-RD,2.5 C28A-9 C27B-9 BU-RD,1.5 C7PL01-2 VBATT
Sheet1
M VT-BN,0.5 C28A-5 C27B-5 VT-BN,0.5 C7PL01-20 LIN
Sheet2
H YE,0.5 C28A-6 C27B-6
Sheet1
C7PL71-5
C7PL71-7
C7PL71-1
C7PL71-8
C27B-10 C28A-10 BK-WH,2.50 S3D138 BK-WH,6.0 G3D138-1
Lamp-Number plate and-tail door switch (A155)
Switch-Taildoor-release (S372)
K BN,0.5 C44N-4 C44M-4 BK,0.5 C4LS04A-1 C4LS04A-2 BK,0.5 S4D149D BK-GY,1.5 C44M-5 C44N-5 BK-GY,1.5 P
Sheet1
Sheet4
Motor-CDL-Tailgate-Upper (M255)
L WH-OG,1.0 C44N-3 C44M-3 BK,1.0 C4PL17A-1 C4PL17A-2 BK,1.0
Sheet1
J YE-OG,0.75 C44N-2 C44M-2 BK,0.75 C4PL17A-3
Sheet1

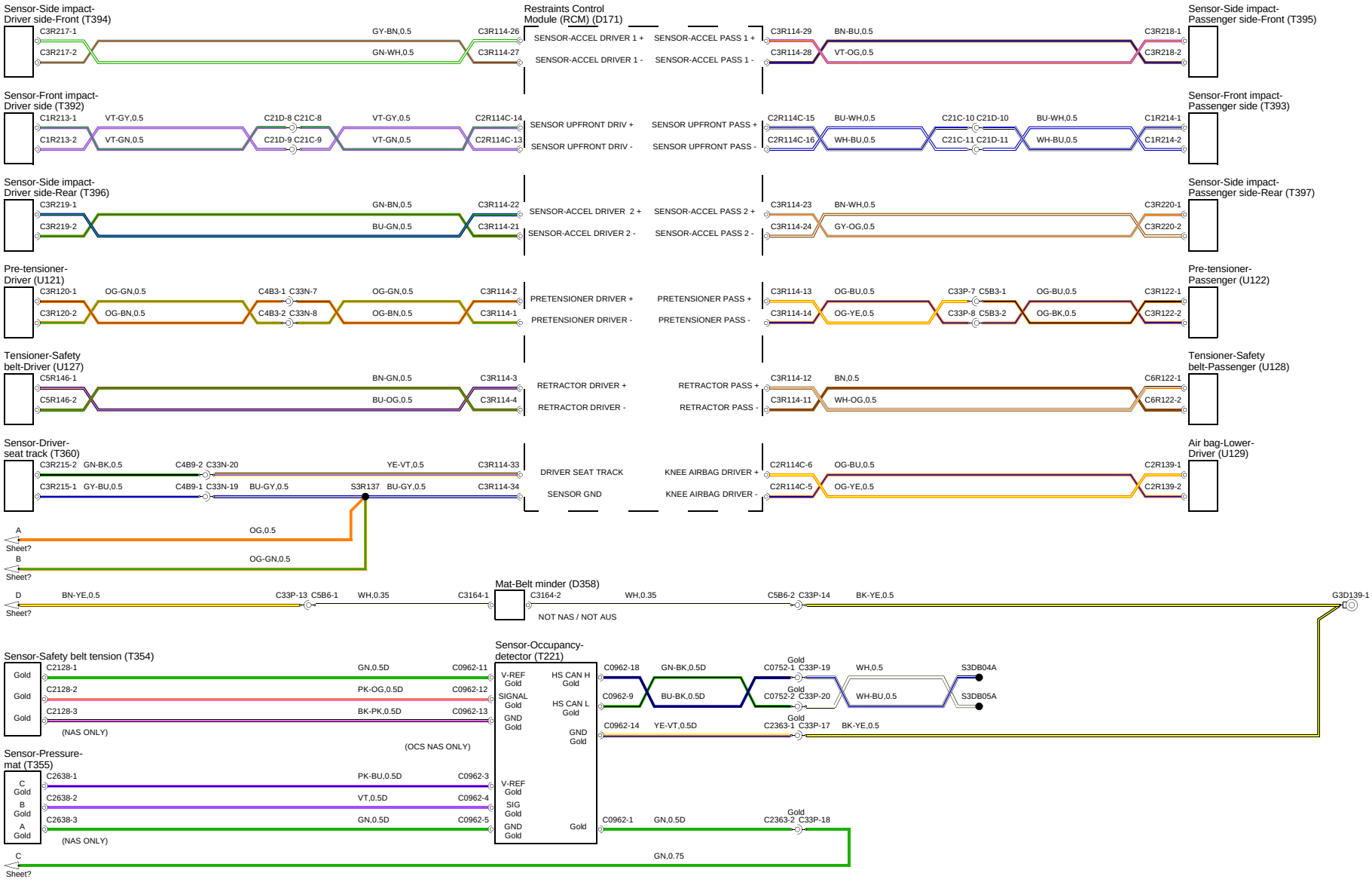

Central junction-box (P101)
Sheet1
BATTA-1
Central Electronics Module (CEM) (D316)
FS21
5.0 Amps
LIN 0
C1BP02H-15 GY-RD,0.5
C1BP02H-5 GY-BN,0.5
C3PL56-3
C3PL56-1
Receiver-Radio-frequency (RF) (T203)
C3PL56-2 BK-YE,0.5
S9D139B BK-YE,1.5
C22D-7 C22C-7 BK-YE,1.5
S2D139A BK-YE,2.5
S2D139B BK-YE,6.0
G6D139-1
FET-Indicator-RH
DI RIGHT SUPPLY
C1BP02A-1 YE-VT,0.75
S1LS25 YE-VT,0.75
C1LS14-1
Lamp-Side repeater-Front-RH (A120)
C1LS14-2 BK-VT,0.75
S1D132A BK-VT,2.5
S1D132C BK-VT,2.5
S1D132B BK-VT,6.0
G1D132A-1
C1BP02B-18 GN-OG,0.75
C4LS36A-3
Tail lamp unit-RH (A140)
C4LS36A-5 BK-BU,2.5
S4D152C BK-BU,2.5
G4D151B-1
Headlamp-RH (A100)
