"2008" SEMINAR INFORMATION

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GM

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"Shiftin' Great in 2008" Seminar Information

ATSG Seminars

Welcome to the ATSG "Shiftin' Great in 2008" Technical Training Seminar.
ATSG has prepared another year of technical information designed to help you be the best in the business. Some shops say they cannot afford to come to these seminars. But as the years roll by we are seeing these shops falling by the wayside and struggling while some have already gone out of business. You cannot afford to **not** come to these seminars and those that come understand the value these seminars have. Sometimes the value of these seminars is hard to gauge in that you learn the solution to a difficult problem before it occurs in your shop. The days of unnecessary work saved and money not wasted becomes an intangible saving. You fix the problem immediately and make money and then move on to the next new money making job and this is just one example. The day is filled with a variety of these time saving tips and technical information with transmission coverage for General Motors, Ford, Chrysler and Import vehicles. All of which is designed to help you make money and to be a success in your field. So have a great day!

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

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Lubegard

ALTO

5L40E
PREMATURE FAILURE OF THE REVERSE, DIRECT AND OR COAST CLUTCH

COMPLAINT: Before and after a rebuild, the transmission may exhibit premature failure of the reverse, direct or coast clutch.

CAUSE: Inside the pump cover there are air bleed ball capsules for each of these three clutches that may not be seating properly. If the unit originally came in with bad pump rings or converter clutch failure, debris may be lodged in the capsule preventing the air bleed ball from seating causing a leak in the circuit (See Figure 1).

CORRECTION: The air bleed capsule can be flushed out with air and mineral spirits. When done, place drums on to an assembled pump and air check to ensure that the balls seat with pressure.

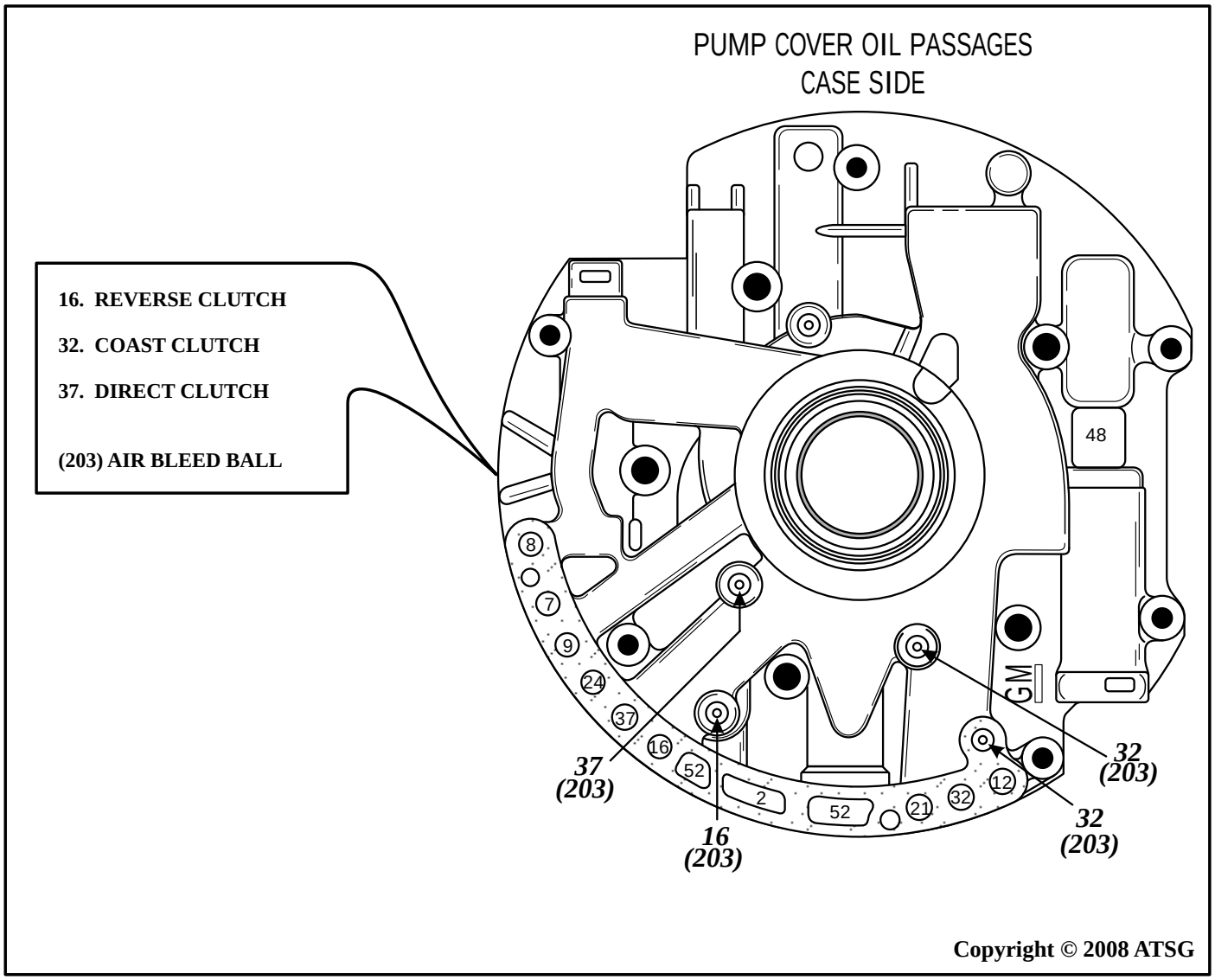


Figure 1

5L40E
DELAYED OR BIND UP IN REVERSE
FLARE OR BIND UP INTO 4th

COMPLAINT: The vehicle owner may complain of a delayed reverse and/or a flare 3-4 shift. In some cases a bind up in reverse or on the 3- 4 shift may be noticed. The unit may failsafe with an incorrect 4th gear ratio code.

CAUSE: Pump rings used to seal reverse clutch and direct clutch oil pressure are known to develop excessive wear causing their respective clutch to slip or to allow fluid pressure to cross leak into the incorrect passage (Figure 2). The middle ring seems to be most prone to wear. This problem is usually attributed to pump misalignment. Pump alignment is critical. The pump is not a full circle which can allow misalignment if care is not taken.

CORRECTION: Replace seal rings and parts as necessary and align the pump. Inspect for high line pressure problems and correct. Inspect for direct clutch drum bushing wear and excessive end play which can accelerate ring wear and repair or adjust as necessary. In some cases the edges of the ring grooves in the aluminum drum support of the cover are rough and cut into the ring. Carefully dress the sharp edges of the ring groove with a fine file.

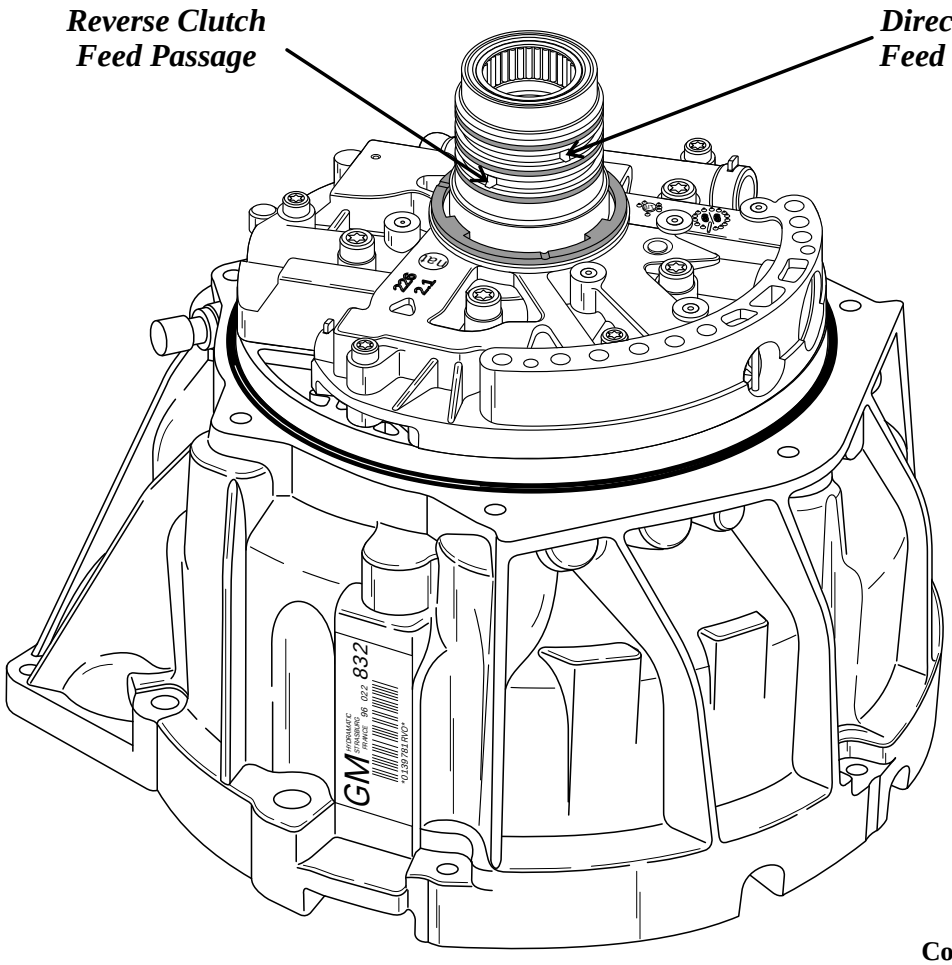
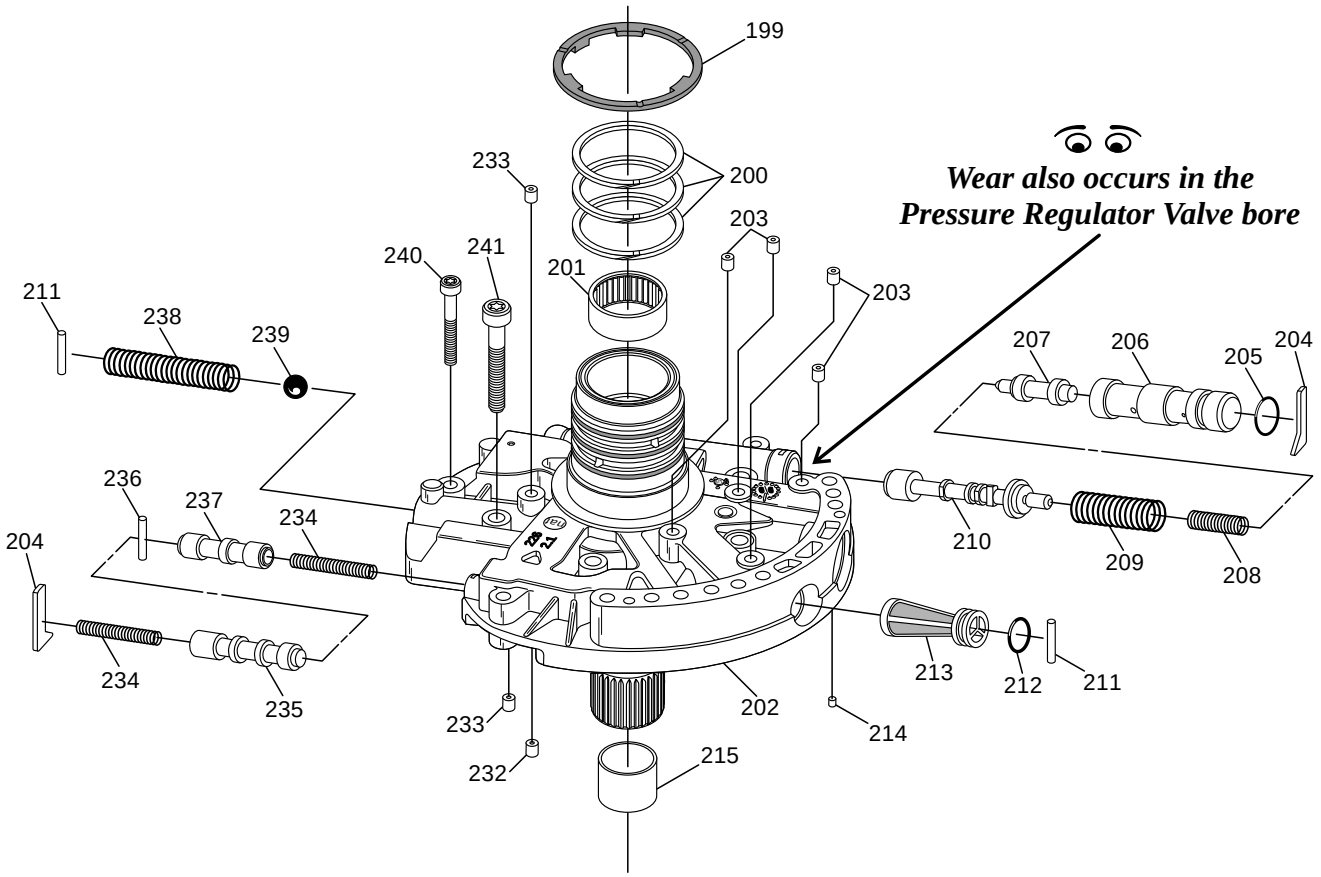


Figure 2

5L40E
DELAYED OR BIND UP IN REVERSE
FLARE OR BIND UP INTO 4th

OIL PUMP COVER ASSEMBLY EXPLODED VIEW



199 PUMP COVER TO REVERSE DRUM THRUST WASHER (SELECTIVE)
200 REVERSE/DIRECT CLUTCH SCARF-CUT SEAL RINGS
201 CAGED NEEDLE BEARING (PUMP COVER TO INPUT SHAFT)
202 OIL PUMP COVER ASSEMBLY
203 BALL CAPSULE ASSEMBLY (4)
204 VALVE BUSHING RETAINER
205 LINE PRESSURE BOOST VALVE BUSHING "O" RING SEAL
206 LINE PRESSURE BOOST VALVE BUSHING
207 LINE PRESSURE BOOST VALVE
208 LINE PRESSURE BOOST VALVE SPRING
209 PRESSURE REGULATOR VALVE SPRING
210 PRESSURE REGULATOR VALVE
211 OIL PUMP COVER RETAINING PIN
212 OIL PUMP COVER SCREEN ASSEMBLY "O" RING SEAL
213 OIL PUMP COVER SCREEN ASSEMBLY
214 BRASS ORIFICE CUP PLUG
215 STATOR SHAFT TO INPUT SHAFT BUSHING
232 ORIFICED SLEEVE ASSEMBLY
233 ORIFICED CUP PLUG (2)
234 TCC CONTROL/ENABLE VALVE SPRINGS (2 SAME)
235 TCC CONTROL VALVE
236 TCC ENABLE VALVE RETAINING PIN
237 TCC ENABLE VALVE
238 LINE PRESSURE RELIEF BALL SPRING
239 LINE PRESSURE RELIEF BALL
240 OIL PUMP COVER RETAINING BOLT 6 X 1.25 X 40 (6)
241 OIL PUMP COVER RETAINING BOLT 8 X 1.25 X 40 (5)

Figure 3

5L40E
NO CONVERTER CLUTCH OPERATION

COMPLAINT: After a rebuild, the transmission may exhibit a no converter clutch apply problem possibly producing code P0741 "converter clutch slippage detected."

CAUSE: Some early pumps utilize a single TCC Valve that can be placed into the pump incorrectly. The valve must go into the pump first followed by the spring and retainer. If the spring is placed into the pump first followed by the valve and retainer, a no converter clutch apply problem will occur.

CORRECTION: Install the TCC valve lineup correctly as shown in figure 4.

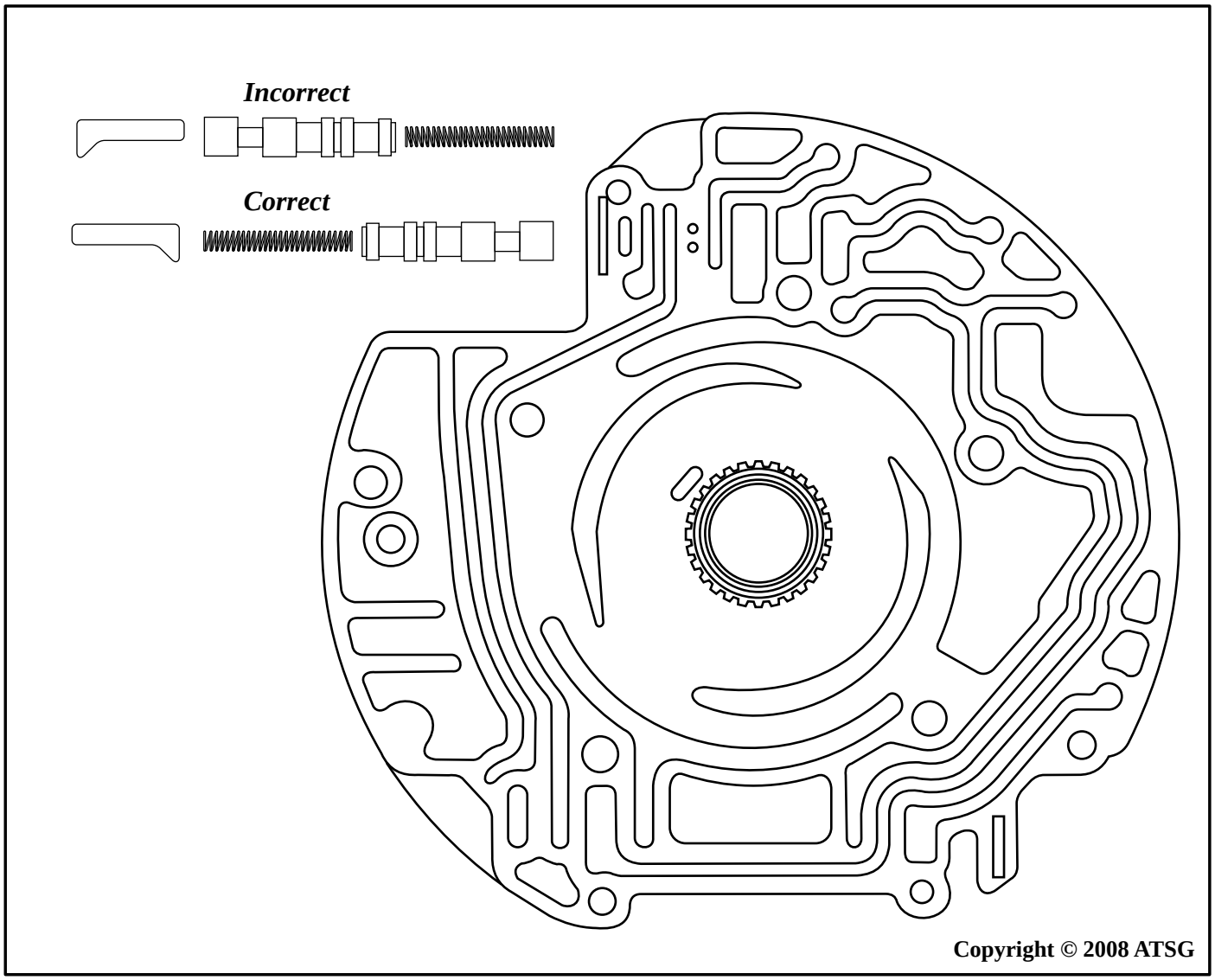


Figure 4

5L40E BMW(A5S 360R)

DELAYED PARK TO DRIVE ON COLD START

(BMW SI 24 07 03)

COMPLAINT: BMW vehicles may exhibit a 2 to 30 second delayed engagement from Park into Drive during the first cold start in the morning.

Models affected:
325iA, 325xiA, 325xiTA, 330xiA, X5 3.0iA from 10/02 up to 12/03
325CiA, 325CicA, 330iA, 330CiA, 330CicA, 330i (HP), 325iTA from 03/03 up to 12/03

CAUSE: Insufficient pressure boost for the C1 forward clutch during the first Park to Drive shift after extended (overnight) parking.

CORRECTION: Reprogram EGS control module using manual determination mode with DIS/GT1 CD 37 "SGC V2.1" online update (released 5/13/04), or higher.

Important: *It is no longer necessary to repair or replace the automatic transmission assembly for this type of complaint.*

Many thanks to Luis Rodrigues from Mister Transmission in Erin Mills, Ontario, Canada.

GM 5L40E / BMW A5S 360/390R

5TH GEAR RATIO ERROR CODES

COMPLAINT: The MIL lamp is illuminated with code 55 or P0735 stored for a "Gear Ratio Error in 5th Gear". There may be no complaint of slipping or drive ability problems.

CAUSE: The Direct/Reverse clutch housing has cracked in the thrust washer area where it contacts the oil pump cover. (Refer to Figure 5 Below)

CORRECTION: Change the housing. Also, pay close attention to the OD accumulator, the seal sleeve in the case between the valve body and OD/INT clutch housing and the # 12 check ball as these are other known causes.

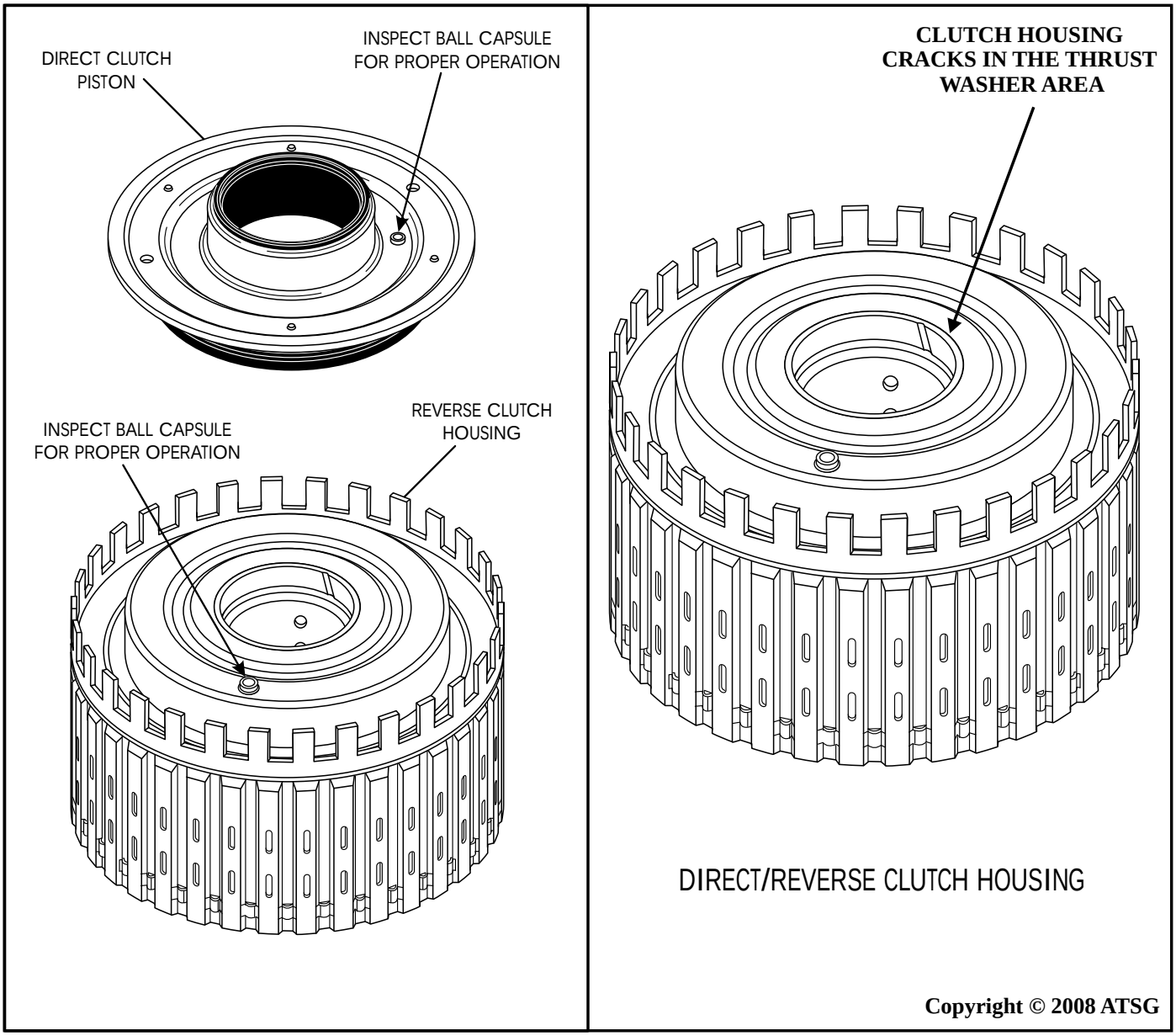


Figure 5

GM 5L40E / BMW A5S 360/390R
1-2 BIND UP
(SAFETY MODE VALVE STRATEGY)

COMPLAINT: Vehicles equipped with the 5L40E transmission may suddenly exhibit a bind up on the 1-2 shift.

CAUSE: One cause may be that the Safety Mode Valve in the valve body is stuck in an un-stroked position. In first gear, this Safety Mode Valve is held closed by spring tension. This allows line pressure to pass through the valve into the Line Safety Mode circuit which then strokes the 4-5 Shift Valve. The 4-5 Shift Valve then directs 123 oil into the 123 Braking circuit applying the L/R Clutch with regulated line pressure for engine breaking in first gear. (Figure 6)

When a 1-2 shift occurs, 1-2 signal oil which becomes memory pilot pressure is suppose to stroke the Line Safety Mode Valve blocking the line pressure feed going to the 4-5 Shift Valve. If the Safety Mode Valve can not stroke, the L/R Clutches remain on and a bind up on a shift into second gear will occur. (Figure 7)

CORRECTION: Clean and free up the Safety Mode Valve. Determine what other problems may have occurred to cause enough debris to stick the valve and repair as necessary.

SAFETY VALVE STRATEGY:

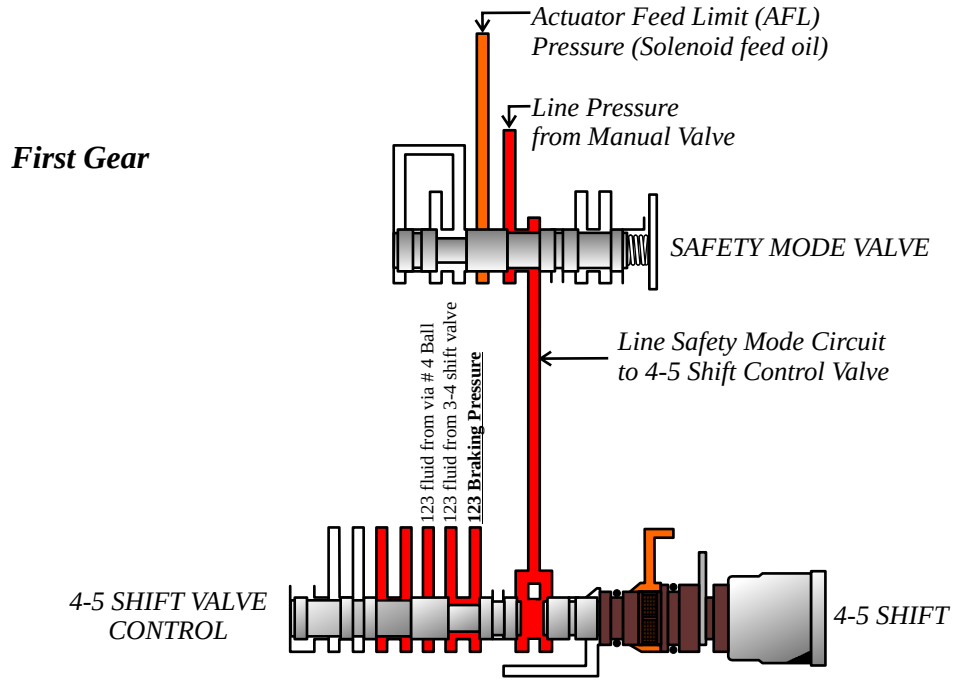
The Safety Mode Valve strategy is to allow for two failsafe gears, 4th and 5th. Should a fault occur while the vehicle is driving, all solenoids will turn Off and the vehicle will failsafe to 5th gear. But with a fault immediately present after an ignition cycle, the vehicle will have 4th gear failsafe.

The Safety Mode Valve is stroked by 1-2 signal oil when a shift into second occurs. When this happens, Actuator Feed Limit Pressure (Solenoid feed oil) is allowed to enter the Memory Circuit which keeps the Safety Mode Valve in a stroked position. (See Figures 8 and 9) This also blocks line pressure from going to the 4-5 shift valve though the Line Safety Mode Circuit.

Once the Safety Mode Valve is stroked it remains stroked throughout 2nd, 3rd, 4th and 5th gear. (See Figures 10 and 11) When a shift into 5th occurs, the 4-5 solenoid turns off and 4-5 oil enters the Overdrive Clutch Feed 2 circuit applying the Overdrive Clutch. The Coast Clutch is exhausted. (Figure 11) And this is exactly what takes place when the vehicle failsafes to 5th while driving. (Figure 12)

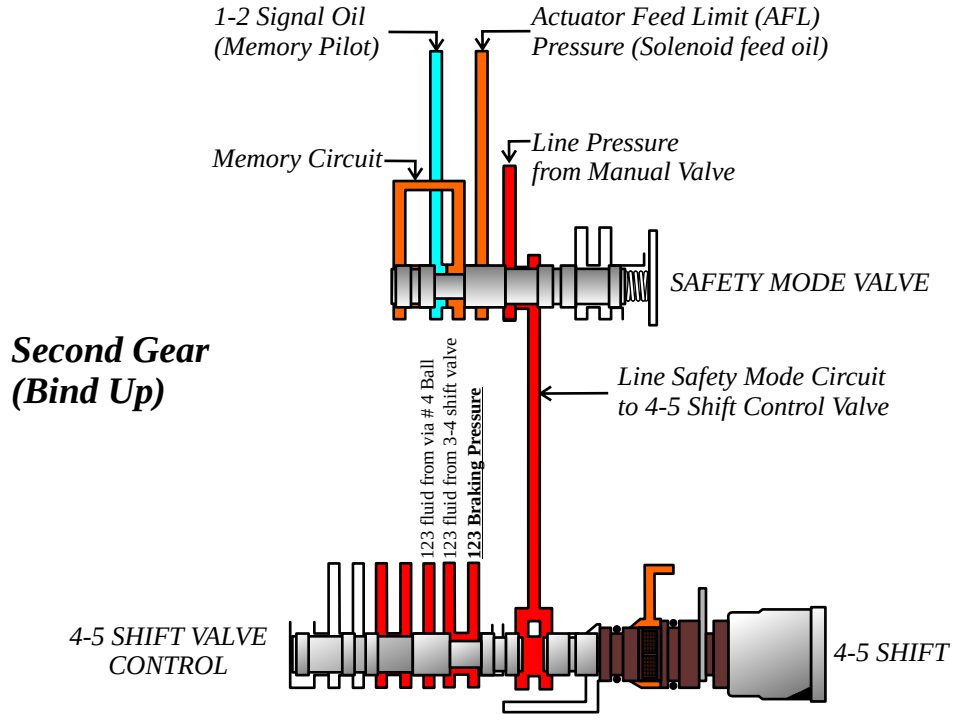
But once the vehicle stops and the ignition is cycled, the Safety Mode Valve is forced closed by spring pressure. Line pressure passes through the valve and into the Line Safety Mode Circuit where it strokes the 4-5 Shift Control Valve. With all solenoids Off, this blocks 4-5 oil from entering the Overdrive Clutch Feed 2 circuit placing the vehicle into a 4th gear failsafe. (See Figure 13)

NOTE: This bulletin explains that if the Safety Mode Valve should stick in an un-stroked position a bind up in 2nd will occur. But if this valve should get stuck in a stroked position, a loss of engine breaking in first gear may be noticed. If the vehicle failsafes, it will have 5th gear even after an ignition cycle.



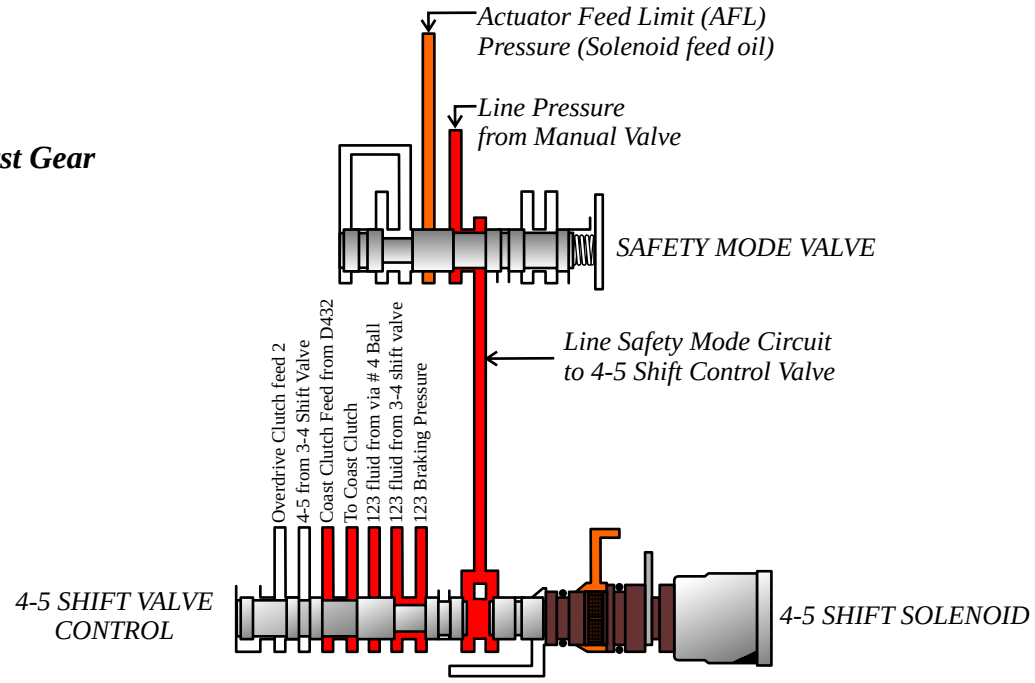
In 1st gear, the Safety Mode Valve directs line pressure into the Line Safety Mode Circuit where it strokes the 4-5 Shift Valve. The 4-5 Shift Valve then directs 123 Fluid into the 123 Braking Circuit where it applies the L/R Clutches for engine breaking in 1st gear.

Figure 6



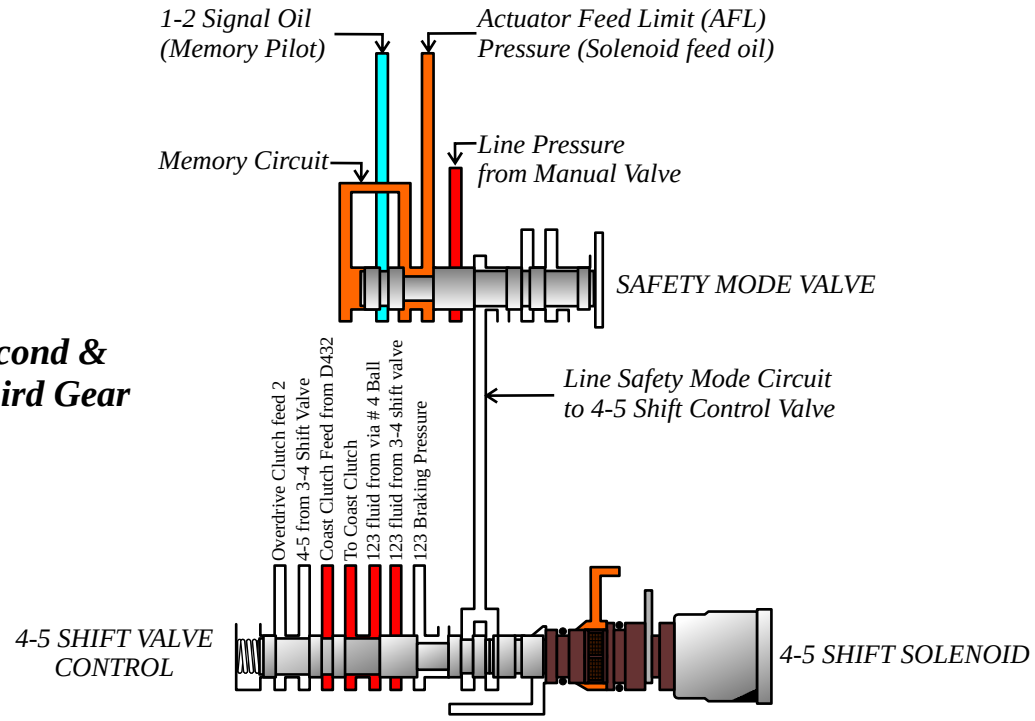
If the Safety Mode Valve cannot stroke on a 1-2 up shift, the L/R clutch stays applied causing the bind up into 2nd.

Figure 7



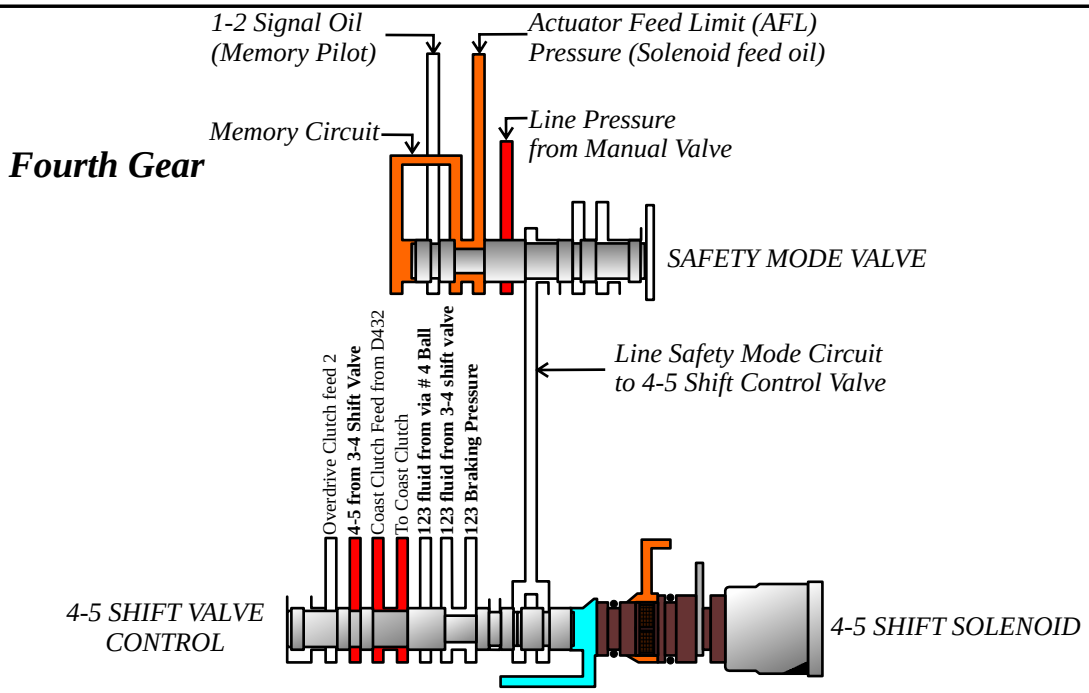
The Safety Mode Valve allows for 5th gear failsafe and 4th gear failsafe. If a fault occurs during driving conditions 5th gear failsafe will occur. After the ignition is cycled, 4th gear will be the failsafe gear.

