Section 7

Transmission/Transaxle

Manual Transmission - New Venture

Specifications

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Back-Up Lamp Switch	28 N·m	21 lb ft
Extension Housing to Case Bolts	54 N·m	40 lb ft
Clutch Housing Cover Bolts	13 N·m	115 lb in
Crossmember to Frame Bolts	77 N·m	56 lb ft
Fuel Line Bracket to Transmission Nut	40 N·m	30 lb ft
Fuel Line to Bracket Bolt	18 N·m	13 lb ft
Oil Drain Plug Bolt	37 N·m	27 lb ft
Oil Fill Plug	37 N·m	27 lb ft
Lower Shift Lever Nut	47 N·m	93 lb ft
Upper Shift Lever Nut	5 N·m	44 lb in
Shift Housing Bolts	10 N·m	89 lb in
Shift Boot Screws	2 N·m	18 lb in
Speed Sensor Bolt	20 N·m	15 lb ft
Transmission to Clutch Housing Bolts	73 N·m	54 lb ft
Rear Transmission Mount bolts	44 N·m	33 lb ft
Transmission Mount to Crossmember Nut	44 N·m	33 lb ft
Yoke Nut	441 N·m	325 lb ft
Clutch Housing to Engine Studs	39 N·m	29 lb ft
Clutch Housing to Engine Bolts	40 N·m	30 lb ft

Lubrication Specifications

Application	Liters	Gallons	Quarts
NV4500 Transmission Use Castrol Syntorq LT Transmission Oil	3.8	—	4.0

Diagnostic Information and Procedures

Manual Transmission Diagnosis

Probable Causes	Correction
Shift shaft binding	Check for the following conditions: • Out of position shift shaft socket roll pin • Worn shift shaft bearing or bushing • Worn shift shaft • Bent shift shaft
Clutch not releasing	Verify with the clutch spin down time test and correct. Refer *Clutch Spin Down Time.*
Shift shaft lever broken	Remove, disassemble, and replace the shift shaft lever.
Internal bind in the transmission caused by shift forks or synchronizer assemblies	• Remove, disassemble, and inspect the shift forks and synchronizer assembly • Replace worn or damaged components as necessary
Incorrect oil	Drain and refill the transmission.

Gears Clash When Shifting From One Gear to Another

Probable Causes	Correction
Oil level is low or incorrect	Drain and fill the transmission. If the oil level is low, check for leaks and repair as necessary.
Clutch not releasing	Verify with the clutch spin down time test and correct. Refer to *Clutch Spin Down Time.*
Synchronizer assemblies worn or damaged	• Remove, disassemble, and inspect the transmission • Replace the worn or damaged components as necessary
4th gear only - Mainshaft or input gear snap ring missing	Install the missing snap ring.

Transmission is Noisy

Probable Causes	Correction
Lubrication level is low or incorrect oil	Drain and fill the transmission. If the oil level is low, check for leaks and repair as necessary.
Crankshaft pilot bearing/bushing worn	Replace the crankshaft pilot bearing/bushing.
Transmission to engine bolts loose	Check and correct the bolt torque as necessary.
Gear selection, mechanism, transmission gears, or bearing components worn or damaged	• Remove, disassemble, and inspect the transmission • Replace the worn components as necessary
Cab floor to shift lever boot screws contacting transmission case	Replace screws with the correct length screws.
Transmission mounted fuel lines contacting the vehicle body	Tighten/attach the fuel line clips in order to prevent body contact.
Transmission shift lever to floor boot out of position, foam insulator missing/damaged, boot screws too long and contacting transmission	Correct/repair the shift boot and isolator installation.

Transmission Jumps Out of Gear

Probable Causes	Correction
4th gear only - Crankshaft pilot bearing/bushing worn	Replace the crankshaft pilot bearing/bushing.
Gear selection mechanism, shift forks, shift rail detent spring worn, broken, or damaged	• Remove, disassemble, and inspect the transmission • Replace worn or damaged components as necessary
Gear teeth back taper on sleeve, gear worn away or damaged	• Remove, disassemble, and inspect the transmission • Replace the worn or damaged components as necessary
Excessive end play caused by worn thrust washers or output shaft gears	• Remove, disassemble, and inspect the transmission • Replace the worn or damaged components as necessary
4th gear only - Mainshaft or input gear snap ring missing	Install the missing snap ring.
Transmission shift lever to cab floor boot out of position (convolutions trapped under boot retainer ring) pulling transmissions out of gear	Correctly install the boot retainer ring.

Transmission Will Shift Only Into One Gear

Probable Causes	Correction
Gear selection mechanism or shift forks worn or damaged	• Remove, disassemble, and inspect the transmission • Replace the worn or damaged components as necessary
Synchronizer sleeves or hubs damaged or worn	• Remove, disassemble, and inspect the transmission • Replace the worn or damaged components as necessary.

Transmission Is Locked In One Gear and Cannot Be Shifted Out

Probable Causes	Correction
Shift rail worn or broken, shift fork bent, worn, or broken	Replace the worn or damaged components as necessary.
Shift shaft lever worn or broken	Replace the worn or damaged components as necessary.
Gear train components damaged	Replace the worn or damaged components as necessary.

Clutch Spin Down Time

Before disassembling the transmission, check the clutch and shift linkages to ensure the problem is in the transmission.

Transmission Mount

1. Raise the vehicle.
2. Move the extension housing up and down.
3. If the plate is loose on the crossmember, tighten the bolts.
4. If the rubber is split or spongy, replace the mount.

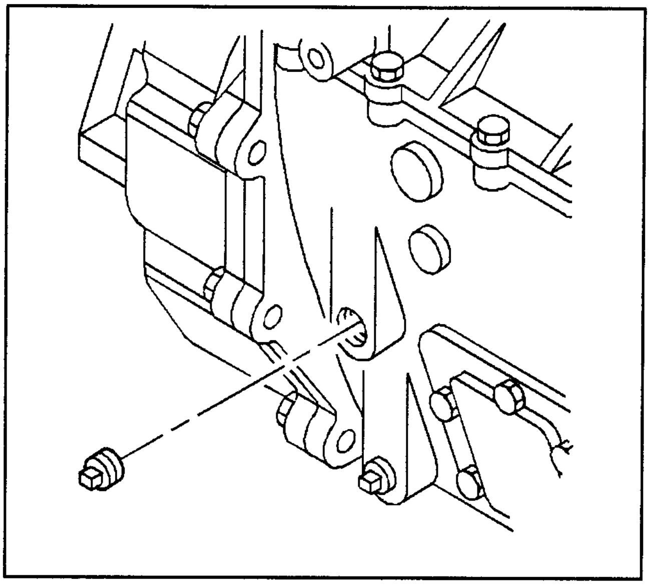
Clutch Spindown Time

1. Run the engine at normal idle speed with the transmission in neutral and the clutch engaged.
2. Disengage the clutch, wait 9 seconds, and shift the transmission into reverse.
3. If a grinding noise is heard, check the clutch system. Refer to *Clutch Noisy* in Clutch.

Repair Instructions

Fluid Replacement

Removal Procedure



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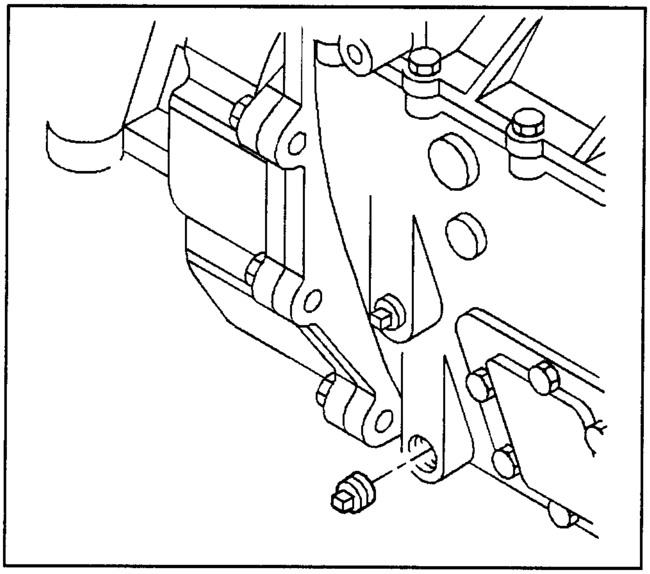
1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the oil fill plug.
3. Catch the oil in a suitable container.



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4. Remove the oil drain plug

Installation Procedure

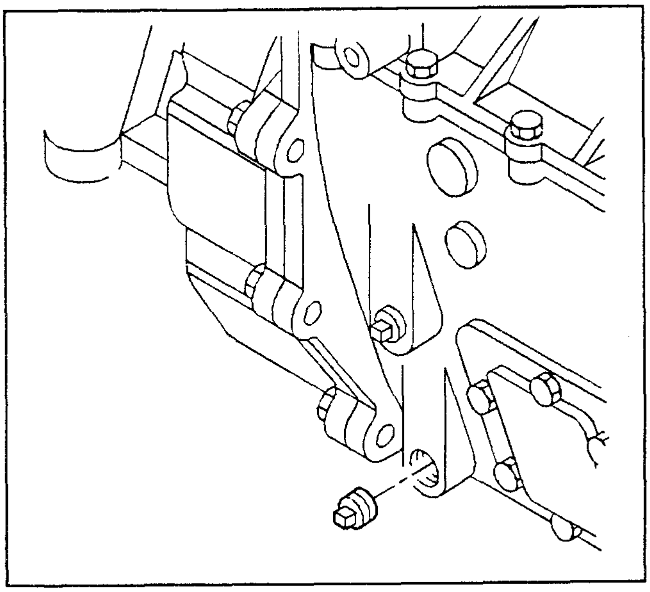
1. Remove all of the existing sealant from the oil drain plug.
2. Apply a thin bead of sealant P/N 12346004 to the threads of the oil drain plug.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Install the oil drain plug.

   Tighten

   Tighten the oil drain plug to 37 N·m (27 lb ft).
4. Fill new transmission oil to the level of the fill plug hole. Refer to *Lubrication Specifications.*



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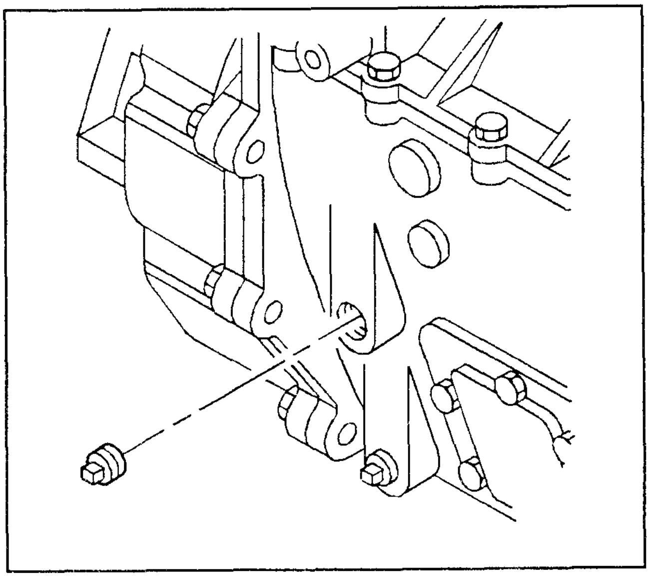
5. Remove all of the existing sealant from the oil drain plug.
6. Apply a thin bead of sealant P/N 12346004 to the threads of the oil drain plug.
7. Install the oil fill plug.

   Tighten

   Tighten the fill plug to 37 N·m (27 lb ft).
8. Lower the vehicle.



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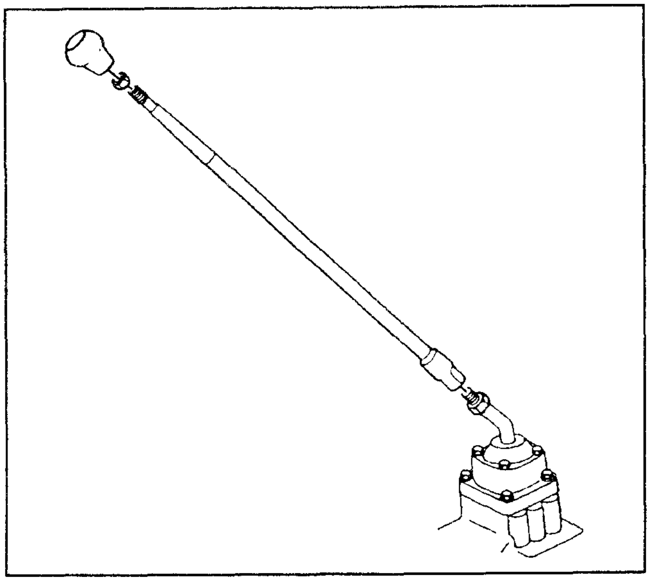
Shift Lever

Removal Procedure

1. Remove the shift lever from the shift housing.
2. Remove the shift knob and shift lever nut from the shift lever.



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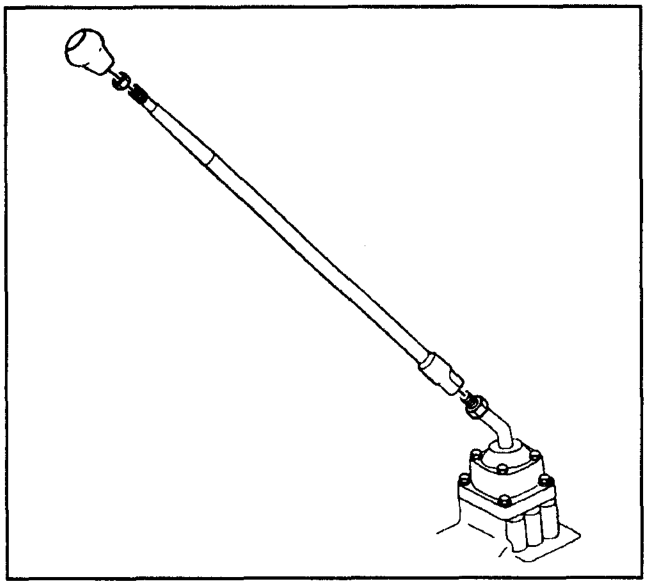

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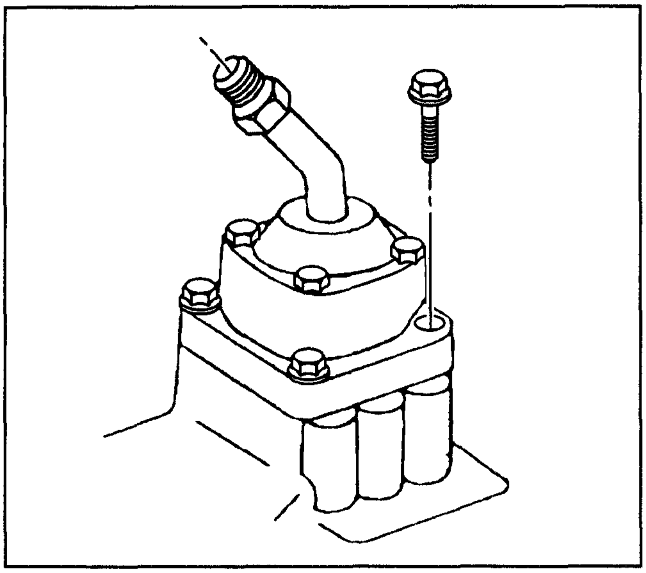
Installation Procedure

Notice: Refer to *Fastener Notice* in Cautions and Notices.

1. Install the shift knob and shift lever nut to the shift lever.

   Tighten

   Tighten the shift lever nut to 20 N·m (15 lb ft).
2. Install the shift lever to the shift housing.



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Shift Tower Replacement

Removal Procedure

Important:

- Ensure that the shift lever is positioned into the mechanical third or fourth gear prior to removal of the shift housing from the transmission.
  The transmission must remain in this state when the shift housing is removed.
- Do not disassemble the transmission shift housing. Internal parts for this shift housing are not available. Opening the shift housing voids the warranty.
- When removing the shift housing from the transmission, use the exposed bolts on the base of the housing.

1. Remove the shift lever. Refer to *Shift Lever.*
2. Remove the four bolts securing the shift housing to the transmission.
3. Remove the insulator from the transmission case.

Installation Procedure

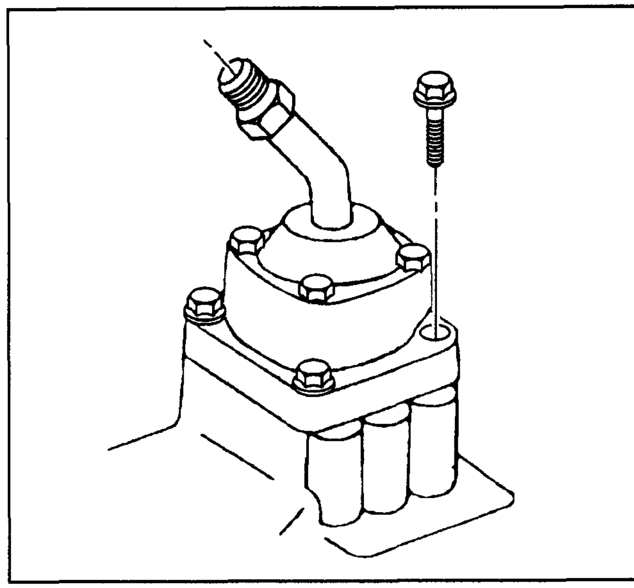
1. Install the insulator to the transmission case.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the four bolts securing the shift housing to the transmission.

   Tighten

   Tighten the shift housing bolts to 10 N·m (89 lb in).
3. Install the shift lever. Refer to *Shift Lever.*



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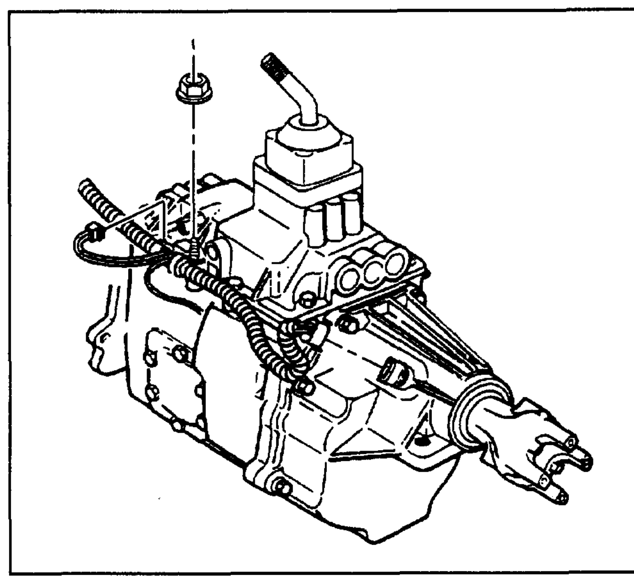
Vehicle Speed Sensor

Removal Procedure

1. Remove the wiring harness connector from the speed sensor.
2. Remove the speed sensor bolt.
3. Place a drain pan under the transmission in order to catch the oil.
4. Remove the speed sensor from the transmission.
5. Remove the O-ring seal.



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Installation Procedure

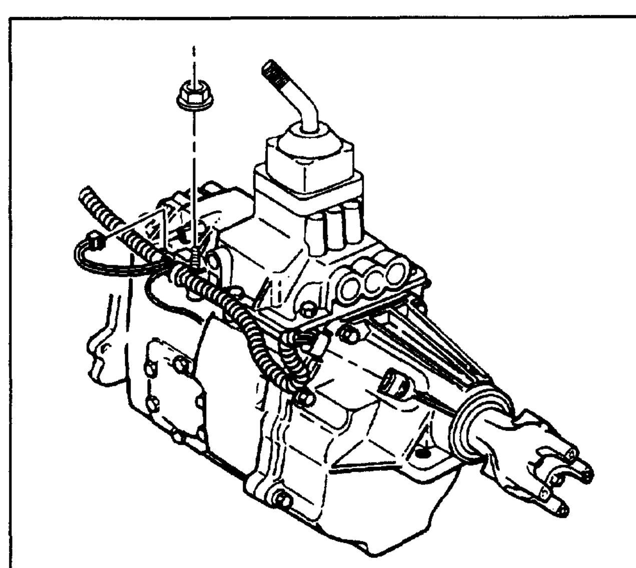
1. Install a new O-ring seal.
2. Coat the O-ring with a thin film of transmission oil.
3. Install the speed sensor and bolt.

   Tighten

   Tighten the speed sensor bolt to 22 N·m (16 lb ft).

Notice: Refer to *Fastener Notice* in Cautions and Notices.

4. Install the wiring harness connector to the vehicle speed sensor.



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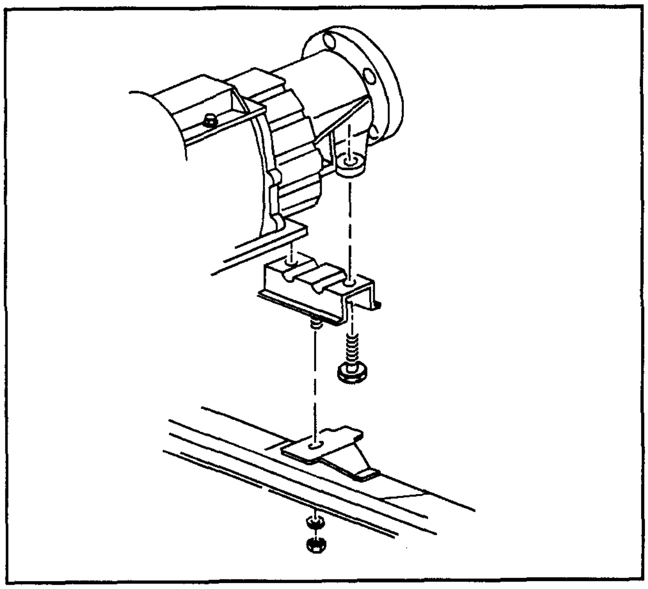
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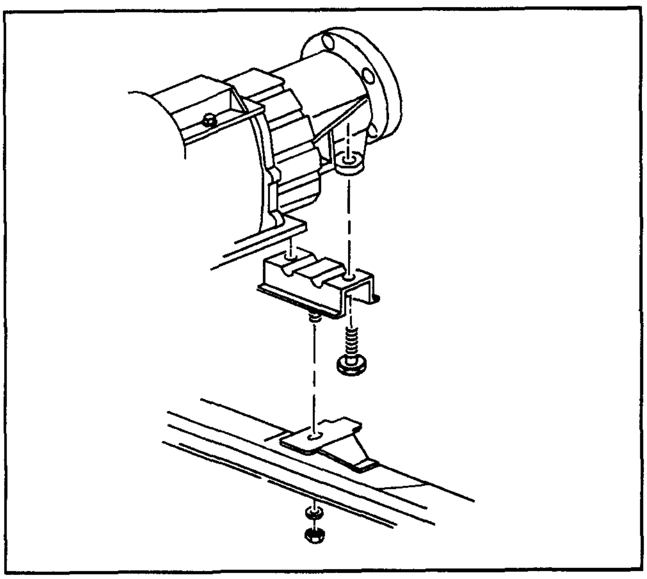
Transmission Mount Replacement

Removal Procedure

Notice: When supporting the engine to replace a mounting, raise the engine only to the height required to provide clearance for mounting removal. It may be necessary to drain the cooling system and disconnect hoses to avoid damage when the engine is raised. Be careful that control linkage and wiring are not damaged from raising the engine. When replacing a single front mounting, both mountings, should be detached before attempting to raise the engine. Failure to do this will place excessive stress on the attached mounting when the engine is raised.

1. Support the rear of the transmission to relieve the weight on the rear transmission mount.
2. Remove the rear transmission mount to crossmember nut and washer.
3. Raise the rear of the transmission only enough to permit removal of the transmission mount.
4. Remove the transmission mount bolts and washers.
5. Remove the rear transmission mount.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Installation Procedure

1. Install the rear transmission mount.

Notice: Refer to *Fastener Notice* in General Information.

2. Install the transmission mount bolts and washers.

   Tighten

   Tighten the bolts to 47 N·m (35 lb ft).
3. Lower the rear of the transmission.
4. Install the rear transmission mount to crossmember nuts and washers.

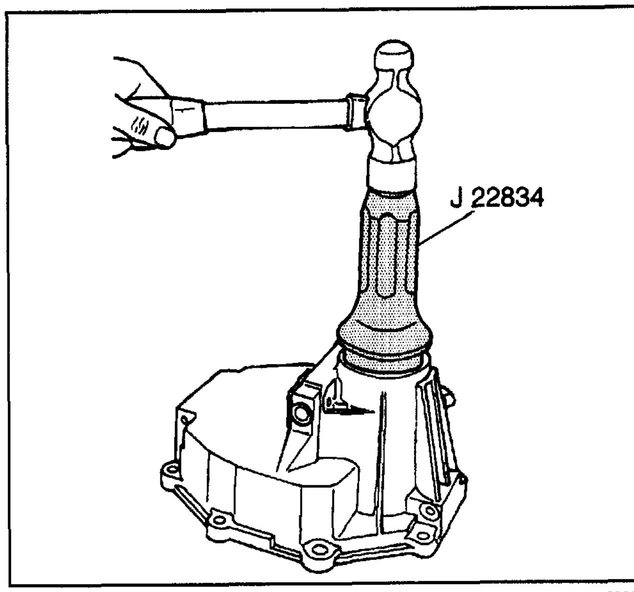
   Tighten

   Tighten the nuts to 47 N·m (35 lb ft).
5. Lower the vehicle.

Transmission Housing Oil Seal Replacement

Removal Procedure

1. Raise the vehicle.
2. Remove the transmission oil. Refer to *Fluid Replacement.*
3. Remove the propeller shaft. Refer to *Two-Piece Propeller Shaft Replacement* or *Three-Piece Propeller Shaft Replacement* in Propeller Shaft.
4. Remove the parking brake, if the vehicle is equipped. Refer to *Backing Plate Replacement* in Parking Brake.
5. Remove the yoke nut and washers.
6. Remove the yoke.
7. Remove the extension oil seal.



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Installation Procedure

Tools Required

J 22834 Extension Housing Seal Installer

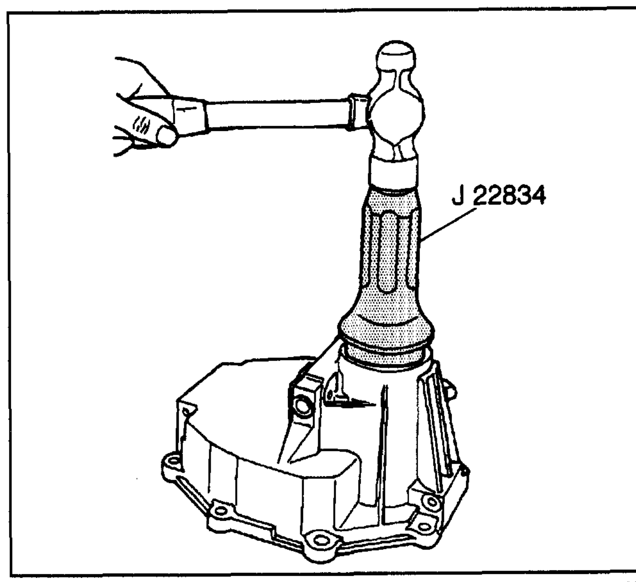
1. Install a new extension oil seal. Use the *J 22834.*
2. Install the yoke.

Notice: Refer to *Fastener Notice* in Caution and Notices.

3. Install the washers and yoke nut.

   Tighten

   Tighten the yoke nut to 441 N·m (325 in ft).
4. Install the parking brake, if the vehicle is equipped. Refer to *Backing Plate Replacement* in Parking Brake.
5. Install the propeller shaft. Refer to *Two-Piece Propeller Shaft Replacement* or *Three-Piece Propeller Shaft Replacement* in Propeller Shaft.
6. Replace the transmission oil. Refer to *Fluid Replacement.*
7. Lower the vehicle.



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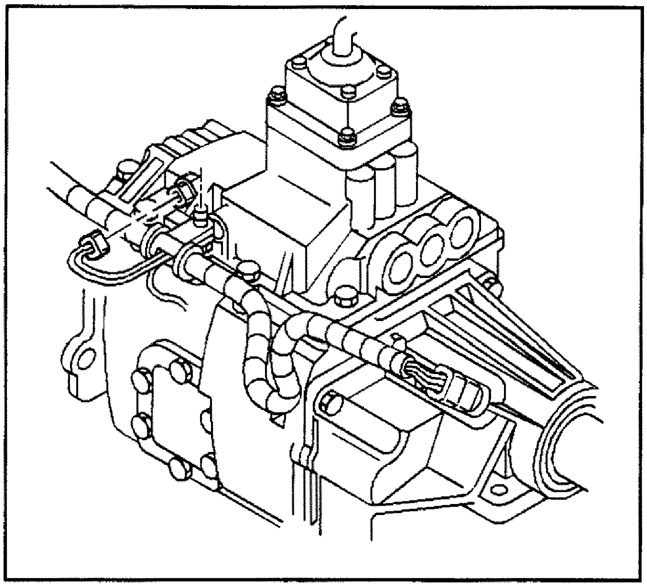

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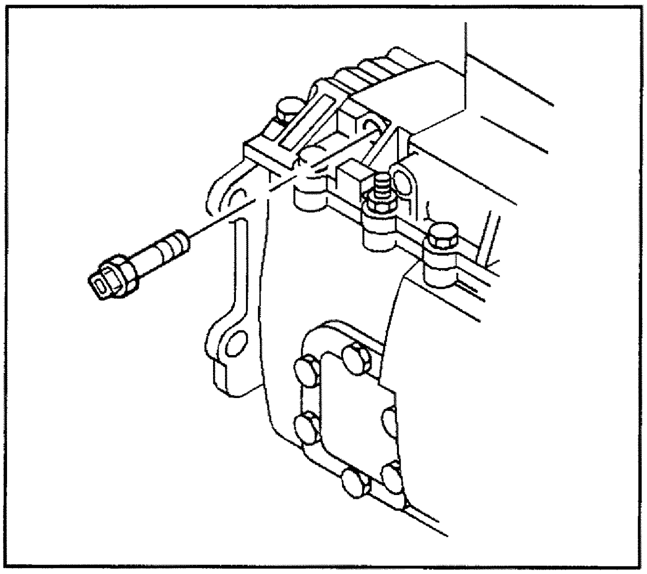
Backup Lamp Switch

Removal Procedure

1. Raise the vehicle.
2. Remove the wiring harness connector from the backup lamp switch.



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3. Remove the backup lamp switch.

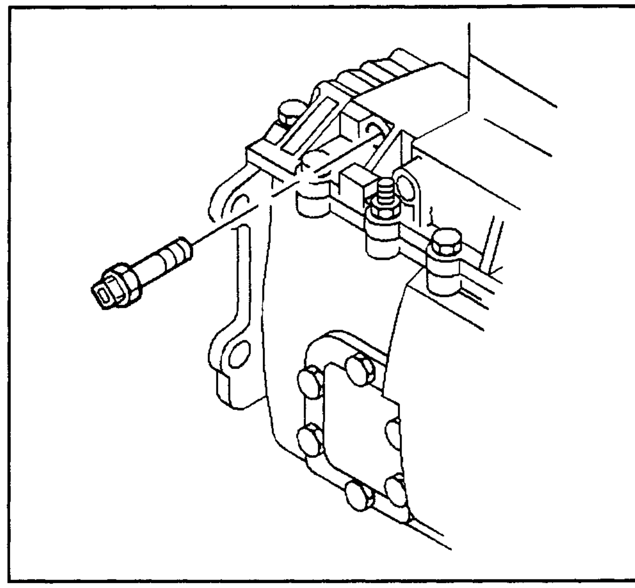
Installation Procedure

Notice: Refer to *Fastener Notice* in Cautions and Notices.

1. Install the backup lamp switch. The backup lamp switch has pre-applied thread sealant on its threads.

   Tighten

   Tighten the backup lamp switch to 28 N·m (21 lb ft).



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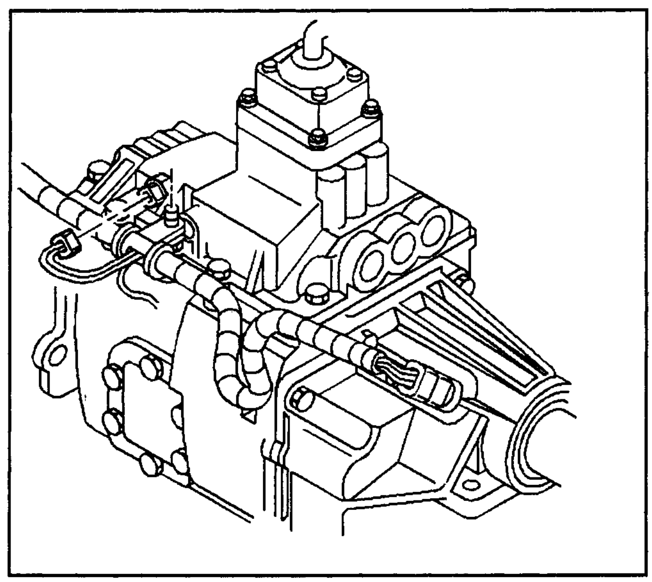
2. Install the wiring harness connector to the backup lamp switch.
3. Lower the vehicle.



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Transmission Replacement

Removal Procedure

Tools Required

J 36221 Hydraulic Clutch Line Separator

1. Shift the transmission into the third or fourth mechanical gear position.
2. Remove the shift lever. Refer to *Shift Lever.*
3. Remove the shift housing. Refer to *Shift Tower Replacement.*
4. Raise and support the vehicle.
5. Remove the transmission oil. Refer to *Fluid Replacement.*
6. Remove the starter motor. Refer to *Starter Motor Replacement (Diesel)* or *Starter Motor Replacement (5.7L and 7.4L)* in Engine Electrical.
7. Remove the three bolts securing the transmission to the clutch housing cover.
8. Remove the propeller shaft.
   - For the two-piece propeller shaft, refer to *Two-Piece Propeller Shaft Replacement* in Propeller Shaft.
   - For the three-piece propeller shaft, refer to *Three-Piece Propeller Shaft Replacement* in Propeller Shaft.
9. Remove the parking brake and controls, if the vehicle is equipped. Refer to *Backing Plate Replacement* in Parking Brake.
10. Remove the exhaust pipes from the exhaust mainfold and catalytic converter from the muffler assembly, if required. Refer to *General Exhaust System Replacement* in Exhaust System.
11. Remove the wiring harness connectors from the speed sensor and backup lamp switch.
12. Remove the wiring harness retainers from the transmission.
13. Remove the transmission vent hose from the NV4500 transmission.
14. Support the transmission with a jack.
15. Remove the transmission mount to crossmember washer and nut.
16. Remove the transmission crossmember from the vehicle.
17. Remove the bell housing bolts securing the transmission to the engine block.

Important:

- Do not let the transmission hang from the clutch plate and clutch cover.
- Pull the transmission straight back on the clutch hub splines.

18. Remove the transmission from the engine.

Installation Procedure

1. Raise the transmission using a transmission jack.
2. Install the transmission.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Install the bell housing bolts securing the transmission.

   Tighten
   Tighten the bolts to 73 N·m (54 lb ft).
4. Install the transmission crossmember and bolts.

   Tighten
   Tighten the bolts to 77 N·m (56 lb ft).
5. Lower and remove the jack.
6. Install the transmission mount to crossmember washer and nut.

   Tighten
   Tighten the nut to 44 N·m (33 lb ft).
7. Install the vent hose onto the transmission.
8. Install the exhaust pipes to the exhaust mainfold and catalytic converter to the muffler assembly if required. Refer to *General Exhaust System Replacement* in Exhaust System.
9. Install the wiring harness retainers to the transmission.
10. Install the wiring harness connectors to the speed sensor and back up switch.
11. Install the parking brake and controls, if the vehicle is equipped. Refer to *Backing Plate Replacement* in Parking Brake.
12. Install the three bolts securing the transmission to the clutch housing cover.
13. Install the starter motor. Refer to *Starter Motor Replacement (Diesel)* or *Starter Motor Replacement (5.7L and 7.4L)* in Engine Electrical.
14. Install the propeller shaft.
    - For the two-piece propeller shaft, refer to *Two-Piece Propeller Shaft Replacement* in Propeller Shaft.
    - For the three-piece propeller shaft, refer to *Three-Piece Propeller Shaft Replacement* in Propeller Shaft.
15. Install New transmission oil. Refer to *Fluid Replacement.*
16. Lower the vehicle.
17. Install the shift housing. Refer to *Shift Tower Replacement.*
18. Install the shift lever. Refer to *Shift Lever.*

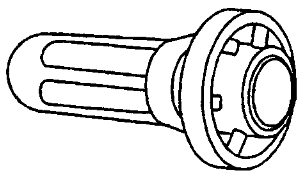
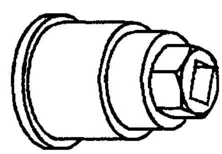
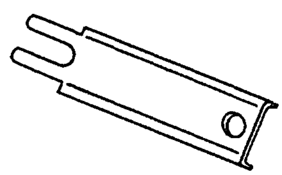
Description and Operation

Transmission Description and Operation

New Venture Gear NV4500

The New Venture Gear NV4500 five-speed manual transmission is the only manual transmission available. The NV4500 is a five-speed manual transmission that provides synchronized shifting in all forward gears and constant mesh helical gearing for reduced noise. Other features include an overspeed inhibitor from low to first gears, dual cone low, and first gear synchronizers. Gear shifting is accomplished by using a shift tower mounted shift lever. The NV4500 transmission can be identified by the RPO code (MW3).

Special Tools and Equipment

Illustration	Tool Number/ Description
 12375	J 22834 Extension Housing Seal Installer
 102584	J 38805 Main Shaft Nut Socket
 41448	J 36221 Quick Connect Disengagement Tool

Automatic Transmission - 4L80-E

Specifications

Temperature vs Resistance

Temperature	Temperature	Minimum Resistance	Nominal Resistance	Maximum Resistance	Signal
°F	°C	Ω	Ω	Ω	volts
–40	–40	90636	100707	110778	5.00
–22	–30	47416	52684	57952	4.78
–4	–20	25809	28677	31545	4.34
14	–10	14558	16176	17794	3.89
32	0	8481	9423	10365	3.45
50	10	5104	5671	6238	3.01
68	20	3164	3515	3867	2.56
86	30	2013	2237	2461	1.80
104	40	1313	1459	1605	1.10
122	50	876	973	1070	3.25
140	60	600	667	734	2.88
158	70	420	467	514	2.56
176	80	299	332	365	2.24
194	90	217	241	265	1.70
212	100	159	177	195	1.42
230	110	119	132	145	1.15
248	120	89.9	99.9	109.9	0.87
266	130	69.1	76.8	84.5	0.60
284	140	53.8	59.8	65.8	0.32
302	150	42.5	47.2	51.9	0.00

Fastener Tightening Specifications (Overhaul)

Application	Specification	
	Metric	English
Accumulator Housing to Valve Body	11 N·m	97 lb in
Case Center Support	44 N·m	32 lb ft
Control Valve Assembly to Case	11 N·m	97 lb in
Cooler Pipe Connector Nut at Case and Radiator	38 N·m	28 lb ft
Engine Rear Mount to Transmission Bolt	44 N·m	32 lb ft
Engine Rear Support Bracket to Frame Nut	44 N·m	32 lb ft
Extension Housing to Case	34 N·m	25 lb ft
Flywheel Housing Cover to Transmission	7 N·m	62 lb in
Flywheel to Converter	44 N·m	32 lb ft
Fourth Clutch	23 N·m	17 lb ft
Manual Shaft to Detent Lever Nut	24 N·m	18 lb ft
Oil Pan Drain Plug	34 N·m	25 lb ft
Oil Pan to Case	24 N·m	18 lb ft
Oil Test Hole Plug	11 N·m	97 lb in
Parking Pawl Bracket to Case	24 N·m	18 lb ft
Pressure Control Solenoid Bracket to Valve Body	8 N·m	71 lb in
Pump Assembly to Case	24 N·m	18 lb ft

Fastener Tightening Specifications (Overhaul) (cont'd)

Application	Specification	
	Metric	English
Pump Body to Cover	24 N·m	18 lb ft
Rear Servo Cover to Case	24 N·m	18 lb ft
Solenoid to Valve Body	8 N·m	71 lb in
Speed Sensor and Bracket Assembly to Case	11 N·m	97 lb in
Transmission Case to Engine	44 N·m	32 lb ft
Valve Body to Case/Lube Pipe	11 N·m	97 lb in
Valve Body to Case/PSM	11 N·m	97 lb in

Fastener Tightening Specifications (On-Vehicle)

Application	Specification	
	Metric	English
Accumulator Cover Bolts	24 N·m	18 lb ft
Auxiliary Valve Body to the Case Bolts	11 N·m	96 lb in
Cooler Line to the Oil Cooler Nut	20 N·m	15 lb ft
Crossmember to the Frame Bolts	77 N·m	56 lb ft
Detent Spring to the Valve Body Bolts	22 N·m	16 lb ft
Interior Wiring Harness Bolts	11 N·m	96 lb in
Lube Pipe Clip Bolt	11 N·m	96 lb in
Manual Shaft Nut	28 N·m	21 lb ft
Oil Cooler Bracket Bolts	6 N·m	53 lb in
Oil Cooler to the Radiator Bolts	10 N·m	89 lb in
Oil Cooler Line Nuts	45 N·m	33 lb ft
Oil Level Indicator Tube Bracket Bolt and Nut	12 N·m	9 lb ft
Oil Pan Bolts	24 N·m	18 lb ft
Torque Converter Cover to Engine Bolts	40 N·m	30 lb ft
Oil Passage Cover to the Case Bolts	11 N·m	96 lb in
Park/Neutral Position Switch Bolts	27 N·m	20 lb ft
Parking Lock Bracket Bolts	24 N·m	18 lb ft
Pressure Switch Manifold	11 N·m	96 lb in
Rear Servo Cover Bolts	24 N·m	18 lb ft
Rear Transmission Mount To Crossmember Nut	47 N·m	35 lb ft
Rear Transmission Mount Bolts	47 N·m	35 lb
Solenoid Assembly to the Pump Bolts	11 N·m	96 lb in
Shift Cable Bracket Nut	6 N·m	53 lb in
Spacer Plate Support Plate Bolts	11 N·m	96 lb in
Speed Sensor Bolts	11 N·m	96 lb in
TCC Solenoid Bolts	11 N·m	96 lb in
Torque Converter Cover Bolts	33 N·m	24 lb ft
Torque Converter to the Flywheel Bolts	55 N·m	41 lb ft
Transmission Control Lever Nut	27 N·m	20 lb ft
Transmission to the Engine Studs	50 N·m	37 lb ft
Transmission Oil Pan Bolts	11 N·m	96 lb in
Transmission to the Engine Bolts	50 N·m	37 lb ft
Valve Body to the Case Bolts	17 N·m	13 lb ft
Vent Hose Clip Bolt	10 N·m	89 lb in

Transmission Scan Tool Data Values (Gas)

Use the scan tool data values under the following conditions:

- The Powertrain On-Board Diagnostic (OBD) System Check is complete
- The On-Board Diagnostics are functioning properly
- No DTCs are present

The values below represent a typical display recorded from a properly functioning system.

Important: Do not use a scan tool that displays faulty data. Report the condition to the scan tool manufacturer. The use of a faulty scan tool can result in misdiagnosis and the unnecessary replacement of parts.

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by Workhorse Custom Chassis for use in diagnosis.

Scan tool values below were recorded under the following conditions:

- Engine at idle
- Upper radiator hose hot
- Closed throttle
- Transmission in Park
- Closed Loop Operation
- Accessories OFF
- Brake pedal not applied

Transmission Scan Tool Data Values (Gas)

Scan Tool Parameter	Data List*	Units	Typical Data Values
1–2 Shift Error	F2,F6	Seconds	Varies
1–2 Shift Time	F0,F2	Seconds	Varies
1-2 Sol.	F0,F2,F3,F4	On/Off	On
1-2 Sol. Open/Short to GRD	F0,F2	Yes/No	No
1-2 Sol. Short to Volts	F0,F2	Yes/No	No
1–2 TAP Cell (4–16)	F6	kPa/Psi	Varies
2–3 Shift Error	F3,F7	Seconds	Varies
2–3 Shift Time	F0,F3	Seconds	Varies
2-3 Sol.	F0,F2,F3,F4	On/Off	Off
2-3 Sol. Open/Short to GRD	F0,F3	Yes/No	No
2-3 Sol. Shorted to Volts	F0,F3	Yes/No	No
2–3 TAP Cell (4–16)	F7	kPa/Psi	Varies
3–4 Shift Error	F4	Seconds	Varies
3–4 Shift Time	F0,F4	Seconds	Varies
4WD	F0	Enabled/Disabled	Disabled
4WD Low	F0	Enabled/Disabled	Disabled
A/C Clutch	F0	On/Off	Off
Adaptable Shift	F0,F6,F7	Yes/No	No
Cruise	F0	Enabled/Disabled	Disabled
Current Gear	F0,F1,F2,F3,F4,F5	1,2,3,4	1
Current TAP Cell	F6,F7	0–16	Varies
ECT	F0,F1	°C (°F)	Varies
Engine Run Time	F0	Hr:Min:Sec	Varies
Engine Speed	F0,F1,F2,F3,F4,F5	RPM	600–800
Engine Torque	F0,F1	N·m (lb ft)	0
Gear Ratio	F0,F2,F3,F4	Ratio	8:00
IAT	F0	°C (°F)	Varies
Ignition Voltage	F0	Volts	13.5–14.5
Last TAP	F6,F7	kPa/Psi	Varies
Maximum TAP	F6,F7	Yes/No	No
PC Sol. Actual Current	F0,F5	Amps	0.92 amps
PC Sol. Duty Cycle	F0,F5	Percent On Time	51%/Varies
PC Sol. Ref. Current	F0,F5	Amps	0.92 amps

Transmission Scan Tool Data Values (Gas) (cont'd)

Scan Tool Parameter	Data List*	Units	Typical Data Values
Power Take-Off	F0	Yes/No	No
Speed Ratio	F0,F1,F2,F3,F4	Ratio	8.00:1
TCC Brake Switch	F0,F1	Open/Closed	Closed
TCC Duty Cycle	F0,F1	%	0%
TCC Duty Cycle Open Short to GRD	F0,F1	Yes/No	No
TCC Duty Cycle Short to Volts	F0,F1	Yes/No	No
TCC Mode	F0,F1	0–5	0
TCC Slip Speed	F0,F1	RPM	+/– 150
TFP Sw. A/B/C	F0	On/Off	Off/On/Off
TFT Sensor	F0	Volts	Varies
TP Angle	F0,F1,F2,F3,F4,F5,F6,F7	Percent	0%
TP Sensor	F0,F1,F2,F3,F4	Volts	0.5–0.7 V
Trans. Fluid Temp.	F0,F1,F5	°C (°F)	Varies
Transmission Hot Mode	F0,F1	On/Off	Off
Transmission ISS	F0,F1,F2,F3,F4	RPM	600–800
Transmission OSS	F0,F1,F2,F3,F4	RPM	0
Turbine Speed	F0,F1,F2,F3,F4	RPM	600–800
Vehicle Speed	F0,F1,F2,F3,F4	km/h (mph)	0

***Data List Legend**

- F0: Transmission Data
- F1: TCC Data
- F2: 1–2 Shift Data
- F3: 2–3 Shift Data
- F4: 3–4 Shift Data
- F5: PC Solenoid Data
- F6: 1–2 Adapt Data
- F7: 2–3 Adapt Data

Transmission Scan Tool Data Values (L57/L65 EFI)

Use the scan tool data values under the following conditions:

- The Powertrain On-Board Diagnostic (OBD) System Check is complete
- The On-Board Diagnostics are functioning properly
- No DTCs are present

The values below represent a typical display recorded from a properly functioning system.

Important: Do not use a scan tool that displays faulty data. Report the condition to the scan tool manufacturer. The use of a faulty scan tool can result in misdiagnosis and the unnecessary replacement of parts.

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by Workhorse Custom Chassis for use in diagnosis.

Scan tool values below were recorded under the following conditions:

- Engine at idle
- Upper radiator hose hot
- Closed throttle
- Transmission in Park
- Closed Loop Operation
- Accessories OFF
- Brake pedal not applied

Transmission Scan Tool Data Values (L57/L65 EFI)

Scan Tool Parameter	Data List*	Units	Typical Data Values
1–2 Shift Time	F0,F2	Seconds	Varies
1–2 Shift Time Error	F2, F6	Seconds	Varies
1-2 Sol.	F0,F2,F3,F4	On/Off	On
1-2 Sol. Open/Short to GND	F0,F2	Yes/No	No
1-2 Sol. Short to Volts	F0,F2	Yes/No	No
1–2 TAP Cell (4–16)	F6	kPa/Psi	Varies
2–3 Shift Time	F0,F3	Seconds	Varies
2–3 Shift Time Error	F3,F7	Seconds	Varies
2-3 Sol.	F0,F2,F3,F4	On/Off	Off
2-3 Sol. Open/Short to GND	F0,F3	Yes/No	No
2-3 Sol. Shorted to Volts	F0,F3	Yes/No	No
2–3 TAP Cell (4–16)	F7	kPa/Psi	Varies
3–4 Shift Time	F0, F4	Seconds	Varies
3–4 Shift Time Error	F4	Seconds	Varies
4WD	F0	Enabled/Disabled	Disabled
4WD Low	F0	Enabled/Disabled	Disabled
A/C Clutch	F0	On/Off	Off
Adaptable Shift	F0,F6,F7	Yes/No	No
APP Angle	F0,F1,F2,F3,F4,F5	%	0%
Cruise	F0	Enabled/Disabled	Disabled
Current Gear	F0,F2,F3,F4,F5	1,2,3,4	1
Current TAP Cell	F6,F7	0–16	Varies
Current TAP Memory	F6,F7	0–16	Varies
ECT	F0,F1	°C (°F)	Varies
Engine Run Time	F0	Hr:Min:Sec	Varies
Engine Speed	F0,F1,F2,F3,F4,F5	RPM	600–800
Engine Torque	F0	N·m (lb ft)	0
Gear Ratio	F0,F2,F3,F4	Ratio	3:98:1
Hot Mode	F0,F1	On/Off	Off
IAT	F0	°C (°F)	Varies
Ignition Voltage	F0	Volts	13.5–14.5
Last TAP	F0	kPa/Psi	Varies
Latest Shift	F0	Sec.	Varies

Transmission Scan Tool Data Values (L57/L65 EFI) (cont'd)

Scan Tool Parameter	Data List*	Units	Typical Data Values
Maximum TAP	F6,F7	Yes/No	No
PC Sol. Actual Current	F0,F5	Amps	0.92 amps
PC Sol. Duty Cycle	F0,F5	Percent On Time	51%/Varies
PC Sol. Ref. Current	F0,F5	Amps	0.92 amps
Speed Ratio	F0,F2,F3,F4	Ratio	3.98
TAP Gear 1	F8	kPa/Psi	0
TAP Gear 2	F8	kPa/Psi	0
TAP Gear 2 TCC	F8	kPa/Psi	0
TAP Gear 3	F8	kPa/Psi	0
TAP Gear 3 TCC	F8	kPa/Psi	0
TAP Gear 4	F8	kPa/Psi	0
TAP Gear 4 TCC	F8	kPa/Psi	0
TAP Gear Reverse	F8	kPa/Psi	0
TCC Brake Switch	F0,F1	Open/Closed	Open
TCC Duty Cycle	F0,F1	%	0%
TCC Duty Cycle Open Short to GND	F0,F1	Yes/No	No
TCC Duty Cycle Short to Volts	F0,F1	Yes/No	No
TCC Slip Speed	F0,F1	RPM	+/– 150
TFP Sw. A/B/C	F0	On/Off	Off/On/Off
TFT Sensor	F0,F1	Volts	Varies
Trans. Fluid Temp.	F0,F1,F5	°C (°F)	Varies
Transmission ISS	F0,F1,F2,F3,F4	RPM	600–800
Transmission OSS	F0,F1,F2,F3,F4	RPM	0
Turbine Speed	F0,F1,F2,F3,F4	RPM	600–800
Vehicle Speed	F0,F1,F2,F3,F4	km/h (mph)	0

***Data List Legend**

- F0: Transmission Data
- F1: TCC Data
- F2: 1–2 Shift Data
- F3: 2–3 Shift Data
- F4: 3–4 Shift Data
- F5: PC Solenoid Data
- F6: 1–2 Adapt Data
- F7: 2–3 Adapt Data
- F8: Steady State Data

Transmission Scan Tool Data Values (L57 MFI)

Use the scan tool data values under the following conditions:

- The Powertrain On-Board Diagnostic (OBD) System Check is complete
- The On-Board Diagnostics are functioning properly
- No DTCs are present

The values below represent a typical display recorded from a properly functioning system.

Important: Do not use a scan tool that displays faulty data. Report the condition to the scan tool manufacturer. The use of a faulty scan tool can result in misdiagnosis and the unnecessary replacement of parts.

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by Workhorse Custom Chassis for use in diagnosis.

Scan tool values below were recorded under the following conditions:

- Engine at idle
- Upper radiator hose hot
- Closed throttle
- Transmission in Park
- Closed Loop Operation
- Accessories OFF
- Brake pedal not applied

Transmission Scan Tool Data Values (L57 MFI)

SCAN Position	Units Displayed	Typical Scan Values
Engine Speed	RPM	600-900
Turbine Speed	RPM	600-900
TCC Slip Speed	RPM	-80 Varies
TCC Duty Cycle	%	0
Transmission ISS	RPM	600-900
Transmission OSS	RPM	0
TFP Sw. A/B/C	On/Off	Off/On/Off
Transmission Range	P/N	Park/Neutral
Current Gear	1, 2, 3, 4	1
Gear Ratio	4:1	4:00:1
PC Sol. Duty Cycle	%	Varies
PC Sol. Ref. Current	Amps	Varies
PC Sol. Actual Current	Amps	Varies
TCC Brake Switch	Open/Closed	Closed
Ignition Voltage	Volts	13-15.5
Trans. Fluid Temp.	°C/°F	80°C (175°F)
TP Angle	%	0
TP Sensor	Volts	0.5 Varies
1-2 Shift Time	Seconds	Varies
2-3 Shift Time	Seconds	Varies
Prom ID:	Numeric Value	Varies

Transmission Scan Tool Data Definitions

1-2 Shift Time: Displays 0.00–6.38 seconds. This parameter is the actual time of the last 1-2 shift. The shift time is based on the gear ratio change after the commanded 1-2 shift. This value is only accurate if the adaptable shift parameter indicates Yes.

1-2 Shift Time Error: Displays a range of –6.38 to +6.38 seconds. This parameter is the difference between the desired 1-2 shift time and the actual 1-2 shift time. A positive number indicates the actual shift time was longer than the desired shift time. This value is only accurate if the Adaptable Shift parameter indicates Yes.

1-2 Solenoid: Displays ON or OFF. These parameters are the commanded status of the 1-2 shift solenoid valves. ON represents a commanded energized state (current is flowing through the solenoid). OFF represents a non-commanded state (current is not flowing through the solenoid).

1-2 Solenoid Open/Shorted to Ground: Displays Yes or No. This parameter indicates if an open or a short to ground exists in the feedback signal from the 1-2 shift solenoid valve to the controller.

1-2 Solenoid Shorted to Voltage: Displays Yes or No. This parameter indicates if a short to B+ exists in the feedback signal from the 1-2 shift solenoid valve to the controller.

1-2 TAP Cell (4–16): Scan tool displays kPa or psi. This parameter displays the amount of pressure varied from a calibrated base line pressure for shifts. Each TAP cell is based on a calibrated shift torque value. Each TAP cell value is calculated from the last shift time. This cell pressure is used in addition to the calibrated base line pressure to adjust the apply of a clutch or band during the next shift.

2-3 Shift Time: Displays 0.00–6.38 seconds. This parameter is the actual time of the last 2-3 shift. The shift time is based on the gear ratio change after the commanded 2-3 shift. This value is only accurate if the adaptable shift parameter indicates Yes.

2-3 Shift Time Error: Displays a range of –6.38 to +6.38 seconds. This parameter is the difference between the desired 2-3 shift time and the actual 2-3 shift time. A positive number indicates the actual shift time was longer than the desired shift time. This value is only accurate if the Adaptable Shift parameter indicates Yes.

2-3 Solenoid: Displays ON or OFF. These parameters are the commanded status of the 2-3 shift solenoid valves. ON represents a commanded energized state (current is flowing through the solenoid). OFF represents a non-commanded state (current is not flowing through the solenoid).

2-3 Solenoid Open/Shorted to Ground: Displays Yes or No. This parameter indicates if an open or a short to ground exists in the feedback signal from the 2-3 shift solenoid valve to the controller.

2-3 Solenoid Shorted to Voltage: Displays Yes or No. This parameter indicates if a short to B+ exists in the feedback signal from the 2-3 shift solenoid valve to the controller.

2-3 TAP Cell (4–16): Scan tool displays kPa or psi. This parameter displays the amount of pressure varied from a calibrated base line pressure for shifts. Each TAP cell is based on a calibrated shift torque value. Each TAP cell value is calculated from the last shift time. This cell pressure is used in addition to the calibrated base line pressure to adjust the apply of a clutch or band during the next shift.

3-4 Shift Time: Displays 0.00–6.38 seconds. This parameter is the actual time of the last 3-4 shift. The shift time is based on the gear ratio change after the commanded 3-4 shift. This value is only accurate if the adaptable shift parameter indicates Yes.

3-4 Shift Time Error: Displays a range of –6.38 to +6.38 seconds. This parameter is the difference between the desired 3-4 shift time and the actual 3-4 shift time. A positive number indicates the actual shift time was longer than the desired shift time. This value is only accurate if the Adaptable Shift parameter indicates Yes.

3-4 TAP Cell (4–16): Scan tool displays kPa or psi. This parameter displays the amount of pressure varied from a calibrated base line pressure for shifts. Each TAP cell is based on a calibrated shift torque value. Each TAP cell value is calculated from the last shift time. This cell pressure is used in addition to the calibrated base line pressure to adjust the apply of a clutch or band during the next shift.

4WD: Displays Enabled or Disabled. This parameter indicates whether the vehicle is currently in a four-wheel drive mode.

4WD Low: Displays Enabled or Disabled. This parameter is the signal state of the four-wheel drive low circuit. Enabled indicates a 0 voltage signal requesting 4WD low. Disabled indicates a B+ voltage signal which does not request 4WD low.

A/C Clutch: Displays ON or OFF. This represents the commanded state of the A/C clutch control relay. The clutch should be engaged whenever ON is displayed. The controller compensates for the additional engine load that is accompanied with the A/C clutch engaged.

Adaptable Shift: The scan tool displays Yes or No. Yes indicates that the proper operating conditions (i.e. TP sensor, engine torque, vehicle speed data, engine vacuum, shift delay, etc.) were all within the proper operating range during the last shift and the shift time was accurate. This shift information is then used through the adaptive function to update the adapt cells. No indicates that not all of the operating conditions were met in order to enable this function and that the adapt cells were not updated.

APP (Accelerator Pedal Position) Angle: Diesel application: Displays a range of 0–100%. The APP angle is computed by the controller from APP voltage. The APP angle should display 0% at idle and 100% at wide open throttle (WOT).

Cruise: Displays ENABLED or DISABLED. This parameter indicates whether the controller is allowing cruise operation. The controller has the ability to disable cruise control under certain conditions.

Current Gear: Displays 1, 2, 3, or 4. This parameter indicates the current commanded state of the shift solenoids.

Current TAP (Transmission Adaptive Pressure) Cell: Displays a torque based cell range of 0–16. This parameter indicates the current cell used for line pressure modification (adaptation).

Current TAP Memory: Displays a range of -110 to +110 kPa (–16 to +16 psi). This parameter is the amount of pressure that is added to base line pressure to adjust the holding effort of a clutch or a band, while shifting.

ECT (Engine Coolant Temperature): Displays -40°C to 151°C (-40°F to 304°F). This parameter is the input signal of the engine coolant temperature sensor. Engine coolant temperature is high when the signal voltage is low (0 volts), and engine coolant temperature is low when the signal voltage is high (5 volts).

Engine Run Time: Displays a range of 0:00:00–18:12:15 Hr/Min/Sec. This parameter measures how long the engine has been operating. When you turn the ignition switch OFF, the value resets to zero.

Engine Speed: Displays 0–8192 RPM. This parameter indicates the rotational speed of the engine expressed as revolutions per minute.

Engine Torque: Displays 0–9999 ft/lb. This parameter is a calculated value based on engine load, throttle position, mass air flow, and other engine and transmission inputs. This parameter is accurate to within 15 ft/lb of actual measured engine torque.

Gear Ratio: Displays a range of 0.00 to 8.00:1. This parameter is the actual gear ratio of the current commanded gear. In the current gear of R, D3, D2, and D1, it is calculated by dividing the input speed by the output speed. In the current gear of D4 with TCC lock up, the gear ratio is calculated by dividing the turbine speed by the output speed.

Hot Mode: Displays ON or OFF. This parameter monitors the transmission fluid temperature. YES indicates that the transmission fluid temperature has exceeded 135°C (275°F).

IAT (Intake Air Temperature): Displays a range of -40°C to 215°C (-40°F to 419°F). The IAT sensor is a thermistor used to monitor the temperature of the air entering the intake manifold. The controller applies 5 volts to the sensor on a 5 volt reference circuit. When the air is cool, the resistance in the sensor is high. If the air is warm, the sensor resistance is low and the controller senses a low voltage signal. The controller converts the signal of the IAT sensor to degrees Celsius. Intake air temperature is used by the controller to adjust fuel delivery and spark timing.

Ignition Voltage: Displays 0.0–25.5 volts. This parameter represents the system voltage measured by the controller at its ignition feed.

Last TAP: Displays psi. This parameter indicates the amount of pressure that was added to base line pressure in order to adjust the apply effort of a clutch or a band during the last adapting shift.

Latest Shift: Displays 0.00–6.38 seconds. This parameter is the actual shift time of the last upshift. This value is only accurate if the adaptable shift parameter indicates YES.

Maximum Tap (Transmission Adaptive Pressure): Displays Yes or No. This parameter indicates when line pressure modification (adaptation) has reached its limit. Yes indicates the limit has been reached. No indicates the limit has not been reached.

PC (Pressure Control) Solenoid Act. (Actual) Current: Displays 0.00–1.1 amps. This parameter is the actual current of the pressure control solenoid circuit at the control module. Zero amp (no current flow) indicates an actual higher line pressure. A reading of 1.1 amp (high current flow) indicates an actual lower line pressure.

PC (Pressure Control) Solenoid Duty Cycle: Displays 0%–100%. This parameter is the commanded state of the pressure control solenoid expressed as a percentage of energized ON time. A reading of 0% indicates zero ON time (non energized), or no current flow. Approximately 60% at idle indicates maximum ON time (energized), or high current flow.

PC (Pressure Control) Solenoid Ref. (Reference) Current: Displays 0.00–1.1 amps. This parameter is the commanded current of the pressure control solenoid circuit at the control module. Zero amp (no current flow) indicates a commanded higher line pressure. A reading of 1.1 amp (high current flow) indicates a commanded lower line pressure.

Power Take-Off: Displays Yes or No. This parameter indicates when the Power Take Off (PTO) is engaged. PTO mode disables all transmission diagnostics.

Shift Torque: Displays a range of 0–510 (0–406 ft). This parameter is the torque value which is used in the commanded pressure calculation during shift. This parameter indicates the last shift torque.

Speed Ratio: The scan tool displays a range of 0.00:1–8.00:1. This parameter indicates engine speed divided by transmission output speed.

Standard TAP (Transmission Adaptive Pressure): Displays Yes or No. The standard TAP is an amount of pressure that is added to the base line pressure. If the shift requires standard TAP to achieve the shift, the scan tool displays Yes. If the shift requires more or less than the standard TAP to achieve the shift, the scan tool displays No. This reading indicates that the TAP is out of the standard range.

TAP Gear 1: Range: 0–876 kPa (0–127). This display indicates a pressure modification which is added to the line pressure in 1st gear when the PCM detects a worn or slipping component.

TAP Gear 2: Range: 0–876 kPa (0–127). This display indicates a pressure modification which is added to the line pressure in 2nd gear when the PCM detects a worn or slipping component.

TAP Gear 2 TCC: Range: 0–876 kPa (0–127). This display indicates a pressure modification which is added to the line pressure in 2nd gear with TCC applied when the PCM detects a worn or slipping component.

TAP Gear 3: Range: 0–876 kPa (0–127). This display indicates a pressure modification which is added to the line pressure in 3rd gear when the PCM detects a worn or slipping component.

TAP Gear 3 TCC: Range: 0–876 kPa (0–127). This display indicates a pressure modification which is added to the line pressure in 3rd gear with TCC applied when the PCM detects a worn or slipping component.

TAP Gear 4: Range: 0–876 kPa (0–127). This display indicates a pressure modification which is added to the line pressure in 4th gear when the controller detects a worn or slipping component.

TAP Gear 4 TCC: Range: 0–876 kPa (0–127). This display indicates a pressure modification which is added to the line pressure in 4th gear with TCC applied when the controller detects a worn or slipping component.

TAP Gear Reverse: Range: 0–876 kPa (0–127). This display indicates a pressure modification which is added to the line pressure in Reverse gear when the PCM detects a worn or slipping component.

TCC Brake Switch (L57/L65 EFI Application): Displays Open or Closed. This parameter indicates the state of the TCC brake switch circuit input. Open indicates a zero voltage input (the brake switch is open and the brake pedal is not applied). Closed indicates a B+ voltage input (the brake switch is closed when the brake pedal is applied).

TCC Brake Switch (L29/L31/L35 Application): Displays Open or Closed. This parameter indicates the state of the TCC brake switch circuit input. Open indicates a zero voltage input (the brake switch is open and the brake pedal is applied). Closed indicates a B+ voltage input (the brake switch is closed and the brake pedal is not applied).

TCC Duty Cycle: Displays 0%–100%. This parameter is the commanded percentage of ON time of the TCC PWM solenoid. 90% represents an ON (energized) commanded state. 0% represents an OFF (non-energized) commanded state.

TCC Duty Cycle Open/Shorted to Ground: Displays Yes or No. This parameter indicates if an open or a short to ground exists in the feedback signal from the TCC PWM solenoid valve to the controller.

TCC Duty Shorted to Voltage: Displays Yes or No. This parameter indicates if a short to B+ exists in the feedback signal from the TCC PWM solenoid valve to the controller.

TCC Mode: Displays a range of 0 through 5. Zero (0), or Off Mode, indicates that the controller commands the TCC OFF at a calibrated minimum throttle. The calibrated minimum throttle is different at low vehicle speeds than it is at high vehicle speeds. Off Mode is also active when the transmission is in the wrong gear range, the engine or the transmission is cold, the brake input indicates that the brakes are ON, a downshift or upshift is initiated, the engine is at idle, the transmission is in Hot Mode or a misfire is detected. One (1), or release Mode, indicates that the controller commands the release of the TCC. Two (2), or Apply Mode, indicates that the controller commands the apply of the TCC. Apply pressure varies based on normal or performance operations, hot conditions or if the cruise control is active. Apply Mode is used under normal driving conditions.
All apply pressure is dependent on throttle position and vehicle speed. The TCC applies with an average 65% duty cycle. Three (3), or Apply Enable Mode, indicates that enabling conditions are met for applying the TCC (enabling conditions include: vehicle speed, gear selection, transmission temperature, throttle angle, brake switch status, etc.). Four (4), or Locked Mode, indicates that the controller commands full capacity of the TCC when the transmission is in fourth gear and the vehicle speed is greater than a calibrated value. When variable TCC apply pressure stops (apply mode), maximum TCC pressure is used. Five (5), or Coast Mode, indicates that the controller commands apply of the TCC when the transmission is in fourth gear and the throttle, and vehicle speed, are not high enough to enable Apply Mode, but high enough to keep the TCC applied. When Coast Mode is active, TCC apply pressure is set to a predetermined amount.

TCC (Torque Converter Clutch) Slip Speed: Displays –4080 to +4079 RPM. This parameter is the difference between transmission input speed and engine speed. A negative value indicates that the engine speed is less than the input speed (deceleration). A positive value indicates that the engine speed is greater than the input speed (acceleration). A value of zero indicates that the engine speed is equal to the input speed (TCC is applied).

TFP Switch A/B/C: Displays On/Off, On/Off, On/Off. These parameters are the three inputs from the automatic transmission fluid pressure manual valve position switch Assembly. ON represents a 0 voltage signal. OFF represents a B+ voltage signal.

TFT (Transmission Fluid Temperature) Sensor: Displays 0.00–5.00 volts. When the transmission fluid is cold, the sensor resistance is high and the controller senses a high signal voltage. As the transmission fluid temperature warms to normal operating temperature, the sensor resistance becomes less and the voltage decreases to about 1.5–2.0 volts.

TP (Throttle Position) Angle: Displays a range of 0%–100%. The TP angle is computed by the VCM from TP voltage. The TP angle should display 0% at idle and 100% at wide open throttle (WOT).

TP (Throttle Position) Sensor: Scan tool displays a range of 0.00–5.00 volts. The VCM uses the TP sensor in order to determine the amount of throttle demanded by the driver. Voltage is below 1 volt at idle. Voltage is above 4 volts at wide open throttle (WOT).

Trailer Mode: Displays a range of 0–20. Zero indicates normal line pressure and shift operation, where 20 indicates high line pressure and a modified shift feel pattern for towing and hauling.

Transfer Case Ratio: The scan tool displays a range of 0.00–3.88:1. This parameter indicates the ratio of the transfer case calculated by input speed divided by transmission output speed based on transmission commanded gear.

Trans. Fluid Temp. (TFT): Displays –40°C to 151°C (–40°F to 304°F). This parameter is the input signal of the transmission fluid temperature sensor. Transmission fluid temperature is high when the signal voltage is low (0 volts), and transmission fluid temperature is low when the signal voltage is high (5 volts).

Transmission ISS (Input Shaft Speed): Displays 0–8192 RPM. This parameter measures the rotational speed of the input shaft expressed as revolutions per minute.

Transmission OSS (Output Shaft Speed): Displays 0–8192 RPM. This parameter indicates the rotational speed of the transmission output shaft expressed as revolutions per minute. On four-wheel drive applications, the transfer case output shaft speed is measured.

Turbine Speed: Displays 0–8192 RPM. This parameter indicates the rotational speed of the torque converter turbine shaft expressed as revolutions per minute. In commanded gears 1, 2, and 3, the turbine speed equals the input speed. In commanded gear 4, the turbine speed equals 3/4 of the input speed.

Vehicle Speed: Displays 0–255 km/h (0–158 mph). This parameter is the input signal from the OSS sensor.

Diagnostic Trouble Code Identification (Gas)

DTC	Description	DTC Type*	Default Action
P0218	Transmission Fluid Overtemperature	D	The VCM freezes shift adapts.
P0502	Vehicle Speed Sensor Circuit — Low Input	D/B	• The VCM illuminates the MIL for California emissions. • The VCM freezes shift adapts. • The VCM commands maximum line pressure • The VCM defaults a calculated OSS from the A/T ISS sensor output.
P0503	Vehicle Speed Sensor Circuit — Intermittent	D/B	• The VCM illuminates the MIL for California emissions. • The VCM freezes shift adapts. • The VCM commands maximum line pressure. • The VCM defaults a calculated OSS from the A/T ISS sensor output.
P0560	System Voltage Malfunction	D	• The VCM commands an immediate landing to second gear. • The VCM freezes shift adapts. • The VCM turns off all transmission output devices.
P0711	Automatic Transmission Fluid Temperature (TFT) Sensor Circuit Range/Performance	D	• The VCM freezes shift adapts. • Default line pressure. • The VCM calculates a default transmission fluid temperature based on engine coolant temperature, intake air temperature and engine run time.
P0712	Transmission Fluid Temperature Sensor Circuit — Low Input	D	• The VCM freezes shift adapts. • Default line pressure. • The VCM calculates a default transmission fluid temperature based on engine coolant temperature, intake air temperature and engine run time.

Diagnostic Trouble Code Identification (Gas) (cont'd)

DTC	Description	DTC Type*	Default Action
P0713	Transmission Fluid Temperature Sensor Circuit — High Input	D	• The VCM freezes shift adapts. • Default line pressure. • The VCM calculates a default transmission fluid temperature based on engine coolant temperature, intake air temperature and engine run time.
P0716	Input Speed Sensor Circuit — Intermittent	D/B	• The VCM illuminates the MIL for California emissions. • The VCM freezes shift adapts. • The VCM commands maximum line pressure.
P0717	Input Speed Sensor Circuit — Low Input	D/B	• The VCM illuminates the MIL for California emissions. • The VCM freezes shift adapts. • The VCM commands maximum line pressure.
P0719	Brake Switch Circuit — Low Input	D	—
P0724	Brake Switch Circuit — High Input	D	—
P0730	Incorrect Gear Ratio	D	• The VCM commands maximum line pressure. • The VCM freezes shift adapts.
P0741	Torque Converter Clutch System Stuck Off	D/B	• The VCM illuminates the MIL for California emissions. • Default line pressure. • The VCM inhibits TCC engagement. • The VCM inhibits fourth gear engagement.
P0742	Torque Converter Clutch System Stuck On	D/B	• The VCM illuminates the MIL for California emissions. • The VCM commands maximum line pressure. • The VCM freezes shift adapts.
P0748	Pressure Control Circuit — Electrical	D	• The VCM disables the PC Solenoid valve. • The VCM freezes shift adapts.
P0751	1-2 Shift Solenoid Valve — Performance	D/B	• The VCM illuminates the MIL for California emissions. • The VCM commands maximum line pressure. • The VCM freezes shift adapts. • 3-2 downshifts above 25 MPH are inhibited.
P0753	1-2 Shift Solenoid Valve Circuit — Electrical	D/A	• The VCM illuminates the MIL for California emissions. • The VCM freezes shift adapts. • 3-2 downshifts above 25 MPH are inhibited. • The VCM commands maximum line pressure.

Diagnostic Trouble Code Identification (Gas) (cont'd)

DTC	Description	DTC Type*	Default Action
P0756	2-3 Shift Solenoid Valve — Performance	D/A	• The VCM illuminates the MIL for California emissions. • The VCM commands an immediate landing to second gear. • The VCM freezes shift adapts. • The VCM commands maximum line pressure.
P0758	2-3 Shift Solenoid Valve Circuit— Electrical	D/A	• The VCM illuminates the MIL for California emissions. • The VCM commands maximum line pressure. • The VCM freezes shift adapts. • The VCM commands an immediate landing to second gear.
P1810	Automatic Transmission Fluid Pressure Manual Valve Position Switch Circuit Malfunction	D/B	• The VCM illuminates the MIL for California emissions. • The VCM freezes shift adapts. • The VCM assumes D4 shift pattern. • The VCM commands maximum line pressure. • The VCM forces TCC apply when fourth gear is commanded.
P1860	Torque Converter Clutch Pulse Width Modulation Solenoid Valve Circuit-Electrical	D/A	• The VCM illuminates the MIL for California emissions. • The VCM inhibit s TCC engagement. • The VCM inhibits fourth gear engagement. • The VCM freezes shift adapts.
P1870	Transmission Component Slipping	D/B	• The VCM illuminates the MIL for California emissions. • The VCM commands maximum line pressure. • The VCM inhibits TCC engagement. • The VCM inhibits fourth gear engagement. • The VCM freezes shift adapts.
P1875	Four-Wheel Drive Low Switch Circuit Electrical	D/B	• The VCM illuminates the MIL for California emissions. • The VCM freezes shift adapts. • The VCM assumes a 4WD Lo state if the switch fails when open, or the VCM assumes a 4WD High state if the switch fails when closed, for a transmission shift pattern. • The VCM inhibits fourth gear engagement. • The VCM freezes shift adapts.

*DTC Types:
A—Emission related, will turn on the MIL after the first failure.
B—Emission related, will turn on the MIL after two consecutive trips with a failure.
C—Non-emission related, will turn on the service lamp after the first failure.
D—Non-emission related, no lamps.

Diagnostic Trouble Code Identification (L57/L65 EFI)

DTC	Description	DTC Type*	Default Action
P0218	Transmission Fluid Overtemperature	D	The PCM freezes shift adapts.
P0560	System Voltage Malfunction	D	• The PCM inhibits TCC engagement. • The PCM freezes shift adapts. • The PCM turns off the PC solenoid valve. • The PCM commands an immediate landing into 2nd gear.
P0711	Transmission Fluid Temperature Sensor Circuit Range/Performance	D	• The PCM freezes shift adapts. • Default line pressure. • The PCM calculates a default transmission fluid temperature based on engine coolant temperature, intake air temperature and engine run time.
P0712	Transmission Fluid Temperature Sensor Circuit — Low Input	D	• The PCM freezes shift adapts. • Default line pressure. • The PCM calculates a default transmission fluid temperature based on engine coolant temperature, intake air temperature and engine run time.
P0713	Transmission Fluid Temperature Sensor Circuit — High Input	D	• The PCM freezes shift adapts. • Default line pressure. • The PCM calculates a default transmission fluid temperature based on engine coolant temperature, intake air temperature and engine run time.
P0716	Input Speed Sensor Circuit — Intermittent	B	• The PCM illuminates the MIL. • The PCM freezes shift adapts. • The PCM commands maximum line pressure.
P0717	Input Speed Sensor Circuit — Low Input	B	• The PCM illuminates the MIL. • The PCM freezes shift adapts. • The PCM commands maximum line pressure.
P0719	Brake Switch Circuit — Low Input	D	—
P0722	Output Speed Sensor — Low Input	B	• The PCM illuminates the MIL. • The PCM freezes shift adapts. • The PCM commands maximum line pressure. • The PCM calculates OSS from ISS.
P0723	Output Speed Sensor Intermittent	B	• The PCM illuminates the MIL. • The PCM freezes shift adapts. • The PCM commands maximum line pressure. • The PCM calculates OSS from ISS.
P0724	Brake Switch Circuit — High Input	D	Apply TCC if APP is greater than 0.5% and the vehicle speed is greater than 30 mph.
P0730	Incorrect gear ratio	D	• The PCM commands maximum line pressure. • The PCM freezes shift adapts.

Diagnostic Trouble Code Identification (L57/L65 EFI) (cont'd)

DTC	Description	DTC Type*	Default Action
P0741	Torque Converter Clutch System Stuck Off	B	• The PCM illuminates the MIL. • The PCM inhibits TCC engagement. • The PCM inhibits fourth gear engagement. • The PCM commands increased line pressure.
P0742	Torque Converter Clutch System Stuck On	B	• The PCM illuminates the MIL. • The PCM freezes shift adapts. • The PCM commands maximum line pressure.
P0748	Pressure Control Solenoid Circuit — Electrical	D	• The PCM freezes shift adapts. • The PCM commands maximum line pressure by disabling the PC solenoid valve.
P0751	1-2 Shift Solenoid Valve —Performance	B	• The PCM illuminates the MIL. • The PCM freezes shift adapts. • The PCM commands maximum line pressure.
P0753	1-2 Shift Solenoid Valve — Electrical	A	• The PCM illuminates the MIL. • The PCM freezes shift adapts. • The PCM commands maximum line pressure.
P0756	2-3 Shift Solenoid Valve — Performance	A	• The PCM illuminates the MIL. • The PCM commands an immediate landing into second gear. • The PCM freezes shift adapts. • The PCM commands maximum line pressure.
P0758	2-3 Shift Solenoid Valve — Electrical	A	• The PCM illuminates the MIL. • The PCM commands an immediate landing to second gear. • The PCM freezes shift adapts. • The PCM commands maximum line pressure.
P1810	Transmission Fluid Pressure Manual Valve Position Switch Assembly — Circuit Malfunction	B	• The PCM illuminates the MIL. • The PCM freezes shift adapts. • The PCM assumes a D4 shift pattern. • The PCM commands maximum line pressure. • The PCM commands TCC apply with 4th gear commanded ON.
P1811	Maximum Adapt and Long Shift	D	• The PCM freezes shift adapts. • The PCM commands maximum line pressure.
P1860	Torque Converter Clutch Pulse Width Modulation Solenoid Circuit — Electrical	A	• The PCM illuminates the MIL. • The PCM inhibits TCC engagement. • The PCM inhibits fourth gear engagement. • The PCM freezes shift adapts.

Diagnostic Trouble Code Identification (L57/L65 EFI) (cont'd)

DTC	Description	DTC Type*	Default Action
P1870	Transmission Component Slipping	B	• The PCM illuminates the MIL. • The PCM commands maximum line pressure. • The PCM inhibits TCC engagement. • The PCM inhibits fourth gear engagement. • The PCM freezes shift adapts.
P1875	Four-Wheel Drive Low Switch Circuit — Electrical	B	• The PCM illuminates the MIL. • The PCM freezes shift adapts. • The PCM assumes a 4WD Lo state if the switch fails when open, or the PCM assumes a 4WD High state if the switch fails when closed, for a transmission shift pattern. • DTC P1875 is stored in PCM history.

DTC Types: A—Emission related, will turn on the MIL after the first failure. B—Emission related, will turn on the MIL after two consecutive trips with a failure. C—Non-emission related, will turn on the service lamp after the first failure. D—Non-emission related, no lamps.

Diagnostic Trouble Code Identification (L57 MFI)

DTC	Description	Default Action
21	Throttle Position Sensor Circuit High Voltage	• Set line pressure to maximum • Use 35% throttle as a default • Inhibit fourth gear if in Hot Mode
22	Throttle Position Sensor Circuit Low Voltage	• Set line pressure to maximum • Use 35% throttle as a default • Inhibit fourth gear if in Hot Mode
24	Output Shaft Speed (OSS) Sensor Low	• Set line pressure to maximum • Allow 4-3, 3-2, and 1-2 shifts, then maintain second gear • Calculate output speed from input speed
28	TFP Valve Position Switch	• Assume Drive 4 is selected • Inhibit fourth gear if in Hot Mode • Inhibit TCC operation
37	TCC Brake Switch Low Input	• No TCC • No fourth gear if in Hot Mode
38	TCC Brake Switch High Input	• No TCC • No fourth gear if in Hot Mode
39	Torque Converter Clutch (TCC) Stuck OFF	Inhibit fourth gear if in Hot Mode
51	Prom Error	—
52	System Voltage High Long	• Maximum line pressure • 2nd gear landing • Inhibit TCC
53	System Voltage High	• Maximum line pressure • 2nd gear only • Inhibit TCC operation
58	Transmission Fluid Temperature (TFT) Sensor Circuit High	• TCC in second, third, and fourth gears • Maximum line pressure • Defaults to 140°C TFT

Diagnostic Trouble Code Identification (L57 MFI) (cont'd)

DTC	Description	Default Action
59	Transmission Fluid Temperature (TFT) Sensor Circuit Low	• TCC in second, third, and fourth gears • Maximum line pressure • Defaults to 140°C TFT
63	BARO Sensor Circuit High	No altitude compensation of shift patterns
64	BARO Sensor Circuit Low	No altitude compensation of shift patterns
68	Transmission Component Slipping	• Inhibit TCC operation • Inhibit manual mode operation
69	Torque Converter Clutch (TCC) Stuck ON	—
71	Camshaft Position Sensor (CMP) Circuit Low (Engine Speed Sensor)	The TCM inhibits TCC
72	Transmission Output Shaft Speed (OSS) Sensor Circuit Loss	• Maximum line pressure • Soft landing into second gear
73	Pressure Control (PC) Solenoid Valve Electrical	Maximum line pressure
74	Automatic Transmission Input Shaft Speed (A/T ISS) Sensor Circuit	The TCM inhibits TCC
75	System Voltage Low	• Turn pressure control solenoid OFF • Allow 4-3, 3-2, and 1-2 shifts, then maintain second gear • Inhibit TCC and fourth gear
79	Transmission Fluid Overtemperature	—
81	2-3 Shift Solenoid (2-3 SS) Valve Circuit Fault	• Inhibit TCC operation • Maximum line pressure
82	1-2 Shift Solenoid (1-2 SS) Valve Circuit Fault	• Second and third gears only • Maximum line pressure
83	TCC PWM Solenoid Valve Circuit Fault	• Inhibit fourth gear if in Hot Mode • Inhibit TCC operation
85	Undefined Gear Ratio	• Maximum line pressure • Inhibit TCC
86	Low Ratio Error	• Defaults to second gear • Maximum line pressure • Inhibits TCC
87	High Ratio Error	• Landing to second gear • Maximum line pressure • Inhibits TCC

Transmission General Specifications

Name	Hydra-matic 4L80-E
RPO Codes	MT1
Production Location	Ypsilanti, MI
Transmission Drive	Longitudinally Mounted Rear Wheel Drive
1st Gear Ratio	2.482:1
2nd Gear Ratio	1.482:1
3rd Gear Ratio	1.000:1
4th Gear Ratio	0.750:1
Reverse	2.077:1
Torque Converter Size (Diameter of Torque Converter Turbine)	310 mm
Pressure Taps	Line Pressure
Transmission Fluid Type	DEXRON® III

Transmission General Specifications (cont'd)

Name	Hydra-matic 4L80-E
Transmission Fluid Capacity (Approximate)	Bottom Pan Removal: 7.3L (7.7 qts) Dry: 12.8L (13.5 qts)
Transmission Type: 4	Four Forward Gears
Transmission Type: L	Longitudinal Mount
Transmission Type: 80	Product Series
Transmission Type: E	Electronic Controls
Position Quadrant	P, R, N, Ⓓ, D, 2, 1
Case Material	Die Cast Aluminum
Transmission Weight Dry	107 kg (236 lbs)
Transmission Weight Wet	118 kg (260 lbs)
Maximum Trailer Towing Capacity	9,525 kg (21,000 lbs)
Maximum Gross Vehicle Weight (GVW)	7,258 kg (16,000 lbs)

Fluid Capacity Specifications

Application	Specification	
	Metric	English
4L80-E Oil Pan Removal, Use Dexron® III Automatic Transmission Oil P/N 12346143	7.3 L	7.7 qt
4L80-E Overhaul, Use Dexron® III Automatic Transmission P/N 12346143	12.8 L	13.5 qt

Range Reference

Range	Park	Reverse	Neutral	OD				D			2		1	
Gear	N	R	N	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st	2nd
@1-2 Shift Solenoid	ON	ON	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	OFF	ON	OFF
@2-3 Shift Solenoid	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF
Fourth Clutch	—	—	—	—	—	—	A	—	—	—	—	—	—	—
Overrun Clutch	—	—	—	—	—	—	—	A	A	A	A	A	A	A
Overdrive Roller Clutch	H	H	H	H	H	H	OR	A	A	A	A	A	A	A
Forward Clutch	—	—	—	A	A	A	A	A	A	A	A	A	A	A
Direct Clutch	—	A	—	—	—	A	A	—	—	A	—	—	—	—
Front Band	—	—	—	—	—	—	—	—	—	—	—	A	—	A
Inter Sprag Clutch	—	—	—	*	H	OR	OR	*	H	OR	*	H	*	H

Range Reference (cont'd)

Range	Park	Reverse	Neutral	OD				D			2		1	
Gear	N	R	N	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st	2nd
Inter Clutch	—	—	—	—	A	A	A	—	A	A	—	A	—	A
Lo Roller Clutch	—	—	—	H	OR	OR	OR	H	OR	OR	H	OR	H	OR
Rear Band	—	A	—	—	—	—	—	—	—	—	—	—	A	—

A = Applied H = Holding OR = Overrunning • = Holding but not effective ON = The solenoid is energized. OFF = The solenoid is de-energized @ = The solenoid's state follows a shift pattern which depends upon vehicle speed and throttle position. The pattern does not depend upon the selected gear.

Shift Solenoid Valve State and Gear Ratio

Gear	1-2 SS Valve	2-3 SS Valve	Gear Ratio
1	ON	OFF	2.48:1
2	OFF	OFF	1.48:1
3	OFF	ON	1.00:1
4	ON	ON	0.75:1
R	ON	OFF	2.08:1

Shift Speed

		1–2 Shift @ +/– 150 RPM Output Shaft Speed			2–3 Shift @ +/– 200 RPM Output Shaft Speed			3–4 Shift @ +/– 250 RPM Output Shaft Speed			3–2 @ +/– 100 RPM Output Shaft Speed	2–1 @ +/– 100 RPM Output Shaft Speed	1–2 Wide Open Throttle Shift	2–3 Wide Open Throttle Shift
% of TPS		10	25	50	10	25	50	10	25	50	0	0	100	100
Model	RPO													
4.3L	L35	581	628	1046	1116	1209	2139	1558	2092	3953	697	419	2096	3446
5.7L	L31	520	700	1070	930	1210	2090	2325	2325	4190	700	420	2090	3490
7.4L	L29	488	721	1302	930	1349	2325	1395	1907	3581	814	419	1674	3069
6.5L 2600 RPM Limit	L57 Derated 9-11K GVWR	360	400	820	720	800	1480	2320	2320	2320	320	620	820	1500
6.5L 2600 RPM Limit	L57 Derated 10-11.5K GVWR	360	400	820	720	800	1480	2000	2000	2240	320	620	820	1500
6.5L 2600 RPM Limit	L57 Derated 12-14.5K GVWR	360	400	820	720	800	1480	2360	2360	2360	320	620	820	1500
6.5L	L57 Motor-home	488	628	1046	698	1232	1790	1279	1721	2883	651	442	1395	2093
5.7L	L31 Isuzu	520	700	1070	930	1210	2090	1560	2090	3050	700	420	1990	3390
6.5L 3400 RPM Limit	L57 9-11 K GVWR	419	465	1023	698	837	1767	2441	2441	2604	372	651	1209	2116

Shift Speed (cont'd)

		1–2 Shift @ +/– 150 RPM Output Shaft Speed			2–3 Shift @ +/– 200 RPM Output Shaft Speed			3–4 Shift @ +/– 250 RPM Output Shaft Speed			3–2 @ +/– 100 RPM Output Shaft Speed	2–1 @ +/– 100 RPM Output Shaft Speed	1–2 Wide Open Throttle Shift	2–3 Wide Open Throttle Shift
% of TPS		10	25	50	10	25	50	10	25	50	0	0	100	100
Model	RPO													
6.5L 3400 RPM Limit	L57 10-11.5K GVWR	419	465	1023	698	837	1767	2186	2186	2604	372	651	1209	2116
6.5L	L57 12-14.5K GVWR	419	465	953	698	837	1721	2697	2697	2744	372	651	1209	2116
6.5L 3400 RPM Limit	L57 Electronic Control 9-11K GVWR	558	651	1070	1000	1163	1674	2418	2418	2627	651	372	1116	1767
6.5L 3400 RPM Limit	L57 Electronic Control 10-11.5K GVWR	558	651	1070	1000	1163	1674	2186	2186	2906	651	372	1116	1767
6.5L 3400 RPM Limit	L57 Electronic Control 12-14.5K GVWR	558	651	1070	1000	1163	1674	2697	2697	2697	651	372	1116	1767

Range Signal

Range Signal	A	B	C
Park	OFF	ON	OFF
Reverse	ON	ON	OFF
Neutral	OFF	ON	OFF
D4	OFF	ON	ON
D3	OFF	OFF	ON
D2	OFF	OFF	OFF
D1	ON	OFF	OFF
Illegal	ON	OFF	ON
Illegal	ON	ON	ON
ON = 0 volts OFF = B+ volts			

Line Pressure

Pressure Control Solenoid Current (Amp)	Approximate Line Pressure (PSI)
0.02	157–177
0.10	151–176
0.20	140–172
0.30	137–162
0.40	121–147
0.50	102–131
0.60	88–113
0.70	63–93
0.80	43–73
0.90	37–61
0.98	35–55

Component Resistance

Component	Wire Color	Pass-Thru Pin	Resistance at 20°C (68°F)	Circuit Number
1-2 Shift Solenoid (SS) Valve	Red	* E	20–40 Ω	839B
	LT Green	A		1222
2-3 Shift Solenoid (SS) Valve	Red	* E	20–40 Ω	839A
	Yellow	B		1223
Pressure Control (PC) Solenoid Valve	Purple	C	3.5–8 Ω	1228
	LT Blue	D		1229
TCC Solenoid Valve	Red	* E	10–15 Ω	839C
	Black	S		418
Automatic Transmission Fluid Temperature (TFT) Sensor	Brown	L	3333–3689 Ω	1227
	Gray	M		452
Automatic Transmission Input Shaft Speed (A/T ISS) Sensor	Red/Black	**	1042–2088 Ω	1230
	Blue/White	**		1231
Automatic Transmission Output Shaft Speed (A/T OSS) Sensor	Purple/White	***	1042–2088 Ω	821
	LT Green/Black	***		822

* Spliced Internally to Pin E (circuit #839)
** A/T ISS Sensor Harness
***A/T OSS Sensor Harness

Diagnostic Information and Procedures

Functional Test Procedure

Step	Action	Value(s)	Yes	No
The Functional Test Procedure is the first step in diagnosing mechanical or hydraulic transmission conditions. The Functional Test provides procedures and references to the Symptom Diagnosis table for specific diagnostic information.				
1	**Important:** Engine performance can greatly affect transmission performance. Ensure that the complaint is not the result of poor engine performance before continuing. Verify the customer complaint. Has the customer complaint been verified?	—	*Go to Step 2*	—
2	**Important:** Many transmissions have default actions that take place once a DTC fault is detected. These actions may be interpreted as being a transmission concern. Has the Powertrain On-Board Diagnostic (OBD) System Check been performed?	—	*Go to Step 3*	Go to *Powertrain OBD System Check* 4.3L or *Powertrain OBD System Check* 5.7L or *Powertrain OBD System Check (EFI)* 6.5L L57 or *Powertrain OBD System Check* 6.5L L65 or *Powertrain OBD System Check* 7.4L
3	Perform a visual inspection. Look for the following conditions: • Vehicle damage • Transmission oil pan damage. Refer to *AT Fluid/Filter Changing.* • Worn or damaged suspension parts. Refer to Front Suspension. Worn or damaged steering parts. Refer to Steering. • Transmission range selector cable damaged or out of adjustment. Refer to *Shift Cable Replacement* or *Shift Cable Adjustment.* • Loose, worn, damaged or missing: – mounts or struts – brackets – mounting hardware Refer to *Transmission Replacement.* • Transmission cooler or cooler line restrictions. Refer to *AT Oil Cooler Flow Test.* • Fluid leaks. Refer to *Fluid Leak Diagnosis.* Was an item identified that needs service?	—	Go to the Appropriate Repair or Diagnosis Section	*Go to Step 4*
4	Perform the *Transmission Fluid Checking Procedure.* Is the procedure complete?	—	*Go to Step 5*	Go to *Transmission Fluid Checking Procedure*
5	Perform the *Road Test Procedure.* Did the vehicle exhibit any objectionable performance condition?	—	*Go to Step 6*	*Go to Step 1*
6	Did the vehicle exhibit objectionable torque converter operation?	—	*Go to Step 15*	*Go to Step 7*
7	Did the vehicle produce any objectionable noise condition?	—	Go to *Symptom Diagnosis* (Noise and Vibration Diagnosis)	*Go to Step 8*

Functional Test Procedure (cont'd)

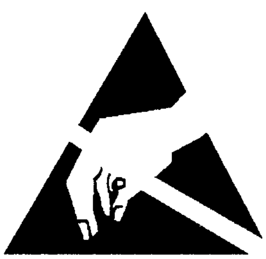
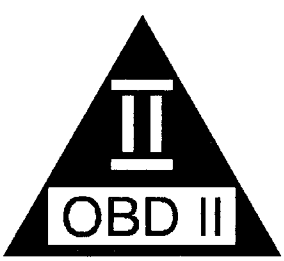
Step	Action	Value(s)	Yes	No
8	Did the vehicle exhibit a vibration condition?	—	*Go to Step 9*	*Go to Step 10*
9	Did the vibration occur only during TCC apply or release?	—	*Go to Step 15*	Go to *Symptom Diagnosis* (Noise and Vibration Diagnosis)
10	Did the vehicle exhibit a shift speed condition such as low or high shift speeds?	—	Go to *Symptom Diagnosis* (Shift Speed Diagnosis)	*Go to Step 11*
11	Did the vehicle exhibit any of the following shift quality (feel) conditions? • Harsh, soft, delayed or no engagement • Harsh, soft or delayed shifts • Shift shudder, flare or tie-up	—	*Go to Step 12*	*Go to Step 13*
12	Perform the *Line Pressure Check Procedure.* Is the line pressure within specification?	—	Go to *Symptom Diagnosis* (Shift Quality (Feel) Diagnosis)	Go to *Symptom Diagnosis* (Fluid Diagnosis)
13	Did the vehicle exhibit any of the following shift pattern conditions? • No upshift or downshift • Only one or two forward gears • No FIRST gear, no SECOND gear, No THIRD gear, or no FOURTH gear • Slipping • Non-FIRST gear start	—	Go to *Symptom Diagnosis* (Shift Pattern Diagnosis)	*Go to Step 14*
14	Did the vehicle exhibit any of the following range performance conditions? • No PARK, no REVERSE or no DRIVE • No engine braking • No gear selection • Incorrect gear selection	—	Go to *Symptom Diagnosis* (Range Performance Diagnosis)	System OK
15	Did the vehicle exhibit any of the following torque converter or TCC conditions? • Stuck ON or OFF • Early or late engagement • Incorrect apply or release • Soft or harsh apply • Clunk or shudder • No torque multiplication • Excessive slip • Poor acceleration • Engine stalls Refer to *Torque Converter Diagnosis Procedure.*	—	Go to *Symptom Diagnosis* (Torque Converter Diagnosis)	System OK

Schematic and Routing Diagrams

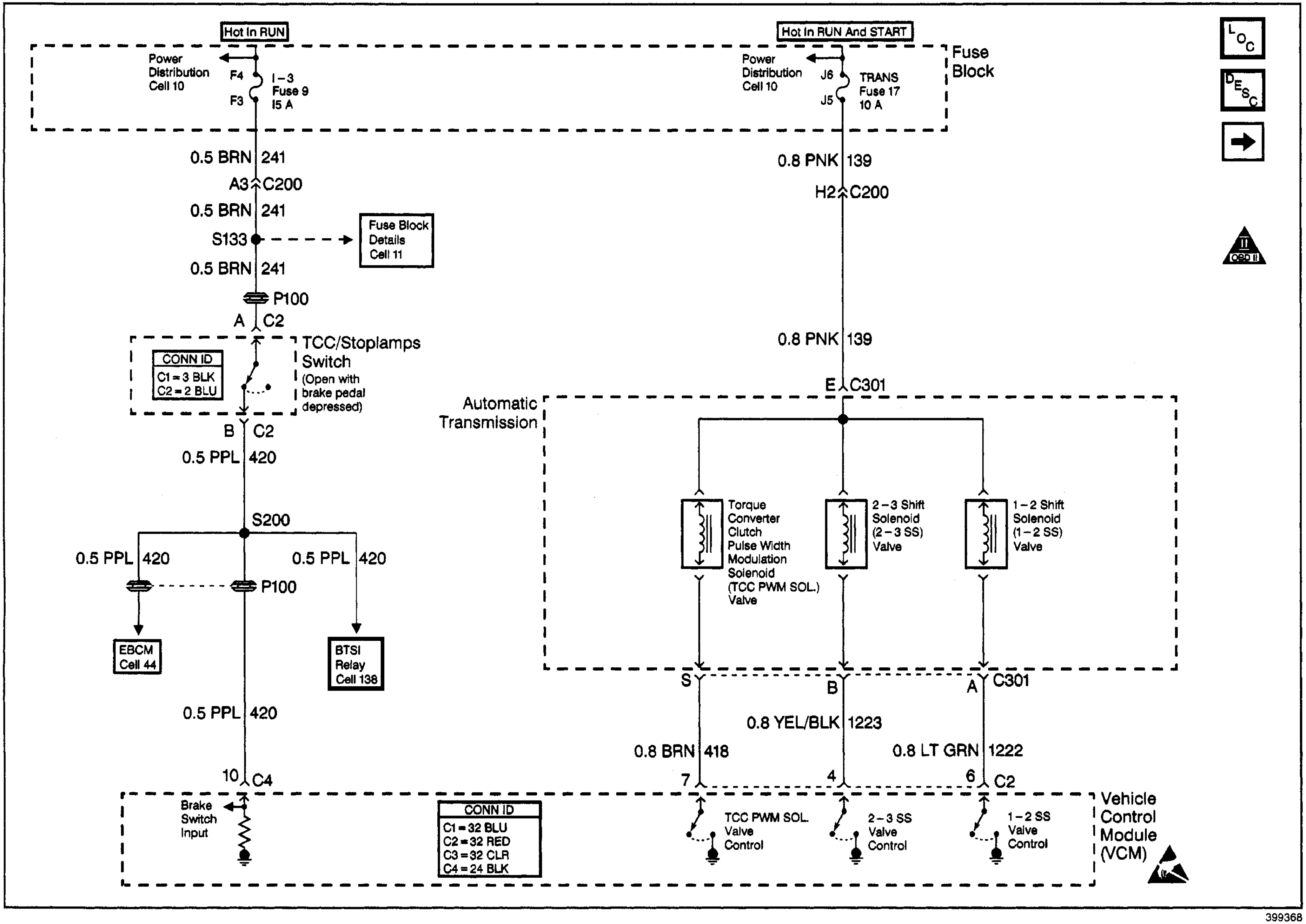
Automatic Transmission Schematic References

Reference on Schematic	Section Number - Subsection Name
BTSI Schematics Cell 138	2 — Steering Wheel and Column - Tilt
ABS Schematics Cell 44	5 — Antilock Brake System
Engine Data Sensors Cell 21	6 — Engine Controls
Engine Data Sensors Cell 22	6 — Engine Controls
Engine Data Sensors Cell 23	6 — Engine Controls
Exterior Lights Cell 110	8 — Lighting Systems
Fuse Block Details Cell 11	8 — Wiring Systems
Ground Distribution Cell 14	8 — Wiring Systems
Power Distribution Cell 10	8 — Wiring Systems

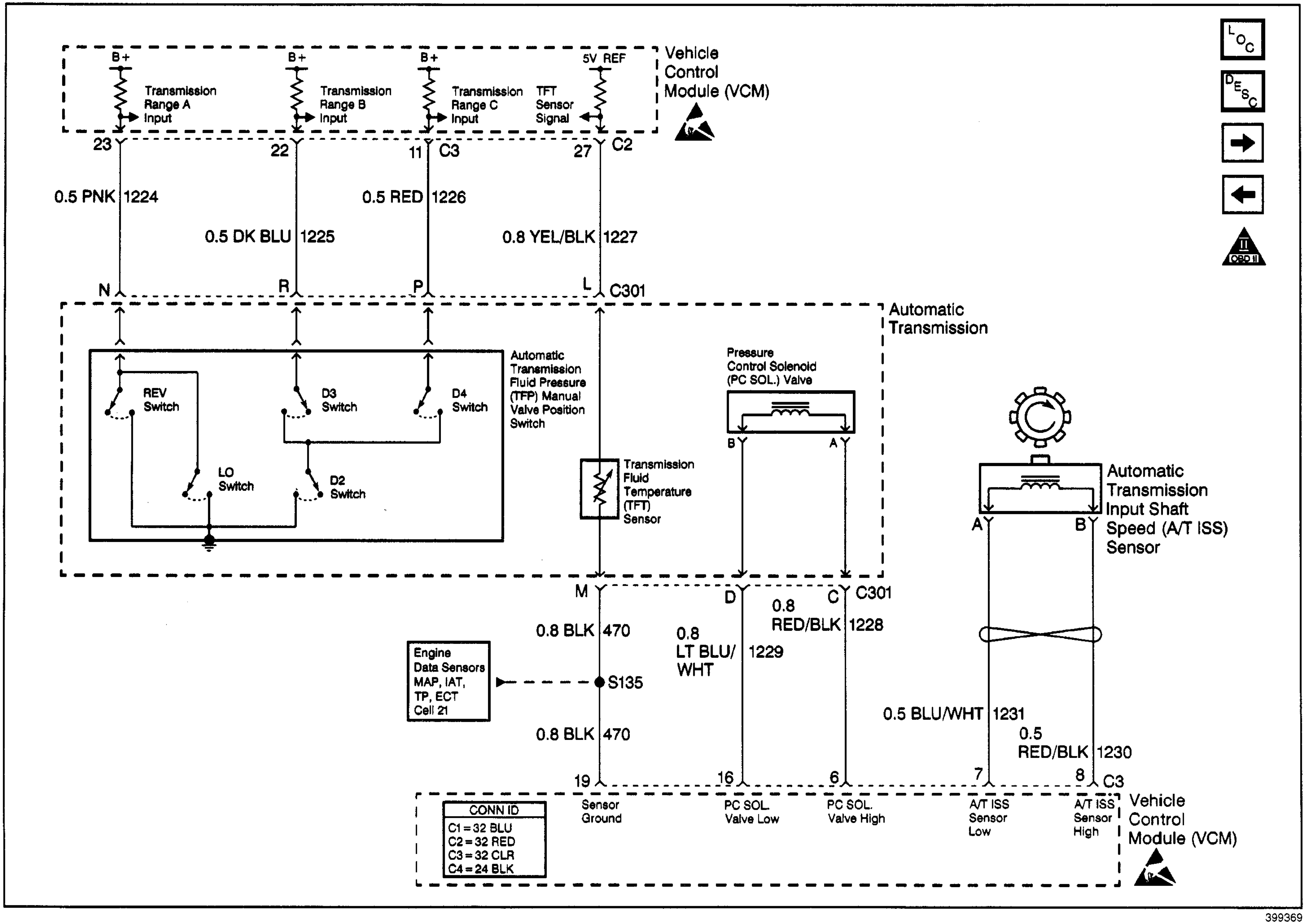
Automatic Transmission Schematic Icons

Icon	Icon Definition
 19384	Refer to *ESD Notice* in Cautions and Notices.
 19385	Refer to *OBD II Symbol Description Notice* in Cautions and Notices.

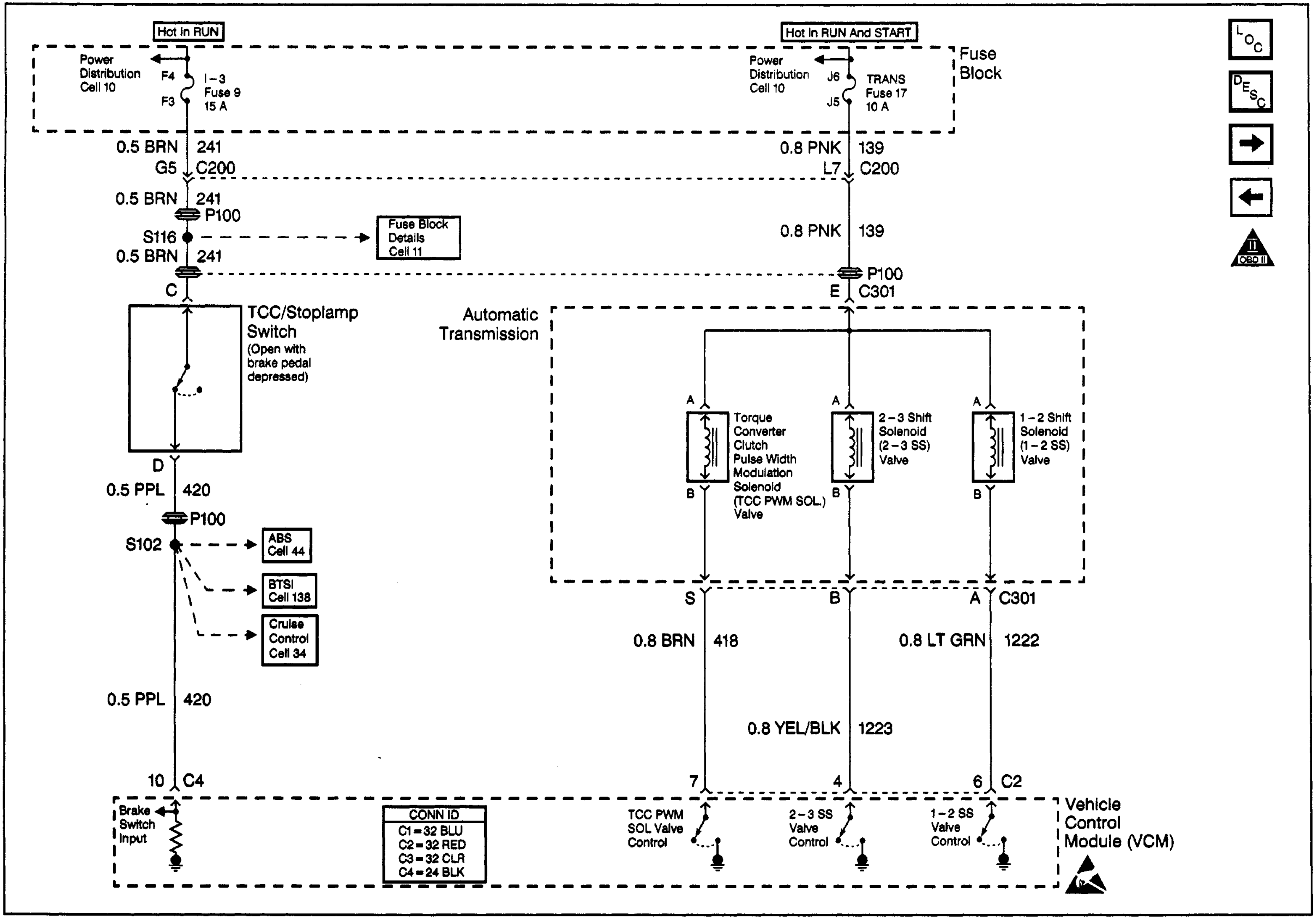
Automatic Transmission Controls Schematics (VCM Control) (Cell 39: L31/L35, Internal Solenoids, TCC/Stoplamps Switch)



Automatic Transmission Controls Schematics (VCM Control) (Cell 39: L31/L35, TR, TFT, TISS, and PC Solenoid Valve)

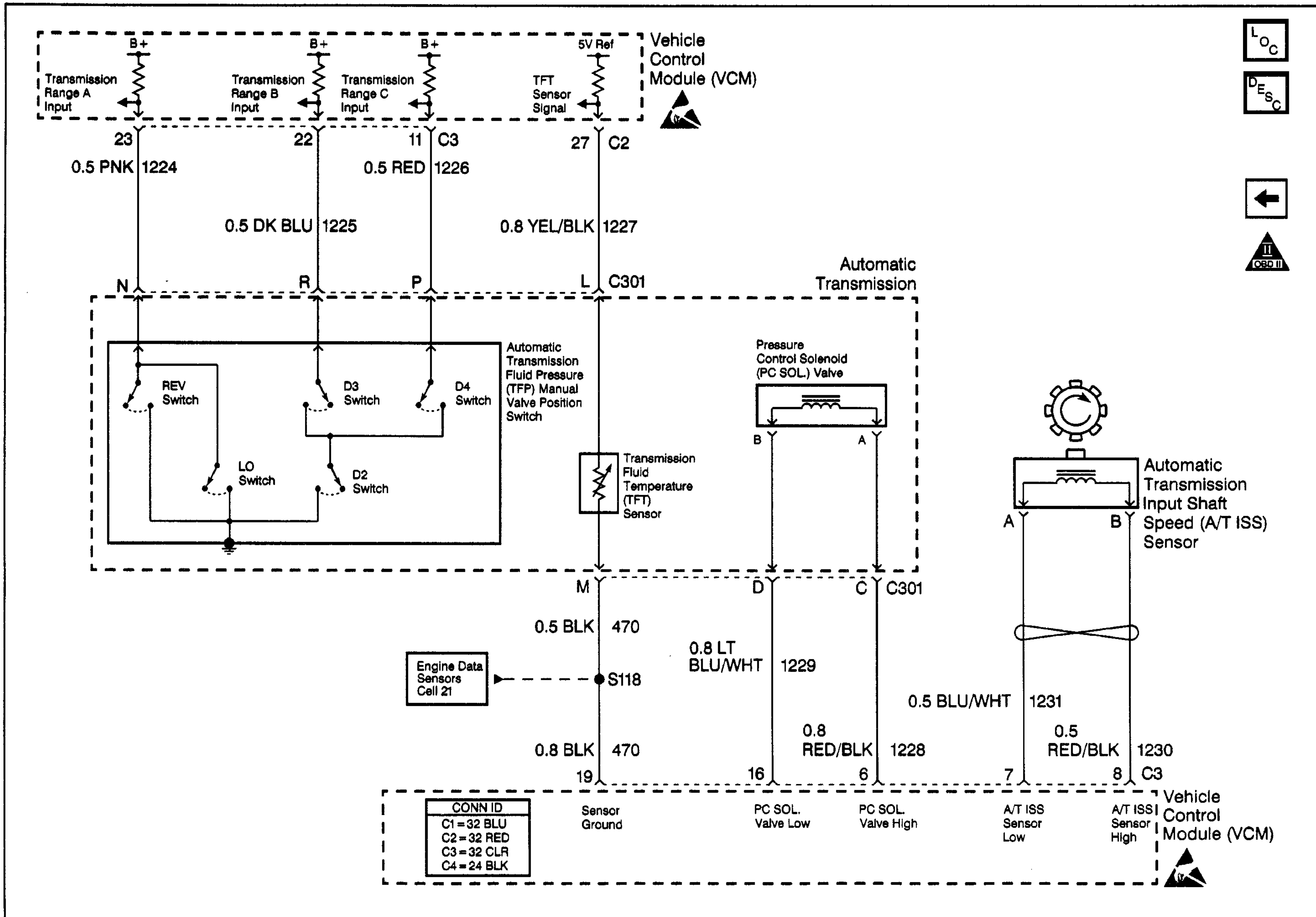


Automatic Transmission Controls Schematics (VCM Control) (Cell 39: L29, Internal Solenoids, TCC/Stoplamps Switch)



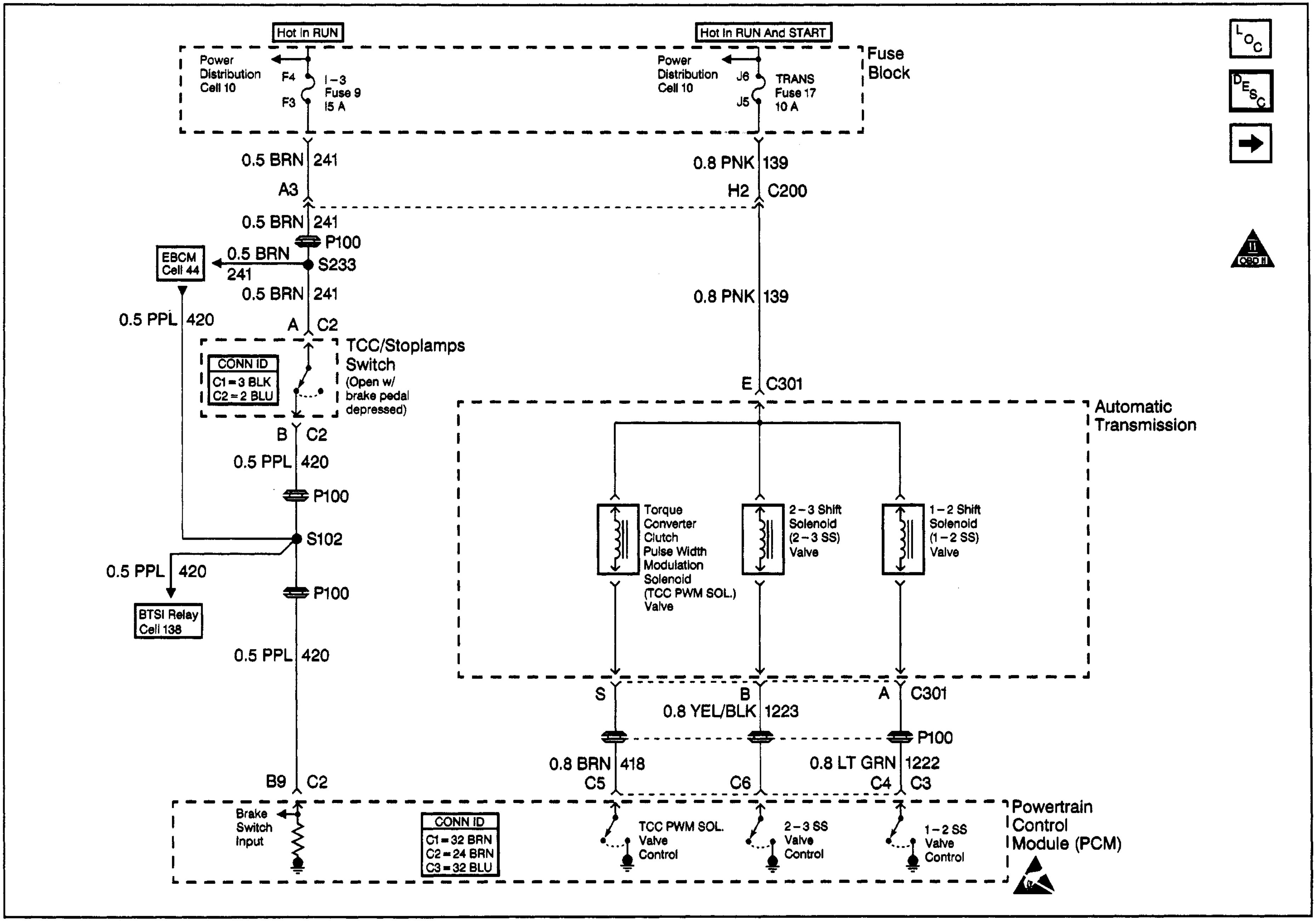
399364

Automatic Transmission Controls Schematics (VCM Control) (Cell 39: L29, TR, TFT, TISS, and PC Solenoid Valve)

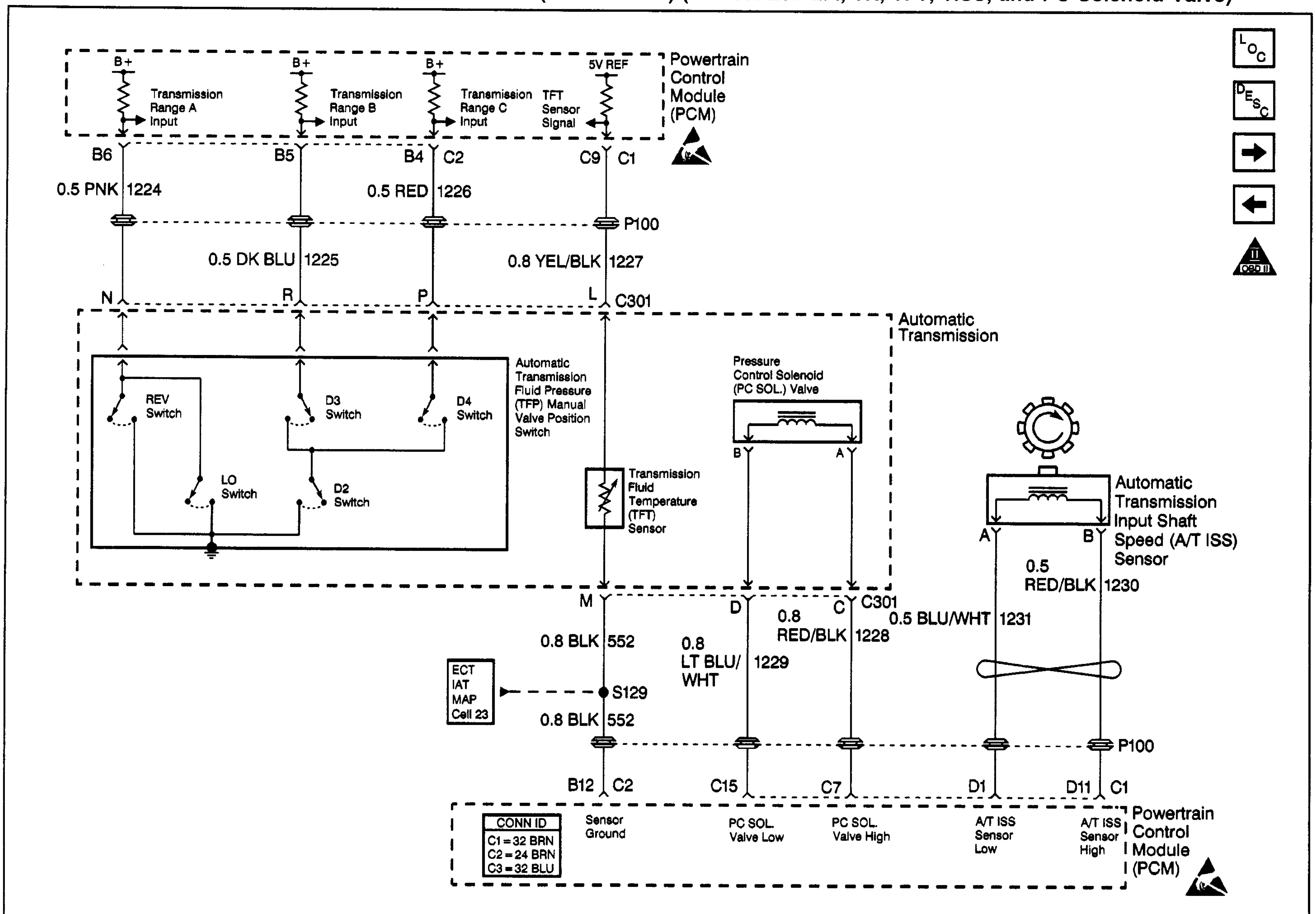


421470

Automatic Transmission Controls Schematics (PCM Control) (Cell 39: L57 EFI, Internal Solenoids, TCC/Stoplamps Switch)

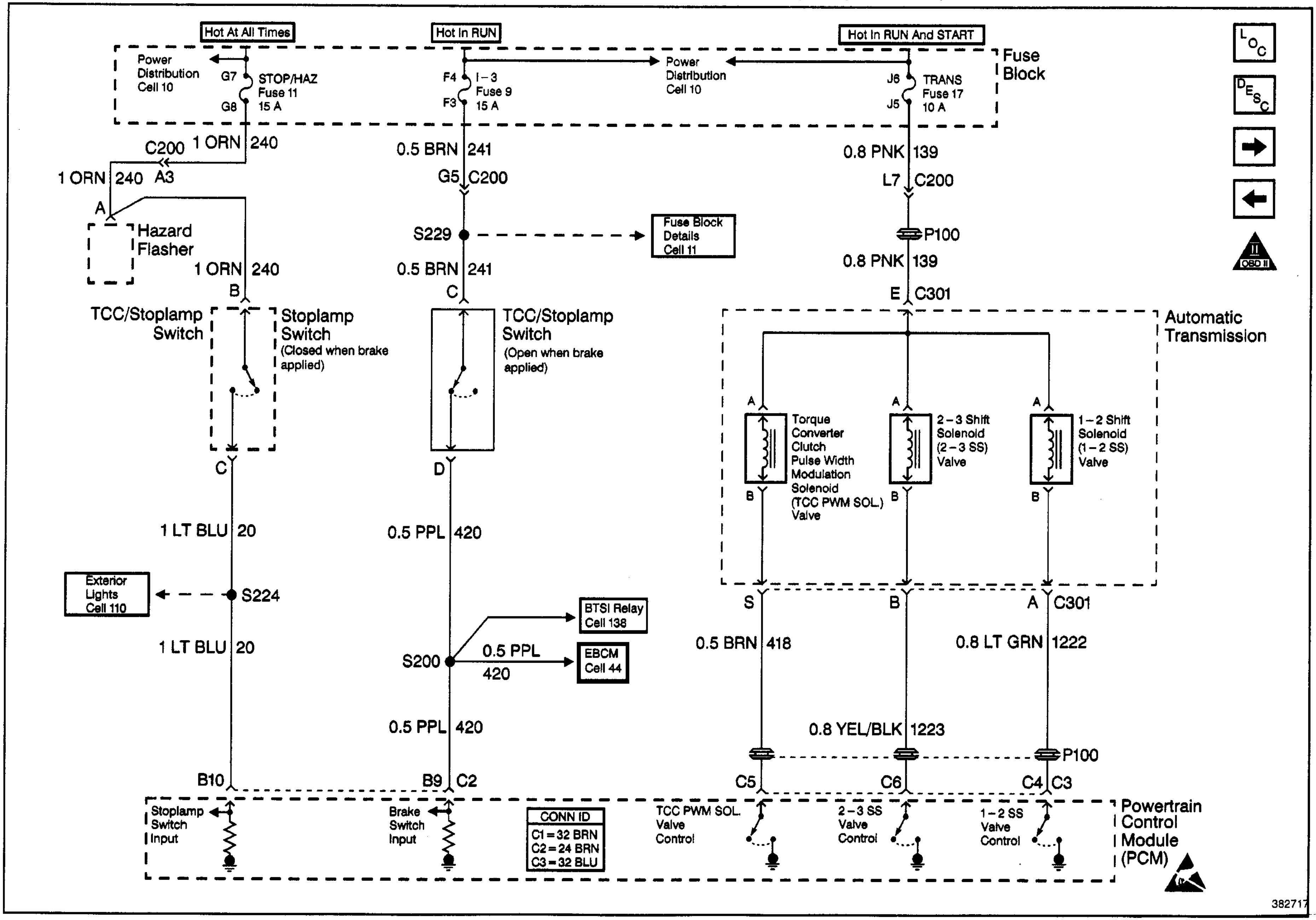


Automatic Transmission Controls Schematics (PCM Control) (Cell 39: L57 EFI, TR, TFT, TISS, and PC Solenoid Valve)

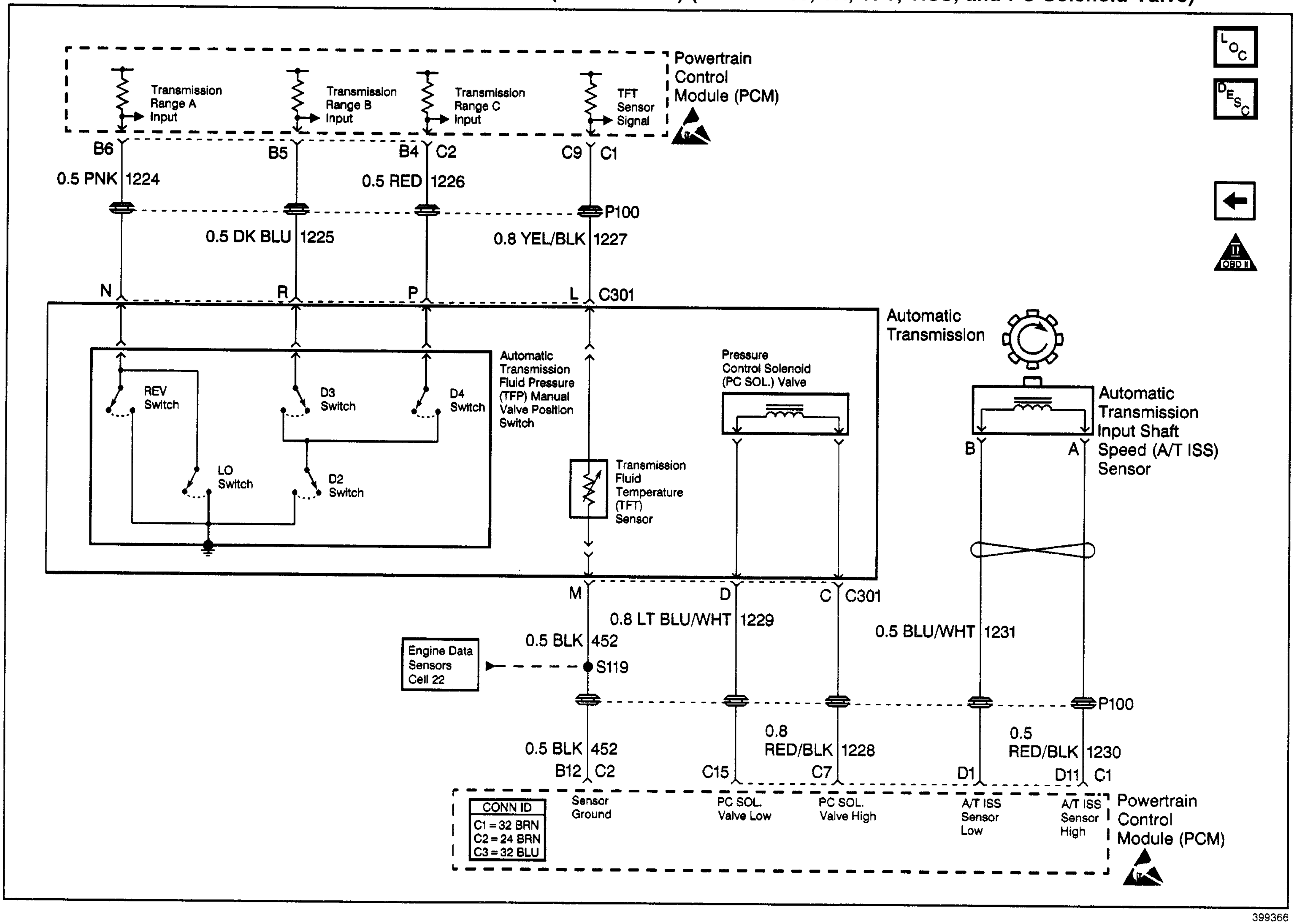


421466

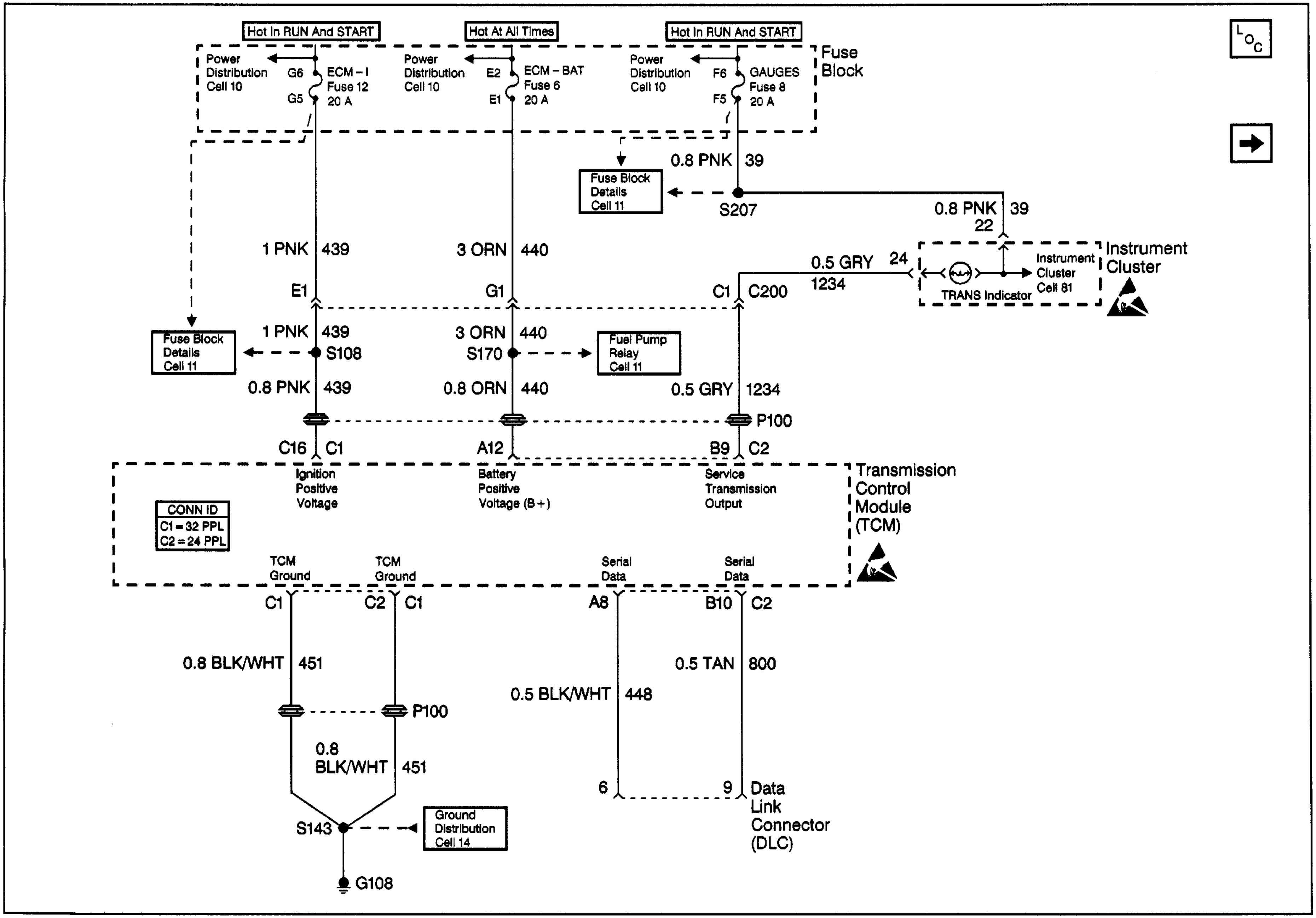
Automatic Transmission Controls Schematics (PCM Control) (Cell 39: L65, PCM Controller, Internal Solenoids, TCC/Stoplamps Switch)



Automatic Transmission Controls Schematics (PCM Control) (Cell 39: L65, TR, TFT, TISS, and PC Solenoid Valve)

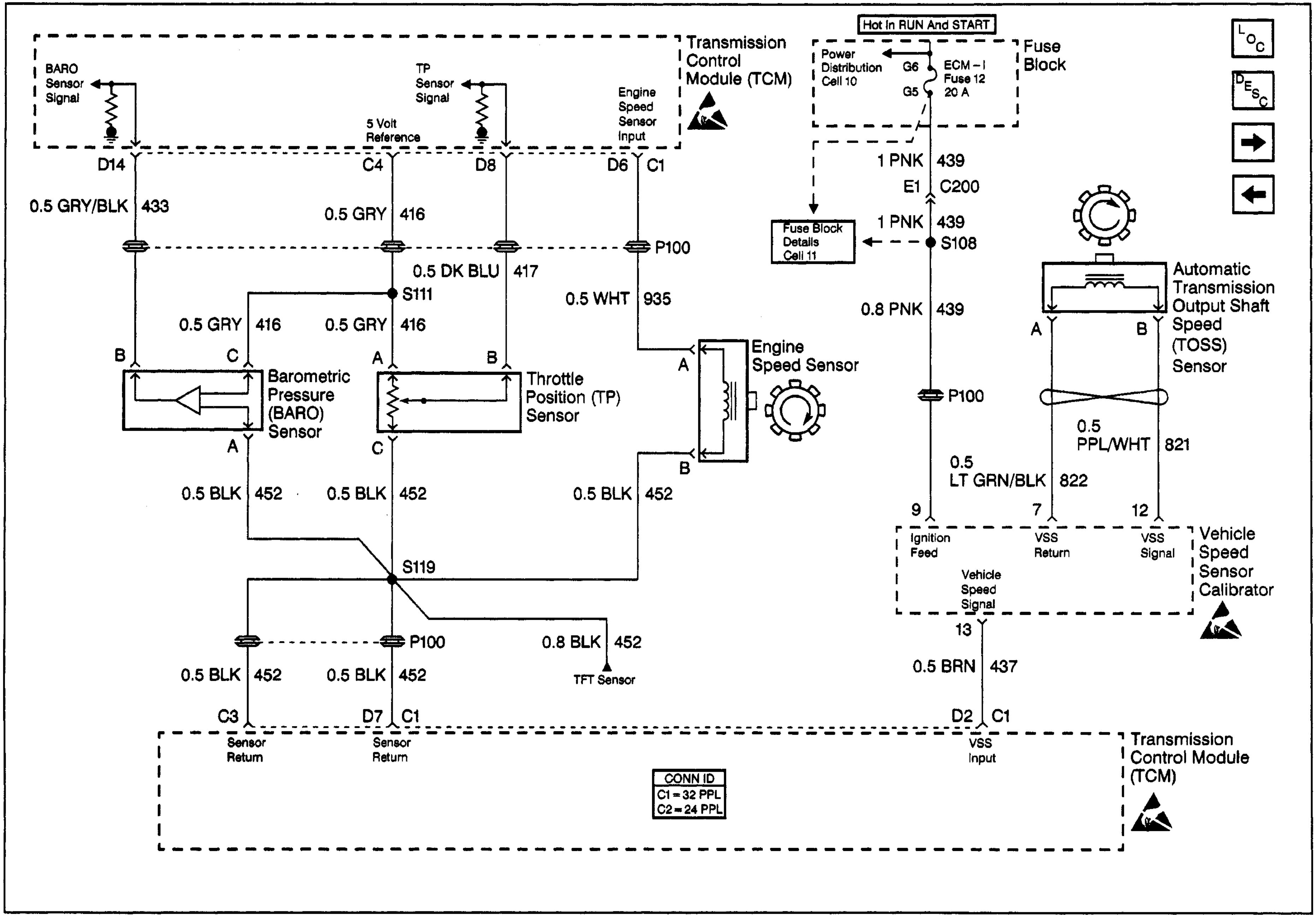


Automatic Transmission Controls Schematics (TCM Control) (Cell 39: L57, TCM Power and Grounding, DLC, TRANS Indicator)



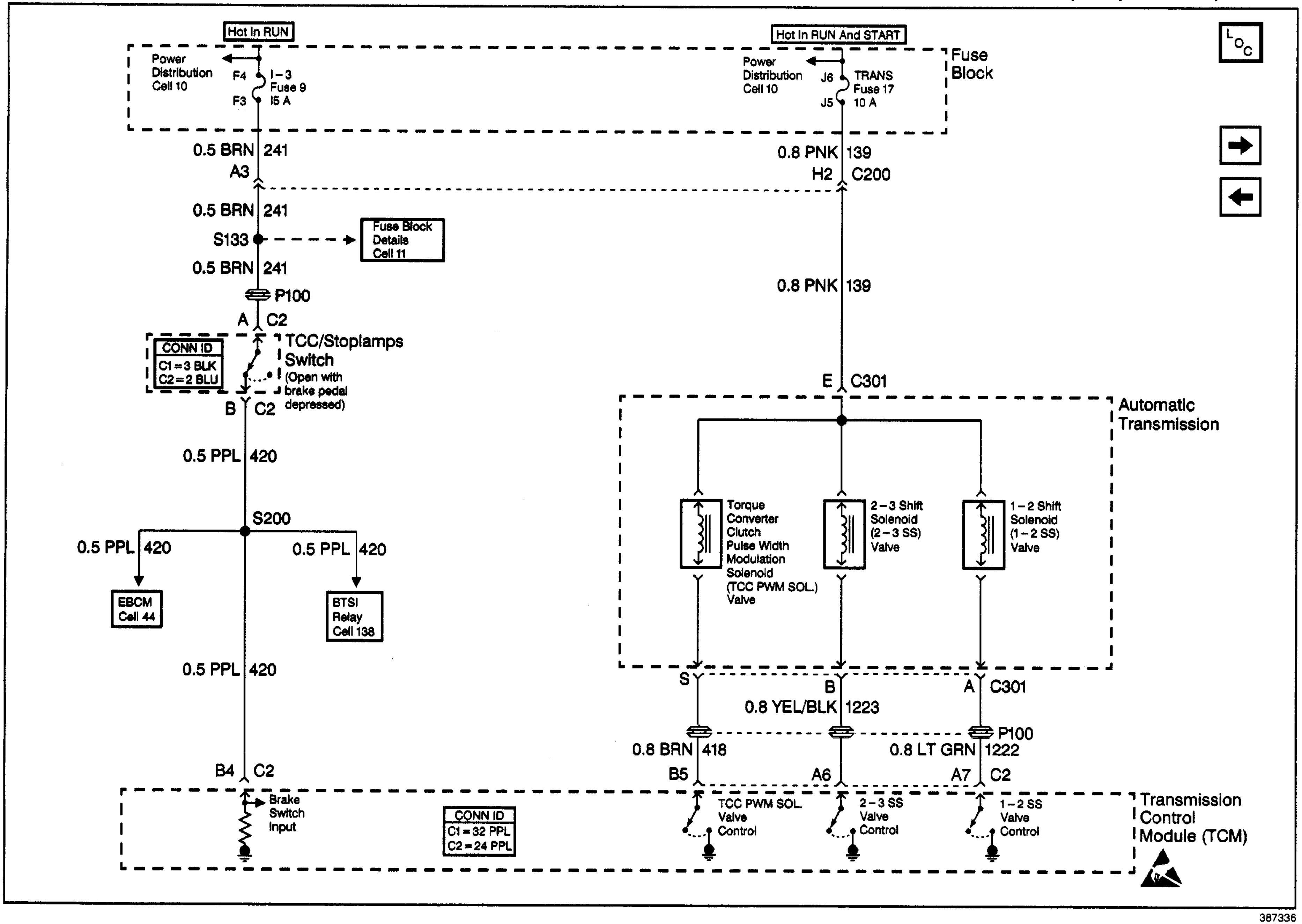
421467

Automatic Transmission Controls Schematics (TCM Control) (Cell 39: L57, Engine/Transmission Data Sensors)

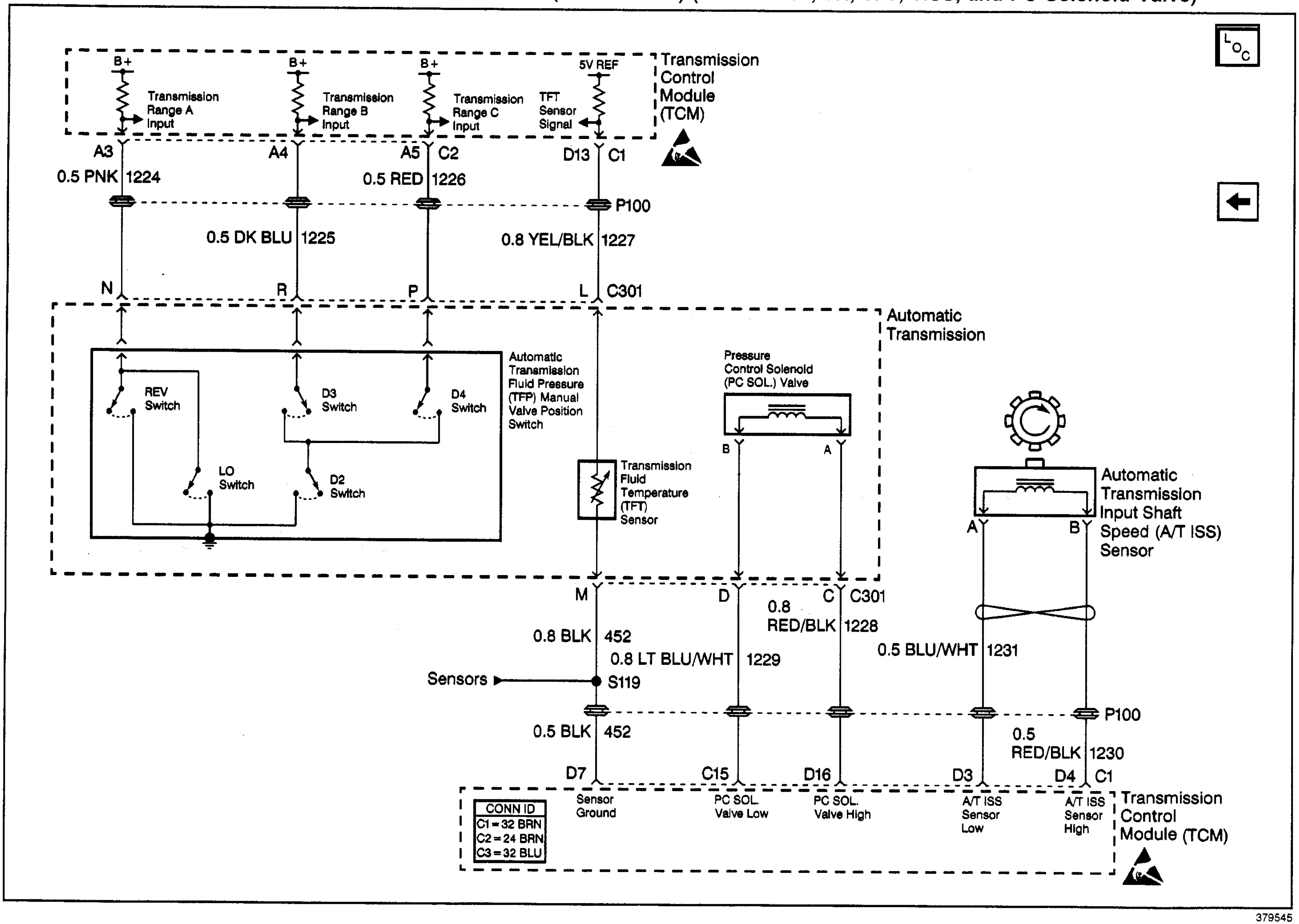


421468

Automatic Transmission Controls Schematics (TCM Control) (Cell 39: L57, Internal Solenoids, TCC/Stoplamps Switch)



Automatic Transmission Controls Schematics (TCM Control) (Cell 39: L57, TR, TFT, TISS, and PC Solenoid Valve)



Component Locator

Automatic Transmission Components (Diesel)

Name	Location	Locator View	Connector End View
Barometric Pressure Sensor	On top of the intake manifold, at the rear LH side near the glowplug controller	*Engine Controls Component Views* in Engine Controls	*Engine Controls Connector End Views (L57 MFI)* in Engine Controls
Data Link Connector (DLC)	On the lower LH side of the passenger compartment bulkhead on the side of the relay bracket	*Data Link Communications Component Views (Commercial)* in Data Link Communications	*Data Link Communications Connector End Views* in Data Link Communications
Engine Speed Sensor	At the rear of the intake manifold, near the fuel/water separator (filter)	*Engine Controls Component Views* in Engine Controls	*Engine Controls Connector End Views (L57 MFI)* in Engine Controls
Hazard Lamps Flasher	At the inner LH side of the steering column support bracket	*Lighting Systems Component Views (Motorhome)* in Lighting Systems	*Lighting Systems Connector End Views (Motorhome)* in Lighting Systems
Instrument Cluster	Body builder installed	—	*Instrument Cluster Connector End Views* in Instrument Panel, Gauges and Console
IP Fuse Block (Commercial)	Located by the body builder	*Electrical Center Identification (Commercial)* in Wiring Systems	*Power and Grounding Connector End Views* in Wiring Systems
IP Fuse Block (Motorhome)	Located by the body builder	*Electrical Center Identification (Motorhome)* in Wiring Systems	*Power and Grounding Connector End Views* in Wiring Systems
Powertrain Control Module (Commercial)	At the LH side of the drivers island on the relay bracket	*Engine Controls Component Views* in Engine Controls	*PCM Connector End Views (EFI)* in Engine Controls
Powertrain Control Module (Motorhome)	On the LH side of the drivers island	*Engine Controls Component Views* in Engine Controls	*PCM Connector End Views* in Engine Controls
Stoplamps Switch	Above the brake pedal at the RH side of the steering column	*Lighting Systems Component Views (Motorhome)* in Lighting Systems	*Lighting Systems Connector End Views (Motorhome)* in Lighting Systems
Throttle Position Sensor	At the RH front of the intake manifold	*Engine Controls Component Views* in Engine Controls	*Engine Controls Connector End Views (L57 MFI)* in Engine Controls
Torque Converter Clutch (TCC) and Stoplamps Switch (Commercial)	Above the brake pedal at the RH side of the steering column	*Lighting Systems Component Views (Commercial)* in Lighting Systems	*Lighting Systems Connector End Views (Motorhome)* in Lighting Systems
Torque Converter Clutch (TCC) and Stoplamps Switch (Motorhome)	Above the brake pedal at the RH side of the steering column	*Lighting Systems Component Views (Motorhome)* in Lighting Systems	*Lighting Systems Connector End Views (Motorhome)* in Lighting Systems
Transmission Control Module	At the LH side of the drivers island on the relay bracket	*Engine Controls Component Views* in Engine Controls	*Engine Controls Connector End Views (L57 MFI)* in Engine Controls
Transmission Input Speed Sensor	On the LH side of the transmission near the middle	*Engine Controls Component Views* in Engine Controls	*Engine Controls Connector End Views (6.5L, L65)* in Engine Controls

Automatic Transmission Components (Diesel) (cont'd)

Name	Location	Locator View	Connector End View
C200 (Commercial)	Engine harness to the IP harness, in the bulkhead near P100	*Harness Routing Views (Commercial)* in Wiring Systems	*Inline Harness Connector End Views (Commercial)* in Wiring Systems
C200 (Motorhome)	At the top front of the steering column support near the park brake pull button switch	*Harness Routing Views (Motorhome)* in Wiring Systems	*Inline Harness Connector End Views (Motorhome)* in Wiring Systems
C301	Engine harness to the transmission, on the LH side of the transmission near the middle	*Automatic Transmission Electronic Component Views (Internal)*	*AT Inline Harness Connector End View*
G108	At the rear of the LH cylinder head	*Power and Grounding Component Views* in Wiring Systems	—
P100	LH bulkhead left of the steering column	*Harness Routing Views (Commercial)* in Wiring Systems	—
S102	In the engine harness, approximately 32 cm (13 in) from the breakout for the battery junction block toward the A/C compressor connectors	—	—
S108	In the engine harness, approximately 22 cm (9 in) from P100	—	—
S111	In the engine harness, approximately 10 cm (4 in) from the starter motor breakout toward C200	—	—
S119 (Commercial)	In the engine harness, approximately 6 cm (2 in) from the glowplug controller breakout toward the breakout for the generator harness connector C102	—	—
S119 (Motorhome)	In the engine harness, approximately 13 cm (5 in) from the breakout for G104, toward the breakout for the generator connector	—	—
S129	In the engine harness, approximately 17 cm (6 in) from the breakout for C101 toward the breakout for the starter motor	—	—
S133	In the engine harness, approximately 17 cm (7 in) from the breakout for C200 and the battery junction block	—	—
S143	In the engine harness, approximately 17 cm (7 in) from P100	—	—
S170	In the engine harness, approximately 22 cm (9 in) from the fuel pump relay connector	—	—
S200 (Commercial)	In the IP side of the engine harness, approximately 16 cm (6 in) from P100 toward the ignition switch	—	—
S200 (Motorhome)	In the IP side of the engine harness, approximately 8 cm (3 in) from the breakout for the turn signal switch, toward P100	—	—
S224	In the IP side of the engine harness, approximately 16 cm (6 in) from P100, toward the PCM	—	—
S229	In the IP side of the engine harness, approximately 3 cm (1 in) from the breakout for the hazard lamps flasher and the wiper switch connector, toward the data link connector	—	—
S233	In the IP side of the engine harness, approximately 31 cm (12 in) from P100 toward the ignition switch	—	—

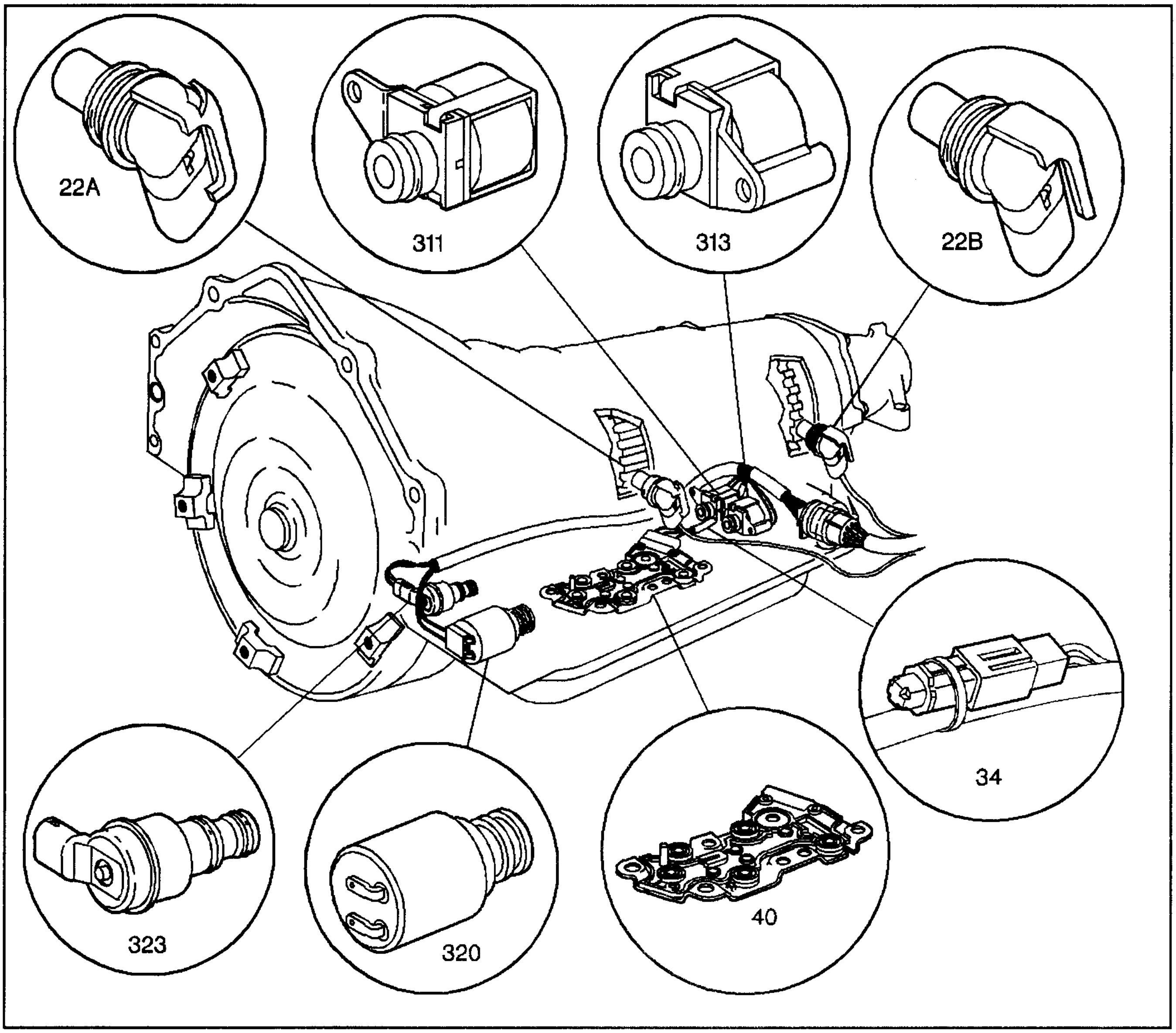
Automatic Transmission Components (Gasoline)

Name	Location	Locator View	Connector End View
Data Link Connector (DLC)	On the lower LH side of the passenger compartment bulkhead on the side of the relay bracket	*Data Link Communications Component Views (Commercial)* in Data Link Communications	*Data Link Communications Connector End Views* in Data Link Communications
Hazard Lamps Flasher	At the inner LH side of the steering column support bracket	*Lighting Systems Component Views (Motorhome)* in Lighting Systems	*Lighting Systems Connector End Views (Motorhome)* in Lighting Systems
Instrument Cluster	Body builder installed	—	*Instrument Cluster Connector End Views* in Instrument Panel, Gauges and Console
IP Fuse Block (Commercial)	Located by the body builder	*Electrical Center Identification (Commercial)* in Wiring Systems	*Power and Grounding Connector End Views* in Wiring Systems
IP Fuse Block (Motorhome)	Located by the body builder	*Electrical Center Identification (Motorhome)* in Wiring Systems	*Power and Grounding Connector End Views* in Wiring Systems
Stoplamps Switch	Above the brake pedal at the RH side of the steering column	*Lighting Systems Component Views (Motorhome)* in Lighting Systems	*Lighting Systems Connector End Views (Motorhome)* in Lighting Systems
Torque Converter Clutch (TCC) and Stoplamps Switch (Commercial)	Above the brake pedal at the RH side of the steering column	*Lighting Systems Component Views (Commercial)* in Lighting Systems	*Lighting Systems Connector End Views (Commercial)* in Lighting Systems
Torque Converter Clutch (TCC) and Stoplamps Switch (Motorhome)	Above the brake pedal at the RH side of the steering column	*Lighting Systems Component Views (Motorhome)* in Lighting Systems	*Lighting Systems Connector End Views (Motorhome)* in Lighting Systems
Transmission Input Speed Sensor	On the LH side of the transmission near the middle	*Engine Controls Component Views* in Engine Controls	*Engine Controls Connector End Views (7.4L)* in Engine Controls
Vehicle Control Module (Commercial)	Mounted to the top of the radiator support	*Engine Controls Component Views* in Engine Controls	*VCM Connector End Views* in Engine Controls
Vehicle Control Module (Motorhome)	Mounted to the top of the radiator support	*Engine Controls Component Views* in Engine Controls	*VCM Connector End Views* in Engine Controls
C200 (Commercial)	Engine harness to the IP harness, in the bulkhead near P100	*Harness Routing Views (Commercial)* in Wiring Systems	*Inline Harness Connector End Views (Commercial)* in Wiring Systems
C200 (Motorhome)	At the top front of the steering column support near the park brake pull button switch	*Harness Routing Views (Motorhome)* in Wiring Systems	*Inline Harness Connector End Views (Motorhome)* in Wiring Systems
C301	Engine harness to the transmission, on the LH side of the transmission near the middle	*Automatic Transmission Electronic Component Views (Internal)*	*AT Inline Harness Connector End View*
P100	Main wiring pass through at the bulkhead	*Harness Routing Views (Motorhome)* in Wiring Systems	—
S102	In the engine harness, 45 cm (18 in) from P100 toward the branch for the mass air flow sensor	—	—
S116	In the engine harness, 32 cm (12 in) from the breakout for C100 and C207, going away from P100	—	—

Automatic Transmission Components (Gasoline) (cont'd)

Name	Location	Locator View	Connector End View
S118	In the engine harness, 21 cm (8 in) from the breakout for the A/C compressor clutch and the EGR valve, toward the breakout for the cruise control connector	—	—
S133	In the engine harness, 8 cm (3 in) from the breakout for the VCM and C200, toward the VCM	—	—
S135 (4.3L)	In the engine harness, 23 cm (9 in) from the breakout for the ECT and the A/C compressor clutch toward C200	—	—
S135 (5.7L)	In the engine harness, 8 cm (3 in) from the breakout for the ECT and the A/C compressor clutch toward C200	—	—
S200	In the IP side of the engine harness, 19 cm (8 in) from P100 toward the ignition switch	—	—

Automatic Transmission Electronic Component Views (Internal)

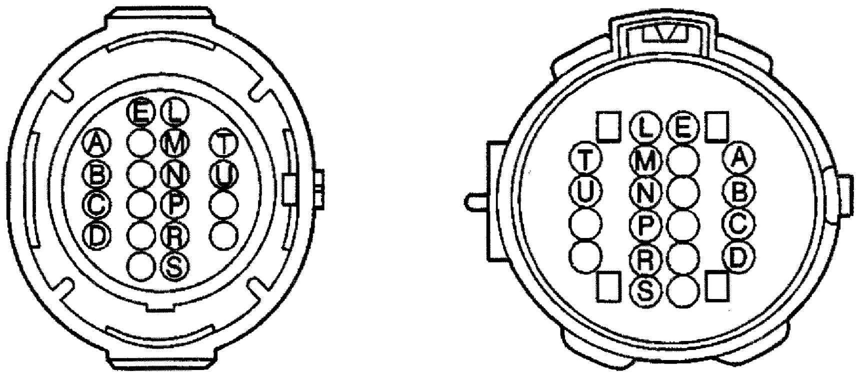


Legend

- (22a) Automatic transmission (A/T) input (shaft) speed sensor (ISS)
- (22b) Automatic transmission (A/T) output (shaft) speed sensor (OSS)
- (34) Automatic transmission fluid temperature (TFT) sensor
- (40) Automatic transmission fluid pressure (TFP) manual valve position switch
- (311) 2–3 shift solenoid (SS) valve
- (313) 1–2 shift solenoid (SS) valve
- (320) Pressure control (PC) solenoid valve
- (323) Torque converter clutch pulse width modulation (TCC PWM) solenoid valve

AT Inline Harness Connector End View

C301 Engine Harness to Transmission

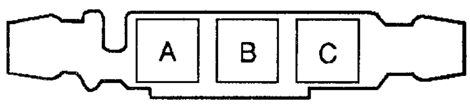


Connector Part Information	• 12160490 • 20 Way F Micro-Pack 100 Series Sealed (GRY)			Connector Part Information	• 12160545 • 20 Way M Micro-Pack 100 Series Sealed (GRY)		
Pin	Wire Color	Circuit No.	Function	Pin	Wire Color	Circuit No.	Function
A	LT GRN	1222	1-2 Shift Solenoid (1-2 SS) Valve Control	A	LT GRN	1222	1-2 Shift Solenoid (1-2 SS) Valve Control
B	YEL/BLK	1223	2-3 Shift Solenoid (2-3 SS) Valve Control	B	YEL	1223	2-3 Shift Solenoid (2-3 SS) Valve Control
C	RED/BLK	1228	Pressure Control Solenoid (PC Sol.) Valve HIGH	C	PPL	1228	Pressure Control Solenoid (PC Sol.) Valve HIGH
D	LT BLU /WHT	1229	PC Sol. Valve LOW	D	LT BLU	1229	PC Sol. Valve LOW
E	PNK	139	Fuse Output-Type III Fuse (Off, Run, Crank)	E	RED	839	Fuse Output-Type III Fuse (Off, Run, Crank)
F-K	—	—	Not Used	F-K	—	—	Not Used
L	YEL/BLK	1227	Transmission Fluid Temperature (TFT) Sensor HIGH	L	BRN	1227	Transmission Fluid Temperature (TFT) Sensor HIGH
M (Gas)	BLK	470	TFT Sensor LOW	M (Gas)	GRY	452	TFT Sensor LOW
M (L57 EFI)	BLK	552	TFT Sensor LOW	M (L57 EFI)	GRY	452	TFT Sensor LOW
M (L65, L57 MFI)	BLK	452	TFT Sensor LOW	M (L65, L57 MFI)	GRY	452	TFT Sensor LOW
N	PNK	1224	Range Signal A	N	PNK	1224	Range Signal A
P	RED	1226	Range Signal C	P	ORN	1226	Range Signal C
R	DK BLU	1225	Range Signal B	R	DK BLU	1225	Range Signal B
S	BRN	418	Torque Converter Clutch Solenoid (TCC Sol.) Valve Control	S	BLK	418	Torque Converter Clutch Solenoid (TCC Sol.) Valve Control
T-W	—	—	Not Used	T-W	—	—	Not Used

Visual Identification

AT Internal Connector End Views

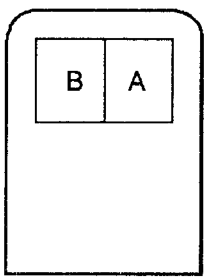
Automatic Transmission Fluid Pressure Manual Valve Position Switch Connector, Wiring Harness Side



177157

Connector Part Information	• 12162200 • Conn 3F M/P 150.2 P2S (RED)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	1224	Range Signal A Input
B	DK BLU	1225	Range Signal B Input
C	ORN	1226	Range Signal C Input

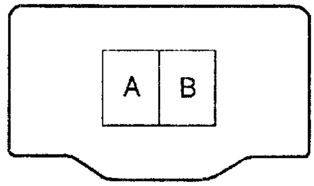
1–2 Shift Solenoid Valve Connector, Wiring Harness Side



168428

Connector Part Information	• 12162201 • Conn 2F M/P 150.2 P2S (NAT)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN	1222	1-2 Shift Solenoid (1-2 SS) Valve Control
B	RED	839B	Transmission Solenoid Power

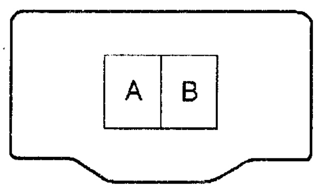
2–3 Shift Solenoid Valve Connector, Wiring Harness Side



177158

Connector Part Information	• 12162205 • Conn 2F M/P 150.2 P2S (MD GRY)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED	839A	Transmission Solenoid Power
B	YEL	1223	2-3 Shift Solenoid (2-3 SS) Valve Control

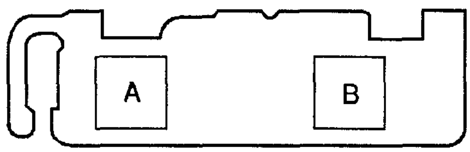
Torque Converter Clutch Pulse Width Modulated (TCC PWM) Solenoid Valve Connector, Wiring Harness Side



177158

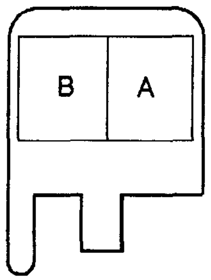
Connector Part Information	• 12162205 • Conn 2F M/P 150.2 P2S (MD GRY)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED	839C	Transmission Solenoid Power
B	BLK	418	Torque Converter Clutch Pulse Width Modulated (TCC PWM) Solenoid Valve

Pressure Control Solenoid Valve Connector, Wiring Harness Side



Connector Part Information	• 12146800 • Conn 2F M/P 480 SPL (NAT)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PPL	1228	Pressure Control (PC) Solenoid Valve HIGH Control
B	LT BLU	1229	PC Solenoid Valve LOW Control

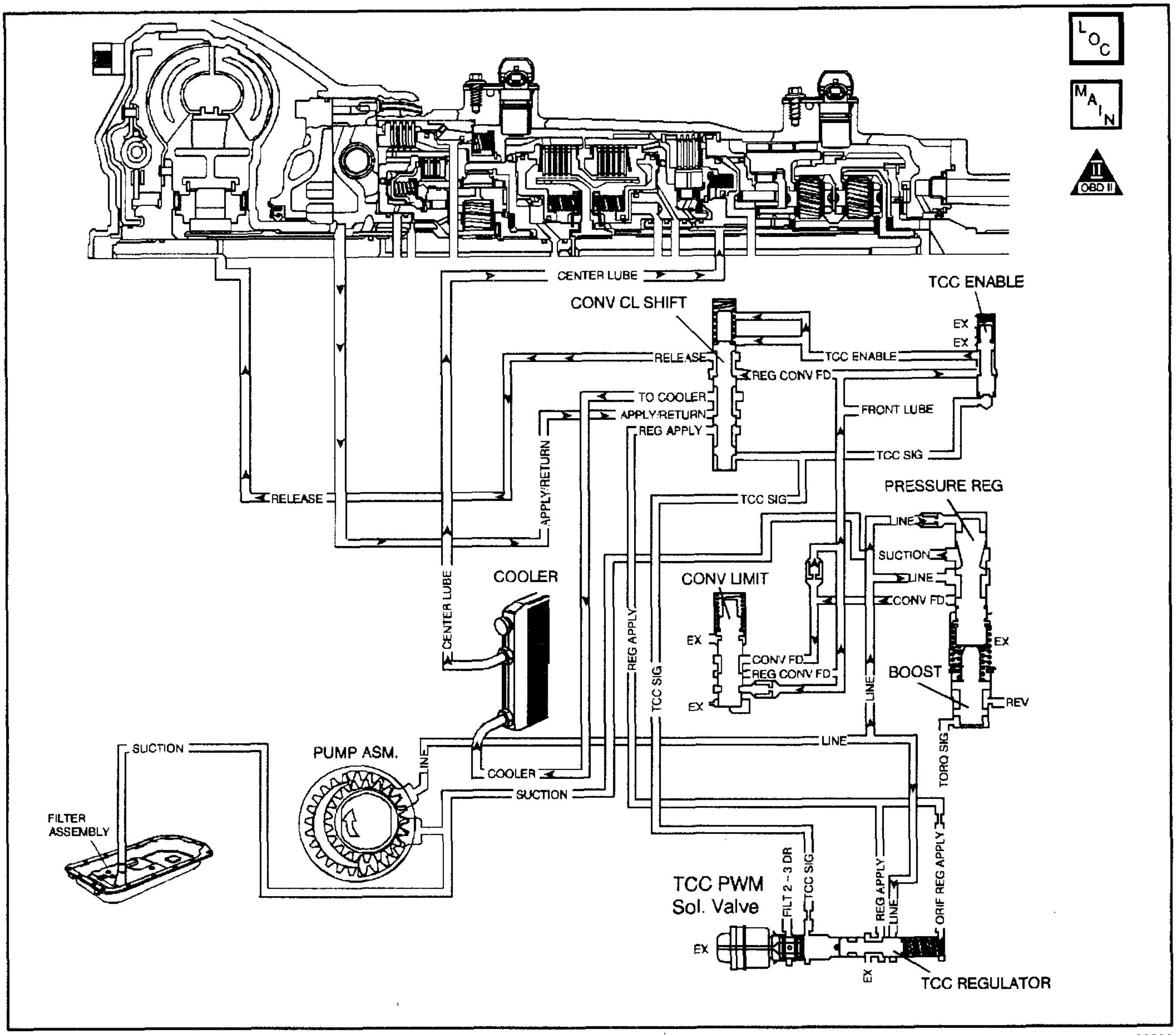
Transmission Fluid Temperature (TFT) Sensor Connector, Wiring Harness Side



Connector Part Information	• 12047662 • CONN 2F M/P 150 (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BRN	1227	Transmission Fluid Temperature (TFT) Sensor Signal
B	GRY	452	TFT Sensor Ground

Diagnostic Information and Procedures

DTC P0218 Transmission Fluid Overtemperature (L29/L31/L35)



199392

Circuit Description

The flow of transmission fluid starts in the transmission pan. It is then drawn through the filter and transmission case into the oil pump assembly. The oil pump assembly pressurizes the fluid (line pressure), which becomes the main supply line of fluid. This fluid is directed to various components and hydraulic circuits within the transmission. The pressure regulator valve receives this fluid and directs it to the converter clutch shift valve. The converter clutch shift valve directs hot fluid leaving the torque converter or regulated converter feed fluid, through the cooler line to the transmission oil cooler. The transmission oil cooler is located in the radiator.

The vehicle may also be equipped with an auxiliary oil cooler. The cooled fluid (center lube) is returned to the transmission through the return cooler line and into center lube port of the transmission. The automatic transmission fluid temperature (TFT) sensor, senses the fluid temperature in the transmission pan.

If the vehicle control module (VCM) detects a high TFT for a long period of time, then DTC P0218 sets. DTC P0218 is a type D DTC.

Conditions for Running the DTC

No TFT sensor DTCs P0712 or P0713.

Conditions for Setting the DTC

The TFT is greater than 130°C (266°F) for 410 seconds.

Action Taken When the DTC Sets

- The VCM does not illuminate the malfunction indicator lamp (MIL).
- The VCM freezes shift adapts from being updated.
- The VCM stores DTC P0218 in VCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from VCM history.
- The VCM clears the DTC from VCM history if the vehicle completes 40 warm-up cycles without a non-emission-related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the cooling system fluid level and condition.
- Verify the customer's driving habits, such as trailer towing, etc...
- The scan tool Transmission Fluid Temperature (TFT) should rise steadily during warm-up cycles then stabilize.
- DTC P0218 may set approximately 600 seconds after DTC P0711 has set. Follow the diagnostic table for DTC P0711 before proceeding to the diagnostic table for DTC P0218. Repairing the condition that set DTC P0711 will likely eliminate DTC P0218.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

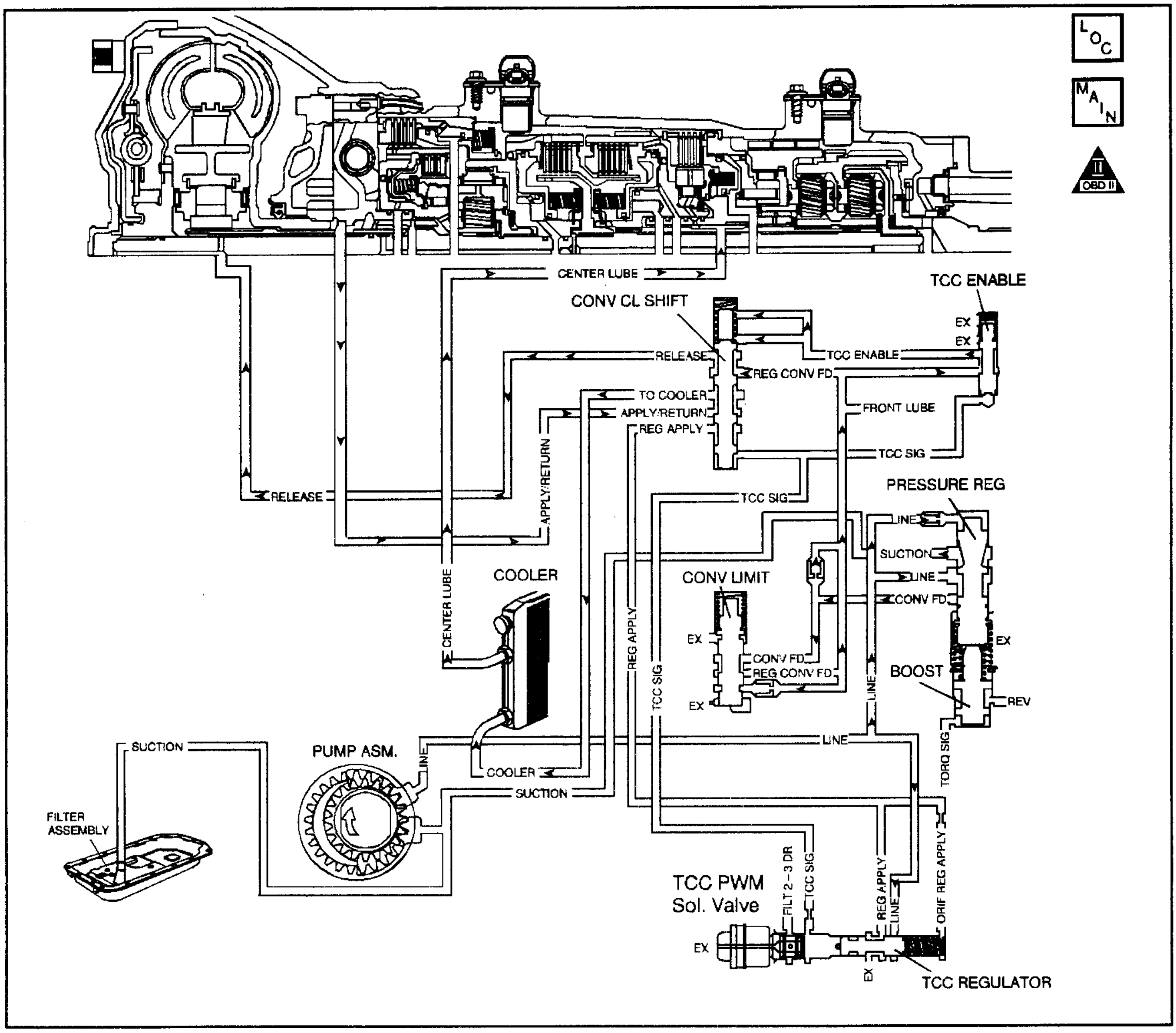
The numbers below refer to the step numbers on the diagnostic table.

3. DTC P0711 may also set a DTC P0218. Go to the DTC P0711 tables for diagnosis.
4. This step inspects for air restrictions and loss of transmission fluid flow, causing an extremely high TFT.

DTC P0218 Transmission Fluid Overtemperature (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. Using the Clear Info function erases the Failure Records from the VCM. 3. Record the Failure Records. 4. Clear the DTCs. 5. Perform the Transmission Fluid Checking Procedure. Refer to 4L80-E *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to 4L80-E *Transmission Fluid Checking Procedure*
3	Is DTC P0711 also set?	—	Go to Diagnostic Aids	*Go to Step 4*
4	1. Inspect the engine cooling system for the following conditions: • Air flow restrictions • Air flow blockage • Debris. 2. Inspect the transmission cooling system for the following conditions: • Air flow restrictions • Air flow blockage • Debris • Damaged cooler lines or hoses. • Low A/T Fluid Cooler flow. Refer to *AT Oil Cooler Flow Test.* Was a condition found?	—	*Go to Step 7*	*Go to Step 5*
5	Perform the Line Pressure Check Procedure. Refer to 4L80-E *Line Pressure Check Procedure.* Was a condition found?	—	*Go to Step 7*	*Go to Step 6*
6	Inspect the torque converter stator for damage. Refer to *Torque Converter Diagnosis Procedure.* Was a condition found?	—	*Go to Step 7*	Go to *Symptom Diagnosis* Transmission Overheating
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions. • Turn the ignition switch to the RUN position. • The TFT must be less than 129°C (265°F) for at least 5 seconds. 4. Select Specific DTC. 5. Enter DTC P0218. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0218 Transmission Fluid Overtemperature (L57/L65 EFI)



199392

Circuit Description

The flow of transmission fluid starts in the transmission pan. It is then drawn through the filter and transmission case into the oil pump assembly. The oil pump assembly pressurizes the fluid (line pressure), which becomes the main supply line of fluid. This fluid is directed to various components and hydraulic circuits within the transmission. The pressure regulator valve receives this fluid and directs it to the converter clutch shift valve. The converter clutch shift valve directs hot fluid leaving the torque converter or regulated converter feed fluid, through the cooler line to the transmission oil cooler. The transmission oil cooler is located in the radiator. The vehicle may also be equipped with an auxiliary oil cooler.

The cooled fluid (center lube) is returned to the transmission trough the return cooler line and into center lube port of the transmission. The automatic transmission fluid temperature (TFT) sensor, senses the fluid temperature in the transmission pan.

If the powertrain control module (PCM) detects a high TFT for a long period of time, then DTC P0218 sets. DTC P0218 is a type D DTC.

Conditions for Running the DTC

No TFT sensor DTC P0712 or P0713.

Conditions for Setting the DTC

The TFT is greater than 130°C (266°F) for greater than 410 seconds.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM freezes shift adapts from being updated.
- The PCM stores DTC P0218 in PCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from PCM history.
- The PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission-related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the cooling system fluid level and condition.
- Verify the customer's driving habits, such as trailer towing, etc...
- The scan tool transmission fluid temperature (TFT) should rise steadily during warm-up cycles then stabilize.
- DTC P0218 may set approximately 600 seconds after DTC P0711 has set. Follow the diagnostic table for DTC P0711 before proceeding to the diagnostic table for DTC P0218. Repairing the condition that set DTC P0711 will likely eliminate DTC P0218.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

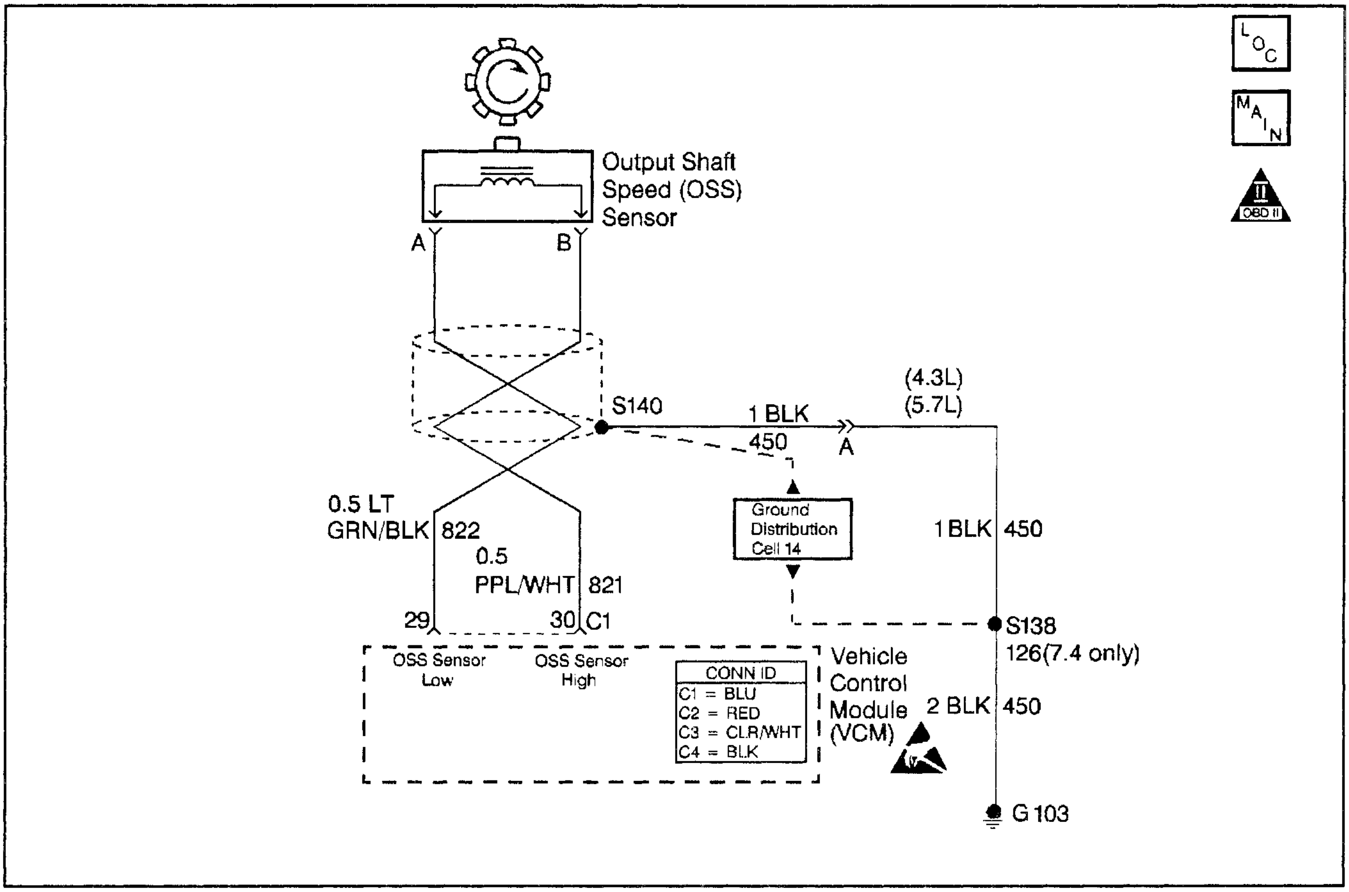
The numbers below refer to the step numbers on the diagnostic table.

3. DTC P0711 may also set a DTC P0218. Go to the DTC P0711 table for diagnosis.
4. This step inspects for air restrictions and loss of transmission fluid flow, causing an extremely high TFT.

DTC P0218 Transmission Fluid Overtemperature (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Failure Records from the PCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Perform the Transmission Fluid Checking Procedure. Refer to 4L80-E *Transmission Fluid Checking Procedure.* Was the fluid checking procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	Is DTC P0711 also set?	—	Go to Diagnostic Aids	*Go to Step 4*
4	1. Inspect the engine cooling system for the following conditions: • Air flow restrictions • Air flow blockage • Debris 2. Inspect the transmission cooling system for the following conditions: • Air flow restrictions • Air flow blockage • Debris • Damaged cooler lines or hoses. • Low A/T fluid cooler flow. Refer to *AT Oil Cooler Flow Test.* Was the condition found?	—	Go to Step 7	*Go to Step 5*
5	Perform the line pressure check procedure. Refer to 4L80-E *Line Pressure Check Procedure.* Was the condition found?	—	*Go to Step 7*	*Go to Step 6*
6	Inspect the torque converter stator for damage. Refer to *Torque Converter Diagnosis Procedure.* Was the condition found?	—	*Go to Step 7*	Go to *Symptom Diagnosis* Transmission Overheating
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions. • Turn the ignition switch to the RUN position. • The TFT must be less than 129°C (264°F) for at least 5 seconds. 4. Select Specific DTC. 5. Enter DTC P0218. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0502 Vehicle Speed Sensor Circuit Low Input (L29/L31/L35)



369875

Circuit Description

The output shaft speed sensor (OSS sensor), which is a permanent magnet (PM) generator, provides the vehicle speed information to the vehicle control module (VCM). The PM generator produces a pulsing AC voltage as the transmission speed sensors rotor teeth pass through the sensor's magnetic field. The AC voltage level and the number of pulses increase as the speed of the vehicle increases. The VCM then converts the pulsing voltage to a digital signal for vehicle speed. The vehicle speed is used for engine and transmission calculations.

If the VCM detects a low vehicle speed and there is a high engine speed in a drive gear range, DTC P0502 sets. DTC P0502 is a type D DTC. For California emissions, DTC P0502 is a type B DTC.

Conditions for Running the DTC

- No mass air flow (MAF) sensor DTCs P0101, P0102 or P0103.
- No MAP DTCs P0106, P0107 or P0108.
- No throttle position (TP) sensor DTCs P0122 or P0123.
- No TFP manual valve position switch DTC P1810.
- No A/T ISS sensor DTC P0716 or P0717.
- The engine torque must be 108 N·m (80 lb ft) to the following:
  - 406 N·m (300 lb ft) 4.3L
  - 542 N·m (400 lb ft) 5.7L
  - 677 N·m (500 lb ft) 7.4L
- The A/T ISS is greater than 1500 RPM.
- The gear range is not PARK or NEUTRAL.
- TP angle is greater than 10%.
- The engine is running more than 475 RPM for more than 7 seconds.

Conditions for Setting the DTC

The OSS is less than 50 RPM for at least 4 seconds.

Action Taken When the DTC Sets

- For California emissions, the VCM illuminates the malfunction indicator lamp (MIL).
- The VCM commands maximum line pressure.
- The VCM freezes the shift adapts.
- The VCM defaults a calculated output speed value by using the ISS values.
- The VCM stores DTC P0502 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- DTC P0502 sets when no vehicle speed is detected at the start off.
- Inspect the wiring at the VCM, the OSS sensor connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or TP sensor codes. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests for voltage in the 822 low circuit.
6. This step tests the 5-volt and ground circuit of the VCM.
11. This step tests the integrity of the OSS sensor.
13. This step tests the OSS circuit.

DTC P0502 Vehicle Speed Sensor Circuit Low Input (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Raise and support the drive axle assembly. 6. Place the Transmission in NEUTRAL. 7. Observe the transmission OSS on the scan tool, while rotating a drive wheel. Ensuring that the drive shaft is rotating, does the Transmission OSS increase with the drive wheel speed?	—	Go to Diagnostic Aids	*Go to Step 3*

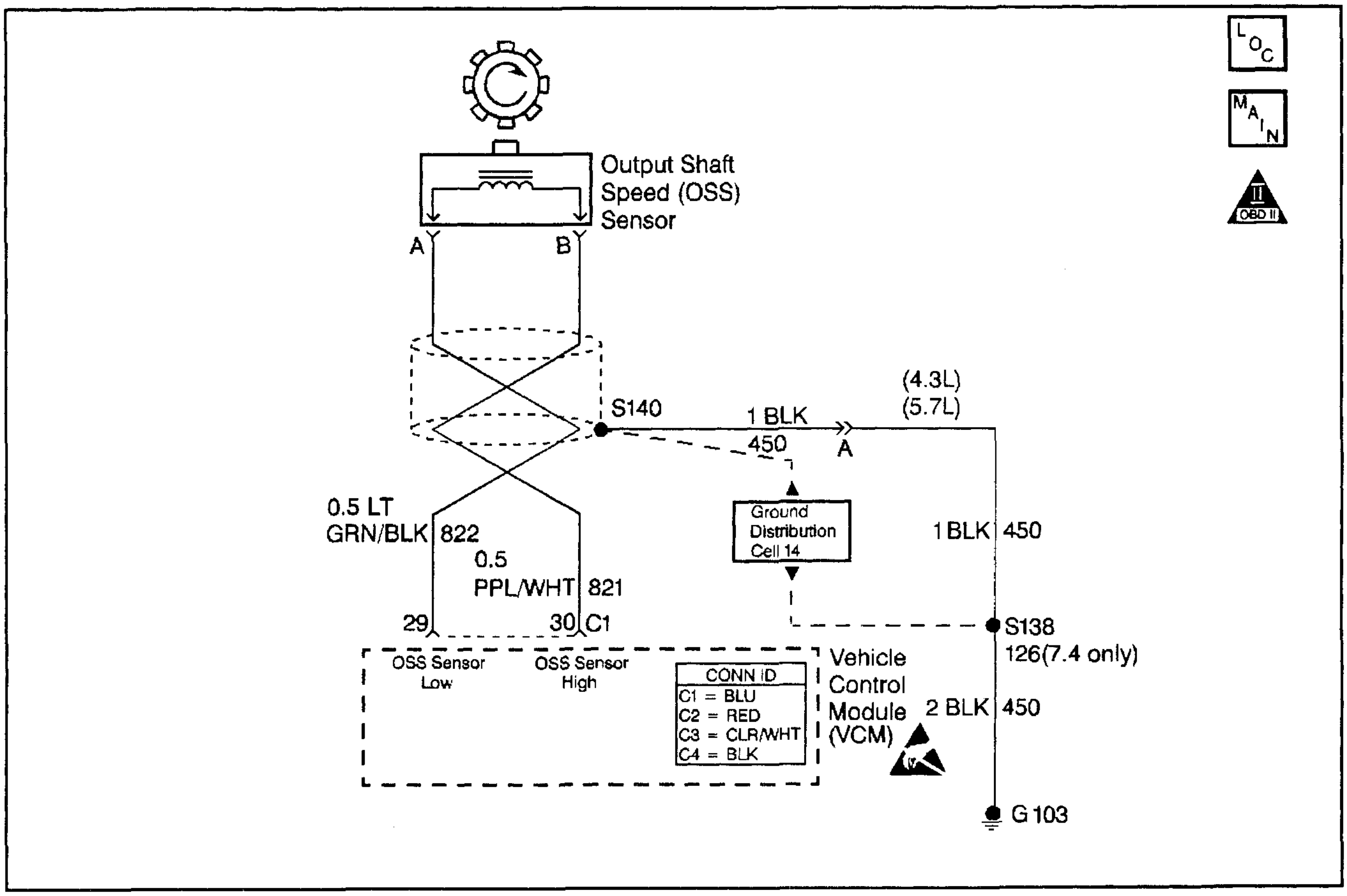
DTC P0502 Vehicle Speed Sensor Circuit Low Input (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition OFF. 2. Disconnect the OSS sensor harness connector from the sensor. 3. Turn the ignition switch to the RUN position. 4. Using the *J 39200* digital multimeter (DMM) on DC volts and *J 35616-A* connector test adapter kit, measure the voltage between the OSS sensor harness connector terminal A and a good ground. Is the voltage within the specified value?	4.0–5.1 volts DC	*Go to Step 4*	*Go to Step 5*
4	With the ignition switch in the RUN position, measure the voltage between terminal B of the OSS sensor harness connector and a good ground. Is the voltage less than the specified value?	0.2 volts	*Go to Step 6*	*Go to Step 12*
5	Was the voltage reading in Step 3 greater than the specified value?	5.1 volts	*Go to Step 12*	*Go to Step 7*
6	With the ignition switch in the RUN position, measure the voltage between terminals A and B of the OSS sensor harness connector. Is the voltage within the specified value?	4.0–5.1 volts	*Go to Step 10*	*Go to Step 8*
7	1. Inspect circuit 821 (PPL/WHT) for high resistance or an open circuit. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Repair the circuit if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the condition found?	—	*Go to Step 18*	*Go to Step 9*
8	1. Inspect circuit 822 (LT GRN/BLK) for an open circuit between the connector and the VCM. 2. Repair the circuit if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the condition found?	—	*Go to Step 18*	*Go to Step 13*
9	1. Inspect circuit 821 (PPL/WHT) for a short to ground. 2. Repair the circuit if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the condition found?	—	*Go to Step 18*	*Go to Step 13*
10	Using the *J 39200* DMM, measure the resistance between terminals A and B of the OSS sensor. Is the resistance within the specified value?	1042–2088Ω	*Go to Step 11*	*Go to Step 17*
11	1. Place the transmission in NEUTRAL. 2. With the *J 39200* DMM on terminals A and B, select the AC volts. 3. Rotate the rear wheels ensuring that the driveshaft is turning. Is the voltage greater than the specified value?	0.5 volts AC	*Go to Step 13*	*Go to Step 15*

DTC P0502 Vehicle Speed Sensor Circuit Low Input (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
12	1. Inspect circuit 821 (PPL/WHT) for a short to voltage B+. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Inspect circuit 822 (LT GRN/BLK) for a short to voltage B+. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 3. Inspect circuits 821 (PPL/WHT) and 822 (LT GRN/BLK) for a short together. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 4. Repair the circuits if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the condition found?	—	*Go to Step 18*	*Go to Step 14*
13	1. Reconnect the OSS sensor connector to the OSS sensor. 2. With the ignition OFF disconnect the VCM connector C1 (blue) from the VCM. 3. Connect the *J 39200* DMM to terminals C1–29 and C1–30. 4. While rotating the rear wheels and ensuring that the driveshaft is turning, measure the voltage with the DMM on AC volts. Is the voltage greater than the specified value?	0.5 volts AC	*Go to Step 14*	—
14	Inspect the VCM pins and C1 terminals for corrosion or reduced terminal tension. Was the condition found?	—	*Go to Step 18*	*Go to Step 16*
15	1. Remove the OSS sensor. 2. Inspect the output shaft speed sensor rotor for damage or misalignment. Refer to Unit Repair. Was the condition found?	—	*Go to Step 18*	*Go to Step 17*
16	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 18*	—
17	Replace the OSS sensor. Refer to *Vehicle Speed Sensor Replacement.* Is the replacement complete?	—	*Go to Step 18*	—
18	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle so that the transmission OSS is greater than 500 RPM for 1 second. 4. Select Specific DTC. 5. Enter DTC P0502. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0503 Vehicle Speed Sensor CKT Intermittent (L29/L31/L35)



369875

Circuit Description

The output shaft speed sensor (OSS sensor), which is a permanent magnet (PM) generator, provides the vehicle speed information to the vehicle control module (VCM). The PM generator produces a pulsing AC voltage as the transmission speed sensors rotor teeth pass through the sensor's magnetic field. The AC voltage level and the number of pulses increase as the speed of the vehicle increases. The VCM then converts the pulsing voltage to a digital signal for vehicle speed. The vehicle speed is used for engine and transmission calculations.

If the VCM detects a low vehicle speed and there is a high engine speed in a drive gear range, DTC P0503 sets. DTC P0503 is a type D DTC. For California emissions, DTC P0503 is a type B DTC.

Conditions for Running the DTC

- No TFP manual valve position switch DTC P1810.
- No TFP manual valve position switch changes in less than 10 seconds.
- The A/T ISS is greater than 1500 RPM.
- The engine is running more than 475 RPM for more than 7 seconds.
- No VSS increase greater than 250 RPM within 2 seconds.

Conditions for Setting the DTC

- The OSS RPM has dropped more than 1000 RPM for at least 4 seconds
- The gear range is not PARK or NEUTRAL.

Action Taken When the DTC Sets

- For California emissions, the VCM illuminates the malfunction indicator lamp (MIL).
- The VCM commands maximum line pressure.
- The VCM freezes the shift adapts.
- The VCM defaults a calculated output speed value by using the ISS values.
- The VCM stores DTC P0503 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.

- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- DTC P0503 sets when the VCM detects an OSS loss.
- Inspect the wiring at the VCM, the OSS sensor connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- The vehicle may need to be driven to duplicate the intermittent condition.
- First diagnose and clear any engine DTCs or TP sensor codes. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the integrity of the OSS sensor.
5. This step tests for voltage in the 822 low circuit.
7. This step tests the 5-volt and ground circuit of the OSS sensor circuit.
13. This step tests the OSS sensor and the circuit.

DTC P0503 Vehicle Speed Sensor CKT Intermittent (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. 5. Raise and support the drive axle assembly. 6. Select *Scan Tool* Transmission OSS. 7. Start the engine and place the transmission selector in D3 range. 8. With the drive wheels rotating, slowly accelerate to 2000 engine RPM and hold. Does the Transmission OSS drop or fluctuate more than the specified value?	1000 RPM	*Go to Step 3*	Go to Diagnostic Aids

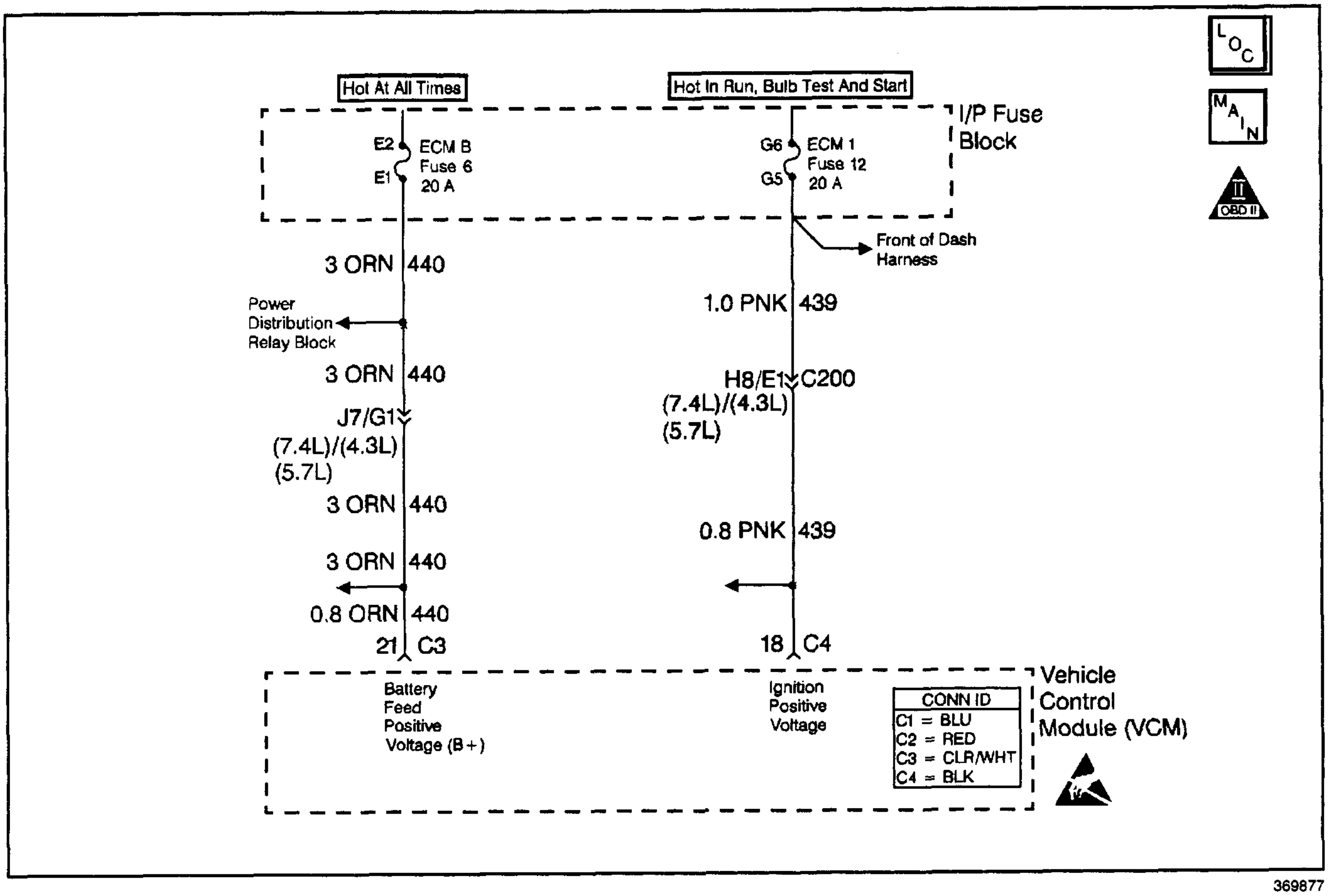
DTC P0503 Vehicle Speed Sensor CKT Intermittent (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition switch to the OFF position. 2. Disconnect the OSS sensor harness connector from the OSS sensor. 3. Using a *J 39200* digital multimeter (DMM) on AC voltage scale, and *J 35616-A* connector test adapter kit, connect the *J 39200* DMM to terminals A and B on the OSS sensor. 4. Turn the ignition switch to the RUN position and start the engine. 5. Place the transmission selector in D3 range. 6. With the drive wheels rotating, slowly accelerate to 2000 engine RPM and hold. Does the DMM voltage drop or fluctuate at 2000 RPM?	—	*Go to Step 11*	*Go to Step 4*
4	1. With the engine OFF, turn the ignition switch to the RUN position. 2. Using the *J 39200* DMM on DC volts, connected to a good ground, measure the voltage at cavity A of the OSS sensor connector. Is the voltage within the specified value and steady?	4.0–5.1 volts DC	*Go to Step 5*	*Go to Step 6*
5	With the ignition switch in the RUN position, measure the voltage at cavity B of the OSS sensor connector. Is the voltage less than the specified value?	0.2 volts	Go to Step 7	*Go to Step 12*
6	Is the voltage reading in Step 4 greater than the specified value?	5.1 volts	*Go to Step 12*	*Go to Step 8*
7	1. Connect the *J 39200* DMM leads to cavity A and cavity B of the OSS sensor connector. 2. With the ignition switch in the RUN position, record the voltage. Is the voltage within the specified value and steady?	4.0–5.1 volts DC	*Go to Step 13*	*Go to Step 9*
8	1. Inspect circuit 821 (PPL/WHT) for high resistance or an open circuit. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Repair the circuit if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the condition found?	—	*Go to Step 18*	*Go to Step 10*
9	1. Inspect circuit 822 (GRN/BLK) for high resistance or an open circuit. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Repair the circuit if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the condition found?	—	*Go to Step 18*	—
10	1. Inspect circuit 821 (PPL/WHT) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Repair the circuit if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the condition found?	—	*Go to Step 18*	*Go to Step 13*
11	Using the *J 39200* DMM, measure the resistance between terminals A and B of the OSS sensor. Is the resistance within the specified value?	1042–2088Ω	*Go to Step 15*	*Go to Step 17*

DTC P0503 Vehicle Speed Sensor CKT Intermittent (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
12	1. Inspect circuits 821 (PPL/WHT) and 822 (GRN/BLK) for a short to B+ voltage or shorted together. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Repair the circuits if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was a shorted condition found?	—	*Go to Step 18*	*Go to Step 14*
13	1. Reconnect the OSS sensor connector to the OSS sensor. 2. With the ignition OFF disconnect the C1 (blue) VCM connector from the VCM. 3. Connect the *J 39200* DMM to terminals C1–29 and C1–30. 4. While rotating the rear wheels by hand and ensuring that the driveshaft is turning, measure the output voltage with the DMM on AC volts. Is the voltage greater than the specified value?	0.5 volts AC	*Go to Step 14*	—
14	1. Inspect the VCM pins for corrosion or poor tension. 2. Inspect the connector terminals for corrosion or poor tension. Was a condition found?	—	*Go to Step 18*	*Go to Step 16*
15	1. Remove the OSS sensor. Refer to *Vehicle Speed Sensor Replacement.* 2. Inspect the output shaft speed sensor rotor for looseness, damage or misalignment. Refer to Unit Repair. Was the condition found?	—	*Go to Step 18*	*Go to Step 17*
16	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 18*	—
17	Replace the OSS sensor. Refer to *Vehicle Speed Sensor Replacement.* Is the replacement complete?	—	*Go to Step 18*	—
18	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle so that the transmission OSS is greater than 500 RPM with no RPM change greater than 450 for one second. 4. Select Specific DTC. 5. Enter DTC P0503. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0560 System Voltage High/Low (L29/L31/L35)



Circuit Description

Circuits 439 is the ignition voltage feed for the vehicle control module (VCM). Circuit 440 is the battery voltage feed for the VCM.

If the VCM detects a low voltage, a high voltage for a long time, or a high voltage, for a short amount of time, then DTC P0560 sets. DTC P0560 is a type D DTC.

Conditions for Running the DTC

System Voltage Low:

The engine speed is greater than 1500 RPM.

System Voltage High:

No engine speed needed.

Conditions for Setting the DTC

System Voltage Low:

One of the following conditions exists for greater than 15 seconds.

- The system voltage is less than 10.5 volts at a maximum transmission temperature of 152°C (305°F) or:
- The system voltage is less than 6.7 volts at a minimum transmission temperature of –40°C (–40°F).

System Voltage High:

The system voltage is greater than 19 volts for 10 seconds.

Action Taken When the DTC Sets

- The VCM does not illuminate the malfunction indicator lamp (MIL).
- The VCM causes an immediate landing to second gear.
- The VCM turns off the PC solenoid valve.
- The VCM inhibits the TCC engagement.
- The VCM freezes the shift adapts.
- The VCM stores DTC P0560 in VCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from VCM history.
- The VCM clears the DTC from VCM history if the vehicle completes 40 warm-up cycles without a non-emission-related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Charging the battery with a battery charger and jumpstarting an engine may set this DTC.
- If this DTC is set when an accessory is operated, inspect for faulty connections or an excessive current draw.
- Inspect for faulty electrical connections at the starter solenoid.
- Inspect for faulty electrical connections at the fusible link.
- Inspect for loose or damaged terminals at the generator.
- Inspect the generator belt condition and tension.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

4. This step tests the charging system voltage.
5. This step tests the battery voltage input at the VCM.
6. This step tests the ignition voltage and battery voltage inputs at the VCM.

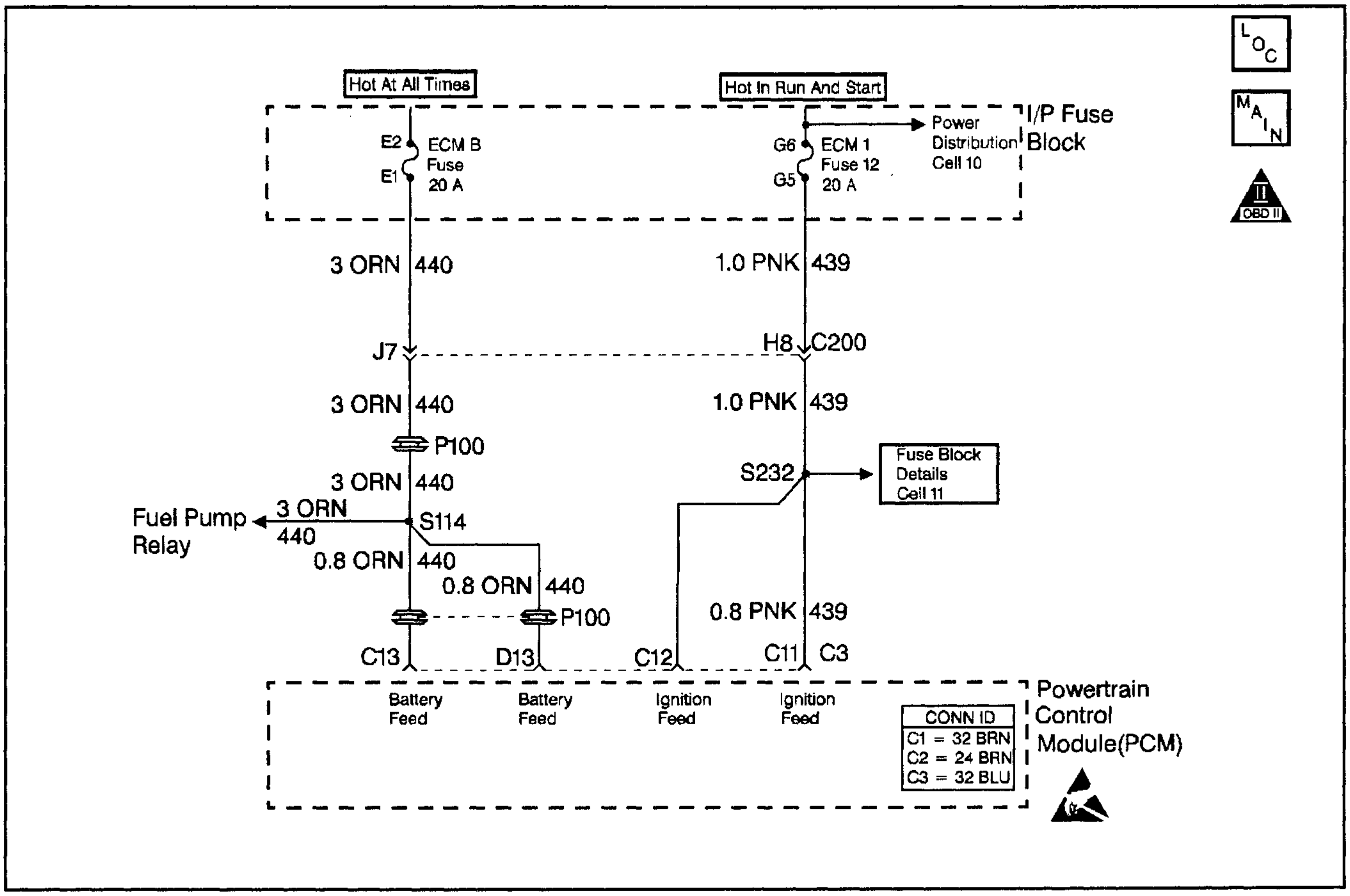
DTC P0560 System Voltage High/Low (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool*. 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the *Scan Tool* in order to record Failure Records. Using the Clear Info function erases the Failure Records from the VCM. 3. Record the Failure Records. 4. Clear the DTCs. 5. Using the *J 39200* digital multimeter (DMM), measure the battery voltage across the battery terminals. Is the voltage higher than the specified value?	10 volts	*Go to Step 3*	Go to Battery Diagnosis
3	1. Start the engine. 2. Warm the engine to normal operating temperature. Is the generator/check engine light ON?	—	Go to *Charging System Check*	*Go to Step 4*
4	1. Turn the headlights and the heater blower motor to the ON position. 2. Increase the engine speed to 1500 RPM. 3. Observe the *J 39200* DMM battery voltage and record your voltage reading for reference. Is the *J 39200* DMM voltage within the specified range?	13–15 volts	*Go to Step 5*	Go to *Charging System Check*
5	1. Increase the engine speed to 1500 RPM. 2. Observe the *Scan Tool* Ignition voltage. Is the *Scan Tool* Ignition Voltage within the specified range.	13–15 volts	Go to Diagnostic Aids	*Go to Step 6*

DTC P0560 System Voltage High/Low (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition switch to the OFF position. 2. Locate terminal C4-18 and terminal C3-21 in the VCM connectors. Do not disconnect the VCM connectors. 3. Connect the *J 39200* DMM black lead to ground. 4. Start the engine. 5. Run the engine at 1500 RPM with the headlights and the blower motor ON. 6. Using the *J 39200* DMM and the *J 35616-A* connector test adaptor kit, backprobe terminals C4-18 and C3-21 to measure the battery voltage and the ignition voltage input at VCM connectors. Is there a voltage variance between the voltage measured at the battery (taken in Step 4) and at terminals C4-18 and C3-21 that is greater than the specified value?	0.5 volts	*Go to Step 7*	*Go to Step 10*
7	Does terminal C4-18 have the voltage variance?	—	*Go to Step 8*	*Go to Step 9*
8	Repair the high resistance condition in circuit 439 (PNK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 11*	—
9	Repair the high resistance condition in circuit 440 (ORN). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 11*	—
10	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 11*	—
11	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Start the vehicle. • Warm the engine to normal operating temperature. • Ensure that the *Scan Tool* Ignition Voltage is 12–18 volts. 4. Select Specific DTC. 5. Enter DTC P0560. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0560 System Voltage High/Low (L57/L65 EFI)



Circuit Description

Circuit 339 is the ignition voltage feed for the powertrain control module (PCM). Circuit 440 is the battery feed for the PCM.

If the PCM detects either a low system voltage or a high system voltage for a short time, then DTC P0560 sets. DTC P0560 is a type D DTC.

Conditions for Running the DTC

System Voltage Low

The engine speed is greater than 1500 RPM.

System Voltage High

No engine speed needed.

Conditions for Setting the DTC

System Voltage Low

One of the following conditions exist for greater than 15 seconds:

- The system voltage is less than 10.5 volts at a maximum transmission temperature of 152°C (305°F).
- The system voltage is less than 6.7 volts at a minimum transmission temperature of –40°C (–40°F).

System Voltage High

System voltage is greater than 19 volts for 10 seconds.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM commands an immediate landing to second gear.
- The PCM turns off the PC solenoid valve.
- The PCM inhibits the TCC engagement.
- The PCM freezes the shift adapts.
- The PCM stores DTC P0560 in PCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from PCM history.
- The PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission-related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Charging the battery with a battery charger and jumpstarting an engine may set DTCs.
- If this DTC is set when an accessory is operated, inspect for faulty connections or an excessive current draw.
- Inspect for faulty electrical connections at the starter solenoid.
- Inspect for faulty electrical connections at the fusible link.
- Inspect for loose or damaged terminals at the generator.
- Inspect the generator belt wear condition and tension.
- First diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

4. This step tests the charging system voltage.
5. This step tests the battery voltage input at the PCM.
7. This step tests the ignition voltage inputs at the PCM.

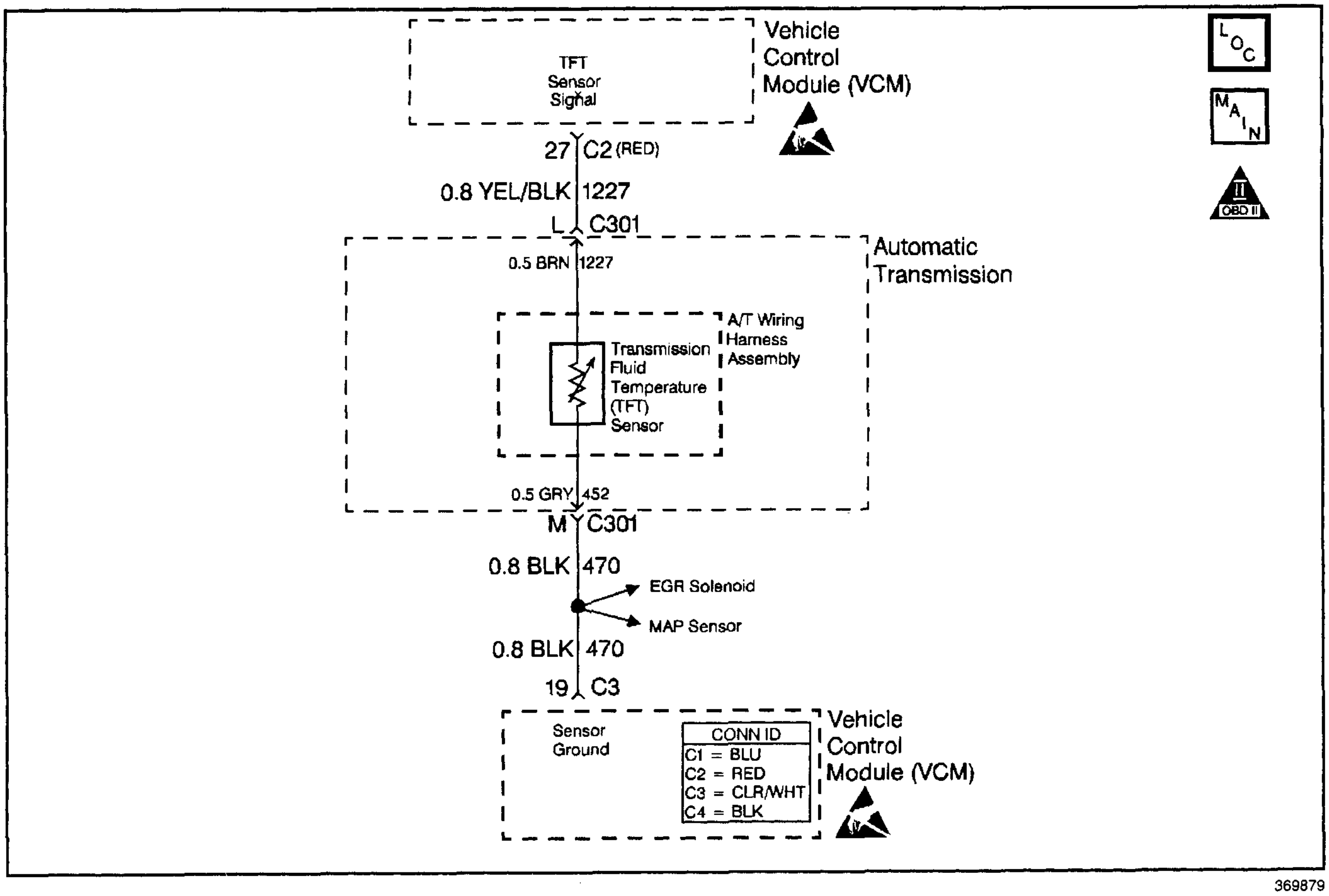
DTC P0560 System Voltage High/Low (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM. 3. Record the Failure Records. 4. Clear the DTC. 5. If any DTCs are present, refer to their applicable diagnostic tables before continuing. 6. Using the *J 39200* digital multimeter (DMM), measure the battery voltage across the battery terminals. 7. Record the battery voltage measurement for future reference. Is the voltage higher than the specified value?	10.5 volts	*Go to Step 3*	Go to *Charging System Check*
3	1. Start the engine. 2. Allow the engine to warm to normal operating temperature. Is the generator lamp ON?	—	Go to *Charging System Check*	*Go to Step 4*
4	1. Increase the engine speed to greater than 1500 RPM. 2. Observe the scan tool ignition voltage. Is the ignition voltage within the specified range?	13-15 volts	*Go to Step 5*	Go to *Charging System Check*
5	1. Turn the ignition switch OFF. 2. Disconnect the PCM connector C3 (Additional DTCs will set). 3. With the engine OFF, turn the ignition switch in the RUN position. 4. Measure the battery voltage input at the PCM connector terminal C3-C13. Use the *J 39200* DMM and the *J 35616-A* connector test adaptor kit. Is there a voltage variance between the voltage measured at the battery (taken in Step 2) and at terminal C3-C13 that is greater than the specified value?	0.5 volts	*Go to Step 6*	*Go to Step 7*
6	Repair the high resistance condition in circuit 440 (ORN). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 11*	—

DTC P0560 System Voltage High/Low (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
7	Measure the ignition voltage input at PCM connector terminal C3-C11. Is there a voltage variance between the voltage measured at the battery (taken in Step 2) and at terminal C3-C11 that is greater than the specified value?	0.5 volts	*Go to Step 8*	*Go to Step 9*
8	Repair the high resistance condition in circuit 439 (PNK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 11*	—
9	1. Inspect PCM connector terminal C3-C13 for damaged or backed out connector pins. 2. Inspect PCM connector terminal C3-C11 for damaged or backed out connector pins. 3. Inspect for reduced terminal tension. Was the condition found?	—	*Go to Step 11*	*Go to Step 10*
10	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 11*	—
11	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Start the vehicle. • Warm the vehicle to normal operating temperature. • Using the scan tool, verify that the PCM sees an ignition voltage between 8.3 and 16.5 volts. 4. Select Specific DTC. 5. Enter DTC P0560. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0711 TFT Sensor Circuit Range/Performance (L29/L31/L35)



Circuit Description

The automatic transmission fluid temperature (TFT) sensor is part of the 4L80–E automatic transmission (A/T) wiring harness assembly. The TFT sensor is a resistor, or thermistor, which changes value based on temperature. The sensor has a negative-temperature coefficient. This means that as the temperature increases, the resistance decreases, and as the temperature decreases the resistance increases. The vehicle control module (VCM) supplies a 5–volt reference signal to the sensor on circuit 1227 and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the VCM detects high signal voltage. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage decreases. The VCM uses this information to control shift quality and torque converter clutch apply.

If the VCM detects the TFT sensor resistance has no change, or an unrealistic change in a short amount of time, (multiple changes within seconds) then DTC P0711 sets. DTC P0711 is a type D DTC.

Conditions for Running the DTC

- No A/T ISS sensor DTC P0716 or P0717.
- No A/T OSS sensor DTC P0722 or P0723.
- No engine coolant temperature (ECT) DTCs P0117 or P0118.
- No A/T component slipping DTC P1870.
- System voltage is 10.0-16.0 volts.
- The engine is running greater than 475 RPM for at least 35 seconds.
- The TFT is –40° to +21°C (–40° to +70°F) at start up.
- The engine coolant temperature (ECT) is greater than 85°C (185°F).
- ECT has changed at least 55°C (130°F) since start up.
- The vehicle speed is greater than 5 mph for at least 900 seconds (15 minutes).
- The TCC slip speed is greater than 60 RPM for at least 800 seconds (13.3 minutes).

Conditions for Setting the DTC

DTC P0711 will set if all of the above conditions have been met and one of the following conditions exist:

- The TFT has not changed more than 2.25°C (4°F), in more than 800 seconds (13.3 minutes) (No TFT change).
- The TFT has changed more than 20°C (68°F) 14 times in 7 seconds (unrealistic temperature change).

Action Taken When the DTC Sets

- The VCM does not illuminates the malfunction indicator lamp (MIL).
- The VCM commands increased line pressure.
- The VCM freezes shift adapts.
- The VCM determines a TFT default transmission temperature (TFT) using the following matrix:
  - If the engine run time is less than 60 seconds then default TFT equals the intake air temperature (IAT), plus 5 degrees.
  - If the engine coolant temperature (ECT) is less than 85°C (185°F) then default TFT equals IAT plus 10 degrees.
  - If the ECT is 85°-110°C (185°-230°F) then default TFT equals ECT plus 10 degrees.
  - If the ECT is greater than 110°C (230°F) then default TFT is set to 140°C (284°F) and transmission shift pattern is in hot mode.
  - If ECT and TFT DTCs are both set then default TFT is 140°C (284°F).
- The VCM stores DTC P0711 in VCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from VCM history.
- The VCM clears the DTC from VCM history if the vehicle completes 40 warm-up cycles without a non-emission-related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the wiring at the VCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or TP sensor DTCs that are present. Then inspect for any transmission DTCs that may have reset.
- DTC P0218 may set approximately 600 seconds after DTC P0711 has set. Follow the diagnostic table for DTC P0711 before proceeding to the diagnostic table for DTC P0218.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step tests for proper A/T fluid level and condition.
3. This step verifies which condition has set DTC P0711.
5. The 12-volt test lamp is used as a fixed resistance.
6. This step ensures that the VCM monitors circuit 1227.

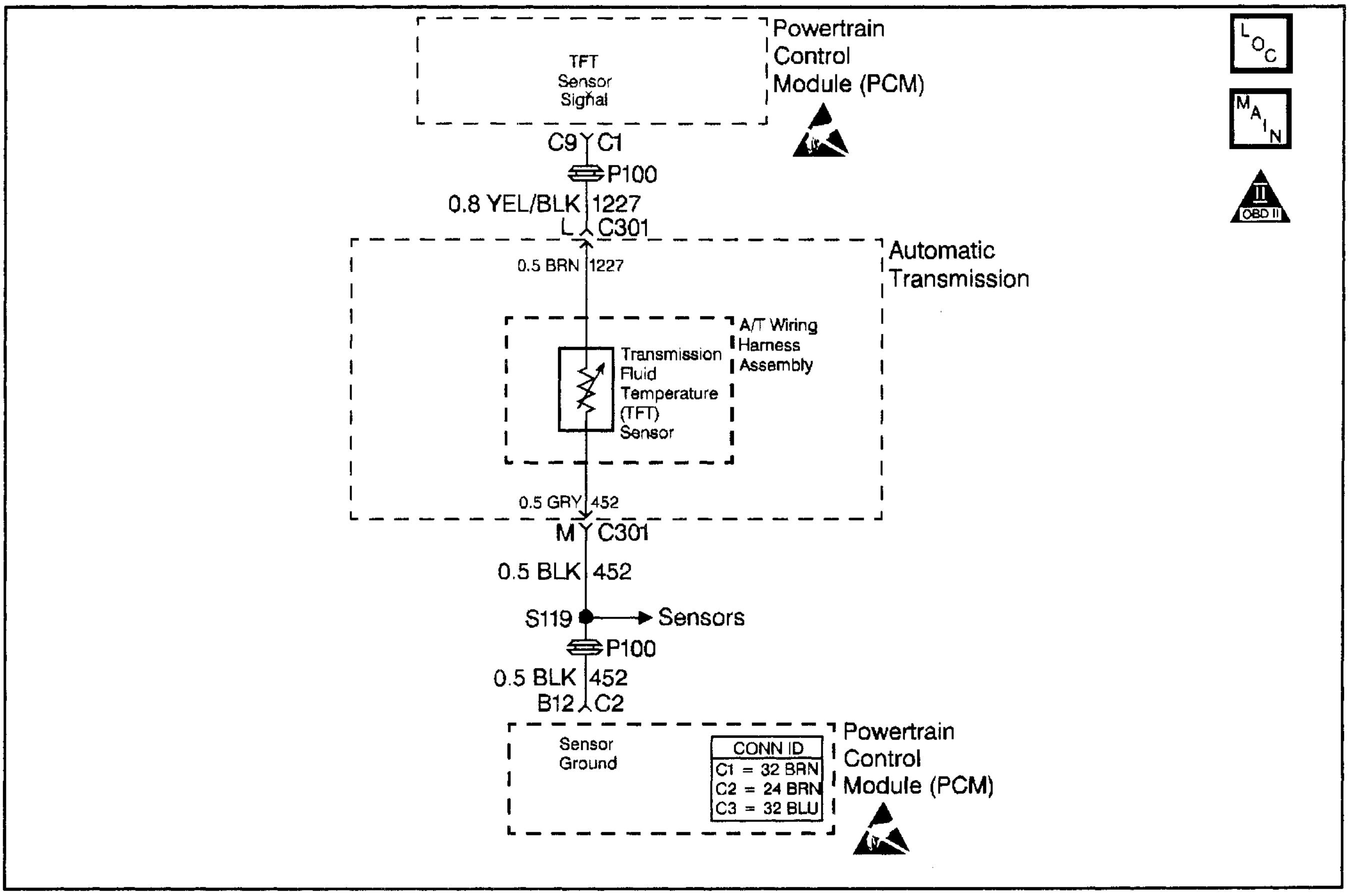
DTC P0711 TFT Sensor Circuit Range/Performance (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*

DTC P0711 TFT Sensor Circuit Range/Performance (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Install the *Scan Tool*. 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the VCM. 3. Record the Failure Records. 4. Clear the DTCs. 5. Select TFT on the scan tool. 6. Drive the vehicle and observe the scan tool for one of the following conditions: • No TFT change, • An unrealistic TFT change (The TFT change is greater than 20°C (36°F) 14 times in 7 seconds). Did either of the fail conditions occur?	—	*Go to Step 4*	Go to Diagnostic Aids
4	Did the scan tool display an unrealistic TFT change?	—	*Go to Step 5*	*Go to Step 6*
5	1. Turn the ignition switch OFF. 2. Disconnect the transmission 20-way connector. Additional DTCs may set. 3. Using the *J 35616-A* connector test adapter kit, install a 12 volt test lamp between terminals L and M of the engine side of the transmission 20-way connector. 4. Turn the ignition switch to the RUN position. Does the scan tool TFT display an unrealistic TFT change?	—	*Go to Step 7*	*Go to Step 8*
6	1. Record the scan tool TFT display from step 4. 2. Turn the ignition OFF. 3. Disconnect the transmission 20-way connector. Additional DTCs may set. 4. Turn the ignition switch to the RUN position. Is the scan tool TFT the same as in step 4?	—	*Go to Step 7*	*Go to Step 8*
7	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 9*	—
8	Replace the TFT sensor. Refer to A/T Fluid Temperature Sensor Replacement. Is the replacement complete?	—	*Go to Step 9*	—
9	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • The TFT changes by more than 3°C (5°F) after the engine has been running for 35 seconds. • For a period of at least 11 seconds, the TFT does not change more than 20°C (36°F) within 0.2 seconds. 4. Select Specific DTC. 5. Enter DTC P0711. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0711 TFT Sensor Circuit Range/Performance (L57/L65 EFI)



Circuit Description

The automatic transmission fluid temperature (TFT) sensor is part of the 4L80-E automatic transmission (A/T) wiring harness assembly. The TFT sensor is a resistor, or thermistor, which changes value based on temperature. The sensor has a negative-temperature coefficient. This means that as the temperature increases, the resistance decreases, and as the temperature decreases the resistance increases. The powertrain control module (PCM) supplies a 5-volt reference signal to the sensor on circuit 1227 and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the PCM detects high signal voltage. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage decreases. The PCM uses this information to control shift quality and torque converter clutch apply.

If the PCM detects the TFT sensor resistance has no change, or an unrealistic change in a short amount of time, (multiple changes within seconds) then DTC P0711 sets. DTC P0711 is a type D DTC.

Conditions for Running the DTC

- No A/T OSS sensor DTC P0722 or P0723.
- No A/T ISS sensor DTC P0716 or P0717.
- No engine coolant temperature (ECT) DTCs P0117 or P0118.
- No A/T component slipping DTC P1870.
- System voltage is 7.5–18.0 volts.
- The engine is running greater than 475 RPM for at least 35 seconds.
- The TFT is –40° to +21°C (–40° to +70°F) at start up.
- The engine coolant temperature (ECT) is greater than 85°C (185°F).
- ECT has changed at least 55°C (130°F) since start up.
- The vehicle speed is greater than 3 mph for at least 900 seconds (15 minutes).
- The TCC slip speed is greater than 60 RPM for at least 700 seconds (13.3 minutes).

Conditions for Setting the DTC

DTC P0711 sets if all of the above conditions have been met and one of the following conditions exist:

- The TFT has not changed more than 2.25°C (4°F), in more than 800 seconds (13.3 minutes) (No TFT change).
- The TFT has changed more than 20°C (68°F) 14 times in 7 seconds (unrealistic temperature change).

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM commands increased line pressure.
- The PCM freezes shift adapts.
- The PCM determines a TFT default transmission fluid temperature (TFT) using the following matrix:
  - If the engine run time is less than 60 seconds then default TFT equals the intake air temperature (IAT), plus 5 degrees.
  - If the engine coolant temperature (ECT) is less than 85°C (185°F) then default TFT equals IAT plus 10 degrees.
  - If the ECT is 85–110°C (185–230°F) then default TFT equals ECT plus 10 degrees.
  - If the ECT is greater 110°C (230°F) then default TFT is set to 140°C (284°F) and transmission shift pattern is in Hot Mode
  - If ECT and TFT DTCs are both set then default TFT is 140°C (284°F).
- The PCM stores DTC P0711 in PCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from PCM history.
- The PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission-related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or APP sensor DTCs that are present. Then inspect for any transmission DTCs that may have reset.
- DTC P0218 may set approximately 600 seconds after DTC P0711 has set. Follow the diagnostic table for DTC P0711 before proceeding to the diagnostic table for DTC P0218.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step tests for proper A/T fluid level and condition.
3. This step verifies which condition has set DTC P0711.
5. The 12-volt test lamp is used as a fixed resistance.
6. This step ensures that the PCM monitors circuit 1227.

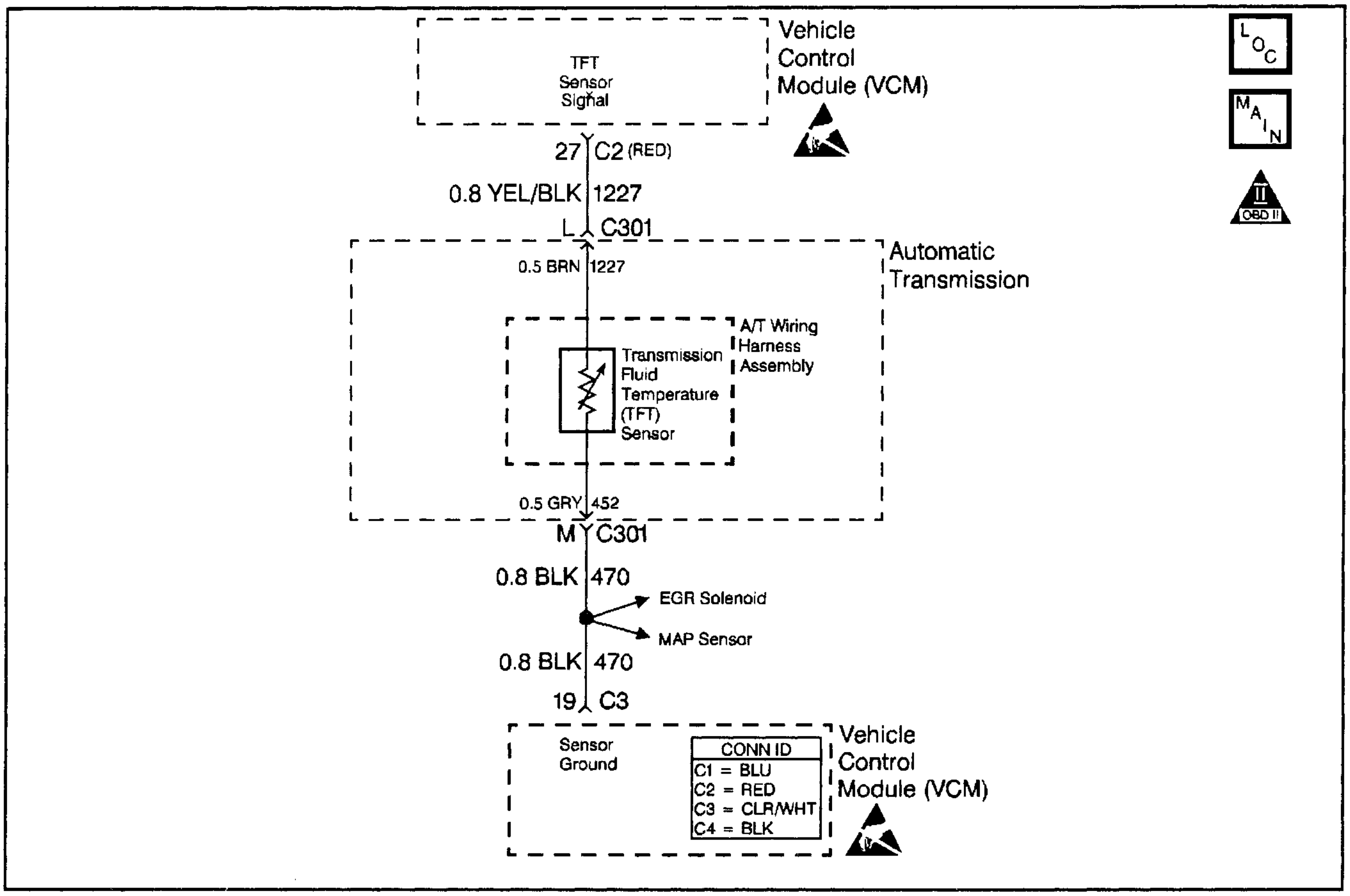
DTC P0711 TFT Sensor Circuit Range/Performance (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Select TFT on the scan tool. 6. Drive the vehicle and observe the scan tool for one of the following conditions: • No TFT change • An unrealistic TFT change (The TFT change is greater than 20°C (36°F) 14 times in 7 seconds) Did either of the fail conditions occur?	—	*Go to Step 4*	Go to Diagnostic Aids

DTC P0711 TFT Sensor Circuit Range/Performance (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
4	Did the scan tool display an unrealistic temperature change?	—	*Go to Step 5*	*Go to Step 6*
5	1. Turn the ignition switch OFF. 2. Disconnect the transmission 20-way connector (multiple DTCs will set). 3. Using the *J 35616-A* connector test adapter kit, install a 12 volt test lamp between terminals L and M of the engine side of the transmission 20-way connector. 4. Turn the ignition switch to the RUN position. Does the scan tool TFT display an unrealistic temperature change?	—	*Go to Step 7*	*Go to Step 8*
6	1. Record the scan tool TFT display from step 4. 2. Turn the ignition OFF. 3. Disconnect the transmission 20-way connector. Additional DTCs may set. 4. Turn the ignition switch to the RUN position. Is the scan tool TFT the same as recorded from step 4?	—	*Go to Step 7*	*Go to Step 8*
7	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 9*	—
8	Replace the TFT sensor. Refer to A/T Fluid Temperature Sensor Replacement. Is the replacement complete?	—	*Go to Step 9*	—
9	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • The TFT changes by more than 3°C (5°F) after the engine has been running for 30 seconds. • For a period of at least 30 seconds, the TFT does not change more than 20°C (36°F) within 0.2 seconds. 4. Select Specific DTC. 5. Enter DTC P0711. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0712 TFT Sensor Circuit Low Input (L29/L31/L35)



Circuit Description

The automatic transmission fluid temperature (TFT) sensor is part of the 4L80–E automatic transmission (A/T) wiring harness assembly. The TFT sensor is a resistor, or thermistor, which changes value based on temperature. The sensor has a negative-temperature coefficient. This means that as the temperature increases, the resistance decreases, and as the temperature decreases the resistance increases. The vehicle control module (VCM) supplies a 5-volt reference signal to the sensor on circuit 1227 and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the VCM detects high signal voltage. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage decreases. The VCM uses this information to control shift quality and torque converter clutch apply.

If the VCM detects a continuous short to ground in the TFT sensor or signal circuit, then DTC P0712 sets. DTC P0712 is a type D DTC.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The TFT sensor indicates a voltage of less than 0.14 volts.
- All conditions met for 15 seconds.

Action Taken When the DTC Sets

- The VCM does not illuminates the malfunction indicator lamp (MIL).
- The VCM commands increased line pressure.
- The VCM freezes shift adapts.
- The VCM determines a TFT default transmission temperature (TFT) using the following matrix:
  - If the engine run time is less than 60 seconds then default TFT equals the intake air temperature (IAT), plus 5 degrees.
  - If the engine coolant temperature (ECT) is less than 85°C (185°F) then default TFT equals IAT plus 10 degrees.
  - If the ECT is 85–110°C (185–230°F) then default TFT equals ECT plus 10 degrees.
  - If the ECT is greater than 110°C (230°F) then default TFT is set to 140°C (284°F) and transmission shift pattern is in hot mode
  - If ECT and TFT DTCs are both set then default TFT is 140°C (284°F).
- The VCM stores DTC P0712 in VCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from VCM history.
- The VCM clears the DTC from VCM history if the vehicle completes 40 warm-up cycles without a non-emission-related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the wiring at the VCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Test the TFT sensor at various temperatures in order to evaluate the possibility of a skewed (mis-scaled) sensor. Use the *Temperature vs Resistance* table. A skewed sensor may cause delayed garage shifts or TCC complaints.
- Verify the customer driving habits, trailer towing, weight, or towing in OVERDRIVE.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests for a short to ground or a skewed sensor by verifying the fault still exists.
4. This step tests for an internal fault within the transmission by creating an open.
6. This step inspects circuit 1227 of the A/T wiring harness assembly for being shorted to ground.

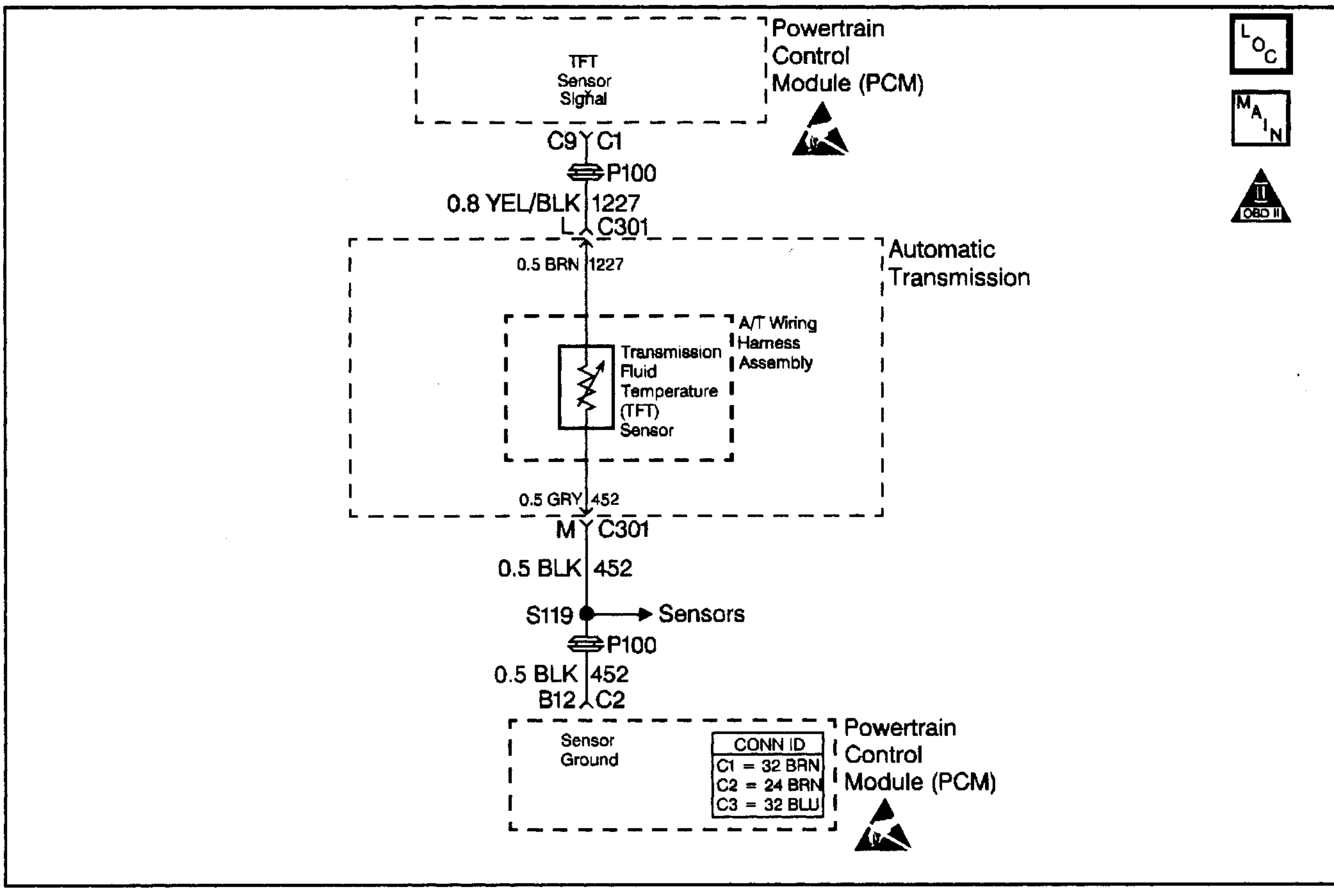
DTC P0712 TFT Sensor Circuit Low Input (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the VCM. 3. Record the Failure Records. 4. Clear the DTCs. Does the scan tool display a TFT Sensor signal voltage less than the specified value?	0.14 volts	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way harness connector. Multiple DTCs may set. 3. Turn the ignition switch to the RUN position. Does the scan tool display a TFT Sensor signal voltage greater than the specified value?	4.92 volts	*Go to Step 5*	*Go to Step 9*

DTC P0712 TFT Sensor Circuit Low Input (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition OFF. 2. Install the *J 39775* jumper harness on the transmission side of the 20-way connector (Automatic Transmission Connector End View). 3. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the resistance between terminals L and M. Refer to *Electronic Component Description.* Is the resistance within the specified values?	16 kΩ at 10°C (50°F) to 133 Ω at 110°C (230°F)	*Go to Step 6*	*Go to Step 7*
6	Measure the resistance between terminal L and a good ground on the transmission case. Is the resistance less than the specified value?	50 kΩ	*Go to Step 10*	Go to Diagnostic Aids
7	1. Disconnect the TFT Sensor from the A/T wiring harness. 2. Measure the resistance between terminals L and M of the jumper harness. Is the resistance less than the specified value?	50 kΩ	*Go to Step 10*	*Go to Step 8*
8	Replace the TFT sensor. Refer to A/T Fluid Temperature Sensor Replacement. Is the replacement complete?	—	*Go to Step 13*	—
9	Inspect circuit 1227 (YEL/BLK) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a short to ground condition found?	—	*Go to Step 13*	*Go to Step 11*
10	Replace the A/T wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 13*	—
11	Inspect the VCM for faulty connections. Was the condition found?	—	*Go to Step 13*	*Go to Step 12*
12	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 13*	—
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Be sure the TFT Sensor indicates a voltage greater than 0.16 volts for 15 seconds. 4. Select Specific DTC. 5. Enter DTC P0712. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0712 TFT Sensor Circuit Low Input (L57/L65 EFI)



370934

Circuit Description

The automatic transmission fluid temperature (TFT) sensor is part of the 4L80–E automatic transmission (A/T) wiring harness assembly. The TFT sensor is a resistor, or thermistor, which changes value based on temperature. The sensor has a negative-temperature coefficient. This means that as the temperature increases, the resistance decreases, and as the temperature decreases the resistance increases. The powertrain control module (PCM) supplies a 5-volt reference signal to the sensor on circuit 1227 and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the PCM detects high signal voltage. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage decreases. The PCM uses this information to control shift quality and torque converter clutch apply.
DTC P0712 is a type D DTC.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The TFT sensor indicates a voltage less than 0.14 volts.
- All conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM commands increased line pressure.
- The PCM freezes shift adapts.
- The PCM determines a TFT default transmission fluid temperature (TFT) using the following matrix:
  - If the engine run time is less than 60 seconds then default TFT equals the intake air temperature (IAT), plus 5 degrees.
  - If the engine coolant temperature (ECT) is less than 85°C (185°F) then default TFT equals IAT plus 10 degrees.
  - If the ECT is 85°–110°C (185°–230°F) then default TFT equals ECT plus 10 degrees.
  - If the ECT is greater 110°C (230°F) then default TFT is set to 140°C (284°F) and transmission shift pattern is in Hot Mode
  - If ECT and TFT DTCs are both set then default TFT is 140°C (284°F).
- The PCM stores DTC P0712 in PCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from PCM history.
- The PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission-related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or APP sensor DTCs that are present. Then inspect for any transmission DTCs that may have reset.
- DTC P0218 may set approximately 600 seconds after DTC P0712 has set. Follow the diagnostic table for DTC P0712 before proceeding to the diagnostic table for DTC P0218.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests for a short to ground or a "skewed" sensor by verifying the fault still exists.
4. This step tests for an internal fault within the transmission by creating an open.
6. This step inspects circuit 1227 of the A/T wiring harness assembly for being shorted to ground.

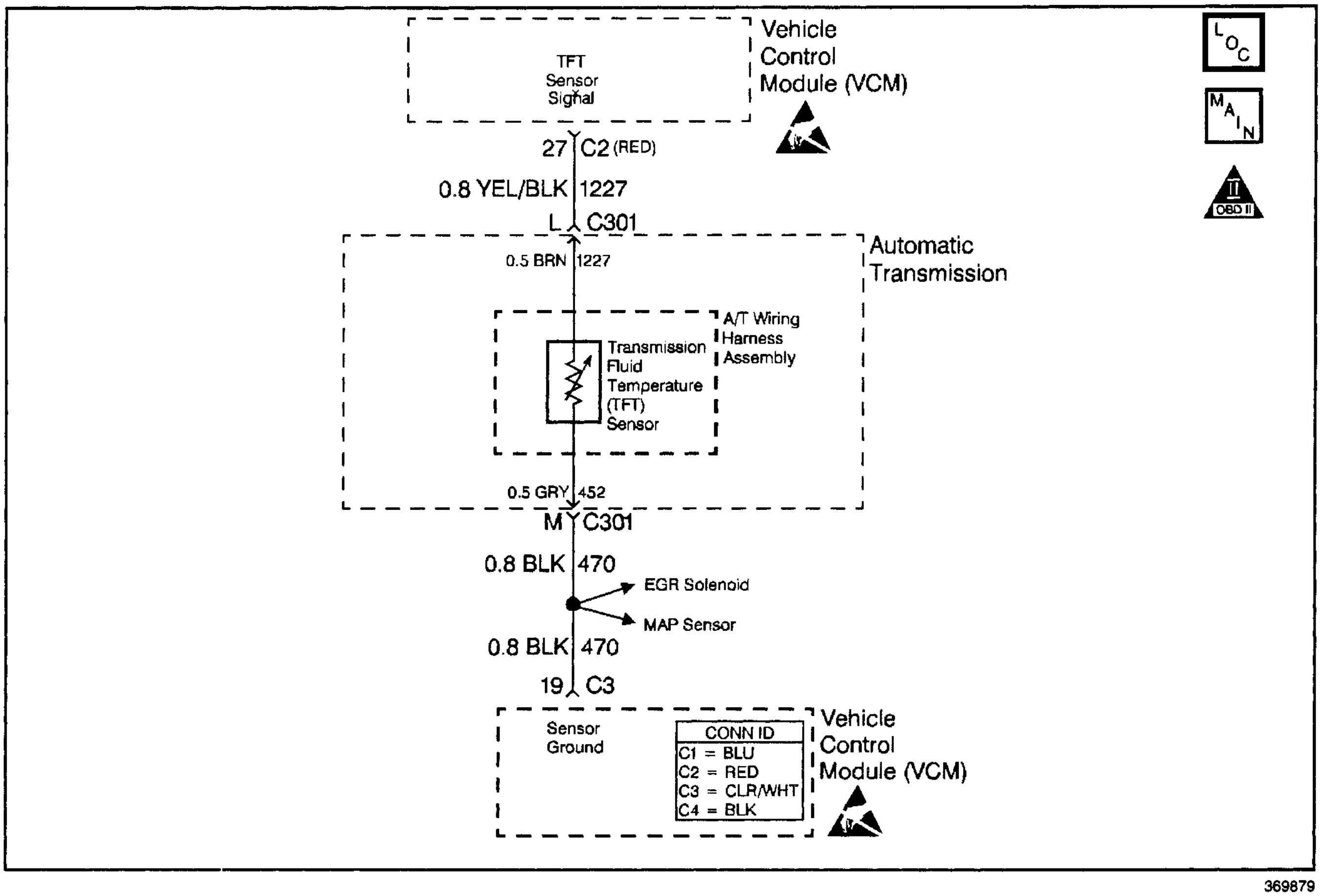
DTC P0712 TFT Sensor Circuit Low Input (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases Failure Records from the PCM. 3. Record the Failure Records. 4. Clear the DTC. Does the scan tool display a TFT sensor voltage less than the specified value?	0.13 volts	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way harness connector (Multiple DTCs will set). 3. Turn the ignition ON. Does the scan tool display a TFT sensor voltage greater than the specified value?	4.92 volts	*Go to Step 5*	*Go to Step 9*
5	1. Turn the ignition OFF. 2. Install the *J 39775* jumper harness on the transmission side of the 20-way connector. 3. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the resistance between terminals L and M. Refer to *Electronic Component Description.* Is the resistance within specified values?	16,000Ω at 10°C (50°F) to 133Ω at 110°C (230°F)	*Go to Step 6*	*Go to Step 7*

DTC P0712 TFT Sensor Circuit Low Input (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
6	Measure the resistance between terminal L and a good ground on the transmission case. Is the resistance less than the specified value?	50k Ω	*Go to Step 10*	Go to Diagnostic Aids
7	1. Disconnect the TFT sensor from the A/T wiring harness assembly. 2. Measure the resistance between terminals L and M of the jumper harness. Is the resistance less than the specified value?	50k Ω	*Go to Step 10*	*Go to Step 8*
8	Replace the TFT sensor. Refer to A/T Fluid Temperature Sensor Replacement. Is the replacement complete?	—	*Go to Step 13*	—
9	Inspect circuit 1227 (YEL/BLK) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 13*	*Go to Step 11*
10	Replace the automatic transmission wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 13*	—
11	Inspect the PCM for faulty connections. Was the condition found?	—	*Go to Step 13*	*Go to Step 12*
12	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 13*	—
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Be sure the TFT sensor indicates a voltage greater than 0.16 volts for 10 seconds. 4. Select Specific DTC. 5. Enter DTC P0712. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0713 TFT Sensor Circuit High Input (L29/L31/L35)



Circuit Description

The automatic transmission fluid temperature (TFT) sensor is part of the 4L80–E automatic transmission (A/T) wiring harness assembly. The TFT sensor is a resistor, or thermistor, which changes value based on temperature. The sensor has a negative-temperature coefficient. This means that as the temperature increases, the resistance decreases, and as the temperature decreases the resistance increases. The vehicle control module (VCM) supplies a 5-volt reference signal to the sensor on circuit 1227 and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the VCM detects high signal voltage. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage decreases. The VCM uses this information to control shift quality and torque converter clutch apply.

If the VCM detects a continuous open or short to the power in the TFT signal circuit or the TFT sensor, then DTC P0713 sets. DTC P0713 is a type D DTC.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The TFT sensor indicates a voltage greater than 4.94 volts.
- All conditions met for 400 seconds.

Action Taken When the DTC Sets

- The VCM does not illuminate the malfunction indicator lamp (MIL).
- The VCM commands increased line pressure.
- The VCM freezes shift adapts.
- The VCM determines a TFT default transmission temperature (TFT) using the following matrix:
  - If the engine run time is less than 60 seconds then default TFT equals the intake air temperature (IAT), plus 5 degrees.
  - If the engine coolant temperature (ECT) is less than 85°C (185°F) then default TFT equals IAT plus 10 degrees.
  - If the ECT is 85–110°C (185–230°F) then default TFT equals ECT plus 10 degrees.
  - If the ECT is greater than 110°C (230°F) then default TFT is set to 140°C (284°F) and transmission shift pattern is in hot mode.
  - If ECT and TFT DTCs are both set then default TFT is 140°C (284°F).
- The VCM stores DTC P0713 in VCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from VCM history.
- The VCM clears the DTC from VCM history if the vehicle completes 40 warm-up cycles without a non-emission-related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the harness for a faulty connection or an open in circuit 1227.
- Inspect the wiring at the VCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- High voltage (B+) in circuit 1227 may also damage the TFT sensor.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- The scan tool displays the transmission fluid temperature (TFT) in degrees. After the transmission operates, the temperature rises steadily to about 100°C (212°F). The temperature then stabilizes.
- Test the TFT sensor at the various temperatures in order to evaluate the possibility of a skewed (mis-scaled) sensor. Use the *Temperature vs Resistance* table. A skewed sensor may cause firm shifts or TCC complaints.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests for higher than normal circuit voltage which may also damage the TFT sensor.
6. This step simulates a TFT sensor DTC P0712. If the VCM recognizes the low signal voltage (high temperature), and the scan tool displays 146°C (295°F) or greater, the VCM and the wiring are OK.
7. This step verifies a condition in the TFT sensor circuit inside the transmission.
8. This step inspects the TFT sensor and the automatic transmission (A/T) wiring harness assembly for an open. Circuit 470 becomes circuit 452 inside the transmission.

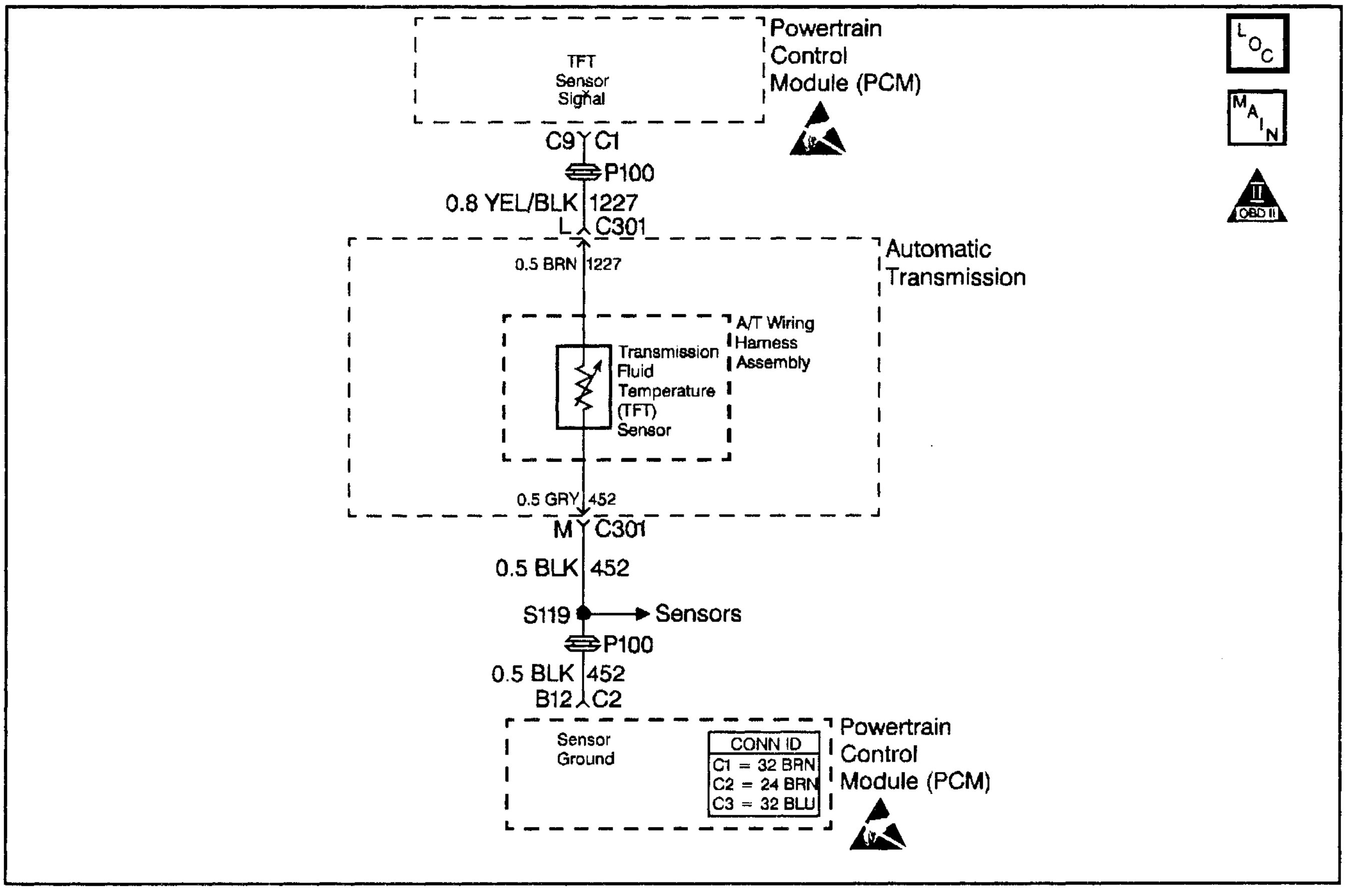
DTC P0713 TFT Sensor Circuit High Input (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	—
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the VCM. 3. Record the Failure Records. Does the scan tool display a TFT sensor signal voltage greater than the specified value?	4.92 volts	*Go to Step 4*	Go to Diagnostic Aids
4	**Important:** Refer to *Test Description* for information about Step 4. Does the scan tool display a TFT voltage greater than the specified value?	5.1 volts	*Go to Step 11*	*Go to Step 5*
5	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector. 3. Install the *J 39775* jumper harness on the engine side of the 20-way connector. 4. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the voltage between jumper harness terminal L and a good ground. Refer to *Electronic Component Description.* 5. Turn the ignition switch to the RUN position. Is the voltage within the specified value?	4.9–5.0 Volts	*Go to Step 6*	*Go to Step 10*
6	1. Turn the ignition OFF. 2. Install a fused jumper wire between terminals L and M on the transmission 20-way connector (Automatic Transmission Connector End View). 3. Turn the ignition switch to the RUN position. Is the scan tool TFT sensor signal voltage less than the specified value?	0.2 volts	*Go to Step 7*	*Go to Step 12*
7	1. Turn the ignition OFF. 2. Install the *J 39775* to the transmission side of the 20-way connector (Automatic Transmission Connector End View). 3. Using the *J 39200* DMM, measure the resistance between terminals L and M. Refer to *Electronic Component Description.* Is the resistance within the specified values?	16 kΩ at 10°C (50°F) to 133 Ω at 110°C (230°F)	Go to Diagnostic Aids	*Go to Step 8*

DTC P0713 TFT Sensor Circuit High Input (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Remove the transmission oil pan. Refer to *AT Fluid/Filter Changing.* 2. Inspect the A/T wiring harness assembly for an open in circuits 1227 (YEL/BLK) and 452 (GRY). Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open condition found?	—	*Go to Step 9*	*Go to Step 15*
9	Replace the A/T wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 16*	—
10	Inspect circuit 1227 (YEL/BLK) for high resistance or an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 13*
11	Inspect circuit 1227 (YEL/BLK) for a short to voltage B+. Was the condition found?	—	*Go to Step 16*	*Go to Step 13*
12	Inspect circuit 470 (BLK) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 13*
13	Inspect the VCM for faulty or intermittent connections. Was the condition found?	—	*Go to Step 16*	*Go to Step 14*
14	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 16*	—
15	Replace the TFT sensor. Refer to A/T Fluid Temperature Sensor Replacement. Is the replacement complete?	—	*Go to Step 16*	—
16	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle so that the TFT Sensor indicates a voltage less than 4.92 volts for 400 seconds (6.8 minutes). 4. Select Specific DTCs. 5. Enter DTC P0713. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0713 TFT Sensor Circuit High Input (L57/L65 EFI)



370934

Circuit Description

The automatic transmission fluid temperature (TFT) sensor is part of the 4L80–E automatic transmission (A/T) wiring harness assembly. The TFT sensor is a resistor, or thermistor, which changes value based on temperature. The sensor has a negative-temperature coefficient. This means that as the temperature increases, the resistance decreases, and as the temperature decreases the resistance increases. The powertrain control module (PCM) supplies a 5-volt reference signal to the sensor on circuit 1227 and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the PCM detects high signal voltage. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage decreases. The PCM uses this information to control shift quality and torque converter clutch apply.
DTC P0713 is a type D DTC.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The TFT sensor indicates a voltage greater than 4.94 volts.
- All conditions are met for 400 seconds.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM commands increased line pressure.
- The PCM freezes shift adapts.
- The PCM determines a TFT default transmission fluid temperature (TFT) using the following matrix:
  - If the engine run time is less than 60 seconds then default TFT equals the intake air temperature (IAT), plus 5 degrees.
  - If the engine coolant temperature (ECT) is less than 85°C (185°F) then default TFT equals IAT plus 10 degrees.
  - If the ECT is 85°–110°C (185°–230°F) then default TFT equals ECT plus 10 degrees.
  - If the ECT is greater 110°C (230°F) then default TFT is set to 140°C (284°F) and transmission shift pattern is in Hot Mode.
  - If ECT and TFT DTCs are both set then default TFT is 140°C (284°F).
- The PCM stores DTC P0713 in PCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from PCM history.
- The PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission-related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or TP sensor DTCs that are present. Then inspect for any transmission DTCs that may have reset.
- DTC P0218 may set approximately 600 seconds after DTC P0713 has set. Follow the diagnostic table for DTC P0713 before proceeding to the diagnostic table for DTC P0218.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests for higher than normal circuit voltage which may also damage the TFT sensor.
6. This step simulates a TFT sensor DTC P0712. If the PCM recognizes the low signal voltage (high temperature), and the scan tool displays 146°C (295°F) or greater, the PCM and the wiring are OK.
7. This step verifies a problem in the TFT sensor circuit.
8. This step inspects the TFT sensor and the A/T wiring harness assembly for an open.

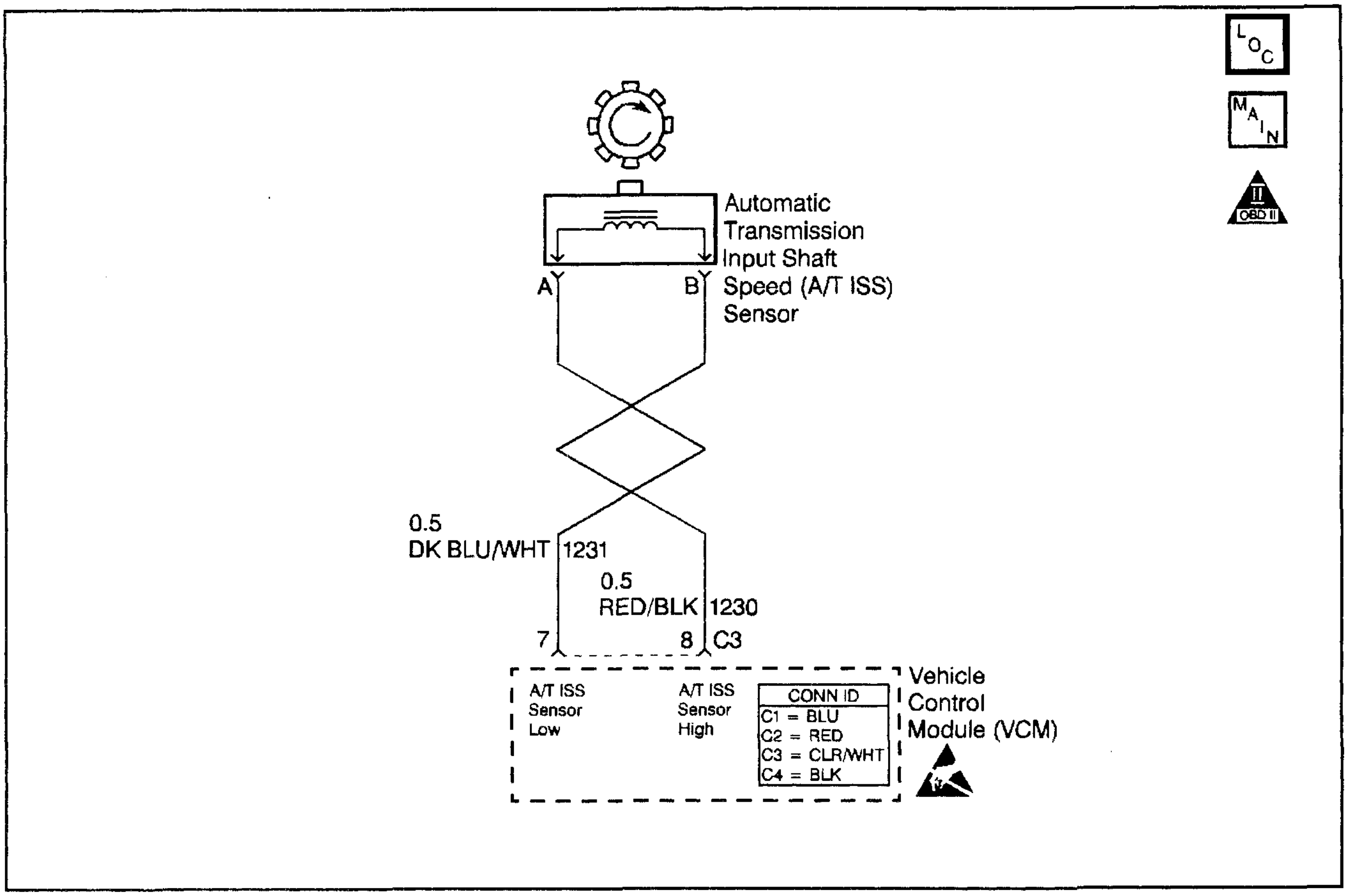
DTC P0713 TFT Sensor Circuit High Input (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM. 3. Record the Failure Records. 4. Clear the DTC. Does the scan tool display a TFT sensor signal voltage greater than the specified value?	4.92 volts	*Go to Step 4*	Go to Diagnostic Aids
4	**Important:** Refer to *Test Description* for information about Step 4. Does the scan tool display a TFT voltage greater than the specified value?	5.1 volts	*Go to Step 11*	*Go to Step 5*
5	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (multiple DTCs will set). 3. Install the *J 39775* jumper harness on the engine side of the 20-way connector. 4. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the voltage between jumper harness terminal L and a good ground. 5. Turn the ignition switch to the RUN position. Is the voltage within the specified value?	4.9–5.0 volts	*Go to Step 6*	*Go to Step 10*
6	1. Turn the ignition OFF. 2. Install a fused jumper wire between terminals L and M of the transmission 20-way connector. 3. Turn the ignition switch to the RUN position. Is the TFT sensor signal voltage less than the specified value?	0.2 volts	*Go to Step 7*	*Go to Step 12*
7	1. Turn the ignition OFF. 2. Install the *J 39775* to the transmission side of the 20-way connector. 3. Using the *J 39200* DMM, measure the resistance between terminals L and M. Refer to *Electronic Component Description.* Is the resistance within the specified values?	16 kΩ at 10°C (50°F) to 133 Ω at 110°C (230°F)	Go to Diagnostic Aids	*Go to Step 8*
8	1. Remove the transmission oil pan. Refer to Transmission Pan Removal. 2. Inspect the automatic transmission (A/T) wiring harness assembly for an open in circuit 1227. 3. Inspect for an open in A/T wiring harness assembly circuit 452 (BLK). Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open condition found?	—	*Go to Step 9*	*Go to Step 15*

DTC P0713 TFT Sensor Circuit High Input (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the A/T wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 16*	—
10	Inspect circuit 1227 (YEL/BLK) for high resistance or an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 13*
11	Inspect circuit 1227 (YEL/BLK) for a short to voltage B+. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 13*
12	Inspect circuit 452 (BLK) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 13*
13	Inspect the PCM for faulty or intermittent connections. Was the condition found?	—	*Go to Step 16*	*Go to Step 14*
14	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 16*	—
15	Replace the TFT sensor. Refer to A/T Fluid Temperature Sensor Replacement. Is the replacement complete?	—	*Go to Step 16*	—
16	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle so that the TFT sensor indicates a voltage less than 4.92 volts for 10 seconds. 4. Select Specific DTC. 5. Enter DTC P0713. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0716 Input Speed Sensor Circuit Intermittent (L29/L31/L35)



369881

Circuit Description

The automatic transmission input (shaft) speed (A/T ISS) sensor provides transmission input speed to the vehicle control module (VCM). The A/T ISS sensor is a permanent magnet (PM) generator. The sensor mounts into the transmission case and maintains a slight air gap between the sensor and the forward clutch housing. The PM generator produces an AC voltage as the forward clutch housing rotor teeth pass through the sensor's magnetic field. The AC voltage level increases as the turbine shaft speed increases. The VCM converts the AC voltage into a digital signal. The VCM determines actual turbine speed using the digital signal. The VCM uses the input speed to calculate torque converter slip speed, and gear ratios.