Turn signal indicator/ hazard warning lamp-Front RH (A116)
YE-VT,0.75
C1LF09A-4
21.0 Watts
C1LF09A-3 BK-VT,1.5
Headlamp-LH (A101)
Turn signal indicator/ hazard warning lamp-Front LH (A117)
FET-Indicator-LH
DI LEFT SUPPLY
C1BP02A-19 BU-GN,0.75
S1LS21 BU-GN,0.75
C1LF08A-4
C1LF08A-3 BK-YE,1.5
S1D130A BK-YE,2.5
S1D130B BK-YE,6.0
G1D130A-1
Lamp-Side repeater-Front-LH (A121)
BU-GN,0.75
C1LS13-1
C1LS13-2 BK-YE,0.75
S1D130C BK-YE,1.5
C1BP02B-36 GY-OG,0.75
C4LS35A-3
Tail lamp unit-LH (A139)
C4LS35A-5 BK-GY,2.5
S4D149A BK-GY,2.5
S4D149B BK-GY,6.0
G4D149-1
P
Sheet3
BK-GY,1.5


Battery (P100)
12.0 Volts
Battery junction-box (P147)
Central junction-box (P101)
Motor-Wiper-Windscreen (M105)
Switch-Park-Windscreen (S293)
Pump-washer-front/rear screen (M278)
Sensor-Rain (T204)
Motor-CDL-Tailgate-Upper (M255)
Sensor-Low washer-fluid level (T168)
Pump-Power wash (M156)
Central Electronics Module (CEM) (D316)
Relay-Power-wash (R139)
Relay-Wiper-Fast-slow (R232)
Relay-Wiper-On-off (R231)
Relay-Ignition (R211)
Relay-Wash-pump-Front (R270)
Relay-Wash-pump-Rear (R271)
Relay-Battery-saver (R250)
FE24 30.0 Amps
FE17 60.0 Amps
FE22 30.0 Amps
FE18 60.0 Amps
FE41 20.0 Amps
FE37 10.0 Amps
FS14 15.0 Amps
FS1 5.0 Amps
FS20 15.0 Amps
FS7 7.5 Amps
FS27 5.0 Amps
6.00 Amps
5.00 Amps
11.40 Amps
Silver
Sheet2