Figure 8



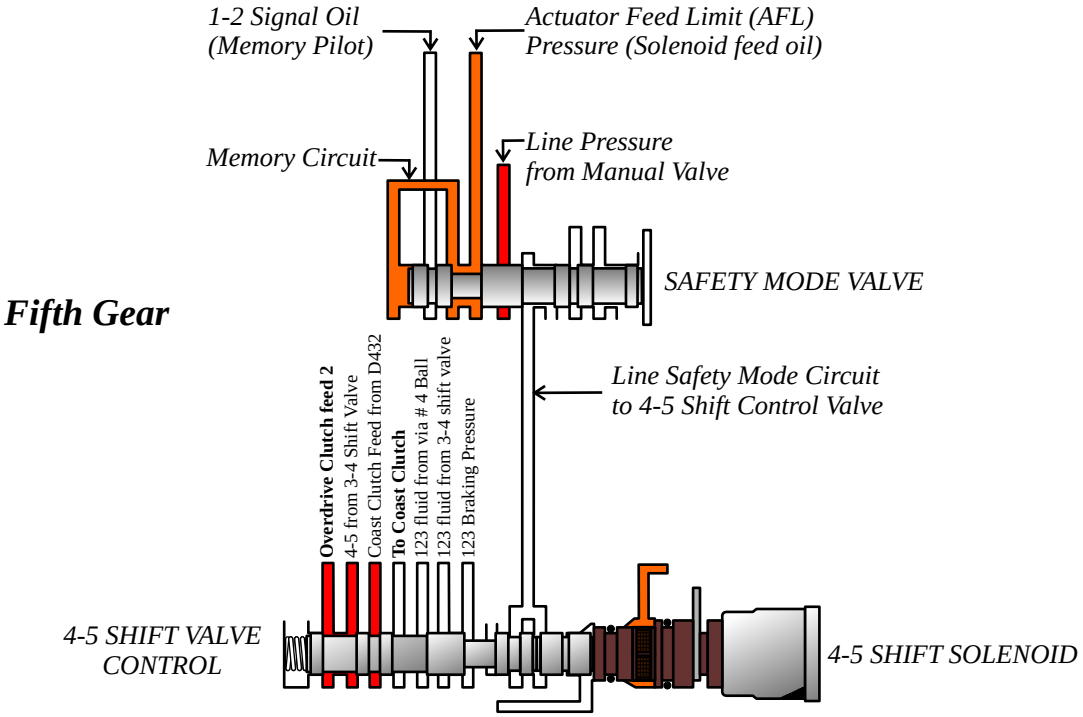
When a shift into second occurs, 1-2 signal oil (memory pilot) is sent to stroke the Safety Mode Valve. When the valve is stroked, actuator feed limit fluid is used to hold the valve in a stroked position. Should all the solenoids turn off due to a fault, this valve is held in a stroked position which will allow for 5th gear failsafe. When the ignition is cycled, the valve will un-stroke making 4th gear the failsafe gear.

Figure 9



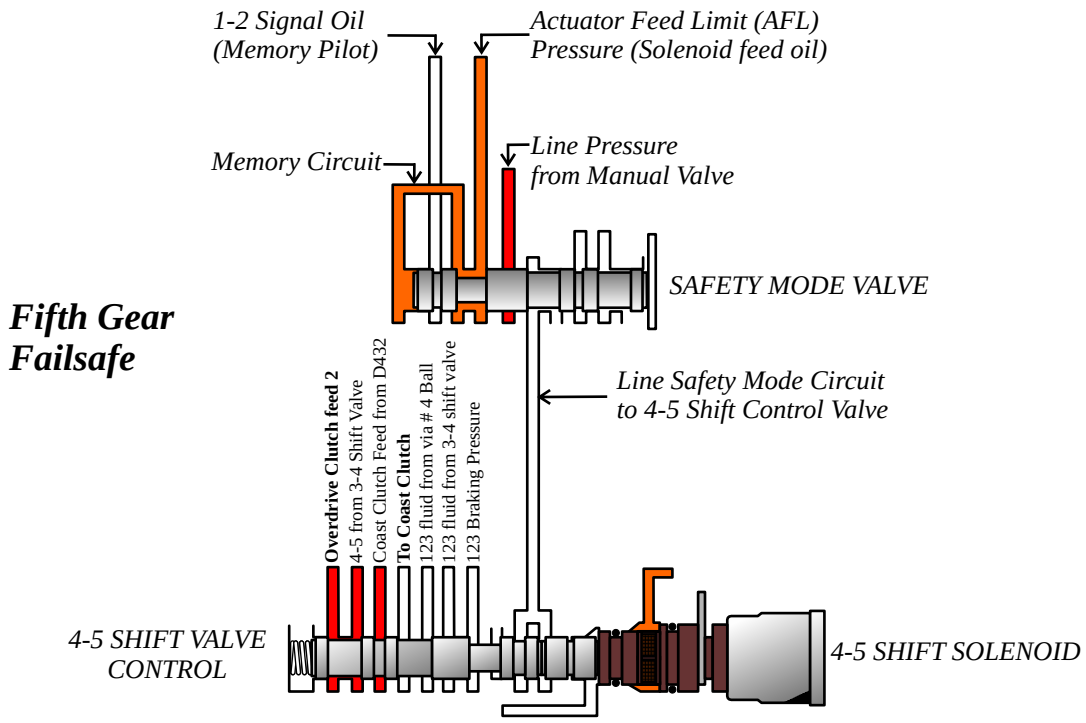
When a shift into 4th is made, the 1-2 Shift Solenoid turns Off causing the 1-2 signal oil to be exhausted This causes the 3-4 shift valve to un-stroke simultaneously exhausting 123 fluid and supplying 4-5 oil pressure at the 4-5 Shift Control Valve. The 4-5 Shift solenoid turns on stroking the 4-5 Shift Control Valve blocking 4-5 oil from entering the Overdrive Clutch Feed 2 circuit. The Safety Mode Valve remains stroked by AFL fluid called the Memory Circuit.

Figure 10



When a shift into 5th occurs, the 4-5 solenoid turns off and 4-5 oil enters the Overdrive Clutch Feed 2 circuit applying the Overdrive Clutch. The Coast Clutch is exhausted and the Safety Mode Valve remains stroked.

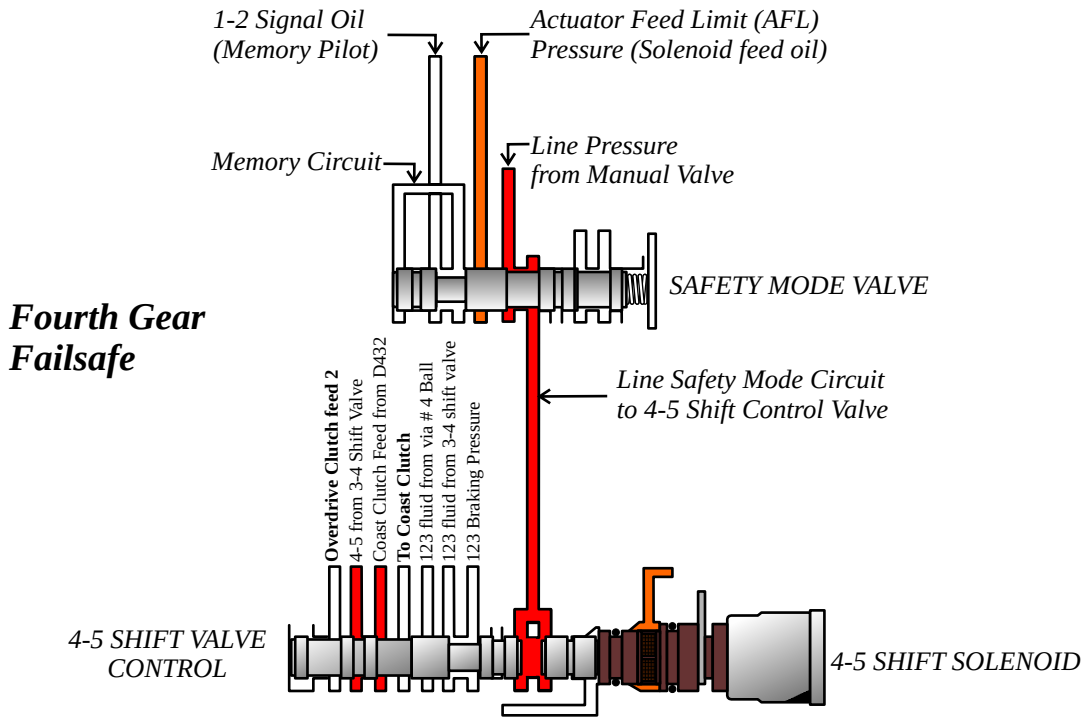
Figure 11



Fifth Gear Failsafe

When a fault is detected while the vehicle is being driven, all solenoids turn off and 5th gear is the failsafe gear.

Figure 12



Fourth Gear Failsafe

After an ignition cycle of a failsafed vehicle, the Safety Mode Valve un-strokes where the valve sends line pressure to stroke the 4-5 Shift Control Valve. This blocks 4-5 oil from entering the Overdrive Clutch Feed 2 circuit and now the vehicle will have a 4th gear failsafe.

Figure 13

GM 5L40E / BMW A5S 360/390R
FALLING OUT OF 5th OR NO 5th AT ALL

COMPLAINT: Before and/or after a rebuild, the transmission may exhibit a sudden falling out of 5th gear or no 5th at all. This condition may be more evident when operating temperature increases and a 5th gear ratio error fault code may be stored.

CAUSE: The Actuator Feed Limit (AFL) valve has developed sufficient bore and valve wear that it causes a pressure drop in the memory pilot circuit. This causes the Safety Mode valve to be closed by spring tension. When the valve closes, line pressure passes through the valve and into the 4-5 shift valve circuit forcing the valve into a 4th gear position. (See Figures 14 and 15) The AFL bore and valve can wear to a point where it prevents 5th gear completely.

CORRECTION: Repair the AFL valve/bore wear with a reamer and sleeve kit or replace the valve body.

Sonnax

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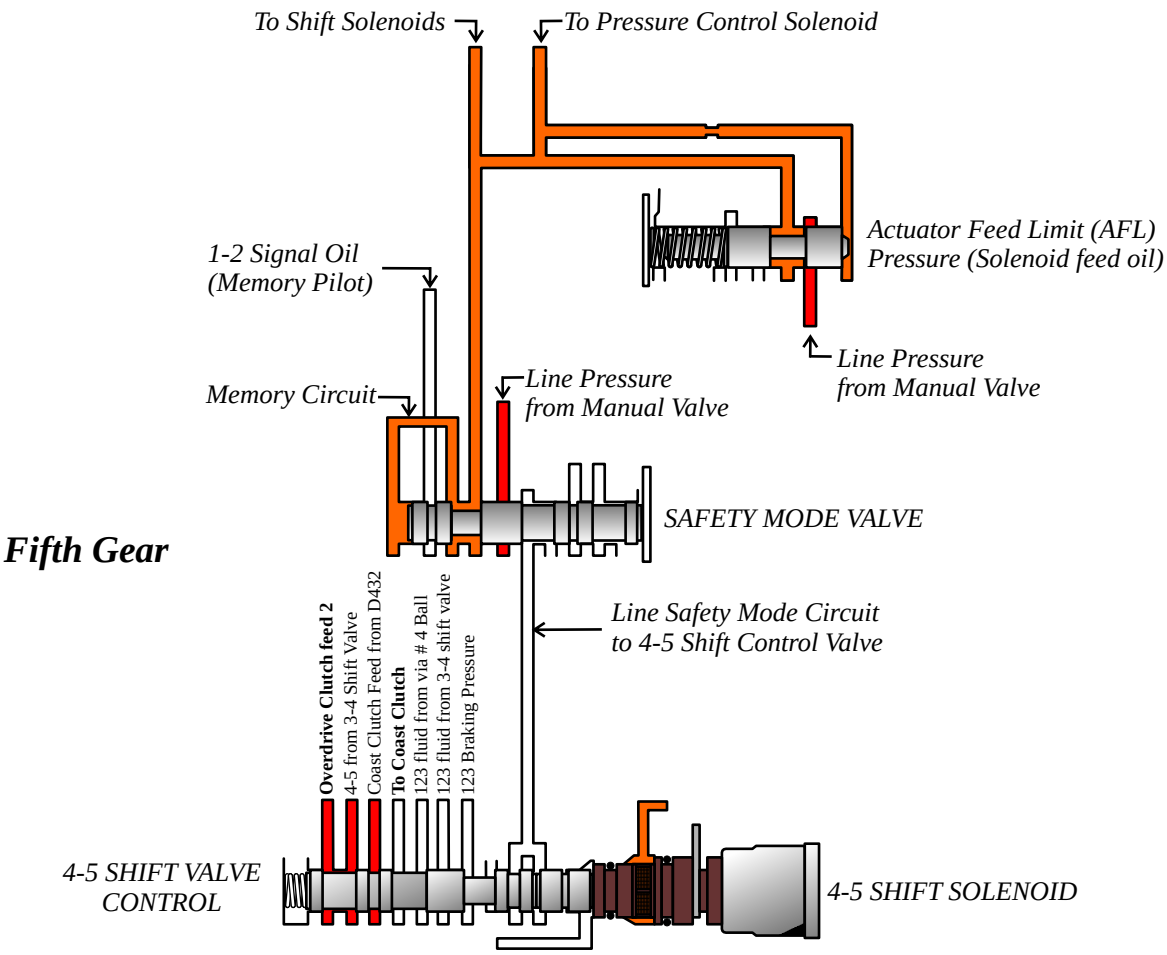
GM 5L40E / BMW A5S 360/390R
FALLING OUT OF 5th OR NO 5th AT ALL

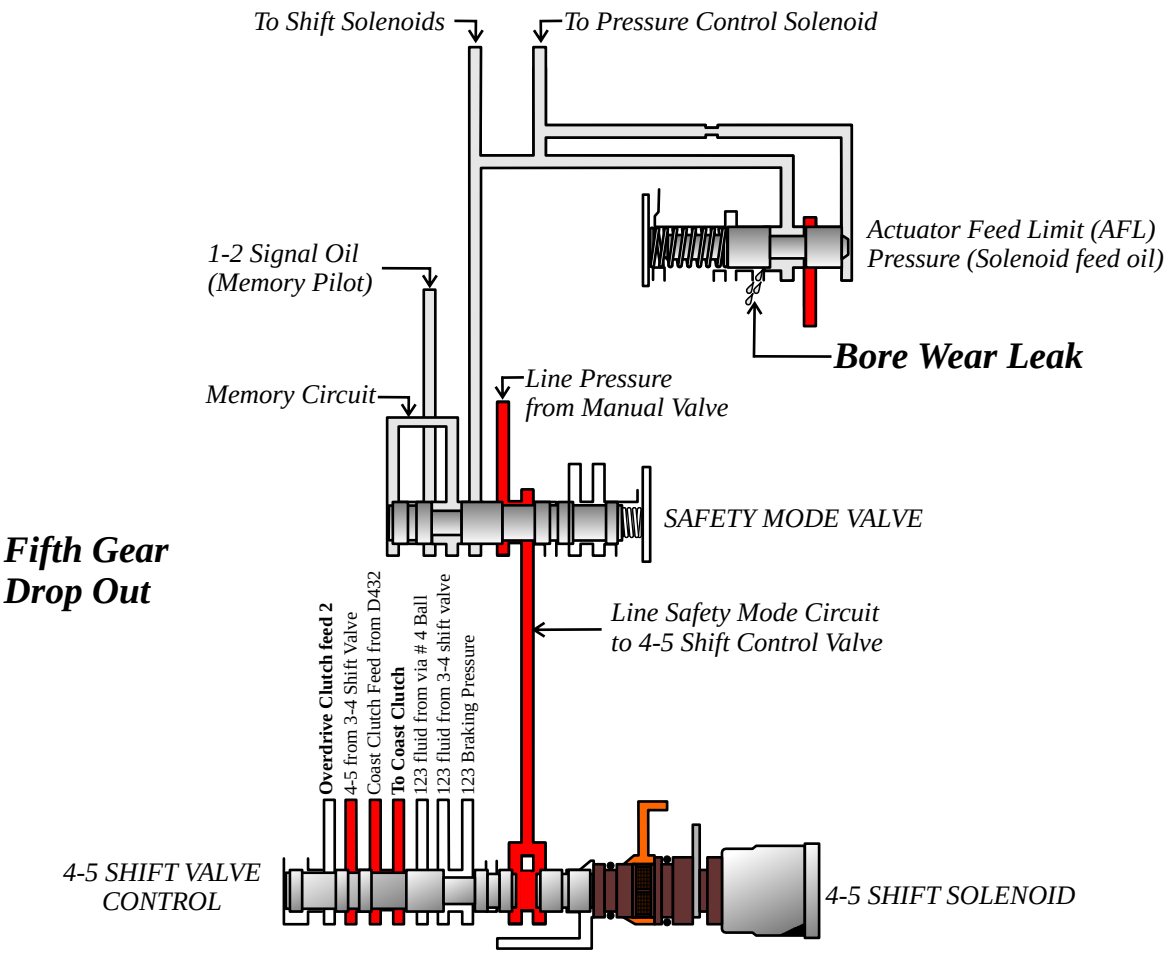


When a shift into 5th occurs, the 4-5 solenoid turns off and 4-5 oil enters the Overdrive Clutch Feed 2 circuit applying the Overdrive Clutch. The Coast Clutch is exhausted and the Safety Mode Valve remains stroked.

Figure 14

WIT

GM 5L40E / BMW A5S 360/390R
FALLING OUT OF 5th OR NO 5th AT ALL



When the Actuator Feed Limit (AFL) Valve develops marginal bore wear, a pressure drop occurs in the Memory Circuit causing the Safety Mode Valve to close by spring tension. This allows line pressure to pass through the Safety Mode Valve to the 4-5 Shift Control Valve closing the valve and causing a " 5th gear fall out" complaint. The AFL valve/bore can develop enough wear to even prevent 5th from occurring at all.

Figure 15

GM TOW/HAUL MODE

TOW/HAUL SWITCH MALFUNCTION

COMPLAINT: Tow/Haul Mode inactive, light on dash will not illuminate when switch is activated on shifter handle. This condition could cause code B2722 to set. In some diagnostic information, the Tow/Haul Mode Switch is referred to as a "Preference Switch".

CAUSE: A break or short in wiring in the area where the shifter arm pivots on steering column. Possible Tow/Haul Mode switch failure.

CORRECTION: Repair the wiring or replace the switch. The switch and wiring are an integral part of the shift lever, it comes as an entire assembly.

SERVICE INFORMATION:

When trying to find a wire schematic either in engine performance or transmissions there are none to be found whether looking in a factory manual, Alldata or Mitchell On Demand. The wire diagrams are located in the Body Control Module schematics only, (See Figure 1). To test the Tow/Haul switch function on a 1999 Chevrolet Silverado 1500 at the Body Control Module, check for voltage on the Light/Blue wire at pin B12 on the BCM. Do not confuse this wire with the Light/Blue Park Brake Switch Signal wire located on pin B10. Use the connector view in Figure 2 to identify the correct connector pin number. With the key on, engine off, there should be 12 volts present at terminal B12. If there is no voltage present, check for a short to ground in the area of the steering column where the shifter arm pivots. If voltage is present, toggle the Tow/Haul switch to see if the voltage drops to zero and back to 12 volts, this will verify the integrity of the switch. If the voltage doesn't change then there is either a break in the wiring to the switch or the switch itself may be bad. At this point the Light Blue wire at pin B12 can be shorted to ground, to verify that the Tow/Haul light is working correctly in the dash.

Check the Tow/Haul parameter on the scan tool for a state of change as the switch is cycled, the scan tool parameter change of state should match the DVOM display.

Tow/Haul Switch & Shift Lever assembly (sold as one assembly) 26075107

GM TOW/HAUL MODE
TOW/HAUL SWITCH MALFUNCTION

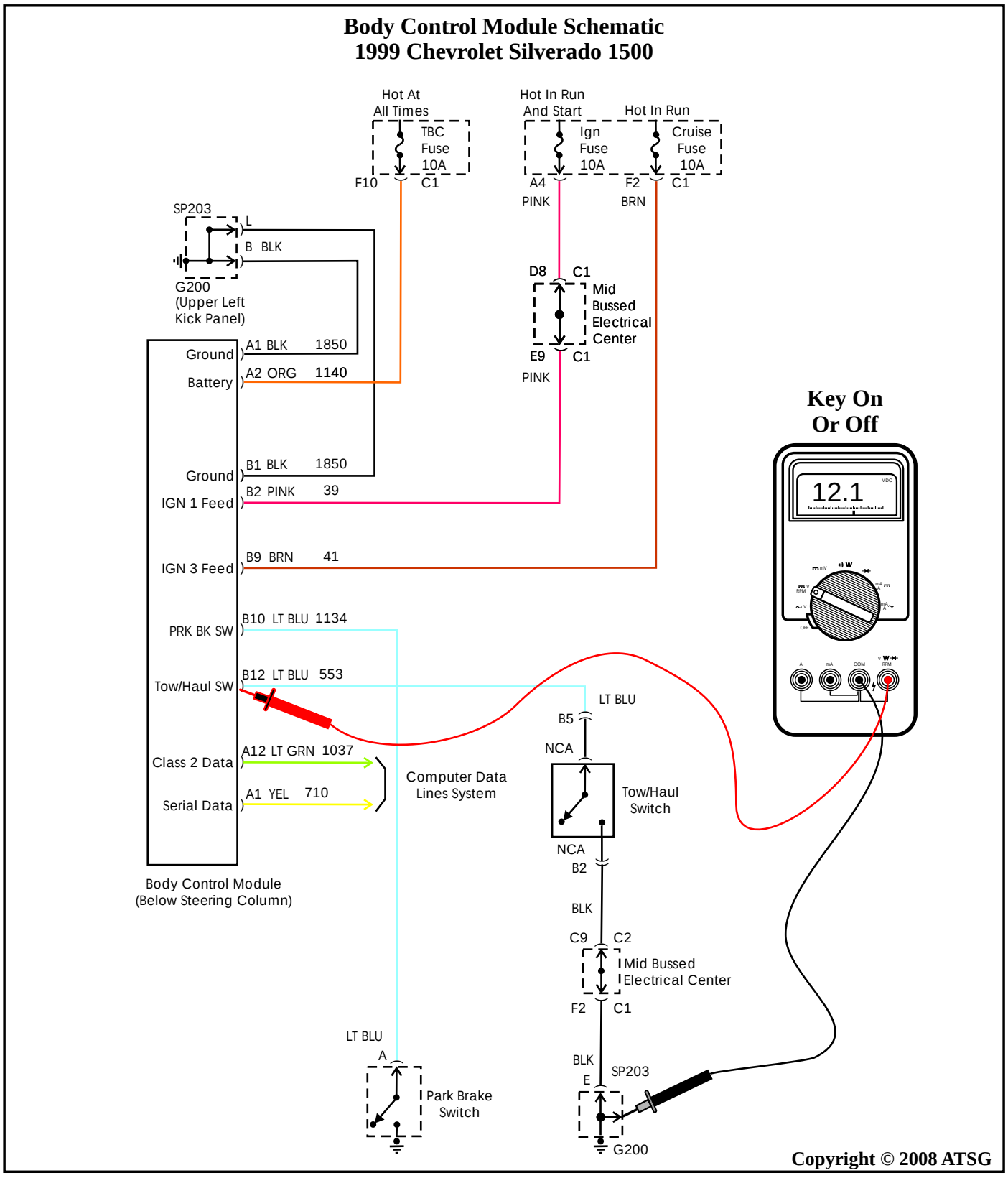
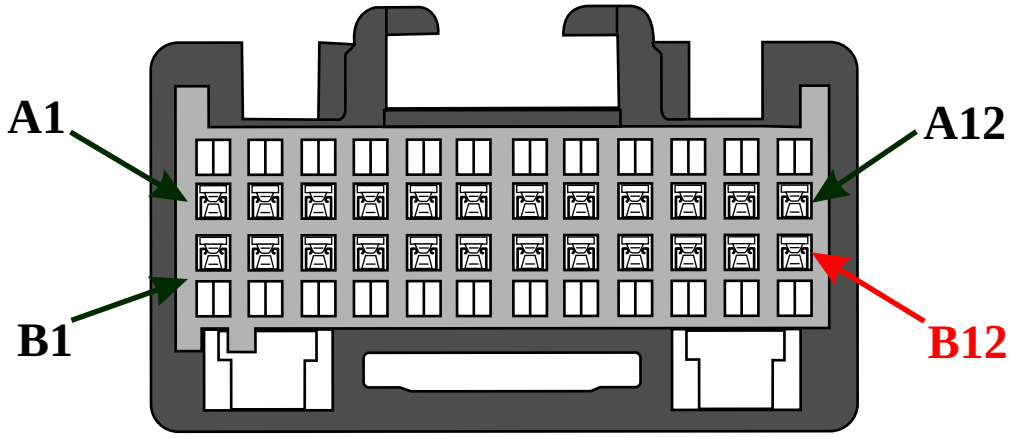


Figure 1

GM TOW/HAUL MODE
TOW/HAUL SWITCH MALFUNCTION

Body Control Module Connector



Connector Part Information		.12160778 .24 Way F Micro	
Pin	**Wire Color**	**Circuit No.**	**Function**
B9	BRN	41	Fused Ignition 3 Output
B10	LT BLU	1134	Park Brake Switch Signal
B11	BLK/WHT	238	Seat Belt Switch Signal
B12	LT BLU	553	Transmission Shift Select Switch Circuit

Figure 2

GM/BMW 5L40E

HARSH OR SLIPPING SHIFTS

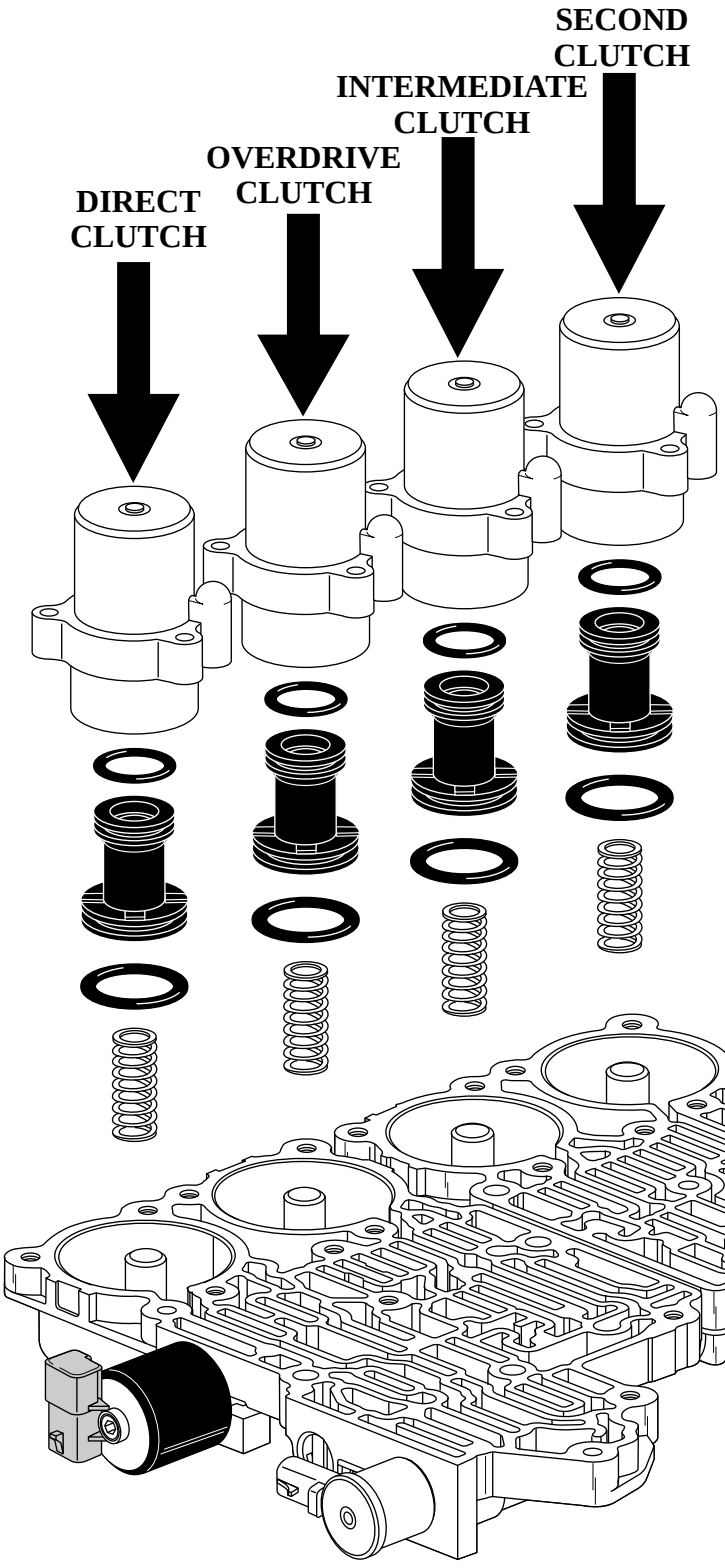
COMPLAINT: After overhaul, the transmission has either harsh or soft shifts. A line pressure check reveals normal operation and there is no valve wear in the valve body.

CAUSE: The accumulator assemblies have been mis-assembled.

CORRECTION: Accumulator housings, pistons and springs are model dependant, therefore, housings, pistons and springs will have varied dimensions depending on which vehicle that 5L40E is in.
The accumulator positions are identified in Figure 1, however, the same accumulator assembly may be used in a different location depending on vehicle model. There are combinations that will use the same accumulator housing and piston, but the spring is dimensionally different.
The two valve bodies that the ATSG Tech Department inspected has the same valve body casting numbers and the same spacer plate ID numbers, however, each valve body has a different engraved number on it, the location of which is seen in Figure 3. The measurements that were taken is also seen in Figure 3.

The measurement charts in Figures 4 and 5 are the results of the two valve bodies with different engraved numbers.
The blank chart in Figure 6 is for the technician to copy and record engraved numbers and measurements that are different than what is seen in the charts.

5L40E ACCUMULATOR IDENTIFICATION



BE SURE TO KEEP ACCUMULATOR HOUSINGS, PISTONS & SPRINGS IN THEIR ORIGINAL LOCATIONS

Figure 1

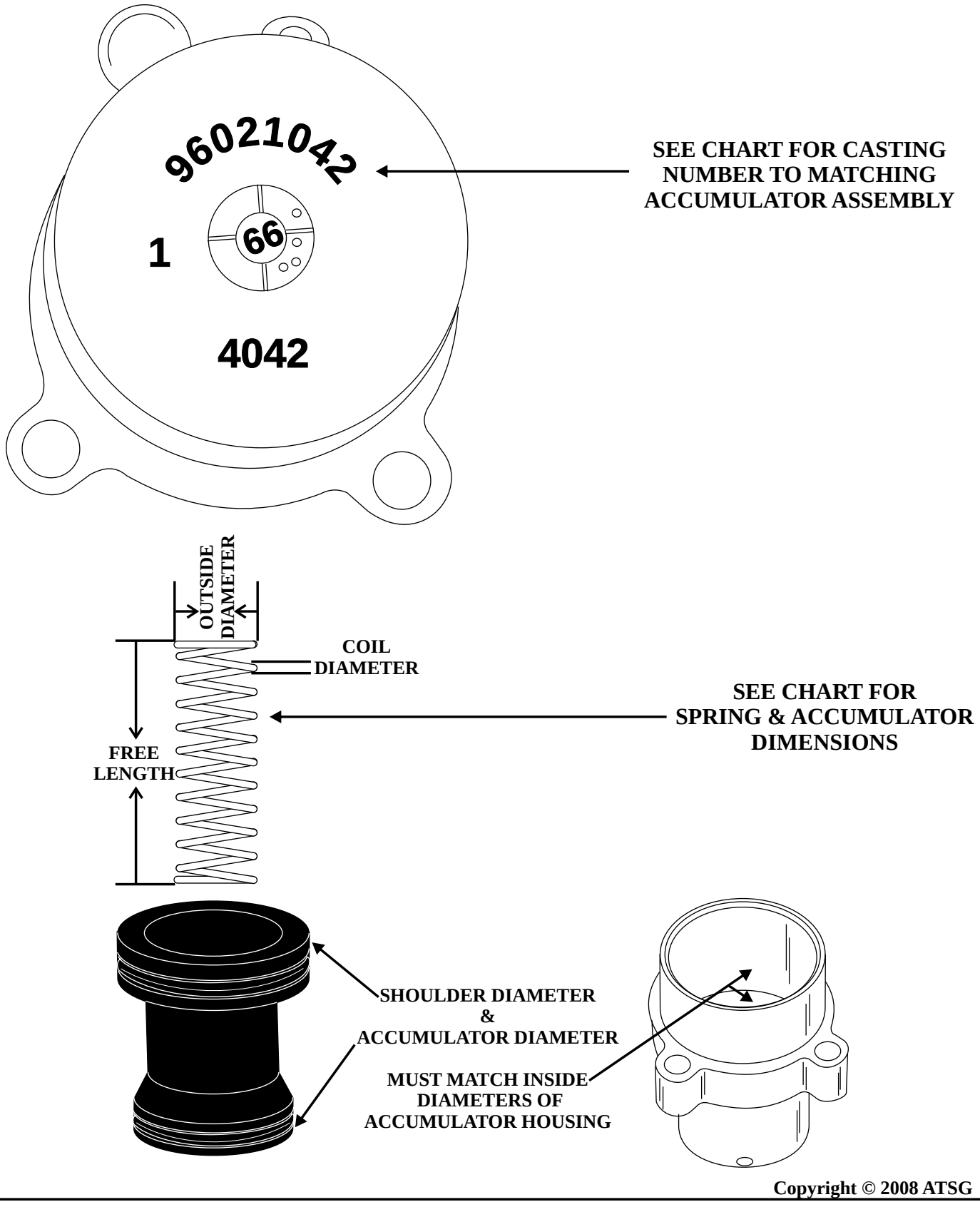

96021042
1
66
4042
SEE CHART FOR CASTING NUMBER TO MATCHING ACCUMULATOR ASSEMBLY
OUTSIDE DIAMETER
COIL DIAMETER
SEE CHART FOR SPRING & ACCUMULATOR DIMENSIONS
FREE LENGTH
SHOULDER DIAMETER & ACCUMULATOR DIAMETER
MUST MATCH INSIDE DIAMETERS OF ACCUMULATOR HOUSING
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Figure 2

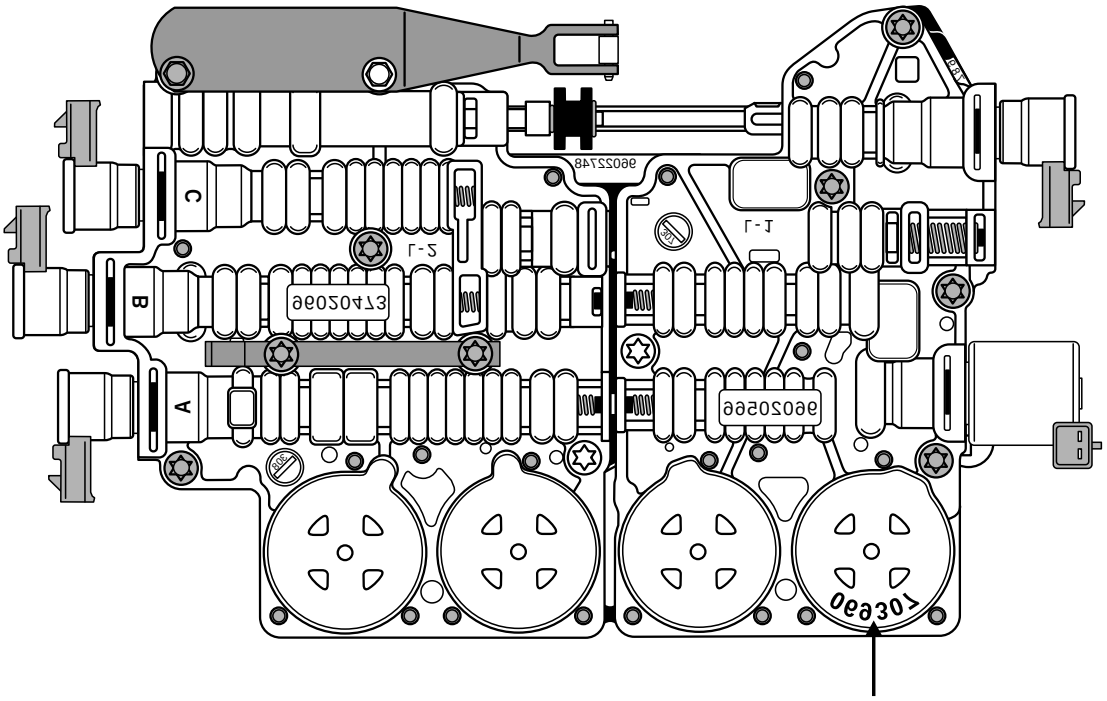


Figure 3

5L40E ACCUMULATOR ASSEMBLY IDENTIFICATION CHART				
ENGRAVED NUMBER ON VALVE BODY - 045501				
PISTON & SPRING DIMENSIONS	**DIRECT CLUTCH ACCUMULATOR HOUSING # 96021042**	**OVERDRIVE CLUTCH ACCUMULATOR HOUSING # 96022005**	**INTERMEDIATE CLUTCH ACCUMULATOR HOUSING # 92021042**	**SECOND CLUTCH ACCUMULATOR HOUSING # 96020762**
PISTON SHOULDER DIAMETER	1.648" (41.86MM)	1.648" (41.86MM)	1.648" (41.86MM)	1.648" (41.86MM)
PISTON ACCUM. DIAMETER	1.336" (33.93MM)	1.410" (35.81MM)	1.336" (33.93MM)	1.277" (32.44MM)
SPRING FREE LENGTH	2.242" (56.95MM)	2.202" (55.93MM)	2.234" (56.74MM)	2.380" (60.45MM)
SPRING OUTSIDE DIAMETER	0.734" (18.65MM)	0.734" (18.65MM)	0.734" (18.65MM)	0.734" (18.65MM)
SPRING COIL DIAMETER	0.080" (2.032MM)	0.082" (2.083MM)	0.090" (2.286MM)	0.094" (2.388MM)

Figure 4

5L40E ACCUMULATOR ASSEMBLY IDENTIFICATION CHART				
ENGRAVED NUMBER ON VALVE BODY - 069307				
PISTON & SPRING DIMENSIONS	**DIRECT CLUTCH ACCUMULATOR HOUSING # 96022005**	**OVERDRIVE CLUTCH ACCUMULATOR HOUSING # 96021042**	**INTERMEDIATE CLUTCH ACCUMULATOR HOUSING # 96021042**	**SECOND CLUTCH ACCUMULATOR HOUSING # 96020762**
PISTON SHOULDER DIAMETER	1.648" (41.86MM)	1.648" (41.86MM)	1.648" (41.86MM)	1.648" (41.86MM)
PISTON ACCUM. DIAMETER	1.410" (35.81MM)	1.336" (33.93MM)	1.336" (33.93MM)	1.277" (32.44MM)
SPRING FREE LENGTH	2.188" (55.58MM)	2.216" (56.29MM)	2.228" (56.59MM)	2.380" (60.45MM)
SPRING OUTSIDE DIAMETER	0.734" (18.65MM)	0.734" (18.65MM)	0.734" (18.65MM)	0.734" (18.65MM)
SPRING COIL DIAMETER	0.080" (2.032MM)	0.090" (2.286MM)	0.090" (2.286MM)	0.090" (2.286MM)

Figure 5

5L40E ACCUMULATOR ASSEMBLY IDENTIFICATION CHART				
ENGRAVED NUMBER ON VALVE BODY -				
PISTON & SPRING DIMENSIONS	**DIRECT CLUTCH ACCUMULATOR HOUSING #**	**OVERDRIVE CLUTCH ACCUMULATOR HOUSING #**	**INTERMEDIATE CLUTCH ACCUMULATOR HOUSING #**	**SECOND CLUTCH ACCUMULATOR HOUSING #**
PISTON SHOULDER DIAMETER				
PISTON ACCUM. DIAMETER				
SPRING FREE LENGTH				
SPRING OUTSIDE DIAMETER				
SPRING COIL DIAMETER				

Figure 6

GENERAL MOTORS 4L80E
NEUTRALS DURING OR AFTER THE UP SHIFT TO 4TH GEAR

COMPLAINT: Before or after overhaul, a GM vehicle equipped with the 4L80E transmission exhibits a complaint of a neutral condition either during the shift to 4th gear, or immediately after the shift.

CAUSE: One cause may be a loss of Actuator Feed Limit (AFL) Valve oil pressure in the valve body, or a leak in the Shift Solenoid B circuit.

