

2010 Transmission

Automatic Transmission - 6T30/6T40/6T45 - Equinox & Terrain

SYMPTOMS - AUTOMATIC TRANSMISSION

NOTE: Use the symptom tables only if the following conditions are met:

- Refer to Diagnostic Starting Point - Vehicle .
- There are no DTCs set.
- The control modules can communicate via the serial data link.
- Review the system operation in order to familiarize yourself with the system functions. Refer to Transmission General Description and Transmission Component and System Description .

VISUAL/PHYSICAL INSPECTION

Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

INTERMITTENT

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to Testing for Intermittent Conditions and Poor Connections .

SYMPTOM LIST

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- Fluid Diagnosis
 - Transmission Fluid Level and Condition Check
 - Fluid Pressure High or Low
 - Automatic Transmission Fluid Leaks
 - Fluid Leak Diagnosis
- Noise and Vibration Diagnosis
 - Whine/Growl Noise
 - Noise and Vibration Analysis
 - Torque Converter Diagnosis
- Range Performance Diagnosis
 - No Park
 - No Drive in All Ranges
 - No Reverse Gear

- Shift Quality Feel Diagnosis
 - Harsh Garage Shift
 - Harsh or Late First, Second, Third, and Fourth Shift
 - Harsh First and Reverse Shift
 - Harsh or Late Second and Sixth Shift
 - Harsh or Late Third, Fifth, and Reverse Shift
 - Harsh Fourth, Fifth, and Sixth Shift
- Shift Pattern
 - No First and Reverse Gears
 - No First, Second, Third, and Fourth Gear
 - No Second and Sixth Gear
 - No Fourth, Fifth, and Sixth Gear
 - No Third, Fifth, and Reverse Gear
- Torque Converter Diagnosis
 - Torque Converter Diagnosis
 - No Torque Converter Clutch Apply
 - No Torque Converter Clutch Release
- Symptom Not Found or No Symptom Detected
 - Transmission Fluid Level and Condition Check
 - Road Test
 - Line Pressure Check

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY INSPECTION

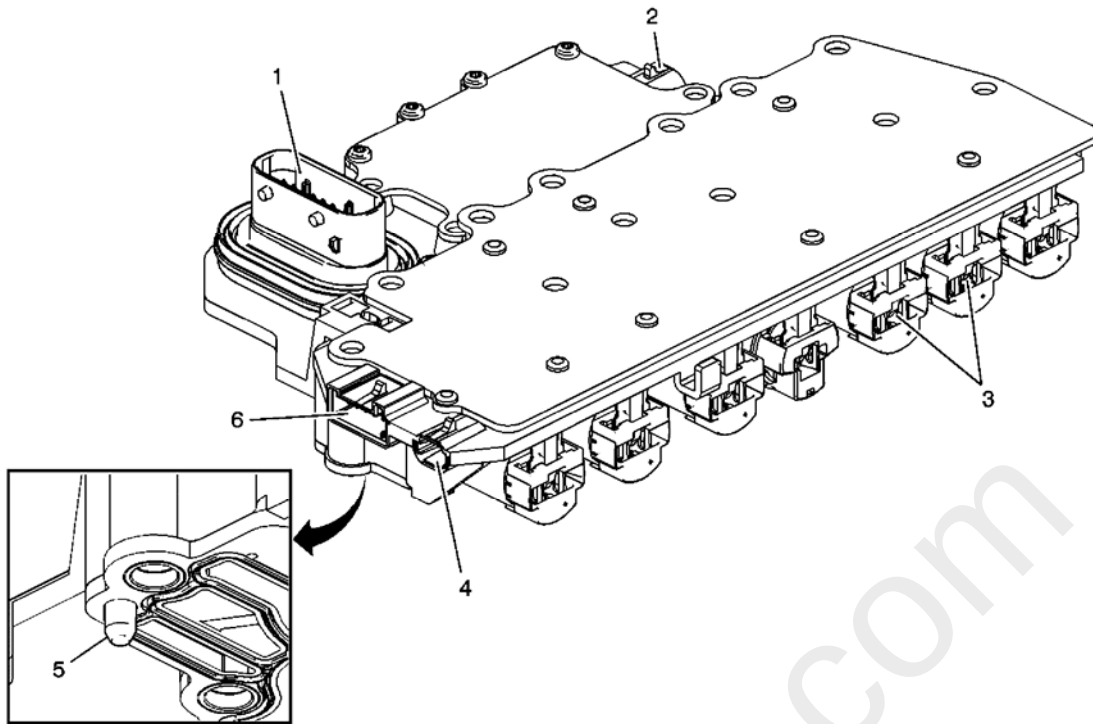


Fig. 1: View Of Control Solenoid Valve & Transmission Control Module Assembly
Courtesy of GENERAL MOTORS CORP.

