

Introducing the **NEW** Aisin-Warner 6-Speed



by Bill Brayton

Ford has a new front wheel drive: the AWF-21. It's a real gas saving 6-speed transmission. With gas prices climbing astronomically around the country, that's an important consideration.

In this edition of *Fun with Transmissions*, we'll be looking at the AWF-21. This transmission is built in Japan by Aisin-Warner for Ford Motor Company (figure 1A, 1B). Ford uses the AWF-21 in the Montego, Fusion, Freestyle, Five Hundred, Zephyr and Milan. It's also used, in different configurations, by Volkswagen (09G), Mini Cooper (Aisin TF-60SN) Mazda (AW6A-EL) and Volvo (TF-80SC).

To get six speeds, this transmission uses the Lepelletier geartrain. The Lepelletier geartrain can be identified by the stationary sun gear in the input planetary gearset (figure 2). Because the front planetary gearset is always rotating around the stationary sun gear, this type of transmission never achieves a 1:1 gear ratio (figure 3). This is the same geartrain used in Ford's 6R60 rear wheel drive transmission.



Figure 1A

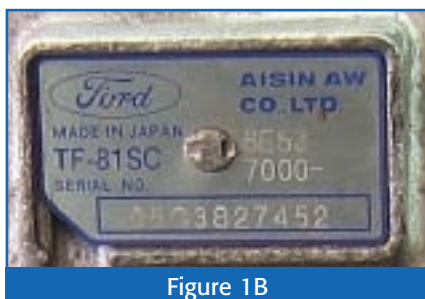


Figure 1B

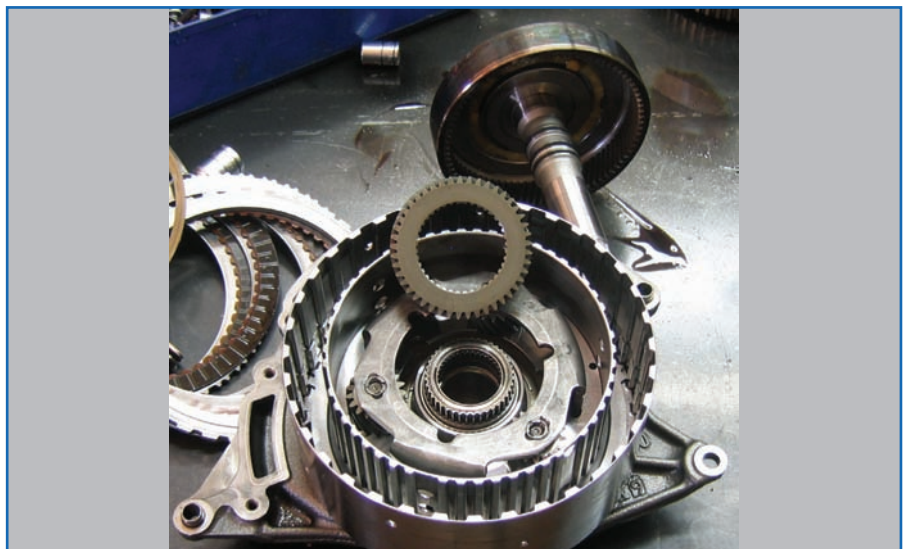


Figure 2

Gear	Ratio
1st	4.148 to 1
2nd	2.370 to 1
3rd	1.556 to 1
4th	1.155 to 1
5th	0.859 to 1
6th	0.686 to 1
Reverse	3.394 to 1
Final Drive	3.46 to 1

Figure 3

Clutch and Band Application Chart						
	C1	C2	C3	B1	B2	F1
Reverse			X		X	
1st	X					X
2nd	X			X		
3rd	X		X			
4th	X	X				
5th		X	X			
6th		X		X		