The Actuator Feed Limit valve is used to control the amount of solenoid pressure that is fed to Shift Solenoid A, Shift Solenoid B, and the Force Motor/EPC Solenoid. If AFL pressure is inadequate, the solenoids cannot function properly. AFL pressure can be lost because of a worn bore in the Actuator Feed Limit Valve line up, or a damaged or worn O-ring on the Actuator Feed Limit Valve Filter located in the valve body behind the manual valve. A pressure leak in the AFL circuit can lead to reduced pressure at the 2-3 shift valve. If this occurs, the 2-3 shift valve spring may push the valve back into the 1st gear position. This causes the transmission to immediately make a shift back to 1st gear, which feels like neutral because 1st gear is in a over speed condition. The reason an issue with the 2-3 Shift Valve occurs before a problem with the 1-2 Shift Valve is because the Shift Valve Spring is heavier on the 2-3 Shift valve causing the valve to return easier to its resting position. Additionally, a leak in the Shift Solenoid B circuit can create the same condition. The transmission can make a shift back into 1st gear during or immediately after an up shift into 4th. A loss of Shift Solenoid B oil pressure, can be caused by a defective solenoid, a leaking solenoid O-ring or an inadequately sized solenoid feed hole in the separator plate. A scan tool may help the technician diagnose this problem by monitoring the parameters for gear ratio during the up shift into 4th gear. Fourth gear ratio for the 4L80E is .75, while 1st gear ratio is 2.48. If a ratio of 2.48 is indicated on the scan tool when the shift takes place it would indicate the transmission has shifted back to 1st gear. Refer to Figure 1 for a gear ratio and shift solenoid apply chart. Refer to Figure 2 for a partial hydraulic schematic of the Actuator Feed Limit Valve, 2-3 Shift Valve, and Shift Solenoid B circuits.

CORRECTION: Check the AFL bore in the valve body and inspect the O-ring on the AFL filter. Replace the O-ring if it is damaged. If the AFL bore is worn, there is a boring tool and a sleeve and valve kit available from Sonnax as well as a Shift Valve Spring Replacement Kit for both the 1-2 and 2-3 Shift Valves. Refer to Figure 3 for a valve body breakdown showing listed components.

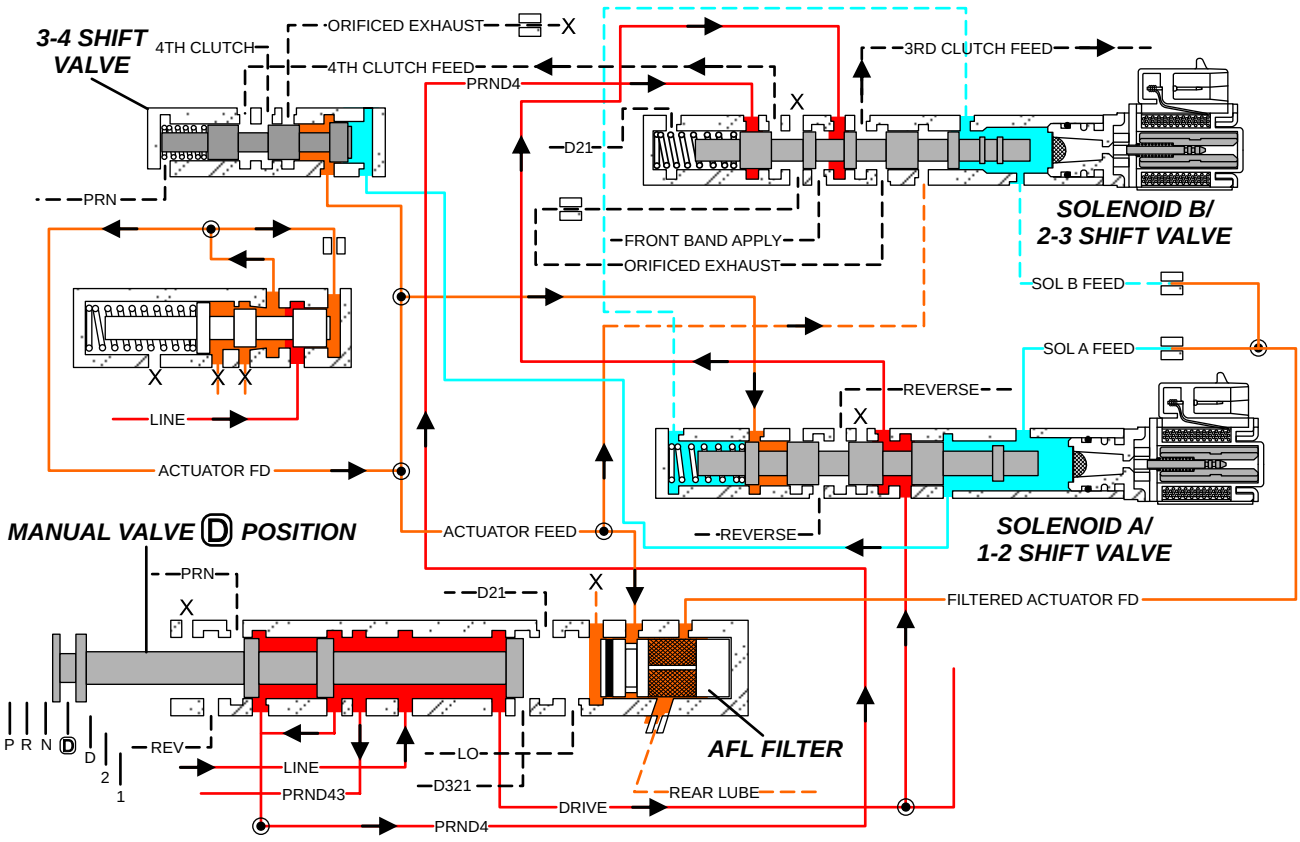
If the AFL valve and the Filter are in good condition, then it may be necessary to replace Shift Solenoid B. In addition, the solenoid feed hole in the separator plate may be enlarged slightly to overcome this condition. Using a .035" drill bit, carefully enlarge solenoid feed hole. ***DO NOT ENLARGE SOLENOID FEED HOLE MORE THAN .035".*** Refer to Figure 4 for Shift Solenoid B feed hole location in the separator plate.

SOLENOID APPLY AND GEAR RATIO CHART

GEAR	SOLENOID A	SOLENOID B	GEAR RATIO
P/N	ON	OFF	2.08
REV	ON	OFF	2.08
1	ON	OFF	2.48
2	OFF	OFF	1.48
3	OFF	ON	1.00
4	ON	ON	.75

Figure 1

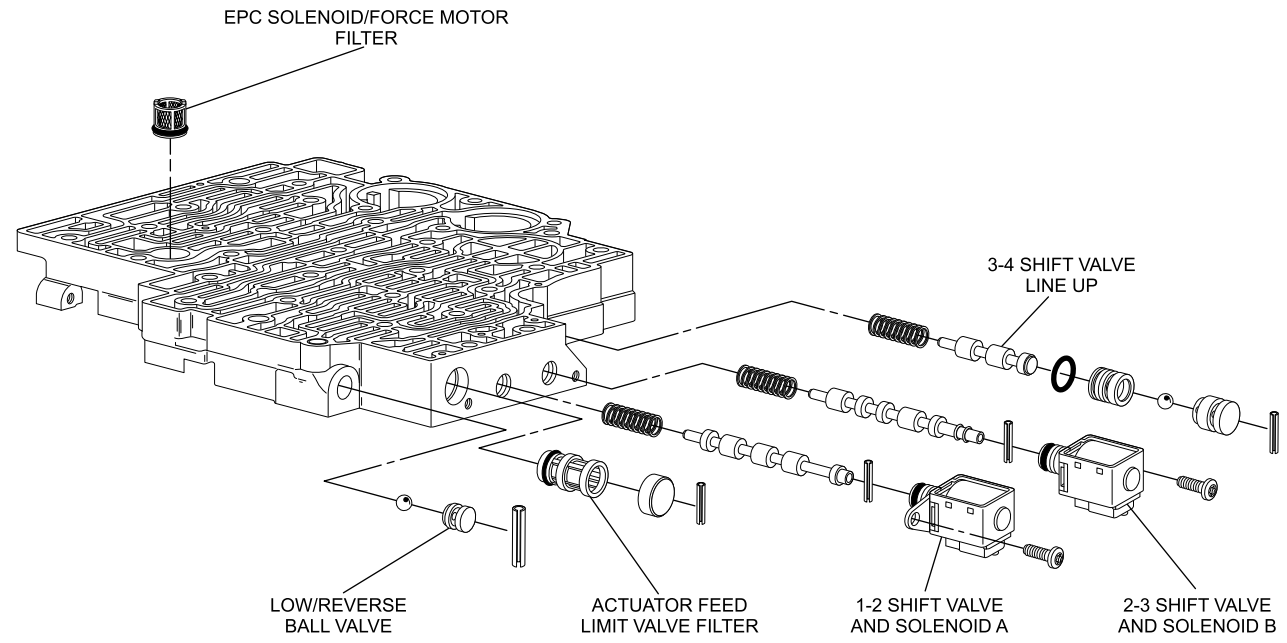
PARTIAL 4TH GEAR HYDRAULIC AFL PRESSURE LOSS



This 4th Gear partial hydraulic diagram depicts AFL pressure loss due to a flattened AFL Filter O-ring and a worn AFL Valve bore. Note the loss of Actuator Feed pressure to the 2-3 Shift Valve and also Sol. B Feed. The 2-3 Shift Valve is affected before the 1-2 Shift Valve because the 2-3 Shift Valve Spring is heavier. This loss of AFL pressure moves the 2-3 Shift Valve into the 1st gear position, and 1st gear is obtained regardless of the position of the 3-4 Shift Valve.

Figure 2

4L80E VALVE BODY BREAKDOWN



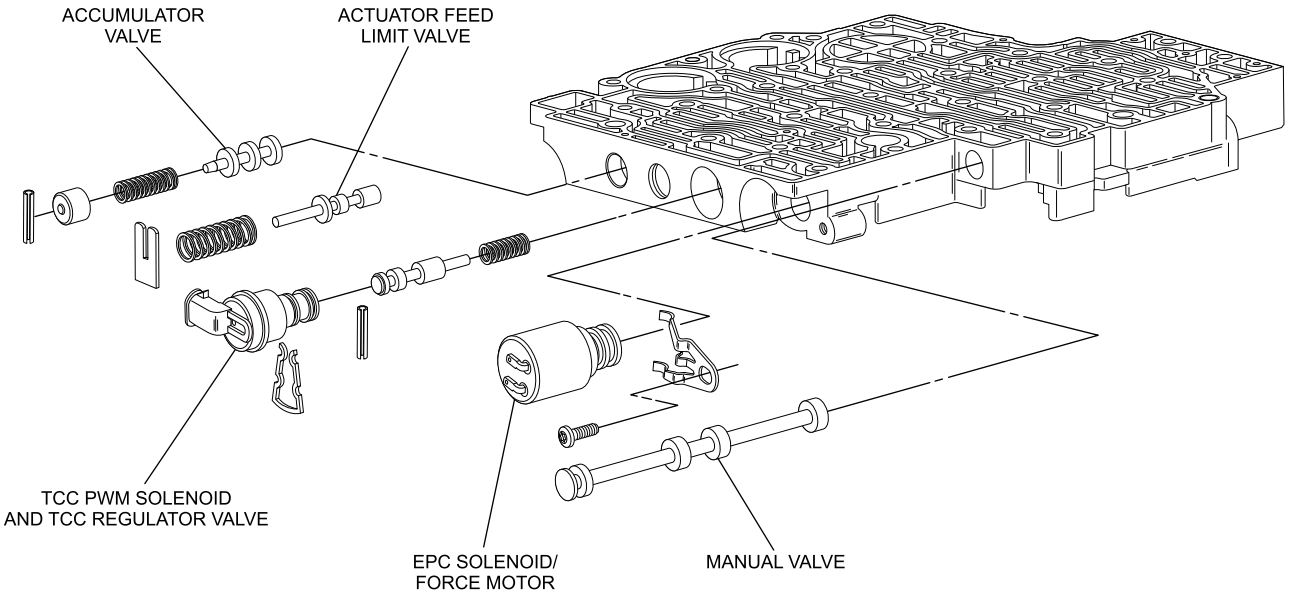
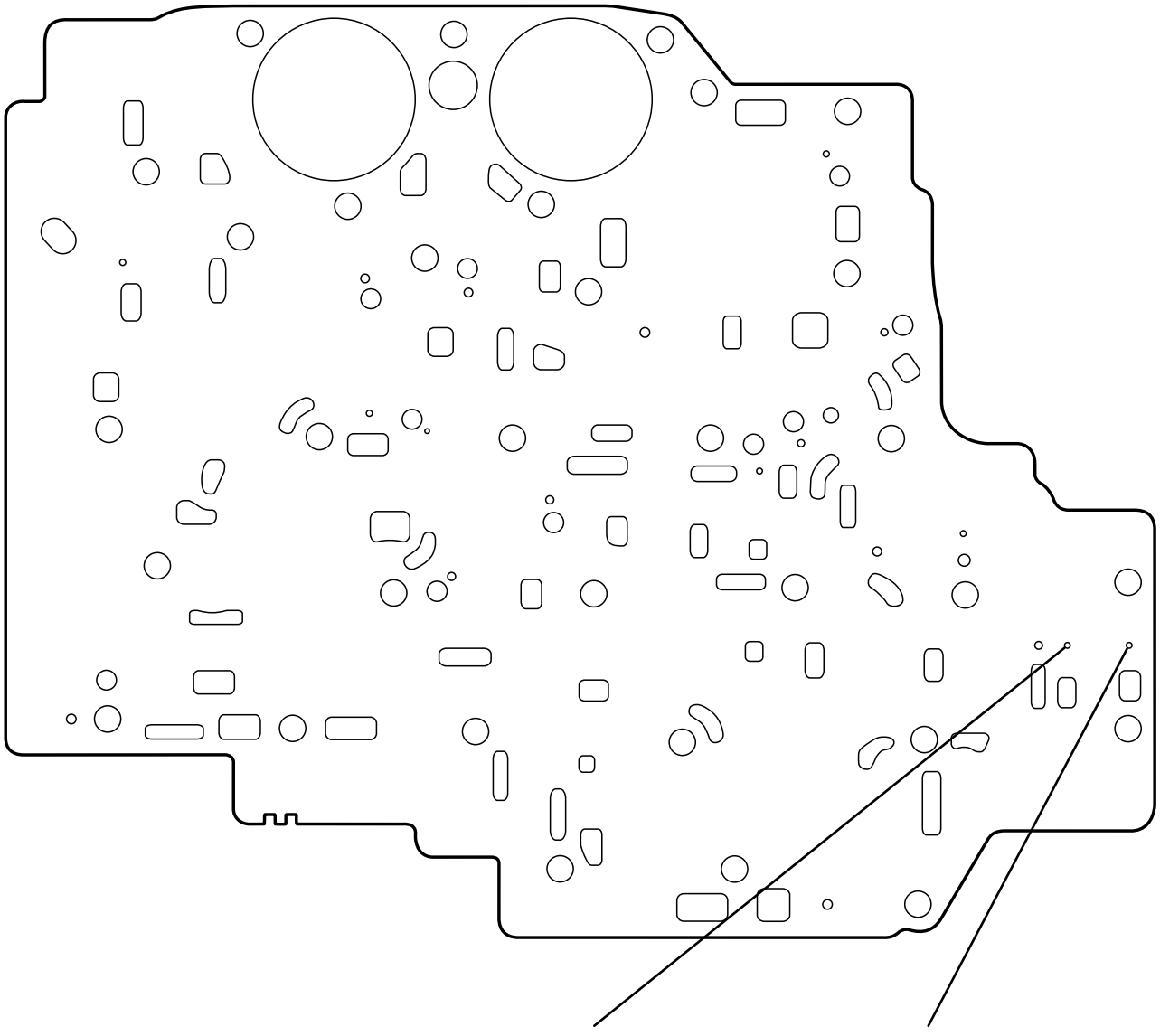


Figure 3

4L80E SPACER PLATE
SOLENOID FEED ORIFICE LOCATIONS



DO NOT ENLARGE EITHER FEED ORIFICE DIAMETER GREATER THAN .035"

Figure 4
Automatic Transmission Service Group

SATURN VUE WITH AF33-5 TRANSMISSION

LIMP MODE WITH CODE P0717 SET

COMPLAINT: The vehicle comes to the shop in limp mode with code P0717 set for "Input Speed Sensor Signal Low".

CAUSE: The Input Speed Sensor like the output speed sensor are two wire Hall Effect type sensors. They are supplied system voltage on the "ISS/OSS HI" circuit and then produce a toggled voltage signal on the "ISS/OSS LO" circuit, as seen in the electrical schematic in Figure 1 as well as TCM connector view and terminal assignment in Figure 2. The voltage signal is unique in as much as the low end of the signal is 0.6 volts, and the high end of the signal is 1.6 volts. This means that the actual switched voltage is one volt.
For those that have the AF33-5 GM Technician's guide, the explanation of the ISS operation is extremely confusing because the guide states that *"the sensor is supplied a reference voltage of 0.6 volts. It also stipulates that the size of the output voltage does not depend on a rotation number and is fixed at 1.4 volts"*. This is misleading at best.

The scan tool displayed an engine rpm of 776, but the ISS parameter was zero. With the ignition on, engine off, the voltmeter indicated that the ISS signal wire had 7.6 volts on it while the OSS signal wire had 1.6 volts. This could only mean that the ISS signal wire was shorted to power or the sensor was bad. The ISS was unplugged and checked for voltage, there was none, this lead to a faulty ISS.

CORRECTION: Once the ISS was replaced, the signal readings were normal, the ISS rpm and engine rpm were close to each other.

SERVICE INFORMATION:
Input Speed Sensor.....24220741

Many thanks to Seth at AAction Transmissions in Miami, FL. for providing the Saturn Vue with the ISS problem.

LIMP MODE WITH CODE P0717 SET

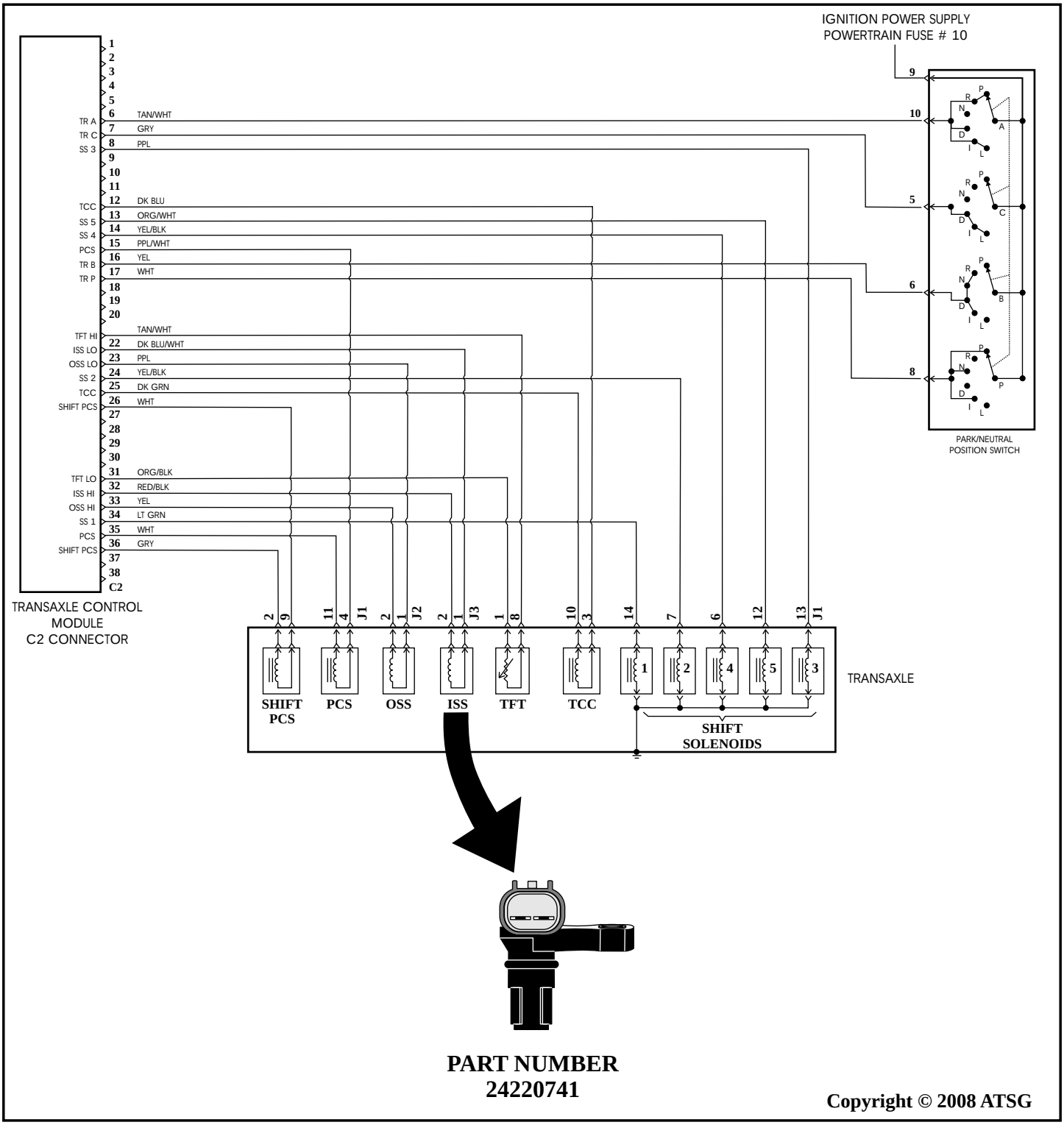


Figure 1

LIMP MODE WITH CODE P0717 SET

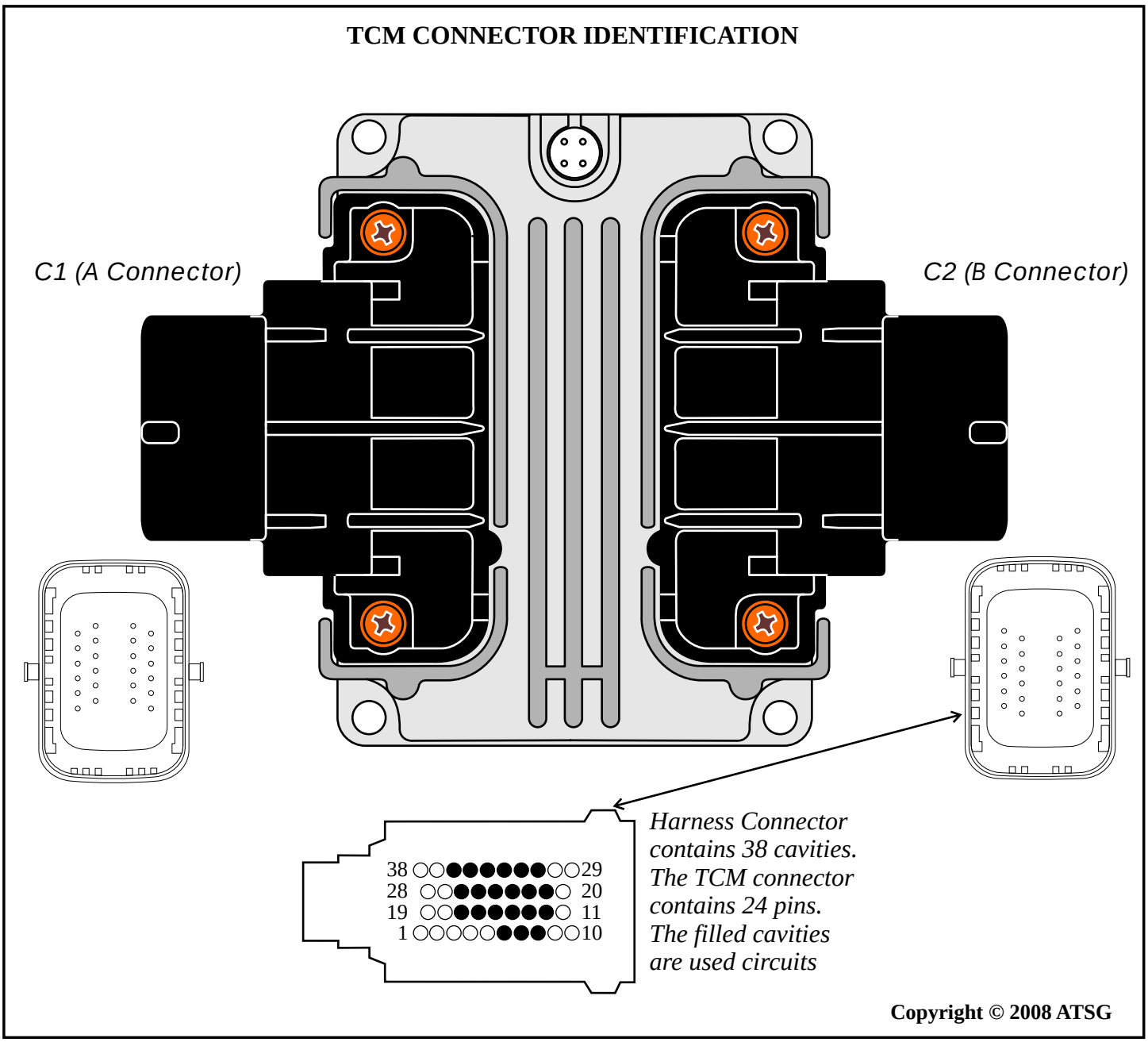


Figure 2

SATURN VUE & ION

2-3 FLARED SHIFT

COMPLAINT: The vehicle came in with a 2-3 flared shift. After overhaul, the 2-3 flared shift is still present, and there is now a flare on the 3-4 shift ad the shifting is erratic and harsh.

CAUSE: The 2-3 flare is due to aeration of the transmission fluid resulting in a delayed apply of the third gear band.
The 2-3 and 3-4 flare and the erratic and harsh shifts are caused by the failure to do a mandatory TCM relearn procedure as seen in Figure 1.

CORRECTION: Once the relearn procedure has been completed, drive the vehicle and see if the shift complaints are gone. If any of the complaints are still present, a reflash may be in order, and is some cases the replacement of the valve body may be necessary depending on transmission and revision part number. as shown in the chart in Figure 2.
GM suggests that the valve body be replaced first after which the vehicle should be driven to reevaluate the shift quality and if necessary, then reflash the TCM.
Check the identification tag on top of the transmission for the part number as illustrated in Figure 3, and compare it to the chart in Figure 2.

SATURN TCM MANUAL RELEARN PROCEDURE

1. **Drive vehicle until ATF operating temperature reaches at least 150ºF (65ºC).**
2. **Use your scan tool to reset the transaxle adaptive learns or, disconnect the battery cables and tape them together and turn the headlight switch and other electrical devices to "Brain Dead" the TCM.**
3. **Perform the following steps for the Garage Shifts Adaptive Relearn:**
   - ***a. Apply the brakes.***
   - ***b. Shift from NEUTRAL to REVERSE and keep it in REVERSE for 3 seconds.***
   - ***c. Shift from REVERSE to NEUTRAL.***
   - ***d. Repeat steps "b" and "c" FIVE times.***
   - ***e. Shift from NEUTRAL to DRIVE and keep it in DRIVE for 3 seconds.***
   - ***f. Shift from DRIVE to NEUTRAL.***
   - ***g. Repeat steps "e" and "f" FIVE times.***

4. **Perform the following steps for Up/DownShifts Adaptive Relearn:**
   - ***a. Drive the vehicle in DRIVE with light (15-20%) throttle until a speed of 31 mph (50 km/h) in Fourth gear.***
   - ***b. Decelerate and apply the brakes until the vehicle comes to a stop. Brake the vehicle so that it takes at least 14 seconds to stop.***
   - ***c. Repeat steps "a" and "b" FIVE times.***
   - ***d. Drive the vehicle in DRIVE with medium (50-55%) throttle until the vehicle shifts into Fifth gear.***
   - ***e. Decelerate and apply the brakes until the vehicle comes to a stop. Brake the vehicle slowly so that each downshift occurs.***
   - ***f. Repeat steps "d" and "e" FIVE times.***

5. **Perform the following steps for 2-1 Manual Downshift Adaptive Relearn:**
   - ***a. Drive the vehicle in Intermediate range until over 16 mph (25 km/h) in Second with any throttle position.***
   - ***b. Decelerate, then shift from Intermediate range to Low range manually and stop the vehicle.***
   - ***c. Repeat steps "a" and "b" TEN times.***

Figure 1

ION SERVICE MATRIX			
TRANSAXLE PART NUMBER	**CALIBRATION PART NUMBER**	**O.E. WHEEL SIZE**	**NEW VALVE BODY REQUIRED (PN 24226260)**
24224464	24230087	16 INCH	YES
24224464	24230088	14 OR 15 INCH	YES
24226999	24231240	16 INCH	NO
24226999	24231241	14 OR 15 INCH	NO
24226418	24231240	16 INCH	NO
24226418	24231241	14 OR 15 INCH	NO
VUE SERVICE MATRIX			
24222116*	24230089	AWD	YES
24224782	24230089	AWD	NO
24225145	24230089	AWD	NO
24225145	24230090	FWD	NO
Electrical harness (PN 24226258) must also be installed with new valve body.			

Figure 2

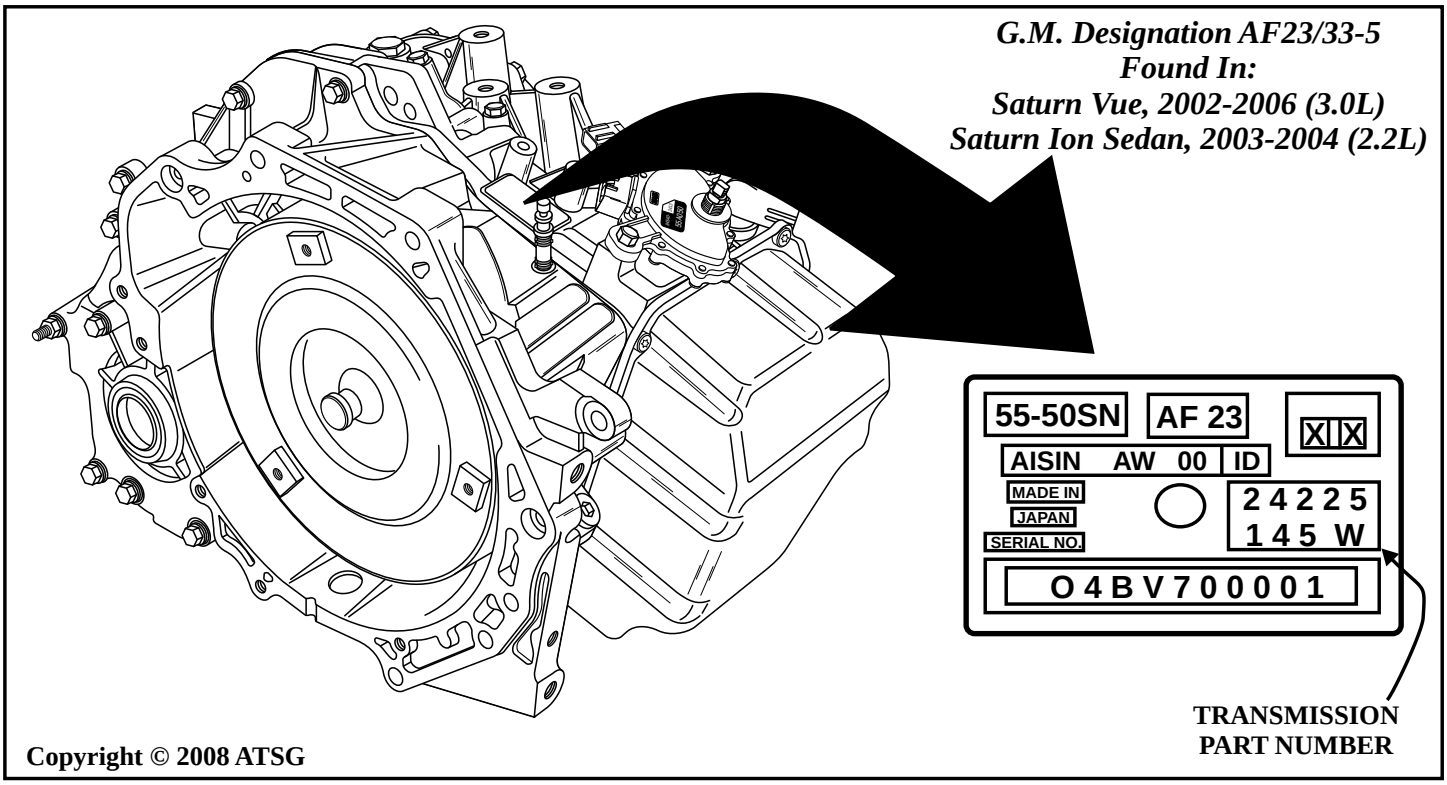


Figure 3

SATURN "S" SERIES

CODE P1624

COMPLAINT: A Saturn "S" Series comes into the shop with a Code P1624 set and a code definition of "Customer Snapshot Data Available", (Refer to Figure 1).

CAUSE: Saturn "S" Series vehicles from 1996 to 2002 have the ability to store a "Freeze Frame" snapshot of a problem that the PCM detected but is not yet a hard code. In other words it is a "Pending Code" which means it has not yet met the failure criteria to become a hard code and will not be stored in the PCM memory. However, one data frame will be stored as a "Freeze Frame" snapshot.
This allows the technician to capture an intermittent driveabilty malfunction that may be difficult to duplicate while driving the vehicle.

NOTE: Only cars with Cruise Control have this ability. This is because in order to retrieve the stored "Freeze Frame", you must cycle the Cruise Control ON/OFF Switch, (Refer to Figure 2), three times within a three second time period from the time the ignition is turned on.

CORRECTION: See if the single "Freeze Frame" that is retrieved can lead the technician to the appropriate repairs. Use your scan tool and scan for "Pending Codes" just in case one has been set. "Pending Codes" are usually stored in the "OBD-II Global" library of your scan tool.

CODE P1624

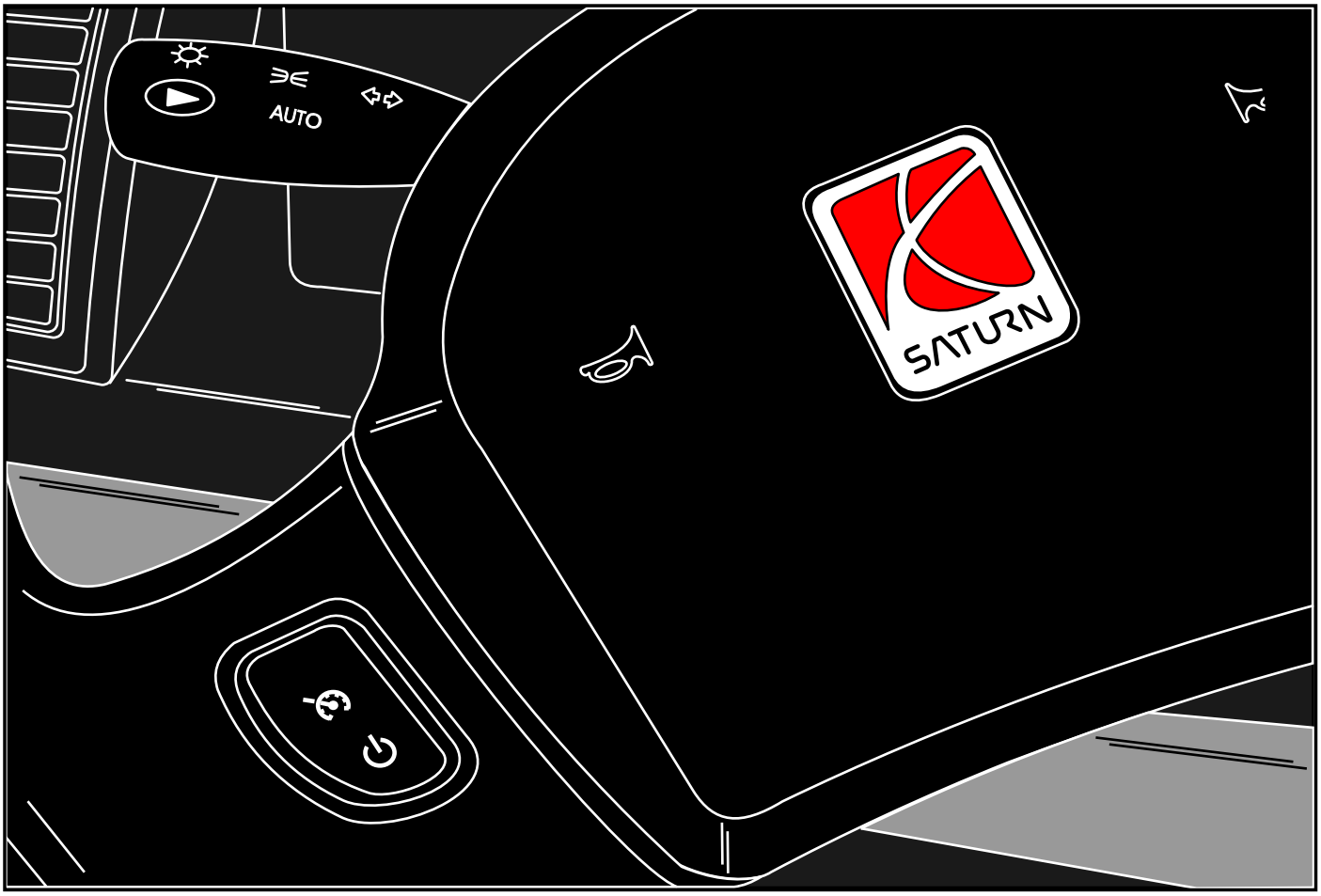


Figure 1

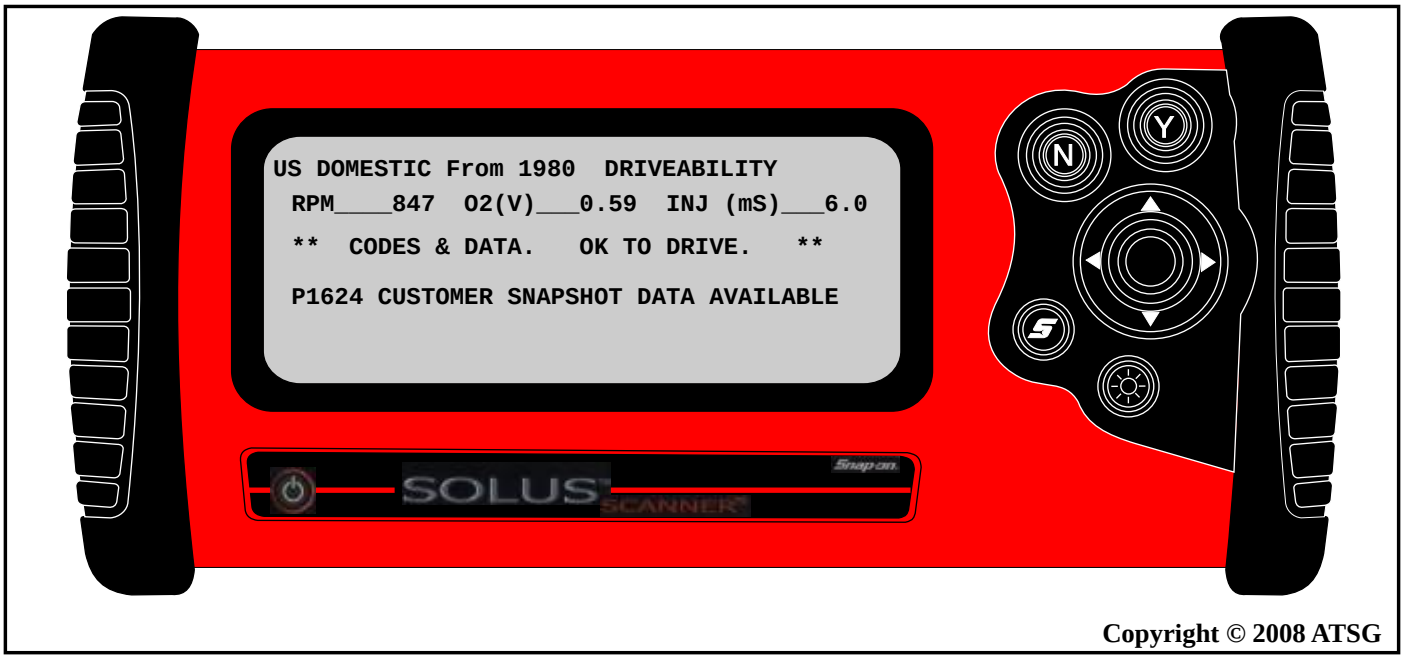


Figure 2

GM 6T70/75

PRELIMINARY INFORMATION

The new Hydra-matic 6T70/75 (6 Speed) is a fully automatic, six speed, front wheel drive, electronically controlled transmission that features clutch to clutch shifting. It is also all-wheel drive capable. It was first introduced in the 2007 GMC Acadia and Pontiac G6, and is shown in Figure 1. It consists primarily of a four element torque converter, three planetary gear sets, five clutch packs, one mechanical one-way clutch and a hydraulic pressurization and control system. Three planetary gear sets provide the six forward gear ratios and reverse. Changing gear ratios is fully automatic and is accomplished through the use of a Transmission Control Module (TCM), that is ***located within the transmission.*** The TCM receives and monitors various electronic sensor inputs, and uses this information to shift the transmission at the optimum time. The TCM commands shift solenoids and variable bleed Clutch Pressure Control (CPC) solenoids within the transmission to control shift timing. The TCM controls shift feel through the CPC solenoids. The TCM also controls the apply and release of the torque converter clutch which allows the engine to deliver the maximum fuel efficiency without sacrificing vehicle performance. This manual contains procedures necessary to diagnose, overhaul and/or repair the new 6T70 (6 Speed) transmission from General Motors.