1. Inspect the control solenoid valve assembly connectors and pins (1, 2, 4, 6) for the following conditions:
 - Damage
 - Bent pins
 - Debris
 - Broken retaining tab
 - Contamination
2. Ensure no metallic debris is inside the connectors near the terminal pins.
3. Inspect the control solenoid valve assembly solenoid leads (3) for contamination or metallic debris.
4. Inspect the 2 control solenoid valve assembly filter plate retaining tabs (5) for cracks and ensure proper tension when filter plate is attached.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY INPUT SHAFT SPEED/OUTPUT SHAFT SPEED INPUT TEST

Special Tools

- **EL 35616:** GM-Approved Terminal Test Kit
- **EL 38522:** Variable Signal Generator

For equivalent regional tools, refer to **Special Tools** .

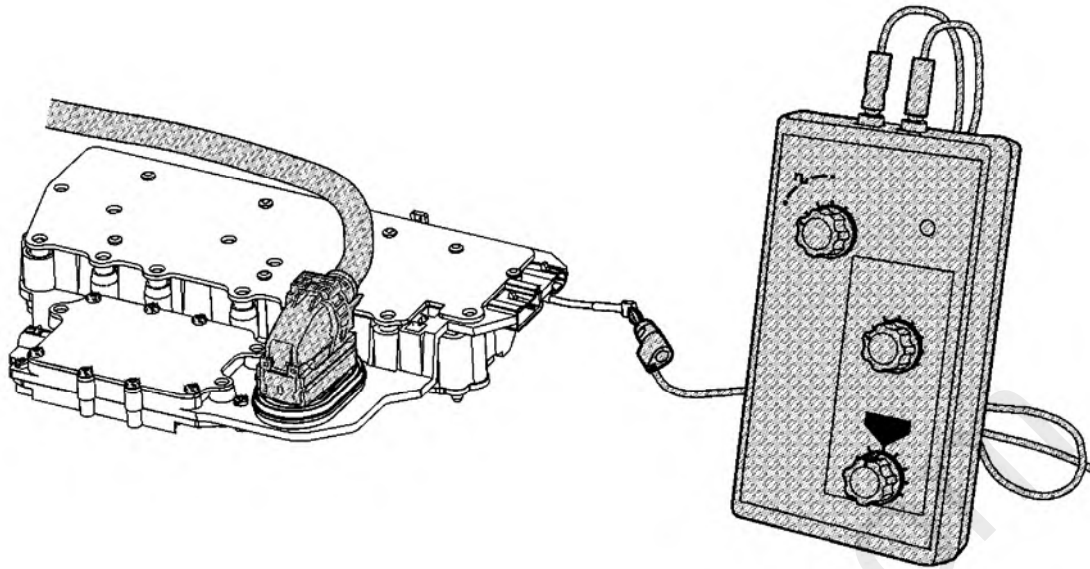


Fig. 2: View Of Special Tool & Control Solenoid Valve and Transmission Control Module Assembly
Courtesy of GENERAL MOTORS CORP.

The purpose of this test is to provide a simulated input/output speed sensor (ISS/OSS) signal to the control solenoid valve assembly ISS/OSS input circuits.

Transmission Input Speed Sensor

1. Ignition OFF, disconnect the ISS wiring harness connector X3 (1) from the control solenoid valve assembly.
2. Ignition ON, test for 11-14 volts at terminal B.
 - If not within the specified range, replace the control solenoid valve assembly. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .
3. Ignition OFF, using the **EL 35616**: terminal test kit, connect the **EL 38522**: variable signal generator red lead to the ISS signal circuit terminal A on the TCM.
4. Connect the black lead from the **EL 38522**: variable signal generator to ground.
5. Set the **EL 38522**: variable signal generator to 5 volts, the frequency to 300 Hz, and the percent duty cycle to 50 or the normal position.
6. Ignition ON, verify with a scan tool the Transmission ISS parameter is between 495-505 RPM.
 - If not within the specified range, replace the control solenoid valve assembly. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .

Transmission Output Speed Sensor

1. Ignition OFF, disconnect the OSS wiring harness connector X4 (2) from the control solenoid valve assembly.

2. Ignition ON, test for 11-14 volts at terminal B.
 - If not within the specified range, replace the control solenoid valve assembly. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .
3. Ignition OFF, using the **EL 35616:** terminal test kit, connect the **EL 38522:** variable signal generator red lead to the OSS signal circuit terminal A on the TCM.
4. Connect the black lead from the **EL 38522:** variable signal generator to ground.
5. Set the **EL 38522:** variable signal generator to 5 volts, the frequency to 300 Hz, and the percent duty cycle to 50 or the normal position.
6. Ignition ON, verify with a scan tool the Transmission OSS parameter is between 745-825 RPM.
 - If not within the specified range, replace the control solenoid valve assembly. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Replacement** .

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY CLEANING

The control solenoid valve assembly cleaning procedure is a specific software based routine, which resides in the TCM. This procedure is activated by the scan tool and is used to cycle the solenoids and valves in the control solenoid valve assembly in an attempt to dislodge debris and free up the valves after a performance diagnostic trouble code (DTC) has set. When the cleaning procedure is completed, the DTC enable criteria should be run again, to see if the DTC concern has been corrected.

