"2006" SEMINAR INFORMATION
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"Top Tech Tricks for 2006" Seminar Information

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4T65-E

P0742 TCC SYSTEM STUCK ON

COMPLAINT: A GM vehicle equipped with a 4T65-E transaxle comes to the shop with complaints of harsh shifting, engine lugging or lack of power. The Service Engine Soon light (MIL) may or may not be illuminated at this time.
When the vehicle is scanned, a P0742 fault code defined as TCC system stuck on, is stored in memory. While this code is current, the PCM will command TCC on at maximum capacity and freeze shift adapts.

CAUSE: The PCM supplies 12 volts on CKT 657 to the TCC release switch with the ignition switch on or in the run position. (See figure 1) The TCC release switch is located inside the transaxle as part of the fluid pressure switch assembly. (See figure 2) This code is typically set when voltage on CKT 657 remains low, 6 times for 4 seconds, when TCC is commanded off during the current ignition cycle.
There are several possible causes for this problem such as follows;
A possible electrical issue could be a short to ground on the signal circuit (CKT 657) between the PCM and the TCC release switch.
A faulty TCC release switch.
The TCC/PWM solenoid is stuck.
Valve body concerns, such as a sticking TCC control valve, TCC regulator apply valve, torque signal regulator valve or pressure regulator valve.
The TCC feed limit/blow off ball valve in the case cover/channel plate is stuck closed.
A faulty PCM.

CORRECTION: ***External electrical checks:***

Scan tool data may not display TCC release switch status.
To test CKT 657, unplug the harness connector at the transmission and identify terminal U. (See figure 3) With a DVOM set to DC volts, place the negative lead to a known good ground and the positive meter lead to terminal U in the harness connector. Turn the ***key on*** with the ***engine off***. Battery voltage should be seen.
If battery voltage ***is*** seen at this time, proceed with ***Scenario 1***.
If battery voltage ***is not*** seen at this time, proceed with ***Scenario 2***.

(Scenario 1) If battery voltage IS seen:

Turn the key off. Plug in trans harness connector and then turn key on again. Recheck voltage on wire at terminal U from wire entry side of connector. No voltage should be seen.
Start the engine and recheck voltage while the engine is running. Battery voltage should be seen. If battery voltage is not seen at this time then either the internal harness is shorted to ground or the TCC release switch is defective.
This switch is normally closed to ground without oil pressure present. With the engine running in Park or Neutral, TCC release oil acting on the switch should open the contact.
Repair internal harness or replace fluid pressure switch assembly as necessary.

4T65-E

P0742 TCC SYSTEM STUCK ON

CORRECTION: ***External electrical checks continued:***

(Scenario 2) If battery voltage IS NOT seen:

For 98 and newer models, cut the wire at terminal 63 in the PCM C2 connector, approximately 2 inches from the connector. For 97 vehicles use terminal 75.
(See figure 4) Recheck voltage on the piece of cut wire that is protruding from the PCM connector. If battery voltage is now present, then trace and repair short to ground in wire between PCM connector and trans connector terminal U. Or, run a new wire to the trans harness connector in place of the existing wire. Cut the old wire out of the harness at both ends and tape it back. Be sure to solder and shrink wrap the new wire and tape it into the existing harness for neatness. This is usually a yellow wire from the PCM to the trans harness connector.
If no voltage is present on the cut wire at PCM connector, then the PCM will require replacement as the circuit would be shorted to ground inside the PCM.

NOTE: ***Electrically, this code can only be set by a short to ground on CKT 657. An intermittent or constant break or open in this circuit will not set a code P0742.***

Internal mechanical concerns:

If all external electrical checks test good at this time, then unplug the harness connector at the transmission. Start the engine, step firmly on the brake pedal and place the shift lever in Overdrive. If the engine stalls out or if it feels like the converter clutch is dragging, then replace the TCC/PWM solenoid. It is stuck right now.
(See figures 5 and 6 for correct solenoid usage and identification information)
With the trans connector unplugged and both shift solenoids off, the transmission will be forced to 3rd gear allowing 2nd clutch oil to feed the TCC/PWM solenoid. (See figure 7)
This does not necessarily mean that the solenoid is good if the engine does not stall out or drag at this time.
Valve body concerns such as a sticking TCC control valve may cause the vehicle to stall in a Drive range 1st gear or Reverse. The TCC regulator apply valve can cause a surge or harsh TCC engagement. Problems with the torque signal regulator or pressure regulator valve can result in harsh engagements and shifting. (See figure 8)
Disassemble and clean valve body. Free up sticking valves or replace control valve assembly as necessary if valves or bores are badly scored or damaged beyond repair.
Check to see if the TCC feed limit/blow off ball valve in the case cover/channel plate is stuck and repair as necessary. (See figure 9)

4T65-E

P0742 TCC SYSTEM STUCK ON

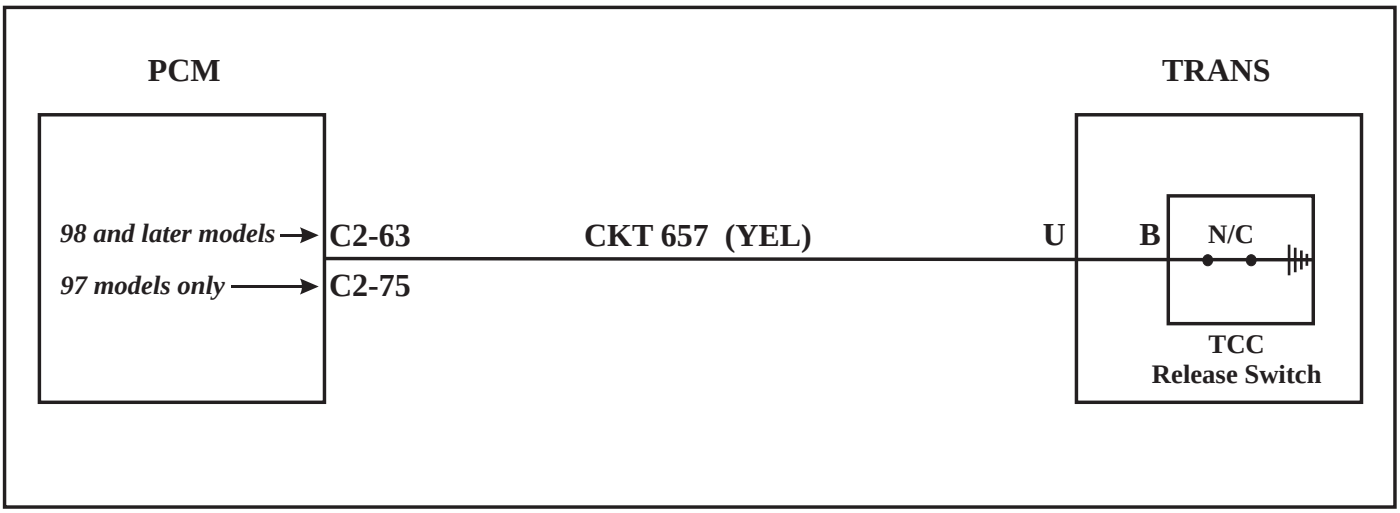


Figure 1

SERVICE INFORMATION: ***(See Figure 2)***

At the time of this printing, the current OEM part numbers are as follows:
24223197 = 1st Design Fluid Pressure Switch Assembly
24216426 = 2nd Design Fluid Pressure Switch Assembly

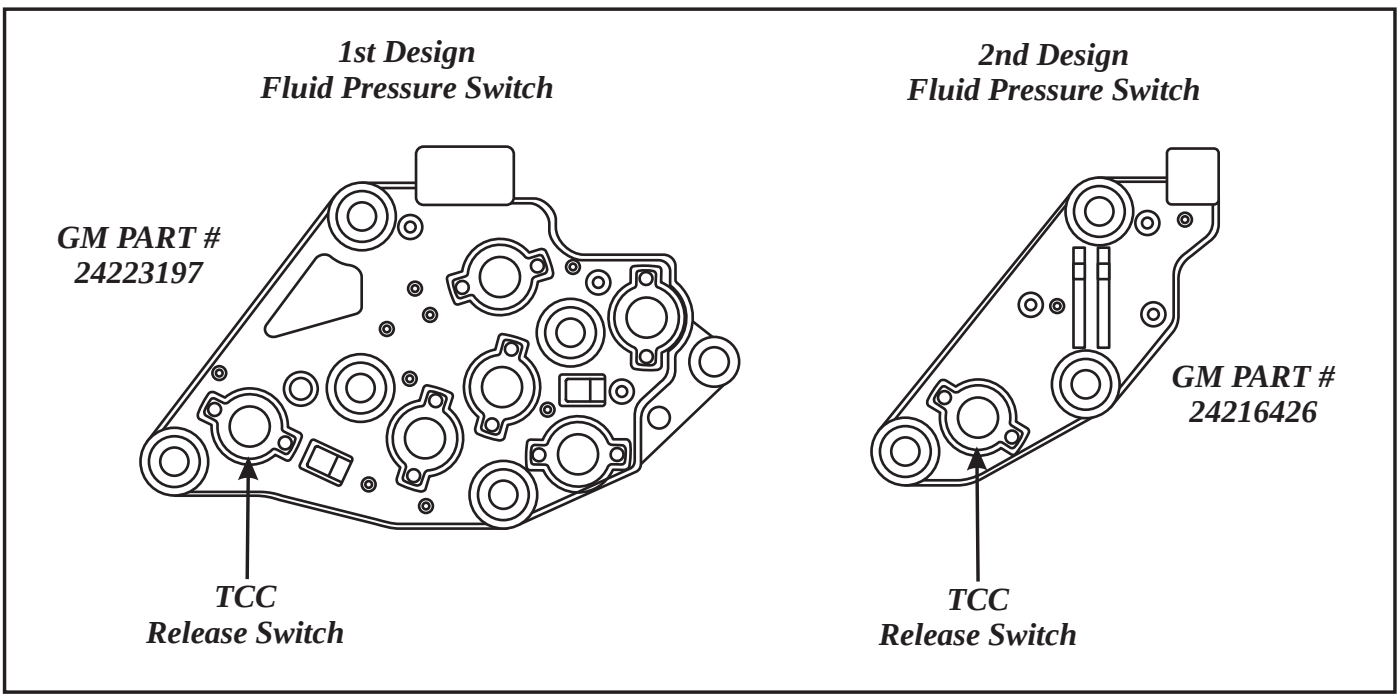
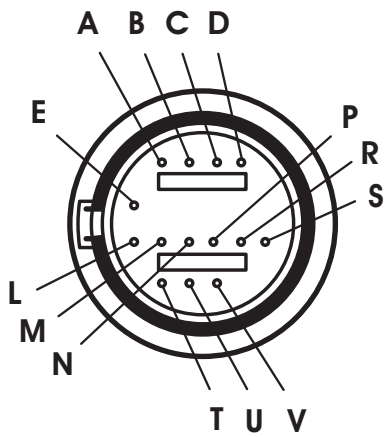


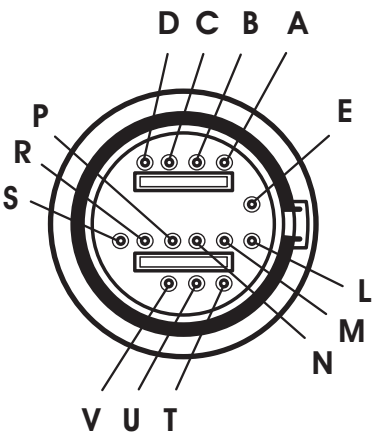
Figure 2

4T65-E

P0742 TCC SYSTEM STUCK ON



Transaxle Case Connector
Face View



Vehicle Harness Connector
Face View

Figure 3

PCM 80 Way Connector
C 1 = Blue
C 2 = Clear

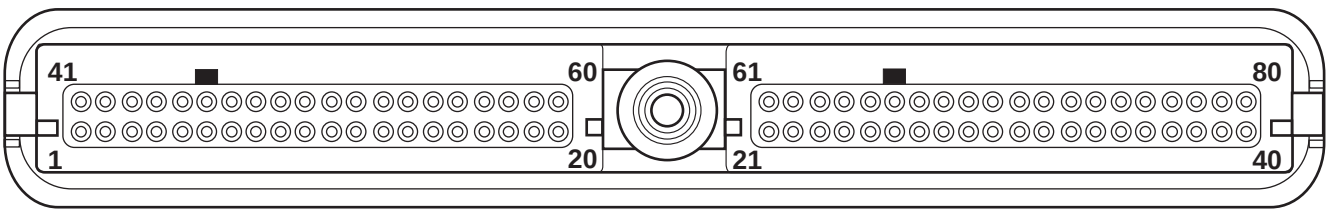


Figure 4

4T65-E

P0742 TCC SYSTEM STUCK ON

SERVICE INFORMATION: ***(See Figures 5 and 6)*** *Identify the correct TCC/PWM solenoid for your application. It is very easy to use the wrong solenoid as both solenoids have a gray plastic connector with the same configuration and appear to be identical. They are not. Both solenoids will have 2 groups of 4 numbers etched on the can surrounding the solenoid winding. The first group indicates the Julian Build Date and the second group are the last 4 digits of the part number. Refer to GM TSB 02-07-30-039A dated Dec/2002.* ***At the time of this printing, the correct OEM part numbers are as follows: 24227747 = TCC Solenoid Valve for 4T65-E ONLY. This number supercedes previous part number 24214974. 24227792 = TCC Solenoid Valve for 4T40/45-E and 4T80-E. This number supercedes previous part number 24212690. Refer to GM TSB 02-07-30-039F dated Aug/2005. Part number 24227792 is currently listed for use in 4L60/65-E units as well.***

SPECIAL THANKS: ***To the good folks in the Parts Dept. at AUTO CITY PONTIAC GMC in Miami Florida and FIDELIO MARTINEZ whose patience and assistance in researching much of this information was invaluable.***

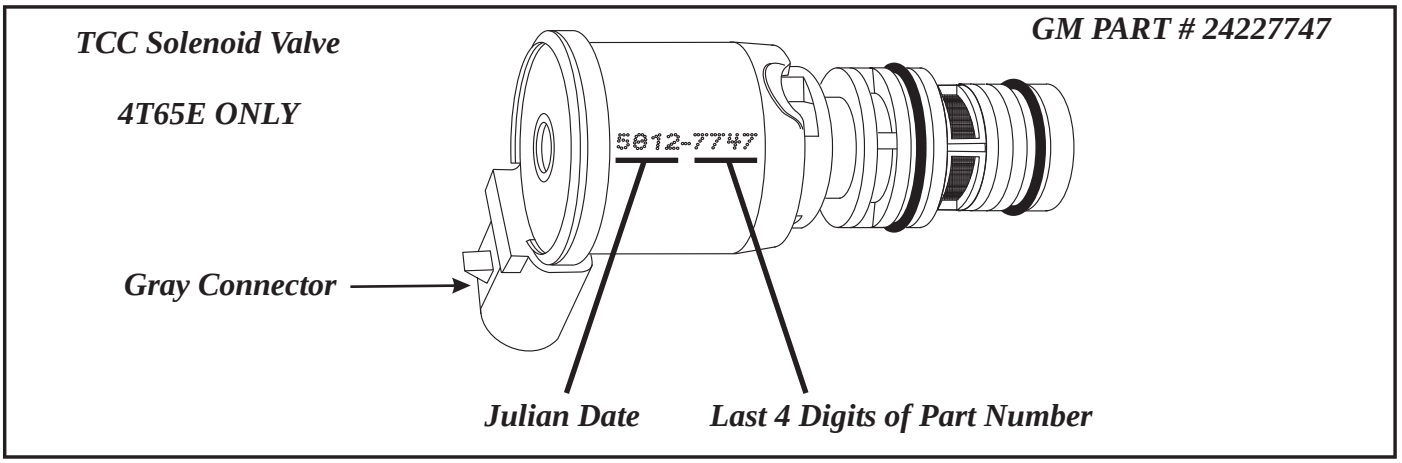


Figure 5

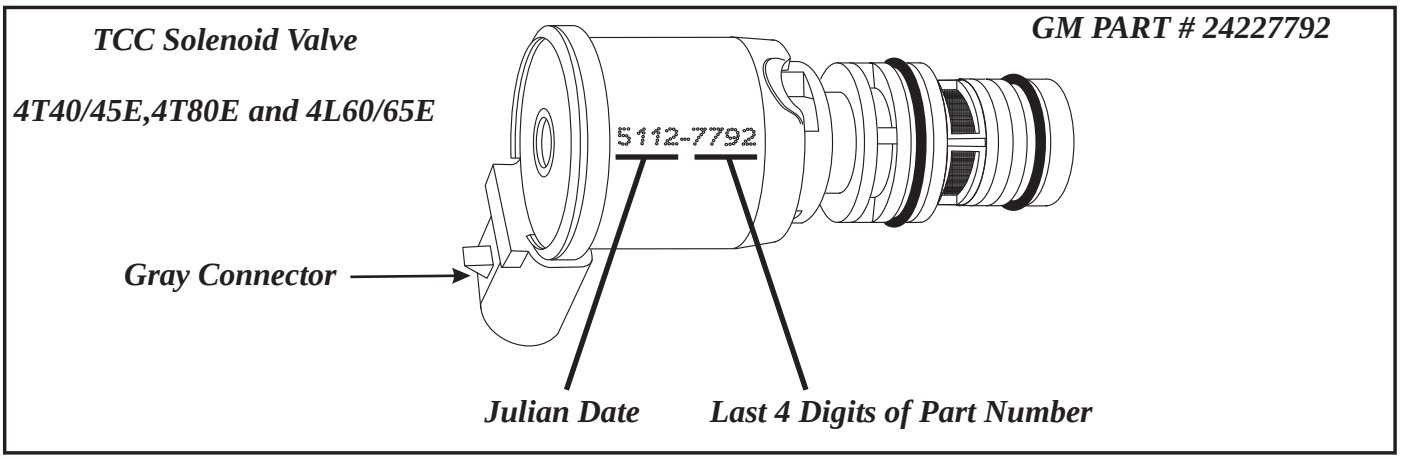
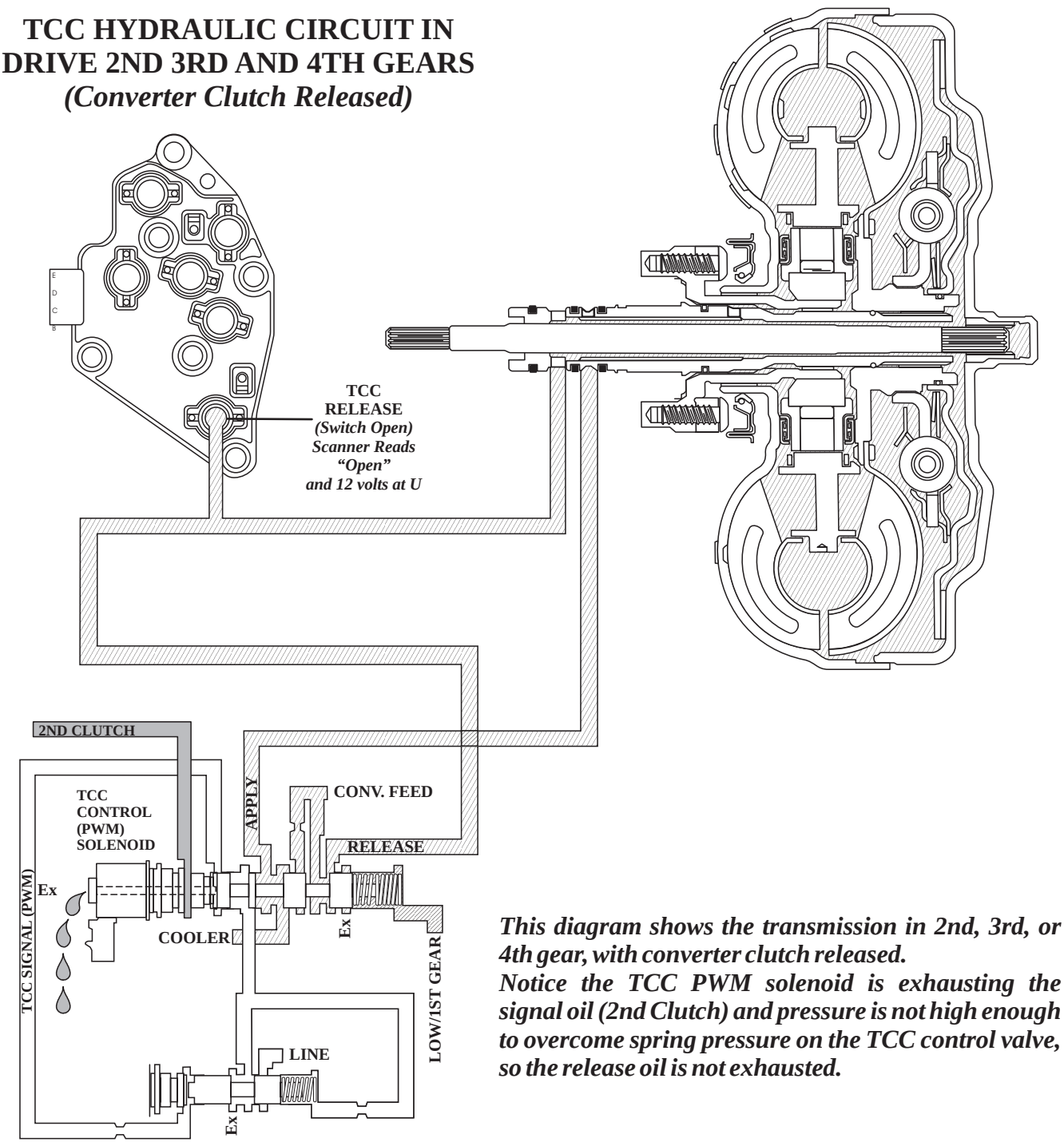


Figure 6

4T65-E

P0742 TCC SYSTEM STUCK ON

TCC HYDRAULIC CIRCUIT IN DRIVE 2ND 3RD AND 4TH GEARS
(Converter Clutch Released)



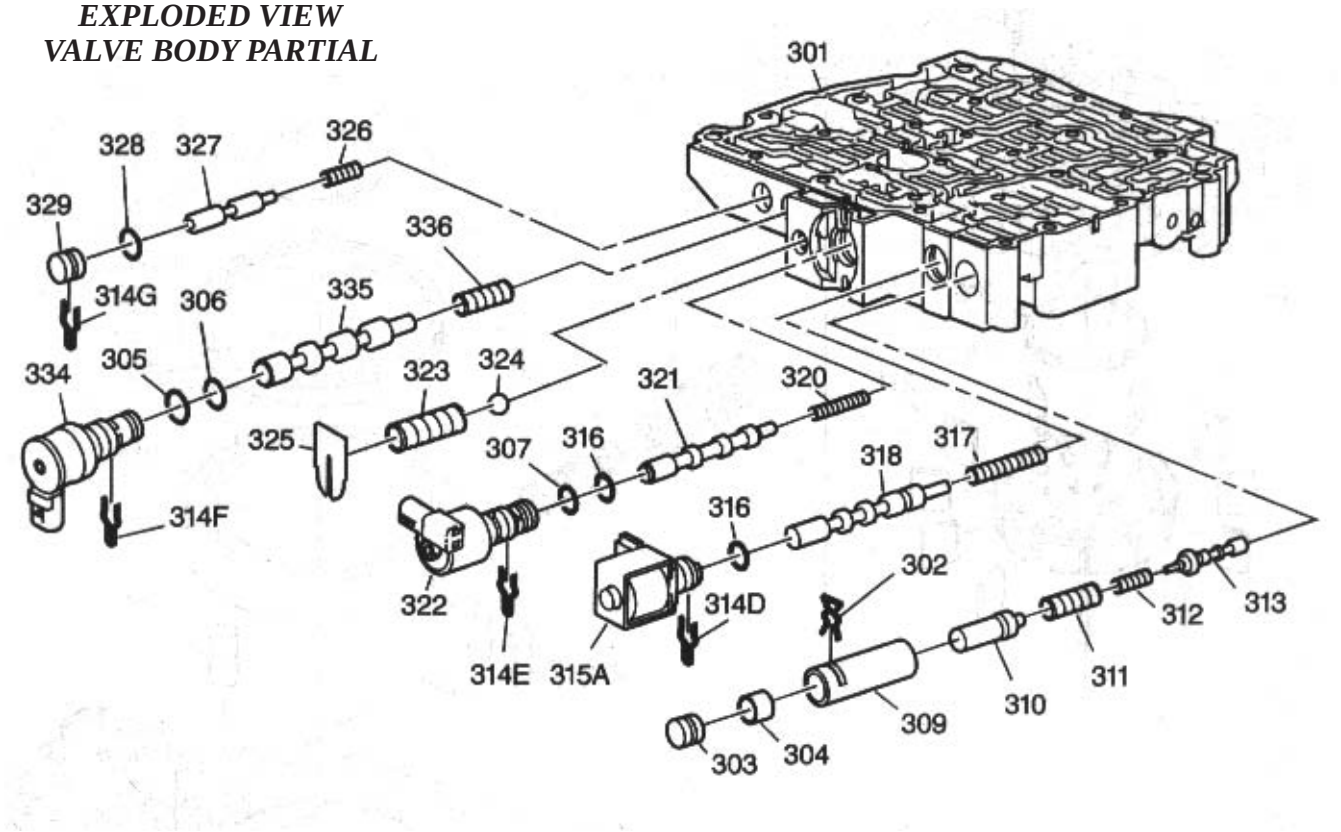
This diagram shows the transmission in 2nd, 3rd, or 4th gear, with converter clutch released.
Notice the TCC PWM solenoid is exhausting the signal oil (2nd Clutch) and pressure is not high enough to overcome spring pressure on the TCC control valve, so the release oil is not exhausted.

Figure 7

4T65-E

P0742 TCC SYSTEM STUCK ON

EXPLODED VIEW
VALVE BODY PARTIAL



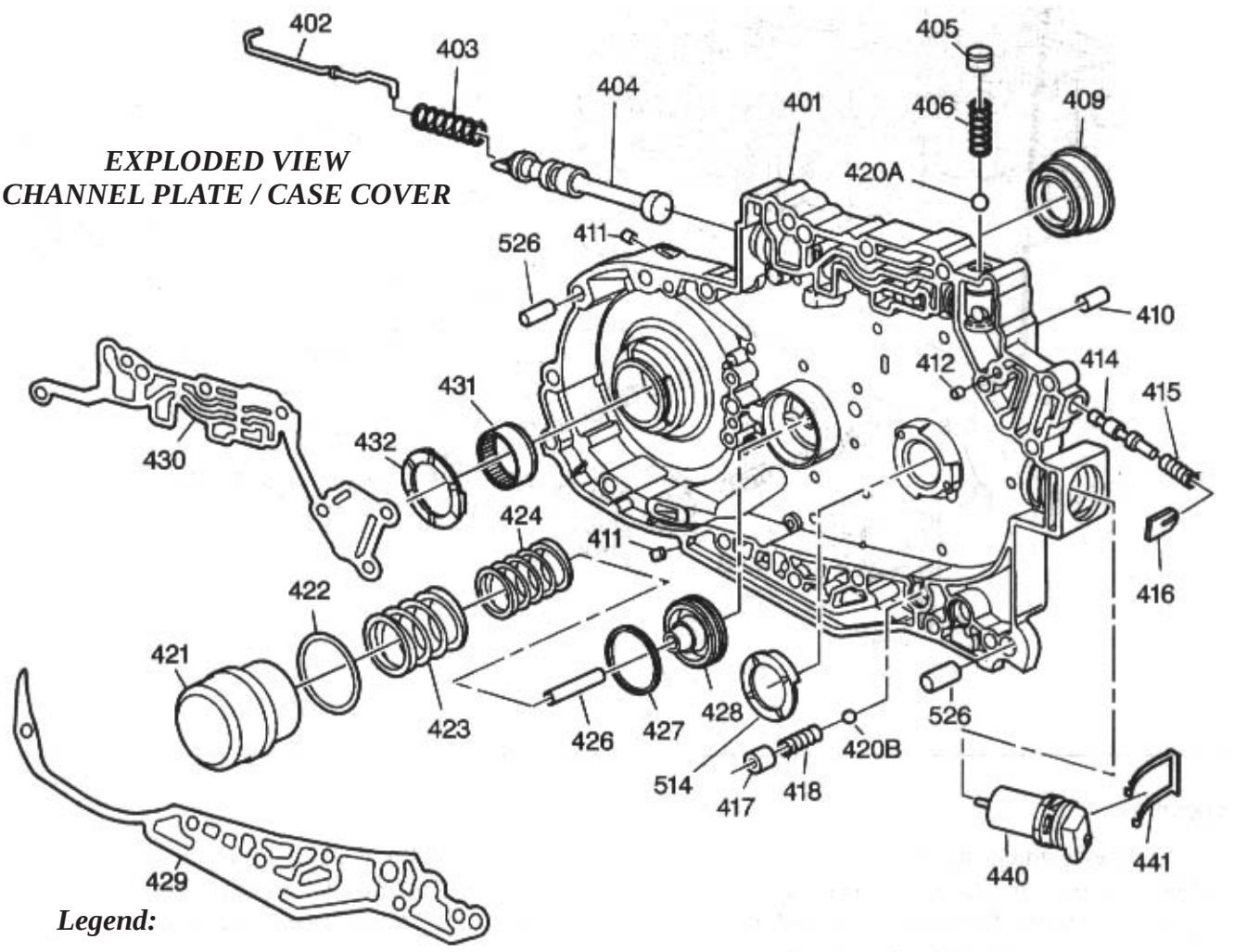
Legend:

(301) Control Valve Body
(302) Line Boost Valve/Bushing Retainer
(303) Line Boost Valve Bore Plug
(304) Line Boost Valve
(305) TCC PWM Solenoid O-Ring Seal
(306) TCC PWM Solenoid O-Ring Seal
(307) EPC Solenoid O-Ring Seal
(309) Reverse Boost Valve Bushing
(310) Reverse Boost Valve
(311) Outer P.R. Valve Spring
(312) Inner P.R. Valve Spring
(313) Pressure Regulator (P.R.) Valve
(314 D) Shift Solenoid Retainer
(314 E) EPC Solenoid Retainer
(314 F) TCC PWM Solenoid Retainer
(314 G) Bore Plug Retainer
(315 A) 1-2/3-4 Shift Solenoid
(316 A) 1-2/3-4 Shift Solenoid O-Ring Seal
(316 B) EPC Solenoid O-Ring Seal
(317) 1-2 Shift Valve Spring
(318) 1-2 Shift Valve
(320) Torque Signal Regulator Valve Spring
(321) Torque Signal Regulator Valve
(322) Pressure Control Solenoid (EPC)
(323) Line Pressure Relief Valve Spring
(324) Line Pressure Relief Valve
(325) Line Pressure Relief Valve Spring Retainer
(326) TCC Regulator Apply Valve Spring
(327) TCC Regulator Apply Valve
(328) TCC Regulator Apply Valve Bore Plug O-Ring Seal
(329) TCC regulator Apply Valve Bore Plug
(334) TCC PWM Solenoid
(335)TCC Control Valve
(336) TCC Control Valve Spring

Figure 8

4T65-E

P0742 TCC SYSTEM STUCK ON



Legend:

(401) Channel Plate/Case Cover
(402) Manual Valve Link
(403) Manual Valve Link Spring
(403) Manual Valve
(405) Low Blow Off Ball Bore Plug
(406) Low Blow Off Ball Valve Spring
(409 Left Side Axle Oil Seal Assembly
(410) Control Valve Body Alignment Sleeve
(411) Bore Plug
(412) Orificed Cup Plug
(414) Actuator Feed Limit Valve
(415) Actuator Feed Limit Valve Spring
(416) Actuator Feed Limit Valve Spring Retainer
(417) Ball Valve Bore Plug
(418) TCC Feed Limit/Blow Off Ball Valve Spring
(420A) Low Blow Off Ball Valve
(420B) TCC Feed Limit/Blow Off Ball Valve
(421) 3-4 Accumulator Piston Cylinder
(422) 3-4 Accumulator Piston Cylinder O-Ring Seal
(423) 3-4 Accumulator Piston Outer Spring
(424) 3-4 Accumulator Piston Inner Spring
(426) 3-4 Accumulator Piston Pin
(427) 3-4 Accumulator Piston Oil Seal Ring
(428) 3-4 Accumulator Piston
(429) Channel Plate/Case Cover Lower Gasket
(430) Channel Plate/Case Cover Upper Gasket
(431) Front Wheel Drive Shaft Bearing Assembly
(432) 4th Clutch Shaft Thrust Washer

Figure 9

4T65-E

P1887 TCC RELEASE SWITCH MALFUNCTION

COMPLAINT: A GM vehicle equipped with a 4T65-E transaxle comes to the shop with complaints of harsh shifting, no TCC operation or loses 4th gear when hot. The Service Engine Soon light (MIL) may or may not be illuminated at this time.
When the vehicle is scanned, a P1887 fault code defined as a TCC release switch malfunction is stored in memory. While this code is current, the PCM will inhibit TCC operation, freeze shift adapts and not allow 4th gear if the transmission is in Hot Mode.

CAUSE: The PCM supplies 12 volts on CKT 657 to the TCC release switch with the ignition switch on or in the run position. (See figure 1) The TCC release switch is located inside the transaxle as part of the fluid pressure switch assembly. (See figure 2) This code is typically set when voltage on CKT 657 remains high for 6 seconds or longer when TCC is commanded on and TCC slip speed is -20 to +60 RPM.
There are several possible causes for this problem such as follows;
A possible electrical issue could be an open in the signal circuit (CKT 657) between the PCM and the TCC release switch.
A faulty TCC release switch.
A damaged turbine shaft, teflon seal rings, O-ring or front stator support bushing.
A worn or damaged drive sprocket and/or bearing or channel plate sleeve.
A sticking or worn TCC control valve or bore in the valve body.
The #1 checkball in the channel plate is leaking or not seating properly.
A faulty PCM.

CORRECTION: ***External electrical checks:***

Scan tool data may not display TCC release switch status.
To test CKT 657, unplug the harness connector at the transmission and identify terminal U. (See figure 3) With a DVOM set to DC volts, place the negative lead to a known good ground and the positive meter lead to terminal U in the harness connector. Turn the ***key on*** with the ***engine off***. Battery voltage should be seen.
If battery voltage ***is*** seen at this time, proceed with ***Scenario 1***.
If battery voltage ***is not*** seen at this time, proceed with ***Scenario 2***.

(Scenario 1) If battery voltage IS seen:

Turn the key off. Plug in trans harness connector and then turn key on again. Recheck voltage on wire at terminal U from wire entry side of connector. No voltage should be seen. If battery voltage remains, then either the internal harness is open or the TCC release switch is defective as this switch is normally closed to ground without oil pressure present. Repair internal harness or replace fluid pressure switch assembly as necessary

4T65-E

P1887 TCC RELEASE SWITCH MALFUNCTION

CORRECTION: ***External electrical checks continued:***

(Scenario 2) If battery voltage IS NOT seen:

For 98 and newer models, check voltage on wire at terminal 63 in the PCM C2 connector. For 97 vehicles use terminal 75. (See figure 4) If battery voltage is present then repair break in wire or run a new wire to the trans harness connector terminal U. This is usually a yellow wire from the PCM to the trans harness connector.
If no voltage is present on the wire at PCM connector then turn ***key off,*** disconnect battery and unplug PCM connector. Remove terminal end and wire from connector to inspect for damaged crimp or broken wire. Test terminal end for loose fit on PCM pin. Repair as necessary. Plug connector in to PCM. Reconnect battery. Turn key on and recheck voltage on wire at PCM connector.
If battery voltage is now seen then verify voltage is present at unplugged trans connector terminal U and your repair is complete.
If there is still no battery voltage with key on/engine off and the trans connector unplugged, then the PCM will require replacement.

NOTE: ***Electrically, this code can only be set by an open or break in CKT 657. An intermittent or constant short to ground on this circuit will not set a code P1887.***

Internal mechanical concerns:

Check for damaged turbine shaft or loose inner steel sleeve. Replace turbine shaft as necessary.
Inspect for worn or damaged turbine shaft O-ring or seal rings and replace as necessary.
Check for worn or loose drive sprocket support bushing and replace bushing or support as needed. (Stator Support)
A worn or damaged drive sprocket where it rides the bearing or a damaged bearing will require replacement of both pieces. (See figure 5)
If the channel plate sleeve has been damaged at the turbine shaft seal ring area from turbine shaft misalignment due to drive sprocket bushing or bearing failure, then replacement of the sleeve or entire channel plate assembly may be required.
Valve body concerns such as a sticking or worn TCC control valve or bore will require repair or replacement of the control valve assembly. (See figure 6)
Look for metal particles or debris that would not allow the # 1 checkball to seat properly. Clean or remove debris from the channel plate area as needed. (See figure 7)

4T65-E

P1887 TCC RELEASE SWITCH MALFUNCTION

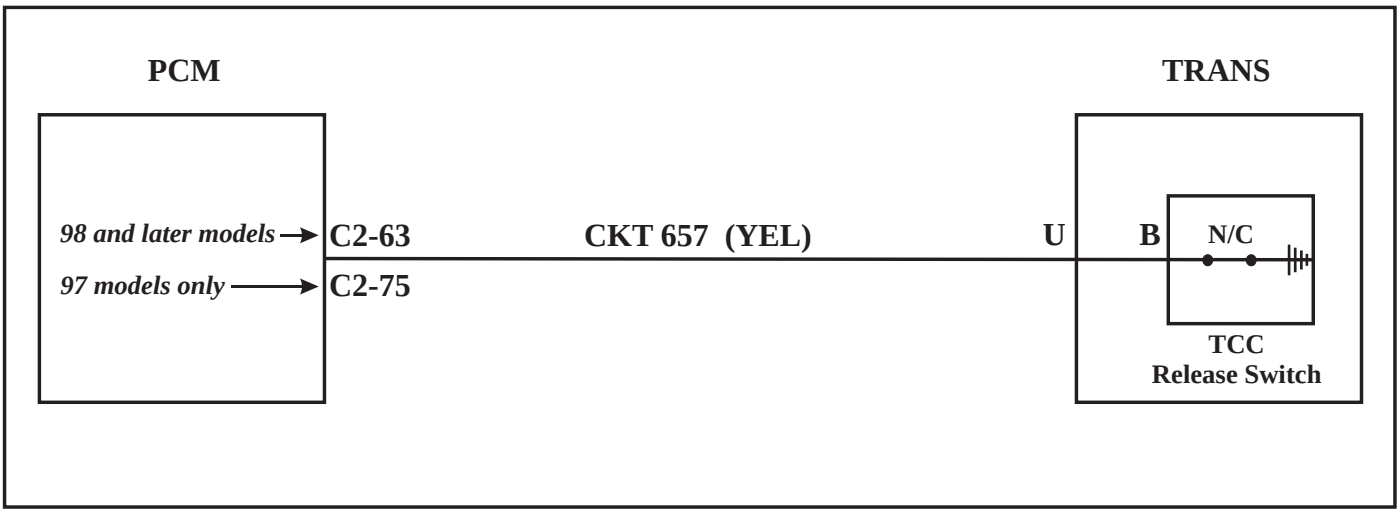


Figure 1

SERVICE INFORMATION: ***(See Figure 2)***

At the time of this printing, the current OEM part numbers are as follows:
24223197 = 1st Design Fluid Pressure Switch Assembly
24216426 = 2nd Design Fluid Pressure Switch Assembly

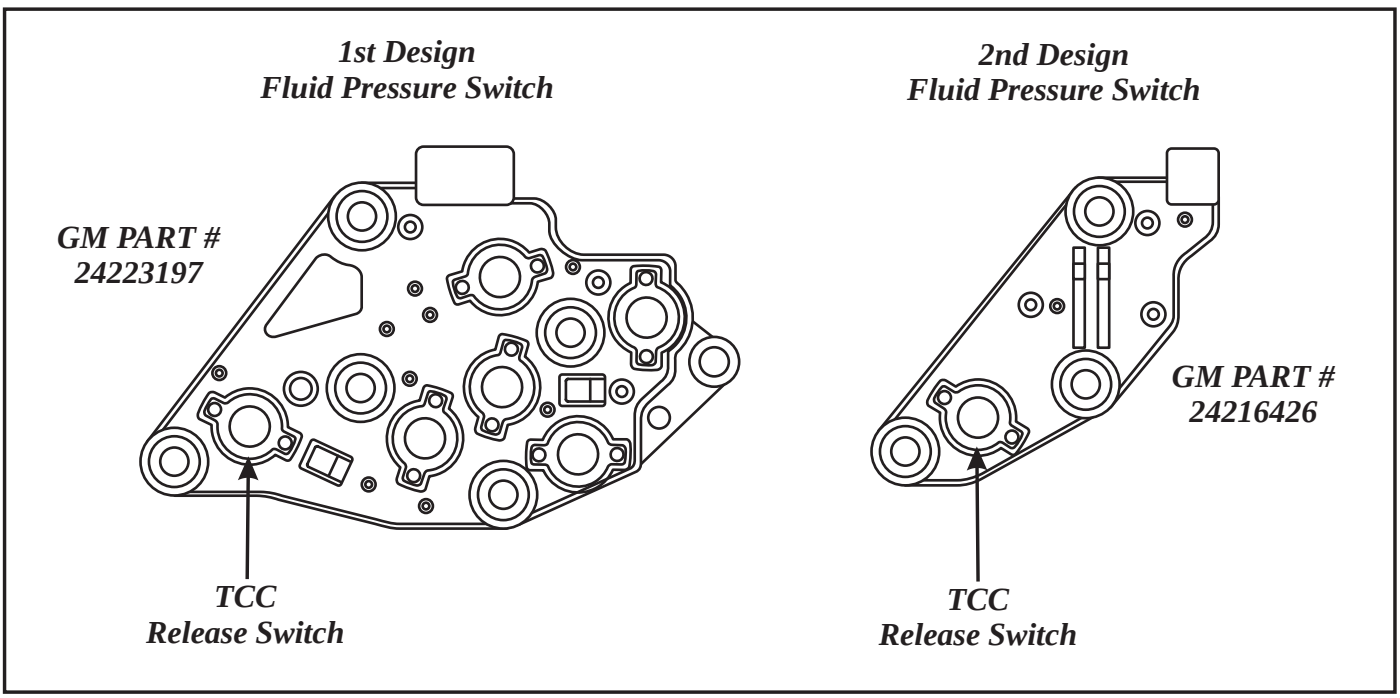
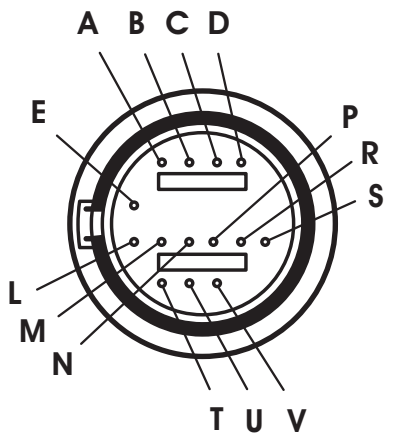


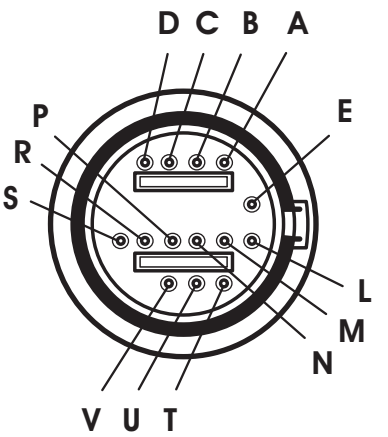
Figure 2

4T65-E

P1887 TCC RELEASE SWITCH MALFUNCTION



Transaxle Case Connector
Face View



Vehicle Harness Connector
Face View

Figure 3

PCM 80 Way Connector
C 1 = Blue
C 2 = Clear

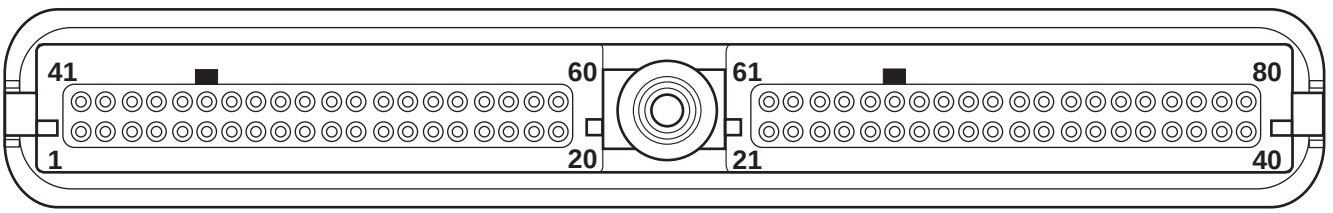


Figure 4

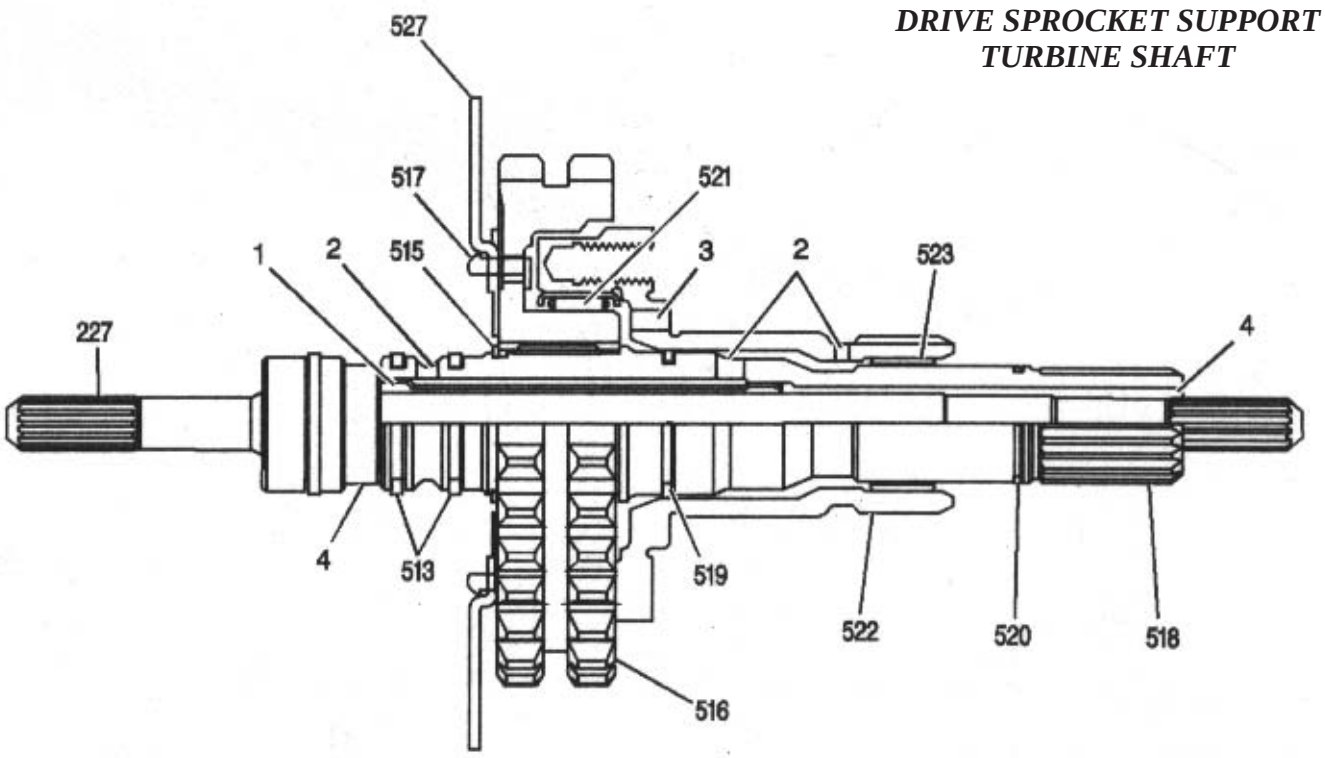
Superior

VBX

4T65-E

P1887 TCC RELEASE SWITCH MALFUNCTION

CROSS SECTION VIEW
DRIVE SPROCKET SUPPORT
TURBINE SHAFT



Legend:

(1) Steel Sleeve
(2) TCC Apply Passage
(3) Converter Seal Drainback Passage
(4) TCC Release Passage
(227) Oil Pump Drive Shaft
(513) Turbine Shaft Oil Seal Ring
(515) Drive Sprocket Retaining Ring
(516) Drive Sprocket
(517) Drive Sprocket Thrust Washer
(518) Turbine Shaft
(519) Turbine Shaft Oil Seal Ring
(520) Turbine Shaft O-Ring Seal
(521) Drive Sprocket Bearing
(522) Drive Sprocket Support
(523) Drive Sprocket Support Bushing
(527) Turbine Speed Sensor Reluctor Wheel

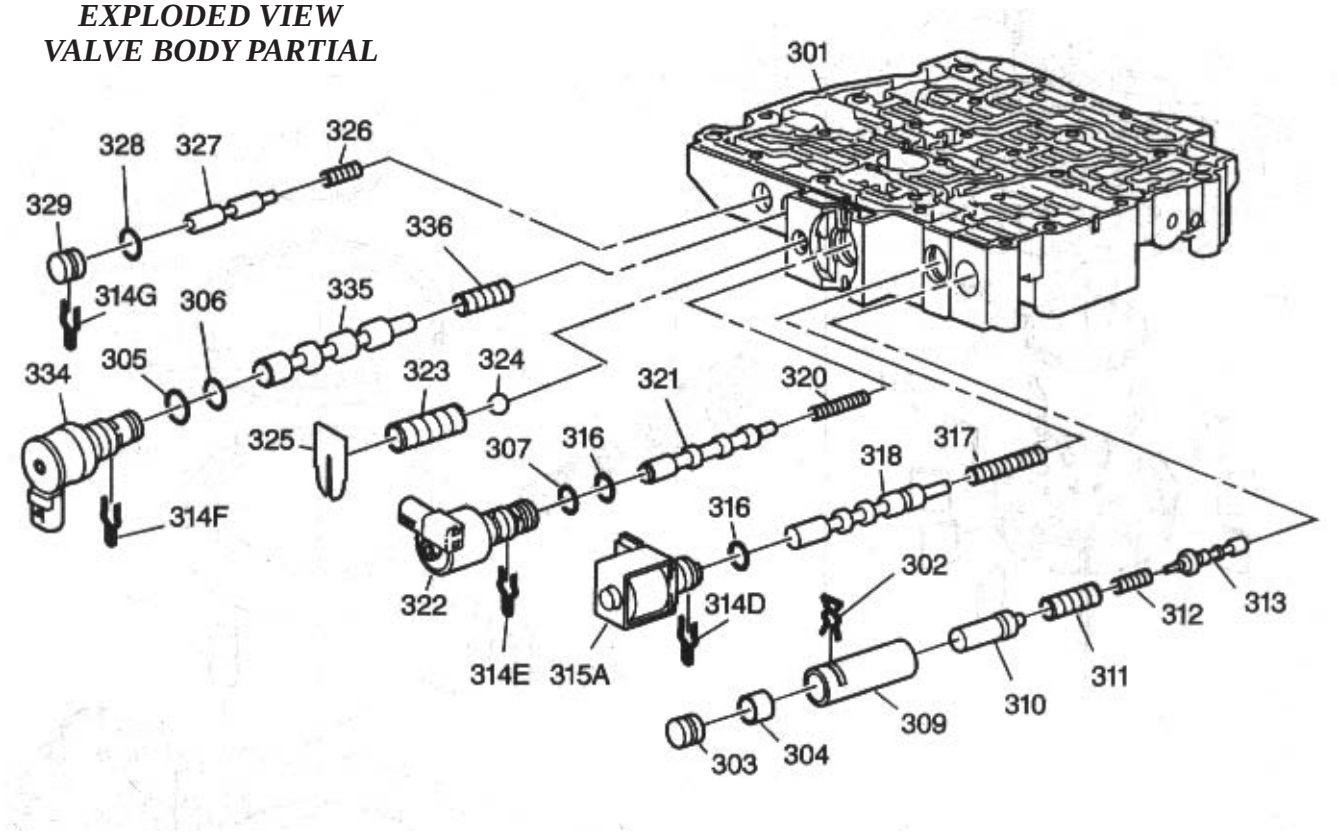
Figure 5

Hannifin/Parker

4T65-E

P1887 TCC RELEASE SWITCH MALFUNCTION

EXPLODED VIEW
VALVE BODY PARTIAL



Legend:

(301) Control Valve Body
(302) Line Boost Valve/Bushing Retainer
(303) Line Boost Valve Bore Plug
(304) Line Boost Valve
(305) TCC PWM Solenoid O-Ring Seal
(306) TCC PWM Solenoid O-Ring Seal
(307) EPC Solenoid O-Ring Seal
(309) Reverse Boost Valve Bushing
(310) Reverse Boost Valve
(311) Outer P.R. Valve Spring
(312) Inner P.R. Valve Spring
(313) Pressure Regulator (P.R.) Valve
(314 D) Shift Solenoid Retainer
(314 E) EPC Solenoid Retainer
(314 F) TCC PWM Solenoid Retainer
(314 G) Bore Plug Retainer
(315 A) 1-2/3-4 Shift Solenoid
(316 A) 1-2/3-4 Shift Solenoid O-Ring Seal
(316 B) EPC Solenoid O-Ring Seal
(317) 1-2 Shift Valve Spring
(318) 1-2 Shift Valve
(320) Torque Signal Regulator Valve Spring
(321) Torque Signal Regulator Valve
(322) Pressure Control Solenoid (EPC)
(323) Line Pressure Relief Valve Spring
(324) Line Pressure Relief Valve
(325) Line Pressure Relief Valve Spring Retainer
(326) TCC Regulator Apply Valve Spring
(327) TCC Regulator Apply Valve
(328) TCC Regulator Apply Valve Bore Plug O-Ring Seal
(329) TCC regulator Apply Valve Bore Plug
(334) TCC PWM Solenoid
(335)TCC Control Valve
(336) TCC Control Valve Spring

Figure 6

4T65-E

P1887 TCC RELEASE SWITCH MALFUNCTION

CHANNEL PLATE / CASE COVER CHECKBALL LOCATIONS

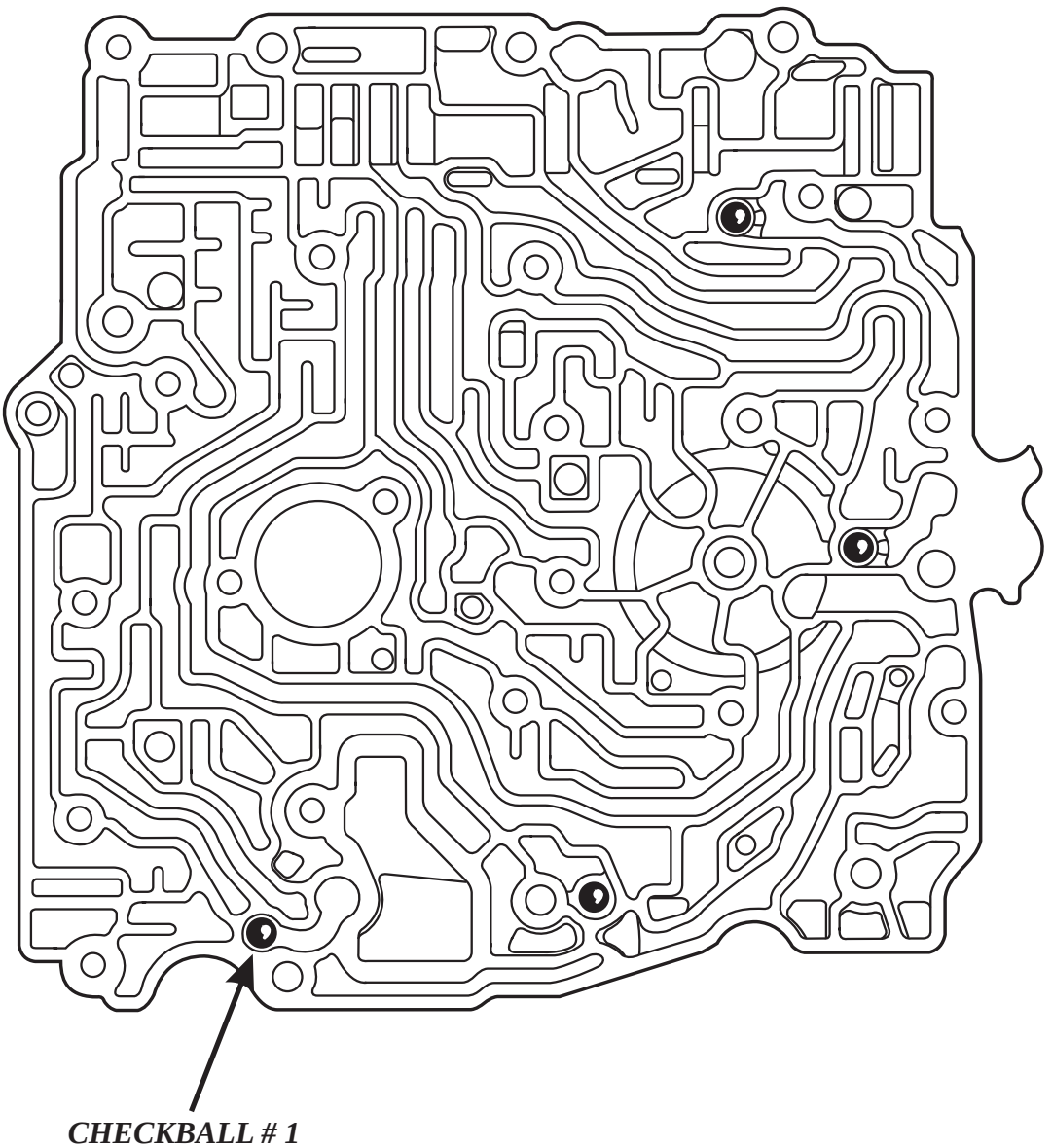


Figure 7

THM 4T65-E/EV-GT
PRELIMINARY INFORMATION

Refer to Figure 1 for gear shift position information.

Refer to Figure 2 for clutch and band application.

Refer to Figure 3 for Geartronic gear shift information.

Refer to Figure 4 for channel plate differences and channel plate check ball locations.

Refer to Figure 5 for channel plate gasket and spacer plate differences.

Refer to Figure 6 for valve body gasket differences and valve body check ball locations.

Refer to Figure 7 for the Volvo TCM wiring diagram.

Refer to Figure 8 for transmission case connector and vehicle harness connector terminal function.

Refer to Figure 9 for check ball function.

Refer to Figures 10 to 16 for input speed sensor differences.

Refer to Figure 17 for fourth clutch pack differences.

THM 4T65-E/EV-GT
PRELIMINARY INFORMATION

GENERAL DESCRIPTION

The Hydra-matic 4T65-E is a fully automatic, four speed front wheel drive electronically controlled transaxle. It consists primarily of a four element torque converter, two planetary gear sets, a hydraulic pressurization and control system, friction and mechanical clutches and a final drive gear set with a differential assembly.

The four element torque converter contains a pump, a turbine, a pressure plate splined to the turbine, and a stator assembly. The torque converter acts as a fluid coupling to smoothly transmit power from the engine to the transaxle. It also hydraulically provides additional torque multiplication when required. The pressure plate, when applied, provides a mechanical "direct drive" coupling of the engine to the transmission.

The two planetary gear sets provide the four forward gear ratios and reverse. Changing gear ratios is fully automatic and is accomplished through the use of a Transmission Control Module (TCM-Volvo).

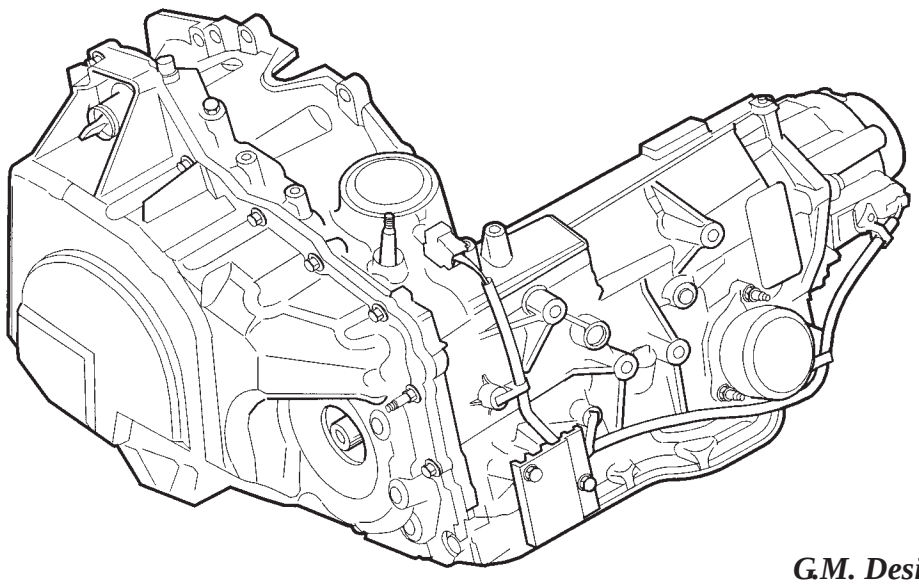
The TCM receives and monitors various electronic sensor inputs and uses this information to shift the transaxle at the optimum time.

The TCM commands shift solenoids, within the transaxle, on and off to control shift timing. The TCM controls the apply and release of the torque converter clutch which allows the engine to deliver the maximum fuel efficiency without sacrificing vehicle performance.

The hydraulic system consists of a vane type pump, control valve body and case cover. The pump maintains the working pressure needed to stroke the servos and clutch pistons that apply and release the friction components.

The friction components used in this transaxle consist of four multiple disc clutches and three bands. The multiple disc clutches combine with one roller clutch and two sprag clutches, to deliver four forward gear ratios and reverse, through the gear sets. The gear sets then transfer torque through the final

Volvo Designation 4T65-E/EV-GT
1999-2002 80 Series 2.5L Engine



G.M. Designation 4T65-E
1997 and up various applications

GENERAL DESCRIPTION (Cont'd)

drive differential assembly and out to the drive axles.

A Component Application chart and solenoid application chart have been provided for you in Figure 2.

GEAR RANGE DESCRIPTION

The transaxle can be operated in any one of the seven different positions on the shift quadrant, that is shown in Figure 1 (Non-Geartronic applications).

P - Park position enables the engine to be started while preventing the vehicle from rolling either forward or backward. For safety reasons the vehicle's parking brake should be used in addition to the "Park" position. Since the final drive differential and output shaft are mechanically locked to the case through the parking pawl and final drive internal gear, Park position should not be selected until the vehicle has come to a complete stop.

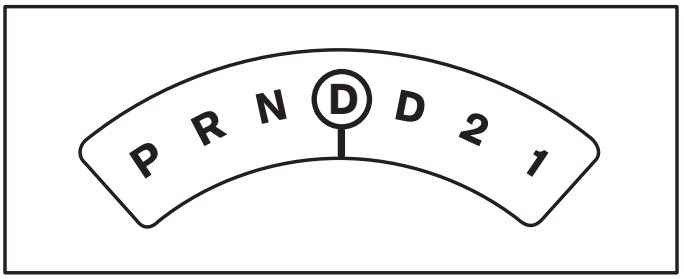


Figure 1

R - Reverse position enables the vehicle to be operated in a rearward direction.

N - Neutral position enables the engine to start and operate without driving the vehicle. If necessary, this position should be selected to restart the engine while the vehicle is moving.

Ⓓ - Overdrive range should be used for all normal driving conditions for maximum efficiency and fuel economy. Overdrive range allows the transaxle to operate in each of the four forward gear ratios. Downshifts to a lower gear, or a higher gear ratio are available for safe passing by depressing the accelerator or by manually selecting a lower gear range with the selector lever.

D - Manual third can be used for conditions where it may be desirable to use only three gear ratios. These conditions include towing a trailer or driving on hilly terrain. This range is also helpful for engine braking when decending slight grades. Upshifts and downshifts are the same as Overdrive range first, second and third gears except that the transaxle will not upshift to fourth.

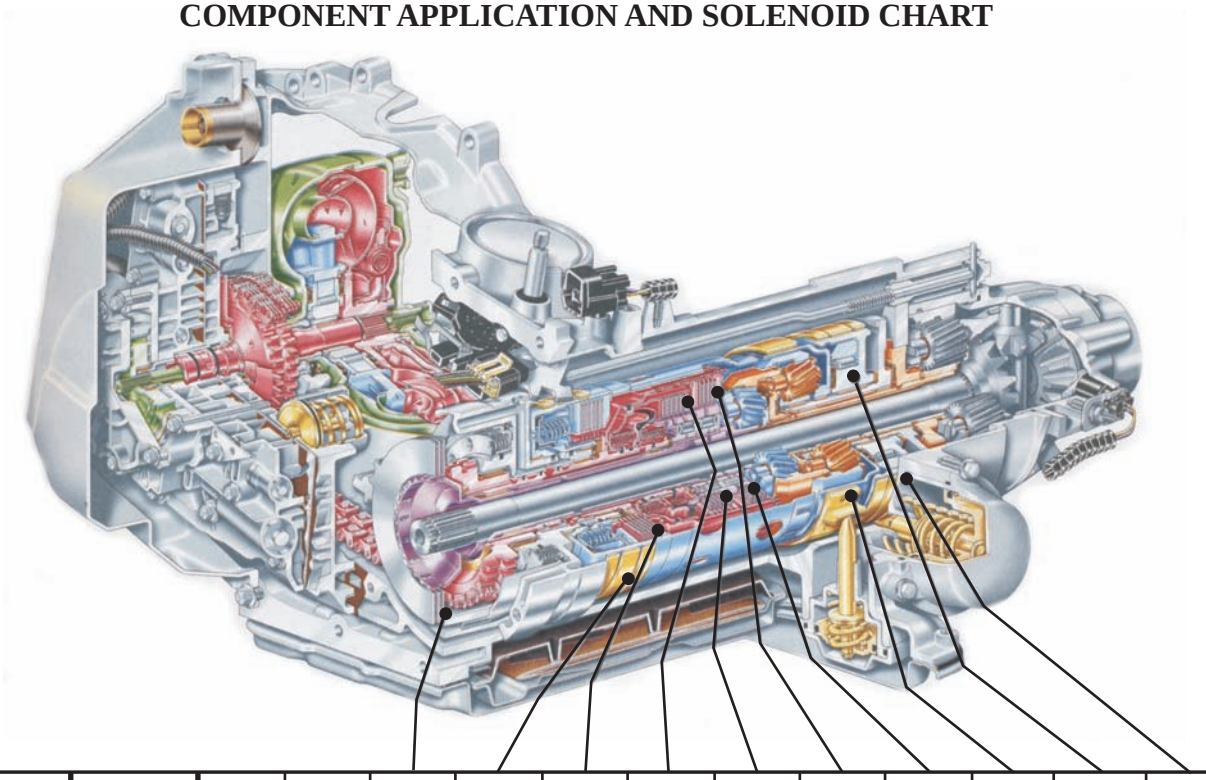
2 - Manual second adds more performance for congested traffic and hilly terrain. It has the same starting ratio (first gear) as Manual third but prevents the transaxle from shifting above second. Thus manual second can be used to retain second gear for accelerations and engine braking as desired. Manual second can be selected at any vehicle speed but will not downshift into second gear until the vehicle speed drops below 100 Km/h (62 mph).

1 - Manual first can be selected at any vehicle speed. If the transaxle is in third or fourth gear it will immediately shift into second gear. When the vehicle speed slows to below approximately 60 Km/h (37 mph) the transaxle will then shift into first gear. This is particularly beneficial for maintaining maximum engine braking when descending steep grades.

Triptronic/Geartronic

As an alternative to the conventional automatic transmission, this transmission is available with Triptronic (Geartronic - GM), a manual shifting position.

COMPONENT APPLICATION AND SOLENOID CHART



RANGE	GEAR	1-2, 3-4 SHIFT SOLENOID	2-3 SHIFT SOLENOID	4TH CLUTCH	REV. BAND	2ND CLUTCH	3RD CLUTCH	3RD CLUTCH SPRAG	INPUT CLUTCH	INPUT CLUTCH SPRAG	2/1 BAND	1-2 ROLLER CLUTCH	FORW. BAND
P-N		ON	ON						*	*			
OD	1ST	ON	ON						APPLIED	HOLDING		HOLDING	APPLIED
	2ND	OFF	ON			APPLIED			*	OVERRUN		HOLDING	APPLIED
	3RD	OFF	OFF			APPLIED	APPLIED	HOLDING				OVERRUN	*
	4TH	ON	OFF	APPLIED		APPLIED	*	OVERRUN				OVERRUN	*
D	3RD	OFF	OFF			APPLIED	APPLIED	HOLDING	APPLIED	HOLDING		OVERRUN	*
	2ND	OFF	ON			APPLIED			*	OVERRUN		HOLDING	APPLIED
	1ST	ON	ON						APPLIED	HOLDING		HOLDING	APPLIED
2	2ND	OFF	ON			APPLIED			*	OVERRUN	APPLIED	HOLDING	APPLIED
	1ST	ON	ON						APPLIED	HOLDING	APPLIED	HOLDING	APPLIED
1	1ST	ON	ON				APPLIED	HOLDING	APPLIED	HOLDING	APPLIED	HOLDING	APPLIED
REV	REVERSE	ON	ON		APPLIED				APPLIED	HOLDING			

The Geartronic version of the 4T65-E uses only these forward gears, plus Park, Neutral and Reverse

* **Applied and holding with no load (Not Transmitting Torque)**

Figure 2

GEAR SELECTOR WITH GEARTRONIC CONTROL

Shifting Using Geartronic

When the gear selector is moved to the Geartronic position (MAN) the automatic transmission remains in hydraulic position D, but when the gear selector is moved upwards (+) the gear selector module (GSM) transmits a signal to the transmission control module (TCM) to shift up. When the gear selector is moved downwards (-) a signal is transmitted to the transmission control module (TCM) to shift down. The driver information module (DIM) switches the symbol in the combined instrument panel from D to the current gear, for example 3, when the gear selector is in the MAN position. A signal is sent to the gear selector module (GSM) to light the M LED and switches off the other LEDs. The transmission control module (TCM) determines if shifting can be carried out and the driver information module (DIM) indicates the current gear. If shifting is permitted the solenoids are activated according to each specific gear pattern. However, in certain situations the transmission control module (TCM) assumes the shifting decision. The following applies:

1. When stationary only 1st, 2nd and 3rd gears can be selected. 4th gear can be selected at speeds exceeding 30 km/h

2. Automatic down shifting occurs for all gears below a certain speed. Example: 2nd gear is selected.

3. Automatic down shifting occurs when shifting from 2nd gear to 1st at 2 km/h if the speed, before this has exceeded 25 km/h. in other cases 2nd gear is retained. For example, when 3rd gear is engaged despite the car being stationary.

4. Manual up shifting is required after automatic down shifting. Kick-down is not available in the Geartronic position (MAN).

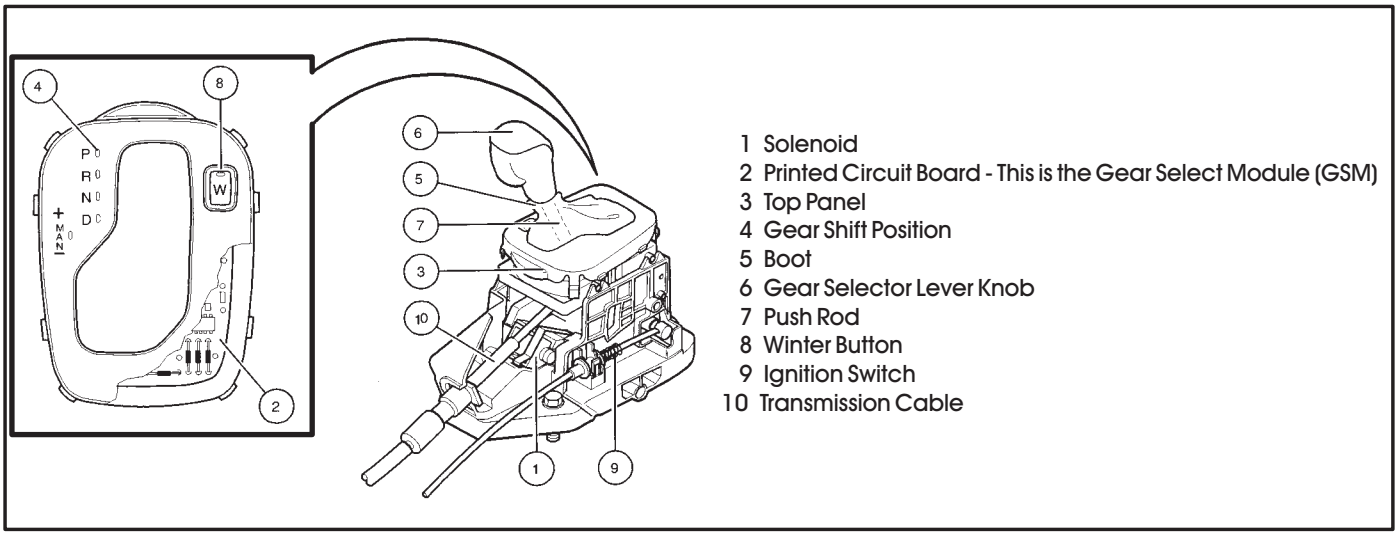
5. The permitted speed for manual down shifting corresponds to those for kick-down up shifting, i.e. engine speed at approximately 6,000 rpm.

6. If the transmission temperature becomes too high the transmission control module (TCM) determines the shift position. The purpose is to maintain a gear where lock-up is possible at the current speed.

7. Lock-up command is possible in 3rd and 4th gears. (1st and 2nd gears do not have commanded lock-up although hydraulically it is possible to have TCC in second.).

Other

In the MAN position a signal about the lever position is generated for the gear selector module (GSM) as follows: For each of the three gear selector positions a hall sensor is mounted on the printed circuit board for the gear selector control module (GSM). A permanent magnet on the lever affects the output signals from the sensors to the control module. The control module can read off the position of the lever through the differences in the signal characteristics.



1 Solenoid
2 Printed Circuit Board - This is the Gear Select Module (GSM)
3 Top Panel
4 Gear Shift Position
5 Boot
6 Gear Selector Lever Knob
7 Push Rod
8 Winter Button
9 Ignition Switch
10 Transmission Cable

Figure 3

Gear Selector Assembly Construction
The housing, shiftlock solenoid (1) and mounting lever for the ignition switch interlock cable is common to both gear selector assemblies.

In the 4T65EV / EV-GT the solenoid in the gear selector assembly has a reverse inhibitor function. The reverse inhibitor makes it impossible to engage R and P when the car is traveling faster than 12 km/h. The gear selector assembly (and therefore the solenoid) is supplied with current and signals via the connector on the rear side.

A printed circuit board (2) is located under the top panel (3). The circuit board has the WINTER button (8) and 14 LEDs (13 LEDs with Geartronic) which light up the gear position (4). The LEDs also indicate the selected gear.

Gear Selector Module
The gear selector assembly, solenoid and printed circuit board together constitute the gear selector module and it is a slave module to the TCM.

Information between the gear selector module and the transmission module is transferred using serial communication, which requires a micro processor located on the printed circuit board.

The TCM gives instructions to the GSM about which LEDs should be lit up and to what strength of illumination. In addition, the TCM controls the solenoid connection at the reverse inhibitor.

The gear selector module informs the TCM about the position of the WINTER button and controls the connection of the solenoid for the reverse inhibitor function. In Geartronic, information is sent about the gear shift position in MAN and if the gear selector lever is moved backwards or forwards.

The gear selector module is connected to the transmission diagnostic system.

The transmission is electronically controlled using the Transmission Control Module (TCM) which controls it based on signals from the network and sensor in the transmission.

The TCM has built-in diagnostics which are read via the Data Link Connector (DLC) using VADIS.

Shifting Program

Economy Mode
When driving at normal acceleration, the transmission control module (TCM) uses a pre-set shifting program, optimized to shift for economy driving. This shifting program is suitable for "normal" driving which provides earlier up shifts and lock-up. In addition the transmission oil pressure is adjusted to provide smooth gear engagement.

Sport mode
In the sport mode shifting program the shifting points are adjusted to provide the best possible performance. Downshifts occur earlier. The transmission control module (TCM) selects the shifting and lock-up points which provide the best possible performance. The transmission switches from economy mode to sport mode in step 1 or step 2 if the accelerator pedal (AP) is pressed down quickly. The conditions are that the throttle opens and the vehicle speed exceeds 50 km/h. As soon as the accelerator pedal (AP) is released to a certain level economy mode is resumed.

Kick-down program
At wide open throttle (WOT) the kick-down function is engaged which provides quick downshifts for maximum performance. In this way a boost of power is achieved when overtaking for example.

Winter mode
Winter mode is selected using the (W) button on the top panel of the gear selector assembly. Winter mode enables starting off in a high gear to prevent the wheels from spinning on a slippery surface. This mode can also be used in other difficult situations in which the driver needs more direct control over gear selection. Lock-up can be engaged in 2nd gear. The shifting pattern is optimized to minimize the number of shifts. Depending on the gear position, the following combinations can be obtained:
D - The car starts in 2nd gear. Automatic shifting between 2nd and 3rd gears occurs earlier than in Economy mode, D position.

3 - The car starts in 2nd gear. 4th gear is locked out

2 - The car starts in 2nd gear. There is no up shifting or downshifting.

1 - The car starts in 1st gear. There is no up shifting or downshifting.

The W lamp on the dashboard lights when winter mode is selected.

If kick-down is activated in Winter mode, the transmission uses all gears for maximum performance.

Emergency programs in the event of a fault

An emergency program is activated to deal with the fault when the transmission control module (TCM) detects a transmission fault (permanent fault). The control system then implements corrective action to protect the transmission, while leaving the car in the best possible drive-able condition. Minor malfunctions do not activate an emergency program. There are different programs depending on the type of fault:

Emergency mode I
Emergency mode II
Emergency mode III
Limp-home mode

Emergency mode I is activated in the event of minor faults and the Limp-home mode is activated for the most serious faults. If the malfunction is intermittent, the transmission control module (TCM) returns to normal operation the next time the ignition is switched on.

Emergency mode I

1. The warning lamp in the combined instrument panel lights (S80), flashes (S/V/C70) for certain diagnostic trouble codes (DTCs).
2. The transmission shifts in all gears but transmits no signal to the lock-up solenoid. This means that lockup is not available.

Emergency mode II

1. Remedy as for Emergency mode I.
2. No reduction of line pressure when moving the gear selector between positions P-R, N-R and N-D. This results in harsh shifting.
3. No torque limiting request from the engine control module (ECM) during gear shifting.
4. The warning lamp in the combined instrument panel lights / flashes.

Emergency mode III

1. Remedy as for Emergency modes I and II.
2. No control of line pressure solenoid STH. Constant maximum system pressure. This results in harsh shifting and harsher gear engagement in positions P-R, N-R and N-D.

Limp -home mode

1. The transmission control module (TCM) interrupts the activation of all solenoids. This results in the transmission not shifting at all. The transmission operates only in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd and 4th gear and reverse gear.
2. No control of line pressure solenoid STH. Constant maximum system pressure. This results in harsh shifting and harsher gear engagement in positions P-R, N-R and N-D.
3. The warning lamp in the combined instrument panel flashes.

Note! When starting and driving, the gear selector should first be moved to position L to minimize stress on the transmission.

Emergency mode in the event of a fault

If the transmission control module (TCM) detects a permanent fault, an emergency mode is activated. The transmission control module (TCM) then implements corrective action to protect the transmission. Minor malfunctions do not activate an emergency program. There are different programs depending on the type of fault:

1. Emergency mode
2. Limp home mode.

Emergency mode is activated for minor faults and the Limp home mode for the most serious faults. If the malfunction is intermittent, the transmission control module (TCM) returns to normal operation the next time the ignition is switched on.

Emergency mode

A text message is displayed in the combined instrument panel for diagnostic trouble codes (DTCs) stored in the transmission control module (TCM). The transmission shifts in all gears but transmits no signal to the lock-up solenoid. This means that lock-up is not available.

Limp home mode

A text message is displayed in the combined instrument panel for diagnostic trouble codes (DTCs) stored in the transmission control module (TCM).

The transmission control module (TCM) interrupts the activation of all solenoids. This means that no shifting is possible. The transmission only functions in 3rd gear and back-up (reverse) gear. No regulation of line pressure solenoid STH. Maximum system pressure constantly which results in harsh P-R, N-R and N-D engagements. This can also result in a whining noise from the transmission pump.

Additional Information

Gear ratios:
1st 2.921:1
2nd 1.568:1
3rd 1.000:1
4th 0.706:1
Reverse: 2.385:1

Weight including fluid: 97.0 kg (214 lbs)

Approximate oil capacity:7.0L (7.4 US quarts)

If the oil pan and the cooling circuit are removed: 7.5L (8 US quarts)

If the oil pan and the torque converter are removed: 9.5L (10 US quarts)

Completely dry with cooling circuit (theoretical value):12.4L (13 US quarts)

Transmission fluid: Dexron III with G-license number (G-32xxx).

Counter for transmission fluid data

A counter for transmission oil quality is built into the software for the transmission control module (TCM). The counter counts up the amount of time the oil is above a certain temperature. When the counter has reached the maximum value, the diagnostic trouble code (DTC) for an oil change is stored in the control module. When replacing transmission fluid, the counter must be reset to prevent a diagnostic trouble code (DTC) being stored incorrectly. This applies when the transmission fluid is changed and when the fluid is changed during a repair.

The reset function is activated via the VIDA vehicle communication socket.

GM and Volvo Differences

As previously stated, this transmission is available with Geartronic, a manual shift strategy package. This means it is also available with GM's typical 7 position gear select of PRND321. It is when a Geartronic shift package is used that there are significantly more differences between GM and Volvo applications. Here are most of the changes to be aware of:

1.Volvo uses the Geartronic shift strategy which allows for engine braking in 1st, 2nd and 3rd gears manually. To accommodate this shift strategy, hydraulic changes were made to the valve body, valve body spacer plate, gaskets and channel plate (See Figures 4-6). Additionally, manual valve position signals from the Pressure Switch manifold are no longer needed with Volvo vehicles as it reads signals from the Internal Mode Switch (IMS) and the Gear Select Module (GSM). The only pressure switch used from the Pressure Switch Manifold (PSM) is the TCC On/Off switch (Figure 7).

Vehicles which use the seven position gear select assembly will make full use of the PSM.

Although the TCM does not use all the signals from the PSM with the Geartronic package, the internal wiring harness is the same. It is the external wiring plugging into the transmission that eliminates the wiring for the switches not being used.

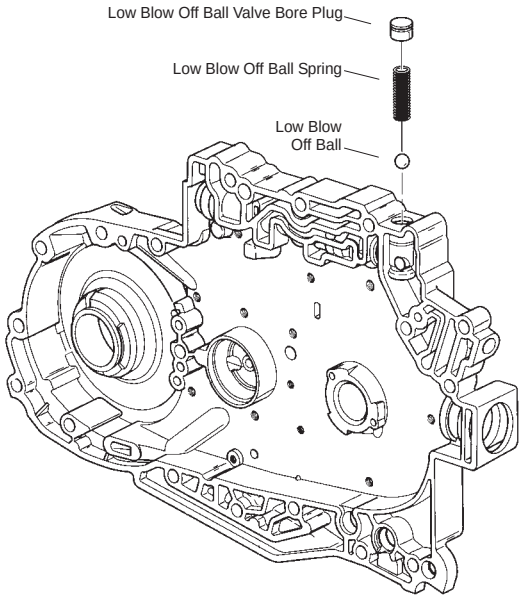
2. Volvo uses an Asian Warner style TCM. As a result of this style TCM, the shift solenoids are power driven rather than ground driven (Figure 7 & 8).

Other significant differences is GM uses an AC pulse generator for the Turbine and Output shaft speed sensor while Volvo uses internally grounded Hall Effect Sensors (Figure 7).

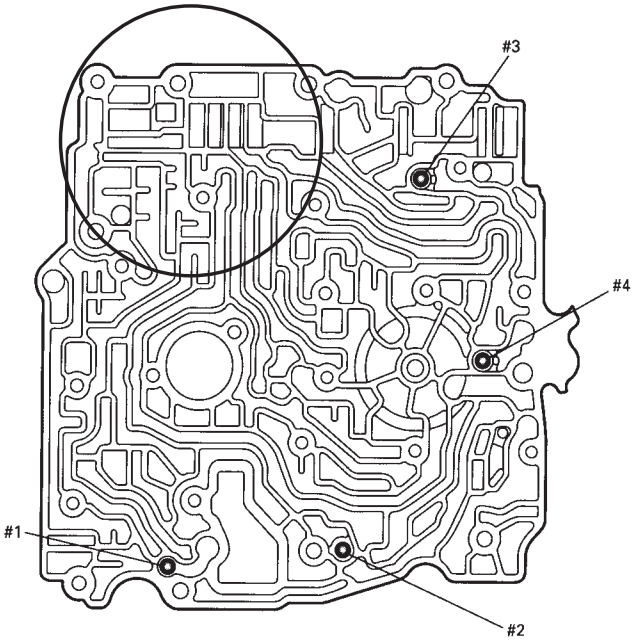
GM uses a typical steel plate and friction plate stack up for the fourth clutch while Volvo uses single sided friction plates (Figure 17).

These are some of the more significant differences that can be found between GM and Volvo applications. Different size right side axle seals would be another, as well as Volvo uses a Viscous clutch in the differential in some applications.

General Motors Application

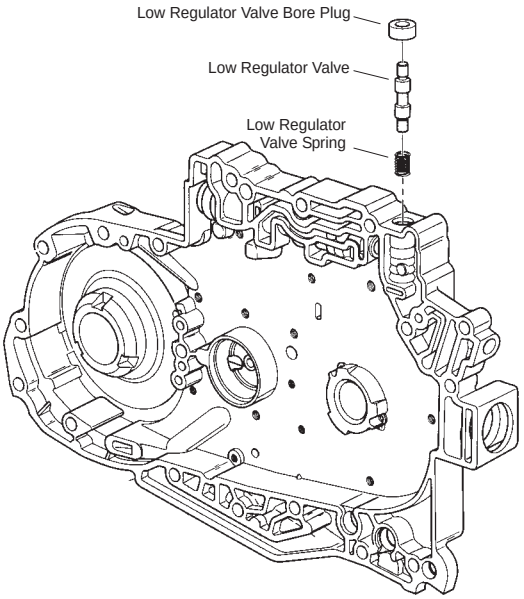


Channel Plate

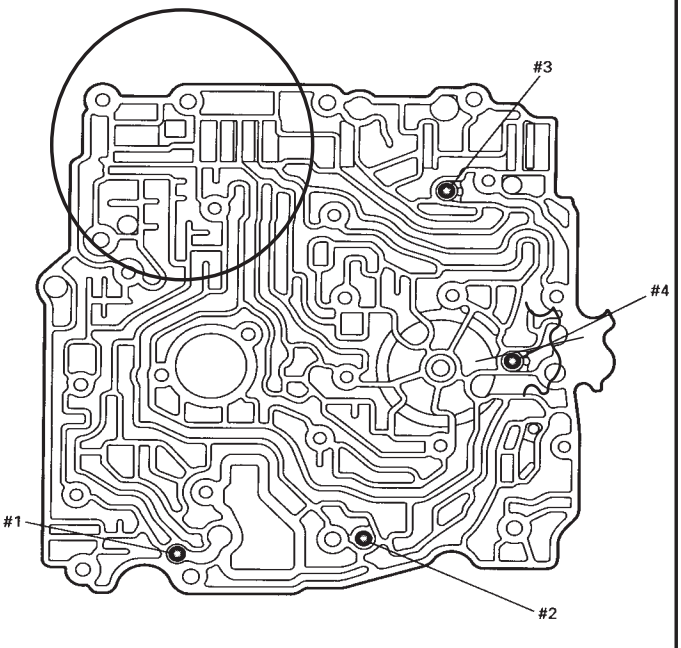


Check ball function and location in the channel plate are the same for GM and Volvo

Volvo Application



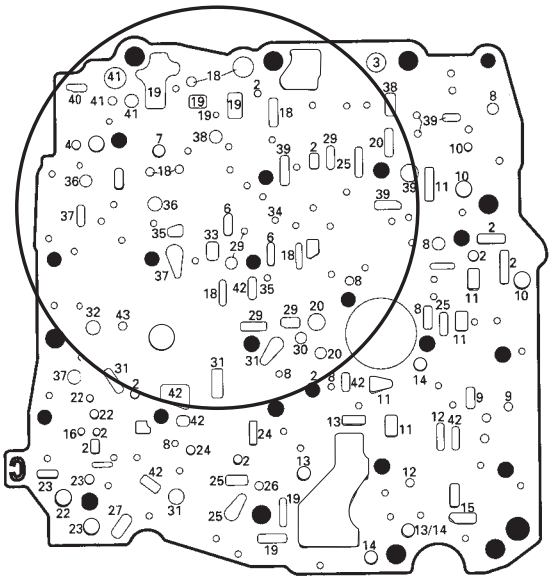
Channel Plate



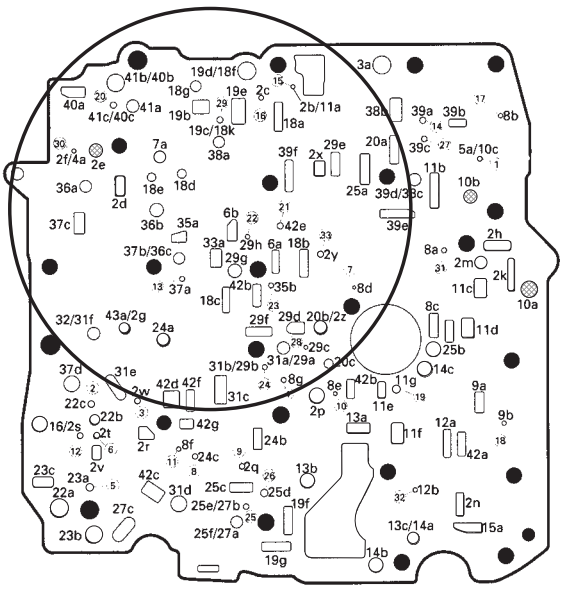
Check ball function and location in the channel plate are the same for GM and Volvo

Figure 4

General Motors Application

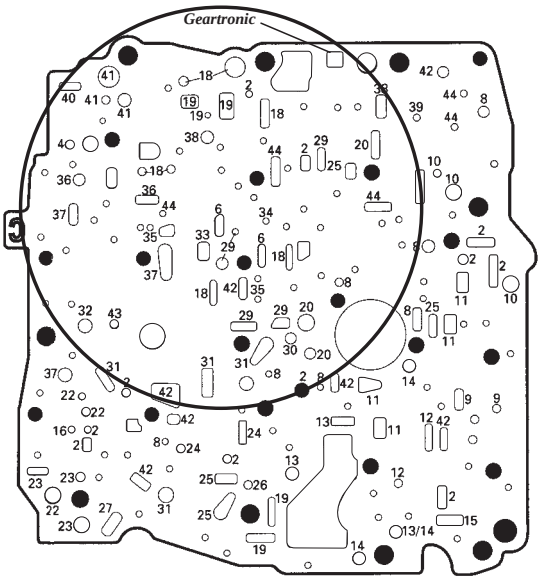


Gasket (Channel Plate to Spacer Plate)

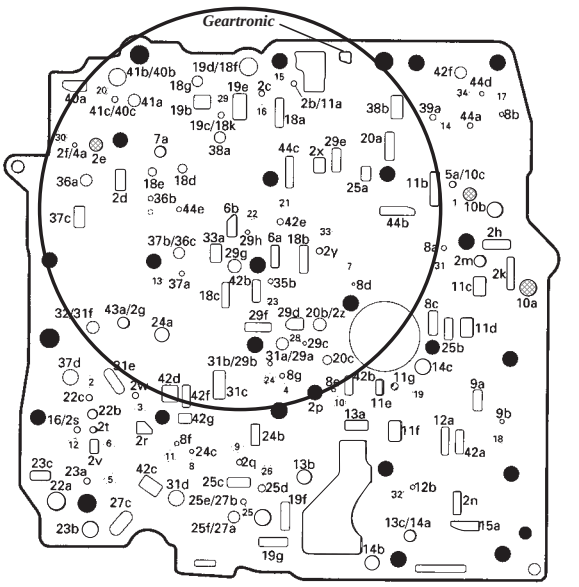


Spacer Plate

Volvo Application



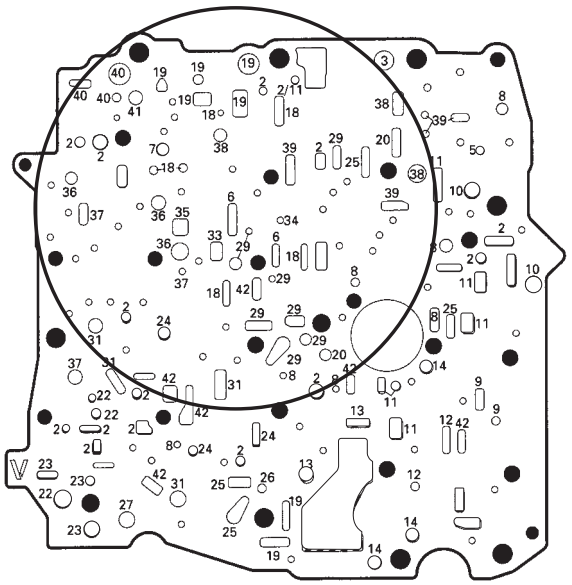
Gasket (Channel Plate to Spacer Plate)