A very special thanks to Robbie Ferguson at Alto Products for the loan of the 6T70 transmission.

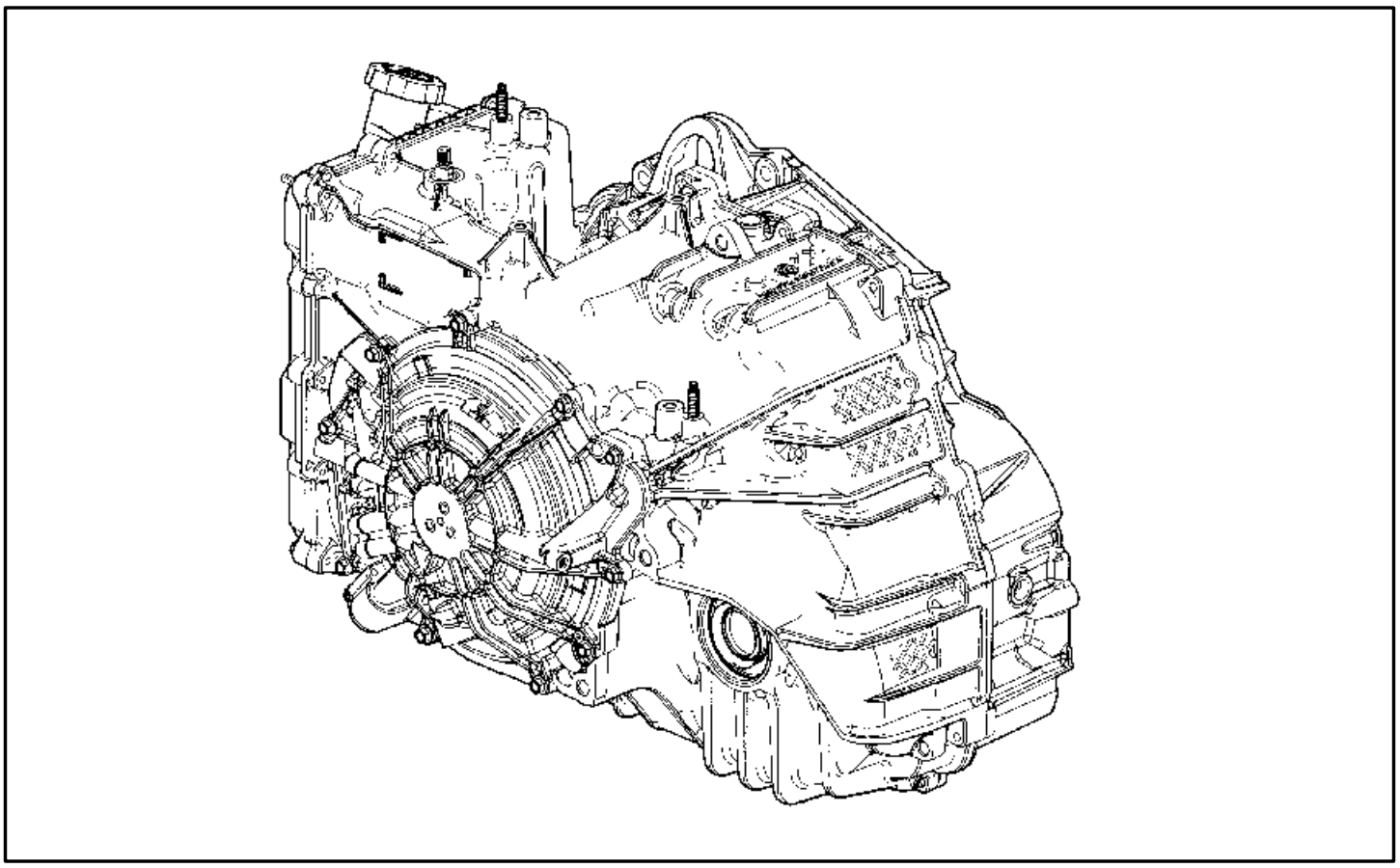


Figure 1

SHIFT QUADRANTS

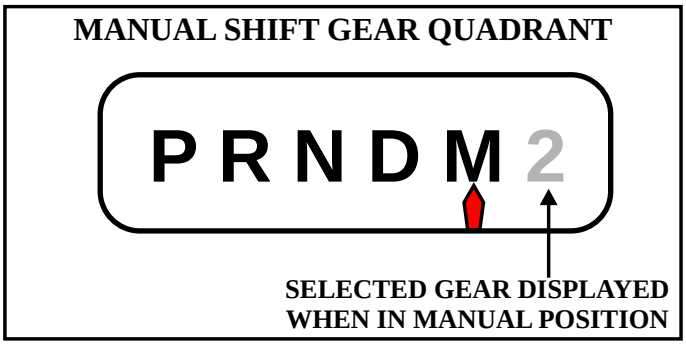


Figure 2

Standard Shift Quadrant

P - Park position enables the engine to be started while preventing the vehicle from moving. For safety reasons, the vehicle's parking brake should always be used in addition to the "Park" position. Park position should not be selected until the vehicle has come to a complete stop.

R - Reverse 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.

D - Drive range should be used for all normal driving conditions for maximum efficiency and fuel economy. Drive range allows the transmission to upshift and downshift in each of the six forward gear ratios, according to the normal shift pattern that is programed in the TCM.

Manual Shift Gear Ranges

Some vehicles are equipped with a shift quadrant that allow manual range selection. For example, "M" manual range and/or manual range "2" or "1", as shown in Figure 2 These ranges can be used for conditions where it may be desirable to control the selection of gear ratios. These conditions include trailer towing, driving on hilly terrain, and are also helpful for engine braking when descending slight grades.

M - When manual mode is selected, the current gear range will be the highest attainable range with all of the lower gears available. Plus/Minus buttons may be used to select the desired range of gears for the current driving conditions.

2 - Manual 2nd just adds more performance for congested traffic and hilly terrain. It has the same starting ratio (1st gear) as the Drive range, but prevents the transmission from shifting above 2nd gear. Manual 2nd can be used to retain 2nd gear for acceleration and engine braking as desired. Manual 2nd can be selected at any vehicle speed, but will downshift into 2nd gear, only if vehicle speed is low enough not to over-rev the engine. This speed is calibrated in the TCM.

1 - Manual 1st has the same starting ratio as Drive range but prevents the transmission from shifting above 1st gear. Manual 1st can be used for heavy towing and engine braking as desired. Manual 1st can be selected at any vehicle speed but will downshift into 1st gear, only if vehicle speed is low enough not to over-rev the engine. This speed is calibrated in the TCM.

Continued on next Page

Standard Shift Quadrant...continued

P - Park position enables the engine to be started while preventing the vehicle from moving. For safety reasons, the vehicle's parking brake should always be used in addition to the "Park" position. Park position should not be selected until the vehicle has come to a complete stop.

R - Reverse 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.

D - Drive range should be used for all normal driving conditions for maximum efficiency and fuel economy. Drive range allows the transmission to upshift and downshift in each of the six forward gear ratios, according to the normal shift pattern that is programed in the TCM.

Driver Shift Control (DSC) Quadrant

Some vehicles are equipped with Driver Shift Control (DSC) version of the selector system, as shown in Figure 2. This configuration allows the driver to manually shift between forward gears.

M - In the M/S (Manual or Sport) position, the driver may manually select the range of gears by tapping the selector lever towards "+" or "-" to cause an upshift or downshift, as shown in Figure 2. The transmission will shift up or down depending on the request that is made by tapping the selector lever.

DRIVER SHIFT CONTROL QUADRANT

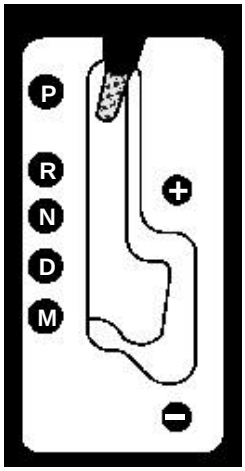


Figure 3

General Operation

The new Hydra-matic 6T70/75 (6 Speed) is a fully automatic, six speed, rear wheel drive, electronically controlled transmission that features clutch to clutch shifting. It consists primarily of a four element torque converter, three planetary gear sets, five clutch packs, one mechanical one-way clutch and a hydraulic pressurization and control system.

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 transmission. 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 turbine shaft of the transmission.

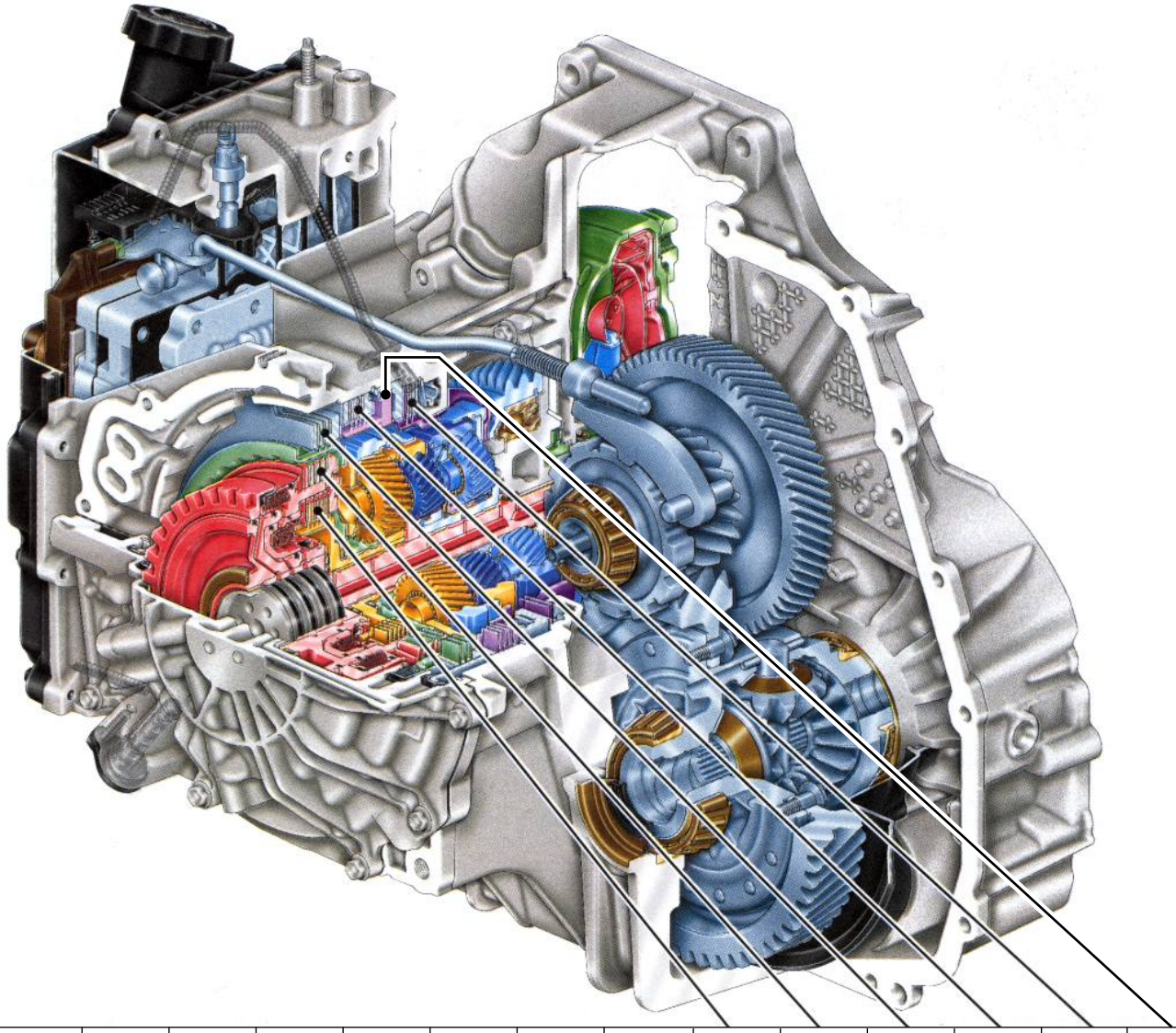
The two planetary gear sets provide the six forward gear ratios and reverse. Changing gear ratios is fully automatic and is accomplished through the use of a Transmission Control Module (TCM) located within the transmission. The TCM receives and monitors various electronic sensor inputs, and uses this information to shift the transmission at the optimum time.

The TCM commands shift solenoids and variable bleed Clutch Pressure Control (CPC) solenoids within the transmission to control shift timing. The TCM controls shift feel through the CPC solenoids. The TCM also 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 primarily consists of a vane type pump, two control valve bodies, converter housing and case. The pump maintains the working pressures needed to apply the clutch pistons that apply or release the friction components. These friction components, when applied or released, support the shifting qualities of the transmission.

The friction components used in this transmission consist of five multiple disc clutches. The multiple disc clutches combine with one mechanical sprag clutch, to deliver seven different gear ratios through the gearsets that then transfer torque through the output shaft. Refer to Figure 4 for the component application chart for this transmission.

INTERNAL COMPONENT IDENTIFICATION AND LOCATION

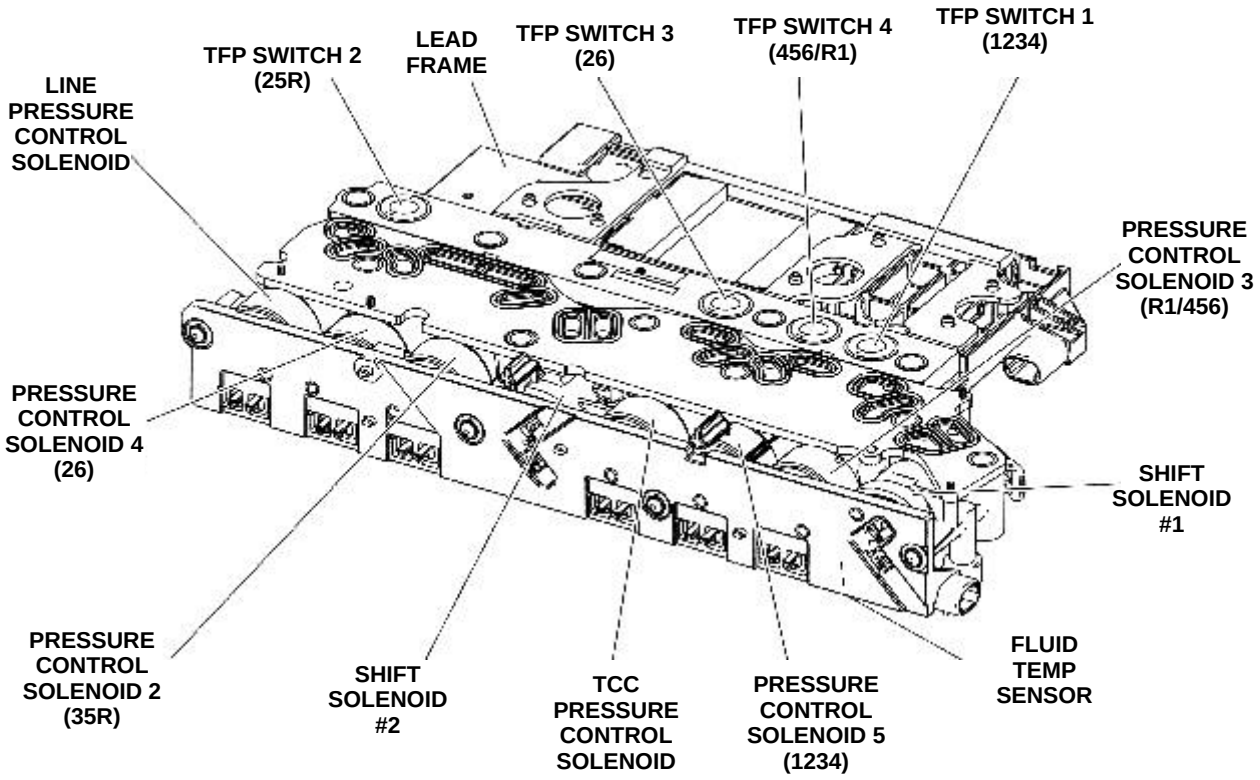


RANGE	GEAR	RATIO	SHIFT SOL #1	SHIFT SOL #2	1-2-3-4CL PC SOL 5 N.L.	2-6 CL PC SOL 4 N.L.	3-5 REV CL PC SOL 2 N.H.	LO/REV 4-5-6 CL PC SOL 3 N.H.	4-5-6 CLUTCH	3-5 REV CLUTCH	2-6 CLUTCH	LO/REV CLUTCH	1-2-3-4 CLUTCH	LOW ONE-WAY CLUTCH
PARK	P		ON	ON	OFF	OFF	ON	OFF				APPLIED*		
REV	R	2.880	ON	OFF	OFF	OFF	OFF	OFF		APPLIED		APPLIED		
NEU	N		ON	ON	OFF	OFF	ON	OFF				APPLIED*		
D R I V E	1ST BRAKING	4.484	OFF	ON	ON	OFF	ON	OFF				APPLIED	APPLIED	
	1ST	4.484	OFF	ON	ON	OFF	ON	ON					APPLIED	HOLD
	2ND	2.872	OFF	ON	ON	ON	ON	ON			APPLIED		APPLIED	
	3RD	1.842	OFF	ON	ON	OFF	OFF	ON		APPLIED			APPLIED	
	4TH	1.414	OFF	ON	ON	OFF	ON	OFF	APPLIED				APPLIED	
	5TH	1.000	OFF	ON	OFF	OFF	OFF	OFF	APPLIED	APPLIED				
	6TH	0.742	OFF	ON	OFF	ON	ON	OFF	APPLIED		APPLIED			

* APPLIED WITH NO LOAD

Figure 4

CONTROL SOLENOID BODY AND TCM ASSEMBLY



SOLENOID APPLICATION CHART

RANGE	Shift Sol. 1	Shift Sol. 2	N.L. CPC Sol. 5 1-2-3-4 CL.	N.L. CPC Sol. 4 2-6 CL.	N.H. CPC Sol. 2 3-5 Rev CL.	N.H. CPC Sol. 3 4-5-6, Low/Rev CL.	TCC PC Sol. Torq Conv CL.	LINE PC Sol. Line Pres Cont	GEAR RATIO
Park	ON	ON	OFF	OFF	ON	OFF	OFF	ON**	——
Reverse	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON**	2.880
Neutral	ON	ON	OFF	OFF	OFF	ON	OFF	ON**	——
"D"-1st Braking	OFF	ON	ON	OFF	ON	OFF	OFF		4.484
"D"-1st	OFF	ON	ON	OFF	ON	ON	OFF	ON**	4.484
"D"-2nd	OFF	ON	ON	ON	ON	ON	ON*	ON**	2.872
"D"-3rd	OFF	ON	ON	OFF	OFF	ON	ON*	ON**	1.842
"D"-4th	OFF	ON	ON	OFF	ON	OFF	ON*	ON**	1.414
"D"-5th	OFF	ON	OFF	OFF	OFF	OFF	ON*	ON**	1.000
"D"-6th	OFF	ON	OFF	ON	ON	OFF	ON*	ON**	0.742

FOR SHIFT SOLENOIDS 1 AND 2: "ON" = ENERGIZED (PRESSURIZED), "OFF" = DE-ENERGIZED (NO PRESSURE).
FOR CPC SOLENOIDS 2, 3, 4, 5: "ON = PRESSURIZED, "OFF" = NO PRESSURE.
** TCC IS AVAILABLE IN 2ND THRU 6TH GEAR, BASED ON THROTTLE POSITION, FLUID TEMP AND VEHICLE SPEED.*
*** CONSTANTLY VARIES LINE PRESSURE BASED ON THROTTLE POSITION, FLUID TEMP, AND GEAR STATE.*

Figure 5

ELECTRONIC COMPONENTS

In the 6T70/75 transmission, the TCM, both shift solenoids, all 6 of the pressure control solenoids, the TFT sensor and fluid pressure switches are contained in one unit, the Control Solenoid Body and TCM Assembly, which is behind the side cover pan, as shown in Figure 6.

Electrical signals from various sensors provide information to the TCM about vehicle speed, throttle position, engine coolant temp, fluid temp, range selector position, engine speed, turbine speed and operating mode. The TCM uses this information to determine the precise moment to upshift or downshift, apply or release the TCC, and what pressure is needed to apply the clutches. This type of control provides consistent and precise shift points and shift quality based on the actual operating conditions of the vehicle.

Adaptive shift control technology enables the TCM to continually monitor and compare shift performance to the optimum shift, and make adjustments to the factory settings to continually deliver excellent shift quality.

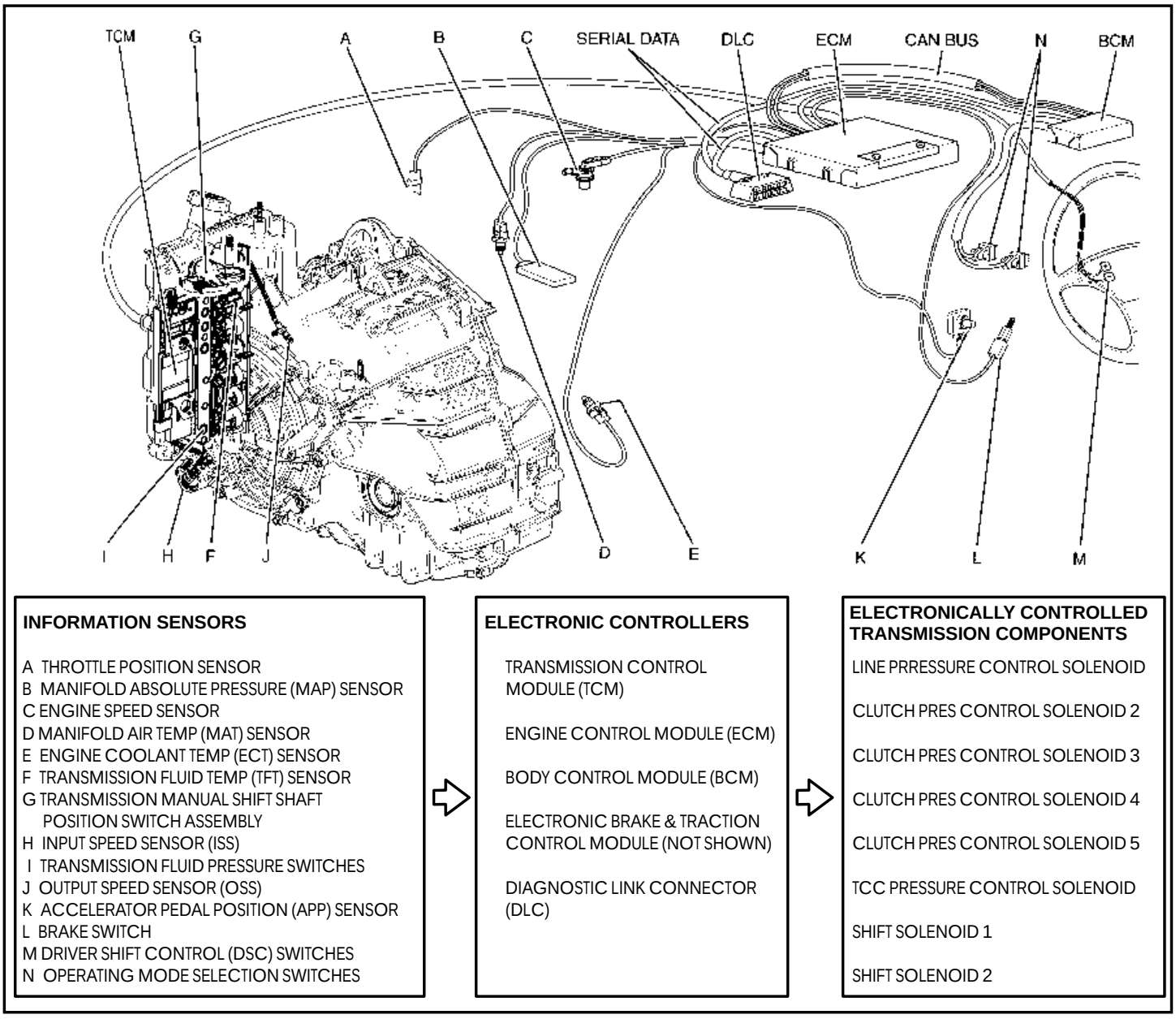


Figure 6

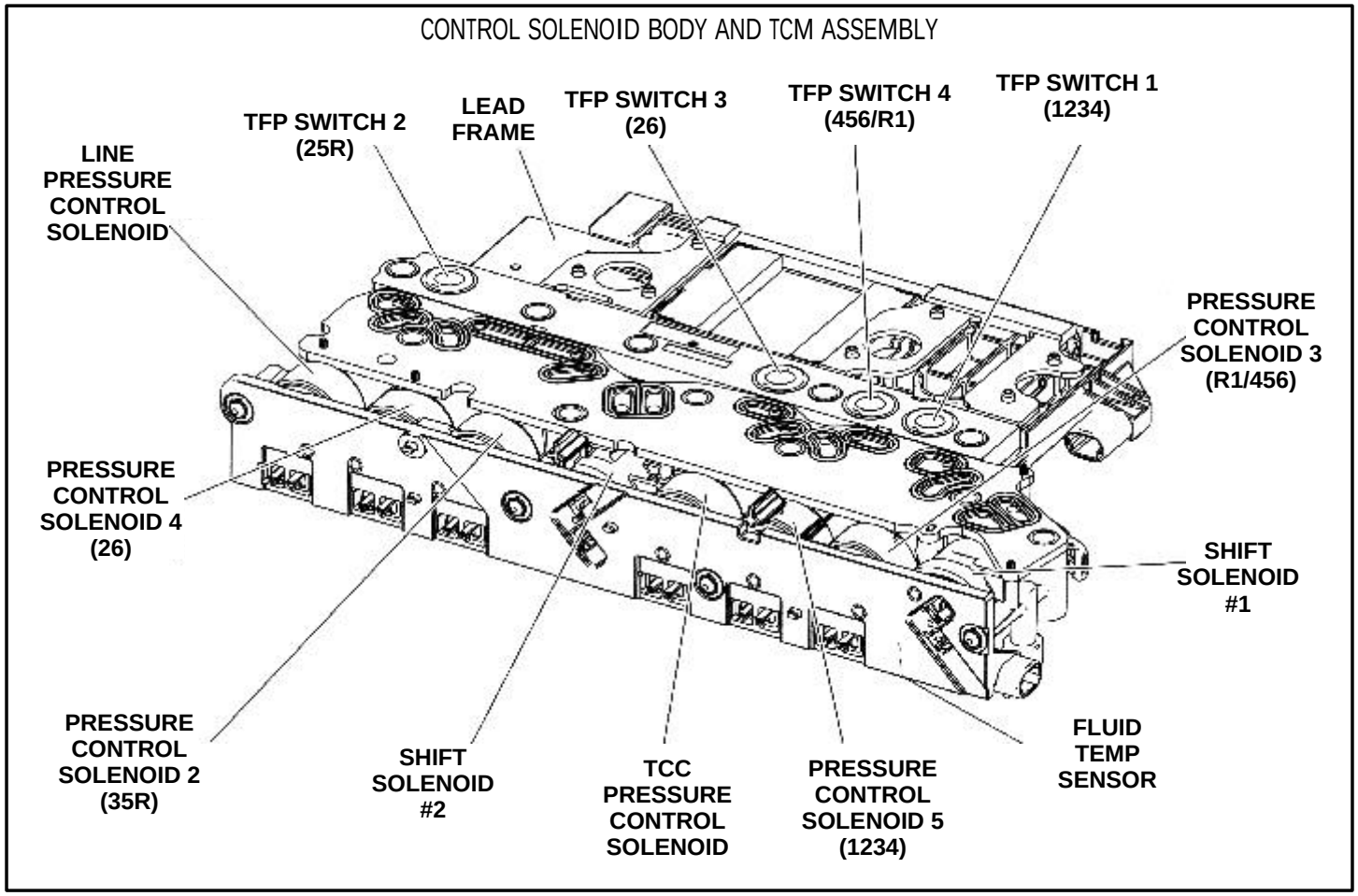


Figure 7

ELECTRONIC COMPONENTS (CONT'D)

Control Solenoid Body And TCM Assembly

The Control Solenoid Body and TCM Assembly bolts directly to the lower and upper valve body assemblies inside the transmission. The solenoid assembly utilizes a lead frame system to connect the components to the TCM, as shown in Figure 7. There are no wires used for these components. The Control Solenoid Body and TCM Assembly connect to the external harness 20 way connector using a pass-thru sleeve. All fluid passages to the switches and solenoids are protected from debris by a serviceable filter plate assembly, as shown in Figure 7. In addition to the components shown in Figure 7, there is a transmission fluid temperature sensor that is an integral part of the control solenoid body and TCM assembly.

The components shown in Figure 7 are diagnosed seperately, but serviced as an assembly.

The TFT sensor is part of the control solenoid body and TCM assembly, and is not serviced separately, as shown in Figure 7 and 8. The TFT sensor is a thermistor, which changes value based on temperature. The sensor has a negative-temperature coefficient, which means as the temp increases, the resistance decreases, and as the temp decreases, the resistance increases. The TCM supplies a voltage reference signal to the sensor and measures the voltage drop in the circuit. The TCM uses this information to maintain shift quality and torque converter clutch apply quality over the entire operating temperature range. If the TCM detects an improper signal from the TFT sensor, a DTC will be activated.

Continued on next Page

HFT
Black & White

SUPERIOR

ATSG

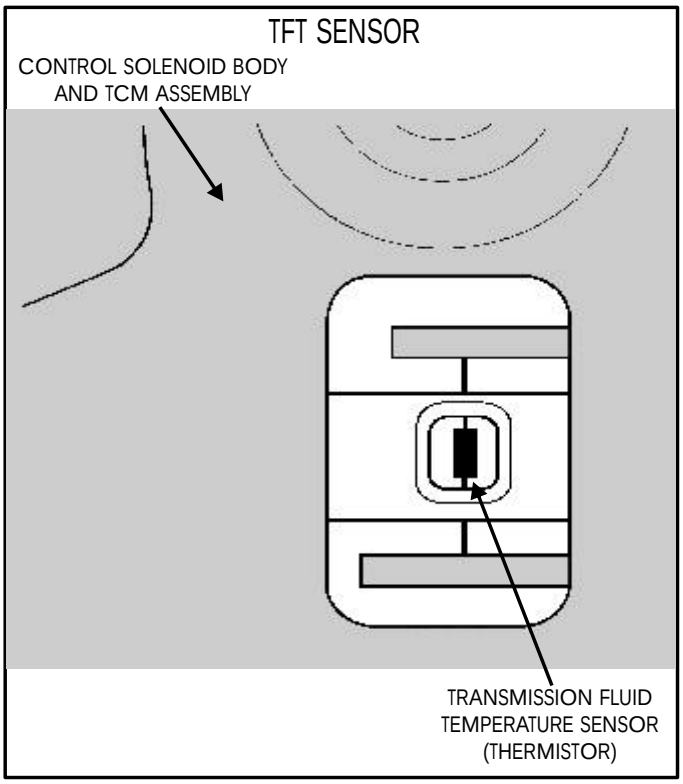


Figure 8

ELECTRONIC COMPONENTS (CONT'D)

Fluid Pressure Switches

The transmission fluid pressure switches located in the control solenoid body and TCM assembly are normally closed. When closed, these switches allow current flow through the switch. When fluid pressure is routed to the switch, pressure moves the diaphragm, piston and disk such that the circuit opens and there is no current flow. See Figure 9 for a cut-away view and a pressure switch logic chart.

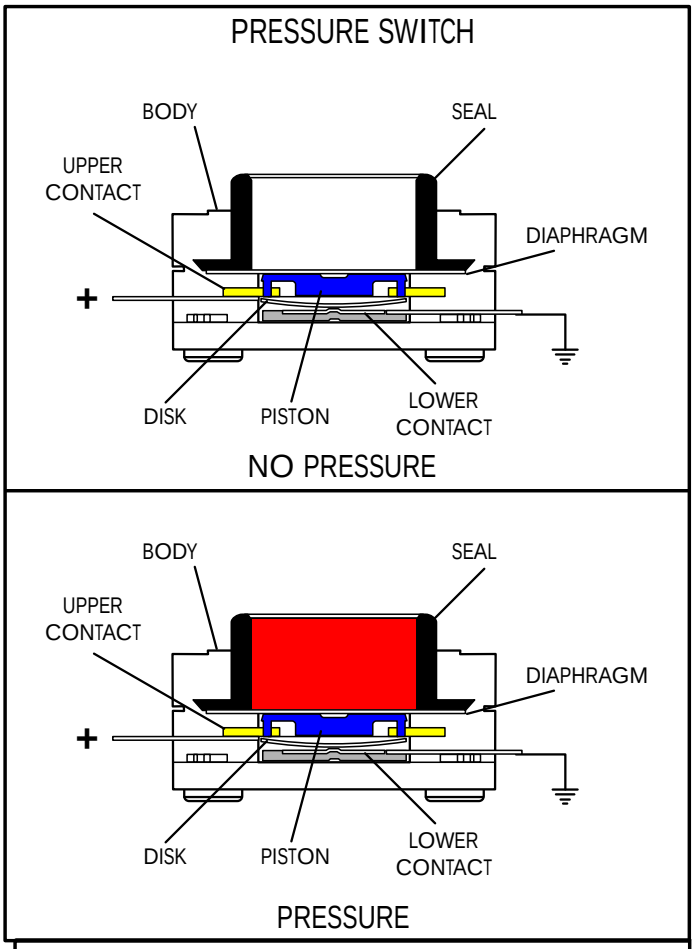
TFP switch 1 sends a signal to the TCM to indicate the state of the 1-2-3-4 clutch regulator valve.

TFP switch 2 sends a signal to the TCM to indicate the state of the 3-5-reverse clutch regulator valve.

TFP switch 3 sends a signal to the TCM to indicate the state of the 2-6 clutch regulator valve.

TFP switch 4 sends a signal to the TCM to indicate the state of R1/4-5-6 clutch regulator valve.
(R1 = Clutch Braking 1st)

The fluid pressure switches are part of the Control Solenoid Body and TCM Assembly, and are not serviced separately.



Pressure Switch Logic				
Selector Position	***Switch 1***	***Switch 2***	***Switch 3***	***Switch 4***
Park	***0***	***1***	***0***	***0***
Reverse	***0***	***0***	***0***	***0***
Neutral	***0***	***1***	***0***	***0***
1st Engine Braking	***0***	***1***	***1***	***0***
"D"-1st	***0***	***1***	***1***	***1***
"D"-2nd	***0***	***1***	***0***	***1***
"D"-3rd	***0***	***0***	***1***	***1***
"D"-4th	***0***	***1***	***1***	***0***
"D"-5th	***1***	***0***	***1***	***0***
"D"-6th	***1***	***1***	***0***	***0***
1 = Pressurized	***0 = Exhausted***			

Figure 9

Continued on next Page

JBH Distributing

ELECTRONIC COMPONENTS (CONT'D)

SHIFT SOLENOIDS 1 AND 2

Shift solenoids 1 and 2 are both identical, normally closed, 3 port, ON/OFF type solenoids controlled by the TCM. These shift solenoids work in combination with the clutch pressure control solenoids to control the various shift and clutch regulator valves in the valve body.

When the TCM provides a path to ground for the electrical circuit to energize (Turn ON) the solenoid, current flows through the coil assembly in the solenoid and creates a magnetic field. The magnetic field moves the plunger and metering ball assembly to the right, as shown in Figure 10, against the exhaust seat, thereby blocking the exhaust passage and creating solenoid control pressure.

Shift solenoids are de-energized (Turned OFF) when the TCM opens the path to ground for the solenoid's electrical circuit. With the solenoid OFF, solenoid spring force moves the plunger and metering ball assembly to the left, as shown in Figure 10, away from the exhaust seat and against the feed seat. This blocks actuator feed limit fluid from entering the solenoid and allows any existing solenoid control pressure to exhaust through the solenoid.

Shift Solenoids 1 and 2 are part of the Control Solenoid Body and TCM Assembly, and are not serviced separately.

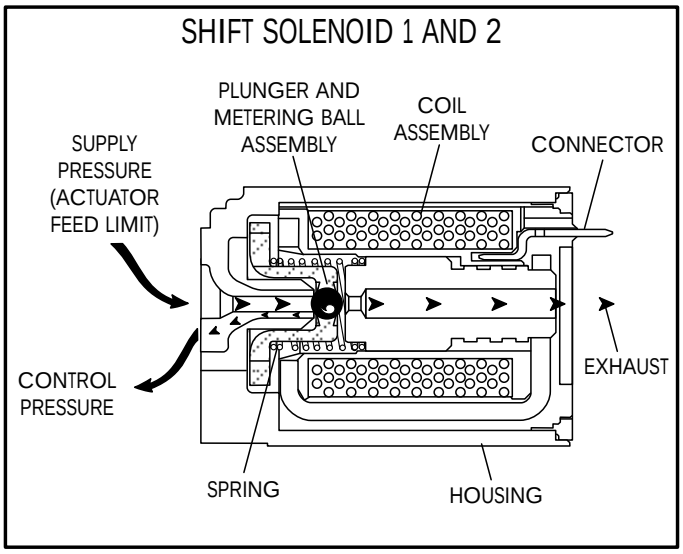


Figure 10

Shift Solenoid 1

Actuator feed limit fluid feeds the shift solenoid 1 fluid circuit to control clutch select valve 2. When shift solenoid 1 is energized (ON), actuator feed limit fluid is allowed to pass through the solenoid, thereby creating solenoid 1 control pressure, as shown in Figure 10. Solenoid 1 control pressure acts against clutch select valve 2 spring force, to move the valve to the apply position.

When shift solenoid 1 is de-energized (OFF), actuator feed limit fluid is blocked from feeding the solenoid 1 circuit, and any existing solenoid 1 control pressure exhausts through the solenoid, as shown in Figure 10.

Shift Solenoid 2

Actuator feed limit fluid feeds the shift solenoid 2 fluid circuit to control clutch select valve 3. When shift solenoid 2 is energized (ON), actuator feed limit fluid is allowed to pass through the solenoid, thereby creating solenoid 2 control pressure, as shown in Figure 10. Solenoid 2 control pressure acts against clutch select valve 3 spring force, to move the valve to the apply position.

When shift solenoid 2 is de-energized (OFF), actuator feed limit fluid is blocked from feeding the solenoid 2 circuit, and any existing solenoid 2 control pressure exhausts through the solenoid, as shown in Figure 10.