Switch-Steering column-Lighting (S175)
Module-Steering wheel (D407)
Switch-Steering column-Wiper (S174)
Switch-Washer-Rear screen (S114)
Switch-Wiper-Rear (S116)
Wash-Switch (Y159)
Slow-wipe (Y155)
Flick-wipe 1 (Y157)
Fast-wipe (Y156)
Switch-Variable delay-windscreen wiper (S239)
Intermittent (Y152)
RR WASH SW
RR WIPE SW
FR WASH SW
FR SLOW WIPE
FR FAST WIPE
DATA 1
DATA 2
DATA 3
Instrument cluster (D107)
Low washer fluid indicator (J198)
Resistor-Terminating (G171)
MS CAN H
MS CAN L
C2MC01A-16 GY-OG,0.5 C23E-17 C23F-17
C2MC01A-32 VT-OG,0.5 C23E-18 C23F-18
B WH,0.35 C2LS41-9 LIN
D WH-RD,0.5 C2LS41-10 BATT
GND C2LS41-1 BK-VT,0.75 S2D134B BK-VT,1.0 S2D134A BK-VT,1.5 G3D134-1
Automatic Temperature Control Module (D243)
E BU-RD,0.75 C2H101D-1 BATT
Defrost
C2H101D-18 BK-VT,0.75
S2DB06G VT-OG,0.5 C2H101D-10 MS CAN H
C2H101D-8 VT-OG,0.5 C23E-20 C23F-20
S2DB07G GY-OG,0.5 C2H101D-11 MS CAN L
C2H101D-9 GY-OG,0.5 C23E-19 C23F-19
Heater-Washer-jet-LH (H127)
Heater-Washer-jet-RH (H128)
F WH,1.0 C11R-1 C11S-1 WH,1.0 S1BB37B WH,0.75 C1RD13A-1
C1RD13A-2 BK-VT,0.75 S1D132D BK-VT,1.0 C11S-2 C11R-2 BK-VT,1.0 S1D132A BK-VT,2.5
S1D132C
BK-VT,2.5 S1D132B BK-VT,6.0 G1D132A-1
WH,0.75 C1RD14A-1
C1RD14A-2 BK-VT,0.75
Motor-Wiper-Rear screen (M106)
C44N-6 C44M-6 VT-GN,1.5 C4RW02-1
C4RW02-3 BK-GY,1.5 S4D149D BK-GY,1.5 C44M-5 C44N-5 BK-GY,1.5
4.50 Amps
Switch-Park-Rear wiper (S231)
C YE-VT,1.5 S4BP20 YE-VT,1.5 C44N-7 C44M-7 YE-VT,1.5 C4RW02-2
S4D149A BK-GY,2.5 S4D149B BK-GY,6.0 G4D149-1
Auxiliary junction box (P107)
Relay-Rear-wiper (R137)
MICRO RA2
YE-VT,1.5 C4BR02A-32
YE-VT,1.5 C4BR02A-28
VT-GN,1.5 C4BR02A-34
C4BR02A-27 BK-GY,1.5
A BU,0.5 C4BR02A-26
Sheet1


Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
FE17
60.0 Amps
C1BB07G-1
RD,6.0
FE18
60.0 Amps
C1BB03H-1
YE-RD,6.0
Relay-Ignition (R211)
POWER MINI RE7
C1BB01A-106
GN-VT,0.75
FE41
20.0 Amps
C1BB01A-98
BU,4.0
BK-YE,1.5
S2D139A
BK-YE,2.5
S2D139B
BK-YE,6.0
G6D139-1
C22C-1 C22D-1
BK-YE,1.5
Switch-Sun roof (S171)
Switch-illumination (B125)
C22C-8 C22D-8
BN,0.75
C9PR40-2
C9PR40-4
BK-YE,0.5
S9D139E
C9PR40-1
YE-OG,0.5
C33R-8 C33S-8
BWD (OPEN)
C9PR40-3
VT-BN,0.5
C33R-4 C33S-4
FWD (CLOSE)
Central junction-box (P101)
C1BP02G-1
FET-IP ILLUM
C1BP02C-54
BN,0.75
S2LN17
BN,0.75
C1BP02G-2
BATT B
FS10
15.0 Amps
C1BP02C-75
RD,1.5
C22C-14 C22D-14
RD,1.5
Roof opening panel control module (D117)
FWD (CLOSE)
C9PR32A-8
VT-BN,0.5
BWD (OPEN)
C9PR32A-4
YE-OG,0.5
Central Electronics Module (CEM) (D316)
BATT A
C1BP02A-45
C1BP02H-3
VT-OG,0.35
C33R-2 C33S-2
VT-OG,0.35
C9PR32A-6
C1BP02H-14
VT-WH,0.35
C33R-7 C33S-7
VT-WH,0.35
C9PR32A-2
C1BP02A-65
IGN
C1BP02H-6
VT,0.5
C33R-3 C33S-3
VT,0.5
C9PR32A-7
VBATT
SPEED OUTPUT
GLOBAL CLOSE
ACC
GND
DIAG
C33R-5 C33S-5
OG-YE,0.5
C9PR32A-3
NOT CONNECTED
DIAG
C33R-10 C33S-10
OG-BU,0.5
C9PR32A-5
FET-SUNROOF
C9PR32A-10
BK-YE,1.5
C33S-6 C33R-6
BK-YE,1.5
C33R-1 C33S-1
RD,1.5
C9PR32A-1


