PRODUCT OFFER

TECHNICAL

THE SYNTHETIC ADVANTAGE

Benefits of Synthetics - Overview

- Synthetic oils offer **performance & protection benefits** superior to conventional oils

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- Higher Viscosity Index → Wide Operating Temperature Range → Reduced Wear
- Better Low Temperature Properties → Faster Oil Circulation → Reduced Wear
- Lower Volatility → Reduced Oil Burn Off / Evaporation → Lower Oil Consumption
- Lower Traction → Increased Efficiency → Better Fuel Economy
- Increased Oxidative Stability → Less Oil Thickening → Longer Oil Life

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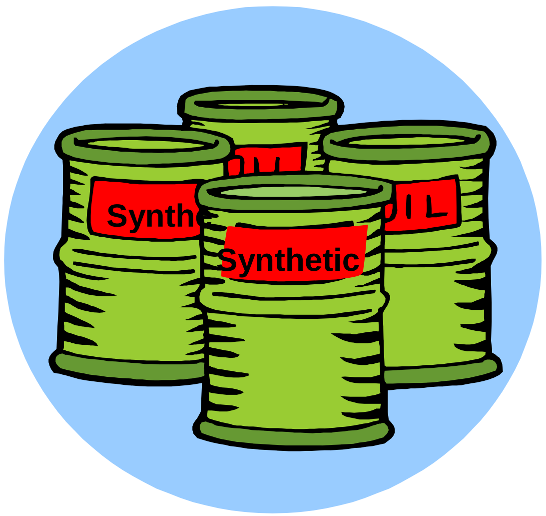
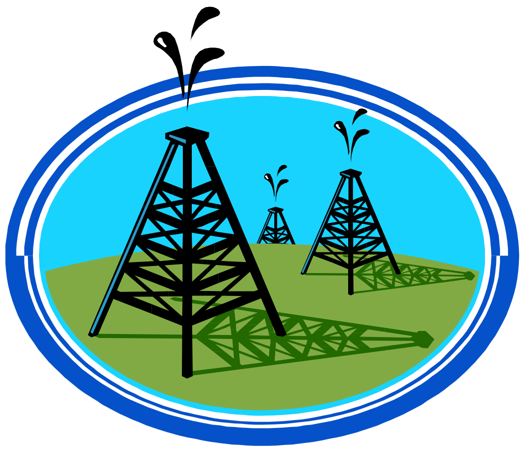
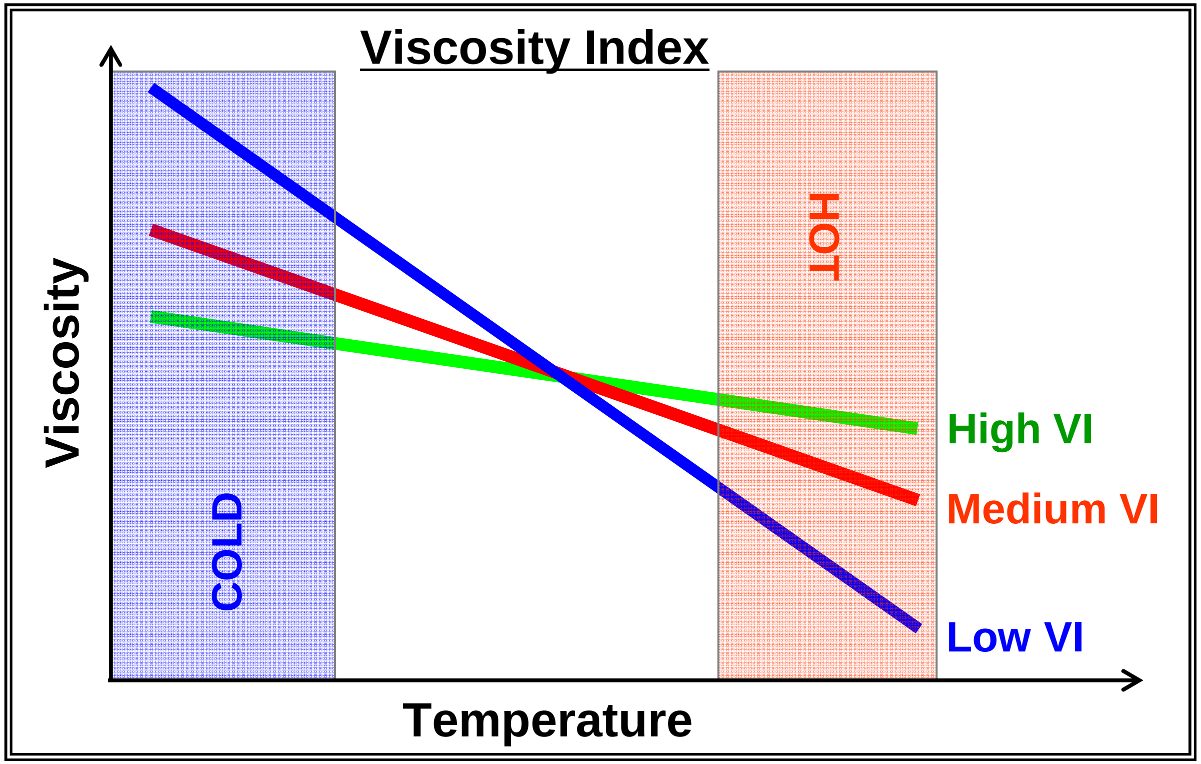




Benefits of Synthetics - Viscosity Index (VI)

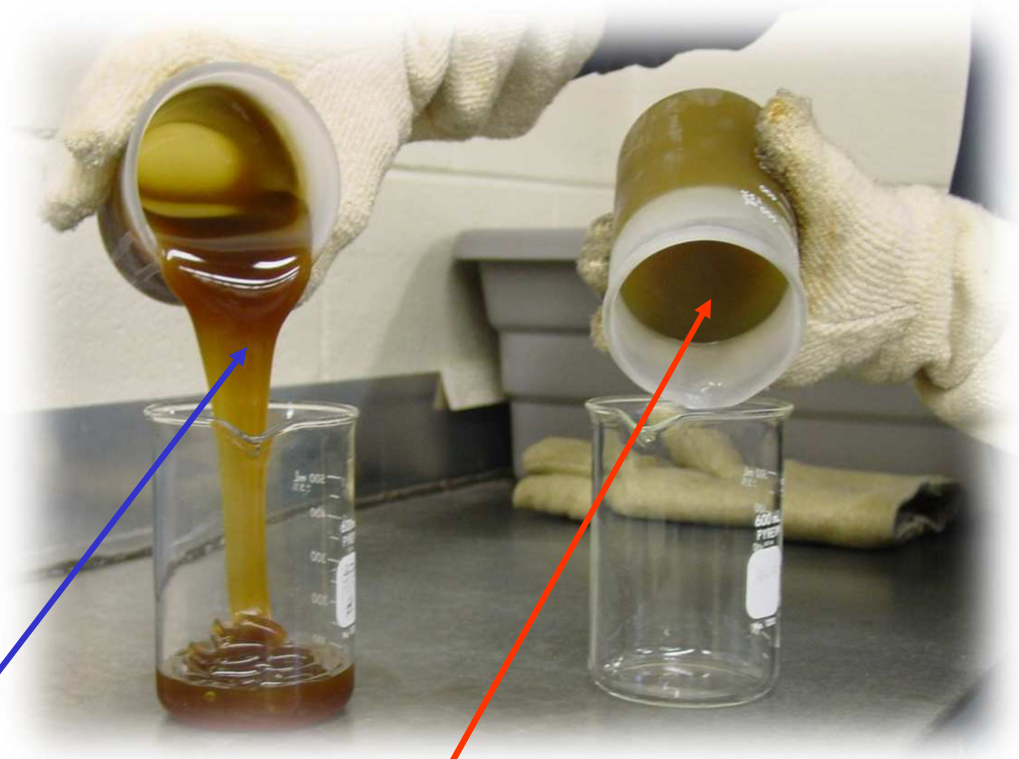
- Viscosity Index (VI) represents the **rate of change of viscosity** with temperature
- Oils with higher VI maintain viscosity better as temperature varies
  - At hotter temperatures, the oil becomes thinner (viscosity decreases) and provides less engine protection
  - At colder temperatures, the oil thickens (viscosity increases) and becomes more difficult to pump around the engine

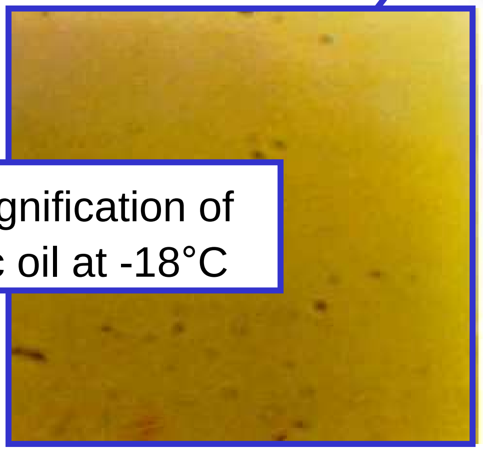


- Synthetic oils have higher VI than conventional oils
- So, synthetic oils provide better engine protection across a wider range of temperatures
- At more extreme temperatures, the benefit becomes greater

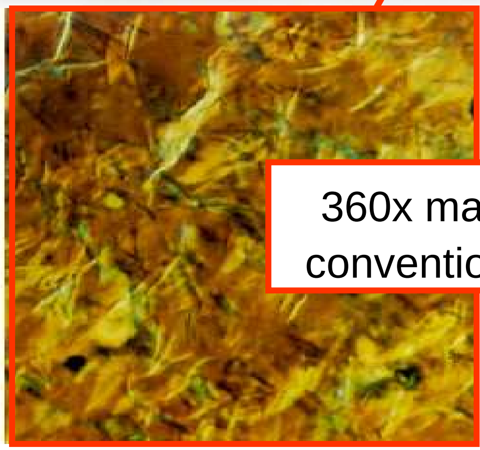
Benefits of Synthetics - Low Temperature Properties

- Wax is a large hydrocarbon molecule that prevents oil from flowing at colder temperatures
- Synthetics contain less wax than conventional oils
- Synthetics remain fluid at lower temperatures than conventional oils
- Cold, thick oil is more difficult for the engine to pump, resulting in less protection at start-up





360x magnification of synthetic oil at -18°C

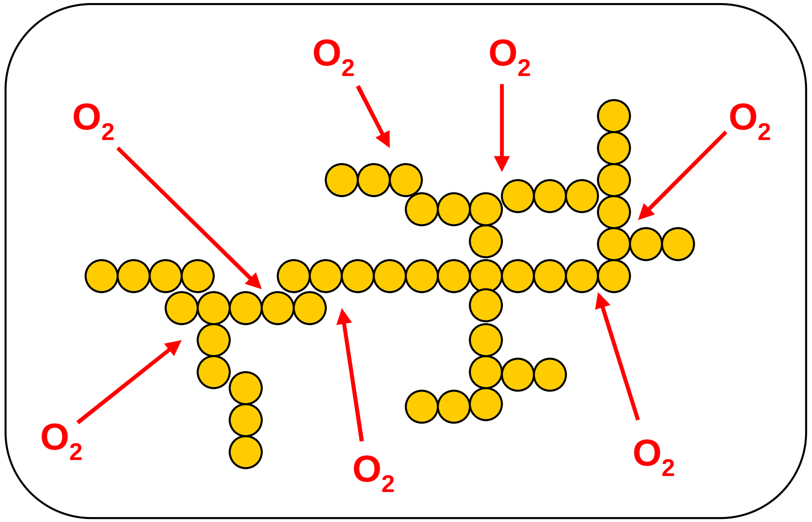


360x magnification of wax in conventional oil at -18ºC (0ºF)

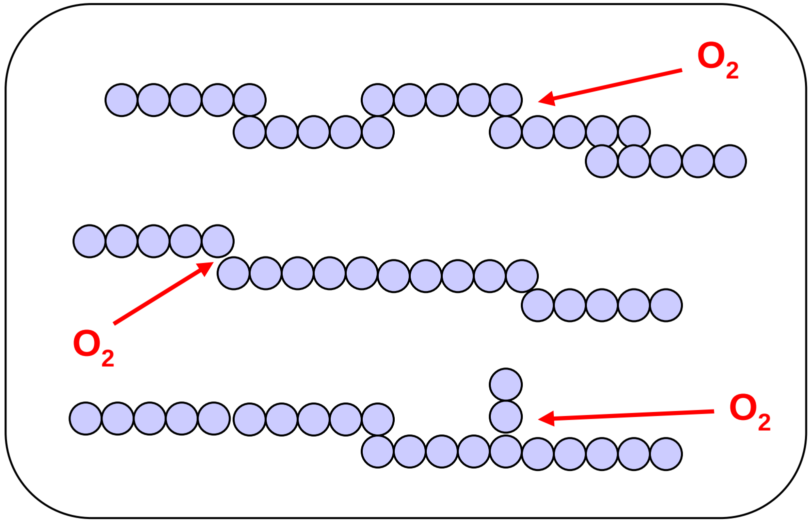
Benefits of Synthetics - Oxidative Stability

- Oxidative stability is the ability of oil to resist breakdown caused by combining with oxygen
- More weak spots in mineral oil allow faster oxidation
- Synthetics have fewer weak spots and so resist oxidation for a longer time
  - As oxidation increases, the oil thickens
  - Also, the engine oil loses its ability to control deposits & varnish