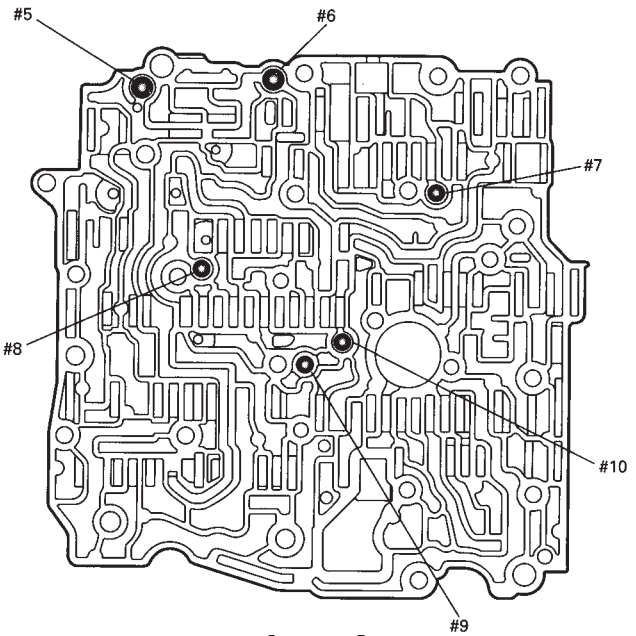
Spacer Plate

Figure 5

General Motors Application



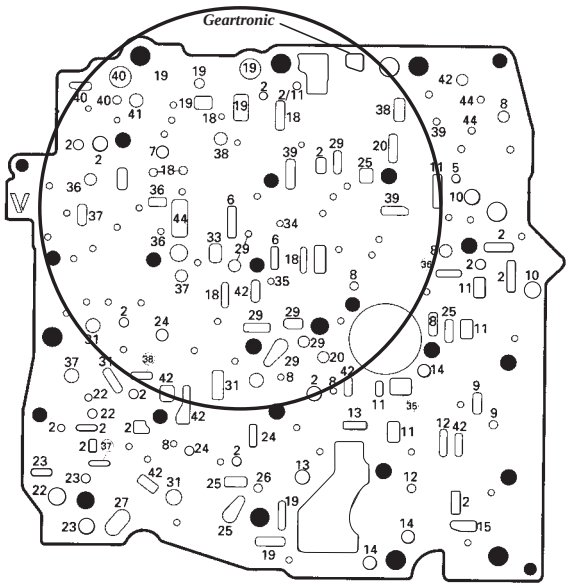
Gasket (Spacer Plate to VB)



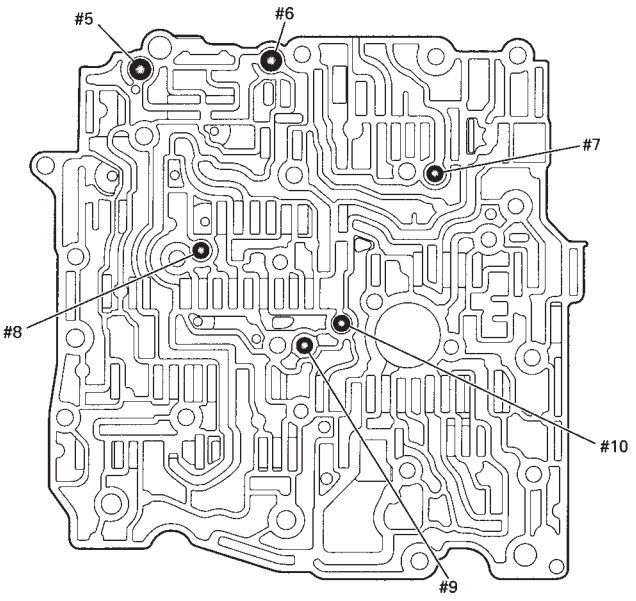
Valve Body

Check ball location in the VB is same for GM and Volvo. The # 7 and # 8 ball have different functions

Volvo Application



Gasket (Spacer Plate to VB)



Valve Body

Check ball location in the VB is same for GM and Volvo. The # 7 and # 8 ball have different functions

Figure 6

Typical Volvo Wiring

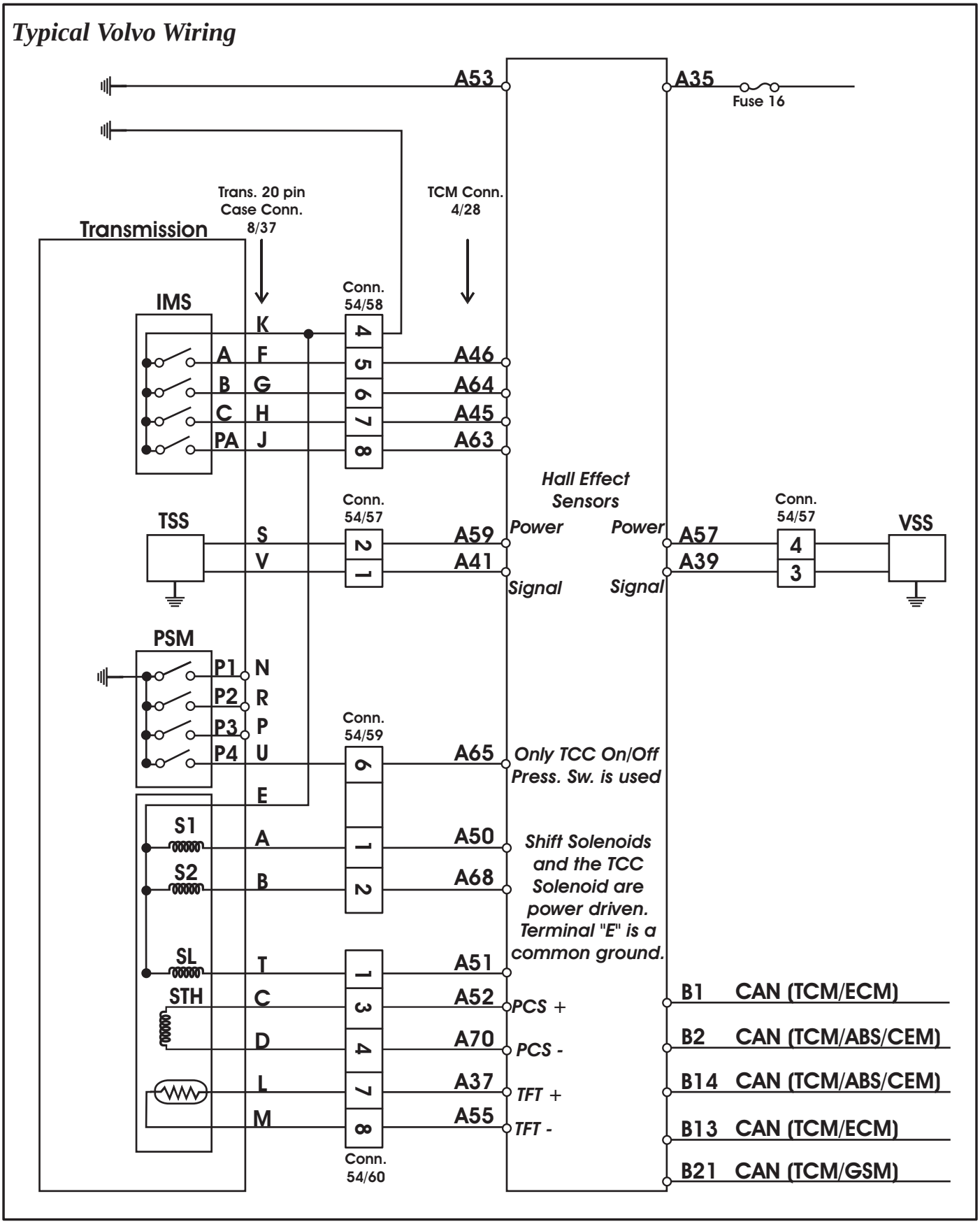
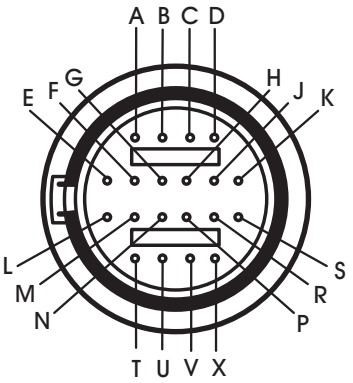


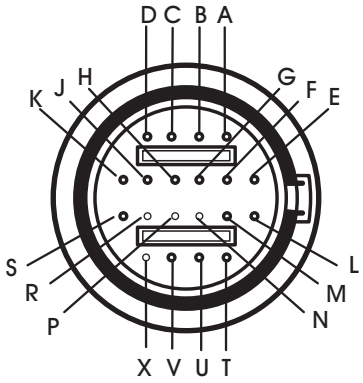
Figure 7



View Looking Into
Transaxle Case Connector

Ohms Resistance Chart			
Cavities	Component	Resistance @ 68°F	Resistance @ 190°F
A-E	1-2 Shift Solenoid	19-24	24-31
B-E	2-3 Shift Solenoid	19-24	24-31
T-E	TCC/PWM Solenoid	10-12	13-15
C-D	EPC Solenoid	3-5	5-6
S-V	Input Speed Sensor	Hall Effect	Hall Effect
M-L	TFT Sensor	3164-3867	225-285
	Output Speed Sensor	Hall Effect	Hall Effect

A - 1-2/3-4 Shift Solenoid 1 power signal wire
B - 2-3 Shift Solenoid 2 power signal wire
C - Pressure Control Solenoid power signal wire
D - Pressure Control Solenoid ground wire
E - Ground for the shift and lock up solenoid
F - IMS "A" Signal
G - IMS "B" Signal
H - IMS "C" Signal
J - IMS "PA" Signal
K - IMS Ground (Shared with terminal "E")
L - Transmission Fluid Temperature Sensor Signal
M -Transmission Fluid Temperature Sensor Ground
N - PSM PS1 Signal
P - PSM PS3 Signal
R - PSM PS2 Signal
S - Turbine Shaft Speed Sensor Power
T - Lock Up Solenoid Power Signal Wire
U - PSM PS4 Signal
V - Turbine Shaft Speed Sensor Signal Wire
X - Not Used



View Looking Into
Vehicle Harness Connector

A - Shift Solenoid 1 power signal wire
B - Shift Solenoid 2 power signal wire
C - Pressure Control Solenoid power signal wire
D - Pressure Control Solenoid ground wire
E - Ground for the shift and lock up solenoid
F - IMS "A" Signal
G - IMS "B" Signal
H - IMS "C" Signal
J - IMS "PA" Signal
K - IMS Ground (Shared with terminal "E")
L - Transmission Fluid Temperature Sensor Signal
M -Transmission Fluid Temperature Sensor Ground
N - Not Used
P - Not Used
R - Not Used
S - Turbine Shaft Speed Sensor Power
T - Lock Up Solenoid Power Signal Wire
U - PSM PS4 Signal (TCC On/Off Signal)
V - Turbine Shaft Speed Sensor Signal Wire
X - Not Used

Figure 8

Channel Plate Valve Description

Manual Valve

The manual valve is fed by line pressure from the pressure regulator valve and is mechanically linked to the gear selector lever. When a gear range is selected, the manual valve directs line pressure into the various circuits by opening and closing feed passages. The circuits that are fed by the manual valve are: Reverse. PRN, D4, D3, D2 and Lo.

Stuck, misaligned or damaged valve and linkage could cause:

No reverse or slips in reverse
No first gear or slips in first gear
No fourth gear or slips in fourth gear
No Park
No engine compression braking in all manual ranges
Drives in neutral
No gear selections
Shift indicator indicates wrong gear selection

Low Regulator Valve Lineup (442, 443 & 444)

The low regulator valve (443) is a spool type regulating valve that regulates braking 1st gear fluid into the low regulator fluid circuit. Low regulator fluid is used to apply the third clutch in manual first.

Damaged/missing valve, spring or bore plug can cause slipping in manual first.

Cooler Blow Off Ball Check Valve Lineup (407, 417 & 420C)

The cooler blow off ball check valve (420C) is held closed by spring force from the cooler blow off spring (407). If cooler fluid pressure exceeds 1103 kPa (160 psi), the ball check valve moves against spring force to exhaust the excess pressure.

Actuator Feed Limit Valve Train (414-416)

The actuator feed limit valve is a spool type regulating valve that regulates line fluid pressure into actuator feed fluid pressure. Actuator feed fluid then feeds the pressure control solenoid and the shift solenoids after passing through a filter (screen assembly 382)

Accumulators

In the Hydra-matic 4T65-E, accumulators are used in the 2nd, 3rd and 4th clutch apply circuits to control shift feel. An accumulator is a spring loaded device that absorbs a certain amount of fluid pressure in a circuit to cushion clutch engagement according to engine torque. The clutch apply fluid pressure acts against spring force and torque signal fluid biased accumulator pressure to act like a shock absorber.

During the apply of the 2nd, 3rd and 4th clutch packs, apply fluid overcomes the clutch piston return springs and begins to compress the clutch plates. When the clearance between the clutch plates is taken up by piston travel and the clutch begins to apply. Pressure in the circuit builds up rapidly. Without an accumulator in the circuit, this rapid build up of fluid pressure would cause the clutch to grab very quickly and create a harsh shift. However, accumulator spring force and accumulator fluid pressure is designed to absorb some of the clutch apply fluid pressure allowing for a more gradual apply of the clutch.

The force of the accumulator spring and accumulator fluid pressure together control the rate at which a clutch applies. In the Hydra-matic 4T65-E, accumulator pressure varies in proportion to the torque signal pressure acting on the accumulator valves. Therefore, when torque signal pressure is high, accumulator pressure will he high. Likewise, when torque signal pressure is low, accumulator pressure will be low. Since torque signal pressure is regulated by the pressure control solenoid, (which is controlled by throttle position through the PCM), the accumulator valves regulate accumulator fluid pressure in proportion to throttle position to control shift feel.

3-4 Accumulator Assembly (421-428)

Shift feel for a 3-4 shift and durability of the 4th clutch is largely dependent upon 4th clutch fluid pressure used to apply the clutch. To control 4th clutch apply pressure and shift feel, a 3-4 accumulator assembly (421-428) and 3-4 accumulator pressure is used.

Fluid pressure in the 3-4 accumulator passage occurs when Line fluid pressure is regulated at the 3-4 accumulator valve (350) by torque signal fluid pressure and spring force. Regulated Line fluid pressure is then directed into the 3-4 accumulator circuit, through the hollow 3-4 accumulator pin (426) to the spring side of the 3-4 accumulator piston (428).

When the 4th clutch applies during a 3-4 shift, 4th clutch pressure is fed to the 3-4 accumulator piston

(428) and compresses the 3-4 accumulator springs (423-424). When this occurs, 3-4 accumulator fluid is forced out of the 3-4 accumulator cannister (421) back to the 3-4 accumulator valve (341) where it exhausts. Again, torque signal fluid pressure and spring force at the 3-4 accumulator valve (341) regulates exhausting 3-4 accumulator fluid to control the 4th clutch apply.

Accumulator Related Diagnostic Tips
A leak at the accumulator piston seal or porosity in the case, case cover or accumulator housing could cause no fourth gear/slips in fourth gear.

Valve Body Valve Description

1-2 Accumulator Assembly (135A-137A, 139 & 142)
Shift feel for a 1-2 shift and durability of the 2nd clutch is largely dependent upon 2nd clutch fluid pressure used to apply the clutch. To control 2nd clutch apply pressure and shift feel, a 1-2 accumulator assembly and 1-2 accumulator fluid pressure is used in addition to the 2nd clutch wave plate (623).

Fluid pressure in the 1-2 accumulator passage occurs when Line fluid pressure is regulated at the (primary) 1-2 accumulator valve (350) by torque signal fluid pressure and spring force. Regulated Line fluid pressure is then directed into the 1-2 accumulator fluid passage where it is routed through orifice #2 to the other end of the accumulator valve where it will oppose torque signal fluid pressure and spring force to regulate 1-2 accumulator fluid pressure. 1-2 accumulator pressure is also routed to the spring side of the 1-2 accumulator piston (136).

When the 2nd clutch applies during a 1-2 shift, 2nd clutch pressure is fed to the 1-2 accumulator piston (136A) and compresses the 1-2 accumulator spring (139). When this occurs, 1-2 accumulator fluid is forced out of the accumulator housing (140) hack to the 1-2 accumulator valve (350) where it exhausts. Torque signal fluid pressure and spring force at the 1-2 accumulator valve regulate exhausting 1-2 accumulator fluid to control 2nd clutch apply.

A leak at the accumulator piston seal or porosity in the case, case cover or accumulator housing could cause no 2nd gear/slips in 2nd gear

A stuck accumulator piston would cause harsh shifts

2-3 Accumulator Assembly (135B-138 & 143)
The 2-3 accumulator assembly functions basically the same as the 1-2 accumulator assembly. To control 3rd clutch apply pressure and shift feel, a 2-3 accumulator assembly and 2-3 accumulator pressure is used in addition to the 3rd clutch waved plate (645).

Fluid pressure in the 2-3 accumulator passage occurs when Line fluid pressure is regulated at the 2-3 accumulator valve (344) by torque signal fluid pressure. Regulated Line fluid pressure is then directed into the 2-3 accumulator fluid passage to the spring side of the 2-3 accumulator piston (136B).

When the 3rd clutch applies during a 2-3 shift, 3rd clutch pressure is fed to the 2-3 accumulator piston (136B) and compresses the 2-3 accumulator spring (143). When this occurs. 2-3 accumulator fluid is forced out of the accumulator housing (140) back to the 2-3 accumulator valve (344) where it exhausts. 'Torque signal fluid pressure and spring force at the 2-3 accumulator valve (344) regulate exhausting 2-3 accumulator fluid to control 3rd clutch apply.

A leak at the accumulator piston seal or porosity in the case, case cover or accumulator housing could cause no 3rd gear/slips in 3rd gear

A stuck accumulator piston would cause harsh shifts

Pressure Regulator Valve Train (302-313)
Pressure Regulator Valve (313)
The pressure regulator valve (313) directs line pressure to the manual valve, the converter feed circuit to control hydraulic apply and release of the converter clutch and the decrease passage to regulate pump output.

If stuck, missing or binding pressure regulator valve or spring could cause incorrect line pressure

Reverse Boost Valve (310)
Acted on by PRN fluid from the manual valve (404) , it moves against pressure regulator valve spring (311 & 312) pressure. This increases line pressure in Park, Reverse and Neutral in response to a high percentage of throttle travel.

Line Boost Valve (304)
Acted on by torque signal fluid pressure, it moves against the reverse boost valve (310) and pressure regulator spring force (311, 312) to increase line pressure. Its function is in response to changes in throttle position (through pressure control solenoid valve response to PCM signals).

1-2 Shift Valve Train (314-318)
1-2,3-4 Shift Solenoid Valve Assembly (315A)
The 1-2 Shift Solenoid Valve assembly (315) is an ON/OFF type. The PCM controls the solenoid by providing a ground (GM) or power (Volvo) to energize it in: Park, Reverse, Neutral, Overdrive Range First and Fourth Gear, and also Manual First Gear. When energized (ON), its exhaust port closes, moves the 1-2 shift valve and allows filtered line pressure to enter the 1-2, 3-4 signal fluid passage. When the PCM removes the ground (GM) or power (Volvo), the solenoid is OFF allowing line pressure to exhaust through the solenoid.

A faulty (stuck on) 1-2, 3-4 Shift Solenoid Valve assembly can cause I st and 4th gear only.
A faulty (stuck off) 1-2, 3-4 Shift Solenoid Valve assembly can cause 2nd and 3rd gear only.

1-2 Shift Valve (318)
The 1-2 shift valve responds to 1-2, 3-4 signal fluid pressure, force from the 1-2 shift valve spring (317) and 2-3 off signal fluid pressure. Depending on the position of the valve, it will route D4 fluid into the 2nd fluid passage or lo fluid into the braking 1st gear fluid passage.

A stuck or binding 1-2 shift valve can cause 1st or 2nd gear only, or slipping/ no 1st or 2nd gear.

Line Pressure Relief Valve (324)
Prevents line pressure from exceeding 1,690-2,480 kPa (245-360 psi). Excess line pressure unseats the ball check valve allowing it to exhaust.

Torque Signal Regulator Valve Train (320-322)
Pressure Control Solenoid Valve Assembly (322)
An electronically controlled pressure regulator that regulates the torque signal regulator valve against torque signal fluid and spring force.

A leaking/damaged o-ring or had electrical connection can cause high or low line pressure.

Torque Signal Regulator Valve (321)
Regulates torque signal fluid, fed by line fluid pressure. The pressure control solenoid, a variable bleed solenoid, acts on one end of the valve (relative to throttle position) against torque signal fluid and spring pressure on the other end.

A stuck torque signal regulator valve can cause high or low line pressure.

TCC Control (PWM) Solenoid Valve (334)
An electronically controlled pressure regulator that regulates 2nd clutch fluid pressure into the TCC signal fluid circuit to shuttle the TCC control valve to the apply position. Regulated TCC signal fluid pressure also shuttles the TCC regulator apply valve to allow line pressure into the TCC regulated apply circuit for a controlled apply and release of the torque converter clutch.

Stuck on, exhaust plugged, would cause no TCC release.
Stuck off, leaking o-ring, no voltage, would cause no TCC/slip or soft apply.

TCC Control Valve (335)
When the TCC PWM solenoid is OFF, the TCC control valve (335) is held in the released position by the TCC spring (336). In this position, converter feed pressure enters the torque converter clutch release circuit and apply fluid flows around the valve into the cooler circuit. When the TCC PWM solenoid (334) is ON, TCC signal fluid moves the valve against spring force. When shifted, it directs regulated line fluid (TCC regulated apply) into the apply passage; converter feed fluid into the cooler passage, and, allows converter release fluid to exhaust.

If stuck, missing or binding the TCC control valve or spring could cause:

TCC stuck on in all gears
No TCC apply

TCC Regulator Apply Valve Train (326-328)
The TCC regulator apply valve (327) is biased by TCC signal and TCC regulated apply fluid pressures in order to regulate line pressure passing through the valve. TCC regulated apply fluid pressure acting on the end of the valve combines with the spring force from the TCC regulator apply valve spring (326). In this manner, line pressure is regulated before it is routed to the converter TCC valve (335).

If stuck. missing or binding the TCC regulator apply valve or spring could cause:

Harsh TCC apply or release, slip, shudder, rough apply or no apply

Forward Servo Boost Valve (367B)
Held by spring force, it opens during hard acceleration to allow D4 fluid to enter the drive servo apply passage, bypassing the feed orifice. This provides for a quick fill of the forward servo apply passage and quick apply of the forward band assembly to prevent slippage during abusive shifts from Park or Neutral to Drive.

Reverse Servo Boost Valve (367A)
Held by spring force, it opens during hard acceleration to allow reverse fluid to enter the reverse servo passage, bypassing the feed orifice. This provides for a quick fill of the reverse servo passage and quick apply of the reverse band to prevent hand slippage during abusive shifts from Park or Neutral to Reverse.

2-3 Shift Solenoid Valve (315B):
The 2-3 Shift Solenoid Valve is an ON/ OFF type. The PCM controls the solenoid by providing a ground (GM) or power (Volvo) to energize it in: Park. Reverse. Neutral, Overdrive Range First and Second Gear; and also Manual Second and Manual First Gear Ranges. When energized (ON), its exhaust port closes, allowing filtered line pressure into the 2-3 signal fluid passage. When the PCM removes the ground (GM) or power (Volvo), the solenoid is OFF allowing line pressure to exhaust through the solenoid.

A faulty (stuck on) 2-3 Shift Solenoid Valve assembly can cause 1st and 2nd gear only.
A faulty (stuck oft) 2-3 Shift Solenoid Valve assembly can cause 3rd and 4th gear only.

3-4 / 4-3 Shift Valve Train (359-362)
3-4 Shift Valve (362)
The 3-4 shift valve is controlled by 1-2, 3-4 signal fluid pressure on one end of the valve and the 4-3 manual downshift valve (360) at the other. When downshifted, input clutch feed pressure can apply or release the input clutch depending on the gear range. When up shifted by 2-3 signal fluid pressure, 3rd fluid is allowed to enter the 4th clutch circuit to apply the 4th clutch.

A stuck or binding 3-4 Shift Valve can cause slipping or no 4th gear.

4-3 Manual Downshift Valve (360)
The 4-3 manual downshift valve is controlled by 2-3 signal fluid pressure acting on one side of the valve and spring force from the 4-3 manual downshift valve spring (361) on the other side. When the 2-3 solenoid is ON, 2-3 signal fluid pressure moves the valve against spring force to hold the 3-4 shift valve (362) in the downshift position.

2-3 / 3-2 Shift Valve Trains (353-357)
3-2 Manual Downshift Valve (356)
The 3-2 manual downshift valve is controlled by 2-3 signal fluid pressure and spring force from the 3-2 downshift valve spring (355). When the 2-3 solenoid is ON, 2-3 signal fluid pressure moves the valve against the 2-3 shift valve (357) to prevent a 2-3 upshift.

2-3 Shift Valve (357)
The 2-3 shift valve (357) is controlled by line pressure acting on one end of the valve and the 3-2 downshift valve (356) at the other end. Depending on the position of the manual valve, 1-2, 3-4 solenoid (315A)and the 2-3 solenoid (315B) state (ON or OFF), the 2-3 shift valve (357) directs: line pressure into the input clutch feed passage, D4 pressure into the auxiliary input clutch feed passage, D3 into the input clutch feed passage, D2 into the into the manual 2-1 servo passage, and 3rd fluid to exhaust at the valve.

A stuck or binding 2-3 Shift Valve can cause slipping or no 3rd gear.

1-2 Accumulator Valve Train (350-351)
1-2 Accumulator Valve (350)
The 1-2 accumulator valve is biased by torque signal fluid pressure and spring force acting on one end of the valve and 1-2 accumulator fluid pressure at the other end. It regulates the amount of line fluid passing through the valve and entering the 1-2 accumulator circuit.

3-4 Accumulator and 2-3 Accumulator Valve Trains (340-346)
3-4 Accumulator Valve (341)
The 3-4 accumulator valve is biased by torque signal fluid pressure and spring force from the 3-4 accumulator spring (351) on one end of the valve and 3-4 accumulator fluid on the other end. It regulates the amount of line pressure passing through the valve and entering the 3-4 accumulator circuit.

2-3 Accumulator Valve (344)
The 2-3 accumulator valve regulates 2-3 accumulator pressure in proportion to torque signal fluid pressure and spring force from the 2-3 accumulator spring (346). It regulates the amount of line pressure entering into the 2-3 accumulator circuit.

Check Ball Function and Location

#1 Converter Clutch Release/Apply
Located in the case cover (400), it directs either release or apply fluid pressures to the TCC blow off ball check valve in the case cover.

#2 2nd Clutch
Located in the case cover (400), it directs 2nd (apply) fluid through orifice 25 on the spacer plate into the 2nd clutch passage. When the 2nd clutch releases, it seats in the case cover (400) forcing 2nd clutch fluid through orifice 26 and into the 2nd fluid passage.

#3 Input Clutch/PRN
Located in the case cover (400), it blocks the PRN passage to direct input clutch fluid to the input clutch during the appropriate gear range. In Park, Reverse or Neutral gear ranges, PRN fluid unseats the ball check valve and also feeds the input clutch.

#4 3rd Clutch/Low Reg
Located in the case cover (400), during Overdrive Range Third Gear, it seats against the low reg passage allowing 3rd clutch fluid into the 3rd clutch/low reg passage to apply the 3rd clutch. During a 3-2 shift, it allows 3rd clutch/low reg fluid to exhaust into the 3rd clutch fluid passage. In Drive Range - Manual First, it seats against 3rd clutch fluid allowing low reg fluid to enter the 3rd clutch/low reg fluid passage to apply the 3rd clutch.

#5 Reverse/Reverse Servo Feed
Located in the valve body (300), it blocks the reverse servo feed passage forcing reverse fluid through an orifice before entering the reverse servo feed passage. When the manual valve is moved out of Reverse gear range, the ball check valve unseats allowing reverse servo fluid to exhaust through the reverse fluid passage.

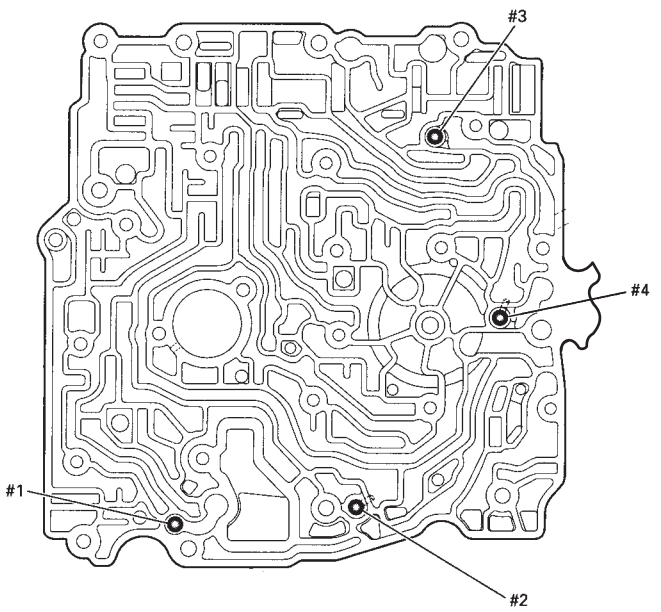
#6 D4 /Servo Apply
Located in the valve body (300), it blocks the forward servo apply passage and forces D4 fluid pressure to the forward servo feed orifice on the spacer plate (370). When the manual valve is moved from Drive Range to Park or Neutral or Reverse, the ball check valve unseats to allow for a quick exhaust of the servo apply fluid and release of the forward band assembly.

#7 LO (Volvo Geartronic)
Located in the valve body (300), it is part of the Lo fluid circuit but has no function as the fluid is blocked at the spacer plate.

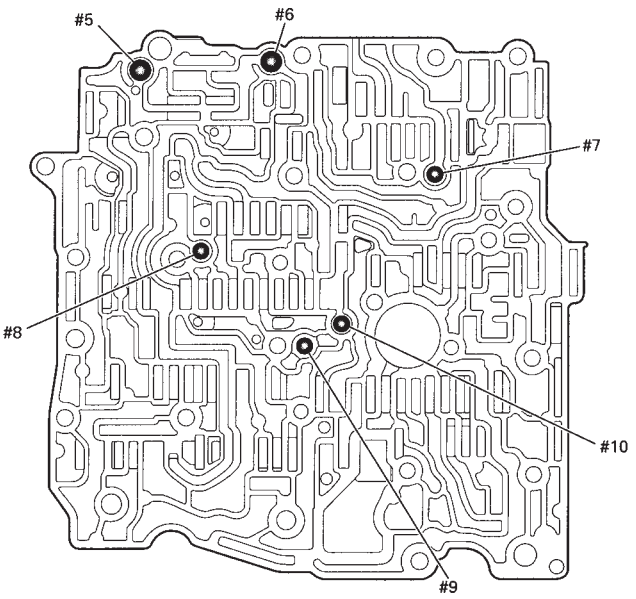
#8 D2 / Manual 2-1 Servo Feed **(Volvo Geartronic)**
Located in the valve body (300), it is fed by D-3 and D-2 fluid from the manual valve and seated against orificed manual 2-1 servo feed fluid at the spacer plate. D-2 fluid is then directed to the 3-2 Manual Downshift valve (356) where it enters the 2-1 manual servo feed passage and is forced through orifice 13. When the 2-1 manual band servo releases the ball check valve unseats and fluid exhausts without going through orifice 13.

#9 3rd / 3rd Clutch
Located in the valve body, it forces 3rd fluid through feed orifice 24 into the 3rd clutch passage during apply of the 3rd clutch. When the 3rd clutch releases, 3rd clutch fluid seats the ball check valve against the 3rd passage, forcing fluid through orifice 28 and into the 3rd fluid passage to the 2-3 shift valve (357) where it exhausts.

#10 Line / 4th Clutch
Located in the valve body, it is seated against the 1st gear fluid passage during all forward ranges, except first, and directs line fluid through orifice 33. In drive range first gear or manual first lst gear fluid pressure unseats the ball check valve and bypasses orifice 33 to send fluid to the input clutch apply passage.



Channel Plate



Valve Body

Figure 9

GM Application

Valve:
Low Blow Off Ball Lineup (405, 406 & 420A)
The low blow off valve (420A) located in the channel plate is a pressure relief valve that exhausts excess Lo-1st fluid pressures above 448 kPa (65 psi) in the 3rd clutch apply circuit.

Check Balls:
#7 LO/LO-1st
Located in the valve body (300), it blocks the lo-1st passage when Drive Range Manual First gear is selected and sends Lo fluid pressure to the 1-2 shift valve where it passes through the valve and is forced through orifice 27 into the Lo-1st circuit.

#8 D2 / Manual 2-1 Servo Feed
Located in the valve body (300), it is fed by D-2 fluid from the manual valve and seated against orificed manual 2-1 servo feed fluid at the spacer plate. D-2 fluid is then directed to the 3-2 Manual Downshift valve (356) where it enters the 2-1 manual servo feed passage and is forced through orifice 13. When the 2-1 manual band servo releases the ball check valve unseats and fluid exhausts without going through orifice 13.

Input Speed Sensor
Located in the channel plate, and excited by a tone ring on the drive sprocket, the North American version is a Permanent Magnet type, while the Volvo version is a Hall Effect type.
In Figure 10, the top illustration shows the Permanent Magnet type and has a small metal tip protruding from the sensor, while the bottom illustration shows the Hall Effect type which has no metal tip.

Although a typical Hall Effect Speed Sensor has three wires, the Volvo version is a two wire Hall Effect Speed Sensor. The third wire could be considered as contained inside the sensor. It is easy to put the wrong sensor in either version transmission, which will cause an incorrect signal and transmission gear ratio problems.

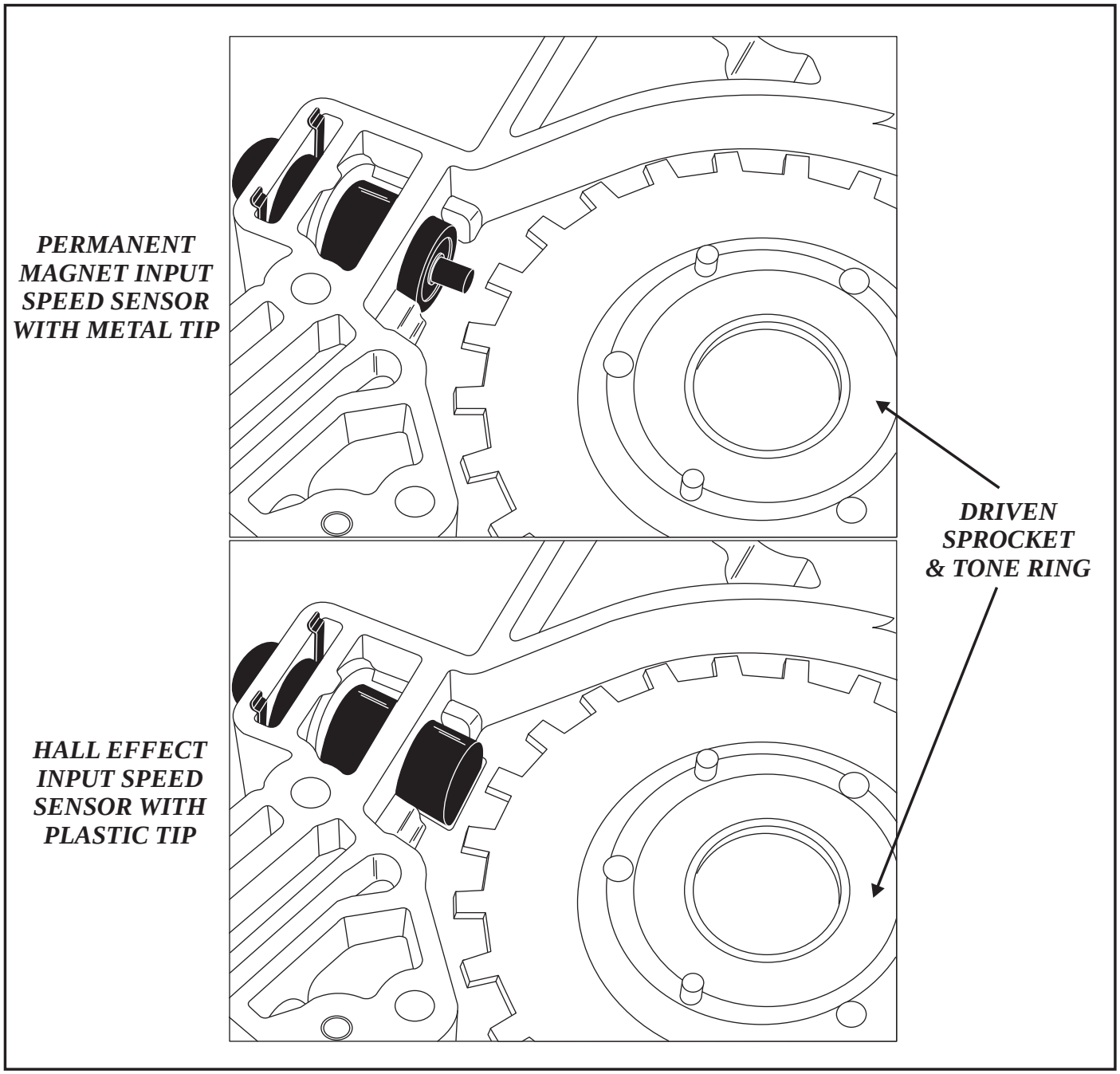


Figure 10

Input Speed Sensor...continued

The diagram in Figure 11 is the Input Speed Sensor circuit found in the North American version of the 4T65E. The input speed sensor is the AC Voltage Generator type. It sends AC voltage sine wave to the PCM where it is buffered internally in order to convert the AC voltage to a DC voltage signal that is pulsed to ground by the buffer. This is done because automotive computers do not understand AC voltage as a language. This signal can also be measured in Hertz which is the frequency of the signal. For example, the specs on the input speed sensor is at least 0.1 volt AC @ 3 mph and approximately 33 Hz @ 30 mph. This signal is best tested with a scope.

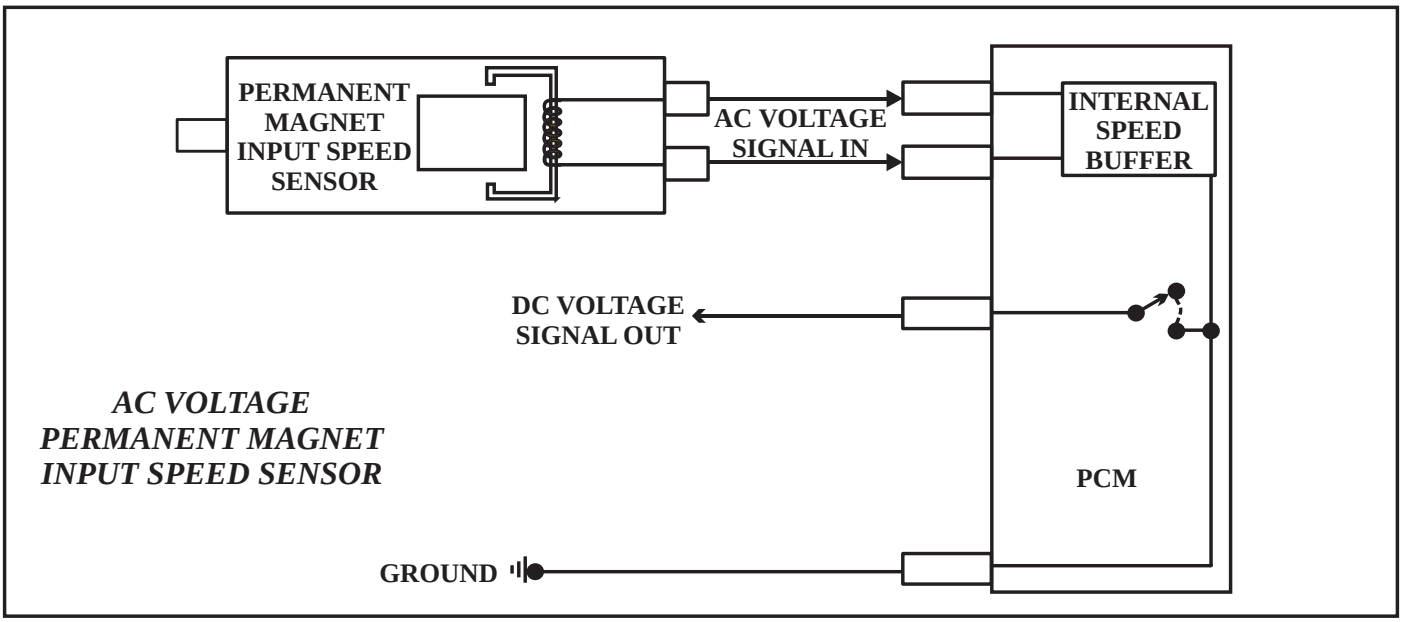


Figure 11

The diagram in Figure 12 is the Input Speed Sensor Circuit found in the Volvo S80 with 4T65E-V. The input speed sensor is a Hall Effect type. What makes this sensor different is instead of the typical 3 wire arrangement, it only has two (2) wires. The third wire is basically a part of and controlled by a capacitor inside the speed sensor.

This sensor receives voltage from the PCM and the sensor toggles this reference voltage between zero and five volts. Internally the PCM reads this signal as 0-5-0-5-0-5 which it uses to calculate turbine speed. This signal can be tested with a volt meter using the MIN/MAX feature or a scope.

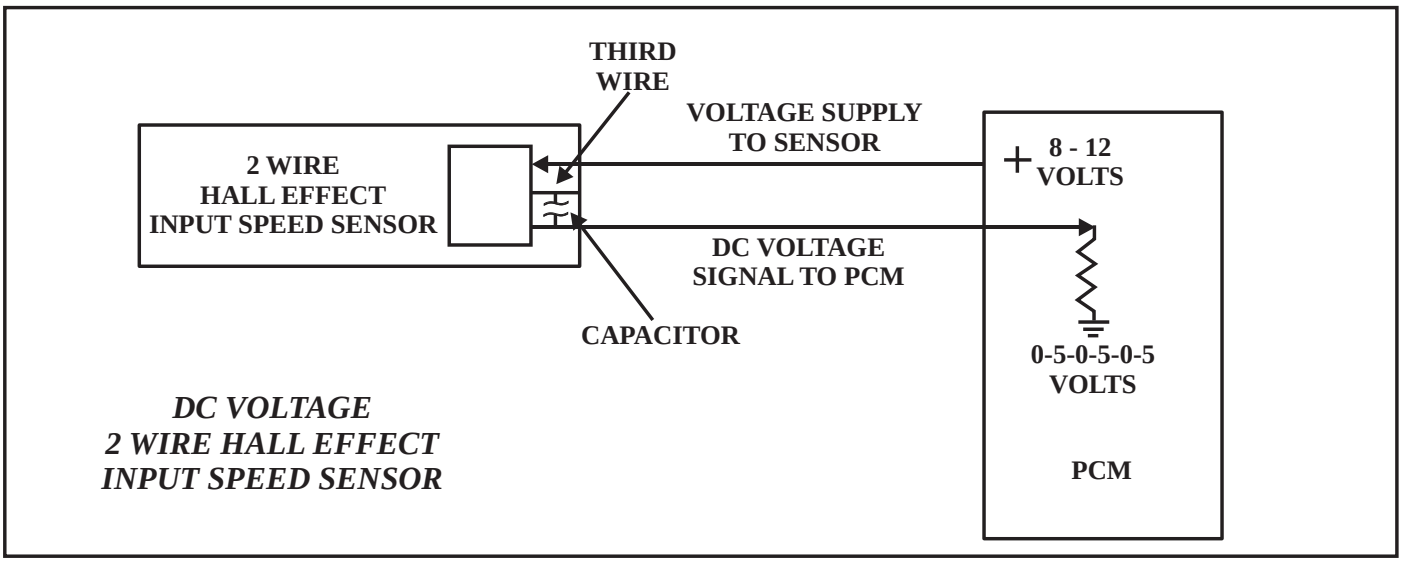


Figure 12

Input Speed Sensor...continued

The biggest problem is how to be sure of which sensor you have when the transmission is out of the vehicle. The test that can resolve this is a "Diode Test". With a "Diode Test", the Permanent Magnet type speed sensor will have the same voltage reading when the meter leads are switched as seen in Figures 13 and 14..

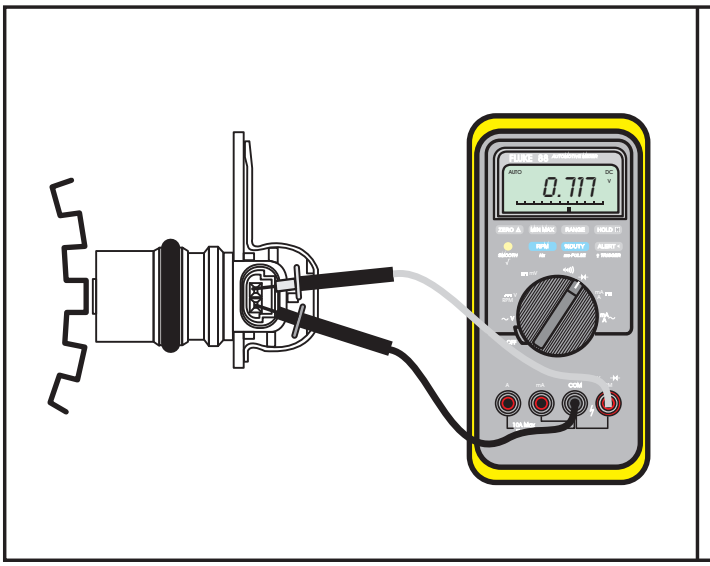


Figure 13

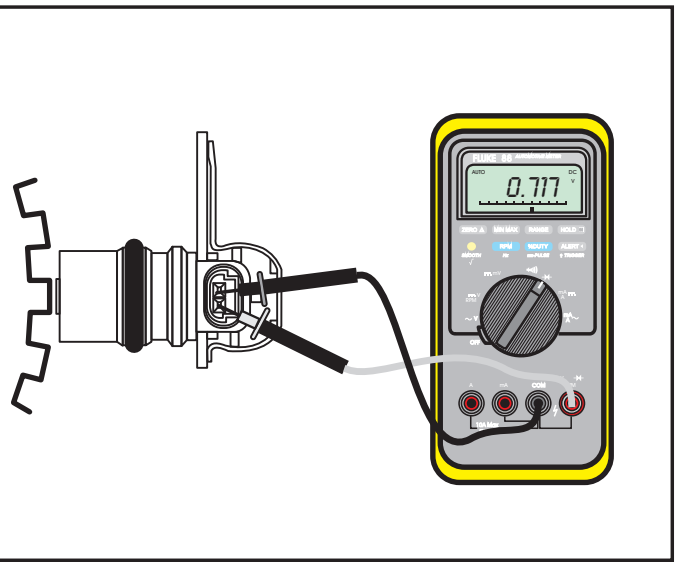


Figure 14

In Figures 15 and 16 there is a significant difference in the voltage that is seen when the meter leads are switched during the "Diode Test" on the two wire Hall Effect Sensor.