When the VCM detects an unreasonably large change in the input speed, in a very short period of time, then DTC P0716 sets. DTC P0716 is a type D DTC. For California emissions vehicles, DTC P0716 is a type B DTC.

Conditions for Running the DTC

- No throttle position (TP) sensor DTCs P0121, P0122 or P0123.
- No OSS DTC P0502 or P0503.
- No A/T ISS DTC P0717.
- No shift solenoid DTC P0751 or P0753.
- The TP is greater than 10%.
- The vehicle speed is greater than 25 mph.
- The engine is running greater than 475 RPM for more than 7 seconds.

Conditions for Setting the DTC

- The transmission is not in PARK or NEUTRAL.
- The input speed varies by 1300 RPM for greater than 5 seconds.

Action Taken When the DTC Sets

- For California emission vehicles only, the VCM illuminates the malfunction indicator lamp (MIL).
- The VCM commands maximum line pressure.
- The VCM freezes shift adapts.
- The VCM stores DTC PO716 in VCM History.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.

- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the wiring at the VCM, the OSS connector and all other circuit connecting points for the following:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
  - The A/T ISS sensor harness being near the DIS components or the ignition wires.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step tests for proper operation to the A/T ISS sensor.
6. This step tests for proper A/T ISS circuit operation up to the VCM connections. Remove the fuel pump relay in order to eliminate a flooding condition during this step.

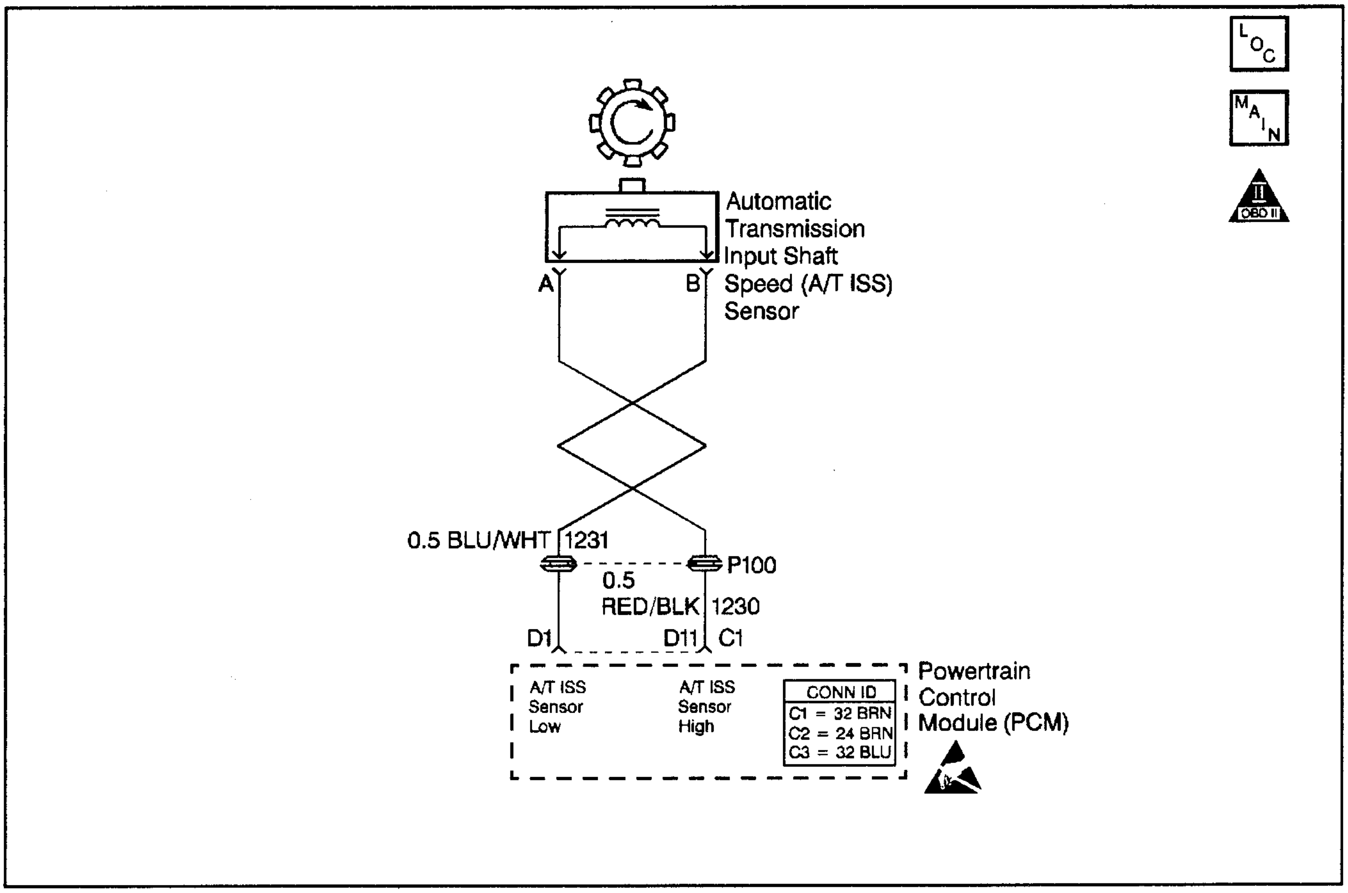
DTC P0716 Input Speed Sensor Circuit Intermittent (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. 5. With the vehicle in PARK, start the engine. 6. Raise the drive wheels. 7. Select *Scan Tool* Transmission ISS and Engine RPM. 8. Observe the Transmission ISS while slowly accelerating the engine to 2000 RPM and hold. Is the *Scan Tool* Transmission ISS more than 800 RPM?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn the ignition switch to the OFF position. 2. Remove the connector from the A/T ISS sensor. 3. Remove the A/T ISS sensor from the transmission. 4. Using the *J 39200* digital multimeter (DMM) and *J 35616* connector test adaptor kit, measure the resistance of the A/T ISS sensor. Is the sensor resistance within the specified value?	1042–2088 Ω	*Go to Step 4*	*Go to Step 9*

DTC P0716 Input Speed Sensor Circuit Intermittent (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
4	Inspect circuit 1230 (RED/BLK) for an open or a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open or short to ground condition found?	—	*Go to Step 7*	*Go to Step 5*
5	Inspect circuit 1231 (DK BLU/WHT) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open condition found?	—	*Go to Step 8*	*Go to Step 6*
6	1. Re-install the A/T ISS sensor in the transmission. 2. Reconnect the A/T ISS sensor connector to the sensor. 3. Disconnect the VCM connector C3 (additional DTCs may set). 4. Probe across terminal C3–7 and terminal C3–8 at VCM connector C3 with *J 39200* DMM on AC voltage. 5. Remove the fuel pump relay. Refer to *Automatic Transmission Components (Gasoline)* (Gas). 6. With the vehicle in PARK, crank the engine. Is the voltage above the specified value?	0.5 volts AC	*Go to Step 10*	Go to Diagnostic Aids
7	Repair the open or short to ground in circuit 1230 (RED/BLK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 12*	—
8	Repair the open in circuit 1231 (DK BLU/WHT). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 12*	—
9	Replace the ISS sensor. Refer to *Vehicle Speed Sensor Replacement*. Is the replacement complete?	—	*Go to Step 12*	—
10	1. Inspect the VCM pins for corrosion or reduced terminal tension. 2. Inspect the C3 connector terminals for corrosion or reduced terminal tension. Was the condition found?	—	*Go to Step 12*	*Go to Step 11*
11	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 12*	—
12	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • The engine must be running and A/T ISS must be greater than 500 RPM. • The VCM must see an input speed change of less than 200 RPM for 1 second. 4. Select Specific DTCs. 5. Enter DTC P0716. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0716 Input Speed Sensor Circuit Intermittent (L57/L65 EFI)



370937

Circuit Description

The automatic transmission input (shaft) speed (A/T ISS) sensor provides transmission input speed to the powertrain control module (PCM). The A/T ISS sensor is a permanent magnet (PM) generator. The sensor mounts into the transmission case and maintains a slight air gap between the sensor and the forward clutch housing. The PM generator produces an AC voltage as the forward clutch housing rotor teeth pass through the sensor's magnetic field. The AC voltage level increases as the turbine shaft speed increases. The PCM converts the AC voltage into a digital signal. The PCM determines actual turbine speed using the digital signal. The PCM uses the input speed to calculate torque converter slip speed, and gear ratios.

When the PCM detects an unrealistically large change in input speed, then DTC P0716 sets. DTC P0716 is a type B DTC.

Conditions for Running the DTC

- No A/T ISS sensor DTC P0717.
- No OSS sensor DTCs P0722 or P0723
- No shift solenoid DTCs P0751 or P0753.
- System voltage is 7.5–18.0 volts.
- Engine speed is greater than 475 RPM.
- The APP angle is greater than 15%.
- Transmission fluid pressure manual valve position switch is not indicating PARK or NEUTRAL.
- The vehicle speed is greater than 32 Km/h (20 mph).

Conditions for Setting the DTC

The A/T ISS varies by more than 1200 RPM within 4 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM commands maximum line pressure.
- The PCM freezes shift adapts.
- The PCM stores DTC P0716 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.
- First diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests for proper operation of the A/T ISS sensor.
8. This step tests for proper A/T ISS sensor circuit operation up to the PCM connections. You remove the fuel solenoid fuse in order to eliminate a flooding condition during this step.
10. This step tests for a short to ground in the A/T ISS sensor circuit.

DTC P0716 Input Speed Sensor Circuit Intermittent (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. Turn the ignition to the RUN position with the engine OFF. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC 5. With the transmission in PARK, start the engine. 6. Observe the scan tool, Transmission ISS. 7. Run the engine to 2000 RPM and hold the engine speed steady. Does the Transmission ISS RPM change by more than 1200 RPM at steady engine speed?	—	*Go to Step 3*	*Go to Diagnostic Aids*
3	1. Turn the ignition to the OFF position. 2. Disconnect the A/T ISS sensor harness connector from the A/T ISS sensor. 3. Using the *J 35616-A* connector test adapter kit select the OHMS scale. Connect the *J 39200* digital multimeter (DMM) to the A/T ISS sensor terminals. Is the A/T ISS sensor resistance within the specified value?	1042–2088Ω	*Go to Step 4*	*Go to Step 15*

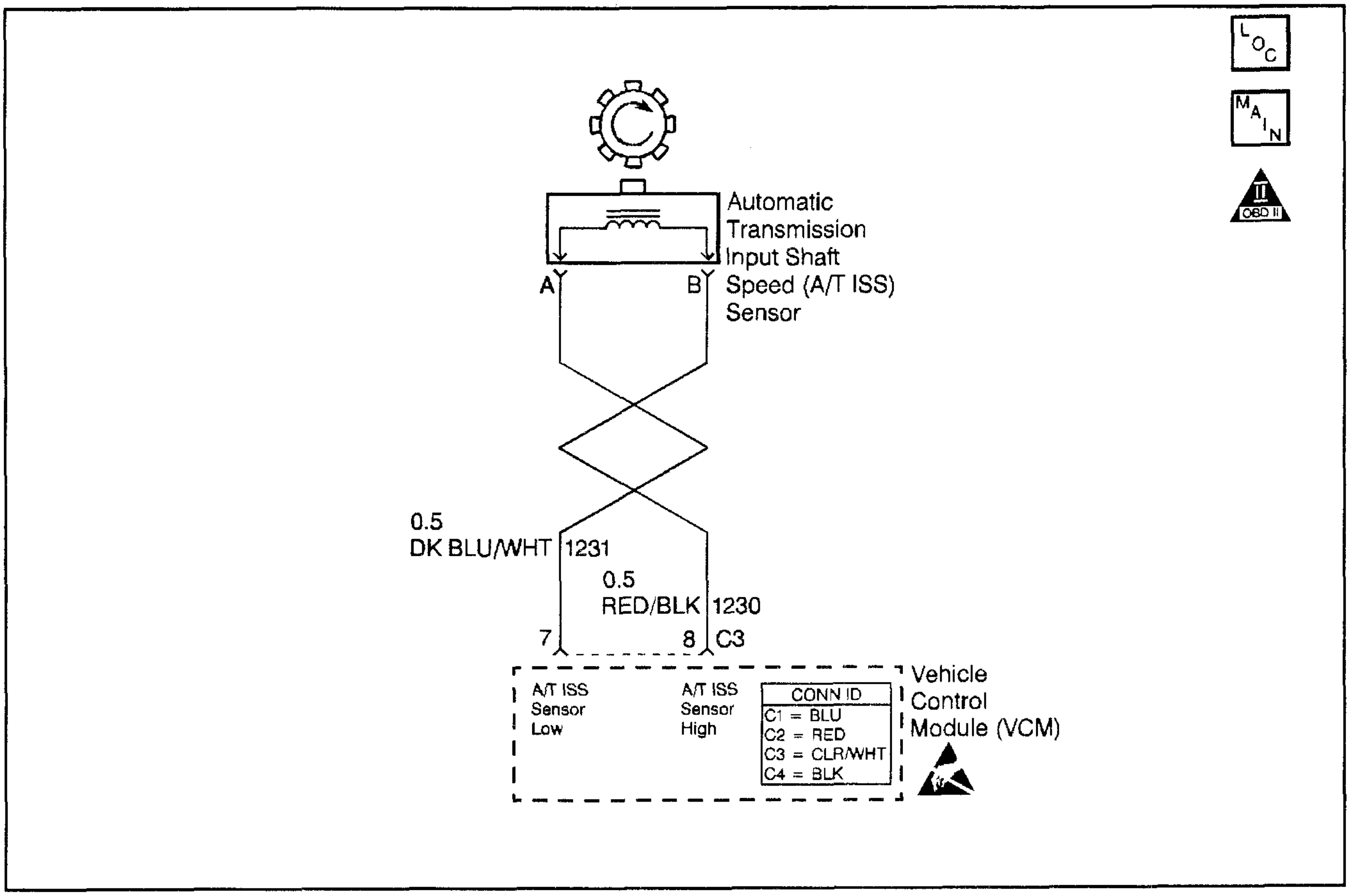
DTC P0716 Input Speed Sensor Circuit Intermittent (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
4	1. With the *J 39200* DMM connected to the ISS sensor, select AC Volts. 2. With the transmission in PARK, start the engine. 3. Run the engine to 2000 RPM and hold the engine speed steady. Is the DMM voltage steady?	Greater than 10.0 volts AC	*Go to Step 5*	*Go to Step 15*
5	1. Turn the ignition to the OFF position. 2. Select DC Volts on the *J 39200* DMM. 3. Turn the ignition to the RUN position with the engine OFF. 4. Measure the voltage at both A/T ISS sensor harness connector terminals A and B to a good ground. Is either voltage reading greater than the specified value?	10.5 volts DC	*Go to Step 6*	*Go to Step 8*
6	1. Inspect circuit 1230 (RED/BLK) for a short to power. 2. Inspect circuit 1231 (BLU/WHT) for a short to power. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 7*	*Go to Step 16*
7	Repair the short to power in circuits 1230 (RED/BLK) and/or 1231 (BLU/WHT) Is the repair complete?	—	*Go to Step 18*	—
8	1. Reconnect the A/T ISS harness connector to the A/T ISS sensor. 2. Turn the ignition to the OFF position. 3. Disconnect the PCM connector C1. 4. Connect the *J 39200* DMM on AC Volts to the C1 connector terminals D1 and D11. 5. Remove the fuel solenoid fuse in the Fuse/Relay Center. Refer to *Automatic Transmission Components (Diesel).* 6. Turn the ignition to the RUN position and crank the engine while observing the *J 39200* DMM. Is the voltage greater than the specified value and steady?	0.4 volts AC	*Go to Step 16*	*Go to Step 9*
9	With the *J 39200* DMM measure the resistance between terminals D1 and D11 of the PCM connector C1. Is the circuit resistance within the specified value?	1042–2088 Ω	*Go to Step 10*	*Go to Step 12*
10	1. Measure the resistance from both PCM connector C1 terminals D1 and D11 to a good ground. 2. Measure the resistance from PCM connector C1 terminal D11 to a good ground. Is either resistance less than the specified value?	50 kΩ	*Go to Step 11*	Go to Diagnostic Aids
11	Inspect circuits 1230 (RED/BLK) and 1231 (BLU/WHT) for short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 18*	—
12	Is the resistance reading from Step 9 less than the specified value?	1042–2088 Ω	*Go to Step 13*	*Go to Step 14*
13	Repair circuits 1230 (RED/BLK) and 1231 (BLU/WHT) for a short together. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 18*	—

DTC P0716 Input Speed Sensor Circuit Intermittent (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
14	1. Inspect circuit 1230 (RED/BLK) 2. Inspect circuit 1231 (BLU/WHT) for high resistance or an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 18*	—
15	Replace the A/T ISS sensor. Refer to *Vehicle Speed Sensor Replacement.* Is the replacement complete?	—	*Go to Step 18*	—
16	Inspect the PCM pins and connector terminals for corrosion or reduced terminal tension. Was the condition found?	—	*Go to Step 18*	*Go to Step 17*
17	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 18*	—
18	Perform the following procedure in order to verify the repair: 1. Select DTC. **Important:** Failure to clear codes first may cause poor engine performance and high idle at start up. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Start and run the engine greater than 475 RPM. • The PCM must see an A/T ISS change of less than 500 RPM for 1 second. 4. Select Specific DTC. 5. Enter DTC P0716. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0717 Input Speed Sensor Circuit Low Input (L29/L31/L35)



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Circuit Description

The automatic transmission input (shaft) speed (A/T ISS) sensor provides transmission input speed to the vehicle control module (VCM). The A/T ISS sensor is a permanent magnet (PM) generator. The sensor mounts into the transmission case and maintains a slight air gap between the sensor and the forward clutch housing. The PM generator produces an AC voltage as the forward clutch housing rotor teeth pass through the sensor's magnetic field. The AC voltage level increases as the turbine shaft speed increases. The VCM converts the AC voltage into a digital signal. The VCM determines actual turbine speed using the digital signal. The VCM uses the input speed to calculate torque converter slip speed, and gear ratios.

When the VCM detects a low or no input speed during high vehicle and high engine speeds, then DTC P0717 sets. DTC P0717 is a type D DTC. For California emissions vehicles, DTC P0717 is a type B DTC.

Conditions for Running the DTC

- No OSS DTC P0502 or P0503.
- No TFP manual valve position switch DTC P1810.
- TFP manual valve position switch is not PARK or NEUTRAL.
- The vehicle speed is greater than 12 mph.
- The engine runs greater than 475 RPM for at least 7 seconds, and not in fuel cutoff.

Conditions for Setting the DTC

The measured input speed is less than 25 RPM for at least 5.0 seconds.

Action Taken When the DTC Sets

- For California emissions only, the VCM illuminates the malfunction indicator lamp (MIL).
- The VCM defaults the transmission to maximum line pressure.
- The VCM freezes shift adapts.
- The VCM stores DTC P0717 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the wiring at the VCM, the OSS connector and all other circuit connecting points for the following:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
  - The A/T ISS sensor harness being near the DIS components or the ignition wires.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests for proper circuit operation up to the VCM connections. Remove the fuel pump relay in order to eliminate a flooding condition during this step.
5. This step tests for proper operation of the ISS sensor.

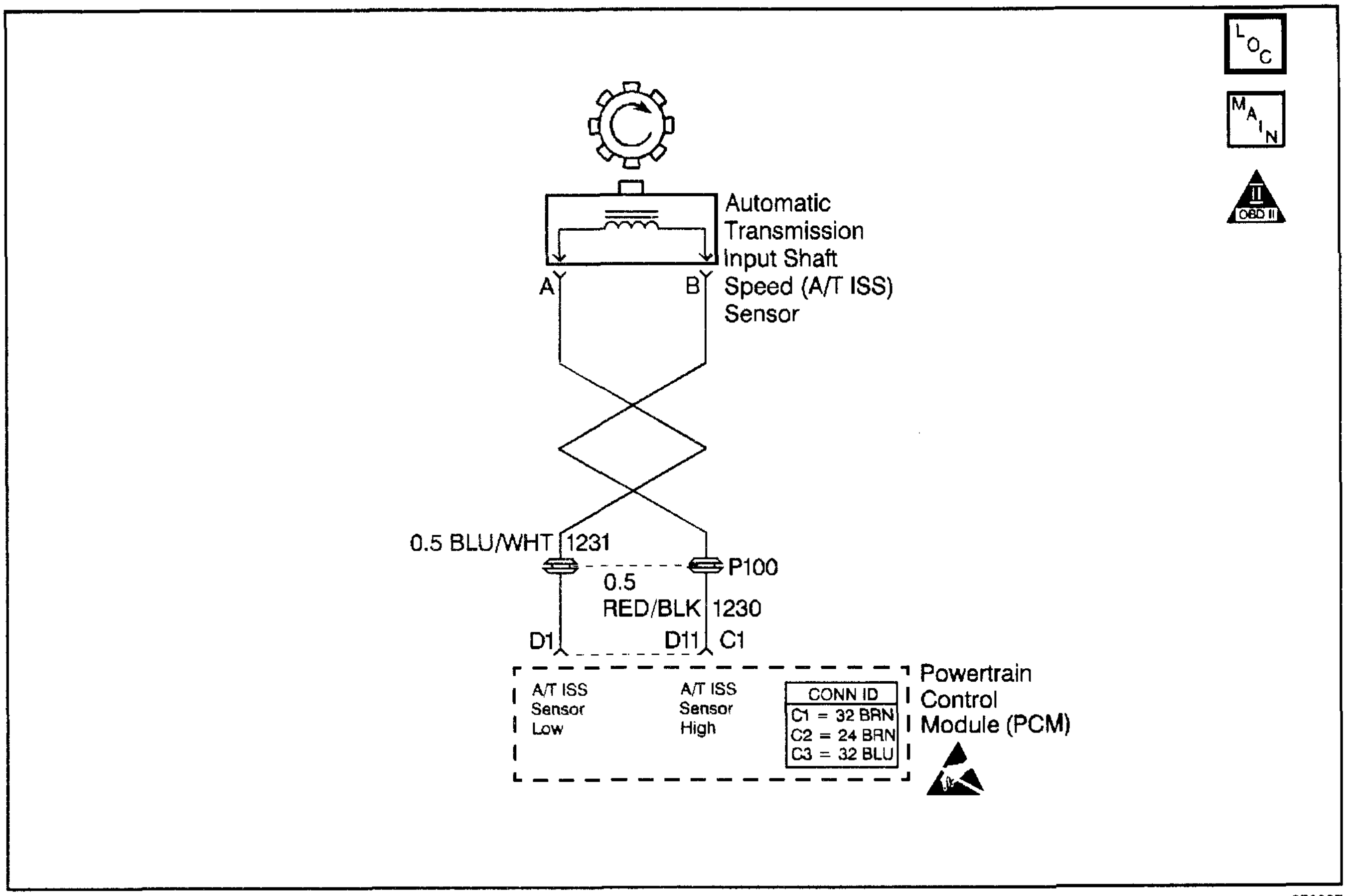
DTC P0717 Input Speed Sensor Circuit Low Input (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool*. 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. 5. With the vehicle in PARK, start the engine and idle greater than 500 RPM. 6. Select scan tool A/T ISS and engine RPM. Is the A/T ISS greater than 50 RPM?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn the ignition switch to the OFF position. 2. Disconnect the VCM connector C3 (additional DTCs may set). 3. Probe across terminal C3–7 and terminal C3–8 at VCM connector with *J 39200* digital multimeter (DMM) on AC voltage. 4. Remove the fuel pump relay. Refer to *Automatic Transmission Components (Gasoline)* (Gas). 5. With the vehicle in PARK, crank the engine. Is the voltage above the specified value?	0.5 volts AC	*Go to Step 12*	*Go to Step 4*
4	1. Turn the ignition switch to the OFF position. 2. Remove the connector from the A/T ISS sensor. 3. Using the *J 39200* DMM and *J 35616* connector test adaptor kit, measure the resistance between terminal A and terminal B of the A/T ISS sensor. Is the sensor's resistance within the specified value?	1042–2088 Ω	*Go to Step 5*	*Go to Step 11*

DTC P0717 Input Speed Sensor Circuit Low Input (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Select AC volts on the *J 39200* DMM. 2. With the vehicle in PARK, crank the engine. Is the *J 39200* DMM voltage greater than the specified value?	0.5 volts AC	*Go to Step 7*	*Go to Step 6*
6	1. Remove the A/T ISS sensor from the transmission. 2. Inspect the A/T ISS sensor. 3. Inspect the forward clutch housing for damage (rotor teeth). Was the condition found?	—	*Go to Step 14*	*Go to Step 11*
7	Inspect circuit 1230 (RED/BLK) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 8*	*Go to Step 9*
8	Repair the open or short to ground in circuit 1230 (RED/BLK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 14*	—
9	Inspect circuit 1231 (BLU/WHT) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 10*	Go to Diagnostic Aids
10	Repair the open or short to ground in circuit 1231 (BLU/WHT). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 14*	—
11	Replace the ISS sensor. Refer to *Vehicle Speed Sensor Replacement.* Is the replacement complete?	—	*Go to Step 14*	—
12	1. Inspect the VCM pins for corrosion or reduced terminal tension. 2. Inspect the VCM C3 connector terminals for corrosion or reduced terminal tension. Was the condition found?	—	*Go to Step 14*	*Go to Step 13*
13	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 14*	—
14	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • The vehicle in drive range and the engine must be running. • Vehicle speed greater than 12 MPH. • The VCM must see an input speed greater than 500 RPM for 1 second. 4. Select Specific DTC. 5. Enter DTC P0717. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0717 Input Speed Sensor Circuit Low Input (L57/L65 EFI)



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Circuit Description

The automatic transmission input (shaft) speed (A/T ISS) sensor provides transmission input speed to the powertrain control module (PCM). The A/T ISS sensor is a permanent magnet (PM) generator.
The sensor mounts into the transmission case and maintains a slight air gap between the sensor and the forward clutch housing. The PM generator produces an AC voltage as the forward clutch housing rotor teeth pass through the sensor's magnetic field. The AC voltage level increases as the turbine shaft speed increases. The PCM converts the AC voltage into a digital signal. The PCM determines actual turbine speed using the digital signal. The PCM uses the input speed to calculate torque converter slip speed, and gear ratios.

When the PCM detects a low or no input speed during high vehicle and high engine speeds, then DTC P0717 sets. DTC P0717 is a type B DTC.

Conditions for Running the DTC

- No OSS sensor DTCs P0722 or P0723.
- No TFP manual valve position switch DTC P1810.
- TFP manual valve position switch is not in PARK or NEUTRAL.
- The vehicle speed is greater than 32 km/h (20 mph).
- System voltage is 7.5–18.0 volts.
- The engine runs greater than 475 RPM 7 seconds.

Conditions for Setting the DTC

The A/T ISS is less than 50 RPM for at least 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM defaults the transmission to maximum line pressure.
- The PCM freezes shift adapts.
- The PCM stores DTC P0717 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset. If a DTC P0717 and a DTC P0730 are both present, diagnose DTC P0717 first.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step tests for proper operation of the A/T ISS sensor.
4. This step tests for proper A/T ISS sensor and circuit operation. Remove the fuel solenoid fuse in order to eliminate a flooding condition.

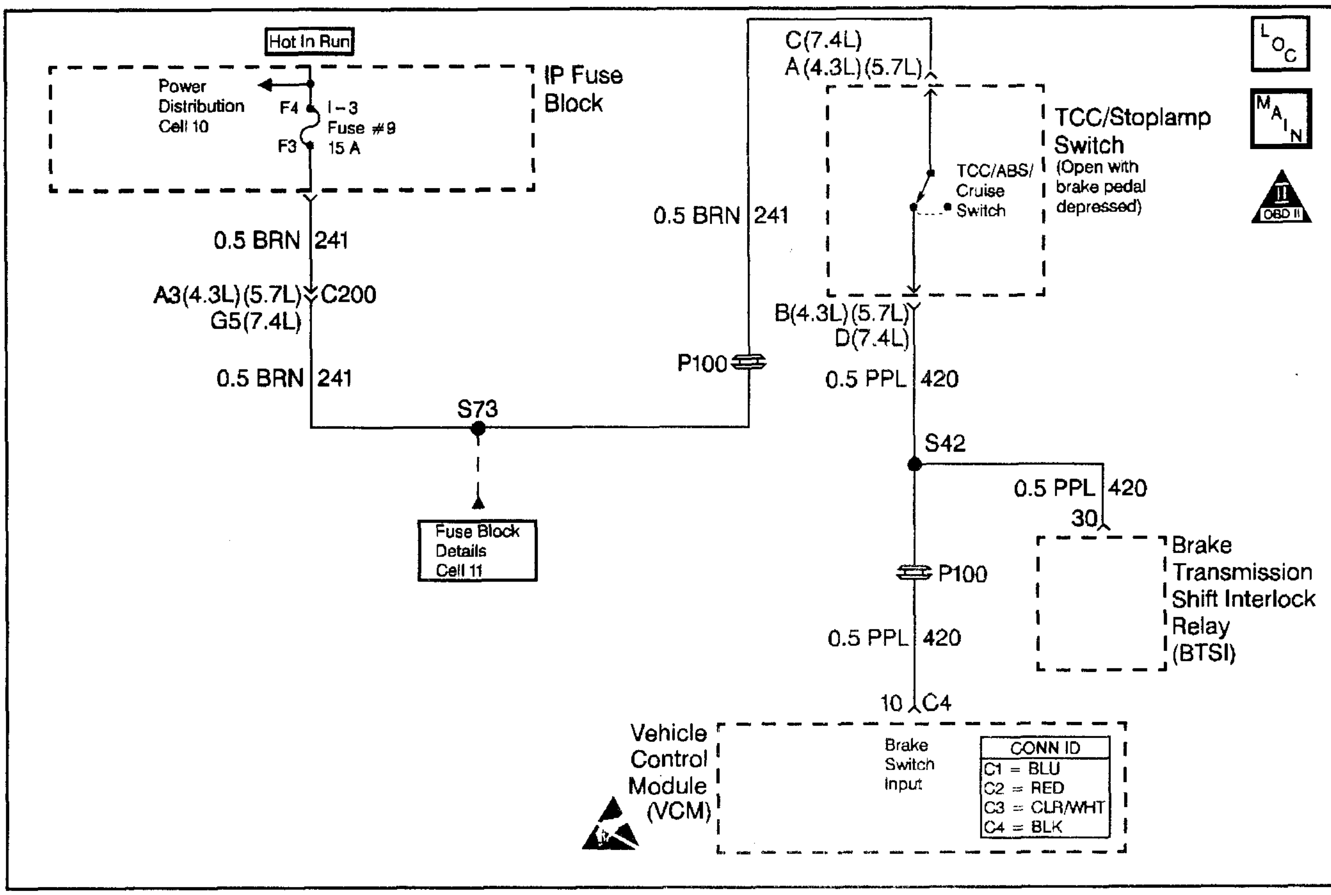
DTC P0717 Input Speed Sensor Circuit Low Input (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool*. 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. **Important:** If a DTC P0730 is also present, refer to the Diagnostic Aids. 5. Disconnect the wiring harness at the input shaft speed sensor. 6. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, connect the test leads to the A/T ISS sensor terminals. Set the *J 39200* DMM selector on OHMS. 7. Measure the resistance of the A/T ISS sensor. Is the resistance within the specified value?	1042–2088 Ω	*Go to Step 3*	*Go to Step 9*
3	1. With the leads on the A/T ISS sensor, select AC volts on the *J 39200* DMM. 2. With the selector in PARK position, start the engine and idle above 700 RPM. Is the DMM voltage greater than the specified value?	3.0 volts AC	*Go to Step 4*	*Go to Step 9*

DTC P0717 Input Speed Sensor Circuit Low Input (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Reconnect the A/T ISS harness to the sensor. 2. With the ignition in the OFF position, disconnect the PCM connector C1. 3. Probe across terminals D11 and D1 at the PCM connector C1 with the *J 39200* DMM on AC voltage. 4. Remove the fuel solenoid fuse located in the Fuse/Relay Center. Refer to *Automatic Transmission Components (Diesel).* 5. With the vehicle in PARK, turn the ignition to the switch to the START position in order to crank the engine. Is the voltage greater than the specified value?	0.4 volts AC	*Go to Step 10*	*Go to Step 5*
5	Inspect circuit 1230 (RED/BLK) for an open, a short to B+ or a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 7*	*Go to Step 6*
6	Inspect circuit 1231 (BLU/WHT) for a short to B+ or an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 8*	Go to Diagnostic Aids
7	Repair the condition in circuit 1230 (RED/BLK). Refer to *Wiring Repairs* in Wiring Systems. Was the condition corrected?	—	*Go to Step 12*	—
8	Repair the condition in circuit 1231 (BLU/WHT). Refer to *Wiring Repairs* in Wiring Systems. Was the condition corrected?	—	*Go to Step 12*	—
9	Replace the input shaft speed sensor. Refer to *Vehicle Speed Sensor Replacement.* Is the replacement complete?	—	*Go to Step 12*	—
10	Inspect the PCM connector C1 pins and the terminals. Was the condition found?	—	*Go to Step 12*	*Go to Step 11*
11	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 12*	—
12	Perform the following procedure in order to verify the repair: 1. Select DTC. **Important:** Failure to clear codes before continuing may cause poor engine performance and high idle at start up. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Start and run the engine above 500 RPM. • Drive the vehicle greater than 12 mph. • The PCM must see a Transmission ISS greater than 500 RPM for 1 second. 4. Select Specific DTC. 5. Enter DTC P0717. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0719 Brake Switch Circuit Low Input (L29/L31/L35)



Circuit Description

The TCC/Stoplamp switch indicates the brake pedal status. The normally-closed TCC/Stoplamp switch supplies a B+ signal on circuit 420 to the vehicle control module (VCM). The signal voltage circuit opens when the brakes are applied.

If the VCM detects an open TCC/Stoplamp switch circuit during accelerations, then DTC P0719 sets. DTC P0719 is a type D DTC.

Conditions for Running the DTC

- No OSS DTC P0502 or DTC P0503.
- The following sequence of events occurs:
  1. The vehicle speed is less than 8 km/h (5 mph).
  2. Then the vehicle speed is 8–40 km/h (5–25 mph) for 3.5 seconds.
  3. Then the vehicle speed is greater than 40 km/h (25 mph) for 6 seconds.

Conditions for Setting the DTC

- All conditions are met for 8 occurrence.
- The VCM detects an open TCC/Stoplamp switch/circuit (0 volts) for 15 minutes.

Action Taken When the DTC Sets

- The VCM does not illuminate the malfunction indicator lamp (MIL).
- For TCC scheduling, the VCM disregards the brake switch state if the TP sensor is greater than 1% and the vehicle speed is greater than 20 MPH.
- The VCM stores DTC P0719 in VCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from VCM history.
- The VCM clears the DTC from VCM history if the vehicle completes 40 warm-up cycles without a non-emission-related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the wiring at the VCM, the TCC/Stoplamp switch and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Ask about the customer's driving habits and any unusual driving conditions he or she might have, such as stop and go traffic or expressway driving.
- Inspect the brake switch for proper mounting and adjustment.
- Inspect for the most current calibration ID and the latest bulletins.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests for TCC/Stoplamp switch voltage to the VCM connector.
7. This step isolates the TCC/Stoplamp switch as a source for setting the DTC.
10. This step tests for a short to ground in circuit 241 (ignition voltage) to the TCC/Stoplamp switch.
12. This step tests for a short to ground in circuit 420, from the TCC/Stoplamp switch to the VCM.
13. This step isolates the VCM as a source for causing the fuse to open.

DTC P0719 Brake Switch Circuit Low Input (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the VCM. 3. Record the Failure Records. 4. Clear the DTCs. 5. Select the TCC Brake Switch on the *Scan Tool.* 6. Do not apply the brake pedal. Does the *Scan Tool* TCC/Stoplamp Switch indicate CLOSED, when the brake pedal is not applied?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Remove the brake fuse. 2. Inspect the brake fuse for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Is the fuse open?	—	*Go to Step 10*	*Go to Step 4*

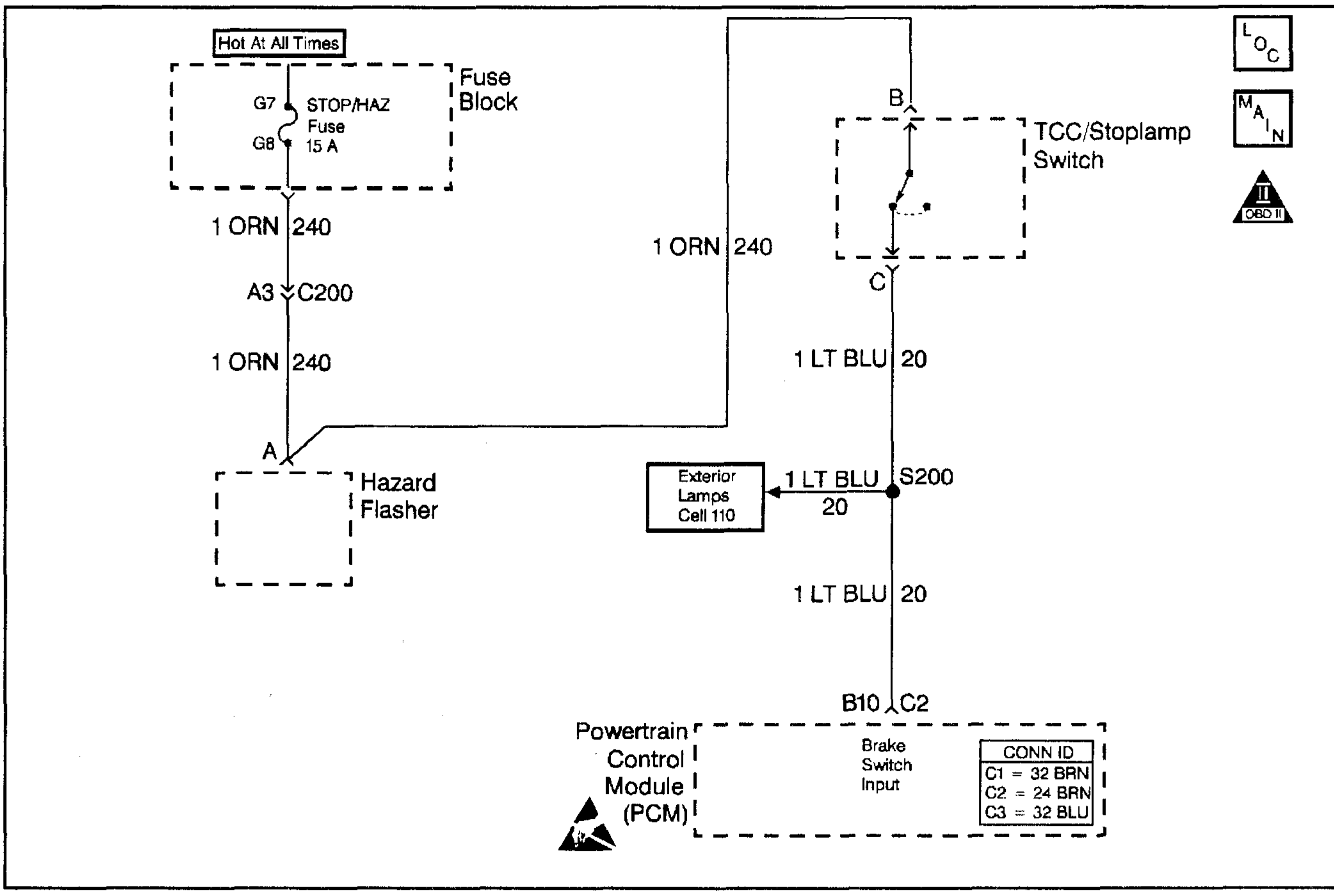
DTC P0719 Brake Switch Circuit Low Input (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition switch to the OFF position. 2. Disconnect the VCM connector C4 from the VCM. 3. Connect a 12-volt test lamp to a good ground. 4. Using the *J 35616* connector test adaptor kit and the 12-volt test lamp, probe terminal C4-10. 5. Re-install the fuse. 6. Turn the ignition switch to the RUN position. 7. Do not apply the brake pedal. Is the test lamp on?	—	*Go to Step 15*	*Go to Step 5*
5	1. Turn the ignition key to the OFF position. 2. Remove the connector from the TCC/Stoplamp switch. 3. Use the *J 39200* digital multimeter (DMM) to measure B+ voltage at terminal D of the brake switch connector. 4. Turn the ignition switch to the RUN position. Is B+ voltage indicated?	10-13 volts	*Go to Step 7*	*Go to Step 6*
6	**Important:** The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Electrical Diagnosis for complete circuit distribution. Inspect circuit 241 (BRN) for an open. Was an open condition found?	—	*Go to Step 17*	—
7	1. Turn the key to the RUN position. 2. Install a fused jumper wire from terminal C to terminal D of the TCC/Stoplamp switch connector. 3. Probe the VCM connector terminal C4-10 with the test lamp. Is the test lamp on?	—	*Go to Step 9*	*Go to Step 8*
8	**Important:** The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Electrical Diagnosis for complete circuit distribution. Inspect circuit 420 (PPL) for an open. Was an open condition found?	—	*Go to Step 17*	—
9	Replace the TCC/Stoplamp switch. Refer to Stoplamp Switch Replacement. Is the replacement complete?	—	*Go to Step 17*	—
10	1. Turn the key to the RUN position. 2. Apply and hold the brake pedal. 3. Install a new fuse while keeping the brake pedal applied. Does the fuse open with the brake pedal applied?	—	*Go to Step 11*	*Go to Step 12*
11	**Important:** The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Electrical Diagnosis for complete circuit distribution. Inspect circuit 241 (BRN) for a short to ground. Was the short to ground condition found?	—	*Go to Step 17*	—
12	With the key in the RUN position, release the brake pedal. Does the fuse open when the brake pedal is released?	—	*Go to Step 13*	Go to Diagnostic Aids

DTC P0719 Brake Switch Circuit Low Input (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
13	1. Disconnect the VCM connector C4 from the VCM (additional DTCs may set). 2. Turn the key to the RUN position. 3. Install a new fuse. 4. Do not apply the brake pedal. Does the fuse open?	—	*Go to Step 14*	*Go to Step 15*
14	**Important:** The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Electrical Diagnosis for complete circuit distribution. Inspect circuit 420 (PPL) for a short to ground. Did you find and correct the short to ground condition?	—	*Go to Step 17*	—
15	Inspect the VCM terminals for corrosion or reduced terminal tension. Was a shorted condition found?	—	*Go to Step 17*	*Go to Step 16*
16	Replace the VCM. Refer to VCM Replacement/Programming with KS calibration prom. Is the replacement complete?	—	*Go to Step 18*	—
17	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 18*	—
18	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • With the engine OFF, turn the ignition switch to the RUN position. • The brake pedal is not applied. • Select TCC Brake Sw. on the *Scan Tool.* Does the TCC Brake Sw. indicate CLOSED when the brake pedal is not applied, then indicate OPEN when the brake pedal is applied?	—	System OK	*Go to Step 1*

DTC P0719 Brake Switch Circuit Low Input (L57/L65 EFI)



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Circuit Description

The normally open TCC/Stoplamp switch indicates brake pedal status to the powertrain control module (PCM). Applying the brake pedal closes the switch, supplying voltage to the PCM. Releasing the brake pedal interrupts voltage to the PCM.

If the PCM detects an open TCC/Stoplamp switch (stuck OFF) during decelerations, then DTC P0719 sets. DTC P0719 is a type D DTC.

Conditions for Running the DTC

- No OSS sensor DTC P0722 or P0723.
- The following sequence of events occur:
  1. the vehicle speed is greater than 32 km/h (20 mph) for 6 seconds.
  2. Then the vehicle speed is 8–32 km/h (5–20 mph) for 3 seconds.
  3. Then the vehicle speed is less than 8 km/h (5 mph).
  4. DTC P0719 has not passed.

Conditions for Setting the DTC

- All conditions are met for ten occurrences.
- The PCM detects a closed TCC/Stoplamp switch/circuit (0 volts).

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM stores DTC P0719 in PCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from PCM history.
- The PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission-related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the TCC/Stoplamp switch connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Ask about the customer's driving habits and any unusual driving conditions he or she might have, such as stop and go traffic or expressway driving.
- A short in the stoplamp circuit will cause the fuse to open.
- Inspect the TCC/Stoplamp switch for proper mounting and adjustment.
- First diagnose and clear any engine DTCs codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step isolates the TCC/Stoplamp switch as a source for setting the DTC.
5. This step tests for a short to ground between the fuse and the TCC/Stoplamp switch.
7. This step tests for a short to ground in circuit 17.
8. This step removes the PCM from circuit 17 as the source of a short to ground.

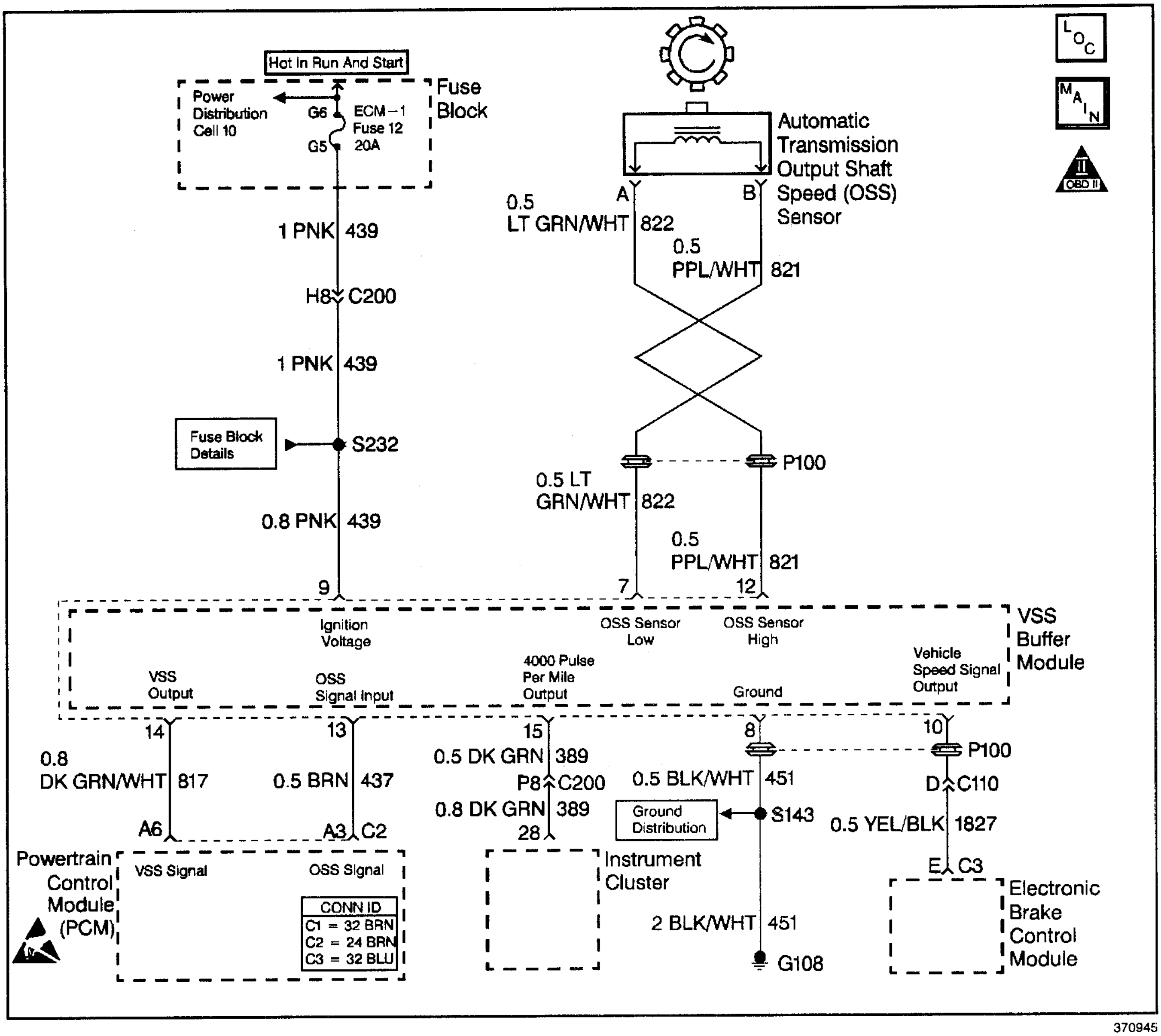
DTC P0719 Brake Switch Circuit Low Input (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Failure Records from the PCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Select the TCC/Brake switch on the scan tool. 6. Disconnect the TCC/Stoplamp switch connector from the TCC/Stoplamp switch. 7. Connect a test lamp from cavity B (circuit 240 ORN) of the TCC/Stoplamp switch connector to a known good ground. Is the test lamp ON?	—	*Go to Step 3*	*Go to Step 4*
3	Install a fused jumper wire from terminal B (circuit 240 ORN) to terminal C (circuit 20 LT BLU) of the TCC/Stoplamp switch connector. Did the scan tool TCC/Brake switch status change from Open to Closed?	—	*Go to Step 10*	*Go to Step 12*
4	1. Remove the Stop/Hazard fuse. 2. Inspect the Stop/Hazard fuse for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Is the fuse open?	—	*Go to Step 5*	*Go to Step 11*
5	Replace the Stop/Hazard fuse. Does the replacement fuse open immediately?	—	*Go to Step 6*	*Go to Step 7*
6	Inspect circuit 240 (ORN) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 13*	—

DTC P0719 Brake Switch Circuit Low Input (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Reconnect the TCC/Stoplamp switch connector. 2. Apply the brake pedal. Does the fuse open immediately?	—	*Go to Step 8*	Go to Diagnostic Aids.
8	1. Disconnect the PCM connector C2. 2. Replace the Stop/Hazard fuse. 3. Apply the brake pedal. Does the fuse open immediately?	—	*Go to Step 9*	*Go to Step 14*
9	Inspect circuit 20 (LT BLU) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 13*	—
10	Replace the stoplamp switch. Refer to Stoplamp Switch Replacement. Is the replacement complete?	—	*Go to Step 16*	—
11	Inspect circuit 240 (ORN) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 13*	—
12	Inspect circuit 20 (LT BLU) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 13*	*Go to Step 14*
13	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 16*	—
14	Inspect the PCM pins, the connector terminals, and the wiring for corrosion or shorting together. Was the condition found?	—	*Go to Step 16*	*Go to Step 15*
15	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 16*	—
16	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • With the engine OFF, the ignition switch is in the RUN position. • Depress the brake pedal. • The scan tool TCC Brake Switch status must indicate Closed (12 volts) for 2 seconds. 4. Select Specific DTC. 5. Enter DTC P0719. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0722 Output Speed Sensor Circuit Low (L57/L65 EFI)



Circuit Description

The speed sensor circuit consists of a magnetic induction type sensor, which is the output shaft speed (OSS) sensor, a vehicle speed sensor (VSS) buffer module, and wiring. Gear teeth pressed onto the output shaft carrier assembly induce an alternating voltage into the sensor. This signal transmits to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module also converts the AC OSS sensor signal into a 40 pulse per revolution (PPR) 5-volt DC square wave form signal on circuit 437 to indicate transmission output speed.

When the powertrain control module (PCM) detects a low output speed when the vehicle has a high engine speed in a drive gear range, then DTC P0722 sets. DTC P0722 is a type B DTC.

Conditions for Running the DTC

- No MAP DTCs P0106, P0107 or P0108.
- No TFP manual valve position switch DTC P1810.
- The APP angle is greater than 10%.
- The engine torque must be 108–642 N·m (80–475 lb ft).
- Engine speed is greater than 475 RPM for 7 seconds.
- The engine speed is less than 3,800 RPM.
- The A/T ISS sensor speed is greater than 1,500 RPM.
- The transmission is not in PARK or NEUTRAL.
- System voltage is 8.0–18.0 volts.

Conditions for Setting the DTC

The OSS sensor speed is less than 25 RPM for at least 3.5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM commands to maximum line pressure.
- The PCM freezes shift adapts.
- The PCM defaults to the calculated output speed value using the input shaft speed sensor values.
- The PCM stores DTC P0722 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the A/T OSS and the VSS buffer module connectors, and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change. It may be necessary to drive the vehicle.
- Inspect the speed sensor wiring for contact with sharp metal edges.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step verifies the fault condition.
3. This step tests sensor integrity.
9. This step verifies power and ground to the VSS buffer module.
15. This step verifies the PCM input controlled by the speed buffer.

DTC P0722 Output Speed Sensor Circuit Low (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. 5. Raise the drive wheels and support the axle assembly. 6. Start the engine and place the transmission in D1 range. 7. Gradually increase the wheel speed. Does the transmission OSS increase with the drive wheel speed?	—	Go to Diagnostic Aids	*Go to Step 3*

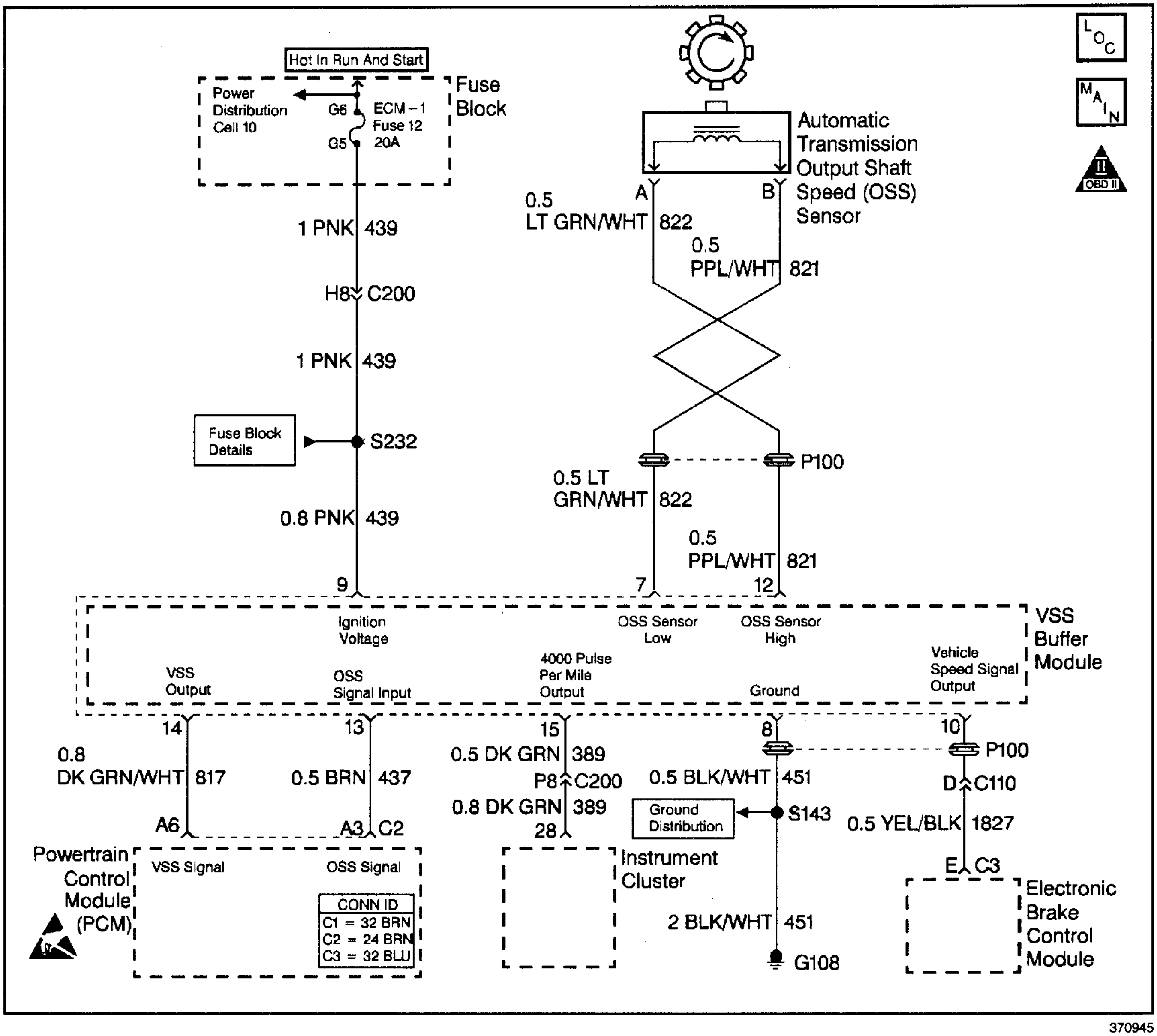
DTC P0722 Output Speed Sensor Circuit Low (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition OFF. 2. Disconnect the OSS sensor connector from the OSS sensor. 3. Connect a *J 39200* digital multimeter (DMM) on AC voltage scale between terminals A and B at the OSS sensor. 4. Start the engine, and place the transmission in D1 range 5. With the wheels turning, slowly accelerate to 2000 engine RPM. Is the voltage greater than the specified value?	2.0 AC volts at 2,000 RPM	*Go to Step 4*	*Go to Step 18*
4	1. Reconnect the OSS sensor connector to the OSS sensor. 2. Disconnect the VSS buffer harness from the VSS buffer. 3. Using the *J 39200* DMM measure the voltage between terminals 7 and 12 of the speed buffer harness connector. 4. Start the engine, and place the transmission in D1. 5. With the wheels turning, slowly accelerate engine speed to 2000 RPM. Is the voltage greater than the specified value?	2.0 volts AC at 2,000 RPM	*Go to Step 7*	*Go to Step 5*
5	1. Inspect circuit 821 (PPL/WHT) for an open. 2. Inspect circuit 822 (LT GRN/WHT) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 6*
6	1. Inspect circuit 821 (PPL/WHT) for a short to ground. 2. Inspect circuit 822 (LT GRN/WHT) for a short to ground. 3. Inspect circuits 821 (PPL/WHT) and 822 (LT GRN/WHT) for a short together. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	Go to Diagnostic Aids
7	1. Turn the ignition to the OFF position. 2. Measure the voltage between terminal 9 of the VSS buffer connector and a good ground with the *J 39200* DMM on DC volts. 3. Turn the ignition to the RUN position. Is the voltage greater than the specified value?	10.5 volts DC	*Go to Step 9*	*Go to Step 8*
8	Inspect the ignition feed circuit 439 (PNK) for high resistance or an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 21*	—
9	With the key to the RUN position, measure the voltage between terminals 8 and 9 of the VSS buffer connector. Is the voltage greater than the specified value?	10.5 volts DC	*Go to Step 11*	*Go to Step 10*
10	Inspect the VSS buffer module ground circuit 451 (BLK/WHT) for high resistance or an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 21*	—

DTC P0722 Output Speed Sensor Circuit Low (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
11	With the connector off of the speed buffer and the key in the RUN position, measure the voltage between terminal 13 of the VSS buffer harness connector and a good ground. Is the voltage within the specified value?	4.8–5.2 volts DC	*Go to Step 15*	*Go to Step 12*
12	Is the voltage in Step 11 greater than the specified voltage?	5.2 volts DC	*Go to Step 14*	*Go to Step 13*
13	Inspect circuit 437 (BRN) for continuity or a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 21*	*Go to Step 17*
14	Inspect circuit 437 (BRN) for a short to power. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 21*	*Go to Step 17*
15	1. Reconnect the VSS buffer harness connector to the speed buffer module. 2. With the *J 39200* DMM set on DC volts and on a good ground, back probe terminal 13 of the VSS buffer module. 3. Start the engine, and place the transmission in D1. 4. With the wheels turning, slowly accelerate the engine speed to 2000 RPM. Is the voltage within the specified values?	1.5–3.5 volts DC	*Go to Step 17*	*Go to Step 19*
16	1. Repair circuit 821 (PPL/WHT). 2. Repair circuit 822 (LT GRN/WHT). Refer to *Wiring Repairs* in Wiring Systems. Was the condition corrected?	—	*Go to Step 21*	—
17	Inspect the PCM for faulty or intermittent connections. Was the condition found?	—	*Go to Step 21*	*Go to Step 20*
18	Replace the OSS sensor. Refer to *Vehicle Speed Sensor Replacement.* Is the replacement complete?	—	*Go to Step 22*	—
19	Replace the VSS buffer module. Refer to *Vehicle Speed Signal Buffer Replacement* in Engine Controls. Is the replacement complete?	—	*Go to Step 22*	—
20	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 22*	—
21	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 22*	—
22	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle under steady acceleration above 10% APP. • The PCM must see an output speed greater than 500 RPM for 1 second. 4. Select Specific DTC. 5. Enter DTC P0722. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0723 Output Speed Sensor Circuit Intermittent (L57/L65 EFI)



Circuit Description

The speed sensor circuit consists of a magnetic induction type sensor, which is the output shaft speed (OSS) sensor, a vehicle speed sensor (VSS) buffer module, and wiring. Gear teeth pressed onto the output shaft carrier assembly induce an alternating voltage into the sensor. This signal transmits to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module also converts the alternating current (AC) OSS signal into a 40 pulse per revolution (PPR) 5-volt DC square wave form signal on circuit 437 to indicate transmission output speed.

If the PCM detects an unrealistically large change in the output shaft speed (OSS) sensor reading, then DTC P0723 sets. DTC P0723 is a type B DTC.

Conditions for Running the DTC

- No TFP manual valve position switch DTC P1810.
- No TFP manual valve position switch change for greater than 6 seconds.
- The engine must be running more than 475 RPM for at least 7 seconds.
- System voltage is 8.0–18.0 volts.

Conditions for Setting the DTC

The OSS RPM decrease is greater than 1000 RPM while in a DRIVE gear for at least 3.5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM commands to maximum line pressure.
- The PCM freezes shift adapts.
- The PCM defaults to the calculated output speed value using the ISS sensor values.
- The PCM stores DTC P0723 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the A/T OSS, the VSS buffer module connectors and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- It may be necessary to drive the vehicle.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step verifies the fault condition.
4. This step verifies the OSS sensor and circuit output to the VSS buffer module.
7. This step tests the voltage supply to the VSS buffer module.
9. This step tests the integrity of the ground circuit.

DTC P0723 Output Speed Sensor Circuit Intermittent (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. 5. Raise the drive wheels and support the axle assembly. 6. Start the engine and place the transmission in D3 range. 7. With the drive wheels rotating, slowly accelerate to 2,000 RPM and hold. Does the transmission OSS fluctuate more than the specified value?	1,000 RPM	*Go to Step 3*	Go to Diagnostic Aids

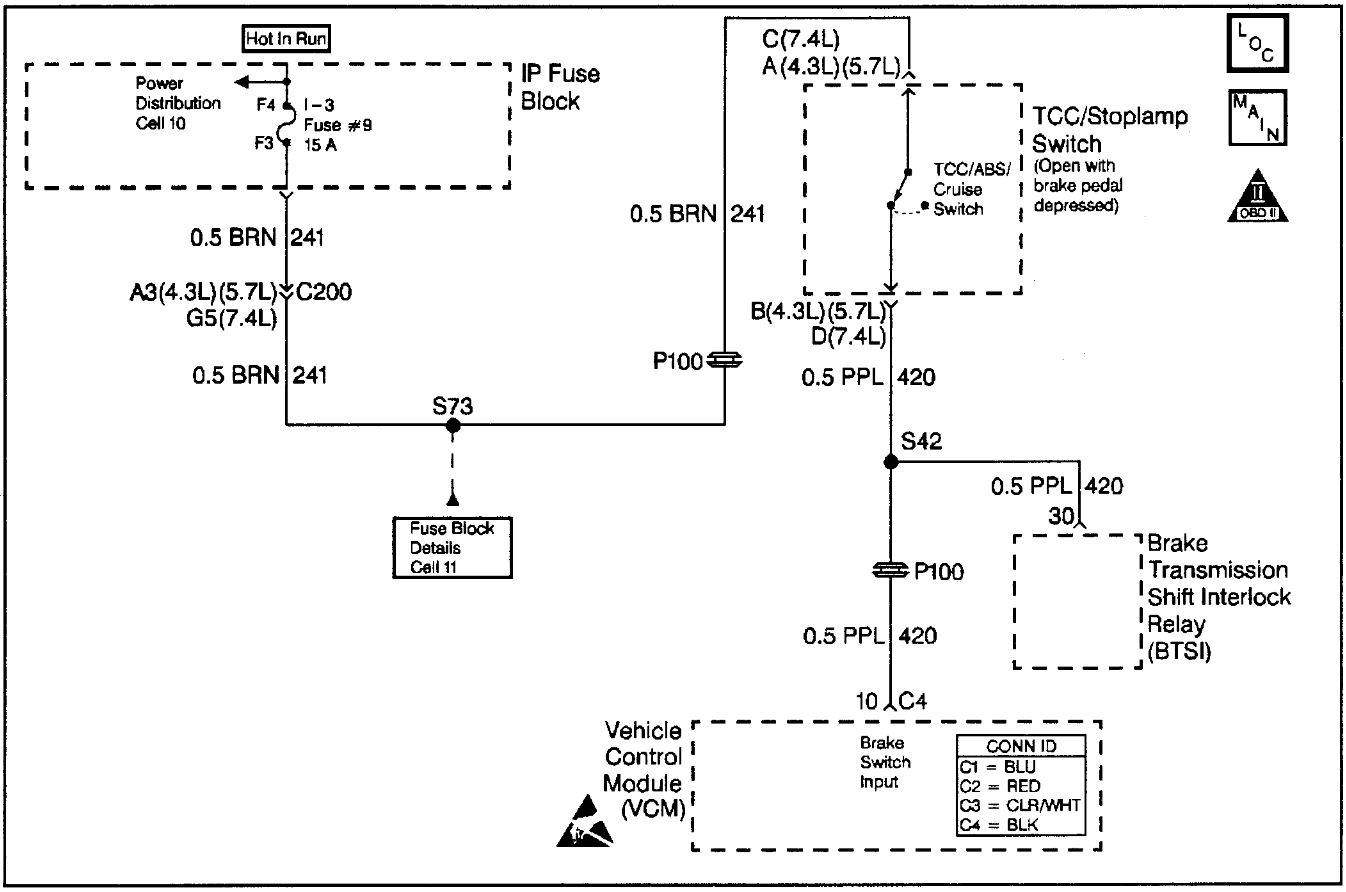
DTC P0723 Output Speed Sensor Circuit Intermittent (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition OFF. 2. Disconnect the OSS sensor connector from the OSS sensor. 3. Connect a *J 39200* digital multimeter (DMM) on AC voltage scale between terminals A and B on the OSS sensor. 4. Start the engine. 5. Place the transmission in D3 range. 6. With the wheels rotating, slowly accelerate to 2,000 engine RPM and hold. Does the voltage fluctuate at 2000 RPM?	—	*Go to Step 17*	*Go to Step 4*
4	1. Turn the ignition OFF. 2. Reconnect the OSS sensor harness to the sensor. 3. Disconnect the VSS buffer module harness connector from the component. 4. Turn the ignition to the RUN position. 5. Set the *J 39200* DMM on AC volts. 6. Connect the *J 39200* DMM between terminals 7 and 12 of the VSS buffer module harness connector. 7. Start the engine. 8. Place the transmission in D3 range. 9. With the wheels rotating, slowly accelerate to 2,000 engine RPM and hold steady. Does the voltage fluctuate at 2,000 RPM?	Greater than 2.0 volts AC	*Go to Step 5*	*Go to Step 7*
5	Inspect circuit 821 (PPL/WHT) and circuit 822 (LT GRN/WHT) for an intermittent open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 12*	*Go to Step 6*
6	Inspect circuit 821 (PPL/WHT) and circuit 822 (LT GRN/WHT) for an intermittent short together or a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 12*	—
7	1. With the engine OFF, turn the ignition switch to the RUN position. 2. Select DC volts, and measure ignition voltage at terminal 9 of the VSS buffer module harness. Is the voltage greater than the specified value?	10.5 volts DC	*Go to Step 9*	*Go to Step 8*
8	Repair the intermittent open or high resistance in circuit 439 (PNK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 21*	—
9	1. Connect the *J 39200* DMM between terminals 8 and 9 of the VSS buffer module harness connector. Set the *J 39200* DMM on DC volts. 2. Turn the ignition to the RUN position. Is the voltage greater than the specified value?	10.5 volts DC	*Go to Step 11*	*Go to Step 10*
10	Repair the open or high resistance in circuit 451 (BLK/WHT) (ground). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 21*	—
11	1. With the engine OFF, turn the ignition to the RUN position. 2. Using the *J 39200* DMM, measure the voltage at the VSS buffer connector terminal 13 Is the voltage steady and within the specified value?	4.8–5.2 volts DC	*Go to Step 13*	*Go to Step 14*

DTC P0723 Output Speed Sensor Circuit Intermittent (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
12	Repair the short in circuit 821 (PPL/WHT) and circuit 822 (LT GRN/WHT). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 21*	—
13	1. Turn the ignition to the OFF position. 2. Reconnect the VSS buffer module harness to the VSS buffer module. 3. Set the *J 39200* DMM on the DC volts scale. 4. Back probe terminal 13 of the VSS buffer harness connector with the *J 39200* DMM. 5. Start the engine. 6. Place the transmission in a D3 range. 7. With the wheels rotating, slowly accelerate the engine to 2,000 RPM and hold. Is the voltage reading steady within the specified value?	1.5–3.5 volts DC	*Go to Step 19*	*Go to Step 18*
14	Is the voltage from step 11 greater than the specified value?	5.2 Volts DC	*Go to Step 15*	*Go to Step 16*
15	Inspect for a short to power in circuit 437 (BRN). Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 21*	*Go to Step 20*
16	Inspect circuit 437 (BRN) for continuity or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 21*	*Go to Step 19*
17	Replace the OSS sensor. Refer to *Vehicle Speed Sensor Replacement.* Is the replacement complete?	—	*Go to Step 21*	—
18	Replace the VSS buffer module. Is the replacement complete?	—	*Go to Step 21*	—
19	Inspect the PCM terminals and connector for reduced terminal tension or corrosion. Was the condition found?	—	*Go to Step 21*	*Go to Step 20*
20	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 21*	—
21	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 22*	—
22	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle in D3. • The PCM must see a transmission OSS greater than 500 RPM and no change greater than 450 RPM for 1 second. 4. Select Specific DTC 5. Enter DTC P0723. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0724 Brake Switch Circuit High Input (L29/L31/L35)



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Circuit Description

The TCC/Stoplamp switch indicates the brake pedal status. The normally closed brake switch supplies a B+ signal on circuit 420 to the vehicle control module (VCM). The signal voltage circuit opens when the brakes are applied.

If the VCM detects a closed TCC/Stoplamp switch during decelerations, then DTC P0724 sets. DTC P0724 is a type D DTC.

Conditions for Running the DTC

- No OSS DTC P0502.
- The following sequence of events occurs 10 consecutive times:
  1. The vehicle speed is greater than 32 km/h (20 mph) for 6 seconds.
  2. Then the vehicle speed is 8–32 km/h (5–20 mph) for 4 seconds.
  3. Then the vehicle speed is less than 8 km/h (5 mph).

Conditions for Setting the DTC

- All conditions are met for 10 occurrence.
- The VCM detects a closed TCC/Stoplamp switch circuit (12 volts) during decelerations.

Action Taken When the DTC Sets

- The VCM does not illuminate the malfunction indicator lamp (MIL).
- The VCM stores DTC P0724 in VCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from VCM history.
- The VCM clears the DTC from VCM history if the vehicle completes 40 warm-up cycles without a non-emission-related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the wiring at the VCM, the TCC/Stoplamp switch connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Ask about the customer's driving habits and any unusual driving conditions he or she might have, such as stop and go traffic or expressway driving.
- Inspect the brake switch for proper mounting and adjustment.
- Inspect for the most current calibration ID and the latest bulletins.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

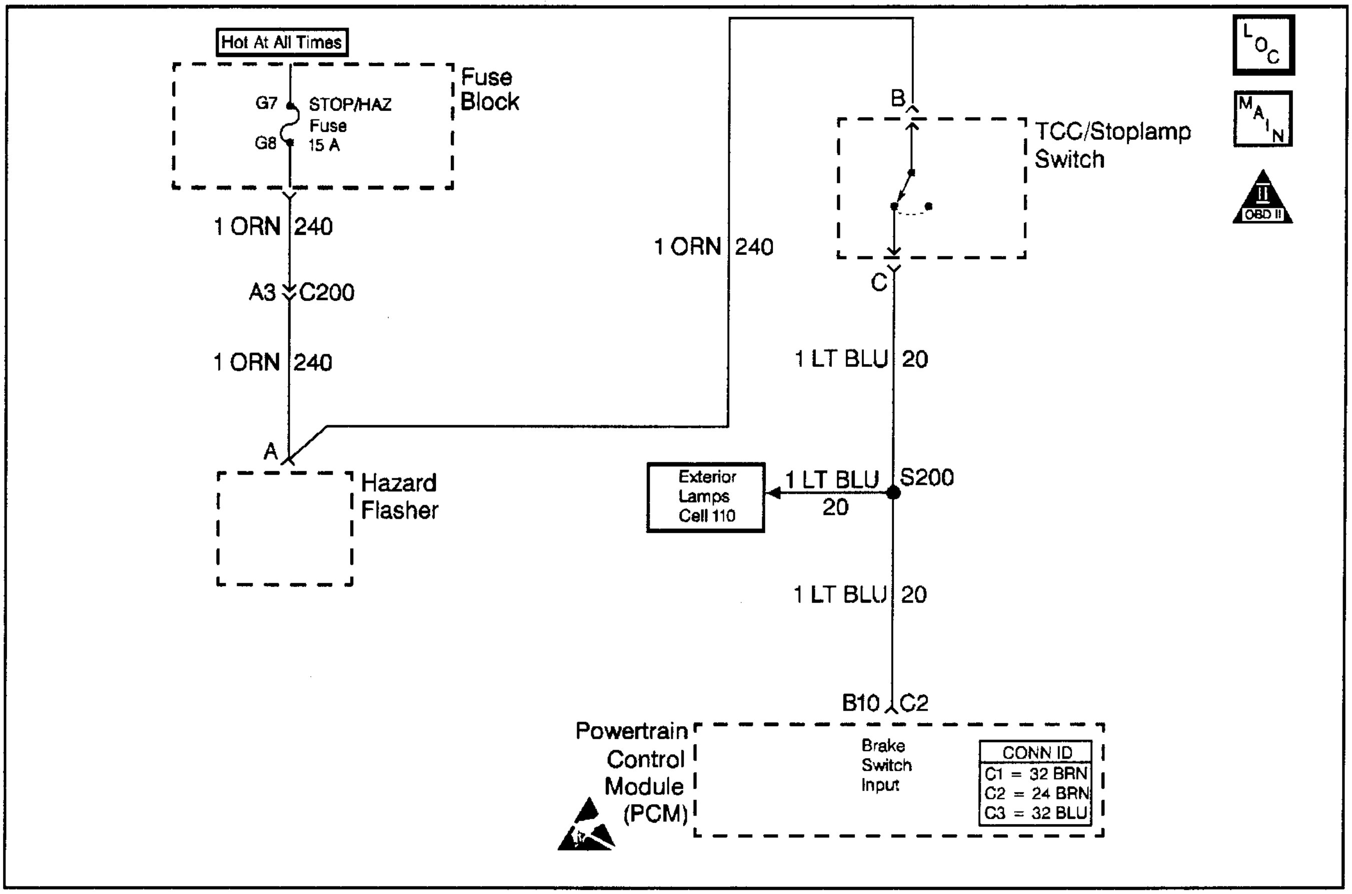
The numbers below refer to the step numbers on the diagnostic table.

3. This step isolates the TCC/Stoplamp switch as a source for setting the DTC.

DTC P0724 Brake Switch Circuit High Input (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the VCM. 3. Record the Failure Records. 4. Clear the DTCs. 5. Select TCC/Stoplamp switch on the scan tool. 6. Do not apply the brake pedal. 7. With the brake pedal not applied, note the TCC brake switch status. 8. Apply the brake pedal. Did the TCC/Brake Switch status change from CLOSED to OPEN?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn the ignition switch to the OFF position. 2. Disconnect the TCC/Stoplamp switch connector from the brake switch. 3. Turn the key to the RUN position. Did the TCC/Stoplamp switch status change from CLOSED to OPEN?	—	*Go to Step 4*	*Go to Step 5*
4	Replace the Stoplamp switch. Refer to Stoplamp Switch Replacement. Is the replacement complete?	—	*Go to Step 7*	—
5	**Important:** The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Electrical Diagnosis for complete circuit distribution. Inspect circuit 420 (PPL) for a short to B+. Was a short to B+ condition found?	—	*Go to Step 7*	*Go to Step 6*
6	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 7*	—
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle brake pedal so that for a total of 2 consecutive times the VCM sees the brake switch CLOSED and then OPEN, for greater than two seconds. Does the *Scan Tool* TCC/Stoplamp switch status change from CLOSED to OPEN?	—	System OK	*Go to Step 1*

DTC P0724 Brake Switch Circuit High Input (L57/L65 EFI)



Circuit Description

The normally open TCC/Stoplamp switch indicates brake pedal status to the powertrain control module (PCM). Applying the brake pedal closes the switch, supplying voltage to the PCM. Releasing the brake pedal interrupts voltage to the PCM.

If the PCM detects a closed TCC/Stoplamp switch (Stuck ON) during accelerations, then DTC P0724 sets. DTC P0724 is a type D DTC.

Conditions for Running the DTC

- No OSS sensor DTCs P0722 or P0723
- The PCM detects a closed TCC/Stoplamp switch or circuit, and the following sequence of events occur:
  1. The vehicle speed is less than 8 km/h (5 mph).
  2. The vehicle speed is 8–32 km/h (5–20 mph) for 3.1 seconds.
  3. The vehicle speed is greater than 32 km/h (20 mph) for 7 seconds.
- DTC P0724 has not passed.

Conditions for Setting the DTC

- The TCC Stoplamp switch is closed for 900 seconds (15 minutes).
- All conditions are met for eight occurrences.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- For TCC scheduling, the PCM disregards the TCC/Stoplamp switch state if the APP sensor is greater than 0.5% and the vehicle speed is greater than 40 Km/h (25 mph).
- The PCM stores DTC P0724 in PCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from PCM history.
- The PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission-related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the TCC/Stoplamp switch connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Ask about the customer's driving habits and any unusual driving conditions he or she might have, such as stop and go traffic or expressway driving.
- Inspect the brake switch for proper mounting and adjustment.
- First diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step isolates the TCC/Stoplamp switch as a source for setting the DTC.

DTC P0724 Brake Switch Circuit High Input (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Select TCC Brake Switch on the scan tool. 6. Disconnect the TCC/Stoplamp Switch connector. Did the scan tool TCC/Brake Switch status change from Closed to Open?	—	*Go to Step 3*	*Go to Step 4*
3	Replace the TCC/Stoplamp switch. Refer to Stoplamp Switch Replacement. Is the replacement complete?	—	*Go to Step 7*	—
4	Inspect circuit 20 (LT BLU) for a short to B+. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 6*	*Go to Step 5*
5	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 7*	—
6	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 7*	—
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Select TCC/Brake switch on the scan tool, and depress the brake pedal. Does the scan tool TCC/Brake switch state change, when the pedal is depressed?	—	System OK	*Go to Step 1*

DTC P0730 Incorrect Gear Ratio (L29/L31/L35)

Range	Gear	1-2 Sol	2-3 Sol	Fourth Clutch	Overrun Clutch	O/D Roller Clutch	FWD Clutch	Direct Clutch	Front Band	Interm. Sprag Clutch	Interm Clutch	Lo Roller Clutch	Rear Band
Overdrive	1st	On	Off	—	—	H	A	—	—	*	—	H	—
	2nd	Off	Off	—	—	H	A	—	—	H	A	O	—
	3rd	Off	On	—	—	H	A	A	—	O	A	O	—
	4th	On	On	A	—	O	A	A	—	O	A	O	—
A = Applied H = Holding * = Holding but not effective O = Overrunning													

Circuit Description

The vehicle control module (VCM) calculates the gear ratio based on the automatic transmission input shaft speed (A/T ISS) and output shaft speed (OSS) sensor readings. The VCM compares the known transmission gear ratio to the calculated ratio for the selected gear ranges.

If the VCM detects an unknown transmission gear ratio, then DTC P0730 sets. DTC P0730 is a type D DTC.

Conditions for Running the DTC

The following conditions are met for 10 seconds.

- No manifold absolute pressure (MAP) DTCs P0106, P0107, or P0108.
- No throttle position (TP) DTCs P0121, P0122, or P0123.
- No OSS DTC P0502 or P0503.
- No A/T ISS DTCs P0716 or P0717.
- No TFP manual valve position switch DTC P1810.
- The vehicle speed is greater than 7 km/h (4 mph).
- The TP angle is greater than 15%.
- The TFT is greater than 20°C (68°F).
- 30 seconds must have elapsed since the last gear range change.
- The engine torque is 110 N·m (80 lb ft) 5.7L and 7.4L or 95 N·m (70 lb ft) 4.3L to the following:
  - 405 N·m (300 lb ft)
  - 542 N·m (400 lb ft) 5.7L
  - 677 N·m (500 lb ft) 7.4L
- The engine is running greater than 475 RPM for 7 seconds and not in fuel cut-off.

Conditions for setting the DTC

- The engine is running longer than 7.0 seconds.
- The Gear Ratio is one of the following:
  - Greater than 2.50 or less than 2.42
  - Greater than 1.50 or less than 1.44
  - Greater than 1.03 or less than 0.25
  - Greater than 2.12 or less than 2.04

Action Taken When the DTC Sets

- The VCM does not illuminate the malfunction indicator lamp (MIL).
- The VCM commands maximum line pressure.
- The VCM freezes shift adapts.
- The VCM stores DTC P0730 in VCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from VCM history.
- The VCM clears the DTC from VCM history if the vehicle completes 40 warm-up cycles without a non-emission-related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.
- A false or incorrect A/T OSS or A/T ISS signal can set DTC P0730.
- DTC P1870 detects an incorrect gear ratio in fourth gear with TCC applied.
- Inspect for any improperly installed after-market equipment.
- Sticking or contamination of shift valves may cause intermittent incorrect gear ratios.
- Refer to the *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the indicated range signal to the actual selected range. A faulty TFP manual valve position switch could set DTC P1810.
4. This step tests for proper ratios in each commanded gear state.

DTC P0730 Incorrect Gear Ratio (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Is the Transmission Fluid Checking Procedure complete?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the VCM. 3. Record the Failure Records. 4. Clear the DTCs. 5. Start the engine. 6. Apply the parking brake, and select each transmission range: D1, D2, D3, D4, N, R, and P. Refer to the *Range Signal* table. Does the scan tool TFP Switch A/B/C display match each selected gear range?	—	*Go to Step 4*	Go to *DTC P1810 TFP Valve Position Switch Circuit (L29/L31/L35)*
4	1. Drive the vehicle in D3 with greater than 15% TP. 2. Drive the vehicle above 7 mph for greater than 2 seconds in each specified gear range. 3. Use the scan tool snapshot mode to record the transmission gear ratio for each commanded gear range: Reverse, 1st, 2nd, and 3rd. Are the commanded gear ratios within the values for each specified gear range?	Rev 2.04–2.12 1st 2.42–2.50 2nd 1.44–1.50 3rd 0.25–1.03	Go to Diagnostic Aids	*Go to Step 5*
5	1. Connect the *J 21867* pressure gauge to the transmission line pressure tap. 2. Perform the Line Pressure Check Procedure. Refer to *Line Pressure Check Procedure.* Is the line pressure within specifications for each selected gear range?	—	*Go to Step 6*	*Go to Step 8*
6	1. Remove the transmission oil pan. Refer to *AT Fluid/Filter Changing.* 2. Inspect the oil pan and the fluid for contamination. Was excessive contamination found?	—	Go to Unit Repair	*Go to Step 7*
7	Inspect the transmission for the following conditions: • Sticking shift valves • Stuck apply pistons Was the condition found?	—	*Go to Step 10*	Go to Unit Repair
8	Is the system line pressure low only in the specific gear which indicated an incorrect gear ratio?	—	*Go to Step 9*	Go to *Symptom Diagnosis* Low Line Pressure

DTC P0730 Incorrect Gear Ratio (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
9	Inspect for fluid pressure loss in the following areas: • 1-2 SS valve seal • 2-3 SS valve seal • Valve body passages • Valve body gaskets • Band apply pistons and seals • Clutch apply pistons and seals. Was the condition found?	—	*Go to Step 10*	Go to Unit Repair
10	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Key ON, the engine is running. • Drive the vehicle in REVERSE, 1st, 2nd, and 3rd gear. • The VCM must see a valid gear ratio range versus the commanded gear ratio. 4. Select Specific DTC. 5. Enter DTC P0730. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0730 Incorrect Gear Ratio (L57/L65 EFI)

Range	Gear	1-2 Sol	2-3 Sol	Fourth Clutch	Overrun Clutch	O/D Roller Clutch	FWD Clutch	Direct Clutch	Front Band	Interm. Sprag Clutch	Interm Clutch	Lo Roller Clutch	Rear Band
Overdrive	1st	On	Off	—	—	H	A	—	—	*	—	H	—
	2nd	Off	Off	—	—	H	A	—	—	H	A	O	—
	3rd	Off	On	—	—	H	A	A	—	O	A	O	—
	4th	On	On	A	—	O	A	A	—	O	A	O	—
A = Applied H = Holding * = Holding but not effective O = Overrunning													

Circuit Description

The powertrain control module (PCM) calculates a ratio based on the automatic transmission input shaft speed (A/T ISS) sensor and output shaft speed (OSS) sensor readings. The PCM compares the known transmission gear ratio to the calculated ratio, for the selected gear range.

If the PCM detects an incorrect gear ratio, then DTC P0730 sets. DTC P0730 is a type D DTC.

Conditions for Running the DTC

- No MAP DTCs P0106, P0107, P0108.
- No A/T ISS sensor DTCs P0716 or P0717.
- No OSS sensor DTCs P0722 or P0723.
- No TFP manual valve position switch DTC P1810.
- The vehicle speed is greater than 6.4 km/h (5 mph).
- The APP angle is greater than 25%.
- The TFT is greater than 20°C (68°F).
- System voltage is 8.0–18.0 volts.
- 10 seconds must have elapsed since the last gear range change.
- The engine speed is greater than 475 RPM for at least 7 seconds.
- The engine speed is less than 3750 RPM.
- The engine torque is 100–642 N·m (80–475 lb ft).

Conditions for Setting the DTC

- All the conditions for Running the DTC are met for 7 seconds.
- The Gear Ratio is one of the following:
  - Greater than 2.52 or less than 2.42
  - Greater than 1.50 or less than 1.45
  - Greater than 1.02 or less than 0.98
  - Greater than 0.77 or less than 0.73
  - Greater than 2.12 or less than 2.04

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM commands maximum line pressure.
- The PCM freezes shift adapts.
- The PCM stores DTC P0730 in PCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from PCM history.
- The PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission-related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Sticking or contaminated shift valves may cause an undefined gear ratio.
- Refer to the *Shift Solenoid Valve State and Gear Ratio* table.
- First diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset. If a DTC P0717 and a DTC P0730 are both present, diagnose DTC P0717 first.
- DTC P1870 detects an incorrect gear ratio in fourth gear with TCC applied.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the indicated range signal to the actual selected range. A faulty TFP manual valve position switch could set DTC P0730.
4. This step tests for proper ratios in each commanded gear state.

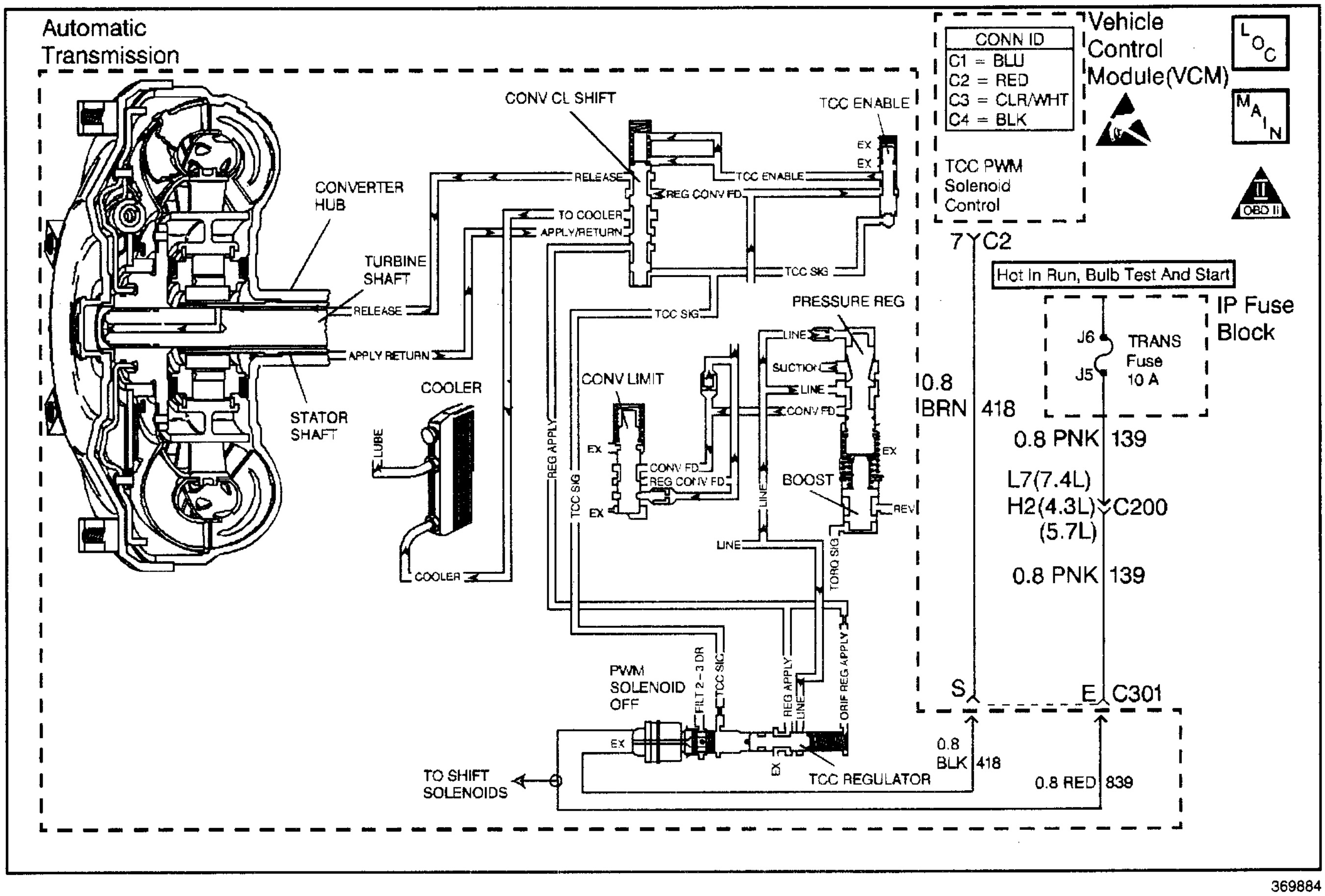
DTC P0730 Incorrect Gear Ratio (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Is the Transmission Fluid Checking Procedure complete?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Start the engine. 6. Apply the parking brake, and select each transmission range: D1, D2, D3, D4, N, R, and P. Does the scan tool TFP Switch A/B/C display match each selected gear range? (Refer to the *Range Signal* table).	—	*Go to Step 4*	Go to *DTC P1810 TFP Valve Position Switch Circuit (L57/L65 EFI)*
4	1. Drive the vehicle in REVERSE and D4. 2. Hold the vehicle speed above 8 km/h (65 mph) for greater than 2 seconds in the specified gear range. 3. Use the scan tool snapshot mode in order to record the transmission gear ratio for each commanded gear range: REVERSE, 1st, 2nd, 3rd and 4th. Are the gear ratios within the parameters for each specified gear range?	Rev-2.04–2.12 1st-2.52–2.42 2nd-1.45–1.50 3rd-0.98–1.02 4th-0.73–0.77	Go to Diagnostic Aids	*Go to Step 5*
5	1. Connect the *J 21867* pressure gauge to the transmission line pressure tap. 2. Perform the Line Pressure Check Procedure. Refer to *Line Pressure Check Procedure.* Is the line pressure within specifications for each selected gear range?	—	*Go to Step 6*	*Go to Step 8*
6	1. Remove the transmission oil pan. Refer to *AT Fluid/Filter Changing.* 2. Inspect the oil pan and the fluid for contamination. Was excessive contamination found?	—	Go to Unit Repair	*Go to Step 7*
7	Inspect the transmission for the following conditions: • Sticking shift valves • Stuck apply pistons Was the condition found?	—	*Go to Step 10*	Go to Unit Repair
8	Is the system line pressure low only in the specific gear which indicated an incorrect gear ratio?	—	*Go to Step 9*	Go to *Symptom Diagnosis* Low Line Pressure

DTC P0730 Incorrect Gear Ratio (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
9	Inspect for fluid pressure loss in the following areas: • 1-2 SS valve seal • 2-3 SS valve seal • Valve body passages • Valve body gaskets • Band apply pistons and seals • Clutch apply pistons and seals. Was the condition found?	—	*Go to Step 10*	Go to Unit Repair
10	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Start, the engine. • Drive the vehicle in REVERSE, 1st, 2nd, 3rd and 4th gear. • The PCM must see a valid gear ratio versus the commanded gear ratio for 7 seconds. 4. Select Specific DTC. 5. Enter DTC P0730. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0741 TCC System Stuck Off (L29/L31/L35)



Circuit Description

Important: DTC P0741 inspects for high torque converter clutch (TCC) slip in 2nd and 3rd gear only. The transmission must be in hot mode or experiencing a wide open throttle maneuver in order for the TCC to be commanded ON in 2nd and 3rd gear.

The vehicle control module (VCM) energizes the torque converter clutch pulse width modulated (TCC PWM) solenoid valve by grounding circuit 418. This blocks the exhaust for TCC signal fluid and allows filtered 2–3 drive fluid to feed the TCC signal circuit. When the vehicle's operating conditions are appropriate for TCC application, the VCM begins the TCC duty cycle to approximately 30%. This allows TCC signal fluid pressure to move the converter clutch shift valve into the apply position and direct regulated apply fluid to the torque converter.

The VCM then increases (ramps) the duty cycle to approximately 60%, where regulated apply fluid pressure, applies the converter clutch. The vehicle application determines the TCC apply rate. Once the TCC applies, the duty cycle immediately increases to approximately 70% to achieve full apply pressure, in the regulated apply fluid circuit.

The TCC PWM solenoid valve is de-energized by the VCM opening circuit 418. This action allows the TCC signal fluid to exhaust through the solenoid and blocks filtered 2–3 drive fluid from entering the TCC signal circuit. The loss of fluid pressure in the TCC signal circuit releases the TCC.

If the VCM detects high TCC slip when the TCC is commanded ON, then DTC P0741 sets. DTC P0741 is a type D DTC. For California emissions vehicles DTC P0741 is a type B DTC.

Conditions for Running the DTC

- No throttle position (TP) sensor DTCs P0121, P0122, or P0123.
- No OSS DTC P0502, or P0503.
- No ISS DTCs P0716 or P0717.
- No TCC DTCs P0742 or P1860.
- No TFP manual valve position switch DTC P1810.
- The engine must be running greater than 475 RPM for at least 7 seconds.
- The gear ratio must indicate 2nd, 3rd, or 4th gear.
- The TP is 10–100%.
- The TFP manual valve position switch must be in D4, D3, or D2 and has not changed in 6 seconds.
- Gear ratio is equal to 2nd, 3rd or 4th.
- The transmission fluid temperature (TFT) is +20° to +150°C (68° to +302°F).
- TCC duty cycle greater than 70% and locked on greater than 0.5 seconds.

Conditions for Setting the DTC

- The TCC slip speed is greater than 140 RPM, for 3 seconds.
- All conditions must be met for a total of 5 occurrences.

Action Taken When the DTC Sets

- The VCM illuminates the malfunction indicator lamp (MIL) for California emissions vehicles.
- The VCM inhibits the TCC.
- The VCM increases line pressure.
- The VCM inhibits 4th gear.
- The VCM stores DTC P0741 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Residue or contamination may cause shift valves to stick intermittently.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

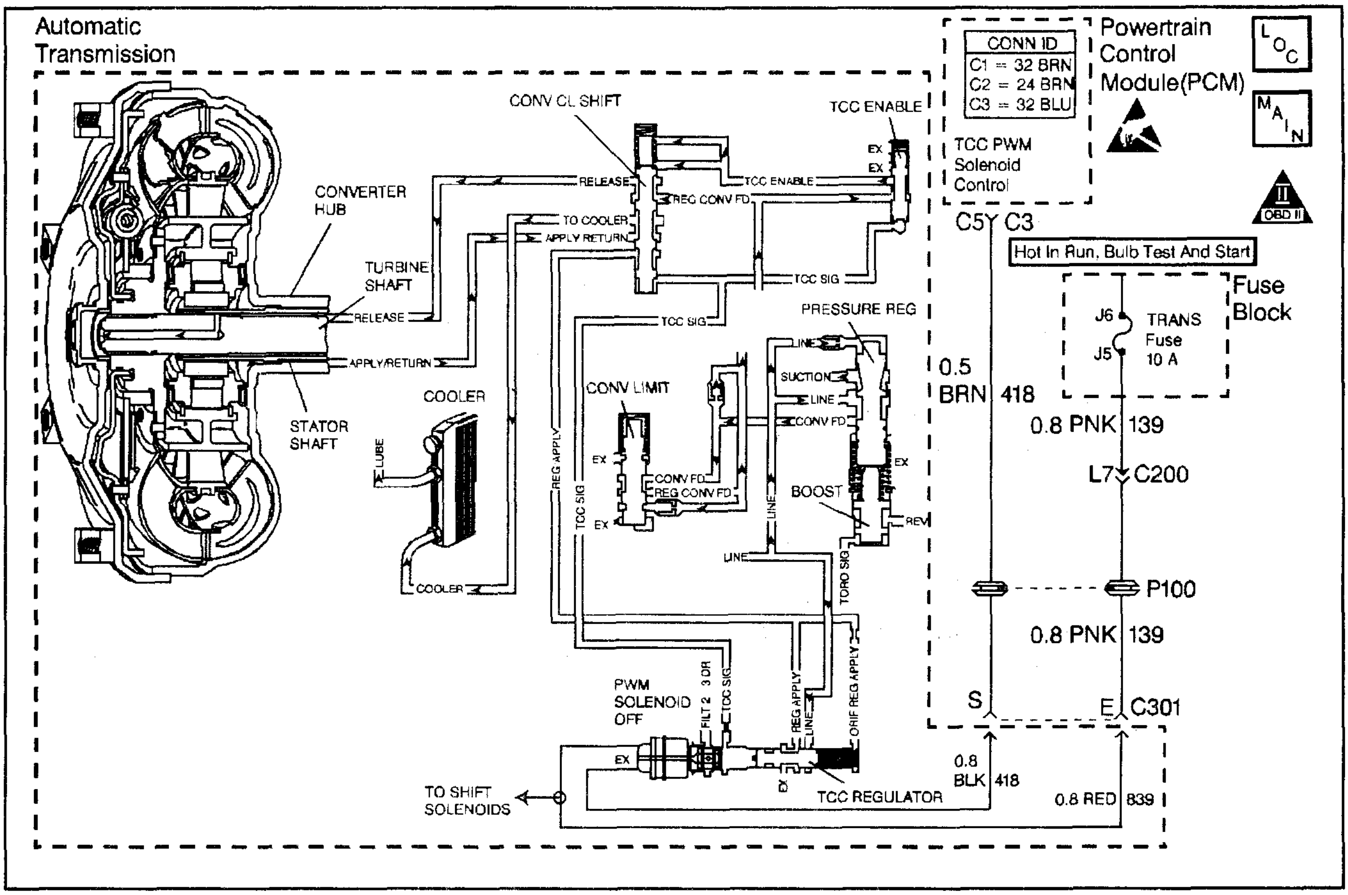
The numbers below refer to the step numbers on the diagnostic table.

2. This step tests for excessive TCC slip when TCC is commanded on.
3. This step inspects for possible causes of no TCC apply.

DTC P0741 TCC System Stuck Off (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 2. Record the Freeze Frame and Failure Records. 3. Clear the DTCs. 4. Drive the vehicle in D3. 5. Record the data using snapshot mode. Is the TCC slip speed snapshot data greater than the specified value when the TCC duty cycle is commanded greater than 70% for greater than 3 seconds?	140 RPM	*Go to Step 3*	Go to Diagnostic Aids
3	Inspect the TCC PWM solenoid valve for being mechanically Stuck OFF. Refer to *Torque Converter Diagnosis Procedure.* Was the condition found?	—	*Go to Step 5*	*Go to Step 4*
4	1. Inspect the TCC PWM solenoid valve for a damaged exhaust orifice. 2. Inspect for the converter regulated apply valve being stuck in the off (release) position. 3. Inspect the converter clutch shift valve for a stuck condition. 4. Inspect for a misaligned or damaged valve body gasket. 5. Inspect for a restricted apply or release passage. 6. Inspect for the torque converter for being mechanically stuck OFF. Refer to *Symptom Diagnosis* No TCC Apply. Did you find and correct the condition?	—	*Go to Step 5*	—
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle in D3 with steady acceleration and TP over 12%. • TCC duty cycle is greater than 70%. • The VCM must see a TCC slip of less than 20 RPM for 3 seconds. • Select Specific DTC. 4. Enter DTC P0741. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0741 TCC System Stuck Off (L57/L65 EFI)



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Circuit Description

Important: DTC P0741 inspects for high torque converter clutch (TCC) slip in 2nd and 3rd gear only. The transmission must be in hot mode or experiencing a wide open throttle maneuver in order for the TCC to be commanded ON in 2nd and 3rd gear.

The powertrain control module (PCM) energizes the torque converter clutch pulse width modulated (TCC PWM) solenoid valve by grounding circuit 418. This blocks the exhaust for TCC signal fluid and allows filtered 2–3 drive fluid to feed the TCC signal circuit. When the vehicle's operating conditions are appropriate for TCC application, the PCM begins the TCC duty cycle to approximately 30%. This allows TCC signal fluid pressure to move the converter clutch shift valve into the apply position and direct regulated apply fluid to the torque converter. The PCM then increases (ramps) the duty cycle to approximately 60%, where regulated apply fluid pressure, applies the converter clutch. The vehicle application determines the TCC apply rate. Once the TCC applies, the duty cycle immediately increases to approximately 70% to achieve full apply pressure, in the regulated apply fluid circuit.

The TCC PWM solenoid valve is de-energized by the PCM opening circuit 418. This action allows the TCC signal fluid to exhaust through the solenoid and blocks filtered 2–3 drive fluid from entering the TCC signal circuit. The loss of fluid pressure in the TCC signal circuit releases the TCC.

If the PCM detects high TCC slip when the TCC is commanded ON, then DTC P0741 sets. DTC P0741 is a type D DTC. For California emissions vehicles DTC P0741 is a type B DTC.

Conditions for Running the DTC

- No A/T ISS sensor DTCs P0716 or P0717.
- No OSS DTCs P0722, or P0723.
- No TCC Stuck ON DTC P0742.
- No TCC PWM solenoid valve DTC P1860.
- No TFP manual valve position switch DTC P1810.
- The TCC PWM solenoid valve is commanded in 2nd or 3rd gear for greater than 0.6 seconds.
- The engine must be running greater than 475 RPM for at least 7 seconds.
- The TCC Duty Cycle is greater than 70% for 1.0 second.
- The gear ratio must indicate 2nd or 3rd gear.
- System voltage is 8.0–18.0 volts.
- The APP angle is 15–99%.
- The TFP manual valve position switch must be in D4, D3, or D2 and has not changed state within 4 seconds.
- The TFT must be 20 to +150°C (68–302°F).

Conditions for Setting the DTC

- The TCC slip speed is greater than 175 RPM for 3 seconds.
- All conditions must be met for a total of 4 occurrences.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) for California emissions vehicles.
- The PCM inhibits the TCC.
- The PCM increases line pressure.
- The PCM inhibits 4th gear.
- The PCM stores DTC P0741 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Residue or contamination may cause shift valves to stick intermittently.
- First diagnose and clear any engine DTCs or APP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

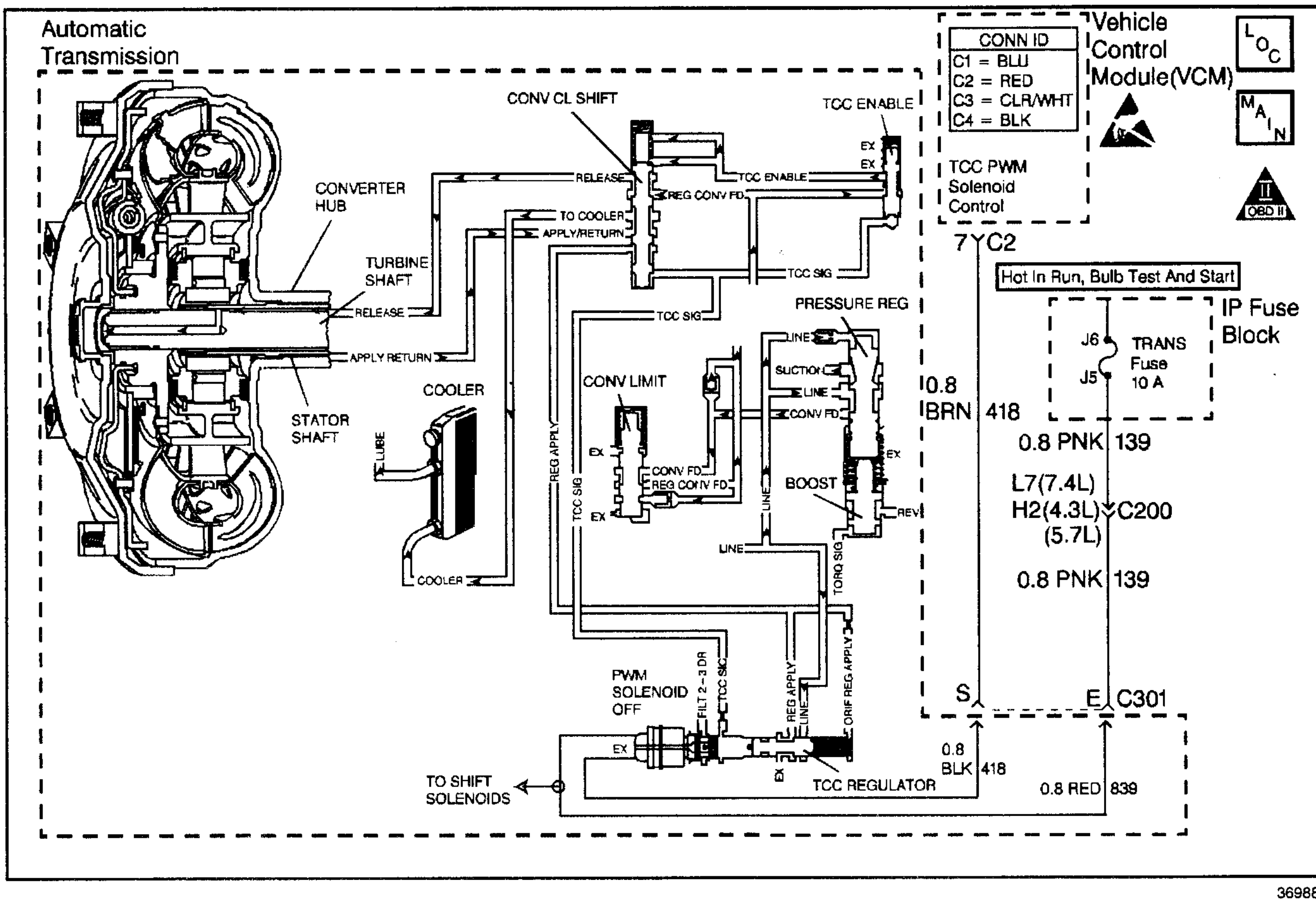
The numbers below refer to the step numbers on the diagnostic table.

2. This step tests for excessive TCC slip when TCC is commanded on.
3. This step inspects for possible causes of no TCC apply.

DTC P0741 TCC System Stuck Off (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 2. Record the Freeze Frame and Failure records. 3. Clear the DTC. 4. Drive the vehicle in D3 with the TCC commanded ON. 5. Record the data using snapshot mode. Is the TCC slip speed greater than the specified value when the TCC PWM solenoid valve is commanded ON (greater than 70%)?	175 RPM	*Go to Step 3*	Go to Diagnostic Aids
3	Inspect the TCC PWM solenoid valve for being mechanically stuck OFF. Refer to *Torque Converter Diagnosis Procedure.* Was the condition found?	—	*Go to Step 5*	*Go to Step 4*
4	1. Inspect for the torque converter for being mechanically stuck OFF 2. Inspect the TCC for a damaged exhaust orifice. 3. Inspect the torque converter for possible damage. 4. Inspect for the converter apply shift valve for being stuck in the off (release) position. 5. Inspect for a misaligned or damaged valve body gasket. 6. Inspect for a restricted apply or release passage. Refer to *Symptom Diagnosis.* Was a condition found?	—	*Go to Step 5*	—
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle in D4 with steady acceleration and the APP Angle over 15%. • The PCM must see a TCC slip of less than 175 RPM for 3 seconds. 4. Select Specific DTC. 5. Enter DTC P0741. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0742 TCC System Stuck On (L29/L31/L35)



Circuit Description

The vehicle control module (VCM) energizes the torque converter clutch pulse width modulated (TCC PWM) solenoid valve by grounding circuit 418. This blocks the exhaust for TCC signal fluid and allows filtered 2–3 drive fluid to feed the TCC signal circuit. When the vehicle's operating conditions are appropriate for TCC application, the VCM begins the TCC duty cycle to approximately 30%. This allows TCC signal fluid pressure to move the converter clutch shift valve into the apply position and direct regulated apply fluid to the torque converter. The VCM then increases (ramps) the duty cycle to approximately 60%, where regulated apply fluid pressure, applies the converter clutch. The vehicle application determines the TCC apply rate. Once the TCC applies, the duty cycle immediately increases to approximately 70% to achieve full apply pressure, in the regulated apply fluid circuit.

The TCC PWM solenoid valve is de-energized by the VCM opening circuit 418. This action allows the TCC signal fluid to exhaust through the solenoid and blocks filtered 2–3 drive fluid from entering the TCC signal circuit. The loss of fluid pressure in the TCC signal circuit releases the TCC.

If the VCM detects low TCC slip when the TCC is commanded OFF, then DTC P0742 sets. DTC P0742 is a type D DTC. For California emissions vehicles DTC P0742 is a type B DTC.

Conditions for Running the DTC

- No MAP sensor DTCs P0106, P0107, or P0108.
- No TP sensor DTCs P0121, P0122 or P0123.
- No OSS DTCs P0502 or P0503.
- No ISS DTCs P0716 or P0717.
- No TCC DTCs P0741 or P1860.
- No TFP manual valve position switch DTC P1810.
- Engine speed is 900–4700 RPM.
- The engine torque must be 75 N·m (60 lb ft) to:
  - 500 N·m (400 lb ft) 5.7L
  - 625 N·m (500 lb ft) 7.4L
- No TFP manual valve position switch change within 5.0 seconds.
- The TFP manual valve position switch must indicate D4, for at least 10 seconds.
- The commanded gear must be 2nd, 3rd, or 4th.
- Engine speed is 900–4700 RPM.
- The throttle position (TP) is 12%-100%.
- Vehicle speed is 7–75 MPH.

Conditions for Setting the DTC

- The TCC slip speed must be −10 to +10 RPM for at least 4.0 seconds.
- All conditions met for 7 occurrences (7.4L, 4 occurrences).

Action Taken When the DTC Sets

- The VCM illuminates the malfunction indicator lamp (MIL) for California emissions vehicles.
- The VCM commands maximum line pressure.
- The VCM freezes shift adapts.
- The VCM stores DTC P0742 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- If the TCC is mechanically stuck ON with the parking brake applied and any gear range selected, the TCC fluid mechanically applies the TCC. TCC fluid mechanically applying the TCC can cause an engine stall.
- A stuck TP sensor may set a DTC P0742.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

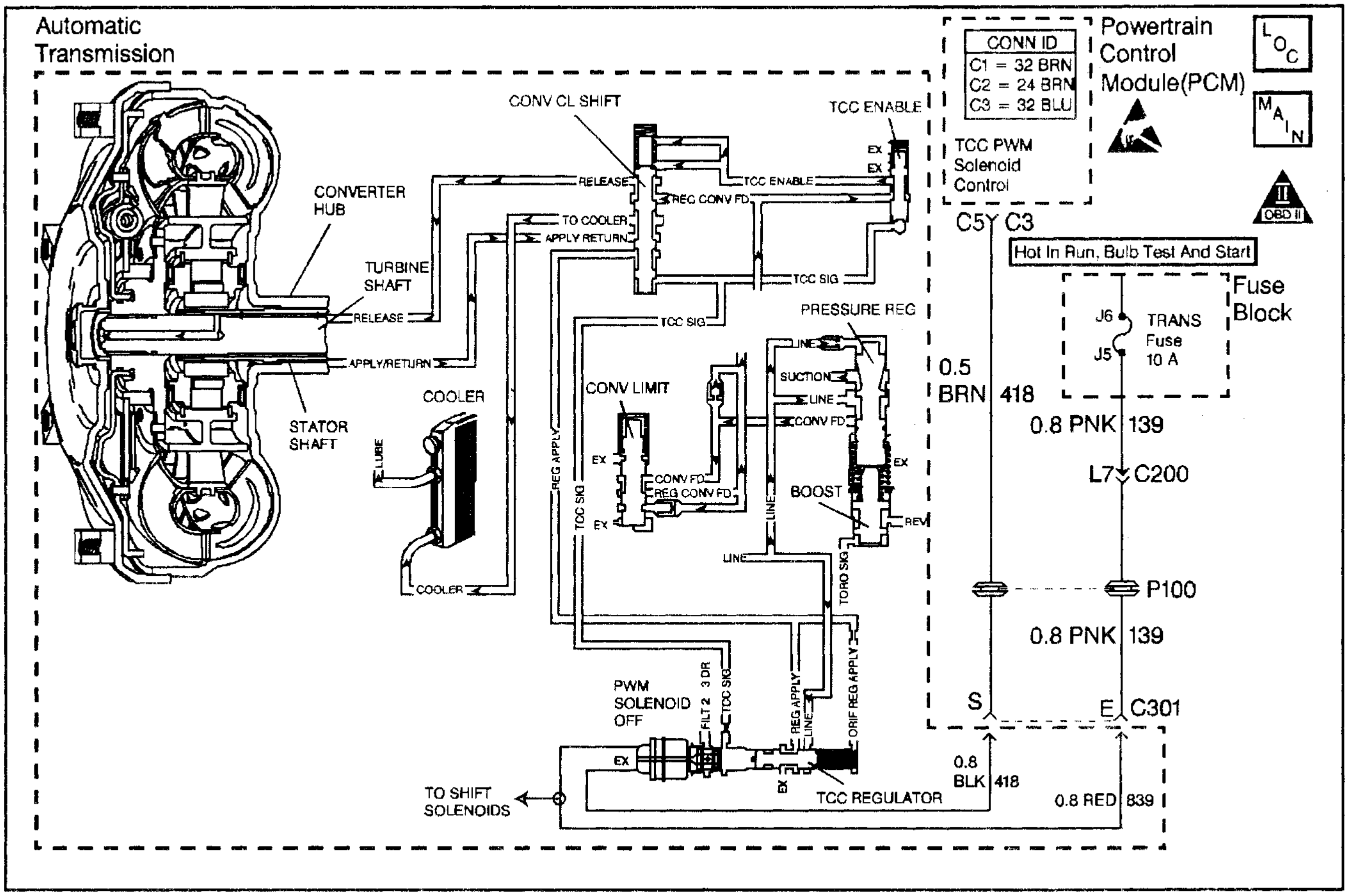
The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the mechanical state of the TCC. When the VCM commands the TCC solenoid OFF, the slip speed should increase.

DTC P0742 TCC System Stuck On (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Select *Scan Tool* TP angle and TP sensor. 6. Apply the accelerator pedal. Are the TP sensor values within the specified range?	0.2–0.9 volts at 0% to 4.5 volts at 100%	*Go to Step 3*	Go to Diagnostic Aids
3	Drive the vehicle in the D4 drive range in fourth gear under steady acceleration with a TP sensor angle greater than 12%. Does the scan tool display a TCC slip speed of −10 to +10 RPM while the displayed TCC duty cycle is 0%?	—	*Go to Step 4*	Go to Diagnostic Aids
4	The TCC is mechanically stuck ON. Perform the following inspections: 1. Inspect the exhaust orifice in the TCC PWM solenoid valve for any clogging. 2. Inspect the converter clutch apply valve for the possibility of being stuck in the apply position. 3. Inspect the valve body gasket for misalignment or damage. 4. Inspect for a restricted release or apply passage. 5. Inspect for restricted transmission cooler line. Refer to *Symptom Diagnosis* TCC Stuck On. Did you find and correct the condition?	—	*Go to Step 5*	—
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Operate the vehicle in D4 with the TCC duty cycle 0% and throttle above 12%. • Ensure that the TCC slip speed is greater than 175 RPM for 6 seconds. 4. Select Specific DTC. 5. Enter DTC P0742. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0742 TCC System Stuck On (L57/L65 EFI)



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Circuit Description

The powertrain control module (PCM) energizes the torque converter clutch pulse width modulated (TCC PWM) solenoid valve by grounding circuit 418. This blocks the exhaust for TCC signal fluid and allows filtered 2–3 drive fluid to feed the TCC signal circuit. When the vehicle's operating conditions are appropriate for TCC application, the PCM begins the TCC duty cycle to approximately 30%. This allows TCC signal fluid pressure to move the converter clutch shift valve into the apply position and direct regulated apply fluid to the torque converter. The PCM then increases (ramps) the duty cycle to approximately 60%, where regulated apply fluid pressure, applies the converter clutch. The vehicle application determines the TCC apply rate. Once the TCC applies, the duty cycle immediately increases to approximately 70% to achieve full apply pressure, in the regulated apply fluid circuit.

The TCC PWM solenoid valve is de-energized by the PCM opening circuit 418. This action allows the TCC signal fluid to exhaust through the solenoid and blocks filtered 2–3 drive fluid from entering the TCC signal circuit. The loss of fluid pressure in the TCC signal circuit releases the TCC.

If the PCM detects LOW TCC slip when the TCC is commanded OFF, then DTC P0742 sets. DTC P0742 is a type B DTC.

Conditions for Running the DTC

The following conditions occur once per TCC cycle two consecutive times:

- No MAP sensor DTCs P0106, P0107, or P0108.
- No A/T ISS sensor DTCs P0716 or P0717.
- No TCC stuck on DTC P0741.
- No OSS sensor DTCs P0722 or P0723.
- No TFP manual valve position switch DTC P1810
- No TCC PWM solenoid valve DTC P1860.
- The engine speed is less than 3300 RPM.
- The engine must run more than 475 RPM for greater than 7 seconds.
- System voltage is 8.0–18.0 volts.
- The engine torque must be 176–645 N·m (130–475 lb ft).
- The gear range is D4.
- The commanded gear must be 2nd, 3rd, or 4th.
- The APP angle must be greater than 15%.

Conditions for Setting the DTC

- The TCC slip speed must be −10 to +10 RPM for at least 3 seconds.
- All conditions for Setting the DTC are met for 4 occurrences.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM commands maximum line pressure.
- The PCM freezes shift adapts.
- The PCM stores DTC P0742 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- If the TCC is mechanically stuck ON with the parking brake applied and any gear range selected, the TCC fluid mechanically applies the TCC. TCC fluid mechanically applying the TCC can cause an engine stall.
- A stuck or skewed APP sensor may set DTC P0742.
- First diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

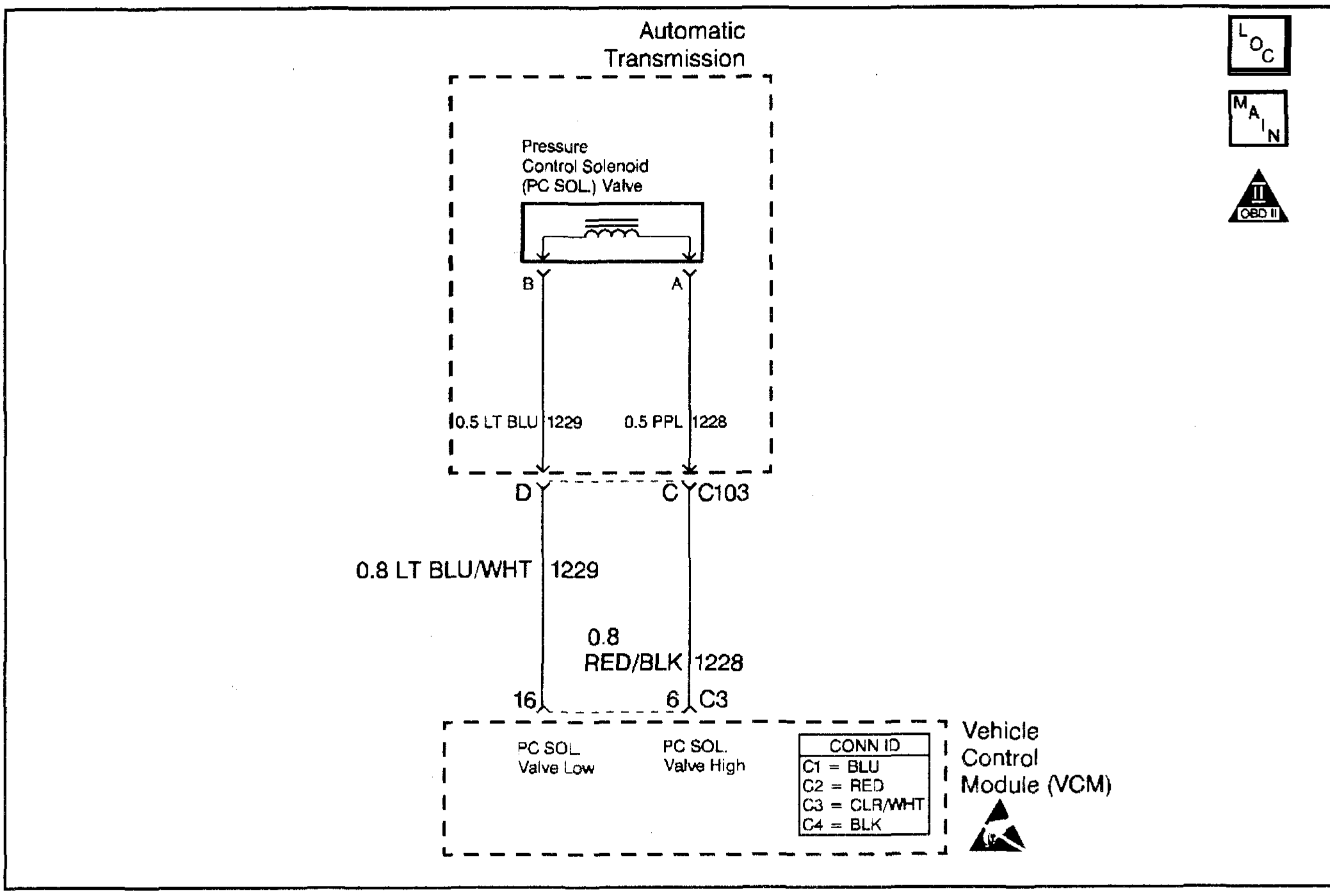
The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the mechanical state of the TCC. When the PCM commands the TCC solenoid OFF, the slip speed should increase.

DTC P0742 TCC System Stuck On (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. 5. Verify the APP sensor operation. Use the scan tool. Are the APP angle values within the specified range?	0% at Closed Throttle 100% at Wide Open Throttle (WOT)	*Go to Step 3*	Go to Diagnostic Aids
3	Drive the vehicle in the D4 drive range in fourth gear under steady acceleration with a APP angle greater than 15%. Does the scan tool display a TCC Slip Speed of –10 to +10 RPM while the displayed TCC Duty Cycle is 0%?	—	*Go to Step 4*	Go to Diagnostic Aids
4	The TCC is mechanically stuck ON. 1. Inspect for the following conditions: • Inspect the exhaust orifice in the TCC PWM solenoid valve for any clogging. • Inspect the converter clutch shift valve for the possibility of being stuck in the apply position. • Inspect the valve body gasket for misalignment or damage. • Inspect for a restricted release or apply passage. • Inspect for a restricted transmission cooler line. • Refer to *Symptom Diagnosis* TCC Stuck On. 2. Repair any of the above items as necessary. Refer to Unit Repair. Is the repair complete?	—	*Go to Step 5*	—
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Operate the vehicle in D4 with the TCC OFF and APP angle above 15%. • Ensure that the TCC slip speed is 175–1500 RPM for 3 seconds. 4. Select Specific DTC. 5. Enter DTC P0742. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0748 PC Solenoid Circuit Electrical (L29/L31/L35)



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Circuit Description

The pressure control (PC) solenoid valve is a vehicle control module (VCM) controlled device that regulates the transmission line pressure. The VCM compares throttle position (TP) sensor voltage, engine RPM, and other inputs in order to determine the appropriate line pressure for a given load. The VCM regulates pressure by applying a varying duty cycle to the PC solenoid valve based on the resistance of the solenoid, and the amperage needed to obtain optimum line pressure. The applied amperage varies from 0.1 amps for maximum line pressure to 1.1 amps for minimum line pressure.

If the VCM detects a PC duty cycle that exceeds 95% or less than 1.9%, then DTC P0748 sets. DTC P0748 is a type D DTC.

Conditions for Running the DTC

- The system voltage is greater than 10.0 volts at –40°C (–40°F) TFT or 12.5 volts at 150°C (302°F) TFT.
- The engine must be running more than 475 RPM for at least 7 seconds, and not in fuel cutoff.

Conditions for Setting the DTC

- The PC duty cycle exceeds 95% or is less than 1.9%.
- All conditions are met for 200 milliseconds (0.2 seconds).

Action Taken When the DTC Sets

- The VCM does not illuminate the malfunction indicator lamp (MIL).
- The VCM disables the PC solenoid valve, defaulting the transmission to maximum line pressure.
- The VCM freezes shift adapts.
- The VCM stores DTC P0748 in VCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from VCM history.
- The VCM clears the DTC from VCM history if the vehicle completes 40 warm-up cycles without a non-emission-related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the wiring at the VCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.
- Inspect for improperly wired after-market equipment.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step tests the ability of the VCM to command the PC solenoid valve.
3. This step tests the PC solenoid valve and the A/T wiring harness assembly for incorrect resistance.
6. This step tests the PC solenoid valve and the internal wiring harness for a short to ground.
8. When performing this step refer to Product Service Bulletin #9474L80E-07 for PC Solenoid Valve Application.
9. This step tests the entire PC solenoid valve circuit up to the VCM for continuity.
10. This step tests for a short to ground in circuits 1228 and 1229, of the engine harness.

DTC P0748 PC Solenoid Circuit Electrical (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the VCM. 3. Record the Failure Records. 4. Clear the DTCs. 5. With the transmission in PARK, start the engine. 6. Using the transmission output control function on the scan tool, apply 0.1–1.0 amps while observing the PC Ref. current and the PC Act. current. Refer to the *Line Pressure* specification table. Is the PC Act. current reading always within the specified value of the PC Ref. current?	0.16 amp	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTCs will set). 3. Install the *J 39775* jumper harness on the transmission side of the 20-way connector (Automatic Transmission Connector End View). 4. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the resistance between terminals C and D. Is the resistance within the specified value?	3–7Ω	*Go to Step 6*	*Go to Step 4*

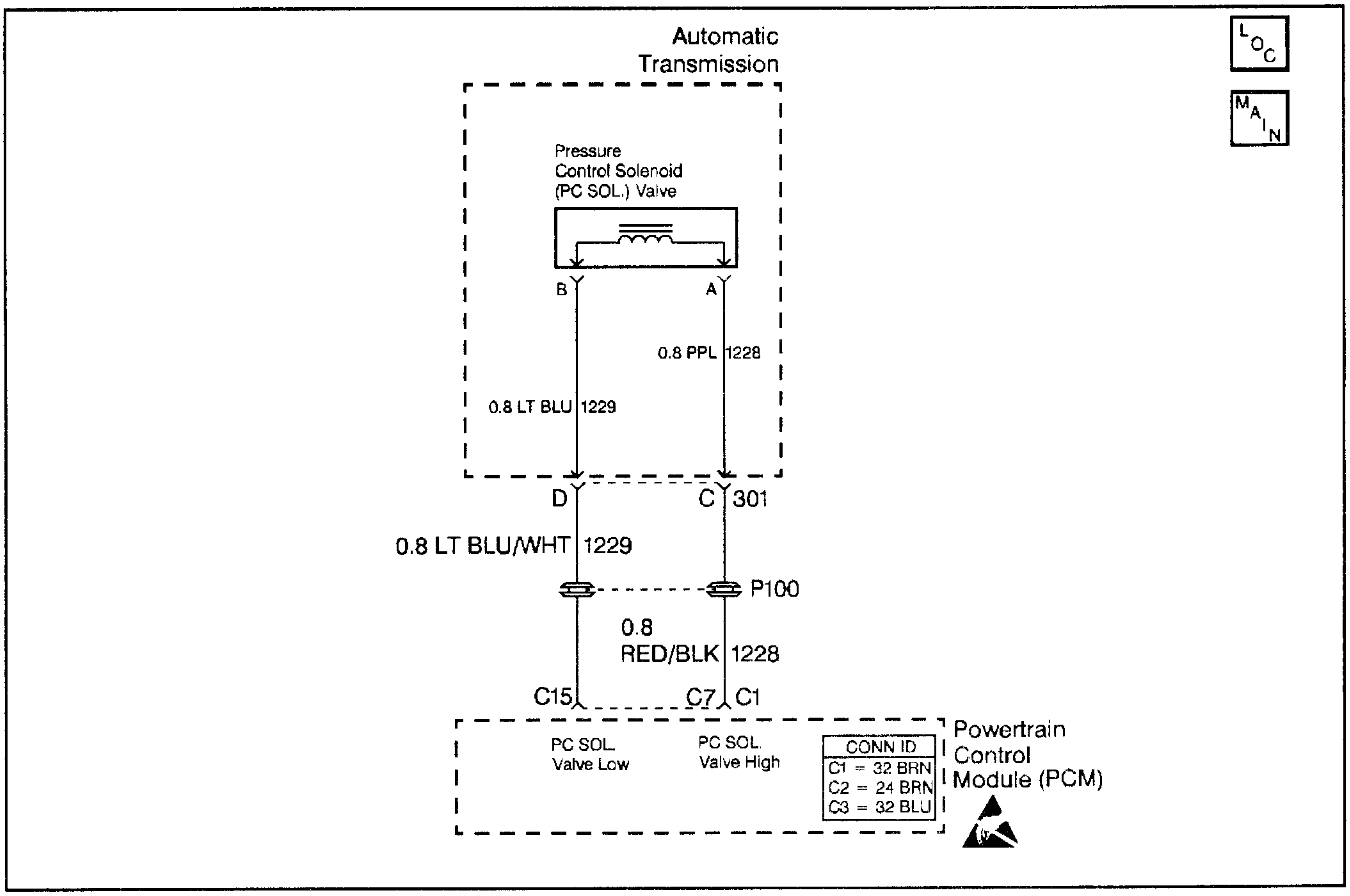
DTC P0748 PC Solenoid Circuit Electrical (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Disconnect the automatic transmission wiring harness assembly at the PC solenoid valve. 2. Measure the resistance of the PC solenoid valve. Is the resistance within the specified range?	3–7Ω	*Go to Step 5*	*Go to Step 8*
5	Replace the automatic transmission wiring harness assembly. Refer to AT Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 16*	—
6	Measure the resistance from terminal C on the jumper harness, to the transmission case. Is the resistance less than the specified value?	7Ω	*Go to Step 7*	*Go to Step 9*
7	1. Inspect the automatic transmission wiring harness assembly (circuits 1228 RED/BLK and 1229 LT BLU/WHT) for a short to ground condition. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Replace the harness if necessary. Refer to AT Wiring Harness Replacement. Was a shorted condition found?	—	*Go to Step 16*	*Go to Step 8*
8	Replace the PC solenoid valve. Refer to *Pressure Regulator Replacement.* **Important:** Refer to the *Test Description* for information on component replacement. Is the replacement complete?	—	*Go to Step 16*	—
9	1. Disconnect the *J 39775* from the transmission side of the 20-way connector (Automatic Transmission Connector End View). 2. Reconnect the transmission 20-way connector. 3. Disconnect the VCM connector C3. 4. Measure the resistance between terminals C3–6 and C3–16. Is the resistance within the specified range?	3–7 Ω	*Go to Step 10*	*Go to Step 11*
10	1. Connect the *J 39200* DMM to terminal C3–6 and to a good ground. 2. Measure the resistance. Is the resistance greater than the specified value?	7 Ω	*Go to Step 15*	*Go to Step 14*
11	Is the resistance in step 9 greater than the specified value?	7 Ω	*Go to Step 12*	*Go to Step 13*
12	1. Inspect circuit 1228 (RED/BLK) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Inspect circuit 1229 (LT BLU/WHT) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 3. Repair the circuits if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the open condition found?	—	*Go to Step 16*	—
13	Inspect circuits 1228 (RED/BLK) and 1229 (LT BLU/WHT) for a shorted together condition. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	—

DTC P0748 PC Solenoid Circuit Electrical (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
14	1. Inspect circuit 1228 (RED/BLK) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Inspect circuit 1229 (LT BLU/WHT) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 3. Repair the circuits if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the short to ground condition found?	—	*Go to Step 16*	—
15	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L), with KS Calibration Prom, in Engine Controls. Is the replacement complete?	—	*Go to Step 17*	—
16	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 17*	—
17	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Ensure the following conditions are met: • The engine is running. • The PC duty cycle is 2–95%. 4. Select Specific DTC. 5. Enter DTC P0748. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0748 PC Solenoid Circuit Electrical (L57/L65 EFI)



370953

Circuit Description

The pressure control (PC) solenoid valve is a powertrain control module (PCM) controlled device that regulates the transmission line pressure. The PCM compares throttle position (TP) sensor voltage, engine RPM, and other inputs in order to determine the appropriate line pressure for a given load.

The PCM regulates pressure by applying a varying duty cycle to the PC solenoid valve based on the resistance of the solenoid, and the amperage needed to obtain optimum line pressure. The applied amperage varies from 0.1 amps for maximum line pressure to 1.1 amps for minimum line pressure.

If the PCM detects a PC duty cycle that exceeds 95% or less than 1.9%, then DTC P0748 sets. DTC P0748 is a type D DTC.

Conditions for Running the DTC

- The system voltage is greater than 10.0 volts at –40°C (–40°F) TFT or 12.5 volts at 150°C (302°F) TFT.
- The engine must be running more than 475 RPM for at least 7 seconds, and not in fuel cutoff.

Conditions for Setting the DTC

- The PC duty cycle exceeds 95% or is less than 1.9%.
- All conditions met for 200 milliseconds (0.2 second).

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM disables the PC solenoid valve, defaulting the transmission to maximum line pressure.
- The PCM freezes shift adapts.
- The PCM stores DTC P0748 in PCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from PCM history.
- The PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission-related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step tests the ability of the PCM to command the PC solenoid valve.
3. This step tests the PC solenoid valve and the automatic transmission wiring harness assembly for incorrect resistance.
6. This step tests the PC solenoid valve and the internal wiring harness for a short to ground.
8. When performing this step refer to Product Service Bulletin #9474L80E-07 for PC solenoid valve application.
9. This step tests the entire PC solenoid valve circuit for proper resistance.
10. This step tests for a short to ground in circuits 1228 and 1229 of the engine harness.

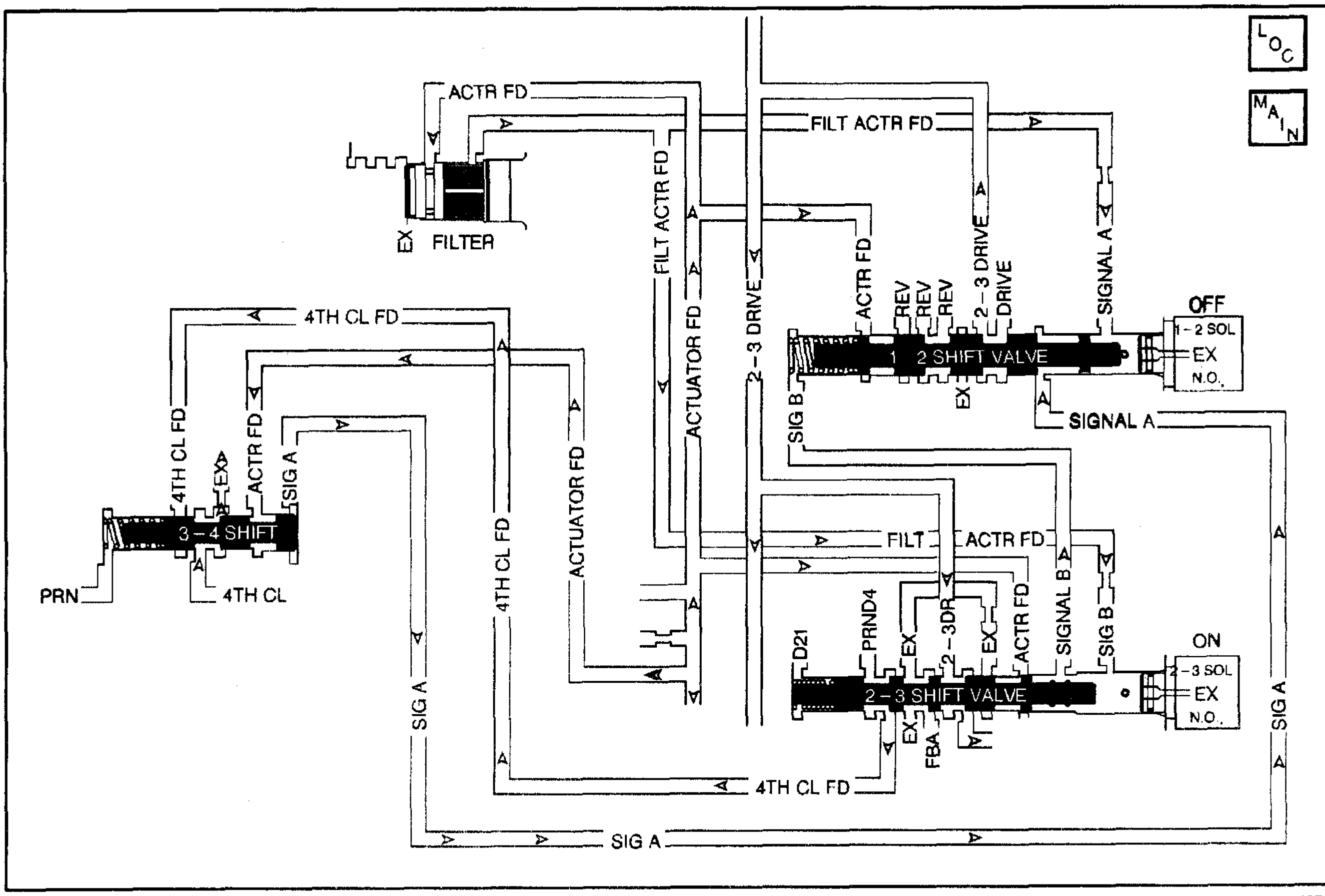
DTC P0748 PC Solenoid Circuit Electrical (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM. 3. Record the Failure Records. 4. Clear the DTC. 5. With the engine running, put the transmission in PARK. 6. Using the scan tool transmission output control function, apply 0.1–1.0 amps while observing the PC Ref. Current and the PC Act. Current. Is the PC Act. Current reading always within the specified value of the PC Ref. Current?	0.16	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTC's may set). 3. Install the *J 39775* jumper harness on the transmission side of the 20-way connector. 4. Measure the resistance between terminals C and D. Use the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit. Is the resistance within the specified value?	3–7 Ω	*Go to Step 6*	*Go to Step 4*
4	1. Disconnect the automatic transmission wiring harness assembly at the PC solenoid valve. 2. Measure the resistance of the PC solenoid valve. Is the resistance within the specified range?	3–7 Ω	*Go to Step 5*	*Go to Step 8*
5	Replace the automatic transmission wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 16*	—
6	Measure the resistance from terminal C in the jumper harness to the transmission case. Is the resistance less than the specified value?	7 Ω	*Go to Step 7*	*Go to Step 9*
7	1. Inspect the automatic transmission wiring harness assembly (circuits 1228 (RED/BLK) and 1229 (LT BLU/WHT), for a short to ground condition. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Replace the harness if necessary. Refer to A/T Wiring Harness Replacement. Was the condition found?	—	*Go to Step 16*	*Go to Step 8*
8	Replace the PC solenoid valve. Refer to *Pressure Regulator Replacement.* Is the replacement complete?	—	*Go to Step 16*	—

DTC P0748 PC Solenoid Circuit Electrical (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
9	1. Disconnect the *J 39775* from the transmission side of the 20-way connector. 2. Reconnect the transmission 20-way connector. 3. Disconnect the PCM connector C1. 4. Measure the resistance between terminals C1–C7 and C1–C15. Is the resistance within the specified range?	3–7 Ω	*Go to Step 10*	*Go to Step 11*
10	Measure the resistance between terminal C1-C7 and a good ground. Is the resistance greater than the specified value?	7 Ω	*Go to Step 15*	*Go to Step 14*
11	Is the resistance in step 9 greater than the specified value?	7 Ω	*Go to Step 12*	*Go to Step 13*
12	1. Inspect circuit 1228 (RED/BLK) and circuit 1229 (LT BLU/WHT) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Repair the circuits if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was an open condition found?	—	*Go to Step 16*	*Go to Step 12*
13	1. Inspect circuits 1228 (RED/BLK) and 1229 (LT BLU/WHT) for a shorted condition. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Repair the circuits if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was a shorted condition found?	—	*Go to Step 16*	—
14	Inspect circuit 1228 (RED/BLK) and circuit 1229 (LT BLU/WHT) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a short to ground condition found?	—	*Go to Step 16*	—
15	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 16*	—
16	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 17*	—
17	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Ensure the following conditions are met: • The engine is running. • The PC solenoid duty cycle is 2–95%. 4. Select Specific DTC. 5. Enter DTC P0748. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0751 1-2 Shift Solenoid Valve Performance (L29/L31/L35)



40795

Circuit Description

The 1-2 shift solenoid (1-2 SS) valve controls the fluid flow action on the 1-2 and the 3-4 shift valves. The 1-2 SS valve is a normally-open exhaust valve that is used with the 2-3 shift solenoid valve (2-3 SS valve) in order to allow four different shifting combinations.

When the vehicle control module (VCM) detects a 2–2–3–3 gear ratio or a 1–1–4–4 gear ratio, then DTC P0751 sets. DTC P0751 is a type D DTC. For California emissions vehicles DTC P0751 is a type B DTC.

Conditions for Running the DTC

- No MAF DTCs P0101, P0102 or P0103.
- No MAP sensor DTCs P0106, P0107, or P0108.
- No TP sensor DTCs P0121, P0122, or P0123.
- No OSS DTCs P0502 or P0503.
- No A/T ISS sensor DTCs P0716 or P0717.
- No 1-2 SS valve DTC P0753.
- No 2-3 SS valve DTC P0758.
- No TFP manual valve position switch DTC P1810.
- No TCC PWM solenoid valve DTC P1860.
- The engine must be running more than 475 RPM for 7 seconds.
- The vehicle speed is greater than 3 km/h (2.0 mph).
- The TP sensor is greater than 10%. (5.7 & 7.4L), 12% (4.3L).
- The engine torque is 95 N·m (70 lb ft) 4.3L, 108 N·m (80 lb ft) 5.7L, 7.4L to the following:
  - 405 N·m (300 lb ft) 4.3L
  - 540 N·m (400 lb ft) 5.7L
  - 675 N·m (500 lb ft) 7.4L.
- The transmission fluid temperature (TFT) is greater than 20°C (68°F).

Conditions for Setting the DTC

All the above conditions are met for running the DTC and one of the following conditions occur:

Stuck Off (after two occurrences)

When the 1-2 SS valve is stuck OFF, first gear is commanded and the ratio is equal to second gear for greater than 2.0 seconds, and 4th gear is commanded with the TCC locked and the ratio equals 3rd gear for greater than 3 seconds.

Stuck On (after five occurrences 5.7L, 7.4L) (seven occurrences 4.3L)

When the 1-2 SS valve is stuck ON, second gear is commanded and the ratio is equal to first gear for greater than 3 seconds.

Action Taken When the DTC Sets

- The VCM illuminates the malfunction indicator lamp (MIL) for California emissions vehicles.
- The VCM commands maximum line pressure.
- The VCM inhibits 3–2 downshifts above 25 mph.
- The VCM freezes shift adapts.
- The VCM stores DTC P0751 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the *Shift Speed* table.
- Other internal transmission failures can cause more than one shift to occur.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

  Refer to *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

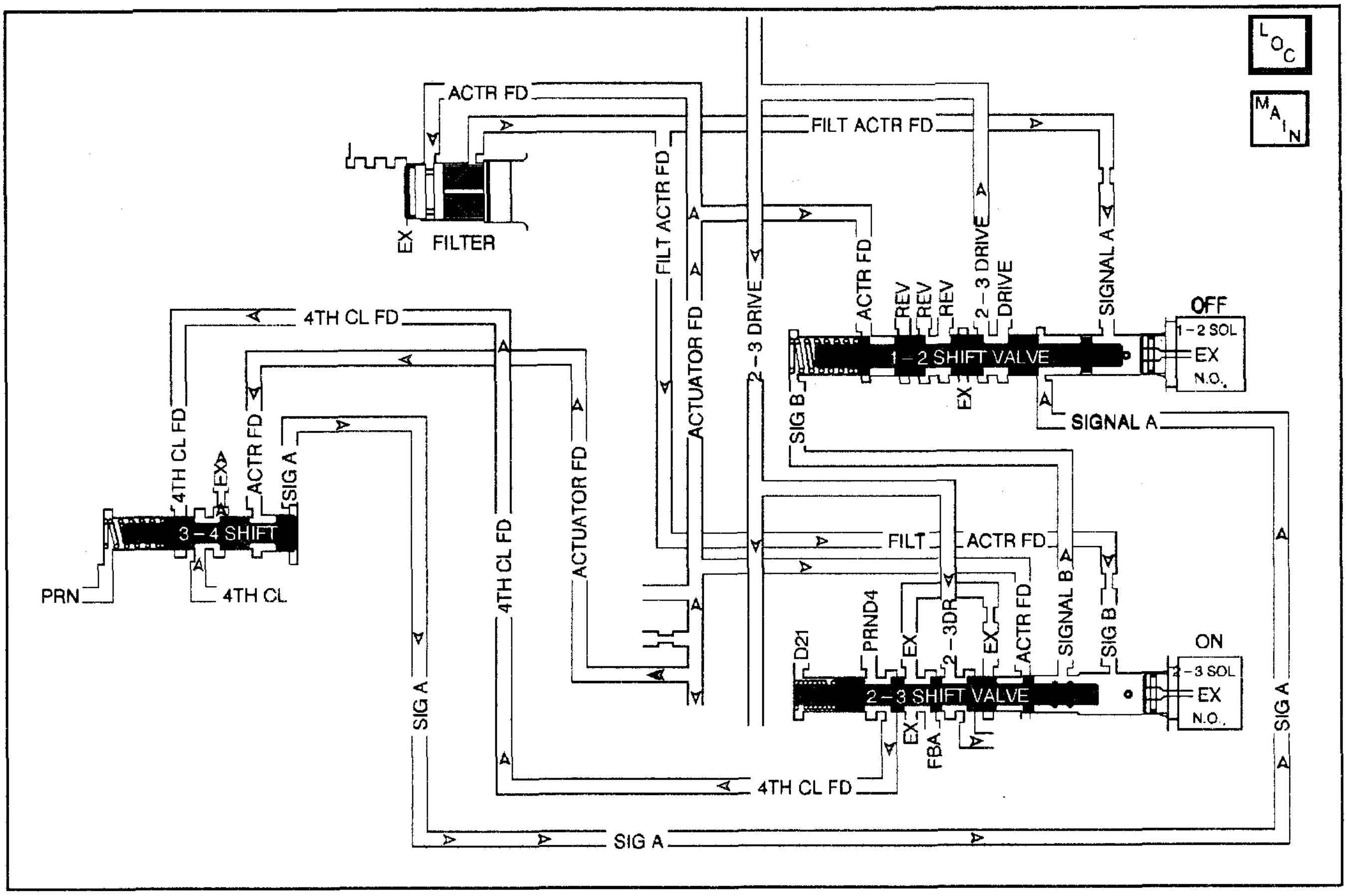
The numbers below refer to the step numbers on the diagnostic table.

2. This step tests the function of the TFP manual valve position switch.
3. This step tests whether the scan tool commanded all the shifts, or whether all the shift solenoids responded correctly but all of the correct shifts did not occur.

DTC P0751 1-2 Shift Solenoid Valve Performance (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Select TFP Sw. A/B/C on the scan tool. 5. With the engine operating, apply the brake pedal, and select each transmission range: D1, D2, D3, D4, N, R, and P. Refer to the *Range Signal* table. Does each selected transmission range match the scan tool TFP Switch display?	—	*Go to Step 3*	Go to *DTC P1810 TFP Valve Position Switch Circuit (L29/L31/L35)*
3	1. Raise and support the drive axle assembly. 2. Start the engine. 3. With the transmission in D4 range, use the scan tool in order to command FIRST, SECOND, THIRD, and FOURTH gears while accelerating the vehicle. Did you detect a 2-2-3-3 or 1-1-4-4 shift pattern only? (You may need to road test the vehicle).	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Inspect the shift solenoid/hydraulic circuit for a 1-2 SS valve internal malfunction. 2. Inspect the shift solenoid/hydraulic circuit for a stuck 1-2 shift valve. 3. Inspect the shift solenoid/hydraulic circuit for damaged seals on one or both of the shift solenoids. The shift solenoids can leak oil into the second gear clutch pack. Refer to *Symptom Diagnosis.* Was the condition found?	—	*Go to Step 5*	Go to Diagnostic Aids
5	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 6*	—
6	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions (If traffic and road conditions permit): • Accelerate the vehicle with the TP angle greater than 12% up to 55 mph. • The VCM must see the proper ratio for each commanded gear for greater than one second in D1, D2, D3, and D4 (wait for the TCC Lock-up in 4th gear). 4. Select Specific DTC. 5. Enter DTC P0751. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0751 1-2 Shift Solenoid Valve Performance (L57/L65 EFI)



40795

Circuit Description

The 1-2 shift solenoid (1-2 SS) valve controls the fluid flow action on the 1-2 and the 3-4 shift valves. The 1-2 SS valve is a normally-open exhaust valve that is used with the 2-3 shift solenoid (2-3 SS) valve to allow four different shifting combinations.

When the powertrain control module (PCM) detects a 2–2–3–3 or a 1–1–4–4 gear ratio, then DTC P0751 sets. DTC P0751 is a type B DTC.

Conditions for Running the DTC

- No MAP sensor DTCs P0106, P0107, or P0108.
- No OSS DTCs P0722 or P0723.
- No A/T ISS sensor DTCs P0716 or P0717.
- No TCC DTCs P0741 or P0742.
- No 1-2 SS valve DTC P0753.
- No 2-3 SS valve DTC P0758.
- No TFP manual valve position switch DTC P1810.
- The engine must be running greater than 475 RPM for at least 7 seconds.
- The vehicle speed is greater than 3.2 km/h (2 mph).
- The APP angle is greater than 10%.
- System voltage is 8.0–18.0 volts.
- The engine torque is 108–644 N·m (80–475 lb ft).
- The transmission fluid temperature is greater than 20°C (68°F) and less than 130°C (255°F).
- The engine speed is less than 3,750 RPM.

Conditions for Setting the DTC

All the above conditions are met for Running the DTC and one of the following conditions occur:

Stuck Off (for two occurrences)

- First gear is commanded and the gear ratio is equal to second gear for greater than 1.5 seconds.
- Fourth gear is commanded (with TCC locked) and the gear ratio equals third gear for greater than 3 seconds.

Stuck On (for five occurrences)

Second gear is commanded and the gear ratio equals first gear for greater than 2.2 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM commands maximum line pressure.
- The PCM freezes shift adapts.
- The PCM stores DTC P0751 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the *Shift Speed* table.
- Other internal transmission failures may cause similar shift patterns.
- First diagnose and clear any engine DTCs or APP Sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

  Refer to *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

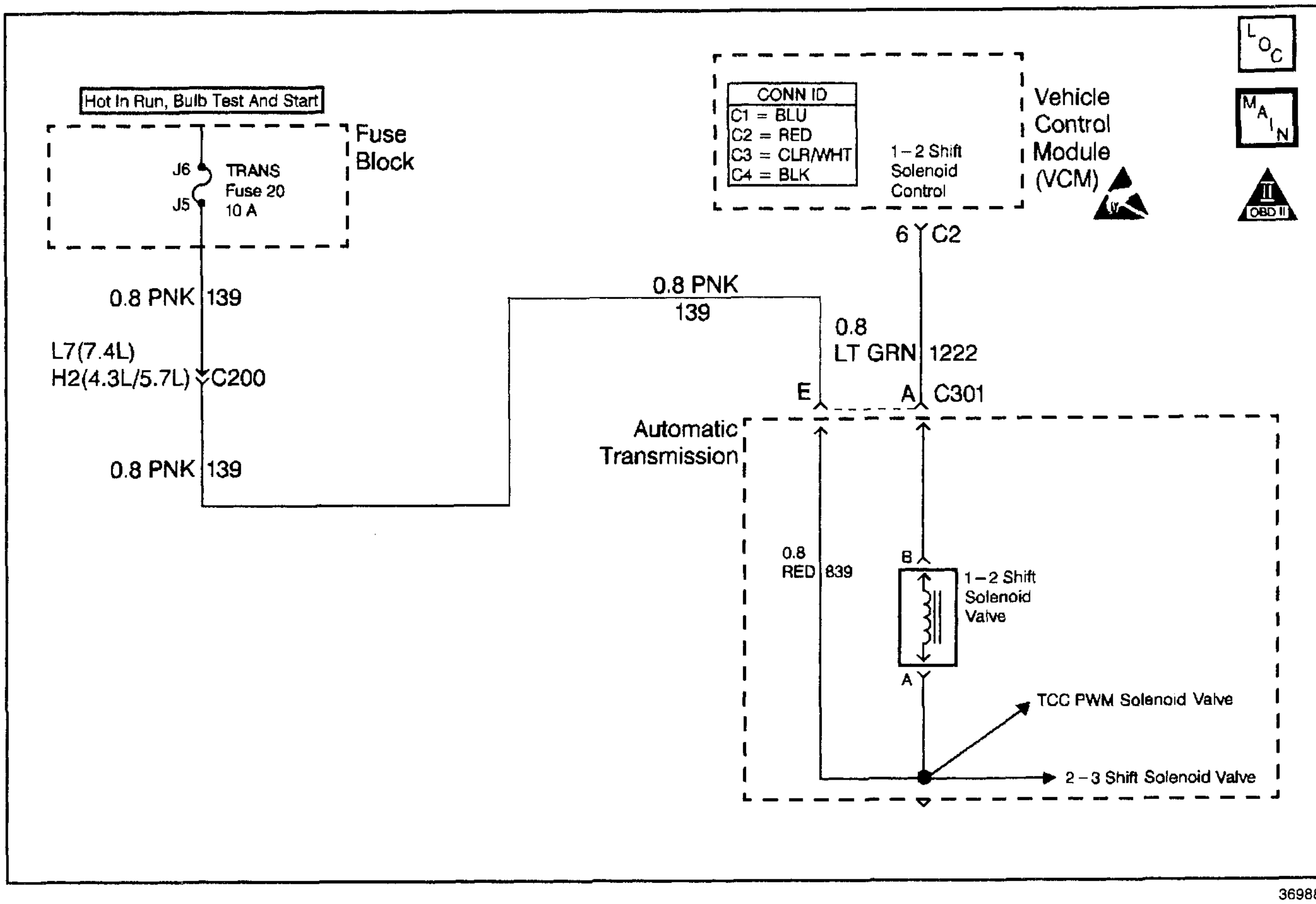
The numbers below refer to the step numbers on the diagnostic table.

2. This step tests the function of the TFP manual valve position switch.
3. This step tests whether the scan tool commanded all the shifts, or whether all the shift solenoids responded correctly but all the shifts did not occur.

DTC P0751 1-2 Shift Solenoid Valve Performance (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. 5. Select TFP Sw. A/B/C on the scan tool. 6. With the engine operating, apply the brake pedal, and select each transmission range: D1, D2, D3, D4, N, R, and P. Refer to the *Range Signal* table. Does each selected transmission range match the scan tool TFP Switch A/B/C display?	—	*Go to Step 3*	Go to *DTC P1810 TFP Valve Position Switch Circuit (L57/L65 EFI)*
3	1. Raise and support the drive axle assembly. 2. Start the engine. 3. With the transmission in D4 range, use the scan tool in order to command FIRST, SECOND, THIRD and FOURTH gears while accelerating the vehicle. Did you detect a 2-2-3-3 or 1-1-4-4 shift pattern only? (You may need to road test the vehicle).	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Inspect the shift solenoid/hydraulic circuit for a 1-2 SS valve internal malfunction. 2. Inspect the shift solenoid/hydraulic circuit for damaged seals on one or both of the shift solenoids. Refer to *Symptom Diagnosis.* Was a condition found?	—	*Go to Step 5*	—
5	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 6*	—
6	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions (If traffic and road conditions permit): • Place the transmission in D4. • Hold the throttle greater than 10%, and accelerate to 55 mph. • The PCM must see the proper gear ratio for each commanded gear for greater than one second in D1, D2, D3, and D4 with TCC locked. 4. Select Specific DTC. 5. Enter DTC P0751. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0753 1-2 Shift Solenoid Circuit Electrical (L29/L31/L35)



Circuit Description

The 1-2 shift solenoid (SS) valve controls the fluid flow action on the 1-2 and the 3-4 shift valves. The 1-2 SS valve is a normally-open exhaust valve that is used with the 2-3 SS valve to allow for four different shifting combinations. The 1-2 SS valve attaches to the control valve body within the transmission.
The ignition voltage goes directly to the 1-2 SS valve. The VCM controls the 1-2 SS Valve by providing the ground path through circuit 1222.

When the vehicle control module (VCM) detects a continuous open or short in the 1-2 SS valve circuit or the 1-2 SS valve, then DTC P0753 sets. DTC P0753 is a type D DTC. For California emissions vehicles, DTC P0753 is a type A DTC.

Conditions for Running the DTC

- The system voltage is 10–16 volts.
- The ignition is ON.
- The engine runs more than 475 RPM for greater than 7 seconds.

Conditions for Setting the DTC

All conditions for running the DTC are met, and either of the following conditions occur for 4.3 out of 5 seconds.

- The VCM commands the solenoid on, and the voltage input remains high (B+).
- The VCM commands the solenoid off and the voltage input remains low.

Action Taken When the DTC Sets

- The VCM illuminates the malfunction indicator lamp (MIL) for California emissions vehicles.
- The VCM commands maximum line pressure.
- The VCM freezes shift adapts.
- The VCM inhibits 3–2 downshifts above 25 MPH.
- The VCM stores DTC P0753 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the wiring at the VCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- An open ignition feed on circuit 1020 can cause multiple DTCs to set.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

  Refer to *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests the function of the 1-2 SS valve and the internal wiring harness.
5. This step tests the power to the 1-2 SS valve from the ignition through the fuse.
7. This step tests the ability of the VCM and the wiring to control the ground circuit.
10. This step measures the resistance of the automatic transmission wiring harness assembly and the 1-2 SS valve.

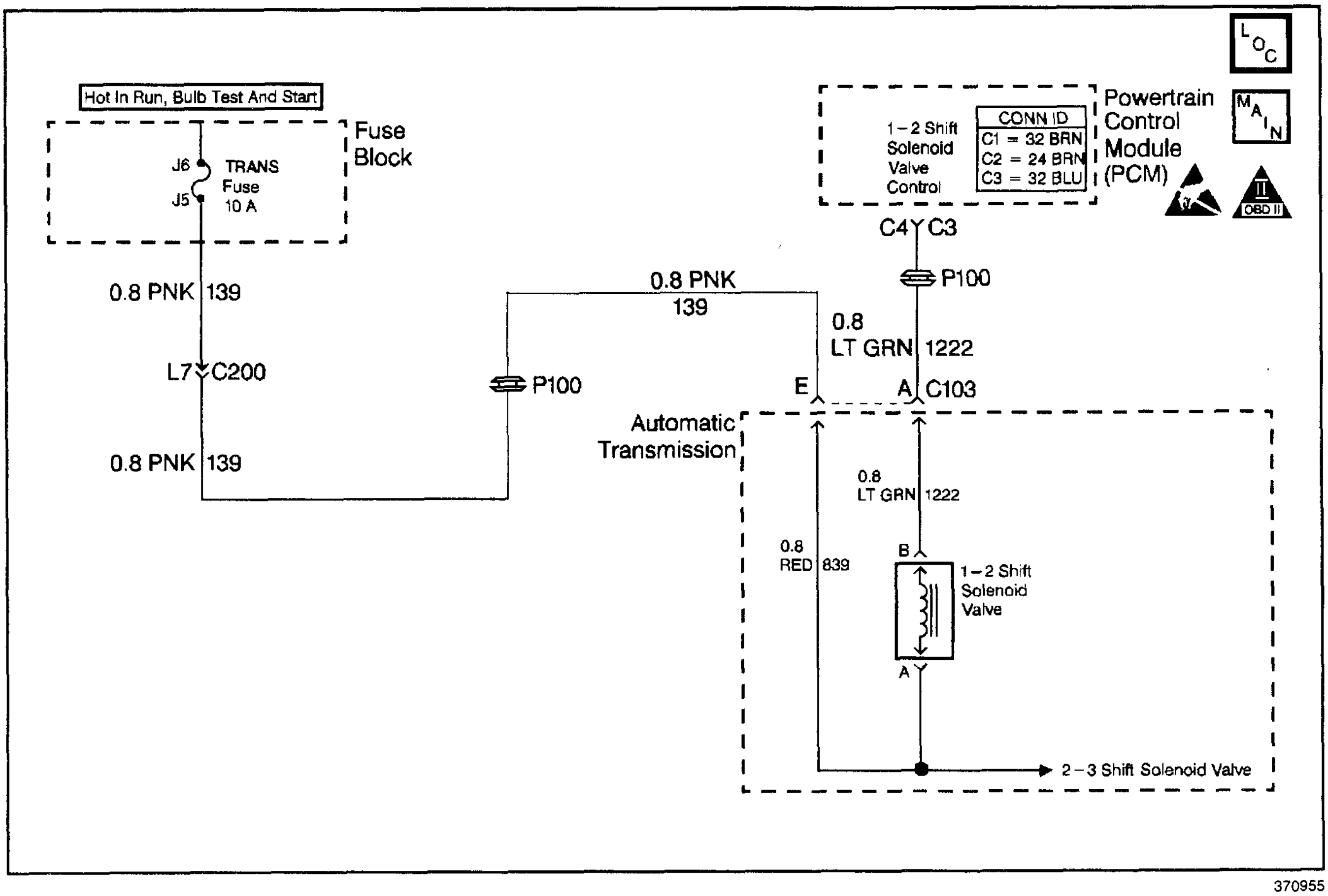
DTC P0753 1-2 Shift Solenoid Circuit Electrical (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. Were DTCs P0753, P0758, or P1860 also set?	—	*Go to Step 3*	*Go to Step 4*
3	1. Inspect the transmission fuse. 2. If an open fuse is found, inspect the following components for a short to ground: • Circuit 139 (PNK) • The 3 solenoids • The automatic transmission wiring harness assembly 3. Repair the circuit, the solenoid, and replace the harness if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 4*
4	Using the transmission output control function on the scan tool, command the 1-2 SS valve ON and OFF three times while listening to the bottom of the transmission pan (use a stethoscope if needed). Does the solenoid click when commanded?	—	Go to Diagnostic Aids	*Go to Step 5*
5	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTCs will set). 3. Install the *J 39775* jumper harness on the engine harness connector. 4. With the engine OFF, turn the ignition switch to the RUN position. 5. Connect a 12 volt test lamp from the *J 39775* cavity E to ground. Is the test lamp on?	—	*Go to Step 7*	*Go to Step 6*
6	Repair the open or high resistance in ignition feed circuit 139 (PNK) to the 1-2 SS valve. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 16*	—
7	1. Install a 12 volt test lamp between cavities E and A of the *J 39775.* 2. Using the transmission output control function, command the 1-2 SS valve ON and OFF three times. Does the test lamp illuminate when you command the shift solenoid ON and turn off when you command the shift solenoid OFF?	—	*Go to Step 10*	*Go to Step 8*

DTC P0753 1-2 Shift Solenoid Circuit Electrical (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
8	Inspect circuit 1222 (LT GRN) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 9*
9	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 16*	—
10	1. Turn the ignition OFF. 2. Install *J 39775* on the transmission 20-way connector (Automatic Transmission Connector End View). 3. With the *J 39200* DMM and the *J 35616-A* connector test adapter kit, measure the resistance between terminals A and E. Is the resistance within the specified values?	19–31 Ω	*Go to Step 12*	*Go to Step 11*
11	1. Disconnect the automatic transmission wiring harness assembly from the 1-2 SS valve. 2. Measure the resistance of the 1-2 SS valve. Is the resistance within the specified values?	19–31 Ω	*Go to Step 14*	*Go to Step 15*
12	1. Measure the resistance between terminal A and ground. Use the *J 39200* DMM. 2. Measure the resistance between terminal E and ground. Are both readings greater than the specified value?	250 kΩ	Go to Diagnostic Aids	*Go to Step 13*
13	1. Disconnect the automatic transmission wiring harness assembly from the 1-2 SS valve. 2. Measure the resistance from the component's terminals to ground. Are both readings greater than the specified value?	250 kΩ	*Go to Step 14*	*Go to Step 15*
14	Replace the automatic transmission wiring harness assembly. Refer to AT Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 16*	—
15	Replace the 1-2 SS valve. Refer to *Control Valve Body Replacement*. Is the replacement complete?	—	*Go to Step 16*	—
16	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 17*	—
17	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Select the parameters 1-2 Solenoid and 1-2 Solenoid Open/Shorted to GND, and 1-2 Solenoid Shorted to Volts. 4. Operate the vehicle under the following conditions: • The VCM commands the 1-2 SS valve ON, and the 1-2 Solenoid Shorted to Voltage is NO. • The VCM commands the 1-2 SS valve OFF, and the 1-2 Solenoid Open/Shorted to GND is NO. • All conditions met for 5 seconds. 5. Select Specific DTC. 6. Enter DTC P0753. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0753 1-2 Shift Solenoid Circuit Electrical (L57/L65 EFI)



Circuit Description

The 1-2 shift solenoid (1-2 SS) valve controls the fluid flow acting on the 1-2 and the 3-4 shift valves. The 1-2 SS valve is a normally-open exhaust valve that is used with the 2-3 shift solenoid (2-3 SS) valve in order to allow four different shifting combinations. The 1-2 SS valve attaches to the control valve body within the transmission. The ignition voltage goes directly to the 1-2 SS valve. The powertrain control module (PCM) controls the 1-2 SS valve by providing the ground path through circuit 1222.

If the PCM detects a continuous open or short to ground in the 1-2 SS valve circuit or the 1-2 SS valve, then DTC P0753 sets. DTC P0753 is a type A DTC.

Conditions for Running the DTC

- The engine runs more than 475 RPM for greater than 7 seconds.
- System voltage is 8.0–18.0 volts.

Conditions for Setting the DTC

The above conditions are met and either of the following conditions occur for 4.3 out of 5 seconds:

- The PCM commands the Solenoid ON and the voltage input remains high (B+).
- The PCM commands the Solenoid OFF and the voltage input remains low (0 volts).

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM commands maximum line pressure.
- The PCM freezes shift adapts.
- The PCM stores DTC P0753 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the transmission connector and all other connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- An open ignition feed circuit can cause multiple DTCs to set.
- First diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.

  Refer to *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests the function of the 1-2 SS valve and the automatic transmission wiring harness assembly.
5. This step tests the power to the 1-2 SS valve from the ignition through the fuse.
7. This step tests the ability of the PCM and the wiring to control the ground circuit.
10. This step measures the resistance of the automatic transmission wiring harness assembly and the 1-2 SS valve.

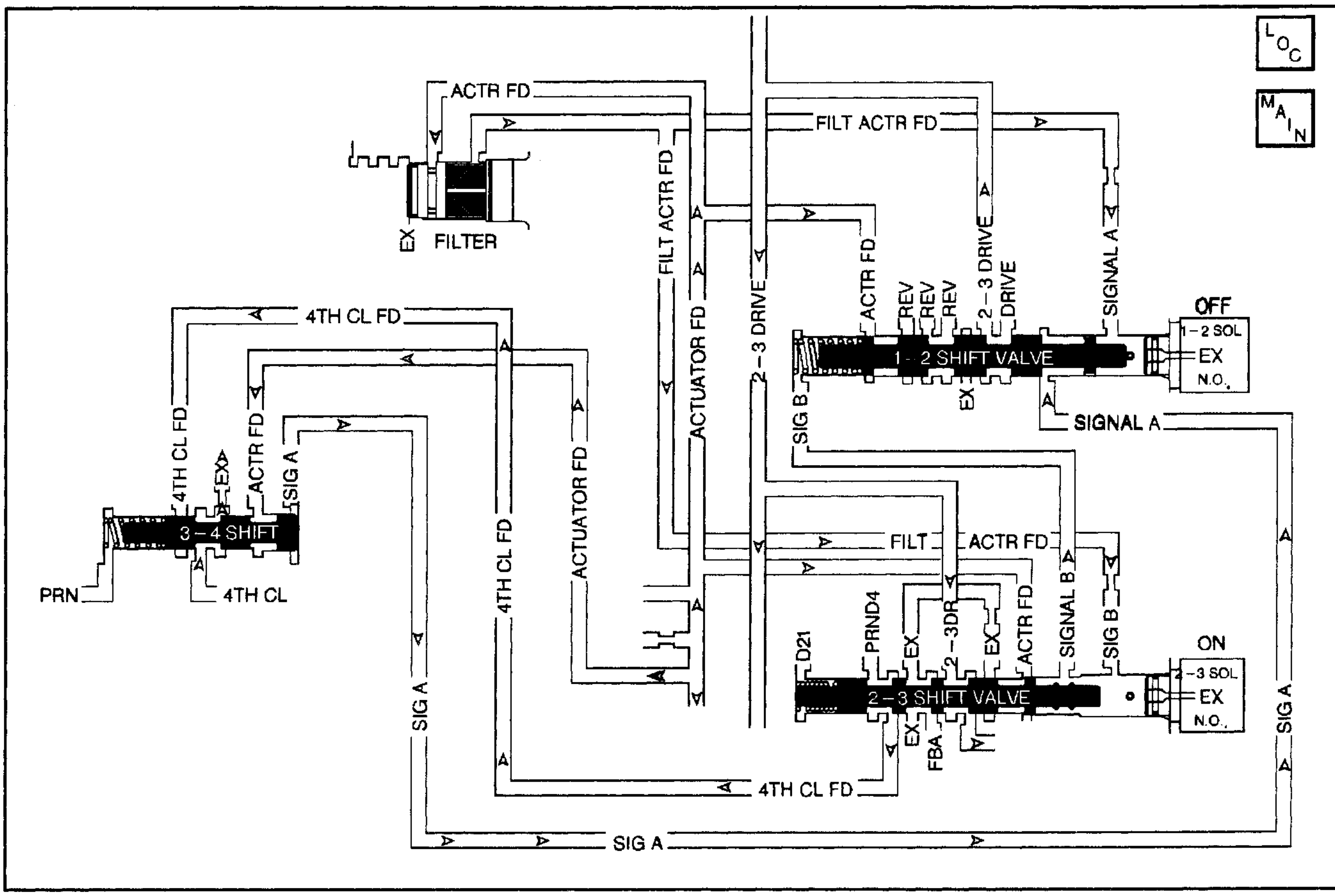
DTC P0753 1-2 Shift Solenoid Circuit Electrical (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. Are DTCs P0758 or P1860 also set?	—	*Go to Step 3*	*Go to Step 4*
3	1. Inspect the transmission fuse for an open. 2. If you found an open fuse, inspect circuit 139 (PNK), the three solenoids, and the automatic transmission wiring harness assembly for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	*Go to Step 5*
4	Using the transmission output control function on the scan tool, command the 1-2 SS valve ON and OFF three times while listening to the bottom of the transmission pan (use a stethoscope if needed). Does the solenoid click when commanded?	—	Go to Diagnostic Aids	*Go to Step 5*
5	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTCs will set). 3. Install the *J 39775* jumper harness on the engine side of the 20-way connector. 4. With the engine OFF, turn the ignition switch to the RUN position. 5. Connect a test lamp from the *J 39775* cavity E to a good ground. Is the test lamp on?	—	*Go to Step 7*	*Go to Step 6*
6	Repair the open or short to ground in ignition feed circuit 139 (PNK) to the 1-2 SS valve. Refer to *Wiring Repairs* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	—
7	1. Install a test lamp between cavity E and cavity A of the *J 39775.* 2. Using the transmission output control function on the scan tool, command the 1-2 SS valve ON and OFF three times. Does the test lamp illuminate when the shift solenoid is commanded ON and turn off when the shift solenoid is commanded OFF?	—	*Go to Step 10*	*Go to Step 8*
8	Inspect circuit 1222 (LT GRN) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 9*
9	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 16*	—

DTC P0753 1-2 Shift Solenoid Circuit Electrical (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Install *J 39775* on the transmission 20-way connector. 3. With the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the resistance between terminals A and E. Is the resistance within the specified value?	19–31 Ω	*Go to Step 12*	*Go to Step 11*
11	1. Disconnect the automatic transmission wiring harness assembly from the 1-2 SS valve. 2. measure the resistance of the 1-2 SS valve. Is the resistance within the specified values?	19–31 Ω	*Go to Step 14*	*Go to Step 15*
12	Measure the resistance between terminals A and E and a good ground. Are both reading greater than the specified value?	250 kΩ	Go to Diagnostic Aids	*Go to Step 13*
13	1. *Disconnect the automatic transmission wiring harness* assembly from the 1-2 SS valve. 2. Measure the resistance from the 1-2 SS valve terminals to a good ground. Are both readings greater than the specified value?	250 kΩ	*Go to Step 14*	*Go to Step 15*
14	Replace the automatic transmission wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 16*	—
15	Replace the 1-2 SS valve. Refer to *Control Valve Body Replacement.* Is the replacement complete?	—	*Go to Step 16*	—
16	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 17*	—
17	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Select the parameters 1-2 Sol. and 1-2 Sol. Open/Shorted to GND, and 1-2 Sol. Shorted to Volts. 4. Operate the vehicle under the following conditions: • The PCM commands the 1-2 SS Valve ON, and the 1-2 Sol. Shorted to Voltage is No. • The PCM commands the 1-2 SS Valve OFF, and the 1-2 Sol. Open/Shorted to GND is No. • All conditions are met for 5 seconds. 5. Select Specific DTC. 6. Enter DTC P0753. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0756 2-3 Shift Solenoid Valve Performance (L29/L31/L35)



40795

Circuit Description

The 2-3 shift solenoid (2-3 SS) valve controls fluid flow acting on the 2-3 shift valves. The 2-3 SS valve is a normally-open exhaust valve used with the 1-2 shift solenoid (1-2 SS) valve in order to allow for four different shift combinations.

If the VCM detects a non first gear ratio while first gear is commanded or a first gear ratio while fourth gear is commanded, then DTC P0756 sets.
DTC P0756 is a type D DTC. For California emissions vehicles, DTC P0756 is a type A DTC.

Conditions for Running the DTC

- No MAF DTCs P0101, P0102 or P0103.
- No MAP DTCs P0106, P0107, or P0108.
- No TP sensor DTCs P0121, P0122, or P0123.
- No OSS DTCs P0502 or P0503.
- No A/T ISS sensor DTCs P0716 or P0717.
- No TFP manual valve position switch DTC P1810.
- No shift solenoid electrical DTCs P0753 or P0758.
- The engine runs more than 475 RPM for 7 seconds.
- The vehicle speed is greater than 4 km/h (2.0 mph).
- The TP angle is greater than 12.5% (4.3L).
- The transmission fluid temperature (TFT) is greater than 20°C (68°F).
- The engine torque is 108 N·m (80 lb ft) to the following:
  - 405 N·m (300 lb ft) 4.3L
  - 540 N·m (400 lb ft) 5.7L
  - 675 N·m (500 lb ft) 7.4L

Conditions for Setting the DTC

All of the conditions for running the DTC are met and either of the two following conditions occur:

Stuck On (for 7 occurrences)

when the 2-3 SS valve is stuck on, the commanded gear equals 1st and the ratio equals 4th for greater than 2 seconds, and the commanded gear equals 2nd and the ratio equals 3rd for greater than 3 seconds.

Stuck Off (for 7 occurrences)

when the 2-3 SS valve is stuck off, the commanded gear equals 3rd and the ratio equals 2nd for greater than 4 seconds.

Action Taken When the DTC Sets

- The VCM illuminates the malfunction indicator lamp (MIL) for California emissions vehicles.
- The VCM commands 2nd gear.
- The VCM commands maximum line pressure.
- The VCM freezes shift adapts.
- The VCM stores DTC P0756 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the *Shift Speed* table.
- Other internal transmission failures may cause more than one shift to occur.
- The customer may complain of an engine over-rev condition or NEUTRAL condition in 4th gear.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

  Refer to *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

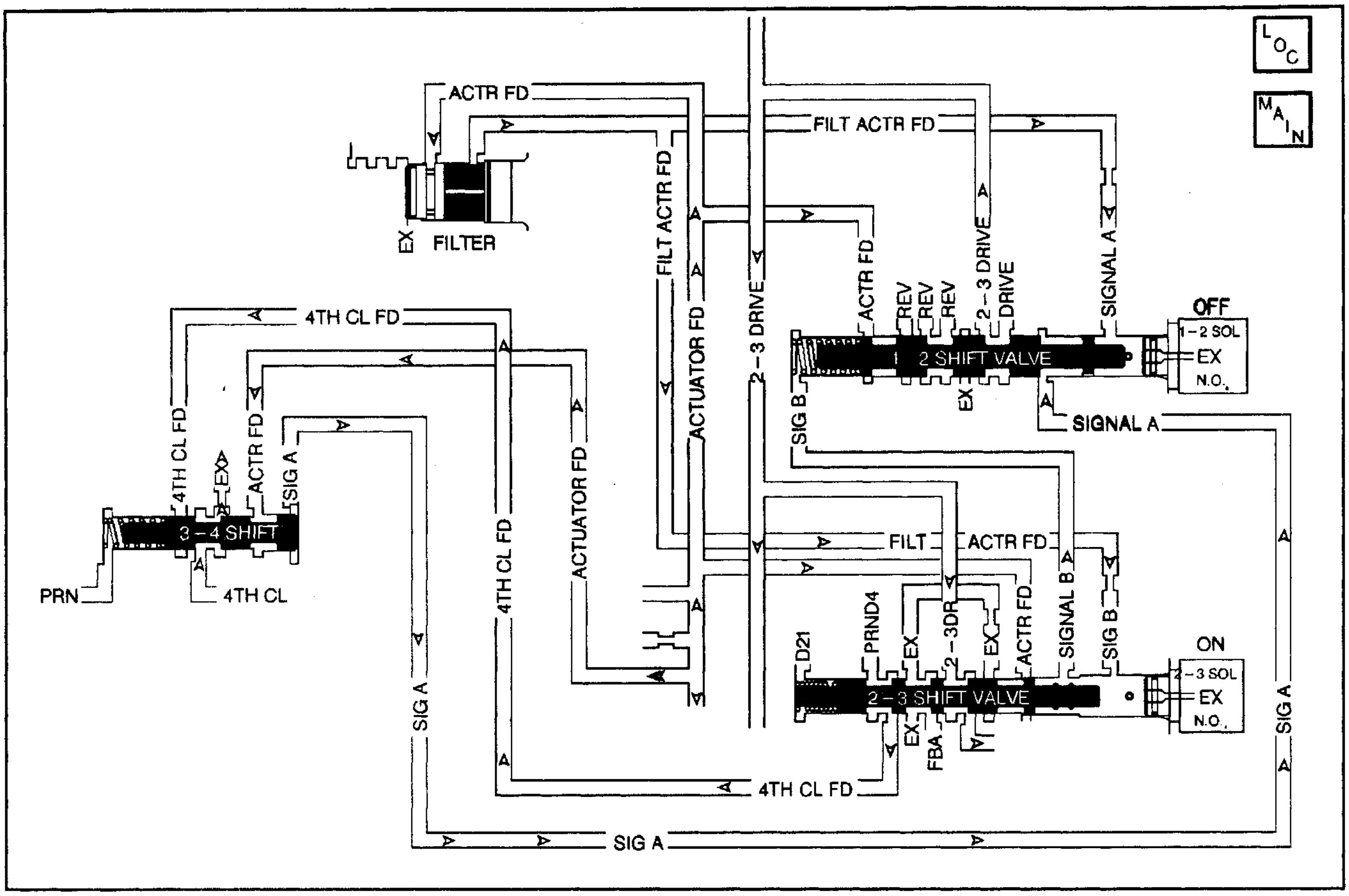
The numbers below refer to the step numbers on the diagnostic table.

2. This step tests the function of the TFP manual valve position switch.
3. This step tests for a selected gear ratio versus a ratio not obtainable under normal operating conditions.

DTC P0756 2-3 Shift Solenoid Valve Performance (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Select TFP Sw. A/B/C on the scan tool. 5. With the engine running, apply the brake pedal and select each transmission range: D1, D2, D3, D4, N, R, and P. Refer to the *Range Signal* table. Does each selected transmission range match the scan tool TFP Switch A/B/C display?	—	*Go to Step 3*	Go to *DTC P1810 TFP Valve Position Switch Circuit (L29/L31/L35)*
3	1. Raise and support the axle assembly. 2. Start the engine. 3. With the transmission in the D4 range, use the scan tool in order to command 1st, 2nd, 3rd, and 4th gears while accelerating the vehicle. Was 1st gear commanded and not achieved, or 4th gear commanded and another gear occurred? (You may need to road test the vehicle).	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Inspect the shift solenoid/hydraulic for an internal malfunction at one or both of the shift solenoids. 2. Inspect the shift solenoid/hydraulic for damaged seals on one or both of the shift solenoids. Refer to *Symptom Diagnosis.* Was the condition found?	—	*Go to Step 5*	—
5	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 6*	—
6	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions only if traffic conditions permit: • The VCM must see the proper gear ratio for each gear for greater than one second in D1, D2, D3, and D4. • Accelerate the vehicle with the TP angle greater than 8% (4.3L, 12.5%) up to 55 mph. The TCC must be locked in fourth gear. 4. Select Specific DTC. 5. Enter DTC P0756. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0756 2-3 Shift Solenoid Valve Performance (L57/L65 EFI)



40795

Circuit Description

The 2-3 shift solenoid (2-3 SS) valve controls fluid flow acting on the 2-3 shift valve. The 2-3 SS valve is a normally-open exhaust valve that is used with the 1-2 shift solenoid (1-2 SS) valve to allow four different shift combinations.

When the powertrain control module (PCM) detects a non first gear ratio while first gear is commanded or a first gear ratio while fourth gear is commanded, then DTC P0756 sets. DTC P0756 is a type A DTC.

Conditions for Running the DTC

- No TFT sensor DTCs P0712 or P0713.
- No A/T ISS sensor DTCs P0716 or P0717.
- No OSS sensor DTCs P0722 or P0723.
- No shift solenoid electrical DTCs P0753 or P0758.
- No TFP manual valve position switch DTC P1810.
- System voltage is 8.0–18.0 volts.
- The vehicle speed is greater than 3.2 km/h (2 mph).
- The APP angle is greater than 10%.
- The transmission fluid temperature (TFT) is 20°–130°C (68°–266°F).
- The engine torque is 100–644 N·m (80–475 lb ft).
- The engine speed is 475–3750 RPM for at least 7 seconds.

Conditions for Setting the DTC

All of the above conditions for Running the DTC are met and either of the two following conditions occur:

Stuck On (after 2 occurrences)

- First gear is commanded and the ratio equals 4th gear for greater than 2.75 seconds.
- Second gear is commanded and the gear ratio equals 3rd for greater than 2.75 seconds.

Stuck Off (after 7 Occurrences)

Third gear is commanded and the gear ratio equals 2nd for greater than 3.25 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM commands 2nd gear.
- The PCM commands maximum line pressure.
- The PCM freezes shift adapts.
- The PCM stores DTC P0756 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the *Shift Speed* table.
- Other internal transmission failures may cause similar shift patterns.
- The customer may complain of an engine over-rev condition or neutral condition in 4th gear.
- First diagnose and clear any engine DTCs or APP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

  Refer to *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

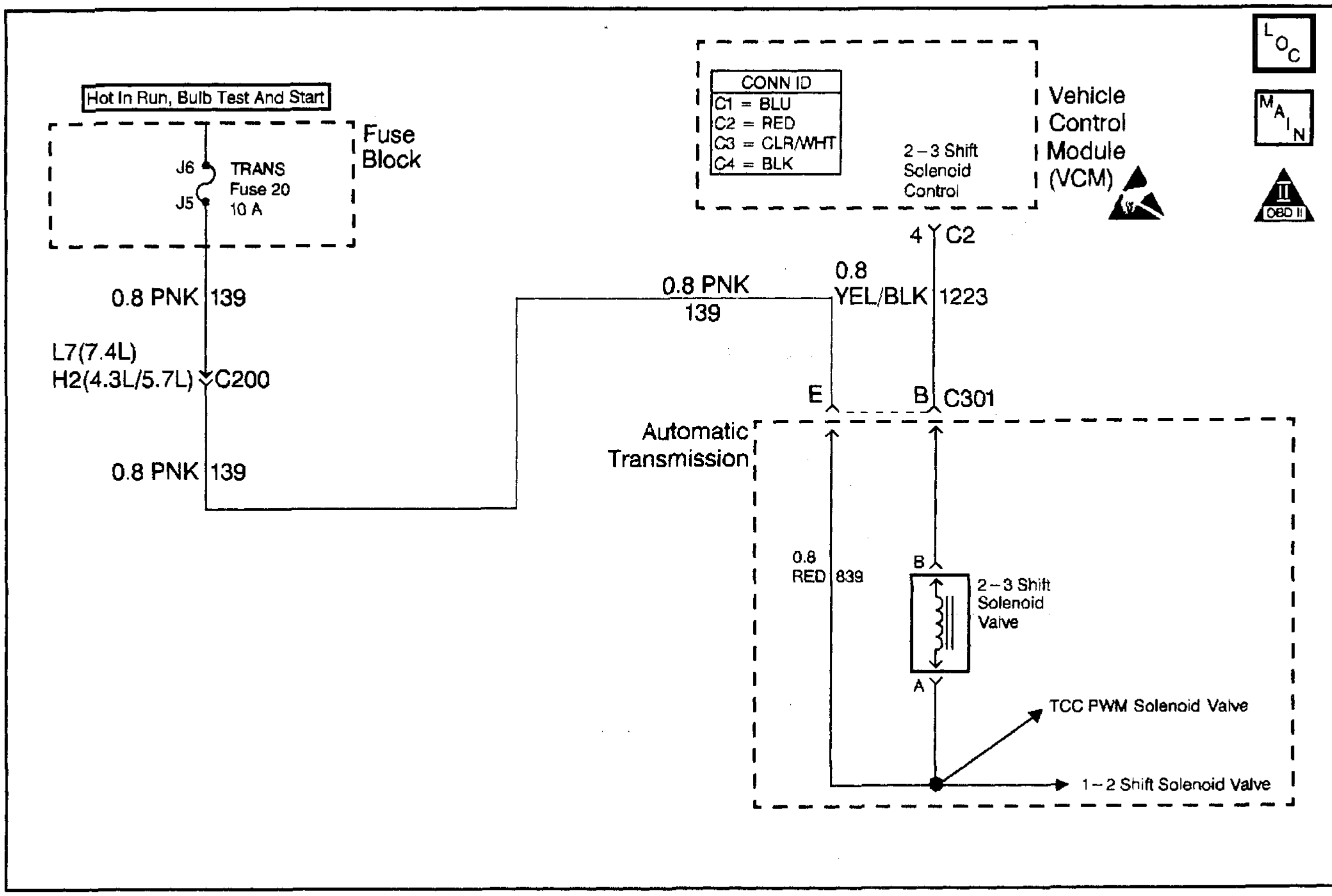
The numbers below refer to the step numbers on the diagnostic table.

2. This step tests the function of the TFP manual valve position switch.
3. This step tests for a selected gear ratio versus a ratio not obtainable under normal driving conditions.

DTC P0756 2-3 Shift Solenoid Valve Performance (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. 5. Select TFP switch A/B/C on the scan tool. 6. With the engine running, apply the brake pedal and select each transmission range: D1, D2, D3, D4, N, R, and P. Refer to the *Range Signal* table. Does each selected transmission range match the scan tool TFP Switch A/B/C display?	—	*Go to Step 3*	Go to *DTC P1810 TFP Valve Position Switch Circuit (L57/L65 EFI)*
3	1. Raise and support the drive axle assembly. 2. Start the engine. 3. With the transmission in the D4 range, use the scan tool in order to command 1st, 2nd, 3rd, and 4th gears while accelerating the vehicle. Was 1st gear commanded and not achieved, or 4th gear commanded and another gear occurred? (The vehicle may need to be road tested).	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Inspect the shift solenoid/hydraulic for an internal malfunction at one or both of the shift solenoids. 2. Inspect the shift solenoid/hydraulic for damaged seals on one or both of the shift solenoids. Refer to *Symptom Diagnosis.* Was a condition found?	—	*Go to Step 5*	—
5	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 6*	—
6	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions only if traffic conditions permit: • The PCM must see the proper gear ratio for each commanded gear for greater than one second in D1, D2, D3, and D4 with TCC locked. • Accelerate the vehicle with the TP greater than 10% to 55 mph. 4. Select Specific DTC. 5. Enter DTC P0756. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0758 2-3 Shift Solenoid Circuit Electrical (L29/L31/L35)



Circuit Description

The 2-3 shift solenoid (SS) valve controls fluid acting on the 2-3 shift valve. The 2-3 SS valve is a normally-open exhaust valve used with the 1-2 SS valve in order to allow four different shifting combinations. The 2-3 SS valve attaches to the control valve body within the transmission. The ignition voltage goes directly to the 2-3 SS valve. The vehicle control module (VCM) controls the 2-3 SS valve by providing the ground path through circuit 1223.

If the VCM detects a continuous open or short in the 2-3 SS valve circuit or the 2-3 SS valve, then DTC P0758 sets. DTC P0758 is a type D DTC. For California emissions vehicles, DTC P0758 is a type A DTC.

Conditions for Running the DTC

- The system voltage is 10–16 volts.
- The engine is running more than 475 RPM for more than 7 seconds.

Conditions for Setting the DTC

The above conditions are met and either of the following conditions occur for 4.3 out of 5 seconds.

- The VCM commands the 2-3 SS valve ON, and the voltage input remains high (B+).
- The VCM commands the 2-3 SS valve OFF, and the voltage input remains low (0 volts).

Action Taken When the DTC Sets

- The VCM illuminates the malfunction indicator lamp (MIL) for California emission vehicles.
- The VCM commands an immediate landing to second gear.
- The VCM commands maximum line pressure.
- The VCM freezes shift adapts form being updated.
- The VCM stores DTC P0758 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the wiring at the VCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

  Refer to *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests the function of the 2-3 SS valve and the internal wiring harness.
5. This step tests the power to the 2-3 SS valve from the ignition through the fuse.
7. This step tests the ability of the VCM and the wiring to control the ground circuit.
10. This step measures the resistance of the automatic transmission (A/T) wiring harness assembly and the 2-3 SS valve.

DTC P0758 2-3 Shift Solenoid Circuit Electrical (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. Were DTCs P0753, or P1860 also set?	—	*Go to Step 3*	*Go to Step 4*
3	1. Inspect the transmission fuse. 2. If an open fuse was found, inspect the following components for a short to ground. • Circuit 139 • The 3 solenoids • The automatic transmission wiring harness assembly 3. Repair the circuit, the solenoid, or replace the harness if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 4*
4	Using the scan tool output control function, command the 2-3 SS valve ON and OFF three times while listening to the bottom of the transmission pan (use a stethoscope if needed). Does the solenoid click when commanded?	—	Go to Diagnostic Aids	*Go to Step 5*

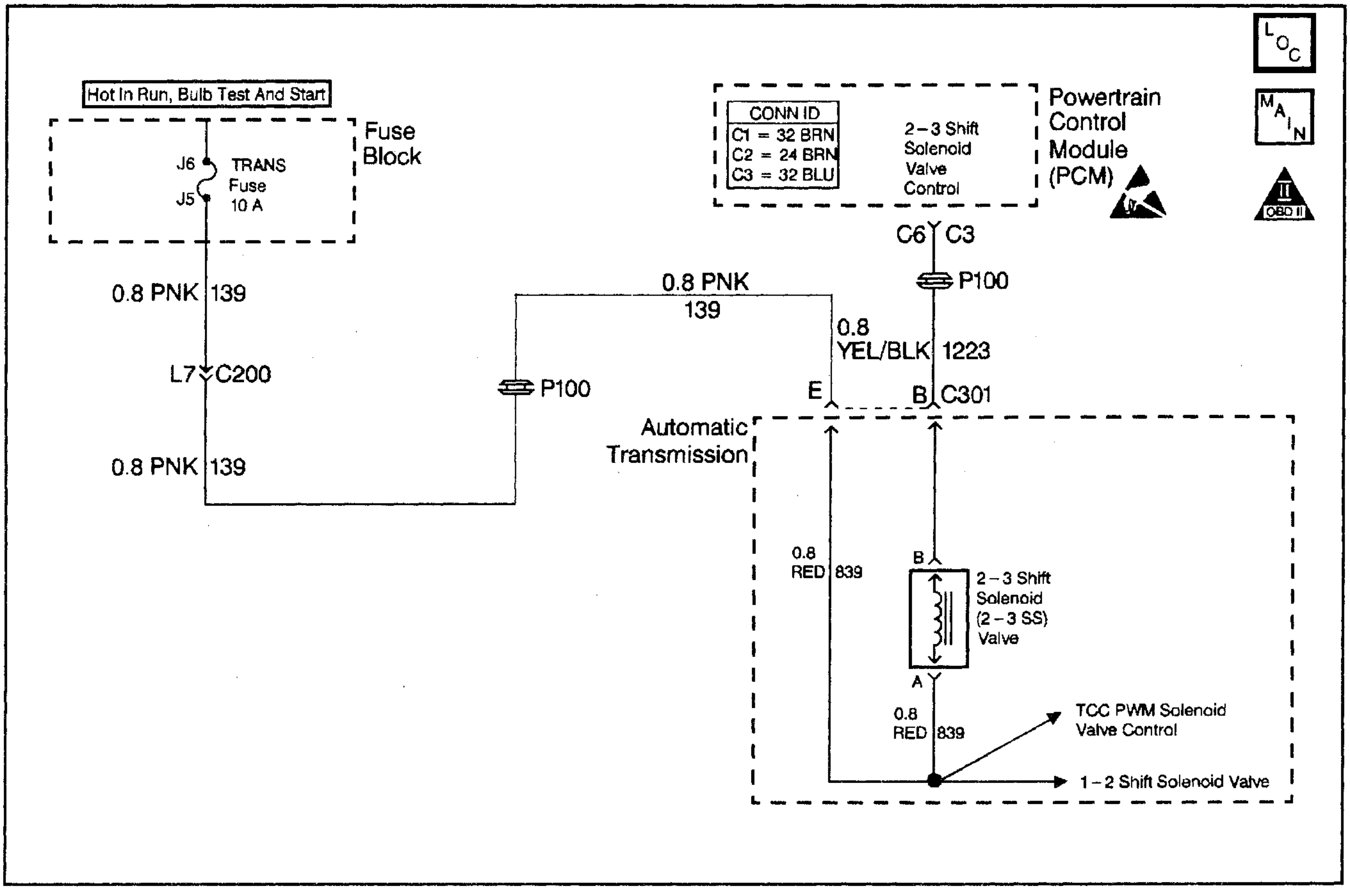
DTC P0758 2-3 Shift Solenoid Circuit Electrical (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTCs will set). 3. Install the *J 39775* jumper harness on the engine harness connector. 4. With the engine OFF, turn the ignition switch to the RUN position. 5. Connect a 12 volt test lamp from the *J 39775* cavity E to ground. Is the test lamp on?	—	*Go to Step 7*	*Go to Step 6*
6	Repair the open or high resistance in ignition feed circuit 139 (PNK) to the 2-3 SS valve. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 16*	—
7	1. Install the test lamp between cavities E and B of the *J 39775*. 2. Using the transmission output control function, command the 2-3 SS valve ON and OFF three times. Does the test lamp illuminate when you command the shift solenoid ON and turn off when you command the shift solenoid OFF?	—	*Go to Step 10*	*Go to Step 8*
8	Inspect circuit 1223 (YEL/BLK) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	*Go to Step 9*
9	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 16*	—
10	1. Turn the ignition OFF. 2. Install *J 39775* on the transmission 20-way connector (Automatic Transmission Connector End View). 3. With the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the resistance between terminals B and E. Is the resistance within the specified values?	19–31 Ω	*Go to Step 12*	*Go to Step 11*
11	1. Disconnect the automatic transmission wiring harness assembly from the 2-3 SS valve. 2. Measure the resistance of the 2-3 SS valve. Is the resistance within the specified values?	19–31 Ω	*Go to Step 14*	*Go to Step 15*
12	1. Measure the resistance between terminal B and a good ground. Use the *J 39200* DMM. 2. Measure the resistance between terminal E and a good ground. Are both readings greater than the specified value?	250 kΩ	Go to Diagnostic Aids	*Go to Step 13*
13	1. Disconnect the automatic transmission wiring harness assembly from the 2-3 SS valve. 2. Measure the resistance from the component's terminals to ground. Are both readings greater than the specified value?	250 kΩ	*Go to Step 14*	*Go to Step 15*

DTC P0758 2-3 Shift Solenoid Circuit Electrical (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
14	Replace the automatic transmission wiring harness assembly. Refer to AT Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 16*	—
15	Replace the 2-3 SS valve. Refer to *Control Valve Body Replacement.* Is the replacement complete?	—	*Go to Step 16*	—
16	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 17*	—
17	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Select the parameters, 2-3 Solenoid, and 2-3 Solenoid Open/Shorted to GND, and 2-3 Solenoid Shorted to Voltage. 4. Operate the vehicle under the following conditions: • The VCM commands the 2-3 SS valve ON, and the 2-3 Solenoid Shorted to Volts is NO. • The VCM commands the 2-3 SS valve OFF, and the 2-3 Solenoid Open/Shorted to GND is NO. • All conditions met for 5 seconds. 5. Select Specific DTC. 6. Enter DTC P0758. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P0758 2-3 Shift Solenoid Circuit Electrical (L57/L65 EFI)



Circuit Description

The 2-3 shift solenoid (2–3 SS) valve controls the fluid flow acting on the 2-3 shift valve. The 2-3 SS valve is a normally-open exhaust valve used with the 1-2 shift solenoid (1-2 SS) valve in order to allow four different shifting combinations. The 2-3 SS valve attaches to the control valve body within the transmission. The ignition voltage goes directly to the 2-3 SS valve. The powertrain control module (PCM) controls the 2-3 SS valve by providing the ground path through circuit 1223.

If the PCM detects a continuous open or short to ground in the 2-3 SS valve circuit or the 2-3 SS valve, then DTC P0758 sets. DTC P0758 is a type A DTC.

Conditions for Running the DTC

- The engine is running greater than 475 RPM for greater than 7 seconds.
- The system voltage is 8.0–18.0 volts.

Conditions for Setting the DTC

The PCM detects either of the following fail conditions for 4.3 out of 5 seconds.

- The PCM commands the solenoid ON and voltage input remains high (B+).
- The PCM commands the solenoid OFF and voltage input remains low (0 volts).

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM commands an immediate landing to second gear.
- The PCM commands maximum line pressure.
- The PCM freezes shift adapts.
- The PCM stores DTC P0758 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- An open ignition feed circuit can cause multiple DTCs to set.
- First diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.

  Refer to *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests the function of the 2-3 SS valve and the automatic transmission wiring harness assembly.
5. This step tests the power to the 2-3 SS Valve from the ignition through the fuse.
7. This step tests the ability of the PCM and the wiring to control the ground circuit.
10. This step measures the resistance of the automatic transmission wiring harness assembly and the 2-3 SS valve.

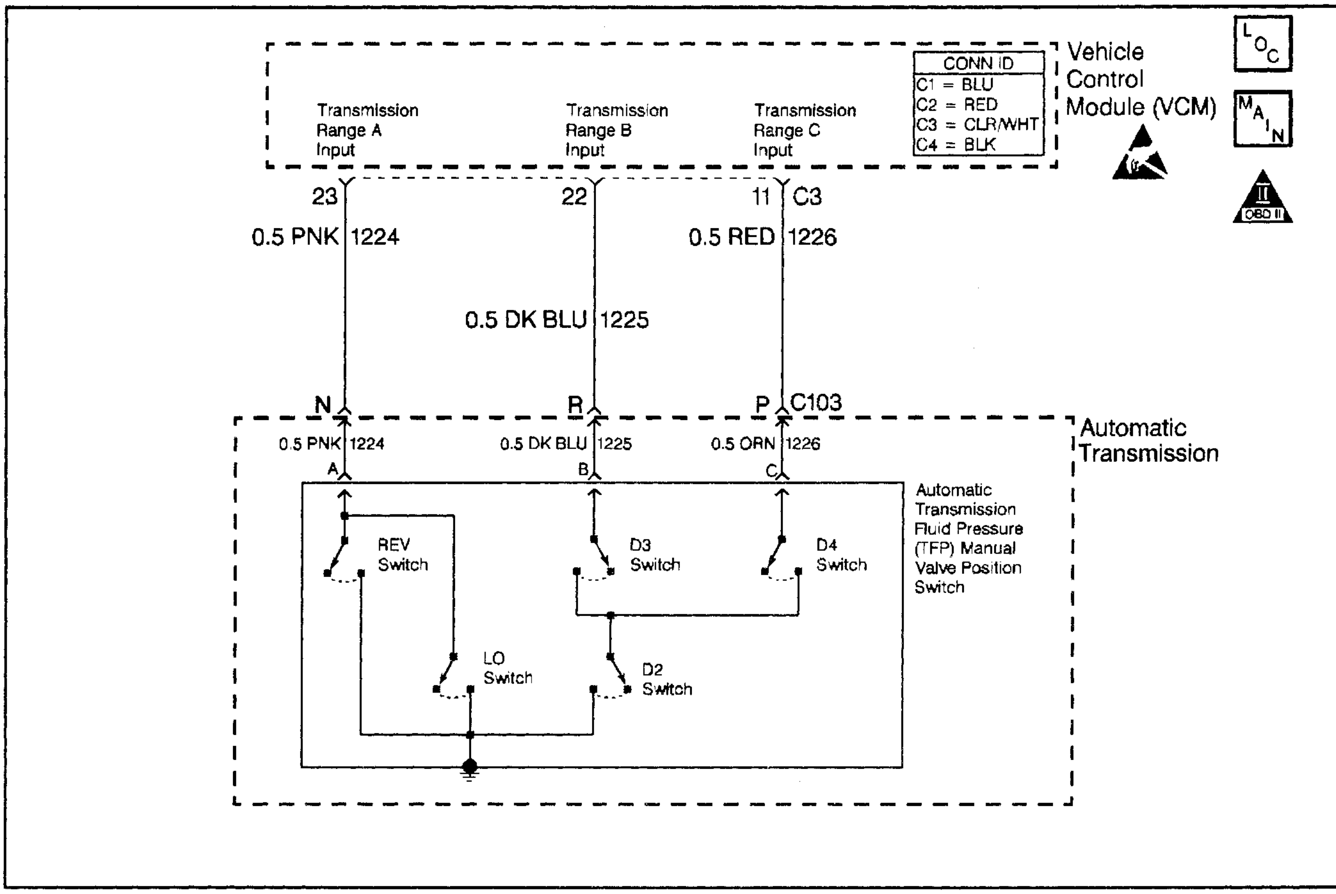
DTC P0758 2-3 Shift Solenoid Circuit Electrical (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. Are DTCs P0753, or P1860 also set?	—	*Go to Step 3*	*Go to Step 4*
3	1. Inspect the transmission fuse for an open. 2. If you found an open fuse, inspect circuit 139 (PNK), the three solenoids, and the automatic transmission wiring harness assembly for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	*Go to Step 5*
4	Using the transmission output control function on the scan tool command the 2-3 SS valve ON and OFF three times while listening to the bottom of the transmission pan (use a stethoscope if needed). Does the solenoid click when commanded?	—	Go to Diagnostic Aids	*Go to Step 5*
5	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTCs will set). 3. Install the *J 39775* jumper harness on the engine side of the 20-way connector. 4. With the engine OFF, turn the ignition switch to the RUN position. 5. Connect a test lamp from *J 39775* cavity E to a good ground. Is the test lamp on?	—	*Go to Step 7*	*Go to Step 6*
6	Repair the open or high resistance in ignition feed circuit 139 (PNK) to the 2-3 SS valve. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 16*	—
7	1. Install a test lamp between cavity E and cavity B of the *J 39775.* 2. Using the transmission output control function on the scan tool, command the 2-3 SS valve ON and OFF three times. Does the test lamp illuminate when the shift solenoid is commanded ON and turn off when the shift solenoid is commanded OFF?	—	*Go to Step 10*	*Go to Step 8*
8	Inspect circuit 1223 (YEL/BLK) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open or short to ground condition found?	—	*Go to Step 16*	*Go to Step 9*
9	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 16*	—

DTC P0758 2-3 Shift Solenoid Circuit Electrical (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Install the *J 39775* on the transmission 20-way connector. 3. With the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the resistance between terminals B and E. Is the resistance within the specified value?	19–31 Ω	*Go to Step 12*	*Go to Step 11*
11	1. Disconnect the automatic transmission wiring harness assembly from the 2-3 SS valve. 2. Measure the resistance of the 2-3 SS valve. Is the resistance within the specified values?	19–31 Ω	*Go to Step 14*	*Go to Step 15*
12	Measure the resistance between terminals B and E to a good ground. Are both reading greater than the specified value?	250 kΩ	Go to Diagnostic Aids	*Go to Step 13*
13	1. Disconnect the automatic transmission wiring harness assembly from the 2-3 SS valve. 2. Measure the resistance from the 2-3 SS valve terminals to a good ground. Are both readings greater than the specified value?	250 kΩ	*Go to Step 14*	*Go to Step 15*
14	Replace the automatic transmission wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 16*	—
15	Replace the 2-3 SS valve. Refer to *Control Valve Body Replacement.* Is the replacement complete?	—	*Go to Step 16*	—
16	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 17*	—
17	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Select the parameters, 2-3 Sol. and 2-3 Sol. Open/ Shorted to GND. 4. Operate the vehicle under the following conditions: • The PCM commands the 2-3 SS valve ON, and the 2-3 Sol. Open/Shorted to Volts is No. • The PCM commands the 2-3 SS valve OFF, and the 2-3 Sol. Open/Shorted to GND is No. • All conditions are met for 5 seconds. 5. Select Specific DTC. 6. Enter DTC P0758. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P1810 TFP Valve Position Switch Circuit (L29/L31/L35)



369890

Circuit Description

The automatic transmission fluid pressure (TFP) manual valve position switch consists of five normally-open pressure switches. The vehicle control module (VCM) supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the VCM detects what manual valve position has been selected, and compares the actual voltage combination of the switches to a TFP manual valve position switch combination table stored in memory.

The TFP manual valve position switch assembly cannot distinguish between PARK and NEUTRAL because the monitored valve body pressures are identical in both cases. With the ignition ON and the engine OFF, D2 is indicated. When the transmission 20-way connector is disconnected, the ground potential for the three range signals to the VCM is removed, and with the ignition ON, D2 is indicated.

If the VCM detects an invalid state of the TFP manual valve position switch circuit by deciphering the TFP manual valve position switch inputs, then DTC P1810 sets. DTC P1810 is a type D DTC. For California emissions vehicles DTC P1810 is a type B DTC.

Conditions for Running the DTC

- The system voltage is 10–16.0 volts.
- The engine speed is greater than 500 RPM for 7 seconds.
- No OSS DTCs P0502 or P0503.
- No ISS DTCs P0716 or P0717.
- No PSA DTC P1810.
- No MAP DTCs P0106, P0107 or P0108.
- No 1-2 SS DTCs P0751 or P0753.
- No 2-3 SS DTCs P0756 or P0758.
- Not in fuel cut off.
- The engine torque is:
  - 108–540 N·m (80–400 lb ft)
  - 108–675 N·m (80–500 lb ft)
- The engine vacuum is 0–105 kPA.

Conditions for Setting the DTC

DTC P1810 sets during the second consecutive trip in which any of the following condition occurs:

Condition 1

The VCM detects an illegal TFP manual valve position switch state for 60 seconds.

Condition 2

- The engine speed is less than 50 RPM for 0.3 second; then between 50 and 550 RPM for 0.3 second; then the engine speed is greater than 550 RPM.
- The vehicle speed is less than 4 km/h (2.5 mph).
- The VCM detects the gear range as D2 before and after start up.
- All conditions are met for 7 seconds.

Condition 3

- The vehicle speed is greater than 8 km/h (5 mph).
- The TP angle is greater than 10%.

The TFP switch indicates the following:

- P/N when the ratio indicates less than 1.05:1 for greater than 15 seconds.
- Reverse when the ratio indicates D4, D3, D2, and D1 for greater than 5 seconds.
- D4, D3, D2, and D1 when the ratio indicates reverse for greater than 7 seconds.

Action Taken When the DTC Sets

- The VCM illuminates the malfunction indicator lamp for California emission vehicles.
- The VCM commands maximum line pressure.
- The VCM assumes D4 for the PRNDL shift pattern.
- The VCM freezes shift adapts.
- The VCM commands the TCC on in commanded fourth gear.
- The VCM stores DTC P1810 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Refer to the *Range Signal* table for the normal range signals and the illegal combinations.
- Inspect the wiring at the VCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- DTC P1810 can be falsely set during a fluid fill procedure. After refilling the fluid, cycle key down then start and run the vehicle for 20 seconds. Key down and allow the VCM to power down, and then restart the vehicle.
- DTC P1810 can be set falsely by low pump pressure or a stuck pressure regulator.
- DTC P1810 can be set by a rolled forward clutch piston seal. It may allow the VCM to see a 2.08:1 ratio (reverse) when the manual valve position is indicated as D4.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the indicated range signal to the manual valve that is actually selected.
4. This step tests the voltage from the VCM to the transmission 20-way connector.

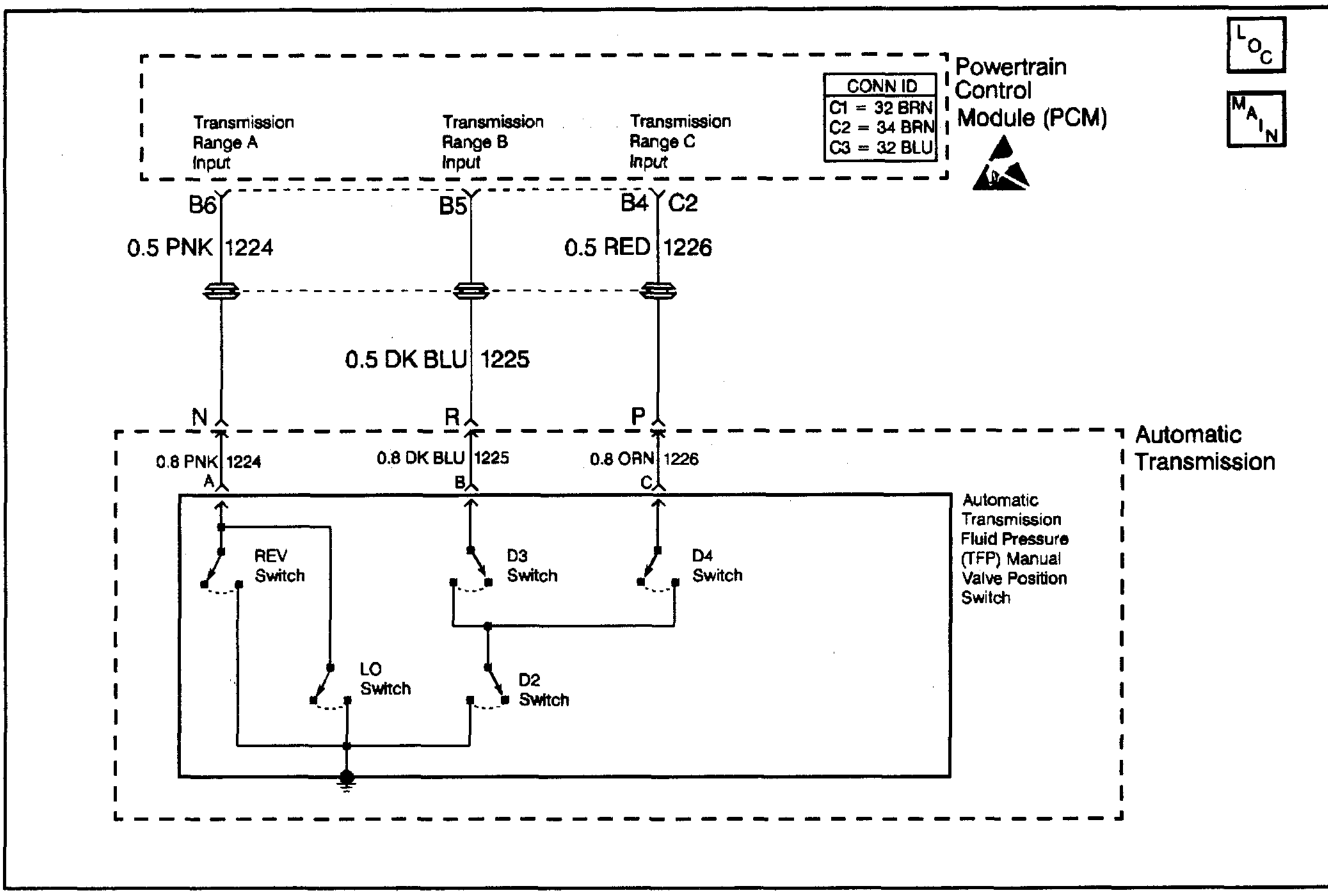
DTC P1810 TFP Valve Position Switch Circuit (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Inspect for proper adjustment of the transmission linkage from the select lever to the manual valve. 2. Inspect the fluid. Were the inspections performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. 5. While the engine idles at normal operating temperature, apply the parking brake. 6. Select each transmission range: D1, D2, D3, D4, N, R, and P. Refer to the *Range Signal* table. Does each selected transmission range match the scan tool TFP switch A/B/C display?	—	Go to Diagnostic Aids	*Go to Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTCs may set). 3. Install the *J 39775* jumper harness on the engine side of the transmission 20-way connector. 4. With the engine OFF, turn the ignition to the RUN position. 5. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, check the voltage at the harness connector terminals N, R, and P. Is B+ displayed on all three circuits?	—	*Go to Step 6*	Go to Step *5*
5	Inspect the circuits that did not indicate B+ in Step 4 for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open or shorted to ground condition found?	—	*Go to Step 8*	*Go to Step 7*
6	Verify that circuits 1224, 1225, and 1226 are not shorted together. Use a fused jumper wire in order to ground each circuit while monitoring the scan tool TFP switch display. When a range signal circuit is grounded, are any of the other range signal circuits affected?	—	*Go to Step 8*	Go to *TFP Manual Valve Position Switch Resistance Check*
7	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 9*	—

DTC P1810 TFP Valve Position Switch Circuit (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
8	Repair the circuit wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 9*	—
9	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Turn the ignition switch to the RUN position for at least 2 seconds. • Start the vehicle. • Idle the vehicle in PARK above 600 RPM for 7 seconds. • Drive the vehicle in D4 with the throttle at least 10% and the TCC locked for 60 seconds. 4. Select Specific DTC. 5. Enter DTC P1810. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P1810 TFP Valve Position Switch Circuit (L57/L65 EFI)



370960

Circuit Description

The automatic transmission fluid pressure (TFP) manual valve position switch consists of five normally-open pressure switches. The powertrain control module (PCM) supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the PCM detects what manual valve position has been selected and compares the actual voltage combination of the switches to a TFP manual valve position switch combination chart stored in memory.

The TFP manual valve position switch cannot distinguish between PARK and NEUTRAL because the monitored valve body pressures are identical in both cases. With the ignition ON and the engine OFF, D2 is indicated. When the transmission 20-way connector is disconnected, the ground potential for the three range signals to the PCM is removed, and with the ignition ON, D2 is indicated.

If the PCM detects an invalid state of the TFP manual valve position switch circuit by deciphering the TFP manual valve position switch inputs, then DTC P1810 sets. DTC P1810 is a type B DTC.

Conditions for Running the DTC

- The system voltage is 8.0–18.0 volts.
- The APP angle is greater than 12%.
- The engine speed is greater than 475 RPM for greater than 7 seconds.
- No OSS DTCs P0502 or P0503.
- No ISS DTCs P0716 or P0717.
- No PSA DTC P1810.
- No MAP DTCs P0106, P0107 or P0108.
- No 1–2 SS DTCs P0751 or P0753.
- No 2–3 SS DTCs P0756 or P0758.
- The engine speed is less than 3750.
- Not in fuel cut-off.
- The engine torque is 108–644 N·m (80–475 lb ft).
- The engine vacuum is 0–105 kPA.

Conditions for Setting the DTC

DTC P1810 sets during the second consecutive trip in which any of the following condition occurs:

Condition 1

The PCM detects an illegal TFP manual valve position switch state for 25.5 seconds.

Condition 2

- The engine speed is less than 50 RPM for 1.5 second; then between 50 and 575 RPM for 0.3 second; then the engine speed is greater than 575 RPM.
- The vehicle speed is less than 4 km/h (2.5 mph).
- The PCM detects the gear range as D2 before and after start-up.
- All conditions are met for 7.5 seconds.

Condition 3

- The vehicle speed is greater than 8 km/h (5 mph).
- The TP angle is greater than 12%.

The PCM detects the following when the TFP switch indicates:

- P/N when the ratio indicates less than 1.05:1 for greater than 15 seconds.
- REVERSE when the ratio indicates D4, D3, D2 and D1 for greater than 15 seconds.
- D4, D3, D2 and D1 when the ratio indicates REVERSE for greater than 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM commands maximum line pressure.
- The PCM assumes D4 for the PRNDL shift pattern.
- The PCM freezes shift adapts.
- The PCM stores DTC P1810 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Refer to the *Range Signal* table for the normal range signals and the illegal combinations.
- Inspect the wiring at the PCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- DTC P1810 can be falsely set during a fluid fill procedure. After refilling the fluid, cycle key down then start and run the vehicle for 20 seconds. Key down and allow the PCM to power down, and then restart the vehicle.
- DTC P1810 can be set falsely by low pump pressure or a stuck pressure regulator.
- DTC P1810 can be set by a rolled forward clutch piston seal. It may allow the PCM to see a 2.08:1 ratio (REVERSE) when the manual valve position is indicated as D4.
- First diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.
- DTC P1810 may be inhibited from passing if the state of the battery is low, or there is a low cranking voltage. To pass DTC P1815, turn the ignition switch to the ON position with the engine OFF. Check that all the range signal switches (A, B, C) read OFF, OFF, OFF. Start the vehicle, and move the PRNDL through each selected transmission range.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the indicated range signal to the manual valve that is actually selected.
4. This step tests the voltage from the PCM to the transmission 20-way connector.

DTC P1810 TFP Valve Position Switch Circuit (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Inspect for proper adjustment of the transmission linkage from the select lever to the manual valve. 2. Inspect the fluid. Were the inspections performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. 5. While the engine idles at normal operating temperature, apply the parking brake. 6. Select each transmission range: D1, D2, D3, D4, N, R, and P. Refer to the *Range Signal* table. Does each selected transmission range match the scan tool *TFP Switch A/B/C display*?	—	Go to Diagnostic Aids	*Go to Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTCs may set). 3. Install the *J 39775* jumper harness on the engine side of the transmission 20-way connector. 4. With the engine OFF, turn the ignition to the RUN position. 5. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, check the voltage at the harness connector terminals N, R, and P. Do all three circuits display B+?	—	*Go to Step 6*	*Go to Step 5*
5	Inspect the circuits that did not indicate B+ in Step 4 for an open or short to ground condition. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 8*	*Go to Step 7*
6	To verify that circuits 1224 (PNK), 1225 (DRK BLU), and 1226 (RED) are not shorted together, use a fused jumper to ground on each circuit while monitoring the scan tool TFP switch display. When a range signal circuit is grounded, are any of the other range signal circuits affected?	—	*Go to Step 8*	Go to *TFP Manual Valve Position Switch Resistance Check*
7	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 9*	—

DTC P1810 TFP Valve Position Switch Circuit (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
8	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 9*	—
9	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Turn the ignition switch to the RUN position for at least 2 seconds. • Start the vehicle. • Idle the vehicle in PARK above 600 RPM for 8.5 seconds. • Drive the vehicle in D4 with throttle more than 12% and obtain TCC lock up. 4. Select Specific DTC. 5. Enter DTC P1810. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P1811 Maximum Adapt and Long Shift (L57/L65 EFI)

Range	Gear	1-2 Sol	2-3 Sol	Fourth Clutch	Overrun Clutch	O/D Roller Clutch	FWD Clutch	Direct Clutch	Front Band	Interm. Sprag Clutch	Interm Clutch	Lo Roller Clutch	Rear Band
Overdrive	1st	On	Off	—	—	H	A	—	—	*	—	H	—
	2nd	Off	Off	—	—	H	A	—	—	H	A	O	—
	3rd	Off	On	—	—	H	A	A	—	O	A	O	—
	4th	On	On	A	—	O	A	A	—	O	A	O	—
A = Applied H = Holding * = Holding but not effective O = Overrunning													

Circuit Description

The powertrain control module (PCM) compares the measured gear ratio to the known actual value. This allows the PCM to determine the actual gear range of the transmission. When an upshift is commanded, the PCM measures the interval during which the gear ratio leaves the current range and changes to reflect the commanded upshift. This interval is expressed on the scan tool as Shift Time. When this interval has exceeded a predetermined limit, the PCM utilizes the shift adapts in order to attempt to shorten the shift time.

If the PCM detects that the maximum allowable shift time has been exceeded, and that the upshift adapts have reached their upper limit, then DTC P1811 sets. DTC P1811 is a type D DTC.

Conditions for Running the DTC

The engine must be running at greater than 475 RPM for more than 7 seconds.

Conditions for Setting the DTC

One of the following conditions exists, with the adapt cells at the maximum pressure allowed for 5 consecutive occurrences of one shift.

- The 1-2 or the 2-3 upshifts are greater than 1.25 seconds.
- The 3-4 upshifts are greater than 6.37 seconds.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM freezes shift adapts.
- The PCM commands maximum line pressure.
- The PCM stores DTC P1811 in PCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from PCM history.
- The PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission-related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- DTC P1811 can be caused by a faulty *turbocharger or wastegate assembly.* If no other symptoms are present, check the turbocharger system for proper operation.
- Ask the customer about overloading the vehicle, exceeding the trailer-towing limit, or towing in OVERDRIVE.
- If, after several unsuccessful attempts to gain accurate shift times, and an adapt can be made, reset adapts and operate the vehicle, in order to assure proper shifting.
- While driving the vehicle, inspect for loss of power, misfire, or other engine-related driving problems.

Test Description

2. This step tests for low fluid level, which can cause delayed shifts.
3. This step compares the indicated range signal from the *Range Signal* table to the automatic transmission fluid pressure (TFP) manual valve position switch selected gear range.
5. This step tests for low line pressure, which can cause delayed and long shifts.

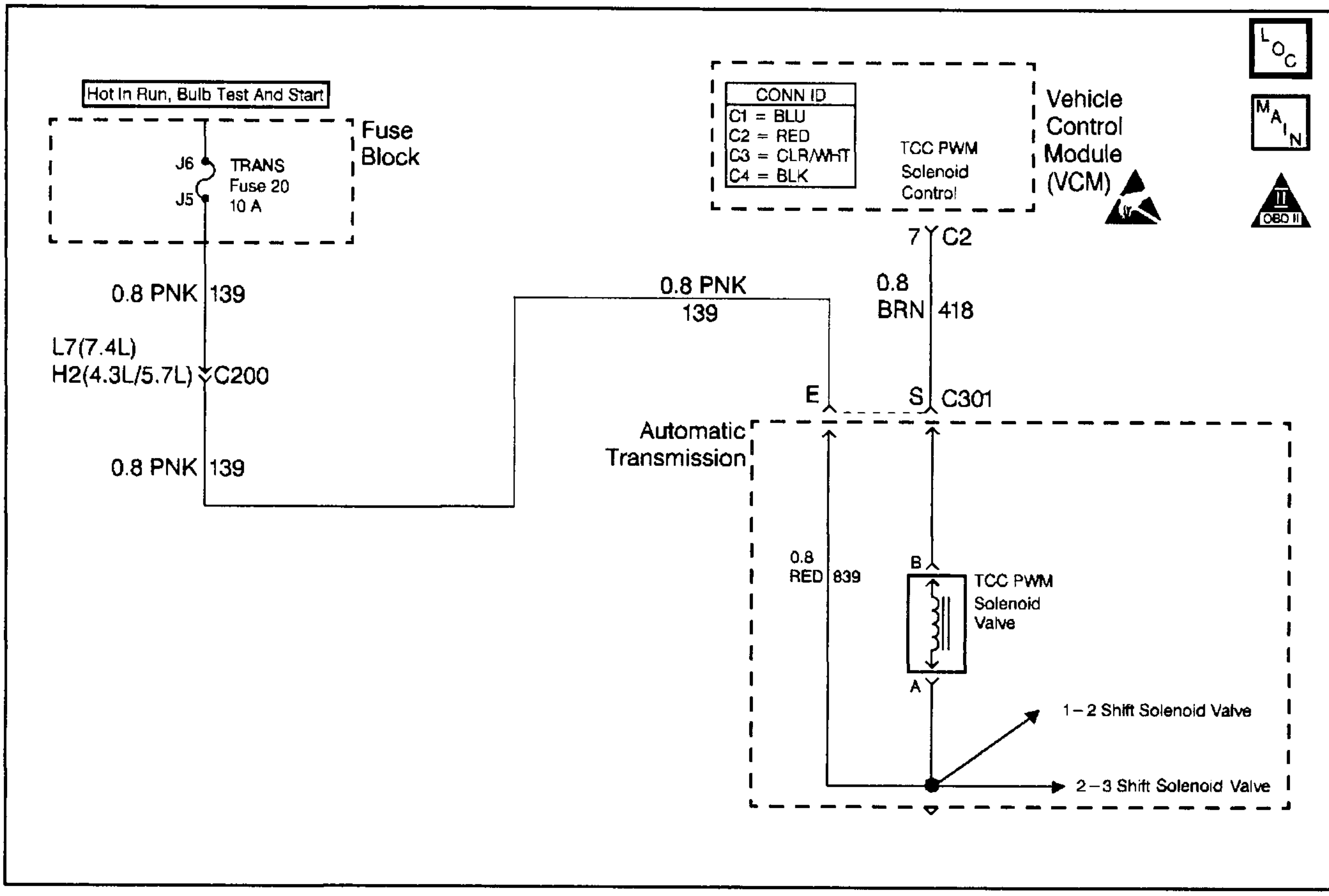
DTC P1811 Maximum Adapt and Long Shift (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Failure Records from the PCM. 3. Record the Freeze Frame. 4. Clear the DTC. **Important:** If any other engine or transmission DTCs are set, refer to their respective diagnostic tables first. 5. Select TFP Sw. A/B/C on the scan tool. 6. Start the engine and apply the brake pedal. 7. Select each gear range: D1, D2, D3, D4, N, R, and P. Refer to the *Range Signal* table. Does each selected transmission range match the TFP Sw. A/B/C display on the scan tool?	—	*Go to Step 4*	Go to *DTC P1810 TFP Valve Position Switch Circuit (L57/L65 EFI)*
4	1. Drive the vehicle in D4 in order to obtain a 1-2, a 2-3, and a 3-4 shift time. Use the scan tool snapshot mode in order to record the shift times. 2. Using the scan tool, review the shift time information for 1-2, 2-3, and 3-4 shift times. Were all of the shift times greater than the specified value?	1-2 or 2-3 upshifts: 1.25 seconds 3-4 upshifts: 6.37 seconds	*Go to Step 5*	*Go to Step 8*
5	Perform the Line Pressure Check Procedure. Refer to *Line Pressure Check Procedure.* Is the line pressure within specifications?	—	*Go to Step 6*	Go to *Symptom Diagnosis* Low Line Pressure
6	1. Remove the transmission oil pan. Refer to *AT Fluid/Filter Changing.* 2. Inspect the pan and the fluid for contamination. Is there excessive contamination in the transmission oil pan?	—	Go to Unit Repair	*Go to Step 7*
7	Inspect the transmission for fluid pressure loss in one of the following areas: • Valve body gasket • Forward clutch seals • Turbine shaft seals Refer to Unit Repair. Was a condition found?	—	*Go to Step 15*	—
8	Select the 1-2, 2-3, and the 3-4 Transmission Adaptive Pressure (TAP) cells on the scan tool. Were any of the upshift TAP cells greater than the specified value?	16.0 psi	*Go to Step 9*	Go to Diagnostic Aids
9	Did the 3-4 shift time exceed the specified value?	6.37 seconds	*Go to Step 12*	*Go to Step 10*
10	Did the 2-3 shift time exceed the specified value?	1.25 seconds	*Go to Step 13*	*Go to Step 11*
11	Did the 1-2 shift time exceed the specified value?	1.25 seconds	*Go to Step 14*	—

DTC P1811 Maximum Adapt and Long Shift (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
12	Inspect the following 3-4 shift circuit components: • 4th gear clutch plates • 4th gear clutch seals • A sticking 3-4 shift valve Refer to Unit Repair. Was a condition found?	—	*Go to Step 15*	—
13	Inspect the following 2-3 shift circuit components: • Turbine shaft seals • Forward clutch plates • Forward clutch seals • Direct clutch plates • Direct clutch seals • Center support seals • Improperly tightened center support bolt Refer to Unit Repair. Was a condition found?	—	*Go to Step 15*	—
14	Inspect the following 1-2 shift circuit components: • Low roller clutch • Intermediate clutch plates • Intermediate clutch seals • Intermediate sprag clutch • Overdrive roller clutch • Improperly tightened center support bolt Refer to Unit Repair. Was a condition found?	—	*Go to Step 15*	—
15	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in D4 range. 4. Operate the vehicle through several 1,2,3,4 usphifts. 5. Review the scan tool 1-2, 2-3 and 3-4 shift times. Are the 1-2, 2-3, or 3-4 shift times less than the specified value?	1-2 and 2-3 upshifts 1.25 seconds 3-4 upshifts 6.37 seconds	System OK	*Go to Step 1*

DTC P1860 TCC PWM Solenoid Circuit Electrical (L29/L31/L35)



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Circuit Description

The torque converter clutch pulse width modulation (TCC PWM) solenoid valve controls fluid acting on the converter clutch valve, which then controls TCC apply and release. The TCC PWM solenoid valve attaches to the control valve body within the transmission. Ignition voltage goes directly to the TCC PWM solenoid valve. The vehicle control modulator (VCM) controls the TCC PWM solenoid valve by providing a ground path on circuit 418. The current flows through the TCC PWM solenoid valve coil according to the duty cycle (percentage of ON time). The TCC PWM solenoid valve provides a smooth engagement of the torque converter clutch by operating on a duty cycle percent of ON time.

If the VCM detects a continuous open or short in the TCC PWM solenoid valve circuit or the TCC PWM solenoid valve, then DTC P1860 sets. DTC P1860 is a type D DTC. For California emission vehicles DTC P1860 is a type A DTC.

Conditions for Running the DTC

- The engine is running greater than 475 RPM for 7 seconds.
- No shift solenoid DTCs P0751, P0753, P0756, or P0758.
- No system voltage DTC P0560.
- Commanded gear is first.

Conditions for Setting the DTC

All conditions for running the DTC are met, and either of the following conditions occur for 4.3 out of 5 seconds.

- The VCM commands the TCC PWM solenoid valve to OFF (0%) and the voltage input remains low (zero volts).
- The VCM commands the TCC PWM solenoid valve to ON (100%) and the voltage input remains high (B+).

Action Taken When the DTC Sets

- The VCM illuminates the malfunction indicator lamp for California emission vehicles.
- The VCM inhibits TCC engagement.
- The VCM inhibits 4th gear.
- The VCM freezes shift adapts from being updated.
- The VCM stores DTC P1860 in VCM history.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- Inspect the wiring at the VCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests for voltage to the TCC PWM solenoid valve circuit at the 20-way connector.
6. This step tests the ability of the VCM and wiring to control the ground circuit.
8. This step tests the resistance of the TCC PWM solenoid valve and the internal wiring harness.

DTC P1860 TCC PWM Solenoid Circuit Electrical (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. 5. If DTCs P0753 or P0758 are also set, inspect the transmission fuse. Is the fuse open?	—	*Go to Step 3*	*Go to Step 4*
3	Inspect the following components for a short to ground. • Circuit 139 • The 3 solenoids • The automatic transmission wiring harness assembly Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 17*	Go to Diagnostic Aids

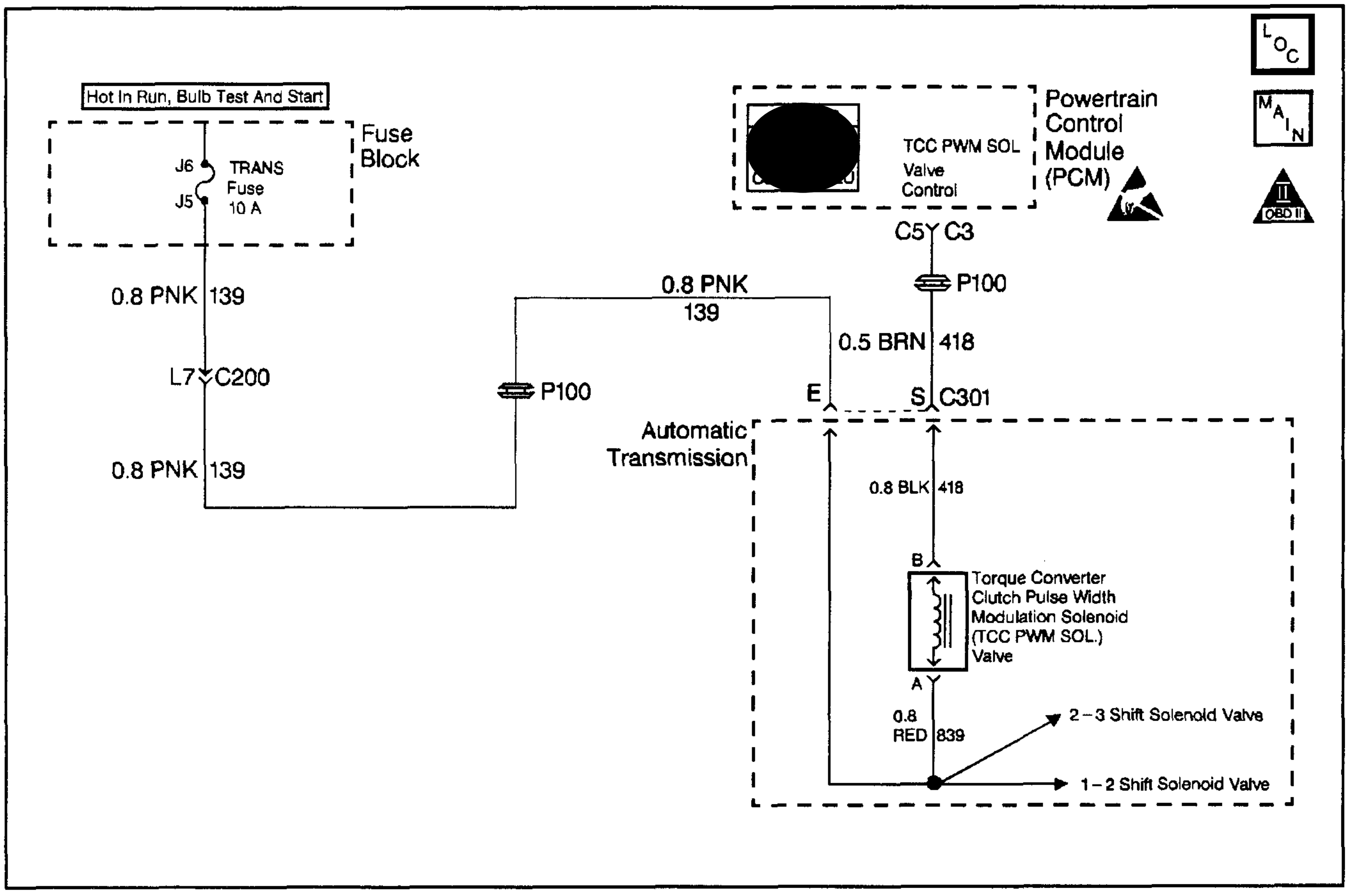
DTC P1860 TCC PWM Solenoid Circuit Electrical (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTCs may set). 3. Install the *J 39775* jumper harness on the engine harness connector. 4. With the engine off, turn the ignition to the RUN position. 5. Connect a test lamp from the *J 39775* cavity E to ground. Is the test lamp ON?	—	*Go to Step 6*	*Go to Step 5*
5	Repair the open or high resistance in ignition voltage feed circuit 139 (PNK) to the TCC PWM solenoid valve. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 17*	—
6	1. Install the test lamp from cavities E to S of the *J 39775*. 2. Command the TCC PWM solenoid valve ON and OFF three times. Does the test lamp turn ON when you command the TCC PWM solenoid valve ON, and does the lamp turn OFF when you command the TCC PWM solenoid valve OFF?	—	*Go to Step 8*	*Go to Step 7*
7	1. Inspect circuit 418 (BRN) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Repair the circuit if necessary. Refer to *Wiring Repairs* in Wiring Systems. Was the condition found?	—	*Go to Step 17*	*Go to Step 9*
8	1. Install the *J 39775* on the transmission 20-way connector (Automatic Transmission Connector End View). 2. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the resistance between terminals E and S. Is the resistance within the specified values?	10–15 Ω	*Go to Step 11*	*Go to Step 10*
9	Replace the VCM. Refer to *VCM Replacement/Programming* (4.3L) or *VCM Replacement/Programming* (5.7L) or *VCM Replacement/Programming* (7.4L) in Engine Controls. Is the replacement complete?	—	*Go to Step 17*	—
10	1. Disconnect the automatic transmission wiring harness assembly at the TCC PWM solenoid valve. 2. Measure the resistance of the TCC PWM solenoid valve. Is the resistance within the specified values?	10–15 Ω	*Go to Step 12*	*Go to Step 15*
11	1. Measure the resistance between terminal E and ground. 2. Measure the resistance between terminal S and ground. Are both readings greater than the specified value?	250 kΩ	Go to Diagnostic Aids	*Go to Step 13*
12	Inspect the A/T wiring harness assembly for an open circuit. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	—

DTC P1860 TCC PWM Solenoid Circuit Electrical (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
13	1. Disconnect the automatic transmission wiring harness assembly at the TCC PWM solenoid valve. 2. Measure the resistance between each of the component terminals and ground. Are both readings greater than the specified value?	250 kΩ	*Go to Step 14*	*Go to Step 15*
14	Inspect the automatic transmission wiring harness assembly for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was the condition found?	—	*Go to Step 16*	—
15	Replace the TCC PWM solenoid valve. Refer to *Control Valve Body Replacement.* Is the replacement complete?	—	*Go to Step 17*	—
16	Replace the automatic transmission wiring harness assembly. Refer to AT Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 17*	—
17	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Select the parameters, TCC Duty Cycle, TCC duty Cycle Open/Shorted to Ground and TCC Duty Cycle Shorted to Voltage. 4. Operate the vehicle under the following conditions: • The TCC PWM Solenoid Valve is commanded ON and TCC Duty Cycle Shorted to Voltage is NO. • The TCC PWM Solenoid Valve is commanded OFF and TCC Duty Cycle Open/Shorted to Ground is NO. • Each condition is met for 5 seconds. 5. Select Specific DTC. 6. Enter DTC P1860. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P1860 TCC PWM Solenoid Circuit Electrical (L57/L65 EFI)



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Circuit Description

The torque converter clutch pulse width modulation (TCC PWM) solenoid valve controls fluid acting on the converter clutch valve, which then controls TCC apply and release. The TCC PWM solenoid valve attaches to the control valve body within the transmission. Ignition voltage goes directly to the TCC PWM solenoid valve. The powertrain control module (PCM) controls the TCC PWM solenoid valve by providing a ground path on circuit 418. The current flows through the TCC PWM solenoid valve coil according to the duty cycle (percentage of ON and OFF time). The TCC PWM solenoid valve provides a smooth engagement of the torque converter clutch by operating on a duty cycle percent of ON time.

If the PCM detects a continuous open or short to ground in the TCC PWM solenoid valve circuit or the TCC PWM solenoid valve, then DTC P1860 sets. DTC P1860 is a type A DTC.

Conditions for Running the DTC

- System voltage is 8.0–18.0 volts.
- The engine is running more than 475 RPM for greater than 7 seconds.
- Commanded gear is 1st.

Conditions for Setting the DTC

All of the above conditions are met, and either of the following conditions occur for 4.3 seconds out of 5 seconds.

- The PCM commands the solenoid OFF, and the voltage input remains low (zero volts).
- The PCM commands the solenoid to ON (100%) and the voltage input remains high (B+).

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM inhibits TCC engagement.
- The PCM inhibits 4th gear.
- The PCM stores DTC P1860 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring at the PCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- An open in the ignition feed circuit 139, causes multiple DTCs to set.
- First, diagnose and clear any present engine DTCs. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests for voltage to the TCC PWM solenoid valve.
6. This step tests the ability of the PCM and wiring to control the TCC PWM solenoid valve ground circuit.
8. This step tests the resistance of the TCC PWM solenoid valve and the automatic transmission wiring harness assembly.
12. If the automatic transmission wiring harness assembly is open, do not repair the wiring harness. You must replace the automatic transmission wiring harness assembly.

DTC P1860 TCC PWM Solenoid Circuit Electrical (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. 5. If DTCs P0753, or P0758, are also set, inspect the fuse. Is the fuse open?	—	*Go to Step 3*	*Go to Step 4*
3	Inspect circuit 139 (PNK), the three solenoids, and the automatic transmission wiring harness assembly for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a shorted condition found?	—	*Go to Step 17*	Go to Diagnostic Aids

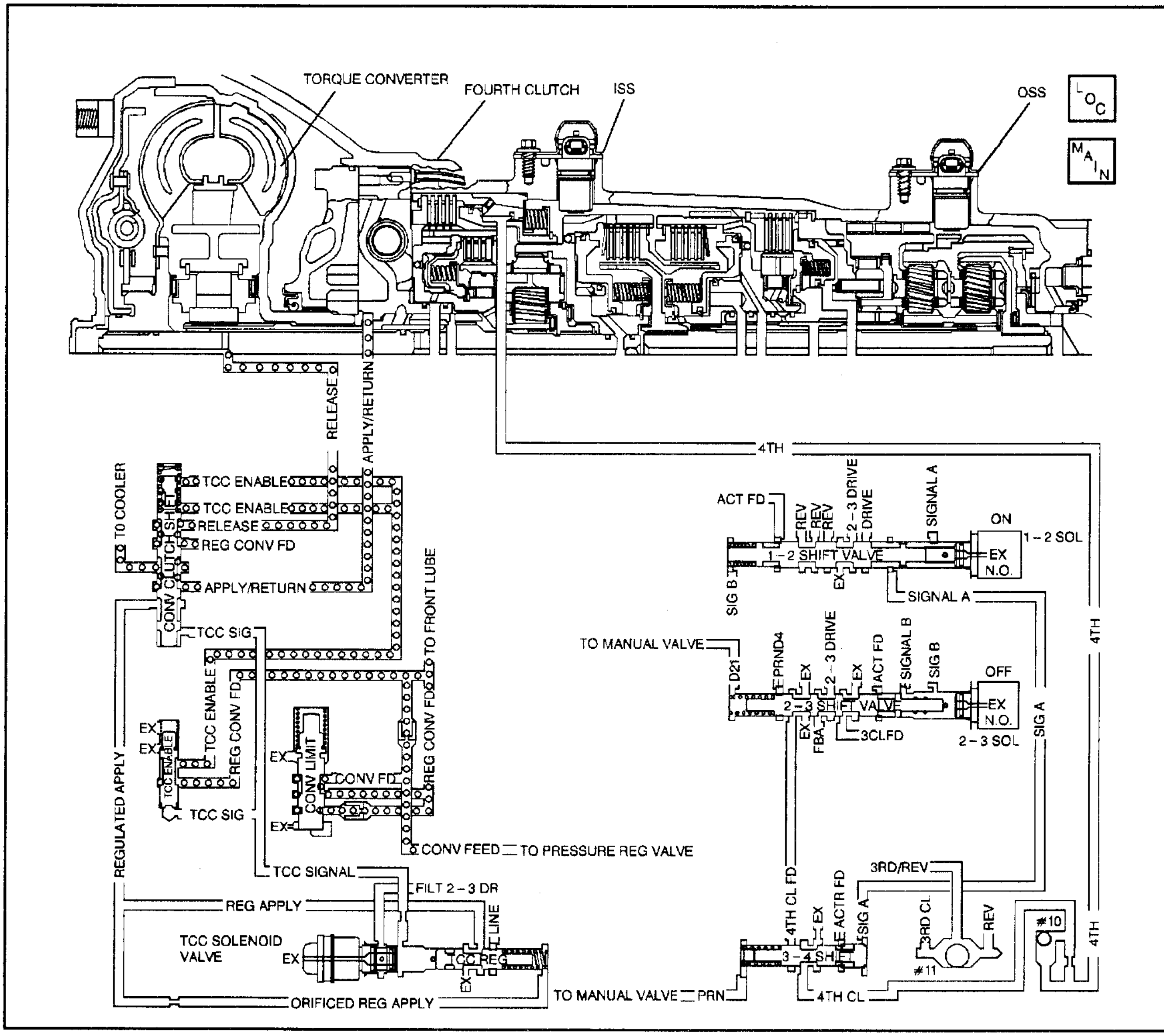
DTC P1860 TCC PWM Solenoid Circuit Electrical (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition OFF. 2. Disconnect the transmission 20-way connector (additional DTCs may set). 3. Install the *J 39775* jumper harness on the engine side of the 20-way connector. 4. With the engine off, turn the ignition to the RUN position. 5. Connect a test lamp from *J 39775* cavity E to a good ground. Is the test lamp ON?	—	*Go to Step 6*	*Go to Step 5*
5	Repair the open or high resistance in ignition feed circuit 139 (PNK) to the TCC PWM solenoid valve. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 17*	—
6	1. Install the test lamp from cavity E to cavity S of the *J 39775.* 2. Use the scan tool output control function in order to command the TCC PWM solenoid valve ON and OFF three times. Does the test lamp illuminate when you command the TCC PWM solenoid valve ON, and does the lamp turn OFF when you command the TCC PWM solenoid valve OFF?	—	*Go to Step 8*	*Go to Step 7*
7	1. Inspect circuit 418 (BRN) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. 2. Repair the circuit if necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find an open or short to ground condition?	—	*Go to Step 17*	*Go to Step 9*
8	1. Install the *J 39775* on the transmission side of the 20-way connector. 2. Measure the resistance between terminals E and S. Use the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit. Is the resistance within the specified value?	10–15 Ω	*Go to Step 11*	*Go to Step 10*
9	Replace the PCM. Refer to *PCM Replacement/Programming* in Engine Controls. Is the replacement complete?	—	*Go to Step 17*	—
10	1. Disconnect the automatic transmission wiring harness assembly at the TCC PWM solenoid valve. 2. Measure the resistance of the TCC PWM solenoid valve. Is the resistance within the specified value?	10–15 Ω	*Go to Step 12*	*Go to Step 15*
11	1. Measure the resistance between terminal E and ground. 2. Measure the resistance between terminal S and a good ground. Are both readings greater than the specified value?	250 kΩ	Go to Diagnostic Aids	*Go to Step 13*
12	Inspect the automatic transmission wiring harness assembly for an open circuit. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open condition found?	—	*Go to Step 16*	—

DTC P1860 TCC PWM Solenoid Circuit Electrical (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
13	1. Disconnect the automatic transmission wiring harness assembly at the TCC PWM solenoid valve. 2. Measure the resistance between each of the component terminals and a good ground. Are both readings greater than the specified value?	250 kΩ	*Go to Step 14*	*Go to Step 15*
14	Inspect the automatic transmission wiring harness assembly for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a short to ground condition found?	—	*Go to Step 16*	—
15	Replace the TCC PWM solenoid valve. Refer to *Control Valve Body Replacement.* Is the replacement complete?	—	*Go to Step 17*	—
16	Replace the automatic transmission (A/T) wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 17*	—
17	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Select the parameters, TCC Duty Cycle, TCC Duty Cycle Open/Shorted to GND and TCC Duty Cycle Shorted to Volts. 4. Operate the vehicle under the following conditions: • The TCC PWM Sol. Valve is commanded ON and TCC Duty Cycle Shorted to Volts is No. • The TCC PWM Sol. Valve is commanded OFF and TCC Duty Cycle Open/Shorted to GND is No. • Each condition is met for 5 seconds. 5. Select Specific DTC. 6. Enter DTC P1860. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P1870 Transmission Component Slipping (L29/L31/L35)



199389

Circuit Description

The vehicle control module (VCM) monitors the engine speed, and the transmission output shaft speed. The VCM calculates turbine shaft speed and torque converter clutch (TCC) slip speed by using inputs from the transmission input (shaft) speed sensor (ISS), transmission output (shaft) speed sensor (OSS), and other transmission components. The forward clutch housing is used as the ISS rotor.

Whenever the TCC is engaged, engine speed and turbine speed will closely match, indicating low TCC slip speed. In D3 with the TCC engaged, calculated transmission component slip can only occur in the torque converter. In D4 OVERDRIVE with the TCC engaged, transmission component slip can occur in the TCC or the fourth clutch assembly.

If the VCM detects an excessive TCC slip speed in D4 OVERDRIVE, when the TCC should be engaged, then DTC P1870 sets. DTC P1870 is a type D DTC. For California emissions vehicles, DTC P1870 is a type B DTC.

Conditions for Running the DTC

The following conditions occur 3 times for 10 seconds:

- No MAP sensor DTCs P0101, P0102 or P0103.
- No MAF sensor DTCs P0106, P0107 or P0108.
- No engine speed DTCs P0335, P0336, P0337, or P0338.
- No TP sensor DTCs P0121, P0122, or P0123.
- No OSS DTC P0502.
- No ISS DTCs P0716 or P0717.
- No TCC PWM solenoid valve DTCs P0741, P0742 or P1860.
- No 1-2 SS valve DTCs P0751 or P0753.
- No 2-3 SS valve DTCs P0756 or P0758.
- No TFP manual valve position switch DTCs P1810.
- The engine speed is greater than 475 RPM for 7 seconds, and not in fuel cutoff mode.
- The TP sensor is 7–80%.
- Engine speed is 1250–5500 RPM.
- The engine vacuum is 0–105 kPa.
- The TFT is 20° to 130°C (68°–266°F).
- Vehicle speed is 56.3–177 Km/h (35–110 MPH)
- TFP manual valve position switch indicates D4.
- Speed ratio is 1.30–0.70 for 5.7L and 7.4L.
- The engine torque is 100 N·m (80 lb ft) to the following:
  - 542 N·m (400 lb ft) 5.7L
  - 677.5 N·m (500 lb ft) 7.4L.
- The TCC is commanded ON for 5 seconds or more.
- TCC duty cycle is greater than 95%.

Conditions for Setting the DTC

- All conditions for running the DTC are met for 10 seconds for 3 occurrences.
- The VCM detects a slip speed of:
  - 120–550 RPM. (5.7L)
  - 110–550 RPM. (7.4L)

Action Taken When the MIL/DTC Sets

- The VCM illuminates the malfunction indicator lamp (MIL) for California emissions vehicles.
- The VCM commands maximum line capacity.
- The VCM inhibits the TCC engagement.
- The VCM inhibits 4th gear if in hot mode.
- The VCM freezes shift adapts.
- The VCM stores DTC 1870 in VCM History.

Conditions for Clearing the MIL/DTC

- For California emissions, the VCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from VCM history.
- For California emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For Federal emissions, the VCM clears the DTC from VCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The VCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the VCM.

Diagnostic Aids

- A TFP manual valve position switch malfunction can set DTC P1870.
- A mechanical failure of the shift solenoids or TCC PWM solenoid valve can set DTC P1870.
- Internal transmission failures can result in a DTC P1870.
- Sticking or contaminated shift valves may cause intermittent slipping in D4.
- First diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the indicated range signal to the actual selected range. A faulty TFP manual valve position switch can set a DTC P1870.
4. This step tests for excessive TCC slip speed while in a commanded TCC lock-up state and in fourth gear; and confirms that the fault is present.
5. This step tests for excessive TCC slip speed while in a commanded TCC lock-up state and in third gear.
6. This step tests for a sticking TCC shift valve.
8. This step tests for proper transmission line pressure.

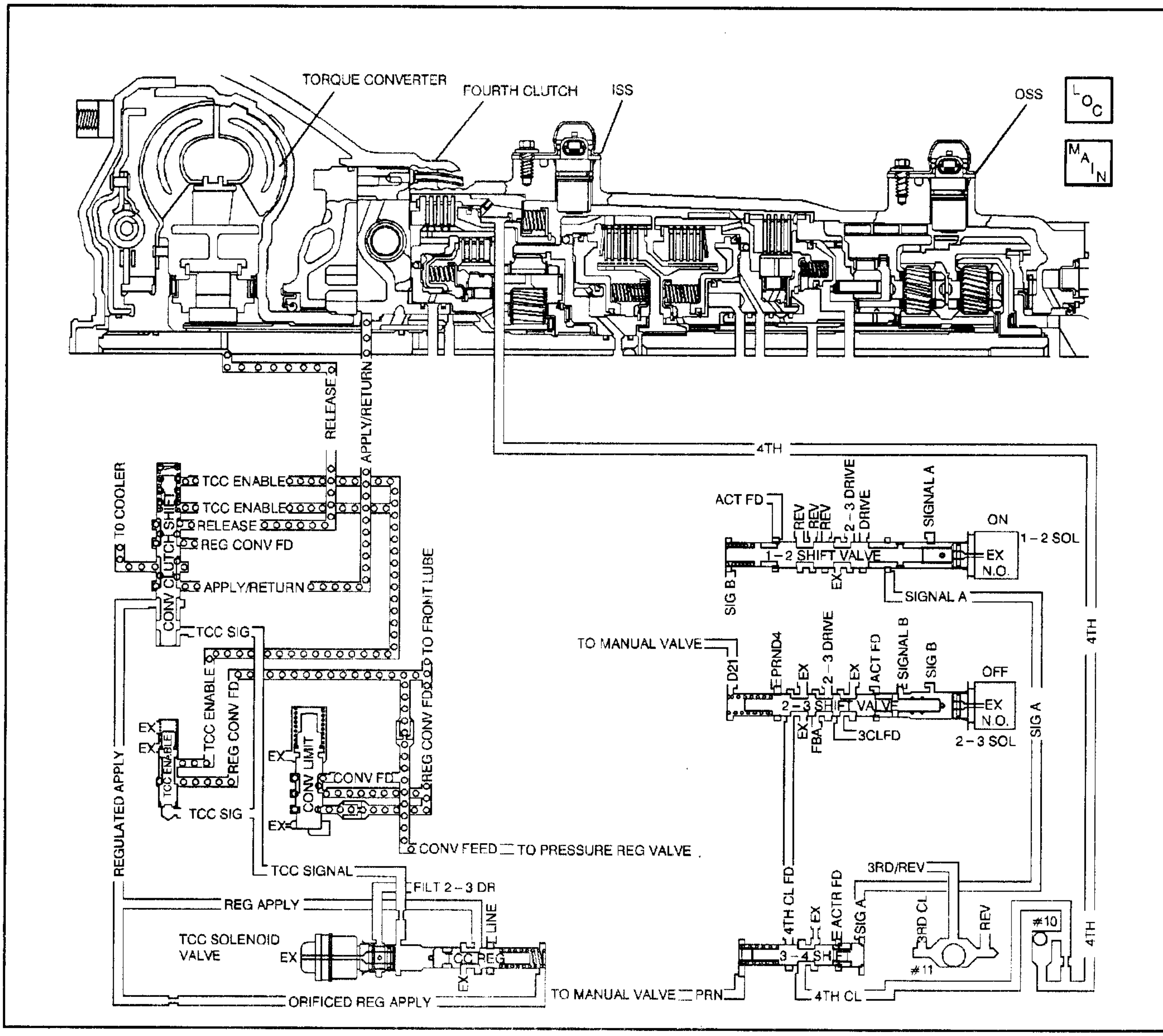
DTC P1870 Transmission Component Slipping (L29/L31/L35)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check* (4.3L) or *Powertrain OBD System Check* (5.7L) or *Powertrain OBD System Check* (7.4L)
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the VCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTCs. 5. With the engine idling and at normal operating temperature, apply the brake pedal. 6. Select each transmission range: D1, D2, D3, D4, N, R, and P. Refer to the *Range Signal* table. Does each selected transmission range match the scan tool TFP switch A/B/C display?	—	*Go to Step 4*	Go to *DTC P1810 TFP Valve Position Switch Circuit (L29/L31/L35)*
4	Drive the vehicle under the following conditions: • The TFT is 20–130°C (50–266°F). • The transmission is in D4. • The TCC duty cycle is greater than 80%. • The TP angle is 10–80%. At any time is the TCC slip speed greater than the specified value for 10 seconds?	120 RPM (5.7L) 110 RPM (7.4L)	*Go to Step 5*	Go to Diagnostic Aids
5	Drive the vehicle under the following conditions: • The transmission is in D3. • Command the TCC ON with the scan tool. • The TP angle is 10–80%. At any time is the TCC slip speed greater than the specified value for 10 seconds?	120 RPM (5.7L) 110 RPM (7.4L)	*Go to Step 7*	*Go to Step 6*
6	Repeat the procedure in step 4. Drive the vehicle under the following conditions: • The transmission is in D4. • The TCC duty cycle is greater than 80%. • The TP angle is 10–80%. Is the TCC slip speed greater than the specified value?	120 RPM (5.7L) 110 RPM (7.4L)	*Go to Step 8*	*Go to Step 11*
7	Refer to *Symptom Diagnosis* Slipping TCC. Did you find and correct the condition?	—	*Go to Step 12*	—
8	1. Connect the *J 21867* pressure gauge to the transmission line pressure tap. 2. Perform the Line Pressure Check Procedure. Refer to *Line Pressure Check Procedure.* Is the line pressure within specifications?	—	*Go to Step 9*	Go to *Symptom Diagnosis* Low Line Pressure

DTC P1870 Transmission Component Slipping (L29/L31/L35) (cont'd)

Step	Action	Value(s)	Yes	No
9	1. Remove the transmission oil pan. Refer to *AT Fluid/Filter Changing.* 2. Inspect for contaminated fluid and excessive material in the pan. Is the fluid or the pan contaminated?	—	Go to Unit Repair	*Go to Step 10*
10	1. Inspect the 1-2 SS valve for contamination or damaged seals. 2. Inspect the 2-3 SS valve for contamination or damaged seals. Was the condition found?	—	*Go to Step 12*	*Go to Step 11*
11	Inspect the following components for contamination or sticking. • The 2-3 shift valve • The 3-4 shift valve Was the condition found?	—	*Go to Step 12*	Go to Unit Repair
12	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 13*	—
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Ensure that TFT is 20–130°C (50–266°F). • Drive the vehicle in 4th gear, with the TCC commanded ON. • The TP angle is 7–80%. • The VCM must see a slip of –20 to +20 RPM for greater than 10 seconds. 4. Select Specific DTC. 5. Enter DTC P1870. Has the test run and passed?	—	System OK	*Go to Step 1*

DTC P1870 Transmission Component Slipping (L57/L65 EFI)



199389

Circuit Description

The powertrain control module (PCM) monitors the engine speed, and the transmission output shaft speed. The PCM calculates turbine shaft speed and torque converter clutch (TCC) slip speed by using inputs from the transmission input shaft speed (ISS) sensor, transmission output shaft speed (OSS) sensor and other transmission components. The forward clutch housing is used as the ISS sensor rotor.

Whenever the TCC is engaged, engine speed and turbine speed will closely match, indicating low TCC slip speed. In D3 with the TCC engaged, calculated transmission component slip can only occur in the torque converter. In D4 overdrive with the TCC engaged, transmission component slip can occur in the TCC or the fourth clutch assembly.

If the PCM detects an excessive TCC slip speed in D4 overdrive, when the TCC should be engaged, then DTC P1870 sets. DTC P1870 is a type D DTC. For California emissions vehicles, DTC P1870 is a type B DTC.

Conditions for Running the DTC

- No MAP DTCs P0106, P0107 or P0108.
- No engine speed DTC P0335.
- No A/T ISS sensor DTCs P0716 or P0717.
- No OSS sensor DTCs P0722 or P0723.
- No TCC PWM solenoid valve DTCs P0741, P0742, or P1860.
- No 1-2 SS valve DTCs P0751 or P0753.
- No 2-3 SS valve DTCs P0756 or P0758.
- No TFP manual valve position switch DTC P1810.
- The gear range is D4.
- The APP angle is 12–80%.
- The TFT is 20–130°C (68–266°F).
- The engine speed is 1200–3750 RPM.
- System voltage is 8.0–18.0 volts.
- The vehicle speed is 48–176 km/h (30–110 mph).
- The engine torque is 95–644 N·m (70–475 lb ft).

Conditions for Setting the DTC

The above conditions are met for Running the DTC, with 4th gear commanded and the TCC ON and one of the following conditions occur:

Condition 1 (after 3 Occurrences)

The PCM detects a slip speed of 120–525 RPM for greater than 6.0 seconds.

Condition 2 (In the following sequence for one occurrence)

1. The PCM detects a TCC slip speed of 110–500 RPM for 10 seconds.
   1.1. The PCM commands maximum line pressure.
   1.2. The PCM freezes shift adapts.
2. The PCM detects a TCC slip speed of 110–500 RPM for 10 seconds.
   2.1. The PCM commands the TCC OFF for 1.5 seconds.
   2.2. The PCM commands the TCC ON.
3. The PCM detects a TCC slip speed of 110–500 RPM for 10 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM commands maximum line pressure.
- The PCM inhibits the TCC engagement.
- The PCM inhibits 4th gear if in hot mode.
- The PCM freezes shift adapts.
- The PCM stores DTC P8170 in PCM history.

Conditions for Clearing the MIL/DTC

- For Federal and California emissions, the PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool clears the DTC from PCM history.
- For Federal and California emissions, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without an emission related diagnostic fault occurring.
- For vehicles equal to or greater than 15,000 lbs GVW, the PCM clears the DTC from PCM history if the vehicle completes 40 consecutive warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- A TFP manual valve position switch malfunction can set DTC P1870.
- A mechanical failure of the shift solenoids or TCC PWM solenoid valve can set DTC P1870.
- Internal transmission failures can result in a DTC P1870.
- Sticking shift valves or contamination may cause intermittent slipping in D4.
- First, diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.
- DTC P1860 can cause a DTC P1870 to set. Diagnose the electrical codes first.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the indicated range signal to the actual selected range. A faulty TFP manual valve position switch can set a DTC P1870.
4. This step tests for excessive TCC slip speed while in a commanded TCC lock-up state and in fourth gear; and confirms that the fault is present.
5. This step tests for excessive TCC slip speed while in a commanded TCC lock-up state and in third gear.
6. This step tests for a sticking TCC shift valve.
8. This step tests for proper transmission line pressure.