Mineral Oil

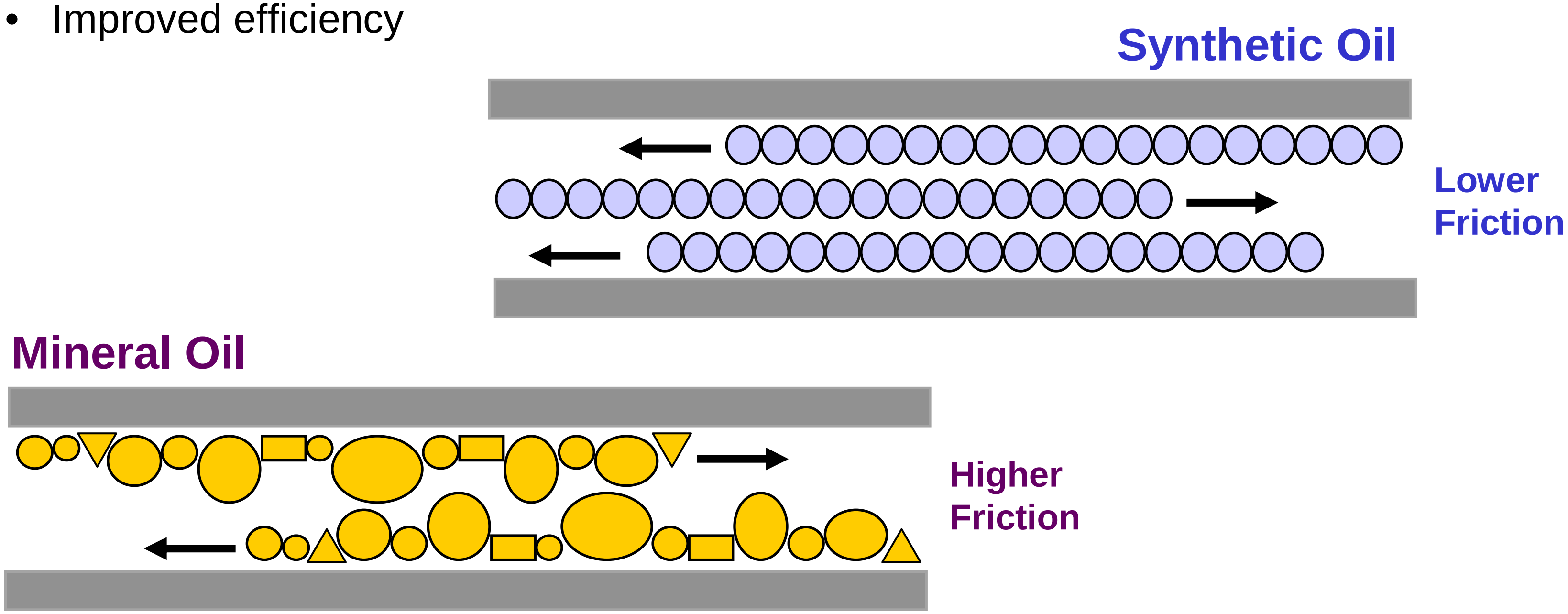


Synthetic Oil



Benefits of Synthetics - Efficiency

- Due to a more consistent molecular structure, synthetics have lower traction than mineral oils
- Lower traction means less internal friction within the fluid
- Less friction within the fluid has several benefits:
  - Lower generation of heat within the fluid
  - Improved efficiency



PRODUCT OFFER

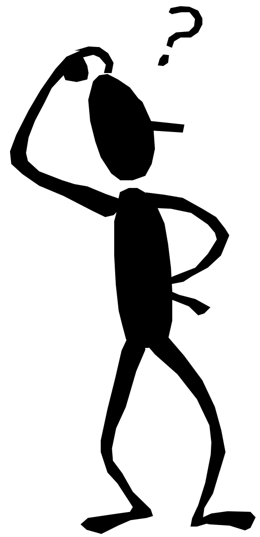
TECHNICAL

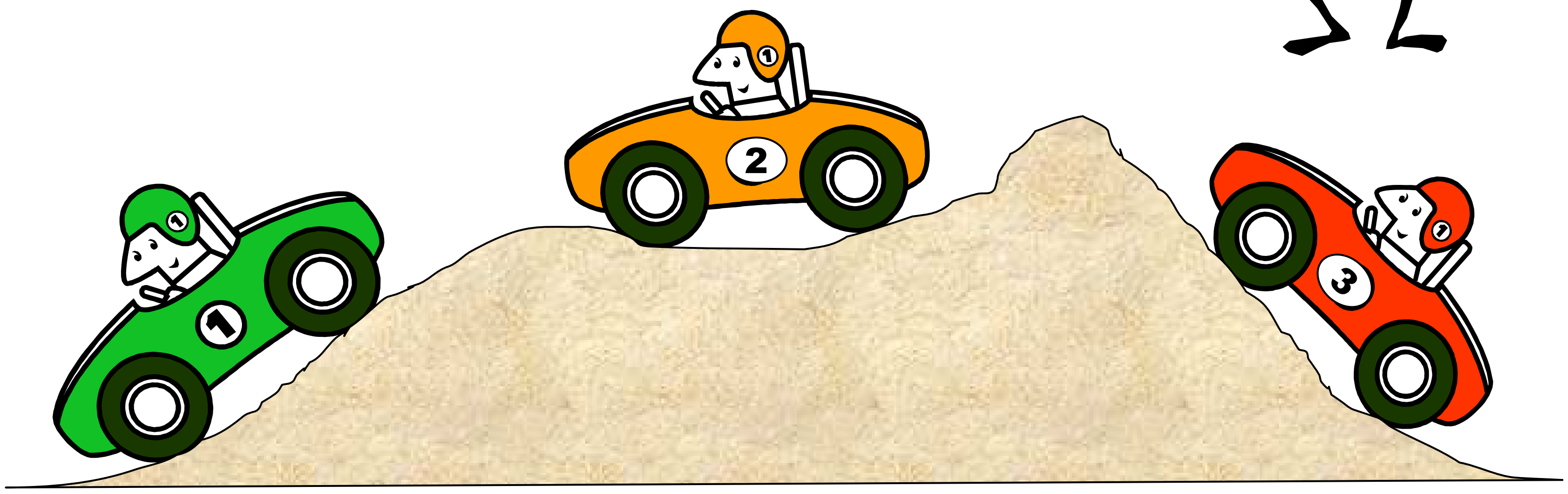
MOBIL SUPER

Interactive Session – Driving Conditions

- Different types of **driving** and different types of **conditions** put different levels of stress on an engine and the engine oil

- Discuss different driving conditions and whether they are likely to be high, medium, or low stress?





Driving Conditions – Stress Levels

OPERATING CONDITIONS	TYPICAL SITUATIONS	ENGINE STRESS LEVEL	DESCRIPTION
HIGHWAY	Cruising	Low	Highway driving allows the engine oil to operate at the optimum temperature so that fuel and moisture don't build up in the oil.
	High Speed	Medium	Rapid acceleration and high speed driving causes higher oil temperatures and lower oil viscosity, resulting in the need for greater engine protection.
CITY	Stop & Go Driving	High	The oil does not heat up sufficiently to burn off the moisture and fuel that build up due to heavy idling, which can cause corrosion and sludge.
	Traffic	High	Becoming stuck in traffic after a period of high speed drivingmay result in increased thermal stress on the engine.
ENVIRONMENT	Cold Weather	Very High	Oil thickens at low temperature, making it harder to pump around the engine and take longer to reach and protect critical engine parts.
	Hot Weather	Medium	In hot weather it becomes tougher to remove heat from the oil. Elevated oil temperatures result in less protection between moving engine parts.
	Humidity	Medium	Moisture build up in the oil may lead to formation of acidic components which can corrode metal parts and shorten oil life.
	Dusty Environments	High	Dirt and sand can make their way into the oil and cause accelerated wear of moving engine parts.

Driving Conditions – Stress Levels

OPERATING CONDITIONS	TYPICAL SITUATIONS	ENGINE STRESS LEVEL	DESCRIPTION
ENGINE TECHNOLOGY	Diesel & Direct Injection Engines	Medium	Soot particles can build up in the oil, and if allowed to agglomerate can cause abrasive wear within the engine.
	Turbochargers	Very High	Low quality oils can become cooked onto the turbocharger, eventually causing it to fail.
	Fuel Quality	Very High	Poor fuel quality can mean that aggressive fuel components get into the oil, leading to poisoning of the engine oil and the creation of sludge.
	Extended Oil Drains	High	Many modern vehicles promote longer intervals between oil changes. This requires higher quality engine oil which can resist breakdown longer.
HARD WORKING	Towing or People Moving	High	Heavily loaded vehicles place increased strain on the engine, requiring an increased level of protection from the oil.
	Racing	Very High	Rapid accleration and very high speeds demand that the oil works extremely hard to properly protect the engine.

Different operating conditions put different stresses on your engine:

Operating Conditions	Typical Engine Stress Level		Description
Highway	Cruising	Low	Highway driving allows the engine oil to operate at the optimum temperature so that fuel and moisture don't build up in the oil.
	High Speed	Medium	Rapid acceleration and high speed driving causes higher oil temperatures and lower oil viscosity, resulting in the need for greater engine protection.
City	Stop & Go Driving	High	The oil does not heat up sufficiently to burn off the moisture and fuel that build up due to heavy idling, which can cause corrosion and sludge.
	Traffic	High	Becoming stuck in traffic after a period of high speed driving may result in increased thermal stress on the engine.
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	Dusty	High	Dirt and sand can make their way into the oil and cause accelerated wear of moving engine parts.
Engine Technology	Diesel & Direct Injection Engines	Medium	Soot particles can build up in the oil, and if allowed to agglomerate can cause abrasive wear of engine parts.
	Turbochargers	Very High	Turbochargers are prone to deposit formation due to the very high operating temperatures (often up to 850°C). Low quality oils can become cooked onto the turbocharger causing it to fail.
	Fuel Quality	Very High	Poor fuel quality can mean that aggressive fuel components get into the oil, leading to poisoning of the engine oil and the creation of sludge.
	Extended Oil Drains	High	Many modern vehicles promote longer intervals between oil changes. This requires higher quality engine oil which can resist breakdown longer.
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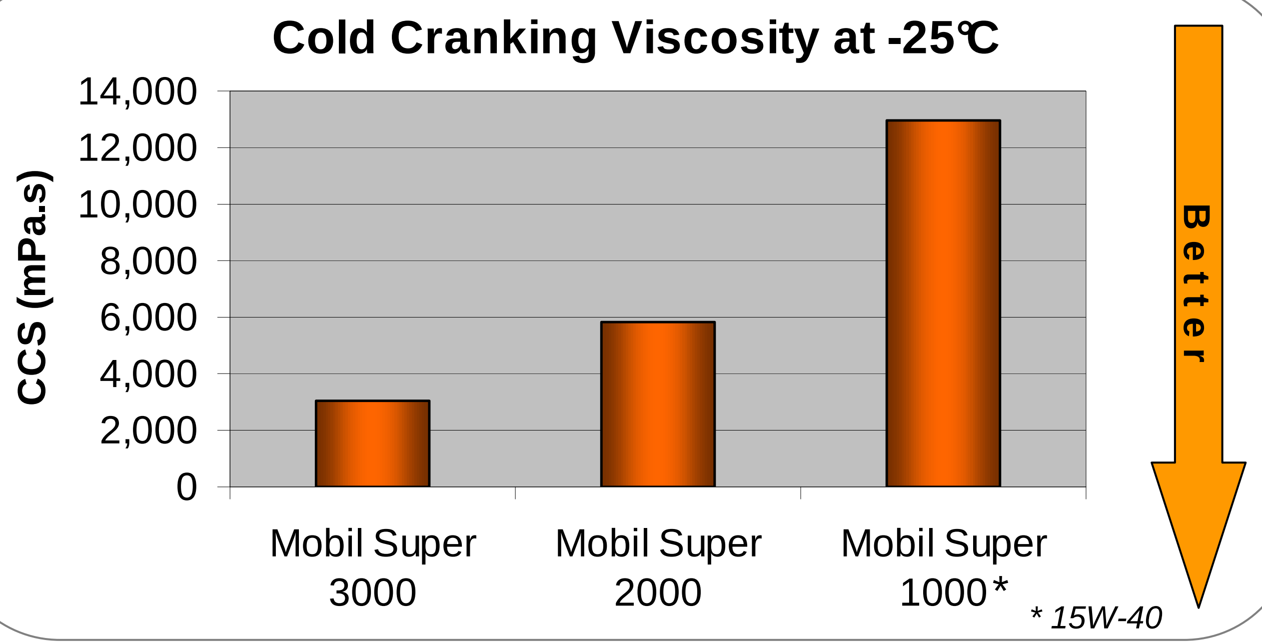
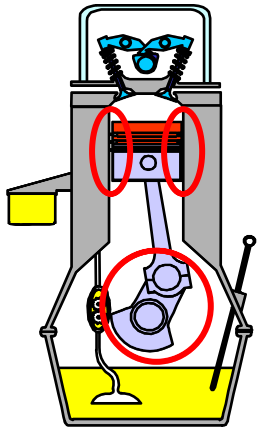
	Racing	Very High	Rapid acceleration and very high speeds demand that the oil works extremely hard to properly protect the engine.