Fail-Safe or Protection Mode

If for any reason, the entire electronic control system of the transmission, or any one of the electrical components within the Control Solenoid Body and TCM Assembly becomes disabled, the transmission will default to fail-safe mode. If the transmission is in 1st, 2nd or 3rd gear during an electrical failure, the transmission will default to 3rd gear. If the transmission is in 4th, 5th or 6th gear during an electrical failure, the transmission will default to 5th gear.

ELECTRONIC COMPONENTS (CONT'D)

PRESSURE CONTROL SOLENOIDS

Line Pressure Control (PC) Solenoid

The line pressure (PC) solenoid is a precision electronic pressure regulator that controls line pressure based on current flow through its coil windings. The TCM varies current to the ***"normally-high"*** amperage line pressure control (PC) solenoid from approximately 0.1 amp (maximum line pressure), to 1.0 amps (minimum line pressure). As current flow is increased, the magnetic field produced by the coil moves the solenoid's variable restriction further away from the exhaust port, as shown in Figure 11. Opening the exhaust port decreases the control pressure, which is routed to the isolator (boost) valve, as shown in Figure 11, which ultimately decreases line pressure. As the current flow is decreased, the reduced magnetic field allows the spring force to move the variable restriction to the left, as shown in Figure 11, closer to the exhaust port, increasing control pressure from the solenoid, which ultimately increases line pressure.

As the throttle position (engine torque) increases, the current flow is decreased by the TCM, which increases the pressure output of the line pressure (PC) solenoid. If the TCM detects a line pressure control solenoid electrical malfunction, a DTC will be activated.

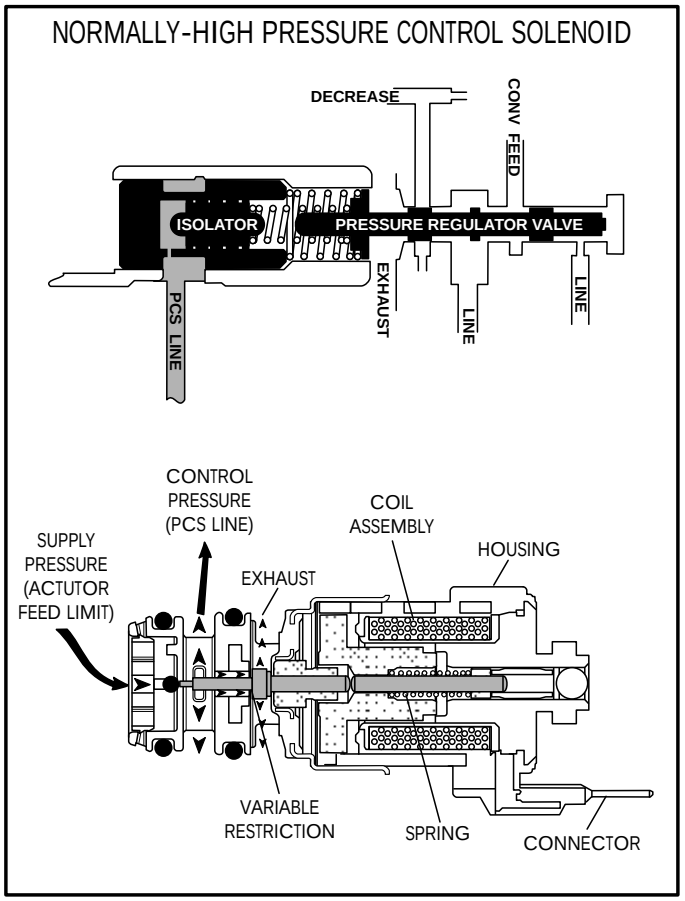


Figure 11

The line pressure control (PC) solenoid is part of the Control Solenoid Body And TCM Assembly and is not serviced separately.

If for any reason, the entire electronic control system of the transmission fails, the line pressure control solenoid will be OFF, and maximum line pressure will be the result. This will create harsh engagements and/or failsafe operation.

If the transmission is in 1st, 2nd or 3rd during an electrical failure, the transmission will default to 3rd gear. All solenoids will default to their normal state. If the torque converter clutch was applied, it will release.

If the transmission is in 4th, 5th or 6th during an electrical failure, the transmission will default to 5th gear. All solenoids will default to their normal state. If the torque converter clutch was applied, it will release.

The transmission will stay in 5th gear default range until the ignition has been turned off or the transmission has been shifted to Reverse. When the vehicle is restarted and shifted back into Drive, the transmission will then operate in the 3rd gear default range.

ELECTRONIC COMPONENTS (CONT'D)

TORQUE CONVERTER CLUTCH (TCC) SOLENOID

The Torque Converter Clutch (TCC) PC Solenoid is a ***"normally-low"amperage***, electronic pressure regulator used to control the apply and release of the torque converter clutch based on current flow through its coil windings. The TCC PC solenoid regulates actuator feed limit fluid pressure to the TCC regulator valve, located in the lower valve body, and provides a signal pressure to shift the TCC control valve, located in the pump, to the apply position, as shown in Figure 12. When the TCM determines to apply the TCC, the TCC PC solenoid is commanded to specific pressures, dependent on vehicle operating conditions, resulting in a smooth apply or release of the TCC. The solenoid's ability to "Ramp" the TCC apply and release pressures results in a smoother TCC operation.

When vehicle operating conditions are appropriate to apply the TCC, the TCM increases current flow to allow the TCC PC solenoid to increase PCS TCC fluid pressure, to move the TCC control valve to the apply position, as shown in Figure 12, and move the TCC regulator valve to the regulating position to regulate fluid pressure proportional to solenoid pressure. Release pressure is directed to exhaust, and regulated apply pressure is directed to the apply side of the converter clutch plate/damper assembly. The TCM then increases the pressure to control a slippage of 20-80 RPM between the clutch plate and converter cover. This "Ramping" procedure for improved dampening of engine vibrations and allows the TCC to apply at low engine speeds in 2nd, 3rd, 4th, 5th and 6th gear.

Release of the TCC is achieved by decreasing TCC solenoid pressure to a level low enough to allow spring force to move the TCC control valve and TCC regulating valve to the release position.

There are also some operating conditions that may prevent or enable TCC apply, such as engine temp, transmission temperature, brake switch activation.

If the TCM detects that the TCC system is stuck ON or OFF, a DTC will be activated.

The TCC PC Solenoid is part of the Control Solenoid Body And TCM Assembly and is not serviced separately.

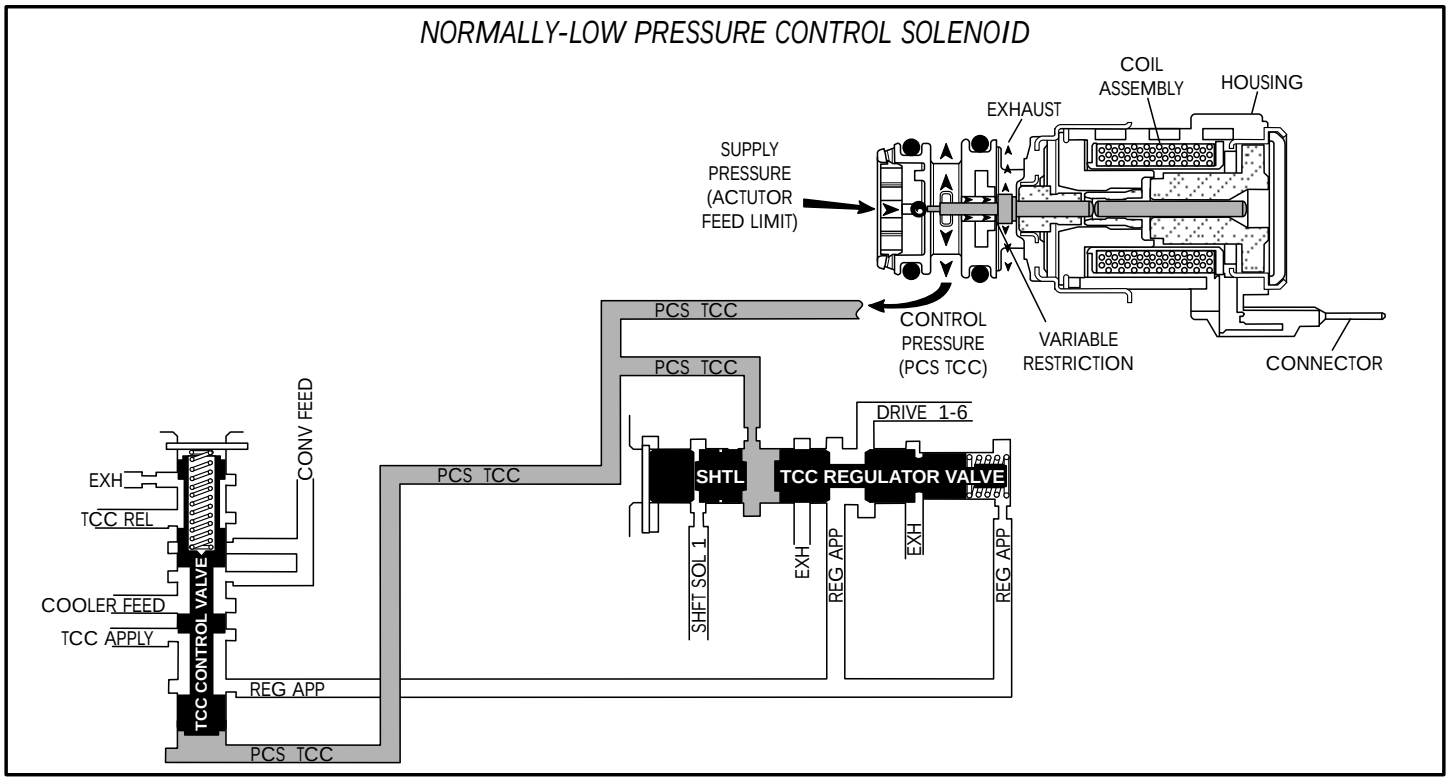


Figure 12

ELECTRONIC COMPONENTS (CONT'D)

CLUTCH PRESSURE CONTROL (CPC) SOLENOIDS 2,3,4 AND 5

There are two different types of clutch pressure control solenoids. Clutch pressure control (PC) solenoids 2 and 3 are ***"normally-high"*** amperage pressure control solenoids, as shown in Figure 14, and are identical to the line pressure control solenoid. Clutch pressure control (PC) solenoids 4 and 5 are ***"normally-low"*** amperage pressure control solenoids, as shown in Figure 13, and are identical to the TCC PC solenoid.

The Clutch Pressure Control PC Solenoids are part of the Control Solenoid Body And TCM Assembly and are not serviced separately.

Clutch Pressure Control Solenoid 2

Clutch pressure control (PC) solenoid 2 controls fluid flow to the 3-5/reverse clutch regulator valve and the 3-5/reverse boost valve. When commanded the solenoid controls the flow of exhaust fluid out of the solenoid to maintain a specific commanded control pressure. This allows the TCM to control the apply and release of the 3-5 and reverse clutch.

Clutch Pressure Control Solenoid 3

Clutch pressure control (PC) solenoid 3 controls fluid flow to the 4-5-6 clutch regulator valve and the 4-5-6 boost valve. When commanded the solenoid controls the flow of exhaust fluid out of the solenoid to maintain a specific commanded control pressure. This allows the TCM to control the apply and release of the 4-5-6 clutch.

Clutch Pressure Control Solenoid 4

Clutch pressure control (PC) solenoid 4 controls fluid flow to the 2-6 clutch regulator valve. When commanded the solenoid controls the flow of exhaust fluid out of the solenoid to maintain a specific commanded control pressure. This allows the TCM to control the apply and release of the 2-6 clutch.

Clutch Pressure Control Solenoid 5

Clutch pressure control (PC) solenoid 5 controls fluid flow to the 1-2-3-4 clutch regulator valve and the 1-2-3-4 boost valve. When commanded the solenoid controls the flow of exhaust fluid out of the solenoid to maintain a specific commanded control pressure. This allows the TCM to control the apply and release of the 1-2-3-4 clutch.

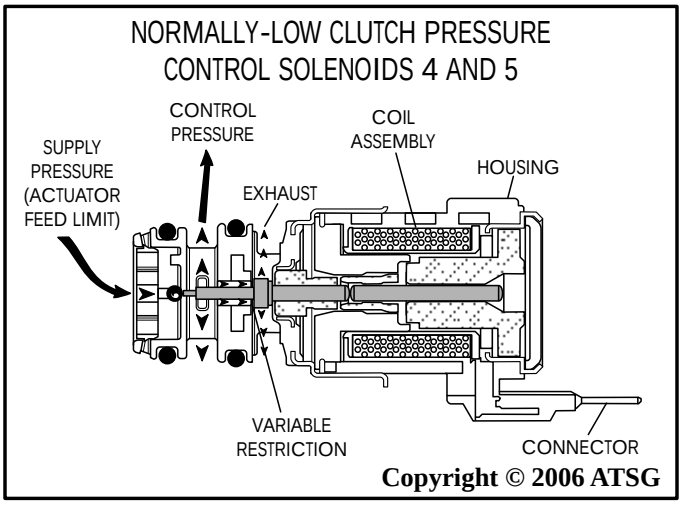


Figure 13

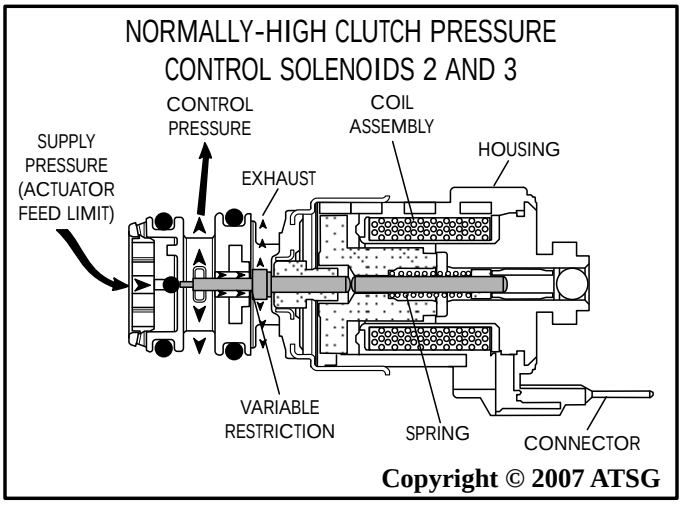


Figure 14

Transmission Adapt Function

Programming within the TCM also allows for automatic adjustments in shift pressure that are based on the changing characteristics of the transmission components. As the apply components within the transmission wear or change over time, the time required to apply a clutch increases or decreases. In order to compensate for these changes, the TCM adjusts the pressure commands to the various pressure control solenoids, to maintain the original calibrations. The automatic adjusting process is referred to as "Adaptive Learning" and is used to ensure consistent shift feel and increase the transmission's durability.

ELECTRONIC COMPONENTS (CONT'D)

TRANSMISSION MANUAL SHIFT POSITION SWITCH ASSEMBLY

The Transmission Manual Shift Position Switch Assembly, sometimes referred to as Internal Mode Switch (IMS), is a sliding contact switch that connects to the manual valve, with a connector that plugs into the control solenoid body and TCM assembly, and is shown in Figure 16.

There are four inputs to the TCM from the position switch assembly, that indicate which transmission gear range has been selected. The state of each input is available for display on the scan tool. The four input parameters represented are Signal A, Signal B, Signal C, and Signal P (Parity).

A fifth input signal "N" (P/N Start), does not input to the TCM, but goes directly to the ECM to determine a Park/Neutral state and allow the engine to be started. Routing Signal N to the ECM will allow the engine to be started, even with a dead TCM. Signal N is not a signal used by the TCM for manual shift selector position logic. A logic chart has been provided for you in Figure 15.

The Transmission Manual Shift Position Switch assembly is serviced separately.

If the TCM detects an improper signal from the transmission manual shift position switch (IMS) assembly, a DTC will be activated.

MANUAL SHIFT DETENT LEVER SWITCH LOGIC

Gear Selector Position	*Signal A*	*Signal B*	*Signal C*	*Signal P*
Park	*LOW*	*HI*	*HI*	*LOW*
Park/Reverse	*LOW*	*LOW*	*HI*	*LOW*
Reverse	*LOW*	*LOW*	*HI*	*HI*
Reverse/Neutral	*HI*	*LOW*	*HI*	*HI*
Neutral	*HI*	*LOW*	*HI*	*LOW*
Neutral/Drive 6	*HI*	*LOW*	*LOW*	*LOW*
Drive 6	*HI*	*LOW*	*LOW*	*HI*
Drive 6/Drive 4	*LOW*	*LOW*	*LOW*	*HI*
Drive 4	*LOW*	*LOW*	*LOW*	*LOW*
Drive 4/Drive 3	*LOW*	*HI*	*LOW*	*LOW*
Drive 3	*LOW*	*HI*	*LOW*	*HI*
Drive 3/Drive 2	*HI*	*HI*	*LOW*	*HI*
Drive 2	*HI*	*HI*	*LOW*	*LOW*
Open	*HI*	*HI*	*HI*	*HI*
Invalid	*HI*	*HI*	*HI*	*LOW*
Invalid	*LOW*	*HI*	*HI*	*HI*

HI = 12 Volts
LOW = 0 Volts

Manual Shift Detent Lever Switch Terminal Identification

Terminal	*Function*
A	*12 Volt Feed From TCM*
B	*Mode Switch Switch Signal "P"*
C	*Mode Switch Switch Signal "C"*
D	*Mode Switch Switch Signal "B"*
E	*Mode Switch Switch Signal "A"*
F	*Park/Neutral Start Signal "N" (Direct to ECM)*

Figure 15

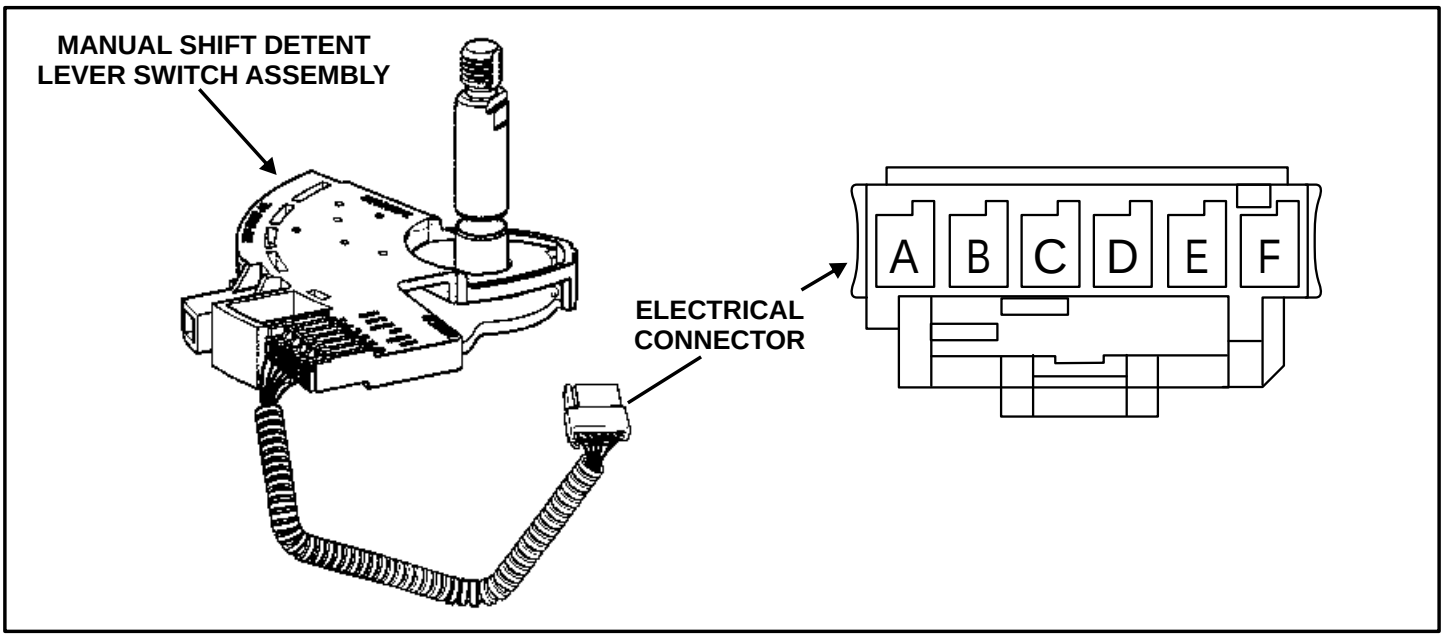


Figure 16

ELECTRONIC COMPONENTS (CONT'D)

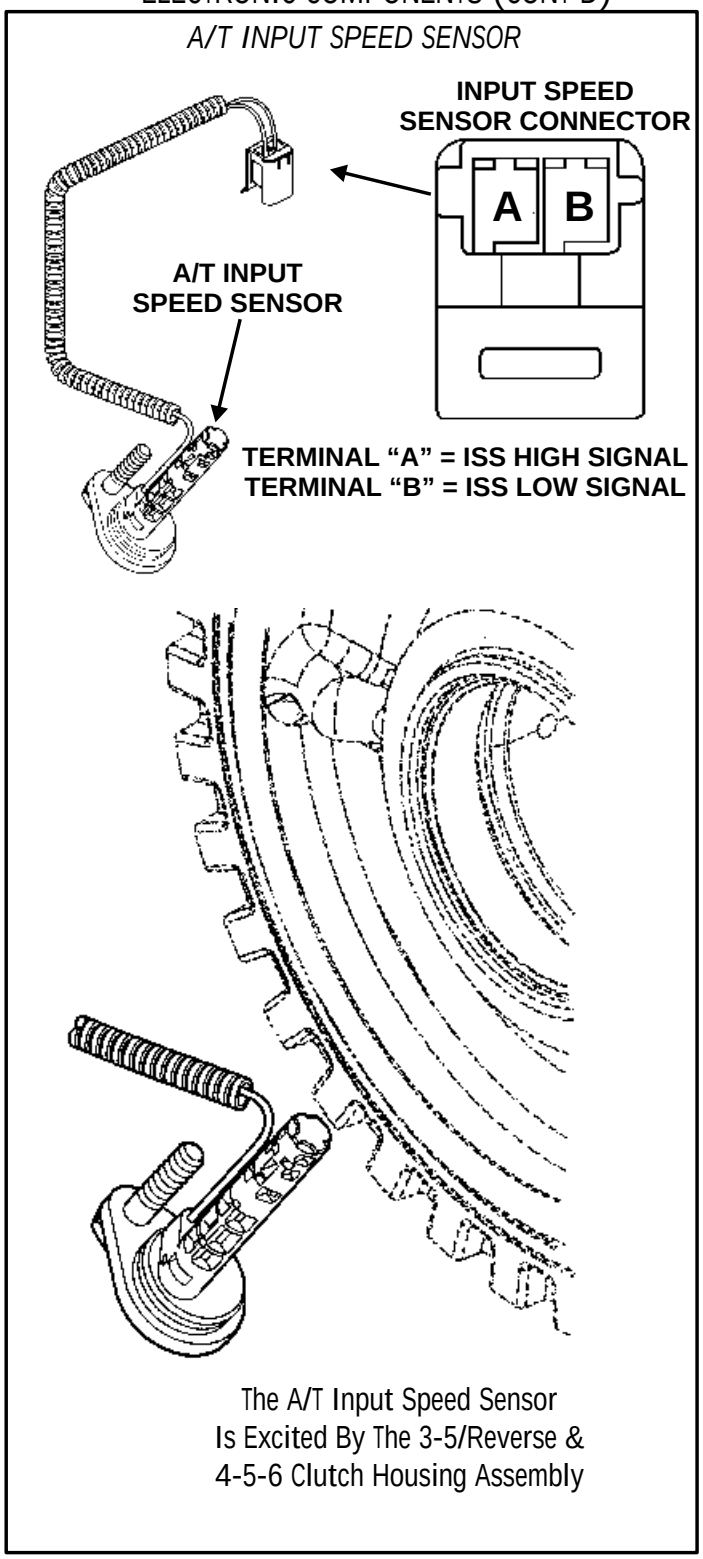


Figure 17

A/T Input Speed Sensor Assembly

The A/T Input Speed Sensor is a 2 wire Hall Effect type speed sensor. It is mounted in the transmission case cover and is excited by the 3-5-Reverse and 4-5-6 clutch housing assembly as shown in Figure 17.

Input Speed Sensor Assembly...continued

The sensor receives 8.3 to 9.3 volts on the A/T ISS/OSS supply voltage circuit from the TCM. The TCM uses the ISS signal to determine line pressure, transmission shift timing, TCC slip speed and gear ratio.

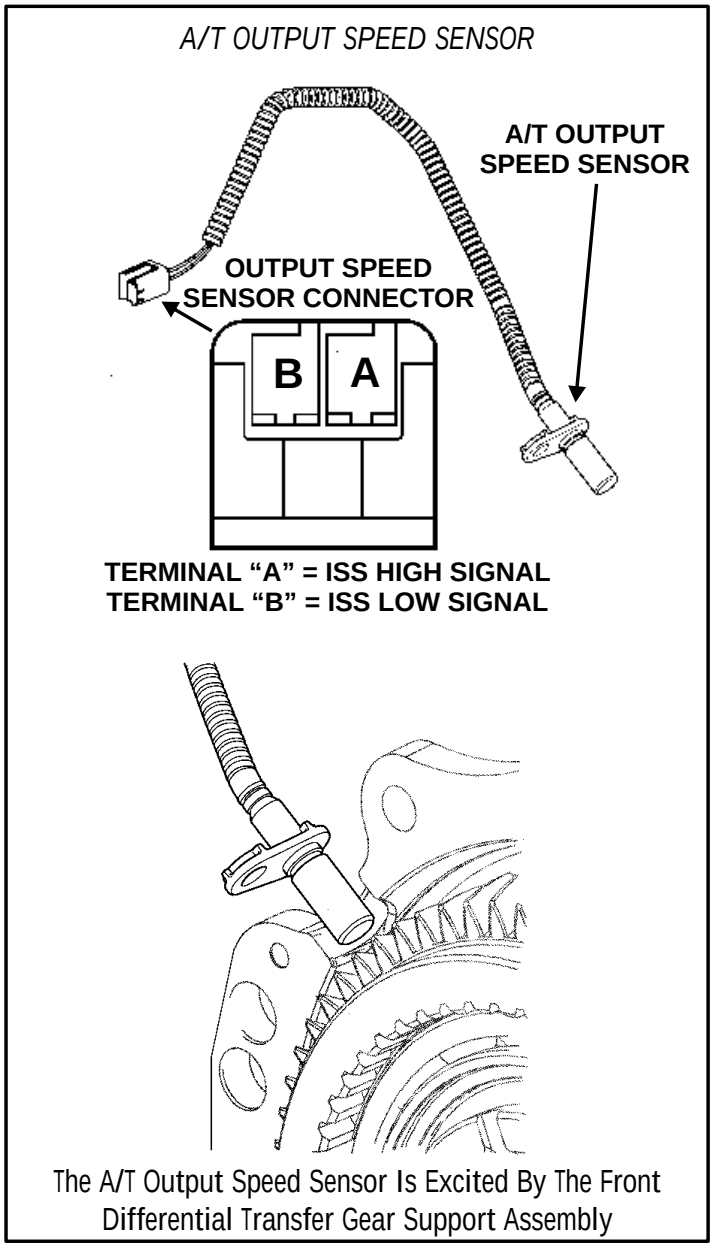


Figure 18

A/T Output Speed Sensor Assembly

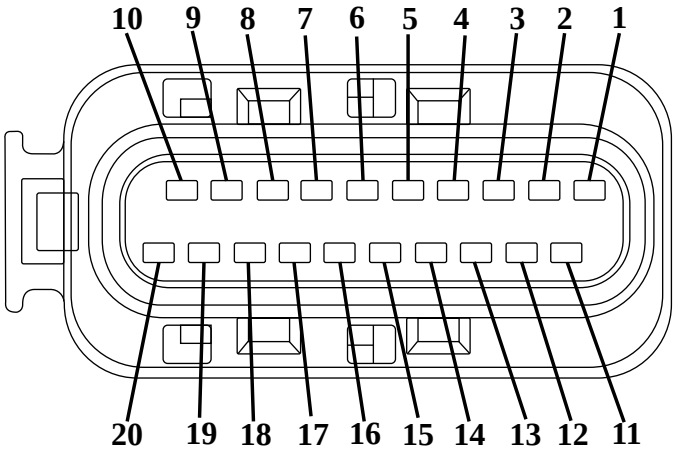
The A/T Output Speed Sensor is a 2 wire Hall Effect type speed sensor. It is mounted in the transmission case cover and is excited by the front differential transfer gear support assembly as shown in Figure 18.

ELECTRONIC COMPONENTS (CONT'D)

A/T Output Speed Sensor Assembly...continued

The sensor receives 8.3 to 9.3 volts on the ISS/OSS supply voltage circuit from the TCM. The TCM uses the OSS signal to determine line pressure, transmission shift timing, vehicle speed and gear ratio.

20-WAY CASE CONNECTOR
TERMINAL IDENTIFICATION



View Looking Into 20-Way Case Connector

Pin No.	*Function*
1	*PSM Ground*
2	*CAN HI*
3	*I CAN HI - Termination*
4	*Not Used*
5	*CAN HI*
6	*Tap Up/Tap Down Switch*
7 - 9	*Not Used*
10	*Battery Positive Power*
11	*I CAN LO - Termination*
12	*CAN LO*
13	*Ignition 1 Voltage Power*
14	*CAN LO*
15	*Accessory Voltage*
16	*Stop Lamp Switch Signal*
17	*Not Used*
18	*Ground*
19	*Battery Positive Voltage (Optional)*
20	*Park/Neutral Signal*

Figure 19

20-Way Case Connector

The 20-way transmission case connector is also part of the control solenoid body and TCM assembly, as shown in Figure 20, and ***is not*** serviced separately. The case connector and the terminal identification chart are both illustrated in Figure 19, for diagnostic purposes. We have also provided a full wiring schematic in Figure 20.

Since the case connector is part of the TCM and is located internally, there is an oval rubber seal required to seal the control unit 20-way connector to the valve body cover which it pass through, as shown in Figure 20.

CONTROL VALVE BODY CONNECTOR & SEAL

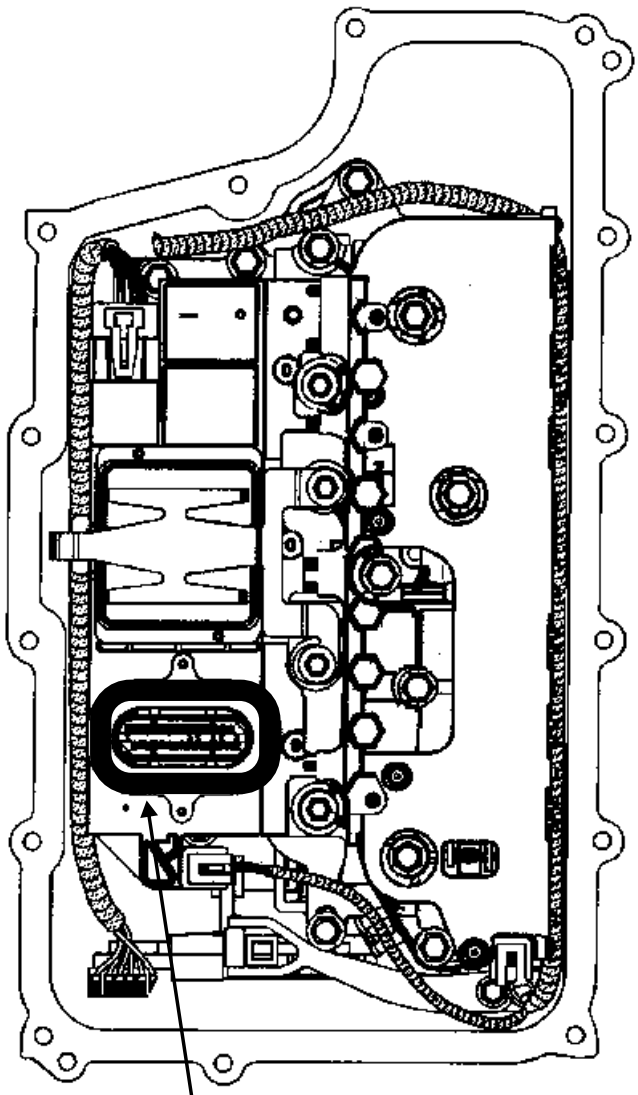


Figure 20

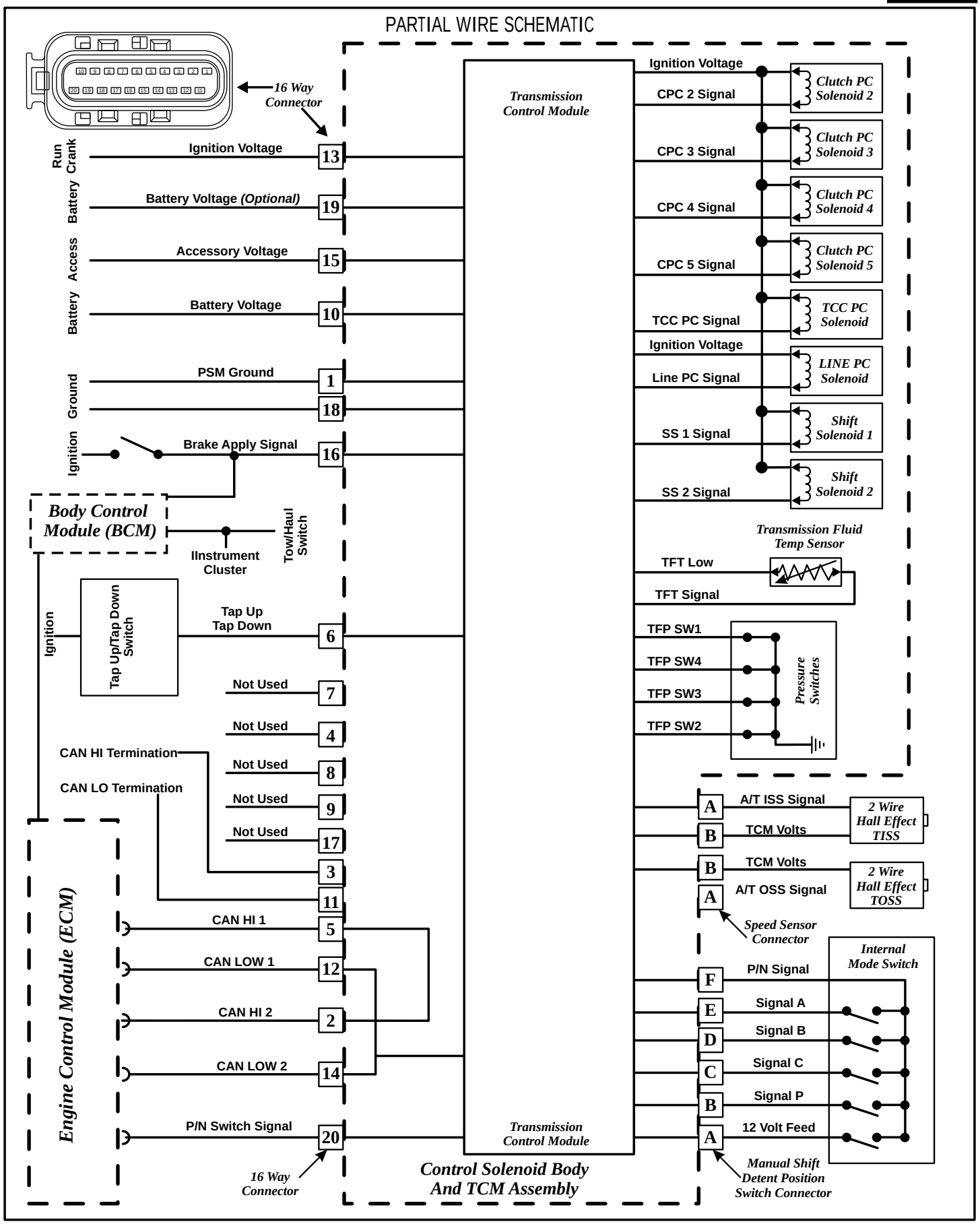

PARTIAL WIRE SCHEMATIC
16 Way Connector
Transmission Control Module
Ignition Voltage
CPC 2 Signal
CPC 3 Signal
CPC 4 Signal
CPC 5 Signal
TCC PC Signal
Ignition Voltage
Line PC Signal
SS 1 Signal
SS 2 Signal
Clutch PC Solenoid 2
Clutch PC Solenoid 3
Clutch PC Solenoid 4
Clutch PC Solenoid 5
TCC PC Solenoid
LINE PC Solenoid
Shift Solenoid 1
Shift Solenoid 2
Run Crank
Battery
Access
Battery
Ground
Ignition
Ignition Voltage
Battery Voltage (Optional)
Accessory Voltage
Battery Voltage
PSM Ground
Brake Apply Signal
13
19
15
10
1
18
16
Body Control Module (BCM)
IInstrument Cluster
Tow/Haul Switch
Transmission Fluid Temp Sensor
TFT Low
TFT Signal
TFP SW1
TFP SW4
TFP SW3
TFP SW2
Pressure Switches
Ignition
Tap Up/Tap Down Switch
Tap Up
Tap Down
6
Not Used
7
Not Used
4
CAN HI Termination
Not Used
8
CAN LO Termination
Not Used
9
Not Used
17
3
11
CAN HI 1
5
CAN LOW 1
12
CAN HI 2
2
CAN LOW 2
14
P/N Switch Signal
20
Engine Control Module (ECM)
A
A/T ISS Signal
B
TCM Volts
2 Wire Hall Effect TISS
B
TCM Volts
A
A/T OSS Signal
2 Wire Hall Effect TOSS
Speed Sensor Connector
Internal Mode Switch
F
P/N Signal
E
Signal A
D
Signal B
C
Signal C
B
Signal P
A
12 Volt Feed
Manual Shift Detent Position Switch Connector
16 Way Connector
Transmission Control Module
Control Solenoid Body And TCM Assembly

Figure 21

DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION		
DTC	*DESCRIPTION*	*DTC TYPE**
P0218	***Transmission Fluid Overtemperature, Over 270°F for 10 minutes.***	**C**
P0562	***System Voltage Low, 11 volts or less for 10 seconds.***	**C**
P0563	***System Voltage High, Greater than 18 volts for 12 seconds.***	**C**
P0601	***TCM (Internal), Read Only Memory (ROM).***	**A**
P0602	***TCM, Not Programmed.***	**A**
P0603	***TCM (Internal), Long term memory reset.***	**A**
P0604	***TCM (Internal), Random Access Memory (RAM).***	**A**
P0634	***TCM (Internal), Overtemperature.***	**A**
P0667	***TCM (Internal), Temperature Sensor Performance.***	**C**
P0668	***TCM (Internal), Temperature Sensor circuit voltage low.***	**C**
P0669	***TCM (Internal), Temperature Sensor circuit voltage high.***	**C**
P0703	***Brake Switch Circuit, signal is invalid for 4 seconds.***	**A**
P0711	***Transmission Fluid Temperature (TFT), Sensor performance.***	**C**
P0712	***Transmission Fluid Temperature (TFT), Sensor circuit voltage low.***	**C**
P0713	***Transmission Fluid Temperature (TFT), Sensor circuit voltage high.***	**C**
P0716	***Input Speed Sensor (ISS), Sensor performance.***	**A**
P0717	***Input Speed Sensor (ISS), Sensor circuit voltage low.***	**A**
P0719	***Brake Switch Circuit, Circuit voltage low.***	**A**
P0722	***Output Speed Sensor (OSS), Sensor circuit voltage low.***	**A**
P0723	***Output Speed Sensor (OSS), Sensor intermittent.***	**A**
P0724	***Brake Switch Circuit, Circuit voltage high.***	**A**
P0729	***Incorrect 6th Gear Ratio.***	**C**
P0731	***Incorrect 1st Gear Ratio.***	**A**
P0732	***Incorrect 2nd Gear Ratio.***	**A**
P0733	***Incorrect 3rd Gear Ratio.***	**A**
P0734	***Incorrect 4th Gear Ratio.***	**A**
P0735	***Incorrect 5th Gear Ratio.***	**A**
P0736	***Incorrect Reverse Gear Ratio.***	**A**
P0741	***Torque Converter Clutch (TCC), System Stuck OFF.***	**B**
P0742	***Torque Converter Clutch (TCC), System Stuck ON.***	**B**
P0751	***Shift Solenoid (SS) 1 Valve Performance, Stuck OFF.***	**C**
P0752	***Shift Solenoid (SS) 1 Valve Performance, Stuck ON.***	**A**

***DTC TYPES**

A - Emission-related, turns the MIL "ON" immediately after the 1st failure.

