TRANSMISSION SEMINAR 1992

INDEX

Automatic Transmission Service Group
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TRANSMISSION SEMINAR
1992

In this years seminar we will give you a look at the Saturn Automatic Transaxle, the new Ford AOD-E, and the Eagle Premier ZF4HP-18 transmission. The video and slide format brings you the latest updates - along with problems that arise in Honda, BMW, Mitsubishi units. The material in this manual has been keyed to visual format of this years seminar. Introduction and similarities between the AOD-E & AOD, the AXOD-E & AXOD. And the latest checks and fixes on the E40D. We have also listed many of the OEM part numbers for late model fixes.

The information and part numbers contained in this booklet have been carefully compiled from industry sources known for their reliability, but ATSG does not guarantee its accuracy.

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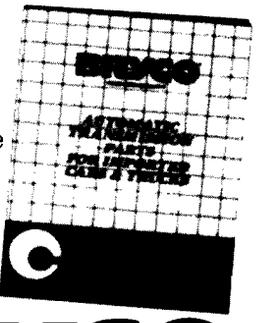

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SATURN TAAT

GENERAL DESCRIPTION

DESCRIPTION

The general design of the *SATURN* automatic transaxle is a parallel shaft arrangement where the entire transaxle is located in line and directly behind the engine. This arrangement is basically the same as most front wheel drive manual transaxles. The transaxle provides four speeds forward and one reverse.

The transaxle is a fully automatic unit consisting of four multiple disc clutches, a four element torque converter with a lock up clutch, 1st gear sprag clutch, and a servo actuated dog clutch.

The most significant departure from the traditional automatic transaxle comes from the use of electronic controls. This unit utilizes five electrohydraulic actuators in conjunction with a powertrain control module (PCM) and its sensors to control shift timing, shift feel, and provide on–board diagnostics.

TRANSAXLE SHIFTS

Transaxle shifts are controlled by the manual valve and the PCM through the hydraulic actuators.

The manual valve controls oil direction to provide 1st gear. When the transaxle has been shifted into D4 or D3, the 1st clutch is applied and the 1st sprag locks the 1st driven gear to the output shaft. The output shaft is driven counterclockwise by the 1st driven gear, causing the differential to turn clockwise in the forward direction. At the same time, 1st oil pressure is directed to the Forward/Reverse servo to assure the dog clutch is moved, locking 2nd driven gear to the output shaft.

At a predetermined point, based on vehicle speed, throttle position, and temperature, an upshift to 2nd will occur when the PCM opens the circuit to the 2nd/Reverse actuator. When the circuit is opened, the actuator is turned off electrically and turned on hydraulically, flowing oil to apply the 2nd/Reverse clutch. As the clutch applies, the ratio change causes the 1st gear sprag to overrun or freewheel and the shift to 2nd is complete.

When the transaxle shifts to 3rd, the 3rd actuator is turned off applying oil pressure to the 3rd clutch. The 2nd/Reverse actuator is then turned on, exhausting the 2nd/Reverse clutch as the 3rd clutch is applied. The 3rd to 4th shift is accomplished in the same manner.

The torque converter clutch (TCC) is applied in 2nd, 3rd, and 4th gears. The initial application takes place after the 1–2 shift. The speed at which the TCC will apply in 2nd is based on vehicle speed and tailored by throttle position, engine temperature, and transaxle temperature. Once applied, the TCC will stay applied until vehicle speed is low enough in 2nd gear for the TCC to release. The TCC will also release when the brake pedal is depressed in 2nd gear at low engine speeds or when the transaxle downshifts into 1st gear.

Reverse is controlled by the manual valve. When reverse is selected, the manual valve directs oil to the Forward/Reverse servo. The servo moves the Forward/Reverse dog clutch to the reverse position, releasing the 2nd driven gear and locking the reverse driven gear to the output shaft. As the dog clutch is engaged, the servo allows oil flow to the 2nd/Reverse actuator. The 2nd/Reverse actuator is turned off allowing the clutch to engage driving the 2nd/Reverse gear. The 2nd/Reverse gear turns the reverse idler gear driving the reverse driven gear clockwise, which in turn, provides reverse.

ACTUATOR OPERATION

The transaxle control actuators are electrohydraulic solenoid valves consisting of a housing, valvebody, sliding armature and electromagnetic coil. They are a three port design with a pressure supply port, a pressure outlet or control pressure port, and an exhaust port.

The actuators have normally open valves. When no voltage is applied to the terminals, a return spring holds the valve open and the actuator will allow oil to flow from the supply port to the outlet pressure port. When current flows through the coil, the magnetic field is energized pulling the sliding armature against the return spring. When the armature is in this position, the valve is closed, the pressure supply port is blocked, and the control port is connected to the exhaust port.

The actuators are located in the transaxle valvebody. An actuator may be completely energized (closed), de–energized (open), or pulse width modulated (PWM). When it is being modulated, the valve opens and closes up to 70 times per second. This allows a percentage of the oil pressure available at the supply port to pass to the control port. The actual percentage is determined by an electrically controlled duty cycle from the PCM. This is the ratio of the length of time the valve remains open (pulse width) to the total length of time of each cycle (one on and off cycle).

SATURN TAAT

		ACTUATOR / SOLENOID				
		2nd / Rev	Third	Fourth	TCC	Line
GEAR	1st	ON	ON	ON	OFF	PRESSURE OUTPUT CONTROLLED BY PCM ALL RANGES
	2nd	OFF	ON	ON	ON*	
	3rd	ON	OFF	ON	ON*	
	4th	ON	ON	OFF	ON*	
	REVERSE	OFF	ON	ON	OFF	

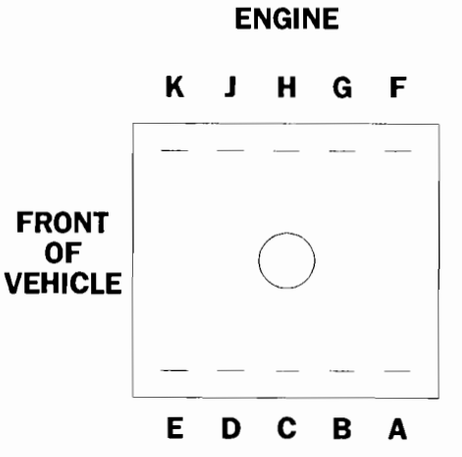
** - Dependant upon P.C.M. Inputs*

All gear Actuators/Solenoids are turned off electrically to provide clutch apply.

The TCC Actuator/Solenoid works opposite of the gear actuators. When the Actuator/Solenoid is turned off the TCC is turned off.

NORMALLY OPEN ACTUATORS/SOLENOIDS

ACTUATOR/SOLENOID RESISTANCE CHART	
DEGREES F.	RESISTANCE
-40	2.2 OHMS
20	3 OHMS
50	3.5 OHMS
90	4 OHMS
110	4.5 OHMS
160	5 OHMS
200	5.5 OHMS



2nd - J and H
3rd - A and B
4th - C and D
TCC - E and K
LINE - F and G

SATURN TAAT

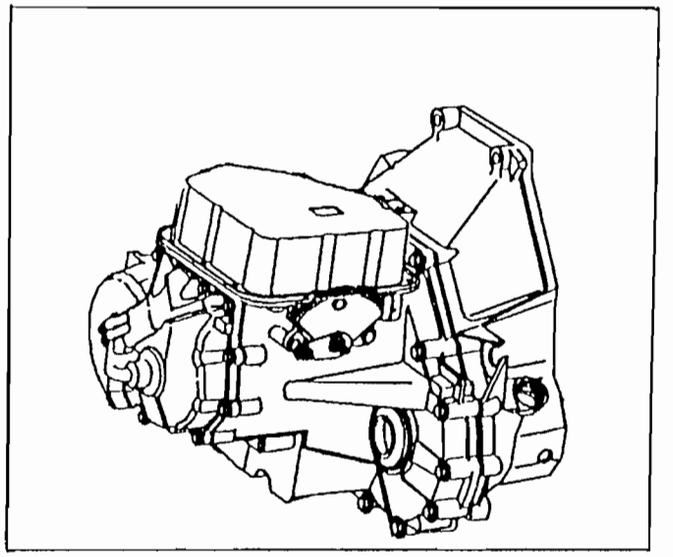
The Saturn Automatic Transaxle has the pan on top.

The solenoid connector is also on top.

The end cover resembles the Honda or Acura.

There is no modulator or throttle cable.

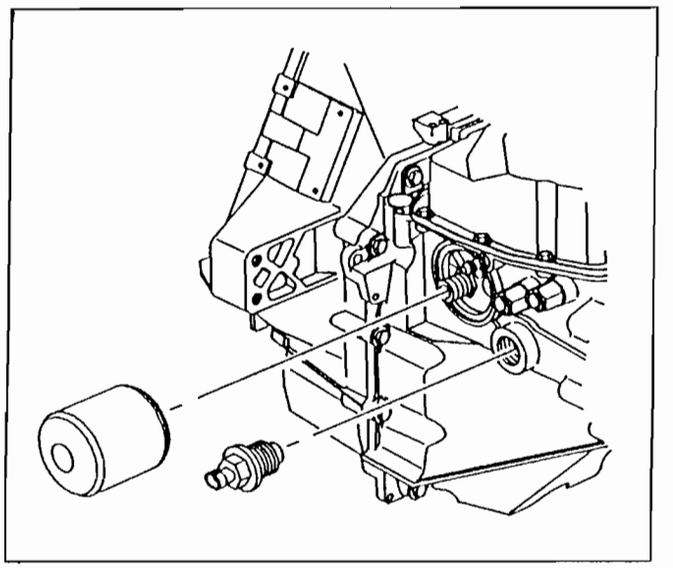
The gear selector switch is on the rear.



The spin on external oil filter looks like an engine oil filter.

The turbine speed sensor (TSS) is the same as the output speed sensor.

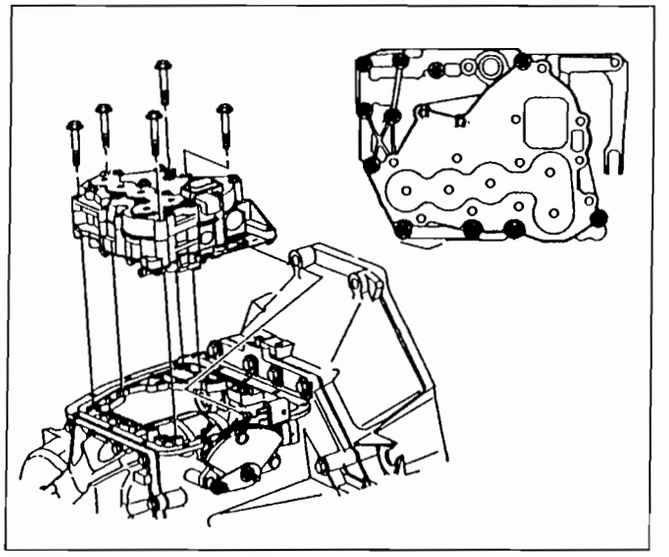
The speed sensor resistance should be approximately 820 ohms.



SATURN TAAT

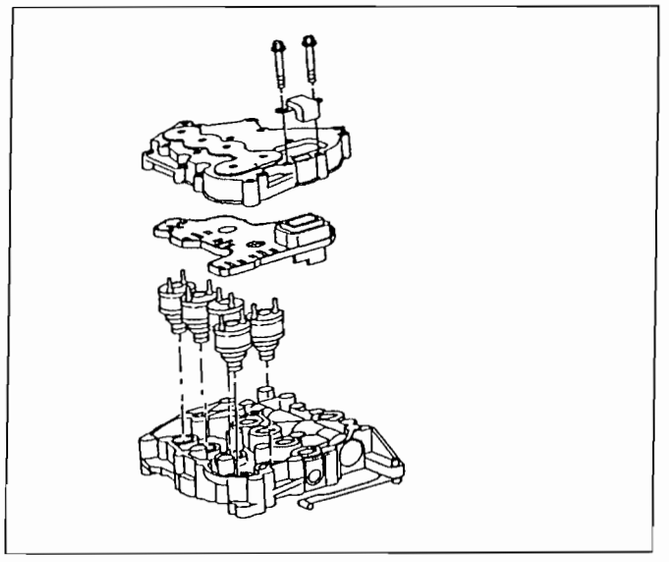
The top pan must be removed to service the valve body and the solenolds.

The valve body and the solenoids are removed as one assembly by removlng just the bolts that are shown darkened.



There are five solenolds in the Saturn valve body. They are all the same even though they are different.

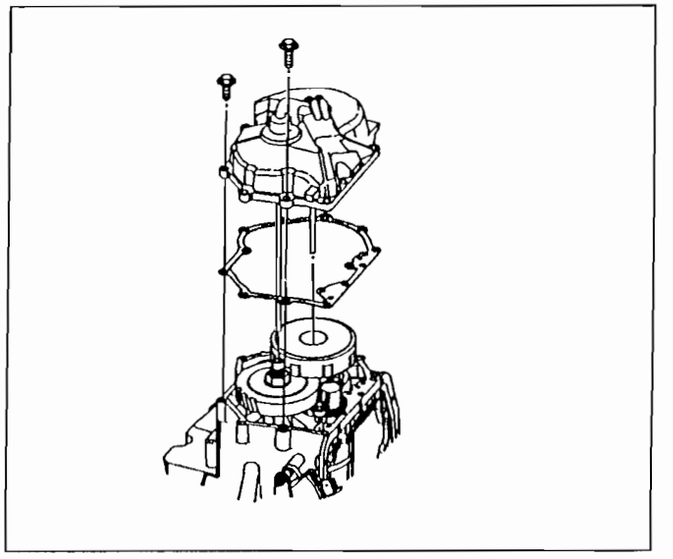
After the valve body has been removed from the trans, then the cover can be removed and the solenoids taken out if necessary.



The Saturn end cover has feed tubes similar to those found in a Honda.

The first clutch Is also accessible by removlng the end cover.

The Saturn uses single sided clutches like those found in the 440T4 third clutch.

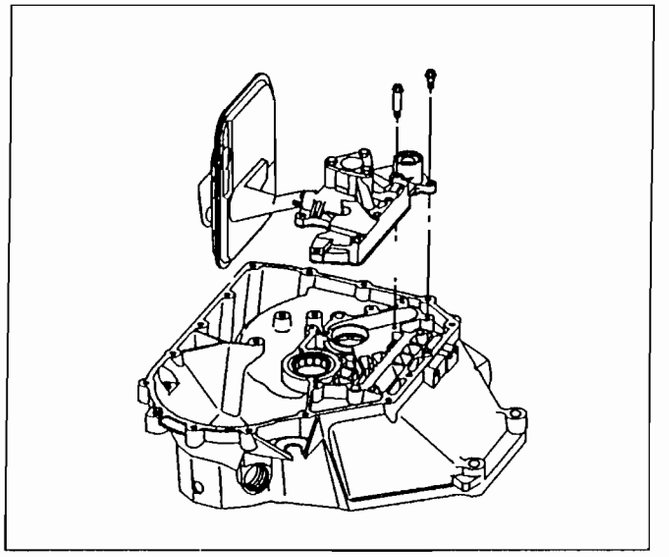


SATURN TAAT

The internal sump filter can be removed only after the pump is removed.

This filter is not meant to be serviced, except during major internal pepairs.

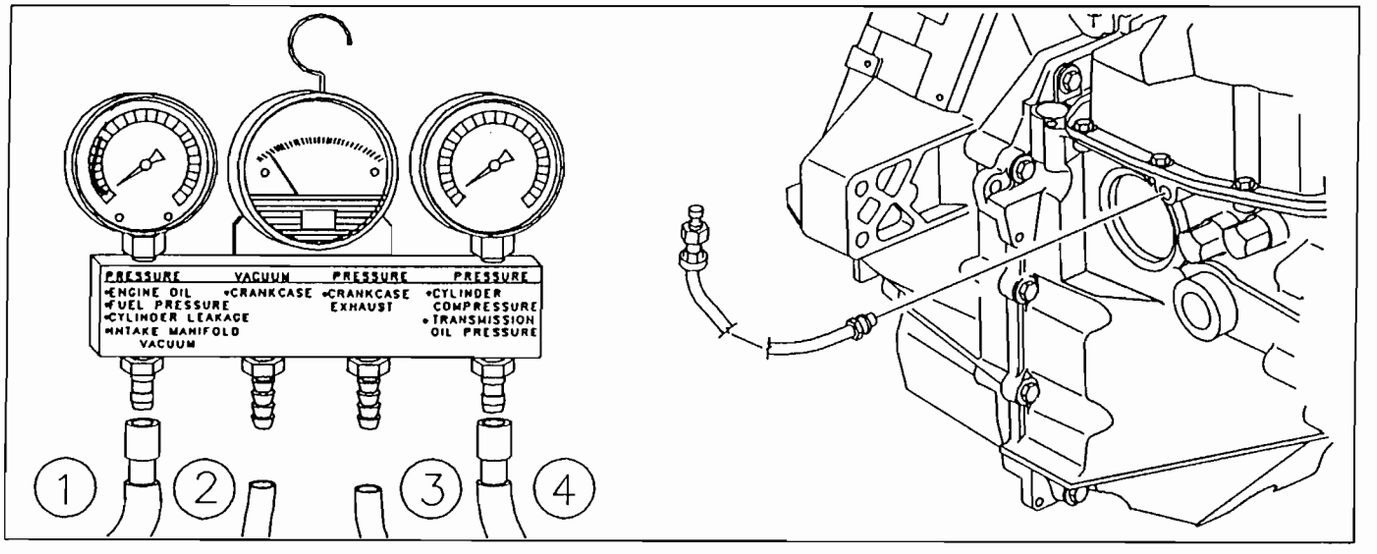
The Saturn gear type pump is made of aluminum and it has a steel wear plate between it and the front case half.

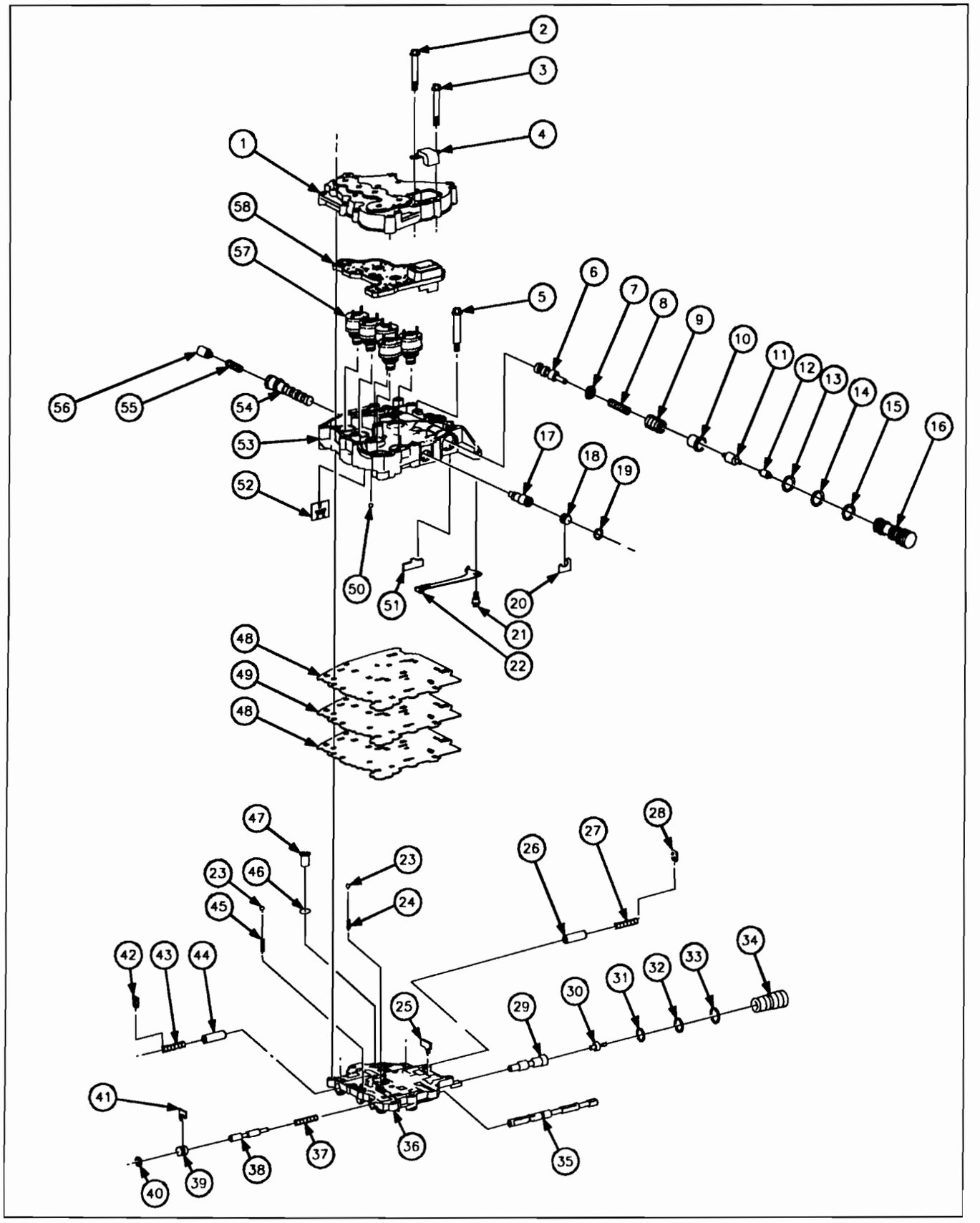


The Transmission oil temperature switch or TOT is connected to the transaxle in the line pressure port. It must be removed in order to check the line pressure. Since the line pressure is controlled by the PCM, the Saturn portable diagnostic tool (PDT) is recommended for this procedure.

The line pressure in the Saturn transaxle varies between 57PSI and 268PSI depending upon the gear selected and the vehicle load.

After a line pressure test is performed, the TOT sensor must be reinstalled with teflon sealer on the threads. After the sensor has been reconnected, PCM codes caused by this disconnection must de cleared.

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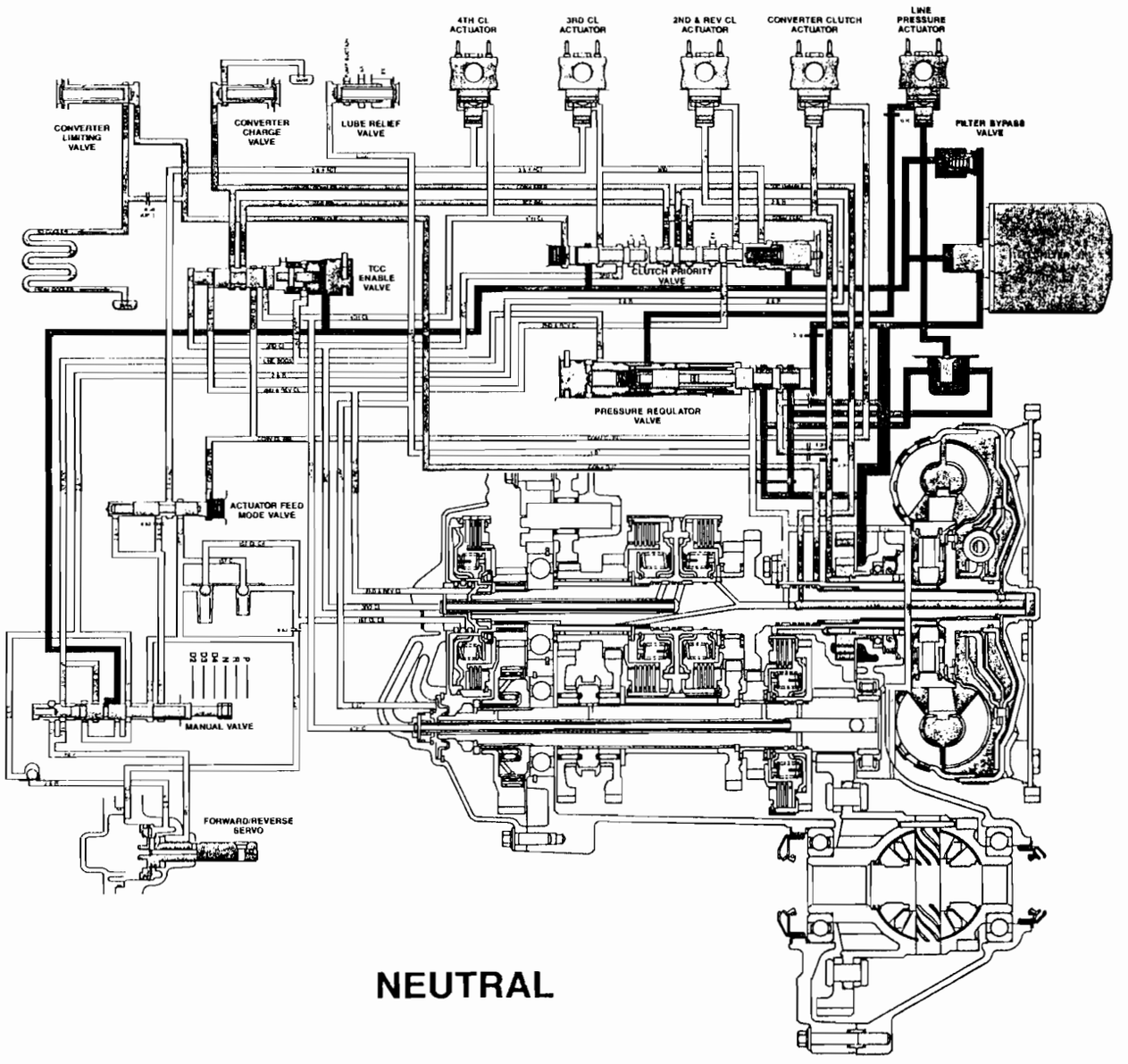
VALVEBODY LEGEND

1. Retainer–Actuator
2. Bolt/Screw–Valvebody Assembly
3. Bolt/Screw–Control Valvebody
4. Diverter–Actuator Return Exhaust
5. Bolt/Screw–Valvebody Assembly
6. Valve–Line Pressure Regulator
7. Washer–Line Pressure Regulator Valve Spring
8. Spring–Line Pressure Regulator Valve
9. Spring–Line Pressure Regulator Valve Cushion
10. Stop–Line Pressure Regulator Valve
11. Plunger–Line Pressure Control
12. Plunger–Line Pressure Booster and Control
13. Seal–Line Pressure Regulator Valve Seal
14. Seal–Line Pressure Regulator Valve Seal
15. Seal–Line Pressure Regulator Valve Seal
16. Sleeve–Line Pressure Regulator Valve
17. Valve–3rd Clutch Exhaust
18. Plug–Clutch Priority Valve
19. Seal–Clutch Priority Valve Plug
20. Retainer–Clutch Priority Valve Plug
21. Bolt/Screw–Spring and RLR Assembly
22. Spring and RLR Assembly Detent Valve
23. Ball–Check
24. Spring–1st Clutch Apply
25. Retainer–TCC Enable Valve Plunger
26. Valve–Lub. & Rel. & Converter Limiting
27. Spring–Converter Charge Valve
28. Retainer–Lub. and Converter Limiting Valve
29. Valve–TCC Enable
30. Plunger–TCC Enable
31. Seal–TCC Enable Valve Plunger Sleeve
32. Seal–TCC Enable Valve Plunger Sleeve
33. Seal–TCC Enable Valve Plunger Sleeve
34. Sleeve–TCC Enable Valve Plunger
35. Valve–Manual
36. Valvebody–Lower
37. Spring–Actuator Feed Mode Valve
38. Valve–Actuator Feed Mode
39. Plug–Actuator Feed Mode Valve Retainer
40. Seal–Actuator PD Mode Valve Retainer Plug
41. Retainer–Actuator Feed Mode Valve
42. Valve–Lub. Rel. and Converter Limiting
43. Spring–Converter Limiting
44. Valve– Lub. Rel. and Converter Limiting
45. Spring–1st Clutch Exhaust
46. Washer–Transaxle Filter Load
47. Filter–Transaxle Load Flushing
48. Gasket–Spacer Plate
49. Plate–Spacer
50. Ball–Check
51. Retainer–Line Pressure Regulator Valve
52. Retainer–Clutch Priority Valve
53. Valvebody–Upper
54. Valve–Clutch Priority
55. Spring–Clutch Priority
56. Plunger–Clutch Priority Valve
57. Valve–Transaxle Control Solenoid W/Filter
58. Connector Assembly–Electrical Actuator


4TH CL ACTUATOR
3RD CL ACTUATOR
2ND & REV CL ACTUATOR
CONVERTER CLUTCH ACTUATOR
LINE PRESSURE ACTUATOR
CONVERTER LIMITING VALVE
CONVERTER CHARGE VALVE
LUBE RELIEF VALVE
FILTER BYPASS VALVE
TCC ENABLE VALVE
CLUTCH PRIORITY VALVE
PRESSURE REGULATOR VALVE
ACTUATOR FEED MODE VALVE
MANUAL VALVE
FORWARD/REVERSE SERVO

NEUTRAL

GENERAL INFORMATION

The ZF-4 is a four speed, automatic transaxle. First gear has a 2.58 to 1 ratio. Second gear has a 1.41 to 1, Third gear is 1 to 1, fourth gear has a .74 to 1 ratio. Reverse provides a 2.88 to 1 ratio.
Transmission shifting is controlled by a governor valve, a line pressure valve, a throttle pressure regulator valve and a modulator valve. Valve operation is dependent on shift lever position, vehicle speed and throttle position.
Overall lockup is achieved through the use of the 3-4 drum shaft. It is splined directly to the damper plate in the converter, thus providing a mechanical connection to the transmission.

The ZF-4 transaxle is equipped with a planetary gear system consisting of an annulus gear, sun gear and planetary carrier. A total of six planetary pinion gears are used.
Two styles of freewheel clutches are used. A roller clutch is used for first gear operation and a sprag clutch is used for second gear operation.

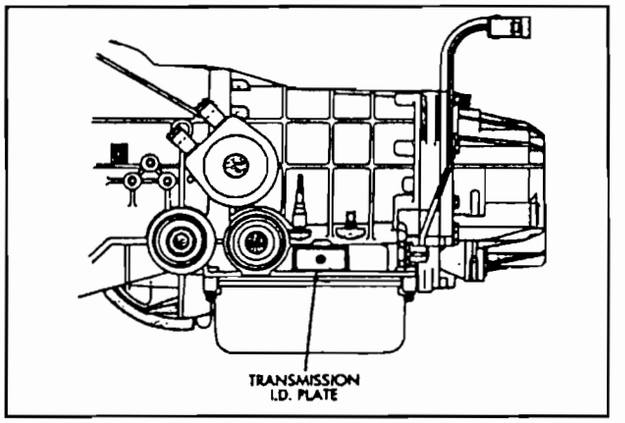


Figure 1

ZF-4 TRANSAXLE IDENTIFICATION

The transaxle identification plate is on the left side of the case above the oil pan (see figure 1).
The information on the plate consists of the build sequence number, manufacturers part number and the transaxle type (see figure 2).

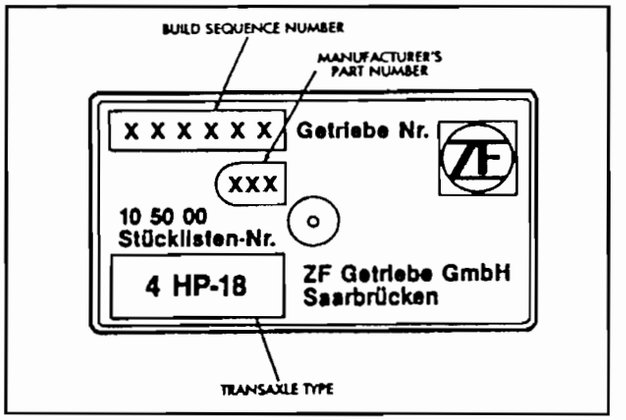
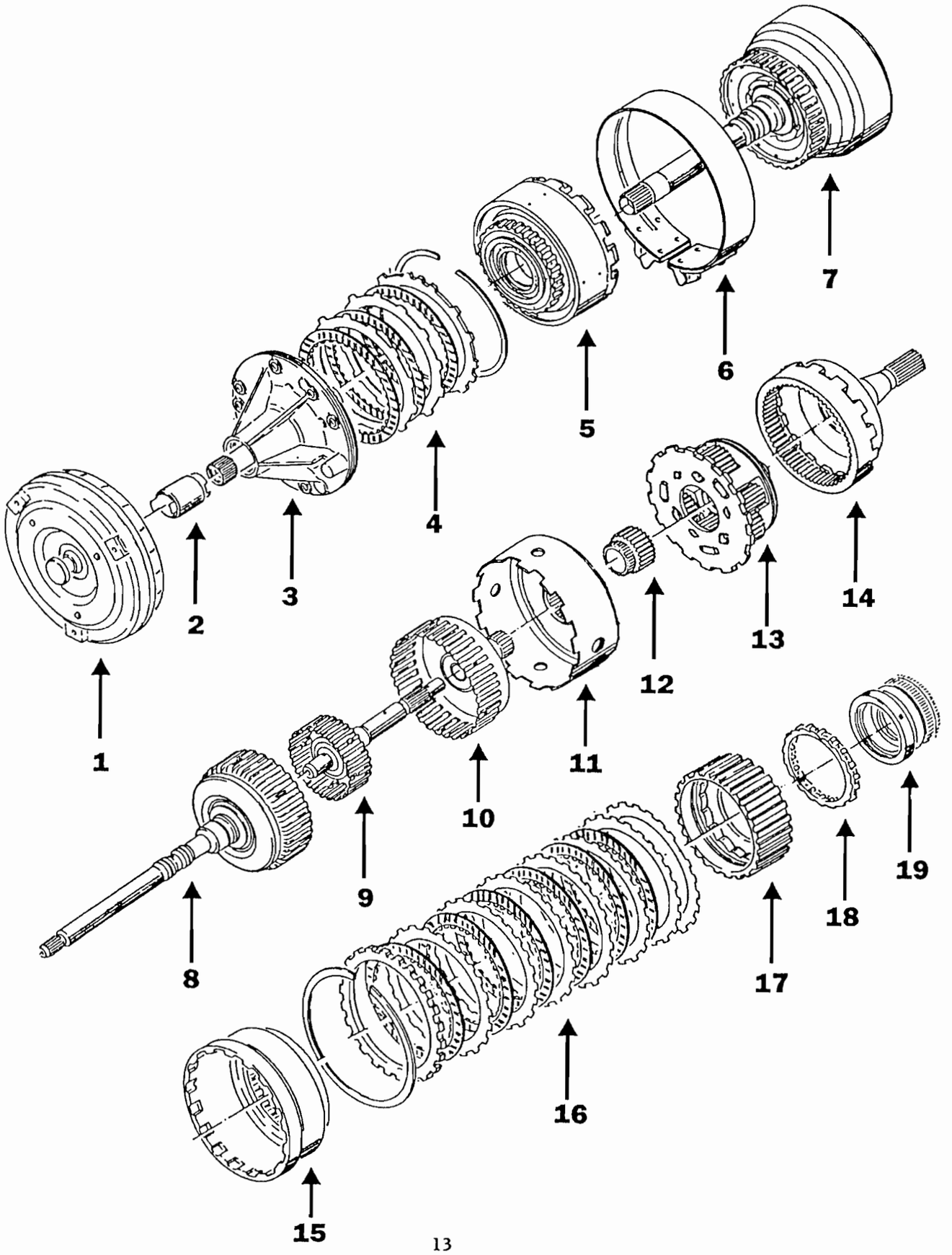


Figure 2

COMPONENT IDENTIFICATION

See legend below and page 5 for component identification. The brackets in the legend indicates Z.F. nominclature.

1) TORQUE CONVERTER
2) PUMP DRIVE SLEEVE
3) PUMP ASSEMBLY
4) INTERMEDIATE CLUTCH PACK (C)
5) REVERSE DRUM W/INTERMEDIATE SPRAG (B)
6) 2-4 BAND (C')
7) FORWARD DRUM (A)
8) 3-4 DRUM (E)
9) 3-4 HUB
10) FORWARD HUB
11) SUN SHELL
12) FRONT SUN GEAR
13) PLANETARY CARRIER WITH REAR SUN GEAR
14) INTERNAL RING GEAR AND OUTPUT SHAFT
15) LOW/REVERSE ALUMINUM SHELL
16) LOW/REVERSE CLUTCH PACK (D)
17) LOW/REVERSE HUB & ONE WAY CLUTCH OUTER RACE
18) LOW ONE WAY CLUTCH
19) LOW ONE WAY CLUTCH INNER RACE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APPLICATION CHART

SELECTOR POSITION	GEAR	FORWARD CLUTCH	INTER. CLUTCH	3 - 4 CLUTCH	2 - 4 BAND	LOW O/R CLUTCH	INTER. SPRAG	LOW/REV CLUTCH	REVERSE CLUTCH
OD	1	*				*			
	2	*	*		*		*		
	3	*	*	*					
	4		*	*	*				
D-3	1	*				*			
	2	*	*		*		*		
	3	*	*	*					
D-2	1	*				*			
	2	*	*		*		*		
D-1	1	*				*		*	
REVERSE								*	*

* **INDICATES IN OPERATION**

NOTE: Some of the common American terminology used in the application chart above differs from that of Z.F. EXAMPLE:

ATSG	Z.F.
FORWARD CLUTCH	1-3 CLUTCH
INTERMEDIATE CLUTCH	FORWARD BRAKE
LOW/REVERSE CLUTCH	FIRST/REVERSE BRAKE

BASIC PRINCIPALS OF HYDRAULIC OPERATION

MAIN PURPOSE

The hydraulic system is designed to perform several different functions. It must supply regulated fluid pressure to the valve body and torque converter. It directs the flow of fluid to the various control elements based on vehicle speed and engine load. It lubricates the moving parts of the transmission and removes heat generated by the torque converter and other parts of the transmission.

In this section, we will discuss each of the hydraulic system elements and identify their function in the overall operation of each gear range.

HYDRAULIC SYSTEM ELEMENTS

PUMP: The pump delivers fluid under pressure from the sump, through a filter element to the valve body and torque converter. The pump is designed to deliver more fluid than the transmission needs. Excess pump output is returned to the sump.

MANUAL VALVE: The manual valve moves with the selector lever and is used to direct line pressure through the shift and lock-up valves in the valve body, to the clutches and band. The manual valve controls the selections of the various gear ranges, depending on the position of the selector lever. In park and neutral the manual valve prevents the application of the clutches and band.

PRESSURE REGULATOR VALVE: The pressure regulator valve is located in the valve body. This valve acts as a pressure-limiting valve for system line pressure. This valve will open and return any excess fluid back to the inlet side of the pump when system line pressure reaches the desired pressure. Modulator pressure, throttle pressure, lubrication pressure, and torque converter pressure are all derived from system line pressure.

OIL COOLER: Transaxle fluid cooling is accomplished by a high pressure cooler that is mounted on the side of the transaxle case.

CONVERTER SAFETY VALVE: This valve is designed to reduce line pressure to maximum torque converter supply pressure of 88.2 psi. (6 bars).

LUBRICATION VALVE: This valve is designed to limit the supply pressure, applied to the lubrication circuit, to a safe operating pressure. Oil flows from the torque converter through the lubrication valve into the transmission case.

MODULATOR VALVE: This modulator valve is used to vary the line pressure applied to the clutches, brakes and accumulators. Throttle pressure and calibrated spring pressure act on one end of the modulator valve to produce a modulated pressure signal. This modulated pressure signal is then used to vary the line pressure produced at the pressure regulator valve. Line pressure must be varied according to the amount of engine torque being transmitted. The line pressure used to apply a clutch must be increased when high torque loads are being transmitted to prevent excessive clutch slippage. Line pressure used to apply a clutch must be decreased when torque loads are light to avoid harsh shifts.

SHIFT VALVES: There are three shift valves located in the valve body. They are the 1-2, 2-3, and 3-4 shift valves. The shift valves control the upshifting and downshifting of the transmission through the application of line pressure to the clutches and brakes according to the changes of throttle pressure and governor pressure. Governor pressure acts as the road speed signal that is used to open and close the shift valves for upshifting and downshifting. Throttle pressure is used as an opposing force, along with spring pressure to delay the shift valve opening to suite engine load or to force a downshift when additional torque is required.

THROTTLE PRESSURE VALVE: The throttle pressure valve is designed to provide the shift valves with a pressure signal that will vary shift timing according to engine load. The throttle pressure valve cam is connected to the throttle linkage by a cable. As the throttle is opened the throttle cam will increase spring pressure on the throttle valve which regulates a line pressure feed. At idle, pressure is passed to the throttle pressure circuit until the pressure on the end of the valves opposite the spring overcomes the spring force and moves the valve to close the line feed port.

FROM PART TO FULL THROTTLE: Throttle pressure will increase in direct proportion to throttle opening and increase spring pressure on the throttle valve.

IN KICK DOWN: The throttle cam roller passes over a detent step on the throttle cam to the kickdown position. This allows full line pressure to be passed to the kickdown circuit for forced downshifts.

GOVERNOR: The governor is a three stage centrifugal valve design. It is located on the differential pinion shaft and rotates at a speed that is proportional to vehicle speed . It is designed to act as a hydraulic road speed sensor for the valve body shift valves . The governor produces pressure that is proportional to vehicle speed.

At speeds below 22 mph regulated line pressure passes through the stage 3 valve to the stage 2 valve. The stage 2 valve regulates fluid to the stage 1 valve. The stage 1 valve regulates governor pressure in direct proportion to vehicle speed. As the speed of the vehicle increases beyond 23 mph, the stage 2 valve begins to move. At this point the stage one valve is fully open due to the centrifugal force. Governor pressure continues to increase as centrifugal force open the stage 2 valve.

When the speed of the vehicle is fast enough for the centrifugal force to fully open the stage 2 valve, the stage 3 valve will begin to open. This causes further increase in governor pressure. The stage 3 valve begins to open at speeds above 42 mph.

As governor pressure increases it sequentially opens the shift valves, which are held closed by calibrated spring pressure and changing throttle pressure. If the speed of the vehicle decreases the governor pressure will decrease allowing the shift valves to close again.

ACCUMULATORS: The accumulators help to provide smooth gear shifting by acting as hydraulic shock absorbers. As the clutches and brakes are applied the accumulators dampen the apply pressure so that a smooth pressure rise occurs in the clutch or band unit.

There are two types of accumulators. One type of accumulator uses a calibrated spring and modulated pressure to cushion and smooth pressure applied to the control elements. The amount of dampening will vary with changes in modulator pressure. This allows the dampening to be varied according to the amount of engine torque being transmitted during gear shifting. The second type is regulated only by spring pressure to carry out the damping and is operational regardless of modulator pressure.

FIRST AND REVERSE LOCK-UP VALVE: This valve has two functions. One function is to prevent the transmission from shifting into reverse above 25 mph, by blocking the oil supply to the reverse clutch and first reverse brake when governor pressure and line pressure are above a set limit. The second function is, in range 1, it prevents the upshift to second gear by applying line pressure to the 1-2 shift valve to block it in the first position. On manual downshifts from second to first, the valve prevents the downshift above a certain speed by blocking the supply oil to the first-reverse brake.

2nd LOCK-UP VALVE: When in range 2 this valve prevents the transmission from shifting from 2nd to 3rd by applying line pressure to the 2-3 shift valve. On downshifts from 3rd to 2nd, the valve prevents the downshift above a certain road speed by blocking the oil supply to the forward brake.

3rd LOCK-UP VALVE: In range 3 this valve blocks fluid to the 2-3-4 upshifting sequence valve. It also blocks the governor supply to the 3-4 shift valve. This prevents any upshift from 3rd to 4th gear. If the 4th gear is already engaged, downshift to 3rd will take place immediately when the selector lever is moved to position 3.

2-3-4 UPSHIFT SEQUENCE VALVE: This valve provides a sequential 2-3-4 upshift. It only releases governor pressure to the 3-4 shift valve after third gear is engaged.

4-3-2 DOWNSHIFT SEQUENCE VALVE: This valve provides a sequential 4-3-2 downshift by applying line pressure to the 2-3 shift valve to keep it in third gear until 3rd has been fully engaged.