1. Operate the transmission to achieve 70°-90°C (158°-194°F).
2. With a scan tool, select the Service Cleaning Procedure. Initiate the cleaning procedure.
3. When the cleaning procedure is completed, shut OFF the ignition for 30 seconds.
4. Restart the engine and operate the vehicle based on the criteria specified in Conditions for Running the DTC.
5. Observe if the applicable DTC or DTCs have run and passed to verify if the cleaning procedure was effective.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY SOLENOID PERFORMANCE TEST

Special Tools

- **DT-48616:** Control Solenoid Test Plate
- **DT-48616-10:** Adapter Harness

For equivalent regional tools, refer to **Special Tools** .

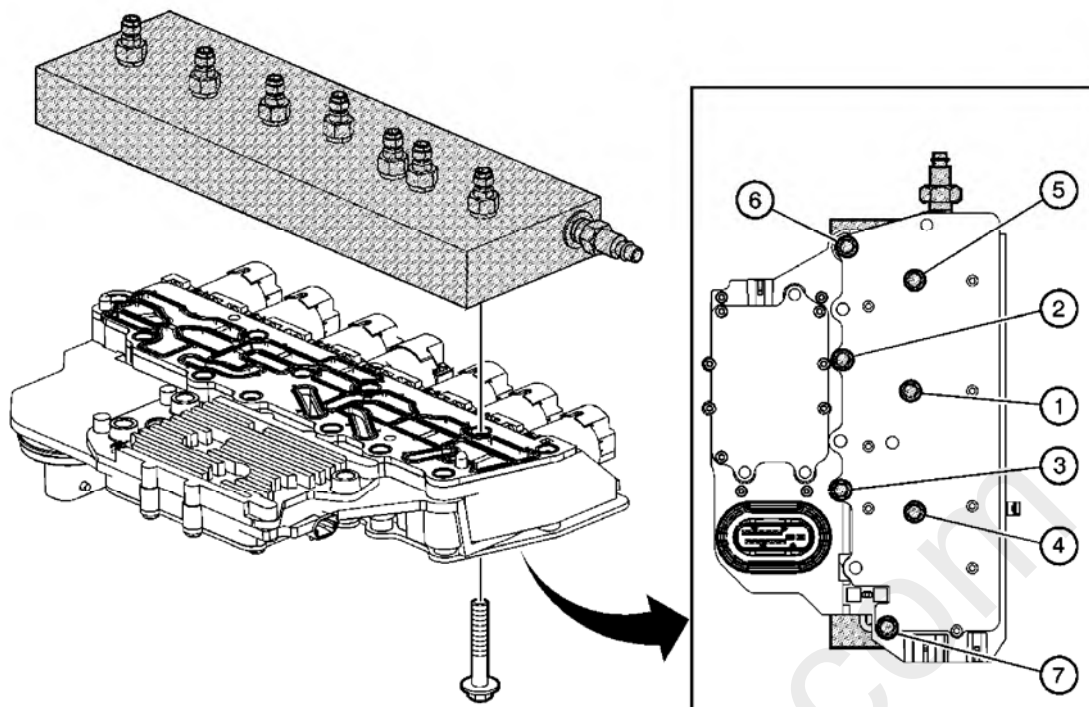


Fig. 3: Identifying Control Solenoid (W/Body & TCM) Valve Assembly Test Points
Courtesy of GENERAL MOTORS CORP.

The purpose of this procedure is to test the functionality of the control solenoid valve assembly solenoids for a gross stuck open or stuck closed condition. **DT-48616:** test plate is bolted to the control solenoid valve assembly on the valve body mounting surface. Pressurized air is passed into the aluminum test block, through the control solenoid valve assembly solenoid passage and back to a pressure gauge on the test block. The pressure gauge indicates open if air pressure is passed through the solenoid, or closed if the solenoid is unable to pass air through. A scan tool is used to command the solenoids ON and OFF. While watching the pressure gauge, one can determine the valve functionality. The recommended shop air pressure for this test is 90-100 psi.

1. Remove the control solenoid valve assembly from the transmission.

NOTE: **Drain the TCM of excess transmission fluid before attaching to test block and use caution when attaching air to test block air inlet.**

2. Bolt the **DT-48616:** test plate to the control solenoid valve assembly on the valve body mounting surface. Use the bolts and washers supplied with the tool to attach the test block. Tighten the bolts to 5 N.m (44 lb in) using a center out alternating torque sequence.
3. Install the pressure gauge to the affected solenoid air port. Reference component to air port table.
4. Connect the shop air pressure line to the **DT-48616:** test plate air psi inlet port.
5. Connect **DT-48616-10:** harness to vehicle and control solenoid valve assembly.