Figure 4

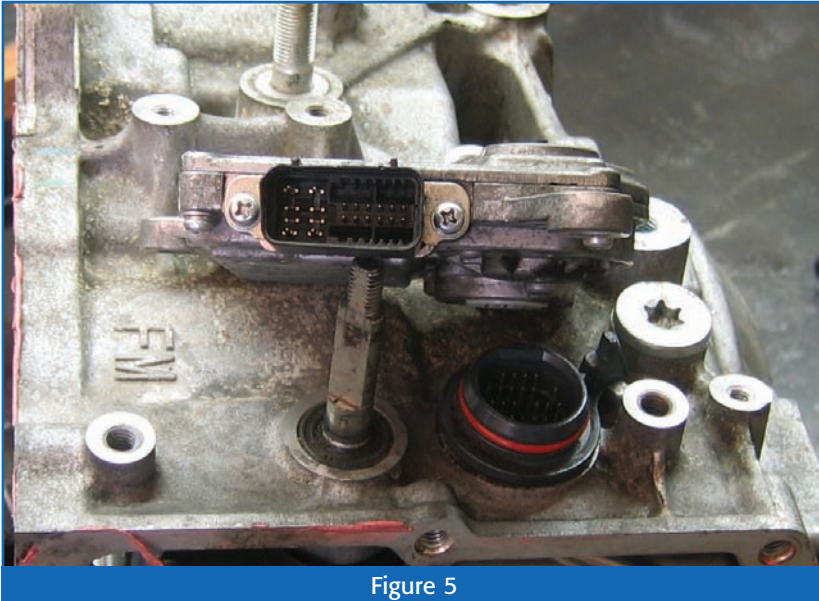


Figure 5

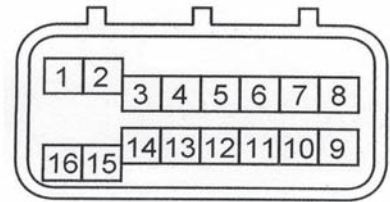
The look of the clutch and band application chart is also a departure for Ford. In the past, Ford has used terms such as *forward clutch* and *intermediate band*. The AWF-21 moves away from

those old Ford names, identifying these clutches as C1, C2 and C3.

As with all Aisin-manufactured transmissions, any band or clutch pack that locks a spinning component to the case, such as a planetary gearset, is called a *brake* (B). The AWF-21 has two brakes: The B1 brake is a band which applies in 2nd and 6th gears. The B2 brake is a clutch pack splined to the case.

The B2 clutch applies in reverse and provides engine braking in manual low (figure 4).

The transmission control module (TCM) is easy to find on this transmission. It looks like a manual



Pin Number	Circuit Function
1	Battery Feed
2	Not Used
3	Not Used
4	Not Used
5	Start Lock Signal Out
6	CAN -
7	Not Used
8	Not Used
9	TCU Ground
10	Not Used
11	Ignition Switch Signal Input
12	Not Used
13	Not Used
14	CAN +
15	Not Used
16	Not Used

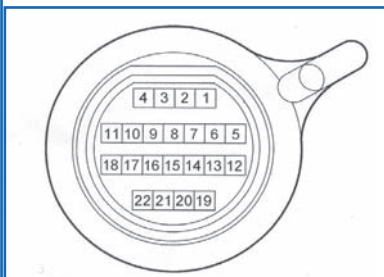
Figure 6

lever position switch (MLPS), but it's actually the transmission controller. The vehicle's harness plugs into the connector and the TCM plugs into the transmission (figure 5).

You'll need an up-to-date scan tool with CAN BUS capability to diagnose this unit. There are only a few wires on the case connector (figure 6). You can remove the TCM and check solenoid, speed sensor and transmission temperature sensor circuits' continuity when needed (figure 7). The TCM should be reprogrammed with the latest calibrations from the factory web site — www.motorcraftservice.com — during every rebuild.