3-4 TRACTION VALVE: The 3-4 traction valve is designed to cut off line pressure to the 1-3 clutch on a 3-4 upshift. As the 3-4 traction valve moves to cut off line pressure it also opens an exhaust port for the forward clutch so that it will release. The 3-4 traction valve is designed so that it will only move to release the forward clutch after the 3-4 shift valve has been opened and the 2-4 band has had a chance to fully apply.

4-3 TRACTION VALVE: The purpose of the 4-3 traction valve is to prefill the forward clutch on a 4-3 downshift and supply the forward accumulator.

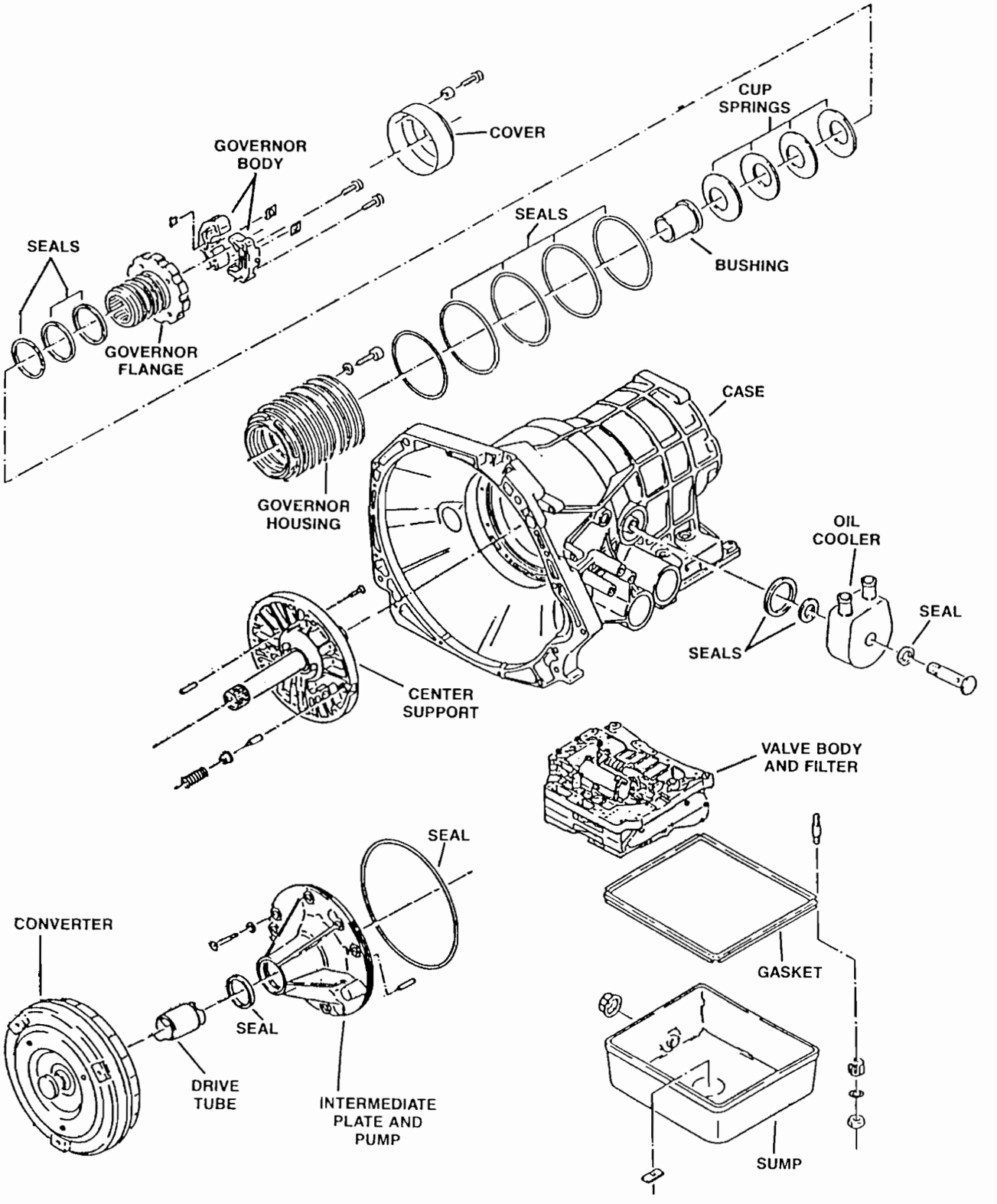
4-3 DOWNSHIFT VALVE: The 4-3 downshift valve is designed to maintain apply pressure to the 2-4 band until the forward clutch is filled. When the forward clutch is filled this valve will shift to vent the 2-4 band.

TIME CONTROL VALVE: The time control valve regulates the overlap period that exists as the 2-4 band is being released and the forward clutch is being applied for a 4-3 gear change. This valve cuts off the 4-3 traction valve from the 4-3 downshift valve. The overlap period corresponds with the operating time of the time control accumulator.

ORIFICE CONTROL VALVE: The orifice control valve is used for sensing the engine load conditions. By means of orifices it controls the pressure supply to the time control valve and the 2-4 band. This provides a shorter or longer operating time for the time control valve accumulator and 2-4 band.

TRANSAXLE COMPONENTS

HYDRAULIC ELEMENTS



LONG OUTPUT SHAFT REMOVAL

1. Remove dust cover with pry tool (Figure 1).
2. Remove long shaft outer seal with tool 6159 and bolt from tool 6149. If you do not have these tools, pry out the seal with a screwdriver being carefull as not to damage the bore (Figure 2).
3. Remove the long shaft snap ring (Figure 3).
4. Remove the long shaft and bearing from the case (Figure 4).
5. If the shaft will not come out, you may need to remove the differential and tap the shaft out with a rubber mallot.

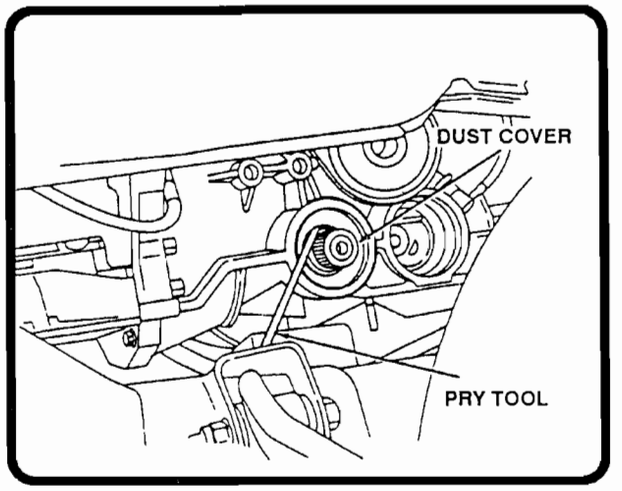


Figure 1

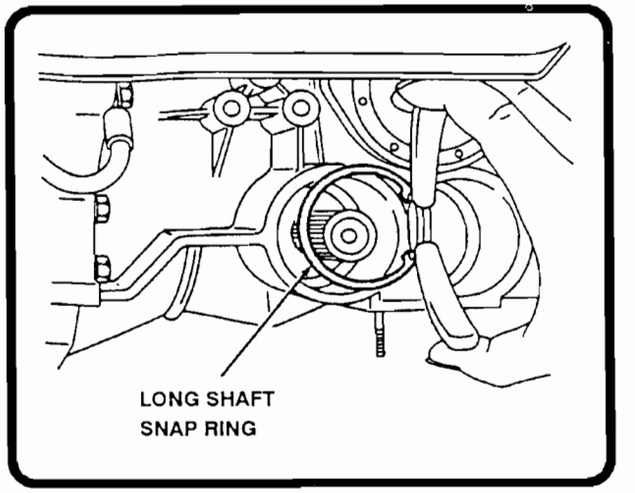


Figure 3

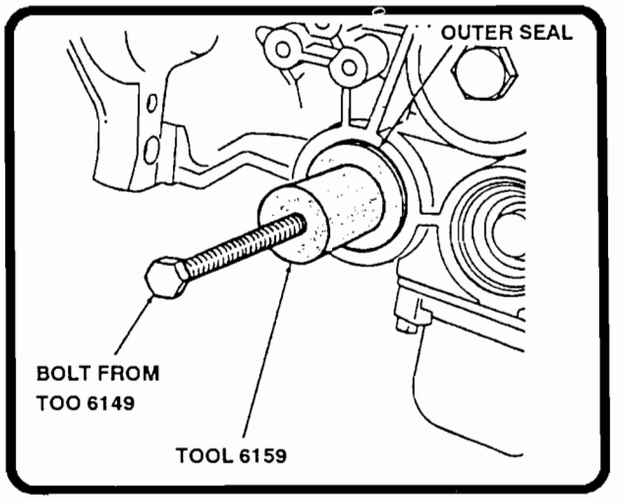


Figure 2

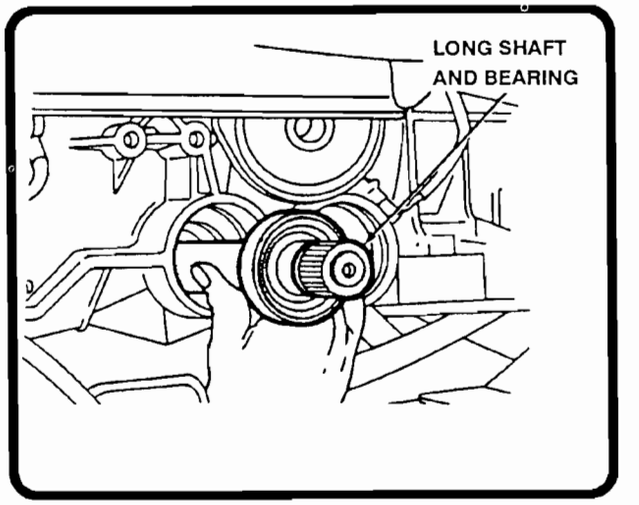


Figure 4

SAAB 9000 / EAGLE PREMIER (ZF4HP-18)
DELAYED OR NO REVERSE

COMPLAINT: Transaxle may exhibit a long delay into reverse or no reverse range at all. The forward gears are fine.

CAUSE: The reverse drum sleeve has moved forward in the drum and blocks the two oil feed holes (see figure 1). The normal position of the sleeve is about .060 in. above the drum surface and covers 50% of the feed holes (see figure 2).

CORRECTION: Replace the reverse drum.

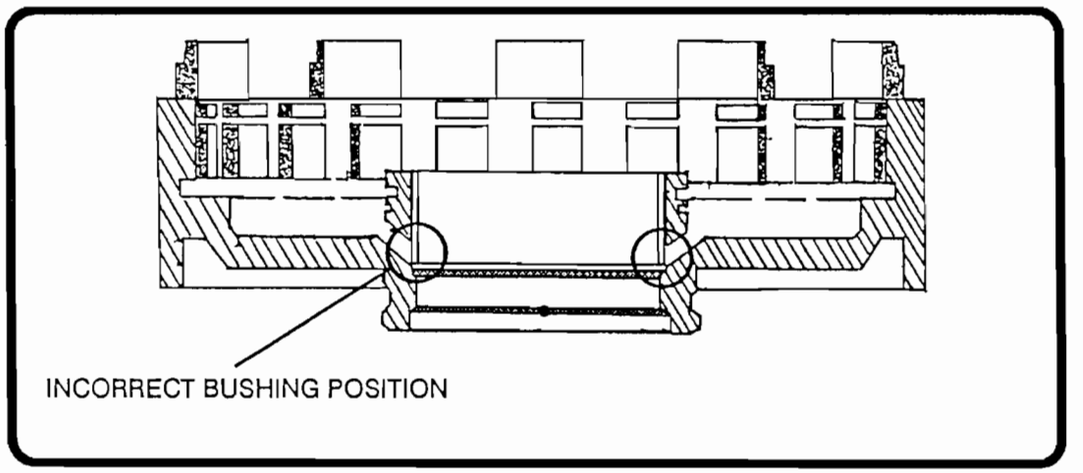


FIGURE 1

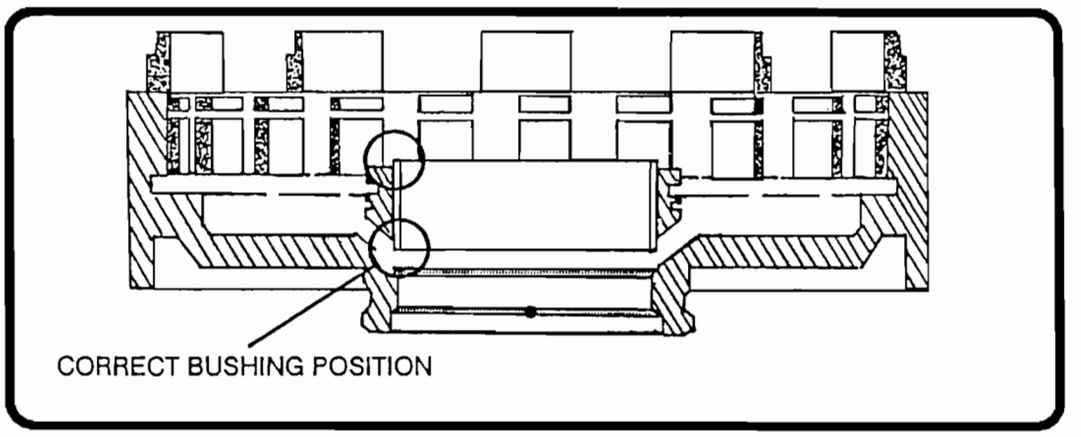
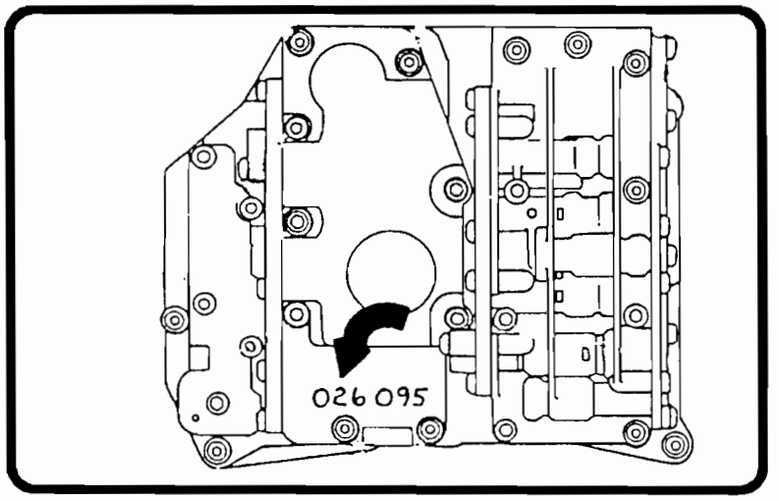


FIGURE 2

COMPLAINT: Harsh 4-3 downshift on deceleration or when lifting your foot during the shift.

CAUSE: Forward (A) cluch accumulator orifice is too large allowing rough engagement of the forward clutch.

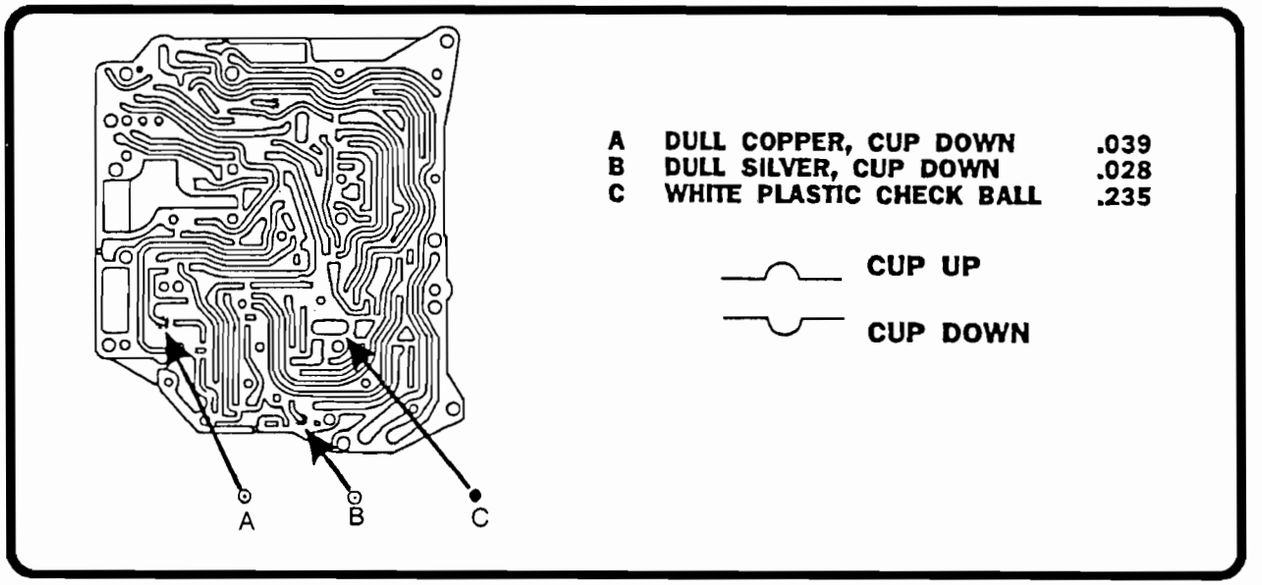
CORRECTION The forward clutch accumulator orifice has been reduced in later valve bodies. See figure 1 for the update levels which can be identified by the numbers stamped on the filter cover. In figure 2, letter "A" identifies the forward "A" clutch accumulator orifice.



(A) ORIFICE IS .059" WITH 026 FILTER COVER

(A) ORIFICE IS .047" WITH 032-052 FILTER COVER

(A) ORIFICE IS .039" WITH 068 FILTER COVER



MAZDA G4A-EL / FORD PROBE

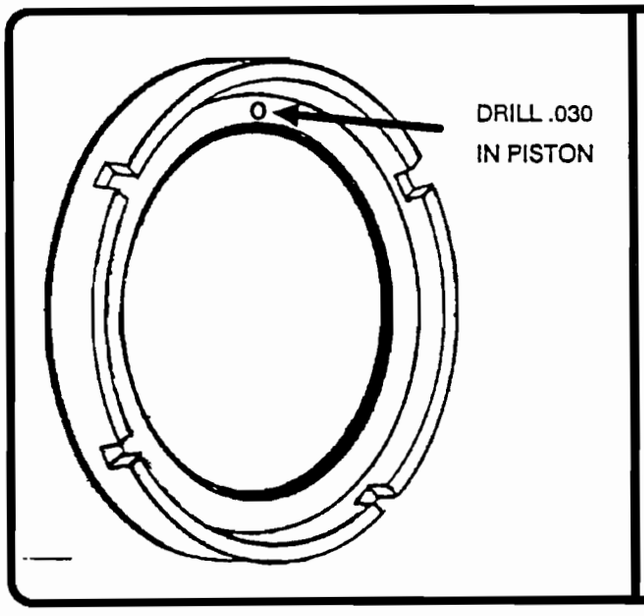
REVERSE CLUTCH FAILURE

COMPLAINT: *Repeated reverse clutch failure.*

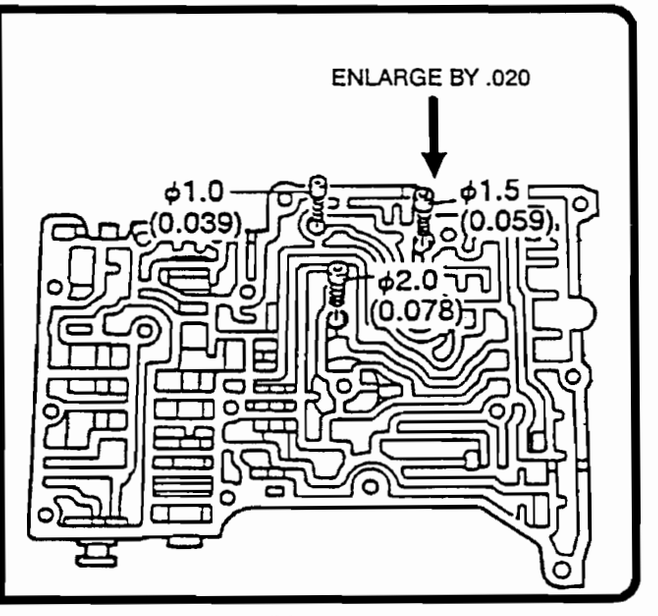
CAUSE: *Cross leak causing the reverse clutch to drag while in forward gears.*

CORRECTION: *Drill a .030 hole through the reverse piston (figure 1), also enlarge the reverse feed orifice by .020 (figure 2). Example: measure existing orifice size, if it is .059 then enlarge to .079.*

NOTE: Always use factory rings from Ford. These rings will work on on both Mazda and Probe. (part # E92Z-7D019-A).

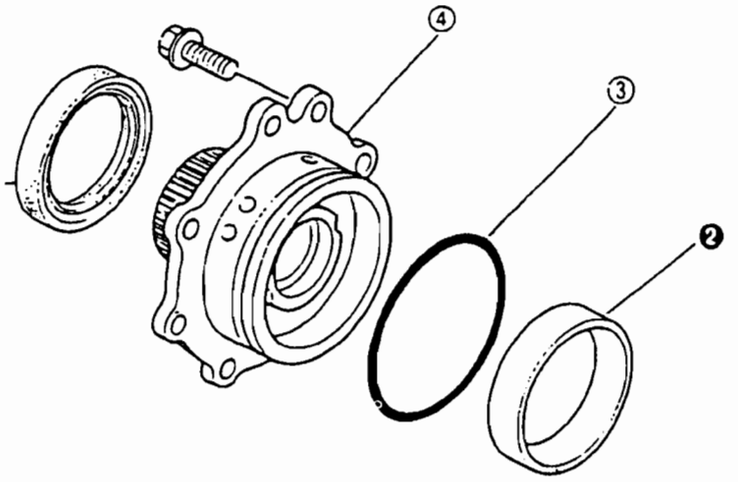


(Figure 1)

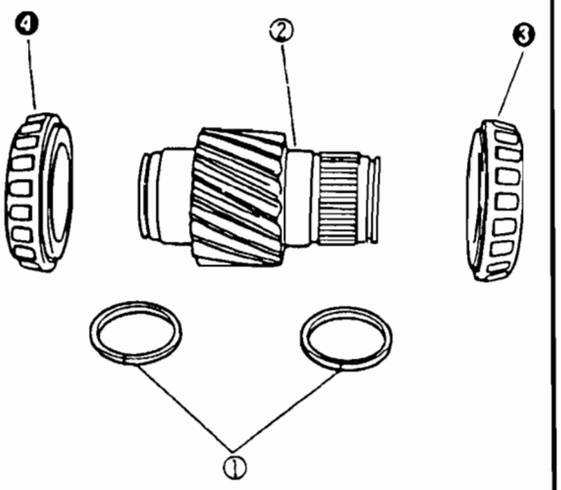


(Figure 2)

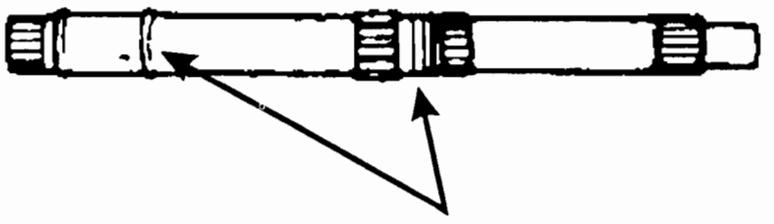
MAZDA G4A-EL / FORD PROBE
3 - 4 CLUTCH FAILURE



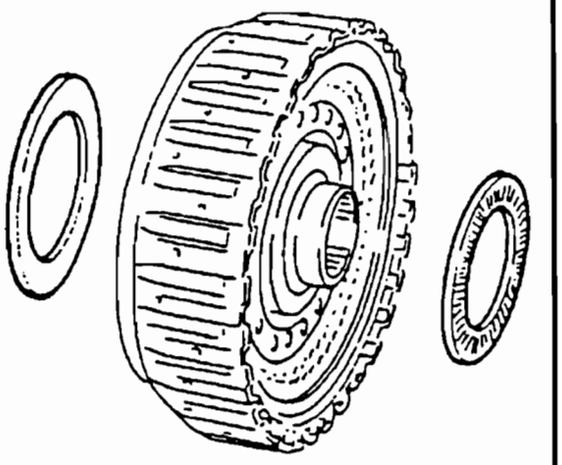
BEARING COVER & GASKET



OUTPUT GEARS & SEALS



TURBINE SHAFT & SEALS



3 - 4 DRUM

ZF4HP22
PREMATURE FORWARD CLUTCH FAILURE

COMPLAINT: Some BMW's, Volvo's, Jaguars, Peugeots and Lincoln's with the ZF4 transmission may experience forward clutch failure for no apparent reason. Others may attempt to pull forward in neutral if the engine is accelerated above idle.

CAUSE: The turbine shaft has two sealing rings that direct oil to the converter. A worn stator support bore can cause a cross leak of converter oil into the forward clutch. Also the rear metal sealing ring on the turbine shaft can leak causing partial forward clutch apply.

CORRECTION: The turbine shaft must have a more positive seal to the stator support, and the forward clutch must be converted to a feed/bleed system. This correction can be accomplished by following the procedure below or by installing a ZF correction kit. This kit is manufactured by Independant Transmissions of South Miami, Florida and can be purchased through most transmission parts suppliers.

Step #1. Replace the stator shaft if the bore is worn.

STEP #2. Remove the rear metal turbine shaft ring and discard it. Replace the ring with one made of teflon. Make your own if neccessary.(See Figure 1.)

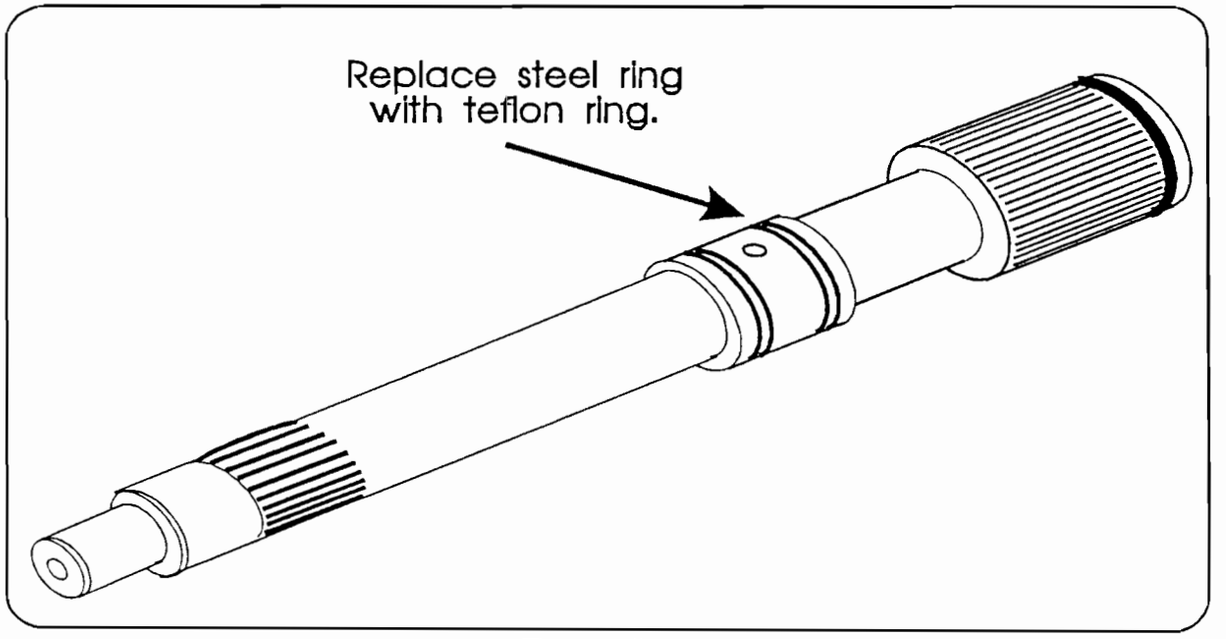


Figure 1.

STEP #3. Drill a .045" bleed hole in the forward clutch piston. See Figure 2.

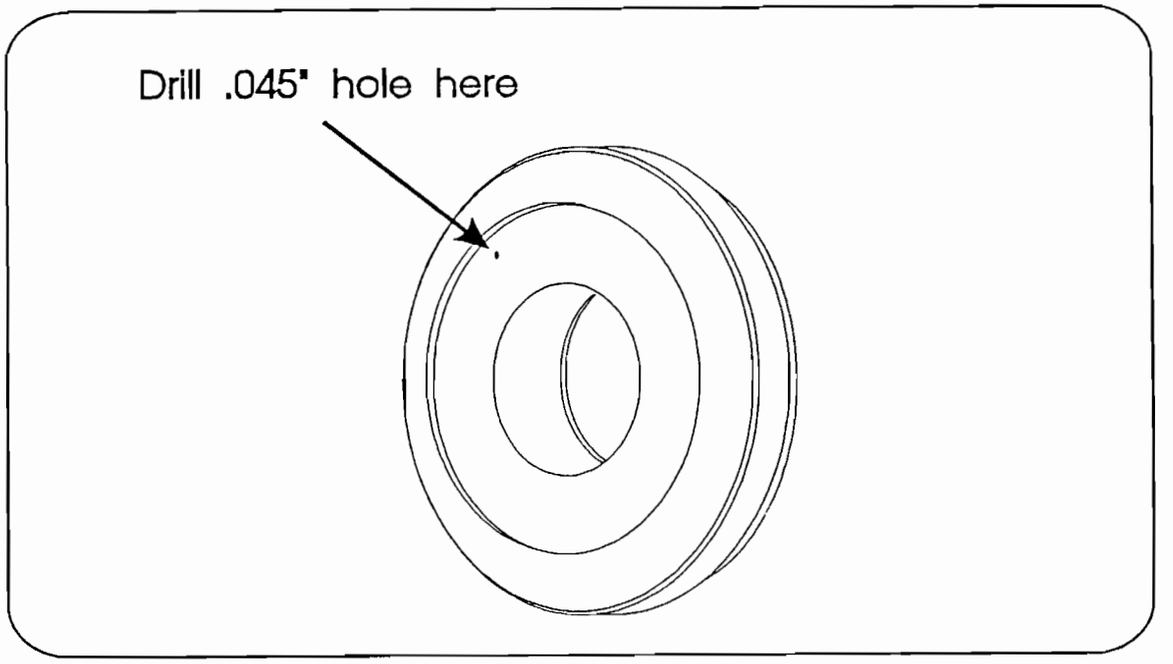


Figure 2.

Step #4. Replace the forward clutch orifice with the larger one found in the ZF correction kit, or drill out the existing one to .093"(3/32). See figure 3.

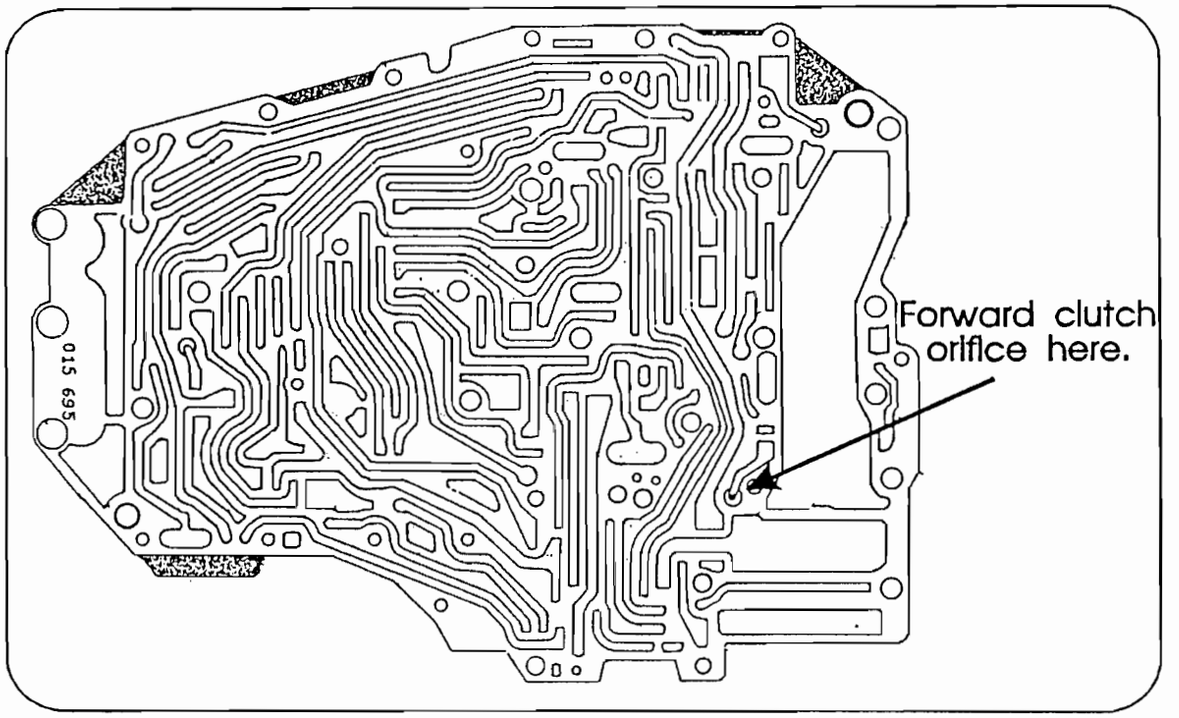


Figure 3.

Step #5. When Installing the forward clutches, waved steel plates must be installed at both ends of the clutch pack. Clutch clearance should be .060-.080 in. See Figure 4.

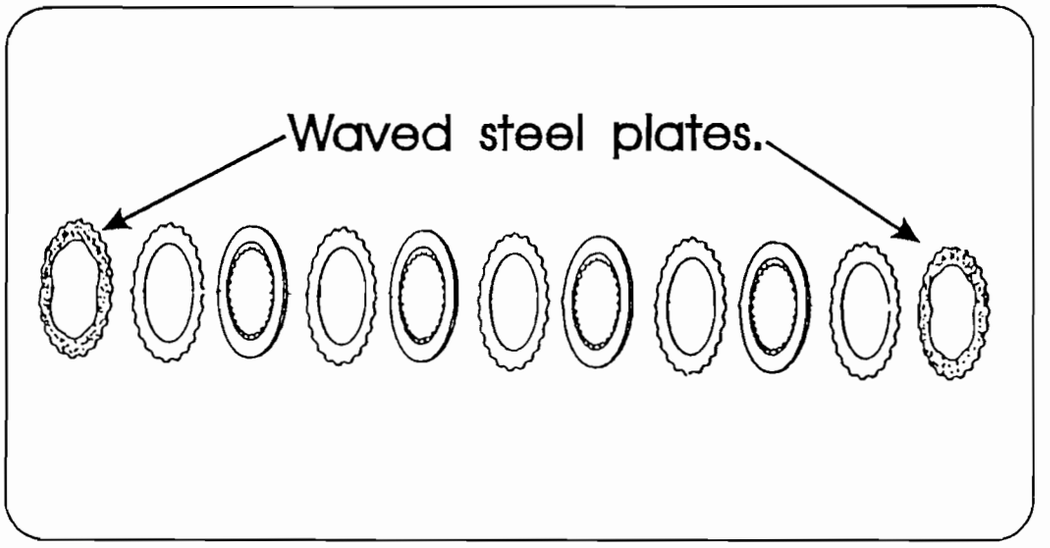


Figure 4.

Step #6. Care must be taken to insure that the snap ring retaining the forward clutch hub to the drum be fully seated in the snap ring grove. See Figure 5.

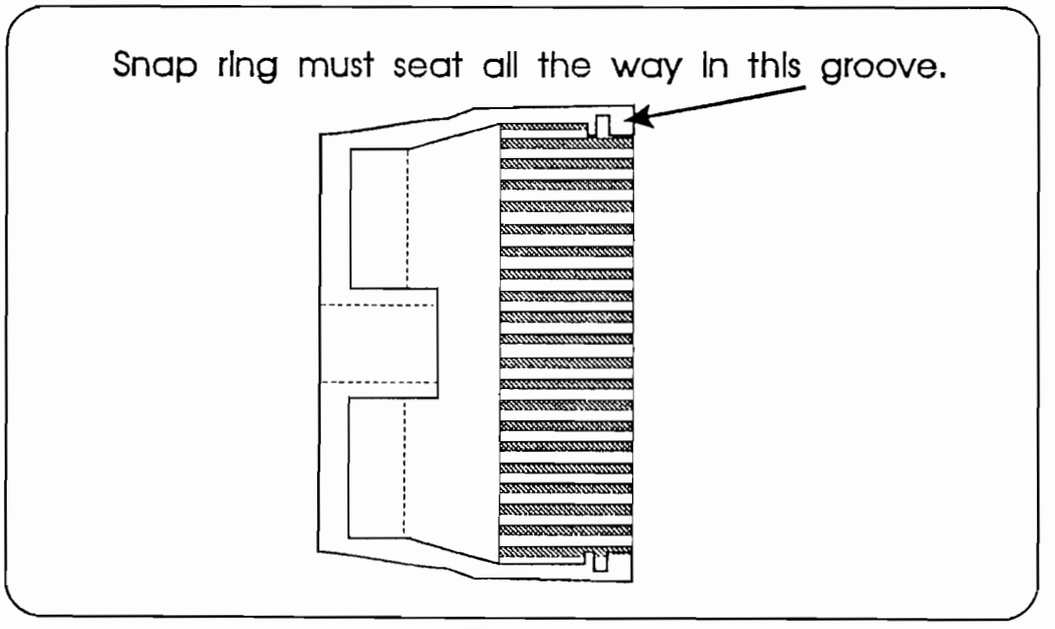
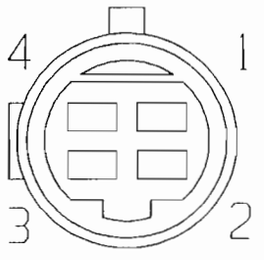
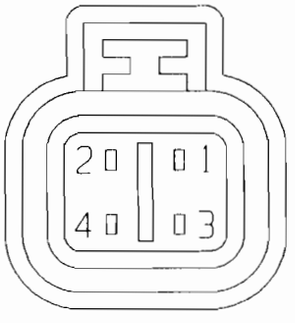


Figure 5.

MITSUBISHI GALANT

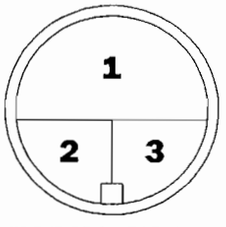


EARLY STYLE



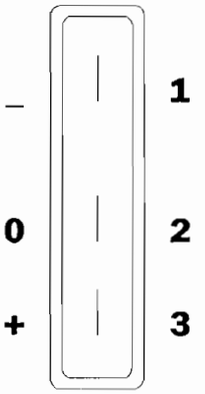
LATE STYLE

TERMINAL	OHMS	OHMS
1 & 2	271.5	
3 & 4	270.4	



EARLY STYLE

TERMINAL	THROTTLE OPENING	
	CLOSED	OPEN
1 & 2	.096	4.95
3 & 4	5.18	5.18

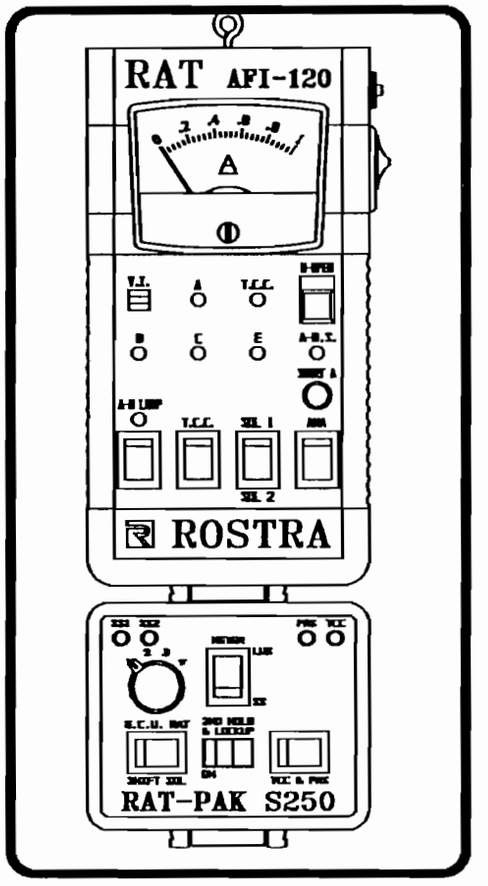


LATE STYLE

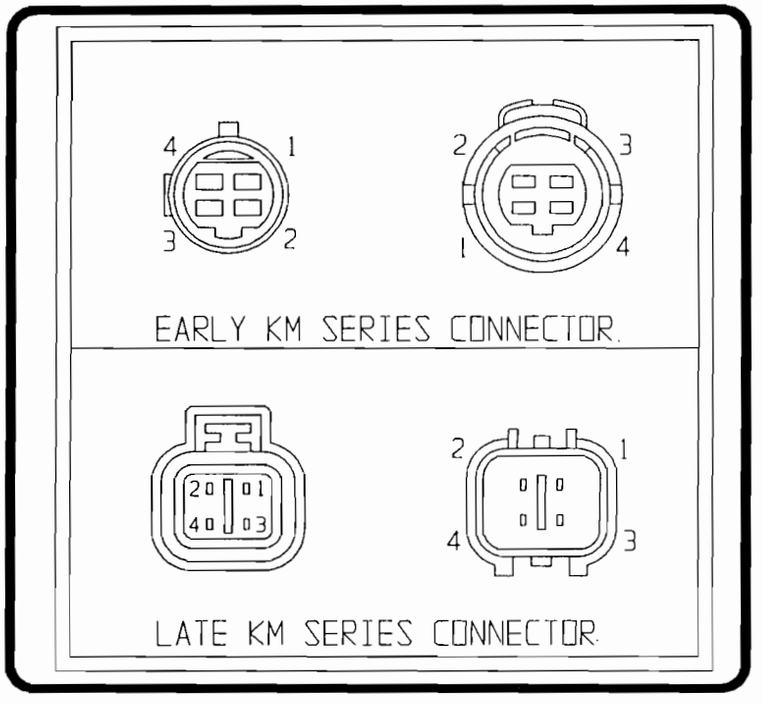
THE ROSTRA RAT PAK S250

Expansion Module for Mitsubishi Computer shifted Transmissions

The RAT-PAK S250 is an expansion module for use with the Rostra RAT AFI 120 diagnostic tool. The RAT-PAK S-250 is intended for use on Mitsubishi computer controlled transmissions (KM-171 THRU KM177). The RAT-PAK serves two functions. First the user can monitor all computer output commands to the transmission. Second, the user can control all transmission functions by manually operating all shift solenoids, lock up solenoid and line pressure solenoid. In addition the RAT AFI-120 will display solenoid current draws, and indicate the presence of shorts or opens in the transmisiin wiring. In a fifteen minute road test the user can determine if the complaint is caused by the transmission or by the control system (computer, sensors).