Battery (P100)
RD,25.0
C1DC02A-1
C1D134B-1
BK,35.0
G1D108A-1
12.0 Volts
Battery junction-box (P147)
C1BB01B-1
Relay-Ignition (R211)
FE41
20.0 Amps
C1BB01A-98
BU,4.0
C1BB01A-106
GN-VT,0.75
FE17
60.0 Amps
C1BB07G-1
RD,6.0
Actuator-Steering column-Collapse (M345)
C2R168A-1
C2R168A-2
YE,0.5
VT-WH,0.5
C2R114C-12
C2R114C-11
STEERING COLUMN +
STEERING COLUMN -
BN,0.5
C23F-13
C23E-13
BN,0.5
C2R114C-23
EVENT SIGNAL
Central junction-box (P101)
Central Electronics Module (CEM) (D316)
C1BP02B-1
CRASH SRS SIG
C1BP02A-65
IGN
MS CAN L
C1BP02A-50
C1BP02A-45
MS CAN H
C1BP02A-49
C1BP02G-1
BATT A
SBR PASSENGER
FS2
10.0 Amps
C1BP02C-66
GN,0.75
FS4
5.0 Amps
C1BP02H-18
VT,0.35
C1BP02B-23
BN-YE,0.5
Restraints Control Module (RCM) (D171)
AIRBAG STAGE 1 PASS +
AIRBAG STAGE 1 PASS -
AIRBAG STAGE 2 PASS +
AIRBAG STAGE 2 PASS -
C2R114C-9
C2R114C-10
C2R114C-8
C2R114C-7
VT-GN,0.5
GY-BU,0.5
WH-BU,0.5
YE-GY,0.5
C2R103-1
C2R103-2
C2R103A-1
C2R103A-2
Air bag-Passenger (U102)
Earth via-fixings (E110)
SENSOR-ROLL OVER
Clock spring (S227)
AIRBAG STAGE 1 DRIV +
AIRBAG STAGE 1 DRIV -
AIRBAG STAGE 2 DRIV +
AIRBAG STAGE 2 DRIV -
C2R114C-3
C2R114C-4
C2R114C-2
C2R114C-1
YE-GN,0.5
VT-BN,0.5
WH,0.5
BU,0.5
C2R115D-7
C2R115D-8
C2R115D-2
C2R115D-1
C68-1
C68-2
C68C-1
C68C-2
Air bag-Driver (U106)
Earth via-fixings (E110)
CENTRAL ACCELEROMETER
CURTAIN PASS +
CURTAIN PASS -
C3R114-10
C3R114-9
YE-VT,0.5
BN-WH,0.5
C6R111-1
C6R111-2
Air bag-Side curtain-Passenger (U126)
Earth via-fixings (E110)
GY-VT,0.5
OG,0.5
C3R203-1
C3R203-2
Switch-Buckle-Passenger (S395)
C5B4-2
C33P-10
OG,0.5
A
Sheet?
BELT LOCK-PASS
C3R114-30
GY-VT,0.5
C33P-9
C5B4-1
SIDE AIRBAG PASS +
SIDE AIRBAG PASS -
C3R114-7
C3R114-8
YE-OG,0.5
VT-GY,0.5
C33P-5
C5B2-1
C33P-6
C5B2-2
YE-OG,0.5
VT-GY,0.5
C3R106-1
C3R106-2
Airbag-Side-Passenger (U118)
Earth via-fixings (E110)
CURTAIN DRIVER +
CURTAIN DRIVER -
C3R114-17
C3R114-18
BU-GN,0.5
BN-BU,0.5
C5R109-1
C5R109-2
Air bag-Side curtain-Driver (U125)
Earth via-fixings (E110)
BU-OG,0.5
OG-GN,0.5
C3R201-1
C3R201-2
Switch-Buckle-Driver (S394)
C4B4-2
C33N-10
OG-GN,0.5
B
Sheet?
BELT LOCK DRIVER
C3R114-25
BU-OG,0.5
C33N-9
C4B4-1
SIDE AIRBAG DRIVER
SIDE AIRBAG DRIVER
C3R114-20
C3R114-19
GY-YE,0.5
GN-BU,0.5
C33N-5
C4B2-1
C33N-6
C4B2-2
GY-YE,0.5
GN-BU,0.5
C3R105-1
C3R105-2
Airbag-Side-Driver (U119)
Earth via-fixings (E110)
PAC0S A +
PAC0S B +
C2R114C-18
C2R114C-21
YE,0.35
GN,0.35
C2R224B-1
C2R224B-2
Switch-Passenger-Air bag disable (S426)
C2R224B-5
BK-VT,0.5
S2D134A
BK-VT,1.5
G3D134-1
HS CAN H
HS CAN L
C2R114C-19
C2R114C-20
WH,0.5
WH-BU,0.5
S2DB04H
S2DB05H
PAD INDICATOR
C2R114C-17
YE-OG,0.35
C22C-9
C22D-9
YE-OG,0.35
C9R116-2
C9R116-1
Passenger airbag disable indicator (J214)
IGN
C2R114C-24
GN,0.75
S2BP02
GN,0.75
C23E-9
C23F-9
GN,0.75
C
Sheet?
Earth via-fixings (E110)
D
Sheet?