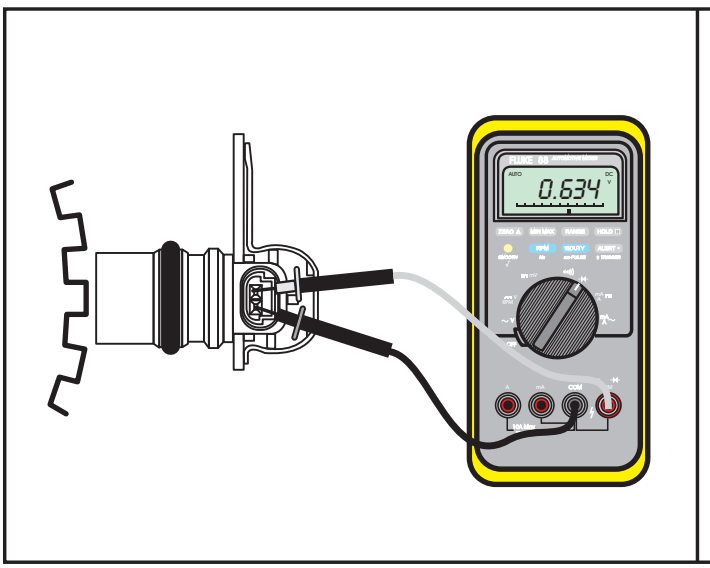


Figure 15

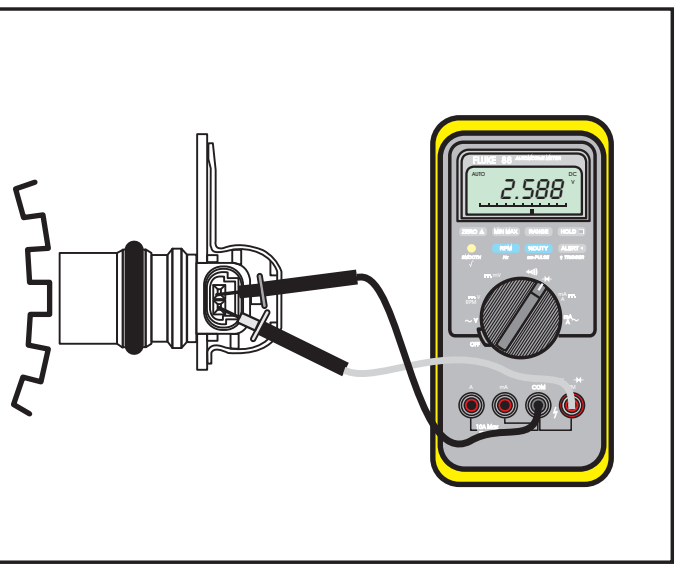


Figure 16

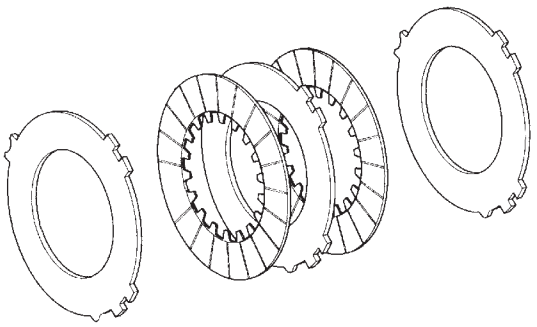
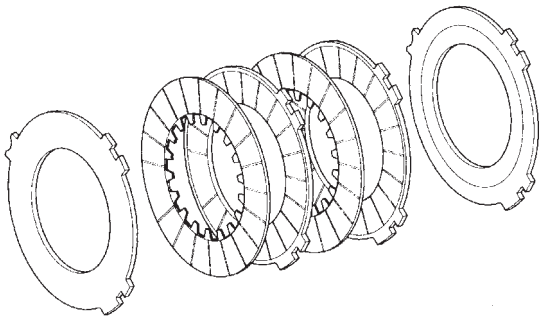
General Motors Application	*Volvo Application*
	
Typical 4th clutch stack up using friction and steel plates	***Single sided internally and externally toothed 4th clutch friction plates***

Figure 17

VOLVO 4T65EV-GT GEARTRONIC SYSTEM

NO MOVEMENT IN D3 OR NO ENGINE BRAKING

COMPLAINT #1: No movement in the D3, D2 or Manual Low position or no engine braking in the D2 or Manual Low position.

COMPLAINT #2: No engine braking in "Tip Up", "Tip Down" in first or second gear.

CAUSE #1: A Volvo Geartronic spacer plate was installed on a GM Non-Geartronic 4T65E.

CAUSE #2: A Non-Geartronic spacer plate was installed with Geartronic components.

CORRECTION: A vehicle with a Geartronic system can be identified by the type of shifter it is equipped with such as the one seen in Figure 1. Geartronic and Non-Geartronic components are not interchangeable. Spacer plate notch identification can be seen in Figure 2. 1 notch represents Non-Geartronic while 2 notches indicate Geartronic operation. Shifters that have D4, D3 , D2 and Manual Low positions are a Non-Geartronic system.
The spacer plate shown in Figure 3 is the Volvo Non-Geartronic spacer plate which is similar to the GM spacer plate. Note that the manual low and manual second circuits are open and therefore functional while circuits 38/35 and 35/36 are closed and are therefore non-functional.

The spacer plate shown in Figure 4 is the Volvo Geartronic spacer plate. Note that the D2 and Manual Low circuits are closed because the D3 position is the lowest position obtainable in a Geartronic system. Also note the circuits 38/35 and 35/36 are open and therefore are functional which provides "Tip Up" and "Tip Down" engine braking into first and second gear while the shifter remains in the D3 position. This is accomplished by allowing the 3rd clutch to be on in first and the manual 2-1 band to be on in first and second gear.

It must also be noted the the valve body and channel plate are cast differently to allow the respective spacer plate to function properly.
The hydraulic schematics shown in Figures 5, 6 and 7 illustrate Geartronic operation in first, second and third gear.

SERVICE INFORMATION:

Volvo Non-Geartronic Bonded Spacer Plate.....30651257
Volvo Geartronic Bonded Spacer Plate.....30651253

GEARTRONIC SHIFTER PATTERN

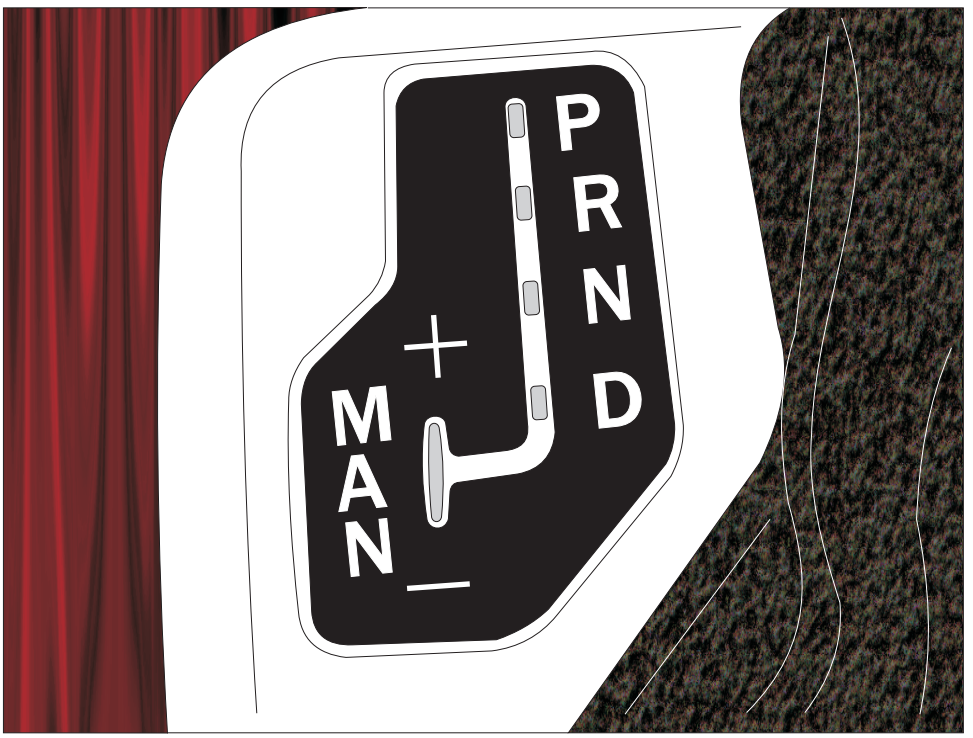


Figure 1

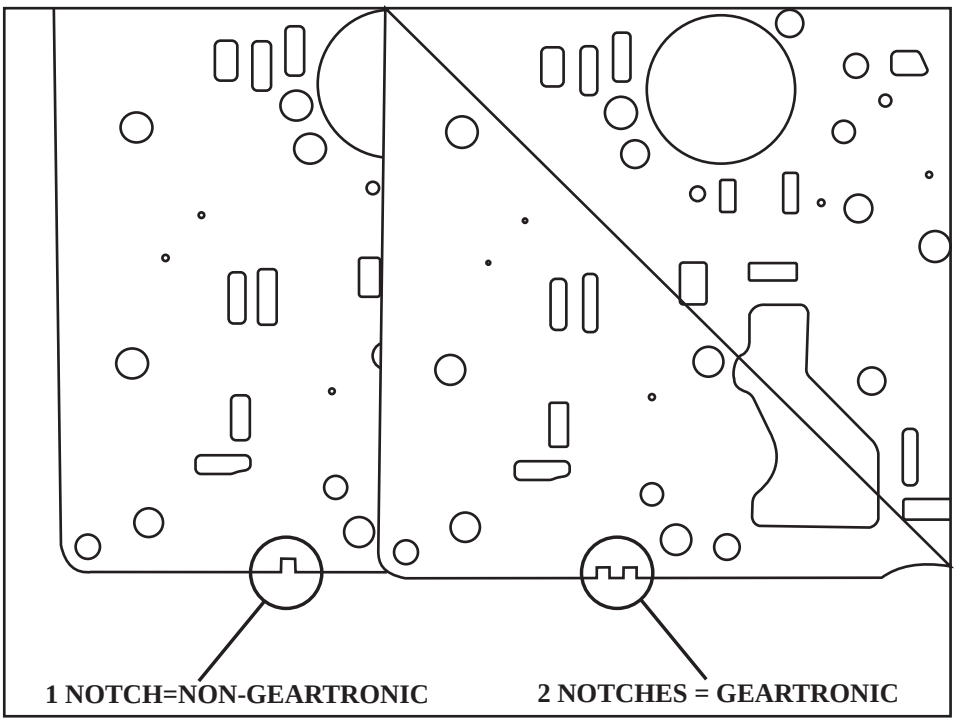


Figure 2

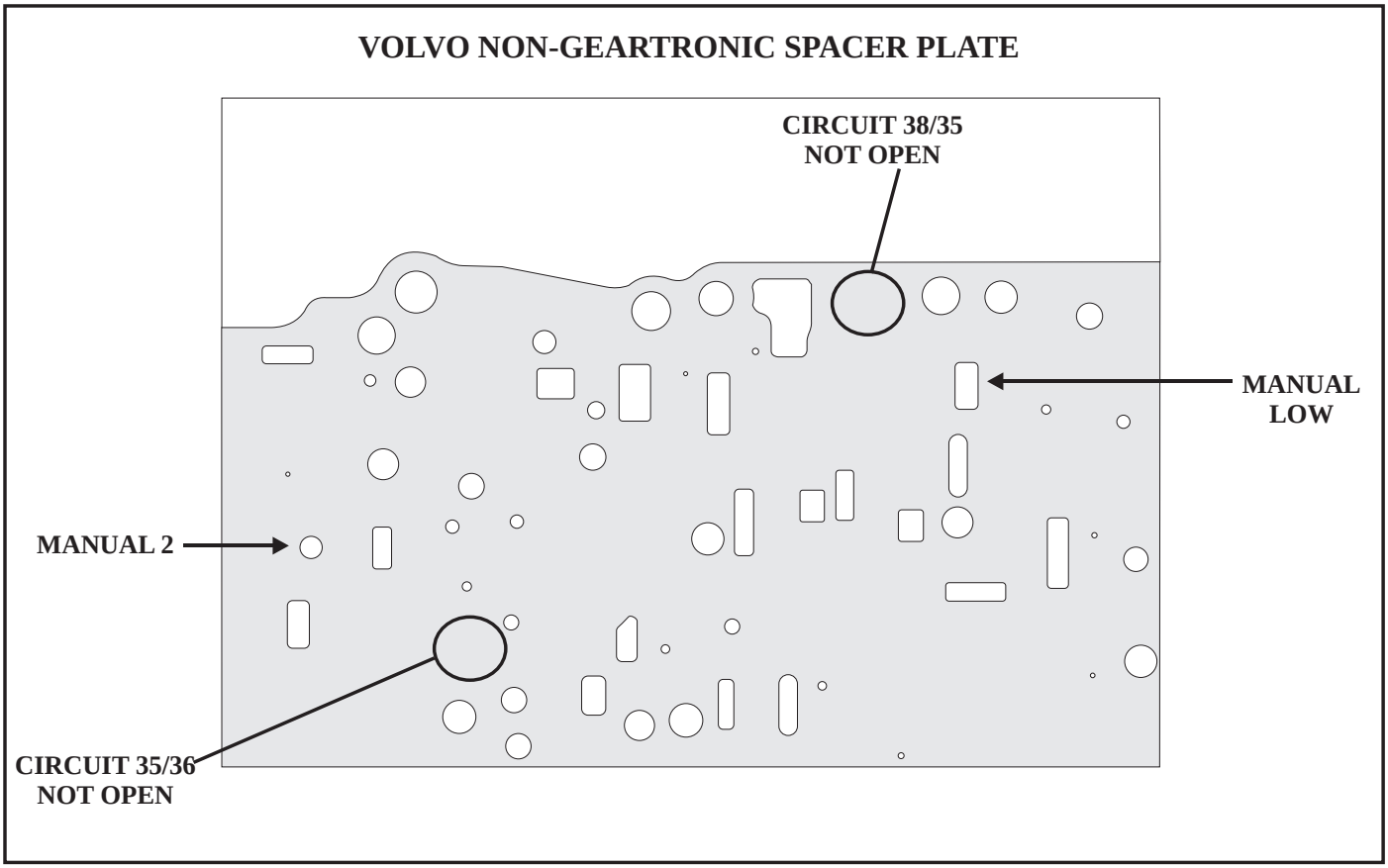


Figure 3

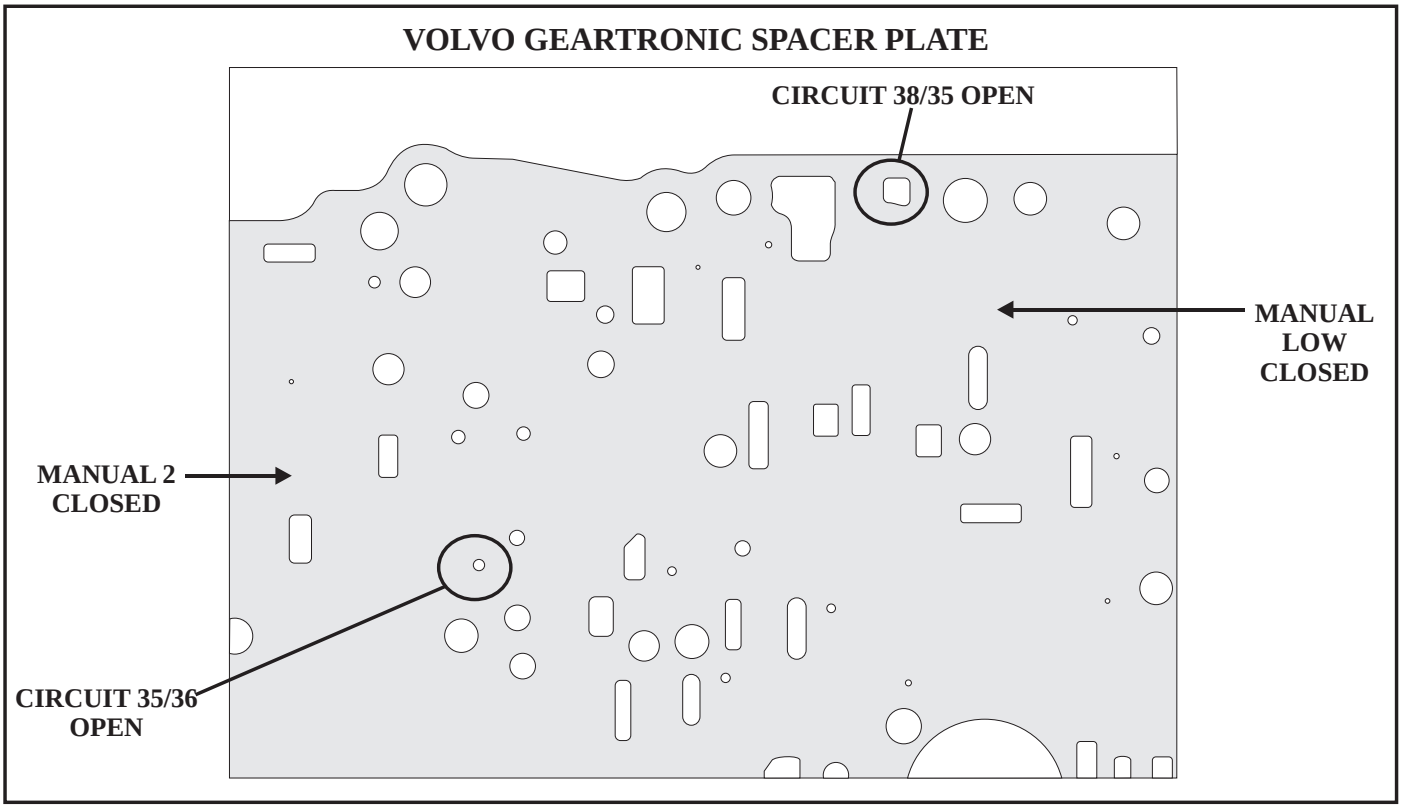


Figure 4

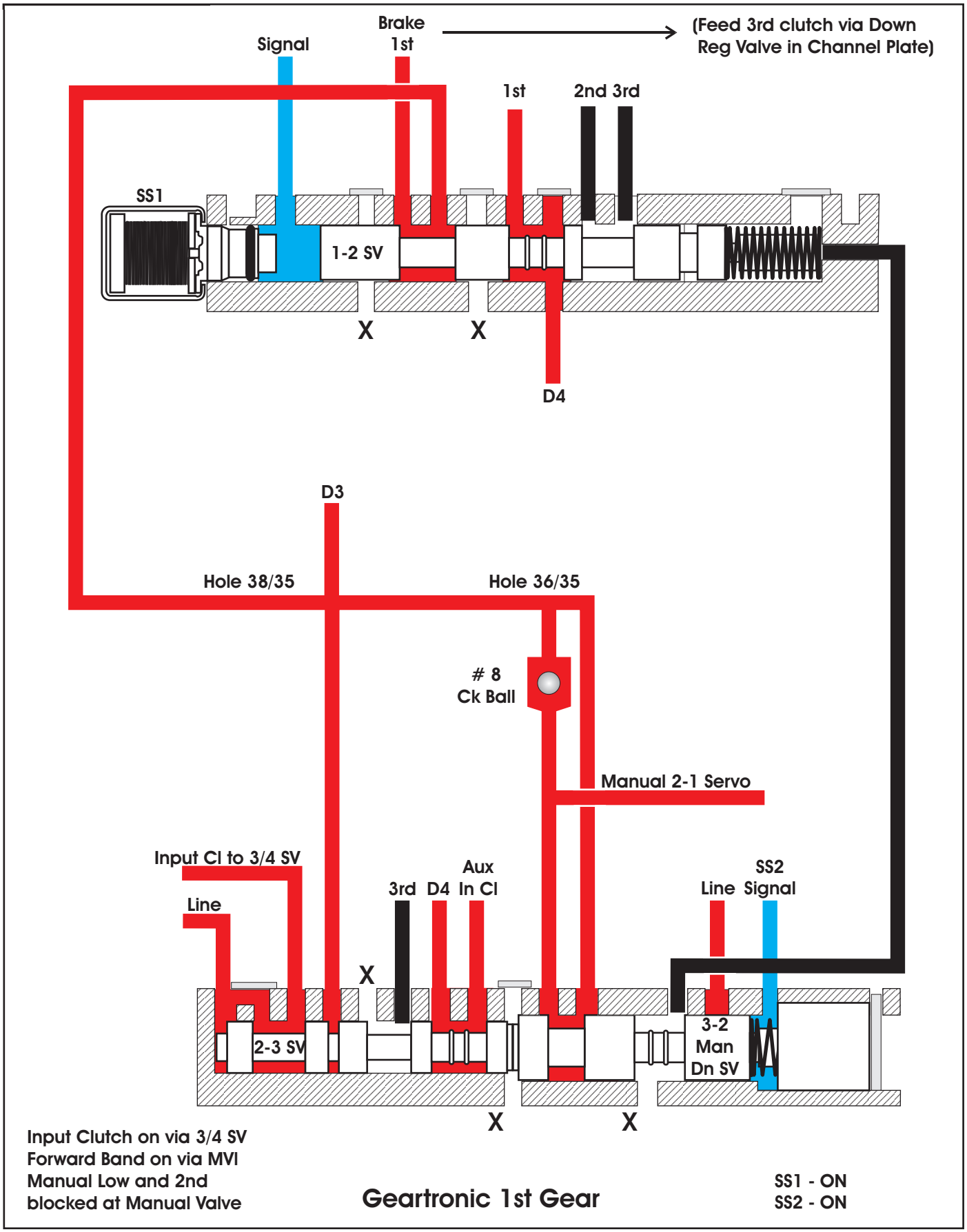


Figure 5

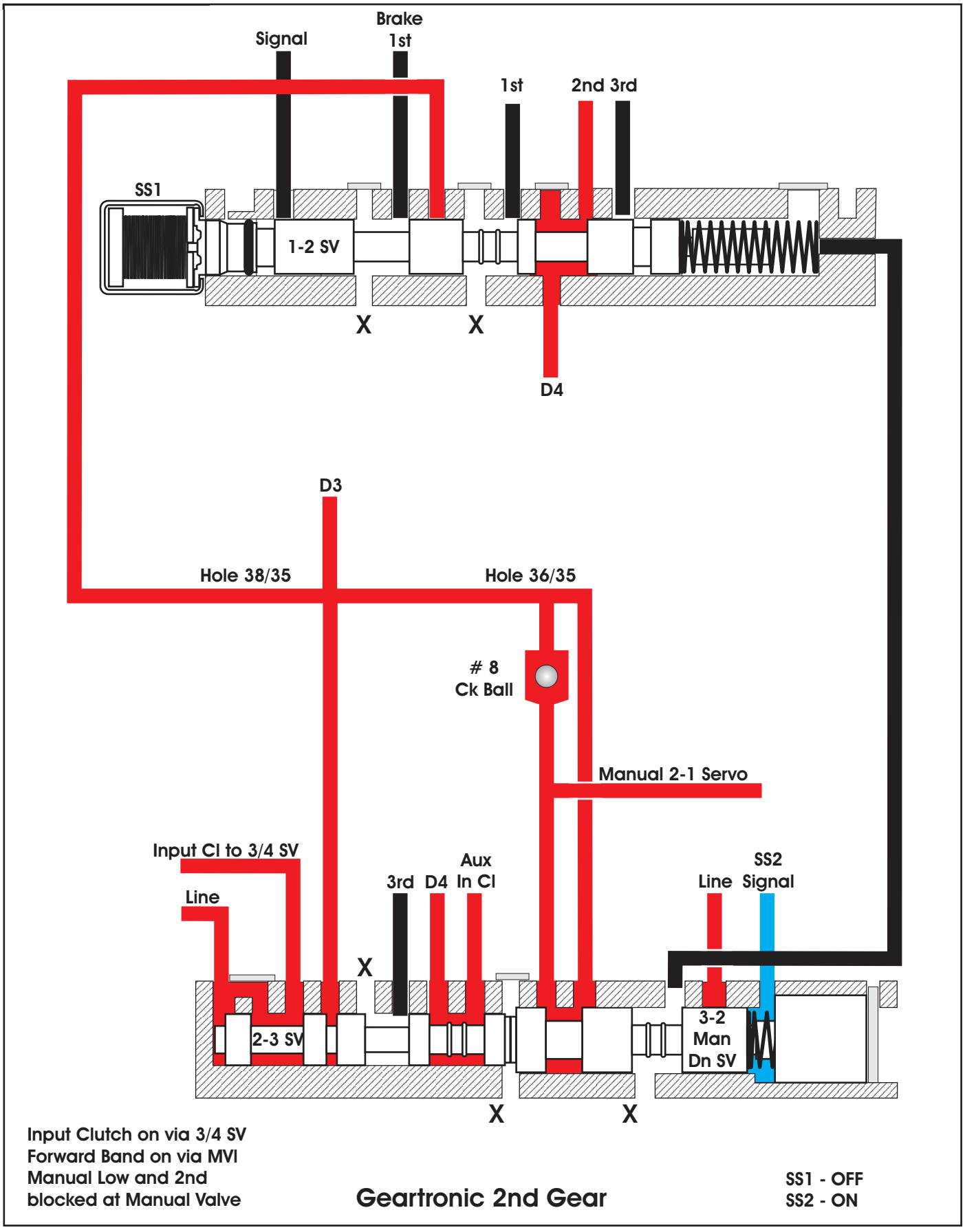


Figure 6

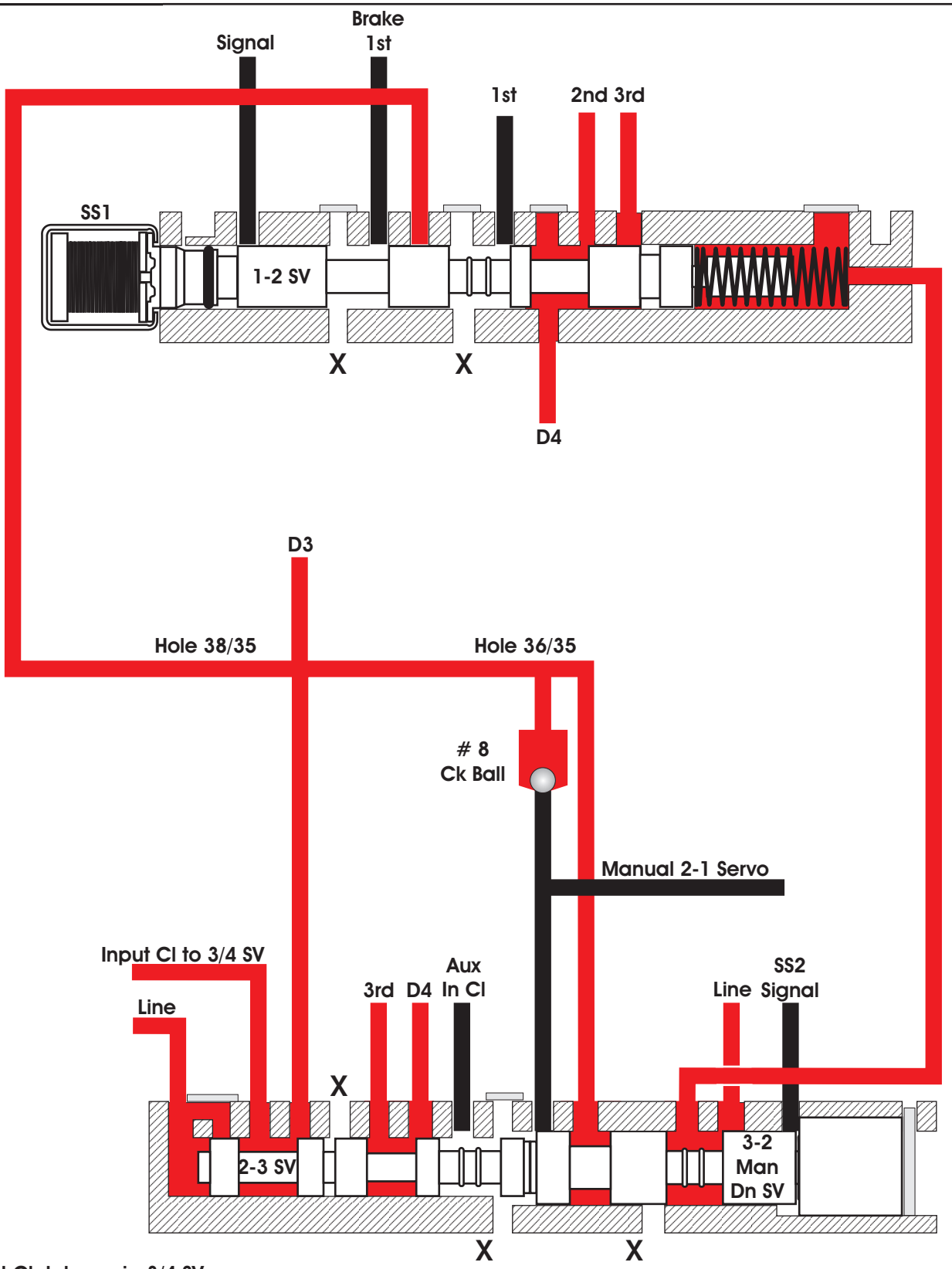


Figure 7

TRANSGO
B&W

GM 4T65E
TCC SURGE AT HIGH SPEEDS OR DTC P0741

COMPLAINT: Vehicles equipped with the 4T65E transaxle may exhibit a Torque converter clutch surge at highway speeds or a Diagnostic Trouble Code P0741, TCC stuck off, before or after overhaul.

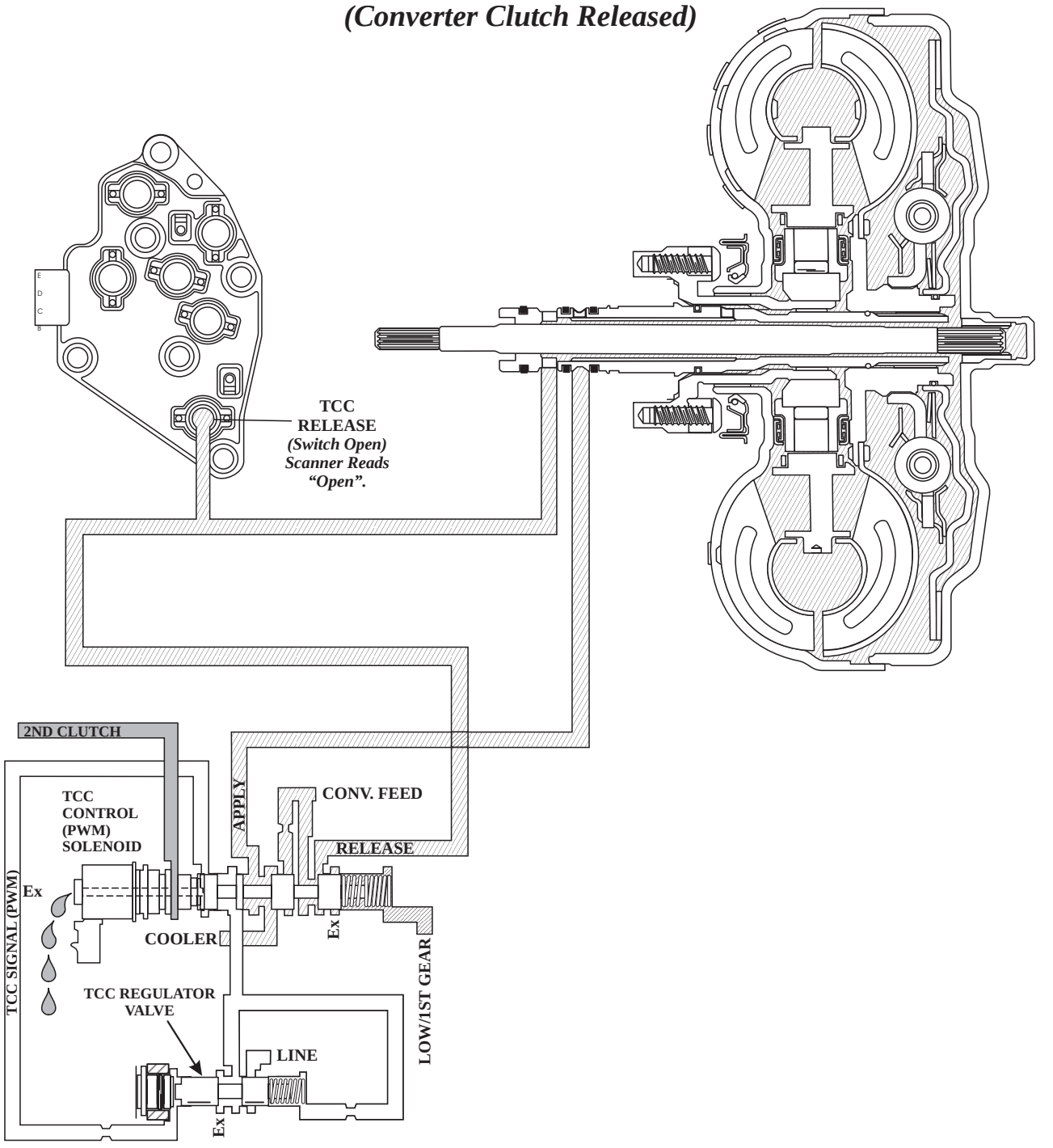
CAUSE: The cause may be, a leaking bore plug "O" ring on the Torque Converter Regulator Valve train. Refer to Figure 1 to see a partial hydraulic circuit of the Torque Converter Regulator valve when the TCC is off. Refer to Figure 2 to see a partial hydraulic circuit of the Torque Converter Regulator valve when the TCC is on. Notice, when there is a leak in the TCC Signal Circuit, the torque converter regulator valve may move to the left causing insufficient converter apply pressure, allowing the Torque Converter Clutch to slip, causing a surging sensation or the P0741 code.

CORRECTION: Refer to Figure 3 and 4 for the valve locations in the valve body and replace the "o"ring on the Torque Converter Regulator Valve bore plug (item number 328).

Special thanks to
Jim at Lee Miles

TCC HYDRAULIC CIRCUIT IN DRIVE 2ND 3RD AND 4TH GEARS

(Converter Clutch Released)

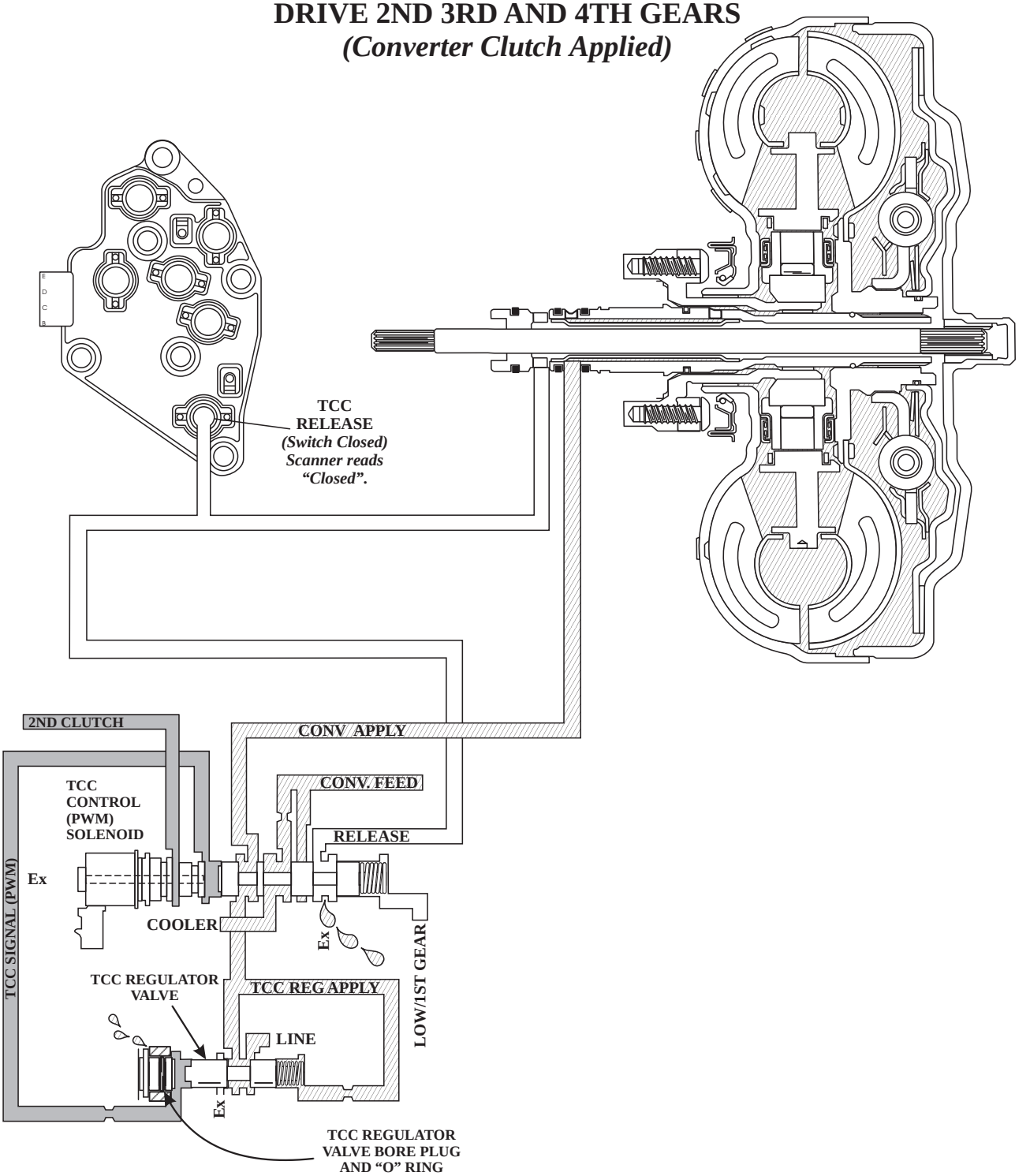


This diagram shows the transmission in 2nd, 3rd, or, 4th gear, with converter clutch released. Notice the TCC PWM solenoid is exhausting the TCC signal oil (2nd Clutch).

Figure 1

TCC HYDRAULIC CIRCUIT IN DRIVE 2ND 3RD AND 4TH GEARS

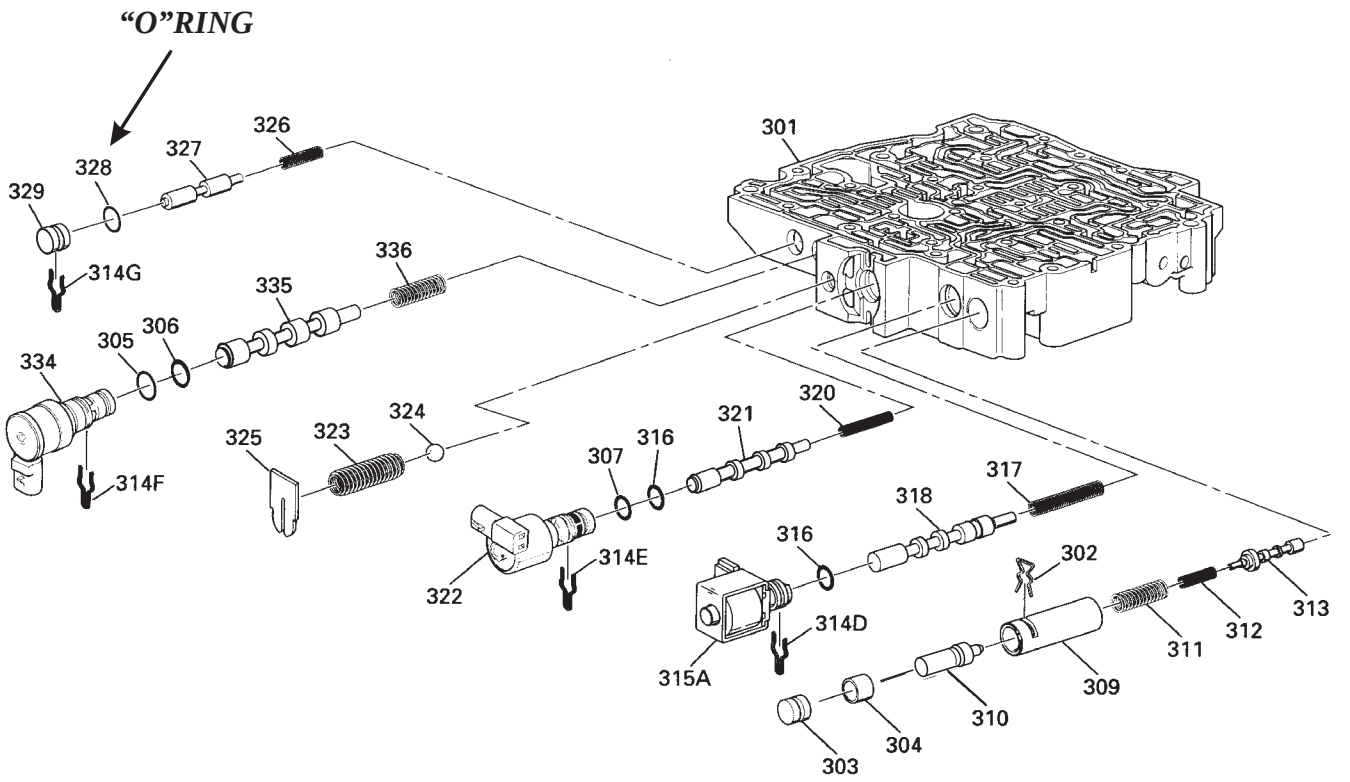
(Converter Clutch Applied)



This diagram shows the transmission in 2nd, 3rd, or, 4th gear, with converter clutch applied. Notice the TCC PWM Solenoid is energized , and TCC signal oil is pushing TCC valve to the right. This same signal oil strokes the TCC regulator valve to the right. A leaking "O"-ring on the bore plug for the TCC regulator valve may cause the TCC reg. Valve to limit the amount of converter apply pressure by allowing the valve to move to the left.

Figure 2

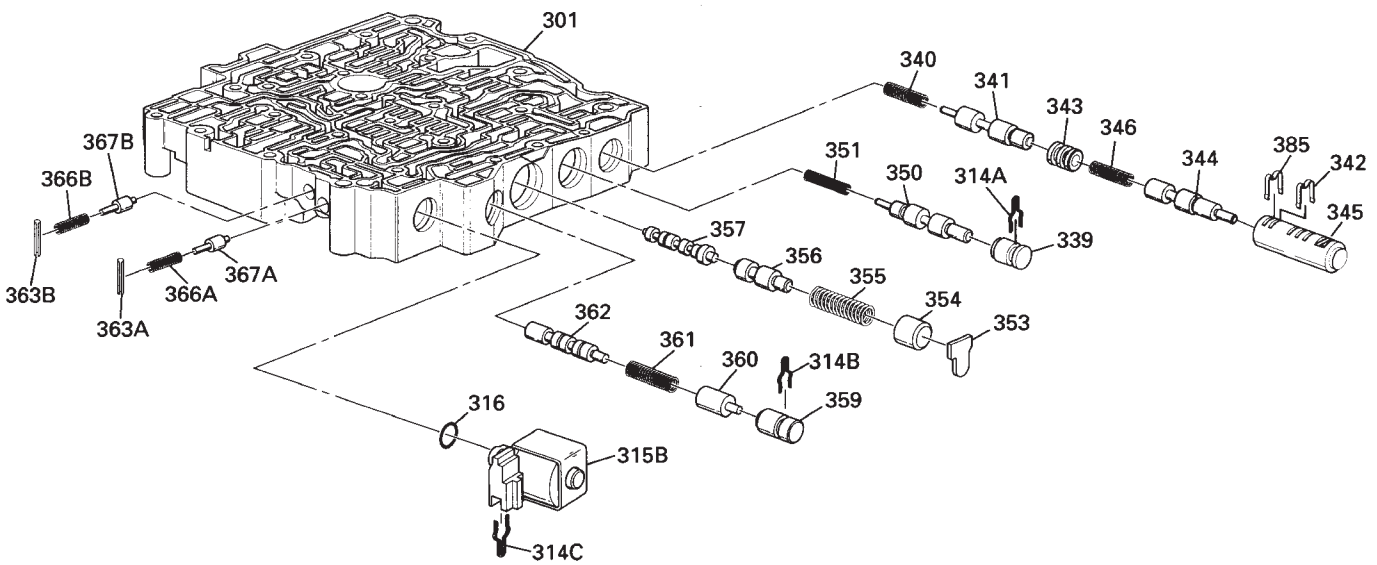
VALVE BODY IDENTIFICATION



301 CONTROL VALVE BODY
302 LINE BOOST VALVE AND BUSHING RETAINER
303 LINE BOOST VALVE BORE PLUG
304 LINE BOOST VALVE
305 TCC PWM SOLENOID "O" RING SEAL
306 TCC PWM SOLENOID "O" RING SEAL
307 PRESSURE CONTROL SOLENOID "O" RING SEAL
309 REVERSE BOOST VALVE BUSHING
310 REVERSE BOOST VALVE
311 PRESSURE REGULATOR VALVE OUTER SPRING
312 PRESSURE REGULATOR VALVE INNER SPRING
313 PRESSURE REGULATOR VALVE
314D 1-2, 3-4 SHIFT SOLENOID RETAINER
314E PRESSURE CONTROL SOLENOID RETAINER
314F TCC PWM SOLENOID RETAINER
314G TCC REGULATOR APPLY VALVE BORE PLUG RETAINER
315A 1-2, 3-4 SHIFT SOLENOID ASSEMBLY
316A 1-2, 3-4 SHIFT SOLENOID "O" RING SEAL
317 1-2 SHIFT VALVE SPRING
318 1-2 SHIFT VALVE
320 TORQUE SIGNAL REGULATOR VALVE SPRING
321 TORQUE SIGNAL REGULATOR VALVE
322 PRESSURE CONTROL SOLENOID ASSEMBLY
323 LINE PRESSURE RELIEF VALVE SPRING
324 LINE PRESSURE RELIEF VALVE
325 LINE PRESSURE RELIEF VALVE SPRING RETAINER
326 TCC REGULATOR APPLY VALVE SPRING
327 TCC REGULATOR APPLY VALVE
328 TCC REGULATOR APPLY VALVE BORE PLUG "O" RING SEAL
329 TCC REGULATOR APPLY VALVE BORE PLUG
334 TCC PWM SOLENOID ASSEMBLY
335 TCC CONTROL VALVE
336 TCC CONTROL VALVE SPRING

Figure 3

VALVE BODY IDENTIFICATION



301 CONTROL VALVE BODY
314A 1-2 ACCUMULATOR VALVE RETAINER
314B 4-3 MANUAL DOWNSHIFT VALVE RETAINER
314C 2-3 SHIFT SOLENOID RETAINER
315B 2-3 SHIFT SOLENOID ASSEMBLY
316 2-3 SHIFT SOLENOID "O" RING SEAL
339 1-2 ACCUMULATOR VALVE BORE PLUG
340 3-4 ACCUMULATOR VALVE SPRING
341 3-4 ACCUMULATOR VALVE
342 2-3 ACCUMULATOR VALVE BUSHING RETAINER
343 2-3 ACCUMULATOR VALVE BORE PLUG
344 2-3 ACCUMULATOR VALVE
345 2-3 ACCUMULATOR VALVE BUSHING
346 2-3 ACCUMULATOR VALVE SPRING
350 1-2 ACCUMULATOR VALVE
351 1-2 ACCUMULATOR VALVE SPRING
353 3-2 MANUAL DOWNSHIFT VALVE RETAINER
354 3-2 MANUAL DOWNSHIFT VALVE BORE PLUG
355 3-2 MANUAL DOWNSHIFT VALVE SPRING
356 3-2 MANUAL DOWNSHIFT VALVE
357 2-3 SHIFT VALVE
359 4-3 MANUAL DOWNSHIFT VALVE BORE PLUG
360 4-3 MANUAL DOWNSHIFT VALVE
361 4-3 MANUAL DOWNSHIFT VALVE SPRING
362 3-4 SHIFT VALVE
363A REVERSE SERVO BOOST VALVE BORE ROLL PIN
363B FORWARD SERVO BOOST VALVE BORE ROLL PIN
366A REVERSE SERVO BOOST VALVE SPRING
366B FORWARD SERVO BOOST VALVE SPRING
367A REVERSE SERVO BOOST VALVE
367B FORWARD SERVO BOOST VALVE
385 2-3 ACCUMULATOR VALVE RETAINER

Figure 4

GM 4T65E

CONVERTER DRAINBACK

COMPLAINT: After overhaul, the vehicle does not move after remaining stationary for a prolonged period of time. When the dip stick is checked, it indicates that the transmission is severely over full, or the transmission cooling system has insufficient cooler flow, neither of these was an original complaint.