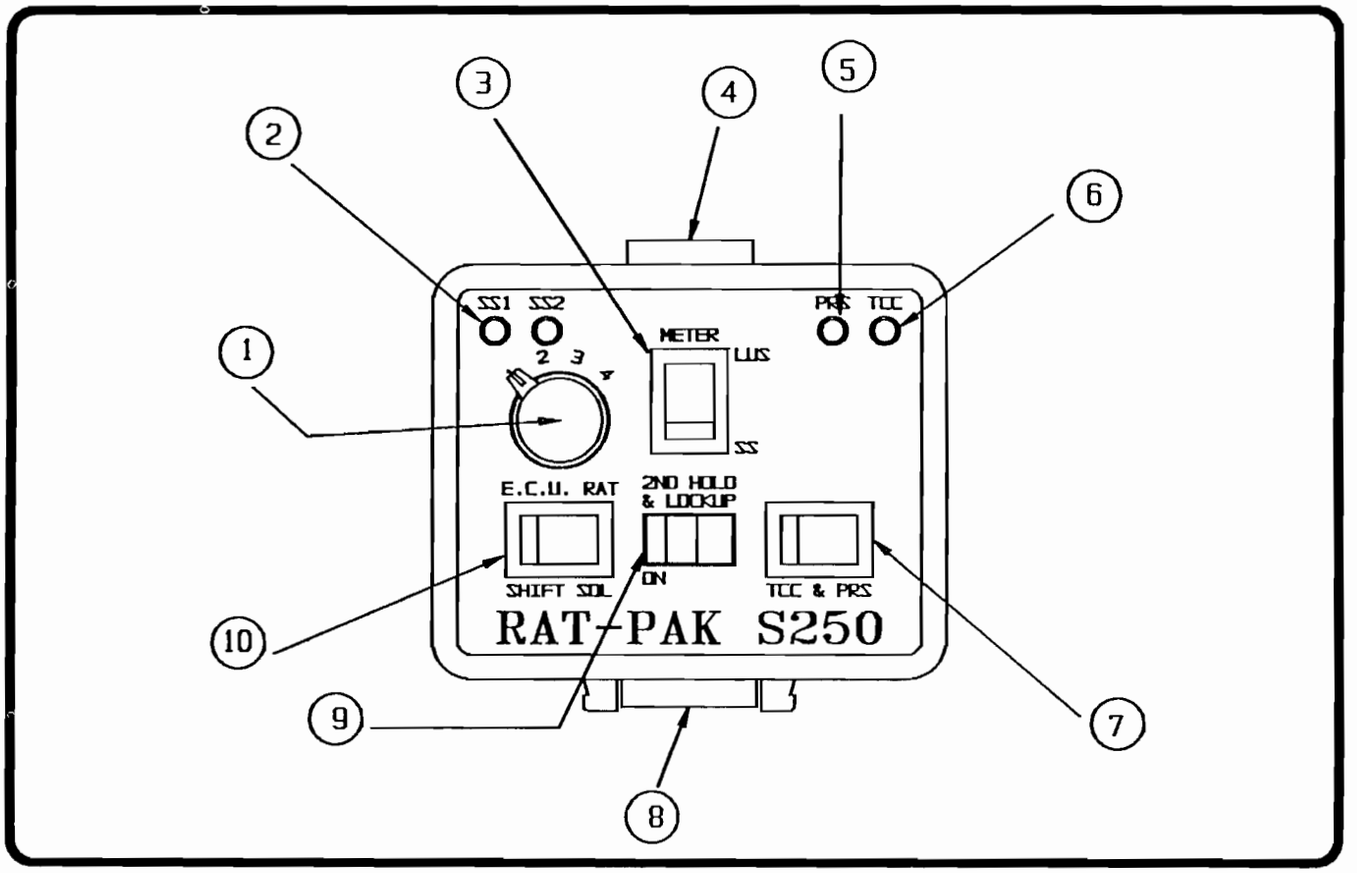
Need help? Have any questions? Call 919-276-4853 for RAT technical service.



The RAT-PAK S250 Kit includes:

* *RAT-PAK S250 diagnostic tester*
* *"Y" connectors for Mitsubishi*
  Early model KM series
  Late Model Km series
* *Laminated Instruction sheets*
* *Protective storage case*

Description of indicators and controls:



1.) Shift Solenoid manual control: This switch will allow the user to manually control gear shift selections.

2.) Shift Solenoid Indicators: These two indicator lamps show the status of shift solenoid #1, and #2.

3.) Meter Position: When the RAT-PAK is in the manual control mode, the current draw of the shift solenoids, or lock-up solenoid can be measured.

4.) 15 pin female connector: This connector plugs into the bottom of the RAT AFI-120.

5.) Pressure Solenoid Indicator light: This indicator flashes as the line pressure control solenoid is pulsed.

6.) Lock up Indicator light: This indicator flashes as the lockup solenoid is pulsed.

7.) Lock up and Pressure computer control: This switch will allow the user to select the pulsed solenoid to be manually contrlled. EPC solenoid or lockup solenoid.

8.) 15 pin male connector: The main cable attaches to this connector for the hook up to the transmission.

9.) Second Gear Hold, and lock up control: This switch turns on the driver circuit to pulse the solenoid selected by 7. While in manual mode turn this on during 1-2 shift, at 2nd gear & hold, and during down shifts. While in monitor mode, turn this on for modulated lockup.

10.) Shift solenoid computer control: This switch will allow the user to monitor the ECU, or manually control the shift solenoids.

PREPARING FOR A ROAD TEST

CONSULT THE RAT AFI-120 INSTRUCTION MANUAL FOR BASIC RAT OPERATION.

CAUTION: FAMILIARIZE YOURSELF WITH THE FUNCTIONING OF THE TRANSMISSION, BOTH ELECTRICALLY, AND MECHANICALLY. When the RAT-PAK is in the manual mode, gear selection is now in control of the user, any misuse can result in severe damage, and/or injury.

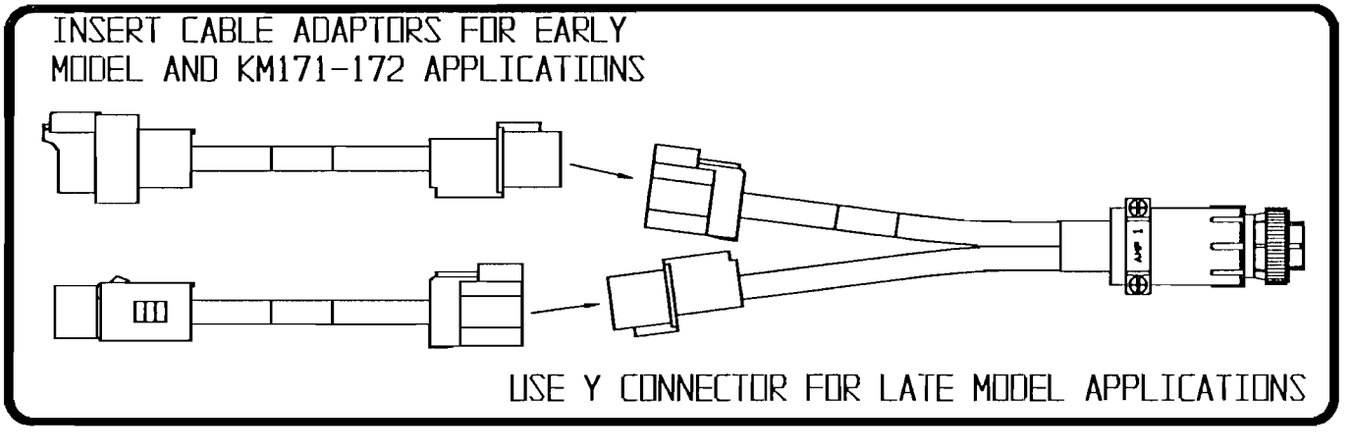
1.) Check and correct fluid level.

2.) Check and record all service codes

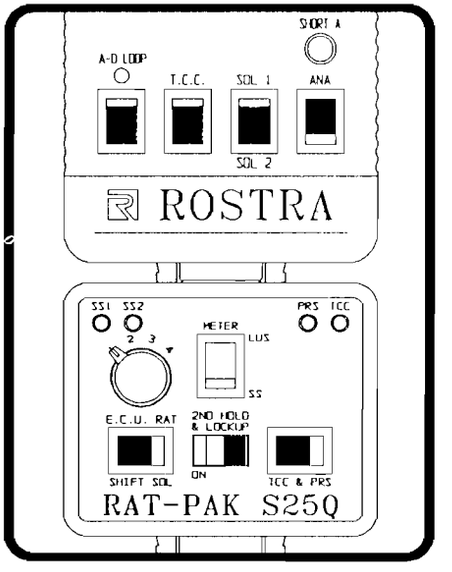
3.) Disconnect vehicle wiring harness from transmission through case connector.

4.) Select proper "Y" connector. Late model applications use the Y connector as is. For early model applications and KM171-172 applications assemble the cable adaptors to the Y connector.

5.) Connect one end of the "Y" connector into the transmission case connector, and the other end of the "Y" connector to the vehicle wiring harness.



6.) Attach main cable to "Y" connector and route cable through driver side window take care not to allow cable to drag on the ground. Connect alligator clip to vehicle ground.



7.) Attach main cable to the RAT-PAK. Attach cigarette lighter plug to the RAT-PAK. Connect RAT-PAK S250 to the RAT AFI 120. Hang unit on the windshield suction cup. **Caution: Do not put excessive force on the main cable which would cause the RAT-PAK to become disconnected from the RAT AFI-120. Doing so would cause the transmission to go into a failure mode.**

8.) Place all switches on the RAT AFI-120 (except the ANA switch) in the down position.

9.) Place both red switches on the RAT-PAK S250 (except the meter switch) to the left (monitor mode). The center switch to the right.

10.) Once again ensure all connections are correct, and secure Turn the key on but don't start the engine.

11.) The "A" indicator should be illuminated along with the "VI" indicator on the RAT AFI-120, if these indicators are not illuminated, ensure the cigarette lighter plug has 12 volts going to the RAT-PAK.

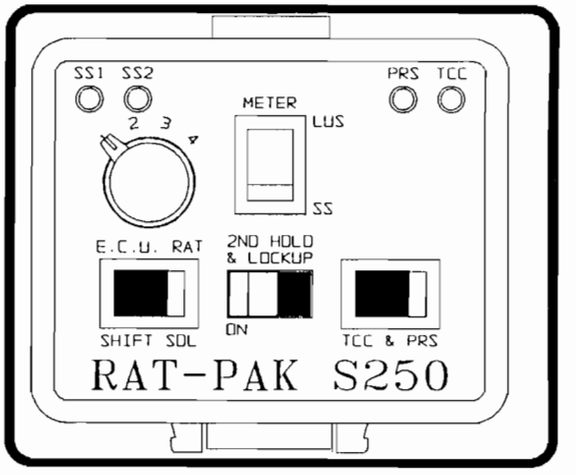
TAKING THE ROSTRA RAT-PAK ON THE ROAD

Once power has been established to the tester, be sure the RAT-PAK is in the monitor mode. Use the monitor mode to verify that the computer is operating properly.

MONITOR MODE

Start the engine and begin your road test. The following table shows the proper solenoid combinations for each given range. SS1 and SS2 indicators will light as the computer turns on the respective solenoids. The PRS light will pulse as the computer controls line pressure. The computer can not engage lockup in the monitor mode, although the user can by pressing the lockup switch on (see controlling lockup). When in the monitor mode, use this table to verify that the computer outputs are correct for the proper range selected.

- **Failure of the transmission to shift into the indicated range may indicate a plugged solenoid, a stuck shift valve, or another internal transmission problem.**
- **Erratic computer outputs, causing transmission malfunction may indicate a faulty sensor or a bad computer. Refer to service codes and check sensors.**
- **If the computer senses a failure in the transmission control system it may put the transmission into a limp in mode (third gear). Check and record trouble codes. Clear memory by disconnecting NEG battery cable. Perform monitor mode testing to verify proper computer outputs are present.**
- **Perform manual mode testing to determine if problem is or is not in transmission.**

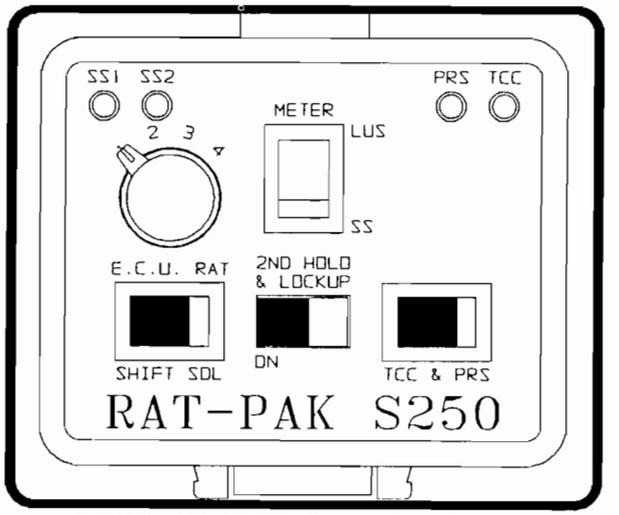


PLACE RED SWITCHES TO THE LEFT IN MONITOR MODE

WIRE COLOR	ORANGE	YELLOW	BLUE	RED
GEAR	SS1	SS2	PRS	TCC
FIRST	ON	ON	PULSE	OFF
SECOND	OFF	ON	PULSE 1-2	OFF
THIRD	OFF	OFF	PULSE 2-3	PULSE
O/DRIVE	ON	OFF	PULSE 3-4	PULSE
REVERSE	OFF	ON	PULSE	OFF

CONTROLLING LOCKUP:

The Mitsubishi computer controlled transmissions have a modulated Lock up control. While the S250 is in the Monitor Mode the user can manually control lock up by turning the 2nd hold/Lock up switch on. The TCC indicator will flash as the RAT-PAK pulses the lock up solenoid. By placing the meter switch in the LUS position the user can see the current draw of the lock up solenoid.

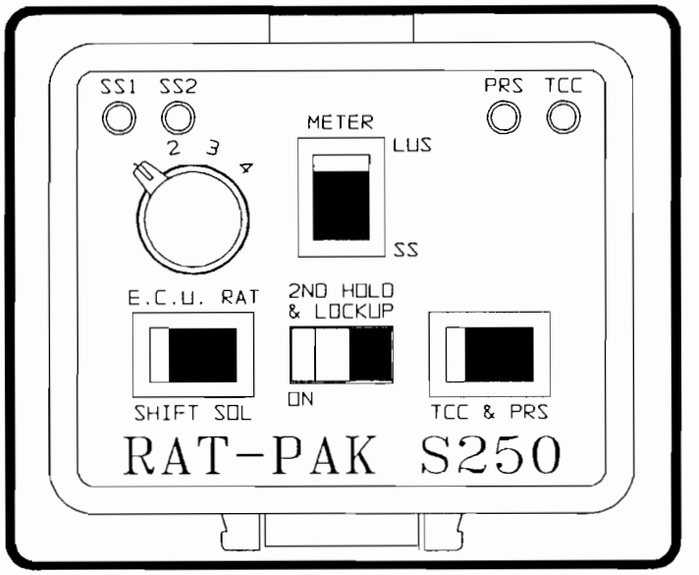


PRESS CENTER SWITCH ON (TO THE LEFT) FOR MANUAL CONTROL

MANUAL OPERATION OF THE RAT-PAK S250

1.) **GOING TO MANUAL MODE:** Stop the vehicle and turn off the key before switching the RAT- PAK in the manual mode.

2.) **SETTING YOUR SWITCHES:** Place the shift solenoid switch and the TCC/PRS switch to the right. **Insure the 2nd gear hold switch is ON!**
NOTE: Manual lock up can only be applied in the monitor mode!!! The 2nd gear hold/lock up switch is used to modulate line pressure in the manual mode.



3.) **SHIFT SELECTOR KNOB:** Turn the shift solenoid selector switch to the 1 position (selector to the left).

4.) **START THE ENGINE.**
WARNING: The transmission is being controlled by the user, start off in a safe driving area. Become very familiar with the operation of the RAT-PAK before going on the open road! Misuse of this tool can result in severe damage, and/or injury!

5.) **READ THE CHART:** Before you start, consult chart #1 for the correct solenoid combinations.

6.) **MANUALLY UPSHIFTING:** Make certain that the TCC & PRS switch is to the right. Press the 2nd Hold switch on. The Pressure solenoid will be pulsed as indicated by the PRS light. Shift gear selector to drive in the vehicle and turn the gear selector switch (ON THE RAT PAK) to 1st gear. Make 1-2 shift at approx 1/4 throttle by turning the gear selector switch to "2", and immediately turn off the 2nd hold switch. 2nd GEAR WILL NOT APPLY UNTIL PRESSURE SOLENOID IS TURNED OFF. Make 2-3, and 3-4 shifts as required.
(NOTE THE RAT PAK WILL AUTOMATICALLY PULSE THE PRESSURE SOLENOID DURING THE 2-3 & 3-4 SHIFTS TO ALLOW FOR SMOOTH APPLICATION).

7.) **DOWNSHIFTING:** To avoid harsh downshifts, turn the 2nd gear hold switch on while down shifting, and when coming to a stop. Leave the pressure solenoid on and the selector in 2nd gear when coming to a stop. Downshift to 1st gear when you start moving again.

8.) **REVERSE:** Put the gear selector switch to 2nd, and turn on the 2nd gear hold switch. Place vehicle gear selector in Rev.

9.) **CURRENT DRAW:** During manual mode operation you can measure the current draw of the the solenoids. The meter has been half scaled to accomodate the high current draw of the Mitsubishi solenoids. Mitsubishi solenoids draw approximately 1 amp, so the correct meter reading is .5 amp, or halfway up the scale. Use the meter selection switch to select shift solenoids or lockup (& epc solenoid).

10.) **CLEAR THE COMPUTER:** Clear all troublecodes by removing the NEG battery cable when done. Failure to do so will put the transmission in the fail safe mode!

FINDING SHORTS: If a short is suspected the RAT and RAT-PAK will help find it. Place the ANA sitch on the RAT down. Put the RAT-PAK in the manual mode an place switch knob into 2nd gear. Put the meter selection switch to SS. If the Red SHORT A light comes on brightly there is a short to ground in shift solenoid #2 circuit. Move shift selector to 4th. If the A SHORT comes on brightly, solenoid # 1 has shorted to ground.

MITSUBISHI KM175

COMPLAINT: Binds up in drive and reverse.

CAUSE: The park rod tip may come loose and extend outward keeping the park pawl engaged.

CORRECTION: Re-crimp the park rod tip or replace the park rod. See Figure 1.

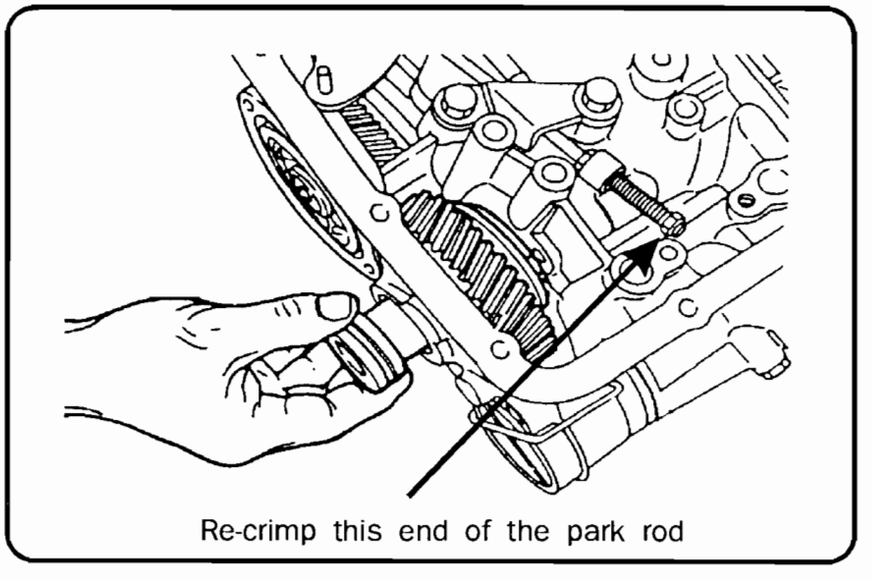


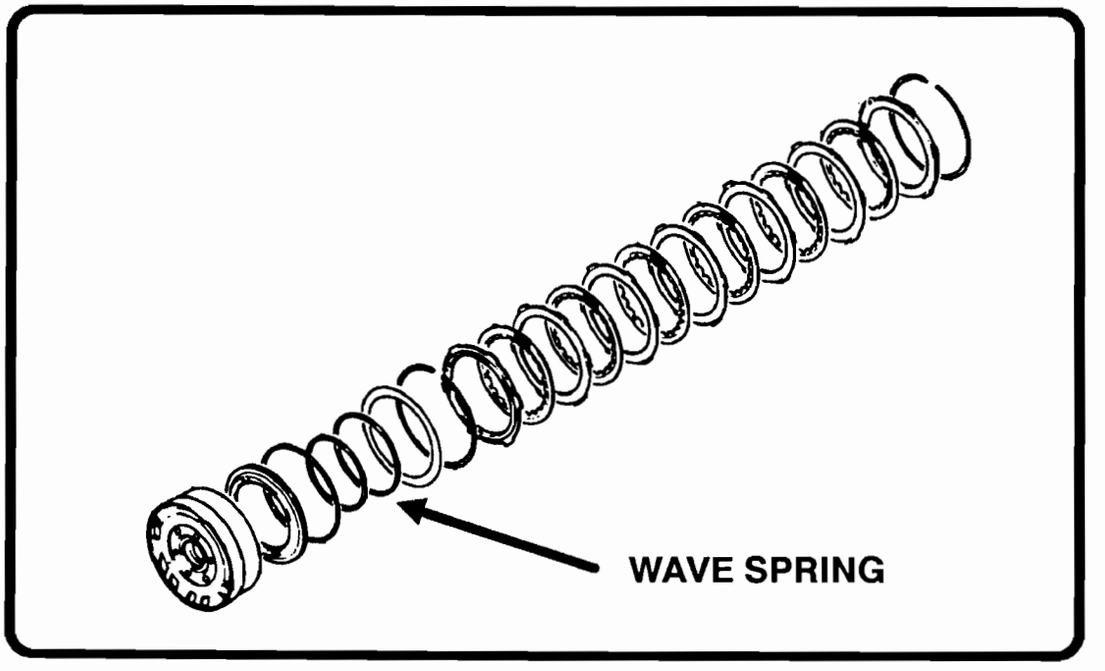
Figure 1.

MITSUBISHI KM-175
BINDING UP

COMPLAINT: *Bind up in D: second, third, or overdrive. Low reverse clutches are burned.*

CAUSE: *Broken square cut waved spacer found underneath the diaphragm return spring in the low reverse clutch housing, will not allow clutch to release properly.*

CORRECTION: *Replace wave spacer.*



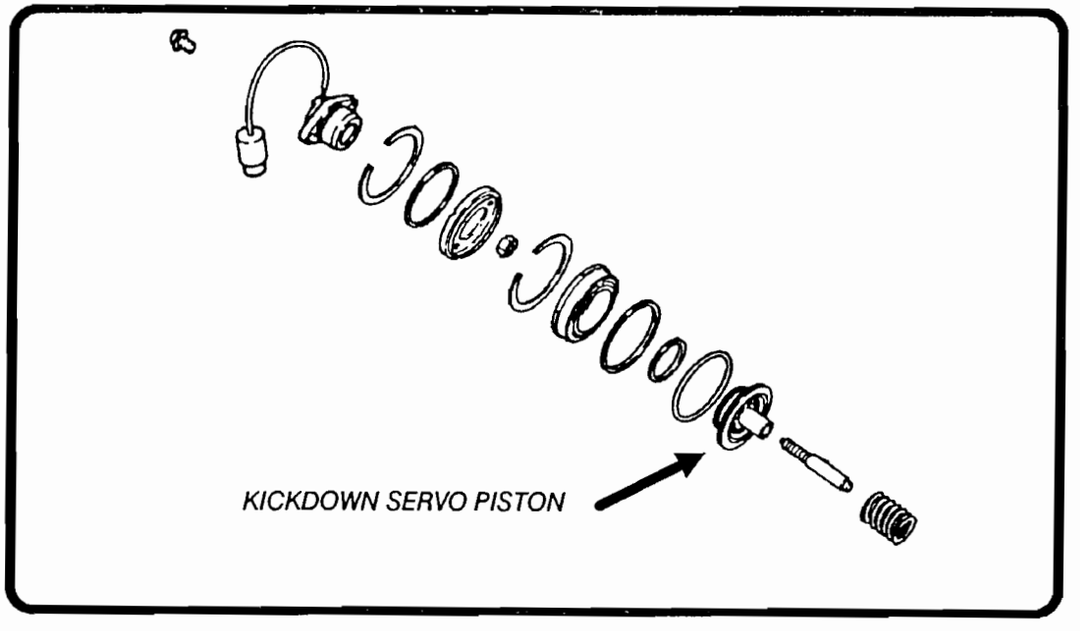
MITSUBISHI KM-175

BIND UP ON THE 2-3 SHIFT WHEN HOT

COMPLAINT: *Vehicle shifts fine when cold, when hot it binds up on the 2-3 shift and breaks free going in to 4th gear.*

CAUSE: *A small crack in the kickdown servo piston which allows the 2-4 band to drag going into 3rd gear.*

CORRECTION: *Replace kickdown servo piston.*



You spoke... ROSTRA listened!

Then engineered these time and cost saving products for improved, easier transmission repair.

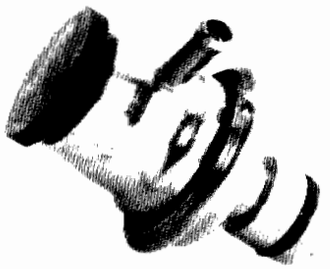
200 years of American know-how guarantees the quality of Rostra Precision Controls Inc. transmission diagnostic equipment and high performance replacement parts. Each saves you time and labor, reduces customer call-backs, and builds greater customer satisfaction. That means increased profits for you!

We're the leader because we always insist on quality, keep on top of technological advances, and most importantly, because we listen to our customers, and make what you request. In addition to the world's most extensive and highest quality line of transmission modulators, Rostra now brings you:

The RAT and RAT PAK

The Rostra RAT diagnoses electric or electronically controlled transmissions— on the road or on your bench. This advanced, moderately priced and time saving analyzer quickly plugs in and shows you what's going on *in* the transmission... not just what the onboard computer says.

Never obsolete! **RAT PAK** modules keep you up to date now— and in the future. Just turn the dial and manually shift the transmission through all ranges.

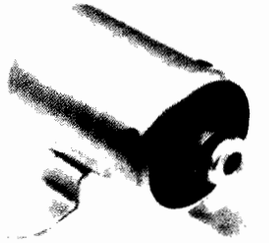


MODO•JUST

Cuts modulator adjustment by 40 minutes! Eliminates squeezing into tight spaces. No more waiting for cooldown. No wasted time getting at A4LDs. Ask your distributor.

The GENERAL Modulator

One General universal modulator replaces 5 OEs! With included adapters, the General fits GM440, 350 and 400 transmissions; it outlasts, outperforms *all* OE modulators. That means fewer stocked parts, no parts shortages, and easy, accurate adjustment. Check for the distinctive dual red stripes. There is *no* substitute! ATRA says: "We tested them all, and if you want the correct pressure every time, use the dual red stripe on all 440s."



Anti-clogging Shift Solenoid

Fits Toyota A140E electronically shifted transmissions. Reliable and inexpensive, this Rostra solenoid virtually eliminates buildup of metallic chips and flakes that stop solenoid operation. No more wasted time cleaning and reassembling. No worry about solenoid failure!

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ROSTRA PRECISION CONTROLS INC.
2519 Dana Drive, Laurinburg, NC 28352
919-276-4853

Making quality transmission parts in the USA for over 50 years... and damn proud of it!

NISSAN RL4F02A

COMPLAINT: NO UPSHIFT, T.V. CABLE LINKAGE BINDING.

CAUSE: IMPROPER POSITIONING OF THE T.V. VALVE (FIGURE 1).

CORRECTION: INSTALL T.V. VALVE IN CORRECT POSITION (FIGURE 2).

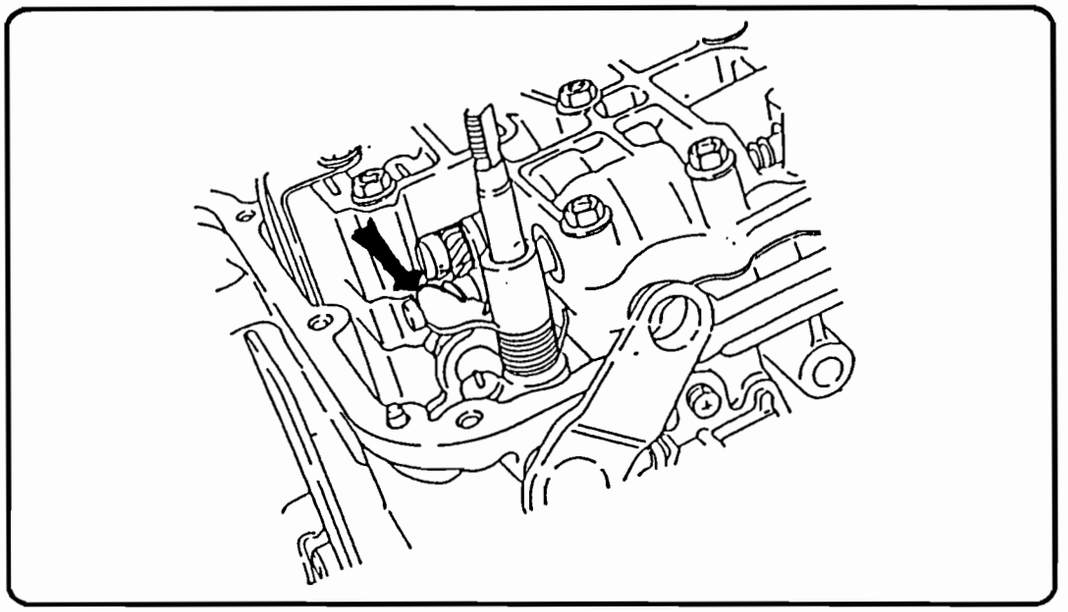


FIGURE 1

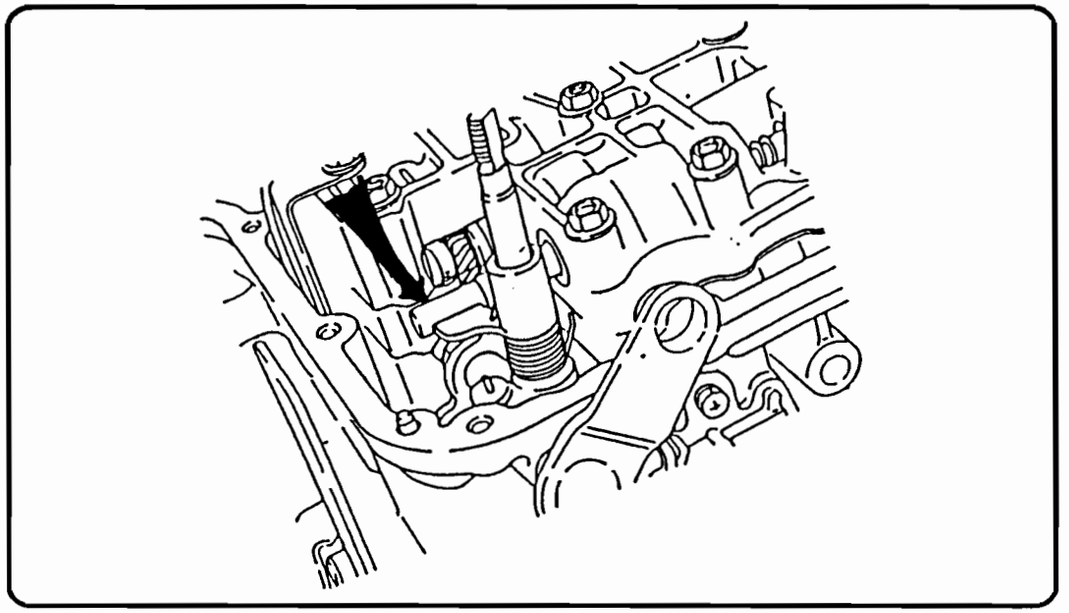


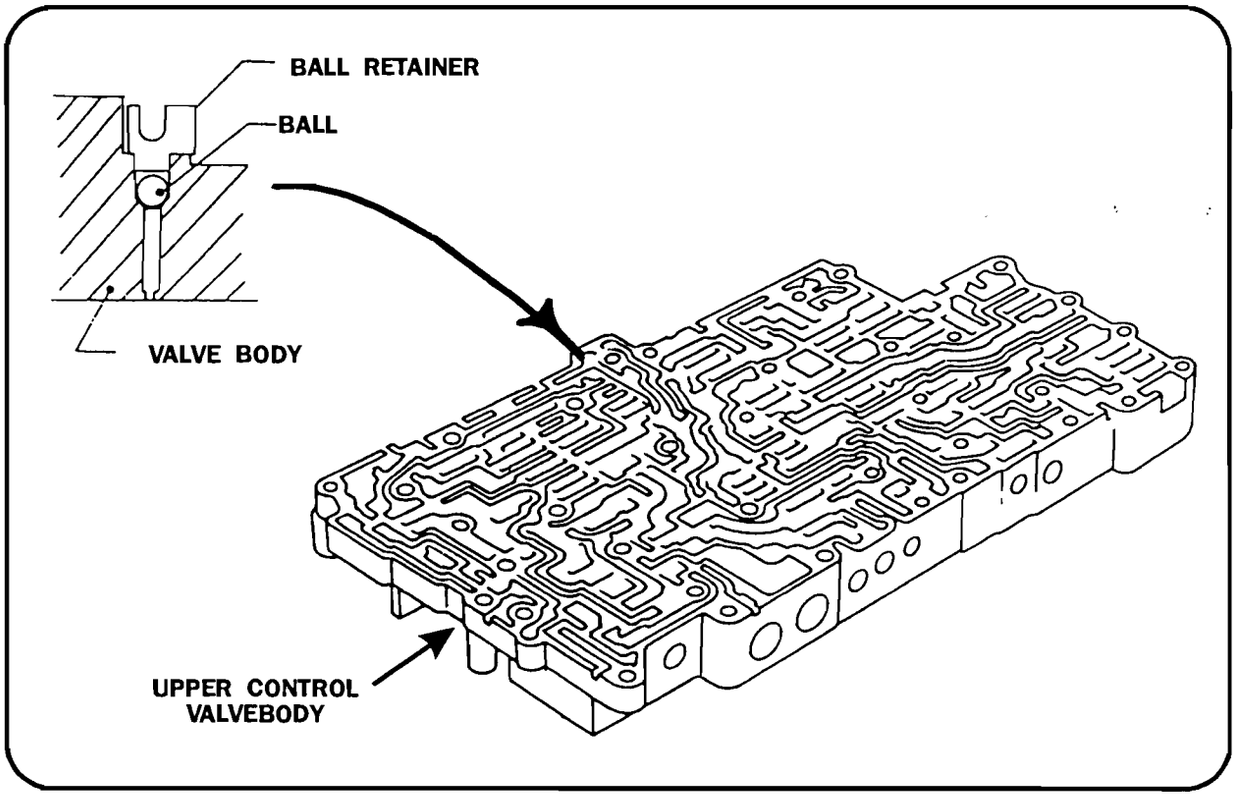
FIGURE 2

NISSAN RL4F02A

COMPLAINT: NO FORWARD MOVEMENT.

CAUSE: THE CAUSE MAY BE THE CHECKBALL AND RETAINER ARE OFF LOCATION OR LEFT OUT.

CORRECTION: INSTALL THE CHECKBALL AND RETAINER IN THE PROPER LOCATION.



RL4F02A

COMPLAINT: INTERMITANT 4-3 DOWNSHIFT UNDER CRUISE CONDITION.

CAUSE: SOME OF THE CAUSES MAY BE: A WORN GOVERNOR PIN (FIGURE 1), DEFECTIVE OVERDRIVE SOLENOID, DEFECTIVE COOLANT TEMPERATURE SENSOR OR POOR CONNECTIONS (FIGURE 2).

CORRECTION: DISCONNECT THE O.D. SOLENOID CONNECTOR AT THE TRANSMISSION. IF THE PROBLEM IS CORRECTED THEN CHECK:

1. THE COOLANT TEMPERATURE SENSOR AND CONNECTOR.
2. THE GOVERNOR PIN FOR ABNORMAL WEAR.
3. THE O.D. SOLENOID.

REPLACE ANY WORN OR DAMAGED PARTS AS NECESSARY.

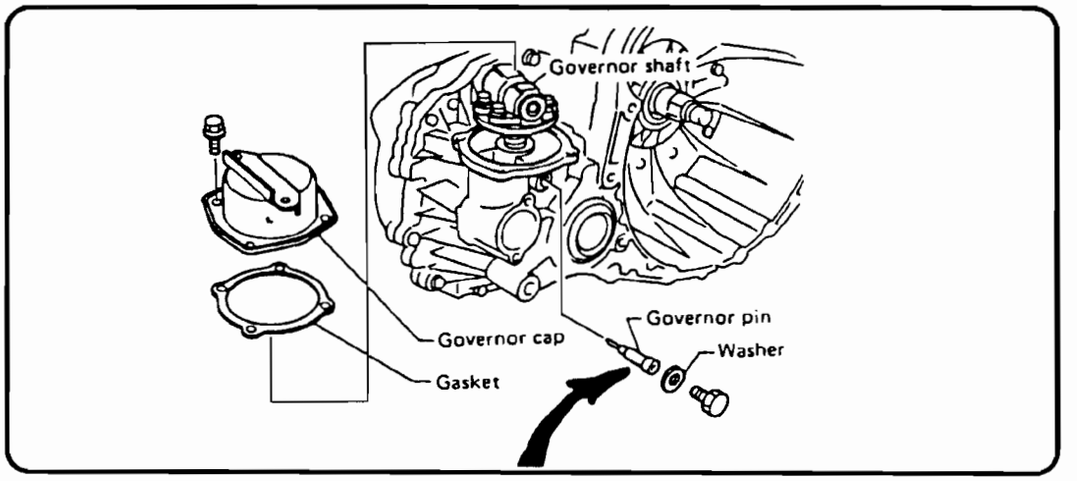


FIGURE 1

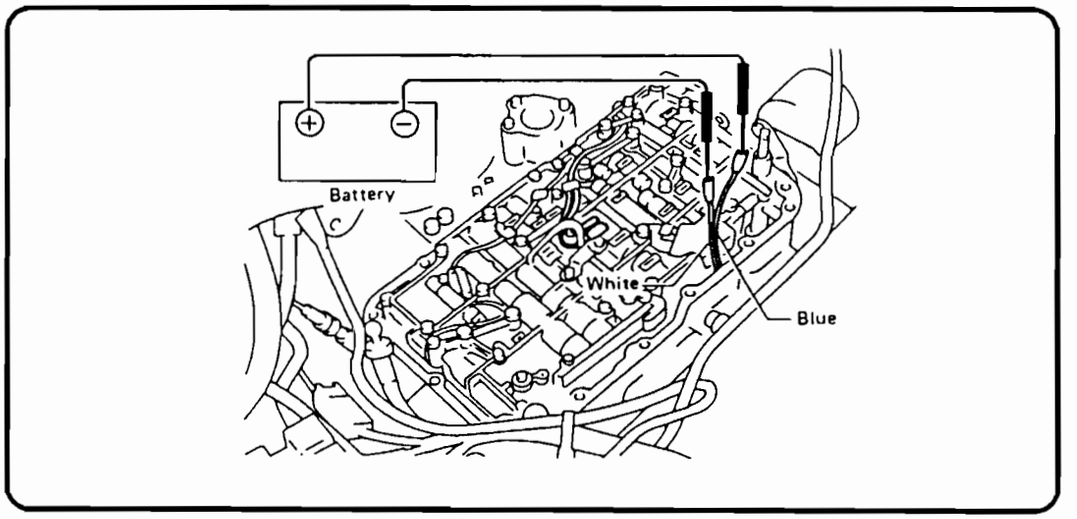
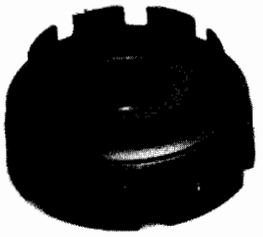
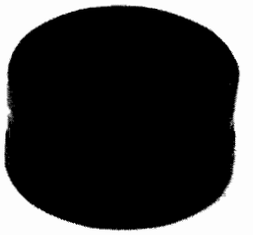
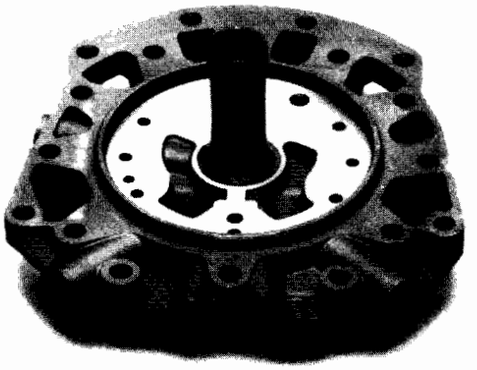


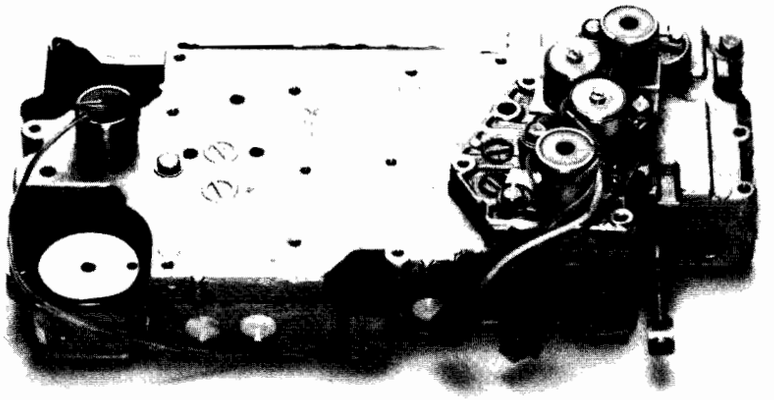
FIGURE 2

WE DO HARD PARTS RIGHT!









IN FACT, HTP HAS THE MOST COMPLETE SUPPLY OF THOSE HARD TO FIND FOREIGN & DOMESTIC HARD PARTS.

LOCATING THE PART IS ONLY HALF THE STRUGGLE. GETTING IT RIGHT, AND TO YOUR SHOP IS THE OTHER HALF.

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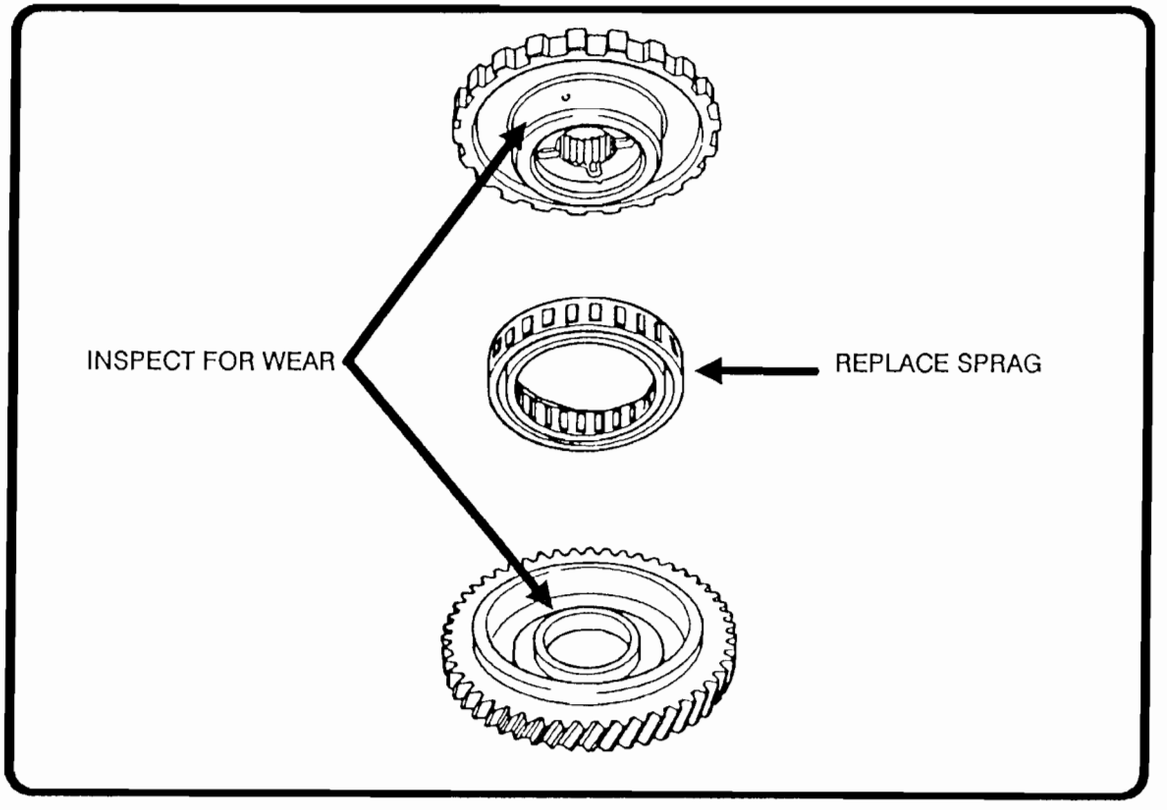
800-374-3487

HONDA - ACURA 4 SPEED
SQUAWKING NOISE GOING INTO 1st

COMPLAINT: Screach or squawking noise going into 1st gear when hot.