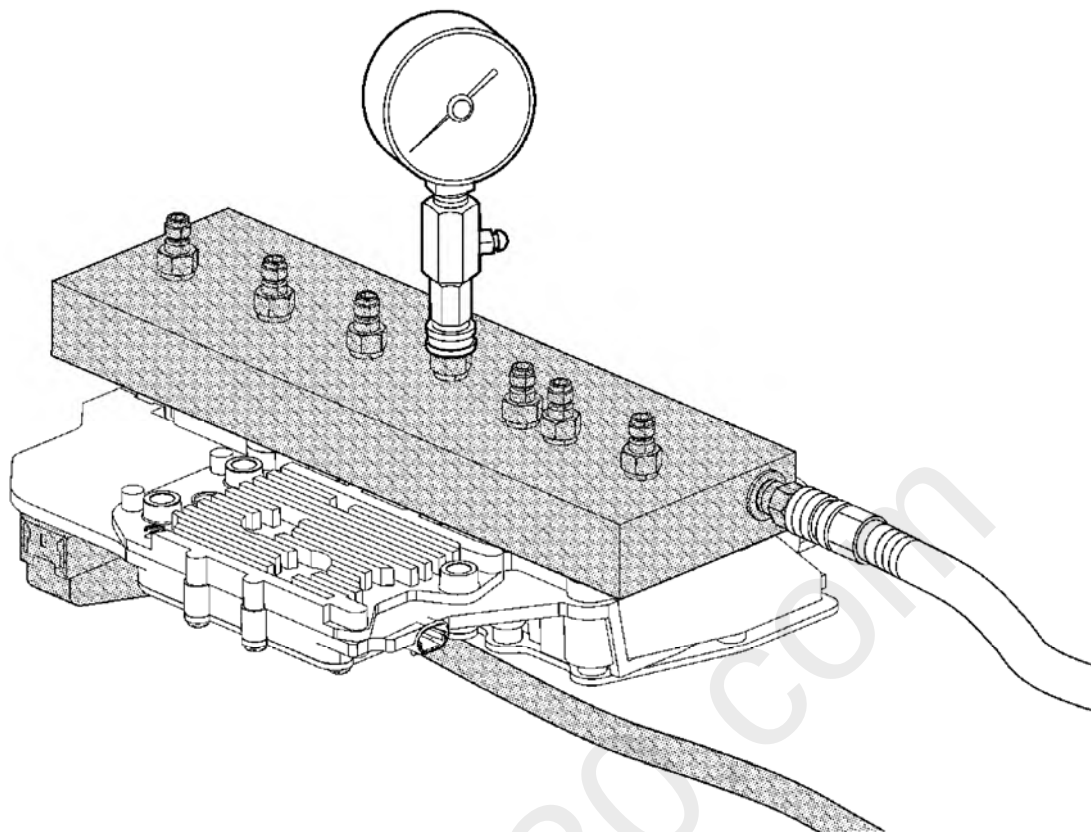


Fig. 4: Valve Pressure Test
 Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not energize the solenoids for more than two minutes or the solenoids could be damaged.

6. Ignition ON, with a scan tool command the solenoid in question On and Off. Watch the air pressure gauge and look for the change in pressure as you command the valve On and Off. The valve should allow air pressure to flow through the valve port to the gauge with a result of pressure reading on the gauge. If the valve is stuck closed, no pressure change will occur. Command the solenoid valve On and Off several times to determine the state of the solenoid valve in question. Release the air pressure in the gauge between pressurization tests.

Control Solenoid Valve Assembly Solenoid Performance Test Plate to Component Identification

Component	Port On Test Plate	Commanded State	
		ON	OFF
PC Solenoid 2, 35R	F	Full pressure to gauge	No pressure to gauge
PC Solenoid 3, R1/456	G	Full pressure to gauge	No pressure to gauge
PC Solenoid 4, 2-6	B	Full pressure to gauge	No pressure to gauge
PC Solenoid 5, 1234	C	Full pressure to gauge	No pressure to gauge

Shift Solenoid	D	Full pressure to gauge	Below full pressure to gauge
Line Pressure Control Solenoid	A	Command to highest setting, full pressure to gauge	Command to lowest setting, below 620.5 kPa (90 psi) to gauge
TCC PC Solenoid	E	Full pressure to gauge	No pressure to gauge

NOTE: With the key on engine off (KOEO), the TCM will normally cycle some of the transmission solenoids On and Off to facilitate keeping the ports and solenoids clean and free of debris. This dither function is a normal activity and will cause the valves to cycle open and closed quickly when the TCM is powered up. This can cause the psi gauge to flicker high and low as the valves open and close. This may cause some air to exit the ports where the psi gauge is not connected as those solenoids cycle on and off.

TRANSMISSION ADAPTIVE VALUES LEARN

Transmission Adaptive Values Learn is a procedure for 6 speed automatic transmissions in which a series of tests are run to allow the transmission control module (TCM) to learn individual clutch characteristics. Once the clutch data is learned, Transmission Adaptive Values Learn translates it into the adaptive data cells, which the TCM uses for clutch control during shifts. The scan tool provides initiation of the Transmission Adaptive Values Learn procedure. This procedure is to be used following transmission repair.