CAUSE: 4T65E transmissions built prior to 1/19/04 have the drainback/cooler blow-off ball and spring located in the return cooler line case fitting. The channel plate contains only the TCC blow-off ball and spring as seen in Figure 1. 4T65E transmissions built after 1/19/04, have had the "drainback/cooler blow off" ball and spring removed from the return line cooler fitting and are now located in the channel plate next to the "torque converter blow off" ball and spring as shown in Figure 2.
These channel plates are not interchangeable, but can be by mistake. In addition, the cooler line case fittings have also changed at the same time.
Having a "drainback/cooler blow off" ball and spring in both locations could cause to much of a restriction in cooler flow. Having the ball and spring in neither location will cause converter drain back.

CORRECTION: When channel plate replacement is required, make certain that the "drainback/cooler blow off" ball and spring is present in it's correct location for the model year transmission being repaired.
If a channel plate without the "drainback/cooler blow off" ball and spring is used in a transmission later than the January 19, 2004 build date with the intension of installing the return line cooler case fitting that has the ball and spring, this cannot be accomplished.

The cooler line case fittings used prior to 1/19/04 have different threads. The return cooler line case fitting with the ball and spring has a 3/8-18 NPSF thread, the supply cooler line case fitting has a 1/4-18 NPSF thread, (Refer to Figure 3).
The 1/19/04 and later cooler line case fittings are both the same which is 9/16-18 UNF threads and the return line cooler case fitting does not contain a ball and spring, (Refer to Figure 3).

NOTE #1: The function of the "drainback/cooler blow off" ball and spring is to seal the cooler return oil circuit when the engine is off to prevent converter drainback causing a delay in forward or reverse movement after the vehicle has remained parked for a period of time. It also is meant to unseat and exhaust the cooler circuit should cooler pressure exceed 100 psi.
is the "drainback ball is held off it's seat by trash in the system, converter drainback will occur.

NOTE #2: The "TCC blow off" ball and spring function is to unseat and exhaust converter clutch pressure when it exceeds 100 psi. If the "TCC blow off" ball is held off it's seat by trash in the system, converter clutch shudder, slippage or no TCC apply could occur with possible trouble code P0741 stored.

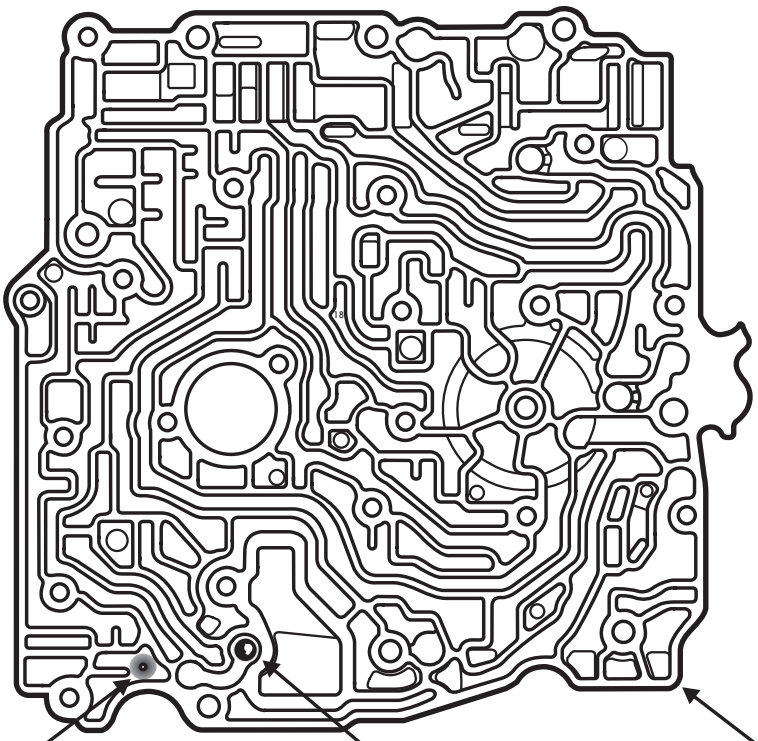
Sonnax

ZOOM

ZOOM

ALTO

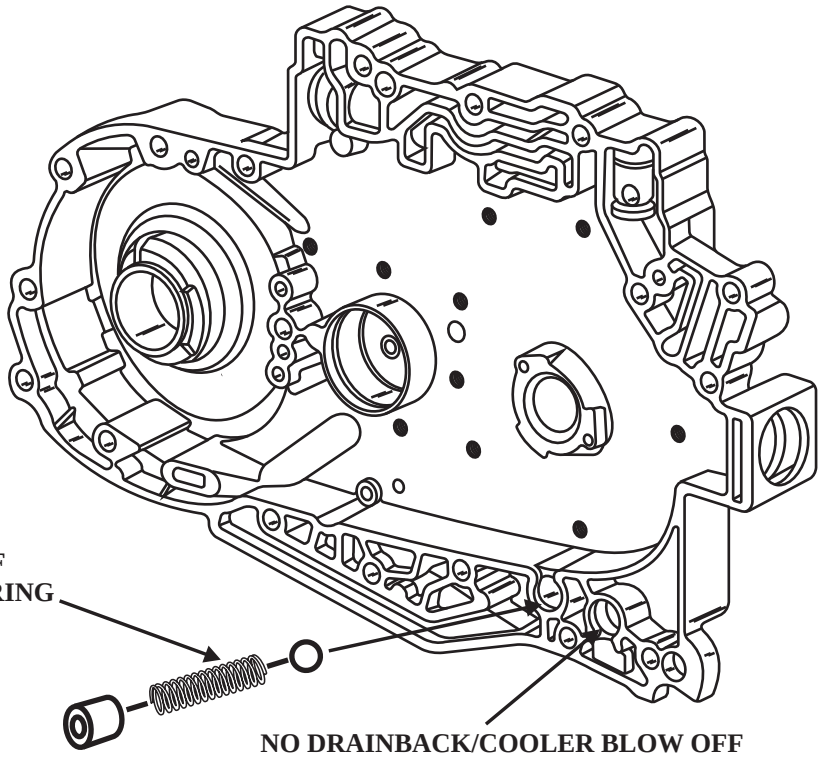
4T65E TRANSMISSIONS BUILT BEFORE 1/19/04



NO DRAINBACK/COOLER BLOW OFF CHECKBALL & SPRING

TCC BLOW-OFF CHECKBALL & SPRING

CHANNEL PLATE (VALVE BODY SIDE)



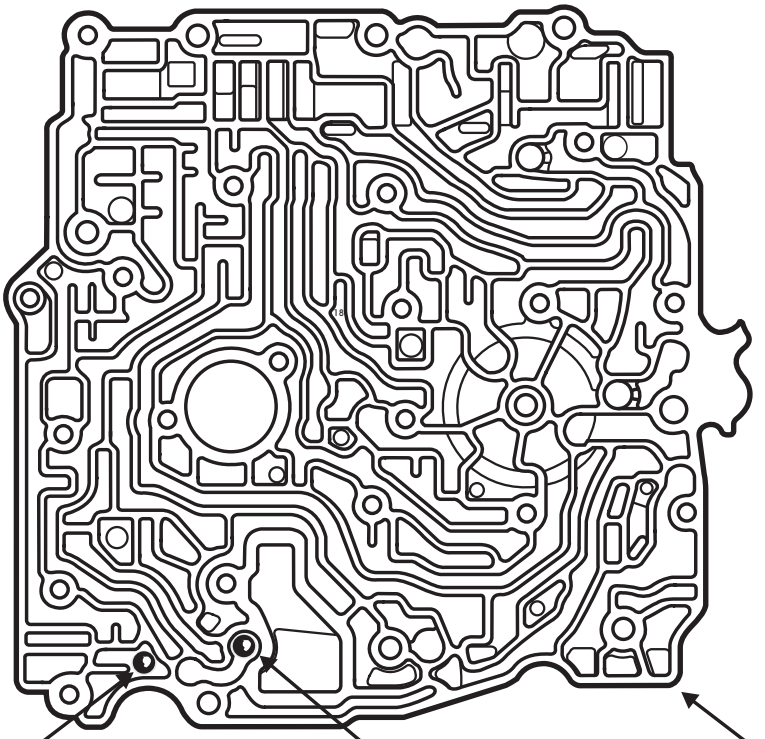
TCC BLOW-OFF CHECKBALL & SPRING

NO DRAINBACK/COOLER BLOW OFF CHECKBALL & SPRING

Figure 1

WIT

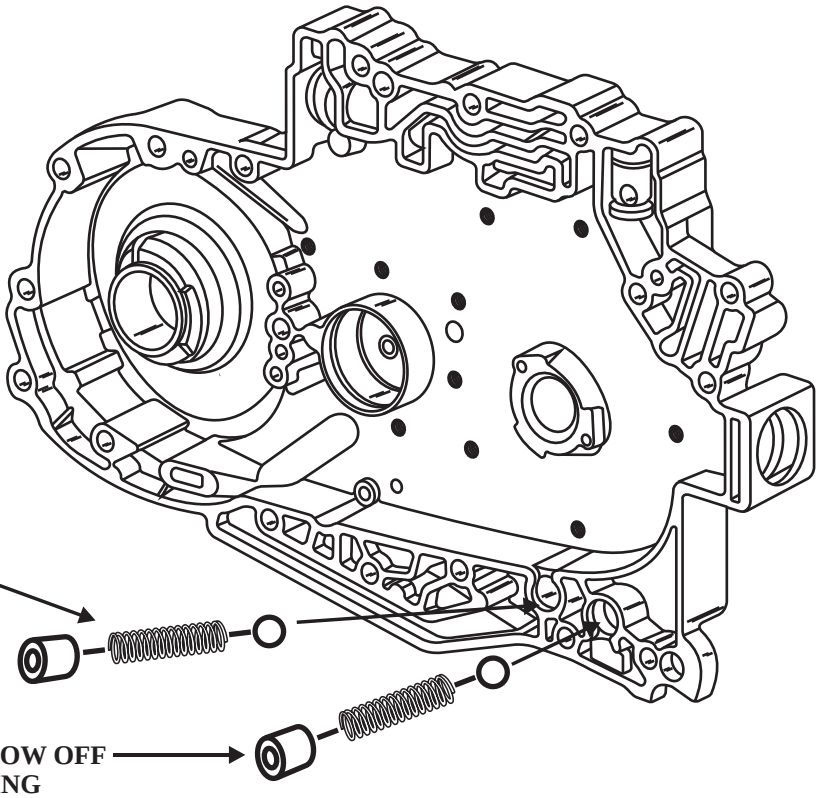
4T65E TRANSMISSIONS BUILT AFTER 1/19/04



DRAINBACK/COOLER BLOW OFF CHECKBALL & SPRING

TCC BLOW-OFF CHECKBALL & SPRING

CHANNEL PLATE (VALVE BODY SIDE)

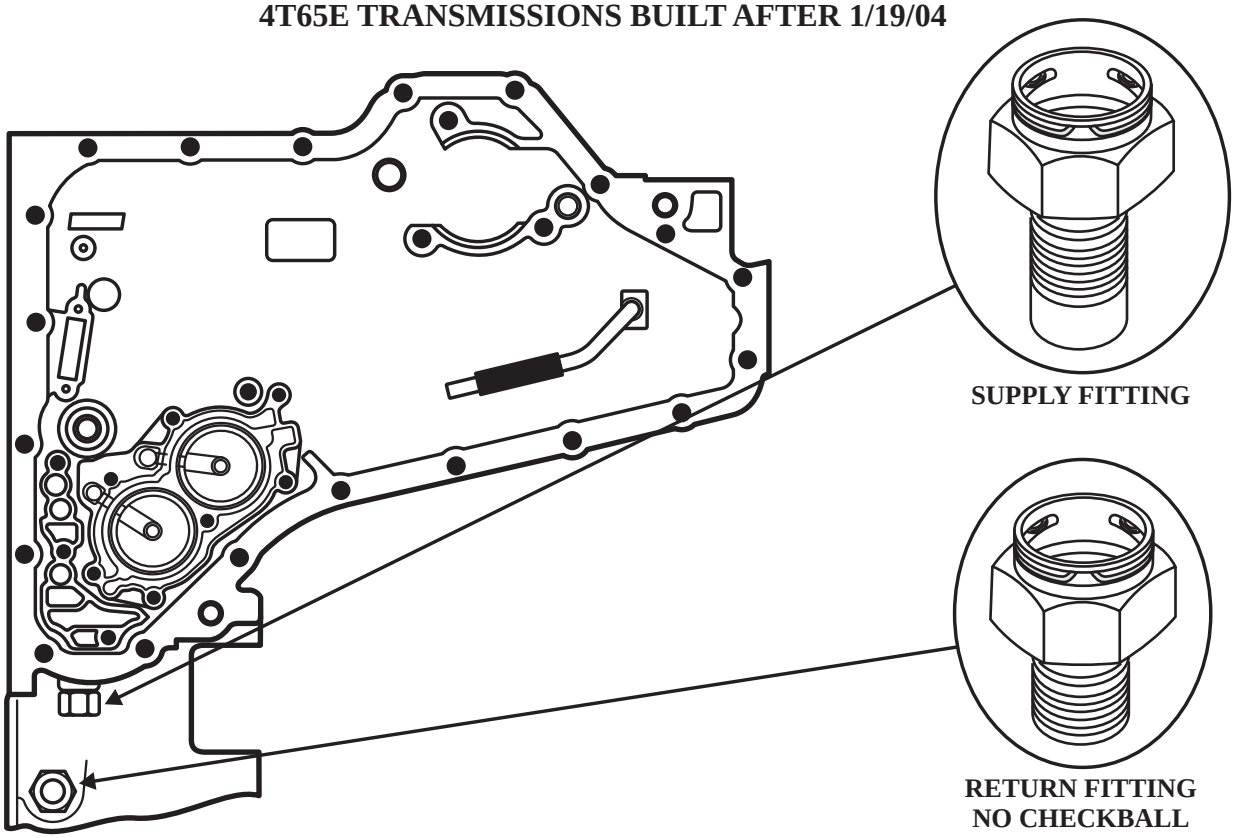


TCC BLOW-OFF CHECKBALL & SPRING

DRAINBACK/COOLER BLOW OFF CHECKBALL & SPRING

Figure 2

4T65E TRANSMISSIONS BUILT AFTER 1/19/04



4T65E TRANSMISSIONS BUILT BEFORE 1/19/04

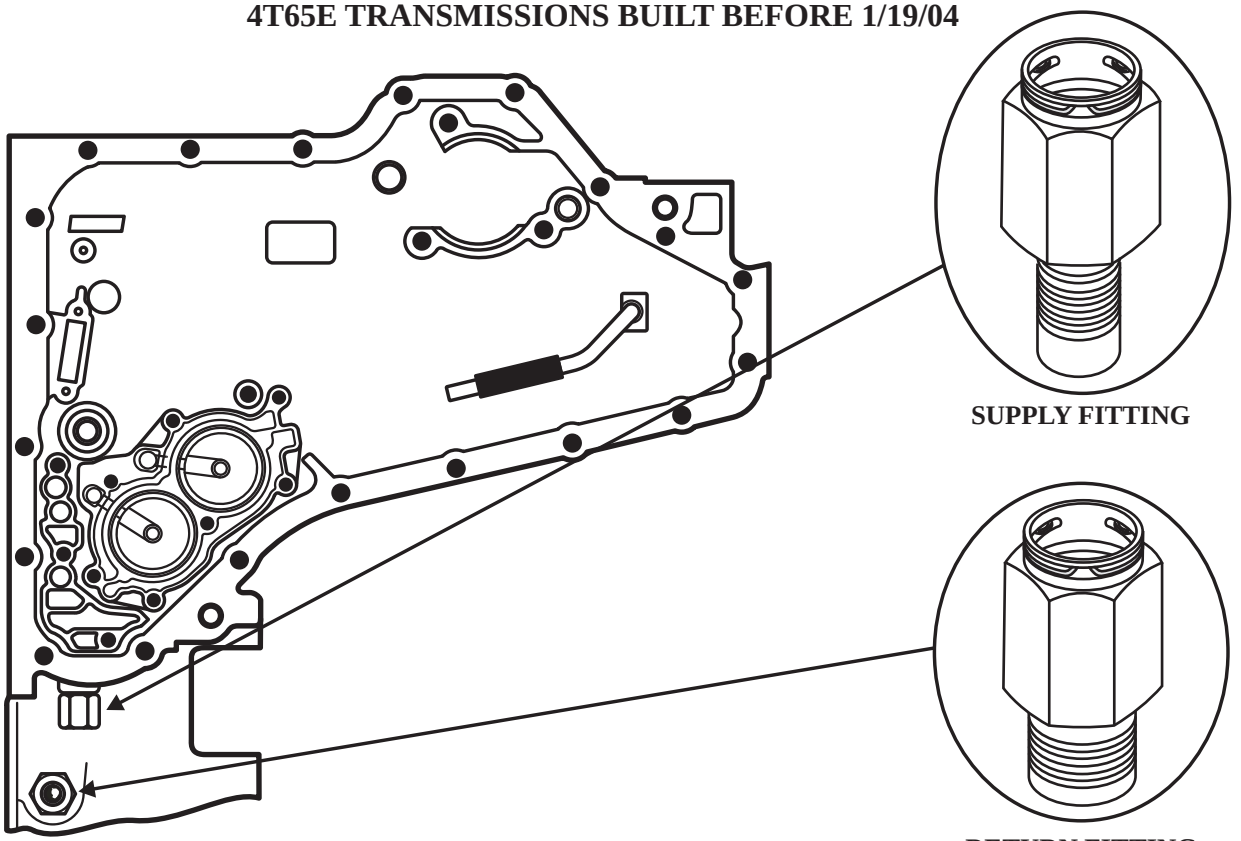


Figure 3

GM 4T65E

ELIMINATION OF THE FORWARD & REVERSE SERVO BOOST VALVES

CHANGE: At the start of production for the 2000 model year, the forward and reverse servo boost valves were eliminated from the valve body.

REASON: The purpose of the forward and reverse servo boost valves is to act as accumulators to cushion forward and reverse engagement. The valves are redundant and were therefore eliminated.

PARTS AFFECTED:

The elimination of the forward and reverse servo boost valves resulted in the valve bores being cast shut, as seen in Figure 1.
The previous design valve body with the valve bores can be seen in Figure 2 and the forward and reverse servo boost valves can be seen in Figure 3.

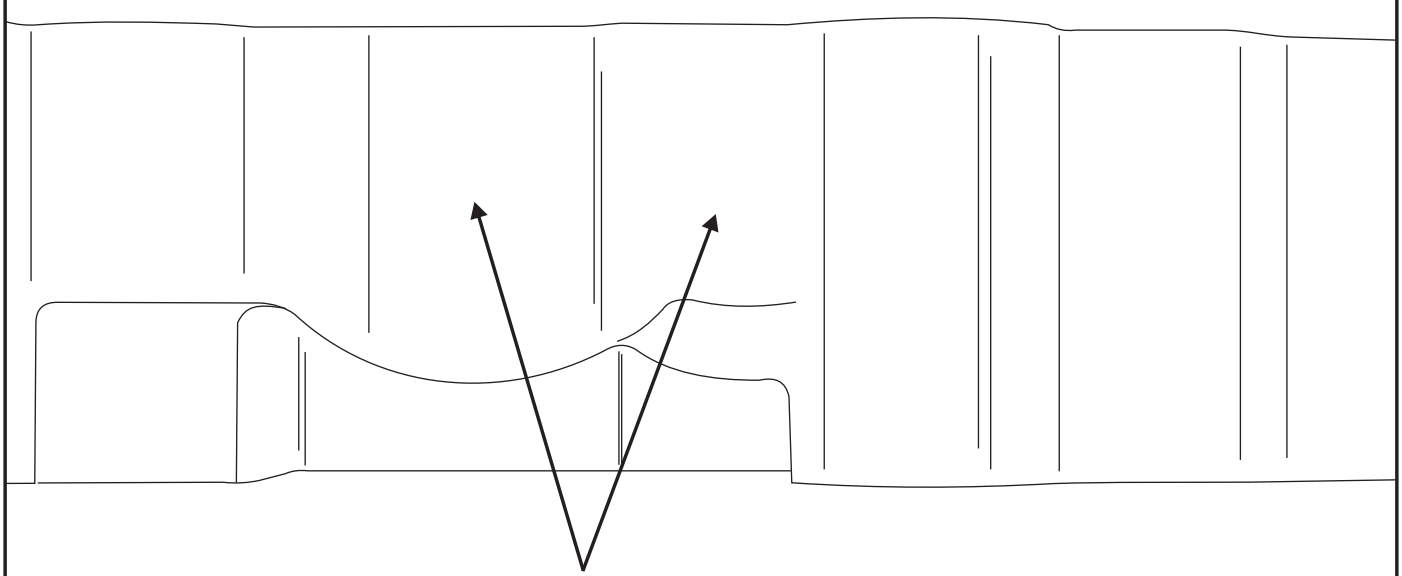
INTERCHANGEABILITY:

The valve body with or without the forward and reverse servo boost valves can be used in any transmission as long as the Fluid Pressure Switch Assembly and Pressure Control Solenoid match the vehicle application.

SERVICE INFORMATION:

Refer to ATSG bulletin 04-07 for information concerning the Pressure Control Solenoid and Fluid Pressure Switch usage mentioned under interchangeability above.

2000 & LATER VALVE BODY WITHOUT FORWARD & REVERSE SERVO BOOST VALVES



VALVE BORES CAST SHUT

Figure 1

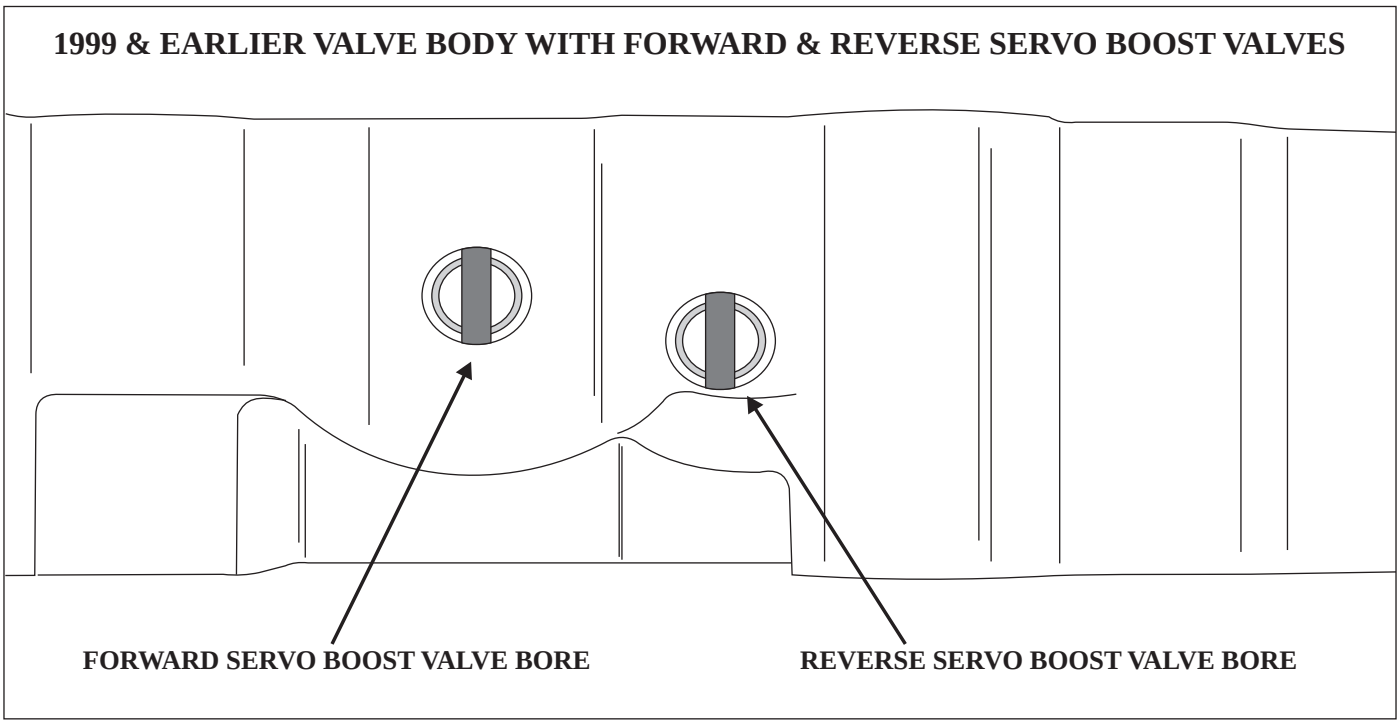


Figure 2

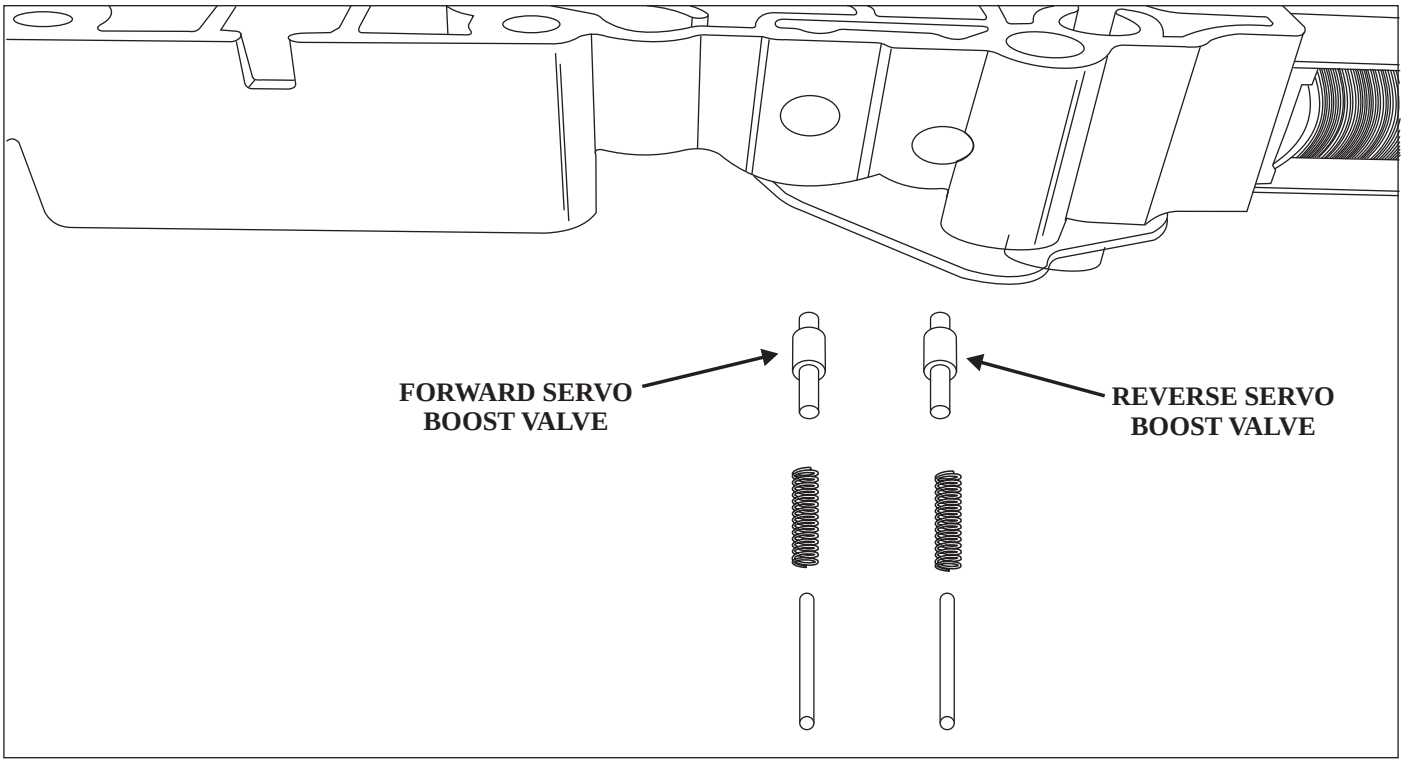


Figure 3

GM 4T40E

SLIPPING FORWARD AND/OR REVERSE

COMPLAINT: The transmission may exhibit one or more of the following complaints, a slipping or loss of forward and reverse movement, lube failure of the forward clutch support and a loss of engine braking in manual low. A code P0730 for an "Incorrect Gear Ratio" may be stored.

CAUSE: The oil feed tube assembly has developed cracks at the welds, located in the bottom pan area. Commonly, it is the forward clutch feed tube that cracks, (Refer to Figure 1).

NOTE #1: When the P0730 code is stored a default action to high line pressure will occur. If the technician checks line pressure, and high line is seen, the technician may assume that the above complaints cannot be related to the forward clutch since there is more than enough line pressure to apply the clutch. The technician, at this time, may disassemble the transmission looking for a failure of an input sprag or low roller clutch when it is the cracked oil feed tube assembly causing the complaint.

NOTE #2: The fluid going through the feed tube to the forward clutch must first pass through a .090" orifice in the spacer plate, (Refer to Figure 2). Line pressure feeding this orifice comes from the manual valve. The line pressure service port is located in the circuit before the manual valve. The feed pressure on the service port side of the orifice via the manual valve is not affected by the pressure drop on the feed tube side of the orifice.
This is why a line pressure check does not reveal the loss of forward clutch pressure due to the cracked feed tube.

CORRECTION: A simple air test can be performed to check the oil feed tubes for cracks. Remove the bottom pan and filter. With the gear shift lever in drive and/or reverse, blow air into the line pressure service port and watch for oil to leak at the feed tube welds where the tubes meet the flange, (Refer to Figure 3).

Many thanks to Louie Zabala at WiWi's Transmissions in Miami, FL. for the feed tube assembly.

SLIPPING FORWARD & REVERSE

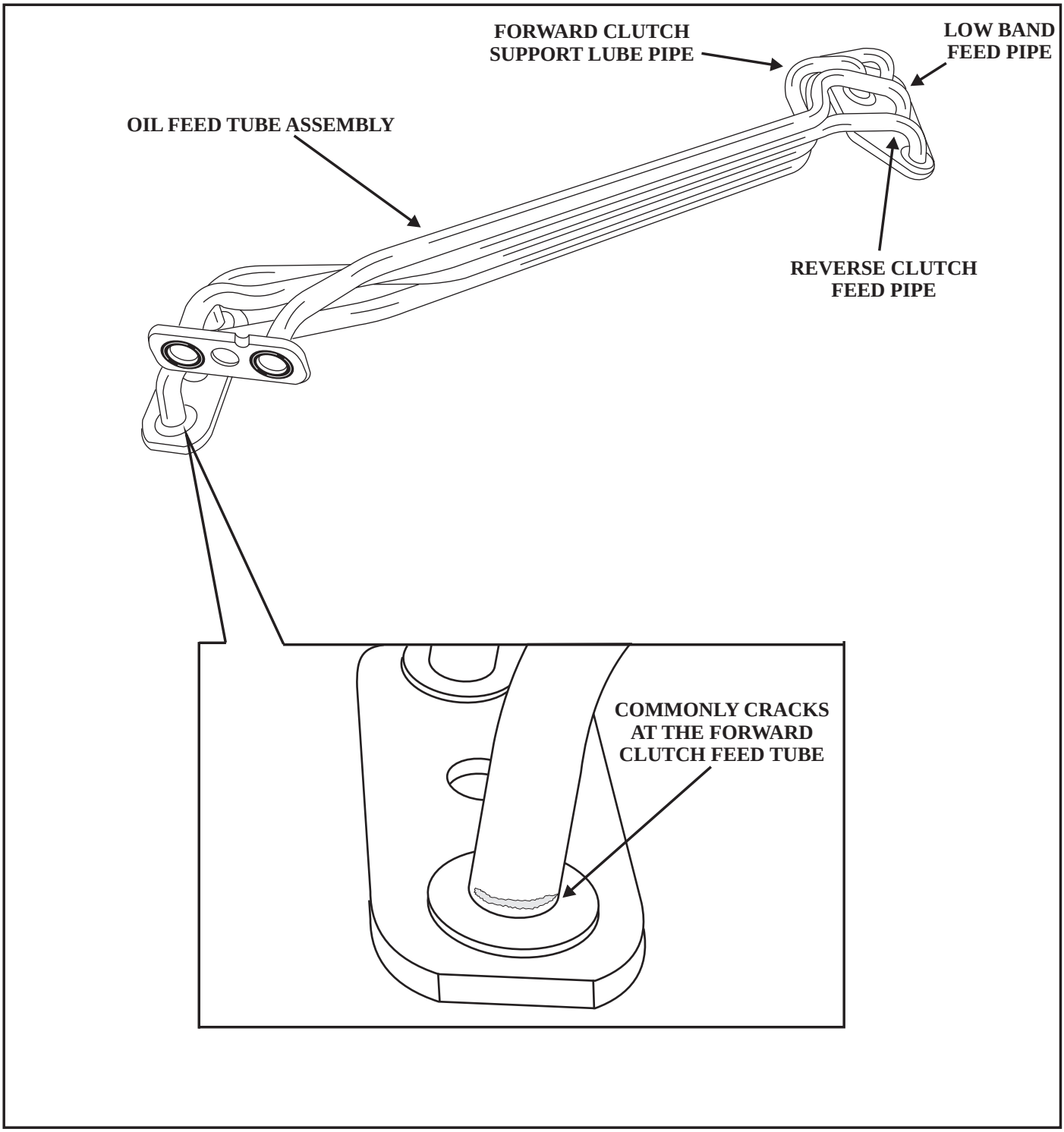


Figure 1

SLIPPING FORWARD & REVERSE

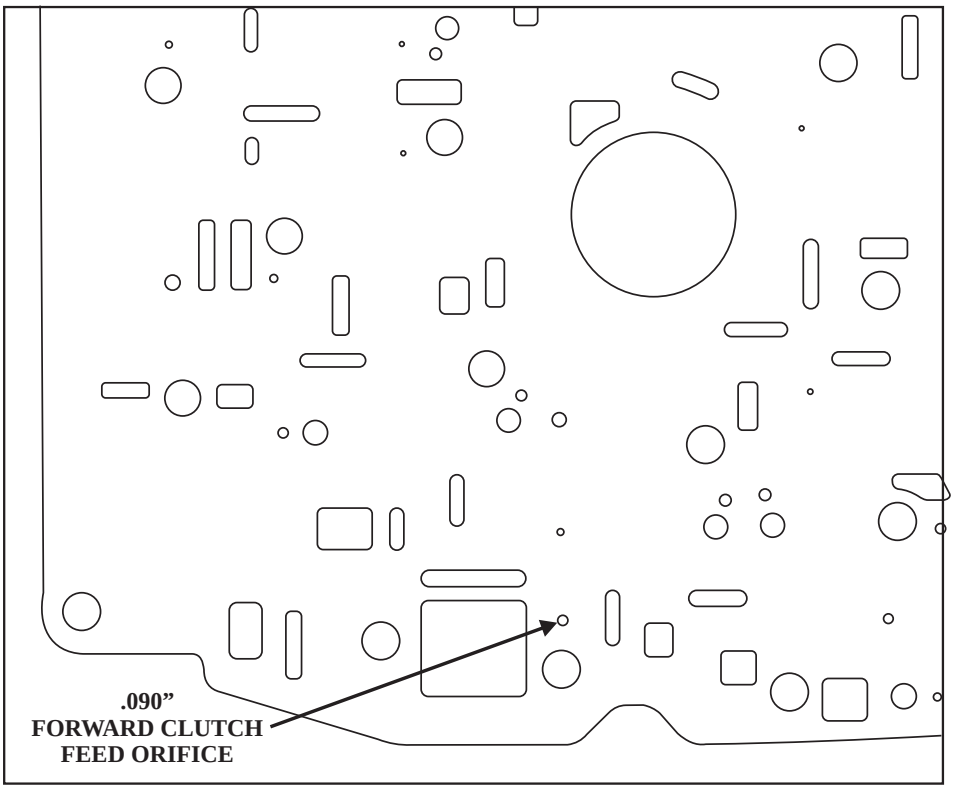


Figure 2

AIR CHECK THE FEED TUBES THROUGH THE LINE PRESSURE SERVICE PORT

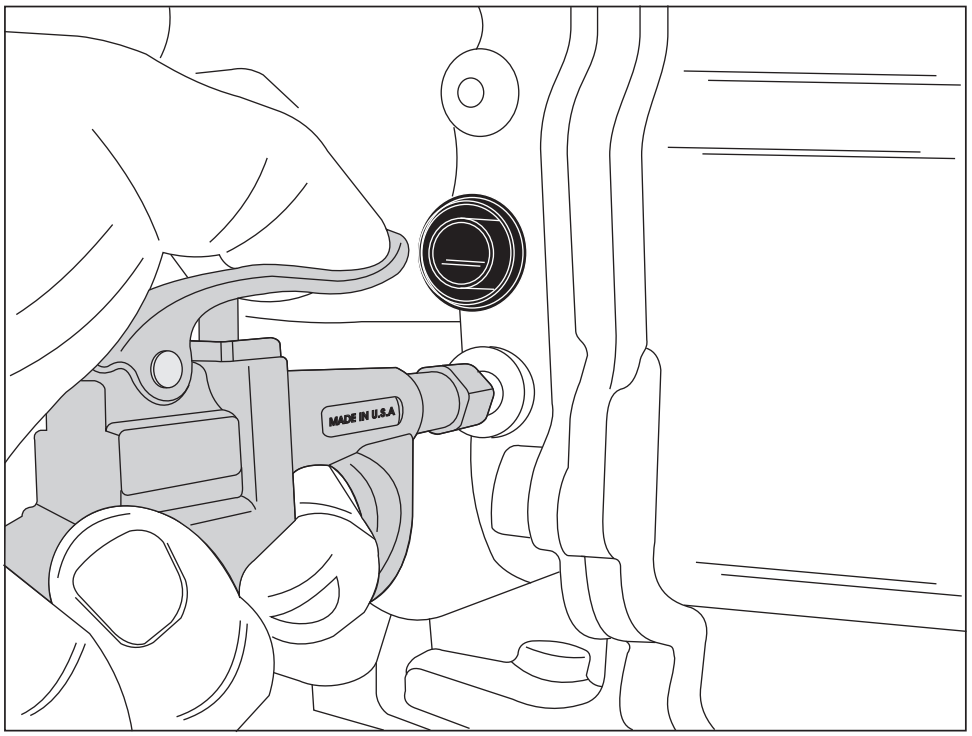


Figure 3

ROCKLAND

4T40E/4T45E

CODE P1810

COMPLAINT: After transmission exchange or valve body replacement, a code P1810 for the Transmission Fluid Pressure Switch Assembly (TFPSA) is stored immediately after engine start up.

CAUSE: A 2004 or later transmission or valve body was installed into a 2003 and earlier vehicle.

CORRECTION: The first design 4T40E transmission or valve body utilized a six (6) switch Transmission Fluid Pressure Switch assembly as seen in Figure 1. The valve body has six (6) feed passages to activate the various pressure switches in the switch assembly, also seen in Figure 1.
At the start of 2004 production a newly designed Transmission Fluid Pressure Switch Assembly was used which only has three (3) pressure switches as seen in Figure 2.
At the same time the pressure switch feed passages in the valve body that were no longer needed were cast shut also seen in Figure 2.

In addition, the pressure switch assembly connector cavity is the same for both the early and the late design which can be seen in Figures 1 and 2 when compared. This means the early and late assemblies will easily connect.

When a late transmission was installed into an earlier vehicle, upon ignition cycle, the TFPSA had an open circuit due to one less terminal and wire, thereby immediately storing the P1810 code.

SERVICE INFORMATION:

Transmission Fluid Pressure Switch Assembly (2003 & Earlier).....24226580
Transmission Internal Wire Harness (2003 & Earlier).....24230346
Transmission Fluid Pressure Switch Assembly (2004 & Later).....24217544
Transmission Internal Wire Harness (2004 & Later).....24229655

Special thanks to
Billy Johnson

2003 & EARLIER

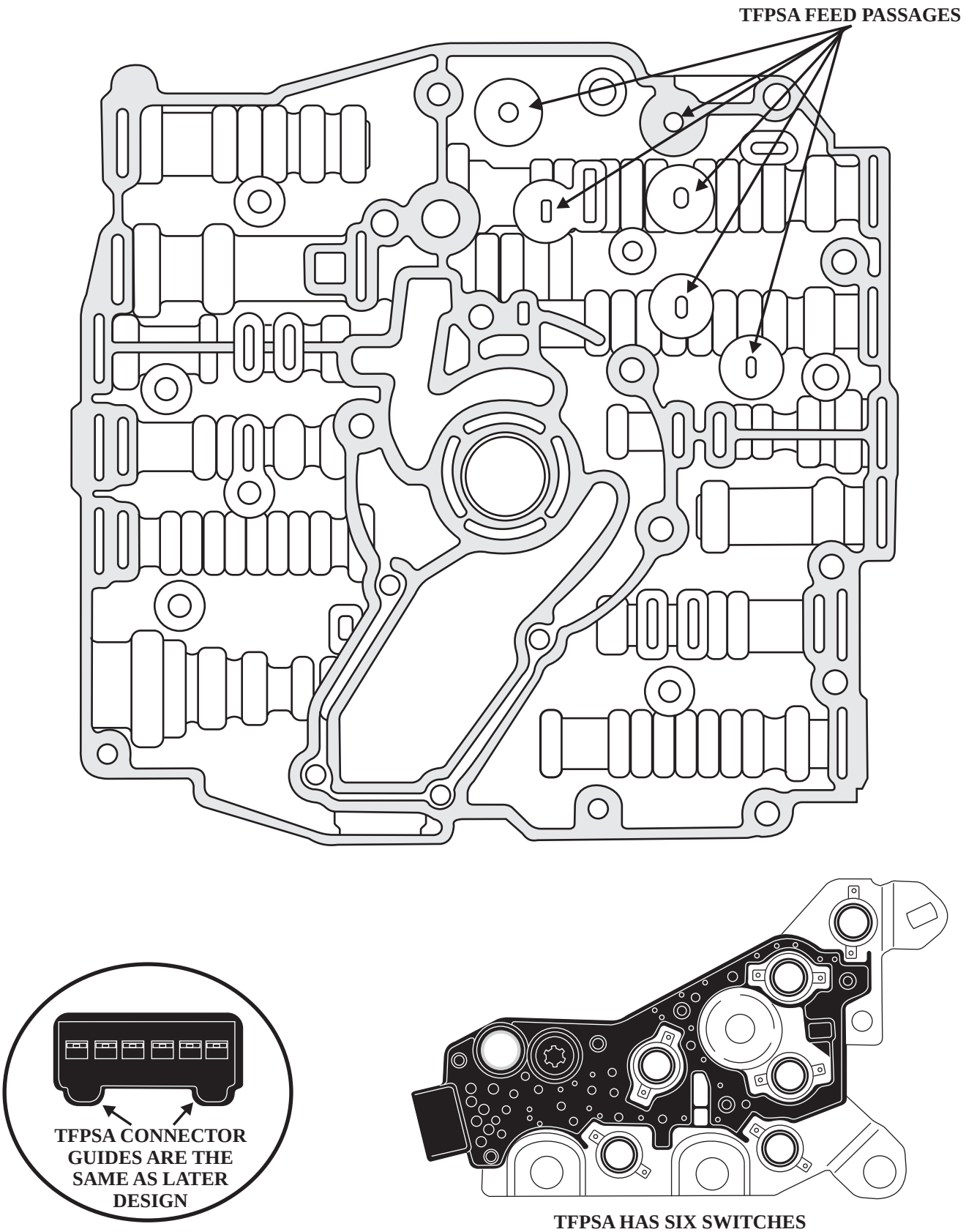


Figure 1

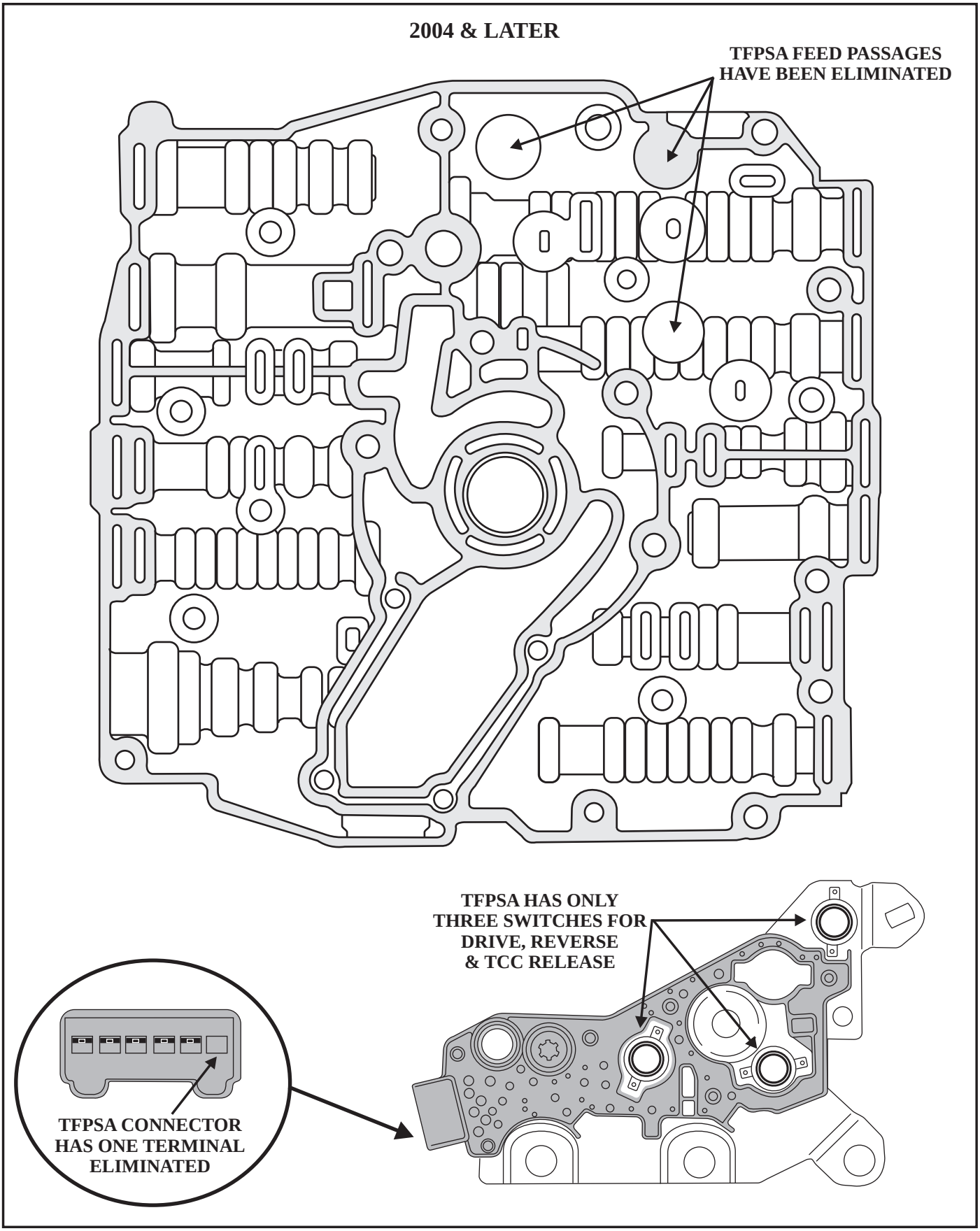


Figure 2

SATURN TAAT

INPUT SHAFT INTERCHANGE

CHANGE: At the start of production for the1997 model year the input shaft has been redesigned in the area of the o-ring groove at the torque converter end.