CAUSE: Sprag is slipping.

CORRECTION: Replace sprag on every rebuild, also check inner and outer races for any wear and replace if necessary.

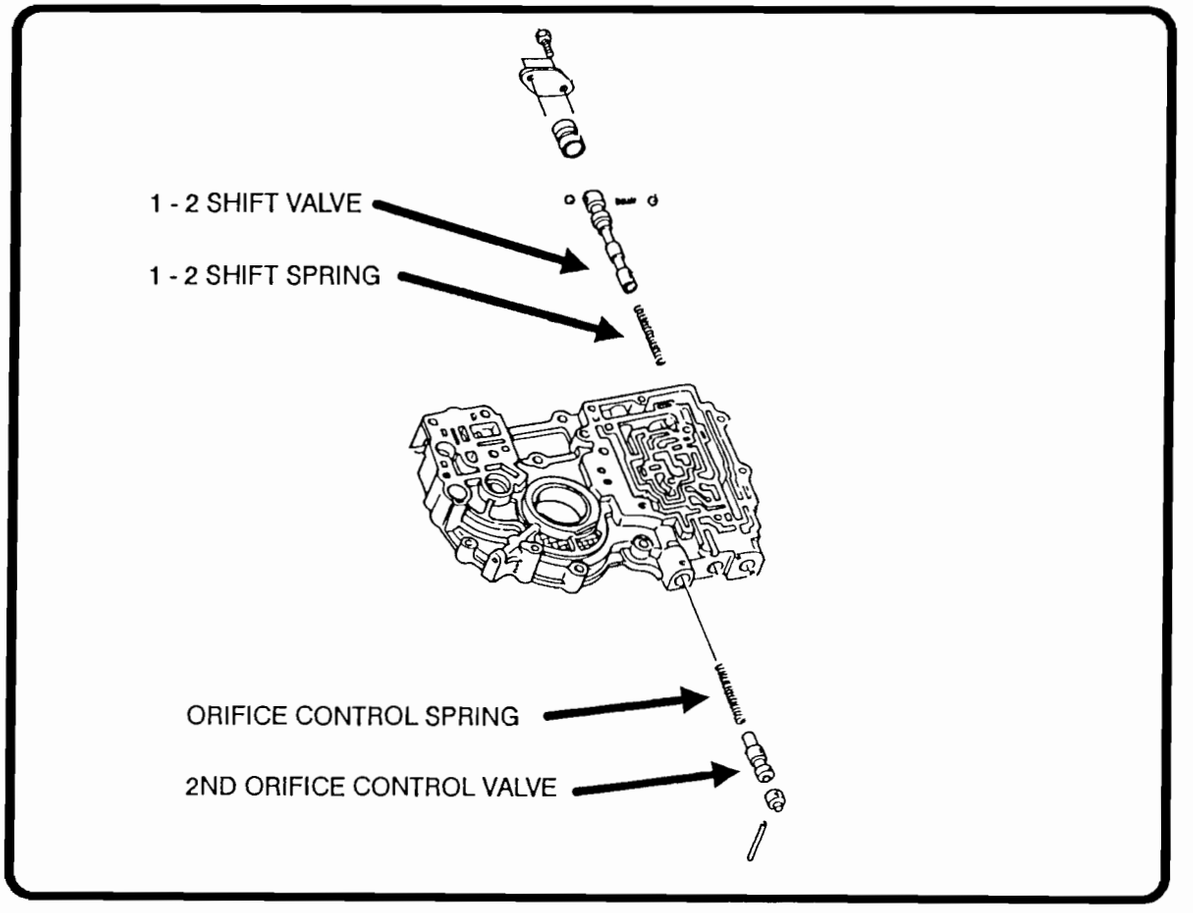


HONDA - ACURA 4 SPEED (HYDRAULIC)
LATE 1 - 2 SHIFT

COMPLAINT: Late 1 - 2 shift.

CAUSE: The second gear orifice control valve spring installed improperly into the 1 - 2 shift valve train.

CORRECTION: Remove the springs and reinstall them into their proper locations.

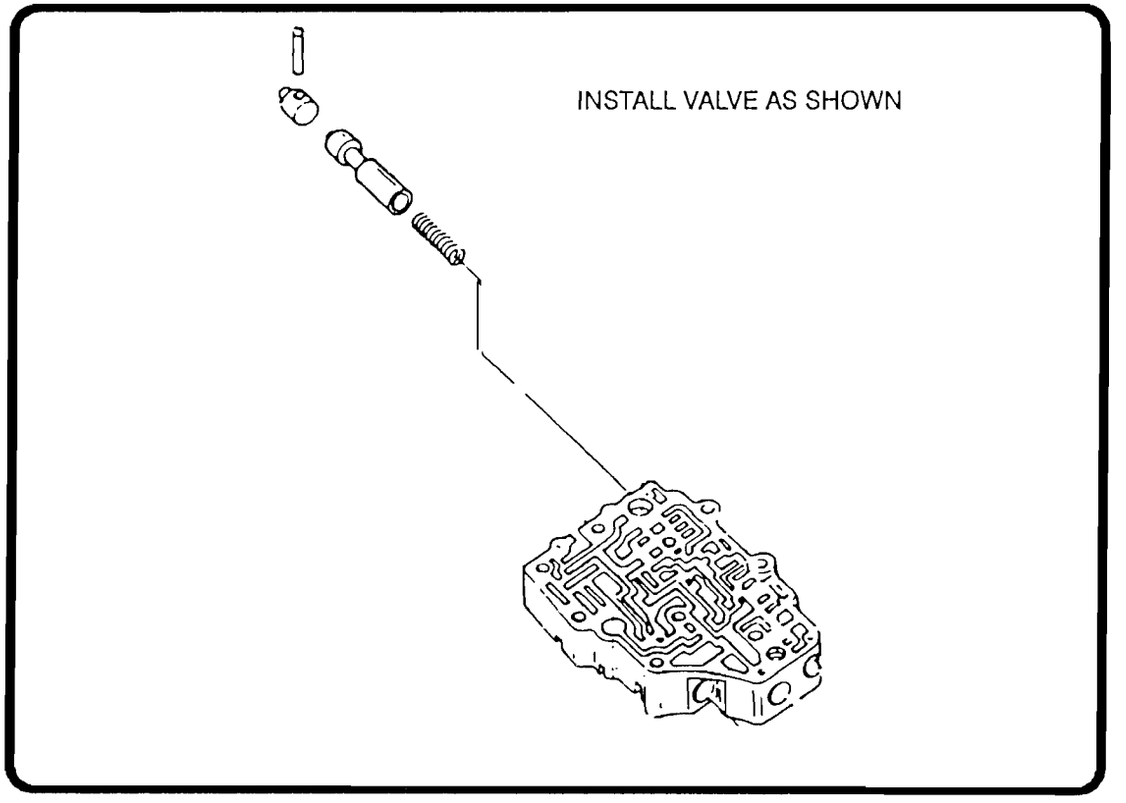


HONDA - ACURA 4 SPEED (HYDRAULIC)
NO UPSHIFT

COMPLAINT: No upshifts (T.V. and governor pressure ok).

CAUSE: Misassembly of the CPV valve and spring.

CORRECTION: Remove and install correctly.

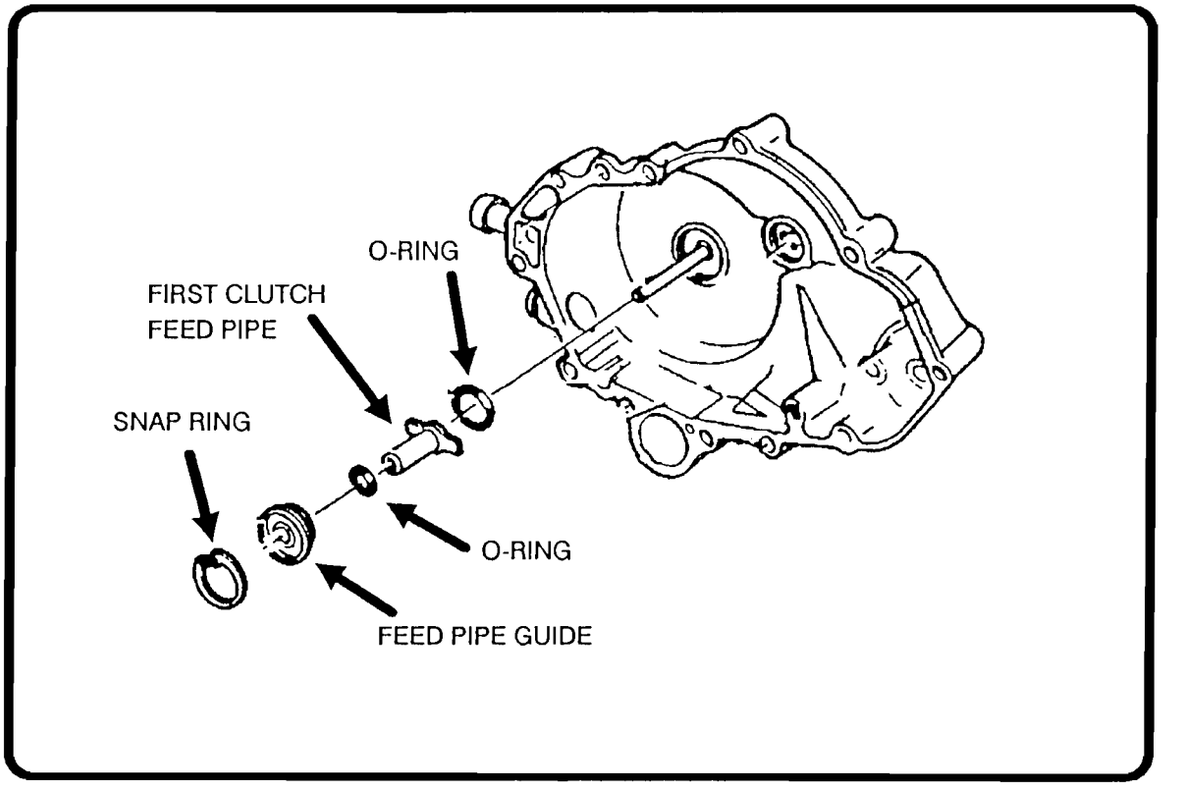


HONDA - ACURA 4 SPEED
SLIPPING OR NO FIRST GEAR

COMPLAINT: Slipping or no 1st gear.

CAUSE: Snap ring is not fully seated causing a sever leak at the first clutch feed pipe.

CORRECTION: Replace the o-ring and reinstall the snap ring pressing down all the way around the snap ring to make sure it is properly seated.

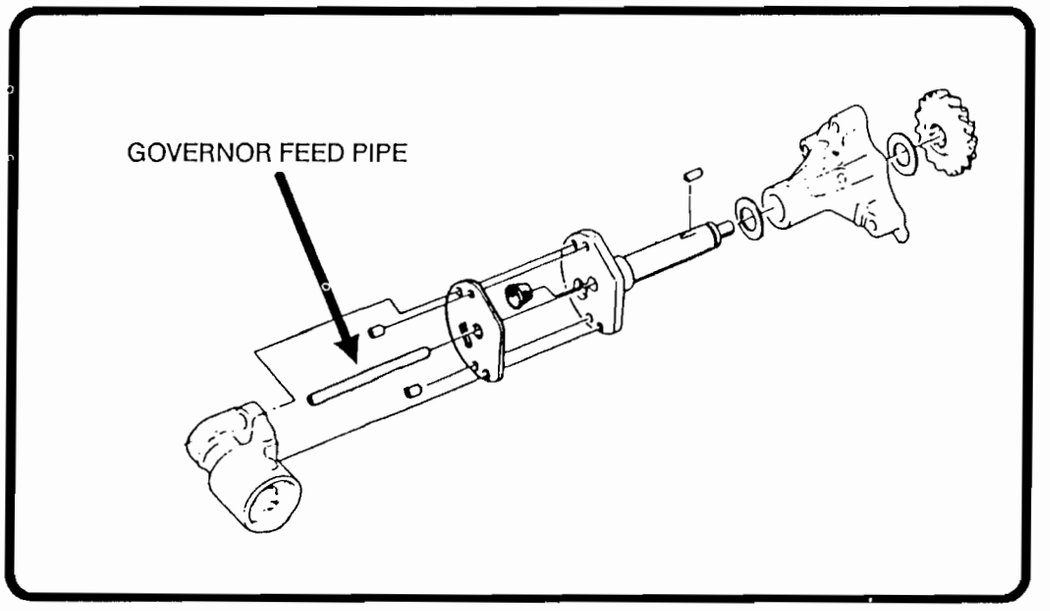


HONDA - ACURA 4 SPEED (HYDRAULIC)
NO REVERSE

COMPLAINT: No reverse.

CAUSE: Missing governor feed pipe.

CORRECTION: Replace feed pipe.



HONDA - ACURA 4 SPEED AUTOMATIC
TICKING OR KNOCKING NOISE

COMPLAINT: Ticking or knocking noise after overhaul.

CAUSE: Stake marks on countershaft locknut hitting 1st clutch drum (see figure 1).

CORRECTION: Always use new nuts, torque and carefully stake nut and check for nut contact on 1st drum. If necessary grind the nut on area that contacts the drum (see figure 2).

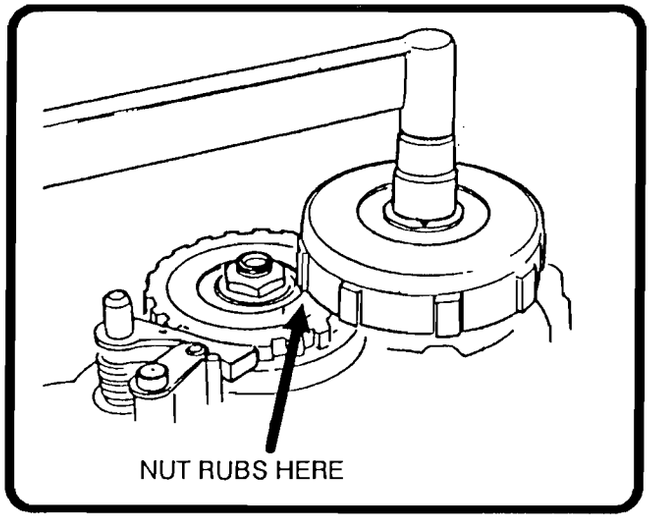


Figure 1

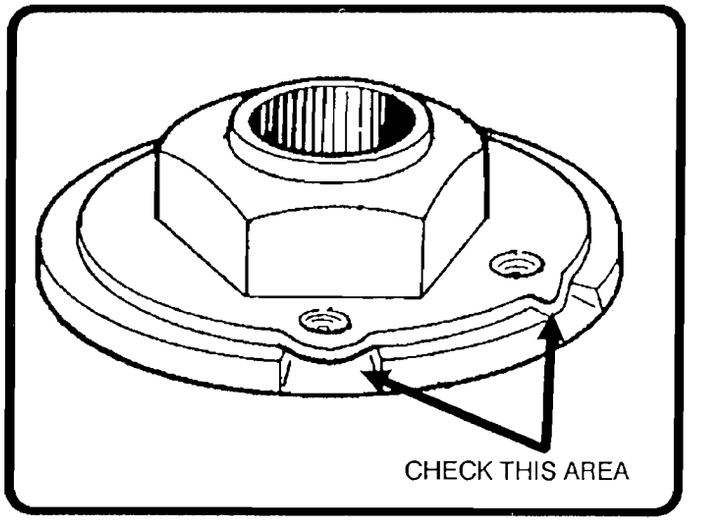


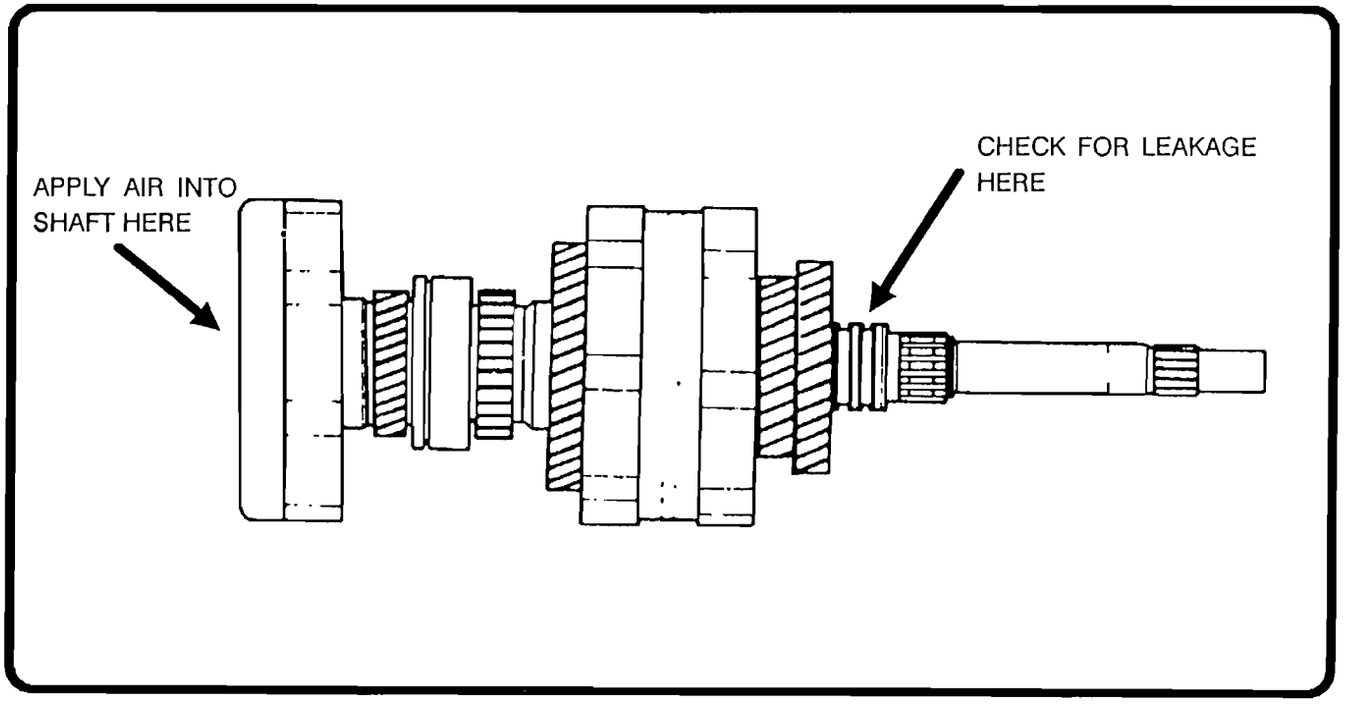
Figure 2

HONDA - ACURA 4 SPEED
3 - 4 HUNTING CONDITION

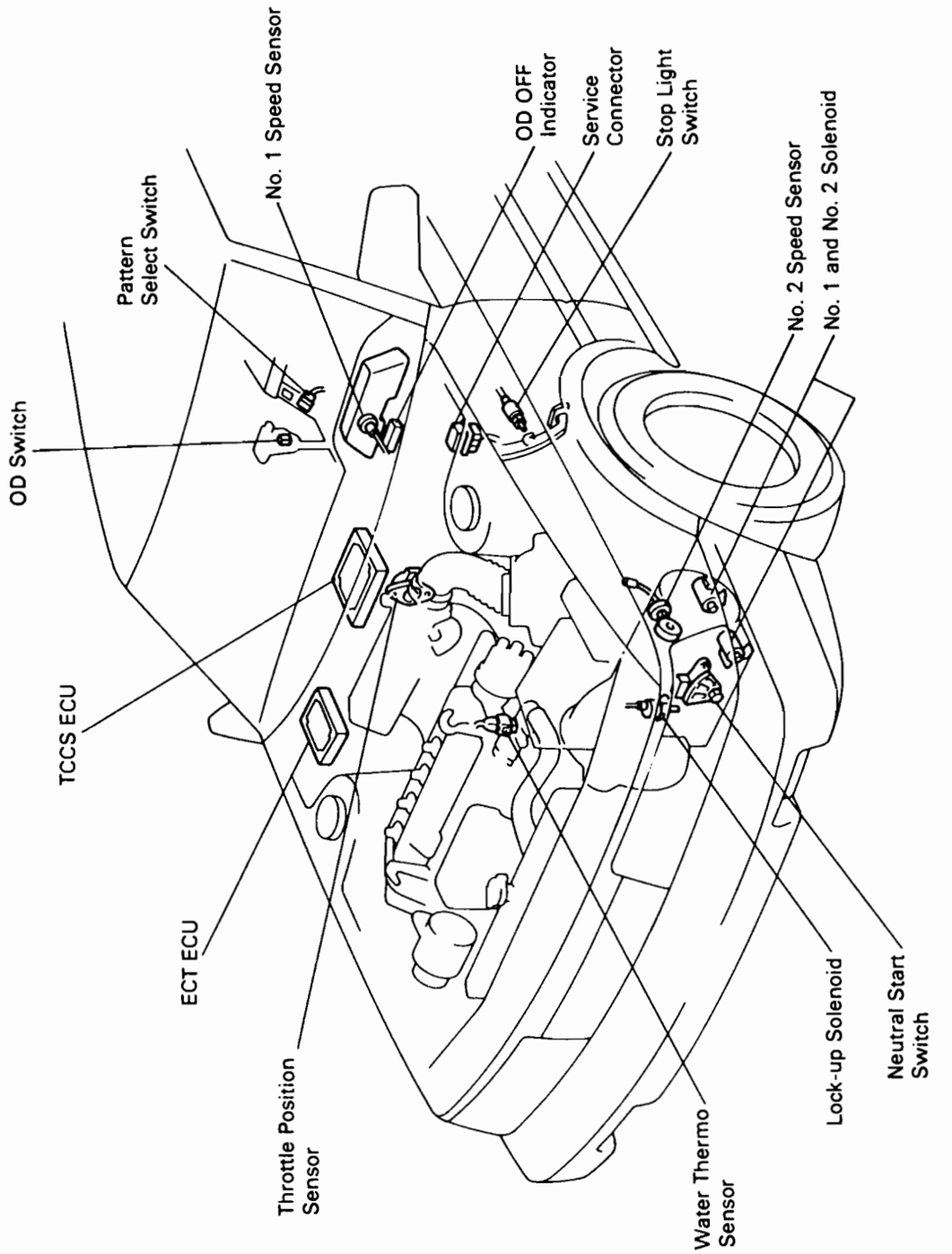
COMPLAINT: Hunting, or shuttle shift in 4th.

CAUSE: Cracked 2 - 4 drum.

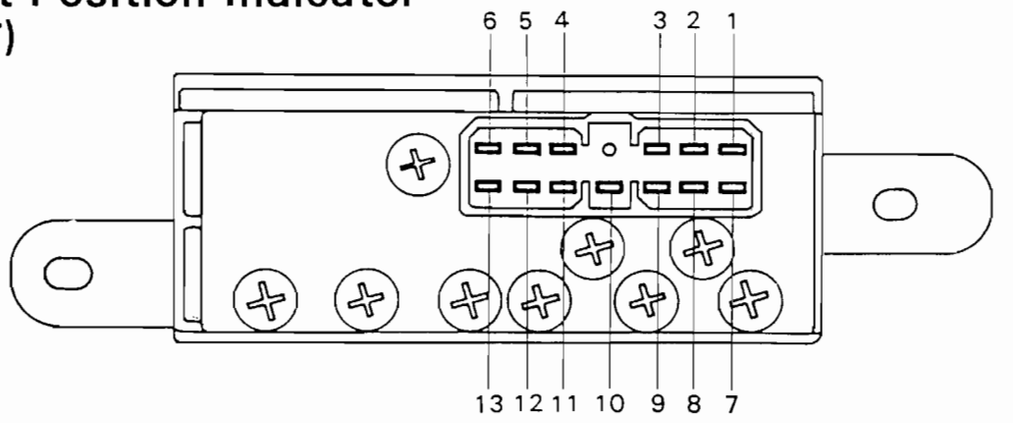
CORRECTION: Check for cracked 2 - 4 drum with mainshaft assembled by blowing air into the shaft and check for air leakage at the second clutch ring area.



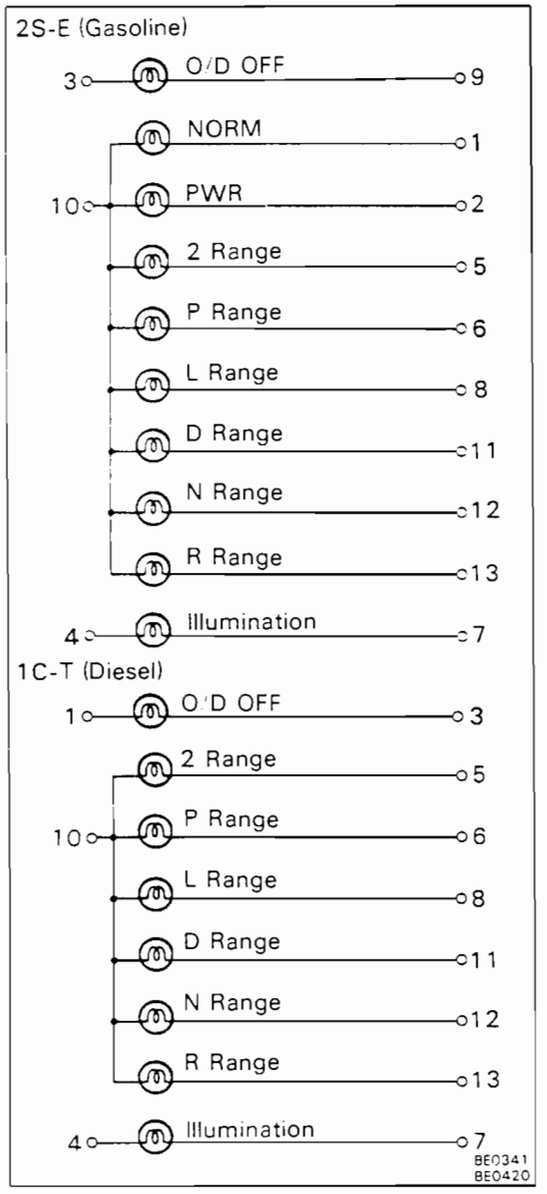
ELECTRONIC CONTROL COMPONENTS



Shift Position Indicator (A/T)



BE0429



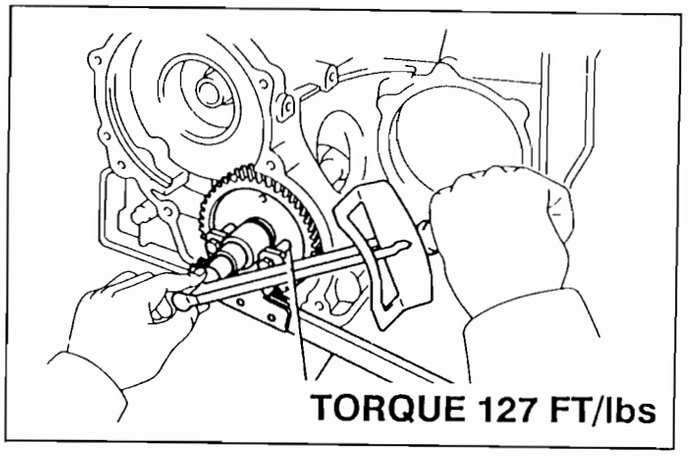
SHIFT POSITION INDICATOR CIRCUIT

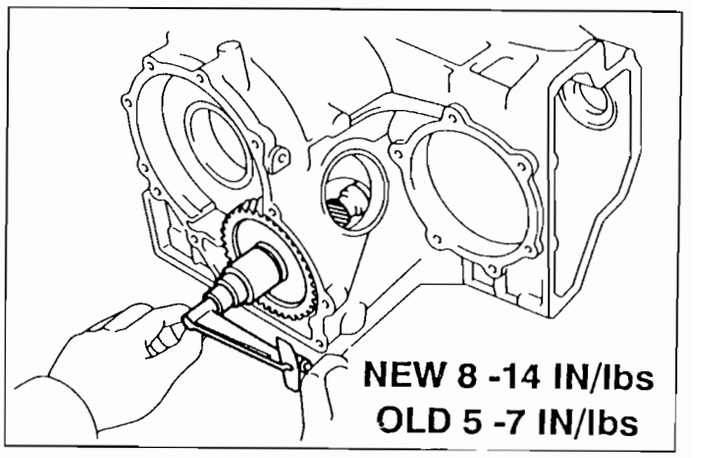
2S-E (Gasoline)

No.	Wiring Connector Side
1	Pattern Select Switch
2	Pattern Select Switch
3	GAUGE Fuse
4	Rheostat Terminal 2 (Analog) or Terminal 3 (Digital)
5	Neutral Start Switch
6	Neutral Start Switch
7	TAIL Fuse
8	Neutral Start Switch
9	OD Switch
10	Ground
11	Neutral Start Switch
12	Neutral Start Switch
13	Neutral Start Switch

1C-T (Diesel)

No.	Wiring Connector Side
1	OD Switch
3	GAUGE Fuse
4	Rheostat Terminal 2
5	Neutral Start Switch
6	Neutral Start Switch
7	TAIL Fuse
8	Neutral Start Switch
10	Rheostat terminal 2
11	Neutral Start Switch
12	Neutral Start Switch
13	Neutral Start Switch





PART NUMBERS

TURBINE SHAFT SEALING RINGS	35712-32010
DIRECT DRUM SEALING RINGS	35617-32010
OVERDRIVE SHAFT SEALING RINGS	35748-32010
SERVO SEALING RINGS	35815-32010
A131L & A140E B2 SEAL	35159-32011
A240E B2 SEAL	35159-20010
A340H B2 SEAL	25159-30010
MANUAL SHAFT PIN RETAINER (COLLAR)	90560-20006
A140E CRUSH SLEEVE	41231-32010
A131L CRUSH SLEEVE	41231-20020
INTERMEDIATE SHAFT NUT A-140E	90179-20004
INTERMEDIATE SHAFT NUT A-131L	90179-18001
GOVERNOR SLEEVE	35145-32011
LUBE PLUGS FOR O/D PLANET	90334-03001

TOYOTA A-140

COMPLAINT:
1. SOFT/SLIDE OR NO 1-2 SHIFT.
2. HARSH 4-3 COAST DOWN SHIFT.

CAUSE:
1. THE 1-2 SHIFT PROBLEM MAY BE CAUSED BY A CROSS LEAK BETWEEN THE VALVE BODY AND CASE (FIGURE 1).
2. THE HARSH DOWN SHIFT MAY BE CAUSED BY A CUT OVERDRIVE ACUMULATOR PISTON SEAL CAUSING THE O.D. PISTON TO BIND UP (FIGURE 2)

CORRECTION:
1. INSTALL THE TUBE TYPE B-2 SEAL PART NUMBER 35159-32001
2. REPLACE THE SEAL ON THE O.D. ACCUMULATOR PISTON

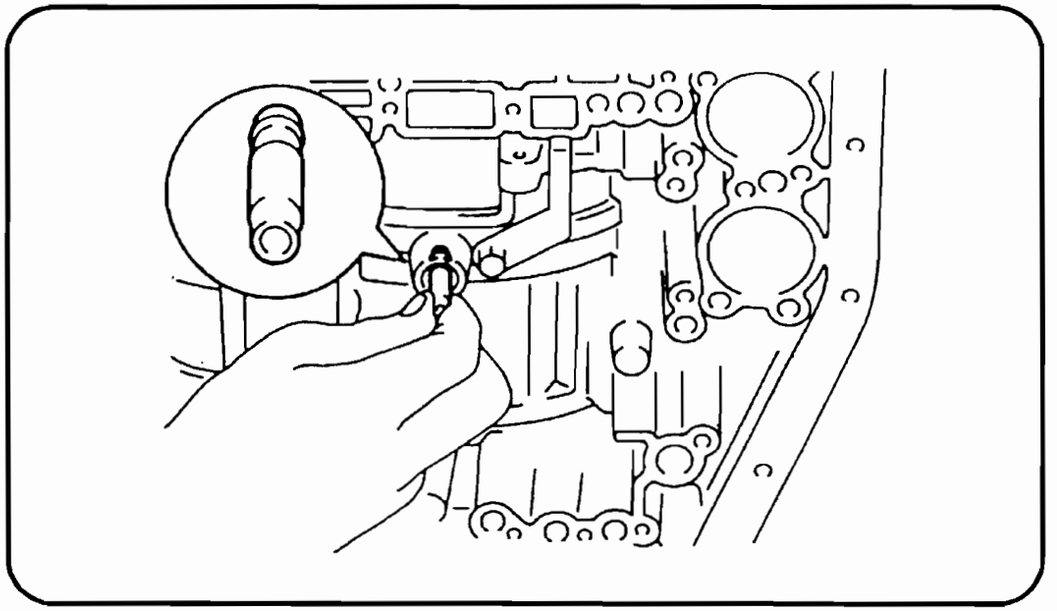


FIGURE 1

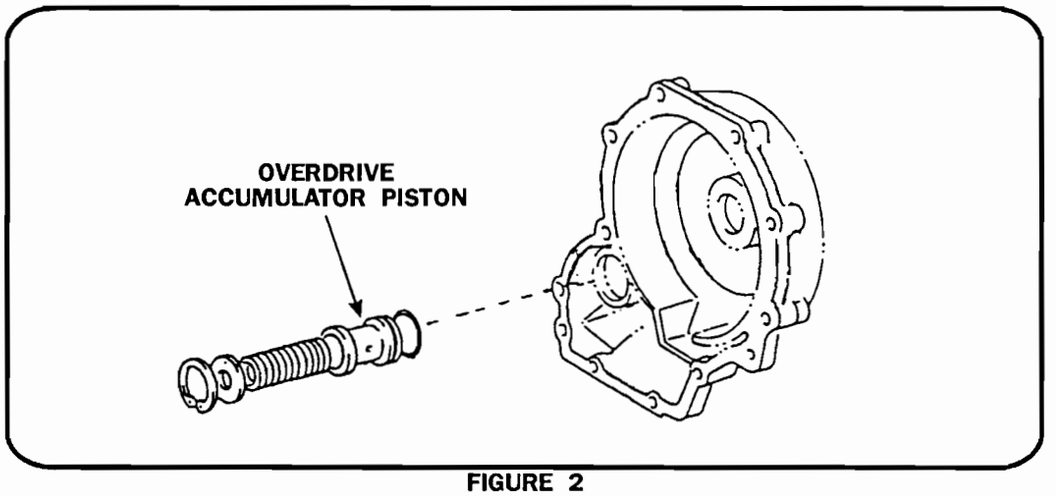


FIGURE 2

BORG WARNER 65/66

COMPLAINT: AFTER OVERHAUL WHEN THE INTERMEDIATE BAND HAS BEEN REPLACED AND A 3-2 FLARE IS EXPERIENCED OVER SPEEDS OF 48 MPH.

CAUSE: THE INTERMEDIATE BAND IS SLIPPING.

CORRECTION: REPLACE THE INTERMEDIATE SERVO SPRING (FIGURE 1) WITH A SPRING FROM A THM 400 LOW REVERSE SERVO. THEN SHIM OR INSTALL A HEAVIER SPRING (FIGURE 2) ON THE SERVO ORIFICE CONTROL VALVE.

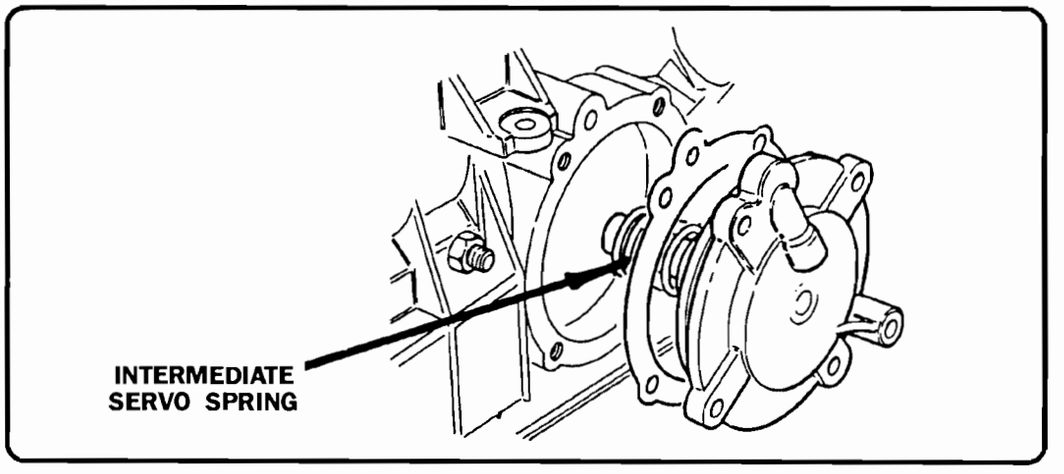


FIGURE 1

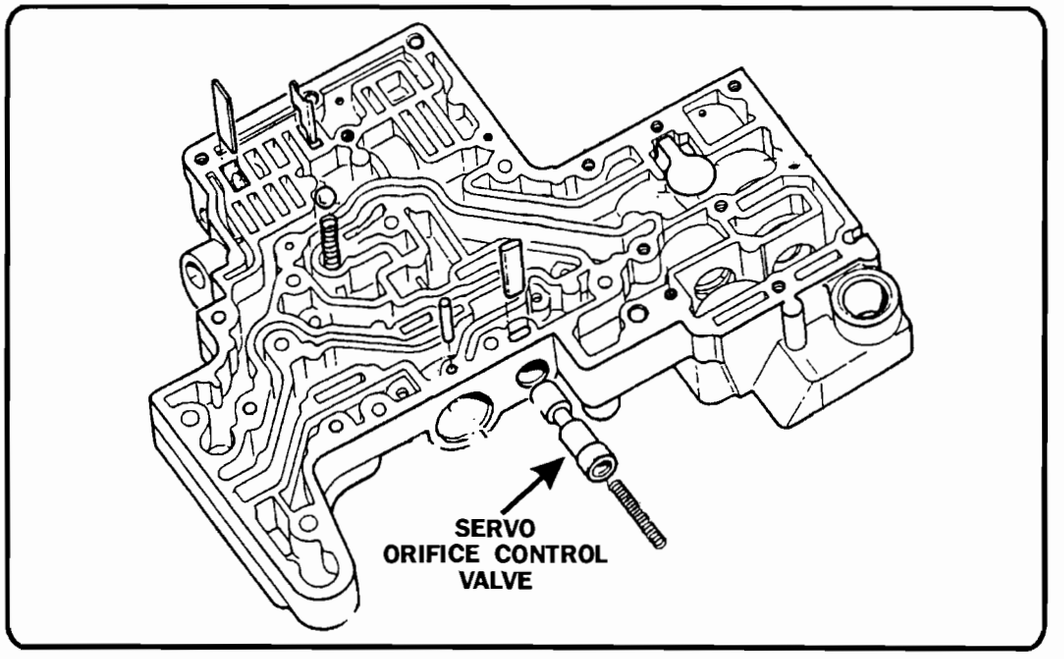


FIGURE 2

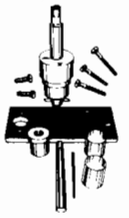
Anyone can fix a transmission, *not* fixing it again requires. . .