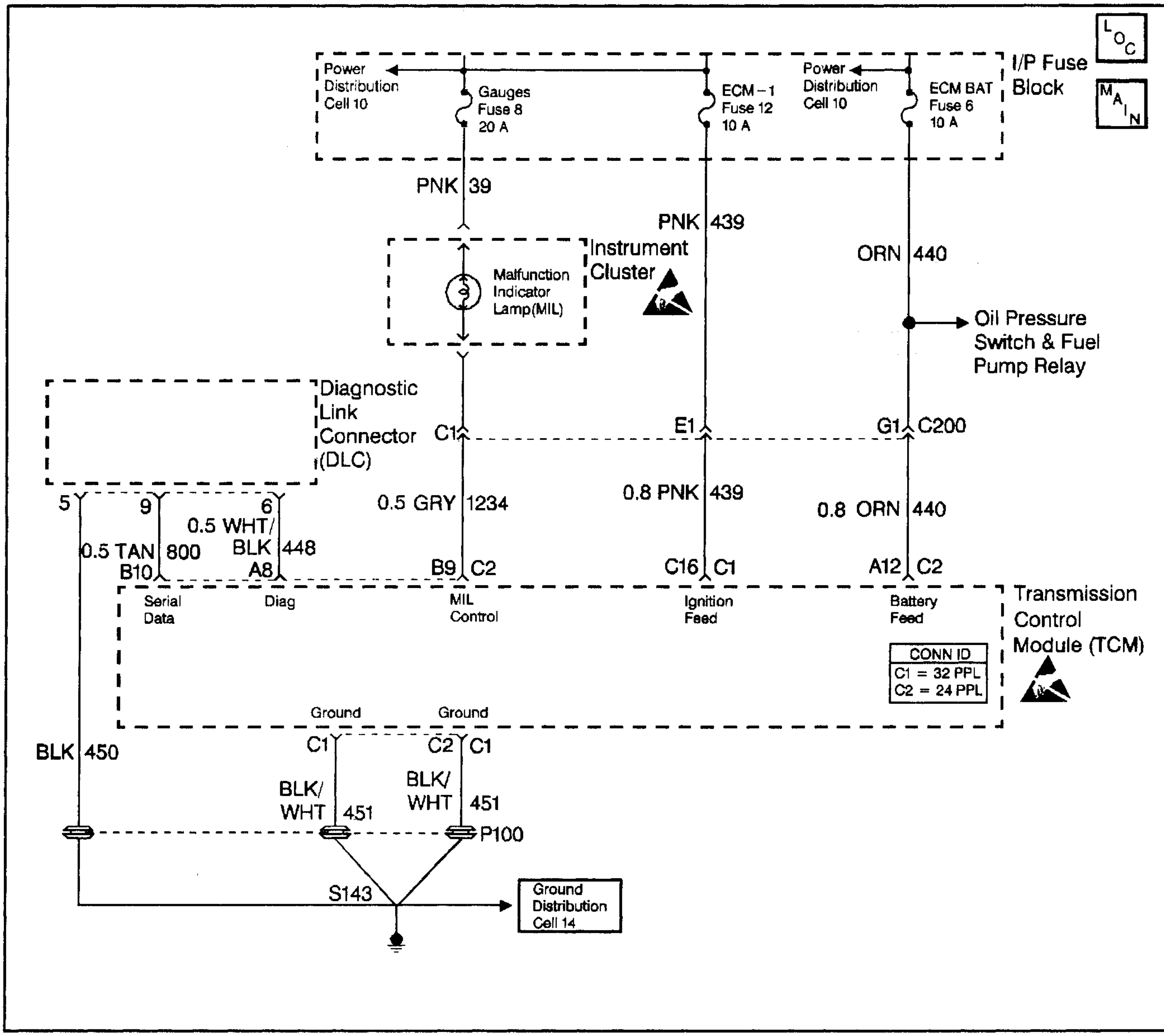
DTC P1870 Transmission Component Slipping (L57/L65 EFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check*
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM. 3. Record the Freeze Frame and Failure Records. 4. Clear the DTC. 5. With the engine idling and at normal operating temperature, apply the brake pedal. 6. Select each transmission range: D1, D2, D3, D4, N, R, and P. Refer to the *Range Signal* table. Does each selected transmission range match the scan tool TFP Switch A/B/C display?	—	*Go to Step 4*	Go to *DTC P1810 TFP Valve Position Switch Circuit (L57/L65 EFI)*
4	Drive the vehicle under the following conditions: • The TFT is 20–130°C (68–266°F) • The transmission is in D4. • The TCC is duty cycle is greater than 70%. • The APP angle is 12–80%. At any time is the TCC slip speed greater than the specified value for 6 seconds?	120 RPM	*Go to Step 5*	Go to Diagnostic Aids
5	Drive the vehicle under the following conditions: • The transmission is in D3. • Command the TCC ON with the scan tool. • The APP angle is 12–80%. At any time is the TCC slip speed greater than the specified value for 6 seconds?	110 RPM	*Go to Step 7*	*Go to Step 6*
6	Repeat the procedure in step 4. Drive the vehicle under the following conditions: • The transmission is in D4. • The TCC duty cycle is greater than 70%. • The APP angle is 12–80%. Is the TCC slip speed greater than the specified value?	120 RPM	*Go to Step 8*	*Go to Step 11*
7	Refer to *Symptom Diagnosis* Slipping TCC. Was a condition found?	—	*Go to Step 12*	—
8	1. Connect the *J 21867* pressure gauge to the transmission line pressure tap. 2. Perform the Line Pressure Check Procedure. Refer to *Line Pressure Check Procedure.* Is the line pressure within specifications?	—	*Go to Step 9*	Go to *Low Line Pressure*
9	1. Remove the transmission oil pan. Refer to *AT Fluid/Filter Changing.* 2. Inspect for contaminated fluid and excessive material in the pan. Is the fluid or the pan contaminated?	—	Go to Unit Repair	*Go to Step 10*

DTC P1870 Transmission Component Slipping (L57/L65 EFI) (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Inspect the 1-2 SS valve for contamination or damaged seals. 2. Inspect the 2-3 SS valve for contamination or damaged seals. Was the condition found?	—	*Go to Step 12*	*Go to Step 11*
11	Inspect the following components for contamination or sticking. • The 2-3 shift valve • The 3-4 shift valve Was the condition found?	—	*Go to Step 12*	Go to Unit Repair
12	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 13*	—
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Ensure that TFT is 20–130°C (68–266°F). • Drive the vehicle in 4th gear, with the TCC commanded ON. • The APP angle is 12–80%. • The PCM must see a slip of –20 to +20 RPM for greater than 7 seconds. 4. Select Specific DTC. 5. Enter DTC P1870. Has the test run and passed?	—	System OK	*Go to Step 1*

On-Board Diagnostic System Check (L57 MFI)



372618

Circuit Description

The On-Board Diagnostic System Check is an organized approach to identifying a condition created by a control module system malfunction. It must be the starting point for any driveability diagnosis. This directs the service technician to the next logical step in diagnosing the concern. Understanding the table, and using it properly, reduces diagnostic time, and prevents the unnecessary replacement of good parts.

Test Description

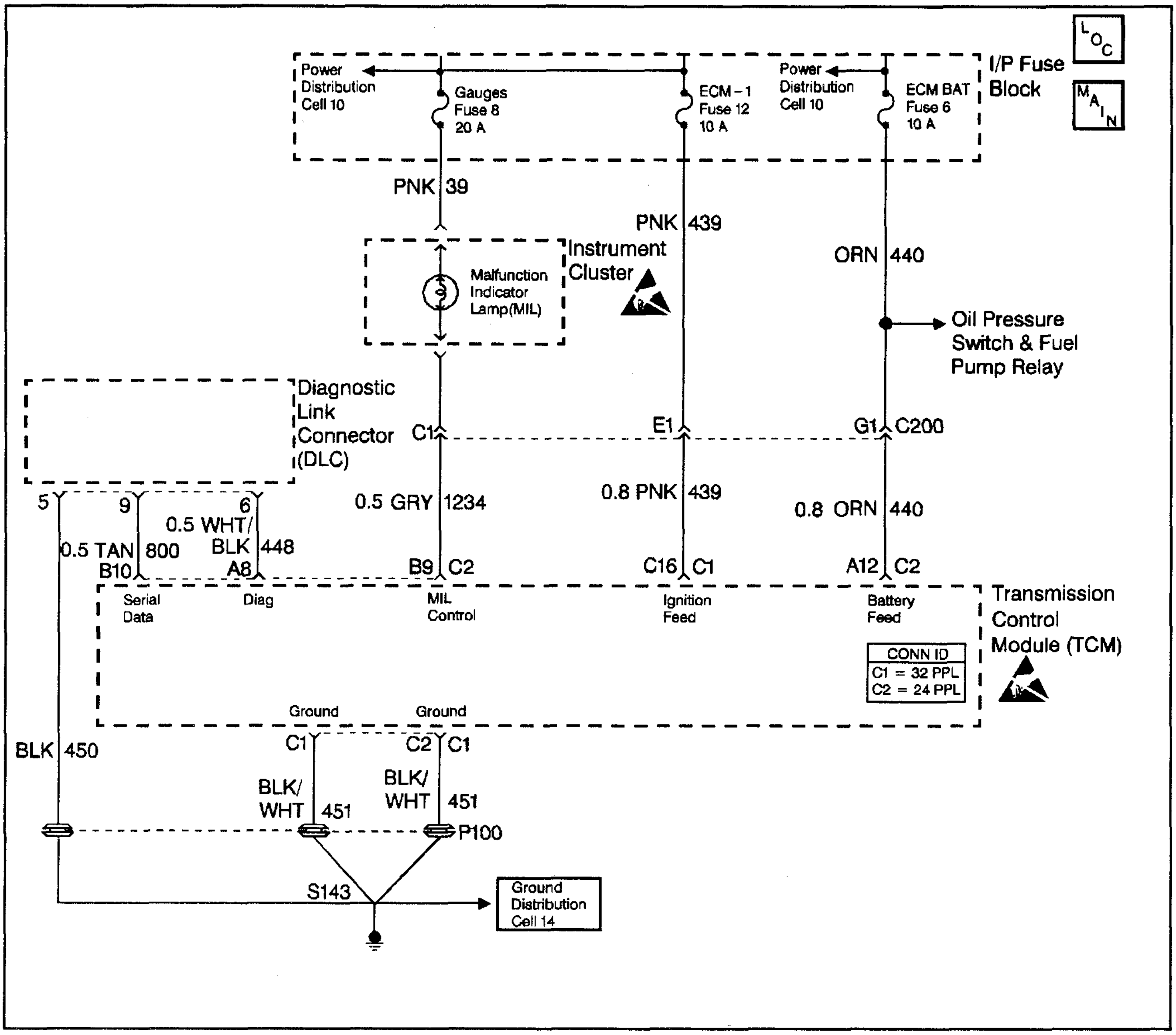
The numbers below refer to the step numbers on the diagnostic table.

1. When the ignition switch is cycled to RUN, the malfunction indicator lamp (MIL) should turn ON briefly, then remain ON steady. This sequence determines the vehicle diagnostics are operational.
2. This step isolates if the customer concern is a MIL or driveability condition.
4. Although the control module is powered up, a symptom could exist because of a system fault.
5. Use the *Scan Tool* to aid diagnosis, therefore, serial data must be available. If a PROM (MEM-CAL) error is present, the TCM may have been able to flash DTC 12/51, but not enable serial data.
6. This step isolates if the customer concern is a MIL or driveability condition with no MIL. Refer to *Diagnostic Trouble Code Identification (L57 MFI)* in this section for a list of valid DTCs. An invalid DTC may be the result of a faulty scan tool, PROM or TCM.

On-Board Diagnostic System Check (L57 MFI)

Step	Action	Value(s)	Yes	No
1	1. Connect the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. Is the MIL ON steady?	—	*Go to Step 4*	*Go to Step 2*
2	Is the MIL flashing?	—	*Go to Step 3*	Go to *No Malfunction Indicator Lamp (L57 MFI)*
3	Check for a grounded diagnostic test circuit 448 (WHT/BLK) (DLC Pin 6). Was a condition found?	—	*Go to Step 1*	—
4	Perform the *Powertrain OBD System Check (EFI)*, or jumper the diagnostic link connector (DLC) terminal 6 to a good ground. Does the MIL flash?	—	*Go to Step 5*	Go to *No Diagnostic Link Connector Data (L57 MFI)*
5	Does the *Scan Tool* display data?	—	*Go to Step 6*	Go to *No Diagnostic Link Connector Data (L57 MFI)*
6	Are any DTCs displayed?	—	*Go to Step 7*	Go to *Transmission Scan Tool Data Values (L57 MFI)*
7	Refer to applicable DTC table. Start with the lowest DTC. Was the condition corrected?	—	System OK	*Go to Step 1*

No Malfunction Indicator Lamp (L57 MFI)



372618

Circuit Description

There should always be a steady malfunction indicator lamp (MIL) with the ignition on RUN and engine OFF. Switched battery voltage is supplied to the lamp. The TCM controls the lamp and turns it ON by providing a ground path through circuit 1234.

Diagnostic Aids

- If the gauge fuse is open, this results in no brake warning light, oil light, generator light, seat belt reminder, etc.
- Inspect the wiring for faulty electrical connections at the TCM. Inspect the wiring for faulty electrical connections at the instrument cluster connector. Look for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step isolates the fault to the wiring circuit or the TCM and its connections.
3. This step inspects for a short to ground that causes the fuse to open.
8. This step checks for an open from the fuse to the MIL bulb.
9. This step checks for an open or short to power from the bulb to the TCM connector.
10. This step checks for an open condition with the instrument panel printed circuit.

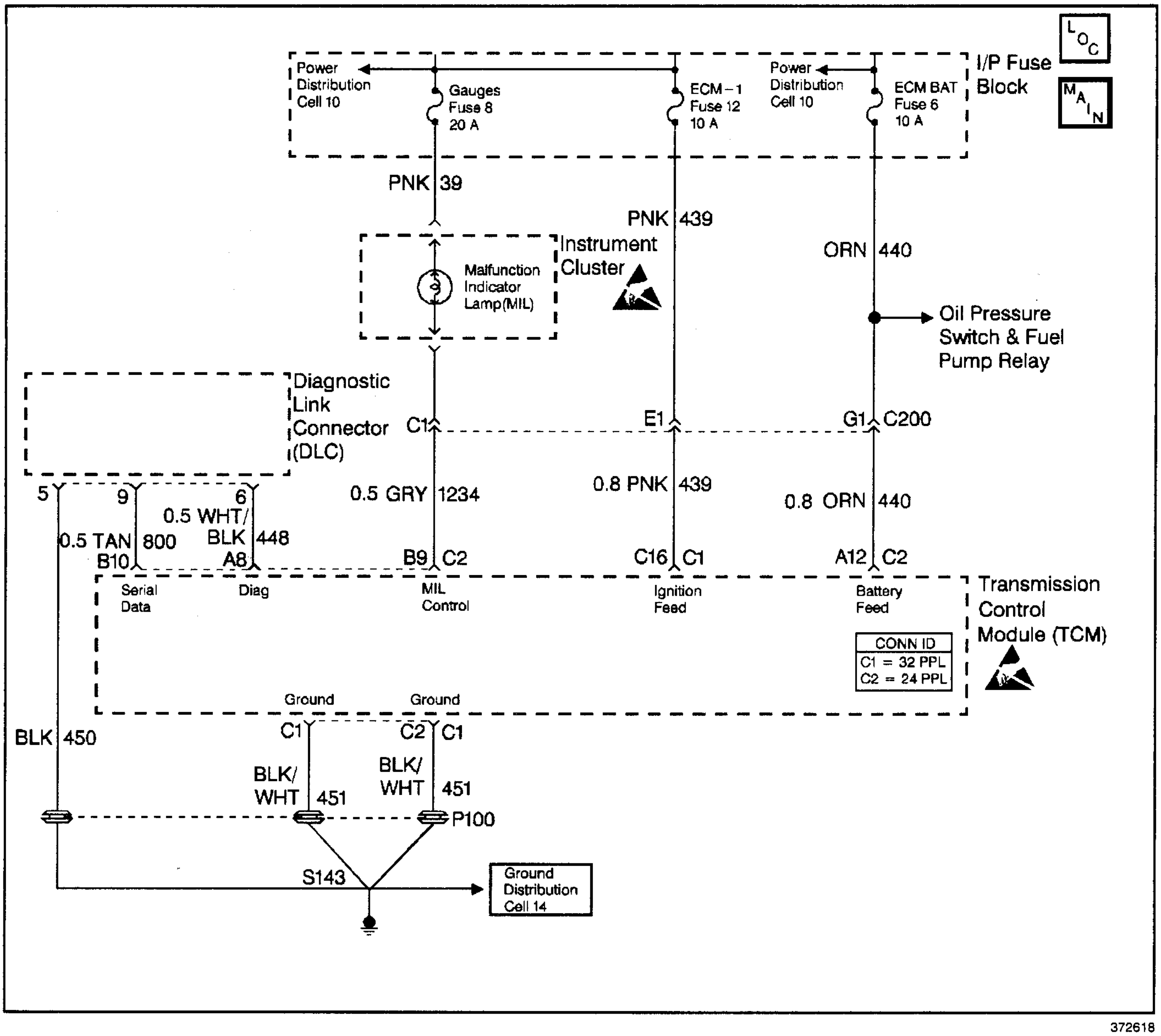
No Malfunction Indicator Lamp (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the On-Board Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Turn the ignition to the OFF position. 2. Disconnect the TCM connectors, (additional DTCs may set). 3. With the engine OFF, turn the ignition switch to the RUN position. 4. Use a *J 39775* jumper harness and ground the TCM wiring harness connector terminal B9. Is the MIL ON?	—	*Go to Step 13*	*Go to Step 3*
3	Inspect the gauge fuse for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open condition found?	—	*Go to Step 4*	*Go to Step 6*
4	Inspect circuit 39 (PNK) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 5*	Go to Diagnostic Aids
5	Repair the short to ground condition. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	Go to *On-Board Diagnostic System Check (L57 MFI)*	—
6	Inspect the MIL bulb. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 7*	*Go to Step 8*
7	Replace the MIL bulb. Is the MIL illuminated?	—	Go to *On-Board Diagnostic System Check (L57 MFI)*	—
8	Inspect circuit 39 (PNK) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open condition found?	—	*Go to Step 12*	*Go to Step 9*
9	Inspect circuit 1234 (GRY) for an open or short to power. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 11*	*Go to Step 10*
10	Inspect for an open in the instrument cluster circuit of the MIL. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 12*	—
11	Repair the open or short to power condition. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	Go to *On-Board Diagnostic System Check (L57 MFI)*	—

No Malfunction Indicator Lamp (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
12	Repair the open condition. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	Go to *On-Board Diagnostic System Check (L57 MFI)*	—
13	Inspect the TCM connector pins and terminals for corrosion, reduced terminal tension or a faulty TCM ground. Was a condition found?	—	*Go to Step 14*	*Go to Step 15*
14	Repair the faulty circuit or terminal connection. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	Go to *On-Board Diagnostic System Check (L57 MFI)*	—
15	Inspect circuit 440 (ORN) and circuit 439 (PNK) for voltage at the TCM connector. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Is the voltage within the specified range?	13.0–15.0 volts	*Go to Step 17*	*Go to Step 16*
16	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	Go to *On-Board Diagnostic System Check (L57 MFI)*	—
17	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	Go to *On-Board Diagnostic System Check (L57 MFI)*	—

No Diagnostic Link Connector Data (L57 MFI)



Circuit Description

There should always be a steady malfunction indicator lamp (MIL) when the ignition is in the RUN position and the engine OFF. Switched ignition voltage is supplied to the lamp. The TCM controls the lamp, and turns it ON, by grounding circuit 1234.

With the diagnostic terminal grounded, the lamp should display a DTC 12, followed by any diagnostic trouble code (DTC) stored in memory.

A steady lamp indicates a short to ground in the lamp control circuit 1234, or an open in diagnostic circuit 448.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. If there is a condition with the TCM that causes a *Scan Tool* not to read serial data, then the TCM should not display a DTC 12. If DTC 12 does display, check that the *Scan Tool* is functioning properly on another vehicle. If the *Scan Tool* is functioning properly, and circuit 800 is OK, the PROM or TCM may be at fault for NO DLC symptom.
4. If the lamp turns OFF when the TCM connector is disconnected, then circuit 1234 is not shorted to the ground.
6. This step checks for an open diagnostic circuit 448.
13. The *J 39200* digital multimeter (DMM) may flash O.L. Select volt DC, Min/Max, then 40 V range. A normal reading during this step is 2.5 to 5.5 V.
21. At this point, the MIL wiring is OK. The condition is a faulty PROM. If DTC 12 does not display, the TCM should be replaced using the original PROM. Replace the PROM only after trying a TCM. A defective PROM usually is an unlikely cause of the fault.

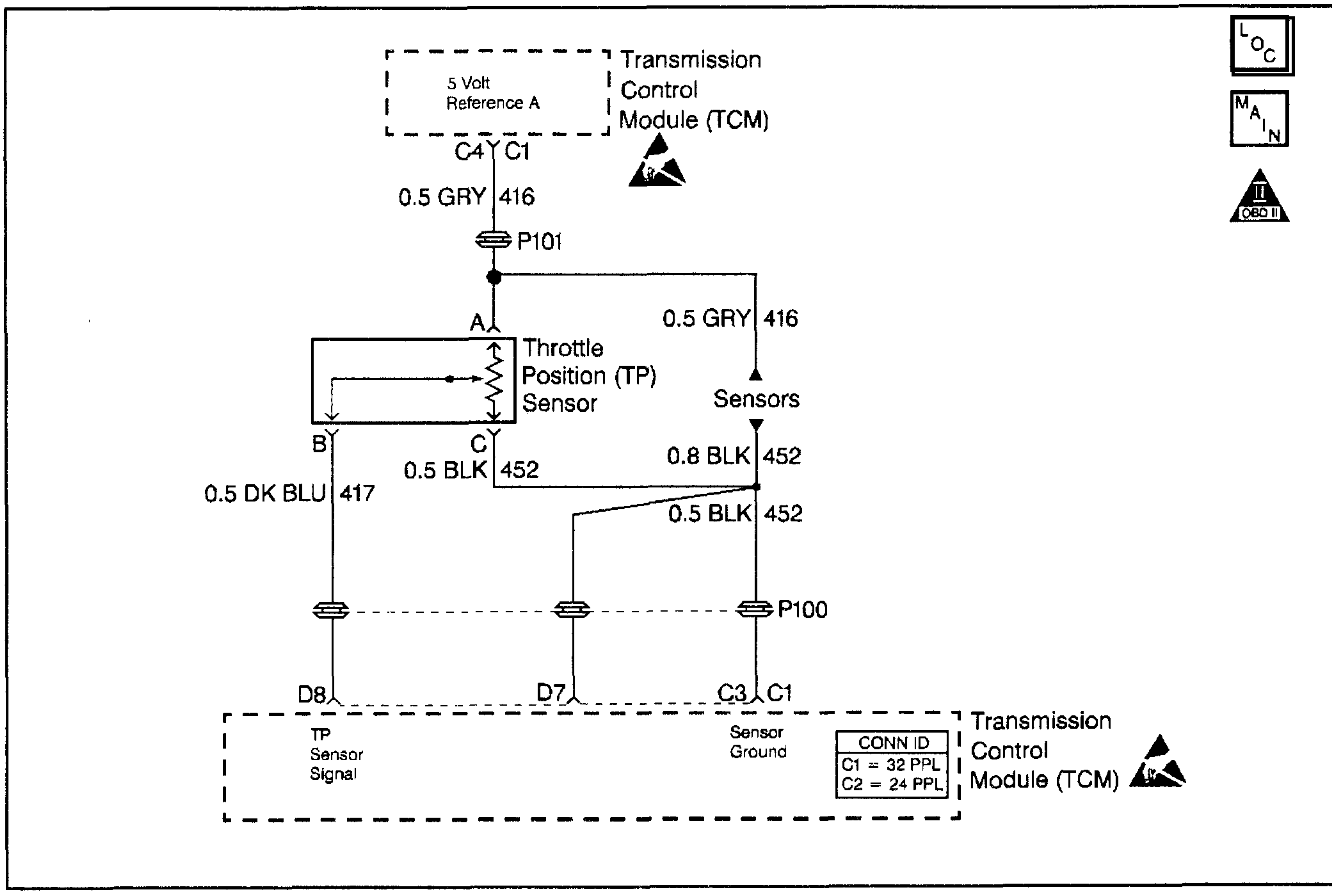
No Diagnostic Link Connector Data (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the On-Board Diagnostic System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool*. 2. With the engine OFF, turn the ignition switch to the RUN position. Is the MIL ON?	—	*Go to Step 3*	Go to *No Malfunction Indicator Lamp (L57 MFI)*
3	Select OBD System Check on the *Scan Tool* and perform as described, or ground the diagnostic link connector (DLC) terminal 6 to a good ground. Does the MIL flash a DTC 12?	—	*Go to Step 12*	*Go to Step 4*
4	1. Turn the ignition switch to the OFF position. 2. Disconnect the TCM wiring harness connectors. (Additional DTCs may be set). 3. With the engine OFF, turn the ignition switch to the RUN position. Is the MIL ON?	—	*Go to Step 5*	*Go to Step 6*
5	Inspect for a short to ground in circuit 1234 (GRY) from the MIL bulb to terminal B9 of the TCM harness connector. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	Go to *On-Board Diagnostic System Check (L57 MFI)*	—
6	1. Turn the ignition switch to the OFF position. 2. Do NOT ground the DLC. 3. Reconnect the TCM connectors to the TCM. 4. With the engine OFF, turn the ignition switch to the RUN position. 5. Backprobe the TCM connector terminal A8 (circuit 448 WHT/BLK), with a test light to a good ground. Does the MIL flash a DTC 12?	—	*Go to Step 7*	*Go to Step 19*
7	Inspect circuit 448 (WHT/BLK) for an open between terminal 6 of the DLC and the terminal A8 of the TCM connector. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 8*	*Go to Step 9*
8	Repair the open in circuit 448 (WHT/BLK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	Go to *On-Board Diagnostic System Check (L57 MFI)*	—

No Diagnostic Link Connector Data (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
9	Inspect circuit 450 (BLK) at terminal 5 of the DLC for a good ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 11*	*Go to Step 10*
10	Inspect circuit 451 (BLK/WHT) and terminals C1 and C2, of the TCM connector, for good ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 11*	—
11	Repair circuit 450 (BLK) to a good ground. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	Go to *On-Board Diagnostic System Check (L57 MFI)*	—
12	Does the *Scan Tool* display serial data?	—	*Go to Step 24*	*Go to Step 13*
13	**Important:** The reading may pulsate. 1. Check for voltage at terminal 9 of the DLC using the *J 39200* digital multimeter (DMM) on DC volts. 2. Record your reading. Disconnect the *Scan Tool* if necessary. Is the voltage within the specified values?	0–2.5 volts DC	*Go to Step 14*	*Go to Step 16*
14	Inspect the serial data link circuit 800 (TAN) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 15*	*Go to Step 23*
15	Repair circuit 800 (TAN) for an open or short to ground. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 24*	—
16	Is the voltage from step 13 within the specified values?	5.5–12.5 volts DC	*Go to Step 17*	System OK
17	Inspect the serial data link circuit 800 (TAN) for a short to power. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 18*	*Go to Step 23*
18	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 24*	—
19	Inspect the TCM and the connector terminals for corrosion or weak tension. Was a condition found?	—	*Go to Step 24*	*Go to Step 20*
20	Inspect the PROM for proper installation. Was a condition found?	—	*Go to Step 24*	*Go to Step 21*
21	Replace the TCM, using the original PROM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the TCM replacement complete?	—	*Go to Step 22*	—
22	Select OBD System Check on the *Scan Tool* or ground terminal 6 of the DLC. Does the MIL flash a DTC 12?	—	*Go to Step 24*	*Go to Step 23*
23	Replace the PROM. Is the PROM replacement complete?	—	*Go to Step 24*	—
24	Operate the vehicle. Is the MIL OFF, with the *Scan Tool* displaying TCM/Vehicle data?	—	System OK	*Go to Step 1*

DTC 21 TP Sensor Circuit High (L57 MFI)



372622

Circuit Description

The throttle position (TP) sensor provides a voltage signal which changes relative to the throttle blade angle. The TP sensor signal voltage varies from about 0.5 volt, at idle, to about 5.0 volts at wide open throttle (WOT).

The TP sensor signal is used by the TCM for most of the TCM control outputs.

Each time the voltage drops below 1.25 volts and stops, the TCM assumes this value as the 0 throttle angle. The TCM measures the percent throttle from this point on.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

The TP sensor signal is greater than 4.9 volts for greater than 1 second.

Action Taken When the DTC Sets

Important: The scan tool does not indicate default values.

- The TCM does not illuminate the MIL.
- The TCM commands maximum line pressure.
- The TCM uses 35% TP as a default.
- The TCM inhibits 4th gear if in hot mode.
- The TCM stores DTC 21 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists, and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

The scan tool reads the throttle position in volts. The TP should read about 0.45 to 0.85 volt, with the throttle closed and the ignition switch turned ON, or at idle. The voltage should increase at a steady rate as the throttle is moved toward the wide open throttle (WOT).

Also, some scan tools read the throttle angle. 0% = closed throttle. 100% = WOT.

Scan the TP sensor while depressing the accelerator pedal with the engine stopped and the ignition ON. The display should vary from below 1.25 volts (1250 mV) when the throttle was closed, to over 4.5 volts (4500 mV) when the throttle is held at the wide open throttle (WOT) position.

This DTC results if the TP ground circuit is open or the TP signal circuit is shorted to the voltage.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. If the TP signal measures greater than 4.9 volts, then the fault exists.
3. With the TP sensor disconnected, and if the TCM and the wiring are okay, the TP signal should go low.
4. Probing the TP ground circuit with a test lamp checks the 5.0 volt return circuit. This step isolates a faulty sensor, the TCM, or an open TP ground circuit.

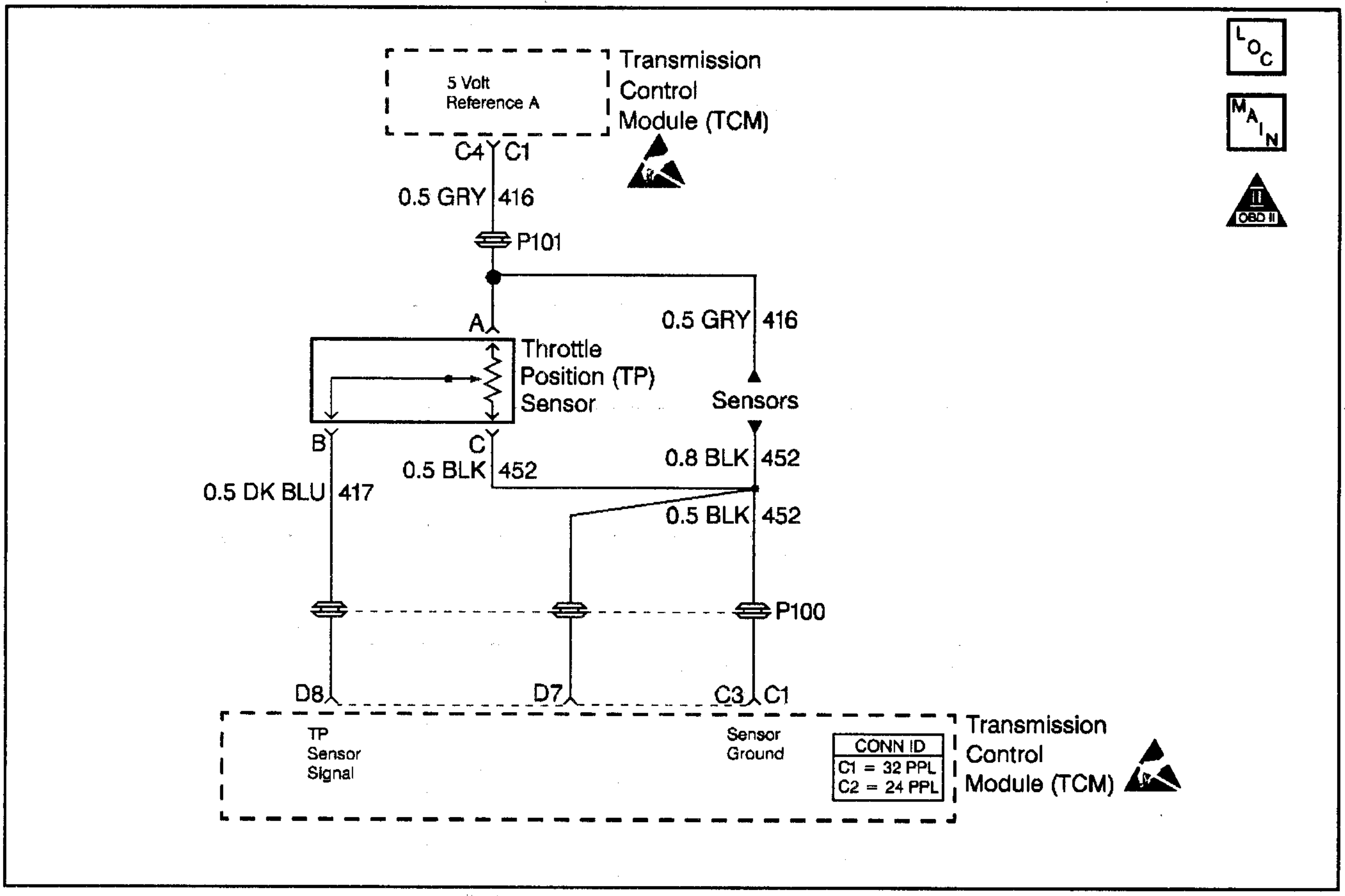
DTC 21 TP Sensor Circuit High (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Connect the *Scan Tool*. 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. Does the *Scan Tool* display a TP sensor signal greater than the specified value?	4.9 volts	*Go to Step 3*	*Go to Step 4*
3	1. Turn the ignition switch OFF. 2. Disconnect the TP sensor electrical connector. 3. Turn the ignition switch to the RUN position. Does the *Scan Tool* display a TP sensor signal less than the specified value?	0.2 volts	*Go to Step 5*	*Go to Step 8*
4	The DTC is intermittent. If no additional DTCs are stored, refer to the Diagnostic Aids. If additional DTCs are stored, refer to those tables first. Are any additional DTCs stored?	—	Go to the Applicable DTC Table	—
5	With a *J 39200* digital multimeter (DMM) connected to ground, probe the 5 V reference circuit (at the TP sensor electrical connector). Is the voltage greater than the specified value?	5.2 volts	*Go to Step 9*	*Go to Step 6*
6	Probe the TP sensor ground circuit (at the TP sensor connector) with a test light connected to B+. Is the test lamp on?	—	*Go to Step 7*	*Go to Step 11*
7	Replace the TP sensor. Refer to *TP Sensor Replacement (MFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 15*	—
8	Inspect for a short to voltage in the TP sensor signal circuit. Was a shorted condition found?	—	*Go to Step 12*	*Go to Step 14*
9	1. Turn the ignition switch OFF. 2. Disconnect the TCM connector C1. 3. Turn the ignition switch ON (additional DTCs may set). 4. With a *J 39200* DMM connected to ground, measure the 5 V reference circuit at terminal C4 of the TCM harness connector. Is the voltage greater than the specified value?	5.2 volts	*Go to Step 10*	*Go to Step 14*

DTC 21 TP Sensor Circuit High (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
10	Inspect for a short to voltage on the 5 V reference circuit 416 (GRY). Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a short to B+ voltage found?	—	*Go to Step 13*	Go to Diagnostic Aids
11	Check the sensor ground circuit 452 (BLK) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open condition found?	—	*Go to Step 12*	*Go to Step 14*
12	Repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 15*	—
13	Repair the short to voltage on the 5 V reference circuit 416 (GRY). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 15*	—
14	**Important:** If the TCM is faulty, reuse the PROM (Mem-cal). Replace the TCM. Is the replacement complete?	—	*Go to Step 15*	—
15	Perform the following procedure in order to verify the repair: 1. Using the *Scan Tool*, select the DTC and the Clear Info. 2. Start the engine. 3. Idle at the normal operating temperature. 4. Observe the *Scan Tool* TP sensor voltage. Is the *Scan Tool* TP sensor voltage within the specified value?	0.5-1.25 volts DC	System OK	*Go to Step 1*

DTC 22 TP Sensor Circuit Low (L57 MFI)



372622

Circuit Description

The throttle position (TP) sensor provides a voltage signal which changes relative to the throttle blade angle.

The TP sensor signal voltage varies from about 0.5 volt at idle, to about 5.0 volts at wide open throttle (WOT). The TP sensor signal is used by the TCM for most of the TCM control outputs.

Each time the voltage drops below 1.25 volts and stops, the TCM assumes this value as the 0 throttle angle. The TCM measures the percent throttle from this point on.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

The TP sensor signal is less than 0.2 volts for greater than 1 second.

Action Taken When the DTC Sets

Important: The scan tool does not indicate a default value.

- The TCM does not illuminate the MIL.
- The TCM commands maximum line pressure.
- The TCM uses 35% TP as a default.
- The TCM inhibits 4th gear if in hot mode.
- The TCM stores DTC 22 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists, and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

The scan tool reads the throttle position in volts. The TP should read about 0.45 to 0.85 volt, with the throttle closed and the ignition switch turned ON, or at idle. The voltage should increase at a steady rate as the throttle is moved toward the wide open throttle (WOT).

An open or short to ground in the 5 volt reference circuit or the TP sensor signal circuit results in a DTC 22.

Scan the TP sensor while depressing the accelerator pedal with the engine stopped and the ignition ON. The display should vary from below 1.25 volts (1250 mV) when the throttle was closed, to over 4.5 volts (4500 mV) when the throttle is held at the wide open throttle (WOT) position.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. If the TP signal measures less than 0.2 volt, then the fault exists.
3. This test simulates the DTC 21 (high voltage). If the TCM recognizes the high signal voltage, the TCM and the wiring harness are okay.
4. This test simulates a high signal voltage in order to check for an open in the TP signal circuit.
6. This step checks the 5 volt reference circuit for an open, short to ground, a poor connection, or a faulty TCM.

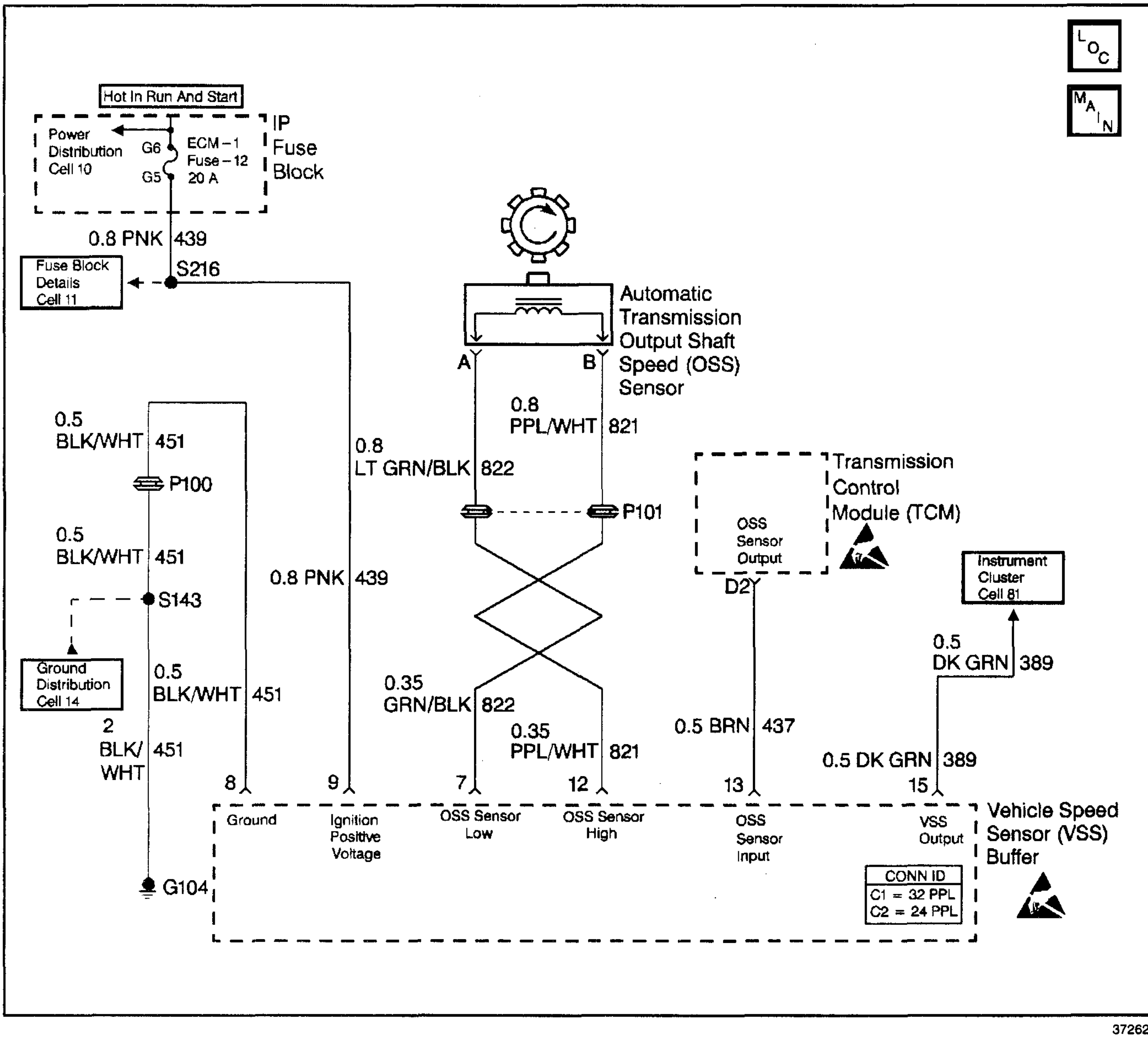
DTC 22 TP Sensor Circuit Low (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Connect the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position, and close the throttle. **Important:** Before clearing the DTCs, use the *Scan Tool* in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. Does the *Scan Tool* display a TP signal less than the specified value?	0.2 volts	*Go to Step 3*	*Go to Step 5*
3	1. Disconnect the TP sensor. 2. Jumper the TP sensor signal circuit 417 (DK BLU) and the TP sensor 5 volt reference circuit 416 (GRY) together. Does the *Scan Tool* display a TP signal greater than the specified value?	4.0 volts	*Go to Step 12*	*Go to Step 4*
4	Probe the TP sensor signal circuit 417 at harness terminal B with a test lamp connected to a 12 source (B+). Does the *Scan Tool* display a throttle position signal greater than the specified value?	4.0 volts	*Go to Step 6*	*Go to Step 8*
5	The DTC is intermittent. If no additional DTCs are stored, refer to the Diagnostic Aids. If additional DTCs are stored, refer to those tables. Are any additional DTCs set?	—	Go to the applicable DTC table	*Go to Step 6*
6	Check for an open in the 5 volt reference circuit 416 (GRY). Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open condition found?	—	*Go to Step 11*	*Go to Step 7*
7	Check the 5 volt reference circuit 416 for a short to the ground. Refer to *General Electrical Diagnosis Procedures* in iring Systems. Was a short to ground condition found?	—	*Go to Step 11*	*Go to Step 10*
8	Check the TP sensor signal circuit 417 (DK BLU) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open condition found?	—	*Go to Step 11*	*Go to Step 9*
9	Check the TP sensor signal circuit 417 for a short to the ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a short to ground condition found?	—	*Go to Step 11*	*Go to Step 10*
10	Check for a faulty connection at the TCM. Was a condition found?	—	*Go to Step 11*	*Go to Step 13*

DTC 22 TP Sensor Circuit Low (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
11	Repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 14*	—
12	Replace the faulty TP sensor. Refer to *TP Sensor Replacement (MFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 14*	—
13	**Important:** If the TCM is faulty, re-use the PROM (Mem-cal). Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Replace the TCM. Is the replacement complete?	—	*Go to Step 14*	—
14	Perform the following procedure in order to verify the repair: 1. Install the *Scan Tool.* 2. Select the DTC and the Clear Info. 3. Start the engine. 4. Idle at the normal operating temperature. 5. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Is the *Scan Tool* TP sensor voltage greater than the specified value?	0.2 volts	System OK	*Go to Step 1*

DTC 24 Output Shaft Speed Sensor Circuit Low Input (L57 MFI)



Circuit Description

The speed sensor circuit consists of a magnetic induction type sensor, which is the output shaft speed (OSS) sensor, a vehicle speed sensor (VSS) buffer module, and wiring. Gear teeth pressed onto the output shaft carrier assembly induce an alternating voltage into the sensor. This signal transmits to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module also converts the AC OSS sensor signal into a 40 pulse per revolution (PPR) 5 volt DC square wave form signal on circuit 437 to indicate transmission output speed.

When the transmission control module (TCM) detects a low output speed when the vehicle has a high engine speed in a drive gear range, then DTC 24 sets.

Conditions for Running the DTC

- No TP sensor DTC 21 or DTC 22.
- No TFP manual valve position switch DTC 28.
- The TP angle is 10–100%.
- Circuit 437 voltage is constant.
- Engine speed is greater than 3000 RPM.
- The transmission is not in PARK or NEUTRAL.

Conditions for Setting the DTC

- All the Conditions for Running the DTC are met for 3 seconds.
- The OSS sensor speed is less than 200 RPM.

Action Taken When the DTC Sets

- The TCM does not illuminate the MIL.
- The TCM commands maximum line pressure.
- The TCM commands 2nd gear.
- The TCM stores DTC 24 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists, and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the A/T OSS and the VSS buffer module connectors and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change. It may be necessary to drive the vehicle.
- Inspect the speed sensor wiring for contact with sharp metal edges.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step verifies the fault condition.
3. This step tests sensor integrity.
9. This step verifies power and ground to the VSS buffer module.
15. This step verifies the TCM input controlled by the speed buffer.

DTC 24 Output Shaft Speed Sensor Circuit Low Input (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Raise the drive wheels and support the axle assembly. 6. Start the engine and place the transmission in D1 range. 7. Gradually increase the wheel speed. Does the Transmission OSS increase with the drive wheel speed?	—	Go to Diagnostic Aids	*Go to Step 3*

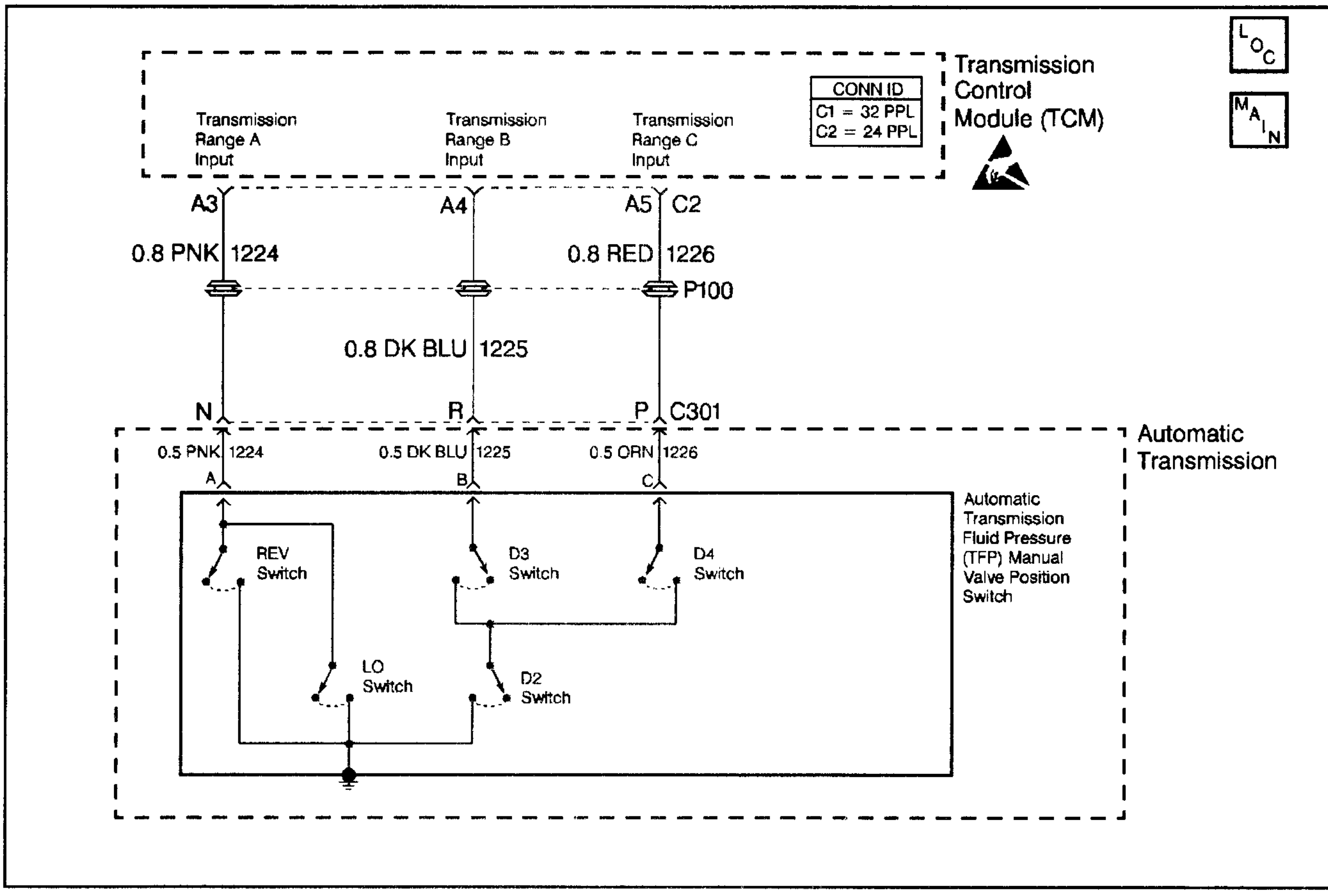
DTC 24 Output Shaft Speed Sensor Circuit Low Input (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition switch OFF. 2. Disconnect the OSS sensor connector from the OSS sensor. 3. Connect a *J 39200* digital multimeter (DMM), on AC Voltage scale, between terminals A and B at the OSS sensor. 4. Start the engine, and place the transmission in D1 range. 5. With the wheels turning, slowly accelerate to 2000 engine RPM. Is the voltage greater than the specified value?	2.0 volts at 2000 RPM	*Go to Step 4*	*Go to Step 17*
4	1. Reconnect the OSS sensor connector to the OSS sensor. 2. Disconnect the VSS buffer harness from the VSS buffer. 3. Using the *J 39200* DMM, measure the voltage between terminals 7 and 12 of the speed buffer harness connector. 4. Start the engine, and place the transmission in D1. 5. With the wheels turning, slowly accelerate engine speed to 2000 RPM. Is the voltage greater than the specified value?	2.0 volts AC at 2000 RPM	*Go to Step 7*	*Go to Step 5*
5	1. Inspect circuit 821 (PPL/WHT) for an open. 2. Inspect circuit 822 (GRN/BLK) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	*Go to Step 6*
6	1. Inspect circuit 821 (PPL/WHT) for a short to ground. 2. Inspect circuit 822 (GRN/BLK) for a short to ground. 3. Inspect circuits 821 (PPL/WHT) and 822 (GRN/BLK) for a short together. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	Go to Diagnostic Aids
7	1. Turn the ignition switch to the OFF position. 2. Using the *J 39200* DMM, on DC volts, measure the voltage between terminal 9 of the VSS buffer connector and a good ground. 3. Turn the ignition to the RUN position. Is the voltage greater than the specified value?	10.5 volts DC	*Go to Step 9*	*Go to Step 8*
8	Inspect the ignition feed circuit 439 (PNK) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	—
9	With the ignition switch in the RUN position, measure the voltage between terminals 8 and 9 of the VSS buffer connector. Is the voltage greater than the specified value?	10.5 volts DC	*Go to Step 11*	*Go to Step 10*
10	Inspect the VSS buffer module ground circuit 451 (BLK/WHT) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	—

DTC 24 Output Shaft Speed Sensor Circuit Low Input (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
11	With the connector off the speed buffer, and the ignition switch in the RUN position, measure the voltage between terminal 13, of the VSS buffer harness connector, and a good ground. Is the voltage within the specified value?	4.8–5.2 volts DC	*Go to Step 15*	*Go to Step 12*
12	Is the voltage in Step 11 greater than the specified voltage?	5.2 volts DC	*Go to Step 14*	*Go to Step 13*
13	Inspect circuit 437 (BRN) for a short to power. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	*Go to Step 17*
14	Inspect circuit 437 (BRN) for a short to power. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	*Go to Step 17*
15	1. Reconnect the VSS buffer harness connector to the speed buffer module. 2. With the *J 39200* DMM set on DC volts, and on a good ground, back probe terminal 13 of the VSS buffer module. 3. Start the engine, and place the transmission in D1. 4. With the wheels turning, slowly accelerate the engine speed to 2000 RPM. Is the voltage within the specified values?	1.5 - 3.5 volts DC	*Go to Step 19*	*Go to Step 18*
16	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 20*	—
17	Replace the OSS sensor. Refer to *Vehicle Speed Sensor Replacement.* Is the replacement complete?	—	*Go to Step 20*	—
18	Replace the VSS buffer module. Refer to *Vehicle Speed Signal Buffer Replacement* in Engine Controls. Is the replacement complete?	—	*Go to Step 20*	—
19	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 20*	—
20	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle under steady acceleration above 10% TP. Does the *Scan Tool* display an output speed greater than 500 RPM for 1 second?	—	System OK	*Go to Step 1*

DTC 28 TFP Manual Valve Position Switch Fault (L57 MFI)



372627

Circuit Description

The automatic transmission fluid pressure (TFP) manual valve position switch consists of five normally—open pressure switches. The transmission control module (TCM) supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the TCM detects what manual valve position has been selected and compares the actual voltage combination of the switches to a TFP Val. Position Sw. combination chart stored in memory.

The TFP manual valve position switch cannot distinguish between PARK and NEUTRAL because the monitored valve body pressures are identical in both cases. With the ignition ON and the engine OFF, D2 is indicated. When the transmission 20–way connector is disconnected, the ground potential for the three range signals to the TCM is removed, and with ignition ON, D2 is indicated.

If the TCM detects an illegal state of the TFP manual valve position switch circuit (range signals A and C are both ON), by deciphering the TFP manual valve position switch inputs, then DTC 28 sets.

Conditions for Setting the DTC

The TCM detects an illegal TFP manual valve position switch combination, (both A and C range signals are ON) for greater than 2 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM commands maximum line pressure.
- The TCM assumes D4 for the PRNDL shift pattern.
- The TCM inhibits TCC.
- The TCM inhibits 4th gear if in hot mode.
- The TCM stores DTC 28 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from the TCM history.
- The TCM clears the DTC from the TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists, and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Refer to the accompanying table for the normal range signals and the illegal combinations.
- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- DTC 28 can be falsely set during a fluid fill procedure. After refilling the fluid, cycle key down then start and run the vehicle for 20 seconds. Key down and allow the TCM to power down, and then restart the vehicle.
- DTC 28 can be set falsely by low pump pressure or a stuck pressure regulator.
- First, diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.
- DTC 28 may be inhibited from passing if the state of the battery is low, or there is a low cranking voltage. To pass DTC 28, turn the ignition switch to the ON position with the engine OFF. Check that all the range signal switches (A, B, C) read OFF, OFF, OFF. Start the vehicle, and move the PRNDL through each selected transmission range.
- Refer to the *Range Signal* table.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the indicated range signal to the manual valve that is actually selected.
4. This step tests the voltage from the TCM to the transmission 20-way connector.

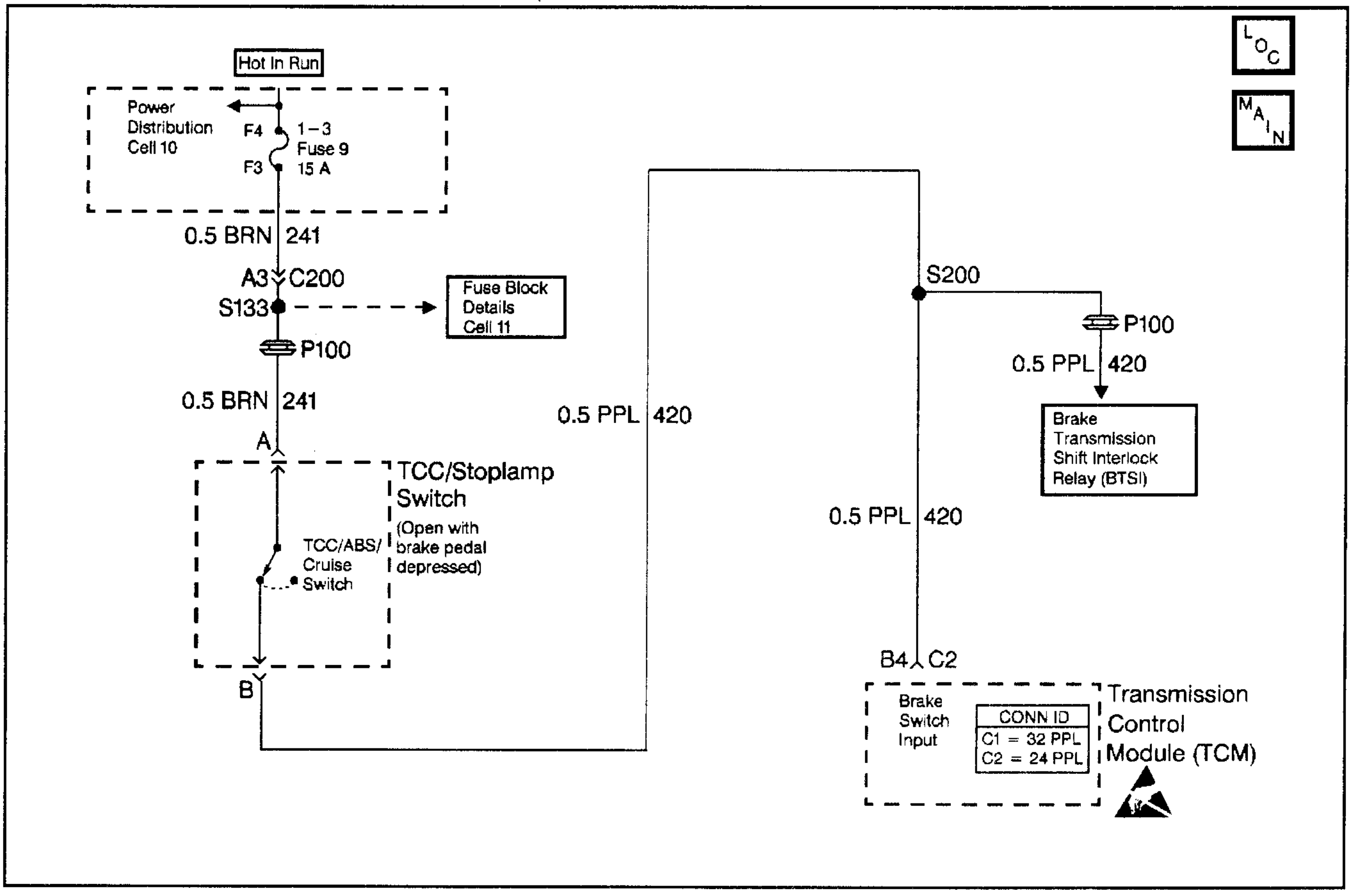
DTC 28 TFP Manual Valve Position Switch Fault (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Inspect for proper adjustment of the transmission linkage, from the select lever to the manual valve. 2. Inspect the fluid. Were the inspections performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the *Scan Tool* in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. While the engine idles at normal operating temperature, apply the parking brake. 6. Select each transmission range: D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the *Scan Tool* TFP Switch A/B/C display? (Refer to the *Range Signal* table.)	—	Go to Diagnostic Aids	*Go to Step 4*
4	1. Turn the ignition switch OFF. 2. Disconnect the transmission 20-way connector (additional DTCs may set). 3. Install the *J 39775* jumper harness on the engine side of the transmission 20-way connector. 4. With the engine OFF, turn the ignition switch to the RUN position. 5. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, check the voltage at the harness connector terminals N, R, and P. Do all three circuits display B+?	—	*Go to Step 6*	*Go to Step 5*

DTC 28 TFP Manual Valve Position Switch Fault (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
5	Inspect the circuits that did not indicate B+ in Step 4, for an open or short to ground condition. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 8*	*Go to Step 7*
6	To verify that circuits 1224 (PNK), 1225 (DK BLU) and 1226 (RED) are not shorted together, use a fused jumper to ground on each circuit, while monitoring the *Scan Tool* TFP Switch display. When a range signal circuit is grounded, are the other range signal circuits affected?	—	*Go to Step 8*	Go to *TFP Manual Valve Position Switch Resistance Check*
7	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Re-use the PROM (Mem-cal.) Is the replacement complete?	—	*Go to Step 9*	—
8	Repair the affected wiring as needed. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 9*	—
9	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: **Important:** Before performing this test be sure to apply vehicle parking brake. • Turn the ignition switch to the RUN position for at least 2 seconds. • Start the vehicle. • While idling vehicle, apply brakes and select each transmission range: D1, D2, D3, D4, N, R and P for at least 2 seconds each. Refer to the *Range Signal* table. Does each selected transmission range match the *Scan Tool* TFP Switch A/B/C display?	—	System OK	*Go to Step 1*

DTC 37 TCC Brake Switch Low Input (L57 MFI)



372629

Circuit Description

The TCC stoplamp switch indicates the brake pedal status. The normally-closed TCC stoplamp switch supplies a B+ signal on circuit 420 to the transmission control module (TCM). The signal voltage circuit opens when the brakes are applied. The TCM uses the open signal voltage circuit in order to de-energize the torque converter clutch pulse width modulation (TCC PWM) solenoid valve when the brakes are applied.

If the TCM detects an open TCC stoplamp switch circuit during accelerations, then DTC 37 sets.

Conditions for Running the DTC

The following sequence of events occurs:

- The vehicle speed is less than 8 km/h (5 mph) for 6 seconds.
- Then vehicle speed is 8–40 km/h (5–25 mph) for 6 seconds.
- Then the vehicle speed is greater than 40 km/h (25 mph) for 6 seconds.

Conditions for Setting the DTC

- The TCM detects an open TCC stoplamp switch/circuit (0 volts).
- All conditions are met for seven occurrences.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM inhibits TCC.
- The TCM inhibits 4th gear if in hot mode.
- The TCM stores DTC 37 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the TCC stoplamp switch and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Ask about the customer's driving habits and any unusual driving conditions he or she might have, such as stop and go traffic or expressway driving.
- Inspect the brake switch for proper mounting and adjustment.
- Inspect for the most current calibration ID and the latest bulletins.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests for TCC stoplamp switch voltage to the TCM connector.
7. This step isolates the TCC stoplamp switch as a source for setting the DTC.
10. This step tests for a short to ground in circuit 241 (ignition voltage) to the TCC stoplamp switch.
12. This step tests for a short to ground in circuit 420, from the TCC stoplamp switch to the TCM.
13. This step isolates the TCM as a source for causing the fuse to open.

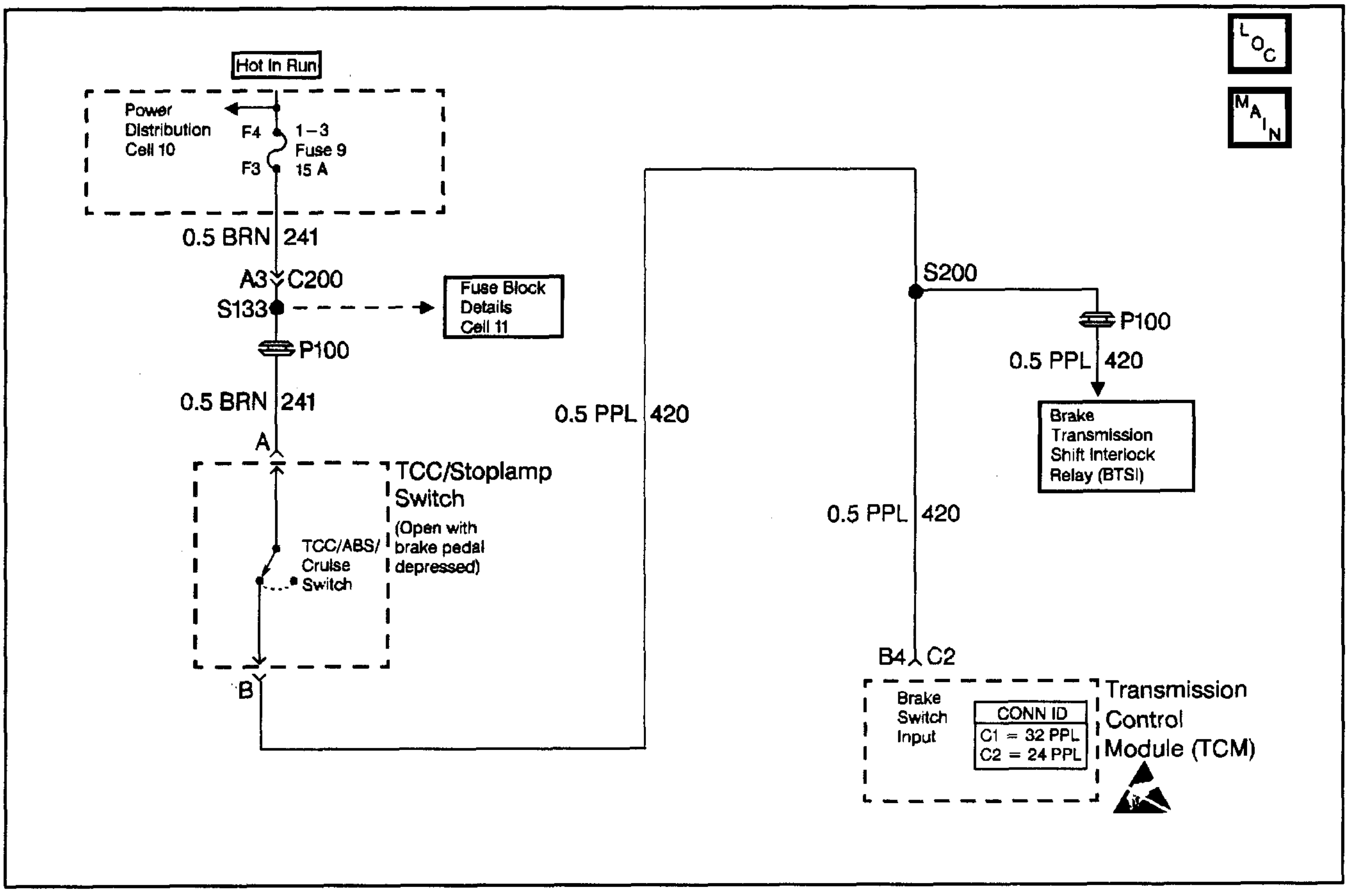
DTC 37 TCC Brake Switch Low Input (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Select the TCC Brake Switch on the *Scan Tool.* 6. Do not apply the brake pedal. Does the *Scan Tool* TCC Brake Switch indicate CLOSED, when the brake pedal is not applied?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Remove the 1–3 (#9) fuse. 2. Inspect the 1–3 fuse for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Is the fuse open?	—	*Go to Step 10*	*Go to Step 4*
4	1. Turn the ignition switch to the OFF position. 2. Disconnect the C2 connector from the TCM. (Additional DTCs may set.) 3. Connect a 12 volt test lamp to a good ground. 4. Using the *J 35616* connector test adapter kit and the 12 volt test lamp connected to ground, probe terminal C2–B4. 5. Re-install the fuse. 6. Turn the ignition switch to the RUN position. 7. Do not apply the brake pedal. Is the test lamp on?	—	*Go to Step 15*	*Go to Step 5*
5	1. Turn the ignition switch to the OFF position. 2. Remove the connector from the TCC/Stoplamp switch. 3. Use the *J 39200* digital multimeter (DMM) to measure B+ voltage at terminal A of the TCC stoplamp switch connector. 4. Turn the ignition switch to the RUN position. Is B+ voltage indicated?	10.0–13.0 volts	*Go to Step 7*	*Go to Step 6*
6	Inspect circuit 241 (BRN) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	—
7	1. Turn the ignition switch to the RUN position. 2. Install a fused jumper wire from terminal B to terminal A of the TCC/Stoplamp switch connector. 3. Probe the TCM connector terminal C2–B4 with the test lamp. Is the test lamp on?	—	*Go to Step 9*	*Go to Step 8*
8	Inspect circuit 420 (PPL) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	—

DTC 37 TCC Brake Switch Low Input (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the TCC/stoplamp switch. Refer to Stoplamp Switch Replacement in Hydraulic Brakes. Is the replacement complete?	—	*Go to Step 17*	—
10	1. Turn the ignition switch to the RUN position. 2. Apply, and hold, the brake pedal. 3. Install a new fuse while keeping the brake pedal applied. Does the fuse open with the brake pedal applied?	—	*Go to Step 11*	*Go to Step 12*
11	Inspect circuit 241 (BRN) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	—
12	With the ignition switch in the RUN position, release the brake pedal. Does the fuse open when the brake pedal is released?	—	*Go to Step 13*	Go to Diagnostic Aids
13	1. Turn the ignition switch to the OFF position. 2. Disconnect the TCM (24 PIN) connector C2. (Additional DTCs may set). 3. Turn the ignition switch to the RUN position. 4. Install a new fuse. 5. Do not apply the brake pedal. Does the fuse open?	—	*Go to Step 14*	*Go to Step 15*
14	Inspect circuit 420 (PPL) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	—
15	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 17*	—
16	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 17*	—
17	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: 3.1. With the engine OFF, turn the ignition switch to RUN position. 3.2. The brake pedal is not applied. 3.3. Select TCC Brake Switch on the *Scan Tool.* 3.4. Observe the *Scan Tool* TCC Brake Switch status. 3.5. Apply the brake pedal. Does the TCC brake switch indicate CLOSED when the brake pedal is not applied, then indicate OPEN when the brake pedal is applied?	—	System OK	*Go to Step 1*

DTC 38 TCC Brake Switch High Input (L57 MFI)



372629

Circuit Description

The TCC stoplamp switch indicates the brake pedal status. The normally-closed TCC stoplamp switch supplies a B + signal on circuit 420 to the transmission control module (TCM). The signal voltage circuit opens when the brakes are applied. The TCM uses the open signal voltage circuit in order to de-energize the torque converter clutch pulse width modulation (TCC PWM) solenoid valve when the brakes are applied.

If the TCM detects a closed TCC stoplamp switch circuit during accelerations, then DTC 38 sets.

Conditions for Running the DTC

The following sequence of events occurs:

- The vehicle speed is greater than 32 km/h (20 mph) for 6 seconds.
- Then the vehicle speed is 8–32 km/h (5–20 mph) for 6 seconds.
- Thn the vehicle speed is less than 8 km/h (5 mph).

Conditions for Setting the DTC

- All conditions are met for seven occurrences.
- The TCM detects a closed TCC stoplamp brake switch/circuit (12 volts) for 2 seconds during decelerations.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM inhibits TCC.
- The TCM will inhibit 4th gear if in hot mode.
- The TCM stores DTC 38 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the TCC stoplamp switch connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion

- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Ask about the customer's driving habits and any unusual driving conditions he or she might have, such as stop and go traffic or expressway driving.
- Inspect the TCC stoplamp switch for proper mounting and adjustment.
- Inspect for the most current calibration ID and the latest bulletins.
- Inspect for any transmission DTCs that may have reset.

Test Description

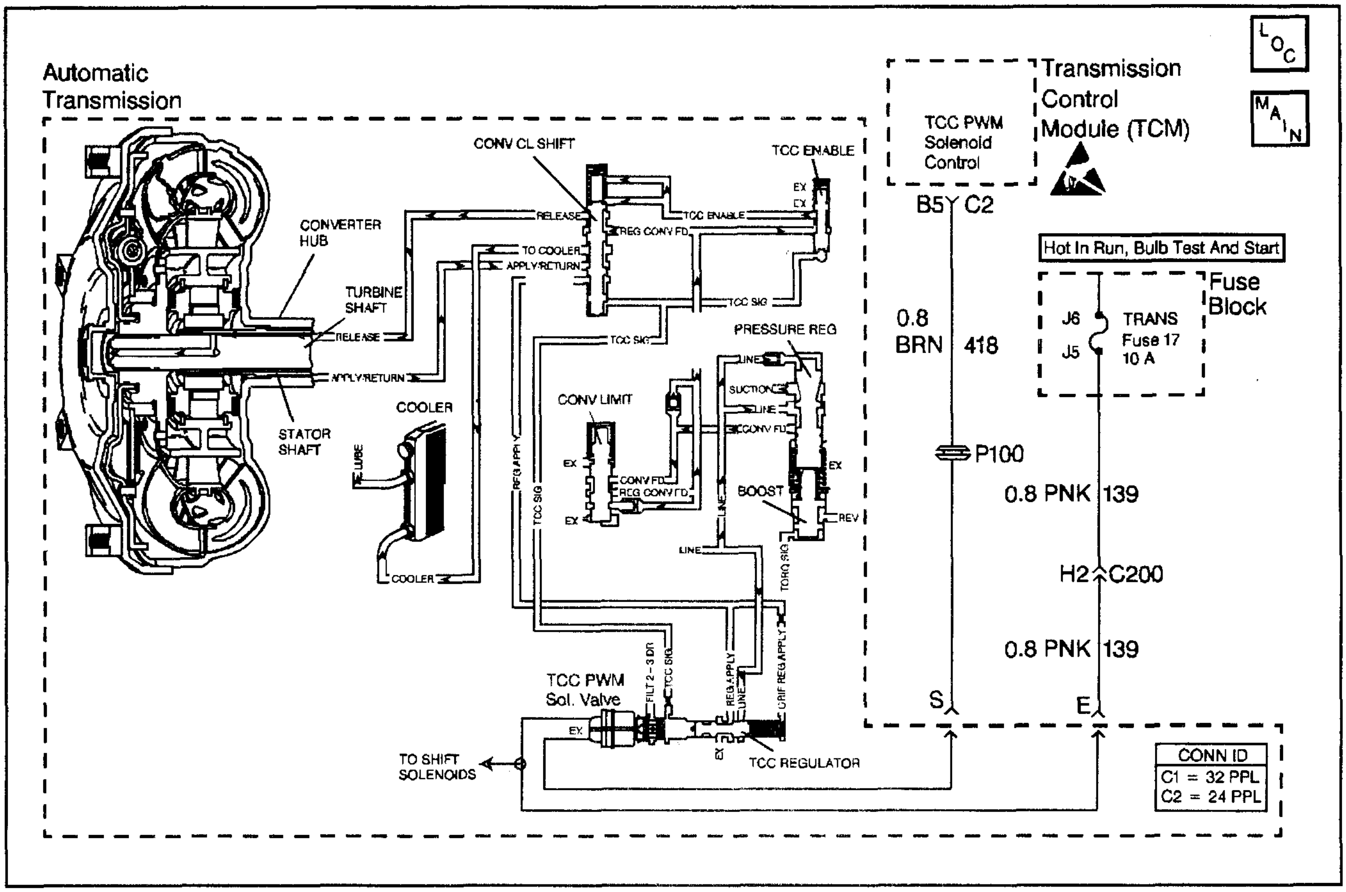
The numbers below refer to the step numbers on the diagnostic table.

3. This step isolates the TCC stoplamp switch as a source for setting the DTC.

DTC 38 TCC Brake Switch High Input (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool*. 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Select TCC Brake Switch on the *Scan Tool*. 6. Do not apply the brake pedal. 7. With the brake pedal not applied, note the TCC brake switch status. 8. Apply the brake pedal. Did the TCC brake switch status change from CLOSED to OPEN?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn the ignition switch to the OFF position. 2. Disconnect the TCC stoplamp switch connector from the switch. 3. Turn the ignition switch to the RUN position. Did the TCC brake switch status change from CLOSED to OPEN?	—	*Go to Step 4*	*Go to Step 5*
4	Replace the TCC stoplamp switch. Refer to Stoplamp Switch Replacement in Hydraulic Brakes. Is the replacement complete?	—	*Go to Step 8*	—
5	Inspect circuit 420 (PPL) for a short to B+. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a short to B+ condition found?	—	*Go to Step 7*	*Go to Step 6*
6	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 8*	—
7	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 8*	—
8	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle brake pedal, so that for a total of 2 consecutive times, the TCM sees the brake switch CLOSED and then OPEN, for greater than 2 seconds. Does the *Scan Tool* TCC brake switch status change from CLOSED to OPEN?	—	System OK	*Go to Step 1*

DTC 39 TCC Stuck OFF (L57 MFI)



372631

Circuit Description

Important: DTC 39 inspects for high torque converter clutch (TCC) slip in 2nd and 3rd gear only. The transmission must be in hot mode or experiencing a wide open throttle maneuver in order for the TCC to be commanded ON in 2nd and 3rd gear.

The transmission control module (TCM) energizes the torque converter clutch pulse width modulation (TCC PWM) solenoid valve by grounding circuit 418. This blocks the exhaust for TCC signal fluid and allows filtered 23 drive fluid to feed the TCC signal circuit. When the vehicle's operating conditions are appropriate for TCC application, the TCM begins the TCC duty cycle to approximately 30%. This allows TCC signal fluid pressure to move the converter clutch shift valve into the apply position and direct regulated apply fluid to the torque converter. The TCM then increases (ramps) the duty cycle to approximately 60%, where regulated apply fluid pressure applies the converter clutch. The vehicle application determines the TCC apply rate. Once the TCC applies, the duty cycle immediately increases to approximately 70%, to achieve full apply pressure in the regulated apply fluid circuit. The TCC PWM solenoid valve is de-energized by the TCM opening circuit 418. This action allows the TCC signal fluid to exhaust through the solenoid and blocks filtered 23 drive fluid from entering the TCC signal circuit. The loss of fluid pressure in the TCC signal circuit releases the TCC.

If the TCM detects high TCC slip when the TCC is commanded ON, then DTC 39 sets.

Conditions for Running the DTC

- No TFP manual valve position switch DTC 28.
- No camshaft position sensor circuit DTC 71.
- No A/T ISS sensor DTC 74.
- The gear ratio must indicate 2nd or 3rd.
- The TFP manual valve position switch must be in D4 or D3.
- TCC duty cycle greater than 70%.

Conditions for Setting the DTC

- The TCC slip speed is greater than 65 RPM.
- All conditions must be met for 2 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM inhibits 4th gear if in hot mode.
- The TCM stores DTC 39 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Residue or contamination may cause shift valves to stick intermittently.
- First, diagnose and clear any TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step tests for excessive TCC slip when the TCC is commanded on.
3. This step inspects for possible causes of no TCC apply.

DTC 39 TCC Stuck OFF (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool*. 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erase the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Drive the vehicle in D3. 6. Record the data using snapshot mode. Is the TCC slip speed snapshot data greater than the specified value, when the TCC Duty Cycle is commanded greater than 70% for greater than 3 seconds?	140 RPM	*Go to Step 3*	Go to Diagnostic Aids
3	Inspect the TCC PWM solenoid valve for being mechanically stuck OFF. Refer to *Torque Converter Diagnosis Procedure.* Was a condition found?	—	*Go to Step 5*	*Go to Step 4*
4	1. Inspect the TCC PWM solenoid valve for a damaged exhaust orifice. 2. Inspect for the converter regulated apply valve being stuck in the OFF (release) position. 3. Inspect the converter clutch shift valve for a stuck condition. 4. Inspect for a misaligned or damaged valve body gasket. 5. Inspect for a restricted apply or release passage. 6. Inspect for the torque converter being mechanically stuck OFF. Refer to *Symptom Diagnosis* No TCC Apply. Was the condition corrected?	—	*Go to Step 5*	—
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: 3.1. Drive the vehicle in D3 with steady acceleration and TP over 12%. 3.2. TCC duty cycle is greater than 70%. Does the *Scan Tool* display a TCC slip of less than 20 RPM for 2 seconds?	—	System OK	*Go to Step 1*

DTC 51 PROM Error (L57 MFI)

Circuit Description

The program read only memory (PROM) is a removable computer chip that is used to calibrate the transmission control module (TCM) for specific vehicle characteristics. Through the use of different PROM chips only one TCM is required for all applications. When the TCM operates, it checks the integrity of the RAM and ROM allocations, and if the memory allocations do not agree with the previous check, then DTC 51 sets.

Conditions for Setting the DTC

- Ignition ON.
- TCM Checksum is incorrect.

Action Taken When the DTC Sets

- TCM commands maximum line pressure.
- TCM commands 2nd gear.
- TCM inhibits TCC engagement.
- TCM freezes shift adapts from being updated.
- The TCM illuminates the malfunction indicator lamp (MIL).
- The TCM stores DTC 51 in TCM memory.

Conditions For Clearing The DTC

History DTCs can be cleared by using a scan tool.

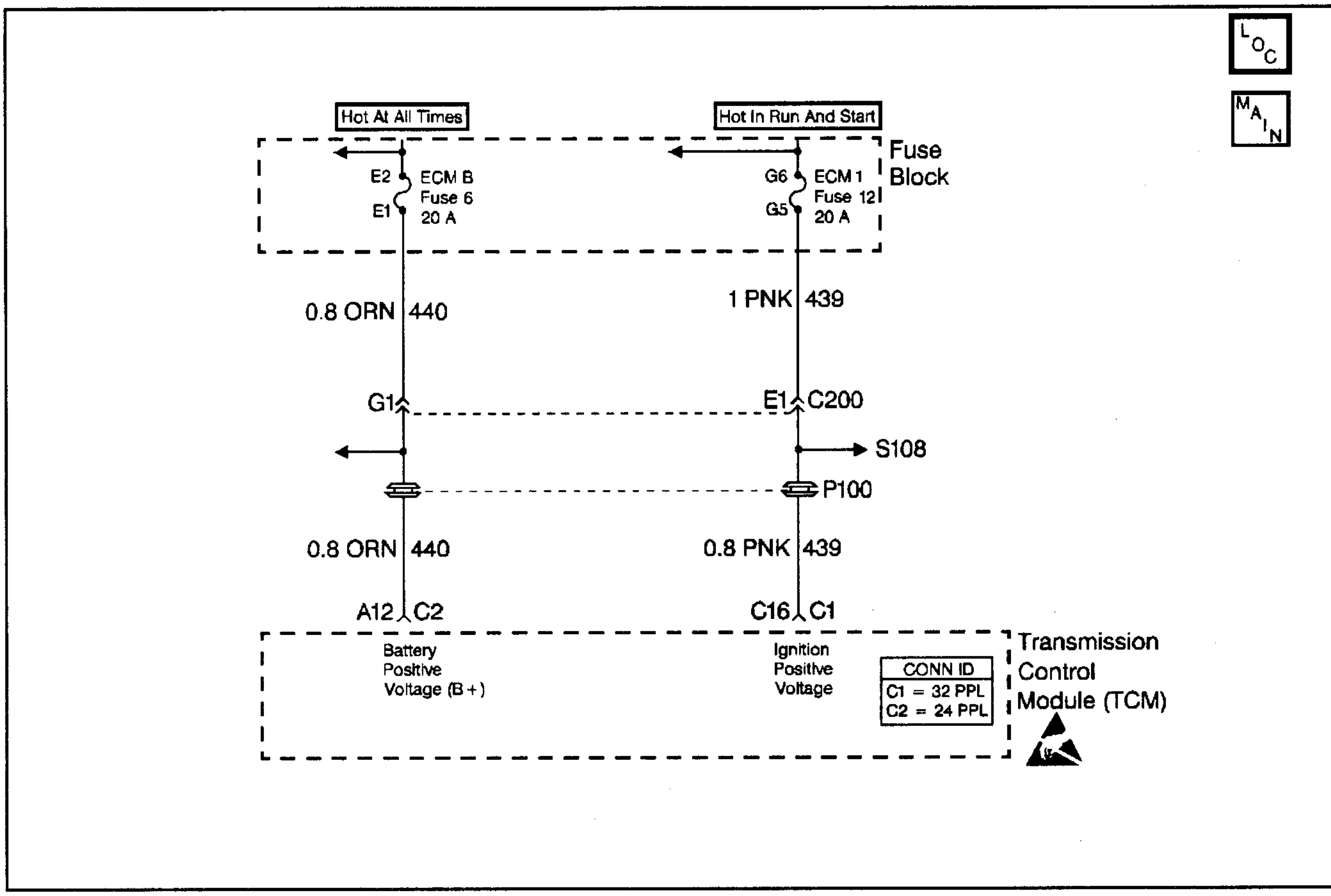
Diagnostic Aids

- Ensure that the PROM pins are fully seated in the socket.
- If you have replaced the PROM and DTC 51 reappears, then the TCM must be replaced. Refer to TCM/PROM Replacement.

DTC 51 PROM Error (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. Turn the ignition switch to the ON position. 3. Clear the DTCs. 4. Turn the ignition switch OFF for more than 30 seconds. 5. Start the engine. Does DTC 51 set?	—	*Go to Step 3*	Go to Diagnostic Aids
3	Replace the PROM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 4*	Go to Diagnostic Aids
4	Perform the following procedure in order to verify the repair: 1. Clear the DTCs. 2. Turn the ignition switch OFF for more than 30 seconds. 3. Start and idle the engine. Does DTC 51 set?	—	Go to Diagnostic Aids	System OK

DTC 52 System Voltage High Long (L57 MFI)



372635

Circuit Description

Ignition voltage is supplied to the transmission control module (TCM) to indicate the ignition status of the ignition switch. Battery voltage is supplied to the TCM to maintain memory of learned functions and parameters.

If the TCM detects a high ignition voltage for a long time, then DTC 52 sets.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The ignition system voltage is greater than 16 volts.
- All conditions are met for 27 minutes.

Action Taken When the DTC Sets

- The TCM commands maximum line pressure.
- The TCM commands 2nd gear.
- The TCM inhibits TCC.
- The TCM stores DTC 52 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Charging the battery and jump-starting an engine may set DTC 52. If DTC sets when an accessory is operated, check for faulty connections or excessive current draw. Refer to the appropriate service manual for circuit details.
- Check for faulty connections at the starter solenoid, fusible link, or battery cable connections.

Test Description

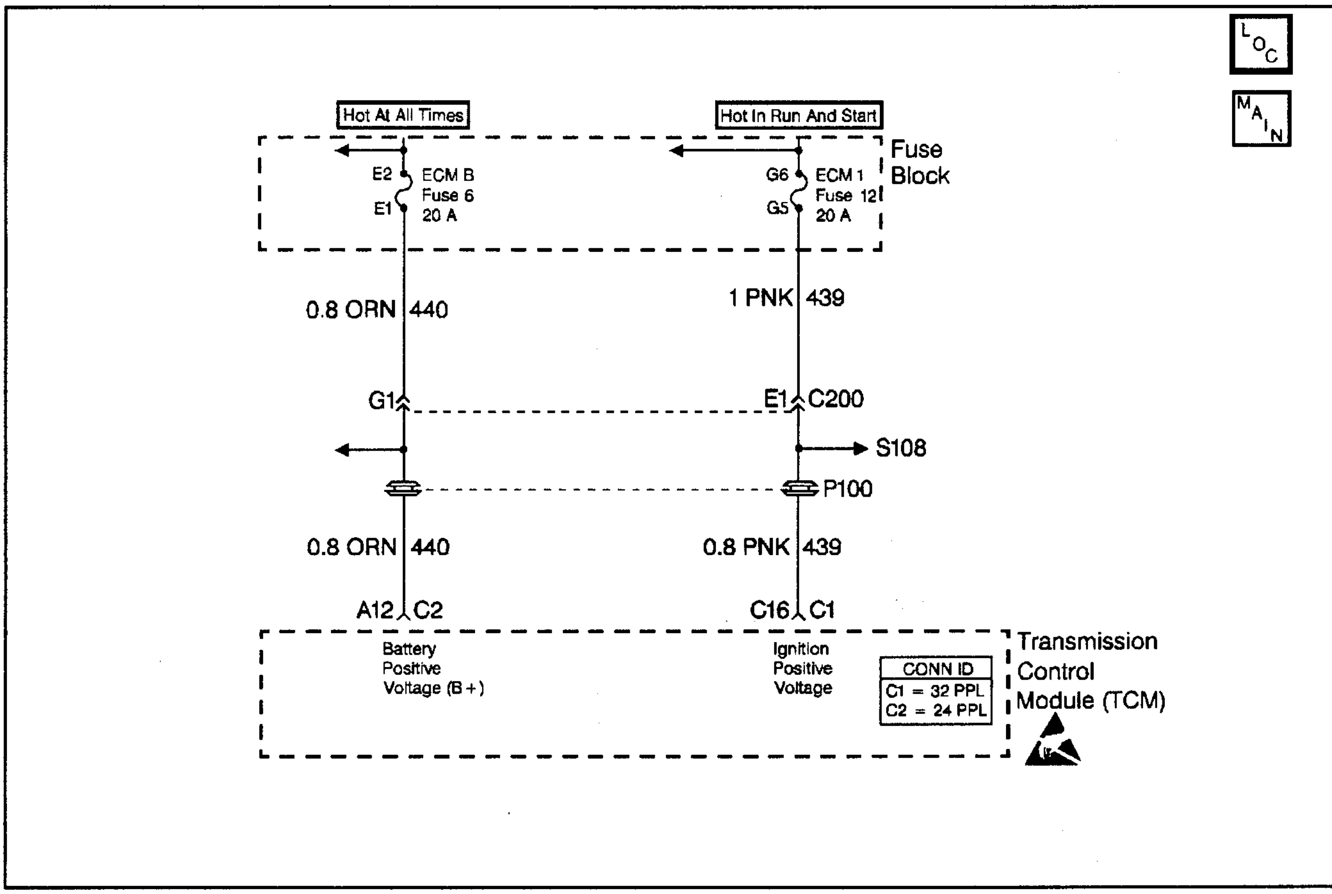
The numbers below refer to the step numbers on the diagnostic table.

2. Normal battery voltage is between 12–15 volts.
3. This determines if the *Scan Tool* is reading a non-actual system voltage from a faulty TCM.

DTC 52 System Voltage High Long (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Start the vehicle. 2. Increase the engine speed to above 1200 RPM. 3. Using the *J 39200* digital multimeter (DMM), measure the voltage across the battery terminals. Is the voltage greater than the specified voltage?	16.0 volts	Go to *Charging System Check*	*Go to Step 3*
3	1. Install the *Scan Tool.* 2. Start the vehicle. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Increase engine speed to above 1200 RPM. 6. Observe Ignition Voltage on the *Scan Tool.* Is the voltage greater than the specified voltage?	16.0 volts	*Go to Step 4*	Go to Diagnostic Aids
4	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 5*	—
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle for at least 2 minutes with the engine speed more than 1200 RPM. 4. Observe Ignition Voltage on the *Scan Tool.* Is the ignition voltage below the specified value for the full 2 minutes?	16.0 volts	System OK	*Go to Step 1*

DTC 53 System Voltage High (L57 MFI)



Circuit Description

Ignition voltage is supplied to the transmission control module (TCM) to indicate the ignition status of the ignition switch. Battery voltage is supplied to the TCM to maintain memory of learned functions and parameters.

If the TCM detects a high ignition voltage for a long time, then DTC 53 sets.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The ignition system voltage is greater than 19.5 volts.
- All conditions are met for 2 minutes.

Action Taken When the DTC Sets

- The TCM commands maximum line pressure.
- The TCM commands 2nd gear.
- The TCM inhibits TCC.
- The TCM stores DTC 53 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Charging the battery and jump-starting an engine may set DTC 53. If DTC sets when an accessory is operated, check for faulty connections or excessive current draw. Refer to the appropriate service manual for circuit details.
- Check for faulty connections at the starter solenoid, fusible link, or battery cable connections.

Test Description

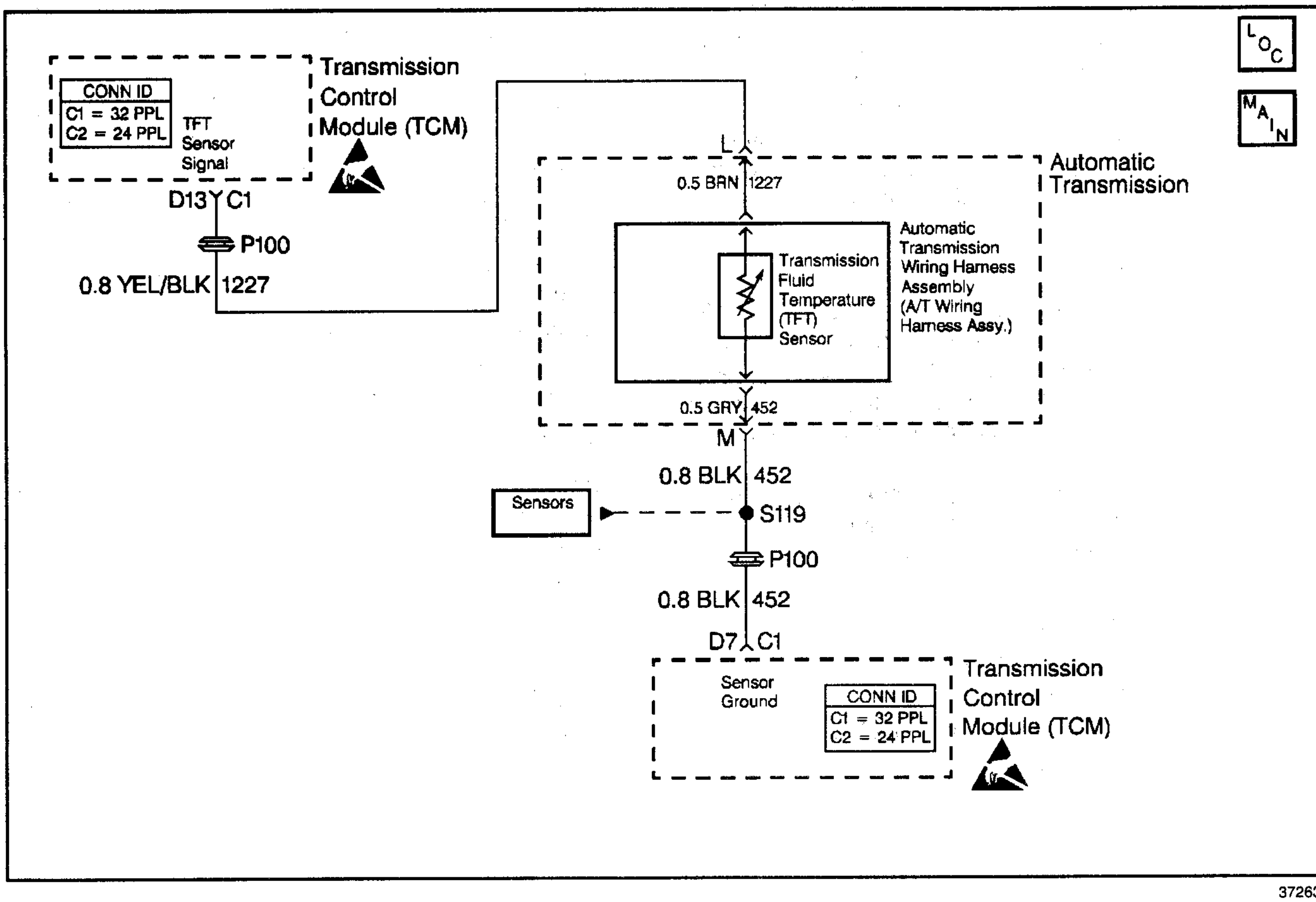
The numbers below refer to the step numbers on the diagnostic table.

2. Normal battery voltage is between 12–15 volts.
3. This determines if the *Scan Tool* is reading a non-actual system voltage from a faulty TCM.

DTC 53 System Voltage High (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Start the vehicle. 2. Increase the engine speed to above 1200 RPM. 3. Using the *J 39200* digital multimeter (DMM), measure the voltage across the battery terminals. Is the voltage greater than the specified voltage?	16.0 volts	Go to *Charging System Check*	*Go to Step 3*
3	1. Install the *Scan Tool.* 2. Start the vehicle. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Increase engine speed to above 1200 RPM. 6. Observe Ignition Voltage on the *Scan Tool.* Is the voltage greater than the specified voltage?	16.0 volts	*Go to Step 4*	Go to Diagnostic Aids
4	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 5*	—
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle for at least 2 minutes, with the engine speed greater than 1200 RPM. 4. Observe ignition voltage on the *Scan Tool.* Is the Ignition Voltage below the specified value for the full 2 minutes?	16.0 volts	System OK	*Go to Step 1*

DTC 58 TFT Sensor Circuit Low (L57 MFI)



Circuit Description

The automatic transmission fluid temperature (TFT) sensor is a thermistor that controls the signal voltage to the transmission control module (TCM). The TCM supplies a 5 volt reference signal to the sensor on circuit 1227. When the transmission fluid is cold, the sensor resistance is high and the controller will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature, the sensor resistance becomes less and the voltage decreases. With a DTC 79 also set, check the transmission cooling system.

If the TCM detects a continuous short to ground in the TFT signal circuit, then DTC 58 sets.

Conditions for Running the DTC

- The ignition is ON.
- System voltage is 12.0–16.0 volts.

Conditions for Setting the DTC

- The TFT signal voltage indicates TFT greater than 151°C (306°F).
- All conditions met for 1 second.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM defaults to 140°C for a transmission fluid temperature (causing a hot mode shift pattern to occur).
- The TCM stores DTC 58 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- With a transmission fluid overtemperature DTC 79 also set, inspect the transmission cooling system.
- Inspect the harness routing for a potential short to ground in circuit 1227. The scan tool transmission fluid temperature display should rise steadily, then stabilize.
- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Test the TFT sensor at the various temperatures in order to evaluate the possibility of a skewed (mis-scaled) sensor. Refer to the *Temperature vs Resistance* table. A skewed sensor may cause firm shifts or TCC complaints, extended shift patterns, and early TCC applies to occur.
- Verify the customer driving habits, trailer towing, weight or towing in OVERDRIVE.
- First, diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

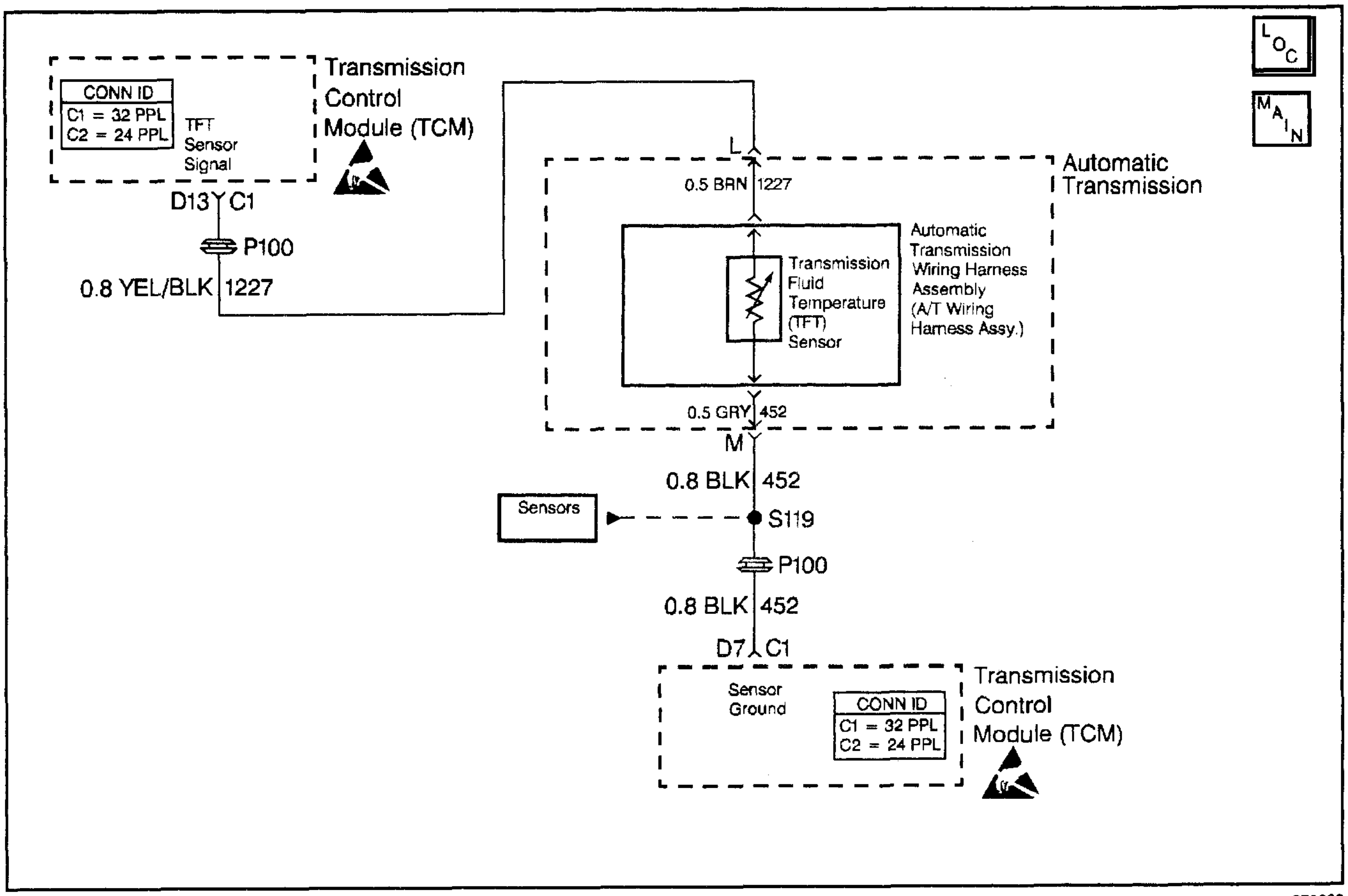
The numbers below refer to the step numbers on the diagnostic table.

3. This step tests for a short to ground or a skewed sensor by verifying the fault still exists.
4. This step tests for an internal fault within the transmission by creating an open.
6. This step tests circuit 1227, of the interior wiring harness, to ground.

DTC 58 TFT Sensor Circuit Low (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. Does the *Scan Tool* display transmission fluid temperature greater than the specified value?	151°C (306°F)	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn the ignition switch OFF. 2. Disconnect the transmission 20-way harness connector (multiple DTCs will set). 3. Turn the ignition switch to the RUN position. Does the *Scan Tool* display a transmission fluid temperature greater than the specified value?	150°C (305°F)	*Go to Step 8*	*Go to Step 5*
5	1. Turn the ignition switch OFF. 2. Install the *J 39775* jumper harness on the transmission side of the 20-way connector. 3. Use the *J 39200* digital multimeter (DMM) and the *J 35616* connector test adapter kit to measure the resistance between terminals L and M. Refer to *Electronic Component Description.* Is the resistance within specified values?	16 k Ω at 10°C (50°F) to 133 k Ω at 110°C (230°F)	*Go to Step 6*	*Go to Step 7*
6	Measure the resistance between terminal L and a good ground on the transmission case. Is the resistance less than the specified value?	50 kΩ	*Go to Step 7*	Go to Diagnostic Aids
7	Replace the automatic transmission wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 11*	—
8	Inspect circuit 1227 (YEL/BLK) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 9*	*Go to Step 9*
9	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 11*	—
10	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 11*	—
11	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. Is the transmission fluid temperature less than 150°C (305°F) for 10 seconds?	—	System OK	*Go to Step 1*

DTC 59 TFT Sensor Circuit High (L57 MFI)



372638

Circuit Description

The automatic transmission fluid temperature (TFT) sensor is a thermistor that controls the signal voltage to the transmission control module (TCM). The TCM supplies a 5 volt reference signal to the sensor on circuit 1227. When the transmission fluid is cold, the sensor resistance is high and the controller senses high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature, the sensor resistance becomes less and the voltage decreases. With a DTC 79 also set, check the transmission cooling system.

If the TCM detects a continuous short to ground in the TFT signal circuit, then DTC 59 sets.

Conditions for Running the DTC

- The ignition is ON.
- System voltage is 12.0–16.0 volts.

Conditions for Setting the DTC

- Signal voltage indicates TFT less than –40°C (–40°F).
- All conditions met for 1 second.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp MIL.
- The TCM defaults to 140°C for a transmission fluid temperature (causing a hot mode shift pattern to occur).
- The TCM stores DTC 59 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
  - Higher than normal voltage in circuit 1227 may also damage the TFT Sensor.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- The scan tool displays the transmission fluid temperature in degrees. After the transmission operates, the temperature rises steadily. The temperature then stabilizes.
- Test the TFT sensor at the various temperatures in order to evaluate the possibility of a skewed (mis-scaled) sensor. Refer to the *Temperature vs Resistance* table. A skewed sensor may cause firm shifts or TCC complaints, extended shift patterns, and early TCC applies to occur.
- First, diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5. This step tests for higher than normal circuit voltage, which may also damage the TFT sensor.
6. This step simulates a TFT sensor DTC 58. If the TCM recognizes the low signal voltage (high temperature), and the *Scan Tool* displays 146°C (295°F) or greater, the TCM and the wiring are OK.
7. This step verifies a condition in the TFT sensor circuit.
8. This step inspects the TFT sensor and the A/T wiring harness assembly.

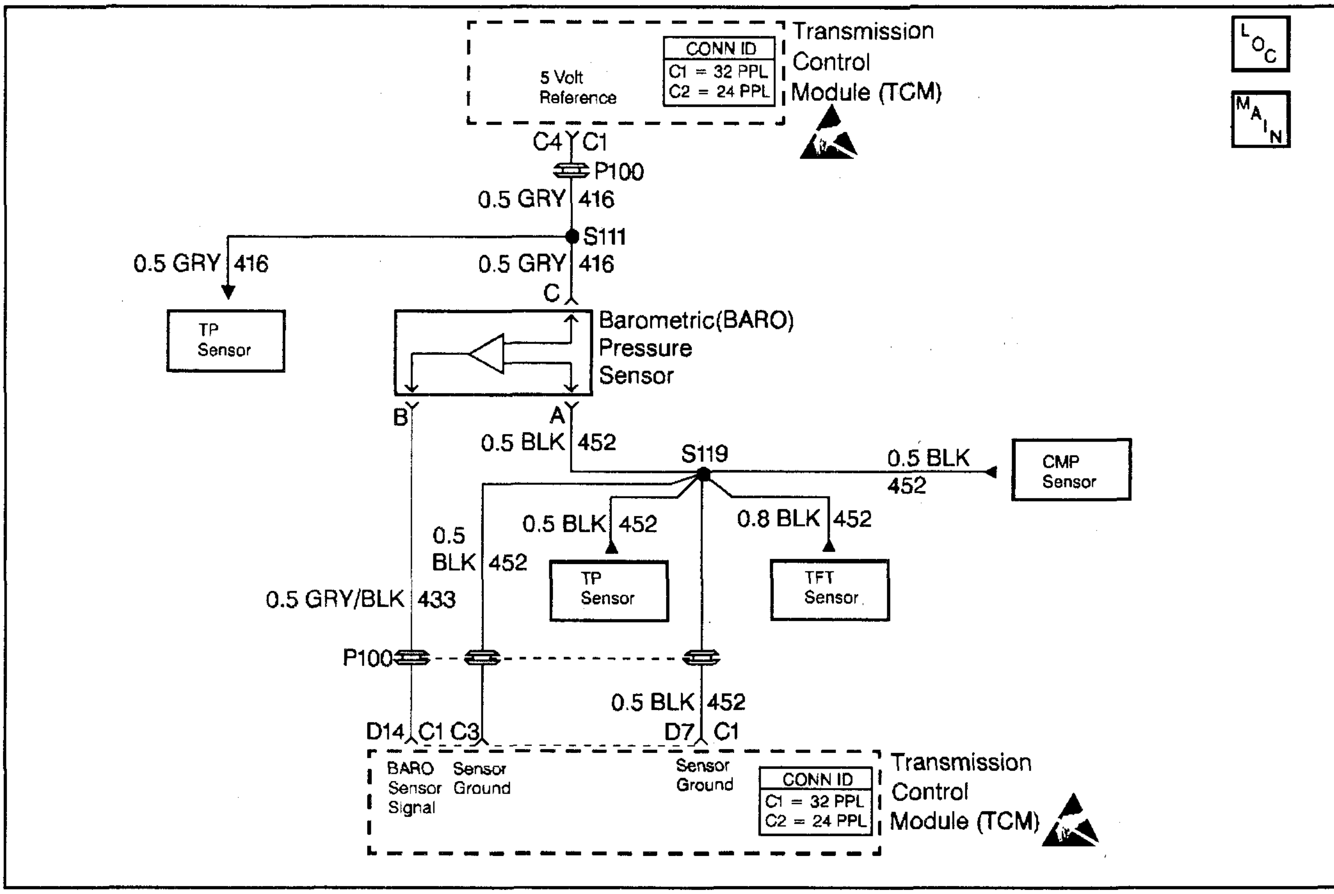
DTC 59 TFT Sensor Circuit High (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. Does the *Scan Tool* display a transmission fluid temperature less than the specified value?	–30°C (–22°F)	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn the ignition switch OFF. 2. Disconnect the transmission 20-way connector. 3. Install the *J 39775* jumper harness on the engine side of the 20-way connector. 4. Using the *J 39200* digital multimeter (DMM) and the *J 35616* connector test adapter kit, measure the voltage between jumper harness terminal L and a good ground. 5. Turn the ignition switch to the RUN position. Is the voltage within the specified value?	4.9–5.0 volts	*Go to Step 6*	*Go to Step 5*
5	Is the *J 39200* DMM voltage greater than the specified value?	5.1 volts	*Go to Step 11*	*Go to Step 10*

DTC 59 TFT Sensor Circuit High (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
6	1. Turn the engine OFF. 2. Install a fused jumper wire from terminal L to terminal M on the transmission 20-way connector. 3. Turn the ignition switch to the RUN position. Is the transmission fluid temperature greater than the specified value?	140°C (284°F)	*Go to Step 7*	*Go to Step 12*
7	1. Turn the ignition switch OFF. 2. Install the *J 39775* to the transmission side of the 20-way connector. 3. Using the *J 39200* DMM, measure the resistance between terminal L and terminal M. Refer to *Electronic Component Description.* Is the resistance within the specified values?	16 kΩ at 10°C (50°F) to 133 kΩ at 110°C (230°F)	Go to Diagnostic Aids	*Go to Step 8*
8	1. Remove the transmission oil pan. Refer to *AT Fluid/Filter Changing.* 2. Inspect the automatic transmission (A/T) wiring harness assembly for an open in circuits 1227 (YEL/BLK) and 452 (BLK). Was a condition found?	—	*Go to Step 9*	Go to Diagnostic Aids
9	Replace the A/T wiring harness assembly. Refer to A/T Wiring Harness Assembly Replacement. Is the replacement complete?	—	*Go to Step 15*	—
10	Inspect the engine harness circuit 1227 (YEL/BLK) for high resistance or an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 13*	*Go to Step 13*
11	Inspect engine harness circuit 1227 (YEL/BLK) for a short to voltage B+. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 13*	*Go to Step 14*
12	Inspect engine harness circuit 452 (BLK) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 13*	*Go to Step 14*
13	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 15*	—
14	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 15*	—
15	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle. Is the transmission fluid temperature greater than –40°C (–40°F).	—	System OK	*Go to Step 1*

DTC 63 BARO Sensor Circuit High (L57 MFI)



372640

Circuit Description

The transmission control module (TCM) supplies 5 volts to the BARO sensor. As the atmospheric pressure changes the resistance within the BARO sensor also changes, modifying the voltage on the BARO sensor input signal. When atmospheric pressure is high, (100 kPa), input signal voltage is high (approx. 4.5 V). As atmospheric pressure decreases, so does the input signal voltage.

If the TCM detects a high voltage on the BARO sensor circuit, then DTC 63 sets.

Conditions for Running the DTC

- The ignition is ON.
- System voltage is 12.0–16.0 volts.

Conditions for Setting the DTC

BARO sensor signal voltage greater than 4.9 volts for at least 2 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- No altitude compensation of shift patterns.
- The TCM uses a default BARO value of 100 kPa.
- The TCM stores DTC 63 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- If the DTC does not set, use snapshot mode on the scan tool to trigger ON this DTC, then review data to identify source.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step verifies the 5 volt supply to the BARO sensor.
3. This step verifies a good BARO sensor ground circuit 452.
4. If the entire circuit is OK, the voltage measured will be approximately 5 volts.

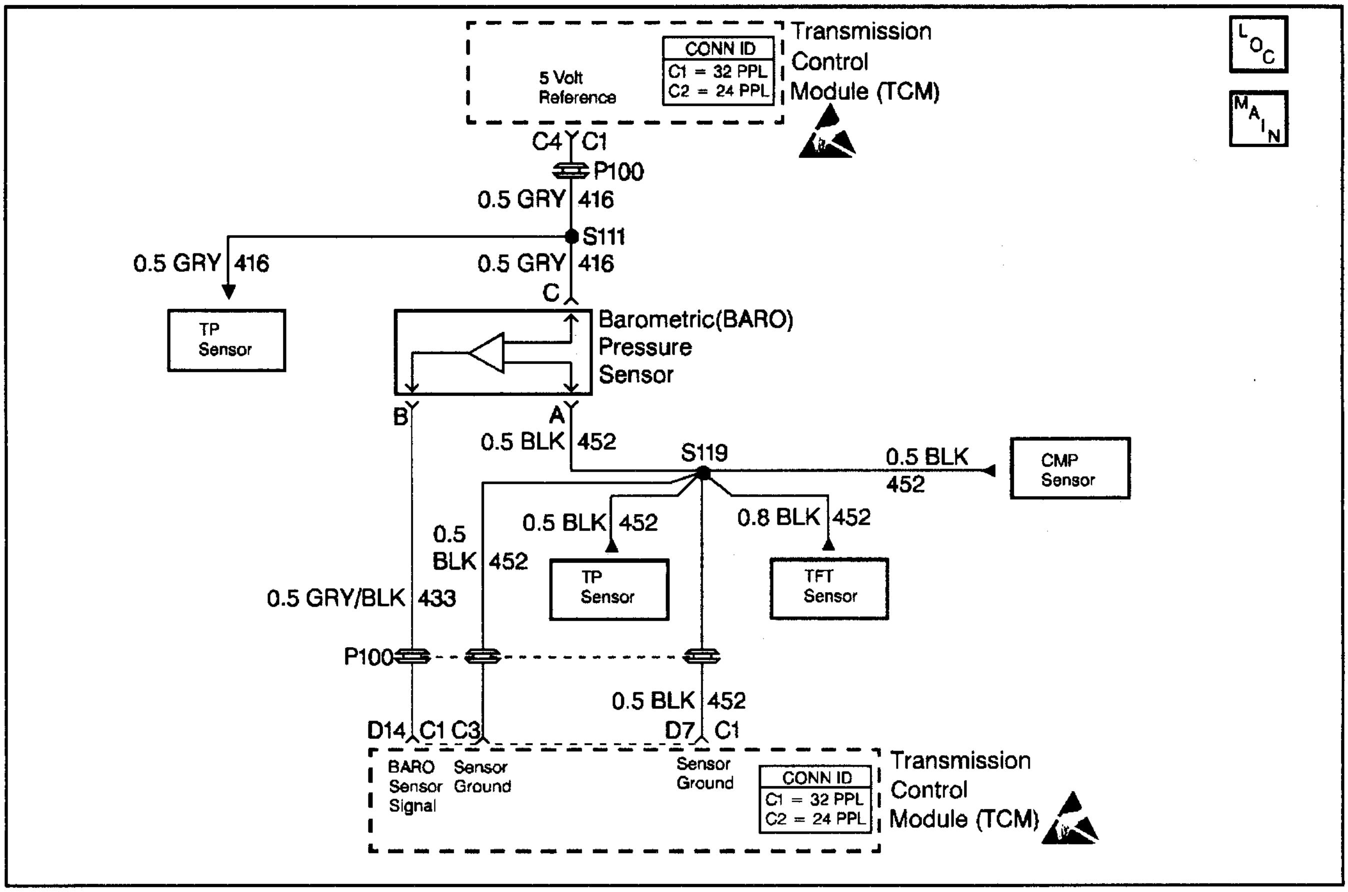
DTC 63 BARO Sensor Circuit High (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Turn the ignition switch OFF. 2. Disconnect the BARO sensor. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Turn the ignition switch ON. 6. Using a *J 39200* digital multimeter (DMM), measure the 5 volt reference signal at terminal C of the BARO sensor connector. Is the voltage within the specified values?	4.7–5.3 volts	*Go to Step 3*	*Go to Step 8*
3	Using a test light connected to B+, probe ground circuit 452 (BLK) at the BARO sensor connector. Is test light ON?	—	*Go to Step 4*	*Go to Step 7*
4	1. Using a fused jumper wire, connect circuits 416 (GRY) and 433 (GRY/BLK) together at the BARO sensor connector. 2. Using a *J 39200* DMM, measure the voltage at TCM connector C1–D14. Is the voltage greater than 4.7 volts?	—	*Go to Step 5*	*Go to Step 9*
5	Verify proper terminal tension at the BARO sensor connector. Was a condition corrected?	—	*Go to Step 12*	*Go to Step 6*
6	Replace the BARO sensor. Refer to BARO Sensor Replacement in Engine Controls. Is the replacement complete?	—	*Go to Step 12*	—
7	Repair the open in the ground circuit 452 (BLK) from the BARO sensor to the TCM. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 12*	—
8	Repair the 5 volt reference circuit 416 (GRY) to the BARO sensor. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 12*	—
9	Inspect circuit 433 (GRY/BLK) for an open or a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 11*	*Go to Step 10*

DTC 63 BARO Sensor Circuit High (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 12*	—
11	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 12*	—
12	Perform the following procedure in order to verify the repair: 1. With the engine OFF, turn the ignition switch to the RUN position. 2. Select DTC. 3. Select Clear Info. 4. Start, and run the vehicle for at least 2 seconds. 5. Using the *J 39200* DMM on DC volts, probe the TCM connector C1–D14. Is the *J 39200* DMM voltage within the specified value?	1.9–4.9 volts	System OK	*Go to Step 1*

DTC 64 BARO Sensor Circuit Low (L57 MFI)



372640

Circuit Description

The transmission control module (TCM) supplies 5 volts to the BARO sensor. As the atmospheric pressure changes the resistance within the BARO sensor also changes, modifying the voltage on the BARO sensor input signal. When atmospheric pressure is high, (100 kPa), input signal voltage is high (approx. 4.5 V). As atmospheric pressure decreases, so does the input signal voltage.

If the TCM detects a low voltage on the BARO sensor circuit, then DTC 64 sets.

Conditions for Running the DTC

- The ignition is ON.
- System voltage is 12.0–16.0 volts.

Conditions for Setting the DTC

BARO sensor signal voltage less than 1.9 volts for greater than 2 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- No altitude compensation of shift patterns.
- The TCM uses a default BARO value of 100 kPa.
- The TCM stores DTC 64 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- If the DTC does not set, use snapshot mode on the scan tool to trigger ON this DTC, then review data to identify source.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step verifies the 5 volt supply to the BARO sensor.
3. This step verifies a good BARO sensor ground circuit 452.
4. If the entire circuit is OK, the voltage measured will be approximately 5 volts.

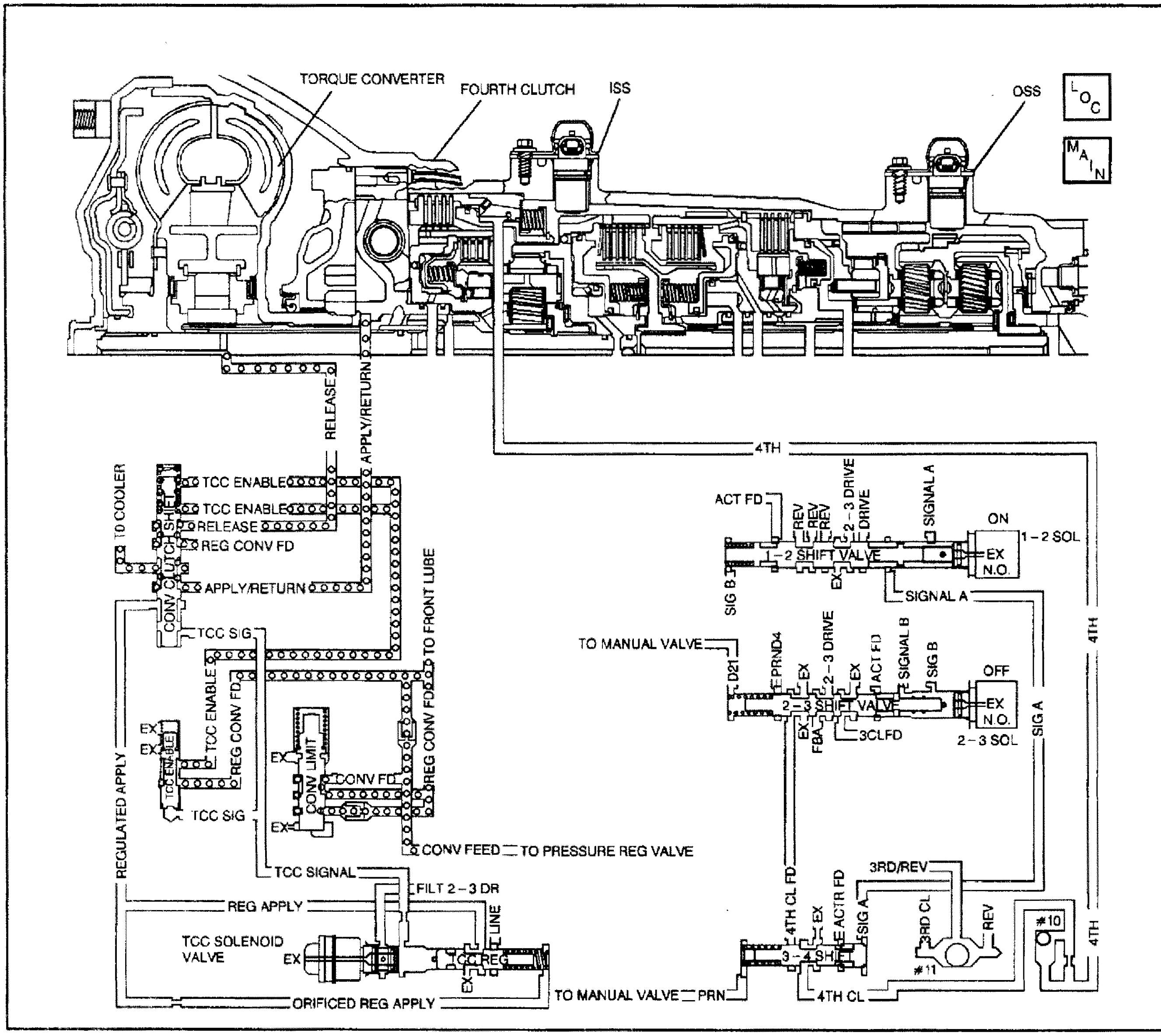
DTC 64 BARO Sensor Circuit Low (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Turn the ignition switch OFF. 2. Disconnect the BARO sensor. 3. Turn the ignition switch ON. 4. Using a *J 39200* digital multimeter (DMM), measure the 5 volt reference signal at terminal C of the BARO sensor connector. Is the voltage within the specified values?	4.7–5.3 v	*Go to Step 3*	*Go to Step 8*
3	Using a test light connected to B+, probe ground circuit 452 (BLK) at the BARO sensor connector. Is test light ON?	—	*Go to Step 4*	*Go to Step 7*
4	1. Using a fused jumper wire, connect circuits 416 (GRY) and 433 (GRY/BLK) together at the BARO sensor connector. 2. Using a *J 39200* DMM, measure the voltage at TCM connector C1–D14. Is the voltage greater than the specified value?	4.7 volts	*Go to Step 5*	*Go to Step 9*
5	Verify proper terminal tension at the BARO sensor connector. Was the condition corrected?	—	*Go to Step 12*	*Go to Step 6*
6	Replace the BARO sensor. Refer to BARO Sensor Replacement in Engine Controls. Is the replacement complete?	—	*Go to Step 12*	—
7	Repair the open in the ground circuit 452 (BLK), from the BARO sensor to the TCM. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 12*	—
8	Repair the 5 volt reference circuit 416 to the BARO sensor. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 12*	—
9	Inspect circuit 433 for an open or a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 11*	*Go to Step 10*
10	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 12*	—

DTC 64 BARO Sensor Circuit Low (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
11	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 12*	—
12	Perform the following procedure in order to verify the repair: 1. Engine OFF, turn the ignition switch to the RUN position. 2. Select DTC. 3. Select Clear Info. 4. Start and run the vehicle for at least 2 seconds. 5. Using the *J 39200* DMM on DC volts, probe C1–D14 at the TCM. Is the *J 39200* DMM voltage within the specified value?	1.9–4.9 volts	System OK	*Go to Step 1*

DTC 68 Transmission Component Slipping (L57 MFI)



230201

Circuit Description

The transmission control module (TCM) monitors the engine speed and the transmission output shaft speed. The TCM calculates turbine shaft speed and torque converter clutch (TCC) slip speed by using inputs from the transmission input shaft speed (ISS) sensor, transmission output shaft speed (OSS) sensor and other transmission components. The forward clutch housing is used as the ISS sensor rotor. Whenever the TCC is engaged, engine speed and turbine speed closely match, indicating low TCC slip speed. In D3 with the TCC engaged, calculated transmission component slip can only occur in the torque converter. In D4 OVERDRIVE with the TCC engaged, transmission component slip can occur in the TCC or the fourth clutch assembly.

If the TCM detects an excessive TCC slip speed in D4 OVERDRIVE when the TCC should be engaged, then DTC 68 sets.

Conditions for Running the DTC

- No DTC 28.
- No DTC 71.
- No DTC 74.
- Not in PARK/NEUTRAL.
- Fourth gear ratio is indicated.

Conditions for Setting the DTC

- TCC slip speed greater than 200 RPM.
- All conditions are met for 2 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM inhibits TCC operation.
- The TCM inhibits manual mode operation.
- The TCM stores DTC 68 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Check for deformed connectors at pass-thru connector.
- DTC 68 sets when going to default (second gear).
- An intermittent, incorrect engine speed signal sets a DTC 68 if the incorrect signal lasts for greater than 2 seconds.
- A mechanical failure in the 1-2 shift solenoid valve (stuck OFF), 2-3 shift solenoid valve (stuck ON), or the TCC PWM solenoid valve, could set DTC 68.
- A TFP manual valve position switch malfunction can set DTC 68.
- Internal transmission failures can result in a DTC 68.
- Sticking shift valves or contamination may cause intermittent slipping in D4.
- First, diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the indicated range signal to the actual selected range. A faulty TFP manual valve position switch can set a DTC 68.
4. This step tests for excessive TCC slip speed while in a commanded TCC lock-up state, and in fourth gear; and confirms that the fault is present.
5. This step tests for excessive TCC slip speed while in a commanded TCC lock-up state, and in third gear.
6. This step tests for a sticking TCC shift valve.
8. This step tests for proper transmission line pressure.

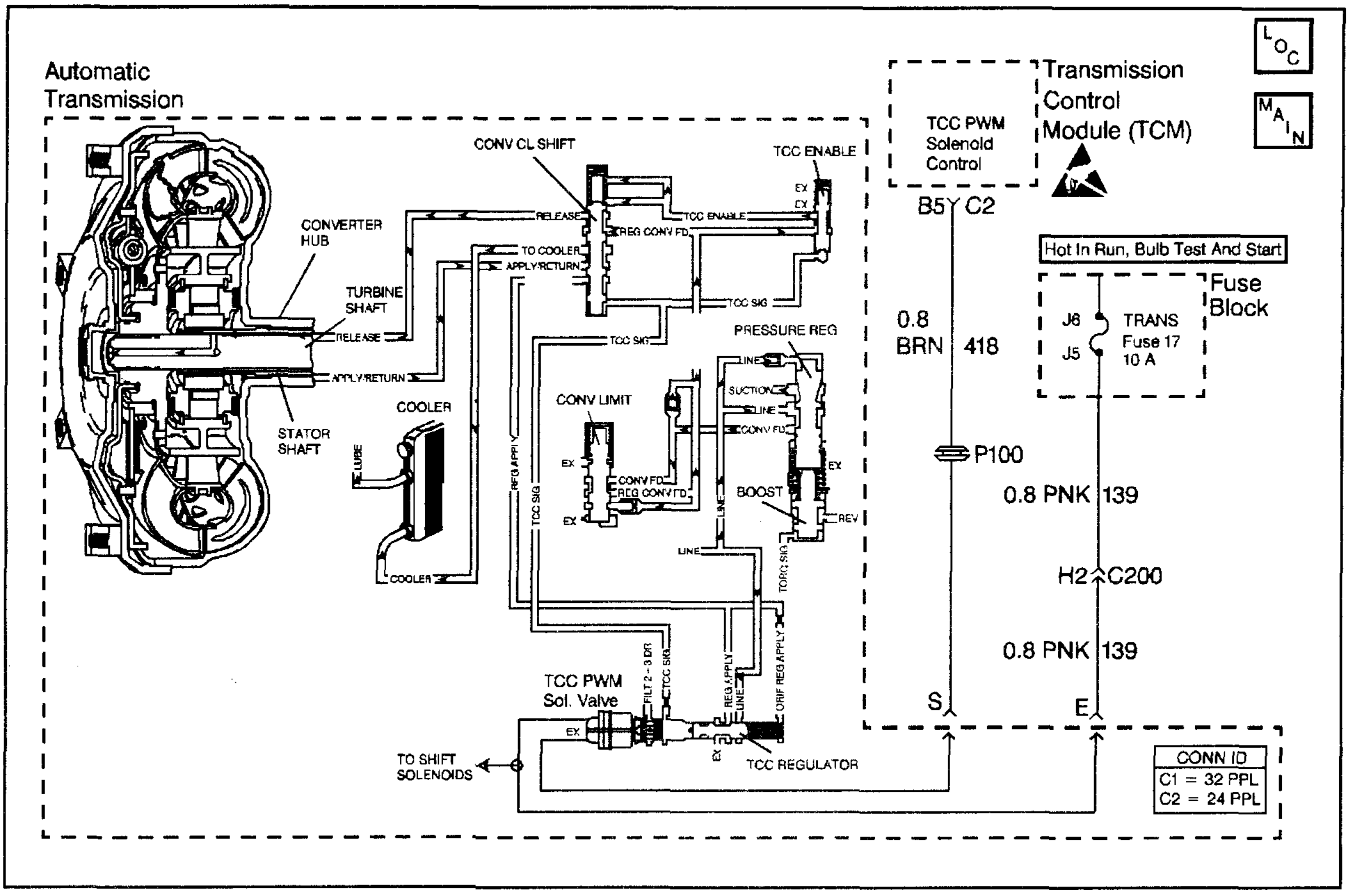
DTC 68 Transmission Component Slipping (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. With the engine idling and at normal operating temperature, apply the brake pedal. 6. Select each transmission range: D1, D2, D3, D4, N, R and P. Refer to the *Range Signal* table. Does each selected transmission range match the *Scan Tool* TFP Sw. A/B/C display?	—	*Go to Step 4*	Go to *DTC P1810 TFP Valve Position Switch Circuit (L57/L65 EFI)*
4	Drive the vehicle under the following conditions: 1. The TFT is 20–130°C (50–266°F) 2. The transmission is in D4. 3. The TCC duty cycle is greater than 80%. 4. The TP angle is 10–80%. At any time, is the TCC slip speed greater than the specified value for 10 seconds?	200 RPM	*Go to Step 5*	Go to Diagnostic Aids

DTC 68 Transmission Component Slipping (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
5	Drive the vehicle under the following conditions: 1. The transmission is in D3. 2. Command the TCC ON with the *Scan Tool*. 3. The TP angle is 10–80%. At any time is the TCC slip speed greater than the specified value for 10 seconds?	200 RPM	*Go to Step 7*	*Go to Step 6*
6	Repeat the procedure in Step 4. Drive the vehicle under the following conditions: 1. The transmission is in D4. 2. The TCC duty cycle is greater than 80%. 3. The TP angle is 10–80%. Is the TCC Slip Speed greater than the specified value?	200 RPM	*Go to Step 8*	*Go to Step 11*
7	Refer to *Symptom Diagnosis* Slipping TCC. Was the condition corrected?	—	*Go to Step 12*	—
8	1. Connect the *J 21867* pressure gauge to the transmission line pressure tap. 2. Perform the Line Pressure Check Procedure. Refer to *Line Pressure Check Procedure.* Is the line pressure within specifications?	—	*Go to Step 9*	Go to *Low Line Pressure*
9	1. Remove the transmission oil pan. Refer to *AT Fluid/Filter Changing.* 2. Inspect for contaminated fluid and excessive material in the pan. Is the fluid or the pan contaminated?	—	Go to Unit Repair	*Go to Step 10*
10	1. Inspect the 1-2 SS valve for contamination or damaged seals. 2. Inspect the 2-3 SS valve for contamination or damaged seals. Was a condition found?	—	*Go to Step 12*	*Go to Step 11*
11	1. Inspect the 2-3 shift valve for contamination or sticking. 2. Inspect the 3-4 shift valve for contamination or sticking. Was a condition found?	—	*Go to Step 12*	Go to Unit Repair
12	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions, with road conditions permitting: 3.1. Ensure that TFT is 20–130°C (50–266°F). 3.2. Drive the vehicle in 4th gear, with the TCC commanded ON, (up to 55 MPH). 3.3. The TP angle is 7–80%. Does the *Scan Tool* indicate a slip of –20 to +20 RPM for greater than 10 seconds?	—	System OK	*Go to Step 1*

DTC 69 TCC Stuck ON (L57 MFI)



372631

Circuit Description

The transmission control module (TCM) energizes the torque converter clutch pulse width modulated (TCC PWM) solenoid valve by grounding circuit 418. This blocks the exhaust for TCC signal fluid and allows filtered 23 drive fluid to feed the TCC signal circuit. When the vehicle's operating conditions are appropriate for TCC application, the TCM begins the TCC duty cycle to approximately 30%. This allows TCC signal fluid pressure to move the converter clutch shift valve into the apply position and direct regulated apply fluid to the torque converter. The TCM then increases (ramps) the duty cycle to approximately 60%, where regulated apply fluid pressure applies the converter clutch. The vehicle application determines the TCC apply rate. Once the TCC applies, the duty cycle immediately increases to approximately 70% to achieve full apply pressure in the regulated apply fluid circuit.

The TCC PWM solenoid valve is de-energized by the TCM opening circuit 418. This action allows the TCC signal fluid to exhaust through the solenoid and blocks filtered 23 drive fluid from entering the TCC signal circuit. The loss of fluid pressure in the TCC signal circuit releases the TCC.

If the TCM detects high TCC slip when the TCC is commanded ON, then DTC 69 sets.

Conditions for Running the DTC

The following conditions occur once per TCC cycle two consecutive times:

- No TP sensor DTC 21 or DTC 22.
- No TFP manual valve position switch DTC 28.
- No A/T ISS sensor DTC 74.
- No camshaft position sensor (CMP).
- Transmission range is D3 or D4.
- The commanded gear indicates 2nd or 3rd.

Conditions for Setting the DTC

The TCC slip speed must be –5 to +10 RPM for at least 4 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM stores DTC 69 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- If the TCC is mechanically stuck ON, with the parking brake applied and any gear range selected, the TCC fluid mechanically applies the TCC. TCC fluid mechanically applying the TCC can cause an engine stall.
- A stuck or skewed TP sensor may set DTC 69.

Test Description

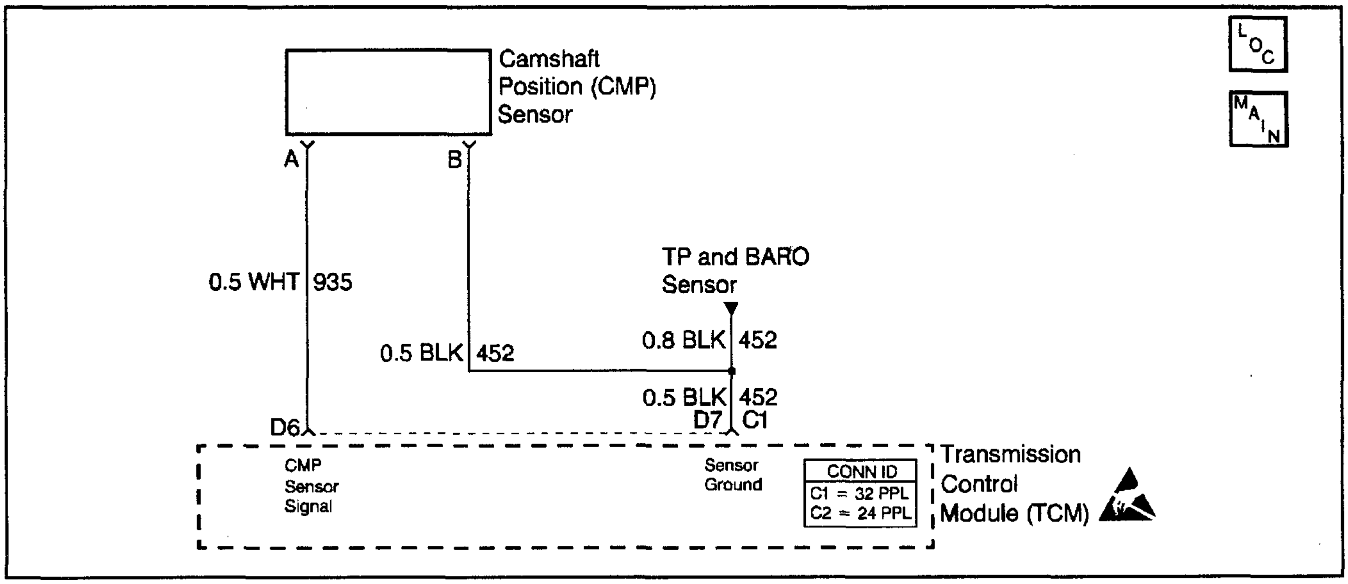
The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the mechanical state of the TCC. When the TCM commands the TCC solenoid OFF, the slip speed should increase.

DTC 69 TCC Stuck ON (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool*. 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Verify the TP sensor operation, using the *Scan Tool*. Are the TP angle values within the specified range?	0% at Closed Throttle 100% at Wide Open Throttle (WOT)	*Go to Step 3*	Go to Diagnostic Aids
3	Drive the vehicle in D4, under steady acceleration, with a TP angle greater than 15%. Does the *Scan Tool* display a TCC slip speed of –5 to 10 RPM, while the displayed TCC duty cycle is 0%?	—	*Go to Step 4*	Go to Diagnostic Aids
4	The TCC is mechanically stuck ON. Perform the following inspections: 1. Inspect the exhaust orifice in the TCC PWM solenoid valve for any clogging. 2. Inspect the torque converter clutch shift valve for the possibility of being stuck in the apply position. 3. Inspect the valve body gasket for misalignment or damage. 4. Inspect for a restricted release or apply passage. 5. Inspect for a restricted transmission cooler line. Refer to *Symptom Diagnosis* TCC Stuck-On. Was the condition corrected?	—	*Go to Step 5*	—
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle in D4, with the TCC commanded OFF, and TP angle above 25%. Does the *Scan Tool* indicate greater than 10 RPM for 4 seconds?	—	System OK	*Go to Step 1*

DTC 71 Camshaft Position Sensor Circuit Low (L57 MFI)



372641

Circuit Description

The camshaft position (CMP) sensor detects the rotational speed of the camshaft. As the camshaft rotates, an AC signal is generated in the CMP sensor. This signal provides the input to the transmission control module (TCM), to determine engine speed. The engine speed is used for various calculations including torque converter clutch (TCC) slip speed and overdrive ratio.

If the TCM detects low output signal voltage, then DTC 71 sets.

Conditions for Running the DTC

- No DTC 28.
- Engine speed less than 50 RPM.
- Transmission range indicates R, D4, D3 or D1.

Conditions for Setting the DTC

All conditions are met for 2 seconds.

Action Taken When the DTC Sets

- The TCM inhibits TCC.
- The TCM stores DTC 71 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- A mechanical condition with the camshaft may set this code. With the CMP sensor removed, the camshaft and CMP sensor drive gear can be checked for damage.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step verifies the fault.
3. This step indicates that the sensor is capable of inducing an AC voltage in the circuit.
13. This step checks circuits 935 and 452 for being shorted together.
14. This step checks the entire CMP sensor circuit for proper signal output.

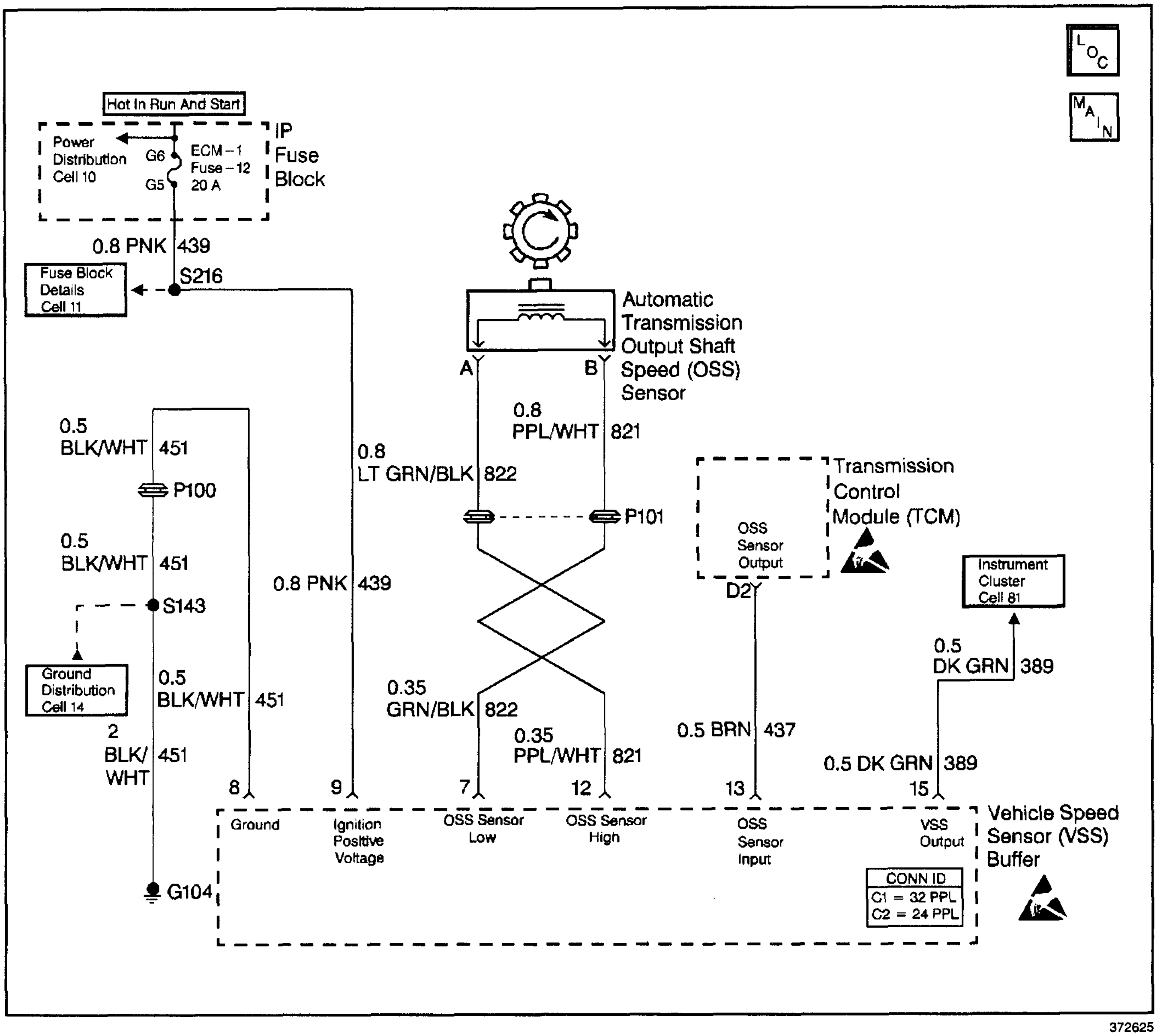
DTC 71 Camshaft Position Sensor Circuit Low (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool*. 2. Turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Place the transmission in PARK. 6. Start the engine, and select Engine Speed on the *Scan Tool*. 7. Slowly accelerate the engine. Does Engine Speed on the *Scan Tool* increase as the engine speed increases?	—	System OK Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn the ignition switch OFF. 2. Disconnect the CMP sensor connector from the sensor. 3. Connect *J 39200* digital multimeter (DMM) to the CMP sensor terminals. 4. Select AC volts. 5. Start the engine, and observe the *J 39200* DMM. Is the AC voltage greater than the specified value?	0.5 volts AC	*Go to Step 4*	*Go to Step 15*
4	1. With the engine OFF, turn the ignition switch to the RUN position. 2. Select DC volts on the *J 39200* DMM. 3. Connect the *J 39200* DMM to a good ground. 4. Measure the voltage in circuit 935 (WHT) at the CMP sensor connector, terminal A. Is the voltage within the specified value?	4.0–5.2 volts DC	*Go to Step 7*	*Go to Step 5*
5	Is the voltage reading from Step 4 greater than the specified value?	4.0–5.2 volts DC	*Go to Step 6*	*Go to Step 8*
6	Inspect circuit 935 (WHT) for a short to B+. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 12*	*Go to Step 13*
7	Connect the *J 39200* DMM between terminals A and B of the CMP sensor connector. Is the voltage within the specified value?	4.0–5.2 volts DC	*Go to Step 13*	*Go to Step 9*
8	Inspect circuit 935 (WHT) for high resistance or an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 12*	*Go to Step 19*
9	Are there any other sensor DTCs?	—	*Go to Step 10*	*Go to Step 11*
10	Inspect for an open in the sensors' ground circuit 452 (BLK). Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 12*	*Go to Step 19*
11	Inspect for an open in circuit 452 (BLK), from the CMP sensor connector terminal B, to the sensors' ground splice. Was a condition found?	—	*Go to Step 12*	—

DTC 71 Camshaft Position Sensor Circuit Low (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
12	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 20*	—
13	1. Turn the ignition switch to the OFF position. 2. Do not reconnect the CMP sensor connector to the sensor. 3. Disconnect the TCM connector C1. 4. Connect the *J 39200* DMM to terminals D6 and D7 of the C1 connector. 5. Select Ω on the *J 39200* DMM. Is the resistance less than the specified value?	50 kΩ	*Go to Step 15*	*Go to Step 14*
14	1. Reconnect the CMP sensor connector to the sensor. 2. With the *J 39200* DMM on terminals D6 and D7, select AC volts. 3. Observe the *J 39200* DMM while cranking the engine. Is the voltage greater than the specified value?	0.5 volts AC	*Go to Step 19*	*Go to Step 16*
15	Repair circuits 935 (WHT) and 452 (BLK) for being shorted together. Is the repair complete?	—	*Go to Step 20*	—
16	1. Remove the CMP sensor assembly. 2. Inspect the driven gear and the camshaft for damage. Was a condition found?	—	*Go to Step 17*	*Go to Step 18*
17	Refer to *Camshaft Replacement* in Engine Mechanical, for repair of the driven gear or camshaft. Is the repair complete?	—	*Go to Step 20*	—
18	Replace the CMP sensor. Is the replacement complete?	—	*Go to Step 20*	—
19	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 20*	—
20	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Start the engine and run at idle speed. Is the engine speed greater than 50 RPM for 2 seconds?	—	System OK	*Go to Step 1*

DTC 72 OSS Sensor Circuit Intermittent (L57 MFI)



Circuit Description

The speed sensor circuit consists of a magnetic induction type sensor, which is the output shaft speed (OSS) sensor, a vehicle speed sensor (VSS) buffer module, and wiring. Gear teeth pressed onto the output shaft carrier assembly induce an alternating voltage into the sensor. This signal transmits to the VSS buffer module. The VSS buffer module compensates for various final drive ratios. The VSS buffer module also converts the alternating current (AC) OSS signal into a 40 pulse per revolution (PPR) 5 volt DC square wave form signal on circuit 437 to indicate transmission output speed.

If the transmission control module (TCM) detects an unrealistically large change in the OSS sensor reading, then DTC 72 sets.

Conditions for Running the DTC

Not in PARK/NEUTRAL

- No TFP manual valve position switch DTC 28.
- The engine must be running more than 300 RPM.

In PARK/NEUTRAL

- No TFP manual valve position switch DTC 28.
- The engine must be running more than 300 RPM.

Conditions for Setting the DTC

Either Case 1 or Case 2 must be true.

Case 1: Not in PARK/NEUTRAL

The OSS sensor RPM change is greater than 1000 RPM for at least 2 seconds.

Case 2: In PARK/NEUTRAL

The OSS sensor RPM change is greater than 2048 RPM, within 2 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM commands maximum line pressure.
- The TCM commands a soft delayed landing into second gear.
- The TCM stores DTC 72 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the A/T OSS, the VSS buffer module connectors and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- It may be necessary to drive the vehicle.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step verifies the fault condition.
4. This step verifies the OSS sensor and circuit output to the VSS buffer module.
7. This step tests the voltage supply to the VSS buffer module.
9. This step tests the integrity of the ground circuit.

DTC 72 OSS Sensor Circuit Intermittent (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Raise the drive wheels and support the axle assembly. 6. Start the engine, and place the transmission in D3 range. 7. With the Drive wheels rotating, slowly accelerate to 2000 RPM and hold. Does the Transmission OSS drop or fluctuate more than the specified value?	1000 RPM	*Go to Step 3*	Go to Diagnostic Aids

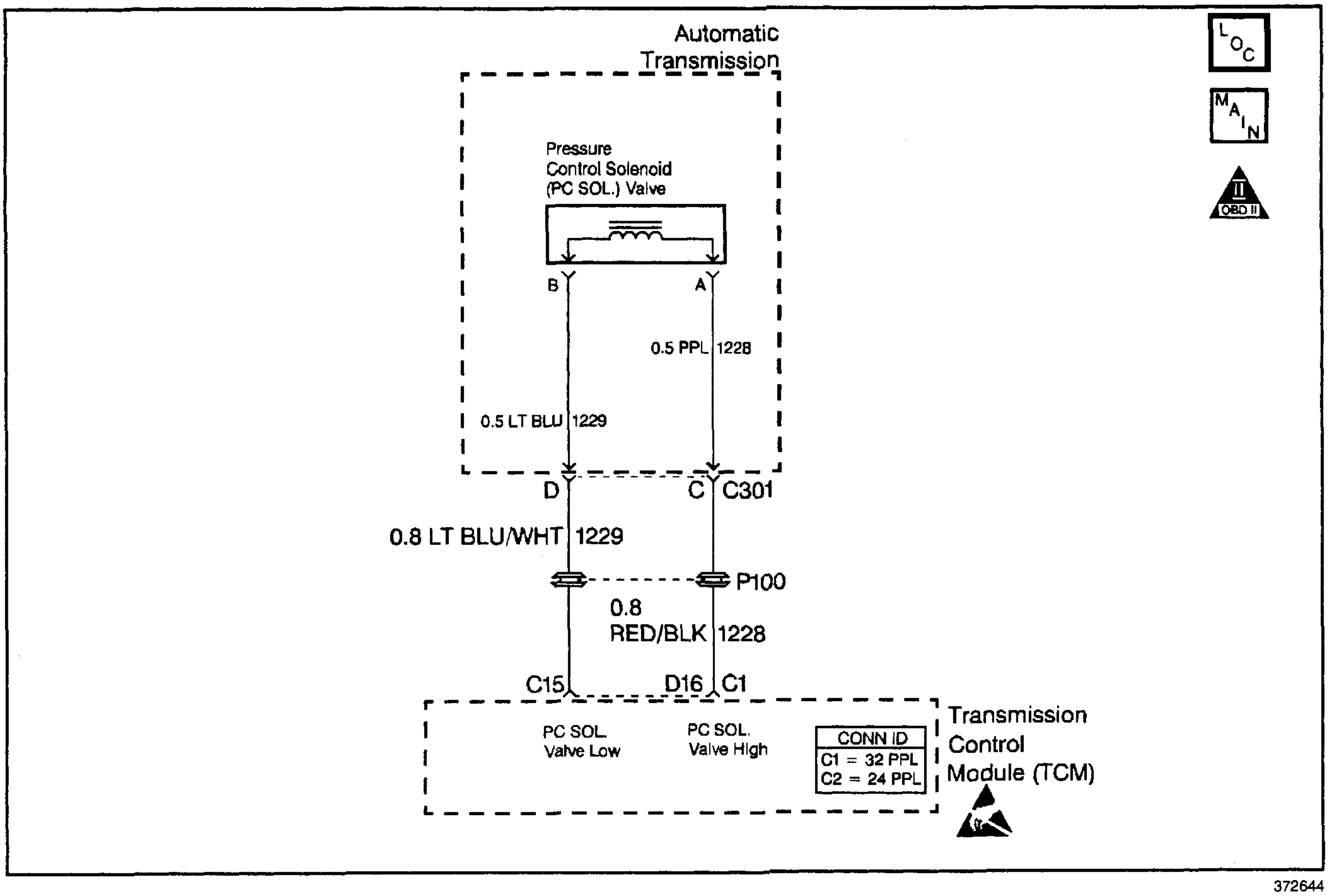
DTC 72 OSS Sensor Circuit Intermittent (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition switch OFF. 2. Disconnect the OSS sensor connector from the OSS sensor. 3. Connect a *J 39200* digital multimeter (DMM) between terminals A and B on the OSS sensor. 4. Select AC volts. 5. Start the engine. 6. Place the transmission in D3 range. 7. With the wheels rotating, slowly accelerate to 2000 engine RPM and hold. Does the voltage drop or fluctuate at 2000 RPM?	—	*Go to Step 17*	*Go to Step 4*
4	1. Turn the ignition switch OFF. 2. Reconnect the OSS sensor harness to the sensor. 3. Disconnect the VSS buffer module harness connector from the component. 4. Turn the ignition switch to the RUN position. 5. Set the *J 39200* DMM on AC volts. 6. Connect the *J 39200* DMM between terminals 7 and 12 of the VSS buffer module harness connector. 7. Start the engine. 8. Place the transmission in D3 range. 9. With the wheels rotating, slowly accelerate to 2000 engine RPM and hold steady. Does the voltage drop or fluctuate at 2000 RPM?	Greater than 2.0 volts AC	*Go to Step 5*	*Go to Step 7*
5	Inspect circuit 821 (PPL/WHT) and circuit 822 (GRN/BLK) for an intermittent open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 12*	*Go to Step 6*
6	Inspect circuit 821 (PPL/WHT) and circuit 822 (GRN/BLK) for an intermittent short together or a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 12*	—
7	1. With the engine OFF, turn the ignition switch to the RUN position. 2. Select DC volts. 3. Measure the ignition voltage at terminal 9 of the VSS buffer module harness. Is the voltage greater than the specified value?	10.5 volts DC	*Go to Step 9*	*Go to Step 8*
8	Repair the intermittent open or high resistance in circuit 439 (PNK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 21*	—
9	1. Connect the *J 39200* DMM between terminals 8 and 9 of the VSS buffer module harness connector. 2. Select DC volts. 3. Turn the ignition switch to the RUN position. Is the voltage greater than the specified value?	10.5 volts DC	*Go to Step 11*	*Go to Step 10*
10	Repair the open or high resistance in circuit 451 (ground). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 21*	—

DTC 72 OSS Sensor Circuit Intermittent (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
11	1. With the engine OFF, turn the ignition switch to the RUN position. 2. Using the *J 39200* DMM, measure the voltage at the VSS buffer connector terminal 13. Is the voltage reading steady, within the specified value?	4.8–5.2 volts DC	*Go to Step 13*	*Go to Step 14*
12	Repair the fault in circuit 821 (PPL/WHT) and/or circuit 822 (GRN/BLK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 21*	—
13	1. Turn the ignition switch OFF. 2. Reconnect the VSS buffer module harness to the VSS buffer module. 3. Select DC volts on the *J 39200* DMM. 4. Back probe terminal 13, of the VSS buffer harness connector, with the *J 39200* DMM. 5. Start the engine. 6. Place the transmission in a D3 range. 7. With the wheels rotating, slowly accelerate the engine to 2000 RPM and hold. Is the voltage reading steady within the specified value?	1.5–3.5 volts DC	*Go to Step 20*	*Go to Step 18*
14	Is the voltage from Step 11 greater than the specified value?	5.2 volts DC	*Go to Step 15*	*Go to Step 16*
15	Inspect for a short to power in circuit 437 (BRN). Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 19*	*Go to Step 20*
16	Inspect circuit 437 (BRN) for continuity or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 19*	*Go to Step 19*
17	Replace the OSS sensor. Refer to *Vehicle Speed Sensor Replacement.* Is the replacement complete?	—	*Go to Step 21*	—
18	Replace the VSS buffer module. Is the replacement complete?	—	*Go to Step 21*	—
19	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 21*	—
20	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Re-use the PROM (Mem-cal). Is the replacement complete?	—	*Go to Step 21*	—
21	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in D3. Does the *Scan Tool* display a Transmission OSS greater than 200 RPM, with no change greater than 1000 RPM for 1 second.	—	System OK	*Go to Step 1*

DTC 73 Pressure Control Solenoid Valve Electrical (L57 MFI)



Circuit Description

The pressure control (PC) solenoid valve is a transmission control module (TCM) controlled device that regulates the transmission line pressure. The TCM compares the throttle position (TP) sensor voltage, engine RPM, and other inputs in order to determine the appropriate line pressure for a given load. The TCM regulates the pressure by applying a varying amperage to the PC solenoid valve. The applied amperage can vary from 0.1 amps for maximum line pressure to 1.1 amps for minimum line pressure. The TCM monitors the circuit amperage.

If the TCM detects a PC duty cycle that exceeds 95% or is less than 1.9%, then DTC 73 sets.

Conditions for Running the DTC

- The ignition is ON.
- No system voltage DTC 75.

Conditions for Setting the DTC

- The PC duty cycle exceeds 95% or is less than 1.9%.
- All conditions met for 200 milliseconds (0.2 seconds).

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM disables the PC solenoid valve, defaulting the transmission to maximum line pressure.
- The TCM stores DTC 73 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step tests the ability of the TCM to command the PC solenoid valve.
3. This step tests the PC solenoid valve, and the automatic transmission (A/T) wiring harness assembly for incorrect resistance.
6. This step tests the PC solenoid valve and the A/T wiring harness assembly for a short to ground.
8. While performing this step, refer to Product Service Bulletin #9474L80E-07 for PC Solenoid Valve Application.
9. This step tests the entire PC solenoid valve circuit for proper resistance.
10. This step tests for a short to ground in circuits 1228 and 1229 of the engine harness.

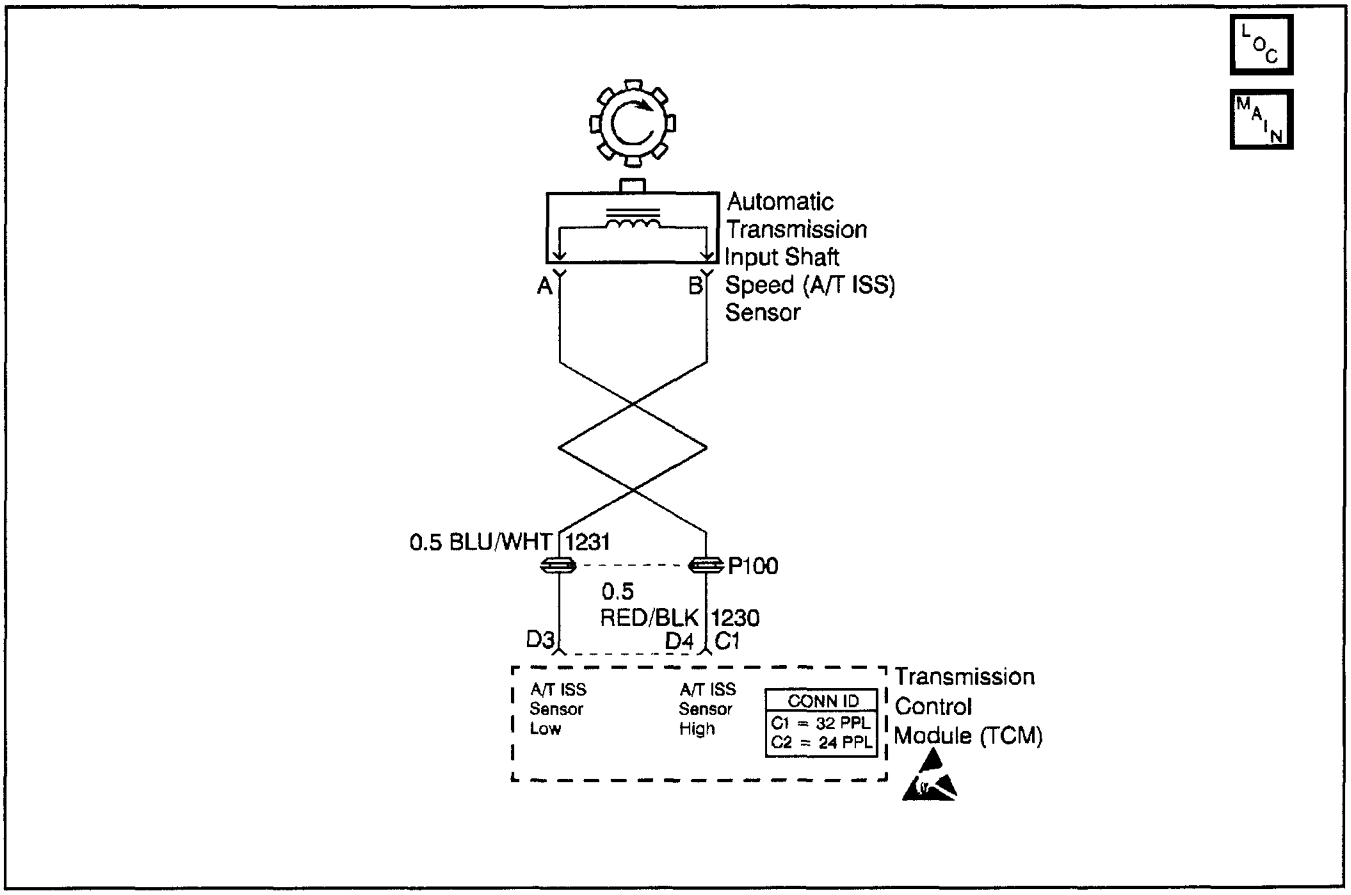
DTC 73 Pressure Control Solenoid Valve Electrical (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. With the engine running, put the transmission in PARK. 6. Using the *Scan Tool* transmission output control function, apply 0.1–1.0 amps while observing the PC Ref. Current and the PC Act. Current. Is the PC Act. Current reading always within the specified value of the PC Ref. Current?	0.16 amps	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn the ignition switch OFF. 2. Disconnect the transmission 20-way connector (additional DTCs may set). 3. Install the *J 39775* jumper harness on the transmission side of the 20-way connector. 4. Using the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the resistance between terminals C and D. Is the resistance within the specified value?	3–7Ω	*Go to Step 6*	*Go to Step 4*
4	1. Disconnect the automatic transmission (A/T) wiring harness assembly at the PC solenoid valve. 2. Measure the resistance of the PC solenoid valve. Is the resistance within the specified range?	3–7Ω	*Go to Step 5*	*Go to Step 8*
5	Replace the A/T wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 18*	—
6	Measure the resistance from terminal C in the *J 39775* jumper harness to the transmission case. Is the resistance less than the specified value?	9Ω	*Go to Step 7*	*Go to Step 9*

DTC 73 Pressure Control Solenoid Valve Electrical (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
7	Inspect the A/T wiring harness assembly circuits 1228 (RED/BLK) and 1229 (LT BLU/WHT), for a short to ground condition. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	*Go to Step 8*
8	**Important:** Refer to Test Description 8 for information on component replacement. Replace the PC solenoid valve. Refer to *Pressure Regulator Replacement.* Is the replacement complete?	—	*Go to Step 18*	—
9	1. Disconnect the *J 39775* from the transmission side of the 20-way connector. 2. Reconnect the transmission 20-way connector. 3. Disconnect the TCM connector C1. 4. Measure the resistance between terminals C1–D16 and C1–C15 in the harness. Is the resistance within the specified range?	3–7Ω	*Go to Step 10*	*Go to Step 11*
10	Measure the resistance between harness terminal C1–D16 and a good ground. Is the resistance greater than the specified value?	7Ω	*Go to Step 17*	*Go to Step 14*
11	Is the resistance in Step 9 greater than the specified value?	7Ω	*Go to Step 12*	*Go to Step 13*
12	Inspect circuit 1228 (RED/BLK) and circuit 1229 (LT BLU/WHT) for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was an open condition found?	—	*Go to Step 15*	—
13	Inspect circuit 1228 (RED/BLK) and circuit 1229 (LT BLU/WHT) for a shorted condition. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a shorted condition found?	—	*Go to Step 15*	—
14	Inspect circuit 1228 (RED/BLK) and circuit 1229 (LT BLU/WHT) for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a short to ground condition found?	—	*Go to Step 15*	—
15	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 18*	—
16	Replace the automatic transmission wiring harness assembly. Is the replacement complete?	—	*Go to Step 18*	—
17	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 18*	—
18	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Select PC Sol. Duty Cycle on the *Scan Tool.* 4. Start the engine. Is the PC Sol. Duty Cycle within the specified range?	2–95%	System OK	*Go to Step 1*

DTC 74 AT ISS Sensor Circuit (L57 MFI)



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Circuit Description

The automatic transmission input (shaft) speed sensor (A/T ISS) provides transmission input speed to the transmission control module (TCM). The A/T ISS is a permanent magnet (PM) generator. The sensor mounts into the transmission case and maintains a slight air gap between the sensor and the forward clutch housing. The PM generator produces an AC voltage as the forward clutch housing rotor teeth pass through the sensor's magnetic field. The AC voltage level increases as the turbine shaft speed increases. The TCM converts the AC voltage into a digital signal. The TCM determines actual turbine speed using the digital signal. The TCM uses the input speed to calculate torque converter slip speed, and gear ratios.

When the (TCM) detects a low, or no input speed during high vehicle and high engine speeds, then DTC 74 sets.

Conditions for Running the DTC

- No OSS DTC 24.
- No TFP manual valve position switch DTC 28.
- No CMP sensor DTC 71.
- The OSS is greater than 200 RPM.
- The engine speed is greater than 300 RPM.

Conditions for Setting the DTC

- The A/T ISS is less than 50 RPM.
- All the above conditions are met for 2 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM inhibits TCC.
- The TCM stores DTC 74 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the output shaft speed (OSS) sensor connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
  - The A/T ISS sensor harness being near the DIS components or the ignition wires.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests for proper circuit operation up to the TCM connections.
5. This step tests for proper operation of the input (shaft) speed (ISS) sensor.

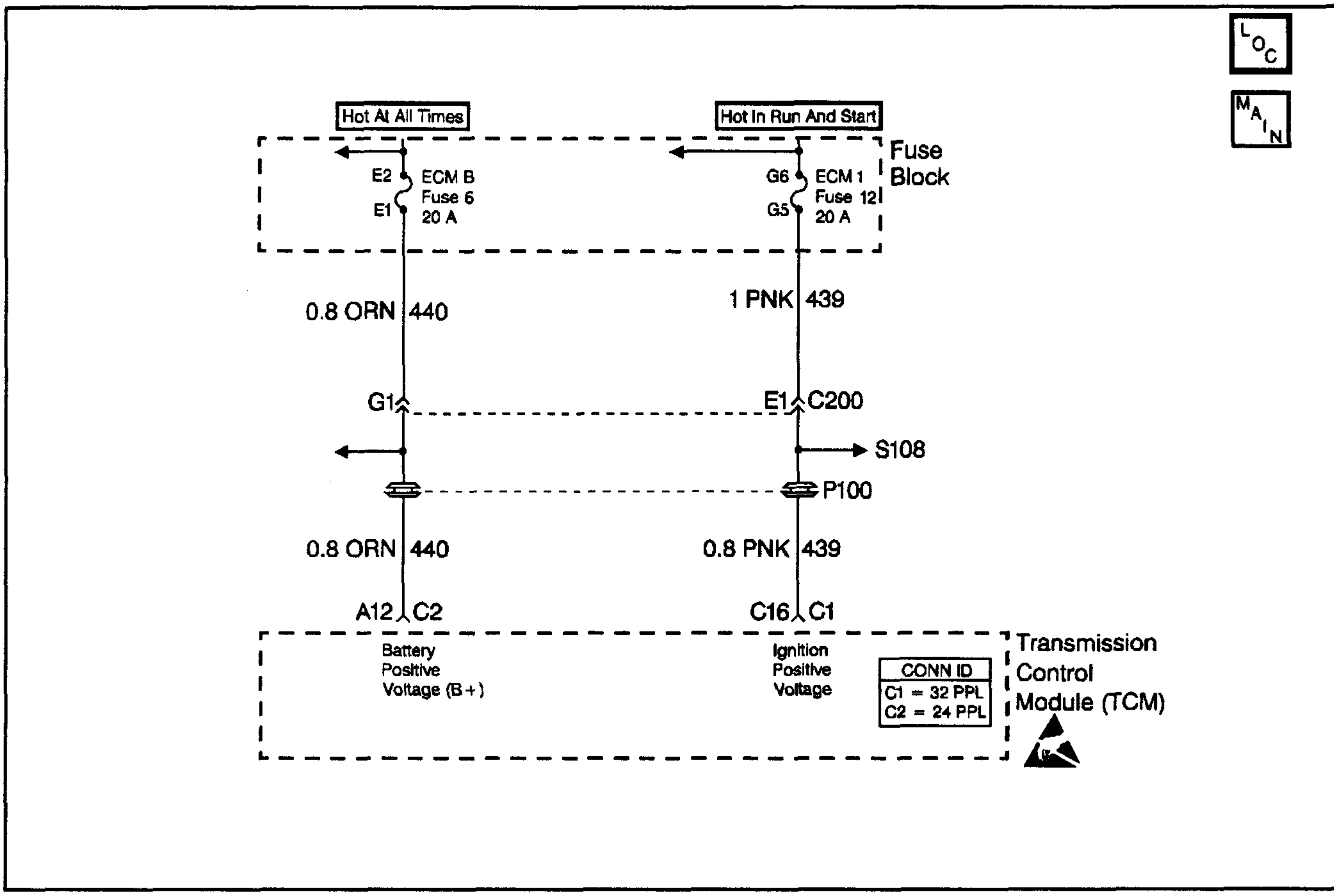
DTC 74 AT ISS Sensor Circuit (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. With the vehicle in PARK, start the engine and idle greater than 500 RPM. 6. Select *Scan Tool* Transmission ISS and Engine RPM. Is the Transmission ISS greater than 25 RPM?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn the ignition switch to the OFF position. 2. Disconnect TCM connector C1. (Additional DTCs may set.) 3. Probe TCM connector terminal C1–D4 and terminal C1–D3 with *J 39200* digital multimeter (DMM) on AC voltage. 4. With the vehicle in PARK, crank the engine. Is the voltage above the specified value?	0.5 volts AC	*Go to Step 12*	*Go to Step 4*
4	1. Turn the ignition switch to the OFF position. 2. Remove the connector from the A/T ISS sensor. 3. Using the *J 39200* DMM and *J 35616* connector test adapter kit, measure the resistance between terminal A and terminal B of the A/T ISS sensor. Is the sensor's resistance within the specified value?	1042–2088Ω	*Go to Step 5*	*Go to Step 11*
5	1. Select AC volts on the *J 39200* DMM. 2. With the vehicle in PARK, crank the engine. Is the *J 39200* DMM voltage greater than the specified value?	0.5 volts AC	*Go to Step 7*	*Go to Step 6*
6	1. Remove the A/T ISS sensor from the transmission. 2. Inspect the A/T ISS sensor. 3. Inspect the forward clutch housing for damage (rotor teeth). Was a condition found?	—	*Go to Step 12*	*Go to Step 11*

DTC 74 AT ISS Sensor Circuit (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
7	Inspect circuit 1230 (RED/BLK) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 8*	*Go to Step 9*
8	Repair the open or short to ground in circuit 1230 (RED/BLK). Refer to *Wiring Repairs* in Wiring Systems. Was a condition found?	—	*Go to Step 14*	—
9	Inspect circuit 1231 (BLU/WHT) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 10*	—
10	Repair the open or short to ground in circuit 1231 (BLU/WHT). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 14*	—
11	Replace the input shaft speed sensor. Refer to *Vehicle Speed Sensor Replacement.* Is the replacement complete?	—	*Go to Step 14*	—
12	Replace the forward clutch housing. Refer to Unit Repair. Is the repair complete?	—	*Go to Step 14*	—
13	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 14*	—
14	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: 3.1. The vehicle in drive range and the engine must be running. 3.2. Vehicle speed greater than 12 MPH. Is the *Scan Tool* A/T ISS greater than the specified value?	200 RPM	System OK	*Go to Step 1*

DTC 75 System Voltage Low (L57 MFI)



372635

Circuit Description

The ignition voltage is supplied to the transmission control module (TCM) to indicate the status of the ignition switch. Battery voltage is supplied to the TCM on circuit 440 to maintain memory of learned functions and parameters.

If the TCM detects low voltage input, then DTC 75 sets.

Conditions for Running the DTC

- The ignition is ON.
- The engine speed is greater than 300 RPM.

Conditions for Setting the DTC

System voltage is:

- Less than 7.3 volts at –40°C (–40°F) or
- Less than 10.3 volts at 90°C (194°F) or
- Less than 11.7 volts at 150°C (304°F)
- The above conditions are met for 4 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The PC solenoid valve is turned OFF.
- Soft landing to default 2nd gear.
- Inhibit fourth gear and TCC.
- The TCM stores DTC 75 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- Charging the battery with a battery charger and jumpstarting an engine may set DTCs.
- If this DTC is set when an accessory is operated, inspect for faulty connections or an excessive current draw.
- Inspect for faulty electrical connections at the starter solenoid.
- Inspect for faulty electrical connections at the fusible link.
- Inspect for loose or damaged terminals at the generator.
- Inspect the generator belt wear condition and tension.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the charging system voltage.
5. This step tests the battery voltage input at the TCM.
7. This step tests the ignition voltage inputs at the TCM.

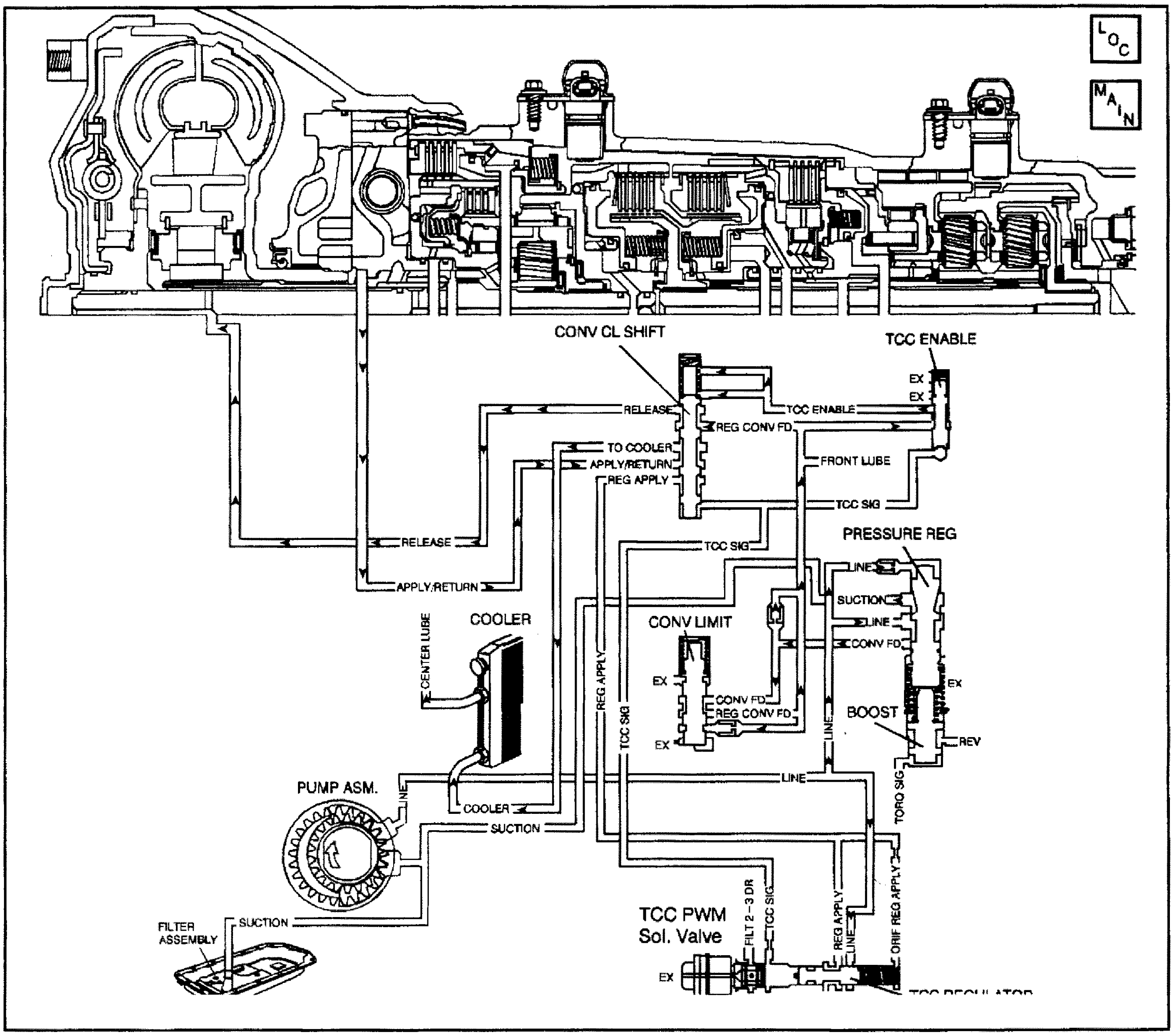
DTC 75 System Voltage Low (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. If any DTCs are present, perform this diagnostic first. 6. Using the *J 39200* digital multimeter (DMM), measure the battery voltage across the battery terminals. 7. Record the battery voltage measurement for future reference. Is the voltage higher than the specified value?	10.5 volts	*Go to Step 3*	Go to *Charging System Check*
3	1. Start the engine. 2. Allow the engine to warm to normal operating temperature. 3. Increase the engine speed to 1500 RPM. 4. Turn on the vehicle headlights. 5. Record the voltage for further reference. Is the *J 39200* DMM battery voltage within the specified value?	13–15.5 volts	*Go to Step 4*	Go to *Charging System Check*
4	1. Run the engine at 1500 RPM. 2. Turn on the vehicle headlights. 3. Compare the *Scan Tool* ignition voltage to the *J 39200* DMM battery voltage. Is the *Scan Tool* voltage within 0.5 volts of the *J 39200* DMM voltage?	—	Go to Diagnostic Aids	*Go to Step 5*
5	1. Run the engine as in Step 4. 2. Backprobe TCM terminal C2–A12 with the *J 39200* DMM on DC volts (do not puncture the wires). 3. Record the voltage. Is the *J 39200* DMM voltage within 0.5 volts of the battery voltage reading from Step 3?	—	*Go to Step 7*	*Go to Step 6*

DTC 75 System Voltage Low (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
6	Repair the high resistance condition in circuit 440 (ORN). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 10*	—
7	1. Run the engine as in Step 4. 2. Backprobe for ignition voltage input at the TCM connector terminals C1–C16 (do not puncture wires). Is the *J 39200* DMM voltage within 0.5 volts of battery voltage from Step 3?	—	*Go to Step 9*	*Go to Step 8*
8	Repair the high resistance condition in circuit 439 (PNK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 10*	—
9	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 10*	—
10	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Start the vehicle. • Warm the vehicle to normal operating temperature. Is the *Scan Tool* ignition voltage within the specified value?	12.0–16.0 volts	System OK	*Go to Step 1*

DTC 79 Transmission Fluid Overtemperature (L57 MFI)



230228

Circuit Description

The flow of transmission fluid starts in the transmission pan. It is then drawn through the filter and transmission case into the oil pump assembly. The oil pump assembly pressurizes the fluid (line pressure), which becomes the main supply line of fluid. This fluid is directed to various components and hydraulic circuits within the transmission. The pressure regulator valve receives this fluid and directs it to the converter clutch shift valve. The converter clutch shift valve directs hot fluid leaving the torque converter, or regulated converter feed fluid, through the cooler line to the transmission oil cooler.

The transmission oil cooler is located in the radiator. The vehicle may also be equipped with an auxiliary oil cooler. The cooled fluid (center lube) is returned to the transmission through the return cooler line and into center lube port of the transmission. The automatic transmission fluid temperature (TFT) sensor, senses the fluid temperature in the transmission pan.

If the transmission control module (TCM) detects a high TFT for a long period of time, then DTC 79 sets.

Conditions for Running the DTC

- The ignition is ON.
- No TFT sensor DTC 58.

Conditions for Setting the DTC

- The TFT is greater than 146°C (295°F).
- All conditions are met for 27 minutes and 30 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM freeze shift adapts from being updated.
- Soft landing to default 2nd gear.
- The TCM stores DTC 79 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the cooling system fluid level and condition.
- Verify the customer's driving habits, such as trailer towing, etc...
- The scan tool transmission fluid temperature (TFT) should rise steadily during warm-up cycles, then stabilize.
- DTC 79 may set approximately 600 seconds after DTC 58 has set. Follow the diagnostic table for DTC 58 before proceeding to the diagnostic table for DTC 79. Repairing the condition that set DTC 58 will likely eliminate DTC 79.

Test Description

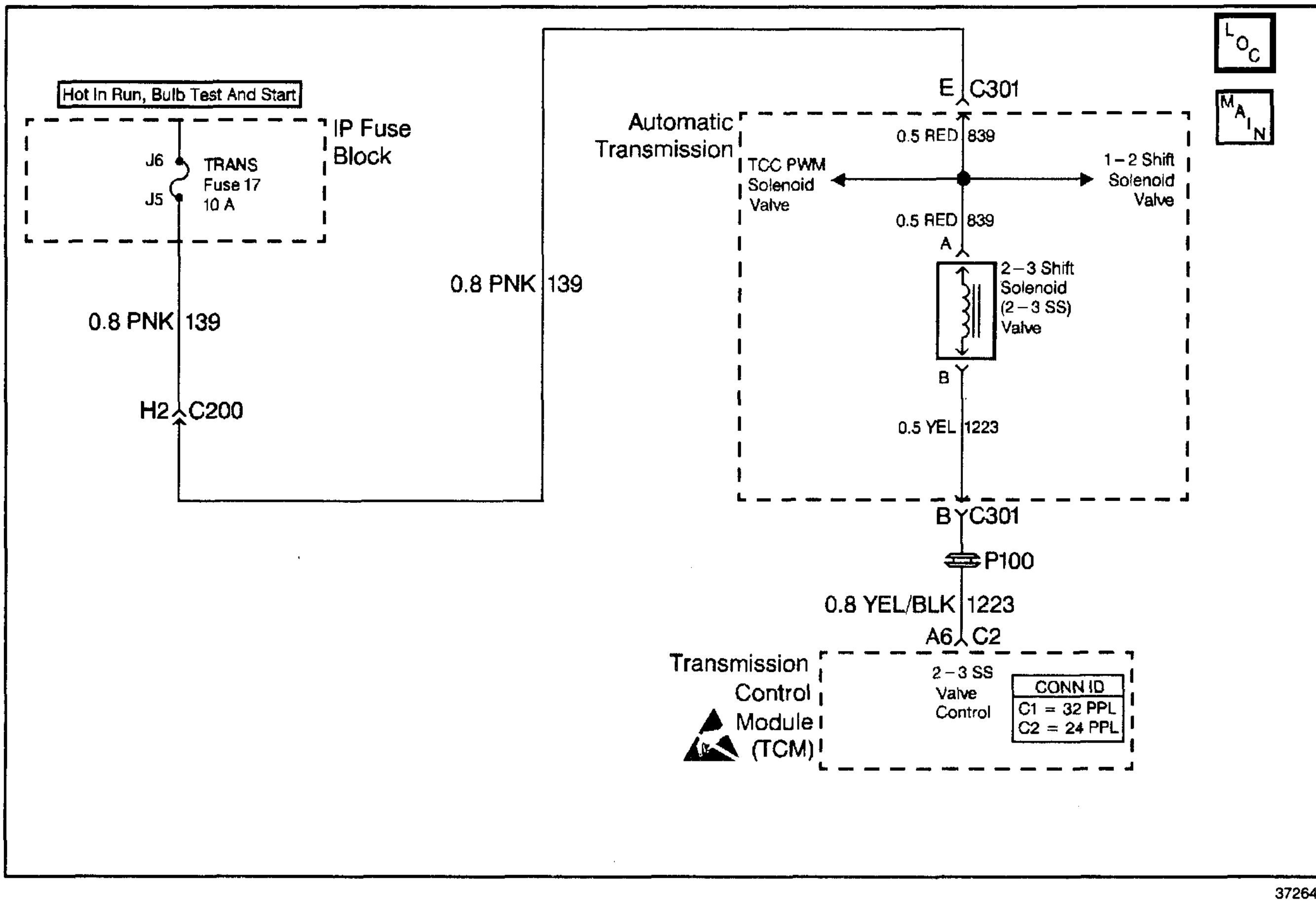
The numbers below refer to the step numbers on the diagnostic table.

3. DTC 58 may also set a DTC 79. Go to the DTC 58 tables for diagnosis.
4. This step inspects for air restrictions and loss of transmission fluid flow, causing an extremely high TFT.

DTC 79 Transmission Fluid Overtemperature (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Was the Transmission Fluid Checking Procedure performed?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	Is DTC 58 also set?	—	Go to Diagnostic Aids	*Go to Step 4*
4	1. Inspect the engine cooling system for the following conditions: 1.1. Air flow restrictions 1.2. Air flow blockage 1.3. Debris 2. Inspect the transmission cooling system for the following conditions: 2.1. Air flow restrictions 2.2. Air flow blockage 2.3. Debris 2.4. Damaged cooler lines or hoses 3. Perform the Automatic Transmission Oil Cooler Flow Test. Refer to *AT Oil Cooler Flow Test.* 4. Make repairs as necessary. Was a condition found?	—	*Go to Step 7*	*Go to Step 5*
5	Perform the Line Pressure Check Procedure. Refer to *Line Pressure Check Procedure.* Was a condition found?	—	*Go to Step 7*	*Go to Step 6*
6	Inspect the torque converter stator for damage. Refer to *Torque Converter Diagnosis Procedure.* Was a condition found?	—	*Go to Step 7*	Go to *Symptom Diagnosis* Transmission Overheating
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: 3.1. Turn the ignition switch to the RUN position. 3.2. Drive the vehicle. Is the TFT less than 145°C (293°F) for the test drive?	—	System OK	*Go to Step 1*

DTC 81 2-3 Shift Solenoid Valve Circuit Electrical (L57 MFI)



Circuit Description

The 2-3 shift solenoid (2-3 SS) valve controls fluid acting on the 2-3 shift valve. The 2-3 SS valve is a normally-open exhaust valve used with the 1-2 shift solenoid (1-2 SS) valve in order to allow four different shifting combinations. The 2-3 SS valve attaches to the control valve body within the transmission. The ignition voltage goes directly to the 2-3 SS valve. The transmission control module (TCM) controls the 2-3 SS valve by providing the ground path through circuit 1223.

If the TCM detects a continuous open or short in the 2-3 valve circuit or the 2-3 SS valve, then DTC 81 sets.

Conditions for Running the DTC

- The ignition is ON.
- System voltage is 12.0–16.0 volts.

Conditions for Setting the DTC

- The TCM commands the 2-3 SS valve ON, and the voltage input remains high (B+) for 0.5 seconds.
- The TCM commands the 2-3 SS valve OFF, and the voltage input remains low (0 volts) for 0.5 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM commands an immediate landing to second gear.
- The TCM commands maximum line pressure.
- The TCM stores DTC 81 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

- First, diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.
- Refer to *Shift Solenoid Valve State and Gear Ratio.*

Test Description

The numbers below refer to the step numbers on the diagnostic table.

6. This step tests the function of the 2–3 SS valve and the automatic transmission (A/T) wiring harness assembly.
7. This step tests the power to the 2–3 SS valve, from the ignition through the fuse.
9. This step tests the ability of the TCM, and the wiring, to control the ground circuit.
12. This step measures the resistance of the A/T wiring harness assembly and the 2–3 valve.

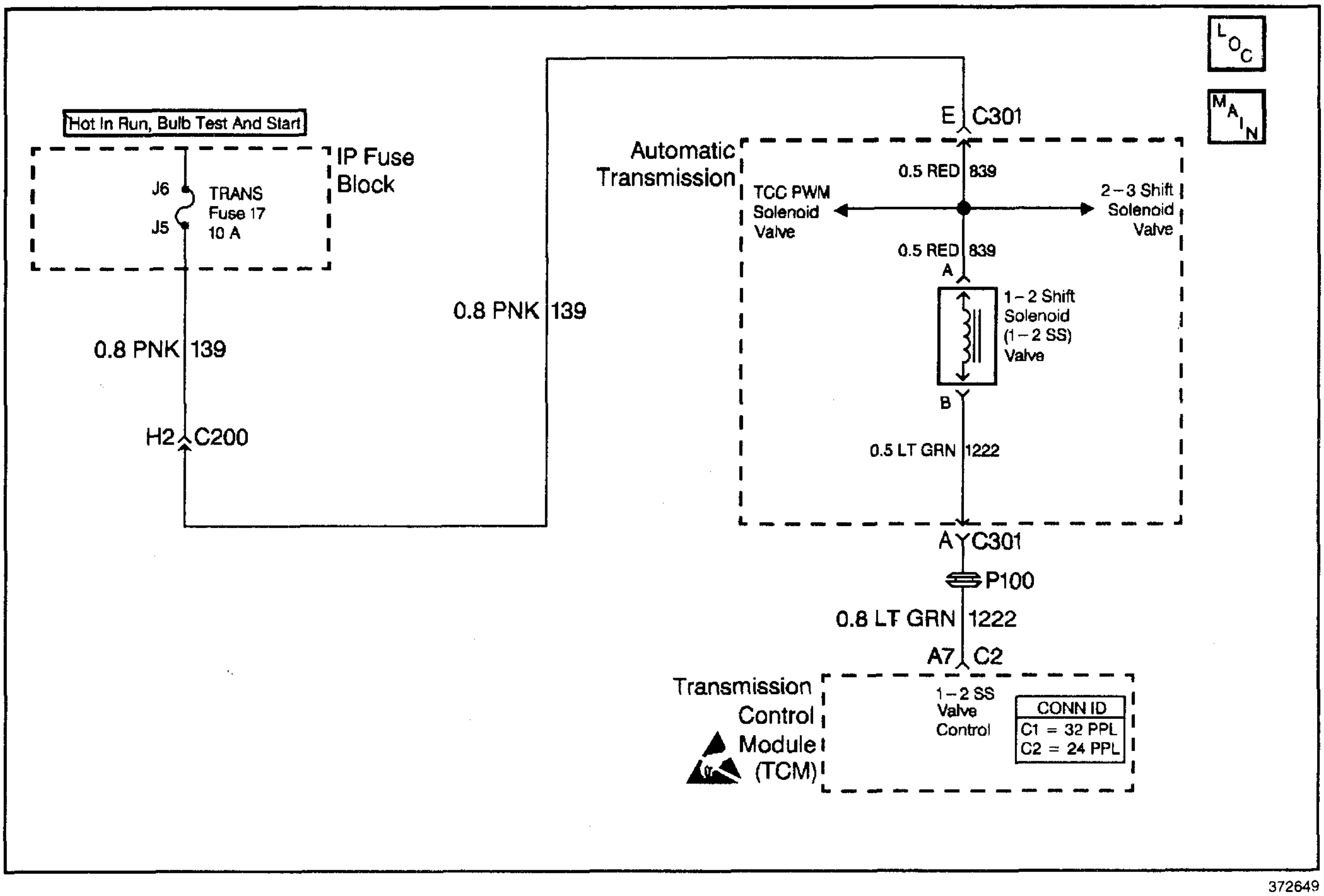
DTC 81 2-3 Shift Solenoid Valve Circuit Electrical (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. Were DTC 81, 82 or 83 also set?	—	*Go to Step 3*	*Go to Step 6*
3	Inspect the transmission fuse for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 5*	*Go to Step 4*
4	1. Inspect engine harness circuit 139 for a short to ground. 2. Inspect the transmission wiring harness circuit 839 for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 5*	*Go to Step 6*
5	1. Repair the engine harness circuit 139 if needed. Refer to *Wiring Repairs* in Wiring Systems. 2. Replace the transmission wiring harness if needed. Refer to AT Wiring Harness Replacement. Is the repair complete?	—	*Go to Step 18*	—
6	Command the 2-3 SS valve ON and OFF three times, while listening to the bottom of the transmission pan (use a stethoscope if needed). Does the solenoid click when commanded?	—	Go to Diagnostic Aids	*Go to Step 7*
7	1. Turn the ignition switch OFF. 2. Disconnect the transmission 20-way connector. (Additional DTCs will set). 3. Install the *J 39775* jumper harness on the engine harness connector. 4. With the engine OFF, turn the ignition switch to the RUN position. 5. Connect a 12 volt test lamp from the *J 39775* cavity E to ground. Is the test lamp on?	—	*Go to Step 9*	*Go to Step 8*

DTC 81 2-3 Shift Solenoid Valve Circuit Electrical (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
8	Repair the open or high resistance in ignition feed circuit 139 (PNK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 18*	—
9	1. Install the test lamp between cavities E and B of the jumper on the engine harness. 2. Using the transmission output control function, command the 2-3 SS valve ON and OFF three times. Does the test lamp illuminate when you command the shift solenoid ON, and turn OFF when you command the shift solenoid OFF?	—	*Go to Step 12*	*Go to Step 10*
10	Inspect engine harness circuit 1223 (YEL/BLK) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found and corrected?	—	*Go to Step 18*	*Go to Step 11*
11	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 18*	—
12	1. Turn the ignition switch OFF. 2. Install *J 39775* on the transmission 20-way connector. 3. With the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the resistance between terminals B and E. Is the resistance within the specified values?	19–31Ω	*Go to Step 14*	*Go to Step 13*
13	1. Disconnect the automatic transmission wiring harness assembly from the 2-3 SS valve 2. Measure the resistance of the 2-3 SS valve. Is the resistance within the specified values?	19–31Ω	*Go to Step 16*	*Go to Step 17*
14	1. Measure the resistance between terminal B and a good ground. Use the *J 39200* DMM. 2. Measure the resistance between terminal E and a good ground. Are both readings greater than the specified value?	250 k	Go to Diagnostic Aids	*Go to Step 15*
15	1. Disconnect the automatic transmission wiring harness assembly from the 2-3 SS valve. 2. Measure the resistance from each of the component's terminals to ground. Are both readings greater than the specified value?	250 k	*Go to Step 16*	*Go to Step 17*
16	Replace the automatic transmission wiring harness assembly. Refer to Automatic Transmission Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 18*	—
17	Replace the 2-3 SS valve. Refer to 1-2 Shift Solenoid Valve Replacement. Is the replacement complete?	—	*Go to Step 18*	—
18	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle in D4 to ensure all commanded shifts occur. Did all shifts occur as commanded?	—	System OK	*Go to Step 1*

DTC 82 1-2 Shift Solenoid Valve Circuit Electrical (L57 MFI)



Circuit Description

The 1-2 shift solenoid (1-2 SS) valve controls the fluid flow action on the 1-2 and the 3-4 shift valves. The 1-2 SS valve is a normally-open exhaust valve that is used with the 2-3 shift solenoid (2-3 SS) valve to allow four different shifting combinations. The 1-2 SS valve attaches to the control valve body within the transmission. The ignition voltage goes directly to the 1-2 SS valve. The transmission control module (TCM) controls the 1-2 SS valve by providing the ground path through circuit 1222.

When the TCM detects a continuous open or short in the 1-2 SS valve circuit or the 1-2 SS valve, then DTC 82 sets.

Conditions for Running the DTC

- The ignition is ON.
- The system voltage is 12.0–16.0 volts

Conditions for Setting the DTC

- The TCM commands the solenoid ON, and the voltage input remains high (B+) for 0.5 seconds.
- The TCM commands the solenoid OFF, and the voltage input remains low for 0.5 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM commands maximum line pressure.
- The TCM stores DTC 82 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion

- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- An open ignition feed on circuit 139 can cause multiple DTCs to set.
- First, diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.
- Refer to *Shift Solenoid Valve State and Gear Ratio* Shift Solenoid Valve State and Gear Ratio table.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

6. This step tests the function of the 1-2 SS valve and the automatic transmission (A/T) wiring harness assembly.
7. This step tests the power to the 1-2 SS valve from the ignition, through the fuse.
9. This step tests the ability of the TCM, and the wiring, to control the ground circuit.
12. This step measures the resistance of the A/T wiring harness assembly and the 1-2 SS valve.

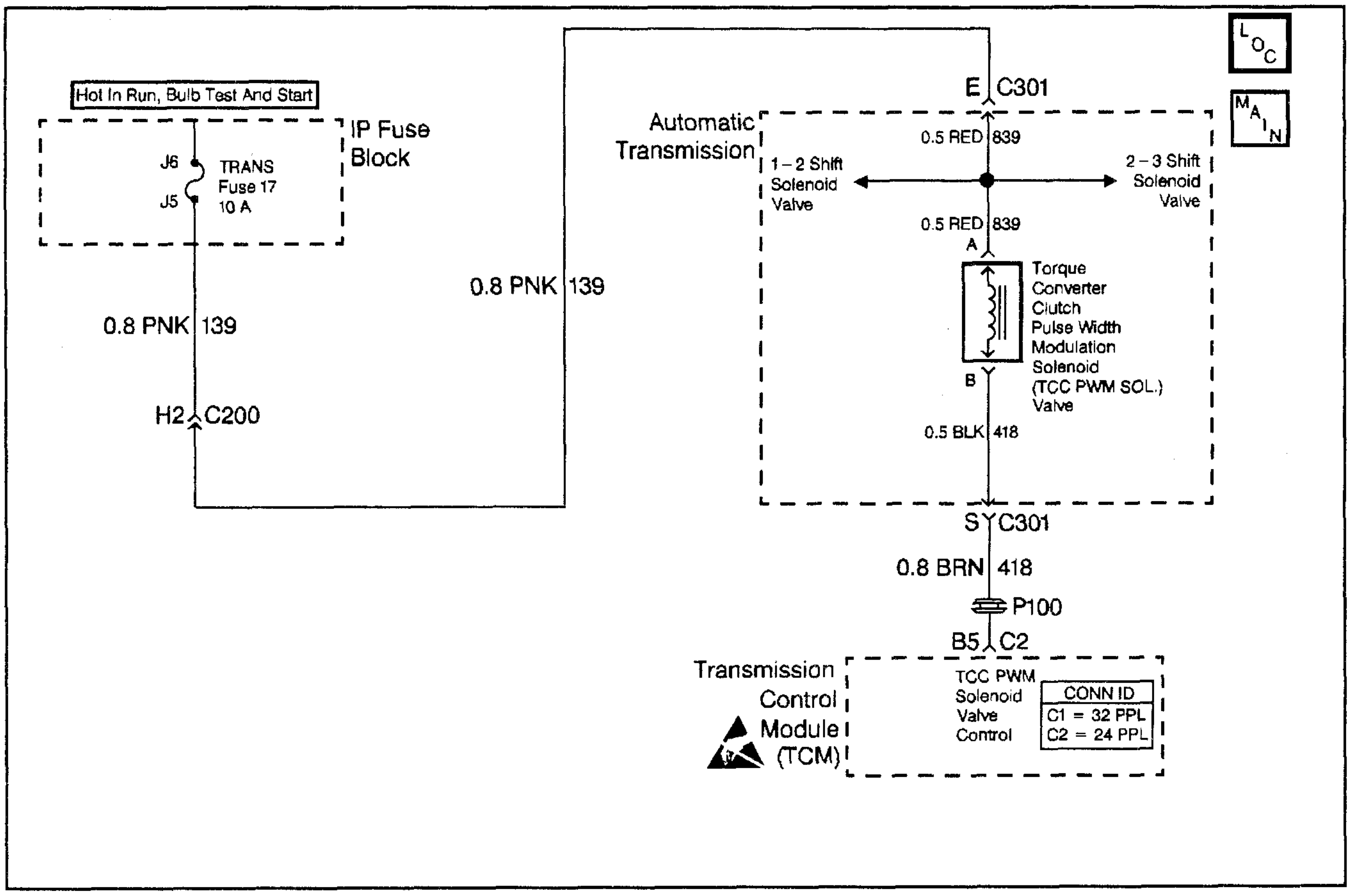
DTC 82 1-2 Shift Solenoid Valve Circuit Electrical (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. Were DTC 81, 82 or 83 also set?	—	*Go to Step 3*	*Go to Step 6*
3	Inspect the transmission fuse for an open. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 5*	*Go to Step 4*
4	1. Inspect engine harness circuit 139 for a short to ground. 2. Inspect the transmission wiring harness circuit 839 for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 5*	*Go to Step 6*
5	1. Repair the engine harness circuit 139 if needed. Refer to *Wiring Repairs* in Wiring Systems. 2. Replace the transmission wiring harness if needed. Refer to AT Wiring Harness Replacement. Is the repair complete?	—	*Go to Step 18*	—
6	Command the 1-2 SS valve ON and OFF three times, while listening to the bottom of the transmission pan (use a stethoscope if needed). Does the solenoid click when commanded?	—	Go to Diagnostic Aids	*Go to Step 7*
7	1. Turn the ignition switch OFF. 2. Disconnect the transmission 20-way connector. (Additional DTCs will set). 3. Install the *J 39775* jumper harness on the engine harness connector. 4. With the engine OFF, turn the ignition switch to the RUN position. 5. Connect a 12 volt test lamp from the *J 39775* cavity E to ground. Is the test lamp on?	—	*Go to Step 9*	*Go to Step 8*

DTC 82 1-2 Shift Solenoid Valve Circuit Electrical (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
8	Repair the open or high resistance in ignition feed circuit 139 (PNK). Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 18*	—
9	1. Install a 12 volt test lamp between cavities E and A of the jumper on the engine harness. 2. Using the transmission output control function, command the 1-2 SS valve ON and OFF three times. Does the test lamp illuminate when the shift solenoid is commanded the ON, and turn OFF when commanded OFF?	—	*Go to Step 12*	*Go to Step 10*
10	Inspect engine harness circuit 1222 (LT GRN) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found and corrected?	—	*Go to Step 18*	*Go to Step 11*
11	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 18*	—
12	1. Turn the ignition switch OFF. 2. Install *J 39775* on the transmission 20-way connector. 3. With the *J 39200* digital multimeter (DMM) and the *J 35616-A* connector test adapter kit, measure the resistance between terminals A and E. Is the resistance within the specified values?	19–31Ω	*Go to Step 14*	*Go to Step 13*
13	1. Disconnect the automatic transmission wiring harness assembly from the 1-2 SS valve. 2. Measure the resistance of the 1-2 SS valve. Is the resistance within the specified values?	19–31Ω	*Go to Step 16*	*Go to Step 17*
14	1. Measure the resistance between terminal A and a good ground. Use the *J 39200* DMM. 2. Measure the resistance between terminal E and a good ground. Are both readings greater than the specified value?	250 k	Go to Diagnostic Aids	*Go to Step 15*
15	1. Disconnect the automatic transmission wiring harness assembly from the 1-2 SS valve. 2. Measure the resistance from each of the component's terminals to ground. Are both readings greater than the specified value?	250 k	*Go to Step 16*	*Go to Step 17*
16	Replace the automatic transmission wiring harness assembly. Refer to Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 18*	—
17	Replace the 1-2 SS valve. Refer to 1-2 Shift Solenoid Valve Replacement. Is the replacement complete?	—	*Go to Step 18*	—
18	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle in D4, to ensure all commanded shift occur. Did all shifts occur as commanded?	—	System OK	*Go to Step 1*

DTC 83 TCC PWM Solenoid Valve Circuit Fault (L57 MFI)



372650

Circuit Description

The torque converter clutch pulse width modulation (TCC PWM) solenoid valve controls fluid acting on the converter clutch valve, which then controls TCC apply and release. The TCC PWM solenoid valve attaches to the control valve body within the transmission. Ignition voltage goes directly to the TCC PWM solenoid valve. The transmission control module (TCM) controls the TCC PWM solenoid valve by providing a ground path on circuit 418. The current flows through the TCC PWM solenoid valve coil according to the duty cycle (percentage of ON time). The TCC PWM solenoid valve provides a smooth engagement of the torque converter clutch by operating on a duty cycle percent of ON time.

If the TCM detects a continuous open or short to ground in the TCC PWM solenoid valve circuit or the TCC PWM solenoid valve, then DTC 83 sets.

Conditions for Running the DTC

- The ignition is ON.
- System voltage is 12.0–16.0 volts.

Conditions for Setting the DTC

- The TCM commands the solenoid ON and voltage remains high (B+) or the TCM commands the solenoid OFF and voltage remains low (zero volts).
- All conditions met for 2 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM inhibits TCC operation.
- The TCM inhibits 4th gear operation if in hot mode.
- The TCM stores DTC 83 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the wiring at the TCM, the transmission connector and all other circuit connecting points for the following conditions:
  - A backed out terminal
  - A damaged terminal
  - Reduced terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
  - Corrosion
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- First, diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4. This step tests for voltage to the TCC PWM solenoid valve.
6. This step tests circuit 139 power and circuit 418 ground circuit to the TCM connector.
8. This step tests the resistance of the TCC PWM solenoid valve and the automatic transmission (A/T) wiring harness assembly.
12. If the A/T wiring harness assembly is open, do not repair the A/T wiring harness assembly. You must replace the automatic transmission wiring harness assembly.

DTC 83 TCC PWM Solenoid Valve Circuit Fault (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. If DTC 81, 82 or 83 are set, inspect the transmission fuse. Is the fuse open?	—	*Go to Step 3*	*Go to Step 4*
3	Inspect circuit 139, the TCC PWM solenoid valve, the 1-2 SS valve or the 2-3 SS valve and the A/T wiring harness assembly for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found and corrected?	—	*Go to Step 18*	Go to Diagnostic Aids
4	1. Turn the ignition switch OFF. 2. Disconnect the transmission 20-way connector. (Additional DTCs will set). 3. Install the *J 39775* jumper harness on the engine harness connector. 4. With the engine OFF, turn the ignition switch to the RUN position. 5. Connect a test lamp from the *J 39775* cavity E to ground. Is the test lamp on?	—	*Go to Step 6*	*Go to Step 5*
5	Repair the open or high resistance located in ignition voltage feed circuit 139 to the TCC PWM solenoid valve. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 18*	—
6	1. Install the test lamp from cavities E to S of the jumper on the engine harness. 2. Turn the ignition switch OFF. 3. Disconnect the TCM connector C2 (additional DTCs may set). 4. With the engine OFF, turn the ignition switch to the RUN position. 5. Using the fused jumper wire, connect the C2–B5 terminal to ground. Does the test lamp turn ON when you ground the TCC PWM solenoid valve circuit 418 (BRN), and turn OFF when you open the circuit 418?	—	*Go to Step 8*	*Go to Step 7*
7	Inspect engine harness circuit 418 (BRN) for an open or short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 17*	*Go to Step 9*

DTC 83 TCC PWM Solenoid Valve Circuit Fault (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Install the *J 39775* on the transmission 20-way connector. 2. Measure the resistance between terminals E and S. Use the *J 39200* digital multimeter (DMM) and the *J 35616* connector test adapter kit. Is the resistance within the specified values?	10–15Ω	*Go to Step 9*	*Go to Step 10*
9	Measure the resistance between terminal E and ground, and terminal S and ground. Are both readings greater than the specified value?	250 kΩ	*Go to Step 11*	*Go to Step 13*
10	1. Disconnect the A/T wiring harness assembly at the TCC PWM solenoid valve. 2. Measure the resistance of the TCC PWM solenoid valve. Is the resistance within the specified values?	10–15Ω	*Go to Step 12*	*Go to Step 15*
11	Replace the TCM. Refer to *PCM Replacement/Programming (EFI)* in Engine Controls. Is the replacement complete?	—	*Go to Step 18*	—
12	Inspect the A/T wiring harness assembly for an open circuit. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	—
13	1. Disconnect the A/T wiring harness assembly at the TCC PWM solenoid valve. 2. Measure the resistance from between each of the component terminals and ground. Are both readings greater than the specified value?	250 kΩ	*Go to Step 14*	*Go to Step 15*
14	Inspect the A/T wiring harness assembly for a short to ground. Refer to *General Electrical Diagnosis Procedures* in Wiring Systems. Was a condition found?	—	*Go to Step 16*	—
15	Replace the TCC PWM solenoid valve. Refer to Torque Converter Clutch Solenoid Replacement. Is the replacement complete?	—	*Go to Step 18*	—
16	Replace the A/T wiring harness assembly. Refer to Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 18*	—
17	Repair the wiring as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 18*	—
18	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle in D4 to obtain 4th gear, with TCC engaged. • Observe that the *Scan Tool* TCC Duty Cycle is greater than 70% and the TCC slip speed is between 10 and –10 RPM. Is the TCC Duty Cycle and slip speed within the specified values?	70% duty cycle (or greater) 10 to –10 RPM slip speed	System OK	*Go to Step 1*

DTC 85 Undefined Gear Ratio (L57 MFI)

Range	Gear	1-2 Sol	2-3 Sol	Fourth Clutch	Overrun Clutch	O/D Roller Clutch	FWD Clutch	Direct Clutch	Front Band	Interm. Sprag Clutch	Interm Clutch	Lo Roller Clutch	Rear Band
Overdrive	1st	On	Off	—	—	H	A	—	—	*	—	H	—
	2nd	Off	Off	—	—	H	A	—	—	H	A	O	—
	3rd	Off	On	—	—	H	A	A	—	O	A	O	—
	4th	On	On	A	—	O	A	A	—	O	A	O	—
A = Applied H = Holding * = Holding but not effective O = Overrunning													

Circuit Description

The transmission control module (TCM) calculates gear ratio from the automatic transmission input shaft speed (A/T ISS) sensor and output shaft speed (OSS) sensor readings. The TCM compares the known transmission gear ratio to the calculated gear ratio for the selected gear range.

When the TCM detects an unknown transmission gear ratio, DTC 85 sets.

Conditions for Running the DTC

- No DTCs 21, 22, 24, 28, 71, 72 and 87.
- TP is greater than 25%.
- Not in P/N or 4th gear commanded gear.
- Engine speed is greater than 300 RPM.
- Vehicle speed is greater than 7 mph.

Conditions for Setting the DTC

- Transmission fluid temperature (TFT) is greater than 24.5°C (76°F).
- All conditions are met for 2 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM commands maximum line pressure.
- The TCM inhibits TCC operation.
- The TCM stores DTC 85 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- DTC 85 sets when an unknown gear ratio is detected for any gear but 4th gear.
- First, diagnose and clear any engine DTCs or TP sensor codes that are present. Then inspect for any transmission DTCs that may have reset.
- Sticking or contaminated shift valves may cause an undefined gear ratio.

  Refer to the Gear Ratio table.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the indicated range signal to the actual selected range. A faulty TFP manual valve position switch could set DTC 28.
4. This step tests for proper ratios in each commanded gear state.

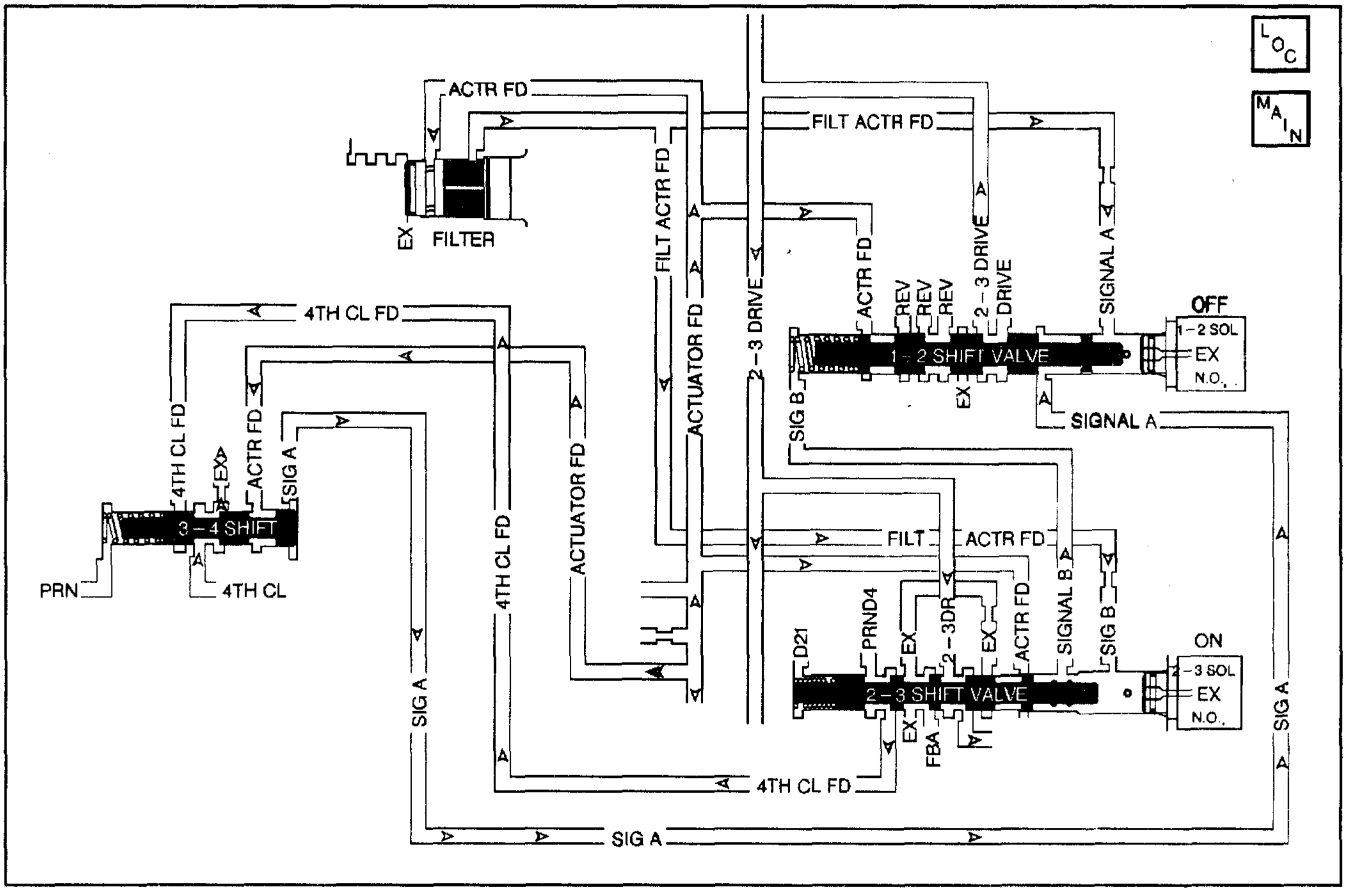
DTC 85 Undefined Gear Ratio (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	Perform the Transmission Fluid Checking Procedure. Refer to *Transmission Fluid Checking Procedure.* Is the Transmission Fluid Checking Procedure complete?	—	*Go to Step 3*	Go to *Transmission Fluid Checking Procedure*
3	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Start the engine. 6. Apply the parking brake, and select each transmission range: D1, D2, D3, D4, N, R and P. Refer to the *Range Signal* table. Does the *Scan Tool* TFP Switch A/B/C display match each selected gear range?	—	*Go to Step 4*	Go to *DTC 28 TFP Manual Valve Position Switch Fault (L57 MFI)*
4	1. Drive the vehicle in D3, with throttle position (TP) greater than 25%. 2. Hold the vehicle speed above 11 km/h (7 mph) for greater than 2 seconds in each gear range. 3. Use the snapshot mode in order to record the transmission gear ratio for each commanded gear range: 1st, 2nd and 3rd. Are the gear ratios within the specified range for each gear? (Refer to the Gear Ratio table).	—	Go to Diagnostic Aids	*Go to Step 5*
5	1. Connect the pressure gauge to the transmission line pressure tap. 2. Perform the Line Pressure Check Procedure. Refer to *Line Pressure Check Procedure.* Is the line pressure within specifications for each selected gear range?	—	*Go to Step 6*	*Go to Step 8*
6	1. Remove the transmission oil pan. Refer to *AT Fluid/Filter Changing.* 2. Inspect the oil pan and the fluid for contamination. Was excessive contamination found?	—	Go to Unit Repair	*Go to Step 7*
7	Inspect the transmission for the following problems: • Sticking shift valves • Stuck apply pistons Was a condition found?	—	*Go to Step 10*	Go to Unit Repair
8	Is the system line pressure low, only in the specific gear which indicated an incorrect gear ratio?	—	*Go to Step 9*	Go to *Symptom Diagnosis* Low Line Pressure

DTC 85 Undefined Gear Ratio (L57 MFI) (cont'd)

Step	Action	Value(s)	Yes	No
9	Inspect for fluid pressure loss in the following areas: • 1-2 SS valve seal • 2-3 SS valve seal • Valve body passages • Valve body gaskets • Band apply pistons and seals • Clutch apply pistons and seals Was a condition found?	—	*Go to Step 10*	Go to Unit Repair
10	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle in REVERSE, 1st, 2nd and 3rd gear. • The TCM must see a valid gear ratio for the commanded gear for 10 seconds. Are the gear ratios within the specified range for each of the selected gears?	1st: 2.38–2.63 2nd: 1.43–1.58 3rd: 0.95–1.05 Rev: 1.97–2.17	System OK	*Go to Step 1*

DTC 86 Low Ratio Error (L57 MFI)



230247

Circuit Description

The transmission control module (TCM) calculates ratio based on the automatic transmission input speed (A/T ISS) sensor and output shaft speed (OSS) sensor readings. The TCM compares the known transmission ratio to the calculated ratio, for the particular gear range selected.

DTC 86 sets when transmission commanded gear is 1st or 2nd and the transmission is mechanically in 3rd or 4th gear. DTC 86 is used to detect a 2-3 shift solenoid or hydraulic circuit malfunction.

Conditions for Running the DTC

- No DTCs 21, 22, 24, 28, 71, 72 and 74.
- TFT is greater than 24.5°C (76°F).
- Transmission is not in P, R, N.
- Engine speed is greater than 300 RPM.
- TP is greater than 25%.
- Vehicle speed is greater than 11 km/h (7 mph).

Conditions for Setting the DTC

- Transmission gear ratio is less than 1.06 with commanded 1st or 2nd gear.
- All conditions are met for 2 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM commands 2nd gear.
- The TCM commands maximum line pressure.
- The TCM inhibits TCC engagement.
- The TCM stores DTC 86 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- First, diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.
- Verify that the transmission meets the specifications in the *Shift Speed* table.
- Other internal transmission failures may cause more than one shift to occur.
- The customer may complain of an engine over-rev condition or neutral condition in 4th gear.

  Refer to *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

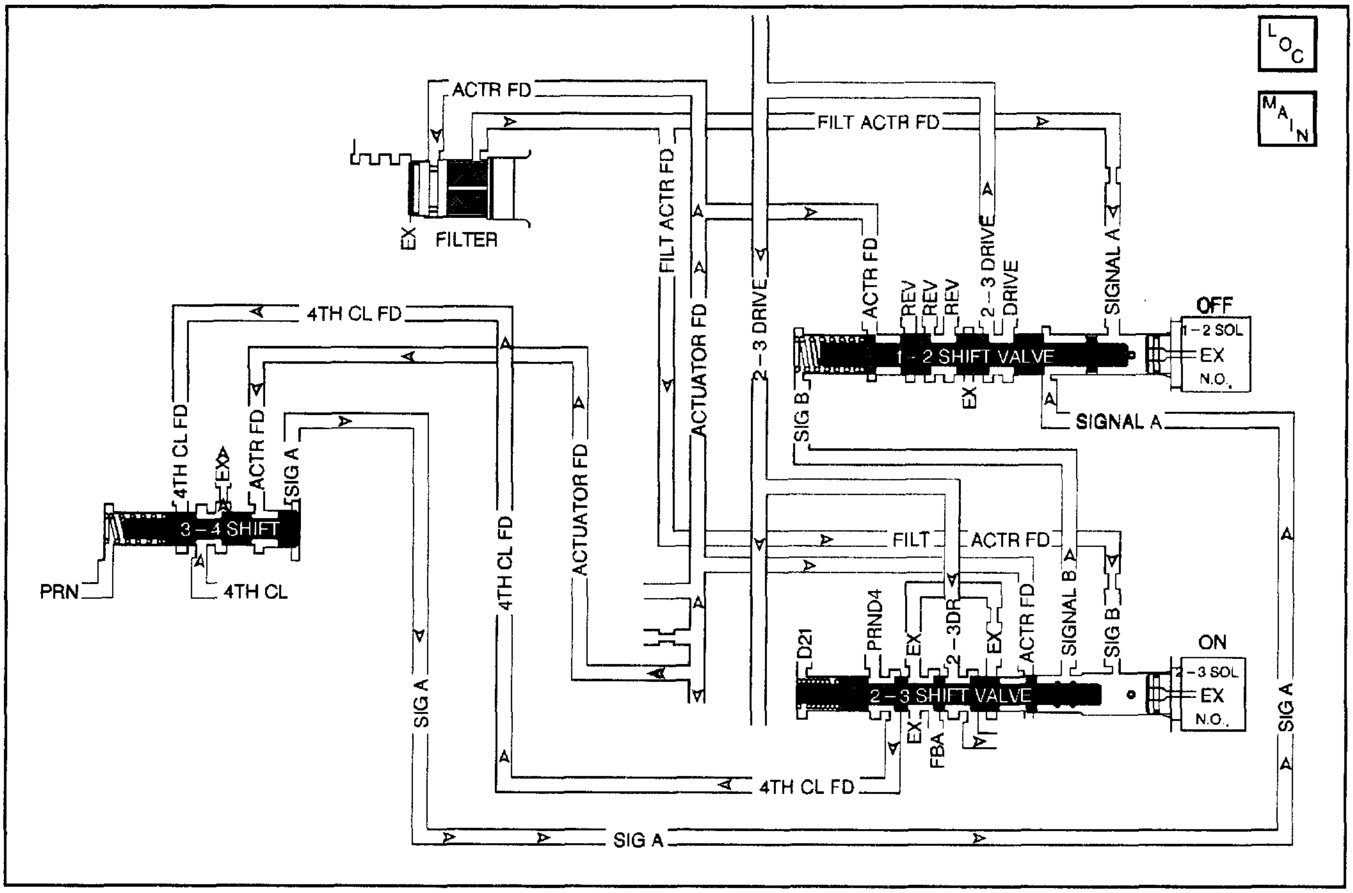
The numbers below refer to the step numbers on the diagnostic table.

2. This step tests the function of the TFP manual valve position switch.
3. This step tests for a selected gear ratio versus a ratio not obtainable under normal driving conditions.

DTC 86 Low Ratio Error (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Select TFP Sw. A/B/C on the *Scan Tool.* 6. With the engine running, apply the brake pedal and select each transmission range: D1, D2, D3, D4, N, R and P. Refer to the *Range Signal* table. Does each selected transmission range match the *Scan Tool* TFP Switch A/B/C display?	—	*Go to Step 3*	Go to *DTC 28 TFP Manual Valve Position Switch Fault (L57 MFI)*
3	Drive the vehicle with the transmission in the D4 range. 1. Using the *Scan Tool*, command FIRST gear. Note the gear ratio. 2. Using the *Scan Tool*, command SECOND gear. Note the gear ratio. Was either gear ratio less than 1.06?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Inspect the 2-3 shift solenoid valve and the 2-3 hydraulic shift valve for a malfunction. 2. Inspect the shift solenoid/hydraulic for damaged seals. Refer to *Symptom Diagnosis*. Refer to Unit Repair for repairs. Was a condition found?	—	*Go to Step 5*	—
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions (only if traffic conditions permit): • The TCM must see the proper gear ratio for each gear, for greater than one second in D1, D2, D3 and D4. • Hold the throttle at greater than 12% to obtain 4th gear. Are the gear ratios within the specified range for each of the selected gears?	1st: 2.38–2.63 2nd: 1.43–1.58 3rd: 0.95–1.05 4th: 0.73–0.77	System OK	*Go to Step 1*

DTC 87 High Ratio Error (L57 MFI)



230247

Circuit Description

The transmission control module (TCM) calculates ratio based on the automatic transmission input speed (A/T ISS) sensor and output (shaft) speed (OSS) sensor readings. The TCM compares the known transmission ratio to the calculated ratio, for the particular gear range selected.

DTC 87 sets when transmission commanded gear is 3rd or 4th and the transmission is mechanically in 1st or 2nd gear. DTC 87 is used to detect a 2-3 shift solenoid or hydraulic circuit malfunction.

Conditions for Running the DTC

- No DTCs 21, 22, 24, 28, 71, 72 and 74.
- Transmission fluid temperature is greater than 24.5°C (76°F).
- TP angle is greater than 25%.
- Not in P, R, N.
- Engine speed greater than 300 RPM.
- Vehicle speed is greater than 11 km/h (7 mph).

Conditions for Setting the DTC

- Transmission gear ratio is greater than 1.42 with commanded 3rd or 4th gear.
- All conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the malfunction indicator lamp (MIL).
- The TCM commands 2nd gear.
- The TCM commands maximum line pressure.
- The TCM inhibits TCC engagement.
- The TCM stores DTC 87 in TCM history.

Conditions for Clearing the DTC

- A scan tool clears the DTC from TCM history.
- The TCM clears the DTC from TCM history if the vehicle completes 40 consecutive key cycles without a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- First, diagnose and clear any engine DTCs that are present. Then inspect for any transmission DTCs that may have reset.
- Verify that the transmission meets the specifications in the *Shift Speed* table.
- Other internal transmission failures may cause more than one shift to occur.
- The customer may complain of an engine over-rev condition or neutral condition in 4th gear.

  Refer to *Shift Solenoid Valve State and Gear Ratio* table.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step tests the function of the TFP manual valve position switch.
3. This step tests for a selected gear ratio versus a ratio not obtainable under normal driving conditions.

DTC 87 High Ratio Error (L57 MFI)

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *Powertrain OBD System Check (EFI)*
2	1. Install the *Scan Tool.* 2. With the engine OFF, turn the ignition switch to the RUN position. **Important:** Before clearing the DTCs, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the TCM. 3. Record the Failure Records. 4. Clear the DTC. 5. Select TFP Sw. A/B/C on the *Scan Tool.* 6. With the engine running, apply the brake pedal and select each transmission range: D1, D2, D3, D4, N, R and P. Refer to the *Range Signal* table. Does each selected transmission range match the TFP Switch A/B/C display?	—	*Go to Step 3*	Go to *DTC 28 TFP Manual Valve Position Switch Fault (L57 MFI)*
3	Drive the vehicle with the transmission in the D4 range. 1. Use the *Scan Tool* in order to command 1st, 2nd, 3rd and 4th gears while accelerating the vehicle. 2. Note the gear ratio in THIRD gear and FOURTH gear. Was the ratio for commanded THIRD or FOURTH gear greater than 1.42?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Inspect the 2-3 shift solenoid valve or the 2-3 hydraulic shift valve for an internal malfunction. 2. Inspect the shift solenoid/hydraulic for damaged seals. Refer to *Symptom Diagnosis.* Was the condition corrected?	—	*Go to Step 5*	—
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions (only if traffic conditions permit): • The TCM must see the proper gear ratio for each gear, for greater than one second in D1, D2, D3 and D4. • Hold the throttle at greater than 12% to obtain 4th gear. Are the gear ratios within the specified range for each of the selected gears?	1st: 2.38–2.63 2nd: 1.43–1.58 3rd: 0.95–1.05 4th: 0.73–0.77	System OK	*Go to Step 1*

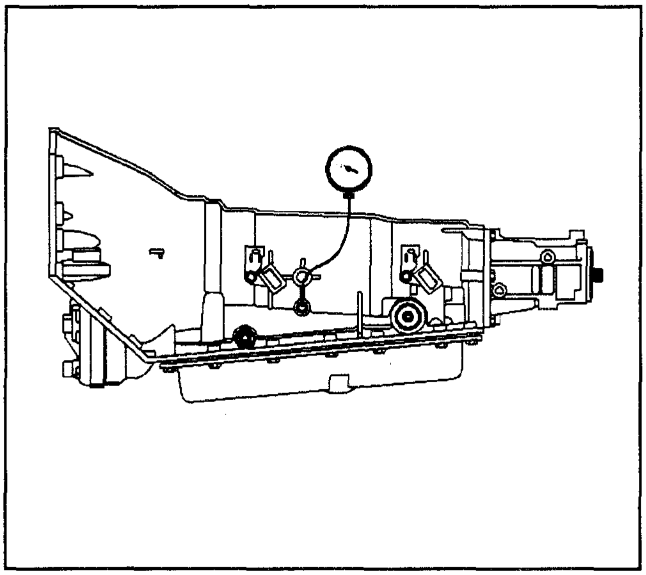
Transmission Fluid Checking Procedure

Step	Action	Value(s)	Yes	No
DEFINITION: Diagnose transmission fluid conditions by color				
1	Check the fluid color. Is the fluid color red?	—	*Go to Step 2*	*Go to Step 11*
2	Is the fluid level satisfactory?	—	*Go to Step 21*	*Go to Step 3*
3	Check the fluid. Is the fluid foamy?	—	*Go to Step 8*	*Go to Step 4*
4	Check the fluid level. The proper fluid level should be in the middle of the X-hatch. Is the level high?	—	*Go to Step 9*	*Go to Step 5*
5	Fluid will be low. Add fluid to the proper fluid level. Is the fluid level satisfactory?	—	*Go to Step 6*	—
6	Check for external leaks. Refer to *Fluid Leak Diagnosis.* Were any leaks found?	—	*Go to Step 7*	*Go to Step 21*
7	Correct the leak condition. Was the leak condition corrected?	—	*Go to Step 21*	—
8	Is the fluid level too high?	—	*Go to Step 9*	*Go to Step 10*
9	Remove excess fluid to the proper fluid level. Refer to *AT Fluid/Filter Changing.* Is the fluid level satisfactory?	—	*Go to Step 21*	—
10	Check for contaminants in the fluid. Drain the fluid to determine the source of the contamination. Was the fluid drained?	—	*Go to Step 15*	—
11	Is the fluid color non-transparent pink?	—	*Go to Step 12*	*Go to Step 13*
12	Replace the cooler. Is the replacement complete?	—	*Go to Step 15*	—
13	The fluid color should be light brown. Notice: Transmission fluid may turn dark with normal use. This does not always indicate oxidation or contamination. Is the fluid color light brown?	—	*Go to Step 14*	—
14	Drain the fluid to determine if the fluid is contaminated. Notice: A very small amount of material in the bottom pan is a normal condition, but large pieces of metal or other material in the bottom pan require a transmission overhaul. Was the fluid contaminated?	—	*Go to Step 15*	*Go to Step 18*
15	Overhaul the transmission. Refer to Unit Repair. Is the overhaul complete?	—	*Go to Step 16*	—
16	Clear TRANS ADAPT. Are the reset procedures complete?	—	*Go to Step 17*	—
17	Add new fluid. Is the procedure complete?	—	*Go to Step 20*	—
18	Change the fluid and the filter. Is this procedure complete?	—	*Go to Step 19*	—
19	Are the reset procedures complete?	—	*Go to Step 20*	—
20	Is the fluid level satisfactory? If not, correct as needed.	—	*Go to Step 21*	—
21	Perform the *Functional Test Procedure.* Is the Functional Test Procedure completed?	—	System OK	—

Transmission Fluid Checking Procedure

1. Start the engine and operate the vehicle for 15 minutes or until the transmission fluid reaches an operating temperature of 82–93°C (180–200°F).
2. Park the vehicle on a level surface.
3. With your foot on the brake, move the shift lever through each gear range. Pause for about three seconds in each range, ending in Park.
4. Apply the parking brake and let the engine idle for three minutes.
5. Remove the transmission fluid level indicator, wipe the indicator clean, and reinsert the indicator. Give the indicator a full twist to close.
6. Wait three seconds and remove the indicator.
7. Read both sides of the indicator. The fluid must be within the hot cross-hatched area using the lowest level reading.

Line Pressure Check Procedure



40720

Line pressures are calibrated for two sets of gear ranges–Drive-Park-Neutral, and Reverse. This allows the transmission line pressure to be appropriate for different pressure needs in different gear ranges:

Gear Range	Line Pressure Range
Drive, Park, or Neutral	35–171 psi
Reverse	67–324 psi

Before performing a line pressure check, verify that the pressure control solenoid for the transmission is receiving the correct electrical signal from the vehicle computer:

1. Install a *Scan Tool.*

Caution: Keep the brakes applied at all times in order to prevent unexpected vehicle motion. Personal injury may result if the vehicle moves unexpectedly.

Notice: The transmission may experience harsh, soft or mushy shifts for up to two days later.

2. Start the engine and set the parking brake.
3. Check for diagnostic trouble codes, including the diagnostic code for a pressure control solenoid.
4. Repair the vehicle if necessary. Include the following areas:
   - Inspect the fluid level
   - Inspect the manual linkage at the transmission
   - Install or connect the scan tool
   - Install or connect the oil pressure gage at the line pressure tap
5. Put the gear selector in Park and set the parking brake.
6. Start the engine and allow the engine to warm up at idle.
7. Access the Override Pressure Control Solenoid test on the scan tool.
8. Increase the Pressure Control Solenoid Current in 0.1-amp increments. Read the corresponding line pressure on the pressure gage. Allow the pressure to stabilize for 5 seconds after each current charge.
9. Compare your data to the Drive-Park-Neutral *Line Pressure.*

If your pressure readings differ greatly from the line pressure table, refer to the Diagnosis Tables.

The scan tool is only able to control the pressure control solenoid in Park and Neutral with the vehicle stopped at idle. This protects the clutches from extremely high or low pressures in Drive or Reverse ranges.

Road Test Procedure

Important: The Road Test Procedure should be performed only as part of the Functional Test Procedure. Refer to *Functional Test Procedure.*

The following test provides a method of evaluating the condition of the automatic transmission. The test is structured so that most driving conditions would be achieved. The test is divided into the following parts:

- Electrical Function Check
- Upshift Control and Torque Converter Clutch (TCC) Apply
- Part Throttle Detent Downshifts
- Full Throttle Detent Downshifts
- Manual Downshifts
- Coasting Downshifts
- Manual Gear Range Selection
  - REVERSE
  - Manual FIRST
  - Manual SECOND
  - Manual THIRD

Important: Complete the test in the sequence given. Incomplete testing cannot guarantee an accurate evaluation.

Before the road test, ensure the following:

- The engine is performing properly.
- Transmission fluid level is correct.
- Tire pressure is correct.

During the road test:

- Perform the test only when traffic conditions permit.
- Operate the vehicle in a controlled, safe manner.
- Observe all traffic regulations.
- View the scan tool data while conducting this test.

  Take along qualified help in order to operate the vehicle safely.
- Observe any unusual sounds or smells.

After the road test, check the following:

- Transmission fluid level. Refer to *Transmission Fluid Checking Procedure.*
- Diagnostic Trouble Codes (DTCs) that may have set during the testing. Refer to the applicable DTC.
- Scan tool data for any abnormal readings or data.

Electrical Function Check

Perform this check first, in order to ensure the electronic transmission components are connected and functioning properly. If these components are not checked, a simple electrical condition could be mis-diagnosed.

1. Connect the scan tool.
2. Ensure the gear selector is in PARK and set the parking brake.
3. Start the engine.
4. Verify that the following scan tool data can be obtained and is functioning properly.

   Refer to *Transmission Scan Tool Data Values (Gas)* or *Transmission Scan Tool Data Values (L57/L65 EFI)* or *Transmission Scan Tool Data Values (L57 MFI)* for typical data values. Data that is questionable may indicate a concern.
   - Engine Speed
   - Transmission input speed (turbine)
   - Transmission output speed
   - Vehicle speed
   - TFP manual valve position switch
   - Transmission range (engine list)
   - 4WD low
   - Commanded gear (current gear)
   - PC solenoid reference current
   - PC solenoid actual current
   - PC solenoid duty cycle
   - Brake switch
   - Engine coolant temperature
   - Transmission fluid temperature
   - Throttle angle
   - Ignition voltage
   - 1-2 shift solenoid
   - 2-3 shift solenoid
   - TCC solenoid duty cycle
   - TCC slip speed
5. Monitor the brake switch signal while depressing and releasing the brake pedal. The scan tool should display:

VCM (L29/L31/L35)

- Closed when the brake pedal is released
- Open when the brake pedal is depressed

PCM (L57/L65)

- Closed when the brake pedal is depressed
- Open when the brake pedal is released

6. Check the garage shifts
   6.1. Apply the brake pedal and ensure the parking brake is set.
   6.2. Move the gear selector through the following ranges:
      6.2.1. PARK to REVERSE
      6.2.2. REVERSE to NEUTRAL
      6.2.3. NEUTRAL to DRIVE
   6.3. Pause 2 to 3 seconds in each gear position.
   6.4. Verify the gear engagements are immediate and not harsh.

Important: Harsh engagement may be caused by any of the following conditions:

- High idle speed. Compare engine idle speed to desired idle speed.
- Commanded low PC solenoid current. Compare PC solenoid reference current to PC solenoid actual current.
- A default condition caused by certain DTCs that result in maximum line pressure to prevent slippage.

Important: Soft or delayed engagement may be caused by any of the following conditions:

- Low idle speed. Compare engine idle speed to desired idle speed.
- Low fluid level.
- Commanded high PC solenoid current. Compare PC solenoid reference current to PC solenoid actual current.
- Cold transmission fluid. Check for low transmission fluid temperature.

7. Monitor transmission range on the scan tool (engine list).
   7.1. Apply the brake pedal and ensure the parking brake is set.
   7.2. Move the gear selector through all ranges.
   7.3. Pause 2 to 3 seconds in each range.
   7.4. Return gear selector to PARK.
   7.5. Verify that all selector positions match the scan tool display.
8. Check throttle angle input.
   8.1. Apply the brake pedal and ensure the parking brake is set.
   8.2. Ensure the gear selector is in PARK.
   8.3. Monitor throttle angle while increasing and decreasing engine speed with the throttle pedal. The scan tool throttle angle should increase and decrease with engine speed.

If any of the above checks do not perform properly, record the result for reference after completion of the road test.

Upshift Control and Torque Converter Clutch (TCC) Apply

The PCM calculates the upshift points based primarily on two inputs: throttle angle and vehicle speed. When the PCM determines that conditions are met for a shift to occur, the PCM commands the shift by closing or opening the ground circuit for the appropriate solenoid.

Perform the following steps:

1. Refer to *Shift Speed* table in this section and choose a throttle position of 10%, 25% or 50%. All throttle angles shown should be tested to cover the normal driving range.
2. Monitor the following scan tool parameters:
   - Throttle angle
   - Vehicle speed
   - Engine speed
   - Output shaft speed
   - Commanded gear
   - Slip speed
   - Solenoid states
3. Place the gear selector in the OVERDRIVE position.
4. Accelerate the vehicle using the chosen throttle angle. Hold the throttle steady.
5. As the transmission upshifts, note the vehicle speed when the shift occurs for each gear change. There should be a noticeable shift feel or engine speed change within 1 to 2 seconds of the commanded gear change.
6. Compare the shift speeds to the Shift Speed table. Refer to *Shift Speed.* Shift speeds may vary slightly due to transmission fluid temperature or hydraulic delays in responding to electronic controls.
   - Note any harsh, soft or delayed shifts or slipping.
   - Note any noise or vibration.
7. Repeat steps 1 through 6 to complete all throttle angles.

Important: The TCC will not engage until the engine is in closed loop operation. The vehicle must be in a near-cruise condition (not accelerating or coasting) and on a level road surface.

8. Check for TCC apply in THIRD and FOURTH gear. Typical apply speeds in FOURTH gear range from 72–88 km/h (45–55 mph) depending on engine size, engine type and axle ratio.
   - Note the TCC apply point. When the TCC applies there should be a noticeable drop in engine speed and a drop in slip speed to below 100 RPM. If the TCC apply can not be detected:
     - Check for DTCs
     - Refer to *Torque Converter Diagnosis Procedure*
   - Lightly tap and release the brake pedal. The TCC will release on most applications.

Part Throttle Detent Downshift

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to 64–88 km/h (40–55 mph) in FOURTH gear.
3. Quickly increase throttle angle to greater than 50%.
4. Verify the following:
   - The TCC releases
   - The transmission downshifts immediately to THIRD gear

Full Throttle Detent Downshift

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to speeds of 64–88 km/h (40–55 mph) in FOURTH gear.
3. Quickly increase throttle angle to 100% (WOT).
4. Verify the following:
   - The TCC releases
   - The transmission downshifts immediately to SECOND gear

Manual Downshifts

The shift solenoid valves do not control manual downshifts. All manual downshifts are hydraulic. The solenoid states will change during, or shortly after, a manual downshift is selected.

Manual 4–3 Downshift

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to 64–88 km/h (40–55 mph) in FOURTH gear.
3. Release the throttle while moving the gear selector to THIRD.
4. Verify the following:
   - The TCC releases
   - The transmission downshifts immediately to THIRD gear
   - The engine slows the vehicle

Manual 4–2 Downshift

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to 64–72 km/h (40–45 mph).
3. Release the throttle while moving the gear selector to SECOND.
4. Verify the following:
   - The TCC releases
   - The transmission downshifts immediately to SECOND gear
   - The engine slows the vehicle

Manual 4–1 Downshift

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to 48 km/h (30 mph).
3. Release the throttle while moving the gear selector to FIRST.
4. Verify the following:
   - The TCC releases
   - The transmission immediately downshifts to FIRST Gear.
   - The engine slows the vehicle.

Coasting Downshifts

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to FOURTH gear with the TCC applied.
3. Release the throttle and lightly apply the brakes.
4. Verify the following:
   - The TCC releases
   - Downshifts occur at speeds shown in the Shift Speed chart. Refer to *Shift Speed.*

Manual Gear Range Selection

The shift solenoids control the upshifts in the manual gear ranges.

Perform the following tests using 10% to 15% throttle angle.

Reverse

1. With the vehicle stopped, move the gear selector to REVERSE.
2. Slowly accelerate the vehicle.
3. Verify that there is no noticeable slip, noise or vibration.

Manual First

1. With the vehicle stopped, move the gear selector to FIRST.
2. Accelerate the vehicle to 32 km/h (20 mph).
3. Verify the following:
   - No upshifts occur
   - The TCC does not apply
   - There is no noticeable slip, noise, or vibration

Manual Second

1. With the vehicle stopped, move the gear selector to SECOND.
2. Accelerate the vehicle to 57 km/h (35 mph).
3. Verify the following:
   - The 1-2 shift occurs
   - The 2-3 shift does not occur
   - There is no noticeable slip, noise, or vibration

Manual Third

1. With the vehicle stopped, move the gear selector to THIRD.
2. Accelerate the vehicle to 64 km/h (40 mph).
3. Verify the following:
   - The 1-2 shift occurs
   - The 2-3 shift occurs
   - There is no noticeable slip, noise, or vibration

Torque Converter Diagnosis Procedure

The Torque Converter Clutch (TCC) is applied by fluid pressure, which is controlled by a PWM solenoid valve. This solenoid valve is located inside of the automatic transmission assembly. The solenoid valve is controlled through a combination of computer controlled switches and sensors.

Torque Converter Stator

The torque converter stator roller clutch can have two different malfunctions.

- The stator assembly freewheels in both directions.
- The stator assembly remains locked up at all times.

Poor Acceleration at Low Speed

If the stator is freewheeling at all times, the car tends to have poor acceleration from a standstill. At speeds above 50–55 km/h (30–35 mph), the car may act normally. For poor acceleration, you should first determine that the exhaust system is not blocked, and the transmission is in First gear when starting out.

If the engine freely accelerates to high RPM in NEUTRAL, you can assume that the engine and the exhaust system are normal. Check for poor performance in DRIVE and REVERSE to help determine if the stator is freewheeling at all times.

Poor Acceleration at High Speed

If the stator is locked up at all times, performance is normal when accelerating from a standstill. Engine RPM and car speed are limited or restricted at high speeds. Visual examination of the converter may reveal a blue color from overheating.

If the converter has been removed, you can check the stator roller clutch by inserting a finger into the splined inner race of the roller clutch and trying to turn the race in both directions. You should be able to freely turn the inner race clockwise, but you should have difficulty in moving the inner race counterclockwise or you may be unable to move the race at all.

Noise (whine)

Important: Do not confuse this noise with pump whine noise, which is usually noticeable in PARK, NEUTRAL and all other gear ranges. Pump whine will vary with line pressure.

You may notice a torque converter whine when the vehicle is stopped and the transmission is in DRIVE or REVERSE. This noise will increase as you increase the engine RPM. The noise will stop when the vehicle is moving or when you apply the torque converter clutch, because both halves of the converter are turning at the same speed.

Perform a stall test to make sure the noise is actually coming from the converter:

1. Place your foot on the brake.
2. Put the gear selector in DRIVE.

Notice: You may damage the transmission if you depress the accelerator for more than six seconds.

3. Depress the accelerator to approximately 1,200 RPM for no more than six seconds.

A torque converter noise will increase under this load.

Torque Converter Clutch Shudder

The key to diagnosing Torque Converter Clutch (TCC) shudder is to note when it happens and under what conditions.

TCC shudder which is caused by the transmission should only occur during the apply or the release of the converter clutch. Shudder should never occur after the TCC plate is fully applied.

If the shudder occurs while the TCC is applying, the problem can be within the transmission or the torque converter. Something is causing one of the following conditions to occur:

- Something is not allowing the clutch to become fully engaged.
- Something is not allowing the clutch to release.
- The clutch is releasing and applying at the same time.

One of the following conditions may be causing the problem to occur:

- Leaking turbine shaft seals
- A restricted release orifice
- A distorted clutch or housing surface due to long converter bolts
- Defective friction material on the TCC plate

If Shudder Occurs After TCC has Applied

If shudder occurs after the TCC has applied, most of the time there is nothing wrong with the transmission!

As mentioned above, the TCC is not likely to slip after the TCC has been applied. Engine problems may go unnoticed under light throttle and load, but they become noticeable after the TCC apply when going up a hill or accelerating. This is due to the mechanical coupling between the engine and the transmission.

Once TCC is applied, there is no torque converter (fluid coupling) assistance. Engine or driveline vibrations could be unnoticeable before TCC engagement.

Inspect the following components in order to avoid misdiagnosis of TCC shudder. An inspection will also avoid the unnecessary disassembly of a transmission or the unnecessary replacement of a torque converter.

- Spark plugs – Inspect for cracks, high resistance or a broken insulator.
- Plug wires – Look in each end. If there is red dust (ozone) or a black substance (carbon) present, then the wires are bad. Also look for a white discoloration of the wire. This indicates arcing during hard acceleration.
- Coil – Look for a black discoloration on the bottom of the coil. This indicates arcing while the engine is misfiring.
- Fuel injector – The filter may be plugged.
- Vacuum leak – The engine will not get a correct amount of fuel. The mixture may run rich or lean depending on where the leak occurs.
- EGR valve – The valve may let in too much or too little unburnable exhaust gas and could cause the engine to run rich or lean.

- MAP/MAF sensor – Like a vacuum leak, the engine will not get the correct amount of fuel for proper engine operation.
- Carbon on the intake valves – Carbon restricts the proper flow of air/fuel mixture into the cylinders.
- Flat cam – Valves do not open enough to let the proper fuel/air mixture into the cylinders.
- Oxygen sensor – This sensor may command the engine too rich or too lean for too long.
- Fuel pressure – This may be too low.
- Engine mounts – Vibration of the mounts can be multiplied by TCC engagement.
- Axle joints – Check for vibration.
- TP Sensor – The TCC apply and release depends on the TP Sensor in many engines. If the TP Sensor is out of specification, TCC may remain applied during initial engine loading.
- Cylinder balance – Bad piston rings or poorly sealing valves can cause low power in a cylinder.
- Fuel contamination – This causes poor engine performance.

Torque Converter Evaluation and Diagnosis

Replace the torque converter if any of the following conditions exist:

- External leaks appear in the hub weld area.
- The converter hub is scored or damaged.
- The converter pilot is broken, damaged, or fits poorly into the crankshaft.
- You discover steel particles after flushing the cooler and the cooler lines.
- The pump is damaged, or you discover steel particles in the converter.
- The vehicle has TCC shudder and/or no TCC apply. Replace the torque converter only after all hydraulic and electrical diagnoses have been made. The converter clutch material may be glazed.
- The converter has an imbalance which cannot be corrected. Refer to *Torque Converter Vibration Test.*
- The converter is contaminated with engine coolant which contains antifreeze.
- An internal failure occurs in the stator roller clutch.
- You notice excessive end play.
- Overheating produces heavy debris in the clutch.
- You discover steel particles or clutch lining material in the fluid filter or on the magnet, when no internal parts in the unit are worn or damaged. This condition indicates that lining material came from the converter.

Do Not Replace the Torque Converter if you discover any of the following symptoms:

- The oil has an odor or the oil is discolored, even though metal or clutch facing particles are not present.
- The threads in one or more of the converter bolt holds are damaged. Correct the condition with a new thread inset.
- Transmission failure did not display evidence of damaged or worn internal parts, steel particles or clutch plate lining material in the unit and inside the fluid filter.

  *The vehicle has been exposed to high mileage only. An exception may exist where the lining of the torque converter clutch dampener plate has seen excess wear by vehicles operated in heavy and/or constant traffic, such as taxi, delivery, or police use.

Torque Converter Vibration Test

To determine and correct a torque converter vibration, the following procedure may have to be performed several times to achieve the best possible torque converter to flywheel balance.

1. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration.
2. Turn the engine OFF.
3. Remove the torque converter bolts.

   Refer to Torque Converter Cover Replacement.
4. Rotate the torque converter one bolt position.
5. Install torque converter bolts.

   Refer to Torque Converter Cover Replacement.
6. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration.

Repeat this procedure until you obtain the best possible balance.

Noise and Vibration Analysis

A noise or vibration that is noticeable when the vehicle is in motion MAY NOT be the result of the transmission.

If noise or vibration is noticeable in PARK and NEUTRAL with the engine at idle, but is less noticeable as RPM increases, the cause may be from poor engine performance.

- Inspect the tire for the following:
  - Uneven wear.
  - Imbalance.
  - Mixed sizes.
  - Mixed radial and bias ply. Refer to Tires and Wheels.
- Inspect the suspension components for the following:
  - Alignment and wear.
  - Loose fasteners. Refer to Front Suspension.
- Inspect the engine and transmission mounts for damage and loose bolts.
- Inspect the transmission case mounting holes for the following:
  - Missing bolts, nuts, and studs.
  - Stripped threads.
  - Cracks.

- Inspect the flywheel for the following:
  - Missing or loose bolts.
  - Cracks.
  - Imbalance.
- Inspect the torque converter for the following:
  - Missing or loose bolts or lugs.
  - Missing or loose balance weights.
  - Imbalance.

Clutch Plate Diagnosis

Composition Plates

Dry the plates and inspect the plates for the following conditions:

- Pitting
- Flaking
- Wear
- Glazing
- Cracking
- Charring
- Chips or metal particles embedded in the lining

Replace a composition plate which shows any of these conditions.

Steel Plates

Important: If the clutch shows evidence of extreme heat or burning, replace the springs.

Wipe the plates dry and check the plates for heat discoloration. If the surfaces are smooth, even if color smear is indicated, you can reuse the plate. If the plate is discolored with heat spots or if the surface is scuffed, replace the plate.

Causes of Burned Clutch Plates

The following conditions can result in a burned clutch plate:

- Incorrect usage of clutch plates
- Engine coolant in the transmission fluid
- A cracked clutch piston
- Damaged or missing seals
- Low line pressure
- Valve body conditions
  - The valve body face is not flat
  - Porosity between channels
  - The valve bushing clips are improperly installed
  - The checkballs are misplaced
- The Teflon® seal rings are worn or damaged

Engine Coolant in Transmission

Notice: The antifreeze will deteriorate the Viton O-ring seals and the glue that bonds the clutch material to the pressure plate. Both conditions may cause damage to the transmission.

If the transmission oil cooler has developed a leak allowing engine coolant to enter the transmission, perform the following:

1. Disassemble the transmission.
2. Replace all of the rubber type seals. (The coolant will attack the seal material which will cause leakage.)
3. Replace the composition-faced clutch plate assemblies. (The facing material may separate from the steel center portion.)
4. Replace all of the nylon parts (washers).
5. Replace the torque converter.
6. Thoroughly clean and rebuild the transmission, using new gaskets and oil filter.
7. Flush the cooler lines after the transmission cooler has been properly repaired or replaced.

Fluid Leak Diagnosis

General Method

1. Verify that the leak is transmission fluid.
2. Thoroughly clean the suspected leak area.
3. Operate the vehicle for 24 km (15 mi), or until normal operating temperatures are reached.
4. Park the vehicle over clean paper or cardboard.
5. Shut OFF the engine.
6. Look for fluid spots on the paper.
7. Make the necessary repairs.

Powder Method

1. Thoroughly clean the suspected leak area with solvent.
2. Apply an aerosol type powder, such as foot powder, to the suspected leak area.
3. Operate the vehicle for 24 km (15 mi), or until normal operating temperatures are reached.
4. Shut OFF the engine.
5. Inspect the suspected leak area.
6. Trace the leak path through the powder in order to find the source of the leak.
7. Make the necessary repairs.

Dye and Black Light Method

A fluid dye and black light kit is available from various tool manufacturers.

1. Follow the manufacturer's instructions in order to determine the amount of dye to use.
2. Detect the leak with the black light.
3. Make the necessary repairs.

Find the Cause of the Leak

Pinpoint the leak and trace it back to the source. You must determine the cause of the leak in order to repair the leak properly. For example, if you replace a gasket, but the sealing flange is bent, the new gasket will not repair the leak. You must also repair the bent flange. Before you attempt to repair a leak, check for the following conditions, and make repairs as necessary:

Gaskets

- Fluid level/pressure is too high
- Plugged vent or drain-back holes
- Improperly tightened fasteners
- Dirty or damaged threads
- Warped flanges or sealing surface
- Scratches, burrs, or other damage to the sealing surface
- Damaged or worn gasket
- Cracking or porosity of the component
- Improper sealant used, where applicable
- Incorrect gasket

Seals

- Fluid level/pressure is too high
- Plugged vent or drain-back holes
- Damaged seal bore
- Damaged or worn seal
- Improper installation
- Cracks in component
- Manual or output shaft surface is scratched, nicked, or damaged
- Loose or worn bearing causing excess seal wear

Possible Points of Fluid Leaks

Transmission Oil Pan

- Incorrectly tightened oil pan bolts.
- Improperly installed or damaged oil pan gasket.
- Damaged oil pan or mounting face.
- Incorrect oil pan gasket.

Case Leak

- Damaged or missing fill tube seal.
- Mislocated fill tube bracket.
- Damaged vehicle speed sensor seal.
- Damaged manual shift seal.
- Loose or damaged oil cooler connector fittings.
- Worn or damaged propeller shaft oil seal.
- Loose line pressure pipe plug.
- Porous casting.

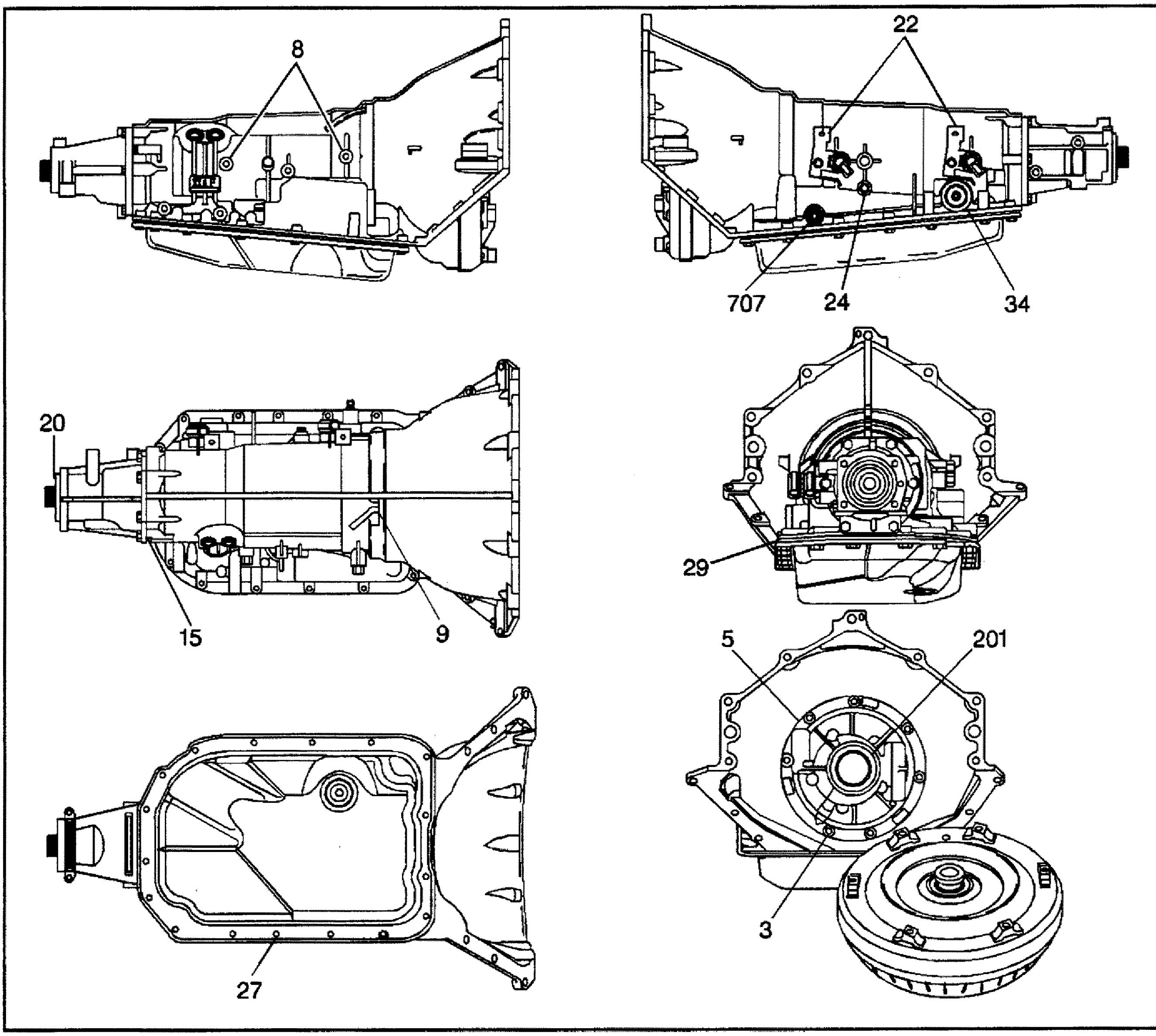
Leak at the Torque Converter End

- Converter leak in the weld area.
- Converter seal lip cut. Check the converter hub for damage.
- Converter seal bushing moved forward and damaged.
- Converter seal garter spring missing from the seal.
- Porous casting of the transmission case or the oil pump.

Leak at the Vent Pipe or the Fluid Fill Tube

- Overfilled system.
- Water or coolant in the fluid. The fluid will appear milky.
- Transmission case porous.
- Incorrect fluid level indicator.
- Plugged vent.
- Drain-back holes plugged.
- Mispositioned oil pump to case gasket, if equipped.

Possible Fluid Leak Points



Legend

(3) Bolt and Seal Assembly, A/Trans O/Pump
(5) Seal, A/Trans Oil Pump
(8) Connector, Transmission Oil Cooler Pipe
(9) Pipe, Vent
(15) Seal, Case Extension
(20) Seal Asm., Prop Shaft Front Slip Yoke Oil
(22) Sensor Assembly, A/T Input Speed and 2WD Output Speed (4WD Plug)
(24) Plug, Line Pressure Test Hole
(27) Bolt, Oil Pan
(29) Seal, Transmission Oil Pan
(34) Harness Assembly, A/Trans Wiring
(201) Seal Asm., Torque Converter Oil
(707) Seal Assembly, Manual Shift Shaft

Case Porosity Repair

Some external leaks are caused by case porosity in non-pressurized areas. You can usually repair these leaks with the transmission in the car.

1. Thoroughly clean the area to be repaired with a cleaning solvent. Air dry the area.

Caution: Epoxy adhesive may cause skin irritations and eye damage. Read and follow all information on the container label as provided by the manufacturer.

2. Using instructions from the manufacturer, mix a sufficient amount of epoxy, P/N 1052533 or equivalent, to make the repair.
3. While the transmission case is still hot, apply the epoxy. You can use a clean, dry soldering acid brush to clean the area and also to apply the epoxy cement. Make certain that the area to be repaired is fully covered.
4. Allow the epoxy cement to cure for three hours before starting the engine.
5. Repeat the fluid leak diagnosis procedures.

AT Wiring Harness Check

Step	Action	Value(s)	Yes	No
Important: The Automatic Transmission (A/T) Wiring Harness Assembly Check cannot be used for checking the automatic transmission fluid pressure (TFP) manual valve position switch circuit. Refer to *TFP Manual Valve Position Switch Resistance Check* for those circuits.				
1	1. Install the *J 39775* jumper harness on the transmission 20-way connector. 2. Using the *J 39200* digital multimeter (DMM), and a *J 35616* connector test adapter kit, measure the resistance between terminals A and E (1-2 shift solenoid valve). Is the resistance within the values indicated?	19–24Ω @ 20°C (68°F) 24–31Ω @ 100°C (212°F)	*Go to Step 3*	*Go to Step 2*
2	1. Disconnect the 1-2 shift solenoid (SS) valve from the automatic transmission (A/T) wiring harness assembly. 2. Using the *J 39200* DMM, measure the resistance of the 1-2 SS valve. Is the resistance within the values indicated?	19–24Ω @ 20°C (68°F) 24–31Ω @ 100°C (212°F)	*Go to Step 12*	*Go to Step 14*
3	Measure the resistance between terminals B and E (2-3 shift solenoid valve). Is the resistance within the values indicated?	19–24Ω @ 20°C (68°F) 24–31Ω @ 100°C (212°F)	*Go to Step 5*	*Go to Step 4*
4	1. Disconnect the 2-3 shift solenoid (SS) valve from the A/T wiring harness assembly. 2. Using the DMM, measure the resistance of the 2-3 SS valve. Is the resistance within the values indicated?	19–24Ω @ 20°C (68°F) 24–31Ω @ 100°C (212°F)	*Go to Step 12*	*Go to Step 14*
5	Measure the resistance between terminals S and E (torque converter clutch pulse width modulation solenoid valve). Is the resistance within the values indicated?	10–11Ω @ 20°C (68°F) 13–15Ω @ 100°C (212°F)	*Go to Step 7*	*Go to Step 6*
6	1. Disconnect the torque converter clutch pulse width modulation (TCC PWM) solenoid valve from the A/T wiring harness assembly. 2. Using the *J 39200* DMM, measure the resistance of the TCC PWM solenoid valve. Is the resistance within the values indicated?	10–11Ω @ 20°C (68°F) 13–15Ω @ 100°C (212°F)	*Go to Step 12*	*Go to Step 14*
7	Measure the resistance between terminals C and D (pressure control solenoid valve). Is the resistance within the values indicated?	3–5Ω @ 20°C (68°F) 4–7Ω @ 100°C (212°F)	*Go to Step 9*	*Go to Step 8*

AT Wiring Harness Check (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Disconnect the pressure control (PC) solenoid valve from the A/T wiring harness assembly. 2. Using the *J 39200* DMM, measure the resistance of the PC solenoid valve. Is the resistance within the values indicated?	3–5Ω @ 20°C (68°F) 4–7Ω @ 100°C (212°F)	*Go to Step 12*	*Go to Step 14*
9	Measure the resistance between terminals L and M (transmission fluid temperature sensor). Is the resistance within the values indicated?	3333–3689Ω @ 20°C (68°F) 167–189Ω @ 100°C (212°F)	*Go to Step 10*	*Go to Step 12*
10	Measure the resistance from terminals A, B, C, D, E, L, M, N, P, R and S of the A/T wiring harness assembly at the transmission 20-way connector, to the transmission case. Is the resistance measured greater than the value indicated?	250 kΩ	System OK	*Go to Step 11*
11	1. Disconnect the A/T wiring harness assembly from all the components. 2. Measure the resistance from all the components terminals to the transmission case. Is the resistance measured greater than the value indicated?	250 kΩ	*Go to Step 12*	*Go to Step 14*
12	Inspect for high resistance or a shorted condition: • Inspect the A/T wiring harness assembly for poor electrical connections at the transmission 20-way connector and at the component connectors. • Look for possible bent, backed out, deformed, or damaged terminals. • Inspect for reduced terminal tension. • Inspect for chafed wire that could short to bare metal or other wiring. • If diagnosing for a possible intermittent condition, move or massage the A/T wiring harness assembly while observing the test equipment for a change. Was high resistance or a shorted condition found?	—	*Go to Step 13*	System OK
13	Replace the A/T wiring harness assembly. Is the replacement complete?	—	Procedure Complete	—
14	Replace the faulty component. Is the replacement complete?	—	Procedure Complete	—

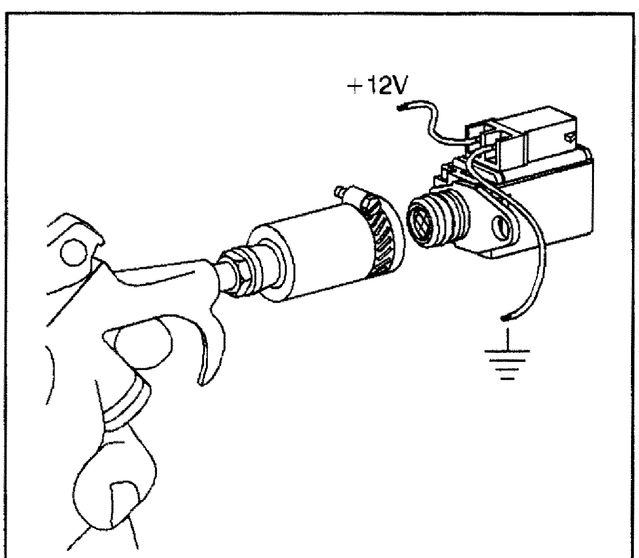
TFP Manual Valve Position Switch Resistance Check

Step	Action	Value(s)	Yes	No
Important: Whenever the transmission 20-way connector is disconnected and the engine is running, multiple DTCs will set. Clear any DTC codes after finishing the procedure.				
1	1. Install the *J 39775* jumper harness on the transmission side of the 20-way connector. 2. Using the *J 39200* digital multimeter (DMM) and the *J 35616* connector test adapter kit, measure the resistance from terminal N to the transmission case. Is the resistance greater than the value indicated?	50 kΩ	*Go to Step 3*	*Go to Step 2*
2	1. Disconnect the automatic transmission (A/T) wiring harness assembly from the automatic transmission fluid pressure (TFP) manual valve position switch. 2. Measure the resistance from terminal A of the TFP manual valve position switch to the switch housing. Is the resistance greater than the value indicated?	50 kΩ	*Go to Step 15*	*Go to Step 16*
3	Measure the resistance from terminal R to the transmission case. Is the resistance greater than the indicated value?	50 kΩ	*Go to Step 5*	*Go to Step 4*
4	1. Disconnect the A/T wiring harness assembly from the TFP manual valve position switch. 2. Measure the resistance from terminal B of the TFP manual valve position switch to the switch housing. Is the resistance greater than the value indicated?	50 kΩ	*Go to Step 15*	*Go to Step 16*
5	Measure the resistance from terminal P to the transmission case. Is the resistance greater than the value indicated?	50 kΩ	*Go to Step 7*	*Go to Step 6*
6	1. Disconnect the A/T wiring harness assembly from the TFP manual valve position switch. 2. Measure the resistance from terminal C of the TFP manual valve position switch to the switch housing. Is the resistance greater than the value indicated?	50 kΩ	*Go to Step 15*	*Go to Step 16*
7	1. Start the engine, and let the engine idle. 2. Set the parking brake. 3. Place the gear selector in Drive (D4). 4. Measure the resistance from terminal R to the transmission case. Is the resistance less than the indicated value?	200 Ω	*Go to Step 8*	*Go to Step 14*
8	1. Place the gear selector in Drive (D4). 2. Measure the resistance from terminal P to the transmission case. Is the resistance less than the value indicated?	200 Ω	*Go to Step 9*	*Go to Step 14*
9	1. Place the selector in Low (D1). 2. Measure the resistance from terminal N to the transmission case. Is the resistance less than the value indicated?	200 Ω	*Go to Step 10*	*Go to Step 14*
10	1. Place the gear selector in Low (D1). 2. Measure the resistance from terminal P to the transmission case. Is the resistance greater than the value indicated?	50 kΩ	*Go to Step 11*	*Go to Step 16*

TFP Manual Valve Position Switch Resistance Check (cont'd)

Step	Action	Value(s)	Yes	No
11	1. Place the gear selector in REVERSE. 2. Measure the resistance from terminal N to the transmission case. Is the resistance less than the value indicated?	200 Ω	*Go to Step 12*	*Go to Step 16*
12	1. Place the transmission in REVERSE. 2. Measure the resistance from terminal P to the transmission case. Is the resistance greater than the value indicated?	50 kΩ	*Go to step 13*	*Go to Step 16*
13	1. Place the gear selector in Manual Third (D3). 2. Measure the resistance from terminal R to the transmission case. Is the resistance greater than the value indicated?	50 kΩ	System OK	*Go to Step 16*
14	1. Disconnect the A/T wiring harness from the TFP manual valve position switch. 2. Inspect circuits 1224, 1225, and 1226 of the A/T wiring harness assembly for an open circuit. Did you find a condition?	—	*Go to Step 15*	*Go to Step 16*
15	Replace the A/T wiring harness assembly. Refer to A/T Wiring Harness Replacement. Is the replacement complete?	—	*Go to Step 1*	—
16	1. Replace the TFP manual valve position switch. 2. Refer to *Control Valve Body Replacement.* 3. Inspect the A/T wiring harness assembly. Is the replacement of the TFP manual valve position switch complete?	—	*Go to Step 1*	—

Shift Solenoid Leak Test



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1. Clamp a piece of 1/2 inch I.D. rubber hose over the fluid inlet end of the solenoid.
2. Connect a wire from one of the solenoid terminals to the negative terminal (ground) of the battery.
3. Apply compressed air to the rubber hose. Do not use air pressure in excess of 120 psi. Excessive pressure will not allow the solenoid ball check valve to seat properly.
4. Connect a wire from the other solenoid terminal to the positive terminal (12 volts) of the battery.
5. Observe air flow through the solenoid. Replace the solenoid if there is an air leak when the solenoid is energized.