B - Emission-related, turns the MIL "ON" after two consecutive drive cycles with failure.

C - Non-emission-related, no lamps and may display message on driver information center.

Figure 22

DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION		
DTC	*DESCRIPTION*	*DTC TYPE**
P0756	***Shift Solenoid (SS) 1 Valve Performance, Stuck OFF.***	**A**
P0776	***Clutch Pressure Control (PC) Solenoid 2, Stuck OFF.***	**A**
P0777	***Clutch Pressure Control (PC) Solenoid 2, Stuck ON.***	**A**
P0796	***Clutch Pressure Control (PC) Solenoid 3, Stuck OFF.***	**A**
P0797	***Clutch Pressure Control (PC) Solenoid 3, Stuck ON.***	**A**
P0815	***Upshift Switch Circuit Error.***	**C**
P0816	***Downshift Switch Circuit Error.***	**C**
P0826	***Upshift and Downshift Switch Circuit Error.***	**C**
P0842	***Transmission Fluid Pressure (TFP) Switch 1, Circuit Voltage Low.***	**C**
P0843	***Transmission Fluid Pressure (TFP) Switch 1, Circuit Voltage High.***	**C**
P0851	***Park/Neutral Position (PNP) Switch, Circuit Voltage Low.***	**C**
P0852	***Park/Neutral Position (PNP) Switch, Circuit Voltage High.***	**C**
P0872	***Transmission Fluid Pressure (TFP) Switch 3, Circuit Voltage Low.***	**C**
P0873	***Transmission Fluid Pressure (TFP) Switch 3, Circuit Voltage High.***	**C**
P0877	***Transmission Fluid Pressure (TFP) Switch 4, Circuit Voltage Low.***	**C**
P0878	***Transmission Fluid Pressure (TFP) Switch 4, Circuit Voltage High.***	**C**
P0961	***Line Pressure Control (PC) Solenoid, System Performance.***	**A**
P0962	***Line Pressure Control (PC) Solenoid, Circuit Voltage Low.***	**A**
P0963	***Line Pressure Control (PC) Solenoid, Circuit Voltage High.***	**A**
P0965	***Clutch Pressure Control (PC) Solenoid 2, System Performance.***	**A**
P0966	***Clutch Pressure Control (PC) Solenoid 2, Circuit Voltage Low.***	**A**
P0967	***Clutch Pressure Control (PC) Solenoid 2, Circuit Voltage High.***	**A**
P0969	***Clutch Pressure Control (PC) Solenoid 3, System Performance.***	**A**
P0970	***Clutch Pressure Control (PC) Solenoid 3, Circuit Voltage Low.***	**A**
P0971	***Clutch Pressure Control (PC) Solenoid 3, Circuit Voltage High.***	**A**
P0973	***Shift Solenoid 1 (SS), Control Circuit Voltage Low.***	**A**
P0974	***Shift Solenoid 1 (SS), Control Circuit Voltage High.***	**A**
P0976	***Shift Solenoid 2 (SS), Control Circuit Voltage Low.***	**A**
P0977	***Shift Solenoid 2 (SS), Control Circuit Voltage High.***	**A**
P0989	***Transmission Fluid Pressure (TFP) Switch 5, Circuit Voltage Low.***	**C**
P0990	***Transmission Fluid Pressure (TFP) Switch 5, Circuit Voltage High.***	**C**
P1621	***TCM (Internal), Long Term Memory Performance.***	**A**
P1684	***TCM (Internal), Power Up Temperature Sensor Performance.***	**A**

***DTC TYPES**

A - Emission-related, turns the MIL "ON" immediately after the 1st failure.
B - Emission-related, turns the MIL "ON" after two consecutive drive cycles with failure.
C - Non-emission-related, no lamps and may display message on driver information center.

Figure 23

DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION		
DTC	*DESCRIPTION*	*DTC TYPE**
P1685	***TCM (Internal), Power Up Temperature Sensor, Circuit Voltage Low.***	**A**
P1686	***TCM (Internal), Power Up Temperature Sensor, Circuit Voltage High.***	**A**
P1751	***Shift Valve 1, Performance of Clutch Select Valve 2.***	**B**
P1825	***Manual Shift Detent Position Switch, Invalid Range***	**A**
P1831	***TCM (Internal), Driver No. 2, (Controls Line Pressure & Shift Lock Solenoids).***	**A**
P1832	***TCM (Internal), Driver No. 2, (Controls Line Pressure & Shift Lock Solenoids).***	**C**
P1876	***Up and Down Shift Switch Performance, Range Switch Not In D3.***	**C**
P1915	***Manual Shift Detent Position Switch, Start In Wrong Range.***	**A**
P2534	***Ignition Switch, Start Circuit Voltage Low.***	**A**
P2714	***Clutch Pressure Control (PC) Solenoid 4, Stuck OFF.***	**A**
P2715	***Clutch Pressure Control (PC) Solenoid 4, Stuck ON.***	**A**
P2719	***Clutch Pressure Control (PC) Solenoid 4, System Performance.***	**A**
P2720	***Clutch Pressure Control (PC) Solenoid 4, Circuit Voltage Low.***	**A**
P2721	***Clutch Pressure Control (PC) Solenoid 4, Circuit Voltage High.***	**A**
P2723	***Clutch Pressure Control (PC) Solenoid 5, Stuck OFF.***	**A**
P2724	***Clutch Pressure Control (PC) Solenoid 5, Stuck ON.***	**A**
P2728	***Clutch Pressure Control (PC) Solenoid 5, System Performance.***	**A**
P2729	***Clutch Pressure Control (PC) Solenoid 5, Circuit Voltage Low.***	**A**
P2730	***Clutch Pressure Control (PC) Solenoid 5, Circuit Voltage High.***	**A**
P2762	***TCC Pressure Control (PC) Solenoid, System Performance.***	**A**
P2763	***TCC Pressure Control (PC) Solenoid, Circuit Voltage High.***	**A**
P2764	***TCC Pressure Control (PC) Solenoid, Circuit Voltage Low.***	**A**

***DTC TYPES**

A - Emission-related, turns the MIL "ON" immediately after the 1st failure.

B - Emission-related, turns the MIL "ON" after two consecutive drive cycles with failure.

C - Non-emission-related, no lamps and may display message on driver information center.

Figure 24

FAIL-SAFE OR PROTECTION MODE

If for any reason, the entire electronic control system of the transmission, or any one of the electrical components within the Control Solenoid Body and TCM Assembly becomes disabled, the transmission will default to fail-safe mode. If the transmission is in 1st, 2nd or 3rd gear during an electrical failure, the transmission will default to 3rd gear. If the transmission is in 4th, 5th or 6th gear during an electrical failure, the transmission will default to 5th gear.

If for any reason, the entire electronic control system of the transmission fails, the line pressure control solenoid will be OFF, and maximum line pressure will be the result. This will create harsh engagements and garage shifts. The TCC PC solenoid would also be OFF, resulting in no torque converter clutch apply.

6T70/75 CHECKBALL LOCATION AND FUNCTION

Number 1 Checkball

The number one checkball is located in the upper valve body, as shown in Figure 25. When the transmission is operating in Drive 1st, 2nd, 3rd, 4th, 5th or 6th gear, drive 1-6 fluid seats the checkball against the drive braking passage and enters the 2-6 clutch/1-2-3-4 clutch feed circuit to apply the 1-2-3-4 clutch.

Number 2 Checkball

The number two checkball is located in the upper valve body, as shown in Figure 25. This shuttle type checkball is seated against the reverse passage while the transmission is operating in Park, Neutral and Drive 1st. With the checkball in this position, shift solenoid 1 fluid enters the CSV2 enable circuit to the "clutch select valve 2". When the transmission is operating in Reverse, the checkball seats against shift solenoid 1 passage to allow reverse fluid to enter the CSV2 enable circuit and hold the "clutch select valve 2" in the applied position.

Number 3 Checkball

The number three checkball is located in the upper valve body, as shown in Figure 25. This shuttle type checkball is seated against the 4-5-6 clutch passage while the transmission is operating in Park, Reverse, Neutral, Drive 1st, 2nd and 3rd gear. With the checkball in this position, shift solenoid 2 fluid enters the CSV3 enable circuit to apply the "clutch select valve 3". When the transmission is operating in Drive 4th, 5th or 6th gear, the checkball seats against the shift solenoid 2 passage to allow 4-5-6 clutch fluid to enter the CSV3 enable circuit and hold the "clutch select valve 3" in the applied position.

Number 4 Checkball

The number four checkball is located in the upper valve body, as shown in Figure 25. This shuttle type checkball is seated against the 4-5-6 clutch passage by Pressure Solenoid 4 fluid, while the transmission is operating in Park, Reverse, Neutral, Drive 1st, 2nd and 3rd gear. With the checkball in this position, PS 4 fluid enters the CSV2 latch circuit to hold the "clutch select valve 2" in the released position. When the transmission is operating in Drive 4th, 5th or 6th gear, 4-5-6 clutch fluid seats the checkball against the PS 4 passage to allow 4-5-6 clutch fluid to enter the CSV2 latch circuit to hold the "clutch select valve 2" in released the position.

Number 5 Checkball

The number five checkball is located in the upper valve body, as shown in Figure 25. This shuttle type checkball is seated against the Drive 1-6 passage by 3-5/Reverse Feed fluid while the transmission is operating in Reverse. With the checkball in this position, 3-5/Reverse Feed fluid enters the 3-5/Reverse Supply circuit and is routed to the number 7 checkball. When the transmission is operating in Drive 1st, 2nd, 3rd, 4th, 5th or 6th gear, Drive 1-6 fluid seats the ball against the 3-5/Reverse Feed passage to allow Drive 1-6 fluid to enter the 3-5/Reverse Supply circuit.

Number 6 Checkball

The number six checkball is located in the upper valve body, as shown in Figure 25. This "one way orifice control" type checkball is used to differentiate the flow rate of fluid between applying and releasing the 1-2-3-4 clutch. 2-6 clutch/1-2-3-4 clutch feed fluid opens the checkball, while the transmission is operating in Drive 1st, 2nd, 3rd, 4th, 5th or 6th gear. With the ball in this position, 2-6 clutch/1-2-3-4 clutch feed fluid flows freely into the 1-2-3-4 clutch feed passage. When Park, Reverse or Neutral is selected after the transmission was operating in Drive, exhausting 1-2-3-4 clutch feed fluid seats the checkball, and forces exhausting fluid through orifice number 32, which allows for a controlled exhaust of the 1-2-3-4 clutch.

Number 7 Checkball

The number seven checkball is located in the upper valve body, as shown in Figure 25. This "one way orifice control" type checkball is used to differentiate the flow rate of fluid between applying and releasing the 3-5/Reverse clutch. 3-5/Reverse Supply fluid pressure seats the checkball against the 3-5/Reverse Feed passage, while the transmission is operating in Reverse, Drive 1st, 2nd, 3rd, 4th, 5th or 6th gear. With the checkball in this position, 3-5/Reverse Supply fluid is forced through orifice number 25 before entering the 3-5/Reverse Feed passage. The orifice helps control the apply rate of the 3-5/Reverse clutch when the transmission shifts into Reverse, 3rd or 5th gear. When Park or Neutral is selected after the transmission was operating in Drive, or Reverse, exhausting 3-5/Reverse Feed fluid unseats the checkball. This allows for a faster exhaust of 3-5/Reverse Feed fluid and a quick release of the 3-5/Reverse clutch.

Number 8 Checkball

The number eight checkball is located in the upper valve body, as shown in Figure 25. This "one way orifice control" type checkball is used to differentiate the flow rate of fluid between applying and releasing the Low/Reverse clutch. When the transmission is operating in Park, Reverse, Neutral and Drive Range 1st gear-Engine Braking, the number eight checkball which allows for a quick apply of the Low/Reverse clutch. When the transmission is operating in Drive Range First Gear, R1 fluid exhausts, seating the ball forcing R1 fluid past orifice #18. The orifice helps control the release of the Low/Reverse clutch.

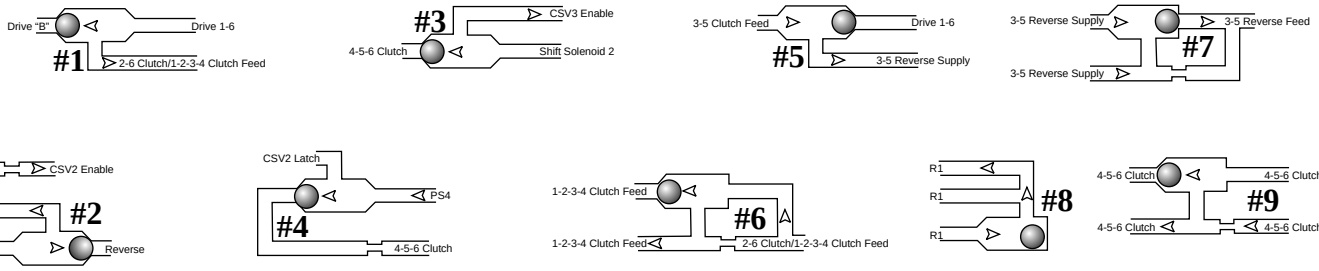
Number 9 Checkball

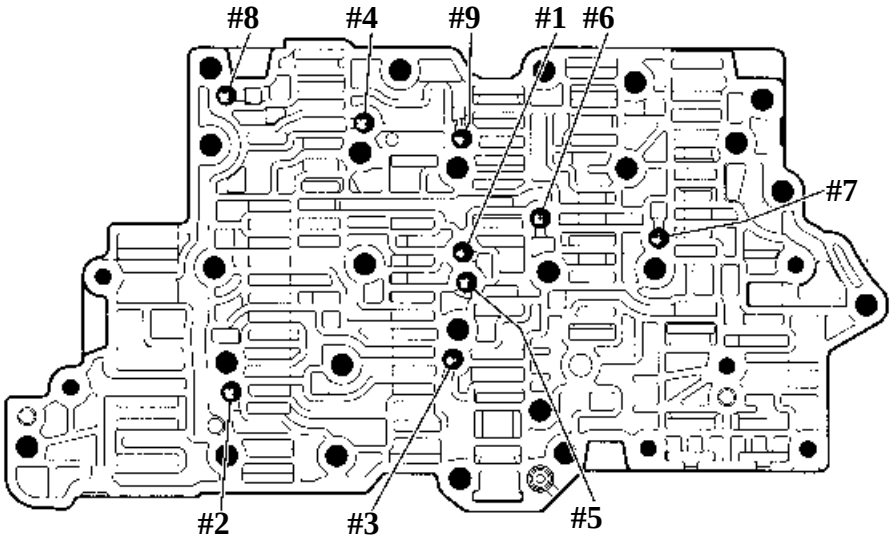
The number nine checkball is located in the upper valve body, as shown in Figure 25. This "one way orifice control" type checkball is used to control the flow rate of fluid when applying and releasing the 4-5-6 clutch. When the transmission is operating in Drive Range Fourth ,Fifth and Sixth gears, this clutch pressure seats the ball. At this time 4-5-6 fluid id forced through orifice #39 before going to the 4-5-6 clutch. The orifice helps control the rate of apply and release of the 4-5-6 clutch.

Actuator Feed Accumulator Piston

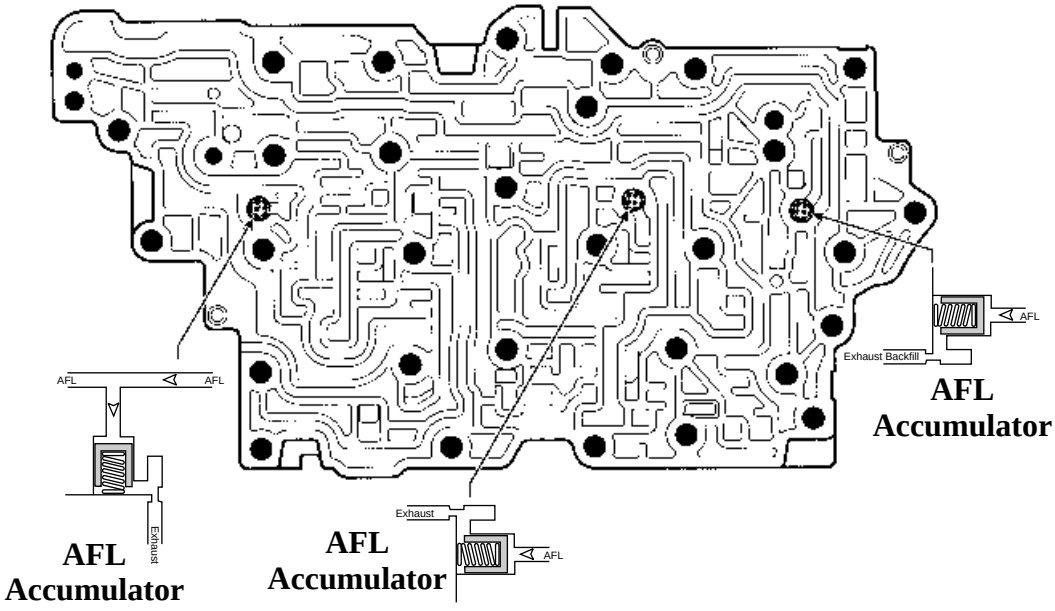
The Actuator Feed Accumulator Piston is located in the control valve channel plate, as shown in Figure 25. Three actuator feed accumulators are used to dampen any pressure irregularities occurrin the in actuator feed limit fluid circuit.

6T70/75 CHECKBALL LOCATION AND FUNCTION





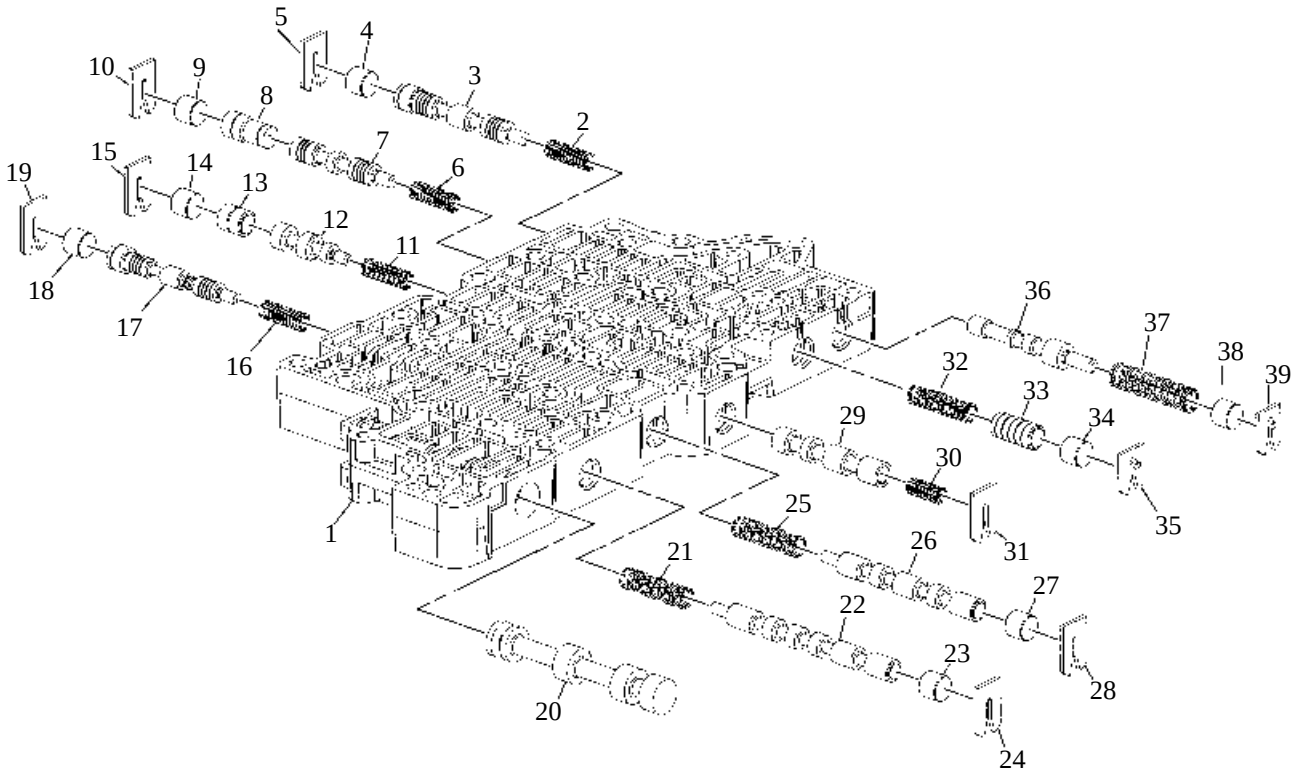
CONTROL VALVE UPPER VALVE BODY



CONTROL VALVE CHANNEL PLATE

Figure 25

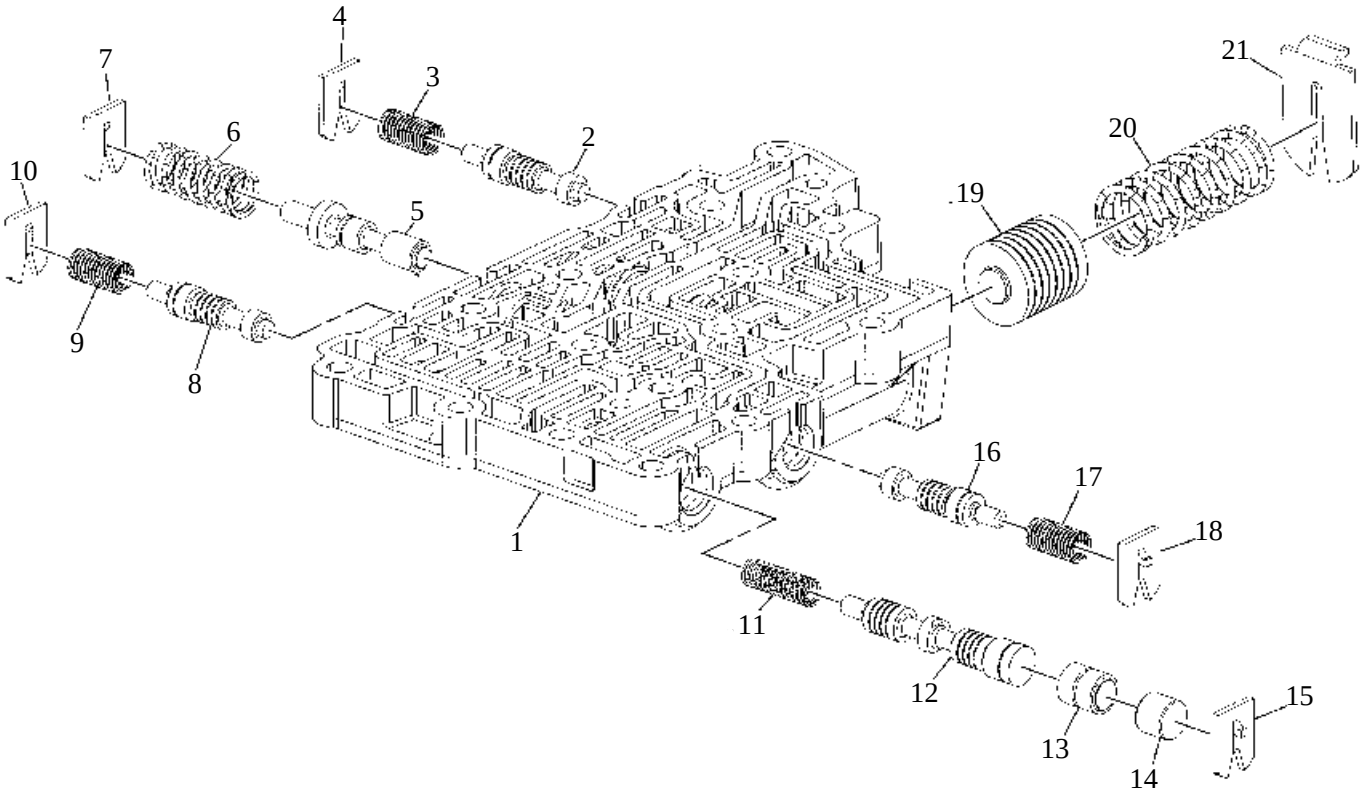
6T70/75 UPPER VALVE BODY IDENTIFICATION



1. Upper Control Valve Body
2. 3-5-Reverse Clutch Regulator Valve Spring
3. 3-5-Reverse Clutch Regulator Valve
4. 3-5-Reverse Clutch Regulator Valve Bore Plug
5. 3-5-Reverse Clutch Regulator Valve Retainer
6. 2-6 Clutch Regulator Valve Spring
7. 2-6 Clutch Regulator Valve
8. 2-6 Clutch Gain Valve
9. 2-6 Clutch Regulator/Gain Valve Bore Plug
10. 2-6 Clutch Regulator/Gain Valve Retainer
11. Torque Converter Clutch Regulator Apply Valve Spring
12. Torque Converter Clutch Regulator Apply Valve
13. Torque Converter Clutch Regulator Apply Shuttle Valve
14. Torque Converter Clutch Regulator Apply/Shuttle Valve Bore Plug
15. Torque Converter Clutch Regulator Apply/Shuttle Valve Retainer
16. Low/Reverse/4-5-6 Clutch Regulator Valve Spring
17. Low/Reverse/4-5-6 Clutch Regulator Valve
18. Low/Reverse/4-5-6 Clutch Regulator Valve Bore Plug
19. Low/Reverse/4-5-6 Clutch Regulator Valve Retainer
20. Manual Valve
21. Clutch Select Solenoid Valve #2 Spring
22. Clutch Select Solenoid Valve #2
23. Clutch Select Solenoid Valve #2 Bore Plug
24. Clutch Select Solenoid Valve #2 Retainer
25. Clutch Select Solenoid Valve #3 Spring
26. Clutch Select Solenoid Valve #3
27. Clutch Select Solenoid Valve #3 Bore Plug
28. Clutch Select Solenoid Valve #3 Retainer
29. Torque Converter Clutch Control Valve
30. Torque Converter Clutch Control Valve Spring
31. Torque Converter Clutch Control Valve Retainer
32. Isolator Valve Spring
33. Isolator Valve
34. Isolator Valve Bore Plug
35. Isolator Valve Retainer
36. Main Pressure Regulator Valve
37. Main Pressure Regulator Valve Spring
38. Main Pressure Regulator Valve Bore Plug
39. Main Pressure Regulator Valve Retainer

Figure 26

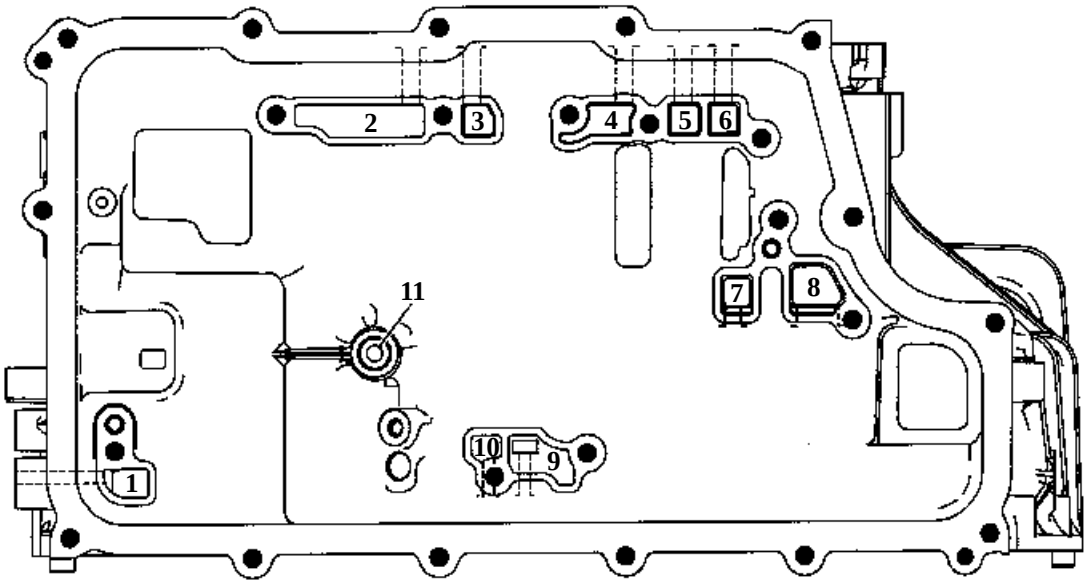
6T70/75 LOWER VALVE BODY IDENTIFICATION



1. Lower Control Valve Body
2. 3-5-Reverse Clutch Boost Valve
3. 3-5-Reverse Clutch Boost Valve Spring
4. 3-5-Reverse Clutch Boost Valve Retainer
5. Actuator Feed Limit Valve
6. Actuator Feed Limit Valve Spring
7. Actuator Feed Limit Valve Retainer
8. 4-5-6 Clutch Boost Valve
9. 4-5-6 Clutch Boost Valve Spring
10. 4-5-6 Clutch Boost Valve Retainer
11. 1-2-3-4 Clutch Regulator Valve Spring
12. 1-2-3-4 Clutch Regulator Valve
13. Default Override 1-2-3-4 Clutch Valve
14. 1-2-3-4 Clutch Regulator Valve/Default Override 1-2-3-4 Clutch Valve Bore Plug
15. 1-2-3-4 Clutch Regulator Valve/Default Override 1-2-3-4 Clutch Valve Retainer
16. 1-2-3-4 Clutch Boost Valve
17. 1-2-3-4 Clutch Boost Valve Spring
18. 1-2-3-4 Clutch Boost Valve Retainer
19. 4-5-6 Clutch Accumulator Piston
20. 4-5-6 Clutch Accumulator Piston Spring
21. 4-5-6 Clutch Accumulator Piston Retainer

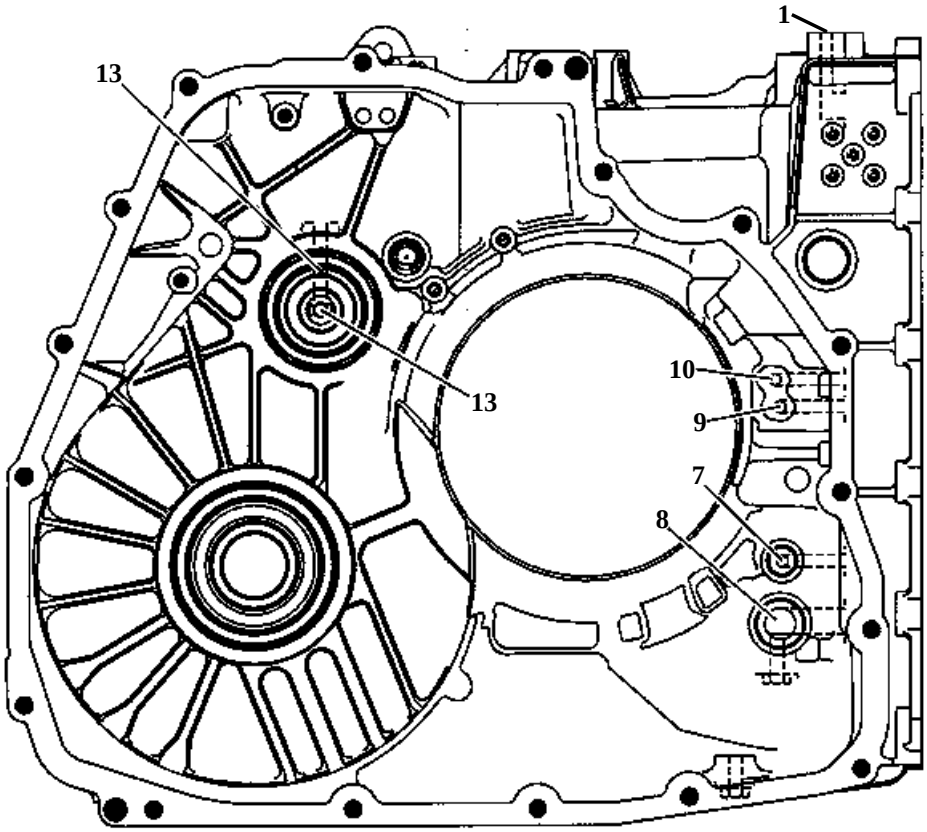
Figure 27

6T70/75 TRANSMISSION CASE -VALVE BODY SIDE PASSAGE IDENTIFICATION



1. Cooler Feed
2. R1
3. 4-5-6 Clutch
4. 2-6 Clutch
5. 3-5-Reverse Clutch
6. Compensator Feed
7. Decrease
8. Line
9. TCC Release
10. TCC Apply
11. 1-2-3-4 Clutch

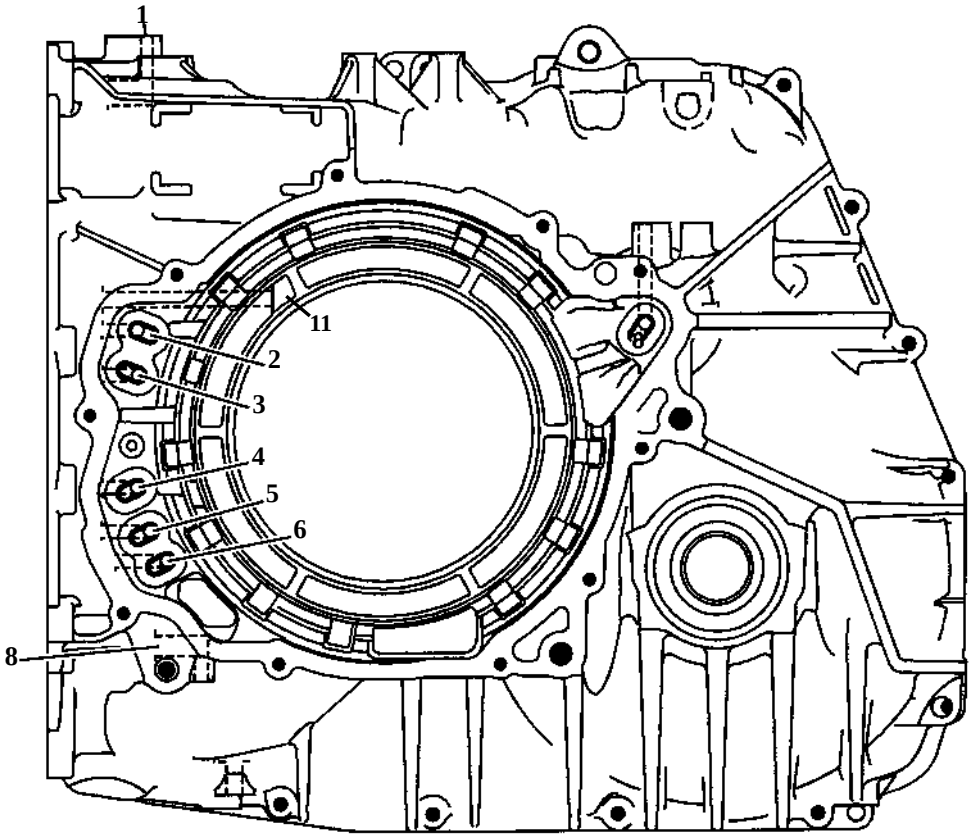
6T70/75 TRANSMISSION CASE -DIFFERENTIAL SIDE PASSAGE IDENTIFICATION



1. Cooler Feed
7. Decrease
8. Line
9. TCC Release
10. TCC Apply
13. Lube

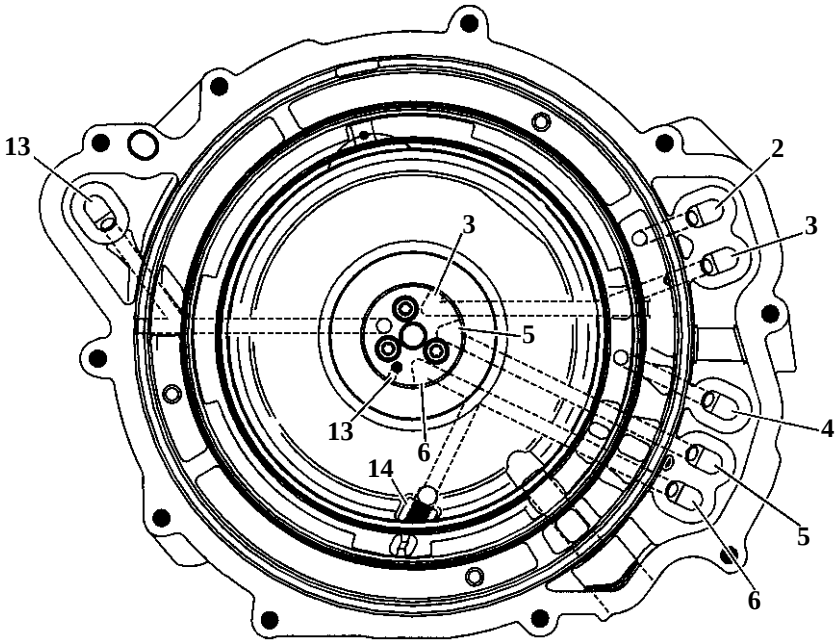
Figure 28

6T70/75 TRANSMISSION CASE -END COVER SIDE PASSAGE IDENTIFICATION



1. Cooler Feed
2. R1
3. 4-5-6 Clucth
4. 2-6 Clutch
5. 3-5-Reverse Clutch
6. Compensator Feed
7. Decrease
8. Line
9. TCC Release
10. TCC Apply
11. 1-2-3-4 Clutch

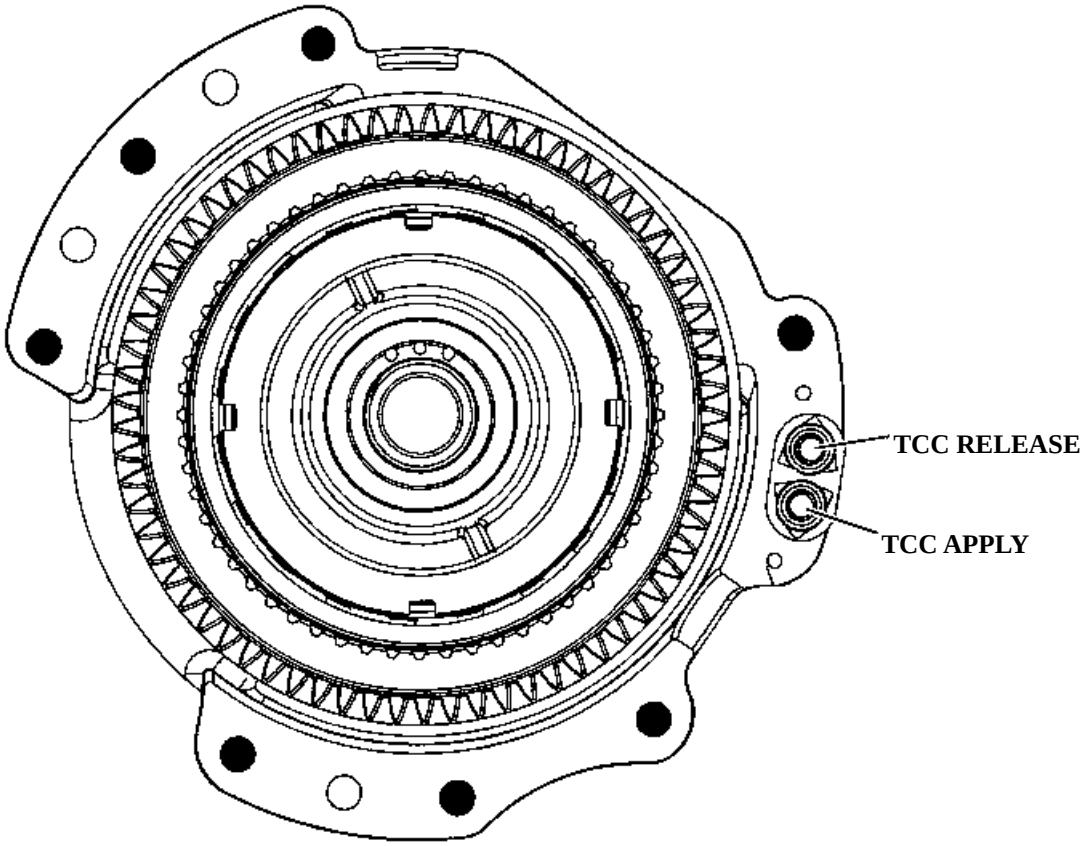
6T70/75 END COVER PASSAGE IDENTIFICATION



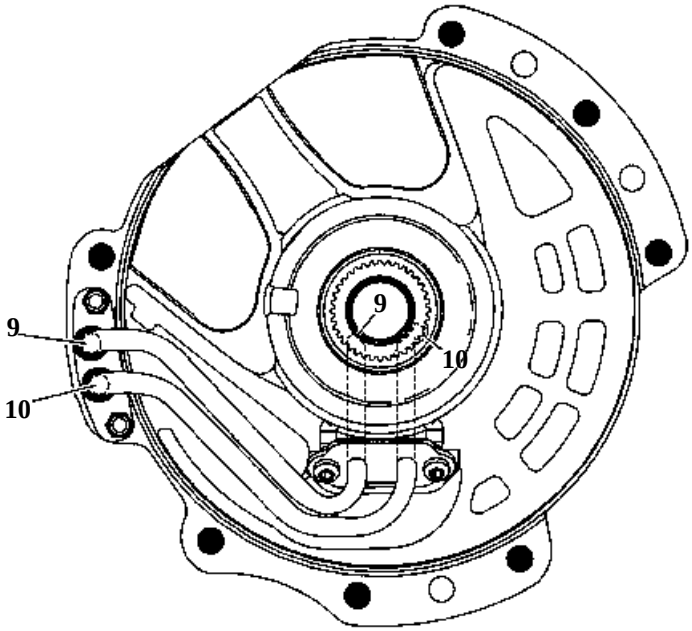
1. Cooler Feed
2. R1
3. 4-5-6 Clucth
4. 2-6 Clutch
5. 3-5-Reverse Clutch
6. Compensator Feed
7. Decrease
8. Line
9. TCC Release
10. TCC Apply
11. 1-2-3-4 Clutch
13. Lube
14. Exhaust

Figure 29

6T70/75 FRONT DIFFERENTIAL TRANSFER DRIVE GEAR SUPPORT -CASE SIDE PASSAGE IDENTIFICATION



6T70/75 FRONT DIFFERENTIAL TRANSFER DRIVE GEAR SUPPORT -
DIFFERENTIAL HOUSING SIDE PASSAGE IDENTIFICATION



9. TCC Release
10. TCC Apply

Figure 30

GM 6T70/75

I/O SPEED SENSOR ISSUES

COMPLAINT: A 2007 GMC Acadia equipped with a 6T70 transaxle may develop a problem illuminating the "Check Engine" lamp with some of the following codes being set: P0716, P0717, P0722, P0723, P0751, P0756, P0776, P0796, P2714 or P2723. A 2007 Buick Enclave Pontiac G6, Saturn Aura or Outlook may also develop this same complaint.