REASON: Elimination of the spiral ring.

PARTS AFFECTED: The input shaft has three (3) different configurations at the o-ring groove to converter area.

(1) The first design input shaft has an o-ring groove that is .189" in width and requires the spiral backup ring, (Refer to Figure 1)

(2) The second design input shaft has an o-ring groove that is .146" in width and has a machined surface that backs up the o-ring and eliminates the need for the spiral ring, (Refer to Figure 2).

(3) The third design input shaft has an o-ring groove that is .140" in width and does not need the spiral ring or the machined surface to back up the o-ring, (Refer to Figure 3).

INTERCHANGEABILITY:

Although all design levels of the o-ring area are interchangeable, attention must be given to the tooth count and width of the fourth drive gear which is part of the input shaft.

SERVICE INFORMATION:

Spiral Backup Ring.....21002144

FIRST DESIGN

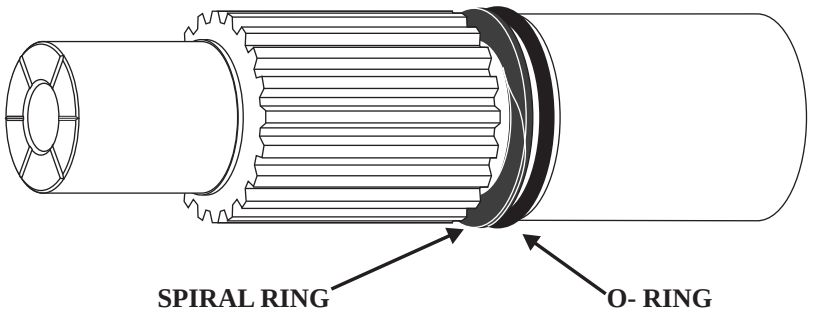


Figure 1

SECOND DESIGN

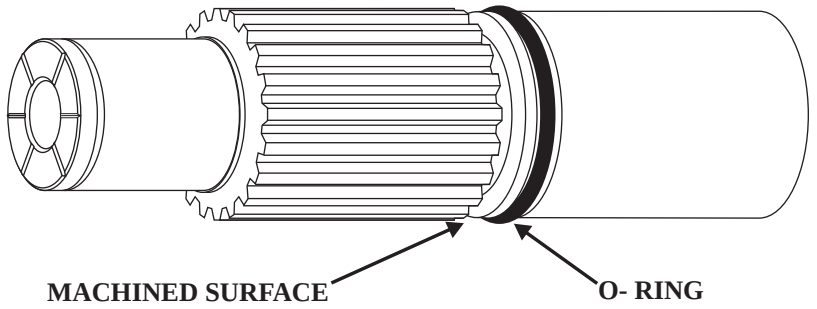


Figure 2

THIRD DESIGN

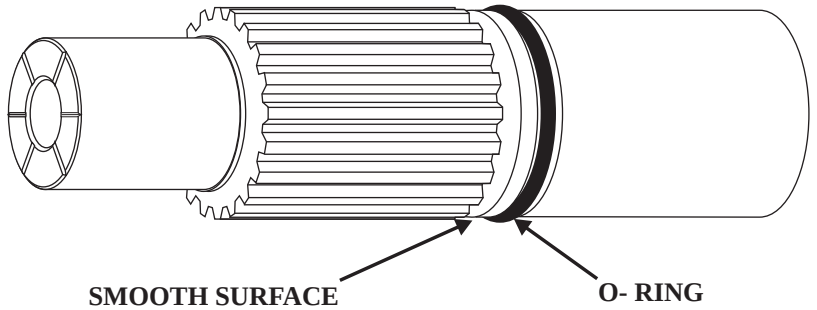


Figure 3

SATURN
NEW ACTUATORS FOR 2000

CHANGE: Beginning in the 2000 model year a 4th design Actuator was introduced to supercede all previous design Actuators. This change involves a complete redesign of the Actuator at the screened end.

REASON: Reduces the possibility for debris to stick a control actuator valve.

PARTS AFFECTED:

(1) ACTUATORS - 4th Design now has redesigned screens added to the control pressure side of the actuators as illustrated in Figure 1, and have the same resistance values as the 2nd and 3rd Design actuators, and are identified ***without*** the previous design plastic top or is called the Black Top Actuator. The 1st and 2nd Design actuators are shown in Figure 2. The 3rd and 4th Design actuators are shown in Figure 3. Actuator locations on the valve body are shown in Figure 4.

INTERCHANGEABILITY:

The 4th Design Actuator is the ***only*** Actuator that is available and will retrofit to previous models.

SERVICE INFORMATION:

4TH DESIGN ACTUATOR.....21003344

4th DESIGN ACTUATOR

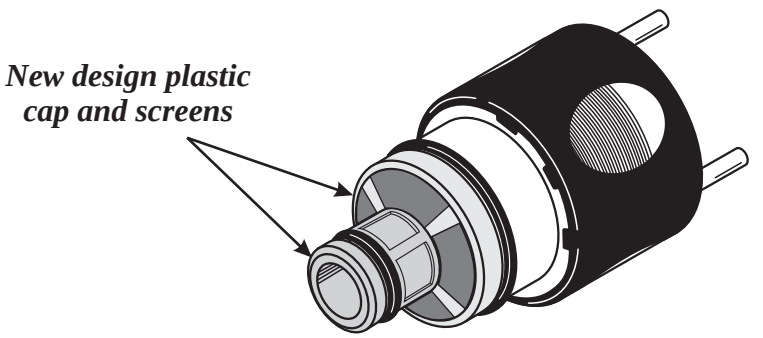
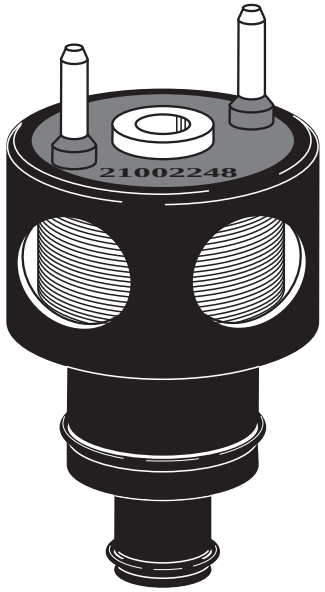


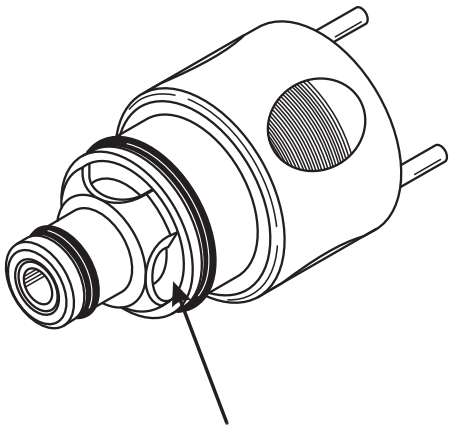
Figure 1

1ST DESIGN CONTROL ACTUATOR SOLENOIDS
1991-1992
No longer available

Black or Blue Plastic Tops For Identification



Measures 2.5 to 4.5 Ohms Resistance

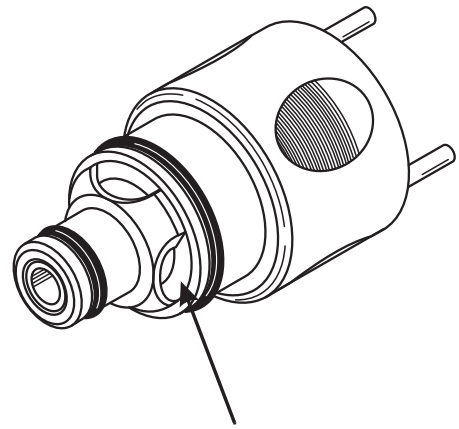


"No Screens" Part Number 21002248

2ND DESIGN CONTROL ACTUATOR SOLENOIDS
1993-1996
No longer available

Red Plastic Tops For Identification

Measures 4.0 to 6.0 Ohms Resistance



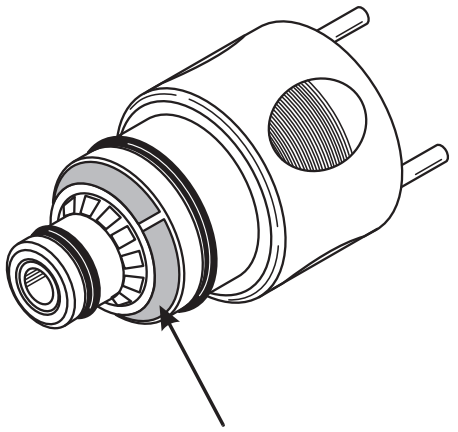
"No Screens" Part Number 21002509

Figure 2

3RD DESIGN CONTROL ACTUATOR SOLENOIDS
1997-1999
No longer available

White Plastic Tops For Identification

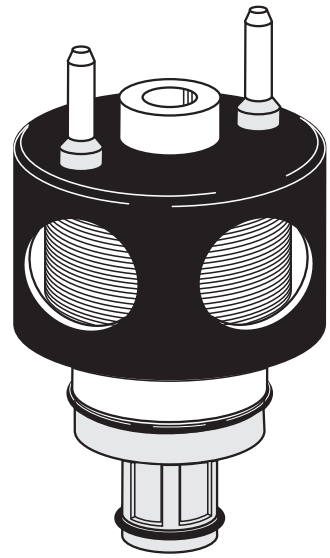
Measures 4.0 to 6.0 Ohms Resistance



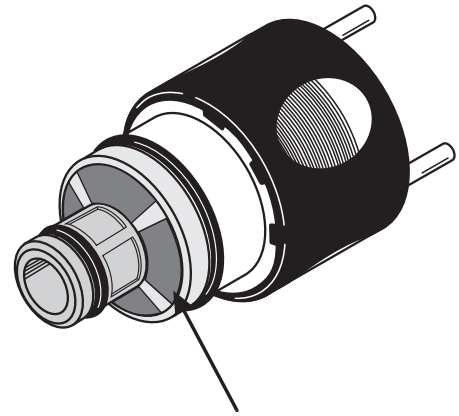
"Screens Added" Part Number 21003289

4th DESIGN CONTROL ACTUATOR SOLENOIDS
ALL MODELS

No Color or Black Top



Measures 4.0 to 6.0 Ohms Resistance



Plastic cap Part Number 21003344

Figure 3

SATURN VALVE BODY ACTUATOR LOCATIONS

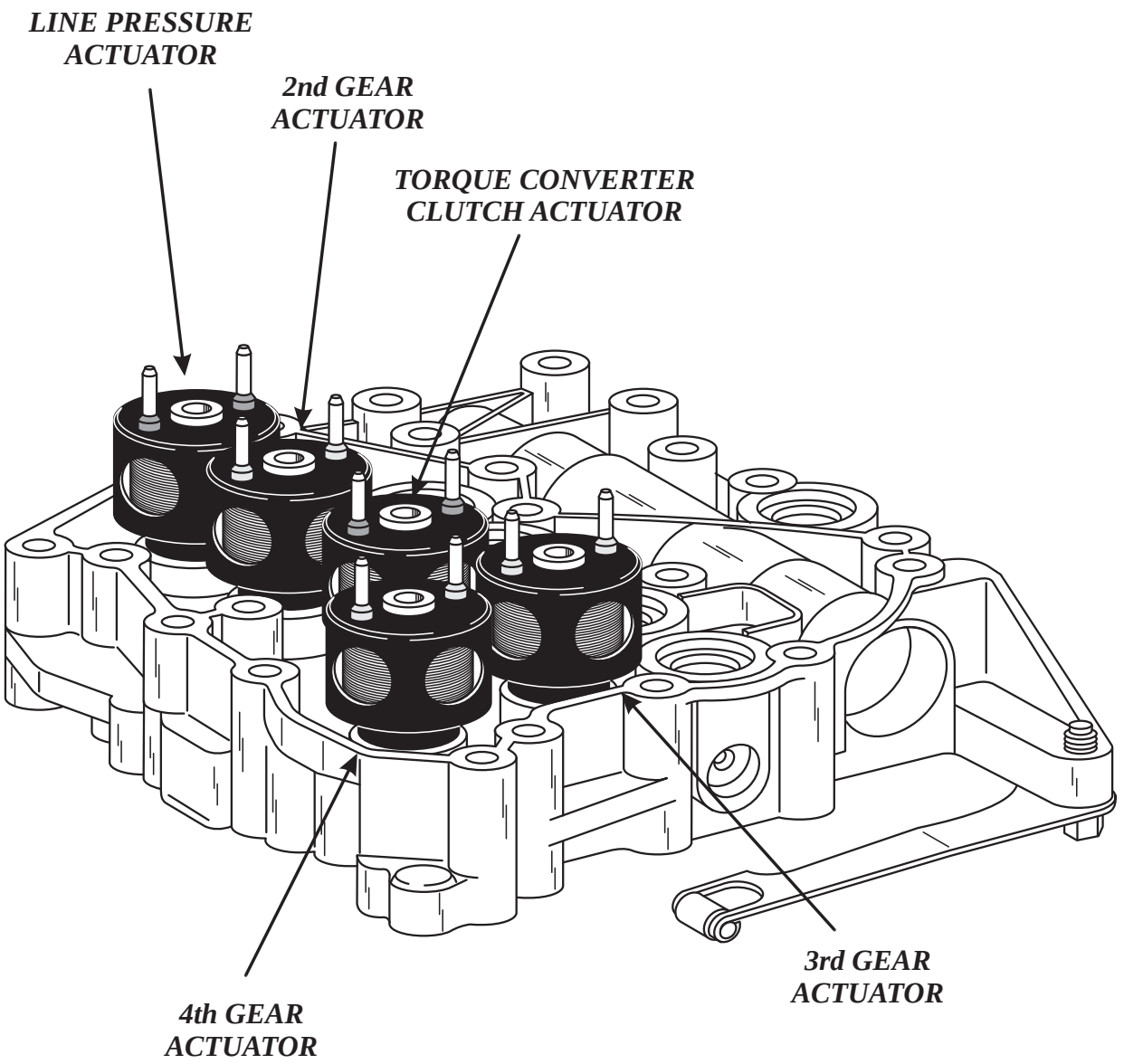


Figure 4

SATURN TAAT
HARSH SHIFTS P0746 AND OR P0789

COMPLAINT: 1996 and up Saturn vehicles equipped with the TAAT transaxle may exhibit Harsh Upshifts and or downshifts, and may have a Diagnostic Trouble Code P0746 Line Pressure Solenoid circuit open / grounded or a P0789 Solenoid Intermittent Circuit fault.

CAUSE: The cause may be, a faulty Line Pressure Solenoid, poor connection at the main harness connector, poor contacts on the "Bus Plate," or a wiring problem leading to the PCM.

CORRECTION: To correct this condition, Refer to the steps below:

Step 1: Remove the external harness connector and ohm test the Line Pressure Solenoid across pins G and F of the Bus Plate, as shown in Figure 1. If the ohm value is not within 4-6 ohms, replace the Line Pressure Solenoid in the location shown in Figure 2 and inspect the Bus Plate for burnt terminals as shown in Figure 1. If the Solenoid Ohm tests well, go to Step 2.

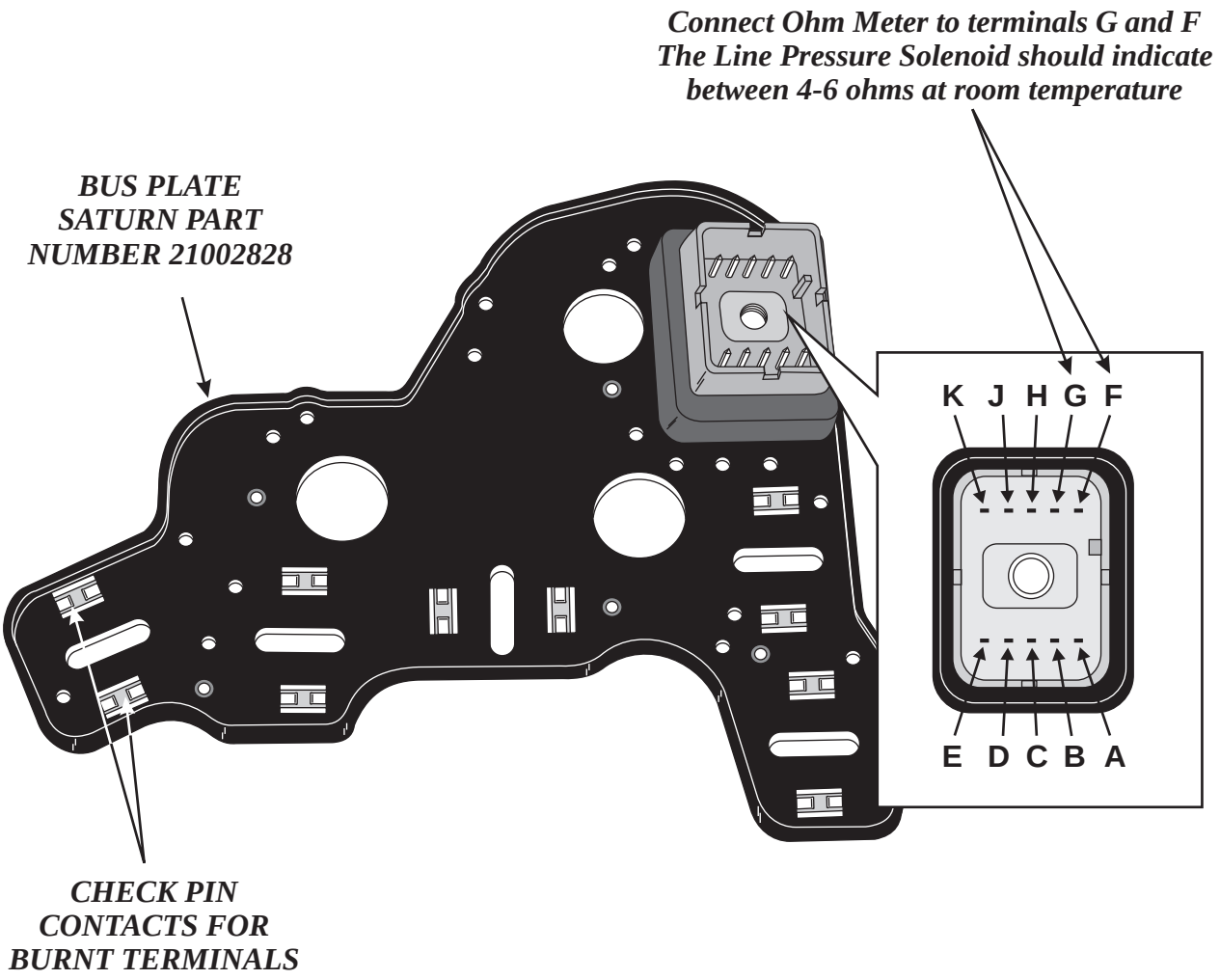
Step 2: Inspect the terminals inside of the Harness Connector for a loose connection or burnt terminals at G and F as shown in Figure 3. If the terminals are faulty, replace the harness connector with the repair harness. If the harness connector is good, go to Step 3.

Step 3: Verify the integrity of the Positive and Ground side of the Line Pressure circuit from the Underhood Fuse Block to the Powertrain Control Module as shown in Figure 4. Repair harness as necessary. ***Note: the Schematic shown is for a 2000 model, terminal locations at the PCM will vary by year model.***

SERVICE INFORMATION:

4TH DESIGN SOLENOID.....21003344
BUS PLATE.....21002828
HARNESS CONNECTOR REPAIR KIT.....21024415

LINE PRESSURE SOLENOID OHM TEST AND BUS PLATE CONNECTOR TERMINAL I.D.



Solenoid	*Positive Terminal*	*Ground Terminal*
LINE PRESSURE	G	F
SOLENOID 4	C	D
SOLENOID 3	A	B
TCC SOLENOID	E	K
SOLENOID 2	J	H

Note: All Solenoids should indicate 4-6 ohms

Figure 1

SATURN VALVE BODY SOLENOID LOCATIONS

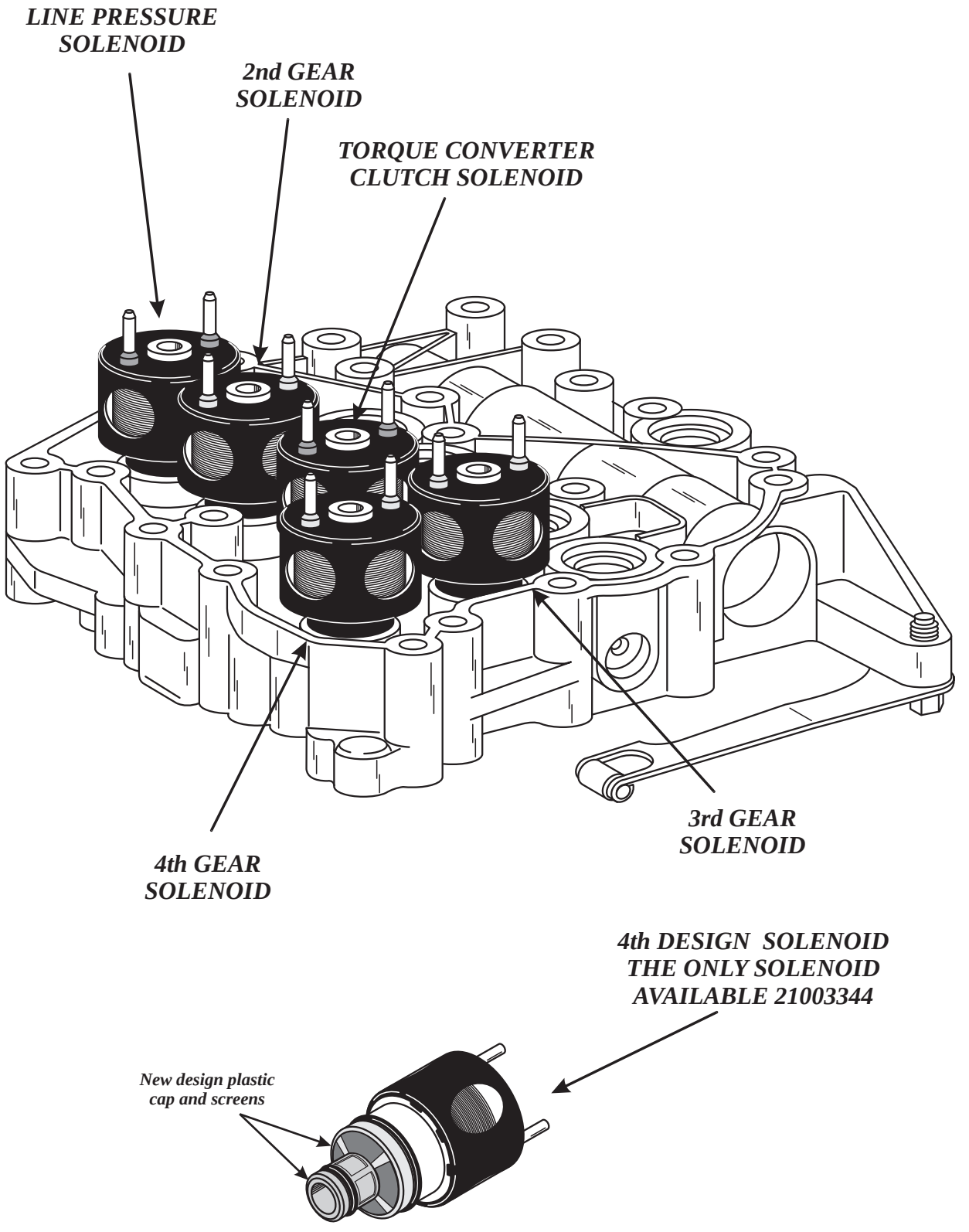
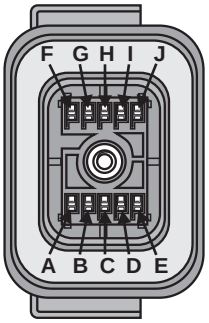


Figure 2

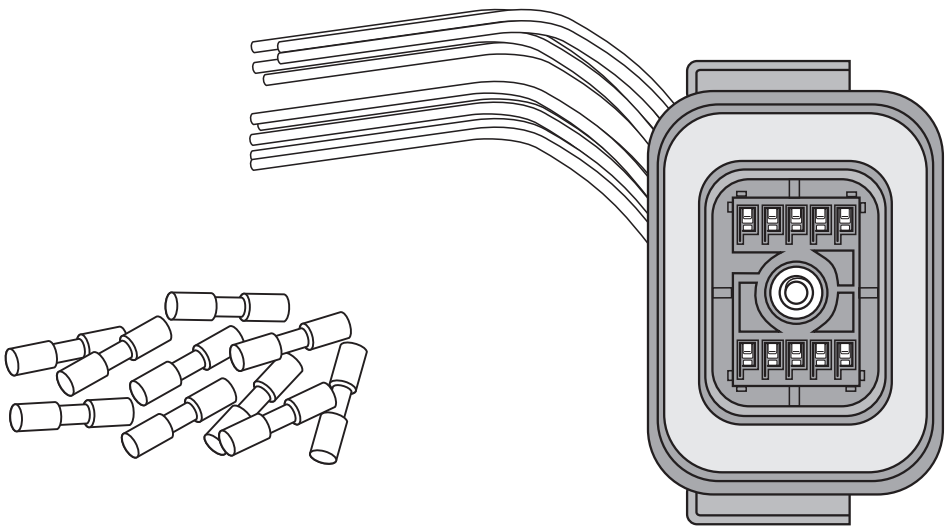
HARNESS CONNECTOR TERMINAL I.D.

Check for burnt or loose terminals



Solenoid	*Positive Terminal*	*Ground Terminal*
LINE PRESSURE	**G**	**F**
SOLENOID 4	**C**	**D**
SOLENOID 3	**A**	**B**
TCC SOLENOID	**E**	**K**
SOLENOID 2	**J**	**H**

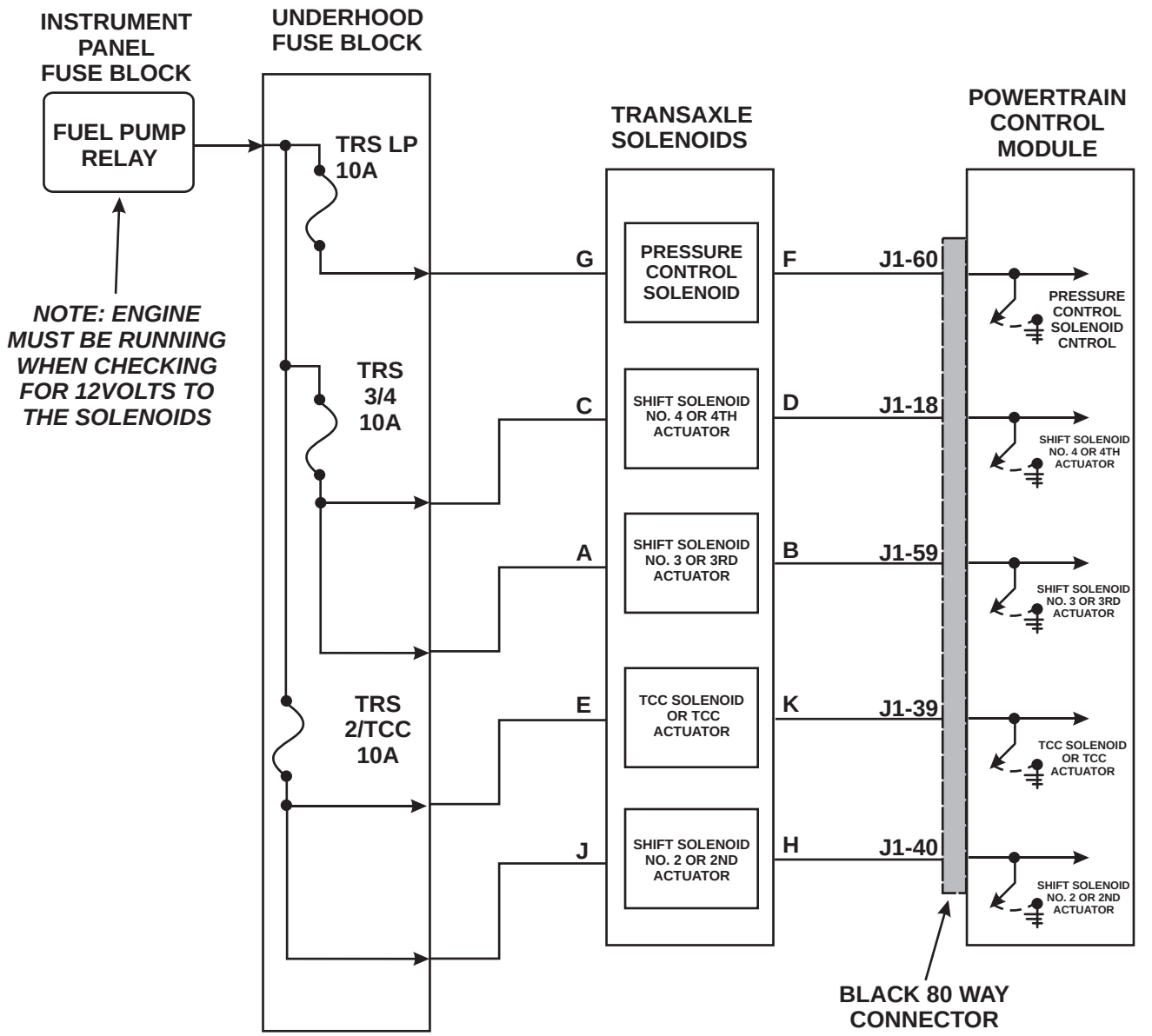
HARNESS REPAIR KIT
21024415



Note: All of the wires are White and there are no instructions identifying wire colors leading to the PCM

Figure 3

PARTIAL WIRE SCHEMATIC



NOTE: 2000 model schematic shown. Pcm Pin and connector terminals will vary by year. Prior to 1994 Each Solenoid had it's own Fuse.

Figure 4

GM/BMW 5L40E

TRANSMISSION PARTS DIFFERENCES

COMPLAINT: When the technician is rebuilding a 5L40E transmission from a Cadillac or BMW, some hard parts which may be acquired as "good used" may not fit the particular application being rebuilt.

CAUSE: Although the 5L40E may look the same for both the Cadillac and the BMW models, there are some very distinct dimensional differences in various parts that make interchangeability impossible.

CORRECTION: Figure 1 illustrates the Cadillac bell housing which also incorporates the pump body.
Figure 2 illustrates the BMW bell housing which also incorporates the pump body.
Figure 3 Illustrates the different stator shaft lengths between the Cadillac and BMW models.
Figure 4 illustrates the different input shaft lengths between the Cadillac and BMW models which is an integral part of the forward drum.
Figure 5 Illustrates the BMW pump cover.
Figure 6 illustrates the BMW or Cadillac pump cover.
Figure 7 illustrates the difference in the Line Boost Valve between Cadillac and BMW models which is the outer most valve assembly in the pressure regulator valve line-up located in the pump cover.

Many thanks to Paul from Hardparts For Transmissions for his help in providing this information.

TRANSMISSION PARTS DIFFERENCES

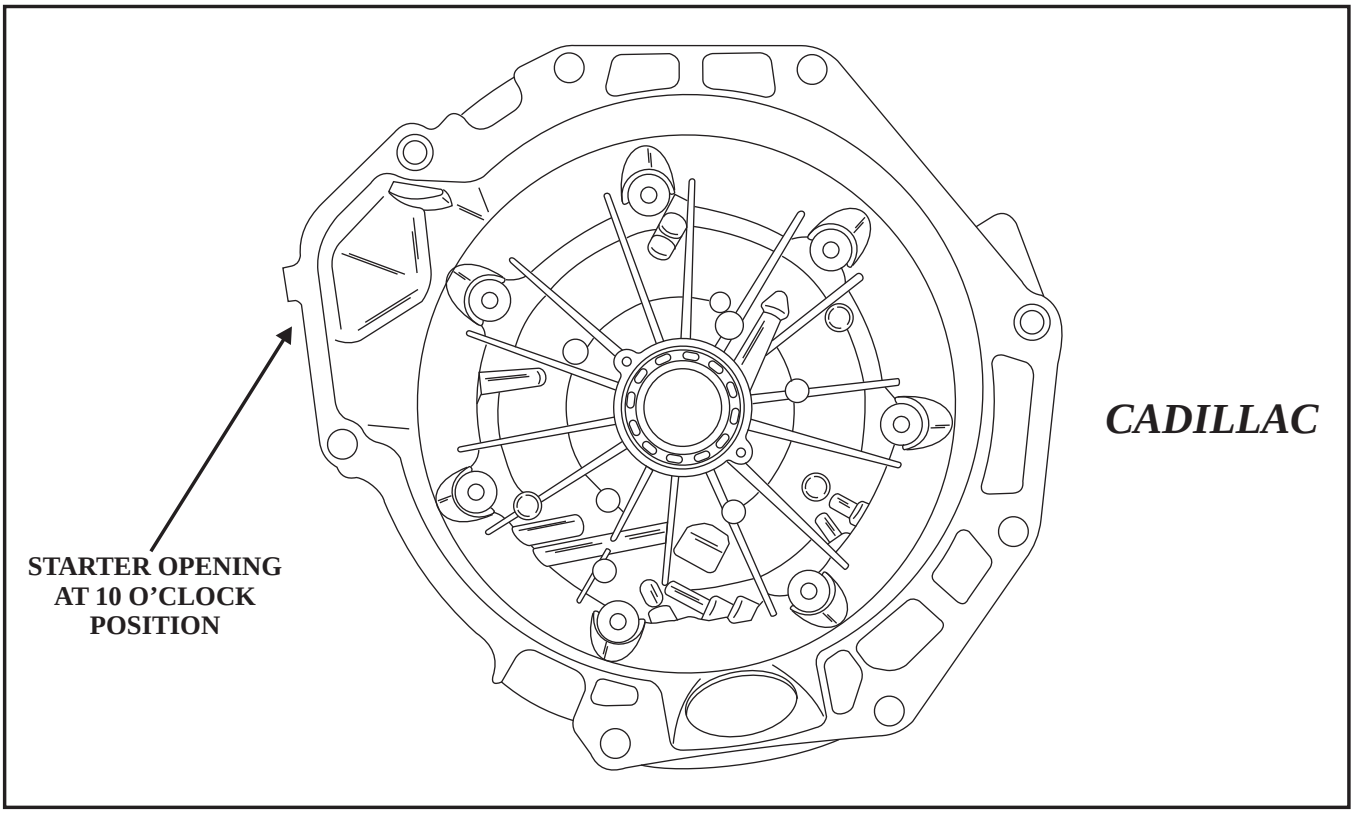


Figure 1

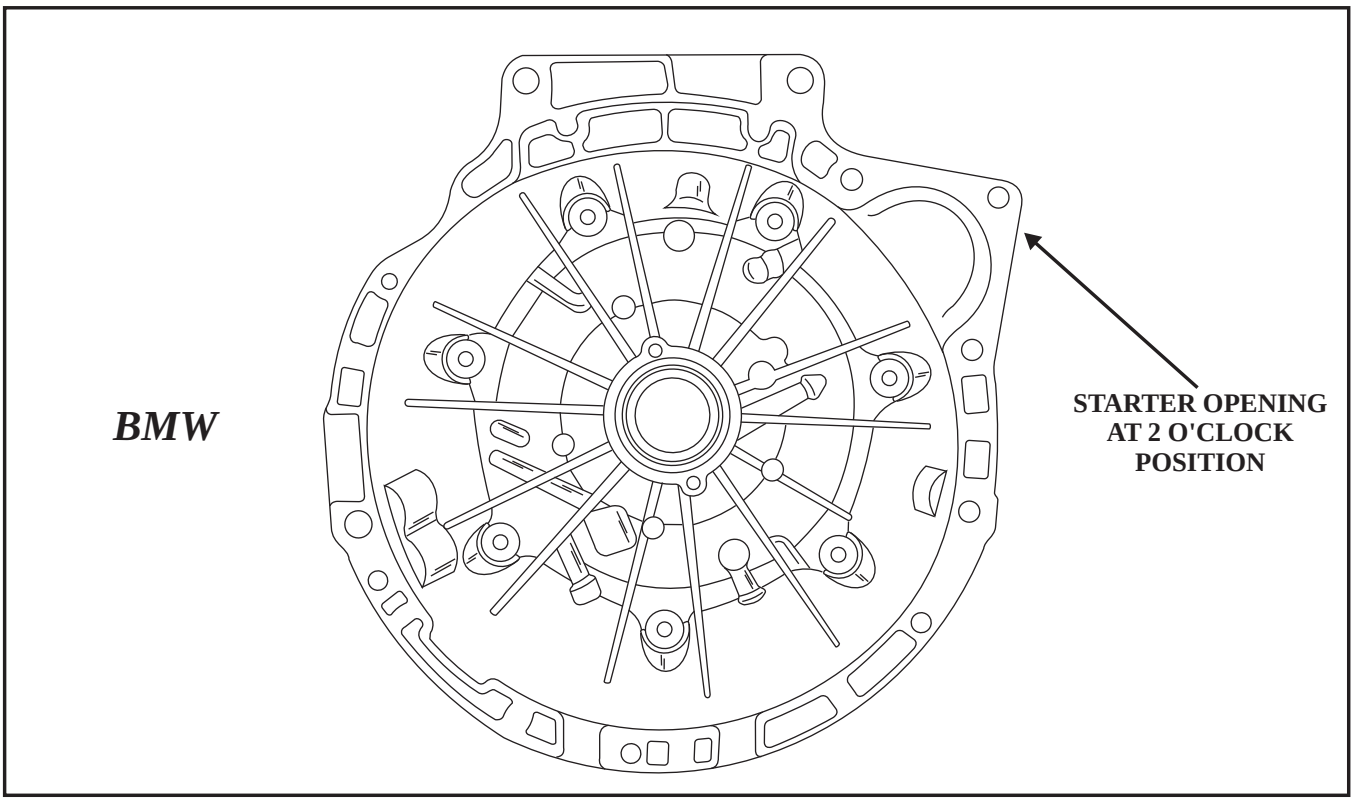


Figure 2

TRANSMISSION PARTS DIFFERENCES

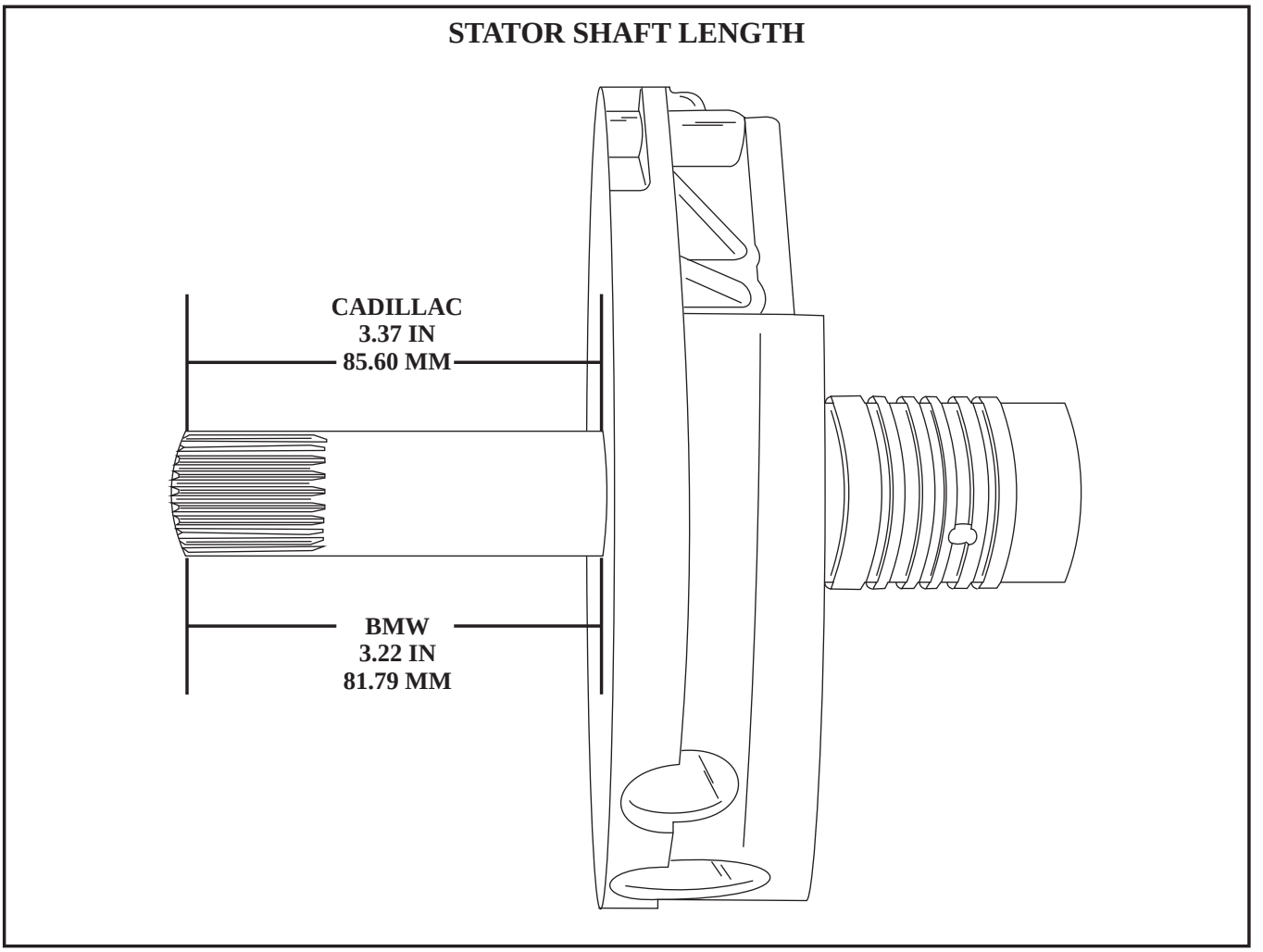


Figure 3

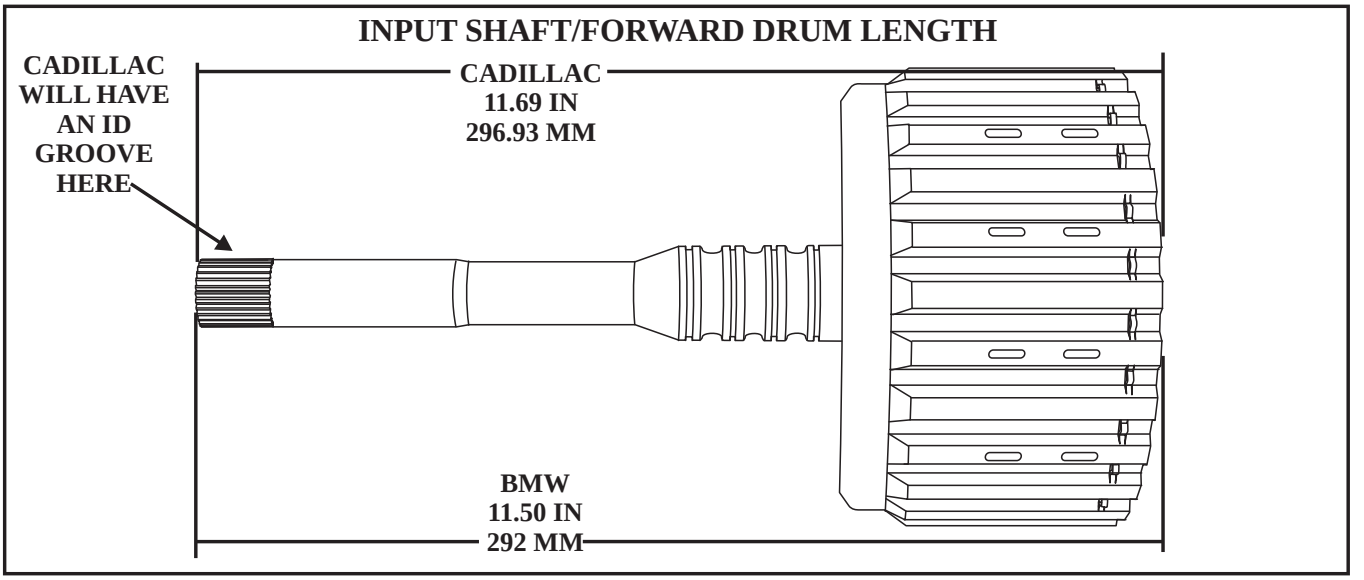


Figure 4

TRANSMISSION PARTS DIFFERENCES

BMW PUMP COVER

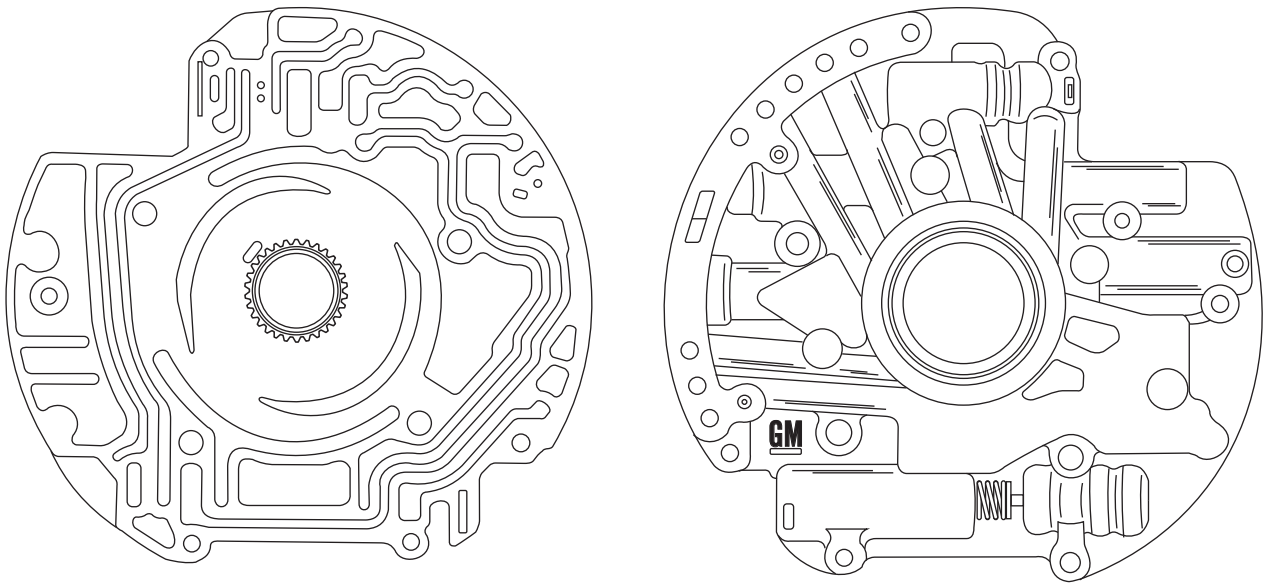


Figure 5

BMW OR CADILLAC PUMP COVER

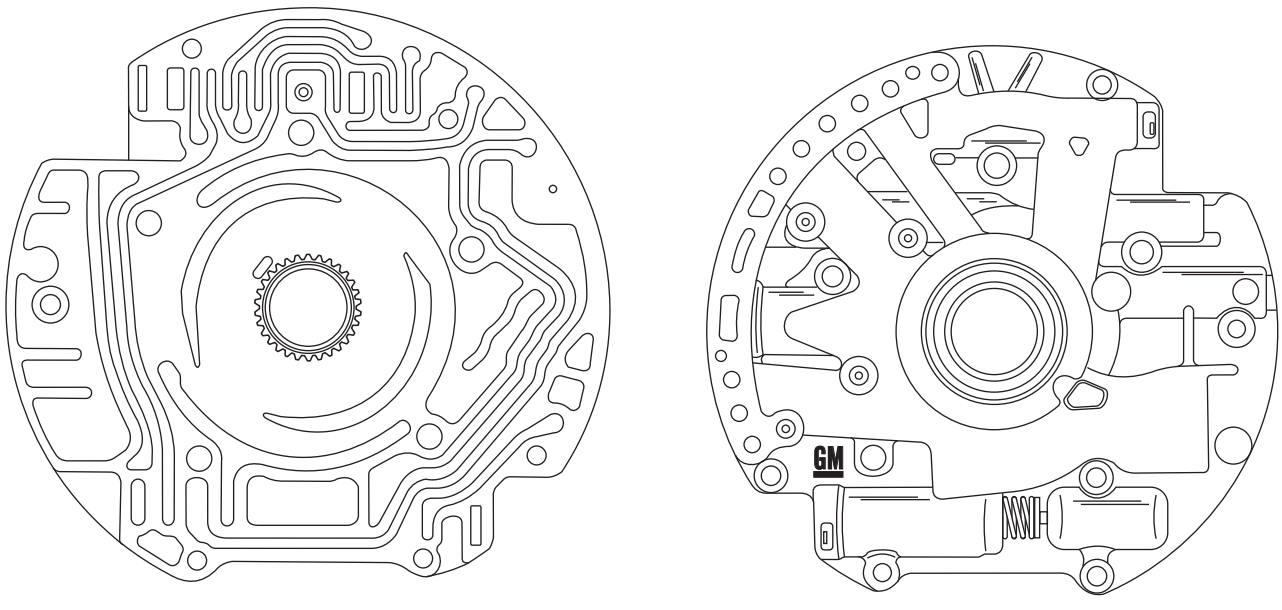
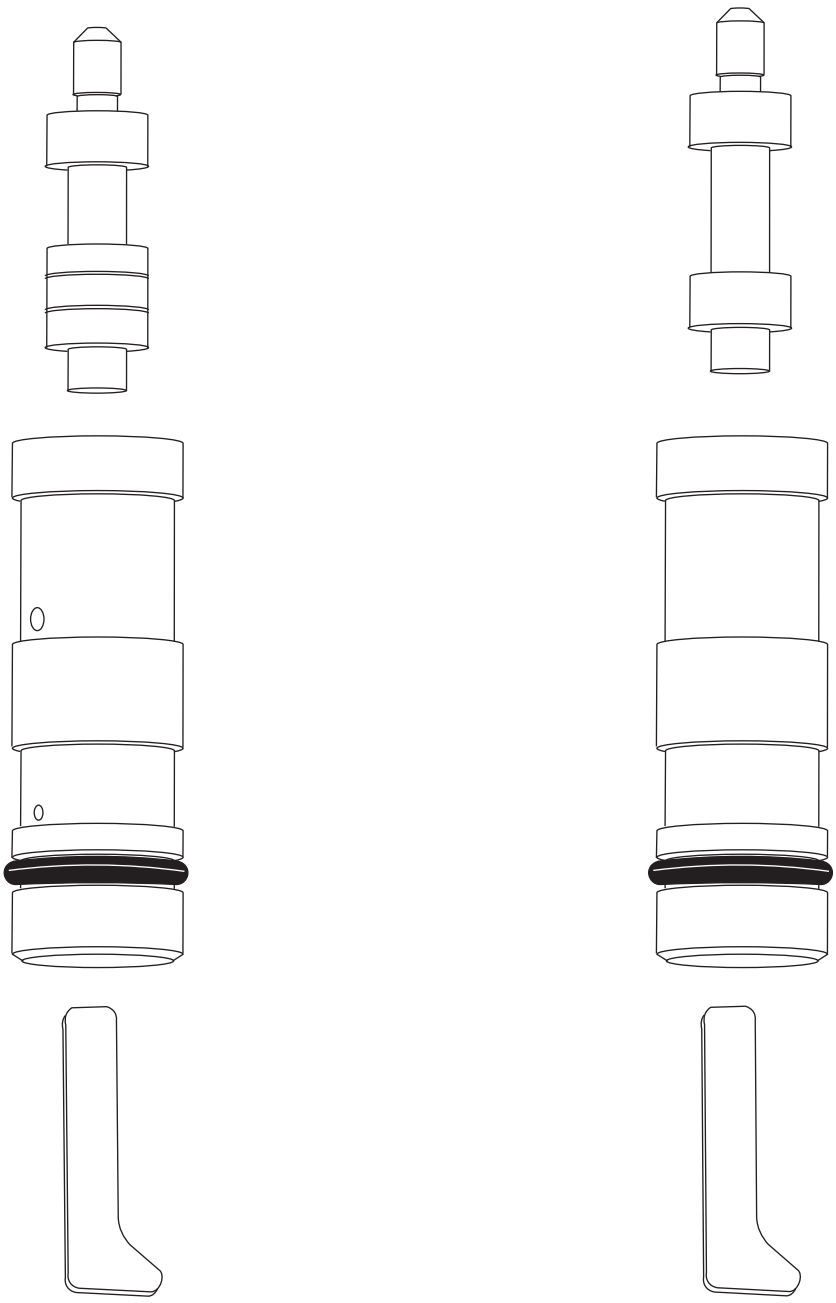


Figure 6

TRANSMISSION PARTS DIFFERENCES

LINE BOOST VALVE



CADILLAC

BMW

SONNAX PART NUMBER
55209-01K

Figure 7

GENERAL MOTORS 4L80E

SLIPPING OR NO THIRD, REVERSE OR FOURTH GEAR

COMPLAINT #1: Either before or after overhaul, the transmission has no reverse or slips in reverse and has no engine braking in Manual Low.