The Transmission Adaptive Values Learn procedure must be performed when one of the following repairs have been made to the vehicle. Failure to perform the procedure after one of the following repairs may result in poor transmission performance, as well as transmission DTCs being set:

- Transmission internal service/overhaul
- Valve body repair or replacement
- Control solenoid valve assembly replacement
- TCM software/calibration update
- Any service in response to a shift quality concern

IMPORTANT: Ensure the following conditions are met before performing the Transmission Adaptive Values Learn procedure:

- Drive wheels are blocked
- Parking brake is applied
- Service brake is applied
- Zero percent throttle and no external engine RPM control
- Transmission fluid temperature (TFT) is between 70-100°C (158-212°F)
- Transmission gear selector has been cycled from Park to Reverse 3 times in order to purge air from the reverse clutches.

1. Use the scan tool to navigate to Transmission Adaptive Values Learn by selecting the following:
 1. Module Diagnosis
 2. Transmission Control Module
 3. Configurations/Reset Functions
 4. Transmission Adaptive Values Learn

IMPORTANT: If at any time during the procedure, required conditions are not met, Transmission Adaptive Values Learn may abort and the process may need to be started again from the beginning.

2. Use the scan tool to perform the Transmission Adaptive Values Learn procedure. As the procedure is being performed, the scan tool data display will provide operator instructions. Follow the scan tool instructions, as required.
3. Once the procedure is complete, shut OFF the engine and power down the TCM. You will lose communication to the scan tool.
4. Restart the engine. This will complete the Transmission Adaptive Values Learn procedure.

IMPORTANT: When the Transmission Adaptive Values Learn procedure is completed, the transmission will remain in a neutral state.

TROUBLESHOOTING

If the Transmission Adaptive Values Learn will not run and the above stated conditions have been met, ensure the following:

- TFT is between 70-100°C (158-212°F)
- Brakes and brake switch are functioning properly
- No active DTCs
- Closed throttle and engine RPM increases above 1,500 RPM while at entrance of the test
- Park/Neutral position switch is properly adjusted and functioning
- Line pressure control is able to provide 1,000 kPa and is within specifications
- Vehicle is not moving or vibrating excessively
- Clutches are properly assembled

TRANSMISSION FLUID LEVEL AND CONDITION CHECK

This procedure checks both the transmission fluid level, as well as the condition of the fluid itself.

CAUTION: Use Dexron VI transmission fluid only. Failure to use the proper fluid may result in transmission internal damage.

NOTE: Ensure the transmission has enough fluid in it to safely start the vehicle without

damaging the transmission. With the vehicle off and the transmission fluid temperature at approximately 20-25°C (68-77°F) there must be at least enough fluid to drain out of the fluid level hole. This will ensure that there is enough fluid in the sump to fill the components once the vehicle is started.

Non Dipstick Level Checking Procedure

1. Start the engine.
2. Depress the brake pedal and move the shift lever through each gear range, pausing for about 3 seconds in each range. Then move the shift lever back to PARK (P).
3. Allow the engine to idle 500-800 rpm for at least 3 minutes to allow any fluid foaming to dissipate and the fluid level to stabilize. Release the brake pedal.

NOTE: If the TFT reading is not at the required temperature, allow the vehicle to cool, or operate the vehicle until the appropriate TFT is reached. If the fluid temperature is below the specified range, perform the following procedure to raise the fluid temperature to the specification.
Drive the vehicle in second gear until the fluid temperature is at the specified temperature.

4. Keep the engine running and observe the transmission fluid temperature (TFT) using the Driver Information Center or a scan tool.

CAUTION: The transmission fluid level must be checked when the transmission fluid temperature (TFT) is at 85-95°C (185-203°F). If the TFT is not at this temperature, operate the vehicle or allow the fluid to cool as required. Setting the fluid level with a TFT outside this temperature will result in either an under or over-filled transmission. TFT 95°C under-filled, TFT 85°C over-filled. An under-filled transmission will cause premature component wear or damage. An over-filled transmission will cause fluid to discharge out the vent tube, fluid foaming, or pump cavitation.

5. Raise the vehicle on a hoist. The vehicle must be level, with the engine running and the shift lever in the PARK range.