Pin Number	Circuit Function	Specification
1	PCA Ground	>0.1V
2	SSB	11.15V
3	PCA Signal	5-5.6V
4	TCC Ground	>0.1V
5	SSA	11.15V
6	Not Used	N/A
7	TFT Ground	>0.1V
8	TFT Signal	Varies
9	TCC Signal	5-5.6V
10	SSC Ground	>0.1V
11	SCC Signal	5-5.6V
12	TSS Sensor Signal	AC Volts
13	TSS Signal Ground	AC Volts
14	SSE Signal	5-5.6V
15	Not Used	N/A
16	SSF Ground	>0.1V
17	SSD Signal	5-5.6V
18	SSD Ground	>0.1V
19	OSS Signal	AC Volts
20	OSS Ground	AC Volts
21	SSF Signal	5-5.6V
22	SSE Ground	>0.1V

Figure 7



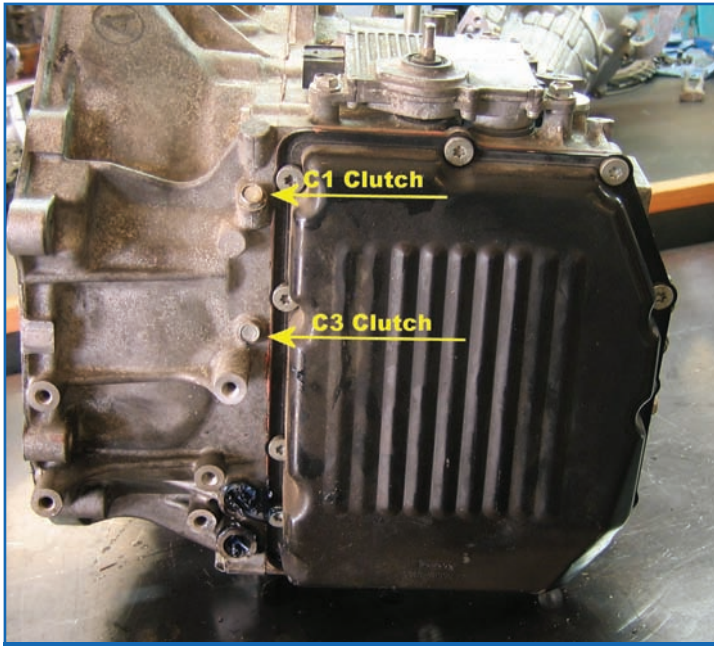


Figure 8

Most Ford-produced transmissions only have a tap for checking line pressure, and maybe a tap for EPC pressure. Because the AWF-21 is an Aisin transmission, this unit has several taps for checking clutch apply pressures (figures 8 and 9). Keep in mind these are minimum and maximum pressure specifications. This will make it easier to diagnose shift problems (figure 10).

Valve Body

The AWF-21 has a complicated valve body. It has lots of little parts that are going to get lost if you aren't extremely careful. The pictures included here are the first to be published. Ford Motor Company hasn't produced pictures of this valve body, and hasn't named the valves at the time of this writing (figures 11-17).

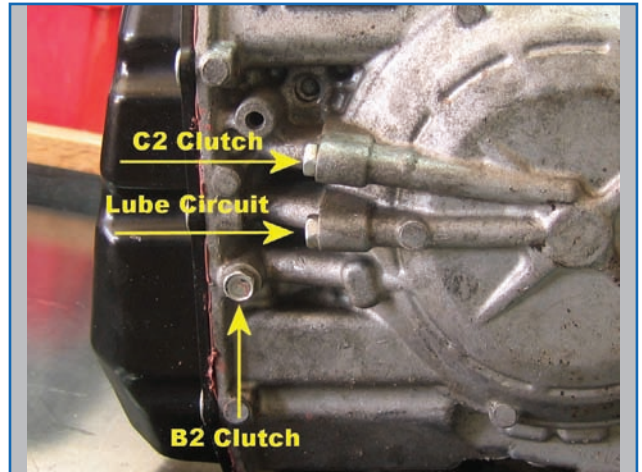


Figure 9

Clutch	Range	Pressure
C1	Drive (1st-4th)	28-199 psi.
C2	Drive (4th-6th)	28-199 psi.
C3	Drive (3rd-5th)	28-199 psi.
C3	Reverse	57-270 psi.
B2	Low/M1	85-199 psi.
B2	Reverse	57-270 psi.