CAUSE: The Input and/or Output Speed Sensors are faulty.

CORRECTION: Use a scan tool to check input and output rpm and replace the defective speed sensor(s).

To replace the ISS or OSS speed sensor, the valve body will have to be removed. Remove only the shaded bolts shown in Figure 1 to remove the valve body assembly.
The location of the speed sensors is explained in Figure 2.

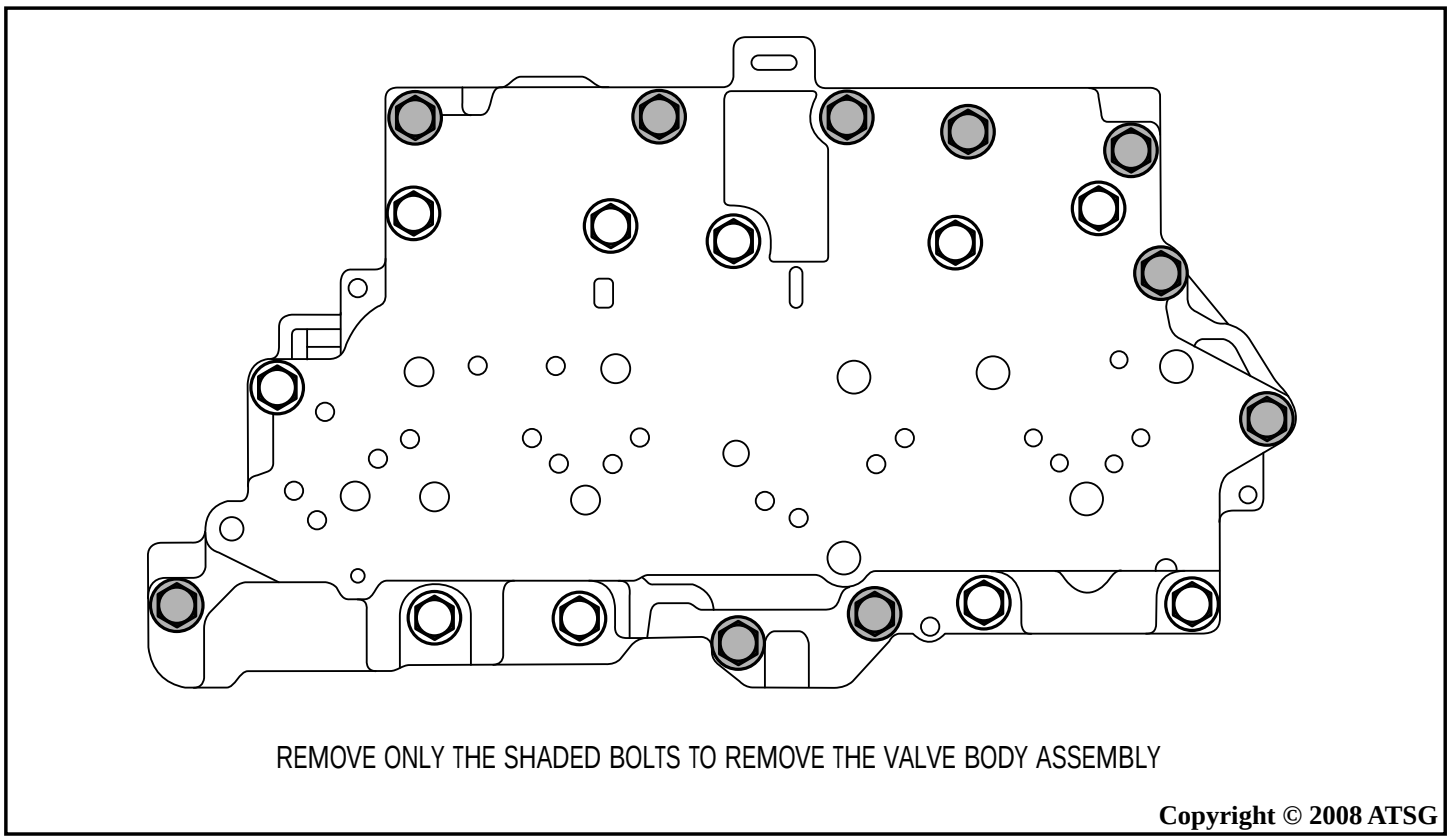
NOTE: There has been problems with the input and output speed sensors while still under the factory warranty. Refer to Factory Bulletin **07-0730-019A.**

SERVICE INFORMATION:

A/T Input Speed Sensor.....24223891
A/T Output Speed Sensor.....24238337

SPECIAL NOTE: *Care must be taken when dropping the frame to gain access to the transmission to not let the splined steering knuckle slip out of the steering rack. If this should occur, after reassembly the steering wheel will rotate continuously and could cause damage to the clock springs setting a variety of codes.*

Many thanks to Luis Zabala
from WiWi's Transmissions



REMOVE ONLY THE SHADED BOLTS TO REMOVE THE VALVE BODY ASSEMBLY

Figure 1

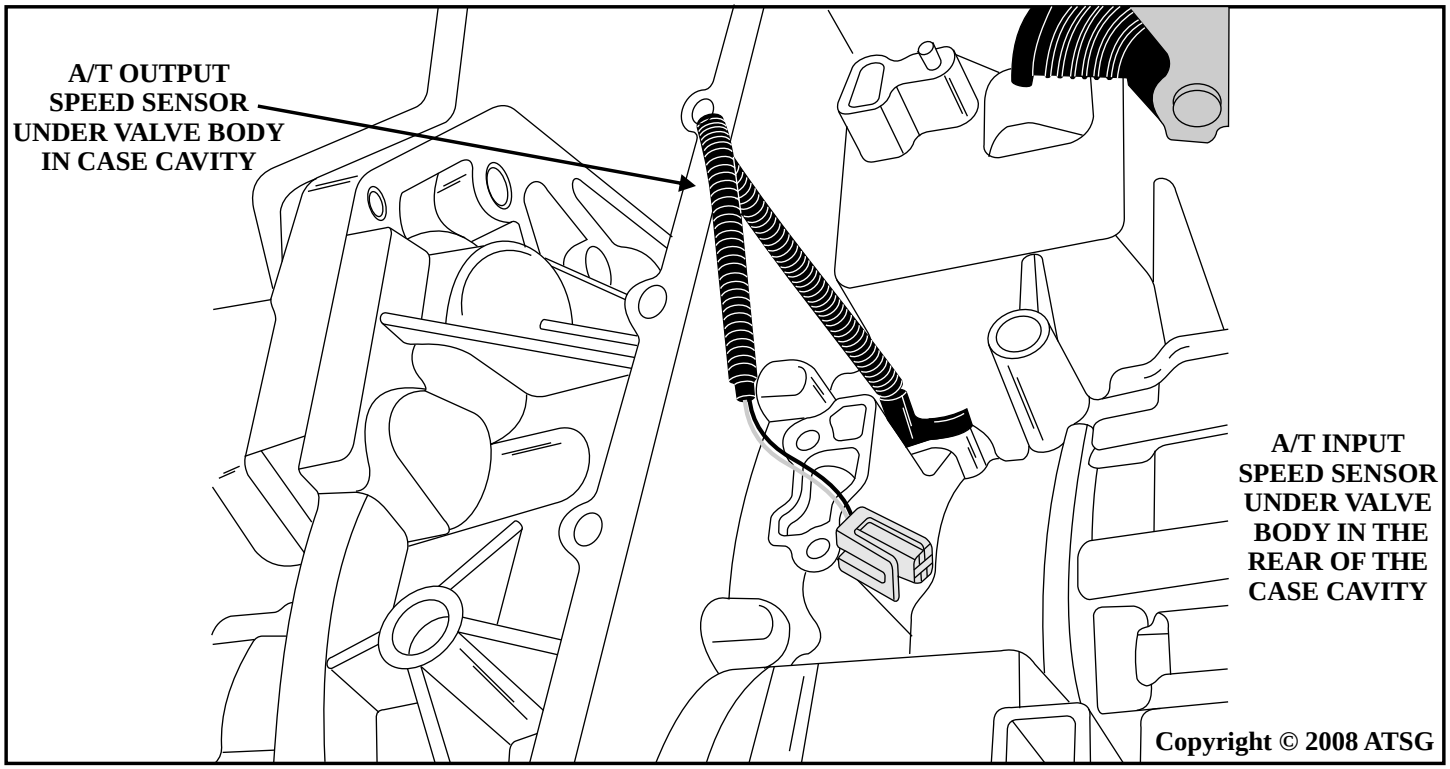


Figure 2

WESCO
Black & White
(Use 07 Ad)

AMG HUMMER H1 1997 - 2000
MYSTERIOUS TRANSMISSION FLUID LOSS

COMPLAINT: Before or after overhaul, a 1995 to 2000 model Hummer H1 enters the shop with an unexplained transmission fluid loss, venting from the transfer case or transmission fluid contaminating the air filter.

CAUSE: One cause may be the oil cooler in the transfer case has a crack and is leaking ATF into the transfer case.

Hummer uses a cooler inside the NV242HD Transfer Case. The cooler tube is prone to cracking which will allow transmission cooler pressure to leak into the transfer case. Once this begins occurring, the transfer case will become overfilled and depending on the severity of the crack, fluid may vent from the transfer case, or the fluid can make its way into the air cleaner and contaminate the air filter and leak near the right front tire. It is also possible for the fluid pressure to push out the rear seal. Transmission damage may also occur if the transmission fluid level becomes too low.

In 2001 Hummer introduced an updated cooler with a revised support bracket and additional mounting tabs to restrict movement and eliminate cracking of the cooler. This revised cooler can be identified by the "Blue" ID Stripe located on one of external fittings.

Refer to Figure 1 for Cooler location in the Transfer Case. Refer to Figure 2 for cracking location of the Cooler Tube. Refer to Figure 3 for description and depiction of revised Transfer Case Cooler. Refer to Figure 4 for Transfer Case Cooler, hose and cooler line routing diagram.

CORRECTION: Install the updated cooler.

SERVICE INFORMATION:

AMG Hummer Part # for: Revised Transfer Case Cooler.....6011652

ROCKLAND
Black & White
(Use 07 Ad)

TRANSFER CASE
COOLER LOCATION

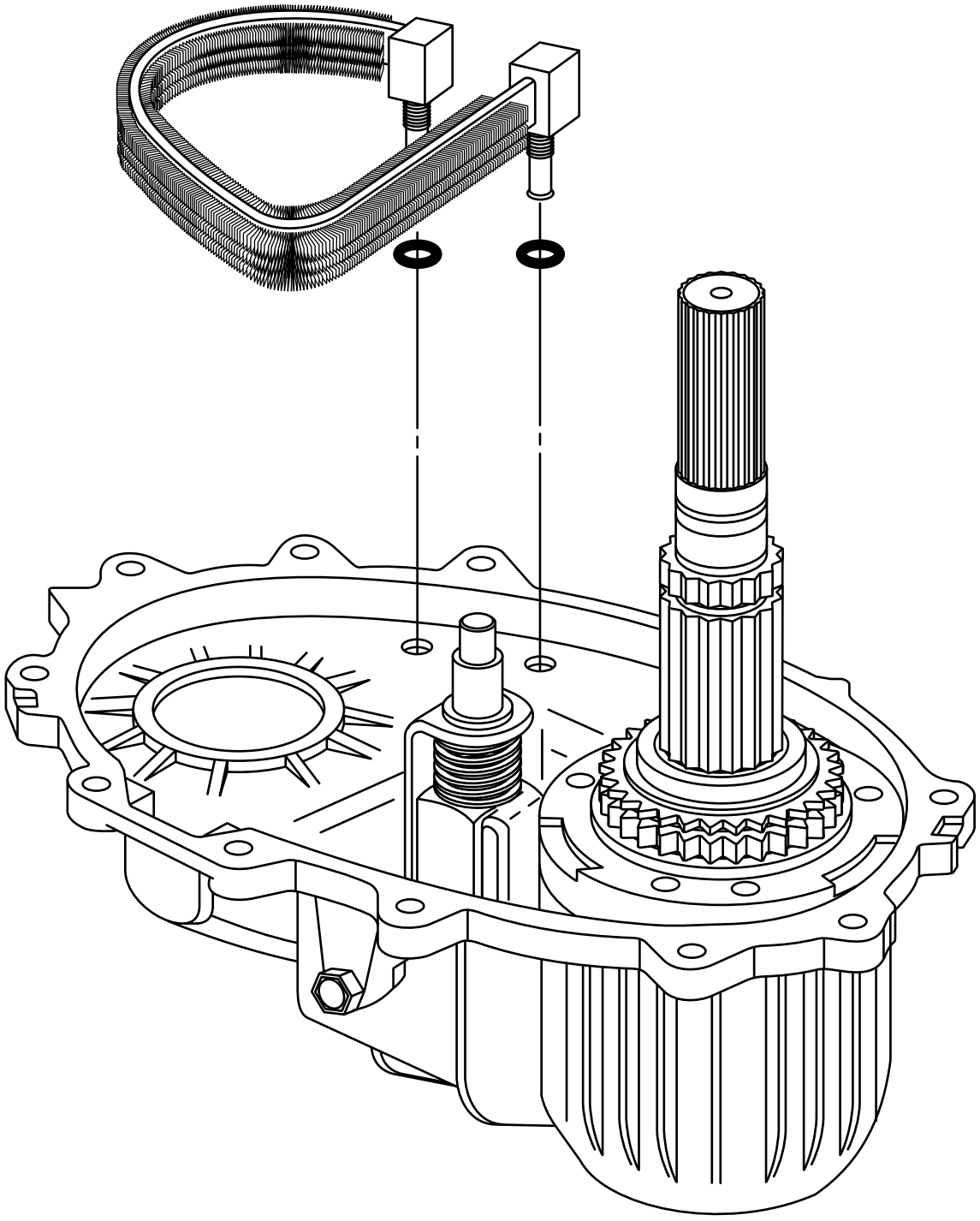


Figure 1

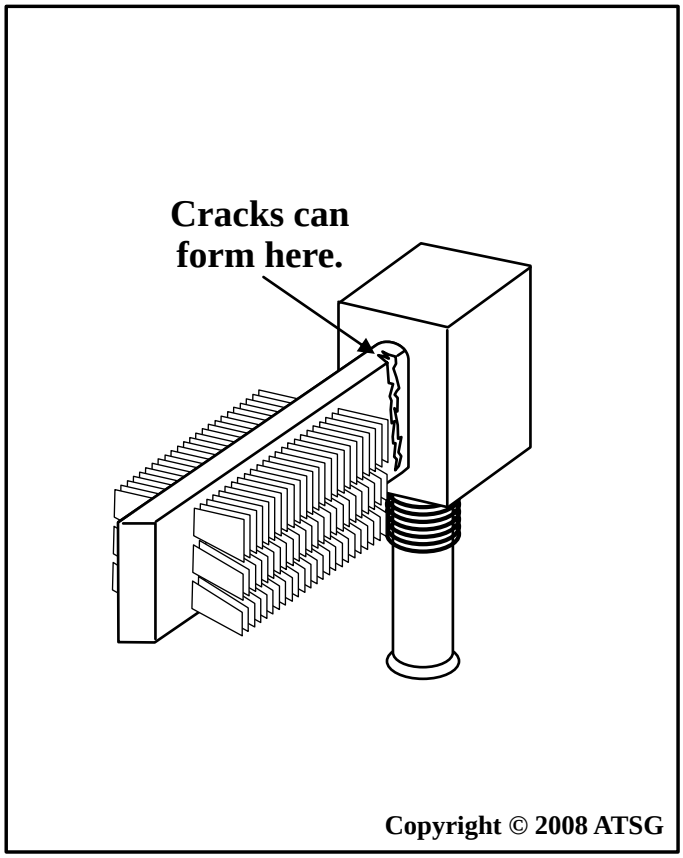


Figure 2

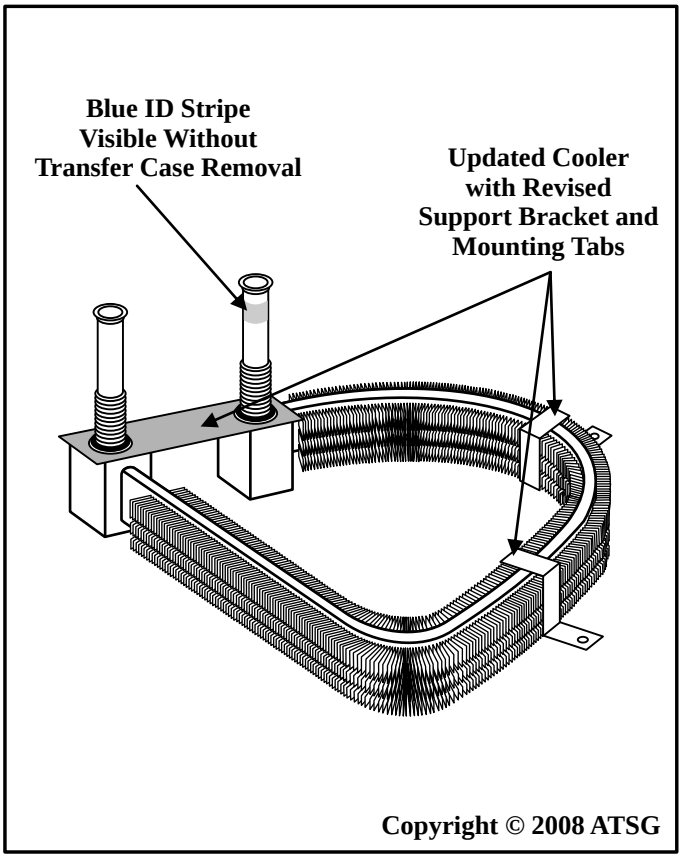


Figure 3

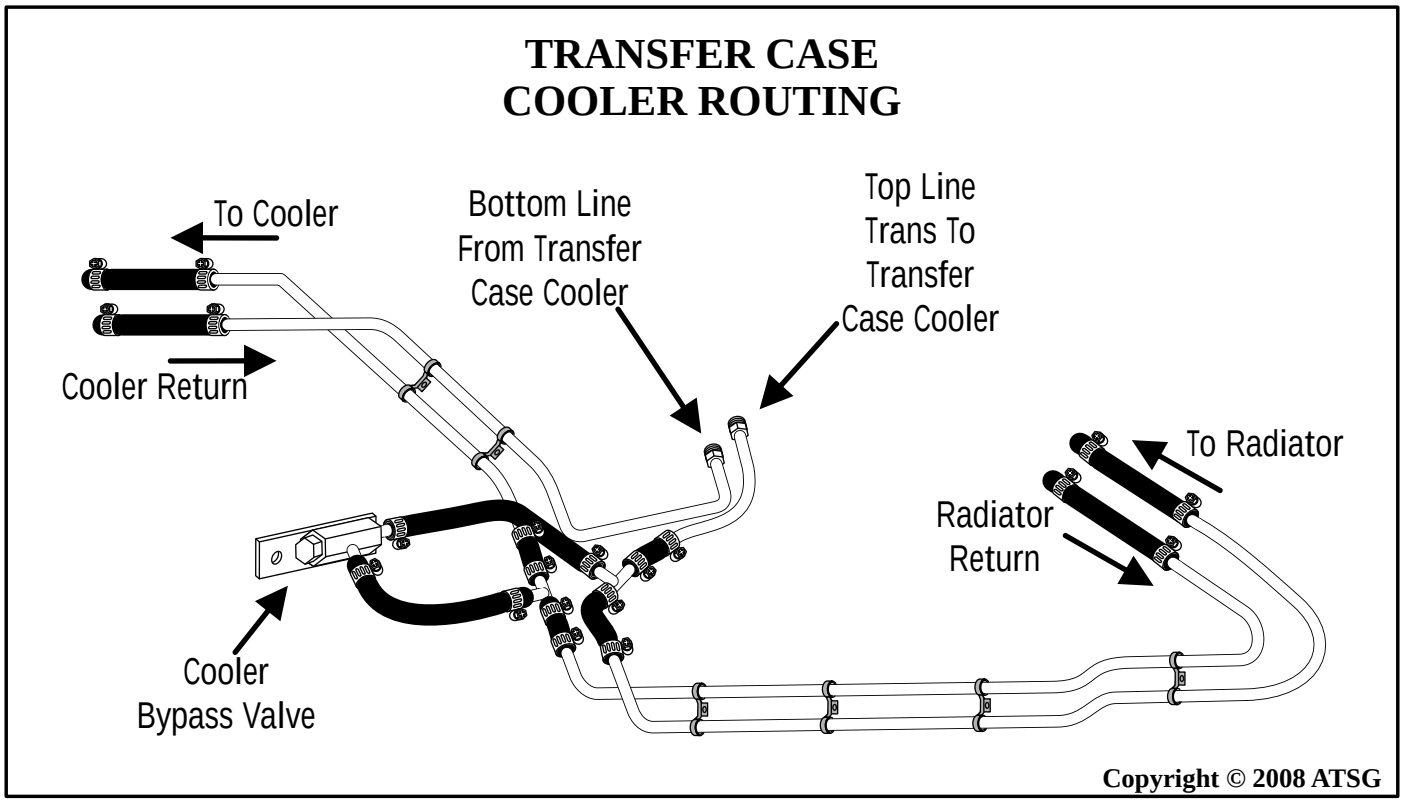


Figure 4

ALLISON MT545

ELECTRIC MODULATOR OPERATION

COMPLAINT: The transmission shifts are to soft or to harsh. The transmission may have durability issues as far as burning the friction plates either before overhaul or prematurely, after overhaul.

CAUSE: One of the components in the electric modulator control system has failed.

CORRECTION: The electric modulator has only two positions, light throttle operation and heavy throttle operation. With light throttle the modulator is not energized, therefore, the transmission is using a set line pressure of approximately 155 psi.
When the throttle is depressed to 80% or greater, the modulator is then energized and pressure is raised to insure proper clutch holding pressure. This is also important when the vehicle is fully loaded. It takes more throttle to move the vehicle thereby energizing the modulator to raise clutch pressure to insure durability.
When the throttle is released to 60% or less, the modulator is released to avoid clunks on the downshifts.

The components involved are the vehicles Engine Control Module, Accelerator Pedal Position Module, (See Figure 1), Modulator Control Relay, (See Figure 2), and the Electric Modulator, (See Figure 3).
The Accelerator Pedal Position Module sends its signal to the ECM. The ECM in turn grounds the normally open Modulator Control Relay which energizes the modulator.
The modulator is provided with system voltage which depends on whether it is a 12 volt or 24 volt system. Once the modulator is energized its plunger shoots out and strokes the modulator valve. This system can be used in a non-comouter controlled vehicle by the use of a throttle controlled ON/OFF switch.
The modulator can be mechanically faulty if it is stuck in or out, or, it can be electrically faulty if it is shorted or open.
The relay could be open which would not energize the modulator or it could be stuck closed which would result in the modulator not withdrawing.
If the APPM signal is faulty, the relay would not be energized or could be energized at all times.
The ECM could be faulty by not providing the necessary ground to the relay or by providing ground at all times. The ECM in the vehicle is provided by the engine builder, (International, Cummins, Caterpillar, etc.). The relay and APPM is provided by the truck maker, (Ford, GMC, Freightliner, Mack, Etc.). The modulator is supplied by Allison.
The modulator has two wires, one is from the relay which provides electricity to the modulator. The other is ground which is usually grounded to the chassis nearby.
Check for system voltage to be present at the modulator on full throttle and no electricity when the throttle is released, (Refer to the wire diagram in Figure 4). In most cases the faulty component is usually the modulator or the relay.

SERVICE INFORMATION:

12 Volt Electric Modulator.....29508036
24 Volt Electric Modulator.....29508037

ELECTRIC MODULATOR OPERATION

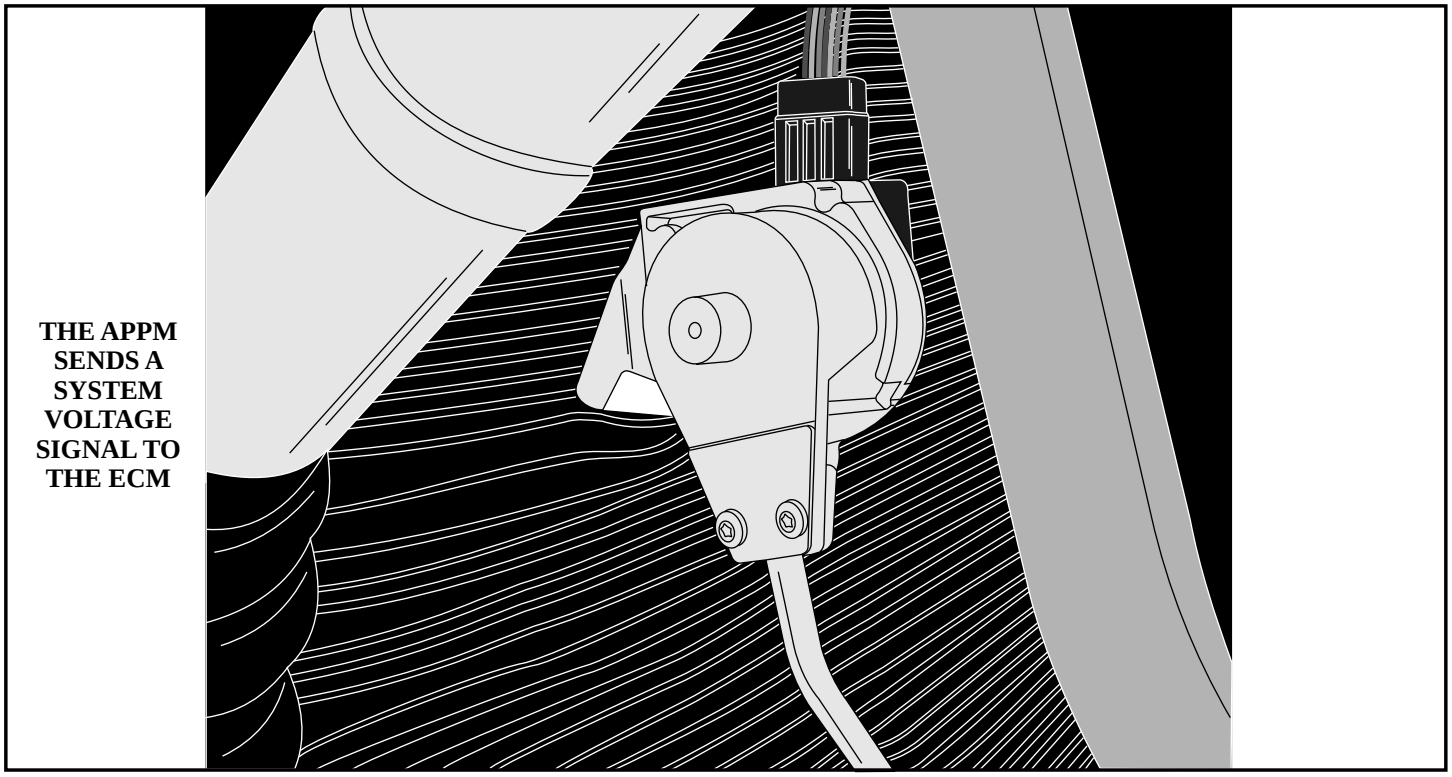


Figure 1

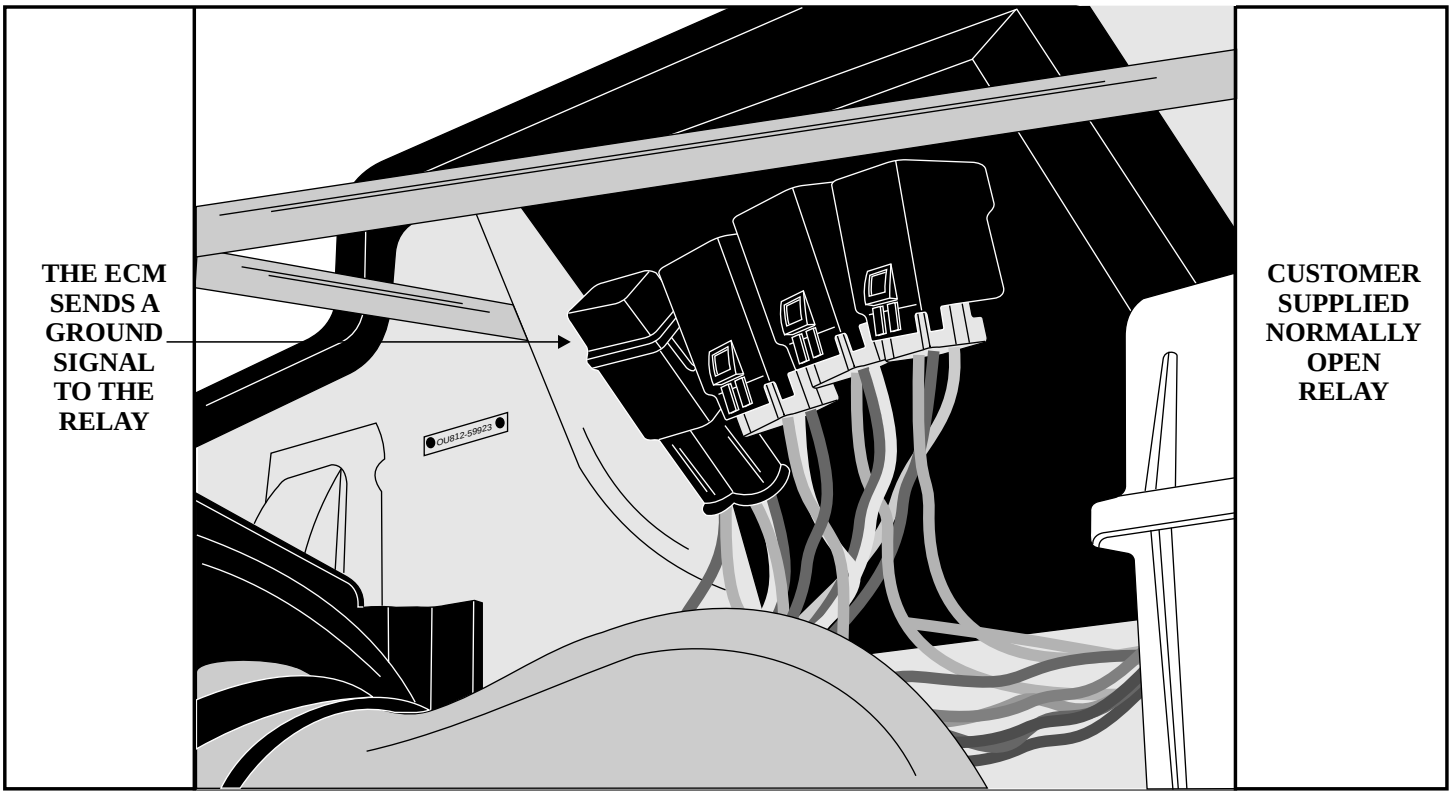


Figure 2

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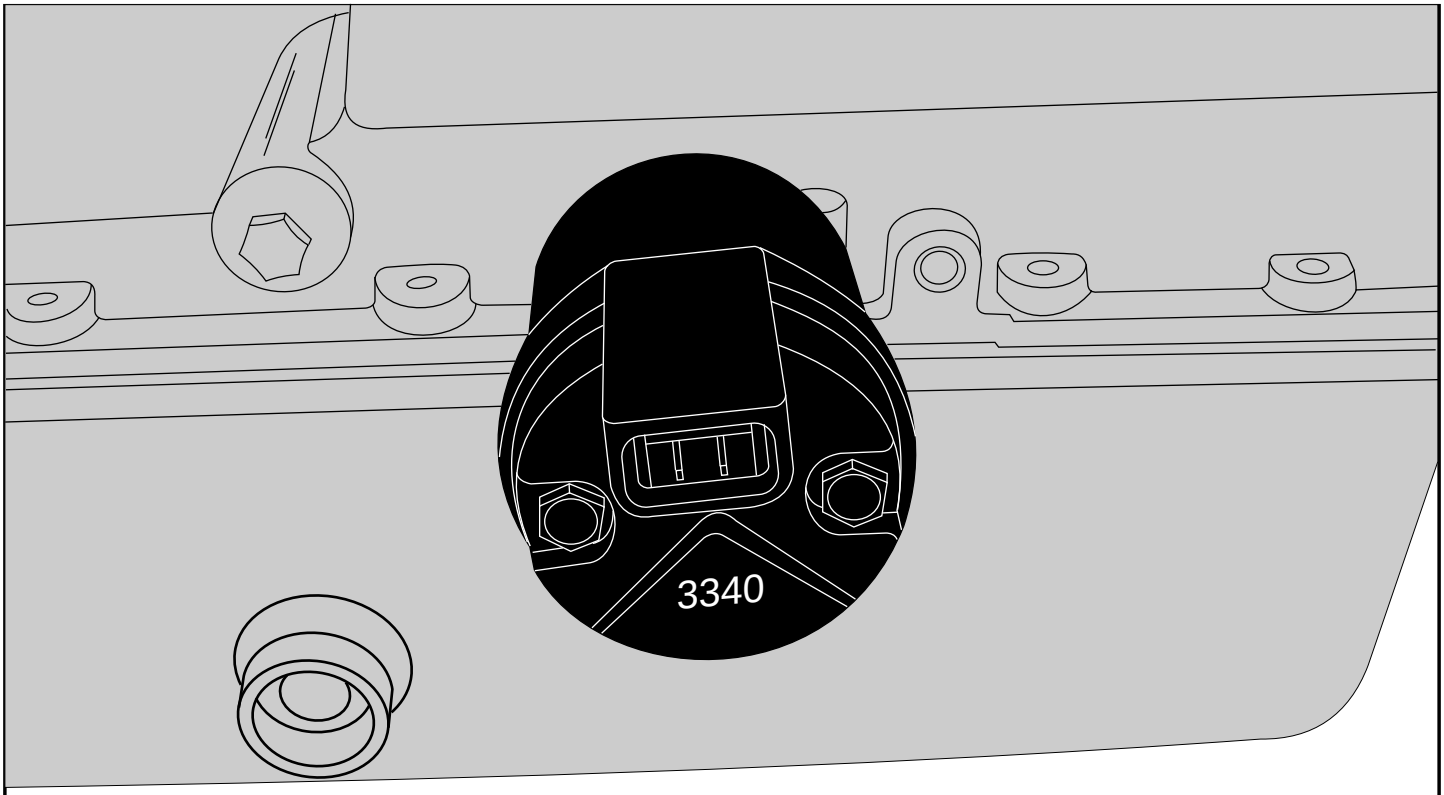
Trans Digest

ELECTRIC MODULATOR OPERATION



12 VOLT MODULATOR - PN 29508036
24 VOLT MODULATOR - PN 29508037

Figure 3

ELECTRIC MODULATOR SYSTEM DIAGRAM

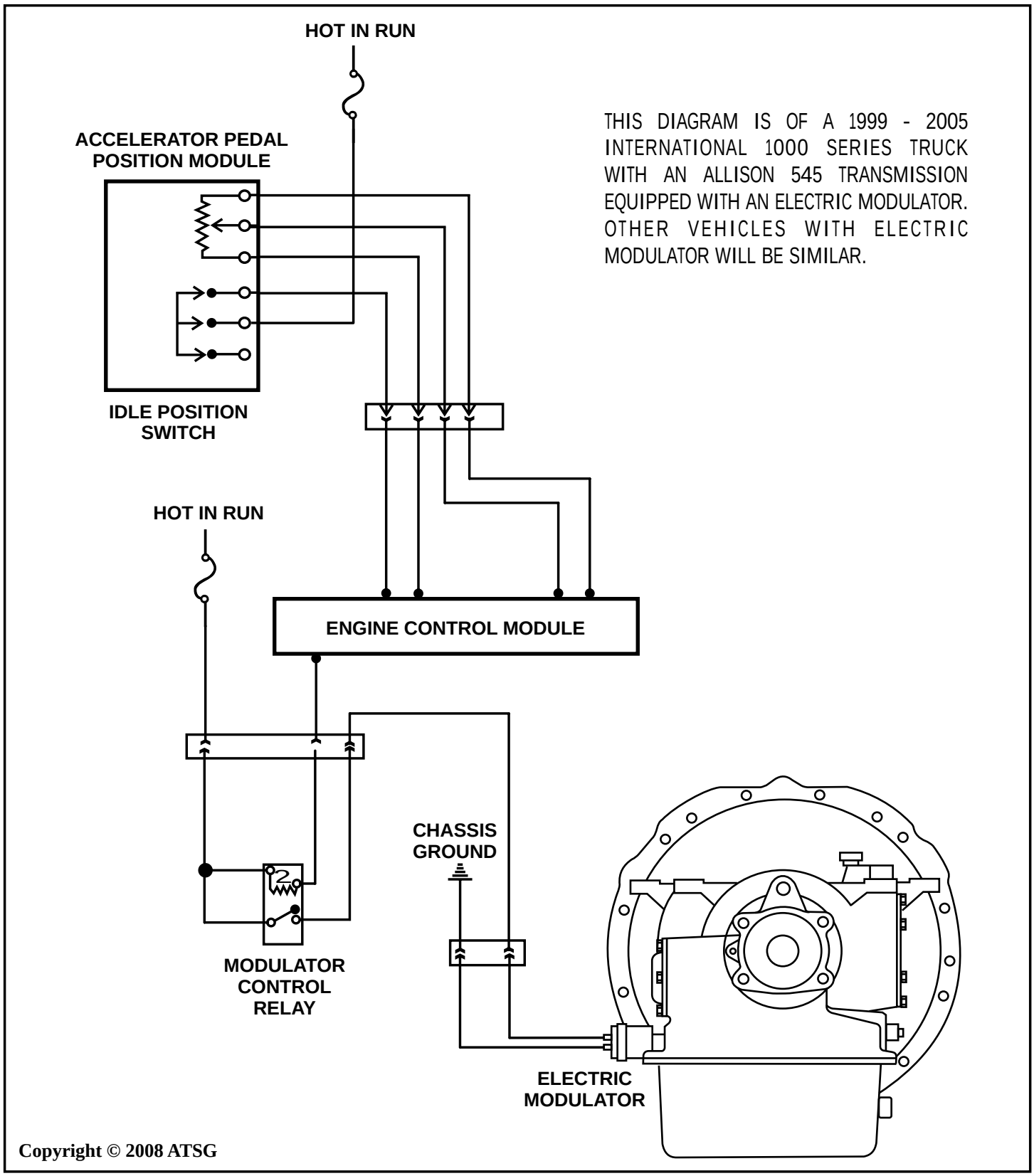


Figure 4

ALLISON AT545 TRANSMISSION

FLYWHEEL DAMAGE

COMPLAINT: The vehicle returns with a complaint of leaking out the front of the transmission and a slight vibration at higher engine speeds. When the transmission is removed, the flywheel is cracked and the front pump bushing is damaged.