Low Medium High Very High

Mobil Super: Cold Temp. Performance



Relevant Part of Engine



bearings, piston rings

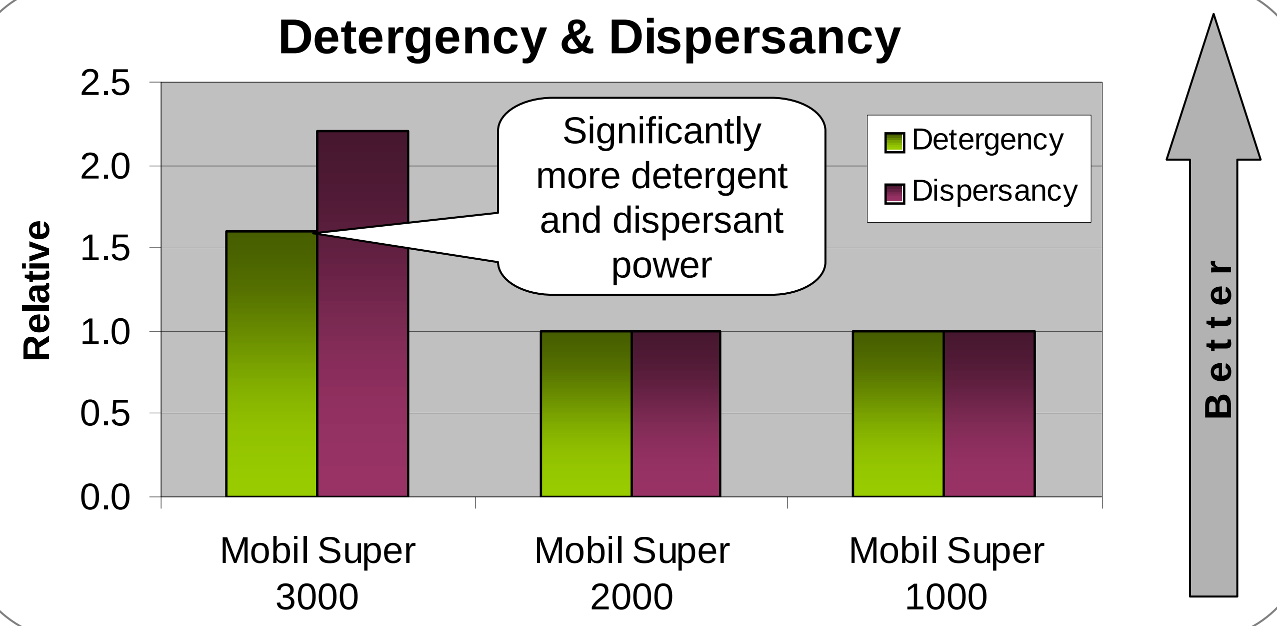
Test Description

In the CCS test (Cold Crank Simulator), the oil is cooled to the test temperature (e.g. -25℃). Oil viscosity, or resistance, is then measured under high shear conditions.

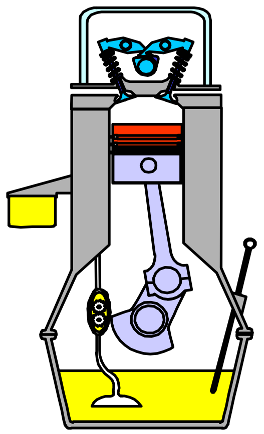
Consumer Relevance

The test simulates low temperature start-up capability. Oils with lower CCS values ensure less resistance for the bearings and piston rings to overcome. This results in quicker start times, meaning less strain on the engine and battery.

Mobil Super 3000: Additional Detergency & Dispersancy



Relevant Part of Engine



Engine cleanliness

Condition

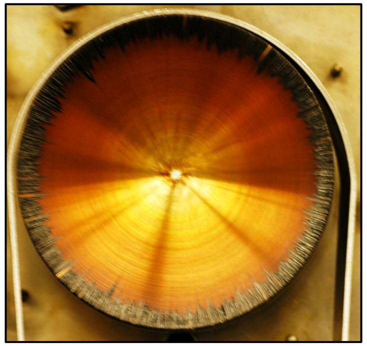
In motor oil, detergents and dispersants work by holding contaminants safely with in the oil rather than being deposited on engine surfaces.

Consumer Relevance

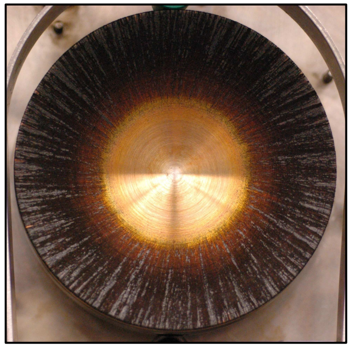
By-products of the combustion process enter the engine oil. Many of these by-products are highly reactive and ultimately lead to the formation of deposits, such as sludge and varnish. An oil with a higher level of detergency and dispersancy will keep the engine operating more efficiently as it will remain cleaner for longer.

Mobil Super: Deposit Control

Deposit Control (Thin Film Oxidation Test)

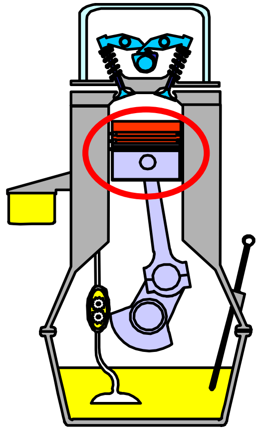


Mobil Super 3000
(Rating = 63 / 100)



Mobil Super 2000
(Rating = 49 / 100)

Relevant Part of Engine



pistons

Test Description

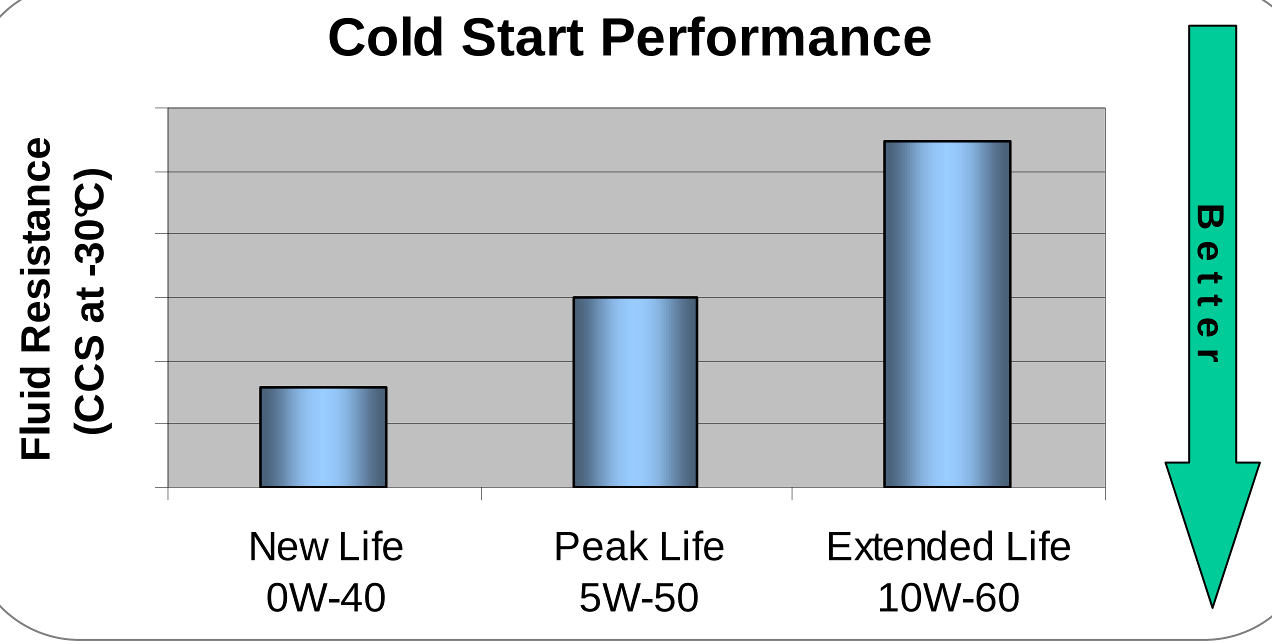
The test oil is heated to 285℃ and directed onto a rapidly spinning (2500rpm) aluminum disc which is heated to 330℃. The test duration is 3 hours. At the end of test, the oil is assigned a cleanliness merit rating out of 100.

Consumer Relevance

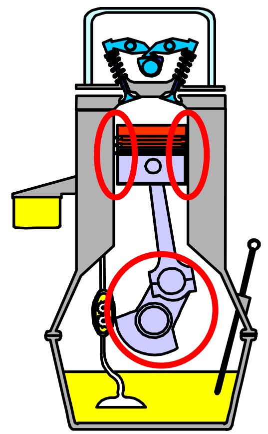
The test simulates high temperature piston deposit formation. Oils of lower oxidative and thermal stability will cause greater deposit formation. As piston deposits increase, engine efficiency decreases.

PRODUCT OFFER
TECHNICAL
MOBIL 1

Mobil 1: Cold Start Performance



Relevant Part of Engine



bearings, piston rings

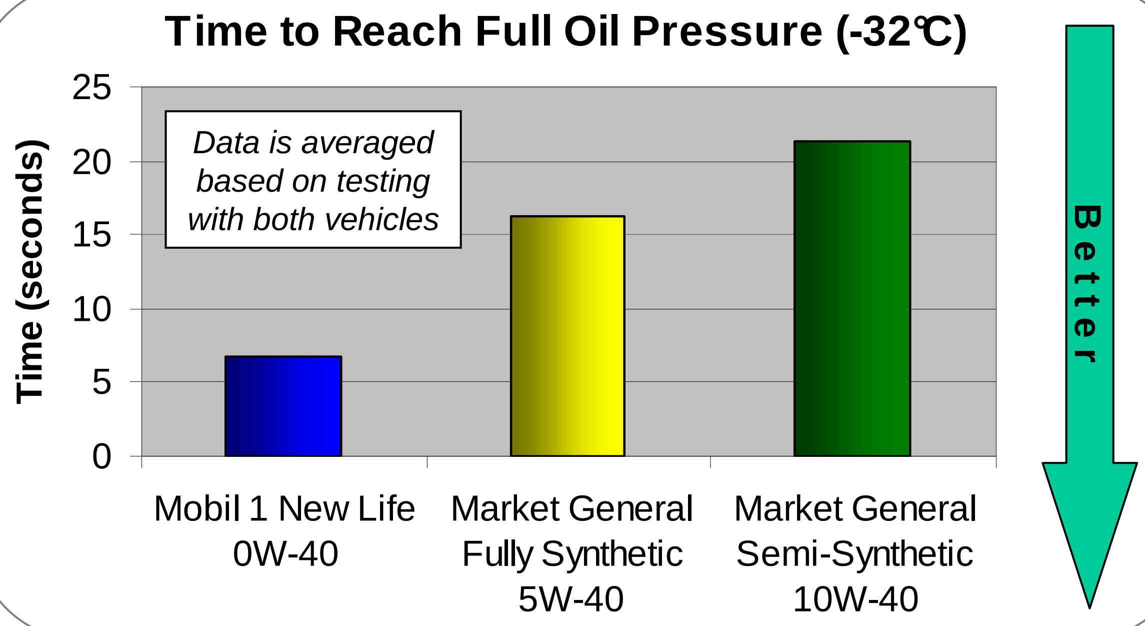
Test Description

In the CCS test (Cold Crank Simulator), the oil is cooled to the test temperature. Oil viscosity, or resistance, is then measured under high shear conditions.

Consumer Relevance

The test simulates low temperature start-up capability. Oils with lower CCS values ensure less resistance for the bearings and piston rings to overcome. This results in quicker start times, meaning less strain on the engine and battery.

Mobil 1: Cold Temperature Performance



Test Vehicles

VW Golf (2006)

Ford Focus (2006)

Test Description

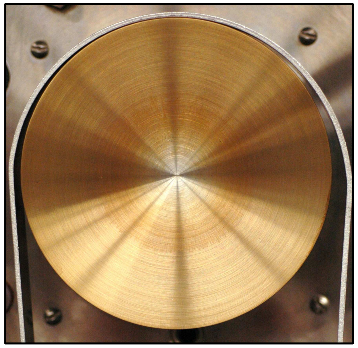
Vehicle engines are filled with test oil, then parked overnight in a cold chamber. In the morning, the ignition key is turned and the total time taken to reach full oil pressure at the furthest point in the engine is recorded.

Consumer Relevance

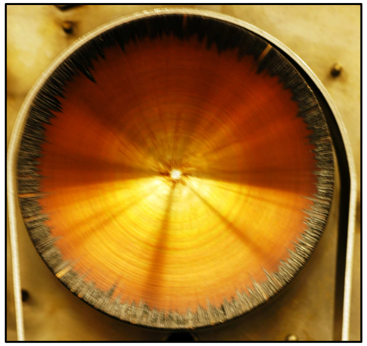
The test simulates low temperature pumpability and cold starting. If the oil is not pumped quickly, the engine may take longer to fire, and it will take longer for the engine to achieve full oil pressure. This can result in poor lubrication and a higher rate of engine wear.