Figure 10

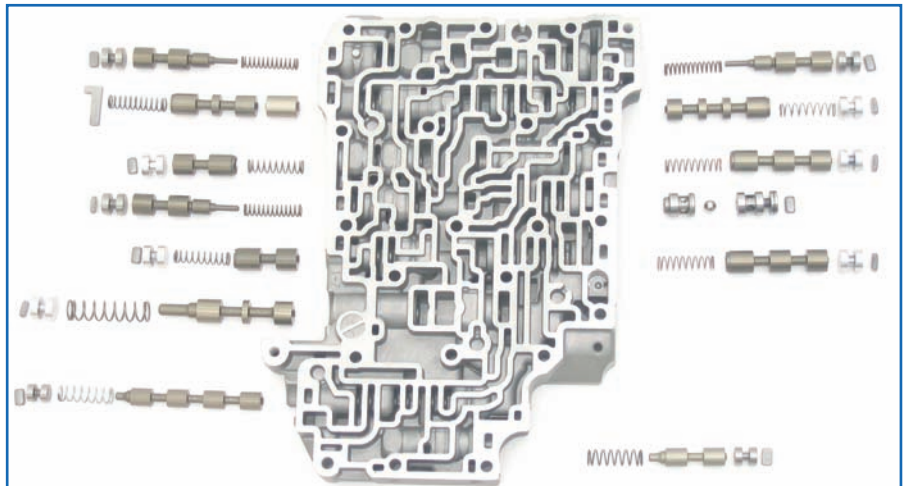


Figure 11

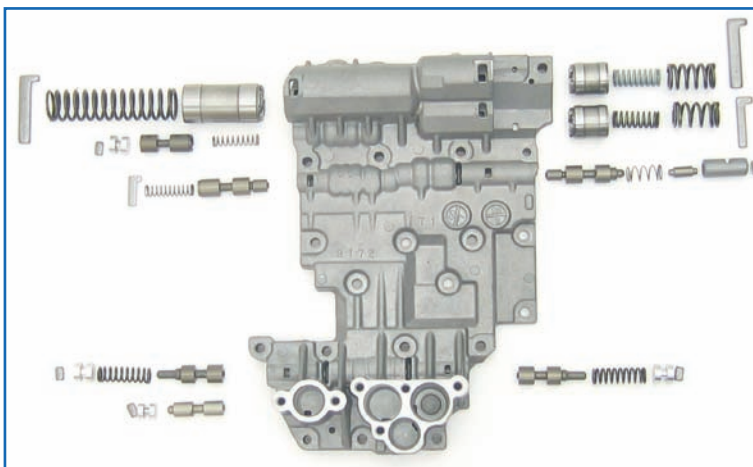


Figure 12

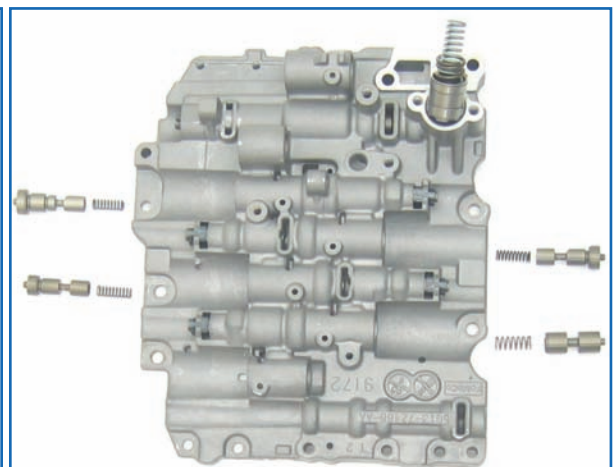


Figure 13

Registration Form

October 30th - November 2nd, 2008 • Las Vegas, Nevada



Register online and Save \$10 per person for Complete Conference Registrants

Company Name _____		ATRA Account Number _____	
Contact Person: (will receive all correspondence) _____			
Address _____			
City _____	State _____	Zip _____	
Country _____			
Area Code Phone No. () -		Fax No. () -	
Email Address _____			

TO REGISTER: Call toll free 1-800-428-8489 or FAX this completed form to 805-988-6761

*Badges will be issued from this list. Use a separate sheet for additional registrations. **

PLEASE PRINT CLEARLY

NAME _____

NAME _____

NAME _____

NAME _____

NAME _____

CONFERENCES*
(Include Luncheon and Trade Show)

OTHER CATEGORIES

Complete Conference	Technical	Management	Trade Show	Luncheon	Golf
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Discount for current ATRA Members only. Join today and enjoy the member discount right away!