CAUSE: The crankshaft pilot (Refer to Figure 1) is worn.

CORRECTION: Replace the crankshaft pilot or have sleeved to original specifications.

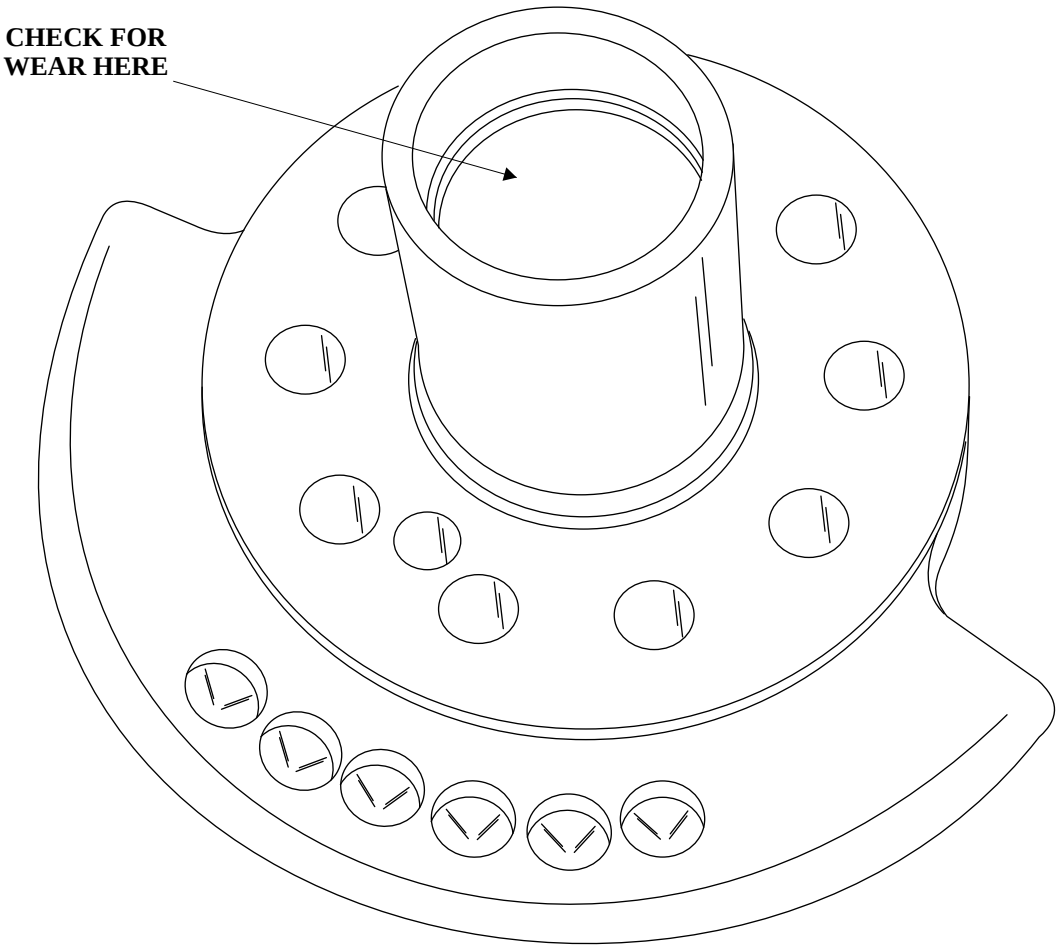


Figure 1

GM ALLISON 1000/2000
NO UP SHIFT, DTC P0708 STORED

COMPLAINT: Before or after overhaul, a GM vehicle equipped with the Allison 1000/2000 transmission may exhibit a no up shift condition. When scanning the truck code P0708 (Transmission Range Sensor Circuit Input High) is stored. Usually when this code is stored, replacing the "Neutral Start Backup Switch" cures the problem, however, when looking for the NSBU switch, the technician notices the switch is not bolted on the driver side of the transmission case.

CAUSE: Beginning in 2006, GM vehicles with the Allison 1000/2000 transmission eliminated the NSBU switch on the outside of the transmission, and instead used an Internal Mode Switch in its place. The Internal Mode Switch is located on the selector shaft inside the transmission and indicates gear selector position to the ECM. When this Internal Mode Switch was introduced, the internal harness in the transmission was also changed because internal harness pin assignments were changed as well.

The switch can be tested in the same way as the previous NSBU switch, and switch parity is identical. Refer to Figure 1 for Internal Mode Switch location. Refer to Figure 2 for Transmission Harness Connector Pin ID Internal Mode Switch models and NSBU models with Line Pressure EPC Solenoid.

CORRECTION: Verify wiring harness integrity, replace the Internal Mode Switch. Refer to Figure 3 for partial wiring diagram and Internal Mode Switch parity test chart.

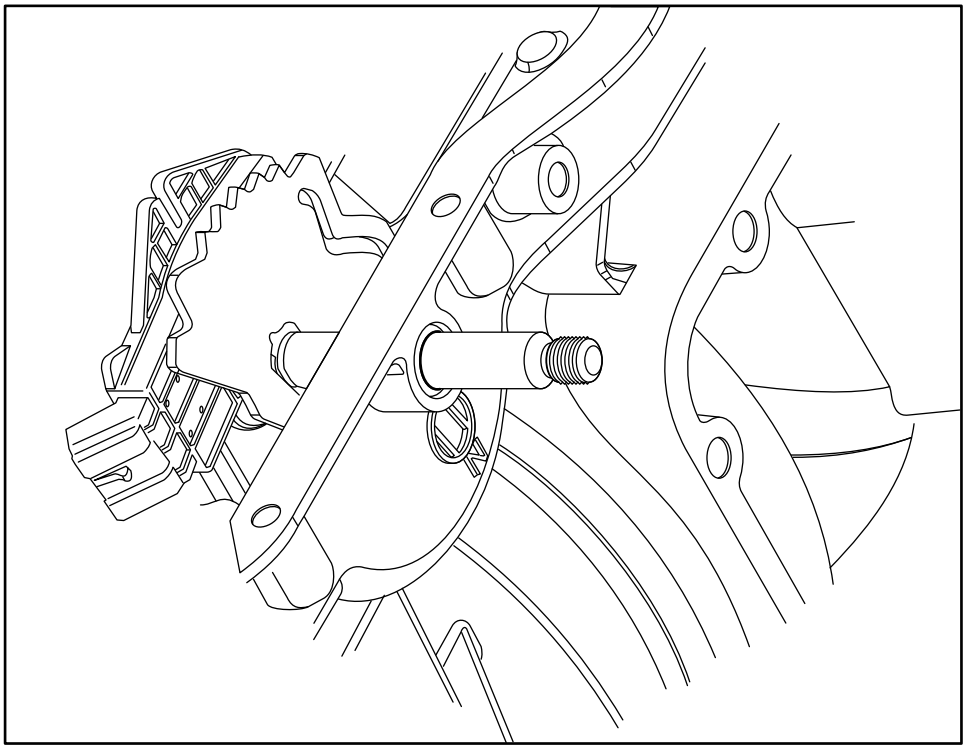
Note: These parts may not be available from GM, but, *are* available from an Allison Dealer.

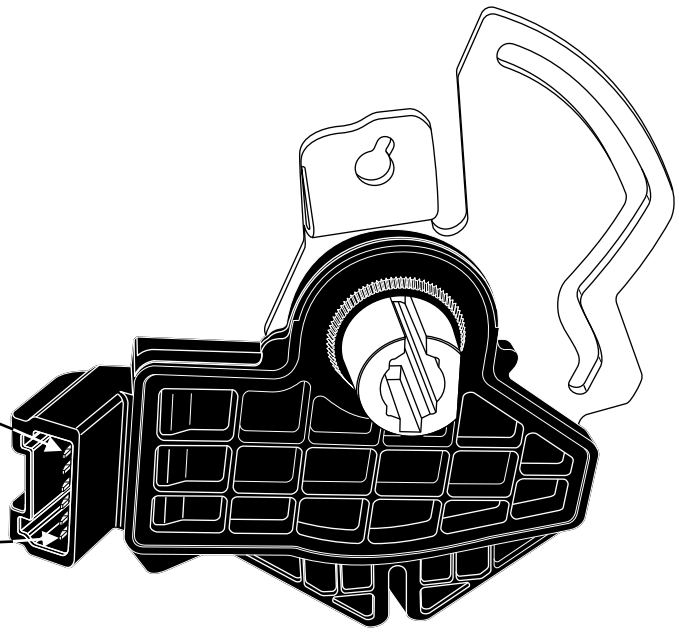
SERVICE INFORMATION:

Detent Lever (Allison Part Number).....29542692
Internal Wiring Harness (Allison Part Number).....29543334

Special thanks to Mitch Uptagraft from John's Transmission in Eightmile AL for supplying the Internal Mode Switch and helping us put this information together.

INTERNAL MODE SWITCH LOCATION





Pin A: Park/Neutral Signal
Pin B: Switch Signal P
Pin C: Switch Signal A
Pin D: Switch Signal B
Pin E: Switch Signal C
Pin F: Ground

Note: Pins are labeled at bottom of switch.

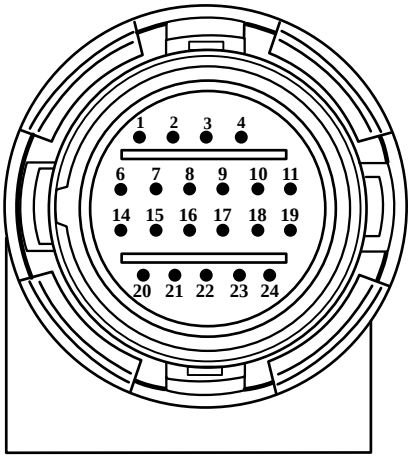
Figure 1

NEW DESIGN

PIN	WIRE COLOR	CIRCUIT	PIN DESIGNATION
1	Grn	1222	Solenoid 1Ground
2	Lt Grn	1223	Solenoid 2 Ground
3	Violet	2527	Solenoid 3 Ground
4	Org	1224	PSA Signal C
6	Grey	1226	PSA Signal E
7	Wht	1225	PSA Signal D
8	Tan	1227	TFT Sensor 5 Volt Ref
9	Blk	2762	TFT/Internal Mode Switch Gnd
10	Pink	418	TCC PWM Sol Signal Low
11	Brn	2529	PSA Signal Reverse
14	Red	1228	Epc/TCC/PCS 1 Power 12V
15	Dk Blue	1229	Pressure Control Solenoid 2 Low
16	Red/Blk	323	Sol 1/2/3/PCS 2 Power 12V
17	Blue	2469	Pressure Control Solenoid 1 Low
18	Violet/Blk	1786	Internal Mode Switch P/N Signal
19	Yellow	1530	Line Pressure EPC Low
20	Blk/White	773	Internal Mode Switch C Signal
21	Tan/White	772	Internal Mode Switch B Signal
22	Yellow/Blk	771	Internal Mode Switch A Signal
23	Pink/Blk	776	Internal Mode Switch P Signal
24	Red	1228	Epc/TCC/PCS 1 Power 12V

Note: Pin 14 and 24 both feed the same solenoids.

TRANSMISSION HARNESS CONNECTOR PIN ID WITH INTERNAL MODE SWITCH

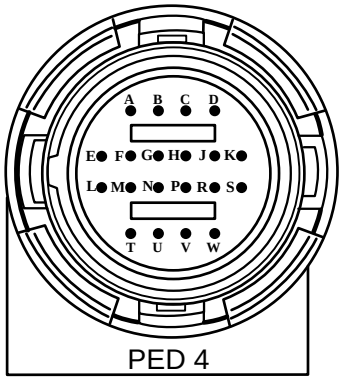


TRANSMISSION EXTERNAL CONNECTOR FACE VIEW WITH INTERNAL WIRE COLORS

PREVIOUS DESIGN

PIN	WIRE COLOR	CIRCUIT	PIN DESIGNATION
A	Dk Grn	1222	Solenoid C Ground
B	Yel/Blk	1223	Solenoid D Ground
C	Pink	839	Shift Solenoid Power 12V
D	Lt Grn	1224	PSA Signal C
E	Red	1226	PSA Signal E
F	Dk Blue	1225	PSA Signal D
G	Yel	1227	TFT Sensor 5 Volt Ref
H	Blk	407	TFT Sensor Ground
J	Brn	418	TCC PWM Sol Signal Low
K	Tan	901	PSA Signal Reverse
L	Red/Blk	1228	Trim Sol A High
M	Lt Blue	1229	Trim Sol A Low
N	Gry	908	Trim Sol B High
P	Ppl	904	Trim Sol B Low
R	Orn	1530	Line Pressure EPC Low
S	Blk	902	TCC PWM/EPC Power 12V
T	Wht	900	TRANS ID
U	—	—	Not Used
V	—	—	Not Used
W	Blk/Wht	452	Solenoid E Ground

TRANSMISSION HARNESS CONNECTOR PIN ID WITH NSBU SWITCH AND EPC



TRANSMISSION EXTERNAL CONNECTOR FACE VIEW WITH EXTERNAL WIRE COLORS

Figure 2

INTERNAL MODE SWITCH PARITY CHART

RANGE	*INTERNAL MODE SWITCH SIGNAL A*	*INTERNAL MODE SWITCH SIGNAL B*	*INTERNAL MODE SWITCH SIGNAL C*	*INTERNAL MODE SWITCH SIGNAL P*
P	***LOW/OFF***	***HIGH/ON***	***HIGH/ON***	***LOW/OFF***
R	***LOW/OFF***	***LOW/OFF***	***HIGH/ON***	***HIGH/ON***
N	***HIGH/ON***	***LOW/OFF***	***HIGH/ON***	***LOW/OFF***
D	***HIGH/ON***	***LOW/OFF***	***LOW/OFF***	***HIGH/ON***
M	***LOW/OFF***	***LOW/OFF***	***LOW/OFF***	***LOW/OFF***
2	***LOW/OFF***	***HIGH/ON***	***LOW/OFF***	***HIGH/ON***
1	***HIGH/ON***	***HIGH/ON***	***LOW/OFF***	***LOW/OFF***

NOTE: HIGH/ON = APPROXIMATELY 5 VOLTS
LOW/OFF = APPROXIMATELY 0 VOLTS

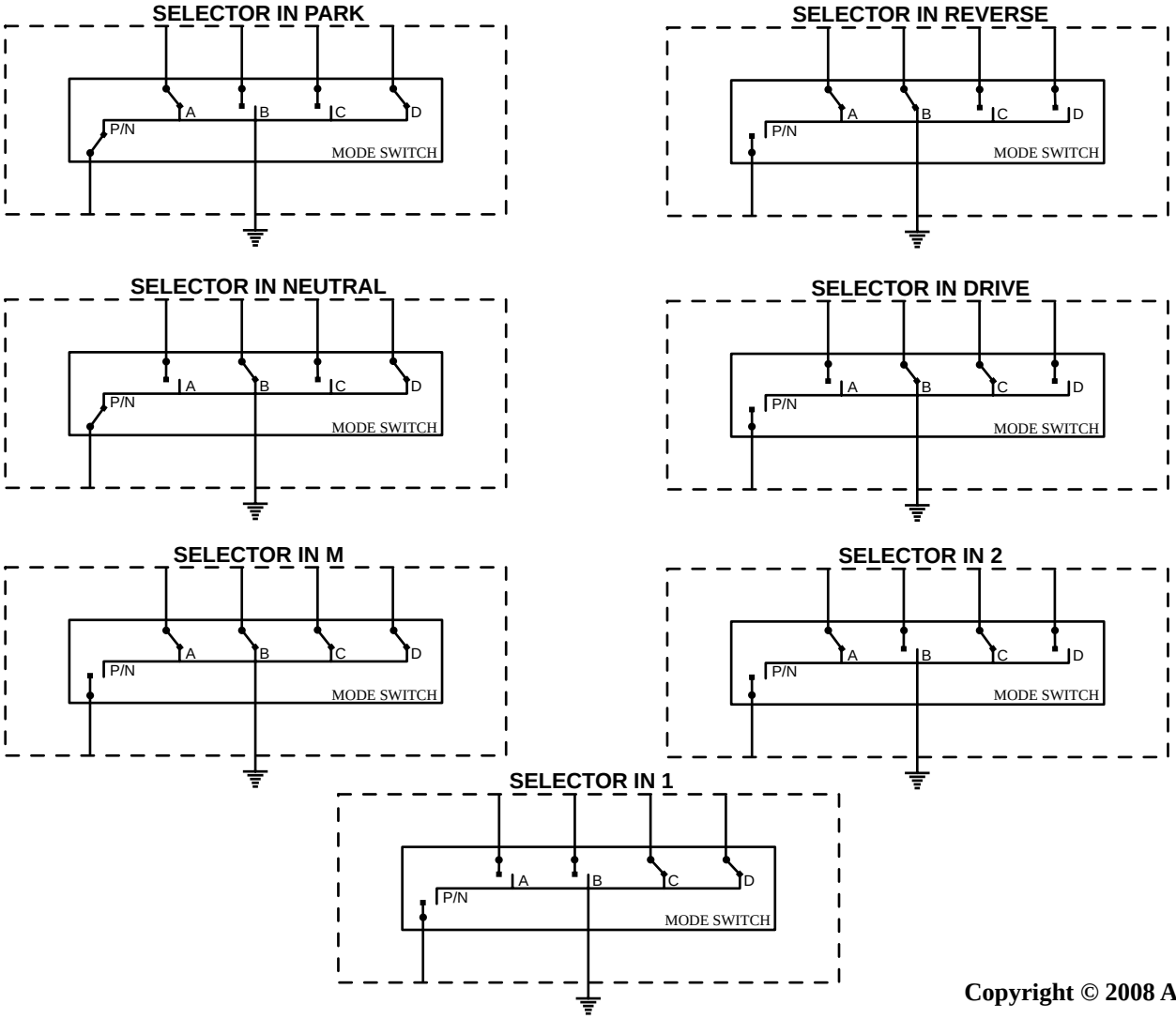


Figure 3

GM ALLISON 1000/2000
SETTING CODE P0735 ON HIGHWAY

COMPLAINT: Before or after overhaul, a GM vehicle equipped with the Allison 1000/2000 transmission exhibits a complaint of a neutralizing condition while driving at highway speeds. Code retrieval indicates code P0735 *(5th gear ratio error)* is stored.

CAUSE: One cause may be severe damage inside the transfer case causing the transfer case to go into neutral which causes the computer to store code P0735. This severe damage in the transfer case is caused by a loss of fluid inside the transfer case itself. The reason for the loss of fluid is overheating. Overheating to the point the fluid vaporizes and escapes through the vent system.

Mike Weinberg from "Rockland Standard Gear" covered this problem very well in the March, 2007 issue of "Transmission Digest". At this time Mike and his Staff are recommending to remove the ATF from the transfer case and replace it with 5w-30 motor oil, and adding an extra quart to the level after it is filled by removing the speed sensor and adding the extra quart there. In addition, Rockland Standard Gear is recommending the fluid level be checked every 5,000 miles, and changed every 10,000 miles. For additional information refer to the March, 2007 issue of Transmission Digest.

CORRECTION: Repair or replace the transfer case, fill with 5w-30 motor oil, adding 1 extra quart, then rechecking levels at 5,000 mile intervals, and changing the fluid at 10,000 mile intervals.

Special thanks to Mike Weinberg of Rockland Standard Gear for the contribution of this article.

ALLISON 1000 SERIES

TCC CYCLING OR SURGE

COMPLAINT: After torque converter replacement, the vehicle has TCC cycling or surge. This might be mistaken for an engine miss. When scanning the TCM, the TCC solenoid operation appeared normal, even the tachometer was steady. No codes were stored, but when a movie was taken during a road test, what was found was a glitch in the engine rpm signal.

CAUSE: The replacement torque converter had damaged dimples on the outside housing, Refer to Figure 1). Since the engine speed sensor is located in the bellhousing and is excited by the dimples on the outside of the converter, (Refer to Figure 2), the damaged dimples created a glitch in the engine speed signal. This glitch or "hiccup" in the engine speed signal was enough to cause the TCC related problems.

CORRECTION: When a replacement converter is used, be sure the dimples on the outside are not damaged. Care must be exercised in handling both the original and the replacement converters.

NOTE: A drain plug cannot be installed as this will cause a similar problem since the engine speed sensor would spike the signal when it sees the drain plug.

TCC CYCLING OR SURGE

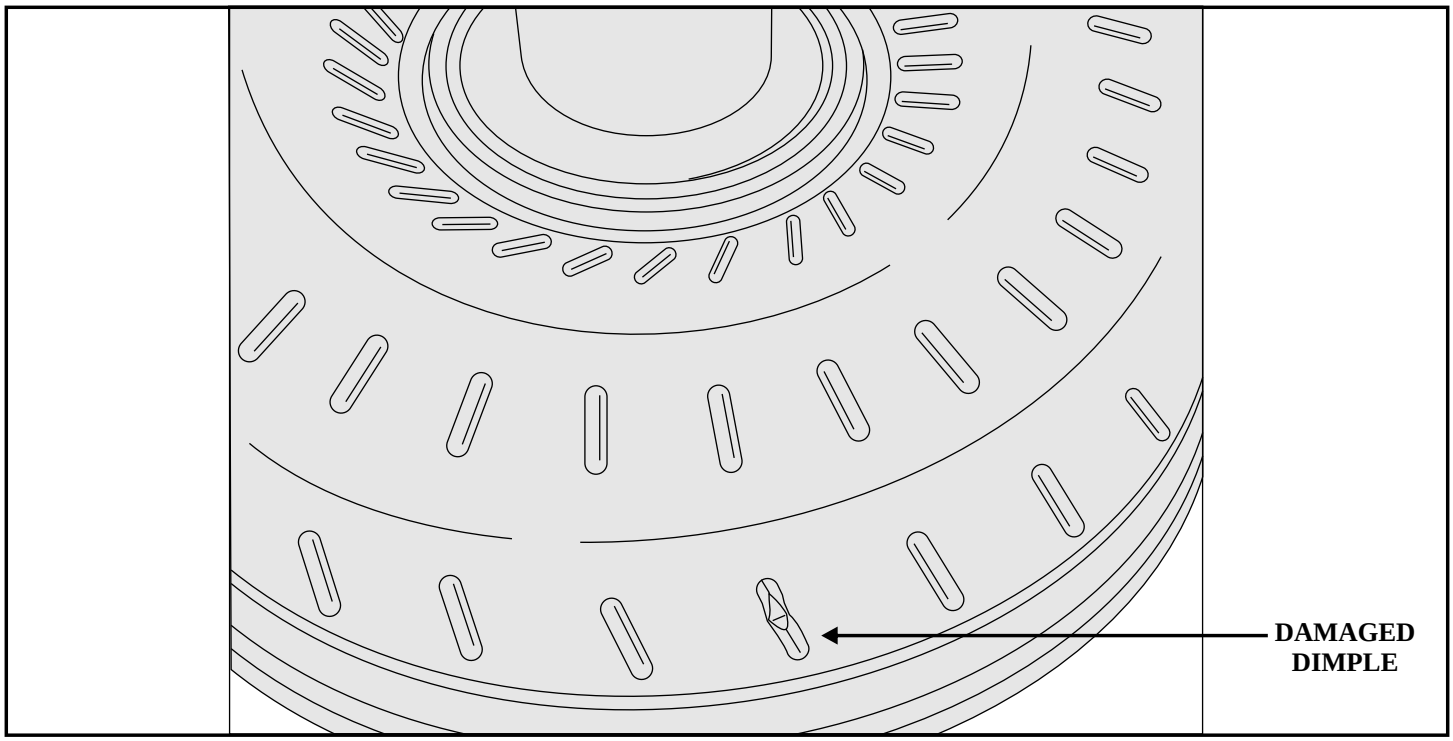


Figure 1

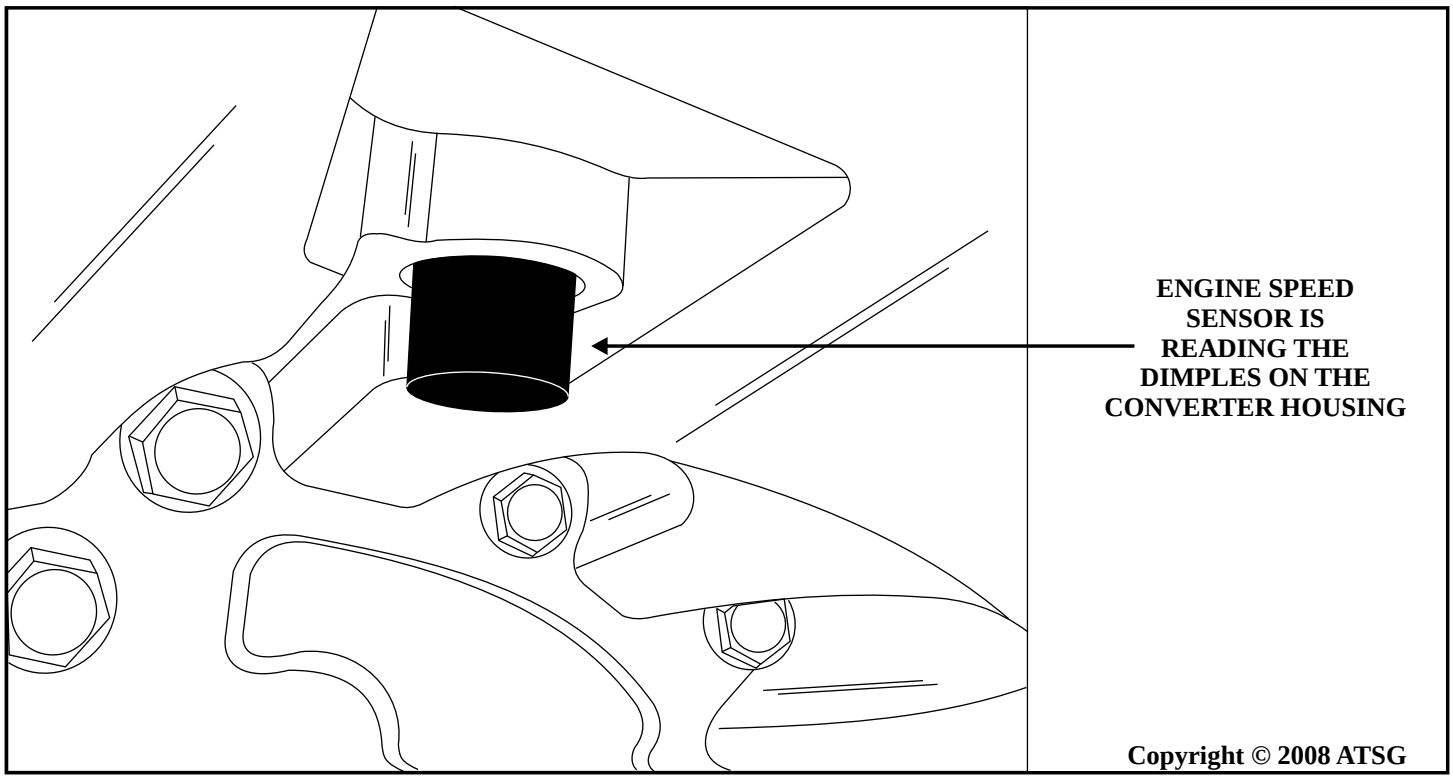


Figure 2

DIAGNOSTIC TROUBLE CODES FOR THE ALLISON 1000/2000

DTC	DESCRIPTION	"CHECK TRANS" LAMP ON*
P0117	Engine Coolant Temperature Circuit Voltage Low (High Temp)	NO
P0118	Engine Coolant Temperature Circuit Voltage High (Low Temp)	NO
P0121	Pedal Position Sensor Performance Problem	NO
P0122	Pedal Position Sensor Circuit Voltage Low	YES
P0123	Pedal Position Sensor Circuit Voltage High	YES
P0218	Transmission Fluid Over Temp	NO
P0561	Unrealistic Variations In System Voltage	NO
P0562	System Voltage Low	YES
P0563	System Voltage High	YES
P0602	TCM Not Programmed	YES
P0606	Controller Internal Performance	YES
P0613	TCM Processing Error	NO
P0614	Torque Control Data Mismatch...ECM/TCM	YES
P0634	TCM Internal Temperature Too High	YES
P0658	Actuator Supply Voltage High Side Driver 1 Low	YES
P0659	Actuator Supply Voltage High Side Driver 1 High	YES
P0700	MIL Illumination Request	YES
P0701	Transmission Control System Performance	NO
P0703	Brake Switch Circuit Malfunction	NO
P0705	Transmission Range Sensor Circuit (PRNDL Input)	YES
P0706	Transmission Range Sensor Circuit Performance	YES
P0708	Transmission Range Sensor Circuit Input High	YES
P0710	Transmission Fluid Temperature Sensor Circuit Fault	YES
P0711	Transmission Fluid Temperature Sensor Circuit Performance	YES
P0712	Transmission Fluid Temperature Sensor Circuit Input Low (High Temp)	YES
P0713	Transmission Fluid Temperature Sensor Circuit Input High (Low Temp)	YES
P0716	Turbine Speed Sensor Circuit Performance	YES
P0717	Turbine Speed Sensor Circuit No Signal	YES
P0719	Brake Switch Circuit Fault	NO
P0721	Output Speed Sensor Circuit Performance	YES
P0722	Output Speed Sensor Circuit No Signal	YES
P0726	Engine Speed Input Circuit Performance	YES
P0727	Engine Speed Sensor Circuit No Signal	YES
P0729	Incorrect 6th Gear Ratio	YES

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DIAGNOSTIC TROUBLE CODES FOR THE ALLISON 1000

DTC	DESCRIPTION	"CHECK TRANS" LAMP ON*
P0731	Incorrect 1st Gear Ratio	YES
P0732	Incorrect 2nd Gear Ratio	YES
P0733	Incorrect 3rd Gear Ratio	YES
P0734	Incorrect 4th Gear Ratio	YES
P0735	Incorrect 5th Gear Ratio	YES
P0736	Incorrect Reverse Gear Ratio	YES
P0741	Torque Converter Clutch System Stuck Off	YES
P0742	Torque Converter Clutch System Stuck On	YES
P0743	Torque Converter Clutch PWM Solenoid Electrical Circuit Fault	YES
P0746	Solenoid "A" Controlled Clutch Stuck Off	YES
P0747	Solenoid "A" Controlled Clutch Stuck On	YES
P0748	Pressure Control (Trim) Solenoid "A" Electrical Circuit Fault	YES
P0751	Shift Solenoid 1 Performance (Stuck Off)	YES
P0752	Shift Solenoid 1 Performance (Stuck On)	YES
P0756	Shift Solenoid 2 Performance (Stuck Off)	YES
P0757	Shift Solenoid 1 Performance (Stuck On)	YES
P0761	Shift Solenoid 3 Performance (Stuck Off)	YES
P0762	Shift Solenoid 3 Performance (Stuck On)	YES
P0763	Shift Solenoid "C" Electrical Circuit Fault	YES
P0768	Shift Solenoid "D" Electrical Circuit Fault	YES
P0773	Shift Solenoid "E" Electrical Circuit Fault	YES
P0776	Solenoid "B" Controlled Clutch Stuck Off	YES
P0777	Solenoid "B" Controlled Clutch Stuck On	YES
P0778	Pressure Control (Trim) Solenoid "B" Electrical Circuit Fault	YES
P0826	Tap Up & Tap Down Shift Switch Circuit Fault	NO
P0827	Tap Up & Tap Down Shift Switch Circuit Low	NO
P0828	Tap Up & Tap Down Shift Switch Circuit High	NO
P0836	Four Wheel Drive Low Switch Malfunction	NO
P0840	Transmission Pressure Switch/Solenoid "C" (PS1) Circuit Fault	YES
P0841	Transmission Pressure Switch/Solenoid "C" (PS1) Circuit Stuck Open	YES
P0842	Transmission Pressure Switch/Solenoid "C" (PS1) Circuit Stuck Closed	YES
P0843	Transmission Pressure Switch/Solenoid "C" (PS1) Circuit High	YES
P0845	Transmission Pressure Switch/Solenoid "D" (PS2) Circuit Fault	YES
P0846	Transmission Pressure Switch/Solenoid "D" (PS2) Circuit Stuck Open	YES

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DIAGNOSTIC TROUBLE CODES FOR THE ALLISON 1000

DTC	DESCRIPTION	"CHECK TRANS" LAMP ON*
P0847	Transmission Pressure Switch/Solenoid "D" (PS2) Circuit Fault	YES
P0848	Transmission Pressure Switch/Solenoid "D" (PS2) Circuit High	YES
P0870	Transmission Pressure Switch/Solenoid "E" (PS3) Circuit Fault	YES
P0871	Transmission Pressure Switch/Solenoid "E" (PS3) Circuit Stuck Open	YES
P0872	Transmission Pressure Switch/Solenoid "E" (PS3) Circuit Stuck Closed	YES
P0873	Transmission Pressure Switch/Solenoid "E" (PS3) Circuit High	YES
P0875	Transmission Reverse Pressure Switch (PS4) Circuit Malfunction	YES
P0876	Transmission Reverse Pressure Switch (PS4) Circuit Stuck Open	YES
P0877	Transmission Reverse Pressure Switch (PS4) Circuit Stuck Closed	YES
P0878	Transmission Reverse Pressure Switch (PS4) Circuit High	YES
P0880	TCM Power Supply Loss	NO
P0881	TCM Power Input Signal Performance Problem	NO
P0882	TCM Power Supply Low	NO
P0883	TCM Power Supply High	NO
P0960	Pressure Control Solenoid ("G") Main Mod Circuit Control Open	NO
P0962	Pressure Control Solenoid ("G") Main Mod Circuit Control Low	YES
P0963	Pressure Control Solenoid ("G") Main Mod Circuit Control High	YES
P0964	Pressure Control Solenoid 2 (PCS 2) Control Circuit Open	YES
P0966	Pressure Control Solenoid 2 (PCS 2) Control Circuit Low	YES
P0967	Pressure Control Solenoid 2 (PCS 2) Control Circuit High	YES
P0972	Shift Solenoid 1 (SS1) Control Circuit Open	YES
P0973	Shift Solenoid 1 (SS1) Control Circuit Low	YES
P0974	Shift Solenoid 1 (SS1) Control Circuit High	YES
P0975	Shift Solenoid 2 (SS2) Control Circuit Open	YES
P0976	Shift Solenoid 2 (SS2) Control Circuit Low	YES
P0977	Shift Solenoid 2 (SS2) Control Circuit High	YES
P0978	Shift Solenoid 3 (SS3) Control Circuit Open	YES
P0979	Shift Solenoid 3 (SS3) Control Circuit Low	YES
P0980	Shift Solenoid 3 (SS3) Control Circuit High	YES
P1688	Unmanaged Engine Torque Delivered to TCM	YES
P1709	See DTC P0870	YES
P1710	See DTC P0871	YES
P1711	See DTC P0872	YES
P1712	See DTC P0873	YES

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DIAGNOSTIC TROUBLE CODES FOR THE ALLISON 1000

DTC	DESCRIPTION	"CHECK TRANS" LAMP ON*
P1713	See DTC P0875	YES
P1714	See DTC P0876	YES
P1715	See DTC P0877	YES
P1716	See DTC P0878	YES
P1720	See DTC P0746	YES
P1721	See DTC P0776	YES
P1723	See DTC P0747	YES
P1724	See DTC P0777	YES
P1760	See DTC P0880	NO
P1779	Engine Torque Delivered to TCM Error	NO
P1835	Kickdown Circuit Malfunction	YES
P1860	See DTC P0743	YES
P1875	Four Wheel Drive Low Switch Circuit Fault	NO
P1891	Throttle Position Sensor PWM Signal Input Low	NO
P1892	Throttle Position Sensor PWM Signal Input High	NO
P2637	Torque Management Feedback Signal-(SEM) Shift Energy Management -ECM Fault	YES
P2641	Torque Management Feedback Signal-(LRTP) Lower Range Torque Protection-ECM Fault	YES
P2670	Actuator Supply Voltage 2 (HSD2) High Side Driver Low	YES
P2671	Actuator Supply Voltage 2 (HSD2) High Side Driver High	YES
P2723	Pressure Control Solenoid 1 (PSC1) Stuck Off	YES
P2724	Pressure Control Solenoid 1 (PSC1) Stuck On	YES
P2727	Pressure Control Solenoid 1 (PSC1) Stuck Open	YES
P2729	Pressure Control Solenoid 1 (PSC1) Stuck Low	YES
P2730	Pressure Control Solenoid 1 (PSC1) Stuck High	YES
P2761	Torque Converter Clutch Control Circuit Open	YES
P2763	Torque Converter Clutch Control Circuit High	YES
P2764	Torque Converter Clutch Control Circuit Low	YES
P2771	See DTCs P0836 or P1875	NO
P2773	Torque Signal Request Sent By TCM Ignored By ECM	YES
P2810	Solenoid "G" Electrical Circuit Fault	YES
U0010	CAN 1 Bus Reset Counter Overrun-No Communication	YES
U0031	J1850 (Class 2) Serial Data Communication Link Low	NO
U0032	J1850 (Class 2) Serial Data Communication Link High	NO
U0073	CAN 2 Bus Reset Counter Overrun-No Communication	YES

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DIAGNOSTIC TROUBLE CODES FOR THE ALLISON 1000

DTC	DESCRIPTION	"CHECK TRANS" LAMP ON*
U0100	Lost Communication With ECM/PCM (CAN 1)	YES (2004 ONLY)
U0115	Lost Communication With ECM/PCM (CAN 2)	NO
U1000	Class 2 Loss of Serial Data Communication	NO
U1016	Class 2 PCM State of Health Failure	NO
U1041	Class 2 Anti-Lock Brake Controller (ABS) State of Health Failure	NO
U1064	J1850 (Class 2) Truck Body Controller (TBC) State of Health Failure	NO
U1096	Class 2 Instrument Panel Controller (IPC) State of Health Failure	NO
U1300	See DTC U0031	NO
U1301	See DTC U0032	NO
U2104	See DTC U0073	NO
U2105	See DTC U0100	NO
U2106	Lost Communications with Transmission Control Systems	

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AVI

VBX
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Techpac

Transtech

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Life Automotive