Southeastools
TRANSMISSION REBUILDER TOOLS

CHRYSLER A404, A413, A470, A670

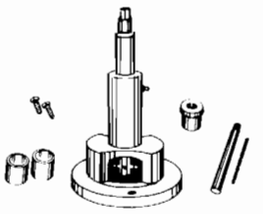
T-1495 Transfer Shaft Case-End Sleeving Tool Kit

CHRYSLER IMPORTS, HYUNDAI, MITSUBISHI



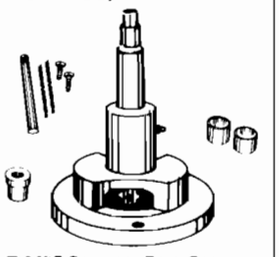
T-1395 Governor Bore Case Sleeving Tool Kit

FORD FIOD-AOD



T-1695 Governor Bore Case Sleeving Tool Kit REF: T-1695

FORD C3, A4LD

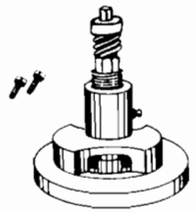


T-0495 Governor Bore Case Sleeving Tool Kit REF: T-0495

FORD C3, A4LD

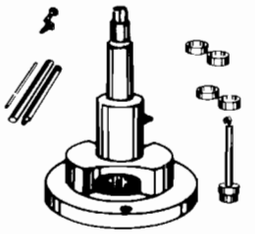
TA-115 Converter Housing Pump-Seal Bushing Sleeving Tool Kit

FORD C6



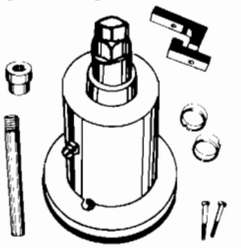
TA-120 C6 Output Shaft Rear Washer Case Resurfacing Tool Kit

FORD C6



TA-118 C6 Rear Case Bushings Sleeving Tool Kit

FORD AXOD

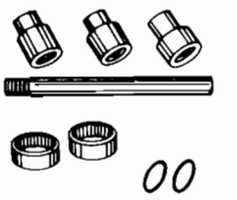


T-2495 Valve Body Cover Pump Driveshaft-Bore Repair Tool

FORD UNIVERSAL SPEEDOMETER GEAR COUNTER

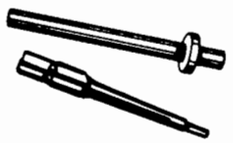
TA-201

FORD AXOD



TA-76949 Oil Pump Needle Bearing & Seal Tool

GM 250, C, 350, C, 375, 400, 700-R4



TG-112 Governor Bore Case Sleeving Tool Kit

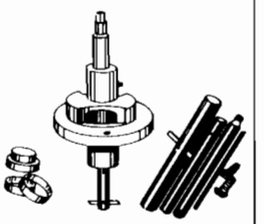
GM 200/325/700

TG-111 Output Shaft Adjustment

GM 200/700 SERIES

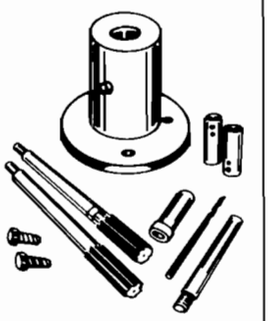
TG-117 Pump Drain-Back Fixit Tool Kit

GM-400, 375, 475



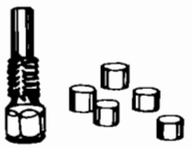
TG-123 Rear Case Sleeving and Inner Seat Fix Tool Kit

ALLISON AT540,543,545; MT640,643,644,650,653, 654; HT740,750,754



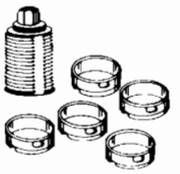
TG-119 Governor Bore Case Sleeving Tool Kit

GM-350



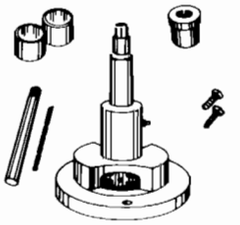
TG-350 Output Shaft Bushing Removal Tool Kit

GM-400



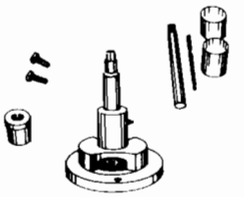
TG-400 Output Shaft Bushing Removal Tool Kit

GM-180, 180C



T-1195 Governor Bore Case Sleeving Tool Kit

TOYOTA, ISUZU, VOLVO



T-2195 Governor Bore Case Sleeving Tool Kit REF: T-2195

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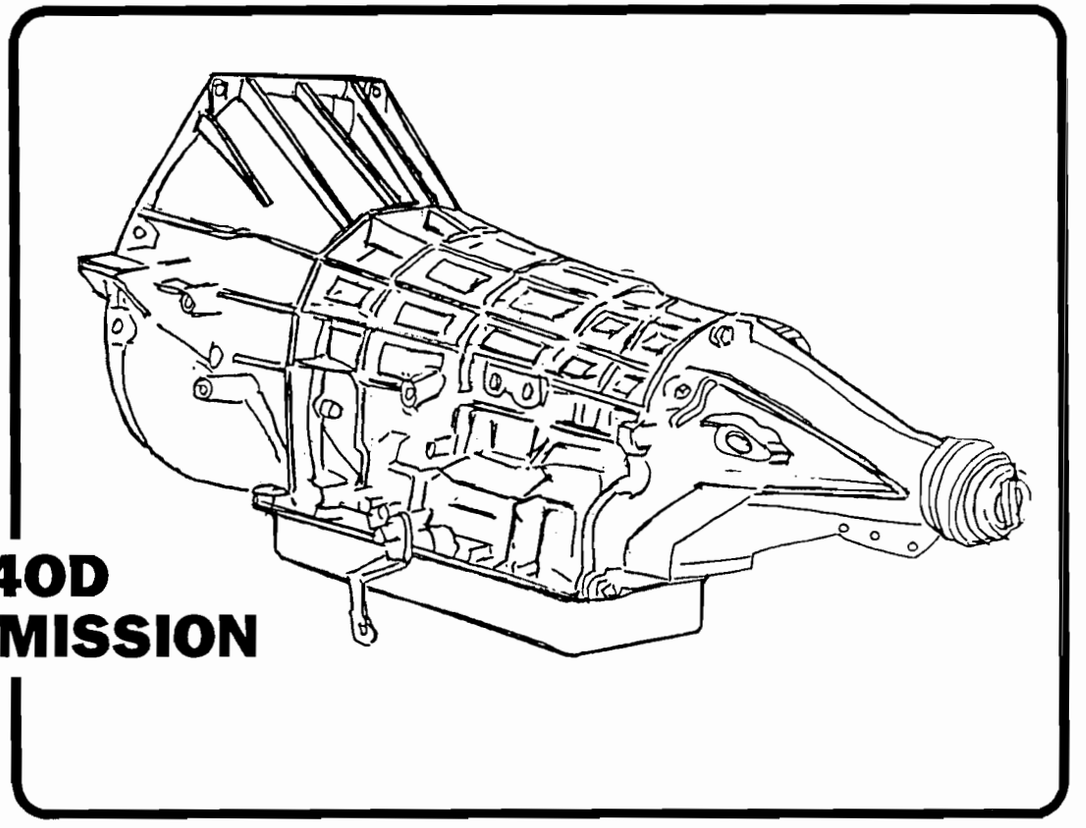


E4OD TRANSMISSION

SOLENOID OPERATION

SOLENOID APPLICATION CHART

GEAR SELECTOR POSITION	ECA COMMANDED GEAR	SHIFT CONTROL			
		SOLENOID 1	SOLENOID 2	CONVERTER CLUTCH CONTROL SOLENOID 3	COAST CLUTCH SOLENOID 4
PARK	FIRST	ON	OFF	OFF	OFF
REVERSE	FIRST	ON	OFF	OFF	OFF
NEUTRAL	FIRST	ON	OFF	OFF	OFF
OD	FIRST	ON	OFF	*	OFF
OD	SECOND	ON	ON	*	OFF
OD	THIRD	OFF	ON	*	OFF
OD	FOURTH	OFF	OFF	*	OFF
OD CANCEL	FIRST THROUGH THIRD GEAR ONLY, S1, S2 AND CCC SAME AS OD, CCS ALWAYS ON.				
MANUAL 2	SECOND	OFF	OFF	*	ON
MANUAL 1	SECOND	OFF	OFF	OFF	ON
MANUAL 1	FIRST	ON	OFF	OFF	ON

*EEC-IV PROCESSOR CONTROLLED

GENERAL DESCRIPTION

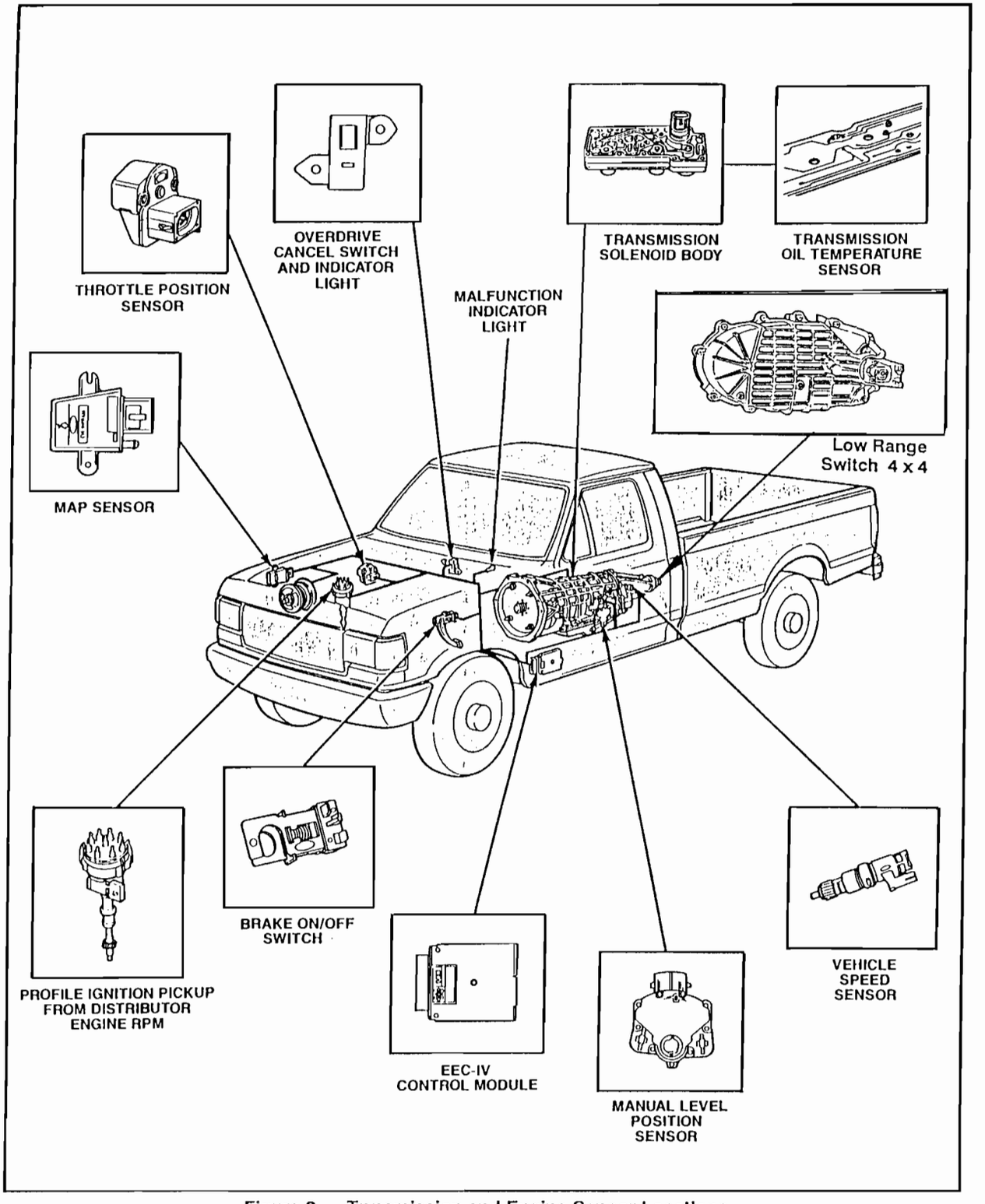


Figure 3 — Transmission and Engine Sensor Locations

GENERAL DESCRIPTION

ELECTRONIC CONTROL — DIESEL ENGINES

On vehicles equipped with diesel engines, the operation of the E4OD transmission is controlled by the Transmission Control System. The Transmission ECA controls the E4OD transmission in the same way the ECA does for gasoline engine-equipped vehicles. However, some of the input components used with the Transmission Control System are different from those used with the EEC-IV system (Fig. 7).

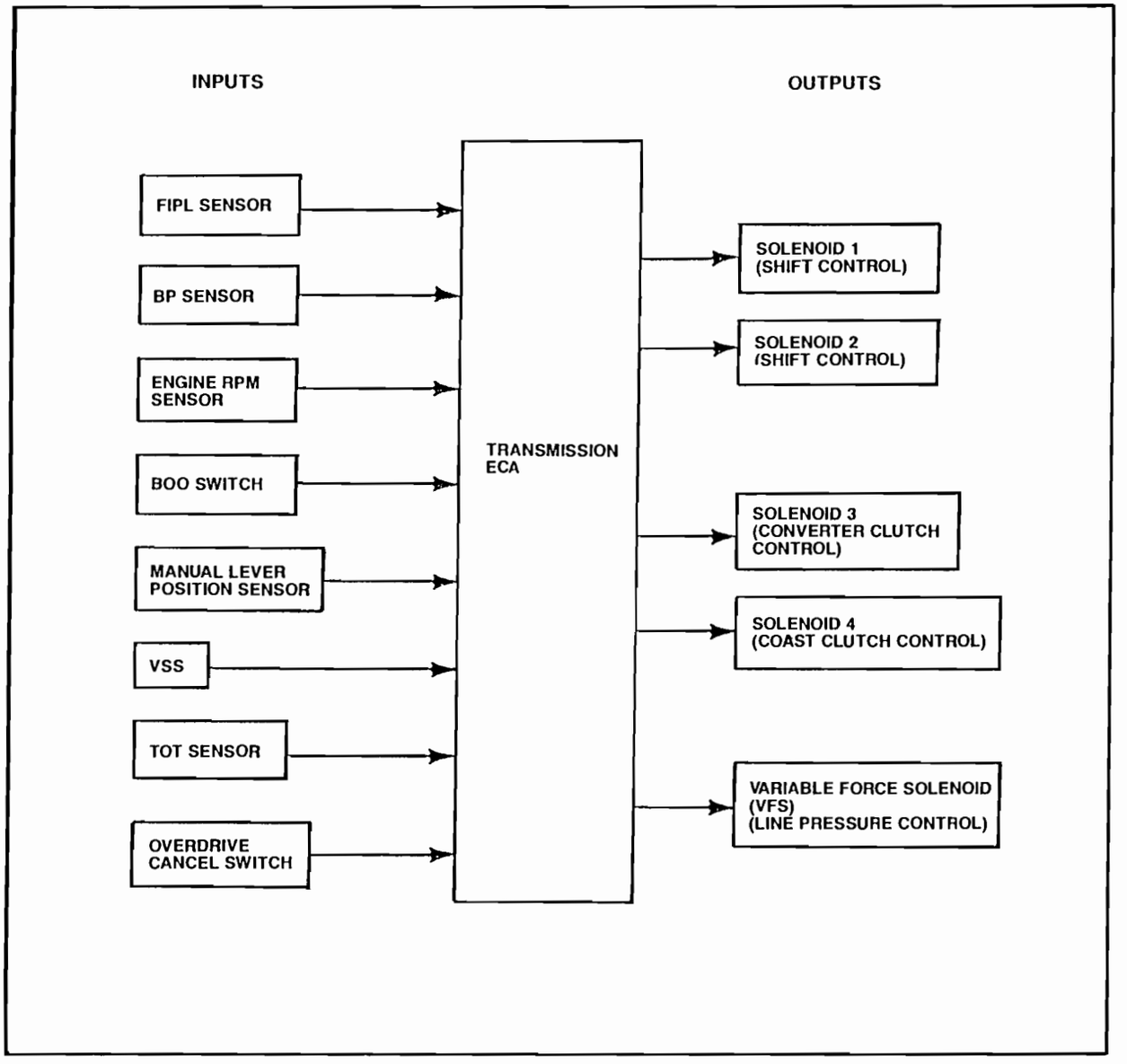


Figure 7 — Transmission Electronic Control (Transmission ECA) Inputs and Outputs

E4OD AUTOMATIC TRANSMISSION

NOTE: Any reference to Intermediate Brake Drum or Direct Clutch Cylinder are one and the same.

The E4OD transmission is a fully automatic, electronically controlled, four-speed unit with a locking torque converter. The main operating components of the E4OD transmission include a converter clutch, six multiple-disc friction clutches, one band, two sprag one-way clutches and a roller one-way clutch which provide for the desired function of three planetary gearsets.

Transmission gear selection in the Ⓓ range and converter clutch operation are controlled by the EEC-IV control system. Operating conditions are relayed to EEC-IV by various sensors throughout the vehicle. The EEC-IV compares these conditions with electronically stored parameters and logically determines the state that the transmission should operate at.

In the Ⓓ range, automatic operation of all four gears is possible. The overdrive cancel switch (OCS), located on the dash panel, disables overdrive operation and enables automatic operation through the first three gears.

Manual gear selection is available in the 1 and 2 range. Second gear is commanded when the gear selector is in the 2 range and when downshifted into the 1 range at speeds above approximately 56 Km/h (35 mph) (for diesel 48 Km/h [30 mph]). First gear is commanded in the 1 range at startups and when downshifted into 1 range below approximately 56 Km/h (35 mph) (for diesel 48 Km/h [30 mph]).

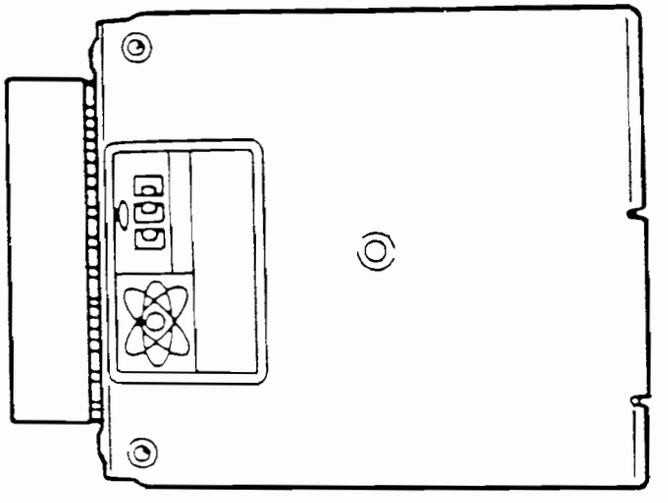
E4OD SENSORS AND ACTUATORS

The following pages provide a brief description of each of the sensors and actuators used with the E4OD transmission. The function of each of these components and the associated symptoms and fault codes are also given.

Processor - Electronic Control Assembly (ECA)

Description: On vehicles equipped with gasoline engines, the operation of the E4OD automatic transmission is controlled by the EEC-IV Electronic Control Assembly (ECA) processor. Many input sensors provide information to the processor. The processor then controls the actuators which affect transmission operation.

On vehicles equipped with diesel engines, the operation of the E4OD transmission is controlled by the transmission Electronic Control Assembly (ECA) processor. This processor controls the E4OD transmission in the same way as the processor for gasoline engines. However, some of the input sensors are different.



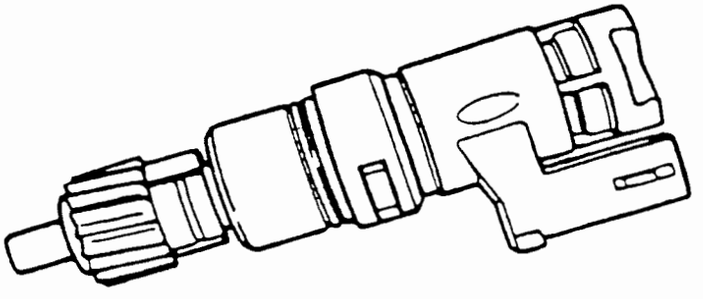
Vehicle Speed Sensor (VSS)

Description: The Vehicle Speed Sensor (VSS) is a variable reluctance sensor that sends a signal to the processor assembly. This VSS signal tells the processor assembly the vehicle speed in MPH.

Transmission function: Used as an input in determining shift scheduling and Electronic Pressure Control (EPC).

Symptoms: Harsh engagements, firm shift feel, abnormal shift schedule, unexpected downshifts may occur at closed throttle, converter clutch engages only at Wide-Open Throttle (WOT).

Fault Codes: 29 (two digit), 452 (three digit).



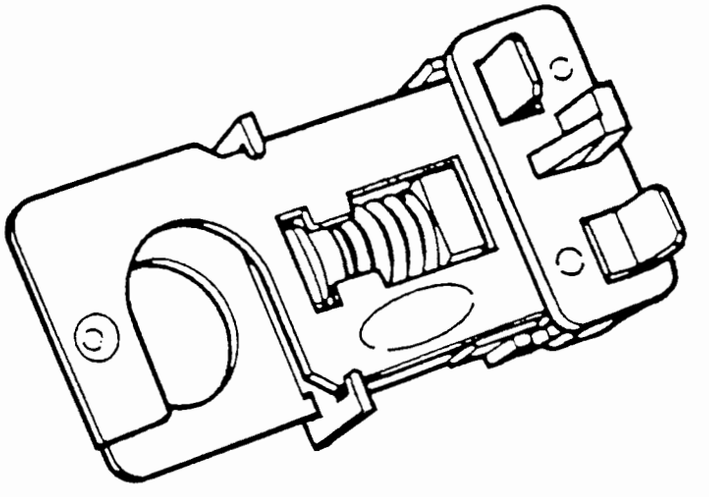
Brake On/Off (BOO) Switch

Description: The Brake On/Off (BOO) switch tells the processor assembly when the brakes are applied. The switch is closed when the brakes are applied and open when they are released.

Transmission function: Disengages converter clutch when brake is applied.

Symptoms: Failed on or not connected - Converter clutch will not engage at less than 1/3 throttle. Failed off - Converter clutch will not disengage when brake is applied.

Fault Codes: 74 (two digit), 536 (three digit).



Profile Ignition Pickup (PIP) Sensor – Gasoline Engines Revolutions Per Minute Sensor (RPMS) – Diesel Engines

Description: On gasoline engines, the Profile Ignition Pickup (PIP) signal is produced by a Hall-Effect device in the distributor. It tells the processor assembly the engine RPM and the crankshaft position.

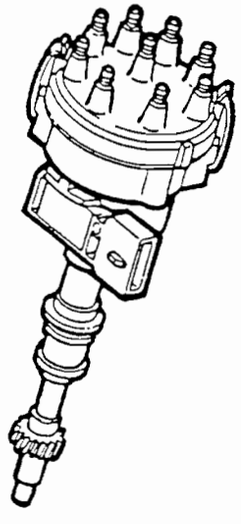
On diesel engines, the RPMS provides engine RPM to the processor assembly.

Transmission function: Used as an input in determining shift scheduling and EPC.

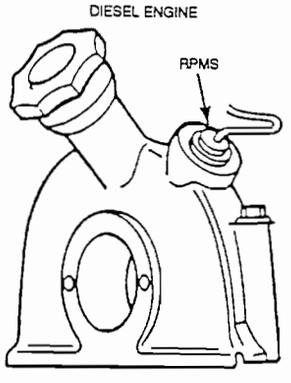
Symptoms: Diesel engines - Harsh engagements and shifts, late WOT upshifts, no converter engagement. Gasoline engines - PIP sensor failure, engine will not run.

Fault Codes: 14 (two digit), 211 (three digit).

GASOLINE ENGINE



DIESEL ENGINE



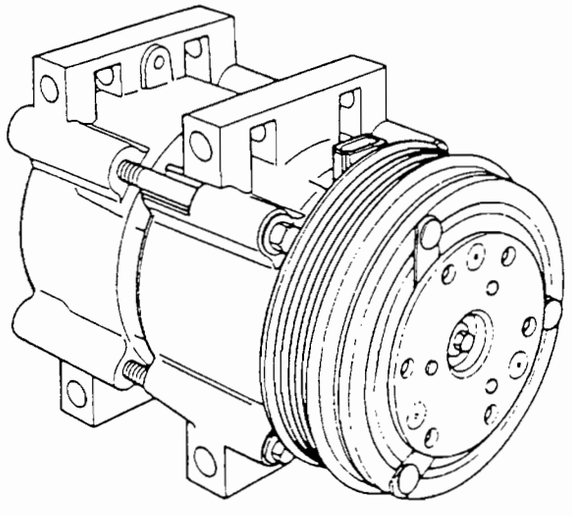
Air Conditioning Clutch (ACC)

Description: The Air Conditioning Clutch (ACC) is an electromagnetic clutch that is energized when the clutch cycling pressure switch closes. The switch is located on the suction accumulator-drier. The closing of the switch completes the circuit to the clutch and draws it into engagement with the compressor driveshaft.

Transmission function: Used as an input to determine EPC when the ACC is engaged to compensate for the additional load on the engine.

Symptoms: Failed on - EPC slightly low with A/C off. Failed off - EPC slightly high with A/C on.

Fault Codes: 67 (two digit), 539 (three digit).



Throttle Position Sensor (TPS) – Gasoline Engines
Fuel Injection Pump Lever (FIPL) Sensor – Diesel Engines

Description: On gasoline engines, the Throttle Position Sensor (TPS) is a potentiometer mounted on the throttle body. The TPS detects the position of the throttle plate and sends this information to the processor assembly as a voltage signal.

On diesel engines, the Fuel Injection Pump Lever (FIPL) sensor is a potentiometer attached to the fuel injection pump. It is operated by the throttle lever and sends a voltage signal to the processor assembly. The processor can then determine how much fuel is being delivered to the engine.

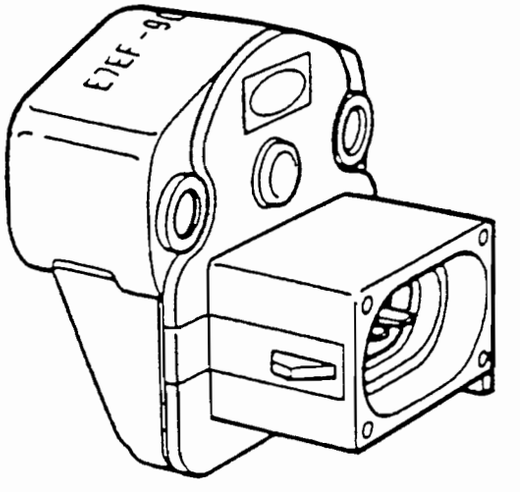
If a malfunction occurs in the FIPL/TPS circuit, the ECA processor will recognize that the FIPL/TPS sensor signal is out of specification. The processor will then operate the E4OD transmission in a high capacity mode to prevent transmission damage. This high capacity mode causes harsh upshifts and engagements, a signal or warning that transmission diagnosis is required.

The FIPL sensor is preset to a gage block specification. To check or re-adjust, refer to the appropriate year Engine/Emissions Diagnosis Manual.

Transmission function: Used as an input to determine shift scheduling and EPC.

Symptoms: Harsh engagements, firm shift feel, abnormal shift schedule, converter clutch does not engage.

Fault Codes: 23, 53, 63, 73 (two digit), 121, 122, 123, 167 (three digit).



Manifold Absolute Pressure (MAP) Sensor – Gasoline Engines Barometric Pressure (BP) Sensor – Diesel Engines

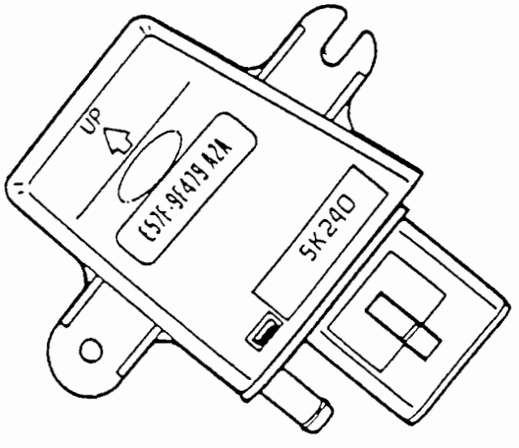
Description: On gasoline engines, the Manifold Absolute Pressure (MAP) sensor senses atmospheric pressure to produce an electrical signal. The frequency of this signal varies with intake manifold pressure. The MAP sensor sends this signal to the processor assembly. The processor assembly uses this signal to determine altitude. The processor assembly then adjusts the E4OD shift schedule for the altitude.

On diesel engines, the Barometric Pressure (BP) sensor operates similar to the MAP sensor. It measures barometric pressure instead of intake manifold pressure. The transmission processor assembly uses the signal from the BP sensor to determine the altitude at which the vehicle is operating. The processor assembly then adjusts the E4OD shift schedule for the altitude.

Transmission function: Used as an input to determine shift schedule and EPC for altitude operation.

Symptoms: Firm shift feel, late shifts at altitude.

Fault Codes: 22, 72 (two digit), 126, 128, 129 (three digit).



Low Range Switch 4 x 4

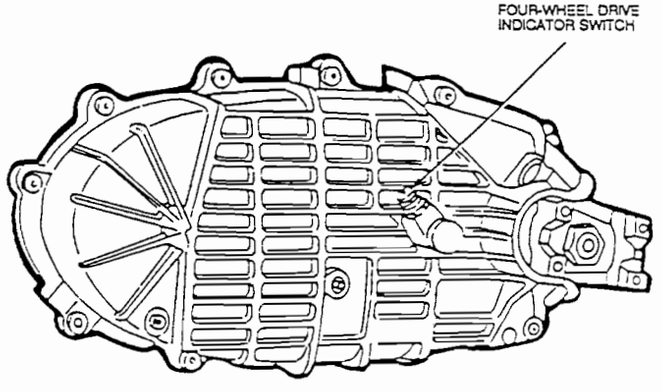
Description: The low range switch is located on the transfer case assembly. It provides an indication of when the 4x4 transfer case gear system is in the LOW range.

Transmission function: Modifies shift schedule for 4x4L transfer case gear ratio.

Symptoms: Failed on - Early shift schedule in 4x2 and 4x4H. Failed off - Shifts delayed in 4x4L.

NOTE: If the 4x4 low indicator light fuse is blown, the transmission will shift according to 4x4 low shift schedule regardless of transfer case position.

Fault Codes: 47 (two digit), 633 (three digit).



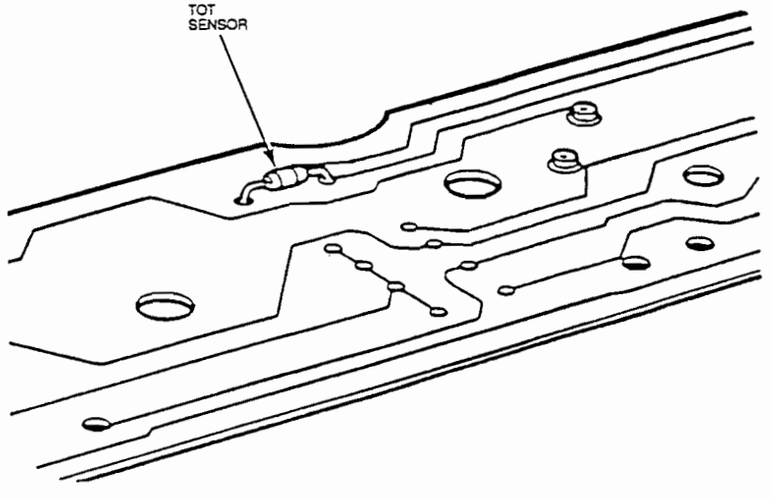
Transmission Operating Temperature (TOT) Sensor

Description: The Transmission Operating Temperature (TOT) sensor is located on the solenoid body in the transmission sump. It is a temperature-sensitive device called a thermistor. It sends a voltage signal to the processor assembly. The voltage signal varies with the transmission oil temperature. The processor assembly uses this signal to determine whether a cold start shift schedule is necessary. The cold start shift schedule lowers shift speeds to allow for the reduced performance of cold engine operation.

Transmission function: Used as an input to determine shift schedule and EPC for temperature effects.

Symptoms: Converter clutch and stabilized shift schedule happens too soon after cold start.

Fault Codes: 26, 56, 66 (two digits), 636, 637, 638 (three digit).



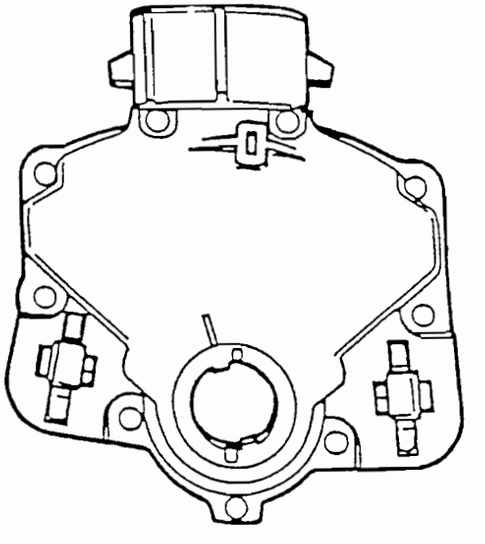
Manual Lever Position Sensor (MLPS)

Description: The Manual Lever Position Sensor (MLPS) sends a signal to the processor assembly. This indicates the position of the shift lever (P, R, N, Ⓓ, 2, or 1). The MLPS is located on the outside of the transmission at the manual lever.

Transmission function: Used as an input to determine desired gear and EPC.

Symptoms: Harsh engagements, firm shift feel.

Fault Codes: 67 (two digit), 634, 654 (three digit) (this code also displays if A/C is on during Self-Test or Self-Test run in NEUTRAL).



Overdrive Cancel Switch (OCS) and Overdrive Cancel Indicator Light (OCIL)

Description: The Overdrive Cancel Switch (OCS) is a momentary contact switch. When this switch is pressed, a signal is sent to the processor assembly. The processor then energizes the Overdrive Cancel Indicator Light (OCIL) and Solenoid 4, applying the coast clutch to provide engine braking and canceling fourth gear operation.

NOTE: The OCIL will also flash if the EPC circuit is shorted.

Sensor: Overdrive Cancel Switch (OCS).

Transmission function: Disable fourth gear operation.

Symptoms: No overdrive lockout when switch is cycled.

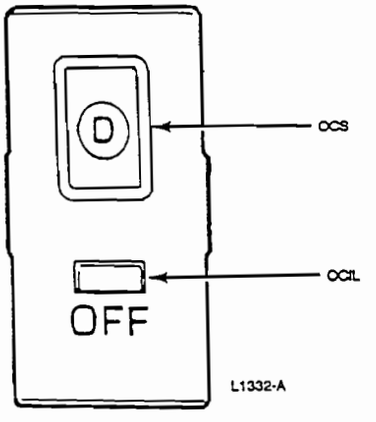
Fault Codes: 65 (two digit), 632 (three digit) (Key On Engine Running [KOER] test only).

Actuator: Overdrive Cancel Indicator Light (OCIL).

Transmission function: Indicates overdrive lockout mode (on) and EPC circuit failure (flashing).

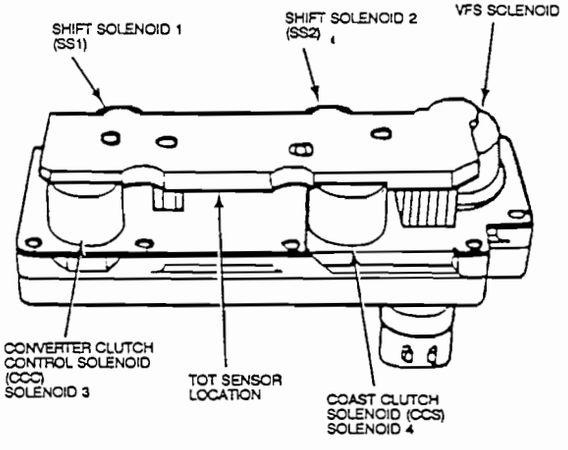
Symptoms: Failed on - Overdrive lockout mode always indicated, no flashing for EPC circuit failure. Failed off - Overdrive lockout mode never indicated, no flashing for EPC circuit failure.

Fault Codes: 97 (two digit), 631 (three digit).



Transmission Solenoid Body

Description: The ECA processor controls the E4OD transmission operation through four on/off solenoids and one Variable Force Solenoid (VFS). These solenoids and TOT sensor are housed in the transmission solenoid body assembly. Refer to the following information for the functions of these solenoids.



Variable Force Solenoid (VFS)

The Variable Force Solenoid (VFS) is an electro-hydraulic actuator combining a solenoid and a regulating valve. It supplies Electronic Pressure Control (EPC) which regulates transmission line pressure. This is done by producing resisting forces to the main regulator circuit and the line modulator circuit. These two pressures control the clutch application pressures.

Transmission function: Regulates EPC pressure.

Symptoms: Failed on - Gasoline engine: minimum EPC pressure (minimum transmission torque capacity). Limit engine torque (partial fuel shut-off, heavy misfire). Flashing OCIL.

Failed on - Diesel engine: cut power on ECA pin 35 (EPC power) to attain maximum EPC pressure, harsh engagement and shifts, flashing (OCIL).

Failed off - Gasoline and diesel engines: Maximum EPC pressure, harsh engagements and shifts.

Fault Codes: 98*, 99* (two digit) 998*, 624* (three digit).

*Output circuit check, generated only by electrical condition.

Shift Solenoids 1 and 2

Shift solenoids 1 and 2 provide gear selection of first through fourth gears by controlling the pressure to the three shift valves.

Shift Solenoid 1 (SS1)

Transmission function: Gear selection.

Symptoms: Improper gear selection depending on failure mode and manual lever position; refer to the Shift Solenoid Application Chart.

Fault Codes: 91*, 49**, 59**, 69** (two digit), 621*, 617**, 618**, 619**, (three digit).

Shift Solenoid 2 (SS2)

Transmission function: Gear selection.

Symptoms: Improper gear selection depending on failure mode and manual lever position; refer to the Shift Solenoid Application Chart.

Fault Codes: 92*, 49**, 69** (two digit), 622*, 617**, 619** (three digit).

*Output circuit check, generated only by electrical condition.

**May also be generated by other non-electronic related transmission hardware condition.

Solenoid 3 (CCC)

Solenoid 3 provides torque converter clutch control by shifting the converter clutch control valve to apply or release the torque converter clutch.

Transmission function: Engages converter clutch.

Symptoms: Failed on - Engine stalls in drive at idle low speeds with brake applied or manual 2. Failed off - Converter clutch never engages.

Fault Codes: 94*, 62** (two digit), 627*, 628** (three digit).

Solenoid 4 (CCS)

Solenoid 4 provides coast clutch control by shifting the coast clutch shift valve. Solenoid 4 is activated by pressing the overdrive cancel switch or by selecting the 1 or 2 range with the transmission selector lever. In manual 1 and 2, the coast clutch is controlled by solenoid 4 and also hydraulically as a fail-safe to ensure engine braking. In reverse, the coast clutch is controlled hydraulically and solenoid 4 is not on.

Transmission function: Engages coast clutch to provide engine braking in third gear when overdrive cancel is on.

Symptoms: Failed on - third gear engine braking with O/D range selected. Failed off - No third gear engine braking in overdrive cancel.

Fault Codes: 93* (two digit), 626* (three digit).

FORD - E40D
ELECTRICAL DIAGNOSIS

The solenoid assembly on the E4OD contains five solenoids, and a Transmission Oil Temperature (TOT) sensor. Refer to Figure 6 for names and locations.The solenoids are activated by the EEC-IV module and together they shift the transmission through the various gears, control line pressure, and control the torque converter clutch. All five of the solenoids should be checked with a digital ohmmeter as follows:

SHIFT SOLENOID NO. 1;
- Connect the ohmmeter leads to pins 1 and 3 (See Figure 6), resistance should be 20-30 ohms.

SHIFT SOLENOID NO. 2;
- Connect the ohmmeter leads to pins 1 and 2 (See Figure 6), resistance should be 20-30 ohms.

COAST CLUTCH SOLENOID;
- Connect the ohmmeter leads to pins 1 and 5 (See Figure 6), resistance should be 20-30 ohms.

TCC SOLENOID;
- Connect the ohmmeter leads to pins 1 and 4 (See Figure 6), resistance should be 20-30 ohms.

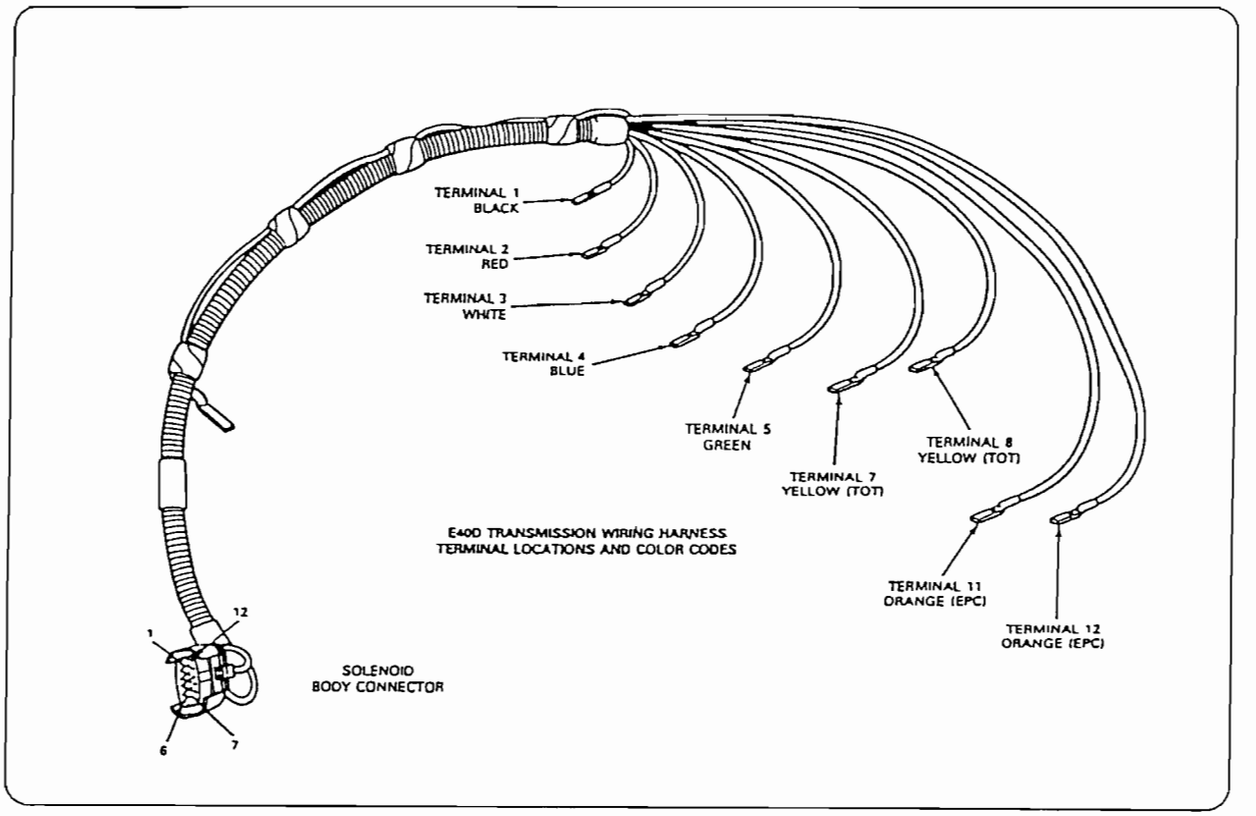
ELECTRONIC PRESSURE CONTROL (EPC) SOLENOID;
- Connect the ohmmeter leads to pins 11 and 12 (See Figure 6) resistance should be 4.25-6.50 ohms.

To verify that there are no additional shorts in the circuit board, continue with the digital ohmmeter as follows:

1. Connect the ohmmeter leads to pin 1 and GROUND, ohmmeter should read NO CONTINUITY.
2. Connect the ohmmeter leads to pin 2 and GROUND, ohmmeter should read NO CONTINUITY.
3. Connect the ohmmeter leads to pin 3 and GROUND, ohmmeter should read NO CONTINUITY.
4. Connect the ohmmeter leads to pin 4 and GROUND, ohmmeter should read NO CONTINUITY.
5. Connect the ohmmeter leads to pin 5 and GROUND, ohmmeter should read NO CONTINUITY.
6. Connect the ohmmeter leads to pin 6 and GROUND, ohmmeter should read NO CONTINUITY.
7. Connect the ohmmeter leads to pin 7 and GROUND, ohmmeter should read NO CONTINUITY.

To check the transmission oil temperature (TOT) sensor, continue with the digital ohmmeter as follows:
1. Connect the ohmmeter leads to pins 7 and 8 (see Figure 6), and refer to the following chart for resistance readings.

32°F - 58°F	-----	37K - 100K Ohms
59°F - 104°F	-----	16K - 37K Ohms
105°F - 158°F	-----	5K - 16K Ohms
159°F - 194°F	-----	2.7K - 5K Ohms
195°F - 230°F	-----	.5K - 2.7K Ohms
231°F - 266°F	-----	.8K - 1.5K Ohms


TERMINAL 1
BLACK
TERMINAL 2
RED
TERMINAL 3
WHITE
TERMINAL 4
BLUE
TERMINAL 5
GREEN
TERMINAL 7
YELLOW (TOT)
TERMINAL 8
YELLOW (TOT)
TERMINAL 11
ORANGE (EPC)
TERMINAL 12
ORANGE (EPC)
E4OD TRANSMISSION WIRING HARNESS
TERMINAL LOCATIONS AND COLOR CODES
SOLENOID
BODY CONNECTOR
12
1
6
7

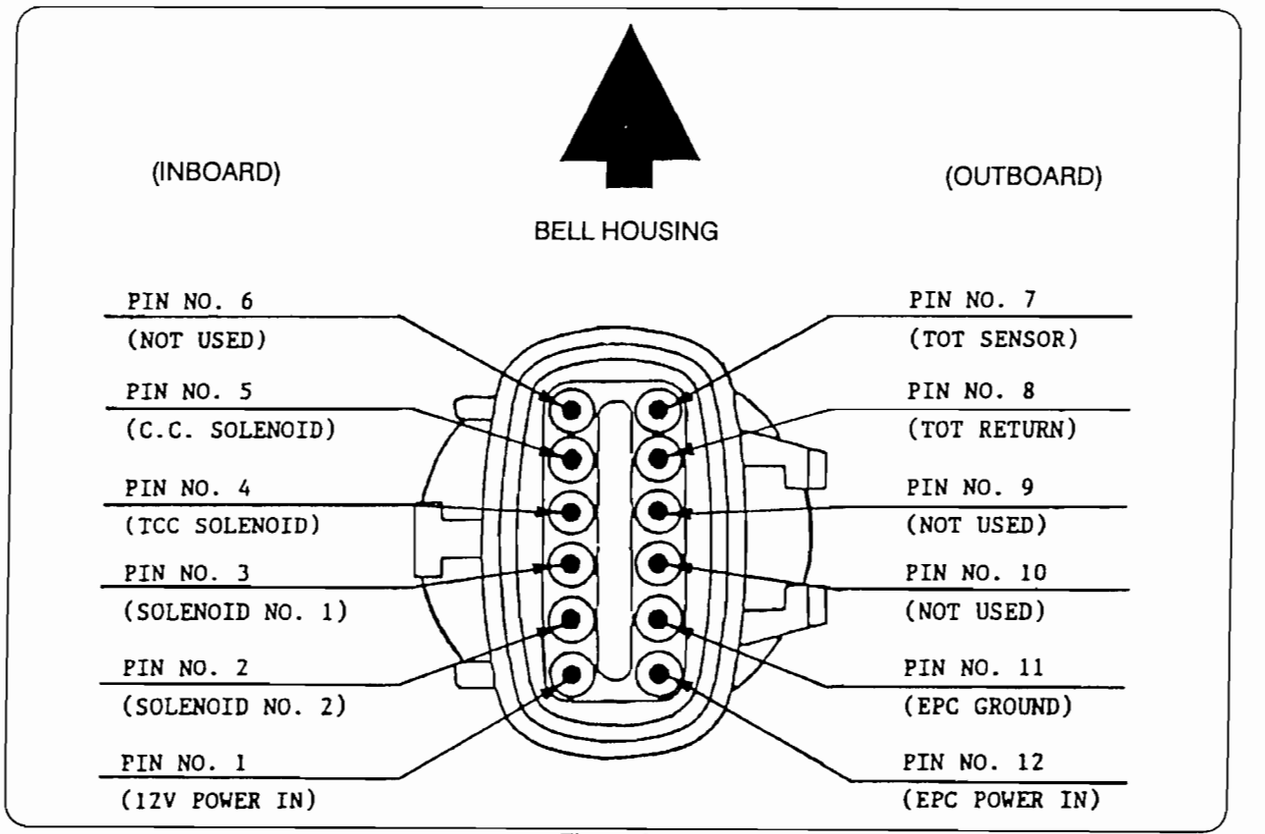

(INBOARD)
(OUTBOARD)
BELL HOUSING
PIN NO. 6
(NOT USED)
PIN NO. 5
(C.C. SOLENOID)
PIN NO. 4
(TCC SOLENOID)
PIN NO. 3
(SOLENOID NO. 1)
PIN NO. 2
(SOLENOID NO. 2)
PIN NO. 1
(12V POWER IN)
PIN NO. 7
(TOT SENSOR)
PIN NO. 8
(TOT RETURN)
PIN NO. 9
(NOT USED)
PIN NO. 10
(NOT USED)
PIN NO. 11
(EPC GROUND)
PIN NO. 12
(EPC POWER IN)

Figure 6

MLPS TESTING

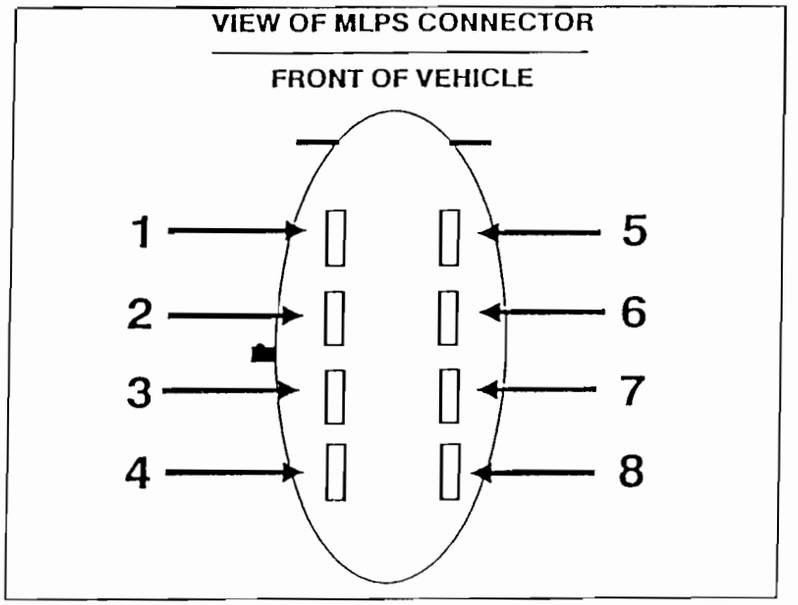


Figure 7

The amount of resistance across terminals 2 and 3 is what informs the computer what position the gear shift selector is in. Use an ohmmeter to verify that resistance is within specifications.