REGISTRATION FEES	Qty	Before Sept. 19 th		Sept. 19 th - Oct. 17 th		ALL ON-SITE	SUBTOTAL
		Member	Non Mem	Member	Non Mem		
Complete Conference Registrant*	_____	\$ 295	\$ 395	\$ 345	\$ 445	\$ 495	\$ _____
Technical or Management Conference*	_____	245	345	295	395	445	\$ _____
Trade Show	_____	10	20	15	25	25	\$ _____
Luncheon (Friday, October 31 st)	_____	45	45	55	55	55	\$ _____
Golf Tournament (Thursday, October 30 th)	_____	99	99	125	125	125	\$ _____
Certification Testing (Sunday, November 2 nd)	_____	0	50	0	50	50	\$ _____
TOTAL							\$ _____

***Conference Registrants may receive Trade Show Passes for spouse and/or children by contacting ATRA Registration at 1-800-428-8489.**

PAYMENT INFORMATION

Check enclosed payable and mail to: ATRA, 2400 Latigo Avenue, Oxnard, CA 93030

Check # _____

Charge to: MasterCard Visa AMEX Discover

Card Number _____

Expiration Date _____

Print Name on Card _____

Signature _____

Tear along dotted line and return to ATRA with payment

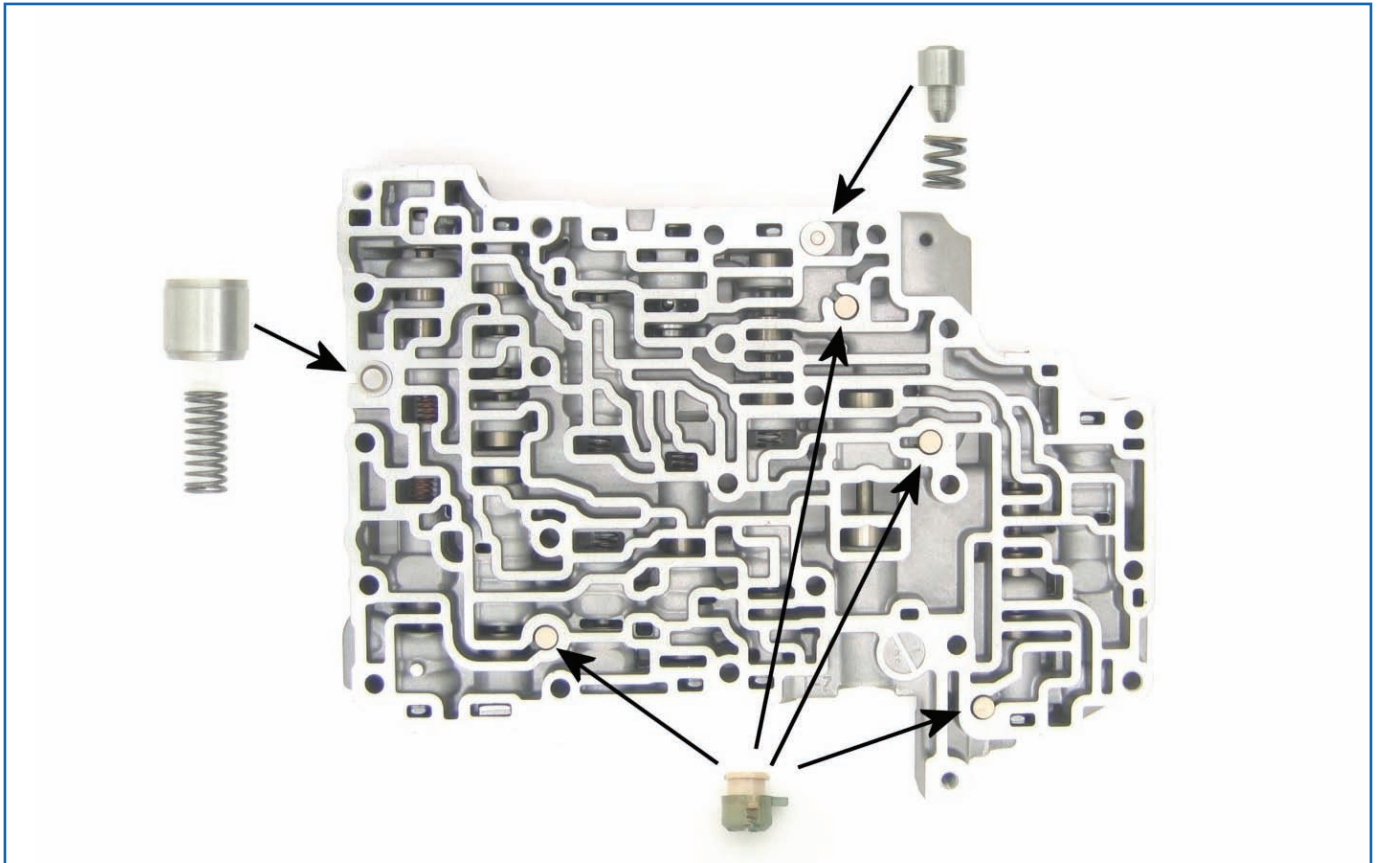


Figure 14

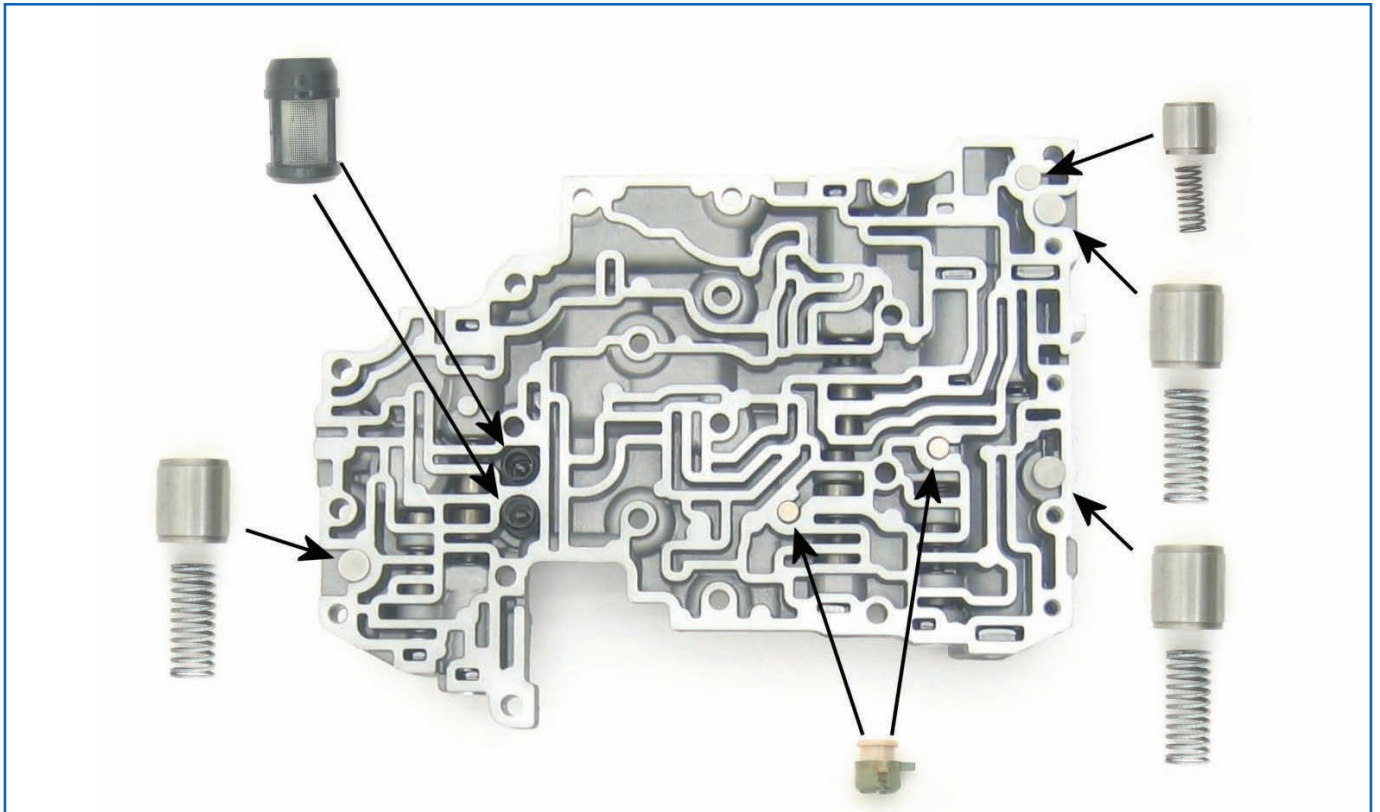