COMPLAINT #2: Either before or after overhaul the transmission may fall out of 4th gear into 3rd or shift from third to neutral. The technician may feel the transmission drop into gear while slowing down, much like the feeling a stuck governor would create in a hydraulically shifted transmission. A component slip code 68 or P1870 may be stored.

CAUSE #1: The number 7 checkball capsule (bore plug) located in the valve body (Refer to Figure 1) is often overlooked and might be full of trash causing the ball not to seat, or the roll pin that retains it is mis-positioned by installing it through the hole in the bore plug instead of on the outside of the capsule, (Refer to Figures 2 and 3).
The number 7, LOW/REVERSE checkball allows either Low fluid, in manual low, or reverse fluid, in reverse, to enter the rear band apply circuit while blocking the other circuit, (Refer to Figure 4).

CAUSE #2: The number11 checkball capsule (bore plug) located in the valve body (Refer to Figure 1) is often overlooked and might be full of trash causing the ball not to seat. The o-ring on the capsule may be damaged or leaking (Refer to Figure 1) or the roll pin that retains it is mis-positioned by installing it through the hole in the bore plug instead of on the outside of the capsule, (Refer to Figures 2 and 3).
The number 11, 3RD/REVERSE checkball allows either third clutch fluid, in third gear, or reverse fluid, in reverse, to enter the 3rd/reverse circuit while blocking the other, (Refer to Figure 5).

CORRECTION #1:
Make certain the number 7 checkball capsule is free of trash, and that the roll pin that retains it is correctly positioned, (Refer to Figures 2 and 3).

CORRECTION #2:
Make certain the number 11 checkball capsule is free of trash, the o-ring on the checkball bushing (Refer to Figure 1) is in good condition and that the roll pin that retains it is correctly positioned, (Refer to Figures 2 and 3).

SLIPPING OR NO THIRD, REVERSE OR FOURTH GEAR

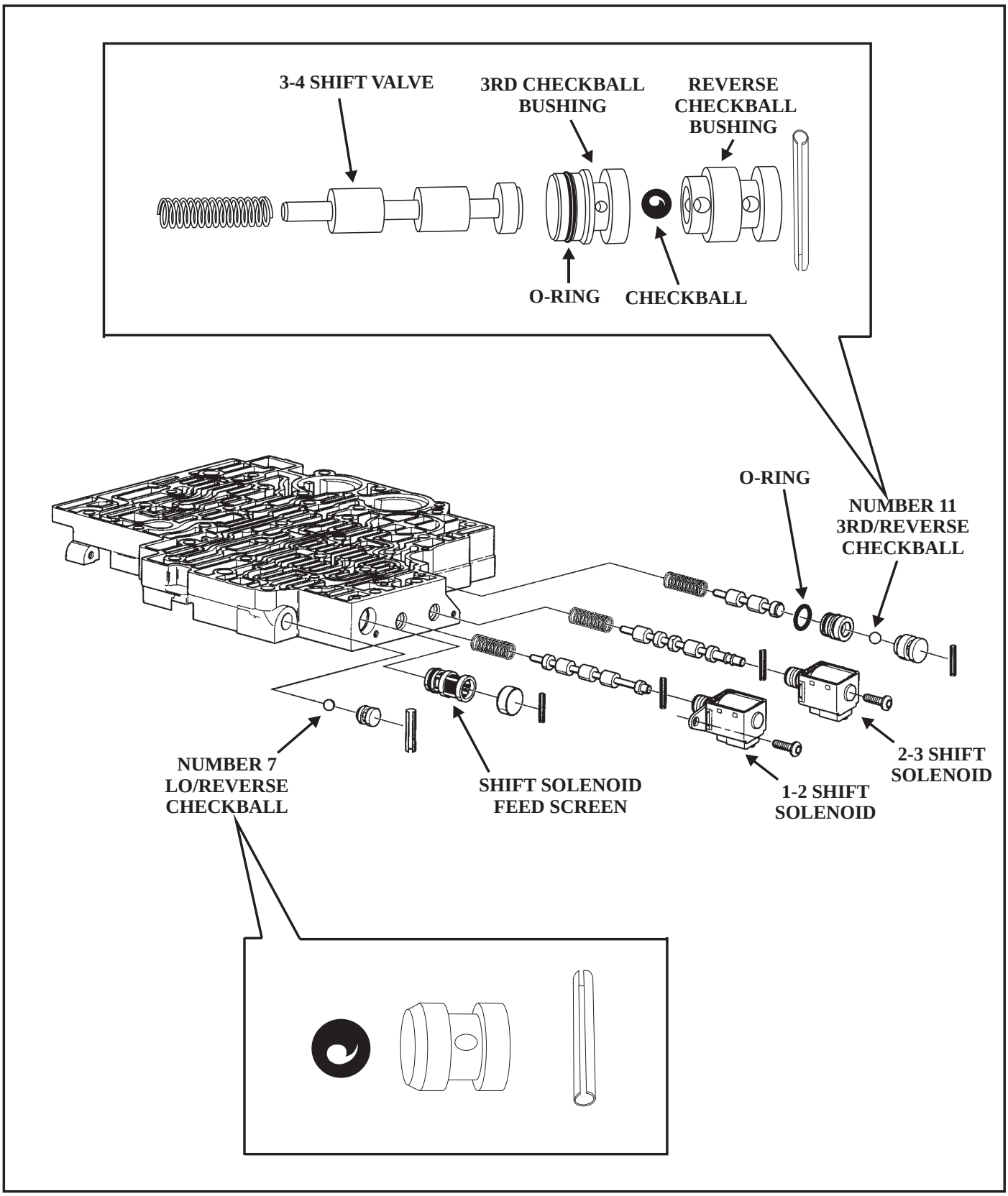


Figure 1

SLIPPING OR NO THIRD, REVERSE OR FOURTH GEAR

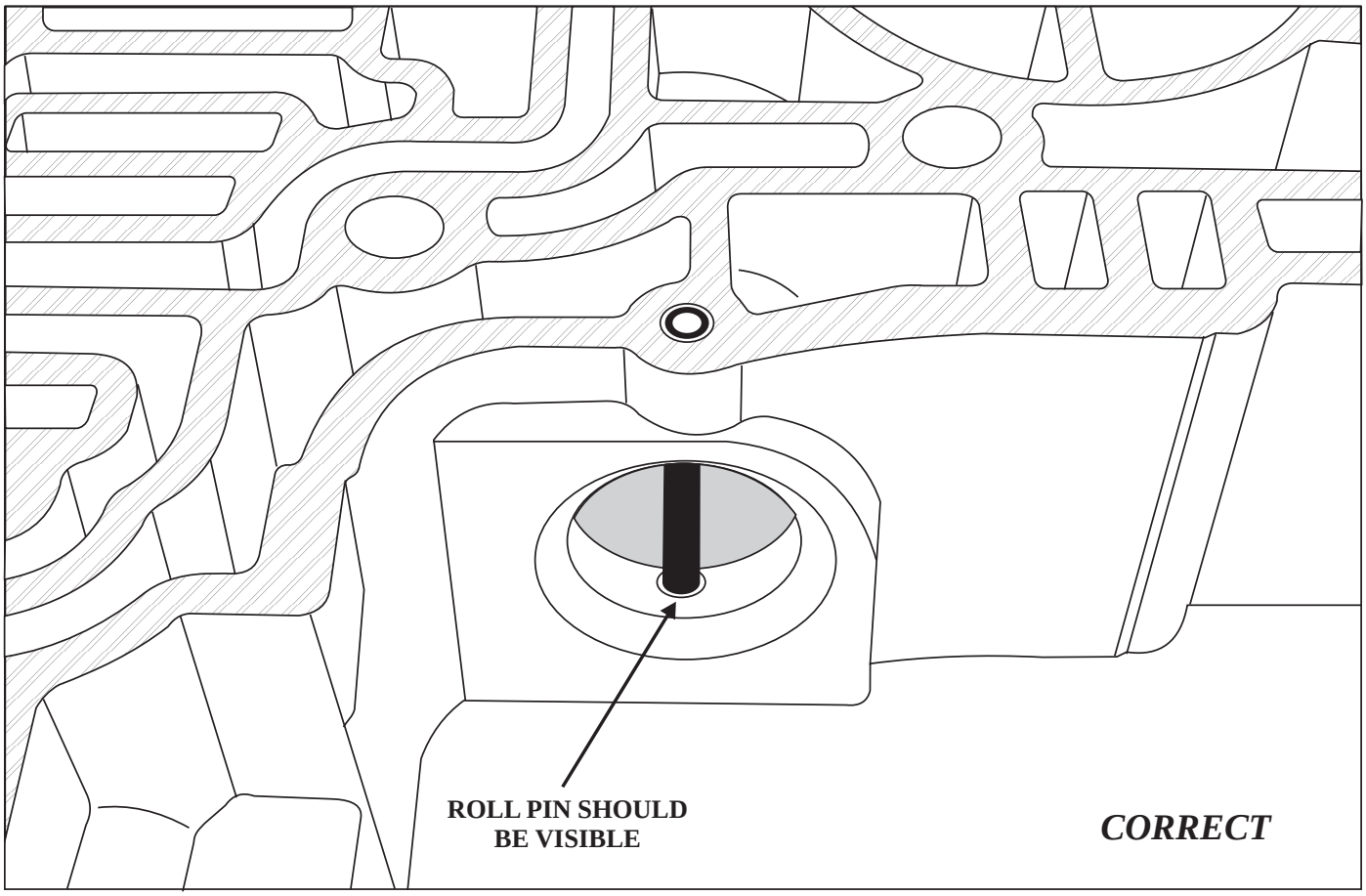


Figure 2

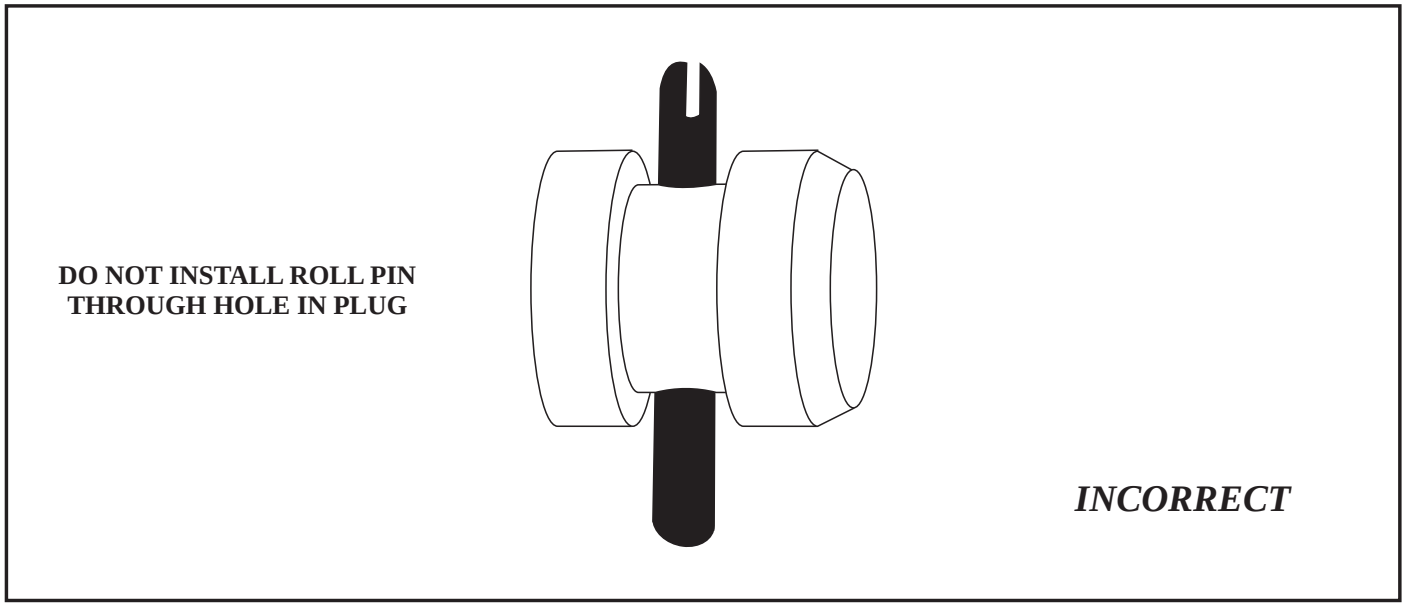


Figure 3

SLIPPING OR NO THIRD, REVERSE OR FOURTH GEAR

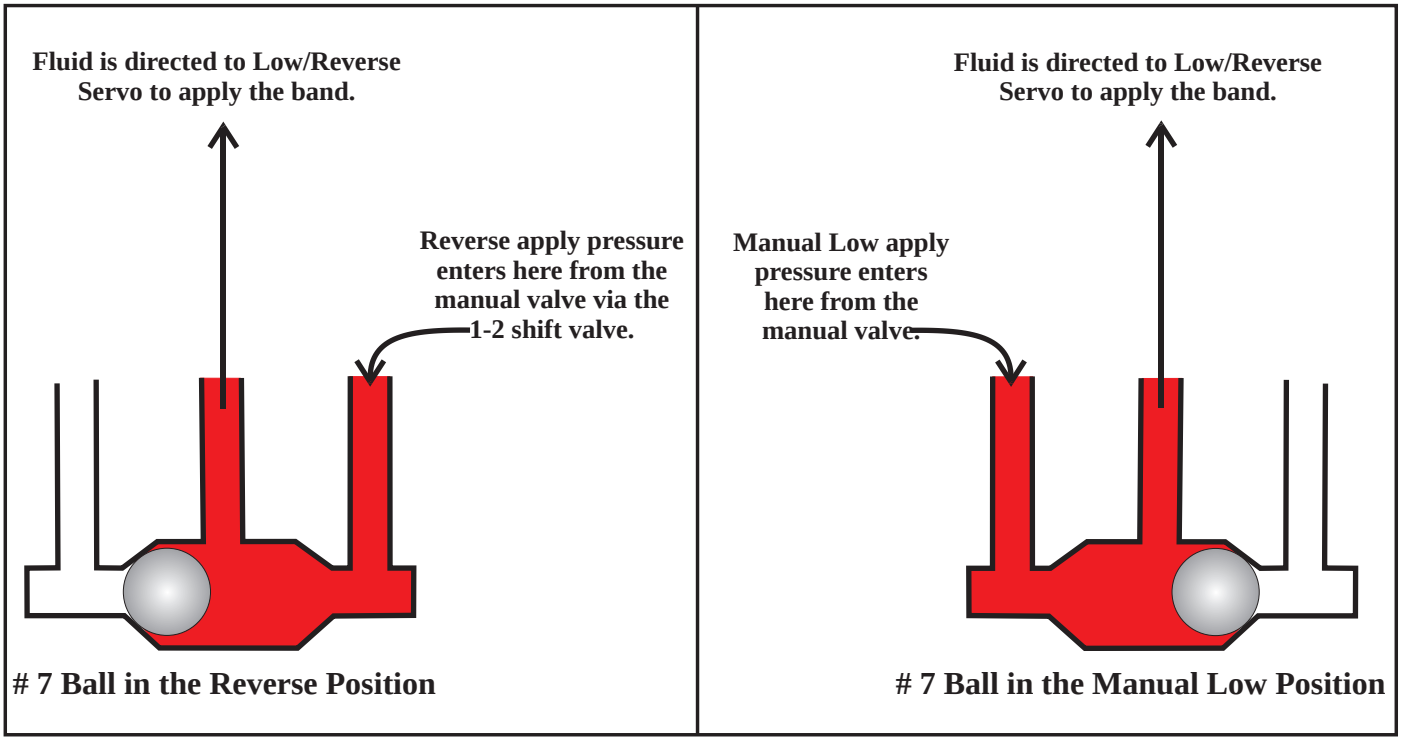


Figure 4

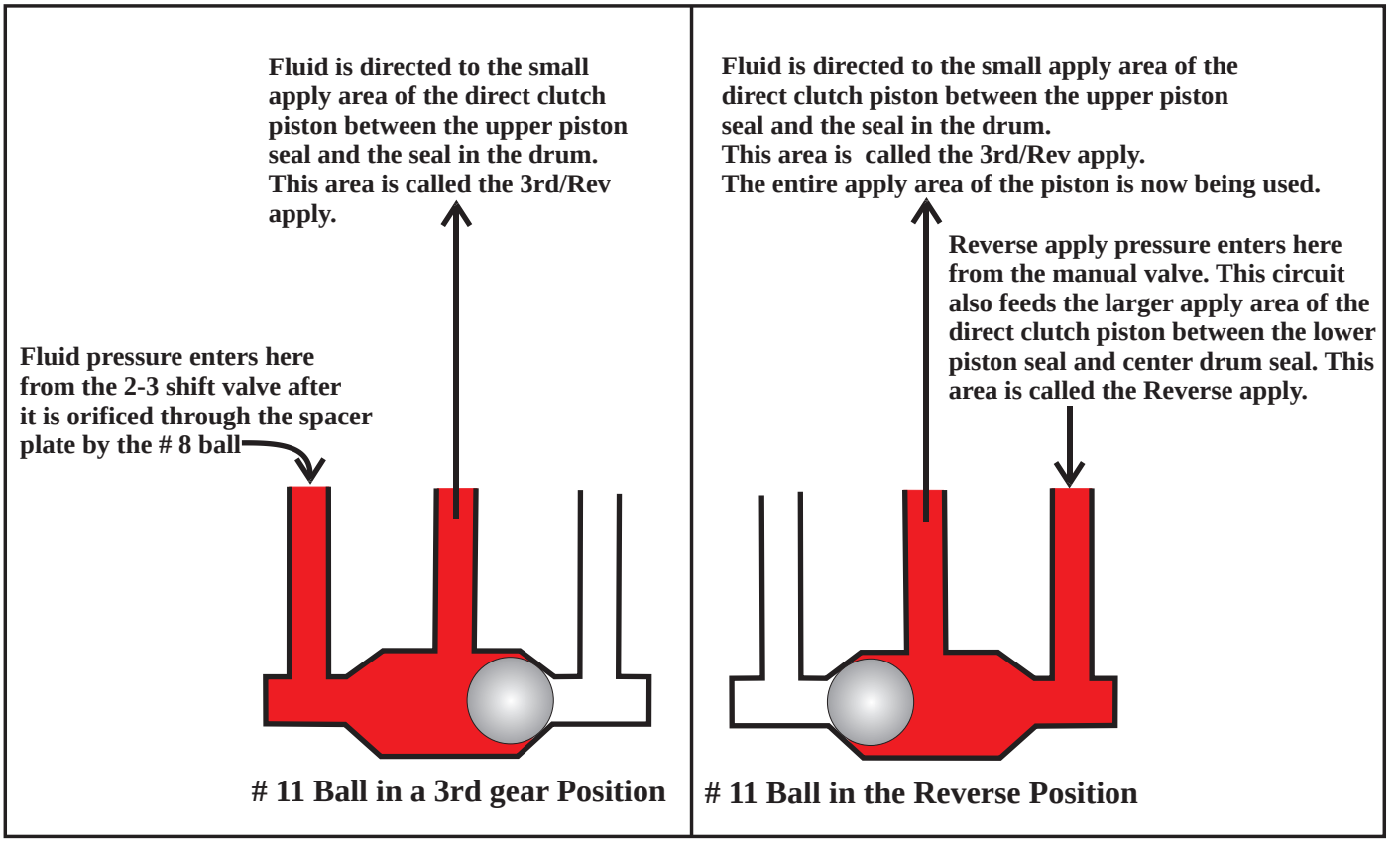


Figure 5

GM 4L60E

BROKEN CASE

COMPLAINT: As the installer is tightening the bolts that attach the shifter cable support bracket to the case, above the pan rail, a section of the pan rail cracks and breaks away from the case.

CAUSE: There are two types of shifter cable support bracket locations, one is to the case above the pan rail, and the other is from the bottom through the pan rail. The bottom pan rail location uses longer bolts to attach the shifter cable. If these bolts are used to secure the pan without the shifter cable bracket, these bolts will stick out of the pan bolt holes too far. When the 45 Torx bolts for the top mounted shifter cable bracket are tightened, they will make contact with the pan bolts that are too tall. The opposing pressure from the bolts making contact will put enough stress on the case in that area to break the case as seen in Figure 1.

CORRECTION: If the type of shifter cable support bracket being used at the time of transmission installation is the one that bolts above the pan rail, make certain the shorter pan bolts are used in the shifter cable bracket mounting location.

Many thanks to Dan Tucker of Tucker's Transmissions in Pine Bluff, AK. for the bulletin suggestion, the information and the photos.

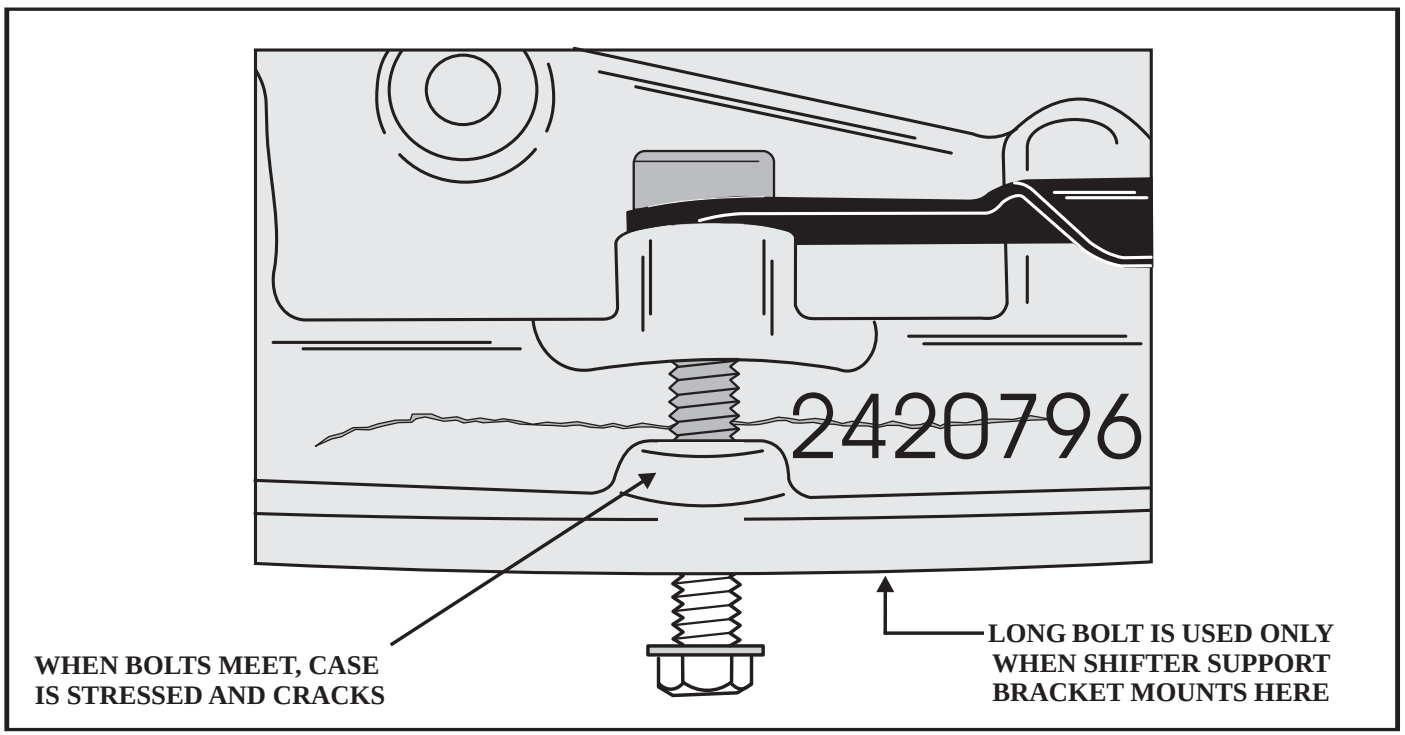


Figure 1

AISIN SEIKI 450-43LE

VALVE BODY EXPLODED VIEWS AND IDENTIFICATION OF COMPONENTS

Refer to Figures 1 and 2 for the Identification and location of valve line-ups in the Upper Valvebody

Refer to Figures 3 and 4 for the Identification and location of valve line-ups in the Lower Valvebody

Refer to Figure 5 for the Identification and location of the Shift Solenoids, Lock-up Solenoid and the Timing Solenoid

Refer to Figure 6 for the Location of Checkballs and Filter in the Upper Valve Body

Refer to Figure 7 for the Location of Checkballs in the Lower Valve Body

Refer to Figure 8 for the Location of the retainers and Filters in the Lower Valve Body (Pan Side)

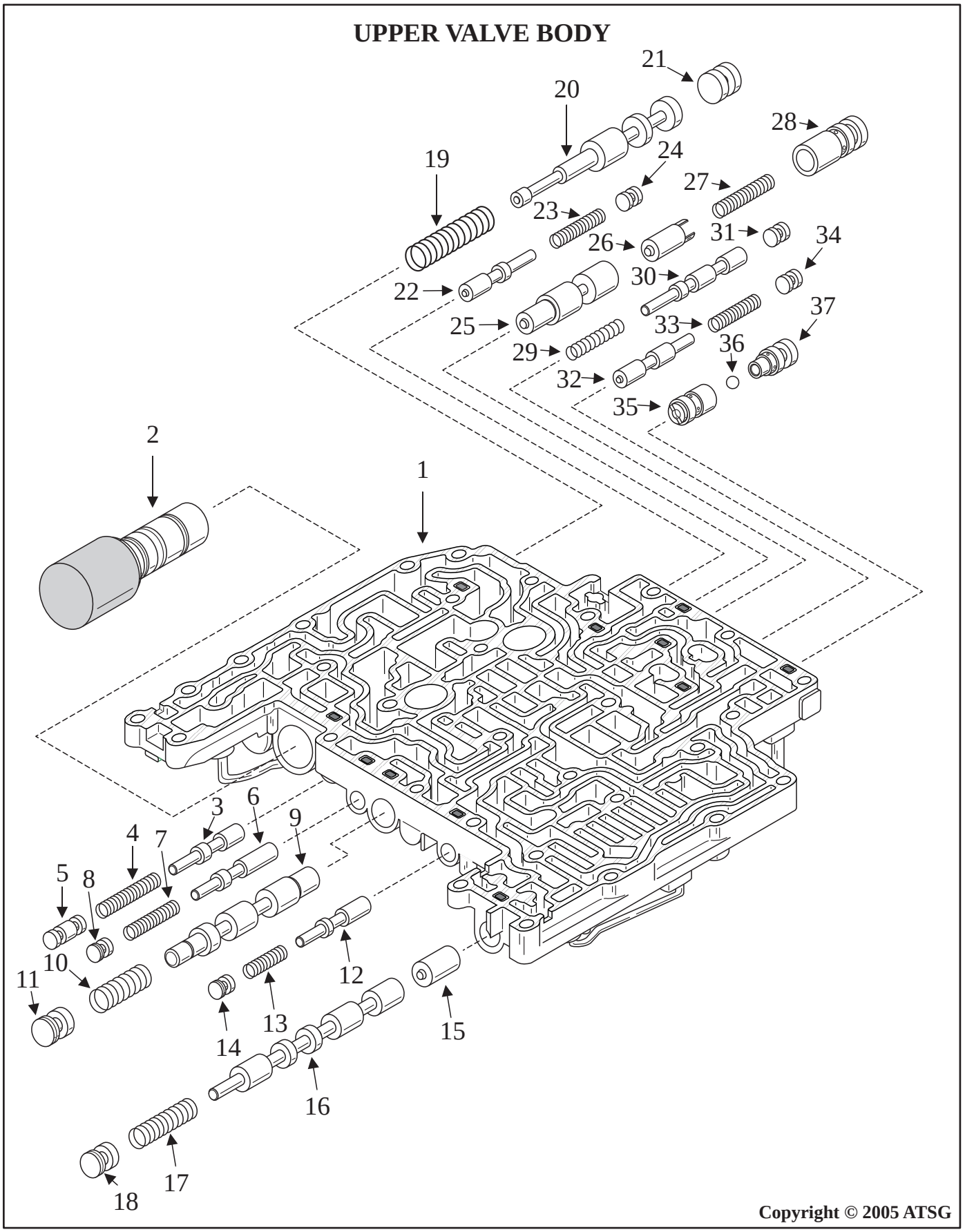

UPPER VALVE BODY
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Figure 1

UPPER VALVE BODY LEGEND

1. UPPER VALVE BODY
2. PRESSURE CONTROL SOLENOID
3. REDUCING VALVE
4. REDUCING VALVE SPRING
5. REDUCING VALVE BORE PLUG
6. LOCK-UP SIGNAL VALVE
7. LOCK-UP SIGNAL VALVE SPRING
8. LOCK-UP SIGNAL VALVE BORE PLUG
9. ACCUMULATOR VALVE
10. ACCUMULATOR VALVE SPRING
11. ACCUMULATOR VALVE BORE PLUG
12. ORFICE CONTROL VALVE
13. ORFICE CONTROL VALVE SPRING
14. ORFICE CONTROL VALVE BORE PLUG
15. 2-3 SHIFT VALVE PLUG
16. 2-3 SHIFT VALVE
17. 2-3 SHIFT VALVE SPRING
18. 2-3 SHIFT VALVE BORE PLUG
19. SECONDARY REGULATOR VALVE SPRING
20. SECONDARY REGULATOR VALVE
21. SECONDARY REGULATOR VALVE BORE PLUG
22. MODULATOR VALVE
23. MODULATOR VALVE SPRING
24. MODULATOR VALVE BORE PLUG
25. REVERSE INHIBITOR VALVE # 1
26. REVERSE INHIBITOR VALVE # 2
27. REVERSE INHIBITOR VALVE SPRING
28. REVERSE INHIBITOR VALVE SLEEVE
29. LOW COAST MODULATOR VALVE SPRING
30. LOW COAST MODULATOR VALVE*
31. LOW COAST MODULATOR VALVE BORE PLUG
32. LOW INHIBITOR VALVE
33. LOW INHIBITOR VALVE SPRING
34. LOW INHIBITOR VALVE BORE PLUG
35. DIRECT CLUTCH CHECK VALVE
36. DIRECT CLUTCH CHECK VALVE BALL
37. DIRECT CLUTCH CHECK VALVE SLEEVE

***A stuck Low Coast Modulator Valve will cause no forward movement and a bind in reverse.**

Figure 2

LOWER VALVE BODY

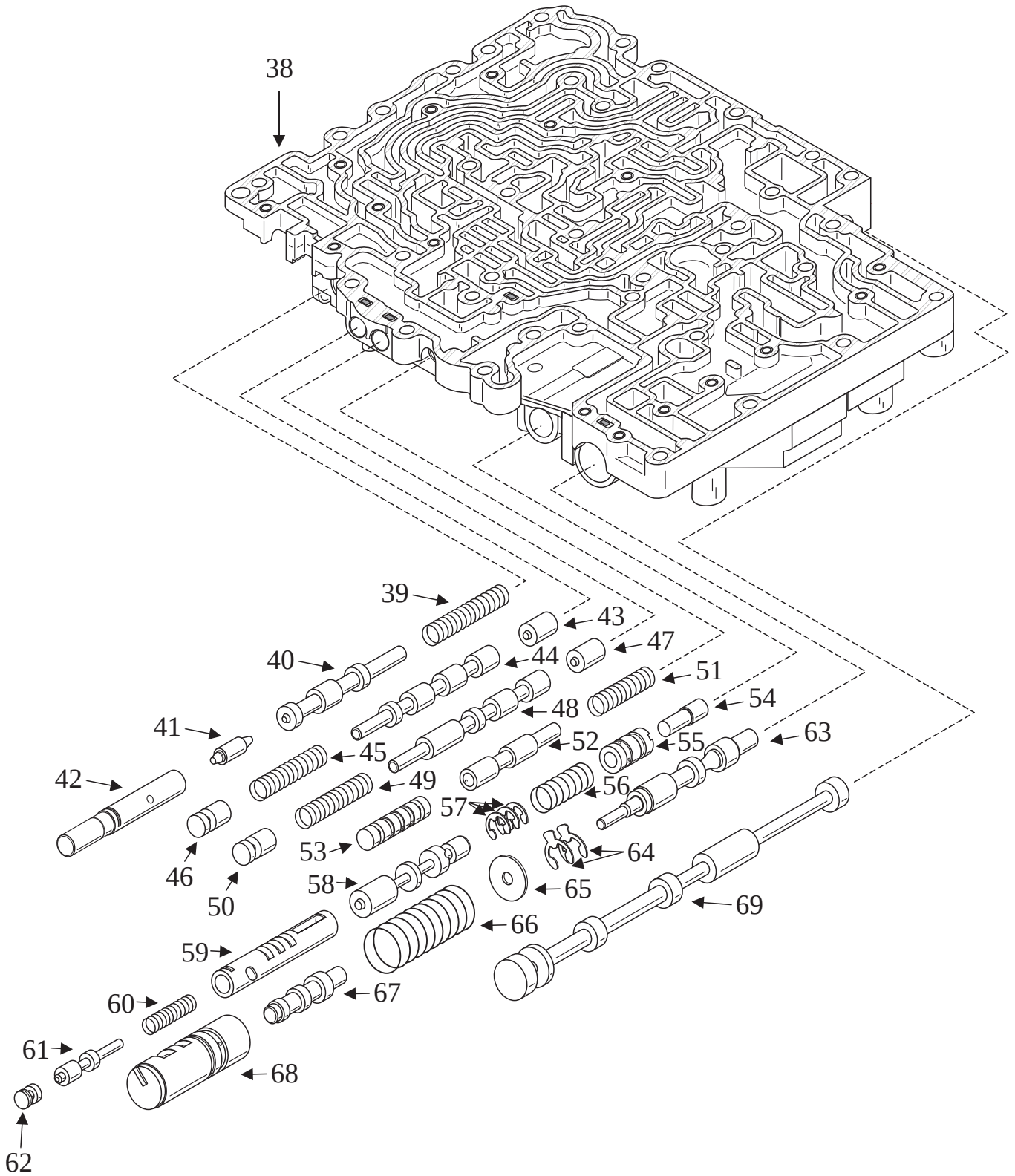


Figure 3

DACCO

AXIOM

LOWER VALVE BODY LEGEND

38. LOWER VALVE BODY
39. 2-3 TIMING VALVE SPRING
40. 2-3 TIMING VALVE
41. 2-3 TIMING VALVE PLUG
42. 2-3 TIMING VALVE SLEEVE
43. 1-2 SHIFT VALVE PLUG
44. 1-2 SHIFT VALVE
45. 1-2 SHIFT VALVE SPRING
46. 1-2 SHIFT VALVE BORE PLUG
47. 3-4 SHIFT VALVE PLUG
48. 3-4 SHIFT VALVE
49. 3-4 SHIFT VALVE SPRING
50. 3-4 SHIFT VALVE BORE PLUG
51. CO EXHAUST VALVE SPRING
52. CO EXHAUST VALVE
53. CO EXHAUST VALVE BORE PLUG
54. LOCK-UP CONTROL VALVE PLUG
55. LOCK-UP CONTROL VALVE SLEEVE*
56. LOCK-UP CONTROL VALVE SPRING
57. LOCK-UP CONTROL VALVE SPACERS
58. LOCK-UP CONTROL VALVE
59. CUT BACK VALVE SLEEVE
60. CUTBACK VALVE SPRING
61. CUTBACK VALVE
62. CUTBACK VALVE BORE PLUG
63. PRIMARY REGULATOR VALVE
64. PRIMARY REGULATOR VALVE SPACERS
65. PRIMARY REGULATOR VALVE SPRING SEAT
66. PRIMARY REGULATOR VALVE SPRING
67. PRIMARY REGULATOR BOOST VALVE
68. PRIMARY REGULATOR BOOST SLEEVE
69. MANUAL VALVE

***A broken Lock-Up Control Valve Sleeve will jam the Lock-Up causing the engine to stall in gear.**

Figure 4

Phoenix

SOLENOID IDENTIFICATION

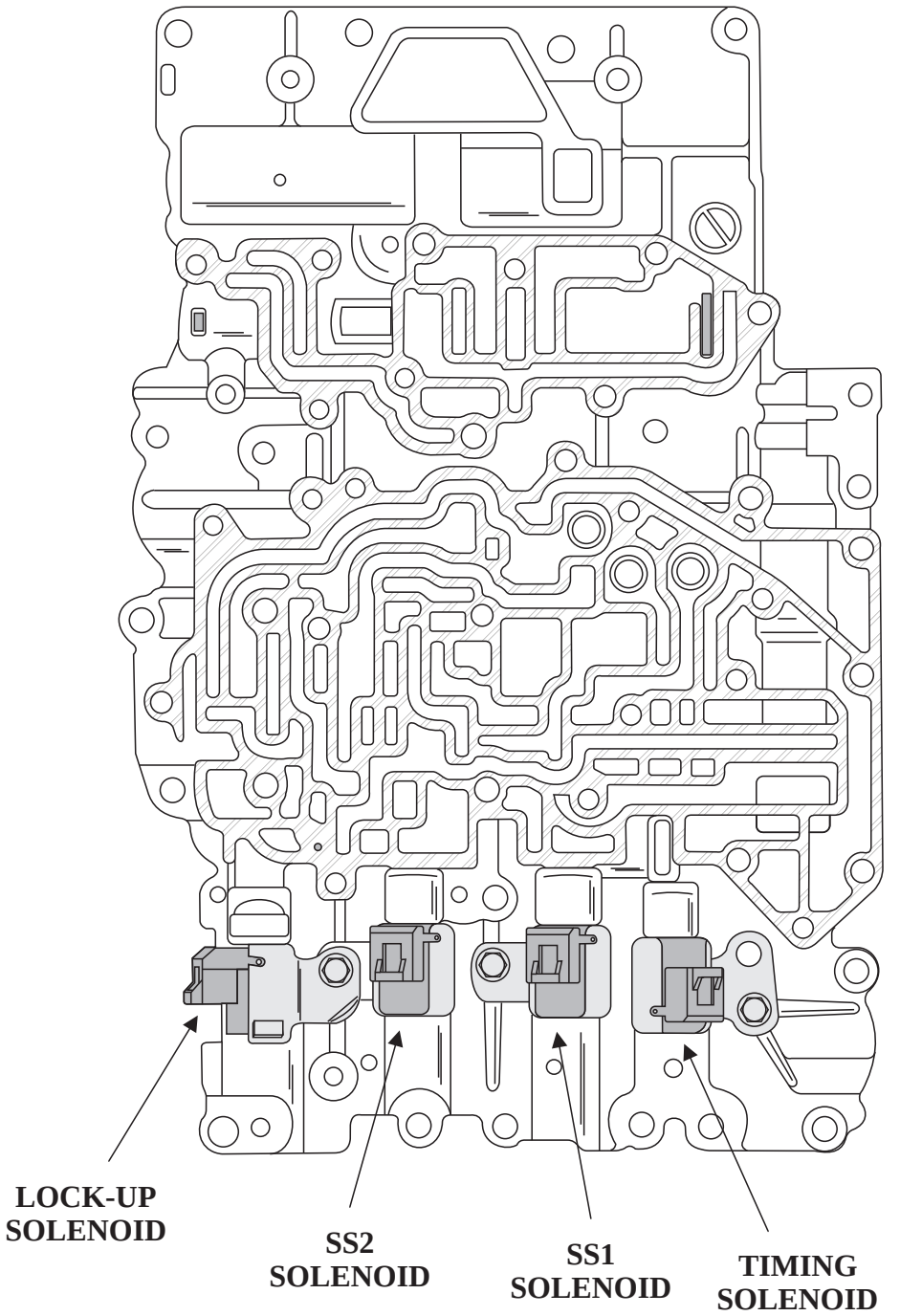
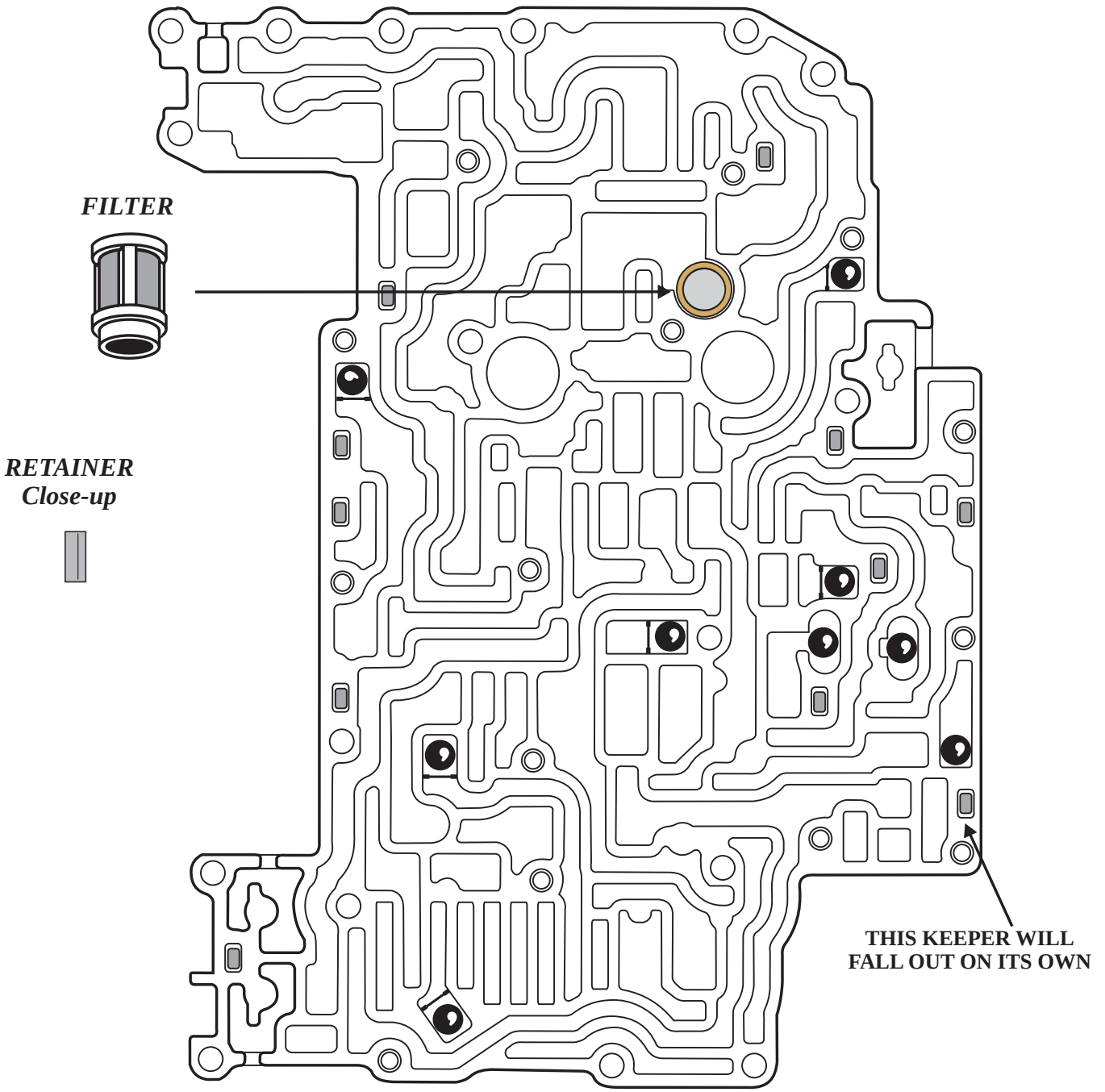