LEVER POSITION	RESISTANCE VALUE SHOULD BE
P	3769 - 4608 OHMS
R	1303 - 1594 OHMS
N	660 - 807 OHMS
D	361 - 442 OHMS
2	190 - 232 OHMS
1	80 - 95 OHMS

CONTINUITY CHECK

Use an ohmmeter or continuity tester to check for continuity in the the following manner: (refer to figure 7 for terminal location).

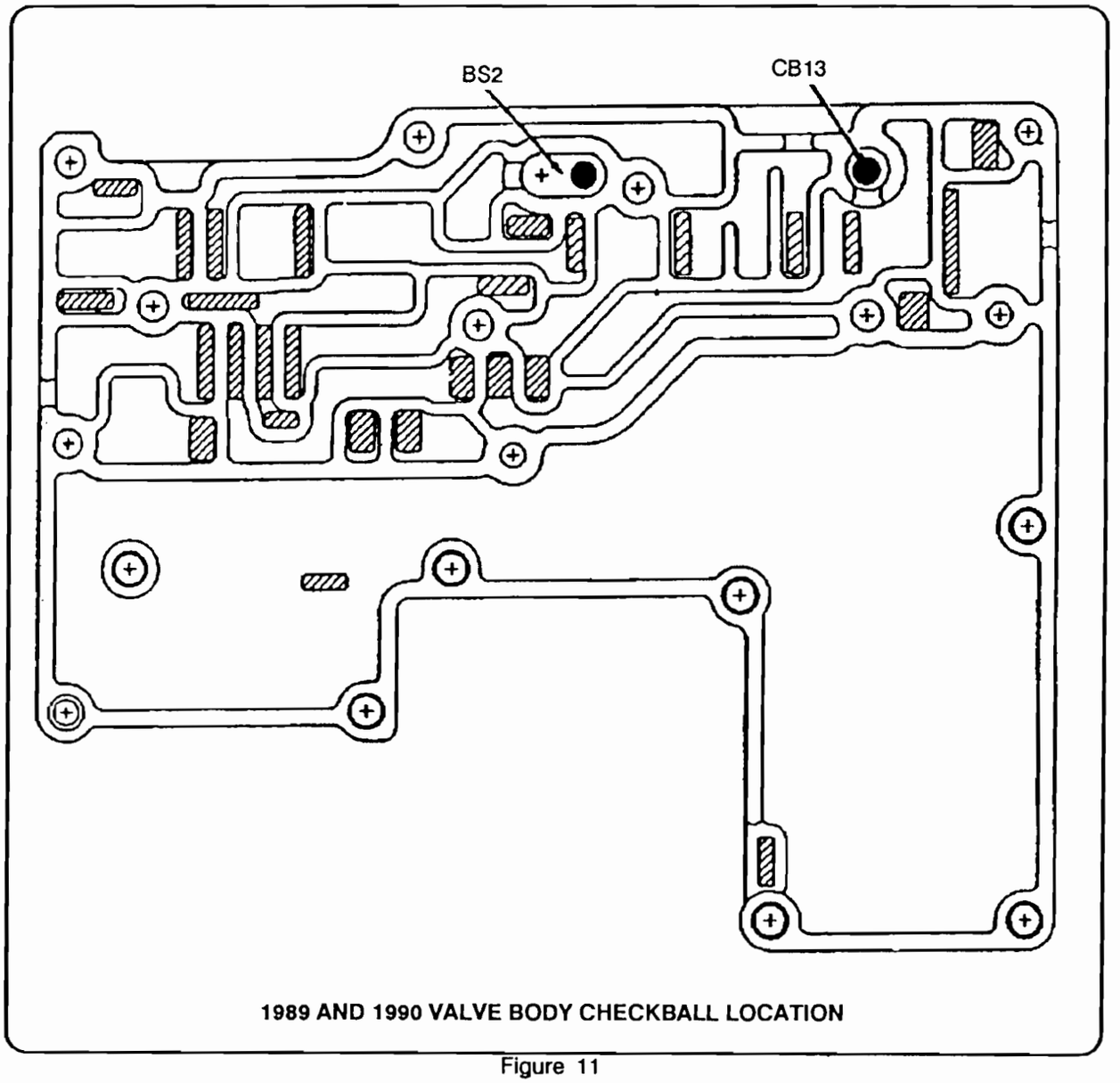
LEVER POSITION	CONTINUITY SHOULD EXIST BETWEEN TERMINALS
P	5 - 8
R	6 - 7
N	5 - 8
N	1 - 4

FORD - E4OD

CHECK BALL LOCATION CHANGE FOR 1990

There has been a change in check ball locations (CASE ONLY), for all 1990 model E4OD transmissions. Valve body locations remained the same as previous models.

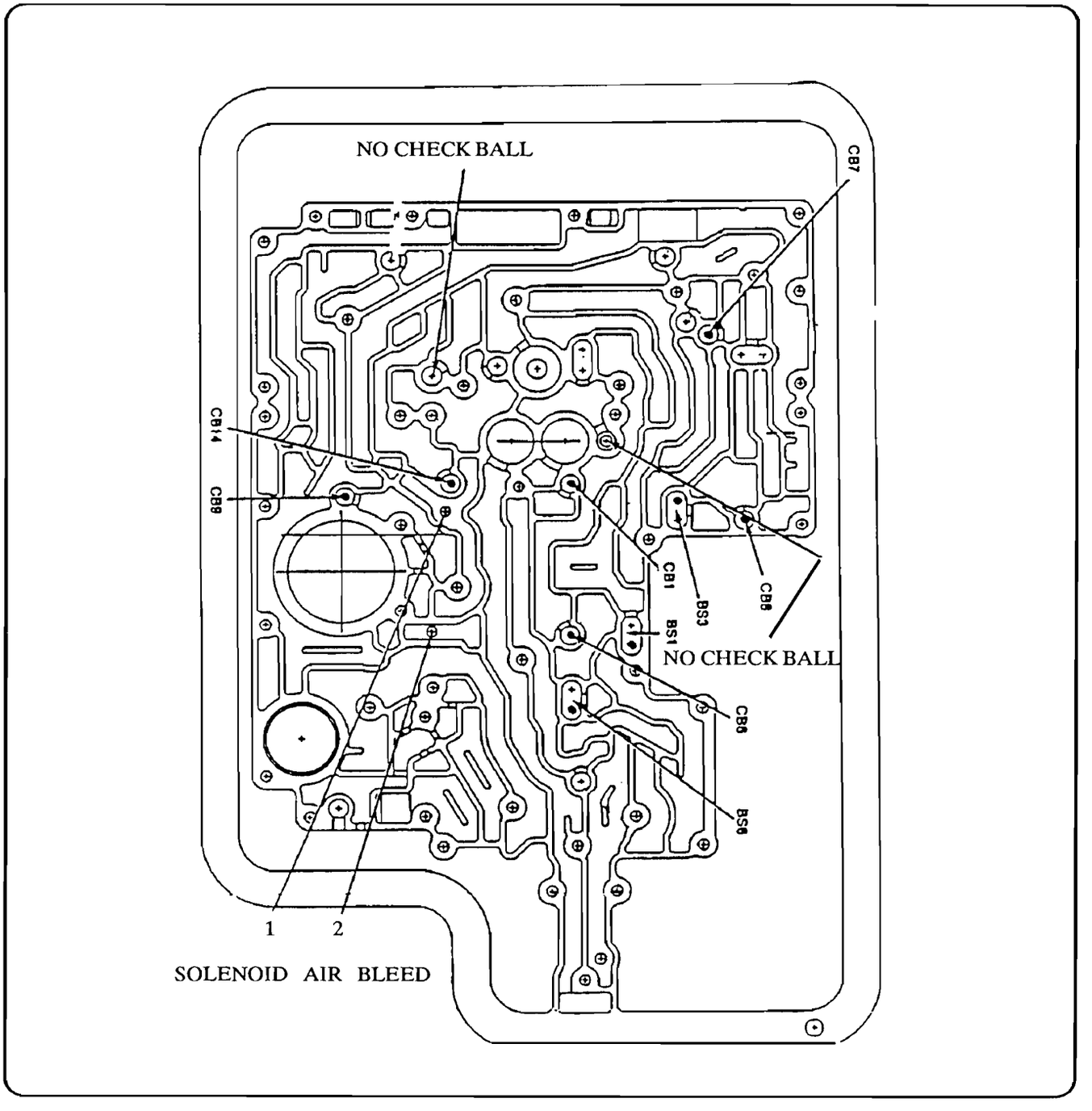
REFER TO FIGURE 11 FOR BOTH YEARS , FOR THE VALVE BODY CHECKBALL LOCATION.
REFER TO FIGURE 12 FOR "1989" CHECKBALL LOCATIONS.
REFER TO FIGURE 13 FOR "1990" CHECKBALL LOCATIONS.



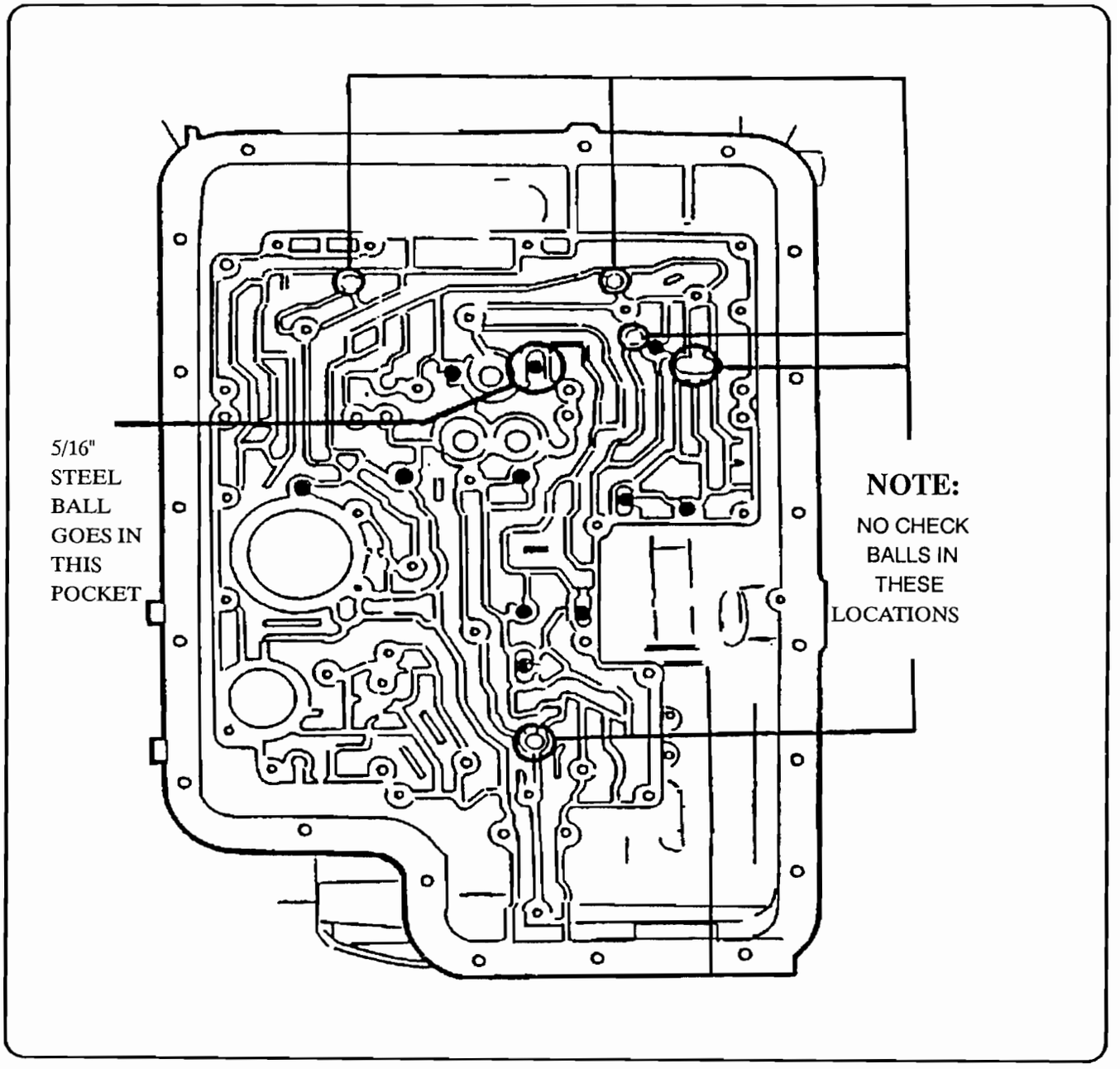
1989 AND 1990 VALVE BODY CHECKBALL LOCATION

Figure 11

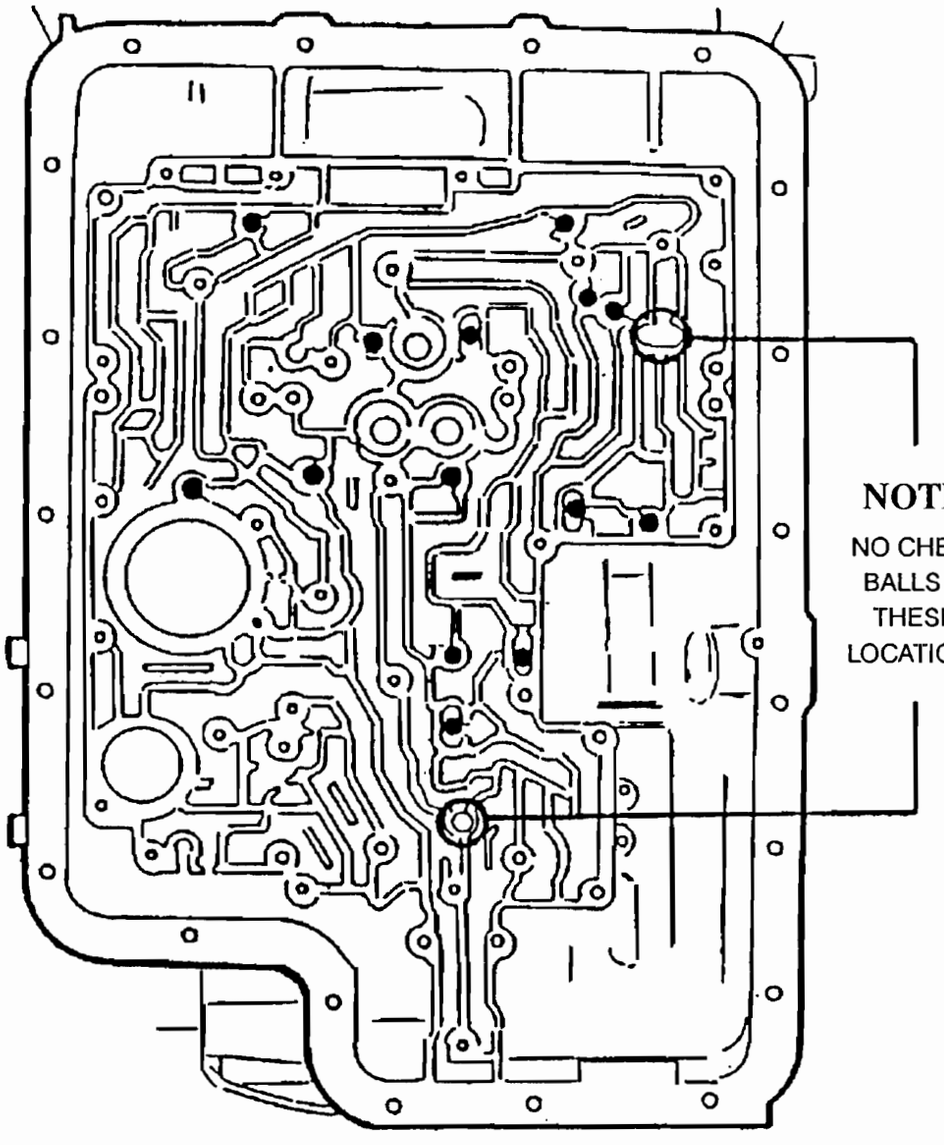
FORD E4OD
1990 - 91 (9) CHECK BALL LOCATION



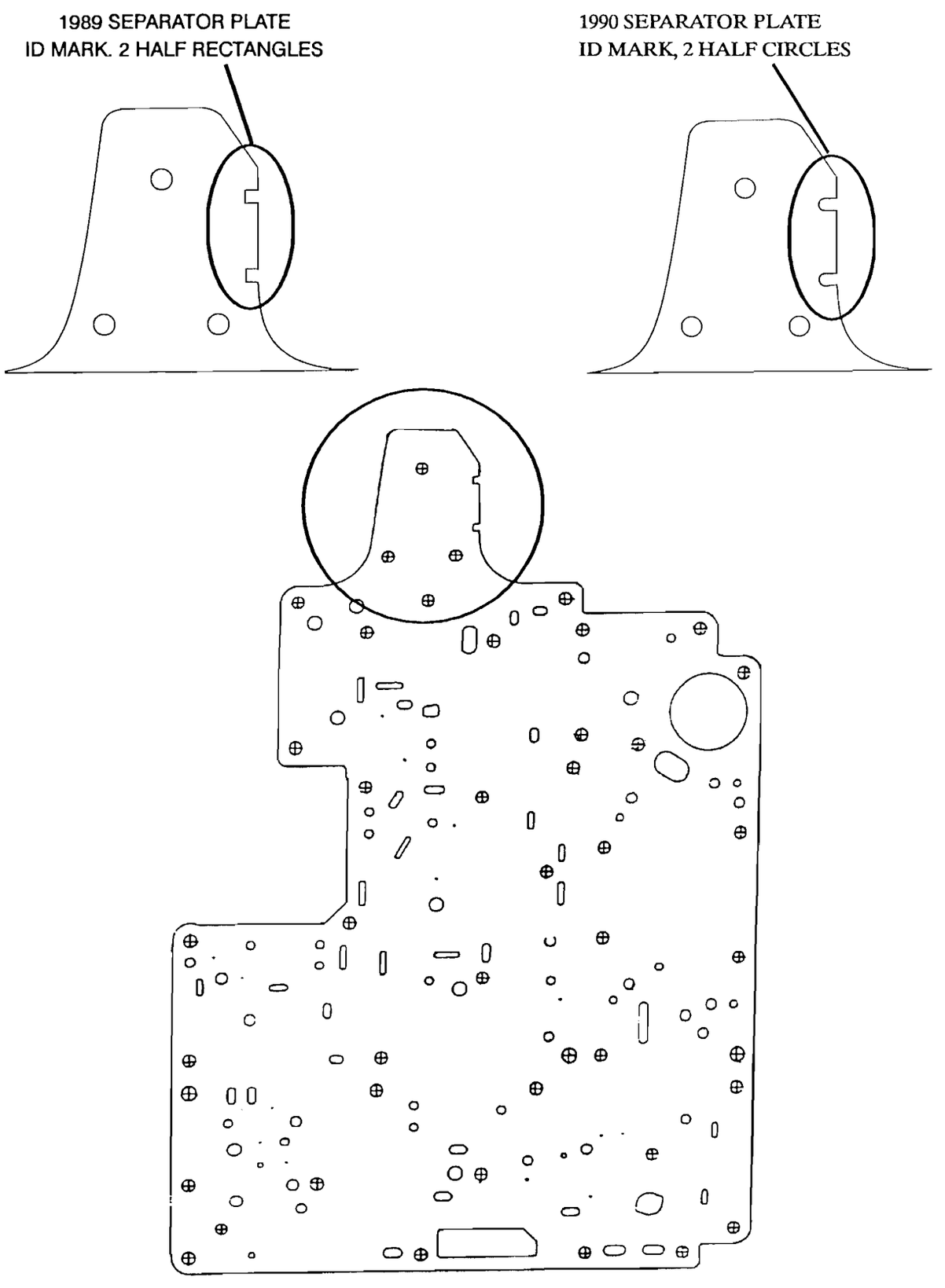
FORD E4OD
MID 1989 (10) CHECK BALL LOCATION



FORD E4OD
EARLY 1989 (14) CHECK BALL LOCATION



NOTES:


1989 SEPARATOR PLATE
ID MARK. 2 HALF RECTANGLES
1990 SEPARATOR PLATE
ID MARK, 2 HALF CIRCLES

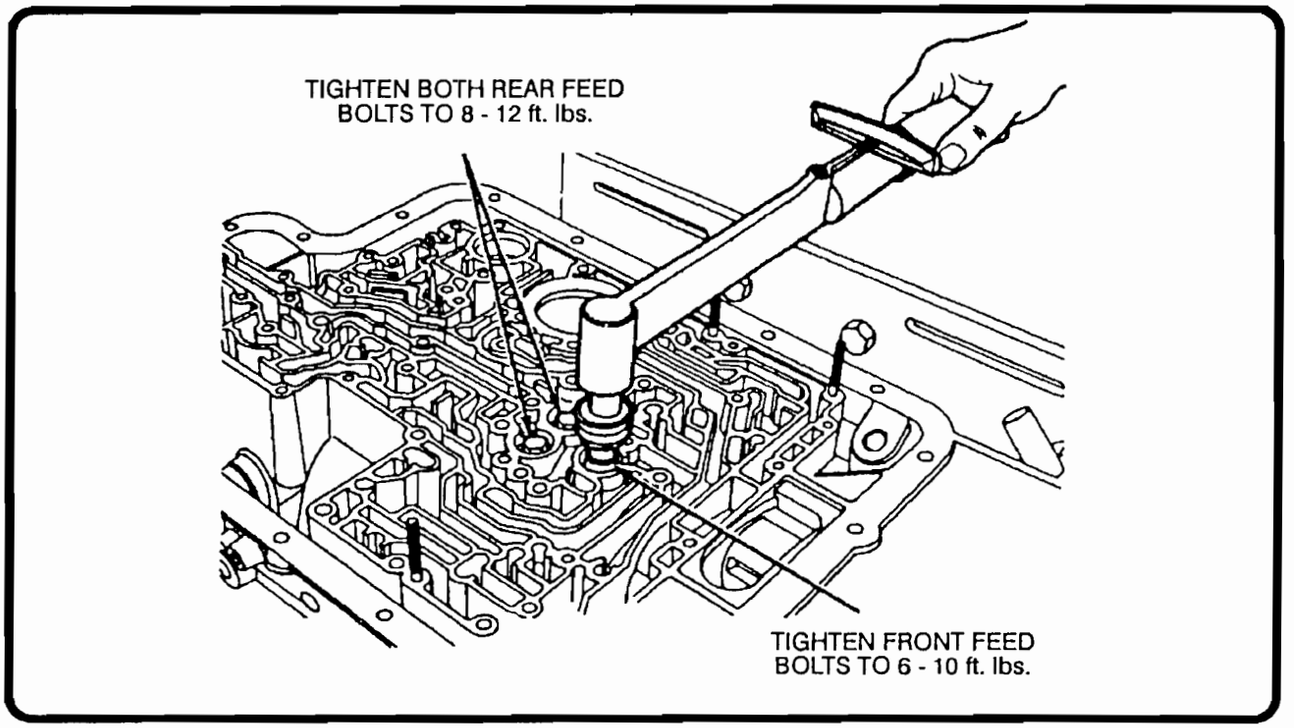
FORD - E4OD

1-2 SLIDE, 2-3 FLARE, OR SLIPS FORWARD AFTER REBUILD

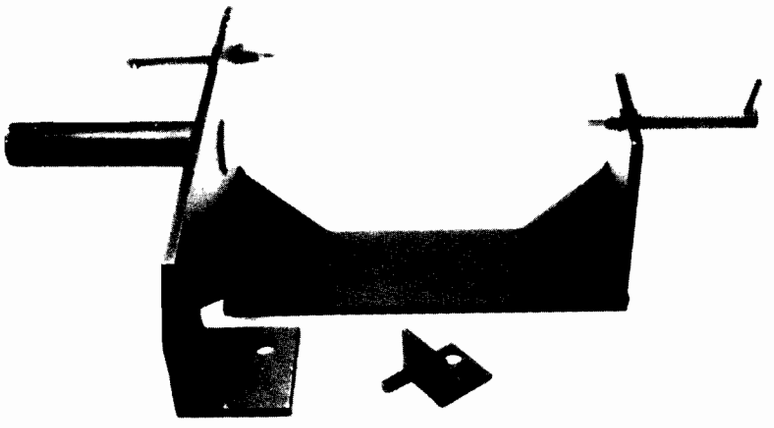
COMPLAINT: *After rebuild, slips or delays in forward when hot, slides on the 1-2 shift, , or flares up on the 2-3 shift, and burns clutches especially when warm.*

CAUSE: *Over tightened center support to case bolts. This will cause leaks across oil feed passages to the clutches.*

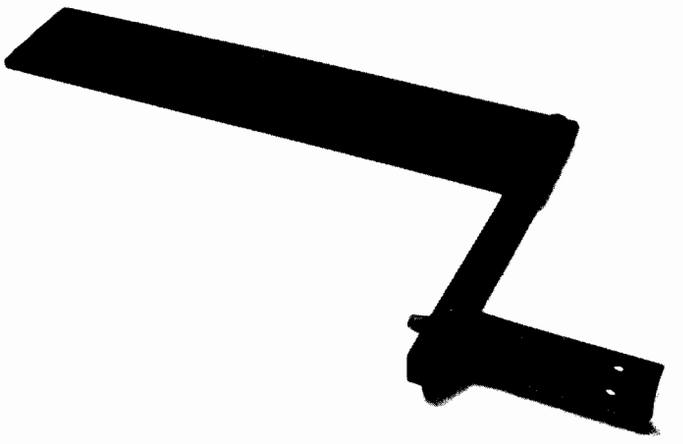
CORRECTION: *Remove valve body and retorque center support bolts to 8 to 10 ft. lbs. In cases where distortion has been extreme, it may be necessary to use two gaskets between the spacer plate and the case.*



Can you afford not to have the right tools for today's transmissions?



E4OD
T-2800-F
Holding Fixture



AXOD
T-2409-F
Holding Fixture

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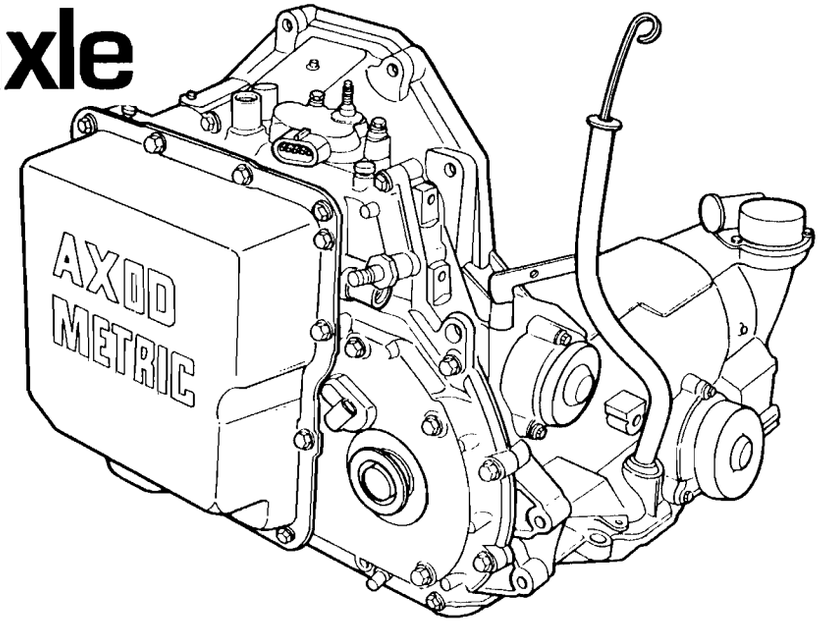
AXOD-E Transaxle



GENERAL DESCRIPTION

The AXOD-E model transaxle (Figure 1) is a fully automatic, electronically controlled unit with a three element hydraulic torque converter. The main operating components of the AXOD-E transaxle (Figure 1) include a converter clutch, four multiple-disc clutches, a roller clutch, a sprag clutch and two bands which provide the friction elements required to obtain the desired function of the compound planetary gearset. These components are identical to those used on the AXOD transaxle.

A lock-up torque converter smoothly couples the engine to the planetary gears and overdrive unit by means of a drive link assembly (chain) connecting the drive and driven sprockets. The application of the converter clutch is scheduled through electronic controls integrated in the on-board EEC-IV system.

Some applications will use a torque converter with piston plate clutch that is modulated by an electronic solenoid to reduce slip and improve fuel economy.

The oil pump is a variable capacity vane and rotor pump with output flow proportional to demand. It is located within the transaxle valve body and pump assembly.

Two reservoir areas are used to control oil level, dependent upon fluid temperature. Along with the lower sump, a fluid reservoir is located in the lower section of the valve body cover. As fluid temperature increases, a thermostatic element increases the quantity of fluid retained in the upper reservoir.

On the AXOD-E, all major transaxle operations, including shifting, torque converter clutch operation and line pressure are controlled by the EEC-IV Electronic Control Assembly (ECA). The ECA receives information on throttle opening, engine speed, turbine speed, and other powertrain operations from sensors. The ECA uses this information to control the major transaxle operations by operating five solenoids located in the AXOD-E valve body. This expanded use of electronic control is the major difference between the AXOD-E and the AXOD transaxles.

OUTPUTS

Location

The AXOD-E output solenoids are located on the valve body assembly (Figure 6).

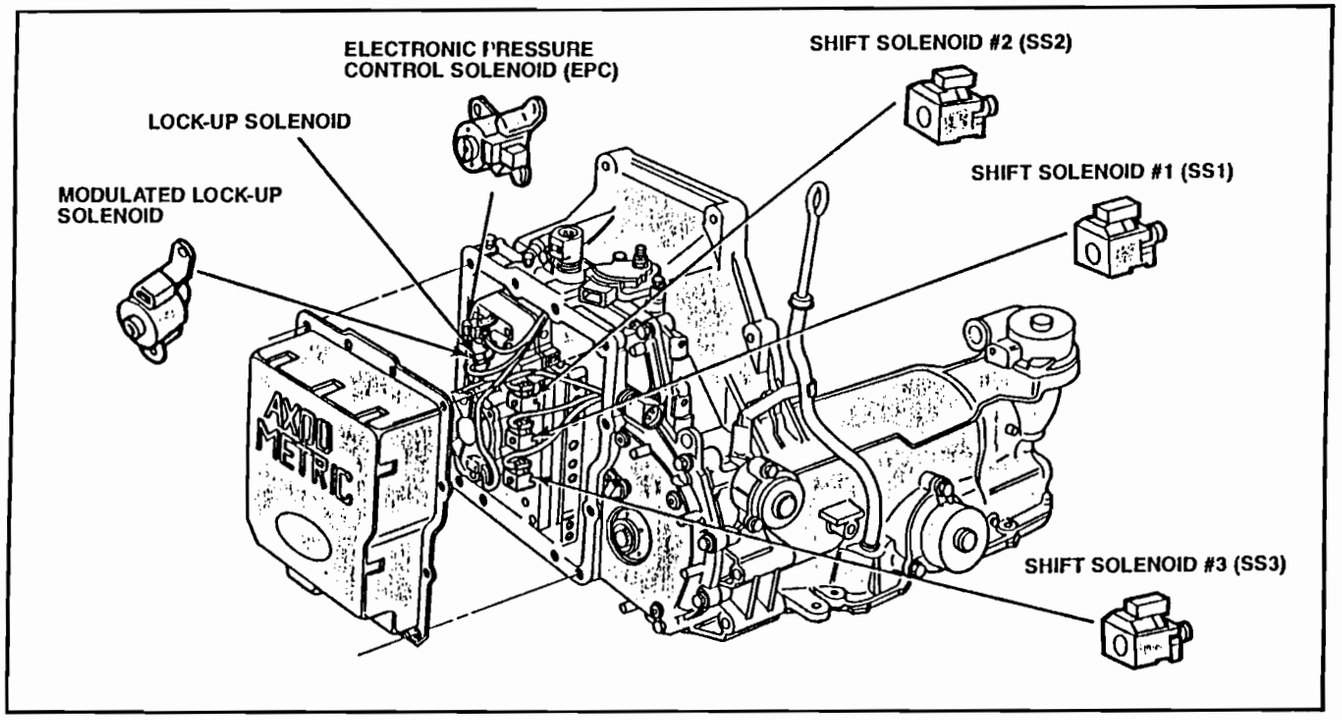


Figure 6 — Output Solenoid Locations

Types of Solenoids

The EEC-IV ECA controls the AXOD-E transaxle operation through four on/off solenoids, and a electronic pressure control solenoid (EPC). Depending upon vehicle model, the on/off solenoid that controls the torque converter clutch may be modulated (see the description later in this reference book). The functions of these solenoids are as follows:

- The shift solenoids provide gear selection by controlling the pressure to the shift valves. There are three shift solenoids on the AXOD-E transaxle. Each solenoid uses a three-port, normally open feed to control oil flow to the hydraulic spool valve.
- The lock-up solenoid which controls the torque converter clutch on Taurus/Sable vehicles is normally open, allowing solenoid regulator pressure to exhaust to the sump. When energized by the ECA, it seals transaxle fluid under pressure and causes the converter clutch to engage.
- The modulated lock-up solenoid, which controls the torque converter clutch on Continental vehicles, receives an electronic signal from the ECA. This signal causes the solenoid to vary its output pressure and control clutch slip.
- The electronic pressure control (EPC) solenoid is a variable force solenoid, combining a solenoid and a pressure regulating valve. It produces electronic pressure control which regulates transaxle line pressure and shifting clutch capacity.

OVERVIEW

The operation of the AXOD-E automatic transaxle is controlled by the EEC-IV system. The EEC-IV Electronic Control Assembly (ECA) receives information on both engine and transaxle operation from the input components. These input components include the throttle position sensor, mass airflow sensor, turbine speed sensor and others. The ECA processes this information and sends signals to operate the output components, including the three shift solenoids, the lock-up or modulated lock-up solenoid, and the variable force solenoid, which controls transaxle line pressure (Figure 4).

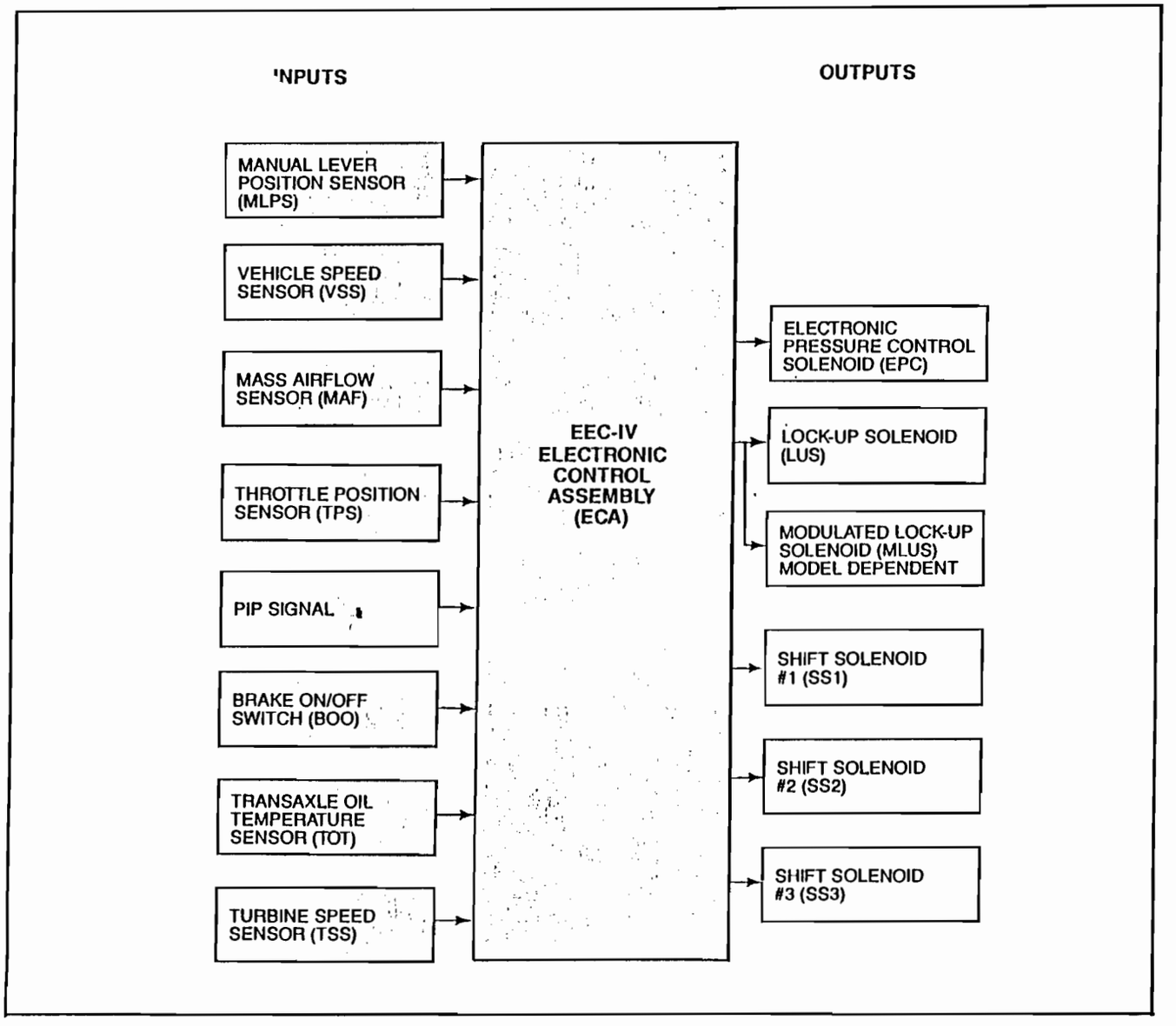


Figure 4 — AXOD-E Inputs and Outputs

INPUTS

Transaxle Inputs (Figure 5)

- Manual Lever Position Sensor (MLPS) — The MLPS sensor tells the ECA which position the shift lever is in (P, R, N, (D), D or 1). It is located on the outside of the transaxle at the manual lever.
- Vehicle Speed Sensor (VSS) — The VSS performs electronically what the governor did hydraulically. It is a magnetic pickup that sends an AC signal to the ECA. This signal is proportional to the transaxle output shaft rpm. The VSS signal tells the ECA what the vehicle speed is.
- Transaxle Oil Temperature (TOT) Sensor — The TOT sensor is a temperature-sensitive device called a thermistor. It sends a voltage signal that varies with the transaxle oil temperature to the ECA. The ECA uses this signal to determine whether a cold start shift schedule is necessary. The cold start shift schedule lowers shift speeds to allow for the increased viscosity of the cold transaxle fluid.
- Turbine Speed Sensor (TSS) — The TSS is a variable reluctance device that generates a variable frequency signal in response to the rotation of an exciter wheel mounted on the driven sprocket. This information is sent to the ECA to determine the rotating speed of the transaxle.

Non-Transaxle Inputs

- Throttle Position Sensor (TPS) — The TPS sensor is a potentiometer mounted on the throttle body. The TPS performs the function of the TV cable and linkage using electronic signals. It consists of a lever fitting between the throttle valve and a variable resistor. The TP sensor detects the opening of the throttle plate and sends this information to the ECA as a varying voltage signal.
- Mass Airflow (MAF) Sensor — The MAF sensor is a constant temperature, hot-wire, anemometric device. ("Anemometric" refers to the process of measuring force, speed, and direction of airflow.) The MAF sensor measures the rate of mass airflow into the engine. By combining this information with information from the Air Charge Temperature (ACT) sensor, the ECA can determine the climate in which the vehicle is operating. The ECA can then control transaxle operation accordingly.
- Profile Ignition Pickup (PIP) Signal — The PIP signal is produced by a Hall-Effect device in the distributor. It tells the ECA the engine rpm and the crankshaft position.
- Brake On/Off (BOO) Switch — The BOO switch tells the ECA whether the brakes are applied or not. The switch is closed when the brakes are applied and open when they are not.

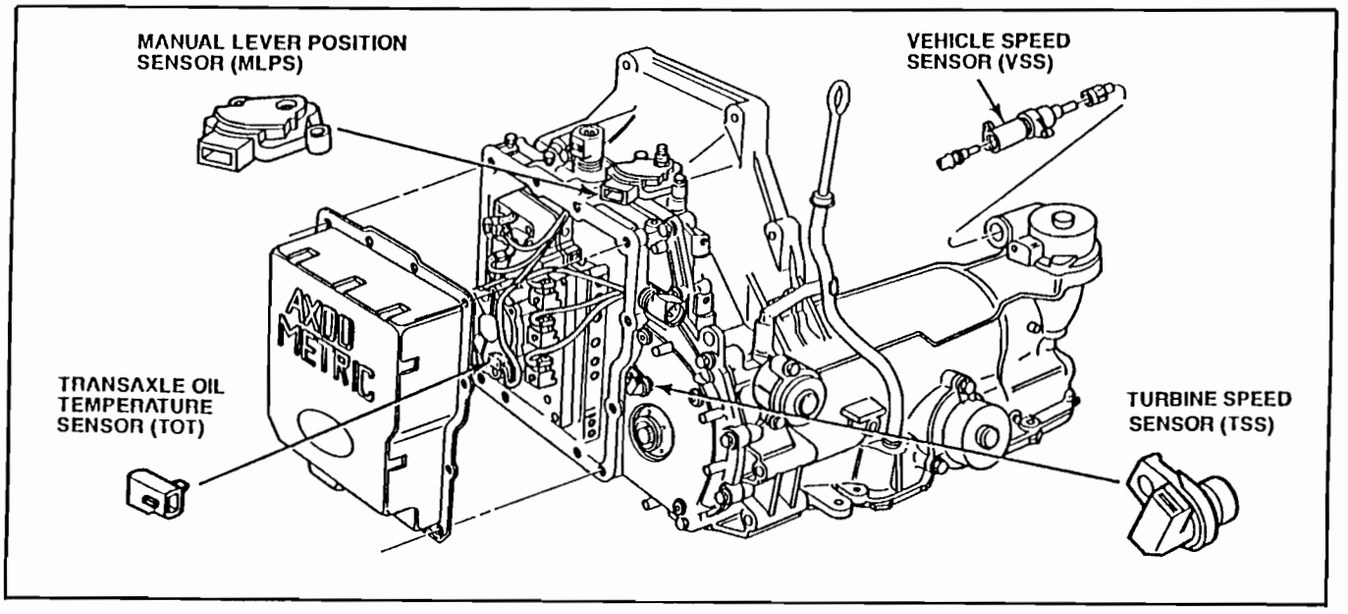


Figure 5 — Transaxle Sensors

SELECTOR AND SHIFT PATTERNS

The AXOD-E quadrant has six positions indicated in the following order: P, R, N, Ⓓ, D, 1

(P) PARK — The transaxle is in neutral with the output shaft locked. This prevents the vehicle from rolling forward or backward. For safety reasons, the vehicle parking brake should be used in addition to the transaxle "PARK" position. Do not select the PARK position until the vehicle comes to a complete stop, because it mechanically locks the output shaft. The engine may be started in the PARK position. This is the only selector position in which the ignition key can be removed.