Mobil 1: Deposit Control

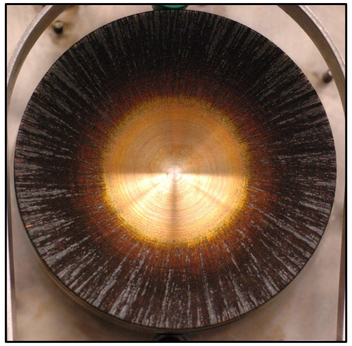
Deposit Control (Thin Film Oxidation Test)



Mobil 1 New Life
0W-40
(Rating = 90 / 100)

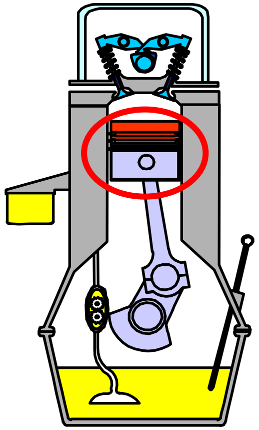


Market General
Fully Synthetic
(Rating = 63 / 100)



Market General
Semi-Synthetic
(Rating = 49 / 100)

Relevant Part of Engine



pistons

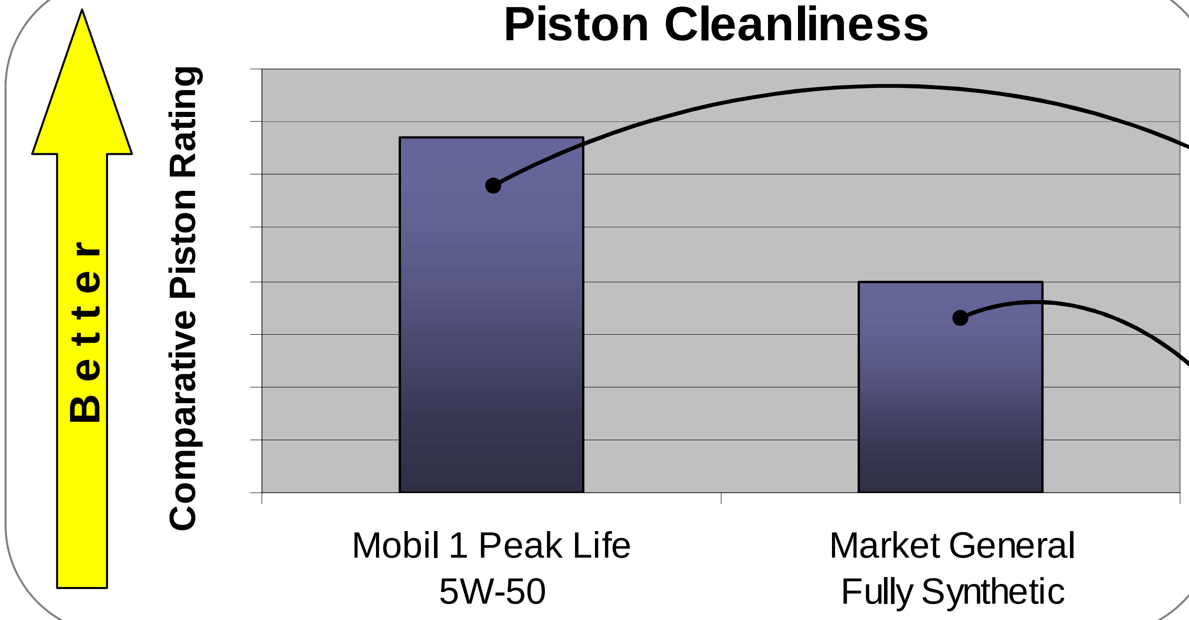
Test Description

The test oil is heated to 285℃ and directed onto a rapidly spinning (2500rpm) aluminum disc which is heated to 330℃. The test duration is 3 hours. At the end of test, the oil is assigned a cleanliness merit rating out of 100.

Consumer Relevance

The test simulates high temperature piston deposit formation. Oils of lower oxidative and thermal stability will cause greater deposit formation. As piston deposits increase, engine efficiency decreases.

Mobil 1: Engine Cleanliness



Pistons at End of Test

Mobil 1

Market General Fully Synthetic

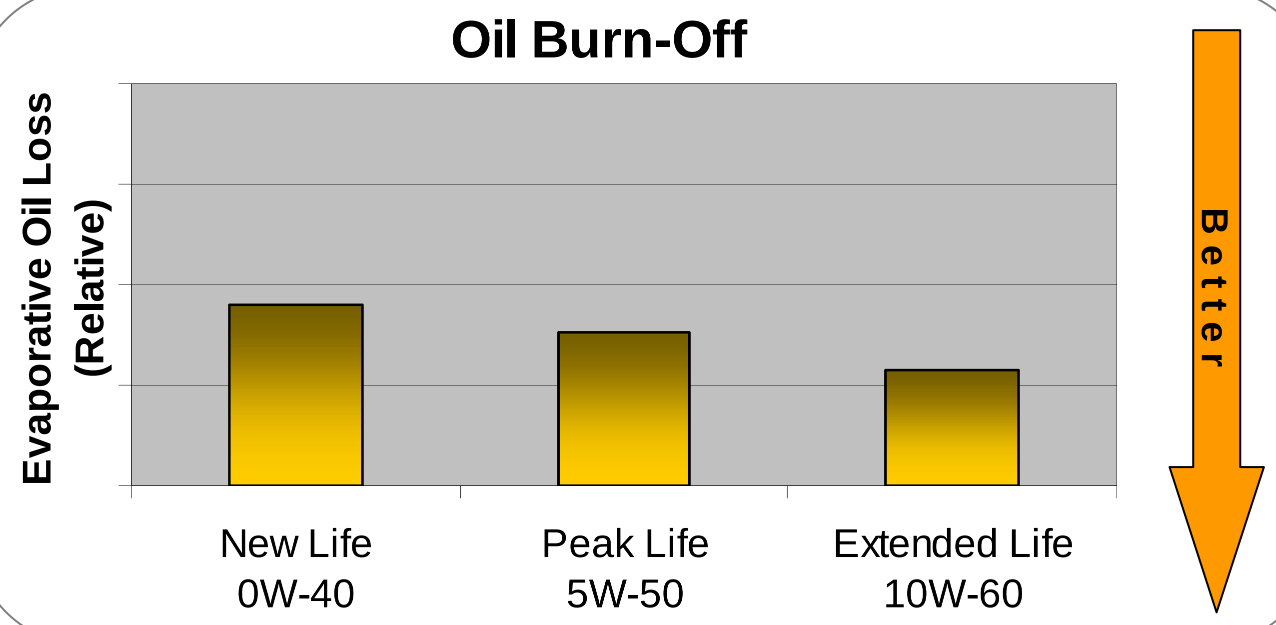
Test Description

The Sequence IIIG test measures oil thickening and piston deposits during high temperature conditions. Oil temperature is 150℃ for 100 hours.

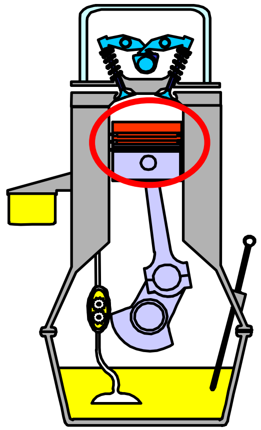
Consumer Relevance

The test simulates high speed driving in very hot weather conditions.

Mobil 1: Oil Consumption / Oil Burn-Off



Relevant Part of Engine



combustion chamber

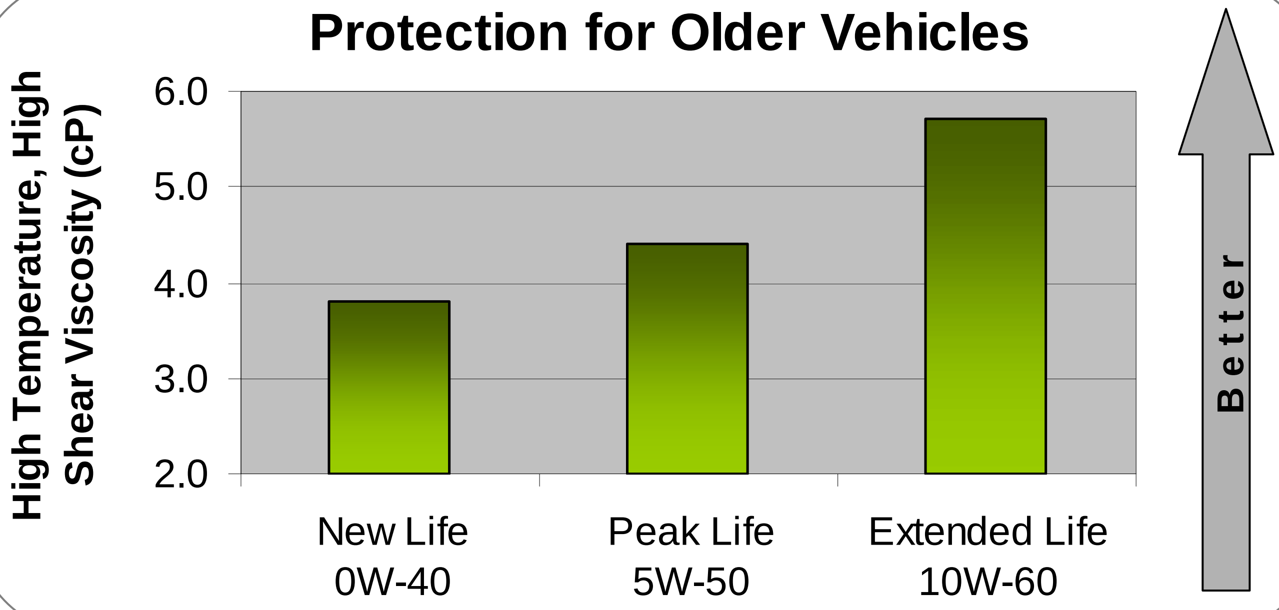
Test Description

In the Noack volatility test, the oil is heated to 250℃ for 1 hour. The amount of oil that evaporates is measured

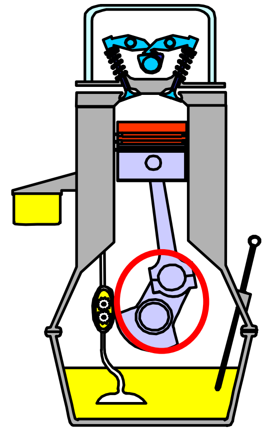
Consumer Relevance

The test evaluates the oil's resistance to burn-off under high temperatures which cause lighter constituents within the oil to vaporize. Higher volatility equates to higher oil consumption, and the need for more oil top-up.

Mobil 1: Protection for Older Vehicles



Relevant Part of Engine



bearings

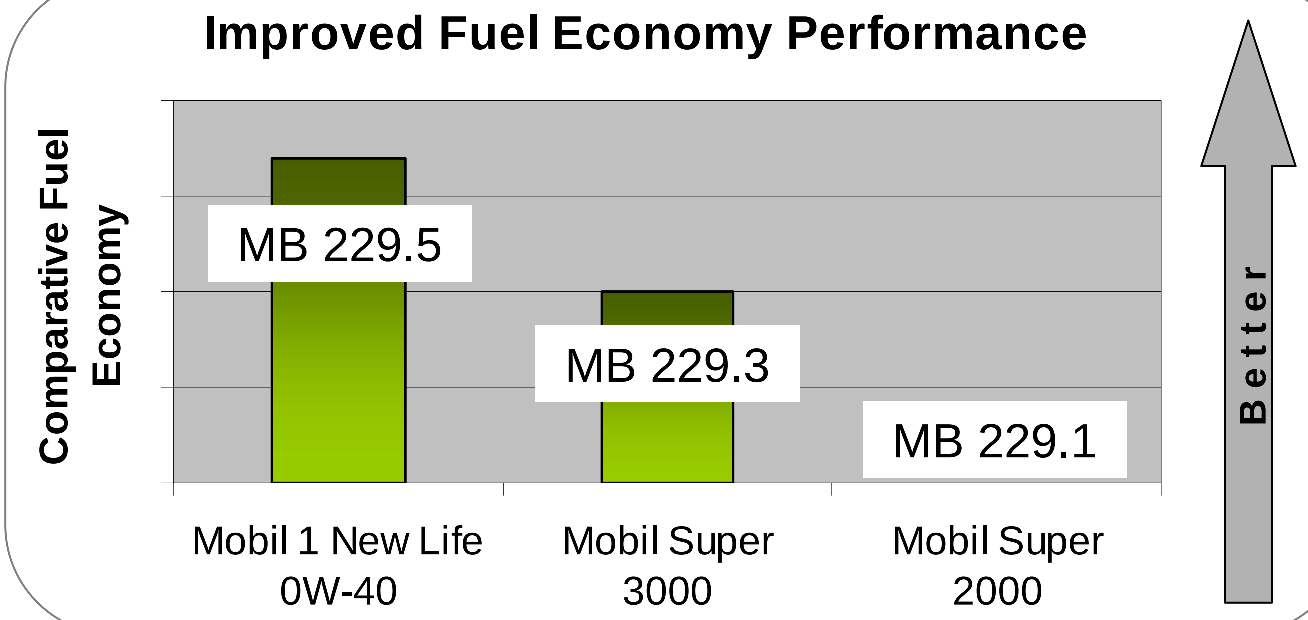
Test Description

The HTHSV test (High Temperature High Shear Viscosity) measures the oil viscosity at 150℃ under high shear conditions.

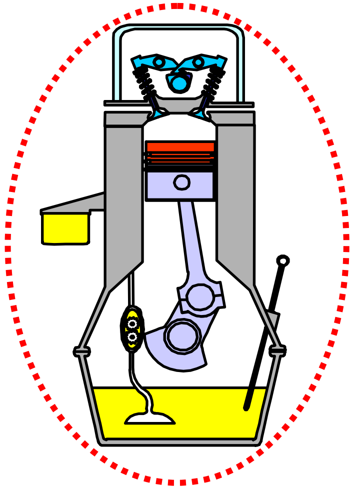
Consumer Relevance

The test simulates engine conditions experienced by the oil in areas such as the bearings where it is important that the oil film remains thick enough to prevent damage from metal-to-metal contact. Modern engines are designed to cope with thinner oils, but many older engines require thicker oils to ensure adequate protection.