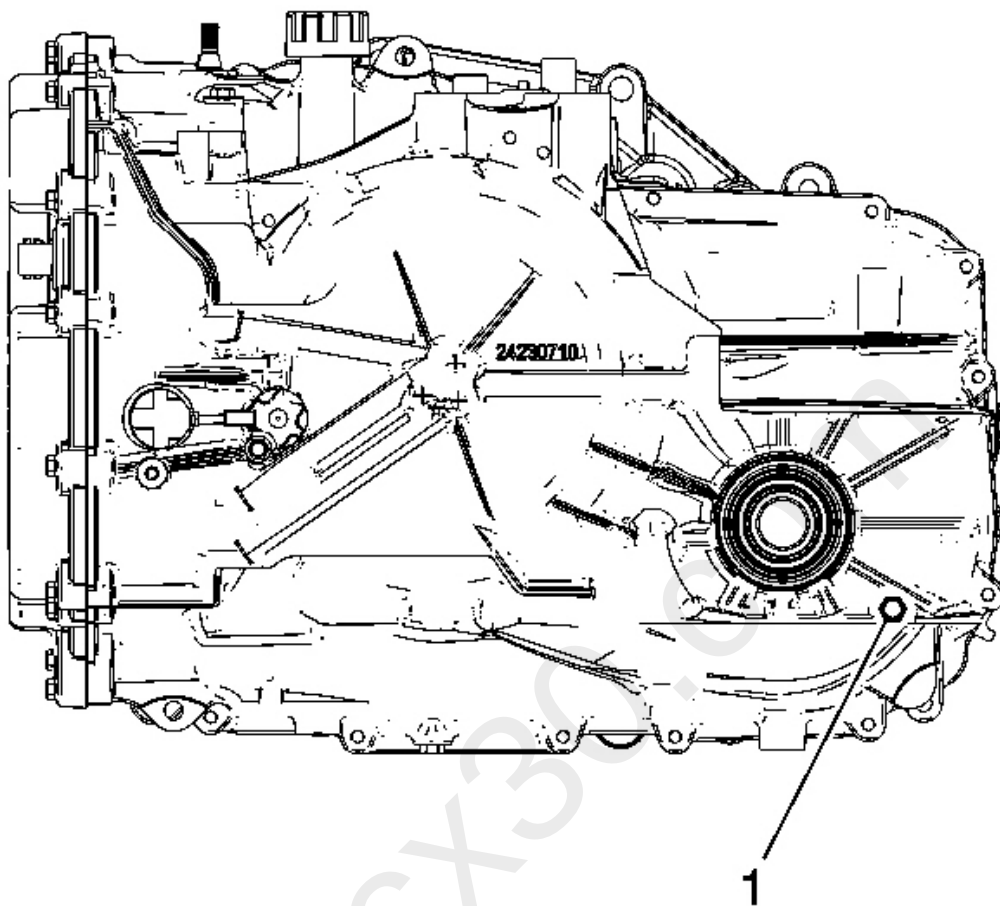


Fig. 5: View of Oil Level Plug
Courtesy of GENERAL MOTORS CORP.

6. While the vehicle is idling, remove the oil level set plug. Allow any fluid to drain.

Oil Level Plug (1)

- If the fluid is flowing as a steady stream, wait until the fluid begins to drip.
 - If no fluid comes out, add fluid until fluid drips out.
7. Inspect the fluid color. The fluid should be red or dark brown.
 - If the fluid color is very dark or black and has a burnt odor, inspect the fluid for excessive metal particles or other debris. A small amount of "friction" material is a "normal" condition. If large pieces and/or metal particles are noted in the fluid, flush the oil cooler and cooler lines and overhaul the transmission. If there are no signs of transmission internal damage noted, replace the fluid, repair the oil cooler, and flush the cooler lines.

- Fluid that is cloudy or milky or appears to be contaminated with water indicates engine coolant or water contamination. Refer to **Engine Coolant/Water in Transmission**.
8. Inspect for external leaks. Refer to **Fluid Leak Diagnosis**.
 9. If the fluid was changed, reset the transmission oil life monitor if applicable.

Dipstick Level Checking Procedure (If equipped)

1. Park the vehicle on a level surface, apply the parking brake and place the shift lever in PARK (P). Start the engine.
2. Depress the brake pedal and move the shift lever through each gear range, pausing for about 3 seconds in each range. Then move the shift lever back to PARK (P).
3. Allow the engine to idle 500-800 rpm for at least 3 minutes to allow any fluid foaming to dissipate and the fluid level to stabilize. Release the brake pedal.
4. Keep the engine running and observe the transmission fluid temperature (TFT) using the Driver Information Center or a scan tool.

CAUTION: The transmission fluid level must be checked when the transmission fluid temperature (TFT) is at 85-95°C (185-203°F). If the TFT is not at this temperature, operate the vehicle or allow the fluid to cool as required. Setting the fluid level with a TFT outside this temperature will result in either an under or over-filled transmission. TFT 95°C under-filled, TFT 85°C over-filled. An under-filled transmission will cause premature component wear or damage. An over-filled transmission will cause fluid to discharge out the vent tube, fluid foaming, or pump cavitation.

NOTE:

- If the TFT reading is not at the required temperature, allow the vehicle to cool, or operate the vehicle until the appropriate TFT is reached. If the fluid temperature is below the specified range, perform the following procedure to raise the fluid temperature to the specification.
- Check the transmission fluid level when the TFT is at between 85-95°C (185-203°F). The fluid level rises as fluid temperature increases, so it is important to ensure the transmission fluid temperature is at the specified temperature.

Drive the vehicle in second gear until the fluid temperature is at the specified temperature.

5. The vehicle must be level, with the engine running and the shift lever in the PARK range.
6. Remove the dipstick and wipe it with a clean rag or paper towel.
7. Inspect the fluid color. The fluid should be red or dark brown.
 - If the fluid color is very dark or black and has a burnt odor, inspect the fluid for excessive metal particles or other debris. A small amount of "friction" material is a "normal" condition. If large

pieces and/or metal particles are noted in the fluid, flush the oil cooler and cooler lines and overhaul the transmission. If there are no signs of transmission internal damage noted, replace the fluid, repair the oil cooler, and flush the cooler lines.