(R) REVERSE — Enables the vehicle to be operated in a rearward direction at a reduced gear ratio. There is no engine braking in reverse.

(N) NEUTRAL — The transaxle is in neutral, but the output shaft is not locked to the case. This position enables the engine to be started and operated without driving the vehicle. If necessary, this position must be selected if the engine has to be restarted while the vehicle is moving.

(Ⓓ) OVERDRIVE — Normal driving position for most highway driving conditions and maximum economy. Selection of this position provides all automatic shifts including the application and release of the converter clutch.

(D) DRIVE — Selection of this position provides all automatic shifts, including the application and release of the converter clutch, except for the shift to overdrive. This position can be used when overdrive is not wanted such as hilly/mountainous terrain, going into a strong headwind, or towing a trailer.

(1) MANUAL LOW — Selection of this position at startup provides only low (1st gear) operation. Selection at higher vehicle speed results in a downshift to second gear. An automatic downshift to low will occur once the vehicle speed drops below approximately 45 km/h (28 mph). This position is especially useful for maintaining maximum engine braking when descending steep grades.

SOLENOID APPLICATIONS CHART

PRNDL	GEAR	ENGING BRAKING	SS1	SS2	SS3
Ⓓ	1	NO	OFF	ON	OFF
	2	YES	ON	ON	OFF
	3	NO	OFF	OFF	ON
	4	YES	ON	OFF	ON
D	1	NO	OFF	ON	OFF
-	2	YES	ON	ON	OFF
-	3	YES	OFF	OFF	OFF
1	1	YES	OFF	ON	OFF
	2	YES	OFF	OFF	OFF
R	R	NO	OFF	ON	OFF
P/N	P/N	NO	OFF	ON	OFF

FORD AXOD-E

ELECTRICAL DIAGNOSIS (UPDATED)

EPC SOLENOID

1. Volt/Ohmmeter set to Ohms, with leads terminal to terminal on EPC Solenoid, Ohmmeter should read 2.5-6.5 ohms resistance.
2. 0-100 PSI gauge installed in TV port:
   EPC energized = 10-20 PSI TV pressure.
   EPC de-energized = 75-85 PSI TV pressure.
3. Wires for the EPC Solenoid are fed through pins 1 and 6, of the "Black" case connector, located on top of the transaxle (See Figures 2 and 3).
4. Could store service codes 624, 625, 649, 651.

MODULATED LOCK-UP SOLENOID (MLUS)

1. Volt/Ohmmeter set to Ohms, with leads terminal to terminal on MLUS, Ohmmeter should read 0.75-2.0 ohms resistance.
2. Wires for the MLUS are fed through pins 4 and 5, of the "Black" case connector, located on top of the transaxle (See Figures 2 and 3).
3. The Modulated Lock-up Solenoid (MLUS) is found on the Lincoln only.

LOCK-UP SOLENOID (LUS)

1. Volt/Ohmmeter set to Ohms, with leads terminal to terminal on the LUS, Ohmmeter should read 16-40 ohms resistance.
2. Wires for the LUS are fed through pins 4 and 5, of the "Black" case connector, located on top of the transaxle (See Figures 2 and 3).
3. Either Lock-up Solenoid could store service codes 628, 629, 652.

TRANSMISSION OIL TEMPERATURE SENSOR (TOT)

1. Volt/Ohmmeter set to Ohms, with leads terminal to terminal on TOT Sensor, Ohmmeter should read resistance approximately as shown in chart below.

FLUID TEMPERATURE DEGREES °C	FLUID TEMPERATURE DEGREES °F	OHMS RESISTANCE
0-20	32-58	33.5K-107K
21-40	59-104	14.5K-33.5K
41-70	105-158	5.0K-14.5K
71-90	159-194	2.5K-5.0K
91-110	195-230	1.5K-2.5K
111-130	231-266	0.8K-1.5K

2. Resistance should decrease if transaxle is heated, and should increase if transaxle is allowed to cool. Oil pan that is warm to the touch is about 105°F-158°F.

TURBINE SPEED SENSOR

1. Volt/Ohmmeter set to Ohms, with leads terminal to terminal on Turbine Speed Sensor, Ohmmeter should read 80-220 ohms resistance.
2. Depth of exciter wheel tooth from outer edge of chain cover should not exceed 20.62mm (.810").
3. Could store service code 639.

VEHICLE SPEED SENSOR

1. Volt/Ohmmeter set to Ohms, with leads terminal to terminal on Vehicle Speed Sensor, Ohmmeter should read 190-240 ohms resistance.
2. Could store service code 452.

SHIFT SOLENOID 1 (SS1)

1. Volt/Ohmmeter set to Ohms, with leads terminal to terminal on SS1, Ohmmeter should read 12-30 ohms resistance.
2. Wires for SS1 are fed through pins 5 and 6, of the "White" case connector, located on the side of the transaxle (See Figures 2 and 3).
3. Could store service code 621.

SHIFT SOLENOID 2 (SS2)

1. Volt/Ohmmeter set to Ohms, with leads terminal to terminal on SS2, Ohmmeter should read 12-30 ohms resistance.
2. Wires for SS2 are fed through pins 1 and 2, of the "White" case connector, located on the side of the transaxle (See Figures 2 and 3).
3. Could store service code 622.

SHIFT SOLENOID 3 (SS3)

1. Volt/Ohmmeter set to Ohms, with leads terminal to terminal on SS3, Ohmmeter should read 12-30 ohms resistance.
2. Wires for SS3 are fed through pins 3 and 4, of the "White" case connector, located on the side of the transaxle (See Figures 2 and 3).
3. Could store service code 641.

MANUAL LEVER POSITION SWITCH (MLPS)

1. Volt/Ohmmeter set to Ohms, with leads to pins 2 and 3 of the Manual Lever Position Switch (See Figure 1), and refer to the chart below for the proper resistance value in each gear selector position.

LEVER POSITION	OHMS RESISTANCE
P	3769-4608
R	1303-1594
N	660-807
D	361-442
2	190-232
1	80-95

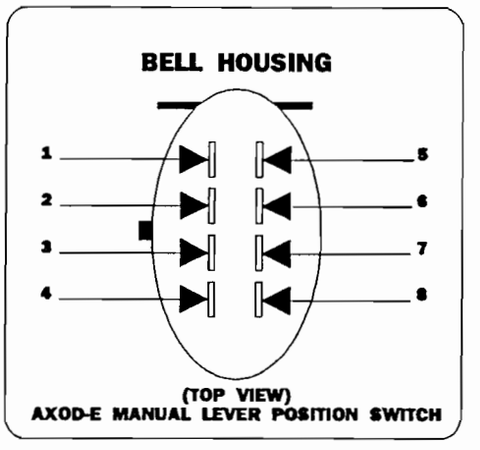
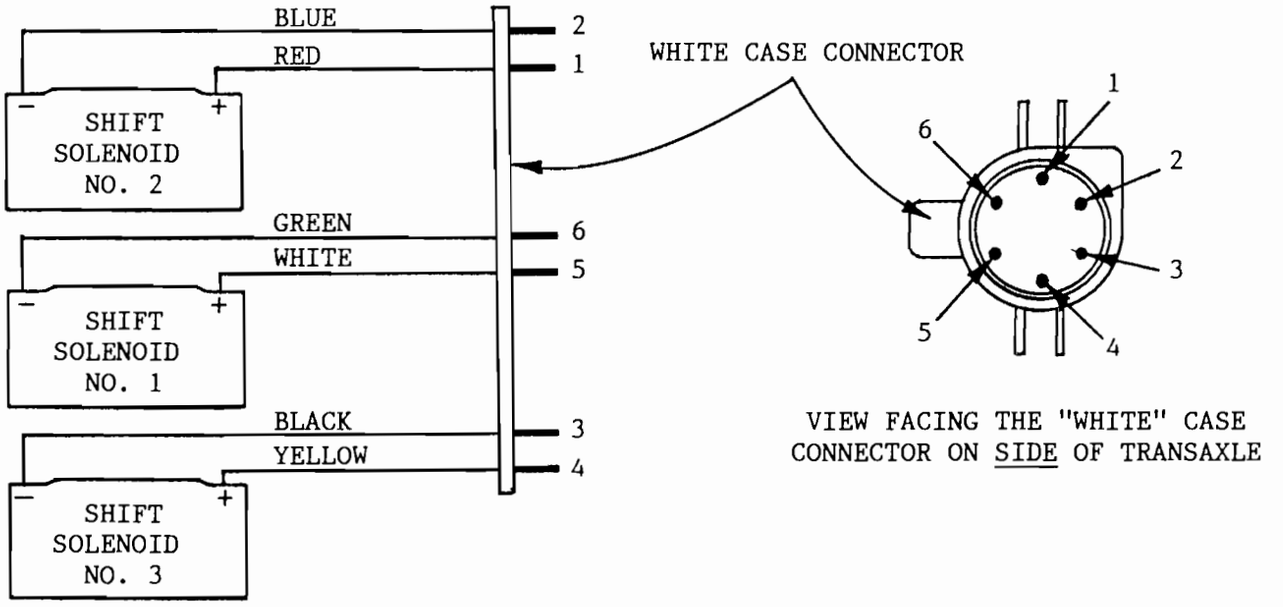


Figure 1

AXOD-E CASE CONNECTOR IDENTIFICATION



THE AXOD-E TRANSAXLE HAS 2 CASE CONNECTORS, 1 WHITE ONE ON THE SIDE OF TRANSAXLE, AND 1 BLACK ONE ON THE TOP OF TRANSAXLE.

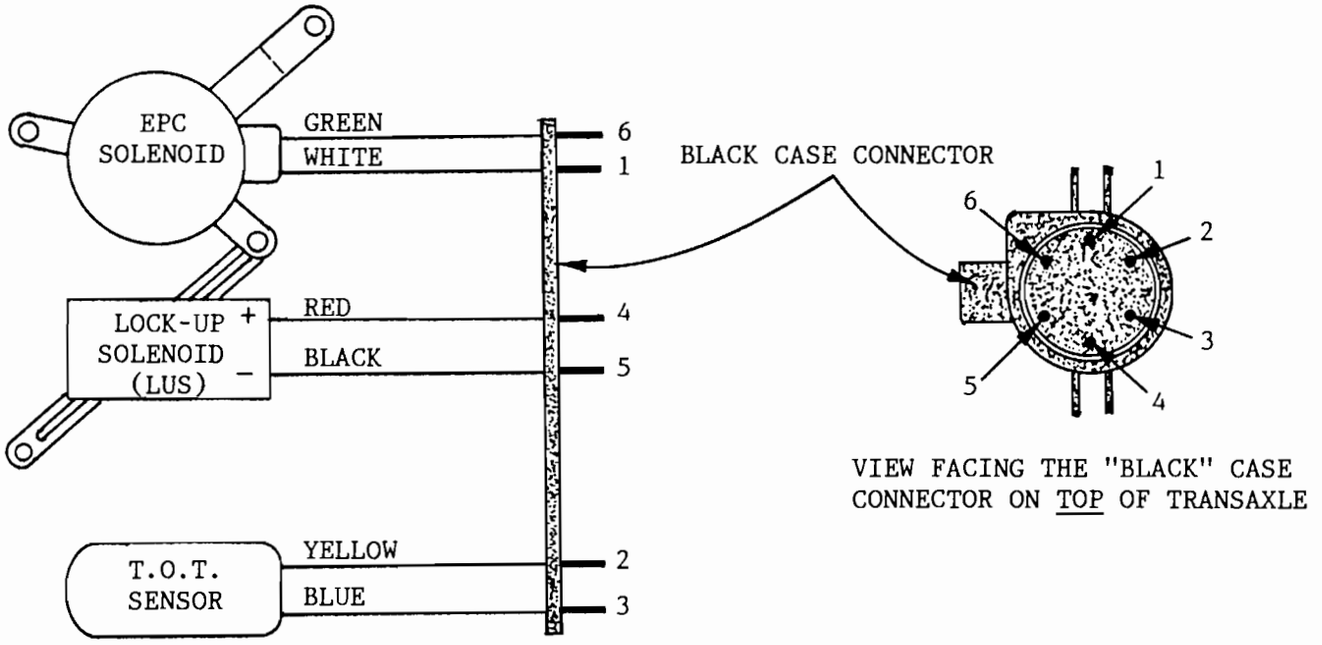
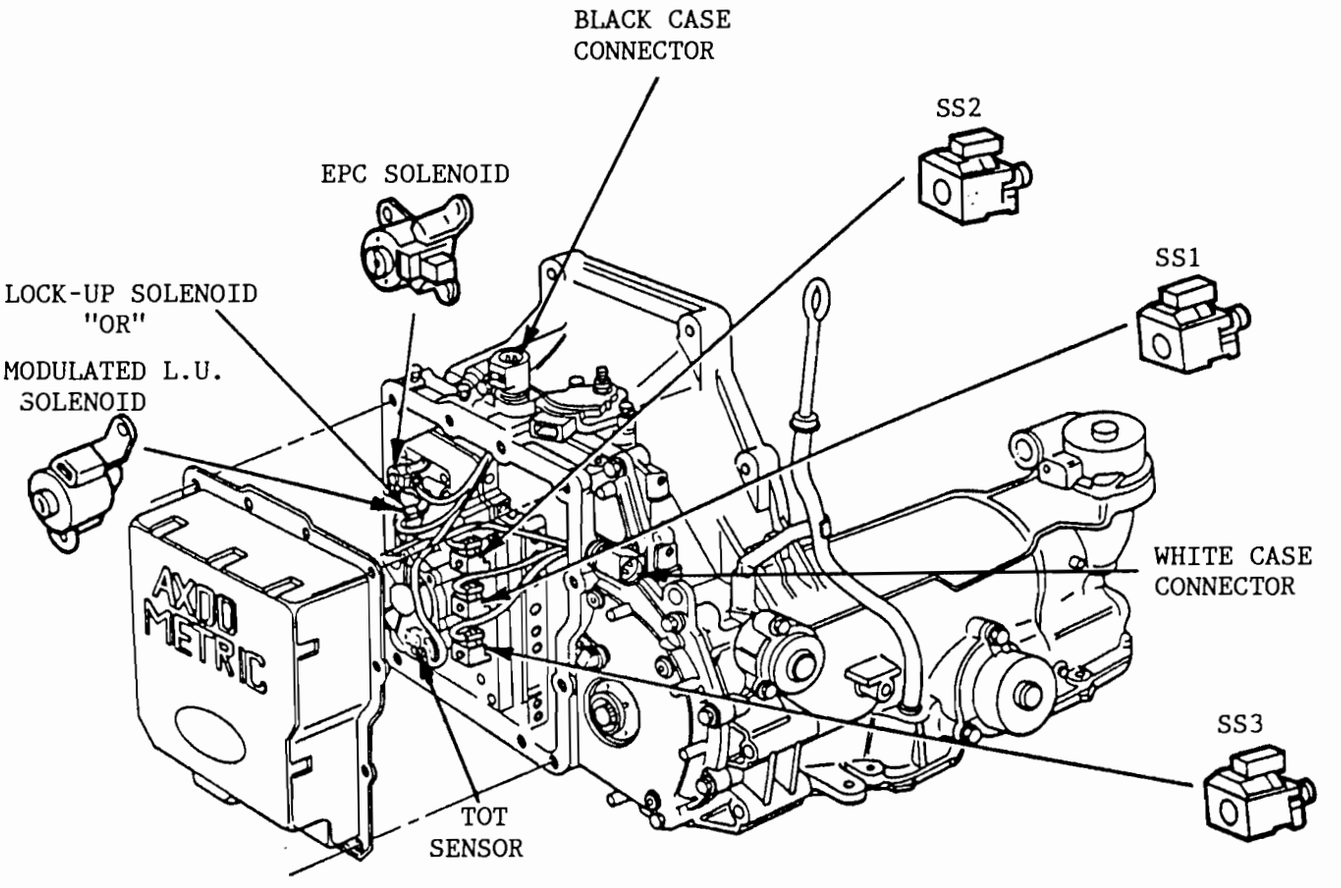


Figure 2



EPC = ELECTRONIC PRESSURE CONTROL SOLENOID
LUS = LOCK-UP SOLENOID (ALL EXCEPT LINCOLN)
MLUS = MODULATED LOCK-UP SOLENOID (LINCOLN ONLY)
SS1 = SHIFT SOLENOID NO. 1
SS2 = SHIFT SOLENOID NO. 2
SS3 = SHIFT SOLENOID NO. 3
TOT = TRANSMISSION OIL TEMPERATURE SENSOR
TSS = TURBINE SPEED SENSOR
VSS = VEHICLE SPEED SENSOR
MLPS = MANUAL LEVER POSITION SWITCH

AXOD-E CASE CONNECTOR
AND SOLENOID LOCATION

Figure 3

AXOD-E Transaxle Delayed Shifts

Vehicles Affected: 1991 Ford Taurus, 1991 Lincoln Continental, 1991 Mercury Sable.

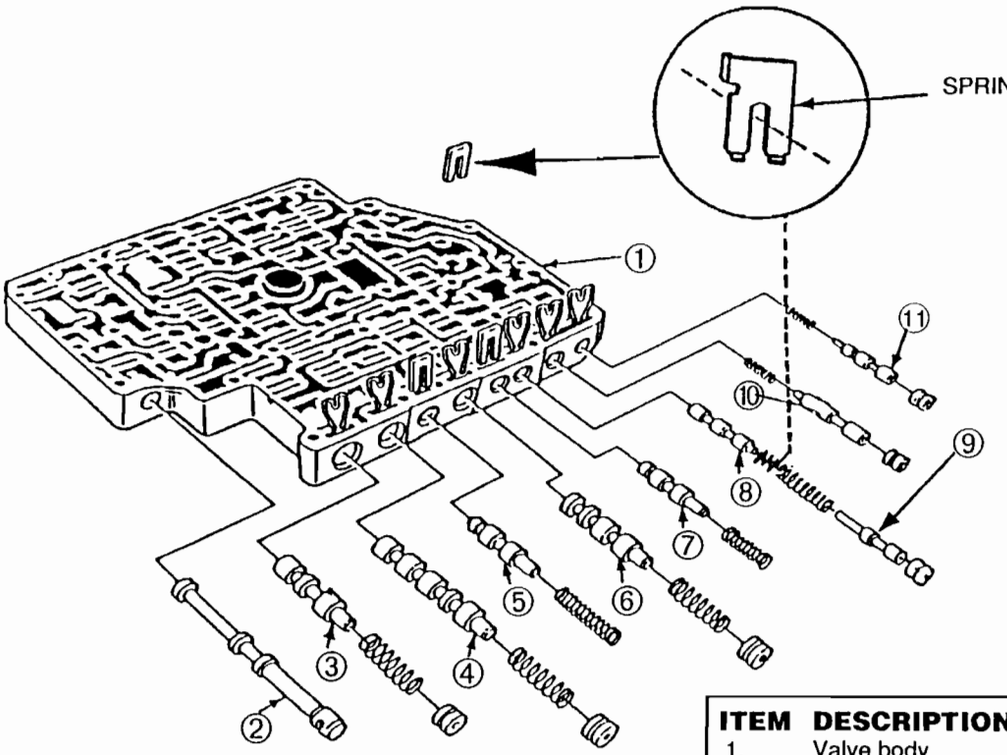
Complaint: A delayed shift may occur during 3-2 torque-demand downshifts, or "kickdown." The complaint also may be described as the transaxle shifting into neutral during the 3-2 downshift.

Cause: This occurs because the spring-retainer clip between the pull-in control valve and the 3-2 timing valve has separated into two pieces.

Correction: Install a new, more durable spring-retainer clip (F1DZ-7F194-A). Refer to the following procedure for service details.

1. Remove the main control and disassemble the lube-control valve (See Figure 3).
2. Remove the spring-retainer clip.
3. If the clip has broken, make sure that all pieces are removed.
4. Install the new spring-retainer clip (F1DZ-7F194-A).

Part Number	Part Name
F1DZ-7F194-A	Spring Retainer Clip



ITEM	DESCRIPTION
1.	Valve body
2.	Manual Valve
3.	2-3 Shift Valve
4.	1-2 Shift Valve
5.	Intermediate control valve
6.	3-4 Shift Valve
7.	Forward Clutch Control Valve
8.	3-2 Control Valve
9.	Pull-In Valve
10.	N-D Engagement Valve
11.	2-3 Servo Regulator Valve

Figure 3

FORD AXOD
BIND-UP IN REVERSE

COMPLAINT: Bind up in transmission when selector is placed in reverse.

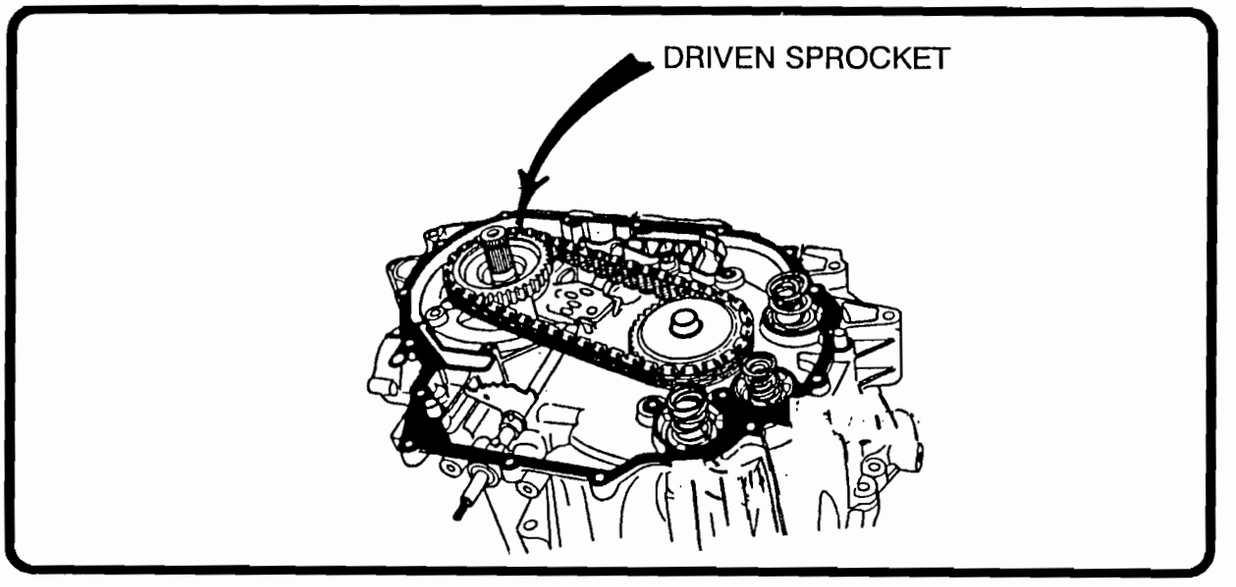
CAUSE: A cross leak at the sprocket support between the clutch drum and support , due to the driven sprocket being machined off center.

CORRECTION: Replace the driven sprocket with the part numbers listed below.

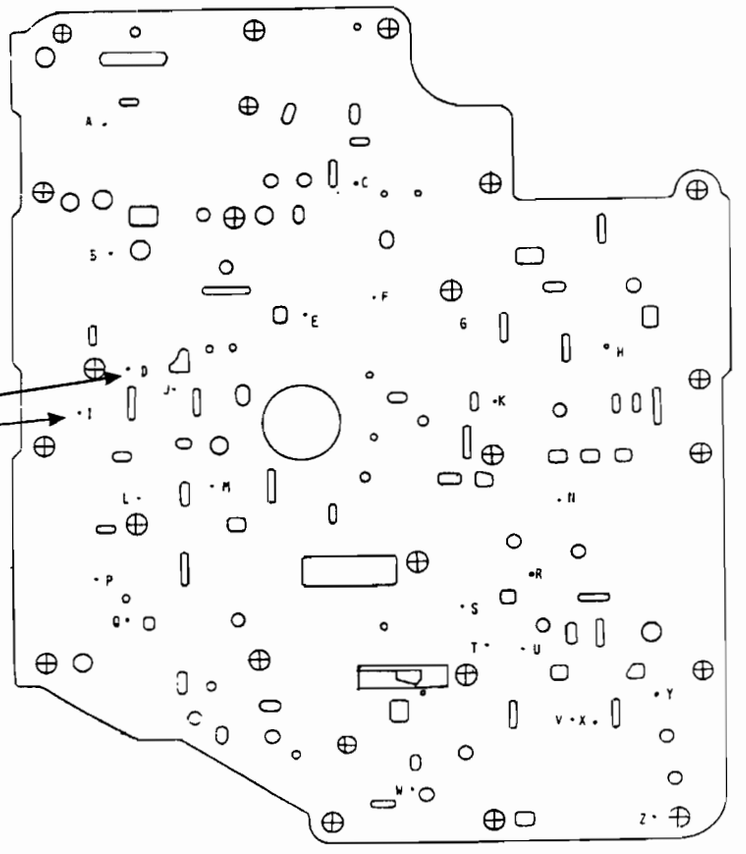
E6DZ-7G132-A
1986 - 1987 ALL ENGINES
1988 - 1990 3.0L ENGINES
1989 - 1990 LINCOLN

E8DZ-7G132-A
1988 - 3.8L ENGINE

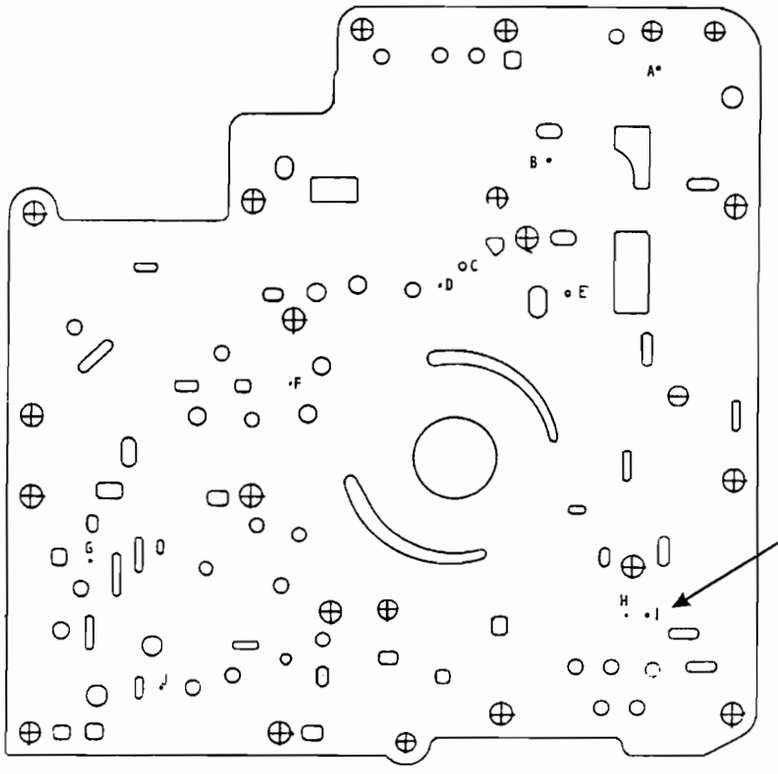
E9DZ-7G132-A
1989 - 1990 3.8L TAURUS / SABLE



FORD AXOD



FOR IMPROVED LUBE
DRILL TCC CHARGE ORIFICE TO .062"
DRILL REAR LUBE TO .076"



DRILL HOLE "I" DIRECT
CLUTCH FEED ORIFICE TO .093
FOR FIRMER 2-3 SHIFT

FORD AXOD-E

COMPLAINT: NO MOVEMENT OR SLIPS FORWARD & REVERSE WHEN HOT.

CAUSE: CRACKED FORWARD CLUTCH PISTON. PROCEDURE FOR CHECKING PISTON IS SHOWN IN FIGURE 1.

CORRECTION: REPLACE PISTON WITH PART NUMBER F1DZ-7A262-A.

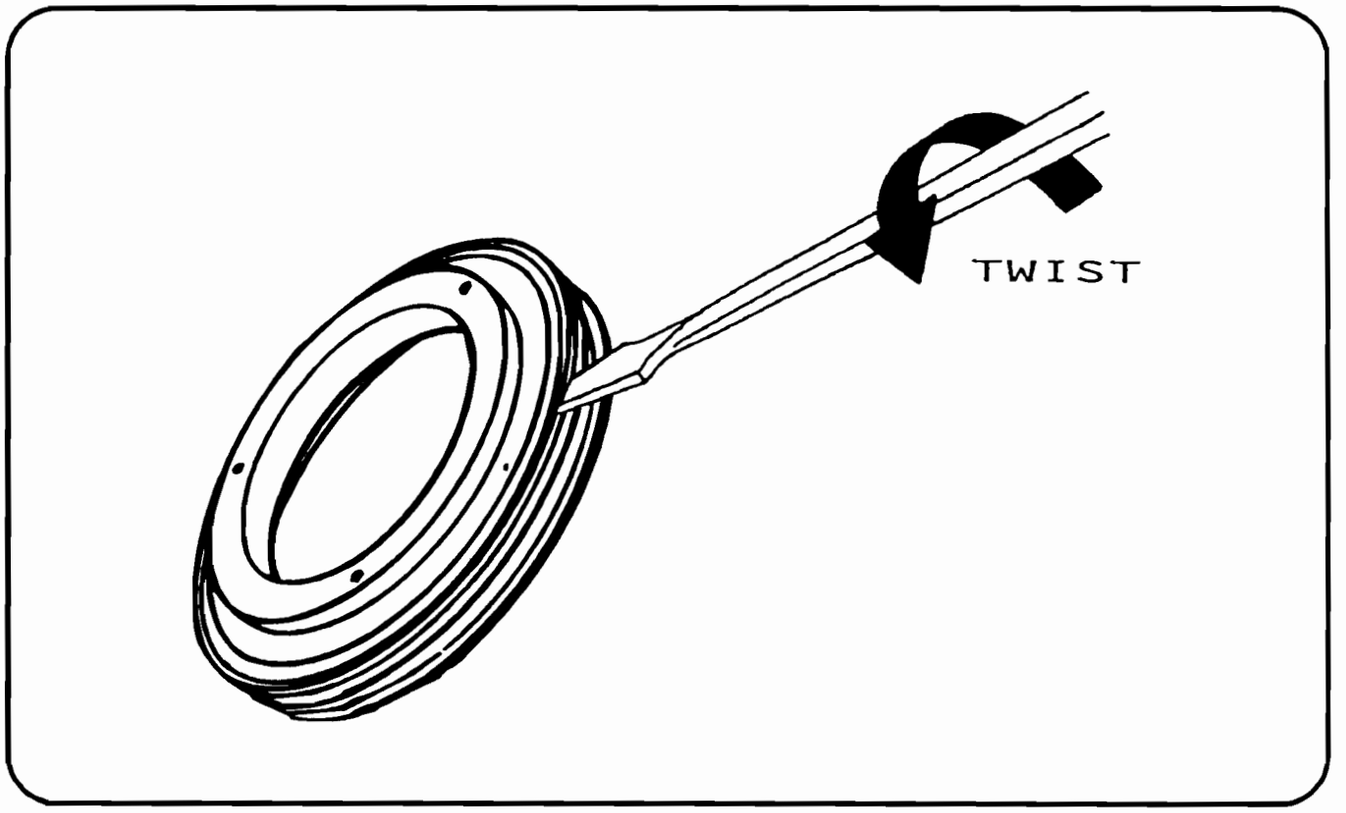
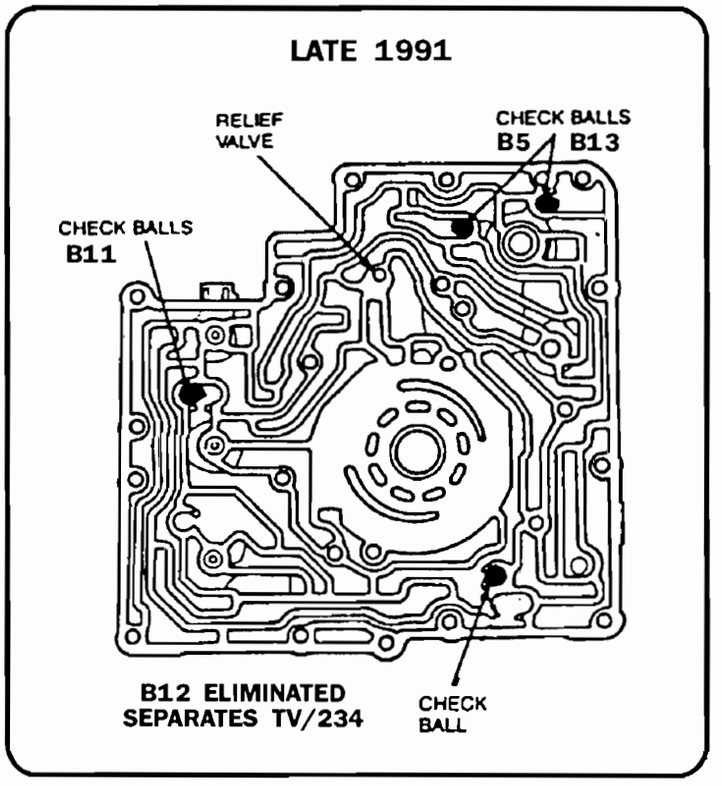
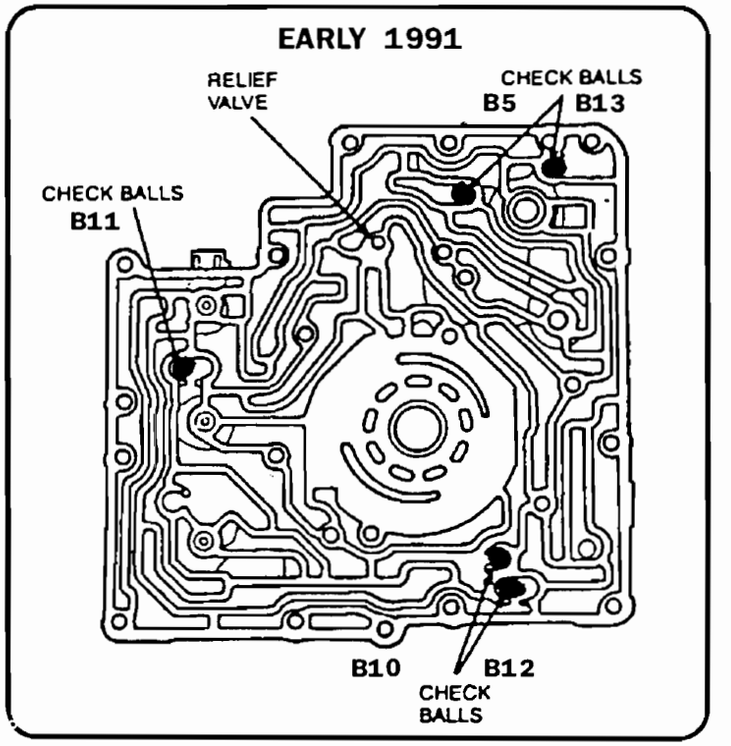
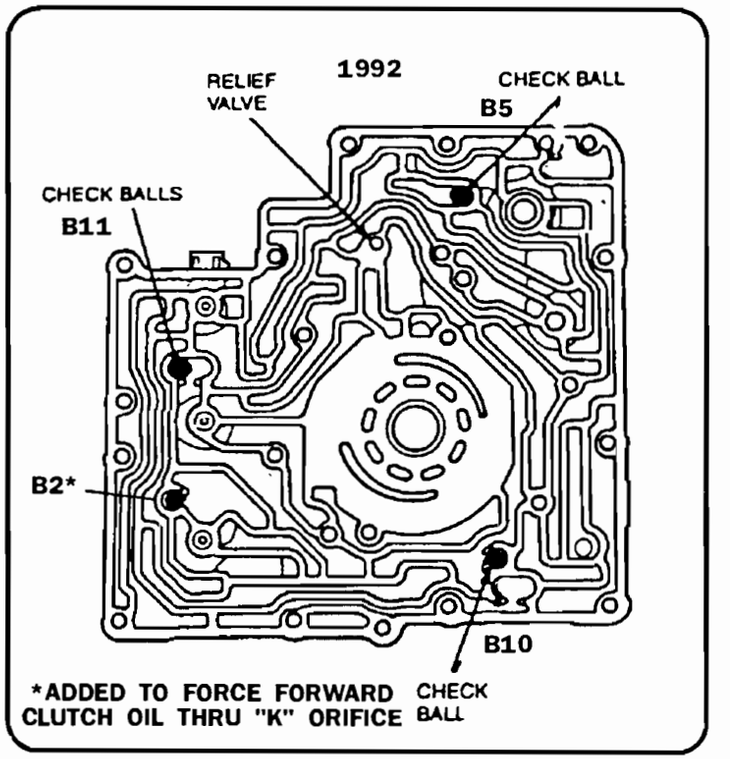


FIGURE 1

FORD AXOD-E CHECK BALL LOCATION IN PUMP BODY







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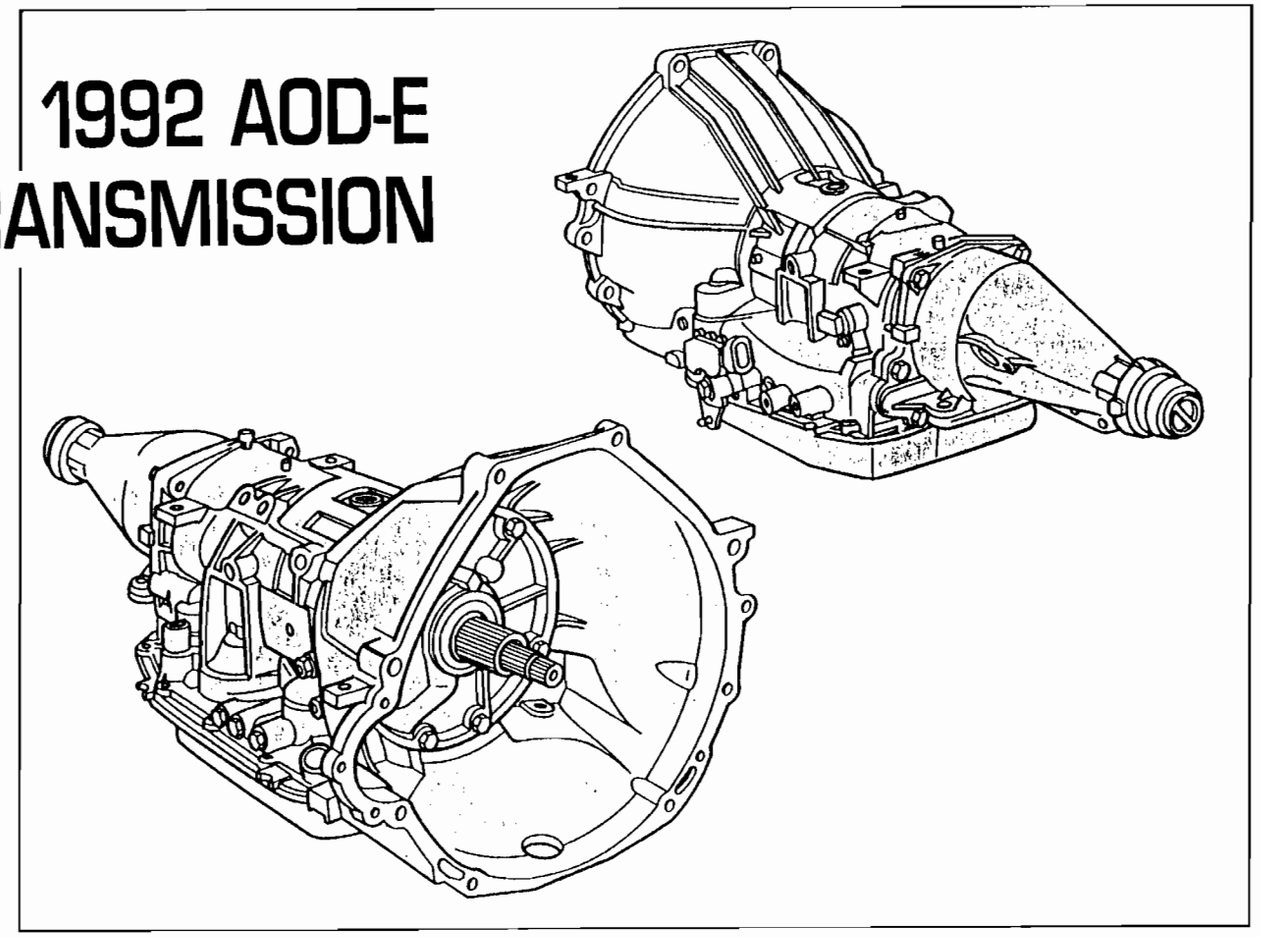
1992 AOD-E TRANSMISSION



GENERAL DESCRIPTION

The AOD-E transmission is a four-speed, rear-wheel drive automatic with electronic controls for:

- shifting
- converter clutch control
- line pressure control

The AOD-E is the second generation of the AOD transmission first introduced in 1980.

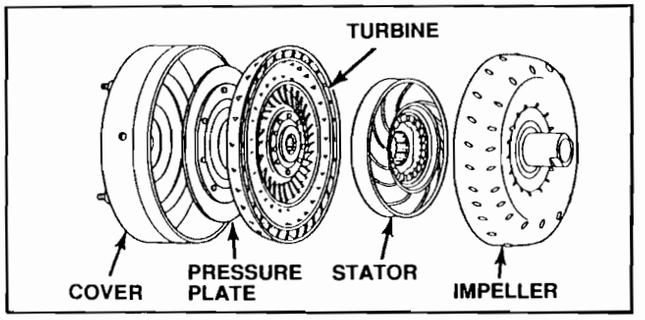
While the AOD-E is mechanically similar to the AOD, it is more than just an "AOD with electronics." There are significant changes to the valve body, torque converter clutch, pump assembly, input shaft and other components. In addition, the split torque function in third and fourth gears has been eliminated to enhance shift quality.

The AOD-E uses a Ravigneaux style compound gearset with two sun gears and a dual pinion set to produce four forward speeds plus reverse. Two bands, two one-way roller clutches and four friction clutches are used to hold or drive various planetary gearset members.

Specific information on the AOD-E transmission is shown below.

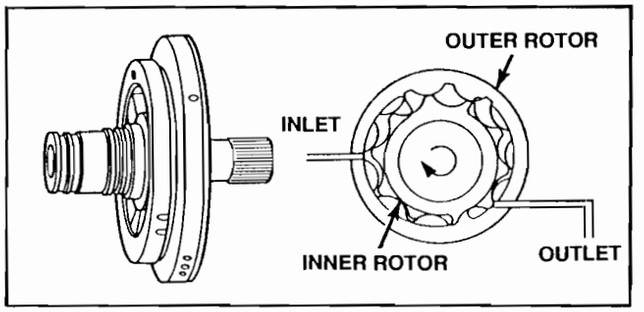
Configuration	RWD
Weight (Dry) Weight (With Oil)	79 kg (173 lbs) 89 kg (197 lbs)
Fluid Capacity	12.2 liters (12.9 qts)
Fluid Type	MERCON®
Converter Size	305 mm (12 in)

MAJOR CHANGES ON AOD-E



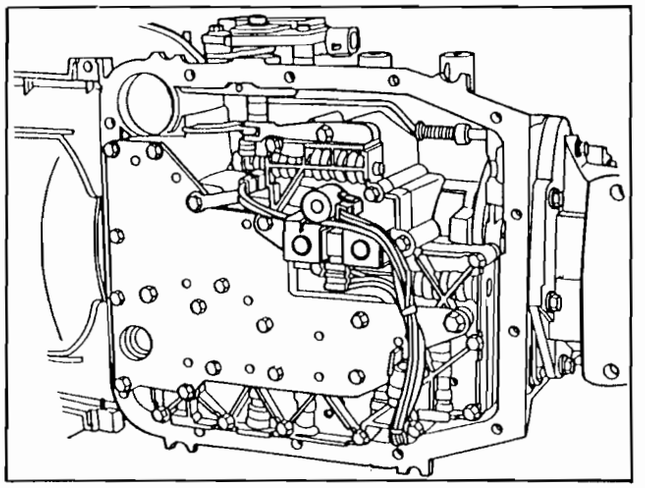
Torque Converter

A pressure plate-style torque converter clutch has been added to the AOD-E. The bell housing and the converter have been lengthened to accommodate the change. The split-torque style converter of the previous AOD has been replaced by this converter clutch style.