Sensor-Side impact-
Driver side-Front (T394)
C3R217-1
C3R217-2
GY-BN,0.5
GN-WH,0.5
C3R114-26
C3R114-27
Restraints Control
Module (RCM) (D171)
SENSOR-ACCEL DRIVER 1 +
SENSOR-ACCEL DRIVER 1 -
SENSOR-ACCEL PASS 1 +
SENSOR-ACCEL PASS 1 -
C3R114-29
C3R114-28
BN-BU,0.5
VT-OG,0.5
C3R218-1
C3R218-2
Sensor-Side impact-
Passenger side-Front (T395)
Sensor-Front impact-
Driver side (T392)
C1R213-1
C1R213-2
VT-GY,0.5
VT-GN,0.5
C21D-8 C21C-8
C21D-9 C21C-9
VT-GY,0.5
VT-GN,0.5
C2R114C-14
C2R114C-13
SENSOR UPFRONT DRIV +
SENSOR UPFRONT DRIV -
SENSOR UPFRONT PASS +
SENSOR UPFRONT PASS -
C2R114C-15
C2R114C-16
BU-WH,0.5
WH-BU,0.5
C21C-10 C21D-10
C21C-11 C21D-11
BU-WH,0.5
WH-BU,0.5
C1R214-1
C1R214-2
Sensor-Front impact-
Passenger side (T393)
Sensor-Side impact-
Driver side-Rear (T396)
C3R219-1
C3R219-2
GN-BN,0.5
BU-GN,0.5
C3R114-22
C3R114-21
SENSOR-ACCEL DRIVER 2 +
SENSOR-ACCEL DRIVER 2 -
SENSOR-ACCEL PASS 2 +
SENSOR-ACCEL PASS 2 -
C3R114-23
C3R114-24
BN-WH,0.5
GY-OG,0.5
C3R220-1
C3R220-2
Sensor-Side impact-
Passenger side-Rear (T397)
Pre-tensioner-
Driver (U121)
C3R120-1
C3R120-2
OG-GN,0.5
OG-BN,0.5
C4B3-1 C33N-7
C4B3-2 C33N-8
OG-GN,0.5
OG-BN,0.5
C3R114-2
C3R114-1
PRETENSIONER DRIVER +
PRETENSIONER DRIVER -
PRETENSIONER PASS +
PRETENSIONER PASS -
C3R114-13
C3R114-14
OG-BU,0.5
OG-YE,0.5
C33P-7 C5B3-1
C33P-8 C5B3-2
OG-BU,0.5
OG-BK,0.5
C3R122-1
C3R122-2
Pre-tensioner-
Passenger (U122)
Tensioner-Safety
belt-Driver (U127)
C5R146-1
C5R146-2
BN-GN,0.5
BU-OG,0.5
C3R114-3
C3R114-4
RETRACTOR DRIVER +
RETRACTOR DRIVER -
RETRACTOR PASS +
RETRACTOR PASS -
C3R114-12
C3R114-11
BN,0.5
WH-OG,0.5
C6R122-1
C6R122-2
Tensioner-Safety
belt-Passenger (U128)
Sensor-Driver-
seat track (T360)
C3R215-2 GN-BK,0.5
C3R215-1 GY-BU,0.5
C4B9-2 C33N-20
C4B9-1 C33N-19
YE-VT,0.5
BU-GY,0.5
S3R137
BU-GY,0.5
C3R114-33
C3R114-34
DRIVER SEAT TRACK
SENSOR GND
KNEE AIRBAG DRIVER +
KNEE AIRBAG DRIVER -
C2R114C-6
C2R114C-5
OG-BU,0.5
OG-YE,0.5
C2R139-1
C2R139-2
Air bag-Lower-
Driver (U129)
A
Sheet?
OG,0.5
B
Sheet?
OG-GN,0.5
Mat-Belt minder (D358)
D
Sheet?
BN-YE,0.5
C33P-13 C5B6-1
WH,0.35
C3164-1
C3164-2
WH,0.35
NOT NAS / NOT AUS
C5B6-2 C33P-14
BK-YE,0.5
G3D139-1
Sensor-Safety belt tension (T354)
Gold
Gold
Gold
C2128-1
C2128-2
C2128-3
GN,0.5D
PK-OG,0.5D
BK-PK,0.5D
C0962-11
C0962-12
C0962-13
(NAS ONLY)
Sensor-Occupancy-
detector (T221)
V-REF
Gold
SIGNAL
Gold
GND
Gold
HS CAN H
Gold
HS CAN L
Gold
GND
Gold
(OCS NAS ONLY)
C0962-18
C0962-9
C0962-14
GN-BK,0.5D
BU-BK,0.5D
YE-VT,0.5D
Gold
C0752-1 C33P-19
Gold
C0752-2 C33P-20
Gold
C2363-1 C33P-17
WH,0.5
WH-BU,0.5
BK-YE,0.5
S3DB04A
S3DB05A
Sensor-Pressure-
mat (T355)
C
Gold
B
Gold
A
Gold
C2638-1
C2638-2
C2638-3
PK-BU,0.5D
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GN,0.5D
C0962-3
C0962-4
C0962-5
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GND
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C
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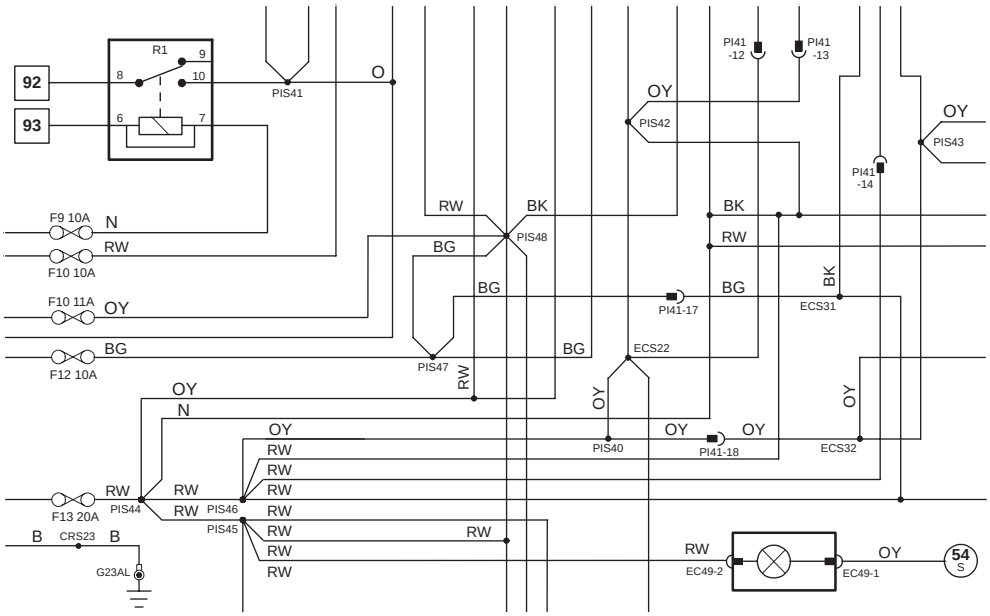
GN,0.75