- Fluid that is cloudy or milky or appears to be contaminated with water indicates engine coolant or water contamination. Refer to **Engine Coolant/Water in Transmission**.

8. Install the dipstick. Wait three seconds and then remove it again.

NOTE: Always check the fluid level at least twice. Consistent readings are important to maintaining proper fluid level. If inconsistent readings are noted, inspect the transmission vent cap to ensure it is clean and unclogged.

NOTE: It is not necessary to get the fluid level all the way up to the MAX mark. Anywhere within the crosshatch band is acceptable.

9. Check both sides of the dipstick and read the lower level.

10. Install and remove the dipstick again to verify the reading.

NOTE: Do not add more than one half pint (0.25L) at a time without rechecking the level. Once the oil is on the dipstick bullet, it will not take much more fluid to raise the fluid level into the crosshatch band. Do not overfill. Also, if the fluid level is low, inspect the transmission for leaks. Refer to **Fluid Leak Diagnosis**.

11. If the fluid level is not within the crosshatch band, and the transmission temperature is at 90°C (194°F), add or drain fluid as necessary to bring the level into the crosshatch band. If the fluid level is low, add only enough fluid to bring the level into the crosshatch band.

12. If the fluid level is in the acceptable range, install the dipstick.

13. If the fluid was changed, reset the transmission oil life monitor if applicable.

Fluid Condition Inspection

- Inspect the fluid color. The fluid should be red in color. The fluid may also turn brown from normal use, and does not always indicate contamination.

NOTE: Fluid that is very dark or black and has a burnt odor usually indicates contamination or overheating.

- If the fluid color is very dark or black and has a burnt odor, inspect the fluid for excessive metal particles or other debris which may indicate transmission damage. Refer to **Road Test** to verify transmission operation. Change the transmission fluid if no other conditions are found.
- Fluid that is cloudy or milky or appears to be contaminated with water indicates engine coolant or water contamination. Refer to **Engine Coolant/Water in Transmission**.

LINE PRESSURE CHECK

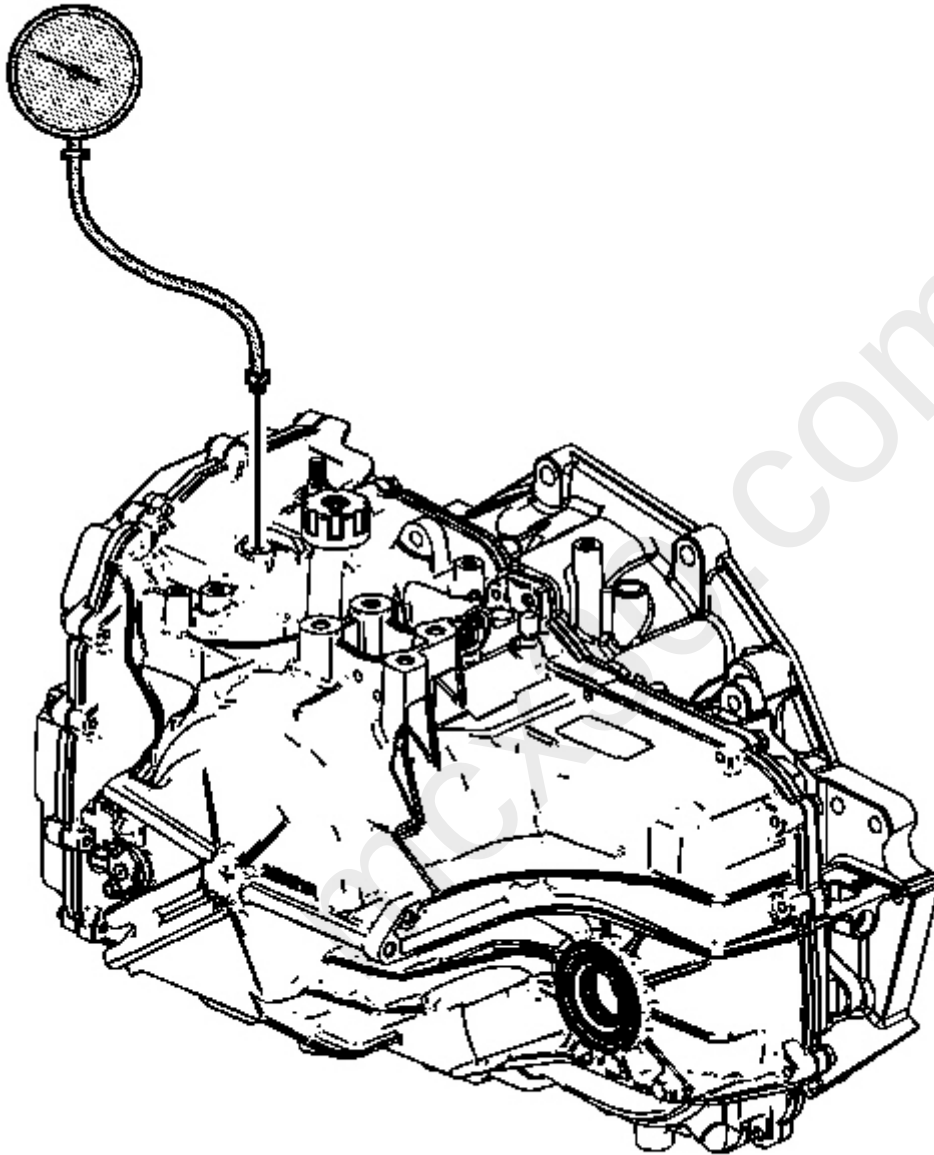


Fig. 6: Line Pressure Check
Courtesy of GENERAL MOTORS CORP.