Mobil 1: Fuel Economy



Relevant Part of Engine



Background

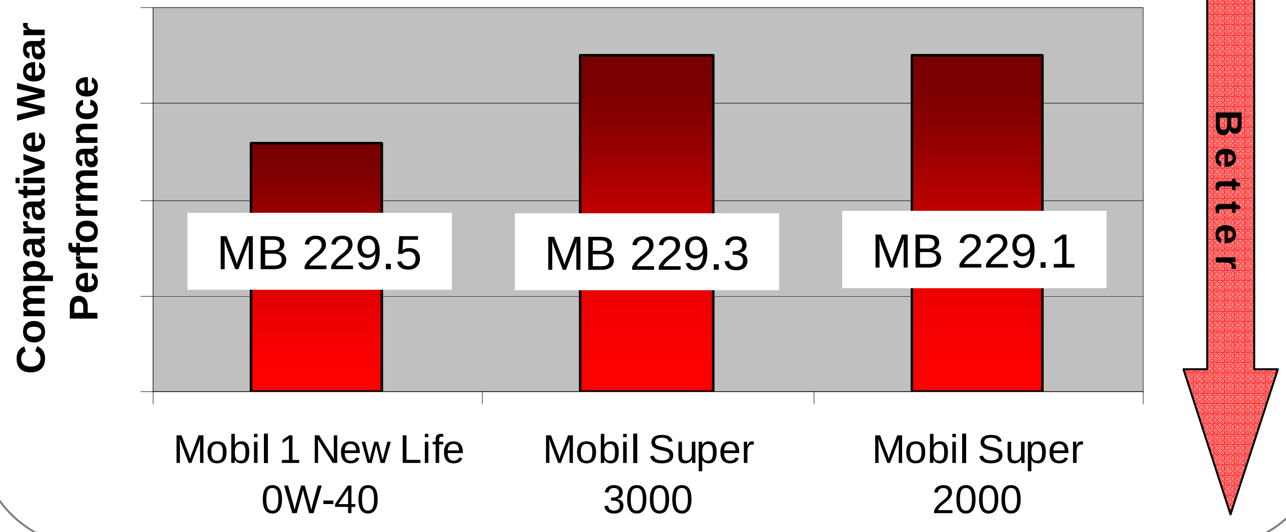
Certain engine oil specifications require a fuel economy test limit to be achieved in order to meet the requirements of that specification. More demanding specifications set tougher limits (e.g. the Mercedes-Benz specification system uses tiered fuel economy limits).

Consumer Relevance

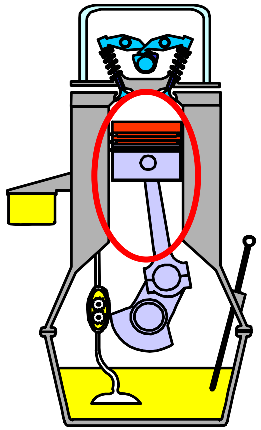
Oils meeting the toughest specifications such as MB 229.5 must provide improved fuel economy compared to less stringent specifications such as MB 229.1.

Mobil 1: Wear Protection

Improved Wear Performance



Relevant Part of Engine



e.g. cylinder

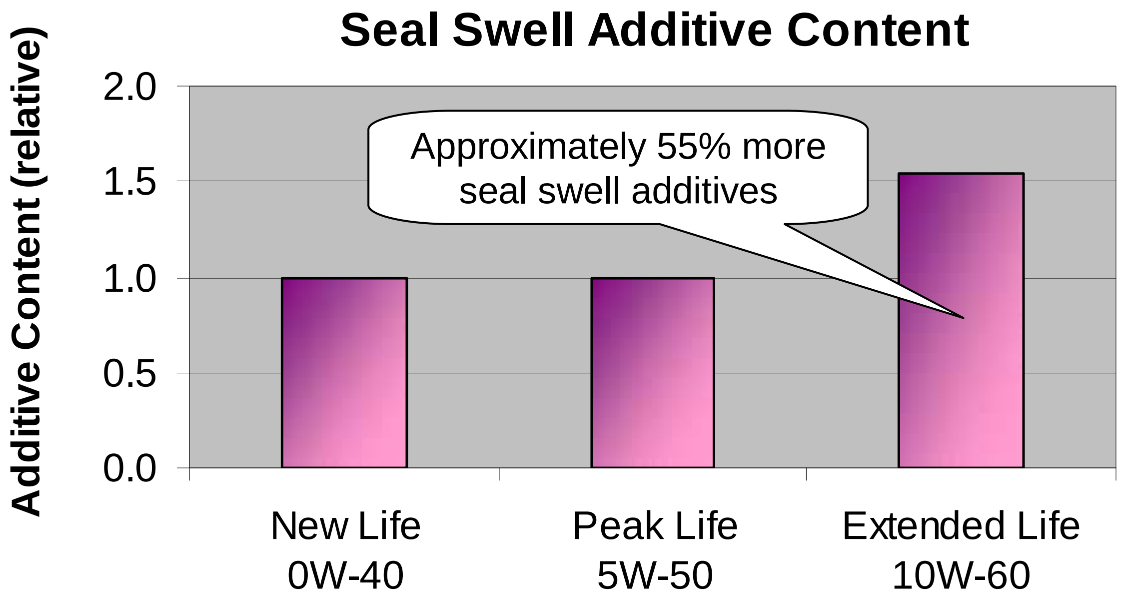
Test Description

Certain engine oil specifications require a minimum passing wear requirement to be achieved. More demanding specifications set tougher limits (e.g. the Mercedes-Benz specification system uses tiered cylinder wear limits in some engine tests).

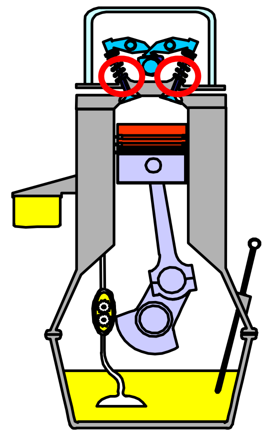
Consumer Relevance

Oils meeting higher performance specification such as MB 229.5 offer improved wear protection. Reduced levels of wear ensure a healthier engine and longer engine life.

Mobil 1 Extended Life: Seal Swell Additive



Relevant Part of Engine



Seals (e.g. valve stem seals)

Condition

With prolonged exposure to engine oils and high temperatures, seal materials used throughout your engine deteriorate as they age.

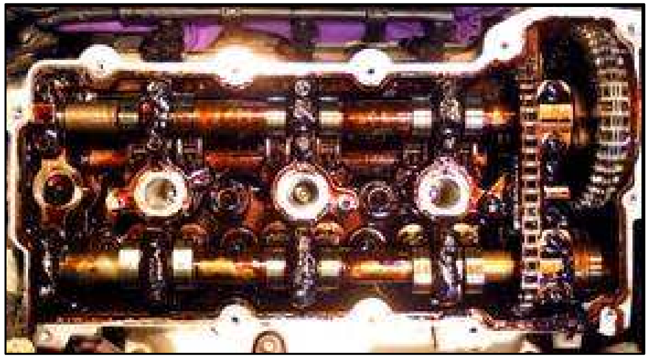
Consumer Relevance

Deteriorated seals can result in increased oil consumption, as engine oil can leak past them. Additional seal swell additives help by causing aged seals to expand in volume, thereby reducing the likelihood of increased oil consumption.

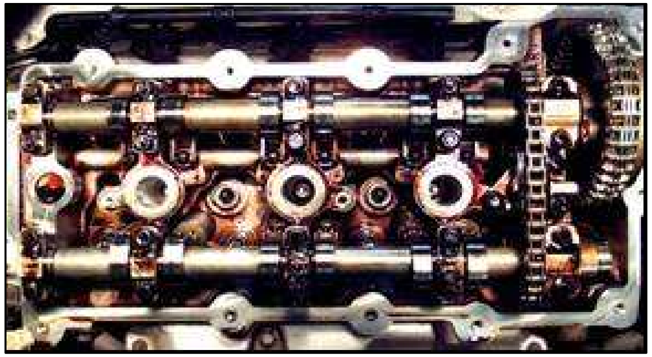
Mobil 1: Clean-Up

Before and After Photos of Engine Top Deck

Before

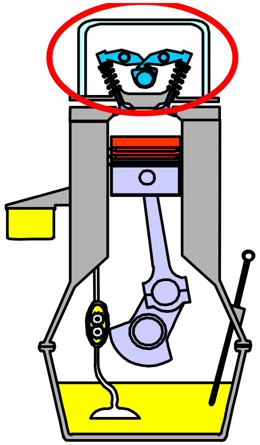


After



Testing carried out in a controlled environment
(American vehicle after 21,000 miles)

Relevant Part of Engine



Top deck

Test Description

A European and an American vehicle that had been run with conventional oil were switched to Mobil 1.

Outcome

After 14,000 miles of driving with Mobil 1 at recommended oil drain intervals, the European vehicle returned to near new levels of cleanliness. The American vehicle experienced even greater improvements.

PRODUCT OFFER

TECHNICAL

VISOM MOBIL 1

AGENDA

- ❑ Why are we reformulating Mobil 1?
- ❑ What’s the customer communication strategy?
- ❑ Technical comparison of current v new formulations
  - Performance Profile
  - Oxidation
  - Deposit Control
  - Volatility
  - Viscosity Control
  - Cleanliness
  - Wear
  - Diesel Performance
  - Low Temperature – Pour Point
  - Low Temperature – MRV
  - Analytical Comparison

Why are we reformulating Mobil 1?

- A natural evolution of the formulation
  - The Mobil 1 formulation strategy has always been based on selecting the best components available. We now have the very high quality Group III+ base stock, 'Visom' exclusively available to ExxonMobil. As we developed the Mobil 1 ESP technology we found that combining Visom with PAO could deliver a formulation of equivalent performance to an all PAO formulation.
- Competitive advantage
  - Visom is the only non-PAO stock that can deliver the required performance to formulate a 0W grade oil that meets European OEM engine oil specifications. Visom is not available to our competition.
- To support Mobil 1 growth
  - Global PAO capacity is limited. As we quickly approach this limit, new base stocks must be explored to ensure we can support the continued growth of the Mobil 1 family of products.

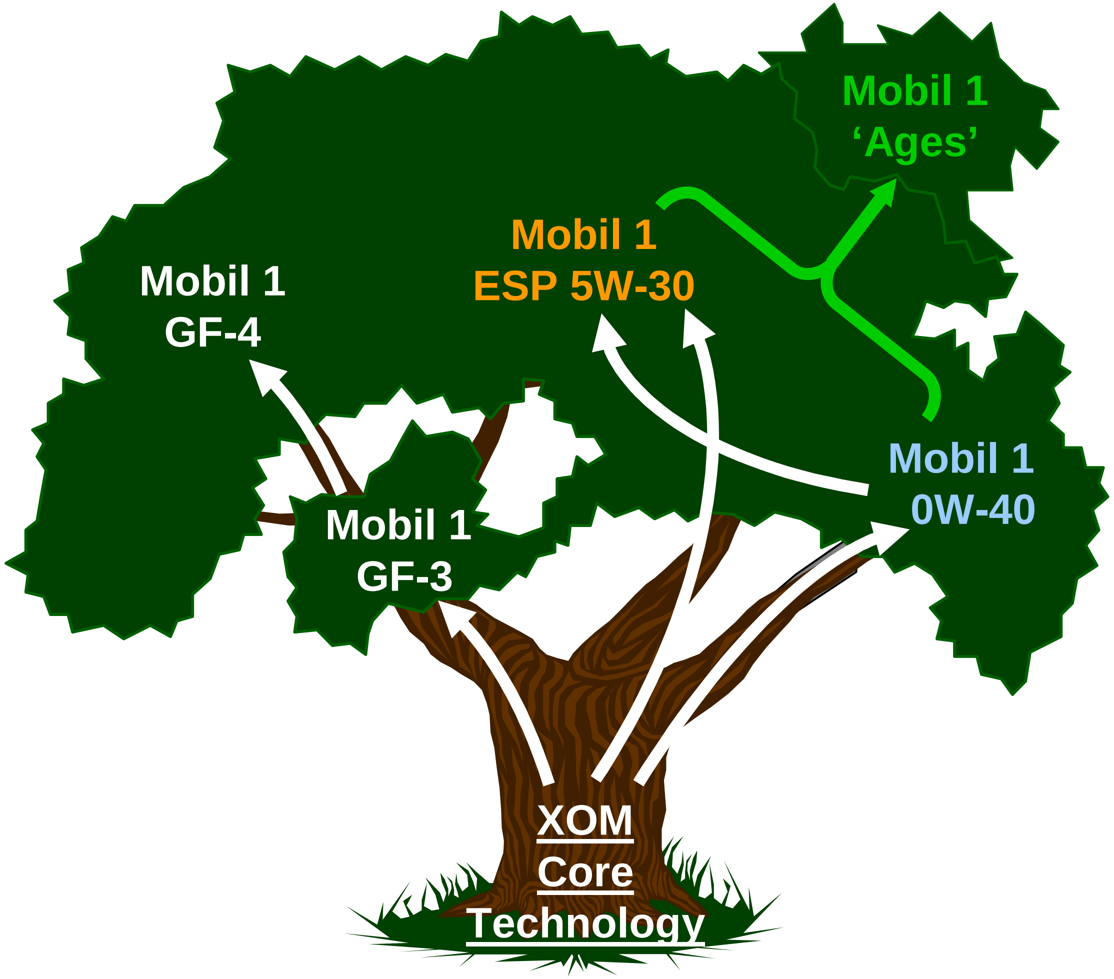
Why are we reformulating Mobil 1?