AT Oil Cooler Flow Test

Flushing Procedure

Tools Required

- *J 35944-A* Oil Cooler and Line Flusher
- *J 35944-20* Flushing Solution

1. Remove the fill cap on the *J 35944-A* and fill with 0.6 liter (20 oz) of the *J 35944-20.*
   - Do not overfill.
   - Follow the manufacturer's suggested procedures for handling the solution.
2. Install the cap on the *J 35944-A* and pressurize it to 550–700 kPa (80–100 psi).
3. Connect the *J 35944-A* to the transmission end of the oil cooler pipe that feeds the bottom fitting of the oil cooler.
4. Connect the discharge hose to the top oil cooler pipe.
5. Clip the discharge hose to the oil drain container.
6. With the water valve on the *J 35944-A* in the OFF position, connect the water supply to the tool.
7. Turn on the water supply.

Notice: If water does not flow through the oil cooler (system is completely plugged), do not continue the flushing procedure, or damage to the tool or components could result. Turn the water OFF immediately. Inspect the pipes and the cooler for restrictions. Replace the oil pipe(s) and/or the oil cooler.

8. Flush the transmission fluid by opening the water valve to the ON position for 10 seconds.
9. Close the water valve and clip the discharge hose to a 5 gallon pail.
10. Cover the pail with a shop towel in order to prevent splash.
11. Turn the water valve to the ON position and depress the trigger in order to mix the flushing solution into the water flow.
12. Use the bale clip provided in order to hold the trigger down.
13. Flush the cooler with water and the solution for 2 minutes. During this flush, attach an air supply to the air valve located on the tool for 3 to 5 seconds every 15 to 20 seconds. This will create a surging action to ensure complete cleaning.
14. Release the trigger and turn off the water valve.
15. Disconnect both hoses from the oil cooler pipes in order to perform an initial flush.
16. Reconnect the hoses to the pipes opposite the initial flush to do a backflush.
17. Turn the water valve to the ON position and depress the trigger in order to mix the flushing solution into the water flow.
18. Use the bale clip provided in order to hold the trigger down.
19. Flush the cooler with water and the solution for 2 minutes. During this flush, attach an air supply to the air valve located on the tool for 3 to 5 seconds every 15 to 20 seconds. This will create a surging action to ensure complete cleaning.
20. Release the trigger. Rinse with water for one minute.
21. Turn off the water valve.
22. Attach the air supply to the air valve.
23. Dry the system with air until no moisture is seen leaving the discharge hose.
24. Connect the cooler feed pipe to the transmission.

    The cooler feed is the TOP connector at the transmission.
25. Clip the discharge hose to the oil drain container.
26. After filling the transmission with fluid, start the engine.
27. Run the engine for 30 seconds to remove the residual moisture from the oil cooler.

    At least two quarts of the fluid should flow during the 30 second period.
28. If the fluid flow was insufficient, check flow from the transmission by disconnecting the feed line at the cooler and observing the flow for another 30 seconds.

    Check for the following conditions:
    - Insufficient Flow — Inspect the transmission for causes.
    - Sufficient Flow — Inspect the cooler pipes, fittings and repeat the cooler flushing procedure. If the flow is still insufficient, replace the cooler.
29. Remove the discharge hose and reconnect the cooler pipes.

    Adjust the fluid level.

Symptom Diagnosis

The following table consists of seven diagnostic categories that are located in the left-hand column. Using this column, choose the appropriate category based on the operating conditions of the vehicle or transmission. After selecting a category, use the right-hand column to locate the specific symptom diagnostic information.

Symptom Diagnosis

Diagnostic Category	Diagnostic Information
Important: The Functional Test Procedure should be performed before beginning any diagnosis. If this procedure has not already been performed, refer to *Functional Test Procedure.*	
Fluid Diagnosis This category contains the following topics: • Fluid condition (appearance, contaminants, smell, overheating) • Line pressure (high or low) • Fluid leaks	• Refer to *Transmission Fluid Checking Procedure.* • Refer to *Fluid Foaming.* • Refer to *Transmission Overheats.* • Refer to *Transmission Overheats at WOT.* • Refer to *High Line Pressure.* • Refer to *Low Line Pressure.* • Refer to *Inadequate Lubrication at Low Line or Heavy Loads.* • Refer to *Inadequate Lubrication.* • Refer to *Fluid Leak Diagnosis.* • Refer to *Case Extension Bearing/Seal Failed.* • Refer to *Oil Out the Vent Tube.* • Refer to *Oil Pan Fluid Leak.* • Refer to *Fill Tube Fluid Leak.* • Refer to *Electrical Connector Fluid Leak.* • Refer to *Cooler Connector Fluid Leaks.* • Refer to *Case Extension Fluid Leak.* • Refer to *Manual Shaft Fluid Leak.* • Refer to *Pump Body Seal Fluid Leak.* • Refer to *Vehicle Speed Sensor Fluid Leak.* • Refer to *Output Shaft Seal Fluid Leak.* • Refer to *Line Pressure Plug Fluid Leak.*
Noise and Vibration Diagnosis This category contains the following topics: • Noise (drive gear, final drive, whine, growl, rattle, buzz, popping) • Vibration	• Refer to *Noise.* • Refer to *Vibration.* • Refer to *Torque Converter Vibration Test.*

Symptom Diagnosis (cont'd)

Diagnostic Category	Diagnostic Information
Range Performance Diagnosis This category contains the following topics: • Drives in Neutral • No Park/Neutral • No Reverse • Engine stalling • No Drive • No engine braking • No or incorrect gear selection	• Refer to *Forward Motion in Neutral.* • Refer to *No Park.* • Refer to *No Reverse.* • Refer to *Engine Stall.* • Refer to *No Torque in Reverse and Third.* • Refer to *Loss of Power.* • Refer to *No Torque in Second Gear.* • Refer to *Loss of Drive.* • Refer to *No Overrun Braking - D1.* • Refer to *No Engine Braking - D1.* • Refer to *No Overrun Braking - D2.* • Refer to *No Engine Braking - D2.* • Refer to *No Second Gear Engine Braking - D2.* • Refer to *No Overrun Braking - D3.* • Refer to *No Engine Braking - D3.* • Refer to *Engine Starts in Gear.* • Refer to *Shift Lever Indicates Wrong Gear.* • Refer to *No Gear Selection.* • Refer to *Remains in Park.* • Refer to *Difficult to Shift Out of Park.* • Refer to *Does Not Stay in Park.*
Shift Quality (Feel) Diagnosis This category contains the following topics: • Erratic shifts • Harsh, soft, delayed or slipping shifts • Harsh, soft, or delayed engagement	• Refer to *Erratic Shift Quality.* • Refer to *Harsh Shifts.* • Refer to *Transmission Slips.* • Refer to *Harsh Shift 3 to 4.* • Refer to *Harsh Shift 4 to 3.* • Refer to *Harsh Shift D4 to D3, D2, or D1.* • Refer to *Soft Shifts.* • Refer to *Delayed Shift 1 to 2.* • Refer to *Soft Shift 2 to 3.* • Refer to *Soft Shift D3 to D2.* • Refer to *Soft Shift 3 to 2.* • Refer to *No D3 to D2.* • Refer to *No D2 to D1.* • Refer to *Harsh Shift D to R.* • Refer to *Soft Shift into R.* • Refer to *Soft Shift R to D.*

Symptom Diagnosis (cont'd)

Diagnostic Category	Diagnostic Information
Shift Pattern This category contains the following topics: • One forward gear missing or slipping • One forward gear only • Two forward gears only • Non-First gear start	• Refer to *No First Gear - D1.* • Refer to *No First Gear - D2.* • Refer to *No First Gear - D4.* • Refer to *No Second Gear - D1.* • Refer to *No Second Gear - D2.* • Refer to *No Second Gear - D4.* • Refer to *No Second Gear - D3.* • Refer to *No Third Gear - D3.* • Refer to *No Third Gear - D4.* • Refer to *No Fourth Gear - D4.* • Refer to *First Gear Only - D4.* • Refer to *Second Gear Only - D4.* • Refer to *First and Second Gear Only - D4.* • Refer to *First and Fourth Gear Only - D4.* • Refer to *Second and Third Gear Only - D4.* • Refer to *Third and Fourth Gear Only - D4.* • Refer to *Second Gear Starts.* • Refer to *Third Gear Starts.* • Refer to *Fourth Gear Starts.*
Shift Speed Diagnosis This category contains the following topic: Inaccurate or inconsistent shift points	Refer to *Inaccurate Shift Points.*
Torque Converter Diagnosis This category contains the following topics: • Torque Converter Diagnosis • TCC does not apply • TCC does not release • TCC apply/release quality • Poor acceleration/No Torque Multiplication • Converter Ballooning • Engine Stall	• Refer to *Torque Converter Diagnosis Procedure.* • Refer to *Torque Converter Vibration Test.* • Refer to *No TCC Apply.* • Refer to *TCC Stuck On.* • Refer to *Soft TCC Apply.* • Refer to *Incorrect TCC Apply or Release.* • Refer to *No Torque Multiplication.* • Refer to *Slipping TCC.* • Refer to *Converter Ballooning.* • Refer to *Engine Stall in Neutral.*

High Line Pressure

Checks	Cause
Pressure Regulator Valve (231)	Valve is stuck at high torque signal due to an undersized bore or sediment
Reverse Boost Valve (228)	Valve is stuck at high torque signal due to an undersized bore or sediment
Retainer Pin (211)	Pin is broken
Orificed Plug (210)	Plug is blocked
Pressure Control Solenoid Valve (320)	• Valve has failed Off • Loose connector
VCM/PCM	Loose connector
Check the VCM/PCM for current DTCs	

Forward Motion in Neutral

Checks	Cause
Manual Valve (319)	Valve is mispositioned or stuck
Forward Clutch Springs (607)	Jammed
Forward Clutch Piston (606)	Jammed
Forward Clutch Plates (610, 611)	Seized or jammed
Forward Clutch Housing (602)	The hole is plugged
Hub (613)	The holes are plugged

Inadequate Lubrication at Low Line or Heavy Loads

Checks	Cause
Converter Limit Valve (214)	Valve is stuck closed by sediment or by a collapsed valve bore
Retainer Pin (211)	Broken

Inadequate Lubrication

Checks	Cause
Pressure Regulator Valve (231)	Valve is stuck in a high demand position
Pump Body (206)	Cross channel leakage
Gasket (6)	Damaged
Oil Transfer Hole Cup Plug	Plug is leaking

Engine Stall in Neutral

Checks	Cause
TCC System	TCC is stuck On or TCC is dragging

Loss of Power

Checks	Cause
Transmission	• Low oil • Not starting in first gear
TCC System	TCC is stuck On, or TCC is dragging
Torque Converter (1)	Debris is in the converter
Stator Shaft (235)	Shaft is broken
Turbine Shaft (502)	The bushing is worn
Main Shaft (662)	The bushing is worn
Output Shaft (671)	The bushing is worn
Bearing (668)	The bearing is worn

No Torque in Reverse and Third

Checks	Cause
Forward Clutch Hub (613)	The hub is broken
Snap Ring (616a)	The ring is not seated
Forward Clutch Housing (602)	The housing is broken
Direct Clutch Piston (619)	Piston Broken

Transmission Overheats

Checks	Cause
TCC Circuit	Blockage during apply or release
TCC Valve Spring (224)	The spring is broken
Pump Cover (206)	Cross channel leakage
Pressure Regulator Valve (231)	The valve is stuck in a high demand position
Oil Cooler	The cooler or the cooler lines are blocked
Gasket (6)	The gasket is damaged
Retainer Pin (211)	The pin is broken
Turbine Shaft O-ring (2)	The O-ring is damaged
Turbine Shaft Seals (503)	The seals are damaged
Stator Shaft Bushing (233)	The bushing is worn or damaged
Oil Transfer Hole Cup Plug	The plug is leaking
Fluid	The fluid level is low
Radiator	Air flow is restricted

Transmission Overheats at WOT

Checks	Cause
Converter Limit Valve Bypass Orificed Cup Plug	The plug is blocked, therefore the converter limit valve is stuck closed

Low Line Pressure

Checks	Cause
Pump (203)	Cross channel air leak at body to cover, or cross channel air leak at body to case gasket
Pressure Regulator Valve (231)	Valve is stuck at a low torque signal, due to an undersized bore or to sediment.
Reverse Boost Valve (228)	Valve is stuck at a low torque signal, due to an undersized bore or to sediment.
Pump Valve Bores	Excessive valve clearance due to wear.
Spring (230)	The spring is broken
Retainer Pin (211)	The pin is broken
Valve Body (301)	• Cross channel leaks • Cross valve land leaks
Gasket/Spacer Plate	Plate is damaged or missing
Pressure Control Solenoid Valve (320)	• Valve is stuck On • Broken clip causes leakage • Wire is pinched to ground • A screen is missing
VCM/PCM	Failed
Check the VCM/PCM for current DTCs	

Engine Starts in Gear

Checks	Cause
Manual Valve (319)	• Valve is not engaged to the detent lever • Valve is stuck in the wrong position
Neutral Safety Switch	The switch is not working

Shift Lever Indicates Wrong Gear

Checks	Cause
Manual Valve (319)	Not engaged to detent lever
Detent Pin (711)	Misaligned or broken
Manual Shaft (708)	The flats are not parallel
Indicator Linkage	Misadjusted

No Gear Selection

Checks	Cause
Detent Lever (711)	The nut is loose or missing
Manual Valve (319)	The valve is stuck
Spacer Plate (46)	The holes are blocked
Valve Body/Case (301, 7)	The channels are blocked

Loss of Drive

Checks	Cause
Torque Converter (1)	• Broken lug or failed lug welds • Sheared lug bolts • Worn turbine shaft splines • Low oil • Pump hub is cracked, scored, or broken • Internal failure • Failure of the closure weld • The cover is cracked at a lug weld
Pump (203)	• The pump is seized • The pump gears are broken
Case Extension Seal (20)	The seal is missing, damaged, or displaced
Orifice Plate	The plate is missing or leaking around the edge
Gasket (6)	Damaged
Oil Transfer Hole Cup Plug	The plug is leaking or missing
Seals (503)	The seals are damaged or missing
Housing (504)	The housing is broken
Roller Clutch (512)	The clutch is worn, broken, or locked
Carrier (514)	Broken
Pinions (518)	• Broken free from the pilot • Spalled pins or pinions • Plugged pinion pin holes • Worn thrust washers • Lack of lube
Bearing (513)	The bearing is broken
Roller Clutch (644)	• Clutch is worn, broken, or locked • Lack of lube
Turbine Shaft (502)	The shaft or the splines are broken
Forward Clutch Components	
Seals (603, 604, 605)	Nicked or cut
Checkball	Leaking
Piston (606)	Cracked or jammed
Housing (602)	Cracked
Friction Plates (611)	The plates are burned or the splines are worn
Reaction Plates (610)	The plates are worn or the splines are worn
Spring Assembly (607)	Jammed

Loss of Drive (cont'd)

Checks	Cause
Driving Hub (615)	Broken
Retainer Ring (616)	The ring is not seated
Driven Hub (613)	The gear teeth are worn
Rear Gear set	
Pinions (655)	Broken or spalled
Pinion Pins (656)	Broken or spalled
Needle Bearings (654)	Broken or spalled
Sun Gear (649)	Broken or spalled
Pinion Thrust Washers (652)	Worn
Rear Internal Gear (666)	Broken or spalled
Front Internal Gear (661)	Broken or spalled
Turbine Shaft Ball Seal	Ineffective
Main Shaft (662)	The shaft or the splines are broken
Fluid Pressure	Too low

No Park

Checks	Cause
Detent Lever (711)	• Incomplete travel • Lever is misaligned
Actuator Rod (710)	The rabbit ears are bent, disconnected, or broken
Detent Spring (41)	Mispositioned
Parking Pawl (703)	Broken
Pawl Shaft (702)	Broken
Park Bracket (713)	Bent or broken
Bolt (714)	Loose or broken
Front Internal Gear (661)	The splines are broken
Manual Shaft (708)	The flats are not parallel

Remains in Park

Checks	Cause
Actuator Rod Assembly (710)	Stretched

Difficult to Shift Out of Park

Checks	Cause
Pawl Return Spring (705)	Weak or broken
Vehicle	Parked on a hill

Does Not Stay in Park

Checks	Cause
Detent Spring (41)	Weak or broken

No Reverse

Checks	Cause
Case (7)	The rear band anchor pin is broken or the pin is not positioned
Center Support (640)	Leaking at the case, or the support is broken
Center Support Seal (639)	Leaking
Center Support Bolt (25)	• The bolt is loose or broken • The feed hole is blocked
Rear Band (657)	Broken, worn, or not anchored
Rear Band Apply Pin (73)	The pin is too short, or the pin is binding in the case
Piston (65)	Binding in the case
Seal (66)	Leaking, damaged, or worn
Gasket (63)	Damaged or displaced
Cover (62)	Damaged
Bolts (61)	Broken, loose, or missing
Checkball	Missing
Fluid Pressure	Too low
Direct Clutch Components	
Reaction Plates (618)	The splines are worn
Friction Plates (611)	The splines or the friction are worn
Spring Assembly (607)	Jammed
Housing (623)	Cracked
Piston (619)	Leaking
Seal (620, 621, 622)	Leaking
Ball Check	Leaking

No First Gear - D1

Checks	Cause
Refer to *No First Gear - D4*	
Housing (504)	Broken
Case (7)	The rear band anchor pin is broken or the pin is not positioned
Detent Lever (711)	Misaligned

No Second Gear - D1

Checks	Cause
Refer to *No Second Gear - D4*	

No Overrun Braking - D1

Checks	Cause
Refer to *No Overrun Braking - D3*	
Check the VCM/PCM for current DTCs	
Automatic Transmission Fluid Pressure Manual Valve Position Switch Assembly	• Pinched wire • Loose connector • Loose bolt causing leakage • No signal to the VCM/PCM

No Engine Braking - D1

Checks	Cause
Rear Band (657)	Damaged, worn, or not anchored
Rear Band Apply Pin (73)	The pin is too short or is binding in the case
Piston (65)	The piston is binding in the case
Seal (66)	Worn or damaged
Cover (62)	Damaged
Gasket (63)	Damaged or missing
Bolt (61)	Loose, broken, or missing
Checkball	• Missing • Damaged • Not sealing • Incorrect size
Fluid Pressure	Too low
Output Shaft (671)	The shaft or the splines are broken
Main Shaft (662)	The shaft or the splines are broken
Thrust Washer (218)	Worn or damaged
Bushing (234)	Worn or damaged

No First Gear - D2

Checks	Cause
Refer to *No First Gear - D4*	
Front Band (628)	Stuck On

No Second Gear - D2

Checks	Cause
Refer to *No Second Gear - D4*	
Case (7)	• The front band anchor pin is broken or the pin is not properly positioned • The intermediate clutch feed cup plug is missing or the plug is not seated.

No Overrun Braking - D2

Checks	Cause
Refer to *No Overrun Braking - D3*	

No Engine Braking - D2

Checks	Cause
Bushing (234)	Worn or damaged
Thrust Washer (218)	Worn or damaged
Rear Gear set	Spalled or broken
Reaction Drum and Carrier (651)	Broken
Main Shaft (662)	The shaft or the splines are broken
Output Shaft (671)	The shaft or the splines are broken
Sun Gear Shaft (649)	The shaft or the splines are broken

No Second Gear Engine Braking - D2

Checks	Cause
Fluid Pressure	Too low
Direct Clutch Housing (623)	• *The internal diameter of the splines are worn* • The outer band surface is worn
Front Band (628)	Broken, worn, or not anchored
Apply Pin (55)	Too short or binding in the case
Apply Clip (56)	Broken or missing
Piston (58)	Cracked, broken, or binding
Seal (57)	Damaged or worn
Case (7)	Cracked or damaged
Spacer Plate (46)	Damaged
Gasket (48)	Torn or pinched
Valve Body Bolts (35)	Loose, broken, or missing

No First Gear - D3

Checks	Cause
Refer to *No First Gear - D4*	
Front Band (628)	Stuck On

No Second Gear - D3

Checks	Cause
Refer to *No Second Gear - D4*	

No Third Gear - D3

Checks	Cause
Refer to *No Third Gear - D4*	
Front Band (628)	Stuck On

No Overrun Braking - D3

Checks	Cause
Clutch Plates (508, 509)	The splines or the plate are worn
Thrust Washer (218)	Damaged or worn
Output Shaft (671)	The shaft or the splines are broken
Seals	Cut or nicked
Checkball	Leaking
Piston (505)	Jammed, cracked, or damaged
Housing (504)	Cracked or damaged
Sun Gear (650)	Worn
Spring Assembly (506)	Jammed
Oil Feed	Plugged

No Engine Braking - D3

Checks	Cause
Main Shaft (662)	The shaft or the splines are broken
Bushing (234)	Damaged or worn

No First Gear - D4

Checks	Cause
Low Roller Assembly (644)	• Assembly is not attached • Broken race
Center Support (640)	Broken support or broken splines
Case (7)	Check damage near the center support
Retainer Rings (633, 643)	Rings are not seated

First Gear Only - D4

Checks	Cause
Sun Gear Shaft (649)	Broken shaft or broken splines
A/T Output Speed Sensor Assembly (22)	Reads zero - Check for DTCs
A/T Input Speed Sensor Assembly (22)	Reads zero - Check for DTCs

First and Second Gear Only - D4

Checks	Cause
2–3 Solenoid (311) - Check for DTCs	• Stuck Off • Loose connector • No voltage to the solenoid • Solenoid O-ring failure • No PCM signal to the solenoid
2–3 Shift Valve (312)	Stuck
Quad Driver Module	Failed
Check the VCM/PCM for current DTCs	

Second Gear Only - D4

Checks	Cause
Check the VCM/PCM for current DTCs	

Second and Third Gear Only - D4

Checks	Cause
1–2 Solenoid (313) - Check for DTCs	• Stuck Off • Loose connector • No voltage to the solenoid • Solenoid O-ring failure • No PCM signal to the solenoid
1–2 Shift Valve (314)	Stuck
Quad Driver Module	Failed
Check the VCM/PCM for current DTCs	

First and Fourth Gear Only - D4

Checks	Cause
1–2 Solenoid (313)	• Stuck On • Pinched wire to ground
1–2 Shift Valve (314)	Stuck
Quad Driver Module	Failed
Check the VCM/PCM for current DTCs	

Third and Fourth Gear Only - D4

Checks	Cause
2–3 Solenoid (311)	• Stuck On • Pinched wire to ground
2–3 Shift Valve (312)	Stuck
Quad Driver Module	Failed
Check the VCM/PCM for current DTCs	

No Second Gear - D4

Checks	Cause
Case (7)	The intermediate clutch feed cup plug is missing or the cup plug is not seated
Intermediate Clutch Components	
Backing Plate (630)	Broken
Retainer Ring (633)	Missing or not seated
Friction Plates (631)	Worn
Outer Race (625)	Worn Splines
Center Support (640)	The support is cracked or the feed hole is blocked
Center Support Bolt (25)	• The bolt is broken or loose • The oil hole is blocked
Seals (637, 638)	Worn
Piston (636)	Cracked or jammed
Springs (635)	Jammed
Transmission Fluid	• Improper fluid • Additive package
Intermediate Sprag (624)	• The outer race splines are worn • The outer race is broken • The splines or the inner race is worn
Direct Clutch Housing (623)	Broken
Retainer Ring (627)	Missing or not seated

No Third Gear - D4

Checks	Cause
Direct Clutch Components	
Seal (620, 621, 622)	Leaking
Ball Check	Leaking
Piston (619)	Cracked or jammed
Housing (623)	Cracked
Reaction Plates (618)	Worn splines
Friction Plates (611)	Worn splines or worn friction
Spring Assembly (607)	Jammed
Center Support Seals (639)	The seals are leaking at the center support hub
Center Support (640)	The support is broken or leaking at the case
Center Support Bolt (25)	• Loose or broken • Blocked hole
2–3 Solenoid (311)	• Stuck Off • Pinched wire • O-ring failure • No voltage to the solenoid
VCM/PCM	No signal to the solenoid
2–3 Shift Valve (312)	Stuck
Quad Driver Module	Failed
Check the VCM/PCM for current DTCs	

No Fourth Gear - D4

Checks	Cause
Fourth Clutch Components	
Seals (527) (531)	Nicked or cut
Cup Plug (530)	Missing
Bolt (26)	Loose, broken, or missing
Piston (528)	Jammed
Spring Assembly (532)	Jammed
Retainer Ring (523)	Not seated
Friction Plates (525)	Worn or burned
Reaction Plates (526)	Worn splices
Housing (529)	Damaged or cracked
Overrun Clutch Components	
Housing (504)	Broken
Reaction Plates (508)	Worn splines
Sun Gear (650)	Worn
1–2 Solenoid (313)	• Stuck Off • Pinched wire • O-ring failure • No voltage to the solenoid
VCM/PCM	No signal to the solenoid
3–4 Shift Valve (308)	Stuck
Quad Driver Module	Failed
Check the VCM/PCM for current DTCs	

No TCC Apply

Checks	Cause
TCC Shift Solenoid Valve (323)	• Stuck Off • O-ring failed • No voltage to the solenoid • Poor connection
Quad Driver Module	Failed
VCM/PCM	No signal to the solenoid
Brake Switch	• The contact is corroded • Poor connection • Pinched wire • Misadjusted • No supply voltage
TCC Valve (223)	The valve is stuck Off due to sediment or to an undersized bore
Retainer Pin (211)	Broken
Torque Converter (1)	Ballooning
Turbine Shaft (502)	Plugged oil holes
Turbine Shaft Seals (501)	Ineffective
Pump Body Bushing (202)	Worn
O-ring (2)	Heat set
Oil Transfer Hole Cup Plug	Leaking
Regulated Apply Valve (324)	Stuck
TCC Valve Release Exhaust Orificed Cup Plug	Blocked
Check VCM/PCM for the current DTCs	
Refer to *Incorrect TCC Apply or Release*	

Soft TCC Apply

Checks	Cause
Turbine Shaft Seals (501)	Ineffective
Pump Body Bushing (202)	Worn
O-ring (2)	Heat set
Oil Transfer Hole Cup Plug	Leaking
TCC Solenoid (323)	Malfunction
Fluid	Low pressure

Slipping TCC

Checks	Cause
TCC Valve Release Exhaust Orificed Cup Plug	Blocked
Turbine Shaft Seal	Cut

TCC Stuck On

Checks	Cause
Gasket (6)	Damaged
TCC Shift Solenoid Valve (323)	• Stuck On • Pinched wire to ground
TCC Apply Valve (324)	Stuck
Quad Driver Module	Failed
Check VCM/PCM for current DTCs	
Refer to *Incorrect TCC Apply or Release*	

Incorrect TCC Apply or Release

Checks	Cause
A/T Output(Shaft) Speed Sensor Assembly (22)	• Poor connection • Pinched wire • A broken coil wire • Incorrect air gap • Inadequate signal
Throttle Position Sensor	• Poor connection • Pinched wire • Incorrect resistance
VCM/PCM	Failed
Automatic Transmission Fluid Pressure Manual Valve Position Switch (40)	• Poor Connection • No signal to the VCM/PCM • Pinched wire
A/T Fluid Temperature Sensor Assembly (332)	• Poor Connection • No signal to the VCM/PCM • Incorrect Resistance • Pinched wire
Engine Coolant (Gas only)	No signal to the VCM/PCM
Brake Switch	• Poor connection • Pinched wire • No voltage supply • Misadjusted
Engine Ignition Module	Loss of signal or intermittent
Check the VCM/PCM for current DTCs	
Only 2WD	
Digital Ratio Adapter (DRAC)	• Malfunction • Incorrect

Converter Ballooning

Checks	Cause
Converter Limit Valve (214)	Stuck open due to sediment or undersized bore
At High Speeds: Converter Limit Valve Feedback Orificed Cup Plug	Blocked
Converter Stator	Locked-up

No Torque Multiplication

Checks	Cause
Stator Shaft (235)	Broken or detached from the pump cover

Fluid Foaming

Checks	Cause
Fluid	• Contaminated antifreeze • Overfilled transmission
Engine	Overheated
Filter (31)	Cracked or not seated
Seal (32)	Damaged or not seated
Vehicle	Overloaded

Noise

Checks	Cause
Torque Converter (1)	• Loose lug bolts • Out of balance • Internal failure
Transmission/Engine	Misaligned
Case Extension (19)	Output shaft support bushing is worn

Engine Stall

Checks	Cause
Fourth Clutch Components	
Plates (525, 526)	Seized or jammed
Piston (528)	Jammed
Spring Assembly (532)	Jammed
Overrun Clutch Components	
Plates (508, 509)	Seized or jammed
Piston (505)	Jammed
Spring Assembly (506)	Jammed

Vibration

Checks	Cause
Torque Converter (1)	• Out of balance • Internal failure
Transmission/Engine	Misaligned
Case Extension (19)	Output shaft support bushing is worn
Turbine Shaft (502)	Worn surface of the stator shaft bushing
Main Shaft (662)	Worn Bushing
Output Shaft (671)	Worn Bushing
Bearing (668)	Worn

Oil Out the Vent Tube

Checks	Cause
Pump Cover (206)	Cross channel leakage can pressurize the vent area
Fluid	• Foaming and filling the pump vent ports • Transmission is overfilled
Transmission	Overheated

No Torque in Second Gear

Checks	Cause
Intermediate Sprag (624)	• Worn • Excessive eccentricity • The sprag is rolled over or the sprag is damaged

Second Gear Starts

Checks	Cause
Intermediate Clutch Plates (631, 632)	Seized
Direct Clutch Lube Feed	Blocked
Center Support Springs (635)	Jammed
Center Support Piston (636)	Jammed
1–2 Shift Solenoid Valve (313)	• Stuck Off • O-ring failed • No voltage to the solenoid • Poor connection
VCM/PCM	No VCM/PCM signal to the solenoid
Quad Driver Module	Failed
1–2 Shift Valve (314)	Stuck
Check the VCM/PCM for current DTCs	

Third Gear Starts

Checks	Cause
Forward Clutch Components	
Driving Hub (615)	Plugged holes
Plates (610, 611)	Seized
Direct Clutch Components	
Piston (619)	Jammed
Spring Assembly (607)	Jammed
Lube Feed Hole	Blocked

Fourth Gear Starts

Checks	Cause
2–3 Shift Solenoid Valve	• Stuck On • Pinched wire to ground
Check the VCM/PCM for current DTCs	

Erratic Shift Quality

Checks	Cause
Gasket (6)	Damaged
Oil Transfer Hole Cup Plug	Leaking
Oil Seal Rings (219)	Damaged

Transmission Slips

Checks	Cause
Fluid Level	Too high or too low

Case Extension Bearing/Seal Failed

Checks	Cause
Orifice Plate	The hole is blocked or the hole is missing
Case Extension (19)	The lube passages are blocked or missing

Inaccurate Shift Points

Checks	Cause
A/T Output(Shaft) Speed Sensor Assembly (22)	• Pinched or broken wire • Loose connector • Incorrect air gap • Inadequate signal • Damaged coil • Damaged rotor teeth • Loose connection
Throttle Position Sensor	• Pinched or damaged wire • Incorrect resistance • Loose connector • VCM/PCM malfunction
A/T Fluid Pressure Manual Valve Position Switch Assembly (40)	• Loose connector • Loose bolts causing leakage • A pinched wire • No signal to the PCM/VCM
Axle Ratio	Ratio is incorrect or ratio has been changed from its original value
Tire Size	Tire size is incorrect or the size has been changed from its original value
Check VCM/PCM for current DTCs	
Only 2WD	
Digital Ratio Adapter (DRAC)	• Incorrect • Malfunction

Harsh Shifts

Checks	Cause
Line Pressure	• Too high • Too low
Pressure Control Solenoid Valve (320)	• Failed Off • Loose connector
VCM/PCM	Loose connector
Accumulator Piston	• Leaking • Stuck
Accumulator Spring	Incorrect
Checkballs	Missing
Calibration PROM	Incorrect
Check the VCM/PCM for current DTCs	

Harsh Shift D to R

Checks	Cause
Direct Lube Exhaust	Blocked
Forward Clutch Spring (607)	Not acting
Retainer Ring (616)	Not seated
Checkball	Plugged

Harsh Shift 3 to 4

Checks	Cause
Spring Assembly (532)	Not compressing evenly
Air Bleed	Plugged

Harsh Shift 4 to 3

Checks	Cause
Retainer Ring (533)	Not seated
Spring Assembly (532)	Not acting
Bolt (26)	The oil feed hole is plugged
Cup Plug (530)	Plugged
Direct Lube Exhaust	Blocked

Harsh Shift D4 to D3, D2, or D1

Checks	Cause
Spring Assembly (506)	Not functioning
Checkball	Plugged
Snap Ring (511)	Not seated

Soft Shifts

Checks	Cause
Line Pressure	Too low
Pressure Control Solenoid Valve (320)	• Stuck On • A broken clip is causing leakage • Pinched wire to ground
VCM/PCM	Failed
Accumulator Piston	• Leaking • Stuck
Accumulator Spring	Incorrect
Calibration PROM	Incorrect
Check the VCM/PCM for current DTCs	

Soft Shift into R

Checks	Cause
Direct Clutch Oil Feed	Plugged
Direct Lube Exhaust	Blocked

Soft Shift R to D

Checks	Cause
Direct Clutch Spring (607)	Not Acting
Retainer Ring (616)	Not engaged or missing
Ball Check	Plugged

Soft Shift 2 to 1

Checks	Cause
Center Support Springs (635)	Not acting
Retainer Ring (634)	Not seated
Center Support (640)	Blocked air bleed

Soft Shift 2 to 3

Checks	Cause
Direct Clutch Oil Feed	Plugged
Direct Lube Exhaust	Blocked

Soft Shift 3 to 2

Checks	Cause
Direct Spring Assembly (607)	Not acting
Retainer Ring (608)	Not engaged or missing
Ball Check	Plugged

Soft Shift D3 to D2

Checks	Cause
Ball Check	Missing
Orifices	Incorrect sizes

Delayed Shift 1 to 2

Checks	Cause
A/T Output(Shaft) Speed Sensor Assembly (22)	• A pinched or broken wire • A loose connector • An incorrect air gap • An inadequate signal • Coil damage
A/T Input (Shaft) Speed Sensor Assembly (22)	• A pinched or damaged wire • Coil damage • An inadequate signal
A/T Fluid Pressure Manual Valve Position Switch Assembly (40)	• A loose connector • A pinched wire • No signal to the VCM/PCM • Loose bolts causing leakage
Calibration PROM	Incorrect
Check the VCM/PCM for current DTCs	
Only 2WD	
Digital Ratio Adapter (DRAC)	• Malfunction • Loose connector

No D2 to D1

Checks	Cause
Rear Band (657)	Broken, worn, or not anchored
Detent Lever (711)	Incomplete travel

No D3 to D2

Checks	Cause
Front Band (628)	Broken, worn, or not anchored

Oil Pan Fluid Leak

Checks	Cause
Oil Pan (28)	The pan is damaged or the pan is not flat
Gasket (29)	Damaged
Case (7)	Porosity or cracked
Bolt (27)	• The flange is inside out • High or low torque

Fill Tube Fluid Leak

Checks	Cause
Seal	• Cut or nicked • Missing
Case (7)	Porosity
Fill Tube	• Damaged at the case end • Not seated in the case
Brackets	Out of position, causing tension on the fill tube

Electrical Connector Fluid Leak

Checks	Cause
Electrical Connector	Damaged, or not seated
O-ring Seal	• Cut or nicked • Missing
Case (7)	Porosity or cracked

Cooler Connector Fluid Leaks

Checks	Cause
Cooler Connectors (8)	• Stripped threads • Damaged flare • High or low torque
Case (7)	• Stripped threads • Porosity • Debris in the threads

Case Extension Fluid Leak

Checks	Cause
Case Extension (19)	Porosity or cracked
Case (7)	Porosity or cracked
Seal (15)	• Cut or nicked • Missing
Bolt (21)	• Low torque • Missing

Manual Shaft Fluid Leak

Checks	Cause
Seal (707)	• Cut or nicked • Not seated
Linkage	Misadjusted

Pump Body Seal Fluid Leak

Checks	Cause
Seal (201)	• Cut, nicked, or worn • Missing garter spring
Torque Converter (1)	Damaged hub
Bolt	Low Torque

Vehicle Speed Sensor Fluid Leak

Checks	Cause
Seal	Cut, missing, or nicked
Vehicle Speed Sensor Assembly (22)	• Damaged • Not seated • Damaged bracket
Bolt (23)	• Low torque • Missing • Damaged threads
Case (7)	Porosity or cracked

Output Shaft Seal Fluid Leak

Checks	Cause
Seal (20)	Cut or nicked
Case (7)	Porosity or cracked

Line Pressure Plug Fluid Leak

Checks	Cause
Plug (24)	• Stripped threads • Low or high torque
Case (7)	• Porosity or cracked • Damaged threads

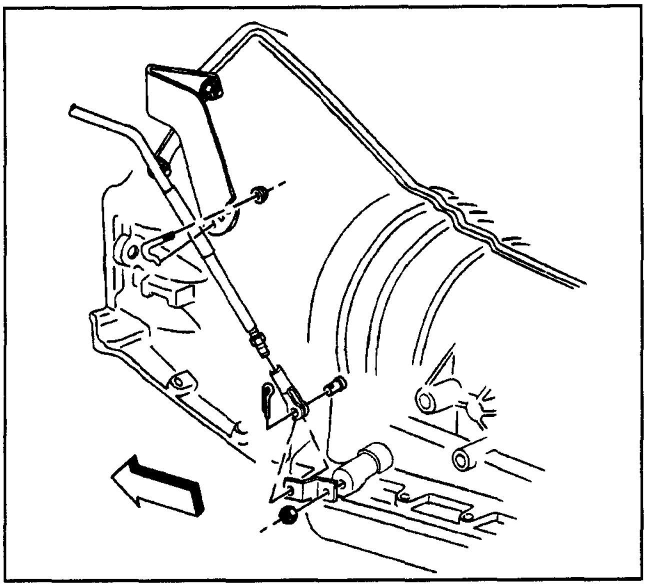
Repair Instructions

Shift Cable Adjustment

1. Apply the parking brake.
2. Place the selector lever in the P (park) position.
3. Place the transmission in the mechanical park position.

Important: The transmission control lever can be positioned to mechanical park by rotating the control lever clockwise until it reaches its full clockwise stop position.

Position each clevis to about the center of travel on the adjusting stud. Make sure that the cotter pin and retainer pin are removed from both ends of the shift cable.



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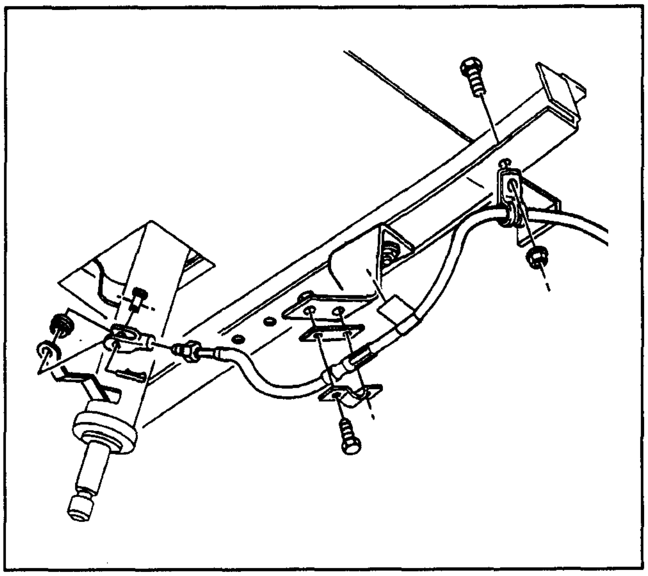
4. Secure the shift cable to the steering column lever with the retainer pin in order to hold the cable to the clevis. Rotate the clevis at the end of the shift cable until the clevis pin hole aligns with the transmission shift lever.
   - Adjust the clevis on the column lever until the transmission end of the shift cable aligns with the shift lever, if the clevis cannot be adjusted to the transmission shift lever,
   - Replace the shift cable if full adjusting travel is reached on both ends of the shift cable and the alignment to the shift lever cannot be made. Refer to *Shift Cable Replacement*.
5. Install the sleeve, cotter pins, and the retainer pins that secure the shift cable ends to the transmission and the steering column lever.
6. Check the alignment of the following:
   - The column selector lever must go into all positions.
   - The engine must start in the P (park) or N (neutral) positions only.
   - Ensure that the parking pawl engages and prevents the vehicle from rolling when the selector lever is positioned to park.
7. Start the engine and check the transmission for normal shift operation.



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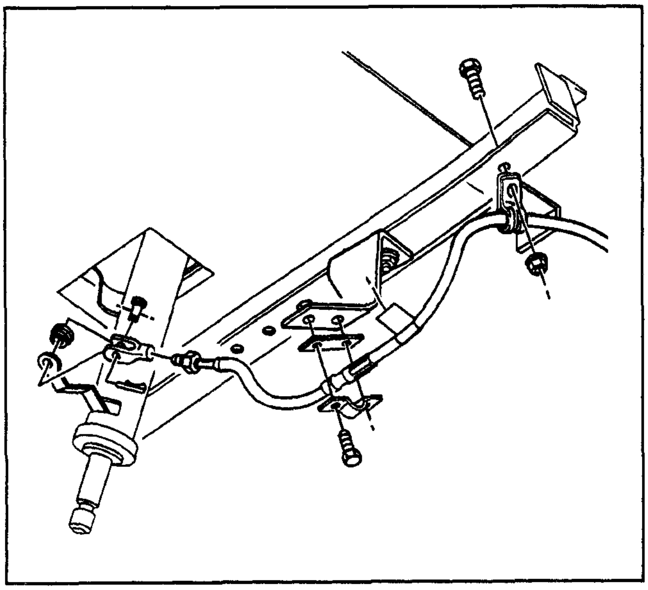

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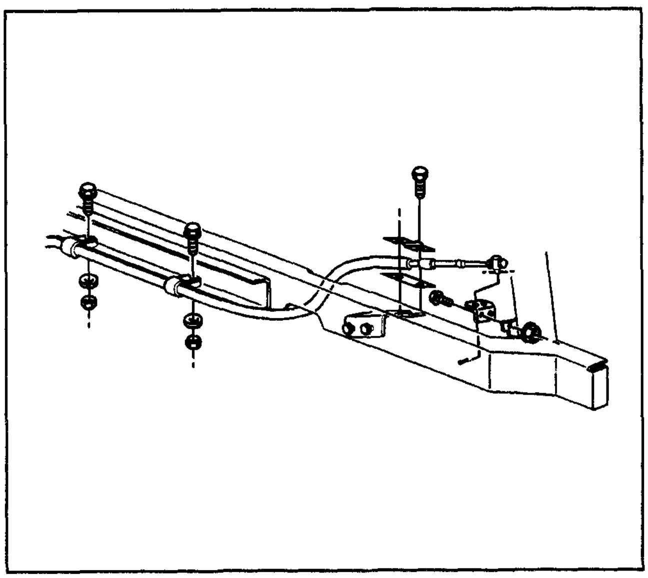
Shift Cable Replacement

Removal Procedure

1. Apply the parking brake.
2. Position the steering column shift lever to park.
3. Remove the following from the steering column lever:
   3.1. The cotter pin
   3.2. The retainer pin
   3.3. The sleeve that secures the shift cable to the steering column lever
4. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.



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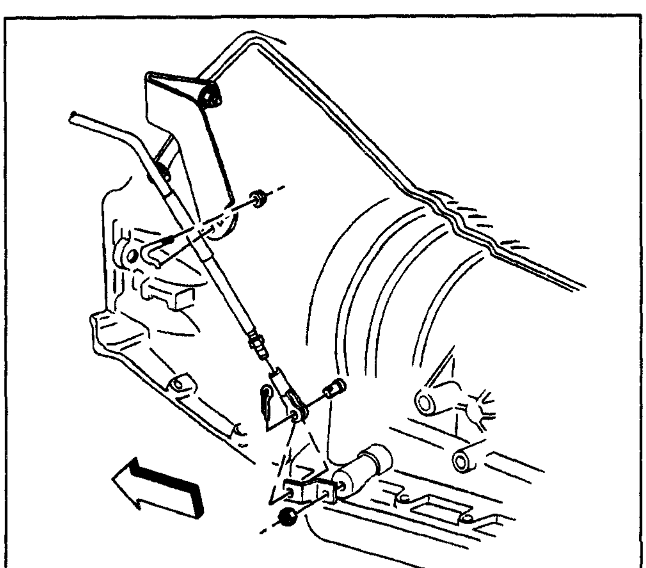
Important: Ensure that the transmission is in the mechanical park position prior to removing the shift cable from the vehicle. The transmission control lever can be positioned to mechanical park by rotating the control lever clockwise until it reaches its full clockwise stop position.

5. Remove the bolts and nuts that secure the shift cable to the frame rail.



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6. Remove the nut that secures the shift cable and clip to the transmission cable bracket.
7. Remove the cotter pin and retainer pin that secures the shift cable to the transmission.
8. Remove the shift cable from the vehicle.

Installation Procedure

Important: Ensure that the column shift lever and the transmission control lever are in the mechanical park position prior to installing the shift cable to the vehicle. The transmission control lever can be positioned to the mechanical park position by rotating the control lever clockwise until it reaches its full clockwise stop position.

1. Install the shift cable to the vehicle.
2. Install the cotter pin and the retaining pin that secures the shift cable to the transmission.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

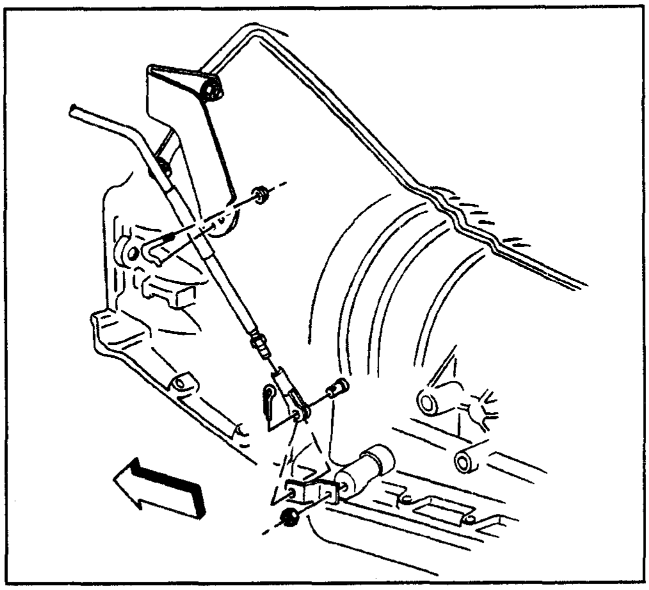
3. Install the nut that secures the shift cable and clip to the transmission cable bracket.

   Tighten

   Tighten the nut that secures the shift cable and clip to the transmission cable bracket to 6 N·m 53 lb in).
4. Install the bolts and nuts that secure the shift cable to the frame rail.

   Tighten

   Tighten the bolts and nuts that secure the shift cable to the frame rail to 10 N·m 53 lb in).
5. Lower the vehicle.



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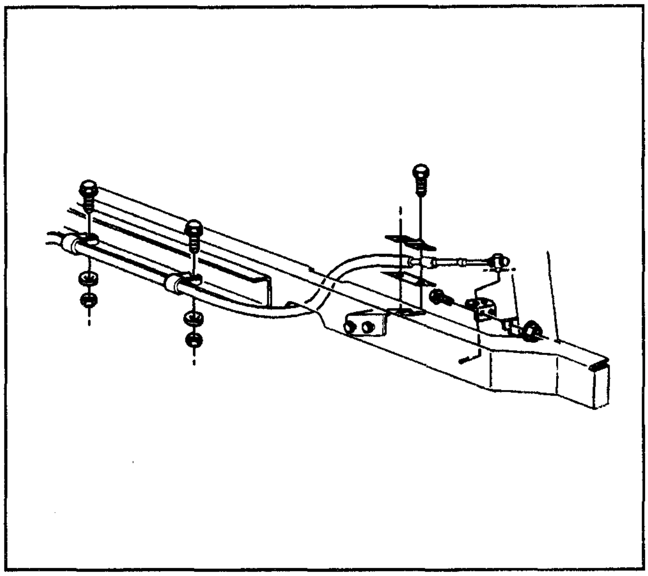

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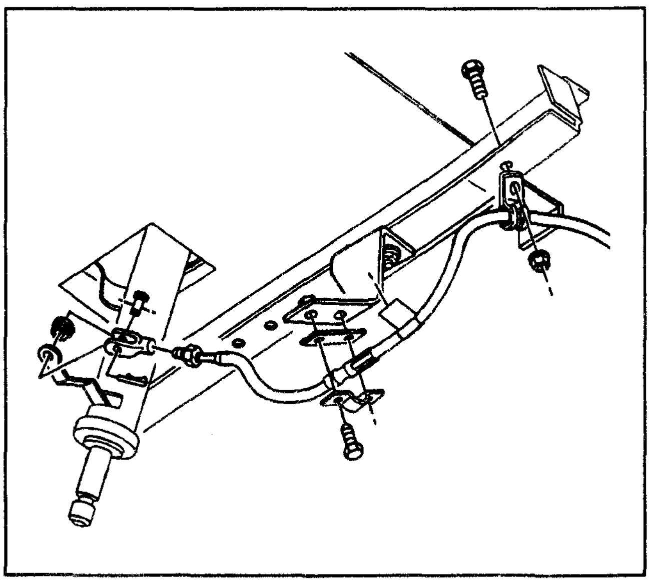
6. Install the following to the steering column lever:
   - The cotter pin
   - The retainer pin
   - The sleeve that secures the shift cable to the steering column lever
7. Adjust the shift cable if required. Refer to *Shift Cable Adjustment.*
8. Start the engine and check the transmission for normal shift operation.



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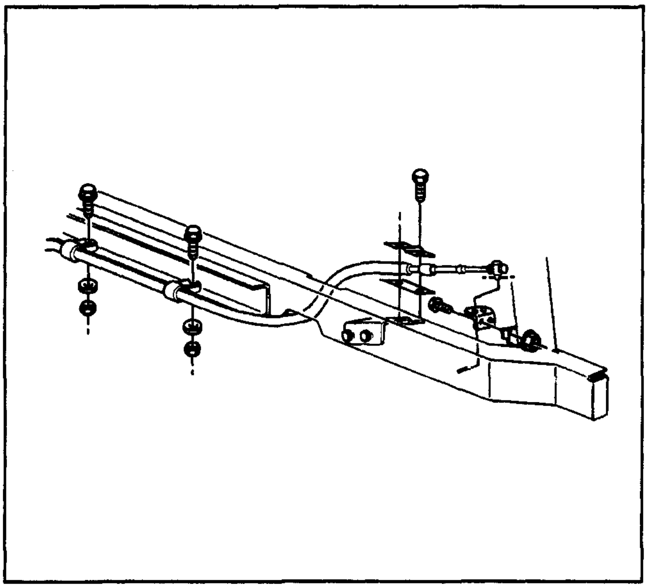

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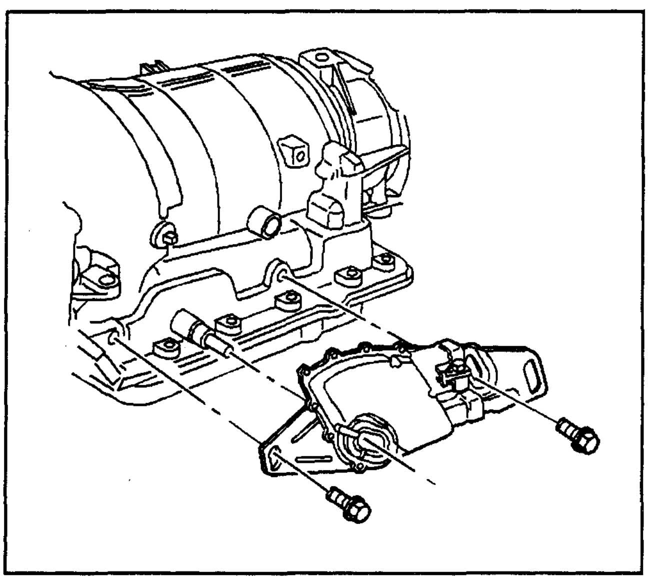


102265

Park/Neutral Position Switch Replacement

Removal Procedure

Tools Required

J 41364-A Neutral Position Adjustment Tool

1. Apply the parking brake.

Caution: Refer to Battery Disconnect Caution in Cautions and Notices.

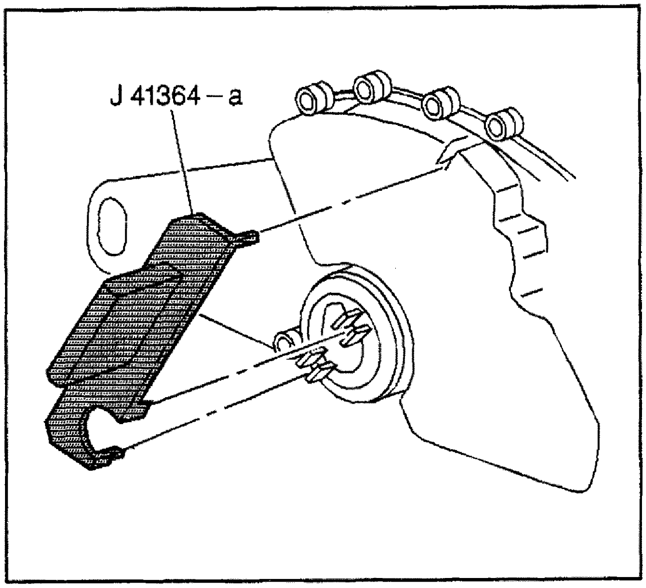
2. Disconnect the negative battery cable.
3. Shift the transmission into neutral.
4. Raise and support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.

Important: Position the transmission into the mechanical neutral position prior to performing this procedure. Position the transmission control lever into the mechanical neutral position by rotating the control lever clockwise until it reaches its full stop position, and then by moving the shift control lever counter-clockwise two detents.

5. Remove the shift cable from the manual shaft.
6. Remove the nut that secures the manual shaft to the transmission.
7. Disconnect the wiring harness from the switch.
8. Remove the two bolts that secure the switch to the transmission.
9. Remove the switch from the manual shaft.
10. Lightly file the outer edge of the manual shaft to remove any burrs from the shaft if the switch does not slide off of the manual shaft.

Installation Procedure

1. Position the *J 41364-A* onto the park/neutral position switch.
2. Ensure that the two slots on the switch (where the manual shaft is inserted) are lined up with the lower two tabs on the tool.
3. Rotate the tool until the upper locator pin on the tool is lined up with the slot on the top of the switch. Do not remove the *J 41364-A* from the park/neutral switch during switch installation.



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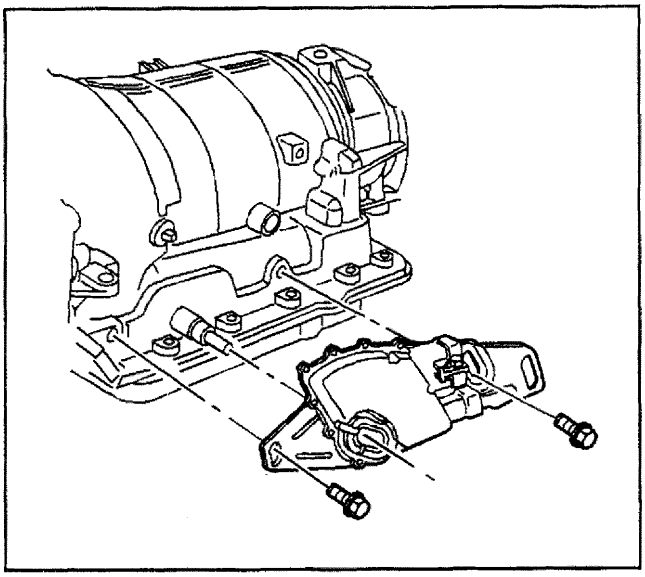
4. Install the switch to the transmission manual shaft by using the following procedure:
   - Lightly file the outer edge of the shaft to remove any burrs before sliding the switch onto the shaft.
   - Align the switch hub flats with the manual shaft flats.
   - Slide the switch onto the transmission manual shaft until the switch mounting bracket contacts the mounting bosses on the transmission.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

5. Install the two bolts that secure the switch to the transmission.

   Tighten

   Tighten the bolts that secure the park/neutral position switch to 28 N·m (21 lb ft).
6. Remove the *J 41364-A* from the switch.
7. Install the wiring harness connectors to the switch.



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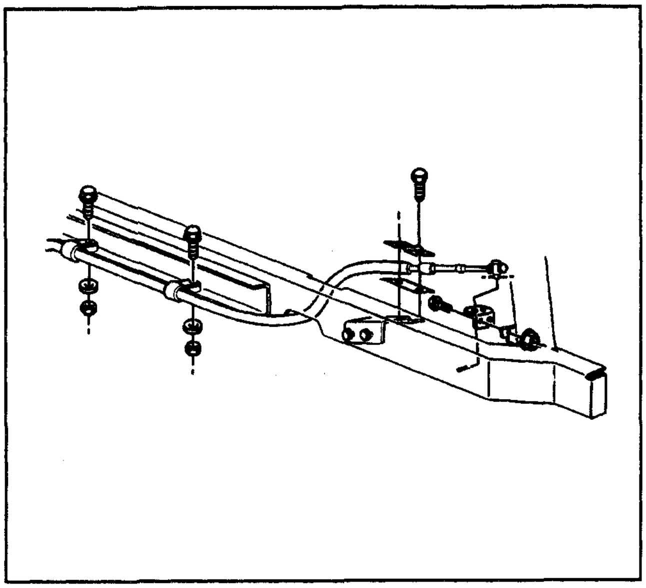

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8. Install the shift cable to the manual shaft.

Important: Hold the manual shaft while tightening the nut to prevent internal transmission damage.

9. Install the nut that secures the manual shaft to the transmission.

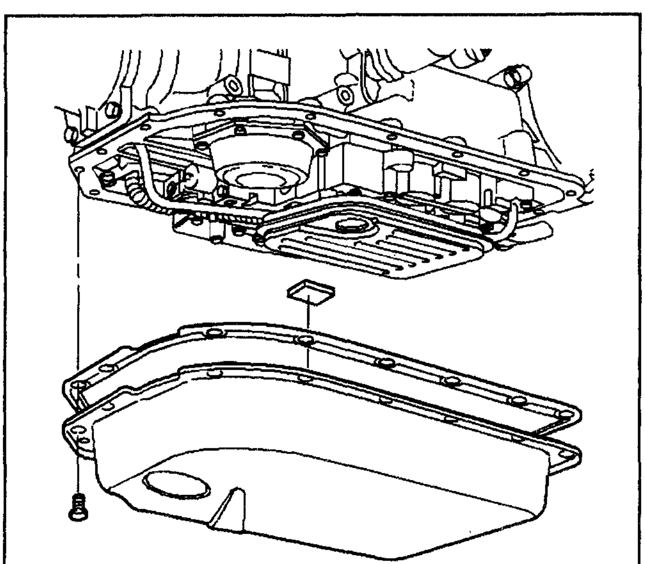
   Tighten

   Tighten the transmission manual shaft nut to 28 N·m (21 lb ft).
10. Lower the vehicle.
11. Connect the negative battery cable. Refer to *Battery Replacement.*
12. Check the switch for proper operation. The engine must start in the P (park) or N (neutral) positions only.
13. Adjust the switch if necessary by using the following procedure:
    - 13.1. Loosen the switch retaining bolts and rotate the switch slightly.
    - 13.2. Tighten the bolts and check the switch for proper operation.

Park/Neutral Position Switch Adjustment

Adjustment Procedure

- Check the switch for proper operation.
- The engine must be in the P (Park) or N (Neutral) positions only. If adjustment is required, loosen the switch retaining bolts and rotate the switch slightly.
- Tighten the bolts and check the switch for proper operation.
- Repeat the switch adjustment procedure until the engine starts when the shift lever is positioned in park and neutral.



102505

AT Fluid/Filter Changing

Removal Procedure

1. Raise and support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Place a drain pan under the transmission oil pan.
3. Remove the oil pan drain plug.
4. Remove all of the oil pan bolts except for the rear bolts.
5. Loosen the rear oil pan bolts approximately 4 turns.

Important: Do not damage the transmission case at the oil pan sealing surfaces.

6. Lightly pry down the front of the oil pan and allow the oil to drain.
7. Remove the remaining oil pan bolts.
8. Remove the oil pan.
9. Remove the gasket.
10. Remove the magnet.
11. Remove the oil filter.
12. Remove the filter neck seal.

13. Transmission oil pan gasket (29) is reusable. Inspect the gasket and replace as needed.
14. Clean the transmission case and the oil pan gasket surfaces with solvent.
15. Air dry the transmission case and surfaces.

Installation Procedure

1. Install the filter neck seal.
2. Install the oil filter.
3. Install the oil pan gasket to the pan.
4. Install the magnet into the bottom of the pan.
5. Install the oil pan drain plug.

   Tighten

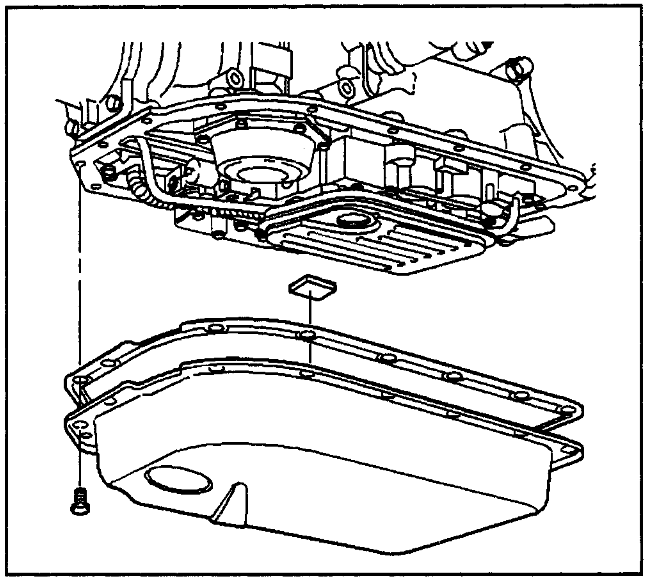
   Tighten the oil pan drain plug to 18 N·m (13 lb ft).

Notice: Refer to *Fastener Notice* in Cautions and Notices.

6. Install the oil pan using all seventeen oil pan bolts.

   Tighten

   Tighten the oil pan bolts to 11 N·m (97 lb in).
7. Install Dexron® III Automatic Transmission Fluid. Refer to *Fluid Capacity Specifications.*
8. Lower the vehicle.
9. Check the oil pan gasket for leaks.

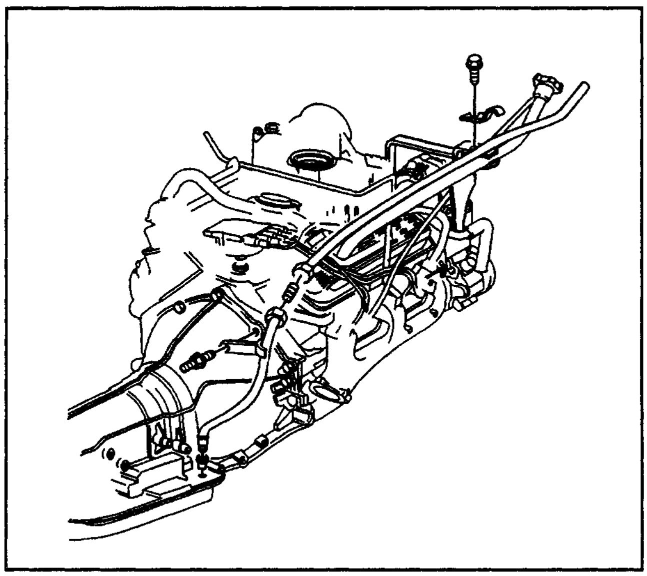


102505

Filler Tube and Seal Replacement (L31/L35)

Removal Procedure

1. Remove the transmission oil lever indicator.
2. Remove the transmission fluid fill tube to air outlet duct bracket bolt.
3. Remove the transmission fluid fill tube stud from the transmission.
4. Raise the vehicle.
5. Remove the oil level indicator tube from the transmission.
6. Remove the transmission fluid fill tube seal from the transmission case.



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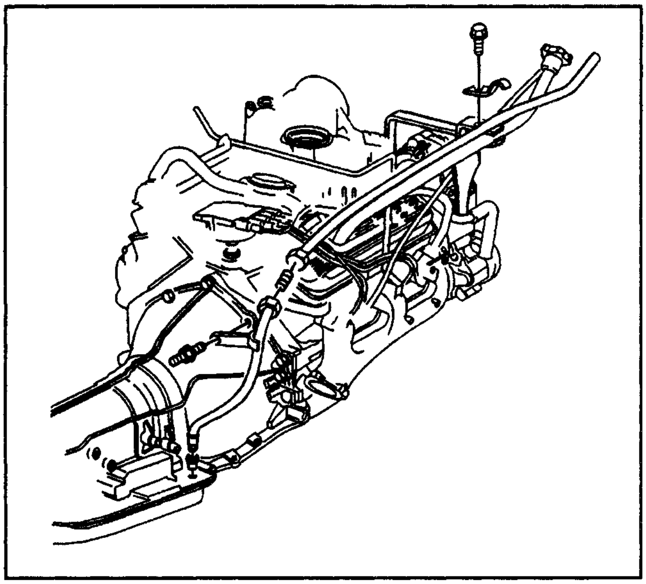

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Installation Procedure

1. Install the transmission fluid fill tube seal into the transmission case.
2. Install the transmission fluid fill tube into the transmission case.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Install the transmission fluid fill tube bracket stud to the transmission.

   Tighten

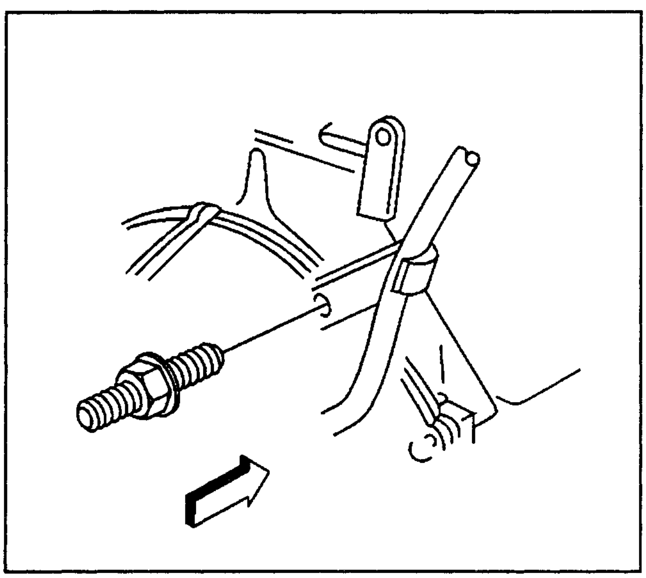
   Tighten the stud to 50 N·m (37 lb ft).
4. Lower the vehicle.

Important: When re-connecting the upper and lower transmission fluid fill tubes, align the white dots (dimples) on the upper and lower transmission fluid fill tubes and re-torque the nuts to 28 N·m (21 lb ft).

5. Install the transmission fluid fill tube to air outlet duct bracket bolt.

   Tighten

   Tighten the bolt to 25 N·m (18 lb ft).
6. Install the transmission oil level indicator.



240999

Filler Tube and Seal Replacement (7.4L)

Removal Procedure

1. Remove the transmission oil lever indicator.
2. Remove the air inlet duct.
3. Remove the transmission fluid fill tube to generator mounting bracket bolt.
4. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
5. Remove the transmission fluid fill tube bracket to transmission stud.
6. Remove the transmission fluid fill tube.
7. Remove the seal from the transmission fluid fill tube.

Installation Procedure

1. Install the new seal into the transmission case.
2. Install the transmission fluid fill tube into the transmission case.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Install the transmission fluid fill tube bracket to transmission stud.

   Tighten

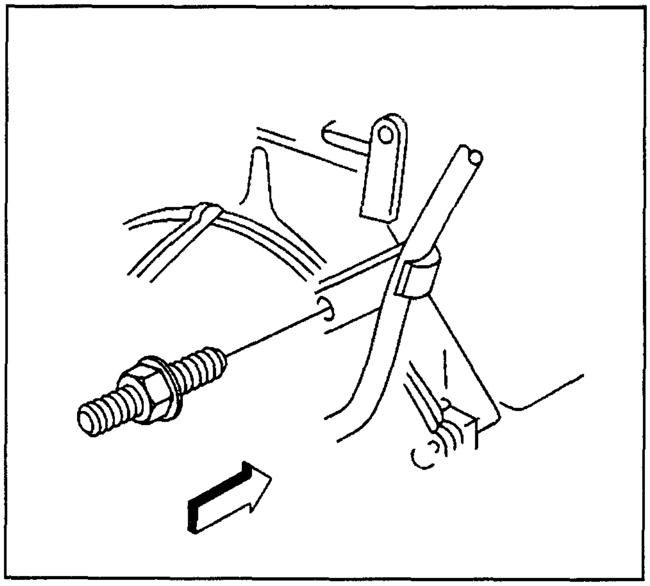
   Tighten the stud to 50 N·m (37 lb ft).
4. Lower the vehicle.

Important: When re-connecting the upper and lower transmission fluid fill tube, align the white dots (dimples) on the upper and lower transmission fluid fill tubes and re-torque the nuts to 28 N·m (21 lb ft).

5. Install the transmission fluid fill tube to generator mounting bracket bolt.

   Tighten

   Tighten the bolt to 25 N·m (18 lb ft).
6. Install the air inlet duct.
7. Install the transmission oil level indicator.

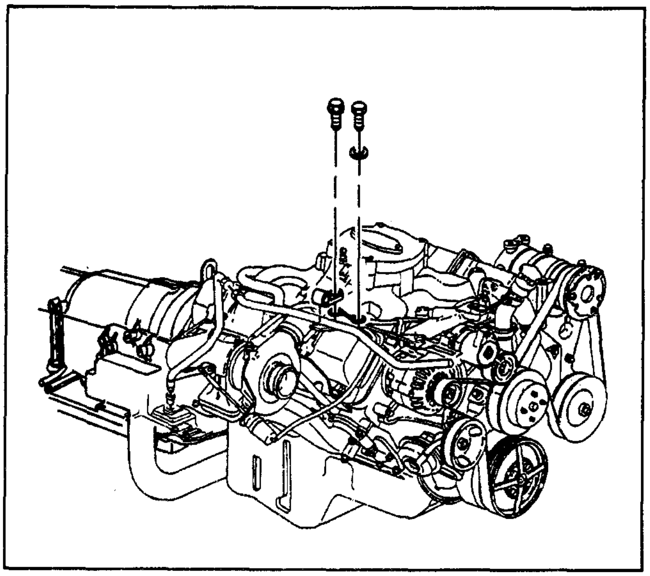


240999

Filler Tube and Seal Replacement (L65)

Removal Procedure

1. Remove the transmission oil lever indicator.
2. Remove the transmission fluid fill tube bolts and washers from the turbocharger.
3. Raise the vehicle.
4. Remove the transmission fluid fill tube bracket to transmission stud.
5. Remove the transmission fluid fill tube from the transmission case.
6. Remove the transmission fluid fill tube seal from the transmission case.



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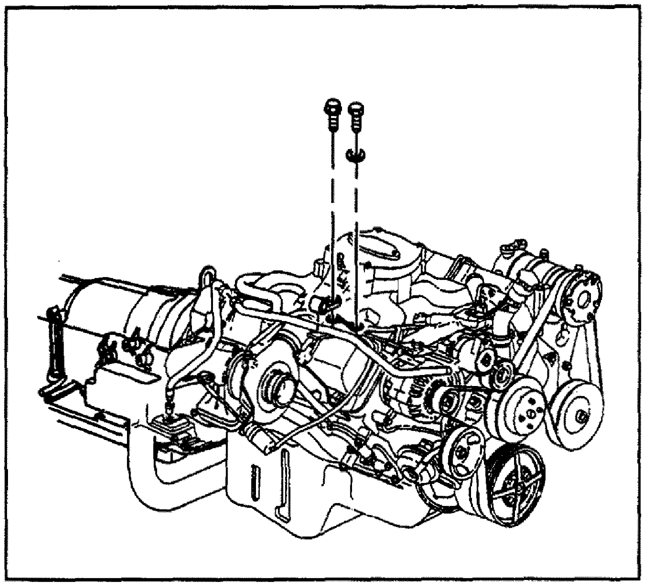
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Installation Procedure

1. Install a NEW transmission fluid fill seal into the transmission case.
2. Install the transmission fluid fill tube into the transmission case.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Install the transmission fluid fill tube bracket to transmission stud.

   Tighten

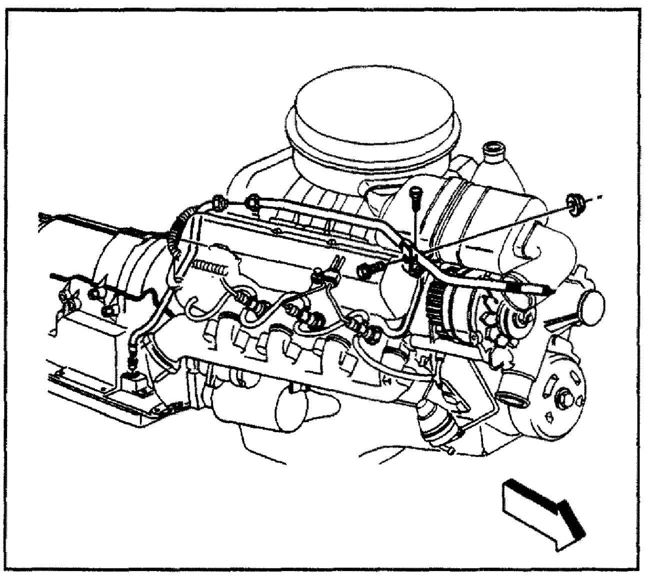
   Tighten the stud to 50 N·m (37 lb ft).
4. Lower the vehicle.

Important: When the transmission fluid fill tubes are separated for service, the following must be done to re-connect the upper and lower tubes. Align the white dots (dimples) on the upper and lower tubes and re-torque the nuts to 28 N·m (21 lb ft).

5. Install the transmission fluid fill tube bolts and washers to the turbocharger.

   Tighten

   Tighten the bolts to 25 N·m (18 lb ft).
6. Install the transmission oil level indicator.


178880

Filler Tube and Seal Replacement (L57)

Removal Procedure

1. Remove the transmission oil lever indicator.
2. Remove the transmission fluid fill tube to air cleaner bracket bolt and nut.
3. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information
4. Remove the transmission fluid fill tube bracket stud from the transmission.
5. Remove the transmission fluid fill tube from the transmission.
6. Remove the transmission fluid fill tube seal from the transmission case.

Installation Procedure

1. Install the NEW transmission fluid fill tube seal into the transmission case.
2. Install the transmission fluid fill tube into the transmission case.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Install the transmission fluid fill tube bracket stud to the transmission.

   Tighten

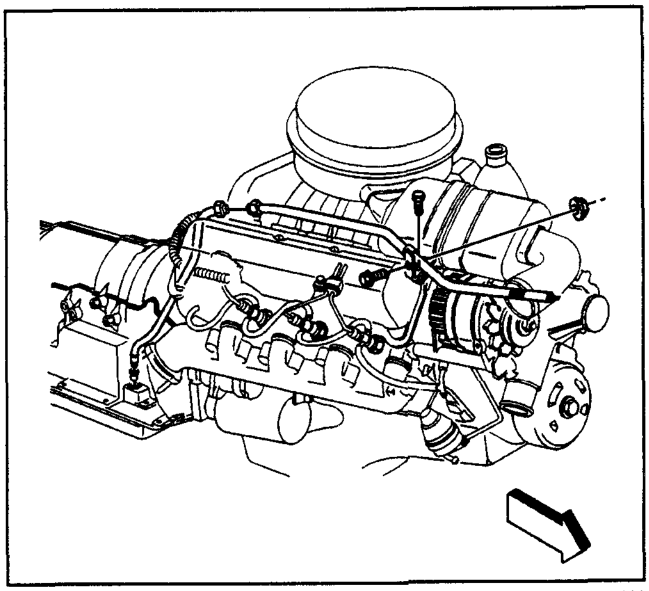
   Tighten the stud to 50 N·m (37 lb ft).
4. Lower the vehicle.

Important: When re-connecting the upper and lower transmission fluid fill tubes, align the white dots (dimples) on the upper and lower tubes and re-torque the nuts to 28 N·m (21 lb ft).

5. Install the transmission fluid fill tube to air cleaner bracket bolt and nut.

   Tighten

   Tighten the to nut to 12 N·m (106 lb in).
6. Install the transmission oil level indicator.



178880

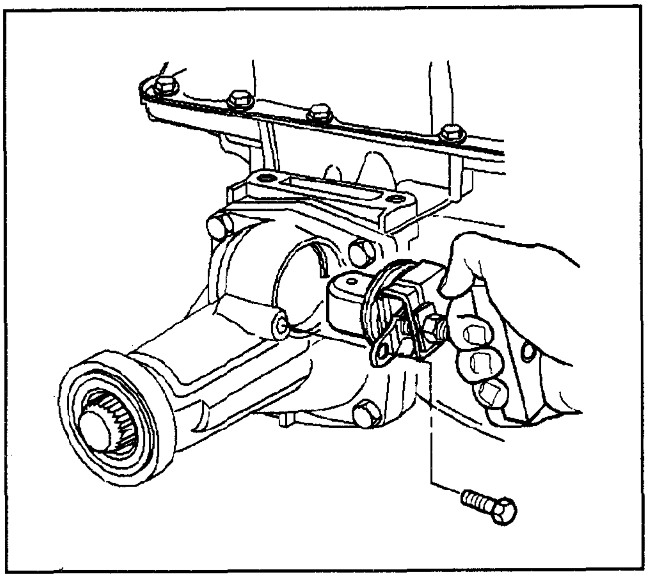
Vehicle Speed Sensor Replacement

Removal Procedure

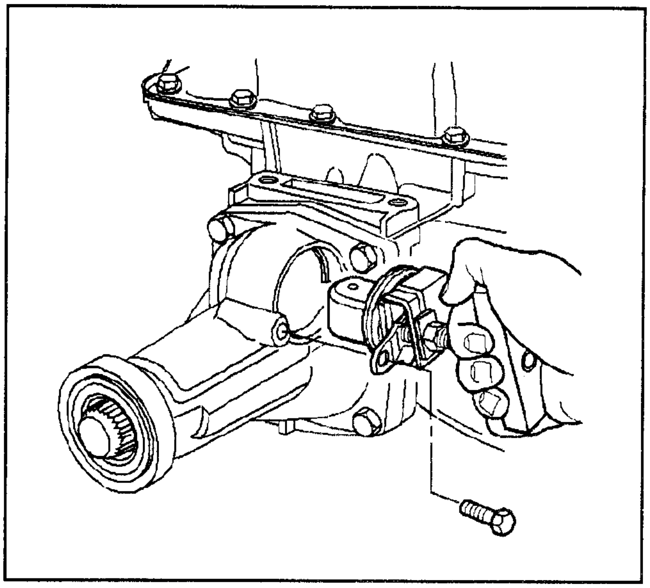
Required Tools

J 38417 Speed Sensor Remover

1. Remove the harness connector
2. Remove the bolt.
3. Remove the vehicle speed sensor using *J 38417*. Have a suitable container in order to catch the fluid.
4. Remove the O-ring seal.



5433



5433

Installation Procedure

Required Tools

J 38417 Speed Sensor Remover

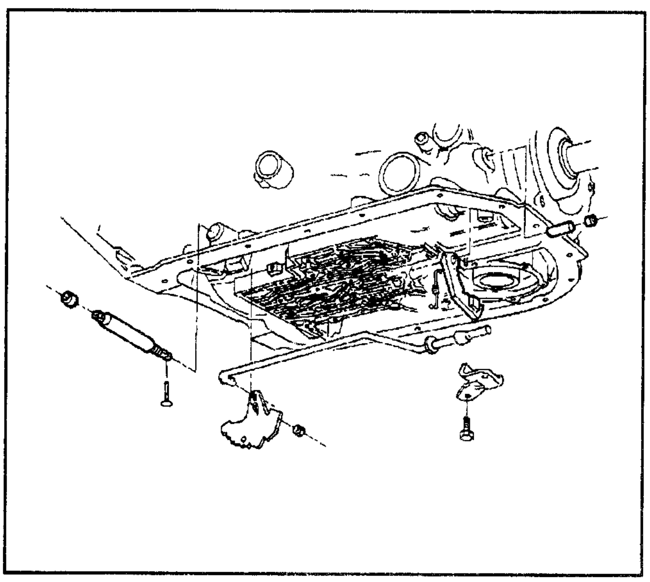
1. Install the new speed sensor and O-ring seal using *J 38417*.
2. Coat the seal with a thin film of transmission fluid.
3. Install the bolt.

   Tighten

   Tighten the bolt to 11 N·m (97 lb in).

Notice: Refer to *Fastener Notice* in Cautions and Notices.

4. Install the harness connector.
5. Refill the fluid as required.

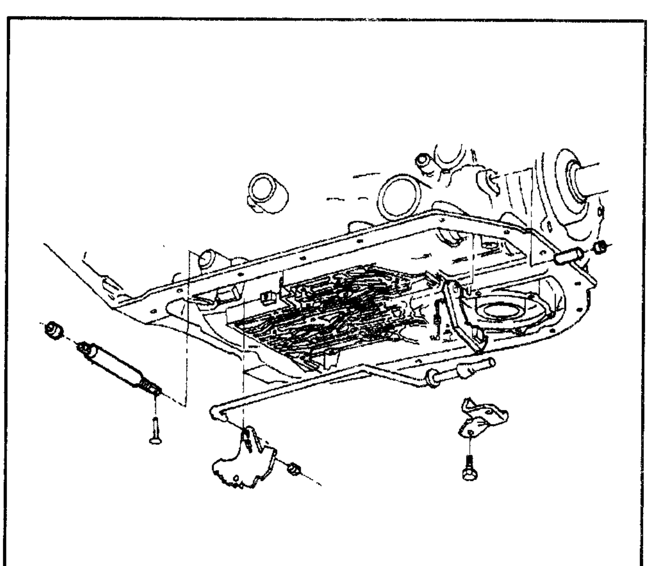


43309

Park Lock Pawl and Actuator Replacement

Removal Procedure

1. Remove the oil pan and filter. Refer to *AT Fluid/Filter Changing*.
2. Remove the nut and the pin.
3. Remove the detent lever and the actuator assembly.
4. Remove the bolts and the parking pawl bracket.
5. Remove the parking pawl return spring.

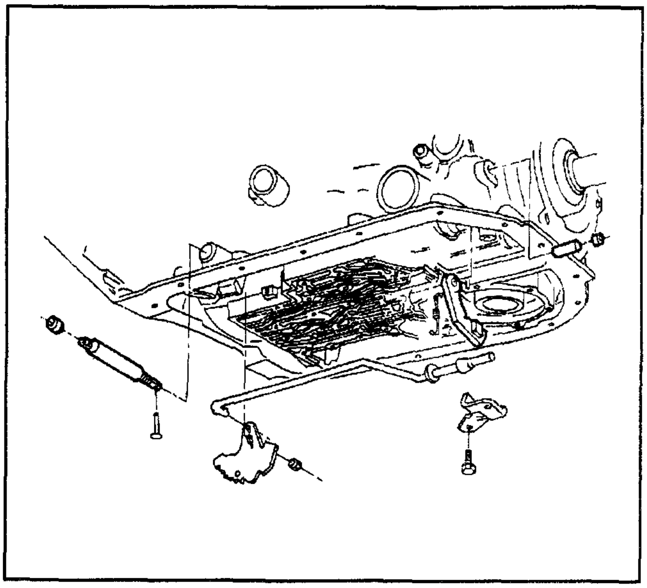


43307

6. Use the modified screw extractor in order to remove the plug.
7. Remove the parking pawl shaft retainer, the shaft and the pawl.
8. Remove the seal and the manual shaft.

Installation Procedure

1. Install the pawl shaft.
2. Install the parking pawl.
3. Install the plug using a 5/16 inch rod with Loctite® or the equivalent.
4. Install the retainer.



43307

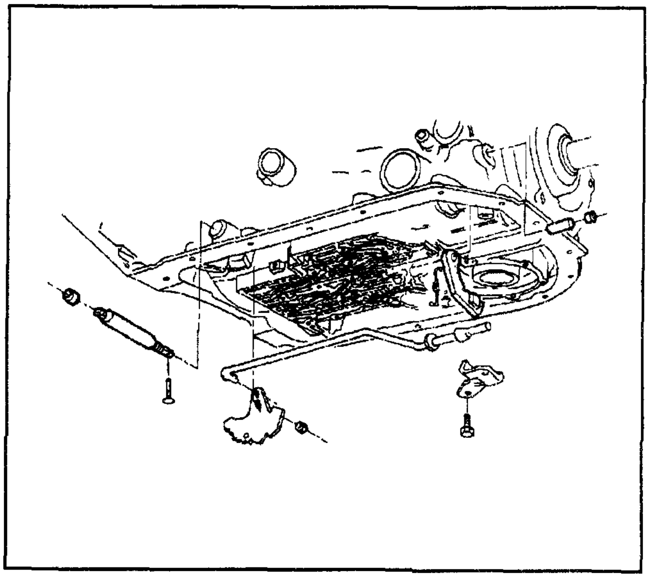
5. Install the pawl return spring.
6. Install the detent lever to the actuator assembly.
7. Install actuator assembly over the parking pawl.
8. Install the seal and the manual shaft.
9. Install the nut on the shaft.
10. Install the roll pin.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

11. Install the parking lock bracket with the two bolts.

    Tighten

    Tighten the bolts to 24 N·m (18 lb ft).
12. Install the oil pan and filter. Refer to *AT Fluid/Filter Changing*.

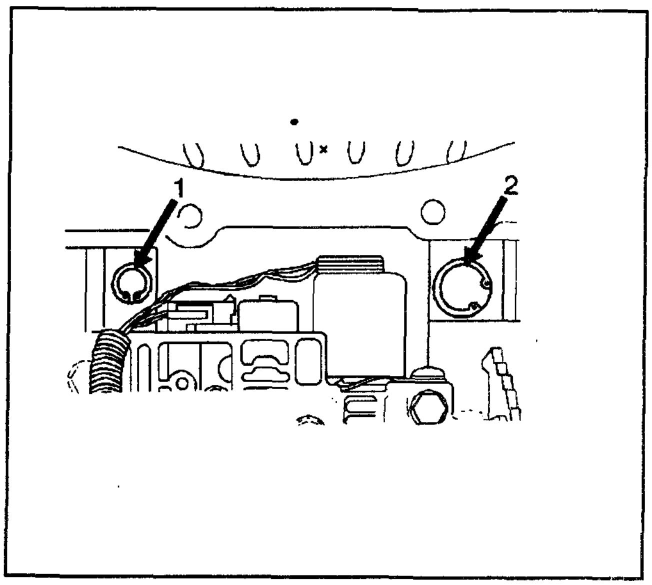


43309

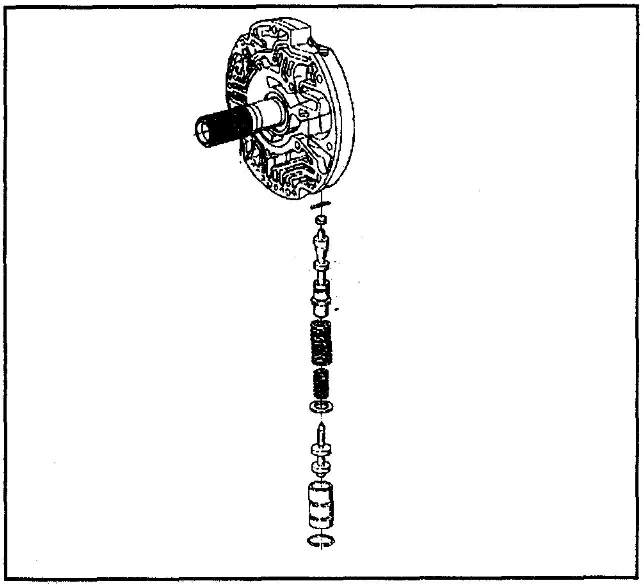
Pressure Regulator Replacement

Removal Procedure

1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the transmission oil pan and the filter. Refer to *AT Fluid/Filter Changing*.
3. Remove the reverse boost valve bushing retainer ring (1).

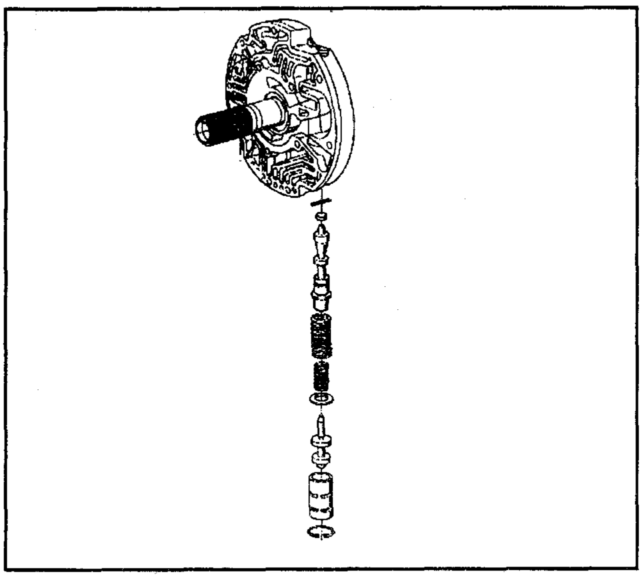


102558



43318

4. Remove the following from the reverse boost valve cylinder:
   - The reverse boost valve bushing
   - The reverse boost valve
   - The pressure regulator spring retainer
   - The pressure regulator spring
   - The pressure regulator valve



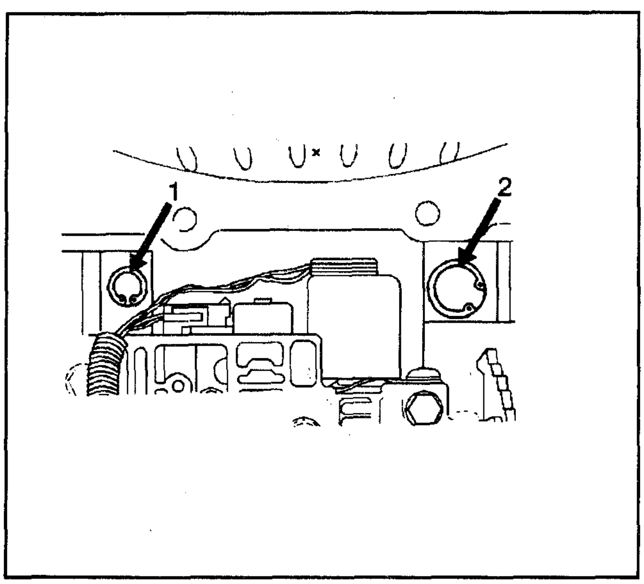
43318

Installation Procedure

Tools Required

J 36850 TRANSJEL

1. Install the pressure regulator valve with *J 36850*.
2. Pre-assemble the following parts:
   2.1. The reverse boost valve bushing
   2.2. A new reverse boost valve
   2.3. A new pressure regulator spring retainer
   2.4. The added isolator pressure regulator spring
   2.5. The pressure regulator spring
3. Install the pre-assembled parts into the pump bore.



102558

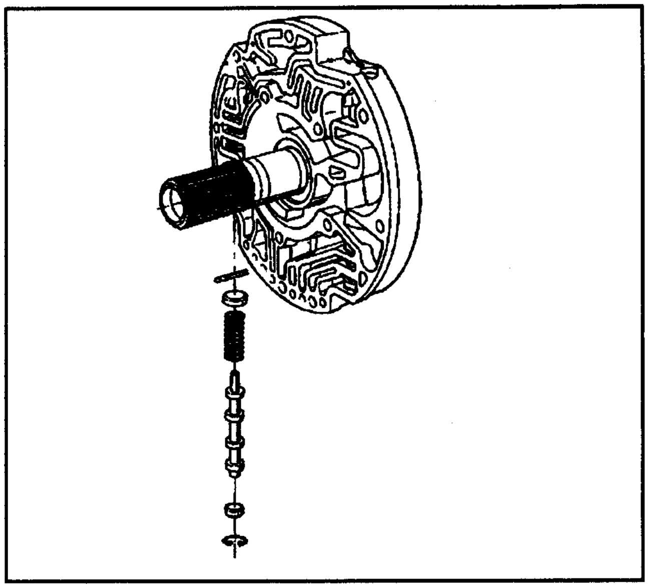
4. Install the reverse boost valve bushing retainer ring while holding the reverse boost valve bushing in place.

   Ensure the retainer ring (1) is in the groove.
5. Install the transmission oil pan and the oil filter. Refer to *AT Fluid/Filter Changing*.
6. Lower the vehicle.

TCC Valve and Spring Replacement

Removal Procedure

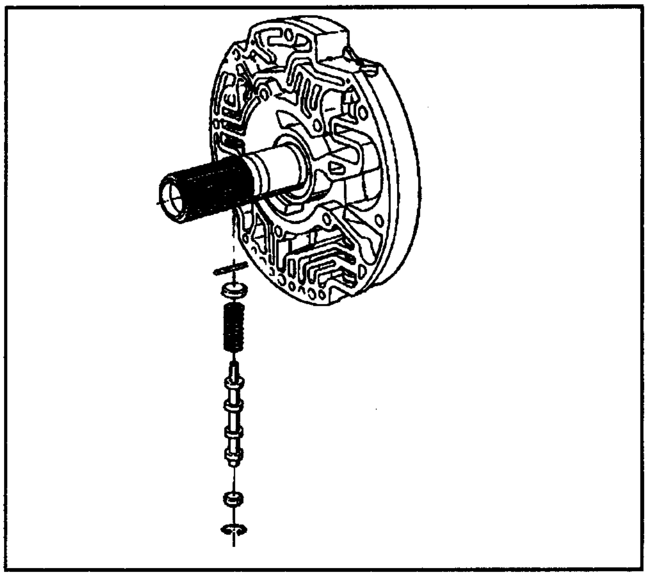
1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the transmission oil pan and the oil filter. Refer to *AT Fluid/Filter Changing.*
3. Remove the valve bore plug retainer ring.
4. Remove the following parts:
   4.1. The valve bore plug.
   4.2. The TCC valve.
   4.3. The TCC valve spring.



43320

Installation Procedure

1. Install the following parts:
   1.1. The TCC valve spring.
   1.2. The TCC valve.
   1.3. The valve bore plug.
2. Install the valve bore plug retainer ring.
3. Install the transmission oil pan and oil filter. Refer to *AT Fluid/Filter Changing.*
4. Lower the vehicle.

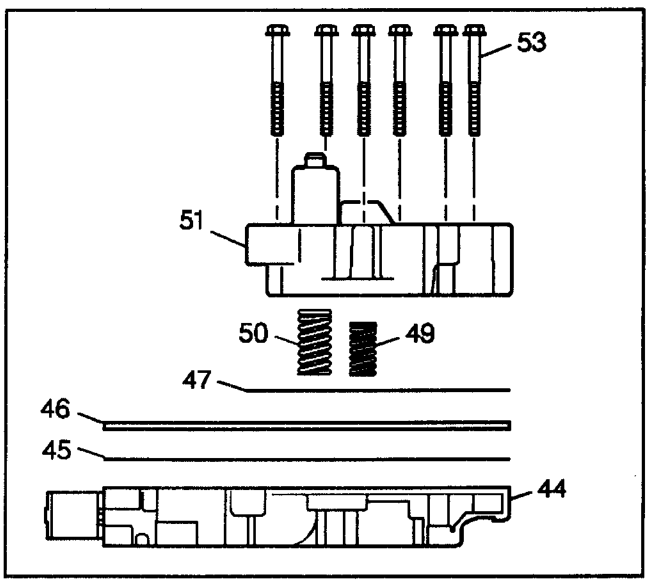


43320

Accumulator Housing Replacement

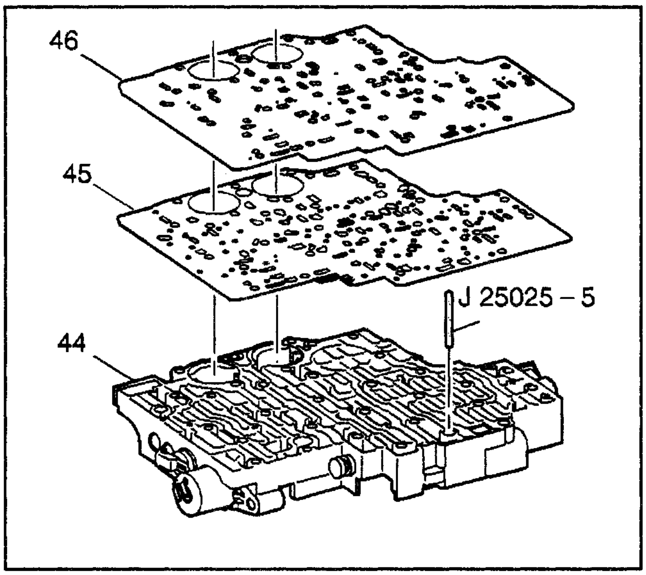
Removal Procedure

1. Raise and support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Place a drain pan under the transmission oil pan.
3. Remove all of the oil pan bolts except for the rear bolts.
4. Loosen the rear oil pan bolts approximately 4 turns.
5. Lightly pry down the front of the oil pan and allow the oil to drain.
6. Remove the remaining oil pan bolts.
7. Remove the oil pan.
8. Remove the oil filter.
9. Remove the 3rd and 4th clutch accumulator housing bolts (53).



40608

10. Remove the 3rd and 4th clutch accumulator housing (51).
11. Remove the accumulator housing gasket (47). The accumulator housing gasket may be stuck to the spacer plate (46).
12. Remove the 3rd clutch accumulator piston spring (50).
13. Remove the 4th clutch accumulator piston spring (49).
14. Remove the control valve body spacer plate (46).
15. Remove the control valve assembly to spacer plate gasket (45) from the spacer plate (46).



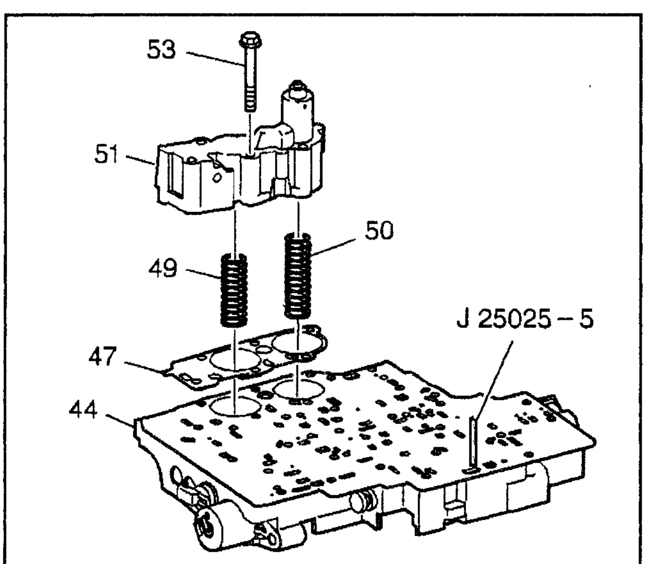
40634

Installation Procedure

Tools Required

J 25025 Guide Pin

1. Install the *J 25025* into the control valve body bolt hole where the manual shaft detent roller and spring assembly is mounted.
2. Install the control valve body gasket (45).
3. Install the control valve body spacer plate (46).



40635

4. Install the third and fourth clutch accumulator housing gasket (47).
5. Install the third clutch accumulator piston spring (50). This spring is the longer of the two springs.
6. Install the fourth clutch accumulator piston spring (49).
7. Install the third and fourth clutch accumulator housing assembly (51) onto the control valve body assembly (44).
8. Install the six accumulator housing bolts (53). Start the bolts finger tight and work towards the opposite end.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

9. Tighten the accumulator housing bolts sequentially.

   Tighten

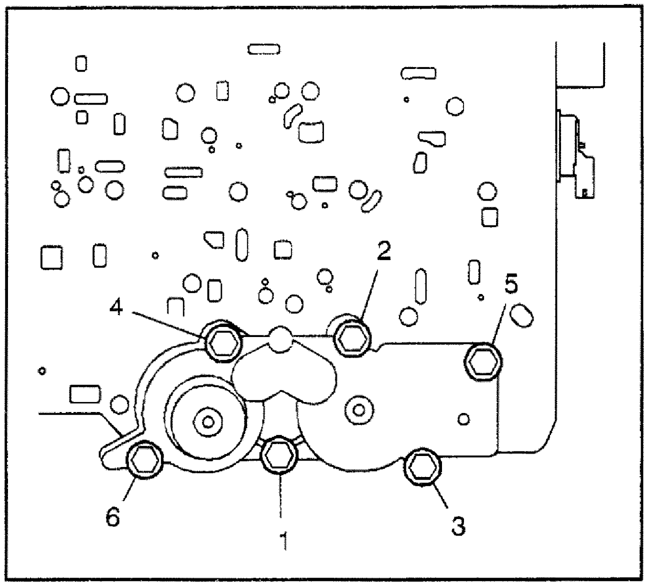
   Tighten the accumulator housing bolts sequentially to 11 N·m (97 lb in).
10. Remove the *J 25025*.
11. Install the oil filter.
12. Install the oil pan gasket to the oil pan.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

13. Install the oil pan using all seventeen bolts.

   Tighten

   Tighten the oil pan bolts to 24 N·m (18 lb ft).
14. Install Dexron® III Automatic Transmission Fluid. Refer to *Approximate Fluid Capacities* in maintenance and Lubrication.
15. Lower the vehicle.

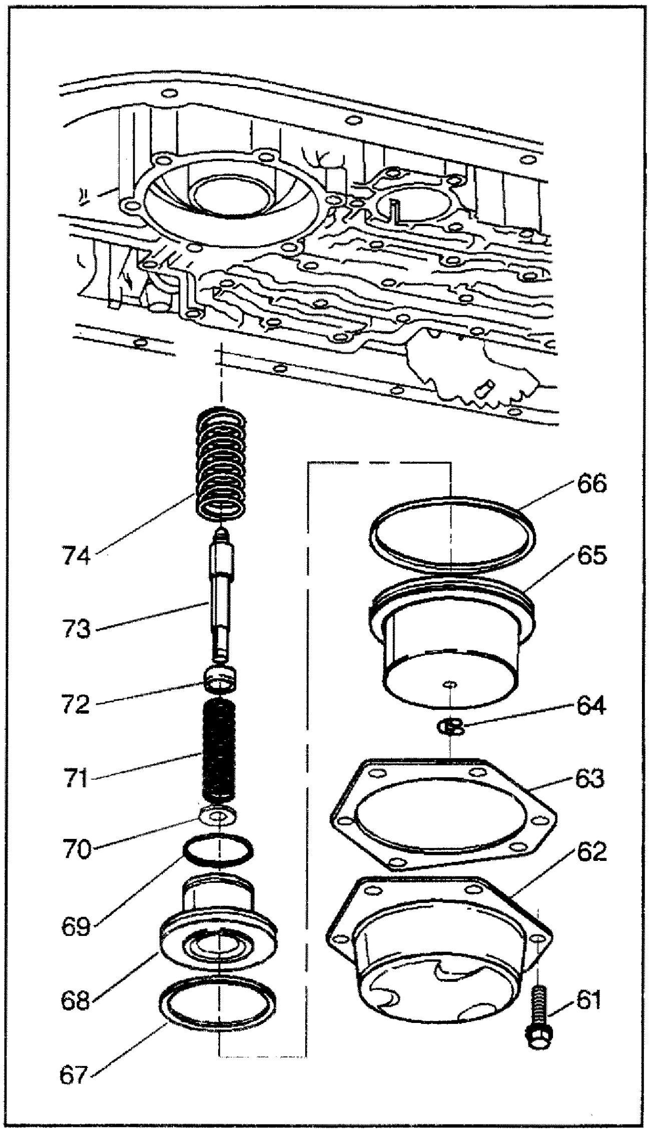


54703

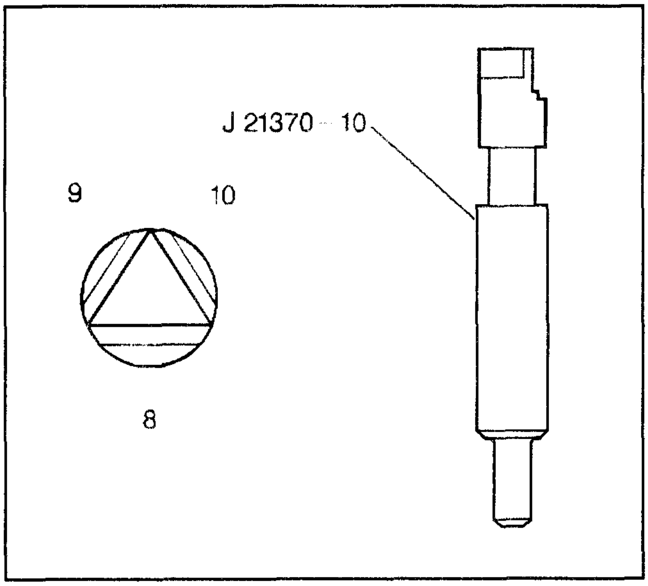
Reverse Servo Replacement

Removal Procedure

1. Remove the transmission oil pan and filter. Refer to *AT Fluid/Filter Changing.*
2. Remove the rear servo assembly from the transmission case as follows:
   - Cover bolts (61).
   - Cover (62).
   - Cover gasket (63).
   - Bottom retaining clip (64).
   - Servo piston (65).
   - Outer ring oil seal (66).
   - Inner ring oil seal (67).
   - Accumulator piston (68).
   - Piston seal (69).
   - Washer (70).
   - Servo spring (71).
   - Servo spring retainer (72).
   - Selective pin (73).
   - Accumulator spring (74).



450519



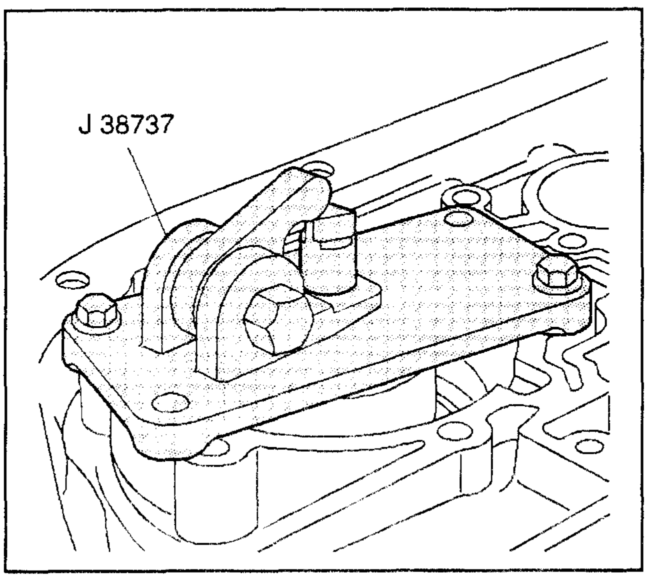
102596

Checking Procedure

Tools Required

- *J 21370-10* Gauge Pin
- *J 38737* Band Apply Pin

1. Place the *J 21370-10* in the servo bore.



102591

2. Position the *J 38737* over the bore with the hex nut facing the parking pawl linkage.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Fasten the *J 38737* with the two rear servo cover bolts.

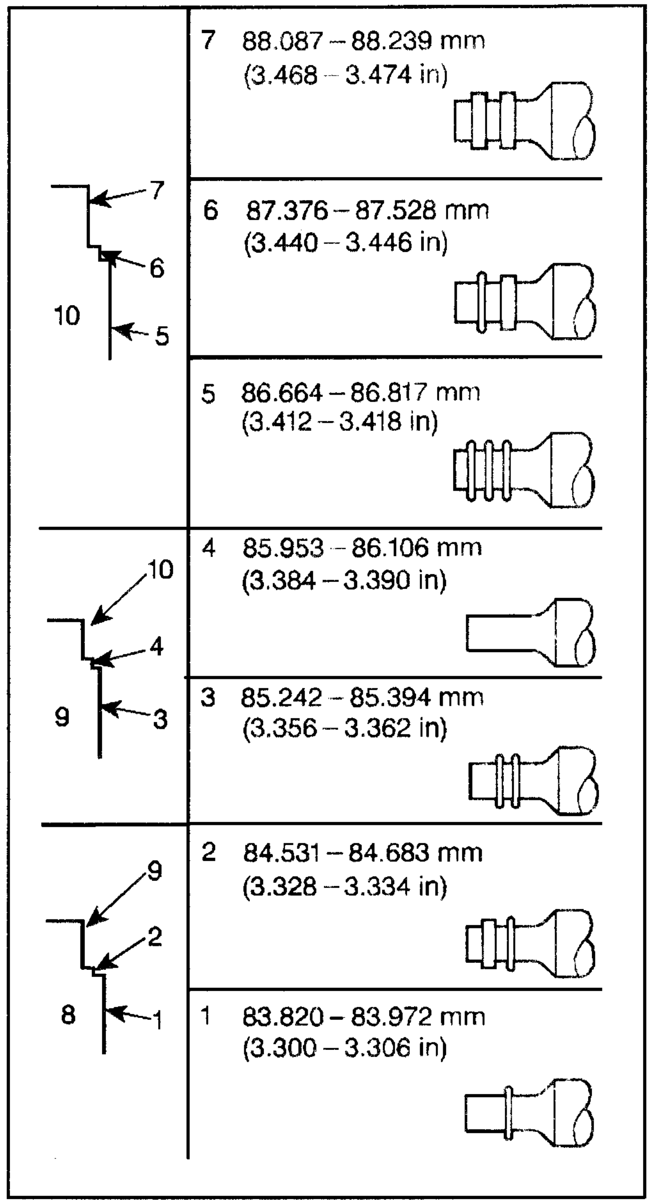
   Tighten

   Tighten the bolts to 24 N·m (18 lb ft).
4. Ensure the *J 21370-10* moves freely in the tool and the pin bore.
5. In order to determine the correct pin length, tighten the nut on the gauge.

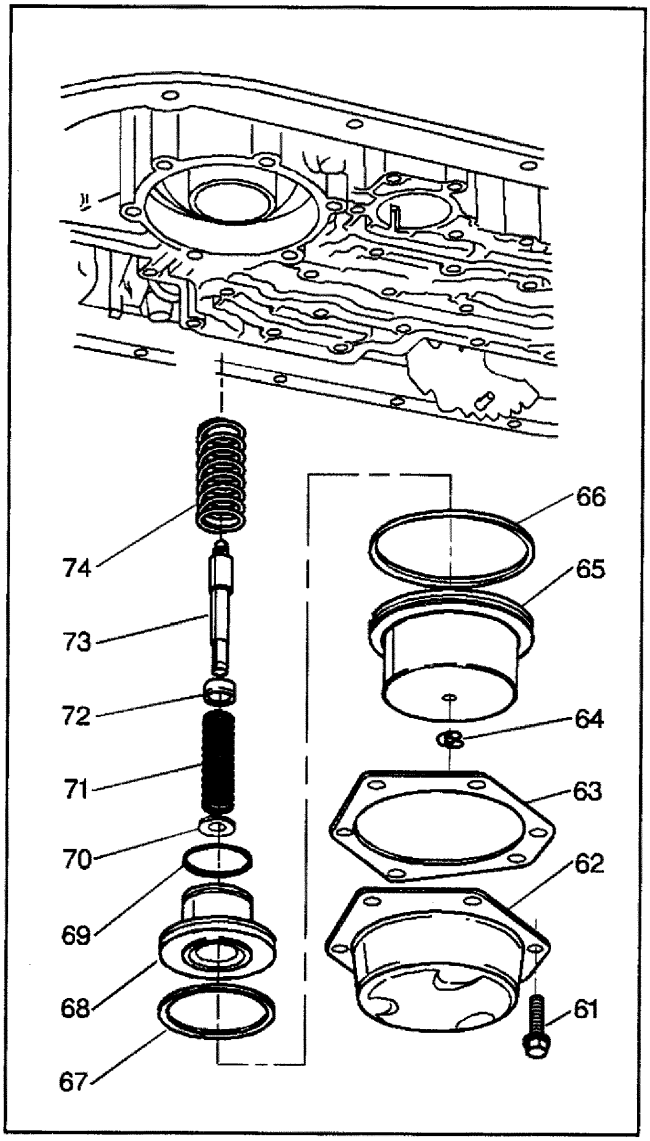
   Tighten

   Tighten the nut to 34 N·m (25 lb ft).

6. Select the correct band apply pin length.



450523



450519

Installation Procedure

1. Remove the rear servo assembly from the transmission case as follows:
   - Accumulator spring (74).
   - Selective pin (73).
   - Servo spring retainer (72).
   - Servo spring (71).
   - Washer (70).
   - Piston seal (69).
   - Accumulator piston (68).
   - Inner ring oil seal (67).
   - Outer ring oil seal (66).
   - Servo piston (65).
   - Bottom retaining clip (64).
   - Cover gasket (63).
   - Cover (62).

Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the cover bolts (61).

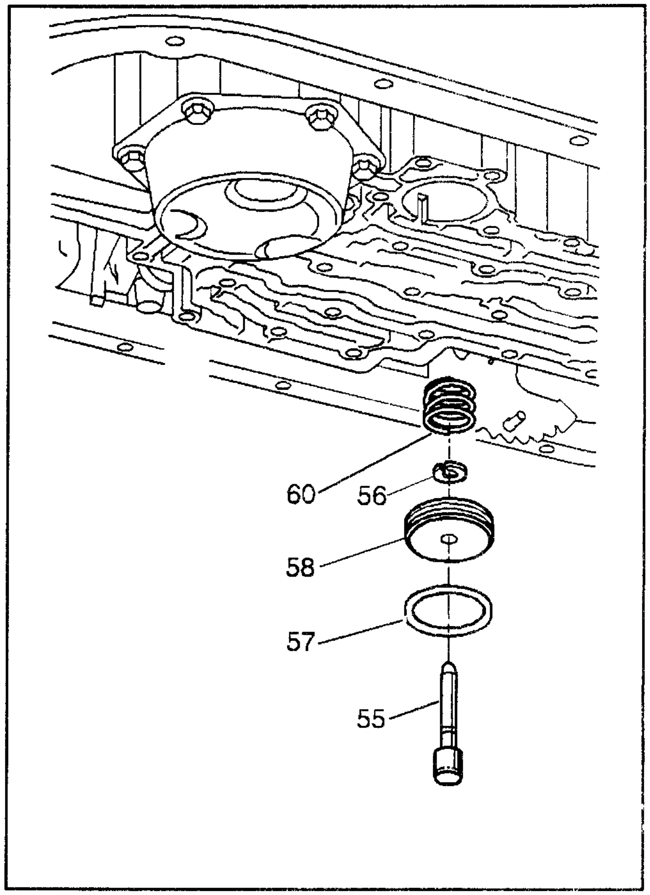
   Tighten

   Tighten the bolts to 24 N·m (18 lb ft).
3. Install the transmission oil pan and filter. Refer to *AT Fluid/Filter Changing.*

Forward Servo Replacement

Removal Procedure

1. Lift the vehicle. Refer to *Lifting and Jacking the Vehicle*.
2. Remove the oil pan and filter. Refer to *AT Fluid/Filter Changing*.
3. Remove the six forward servo cover bolts, cover, and gasket.
4. Remove the following parts:
   - 4.1. Forward servo piston pin (55).
   - 4.2. O-ring seal (57).
   - 4.3. Servo piston (58).
   - 4.4. Retainer (56).
   - 4.5. Piston spring (60).



450527

Installation Procedure

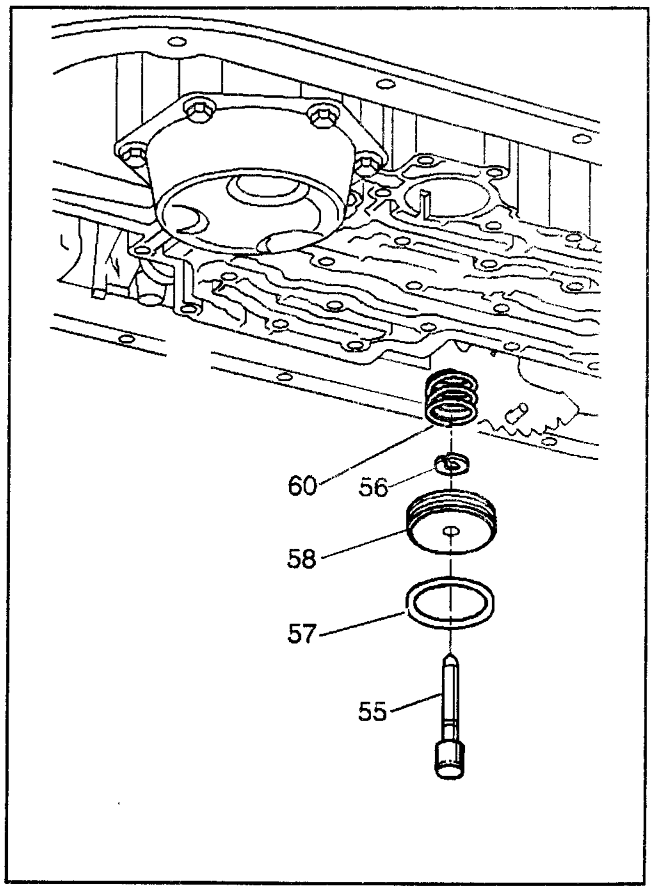
1. Install the following parts:
   - Piston spring (60).
   - Retainer (56).
   - Servo piston (58).
   - O-ring seal (57).
   - Forward servo piston pin (55).

Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the six forward servo gasket, cover, and six bolts.

   Tighten

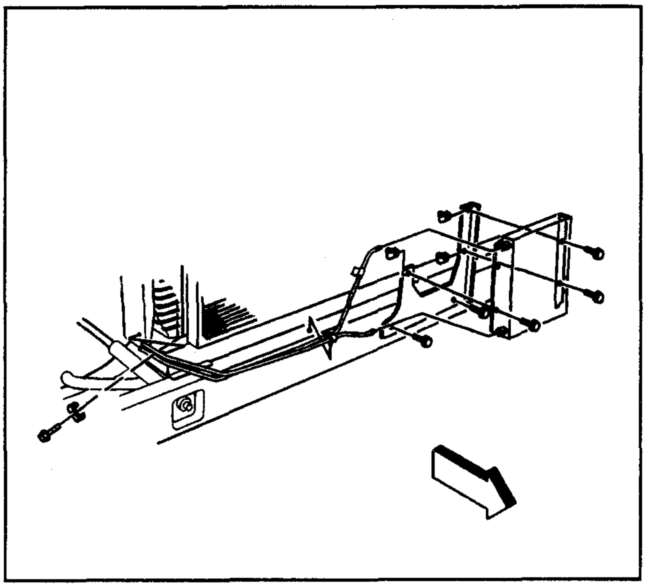
   Tighten the bolts to 24 N·m (18 lb ft).
3. Install the oil pan and filter. Refer to *AT Fluid/Filter Changing*.
4. Lower the vehicle.



450527

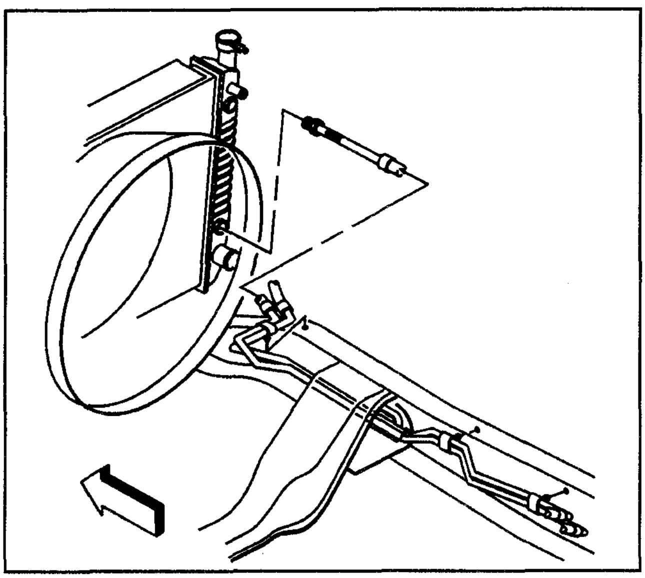
Oil Cooler Line Replacement

Removal Procedure



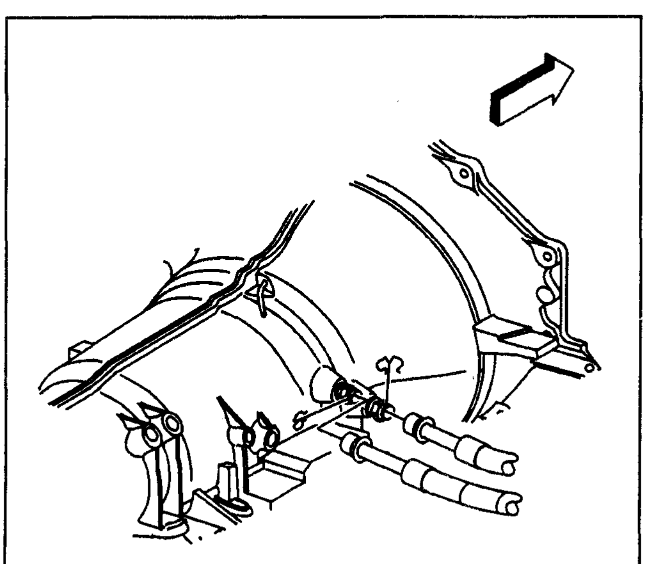
178872

1. Remove the quick connect fittings that secure the transmission oil cooler hoses to the auxiliary transmission oil cooler, if equipped.



178867

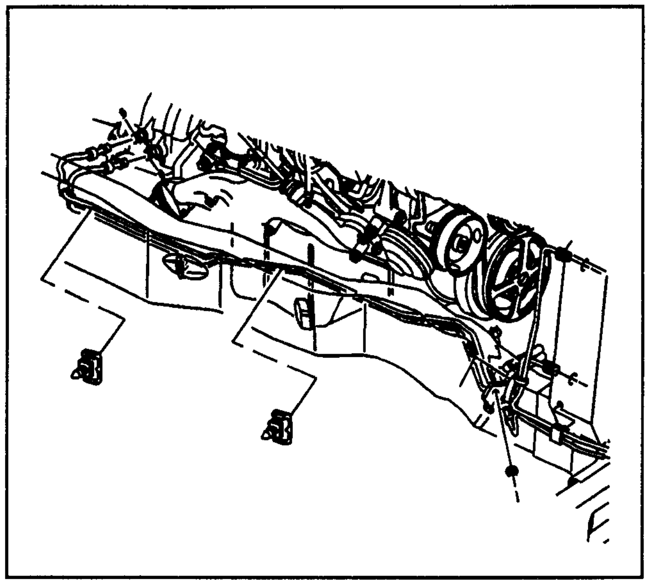
2. Remove the quick connect fittings that secure the transmission oil cooler hoses to the radiator.
3. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.



178883

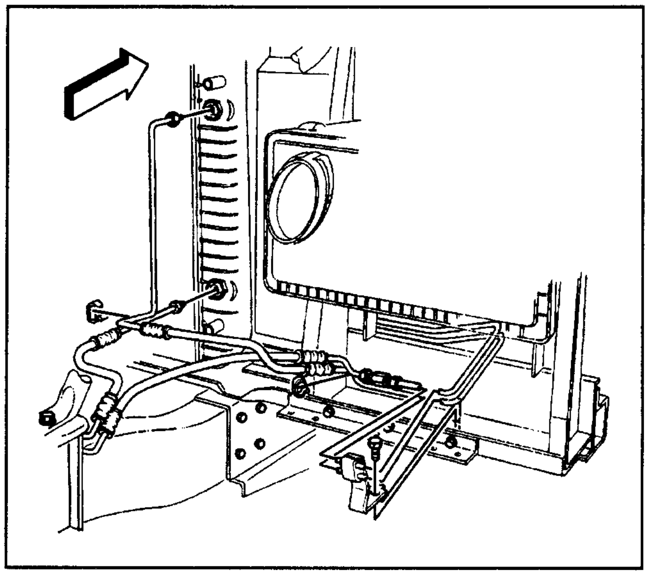
4. Remove the retaining clips that secure the transmission oil cooler hoses to the transmission oil cooler hose fittings.
5. Discard the two retaining clips.

6. Remove the transmission oil cooler hoses with the transmission oil cooler hose clips from the transmission oil cooler hose clip retaining brackets.



178870

7. Disconnect the auxiliary transmission oil cooler hose line nuts from the union, if equipped.
8. Remove the transmission oil cooler hoses from the vehicle.
9. Separate the transmission oil cooler hoses from the transmission oil cooler hose clips.



178869

Installation Procedure

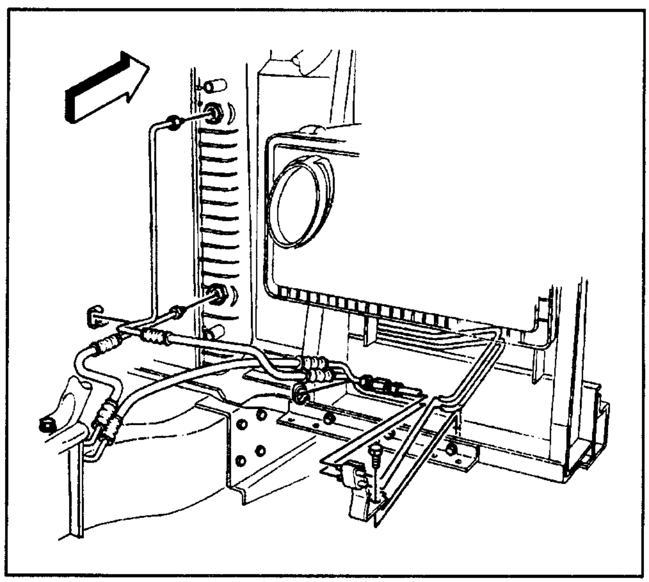
1. Secure the transmission oil cooler hoses into the transmission oil cooler hose clips.
2. Install the transmission oil cooler hoses to the vehicle.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

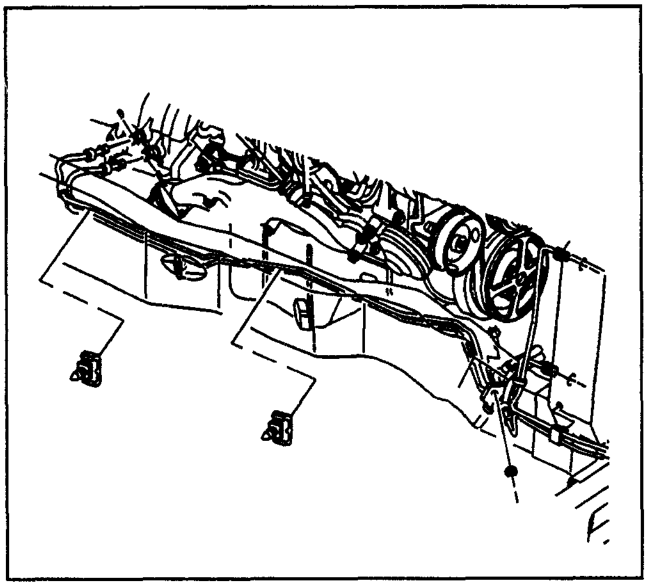
3. Connect the auxiliary transmission oil cooler hose line nuts to the union, if equipped.

   Tighten

   Tighten the nuts to 14 N·m (124 lb in).

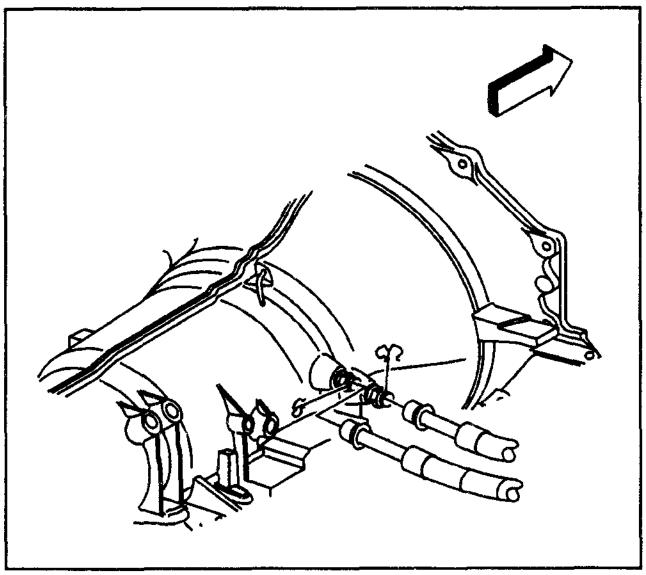


178869



178870

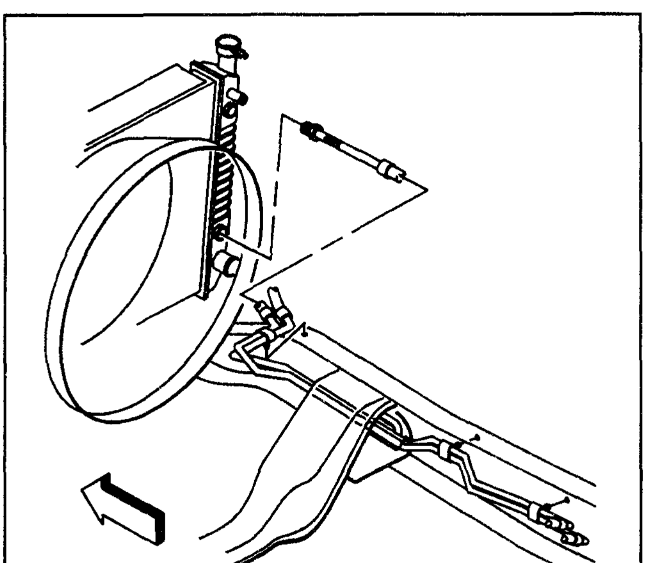
4. Install the transmission oil cooler hoses with the transmission oil cooler hose clips to the transmission oil cooler hose clip retaining brackets.



178883

Important: Do not reuse the existing retaining clips that were removed from the transmission oil cooler hose fittings.

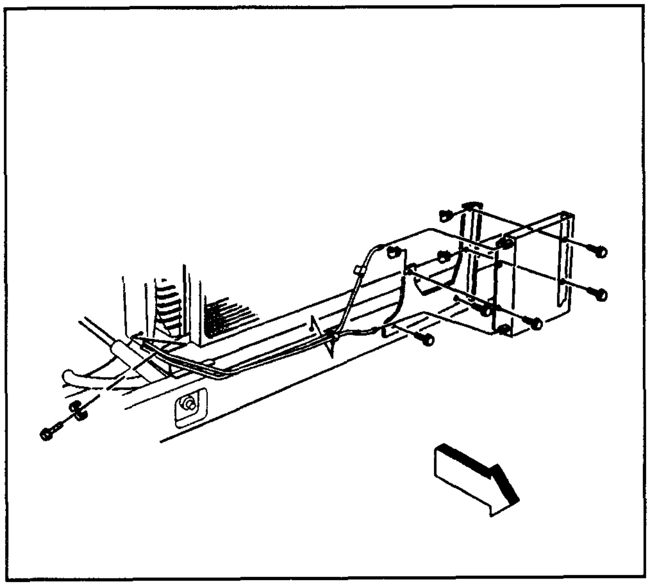
5. Install the NEW retaining clips that secure the transmission oil cooler hoses to the transmission oil cooler hose fittings.
6. Push the cooler lines into the transmission fittings until the cooler lines lock into place:
   6.1. Lightly pull on the cooler hoses, away from the fitting, to ensure that the cooler hose is locked into the fitting.
   6.2. Position the plastic cap located on the cooler hose onto the hex fitting.
7. Lower the vehicle.



178867

8. Install the quick connect fittings that secure the transmission oil cooler hoses to the radiator.

9. Install the quick connect fittings that secure the auxiliary transmission oil cooler hoses to the auxiliary transmission oil cooler, if equipped.
10. Check the transmission fluid level. Refer to *Fluid Capacity Specifications.*

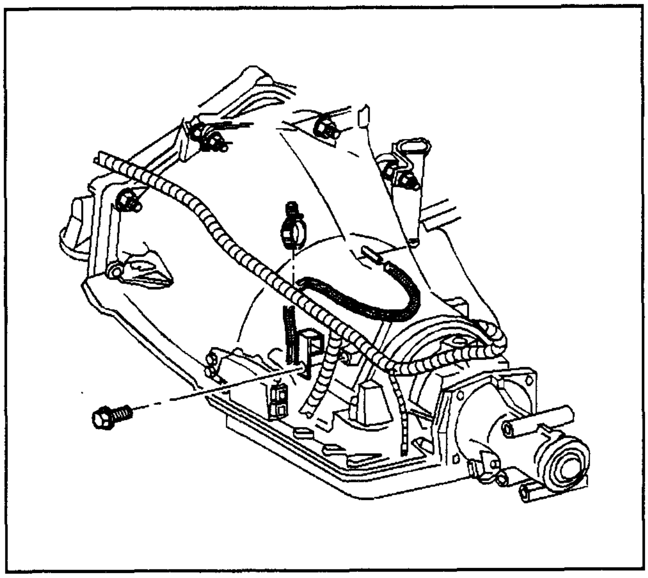


178872

Vent Hose

Removal Procedure

1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the vent hose bolt and the clamp.
3. Remove the strap securing the vent hose to the transmission and the wiring harness.
4. Remove the vent hose from the transmission vent.



102339

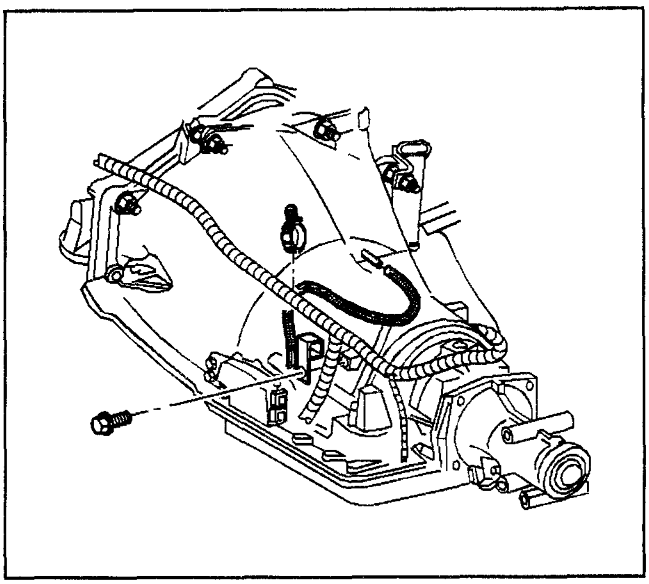
Installation Procedure

1. Install the vent hose to the transmission.
2. Install the strap that secures the vent hose and the wiring harness to the transmission.

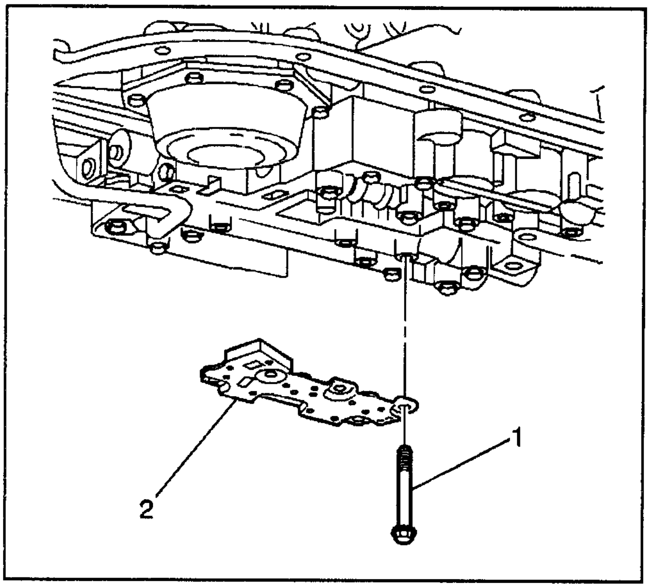
Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Install the bolt and the clamp.

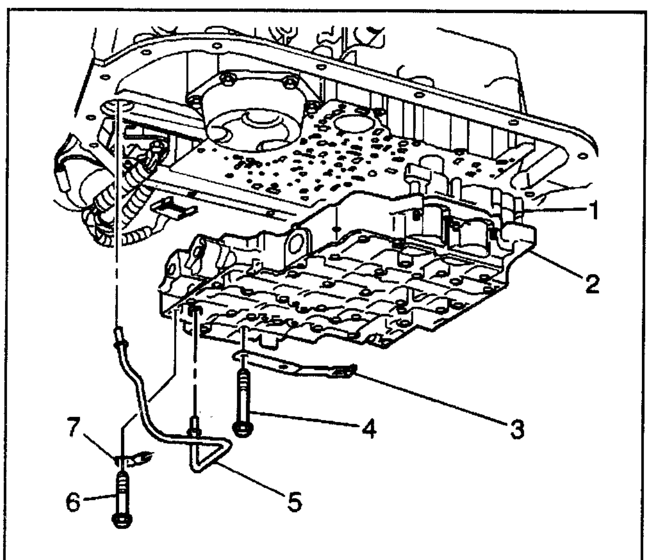
   Tighten
   Tighten the bolt to 10 N·m (89 lb in).
4. Lower the vehicle.



102339



237246



237254

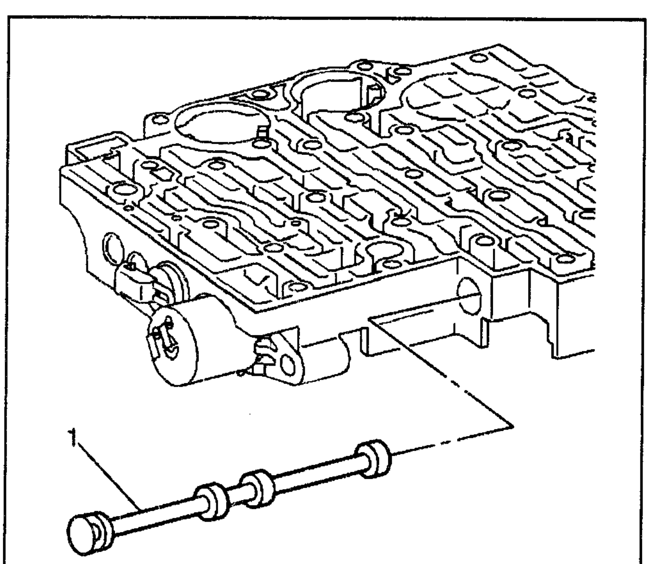
Control Valve Body Replacement

Removal Procedure

1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Place a drain pan under the transmission oil pan.
3. Remove all of the oil pan bolts except for the rear bolts.
4. Loosen the rear oil pan bolts approximately 4 turns.
5. Lightly pry down the front of the oil pan and allow to drain.
6. Remove the remaining oil pan bolts.
7. Remove the oil pan and gasket.
8. Remove the transmission fluid pressure (TFP) manual valve position switch bolts and the TFP valve position switch).

Important: The five o-rings should remain attached to the TFP valve position switch (2).

9. Remove the control valve assembly bolts (4).
10. Remove the fluid level indicator stop bracket.
11. Remove the lube oil pipe retainer (7) and the clamp.
12. Remove the lube oil pipe (5).
13. Remove the manual shaft detent spring assembly (3).
14. Remove the control valve assembly (2) which includes the following:
    - The accumulator housing assembly (1)
    - The control valve assembly to the spacer plate gasket
    - The spacer plate
    - The accumulator gasket



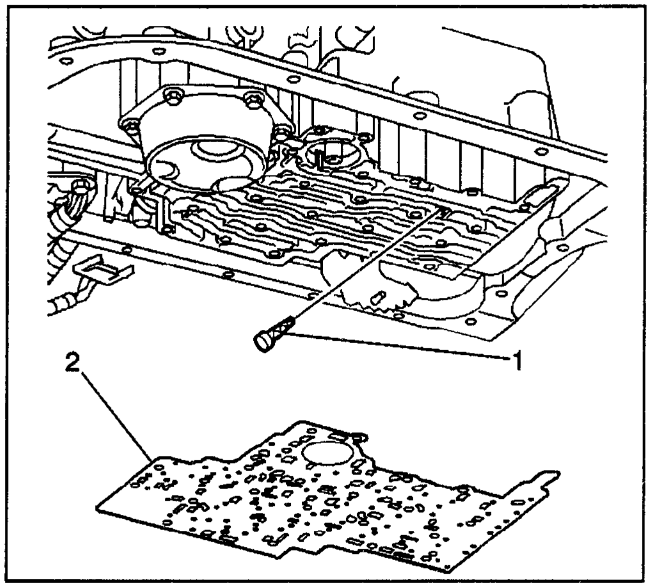
237271

15. Remove the manual valve (1) from the control valve body to prevent any damage.
16. Inspect the manual valve for nicks and burrs.

17. Remove the spacer plate to case gasket (2) from the case. The gasket may stick to the spacer plate.
18. Remove the PWM screen (1) from the case passages.
19. Inspect the PWM screen for debris and damage.

Important: Do not use a magnet in order to remove the checkballs. Using a magnet to remove the checkballs may magnetize the checkballs, causing metal particles to stick.

20. Remove the eight checkballs (nine checkballs for some models).



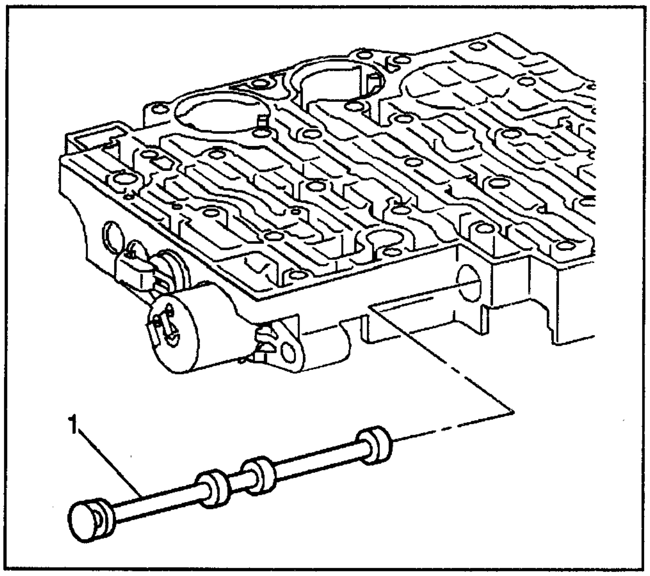
237276

Installation Procedure

Tools Required

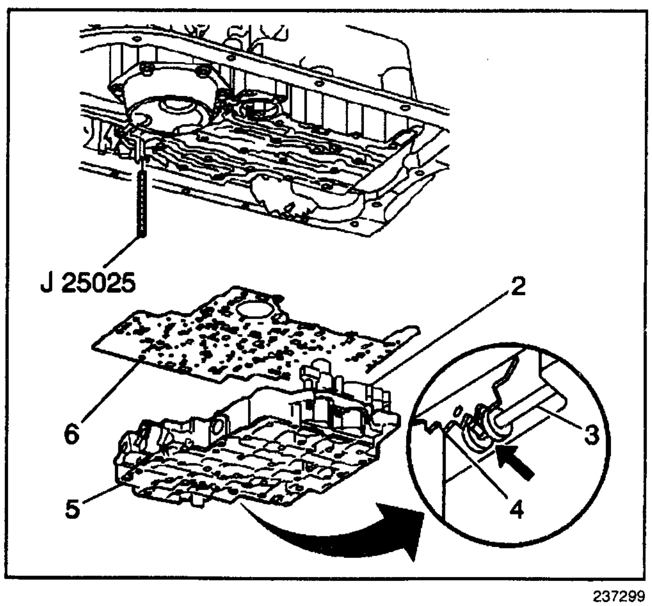
- *J 25025* Guide Pin
- *J 36850* Trans Gel

1. Install the 8 checkballs (9 Checkballs for some models) into the control valve body.
   - The checkball marked as number 2, is used on RCP, RDP, ZJP and ZLP models only.
   - To hold the checkballs in place, use tool *J 36850*.
2. Install the PWM screen into the control valve body.
3. Install the manual valve (1) into the control valve body.

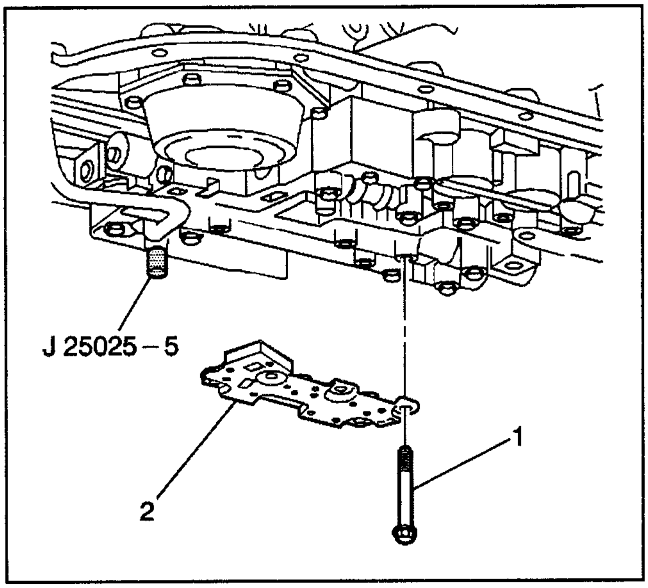


237271

4. To aid in alignment and assembly, install tool *J 25025*.
5. Install the control valve body gasket (6).
6. Install the control valve body assembly (5). Attach the manual valve to the detent lever while installing the control valve body assembly.

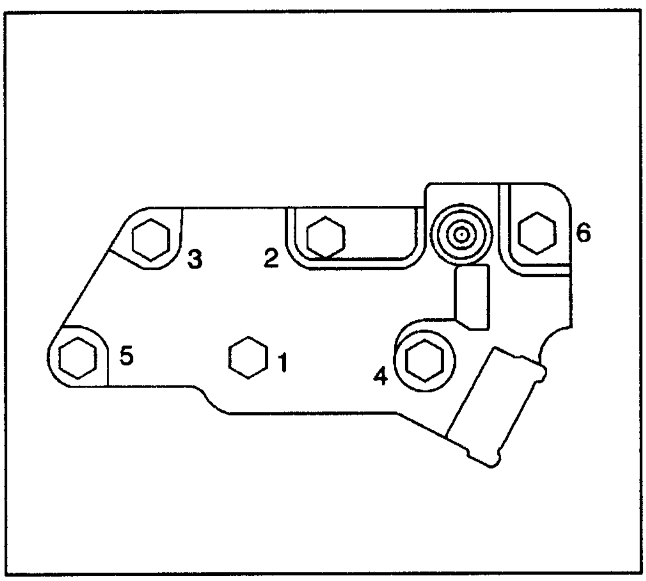


237299



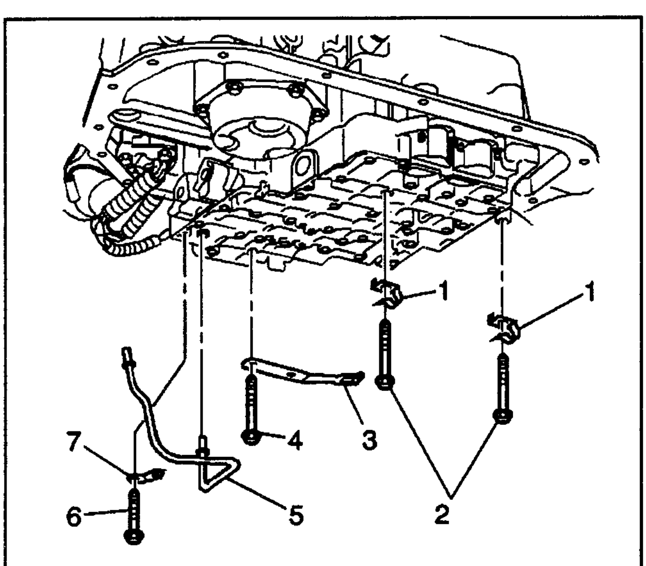
237322

7. Install the transmission fluid pressure manual valve position switch (2).
8. Install the transmission fluid pressure manual valve position switch bolts (1) finger tight.



237341

9. Tighten the bolts in sequence (1, 2, 3, 4, 5, 6) to 11 N·m (97 lb in).
10. Remove *J 25025*.



237346

11. Install the manual shaft detent roller and spring assembly (3) and bolts (2 and 4).
12. Install the two wiring harness clips (1) and bolts (2).
13. Install the wiring harness clip (1) and bolts (2).
14. Install the lube oil pipe (5) with the short end into the control valve body.
15. Install the lube oil pipe retainer (7) and the bolt (6).

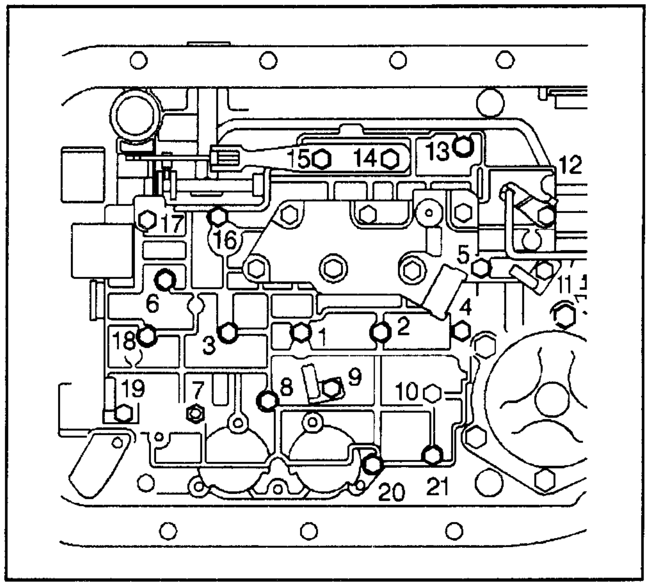
Tighten

Tighten the bolts sequentially to 11 N·m (97 lb in).

16. Install the remaining control valve body bolts.
17. Install the oil pan and gasket using all seventeen bolts.

    Tighten

    Tighten the oil pan bolts to 24 N·m (18 lb ft).
18. Install Dexron® III Automatic Transmission Fluid. Refer to *Approximate Fluid Capacities* in Maintenance and Lubrication.
19. Lower the vehicle



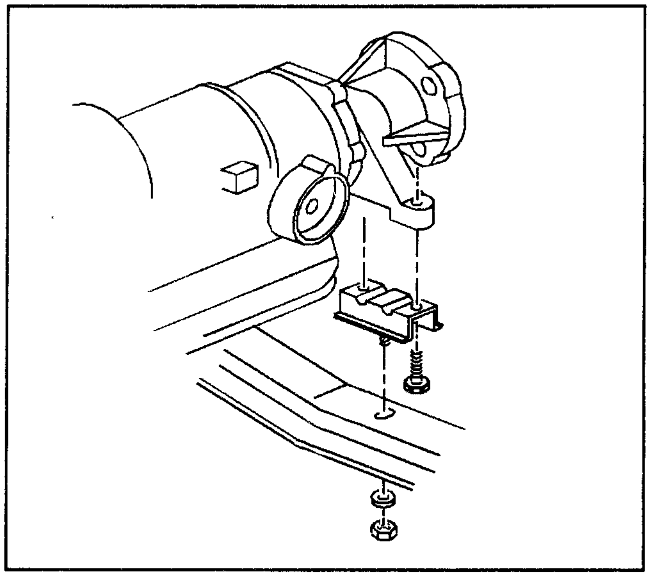
54712

Transmission Mount Replacement

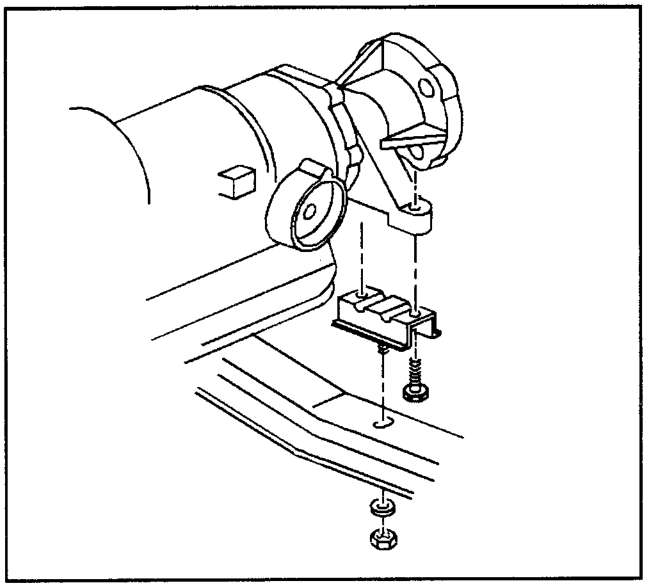
Removal Procedure

Notice: When supporting the engine to replace a mounting, raise the engine only to the height required to provide clearance for mounting removal. It may be necessary to drain the cooling system and disconnect hoses to avoid damage when the engine is raised. Be careful that control linkage and wiring are not damaged from raising the engine. When replacing a single front mounting, both mountings, should be detached before attempting to raise the engine. Failure to do this will place excessive stress on the attached mounting when the engine is raised.

1. Support the rear of the transmission to relieve the weight on the rear transmission mount.
2. Raise and safely support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
3. Remove the mount to crossmember nut and washer.
4. Raise the rear of the transmission only enough to permit removal of the mount.
5. Remove the transmission mount bolts and washers.
6. Remove the rear transmission mount.



66075



66075

Installation Procedure

1. Install the rear transmission mount.

Notice: Refer to *Fastener Notice* in General Information.

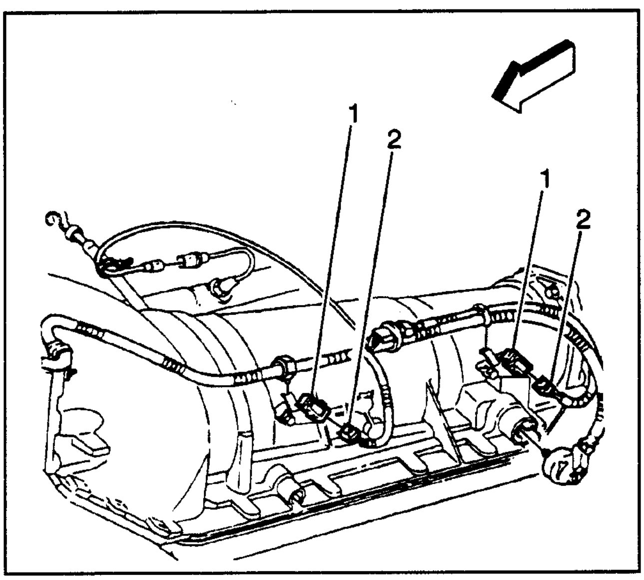
2. Install the transmission mount bolts and washers.

   Tighten

   Tighten the bolts to 47 N·m (35 lb ft).
3. Lower the rear of the transmission.
4. Install the transmission mount to crossmember nut and washer.

   Tighten

   Tighten the nut to 47 N·m (35 lb ft).
5. Lower the vehicle.



178875

Transmission Replacement

Removal Procedure

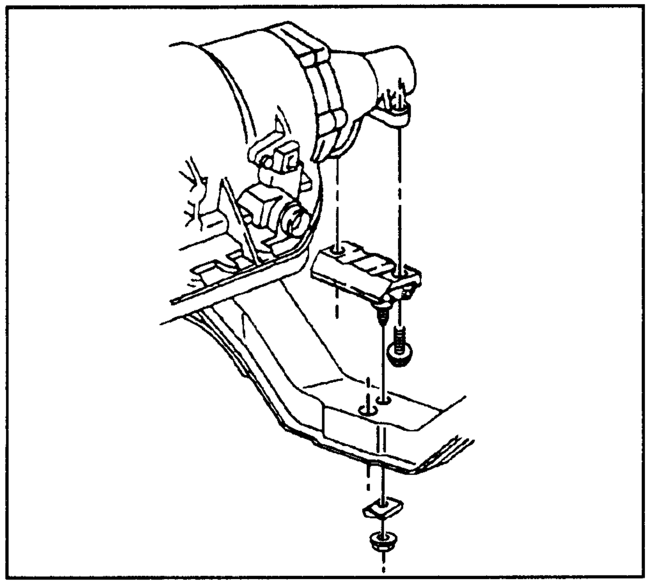
Tools Required

J 21366 Converter Holding Strap

Caution: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable.
2. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
3. Drain the transmission fluid. Refer to *AT Fluid/Filter Changing.*
4. Remove the shift cable from the transmission shift lever. Refer to *Shift Cable Replacement.*
5. Disconnect the electrical connectors (1,2) from each other.
6. Remove the propeller shaft. Refer to *Two-Piece Propeller Shaft Replacement* or *Three-Piece Propeller Shaft Replacement.*
7. Remove the park brake assembly. Refer to *Backing Plate Replacement* in Parking Brake.
8. Support the transmission with a transmission jack.

9. Remove the rear transmission mount to crossmember nut and washer.
10. Remove the transmission crossmember and the bolts.



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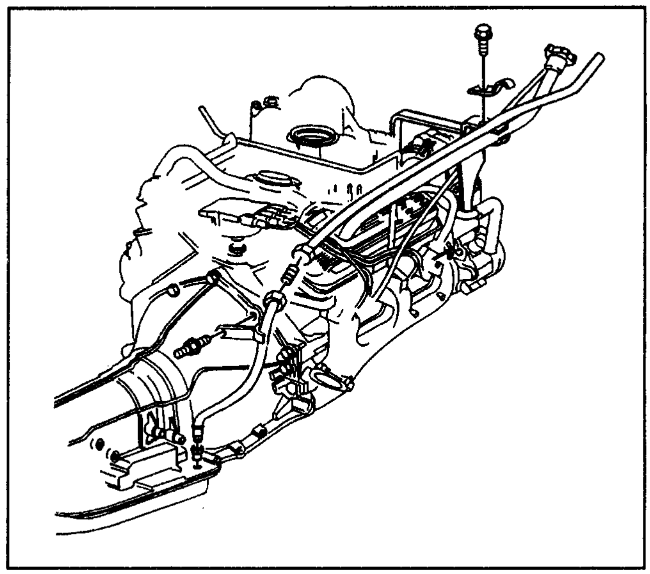
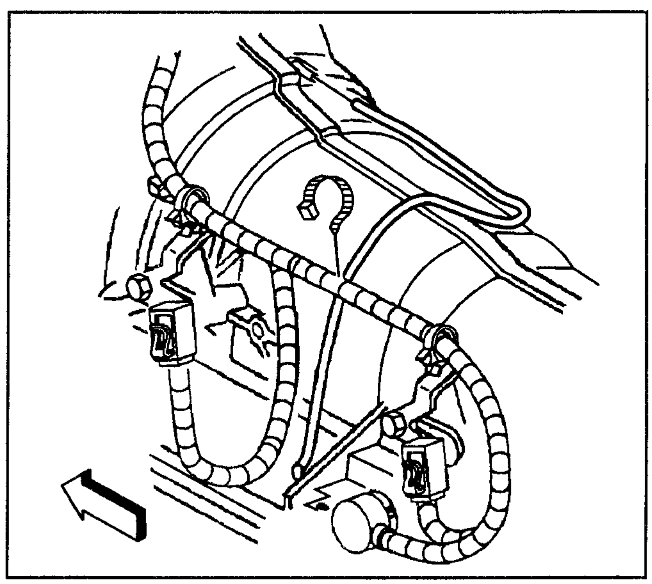
11. Remove the oil level indicator tube from the transmission.



178886

12. Remove the transmission vent hose from the transmission. Refer to *Vent Hose*.
13. Disconnect the transmission cooler lines. Refer to *Oil Cooler Line Replacement*.
14. Remove the front exhaust pipe from the vehicle. Refer to *Exhaust Pipe Replacement (Front)* in Engine Exhaust.



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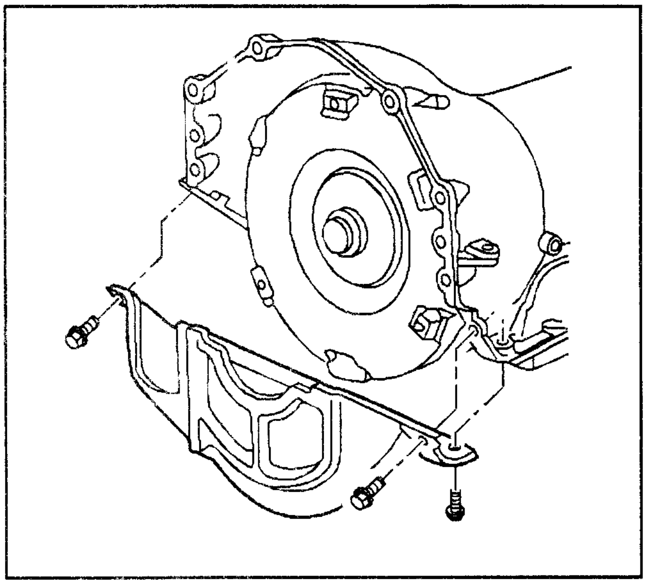
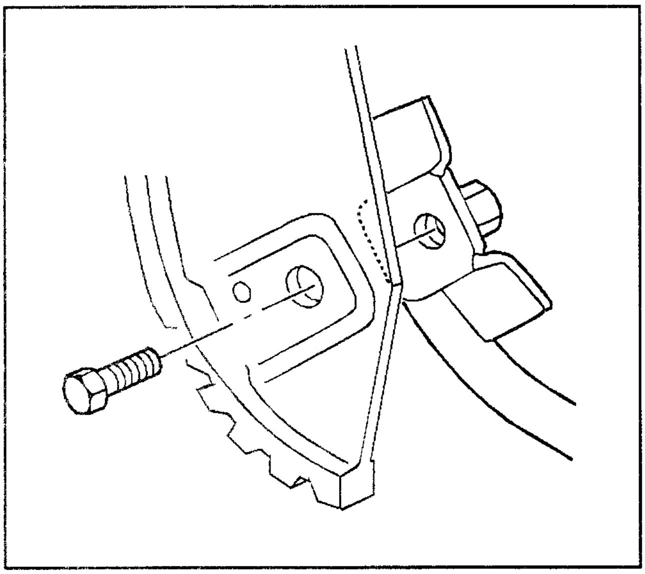


102335

15. Remove the converter housing cover from the transmission.



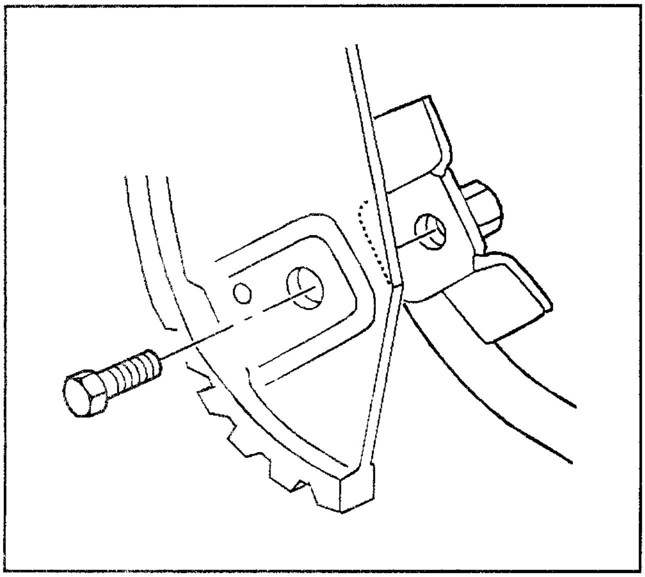
102211

16. Mark the flywheel and the torque converter for installation alignment.

    Remove the bolts that connect the flywheel to the torque converter.

Important: Support the engine with a jack or a hoist before disconnecting the transmission from the engine.

17. Remove the bolts that secure the engine to the transmission.
18. Slide the transmission straight back from the locating pins and install the *J 21366* in order to prevent the converter from falling out of the bell housing.
19. Remove the transmission from the vehicle.



102211

Installation Procedure

1. Install the transmission to the engine by using the following procedure:
   - The torque converter must be seated properly and the *J 21366* must be in place.
   - Support the transmission with a transmission jack.
   - Raise the transmission into place. Remove the *J 21366*.
   - Slide the transmission straight onto the locating pins while lining up the marks on the flywheel and the torque converter.

Important: The torque converter must be flush onto the flywheel and rotate freely by hand.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the bolts that secure the transmission to the engine.

   Tighten

   Tighten the bolts and the studs to 50 N·m (37 lb ft).
3. Install the bolts that secure the flywheel to the torque converter.

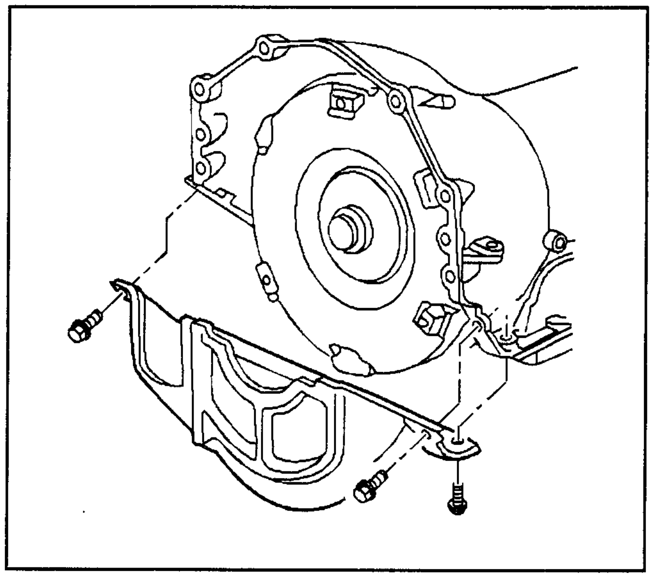
   Tighten to finger tight to insure proper converter seating.

   Tighten

   Tighten the bolts to 55 N·m (41 lb ft).
4. Install the converter housing cover.
5. Install the bolts for the converter housing cover.

   Tighten

   Tighten the cover bolts to 33 N·m (24 lb ft).
6. Connect the transmission cooler lines. Refer to *Oil Cooler Line Replacement.*
7. Install the front exhaust pipe to the vehicle. Refer to *Exhaust Pipe Replacement (Front)* in Engine Exhaust.



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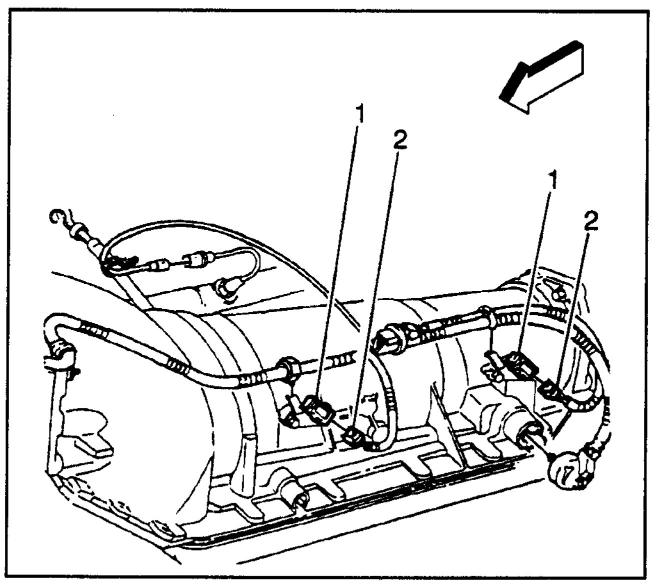
8. Connect the electrical connectors (1,2) to each other.



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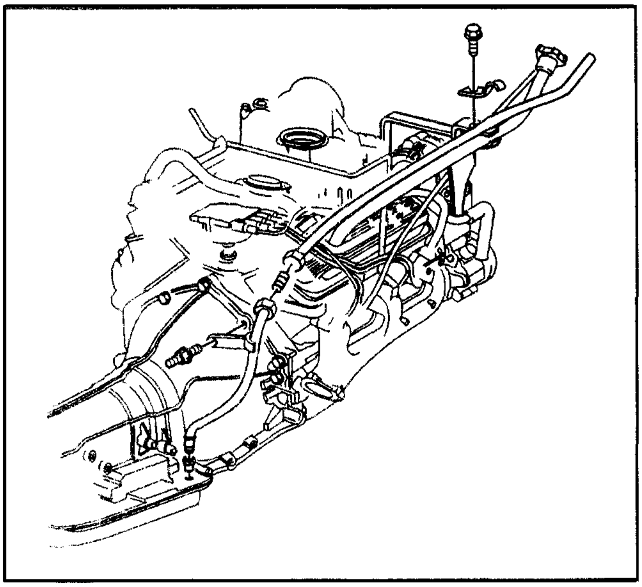
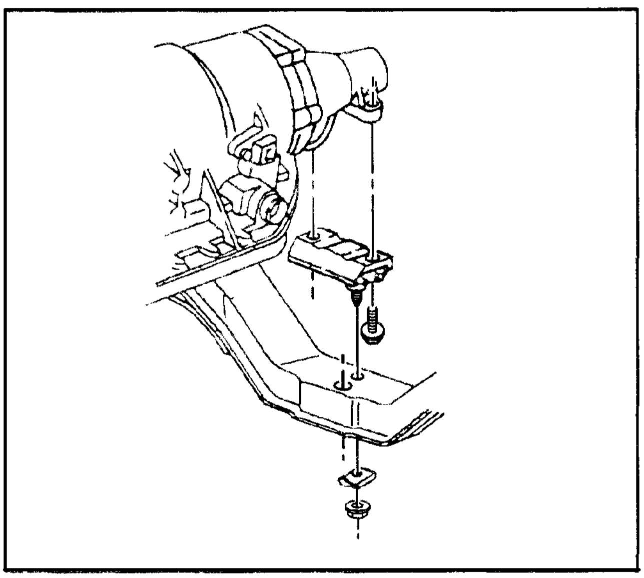


178886

9. Install the oil level indicator tube.



178874

10. Install the transmission mount.

    Tighten

    Tighten the transmission mount bolts to 44 N·m (33 lb ft).
11. Install the transmission crossmember and the bolts.

    Tighten

    Tighten the crossmember to frame bolts to 77 N·m (56 lb ft).
12. Remove the transmission jack.
13. Install the transmission mount to transmission crossmember washer and nut.

    Tighten

    Tighten the nut to 44 N·m (33 lb ft).
14. Install the park brake assembly. Refer to *Backing Plate Replacement* in Parking Brake.
15. Install the propeller shaft. Refer to *Two-Piece Propeller Shaft Replacement* or *Three-Piece Propeller Shaft Replacement.*
16. Install the shift cable. Refer to *Shift Cable Replacement.*
17. Lower the vehicle.
18. Check the transmission fluid level. Refer to *Fluid Capacity Specifications.*
19. Connect the negative battery cable.

AT Oil Cooler Flushing

Preparation

1. After the repaired or replacement transmission is installed in the vehicles, do not reconnect the oiler cooler pipes.
2. Remove the fill cap on the J 35944 and fill the can with 0.6 L (20–21 oz.) of flushing solution. Do not overfill.
3. Install the fill cap on the J 35944 and pressurize the flusher can, using a shop air supply regulated at 550–700 kPa (80–100 psi).
4. Connect the J 35944 discharge hose to the oil cooler return pipe.
5. Clip the discharge hose onto the oil drain container.
6. Attach the J 35944 to the undercarriage of the vehicle with the hook provided and connect the hose from the J 35944 to the other (feed) oil cooler pipe.
7. With the water valve on the J 35944 in the OFF position, connect the water hose from the water supply to the J 35944.
8. Turn ON the water supply at the faucet.

Initial Flush

1. Turn the water valve on the J 35944 to the ON position and allow the water to flow through the oil cooler pipes for 10 seconds to remove any remaining transmission fluid. If the water does not flow through the cooler and pipes, the cause of the blockage must be diagnosed and the plugged component must be repaired or replaced. Continue with the cooler flushing and flow check procedure once the blockage is corrected.
2. Turn the water supply on the J 35944 to the OFF position and clip the discharge hose onto the five gallon pail with a lid.
3. Turn the water valve on the J 35944 to the ON position and depress the trigger to mix cooler flushing solution into the water flow. Use the clip provided on the handle to hold the trigger down. The discharge will foam vigorously when the solution is introduced into the water stream.
4. Flush the oil cooler and pipes with water and solution for two minutes. During this flush, attach the air supply to the air valve located on the J 35944 for 3 to 5 seconds at the end of even 15 to 20 second interval to create a surge action
5. Release the trigger and turn the water valve on the J to the off position.

Back Flush

1. Disconnect both hoses from the oil cooler pipes and then connect them to the opposite oil cooler pipe. This will allow the oil cooler and pipes to be back flushed.
2. Repeat steps 3 and 4 on the Initial Flush Procedure.
3. Release the trigger on the J 35944 and allow water only to rinse the oil cooler and pipes for one minute.
4. Turn OFF the water supply at the faucet.
5. Attach the air supply to the valve on the J 35944 and blow out the water from the oil cooler and pipes. Continue until no water comes out of the discharge hose.

Flow Check

1. Disconnect both hoses from the oil cooler pipes. Connect the oil cooler feed pipe to the transmission and the return pipe to the discharge hose. Refer to Transmission Specifications. Clip the discharge hose onto the empty oil drain container.
2. Confirm the transmission is filled with automatic transmission fluid. Refer to Specifications for the correct automatic transmission fluid capacity.
3. Start the engine with the transmission in PARK range and run for 30 seconds. A minimum of 1.9 L (2 quarts) must be discharged during this 30 second fun time.
   - If fluid flow is greater than 1.9 L (2 quarts) in 30 seconds, go to step 7.
   - If fluid flow is less than 1.9 L (2 quarts) in 30 seconds, perform the following diagnosis:
4. Disconnect the oil cooler feed line at the radiator.
5. Connect the discharge hose to the cooler feed line. Clip the discharge hose onto the empty oil drain container.
6. Start the engine with the transmission in PARK and fun for 30 seconds. A minimum of 1.9 L (2 quarts) must discharge during the 30 second run time. Do the following according to flow rate:
   - Insufficient feed flow: Inspect the transmission.
   - Sufficient feed flow: Inspect the cooler return pipe and the cooler.
7. Remove the discharge hose, reconnect the cooler feed and return pipes to the transmission and refill the unit to the proper fluid level Refer to specifications for the correct automatic transmission capacity.

Description and Operation

Transmission General Information

How to Use This Section

This section provides the following information:

- General diagnosis information on transmissions
- A detailed description of the Hydra-matic transmission operation
- Procedures for diagnosing the Hydra-matic transmission

When you diagnose any condition of the Hydra-matic transmission, begin with the Functional Test Procedure. This procedure indicates the proper path of diagnosing the transmission by describing the basic checks. This procedure will then refer you to the locations of specific checks. After you have determined the cause of a condition, refer to Repair Instructions for repair procedures. If the faulty component is not serviceable without removing the transmission from the vehicle, refer to Unit Repair for repair information.

Basic Knowledge

Notice: Do not, under any circumstances, attempt to diagnose a powertrain condition without basic knowledge of this powertrain. If you perform diagnostic procedures without this basic knowledge, you may incorrectly diagnose the condition or damage the powertrain components.

You must be familiar with some basic electronics in order to use this section of the service manual. You should also be able to use the following special tools:

- A Digital Multimeter (DMM)
- A circuit tester
- Jumper wires or leads
- A line pressure gage set

The Functional Test Procedures verify the correct operation of electronic components in the transmission. These procedures eliminate the unnecessary removal of transmission components.

Diagnosis

Notice: If you probe a wire with a sharp instrument and do not properly seal the wire afterward, the wire corrodes and an open circuit results.

Diagnostic test probes are now available that allow you to probe individual wires without leaving the wire open to the environment. These probe devices are inexpensive and easy to install, and they permanently seal the wire from corrosion.

Definitions and Abbreviations

Throttle Positions

Engine Braking: A condition where the engine is used to slow the vehicle by manually downshifting during a zero throttle coastdown.

Full Throttle Detent Downshift: A quick apply of the accelerator pedal to its full travel, forcing a downshift.

Heavy Throttle: Approximately 3/4 of accelerator pedal travel (75% throttle position).

Light Throttle: Approximately 1/4 of accelerator pedal travel (25% throttle position).

Medium Throttle: Approximately 1/2 of accelerator pedal travel (50% throttle position).

Minimum Throttle: The least amount of throttle opening required for an upshift.

Wide Open Throttle (WOT): Full travel of the accelerator pedal (100% throttle position).

Zero Throttle Coastdown: A full release of the accelerator pedal while the vehicle is in motion and in drive range.

Shift Condition Definitions

Bump: A sudden and forceful apply of a clutch or a band.

Chuggle: A bucking or jerking. This condition may be most noticeable when the converter clutch is engaged. It is similar to the feel of towing a trailer.

Delayed: A condition where a shift is expected but does not occur for a period of time. This could be described as a clutch or band engagement that does not occur as quickly as expected during a part throttle or wide open throttle apply of the accelerator, or during manual downshifting to a lower range. This term is also defined as LATE or EXTENDED.

Double Bump (Double Feel): Two sudden and forceful applies of a clutch or a band.

Early: A condition where the shift occurs before the car has reached proper speed. This condition tends to labor the engine after the upshift.

End Bump: A firmer feel at the end of a shift than at the start of the shift. This is also defined as END FEEL or SLIP BUMP.

Firm: A noticeably quick apply of a clutch or band that is considered normal with a medium to heavy throttle. This apply should not be confused with HARSH or ROUGH.

Flare: A quick increase in engine RPM along with a momentary loss of torque. This most generally occurs during a shift. This condition is also defined as SLIPPING.

Harsh (Rough): A more noticeable apply of a clutch or band than FIRM. This condition is considered undesirable at any throttle position.

Hunting: A repeating quick series of upshifts and downshifts that causes a noticeable change in engine RPM, such as a 4-3-4 shift pattern. This condition is also defined as BUSYNESS.

Initial Feel: A distinctly firmer feel at the start of a shift than at the finish of the shift.

Late: A shift that occurs when the engine RPM is higher than normal for a given amount of throttle.

Shudder: A repeating jerking condition similar to CHUGGLE but more severe and rapid. This condition may be most noticeable during certain ranges of vehicle speed.

Slipping: A noticeable increase in engine RPM without a vehicle speed increase. A slip usually occurs during or after initial clutch or band apply.

Soft: A slow, almost unnoticeable clutch or band apply with very little shift feel.

Surge: A repeating engine related condition of acceleration and deceleration that is less intense than CHUGGLE.

Tie-Up: A condition where two opposing clutch and/or bands are attempting to apply at the same time causing the engine to labor with a noticeable loss of engine RPM.

Noise Conditions

Drive Link Noise: A whine or growl that increases or fades with vehicle speed, and is most noticeable under a light throttle acceleration. It may also be noticeable in PARK or NEUTRAL operating ranges with the vehicle stationary.

Final Drive Noise: A hum related to vehicle speed which is most noticeable under a light throttle acceleration.

Planetary Gear Noise: A whine related to vehicle speed, which is most noticeable in FIRST gear, SECOND gear, FOURTH gear or REVERSE. The condition may become less noticeable, or go away, after an upshift.

Pump Noise: A high pitched whine that increases in intensity with engine RPM. This condition may also be noticeable in all operating ranges with the vehicle stationary or moving.

Torque Converter Noise: A whine usually noticed when a vehicle is stopped, and the transmission is in DRIVE or REVERSE. The noise will increase with engine RPM.

Transmission Abbreviations

A/C: Air Conditioning

AC: Alternating Current

A/T: Automatic Transmission

CCDIC: Climate Control Driver Information Center

DC: Direct Current

DIC: Driver Information Center

DLC: Diagnostic Link Connector

DMM: Digital Multimeter

DTC: Diagnostic Trouble Code

EBTCM: Electronic Brake/Traction Control Module

ECCC: Electronically-Controlled Capacity Clutch

ECT: Engine Coolant Temperature

EMI: Electromagnetic Interference

IAT: Intake Air Temperature

IGN: Ignition

IMS: Internal Mode Switch

ISS: Input (Shaft) Speed Sensor

MAP: Manifold Absolute Pressure

MIL: Malfunction Indicator Lamp

NC: Normally Closed

NO: Normally Open

OBD: On Board Diagnostic

OSS: Output (Shaft) Speed Sensor

PC: Pressure Control

PCM: Powertrain Control Module

PM: Permanent Magnet

PWM: Pulse Width Modulation

RPM: Revolutions Per Minute

SS: Shift Solenoid

STL:: Service Transmission Lamp

TAP: Transmission Adaptive Pressure

TCC: Torque Converter Clutch

TCM: Transmission Control Module

TFP: Transmission Fluid Pressure

TFT: Transmission Fluid Temperature

TP: Throttle Position

TV: Throttle Valve

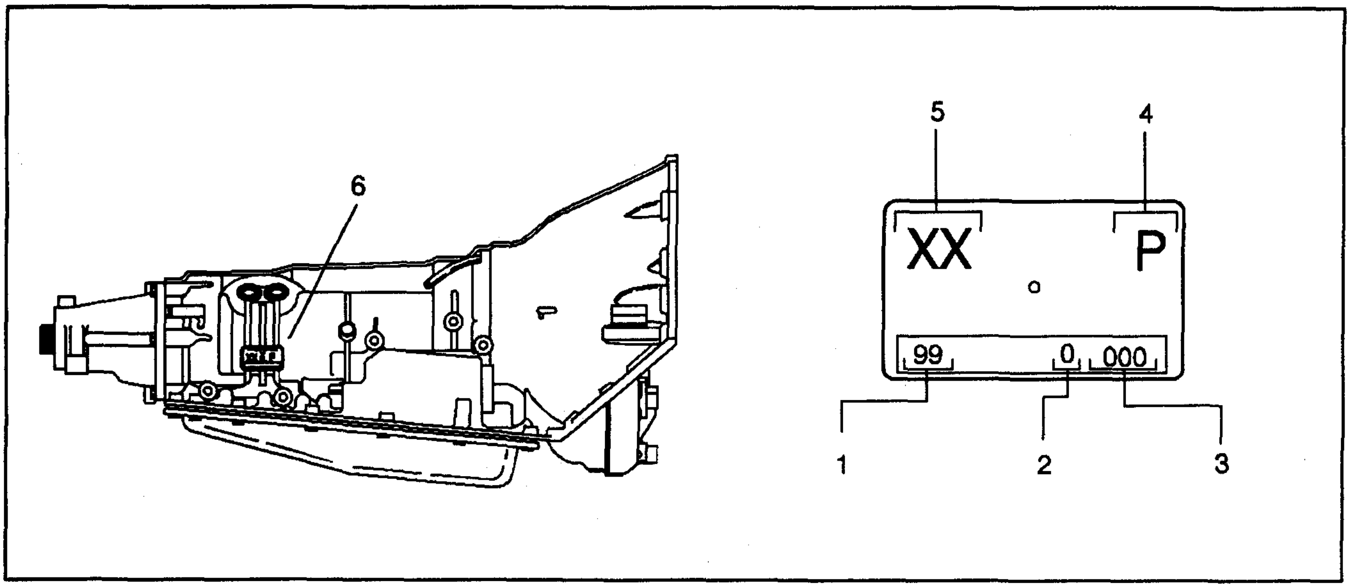
VCM: Vehicle Control Module

VSS: Vehicle Speed Sensor

WOT: Wide Open throttle

4WD: Four-Wheel Drive

Transmission Identification Information



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Legend

(1) Model Year (99 = 1999)
(2) Calendar Year
(3) Julian Date
(4) Hydra-Matic 4L80-E
(5) Model
(6) Transmission ID Location

Transmission General Description

The 4L80-E is a fully automatic rear wheel drive electronically controlled transmission. The 4L80-E provides four forward ranges including overdrive and reverse. A gear type of oil pump controls shift points. The VCM/PCM and the pressure control (PC) solenoid (force motor) regulate these shift points. The VCM/PCM also controls shift schedules and TCC apply rates. Transmission temperature also influences shift schedules and TCC apply rates.

You can operate the transmission in any one of the following seven modes:

- P – PARK position prevents the vehicle from rolling either forward or backward on vehicles less than 15,000 G.V.W. For safety reasons, use the parking brake in addition to the park position.
- R – REVERSE allows the vehicle to be operated in a rearward direction.
- N – NEUTRAL allows the engine to be started and operated while driving the vehicle. If necessary, you may select this position in order to restart the engine with the vehicle moving.
- OD – OVERDRIVE is used for all normal driving conditions. Overdrive provides four gear ratios plus a converter clutch operation. Depress the accelerator in order to downshift for safe passing.
- D – DRIVE position is used for city traffic, and hilly terrain. Drive provides three gear ranges. Depress the accelerator in order to downshift.
- 2 – Manual SECOND provides acceleration and engine braking or greater traction from a stop. When you choose manual SECOND, the vehicle will start out in first gear and upshift to second gear. You may select this gear at a vehicle speed of up to 22 km/h (35 mph).
- 1 – Manual LOW provides maximum engine braking. You may select this gear at a vehicle speed of up to 13 km/h (20 mph).

Transmission Component and System Description

The mechanical components of this unit are as follows:

- A torque converter with a torque converter clutch (TCC)
- A gear type oil pump
- Five multiple disk clutches
- Two band assemblies
- Three planetary gear sets
- One sprag clutch
- Two roller clutches
- A control valve body assembly

The electrical components of this unit are as follows:

- Two shift solenoid valves, 1-2 and 2-3
- A torque converter clutch (TCC) solenoid valve
- A transmission pressure control (PC) solenoid valve
- An automatic transmission fluid temperature (TFT) sensor
- An automatic transmission fluid pressure (TFP) manual valve position switch assembly
- An output speed sensor (OSS)
- An input speed sensor (ISS)

Adapt Function

The 4L80-E transmission uses a line pressure control system that has the ability to adapt line pressure to compensate for normal wear of the following parts:

- The clutch fiber plates
- The springs and seals
- The apply bands

This adaptive feature is similar to the fuel and idle control systems, where the PCM has the ability to learn and adjust for monitored system changes.

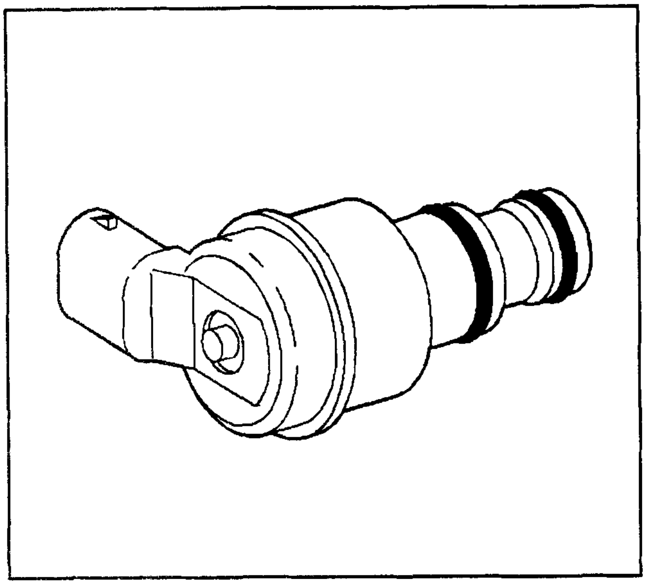
The PCM maintains information for the following transmission adaptive systems:

1–2, 2–3, 3–4 Upshift Adapts — The PCM/VCM monitors the automatic transmission input (shaft) speed sensor (A/T ISS) and the output speed sensor (OSS), to determine when the transmission has started, and completed an upshift. The PCM looks at the time from the beginning, until the completion of the upshift. If the time of the upshift was longer than a calibrated value, then the PCM will adjust the current to the transmission pressure control (PC) solenoid to increase line pressure for the next, same, upshift under identical conditions. If the time of the upshift was shorter than a calibrated value, then the PCM will adjust the current, to the transmission PC solenoid, to decrease line pressure for the next, same, upshift under identical conditions.

Steady State Adapts (PCM only) — The PCM monitors the automatic transmission input (shaft) speed sensor (A/T ISS) and the output speed sensor (OSS) after a shift has occurred, to determine the amount of clutch slippage in the transmission. If to much slippage is detected, the PCM adjusts the current, to the transmission PC solenoid, to increase the line pressure and reduce clutch slip.

Electronic Component Description

Torque Converter Clutch Solenoid Valve



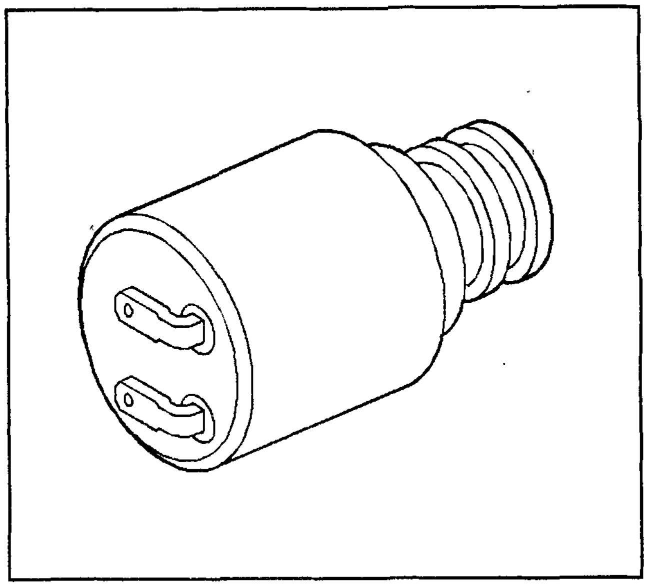
40716

The VCM/PCM energizes the torque converter clutch pulse width modulated (TCC PWM) solenoid valve, which is located on the transmission valve body. The TCC PWM solenoid valve acts on the TCC apply valve in order to control the torque converter clutch application.

The TCC PWM Sol. Valve is pulse width modulated by the VCM/PCM. This means that the VCM/PCM pulses the solenoid so that the hydraulic pressure against the torque converter clutch modulates. This modulated pressure allows the TCC to slip slightly, thus keeping the TCC balanced just at the point of engagement.

One diagnostic code is associated with the TCC PWM solenoid valve Code P1860, TCC solenoid circuit – electrical, detects a fault in the TCC circuit. While Code P1860 is set, both fourth gear in hot mode and the TCC are inhibited. Shift adapts does not update and the MIL illuminates. Recovery can occur on the next ignition cycle.

Transmission Pressure Control Solenoid Valve (Force Motor)



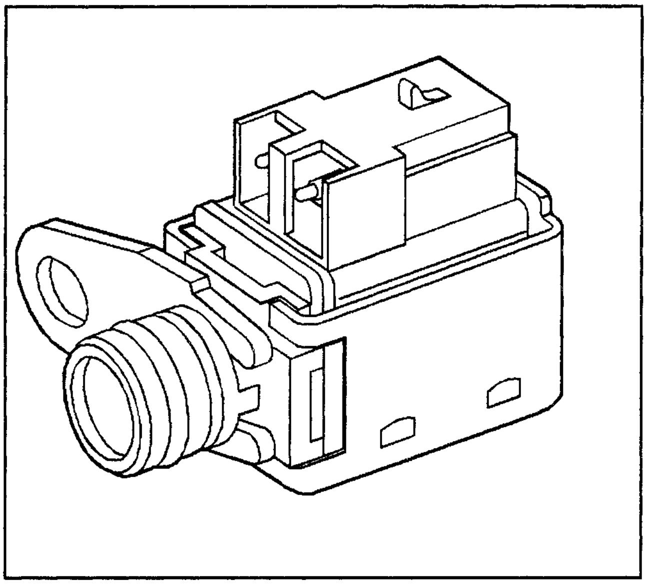
40717

The pressure control (PC) solenoid valve is attached to the valve body. The valve controls line pressure by moving a pressure regulator valve against spring pressure. The PC solenoid valve takes the place of the throttle valve or the vacuum modulator, which was used on past model transmissions.

The VCM/PCM varies line pressure based on engine load. Engine load is calculated from various inputs, especially the TP sensor switch. Line pressure is actually varied by changing the amperage applied to the PC solenoid valve from 0 amps (high pressure) to 1.1 amps (low pressure).

One diagnostic code is associated with the PC solenoid valve. Code P0748 sets when the VCM/PCM detects a difference of.16 amp or more between the amperage commanded and actual amperage. While the code is set, the PC solenoid valve turns OFF. Recovery can occur after the next ignition cycle. Code P0748 does not sense a hydraulic problem such as a stuck valve.

1-2 Shift Solenoid Valve



40714

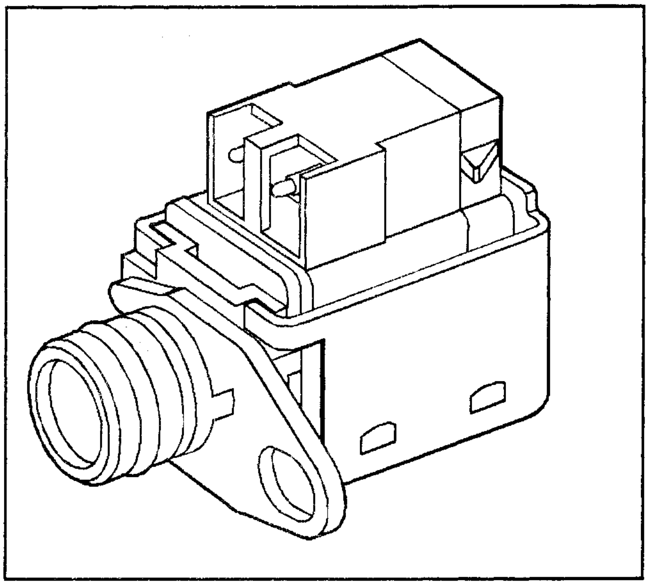
The 1–2 shift solenoid (SS) valve is a normally open exhaust valve that is attached to the valve body. The VCM/PCM controls the solenoid by grounding the solenoid through an internal quad driver. The 1–2 SS valve is ON in FIRST and FOURTH gear. When commanded ON, the 1–2 SS valve redirects fluid to act on the 1–2 shift valve.

There are two VCM related diagnostic trouble codes (DTCs) associated with the 1–2 SS valve: P0751 and P0753. There are four PCM related diagnostic trouble codes associated with the 1–2 SS valve: P0751, P0752, P1842 and P1843.

The VCM monitors the 1–2 SS circuit for an open or short to ground condition. If the VCM detects an open or short to ground condition, then DTC P0753 (1–2 SS Valve-Electrical) sets. If the VCM detects an incorrect gear ratio, then DTC P0751 (1–2 SS Valve-Performance) sets. When DTC P0753 or P0751 sets, the VCM commands maximum line pressure, freezes shift adapts from being updated, and inhibits 3–2 downshifts.

The PCM monitors the 1–2 SS circuit for low voltage. If the voltage is low, then DTC P1842 (1–2 SS Valve-Low Voltage) sets. The PCM also monitors the 1–2 SS circuit for high voltage. If the voltage is high, then DTC P1843 (1–2 SS Valve-High Voltage) sets. When DTC P1842 or P1843 sets, the PCM commands maximum line pressure, and freezes shift adapts from being updated. If the PCM detects an incorrect gear ratio, then DTC P0751 (1–2 SS Valve-Stuck OFF) sets, or DTC P0752 (1–2 SS Valve-Stuck ON) sets. When DTC P0751 or P0752 sets, the PCM commands maximum line pressure, and freezes shift adapts from being updated.

2-3 Shift Solenoid Valve



40713

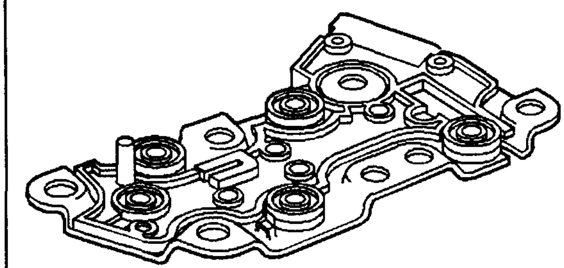
The 2–3 shift solenoid (SS) valve is a normally open exhaust valve that is attached to the valve body. The VCM/PCM controls the solenoid by grounding the solenoid through an internal quad driver. The 2–3 SS valve is ON in THIRD and FOURTH gear. When commanded ON, the 2–3 SS valve redirects fluid to act on the 2–3 shift valve.

There are two VCM related diagnostic trouble codes (DTCs) associated with the 2–3 SS valve: P0756 and P0758. There are four PCM related diagnostic trouble codes associated with the 2–3 SS valve: P0756, P0757, P1845 and P1847.

The VCM monitors the 2–3 SS circuit for an open or short to ground condition. If the VCM detects an open or short to ground condition, then DTC P0758 (2–3 SS Valve-Electrical) sets. If the VCM detects an incorrect gear ratio, then DTC P0756 (2–3 SS Valve-Performance) sets. When DTC P0758 or P0756 sets, the VCM commands maximum line pressure, freezes shift adapts from being updated, and inhibits 3–2 downshifts.

The PCM monitors the 2–3 SS circuit for low voltage. If the voltage is low, then DTC P1845 (2–3 SS Valve-Low Voltage) sets. The PCM also monitors the 2–3 SS circuit for high voltage. If the voltage is high, then DTC P1847 (2–3 SS Valve-High Voltage) sets. When DTC P1845 or P1847 sets, the PCM commands an immediate landing to SECOND gear, maximum line pressure, and freezes shift adapts from being updated. If the PCM detects an incorrect gear ratio, then DTC P0751 (2–3 SS Valve-Stuck OFF) sets, or DTC P0752 (1–2 SS Valve-Stuck ON) sets. When DTC P0756 or P0757 sets, the PCM commands an immediate landing to SECOND gear, maximum line pressure, and freezes shift adapts from being updated.

Automatic Transmission Fluid Pressure Manual Valve Position Switch Assembly



40718

A gear range sensing device call an automatic transmission fluid pressure (TFP) valve position switch assembly is used by the VCM/PCM in order to sense which gear range has been selected by the vehicle operator. The TFP valve position switch assembly is located on the valve body, and consists of five pressure switches combined into one unit. The VCM/PCM applies system voltage to the TFP valve position switch assembly on three separate wires. These three circuits are either grounded or open, depending on which gear range has been selected, and on which combination of the five switches gave pressure applied to them.

When the vehicle is in PARK, with the key ON and the engine OFF, the normal state of the TFP valve position switch assembly will be DRIVE 2. When the key is ON and the engine is running, the normal state of the TFP valve position switch assembly will be in PARK/NEUTRAL.

There are two possible combinations of the switches within the pressure switch manifold that do not represent an actual gear range. If the VCM/PCM detects either of these combinations, then a diagnostic trouble code (DTC) sets.

The VCM DTC P1810 sets when the TFP switch indicates the following:

- An illegal gear range
- DRIVE2 position before and after start-up
- PARK/NEUTRAL with a ratio greater than 1.05
- REVERSE with ratio indicating outside of REVERSE
- DRIVE4, DRIVE3, DRIVE2 or DRIVE1 with ratio indicating REVERSE

While DTC P1810 is present, the VCM assumes DRIVE4 for shift pattern, sets line pressure to maximum, freezes shift adapts, and forces TCC ON with 4th gear commanded.

The PCM TFP DTCs set when the TFP switch indicates the following:

- An illegal gear range (DTC 1810)
- DRIVE2 position before and after start-up (DTC P1815)
- PARK/NEUTRAL with a drive ratio (DTC P1816)
- REVERSE with ratio indicating a drive ratio (DTC P1817)
- DRIVE4, DRIVE3, DRIVE2 or DRIVE1 with ratio indicating REVERSE (DTC P1818)

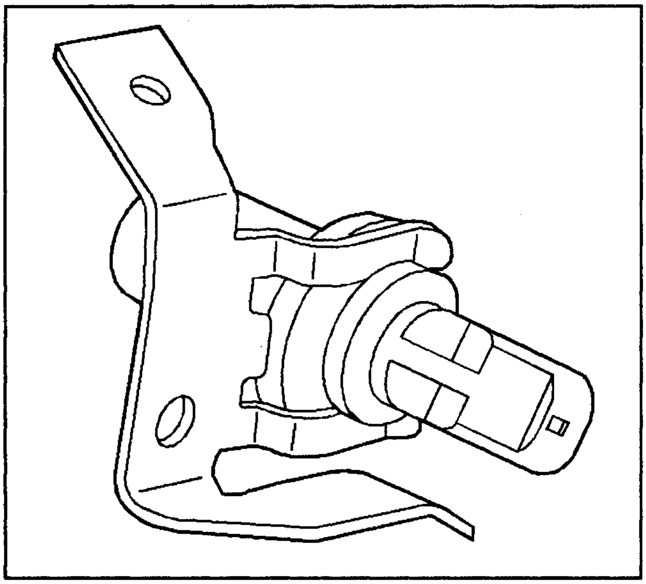
While DTC P1810, P1815, P1816, P1817 and P1818 are present, the VCM assumes DRIVE4 for shift pattern, sets line pressure to maximum, freezes shift adapts, and forces TCC ON with 4th gear commanded.

Oil Pressure and Circuit Combination Table

Range Indicator	Oil Pressure Present					Circuit/Mode		
	REV	LO	PRND4	PRND43	D4	A	B	C
PARK	—	—	X	X	—	OFF	ON	OFF
REVERSE	X	—	X	X	—	ON	ON	OFF
NEUTRAL	—	—	X	X	—	OFF	ON	OFF
Overdrive	—	—	X	X	X	OFF	ON	ON
D	—	—	—	X	X	OFF	OFF	ON
2	—	—	—	—	X	OFF	OFF	OFF
1	—	X	—	—	X	ON	OFF	OFF

Seven valid combinations and two invalid combinations are available from the TR. Valid combinations for Circuits A, B, and C are shown in the figure. The invalid combinations displayed on the scan tool are A = ON, B = ON, C = ON or A = ON, B = OFF, C = ON. ON means that the switch is closed; OFF means that the switch is open.

Automatic Transmission Input (Shaft) Speed, Output (Shaft) Speed Sensors



40712

Both of the automatic transmission input (shaft) speed (A/T ISS) and the automatic transmission output (shaft) speed (A/T OSS) sensors are magnetic induction sensors. The input and the output sensors are accessible from the left hand side of the transmission. The A/T ISS sensor is located just forward of center and the A/T OSS sensor is located near the rear. A voltage signal is induced in the A/T ISS sensor by serrations, which are cut in the outside diameter of the forward clutch housing. Voltage is induced in the output sensor by gear teeth, which are pressed on the outside diameter of the rear carrier assembly.

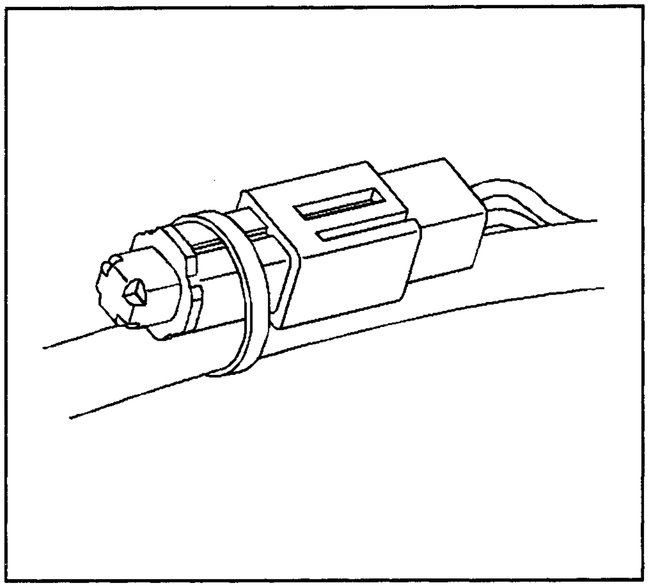
The VCM/PCM used speed information from these sensors in order to determine the following:

- Whether the engine is running
- Vehicle speed
- Calculation of the gear ratio
- Calculation of TCC slip
- Calculation of turbine speed

Code(s) P0502 and P0503 set if a fault exists in the A/T OSS sensor circuit, and the VCM/PCM calculates a default value using the A/T ISS sensor values. As long as the fault remains, and the code is set, the VCM/PCM also commands maximum line pressure, freeze shift adapts, and the MIL illuminates. If the fault is removed, normal operation resumes after the next ignition cycle.

For diesel engines, type B fault codes P0723 and P0724 set.

Automatic Transmission Fluid Temperature Sensor Assembly



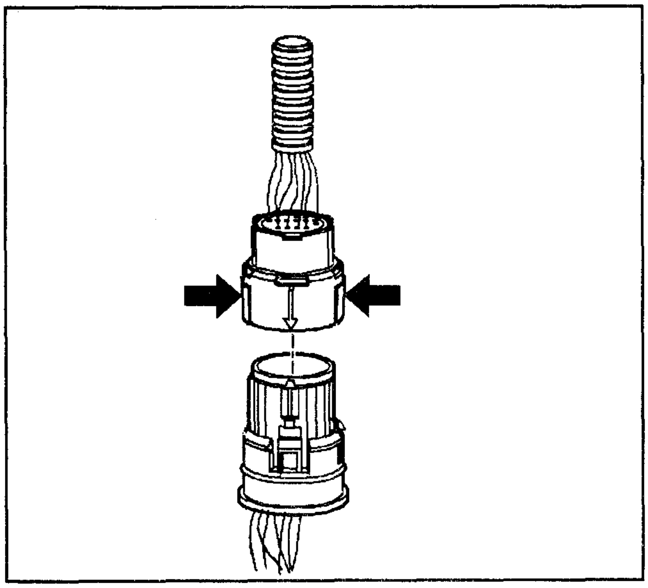
71423

The automatic transmission fluid temperature (TFT) sensor assembly is a thermistor which is mounted in the wiring harness assembly. Low transmission temperature produces high resistance, while high temperature produces low resistance. The VCM/PCM supplies a 5-volt signal to the TFT sensor assembly through an internal resistor. Then the VCM/PCM measures the voltage drop in the circuit. Voltage is high when the transmission is cold and low when the transmission is hot.

The VCM/PCM uses the TFT sensor assembly in order to regulate torque converter clutch apply, as well as shift quality.

DTCs P0711, P0712 and P0713 indicate a fault in the TFT Sensor Assembly circuit. After the vehicle has been started, transmission temperature should rise steadily and stabilize between 90°–115°C, depending on load. All three DTCs causes the VCM/PCM to use a default value of 140°C, thus reacting as if the transmission were hot in either case. When DTCs P0711, P0712 or P0713 are set, the VCM/PCM freezes the shift adapts from being updated, and the MIL illuminates. Some driveability symptoms will be noticed, especially when cold.

Electrical Connector



13265

The transmission electrical connector is an important part of the transmission operating system. Any interference with the electrical connection can cause the transmission to set Diagnostic Trouble Codes (DTCs) or affect proper operation.

The following items can affect the electrical connection:

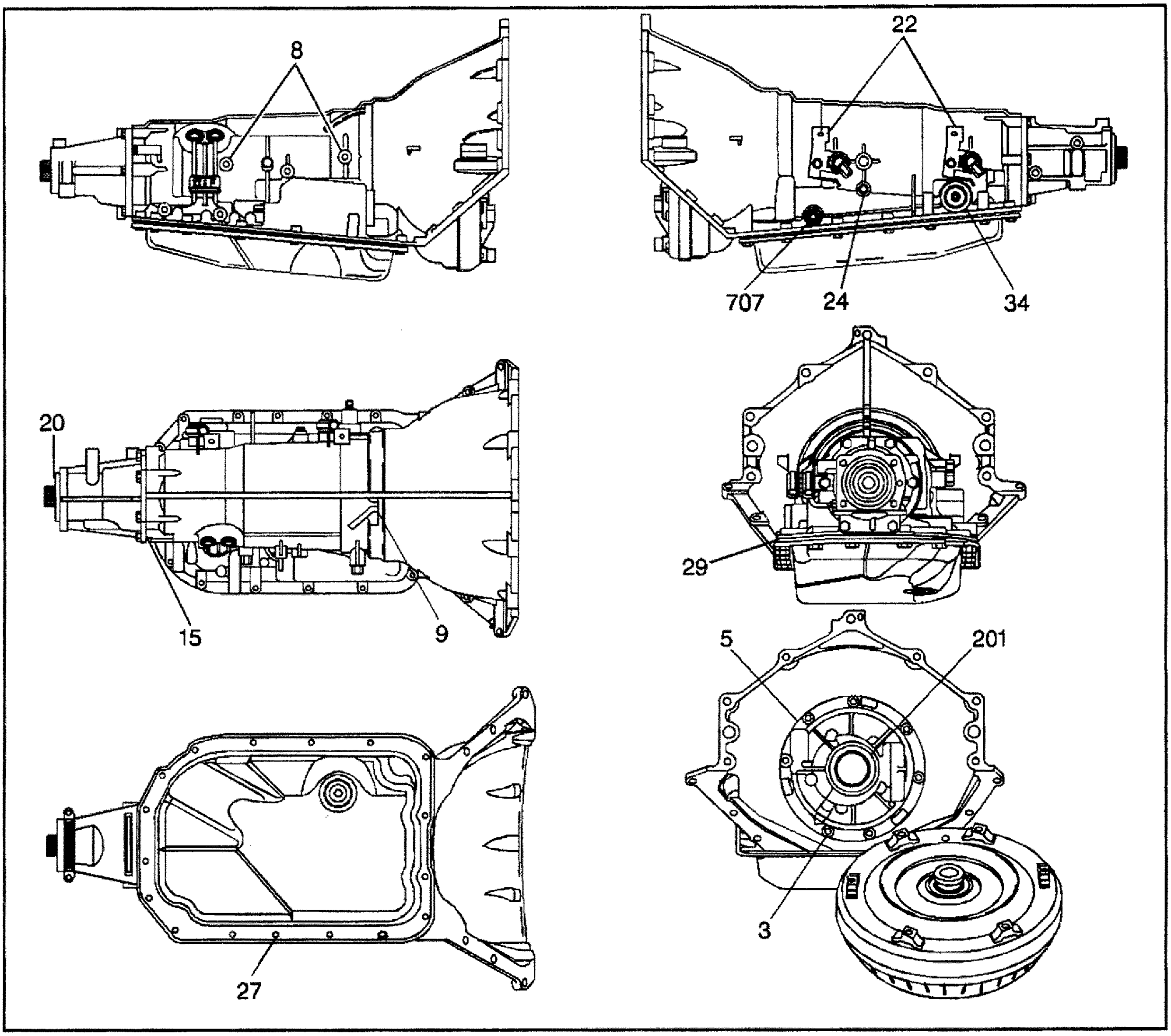
- Bent pins in the connector from rough handling during connection and disconnection
- Wires backing away from the pins or coming uncrimped (in either the internal or the external wiring harness)
- Dirt contamination entering the connector when disconnected
- Pins in the internal wiring connector backing out of the connector or pushed out of the connector during reconnection
- Excessive transmission fluid leaking into the connector, wicking up into the external wiring harness and degrading the wire insulation
- Moisture intrusion in the connector
- Low pin retention in the external connector from excessive connection and disconnection of the wiring connector assembly
- Pin corrosion from contamination
- Damaged connector assembly

Remember the following points:

- In order to remove the connector, squeeze the two tabs toward each other and pull straight up without pulling by the wires.
- Limit twisting or wiggling the connector during removal. Bent pins can occur.
- Do not pry the connector off with a screwdriver or other tool.
- Visually inspect the seals to ensure that they are not damaged during handling.
- In order to reinstall the external wiring connector, first orient the pins by lining up the arrows on each half of the connector. Push the connector straight down into the transmission without twisting or angling the mating parts.
- The connector should click into place with a positive feel and/or noise.
- Whenever the transmission external wiring connector is disconnected from the internal harness and the engine is operating, DTCs will set. Clear these DTCs after reconnecting the external connector.

Transmission Component Location

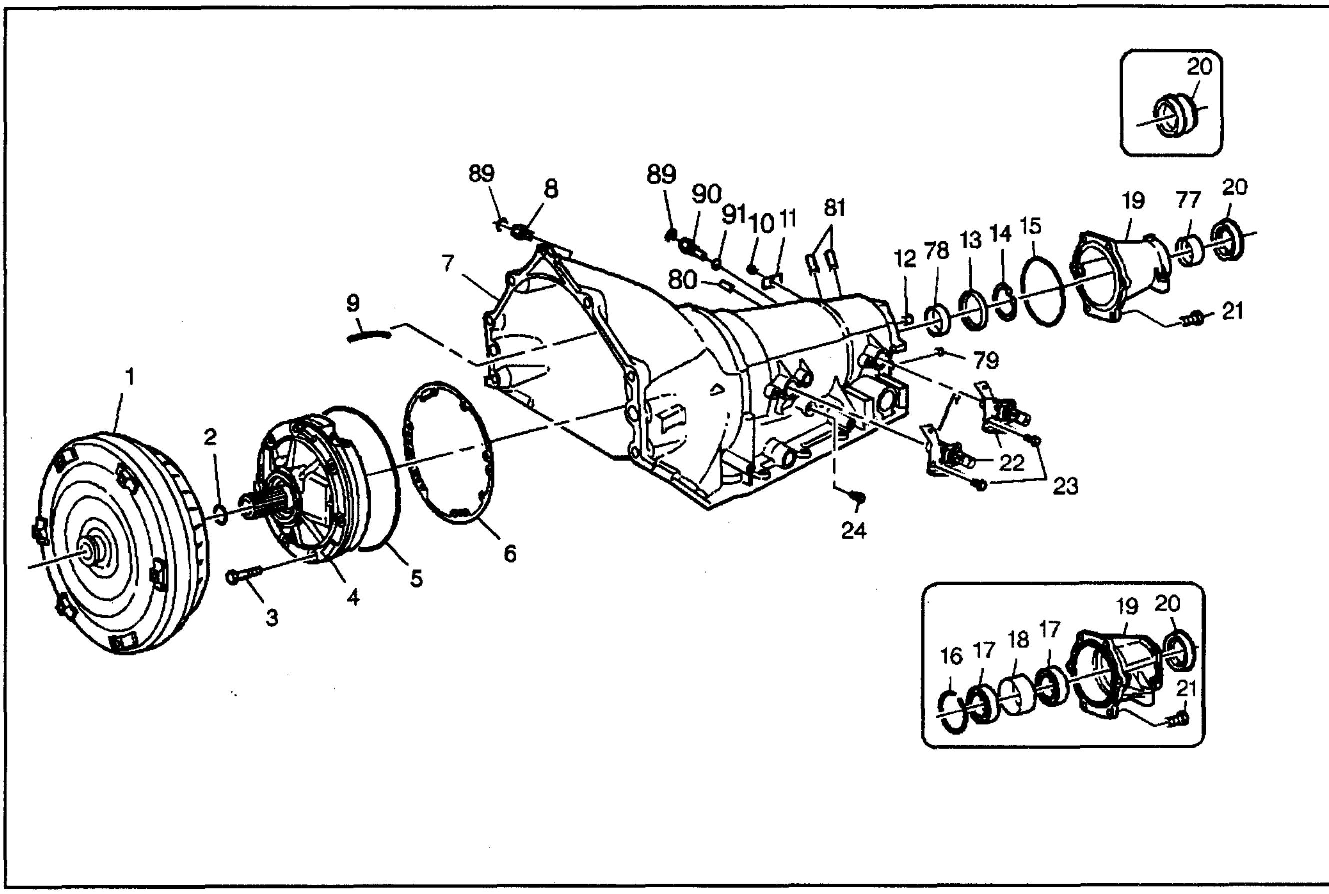
Possible Fluid Leak Points



Legend

- (3) Bolt and Seal Assembly, A/Trans O/Pump
- (5) Seal, A/Trans Oil Pump
- (8) Connector, Transmission Oil Cooler Pipe
- (9) Pipe, Vent
- (15) Seal, Case Extension
- (20) Seal Asm., Prop Shaft Front Slip Yoke Oil
- (22) Sensor Assembly, A/T Input Speed and 2WD Output Speed (4WD Plug)
- (24) Plug, Line Pressure Test Hole
- (27) Bolt, Oil Pan
- (29) Seal, Transmission Oil Pan
- (34) Harness Assembly, A/Trans Wiring
- (201) Seal Asm., Torque Converter Oil
- (707) Seal Assembly, Manual Shift Shaft

Case and Associated Parts (1 of 3)

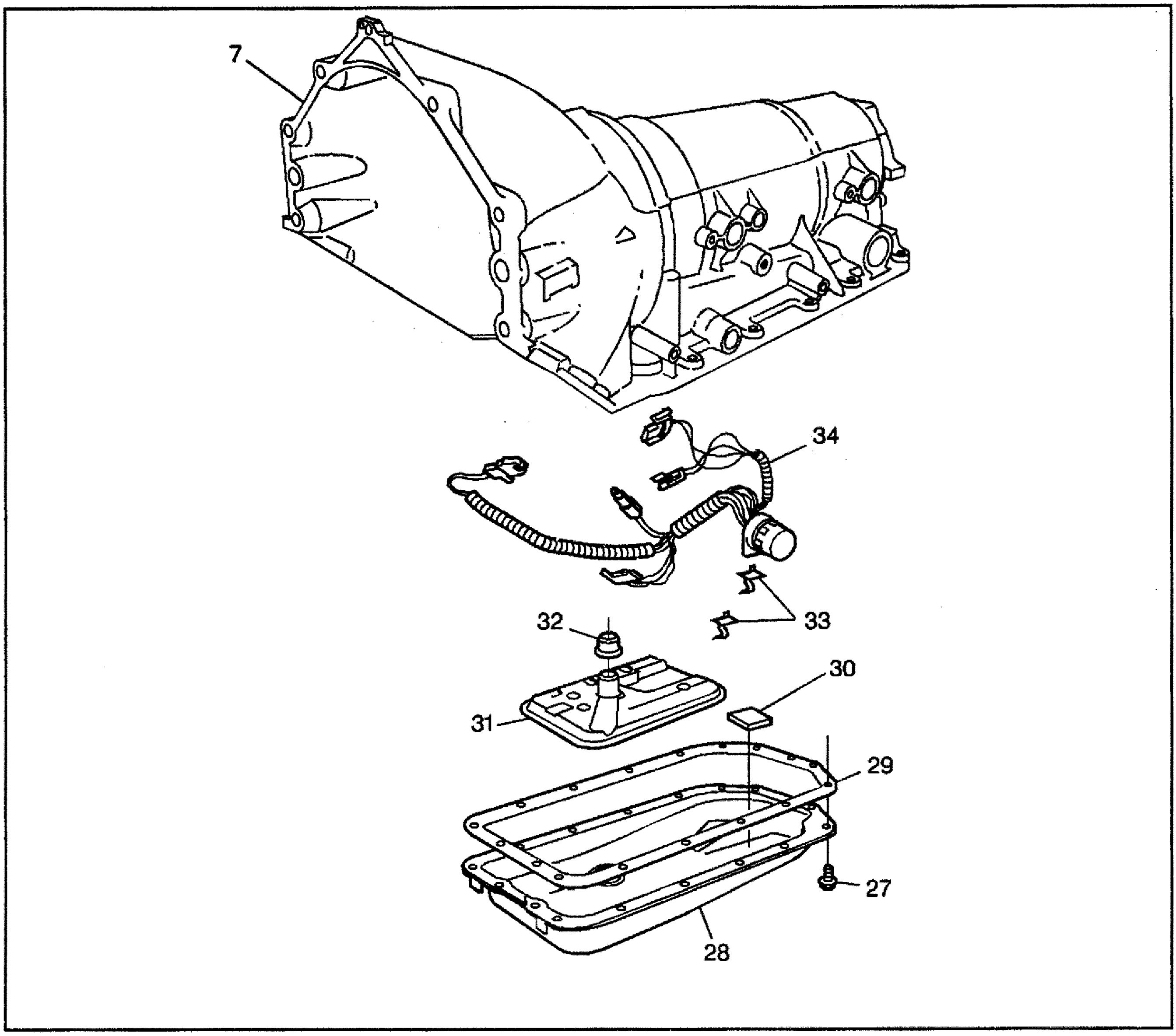


335075

Legend

(1) Torque Converter Assembly
(2) Seal Ring, Turbine Shaft Front Oil
(3) Bolt and Seal Assembly, A/Trans O/Pump
(4) Pump Assembly, A/Trans Oil
(5) Seal, A/Trans Oil Pump
(6) Gasket, A/Trans Oil Pump
(7) Case Assembly, A/Trans
(8) Connector, Transmission Oil Cooler Pipe
(9) Pipe, Vent
(10) Pin, Nameplate
(11) Plate, A/Trans Name
(12) Orifice (2WD) [Plug (4WD)], Lube Oil
(13) Seal, Output Shaft
(14) Ring, Output Shaft Seal Retainer
(15) Seal, Case Extension
(16) Ring, Bearing Retainer
(17) Bearing Assembly, Ball
(18) Spacer, Bearing
(19) Extension Assembly, Case
(20) Seal Asm., Prop Shaft Front Slip Yoke Oil
(21) Bolt, Case Extension
(22) Sensor Assembly, A/T Input Speed and 2WD Output Speed (4WD Plug)
(23) Bolt, Input Speed and Output Speed Sensor
(24) Plug, Line Pressure Test Hole
(77) Bushing, Prop Shaft Front Slip Yoke
(78) Bushing, Output Shaft
(79) Plug, Direct Oil Gal – 0.25 Diameter Cup
(80) Pin, Manual 2-1 Band Anchor
(81) Pin, Low and Reverse Band Anchor
(89) Retainer, Transmission Oil Cooler Pipe (Some Models)
(90) Fitting, Transmission Rear Oil Cooler Pipe
(91) Seal, Transmission Rear Oil Cooler Pipe Fitting

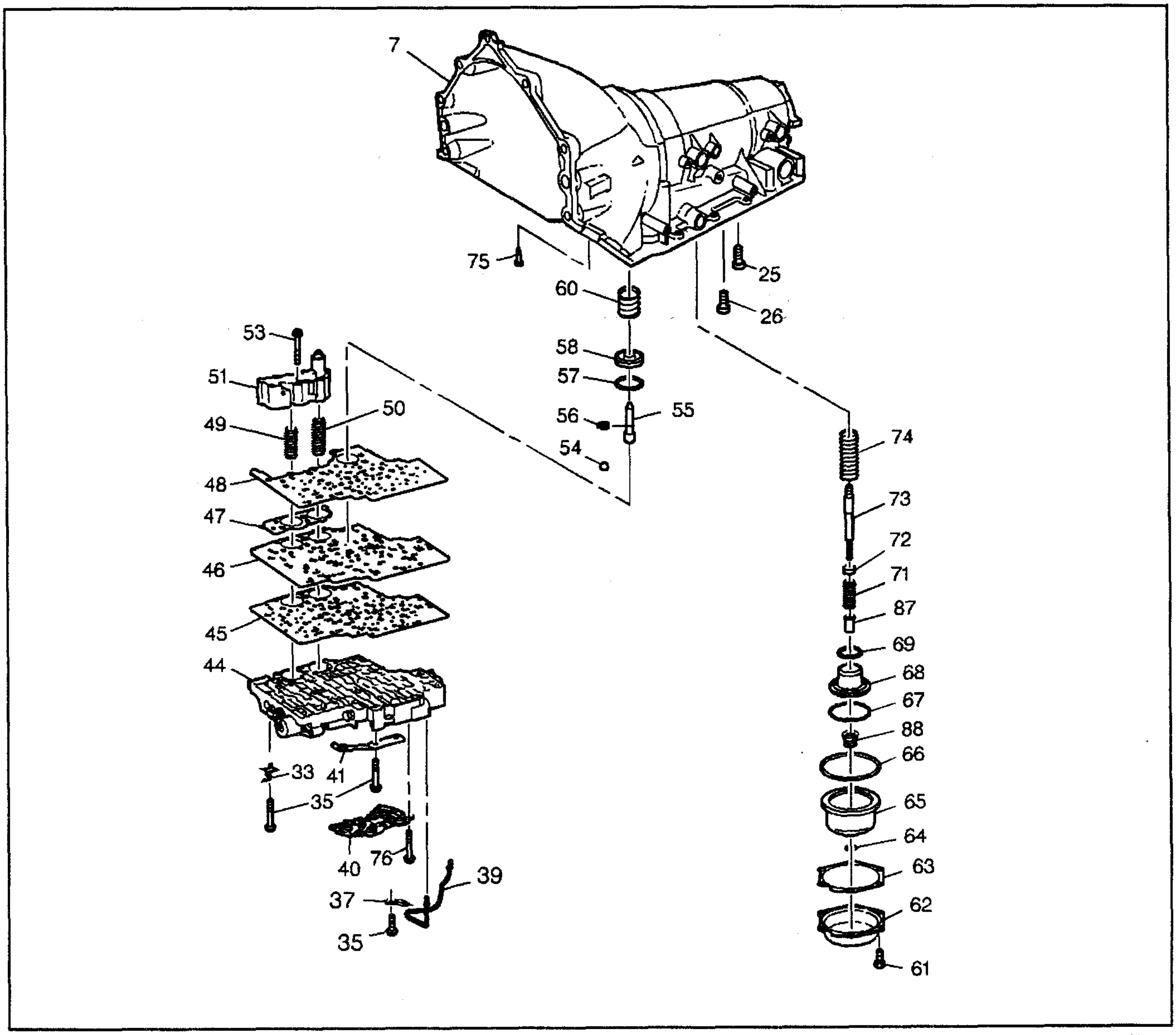
Case and Associated Parts (2 of 3)



Legend

(7) Case Assembly, A/Trans
(27) Bolt, Transmission Oil Pan
(28) Pan, Transmission Oil
(29) Seal, Transmission Oil Pan
(30) Magnet, A/Trans Oil Pan
(31) Filter Assembly, Transmission Oil
(32) Seal Assembly, Filter Neck
(33) Clamp, A/Trans Wiring Harness
(34) Harness Assembly, A/Trans Wiring

Case and Associated Parts (3 of 3)

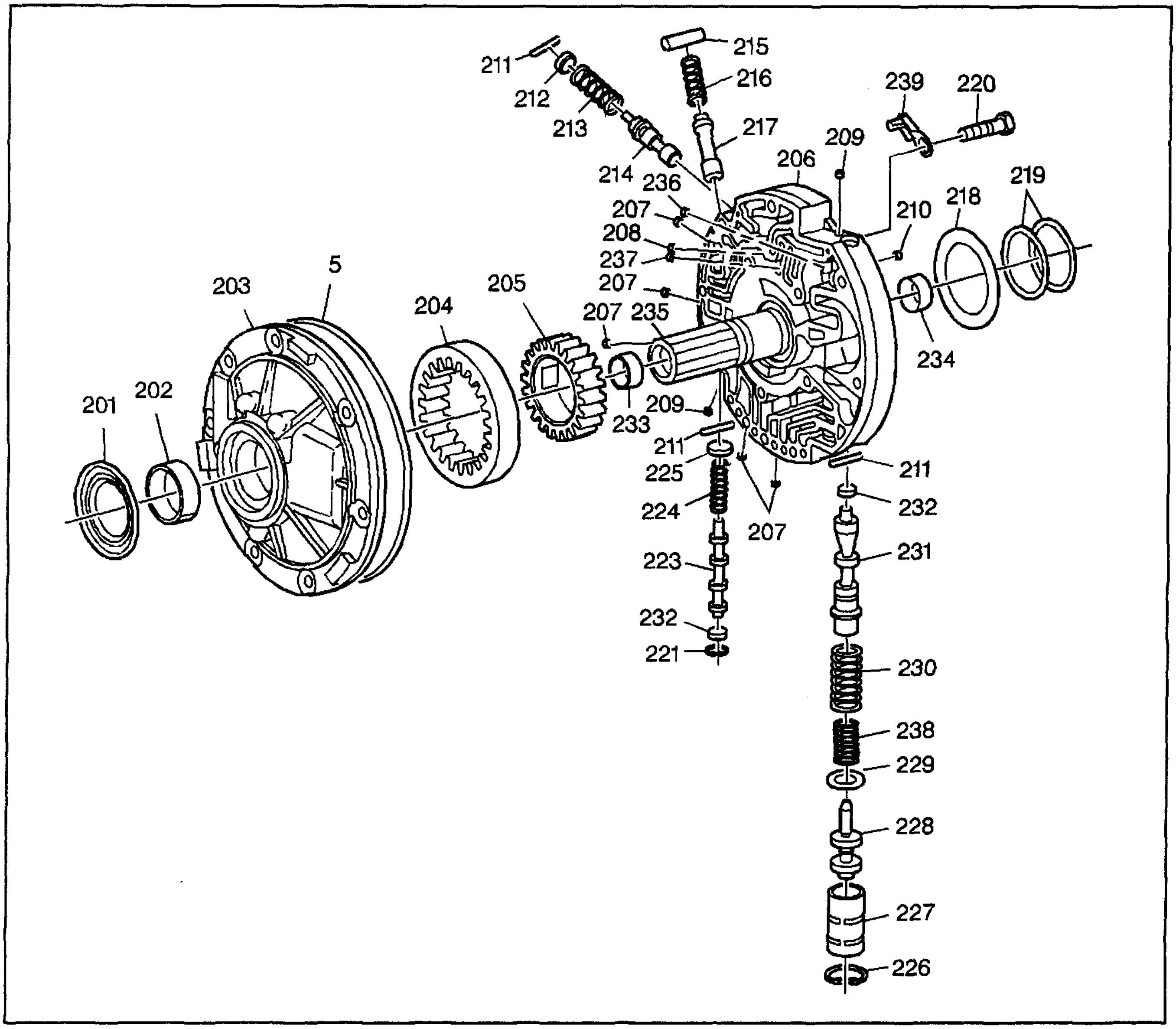


Legend

- (7) Case Assembly, A/Trans
- (25) Bolt, Center Support
- (26) Bolt, Fourth Clutch Housing
- (33) Clamp, Electrical Cable
- (35) Bolt, Control Valve Body Assembly
- (37) Retainer, Lube Oil Pipe
- (39) Pipe, Lube Oil
- (40) Switch, A/T Fluid Pressure Manual Valve Position
- (41) Spring Assembly, Manual Shift Shaft Detent
- (44) Valve Assembly, Control (w/Body and Valves)
- (45) Gasket, Control Valve Body
- (46) Plate, Control Valve Body Spacer
- (47) Gasket, Accumulator Housing
- (48) Gasket, Control Valve Body Spacer Plate
- (49) Spring, Fourth Clutch Accumulator Piston
- (50) Spring, Third Clutch Accumulator Piston
- (51) Housing, 3rd and 4th Clutch Accumulator
- (53) Bolt, 3rd and 4th Clutch Accumulator Housing
- (54) Valve, Control Valve Body Ball Check
- (55) Pin, Manual 2-1 Band Servo Piston
- (56) Ring, Manual 2-1 Band Servo Piston Pin Retainer
- (57) Seal, Manual 2-1 Band Servo Piston
- (58) Piston, Manual 2-1 Band Servo
- (60) Spring, Manual 2-1 Band Servo Piston Cushion
- (61) Bolt, Low and Reverse Band Servo Cover
- (62) Cover, Low and Reverse Band Servo

(63) Gasket, Low and Reverse Band Servo Cover
(64) Ring, Low and Reverse Band Servo Piston Pin Retainer
(65) Piston, Low and Reverse Band Servo
(66) Seal, Low and Reverse Band Servo Piston
(67) Ring, Low and Reverse Accumulator Piston Outer Oil Seal
(68) Piston, 1-2 Accumulator
(69) Ring, Low and Reverse Accumulator Piston Inner Oil Seal
(71) Spring, Low and Reverse Band Servo Piston
(72) Retainer, Low and Reverse Band Servo Piston Spring
(73) Pin, Low and Reverse Band Servo Piston (Selective)
(74) Spring, Low and Reverse Accumulator Piston
(75) Screen, TCC Solenoid Valve
(76) Bolt, TFP Manual Valve Position Switch
(87) Spacer, Low and Reverse Band Servo Piston
(88) Spring Assembly, 1-2 Accumulator Piston

Oil Pump Assembly

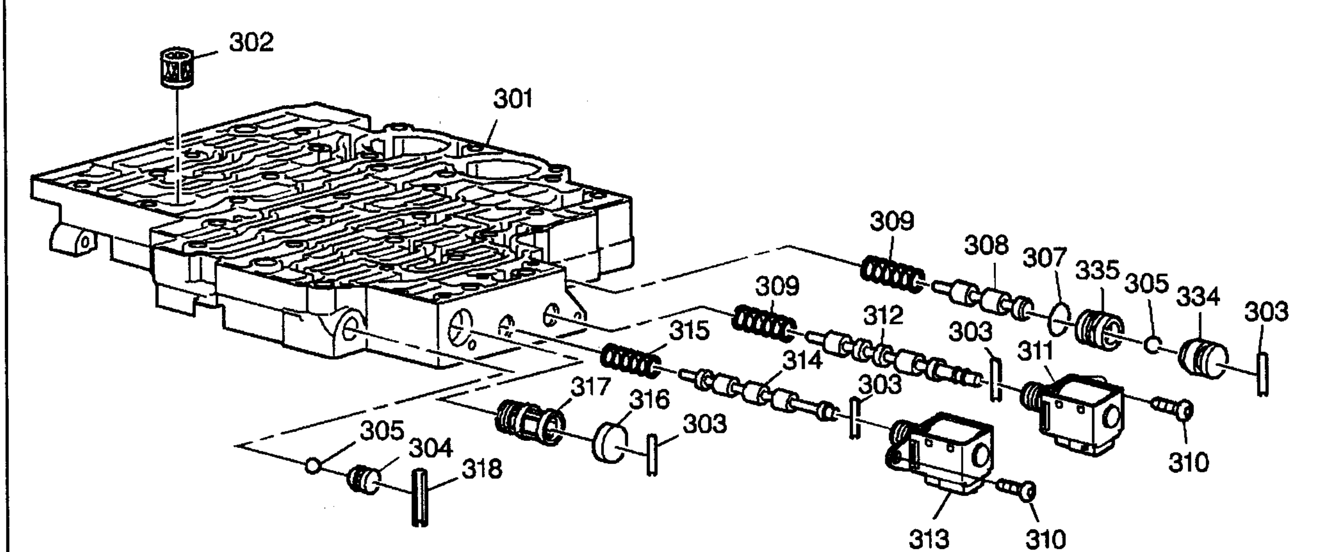


Legend

(5) Seal, A/Trans Oil Pump
(201) Seal Asm., Torque Converter Oil
(202) Bushing, Torque Converter
(203) Body Asm., Oil Pump
(204) Gear, Oil Pump Driven
(205) Gear, Oil Pump Drive
(206) Cover, Oil Pump
(207) Plug, Oil Pump Cover (5)
(208) Plug, Orificed Cup, Converter Limit Valve Bypass (1)
(209) Plug, Oil Pump Cover (2)
(210) Plug, Orificed Cup, Line Air Bleed (1)
(211) Pin, Pressure Regulator Valve Bore Plug (3)
(212) Plug, Converter Limit Valve Bore
(213) Spring, Converter Limit Valve
(214) Valve, Converter Limit
(215) Sleeve, TCC Enable Valve Spring Retainer
(216) Spring, TCC Enable Valve
(217) Valve, TCC Enable
(218) Washer, Thrust, Selective
(219) Ring, Oil Seal, Overrun Clutch Housing
(220) Bolt, Oil Pump Cover (5)
(221) Ring, TCC Shift Valve Bore Plug Retainer
(223) Valve, TCC Shift
(224) Spring, TCC Shift Valve
(225) Seat, TCC Shift Valve Spring
(226) Ring, Retainer (Reverse Boost Valve Bushing)
(227) Bushing, Reverse Boost Valve
(228) Valve, Reverse Boost
(229) Retainer, Pressure Regulator Valve Spring
(230) Spring, Pressure Regulator Valve Outer

(231) Valve, Pressure Regulator
(232) Plug, TCC Shift Valve, Lower and Pressure Regulator Valve Bore
(233) Bushing, Turbine Shaft Front
(234) Bushing, Turbine Shaft Rear
(235) Shaft, Stator
(236) Plug, Orificed Cup, Pressure Regulator Valve Feedback (1)
(237) Plug, Orificed Cup, Converter Limit Valve Feedback (1)
(238) Spring, Pressure Regulator Valve Inner
(239) Shield, Vent Passage Splash

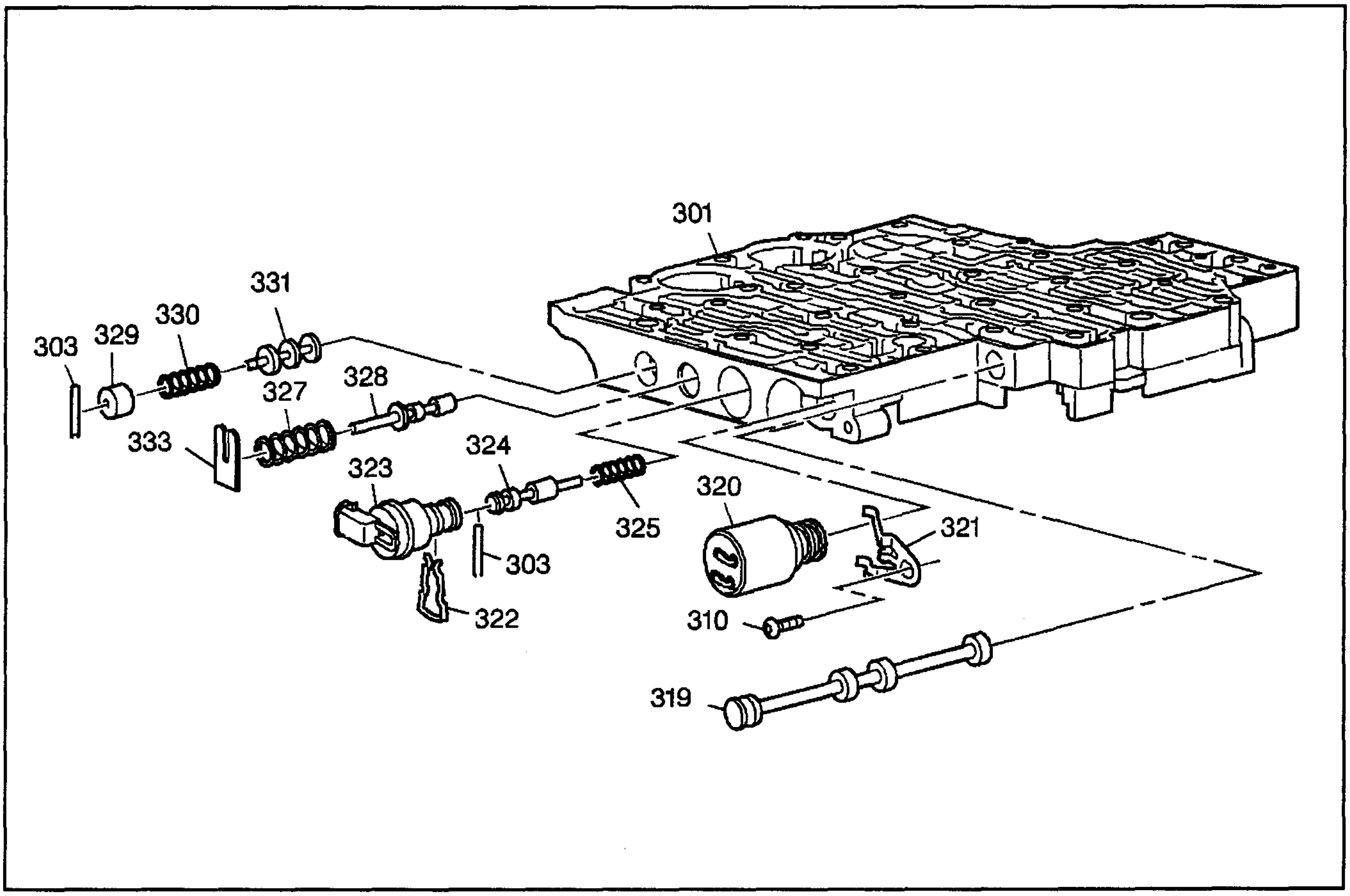
Control Valve Body Assembly (1 of 2)



Legend

(301) Body, Control Valve
(302) Filter, Pressure Control Solenoid Valve Fluid
(303) Pin, Shift Valve, Fluid Filter Bore Plug
(304) Seat, Low-Reverse Ball Valve
(305) Valve, Low-Reverse Ball
(307) Seal, 3rd Ball Valve Bushing
(308) Valve, 3-4 Shift
(309) Spring, 3-4 Shift Valve
(310) Bolt, Solenoid (1-2 and 2-3 Shift Valve)
(311) Valve Assembly, 2-3 Shift Solenoid
(312) Valve, 2-3 Shift
(313) Valve Assembly, 1-2 Shift Solenoid
(314) Valve, 1-2 Shift
(315) Spring, 1-2 Shift Valve
(316) Plug, Shift Valve Fluid Filter Bore
(317) Filter, Shift Solenoid Valve Fluid
(318) Pin, Low-Reverse Ball Valve Seat
(334) Bushing, Reverse Ball Valve
(335) Bushing, 3rd Ball Valve

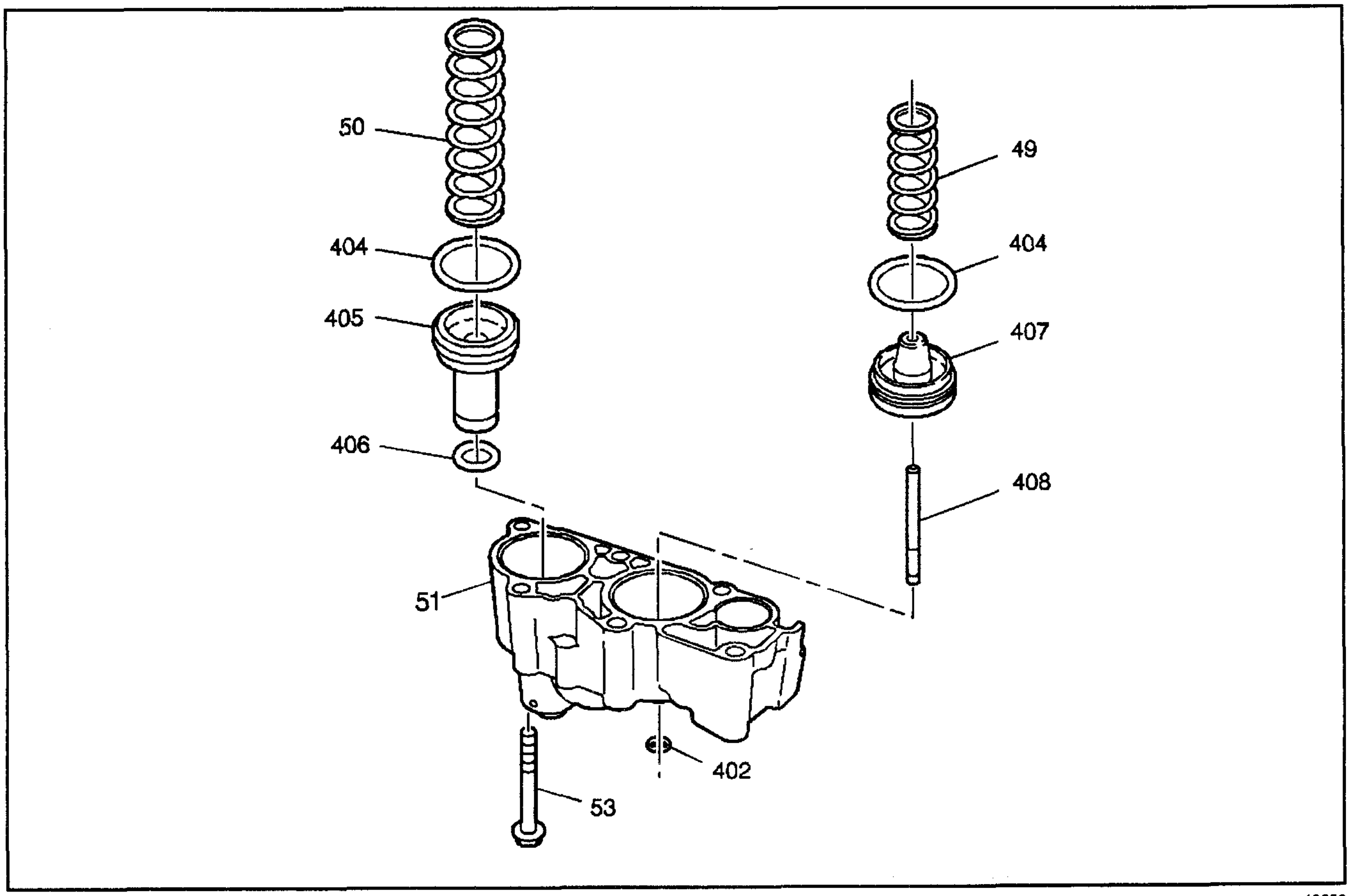
Control Valve Body Assembly (2 of 2)



Legend

(301) Body, Control Valve
(303) Pin, Accumulator Valve Bore Plug, Shift Valve
(310) Bolt, Pressure Control Solenoid Clamp
(319) Valve, Manual
(320) Valve Asm., Pressure Control Solenoid
(321) Clamp, Pressure Control Solenoid
(322) Retainer, TCC PWM Solenoid Valve
(323) Valve Asm., TCC PWM Solenoid
(324) Valve, TCC Regulator Apply
(325) Spring, TCC Regulator Apply Valve
(327) Spring Actuator Feed Limit Valve
(328) Valve, Actuator Feed Limit
(329) Plug, Accumulator Valve Bore
(330) Spring, Accumulator Valve
(331) Valve, Accumulator
(333) Retainer, Actuator Feed Limit Valve Spring

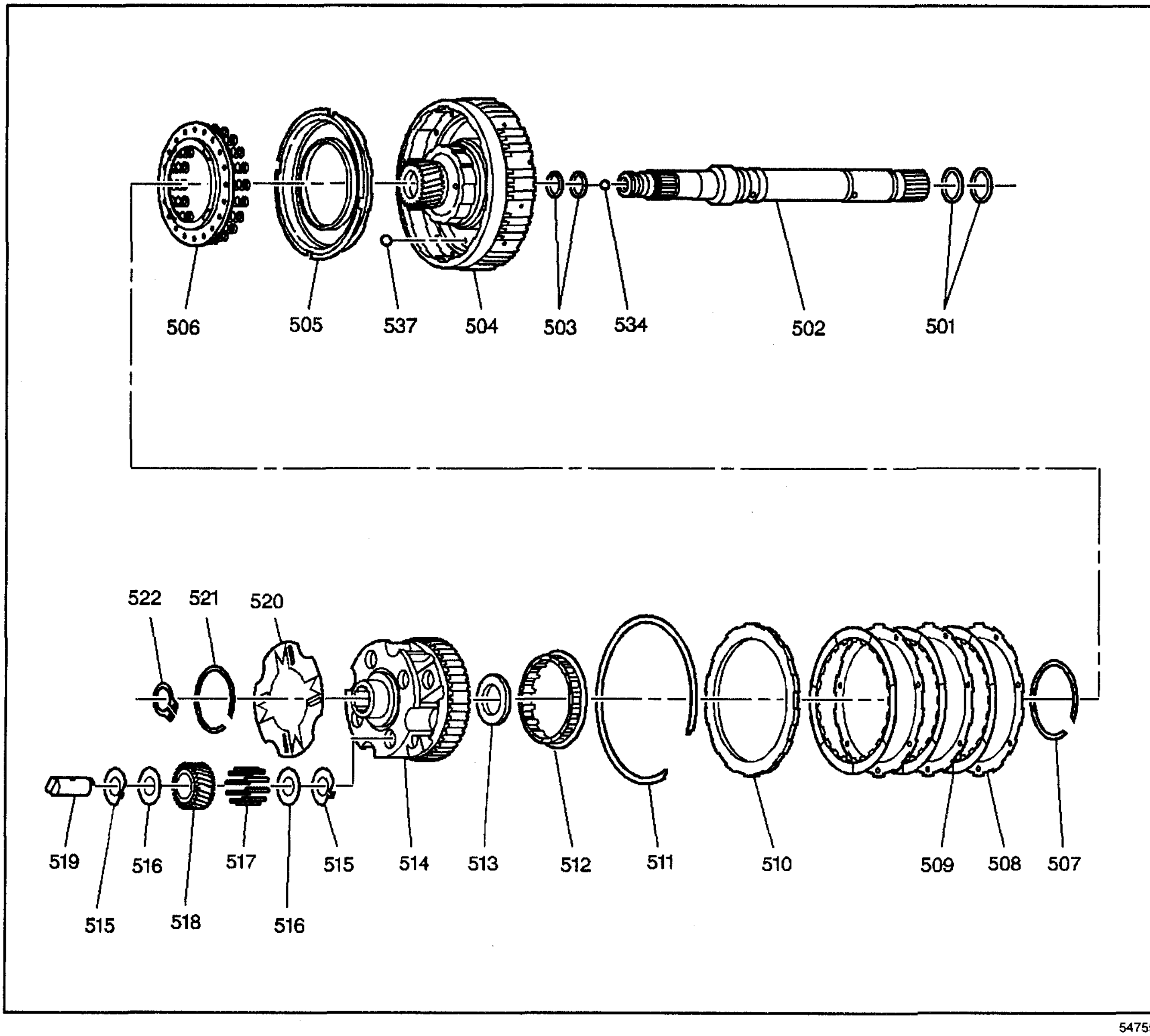
Accumulator Assembly



Legend

(49) Spring, 4th Clutch Accumulator Piston
(50) Spring, 3rd Clutch Accumulator Piston
(51) Housing, 3rd and 4th Clutch Accumulator
(53) Bolt, 3rd and 4th Clutch Accumulator Housing
(402) Ring, 4th Clutch Accumulator Piston Pin
(404) Seal, 3rd and 4th Clutch Accumulator Piston
(405) Piston, 3rd Clutch Accumulator
(406) Seal, 3rd Clutch Accumulator Piston Inner
(407) Piston, 4th Clutch Accumulator
(408) Pin, 4th Clutch Accumulator Piston

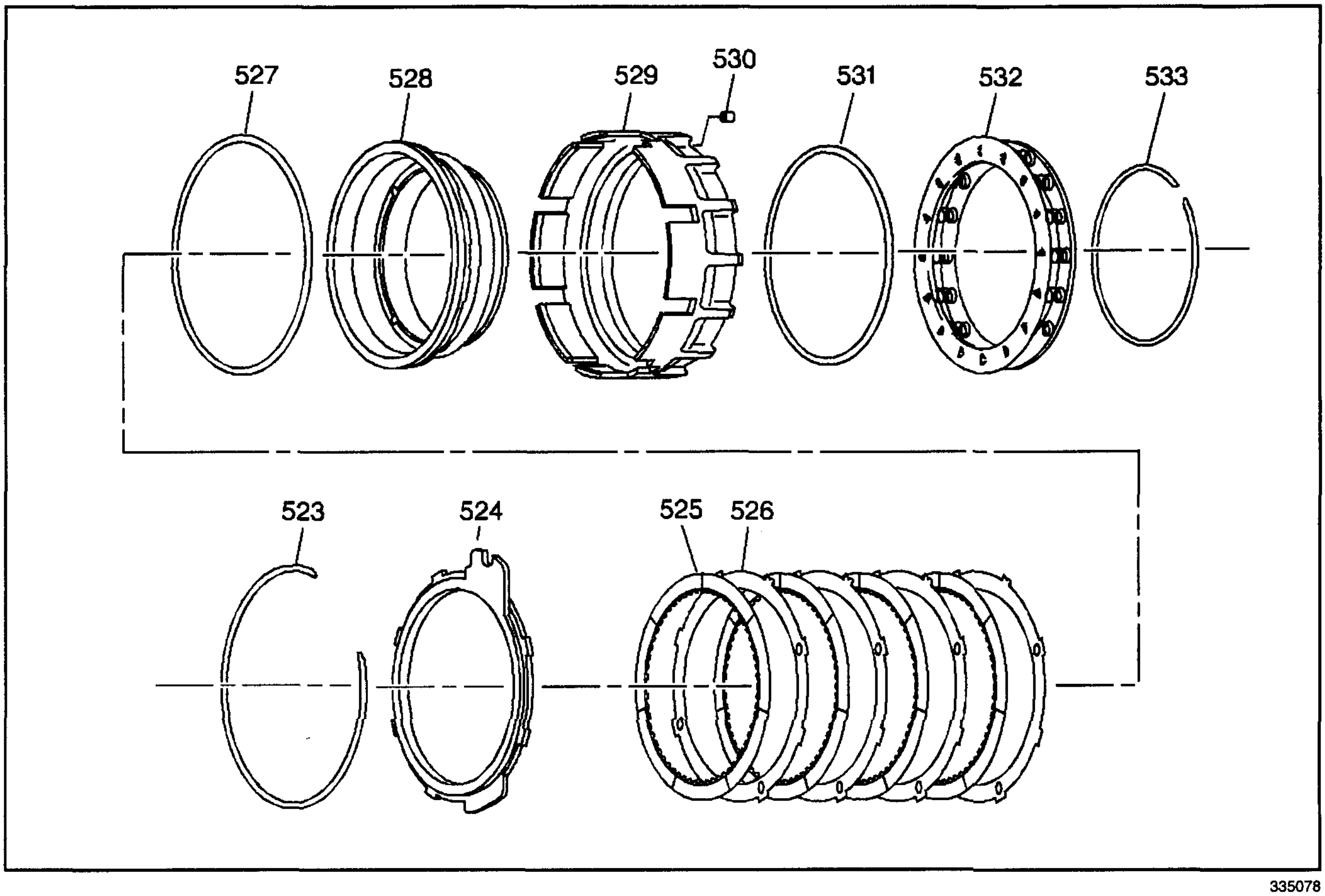
Overrun Clutch Assembly



Legend

(501) Ring, Turbine Shaft Rear Oil Seal
(502) Shaft, Turbine
(503) Ring, Turbine Shaft Intermediate Oil Seal
(504) Housing Assembly, Overrun Clutch
(505) Piston Assembly, Overrun Clutch
(506) Spring Assembly, Overrun Clutch
(507) Ring, Overrun Clutch Spring Retainer
(508) Plate, Overrun Clutch
(509) Plate Assembly, Overrun Clutch
(510) Plate, Overrun Clutch Backing
(511) Ring, Overrun Clutch Backing Plate Retainer
(512) Roller Assembly, Overdrive Clutch
(513) Bearing Assembly, Overrun Clutch Housing
(514) Carrier Assembly, Overdrive
(515) Washer, Overdrive Carrier Pinion Gear Thrust
(516) Washer, Overdrive Carrier Pinion Gear Thrust (Steel)
(517) Roller, Overdrive Carrier Pinion Gear Bearing
(518) Gear, Overdrive Carrier Pinion
(519) Pin, Overdrive Carrier Pinion Gear
(520) Retainer, Overdrive Carrier Pinion Gear Pin
(521) Retainer, Overdrive Carrier Pinion Gear Pin
(522) Ring, Overdrive Carrier Retainer
(534) Plug, Turbine Shaft
(537) Valve, Direct Clutch Housing Ball Check

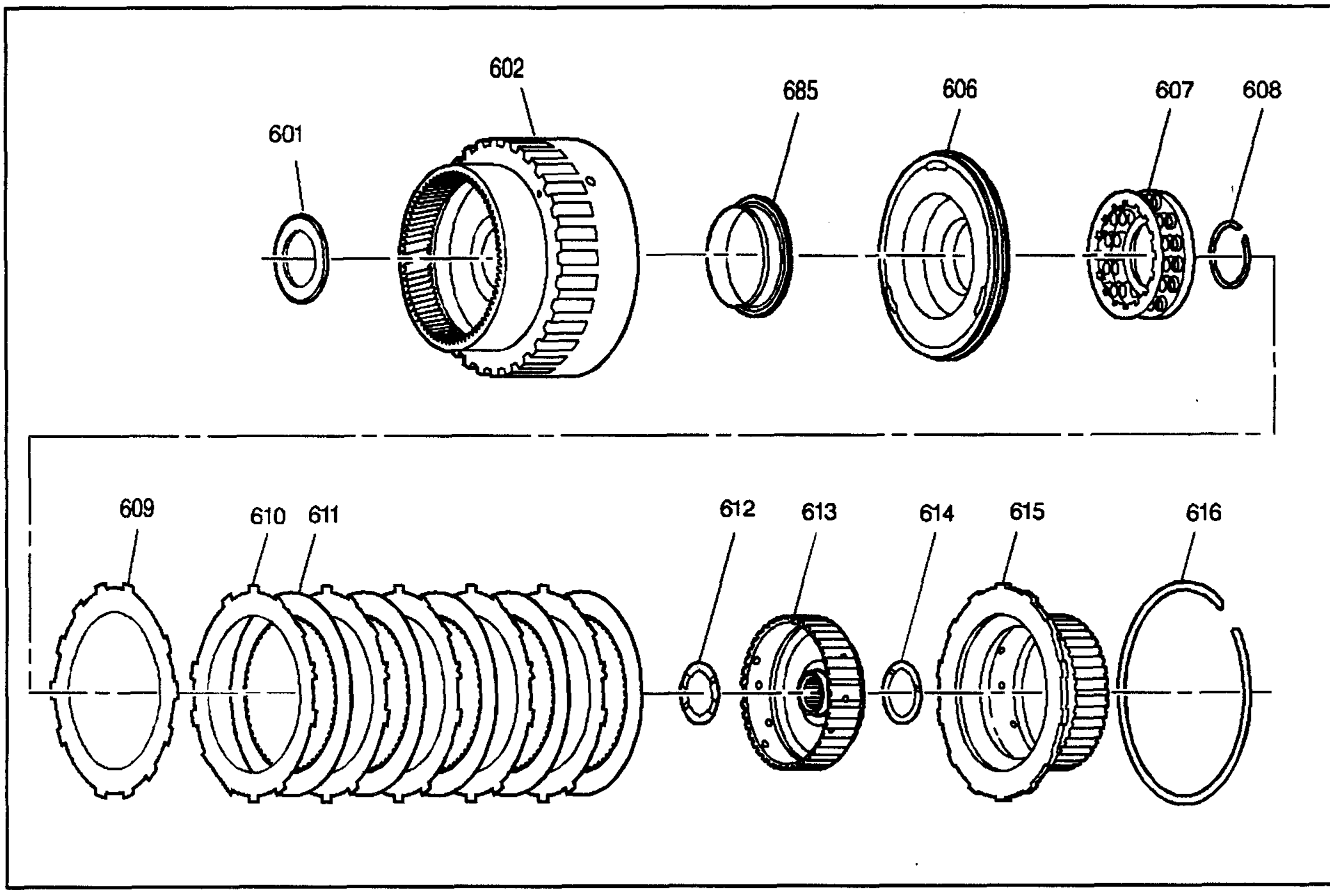
Fourth Clutch Assembly



Legend

(523) Ring, 4th Clutch Backing Plate Retainer
(524) Plate, 4th Clutch Backing
(525) Plate Assembly, 4th Clutch
(526) Plate, 4th Clutch
(527) Seal, 4th Clutch Piston Inner
(528) Piston, 4th Clutch
(529) Housing, 4th Clutch
(530) Orifice, 4th Clutch
(531) Seal, 4th Clutch Piston Outer
(532) Spring Assembly, 4th Clutch
(533) Ring, 4th Clutch Spring Retainer

Forward Clutch Assembly

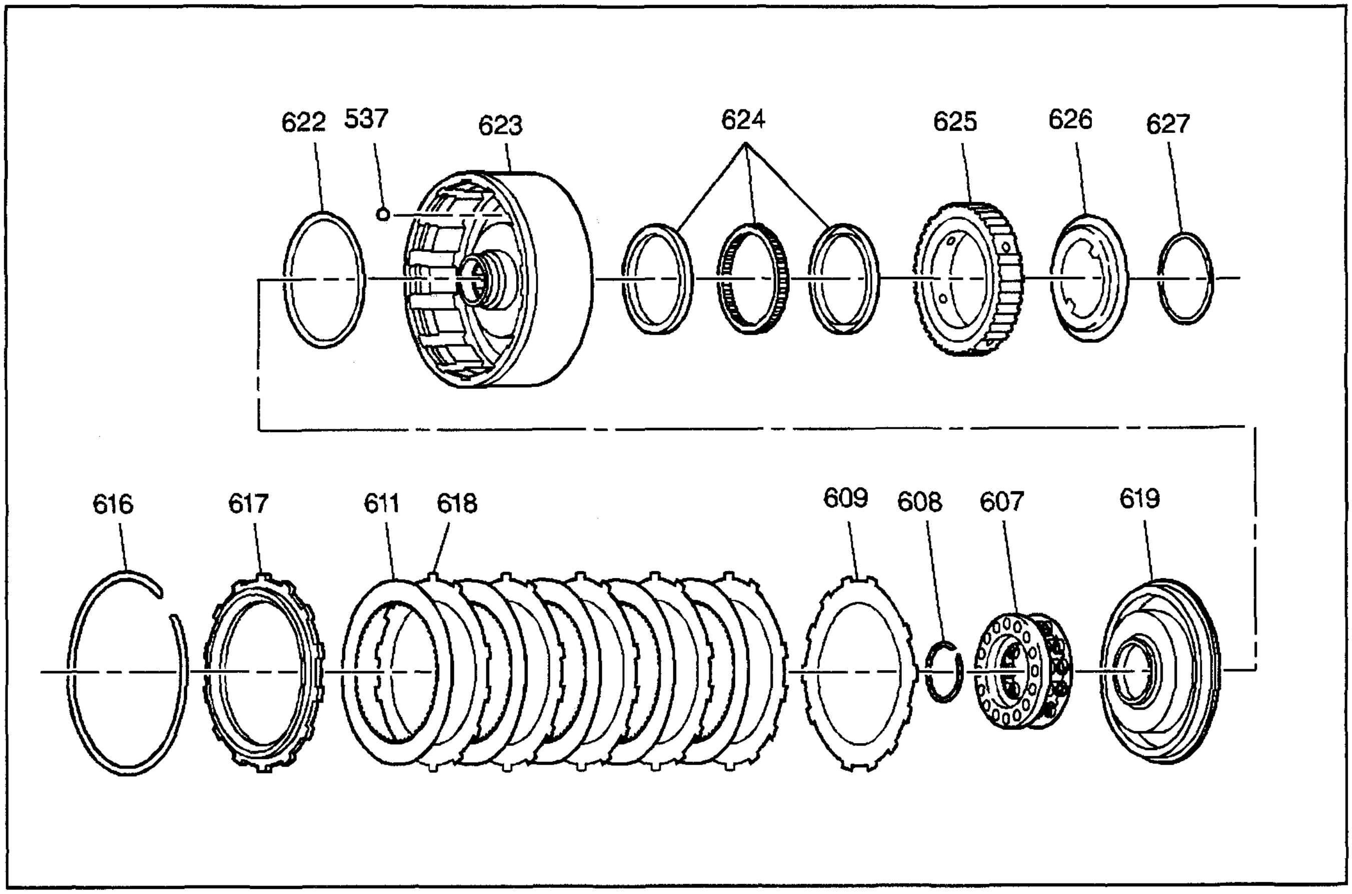


54722

Legend

(601) Bearing Assembly, Thrust Carrier/Forward Clutch
(602) Housing Assembly, Forward Clutch
(606) Piston, Forward Clutch
(607) Spring Assembly, Forward Clutch
(608) Ring, Forward Clutch Spring Retainer
(609) Plate, Forward Clutch Waved
(610) Plate, Forward Clutch
(611) Plate Assembly, Forward Clutch
(612) Washer, Forward Clutch Housing Thrust
(613) Hub, Forward Clutch
(614) Washer, Direct Clutch Housing Thrust
(615) Hub, Direct Clutch
(616) Ring, Direct Clutch Hub Retainer
(685) Seal Assembly, Forward Clutch Piston Intermediate