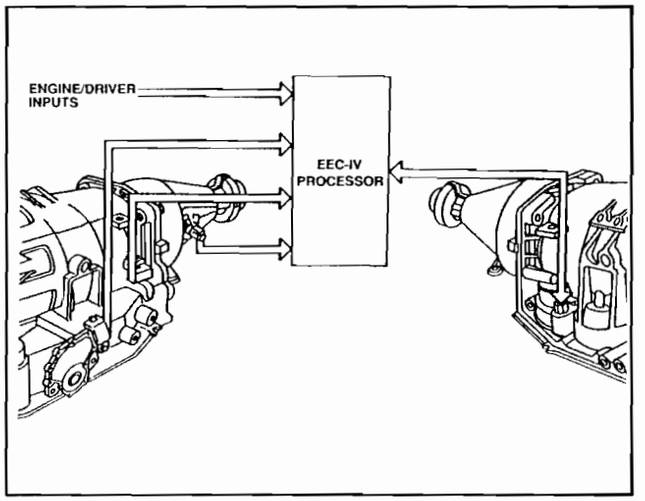
Fluid Pump

An updated gerotor design replaces the gear and crescent design of the AOD. The new pump has approximately the same pumping capacity as the old one, but has a higher flow at lower engine speeds due to better efficiencies. The AOD-E pump housing is made of aluminum, making it lighter than the AOD pump.



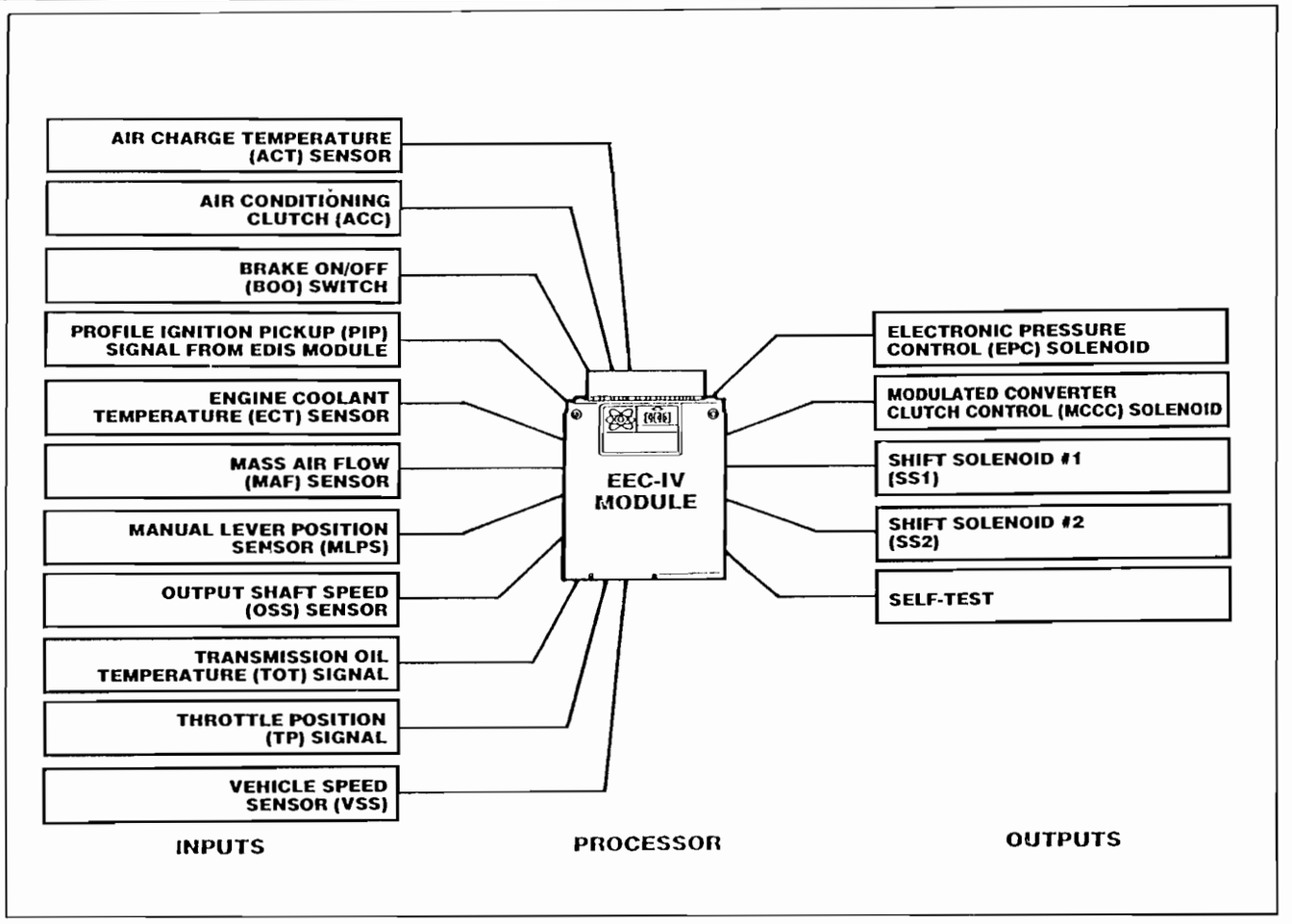
Main Control Body

The thickness of the valve body has been increased for more rigidity. Three electronic solenoids (two shift solenoids and a torque converter clutch control solenoid) have been added and most spool valves are now made of aluminum for reduced leaking and more consistent operation. (An electronic pressure control solenoid has also been added to the case.)



Electronics

The tie-in between the transmission, the engine and other vehicle systems is now electronic. This provides more accurate information (on temperature and engine load, for example) for smoother, more accurate shifting. Some of the new components you will find on the AOD-E transmission include an output shaft speed sensor, a manual lever position sensor and a transmission electrical connector. What you won't find on the AOD-E are the TV cables and linkages of the past.



OVERVIEW

The AOD-E electronic control system consists of inputs (sensors and switches), a computer processor (EEC-IV module) and outputs (solenoid valves). The EEC-IV processor receives electrical signals from input components related to driver demands, engine state, external conditions and transmission state.

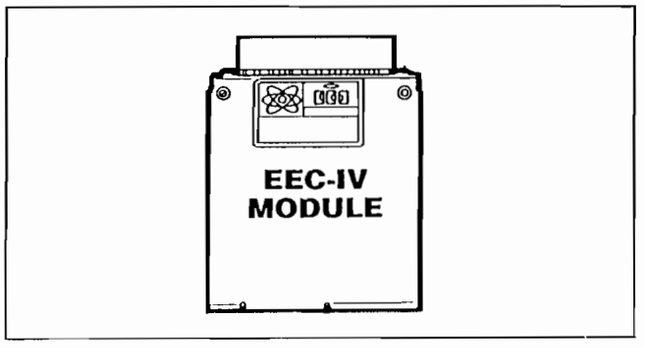
Based on the signals from these inputs, the EEC-IV processor controls:

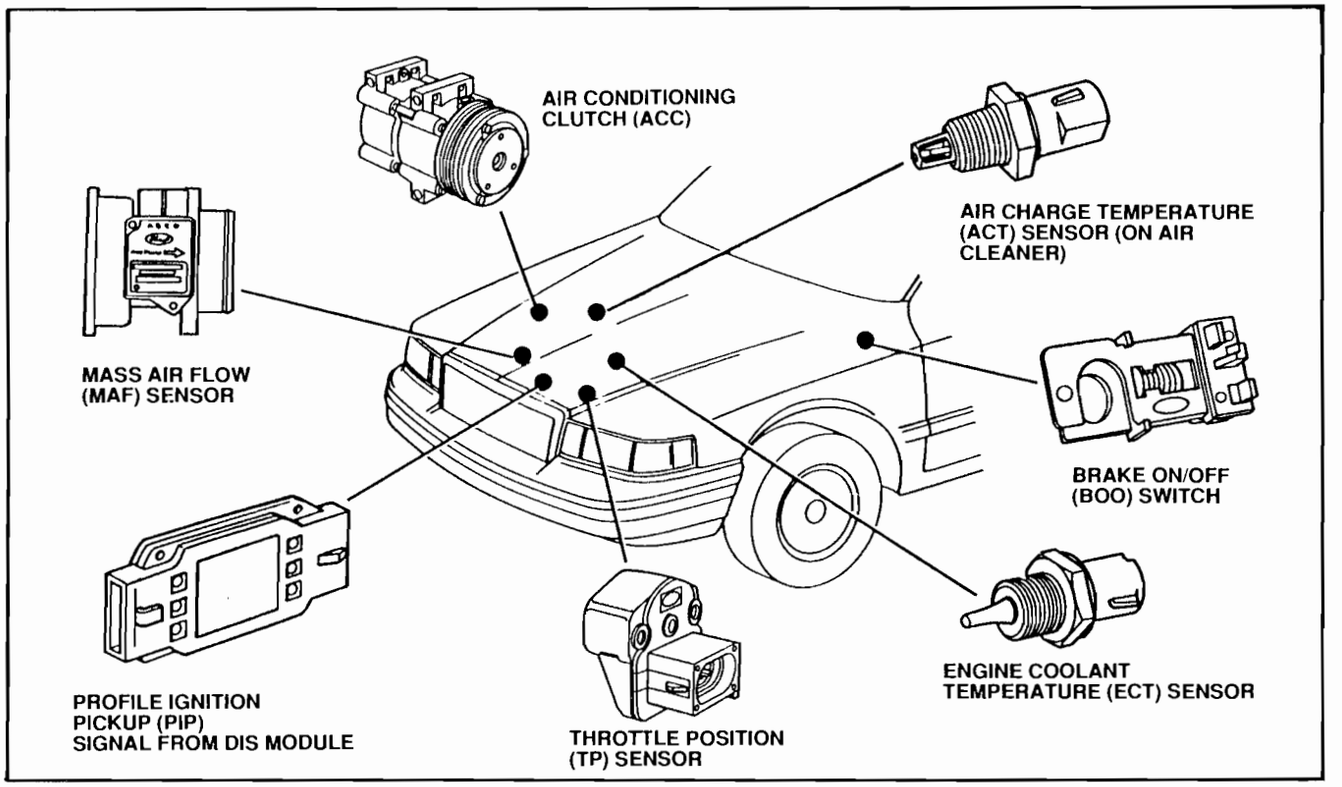
- transmission shift scheduling
- modulated torque converter clutch operation
- line pressure (shift feel)

A summary of electronic transmission control functions and a description of the solenoids involved follows the discussion on inputs.

EEC-IV Processor

The control center for the AOD-E electronic control system is the EEC-IV processor. The processor computes engine load, vehicle conditions and transmission conditions, then uses this information to control the output solenoids. The processor controls the solenoids by selectively grounding certain electrical circuits.





NON-TRANSMISSION INPUTS

Throttle Position (TP) Sensor

The TP sensor is a potentiometer mounted on the engine throttle body. This sensor uses a variable resistor to detect the throttle plate opening (accelerator pedal position), and sends this information to the processor as a varying voltage signal.

Mass Air Flow (MAF) Sensor and Air Charge Temperature (ACT) Sensor

The MAF sensor is an anemometric device which measures the rate of mass air flow into the engine. The term "anemometric" refers to the process of measuring the force, speed and direction of air flow. By combining information from the MAF sensor with information from the air charge temperature (ACT) sensor, the EEC-IV processor can determine the climate in which the vehicle is operating, and adjust shift schedules, converter clutch schedules and EPC solenoid pressure accordingly.

Profile Ignition Pickup (PIP) Signal

The cylinder identification (CID) signal is provided to the EDIS module on vehicles with a distributorless ignition system. The EDIS module then sends this information to the EEC-IV processor as part of its profile ignition pickup (PIP) signal. This signal tells the EEC-IV processor the crankshaft position and engine rpm.

Engine Coolant Temperature (ECT) Sensor

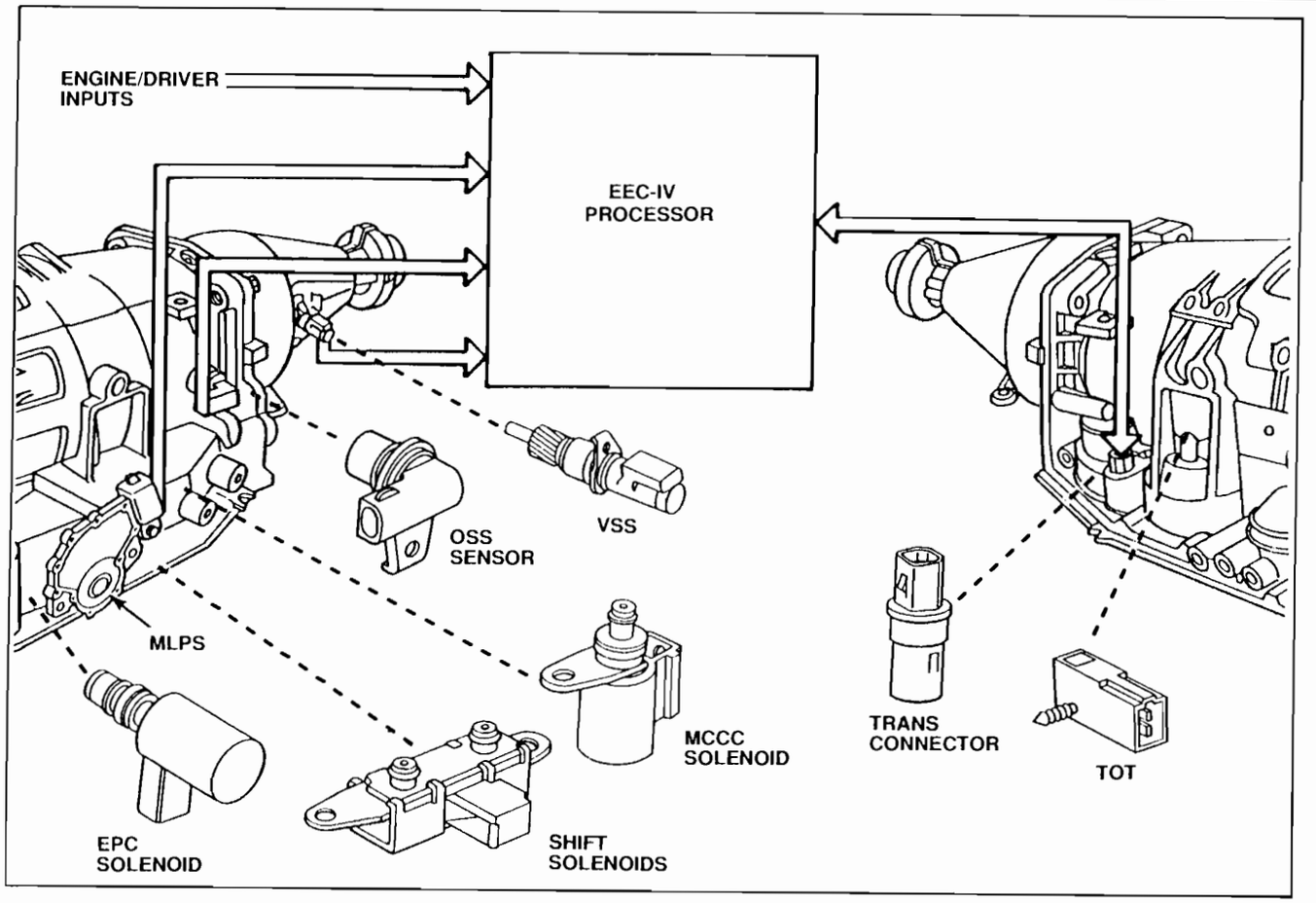
The ECT sensor is a thermistor that produces a voltage signal related to engine coolant temperature. The EEC-IV processor uses this information to determine if the engine is warm enough to allow for converter clutch application. However, the EEC-IV processor only uses this signal if it cannot read an input from the transmission oil temperature (TOT) sensor. If the temperature is too cold, the EEC-IV processor will keep the modulated converter clutch control (MCCC) solenoid turned off, preventing converter clutch application and thus helping prevent engine stall.

Air Conditioning Clutch (ACC)

The EEC-IV processor receives a signal when the air conditioning compressor clutch is on. With the clutch on, the EEC-IV processor may adjust transmission EPC pressure to compensate for the change in torque supplied to the transmission.

Brake On/Off (BOO) Switch

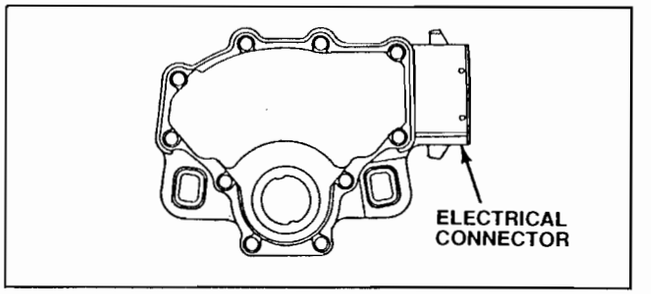
The BOO switch tells the EEC-IV processor whether the brakes are applied or not, to aid in converter clutch control. The switch is mounted on the brake pedal bracket and is normally open. When the brake pedal is applied, the switch is mechanically closed.



TRANSMISSION RELATED INPUTS

Manual Lever Position Sensor (MLPS)

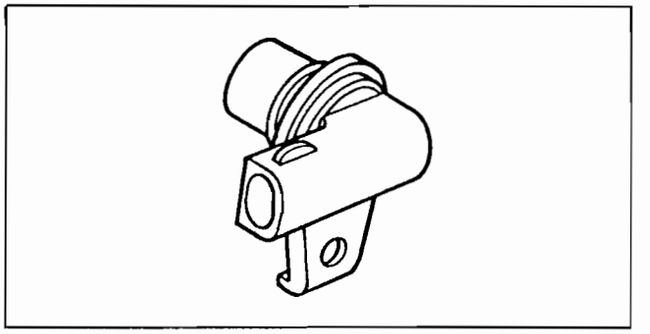
The MLPS tells the EEC-IV processor the position of the manual lever (P, R, N, (D), D or 1). It is located on the lower left side of the transmission, at the manual lever. The MLPS also houses the switches for the park/neutral start and backup lamp functions.

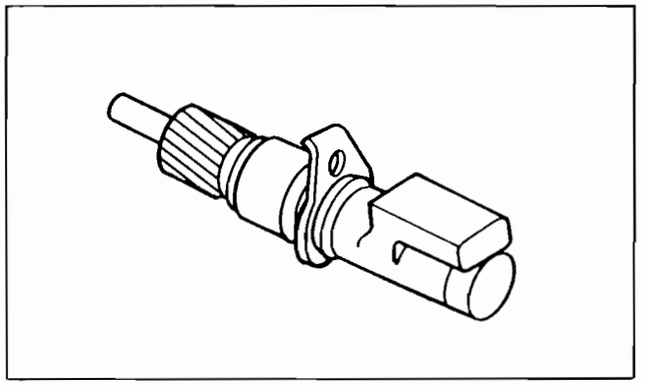


Output Shaft Speed (OSS) Sensor

The output shaft speed sensor does electronically what the governor did hydraulically — that is, it tells the EEC-IV processor what the output speed of the transmission is.

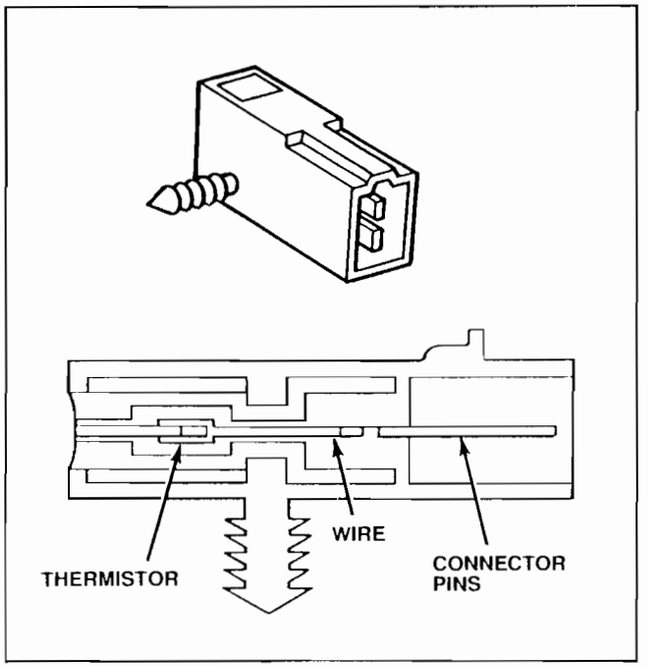
The OSS sensor is a magnetic pickup. It sends a voltage signal to the EEC-IV processor that is proportional to output shaft ring gear rpm. The signal from this input is used for shift schedules, modulated converter clutch control and in determining EPC pressure.





Vehicle Speed Sensor (VSS)

The vehicle speed sensor is a magnetic pickup mounted near the rear of the transmission and is driven through a small gear. It sends a voltage signal to the EEC-IV processor which is proportional to output shaft rpm. Its signal is used as an additional speed input to modify upshift scheduling only. (The output shaft speed sensor provides the main vehicle speed signal for transmission control.)

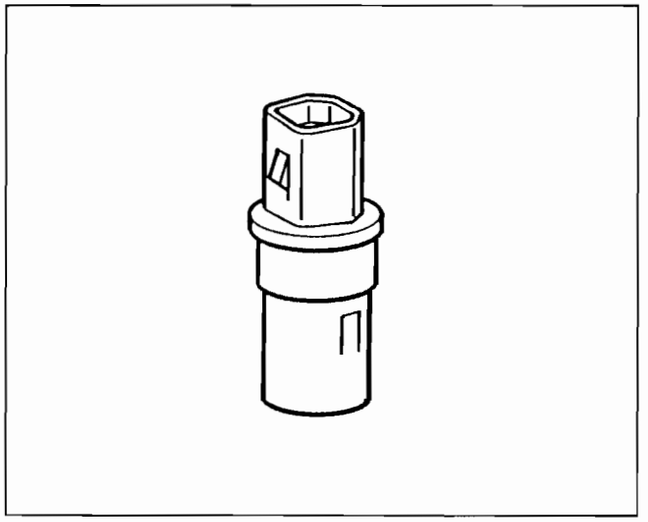


Transmission Oil Temperature (TOT) Sensor

The TOT sensor is a thermistor. It sends a voltage signal to the EEC-IV processor related to the temperature of the fluid in the pan.

The EEC-IV processor uses the TOT sensor signal to determine if a "cold start" shift schedule is necessary.

The shift schedule is compensated when the transmission fluid temperature is cold. The EEC-IV strategy will also prevent converter clutch engagement when the fluid is cold.



Transmission Connector

The transmission connector is mounted on the right side of the transmission. It is the electrical connector used to receive control signals for all four solenoids. The connector also has a pin for sending the TOT sensor signal to the EEC-IV processor.

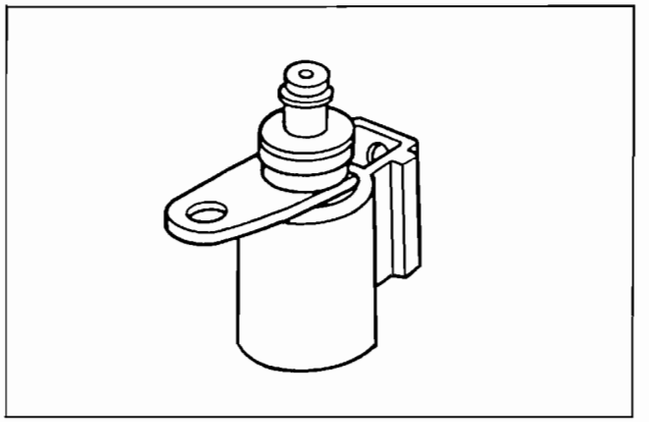
OUTPUTS

There are three types of solenoids used as output devices in the AOD-E transmission control system: a pulse-width modulated (PWM) solenoid, on/off solenoids, and a variable force solenoid (VFS).

Pulse-Width Modulated (PWM) Solenoid

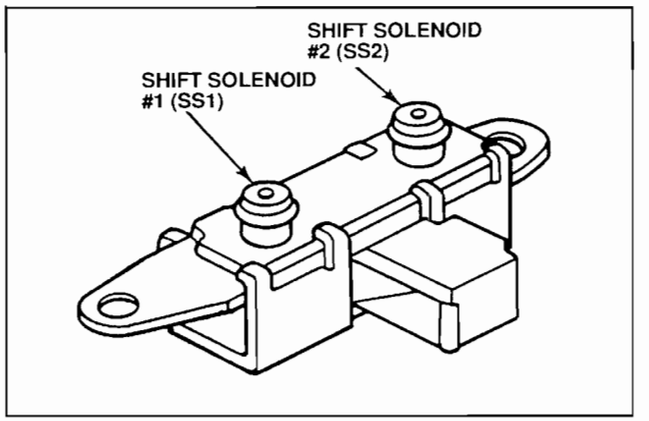
A PWM solenoid is used to control the apply and release of the torque converter clutch. A duty cycle signal controlled by the EEC-IV processor commands the PWM solenoid to allow an appropriate amount of pressure to flow to the converter clutch control valve. This provides for smoother clutch apply and release.

In this publication, we refer to the PWM solenoid as the modulated converter clutch control (MCCC) solenoid.



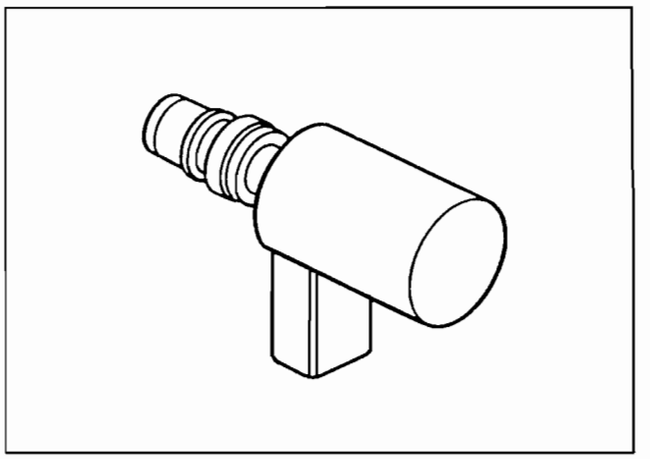
On/Off Solenoids

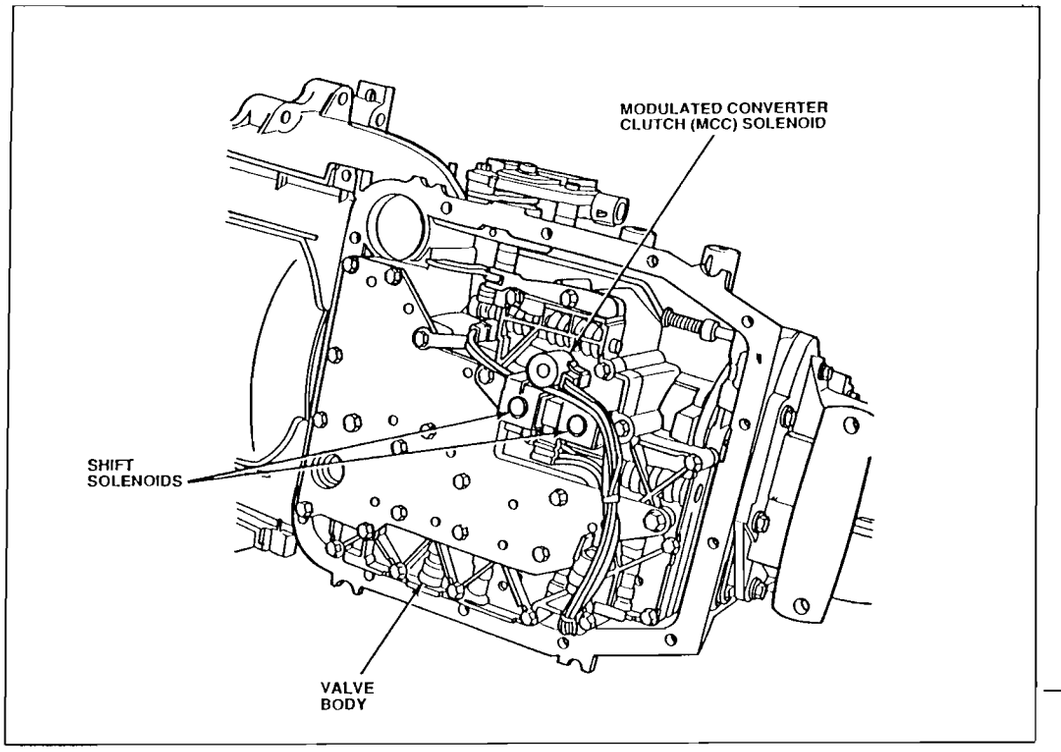
The two shift solenoids are simple on/off types used to either pressurize or exhaust fluid passages to the 1-2, 2-3 and 3-4 shift valves. They do not regulate the fluid that passes through, they can only turn the flow on or off. These two solenoids, called shift solenoid 1 (SS1) and shift solenoid 2 (SS2), are mounted in a single housing.

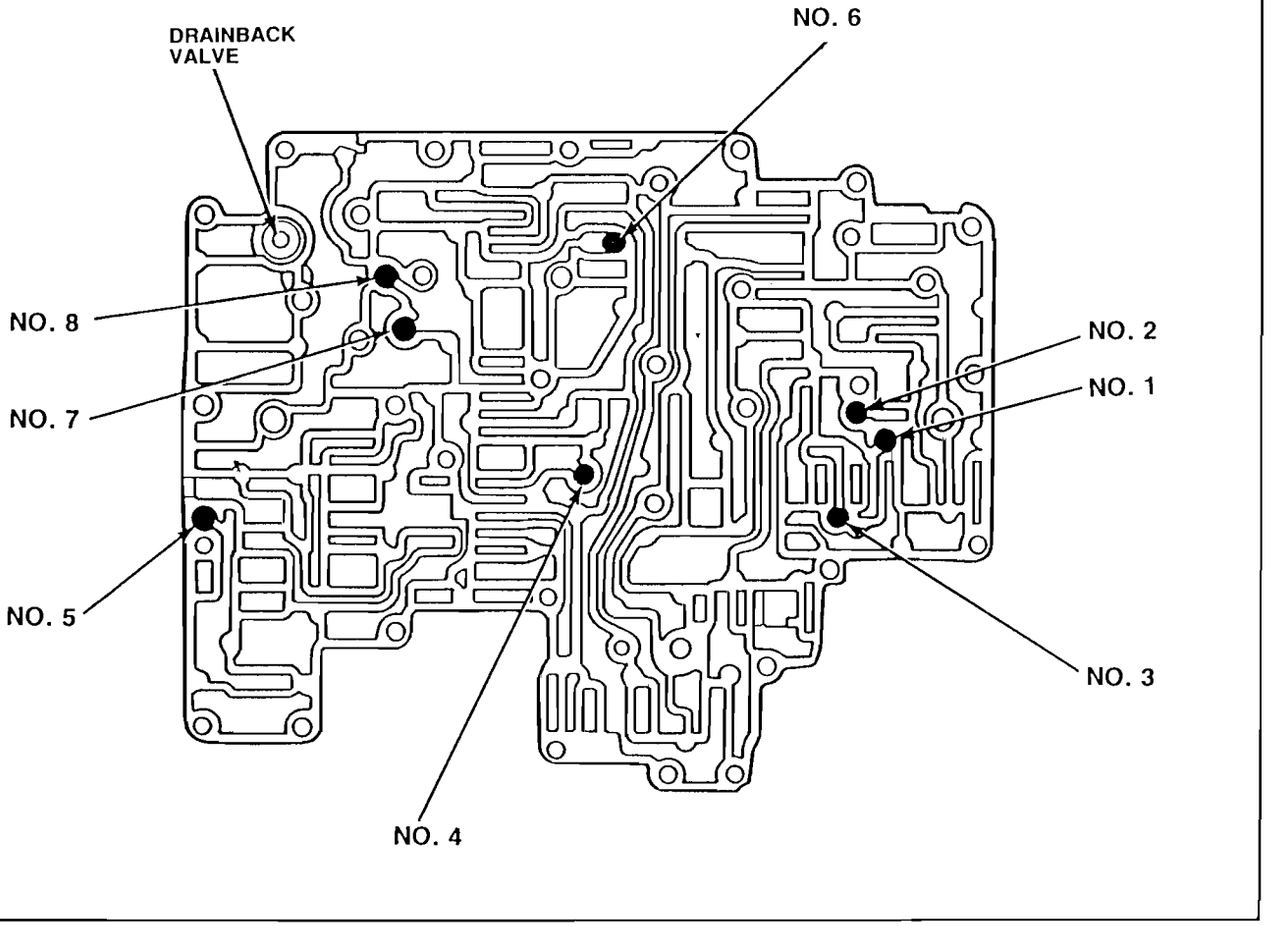


Variable Force Solenoid (VFS)

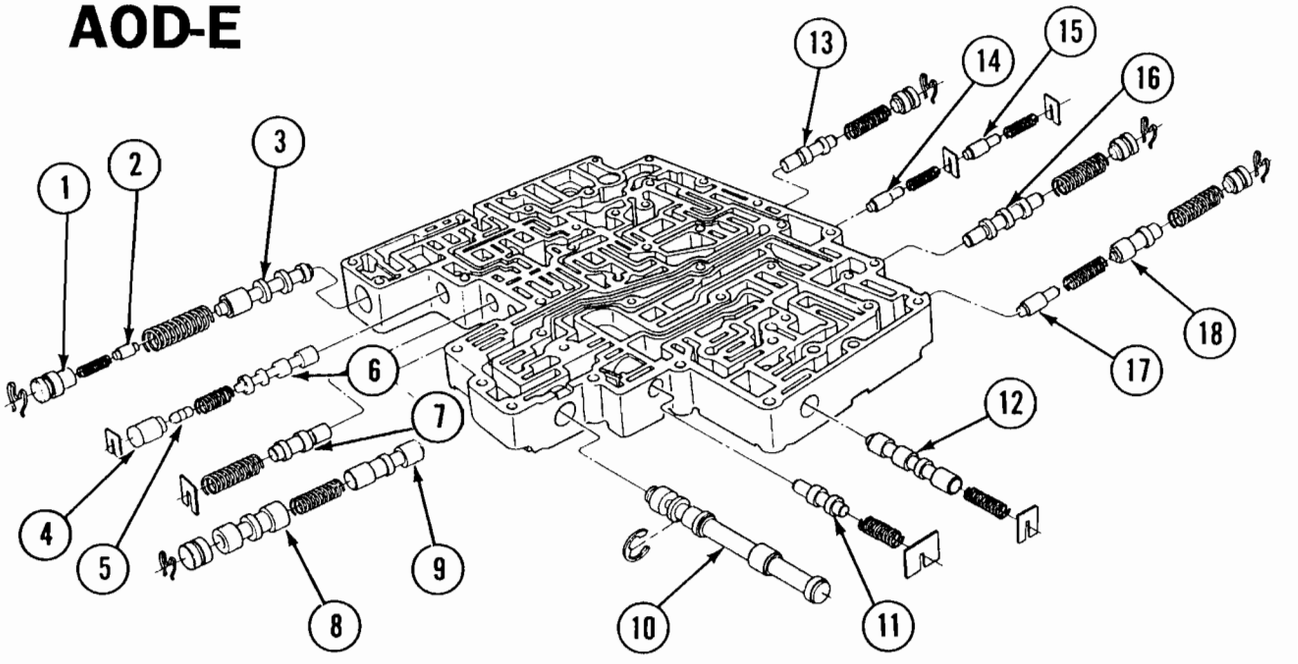
A VFS solenoid is used to control shift feel by controlling line pressure. Based on the selective grounding action of the EEC-IV processor, the solenoid varies its output pressure. In this publication, we refer to the VFS as the electronic pressure control (EPC) solenoid.




MODULATED CONVERTER CLUTCH (MCC) SOLENOID
SHIFT SOLENOIDS
VALVE BODY


DRAINBACK VALVE
NO. 6
NO. 8
NO. 7
NO. 2
NO. 1
NO. 5
NO. 3
NO. 4

AOD-E



1. MAIN OIL PRESSURE BOOSTER SLEEVE
2. MAIN OIL PRESSURE BOOSTER VALVE
3. MAIN REGULATOR VALVE
4. BYPASS CLUTCH CONTROL PLUNGER SLEEVE
5. BYPASS CLUTCH CONTROL PLUNGER VALVE
6. BYPASS CLUTCH CONTROL VALVE
7. CONVERTER PRESSURE LIMIT VALVE
8. 2-3 SHIFT VALVE
9. 1-2 SHIFT VALVE
10. MANUAL VALVE
11. SOLENOID PRESSURE REGULATOR VALVE
12. 2-3 BACKOUT VALVE
13. OVERDRIVE SERVO REGULATOR VALVE
14. 3-4 CAPACITY MODULATOR VALVE
15. LOW SERVO MODULATOR VALVE
16. 3-4 SHIFT VALVE
17. 2-3 CAPACITY MODULATOR VALVE
18. ORIFICE CONTROL VALVE

	GEAR	SOLENOIDS SS1	SS2	MODULATED CONVERTER CLUTCH CONTROL SOLENOID	EPC SOLENOID
OVERDRIVE RANGE	1	ON	OFF	CLUTCH HYDRAULICALLY DISABLED	PRESSURE OUTPUT CONTROLLED BY EEC-IV STRATEGY IN ALL RANGES
	2	OFF	OFF	CONTROLLED BY EEC-IV STRATEGY	
	3	OFF	ON		
	4	ON	ON		
D RANGE	1	ON	OFF	CLUTCH HYDRAULICALLY DISABLED	
	2	OFF	OFF	CONTROLLED BY EEC-IV STRATEGY	
	3	OFF	ON		
"1" RANGE	1	ON	OFF	CLUTCH HYDRAULICALLY DISABLED	
	2	OFF	OFF	CONTROLLED BY EEC-IV STRATEGY	
REVERSE, PARK NEUTRAL	-	ON	OFF	CLUTCH HYDRAULICALLY DISABLED	

FORD PART NUMBERS

E4OD

GASKET	F1TZ-7C155-A
EXTENSION HOUSING	F0UZ-7A039-B
FITTING	F0TZ-7D174-A
HARNESS	T89T-70100-A
SHAFT	F0TZ-7060-F
TORQUE REAR SUPPORT	8 - 12 FT. LBS.
O.D. SUPPORT	6 - 10 FT. LBS.

AXOD-E

EPC SOLENOID	
1991 - UP (ALL MODELS)	F1DZ-7N144-A
SHIFT SOLENOIDS	
1991 - UP (ALL MODELS)	F1DZ-7G484-A
LOCK-UP SOLENOID	
1991 - UP (TAURUS & SABLE)	F1DZ-7G136-A
1991 - UP (LINCOLN ONLY)	F1OY-7G136-A

AOD

FORWARD STEELS	F0SZ-7B442-A
FORWARD DRUM & STEELS	F0FZ-7F207-A

ATX

ANTI CLUNK	E6FZ-7A230-A

SOLENOID WIRE COLOR AND APPLICATION CHARTS

HONDA - ACURA

	SHIFT SOLENOID A	SHIFT SOLENOID B
1st	OFF	ON
2nd	ON	ON
3rd	ON	OFF
4th	OFF	OFF

ACURA - INTEGRA

WIRE COLOR CODE	
SHIFT SOLENOID A	BLUE
SHIFT SOLENOID B	GREEN
LOCK-UP SOLENOID A	RED
LOCK-UP SOLENOID B	GREEN/BLACK

ACURE - LEGEND

WIRE COLOR CODE	
SHIFT SOLENOID A	BLUE/GREEN
SHIFT SOLENOID B	GREEN/WHITE
LOCK-UP SOLENOID A	RED/WHITE
LOCK-UP SOLENOID B	WHITE/BLACK

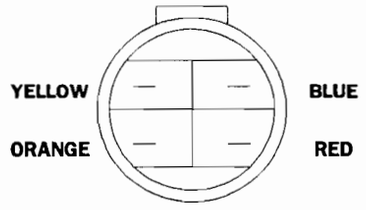
HONDA 4 SPEED

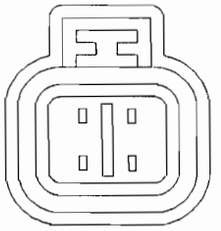
WIRE COLOR CODE	
SHIFT SOLENOID A	BLUE/YELLOW
SHIFT SOLENOID B	GREEN/WHITE
LOCK-UP SOLENOID A	RED/WHITE
LOCK-UP SOLENOID B	WHITE/BLACK

MITSUBISHI KM-175

COLOR	ORANGE	YELLOW	RED	BLUE
GEAR	SOLENOID A	SOLENOID B	TCC SOL.	PRESSURE
1st	ON	ON	OFF	PULSE MODULATED BY COMPUTER
2nd	OFF	ON	ON*	
3rd	OFF	OFF	ON*	
4th	ON	OFF	ON*	
OHMS	20.8 - 23.8	20.8 - 23.8	2.6 - 3.2	2.6 - 3.2

* - AS DETERMINED BY COMPUTER

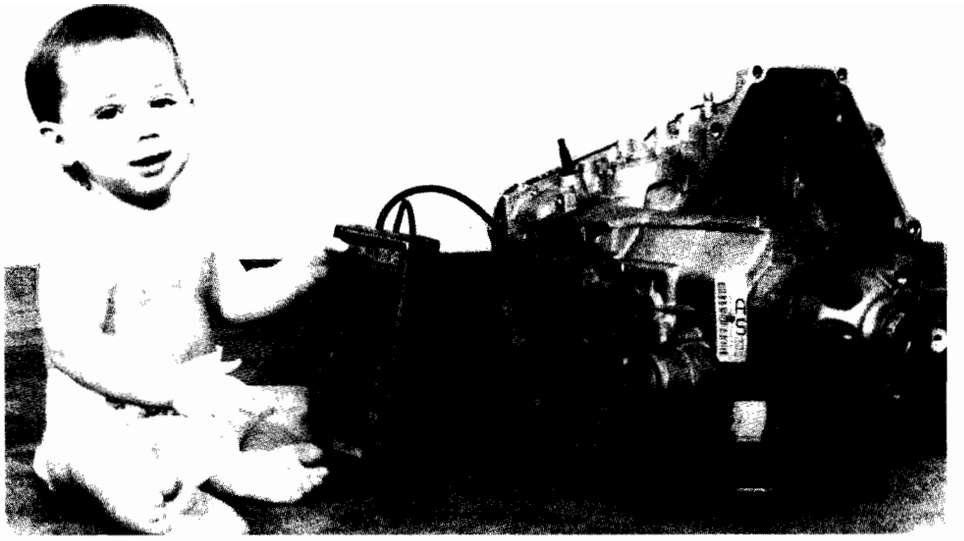




TOYOTA

COLOR	WHITE	BLACK	YELLOW
GEAR	SHIFT SOLENOID 1	SHIFT SOLENOID 2	LOCK-UP SOLENOID
1st	ON	OFF	OFF
2nd	ON	ON	OFF
3rd	OFF	ON	OFF
4th	OFF	OFF	ON*
OHMS	11 - 15	11 - 15	11 - 15

* - AS DETERMINED BY COMPUTER



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Remember the four letters that spell help

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