- To ensure continuity of supply
  - As we saw with the 2005 hurricane, the more flexibility we have in our formulations, the better placed we are to withstand disruption to our supply. We can balance PAO and Visom supply fluctuations to ensure we can always deliver the final product to our customers.
- To maintain market relevant pricing
  - As PAO supply has tightened globally, raw material costs have increased substantially. In the future, an exclusively PAO formulation may be priced out of the market or result in significant margin erosion.
- To prepare for next generation basestocks (GTL)
  - Commencing 2010, the next generation of base stocks derived from Natural Gas (Gas To Liquids) will enter the market. These high quality basestocks will arrive in substantial quantities and will probably be used in the majority of competitive premium formulations. Visom is viewed as a precursor of GTL, and hence it's use now in our flagship formulations eases our transition to a GTL world, and helps us understand how to maintain flagship performance using these high quality non-PAO basestocks.

What is the communication strategy?

- With the exception of Germany, this reformulation will be <u>invisible</u> to consumers and B2B customers.
  - Claims are identical with the exception of some now obsolete or soon to be obsolete claims
  - Performance of new formulations are equivalent to current formulations
    - Testing is underway to provide read-across of current marketing claims to new formulations
    - Review will take place of current marketing literature to ensure accuracy of specific claims to new formulations (e.g. if we quote actual pour point values then this would need to be updated).
  - There will be no proactive customer communication relating to this reformulation. However, an internal briefing document and Q&A has been prepared to allow sales to respond in the unlikely event of a customer question.
- Due to the unique definition of synthetic in Germany (Synthetic = 100% PAO) this reformulation <u>is</u> visible to the consumer and B2B customers.
  - A more proactive communication is being prepared for German use

Mobil 1 Family Tree



- **Mobil 1 'Ages'** family was designed from a very strong technology platform
- **Mobil 1 'Ages'** builds upon the strength of **Mobil 1 0W-40** by incorporating some of the latest formulation advances contained in **Mobil 1 ESP Formula 5W-30**
- **Mobil 1 'Ages'** was developed as a standard ash formulation to address the needs of engines that do not require a low ash product

Mobil 1 'Ages' Technology

'Old' Mobil 1 0W-40

- Anti-wear system
- SuperSyn Technology
- Dispersant system
- Anti-oxidant system
- Detergent system

Mobil 1 'Ages' 0W-40

- Shear stable viscosity modifier
- Base stock composition
  - Thermally stable ester
  - GTL precursor
- Friction modifier

Mobil 1 ESP Formula 5W-30

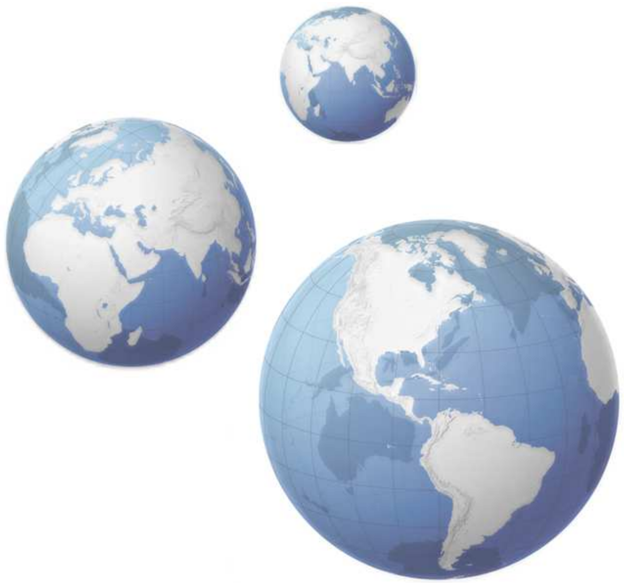
Mobil 1 0W-40 Technical Comparison

<u>NOTE: Terminology</u>

Future Mobil 1

Mobil 1 ‘Ages’ Family

- Mobil 1 New Life 0W-40
- Mobil 1 Peak Life 5W-50
- Mobil 1 Extended Life 10W-60



ExxonMobil
Lubricants & Specialties

Performance Profile

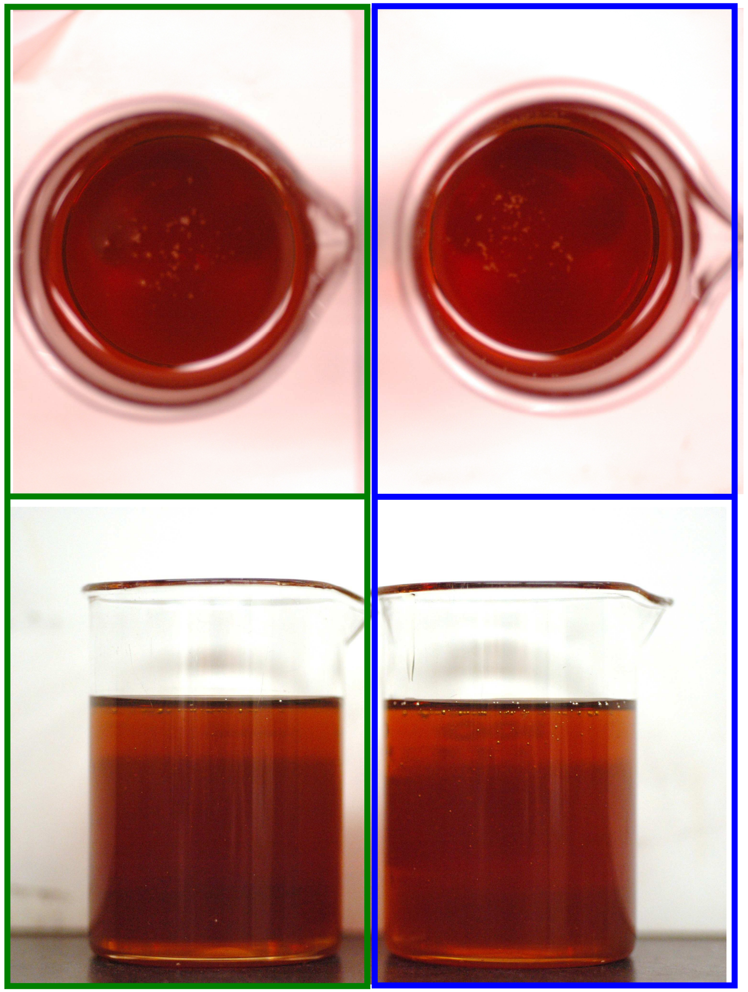
	Current 0W-40	Future 0W-40
API		
SM	X	X
SL	X	X
SL (EC)	X	
SJ	X	X
CF	X	X
ACEA		
A3/B3	X	X
A3/B4	X	X
ILSAC		
GF-3	X	
MB		
229.3	X	X
229.5	X	X
VW		
503.01	X	
502.00	X	X
505.00	X	X
BMW		
LL-01	X	X
Opel		
Long Life Service Fill GM-LL-A-025	X	X
Diesel Service Fill GM-LL-B-025	X	X
MS		
10850	X	X
Porsche		
Special Oil List	X	X

- API SL (EC) – Obsolete
- ILSAC GF-3 – Obsolete
- VW 503.01 – Spec will become obsolete in 2009

(NOTE: VW 504.00 can be used to cover VW 503.01 applications)

Visual Comparison

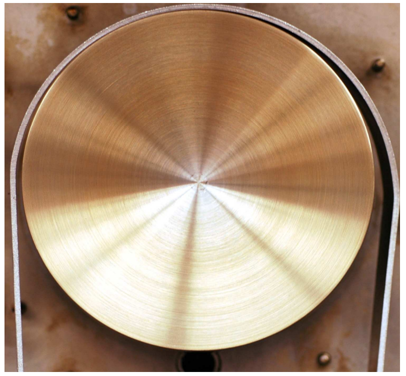
Mobil 1
New Life
0W-40



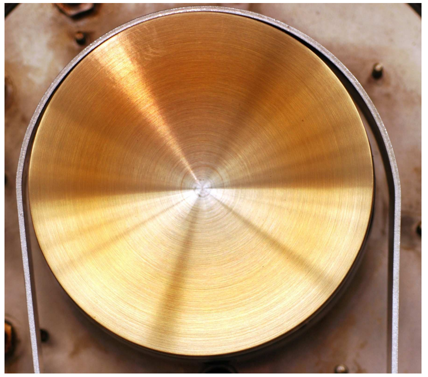
Current
Mobil 1 0W-40

Bench Test Comparison – Oxidation

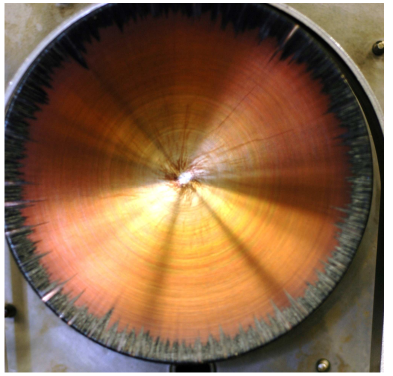
Thin Film Oxidation (TFO)



Current
Mobil 1 0W-40
Rating = 94 / 100

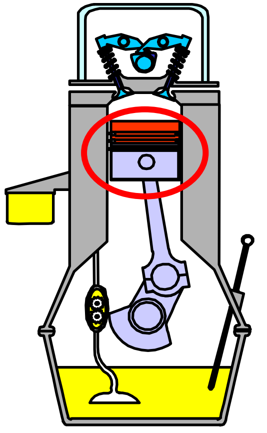


Future
Mobil 1 0W-40
Rating = 90 / 100



Esso Ultron
5W-40
Rating = 63 / 100

Relevant Part of Engine



pistons

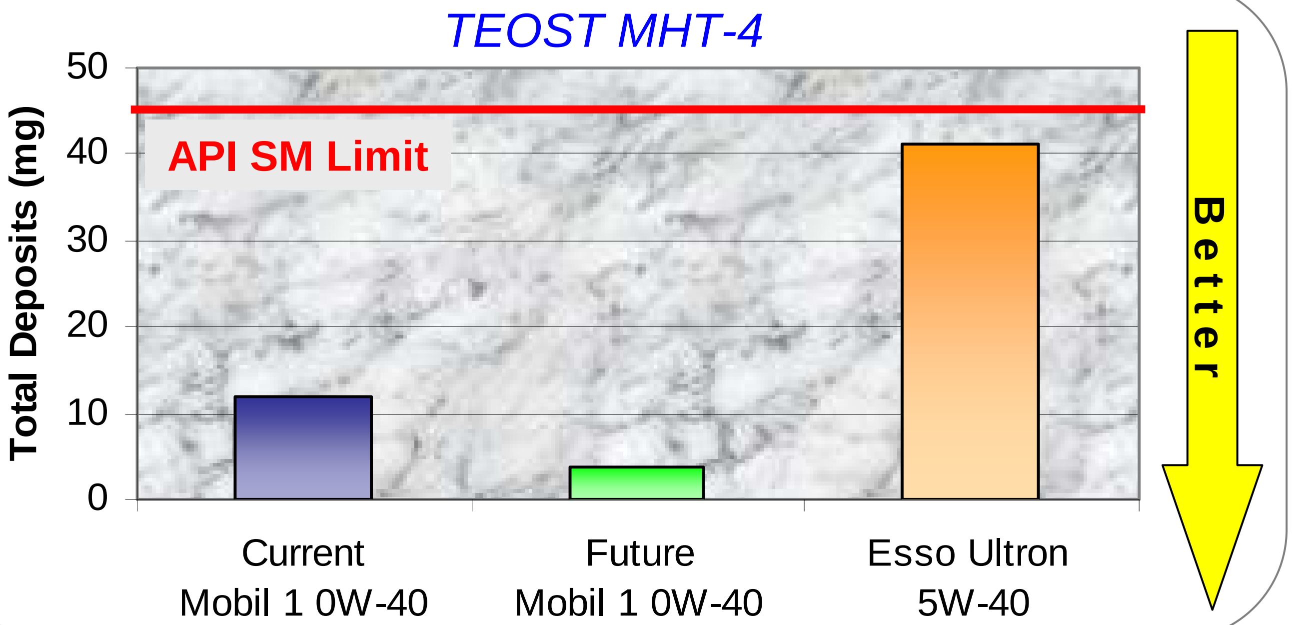
Test Description

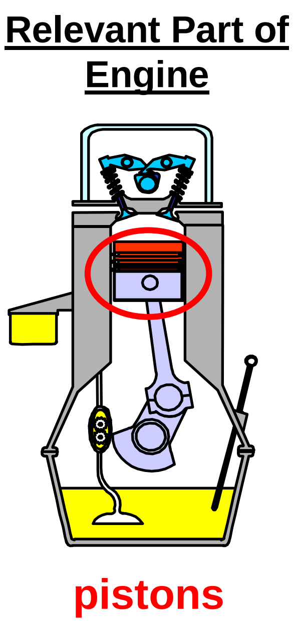
The test oil is heated to 285℃ and directed onto a rapidly spinning (2500rpm) aluminum disc which is heated to 330℃. The test duration is 3 hours. At the end of test the oil is assigned a cleanliness merit rating out of 100.

Consumer Relevance

The test simulates high temperature piston deposit formation. Oils of lower oxidative and thermal stability will result in greater deposit formation. As piston deposits increase, engine efficiency decreases.