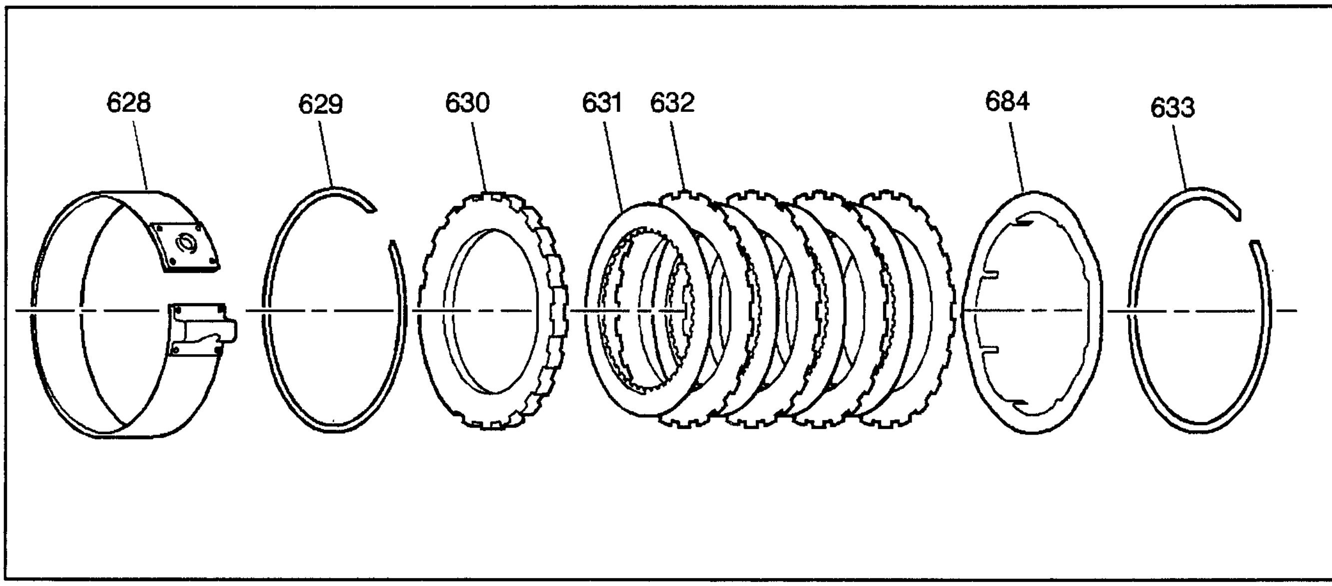
Direct Clutch and Intermediate Sprag Assembly



Legend

(537) Valve, Direct Clutch Housing Ball Check
(607) Spring Assembly, Direct Clutch
(608) Ring, Direct Clutch Spring Retainer
(609) Plate, Direct Clutch Apply (Waved)
(611) Plate Assembly, Direct Clutch
(616) Ring, Direct Clutch Backing Plate Retaining
(617) Plate, Direct Clutch Backing
(618) Plate, Direct Clutch
(619) Piston Assembly, Direct Clutch
(622) Seal, Direct Clutch Piston Intermediate
(623) Housing Asm., Direct Clutch
(624) Sprag Assembly, Intermediate Clutch
(625) Race, Intermediate Clutch Sprag (Outer)
(626) Retainer, Intermediate Clutch Sprag
(627) Ring, Intermediate Clutch Sprag Retainer Retaining

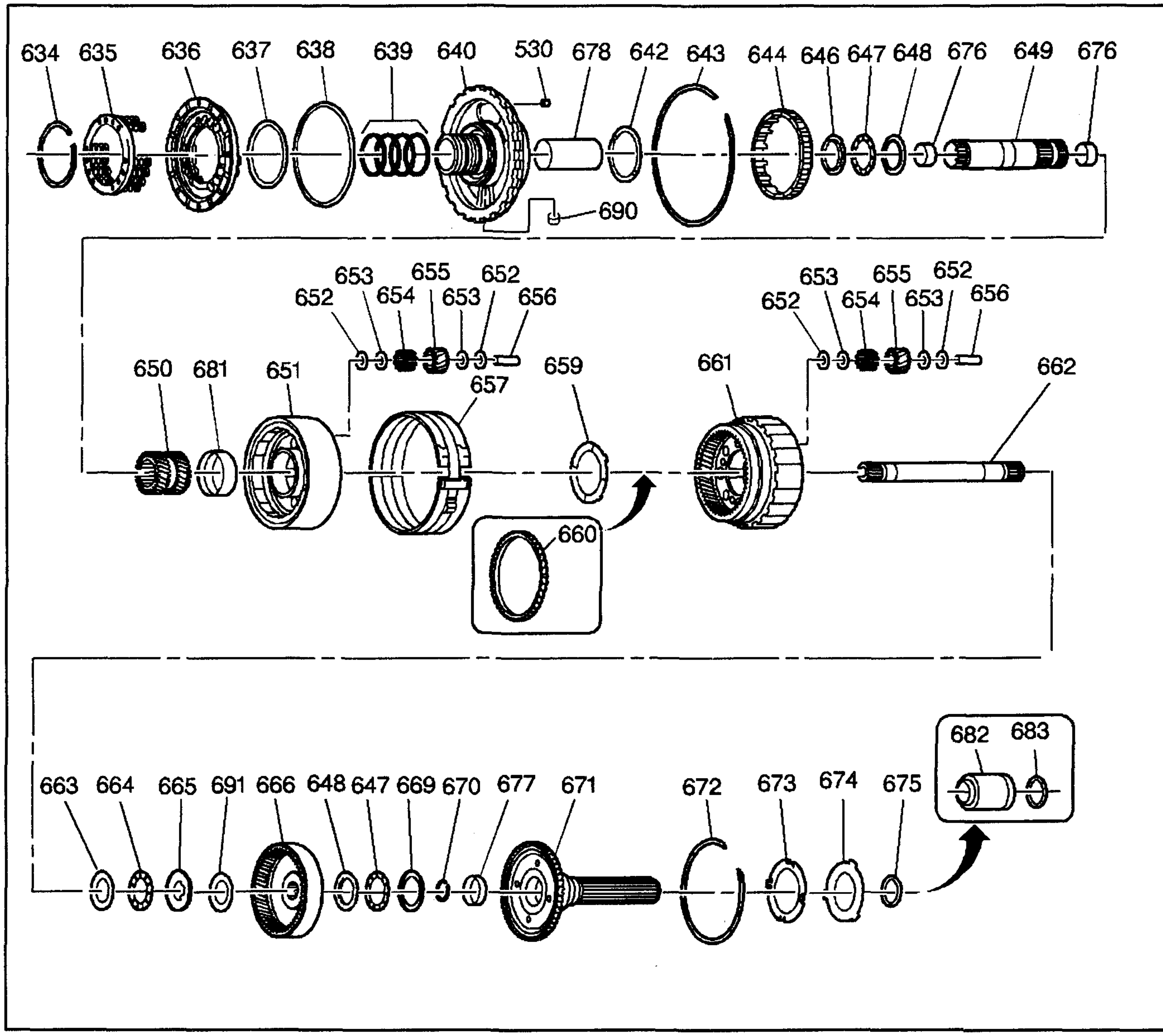
Intermediate Clutch Plates and Manual 2-1 Band Assembly



Legend

(628) Band Assembly, Manual 2-1
(629) Ring, Intermediate Clutch Backing Plate Retainer
(630) Plate, Intermediate Clutch Backing
(631) Plate Assembly, Intermediate Clutch
(632) Plate, Intermediate Clutch
(633) Ring, Center Support Retaining
(684) Plate, Intermediate Clutch (Waved)

Center Support and Gear Unit Assembly



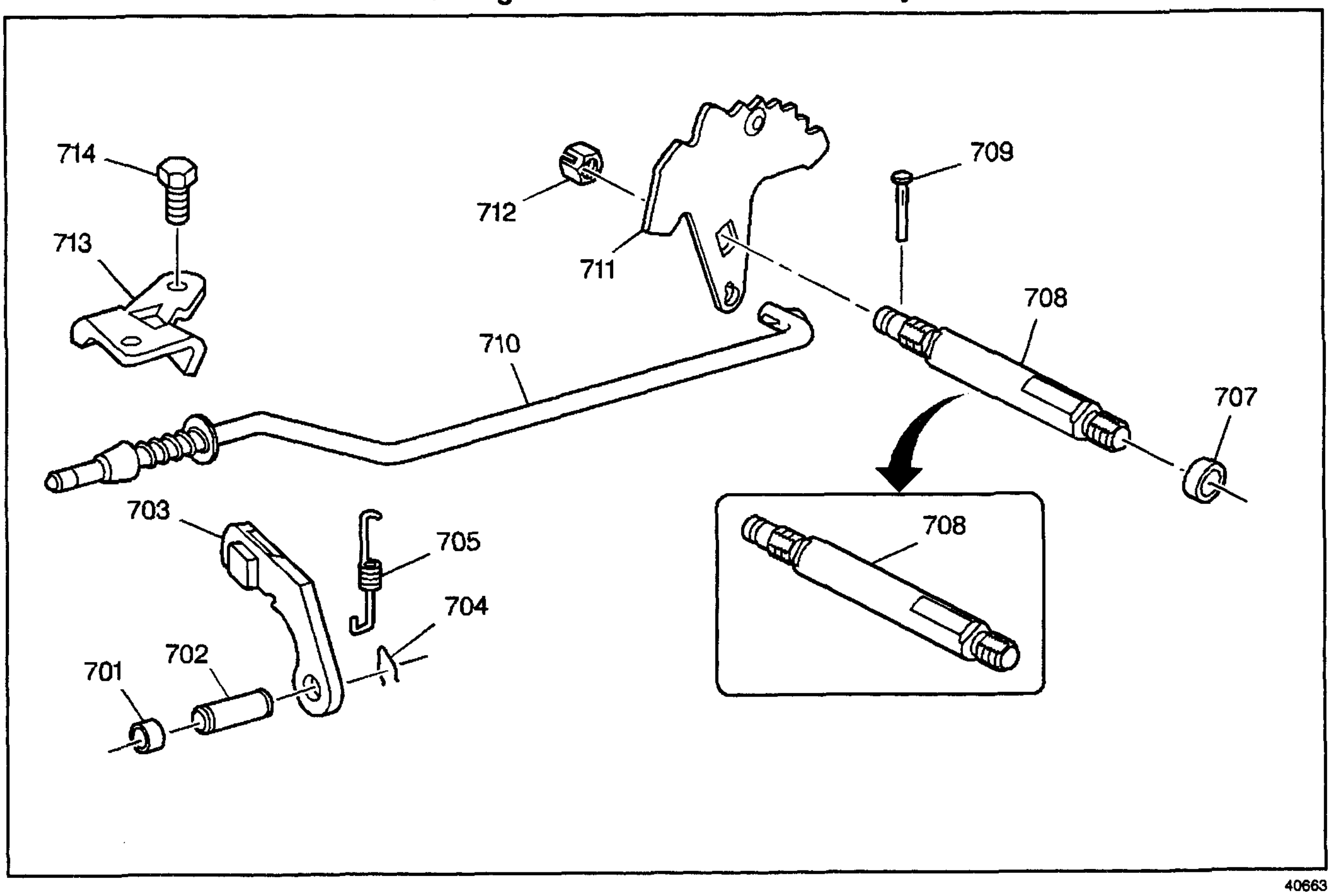
335081

Legend

(530) Orifice, Intermediate Clutch
(634) Ring, Intermediate Clutch Spring Retainer
(635) Spring Assembly, Intermediate Clutch
(636) Piston, Intermediate Clutch
(637) Seal, Intermediate Clutch Inner
(638) Seal, Intermediate Clutch Outer
(639) Ring, Direct Clutch Housing Oil Seal
(640) Support Assembly, Center
(642) Washer, Thrust Reaction Carrier
(643) Spacer, Center Support
(644) Roller Assembly, Low Clutch
(646) Race, Sun Gear Front Thrust Bearing
(647) Bearing Asm., Sun Gear Front Thrust
(648) Race, Sun Gear Rear Thrust Bearing
(649) Shaft Assembly, Sun Gear
(650) Gear, Sun
(651) Carrier Assembly, Reaction
(652) Washer, Reaction Carrier Pinion Gear Thrust (Bronze)
(653) Washer, Reaction Carrier Pinion Gear Thrust (Steel)
(654) Roller, Reaction Carrier Pinion Gear Bearing
(655) Gear, Reaction Carrier Pinion
(656) Pin, Reaction Carrier Pinion Gear
(657) Band Assembly, Low and Reverse
(659) Washer, Output Carrier Thrust
(660) Ring, Vehicle Speed Sensor Reluctor
(661) Carrier Assembly, Output
(662) Shaft, Main
(663) Race, Sun Gear Rear Thrust Bearing
(664) Bearing Asm., Sun Gear Front Thrust
(665) Bearing Asm., Sun Gear Rear Thrust

(666) Gear, Rear Internal
(669) Race, Rear Internal Gear Thrust Bearing
(670) Ring, Main Shaft Retainer
(671) Shaft Assembly, Output
(672) Ring, Output Shaft Retainer
(673) Washer, Output Shaft Thrust
(674) Washer, Thrust Selective
(675) Seal, Output Shaft
(676) Bushing, Main Shaft
(677) Bushing, Rear Internal Gear
(678) Sleeve, Center Support Oil Passage
(681) Bushing, Reaction Carrier
(682) Sleeve, Transmission Output Shaft Yoke Seal
(683) Seal, Output Shaft
(690) Seal, Center Support Cooler Pipe Connector
(691) Spacer

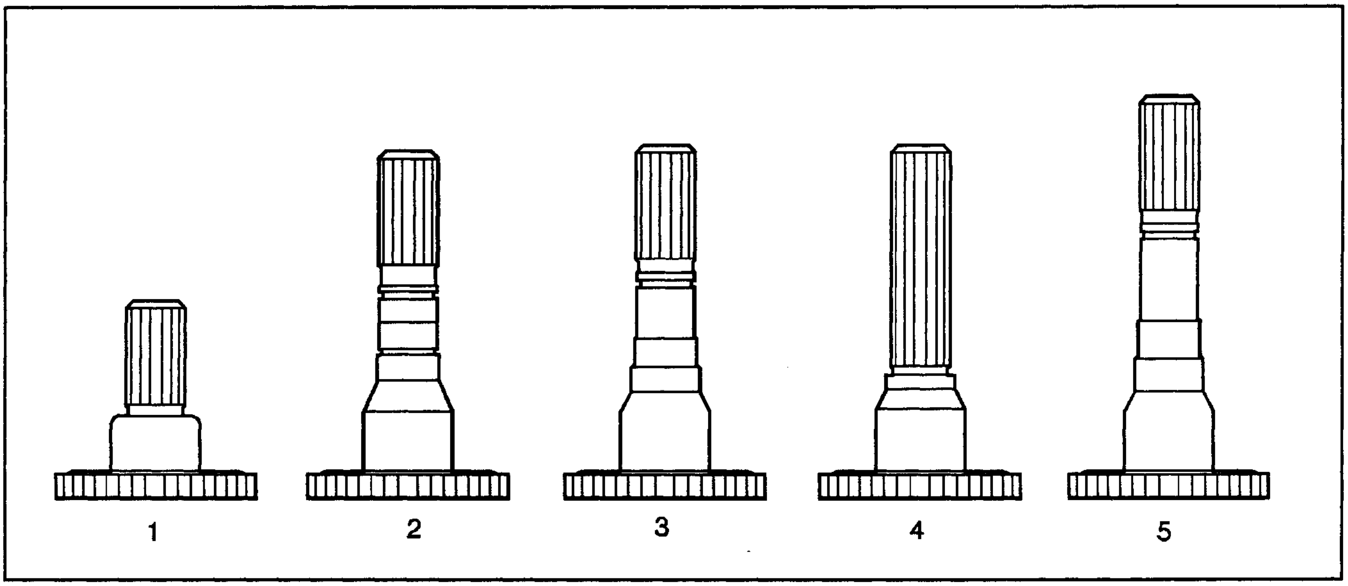
Parking Lock and Actuator Assembly



Legend

(701) Plug, Parking Pawl Shaft Hole
(702) Shaft, Parking Pawl
(703) Pawl, Parking
(704) Retainer, Parking Pawl Shaft
(705) Spring, Parking Pawl
(707) Seal, Manual Shift Shaft
(708) Shaft, Manual Shift
(709) Pin, Manual Shift Shaft
(710) Actuator Assembly, Parking Pawl
(711) Lever Assembly, Manual Shift Shaft Detent
(712) Nut, Manual Shift Shaft Detent Lever
(713) Bracket, Parking Pawl Actuator
(714) Bolt, Parking Pawl Actuator Bracket

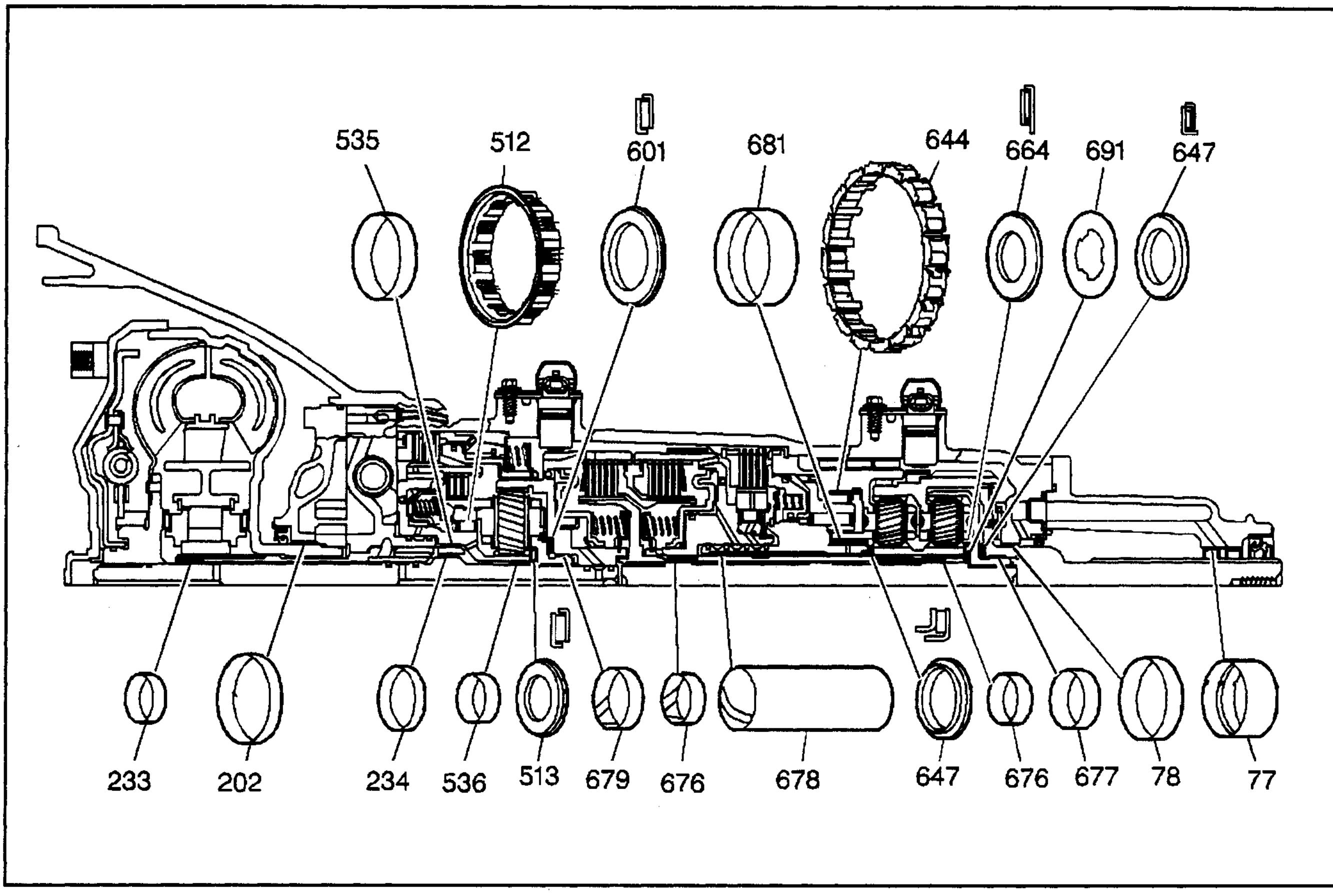
Output Shaft Identification



Legend

(1) Four Wheel Drive
(2) Fixed Yoke, Heavy Duty
(3) Fixed Yoke
(4) Slip Yoke
(5) Long Heavy Duty Fixed Yoke

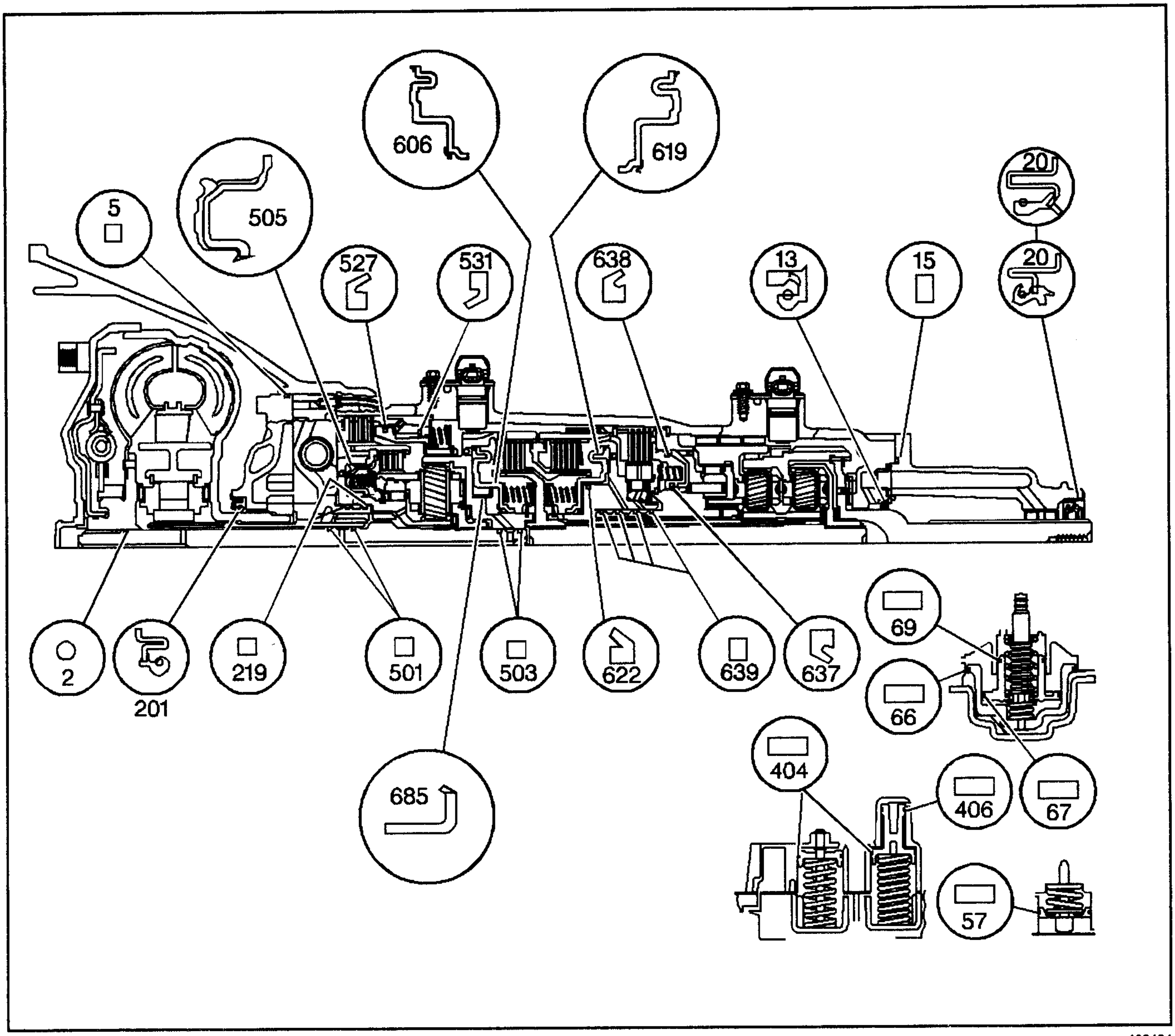
Bushing and Bearing Locations



Legend

(77) Bushing, Prop Shaft Front Slip Yoke
(78) Bushing, Output Shaft
(202) Bushing, Torque Converter
(233) Bushing, Turbine Shaft Front
(234) Bushing, Turbine Shaft Rear
(512) Roller Assembly, Overdrive Clutch
(513) Bearing Assembly, Overrun Clutch Housing Thrust
(535) Bushing, Overrun Clutch Housing
(536) Bushing, 1.12 in. Outside Diameter x 0.50 in.
(601) Bearing Assembly, Thrust Carrier/Forward Clutch
(644) Roller Assembly, Low Clutch
(647) Bearing Asm., Sun Gear Front Thrust
(664) Bearing Asm., Sun Gear Front Thrust
(676) Bushing, Main Shaft
(677) Bushing, Rear Internal Gear
(678) Sleeve, Center Support Oil Passage
(679) Bushing, 1.536 in. Diameter x 3.52
(681) Bushing, Reaction Carrier

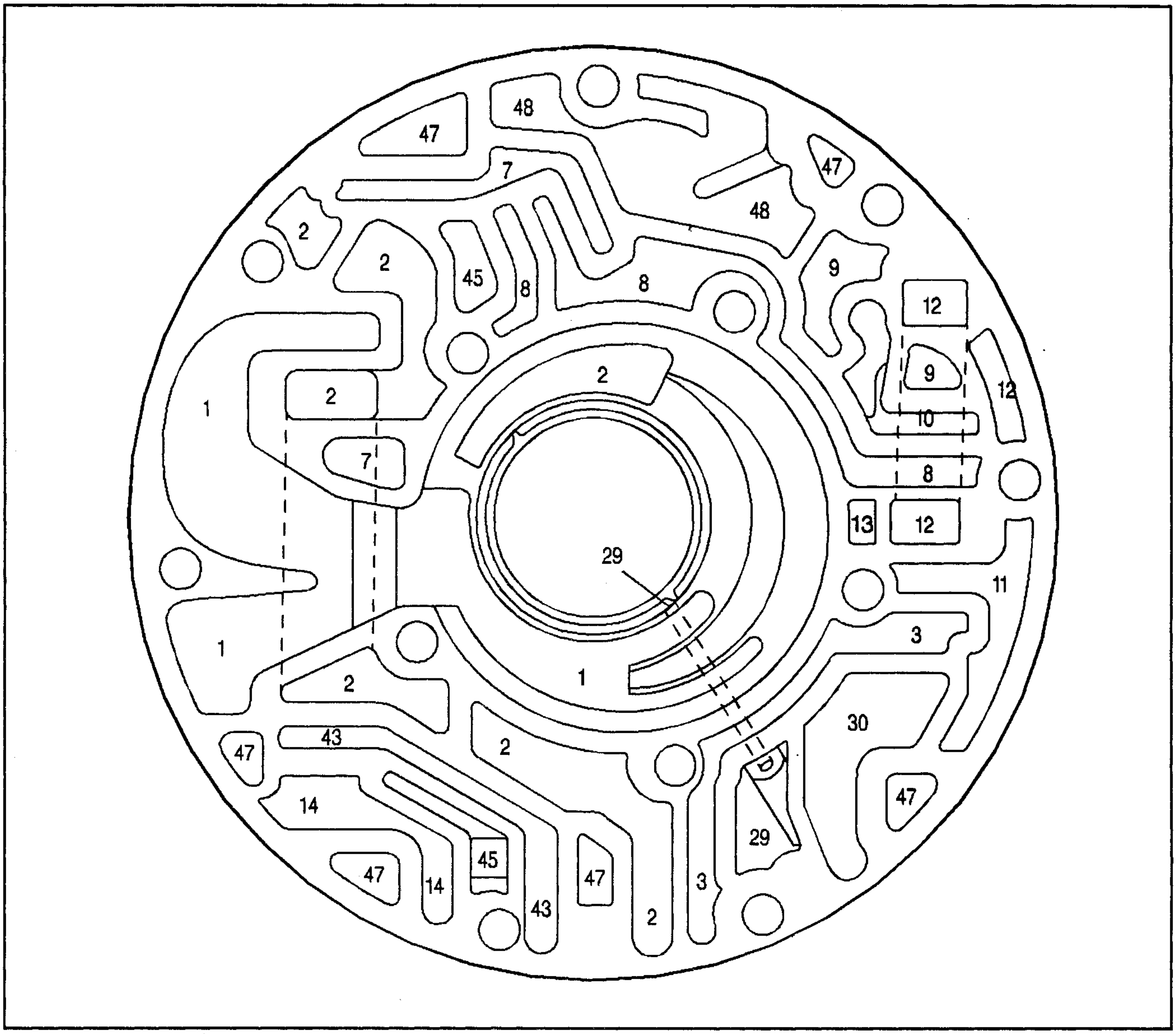
Seal Locations



Legend

(2) Ring, Turbine Shaft Front Oil Seal
(5) Seal, Oil Pump
(13) Seal, Output Shaft
(15) Seal, Case Extension
(20) Seal Asm., Prop Shaft Front Slip Yoke Oil
(57) Seal, Manual 2-1 Band Servo Piston
(66) Seal, Low and Reverse Servo Piston
(67) Ring, Low and Reverse Accumulator Piston Outer Oil Seal
(69) Ring, Low and Reverse Accumulator Piston Inner Oil Seal
(201) Seal Asm., Torque Converter Oil
(219) Ring, Oil Seal, Overrun Clutch Housing
(404) Seal, 3rd Clutch Accumulator Piston Outer
(406) Seal, 3rd Clutch Accumulator Piston Inner
(501) Ring, Turbine Shaft Rear Oil Seal
(503) Ring, Turbine Shaft Intermediate Oil Seal
(505) Piston Assembly, Overrun Clutch
(527) Seal, Fourth Clutch Piston Inner
(531) Seal, Fourth Clutch Piston Outer
(606) Piston, Forward Clutch
(619) Piston, Direct Clutch
(622) Seal, Direct Clutch Piston Intermediate
(637) Seal, Intermediate Clutch Piston Inner
(638) Seal, Intermediate Clutch Piston Outer
(639) Ring, Direct Clutch Housing Oil Seal
(685) Seal Assembly, Forward Clutch Piston Intermediate

Pump Body Fluid Passages (Pump Cover Side)

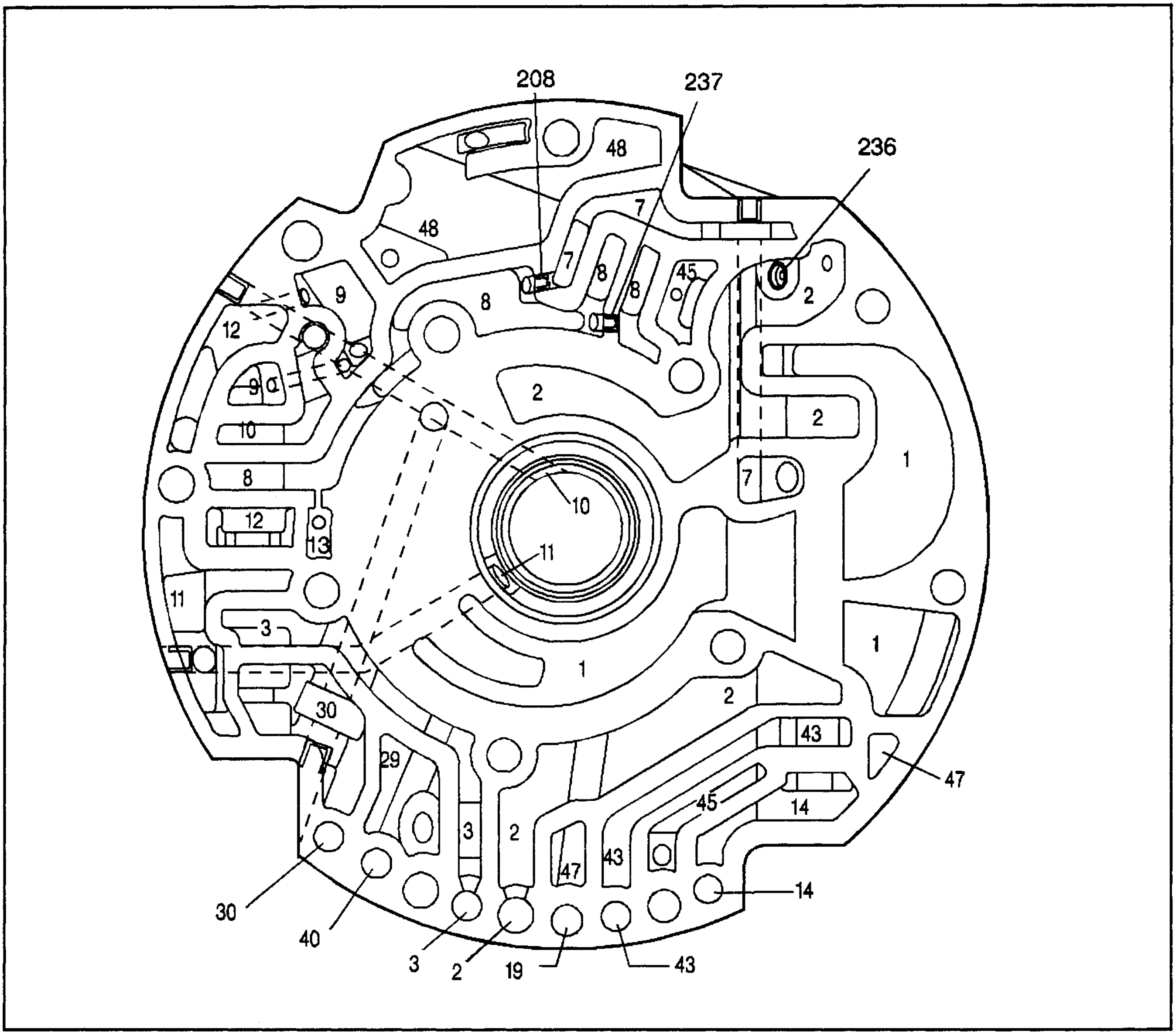


55234

Legend

(1) Suction
(2) Line
(3) Regulated Apply
(7) Converter Feed
(8) Regulated Converter Feed
(9) TCC Enable
(10) Converter Release
(11) Converter Apply/Return
(12) Cooler
(13) Lube
(14) Torque Signal
(29) Pump Seal Drainback
(30) TCC Signal
(43) Reverse
(45) Exhaust
(47) Void
(48) Vent

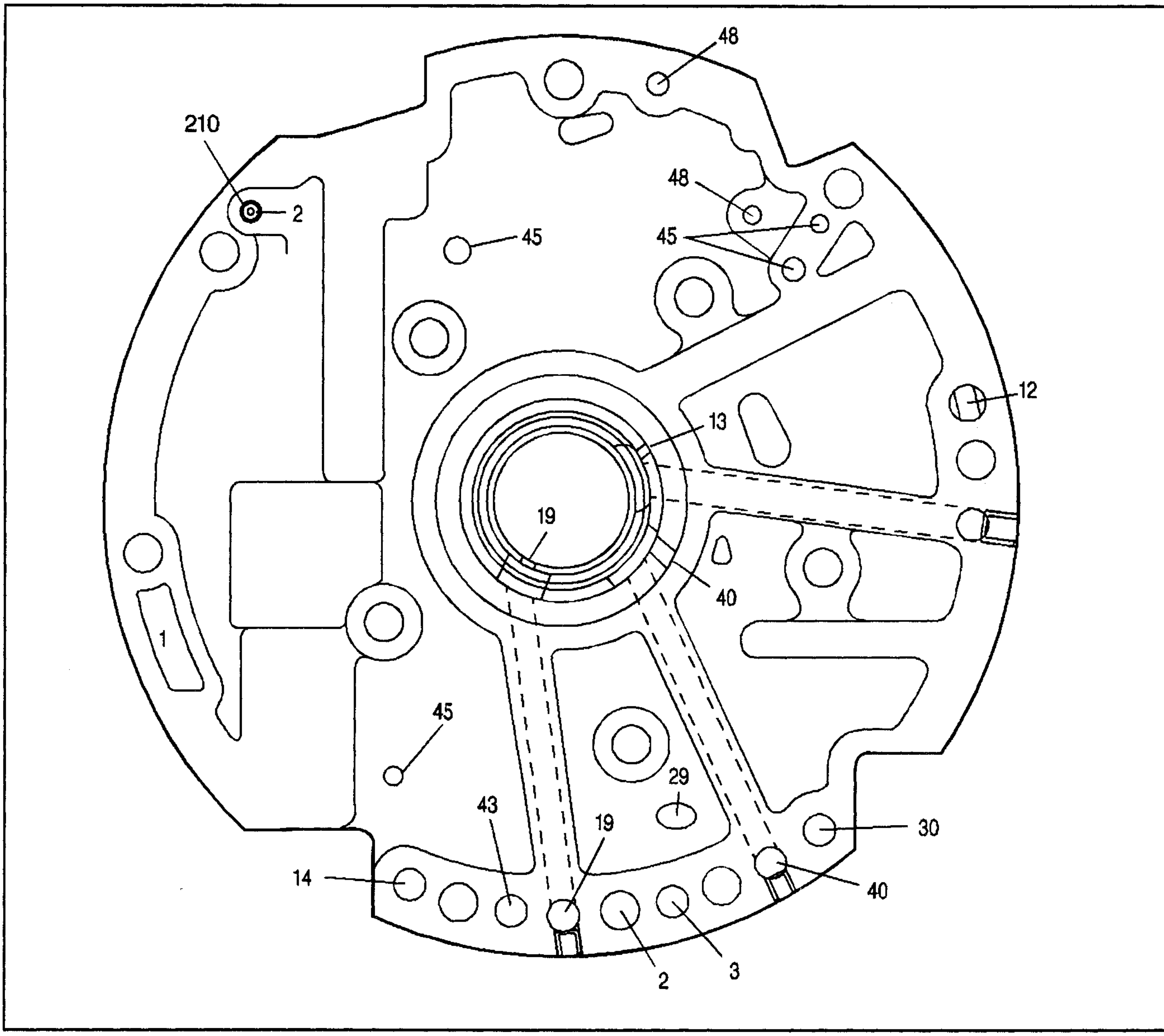
Pump Cover Fluid Passages (Pump Body Side)



Legend

(1) Suction
(2) Line
(3) Regulated Apply
(7) Converter Feed
(8) Regulated Converter Feed
(9) TCC Enable
(10) Converter Release
(11) Converter Apply/Return
(12) Cooler
(13) Lube
(14) Torque Signal
(19) Drive
(29) Pump Seal Drainback
(30) TCC Signal
(40) Overrun Clutch
(43) Reverse
(45) Exhaust
(47) Void
(48) Vent
(208) Plug, Orificed Cup
(236) Plug, Orificed Cup
(237) Plug, Orificed Cup

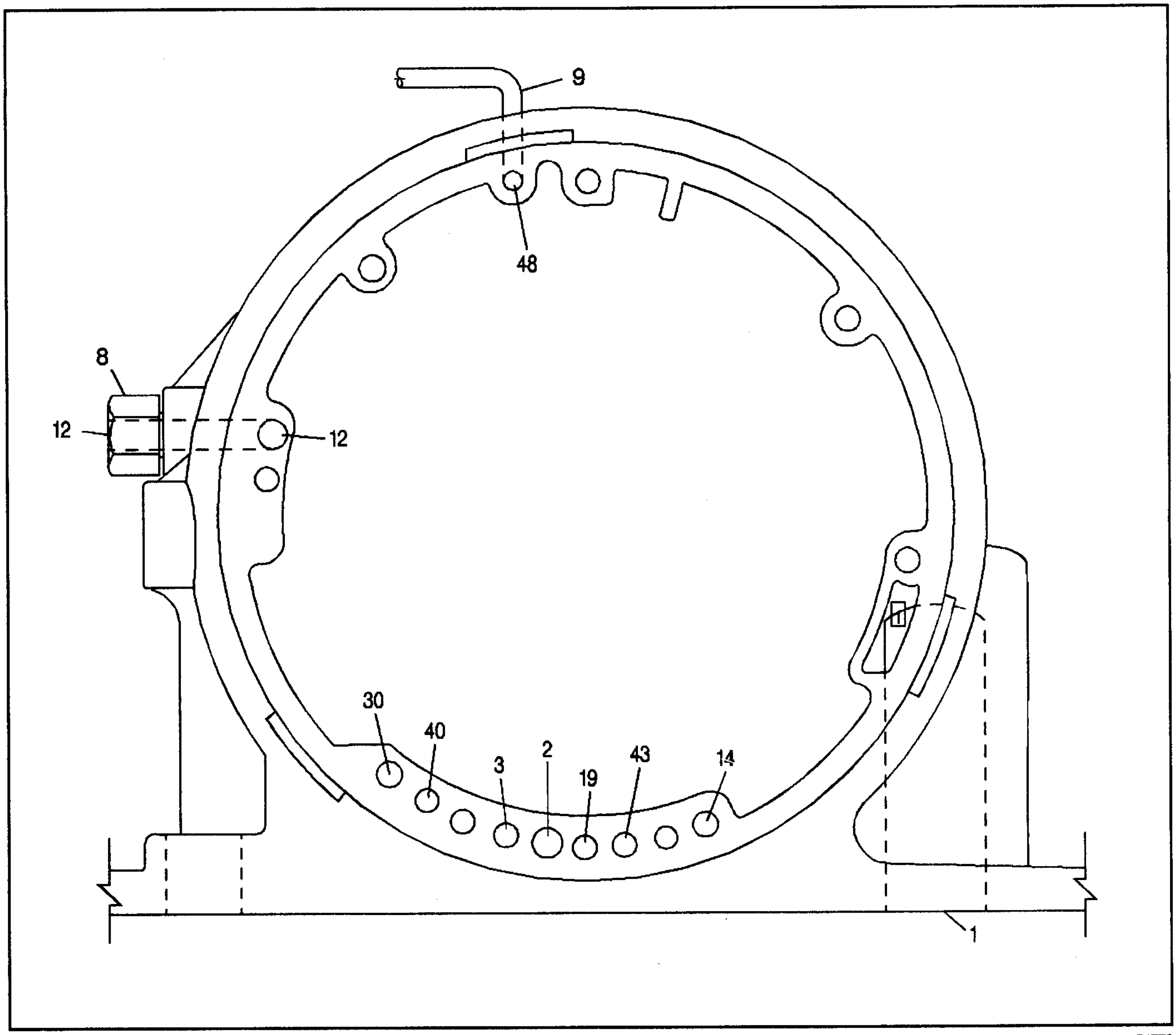
Pump Cover Fluid Passages (Case Side)



Legend

- (1) Suction
- (2) Line
- (3) Regulated Apply
- (12) Cooler
- (13) Lube
- (14) Torque Signal
- (19) Drive
- (29) Pump Seal Drainback
- (30) TCC Signal
- (40) Overrun Clutch
- (43) Reverse
- (45) Exhaust
- (48) Vent
- (210) Plug, Orificed Cup

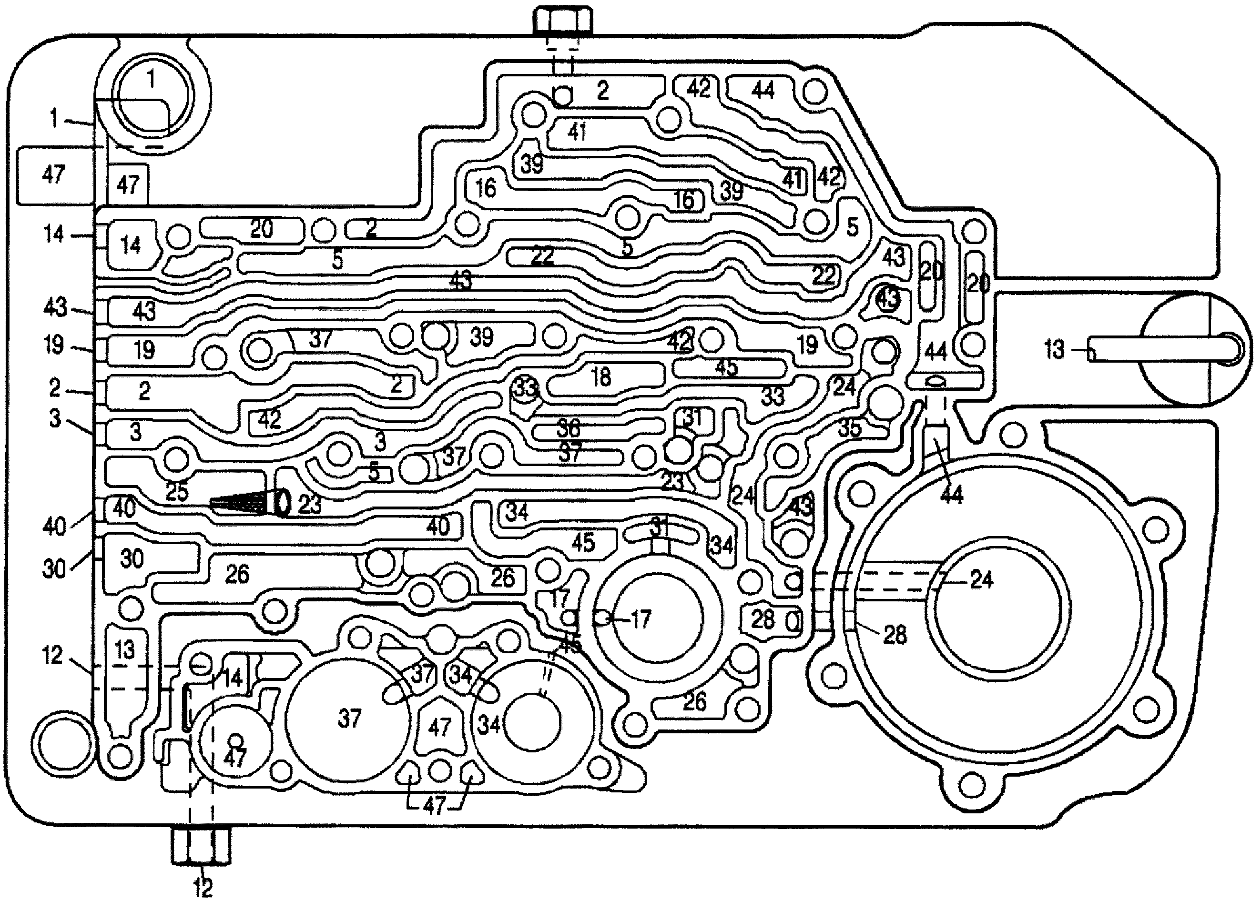
Case Fluid Passages (Pump Cover Side)



Legend

- (1) Suction
- (2) Line
- (3) Regulated Apply
- (8) Connector, Transmission Oil Cooler Pipe
- (9) Pipe, Vent
- (12) Cooler
- (14) Torque Signal
- (19) Drive
- (30) TCC Signal
- (40) Overrun Clutch
- (43) Reverse
- (48) Vent

Case Fluid Passages (Control Valve Body Side)

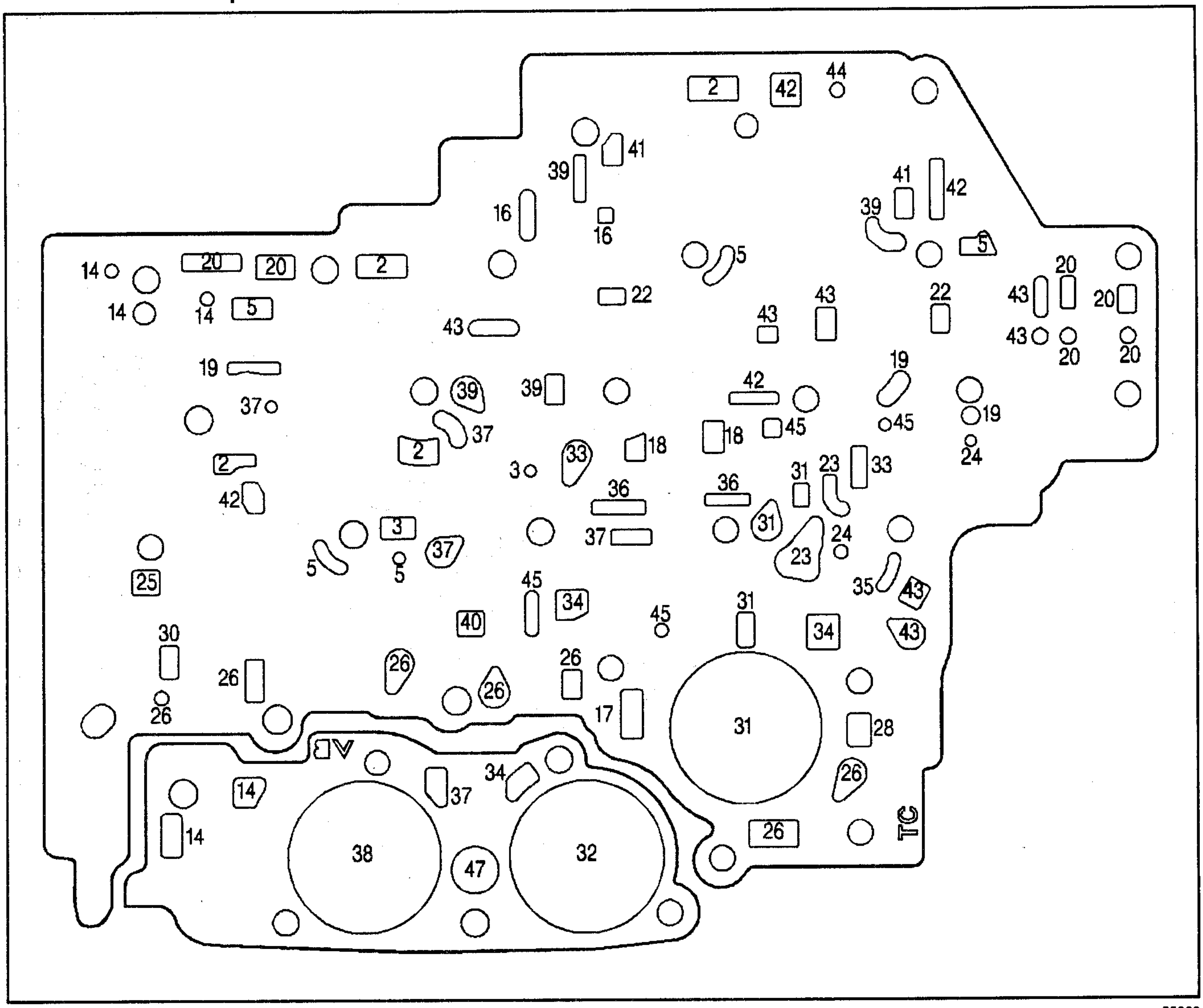


54777

Legend

- (1) Suction
- (2) Line
- (3) Regulated Apply
- (5) Actuator Feed
- (12) Cooler
- (13) Lube
- (14) Torque Signal
- (16) PRN (Park Reverse Neutral)
- (17) PRND43
- (18) PRND4
- (19) Drive
- (20) Filtered Actuator Feed
- (22) Signal B
- (23) 2-3 Drive
- (24) 2nd Clutch
- (25) Filtered 2-3 Drive
- (26) Accumulator
- (28) 2nd Accumulator
- (30) TCC Signal
- (31) FBA (Front Band Apply)
- (32) 3rd Accumulator
- (33) 3rd Clutch Feed
- (34) 3rd Clutch
- (35) 3rd/Reverse
- (36) 4th Clutch Feed
- (37) 4th Clutch
- (39) D321
- (40) Overrun Clutch
- (41) D21
- (42) Lo
- (43) Reverse
- (44) RBA (Rear Band Apply)
- (45) Exhaust
- (47) Void

Spacer Plate to Case Gasket with Accumulator Housing Gasket

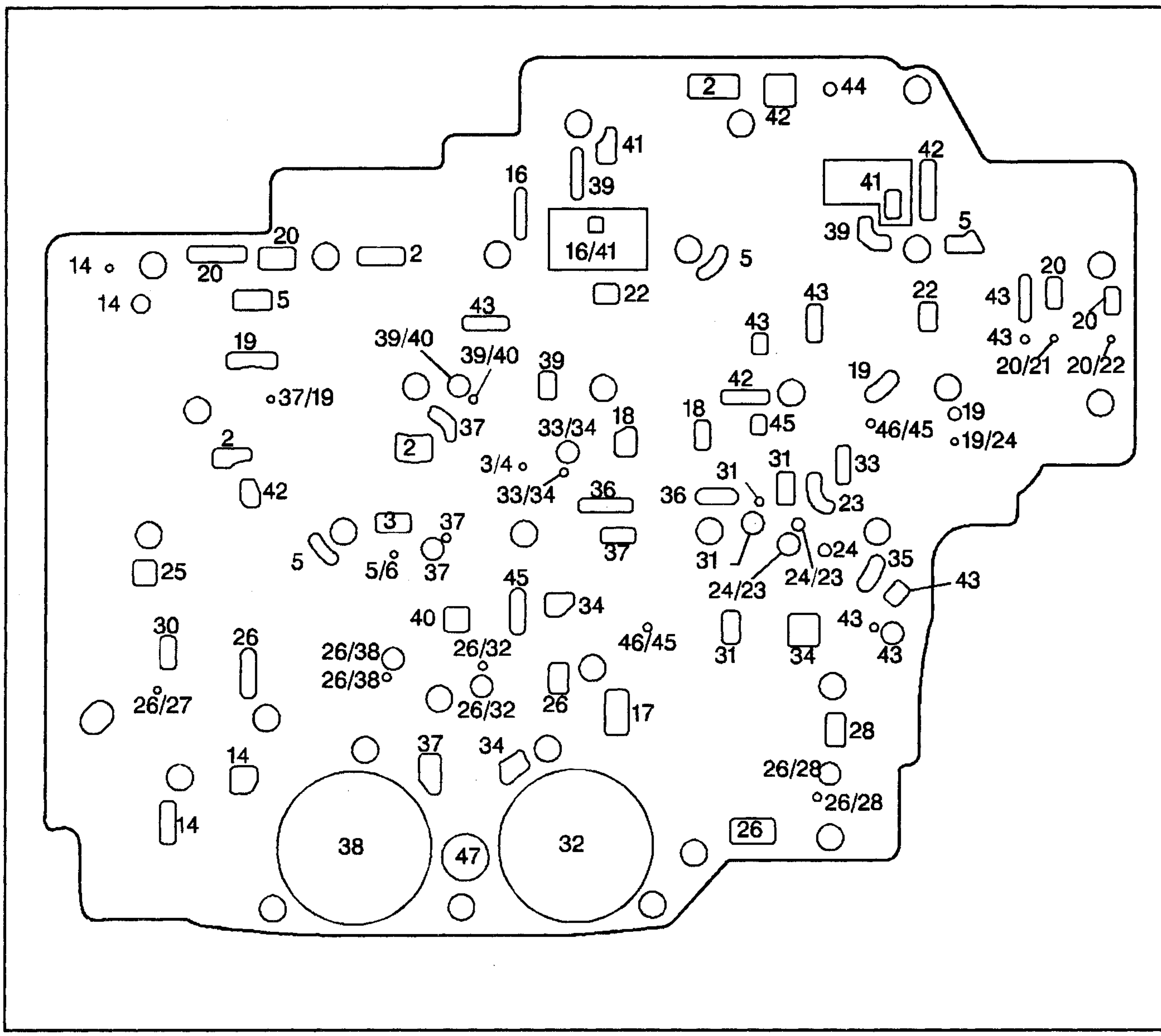


55309

Legend

- (2) Line
- (3) Regulated Apply
- (5) Actuator Feed
- (14) Torque Signal
- (16) PRN (Park Reverse Neutral)
- (17) PRND43
- (18) PRND4
- (19) Drive
- (20) Filtered Actuator Feed
- (22) Signal B
- (23) 2-3 Drive
- (24) 2nd Clutch
- (25) Filtered 2-3 Drive
- (26) Accumulator
- (28) 2nd Accumulator
- (30) TCC Signal
- (31) FBA (Front Band Apply)
- (32) 3rd Accumulator
- (33) 3rd Clutch Feed
- (34) 3rd Clutch
- (35) 3rd/Reverse
- (36) 4th Clutch Feed
- (37) 4th Clutch
- (38) 4th Accumulator
- (39) D321
- (40) Overrun Clutch
- (41) D21
- (42) Lo
- (43) Reverse
- (44) RBA (Rear Band Apply)
- (45) Exhaust
- (47) Void

Spacer Plate



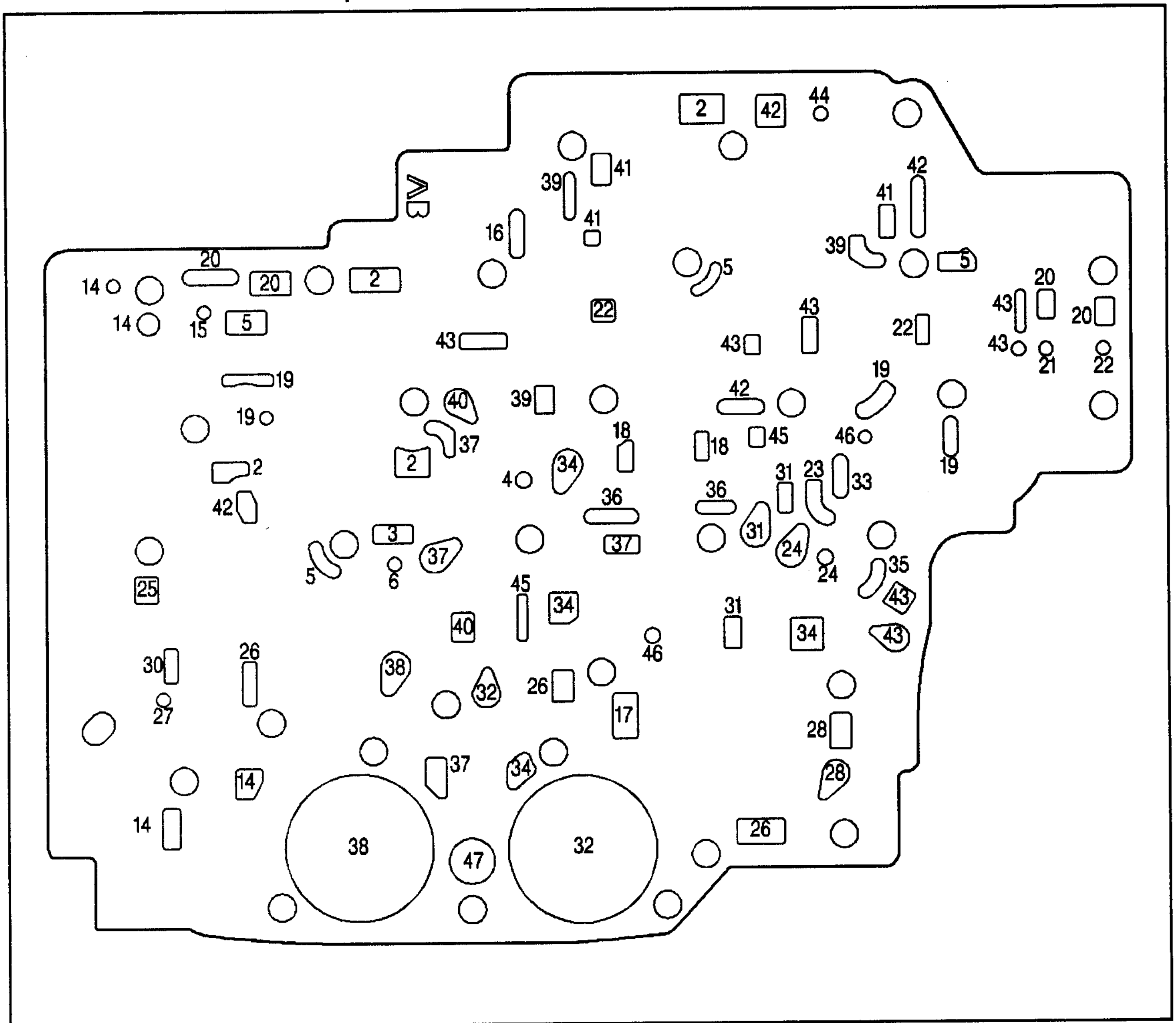
54780

Legend

(2) Line	(26) Accumulator
(3) Regulated Apply	(27) Orificed Accumulator
(4) Orificed Regulator Apply	(28) 2nd Accumulator
(5) Actuator Feed	(30) TCC Signal
(6) Orificed Actuator Feed	(31) FBA (Front Band Apply)
(14) Torque Signal	(32) 3rd Accumulator
(16) PRN (Park Reverse Neutral)	(33) 3rd Clutch Feed
(17) PRND43	(34) 3rd Clutch
(18) PRND4	(35) 3rd/Reverse
(19) Drive	(36) 4th Clutch Feed
(20) Filtered Actuator Feed	(37) 4th Clutch
(21) Signal A	(38) 4th Accumulator
(22) Signal B	(39) D321
(23) 2-3 Drive	(40) Overrun Clutch
(24) 2nd Clutch	(41) D21
(25) Filtered 2-3 Drive	(42) Lo

(43) Reverse
(44) RBA (Rear Band Apply)
(45) Exhaust
(46) Orificed Exhaust
(47) Void

Spacer Plate to Control Valve Body Gasket



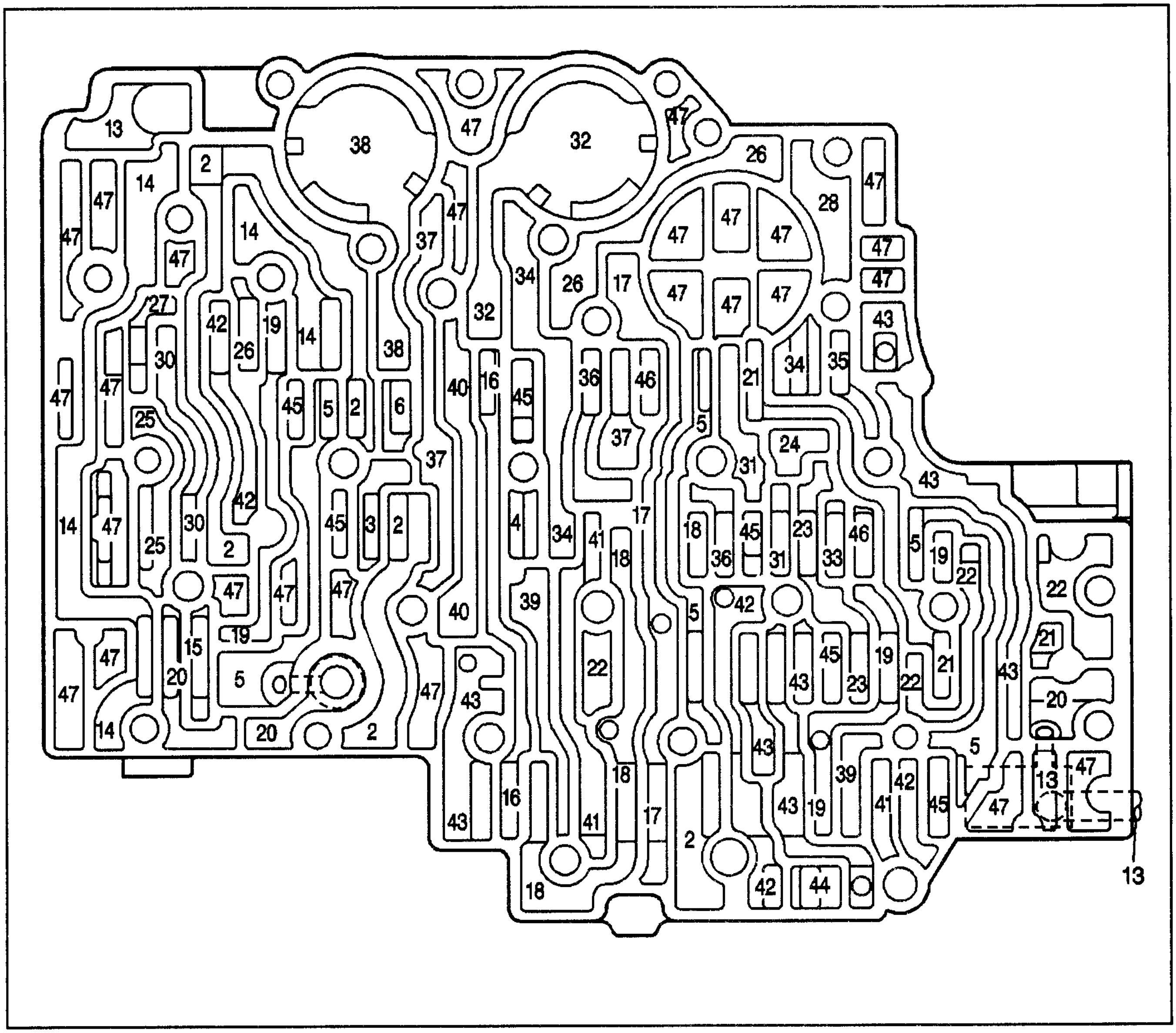
54627

Legend

(2) Line
(3) Regulated Apply
(4) Orificed Regulator Apply
(5) Actuator Feed
(6) Orificed Actuator Feed
(14) Torque Signal
(15) Orificed Torque Signal
(16) PRN (Park Reverse Neutral)
(17) PRND43
(18) PRND4
(19) Drive
(20) Filtered Actuator Feed
(21) Signal A
(22) Signal B
(23) 2-3 Drive
(24) 2nd Clutch
(25) Filtered 2-3 Drive
(26) Accumulator
(27) Orificed Accumulator
(28) 2nd Accumulator
(30) TCC Signal
(31) FBA (Front Band Apply)

(32) 3rd Accumulator
(33) 3rd Clutch Feed
(34) 3rd Clutch
(35) 3rd/Reverse
(36) 4th Clutch Feed
(37) 4th Clutch
(38) 4th Accumulator
(39) D321
(40) Overrun Clutch
(41) D21
(42) Lo
(43) Reverse
(44) RBA (Rear Band Apply)
(45) Exhaust
(46) Orificed Exhaust
(47) Void

Control Valve Body Fluid Passages (Case Side)



54783

Legend

(2) Line
(3) Regulated Apply
(4) Orificed Regulator Apply
(5) Actuator Feed
(6) Orificed Actuator Feed
(13) Lube
(14) Torque Signal
(15) Orificed Torque Signal
(16) PRN (Park Reverse Neutral)
(17) PRND43
(18) PRND4
(19) Drive
(20) Filtered Actuator Feed
(21) Signal A
(22) Signal B
(23) 2-3 Drive
(24) 2nd Clutch
(25) Filtered 2-3 Drive
(26) Accumulator
(27) Orificed Accumulator
(28) 2nd Accumulator
(30) TCC Signal
(31) FBA (Front Band Apply)
(32) 3rd Accumulator
(33) 3rd Clutch Feed
(34) 3rd Clutch
(35) 3rd/Reverse
(36) 4th Clutch Feed
(37) 4th Clutch
(38) 4th Accumulator
(39) D321
(40) Overrun Clutch

(41) D21
(42) Lo
(43) Reverse
(44) RBA (Rear Band Apply)
(45) Exhaust
(46) Orificed Exhaust
(47) Void

Special Tools and Equipment

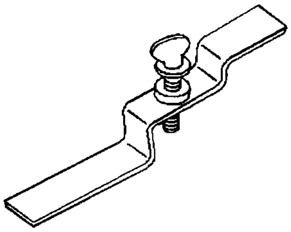
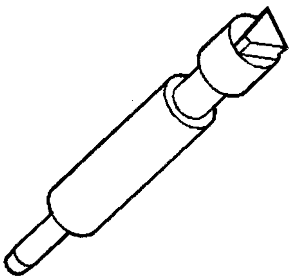
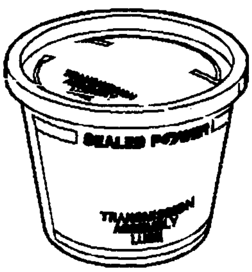
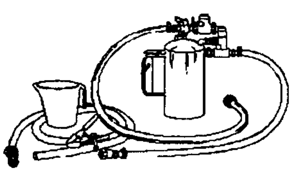
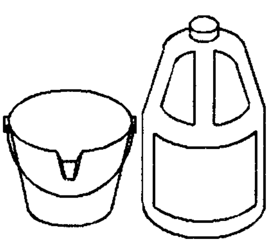
Illustration	Tool Number/Description
 9353	J 21366 Converter Holding Strap
 40674	J 21370-10 Gauge Pin
 13128	J 36850 TRANSJEL®
 9210	J 35944 Cooler Flushing Tool
 15015	J 3944-20 Biodegradable Flushing Solution

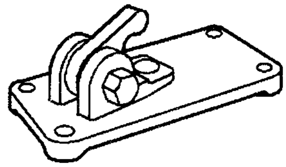
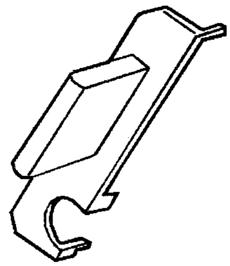
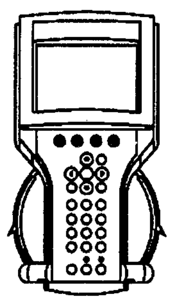
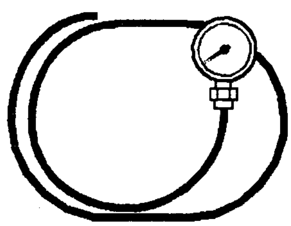
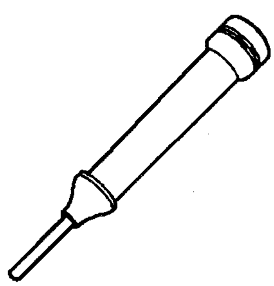
Illustration	Tool Number/Description
 40677	J 38787 Band Apply Pin Checking Tool
 102613	J 41364-A Neutral Position Adjustment Tool
 59260	Scan Tool
 29339	J 21867 Universal Pressure Gauge Set
 339985	J 36400-5 Push Terminal Release Tool

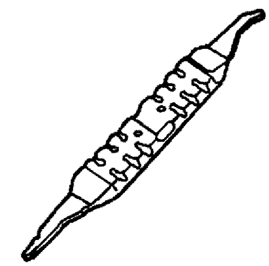
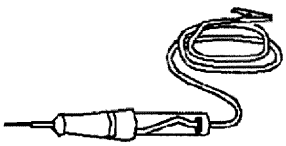
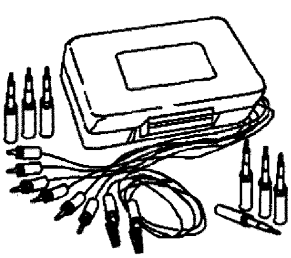
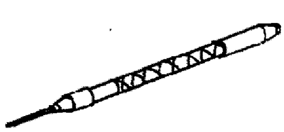
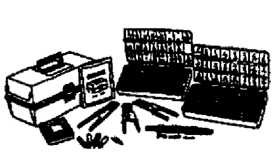
Illustration	Tool Number/Description
 339975	J 36400-4 Computer Terminal Release Tool
 5382	J 34142-B Unpowered Test Lamp
 8917	J 35616 Connector Test Adapter Kit
 5395	J 35689-A Metri-pack Terminal Remover
 9081	J 38125-4 Terminal Repair Kit

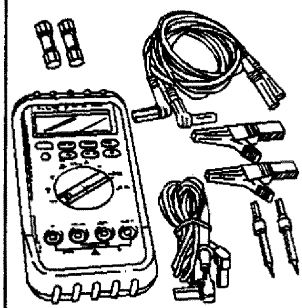
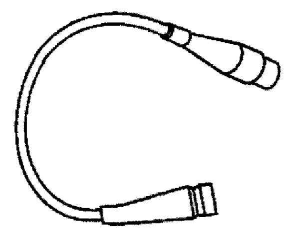
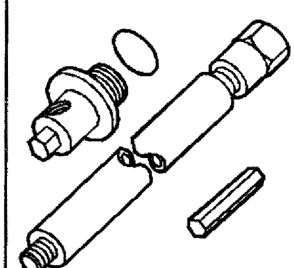
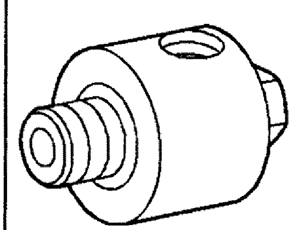
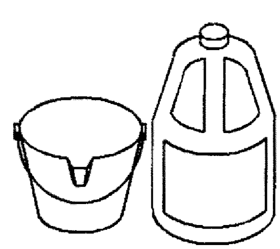
Illustration	Tool Number/Description
 3430	J 39200 Digital Multimeter (DMM)
 13538	J 39775 Jumper Harness
 20653	J 21867-94 Line Pressure Adapter Kit
 326786	J 21867-100 Pressure Gauge Adapter
 15015	J 35944-20 Cooler Flushing Fluid

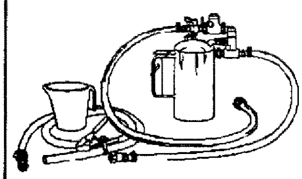
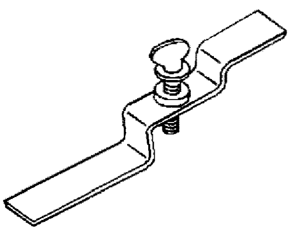
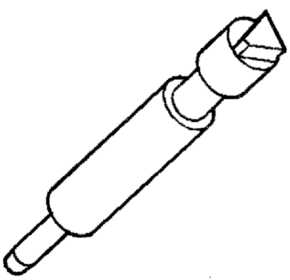
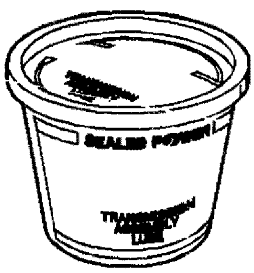
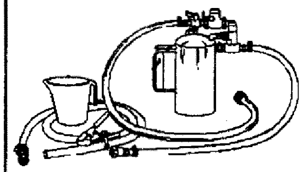
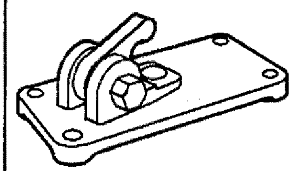
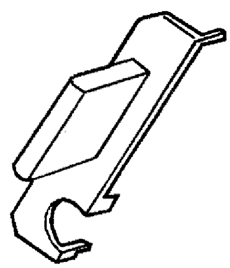
Illustration	Tool Number/Description
 9210	J 35944-A Transmission Oil Cooler and Line Flusher
 9353	J 21366 Converter Holding Strap
 40674	J 21370-10 Gage Pin
 13128	J 36850 TRANSJEL®

Illustration	Tool Number/Description
 9210	J 35944 Cooler Flushing Tool
 40677	J 38787 Band Apply Pin Checking Tool
 102613	J 41364-A Neutral Position Adjustment Tool

Clutch

Specifications

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Transmission to Clutch Housing Bolts	73 N·m	54 lb ft
Clutch Pressure Plate to Flywheel Bolts	41 N·m	30 lb ft
Concentric Slave Cylinder Bolts	8 N·m	71 lb in
Clutch Housing Cover Bolts	13 N·m	115 lb ft
Retainer Nut	20 N·m	15 lb ft

Diagnostic Information and Procedures

Preliminary Checking Procedure

Before attempting to repair the clutch, transmission, or related components for any reason other than an obvious failure, identify the problem and the probable cause. Shifting difficulties, such as a high shift effort, a gear clash, or grinding, are symptomatic of a large percentage of any clutch or manual transmission problems. When any of these problems occur, it is necessary to perform a careful analysis of these difficulties.

Before removing a suspected failed hydraulic clutch system, check the reservoir fluid level. The actuator cylinder must be in place when checking the fluid level. If the fluid level is low, fill the reservoir to the specified level with DOT 3 brake fluid GM P/N 1052535 or the equivalent. Do not overfill the system.

Notice: Carefully clean the top and sides of the reservoir before opening to prevent contamination of the system with dirt, water, or other foreign material. Remove the reservoir diaphragm before adding fluid. Carefully replace the diaphragm and cover after filling.

If the reservoir requires any fluid, check the hydraulic system components for leakage. A slight wetting of the surfaces is acceptable. Replace the system if any excessive leakage is evident.

Clutch Spin Down Time

1. Run the engine at a normal idle with the transmission in neutral while engaging the clutch.
2. Disengage the clutch, wait 9 seconds, and shift the transmission into reverse.
3. If a grinding noise exists, refer to *Clutch Noisy*.

Clutch Does Not Disengage

Problem	Action
Air in the hydraulic system.	Bleed the system and check for damage.
Master cylinder seals or actuator hydraulic cylinder seals worn.	Replace the worn seals.
Not enough pedal travel.	Remove the aftermarket follor covering from behind the clutch pedal.
Worn or damaged concentric slave cylinder.	Replace the worn or damaged concentric slave cylinder.
Worn or damaged driven plate.	Replace the worn or damaged driven plate.
Binding in the driven plate.	Replace the plate.

Clutch Slipping

Problem	Action
Worn or oil soaked driven plate friction material.	Replace the driven plate and check for leaks.
Warped clutch cover or flywheel.	Replace the clutch cover or flywheel.
Weak diaphragm spring.	Replace the clutch cover.
Overheated driven plate.	Allow the driven plate to cool and make 30–40 normal starts. Do not overheat.

Clutch Grabbing (Chattering)

Problem	Action
Warped clutch cover or flywheel.	Replace the clutch cover or the flywheel.
Damaged driven plate friction material.	Replace the driven plate.
Contaminated driven plate friction material.	Replace the driven plate and check for leaks.
Loose or damaged engine mounts.	Tighten or replace the engine mounts.
Worn transmission pilot bearing.	Replace the transmission pilot bearing.

Clutch Rattle (Trans Click)

Problem	Action
Weak or damaged driven plate springs.	Replace the driven plate.

Release Bearing Noisy with Clutch Engaged

Problem	Action
Binding in the concentric slave cylinder release bearing.	Replace the concentric slave cylinder release bearing.

Clutch Noisy

Problem	Action
Worn or damaged release bearing.	Replace the release bearing.
Worn or damaged pilot bearing.	Replace the pilot bearing.

Pedal Stays on Floor (Clutch Disengaged)

Problem	Action
Binding in the release bearing.	Free up, or replace, and lubricate the release bearing.
Weak diaphragm spring.	Replace the clutch cover.

Clutch Pedal Hard to Push

Problem	Action
Blocked or crimped hydraulic tube.	Replace the hydraulic tube.
Binding in the master cylinder or the actuator cylinder.	Replace the master cylinder or the actuator cylinder.
Worn driven plate.	Replace the driven plate and the clutch cover.

Clutch Pedal Travels to Floor(Fluid in Master Cyl)

Problem	Action
DEFINITION: Pedal Travels to the floor. No pressure or very little resistance	
Faulty master cylinder or actuator cylinder.	Replace the hydraulic clutch control assembly.
Burst or leaking hydraulic line.	Replace the hydraulic clutch control assembly.
No fluid in the reservoir.	Replace the hydraulic clutch control assembly.

Clutch Master Cylinder Fluid Leaks

Problem	Action
DEFINITION: Fluid in the area of the pedal or on the carpet.	
Faulty seal in the master cylinder.	Replace the hydraulic clutch control assembly.

Clutch Actuator Fluid Leaks

Problem	Action
DEFINITION: Fluid in the actuator cylinder and on the cylinder body.	
Faulty actuator cylinder seal.	Replace the hydraulic clutch control assembly.

Clutch Pedal Spongy

Problem	Action
DEFINITION: Pedal feels spongy when depressed.	
Air in the hydraulic system.	Check the fluid level. Bleed the system if necessary. If the symptom recurs, check and replace the hydraulic clutch control assembly.

Unable To Select Gears

Problem	Action
DEFINITION: Unable to select any gears. Normal pedal effort and travel.	
Faulty clutch or transmission.	Check and replace the clutch or the transmission components.

Clutch Pedal Sticks or Binds

Problem	Action
DEFINITION: Pedal sticks or binds during travel.	
Worn clutch pedal bushings.	Check and replace the worn parts.

Repair Instructions

Hydraulic Clutch Bleeding

Clutch System Bleeding

Important: Never use fluid that you have bled from a system to fill the reservoir. The fluid may be aerated or contaminated.

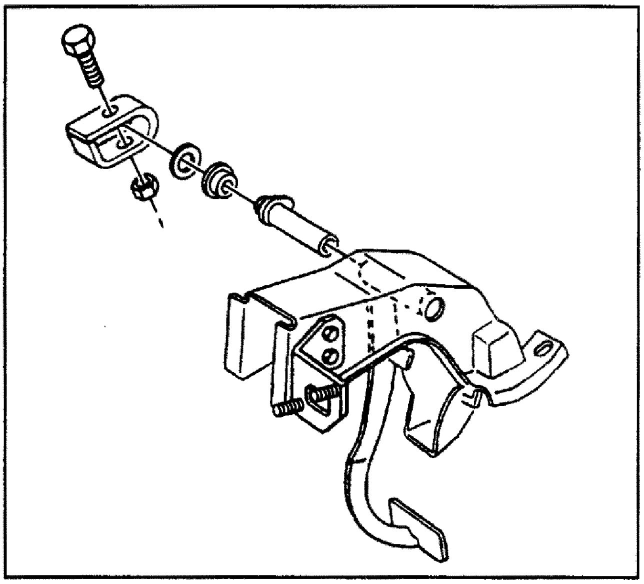
1. Fill the reservoir with DOT 3 brake fluid P/N 1052535 or the equivalent. Do not overfill the system.
2. Depress and hold down the clutch pedal.
3. Open the bleed screw, located on the side of the transmission above the quick connect coupling, to expel any air.
4. Close the bleed screw and release the clutch pedal.

Important: Ensure no air is drawn into the clutch system.

5. Repeat steps 2, 3, and 4 until all the air is out of the clutch system.
   5.1. Check and refill the reservoir as needed while bleeding.
   5.2. After bleeding, pump the clutch pedal several times. If the clutch engagement is not satisfactory, repeat the bleeding procedure.
6. If the previous procedures are unsuccessful, perform the following steps:
   6.1. Remove the reservoir cap.
   6.2. Pump the clutch pedal very fast for 30 seconds.
   6.3. Stop pumping and let the air escape.
   6.4. Repeat this procedure as necessary.

Clutch Pedal Replacement

Removal Procedure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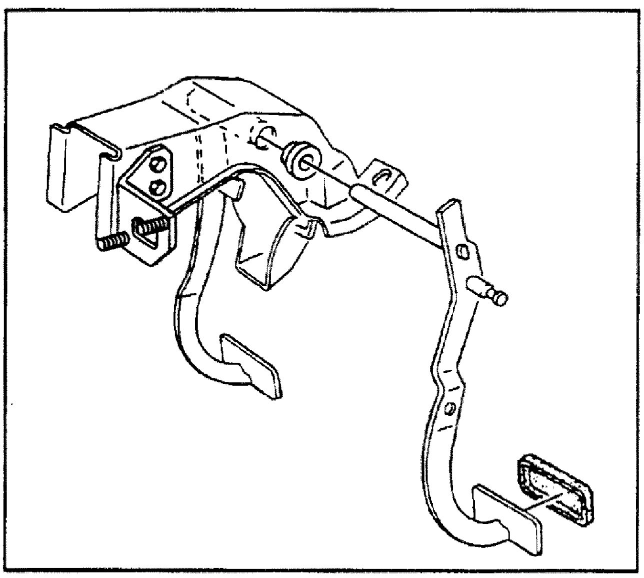
1. Remove the pushrod from the clutch pedal.
2. Remove the nut and the bolt from the retainer.
3. Remove the retainer.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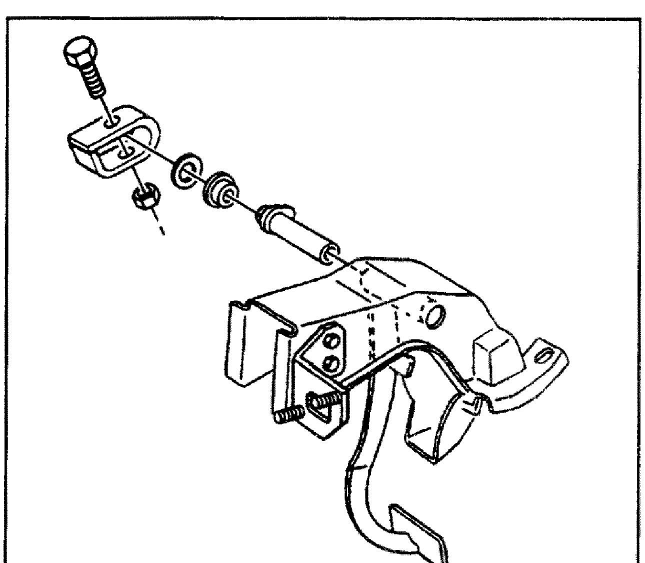
4. Remove the washer and the bushing from the shaft.
5. Remove the shaft from the bracket. Slide a long screw or rod into the bracket in order to hold the brake pedal in place.
6. Remove the clutch pedal and the bushing.

Installation Procedure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1. Lightly grease the inside and the outside of the new bushing.
2. Install the new bushing into the bracket.
3. Install the clutch pedal. Remove the long screw or rod supporting the brake pedal while installing the clutch pedal into the bracket.

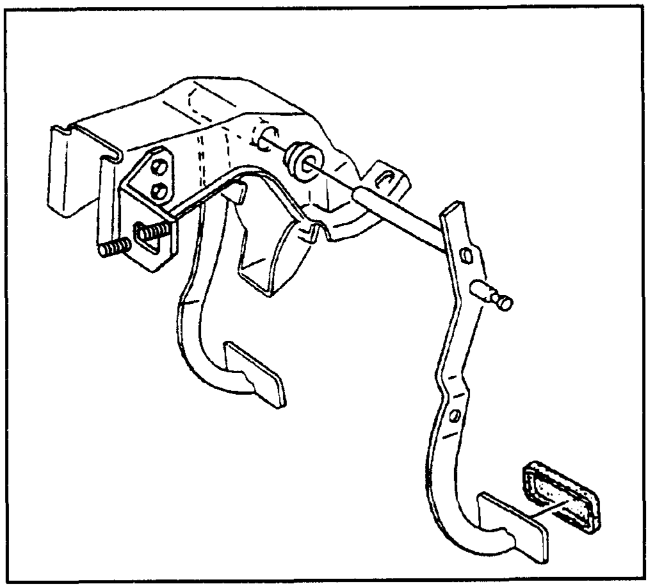
4. Install the shaft into the bracket.
5. Install the retainer.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

6. Install the bolt and the nut onto the retainer.

   Tighten

   Tighten the retainer nut to 20 N·m (15 lb ft).
7. Install the pushrod onto the clutch pedal.



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Clutch Master Cylinder Replacement

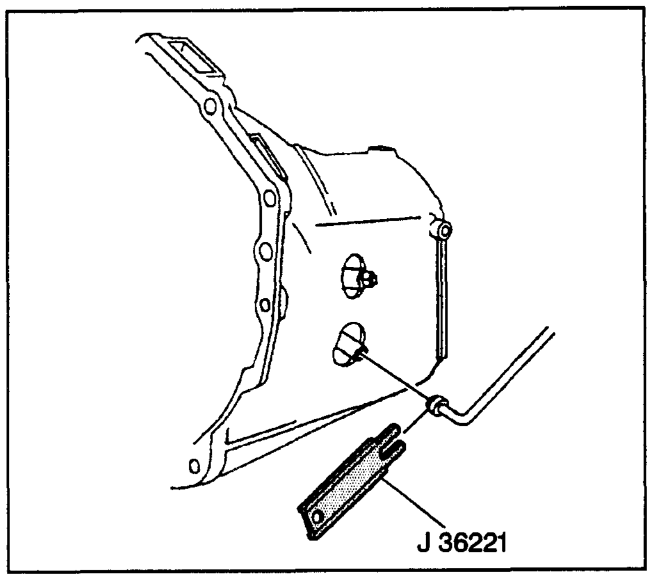
Removal Procedure

Notice: When servicing a vehicle that requires replacement of the master cylinder, the reservoir, or the tubing, you must replace the entire master cylinder assembly. Replacement of individual components cannot be performed. A complete pre-filled, pre-bled master cylinder must be installed.

Tools Required

J 36221 Quick Connect Coupling Removal Tool

1. Disconnect the pushrod from the clutch pedal.
2. Remove the hydraulic tube from the concentric slave cylinder quick connect coupling. Use *J 36221* to depress the white plastic sleeve on the quick connect coupling to separate the clutch line from the concentric slave cylinder.



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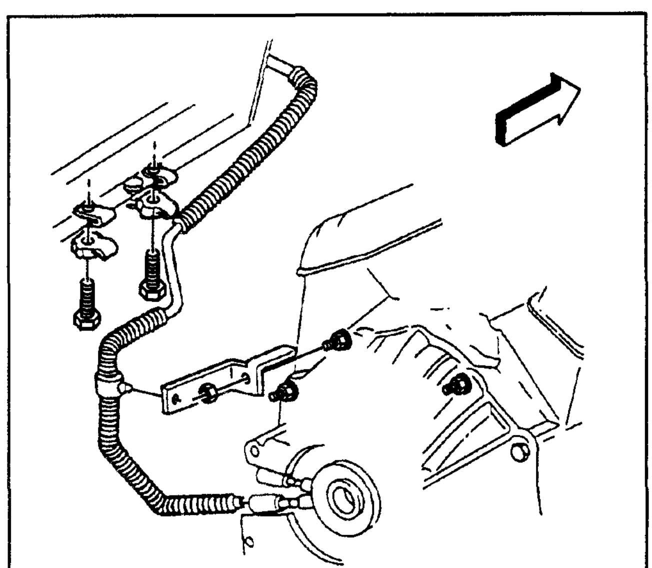
3. Remove the plastic clip and the clutch line from the frame.



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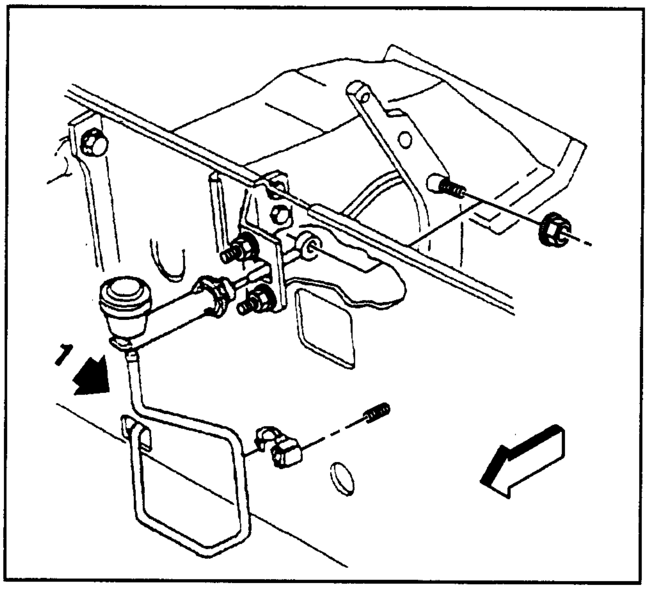

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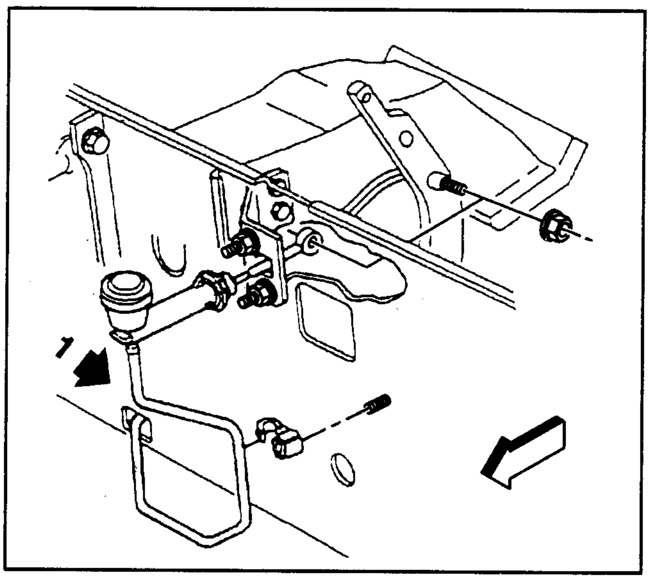
4. Rotate the master cylinder 45 degrees clockwise. Remove the master cylinder from the cowl panel.



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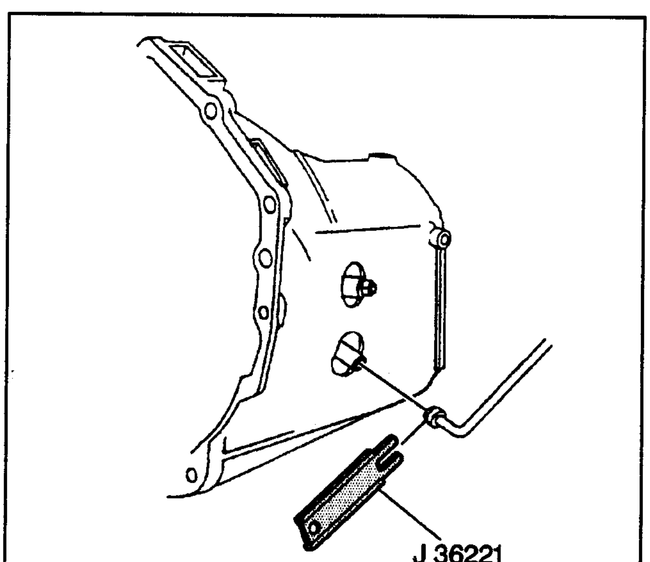
Installation Procedure

1. Install the master cylinder to the cowl panel by holding it at a 45 degree angle and rotating it counterclockwise. Be sure not to over rotate the master cylinder or damage will occur.



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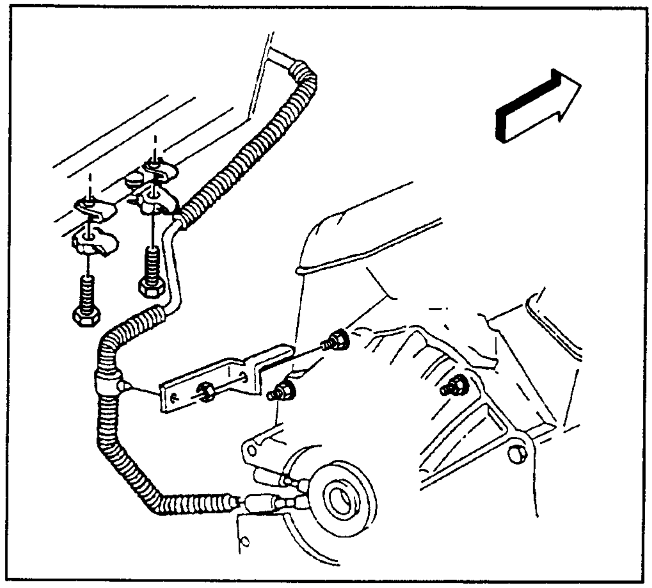
2. Install the hydraulic tube to the concentric slave cylinder quick connect coupling.

3. Install the tube clips to the frame.
4. Install the pushrod to the clutch pedal. Check the reservoir for fluid. If more fluid is required, add DOT 3 brake fluid P/N 1052535 or the equivalent.
5. Connect the pushrod to the clutch pedal.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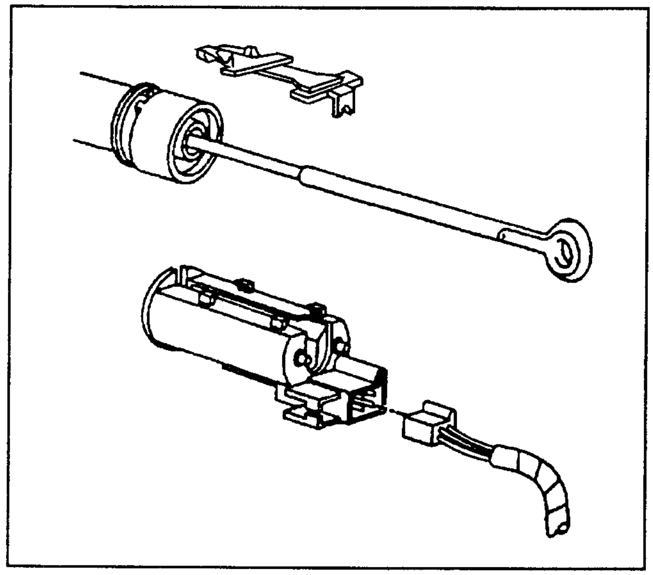
Clutch Start Switch Replacement

Removal Procedure

1. Remove the LH IP sound insulator panel.
2. Remove the plastic retainer tabs from the clutch start switch.
3. Remove the clutch start switch from the push rod.
4. Remove the connector from the switch.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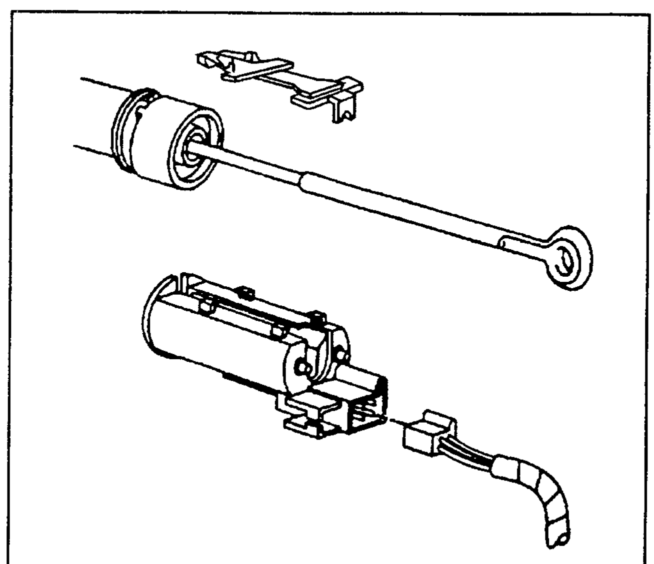
Installation Procedure

1. Install the connector to the clutch start switch.
2. Install the clutch start switch to the pushrod with the plastic tabs.
3. Install the push rod to the clutch pedal.
4. Install the LH IP sound insulator panel.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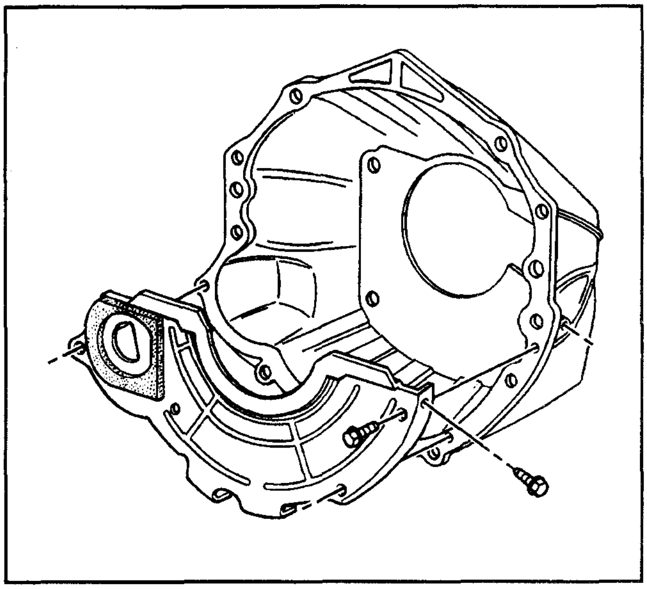

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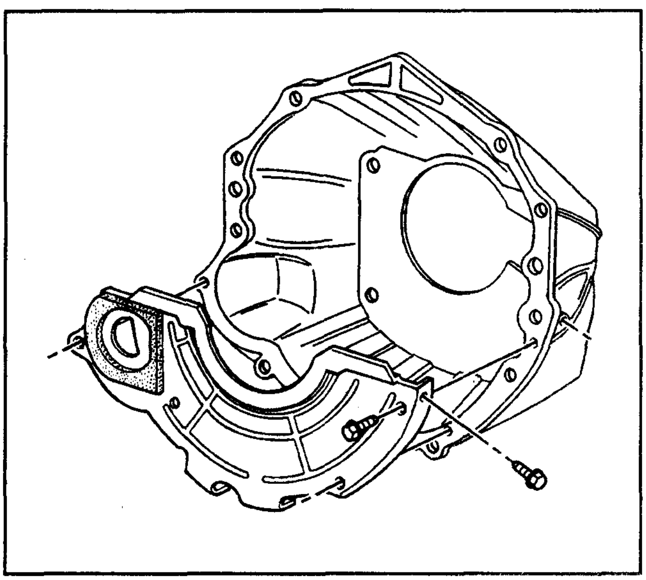
Clutch Housing Replacement

Removal Procedure

Tools Required

J 36221 Hydraulic Clutch Line Separator

1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the propeller shaft.
   - For the two-piece, refer to *Two-Piece Propeller Shaft Replacement* in Propeller Shaft.
   - For the three-piece, refer to *Two-Piece Propeller Shaft Replacement* in Propeller Shaft.
3. Remove the bolts and the flywheel housing cover.
4. Remove the transmission. Refer to *Transmission Replacement* in Manual Transmission.
5. Remove the hydraulic clutch line retaining bracket and nut.
6. Remove the concentric slave cylinder and bolts from the clutch housing cover.
7. Remove the clutch housing to engine bolts and studs.



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Installation Procedure

Notice: Refer to *Fastener Notice* in Cautions and Notices.

1. Install the bolts which secure the clutch housing to the engine.

   Tighten

   Tighten the bolts to 40 N·m (30 lb ft).
2. Install the studs which secure the clutch housing to the engine.

   Tighten

   Tighten the studs to 39 N·m (29 lb ft).
3. install the concentric slave cylinder and bolts to the clutch housing cover.

   Tighten

   Tighten the bolts to 8 N·m (71 lb in).
4. Install the hydraulic clutch line retaining bracket and nut.

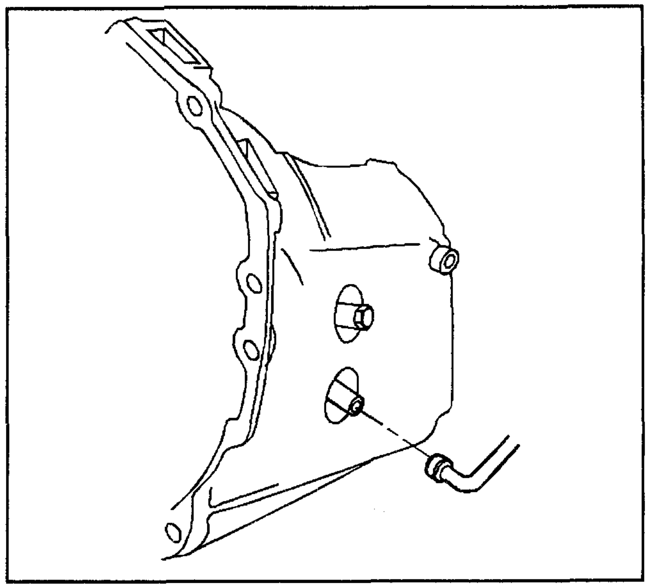
   Tighten

   Tighten the nut to 8 N·m (71 lb in).
5. Install the transmission. Refer to *Transmission Replacement* in Manual Transmission.
6. Install the flywheel housing cover and the bolts.

   Tighten

   Tighten the bolts to 13 N·m (115 lb in).

7. Install the hydraulic clutch fitting to the concentric slave cylinder quick connect.
8. Install the propeller shaft.
   - For the two-piece, refer to *Two-Piece Propeller Shaft Replacement* in Propeller Shaft.
   - For the three- piece, refer to *Two-Piece Propeller Shaft Replacement* in Propeller Shaft.
9. Lower the vehicle.



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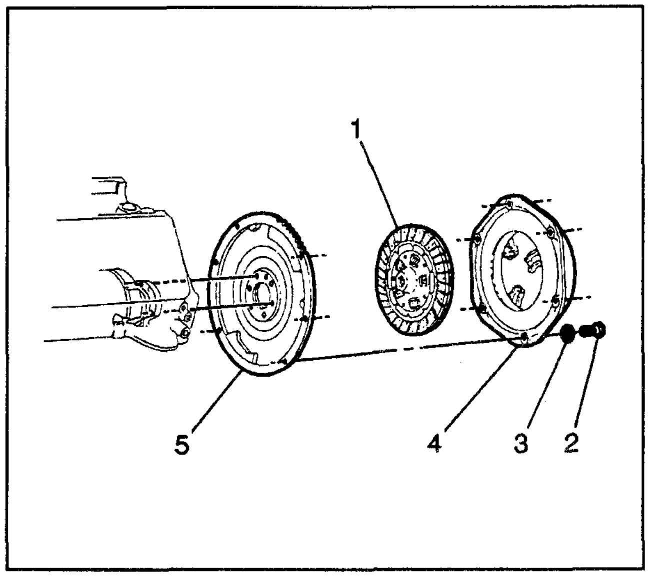
Clutch Assembly Replacement

Removal Procedure

Tools Required

J 36221 Clutch Alignment Tool

1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the quick disconnect from the concentric slave cylinder. Refer to *Clutch Master Cylinder Replacement.*
3. Remove the transmission. Refer to *Transmission Replacement* in Manual Transmission.
4. Remove the clutch housing cover. Refer to *Clutch Housing Replacement.*
5. Install the *J 36221* to support the clutch.
6. Mark the flywheel (5) and a clutch pressure plate lug for the installation alignment.
7. Remove the bolts (2) and the washers (3). Secure the clutch pressure plate (4) and the clutch driven plate (1) to the flywheel (5).
   7.1. Remove the *J 36221*.
   7.2. Clean all of the parts with a water dampened cloth.
   7.3. Inspect all of the parts for wear and damage.
   7.4. Use a straight edge to inspect the contact surfaces for scoring and flatness.
   7.5. Inspect the friction pads for scoring, gouges, and loose rivets.
   7.6. Inspect the friction pads for oil. Replace the clutch driven plate if the friction pads are soaked with oil.
   7.7. Inspect all of the splines for nicks, burrs, and a smooth sliding fit.
   7.8. Inspect all of the springs for bending and breakage.



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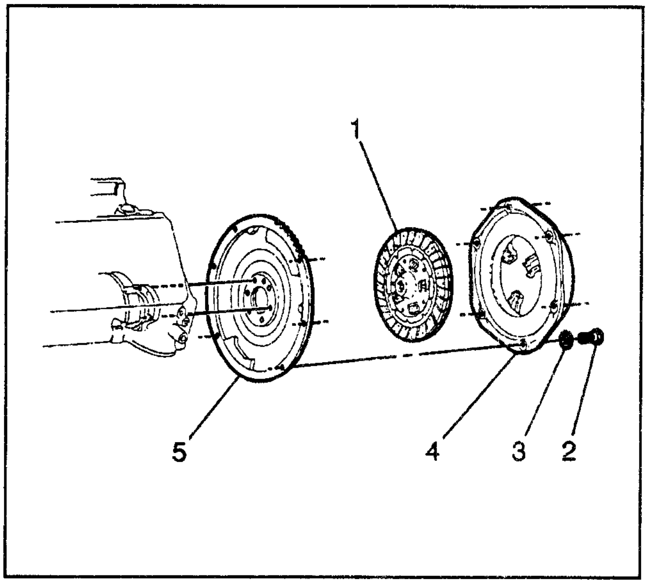

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Installation Procedure

Tools Required

J 36221 Clutch Alignment Tool

1. Install the bolts (2) and the washers (3) securing the clutch pressure plate (4) and the clutch driven plate (1) to the flywheel (5).
2. Install the *J 36221* to support the clutch.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Align the marks made during removal or, if new align the lightest part of the clutch pressure plate, identified by a yellow dot, to the heaviest part of the flywheel, identified by an "X".

   Tighten

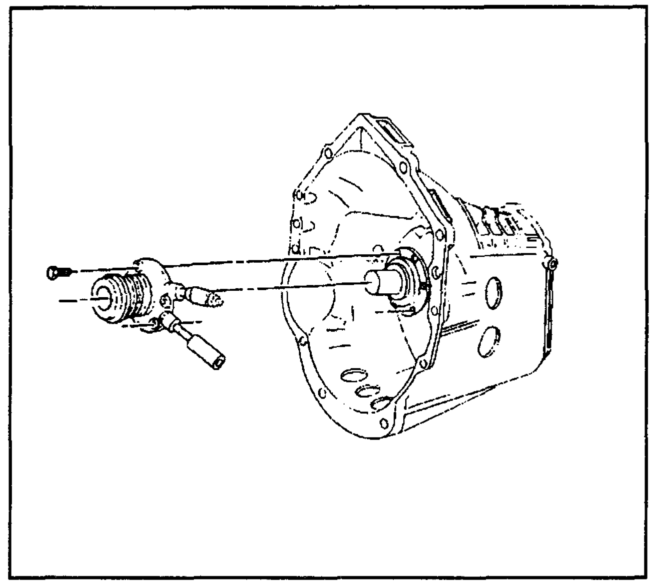
   Tighten the clutch pressure plate to the flywheel bolts to 41 N·m (30 lb ft).

   Remove the *J 36221*.
4. Install the clutch housing cover. Refer to *Clutch Housing Replacement.*
5. Install the transmission. Refer to *Transmission Replacement* in Manual Transmission.
6. Install the hydraulic line fitting to the concentric slave cylinder. Refer to *Clutch Master Cylinder Replacement.*
7. Lower the vehicle.

Concentric Slave Cylinder

Removal Procedure

1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the quick disconnect from the concentric slave cylinder. Refer to *Clutch Master Cylinder Replacement.*
3. Remove the transmission.
4. Remove the bolts which are securing the concentric slave cylinder to the clutch housing shaft.
5. Remove the slave cylinder from the transmission input shaft.
6. Remove the bearing from the slave cylinder.



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Installation Procedure

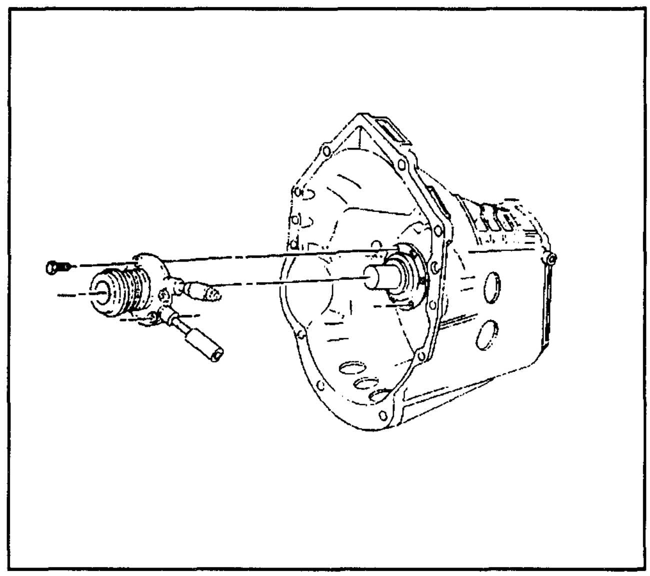
1. Install the bearing to the slave cylinder.
2. Install the slave cylinder to the transmission input shaft ensuring that the bleed screw and coupling are positioned through the transmission opening.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Install the two bolts which are securing the concentric slave cylinder to the clutch housing shaft.

   Tighten

   Tighten the concentric slave cylinder bolts to 8 N·m (71 lb in).
4. Install the transmission.
5. Install the quick disconnect to the concentric slave cylinder. Refer to *Clutch Master Cylinder Replacement.*
6. Lower the vehicle.



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Description and Operation

Clutch Driving Members

The driving members consist of the following two flat surfaces:

- The rear face of the engine flywheel.
- The front face of the clutch cover assembly.

Clutch Driven Members

The driven member is the clutch disc with a splined hub. The splined hub is free to slide lengthwise along the splines of the input shaft. The splined hub drives the input shaft through the splines of the input shaft. The driving and driven members are held in contact by the spring pressure. A diaphragm in the clutch cover assembly exerts the spring pressure.

Clutch Operating Members

Hydraulic Clutch Fluid

Notice: Do not use mineral or paraffin-base oil in the clutch hydraulic system. These fluids may damage the rubber parts in the cylinders.

When adding fluid to or refilling the system after service operations use DOT 3 brake fluid P/N 1052535 or the equivalent.

Hydraulic Clutch

The clutch release system consists of the following components:

- A combined clutch master cylinder.
- A reservoir.
- A switch.
- An actuator cylinder which is connected to the hydraulic tubing.

With the depression of the clutch pedal, the clutch master cylinder becomes pressurized from the force of the push rod into the master cylinder. This forces the hydraulic fluid into the tubing from the master cylinder to the concentric slave cylinder. The slave cylinder then engages by pushing the release bearing into the diaphragm spring and releasing the clutch.

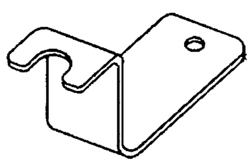
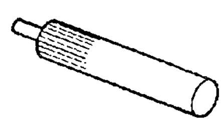
The clutch master cylinder is positioned through the cowl panel. the hydraulic tubing is routed from the clutch master cylinder to the concentric slave cylinder via a quick connect coupling. The concentric slave cylinder is located inside the transmission input bearing retainer.

For easier replacement of the hydraulic control system, remove the hydraulic tubing connecting the slave cylinder to the master cylinder from the internalized slave cylinder by engaging the quick connect coupling mounted through the transmission housing. This procedure allows the replacement of the hydraulic control system without having to gain access to the clutch system internal components.

The hydraulic clutch system provides automatic clutch adjustments, therefore an adjustment of the clutch linkage or the pedal position is not required. As the clutch disc wears, the fluid level in the master cylinder reservoir will rise to accommodate for the extra fluid which is not required in the hydraulic system. A new system will have a completely filled reservoir, with the hydraulic fluid level at the top of the reservoir.

An electrical switch with two functions is located on the pushrod. The electrical switch serves as a clutch interlock to ensure that the engine does not start unless the clutch pedal is engaged (positioned on the floor). The second function of the electrical switch is to cut off the cruise control system (if the vehicle is so equipped) when the clutch pedal is engaged.

Special Tools and Equipment

Illustration	Tool Number/ Description
 400483	J 42371 Clutch Line to Concentric Slave Cylinder Removal Tool
 586	J 5824-01 Clutch Alignment Tool

Section 7

Transmission/Transaxle

Notice: Do not remove or attempt to repair the Allison LCT1000 automatic transmission without calling Workhorse Technical Assistance.

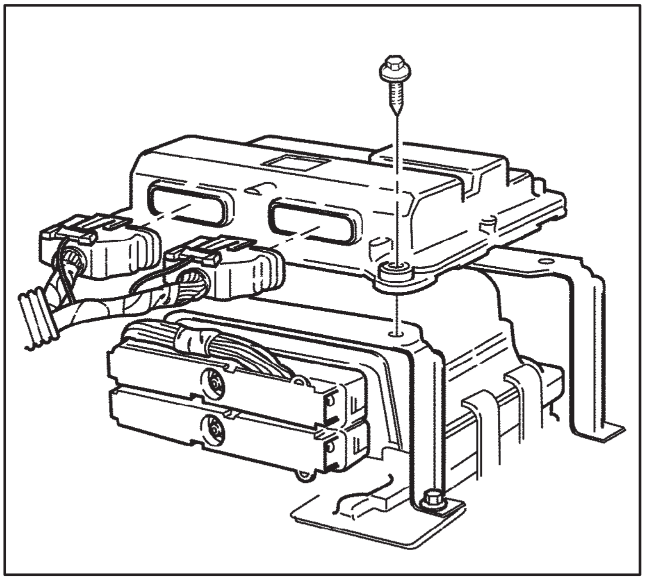
BLANK

Automatic Transmission – Allison

Specifications

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Oil Cooler Line Bracket to Frame Bolt	30 N·m	22 lb ft
Oil Cooler Line Bracket to Transmission Bolt	65 N·m	48 lb ft
PNP Switch to Main Housing Bolt	27 N·m	20 lb ft
Shift Cable Retainer to Frame Bolt	27 N·m	20 lb ft
Shift Lever to Shift Selector Shaft Nut	24 N·m	18 lb ft
Transmission Control Module to Bracket Bolt	6 N·m	53 lb in
Transmission Oil Cooler to Bracket Screw	13 N·m	115 lb in



WRK71007

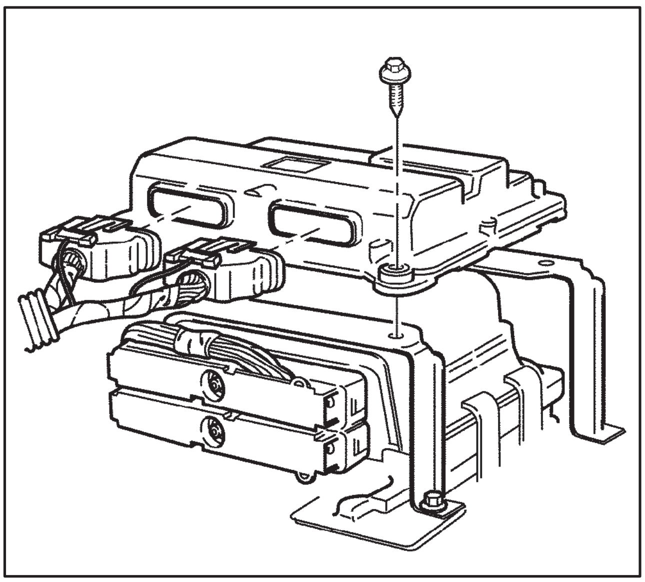
Repair Instructions

Transmission Control Module Replacement

Removal Procedure

Caution: Refer to Battery Disconnect Caution in Cautions and Notices in the WCC Service Manual.

1. Disconnect the negative battery cable.
2. Disconnect the electrical connectors from the transmission control module (TCM).
3. Remove the bolts from the TCM.
4. Remove the TCM from the TCM/PCM bracket.



WRK71007

Installation Procedure

1. Install the TCM to the TCM/PCM bracket.

Notice: Refer to *Fastener Notice* in Cautions and Notices in the WCC Service Manual.

2. Install the bolts to the TCM.

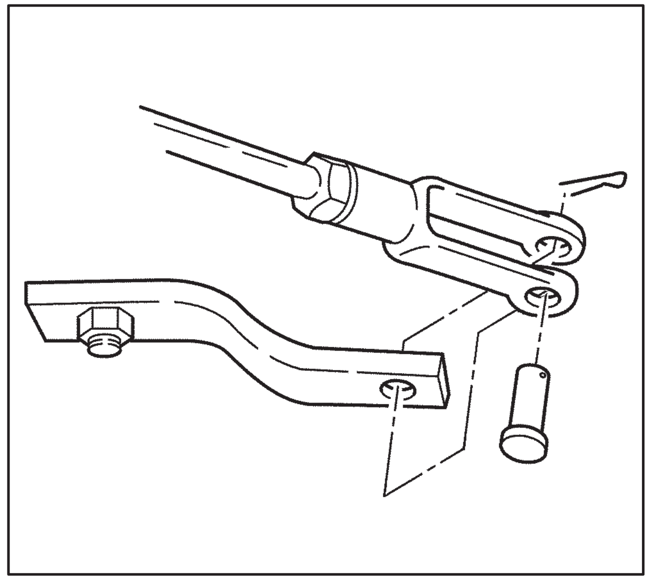
   Tighten

   Tighten the bolts to 6 N·m (53 lb in).

3. Connect the electrical connectors to the TCM.
4. Connect the negative battery cable. Refer to *Battery Cable Replacement* in the WCC Service Manual.
5. Reprogram the TCM.

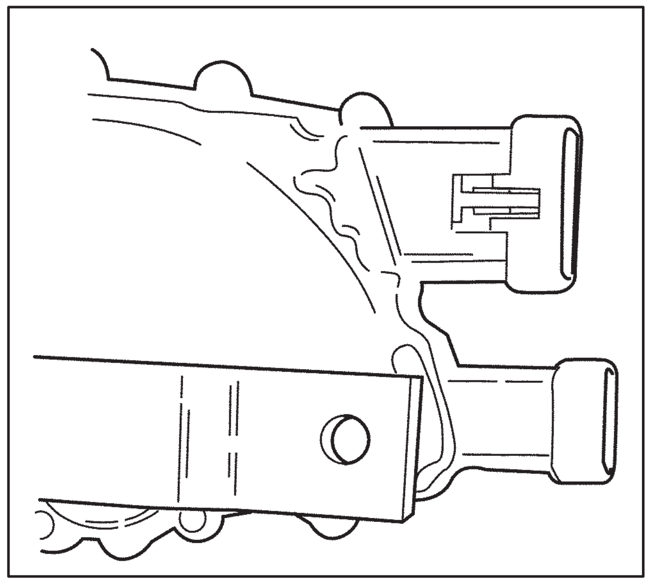
Shift Cable Adjustment

1. Ensure that the parking brake is set, and the wheels are blocked.
2. Place the steering column shift lever to the P (Park) position.
3. Remove the cotter pin from the shift cable clevis pin, and remove the clevis pin, if necessary.



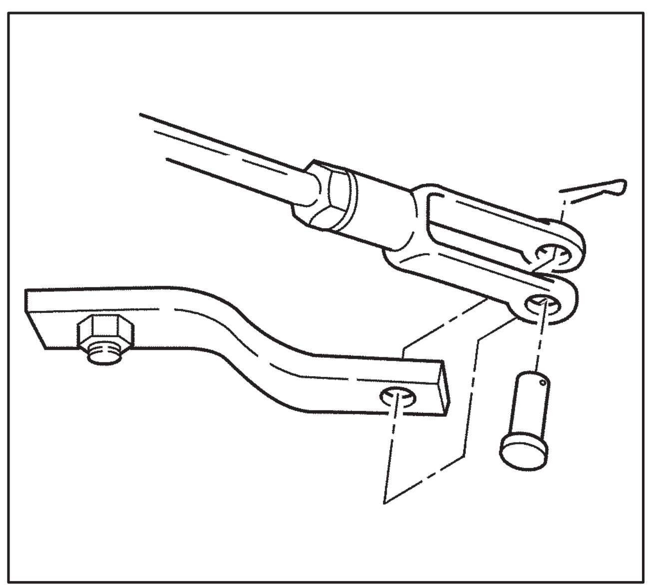
WRK71016

4. Place the transmission shift lever to the park position (top of lever pointing toward rear of vehicle).



WRK71018

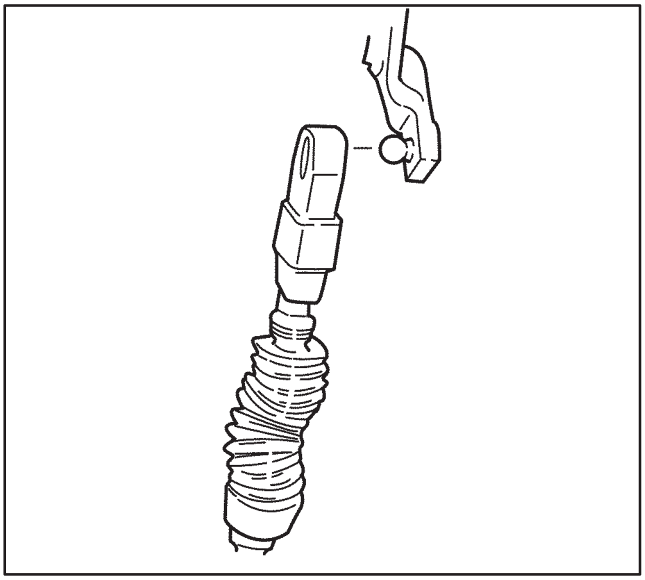
5. Loosen the nut on the back of the clevis, and tighten or loosen the clevis until the holes on the clevis and the transmission shift lever line up.
6. Install the clevis pin to the clevis and the transmission shift lever.
7. Install the cotter pin to the clevis pin.
8. Tighten the nut on the back of the clevis.
9. Move the steering column shift lever to ensure proper operation.
10. Remove the blocks from the wheels.



WRK71016

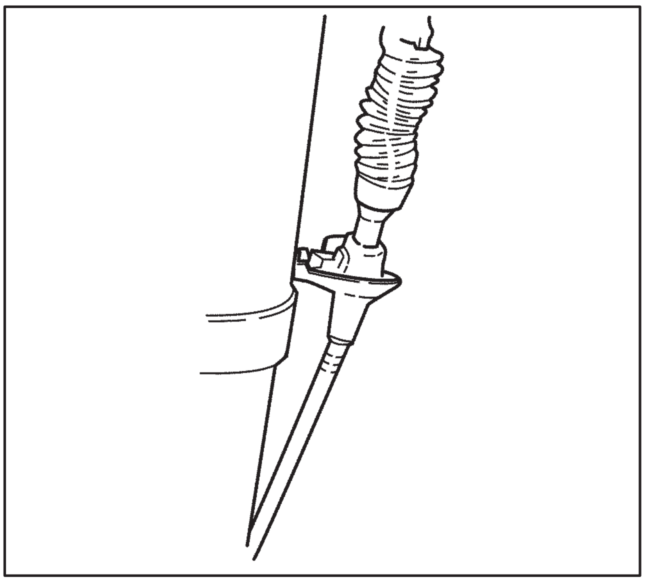
Shift Cable Replacement

Removal Procedure



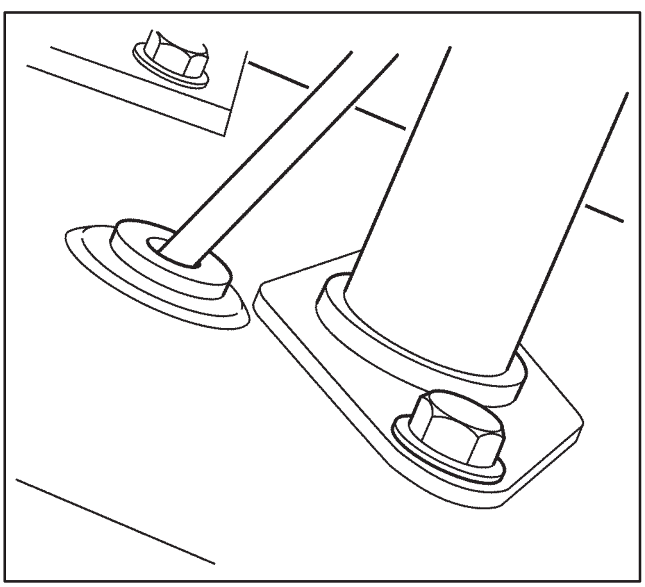
WRK71013

1. Position the steering column shift lever to the P (Park) position.
2. Ensure the transmission manual shaft is positioned to mechanical park.
3. Remove the shift cable from the ball stud on steering column with a flat-bladed tool.



WRK71014

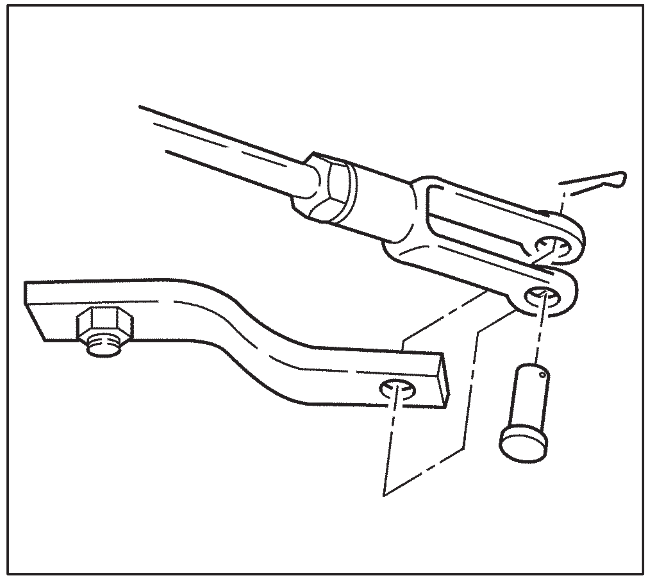
4. Compress the tabs on the shift cable and remove the shift cable from the bracket on the steering column.



WRK71015

5. Gently remove the shift cable rubber grommet from the floorboard using a flat-bladed tool.

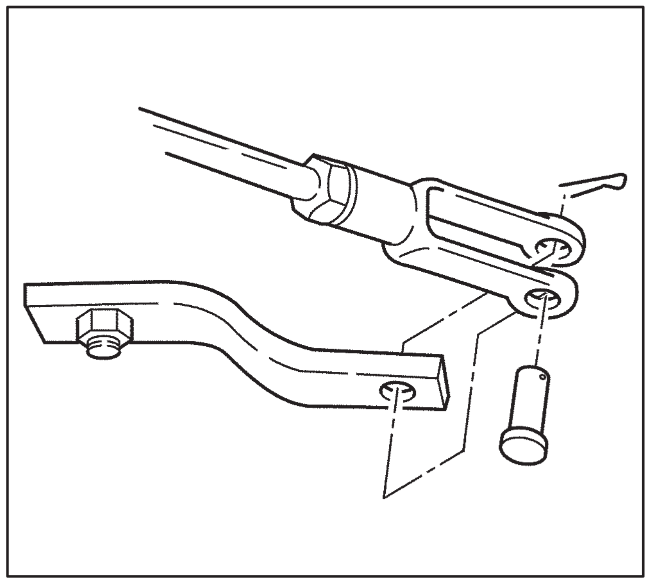
6. Remove the cotter pin from the shift cable clevis pin at the transmission shift lever.
7. Remove the shift cable clevis pin from the shift cable clevis and the transmission shift lever.
8. Compress the tabs on the shift cable and remove the shift cable from the bracket on the transmission.
9. Remove the bolts from the shift cable retaining brackets on the frame.
10. Carefully remove the shift cable from the hole in the floorboard.
11. Remove the shift cable from the vehicle.



WRK71016

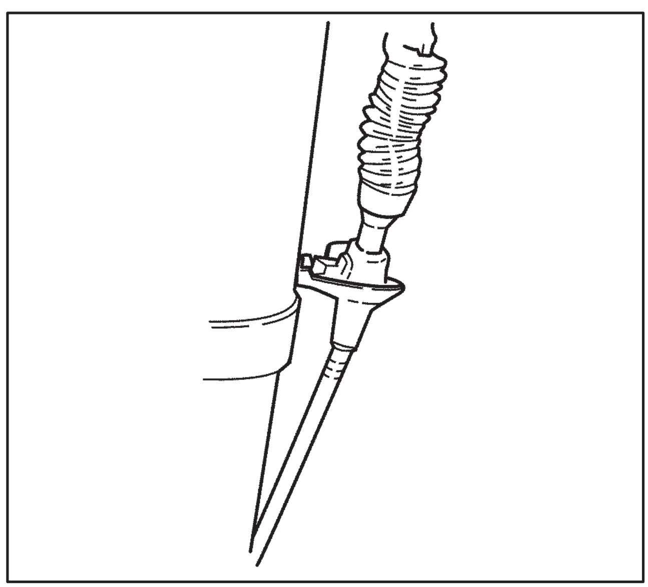
Installation Procedure

1. Install the shift cable to the vehicle.
2. Carefully insert the shift cable through the hole in the floorboard.
3. Install the shift cable to the bracket on the transmission.
4. Align the shift cable clevis to the transmission shift lever and install the clevis pin to the clevis and the transmission shift lever.
5. Install a new cotter pin to the shift cable clevis pin.

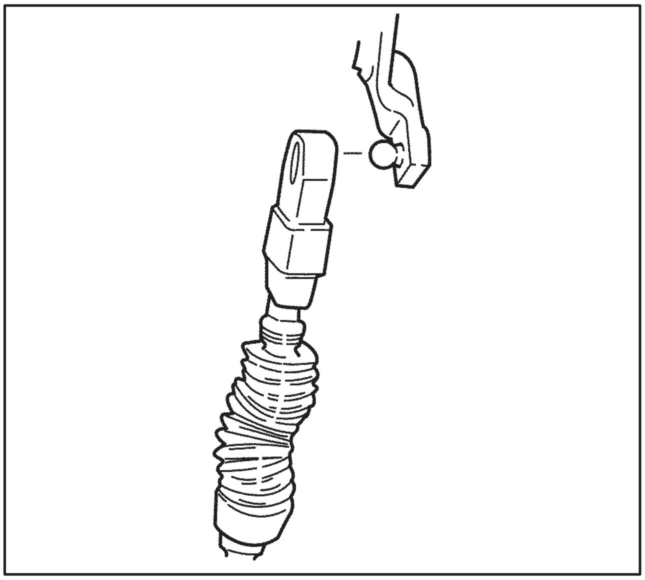


WRK71016

6. Install the shift cable to the bracket on the steering column.

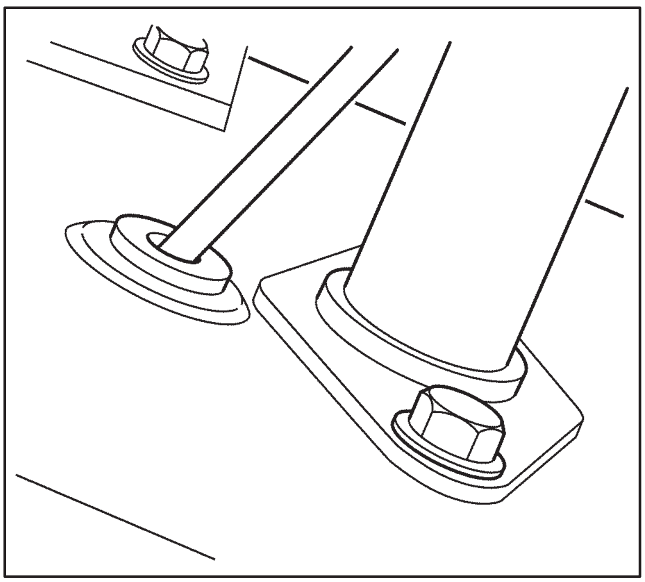


WRK71014



WRK71013

7. Press the shift cable connector on to the ball stud on the steering column.



WRK71015

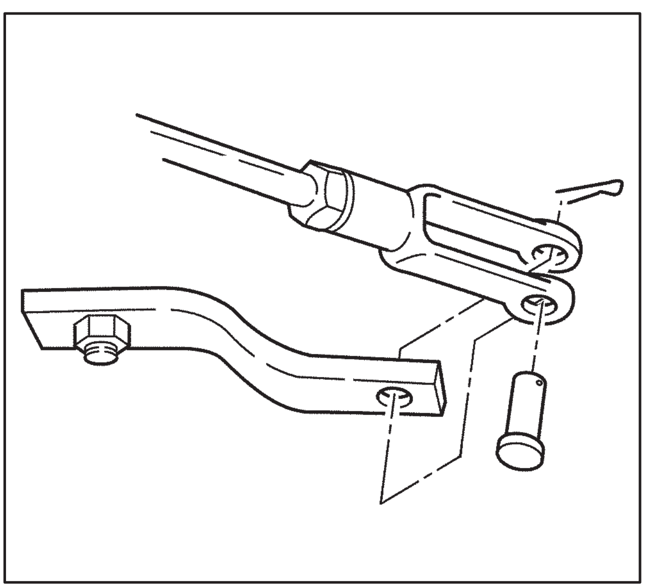
8. Install the shift cable rubber grommet to the floorboard using a flat-bladed tool.

Notice: Refer to *Fastener Notice* in Cautions and Notices in the WCC Service Manual.

9. Install the shift cable retainers and bolts to the frame.

   Tighten

   Tighten the bolts to 27 N·m (20 lb ft).
10. Perform the shift control cable adjustment procedure. Refer to *Shift Cable Adjustment* in this supplement.



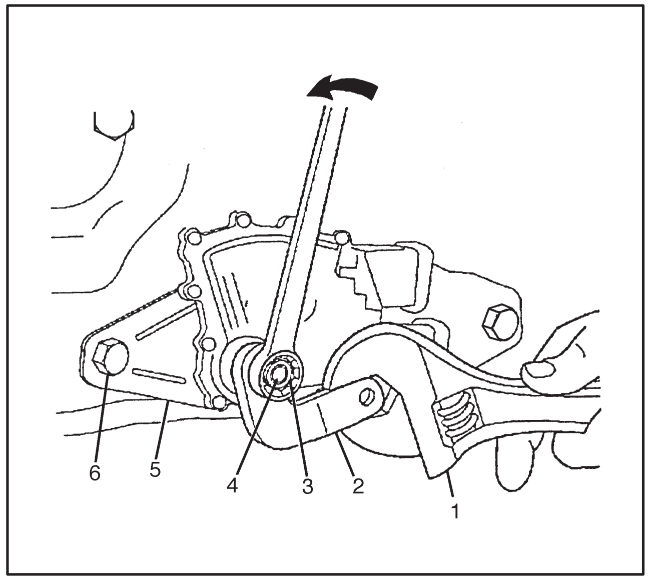
WRK71016

Transmission Shift Lever Replacement

Removal Procedure

1. Remove the cotter pin from the shift cable clevis pin at the transmission shift lever.
2. Remove the shift cable clevis pin and disconnect the shift cable from the shift lever on the selector shaft .

3. Use a wrench (1) to prevent the shift lever (2) from rotating. Remove the nut (3) from the end of the selector shaft (4). Carefully remove the shift lever (2) from the selector shaft (4).



WRK71068

Installation Procedure

Notice: Refer to *Fastener Notice* in Cautions and Notices in the WCC Service Manual.

Notice:

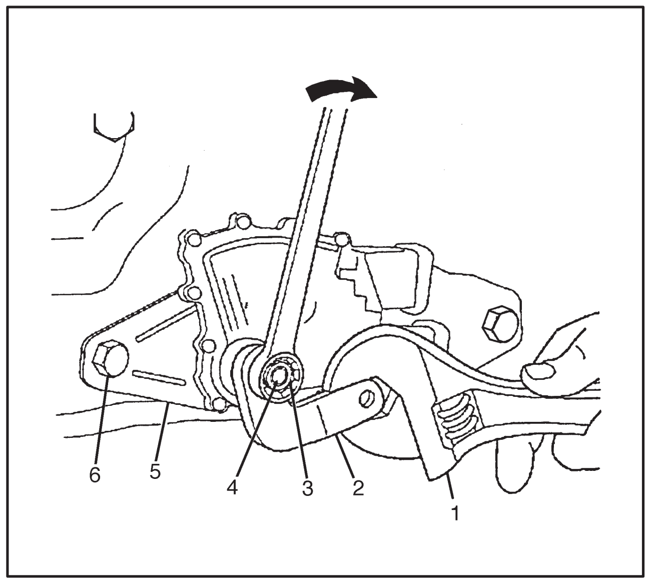
- DO NOT drive the selector lever onto the selector shaft.
- DO NOT use an impact wrench in order to tighten the selector lever nut. Hold the lever with a wrench while tightening the nut.

Failure to follow these instructions may result in transmission damage.

1. Install shift lever (2). Install nut (3), by hand, on the end of selector shaft (4). Use a wrench (1) to keep the shift lever from rotating.

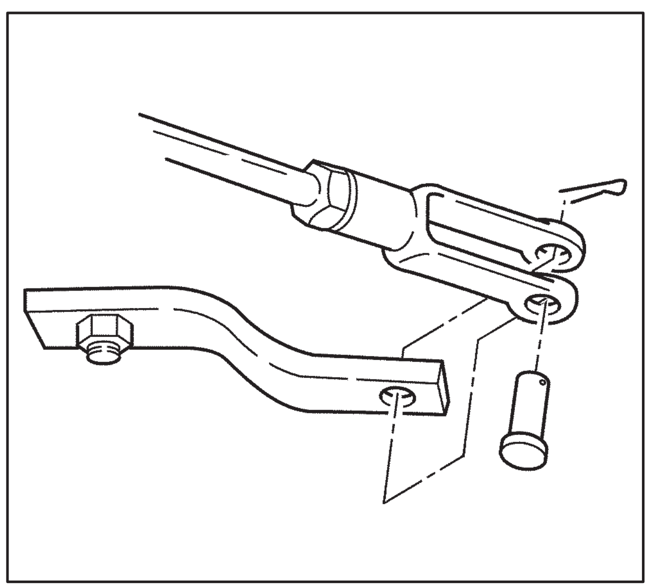
   Tighten

   Tighten nut (3) to 24 N·m (18 lb ft).



WRK71070

2. Connect the shift cable to the shift lever and install the clevis pin.
3. Install a new cotter pin to the shift cable clevis pin.

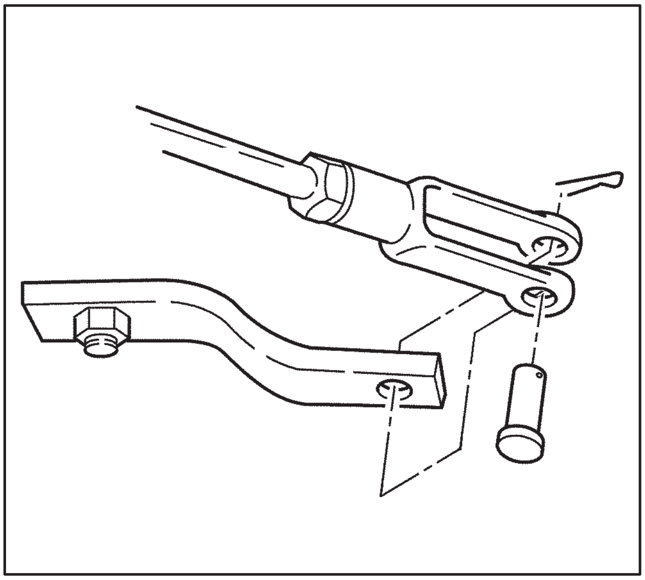


WRK71016

Park/Neutral Position Switch Replacement

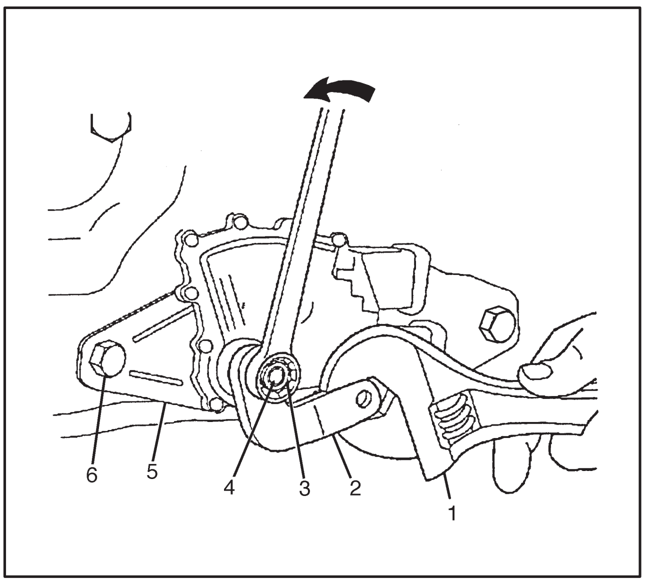
Removal Procedure

Caution: Refer to Battery Disconnect Caution in Cautions and Notices in the WCC Service Manual.



WRK71016

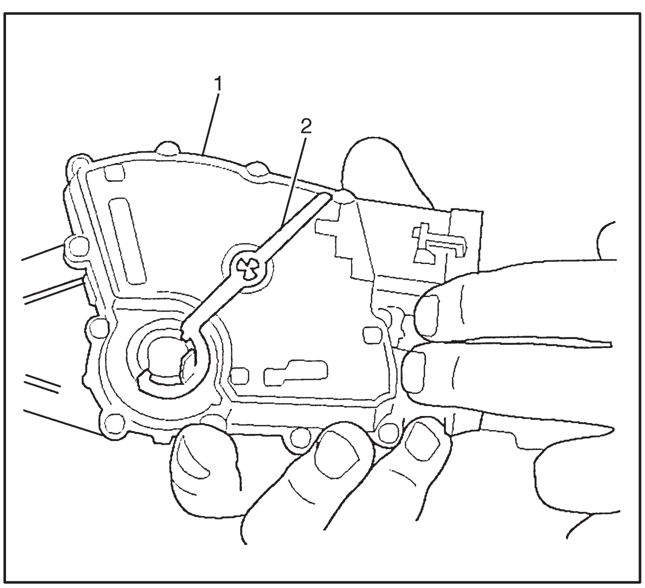
1. Disconnect the external wiring harness from the PNP switch.
2. Remove the cotter pin from the shift cable clevis pin at the transmission shift lever.
3. Remove the shift cable clevis pin and disconnect the shift cable from the shift lever on the selector shaft .



WRK71068

4. Use wrench (1) to prevent the shift lever (2) from rotating. Remove nut (3) from the end of the selector shaft (4). Carefully remove the shift lever (2) from selector shaft (4).
5. Remove the two bolts (6). Remove the PNP switch (5) by sliding it outward over the selector shaft (4).

Installation Procedure



WRK71069

1. Be sure that the neutral assurance bracket (2) is in the proper position on PNP switch (1).
2. Make sure the selector shaft is in the N (Neutral) position as follows:
   - 2.1 Place a wrench on the selector shaft flats and rotate the shaft to its furthest clockwise position.
   - 2.2 Rotate the selector shaft counter-clockwise two detents.

3. Align the PNP switch (5) with the main housing so that the neutral assurance bracket is facing outward.
4. While maintaining the correct PNP switch-to-selector-shaft alignment, slide the new PNP switch (5) over the selector shaft (4).

Notice: Refer to *Fastener Notice* in Cautions and Notices in the WCC Service Manual.

5. While holding the neutral assurance bracket in engagement with the PNP switch, install the two bolts (6) so that the PNP switch may be rotated with some effort.

   Tighten

   Tighten the two bolts (6) to 27 N·m (20 lb ft).
6. Remove and discard the neutral assurance bracket.

Notice:

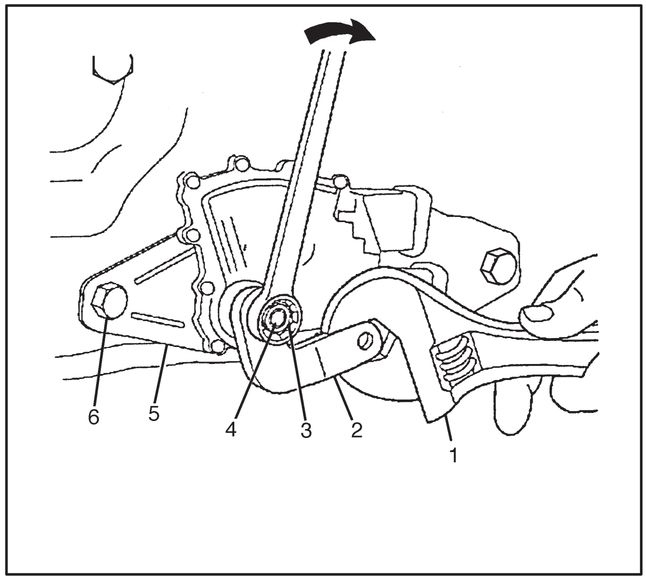
- DO NOT drive the selector lever on to the selector shaft.
- DO NOT use an impact wrench in order to tighten the selector lever nut. Hold the lever with a wrench while tightening the nut.

Failure to follow these instructions may result in transmission damage.

7. Install the shift lever (2). Install nut (3), by hand, on the end of selector shaft (4). Use a wrench (1) to keep the shift lever from rotating.

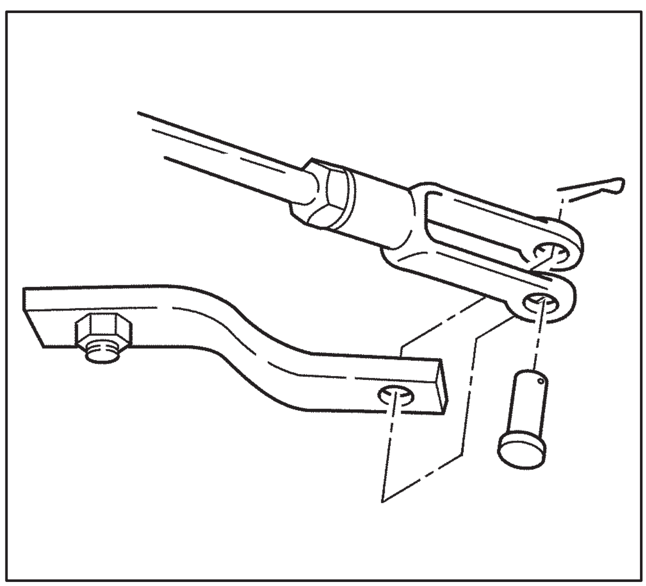
   Tighten

   Tighten the nut (3) to 24 N·m (18 lb ft).

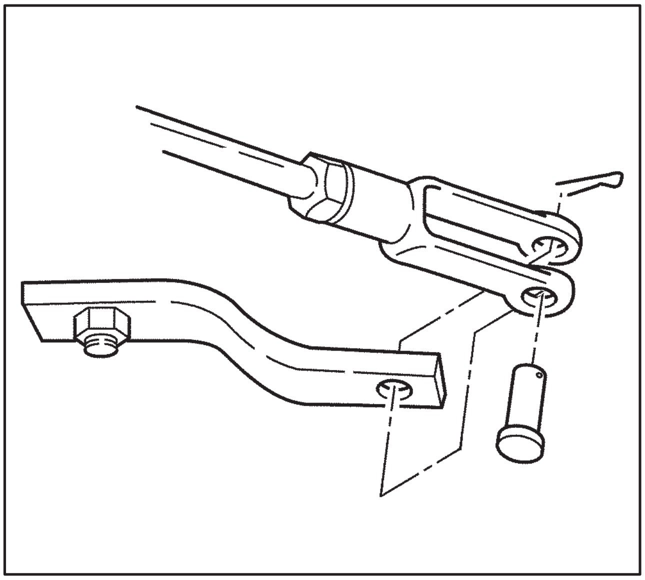


WRK71070

8. Connect the shift cable to the shift lever and install the clevis pin.
9. Install a new cotter pin to the shift cable clevis pin.
10. Connect the external wiring harness to the PNP switch.



WRK71016



WRK71016

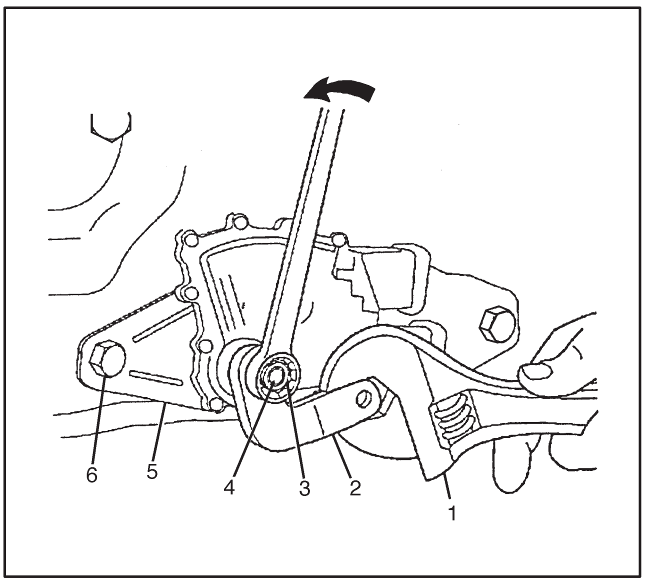
Park/Neutral Position Switch Adjustment

Tools Required

J 43164-A PNP Switch Adjusting Tool

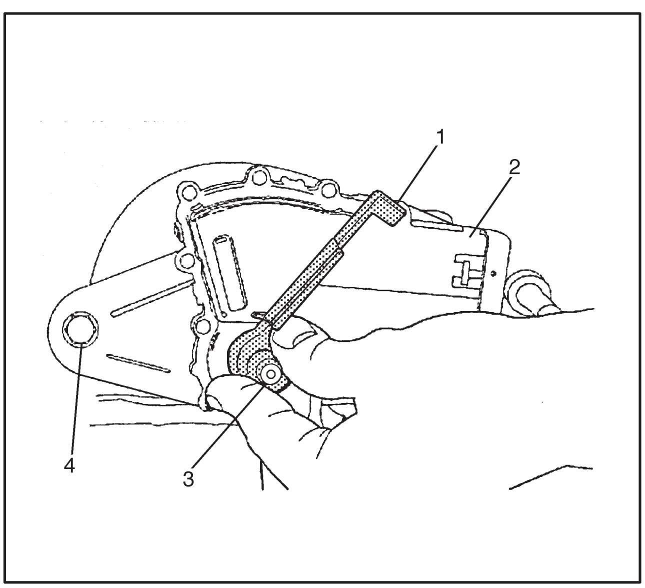
Caution: Refer to Battery Disconnect Caution in Cautions and Notices in the WCC Service Manual.

1. Disconnect the external wiring harness from the PNP switch.
2. Remove the cotter pin from the shift cable clevis pin at the transmission shift lever.
3. Remove the shift cable clevis pin and disconnect the shift cable from the shift lever at the transmission.



WRK71068

4. Use a wrench (1) to keep the shift lever (2) from rotating. Remove the nut (3) from the end of the selector shaft (4). Carefully remove the shift lever (2) from the selector shaft (4).
5. Loosen the two bolts (6) so that the PNP switch may be rotated with some effort.
6. Put the selector shaft in the N (Neutral) position as follows:
   6.1. Place a wrench on the selector shaft flats and rotate the shaft to its furthest clockwise position.
   6.2. Rotate the selector shaft counter-clockwise two detents.



WRK71071

7. Position *J 43164-A* over the selector shaft (3) so the two tabs on the tool engage the two slots in the PNP switch (2) just outside the selector shaft. Rotate the PNP switch (2) until the single tab (1) at the other end of the tool engages the single slot at the top of the PNP switch.

Notice: Refer to *Fastener Notice* in Cautions and Notices in the WCC Service Manual.

8. Hold the special tool in engagement with the PNP switch to maintain alignment of the PNP switch with the selector shaft.

   Tighten

   Tighten the two bolts (4) to 27 N·m (20 lb ft).

Notice:

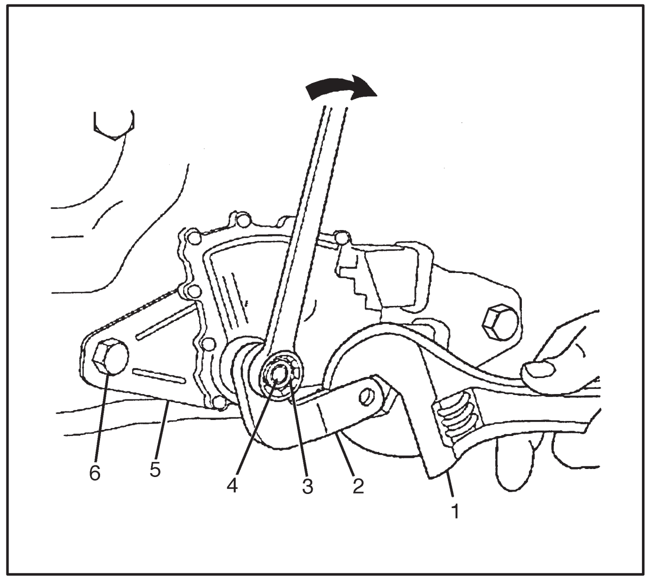
- DO NOT drive the selector lever on to the selector shaft.
- DO NOT use an impact wrench in order to tighten the selector lever nut. Hold the lever with a wrench while tightening the nut.

Failure to follow these instructions may result in transmission damage.

9. Install the shift lever (2). Install nut (3), by hand, on the end of selector shaft (4). Use a wrench (1) to keep the shift lever from rotating.

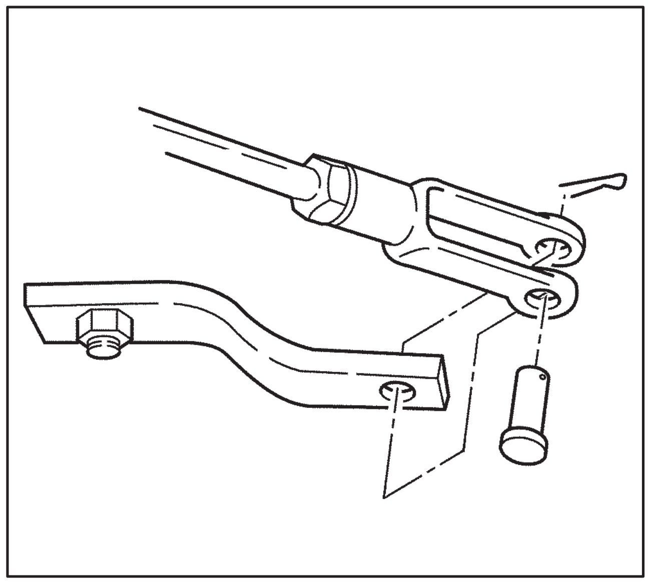
   Tighten

   Tighten the nut (3) to 24 N·m (18 lb ft).



WRK71070

10. Connect the shift cable to the shift lever and install the clevis pin.
11. Install a new cotter pin to the shift cable clevis pin.
12. Connect the external wiring harness connector to the PNP switch.



WRK71016

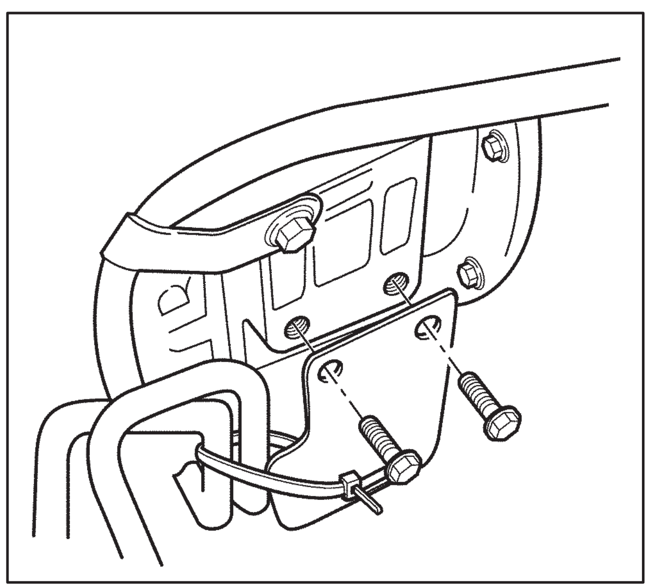
Oil Cooler Line Replacement

Removal Procedure

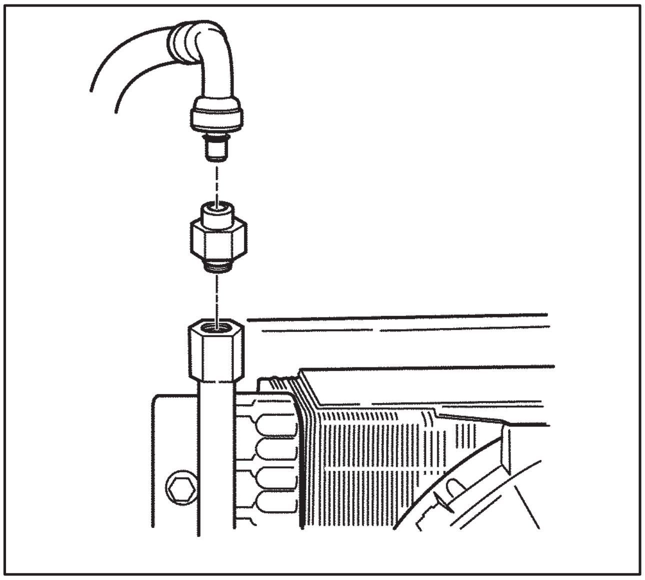
Tools Required

J 42971 Quick Disconnect Tool

1. Remove the bolts from the transmission oil cooler line bracket.
2. Remove the bolt from the oil cooler line bracket at the frame.

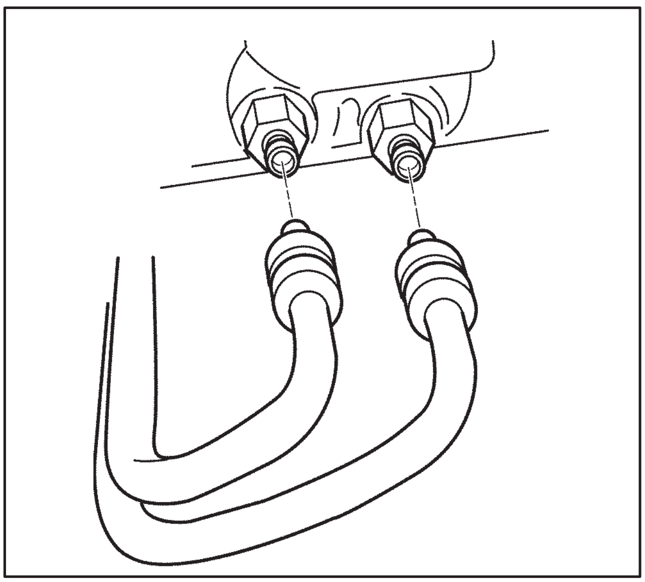


WRK71005



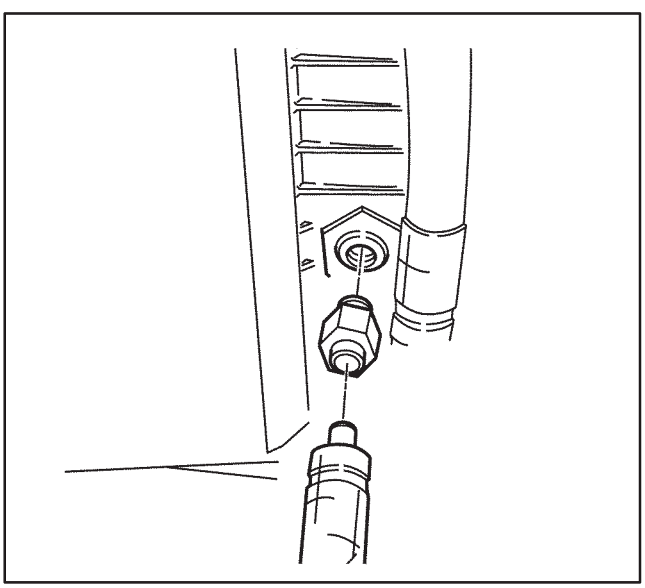
WRK71001

3. Disconnect the upper oil cooler line from the auxiliary oil cooler fitting using *J 42971*.



WRK71006

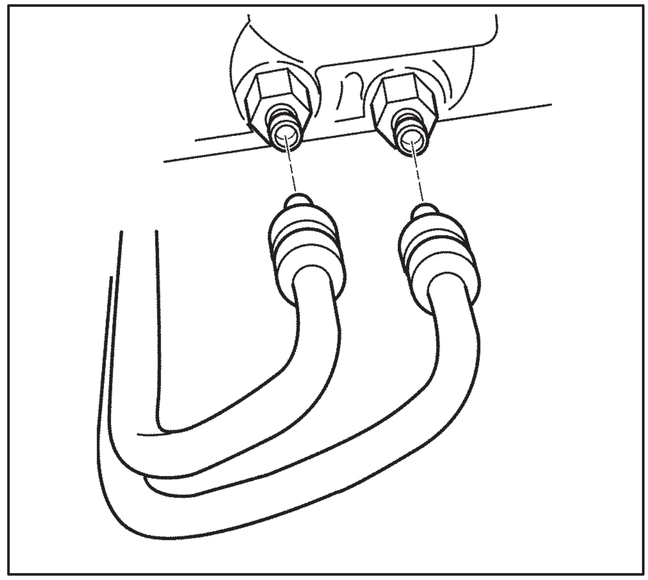
4. Disconnect the upper oil cooler line from the transmission fitting using *J 42971*.
5. Remove the upper oil cooler line from the vehicle.



WRK71002

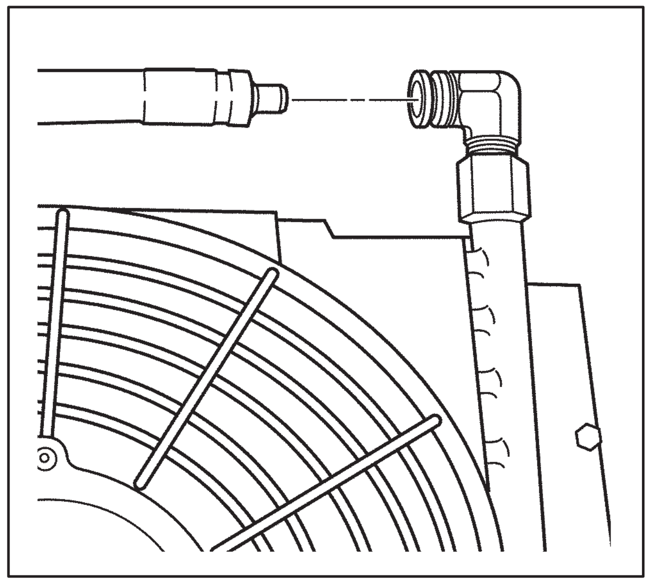
6. Disconnect the lower oil cooler line from the radiator fitting using *J 42971*.

7. Disconnect the lower oil cooler line from the transmission fitting using *J 42971*.
8. Remove the lower oil cooler line from the vehicle.



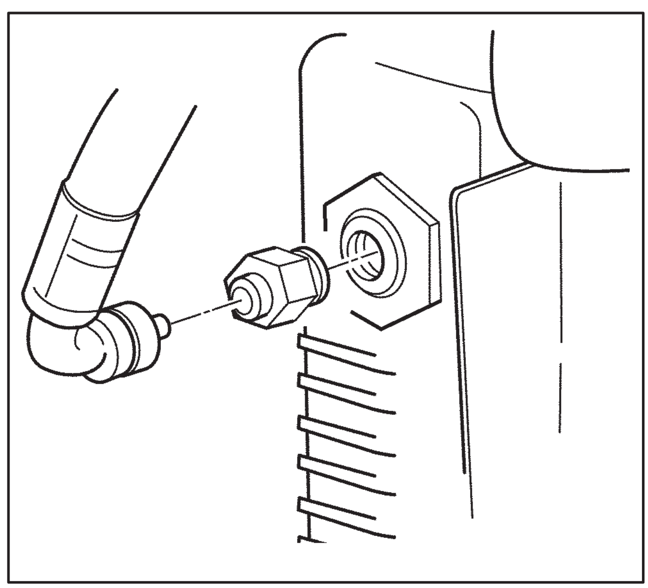
WRK71006

9. Disconnect the auxiliary oil cooler line from the auxiliary oil cooler fitting using *J 42971*.



WRK71004

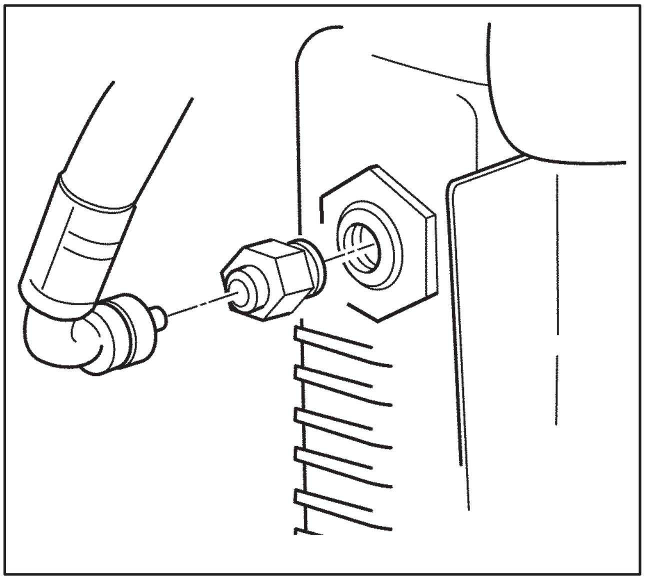
10. Disconnect the auxiliary oil cooler line from the radiator fitting using *J 42971*.
11. Remove the auxiliary oil cooler line from the vehicle.



WRK71003

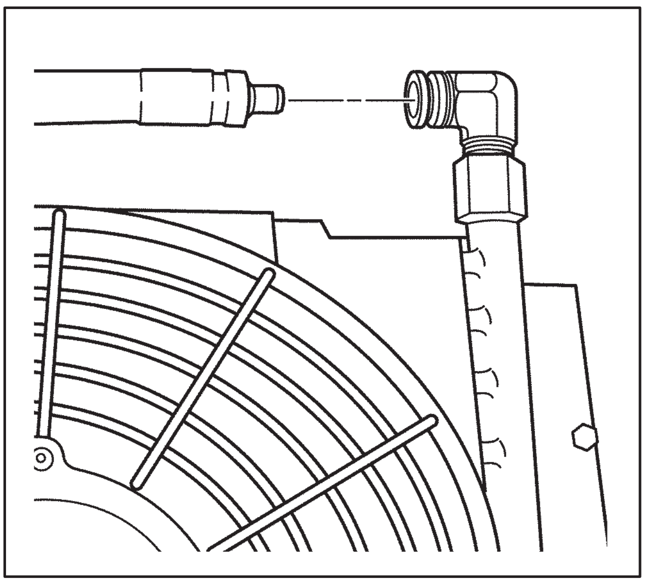
Installation Procedure

1. Install the auxiliary oil cooler line to the vehicle.
2. Connect the auxiliary oil cooler line to the radiator fitting.



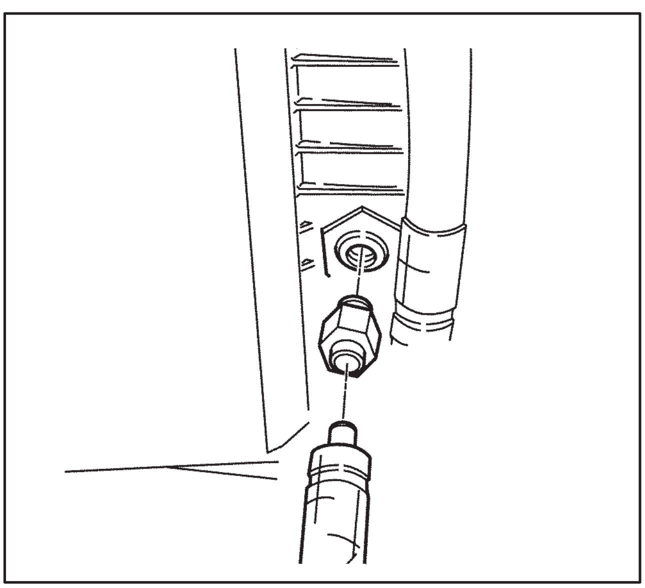
WRK71003

3. Connect the auxiliary oil cooler line to the auxiliary oil cooler fitting.
4. Install the lower oil cooler line to the vehicle.



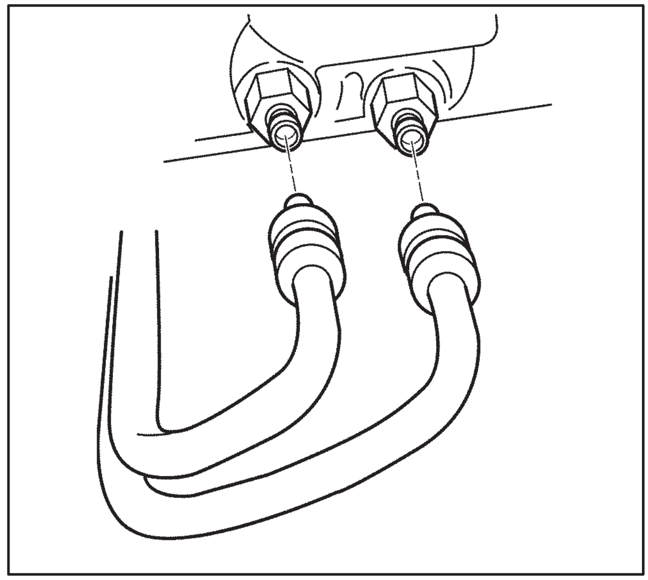
WRK71004

5. Connect the lower oil cooler line to the radiator fitting.

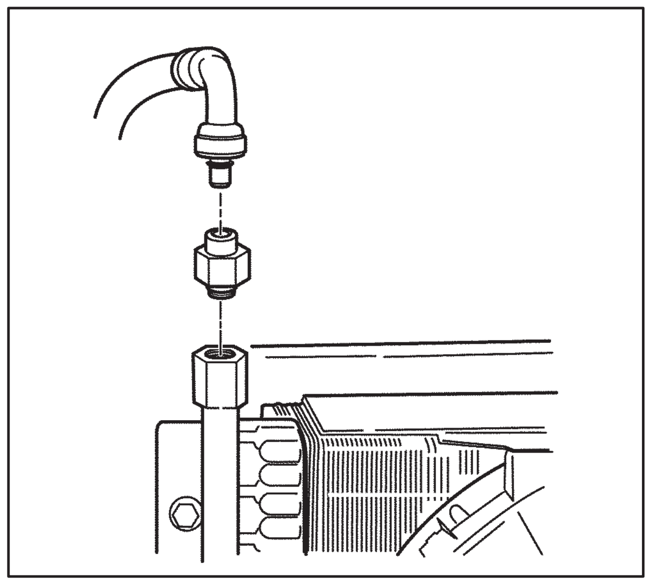


WRK71002

6. Connect the lower oil cooler line to the transmission fitting.
7. Install the upper oil cooler line to the vehicle.


WRK71006

8. Connect the upper oil cooler line to the auxiliary oil cooler fitting.


WRK71001

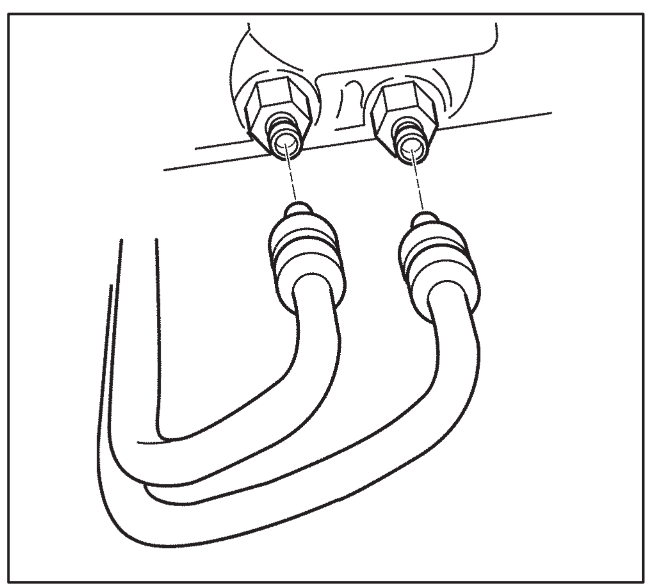
9. Connect the upper oil cooler line to the transmission fitting.

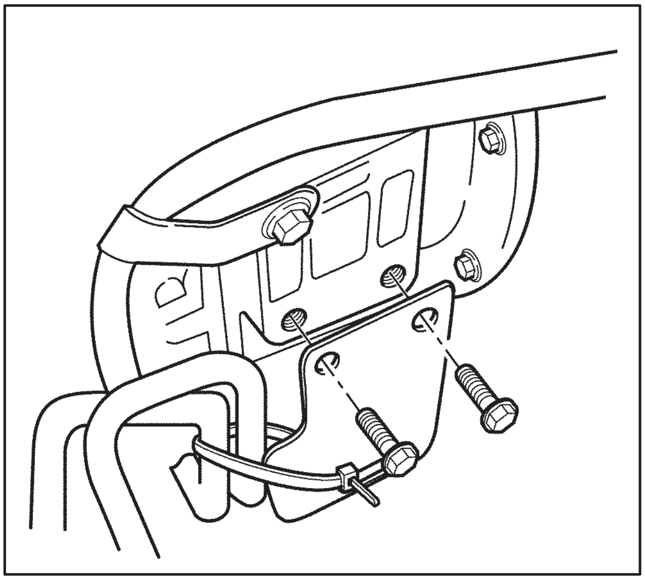
Notice: Refer to *Fastener Notice* in Cautions and Notices in the WCC Service Manual.

10. Install the oil cooler line bracket and bolt to the frame.

    Tighten

    Tighten the bracket bolt at the frame to 30 N·m (22 lb ft).


WRK71006



WRK71005

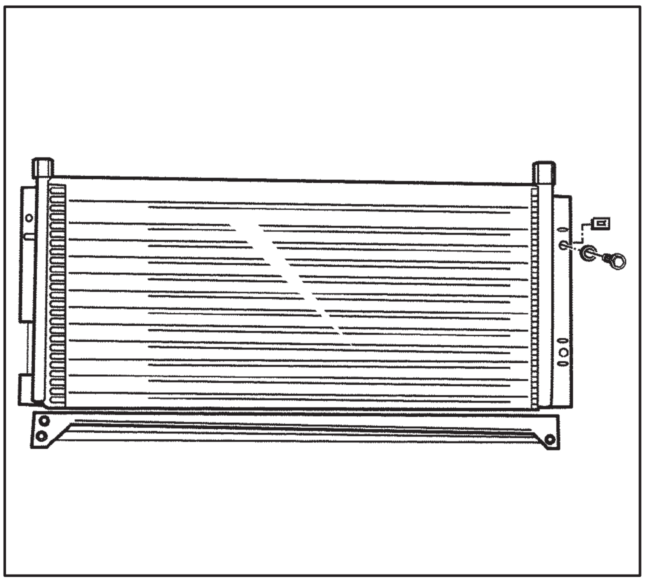
11. Install the transmission oil cooler line bracket and bolts to the transmission.

    Tighten

    Tighten the bracket bolt at the transmission to 65 N·m (48 lb ft).

Notice: Use only clean and approved transmission fluid.

12. Refill the transmission with DEXRON®III Automatic Transmission Fluid.
13. Check the transmission fluid level.



WRK71009

Transmission Oil Cooler Replacement.

Removal Procedure

1. Remove the air inlet duct from the air filter housing. Refer to *Outside Air Duct Replacement* in this supplement.
2. Remove the cooling fans from the auxiliary oil cooler. Refer to *Auxiliary Cooling Fan Replacement (8.1L)* in this supplement.
3. Remove the transmission oil cooler lines from the auxiliary oil cooler. Refer to *Oil Cooler Line Replacement* in this supplement.
4. Remove the screws and flatwashers from the auxiliary oil cooler.
5. Remove the auxiliary oil cooler from the vehicle.

Installation Procedure

1. Install the auxiliary oil cooler to the vehicle.

Notice: Refer to *Fastener Notice* in Cautions and Notices in the WCC Service Manual.

2. Install the flatwashers and screws to the auxiliary oil cooler.

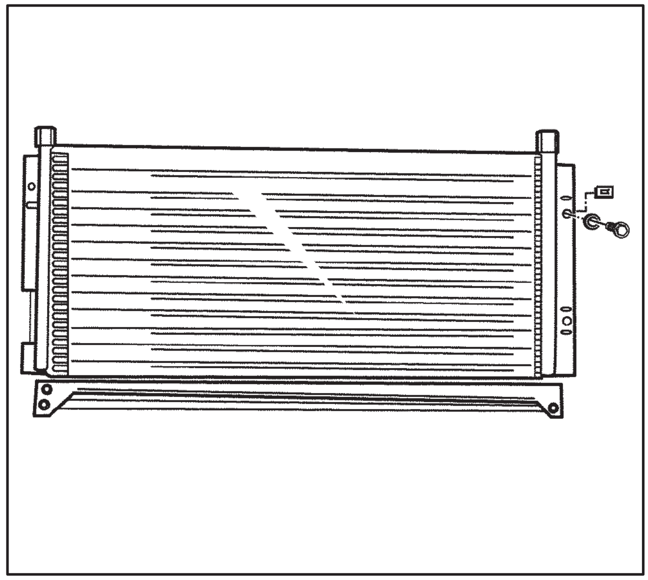
   Tighten

   Tighten screws to 13 N·m (115 lb in).

3. Install the transmission oil cooler lines to the auxiliary oil cooler. Refer to *Oil Cooler Line Replacement* in this supplement.
4. Install the cooling fans to the auxiliary oil cooler. Refer to *Auxiliary Cooling Fan Replacement (8.1L)* in this supplement.
5. Install the air inlet duct to the air filter housing. Refer to *Outside Air Duct Replacement* in this supplement.

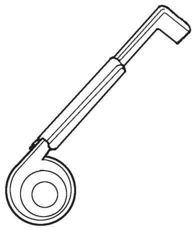
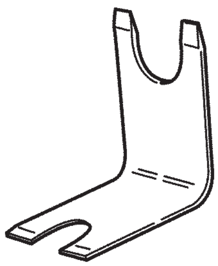
Notice: Use only clean and approved transmission fluid.

6. Refill the transmission with DEXRON®III Automatic Transmission Fluid.
7. Check the transmission fluid.



WRK71009

Special Tools and Equipment

Illustration	Tool Number/ Description
 WRK71114	J 43164-A PNP Switch Adjusting Tool
 WRK71130	J 42971 Quick Disconnect Tool

Section 7

Transmission

Sub-Section 7.2 – Automatic Transmission – 4L80-E

BLANK

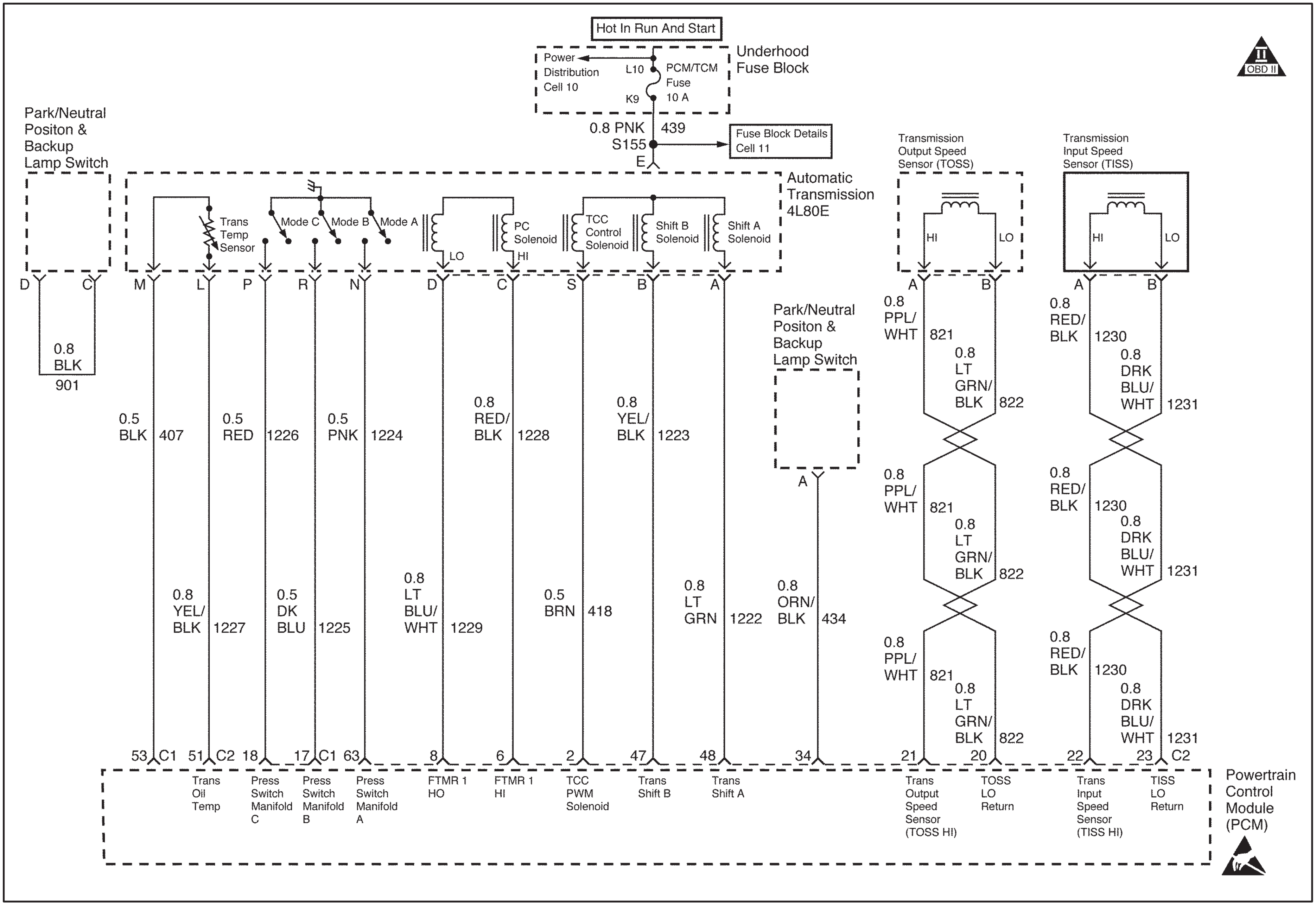
Automatic Transmission – 4L80E

Schematic and Routing Diagrams

Automatic Transmission Schematic Icons

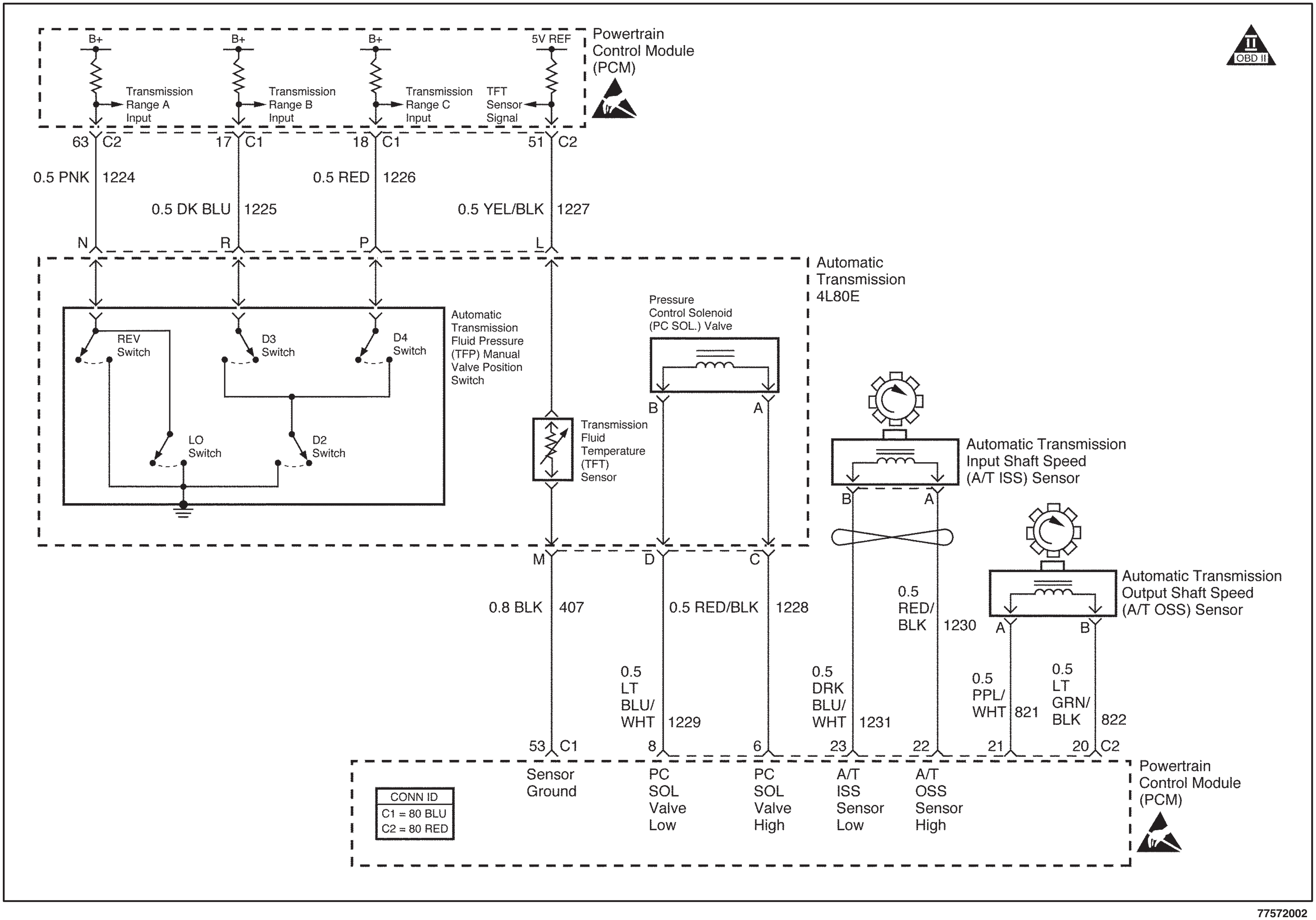
Icon	Icon Definition
 19384	Refer to *Handling ESD Sensitive Parts Notice* in Cautions and Notices in the WCC Service Manual.
 19385	Refer to *OBD II Symbol Description Notice* in Cautions and Notices in the WCC Service Manual.

Automatic Transmission Controls Schematics (PCM Control) (P32 Motorhome) (Cell 39) (L18)

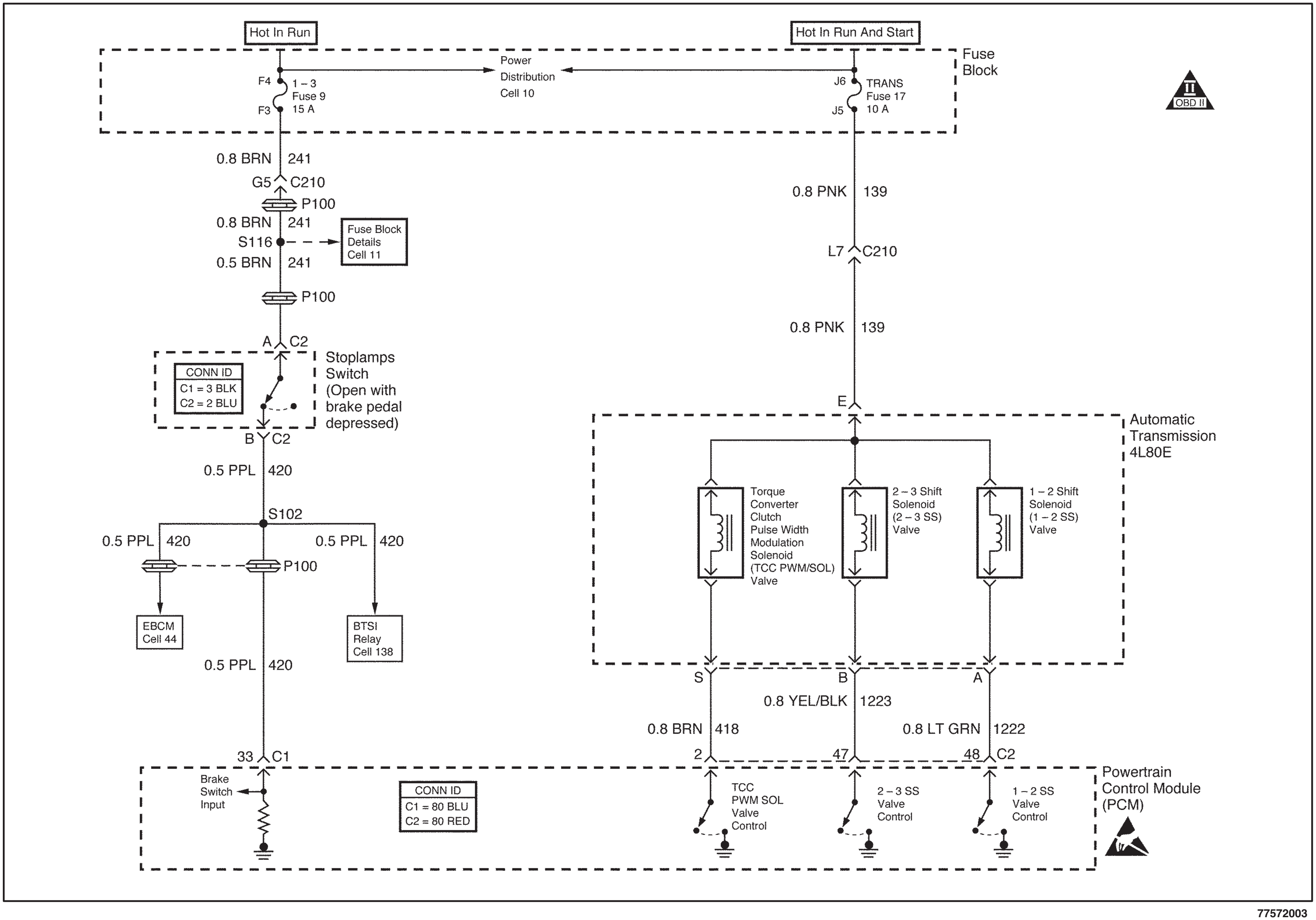


77572001

Automatic Transmission Controls Schematics (PCM Control) (P32 Motorhome) (Cell 39: TFP, TFT, ISS, OSS, PC SOL) (L31)



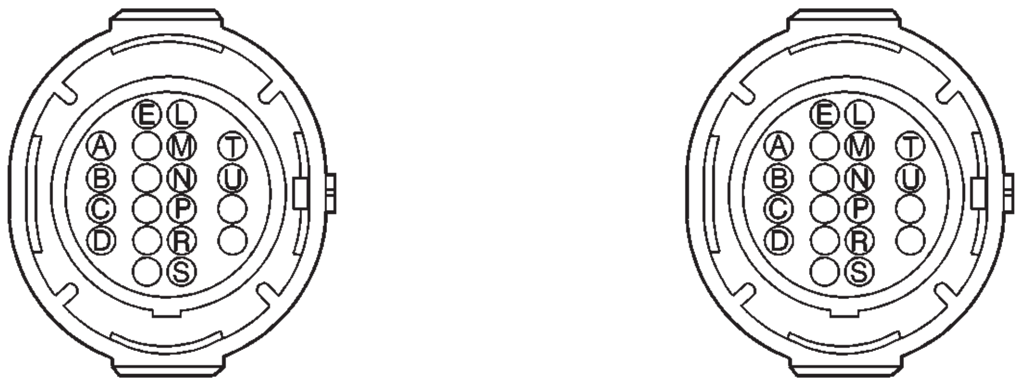
Automatic Transmission Controls Schematics (PCM Control) (P32 Motorhome) (Cell 39: Internal Solenoids, Stoplamps Switch) (L31)



Visual Identification

AT Inline Harness Connector End View

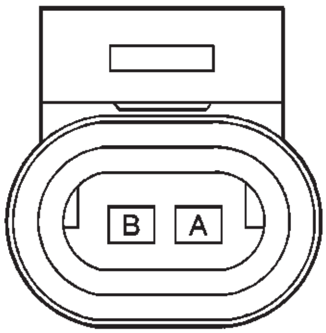
Engine Harness to Transmission

P32/L18				P32/L31			
							
Connector Part Information		• 12160490 • 20 Way F Micro-Pack 100 Series Sealed (GRY)		Connector Part Information		• 12160490 • 20 Way M Micro-Pack 100 Series Sealed (GRY)	
Pin	**Wire Color**	**Circuit No.**	**Function**	**Pin**	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN	1222	1–2 Shift Solenoid (1–2 SS) Valve Control	A	LT GRN	1222	1–2 Shift Solenoid (1–2 SS) Valve Control
B	YEL/BLK	1223	2–3 Shift Solenoid (2–3 SS) Valve Control	B	YEL/BLK	1223	2–3 Shift Solenoid (2–3 SS) Valve Control
C	RED/BLK	1228	Pressure Control Solenoid (PC Sol.) Valve HIGH	C	RED/BLK	1228	Pressure Control Solenoid (PC Sol.) Valve HIGH
D	LT BLU / WHT	1229	PC Sol. Valve LOW	D	LT BLU/ WHT	1229	PC Sol. Valve LOW
E	PNK	439	Fuse Output-Type III Fuse (Off, Run, Crank)	E	PINK	139	Fuse Output-Type III Fuse (Off, Run, Crank)
F-K	—	—	Not Used	F-K	—	—	Not Used
L	YEL/BLK	1227	Transmission Fluid Temperature (TFT) Sensor HIGH	L	YEL/BLK	1227	Transmission Fluid Temperature (TFT) Sensor HIGH
M (Gas)	BLK	407	TFT Sensor LOW	M (Gas)	BLK	407	TFT Sensor LOW
N	PNK	1224	Range Signal A	N	PNK	1224	Range Signal A
P	RED	1226	Range Signal C	P	RED	1226	Range Signal C
R	DK BLU	1225	Range Signal B	R	DK BLU	1225	Range Signal B
S	BRN	418	Torque Converter Clutch Solenoid (TCC Sol.) Valve Control	S	BRN	418	Torque Converter Clutch Solenoid (TCC Sol.) Valve Control
T-W	—	—	Not Used	T-W	—	—	Not Used

283826

AT Connector End Views

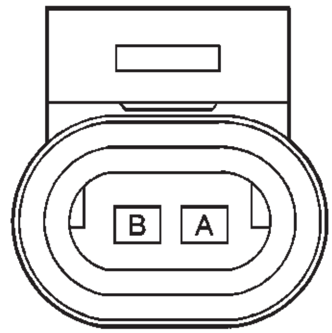
Transmission Input Speed Sensor (TISS)



232831

Connector Part Information	• 12162194 • 2-Way F Metri-Pack 150.2 Series P2S (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED/BLK	1230	Transmission Input Speed Sensor Return
B	DK BLU/ WHT	1231	Transmission Input Speed Sensor Signal

Transmission Output Speed Sensor (TOSS)



232831

Connector Part Information	• 12162194 • 2-Way F Metri-Pack 150.2 Series P2S (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PPL/WHT	821	Vehicle Speed Sensor Return
B	LT GRN/ BLK	822	Vehicle Speed Sensor Signal

Section 7

Transmission

Sub-Section 7.3 – Automatic Transmission – Allison LCT 1000

Notice: Do not remove or attempt to repair the Allison LCT 1000 automatic transmission without calling Workhorse Technical Assistance.

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Automatic Transmission – Allison LCT 1000

Specifications

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Oil Drain Plug	35 N·m	26 lb ft
Speed Sensor Mounting Bolt	12 N·m	108 lb in
Transmission to Transmission Mount Bolts	41 N·m	30 lb ft
Transmission to Transmission Mount Nuts	41 N·m	30 lb ft
Transmission Support to Transmission Mount Nuts	45 N·m	33 lb ft
Transmission Support to Frame Bolts and Nuts	110 N·m	81 lb ft
Torque Converter to Flywheel Bolts	60 N·m	44 lb ft
Transmission to Engine Mounting Bolts and Studs	50 N·m	37 lb ft
Park Brake Bracket to Case Bolt	34 N·m	25 lb ft
Shift Cable Bracket to Transmission Mounting Bolts	25 N·m	18 lb ft

Transmission General Specifications

Description	Specification
Name	**Allison LCT 1000**
RPO Code	M74
First Range Ratio	3.10:1
Second Range Ratio	1.81:1
Third Range Ratio	1.41:1
Fourth Range Ratio	1.00:1
Fifth Range Ratio	0.71:1
Reverse Range Ratio	– 4.49:1
Transmission Fluid Type	DEXRON®III
Maximum Engine Torque	520 lb ft
Maximum Gross Vehicle Weight (GVW)	19,850 lb (W19) 22,000 lb (W22)

Approximate Fluid Capacities

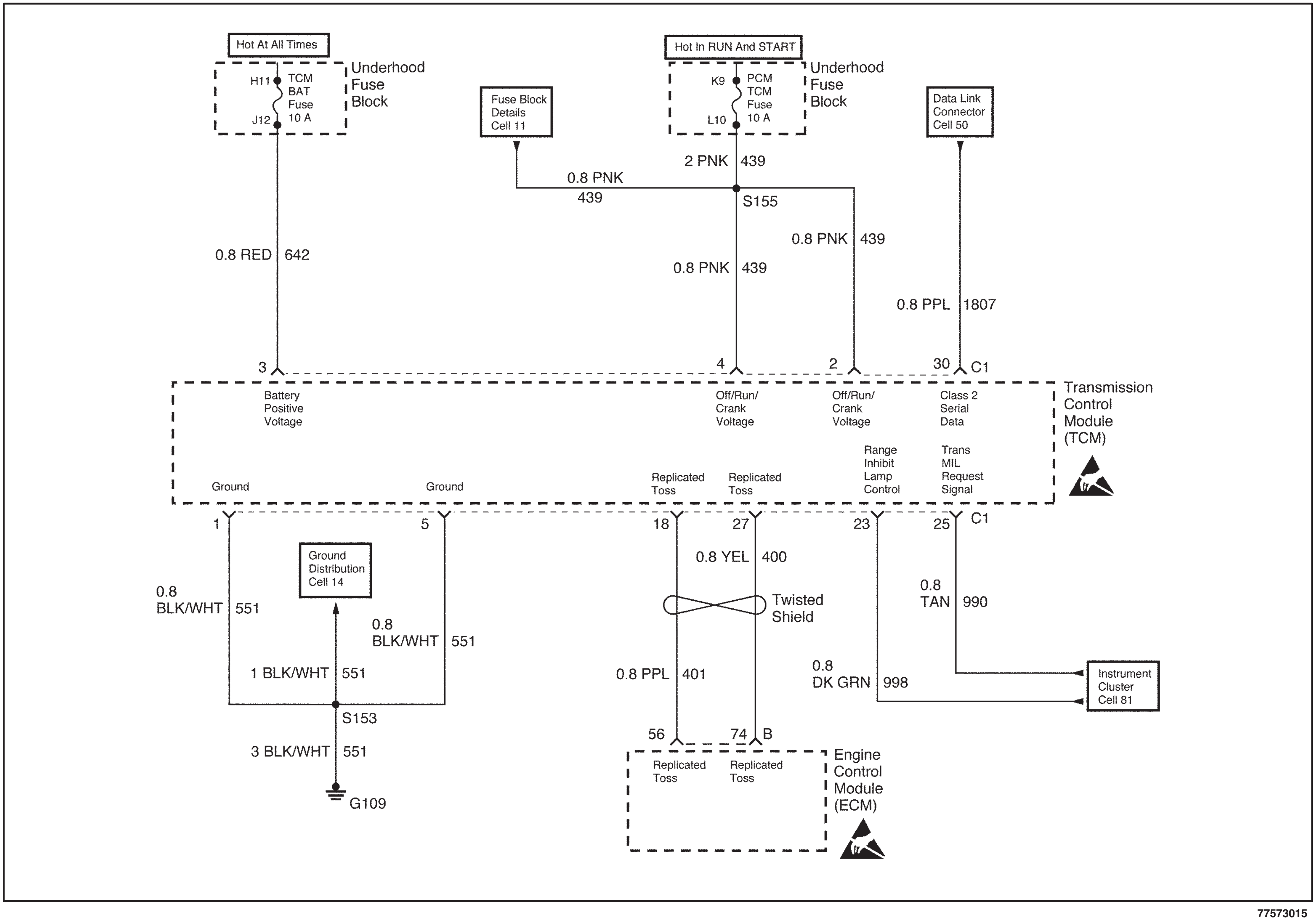
Application	Specification	
	Metric	English
Fill After Rebuild With Standard Oil Pan With Shallow Oil Pan	 17.9 L 17.1 L	 19 qt 18 qt
Fill After Fluid and Filter Change With Standard Oil Pan With Shallow Oil Pan	 7.0 L 6.2 L	 7.4 qt 6.4 qt

Schematic and Routing Diagrams

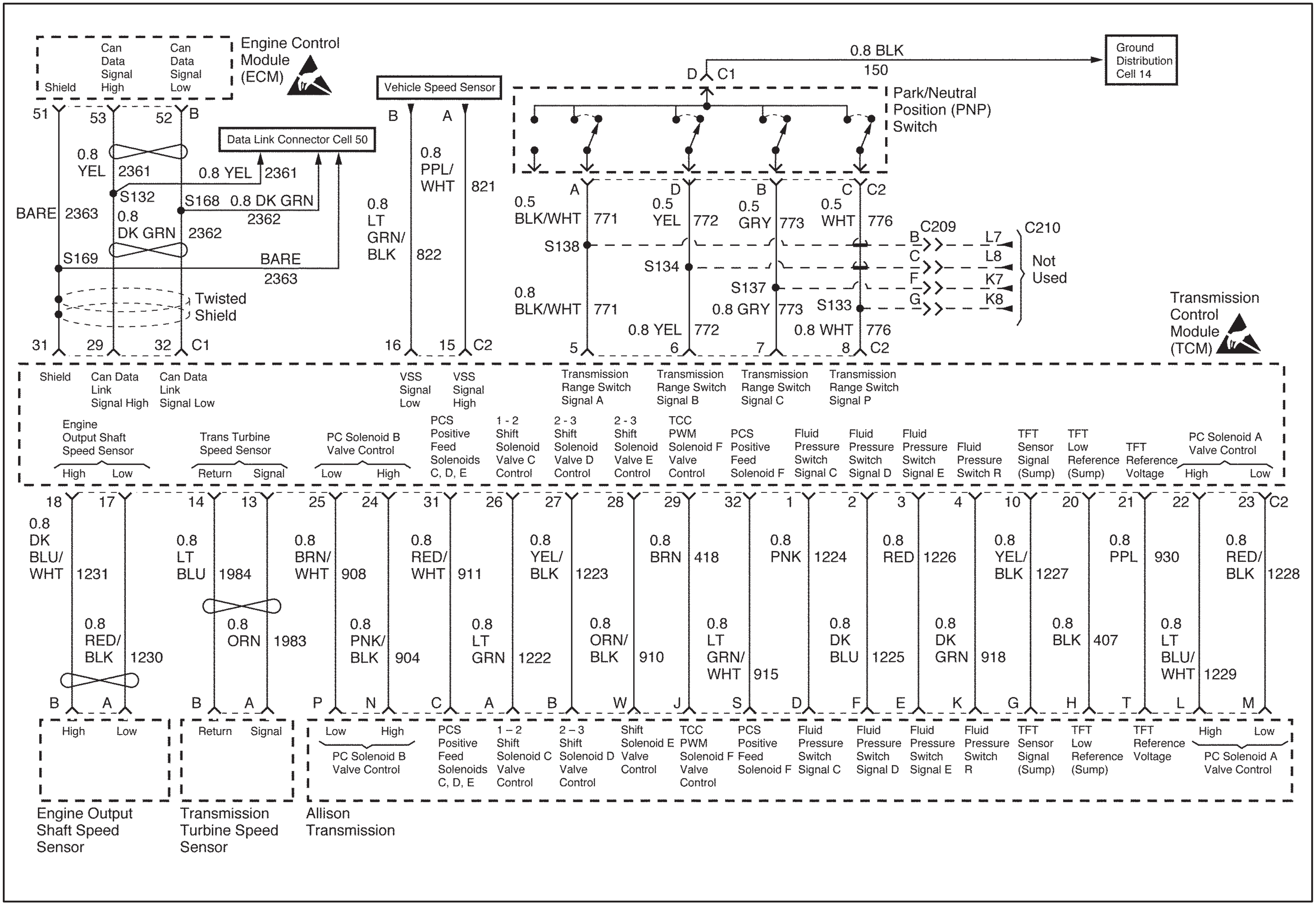
Automatic Transmission – Allison LCT 1000 Schematic Icons

Icon	Icon Definition
 19384	Refer to *ESD Notice* in Cautions and Notices in the WCC Service Manual.

Automatic Transmission Controls Schematics (P42 Commercial) (Cell 39: Fuse Block, Transmission Control Module) (L4B)

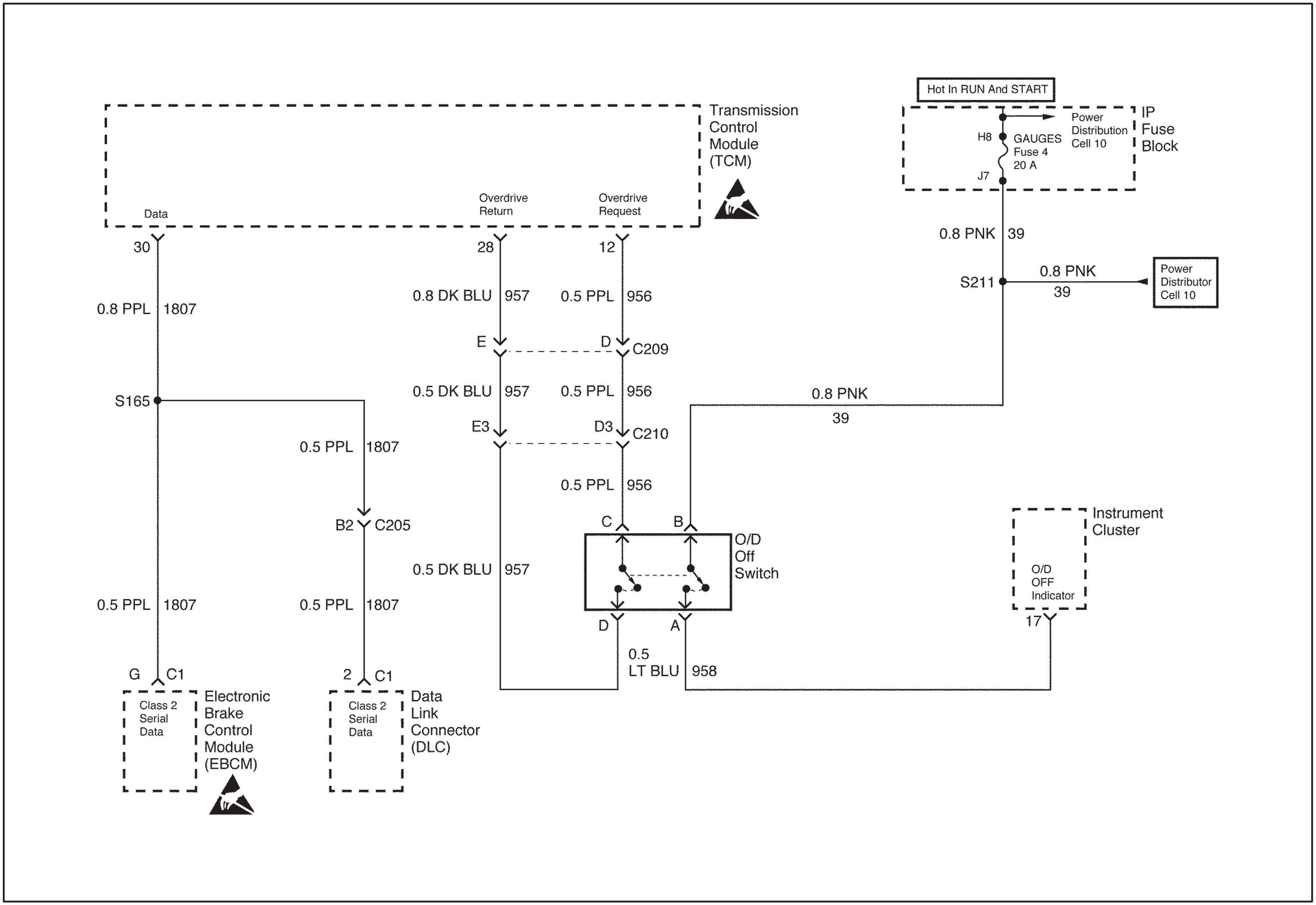


Automatic Transmission Controls Schematics (P42 Commercial) (Cell 39: Park Neutral Position Switch, TCM) (L4B)



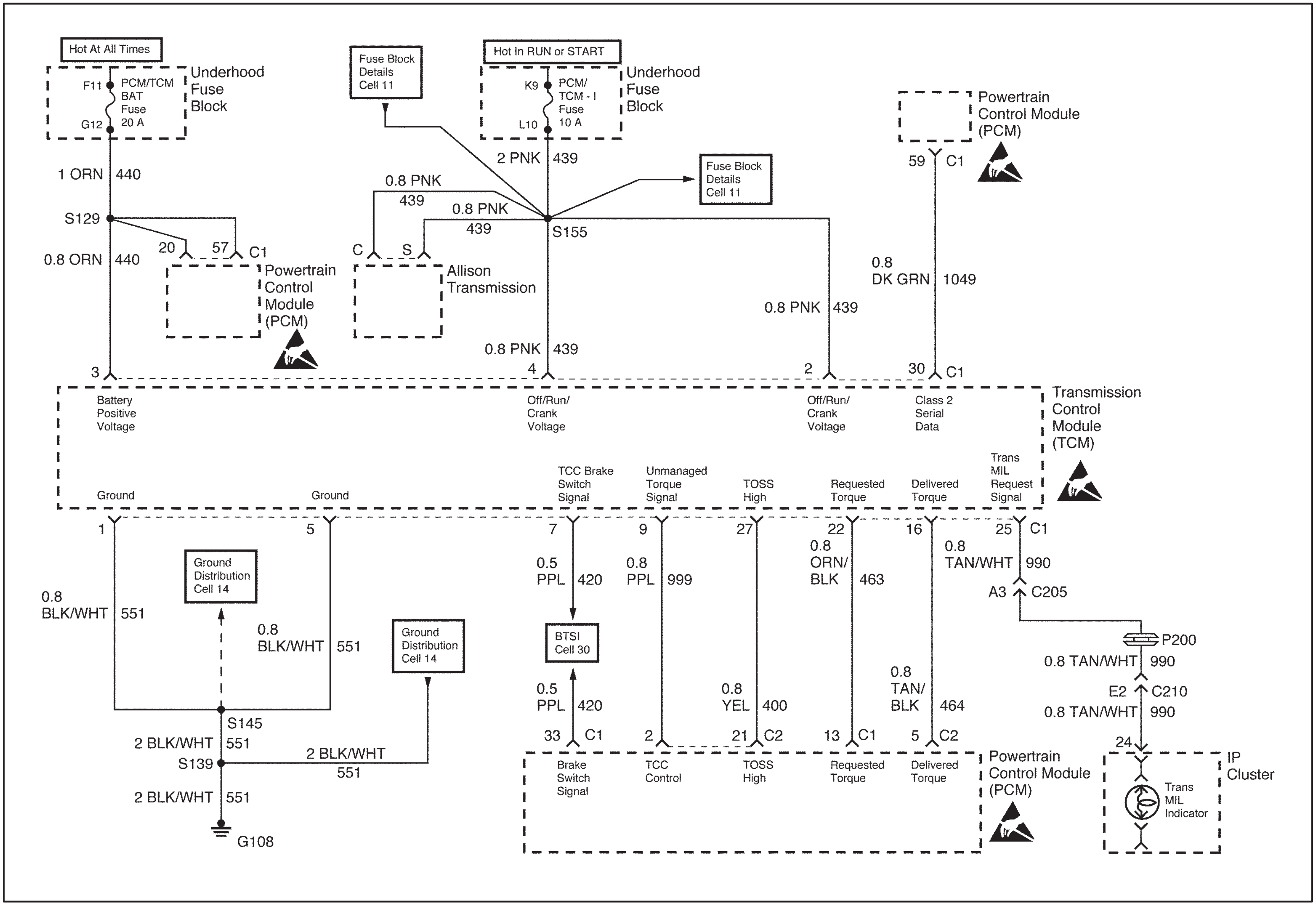
77573016

Automatic Transmission Controls Schematics (P42 Commercial) (Cell 39: O/D Off Switch, ABS Data) (L4B)

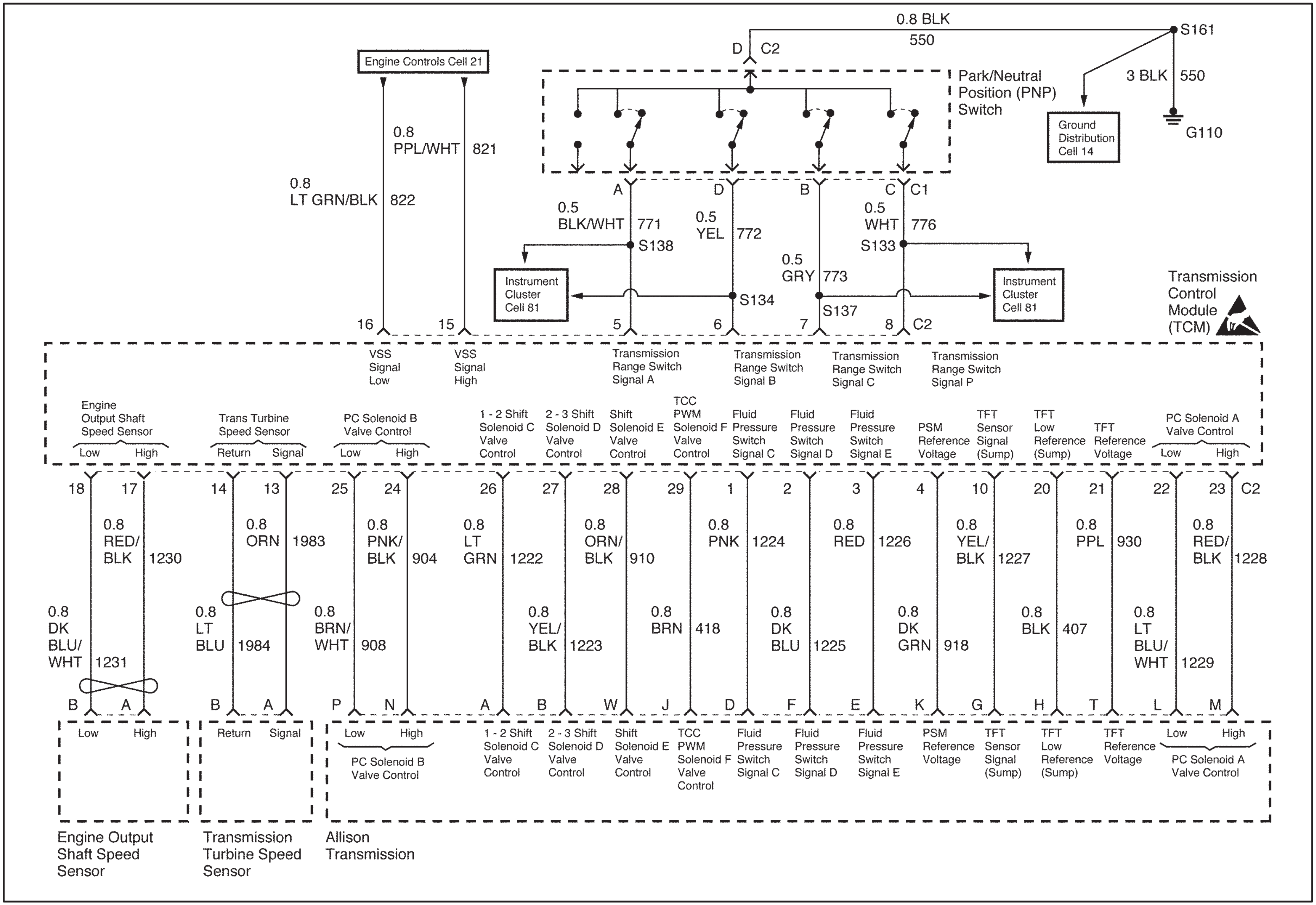


77573017

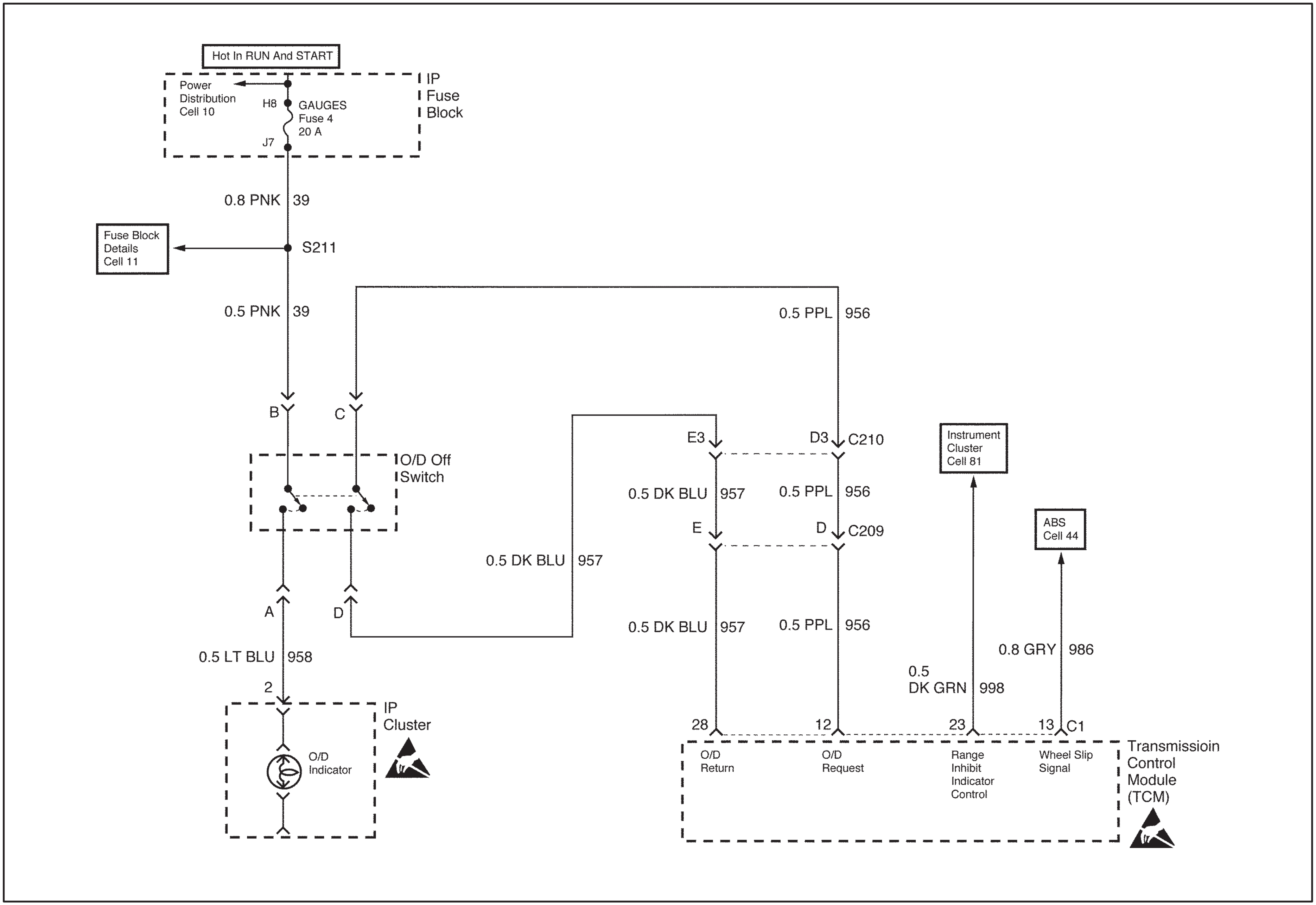
Automatic Transmission Controls Schematics (P22 Motorhome) (Cell 39: Fuse Block, Transmission Control Module) (L18)



Automatic Transmission Controls Schematics (P22 Motorhome) (Cell 39: Park/Neutral Position Switch, TCM) (L18)

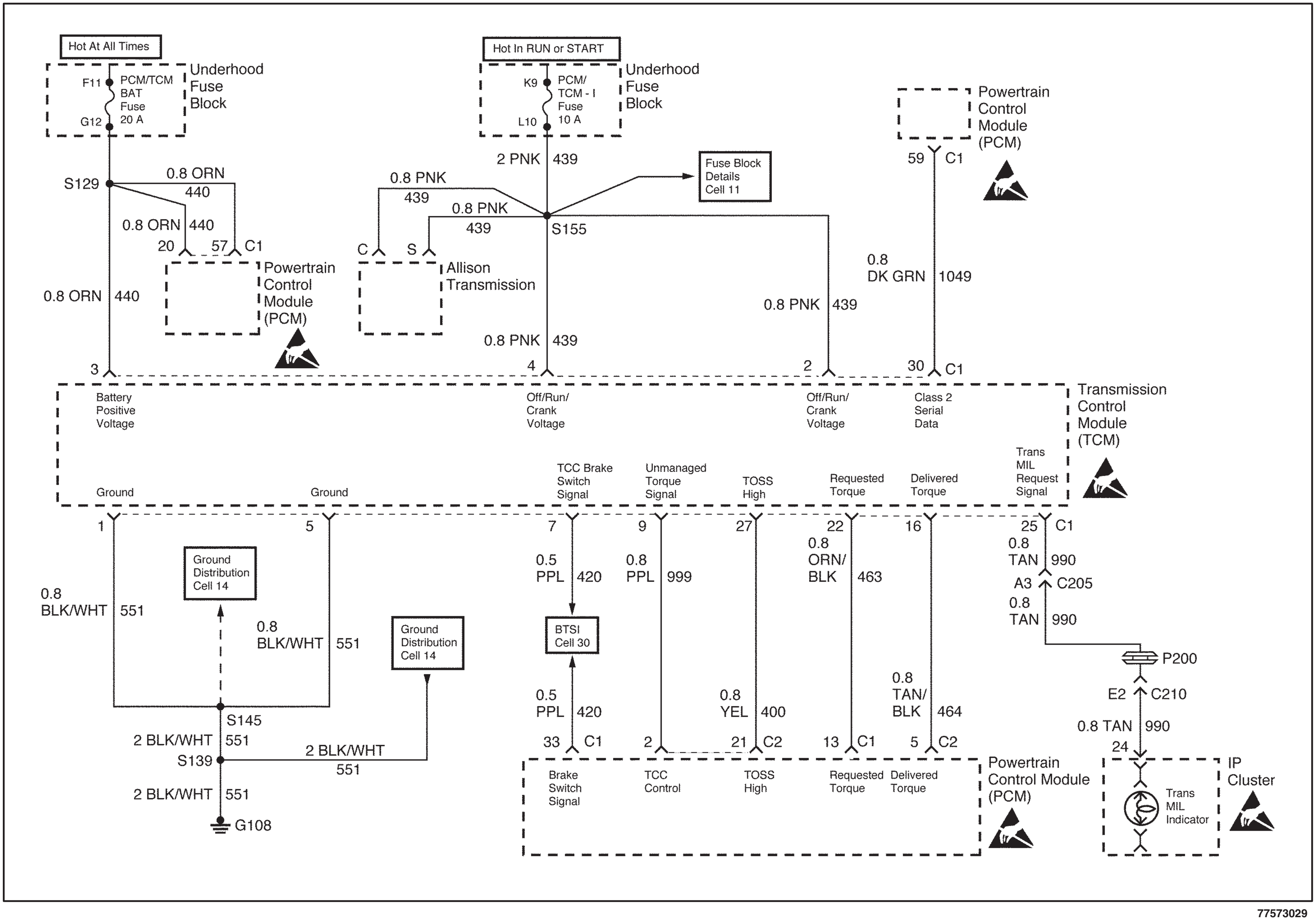


Automatic Transmission Controls Schematics (P22 Motorhome) (Cell 39: O/D Off Switch) (L18)

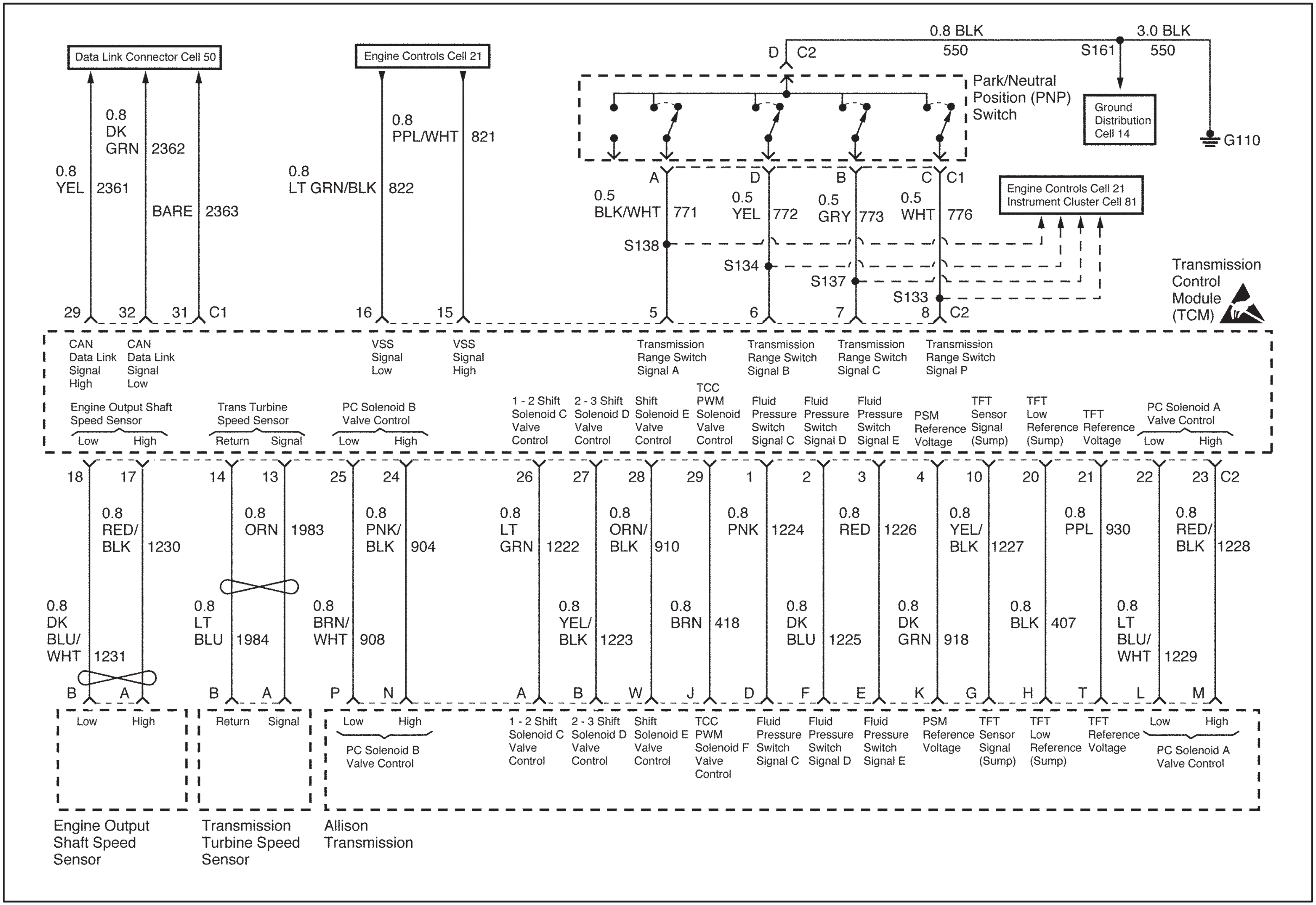


77573026

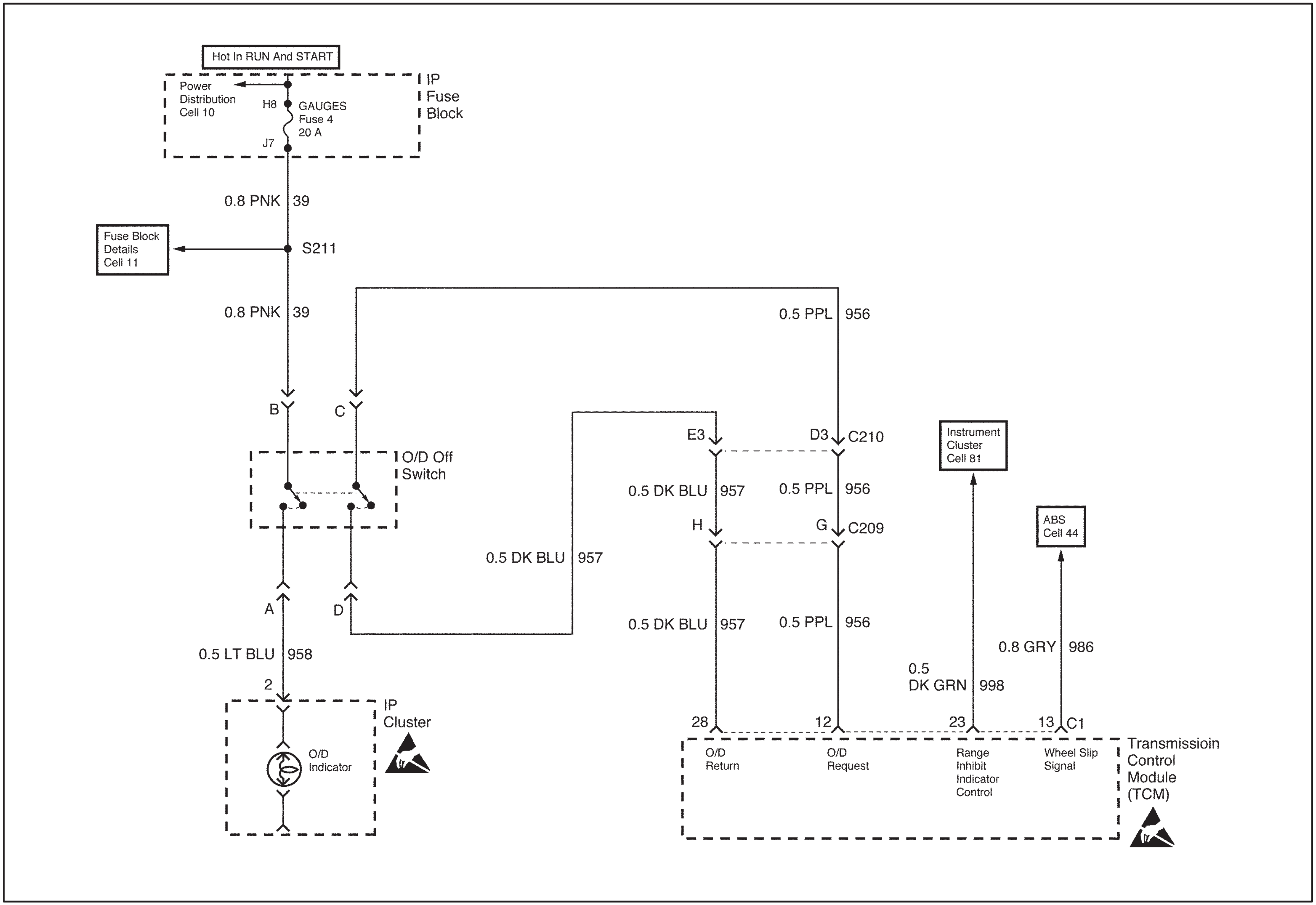
Automatic Transmission Controls Schematics (P52 Commercial) (Cell 39: Fuse Block, Transmission Control Module) (L18)



Automatic Transmission Controls Schematics (P52 Commercial) (Cell 39: Park/Neutral Position Switch, TCM) (L18)



Automatic Transmission Controls Schematics (P52 Commercial) (Cell 39: O/D Off Switch) (L18)

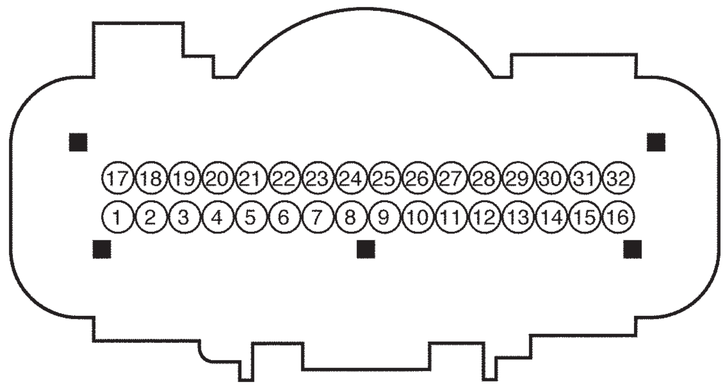


77573031

Visual Identification

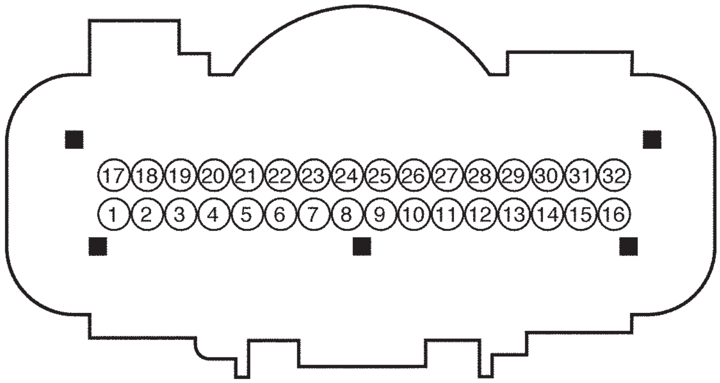
Engine Controls Connector
End Views (P42 Commercial) (L4B)

Transmission Control Module C1



Connector Part Information	• 15305371 • 32 Way F Micro-Pack 100 W Series (NAT)		
Pin	**Wire Color**	**Circuit No.**	**Function**
1	BLK/WHT	451	Ground
2	PNK	439	Ignition Feed
3	RED	642	Battery Feed
4	PNK	439	Ignition Feed
5	BLK/WHT	451	Ground
6-11	—	—	Not Used
12	PPL	956	Overdrive Req
13-17	—	—	Not Used
18	PPL	401	Replicated Trans Output Speed Sensor
19-22	—	—	Not Used
23	DK GRN	998	Range Inhibit Indicator Control
24	—	—	Not Used
25	TAN	990	Trans MIL Request
26	—	—	Not Used
27	YEL	400	Replicated Trans Output Speed Sensor
28	DK BLU	957	Overdrive Return
29	YEL	2361	High Signal
30	PPL	1807	Class 2 Serial Data
31	BARE	2363	Shield
32	DK GRN	2362	Low Signal CAN Data

Transmission Control Module C2

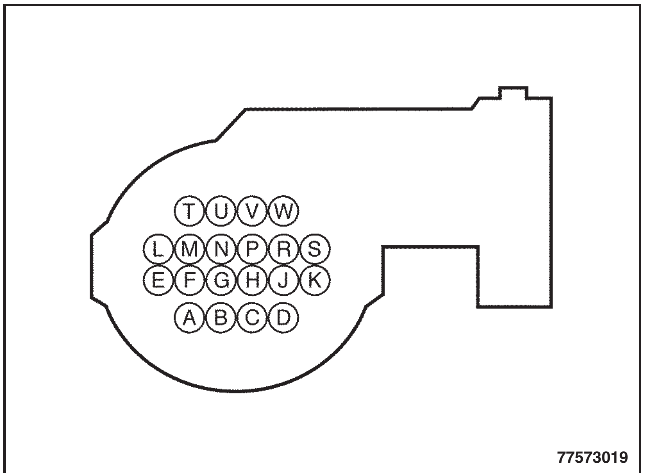


77573018

Connector Part Information	• **15305371** • **32 Way F Micro-Pack 100 W Series (NAT)**

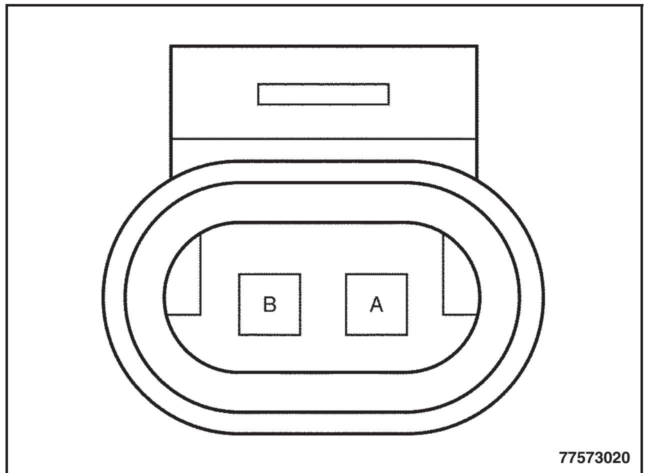
Pin	Wire Color	Circuit No.	Function
1	PNK	1224	TFP Switch C
2	DK BLU	1225	TFP Switch D
3	RED	1226	TFP Switch E
4	DK GRN	918	TFP Switch R
5	BLK/WHT	771	Trans Range Input Signal A
6	YEL	772	Trans Range Input Signal B
7	GRY	773	Trans Range Input Signal C
8	WHT	776	Trans Range Input Signal P
9	—	—	Not Used
10	YEL/BLK	1227	Sump Temp Sensor
11-12	—	—	Not Used
13	ORN	1983	Turbine Speed Sensor Signal
14	LT BLU	1984	Turbine Speed Sensor Return
15	PPL/WHT	821	VSS Signal High
16	LT GRN/BLK	822	VSS Signal Low
17	RED/BLK	1230	Engine Output Shaft Speed Sensor Low
18	DK BLU/WHT	1231	Engine Output Shaft Speed Sensor High
19	—	—	Not Used
20	BLK	407	Sump Temp Sensor Ground
21	PPL	930	Transmission Fluid Temperature Reference Voltage
22	LT BLU/WHT	1229	Solenoid A PCS High
23	RED/BLK	1228	Solenoid A PCS Low
24	PNK/BLK	904	Solenoid B PCS High
25	GRN/WHT	908	Solenoid B PCS Low
26	LT GRN	1222	Solenoid C PCS Low
27	YEL/BLK	1223	Solenoid D PCS Low
28	ORN/BLK	910	Solenoid E PCS Low
29	BRN	418	Solenoid F PCS Low
30	—	—	Not Used
31	RED/WHT	911	PCS C, D, E Positive Feed Solenoids
32	LT GRN	915	PCS Positive Feed Solenoid F

Engine Harness to Transmission



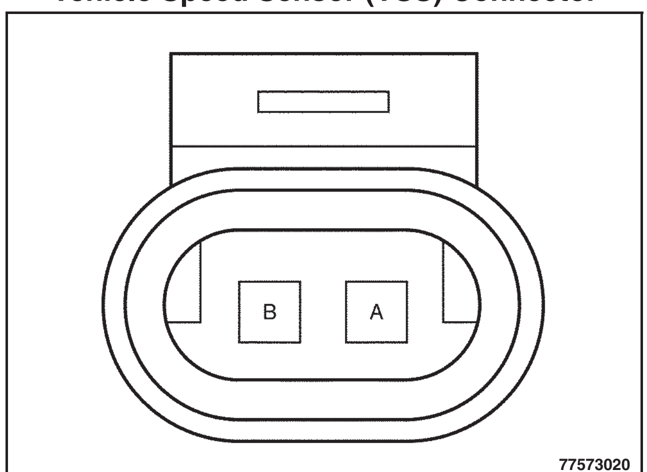
Connector Part Information	• 12160280 • 20 Way F Micro-Pack 100 W Series (GRY)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN	1222	Sol C (PCS) Low
B	YEL/BLK	1223	Sol D (PCS) Low
C	RED/WHT	911	Sol D, E, F (PCS) High
D	PNK	1224	Pressure Switch C
E	RED	1226	Pressure Switch E
F	DK BLU	1225	Pressure Switch D
G	YEL/BLK	1227	Sump Temp Sensor
H	BLK	407	Sensor Ground
J	BRN	418	Sol F (PCS) Low
K	DK GRN	918	Pressure Switch R
L	LT BLU/WHT	1229	Sol A (PCS) High
M	RED/BLK	1228	Sol A (PCS) Low
N	PNK/BLK	904	Sol B (PCS) High
P	BRN/WHT	908	Sol B (PCS) Low
R	—	—	Not Used
S	LT GRN	915	Sol F (PCS) High
T	PPL	930	TFT Reference Voltage
U–V	—	—	Not Used
W	ORN/BLK	910	Sol F (PCS) Low

Transmission Turbine Speed Sensor Connector



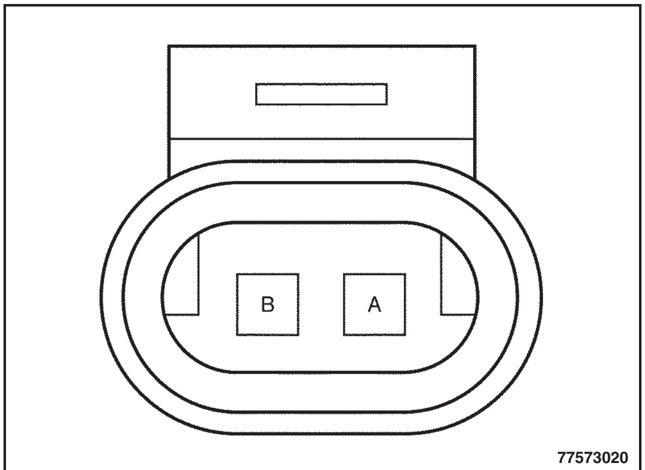
Connector Part Information	• 12162194 • ASM 2F M/P 150.2 P2S SLD (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	ORN	1983	Transmission Turbine Speed Sensor Signal
B	LT BLU	1984	Transmission Turbine Speed Sensor Return

Vehicle Speed Sensor (VSS) Connector



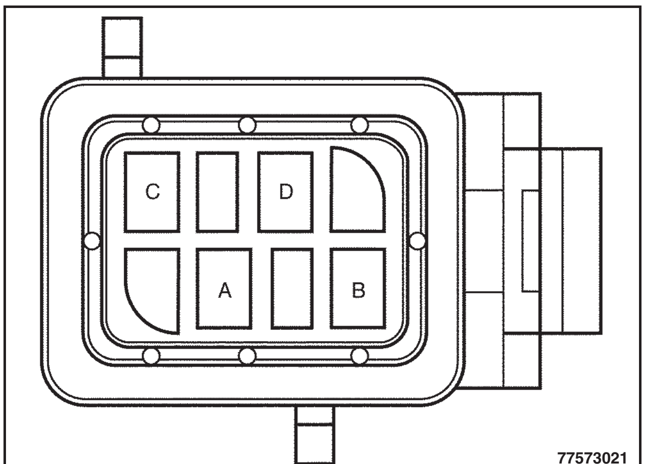
Connector Part Information	• 12162194 • 2 Way ASM 2F M/P 150.2 P2S SLD (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PPL/WHT	821	VSS High To Trans Control Module
B	LT GRN/BLK	822	VSS Low To Trans Control Module

Engine Output Speed Sensor Connector



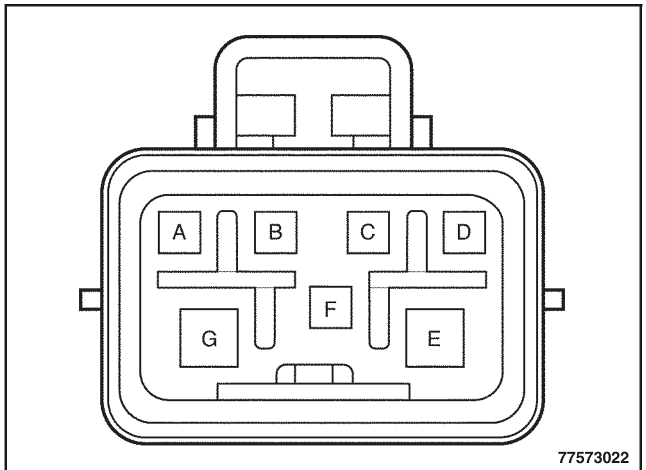
Connector Part Information		• 12162194 • 2 Way ASM 2F M/P 150.2 P2S SLD (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED/BLK	1230	Engine Output Speed Sensor Signal Low
B	DK BLU/WHT	1231	Engine Output Speed Sensor Signal High

Park/Neutral Position Switch



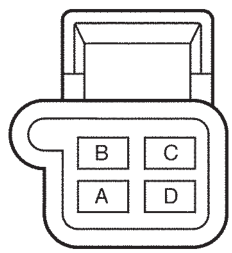
Connector Part Information		• 12191757 • 4 Way Metri-Pack Connector (NAT)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BLK/WHT	771	PRNDL Input A
B	GRY	773	PRNDL Input C
C	WHT	776	PRNDL Input P
D	YEL	772	PRNDL Input B

Park/Neutral Position Switch



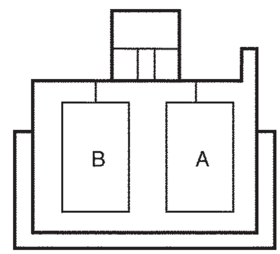
Connector Part Information		• 12129840 • 7 Way Metri-Pack Mixed Series	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	—	—	Not Used
B	LT GRN	275	BTSI Relay Feed/Body Builder Park Accessory
C	PNK	139	PRNDL Switch Backup Lamp Feed
D	BLK	150	Ground
E	PPL	806	Crank Input
F	LT GRN	24	Backup Lamp Output/Body Builder Park Assist
G	YEL	1737	Start Relay Feed (Active in Park or Neutral)

O/D Off Switch



Connector Part Information	• 12064761 • 4 Way Metri-Pack 150 Series (BLK) (Male)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT BLU	958	O/D Indicator Control
B	PNK	39	Ignition Positive Feed
C	PPL	956	Overdrive Request
D	DK BLU	957	Overdrive Return

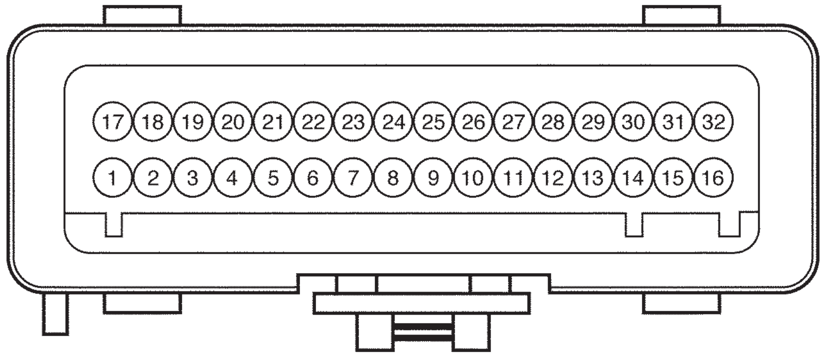
Stop Lamp Switch C1 (BTSI)



Connector Part Information	• 12015197 • 4 Way Metri-Pack 150 Series (BLK) (Male)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BRN	241	Ignition Positive Feed
B	PPL	420	BTSI Relay Feed

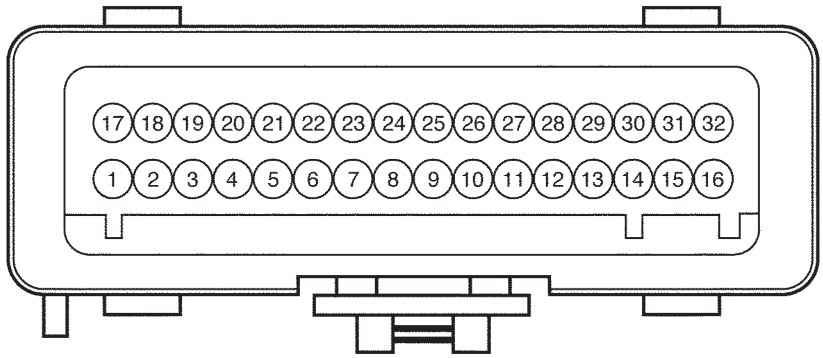
Engine Controls Connector End Views (P22 Motorhome) (L18)

Transmission Control Module Connector C1 (Clear)



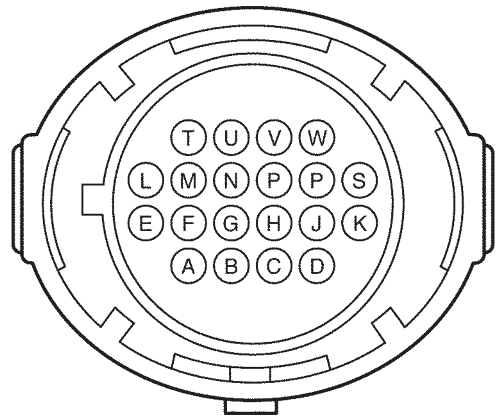
Connector Part Information		• 12129025 • 32 Pin TCM Connector C1 (CLR)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	BLK/WHT	551	Ground
2	PNK	439	Ignition Positive
3	ORN	440	Battery Positive
4	PNK	439	Ignition Positive
5	BLK/WHT	551	Ground
6	—	—	Not Used
7	PPL	420	TCC Brake Switch Signal
8	—	—	Not Used
9	PPL	999	TCC Control
10-11	—	—	Not Used
12	PPL	956	Overdrive Request
13	GRY	986	Wheel Slip Signal
14-15	—	—	Not Used
16	TAN/BLK	464	Delivered Torque Signal
17-21	—	—	Not Used
22	ORN/BLK	463	Requested Torque Signal
23	DK GRN	998	Range Inhibit Indicator Control
24	—	—	Not Used
25	TAN	990	Trans MIL Request
26	—	—	Not Used
27	YEL	400	TOSS High
28	DK BLU	957	Overdrive Return
29	—	—	Not Used
30	DK GRN	1049	Serial Data (PCM)
31-32	—	—	Not Used

Transmission Control Module Connector C2 (Red)



Connector Part Information		• 12129025 • 32 Pin TCM Connector C2 (RED)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	PNK	1224	Fluid Pressure Switch Signal C
2	DK BLU	1225	Fluid Pressure Switch Signal D
3	RED	1226	Fluid Pressure Switch Signal E
4	DK GRN	918	PSM Reference Voltage
5	BLK/WHT	771	Range Switch Signal A
6	YEL	772	Range Switch Signal B
7	GRY	773	Range Switch Signal C
8	WHT	776	Range Switch Signal P
9	—	—	Not Used
10	YEL/BLK	1227	TFT Sensor Signal (Sump)
11-12	—	—	Not Used
13	ORN	1983	Turbine Speed Sensor Signal
14	LT BLU	1984	Turbine Speed Sensor Return
15	PPL/WHT	821	VSS Signal High
16	LT GRN/BLK	822	VSS Signal Low
17	RED/BLK	1230	Engine Output Shaft Speed Sensor Signal High
18	DK BLU/WHT	1231	Engine Output Shaft Speed Sensor Signal Low
19	—	—	Not Used
20	BLK	407	TFT Sensor Low Reference (Sump)
21	PPL	930	TFT Reference Voltage
22	LT BLU/WHT	1229	PC Solenoid Control (A) Low
23	RED/BLK	1228	PC Solenoid Control (A) High
24	PNK/BLK	904	PC Solenoid Control (B) High
25	BRN/WHT	908	PC Solenoid Control (B) Low
26	LT GRN	1222	1-2 Shift Solenoid C Valve Control
27	YEL/BLK	1223	2-3 Shift Solenoid D Valve Control
28	ORNBLK	910	Shift Solenoid E Valve Control C
29	BRN	418	TCC PWM Solenoid Valve Control
30-32	—	—	Not Used

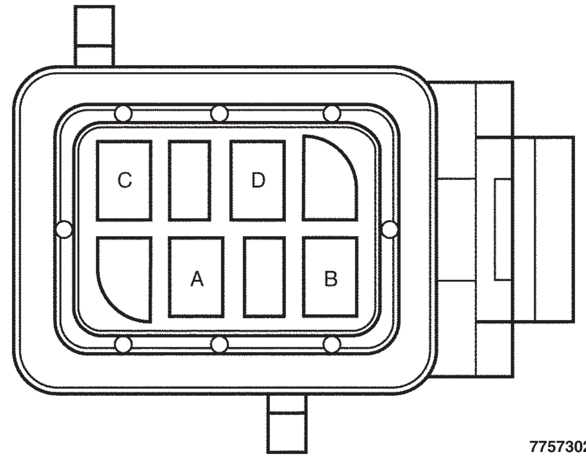
Transmission Connector (Harness Side)



77573028

Connector Part Information		• Similar to 12160490 • 20 Way F Micro-Pack 100W Series (GRY)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN	1222	1-2 Shift Solenoid C Control
B	YEL/BLK	1223	2-3 Shift Solenoid D Control
C	PNK	439	12 Volt Feed (Solenoids)
D	PNK	1224	Pressure Switch Signal C
E	RED	1226	Pressure Switch Signal E
F	DK BLU	1225	Pressure Switch Signal D
G	YEL/BLK	1227	TFT Sensor Signal (Sump)
H	BLK	407	TFT Low Reference (Sump)
J	BRN	418	TCC PWM Solenoid F Control
K	DK GRN	918	PSM Reference Voltage
L	LT BLU/WHT	1229	PC Solenoid A Low
M	RED/BLK	1228	PC Solenoid A High
N	PNK/BLK	904	PC Solenoid B High
P	BRN/WHT	908	PC Solenoid B Low
R	—	—	Not Used
S	PNK	439	TCC Solenoid Feed
T	PPL	930	TFT Reference Voltage
U–V	—	—	Not Used
W	ORN/BLK	910	Shift Solenoid E Control

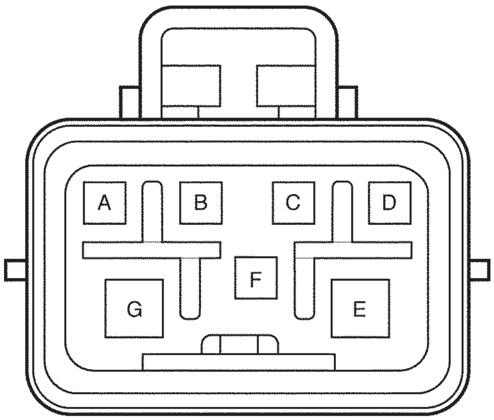
Park/Neutral Position Switch C1



77573021

Connector Part Information		• 12191757 • 4 Way Metri-Pack Connector (NAT)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BLK/WHT	771	PRNDL Input A
B	GRY	773	PRNDL Input C
C	WHT	776	PRNDL Input P
D	YEL	772	PRNDL Input B

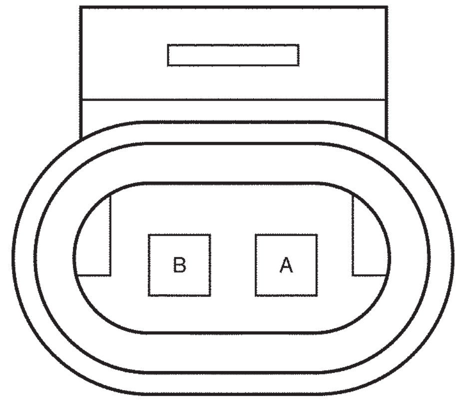
Park/Neutral Position Switch C2



77573022

Connector Part Information		• 12129840 • 7 Way Metri-Pack Mixed Series	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	—	—	Not Used
B	LT GRN	275	BTSI Relay Feed/Body Builder Park Accessory
C	PNK	139	PRNDL Switch Backup Lamp Feed
D	BLK	550	Ground
E	PPL	806	Crank Input
F	LT GRN	24	Backup Lamp Outout/Body Builder Park Assist
G	YEL	1737	Start Relay Feed (Active in Park or Neutral)

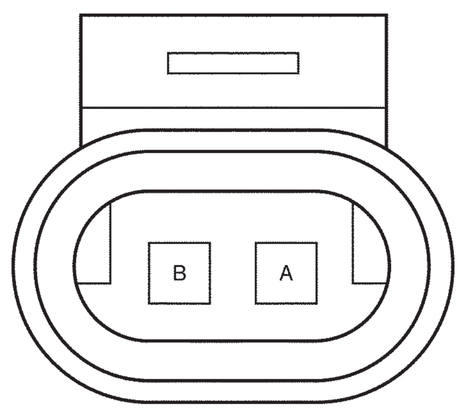
Engine Output Shaft Speed Sensor Connector



77573020

Connector Part Information		• 12162194 • 2 Way ASM 2F M/P 150.2 P2S SLD (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED/BLK	1230	Engine Output Speed Sensor Signal Low
B	DK BLU/WHT	1231	Engine Output Speed Sensor Signal High

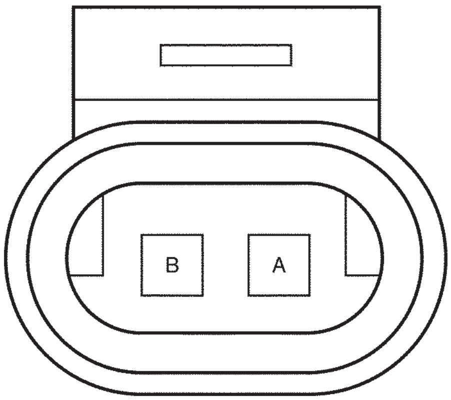
Transmission Turbine Speed Sensor Connector



77573020

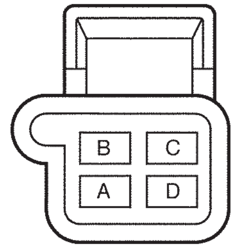
Connector Part Information		• 12162194 • ASM 2F M/P 150.2 P2S SLD (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	ORN	1983	Transmission Turbine Speed Sensor Signal
B	LT BLU	1984	Transmission Turbine Speed Sensor Return

Vehicle Speed Sensor (VSS)



Connector Part Information	• 12162194 • 2 Way ASM 2F M/P 150.2 P2S SLD (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PPL/WHT	821	VSS High To Trans Control Module
B	LT GRN/BLK	822	VSS Low To Trans Control Module

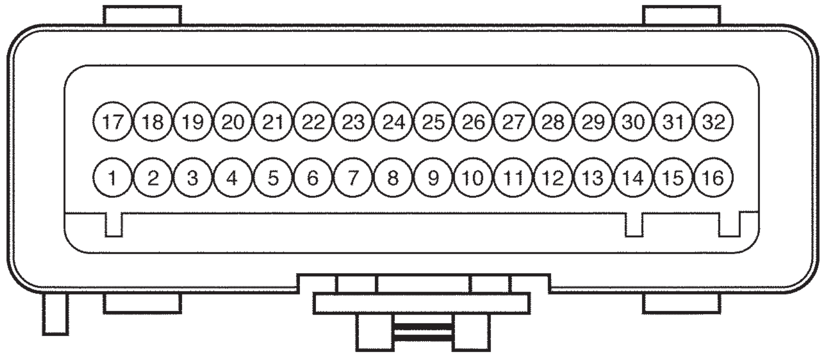
O/D Off Switch



Connector Part Information	• 12064761 • 4 Way Metri-Pack 150 Series (BLK) (Male)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT BLU	958	O/D Indicator Control
B	PNK	39	Ignition Positive Feed
C	PPL	956	Overdrive Request
D	DK BLU	957	Overdrive Return

Engine Controls Connector End Views (P52 Commercial) (L18)

Transmission Control Module Connector C1 (Clear)

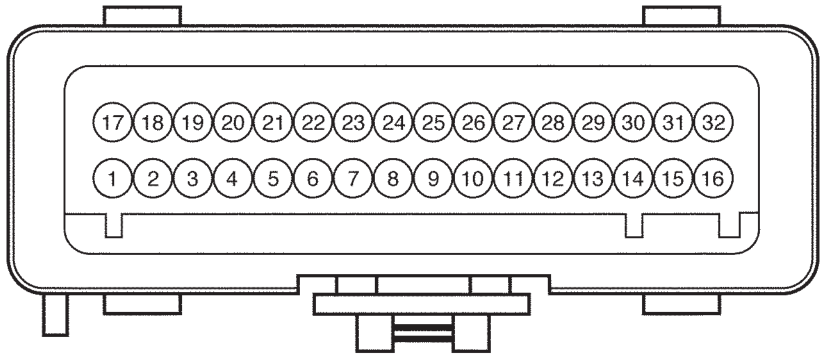


77573027

Connector Part Information	
	• 12129025 • 32 Pin TCM Connector C1 (CLR)

Pin	Wire Color	Circuit No.	Function
1	BLK/WHT	551	Ground
2	PNK	439	Ignition Positive
3	ORN	440	Battery Positive
4	PNK	439	Ignition Positive
5	BLK/WHT	551	Ground
6	—	—	Not Used
7	PPL	420	TCC Brake Switch Signal
8	—	—	Not Used
9	PPL	999	TCC Control
10-11	—	—	Not Used
12	PPL	956	Overdrive Request
13	GRY	986	Wheel Slip Signal
14-15	—	—	Not Used
16	TAN/BLK	464	Delivered Torque Signal
17-21	—	—	Not Used
22	ORN/BLK	463	Requested Torque Signal
23	DK GRN	998	Range Inhibit Indicator Control
24	—	—	Not Used
25	TAN	990	Trans MIL Request
26	—	—	Not Used
27	YEL	400	TOSS High
28	DK BLU	957	Overdrive Return
29	YEL	2361	Data High Signal
30	DK GRN	1049	Serial Data (PCM)
31	BARE	2363	Data Signal Ground
32	DK BRN	2362	Data Low Signal

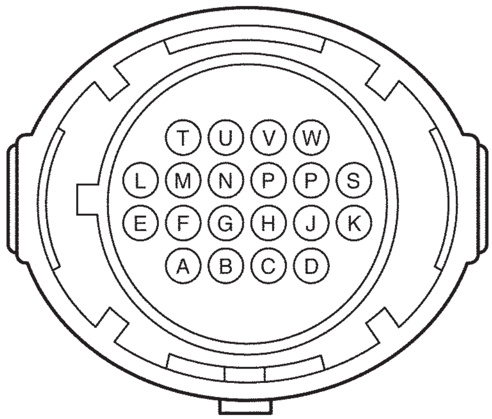
Transmission Control Module Connector C2 (Red)



77573027

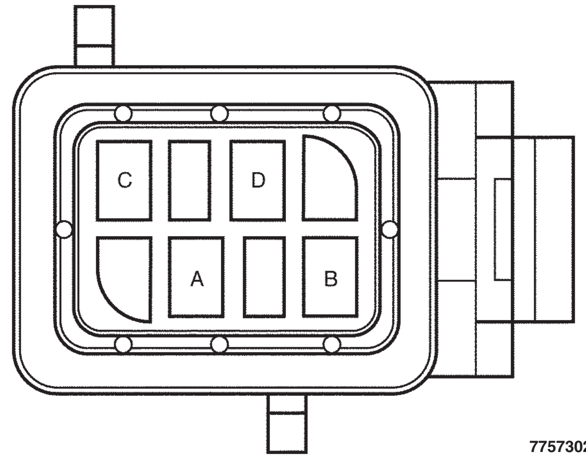
Connector Part Information			• 12129025 • 32 Pin TCM Connector C2 (RED)
Pin	**Wire Color**	**Circuit No.**	**Function**
1	PNK	1224	Fluid Pressure Switch Signal C
2	DK BLU	1225	Fluid Pressure Switch Signal D
3	RED	1226	Fluid Pressure Switch Signal E
4	DK GRN	918	PSM Reference Voltage
5	BLK/WHT	771	Range Switch Signal A
6	YEL	772	Range Switch Signal B
7	GRY	773	Range Switch Signal C
8	WHT	776	Range Switch Signal P
9	—	—	Not Used
10	YEL/BLK	1227	TFT Sensor Signal
11-12	—	—	Not Used
13	ORN	1983	Turbine Speed Sensor Signal
14	LT BLU	1984	Turbine Speed Sensor Return
15	PPL/WHT	821	VSS Signal High
16	LT GRN/BLK	822	VSS Signal Low
17	RED/BLK	1230	Engine Output Speed Sensor Signal High
18	DK BLU/WHT	1231	Engine Output Speed Sensor Signal Low
19	—	—	Not Used
20	BLK	407	TFT Low Reference (Sump)
21	PPL	930	TFT Reference Voltage
22	LT BLU/WHT	1229	PC Solenoid Control (A) Low
23	RED/BLK	1228	PC Solenoid Control (A) High
24	PNK/BLK	904	PC Solenoid Control (B) High
25	BRN/WHT	908	PC Solenoid Control (B) Low
26	LT GRN	1222	1-2 Shift Solenoid C Valve Control
27	YEL/BLK	1223	2-3 Shift Solenoid D Valve Control
28	ORNBLK	910	Shift Solenoid E Valve Control C
29	BRN	418	TCC PWM Solenoid Valve Control
30-32	—	—	Not Used

Transmission Connector (Harness Side)



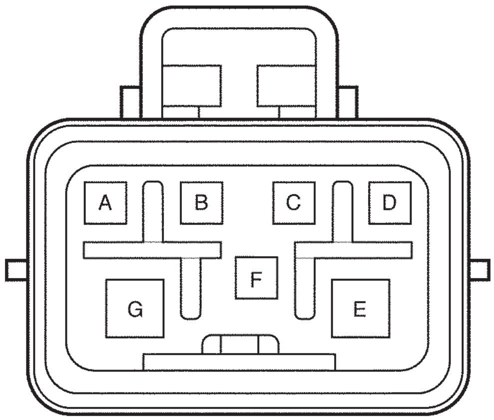
Connector Part Information	• Similar to 12160490 • 20 Way F Micro-Pack 100W Series (GRY)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN	1222	1-2 Shift Solenoid C Control
B	YEL/BLK	1223	2-3 Shift Solenoid D Control
C	PNK	439	12 Volt Feed (Solenoids)
D	PNK	1224	Pressure Switch Signal C
E	RED	1226	Pressure Switch Signal E
F	DK BLU	1225	Pressure Switch Signal D
G	YEL/BLK	1227	TFT Sensor Signal (Sump)
H	BLK	407	TFT Low Reference (Sump)
J	BRN	418	TCC PWM Solenoid F Control
K	DK GRN	918	PSM Reference Voltage
L	LT BLU/WHT	1229	PC Solenoid A Low
M	RED/BLK	1228	PC Solenoid A High
N	PNK/BLK	904	PC Solenoid B High
P	BRN/WHT	908	PC Solenoid B Low
R	—	—	Not Used
S	PNK	439	TCC Solenoid Feed
T	PPL	930	TFT Reference Voltage
U–V	—	—	Not Used
W	ORN/BLK	910	Shift Solenoid E Control

Park/Neutral Position Switch C1



Connector Part Information	• 12191757 • 4 Way Metri-Pack Connector (NAT)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BLK/WHT	771	PRNDL Input A
B	GRY	773	PRNDL Input C
C	WHT	776	PRNDL Input P
D	YEL	772	PRNDL Input B

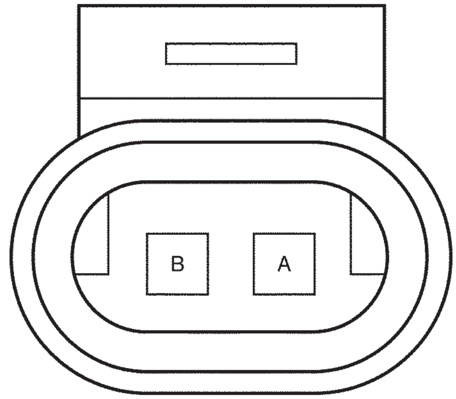
Park/Neutral Position Switch C2



77573022

Connector Part Information		• 12129840 • 7 Way Metri-Pack Mixed Series	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	—	—	Not Used
B	LT GRN	275	BTSI Relay Feed/Body Builder Park Accessory
C	PNK	39	PRNDL Switch Backup Lamp Feed
D	BLK	150	Ground
E	PPL	806	Crank Input
F	LT GRN	24	Backup Lamp Outout/Body Builder Park Assist
G	YEL	1737	Start Relay Feed (Active in Park or Neutral)

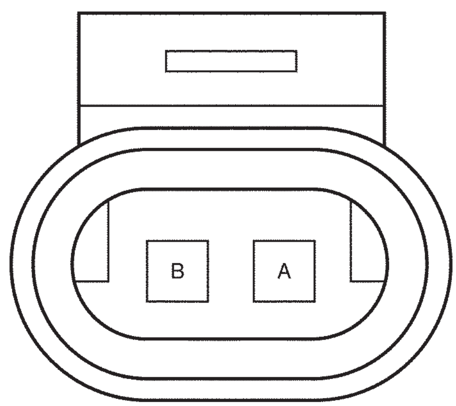
Engine Output Shaft Speed Sensor Connector



77573020

Connector Part Information		• 12162194 • 2 Way ASM 2F M/P 150.2 P2S SLD (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED/BLK	1230	Engine Output Speed Sensor Signal Low
B	DK BLU/WHT	1231	Engine Output Speed Sensor Signal High

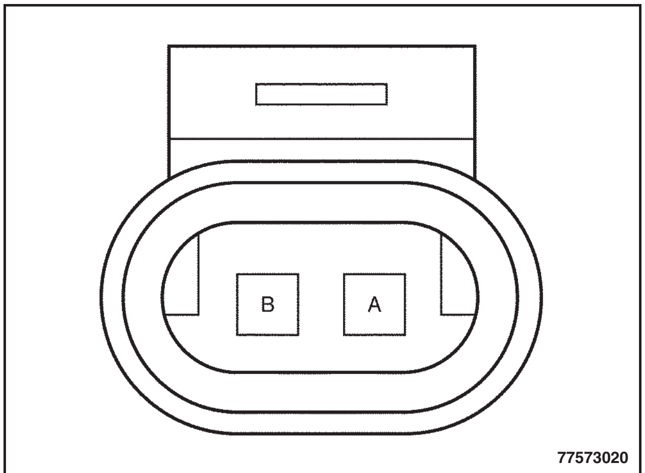
Transmission Turbine Speed Sensor Connector



77573020

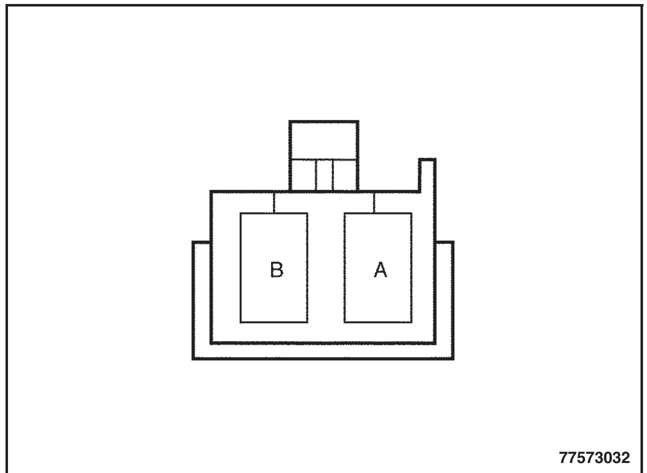
Connector Part Information		• 12162194 • ASM 2F M/P 150.2 P2S SLD (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	ORN	1983	Transmission Turbine Speed Sensor Signal
B	LT BLU	1984	Transmission Turbine Speed Sensor Return

Vehicle Speed Sensor (VSS)



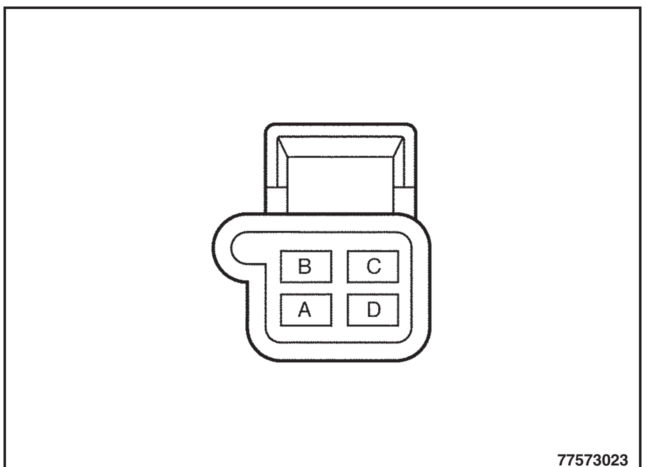
Connector Part Information		• 12162194 • 2 Way ASM 2F M/P 150.2 P2S SLD (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PPL/WHT	821	VSS High To Trans Control Module
B	LT GRN/BLK	822	VSS Low To Trans Control Module

Stop Lamp Switch C1 (BTSI)



Connector Part Information		• 12015197 • 4 Way Metri-Pack 150 Series (BLK) (Male)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BRN	241	Ignition Positive Feed
B	PPL	420	BTSI Relay Feed

O/D Off Switch



Connector Part Information		• 12064761 • 4 Way Metri-Pack 150 Series (BLK) (Male)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT BLU	958	O/D Indicator Control
B	PNK	39	Ignition Positive Feed
C	PPL	956	Overdrive Request
D	DK BLU	957	Overdrive Return

Repair Instructions

Automatic Transmission Fluid/Filter Replacement

Removal Procedure

Important: Do not drain the fluid if only the control main filter is being replaced.