Figure 15

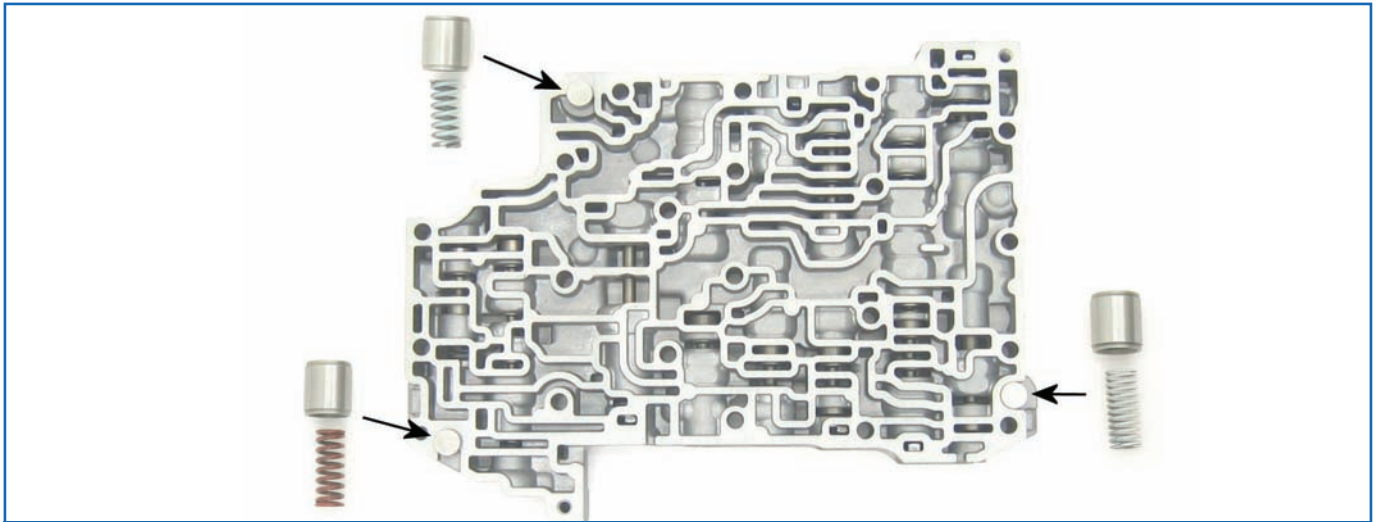


Figure 16

When you remove the bracket for the speed sensors during the valve body R&R, it exposes a pin that retains a solenoid to the valve body (figure 18). Be very careful turning the valve body over: This pin will surely drop out and get lost! If that happens, the measurements for all solenoid retaining pins are 0.118" x 0.932".

There are no checkballs in this unit; instead, it uses relief valves that do the same thing as checkballs (figure 19).