Bench Test Comparison – Deposit Control





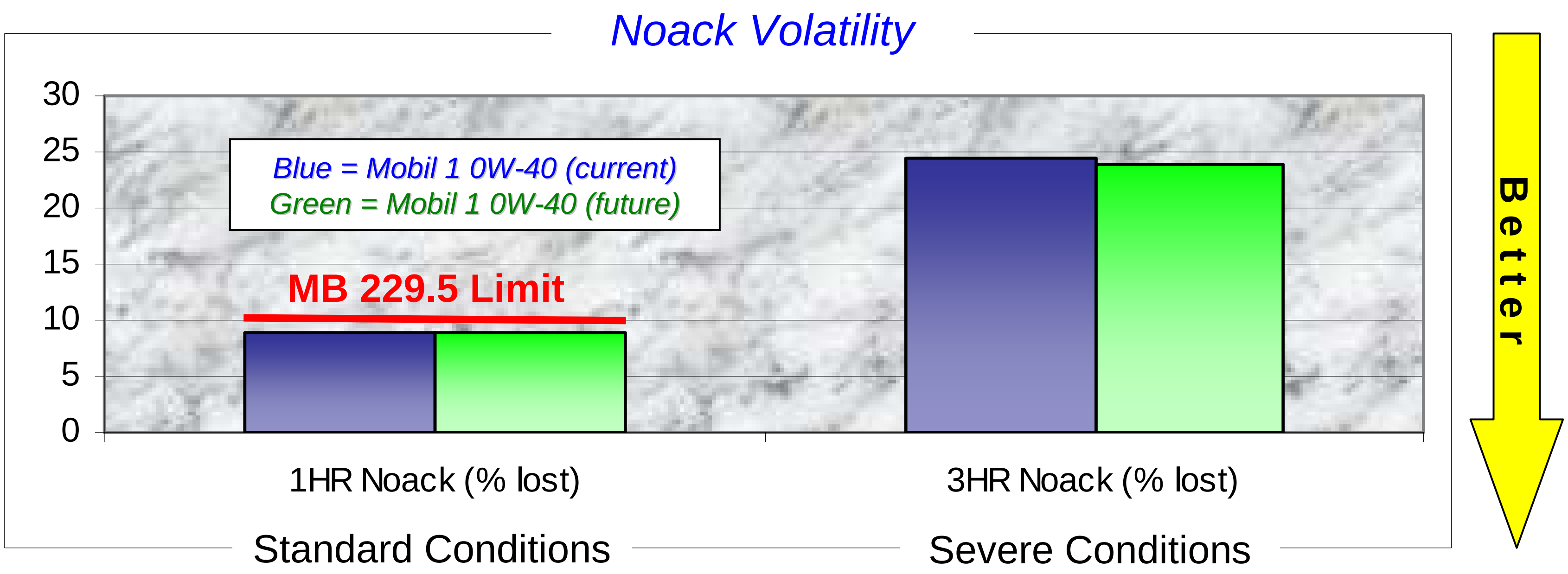
Test Description

The test oil is heated to 285℃ and slowly circulated through a metal spiral for a period of 24 hours. The weight of the deposits that accumulate on the metal rod are measured.

Consumer Relevance

The test simulates high temperature piston deposit formation. Oils of lower oxidative and thermal stability will result in greater deposit formation. As piston deposits increase, engine efficiency decreases.

Bench Test Comparison - Volatility



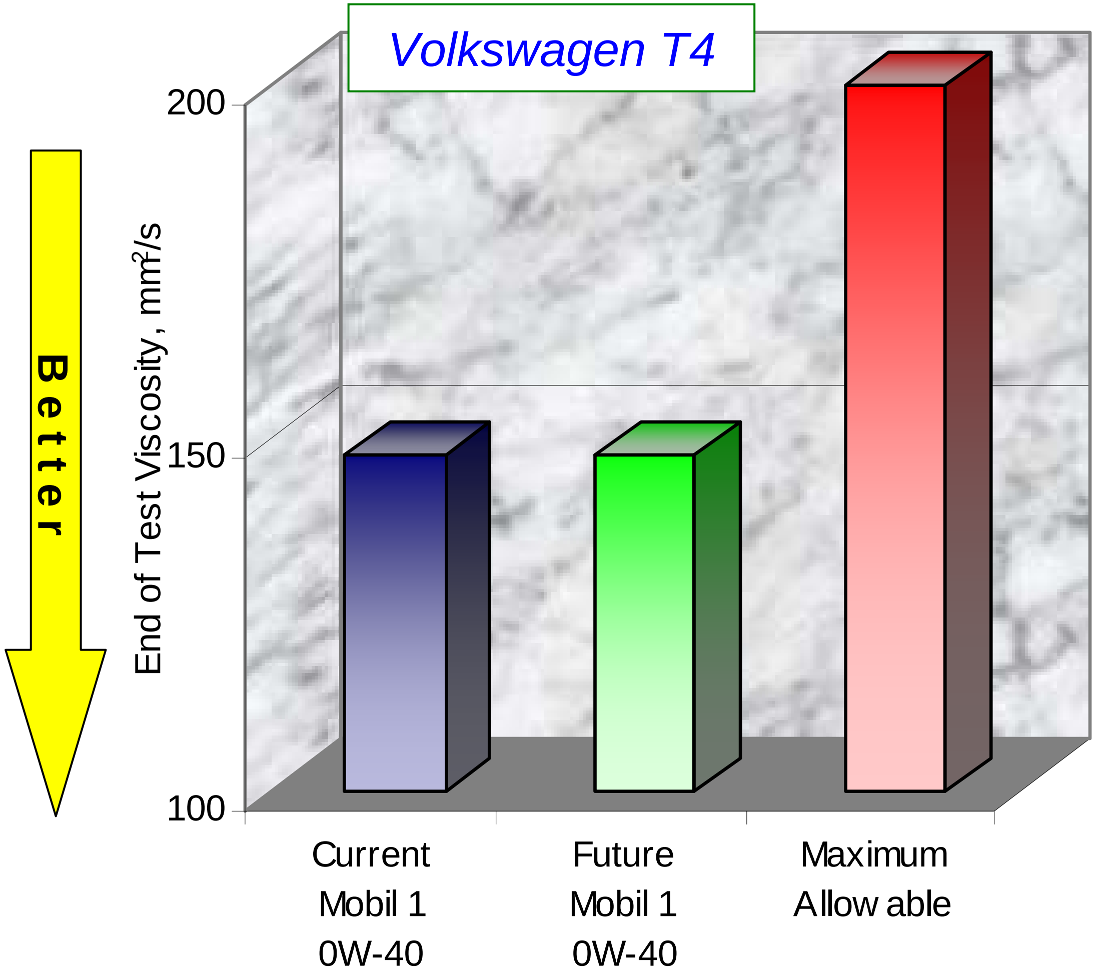
Test Description

The test oil is placed in an evaporation dish within a heating block, and the oil is held at a temperature of 250℃, and under reduced pressure, for 1 hour. The amount of volatilized oil is measured.

Consumer Relevance

The test simulates engine oil consumption as a result of oil burn-off. Oils with low volatility will result in a lower rate of oil consumption.

Engine Test Comparison – Viscosity Control



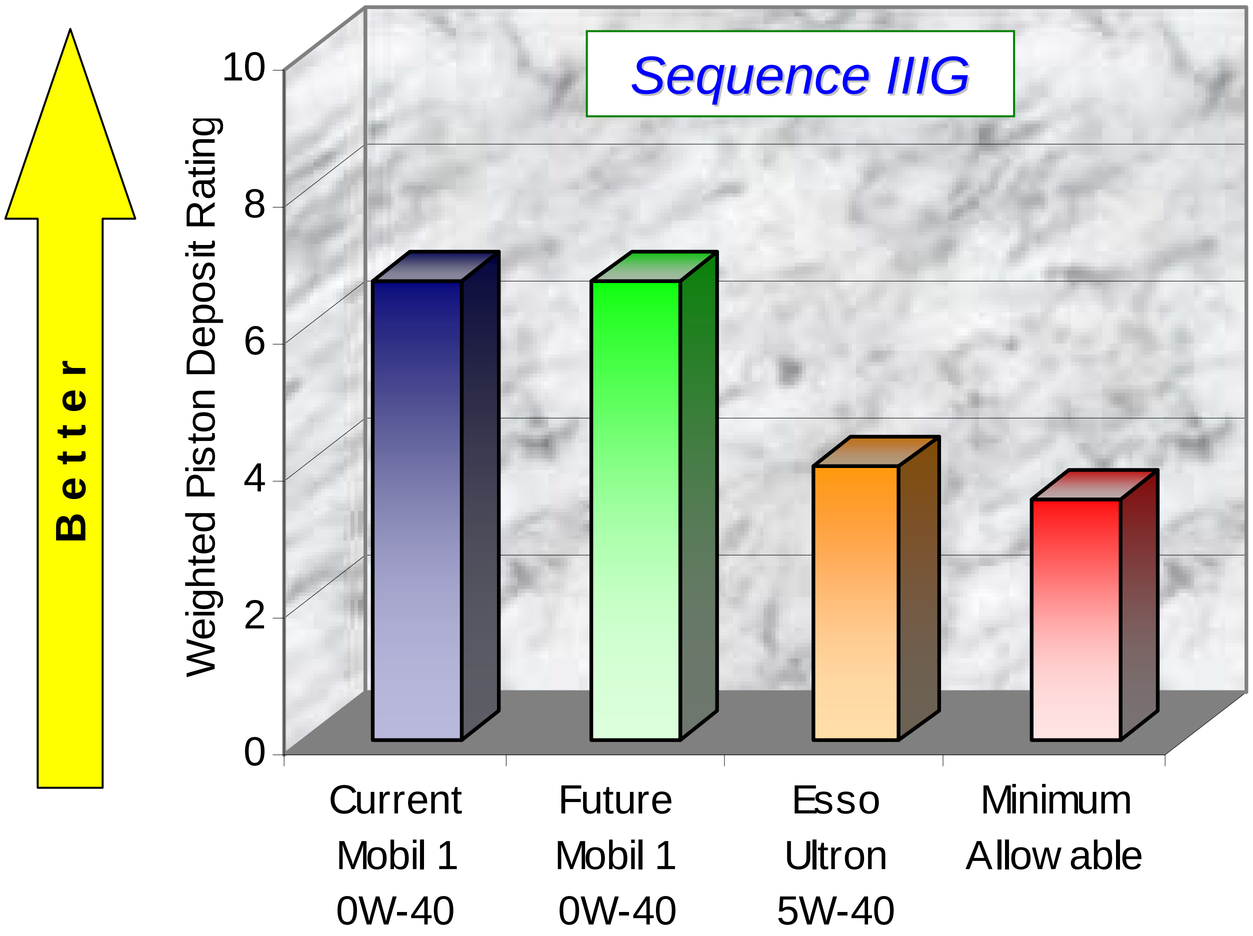
Test Description

Severe 248 hour test designed for gasoline engines following extended oil drain intervals. Oil temperature cycles in range of 40℃ – 133℃.

Consumer Relevance

The test simulates high temperature stop & go driving with extended oil drain interval and without oil top-up.

Engine Test Comparison - Cleanliness



Test Description

The Sequence IIIG test measures oil thickening and piston deposits during high temperature conditions. Oil temperature is 150℃ for 100 hours.

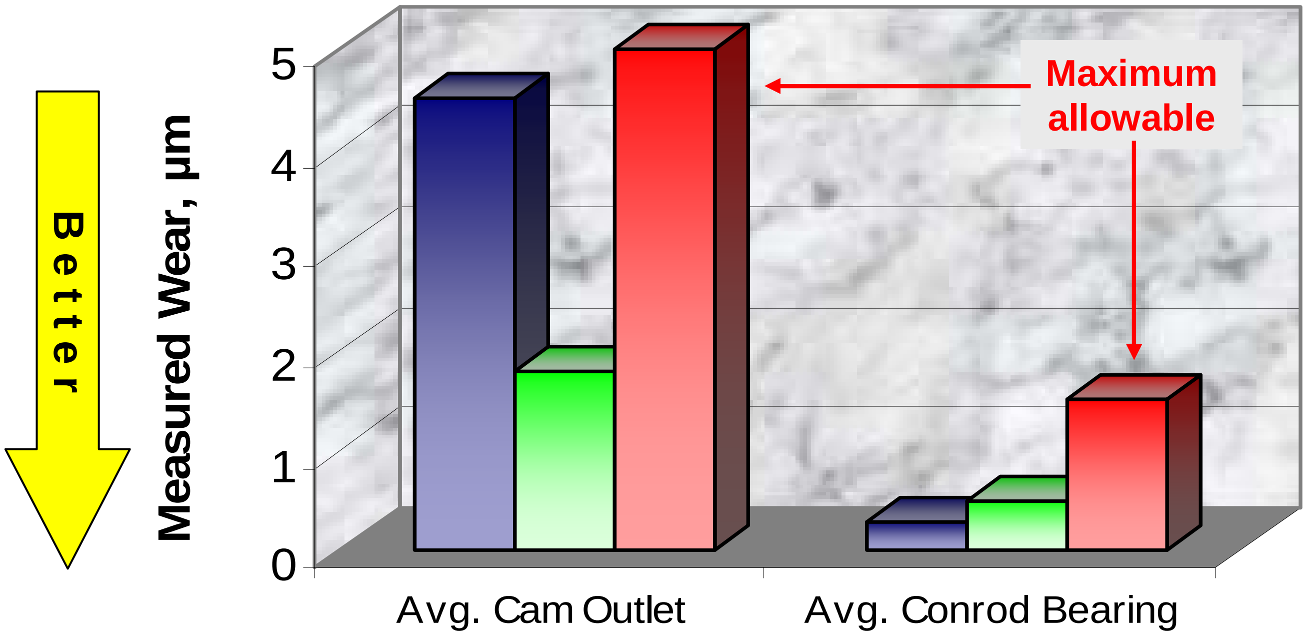
Consumer Relevance

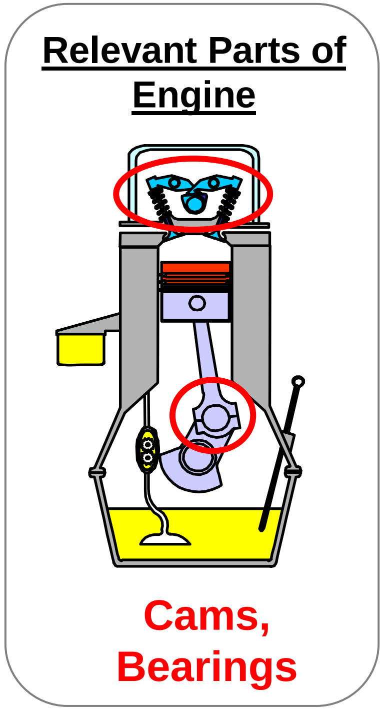
The test simulates high speed driving in very hot weather conditions.