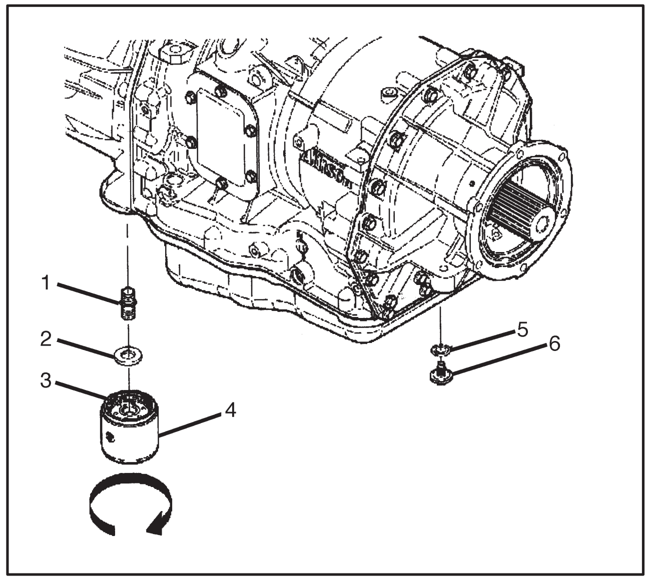
1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in the WCC Service Manual.
2. Place a suitable drain pan under the transmission drain plug.
3. Remove the drain plug (6) and the drain plug seal (5) and allow the fluid to drain.

Important: If any debris, foreign materials, or metal chips are found in the fluid, contact an authorized Allison Repair Center.

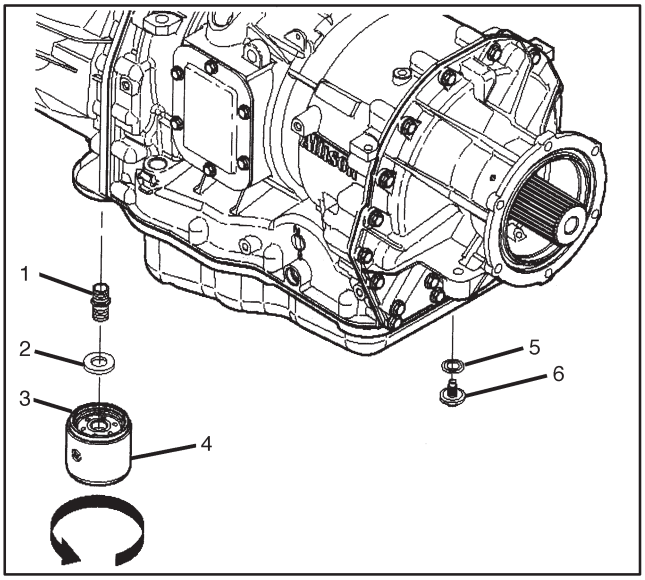
4. Inspect the drained fluid for foreign materials and metallic particles.
5. Using a strap type oil filter wrench, remove the control main filter (4) by turning it in a counterclockwise direction.
6. Remove the magnet (2) from the filter attachment tube (1) in the converter housing.

Notice: The presence of any metal chips or excessive amounts of foreign material may indicate internal transmission damage.

7. Clean any metal debris from the magnet.



77573010



77573011

Installation Procedure

1. Install the magnet (2) onto the filter attachment tube (1) in the converter housing.
2. Lubricate the gasket (3) on the control main filter (4) with clean automatic transmission fluid.

Notice: Turning the control main filter more than one full turn after the gasket touches the torque converter housing may damage the filter and may cause fluid leakage.

3. Install the control main filter (4) by turning it in a clockwise direction until the gasket touches the torque converter housing.

   Tighten

   Tighten the control main filter (4) by turning it in a clockwise direction one full turn.

Notice: Refer to *Fastener Notice* in Cautions and Notices in this supplement.

4. Install the drain plug seal (5) and the drain plug (6).

   Tighten

   Tighten the drain plug to 35 N·m (26 lb ft).

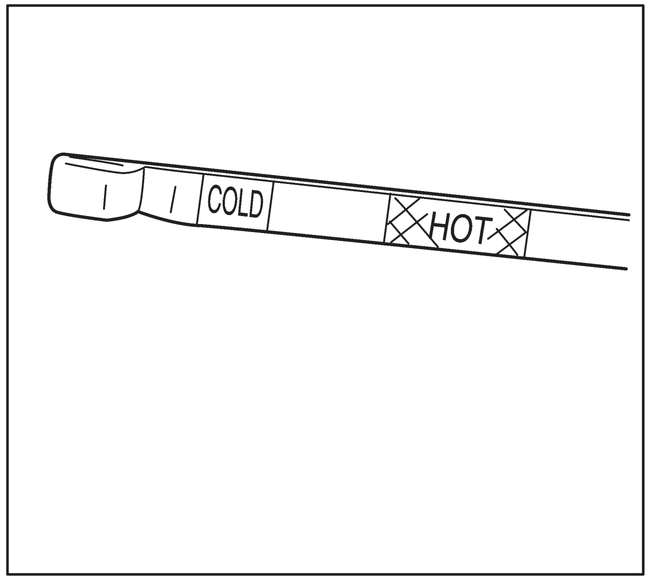
5. Lower the vehicle.
6. Fill the transmission with DEXRON® III Automatic Transmission Fluid. Refer to *Fluid Capacity Specifications* in this supplement.

Important: DTC P0701, Transmission Control System Performance, may often set following fluid service.

7. If DTC P0701 sets, cycle the ignition switch until drive or reverse is restored.

Important: Do not overfill the transmission. Some fluid remains in the external circuits and transmission cavities after draining the transmission. If the fluid level is low during a cold check, warm the engine to normal operating temperature and perform a hot check before adding fluid.

8. Check the transmission fluid Level.
   8.1. If necessary, move the vehicle to a level spot.
   8.2. Warm the engine to normal operating temperature.
   8.3. Ensure that engine is idling and the transmission is in Park.
   8.4. Pull out the oil level indicator and wipe it off with a shop towel.
   8.5. Push the oil level indicator into the fill tube all the way, wait three seconds, then pull it out.
   8.6. Check both sides of the indicator and read the lowest level.
   8.7. Verify that the fluid level is in the COLD area for a cold check or in the HOT area for a hot check.
   8.8. If the fluid level is in the acceptable range, push the oil level indicator into the fill tube.
   8.9. If the fluid level is low, add the necessary fluid, then recheck the level.



OG-089

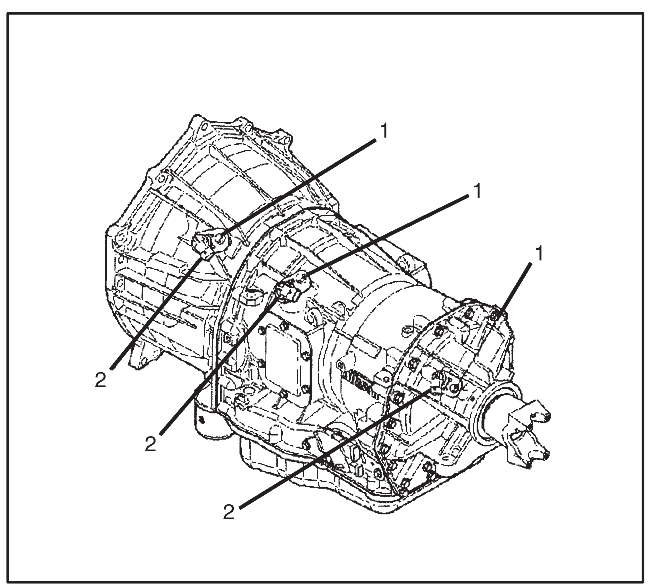
Speed Sensor Replacement

Important: This procedure can be used for the turbine speed sensor, the input speed sensor, or the output speed sensor.

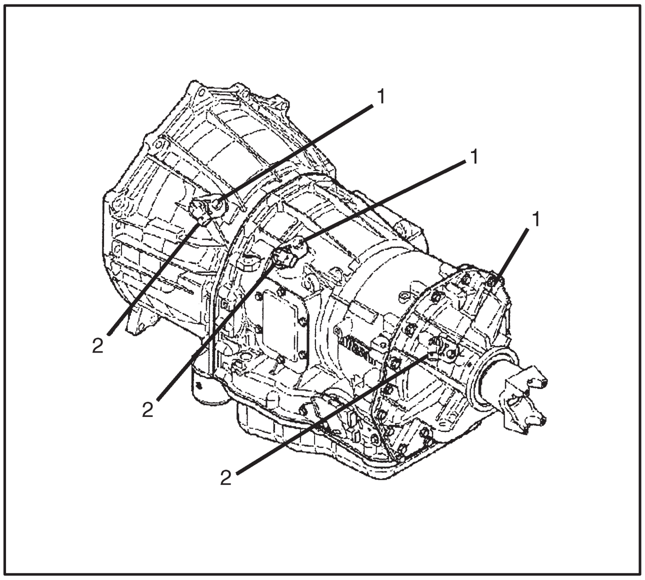
Removal Procedure

Caution: Refer to Battery Disconnect Caution in Cautions and Notices in this supplement.

1. Disconnect the battery(s). Refer to *Battery Replacement* in the WCC Service Manual.
2. Disconnect the external wiring harness connector from the speed sensor.
3. Remove the speed sensor mounting bolt (1).
4. Carefully remove the speed sensor (2) and O-ring seal from the transmission.
5. Remove the O-ring seal from the speed sensor and discard it.



77573009



77573009

Installation Procedure

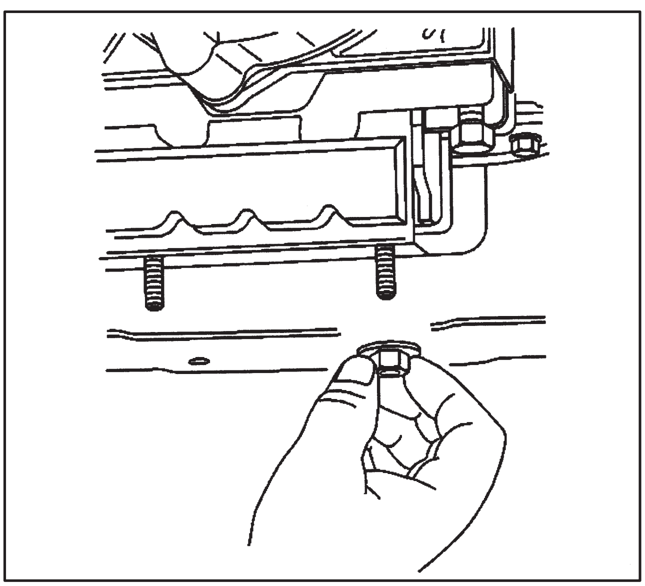
Important: Be careful not to rotate the speed sensor in its retaining bracket. Changing the sensor to bracket orientation may cause improper operation of the speed sensor.

1. Install a new O-ring seal onto the speed sensor.
2. Install the speed sensor.
   2.1. Lubricate the O-ring seal with clean automatic transmission fluid.
   2.2. Install the speed sensor so that the hole in the retaining bracket is aligned with the bolt hole in the speed sensor boss.
   2.3. Ensure that the speed sensor retaining bracket is seated against the speed sensor boss in the transmission.

Notice: Refer to *Fastener Notice* in Cautions and Notices in this supplement.

3. Install the speed sensor mounting bolt (1).

   Tighten
   The sensor mounting bolt (1) to 12 N·m (108 lb in).
4. Connect the external wiring harness connector to the speed sensor.
5. Connect the battery(s). Refer to *Battery Replacement* in the WCC Service Manual.



77573002

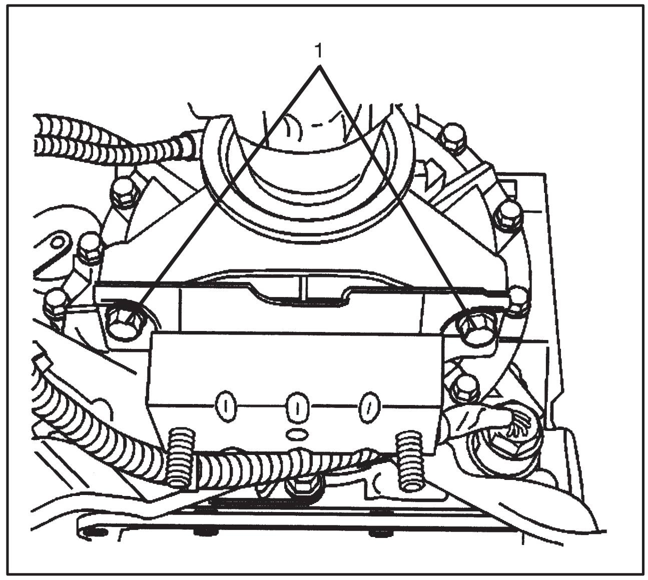
Transmission Mount Replacement

Removal Procedure

1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in the WCC Service Manual.
2. Support the transmission with a suitable transmission jack.
3. Remove the two nuts securing the transmission mount to the transmission support.

Important: Some models use studs with nuts to secure the transmission mount to the transmission; other models use bolts. The procedure is the same in either case.

4. Remove the bolts or nuts (1) securing the transmission mount to the transmission.
5. Raise the transmission just high enough to remove the transmission mount from the vehicle.
6. Remove the transmission mount from the vehicle.



7757308

Installation Procedure

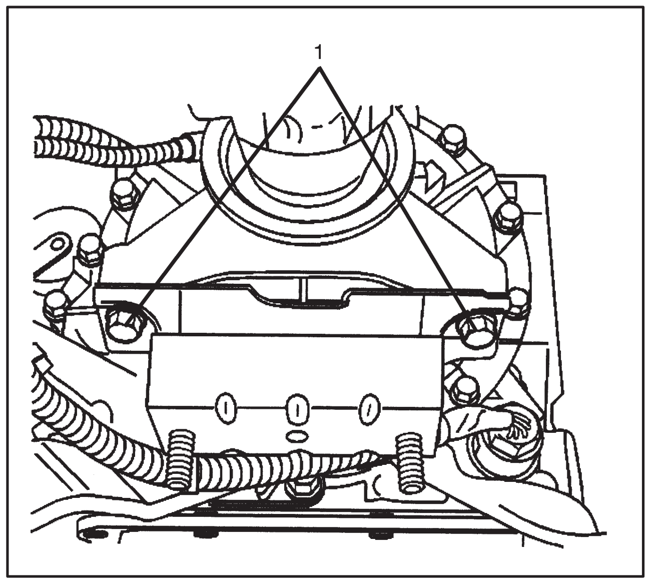
1. Position the transmission mount between the transmission and the transmission support.

Notice: Refer to *Fastener Notice* in Cautions and Notices in this supplement.

2. Install the bolts or nuts (1) securing the transmission mount to the transmission.

   Tighten

   - For vehicles equipped with nuts, tighten the nuts to 41 N·m (30 lb ft).
   - For vehicles equipped with bolts, tighten the bolts to 41 N·m (30 lb ft).
3. Slowly lower the transmission until the transmission mount studs are in the holes in the transmission support and the mount is seated.

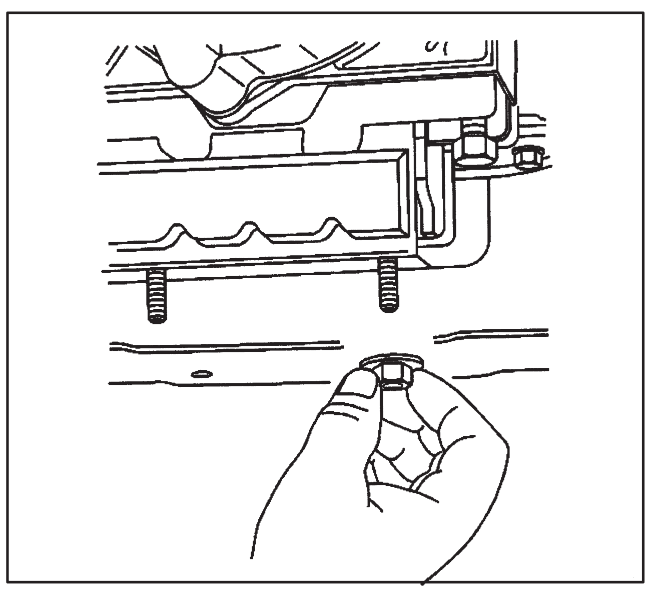


77573008

4. Install the two nuts securing the transmission mount to the transmission support.

   Tighten

   Tighten the nuts to 45 N·m (33 lb ft).
5. Remove the transmission jack.
6. Lower the vehicle.



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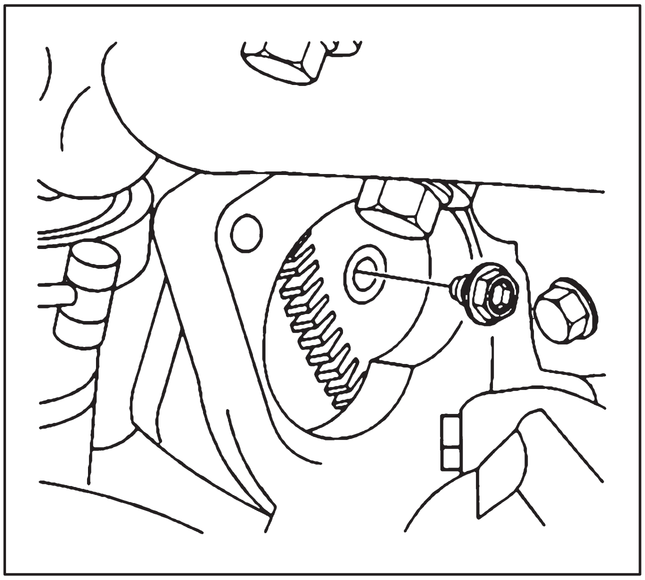


77573001

Transmission Replacement

Tools Required

- *J 21366* Converter Holding Strap
- *J 44257* Main Wiring Harness Connector Remover

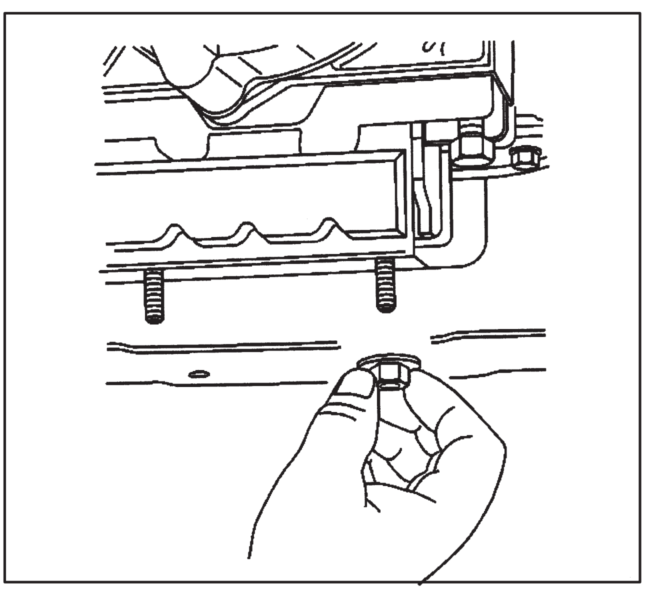
Removal Procedure

Caution: Refer to Battery Disconnect Caution in Cautions and Notices in this supplement.

1. Disconnect the battery(s). Refer to *Battery Replacement* in the WCC Service Manual.
2. Remove the transmission oil level indicator and oil fill tube.
3. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in the WCC Service Manual.
4. Remove the starter motor bolts and move the starter toward the front of the engine. Refer to *Starter Motor Replacement – 8.1L* in the WCC 2001 Service Manual Supplement or *Starter Motor Replacement – 3.9L* in this supplement.

Notice: The torque converter bolts can only be accessed through the starter motor opening. Remove the torque converter bolts before removing the transmission support in order to ensure that the transmission is supported properly during the procedure. Failure to support the transmission properly may result in vehicle damage.

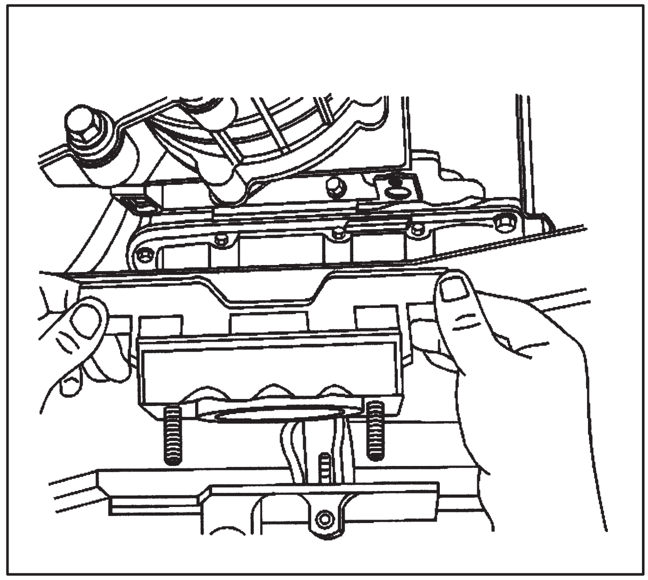
5. Using the front crankshaft bolt, rotate the engine to align the torque converter bolts with the starter motor opening.
6. Mark the flywheel to torque converter relationship to aid in assembly.
7. Remove the torque converter bolts.



77573002

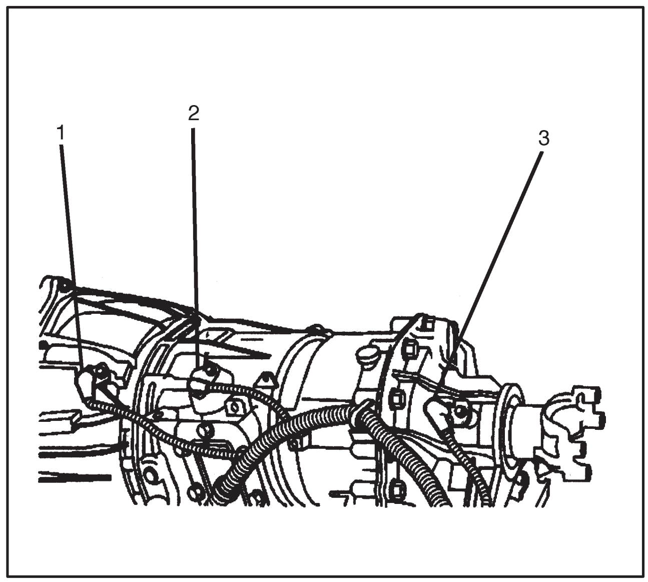
8. Drain the transmission fluid. Refer to *Automatic Transmission Fluid/Filter Replacement* in this supplement.
9. Remove the propeller shaft. Refer to *Two Piece Propeller Shaft Replacement* or *Three Piece Propeller Shaft Replacement* in the WCC Service Manual.
10. Support the transmission with a suitable transmission jack.
11. Remove the two nuts securing the transmission mount to the transmission support.

12. Remove the transmission support nuts and bolts.
13. Remove the transmission support from the vehicle.
14. Remove the mount from the transmission. Refer to *Transmission Mount Replacement* in this supplement.



77573003

15. Remove the shift cable from the transmission. Refer to *Shift Cable Replacement* in the WCC 2001 Service Manual Supplement.
16. Remove the shift cable bracket from the transmission.
17. Disconnect the parking brake cable.
    17.1 Remove the clevis pin from the parking brake lever and the clevis.
    17.2 Depress the lock tangs on the cable housing, then slide the cable housing out of the bracket.
18. Disconnect the wiring harness connectors from the turbine speed sensor (1), the input speed sensor (2), and the output speed sensor (3).

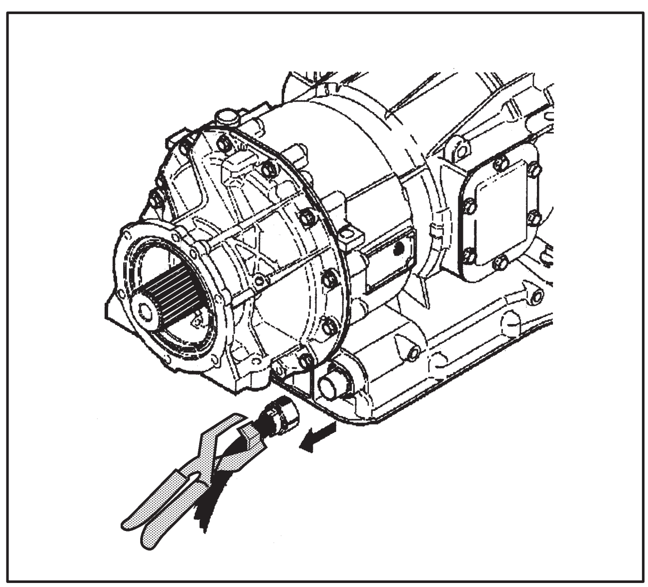


77573004

19. Remove the main electrical connector using the *J 44257*.
20. Disconnect the electrical connectors from the park/neutral position switch.

Notice: When securing the transmission to the jack with a safety chain, be careful not to overlap any wiring, fuel lines, or components that may still be attached to the vehicle.

21. Secure the transmission to the jack with a safety chain wrapped around the transmission.
22. Disconnect the transmission oil cooler lines from the transmission. Refer to *Oil Cooler Line Replacement* in the WCC 2001 Service Manual Supplement.
23. Plug the oil cooler fittings in the transmission case.



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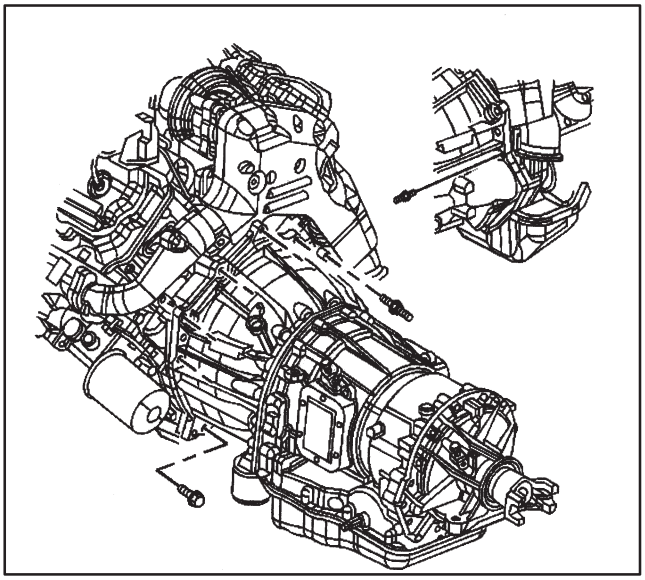
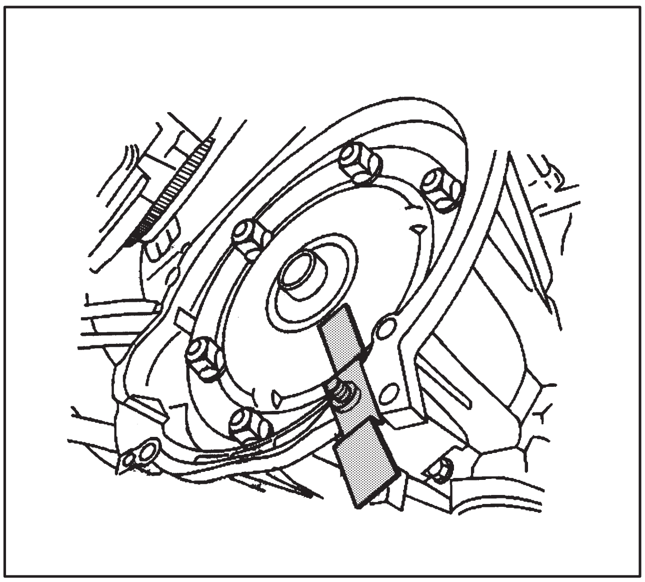


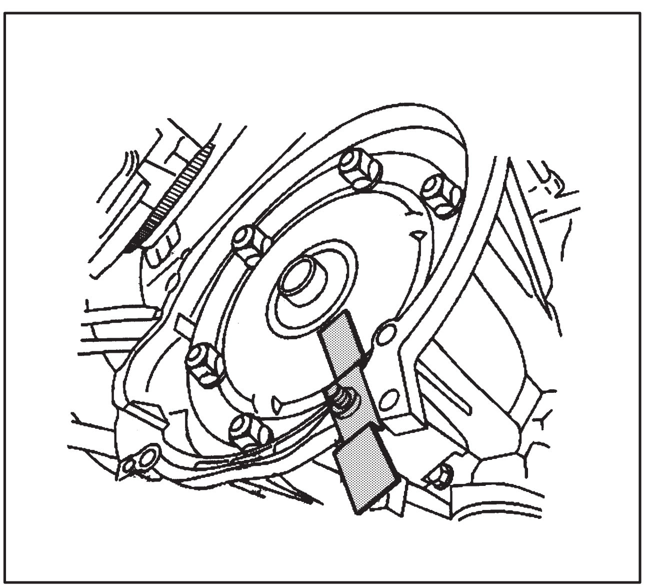
77573006

24. Remove the three studs at the top of the converter housing.
25. Remove the remaining bolts from the converter housing.
26. Separate the transmission from the engine.



77573007

27. Install the *J 21366* to the torque converter housing to keep the torque converter from sliding off of the transmission turbine shaft.
28. Lower the transmission and roll it away from the vehicle.



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Installation Procedure

Important: If the original transmission is being replaced, you will need to transfer the parking brake components and any other components, such as sensors that are not included with the replacement transmission.

1. Raise the transmission into position behind the engine.
2. Remove the *J 21366* from the torque converter housing.

Notice: Do not install the transmission by drawing it to the engine using the studs and bolts. This can cause damage to transmission and engine components.

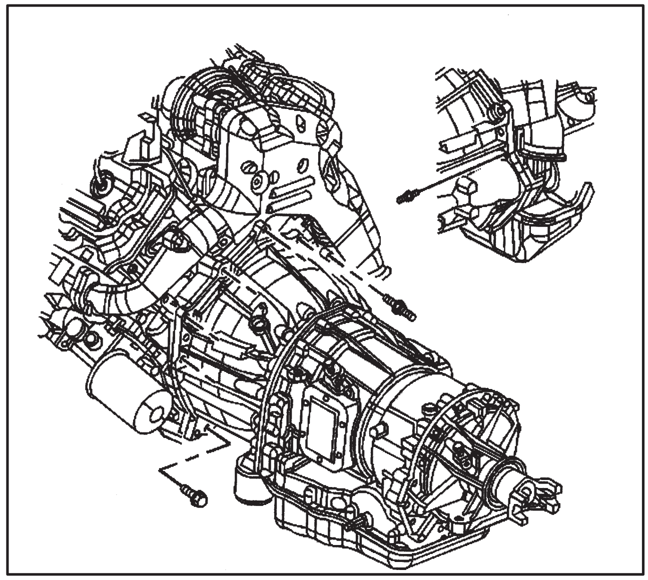
3. Align the transmission using the alignment dowels located at the rear of the engine.
4. Roll the transmission forward until it is flush against the engine.

Notice: Refer to *Fastener Notice* in Cautions and Notices in this supplement.

5. Install the studs and bolts that secure the transmission to the engine.

   Tighten

   Tighten the studs and bolts to 50 N·m (37 lb ft).
6. Remove the safety chain wrapped around the transmission.
7. Connect the electrical connectors to the park/neutral position switch.
8. Connect the main electrical connector.



77573006

9. Connect the wiring harness connectors to the turbine speed sensor (1), the input speed sensor (2), and the output speed sensor (3).

10 Install the parking brake cable bracket and mounting bolt to the transmission.

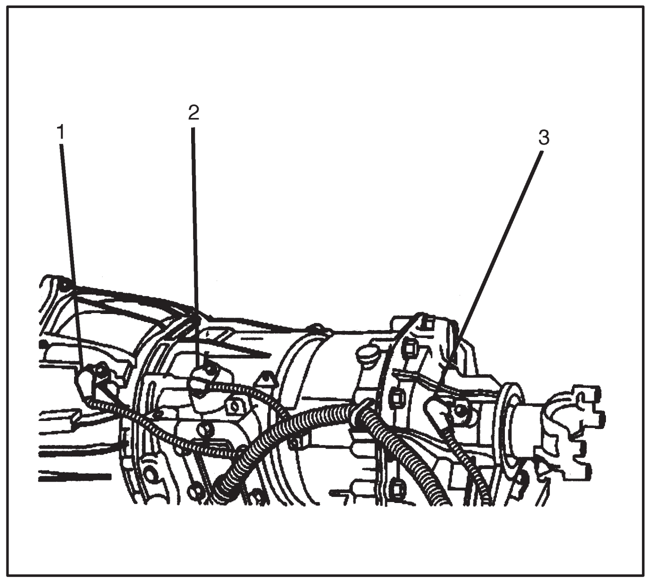
   Tighten

   Park brake cable bracket to case mounting bolt to 34 N·m (25 lb ft).

11. Connect the parking brake cable.
    11.1 Slide the cable housing into the bracket until the lock tangs seat.
    11.2 Install the clevis pin to the parking brake lever and the clevis.
12. Install the shift cable bracket and mounting bolts to the transmission.

    Tighten

    Tighten the shift cable bracket mounting bolts to 25 N·m 18 lb ft
13. Install the shift cable to the transmission. Refer to *Shift Cable Replacement* in the WCC 2001 Service Manual Supplement.



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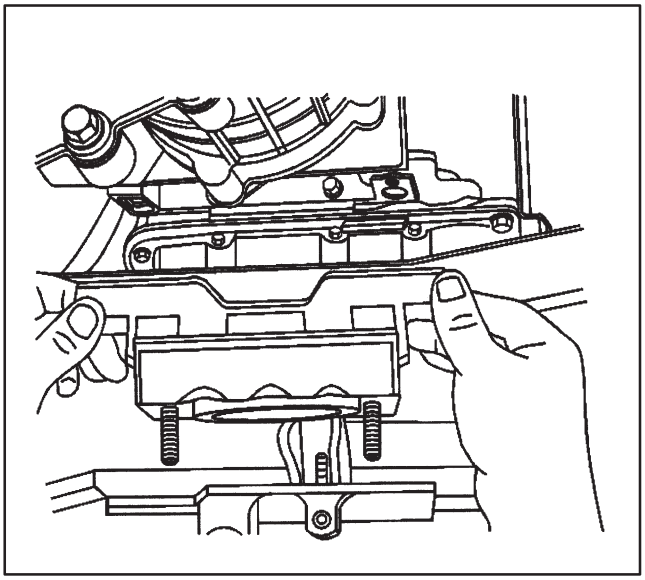
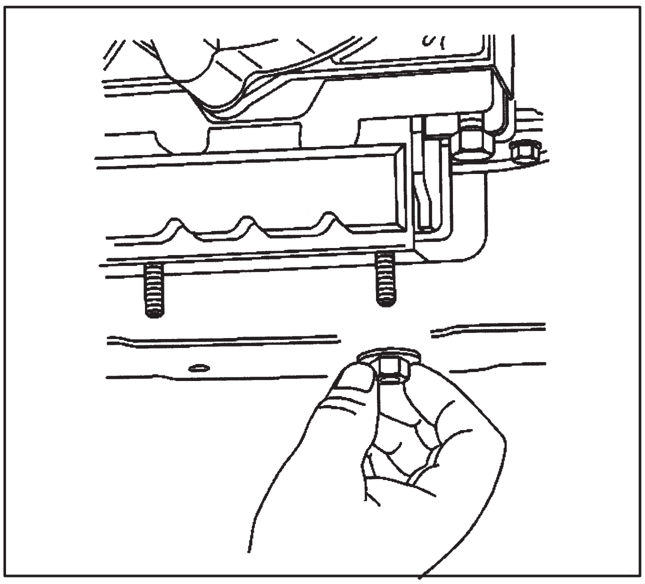


77573003

14. Install the mount to the transmission. Refer to *Transmission Mount Replacement* in this supplement.
15. Install the transmission support to the vehicle.
16. Install the transmission support nuts and bolts.

    Tighten

    Tighten the nuts and bolts to 110 N·m (81 lb ft).
17. Lower the transmission.



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18. Install the two nuts securing the transmission mount to the transmission support.

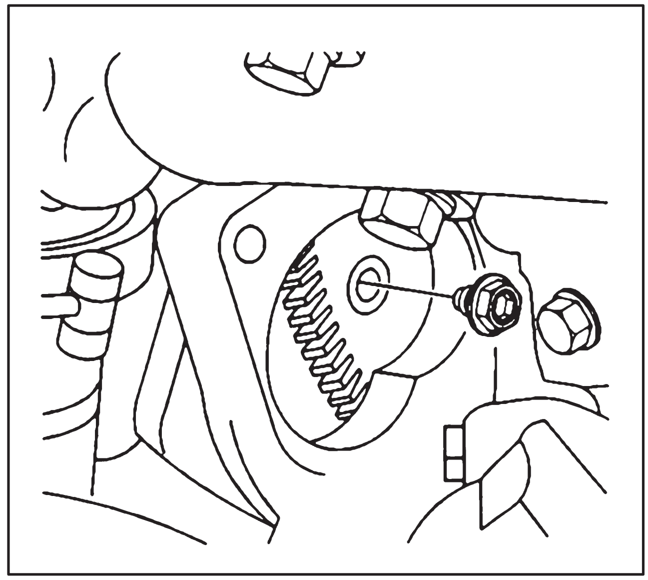
    Tighten

    Tighten the nuts to 45 N·m (33 lb ft).
19. Install the propeller shaft. Refer to *Two Piece Propeller Shaft Replacement* or *Three Piece Propeller Shaft Replacement* in the WCC Service Manual.
20. Remove the jack from the transmission.

21. If necessary, using the front crankshaft bolt, rotate the engine to align the torque converter and the flywheel to the marks made during transmission removal at the starter motor opening.
22. Install the torque converter bolts, using the front crankshaft bolt to rotate the engine to align the bolt holes in the torque converter and the flywheel with the starter motor opening.

    Tighten

    Tighten the bolts to 60 N·m (44 lb ft).
23. Install the starter motor. Refer to *Starter Motor Replacement – 8.1L* in the WCC 2001 Service Manual Supplement or *Starter Motor Replacement – 3.9L* in this supplement.
24. Flush the transmission oil cooler. Refer to *Automatic Transmission Oil Cooler Flushing and Flow Test* in the WCC Service Manual.
25. Unplug the oil cooler fittings in the transmission case.
26. Connect the transmission oil cooler lines to the transmission. Refer to *Oil Cooler Line Replacement* in the WCC 2001 Service Manual Supplement.
27. Lower the vehicle.
28. Install the transmission oil level indicator and oil fill tube.
29. Connect the battery(s). Refer to *Battery Replacement* in the WCC Service Manual.
30. Fill the transmission with new transmission fluid. Refer to *Automatic Transmission Fluid/Filter Replacement* in this supplement.
31. Adjust the park/neutral position switch as necessary. Refer to *Park/Neutral Position Switch Adjustment* in the WCC 2001 Service Manual Supplement.
32. Adjust the shift cable as necessary. Refer to *Shift Cable Adjustment* in the WCC 2001 Service Manual Supplement.



77573001

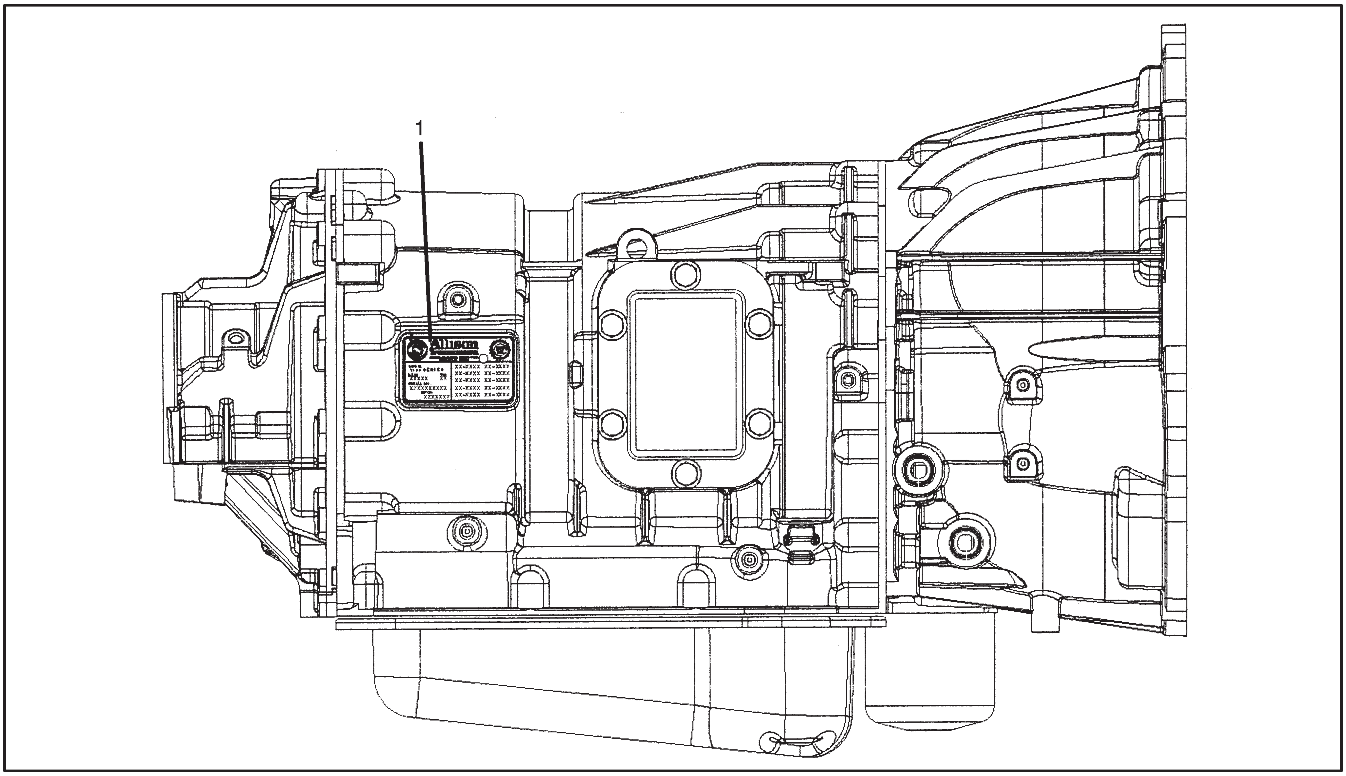
Description and Operation

Transmission General Information

The Allison LCT 1000 (RPO M74), five-speed automatic is a premium transmission that puts the design experience of General Motors within the reach of Workhorse customers requiring large application motorhomes and commercial chassis. Its high torque capacity enables it to handle the torque of the 455 lb ft output of the new Vortec 8.1L gasoline engine as well as the high torque output of the Cummins 3.9L 4BE diesel engine. The premium design provides unparalleled toughness and driveability while towing and hauling heavy loads, strong launch and hill climbing power, and sophisticated downhill speed control. The Allison 1000 Series, offered industry wide, began production in 1999, but is all new for 2001.

Transmission Identification Information

Nameplate Location



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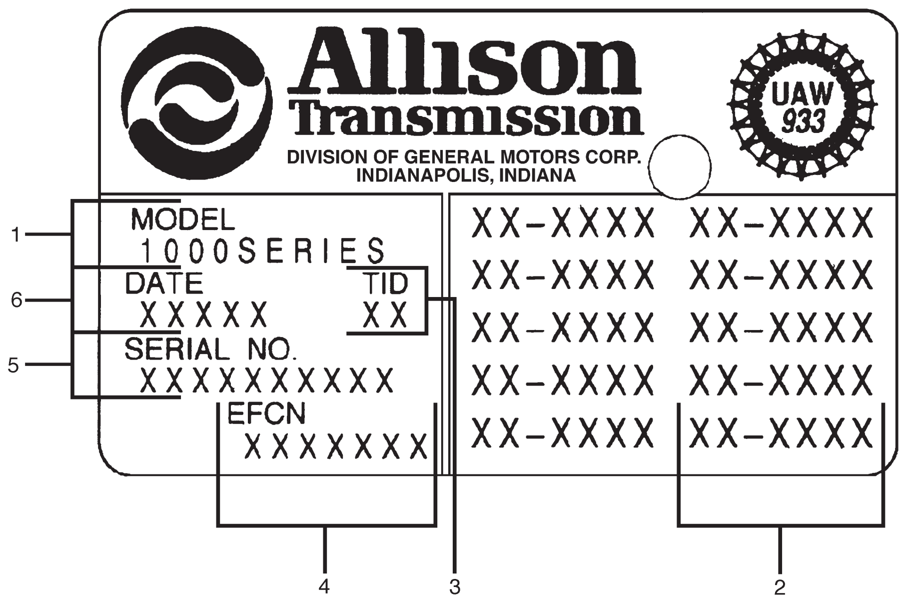
Legend

(1) Nameplate

Nameplate Components



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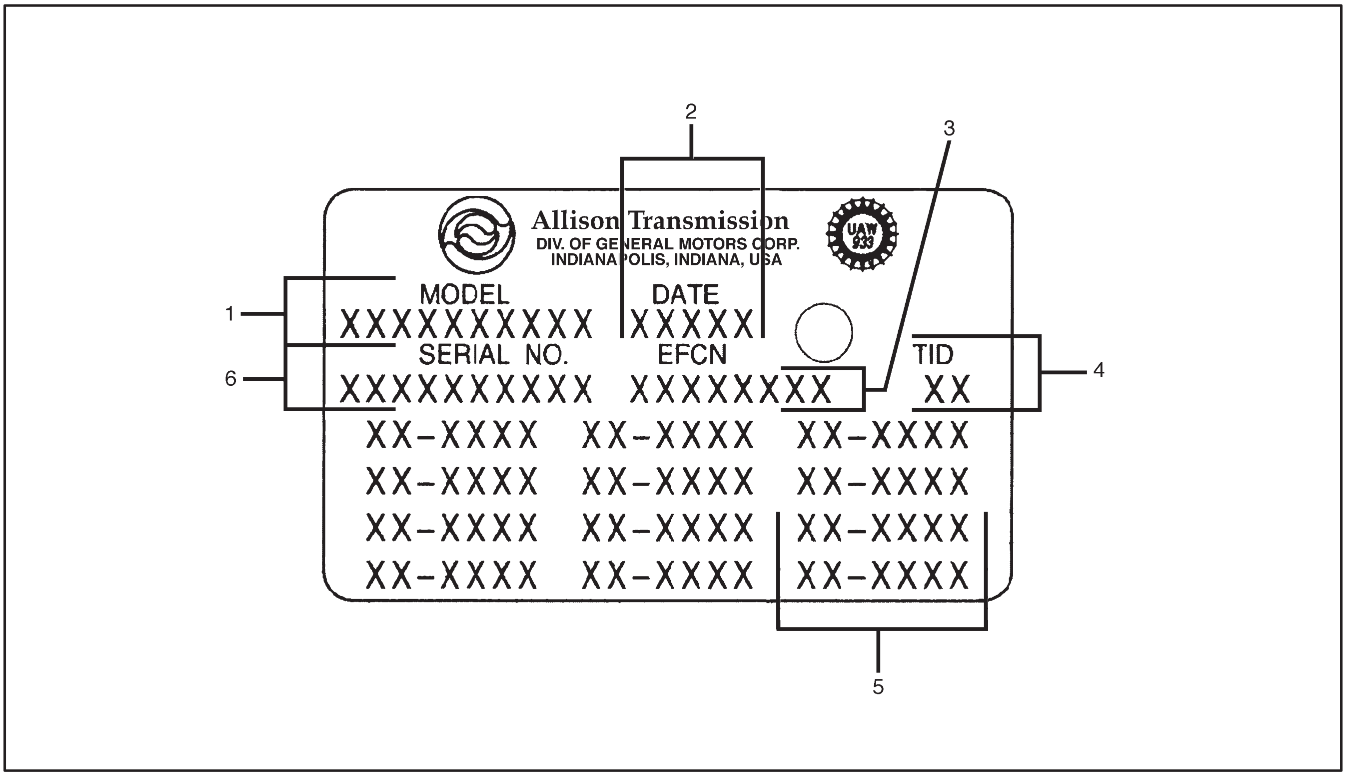
Legend

(1) Model (Series)
(2) Engineering Group Number
(3) Transmission Identification Number
(4) Engineering Feature Configuration Number
(5) Serial Number
(6) Date of Manufacture



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Legend

(1) Model (Series)
(2) Date of Manufacture
(3) Engineering Feature Configuration Number
(4) Transmission Identification Number
(5) Engineering Group Number
(6) Serial Number

Transmission General Description

The Allison LCT 1000 Transmissions are torque converter driven, fully automatic, transmission systems. They have up to five forward speeds, neutral, and reverse. The fifth range has an overdrive ratio for increased fuel economy and reduced engine wear. These transmissions incorporate a variety of standard and optional design features. These design features include:

- Direct mount to engine block
- Flexplate drive
- Torque converter with a torque converter clutch (TCC) and an internal vibration damper
- Three constant-mesh, planetary gear sets with helical cut gears
- Five multiple disk clutches (two rotating and three stationary)
- Common hydraulic system for all transmission functions
- Two transmission fluid filtration systems
- Electro-hydraulic control valve assembly
- Electronically controlled automatic gear selection and clutch apply
- Provision for remote transmission fluid cooler
- Fill tube/dipstick provision on both sides of transmission
- Parking pawl
- Power takeoff (PTO) provision on both sides of transmission
- Variety of output yokes or flanges

Electronic Component Description

Transmission Control Module

A microcomputer controls the transmission by receiving and processing signals from various switches and sensors. The microcomputer determines shift sequences, shift timing, and clutch apply and release characteristics. The microcomputer is an independent controller and is referred to a Transmission Control Module (TCM). TCMs are available in 12V configurations to match the configuration of the vehicle electrical system. The Pressure Switch Manifold (PSM) and Park/Neutral Position (PNP) Switch provide operator input to the TCM. Other data sent to the TCM include throttle position; engine, turbine, and output speeds; and sump temperature. Any active special function, such as anti-lock brakes or power takeoff, is also an input to the TCM. The TCM process these data to determine proper shift points, to monitor the current range, to perform ratio tests, and to compile diagnostic data. The TCM is programmed to protect the transmission and other vehicle driveline components by inhibiting actions such as full throttle neutral-to-range shifts and high-speed direction changes. The TCM determines if a system malfunction exists and stores diagnostic codes related to the malfunction. The codes, accessed by the service mechanic, are used in diagnosing persistent or intermittent trouble in the system.

Throttle Position/Torque Management

The TCM receives input on throttle position/torque management from a signal transmitted by the engine electronic controls. The engine electronic controls communicate directly to the transmission electronic controls over an SAE *J 1850* or *J 1939* Serial Communication Interface (SCI) data link. The transmission TCM must be calibrated to receive these signals.

Speed Sensors

Important: Do not rotate the sensor in its retaining bracket. Changing the sensor/bracket orientation may cause improper operation. There are three speed sensors typically required for use with 1000 series transmissions; the engine speed sensor, the turbine speed sensor, and the output speed sensor. The speed sensors provide rpm information to the TCM. The speed ratios between the various sensors allow the TCM to determine the transmission operating range. Speed sensor information is also used to control the timing of clutch apply pressures, resulting in the best possible shift quality. Hydraulic problems are detected by comparing the speed sensor information stored in the TCM memory. The speed sensors are variable reluctance devices that convert mechanical motion to an AC voltage. Each sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing that is mounted adjacent to a rotating ferrous member.

Shift Selector

The vehicle is equipped with a column-type shift selector. In addition to the column shifter provided for the operator, another component associated with the shift selector is the Park/Neutral Position (PNP) switch mounted on the selector shaft. The PNP switch transmits selector position information to the TCM. The PNP switch mounts directly onto the transmission housing from the outside and detects the angular position of the shift selector shaft. This position is communicated to the TCM so that certain vehicle control functions can be coordinated with the position of the shift controls. The PNP switch has redundant circuitry to alert the TCM in the event of a single wire or switch failure. The neutral signal output of the PNP switch is typically used as confirmation that the transmission is in Neutral before the engine starter is engaged. The PNP switch is interfaced to the starter circuit with weatherproof electrical connectors. The reverse signal provision may be used to activate vehicle back-up lights and/or reverse warning devices. The shift selector and PNP switch are customer supplied.

The operator chooses the transmission range by moving the selector lever to the appropriate gate position. When properly adjusted, the shifter gates prevent inadvertent shifting between ranges, and correspond to the internal transmission detent positions. A positive detent is provided in the transmission to maintain the selector shaft in the selected position.

The TCM shift calibration determines the available forward ranges for each selector position. Although specific ranges vary, typical selector positions for the 1000 series are:

P – Park: Parking pawl is engaged. The transmission is in neutral. This position is not available on all shift selectors. When available, may be used when starting the engine and for stationary operations.

R – Reverse: Selected to move vehicle backward

N – Neutral: May be used when starting the engine and for stationary operations. The TCM disables the starter switch if a range other than N (Neutral) or P (Park) is selected before starting the vehicle.

D – Drive: The highest forward range, used for normal driving. The transmission shifts into first range for starting, and then automatically upshifts through the ranges (as operating conditions permit) until the highest range is attained.

4, (3), 2, 1 – Forward Range: There are four forward range selector positions. The first position after N (Neutral) is D (Drive) where all five forward ranges are available. Another position is first range hold. There are three choices for the next two positions. These choices are 1–4, 1–3, and 1–2 which describe the ranges available in that position. Workhorse Custom Chassis chooses the two positions that best fit the vocation for which the vehicle is intended.

Internal Components

Several components of the LCT 1000's electrical control system are located within the transmission as part of the main control valve body. These components include three types of solenoids for controlling the hydraulic action of the valves, the pressure switch manifold and an internal wiring harness that links the internal components with the TCM.

Solenoids

The LCT 1000's control valve body contains both normally closed (N.C.) and normally open (N.O.) solenoids. A normally closed solenoid remains closed until a signal from the TCM energizes the solenoid. A normally open solenoid remains open until the TCM energizes the solenoid. When a solenoid valve is in the closed position, the valve blocks flow. When a solenoid valve is in the open position, flow is permitted through the valve. The pulse width modulated F and the ON/OFF shift valve solenoids C, D, and E, are normally closed (N.C.). Both solenoid types have an orifice, electrical windings, an iron core, and a steel check ball. The solenoids used in the 1000 Series differ in their ability to control flow or fluid pressure. The solenoids may operate in the open or closed state with no modulation capacity (C, D, and E solenoids), an intermediate flow and resultant pressure based on duty cycle (F solenoid) or produce pressure proportional to current (A and B solenoids).

Shift solenoids C, D, and E provide the necessary logic to distribute fluid to the correct clutches. The shift solenoids provide either full control main pressure or exhaust to the head of each of the corresponding shift valves, C, D, and E. Since the valve states (stroked or unstroked) are critical to providing the correct transmission range, each shift valve has a pressure switch (located in the pressure switch manifold) which provides feedback to the computer as to the valve's position.

Trim solenoids A and B are used to control oncoming, off-going, and holding pressure to the five clutches. These solenoids are referred to as Pressure Proportional to Current (PPC) solenoids since the output hydraulic pressure supplied by these solenoids is proportional to the controlled current command.

Pressure Switch Manifold

The pressure switch manifold (PSM) is a multiple-switch assembly made up of three normally open pressure switches and one normally closed switch.

Normally open switches correspond to shift valves C, D, and E. Fluid pressures are fed from shift valves C, D, and E and the manual selector valve to the switches based on the positions of the valves and shift selector. The shift valve fluid pressures reflect the logic condition at the corresponding solenoids. This logic indicates the current transmission operating range to the TCM.

The three fluid pressure switches corresponding to the shift valves are normally open (contacts not touching) when no fluid pressure is present, so that electrical current is stopped at that switch. When fluid pressure is routed to the switch, it moves the diaphragm and upper contact so that the contact element touches both the positive and the ground contacts. This closes the circuit and allows current to flow from the positive contact through a switch.

The pressure switch corresponding to reverse is normally closed, since fluid pressure is always present unless the selector valve is moved to Reverse. The PSM also contains a temperature sensor thermistor for sump temperature. Changes in sump fluid temperature are indicated by changes in sensor resistance (for example, increasing temperature causes decreased sensor resistance). The resistance value is then relayed to the TCM as an input for shift control.

Internal Wiring Harness

The internal wiring harness has connectors for the shift solenoids C, D, and E. Connectors go to clutch trim solenoids A and B. A connector goes to the torque converter clutch solenoid (F). There is also a connector for the pressure switch manifold. All of these connectors go to the main electrical connector. The transmission main electrical connector transports signals from these connectors to the TCM via the external harness.

Special Tools and Equipment

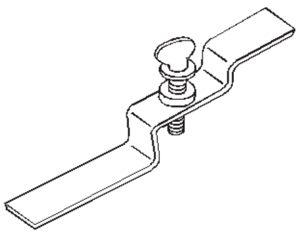
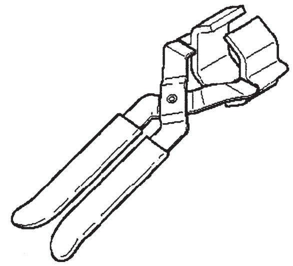
Illustration	Tool Number/ Description
 9253	J 21366 Torque Converter Retaining Strap

Illustration	Tool Number/ Description
 665967	J 44257 Main Wiring Harness Connector Remover

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Transmission Unit Repair Manual

This manual provides information on the unit repair procedures, adjustments, and specifications for the 4L80-E automatic transmission and the NV4500 manual transmission.

For diagnosis, refer to the Workhorse Custom Chassis Motorhome/Commercial Chassis Service Manual

The technicians who understand the material in this manual and in the appropriate service bulletins can better serve the vehicle owners.

When this manual refers to a brand name, a number, or a specific tool, you may use an equivalent product in place of the recommended item. All information, illustrations, and specifications in this manual are based on the latest product information available at the time of publication approval. Workhorse Custom Chassis reserves the right to make changes at any time without notice.

Published by
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940 South State Route 32
Union City, IN 47390

The information cutoff date is 10/15/98.
LITHO IN U.S.A.

Table of Contents

Automatic Transmission 4L80-E

Manual Transmission NV4500

Automatic Transmission - 4L80-E

Specifications

Fastener Tightening Specifications (Overhaul)

Application	Specification	
	Metric	English
Accumulator Housing to Valve Body	11 N·m	97 lb in
Case Center Support	44 N·m	32 lb ft
Control Valve Assembly to Case	11 N·m	97 lb in
Cooler Pipe Connector Nut at Case and Radiator	38 N·m	28 lb ft
Engine Rear Mount to Transmission Bolt	44 N·m	32 lb ft
Engine Rear Support Bracket to Frame Nut	44 N·m	32 lb ft
Extension Housing to Case	34 N·m	25 lb ft
Flywheel Housing Cover to Transmission	7 N·m	62 lb in
Flywheel to Converter	44 N·m	32 lb ft
Fourth Clutch	23 N·m	17 lb ft
Manual Shaft to Detent Lever Nut	24 N·m	18 lb ft
Oil Pan Drain Plug	34 N·m	25 lb ft
Oil Pan to Case	24 N·m	18 lb ft
Oil Test Hole Plug	11 N·m	97 lb in
Parking Pawl Bracket to Case	24 N·m	18 lb ft
Pressure Control Solenoid Bracket to Valve Body	8 N·m	71 lb in
Pump Assembly to Case	24 N·m	18 lb ft
Pump Body to Cover	24 N·m	18 lb ft
Rear Servo Cover to Case	24 N·m	18 lb ft
Solenoid to Valve Body	8 N·m	71 lb in
Speed Sensor and Bracket Assembly to Case	11 N·m	97 lb in
Transmission Case to Engine	44 N·m	32 lb ft
Valve Body to Case/Lube Pipe	11 N·m	97 lb in
Valve Body to Case/PSM	11 N·m	97 lb in

Fluid Capacity Specifications (Overhaul)

	Liters	Quarts
	(approximate)	
Dry	12.8	13.5
Oil Pan Removal	7.3	7.7

End Play Specifications

Specification	Thickness (mm)	Thickness (in)
Front End Play	0.102–0.559	0.004–0.022
Rear End Play	0.127–0.635	0.005–0.025
Output Carrier Pinion Gear End Play	0.228–0.610	0.009–0.024
Reaction Drum and Carrier Assembly Pinion Gear End Play	0.228–0.610	0.009–0.024
Overdrive Carrier Pinion Gear End Play	0.2032–0.6350	0.008–0.025
Torque Converter End Play	0.0–0.6	0.0–0.024

Overrun Clutch Housing Selective Thrust Washer Specifications

Stripe	Thickness (mm)	Thickness (in)
Blue	1.448–1.549	0.057–0.061
Red	1.854–1.956	0.073–0.077
Brown	2.261–2.362	0.089–0.093
Green	2.667–2.769	0.105–0.109
Plain	3.073–3.175	0.121–0.125

Output Shaft Selective Thrust Washer Specifications

Identification Notch	Numeral	Thickness (mm)	Thickness (in)
None	1	1.880–1.981	0.074–0.078
On the side of 1 tab	2	2.083–2.184	0.082–0.086
On the side of 2 tabs	3	2.286–2.388	0.090–0.094
On the end of 1 tab	4	2.489–2.591	0.098–0.102
On the end of 2 tabs	5	2.692–2.794	0.106–0.110
On the end of 3 tabs	6	2.896–2.997	0.114–0.118

Oil Pump Specifications

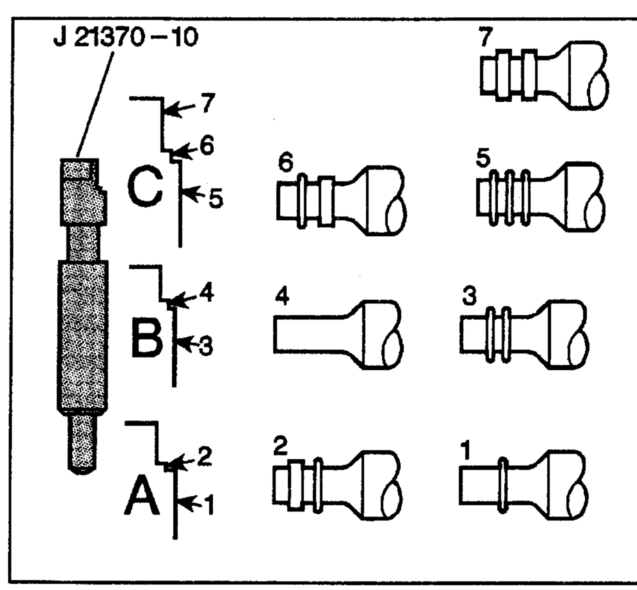
	Length (mm)	Length (in)
Oil Pump Gear Clearance	0.017–0.071	0.0008–0.0028

Transmission General Specifications

	Length (mm)	Length (in)
Direct Clutch Piston Travel Specification	1.27–4.369	0.050–0.172
Intermediate Clutch Piston Travel Specification	1.02–2.72	0.040–0.107
Forward Clutch Piston Travel Specification	1.27–4.369	0.050–0.172
Overrun Clutch Piston Travel Specification	0.838–2.38	0.033–0.094
Fourth Clutch Piston Travel Specification	1.016–2.540	0.040–0.100

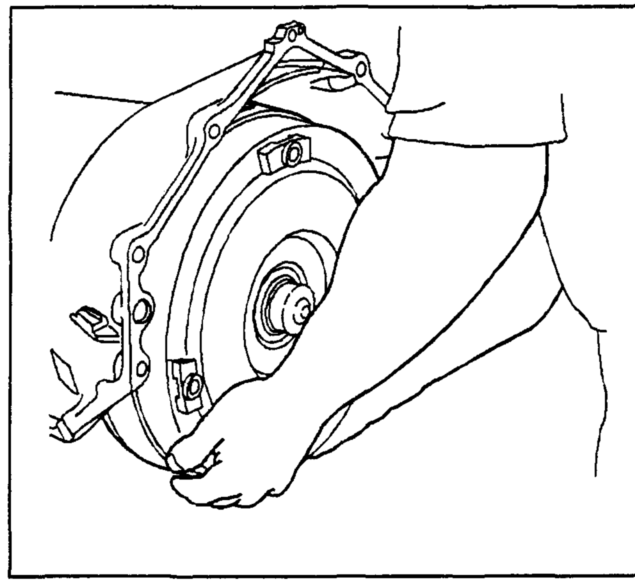
Low and Reverse Band Servo Pin Specification

Refer to the low and reverse band servo pin selection chart in order to determine the correct low and reverse band servo pin length to use. A, B and C on the chart refer to markings on the *J 21370-10* Band Apply Pin Gauge. Numbers 1–7 match the correct pin length to the *J 21370-10* land indicated by the low and reverse band servo pin check procedure.



Repair Instructions

Torque Converter Removal



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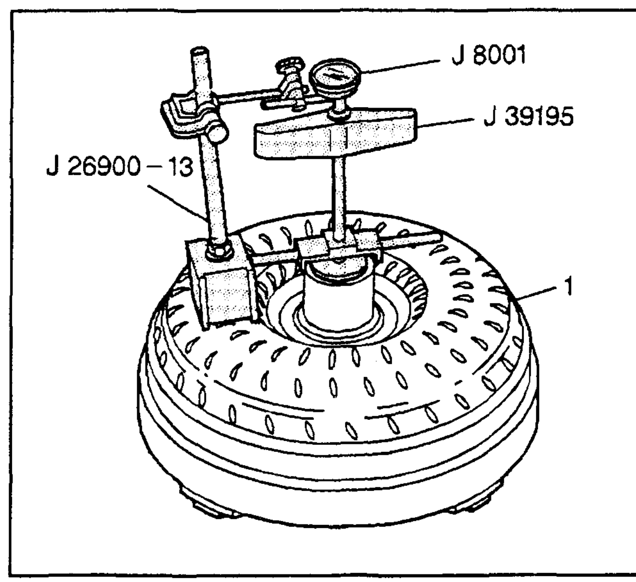
1. Remove the transmission torque converter assembly.
2. Inspect the torque converter assembly for the following:
   - Evidence of damage
   - Metal particles found after flushing the oil cooler and the cooler lines
   - External leaks in the hub weld area
   - Inspect the torque converter pilot for the following:
     - Damage
     - Poor fit into the crankshaft
     - scoring
   - Internal failure of the stator
   - Contamination from the engine coolant
   - Excessive end play

Torque Converter End Play Check



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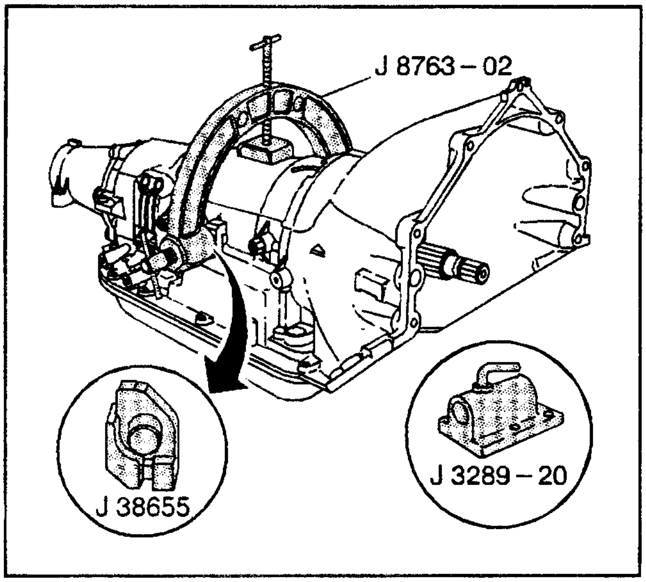
Tools Required

- *J 26900-13* Magnetic Indicator Base
- *J 8001* Dial Indicator Set
- *J 39195* Converter End Play Check Tool

1. Place the *J 39195* base into the torque converter assembly. The *J 39195* will bottom itself on the face of the stator.
2. Insert the T-handle forcing screw of the *J 39195* into the base and hand tighten.
3. Using the *J 26900-13*, position the *J 8001* so that the dial indicator tip is in the center of the *J 39195* T-handle.
4. Push down on the *J 39195* handles to bottom the stator.
5. Preload the *J 8001*.
6. Set the dial indicator to zero.
7. Pull up on the *J 39195* handles.
8. Inspect the reading on the dial indicator. The total end play should be 0.0–0.6 mm (0.0–0.024 in).
9. Repeat this procedure several times in order to get an accurate measurement.
10. Remove the tools.



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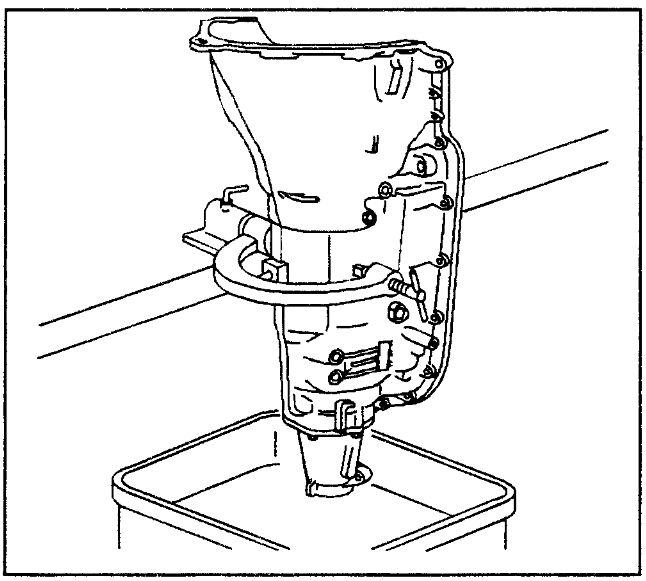
Transmission Holding Fixture Installation

Tools Required

- *J 3289-20* Holding Fixture Base Assembly
- *J 8763-02* Holding Fixture
- *J 38655* Holding Fixture Adapter

1. Install the *J 8763-02* and the *J 38655* onto the transmission assembly.
2. Install the transmission assembly and the *J 8763-02* into the *J 3289-20*.
3. Lock the *J 8763-02* in place with the locking pin.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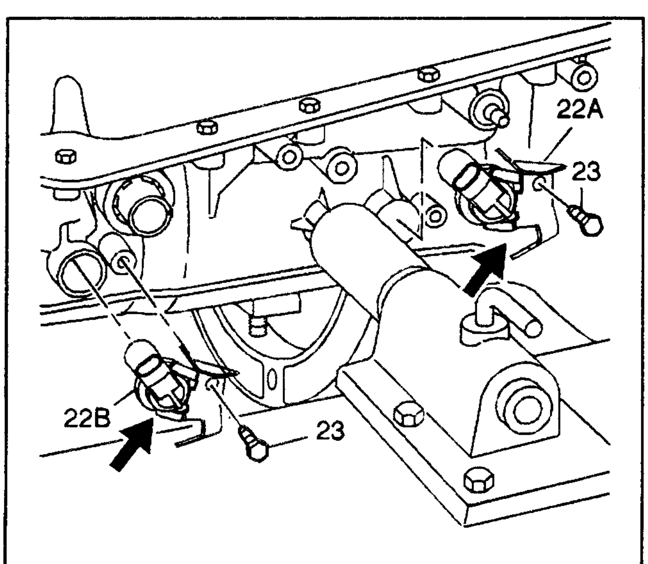
Draining Transmission Fluid

1. Place a suitable fluid collection pan under the transmission assembly.
2. Slowly rotate the transmission so that the input shaft is up, to drain the transmission fluid out of the case extension.
3. Remove the collection pan and properly dispose of the transmission fluid.



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Speed Sensors Removal

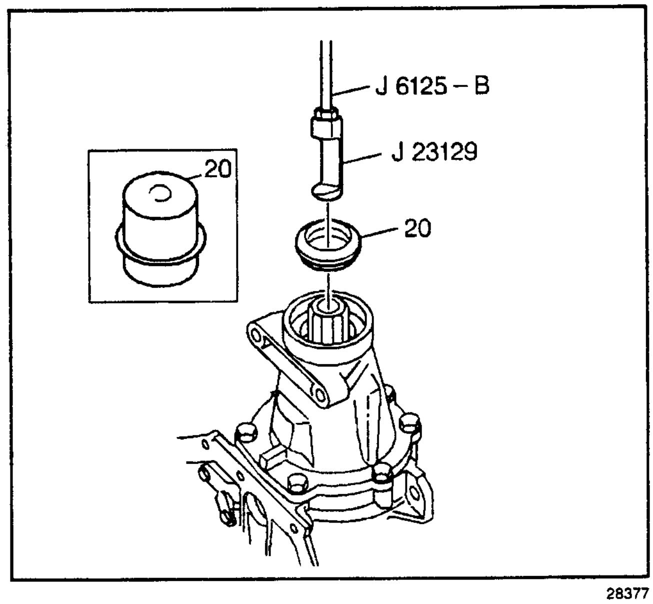
1. Remove the input speed sensor bolt (23).
2. Remove the input speed sensor (22A).
3. Remove the output speed sensor bolt (23).
4. Remove the output speed sensor (22B), (output speed sensor plug on 4WD model).
5. Inspect the speed sensors for damage.

Case Extension Assembly Removal

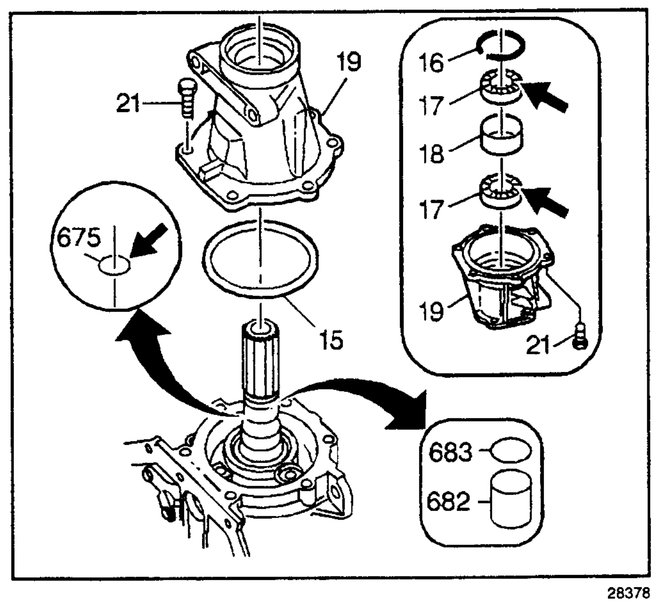
Tools Required

- *J 23129* Universal Seal Remover
- *J 6125-1B* Slide Hammer

1. Remove the prop shaft front slip yoke seal assembly (20) (model dependent) with the *J 23129* and the *J 6125-1B*.



2. Remove the case extension bolts (21).
3. Remove the case extension assembly (19).
4. Remove the case extension seal (15).
5. Inspect the following parts for damage and wear:
   - The output shaft seal (675) (for some models)
   - The transmission output shaft yoke seal (682) and output shaft seal (683) (for some models)
   - The case extension ball bearing assembly (17) (for some models)
   - The bushing for damage and wear

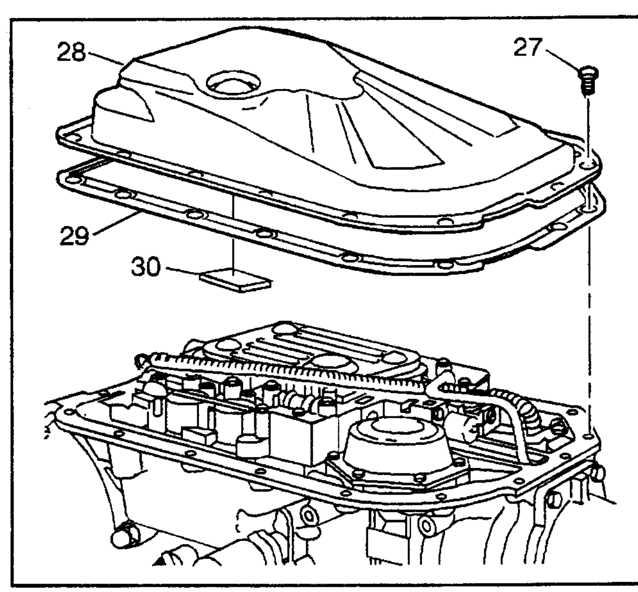


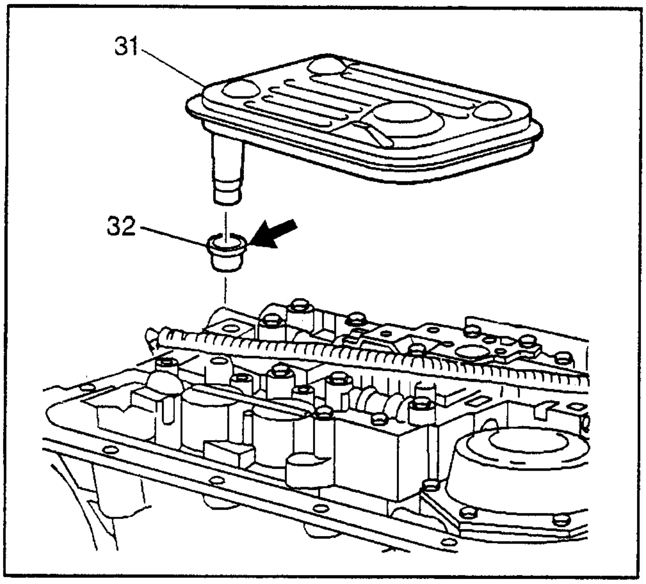
Transmission Oil Pan Removal

1. Remove the transmission oil pan bolts (27).
2. Remove the transmission oil pan (28).
3. Inspect the transmission oil pan (28) for damage or contact with the oil filter.

Important: The transmission oil pan gasket (29) is reusable.

4. Remove the transmission oil pan gasket (29).





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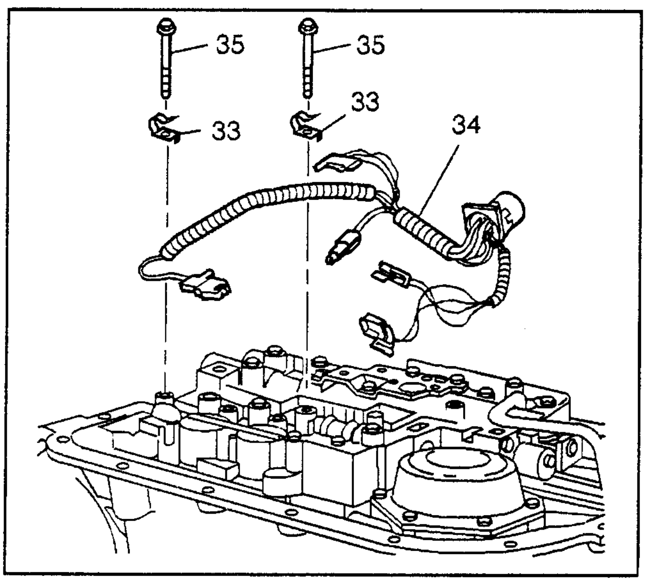
Oil Filter Assembly Removal

1. Remove the transmission oil filter assembly (31).
2. Inspect the filter seal (32) for damage.
3. Remove the filter seal (32) from the case, if necessary.



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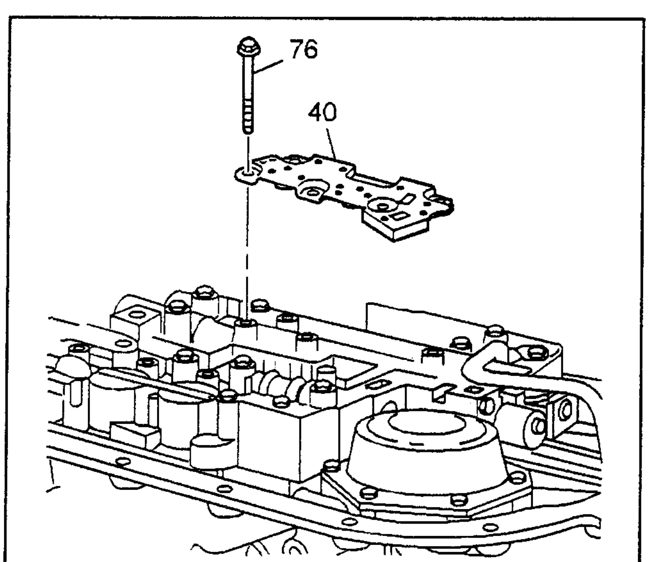
Transmission Wire Harness Removal

1. Disconnect the wire harness connectors from the electrical components.
2. Remove the transmission wiring harness assembly (34) from the wiring harness clamps (33).

Important: If the transmission wiring harness assembly (34) does not need servicing, do not remove the assembly from the case. Excessive force may damage the pass through connector.

3. Remove the transmission wiring harness assembly (34) from the case. Use a 1-5/16 inch 12 point socket in order to release the pass through connector retaining clips from the case.



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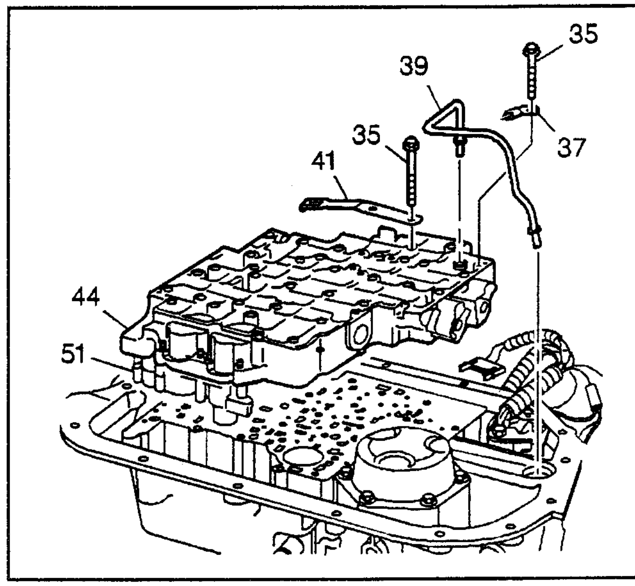
Control Valve Body Assembly Removal

1. Remove the transmission fluid pressure manual valve position switch (TFP manual valve position switch) bolts (76) and the TFP manual valve position switch (40).

2. Remove the control valve body assembly bolts (35).
3. Remove the manual shift shaft detent spring assembly (41).
4. Remove the control valve body assembly bolt (35) and the lube oil pipe retainer (37).
5. Remove the lube oil pipe (39).
6. Remove the control valve assembly (44) including the following:
   - The 3rd and 4th clutch accumulator housing assembly (51)
   - The control valve body gasket
   - The control valve body spacer plate
   - The accumulator housing gasket



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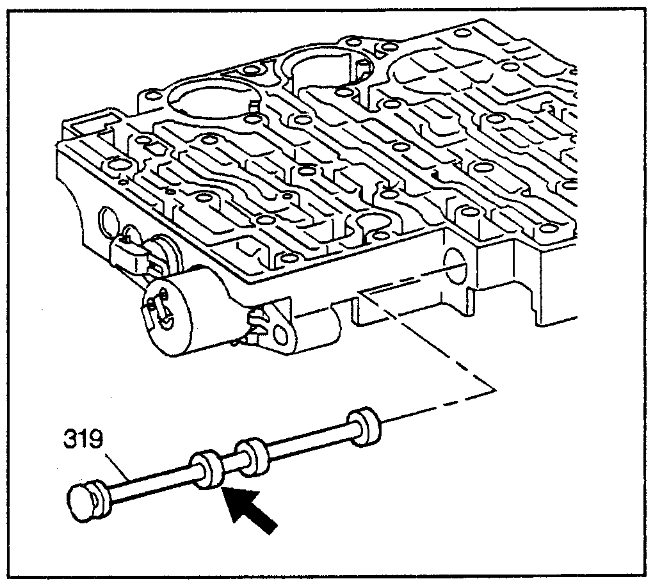
7. Remove the manual valve (319) from the control valve assembly to prevent any damage.
8. Inspect the manual valve (319) for nicks and burrs.



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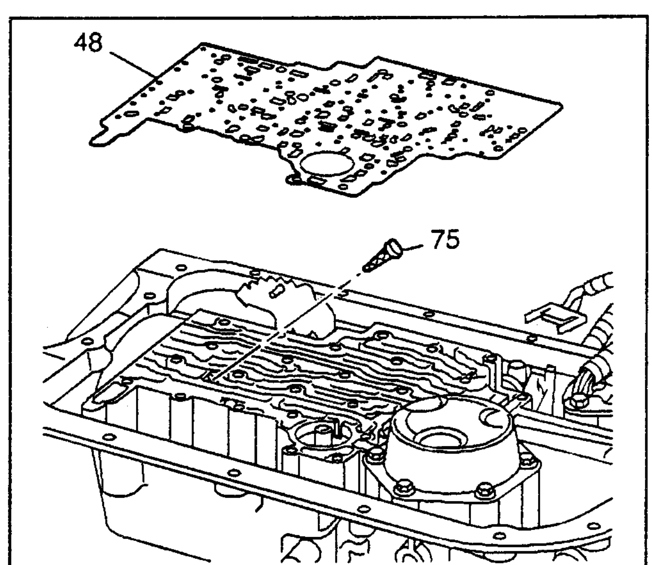
9. Remove the control valve body spacer plate gasket (48) from the case. The gasket may stick to the spacer plate.
10. Remove the TCC solenoid valve screen (75) from the case passages.
11. Inspect the TCC solenoid valve screen (75) for debris and damage.



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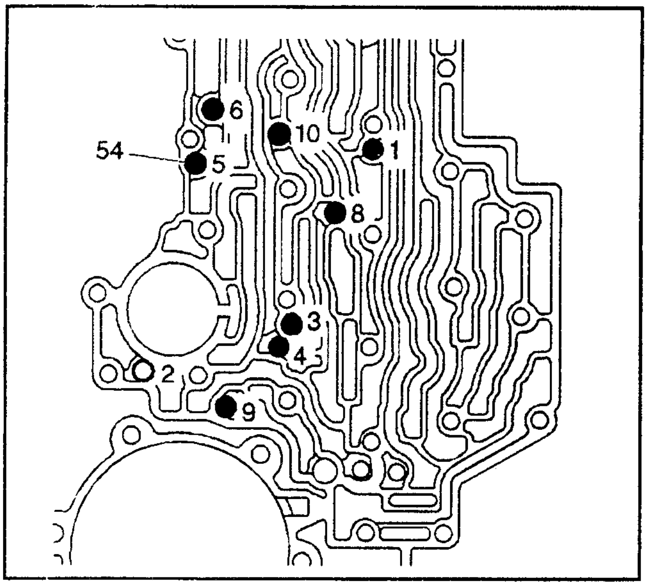

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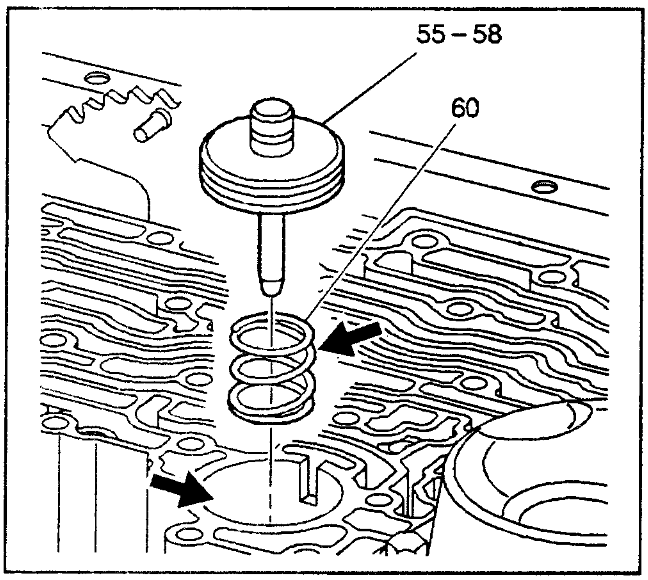
Important: Do not use a magnet in order to remove the control valve body ball check valves. This may magnetize the control valve body ball check valves, causing metal particles to stick to them.

12. Remove the eight control valve body ball check valves (54) (nine control valve body ball check valves for some models).



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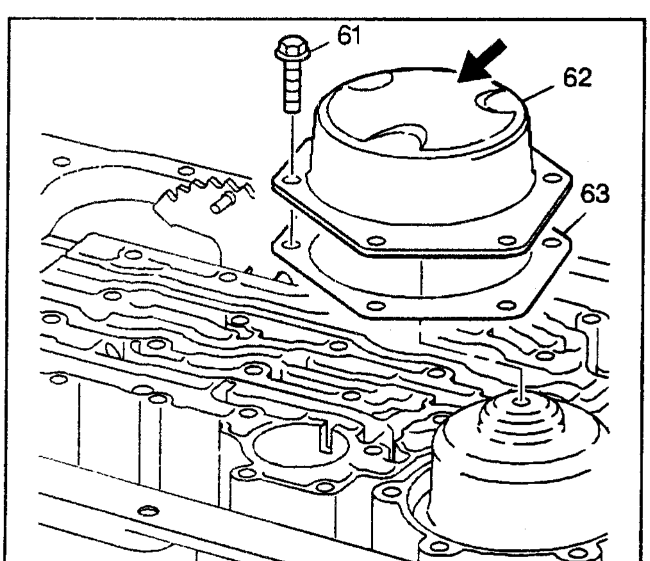
Manual 2-1 Band Servo Assembly Removal

1. Remove the manual 2-1 band servo assembly (55–58).
2. Remove the servo piston cushion spring (60).
3. Inspect the servo piston cushion spring (60) for distortion.
4. Inspect the servo piston case bore for wear and scoring.



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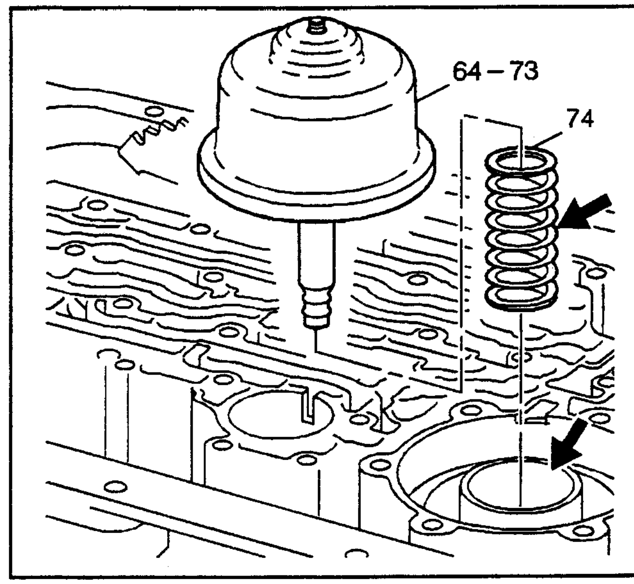
Low and Reverse Band Servo Assembly Removal

1. Remove the low and reverse band servo cover bolts (61).
2. Remove the low and reverse band servo cover (62).
3. Remove the low and reverse band servo cover gasket (63).
4. Inspect the low and reverse band servo cover (62) for damage.

5. Remove the low and reverse band servo assembly (64–73).
6. Remove the low and reverse accumulator piston spring (74) from the transmission case.
7. Inspect the low and reverse band servo transmission case bore for wear and scoring.
8. Inspect the low and reverse accumulator piston spring (74) for distortion.



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Low and Reverse Band Servo Pin Check

Tools Required

- *J 21370-10* Band Apply Pin Gage
- *J 38737* Band Apply Pin Checking Tool

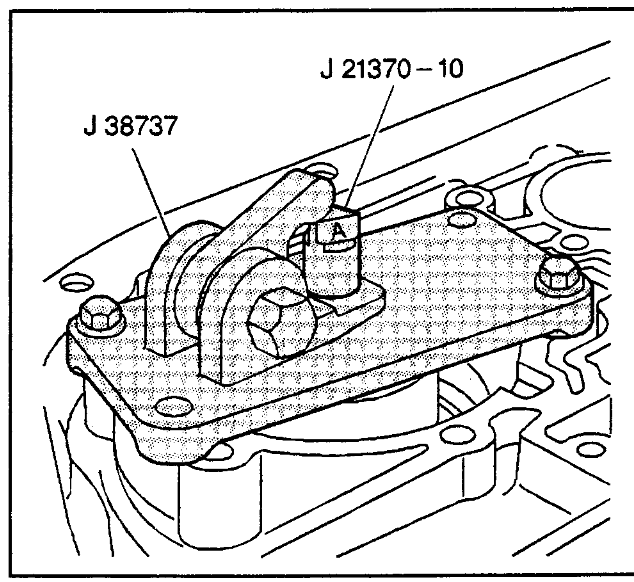
1. Install the *J 21370-10* into the low and reverse band servo pin bore.
2. Position the *J 38737* over the low and reverse band servo bore with the hex hub facing the parking pawl linkage.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

3. Fasten the *J 38737* to the case with two low and reverse band servo cover bolts.

   Tighten

   Tighten the bolts to 24 N·m (18 lb ft).
4. Verify that the *J 21370-10* moves freely in the *J 38737* and in the low and reverse band servo pin bore.
5. In order to determine the correct low and reverse band servo pin length, apply 34 N·m (25 lb ft) of torque to the hex hub of the *J 38737*.
6. Observe the lands on the *J 21370-10* in order to see which land is even with the top edge of the *J 38737* and note the letter (A, B or C) stamped on the *J 21370-10*.
7. Refer to the Low and Reverse Band Servo Pin Specification chart, in the *Transmission General Specifications*, in order to determine the correct low and reverse band servo pin length to use.



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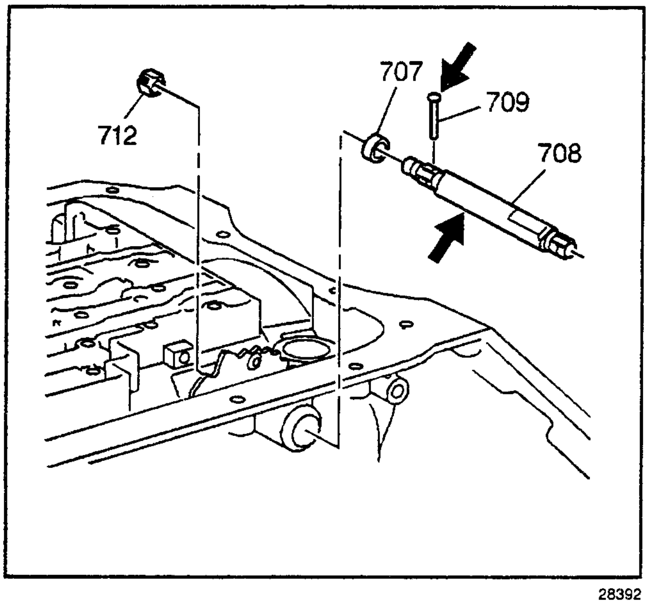
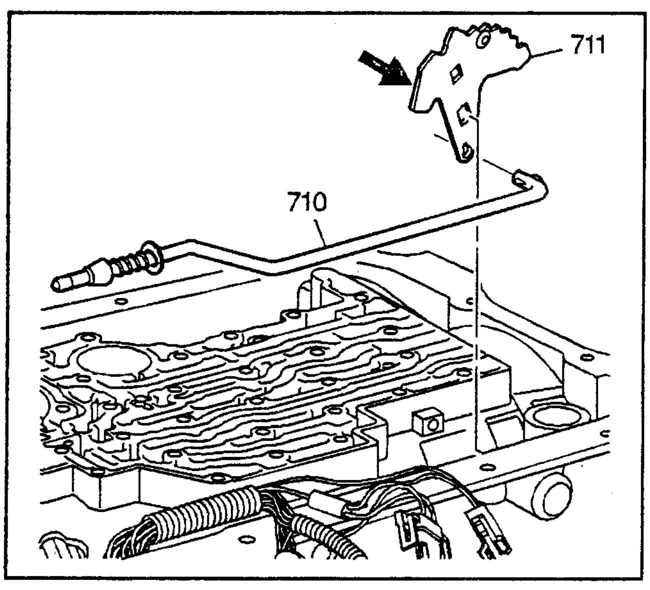


Manual Shift Shaft Removal

Important: Do not pry against the case passage wall while you remove the retaining pin.

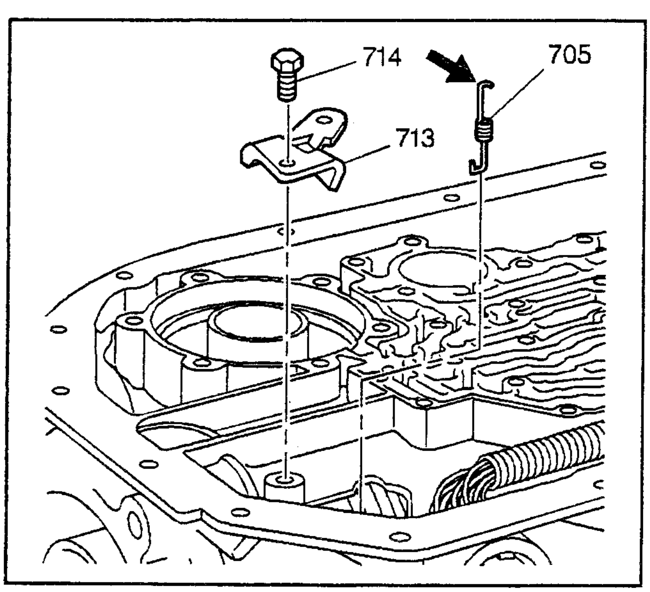
1. Remove the manual shift shaft pin (709).
2. Remove the manual shift shaft detent lever nut (712).
3. Remove the manual shift shaft (708).
4. Remove the manual shift shaft seal (707).
5. Inspect the manual shift shaft for the following conditions:
   - Damaged flats or threads
   - Burrs
   - Wear
6. Inspect the manual shift shaft pin for tightness.



Parking System Components Removal

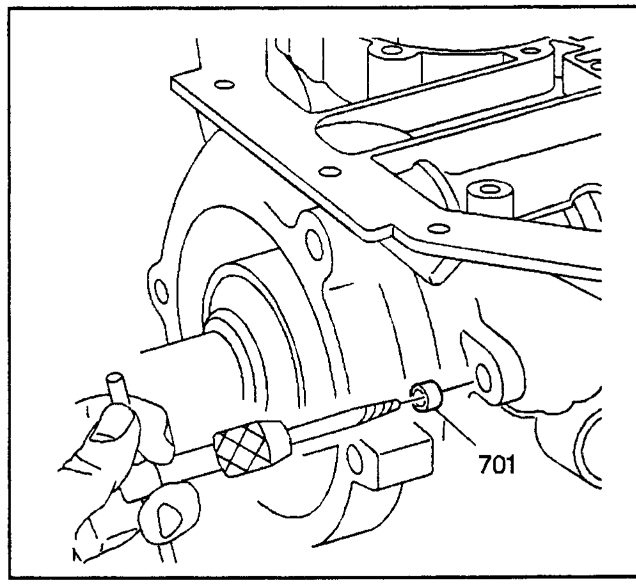
Important: Do not apply excessive force, prying or hammering to any of the parking mechanism parts. This could cause the parking system to fail.

1. Remove the manual shift shaft detent lever (711) and the parking pawl actuator assembly (710).
2. Inspect the manual shift shaft detent lever and the parking pawl actuator assembly for cracks, burrs or damage.



3. Remove the parking pawl actuator bracket (713) and bolts (714).
4. Inspect the parking pawl actuator bracket (713) for cracks, burrs or damage.
5. Remove the parking pawl spring (705).
6. Inspect the parking pawl spring (705) for distortion or damage.

7. Remove the parking pawl shaft hole plug (701) from the transmission case using a screw extractor.



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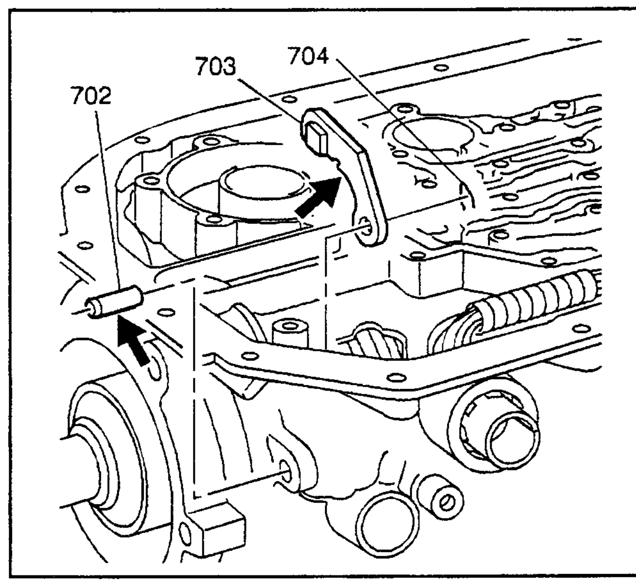
8. Remove the parking pawl shaft retainer (704).
9. Remove the parking pawl shaft (702).

Important: Do not damage the parking pawl shaft case bore or a fluid leak may occur at the hole plug.

10. Remove the parking pawl (703) from the transmission case.
11. Inspect the parking pawl (703) for cracks, burrs or damage.
12. Inspect the parking pawl shaft (702) for damage and proper fit.



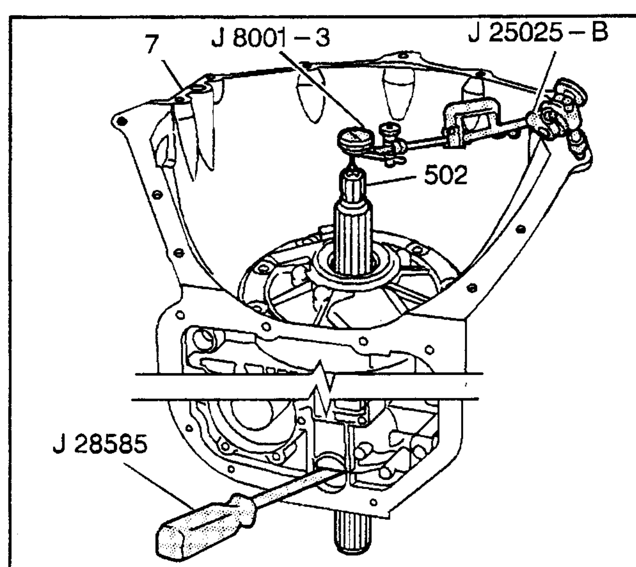
28396

Front End Play Check

Tools Required

- *J 8001-3* Dial Indicator
- *J 25025-B* Guide Pin Set
- *J 28585* Snap Ring Remover

1. Assemble the *J 25025-B* by attaching the threaded rod and the dial indicator holder to one of the bolt holes on the transmission case.
2. Assemble the *J 8001-3* onto the dial indicator holder. Index the *J 8001-3* to the end of the turbine shaft (502).
3. Eliminate any slack by pressing down on the turbine shaft (502).
4. Apply upward pressure on the output carrier with the *J 28585*, until feel free play in retainer ring is "taken up".
5. Set the *J 8001-3* to 0.



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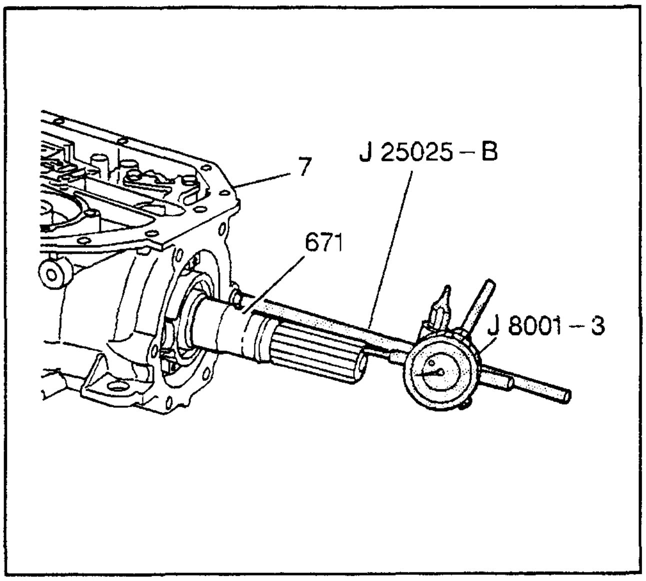
6. Pull up on the turbine shaft (502) while holding up the output carrier with the *J 28585*. The correct end play is between 0.102–0.559 mm (0.004–0.022 in).
7. Record this measurement for future reference.
8. Remove the tools.



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Rear Unit End Play Check

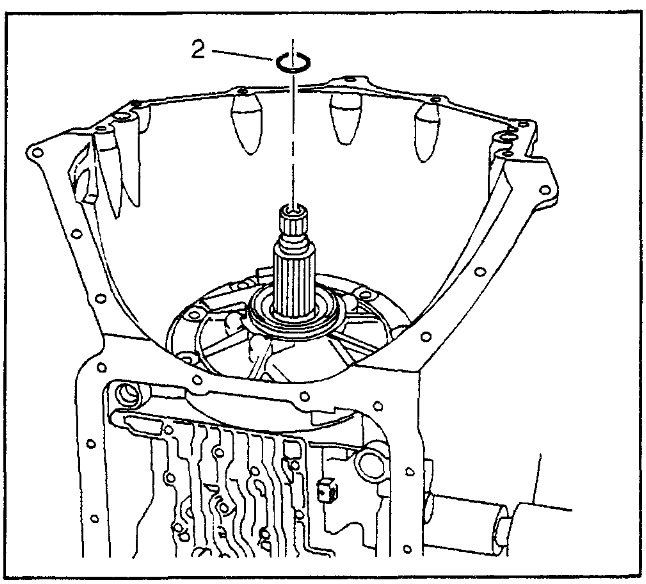
Tools Required

- *J 8001-3* Dial Indicator
- *J 25025-B* Guide Pin Set

1. Assemble the *J 25025-B* by attaching the threaded rod and the dial indicator holder to one of the case extension bolt holes on the transmission case.
2. Push the output shaft (671) in to take up any slack.
3. Assemble the *J 8001-3* onto the dial indicator holder. Index the *J 8001-3* to the end of the output shaft (671).
4. Set the *J 8001-3* to 0.
5. Move the output shaft (671) in and out, noting the amount of end play. The correct end play is between 0.127–0.635 mm (0.005–0.025 in).

Important: During reassembly, the rear unit end play check must be repeated to verify the accuracy of the selective washer.

6. Record this measurement for future reference.
7. Remove the tools from the transmission.



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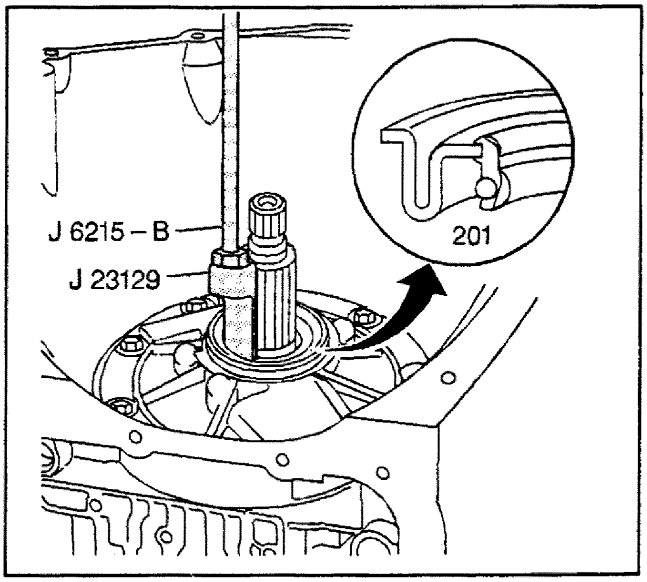
Pump Assembly Removal

Tools Required

- *J 23129* Universal Seal Remover
- *J 6125-1B* Slide Hammer
- *J 37789-A* Oil Pump Remover/Installer

1. Remove the turbine shaft front oil seal ring (2).

2. Remove the torque converter oil seal assembly (201) using the *J 23129* and the *J 6125-1B*.



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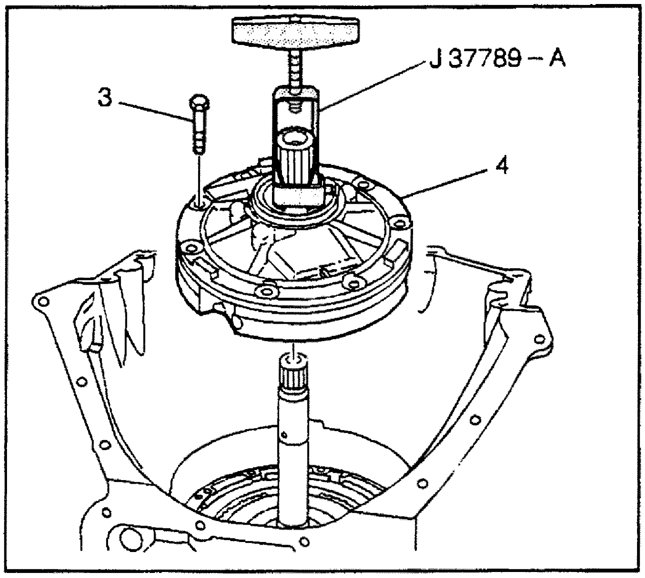
3. Remove the seven oil pump bolt and seal assemblies (3).
4. Attach the *J 37789-A* to the oil pump shaft. Tighten the thumb screw.
5. Turn the handle of the *J 37789-A* down onto the turbine shaft in order to raise the oil pump assembly (4) out of the case.
6. Remove the oil pump assembly (4).
7. Remove the *J 37789-A*.



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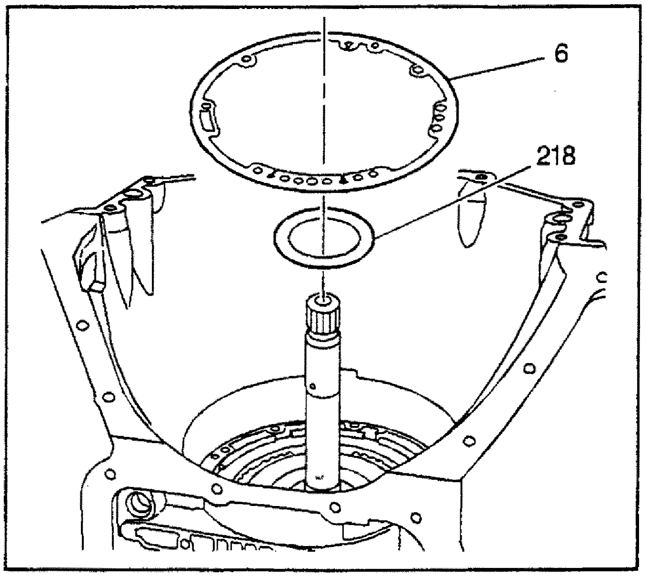
8. Remove the transmission oil pump gasket (6).

Important: The selective thrust washer (218) may be stuck to the pump cover.

9. Remove the selective thrust washer (218).



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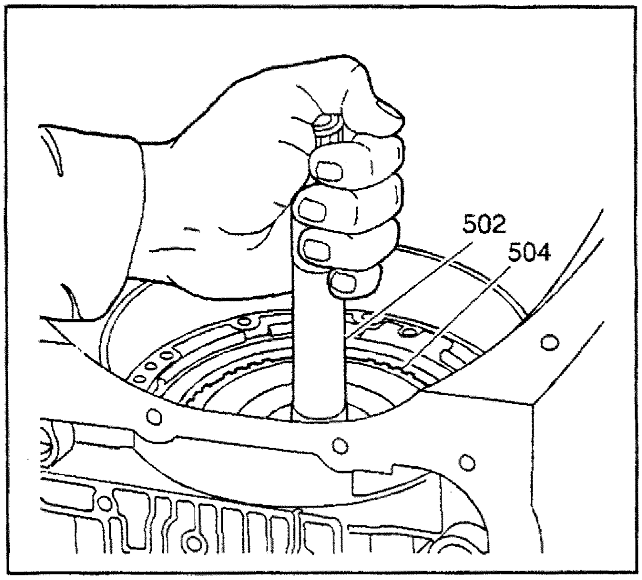

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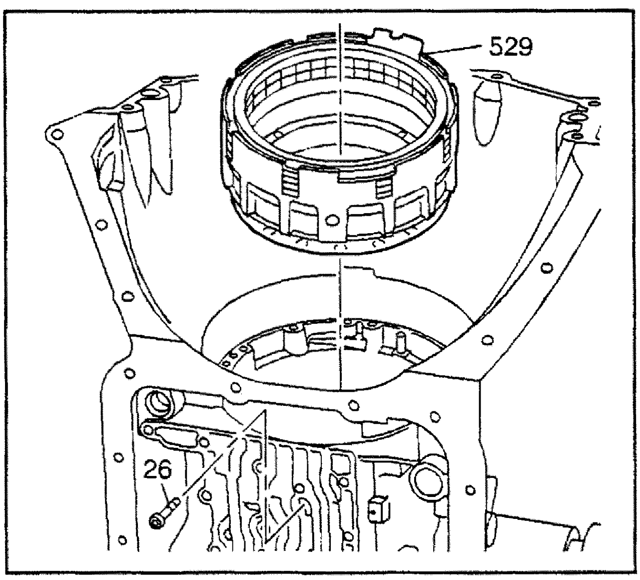
Overdrive Assembly Removal

Remove the overdrive unit assembly (504) by grasping the turbine shaft (502) and lifting.



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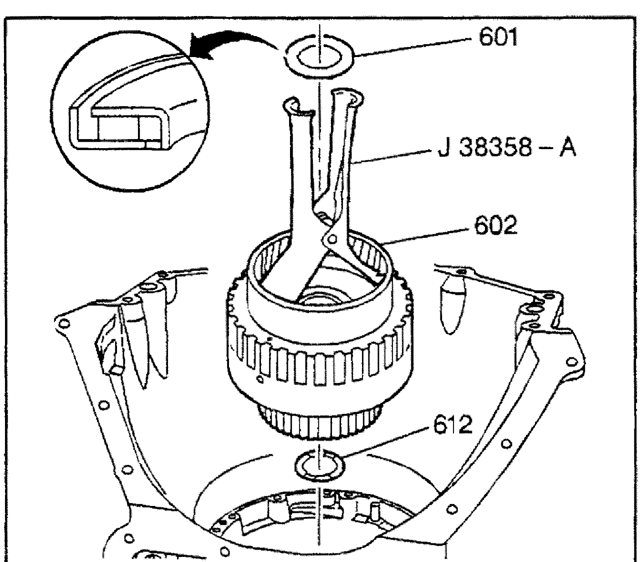
Fourth Clutch Assembly Removal

1. Inspect the torque of the fourth clutch housing bolt (26). The torque should be 23 N·m (204 lb in) minimum.

Important: Discard the fourth clutch housing bolt (26) after removal. Damage could result to the fourth clutch housing (529) if the bolt is reused.

2. Remove the fourth clutch housing bolt (26).
3. Remove the fourth clutch housing assembly (529) from the transmission case.



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Forward Clutch Assembly Removal

Tools Required

J 38358-A Forward Clutch Assembly Remover/Installer

1. Remove the overdrive carrier/forward clutch thrust bearing assembly (601). The bearing may be stuck to the overdrive unit assembly.
2. Remove the forward clutch housing assembly (602) using the *J 38358-A*.

Important: The forward clutch housing thrust washer (612) may be on top of the direct clutch housing or stuck to the bottom of the forward clutch housing assembly (602).

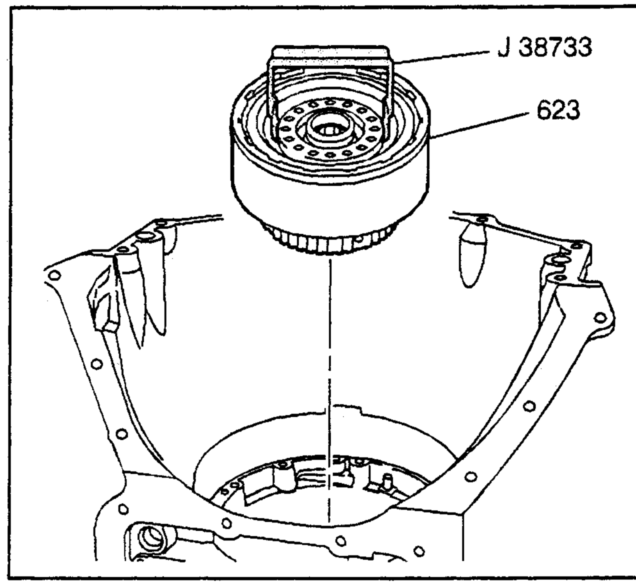
3. Remove the forward clutch housing thrust washer (612).

Direct Clutch Assembly Removal

Tools Required

J 38733 Direct Clutch Assembly Remover/Installer

Remove the direct clutch housing assembly (623) using the *J 38733*.



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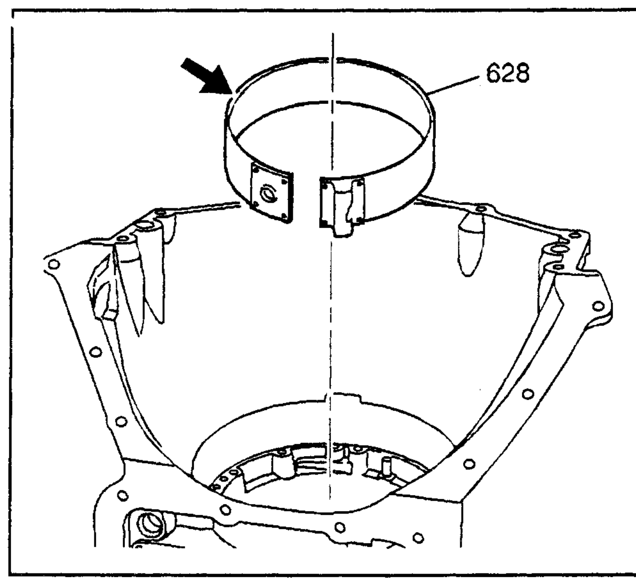
Manual 2-1 Band Removal

1. Remove the manual 2-1 band (628).
2. Inspect the manual 2-1 band for the following conditions:
   - Wear
   - Pitting
   - Flaking
   - Cracks



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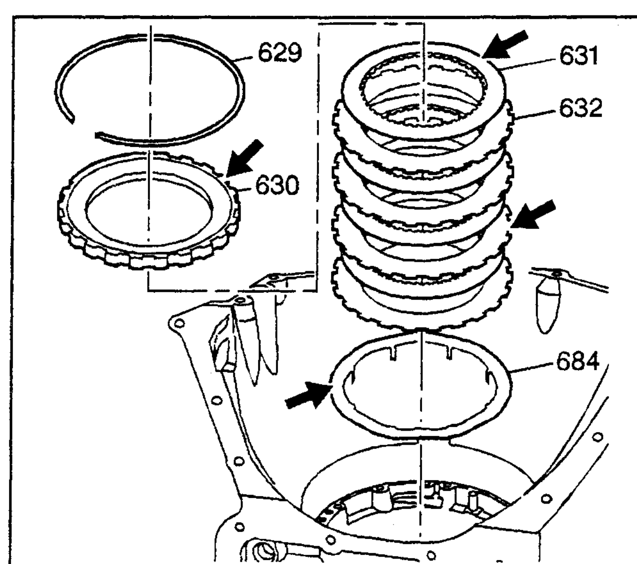
Intermediate Clutch Assembly Removal

1. Remove the intermediate clutch retainer ring (629).
2. Remove the intermediate clutch backing plate (630) and the intermediate clutch plates (631, 632) (4 each).
3. Remove the intermediate clutch wave plate (684).
4. Inspect the intermediate clutch plates (631, 632, 684) for the following conditions:
   - Wear
   - Pitting
   - Flaking
   - Cracks
5. Inspect the intermediate clutch backing plate (630) for the following conditions:
   - Burrs
   - Dirt



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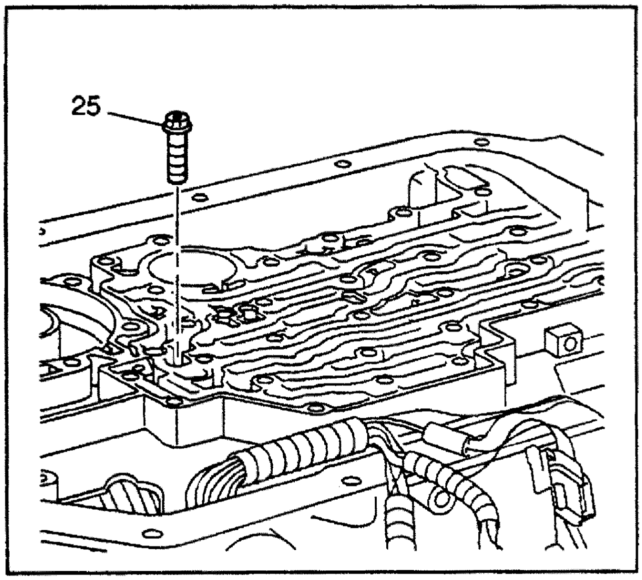
Center Support and Gear Unit Assembly Removal



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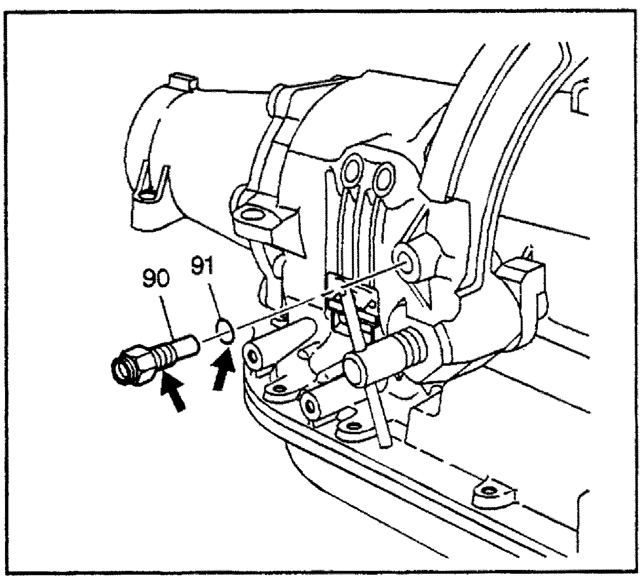
Tools Required

- *J 6116-01* Rear Gear Holding Fixture
- *J 21364-A* Rear Gear Holding Fixture Adapter
- *J 38868* Lower Gear Unit Assembly Remover/Installer
- *J 6129* Handle

Important: Discard the center support bolt (25) after you have removed the bolt. Damage could result to the center support housing if you reuse the bolt.

1. Remove the center support bolt (25).



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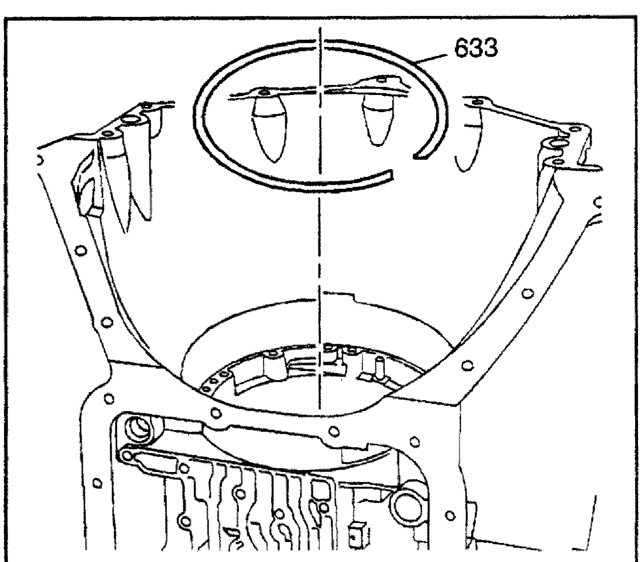
2. Remove the rear oil cooler pipe fitting (90).
3. Inspect the rear oil cooler pipe fitting (90) for damaged threads.
4. Inspect the rear oil cooler pipe fitting seal (91) for nicks or cuts.



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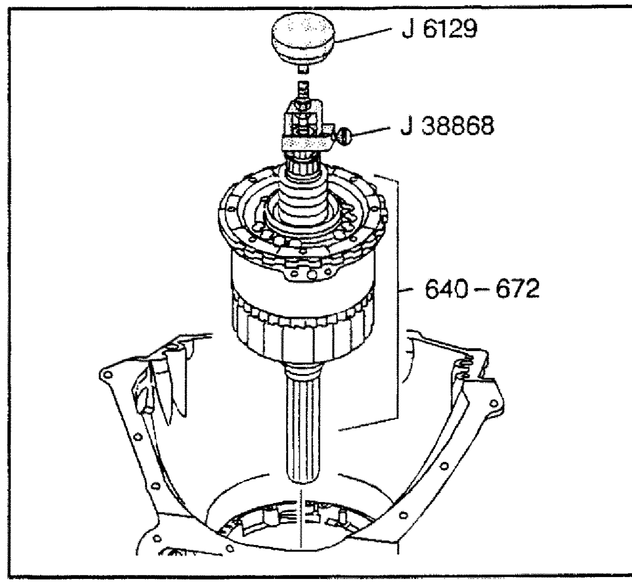
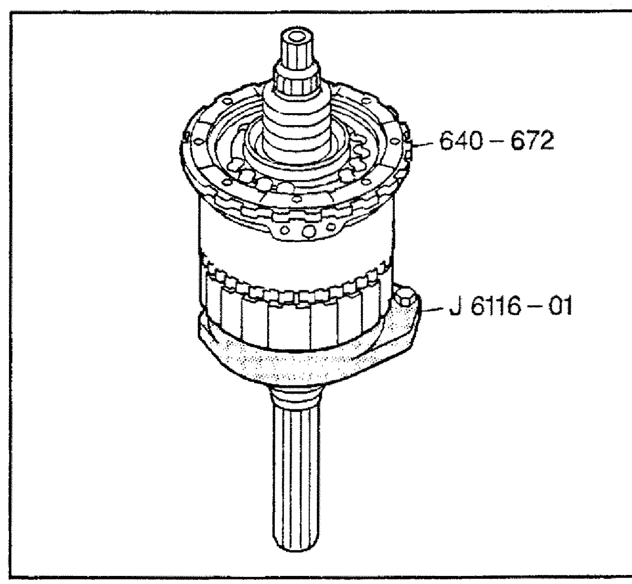
5. Remove the center support retainer ring (633).

6. Attach the *J 38868* to the transmission main shaft.
7. Tighten the thumb screw on the *J 38868*.
8. Install the *J 6129* to the *J 38868*.
9. Turn the *J 6129* so that the shaft contacts the main shaft.
10. Remove the center support and gear unit assembly (640–672) by lifting the *J 38868* with the *J 6129*.
11. Remove the *J 6129* and the *J 38868*.



334768

12. Place the center support and gear unit assembly (640–672) into the *J 21364-A* (not visible in the illustration) and then into the *J 6116-01*.



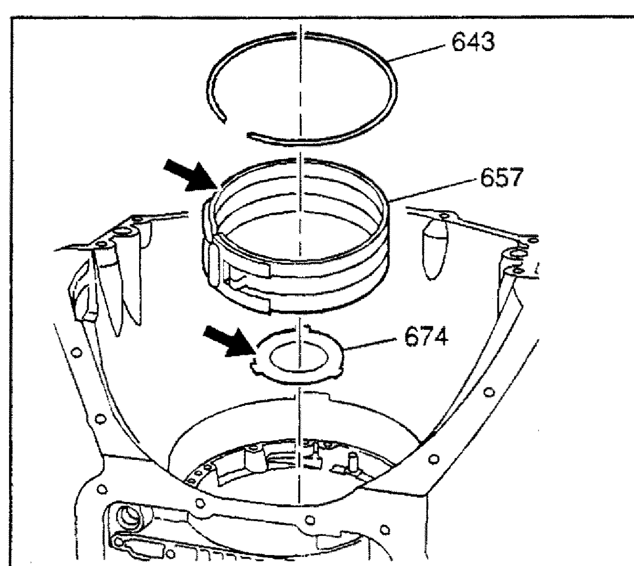
28411

Low and Reverse Band Removal

1. Remove the center support spacer (643).

Important: The thrust washers may be stuck to the output shaft and gear unit assembly or to the bottom of the transmission case.

2. Remove the selective thrust washer (674) from the transmission case.
3. Remove the low and reverse band (657).
4. Inspect the low and reverse band (657) and the selective thrust washer (674) for wear and damage.



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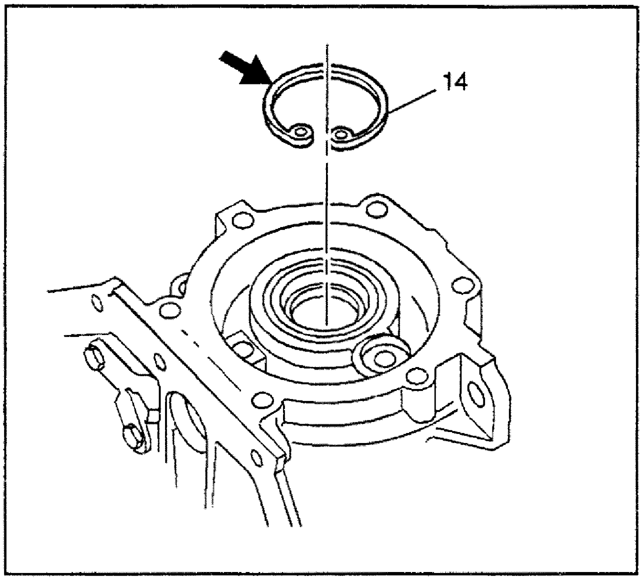


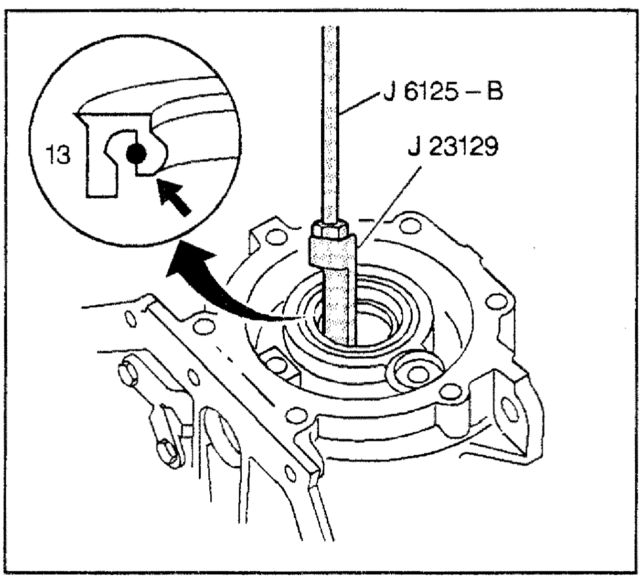
28415

Output Shaft Seal Removal

Tools Required

- *J 6125-1B* Slide Hammer
- *J 23129* Universal Seal Remover

1. Remove the output shaft seal retainer ring (14).
2. Inspect the output shaft seal retainer ring (14) for damage.



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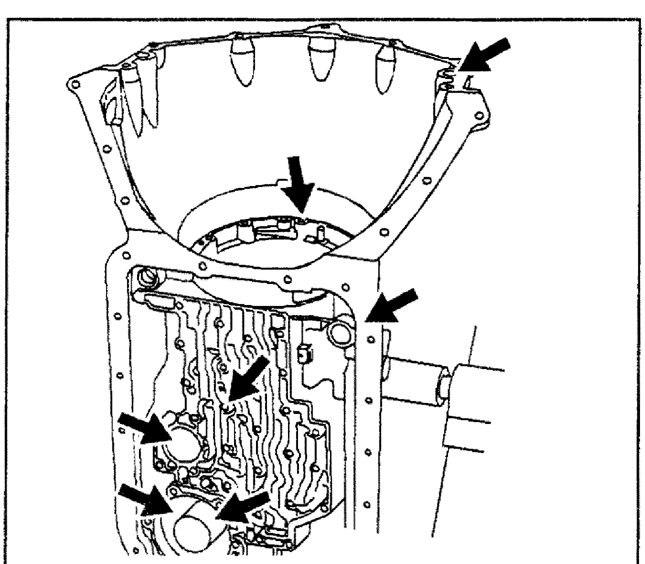
3. Remove the output shaft seal (13) using the *J 23129* and the *J 6125-1B*.



334772

Transmission Case Inspection

Tools Required

J 36850 Assembly Lubricant

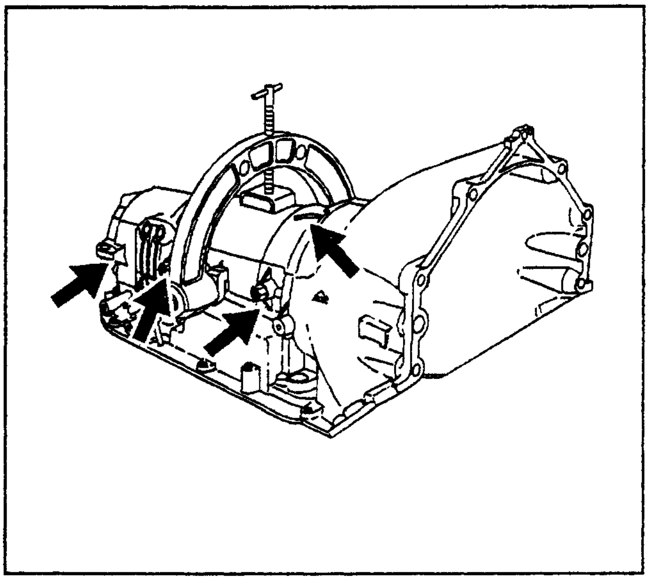
Notice: Use Transjel™ J 36850 or equivalent during assembly in order to retain checkballs or to lubricate components. Greases other than the recommended assembly lube will change the transmission fluid characteristics and will cause undesirable shift conditions or filter clogging.

1. Inspect the transmission case for the following:
   - Cracks
   - Porosity
   - Connected passages
   - Scored bushing
   - Excess gasket material left on any case surfaces

2. Inspect all threaded holes for damage. Use a Heli-Coil kit in order to repair damage to the threaded holes.
3. Air check all fluid passages. Refer to the Hydraulic Fluid Flow Diagrams and the fluid passage drawings in the *Transmission Component Location* section in this manual for fluid passage identification.
4. Inspect the manual 2-1 band servo bore and the low and reverse band servo bore for the following:
   - Porosity
   - Burrs
   - Damage
5. Inspect the intermediate clutch plate lugs for damage.
6. Inspect the retainer ring grooves for damage.
7. Inspect the case center support bolt hole for damage.
8. Inspect the oil cooler pipe connector for damage and for proper torque.
9. Inspect the vent pipe for damage.
10. Inspect the lube oil orifice cup plug with seal (some models) for damage.
11. Inspect the low/reverse band anchor pins and intermediate band anchor pins for proper position and tightness.
12. Inspect the manual shaft bore for damage and perosity.

Important: Dirty solvent can deposit sediment that could damage the transmission.

13. Clean all of the transmission case components using clean solvent.



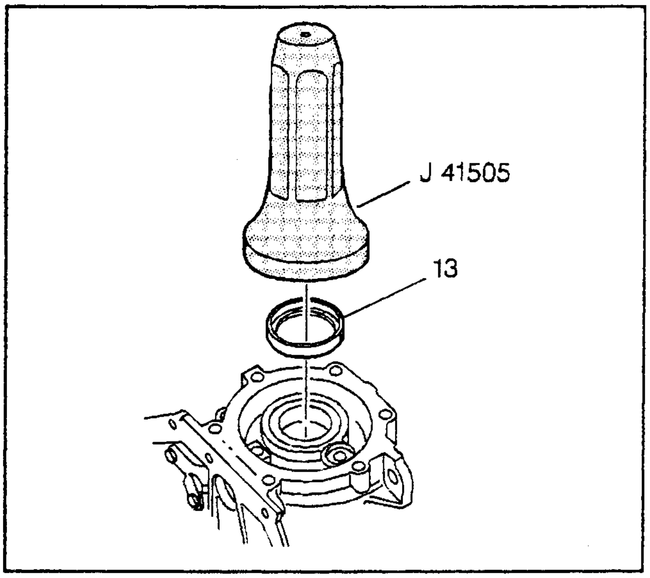
334787

Output Shaft Seal Installation

Tools Required

J 41505 Output Shaft Seal Installer

1. Install a new output shaft seal (13) with the *J 41505*.



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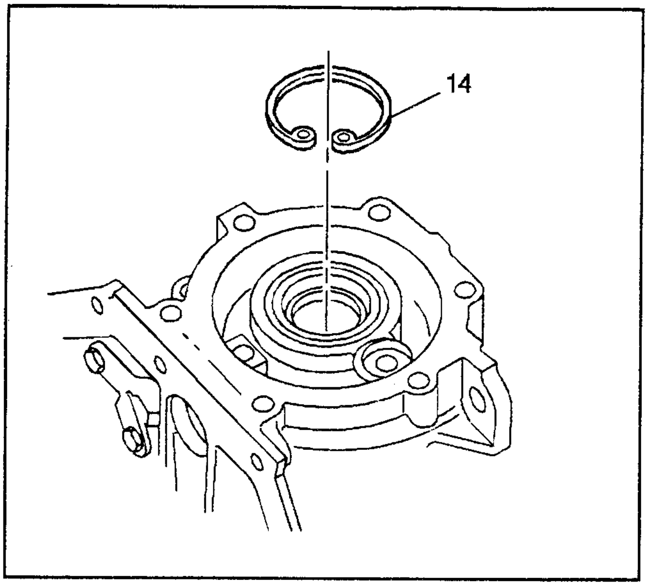

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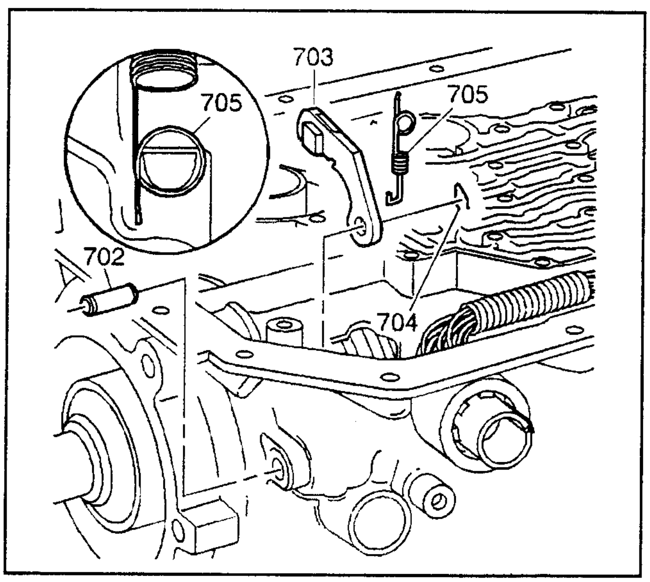
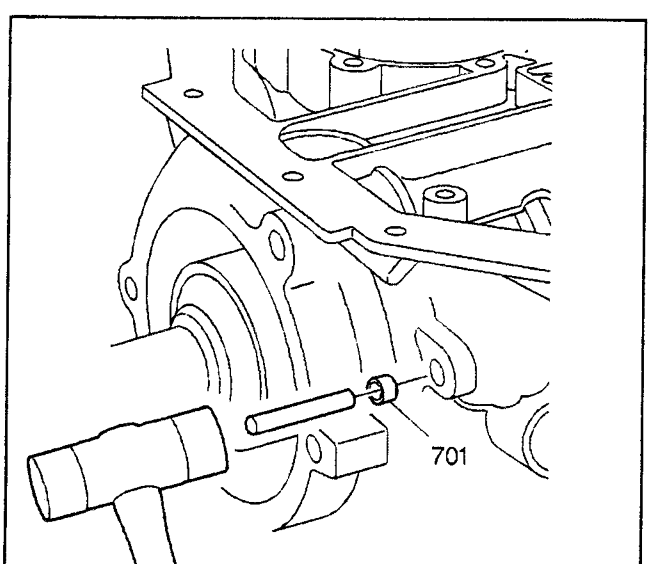
2. Install the output shaft seal retainer ring (14).



28421

Parking System Components Installation

1. Install the parking pawl shaft (702) and the parking pawl (703).
2. Install the parking pawl shaft retainer (704).
3. Install the parking pawl spring (705).



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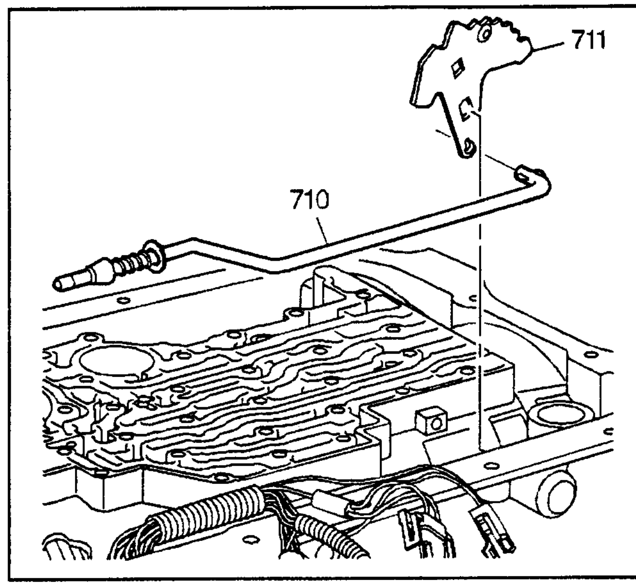
4. Apply Loctite® to the parking pawl shaft hole plug (701).
5. Install the parking pawl shaft hole plug (701) using a 5/16 inch diameter rod.

6. Assemble the manual shift shaft detent lever (711) to the parking pawl actuator assembly (710).
7. Install the parking pawl actuator assembly (710) over the parking pawl.



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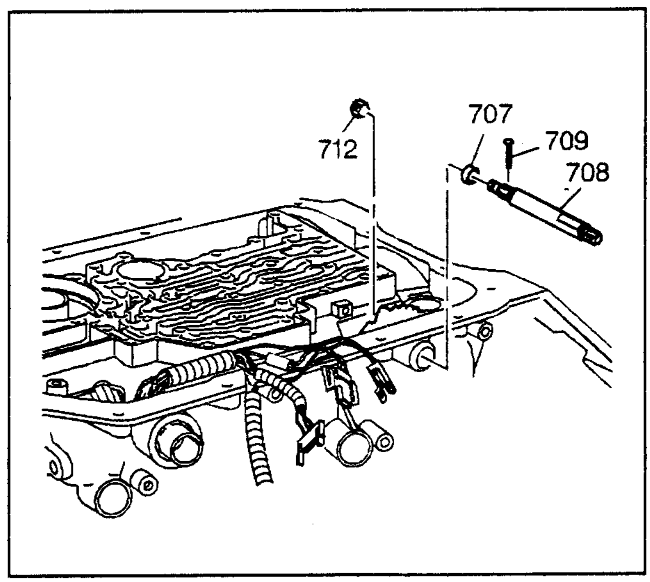
8. Install the manual shift shaft seal (707).
9. Partially install the manual shift shaft (708).
10. Install the manual shift shaft detent lever nut (712) onto the manual shift shaft (708).
11. Fully install the manual shift shaft (708).
12. Install the manual shift shaft pin (709) onto the manual shift shaft (708).

Notice: Refer to *Fastener Notice* in Cautions and Notices.

13. Tighten the manual shift shaft detent lever nut.

    Tighten

    Tighten the nut to 24 N·m (18 lb ft).



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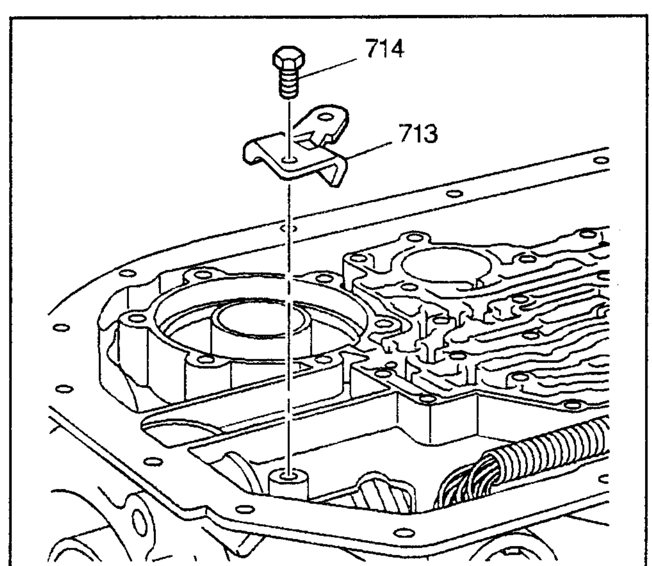
14. Install the parking pawl actuator bracket (713).
15. Install the parking pawl actuator bracket bolts (714).

    Tighten

    Tighten the bolts to 24 N·m (18 lb ft).



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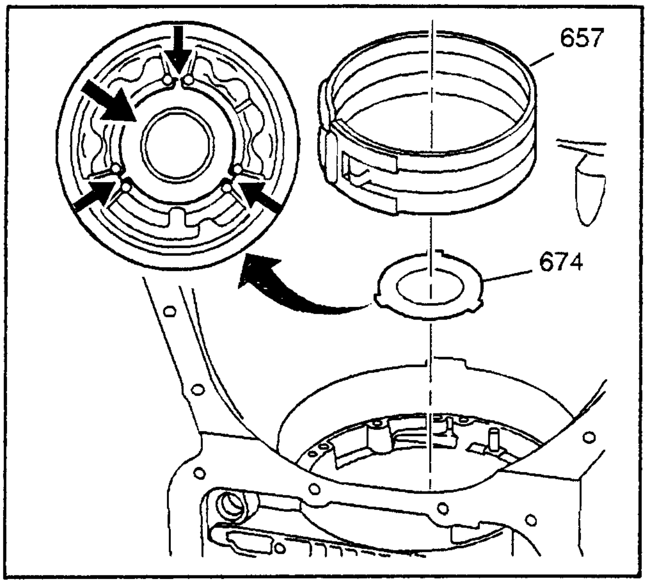

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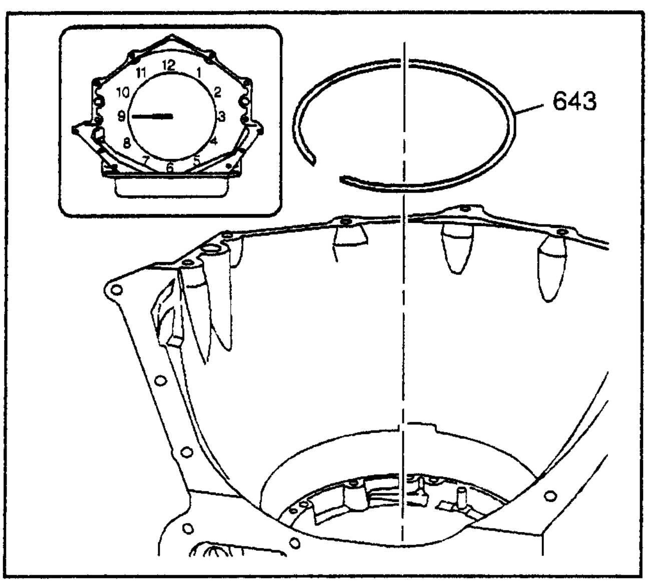


334791

Low and Reverse Band/Thrust Washer Installation

Tools Required

J 36850 Assembly Lubricant

1. Refer to the rear unit end play measurement taken during disassembly. If the rear unit end play measurement was incorrect, use the removed selective thrust washer (674) and the Output Shaft Selective Thrust Washer Specifications table in order to select the correct selective thrust washer. Refer to *End Play Specifications.*

Important: One side of the output shaft selective thrust washer (674) is machined completely flat with no rounded edges. This side must face up.

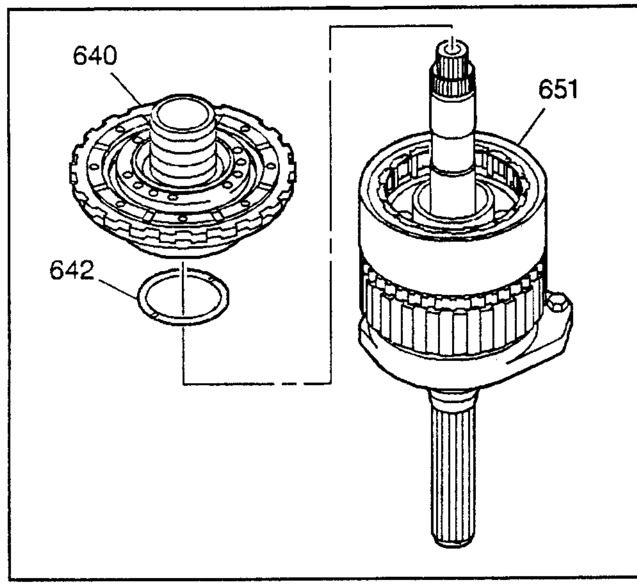
2. Install the output shaft selective thrust washer (674).
3. Retain with *J 36850* or equivalent.

Important: During the following installation procedure, align the low and reverse band tab with the low and reverse band servo pin hole.

4. Install the low and reverse band (657).
5. Install the center support spacer (643) into the groove above the low and reverse band. The center support spacer opening should be placed at the nine o'clock position.

Center Support and Gear Unit Assembly Disassemble

1. Separate the center support assembly (640) from the reaction carrier assembly (651).
2. Remove the reaction carrier thrust washer (642) (brass). The thrust washer may be stuck to the center support assembly.



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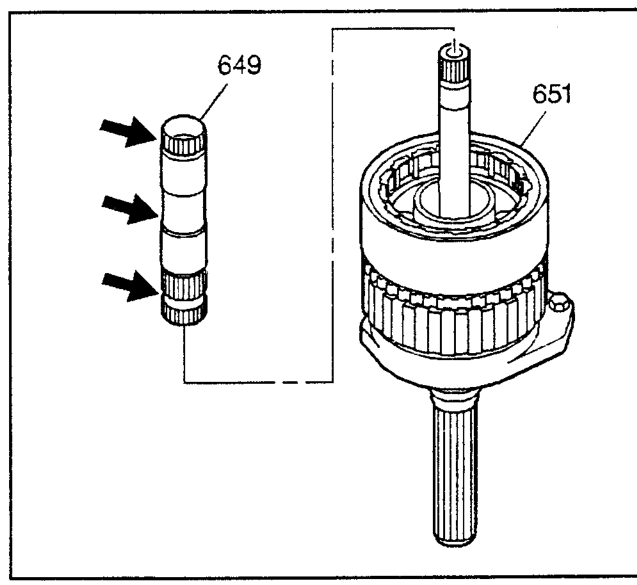
3. Remove the sun gear shaft (649).
4. Inspect the sun gear shaft (649) for the following:
   - Nicked, scored or worn bushings
   - Damaged splines and teeth
   - Cracks



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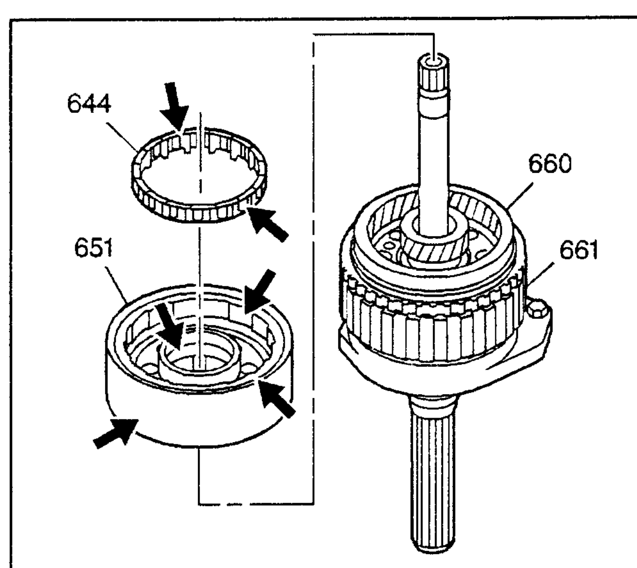
5. Remove the reaction carrier assembly (651) from the output carrier assembly (661).
6. Remove the low clutch roller assembly (644) from the reaction carrier assembly (651).
7. Inspect the reaction carrier (651) assembly for the following:
   - The pinion gear and pocket thrust surfaces for damage
   - Cracks or damage to band apply surface
   - Pinion gear damage
   - Pinion gear pin for proper location (walking)
   - The bushings for damage
8. Inspect the low clutch roller assembly (644) for damage to the rollers, springs and cage surfaces.



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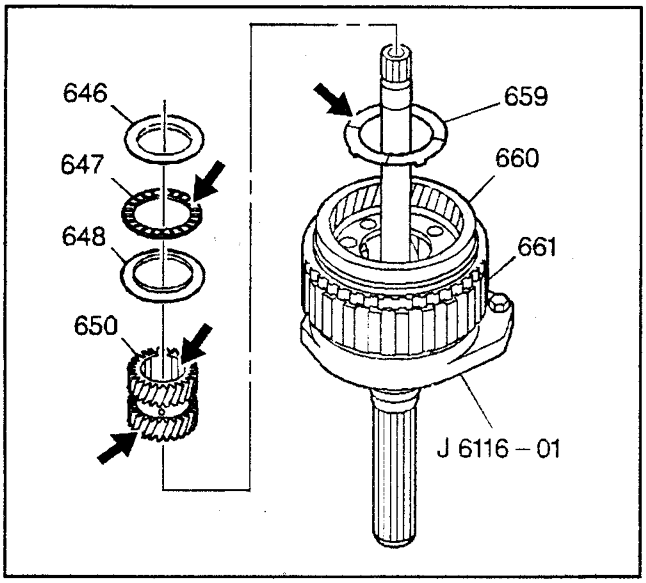

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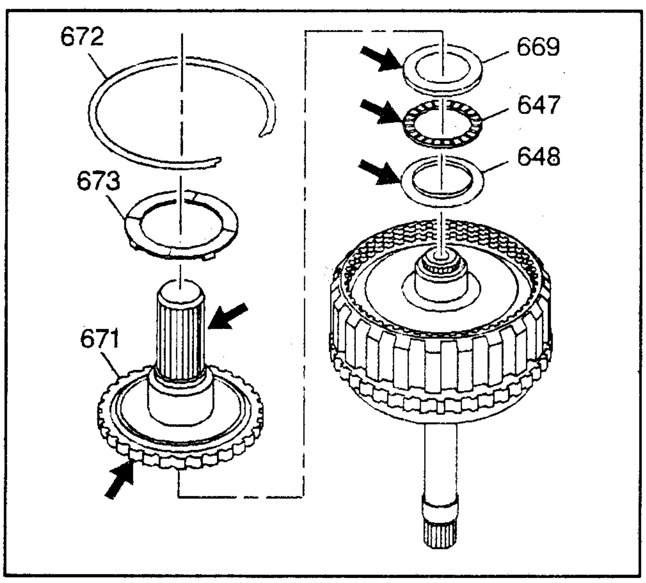
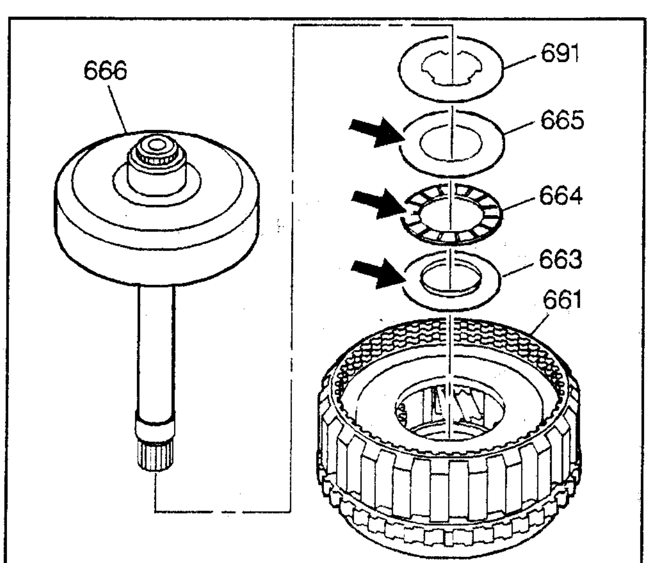
9. Remove the sun gear front thrust bearing assembly (647).
10. Remove the sun gear thrust bearing races (646, 648). One race (646) may be stuck to the center support assembly.
11. Remove the sun gear (650).
12. Remove the output carrier thrust washer (659) from the output carrier assembly (661).
13. Inspect the thrust washers, the bearings and the races for damage.
14. Inspect the sun gear teeth for damage.



28434

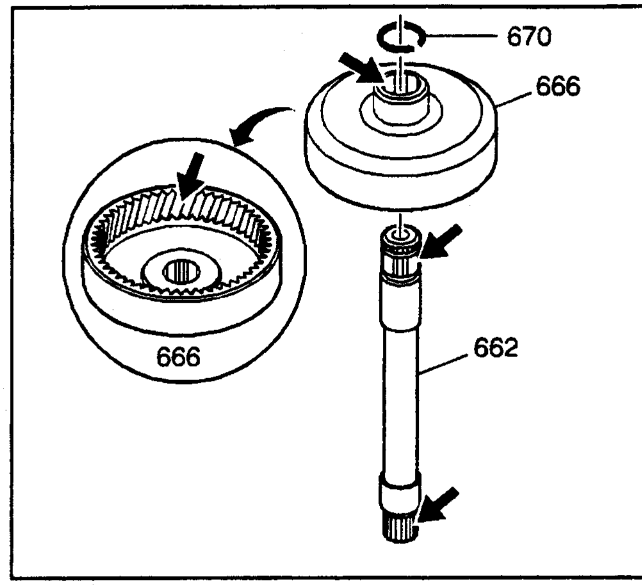
15. Turn the output carrier assembly (661) over so that the output shaft (671) faces up.
16. Remove the output shaft thrust washer (673).
17. Remove the output shaft retainer ring (672).
18. Remove the output shaft (671).
19. Inspect the output shaft (671) for the following:
    - Stripped splines
    - Damaged teeth
    - Cracks
    - Damage to the bushing
20. Remove the thrust bearing (647) and the thrust bearing races (648, 669) from the rear internal gear (666). The thrust bearing may be stuck to the output shaft (671).
21. Inspect the thrust bearing and races for damage.



334796

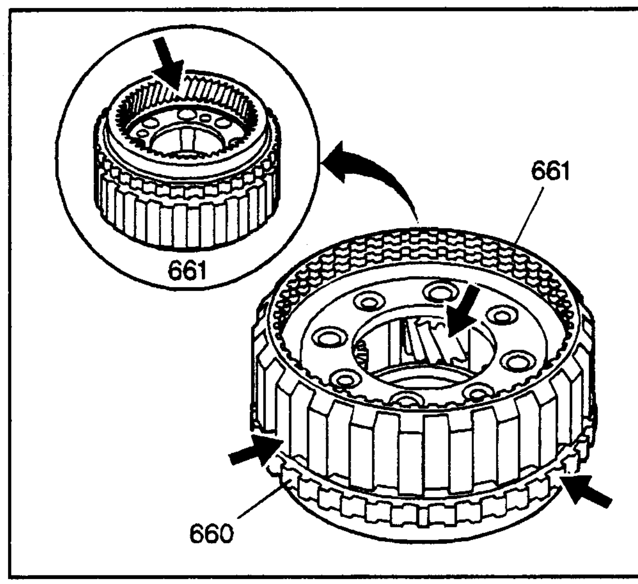
22. Remove the rear internal gear (666) and the main shaft (662) from the output carrier assembly (661).
23. Remove the spacer (691), the rear internal gear thrust bearing (664) and races (663 and 665).
24. Inspect the thrust washers, the bearings, and the races for damage.

25. Remove the main shaft retainer ring (670). Hold the main shaft (662) so it will not fall and become damaged.
26. Remove the main shaft (662) from the rear internal gear (666).
27. Inspect the main shaft (662) for damaged splines.
28. Inspect the main shaft (662) for wear.
29. Inspect the rear internal gear (666) for the following:
    - Stripped splines
    - Damaged teeth
    - Wear



54564

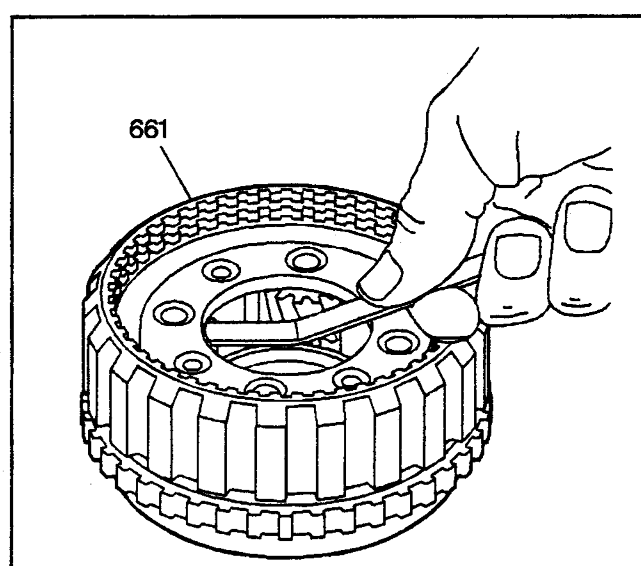
30. Clean all components thoroughly
31. Inspect the output carrier assembly (661) for the following:
    - Excessive wear
    - Damage to the park pawl lugs
    - Damage to the pinion gears
    - Excessive wear to the pinion gear steel and brass washers
    - Damage to the pinion gear and pocket thrust surfaces.
32. Inspect the front internal gear for damage and cracks.
33. Inspect the vehicle speed sensor reluctor ring (660) for tightness and damage.



28437

Output Carrier Pinion End Play Measurement

Measure the pinion washer wear using a feeler gage. Proper end play should be within 0.228–0.610 mm (0.009–0.024 in).



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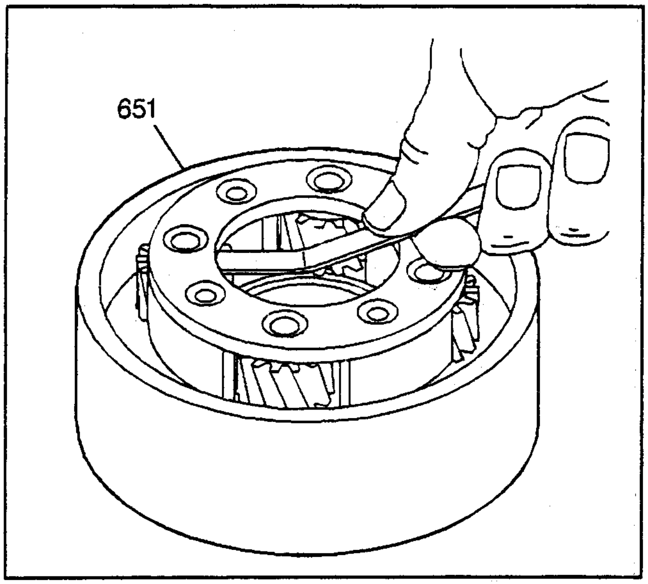
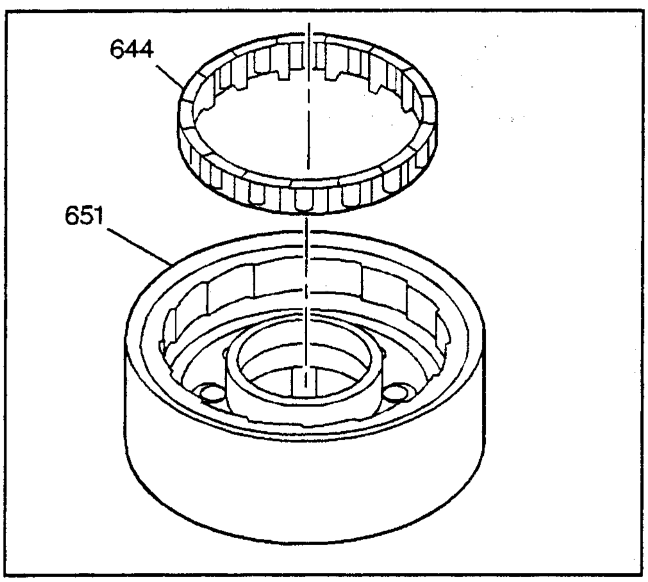


28691

Reaction Carrier Pinion End Play

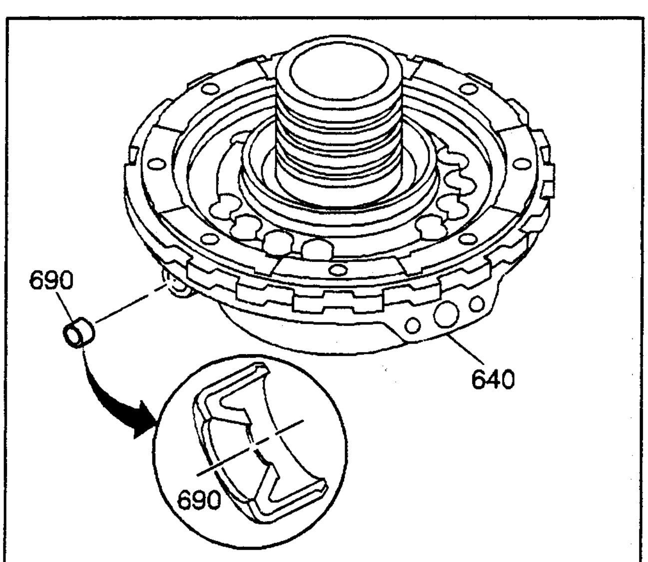
Measure the pinion washer wear using a feeler gage. The end play should be 0.228–0.610 mm (0.009–0.024 in).



28693

Reaction Carrier Assemble

Insert the low clutch roller assembly (644) into the reaction carrier assembly (651).



54646

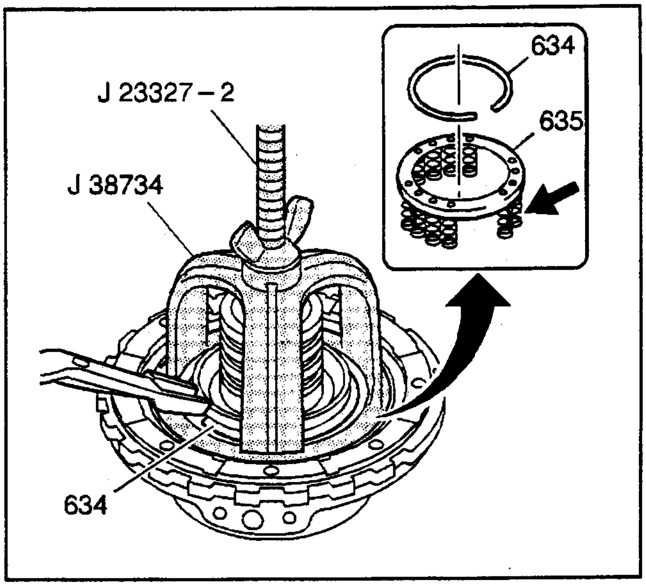
Center Support Assembly Disassemble

Tools Required

- *J 23327* Clutch Spring Compressor
- *J 38734* Intermediate Spring Compressor Adapter

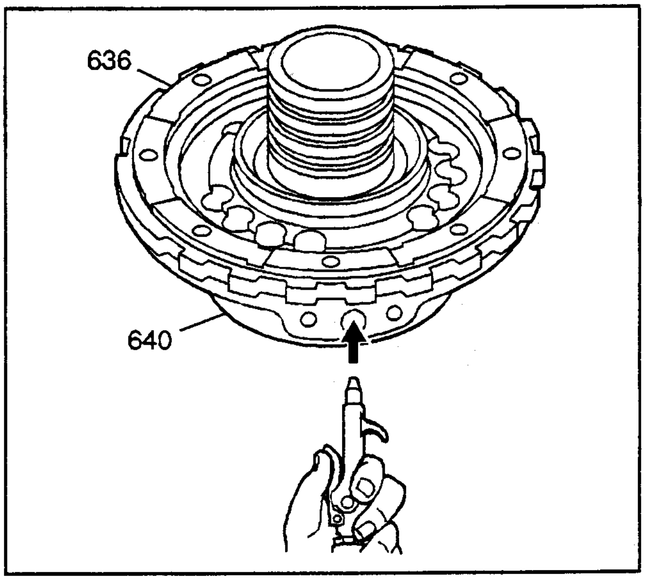
1. Remove the oil cooler pipe fitting seal (690) from the center support (640).
2. Inspect the center support (640) for damage.

3. Compress the intermediate clutch spring assembly (635) using the *J 23327* and the *J 38734.*
4. Remove the intermediate clutch spring retainer ring (634).
5. Remove the *J 23327* and the *J 38734.*
6. Remove the intermediate clutch spring assembly (635).
7. Inspect the intermediate clutch spring assembly (635) for collapsed coils and distortion.



28695

8. Remove the intermediate clutch piston (636). Apply shop air to the center support bolt hole to aid in piston removal.



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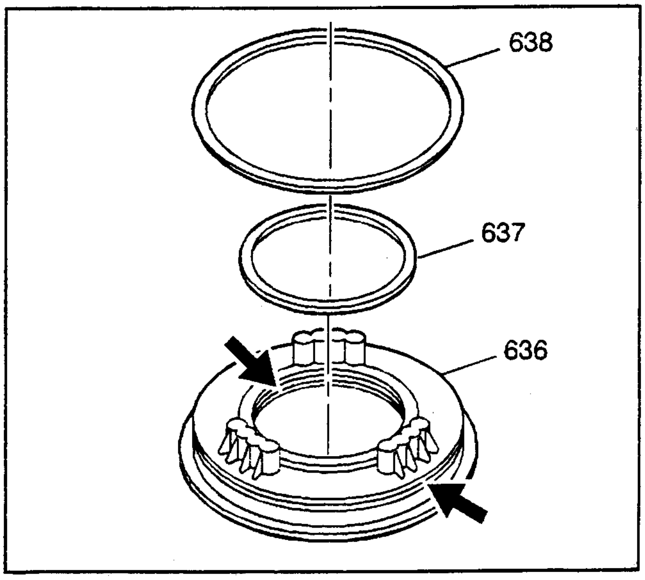
9. Remove the inner (637) and outer (638) seals from the intermediate clutch piston (636).
10. Inspect the intermediate clutch piston (636) for cracks and damage.



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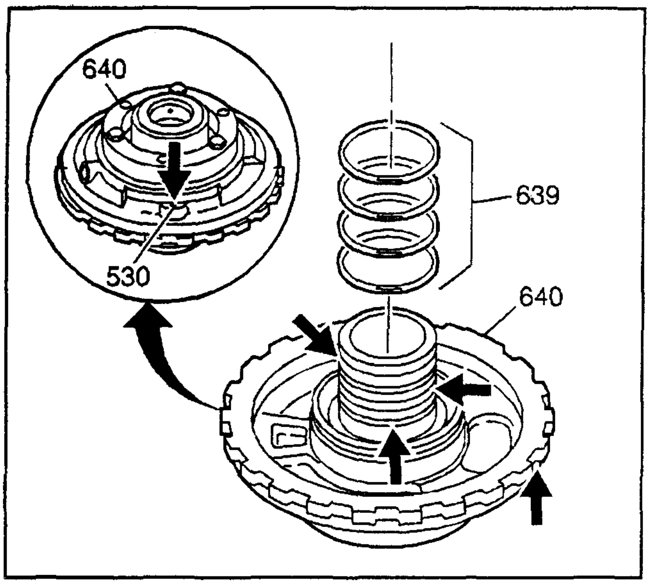
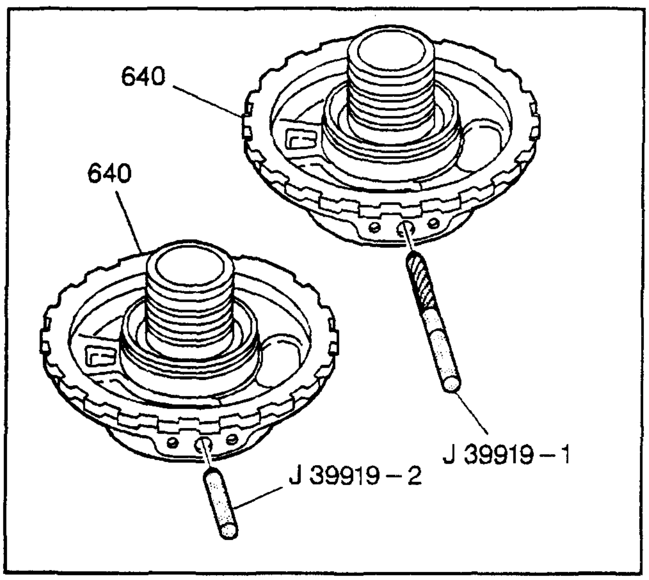


181740

11. Remove the direct clutch housing oil seal rings (639) from the center support hub.

Important: Do not disassemble the roller clutch race from the center support (640). If a new center support (640) is required, the support will come with a roller clutch race already installed.

12. Inspect the center support intermediate clutch orifice (530) to be open approximately 0.51 mm (0.020 in).
13. Inspect for damage to the oil seal ring pockets.



54567

Center Support Reconditioning Repair

Tools Required

- *J 39919-1* Center Support Thread Reamer
- *J 39919-2* Center Support Gauge Pin

Important: You may recondition the original center support (640) one time only by using the tools listed above. You must use the new, larger, service bolt with the reconditioned center support in order to avoid component damage. The service bolt is yellow in color, and the production bolt is black in color.

Perform ONE of the following steps:

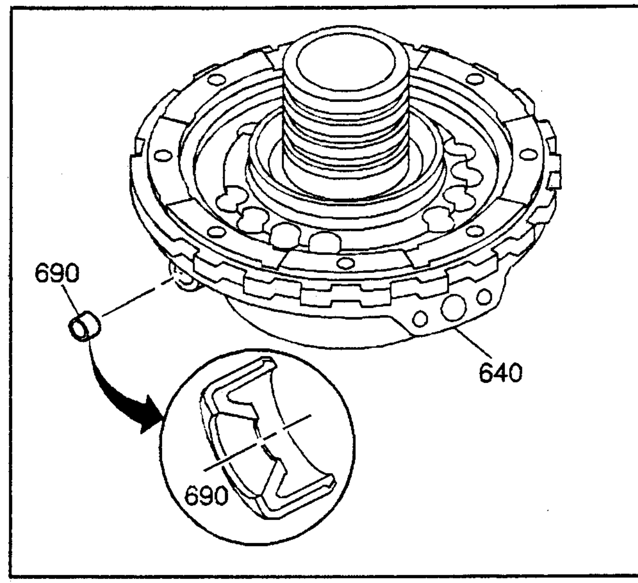
- If the center support has been previously reconditioned, or if the *J 39919-2* fits into the bolt hole, you MUST replace the center support and bolt in order to avoid component damage.
- If the center support has never been previously reconditioned:
  - Insert the *J 39919-2* into the center support bolt hole. If the *J 39919-2* does NOT fit into the center support bolt hole, you can recondition the center support for reuse.
  - Ream the center support bolt hole to the proper dimension using the *J 39919-1.*

Center Support Assembly Assemble

Tools Required

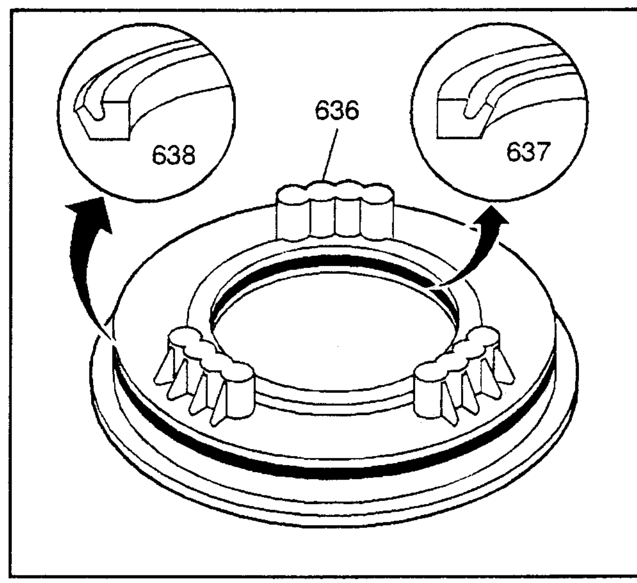
- *J 21363* Intermediate Clutch Inner Seal Protector
- *J 23327* Clutch Spring Compressor
- *J 38734* Intermediate Spring Compressor Adapter
- *J 36850* Assembly Lubricant

1. Install the oil cooler pipe fitting seal (690) into the center support (640).



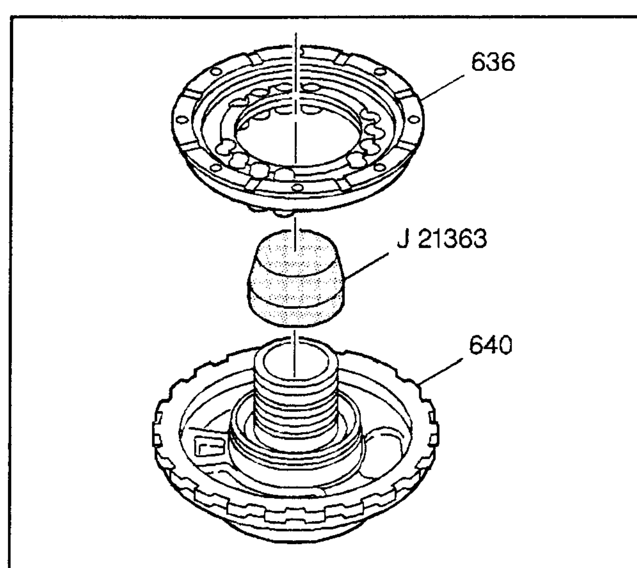
54646

2. Lubricate the new inner (637) and outer (638) intermediate clutch piston seals and seal pockets in the intermediate clutch piston (636) with DEXRON® III transmission fluid.
3. Install the inner (637) and outer (638) intermediate clutch piston seals onto the intermediate clutch piston (636) with the seal lip facing away from the spring pockets.



28706

4. Install the intermediate clutch piston (636) onto the center support (640) using the *J 21363*. A fine gauge feeler blade can be used to assist with the piston outer seal installation.
5. Remove the *J 21363*.



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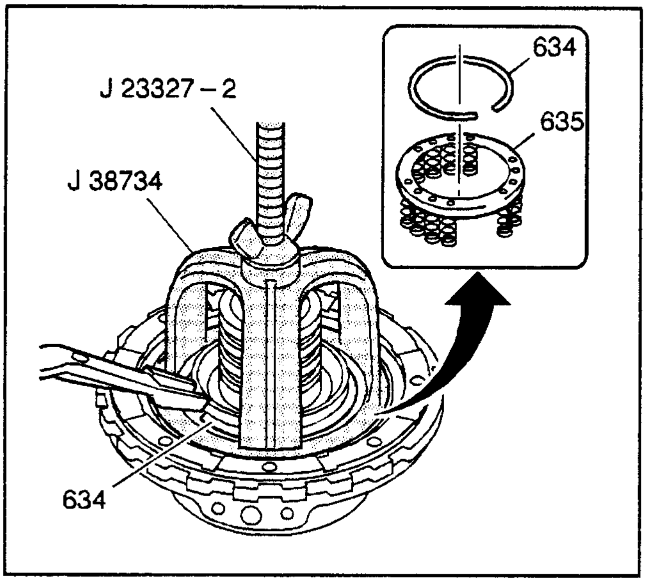
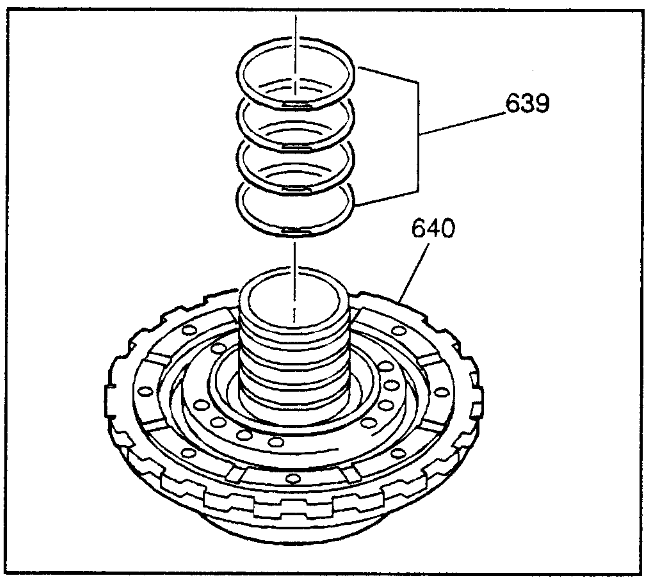


28709

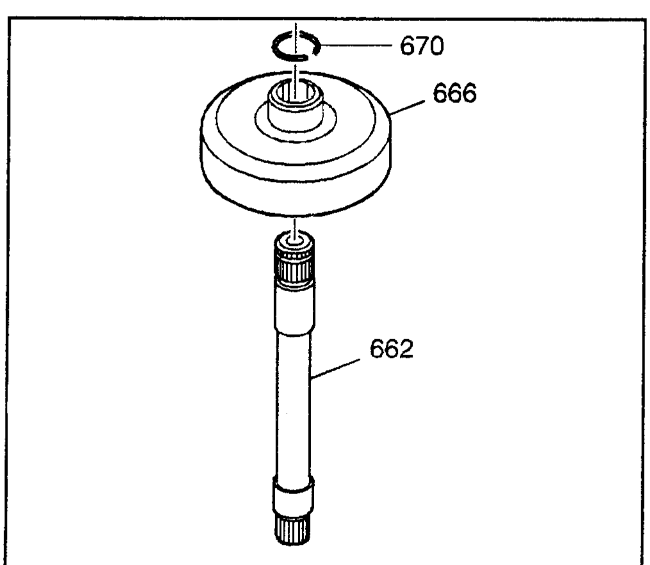
6. Install the intermediate clutch piston spring assembly (635). Align the springs with the pockets in the intermediate clutch piston.
7. Install the intermediate clutch piston spring retainer ring (634) using the *J 38734* and the *J 23327*.
8. Remove the tools.



181742

Notice: Do not overexpand the oil seal as it may become damaged.

9. Install the new direct clutch housing oil seal rings (639) onto the center support (640).
10. Use *J 36850* or the equivalent in order to keep the oil seals in place.



54575

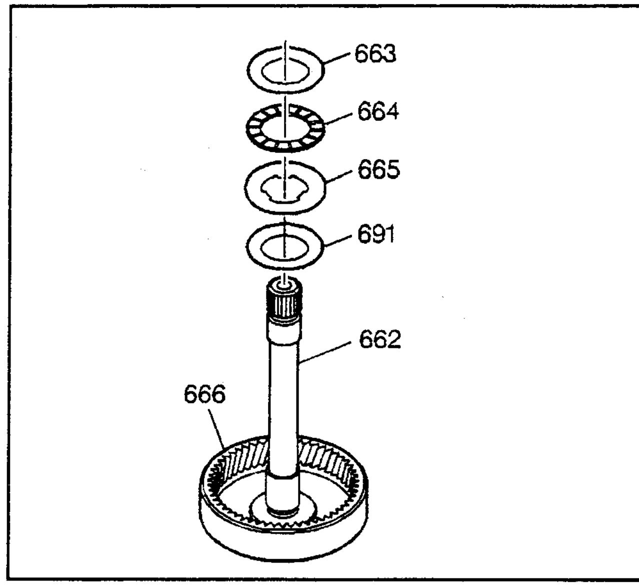
Reaction Drum and Carrier Assembly Assemble

Tools Required

- *J 6116-01* Rear Gear Holding Fixture
- *J 36850* Assembly Lubricant

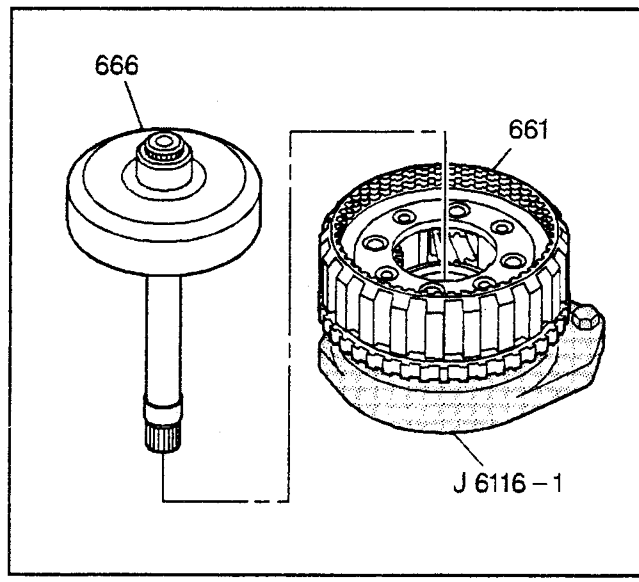
1. Assemble the main shaft (662) into the rear internal gear (666).
2. Install the main shaft retaining ring (670) onto the main shaft (662).

3. Assemble the spacer (691) onto the main shaft (662).
4. Assemble the sun gear rear thrust bearing (664) and races (663 and 665) onto the main shaft (662).
5. The lips on the sun gear thrust bearing races (663 and 665) should face the sun gear rear thrust bearing (664).
6. Retain the spacer, sun gear rear thrust bearing and races with *J 36850* or equivalent.



334798

7. Lubricate the output carrier pinion gears (655) with DEXRON® III transmission fluid.
8. Assemble the main shaft and rear internal gear assembly (666) into the output carrier assembly (661).
9. Place the assembly into the *J 6116-01* with the main shaft facing down.



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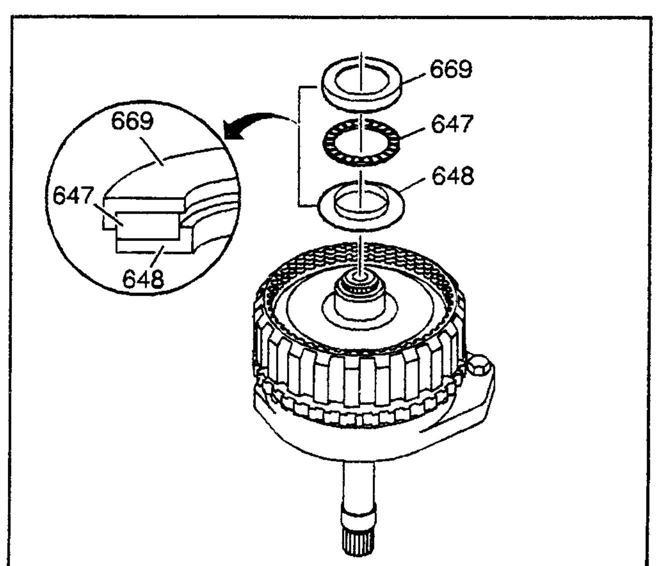
10. Assemble the sun gear front thrust bearing (647) and races (648 and 669). The lips of the sun gear thrust bearing races (648 and 669) should face the sun gear front thrust bearing (647).
11. Place the bearing and race assembly onto the rear internal gear hub. Retain with *J 36850* or equivalent.



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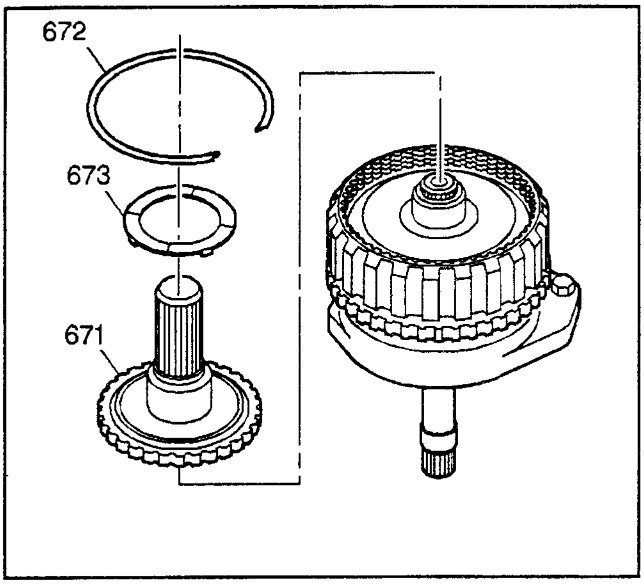
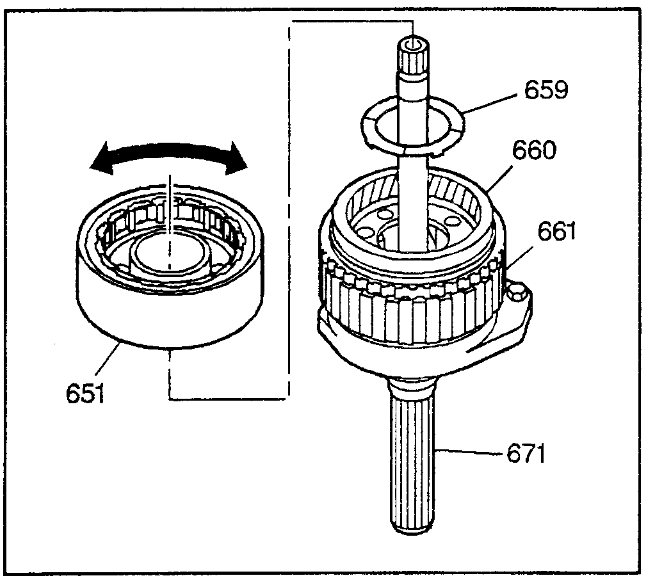


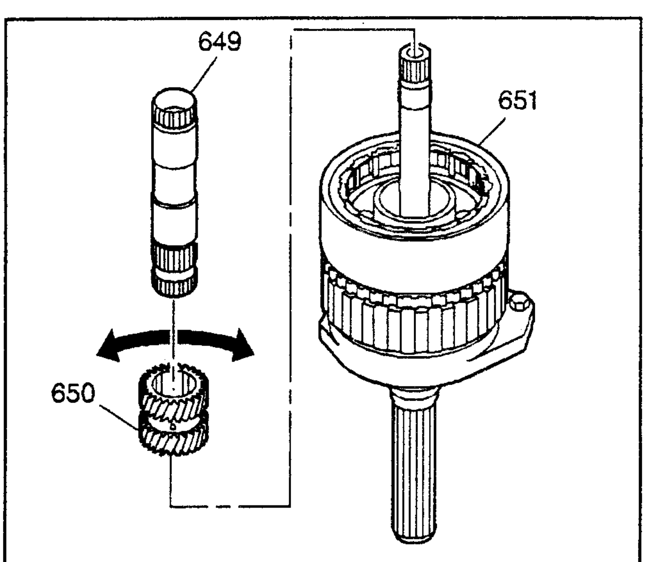
28725

12. Assemble the output shaft (671) into the output carrier assembly.
13. Install the output shaft retainer ring (672).
14. Assemble the output shaft thrust washer (673) to the output shaft. Align the output shaft thrust washer tabs with the pockets in the output carrier.
15. Retain the thrust washer with *J 36850* or equivalent.



54584

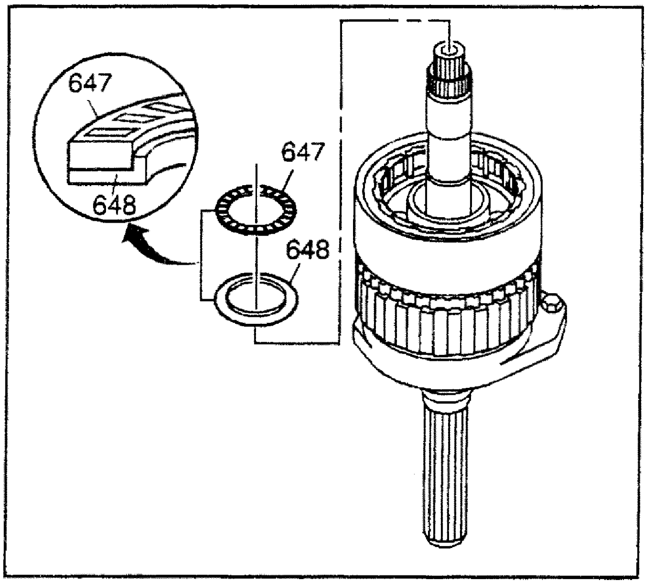
16. Turn the gear unit assembly over and place it into the *J 6116-01* with the output shaft (671) facing down.
17. Install the output carrier thrust washer (659) into the output carrier assembly (661).
18. Lubricate the reaction carrier pinion gears with DEXRON® III transmission fluid.
19. Assemble the reaction carrier assembly (651) into the output carrier assembly (661).
20. Rotate the reaction carrier assembly (651) to ease assembly.



54593

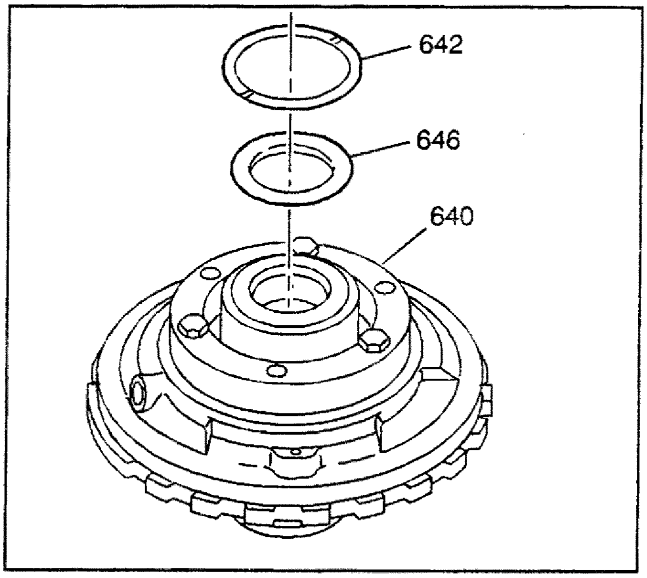
21. Assemble the sun gear (650) into the reaction carrier assembly (651).
    - Insert the chamfered inner diameter first
    - Rotate the sun gear to ease assembly
22. Assemble the sun gear shaft (649) with the long splined end into the sun gear (651).

23. Assemble the longer lipped sun gear rear thrust bearing race (648) onto the sun gear with the lip facing upward.
24. Assemble the sun gear front thrust bearing (647) onto the sun gear rear thrust bearing race (648).



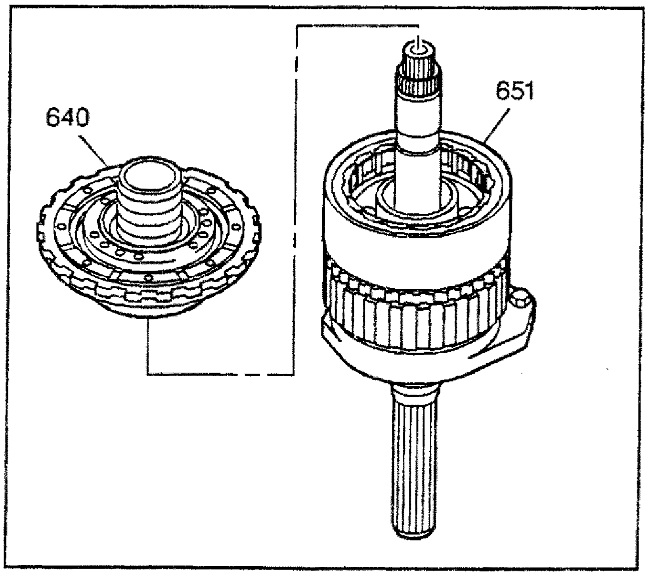
54600

25. Assemble the sun gear front thrust bearing race (646) to the rear hub of the center support (640). Retain the sun gear front thrust bearing race (646) with *J 36850* or equivalent.
26. Assemble the reaction carrier thrust washer (642) (brass) into the recess of the center support. Retain the reaction carrier thrust washer (642) with *J 36850* or equivalent.

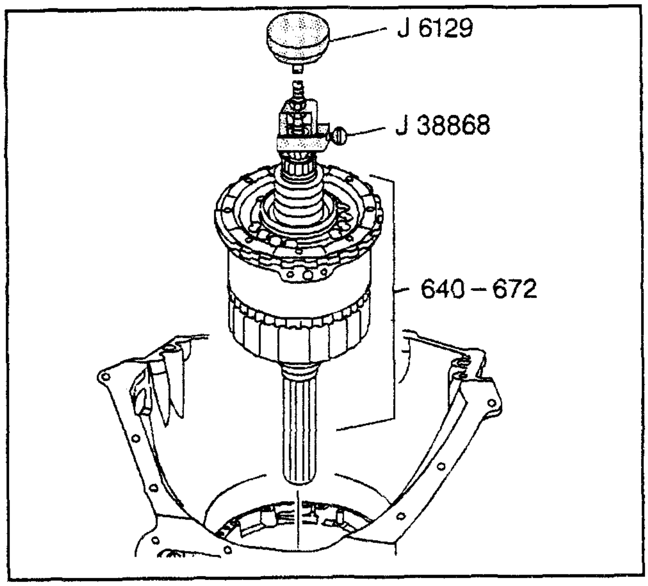


54607

27. Install a new center support (640), or the reconditioned center support, into the reaction carrier (651).
28. Verify correct assembly by holding the reaction carrier assembly (651) stationary and by rotating the center support (640). The center support (640) should only turn counterclockwise.



28733



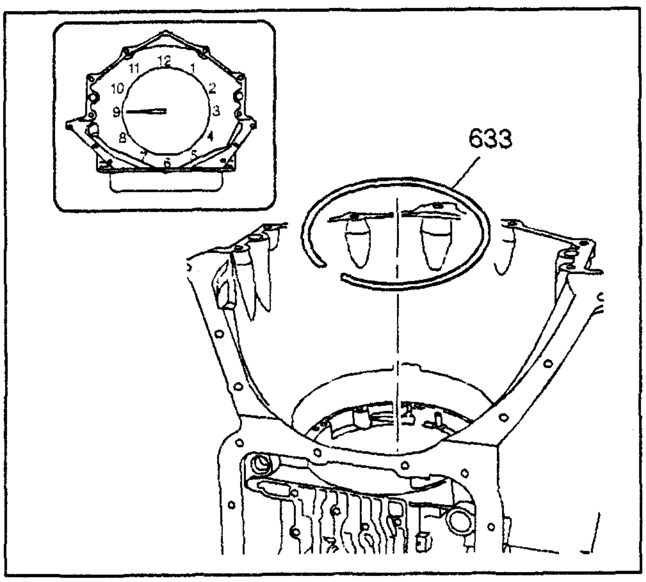
334768

Center Support and Gear Unit Assembly Installation

Tools Required

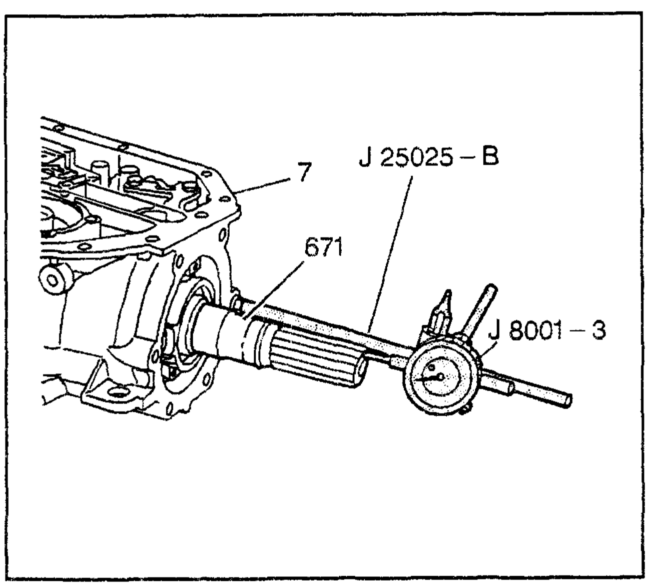
- *J 38868* Lower Gear Unit Assembly Remover/Installer
- *J 6129* Handle
- *J 28585* Snap Ring Remover

1. Attach the *J 38868* and the *J 6129* onto the main shaft.
2. Align the bolt hole in the center support with the bolt hole in the case and carefully lower the gear unit assembly (640–672) into the case.
3. Remove the tools.



334801

4. Install the center support retaining ring (633) using the *J 28585*. The end gap of the center support retaining ring (633) should be located at the nine o'clock position with the beveled edge of the retaining ring facing up.



28398

Rear Unit End Play Check

Tools Required

- *J 8001-3* Dial Indicator
- *J 8520* Cam Lobe Lift Indicator Set

1. Assemble the *J 8520* by attaching the threaded rod and the dial indicator holder to one of the case extension bolt holes on the transmission case (7).
2. Push the output shaft (671) in to take up any slack.
3. Mount the *J 8001-3* on the *J 8520* and index the *J 8001-3* to the end of the output shaft (671).
4. Set the *J 8001-3* to 0.

5. Move the output shaft (671) in and out noting the amount of end play.
   - The correct end play is 0.127–0.635 mm (0.005–0.025 in).
   - If the end play is not correct, change the output shaft selective thrust washer (674). Refer to the Output Shaft Selective Thrust Washer Specifications table found in *End Play Specifications*.
6. Remove the tools from the transmission.

Center Support Bolt/Cooler Pipe Fitting Install

Tools Required

J 23093 Center Support Alignment Tool

Important: If the center support has been reconditioned, you must use a new yellow colored center support bolt in order to maintain proper bolt torque.

1. Using the *J 23093*, locate the center support 2nd clutch fluid passage through the hole in the case bottom. Refer to *Transmission Component Location*, Case Fluid Passages Illustration.
2. Push the *J 23093* toward the low and reverse band servo bore, seating the center support splines against the case splines.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

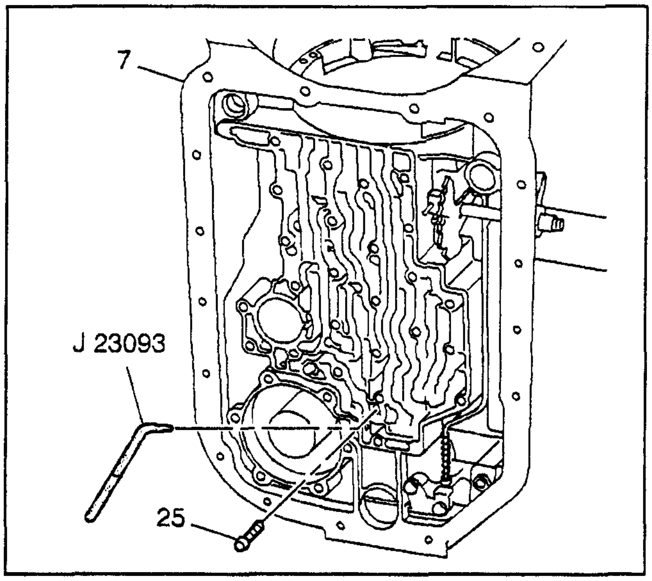
3. Install the new center support bolt (25).

   Tighten

   Maintain pressure on J 23093 while tightening the new center support bolt to 43 N·m (32 lb ft). Do not overtighten.
4. Ensure that the center support bolt head is seated to the bottom of the case.
5. Install a new rear oil cooler pipe fitting seal (91) onto the rear oil cooler pipe fitting (90).
6. Install the rear oil cooler pipe fitting (90) into the transmission case.

   Tighten

   Tighten the fitting to 35 N·m (26 lb ft).



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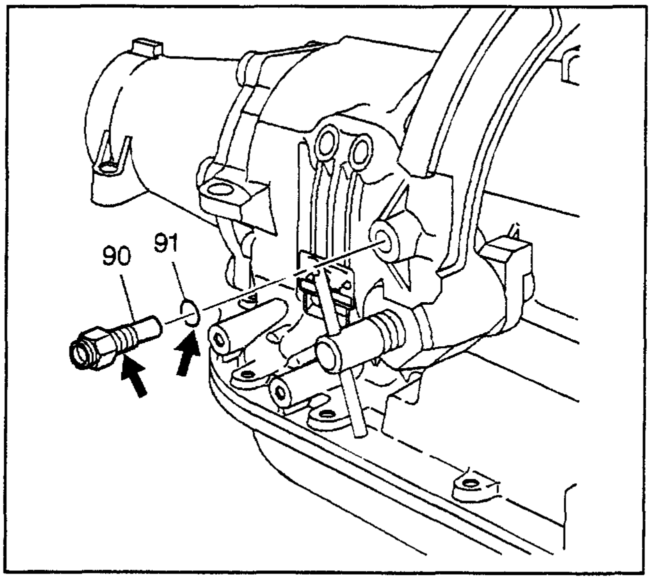

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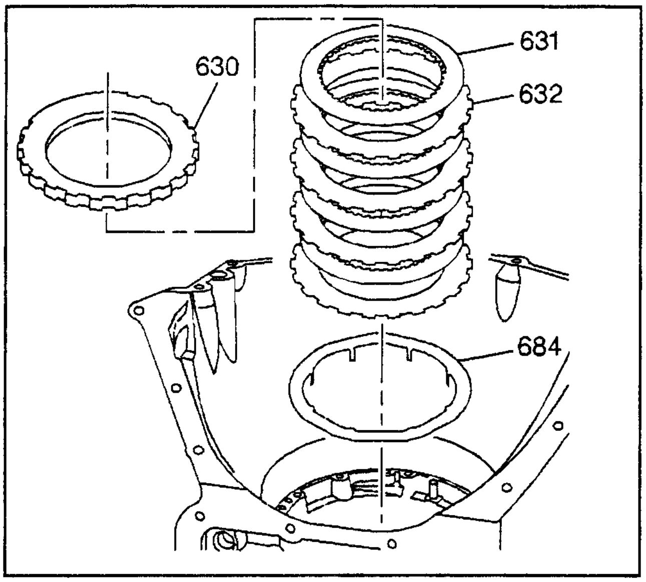
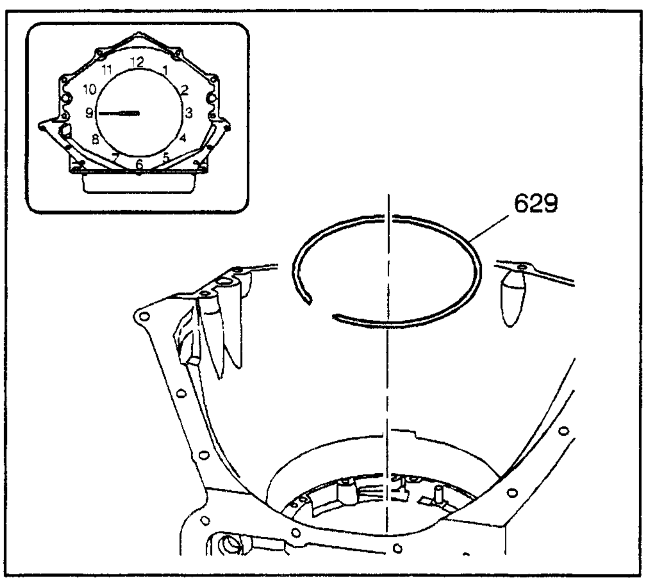


334809

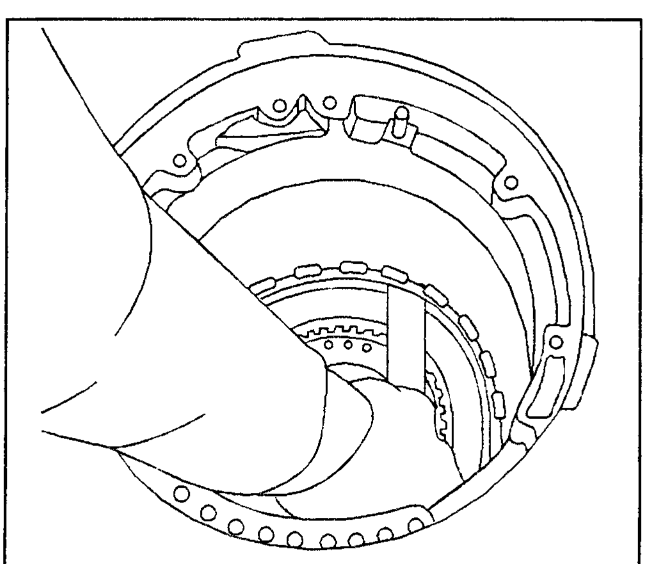
Intermediate Clutch Installation

1. Dip all of the intermediate clutch plates in DEXRON® III transmission fluid.
2. Install the intermediate clutch wave plate (684) with the tangs facing down.
3. Install the intermediate clutch plates (631, 632).
4. Alternate the clutch plates, starting with the steel clutch plate (4 steel and 4 composite).
5. Install the intermediate clutch backing plate (630).



334811

6. Install the intermediate clutch backing plate retainer ring (629). The opening of the retainer ring (629) should be at the nine o'clock position.



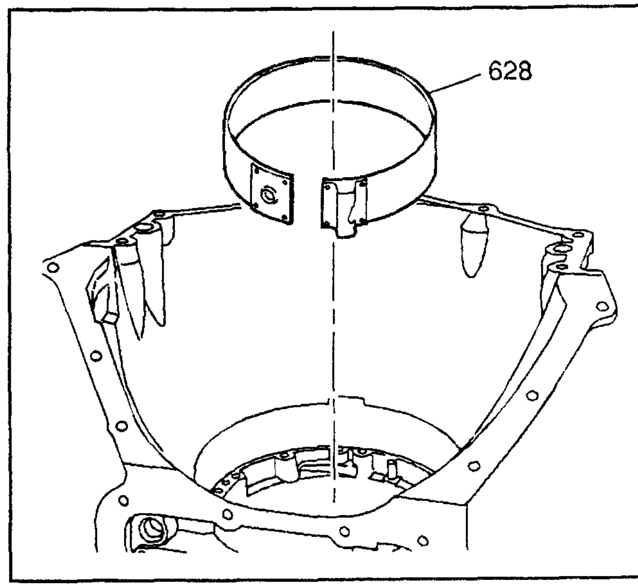
334814

Intermediate Clutch Piston Travel Check

Insert a feeler gauge between the intermediate clutch backing plate (630) and the intermediate clutch backing plate retaining ring (629). Piston travel should be 1.02–2.72 mm (0.040–0.107 in).

Manual 2-1 Band Installation

Install the manual 2-1 band (628) into the transmission case. Inspect for proper alignment with the anchor pin and inspect for freedom of movement.



334815

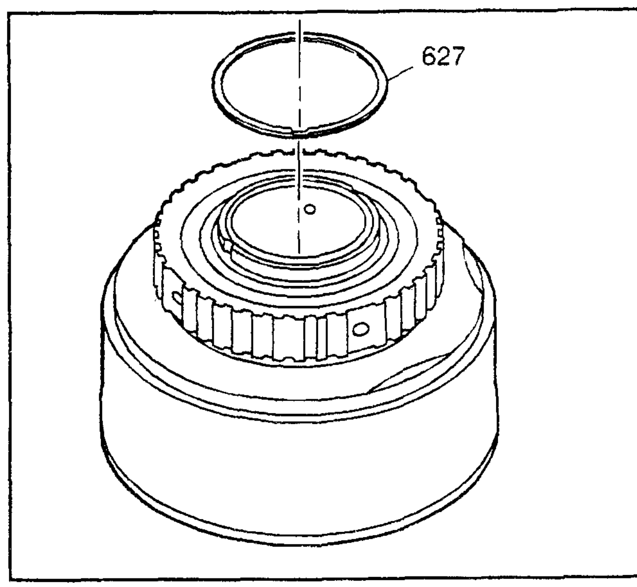
Direct Clutch Assembly Disassemble

Tools Required

- *J 23327* Clutch Spring Compressor
- *J 25018-A* Clutch Spring Compressor Adapter

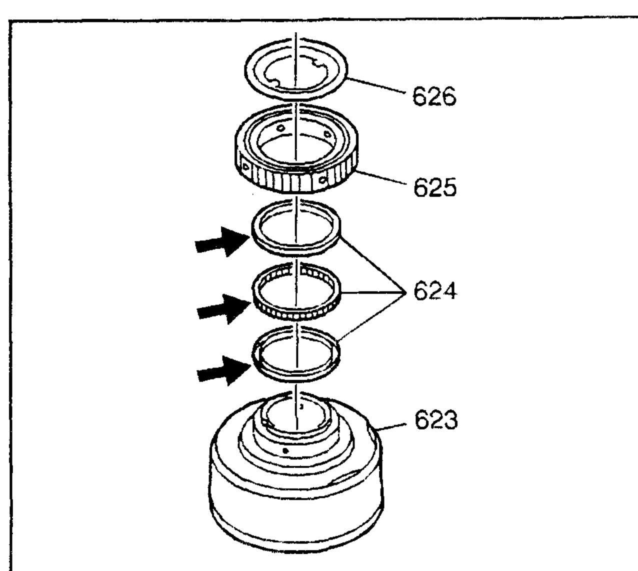
Important: If the intermediate sprag clutch retainer retaining ring (627) has been removed, you must use a new ring.

1. Remove the intermediate sprag clutch retainer retaining ring (627).

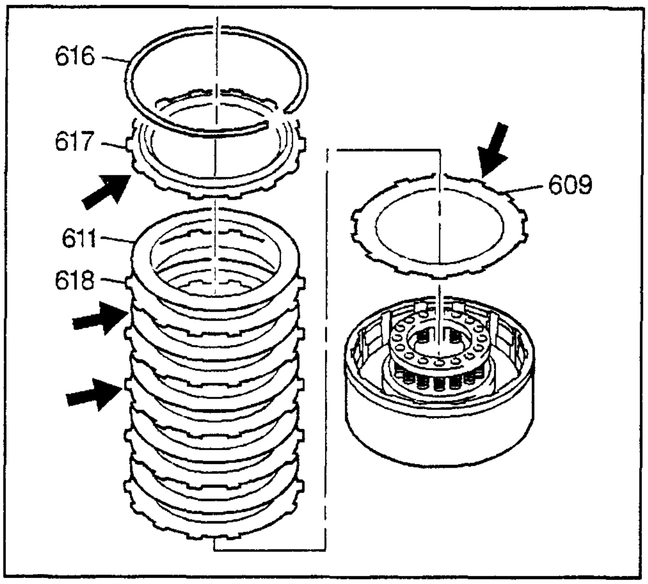


335037

2. Remove the intermediate sprag clutch retainer (626).
3. Remove the intermediate roller clutch (624) and race (625) as an assembly.
4. Remove the intermediate sprag clutch outer race (625).
5. Inspect the intermediate roller clutch (624) for damaged rollers, a damaged cage or distorted springs.

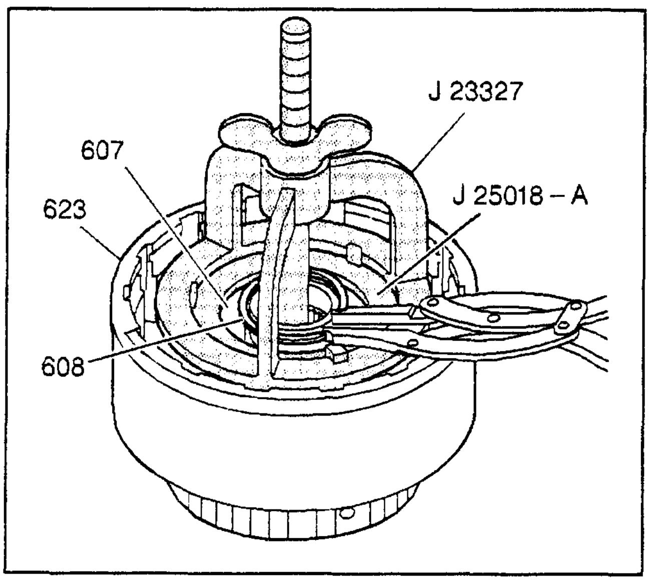


335038



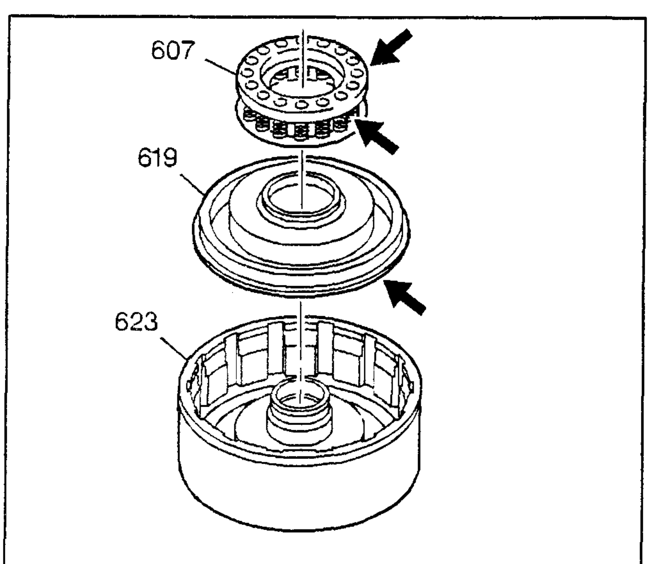
335039

6. Remove the direct clutch backing plate retaining ring (616).
7. Remove the direct clutch backing plate (617).
8. Remove the direct clutch plates (611, 618).
9. Remove the direct clutch apply plate (wave) (609).
10. Inspect the direct clutch backing plate (617) for damage and cracks.
11. Inspect the direct clutch plates (609, 611, 618) for wear, burned, flaking, scoring, and pitting.



335040

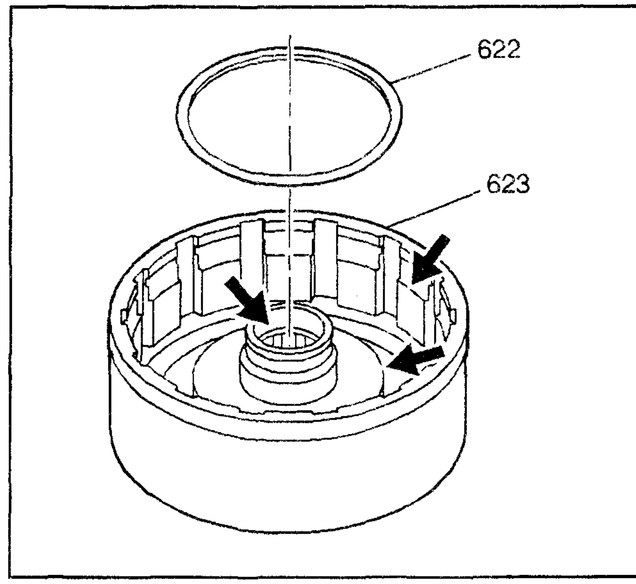
12. Install the *J 23327* and the *J 25018-A* onto the direct clutch housing (623).
13. Compress the direct clutch spring assembly (607).
14. Remove the direct clutch spring retainer ring (608).
15. Remove the tools.



335041

16. Remove the direct clutch spring assembly (607).
17. Inspect the direct clutch spring assembly (607) for collapsed coils and distortion.
18. Remove the direct clutch piston (619). The direct clutch piston is reusable unless it is damaged.
19. Inspect the direct clutch piston (619) for damage and cracks.

20. Remove the direct clutch piston intermediate seal (622) from the direct clutch housing (623).
21. Inspect the direct clutch housing (623) for the following:
    - Cracks
    - Wear
    - Proper opening of oil passages
    - Checkball for free movement (rattles)



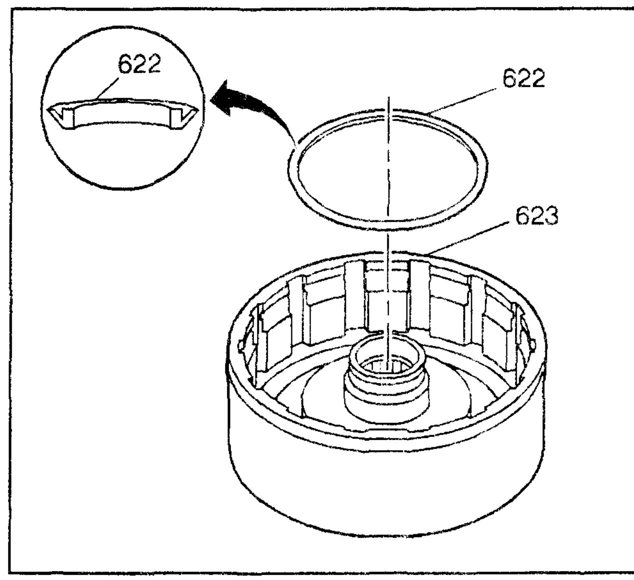
335042

Direct Clutch Assemble

Tools Required

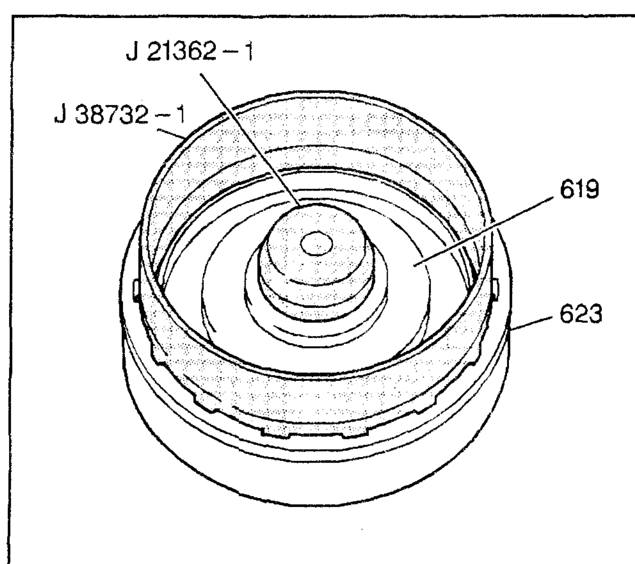
- *J 21362-1* Direct Clutch Piston and Inner Seal Protector
- *J 38732-1* Direct Clutch Piston and Outer Seal Protector
- *J 23327* Clutch Spring Compressor
- *J 25018-A* Clutch Spring Compressor Adapter
- *J 38695* Direct Clutch Spiral Retaining Ring Installer

1. Install the direct clutch intermediate seal (622) onto the direct clutch housing (623) with the seal lip facing upward.



335043

2. Lubricate the direct clutch piston seal (619) with DEXRON® III transmission fluid.
3. Install the *J 21362-1* and the *J 38732-1* onto the direct clutch housing (623). Lubricate the tools with DEXRON® III transmission fluid.
4. Install the direct clutch piston (619) into the direct clutch housing (623) using a rotating movement until the direct clutch piston (619) is seated.



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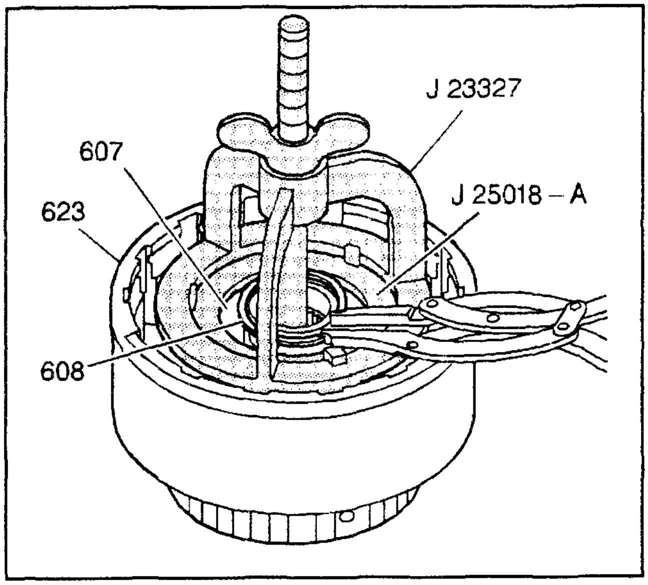
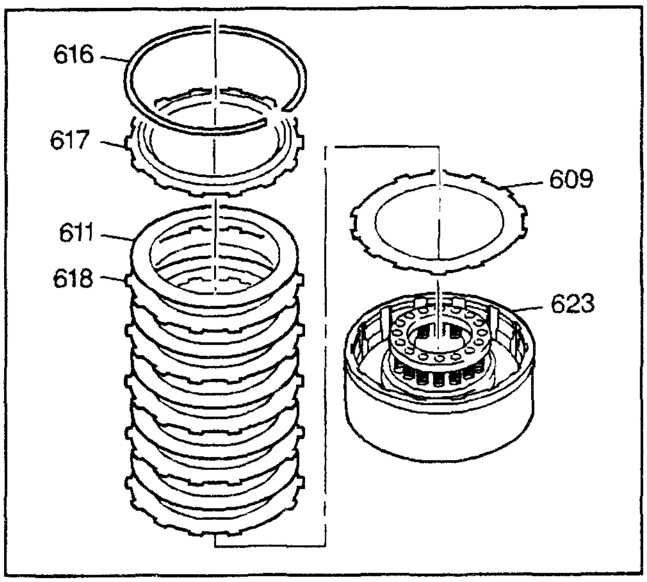


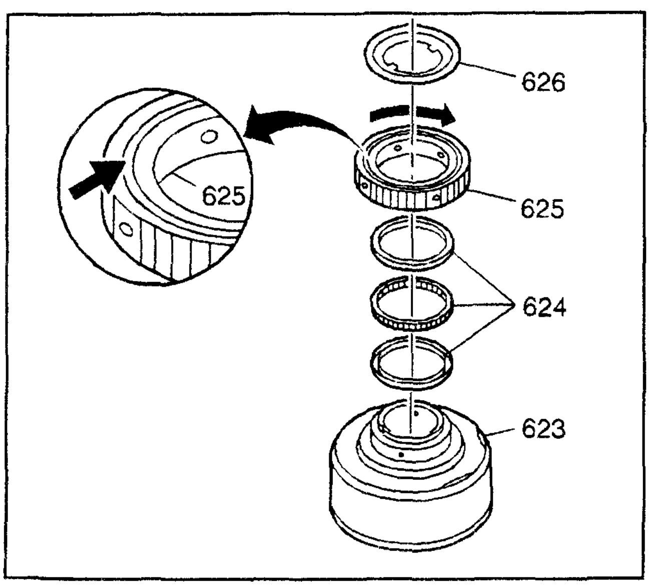
335040

5. Install the direct clutch spring assembly (607).
6. Install the *J 23327* and the *J 25018-A* onto the direct clutch housing (623).
7. Compress the direct clutch spring assembly (607).
8. Install the direct clutch spring retainer ring (608).
9. Remove the tools.



335044

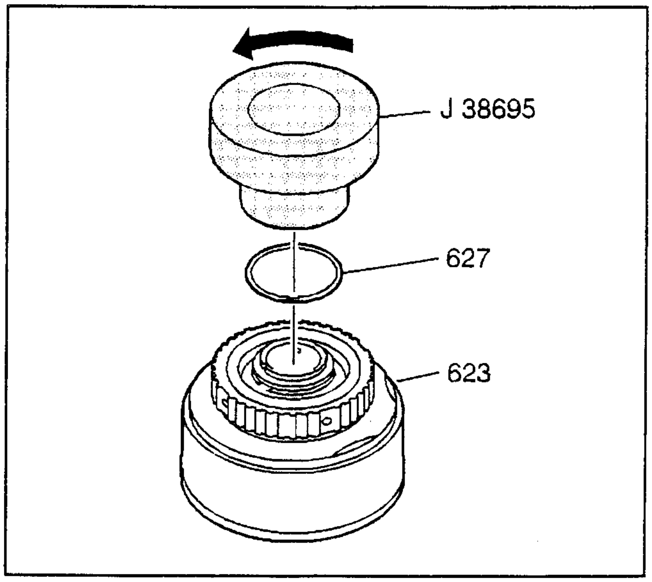
10. Dip all of the direct clutch plates in DEXRON® III transmission fluid.
11. Install the direct clutch apply plate (wave) (609).
12. Install the direct clutch plates (611, 618). Alternate the clutch plates, starting with the steel plate first (5 steel, 5 composite).
13. Install the direct clutch backing plate (617).
14. Install the direct clutch backing plate retaining ring (616).



335045

15. Turn the direct clutch housing (623) over.
16. Assemble the intermediate roller clutch assembly (624) and races into the intermediate sprag clutch outer race (625) with the lip of the cage facing the direct clutch drum.
17. Install the intermediate sprag clutch outer race (625) with the grooved side facing up:
    - Use a clockwise rotating motion to ease assembly
    - The sprag clutch outer race (625) should not rotate counterclockwise
18. Assemble the intermediate sprag clutch retainer (626).

19. Insert the intermediate sprag clutch retainer retaining ring (627) onto the direct clutch housing hub (623).
20. Use the *J 38695* in order to complete the installation of the intermediate sprag clutch retainer retaining ring. Rotate the *J 38695* counterclockwise while pressing down.



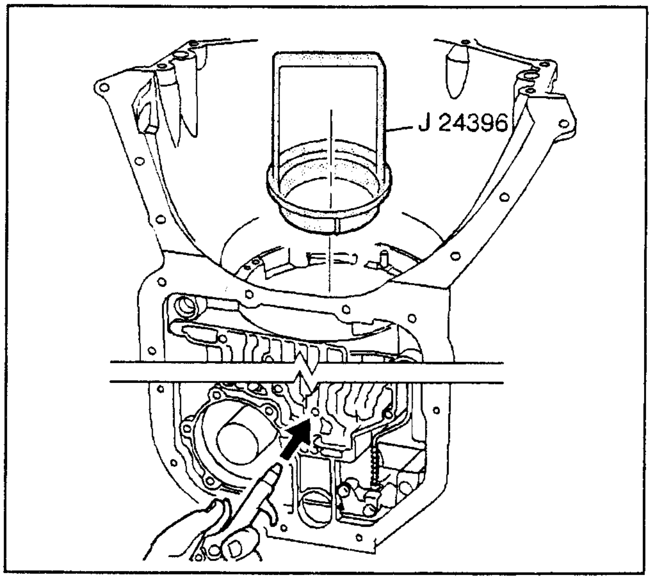
335046

Direct Clutch Installation

Tools Required

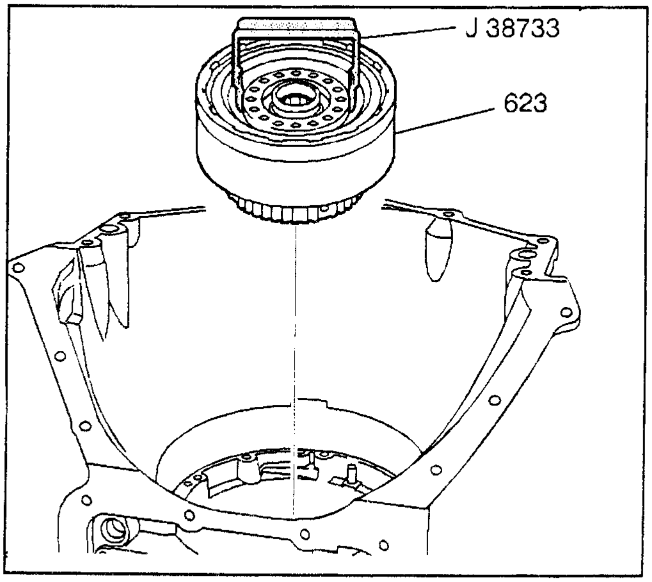
- *J 24396* Intermediate Clutch Pack Alignment Tool
- *J 38733* Direct Clutch Assembly Remover/Installer

1. Align the intermediate clutch plates with the *J 24396*.
2. Apply compressed air through the center support bolt hole to apply the intermediate clutch. Continue applying compressed air to hold the intermediate clutch plates in place until the direct clutch assembly is installed.
3. Remove the *J 24396*.



335047

4. Lower the direct clutch assembly (623) into the transmission case using the *J 38733*. Rotating the direct clutch assembly slightly in each direction can make installation easier.
5. Remove the *J 38733*.



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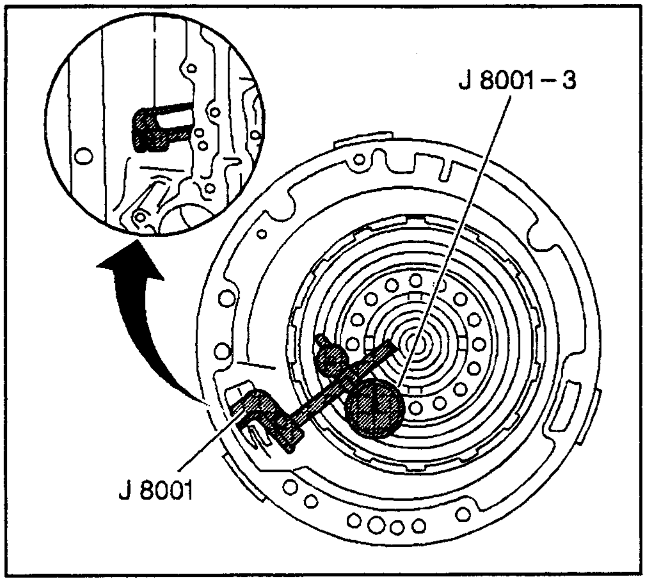


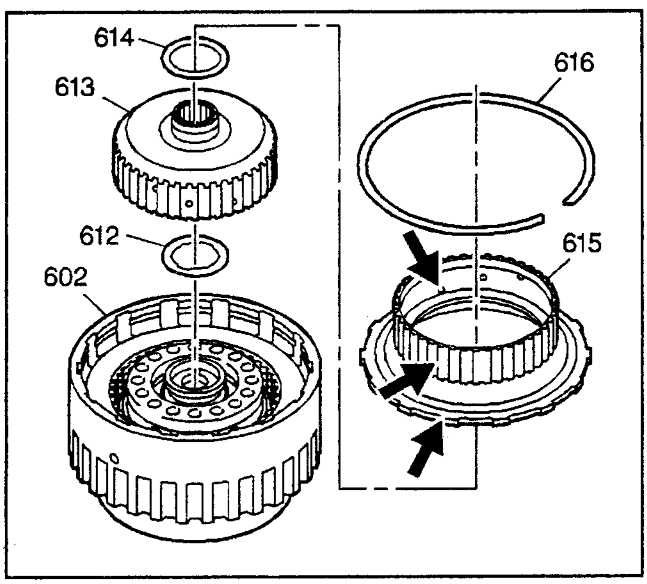
31061

Direct Clutch Piston Travel Check

Tools Required

- *J 8001* Dial Indicator Set
- *J 7057* Dial Indicator Plunger Extension

1. Attach the *J 7057* (not visible in the illustration) to the *J 8001-3*.
2. Mount the *J 8001-3* to the transmission case through the opening in the case barrel using the *J 8001-1*. Place the *J 7057* onto the direct clutch piston.
3. Index the *J 8001-3*. Set the dial to 0.
4. Apply 80 psi of air pressure to the direct clutch fluid passage, in the case bottom, in order to actuate the direct clutch piston. Refer to *Transmission Component Location*, Case Fluid Paggages Illustration.
5. The direct clutch piston travel should be 1.27–4.369 mm (0.050–0.172 in).
6. Remove the tools.



31063

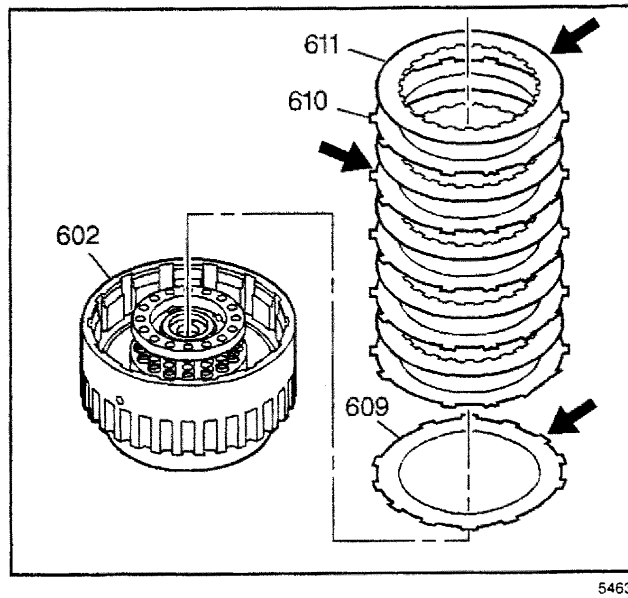
Forward Clutch Disassemble

Tools Required

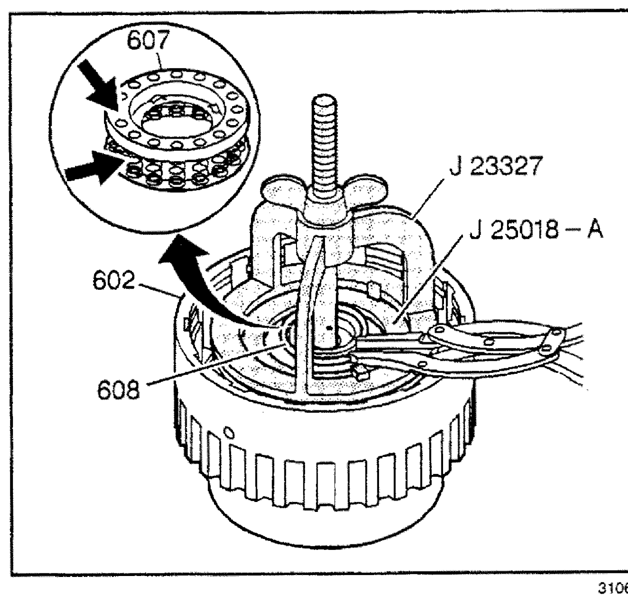
- *J 23327* Clutch Spring Compressor
- *J 25018-A* Clutch Spring Compressor Adapter

1. Remove the direct clutch hub retainer ring (616).
2. Remove the direct clutch hub (615).
3. Remove the direct clutch housing thrust washer (614) (plastic).
4. Remove the forward clutch hub (613).
5. Remove the forward clutch housing thrust washer (612) (bronze). The washer may stick to the housing.
6. Inspect the direct clutch hub (615) for the following:
   - Spline wear
   - Open lubrication holes
   - A damaged clutch surface

7. Remove the forward clutch steel and composite plates (610, 611).
8. Remove the forward clutch apply plate (waved) (609).
9. Inspect the forward clutch plates (609–611) for the following:
   - Burning
   - Scoring
   - Flaking
   - Pitting
   - Wear



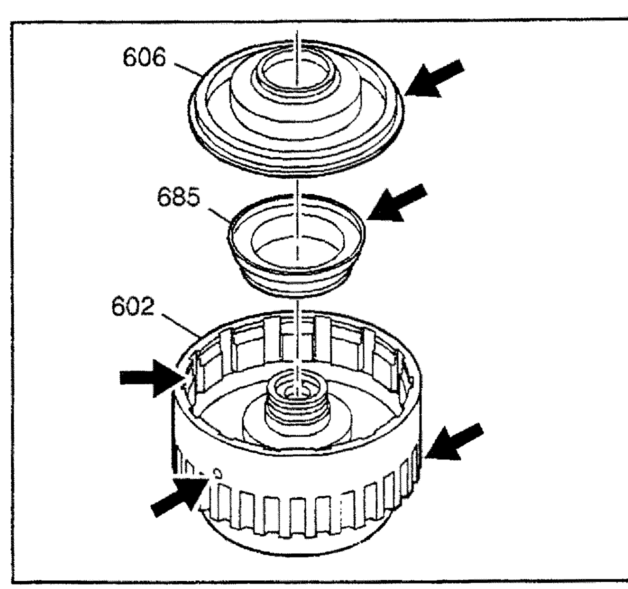
10. Use the *J 23327* and the *J 25018-A* in order to compress the forward clutch spring assembly (607).
11. Remove the forward clutch spring retainer ring (608).
12. Remove the tools.
13. Remove the forward clutch spring assembly (607).
14. Inspect the forward clutch spring assembly (607) for collapsed spring coils and distortion.

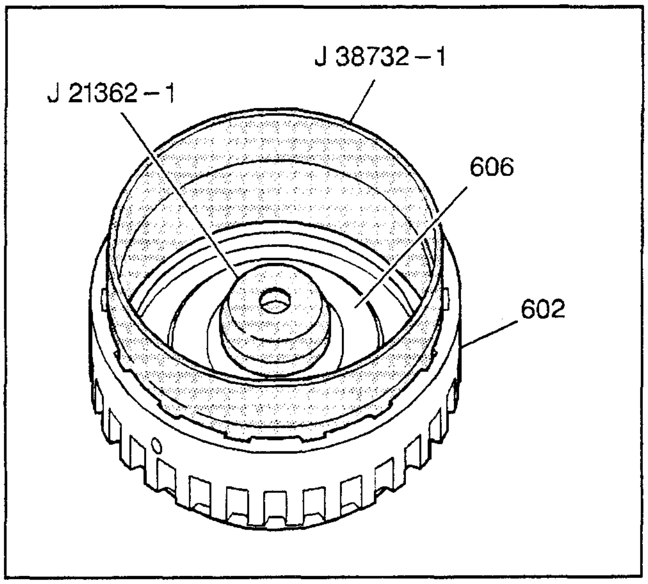


15. Remove the forward clutch piston (606). The forward clutch piston is reusable if it is not damaged.
16. Inspect the forward clutch piston (606) for cracks.
17. Inspect the forward clutch piston seal for cuts, tears, and nicks.

Important: This seal is reuseable. Replace the forward clutch housing if the seal is worn or damaged.

18. Inspect the forward clutch piston intermediate seal assembly (685) for cuts, tears, and nicks.
19. Inspect the forward clutch housing (602) for the following:
    - Wear
    - Open lubrication holes
    - Damaged thrust faces
    - Free operation of checkball (rattles)





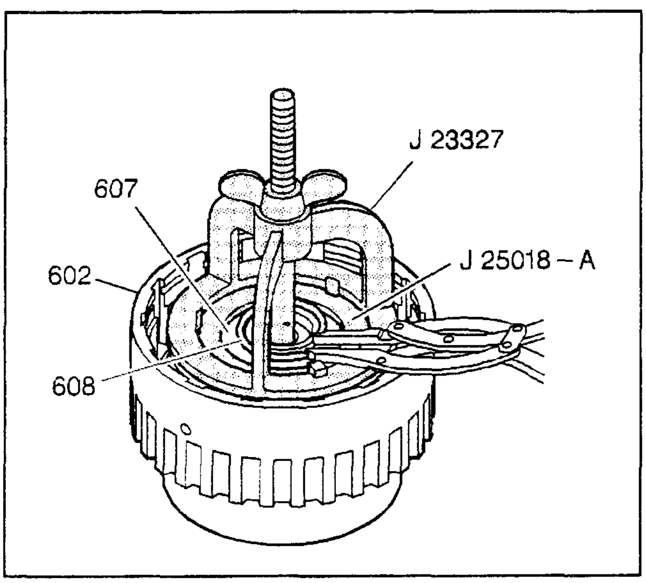
54653

Forward Clutch Assemble

Tools Required

- *J 21362-1* Forward Clutch Piston and Inner Seal Protector
- *J 38732-1* Forward Clutch Piston and Outer Seal Protector
- *J 23327* Clutch Spring Compressor
- *J 25018-A* Clutch Spring Compressor Adapter
- *J 36850* Assembly Lubricant

1. Lubricate the forward clutch piston seal with DEXRON® III transmission fluid.
2. Lubricate the forward clutch piston intermediate seal assembly with DEXRON® III transmission fluid.
3. Install the *J 21362-1* over the forward clutch housing hub.
4. Place the forward clutch piston (606) inside the *J 38732-1* and insert the assembly into the forward clutch housing assembly (602).
5. Push down on and slightly rotate the forward clutch piston (606) until it is seated.
6. Remove the tools.
7. Install the forward clutch spring assembly (607).
8. Compress the forward clutch spring assembly (607) using the *J 23327* and the *J 25018-A*.
9. Install the forward clutch spring retainer ring (608).
10. Remove the tools.

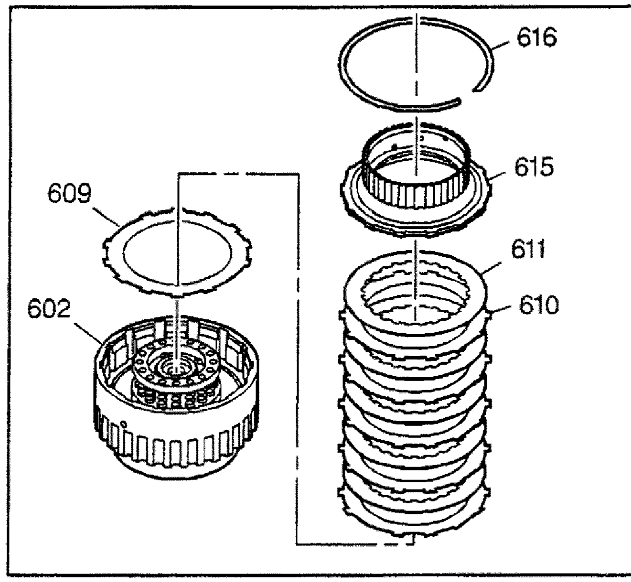


31075

11. Dip the forward clutch plates in DEXRON® III transmission fluid.
12. Install the forward clutch waved plate (609).
13. Install the steel and composite forward clutch plates (610, 611). Alternate the clutch plates, starting with the steel clutch plate (5 steel and 5 composite).

Important: The forward clutch hub and the forward clutch housing thrust washer should not be installed at this time. This will allow easier access in order to perform the forward clutch piston travel check.

14. Install the direct clutch hub (615).
15. Install the direct clutch hub retainer ring (616).



54657

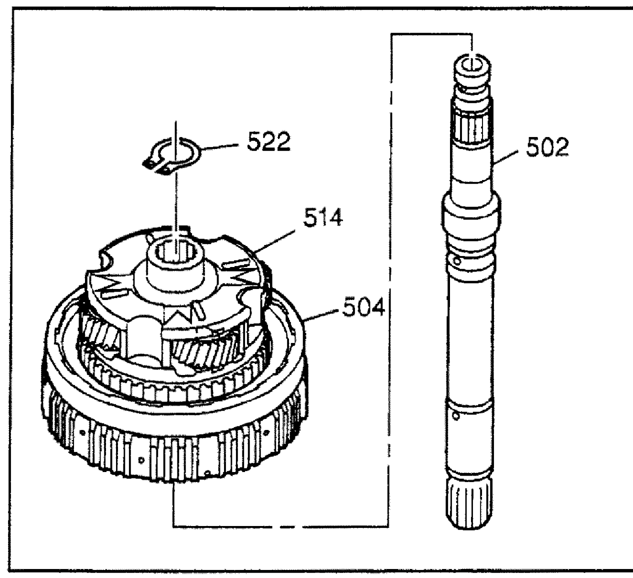
Forward Clutch Piston Travel Check

Tools Required

- *J 8001-3* Dial Indicator
- *J 26900-13* Magnetic Indicator Base

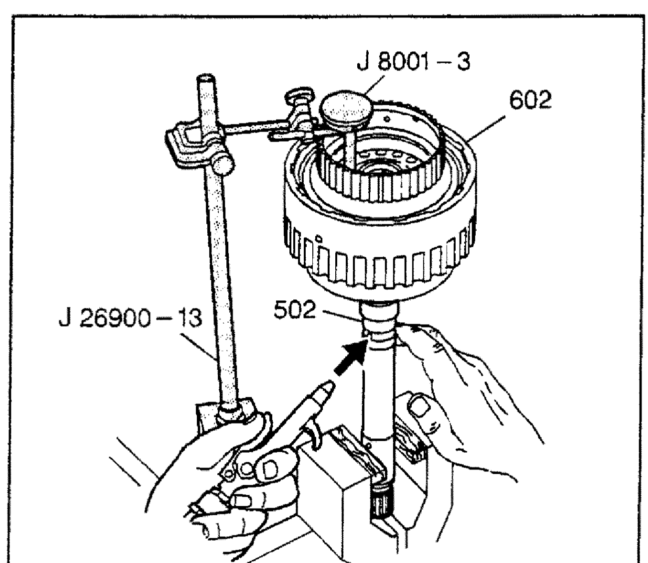
Important: The turbine shaft (502) is required to perform the forward clutch piston travel check.

1. Remove the overdrive carrier retainer ring (522).
2. Remove the turbine shaft (502).



31080

3. Place the turbine shaft (502) in a soft jawed vice.
4. Install the forward clutch housing assembly (602) onto the turbine shaft (502).
5. Attach the *J 8001-3* to the *J 26900-13*.
6. Place an index finger over one side of the forward clutch fluid passage in the turbine shaft (502).
7. Apply air to the other side of the forward clutch fluid passage in the turbine shaft (502). The piston travel is 1.27–4.369 mm (0.050–0.172 in).
8. Remove the tools.
9. Remove the forward clutch housing assembly (602) from the turbine shaft (502).



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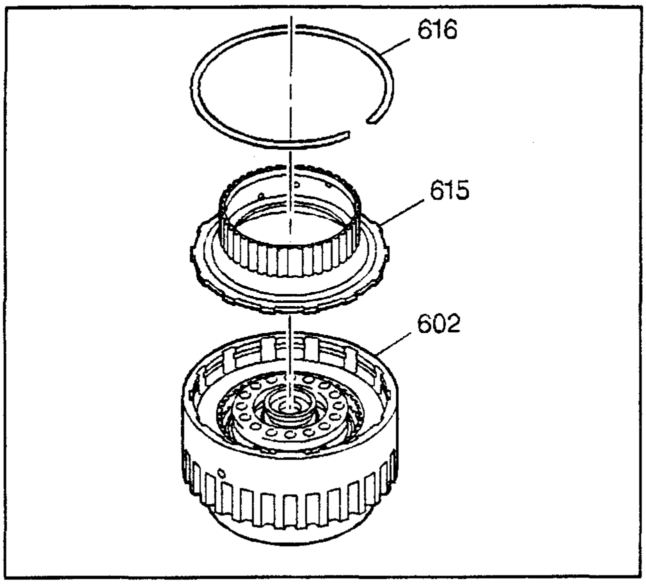


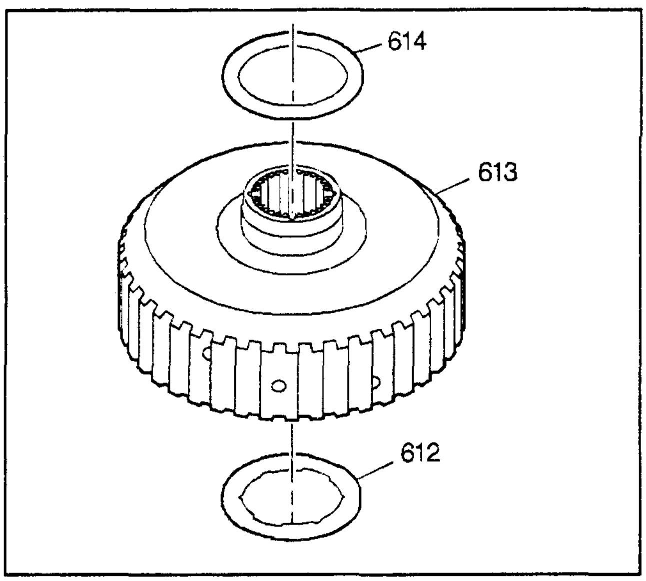
31084

Forward Clutch Hub Assemble

Tools Required

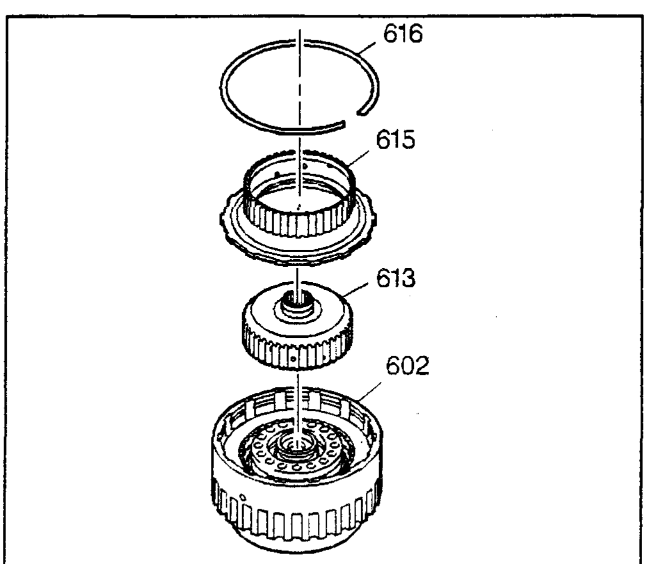
J 36850 Assembly Lubricant

1. Remove the direct clutch hub retainer ring (616).
2. Remove the direct clutch hub (615).



31086

3. Install the forward clutch housing thrust washer (612) (bronze) on the inside of the forward clutch hub (613). Retain the thrust washer with *J 36850* or equivalent.
4. Install the direct clutch housing thrust washer (614) (plastic) on the outside of the forward clutch hub (613). Retain the thrust washer with *J 36850* or equivalent.



31087

5. Install the forward clutch hub (613) into the forward clutch housing (602). Rotate the hub slightly in each direction in order to ease assembly.
6. Install the direct clutch hub (615) into the forward clutch housing (602).
7. Install the direct clutch hub retainer ring (616).

Forward Clutch Installation

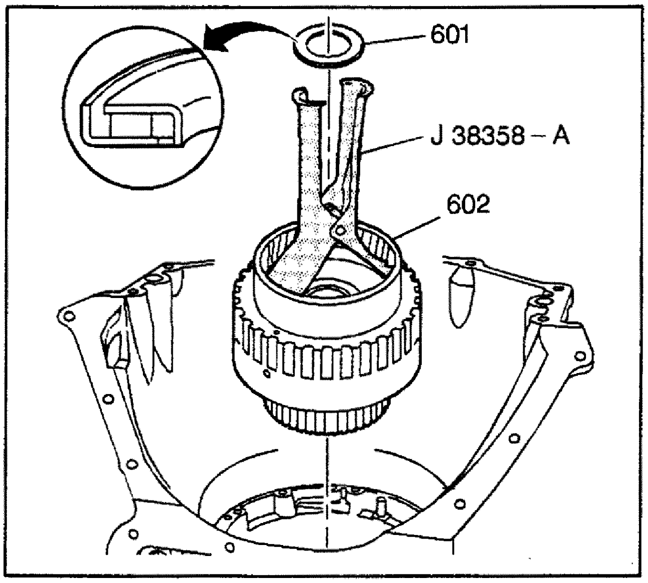
Tools Required

- *J 38358-A* Forward Clutch Assembly Remover/Installer
- *J 36850* Assembly Lubricant

1. Align the direct clutch plates in order to aid in the installation of the forward clutch assembly (602).

Important: Following installation of the forward clutch assembly (602), the distance between the top of the speed sensor ring and the pump gasket surface should be approximately 98–99 mm (3.85–3.89 in).

2. Use the *J 38358-A* in order to install the forward clutch assembly (602).
3. Install the overdrive carrier thrust bearing (601) (silver side up) onto the forward clutch housing assembly (602). Retain with *J 36850* or equivalent.



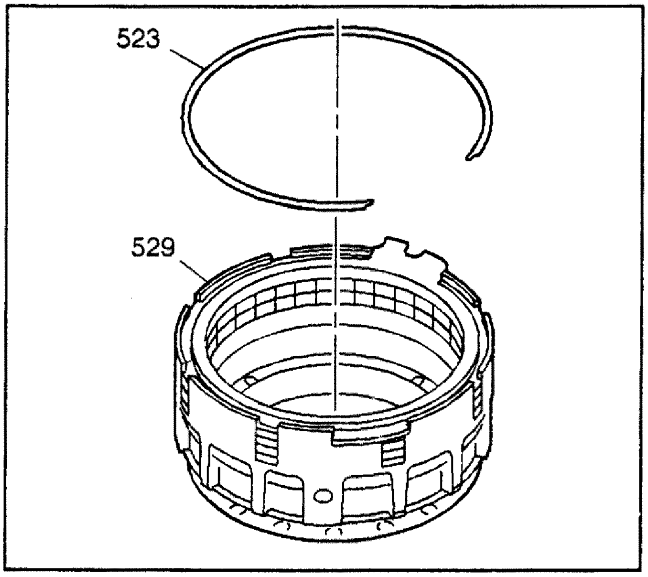
335049

Fourth Clutch Assembly Disassemble

Tools Required

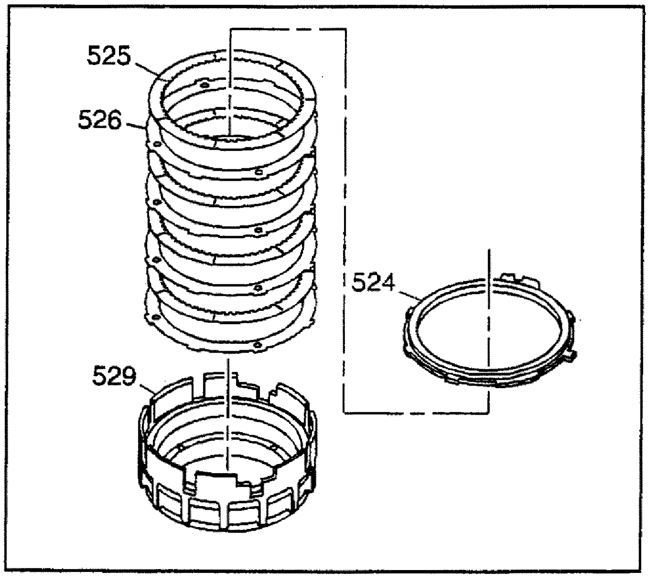
- *J 38882* Fourth Clutch Spring and Retainer Assembly Adapter
- *J 23327* Clutch Spring Compressor
- *J 38731-3* Fourth Clutch Piston and Housing Seal Spacer

1. Remove the fourth clutch backing plate retainer ring (523).

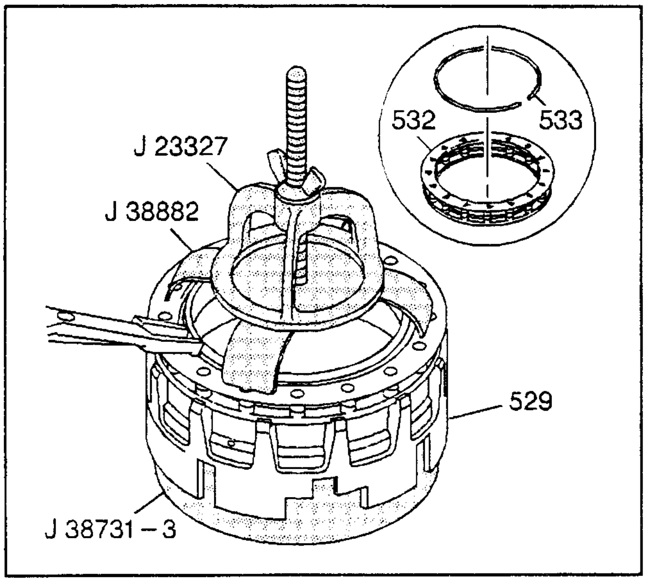


335050

2. Remove the fourth clutch backing plate (524).
3. Remove the fourth clutch plates (525, 526).

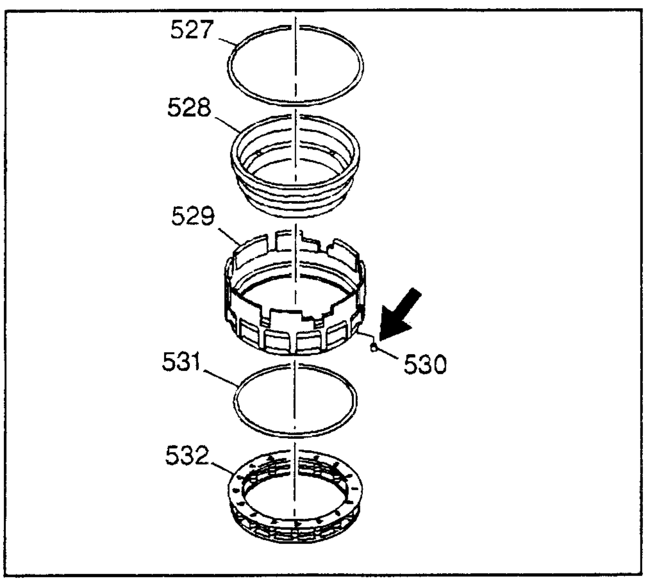


335051



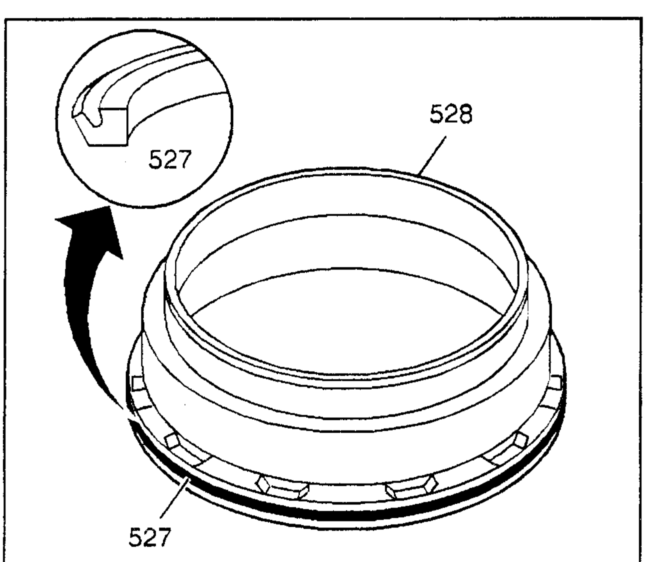
335052

4. Place the fourth clutch housing (529) onto the *J 38731-3*.
5. Compress the fourth clutch spring assembly (532) using the *J 38882* and the *J 23327*.
6. Remove the fourth clutch spring retainer ring (533).
7. Remove the *J 38882* and the *J 23327*.
8. Remove the fourth clutch spring assembly (532).