Ford is using the AWF-21 in six late-model vehicles, in part due to its gas mileage benefits. And as the price at the pump continues to climb, look for the Aisin-Warner six-speed to become a very popular transmission in all its variations over the coming years.

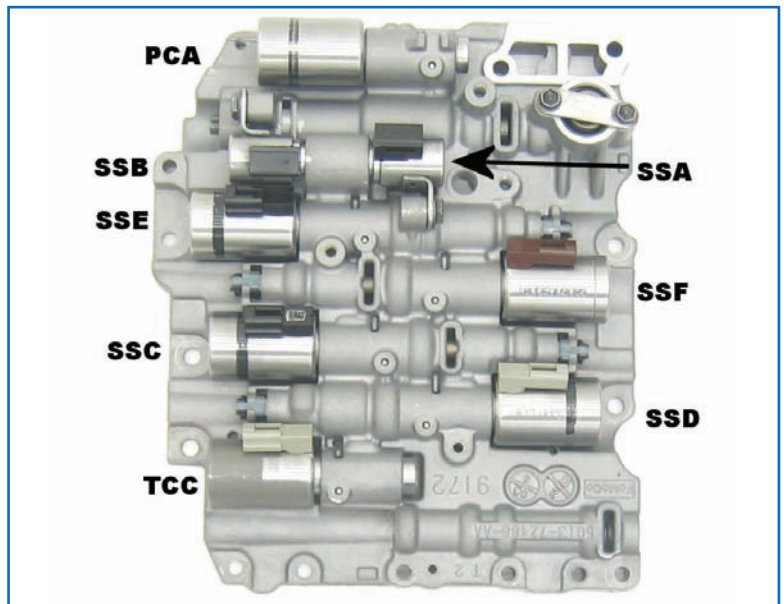


Figure 17

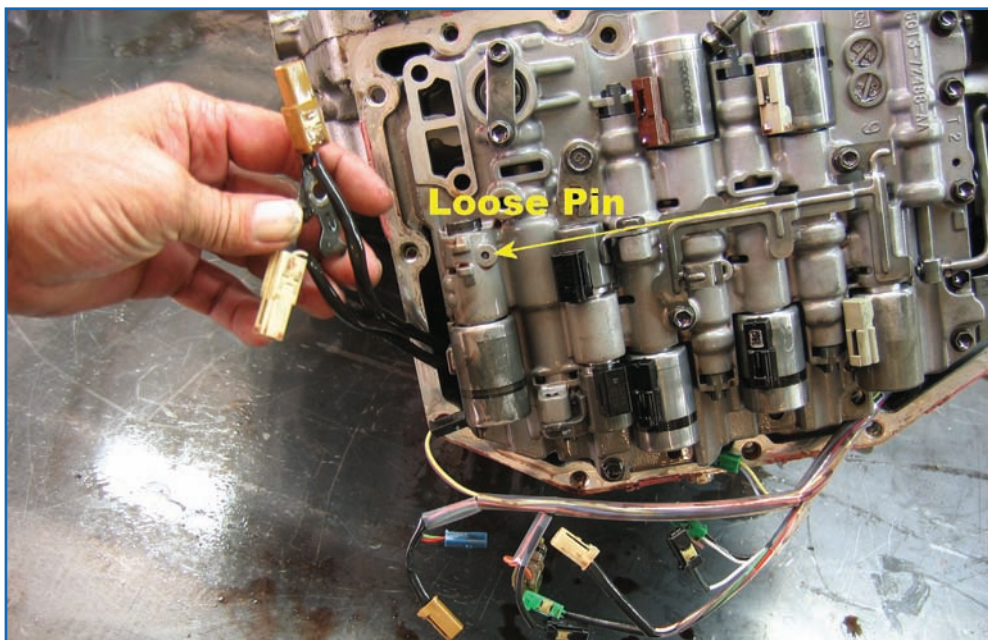


Figure 18

When you remove the bracket for the speed sensors during the valve body R&R, it exposes a pin that retains a solenoid to the valve body.



Figure 19