Electrical Wiring Diagrams



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Abbreviation	Description
ABS	Anti-lock braking system
AFS	Adaptive front lighting system
AUTO	Automatic transmission
CAN	Controller area network
DSC	Dynamic stability control
D4	Diesel engine - Straight-four
DV6	Diesel engine - V6
DV8	Diesel engine - V8
EGR	Exhaust gas recirculation
FET	Field effect transistor
GPS	Global positioning system
HS CAN	High speed controller area network bus
PV6	Petrol engine - V6
PV8	Petrol engine - V8
PV8NA	Naturally aspirated engine - V8
PV8SC	Super charged engine - V8
LH	Left-hand
LIN	Local interconnect network
MAF/IAT	Mass air flow / intake air temperature
MS CAN	Medium speed controller area network bus
NAS	North American specification
PDC	Park distance control
RH	Right-hand
TPMS	Tire pressure monitoring system
TSD	Touch screen display

USING THIS PUBLICATION

Health and safety

Always follow health and safety guidelines, specifically those detailed in the Workshop Manual.

Using this publication

The information provided in this publication is for use only by competent, qualified auto-electricians. Good product knowledge is assumed, as well as the ability to access and use recommended test equipment and other reference material provided.

Test equipment and other reference material

The information in this publication should be used in conjunction with the recommended test equipment; refer to Workshop Manual. Other reference material includes: Technical Service Bulletins (TSB) and the Workshop Manual.

The Electrical Reference Library (ERL) may also prove useful since it provides detailed connector information.

Battery disconnection and reconnection

It is imperative that any information relating to battery disconnection and reconnection is followed; refer to the appropriate sections in the Workshop Manual.

Fault Diagnosis

Always use the recommended test equipment for correct and reliable fault diagnosis, refer to the Workshop Manual.