Engine Test Comparison – Wear

M271 Wear

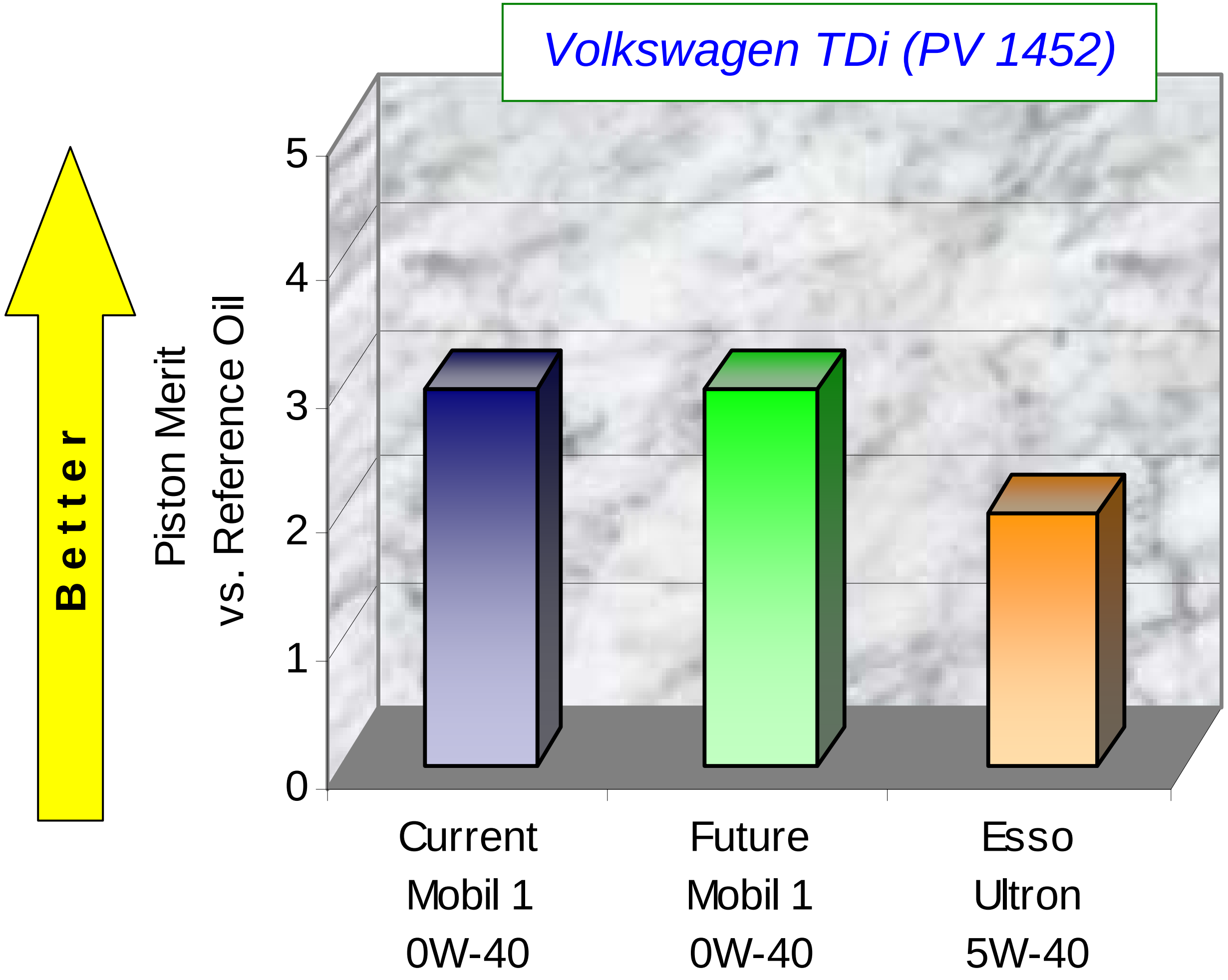
- *270-hr proprietary engine test designed by Mercedes-Benz*





Blue = Mobil 1 0W-40 (current)
Green = Mobil 1 0W-40 (future)

Engine Test Comparison – Diesel Performance



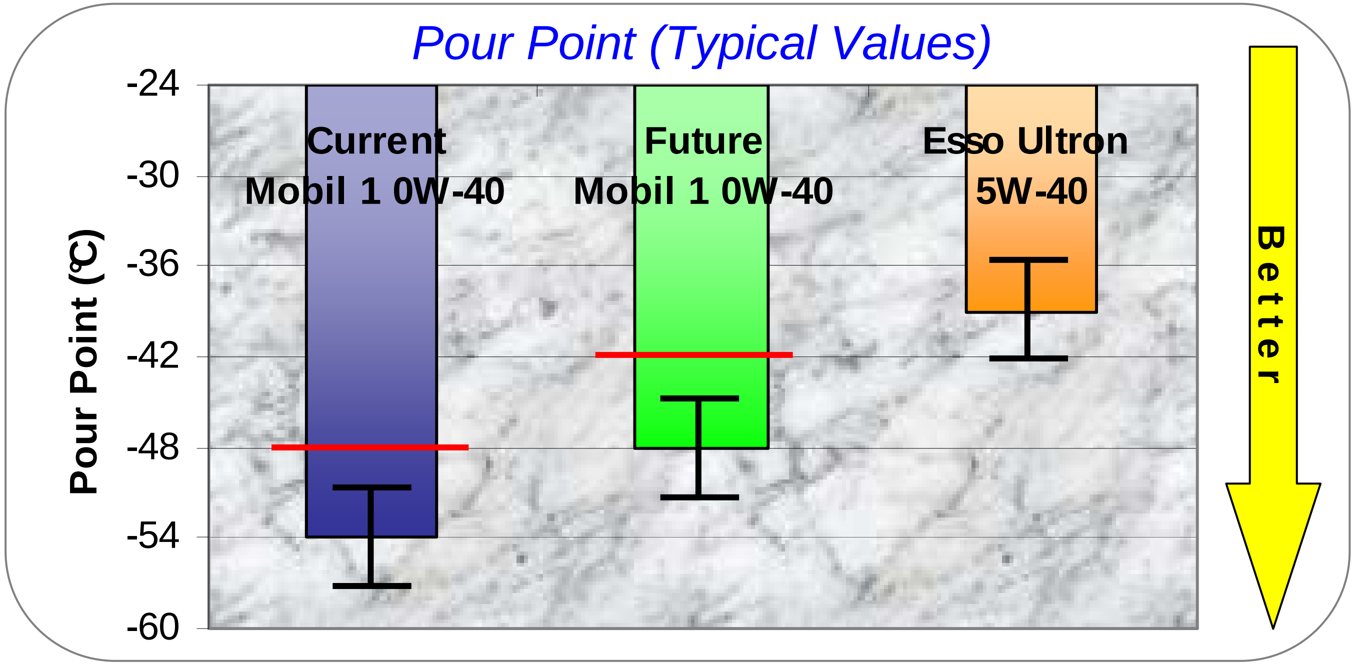
Test Description

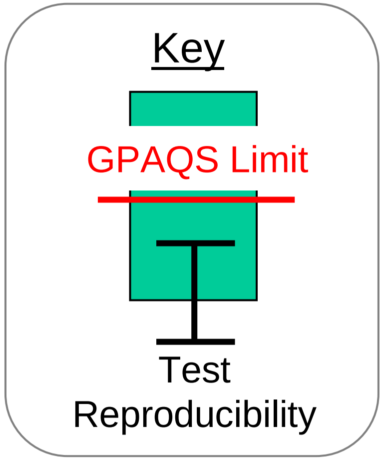
The VW TDi engine test uses a direct injection diesel engine. Duration is 54 hours. Bulk oil temperature reaches 145°C

Consumer Relevance

The test is designed to simulate high temperature stop and go driving, with emphasis on piston cleanliness and ring sticking.

Bench Test Comparison – Low Temperature





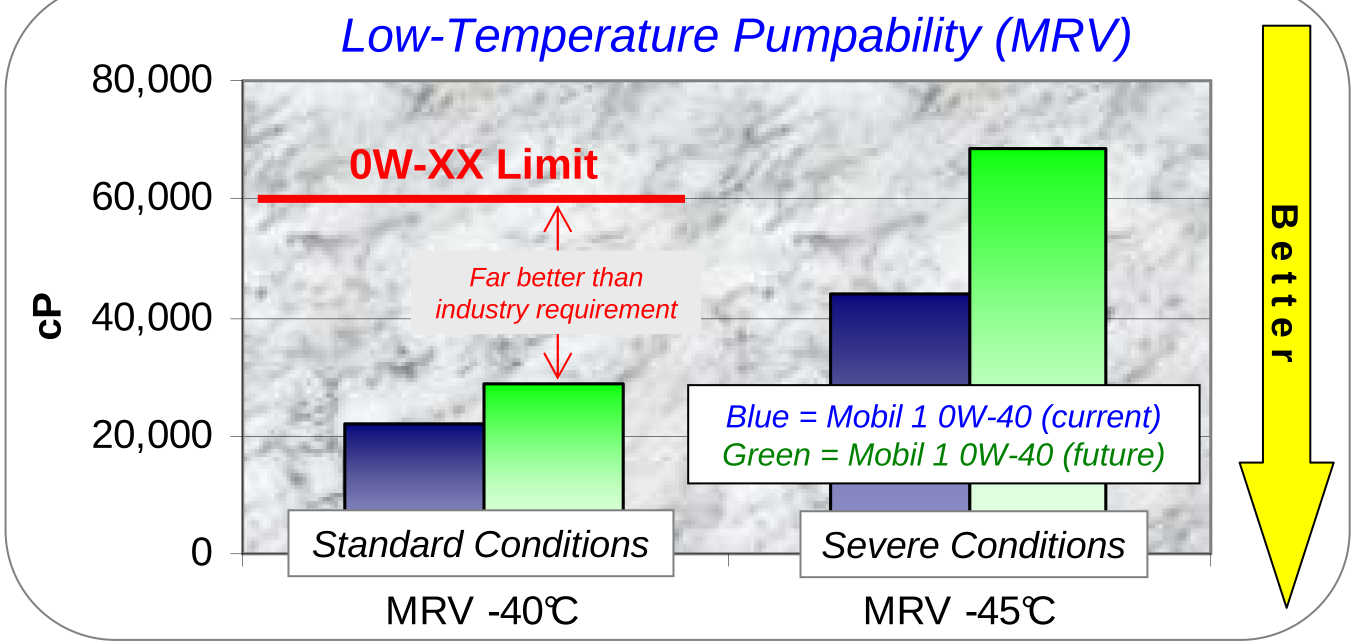
Test Description

The pour point test measures the ability of an oil to flow at very low temperatures. The oil is cooled relatively quickly in -3℃ increments and its ability to flow at successively lower temperatures is measured.

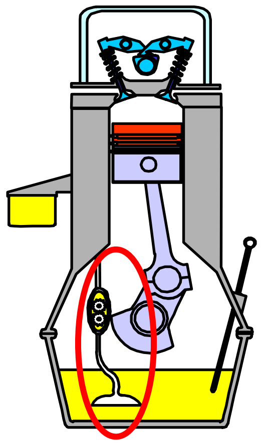
Consumer Relevance

The test is somewhat historical, dating back to 1917. From a technical perspective, attributes such as pumpability (MRV) and cold cranking viscosity (CCS) are considered more relevant to engine performance.

Bench Test Comparison – Low Temperature



Relevant Part of Engine



Test Description

In the MRV test (Mini Rotary Viscometer), the oil is gradually cooled to the test temperature overnight (-40℃). This slow cooling allows any wax to crystallize. The oil's resistance to flow is then evaluated.

Consumer Relevance

The test simulates low temperature pumpability (e.g. starting a car on a cold winter morning). If the oil cannot be pumped, then lubrication will be inadequate, resulting in engine damage.

Analytical Properties

- Very little difference in analytical properties between the two formulations

	Current 0W-40	Future 0W-40
ASTM Color	4	4.5
Kinematic Viscosity 100ºC, mm2/s	14.3	13.5
HTHS, cP	3.6	3.8
Phosphorus wt %	0.10	0.10
Molybdenum, ppm	90	90
Calcium, wt %	0.32	0.32
Boron, ppm	231	230
Nitrogen, ppm	1300	1300
Noack, % lost	9	9
Total Base Number, mgKOH/mg	11	11
CCS, cP @ -35ºC	5600	5700
Pour Point, ºC	-54	-48
MRV, mPa*s @ -40ºC	22000	29000
Sulfated ash, % m/m	1.2	1.2
Kinematic Viscosity 40ºC, mm2/s	77	75
Density, g/ml	0.85	0.85
Viscosity Index	194	185