335053

9. Remove the fourth clutch piston (528).
10. Remove the fourth clutch piston inner seal (527).
11. Remove the fourth clutch piston outer seal (531) from the fourth clutch housing (529).
12. Inspect the fourth clutch housing orifice (530). The orifice should be open approximately 0.51 mm (0.020 in).



31099

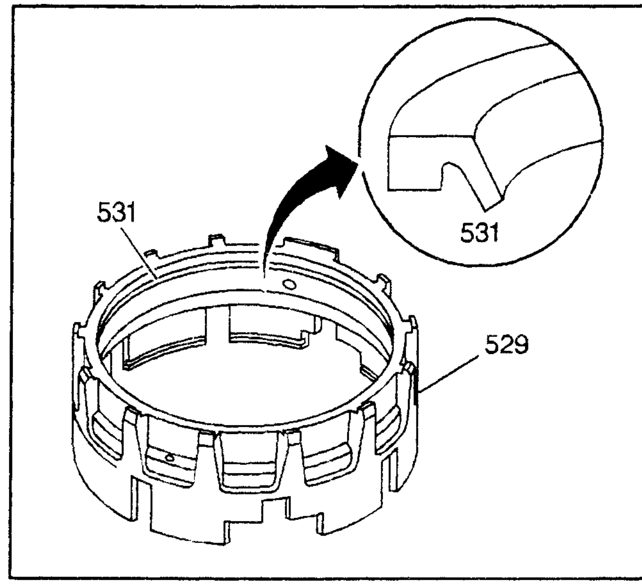
Fourth Clutch Assembly Assemble

Tools Required

- *J 38731-1* Fourth Clutch Piston and Housing Seal Protector
- *J 38731-2* Fourth Clutch Piston and Housing Seal Protector
- *J 38731-3* Fourth Clutch Piston and Housing Seal Spacer
- *J 38882* Fourth Clutch Spring and Retainer Assembly Adapter
- *J 23327* Clutch Spring Compressor

1. Install the fourth clutch piston inner seal (527) onto the fourth clutch piston (528).

2. Install the fourth clutch piston outer seal (531) into the fourth clutch housing (529). The seal lip should face the bottom of the piston when the piston is installed.



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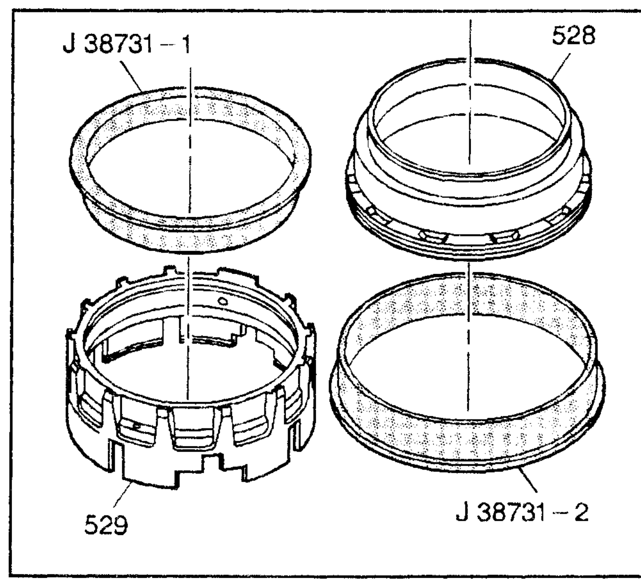
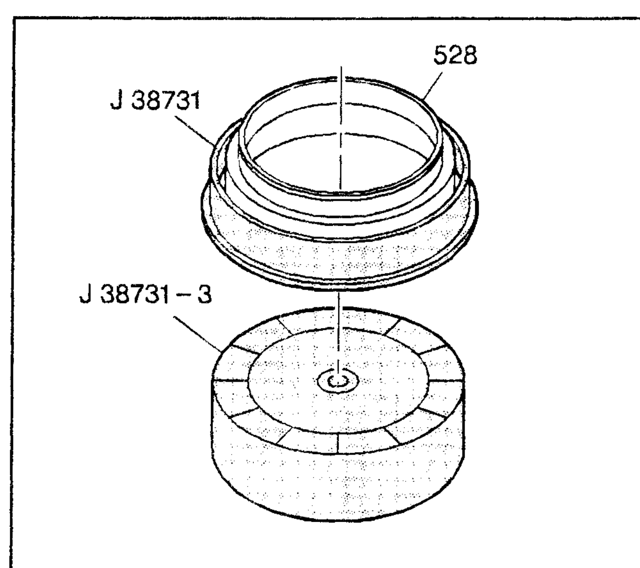
3. Place the *J 38731-1* onto the fourth clutch housing (529) through the small end.
4. Place the *J 38731-2* onto the large end of the fourth clutch piston (528).

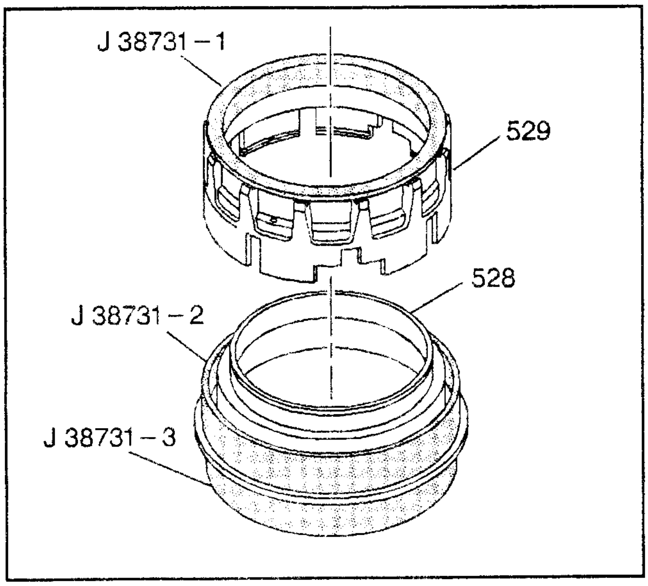


335056

5. Place the *J 38731-2* and the fourth clutch piston (528) onto the *J 38731-3*.

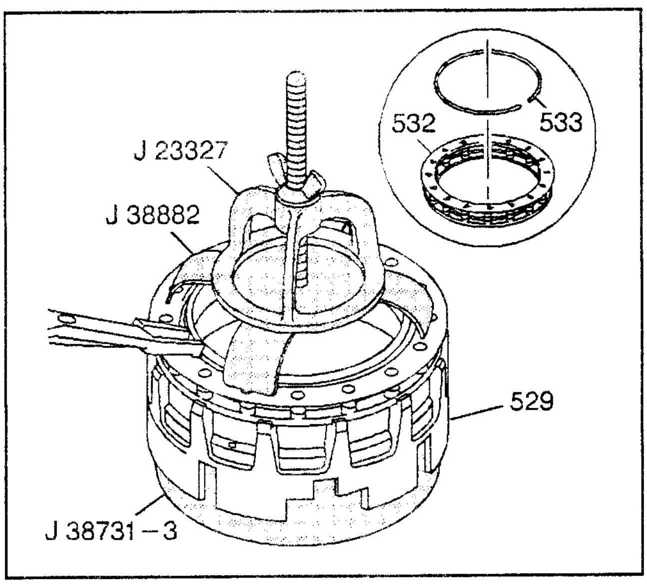


31102



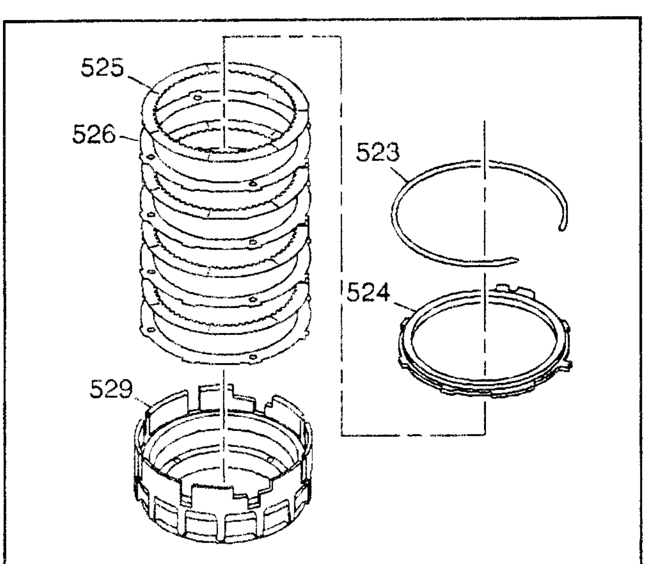
335058

6. Gently push down on the fourth clutch housing (529) until the fourth clutch piston (528) is through the fourth clutch housing (529), exposing the retainer ring groove.
7. Remove all tools.



335052

8. Place the fourth clutch spring (532) and the fourth clutch spring retainer ring (533) onto the fourth clutch piston (528).
9. Compress the fourth clutch spring (532) using the *J 38882*, the *J 23327* and the *J 38731-3*.
10. Install the fourth clutch spring retainer ring (533).
11. Remove the tools.

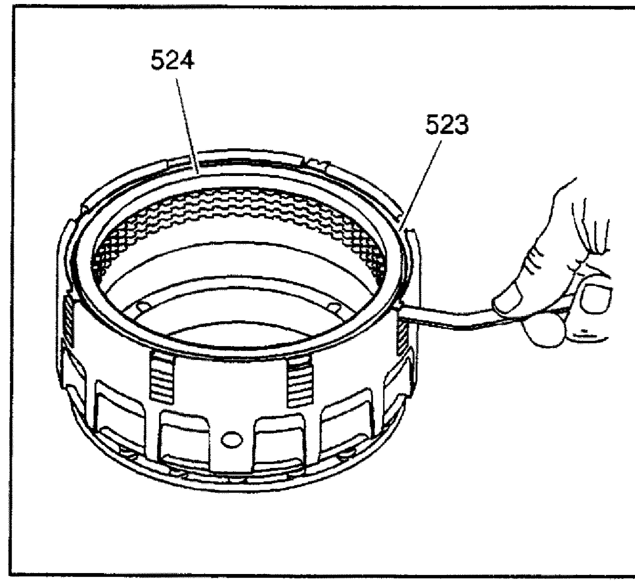


335059

12. Install the fourth clutch plates (525, 526) into the fourth clutch housing (529):
    - Alternate the clutch plates, starting with the steel clutch plate (526) (4 steel and 4 composite)
    - Locate the steel plate index notch opposite the fourth clutch bolt hole
13. Install the fourth clutch backing plate (524). Locate the notched tab in the same direction as the steel plate index notches.
14. Install the fourth clutch backing plate retainer ring (523).

Fourth Clutch Piston Travel Check

Using a feeler gage, measure between the fourth clutch backing plate (524) and the fourth clutch backing plate retainer ring (523). The measurement should be 1.016–2.540 mm (0.040–0.100 in).

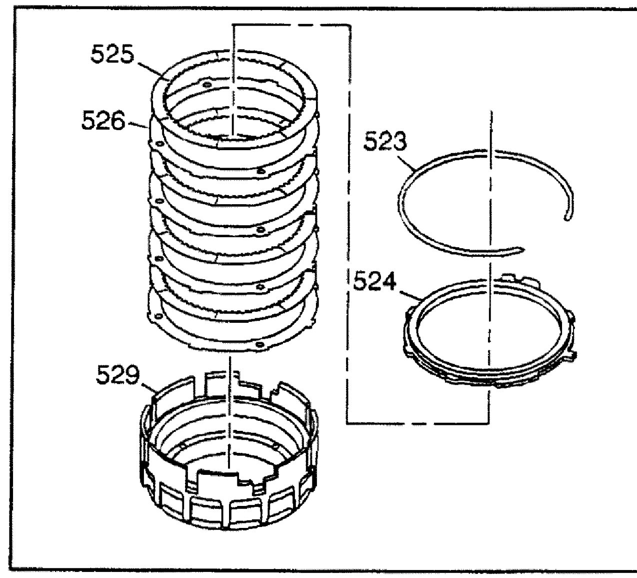


335060

Fourth Clutch Assembly Installation

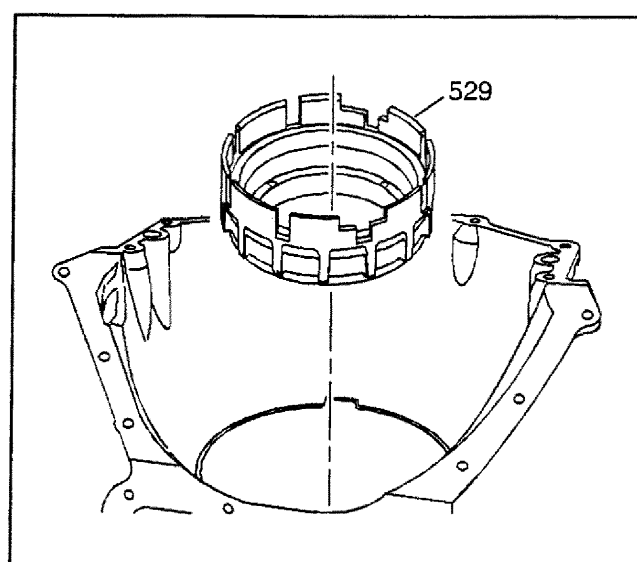
Important: Removal of the fourth clutch backing plate retainer ring, the fourth clutch backing plate, and the fourth clutch plates will ease assembly of the overrun clutch housing assembly.

1. Remove the fourth clutch backing plate retainer ring (523).
2. Remove the fourth clutch backing plate (524).
3. Remove the clutch plates (525, 526).



335059

4. Install the fourth clutch housing (529) into the transmission case.



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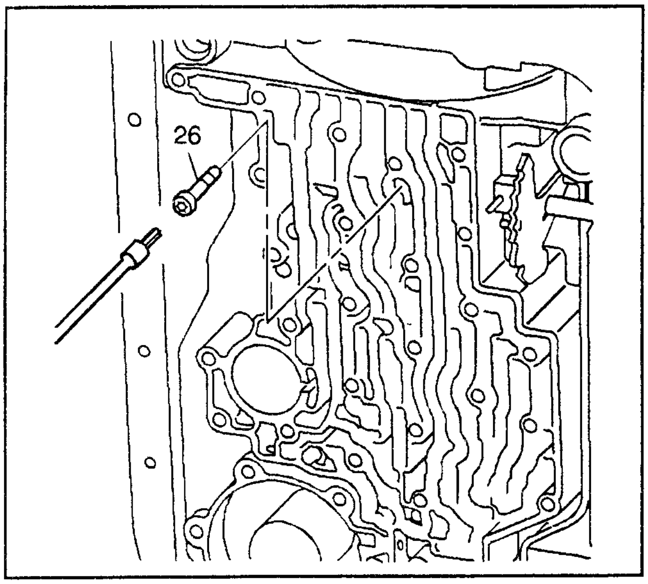


31110

5. Install a new fourth clutch housing bolt (26).

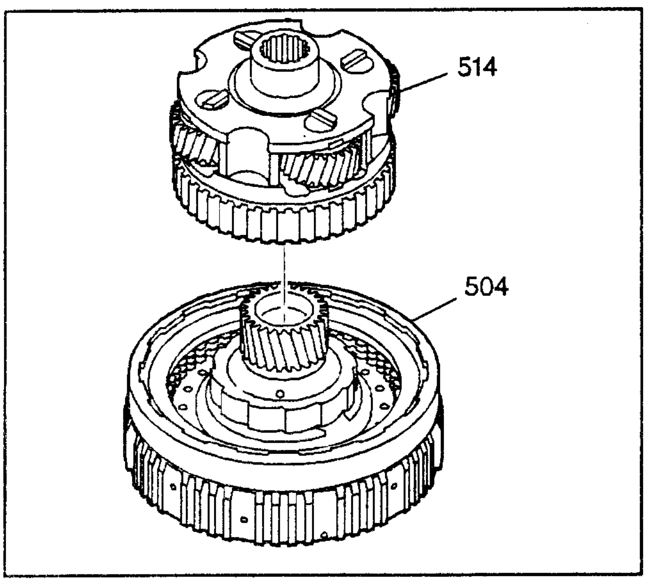
Important: Do not over torque the fourth clutch housing bolt (26).

Notice: Refer to *Fastener Notice* in Cautions and Notices.

6. Tighten the fourth clutch housing bolt (26).

Tighten

Tighten the bolt to 23–26 N·m (17–19 lb ft).



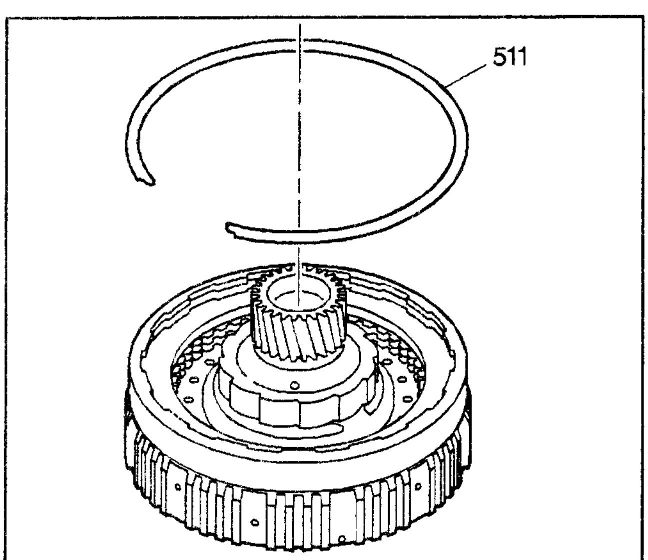
31111

Overrun Clutch Assembly Disassemble

Tools Required

- *J 38734* Intermediate Spring Compressor Adapter
- *J 23327* Clutch Spring Compressor

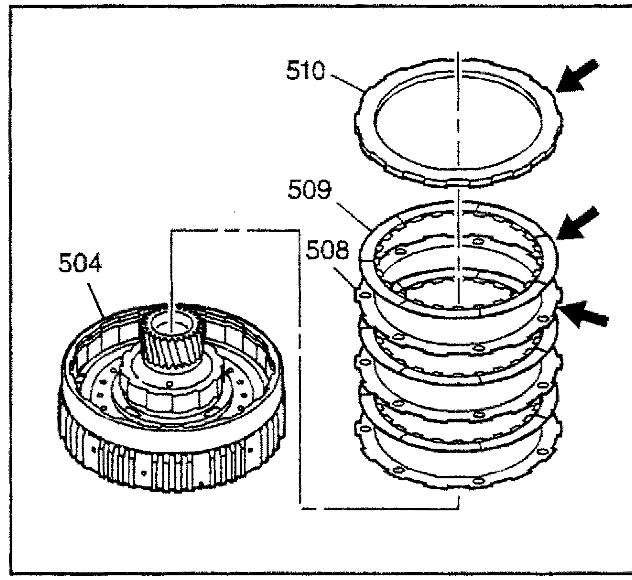
1. Separate the overdrive carrier assembly (514) from the overrun clutch housing assembly (504).



31112

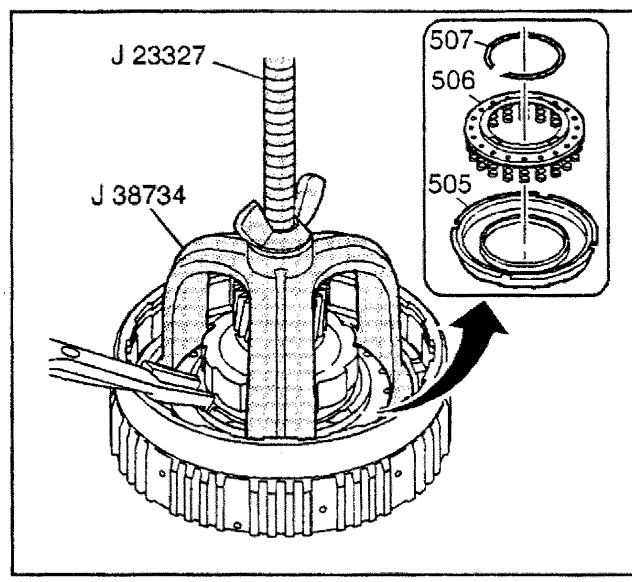
2. Remove the overrun clutch backing plate retainer ring (511).

3. Remove the overrun clutch backing plate (510) and the overrun clutch plates (508, 509) (3 steel and 3 composite).
4. Inspect the overrun clutch plates (508–510) for burning, scoring, flaking, pitting, and wear.



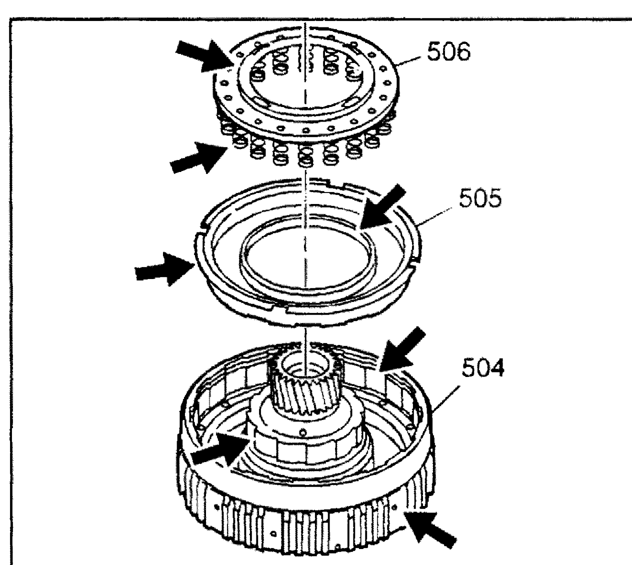
54673

5. Using the *J 23327* and the *J 38734*, remove the overrun clutch spring assembly (506).
6. Remove the overrun clutch spring retainer ring (507).
7. Remove the tools.
8. Remove the overrun clutch spring assembly (506).
9. Remove the overrun clutch piston (505).



31115

10. Inspect the overrun clutch springs (506) for collapsed coils and distortion.
11. Inspect the overrun clutch piston (505) for cracks and a cut seal.
12. Inspect the overrun clutch housing (504) for wear, open lubrication holes, and damaged thrust surfaces.



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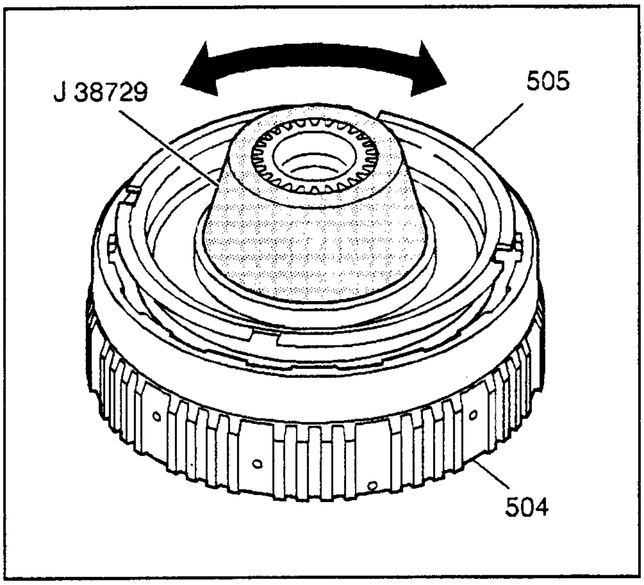


31117

Overrun Clutch Assembly Assemble

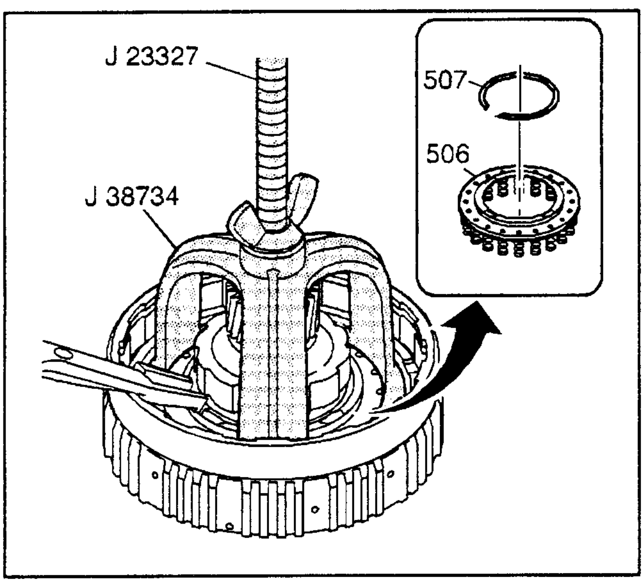
Tools Required

- *J 38729* Overrun Clutch Piston Seal Protector
- *J 38734* Intermediate Spring Compressor Adapter
- *J 23327* Clutch Spring Compressor

1. Install the *J 38729* onto the overrun clutch housing (504).
2. Lubricate the overrun clutch piston seal with DEXRON® III transmission fluid.
3. Assemble the overrun clutch piston (505) into the overrun clutch housing (504).

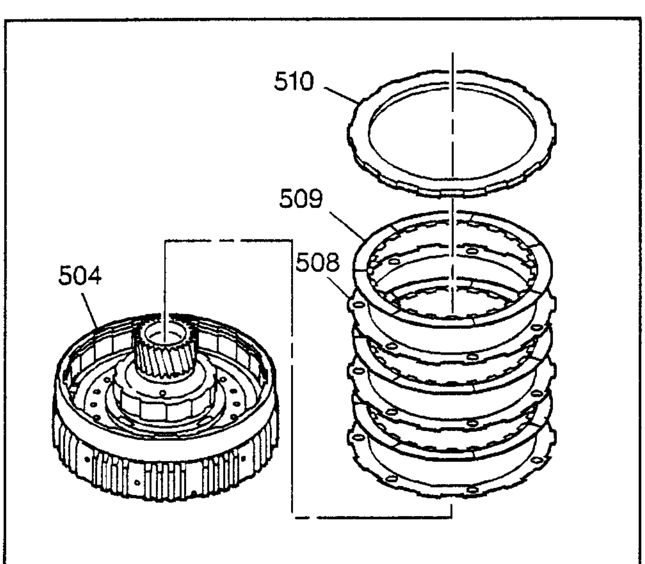
Important: Keep the overrun clutch piston (505) level, while rotating, in order to avoid damaging the seal.

4. Rotate the overrun clutch piston (505) in order to aid in assembly.



31119

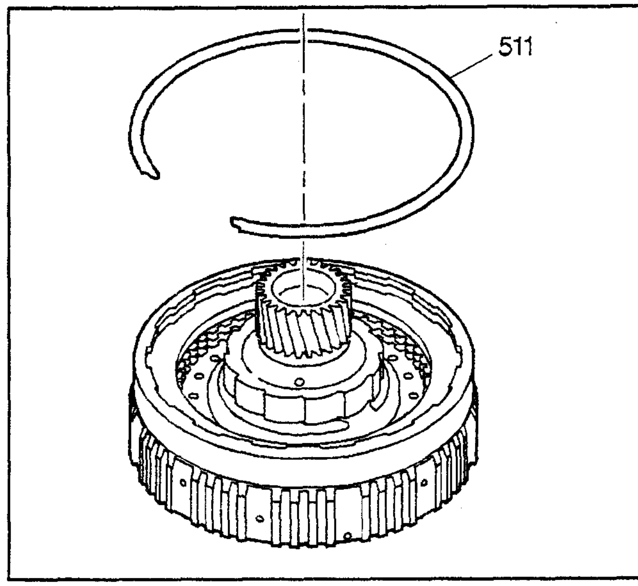
5. Place the overrun clutch spring assembly (506) onto the overrun clutch piston (505).
6. Compress the overrun clutch spring assembly (506) using the *J 23327* and the *J 38734*.
7. Install the overrun clutch spring retainer ring (507).



54675

8. Install the overrun clutch plates (508, 509).
9. Alternate the clutch plates, starting with the steel clutch plate (508) (3 steel, 3 composite).
10. Install the overrun clutch backing plate (510).

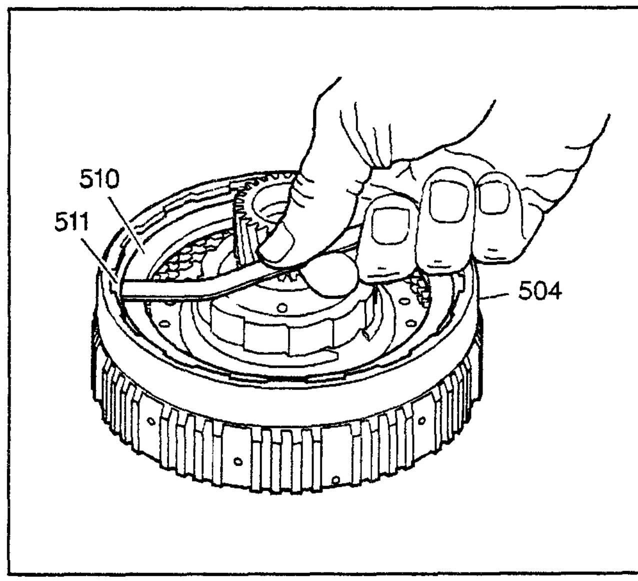
11. Install the overrun clutch backing plate retainer ring (511).



31112

Overrun Clutch Piston Travel Check

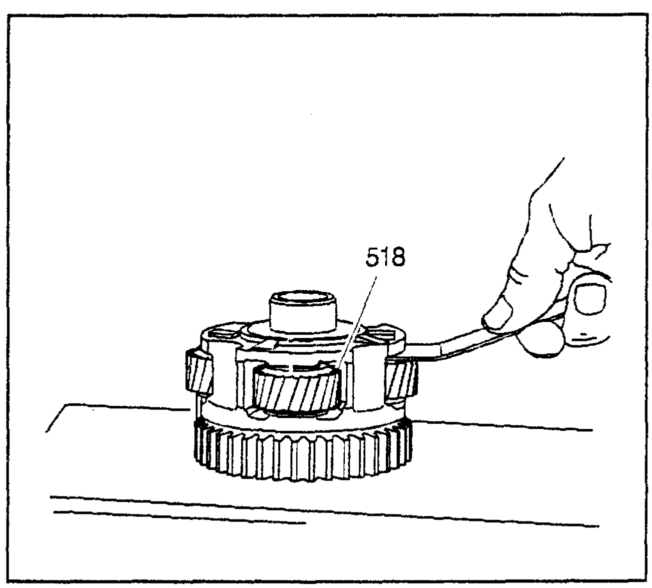
Place a feeler gage between the overrun clutch backing plate (510) and the overrun clutch backing plate retainer ring (511). The clearance should be 0.838–2.38 mm (0.033–0.094 in).



31121

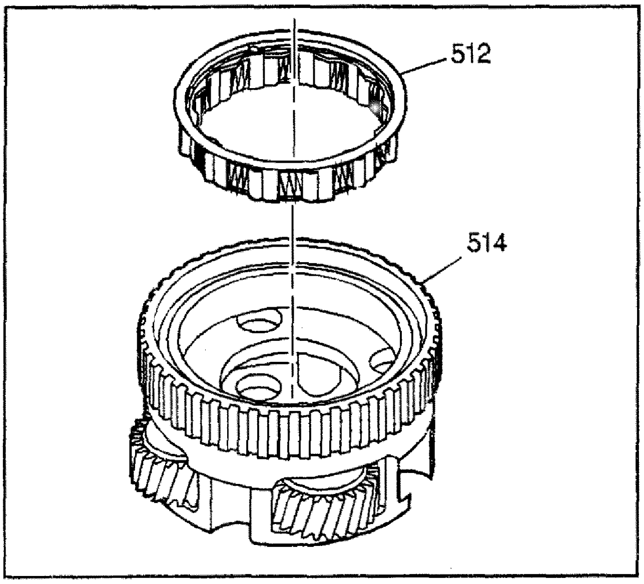
Overdrive Carrier Pinion End Play Check

Measure the pinion washer wear using a feeler gauge. The end play should be 0.228–0.610mm (0.008–0.025 in).



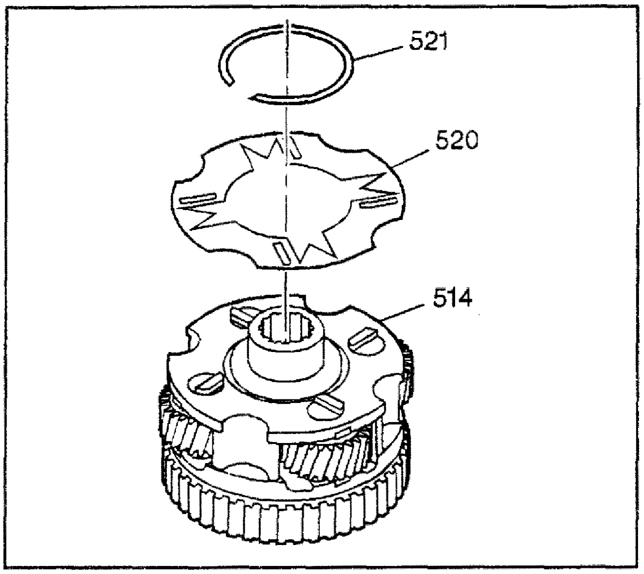
31122

Overdrive Carrier Assembly Disassemble



31124

1. Remove the overdrive clutch roller assembly (512) from the overdrive carrier assembly (514).

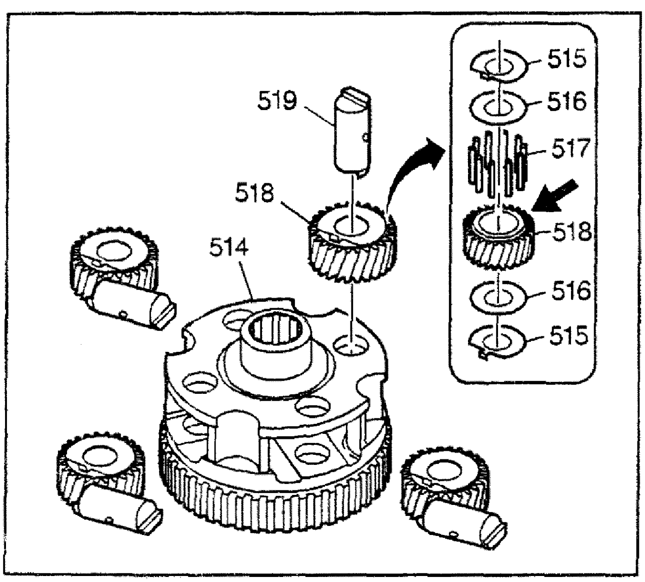


31125

2. Remove the overdrive carrier pinion gear pin retainer (521) from the overdrive carrier assembly (514).

Important: Before removing the pinion gear pins, mark the overdrive carrier pinion gears and the overdrive carrier pinion gear pins locations so they can be identified for reassembly.

3. Remove the overdrive carrier pinion pin gear retainer (520)

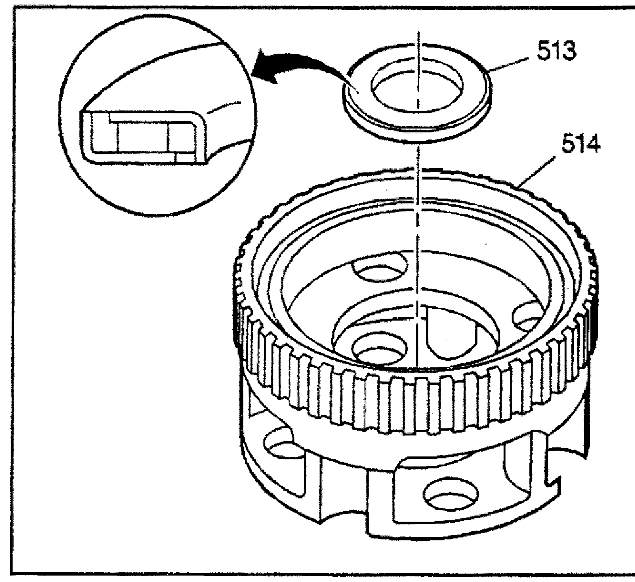


31127

Important: Keep all washers and bearings together with the overdrive carrier pinion gear and pin they were removed with. The pinion gears, washers and bearings must be reinstalled in their original locations.

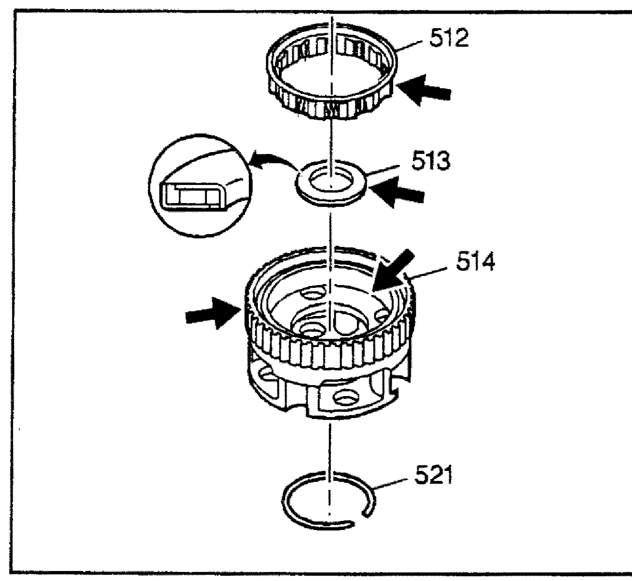
4. Remove one overdrive carrier pinion gear (518) and pin (519) at a time.
5. Inspect the overdrive carrier pinion gear (518), pin (519), roller bearings (517), steel thrust washers (516) and thrust washers (515) for wear or damage.

6. Remove the overrun clutch housing thrust bearing (513). The bearing will fall out when the pinion gears are removed.



31129

7. Inspect the pinion pocket thrust surfaces for burrs.
8. Inspect the overdrive clutch roller assembly (512).
9. Inspect the overdrive carrier assembly (514) for cracks, damage and wear.
10. Inspect the overrun clutch housing thrust bearing (513).



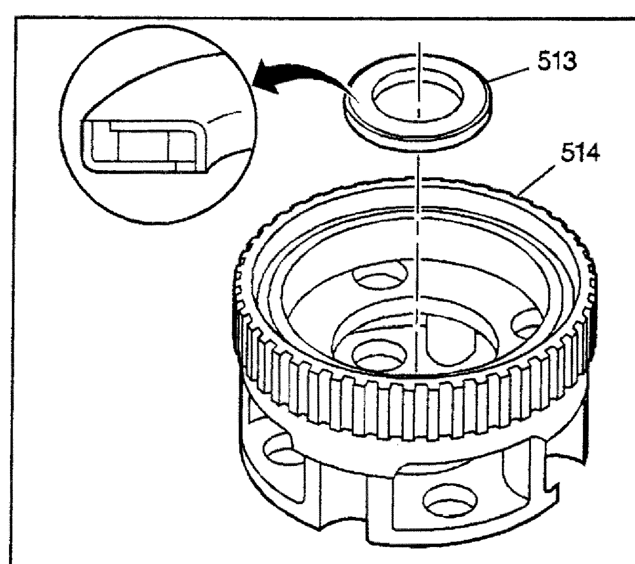
31132

Overdrive Carrier Assembly Assemble

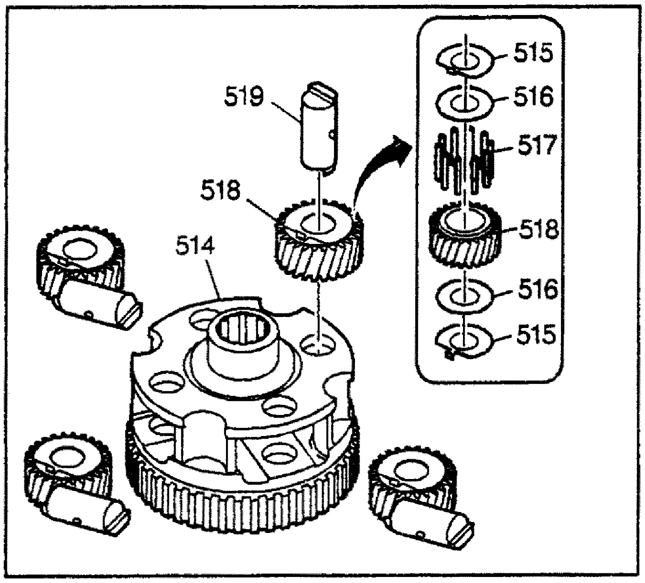
Tools Required

J 36850 Assembly Lubricant

1. Install the overrun clutch housing thrust bearing (513). Retain with *J 36850* or equivalent.



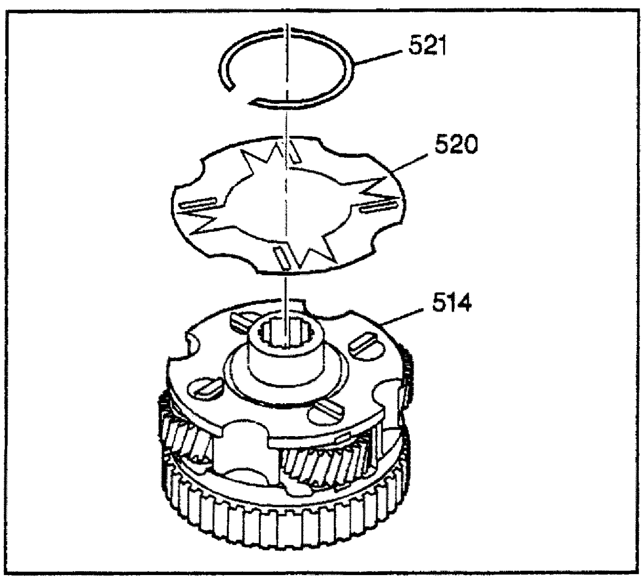
31129



31137

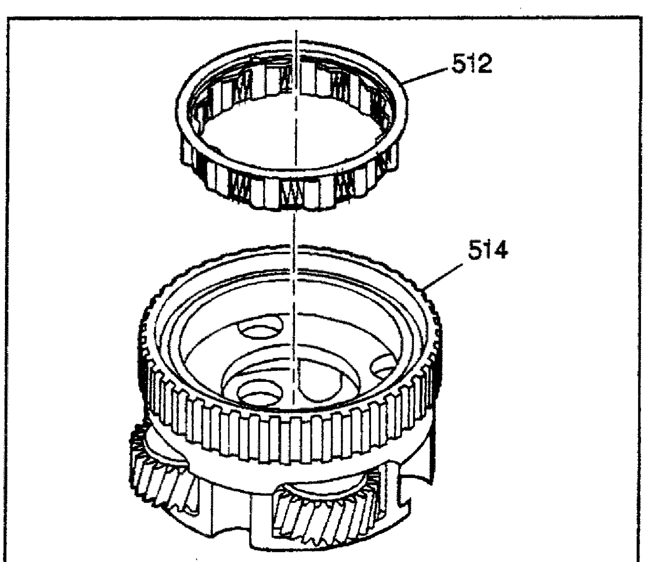
Important: Keep all washers and bearings together with the overdrive carrier pinion gear and pin they were removed with. The pinion gears, pins, washers and bearings must be reinstalled in their original locations.

2. Install one overdrive pinion carrier gear (518) and its roller bearings (517) and thrust washers (515, 516), into the overdrive carrier (514) at the location marked at disassembly.
3. Install the overdrive carrier pinion gear pin (519).
4. Repeat steps 2 and 3 until all four pinion gear assemblies are installed in their original locations.



31125

5. Install the overdrive carrier pinion gear pin retainer (520). Align the pinion gear pins with the retainer slots.
6. Install the overdrive carrier pinion gear pin retainer (521).

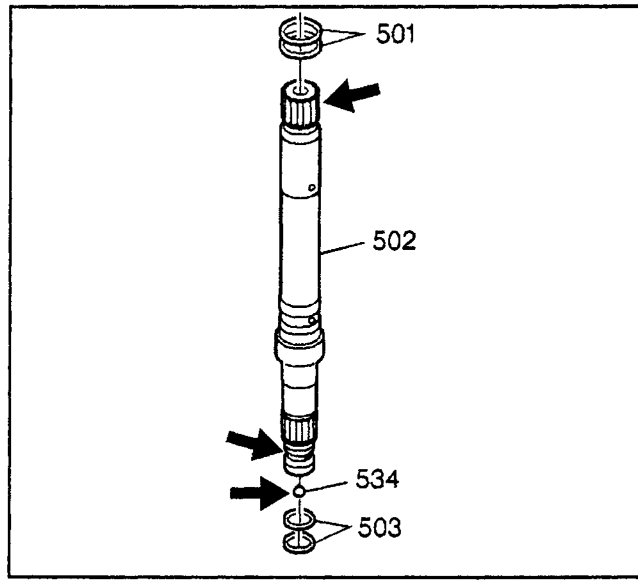


31124

7. Install the overdrive clutch roller assembly (512).

Turbine Shaft Disassemble

1. Remove the turbine shaft rear (501) and intermediate (503) oil seal rings.
2. Inspect the turbine shaft (502) for damage or cracks.
3. Inspect the turbine shaft plug (534) on the end of the turbine shaft (502).



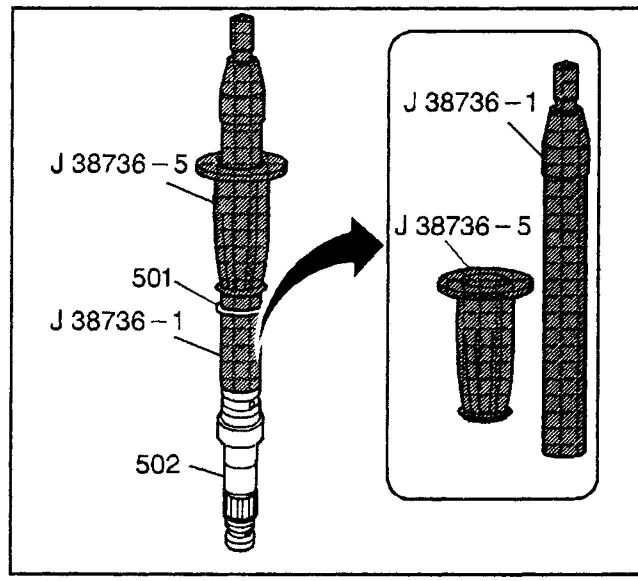
31139

Turbine Shaft Assemble

Tools Required

- *J 38736-1* Turbine Shaft Seal Installer
- *J 38736-2* Turbine Shaft Seal Installer
- *J 38736-3* Turbine Shaft Seal Sizer
- *J 38736-4* Turbine Shaft Seal Sizer
- *J 38736-5* Turbine Shaft Seal Pusher
- *J 38736-6* Turbine Shaft Seal Pusher

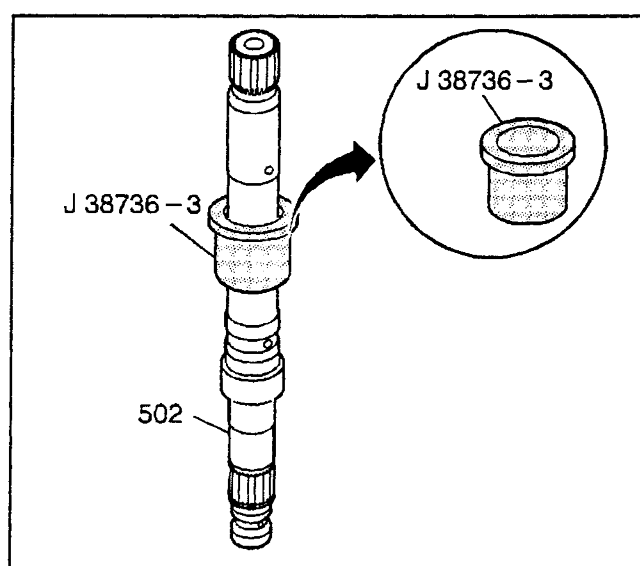
1. Place the *J 38736-1* onto the turbine shaft (502).
2. Set the *J 38736-1* to position #1.
3. Install the turbine shaft rear oil seal ring (501) using the *J 38736-5.*
4. Remove the tools.



31141

Important: Be sure to use the small chamfered end of the *J 38736-3* in order to size the lower turbine shaft rear oil seal ring. Then use the larger chamfered end of the *J 38736-3* in order to size the upper turbine shaft rear oil seal ring.

5. Place the *J 38736-3* over the turbine shaft rear oil seal ring with the small chamfer down.
6. Leave the *J 38736-3* on the turbine shaft rear oil seal ring for at least one minute in order to allow the turbine shaft rear oil seal ring to become the proper size.



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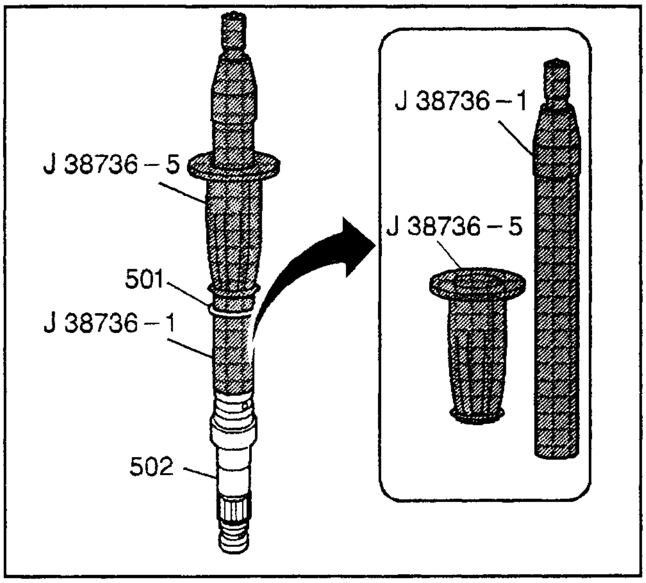
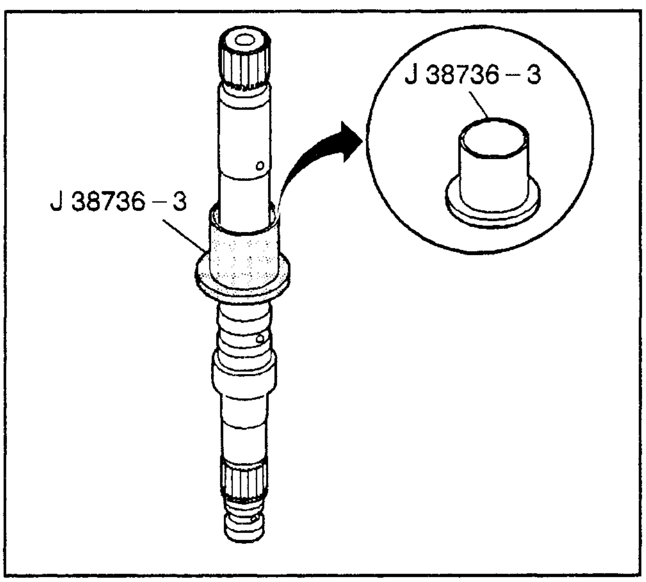


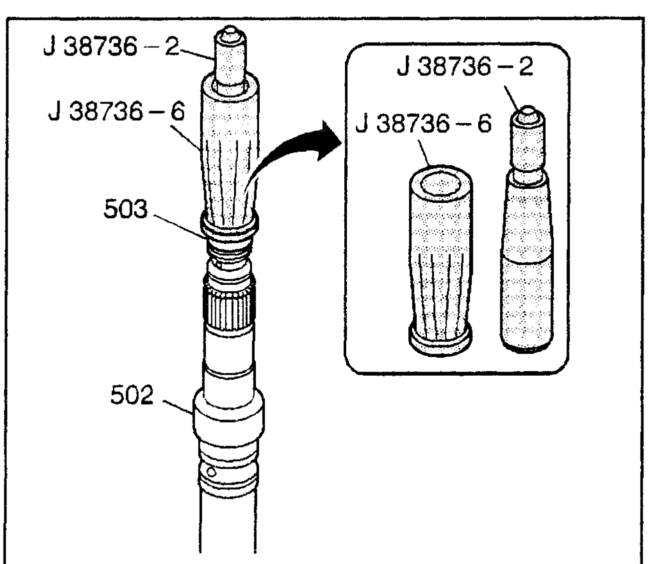
31141

7. Place the *J 38736-1* onto the turbine shaft (502).
8. Set the *J 38736-1* to position #2.
9. Install the turbine shaft rear oil seal ring (501) using the *J 38736-5*.
10. Remove the tools.



40708

11. Place the *J 38736-3* over the turbine shaft rear oil seal ring with the large chamfer down.
12. Leave the *J 38736-3* on the turbine shaft rear oil seal ring for at least one minute to allow the turbine shaft front oil seal to become the proper size.

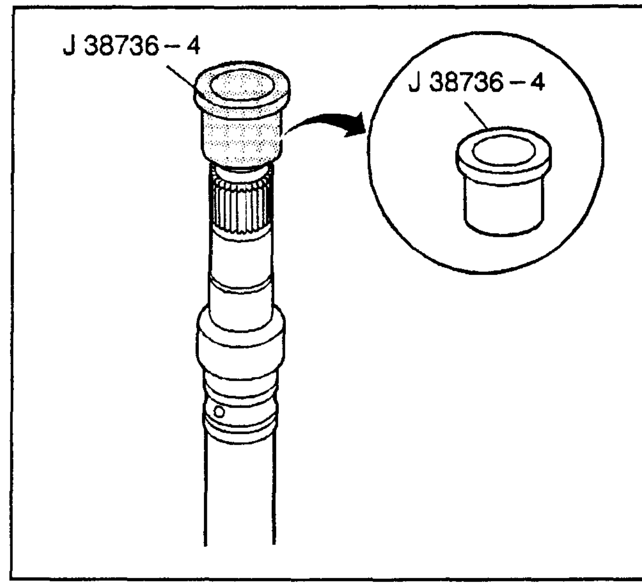


31183

13. Turn the turbine shaft (502) over.
14. Place the *J 38736-2* onto the turbine shaft.
15. Set the *J 38736-2* to position #1.
16. Install the turbine shaft intermediate oil seal ring (503) using the *J 38736-6*.
17. Remove the tools.

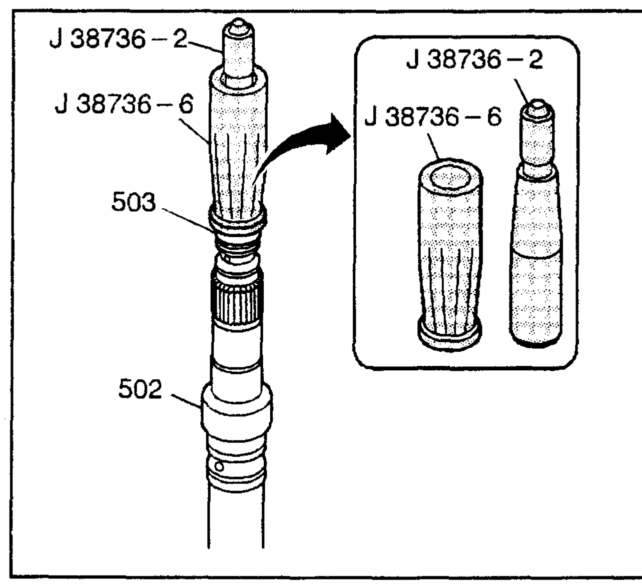
Important: Be sure to use the small chamfered end of the *J 38736-4* in order to size the lower turbine shaft intermediate oil seal ring. Then use the larger chamfered end of the *J 38736-4* in order to size the upper turbine shaft intermediate oil seal ring.

18. Place the *J 38736-4* over the turbine shaft intermediate oil seal ring with the small chamfer down.
19. Leave the *J 38736-4* on the turbine shaft intermediate oil seal ring for at least one minute in order to allow the turbine shaft intermediate oil seal ring to become the proper size.



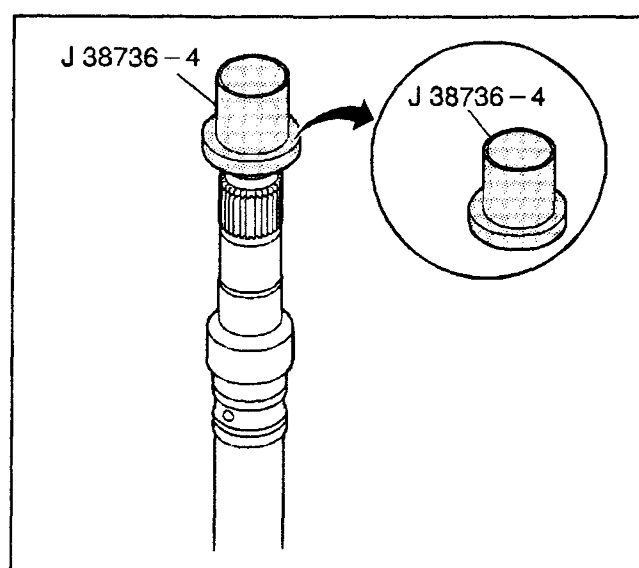
40709

20. Place the *J 38736-2* onto the turbine shaft (502).
21. Set the *J 38736-2* to position #2.
22. Install the turbine shaft intermediate oil seal ring (503) using the *J 38736-6.*
23. Remove the tools.



31183

24. Place the *J 38736-4* over the turbine shaft intermediate oil seal ring with the large chamfer down.
25. Leave the *J 38736-4* on the turbine shaft intermediate oil seal ring for at least one minute in order to allow the turbine shaft intermediate oil seal ring to become the proper size.



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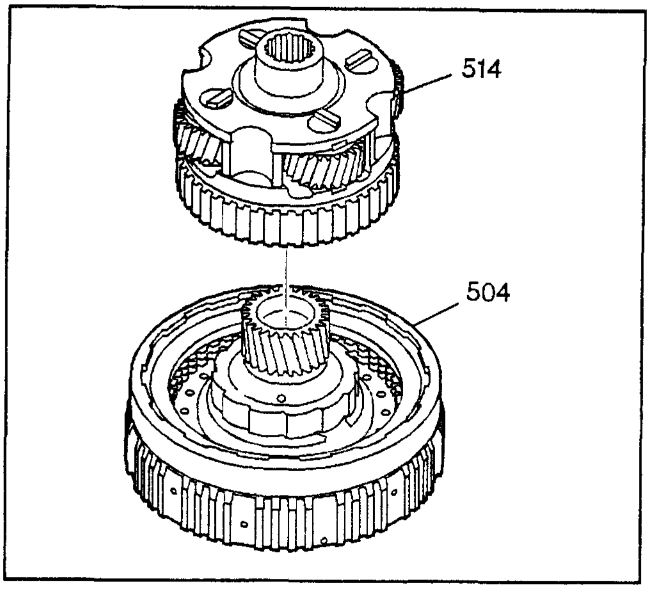
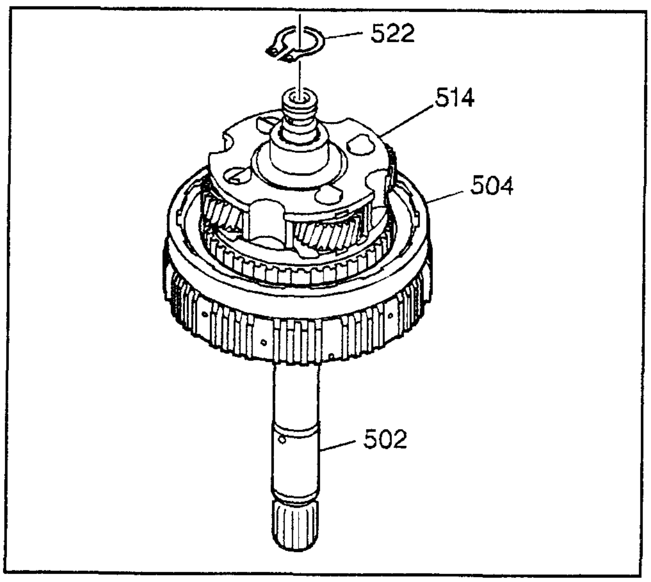


31111

Overdrive Carrier Assemble

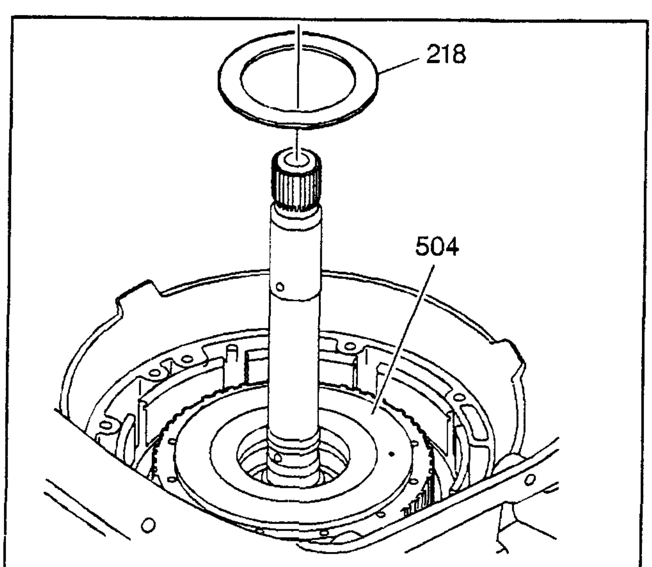
1. Assemble the overdrive carrier assembly (514) and the overrun clutch housing (504).
2. Rotate the overdrive carrier assembly (514) during installation in order to line up the overdrive clutch plates with the overdrive carrier assembly splines.



31185

Important: Do not damage the turbine shaft oil seal rings.

3. Install the turbine shaft (502) through the overrun clutch housing (504) and the overdrive carrier assembly (514).
4. Install the overdrive carrier retainer ring (522).



335062

Turbine Shaft/Overdrive Carrier Installation

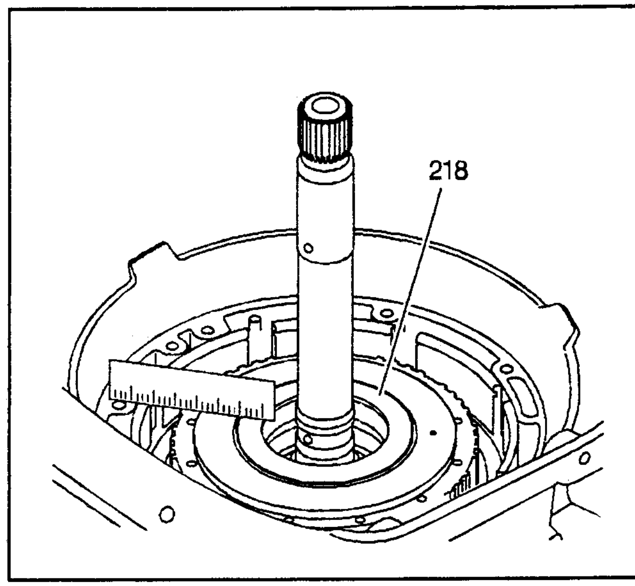
Tools Required

J 36850 Assembly Lubricant

Important: Be sure the overdrive assembly is fully engaged and is at the level of the fourth clutch housing.

1. Install the turbine shaft and overdrive assembly into the transmission case.
2. Install the overrun clutch housing thrust washer (218) onto the overrun clutch housing (504). Retain with *J 36850* or equivalent.

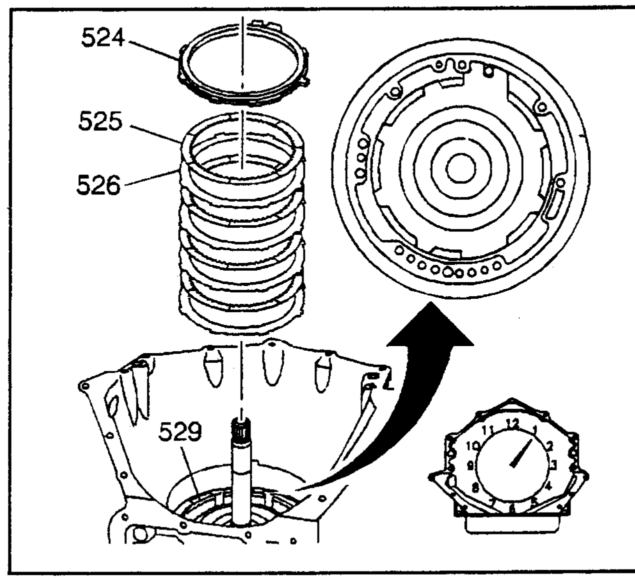
3. Place a straight edge from the oil pump mating surface to the overrun clutch housing thrust washer (218). The two surfaces should be flush.



335063

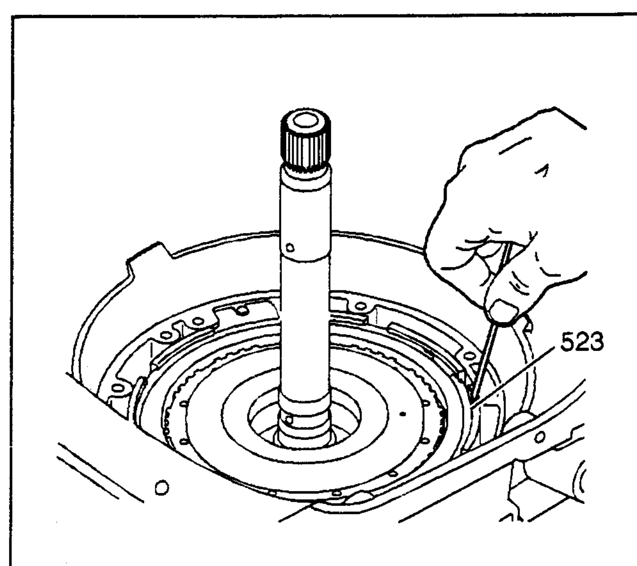
Fourth Clutch Plate Installation

1. Install the fourth clutch plates (525, 526) into the fourth clutch housing:
   - Alternate the fourth clutch plates (525, 526), starting with a steel clutch plate (526) (4 steel, 4 composite)
   - Install the fourth clutch steel plates (526) with the V notch tang at the one o'clock position in the fourth clutch housing
2. Install the fourth clutch backing plate (524). Locate the notched tab of the fourth clutch backing plate (524) over the anchor pin in the case.



335064

3. Install the fourth clutch backing plate retainer ring (523).



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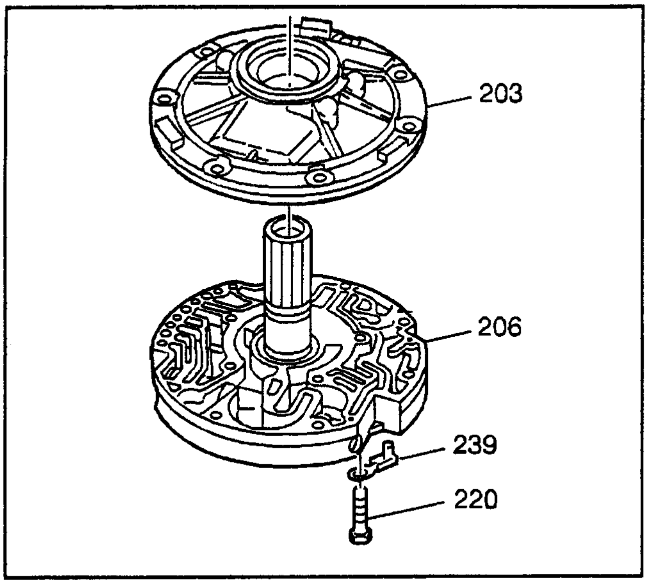
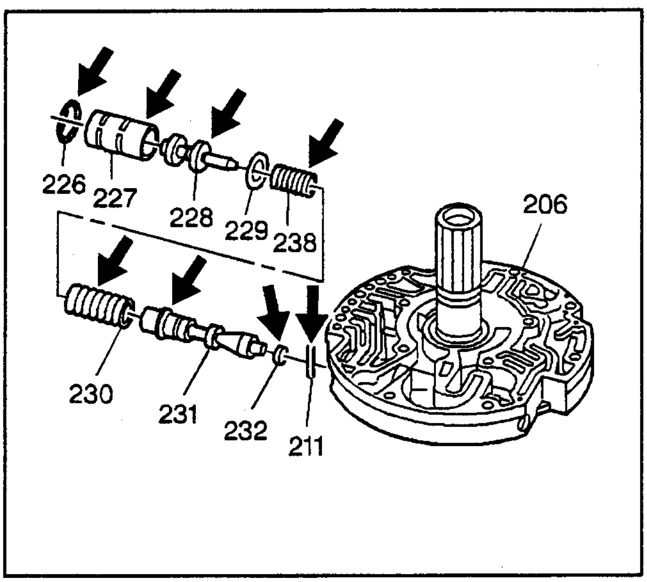


31190

Transmission Oil Pump Disassemble

1. Remove the transmission oil pump cover bolts (220).
2. Remove the vent passage splash shield (239).
3. Separate the oil pump body (203) and the oil pump cover (206).



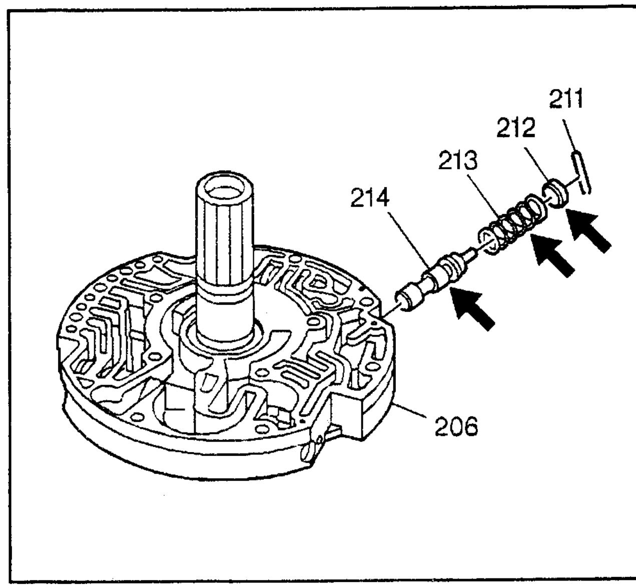
31191

Transmission Oil Pump Cover Disassemble

Caution: Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.

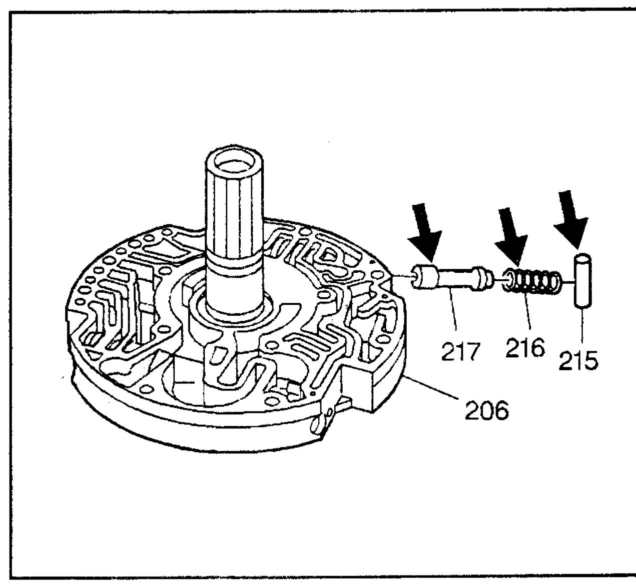
1. Remove the reverse boost valve bushing retainer ring (226).
2. Remove the pressure regulator boost valve bushing (227).
3. Remove the reverse boost valve (228).
4. Remove the pressure regulator valve spring retainer (229).
5. Remove the pressure regulator valve inner (238) and outer springs (230).
6. Remove the pressure regulator valve (231).
7. Remove the pressure regulator valve bore plug (232).
8. Remove the pressure regulator valve bore plug pin (211).
9. Inspect the pressure regulator valve components for chips, burrs, distortion, plugged oil passages.

10. Remove the converter limit valve bore plug pin (211).
11. Remove the converter limit valve bore plug (212).
12. Remove the converter limit valve spring (213).
13. Remove the converter limit valve (214).
14. Inspect the converter limit valve components for chips, burrs, and distortion.



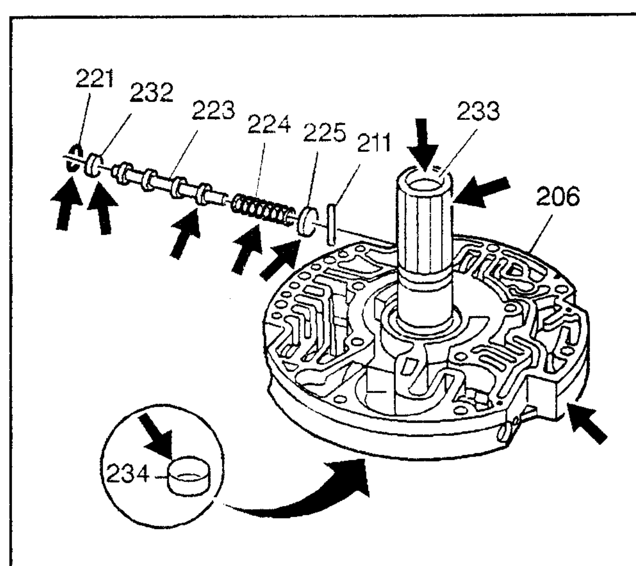
31192

15. Remove the TCC enable valve spring retainer sleeve (215).
16. Remove the TCC enable valve spring (216).
17. Remove the TCC enable valve (217).
18. Inspect the TCC enable valve components for chips, burrs, and distortion.



31193

19. Remove the TCC shift valve bore plug retainer ring (221).
20. Remove the TCC shift valve bore plug (232).
21. Remove the TCC shift valve (223).
22. Remove the TCC shift valve spring (224).
23. Remove the TCC shift valve spring seat (225).
24. Remove the TCC shift valve spring seat pin (211).
25. Inspect the TCC shift valve components for chips, burrs, and distortion.
26. Inspect the oil pump cover vent hole for blockage.
27. Inspect the stator shaft splines for damage.
28. Inspect the turbine shaft bushings (233, 234) for wear, and galling.



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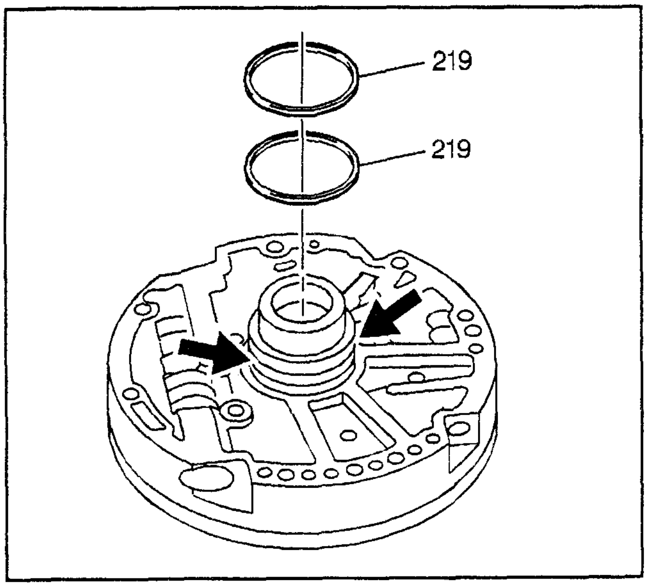
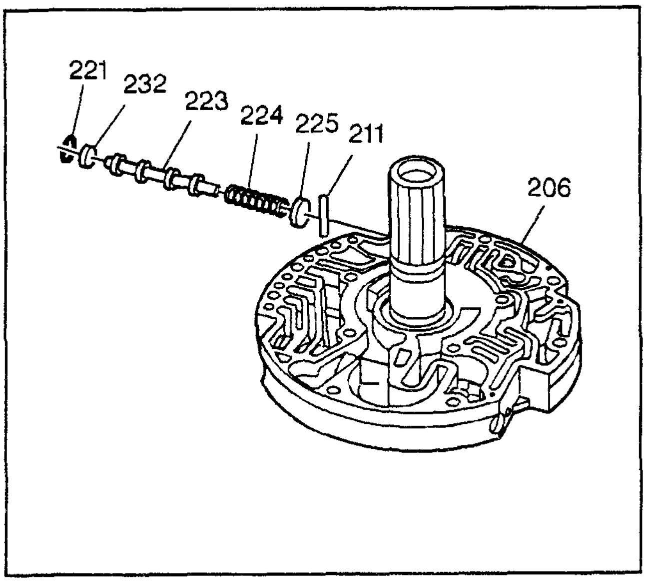


31196

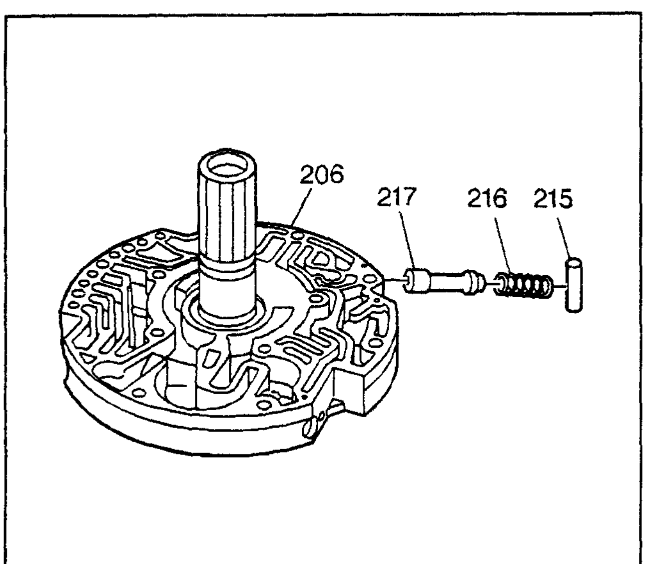
29. Remove the overrun clutch housing oil seal rings (219).
30. Inspect the overrun clutch housing oil seal ring grooves for nicks, burrs, and debris.



31197

Transmission Oil Pump Cover Assemble

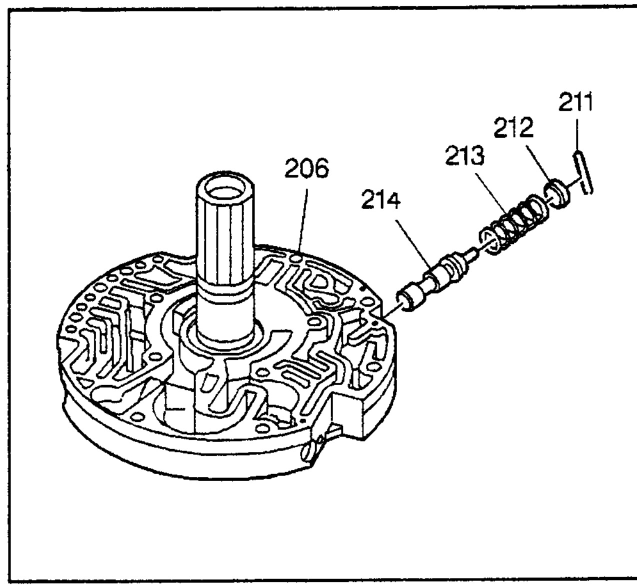
1. Install the TCC shift valve spring seat pin (211).
2. Install the TCC shift valve spring seat (225).
3. Install the TCC shift valve spring (224).
4. Install the TCC shift valve (223).
5. Install the TCC shift valve bore plug (232).
6. Install the TCC shift valve bore plug retainer ring (221).
7. Inspect the TCC shift valve (223) for free movement in the bore.



31198

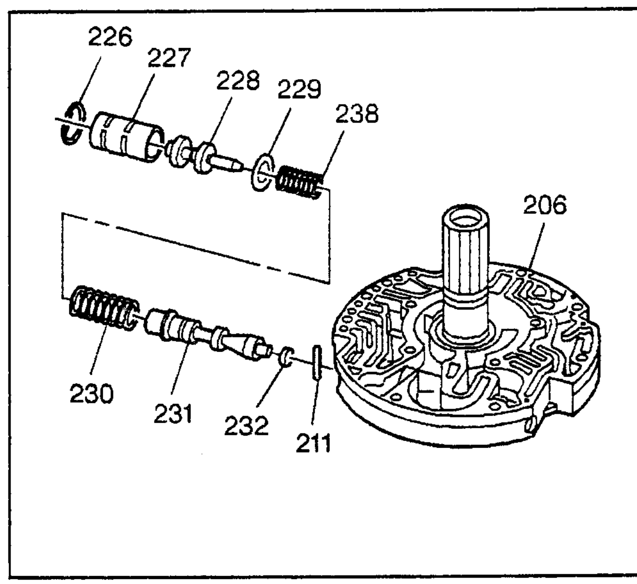
8. Install the TCC enable valve (217).
9. Install the TCC enable valve spring (216).
10. Compress the TCC enable valve spring (216), and insert a small rod into the fluid passage in order to retain the TCC enable valve spring.
11. Install the TCC enable valve spring retainer sleeve (215).
12. Remove the small rod.
13. Inspect the TCC enable valve (217) for free movement in the bore.

14. Install the converter limit valve (214).
15. Install the converter limit valve spring (213).
16. Install the converter limit valve bore plug (212).
17. Install the converter limit valve bore plug pin (211).
18. Inspect the converter limit valve (214) for free movement in the bore.



31199

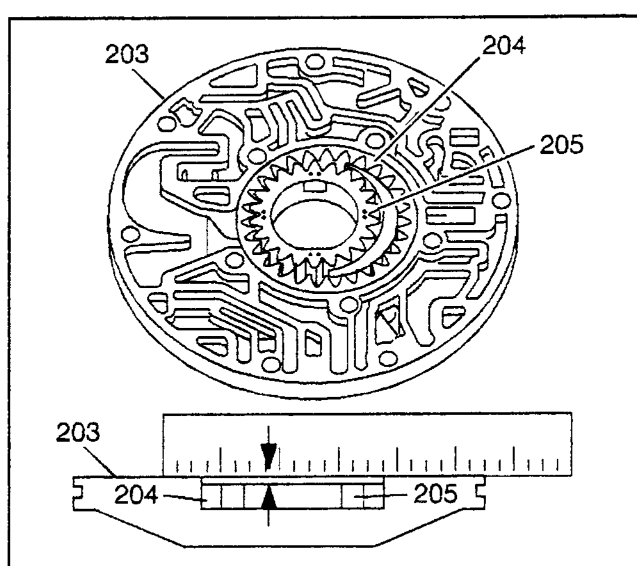
19. Install the pressure regulator valve bore plug pin (211).
20. Install the pressure regulator valve bore plug (232).
21. Install the pressure regulator valve (231).
22. Install the pressure regulator valve inner (238) and outer (230) springs.
23. Install the pressure regulator valve spring retainer (229).
24. Assemble the reverse boost valve (228) into the reverse boost valve bushing (227) with the reverse boost valve stem facing out of the bushing.
25. Install the reverse boost valve assembly (227 and 228).
26. Install the reverse boost valve bushing retainer ring (226).



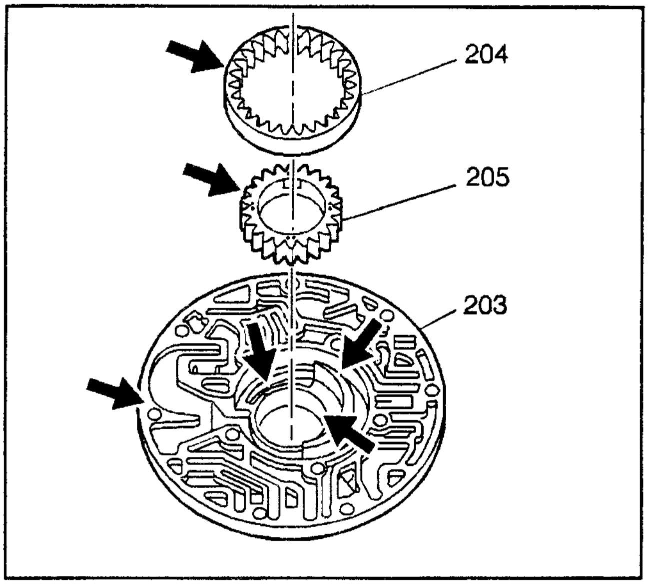
31200

Trans Oil Pump Body to Gear Face Clearance Check

1. Place a straight edge across the oil pump body (203) face and the oil pump gear (204, 205) faces.
2. Measure the clearance between the straight edge and the oil pump gear faces. The clearance should be 0.02–0.071 mm (0.0008–0.0028 in).



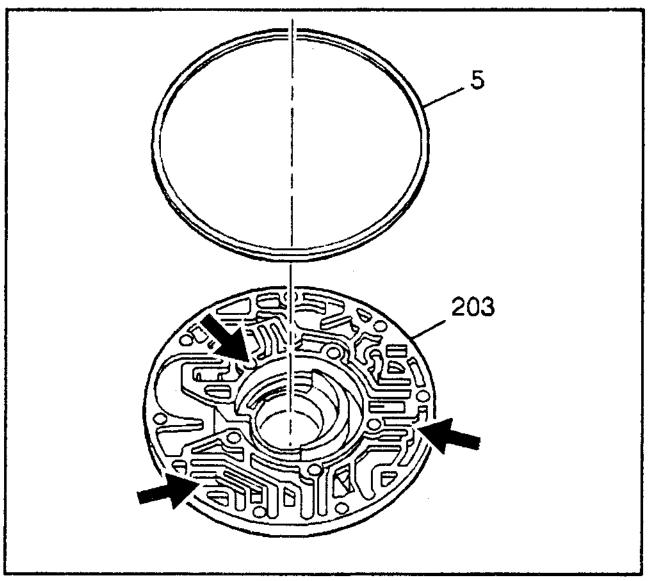
181744



181746

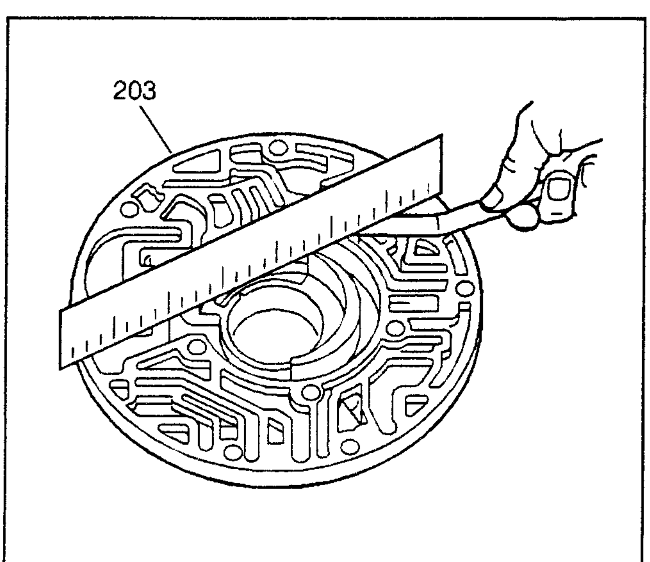
Transmission Oil Pump Body Disassemble

1. Remove the transmission oil pump drive (205) and driven (204) gears.
2. Inspect the oil pump body (203) gear pockets, crescent, pump body face and bushing for scoring nicks and wear.
3. Inspect the oil pump drive (205) and driven (204) gears for wear.



31203

4. Remove the transmission oil pump seal (5).
5. Inspect the oil pump body fluid passages for debris.
6. Inspect the oil pump body fluid passages for scored or irregular mating surfaces.
7. Inspect the oil pump body fluid passages for cross channel leaks.
8. Inspect the oil pump body bolt threads for damage.



31209

Transmission Oil Pump Body Flatness Check

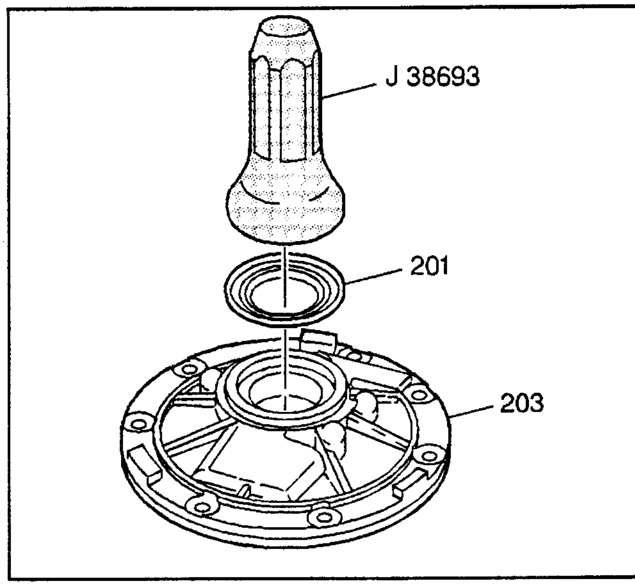
Inspect the oil pump body (203) face with a straight edge and a feeler gauge to ensure flatness.

Transmission Oil Pump Body Assemble

Tools Required

J 38693 Oil Pump Seal Installer

1. Install the torque converter oil seal (201) using the *J 38693*.

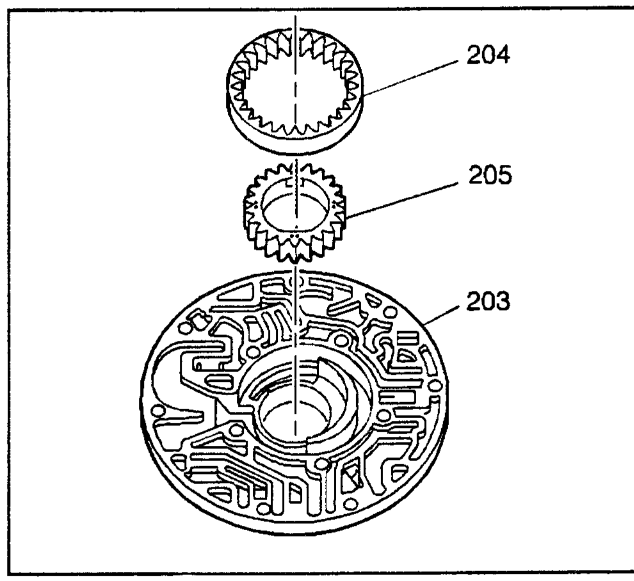


31210

2. Lubricate the oil pump drive (205) and driven (204) gears with DEXRON® III automatic transmission fluid.

Important: The identifications dots on the oil pump drive gear (205) must be facing up in order to ensure correct orientation of the drive flats.

3. Install the oil pump driven gear (204) and drive gear (205) with the identification dots facing up.



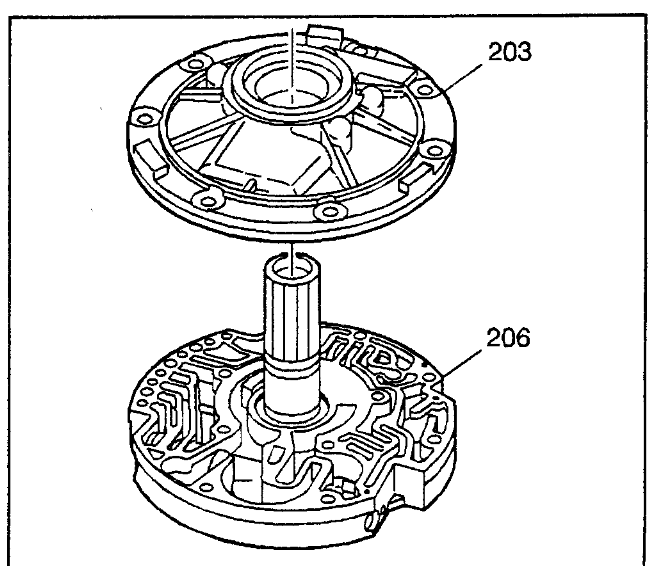
181748

Transmission Oil Pump Assemble

Tools Required

- *J 21368* Pump Body and Cover Alignment Band
- *J 36850* Assembly Lubricant

1. Assemble the oil pump cover (206) and the oil pump body (203).



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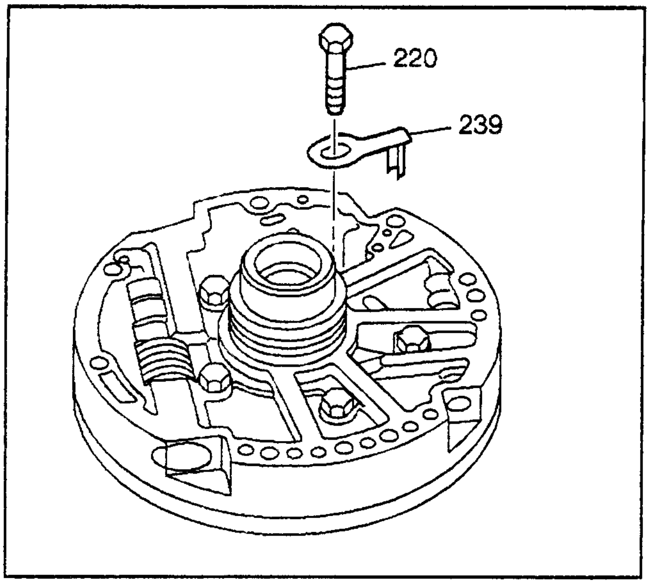
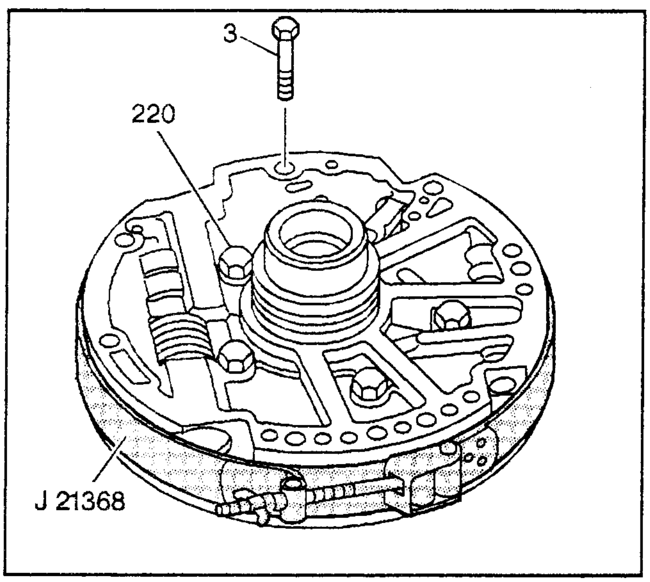


31213

Important: The round end on the vent passage splash shield (239) fits into the hole in the oil pump cover. The slotted hole in the vent passage splash shield fits under the bolt head.

2. Install the vent passage splash shield (239).
3. Install the oil pump cover bolts (220). Tighten the bolts with your fingers only.



31217

4. Install an oil pump to case bolt and seal assembly (3) into an oil pump bolt hole.

Important: The outside diameter of the oil pump body and oil pump cover must be properly aligned and then the alignment band can be tightened. This ensures that the oil pump will fit into the transmission case opening and maintains maximum oil pump efficiency.

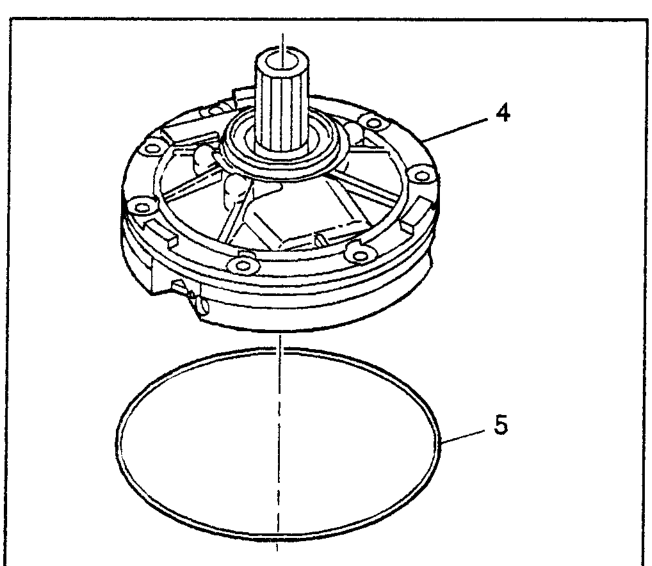
5. Install the *J 21368* onto the transmission oil pump assembly and tighten.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

6. Tighten the five oil pump cover bolts (220).

   Tighten

   Tighten the bolts to 24 N·m (18 lb ft) in an alternating pattern.
7. Remove the *J 21368* and the oil pump to case bolt and seal assembly (3).



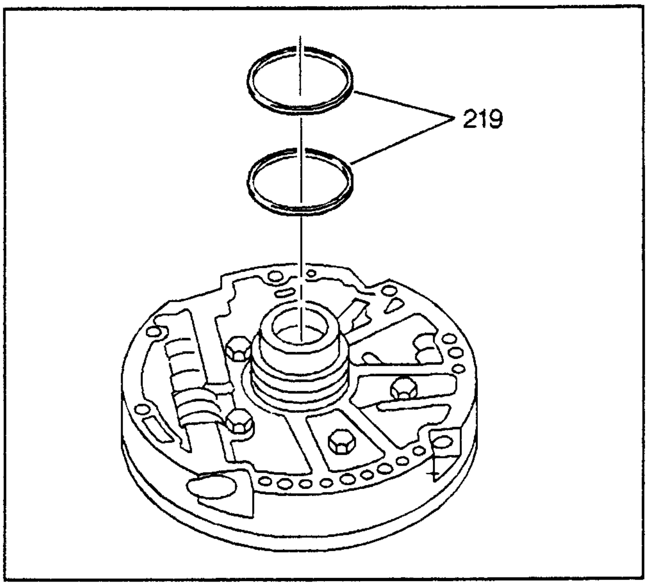
31219

Important: Coat the transmission oil pump seal (5) with *J 36850* or equivalent. This will ease assembly and prevent damage to the seal.

8. Install the transmission oil pump seal (5).

Notice: Do not overexpand the oil seal as it may become damaged.

9. Install the new overrun clutch housing oil seal rings (219) onto the oil pump assembly.
10. Ensure that the overrun clutch housing oil seal rings (219) move freely in the grooves.
11. Use *J 36850* or equivalent in order to keep the overrun clutch housing oil seal rings in place.



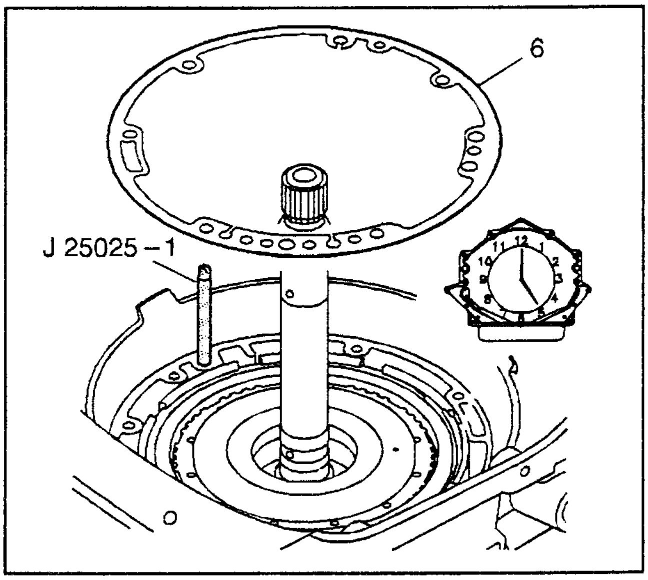
31221

Transmission Oil Pump Assembly Installation

Tools Required

- *J 25025-1* Guide Pins
- *J 37789-A* Oil Pump Remover/Installer

1. Install the *J 25025-1* at the 12 o'clock and the 5 o'clock positions.
2. Install the transmission oil pump gasket (6).



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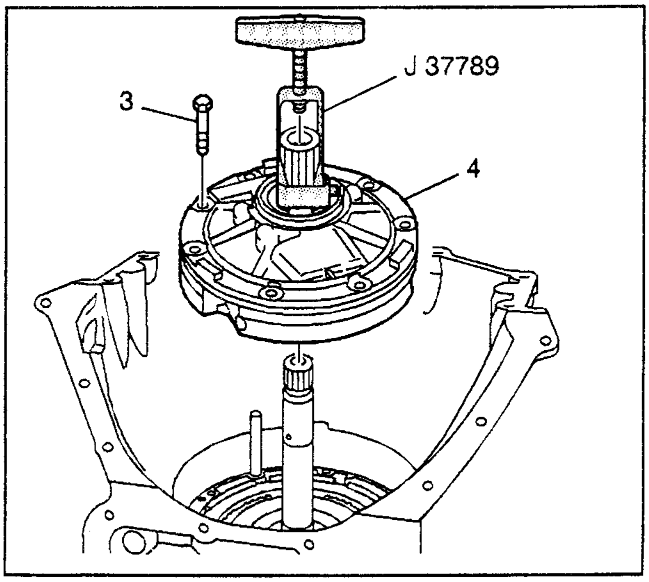
3. Install the *J 37789-A* onto the transmission oil pump assembly (4).
4. Install the oil pump assembly (4) into the transmission case. The bolt holes closest together should be positioned toward the transmission case bottom.



31230

5. Remove the tools.

Important: If you cannot rotate the turbine shaft while lowering the oil pump assembly into place, then you have improperly installed the overrun clutch, the fourth clutch, the forward clutch and/or the direct clutch housings. These components have not indexed with all of the clutch plates. Correct the condition before installing the oil pump assembly.

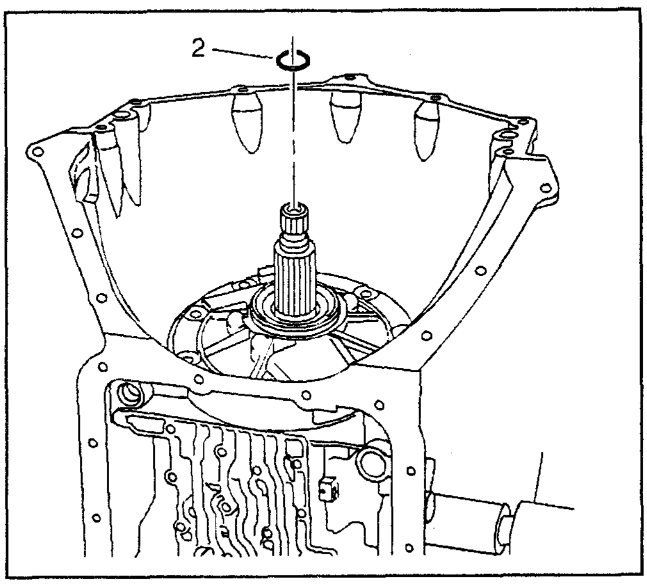
Notice: Refer to *Fastener Notice* in Cautions and Notices.

6. Install the transmission oil pump bolt and seal assemblies (3).

   Tighten

   Tighten the bolts to 24 N·m (18 lb ft).

7. Install the turbine shaft oil seal (2).



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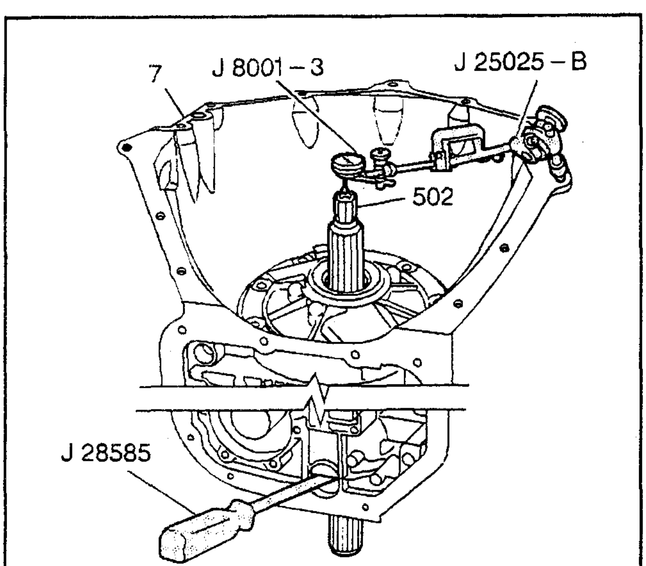


334755

Front End Play Check

Tools Required

- *J 8001-3* Dial Indicator
- *J 8520* Cam Lobe Lift Indicator Set
- *J 28585* Snap Ring Remover

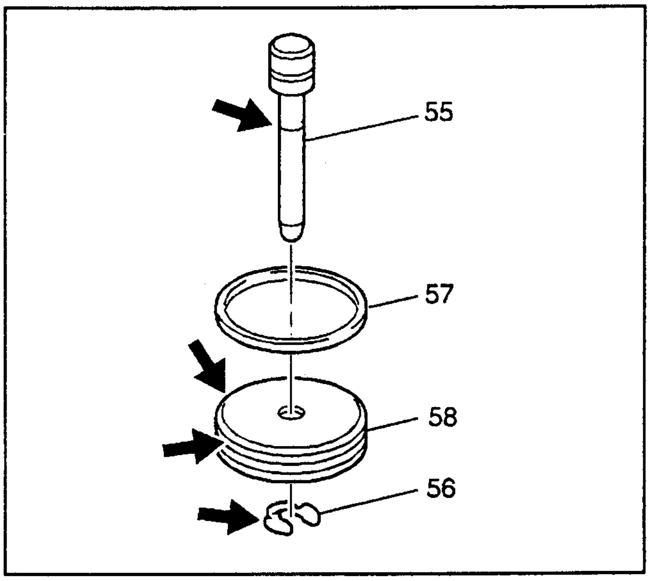
Important: If the front end play check procedures are not closely followed, you may select an incorrect selective thrust washer thickness. This could result in severe damage to the internal transmission components.

1. Assemble the *J 8520* by attaching the threaded rod and the dial indicator holder to one of the bolt holes on the transmission case (7).
2. Mount the *J 8001-3* onto the *J 8520.* Index the *J 8001-3* to the end of the turbine shaft (502).
3. Eliminate any slack by pressing down on the turbine shaft (502).
4. Apply upward pressure on the output carrier with the *J 28585.*
5. Set the *J 8001-3* to 0.

6. Pull up on the turbine shaft (502) while holding the output carrier up with the *J 28585*. Proper end play is 0.102–0.559 mm (0.004–0.022 in).
7. Remove the tools from the transmission.
8. If the front end play measurement is incorrect, refer to the Overrun Clutch Housing Selective Thrust Washer Specifications table in the *End Play Specifications*. Choose a new selective thrust washer based on the original selective washer and the information contained in the table.
9. Correct the end play by changing the overrun housing selective thrust washer.

Manual 2-1 Band Servo Assembly Disassemble

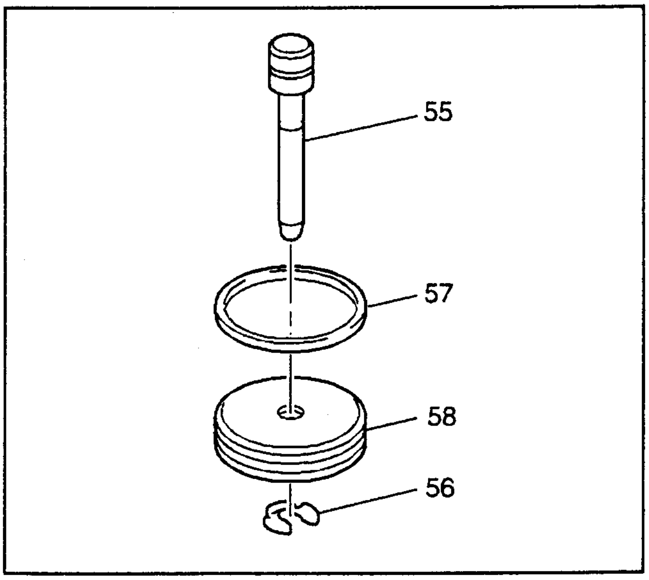
1. Remove the manual 2-1 band servo piston pin retainer ring (56).
2. Remove the manual 2-1 band servo piston pin (55).
3. Remove the manual 2-1 band servo piston seal (57).
4. Inspect the manual 2-1 band servo piston (58) for porosity, wear and seal ring groove damage.
5. Inspect the manual 2-1 band servo piston pin (55) for wear and damage.



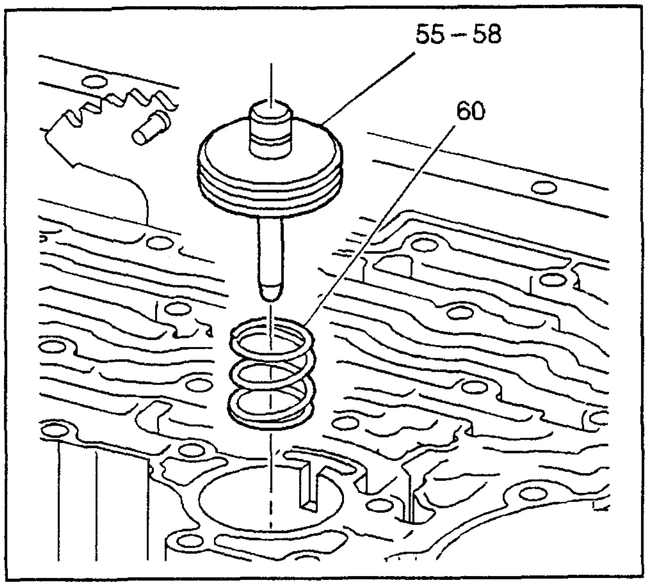
335068

Manual 2-1 Band Servo Assembly Assemble

1. Install a new manual 2-1 band servo piston seal (57) onto the manual 2-1 band servo piston (58).
2. Install the manual 2-1 band servo piston pin (55) into the manual 2-1 band servo piston (58).
3. Install the manual 2-1 band servo piston pin retainer ring (56).



335069



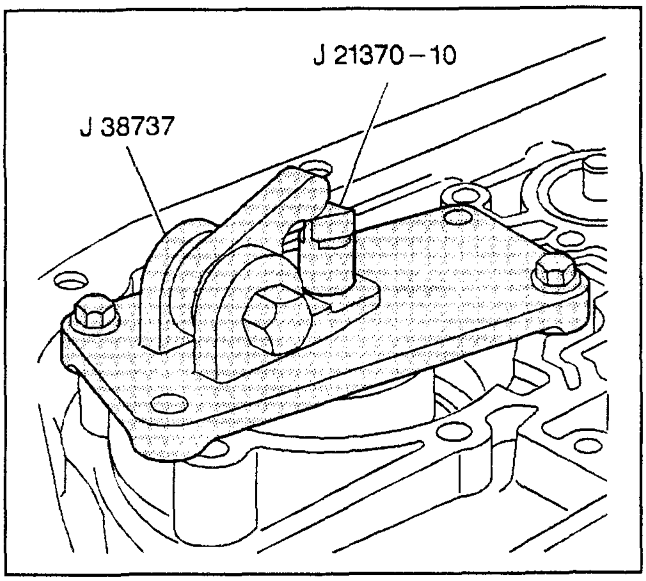
335070

Manual 2-1 Band Servo Assembly Installation

1. Install the manual 2-1 band servo piston cushion spring (60).

Important: Make certain that the tapered end of the manual 2-1 band servo piston pin contacts the manual 2-1 band.

2. Install the manual 2-1 band servo piston assembly (55-58).



31240

Low and Reverse Band Servo Apply Pin Check

Tools Required

- *J 21370-10* Band Apply Pin Gauge
- *J 38737* Band Apply Pin Checking Tool

1. Install the *J 21370-10* into the low and reverse band servo pin bore.
2. Position the *J 38737* over the low and reverse band servo bore with the hex hub facing the parking pawl linkage.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

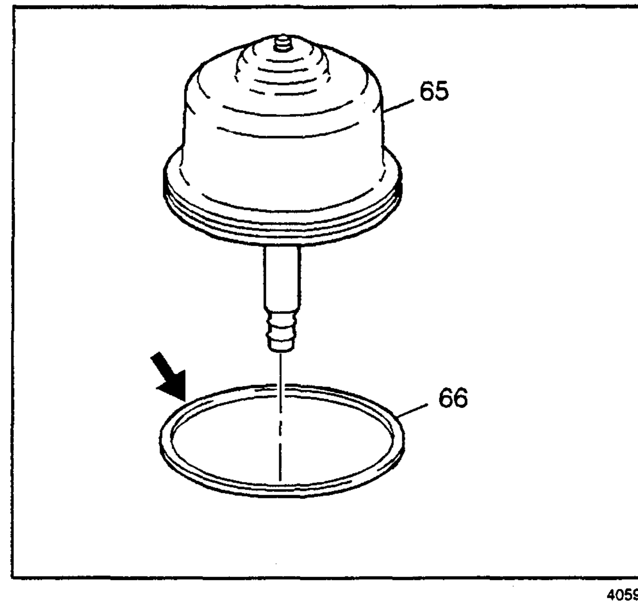
3. Fasten the *J 38737* to the case with two low and reverse band servo cover bolts.

   Tighten

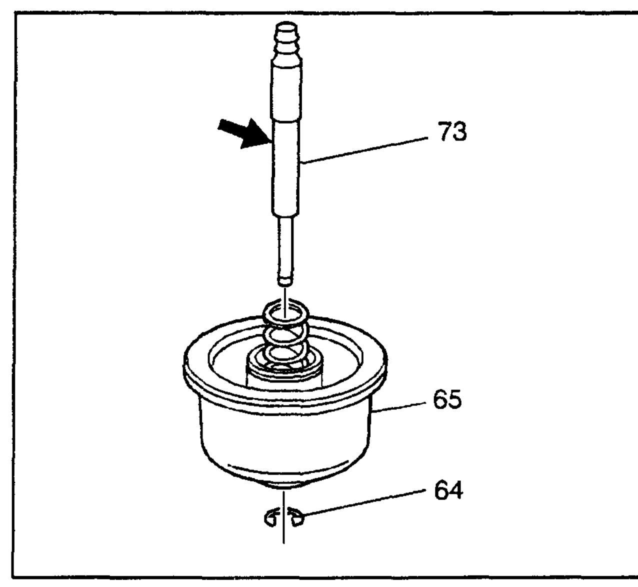
   Tighten the bolts to 24 N·m (18 lb ft).
4. Verify that the *J 21370-10* moves freely in the *J 38737* and in the low and reverse band servo pin bore.
5. In order to determine the correct low and reverse band servo pin length, apply 34 N·m (25 lb ft) of torque to the hex hub of the *J 38737*.
6. Observe the lands on the *J 21370-10* in order to see which land is even with the top edge of the *J 38737* and note the letter (A, B or C) stamped on the *J 21370-10*.
7. Refer to the Low and Reverse Band Servo Pin Specification chart, in the *Transmission General Specifications*, in order to determine the correct pin length to use.
8. Remove the tools.

Low and Reverse Band Servo Assembly Disassemble

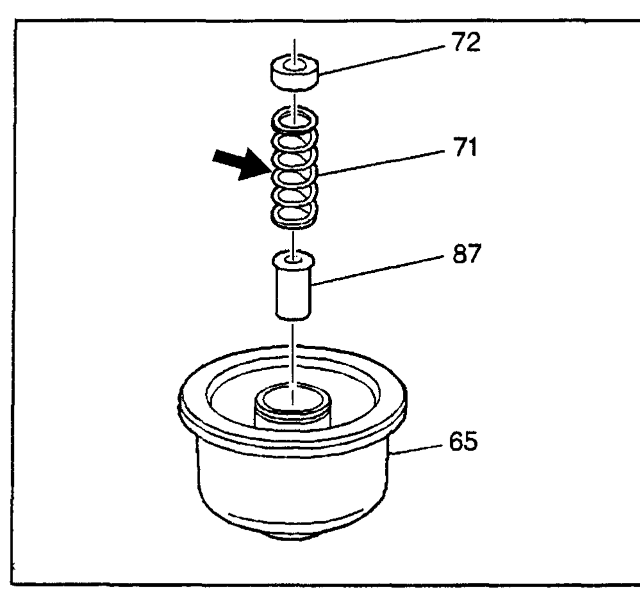
1. Remove the low and reverse band servo piston seal (66).
2. Inspect the low and reverse band servo piston seal (66) for nicks and cuts.

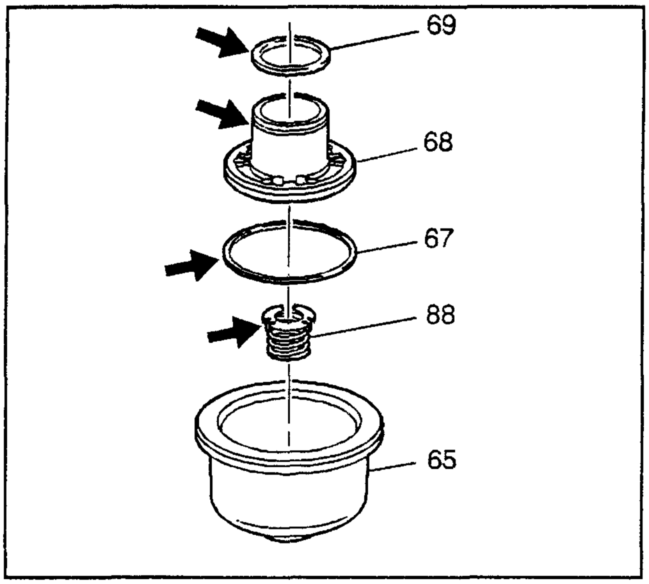


3. Remove the low and reverse band servo piston pin retainer ring (64).
4. Remove the low and reverse band servo piston pin (73).
5. Inspect the low and reverse band servo piston pin (73) for wear.



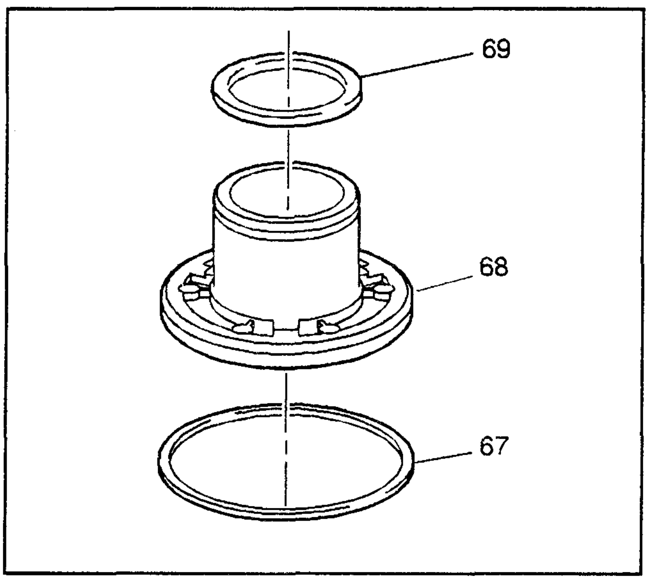
6. Remove the low and reverse band servo piston spring retainer (72).
7. Remove the low and reverse band servo piston spring (71).
8. Inspect the low and reverse band servo piston spring (71) for distortion.
9. Remove the low and reverse band servo piston spacer (87).





40601

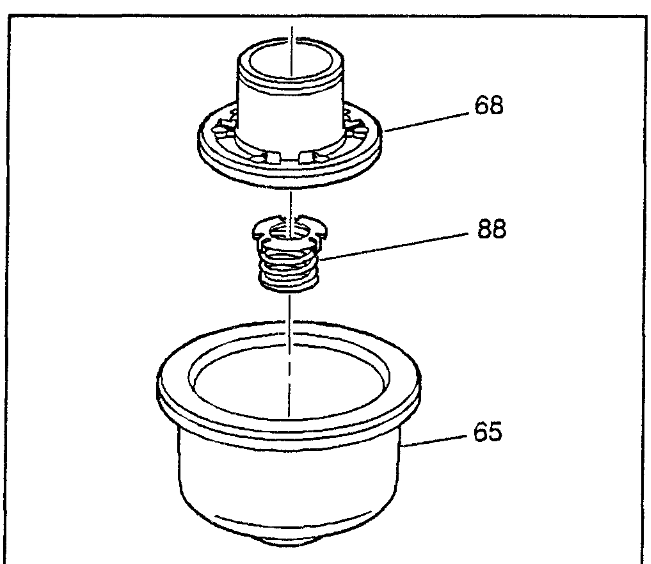
10. Remove the 1-2 accumulator piston (68).
11. Remove the low and reverse accumulator piston oil seal rings (67, 69).
12. Remove the 1-2 accumulator piston spring assembly (88).
13. Inspect the low and reverse band servo piston (65) and the 1-2 accumulator piston (68) for porosity and damage.
14. Inspect the low and reverse accumulator piston oil seal rings (67, 69) for nicks and cuts.



40602

Low and Reverse Band Servo Accumulator Assemble

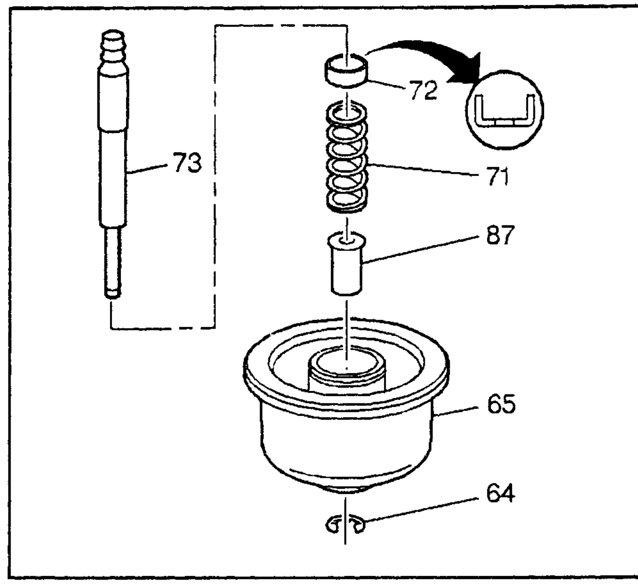
1. Install the new low and reverse accumulator piston oil seal rings (67, 69). Lubricate the low and reverse accumulator piston oil seal rings (67, 69) with DEXRON® III automatic transmission fluid.



40603

2. Install the 1-2 accumulator piston spring assembly (88).
3. Install the 1-2 accumulator piston (68).

4. Assemble the following items, in order, onto the small diameter end of the correct low and reverse band servo piston pin (73):
   4.1. the servo piston spring retainer (72)
   4.2. the servo piston spring (71)
   4.3. the low and reverse band servo piston spacer (87)
   4.4. the low and reverse band servo piston (65)
5. Install the low and reverse band servo piston pin retainer ring (64).



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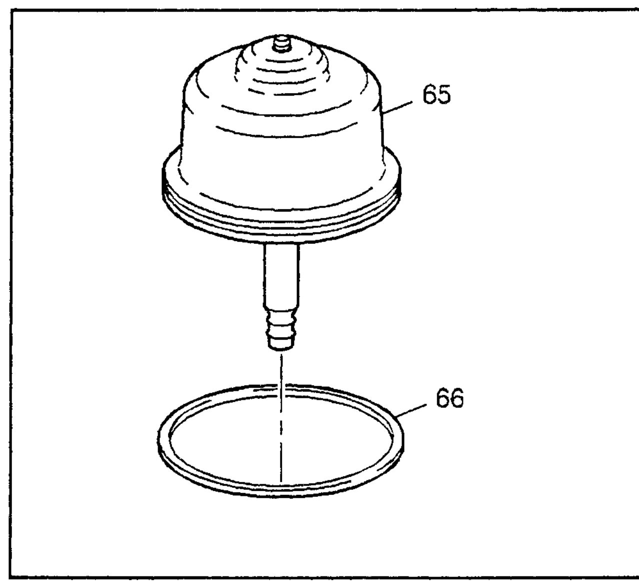
6. Install the new low and reverse band servo piston seal (66). Lubricate the low and reverse band servo piston seal (66) with DEXRON® III automatic transmission fluid.



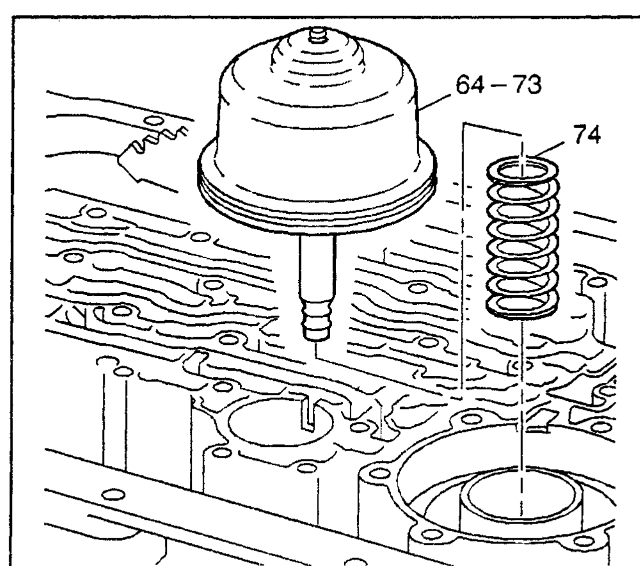
40605

Low/Reverse Band Servo Accumulator Installation

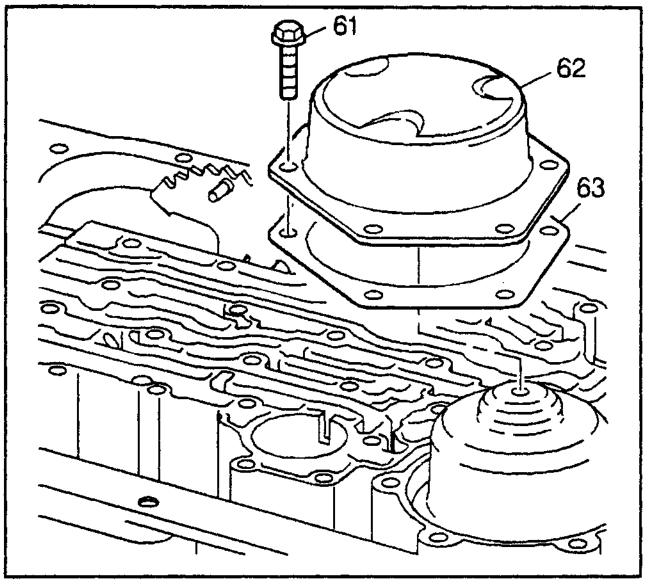
1. Install the low and reverse accumulator piston spring (74).

Important: The low and reverse band servo piston assembly (64–73) is pushed down when tightening the low and reverse band servo cover bolts. Do not force the low and reverse band servo piston assembly (64–73) into the servo bore.

2. Install the low and reverse band servo piston assembly (64–73).



40606



40607

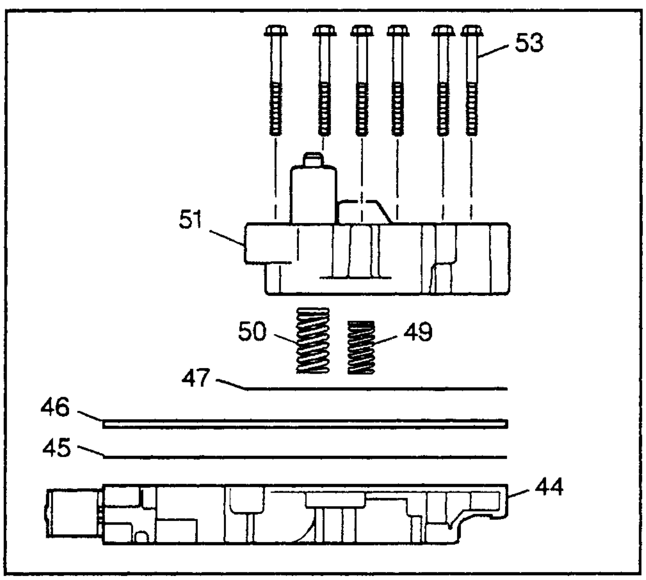
3. Install the low and reverse band servo cover gasket (63).
4. Install the low and reverse band servo cover (62).

Notice: Refer to *Fastener Notice* in Cautions and Notices.

5. Install the six low and reverse band servo cover bolts (61).

   Tighten

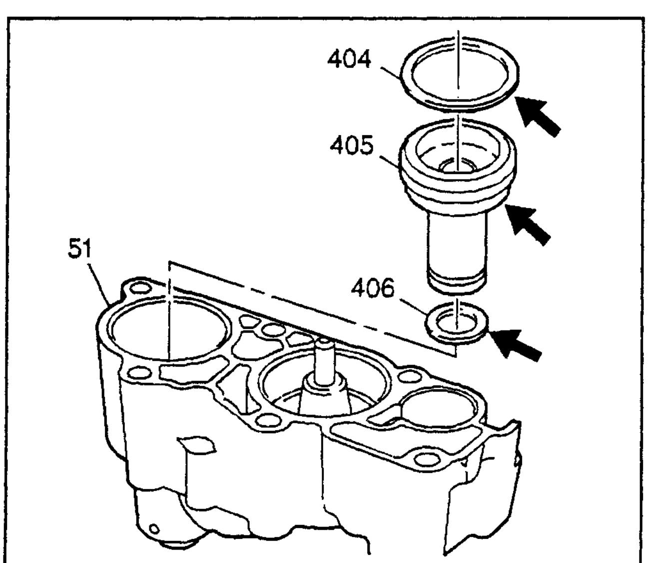
   Tighten the bolts to 24 N·m (18 lb ft) in an alternating pattern.



40608

3rd and 4th Clutch Accumulator Housing Removal

1. Remove the 3rd and 4th clutch accumulator housing bolts (53).
2. Remove the 3rd and 4th clutch accumulator housing (51).
3. Remove the accumulator housing gasket (47). The accumulator housing gasket (47) may be stuck to the control valve body spacer plate (46).
4. Remove the 3rd clutch accumulator piston spring (50).
5. Remove the 4th clutch accumulator piston spring (49).
6. Remove the control valve body spacer plate (46).
7. Remove the control valve assembly to spacer plate gasket (45) from the control valve body spacer plate (46).



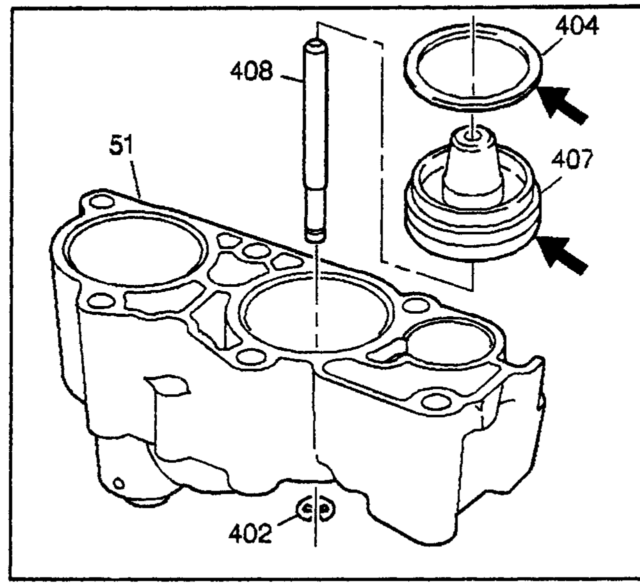
40609

3rd and 4th Clutch Accumulator Housing Disassemble

Important: Apply low pressure compressed air to the hole at the top of the accumulator housing to assist with the piston removal.

1. Remove the 3rd clutch accumulator piston (405).
2. Remove the 3rd clutch accumulator piston seals (404, 406).
3. Inspect the 3rd clutch accumulator piston and seals for porosity, scoring, nicks, scratches and damage.

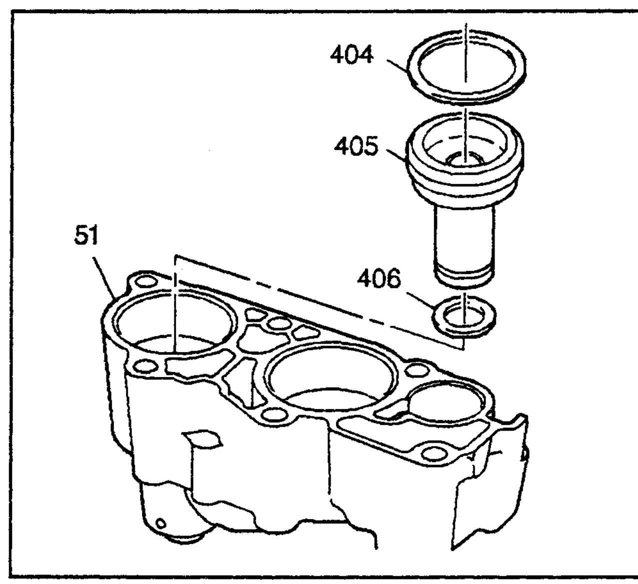
4. Remove the 4th clutch accumulator piston pin retainer ring (402).
5. Remove the 4th clutch accumulator piston (407) and pin (408).
6. Remove the 4th clutch accumulator piston pin (408).
7. Remove the 4th clutch accumulator piston seal (404).
8. Inspect the 4th clutch accumulator piston, pin and seal for porosity, scoring, nicks, scratches and damage.



40610

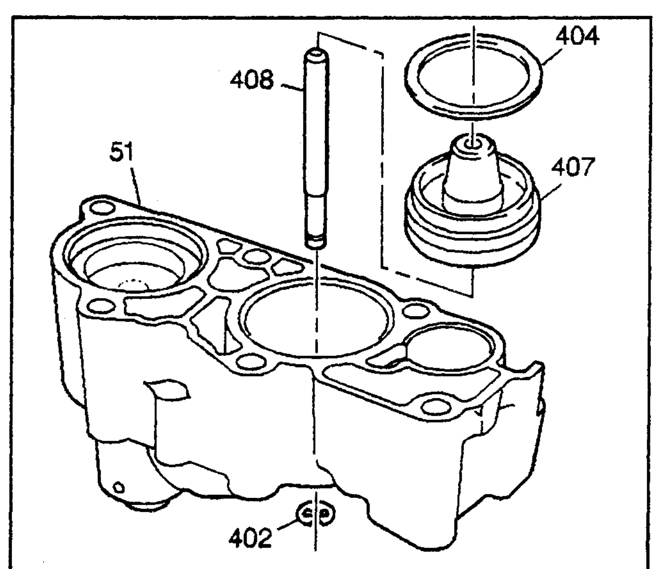
3rd and 4th Clutch Accumulator Housing Assemble

1. Install the 3rd clutch accumulator piston inner (406) and outer (404) seals. Lubricate the 3rd clutch accumulator piston seals (404, 406) with DEXRON® III automatic transmission fluid.
2. Install the 3rd clutch accumulator piston (405).



40611

3. Install the 4th clutch accumulator piston seal (404). Lubricate the 4th clutch accumulator piston seal (404) with DEXRON® III automatic transmission fluid.
4. Assemble the 4th clutch accumulator piston pin (408) with the 4th clutch accumulator piston (407).
5. Install the 4th clutch accumulator piston assembly.
6. Install the 4th clutch accumulator piston pin retainer ring (402).



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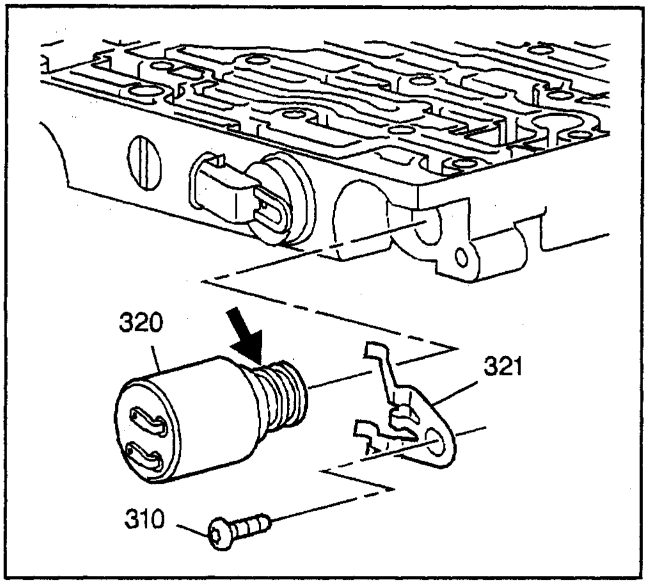
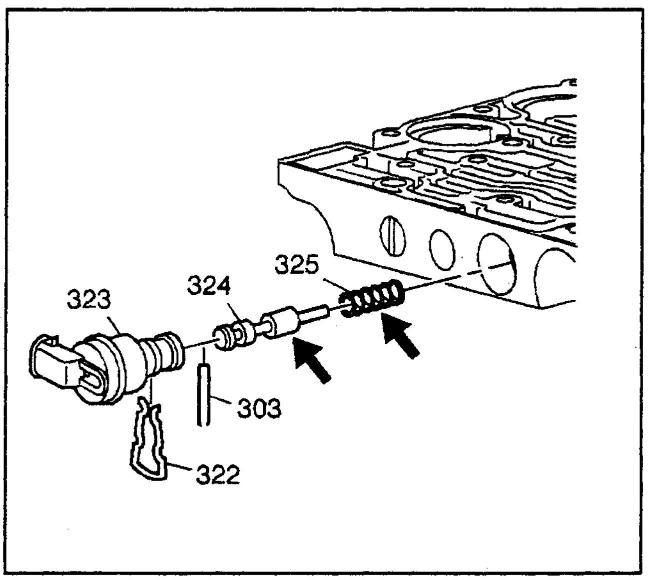


40613

Control Valve Body Assembly Disassemble

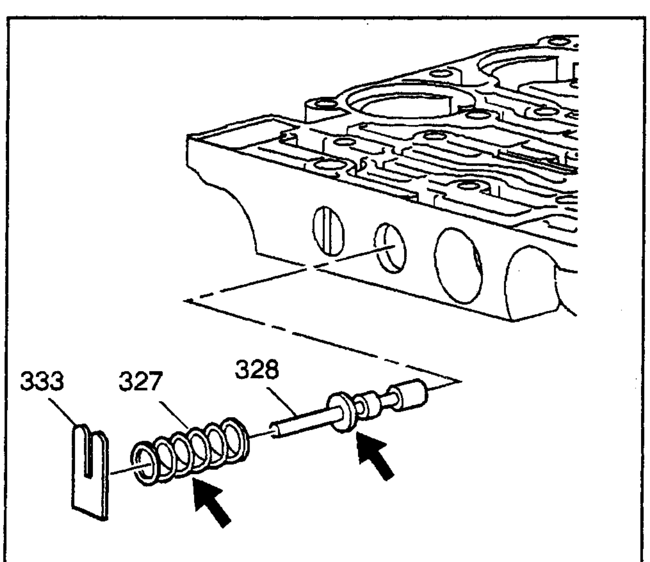
Caution: Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.

1. Remove the pressure control solenoid clamp bolt (310) and clamp (321).
2. Remove the pressure control solenoid (320).
3. Inspect the pressure control solenoid (320) for a plugged or damaged screen.



40614

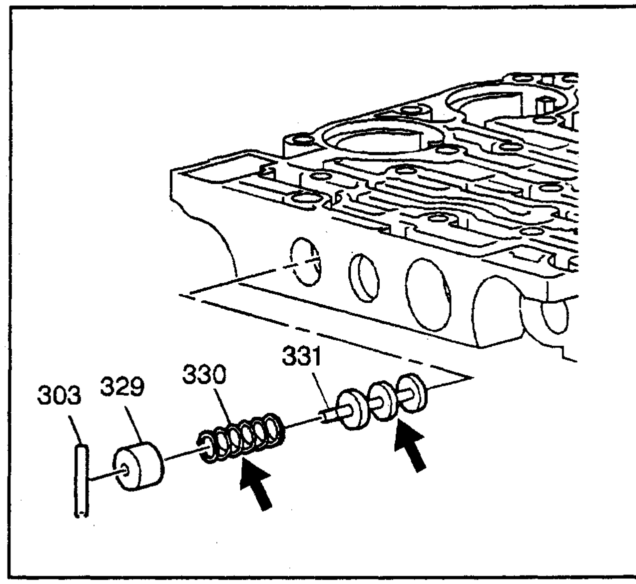
4. Remove the TCC PWM solenoid retainer (322).
5. Remove the TCC PWM solenoid (323).
6. Remove the TCC regulator apply valve pin (303). Use a drill bit to remove the spring pin.
7. Remove the TCC regulator apply valve (324).
8. Remove the TCC regulator apply valve spring (325).
9. Inspect the TCC regulator apply valve (324) for porosity, scoring, and nicks.
10. Inspect the TCC regulator apply valve spring (325) for distortion.



40615

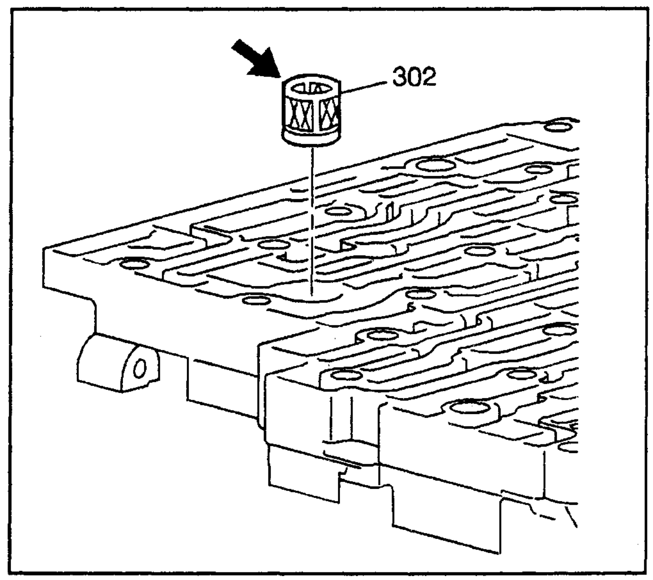
11. Remove the actuator feed limit valve spring retainer (333).
12. Remove the actuator feed limit valve spring (327).
13. Remove the actuator feed limit valve (328).
14. Inspect the actuator feed limit valve (328) for porosity, scoring, and nicks.
15. Inspect the actuator feed limit valve spring (327) for distortion.

16. Remove the accumulator valve bore plug retainer pin (303).
17. Remove the accumulator valve bore plug (329).
18. Remove the accumulator valve spring (330).
19. Remove the accumulator valve (331).
20. Inspect the accumulator valve (331) and accumulator valve bore plug (329) for porosity, scoring, and nicks.
21. Inspect the accumulator valve spring (330) for distortion.



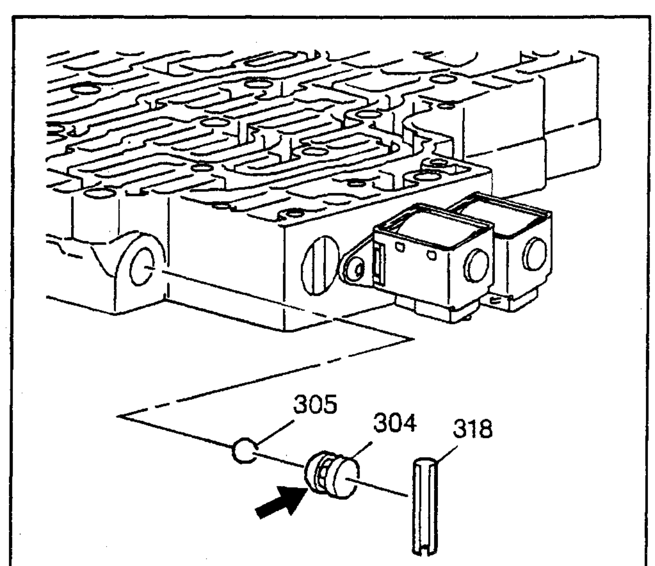
40616

22. Remove the pressure control solenoid valve fluid filter (302).
23. Inspect the pressure control solenoid valve fluid filter (302) for damage.

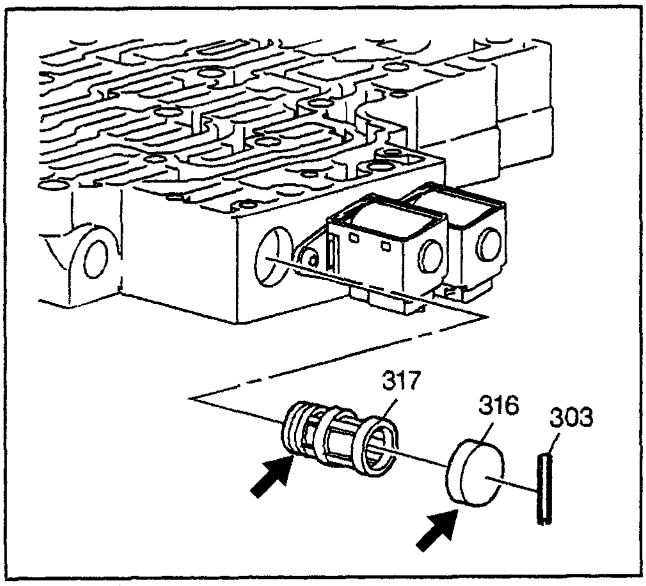


40617

24. Remove the low-reverse ball valve seat pin (318).
25. Remove the low-reverse ball valve seat (304).
26. Remove the low-reverse ball valve (305).
27. Inspect the low-reverse ball valve seat (304) and the low-reverse ball valve (305) for porosity, scoring, and nicks.

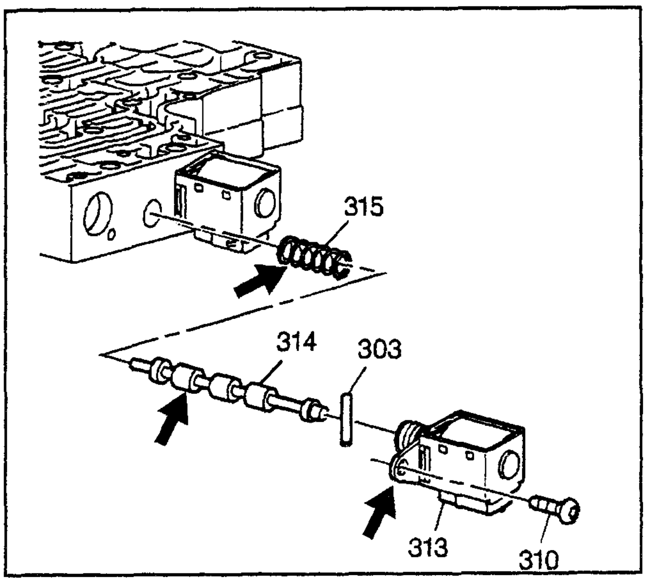


54678



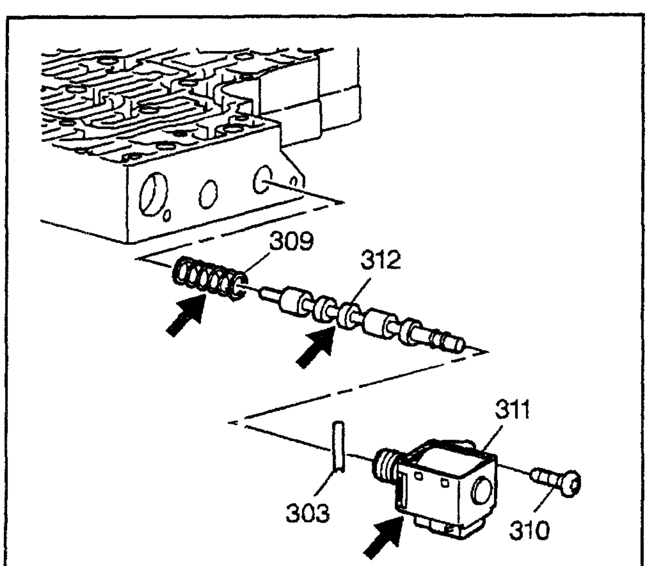
54680

28. Remove the shift valve fluid filter bore plug pin (303).
29. Remove the shift valve fluid filter bore plug (316).
30. Remove the shift solenoid valve fluid filter (317).
31. Inspect the shift solenoid valve fluid filter (317) for damage.
32. Inspect the shift valve fluid filter bore plug (316) for porosity, scoring, and nicks.



54682

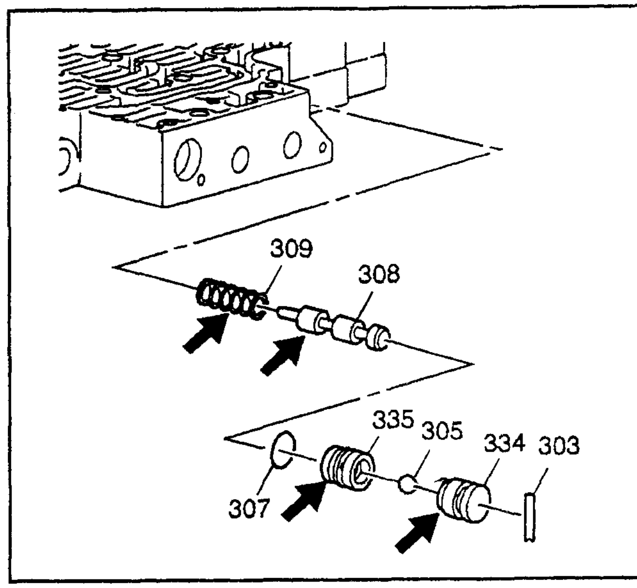
33. Remove the 1-2 shift solenoid valve bolt (310).
34. Remove the 1-2 shift solenoid valve (313).
35. Remove the 1-2 shift valve pin (303).
36. Remove the 1-2 shift valve (314).
37. Remove the 1-2 shift valve spring (315).
38. Inspect the 1-2 shift valve (314) for porosity, scoring, and nicks.
39. Inspect the 1-2 shift valve spring (315) for distortion.



54686

40. Remove the 2-3 shift solenoid valve bolt (310).
41. Remove the 2-3 shift solenoid valve (311).
42. Remove the 2-3 shift valve pin (303).
43. Remove the 2-3 shift valve (312).
44. Remove the 2-3 shift valve spring (309).
45. Inspect the 2-3 shift valve (312) for porosity, scoring, and nicks.
46. Inspect the 2-3 shift valve spring (309) for distortion.

47. Remove the 3rd-reverse ball valve seat pin (303).
48. Remove the reverse ball valve bushing (334).
49. Remove the 3rd-reverse ball valve (305).
50. Remove the 3rd ball valve bushing (335) and 3rd ball valve bushing seal (307).
51. Remove the 3-4 shift valve (308).
52. Remove the 3-4 shift valve spring (309).
53. Inspect the 3rd-reverse ball valve bushings (305, 335), the 3rd-reverse ball valve (305) and the 3-4 shift valve (308) for porosity, scoring, and nicks.
54. Inspect the 3-4 shift valve spring (309) for distortion.

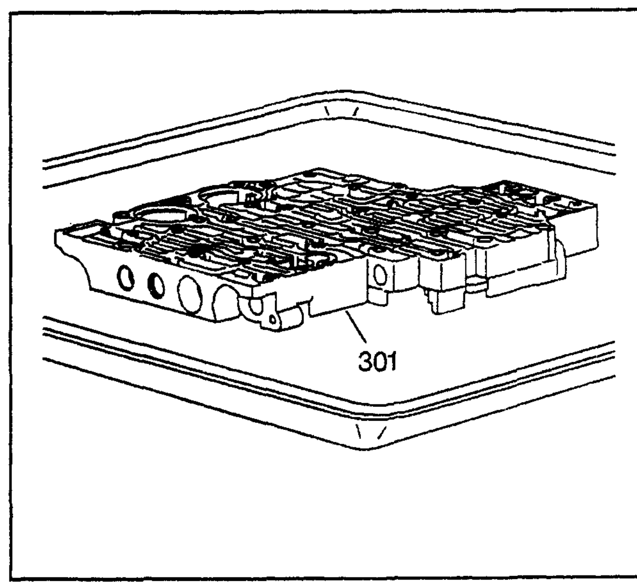


40622

Control Valve Body Cleaning and Inspection

Important: Dirty solvent can deposit sediment that could damage the transmission.

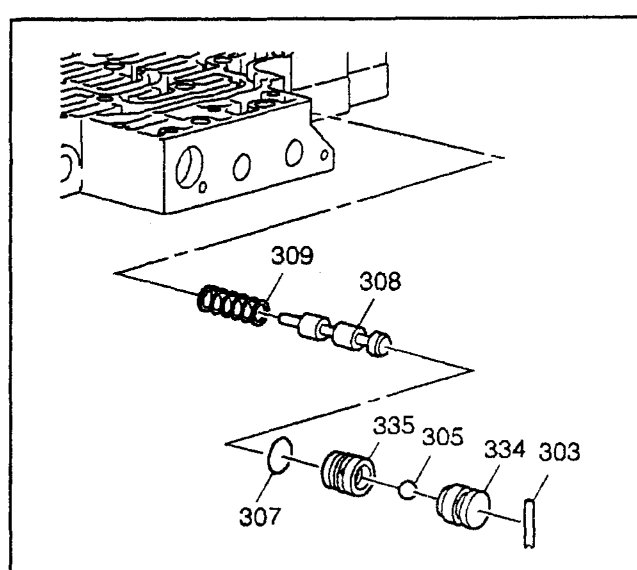
1. Clean the control valve body (301) in clean solvent.
2. Dry the control valve body (301) using compressed air.
3. Inspect the control valve body casting for the following conditions:
   - Porosity
   - Cracks
   - Interconnected passages
   - Damaged machined surfaces



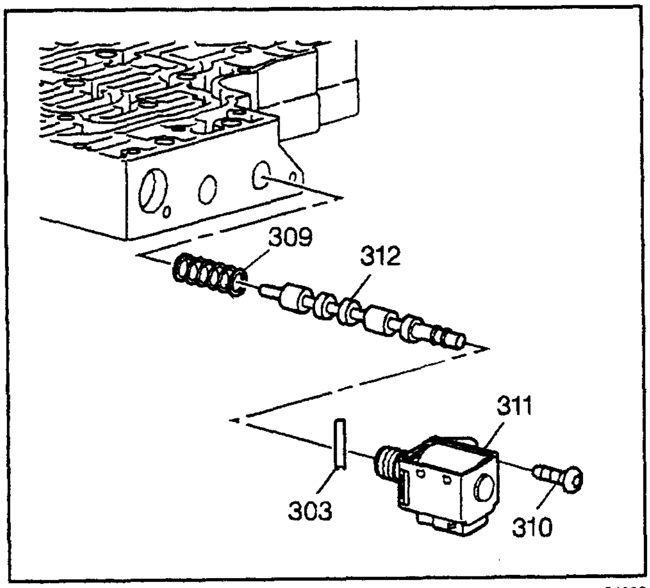
40623

Control Valve Body Assembly Assemble

1. Install the 3-4 shift valve spring (309).
2. Install the 3-4 shift valve (308).
3. Install the 3rd ball valve bushing (335) and 3rd ball valve bushing seal (307).
4. Install the 3rd-reverse ball valve (305).
5. Install the reverse ball valve bushing (334).
6. Install the 3rd-reverse ball valve seat pin (303).



40624



54688

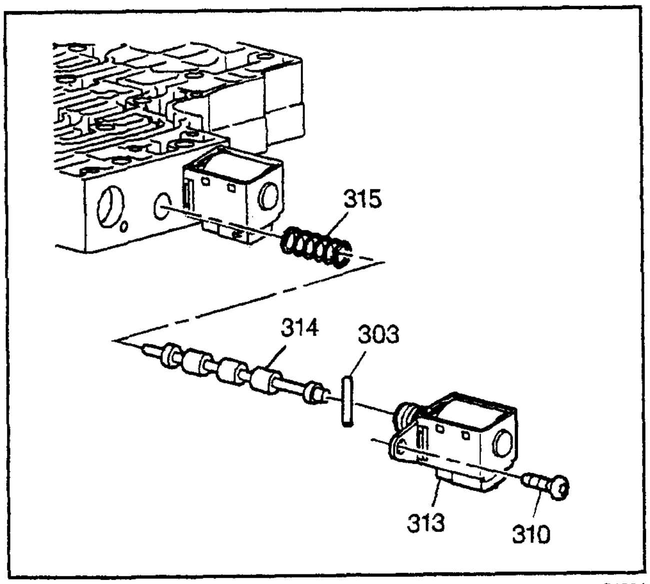
7. Install the 2-3 shift valve spring (309).
8. Install the 2-3 shift valve (312).
9. Install the 2-3 shift valve pin (303).
10. Install the 2-3 shift solenoid valve (311).

Notice: Refer to *Fastener Notice* in Cautions and Notices.

11. Install the 2-3 shift solenoid valve bolt (310).

    Tighten

    Tighten the bolt to 8 N·m (71 lb in).

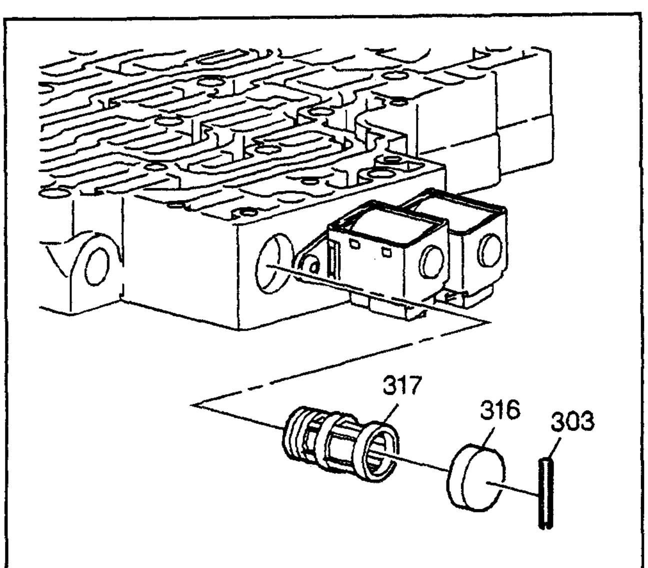


54694

12. Install the 1-2 shift valve spring (315).
13. Install the 1-2 shift valve (314).
14. Install the 1-2 shift valve pin (303).
15. Install the 1-2 shift solenoid valve (313).
16. Install the 1-2 shift solenoid valve bolt (310).

    Tighten

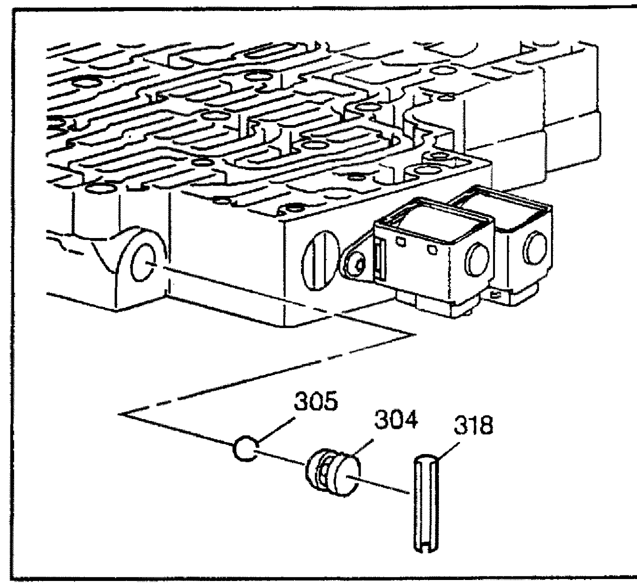
    Tighten the bolt to 8 N·m (71 lb ft).



54698

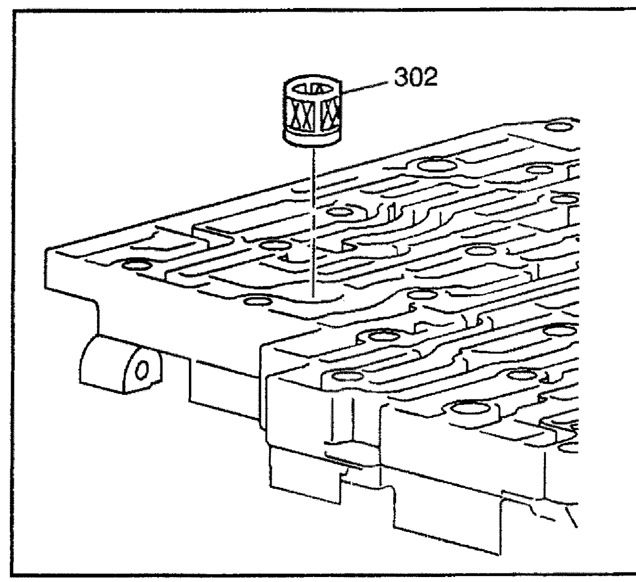
17. Install the shift solenoid valve fluid filter (317).
18. Install the shift valve fluid filter bore plug (316).
19. Install the shift valve fluid filter bore plug pin (303).

20. Install the low-reverse ball valve (305).
21. Install the low-reverse ball valve seat (304).
22. Install the low-reverse ball valve seat pin (318).



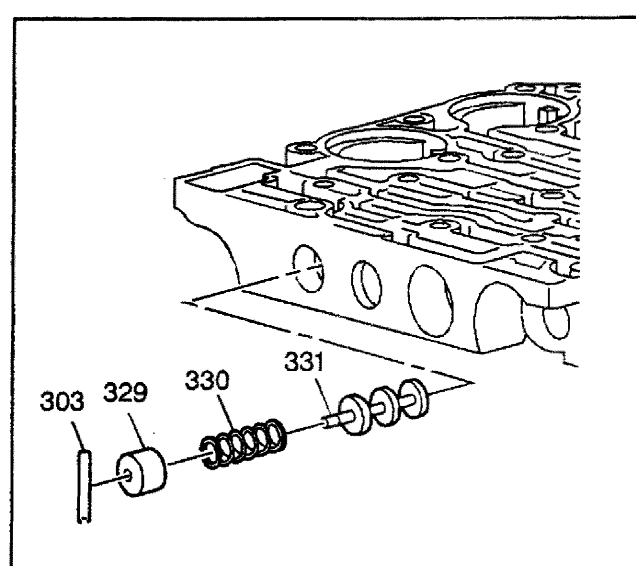
54702

23. Install the pressure control solenoid valve fluid filter (302).

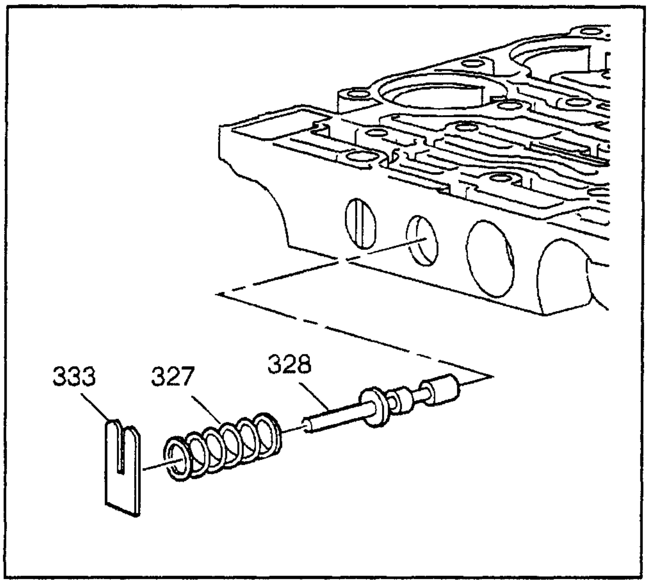


40629

24. Install the accumulator valve (331).
25. Install the accumulator valve spring (330).
26. Install the accumulator valve bore plug (329).
27. Install the accumulator valve bore plug retainer pin (303).

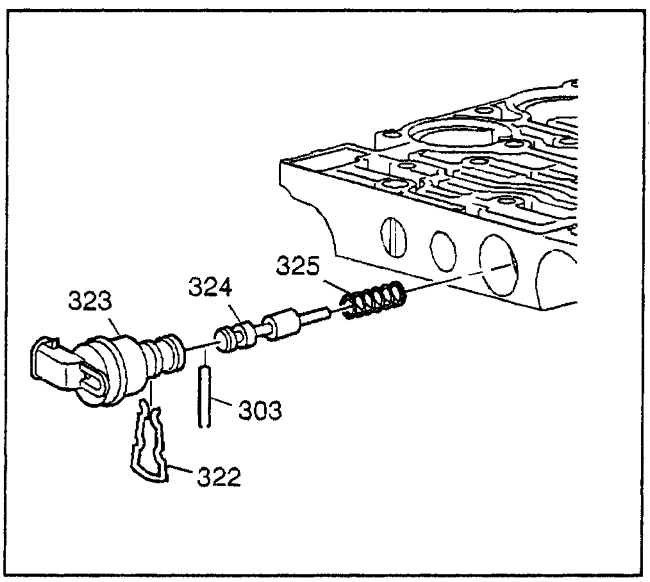


40630



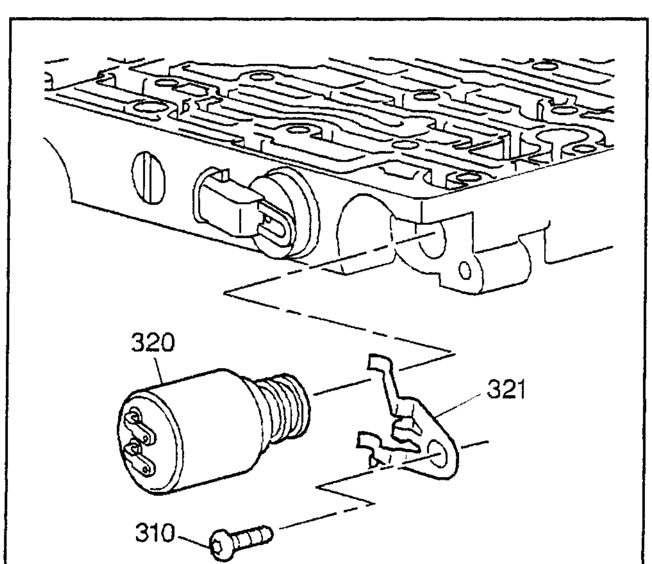
40631

28. Install the actuator feed limit valve (328).
29. Install the actuator feed limit valve spring (327).
30. Install the actuator feed limit valve spring retainer (333).



40632

31. Install the TCC regulator apply valve spring (325).
32. Install the TCC regulator apply valve (324).
33. Install the TCC regulator apply valve pin (303).
34. Install the TCC PWM solenoid valve (323).
35. Install the TCC PWM solenoid valve retainer (322).



40633

36. Install the pressure control solenoid valve (320) with the electrical connector facing away from the control valve body.
37. Install the pressure control solenoid clamp (321).
38. Install the pressure control solenoid clamp bolt (310).

Tighten

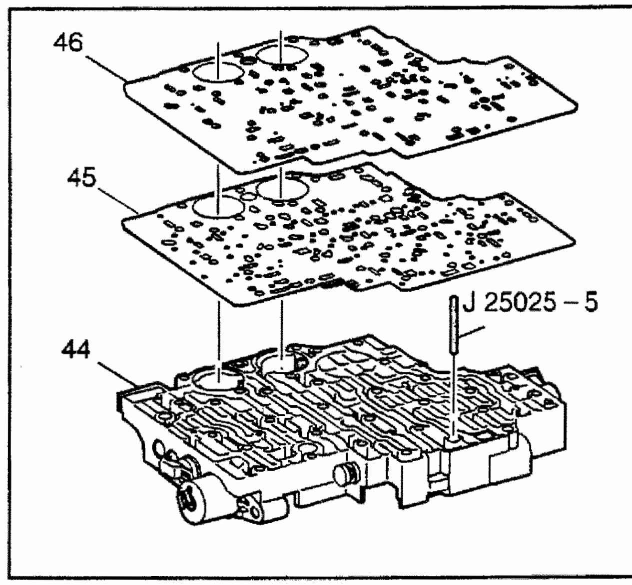
Tighten the bolt to 8 N·m (71 lb in).

3rd/4th Clutch Accumulator Housing Installation

Tools Required

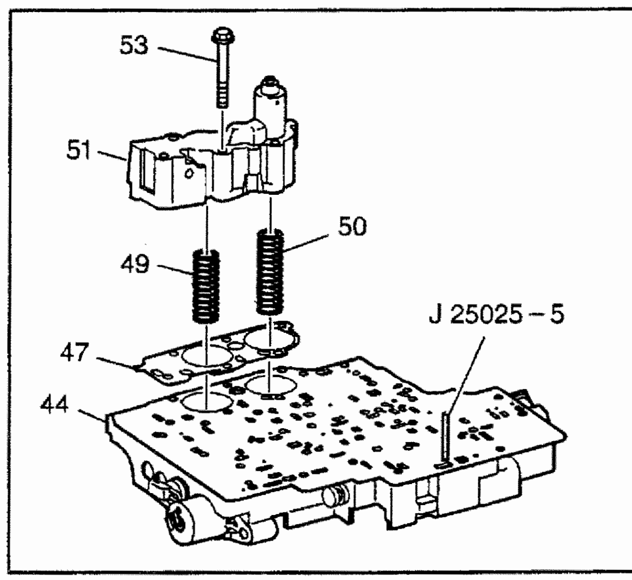
J 25025-5 Guide Pin

1. Install the *J 25025-5* into the control valve body bolt hole where the manual shaft detent roller and spring assembly is mounted.
2. Install the control valve body gasket (45).
3. Install the control valve body spacer plate (46).



40634

4. Install the accumulator housing gasket (47).
5. Install the 3rd clutch accumulator piston spring (50). This spring is the longer of the two accumulator springs.
6. Install the 4th clutch accumulator piston spring (49).
7. Install the 3rd and 4th clutch accumulator housing assembly (51) onto the control valve assembly (44).
8. Install the six 3rd and 4th clutch accumulator housing bolts (53). Start the bolts finger tight and work from one end of the accumulator housing towards the opposite end.



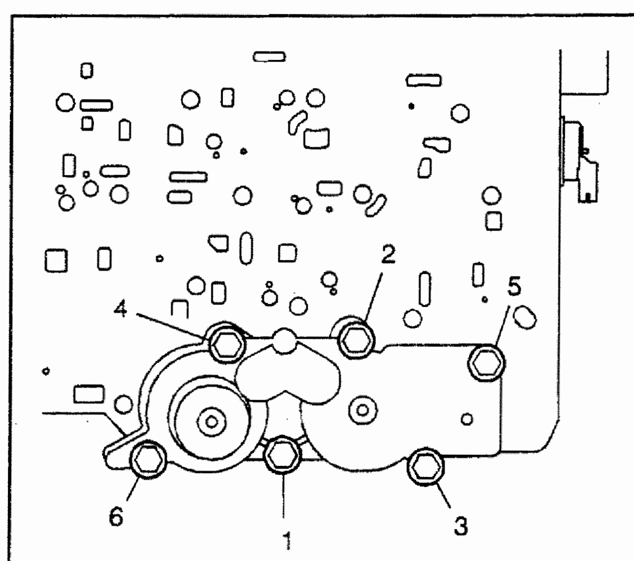
40635

Notice: Refer to *Fastener Notice* in Cautions and Notices.

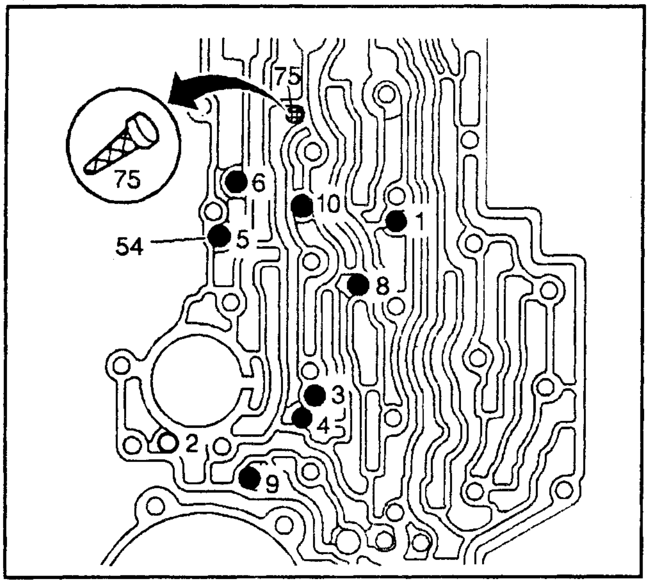
9. Tighten the 3rd and 4th clutch accumulator housing bolts (53) in the order shown.

   Tighten

   Tighten the bolts to 11 N·m (97 lb in).
10. Remove the *J 25025-5*.



54703



40637

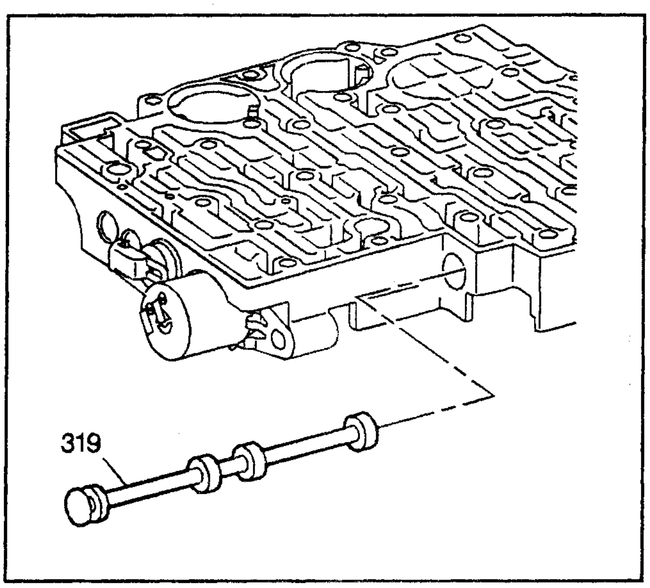
Control Valve Body Assembly Installation

Tools Required

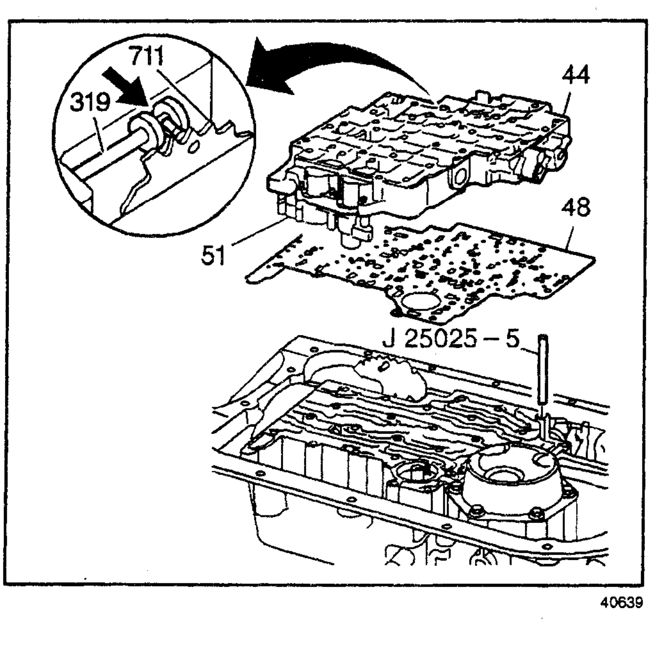
- *J 25025-5* Guide Pin
- *J 36850* Assembly Lubricant

Notice: Use Transjel™ J 36850 or equivalent during assembly in order to retain checkballs or to lubricate components. Greases other than the recommended assembly lube will change the transmission fluid characteristics and will cause undesirable shift conditions or filter clogging.

1. Install the 8 control valve body ball check valves (54) (9 some models) into the case passages:
   - The #2 control valve body ball check valve is only used on some models.
   - Use *J 36850* or equivalent in order to hold the control valve body ball check valves in place.
2. Install the TCC solenoid valve screen (75) into the case.
3. Install the manual valve (319) into the control valve assembly.



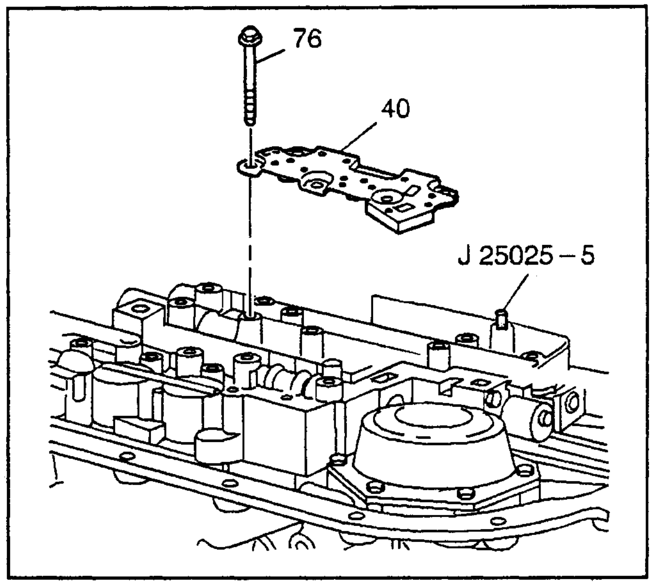
40638



40639

4. Install the *J 25025-5* into the transmission case.
5. Install the control valve body spacer plate gasket (48).
6. Install the control valve assembly (44). Attach the manual valve to the detent lever while installing the control valve assembly (44).

7. Install the transmission fluid pressure manual valve position switch (40).
8. Install the transmission fluid pressure manual valve position switch bolts (76) finger tight.



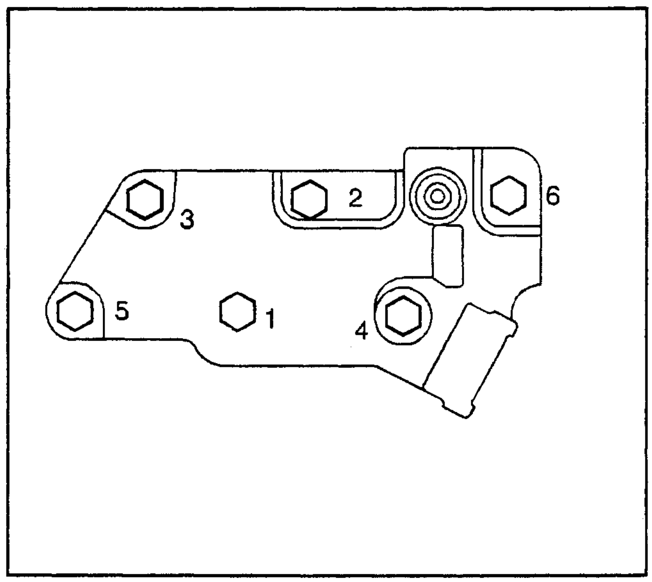
40640

Notice: Refer to *Fastener Notice* in Cautions and Notices.

9. Tighten the bolts (76) in the order shown.

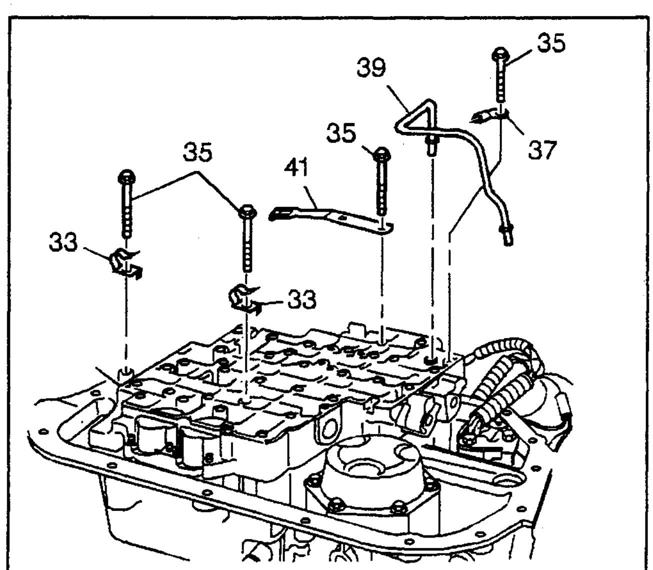
   Tighten

   Tighten the bolts to 11 N·m (97 lb in).
10. Remove the *J 25025-5*.

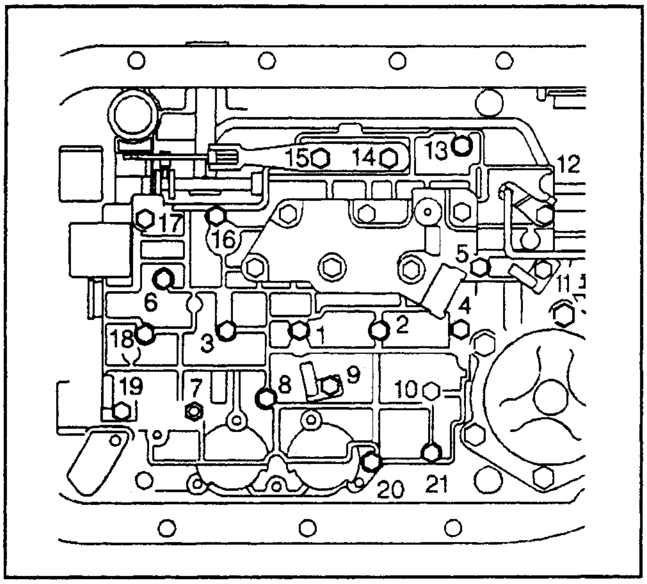


40641

11. Install the manual shift shaft detent spring assembly (41) and bolts (35).
12. Install the two wiring harness clamps (33) and bolts (35).
13. Install the lube oil pipe (39) with the short end into the control valve assembly.
14. Install the lube oil pipe retainer (37) and the bolt (35).
15. Install the remaining control valve body assembly bolts (35).



54709



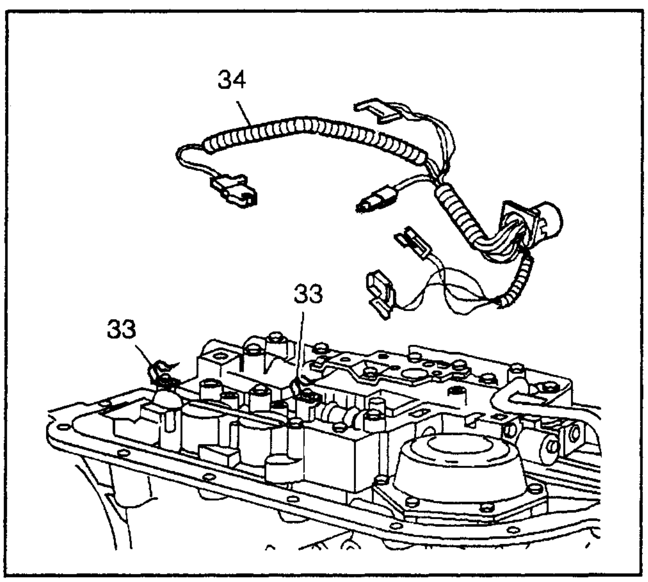
54712

Notice: Tighten the control valve assembly bolts in a spiral pattern starting from the center. If the bolts are tightened in a random pattern, the valve bores may become distorted, which can inhibit valve operation.

16. Tighten the control valve body assembly bolts (35) in the order shown.

    Tighten

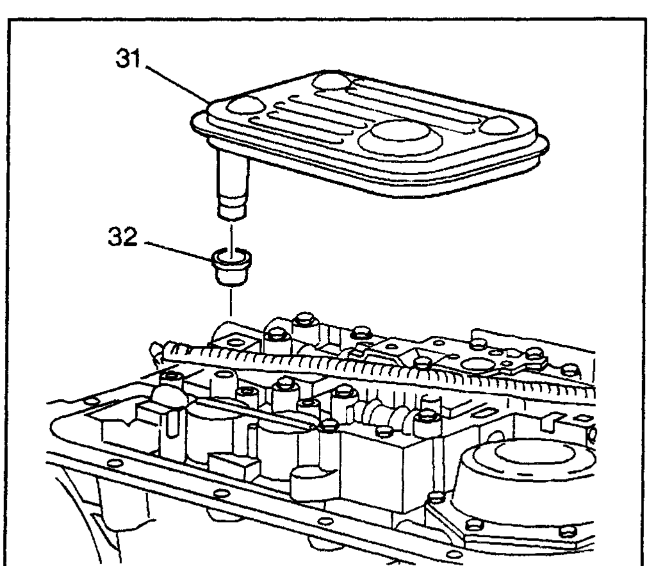
    Tighten the bolts to 11 N·m (97 lb in).



54716

Wiring Harness Installation

1. If the wiring harness assembly (34) was removed, install the wiring harness assembly (34) into the case first.
2. Connect the wiring harness assembly (34) to the electrical components.
3. Place the wiring harness assembly (34) under the wire harness clamps (33).



54719

Transmission Oil Filter Installation

1. If the transmission filter neck seal (32) was removed, install a new transmission filter neck seal (32) into the transmission case.
2. Install the oil filter (31) into the filter neck seal (32).

Transmission Oil Pan Installation

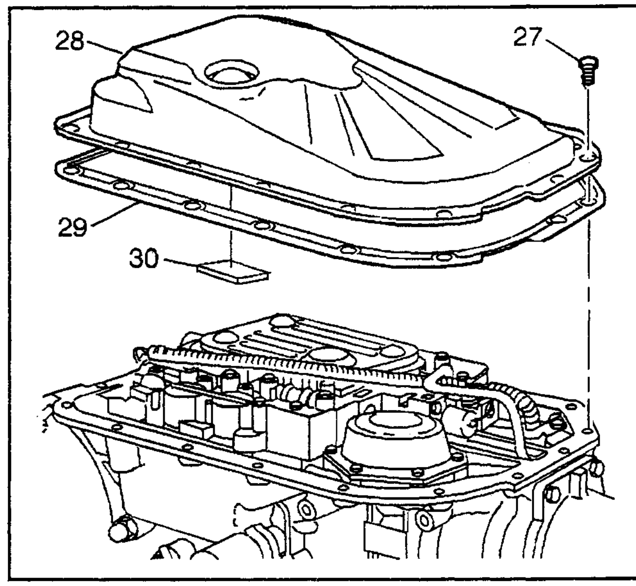
Important: You may reuse the transmission oil pan gasket (29).

1. Install the transmission oil pan gasket (29).
2. If the transmission oil pan magnet (30) was removed, install the magnet into the transmission oil pan (28).
3. Install the transmission oil pan (28).

Notice: Refer to *Fastener Notice* in Cautions and Notices.

4. Install the transmission oil pan bolts (27).

   Tighten
   Tighten the bolts to 24 N·m (18 lb ft).



54531

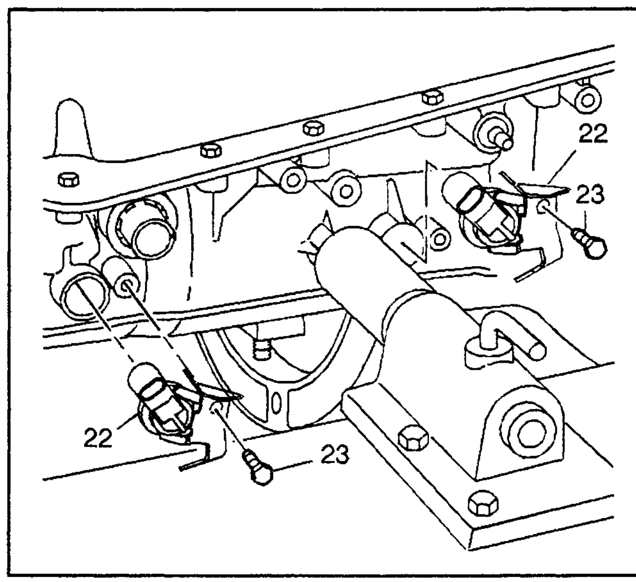
Speed Sensor Assembly Installation

1. Install the input and output speed sensors (22), (output speed sensor plug–4WD) into the transmission case.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the input and output speed sensor bolts (23).

   Tighten
   Tighten the bolts to 11 N·m (97 lb in).



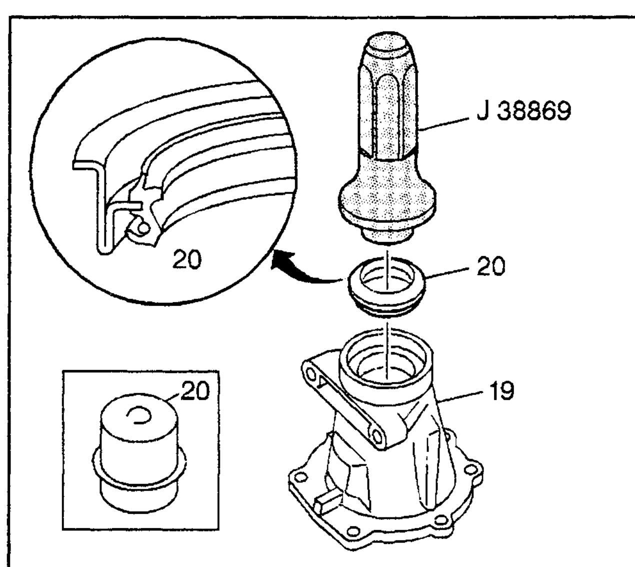
181639

Case Extension Assembly Installation

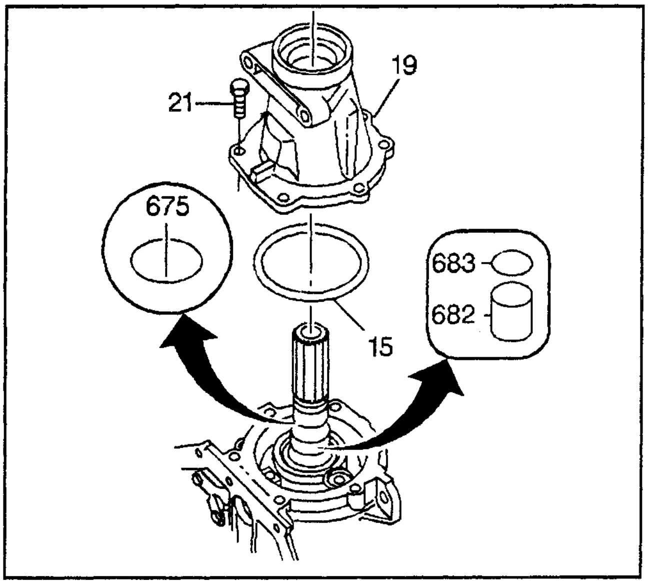
Tools Required

- *J 38694* Extension Housing Seal Installer
- *J 38869* Extension Seal Installer
- *J 36850* Assembly Lubricant

1. Install the prop shaft front slip yoke oil seal (20) (model dependent) with the *J 38869* or the *J 38694* for fixed yoke applications. Apply *J 36850* or equivalent to the spring pocket of the seal.



40647



40648

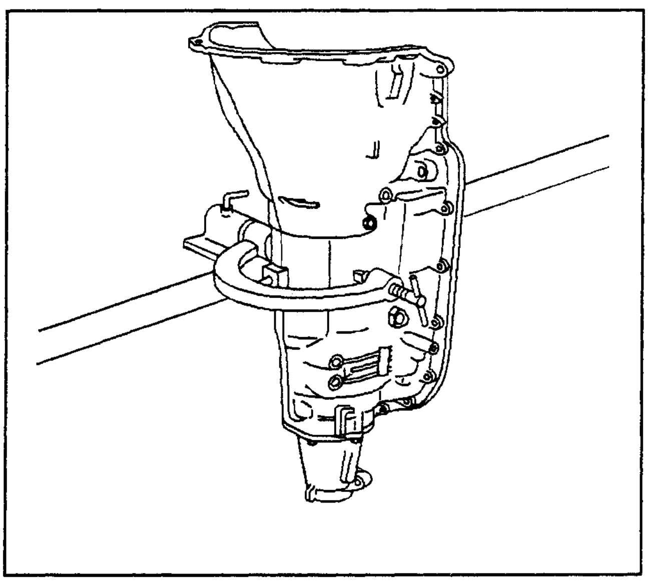
2. Install the transmission output shaft yoke seal (682) and the output shaft seal (683) (some models).
3. Install the output shaft seal (675) (some models).
4. Install the case extension seal (15) onto the case extension assembly (19).
5. Install the case extension assembly (19) onto the transmission case.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

6. Install the case extension bolts (21).

   Tighten

   Tighten the bolts to 34 N·m (25 lb ft).



335071

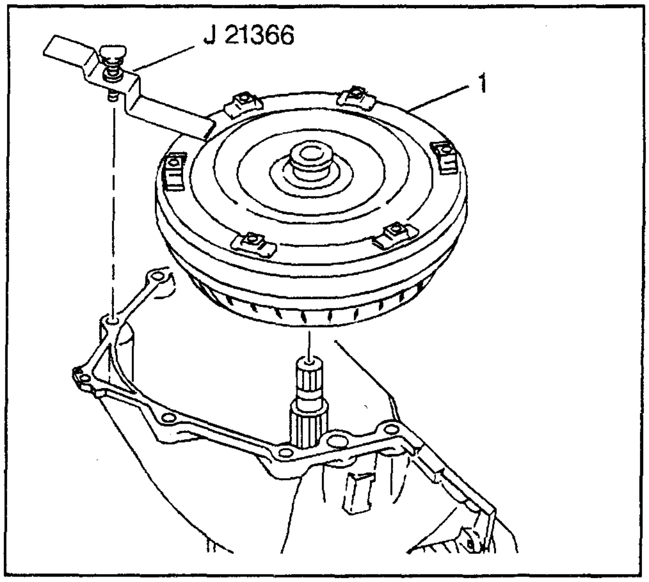
Torque Converter Assembly Installation

Tools Required

J 21366 Converter Holding Strap

1. Rotate the transmission so the converter housing is facing up.

2. Install the torque converter assembly (1). Rotate the torque converter assembly (1) in order to engage the turbine shaft, the stator shaft, and the lugs onto the oil pump drive gear.
3. Install the *J 21366* in order to hold the torque converter assembly (1) in place while moving the transmission assembly around. Remove the *J 21366* prior to installing the transmission into the vehicle.



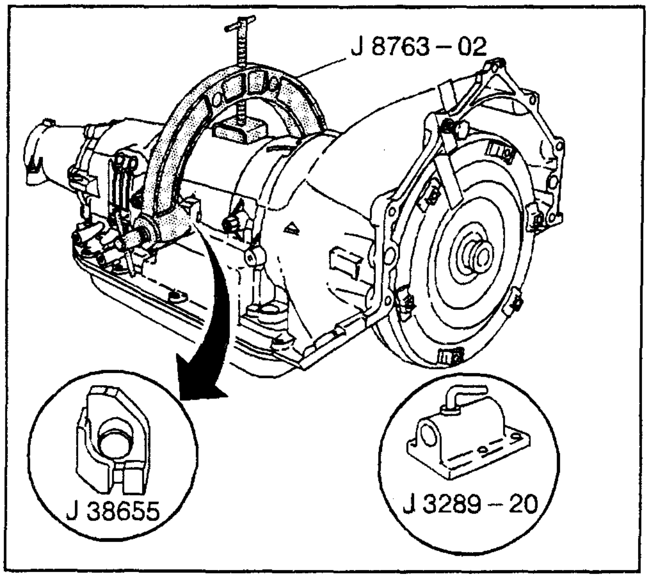
335072

Holding Fixture Removal

Tools Required

- *J 3289-20* Holding Fixture Base Assembly
- *J 8763-02* Transmission Holding Fixture
- *J 38655* Holding Fixture Adapter

1. Remove the transmission assembly and the *J 8763-02* from the *J 3289-20*.
2. Remove the *J 8763-02* and the *J 38655*.

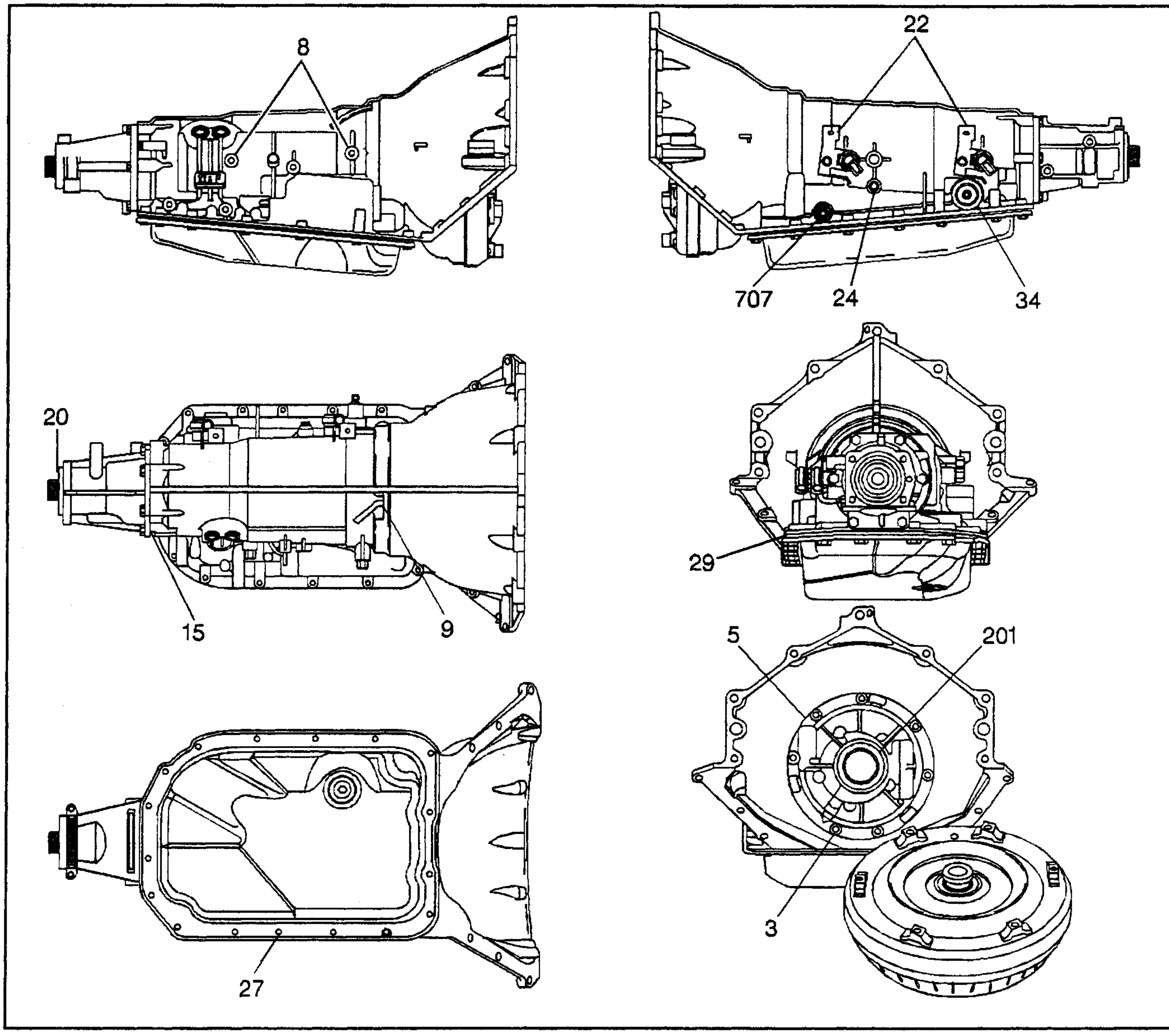


335084

Component Locator

Transmission Component Location

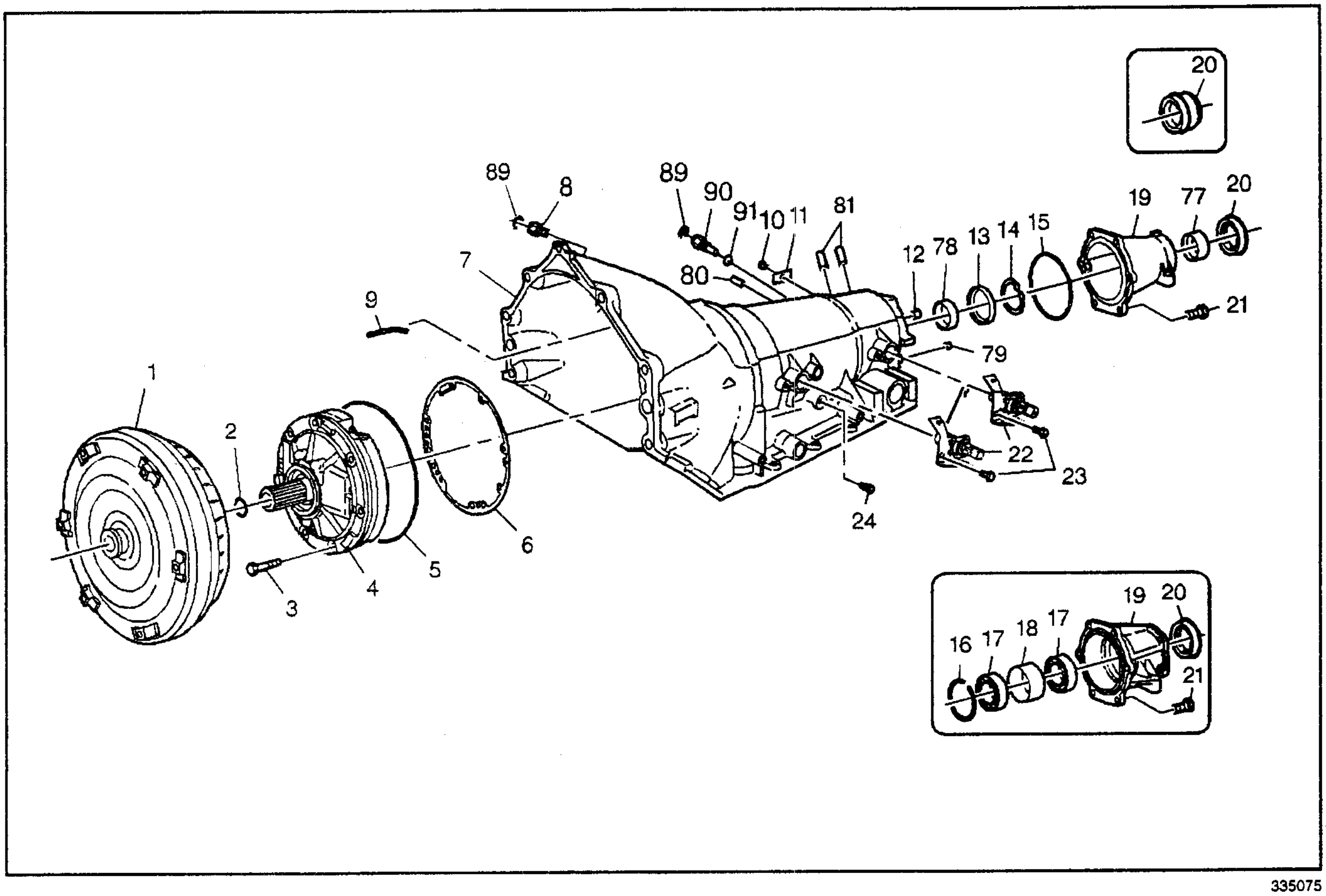
Possible Fluid Leak Points



Legend

(3) Bolt and Seal Assembly, A/Trans O/Pump
(5) Seal, A/Trans Oil Pump
(8) Connector, Transmission Oil Cooler Pipe
(9) Pipe, Vent
(15) Seal, Case Extension
(20) Seal Asm., Prop Shaft Front Slip Yoke Oil
(22) Sensor Assembly, A/T Input Speed and 2WD Output Speed (4WD Plug)
(24) Plug, Line Pressure Test Hole
(27) Bolt, Oil Pan
(29) Seal, Transmission Oil Pan
(34) Harness Assembly, A/Trans Wiring
(201) Seal Asm., Torque Converter Oil
(707) Seal Assembly, Manual Shift Shaft

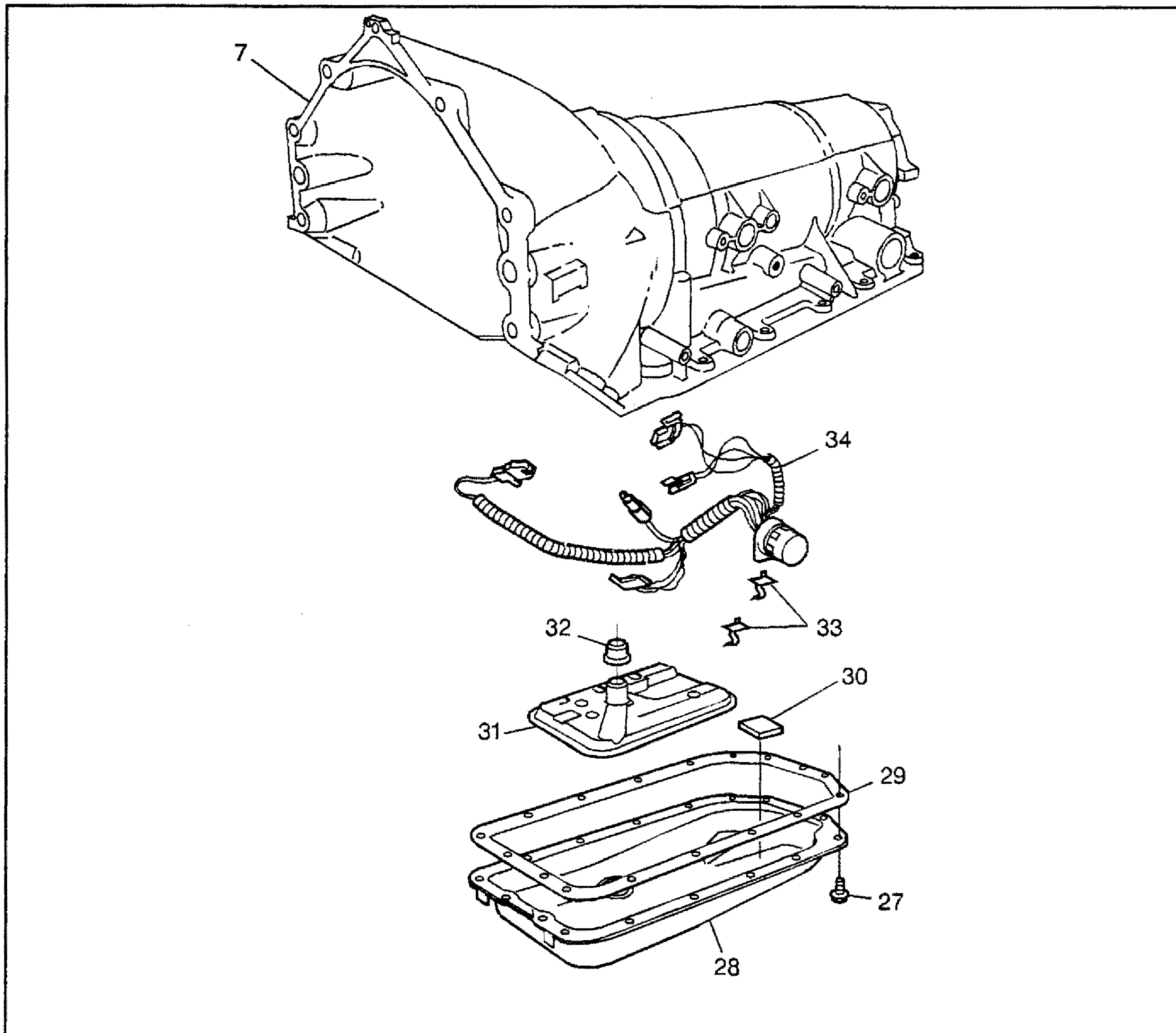
Case and Associated Parts (1 of 3)



Legend

(1) Torque Converter Assembly
(2) Seal Ring, Turbine Shaft Front Oil
(3) Bolt and Seal Assembly, A/Trans O/Pump
(4) Pump Assembly, A/Trans Oil
(5) Seal, A/Trans Oil Pump
(6) Gasket, A/Trans Oil Pump
(7) Case Assembly, A/Trans
(8) Connector, Transmission Oil Cooler Pipe
(9) Pipe, Vent
(10) Pin, Nameplate
(11) Plate, A/Trans Name
(12) Orifice (2WD) [Plug (4WD)], Lube Oil
(13) Seal, Output Shaft
(14) Ring, Output Shaft Seal Retainer
(15) Seal, Case Extension
(16) Ring, Bearing Retainer
(17) Bearing Assembly, Ball
(18) Spacer, Bearing
(19) Extension Assembly, Case
(20) Seal Asm., Prop Shaft Front Slip Yoke Oil
(21) Bolt, Case Extension
(22) Sensor Assembly, A/T Input Speed and 2WD Output Speed (4WD Plug)
(23) Bolt, Input Speed and Output Speed Sensor
(24) Plug, Line Pressure Test Hole
(77) Bushing, Prop Shaft Front Slip Yoke
(78) Bushing, Output Shaft
(79) Plug, Direct Oil Gal – 0.25 Diameter Cup
(80) Pin, Manual 2-1 Band Anchor
(81) Pin, Low and Reverse Band Anchor
(89) Retainer, Transmission Oil Cooler Pipe (Some Models)
(90) Fitting, Transmission Rear Oil Cooler Pipe
(91) Seal, Transmission Rear Oil Cooler Pipe Fitting

Case and Associated Parts (2 of 3)

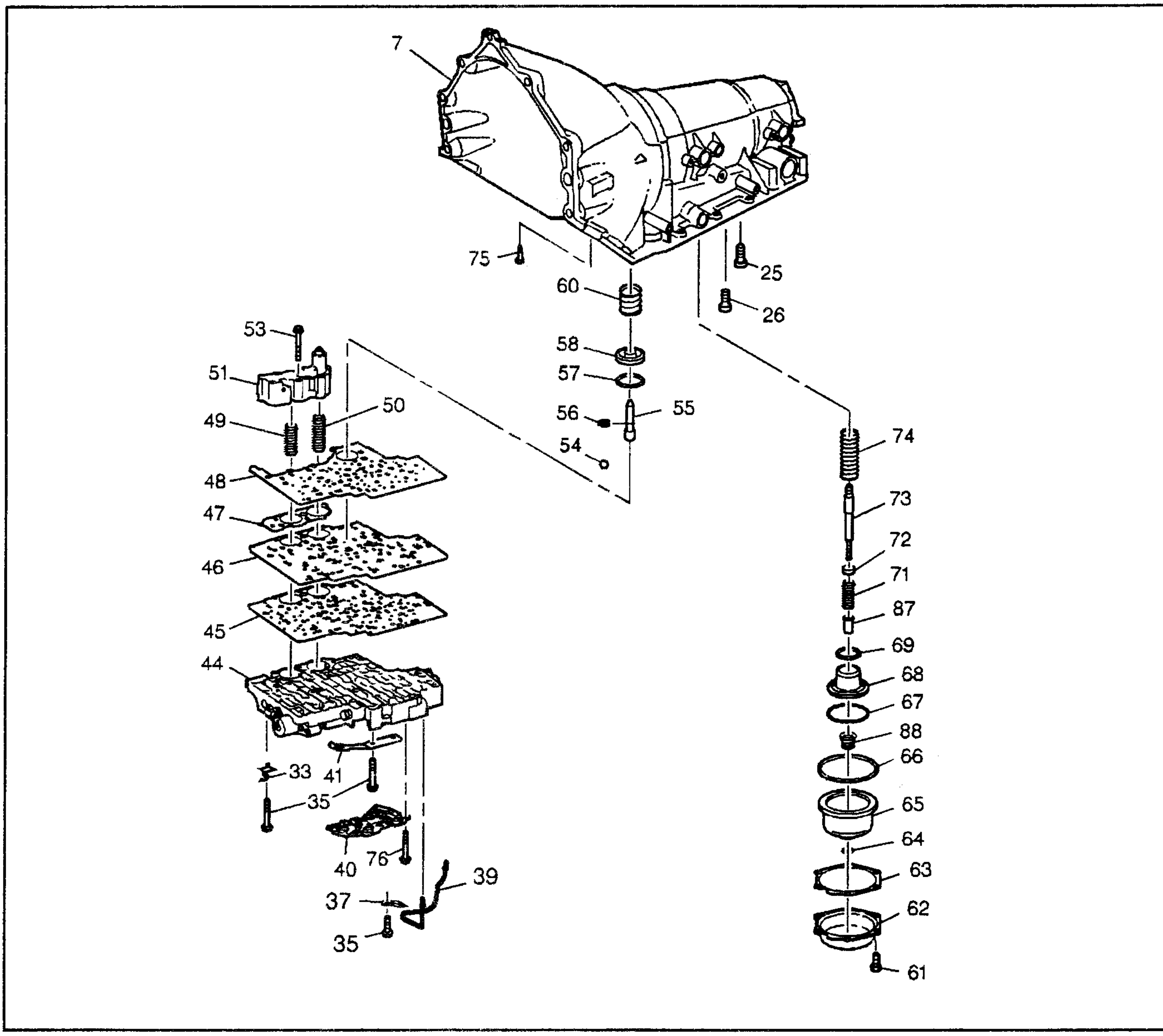


335076

Legend

(7) Case Assembly, A/Trans
(27) Bolt, Transmission Oil Pan
(28) Pan, Transmission Oil
(29) Seal, Transmission Oil Pan
(30) Magnet, A/Trans Oil Pan
(31) Filter Assembly, Transmission Oil
(32) Seal Assembly, Filter Neck
(33) Clamp, A/Trans Wiring Harness
(34) Harness Assembly, A/Trans Wiring

Case and Associated Parts (3 of 3)

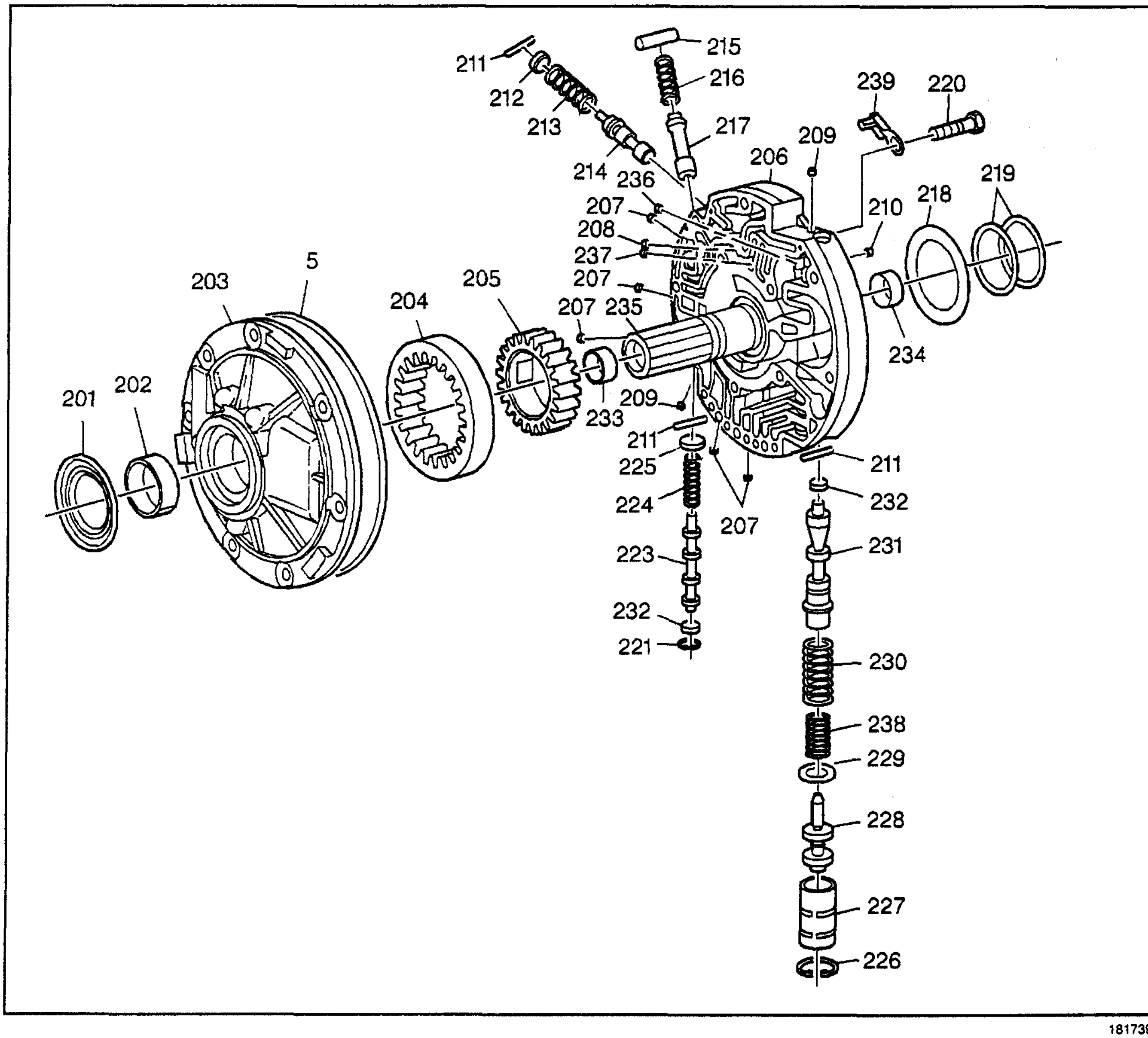


Legend

(7) Case Assembly, A/Trans
(25) Bolt, Center Support
(26) Bolt, Fourth Clutch Housing
(33) Clamp, Electrical Cable
(35) Bolt, Control Valve Body Assembly
(37) Retainer, Lube Oil Pipe
(39) Pipe, Lube Oil
(40) Switch, A/T Fluid Pressure Manual Valve Position
(41) Spring Assembly, Manual Shift Shaft Detent
(44) Valve Assembly, Control (w/Body and Valves)
(45) Gasket, Control Valve Body
(46) Plate, Control Valve Body Spacer
(47) Gasket, Accumulator Housing
(48) Gasket, Control Valve Body Spacer Plate
(49) Spring, Fourth Clutch Accumulator Piston
(50) Spring, Third Clutch Accumulator Piston
(51) Housing, 3rd and 4th Clutch Accumulator
(53) Bolt, 3rd and 4th Clutch Accumulator Housing
(54) Valve, Control Valve Body Ball Check
(55) Pin, Manual 2-1 Band Servo Piston
(56) Ring, Manual 2-1 Band Servo Piston Pin Retainer
(57) Seal, Manual 2-1 Band Servo Piston
(58) Piston, Manual 2-1 Band Servo
(60) Spring, Manual 2-1 Band Servo Piston Cushion
(61) Bolt, Low and Reverse Band Servo Cover
(62) Cover, Low and Reverse Band Servo

(63) Gasket, Low and Reverse Band Servo Cover
(64) Ring, Low and Reverse Band Servo Piston Pin Retainer
(65) Piston, Low and Reverse Band Servo
(66) Seal, Low and Reverse Band Servo Piston
(67) Ring, Low and Reverse Accumulator Piston Outer Oil Seal
(68) Piston, 1-2 Accumulator
(69) Ring, Low and Reverse Accumulator Piston Inner Oil Seal
(71) Spring, Low and Reverse Band Servo Piston
(72) Retainer, Low and Reverse Band Servo Piston Spring
(73) Pin, Low and Reverse Band Servo Piston (Selective)
(74) Spring, Low and Reverse Accumulator Piston
(75) Screen, TCC Solenoid Valve
(76) Bolt, TFP Manual Valve Position Switch
(87) Spacer, Low and Reverse Band Servo Piston
(88) Spring Assembly, 1-2 Accumulator Piston

Oil Pump Assembly

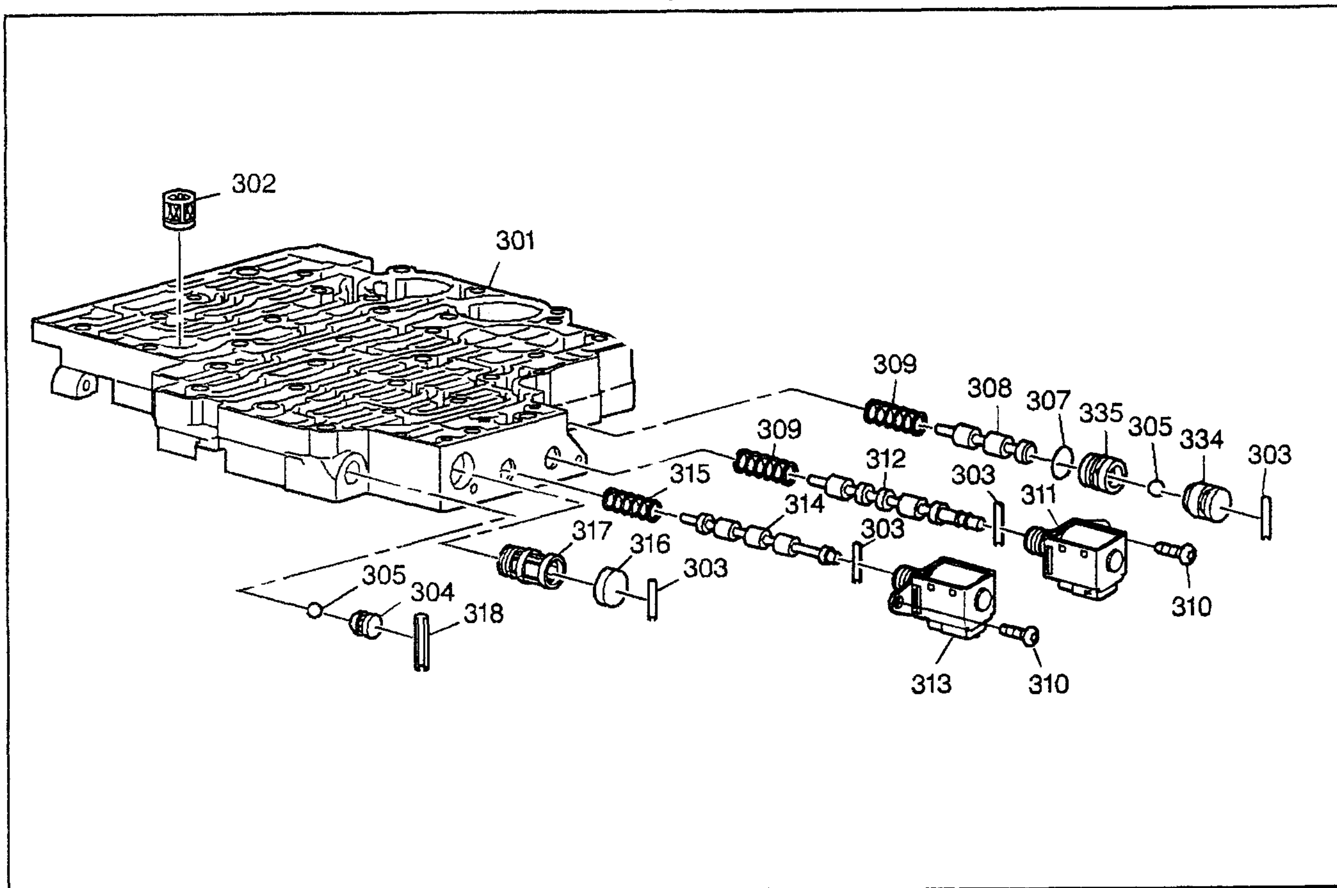


Legend

(5) Seal, A/Trans Oil Pump
(201) Seal Asm., Torque Converter Oil
(202) Bushing, Torque Converter
(203) Body Asm., Oil Pump
(204) Gear, Oil Pump Driven
(205) Gear, Oil Pump Drive
(206) Cover, Oil Pump
(207) Plug, Oil Pump Cover (5)
(208) Plug, Orificed Cup, Converter Limit Valve Bypass (1)
(209) Plug, Oil Pump Cover (2)
(210) Plug, Orificed Cup, Line Air Bleed (1)
(211) Pin, Pressure Regulator Valve Bore Plug (3)
(212) Plug, Converter Limit Valve Bore
(213) Spring, Converter Limit Valve
(214) Valve, Converter Limit
(215) Sleeve, TCC Enable Valve Spring Retainer
(216) Spring, TCC Enable Valve
(217) Valve, TCC Enable
(218) Washer, Thrust, Selective
(219) Ring, Oil Seal, Overrun Clutch Housing
(220) Bolt, Oil Pump Cover (5)
(221) Ring, TCC Shift Valve Bore Plug Retainer
(223) Valve, TCC Shift
(224) Spring, TCC Shift Valve
(225) Seat, TCC Shift Valve Spring
(226) Ring, Retainer (Reverse Boost Valve Bushing)
(227) Bushing, Reverse Boost Valve
(228) Valve, Reverse Boost
(229) Retainer, Pressure Regulator Valve Spring
(230) Spring, Pressure Regulator Valve Outer

(231) Valve, Pressure Regulator
(232) Plug, TCC Shift Valve, Lower and Pressure Regulator Valve Bore
(233) Bushing, Turbine Shaft Front
(234) Bushing, Turbine Shaft Rear
(235) Shaft, Stator
(236) Plug, Orificed Cup, Pressure Regulator Valve Feedback (1)
(237) Plug, Orificed Cup, Converter Limit Valve Feedback (1)
(238) Spring, Pressure Regulator Valve Inner
(239) Shield, Vent Passage Splash

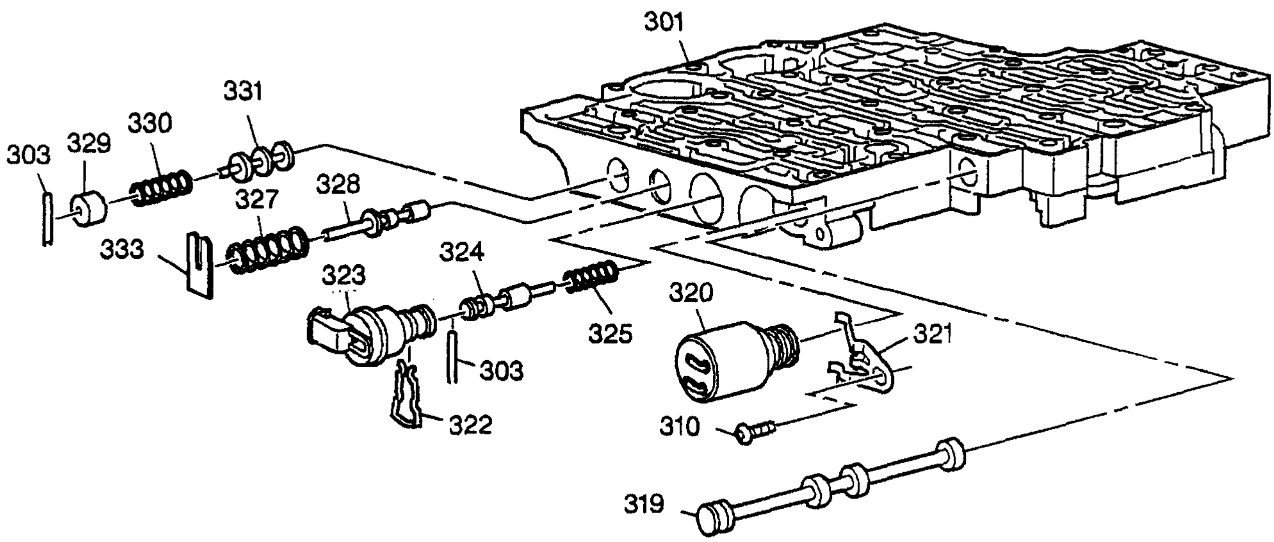
Control Valve Body Assembly (1 of 2)



Legend

(301) Body, Control Valve
(302) Filter, Pressure Control Solenoid Valve Fluid
(303) Pin, Shift Valve, Fluid Filter Bore Plug
(304) Seat, Low-Reverse Ball Valve
(305) Valve, Low-Reverse Ball
(307) Seal, 3rd Ball Valve Bushing
(308) Valve, 3-4 Shift
(309) Spring, 3-4 Shift Valve
(310) Bolt, Solenoid (1-2 and 2-3 Shift Valve)
(311) Valve Assembly, 2-3 Shift Solenoid
(312) Valve, 2-3 Shift
(313) Valve Assembly, 1-2 Shift Solenoid
(314) Valve, 1-2 Shift
(315) Spring, 1-2 Shift Valve
(316) Plug, Shift Valve Fluid Filter Bore
(317) Filter, Shift Solenoid Valve Fluid
(318) Pin, Low-Reverse Ball Valve Seat
(334) Bushing, Reverse Ball Valve
(335) Bushing, 3rd Ball Valve

Control Valve Body Assembly (2 of 2)

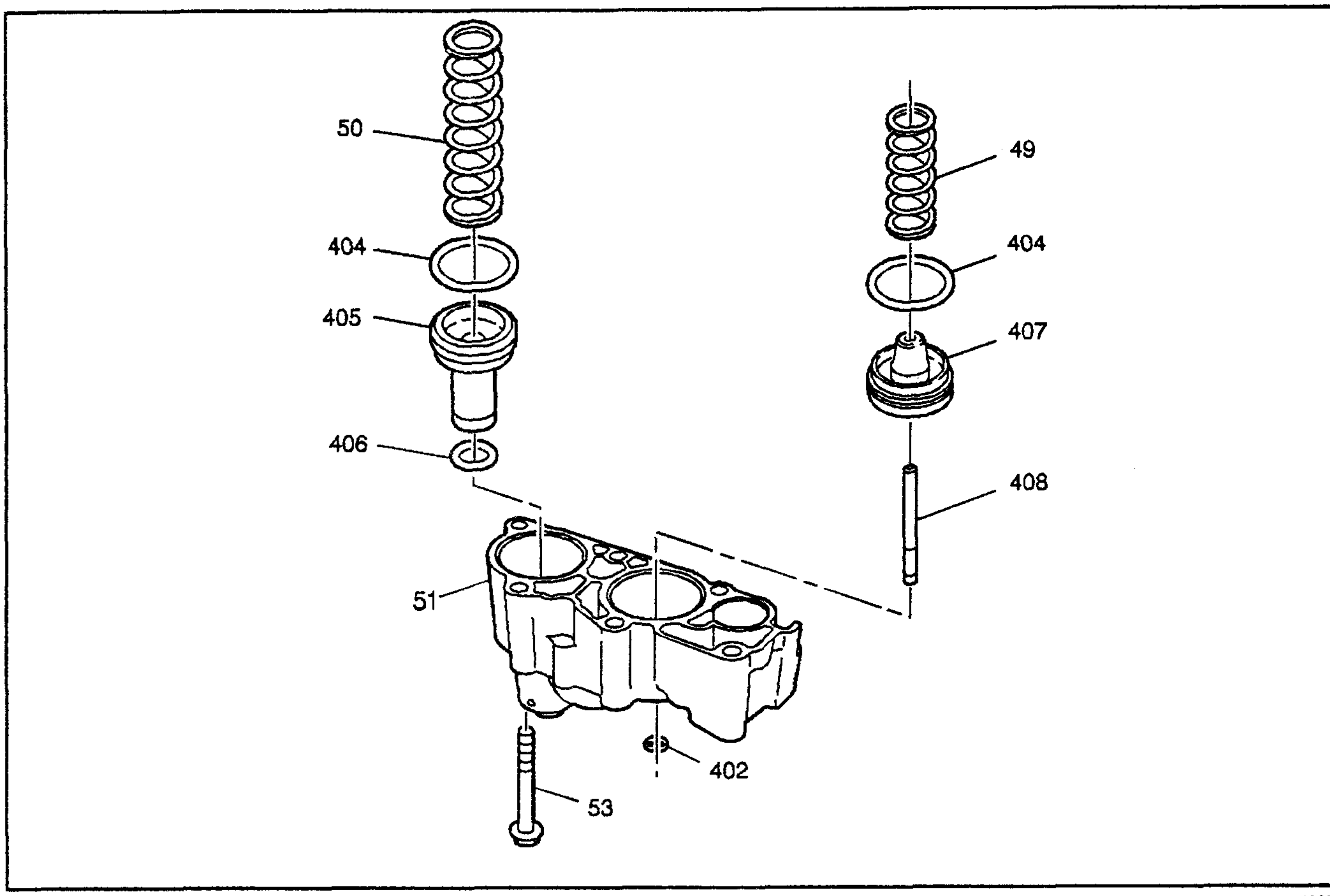


54726

Legend

(301) Body, Control Valve
(303) Pin, Accumulator Valve Bore Plug, Shift Valve
(310) Bolt, Pressure Control Solenoid Clamp
(319) Valve, Manual
(320) Valve Asm., Pressure Control Solenoid
(321) Clamp, Pressure Control Solenoid
(322) Retainer, TCC PWM Solenoid Valve
(323) Valve Asm., TCC PWM Solenoid
(324) Valve, TCC Regulator Apply
(325) Spring, TCC Regulator Apply Valve
(327) Spring Actuator Feed Limit Valve
(328) Valve, Actuator Feed Limit
(329) Plug, Accumulator Valve Bore
(330) Spring, Accumulator Valve
(331) Valve, Accumulator
(333) Retainer, Actuator Feed Limit Valve Spring

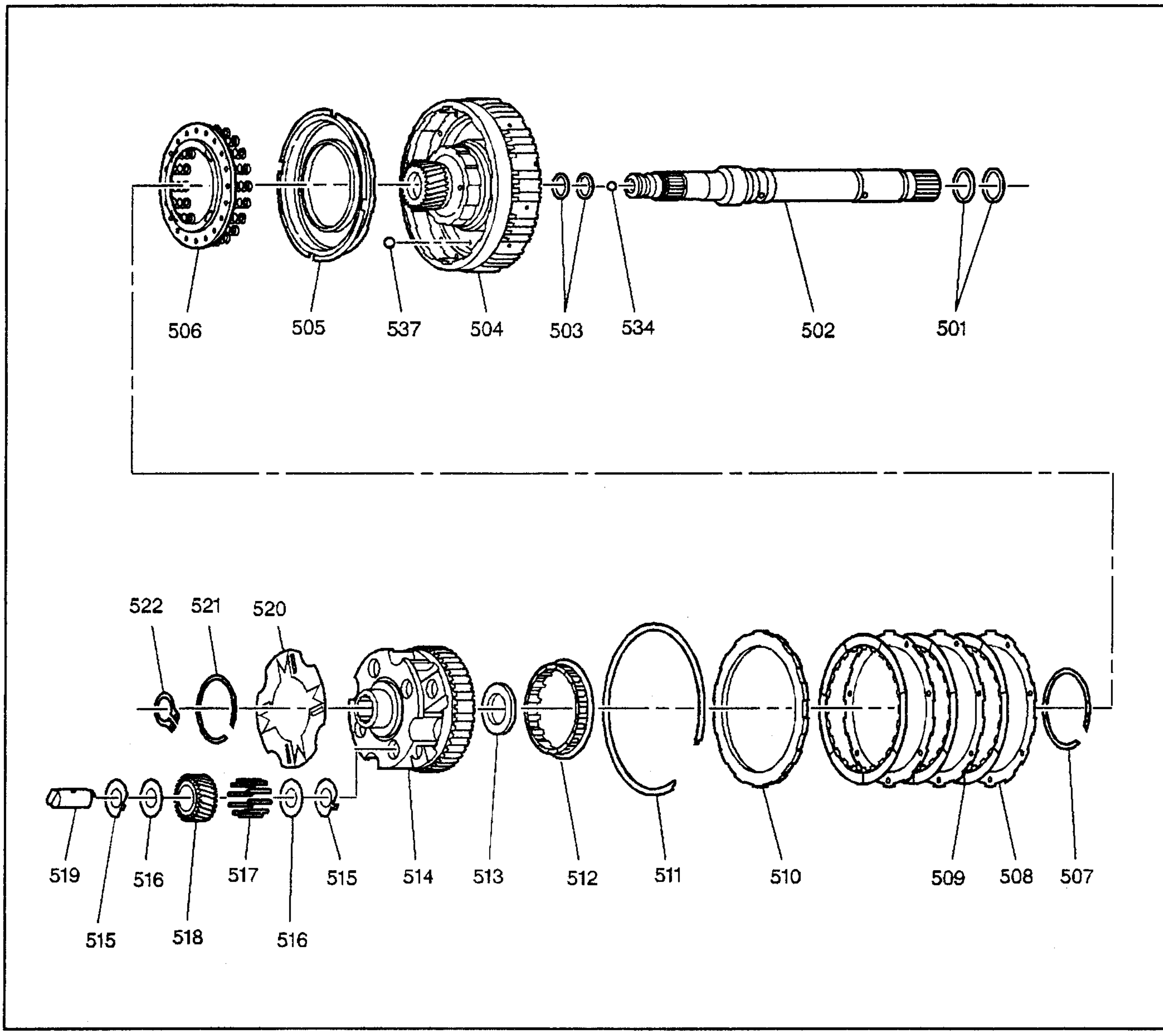
Accumulator Assembly



Legend

- (49) Spring, 4th Clutch Accumulator Piston
- (50) Spring, 3rd Clutch Accumulator Piston
- (51) Housing, 3rd and 4th Clutch Accumulator
- (53) Bolt, 3rd and 4th Clutch Accumulator Housing
- (402) Ring, 4th Clutch Accumulator Piston Pin
- (404) Seal, 3rd and 4th Clutch Accumulator Piston
- (405) Piston, 3rd Clutch Accumulator
- (406) Seal, 3rd Clutch Accumulator Piston Inner
- (407) Piston, 4th Clutch Accumulator
- (408) Pin, 4th Clutch Accumulator Piston

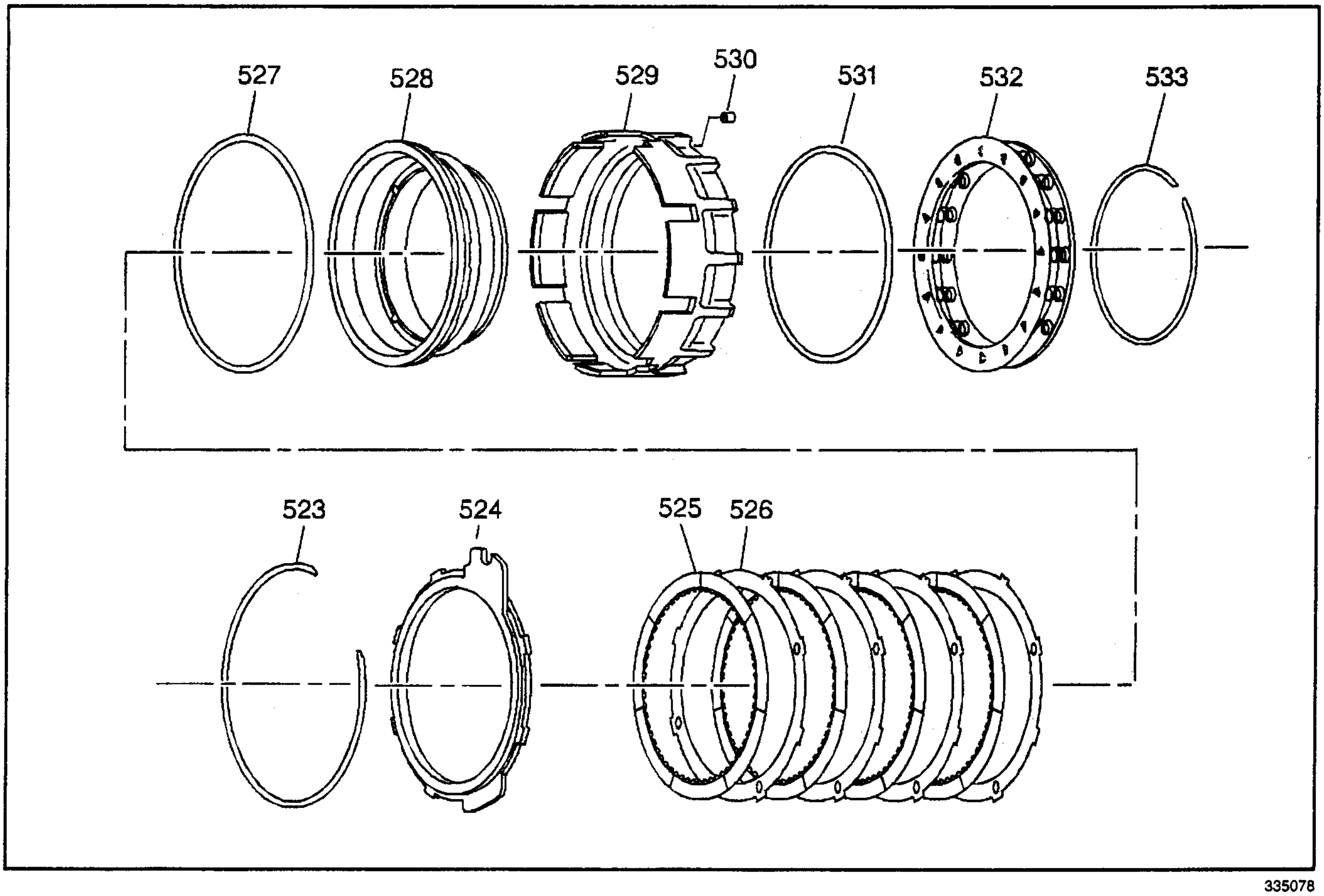
Overrun Clutch Assembly



Legend

(501) Ring, Turbine Shaft Rear Oil Seal
(502) Shaft, Turbine
(503) Ring, Turbine Shaft Intermediate Oil Seal
(504) Housing Assembly, Overrun Clutch
(505) Piston Assembly, Overrun Clutch
(506) Spring Assembly, Overrun Clutch
(507) Ring, Overrun Clutch Spring Retainer
(508) Plate, Overrun Clutch
(509) Plate Assembly, Overrun Clutch
(510) Plate, Overrun Clutch Backing
(511) Ring, Overrun Clutch Backing Plate Retainer
(512) Roller Assembly, Overdrive Clutch
(513) Bearing Assembly, Overrun Clutch Housing
(514) Carrier Assembly, Overdrive
(515) Washer, Overdrive Carrier Pinion Gear Thrust
(516) Washer, Overdrive Carrier Pinion Gear Thrust (Steel)
(517) Roller, Overdrive Carrier Pinion Gear Bearing
(518) Gear, Overdrive Carrier Pinion
(519) Pin, Overdrive Carrier Pinion Gear
(520) Retainer, Overdrive Carrier Pinion Gear Pin
(521) Retainer, Overdrive Carrier Pinion Gear Pin
(522) Ring, Overdrive Carrier Retainer
(534) Plug, Turbine Shaft
(537) Valve, Direct Clutch Housing Ball Check

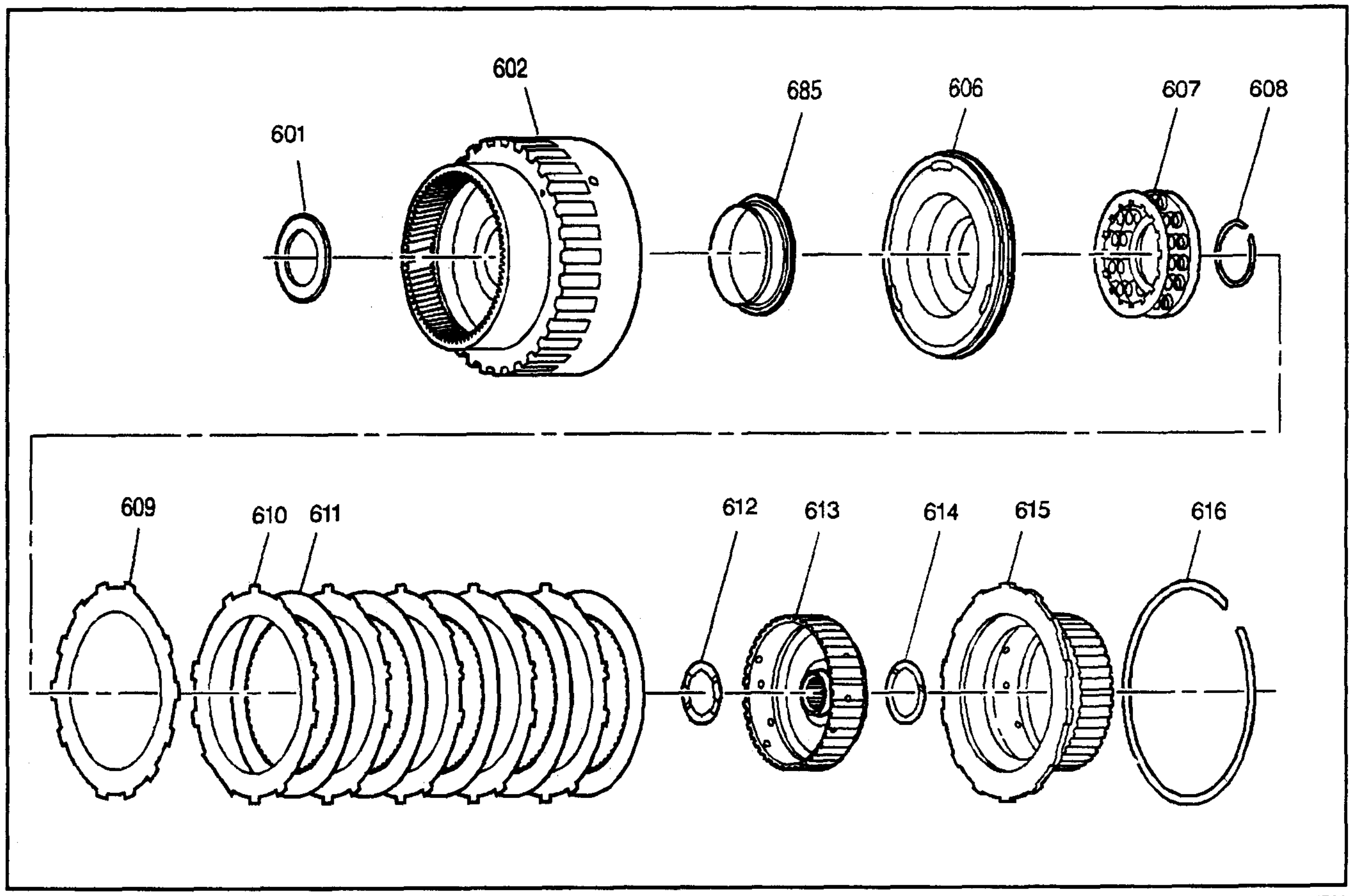
Fourth Clutch Assembly



Legend

(523) Ring, 4th Clutch Backing Plate Retainer
(524) Plate, 4th Clutch Backing
(525) Plate Assembly, 4th Clutch
(526) Plate, 4th Clutch
(527) Seal, 4th Clutch Piston Inner
(528) Piston, 4th Clutch
(529) Housing, 4th Clutch
(530) Orifice, 4th Clutch
(531) Seal, 4th Clutch Piston Outer
(532) Spring Assembly, 4th Clutch
(533) Ring, 4th Clutch Spring Retainer

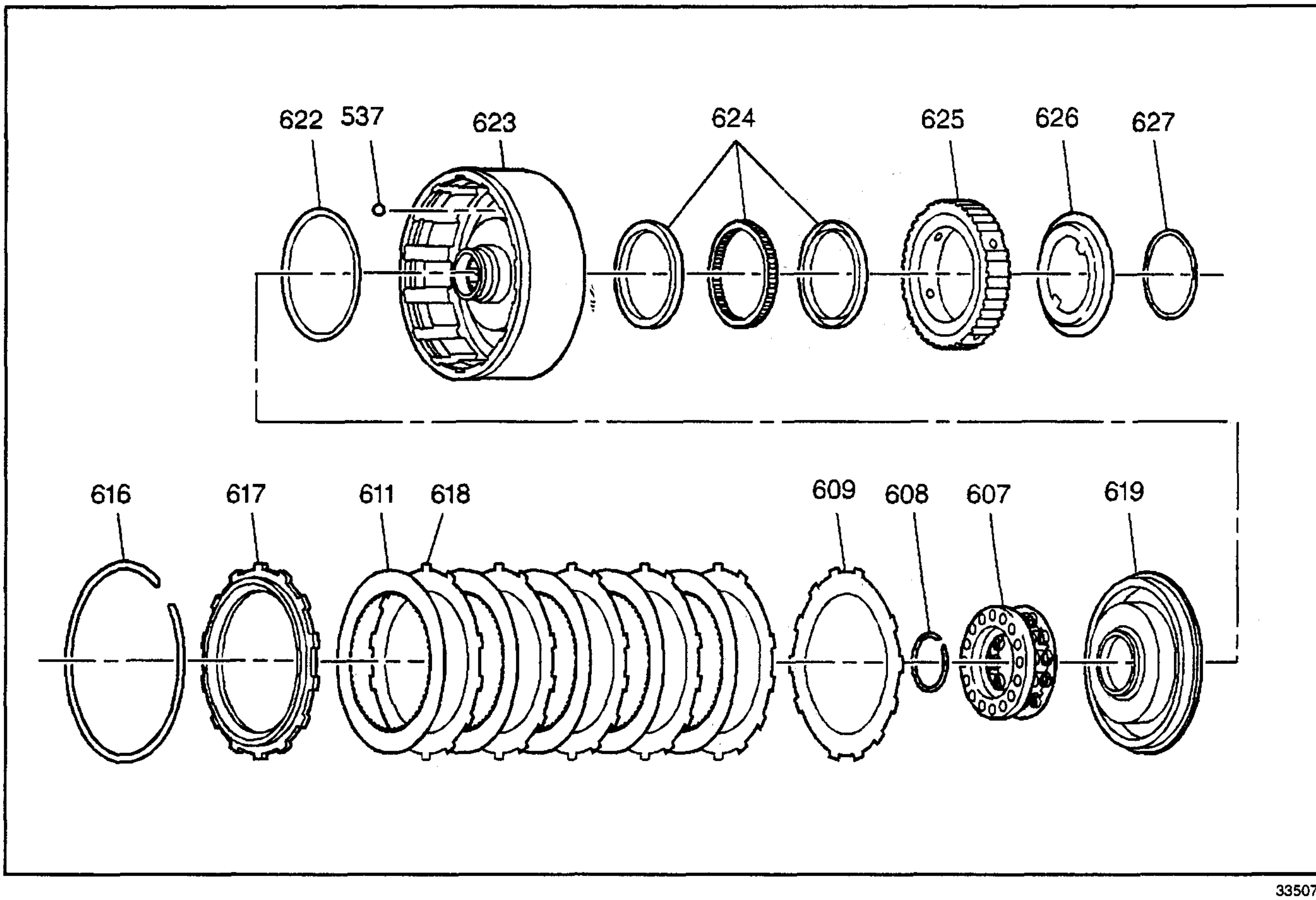
Forward Clutch Assembly



Legend

(601) Bearing Assembly, Thrust Carrier/Forward Clutch
(602) Housing Assembly, Forward Clutch
(606) Piston, Forward Clutch
(607) Spring Assembly, Forward Clutch
(608) Ring, Forward Clutch Spring Retainer
(609) Plate, Forward Clutch Waved
(610) Plate, Forward Clutch
(611) Plate Assembly, Forward Clutch
(612) Washer, Forward Clutch Housing Thrust
(613) Hub, Forward Clutch
(614) Washer, Direct Clutch Housing Thrust
(615) Hub, Direct Clutch
(616) Ring, Direct Clutch Hub Retainer
(685) Seal Assembly, Forward Clutch Piston Intermediate

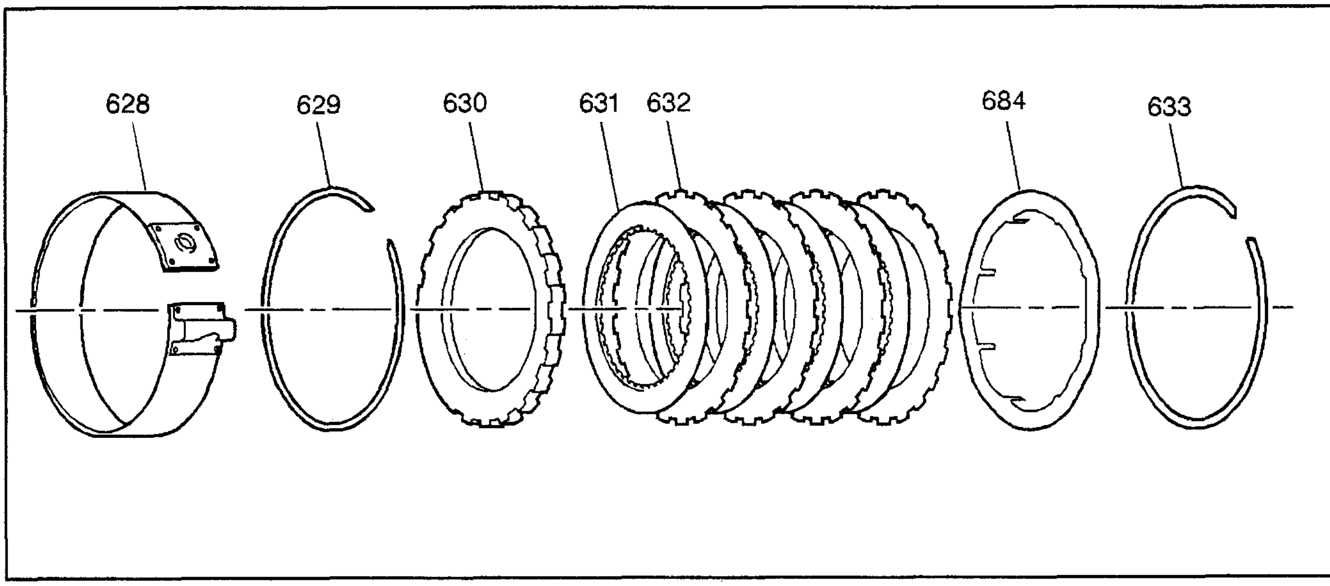
Direct Clutch and Intermediate Sprag Assembly



Legend

(537) Valve, Direct Clutch Housing Ball Check
(607) Spring Assembly, Direct Clutch
(608) Ring, Direct Clutch Spring Retainer
(609) Plate, Direct Clutch Apply (Waved)
(611) Plate Assembly, Direct Clutch
(616) Ring, Direct Clutch Backing Plate Retaining
(617) Plate, Direct Clutch Backing
(618) Plate, Direct Clutch
(619) Piston Assembly, Direct Clutch
(622) Seal, Direct Clutch Piston Intermediate
(623) Housing Asm., Direct Clutch
(624) Sprag Assembly, Intermediate Clutch
(625) Race, Intermediate Clutch Sprag (Outer)
(626) Retainer, Intermediate Clutch Sprag
(627) Ring, Intermediate Clutch Sprag Retainer Retaining

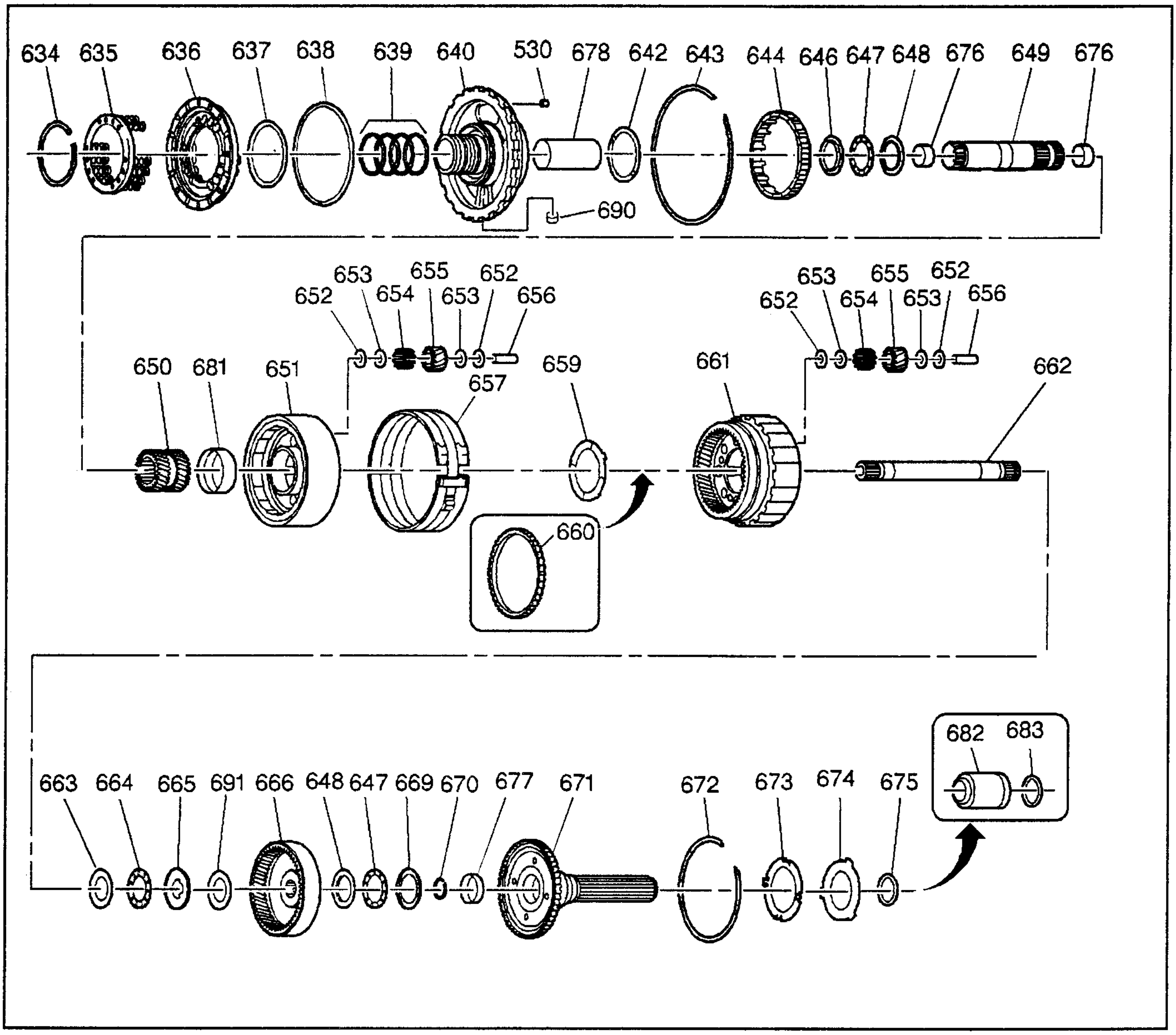
Intermediate Clutch Plates and Manual 2-1 Band Assembly



Legend

(628) Band Assembly, Manual 2-1
(629) Ring, Intermediate Clutch Backing Plate Retainer
(630) Plate, Intermediate Clutch Backing
(631) Plate Assembly, Intermediate Clutch
(632) Plate, Intermediate Clutch
(633) Ring, Center Support Retaining
(684) Plate, Intermediate Clutch (Waved)

Center Support and Gear Unit Assembly



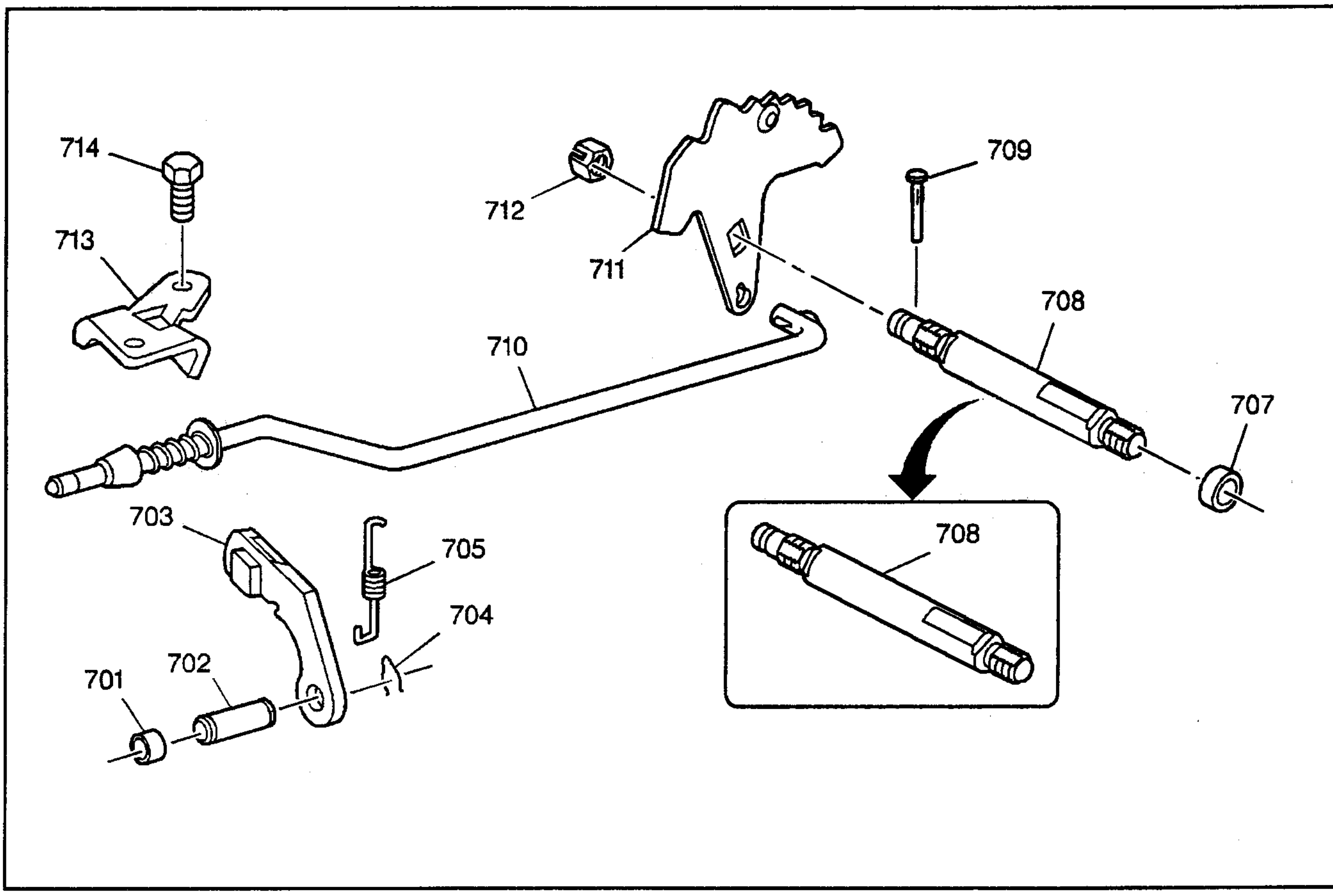
335081

Legend

(530) Orifice, Intermediate Clutch
(634) Ring, Intermediate Clutch Spring Retainer
(635) Spring Assembly, Intermediate Clutch
(636) Piston, Intermediate Clutch
(637) Seal, Intermediate Clutch Inner
(638) Seal, Intermediate Clutch Outer
(639) Ring, Direct Clutch Housing Oil Seal
(640) Support Assembly, Center
(642) Washer, Thrust Reaction Carrier
(643) Spacer, Center Support
(644) Roller Assembly, Low Clutch
(646) Race, Sun Gear Front Thrust Bearing
(647) Bearing Asm., Sun Gear Front Thrust
(648) Race, Sun Gear Rear Thrust Bearing
(649) Shaft Assembly, Sun Gear
(650) Gear, Sun
(651) Carrier Assembly, Reaction
(652) Washer, Reaction Carrier Pinion Gear Thrust (Bronze)
(653) Washer, Reaction Carrier Pinion Gear Thrust (Steel)
(654) Roller, Reaction Carrier Pinion Gear Bearing
(655) Gear, Reaction Carrier Pinion
(656) Pin, Reaction Carrier Pinion Gear
(657) Band Assembly, Low and Reverse
(659) Washer, Output Carrier Thrust
(660) Ring, Vehicle Speed Sensor Reluctor
(661) Carrier Assembly, Output
(662) Shaft, Main
(663) Race, Sun Gear Rear Thrust Bearing
(664) Bearing Asm., Sun Gear Front Thrust

(665) Bearing Asm., Sun Gear Rear Thrust
(666) Gear, Rear Internal
(669) Race, Rear Internal Gear Thrust Bearing
(670) Ring, Main Shaft Retainer
(671) Shaft Assembly, Output
(672) Ring, Output Shaft Retainer
(673) Washer, Output Shaft Thrust
(674) Washer, Thrust Selective
(675) Seal, Output Shaft
(676) Bushing, Main Shaft
(677) Bushing, Rear Internal Gear
(678) Sleeve, Center Support Oil Passage
(681) Bushing, Reaction Carrier
(682) Sleeve, Transmission Output Shaft Yoke Seal
(683) Seal, Output Shaft
(690) Seal, Center Support Cooler Pipe Connector
(691) Spacer