Figure 5

UPPER VALVE BODY
CHECKBALL LOCATIONS

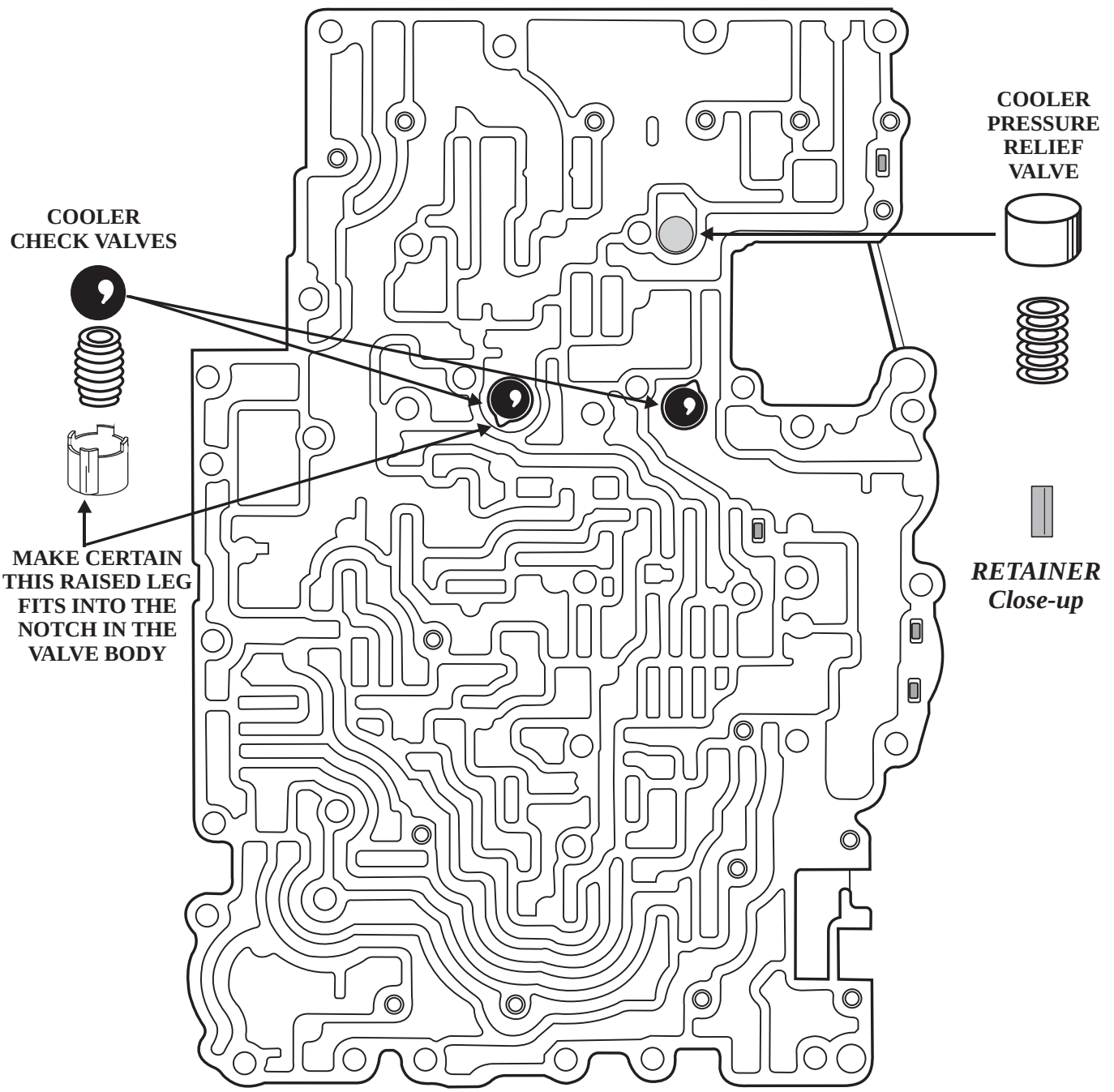


THE UPPER VALVE BODY HAS NINE 6.35MM (.250") STEEL CHECKBALLS

NOTE: RETAINER LOCATIONS ARE HIGHLIGHTED IN GREY

Figure 6

LOWER VALVEBODY CHECKVALVE LOCATIONS



THE LOWER VALVE BODY HAS TWO 10.00MM (.394") STEEL CHECKBALLS ON BARREL SPRINGS AND CAPSULES

NOTE: RETAINER LOCATIONS ARE HIGHLIGHTED IN GREY

Figure 7

LOWER VALVEBODY *(Pan Side)* RETAINER AND FILTER LOCATIONS

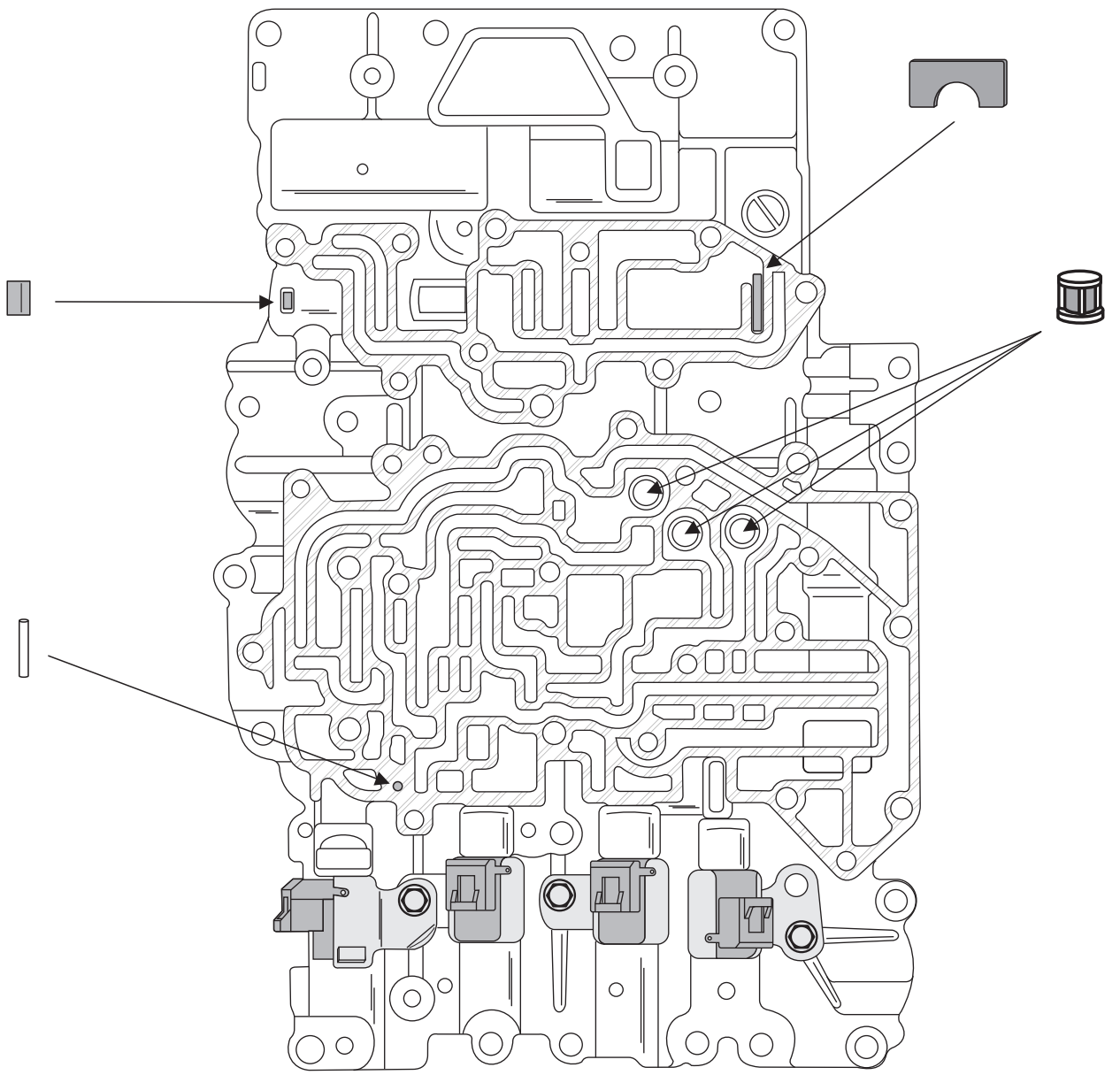


Figure 8

FORD 4R70E/4R75E
CHANGES FOR 2004

CHANGE: Beginning at the start of production for 2004, Ford Motor Company introduced a new rear drive transmission with the designation 4R70E or 4R75E, which is based on the 4R70W. This transmission now has a redesigned Pump and Stator assembly, Intermediate Clutch assembly, Forward Drum, Sun Gear Shell, Center Support, Anti-Rattle Clip, an added Turbine Speed Sensor, a redesigned transmission case, a shorter Output Speed Sensor and a redesigned Ring gear.

REASON: Improved up-shift and downshift timing and better gear calculation and for ease of assembly.

PARTS AFFECTED:

(1) INTERMEDIATE CLUTCH PISTON AND PUMP BODY - The Intermediate Clutch Piston was changed form the previous design Aluminum piston with individual lip seals, as shown in Figure 1, to a stamped steel bonded rubber piston as shown in Figure 2. Along with this change, the Pump Body was redesigned to accommodate the new larger piston and the elimination of the Spring Retainer. A new return spring and retainer was added into the case as shown in Figures 3 and 4.

(2) PUMP STATOR - The Pump Stator Forward Clutch sealing ring groove depth changed to accommodate a new Plastic Butt Cut Sealing Ring as shown in Figure 5.

(3) FORWARD DRUM - The Forward Drum had a stamping change to provide projections for the added Turbine Shaft Speed Sensor, as shown in Figure 6.

(4) SUN SHELL - The Sun shell can be easily identified by the new rivets that retain the shell to the Sun Gear as shown in Figure 7. The new shell is manufactured from a non-ferrous metal which will not attract a magnet, so the added turbine sensor can read the Forward Clutch Drum. ***NOTE: 2005 models do not have the rivets for identification and will retrofit to 2004 models.***

(5) CENTER SUPPORT - The new design Center Support has a notch cut out of it to accommodate the added Turbine Sensor, as shown in Figure 8. A new design Anti-rattle Clip was also added for ease of assembly, which was changed in the 2002 model year.

(6) TRANSMISSION MAIN CASE - The case was changed to accommodate the added turbine sensor as shown in Figure 9.

(7) REAR INTERNAL RING GEAR - Now manufactured with extended parking lugs on the ring gear to trigger the New ***Shorter*** Output Speed Sensor, instead of the previous design holes in the center of the ring gear as shown in Figure 10.

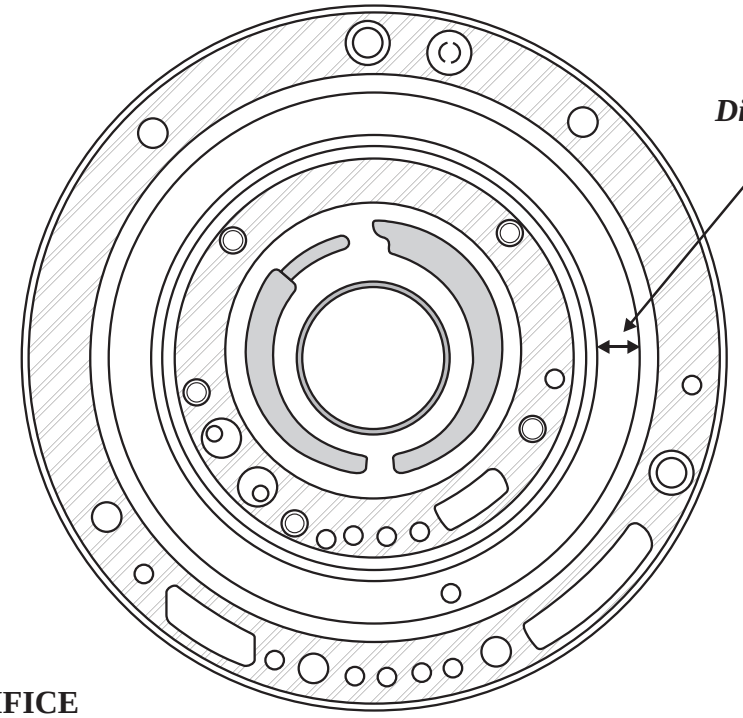
INTERCHANGEABILITY:

None of the parts listed above will interchange with the previous design 4R70W parts.

SERVICE INFORMATION:

INTERMEDIATE CLUTCH BONDED PISTON.....3L3Z-7E005-AA
FORWARD CLUTCH PLASTIC SEALING RINGS (2).....3L3Z-7D019-AA
FORWARD CLUTCH DRUM..... 3L3Z-7F207-AA
SUN GEAR SHELL.....5L3Z-7A019-AB
TURBINE SHAFT SPEED SENSOR.....3L3Z-7M101-AA
OUTPUT SHAFT SPEED SENSOR.....3L3Z-7H103-AA

PREVIOUS DESIGN PUMP AND INTERMEDIATE CLUTCH PISTON ASSEMBLY



BLEED ORIFICE

Dimension "A"= .550"

INTERMEDIATE PISTON SPRING RETAINER

INTERMEDIATE PISTON

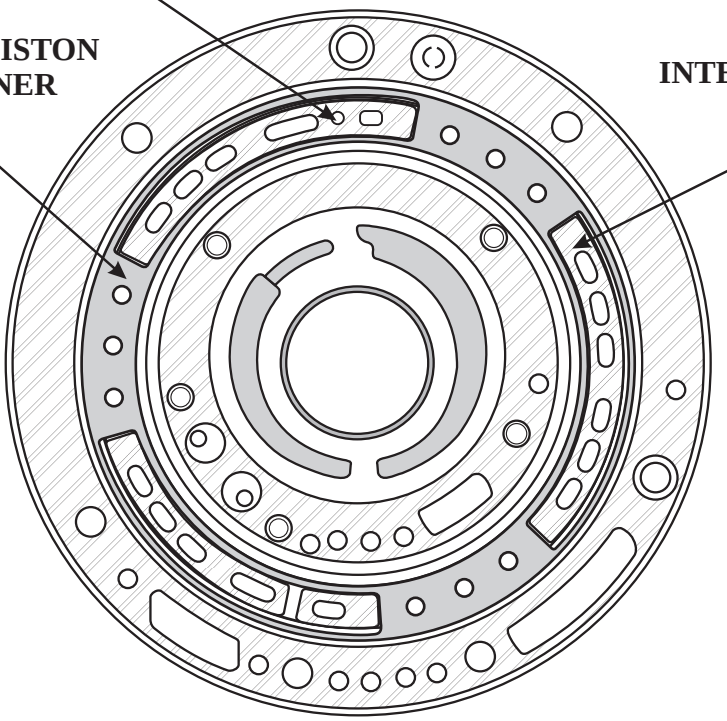
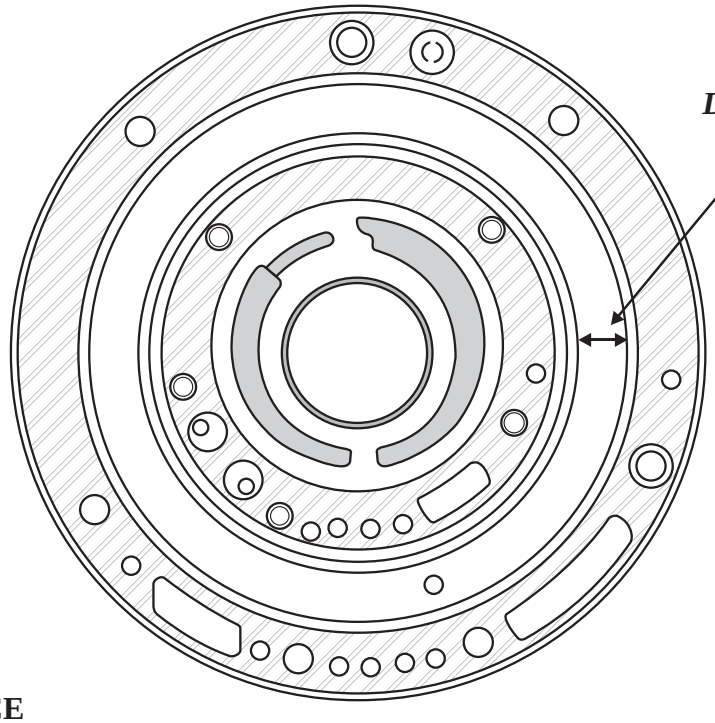


Figure 1

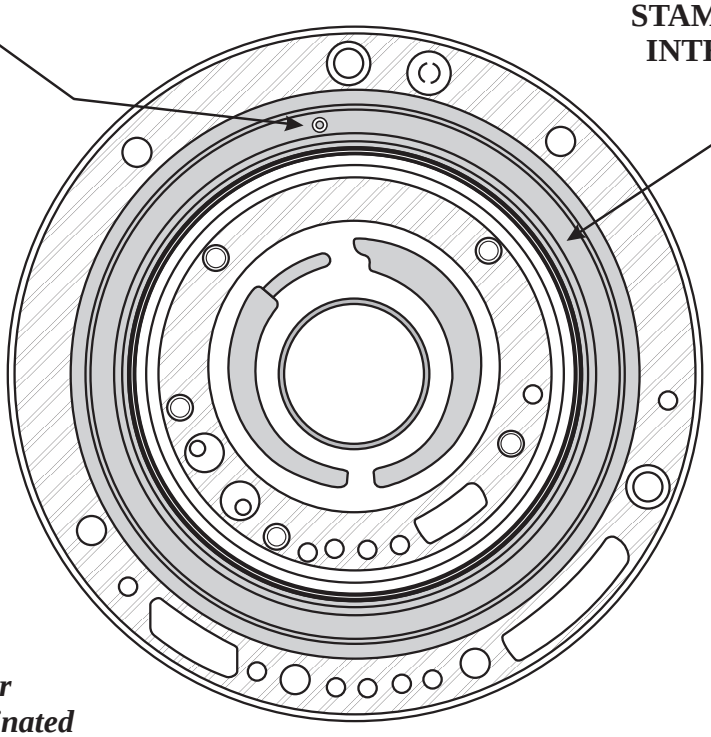
NEW DESIGN PUMP AND INTERMEDIATE CLUTCH PISTON ASSEMBLY



Dimension "A"= .690"

BLEED ORIFICE IS NOW A CHECK BALL CAPSULE

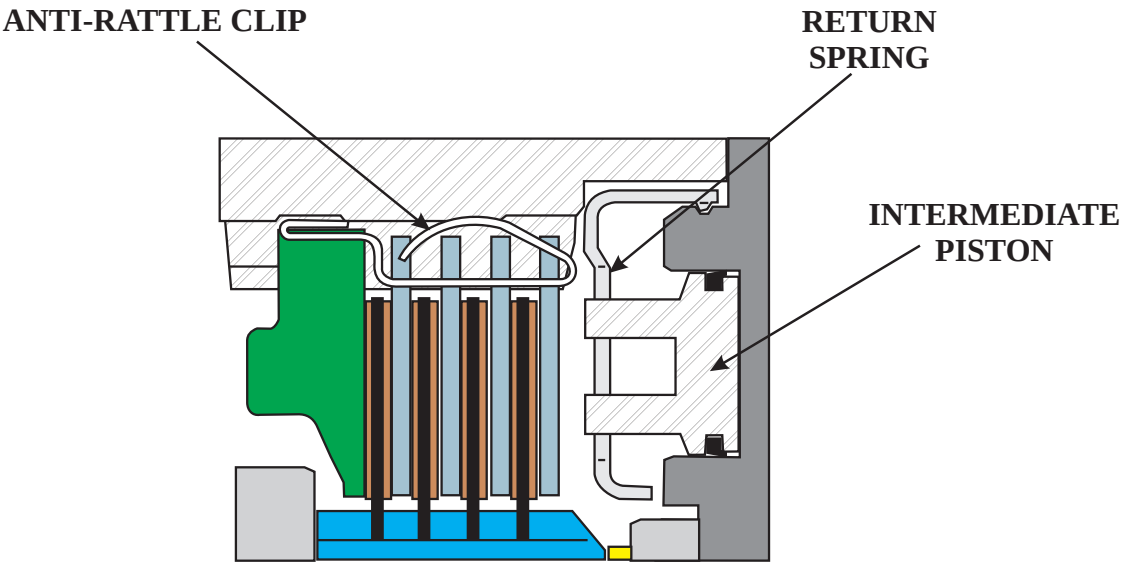
STAMPED STEEL BONDED INTERMEDIATE PISTON



Spring retainer has now been eliminated

Figure 2

PREVIOUS DESIGN PUMP AND INTERMEDIATE CLUTCH PISTON CROSS-SECTION



NEW DESIGN PUMP AND INTERMEDIATE CLUTCH PISTON CROSS-SECTION

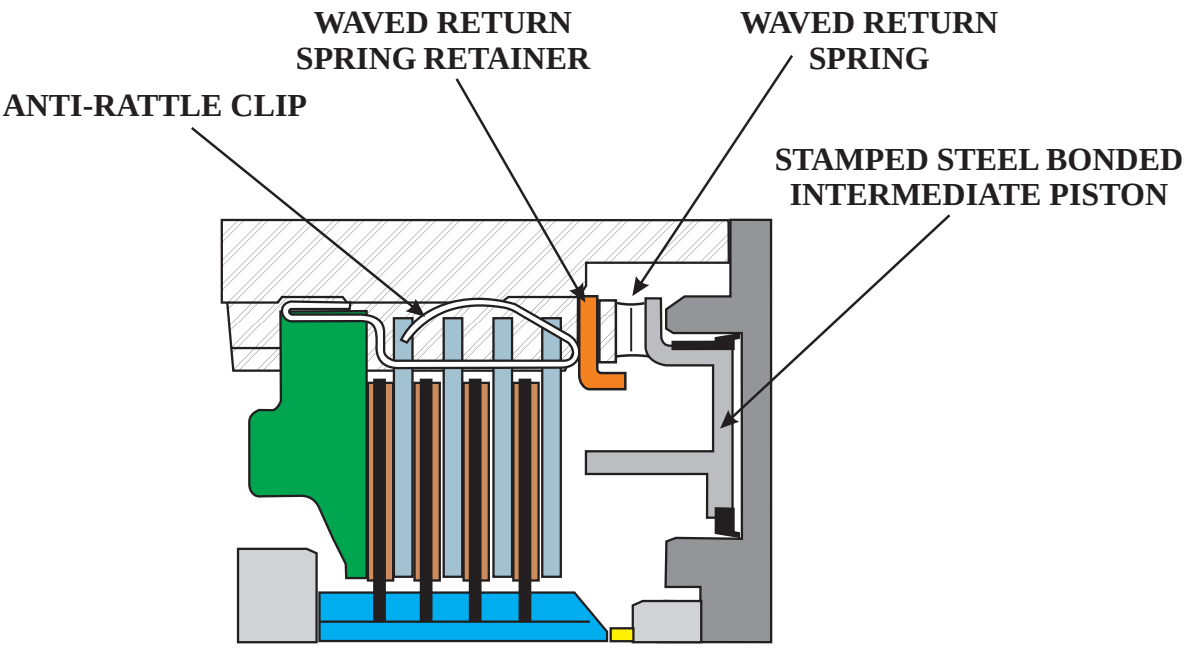


Figure 3

INTERMEDIATE CLUTCH ASSEMBLY

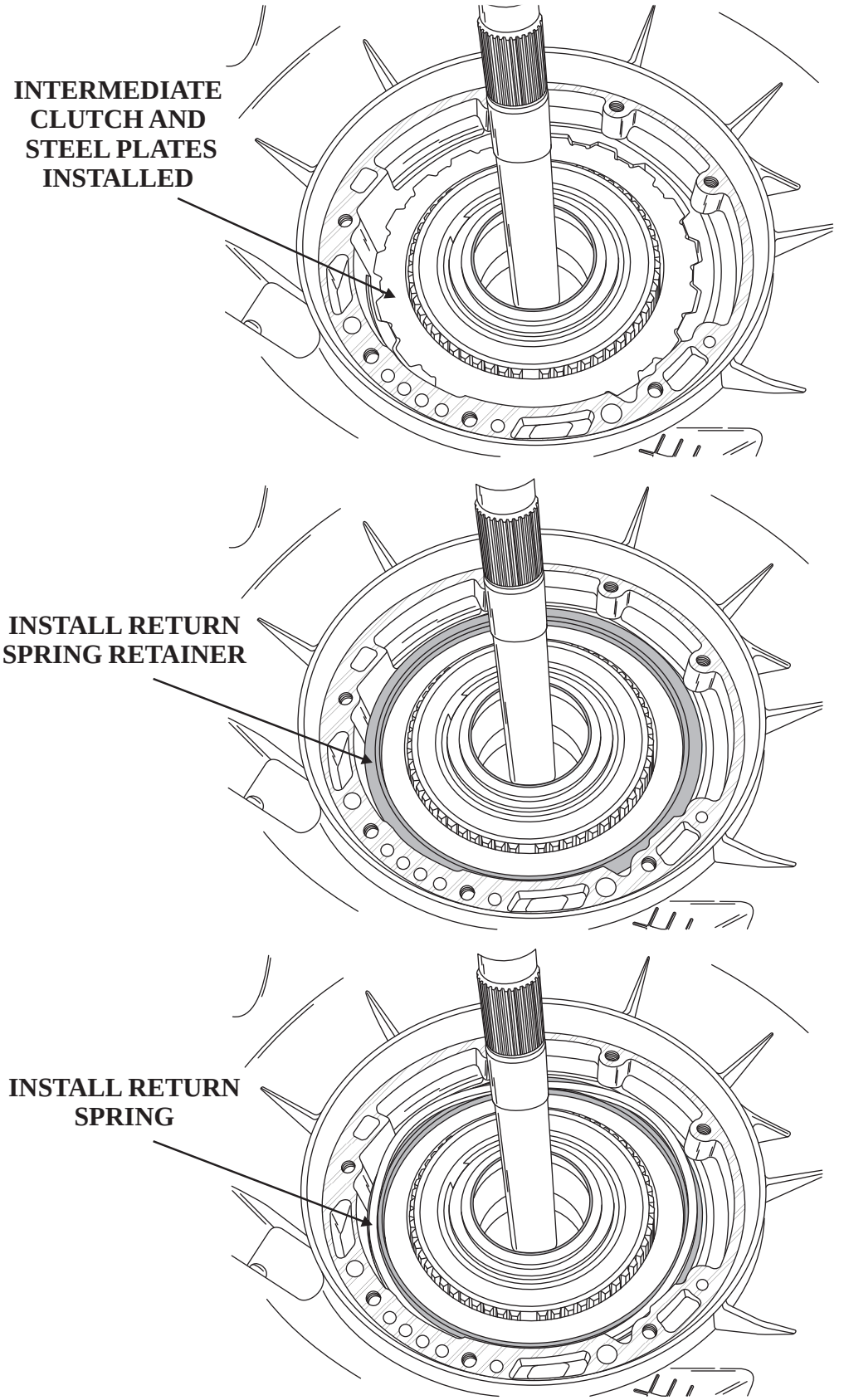
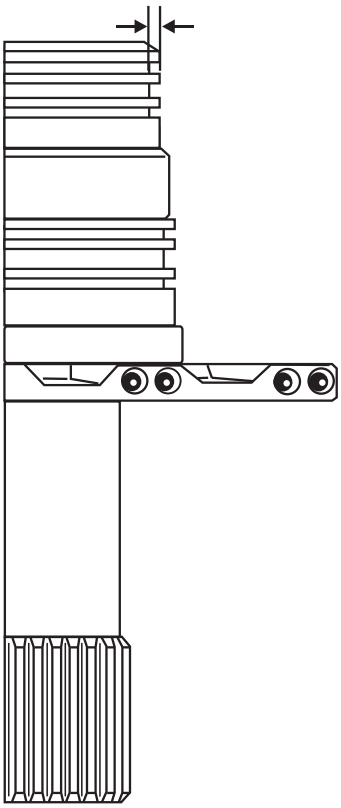


Figure 4

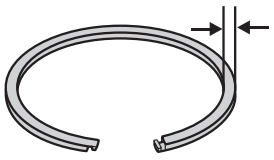
PUMP STATOR

PREVIOUS DESIGN

RING GROOVE DEPTH .100"



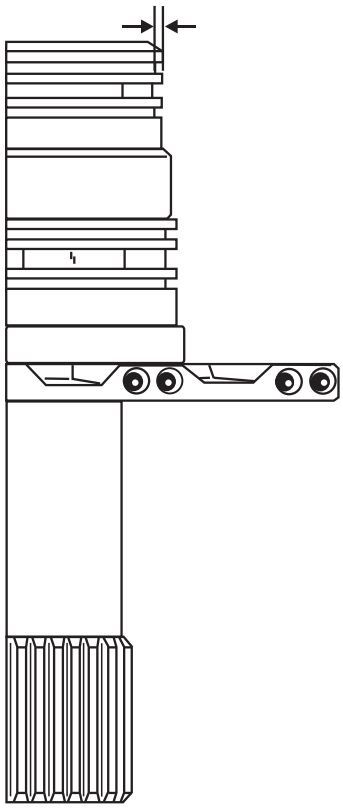
SEALING RING WIDTH .110"



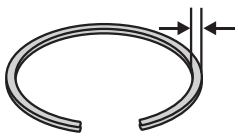
LATCH TYPE STEEL SEALING RINGS

NEW DESIGN

RING GROOVE DEPTH .072"



SEALING RING WIDTH .083"



BUTT CUT PLASTIC SEALING RINGS

Figure 5

FORWARD CLUTCH DRUM

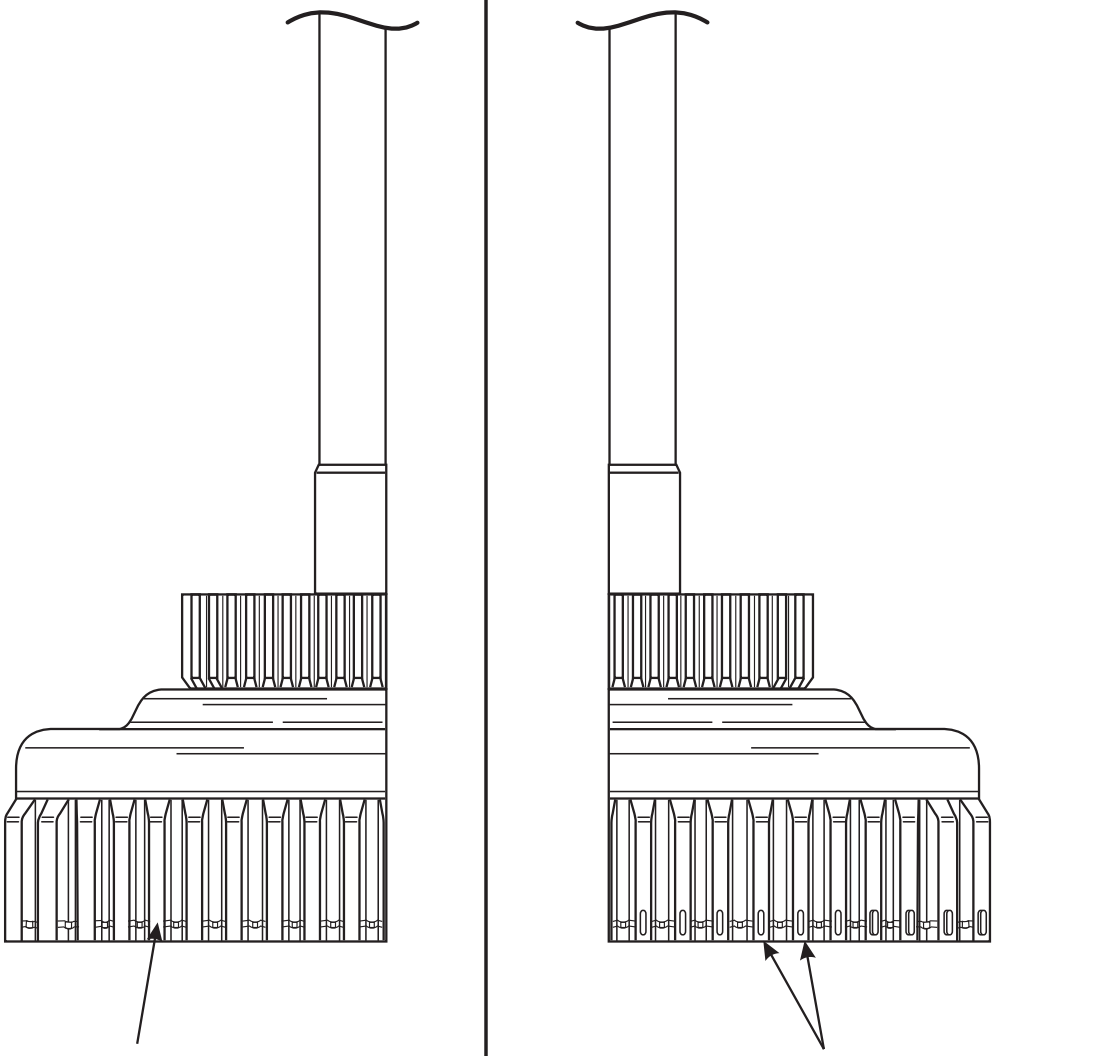
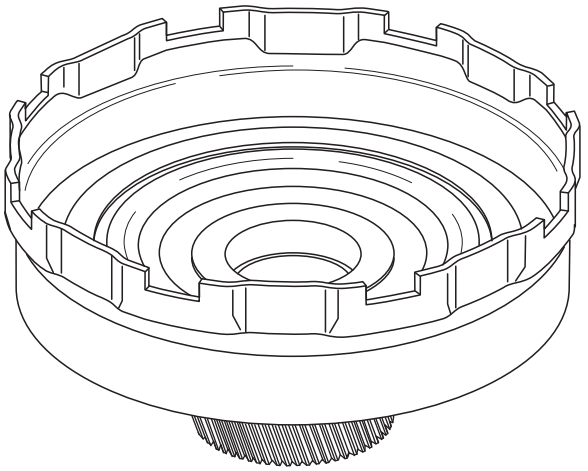


Figure 6

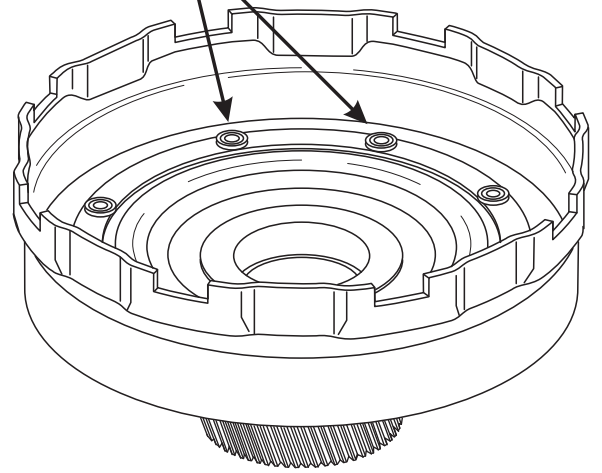
SUN GEAR SHELL

PREVIOUS DESIGN



NEW DESIGN

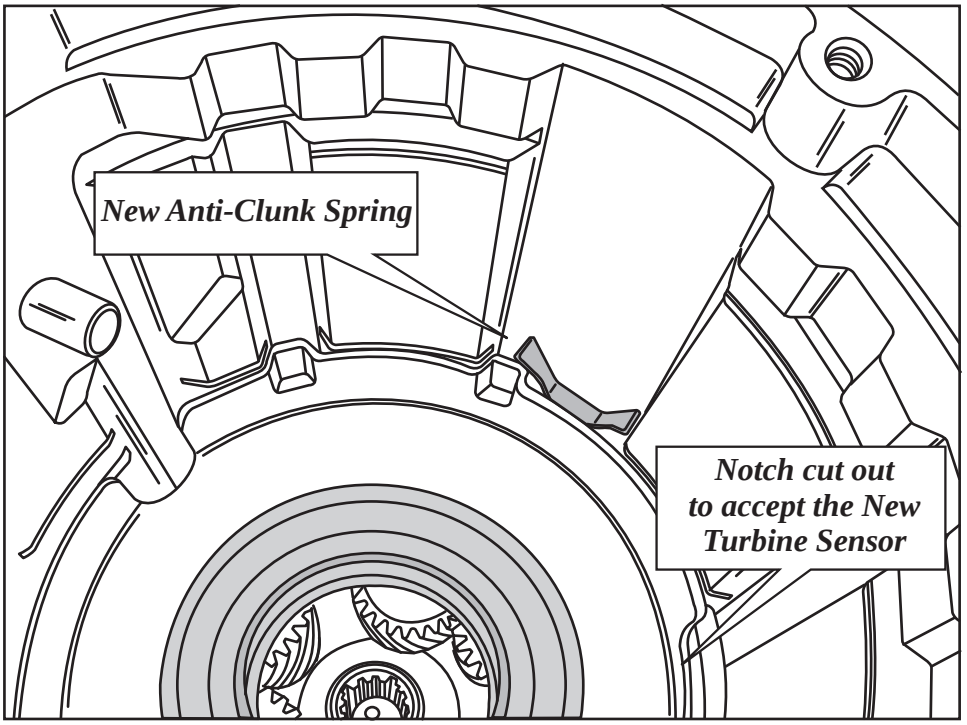
New Sun Shell Is Now Riveted To The Sun Gear And Hub



NOTE: The New Sun Shell is made from a non-ferrous material so the Turbine sensor can read the Forward drum. In the 2005 model year the same type of Sun Shell is used and the rivets for identification are removed

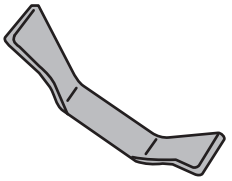
Figure 7

CENTER SUPPORT



PREVIOUS DESIGN
Anti-Clunk Spring

NEW DESIGN
Anti-Clunk Spring



NOTE: The anti-clunk spring was changed in the 2002 model year. Ford part number 2L3Z-7F277-AA

Figure 8

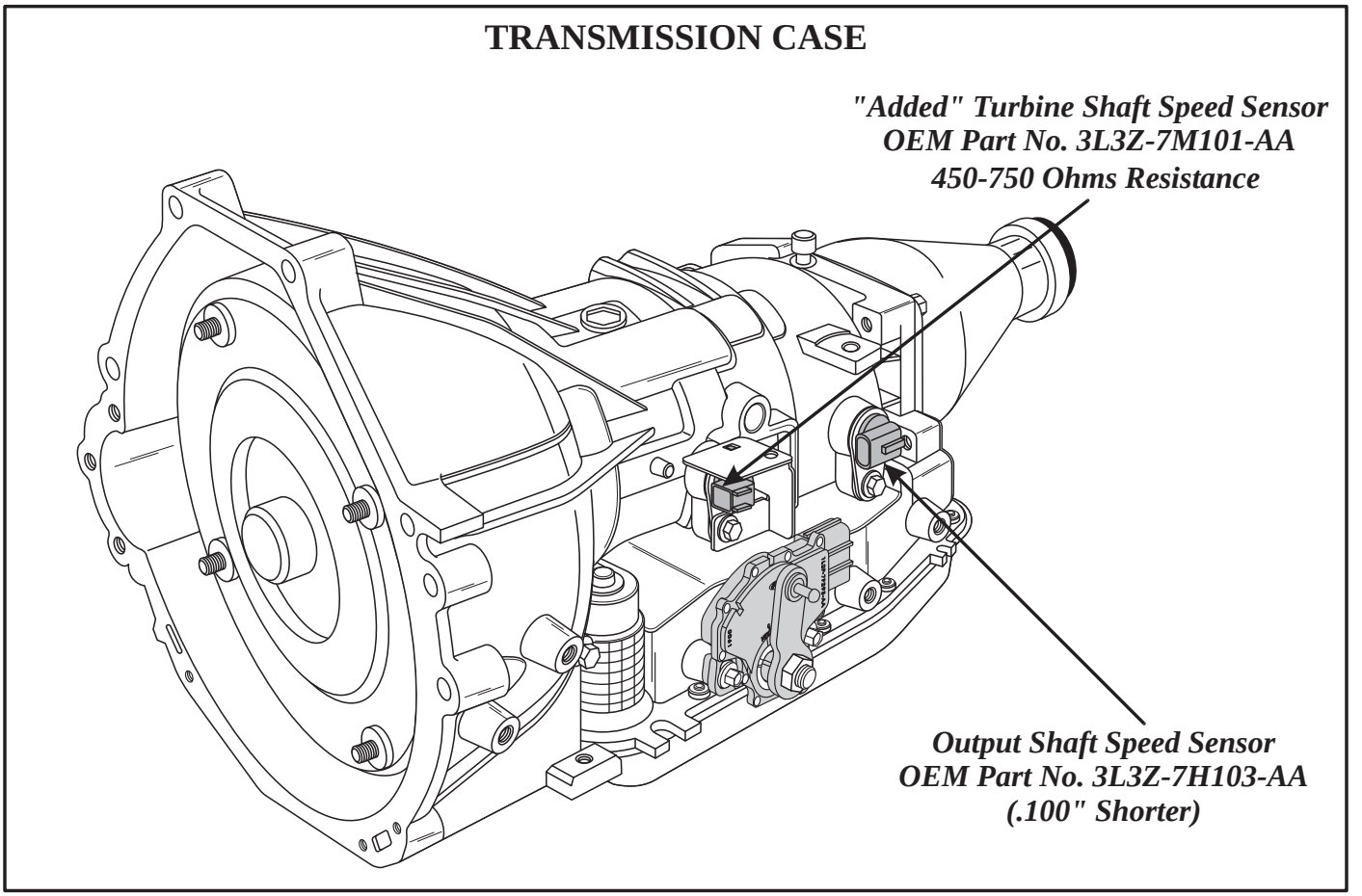


Figure 9

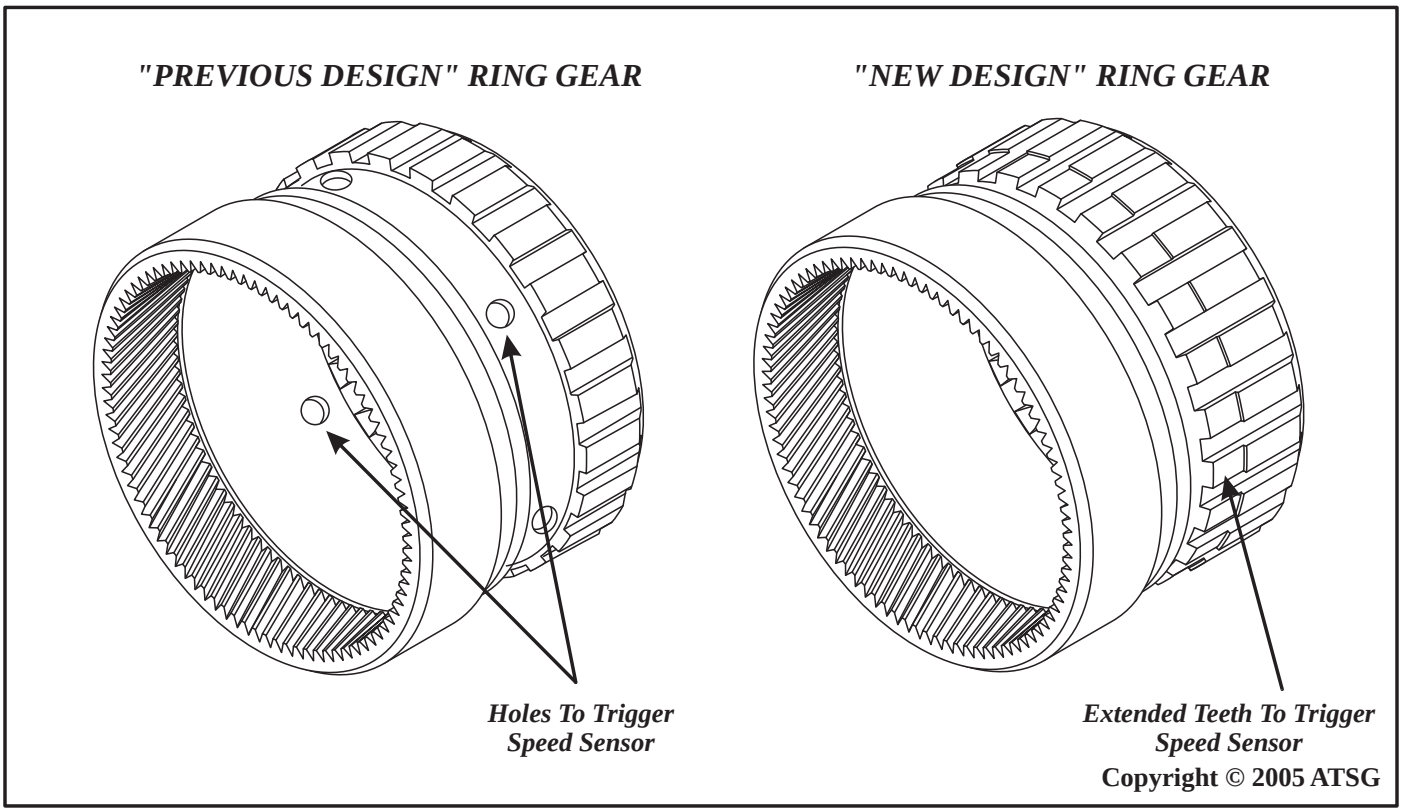


Figure 10

AVI

Techpac

Transtech

BC

Life Automotive