Harness Repair

Repairs should only be undertaken for connectors where a Service Repair Kit is available; refer to the appropriate Electrical Reference Library (ERL).
Note: Fibre Optic circuits cannot be repaired; refer to the Workshop Manual.

Section numbering

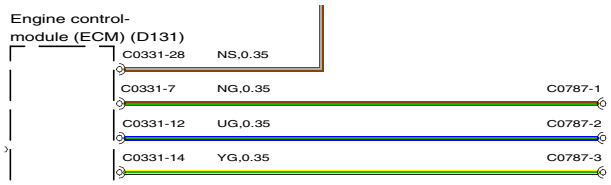
The sections in this publication are ordered to match the Global Outline numbering system as found in the current Workshop Manual. The Power and Ground distribution circuits can be found under section 414-01, BATTERY, MOUNTING AND CABLES.
Note: Where circuit diagrams show more than one sub-system, the circuit will be located in the section that carries the first-named sub-system, for example: Starting and Charging will be located under section 303-06 Starting System, since 'Starting' is the first-named sub-system.

Circuit sheet numbering

The figures in brackets to the left of the page number indicate a circuit sheet number and the total number of sheets per circuit, for example (01 / 05) represents sheet 1 of 5.

Understanding the circuit diagrams

Components



After each component description, a translation code is displayed in brackets, for example: Starter relay (R102), Engine control-module (ECM)(D131). The codes can be ignored.
Note: A dotted outline indicates that the component identified is not shown in its entirety.

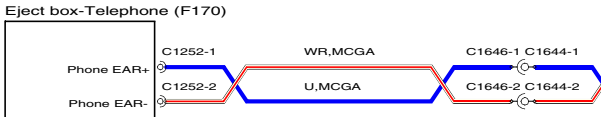
Connectors

Connectors and header joints are identified by their corresponding connector number with a numbered suffix to indicate the pin-out detail of the wire, i.e. C0292-1 identifies connector 292, pin number 1. Wire insulation colours are listed in a table at the end of this section. Where wires have a predominant colour with a secondary colour tracer, the main colour is identified first, i.e. WH-BK - white with a black tracer.

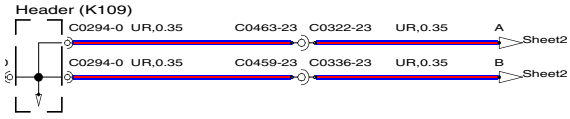
Wire length (Power and Ground Distribution only)

The wire length (in millimetres) is displayed after the colour and cross sectional area; for example, SR,0.35,480. In this example, the figure, 480 indicates the approximate position of the harness splice is 480mm from connector C2335.

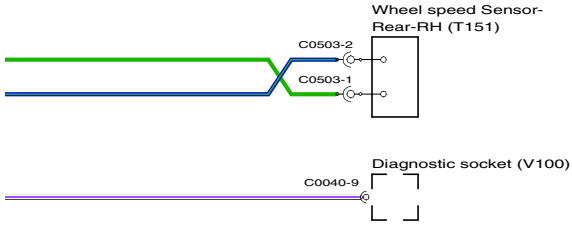
Line Types



Crossed wires as illustrated above show an example of how a twisted pair of wires may be represented on the circuits.



The arrows illustrated above show an example of the page break symbols, identifying that the circuit continues at the corresponding letter on the sheet number indicated.



The cup and ball symbol represents the male and female halves of connector. Most connectors plug directly into a component but some are wired directly to the component using a ‘flylead’ as with C503 above.

Ground points

Ground points are identified with an eyelet symbol and a connector number, except where components are grounded through its fixings, when only the eyelet is shown.

Colour Codes

CODE	COLOUR
BK	BLACK
GN	GREEN
BN	BROWN
OG	ORANGE
VT	PURPLE
RD	RED
GY	GREY
BU	BLUE
WH	WHITE
PK	PINK
YE	YELLOW

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Version 1.3, 3 November 2008

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Version 3, 29 June 2007

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