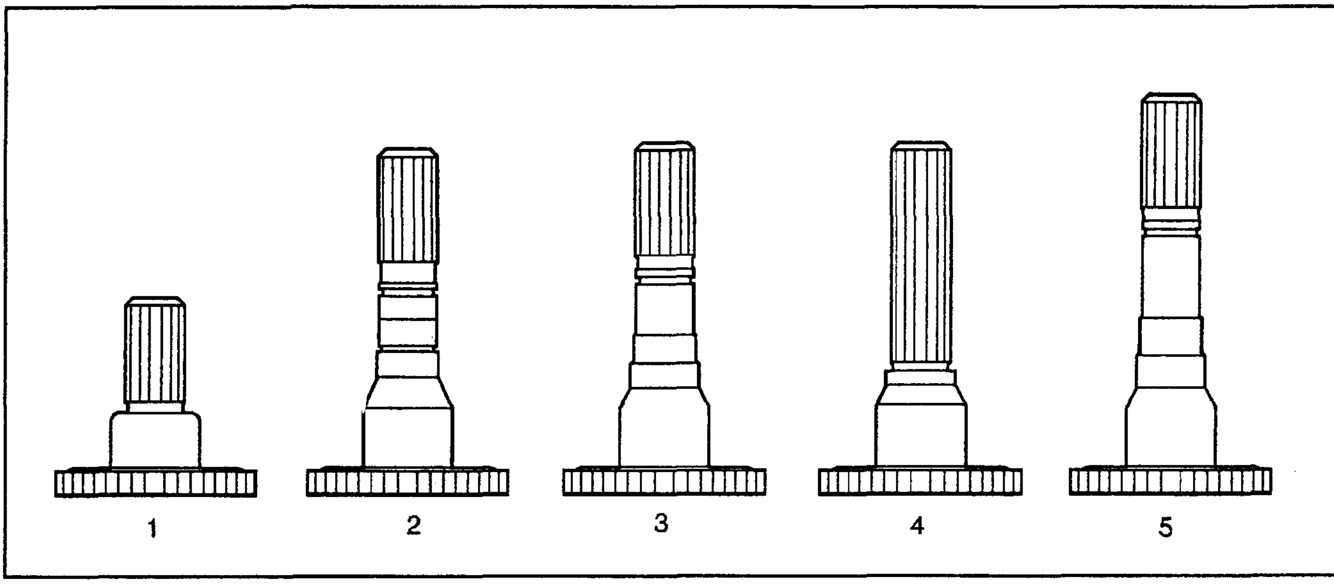
Parking Lock and Actuator Assembly



Legend

(701) Plug, Parking Pawl Shaft Hole
(702) Shaft, Parking Pawl
(703) Pawl, Parking
(704) Retainer, Parking Pawl Shaft
(705) Spring, Parking Pawl
(707) Seal, Manual Shift Shaft
(708) Shaft, Manual Shift
(709) Pin, Manual Shift Shaft
(710) Actuator Assembly, Parking Pawl
(711) Lever Assembly, Manual Shift Shaft Detent
(712) Nut, Manual Shift Shaft Detent Lever
(713) Bracket, Parking Pawl Actuator
(714) Bolt, Parking Pawl Actuator Bracket

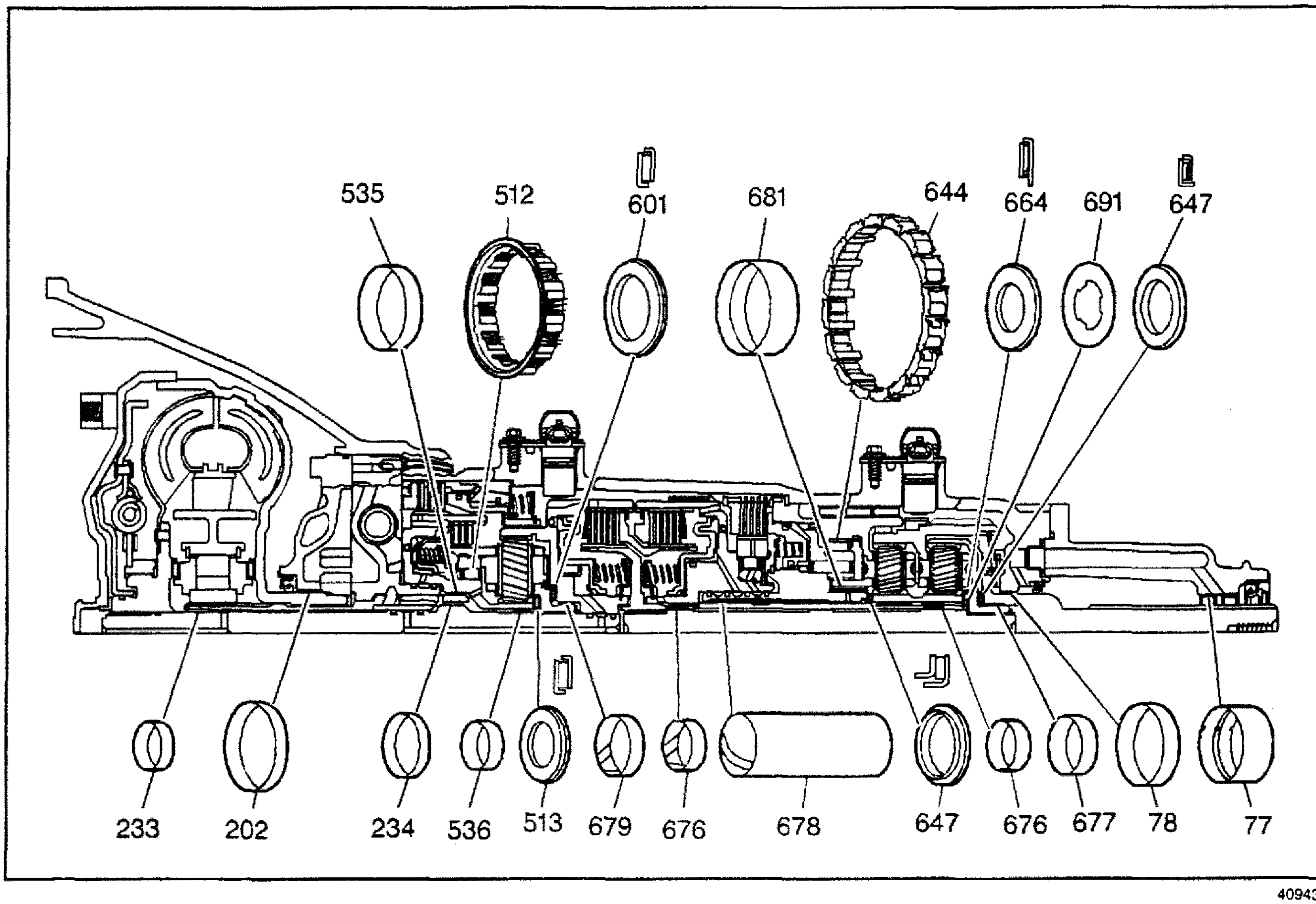
Output Shaft Identification



Legend

(1) Four Wheel Drive
(2) Fixed Yoke, Heavy Duty
(3) Fixed Yoke
(4) Slip Yoke
(5) Long Heavy Duty Fixed Yoke

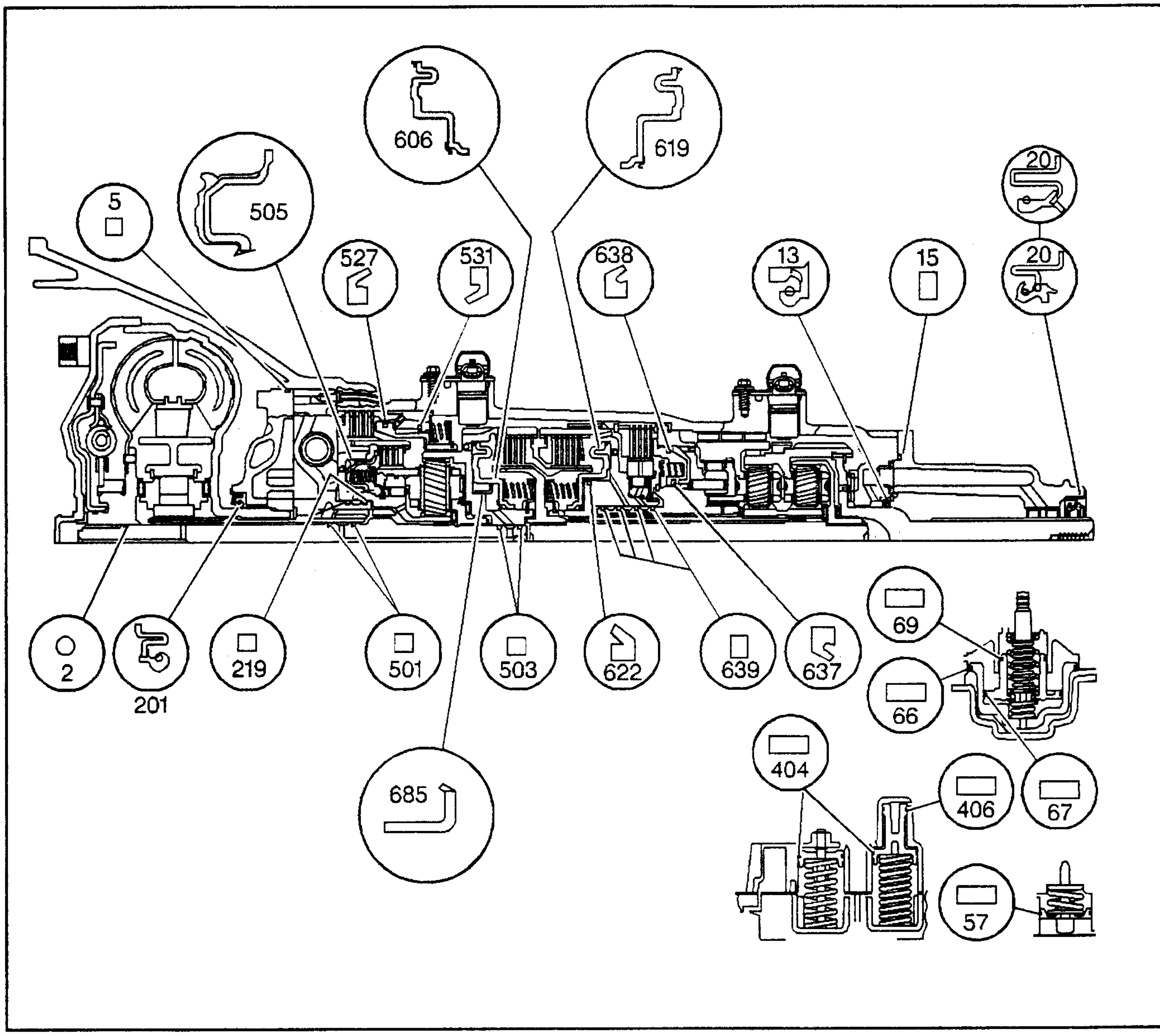
Bushing and Bearing Locations



Legend

(77) Bushing, Prop Shaft Front Slip Yoke
(78) Bushing, Output Shaft
(202) Bushing, Torque Converter
(233) Bushing, Turbine Shaft Front
(234) Bushing, Turbine Shaft Rear
(512) Roller Assembly, Overdrive Clutch
(513) Bearing Assembly, Overrun Clutch Housing Thrust
(535) Bushing, Overrun Clutch Housing
(536) Bushing, 1.12 in. Outside Diameter x 0.50 in.
(601) Bearing Assembly, Thrust Carrier/Forward Clutch
(644) Roller Assembly, Low Clutch
(647) Bearing Asm., Sun Gear Front Thrust
(664) Bearing Asm., Sun Gear Front Thrust
(676) Bushing, Main Shaft
(677) Bushing, Rear Internal Gear
(678) Sleeve, Center Support Oil Passage
(679) Bushing, 1.536 in. Diameter x 3.52
(681) Bushing, Reaction Carrier

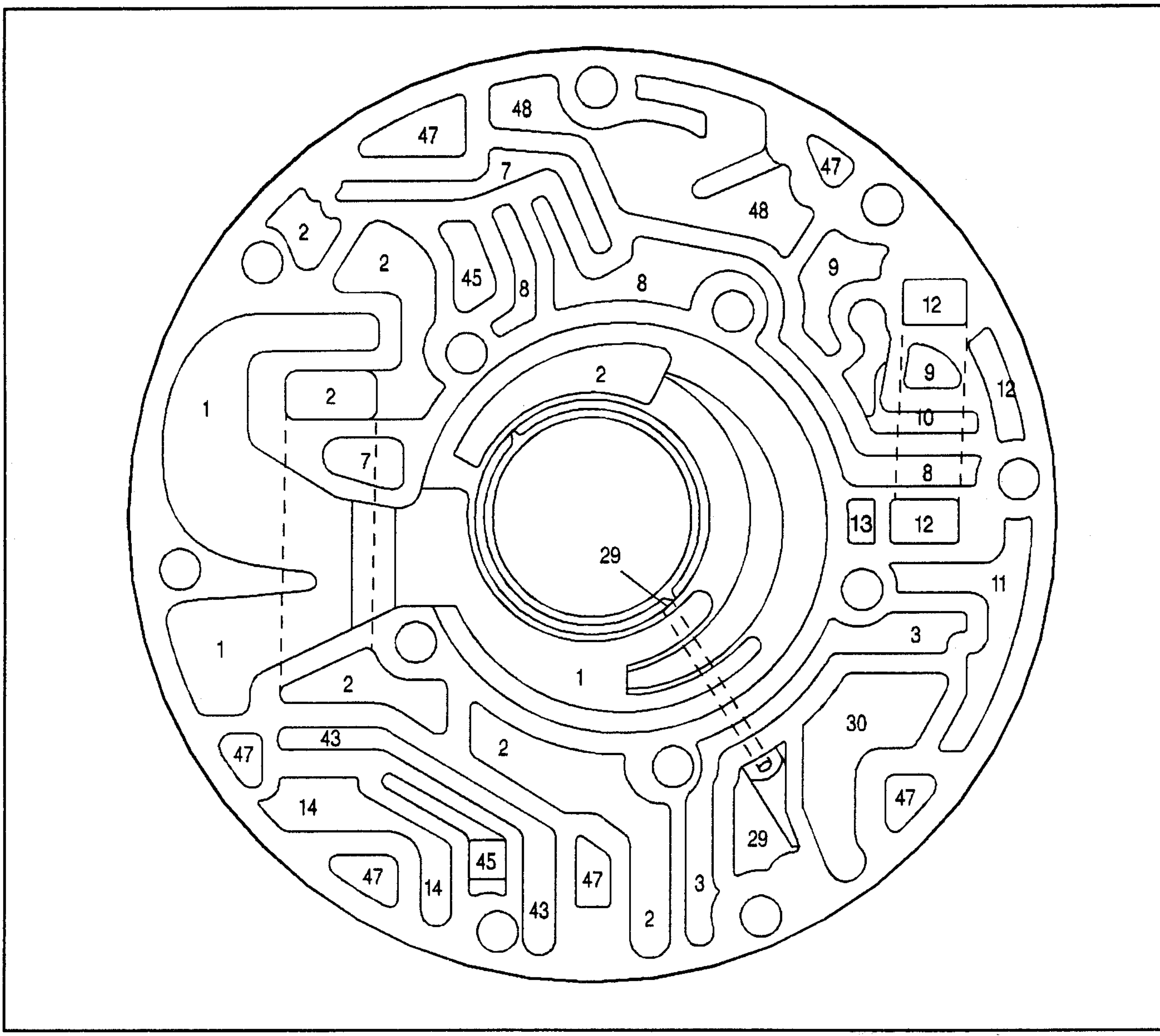
Seal Locations



Legend

(2) Ring, Turbine Shaft Front Oil Seal
(5) Seal, Oil Pump
(13) Seal, Output Shaft
(15) Seal, Case Extension
(20) Seal Asm., Prop Shaft Front Slip Yoke Oil
(57) Seal, Manual 2-1 Band Servo Piston
(66) Seal, Low and Reverse Servo Piston
(67) Ring, Low and Reverse Accumulator Piston Outer Oil Seal
(69) Ring, Low and Reverse Accumulator Piston Inner Oil Seal
(201) Seal Asm., Torque Converter Oil
(219) Ring, Oil Seal, Overrun Clutch Housing
(404) Seal, 3rd Clutch Accumulator Piston Outer
(406) Seal, 3rd Clutch Accumulator Piston Inner
(501) Ring, Turbine Shaft Rear Oil Seal
(503) Ring, Turbine Shaft Intermediate Oil Seal
(505) Piston Assembly, Overrun Clutch
(527) Seal, Fourth Clutch Piston Inner
(531) Seal, Fourth Clutch Piston Outer
(606) Piston, Forward Clutch
(619) Piston, Direct Clutch
(622) Seal, Direct Clutch Piston Intermediate
(637) Seal, Intermediate Clutch Piston Inner
(638) Seal, Intermediate Clutch Piston Outer
(639) Ring, Direct Clutch Housing Oil Seal
(685) Seal Assembly, Forward Clutch Piston Intermediate

Pump Body Fluid Passages (Pump Cover Side)

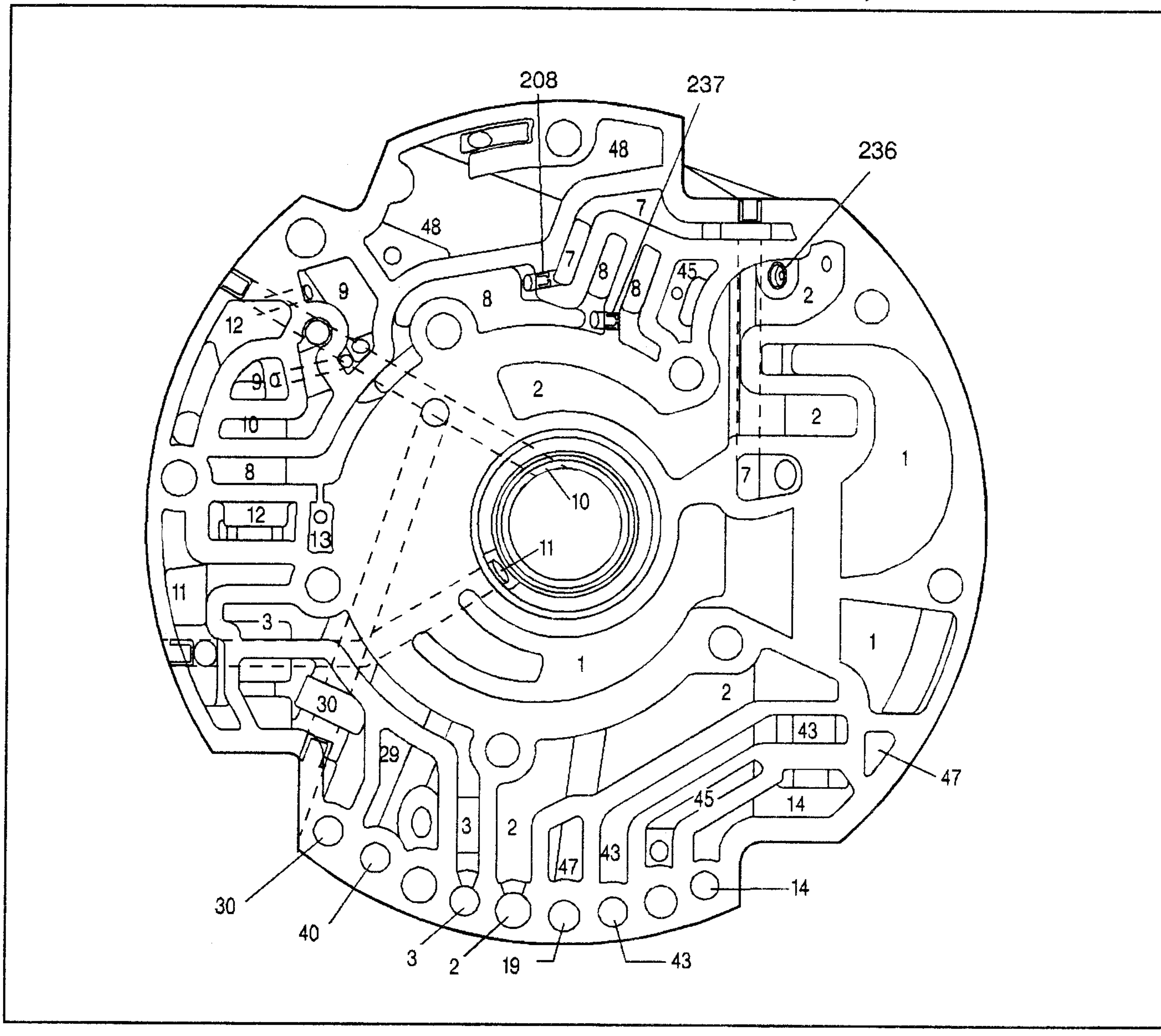


55234

Legend

(1) Suspension
(2) Line
(3) Regulated Apply
(7) Converter Feed
(8) Regulated Converter Feed
(9) TCC Enable
(10) Converter Release
(11) Converter Apply/Return
(12) Cooler
(13) Lube
(14) Torque Signal
(29) Pump Seal Drainback
(30) TCC Signal
(43) Reverse
(45) Exhaust
(47) Void
(48) Vent

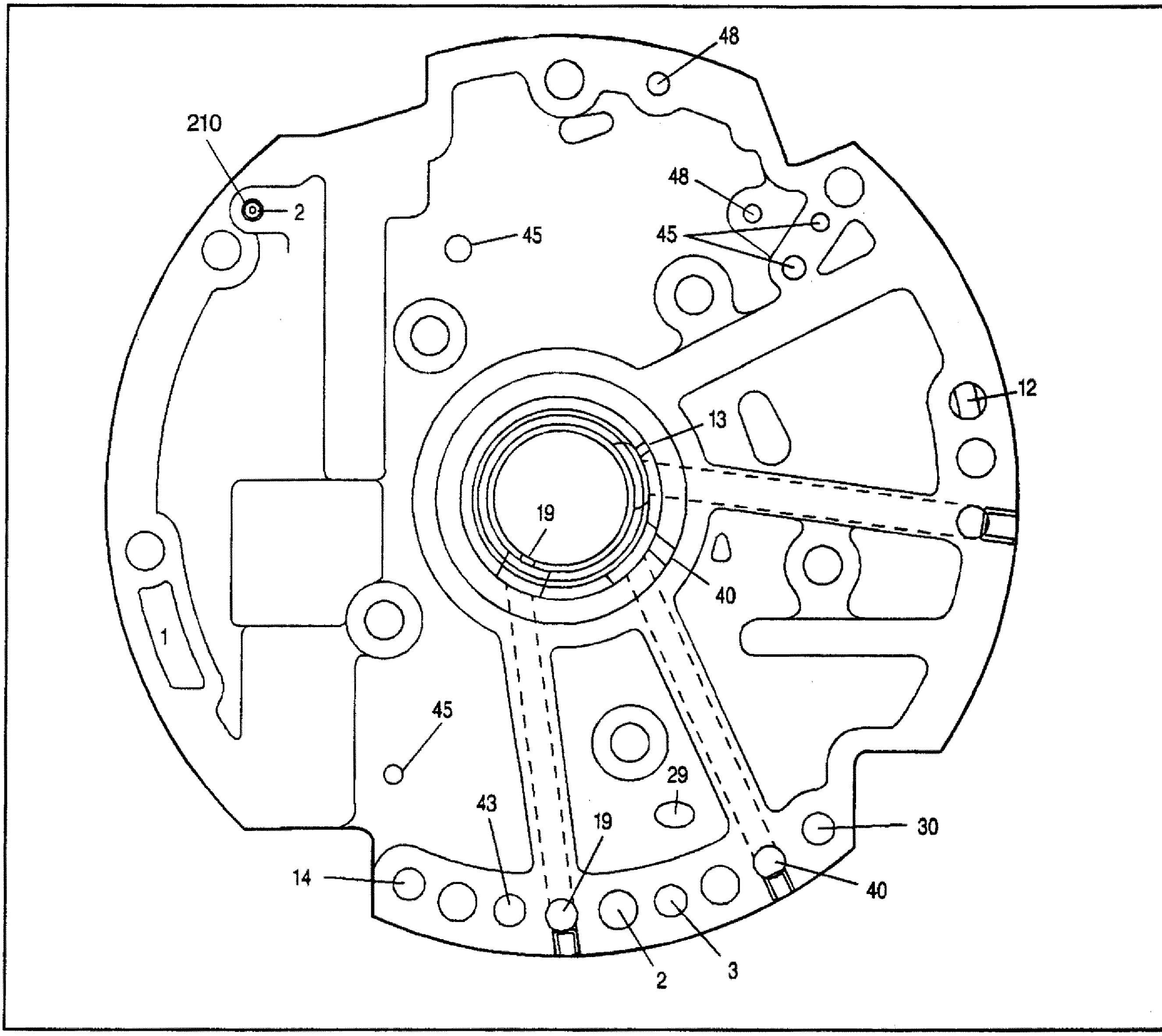
Pump Cover Fluid Passages (Pump Body Side)



Legend

(1) Suspension
(2) Line
(3) Regulated Apply
(7) Converter Feed
(8) Regulated Converter Feed
(9) TCC Enable
(10) Converter Release
(11) Converter Apply/Return
(12) Cooler
(13) Lube
(14) Torque Signal
(19) Drive
(29) Pump Seal Drainback
(30) TCC Signal
(40) Overrun Clutch
(43) Reverse
(45) Exhaust
(47) Void
(48) Vent
(208) Plug, Orificed Cup
(236) Plug, Orificed Cup
(237) Plug, Orificed Cup

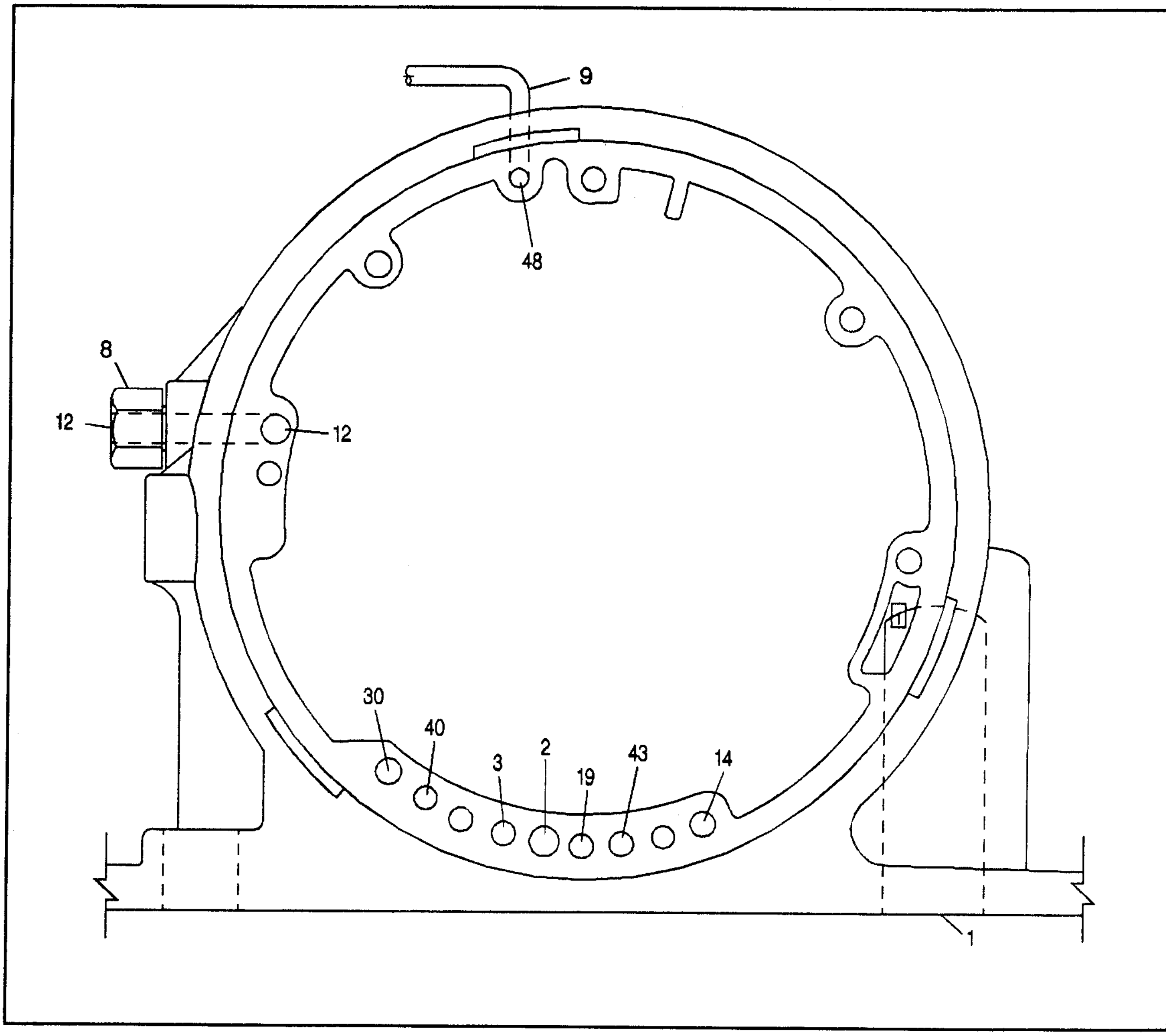
Pump Cover Fluid Passages (Case Side)



Legend

(1) Suction
(2) Line
(3) Regulated Apply
(12) Cooler
(13) Lube
(14) Torque Signal
(19) Drive
(29) Pump Seal Drainback
(30) TCC Signal
(40) Overrun Clutch
(43) Reverse
(45) Exhaust
(48) Vent
(210) Plug, Orificed Cup

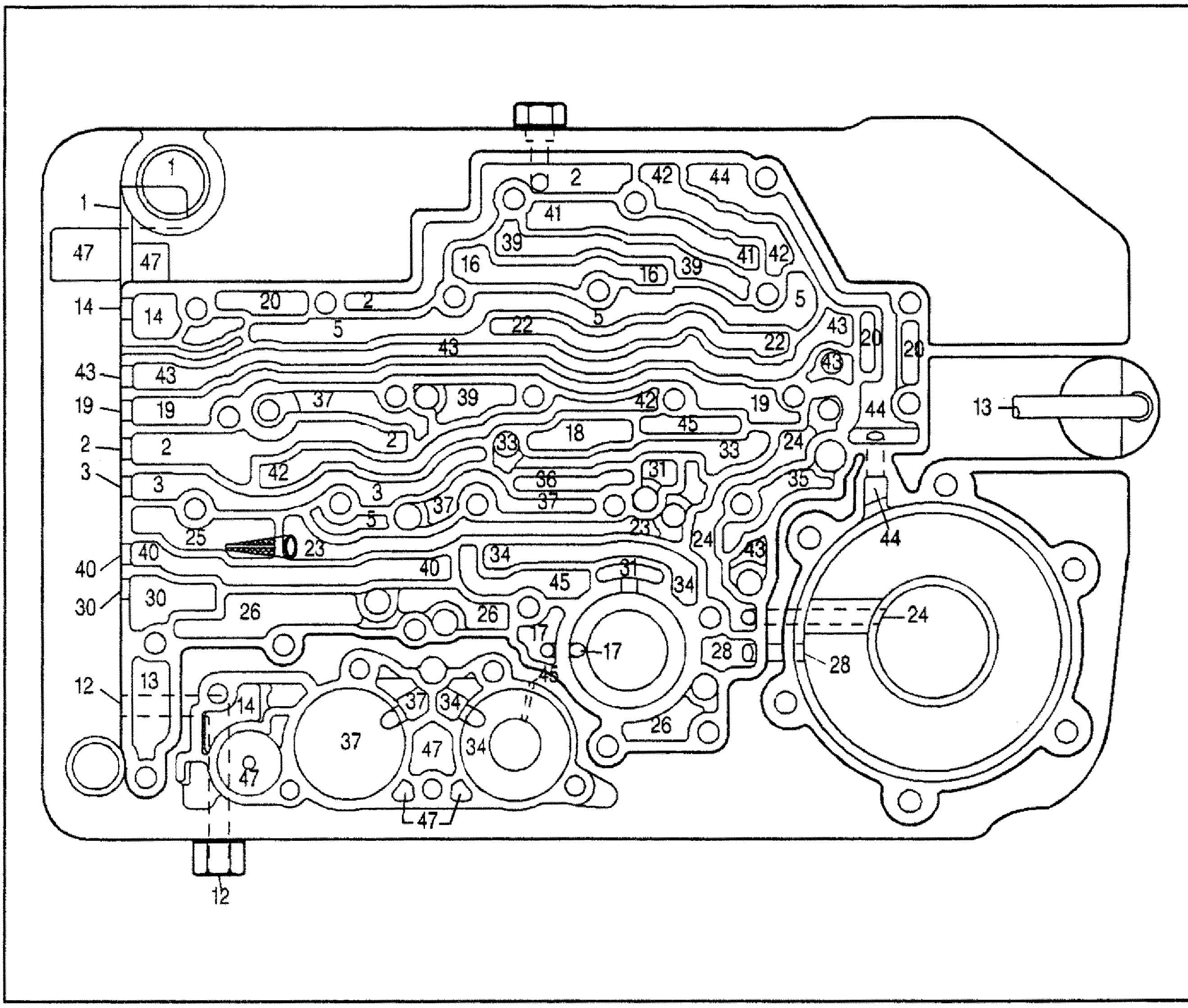
Case Fluid Passages (Pump Cover Side)



Legend

(1) Suction	(14) Torque Signal
(2) Line	(19) Drive
(3) Regulated Apply	(30) TCC Signal
(8) Connector, Transmission Oil Cooler Pipe	(40) Overrun Clutch
(9) Pipe, Vent	(43) Reverse
(12) Cooler	(48) Vent

Case Fluid Passages (Control Valve Body Side)

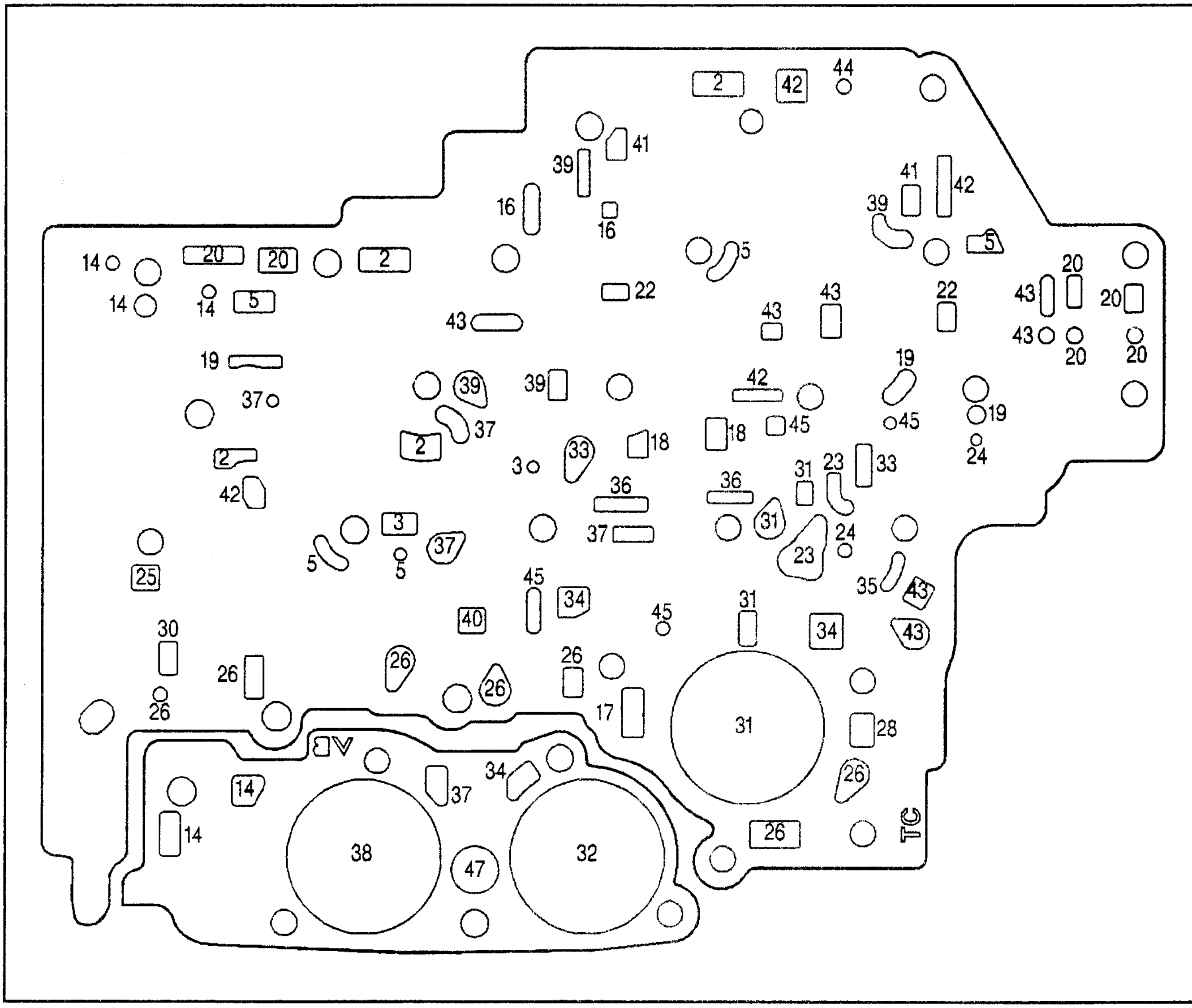


54777

Legend

(1) Suction
(2) Line
(3) Regulated Apply
(5) Actuator Feed
(12) Cooler
(13) Lube
(14) Torque Signal
(16) PRN (Park Reverse Neutral)
(17) PRND43
(18) PRND4
(19) Drive
(20) Filtered Actuator Feed
(22) Signal B
(23) 2-3 Drive
(24) 2nd Clutch
(25) Filtered 2-3 Drive
(26) Accumulator
(28) 2nd Accumulator
(30) TCC Signal
(31) FBA (Front Band Apply)
(32) 3rd Accumulator
(33) 3rd Clutch Feed
(34) 3rd Clutch
(35) 3rd/Reverse
(36) 4th Clutch Feed
(37) 4th Clutch
(39) D321
(40) Overrun Clutch
(41) D21
(42) Lo
(43) Reverse
(44) RBA (Rear Band Apply)
(45) Exhaust
(47) Void

Spacer Plate to Case Gasket with Accumulator Housing Gasket

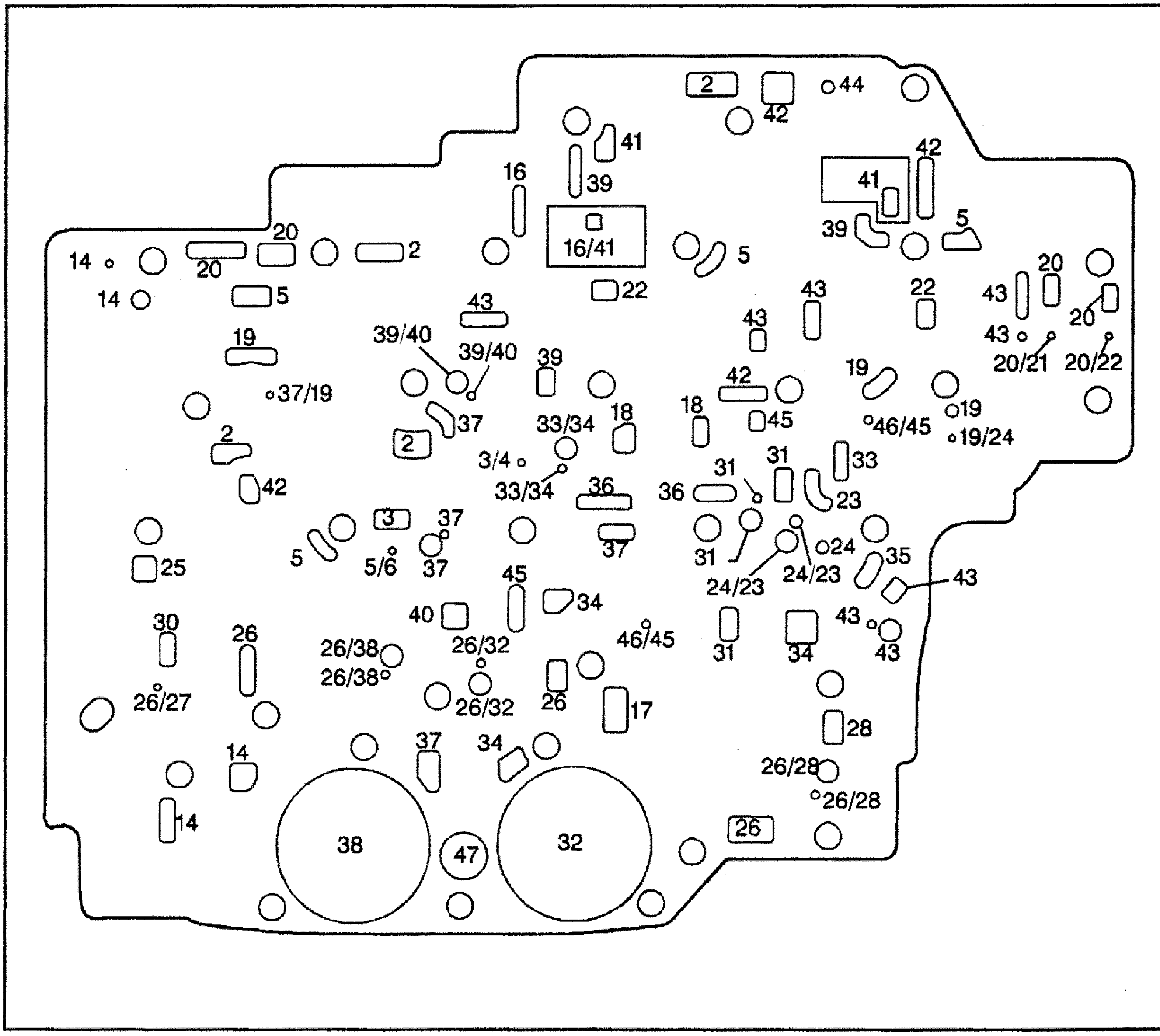


55309

Legend

(2) Line
(3) Regulated Apply
(5) Actuator Feed
(14) Torque Signal
(16) PRN (Park Reverse Neutral)
(17) PRND43
(18) PRND4
(19) Drive
(20) Filtered Actuator Feed
(22) Signal B
(23) 2-3 Drive
(24) 2nd Clutch
(25) Filtered 2-3 Drive
(26) Accumulator
(28) 2nd Accumulator
(30) TCC Signal
(31) FBA (Front Band Apply)
(32) 3rd Accumulator
(33) 3rd Clutch Feed
(34) 3rd Clutch
(35) 3rd/Reverse
(36) 4th Clutch Feed
(37) 4th Clutch
(38) 4th Accumulator
(39) D321
(40) Overrun Clutch
(41) D21
(42) Lo
(43) Reverse
(44) RBA (Rear Band Apply)
(45) Exhaust
(47) Void

Spacer Plate



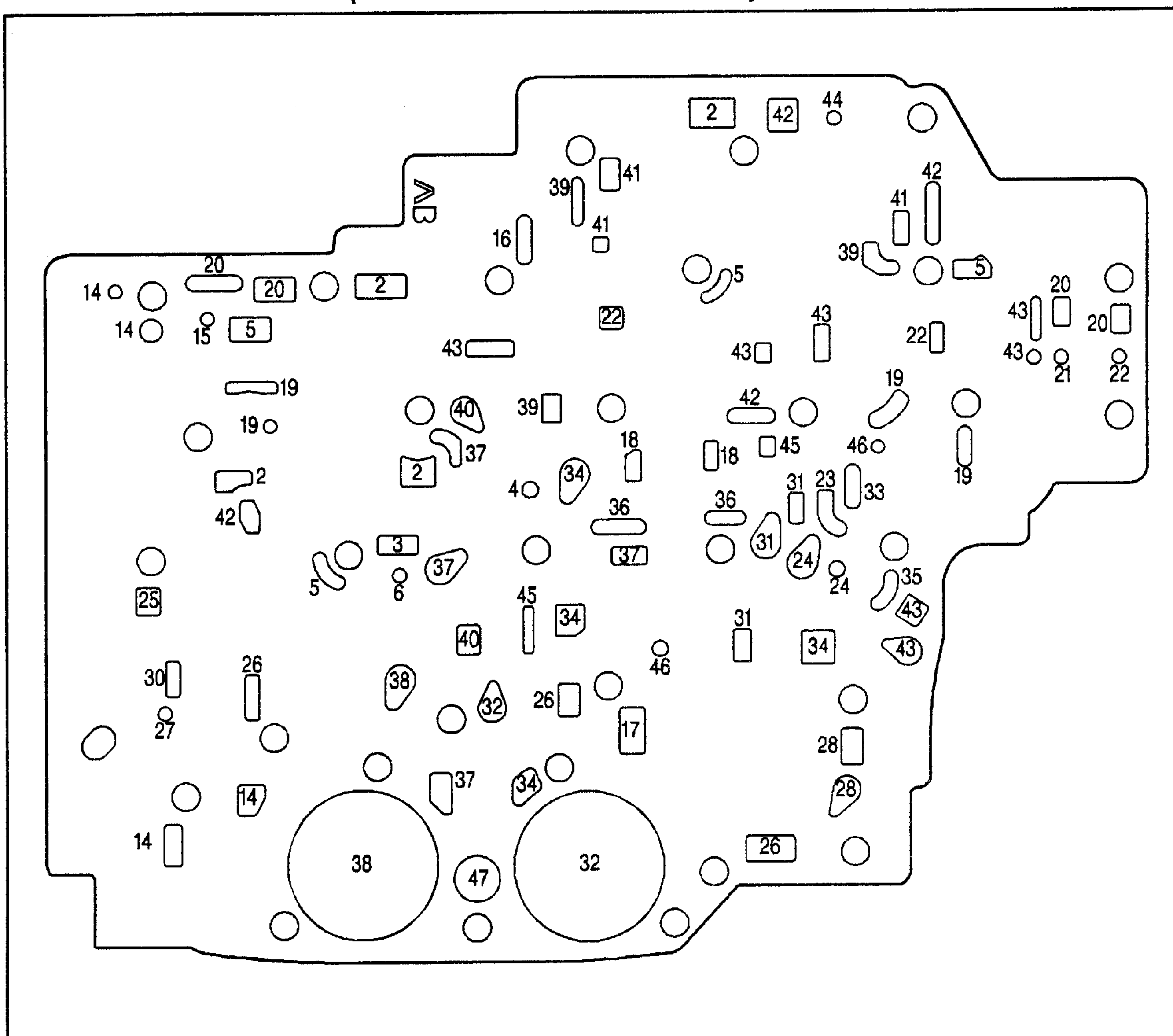
54780

Legend

(2) Line
(3) Regulated Apply
(4) Orificed Regulator Apply
(5) Actuator Feed
(6) Orificed Actuator Feed
(14) Torque Signal
(16) PRN (Park Reverse Neutral)
(17) PRND43
(18) PRND4
(19) Drive
(20) Filtered Actuator Feed
(21) Signal A
(22) Signal B
(23) 2-3 Drive
(24) 2nd Clutch
(25) Filtered 2-3 Drive
(26) Accumulator
(27) Orificed Accumulator
(28) 2nd Accumulator
(30) TCC Signal
(31) FBA (Front Band Apply)
(32) 3rd Accumulator
(33) 3rd Clutch Feed
(34) 3rd Clutch
(35) 3rd/Reverse
(36) 4th Clutch Feed
(37) 4th Clutch
(38) 4th Accumulator
(39) D321
(40) Overrun Clutch
(41) D21

(42) Lo
(43) Reverse
(44) RBA (Rear Band Apply)
(45) Exhaust
(46) Orificed Exhaust
(47) Void

Spacer Plate to Control Valve Body Gasket



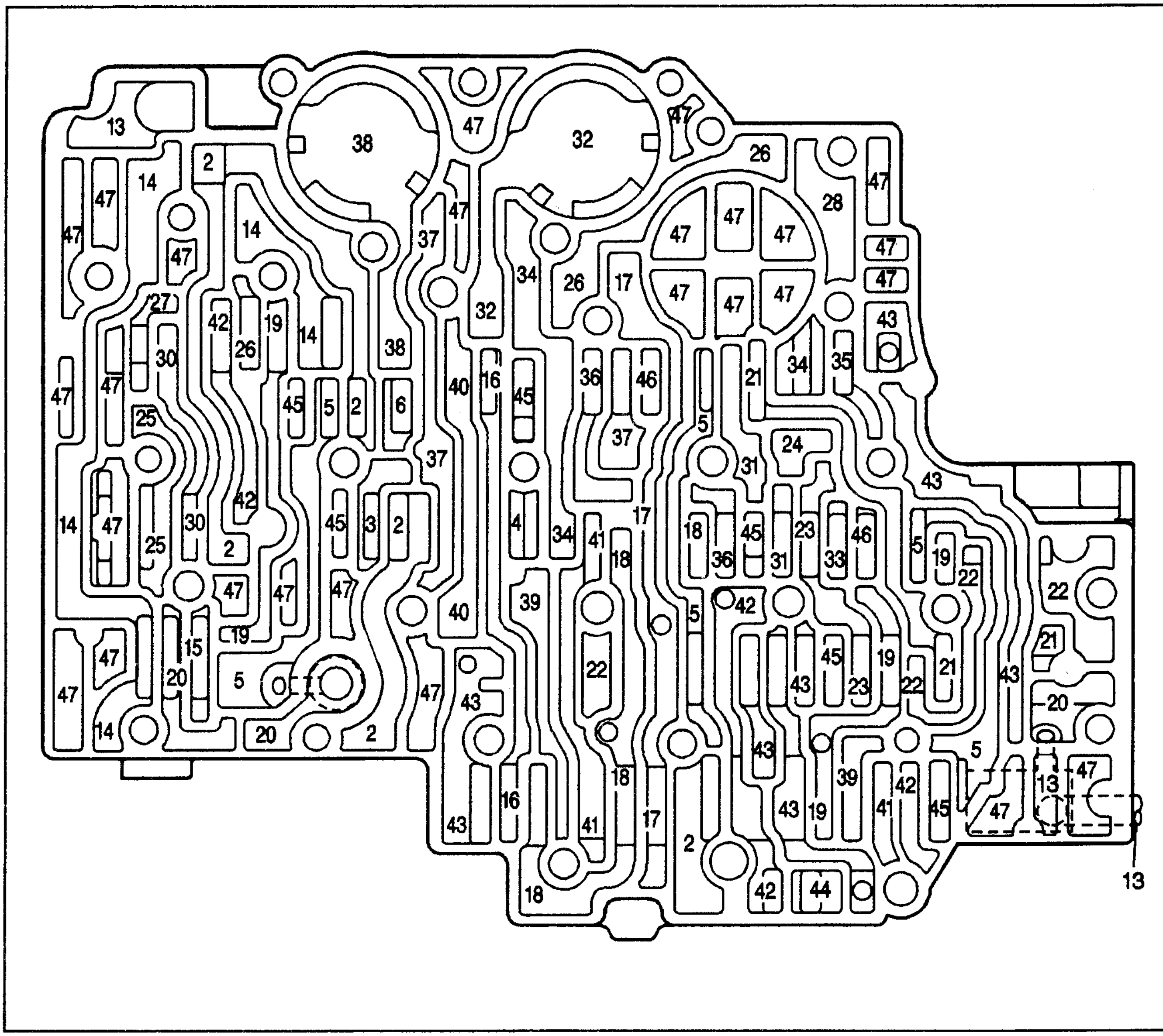
54627

Legend

(2) Line
(3) Regulated Apply
(4) Orificed Regulator Apply
(5) Actuator Feed
(6) Orificed Actuator Feed
(14) Torque Signal
(15) Orificed Torque Signal
(16) PRN (Park Reverse Neutral)
(17) PRND43
(18) PRND4
(19) Drive
(20) Filtered Actuator Feed
(21) Signal A
(22) Signal B
(23) 2-3 Drive
(24) 2nd Clutch
(25) Filtered 2-3 Drive
(26) Accumulator
(27) Orificed Accumulator
(28) 2nd Accumulator
(30) TCC Signal
(31) FBA (Front Band Apply)
(32) 3rd Accumulator

(33) 3rd Clutch Feed
(34) 3rd Clutch
(35) 3rd/Reverse
(36) 4th Clutch Feed
(37) 4th Clutch
(38) 4th Accumulator
(39) D321
(40) Overrun Clutch
(41) D21
(42) Lo
(43) Reverse
(44) RBA (Rear Band Apply)
(45) Exhaust
(46) Orificed Exhaust
(47) Void

Control Valve Body Fluid Passages (Case Side)



54783

Legend

(2) Line
(3) Regulated Apply
(4) Orificed Regulator Apply
(5) Actuator Feed
(6) Orificed Actuator Feed
(13) Lube
(14) Torque Signal
(15) Orificed Torque Signal
(16) PRN (Park Reverse Neutral)
(17) PRND43
(18) PRND4
(19) Drive
(20) Filtered Actuator Feed
(21) Signal A
(22) Signal B
(23) 2-3 Drive
(24) 2nd Clutch
(25) Filtered 2-3 Drive
(26) Accumulator
(27) Orificed Accumulator
(28) 2nd Accumulator
(30) TCC Signal
(31) FBA (Front Band Apply)
(32) 3rd Accumulator
(33) 3rd Clutch Feed
(34) 3rd Clutch
(35) 3rd/Reverse
(36) 4th Clutch Feed
(37) 4th Clutch
(38) 4th Accumulator
(39) D321
(40) Overrun Clutch

(41) D21
(42) Lo
(43) Reverse
(44) RBA (Rear Band Apply)
(45) Exhaust
(46) Orificed Exhaust
(47) Void

Description and Operation

Park or Neutral - Engine Running

When you start the vehicle, the oil pump generates fluid flow from the transmission sump through the filter and into the pump. Filtered transmission fluid is directed to the pressure regulator valve.

Pressure Regulator Valve: The pressure regulator valve regulates line pressure according to various driving conditions. The converter feed pressure is directed to the torque converter hydraulic system. Regulated line pressure is directed to the torque converter clutch regulated apply valve, the actuator feed limit valve, and the manual valve.

Torque Converter Clutch Regulated Apply Valve (TCCRAV): Line pressure is supplied to the TCCRAV to be utilized in other gear ranges.

Actuator Feed Limit Valve: This valve regulates the actuator feed pressure to the 1-2, 2-3, 3-4 shift valves, to the pressure control solenoid valve, and to the 1-2 and 2-3 shift solenoid valves.

Manual Valve: The line pressure from the pressure regulator valve is supplied to the manual valve in order to be utilized in other gear ranges. In Park range, line pressure is directed as PRND43, PRND4, and PRN fluid pressure.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly: PRND4 and PRND43 fluid pressures from the manual valve are directed to their respective switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Park range.

1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve is energized, Signal A fluid pressure forces the 1-2 shift valve to the extreme left against a spring force.

2-3 Shift Solenoid (2-3 SS) Valve: When the 2-3 SS valve is de-energized, Signal B fluid exhausts through the solenoid. A spring force holds the 2-3 shift valve to the extreme right.

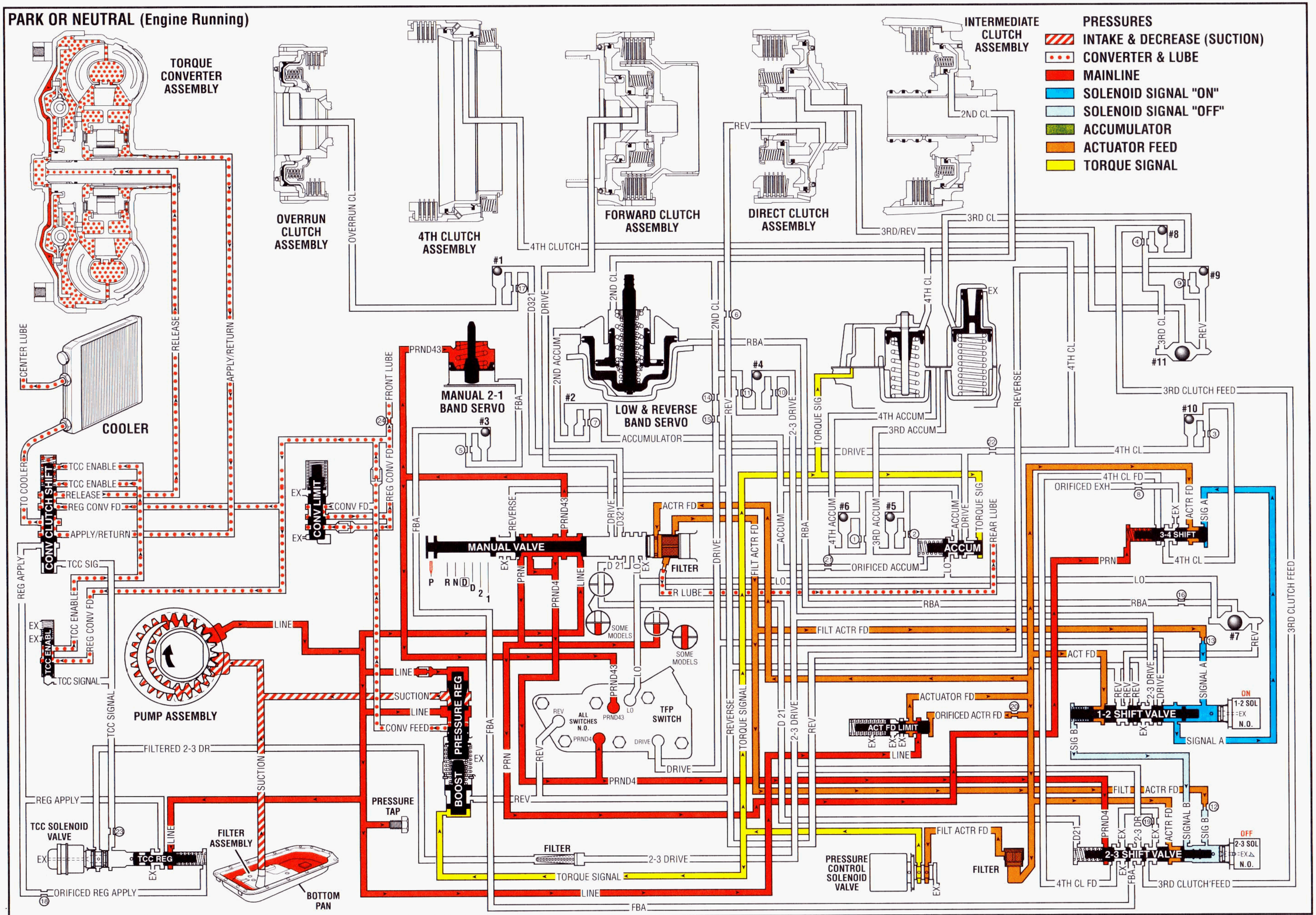
1-2 Shift Valve: Signal A fluid pressure holds the 1-2 shift valve to the left against a spring force.

2-3 Shift Valve: Spring force holds the 2-3 shift valve to the extreme right. This action blocks the PRND4 fluid pressure at the 2-3 Shift Valve.

3-4 Shift Valve: Spring force and PRN fluid pressure hold the 3-4 shift valve to the extreme right.

Manual 2–1 Band Servo: PRND43 fluid pressure from the manual valve is directed to the manual 2–1 band servo. This pressure assists the spring force in holding the manual 2–1 band servo off.

PARK OR NEUTRAL (Engine Running)



362676

Overdrive Range, First Gear

When you move the gear selector lever to the Overdrive position, the manual valve is repositioned in order to allow line pressure to flow in its respective circuits.

Manual Valve: In the Overdrive range first gear, line pressure from the pressure regulator valve is directed as PRND4, PRND43, and Drive fluid pressures. The PRND4 fluid pressure is directed to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly and to the 2-3 shift valve. The PRND43 fluid is directed to the TFP manual valve position switch and to the manual 2-1 band servo. The Drive fluid is directed to the TFP manual valve position switch, the forward clutch, the 1-2 shift valve, and the accumulator valve.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly: Drive, PRND4, and PRND43 fluid pressures from the manual valve are directed to the DR, PRND4, and the PRND43 switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Overdrive range.

1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve is energized, Signal A fluid pressure forces the 1-2 shift valve to the extreme left against a spring force.

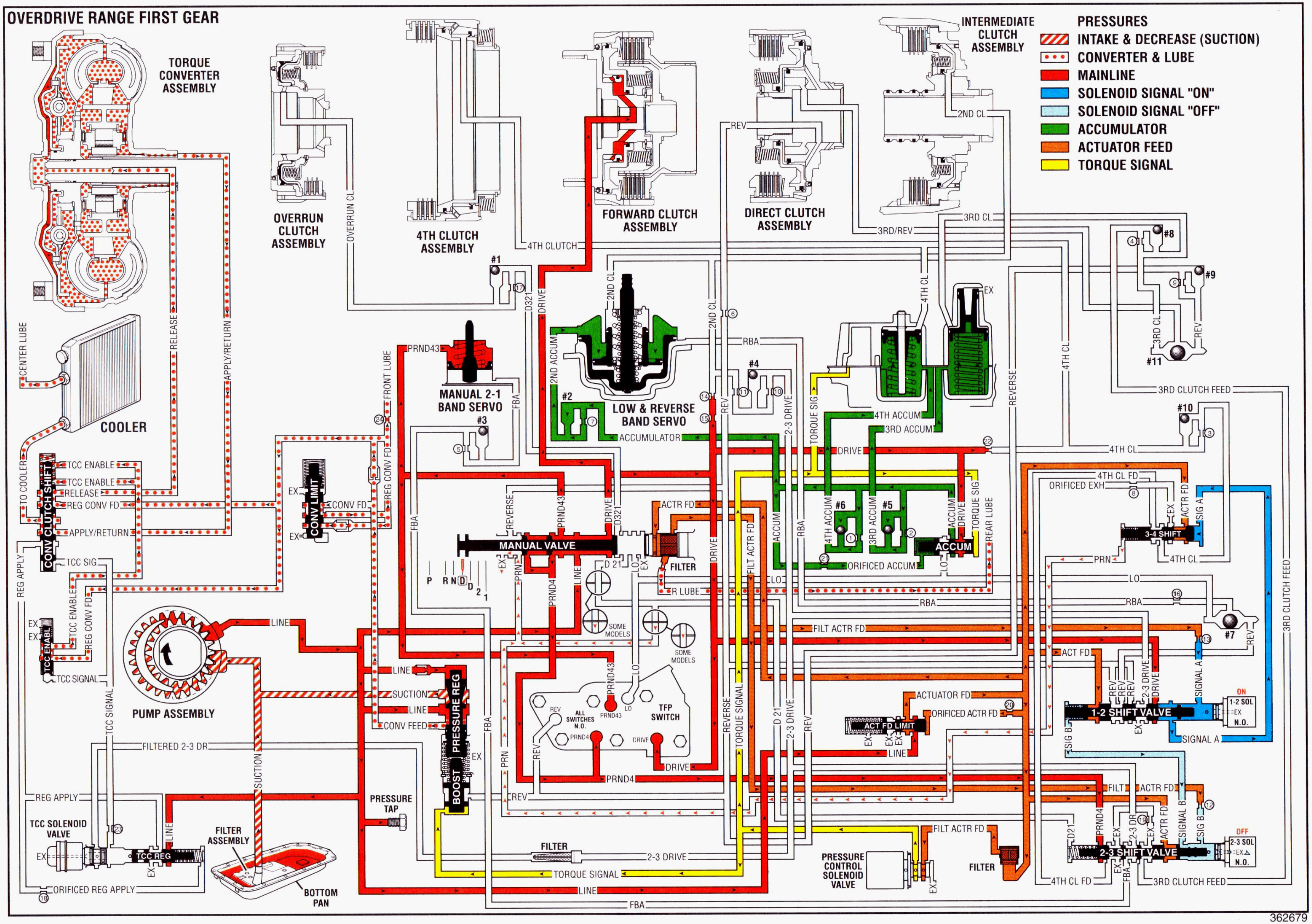
2-3 Shift Solenoid (2-3 SS) Valve: When the 2-3 SS valve is de-energized, Signal B fluid exhausts through the solenoid. A spring force holds the 2-3 shift valve to the extreme right.

1-2 Shift Valve: Drive fluid pressure from the manual valve is held at the 1-2 shift valve in order to be utilized in other gear ranges.

2-3 Shift Valve: PRND4 fluid pressure from the manual valve is held at the 2-3 shift valve in order to be utilized in other gear ranges.

3-4 Shift Valve: Signal A pressure holds the 3-4 shift valve to the extreme left. PRN fluid pressure is blocked by the manual valve.

Forward Clutch: Drive fluid pressure from the manual valve is directed through the case, the pump housing, and the turbine shaft into the forward clutch housing. This applies the forward clutch, shifting the transmission into first gear.


OVERDRIVE RANGE FIRST GEAR
PRESSURES
INTAKE & DECREASE (SUCTION)
CONVERTER & LUBE
MAINLINE
SOLENOID SIGNAL "ON"
SOLENOID SIGNAL "OFF"
ACCUMULATOR
ACTUATOR FEED
TORQUE SIGNAL
TORQUE CONVERTER ASSEMBLY
OVERRUN CLUTCH ASSEMBLY
4TH CLUTCH ASSEMBLY
FORWARD CLUTCH ASSEMBLY
DIRECT CLUTCH ASSEMBLY
INTERMEDIATE CLUTCH ASSEMBLY
COOLER
MANUAL 2-1 BAND SERVO
LOW & REVERSE BAND SERVO
PUMP ASSEMBLY
MANUAL VALVE
P R N D D 2 1
FILTER
TFP SWITCH
ALL SWITCHES N.O.
SOME MODELS
CONV CLUTCH SHIFT
CONV LIMIT
TCC ENABLE
PRESSURE REG
BOOST
PRESSURE TAP
TCC SOLENOID VALVE
TCC REG
FILTER ASSEMBLY
BOTTOM PAN
ACCUM
3-4 SHIFT
1-2 SHIFT VALVE
2-3 SHIFT VALVE
1-2 SOL N.O.
2-3 SOL N.O.
ON
OFF
ACT FD LIMIT
PRESSURE CONTROL SOLENOID VALVE
LINE
SUCTION
CONV FEED
FILTERED 2-3 DR
REG APPLY
ORIFICED REG APPLY
TORQUE SIGNAL
2-3 DRIVE
FBA
PRND4
DRIVE
REV
RBA
LO
FILT ACTR FD
ACT FD
ACTUATOR FD
ORIFICED ACTR FD
4TH CL FD
3RD CLUTCH FEED
ORIFICED EXH
ORIFICED ACCUM
4TH ACCUM
3RD ACCUM
2ND ACCUM
ACCUMULATOR
REVERSE
RELEASE
APPLY/RETURN
CENTER LUBE
TO COOLER
FRONT LUBE
REAR LUBE
R LUBE
REG CONV FD
TCC SIGNAL
TCC SIG
SIGNAL A
SIGNAL B
362679

Overdrive Range, Second Gear

In order to obtain second gear, the PCM receives input signals from the Vehicle Speed Sensor (VSS), from the Throttle Position (TP) Sensor, and from other engine sensors. These signals determine when to de-energize the 1-2 Shift Solenoid (SS) Valve.

Manual Valve: In the Overdrive range second gear, line pressure from the pressure regulator valve is directed as PRND4, PRND43, and Drive fluid pressures. The PRND4 fluid pressure is directed to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly and to the 2-3 shift valve. The PRND43 fluid is directed to the TFP manual valve position switch and to the manual 2-1 band servo. The Drive fluid is directed to the TFP manual valve position switch, and the forward clutch.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly: Drive, PRND4, and PRND43 fluid pressures from the manual valve are directed to the DR, PRND4, and the PRND43 switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Overdrive range.

1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve is de-energized, Signal A fluid exhausts through the solenoid. A spring force holds the 1-2 shift valve to the extreme right.

2-3 Shift Solenoid (2-3 SS) Valve: When the 2-3 SS valve is de-energized, Signal B fluid pressure forces the 2-3 shift valve to the extreme right against a spring force.

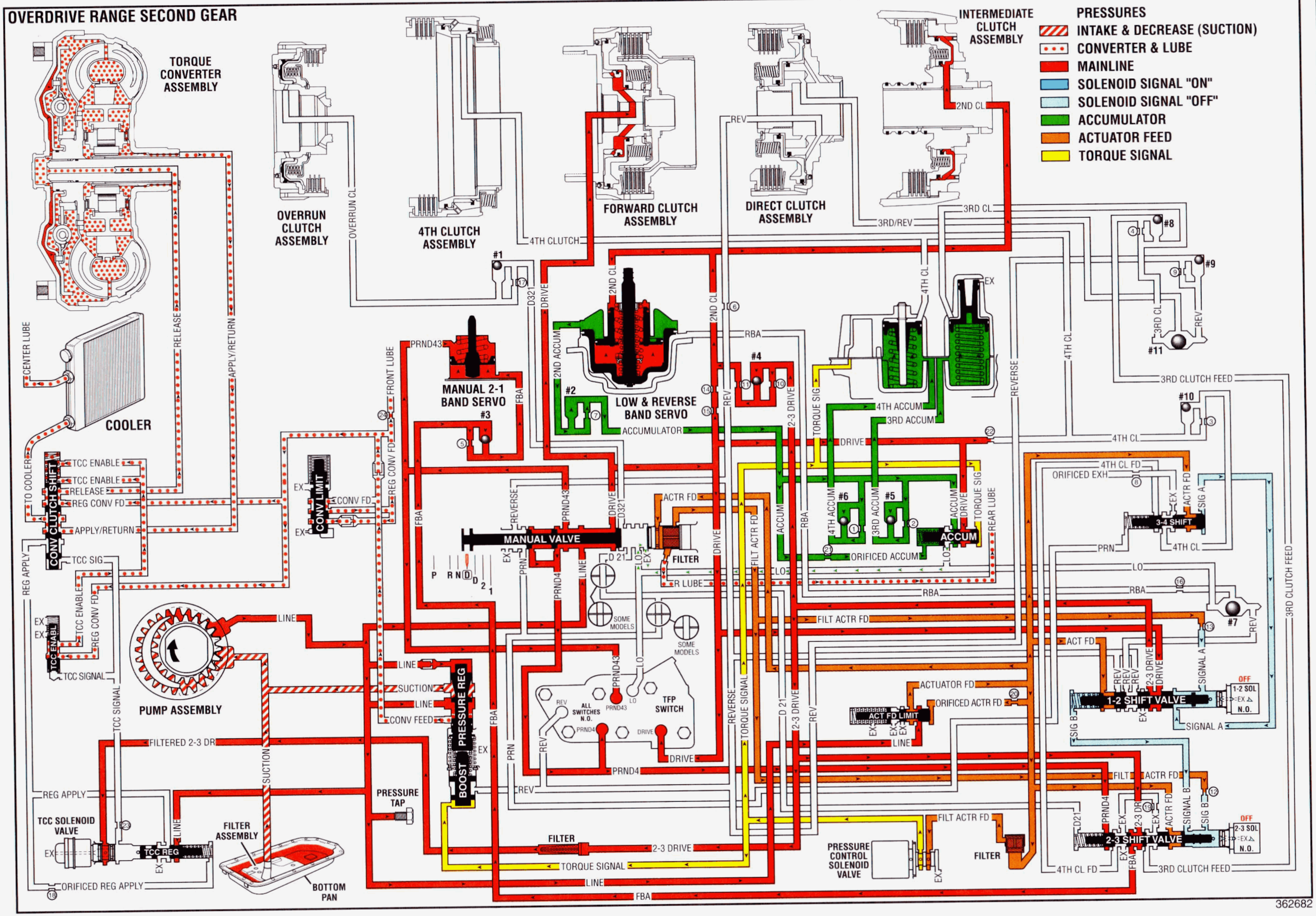
1-2 Shift Valve: Spring force holds the 1-2 shift valve to the extreme right. Drive fluid pressure from the manual valve changes into 2-3 drive fluid pressure at the 1-2 shift valve. This pressure is directed to the 2-3 shift valve, to the TCC PWM Solenoid Valve, and to the intermediate (second) clutch.

2-3 Shift Valve: Spring force holds the 2-3 shift valve to the extreme right. The 2-3 drive fluid pressure from the 1-2 shift valve changes into Front Band Apply (FBA) and is directed to the manual 2-1 band servo. The PRND4 fluid pressure from the manual valve is held at the 2-3 shift valve in order to be utilized in other gear ranges.

3-4 Shift Range: Spring force holds the 3-4 shift valve to the extreme right.

Forward Clutch: Drive fluid pressure from the manual valve applies the forward clutch.

Intermediate (Second) Clutch: Second fluid pressure from the 1-2 shift valve applies the intermediate clutch. The 2-3 drive fluid pressure from the 1-2 shift valve seats the #4 checkball, causing the fluid to flow through two orifices and into the center support. This applies the Intermediate (Second) clutch. The 2-3 drive fluid pressure changes into Second apply fluid pressure at the orifices.


OVERDRIVE RANGE SECOND GEAR
PRESSURES
INTAKE & DECREASE (SUCTION)
CONVERTER & LUBE
MAINLINE
SOLENOID SIGNAL "ON"
SOLENOID SIGNAL "OFF"
ACCUMULATOR
ACTUATOR FEED
TORQUE SIGNAL
TORQUE CONVERTER ASSEMBLY
OVERRUN CLUTCH ASSEMBLY
4TH CLUTCH ASSEMBLY
FORWARD CLUTCH ASSEMBLY
DIRECT CLUTCH ASSEMBLY
INTERMEDIATE CLUTCH ASSEMBLY
COOLER
MANUAL 2-1 BAND SERVO
LOW & REVERSE BAND SERVO
MANUAL VALVE
CONV CLUTCH SHIFT
CONV LIMIT
TCC ENABL
PUMP ASSEMBLY
PRESSURE REG
BOOST
PRESSURE TAP
TFP SWITCH
ALL SWITCHES N.O.
SOME MODELS
FILTER
FILTER ASSEMBLY
BOTTOM PAN
TCC SOLENOID VALVE
TCC REG
ACCUM
ACT FD LIMIT
PRESSURE CONTROL SOLENOID VALVE
1-2 SHIFT VALVE
2-3 SHIFT VALVE
3-4 SHIFT
1-2 SOL
2-3 SOL
OFF
N.O.
362682

Overdrive Range, Third Gear - TCC Applied

In order to obtain third gear, the PCM receives input signals from the VSS, from the TP Sensor, and from other engine sensors. These signals determine when to energize the 2-3 Shift Solenoid (SS) Valve.

Manual Valve: In the Overdrive range third gear, line pressure from the pressure regulator valve is directed as PRND4, PRND43, and Drive fluid pressures. The PRND4 fluid pressure is directed to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly and to the 2-3 shift valve. The PRND43 fluid is directed to the TFP manual valve position switch and to the manual 2-1 band servo. The Drive fluid is directed to the TFP manual valve position switch, and the forward clutch.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly: Drive, PRND4, and PRND43 fluid pressures from the manual valve are directed to the DR, PRND4, and the PRND43 switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Overdrive range.

1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve is de-energized, Signal A fluid exhausts through the solenoid. A spring force holds the 3-4 shift valve to the extreme right.

2-3 Shift Solenoid (2-3 SS) Valve: When the 2-3 SS valve is energized, Signal B fluid pressure forces the 1-2 shift valve to the extreme right against a spring force.

1-2 Shift Valve: Spring force and Signal B fluid pressure hold the 1-2 shift valve to the extreme right. Drive fluid pressure from the manual valve changes into 2-3 drive fluid pressure at the 1-2 shift valve. This pressure is directed to the 2-3 shift valve, to the TCC PWM Solenoid Valve, and to the intermediate (second) clutch.

2-3 Shift Valve: The PRND4 fluid pressure from the manual valve is directed through the 2-3 shift valve, to the 3-4 shift valve. The PRND4 fluid pressure changes into Fourth clutch fluid pressure at the 2-3 shift valve. The 2-3 DR fluid pressure from the 1-2 shift valve is changed into Third clutch fluid pressure at the 2-3 shift valve. This seats the #8 checkball, causing the fluid to flow through an orifice and toward the third accumulator. Third clutch fluid pressure also seats the #11 checkball, causing the fluid to flow through an orifice and toward the direct clutch.

3-4 Shift Valve: Fourth clutch fluid pressure is blocked at the 3-4 shift valve, where the pressure is utilized in Overdrive range fourth gear.

Forward Clutch: Drive fluid pressure from the manual valve applies the forward clutch.

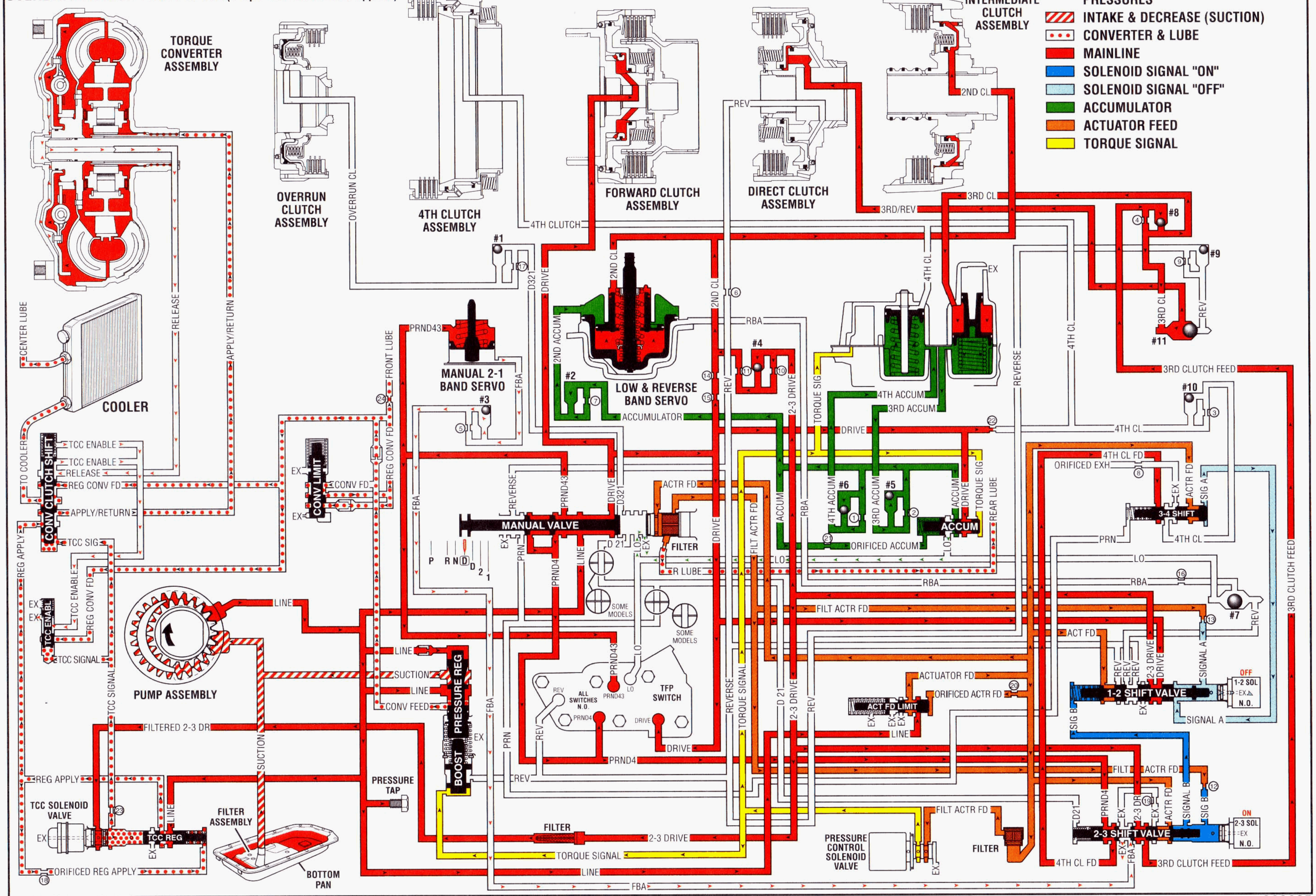
Intermediate (Second) Clutch: Second fluid pressure from the 1-2 shift valve applies the intermediate clutch. The 2-3 drive fluid pressure from the 1-2 shift valve seats the #4 checkball, causing the fluid to flow through two orifices and into the center support. This applies the Intermediate (Second) clutch. The 2-3 drive fluid pressure changes into Second apply fluid pressure at the orifices.

Direct Clutch: Third/Reverse pressure from the #11 checkball flows through the case and through the center support in order to apply the inner piston area of the direct clutch.

Third Clutch Accumulator: Third clutch fluid pressure is also applied to the third clutch accumulator, which is encased in the accumulator housing. This moves the third accumulator piston against the spring force and accumulator fluid pressure.

Torque Converter Clutch Pulse Width Modulated (TCC PWM) Solenoid Valve: The PCM energizes the TCC PWM solenoid valve, and pressure is applied to the converter clutch shift valve. The Torque Converter Clutch (TCC) is applied. The signal pressure also acts on the torque converter clutch regulator valve, which regulates the output pressure. This controls the apply and release of the TCC.

OVERDRIVE RANGE THIRD GEAR (Torque Converter Clutch Applied)



362685

Overdrive Range, Fourth Gear - TCC Applied

In order to obtain third gear, the PCM receives input signals from the VSS, from the TP Sensor, and from other engine sensors. These signals determine when to energize the 1-2 Shift Solenoid (SS) Valve.

Manual Valve: In the Overdrive range third gear, line pressure from the pressure regulator valve is directed as PRND4, PRND43, and Drive fluid pressures. The PRND4 fluid pressure is directed to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly and to the 2-3 shift valve. The PRND43 fluid is directed to the TFP manual valve position switch and to the manual 2–1 band servo. The Drive fluid is directed to the TFP manual valve position switch, and the forward clutch.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly: Drive, PRND4, and PRND43 fluid pressures from the manual valve are directed to the DR, PRND4, and the PRND43 switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Overdrive range.

1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve is energized, Signal A pressure forces the 3-4 shift valve against the spring force in order to move the 3-4 shift valve to the extreme left.

2-3 Shift Solenoid (2-3 SS) Valve: When the 2-3 SS valve is energized, Signal B fluid pressure forces the 1-2 shift valve to the extreme right against a spring force.

1-2 Shift Valve: Spring force and Signal B fluid pressure hold the 1-2 shift valve to the extreme right. Drive fluid pressure from the manual valve changes into 2-3 drive fluid pressure at the 1-2 shift valve. This pressure is directed to the 2-3 shift valve, to the TCC PWM Solenoid Valve, and to the intermediate (second) clutch.

2-3 Shift Valve: The PRND4 fluid pressure from the manual valve is directed through the 2-3 shift valve, to the 3-4 shift valve. The PRND4 fluid pressure changes into Fourth clutch fluid pressure at the 2-3 shift valve. The 2-3 DR fluid pressure from the 1-2 shift valve is changed into Third clutch fluid pressure at the 2-3 shift valve. This seats the #8 checkball, causing the fluid to flow through an orifice and toward the third accumulator. Third clutch fluid pressure also seats the #11 checkball, causing the fluid to flow through an orifice and toward the direct clutch.

3-4 Shift Valve: Signal A fluid pressure holds the 3-4 Shift Valve to the extreme left. Fourth clutch fluid from the 2-3 shift valve changes to Fourth Clutch fluid pressure at the 3-4 Shift Valve. Fourth clutch fluid seats the #10 checkball, causing the fluid to flow through an orifice in order to apply the fourth clutch and the fourth clutch accumulator.

Low & Reverse Band Servo: Second fluid pressure is supplied to the low & reverse band servo in the same manner as the second fluid pressure is supplied to the second clutch. This fluid pressure is directed to the inner piston of the low & reverse band servo, which applies the inner piston.

Forward Clutch: Drive fluid pressure from the manual valve applies the forward clutch.

Direct Clutch: Third/Reverse pressure from the #11 checkball flows through the case and through the center support in order to apply the inner piston area of the direct clutch.

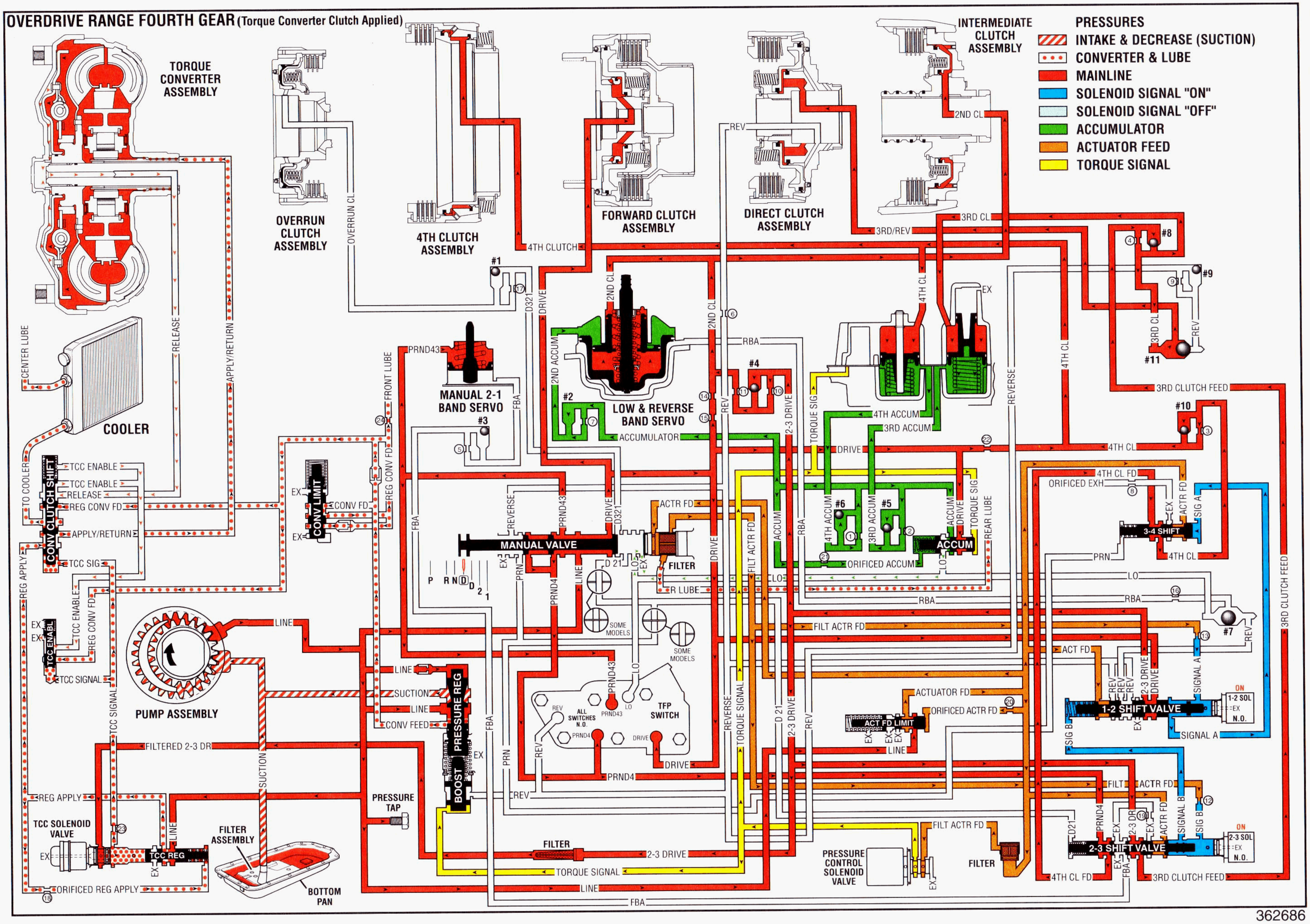
Intermediate (Second) Clutch: Second fluid pressure from the 1-2 shift valve applies the intermediate clutch. The 2-3 drive fluid pressure from the 1-2 shift valve seats the #4 checkball, causing the fluid to flow through two orifices and into the center support. This applies the Intermediate (Second) clutch. The 2-3 drive fluid pressure changes into Second apply fluid pressure at the orifices.

Fourth Clutch: Fourth clutch pressure leaves the 3-4 shift valve and seats the #10 checkball. This causes the fluid to flow through an orifice, through the case into the fourth clutch housing, and applies the fourth clutch. During the fourth clutch piston stroke, the transmission shifts into fourth gear.

Third Clutch Accumulator: Third clutch fluid pressure is also applied to the third clutch accumulator, which is encased in the accumulator housing. This moves the third accumulator piston against the spring force and accumulator fluid pressure.

Fourth Clutch Accumulator: Fourth clutch pressure is also supplied to the fourth clutch accumulator, which is encased in the accumulator housing. This moves the fourth accumulator piston against the spring and the accumulator pressure, smoothing the 3-4 shift.

Torque Converter Clutch Pulse Width Modulated (TCC PWM) Solenoid Valve: The PCM energizes the TCC PWM solenoid valve, and pressure is applied to the converter clutch shift valve. The Torque Converter Clutch (TCC) is applied. The signal pressure also acts on the torque converter clutch regulator valve, which regulates the output pressure. This controls the apply and release of the TCC.


OVERDRIVE RANGE FOURTH GEAR (Torque Converter Clutch Applied)
TORQUE CONVERTER ASSEMBLY
OVERRUN CLUTCH ASSEMBLY
4TH CLUTCH ASSEMBLY
FORWARD CLUTCH ASSEMBLY
DIRECT CLUTCH ASSEMBLY
INTERMEDIATE CLUTCH ASSEMBLY
PRESSURES
INTAKE & DECREASE (SUCTION)
CONVERTER & LUBE
MAINLINE
SOLENOID SIGNAL "ON"
SOLENOID SIGNAL "OFF"
ACCUMULATOR
ACTUATOR FEED
TORQUE SIGNAL
COOLER
MANUAL 2-1 BAND SERVO
LOW & REVERSE BAND SERVO
MANUAL VALVE
CONV CLUTCH SHIFT
CONV LIMIT
TCC ENABL
PUMP ASSEMBLY
PRESSURE REG
BOOST
PRESSURE TAP
TCC SOLENOID VALVE
TCC REG
FILTER ASSEMBLY
BOTTOM PAN
TFP SWITCH
ALL SWITCHES N.O.
SOME MODELS
ACT FD LIMIT
1-2 SHIFT VALVE
2-3 SHIFT VALVE
3-4 SHIFT
ACCUM
1-2 SOL
2-3 SOL
PRESSURE CONTROL SOLENOID VALVE
FILTER
362686

Overdrive Range, 4-3 Downshift

In order to obtain the 4-3 downshift, the PCM receives an input signal from the TP Sensor at increased throttle openings. This causes the PCM to de-energize the 1-2 Shift Solenoid (SS) Valve.

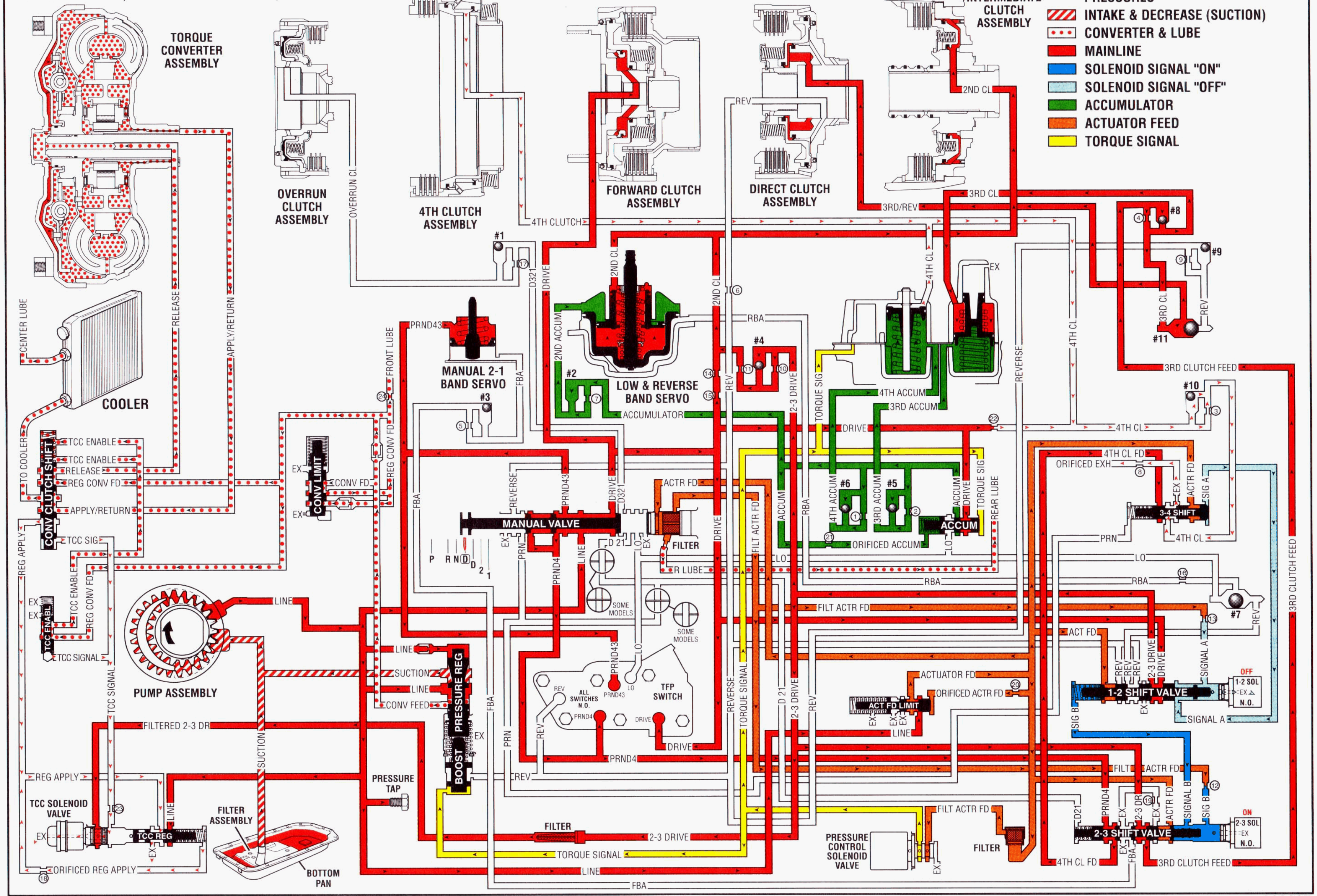
1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve is de-energized, Signal A fluid exhausts at the solenoid valve. This allows spring force to move the 3-4 shift valve to the extreme right.

3-4 Shift Valve: The fourth clutch apply pressure is shut off and a port is opened at the valve. This exhausts the fourth clutch fluid which leaves the fourth clutch and the fourth clutch accumulator. The fourth clutch releases, shifting the transmission into third gear.

Fourth Clutch: Fluid which exhausts from the fourth clutch unseats the #10 checkball. This allows for a rapid exhausting of the fourth clutch apply fluid at the 3-4 shift valve.

Fourth Clutch Accumulator: Fluid which exhausts from the fourth clutch accumulator also exhausts through the unseated #10 check valve and exhausts at the 3-4 shift valve.

4-3 DOWNSHIFT (Valves in Third Gear Position)



362687

Overdrive Range, 3-2 Downshift

In order to obtain the 4-3 downshift, the PCM receives an input signal from the TP Sensor at increased throttle openings. This causes the PCM to de-energize the 1-2 Shift Solenoid (SS) Valve.

1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve de-energizes, spring force holds the 1-2 shift valve to the extreme right.

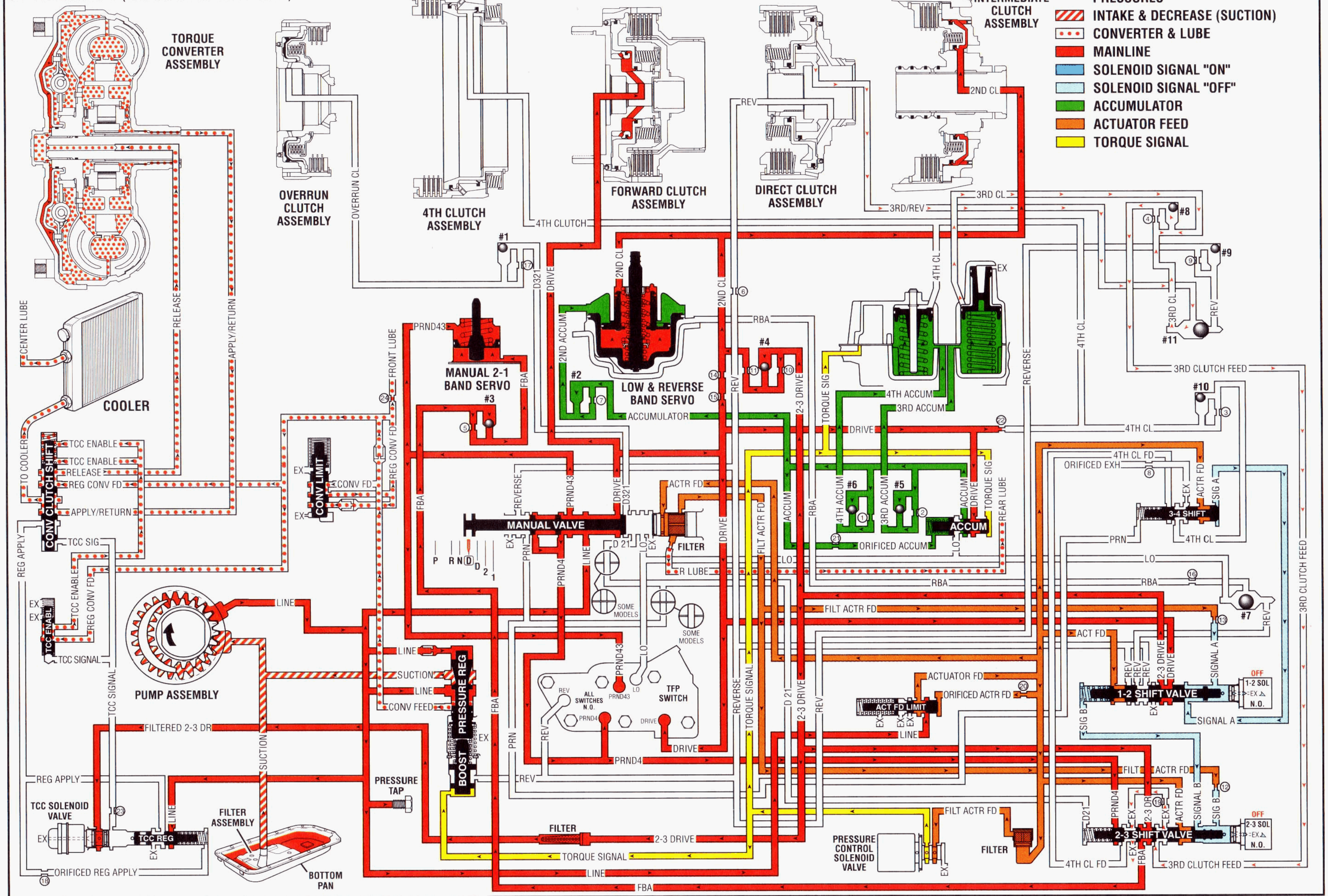
2-3 Shift Solenoid (2-3 SS) Valve: When the 2-3 SS valve de-energizes, Signal B pressure exhausts at the solenoid. This allows a spring force to move the 2-3 shift valve to the extreme right.

2-3 Shift Valve: The third clutch feed pressure from the 2-3 shift valve is shut off and an exhaust port is opened at the 2-3 shift valve. This exhausts the third clutch fluid as the fluid leaves the third clutch accumulator. This causes the direct clutch to release, shifting the transmission into second gear.

Direct Clutch: Exhausting third clutch fluid unseats the #8 checkball. This allows for a rapid exhausting of the third clutch apply fluid at the 2-3 shift valve.

Third Clutch Accumulator: As fluid exhausts from the third clutch accumulator, fluid also exhausts through the unseated #8 check valve and exhausts at the 2-3 shift valve.

3-2 DOWNSHIFT (Valves in Second Gear Position)



362688

Manual Third Gear - TCC Applied

Manual Third can be used in order to increase the performance of the vehicle by allowing higher engine RPM for more torque. Manual Third will also provide vehicle engine compression braking when descending slight grades. Manual Third can be selected at any vehicle speed. The transmission will downshift into third gear at any vehicle speed.

Manual Valve: In the Manual Third range, line pressure from the pressure regulator valve is converted into PRND43, Drive, and D321 pressures. The PRND43 fluid pressure is directed to the TFP manual valve position switch and to the manual 2–1 band servo. The Drive fluid pressure is directed to the forward clutch. The D321 fluid pressure is directed to the #1 checkball and to the overrun clutch.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly: Drive and PRND43 fluid pressures from the manual valve are directed to the DR and the PRND43 switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in manual third.

1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve de-energizes, Signal A pressure exhausts through the solenoid. This allows spring pressure to move the 3-4 shift valve to the extreme right.

2-3 Shift Solenoid (2-3 SS) Valve: When the 2-3 SS valve energizes, the Signal B fluid pressure moves the 2-3 shift valve against the spring force to the extreme left.

1-2 Shift Valve: Spring pressure and Signal B fluid hold the 1-2 shift valve to the extreme right. Drive fluid pressure from the manual valve is changed into 2-3 drive fluid pressure at the 1-2 shift valve. This pressure is directed to the 2-3 shift valve, the TCC PWM solenoid valve, and the intermediate (second) clutch.

2-3 Shift Valve: The 2-3 fluid pressure from the 1-2 shift valve is changed into Third Clutch fluid pressure at the 2-3 shift valve. This fluid seats the #8 checkball, causing the fluid to flow through an orifice, and toward the third accumulator. Third clutch fluid pressure also seats the #11 checkball, causing the fluid to flow through an orifice and toward the third clutch. Third clutch fluid pressure changes into Third/Reverse fluid pressure at the orifice.

Low & Reverse Band Servo: Second fluid pressure is supplied to the low & reverse band servo in the same manner as to the second clutch. This fluid pressure is directed to the inner piston of the low & reverse band servo, which applies the inner piston.

Manual 2–1 Band Servo: The PRND43 fluid pressure from the manual valve is directed to the manual 2–1 band servo. This pressure and the force of the spring hold the manual 2–1 band servo off.

Overrun Clutch: The D321 fluid pressure from the manual valve seats the #1 checkball in the case. This causes the fluid to flow through an orifice, where the D321 fluid pressure changes into overrun fluid pressure. The overrun fluid pressure flows through the case and the pump housing, and into the overrun clutch housing, which applies the overrun clutch. The overdrive roller clutch becomes ineffective and provides vehicle engine compression braking.

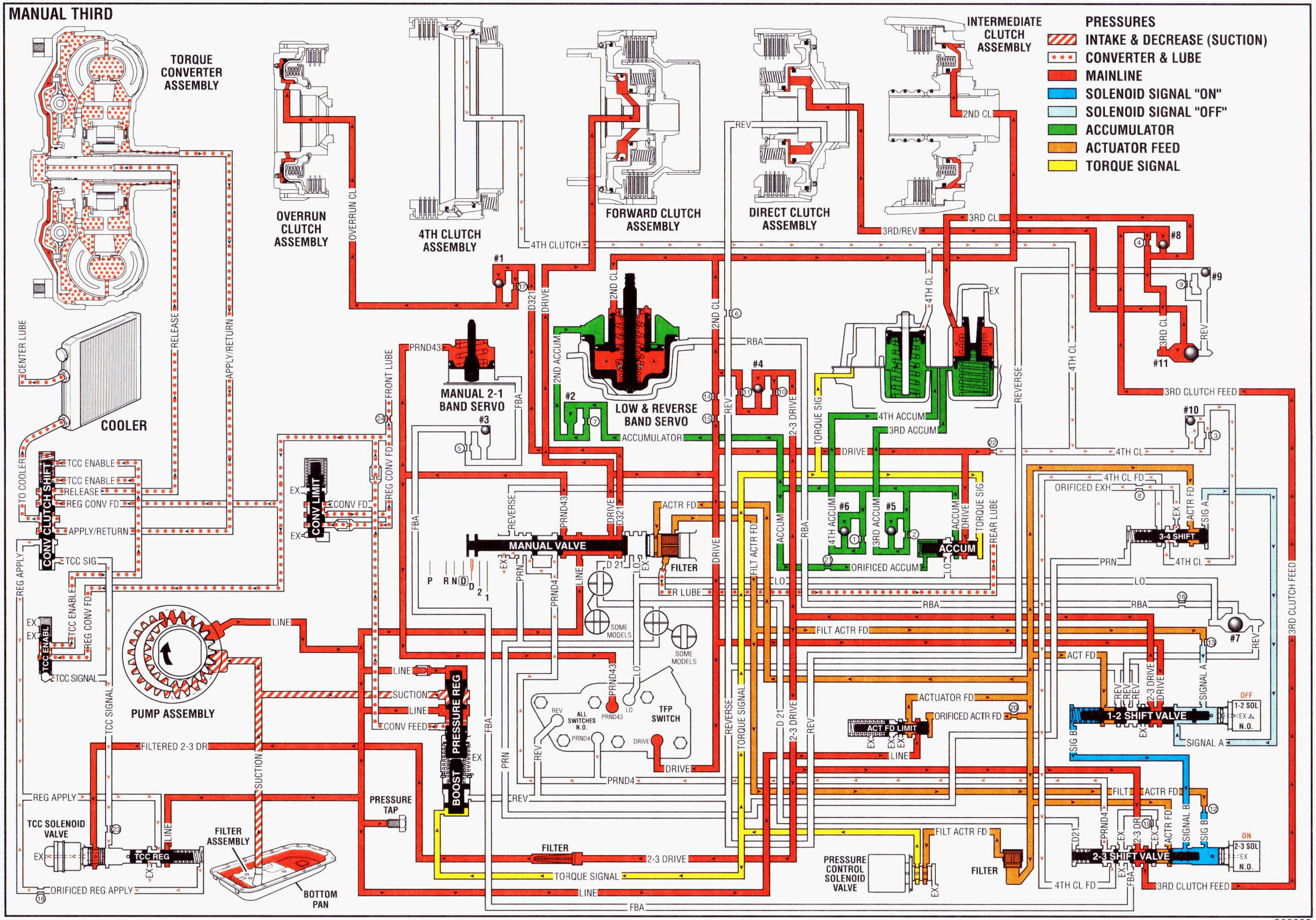
Forward Clutch: The forward clutch is applied by Drive fluid pressure from the manual valve.

Direct Clutch: Third/Reverse pressure from the #11 checkball flows through the case and into the center support in order to apply the inner piston area of the direct clutch.

Intermediate (Second) Clutch: The Intermediate (Second) Clutch is applied by second fluid pressure from the 1-2 shift valve. The 2-3 drive fluid pressure from the 1-2 shift valve seats the #4 checkball in the case, causing the fluid to flow through two orifices. The 2-3 drive fluid pressure changes to Second apply fluid pressure at the orifices. The Second apply fluid flows into the center support, which applies the intermediate (second) clutch.

Third Clutch Accumulator: Third clutch pressure is also applied to the third clutch accumulator, which is encased in the accumulator housing. This moves the third accumulator piston against the spring force and the accumulator pressure, which smooths the 2-3 shift.

Torque Converter Clutch Pulse Width Modulated (TCC PWM) Solenoid Valve: When the PCM signal energizes the TCC PWM solenoid valve, the pressure shifts the converter clutch shift valve, which applies the TCC solenoid valve. The signal pressure also acts on the torque converter clutch regulator valve. This regulates the output pressure in order to control the apply and the release of the TCC.


MANUAL THIRD
TORQUE CONVERTER ASSEMBLY
OVERRUN CLUTCH ASSEMBLY
4TH CLUTCH ASSEMBLY
FORWARD CLUTCH ASSEMBLY
DIRECT CLUTCH ASSEMBLY
INTERMEDIATE CLUTCH ASSEMBLY
PRESSURES
INTAKE & DECREASE (SUCTION)
CONVERTER & LUBE
MAINLINE
SOLENOID SIGNAL "ON"
SOLENOID SIGNAL "OFF"
ACCUMULATOR
ACTUATOR FEED
TORQUE SIGNAL
COOLER
MANUAL 2-1 BAND SERVO
LOW & REVERSE BAND SERVO
MANUAL VALVE
FILTER
ACCUM
3-4 SHIFT
1-2 SHIFT VALVE
2-3 SHIFT VALVE
1-2 SOL
2-3 SOL
OFF
ON
N.O.
ACT FD LIMIT
CONV CLUTCH SHIFT
CONV LIMIT
TCC ENABLE
PUMP ASSEMBLY
PRESSURE REG
BOOST
PRESSURE TAP
TFP SWITCH
ALL SWITCHES N.O.
SOME MODELS
TCC SOLENOID VALVE
TCC REG
FILTER ASSEMBLY
BOTTOM PAN
PRESSURE CONTROL SOLENOID VALVE
P R N D D 2 1

362689

Manual Second Gear

Use the Manual 3-2 downshift in order to provide increased engine braking over Manual Third. Move the shift selector from the Manual Third position to the Manual Second position. You can select Manual Second at any vehicle speed or from any gear range in order to downshift the transmission into second gear.

Manual Valve: In the Manual Second range, line pressure which turns into D21 is directed to the 2-3 shift valve. The manual valve shuts off PRND4 fluid pressure to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly. The manual valve also shuts off PRND43 fluid pressure in order to assist the manual 2–1 band servo spring. This allows the manual 2–1 band to apply.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly: The PRND43 pressure is shut off from the manual valve. This shuts off the electrical signal to the PCM.

1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve is de-energized, Signal A pressure exhausts through the solenoid. This allows spring force to move the 1-2 shift valve to the extreme right.

2-3 Shift Solenoid (2-3 SS) Valve: When the 2-3 SS valve is de-energized, Signal B pressure exhausts through the solenoid. This forces the 2-3 shift valve to the extreme right by spring force and by D21 fluid pressure from the manual valve.

1-2 Shift Valve: Spring force holds the 1-2 shift valve to the extreme right. Drive fluid pressure from the manual valve is changed into the 2-3 drive fluid pressure at the 1-2 shift valve. This pressure is directed to the 2-3 shift valve, the TCC PWM solenoid valve, and the intermediate (second) clutch.

2-3 Shift Valve: Spring force and the D21 fluid pressure from the manual valve hold the 2-3 shift valve to the extreme right. The 2-3 drive pressure from the 1-2 shift valve changes into Front Band Apply (FBA) and is directed to the manual 2–1 band servo.

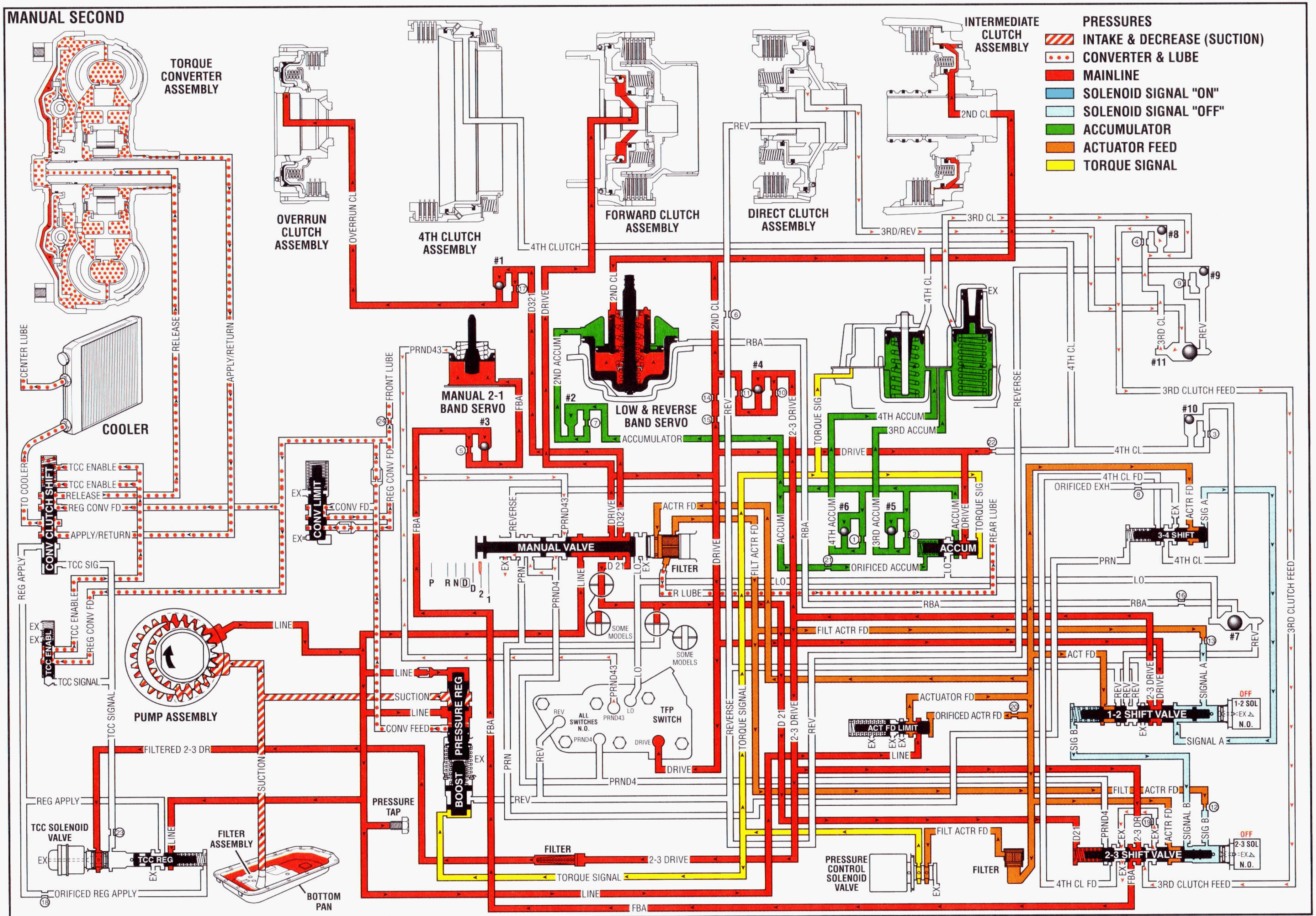
3-4 Shift Valve: Spring force holds the 3-4 shift valve to the extreme right.

Manual 2–1 Band Servo: Front Band Apply (FBA) fluid pressure from the 2-3 shift valve seats the #3 checkball. This causes the fluid to flow through an orifice and into the manual 2–1 band servo piston housing, which applies the manual 2–1 band servo and band.

Forward Clutch: The forward clutch is applied by Drive fluid pressure from the manual valve.

Intermediate (Second) Clutch: The Intermediate (Second) Clutch is applied by second fluid pressure from the 1-2 shift valve. The 2-3 drive fluid pressure from the 1-2 shift valve seats the #4 checkball in the case, causing the fluid to flow through two orifices. The 2-3 drive fluid pressure changes to Second apply fluid pressure at the orifices. The Second apply fluid flows into the center support, which applies the intermediate (second) clutch.

Overrun Clutch: The D321 fluid pressure from the manual valve seats the #1 checkball in the case. This causes the fluid to flow through an orifice, where the D321 fluid pressure changes into overrun fluid pressure. The overrun fluid pressure flows through the case and the pump housing, and into the overrun clutch housing, which applies the overrun clutch. The overdrive roller clutch becomes ineffective and provides vehicle engine compression braking.


MANUAL SECOND
TORQUE CONVERTER ASSEMBLY
OVERRUN CLUTCH ASSEMBLY
4TH CLUTCH ASSEMBLY
FORWARD CLUTCH ASSEMBLY
DIRECT CLUTCH ASSEMBLY
INTERMEDIATE CLUTCH ASSEMBLY
PRESSURES
INTAKE & DECREASE (SUCTION)
CONVERTER & LUBE
MAINLINE
SOLENOID SIGNAL "ON"
SOLENOID SIGNAL "OFF"
ACCUMULATOR
ACTUATOR FEED
TORQUE SIGNAL
COOLER
MANUAL 2-1 BAND SERVO
LOW & REVERSE BAND SERVO
MANUAL VALVE
FILTER
CONV CLUTCH SHIFT
CONV LIMIT
TCC ENABLE
PUMP ASSEMBLY
PRESSURE REG
BOOST
PRESSURE TAP
TCC SOLENOID VALVE
TCC REG
FILTER ASSEMBLY
BOTTOM PAN
TFP SWITCH
ALL SWITCHES N.O.
SOME MODELS
ACCUM
3-4 SHIFT
1-2 SHIFT VALVE
2-3 SHIFT VALVE
1-2 SOL N.O.
2-3 SOL N.O.
OFF
ACT FD LIMIT
PRESSURE CONTROL SOLENOID VALVE
4TH ACCUM
3RD ACCUM
ACCUMULATOR
ORIFICED ACCUM
3RD CLUTCH FEED
4TH CL FD
ORIFICED EXH
SIGNAL A
SIG B
FILT ACTR FD
ACTUATOR FD
ORIFICED ACTR FD
FILTERED 2-3 DR
REG APPLY
ORIFICED REG APPLY
TORQUE SIGNAL
2-3 DRIVE
LINE
FBA
SUCTION
CONV FEED
RBA
REVERSE
OVERRUN CL
4TH CLUTCH
2ND CL
3RD CL
3RD/REV
DRIVE
D321
PRND43
PRND4
P R N D D 2 1

362690

Manual First Gear

Use Manual First for maximum engine braking when the car is descending steep grades. Select Manual First at any vehicle speed. However, the transmission will first downshift into Manual Second. The transmission will later downshift to Manual First when the vehicle is at a specified speed according to vehicle application.

Manual Valve: In the Manual First range, line pressure from the pressure regulator valve is turned into Drive, D321, D21, and Lo fluid pressures. The Drive fluid pressure is directed to the forward clutch. The D321 fluid pressure is directed to the overrun clutch. The D21 fluid pressure is directed to the 2-3 shift valve. The Lo fluid pressure is directed to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly and to the low & reverse band servo.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly: Lo fluid pressure from the manual valve is directed to the Lo pressure switch on the TFP manual valve position switch. This sends a signal to the Powertrain Control Module (PCM) that the transmission is in Manual First. Drive fluid pressure is also supplied to the TFP manual valve position switch.

1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve is energized, Signal A fluid pressure forces the 1-2 and the 3-4 shift valves to the extreme left.

2-3 Shift Solenoid (2-3 SS) Valve: When the 2-3 SS valve is de-energized, Signal B fluid pressure exhausts through the solenoid.

1-2 Shift Valve: Signal A fluid pressure holds the 1-2 shift valve to the extreme left. The actuator feed and the drive pressures supplied to the 1-2 shift valve are blocked.

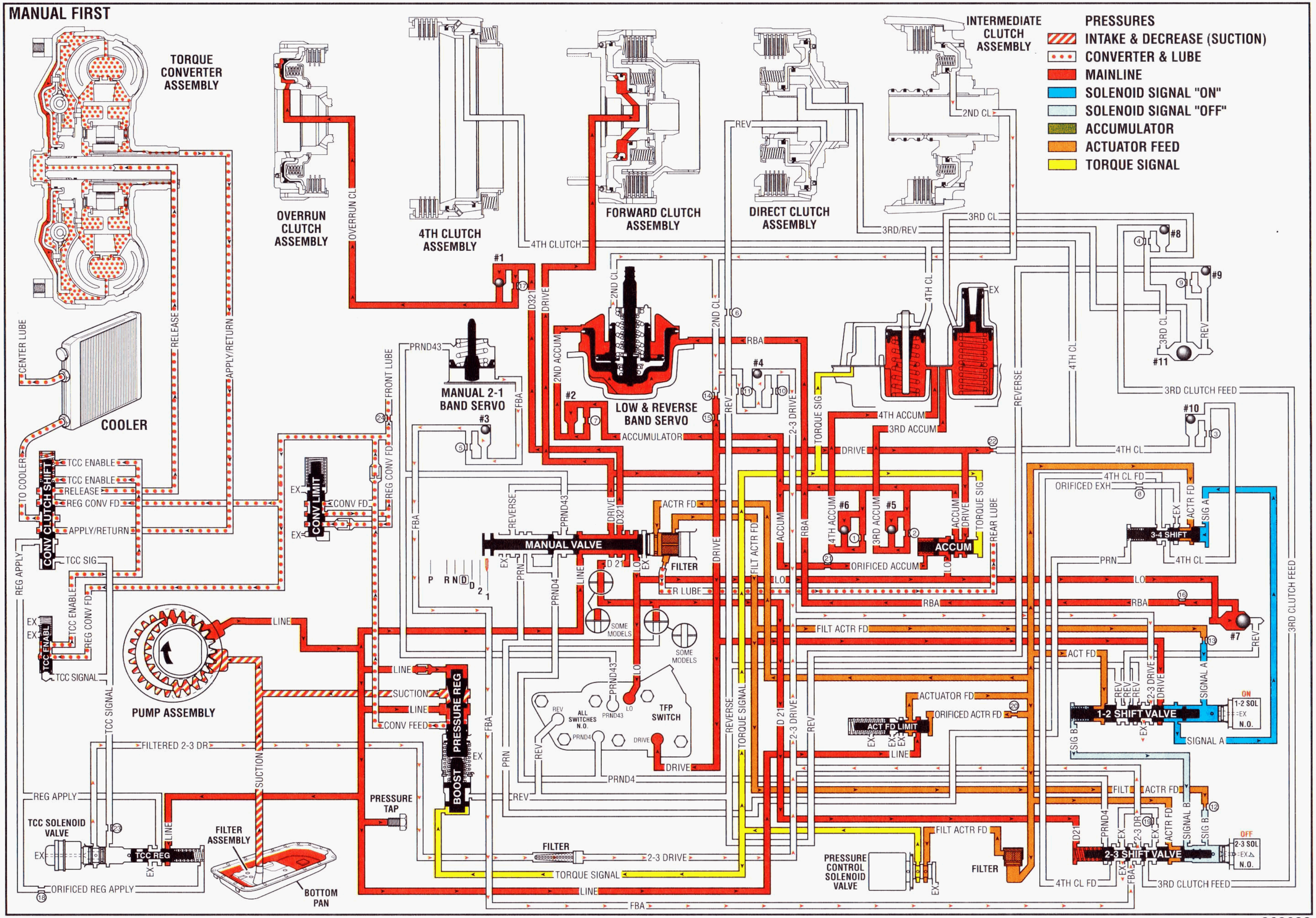
2-3 Shift Valve: Spring pressure and the D21 fluid pressure from the manual valve hold the 2-3 Shift Valve to the extreme right.

3-4 Shift Valve: Signal A pressure forces the 3-4 shift valve to the extreme left.

Low & Reverse Band Servo: Low fluid pressure from the manual valve is directed to the #7 checkball and to the low & reverse band servo, which applies the low & reverse band. Low fluid pressure changes to Rear Band Apply (RBA) fluid pressure at the checkball.

Forward Clutch: The forward clutch is applied by Drive fluid pressure from the manual valve.

Overrun Clutch: The D321 fluid pressure from the manual valve seats the #1 checkball in the case. This causes the fluid to flow through an orifice, where the D321 fluid pressure changes into overrun fluid pressure. The overrun fluid pressure flows through the case and the pump housing, and into the overrun clutch housing, which applies the overrun clutch. The overdrive roller clutch becomes ineffective and provides vehicle engine compression braking.


MANUAL FIRST
TORQUE CONVERTER ASSEMBLY
OVERRUN CLUTCH ASSEMBLY
4TH CLUTCH ASSEMBLY
FORWARD CLUTCH ASSEMBLY
DIRECT CLUTCH ASSEMBLY
INTERMEDIATE CLUTCH ASSEMBLY
PRESSURES
INTAKE & DECREASE (SUCTION)
CONVERTER & LUBE
MAINLINE
SOLENOID SIGNAL "ON"
SOLENOID SIGNAL "OFF"
ACCUMULATOR
ACTUATOR FEED
TORQUE SIGNAL
COOLER
MANUAL 2-1 BAND SERVO
LOW & REVERSE BAND SERVO
MANUAL VALVE
CONV CLUTCH SHIFT
CONV LIMIT
TCC ENABL
PUMP ASSEMBLY
PRESSURE REG
BOOST
PRESSURE TAP
TCC SOLENOID VALVE
TCC REG
FILTER ASSEMBLY
BOTTOM PAN
TFP SWITCH
ALL SWITCHES N.O.
SOME MODELS
ACCUM
ACT FD LIMIT
PRESSURE CONTROL SOLENOID VALVE
FILTER
1-2 SHIFT VALVE
2-3 SHIFT VALVE
3-4 SHIFT
1-2 SOL
2-3 SOL
ON
OFF
N.O.
P R N D D 2 1

362692

Reverse

When you move the gear selector lever to the Reverse position, the manual valve blocks the line fluid pressure from entering the Drive, D321, D21 and Lo fluid circuits. These fluids exhaust at the manual valve. The manual valve allows the line fluid pressure to enter the Reverse, PRN, PRND43, and PRND4 hydraulic circuits.

Manual Valve: In the Reverse range, the line pressure from the pressure regulator valve is directed as Reverse, PRN, PRND4, and PRND43 fluid pressures at the manual valve. The Reverse fluid pressure is directed to the #9 checkball, to the direct clutch, to the 1-2 shift valve, and to the pressure regulator boost valve. The PRN fluid is directed to the 3-4 shift valve. The PRND4 fluid is directed to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly and to the 2-3 shift valve. The PRND43 fluid is directed to the TFP manual valve position switch and to the manual 2–1 band servo.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly: Reverse, PRND4, and PRND43 fluid pressures from the manual valve are directed to the respective switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Reverse.

1-2 Shift Solenoid (1-2 SS) Valve: When the 1-2 SS valve is energized, Signal A pressure forces the 1-2 shift valve to the extreme left.

2-3 Shift Solenoid (2-3 SS) Valve: When the 2-3 SS valve is de-energized, Signal B fluid exhausts through the solenoid.

1-2 Shift Valve: Signal A fluid pressure holds the 1-2 shift valve to the extreme left. Reverse fluid pressure from the 1-2 shift valve seats the #7 checkball. Then the pressure is directed to the low & reverse band servo, which applies the low & reverse band.

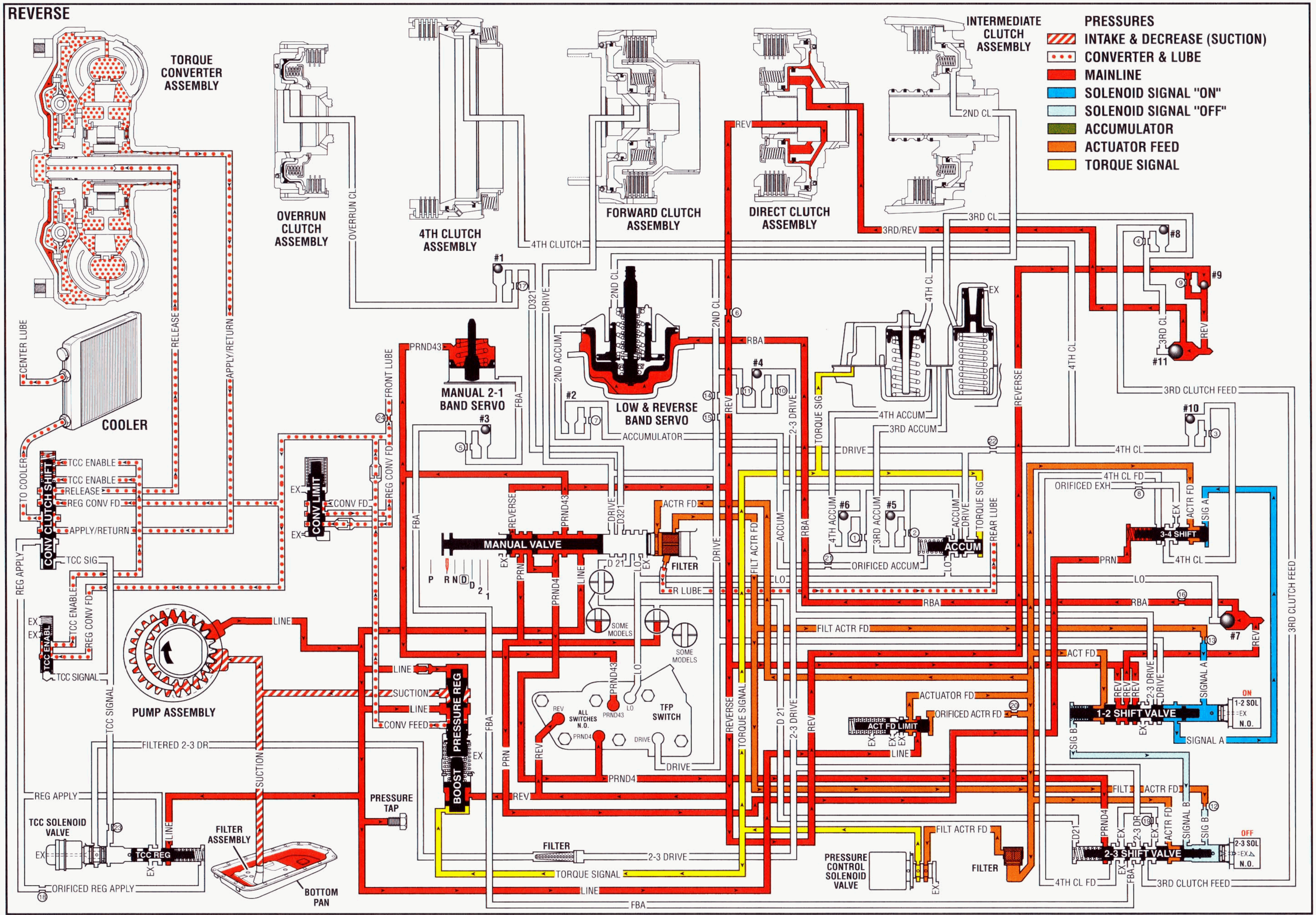
2-3 Shift Valve: Spring force holds the 2-3 shift valve to the extreme right. The blocks the PRND4 fluid pressure at the 2-3 shift valve, which is used in other gear ranges.

3-4 Shift Valve: The PRN fluid pressure forces the 3-4 shift valve to the extreme right.

Low & Reverse Band Servo: Reverse fluid pressure from the 1-2 shift valve seats the #7 checkball, flows through an orifice, flows through the case, and flows into the low & reverse band servo, which applies the low & reverse band. The Reverse fluid pressure changes to Rear Band Apply (RBA) fluid pressure at the orifice.

#9 and #11 Checkballs: Reverse fluid pressure from the manual valve seats the #9 checkball. This causes the fluid to flow through an orifice and to seat the #11 checkball, before flowing into the direct clutch. The Reverse fluid pressure changes to Third/Reverse fluid pressure at the orifice.

Direct Clutch: The Third/Reverse fluid pressure is directed through the case, through the center support, and into the direct clutch inner piston area. Reverse fluid pressure is directed to the direct clutch outer piston. The combination of these two pressures apply the direct clutch. Using both fluid pressures on an increased area of the piston increases the holding capacity of the clutch.


REVERSE
TORQUE CONVERTER ASSEMBLY
OVERRUN CLUTCH ASSEMBLY
4TH CLUTCH ASSEMBLY
FORWARD CLUTCH ASSEMBLY
DIRECT CLUTCH ASSEMBLY
INTERMEDIATE CLUTCH ASSEMBLY
PRESSURES
INTAKE & DECREASE (SUCTION)
CONVERTER & LUBE
MAINLINE
SOLENOID SIGNAL "ON"
SOLENOID SIGNAL "OFF"
ACCUMULATOR
ACTUATOR FEED
TORQUE SIGNAL
COOLER
CENTER LUBE
TO COOLER
REG APPLY
CONV CLUTCH SHIFT
TCC ENABLE
RELEASE
REG CONV FD
APPLY/RETURN
TCC SIG
CONV LIMIT
CONV FD
TCC ENABLE
TCC SIGNAL
PUMP ASSEMBLY
LINE
SUCTION
CONV FEED
PRESSURE REG
BOOST
PRESSURE TAP
FILTER ASSEMBLY
BOTTOM PAN
TCC SOLENOID VALVE
TCC REG
ORIFICED REG APPLY
FILTERED 2-3 DR
MANUAL 2-1 BAND SERVO
LOW & REVERSE BAND SERVO
ACCUMULATOR
MANUAL VALVE
P R N D D 2 1
FILTER
R LUBE
SOME MODELS
ALL SWITCHES N.O.
TFP SWITCH
FRONT LUBE
RELEASE
APPLY/RETURN
OVERRUN CL
4TH CLUTCH
2ND CL
3RD CL
3RD/REV
4TH CL
2ND ACCUM
3RD CLUTCH FEED
4TH ACCUM
3RD ACCUM
DRIVE
TORQUE SIG
ORIFICED EXH
4TH CL FD
3-4 SHIFT
ORIFICED ACCUM
ACCUM
REAR LUBE
RBA
FILT ACTR FD
ACT FD
ACTUATOR FD
ORIFICED ACTR FD
ACT FD LIMIT
1-2 SHIFT VALVE
1-2 SOL
ON
OFF
2-3 SOL
SIGNAL A
SIGNAL B
2-3 SHIFT VALVE
PRESSURE CONTROL SOLENOID VALVE
TORQUE SIGNAL
2-3 DRIVE
FBA
PRND4
PRND43
REVERSE
#1
#2
#3
#4
#5
#6
#7
#8
#9
#10
#11

362693

Special Tools and Equipment

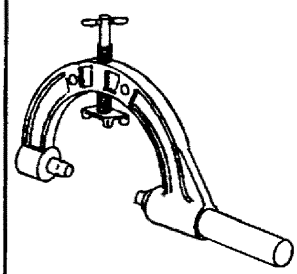
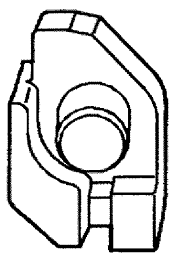
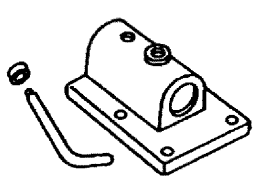
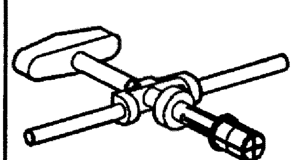
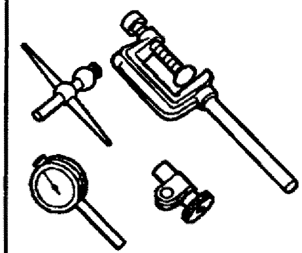
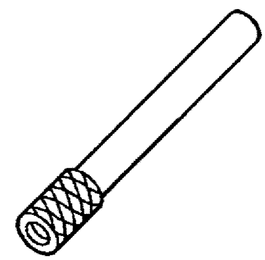
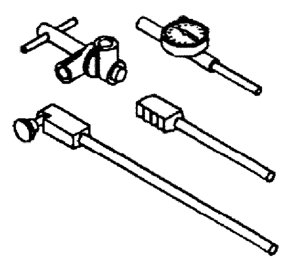
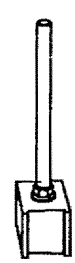
Illustration	Tool Number/Description
 335082	J 8763-02 Transmission Holding Fixture
 40733	J 38655 Holding Fixture Adapter
 144067	J 3289-20 Holding Fixture Base Assembly
 40676	J 39195 Converter End Play Check Tool

Illustration	Tool Number/Description
 25473	J 8001 Dial Indicator Set
 40734	J 7057 Dial Indicator Plunger Extension
 3408	J 8520 Cam Lobe Lift Indicator Set
 9200	J 26900-13 Magnetic Indicator Base

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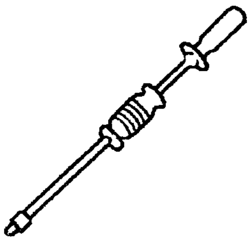
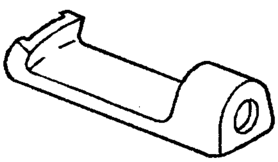
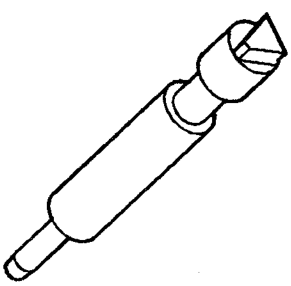
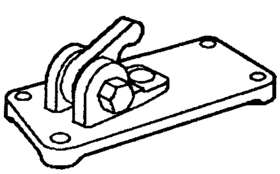
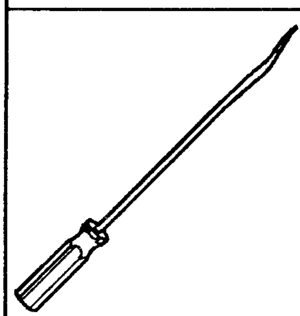
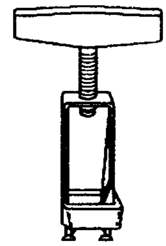
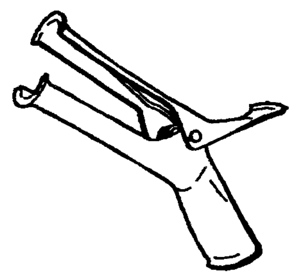
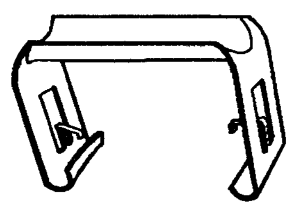
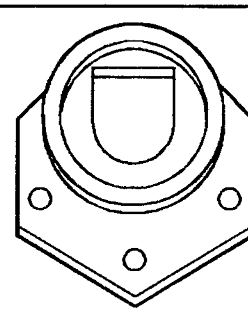
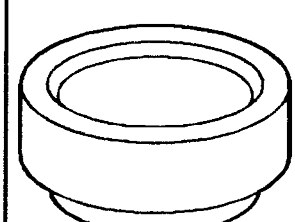
 4865	J 6125-1B Slide Hammer
 13070	J 23129 Universal Seal Remover
 40674	J 21370-10 Band Apply Pin Gage
 40677	J 38737 Band Apply Pin Checking Tool
 13077	J 28585 Snap Ring Remover

Illustration	Tool Number/Description
 9214	J 37789-A Oil Pump Remover/Installer
 13121	J 38358-A Forward Clutch Assembly Remover/Installer
 40694	J 38733 Direct Clutch Assembly Remover/Installer
 40670	J 6116-01 Rear Gear Holding Fixture
 40673	J 21364-A Rear Gear Holding Fixture Adapter

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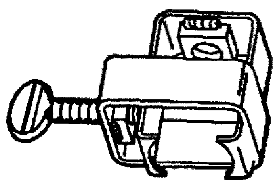
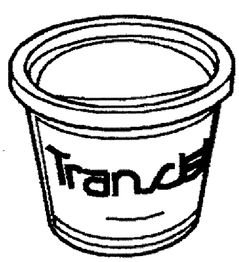
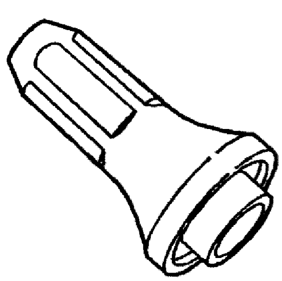
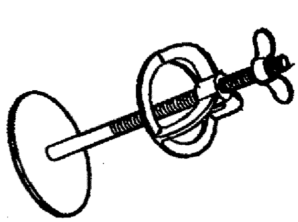
 20885	J 38868-A Lower Gear Unit Assembly Remover/Installer
 40707	J 6129 Handle
 24825	J 38650 Assembly Lubricant
 40683	J 41505 Output Shaft Seal Installer
 9186	J 23327 Clutch Spring Compressor

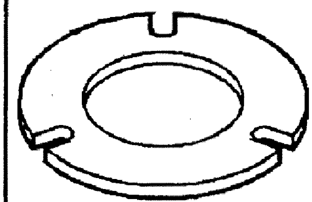
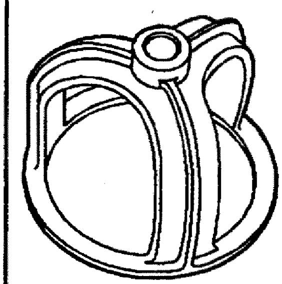
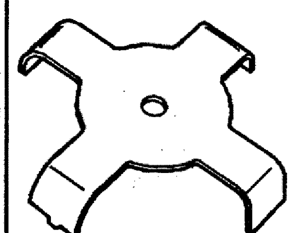
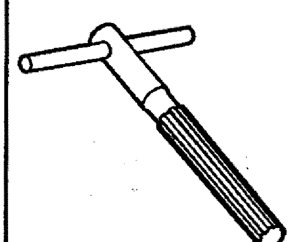
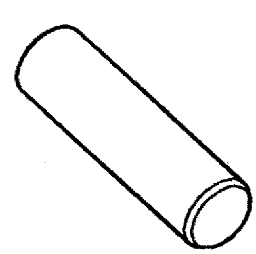
Illustration	Tool Number/Description
 9193	J 25018-A Clutch Spring Compressor Adapter
 40687	J 38734 Intermediate Spring Compressor Adapter
 40693	J 38882 Fourth Clutch Spring and Retainer Assembly Adapter
 40705	J 39919-1 Center Support Thread Reamer
 40706	J 39919-2 Center Support Gage Pin

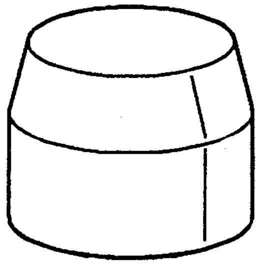
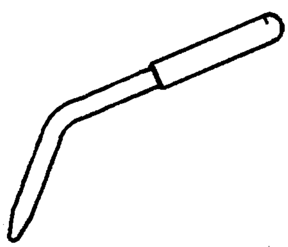
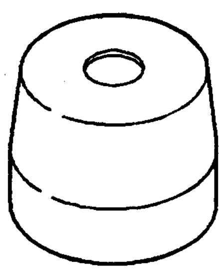
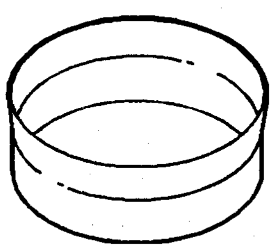
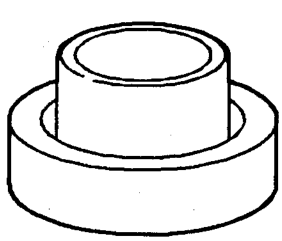
Illustration	Tool Number/Description
 40671	J 21363 Intermediate Clutch Inner Seal Protector
 40681	J 23093 Center Support Alignment Tool
 40690	J 21362 Direct and Forward Clutch Piston and Inner Seal Protector
 40689	J 38732-1 Direct and Forward Clutch Piston and Outer Seal Protector
 40672	J 38695 Direct Clutch Spiral Retaining Ring Installer

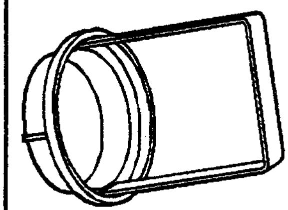
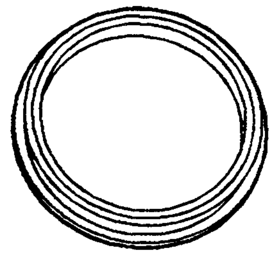
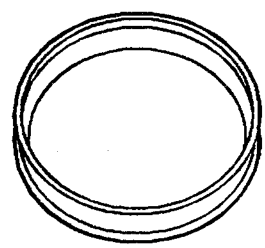
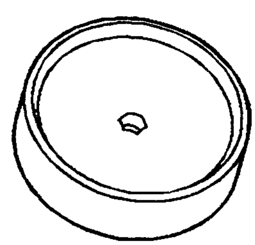
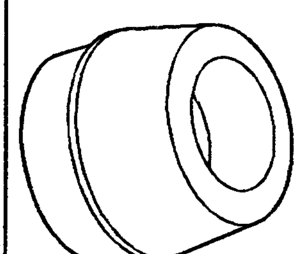
Illustration	Tool Number/Description
 40679	J 24396 Intermediate Clutch Pack Alignment Tool
 40684	J 38731-1 Fourth Clutch Piston and Housing Seal Protector
 40685	J 38731-2 Fourth Clutch Piston and Housing Seal Protector
 40686	J 38731-3 Fourth Clutch Piston and Housing Seal Spacer
 40667	J 38729 Overrun Clutch Piston Seal Protector

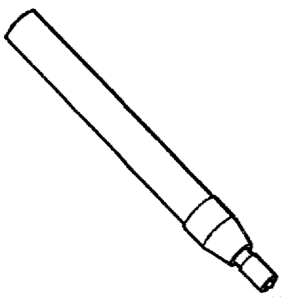
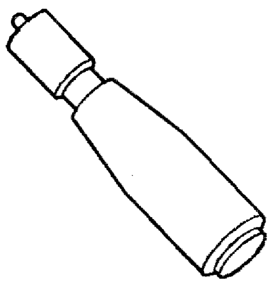
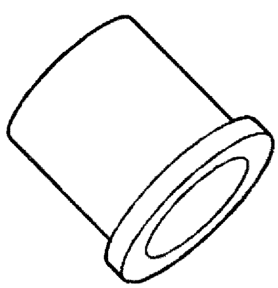
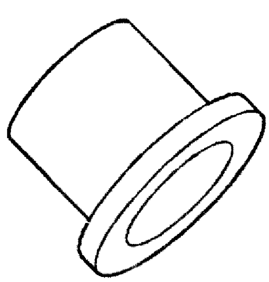
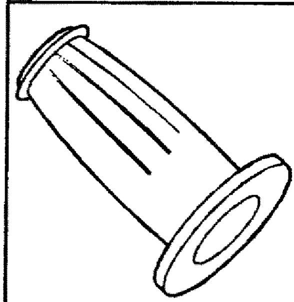
Illustration	Tool Number/Description
 40695	J 38736-1 Turbine Shaft Seal Installer
 40696	J 38736-2 Turbine Shaft Seal Installer
 40697	J 38736-3 Turbine Shaft Seal Sizer
 40698	J 38736-4 Turbine Shaft Seal Sizer
 40699	J 38736-5 Turbine Shaft Seal Pusher

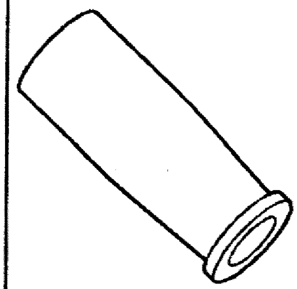
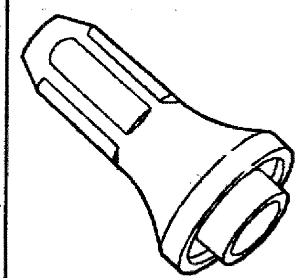
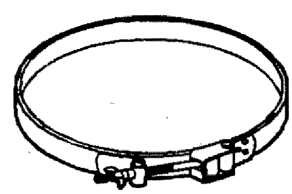
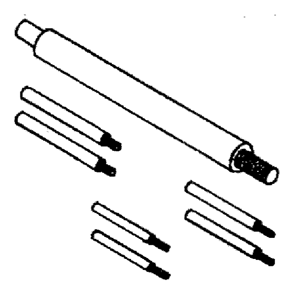
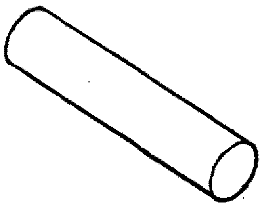
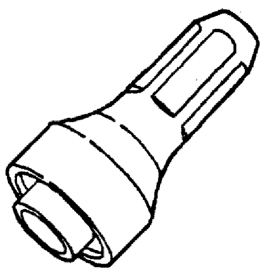
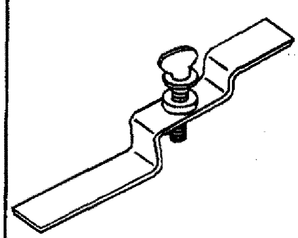
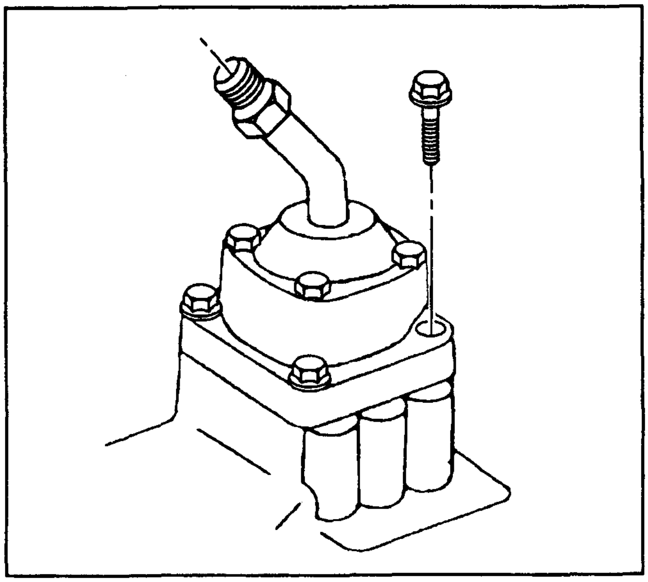
Illustration	Tool Number/Description
 40700	J 38736-6 Turbine Shaft Seal Pusher
 409446	J 38693 Oil Pump Seal and Rear Lube Seal Installer
 9181	J 21368 Pump Body and Cover Alignment Band
 19110	J 25025-B Dial Indicator Post and Guide Pin Set
 5724	J 25025-1 Guide Pins

Illustration	Tool Number/Description
 290400	J 25025-5 Guide Pins
 40668	J 38869 Rear Extension Seal Installer
 9353	J 21366 Converter Holding Strap

Manual Transmission - NV4500



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Repair Instructions

Transmission Disassemble (NV4500)

Disassembly Procedure

For component locations, refer to *Transmission Component Location* as needed.

Tools Required

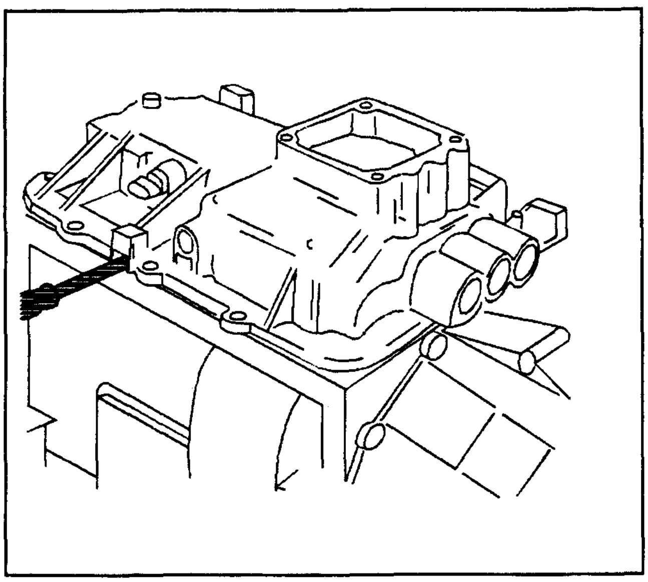
J 38805 Output Shaft Nut Socket (4WD only)

Important: Shift the transmission to neutral before beginning this procedure.

1. Remove the shift tower to the shift cover bolts.
2. Remove the shift tower from the shift cover.

Important: Do not pry apart on the mating surfaces. The mating surfaces may be damaged.

3. Remove the shift tower isolator plate from the shift cover.



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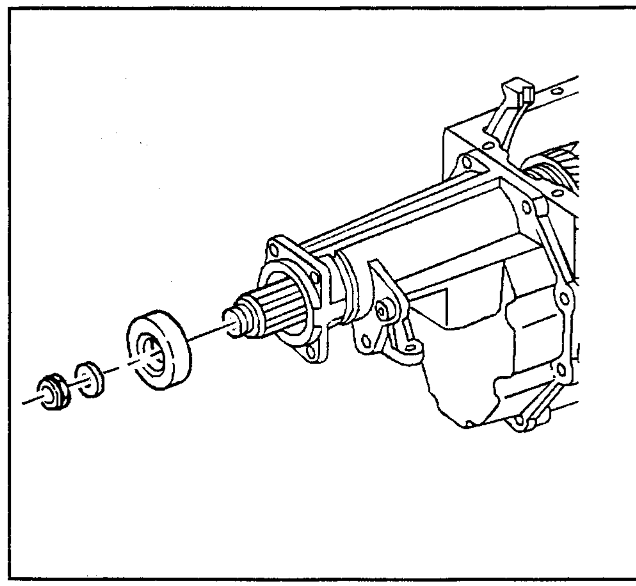
Important: Do not disassemble the shift cover. Individual components of the shift cover are not serviced. A damaged or worn shift cover must be replaced as a complete assembly.

4. Remove the shift cover to the transmission case bolts. Pry the cover off by inserting screwdrivers in the slots provided. Note the location of the stud bolts.
5. (RWD P-models, C-models and 4WD models) Shift the transmission into two gears in order to lock the output shaft.

6. (RWD P-models) Remove the following parts:
   6.1. The mainshaft nut
   6.2. The washer
   6.3. The spline seal



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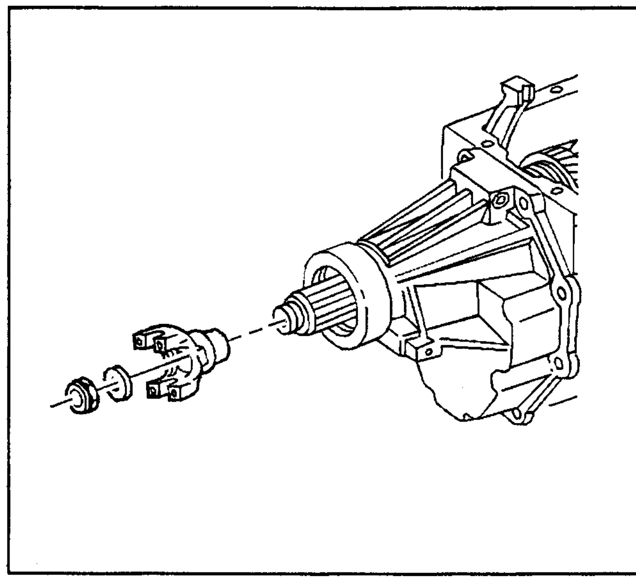
7. (RWD C-models) Remove the following parts:
   7.1. The mainshaft nut
   7.2. The washer
   7.3. The yoke assembly



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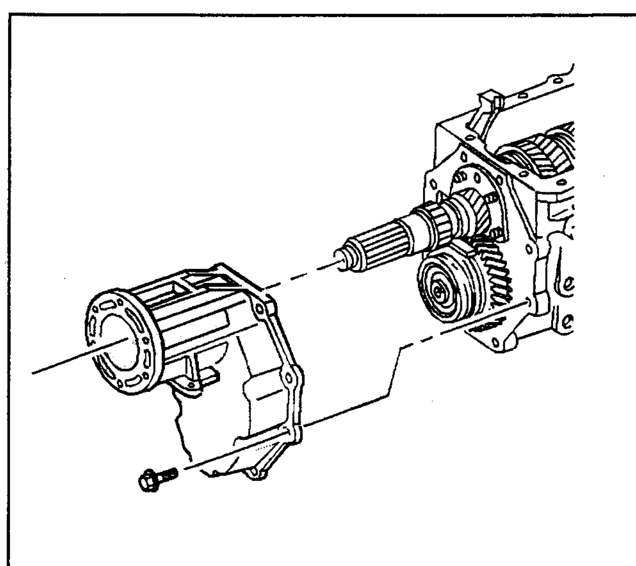
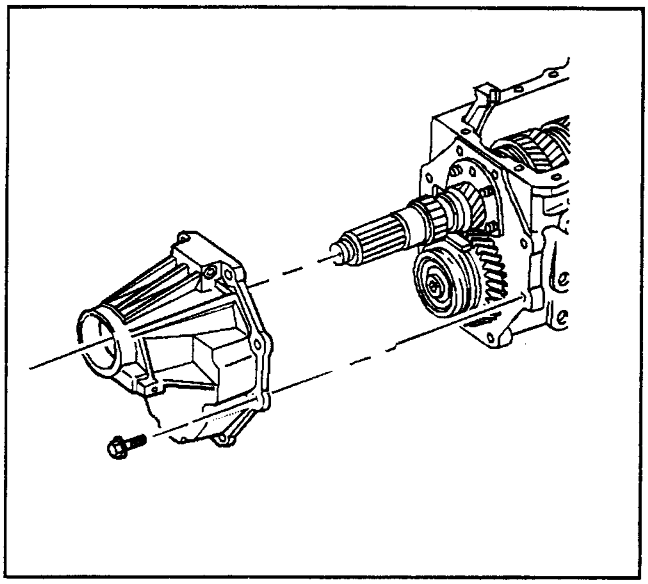
8. (4WD models) Remove the rear oil retainer bolts. Strike the housing lightly with a soft-faced hammer. Pry off the housing.



102243



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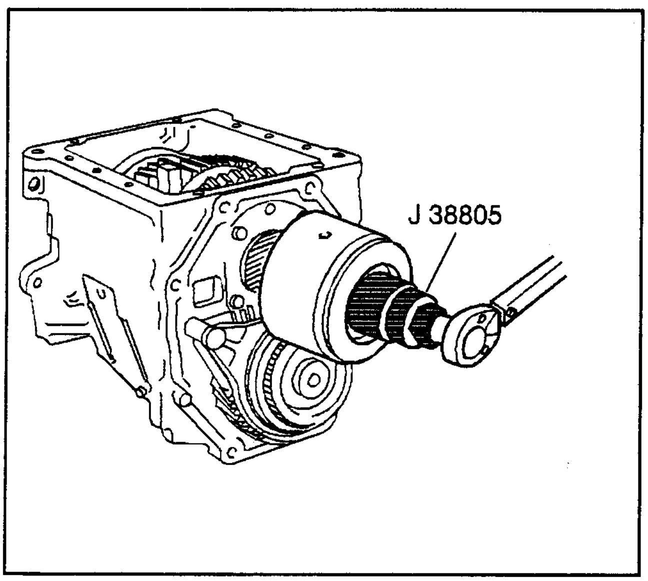
9. (RWD models) Remove the rear oil retainer bolts. Strike the housing lightly with a soft-faced hammer. Pry off the housing.



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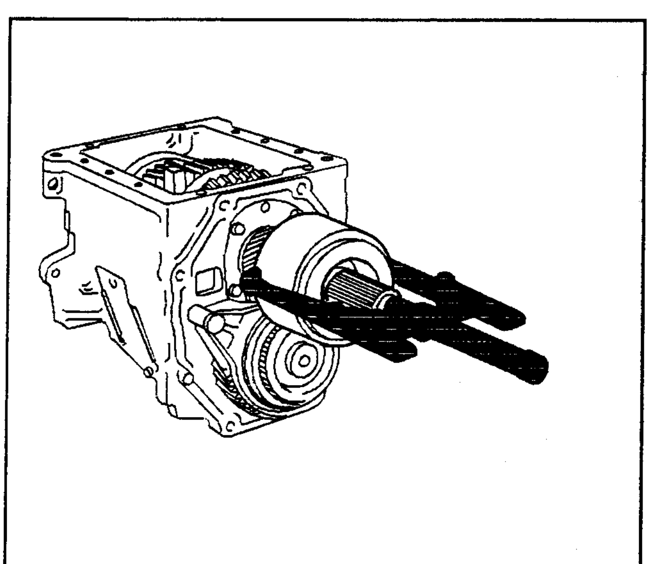
10. (4WD models) Remove the mainshaft nut and the washer. Use the *J 38805.*



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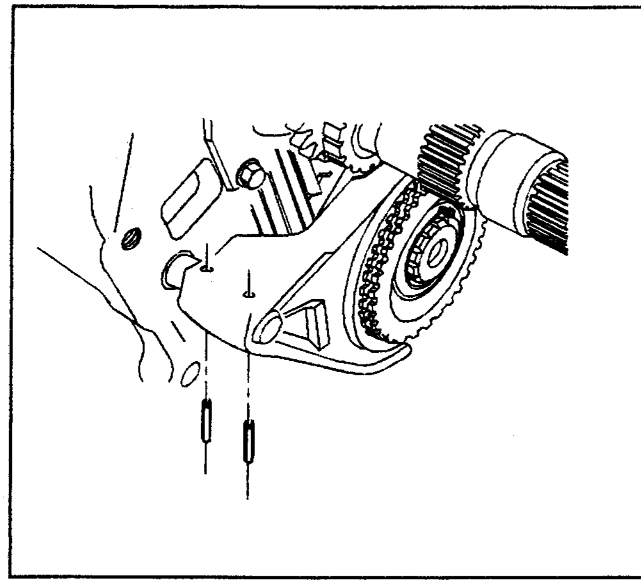
11. (4WD models) Remove the vibration damper. Use a suitable gear puller.

12. Support the 5th gear shift fork. Drive out the 5th gear shift fork roll pins.



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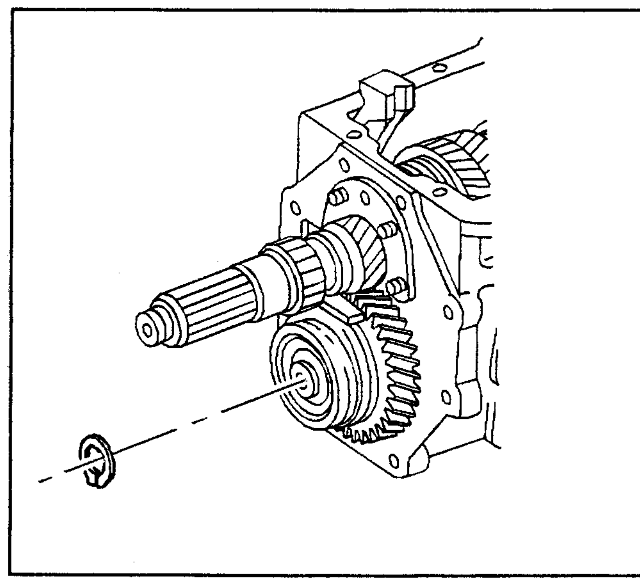
13. Remove the 5th gear clutch gear retainer ring.



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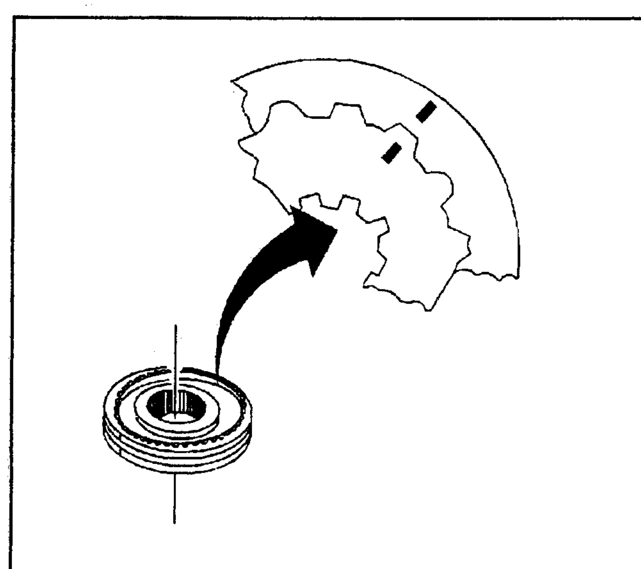
14. Scribe a mark on the overdrive synchronizer hub and on the sleeve. This will help you to replace the parts in the same position.



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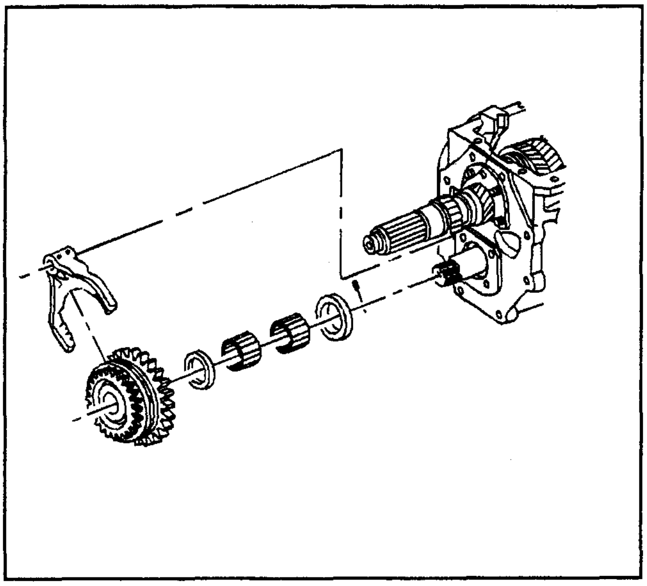
15. Remove the following parts:
    15.1. The countershaft overdrive gear and the shift fork as an assembly (Do not let the synchronizer come apart. If necessary, remove the clutch gear, the synchronizer ring, the spacer, and the bearings. The overdrive gear will drop down for easy removal.)
    15.2. The countershaft thrust washer
    15.3. The pin



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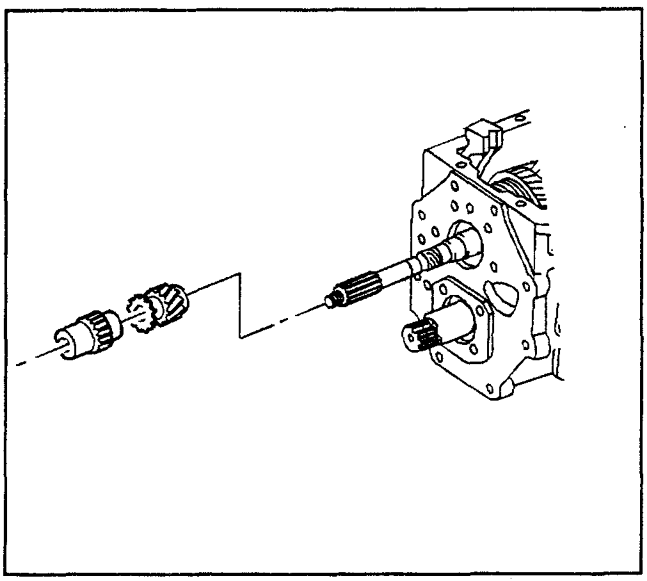
16. (RWD models) Use a puller to remove the mainshaft 5th gear and the vehicle speed sensor reluctor wheel. Note the direction that the mainshaft 5th gear and the vehicle speed sensor reluctor wheel are pressed onto the main shaft.



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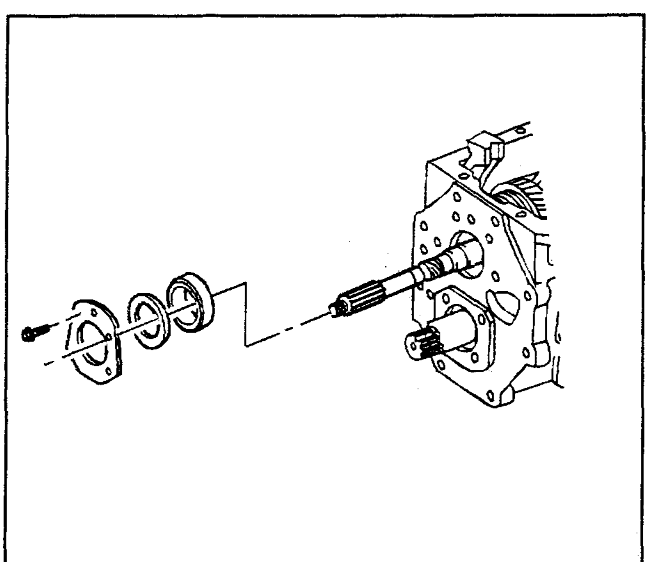
17. Remove the following parts:
    17.1. The mainshaft rear bearing retaining plate bolts
    17.2. The bearing retainer plate
    17.3. The shim(s)
18. Move the transmission to a horizontal position.
19. Remove the mainshaft rear bearing cup:
    19.1. Move the synchronizer sleeves into neutral position.
    19.2. Raise the fifth gear shift lever up out of the way and hold with a rubber band.



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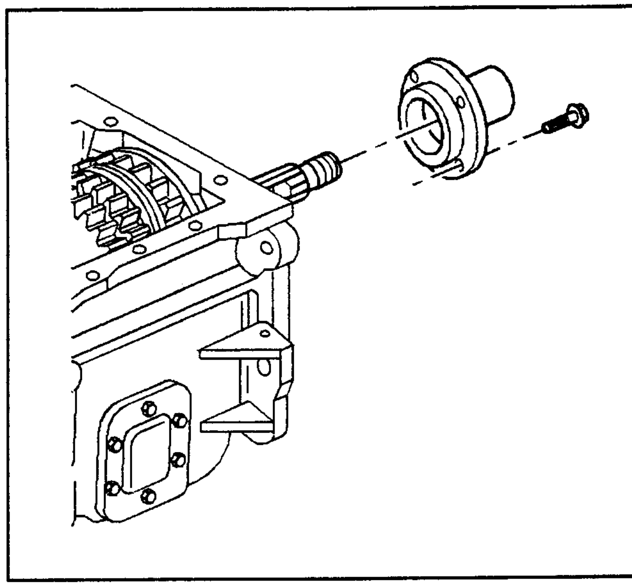
20. Mark the main drive gear bearing retainer and the case for alignment. Remove the main drive gear bearing retainer bolts. Drive the bearing retainer outward from inside the transmission case. Use a brass punch.



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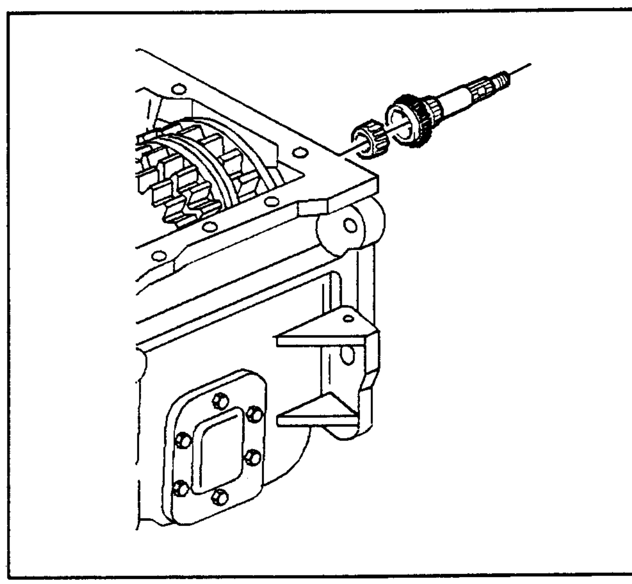
21. Remove the main drive gear and the main drive gear bearing.



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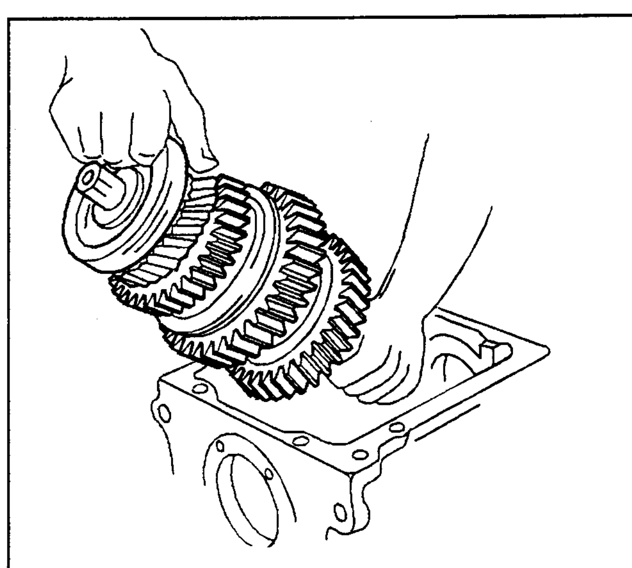
22. Invert the transmission with the countershft plate upward.
23. Remove the mainshaft assembly as follows:
    - 23.1. Move the synchronizer sleeves into neutral position.
    - 23.2. Raise the 5th gear shift lever up out of the way. Secure the lever with a rubber band.
    - 23.3. Lift the mainshaft assembly by the nose through the front of the case. You may have to wiggle and twist the mainshaft assembly in order to disengage the second speed gear from the countershaft.
    - 23.4. Remove the mainshaft assembly from the transmission case.



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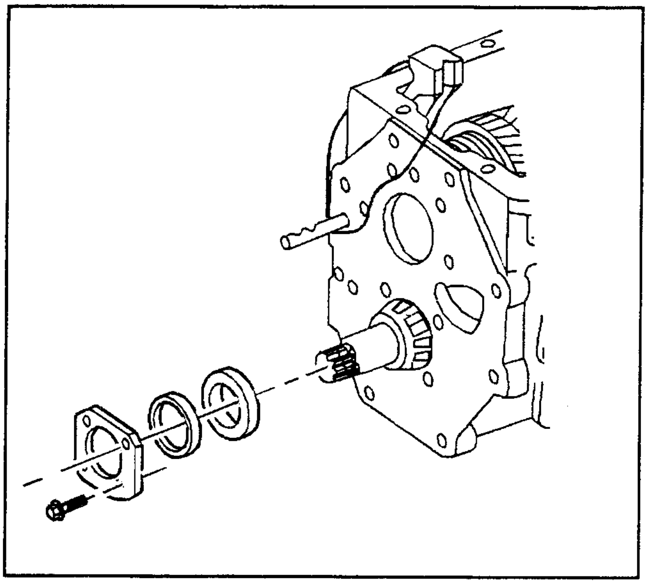
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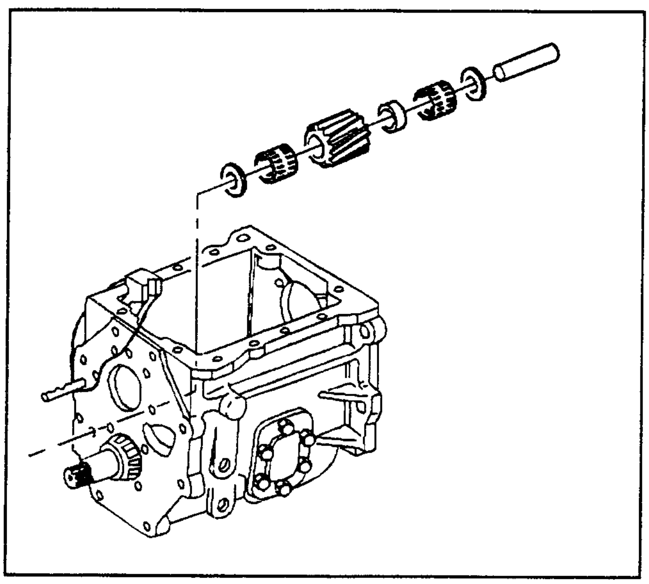
24. Remove the following parts:
    24.1. The countershaft bearing retaining plate bolts
    24.2. The bearing retainer plate
    24.3. The shim(s)
    24.4. The countershaft rear bearing cup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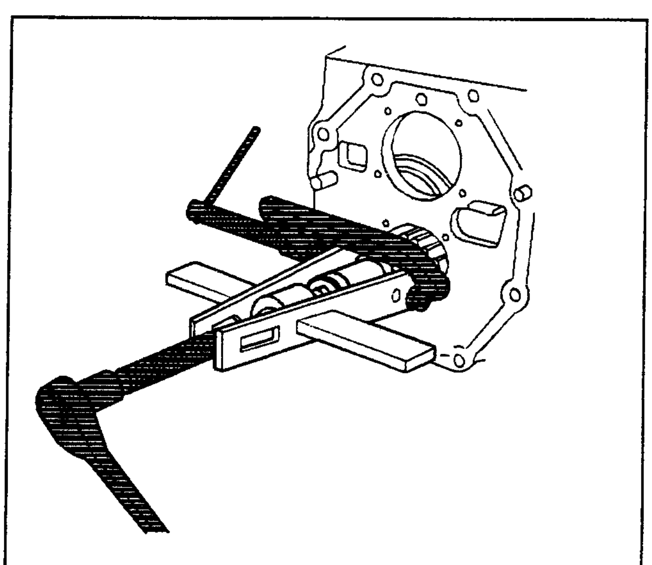
25. Remove the following parts:
    25.1. The reverse idler gear shaft (Push the reverse idler shaft out from inside the transmission case.)
    25.2. The reverse idler gear
    25.3. The washers
    25.4. The bearings
    25.5. The spacer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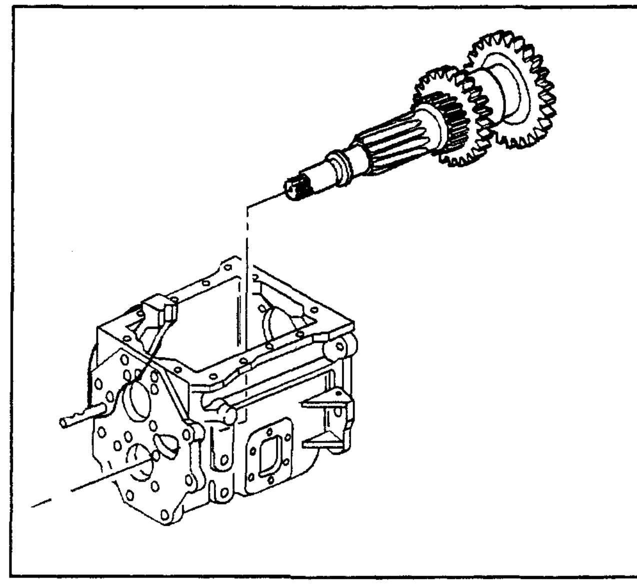
26. Remove the countershaft rear bearing. Use a suitable bearing puller. Position the bearing puller behind the bearing inner race.

27. Remove the countershaft assembly from the transmission case.



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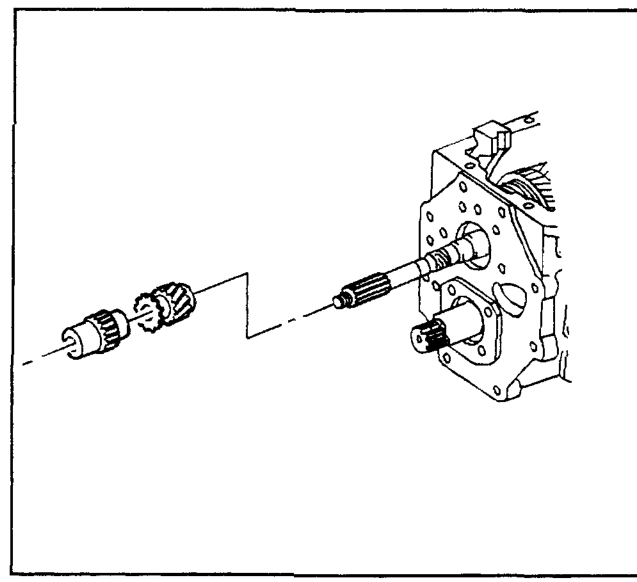
28. Remove the countershaft bearing cap and the front bearing cup.



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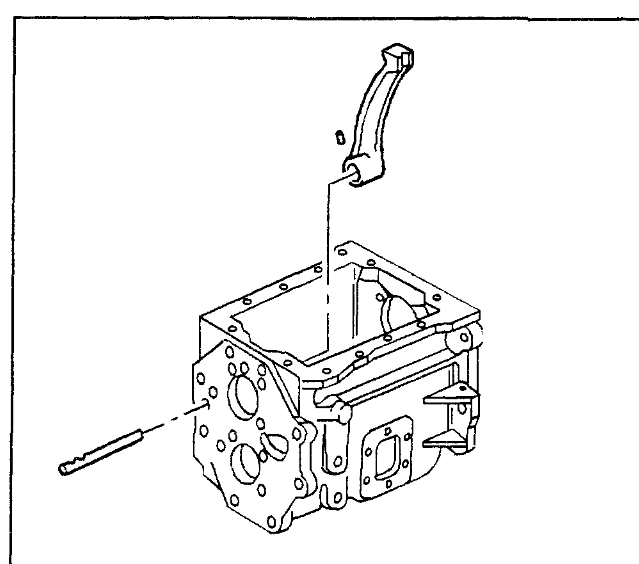
Important: Remove the 5th gear shift lever only if shifting into 5th gear is difficult.

29. Drive out the roll pin from the 5th gear shift lever. Remove the shift lever shaft. Push the shaft outward from inside the case. Remove the 5th gear shift lever from the shift lever shaft.



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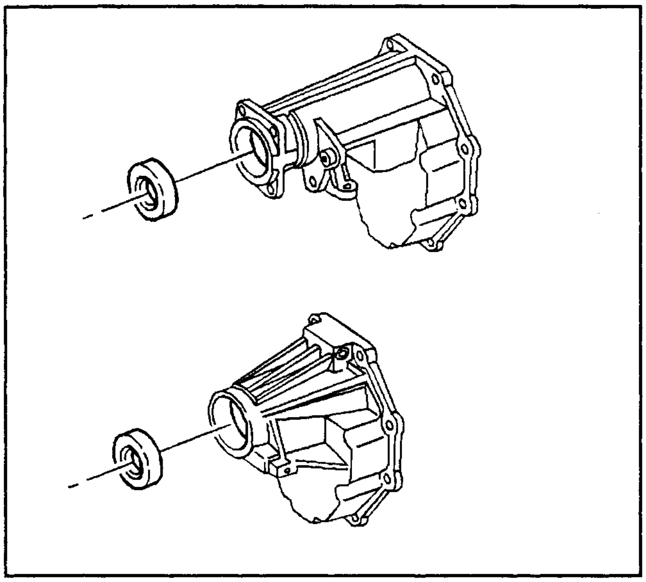
Rear Housing Disassemble (NV4500)

Removal Procedure



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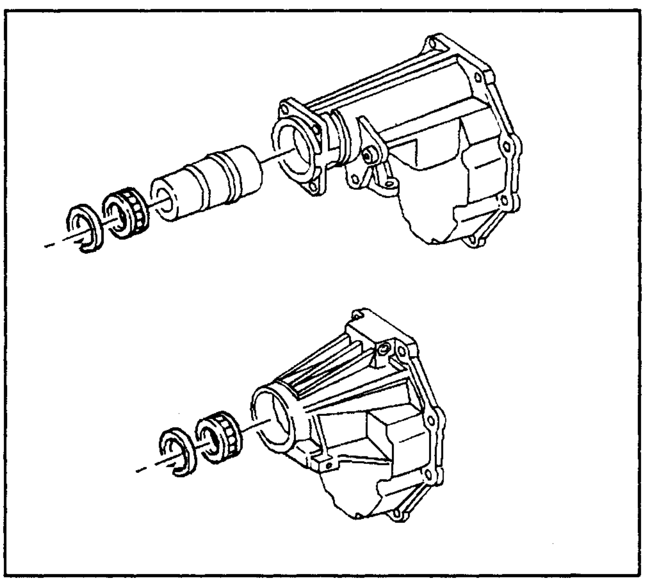
1. Remove the extension oil seal from the extension housing. Use a small pry bar.



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2. Remove the following parts:
   2.1. The bearing retainer ring/snap ring
   2.2. The bearing from the extension housing

Mainshaft and Synchronizers

1. Clean all the parts in a suitable solvent. Air dry all the parts.

Important: Do not spin the bearings without a lubricant.

2. Lubricate the mainshaft bearings with the proper transmission lubricant. Refer to *Lubrication Specifications.*
3. Check the bearings for rough rotation.
4. Inspect the mainshaft gears for the following conditions:
   - Cracks
   - Nicks
   - Chipped gear teeth
   - High spots (small-shiny spots on the gear teeth mating surface) that could cause gear noise
5. Inspect related gear surfaces like thrust faces and bearing surface diameters.
6. Inspect the synchronizer sleeves for a sliding fit on the synchronizer hubs. The synchronizer hubs must have a force fit on the mainshaft splines.
7. Replace a synchronizer hub that does not require a force fit on the mainshaft splines.
8. Inspect the synchronizer springs and the keys for damage.
9. Inspect the synchronizer rings for excess wear.
10. Inspect the synchronizer clutching teeth for the following conditions:
    - Scuffs
    - Nicks
    - Burrs
    - Damage
11. Inspect the mainshaft drive gear clutching cones for synchronizer ring metal transfer.
12. Inspect all the gear teeth for excess wear.
13. Remove nicks and burrs with a soft stone or a crocus cloth.
14. Replace any components that are bent or show signs of excessive wear. Inspect the mating parts.
15. Inspect the bearings and the bearing surfaces for the following conditions:
    - Nicks
    - Burrs
    - Bent cages
    - Wear
    - Overheating
    - Scoring
    - Pitted condition

Countershaft

Important: Do not disassemble the countershaft. Individual components of the countershaft are not serviced. A damaged or worn countershaft must be replaced as a complete assembly.

1. Clean the countershaft in a suitable solvent. Air dry the countershaft.
2. Inspect the countershaft for cracks.
3. Replace a cracked countershaft.
4. Inspect the countershaft gears for the following conditions:
   - Scuffed gear teeth
   - Nicked gear teeth
   - Burred gear teeth
   - Broken gear teeth
   - High spots (Small shiny spots on the gear teeth mating surfaces) that could cause gear noise
5. Lubricate the countershaft bearings with the proper transmission lubricant. Refer to *Lubrication Specifications.*
6. Replace the bearing assembly if any of the following conditions exist:
   - Roughness of rotation
   - Burrs
   - Pitted condition
7. Replace the bearing race and inspect the mating parts If the following conditions exist:
   - Scoring
   - Wear
   - Discoloration from overheating

Front and Rear Housings

Tools Required

- *J 38807* Extension Housing Bearing Installer
- *J 22834* Extension Housing Seal Installer

1. Clean the transmission housing in a suitable solvent. Air dry the housing.
2. Remove the extension oil seal. Refer to Seal Replacement.
3. Remove the extension housing bearing snap ring.
4. Remove the bearing from the extension housing.
5. Inspect the countershaft bearing race bore for the following conditions:
   - Wear
   - Scratches
   - Grooves
6. Replace the housing if the countershaft bearing race bore is worn or damaged.

7. Inspect the housing for the following conditions:
   - Cracks
   - Damaged threads
   - Nicked mounting surfaces
   - Burrs
   - Scratches
8. Replace a cracked housing.
9. Clean up damaged threads with the correct size tap.
10. Replace the housing if scratches, grooves or scoring cannot be removed with a soft stone or a crocus cloth.
11. Inspect the machined mating surfaces for flatness. Check the mating surfaces with a straight edge.
12. Install the bearing into the extension housing using *J 38807*.
13. Install the extension housing bearing snap ring.
14. Install the extension oil seal. Refer to Seal Replacement.
15. Remove the oil seal from the extension housing:
    15.1. Use a small prybar or the equivalent to pry out the seal.
    15.2. Inspect the retainer for damage.
16. Install the new seal into the extension housing using *J 22834*.

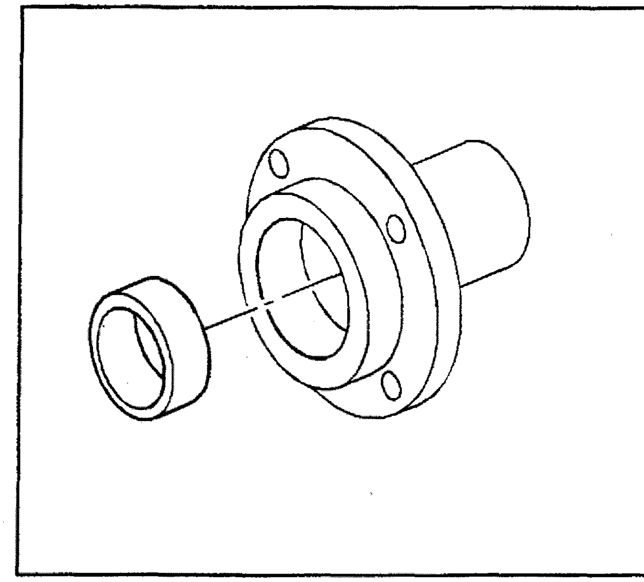
Shift Shaft and Shift Forks

- Clean all the parts in a suitable solvent. Air dry the parts.
- Inspect the shift shaft for wear or scoring.
- Inspect the shift shaft forks for wear, scoring, or distortion.
- Inspect the roll pins for wear or distortion.
- Inspect the shift shaft socket assembly components for wear or distortion.
- Replace the worn or distorted parts. Inspect all the mating parts.

Input Shift Bearing Retainer Assembly

Removal Procedure

Remove the seal from the main drive gear bearing retainer. Pry the seal out with a small pry bar or the equivalent.



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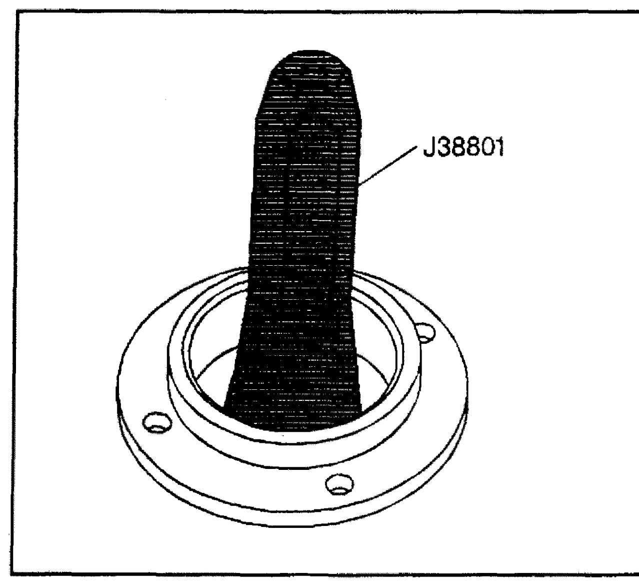
Installation Procedure

Tools Required

J 38807 Main Drive Gear Bearing Retainer Seal Installer

Install the oil seal into the main drive gear bearing retainer. The lip of the seal goes toward the installing tool. Use the *J 38807.*



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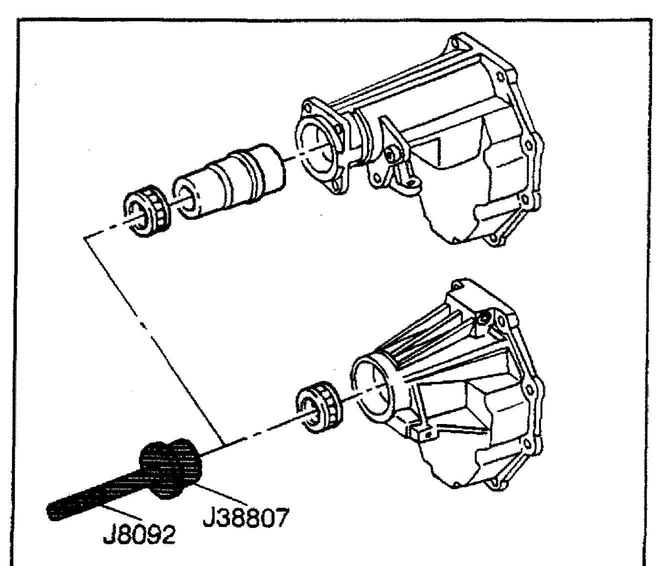
Rear Housing Assemble (NV4500)

Installation Procedure

Tools Required

- *J 38807* Extension Housing Bearing Installer
- *J 8092* Universal Driver Handle
- *J 22834* Extension Housing Seal Installer

1. Install the rear output shaft bearing. Use the *J 38807* and the *J 8092.*



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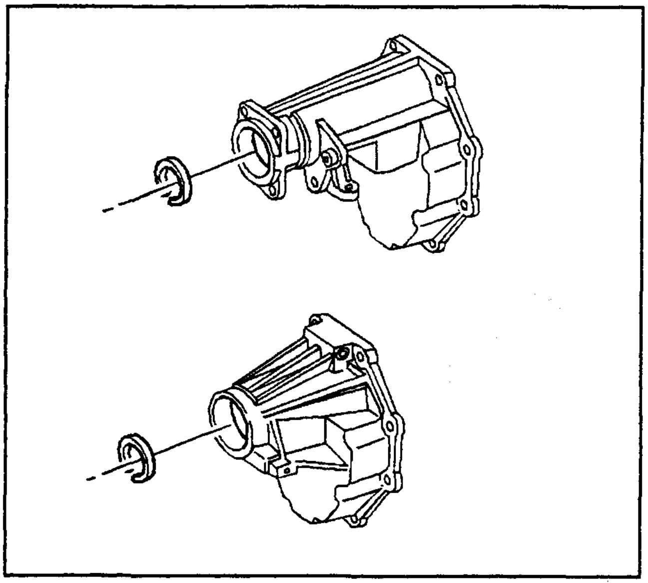

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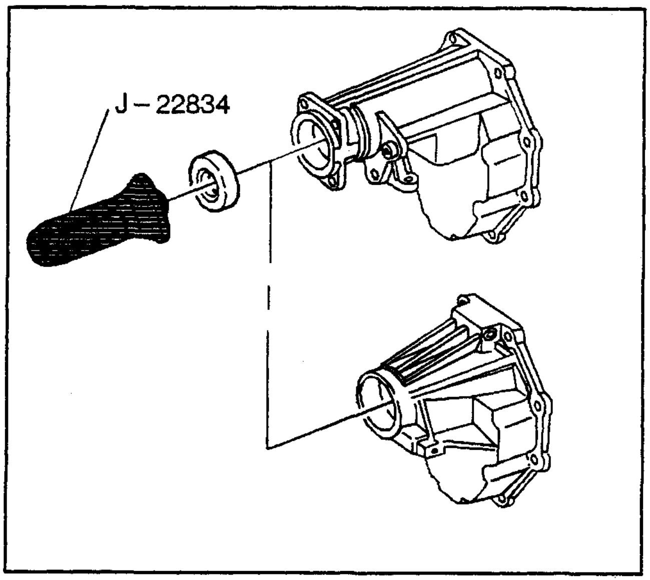
2. Install the bearing retainer ring.



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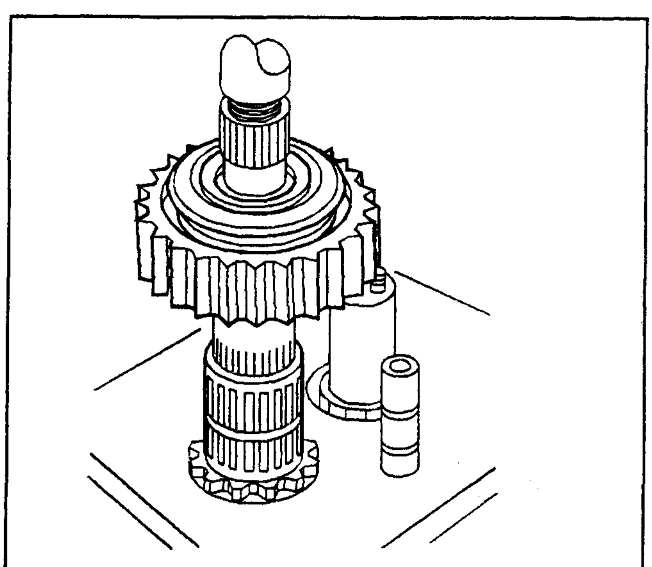
3. Install a new oil seal. Use the *J 22834*.



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Mainshaft Assemble (NV4500)

1. Clean all the parts in a suitable solvent. Air dry all the parts.

Important: Do not spin the bearings without a lubricant.

2. Lubricate the mainshaft bearings with the proper transmission lubricant. Refer to *Lubrication Specifications*.
3. Check the bearings for rough rotation.
4. Inspect the mainshaft gears for the following conditions:
   - Cracks
   - Nicks
   - Chipped gear teeth
   - High spots (small-shiny spots on the gear teeth mating surface) that could cause gear noise

5. Inspect related gear surfaces like thrust faces and bearing surface diameters.
6. Inspect the synchronizer sleeves for a sliding fit on the synchronizer hubs. The synchronizer hubs must have a force fit on the mainshaft splines.
7. Replace a synchronizer hub that does not require a force fit on the mainshaft splines.
8. Inspect the synchronizer springs and the keys for damage.
9. Inspect the synchronizer rings for excess wear.
10. Inspect the synchronizer clutching teeth for the following conditions:
    - Scuffs
    - Nicks
    - Burrs
    - Damage
11. Inspect the mainshaft drive gear clutching cones for synchronizer ring metal transfer.
12. Inspect all the gear teeth for excess wear.
13. Remove nicks and burrs with a soft stone or a crocus cloth.
14. Replace any components that are bent or show signs of excessive wear. Inspect the mating parts.
15. Inspect the bearings and the bearing surfaces for the following conditions:
    - Nicks
    - Burrs
    - Bent cages
    - Wear
    - Overheating
    - Scoring
    - Pitted condition

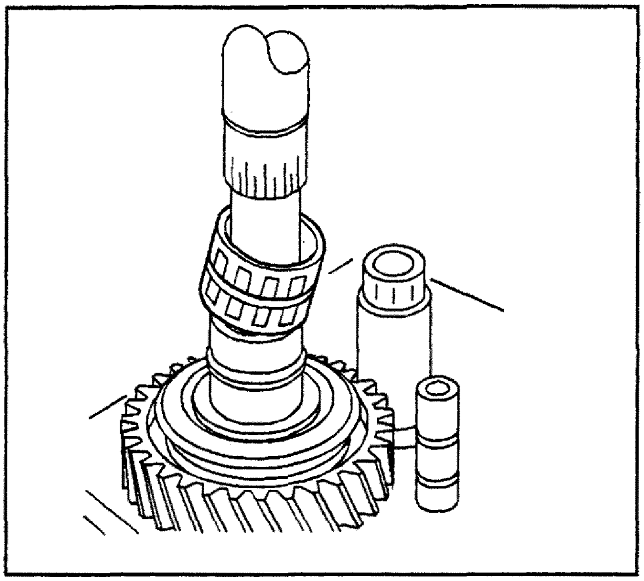
Assembly Procedure

Tools Required

J 22828 Gear and Bearing Installer

Important: Use TRANSJEL on bearings and contact surfaces.

1. Install the 1st speed gear bearing and the 1st speed gear.
2. Install the reverse gear clutch gear and the synchronizer ring. Ensure that the synchronizer ring teeth face down toward the mainshaft shoulder.
3. Install the reverse gear clutch gear retainer ring.



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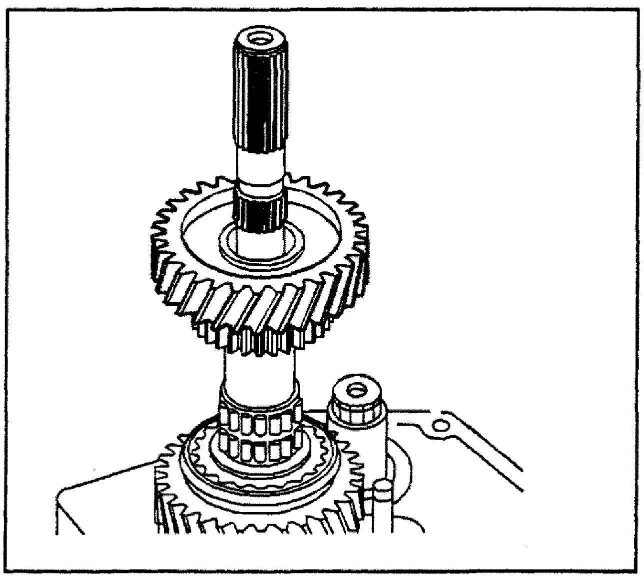
4. Install the reverse bearing spacer and the bearing.



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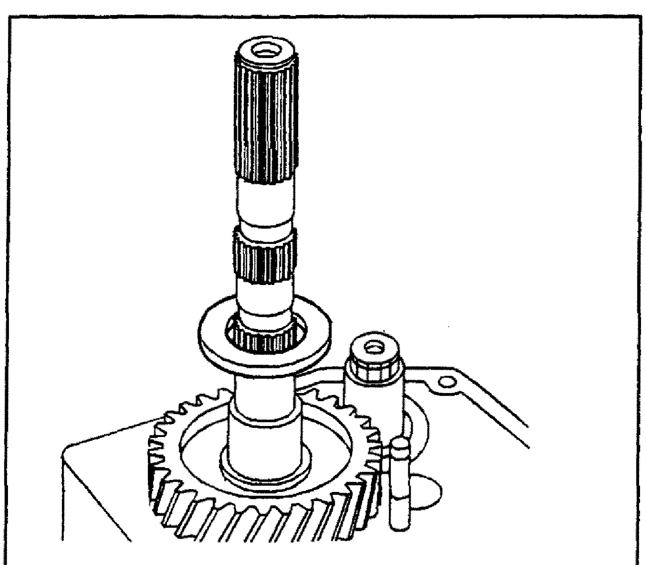
5. Install the reverse gear and the synchronizer assembly. Rotate the assembly until the gear drops into the fully seated position. If the synchronizer assembly was disassembled, the synchronizer sleeve must be reinstalled with the taper of the sleeve towards the reverse gear.



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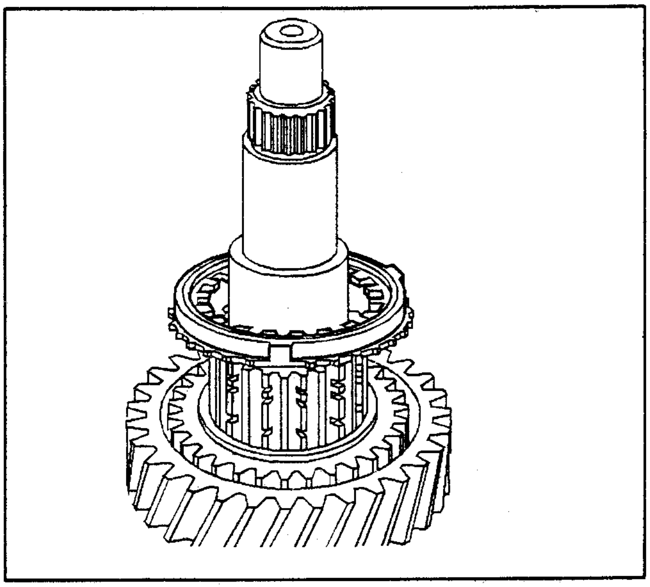
6. Install the reverse gear thrust washer.
7. Install the rear mainshaft bearing. Use a hydraulic press and the *J 22828*.
8. Turn the mainshaft over.

9. Install the following parts:
   9.1. The 1st speed gear clutch gear
   9.2. The clutch gear snap ring
   9.3. The synchronizer rings



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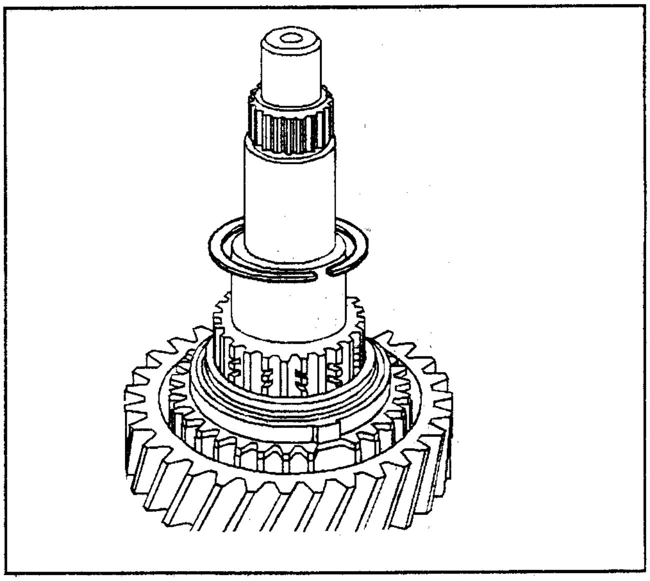
10. Install the 1st speed gear synchronizer ring retainer ring.



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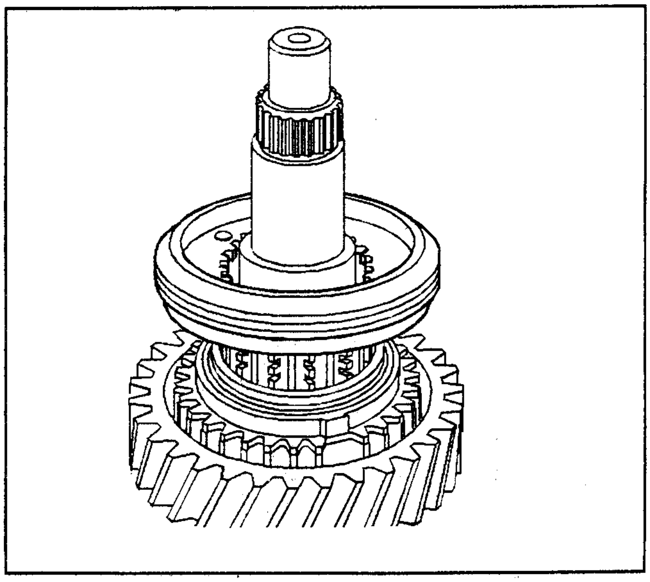
11. Install the 1-2 synchronizer assembly. Install the synchronizer with the taper side of the synchronizer sleeve towards 2nd speed gear.



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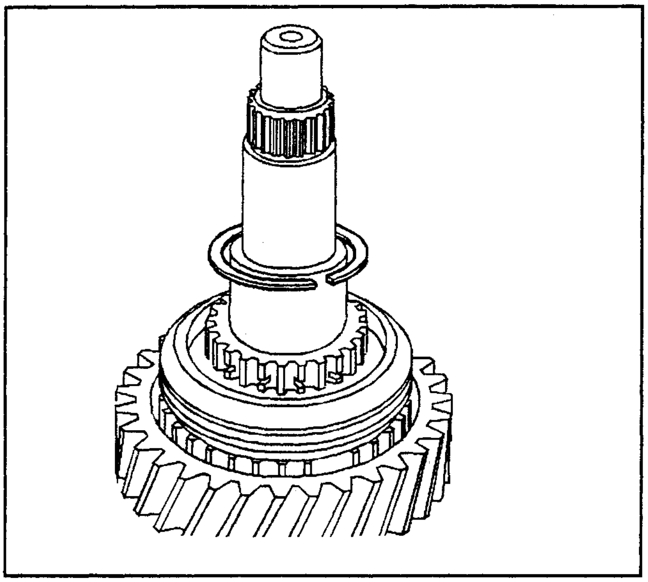

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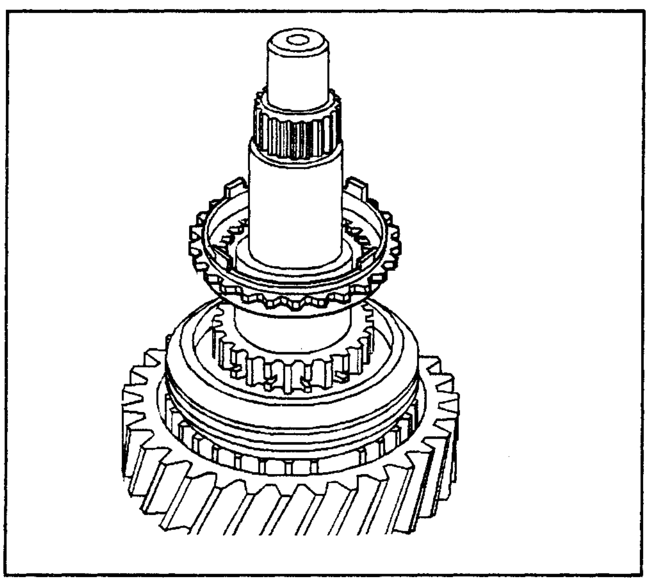
12. Install the 1-2 synchronizer assembly retainer ring. Verify proper orientation of ring by ensuring that the letter R on the hub is up.



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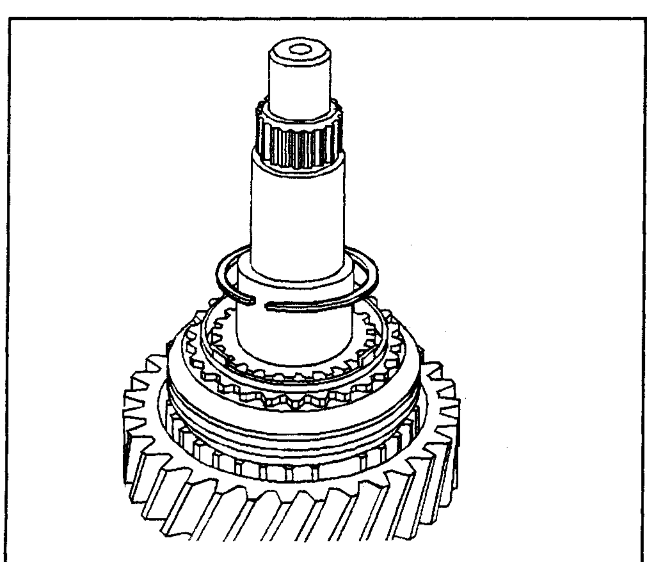
13. Install the 2nd speed gear synchronizer rings.



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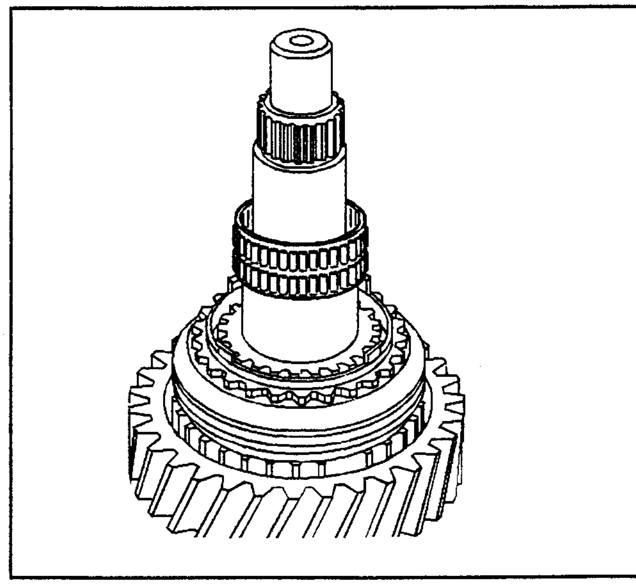
14. Install the 2nd speed gear synchronizer ring retainer ring.

15. Install the 2nd speed gear bearing.



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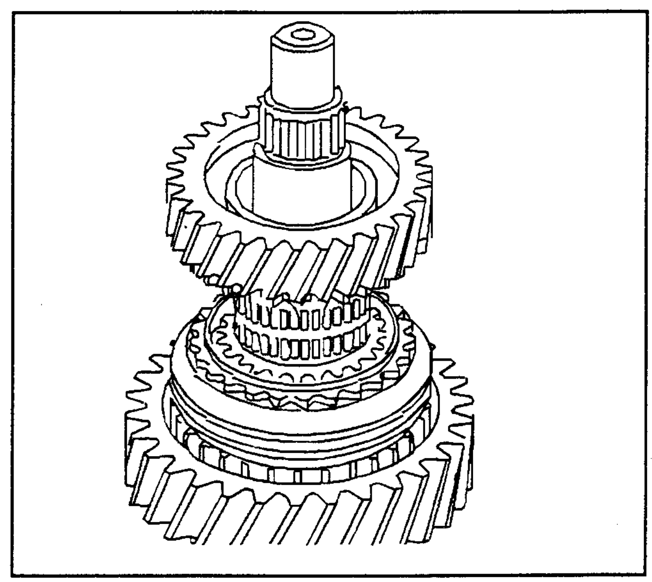
16. Install the 2nd speed gear.



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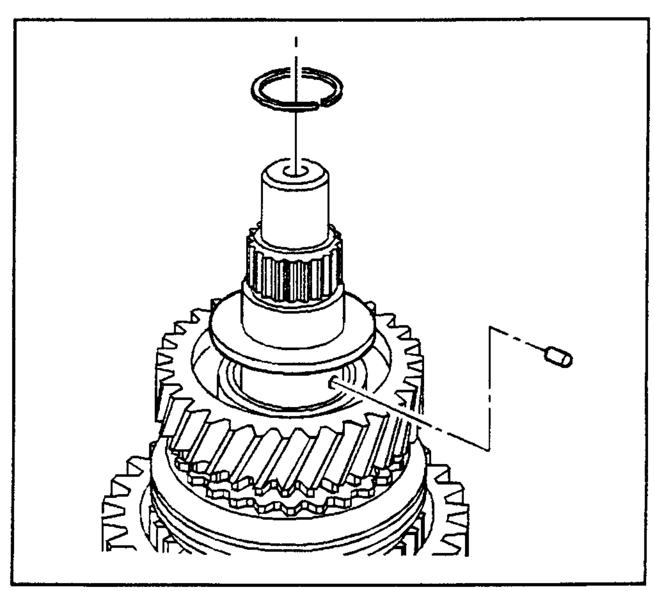
17. Install the following parts:
    17.1. The 2nd speed gear thrust washer retaining pin
    17.2. The 2nd speed gear thrust washer (Be sure the thrust washer is seated on the gear and the retaining pin.)
    17.3. The 2nd speed gear thrust washer retainer ring.



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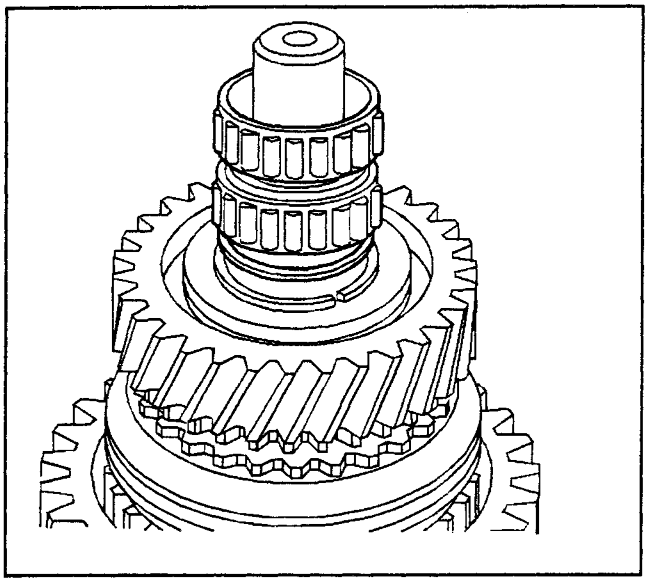

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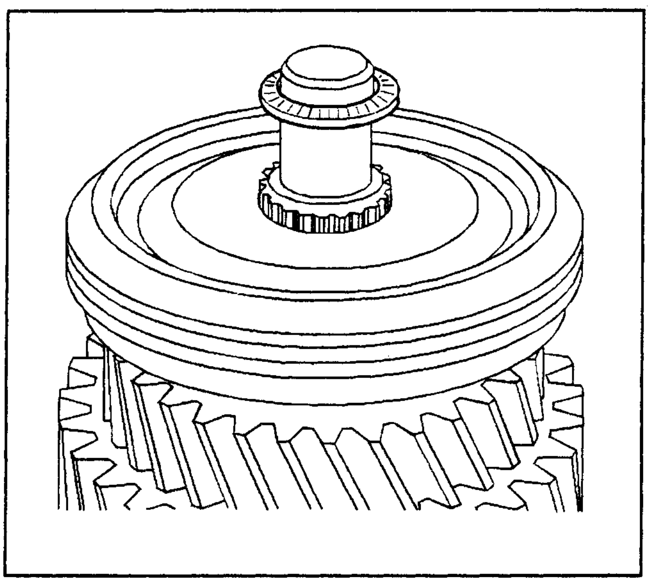
18. Install the 3rd speed gear bearing spacer and the bearing.
19. Install the 3rd speed gear and the synchronizer assembly. Hold the unit together and press on as an assembly.



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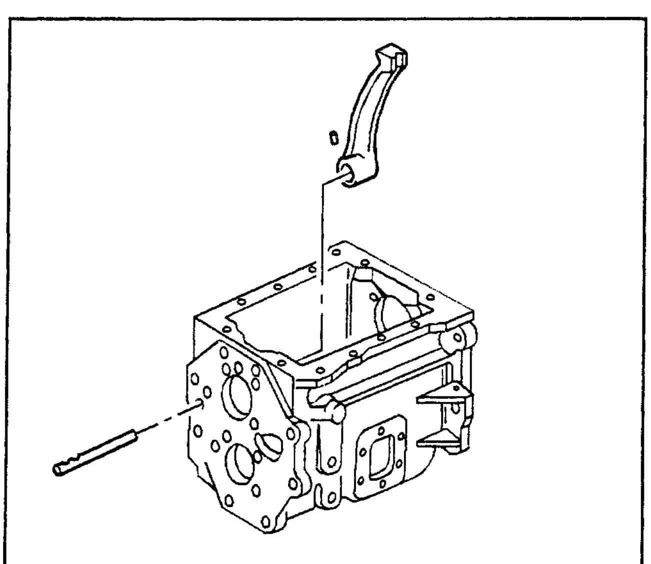
20. Install the main drive gear thrust bearing.
21. Install the 4th speed gear synchronizer ring.
22. Install the 4th speed gear clutch gear.



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Transmission Assemble (NV4500)

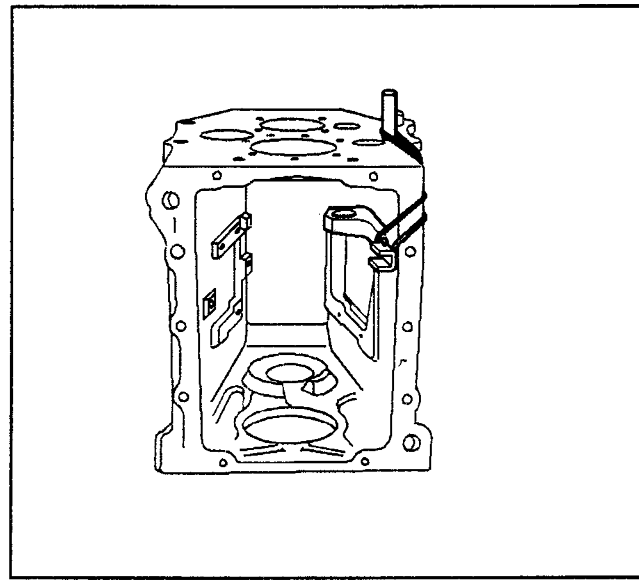
Assembly Procedure

Tools Required

- *J 22828* Countershaft Bearing and Input Shaft Bearing Installer
- *J 38805* Output Shaft Nut Socket
- *J 38856* Countershaft Bearing Cone and Retainer Installer
- *J 39314* Vibration Damper Installer

1. Install the following parts:
   1.1. The 5th speed gear shift lever
   1.2. The shift lever shaft (The notches that retain the 5th speed gear shift fork are to the outside of the case.)
   1.3. The shift lever retaining pin

2. Install a rubber band in order to hold the 5th speed gear shift lever back out of the way.



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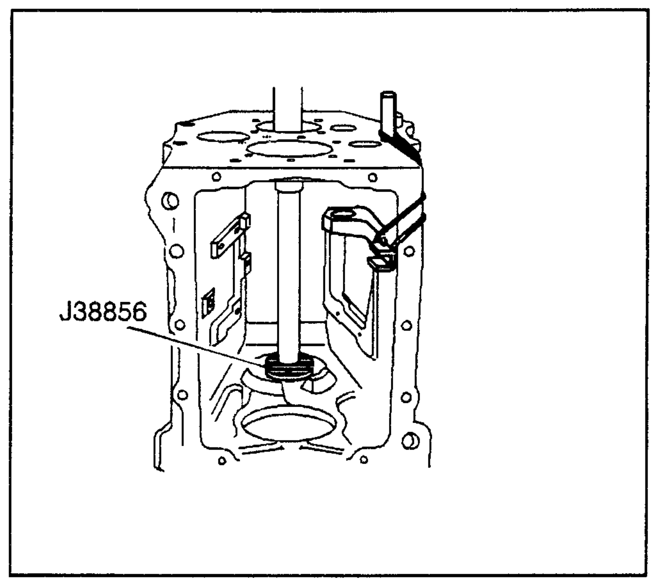
3. Install the countershaft front bearing cup. Use the *J 38856*.



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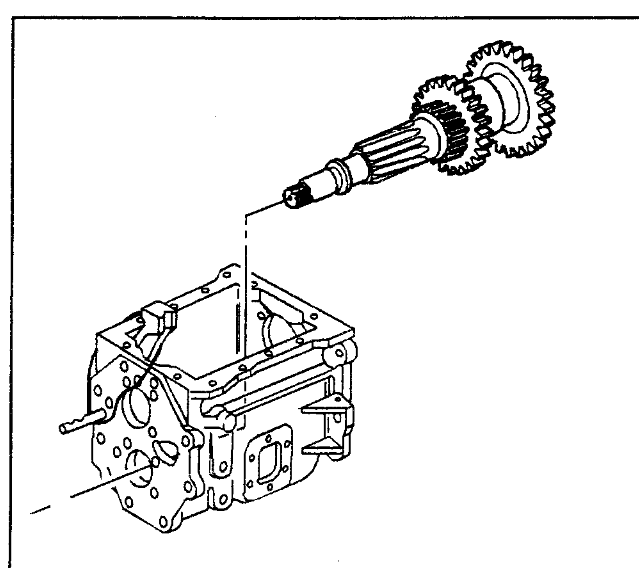
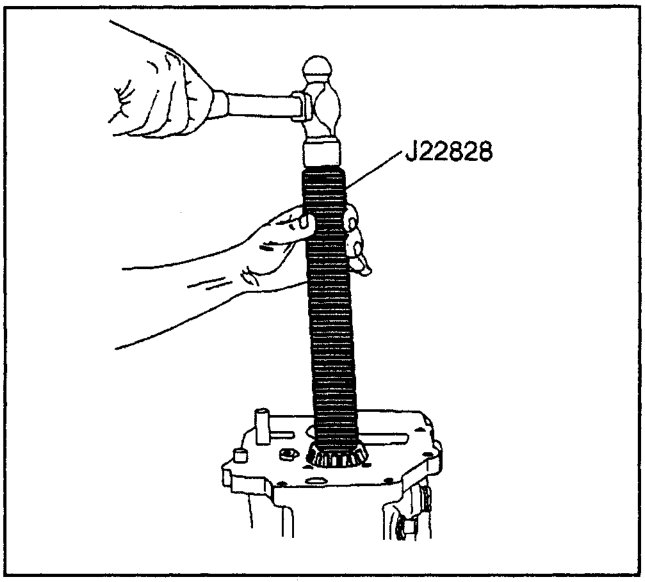
4. Install the countershaft assembly into the transmission case.

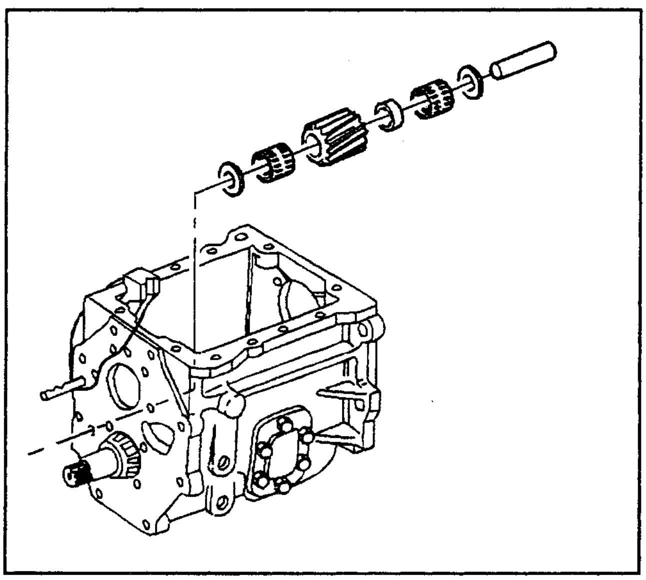


100559



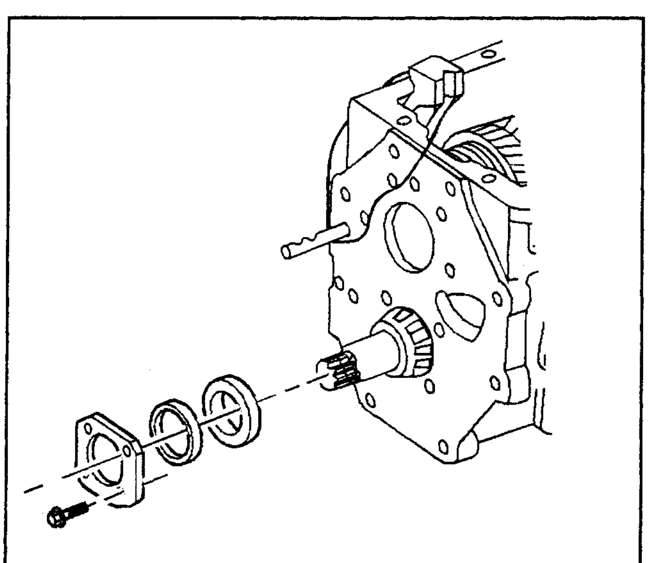
101015

5. Install the countershaft rear bearing. Raise and support the countershaft assembly. Install a wood block between the front of the countershaft and the transmission case. Use the *J 22828*.



100557

6. Install the following parts:
   6.1. The reverse idler gear
   6.2. The bearings
   6.3. The spacer
   6.4. The washers
   6.5. The reverse idler gear shaft



100556

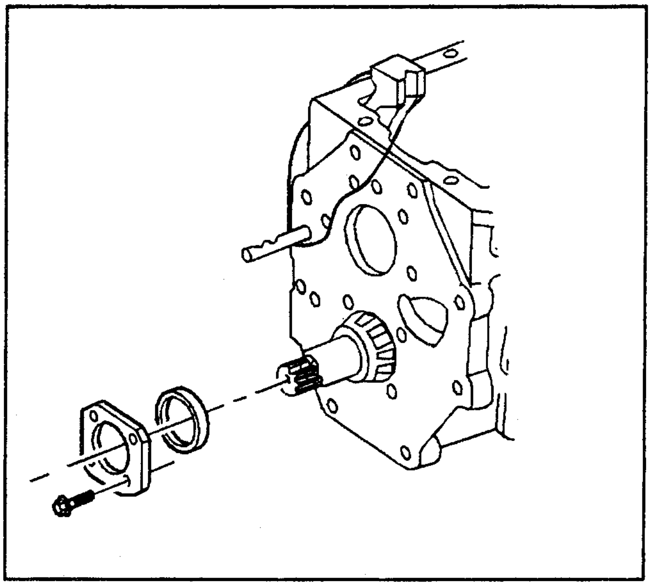
7. Install the countershaft rear bearing cup.

8. Install the countershaft shim(s) and the bearing retainer plate.

   Tighten

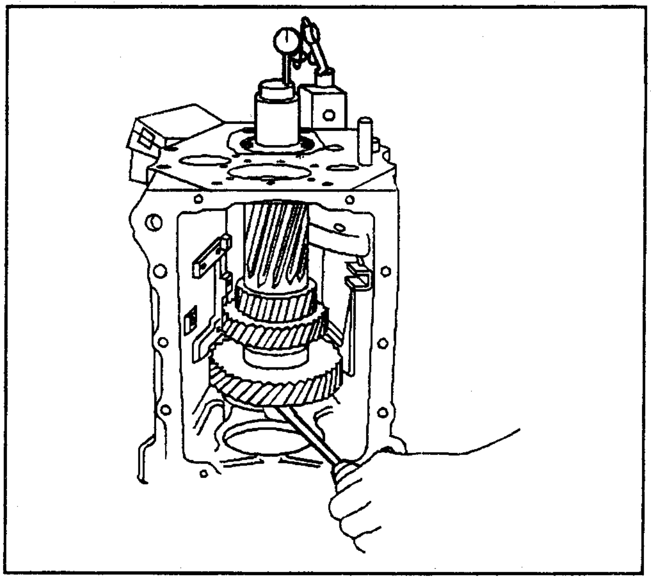
   Tighten the bolts to 35 N·m (26 lb ft).

Notice: Refer to *Fastener Notice* in General Information.



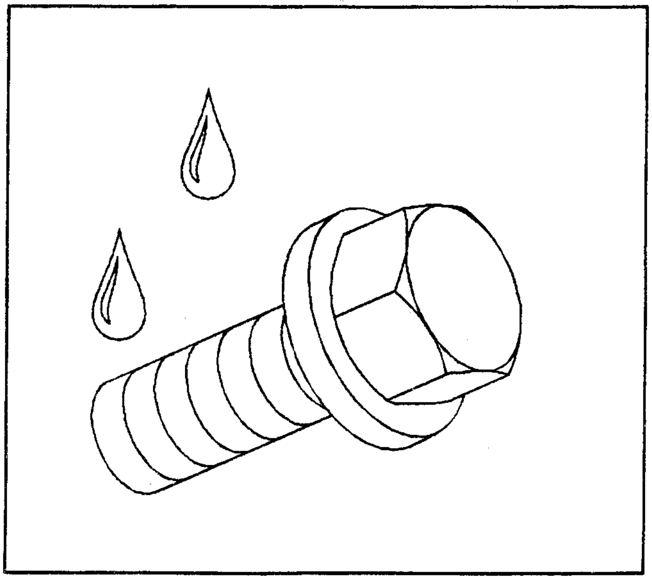
101017

9. Measure the countershaft end play. Use the fallowing procedure:
   9.1. Set the dial indicator up on the end of the countershaft.
   9.2. Use a screwdriver or the equivalent to lift the countershaft up and down in order to measure the end play.
   9.3. The countershaft end play should be 0.05–0.15 mm (0.002–0.006 in). Add or remove shim(s) under the bearing retainer plate in order to adjust.
   9.4. Remove the retainer plate bolts.

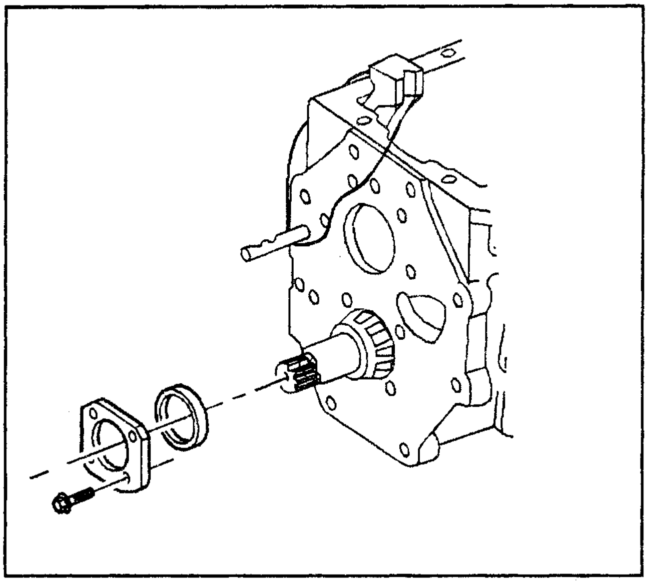


101025

10. Apply sealant to the bolt threads. Use Loctite™ or Dri-Loc™ 201 or the equivalent.



102236

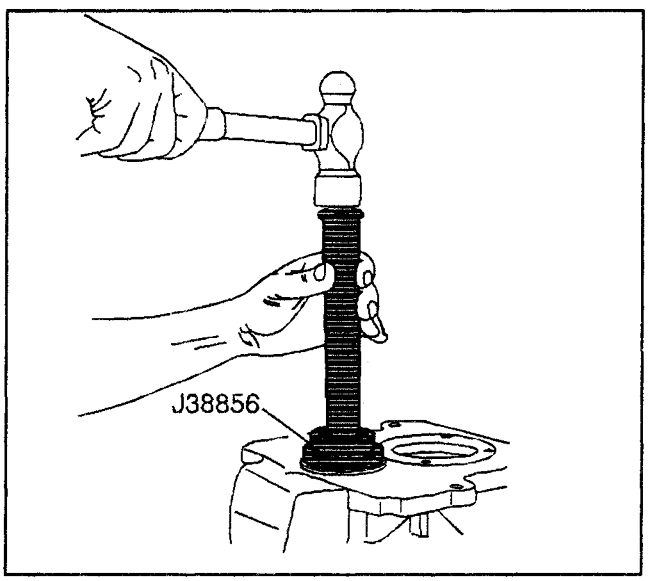


101017

11. Install the countershaft shim(s) and the bearing retainer plate.

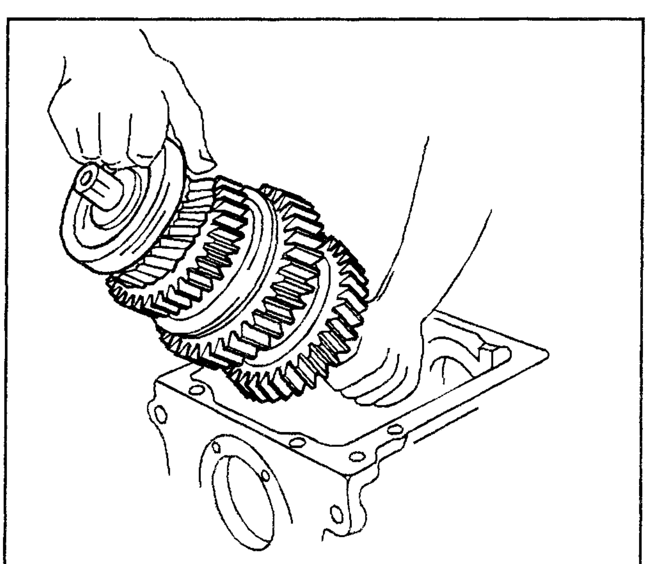
Tighten

Tighten the bolts to 35 N·m (26 lb ft).



101033

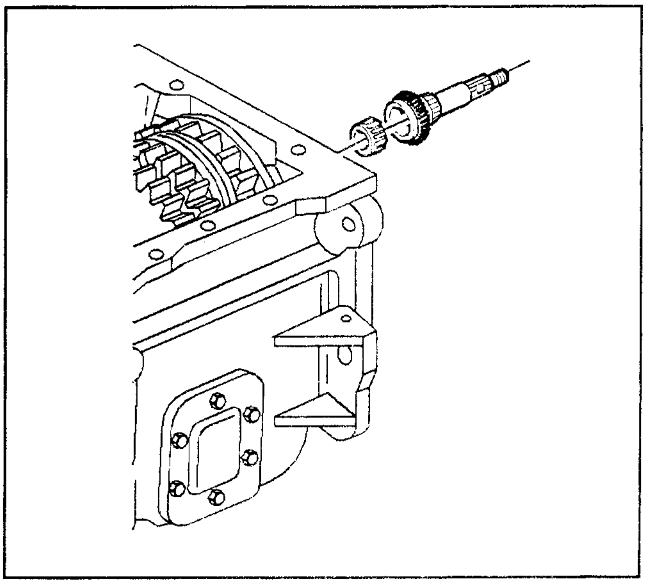
12. Install the countershaft bearing cap. When properly installed, the outer lip of the cap will be flush with case. Use the *J 38856.*



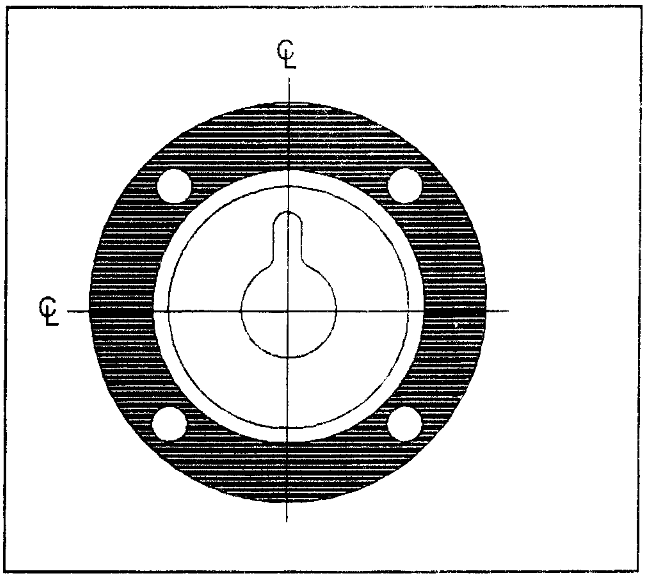
100555

13. Install the mainshaft assembly into the transmission case.

14. Install the main drive gear bearing and the main drive gear assembly into the transmission case.


101452

15. Apply sealant to the main drive gear bearing retainer mating surface. Use P/N 1052942 or the equivalent. Do not seal off the oil hole.



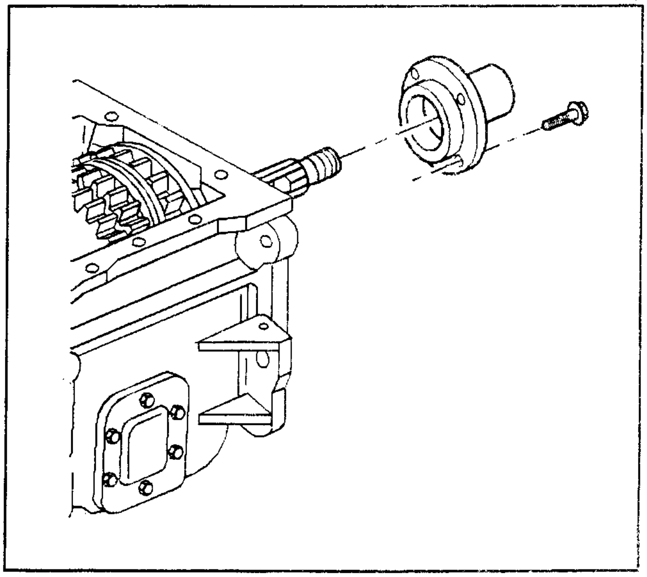
101455

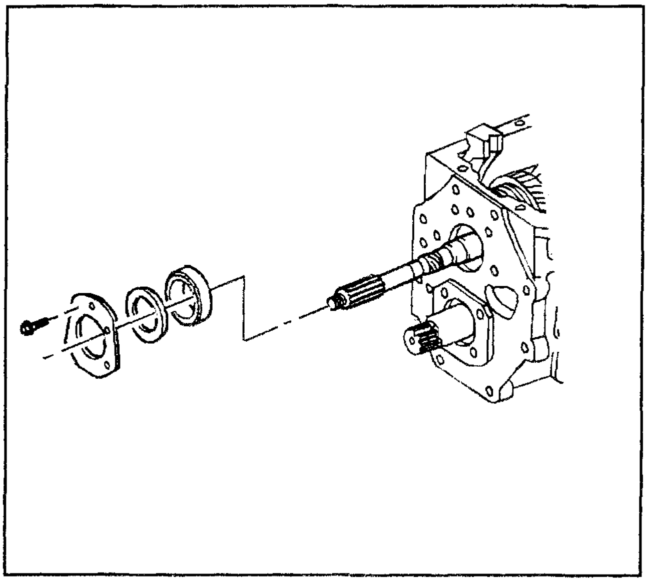
16. Install the main drive gear bearing retainer. Position the retainer with the oil hole at the top-center position. Install the main drive gear bearing retainer bolts.

Tighten

16.1. Tighten the main drive gear bearing retainer bolts to 31 N·m (23 lb ft).

16.2. Tighten the mainshaft bearing retainer plate bolts to 35 N·m (26 lb ft).


100530

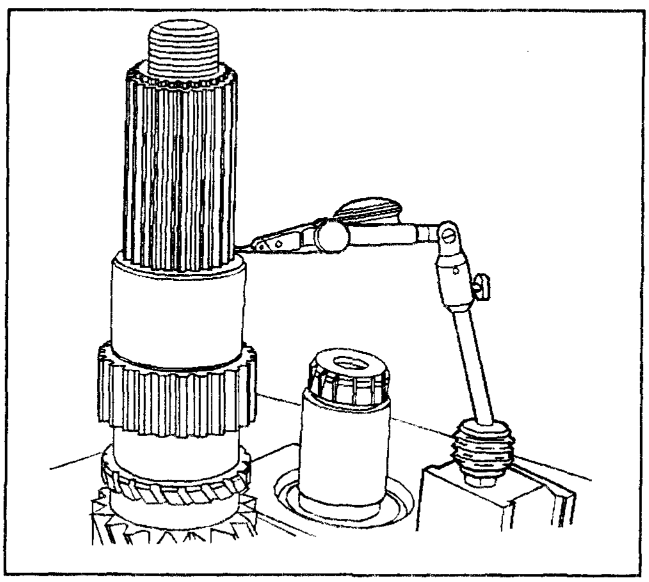


102253

17. Install the following parts:
    17.1. The mainshaft rear bearing cup
    17.2. The shim(s)
    17.3. The bearing retainer plate
    17.4. The mainshaft bearing retainer plate bolts

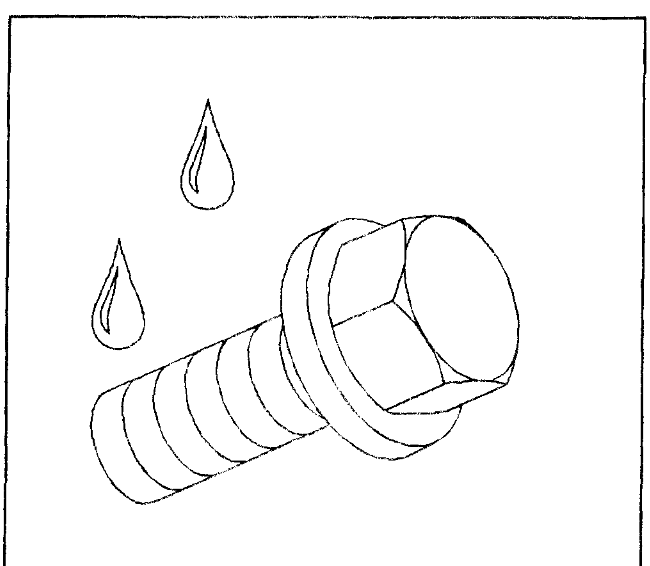
    Tighten

    Tighten the bolts finger tight only.



101459

18. Measure the mainshaft end play using the following procedure:
    18.1. Set the dial indicator up on the end of the mainshaft.
    18.2. Use a screwdriver or the equivalent to lift the mainshaft up and down to measure the end play.
    18.3. The mainshaft end play should be 0.05–0.15 mm (0.002–0.006 in). Add or remove shim(s) under mainshaft bearing retainer plate in order to adjust.
    18.4. Remove the mainshaft bearing retainer plate bolts.



102236

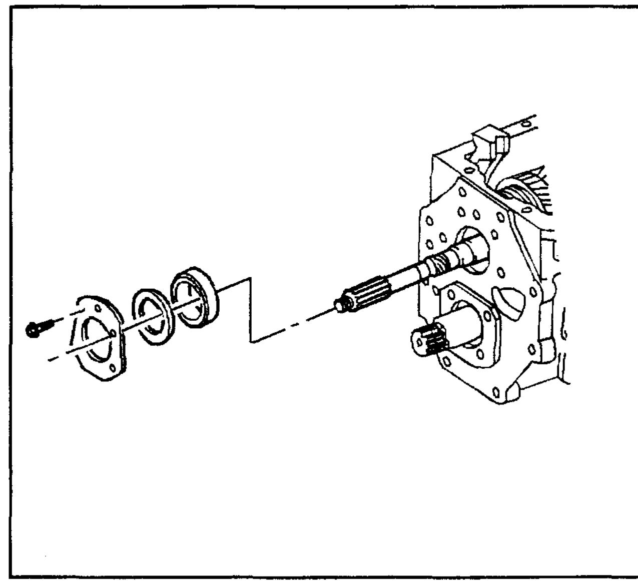
19. Apply sealant to the bolt threads.

    Use Loctite® or Dri-Loc® 201 or the equivalent.

20. Install the mainshaft bearing retainer plate bolts.

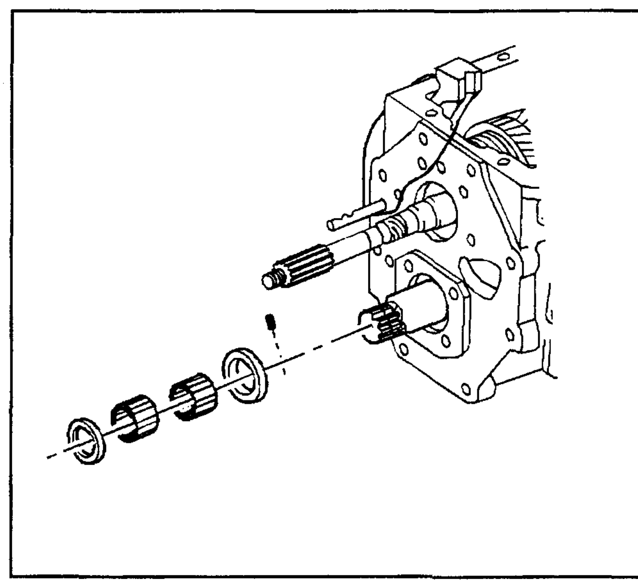
    Tighten

    Tighten the bolts to 35 N·m (26 lb ft).



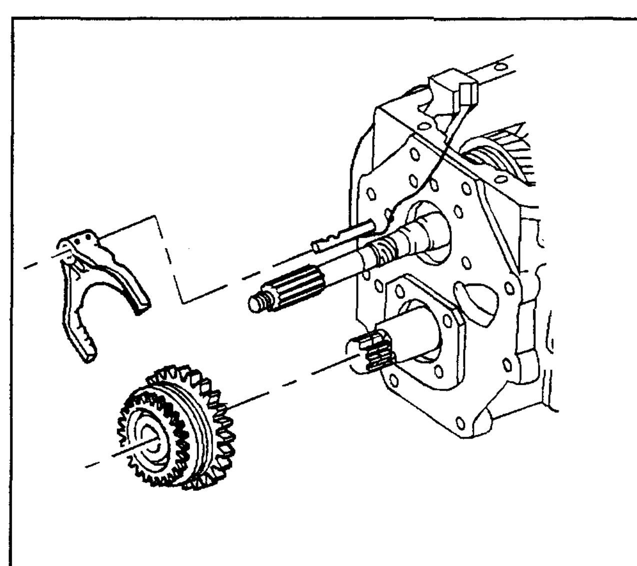
102253

21. Install the following parts:
    21.1. The countershaft thrust washer retainer pin
    21.2. The countershaft thrust washer
    21.3. The 5th speed gear bearings
    21.4. The spacer

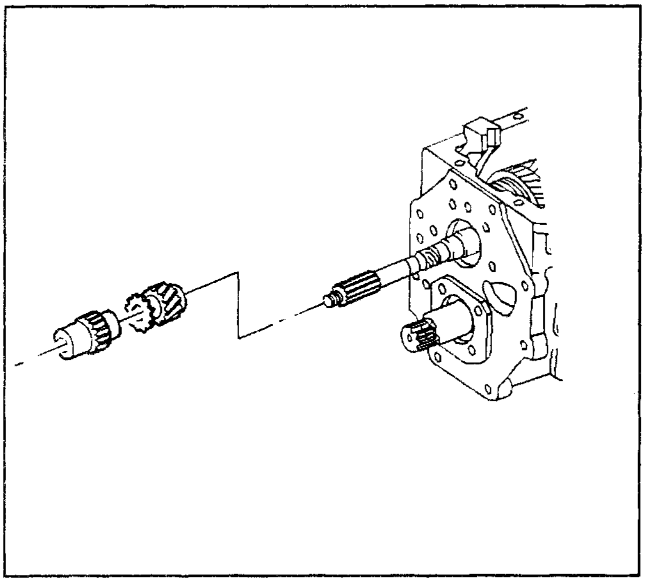


101036

22. Install the 5th speed gear assembly onto the 5th speed shift shaft and the countershaft. Slide 5th speed gear fork and the 5th speed gear assembly onto the shift shaft.

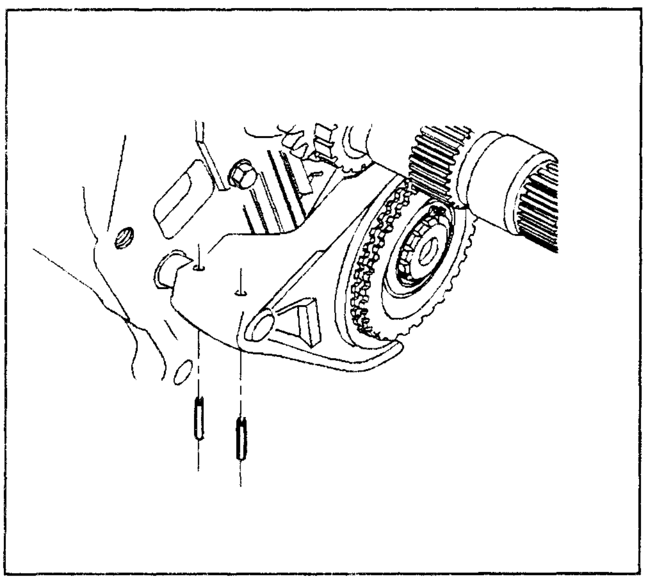


101448



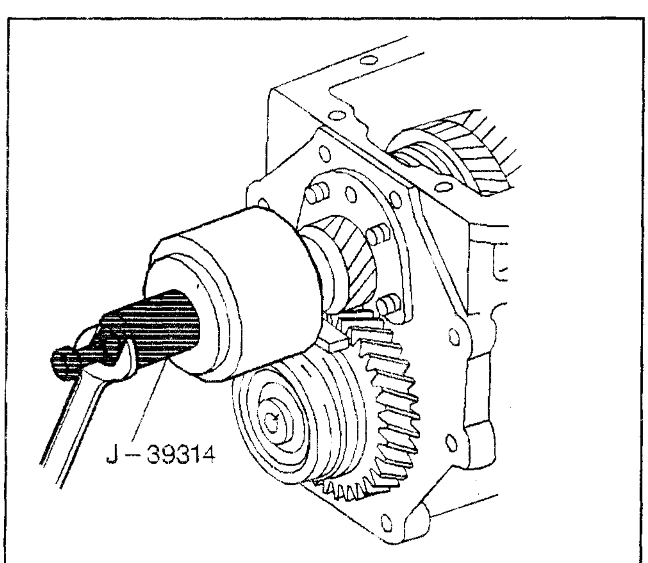
100553

23. Install the 5th speed gear clutch gear retainer ring.



100547

24. Install the 5th speed gear shift fork roll pins. Support the fork and drive the roll pins downward from the top of the fork.



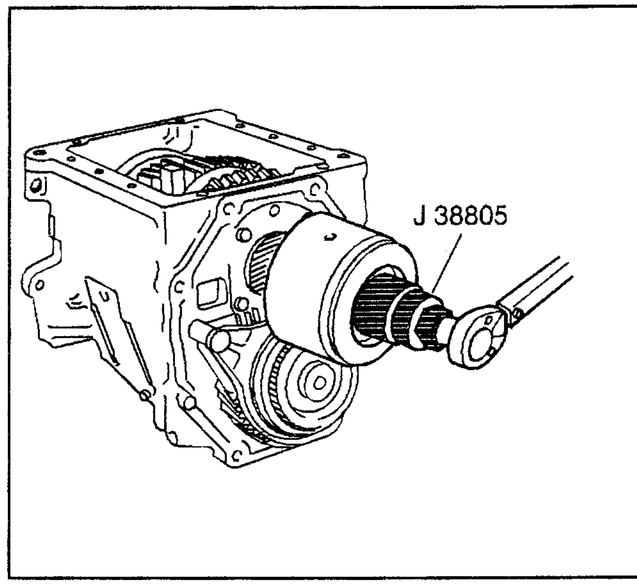
101471

25. (4WD models) Install the vibration damper to the mainshaft. Move the synchronizer sleeves to lock the transmission into two gears at once. Use the *J 39314*.

26. (4WD models) Install the mainshaft washer and nut. Use the *J 38805*.

Tighten

Tighten the mainshaft nut to 441 N·m (325 lb ft).

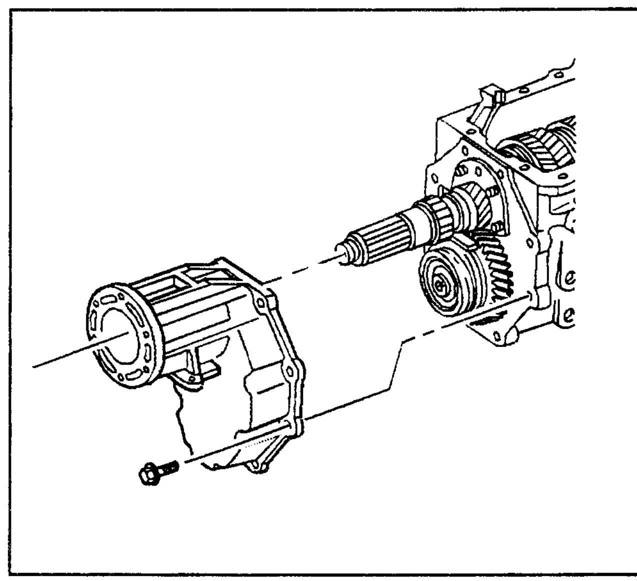


100535

27. (4WD models) Install the rear oil retainer to the transmission case.

Tighten

Tighten the bolts to 54 N·m (40 lb ft).

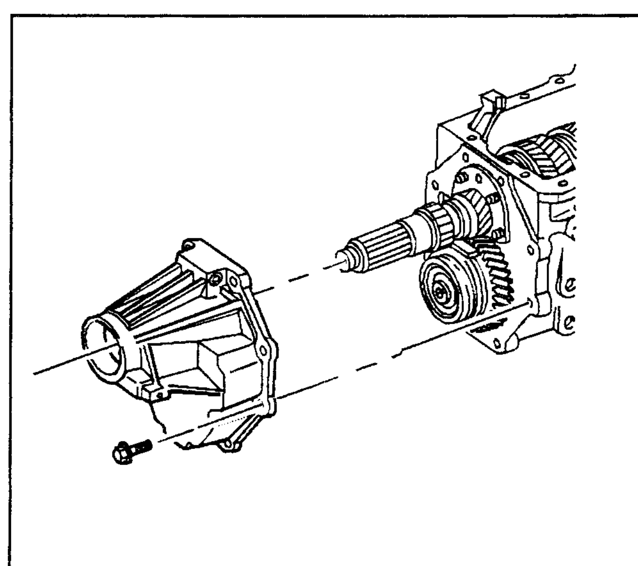


102243

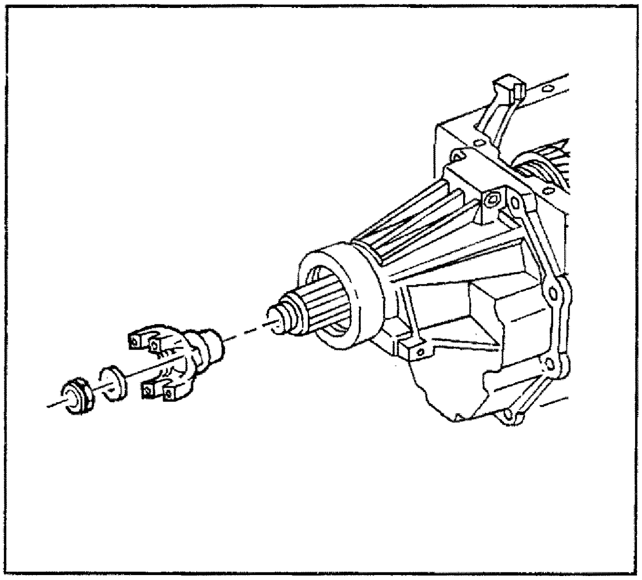
28. (RWD models) Install the rear oil retainer to the transmission case.

Tighten

Tighten the bolts to 54 N·m (40 lb ft).



100532



100520

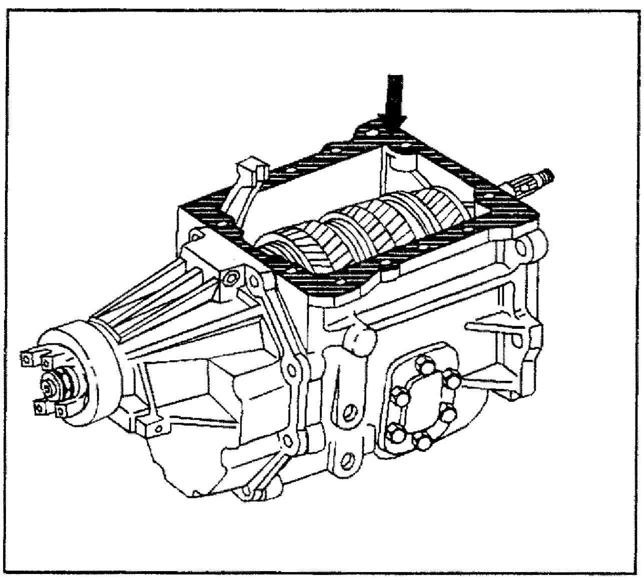
29. (RWD models) Install the following parts:
    29.1. The yoke assembly.
    29.2. The spline seal
    29.3. The washer
    29.4. A new nut. Shift the transmission into 1st gear to aid the tightening of the yoke nut.

    Tighten

    Tighten the yoke nut to 441 N·m (325 lb ft).

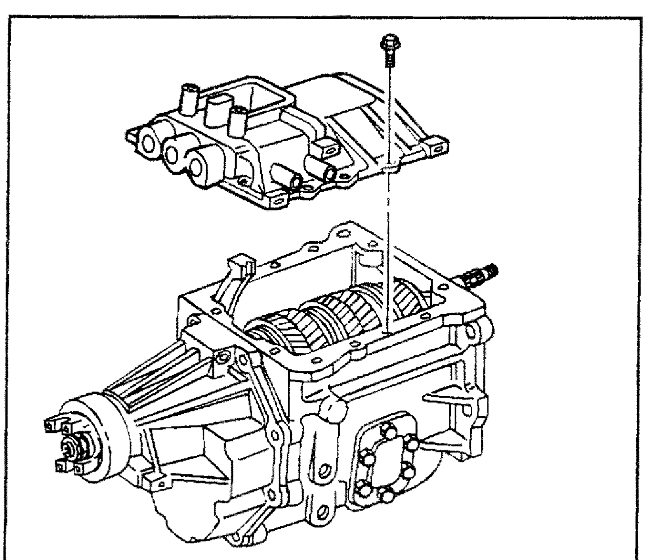
Important: Do not use any lubricant other than Castrol® Syntorq LT transmission fluid or the equivalent. Using other lubricants may cause transmission failure.

30. Fill the transmission with the proper amount of lubricant. Refer to *Lubrication Specifications.*



101493

31. **Apply sealer to the mating surfaces of the transmission cover. Use P/N 1052942 or the equivalent.**



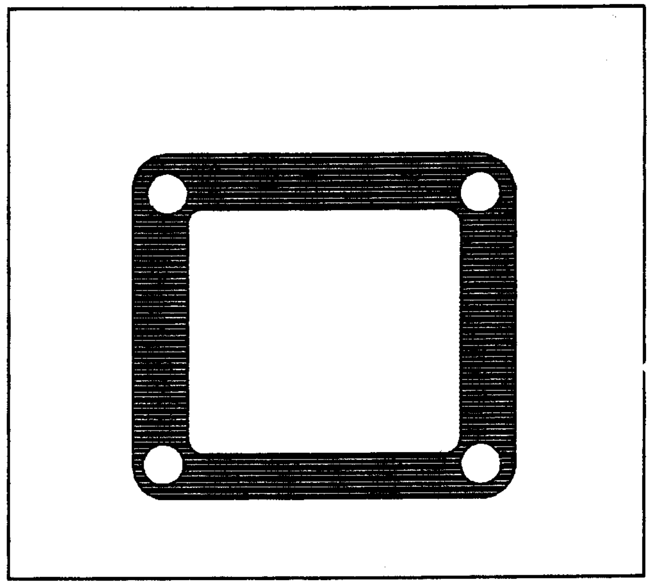
101476

32. Install the shift cover to the transmission case.

    Tighten

    Tighten the bolts to 23 N·m (17 lb ft).

33. Apply sealer to the shift cover side of the shift tower isolator plate. Use P/N 1052942 or the equivalent.



101498

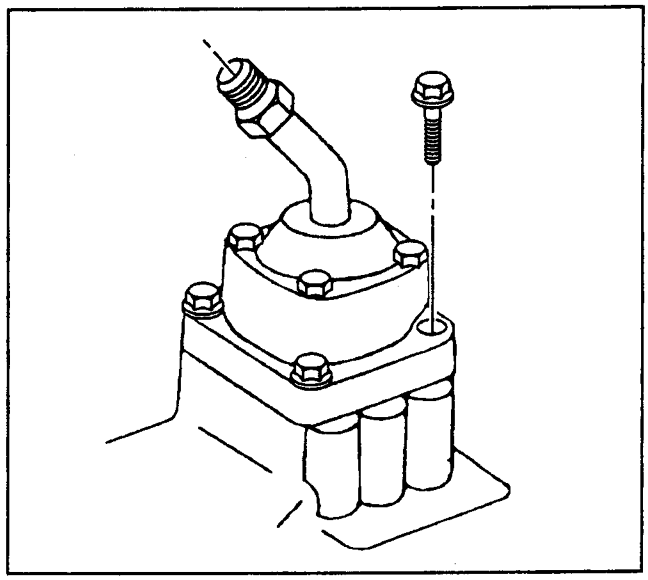
34. Install the shift tower isolator plate to the shift cover.

    Install the shift tower to the isolator plate.

    Install the shift tower to shift cover bolts.

    Tighten

    Tighten the bolts to 6 N·m (53 lb in).

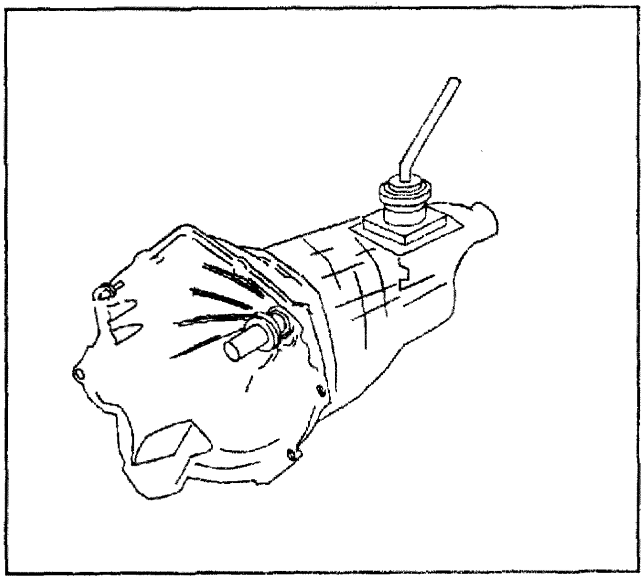


178851

Description and Operation

Transmission Description and Operation

Identify transmissions by the number of forward gears and the measured distance (in millimeters) between centerlines of the mainshaft and the countershaft.



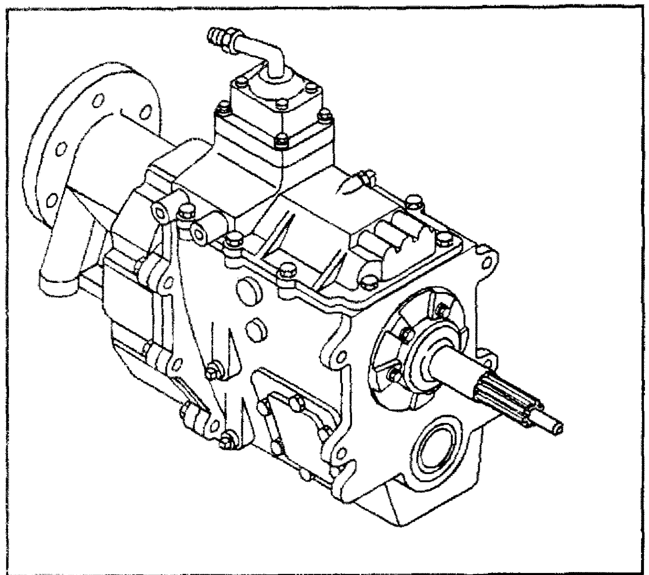
1327

The New Venture Gear NV3500 (85 mm) five—speed overdrive manual transmission is identified by the RPO M50 for four wheel drive vehicles and RPO MG5 for rear wheel drive (RWD) vehicles.

The transmission has the following features:

- Constant mesh helical gearing for reduced noise
- A two–piece aluminum housing.
- Synchronized shifting in all forward gears
- A shift tower mounted shift lever.

Identify the transmissions by the number of forward gears and the measured distance (in millimeters) between centerlines of the mainshaft and the countershaft.



102867

The New Venture Gear NV4500 (109 mm) five—speed manual transmission is available as RPO MW3.

The transmission has the following features:

- Synchronized shifting in all forward gears
- Constant mesh helical gearing for reduced noise
- Overspeed inhibitor from low to first speed gears
- Dual cone low speed gear and 1ST speed gear synchronizer
- A shift tower mounted shift lever

Special Tools and Equipment

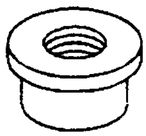
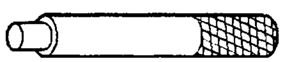
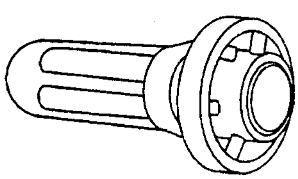
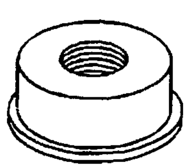
Illustration	Part Number Description
 102587	J 3880 Extension Housing Bearing Installer
 2015	J 8092 Universal Driver Handle
 12375	J 22834 Extension Housing Seal Installer
 102588	J 38856 Countershaft Bearing Cone And Retainer Installer

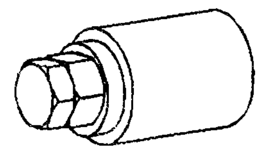
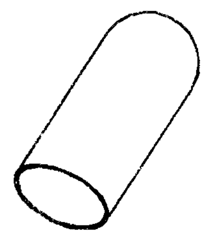
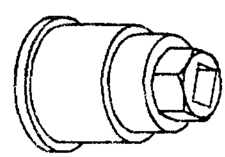
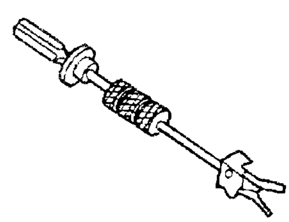
Illustration	Part Number Description
 102592	J 39314 Vibration Damper Installer
 102580	J 22828 Gear And Bearing Installer
 102584	J 38805 Output Shaft Nut Socket
 4855	J 23907 Slide Hammer

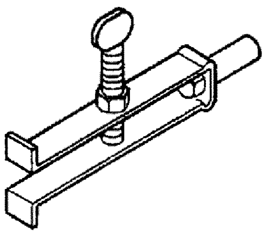
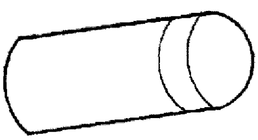
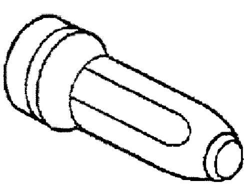
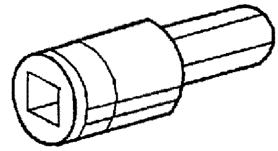
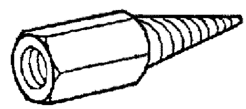
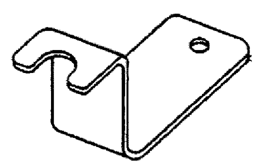
Illustration	Part Number Description
 4862	J 26941 Output Shaft Oil Seal Remover
 4884	J 36502 Output Shaft Seal Installer
 1342	J 36503 Extension Housing Seal Installer

Illustration	Part Number Description
 4869	J 36511 OilFill Plug Hex Bit (17 mm)
 4856	J 36825 Output Shaft Oil Seal Remover
 400483	J 42371 Quick Connect Disengagement Tool