SPECIAL TOOLS

J-21867: Pressure Gauge

CHECK

WARNING: Keep the brakes applied at all times in order to prevent unexpected vehicle motion. Personal injury may result if the vehicle moves unexpectedly.

1. Install a scan tool.
2. Start the engine.
3. Inspect the transmission for the proper fluid level. Refer to **Transmission Fluid Level and Condition Check**.
4. Use the scan tool to inspect for any active or stored diagnostic trouble codes.
5. Inspect the manual linkage at the transmission for proper function.
6. Turn the engine OFF.
7. Remove the line pressure test hole plug.
8. Install the **J-21867**: pressure gauge.
9. Access the scan tool transmission output controls for the line PC solenoid.
10. Start the engine.

NOTE:

- In order to achieve accurate line pressure readings, the following procedure must be performed at least 3 times in order to gather uniform pressure readings.
- The scan tool is only able to control the line PC solenoid in **PARK** and **NEUTRAL** with engine speeds below 1500 RPM. This protects the clutches from extreme high or low line pressures.

11. Use the scan tool to increase and decrease the Line PC Solenoid in increments of approximately 100 KPa (15 psi). The scan tool commands the increment values automatically.
12. Allow the pressure to stabilize between increments.
13. Compare the pressure readings on the scan tool to those indicated on the **J-21867**: gauge.
14. If the pressure readings vary greatly, refer to **Fluid Pressure High or Low**.
15. Turn the engine OFF.
16. Remove the **J-21867**: gauge.

CAUTION: Refer to **Fastener Caution** .

17. Install the line pressure test hole plug and tighten to 12 N.m (106 lb in).

ROAD TEST

NOTE: **The Road Test Procedure should be performed only as part of the Symptom Diagnosis. Refer to Symptoms - Automatic Transmission.**

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 Step-In Downshifts
- Manual Downshifts
- Coasting Downshifts
- Manual Gear Range Selection
 - REVERSE
 - Driver Shift Control

NOTE: **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. Refer to Transmission Fluid Level and Condition Check.
- 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:

- Inspect for proper transmission fluid level. Refer to Transmission Fluid Level and Condition Check.
- Inspect for any diagnostic trouble codes (DTCs) that may have set during the testing. Refer to the applicable DTC.
- Monitor the scan tool data for any abnormal readings or data.
- Inspect for fluid leaks. Refer to Fluid Leak Diagnosis.

ELECTRICAL FUNCTION CHECK

Perform this procedure first in order to ensure the electronic transmission components are functioning properly. If these components are not checked, a simple electrical condition could be misdiagnosed.

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 **Control Module References** for typical data values. Data that is questionable may indicate a concern.

- Engine Speed
- Transmission ISS
- Transmission OSS
- Vehicle Speed
- IMS
- Commanded Gear
- Gear Ratio
- Line PC Sol. Pressure Cmd.
- Brake Switch
- ECT, Engine Data List
- Trans. Fluid Temp.
- TCM Temperature
- Calc. Throttle Position
- Ignition Voltage
- TFP Switch 1
- TFP Switch 3
- TFP Switch 4
- TFP Switch 5
- PC Sol. 2 Pressure Cmd.
- PC Sol. 3 Pressure Cmd.
- PC Sol. 4 Pressure Cmd.
- PC Sol. 5 Pressure Cmd.
- Shift Solenoid 1
- Shift Solenoid 2
- TCC PC Sol. Duty Cycle
- TCC Slip Speed

5. Check the garage shifts.

1. Apply the brake pedal and ensure the parking brake is set.
2. Move the gear selector through the following ranges:
 1. PARK to REVERSE
 2. REVERSE to NEUTRAL
 3. NEUTRAL to DRIVE
 4. DRIVE to REVERSE
 5. REVERSE to DRIVE
3. Pause 2 to 3 seconds in each gear position.
4. Verify the gear engagements are immediate (less than 2 seconds to complete if trans fluid temperature is above 20°C) and not harsh. Note that these shifts may be almost imperceptible in some applications. Using the scan tool to monitor Transmission ISS achieving 0 rpm can be used to check delay in these cases.

NOTE: Harsh engagement may be caused by any of the following conditions:

- High engine idle speed-Compare engine idle speed to desired idle speed.
- Incorrect line pressure-Investigate Line PC Sol. Pressure Cmd. kPa (psi), also perform Line Pressure Check.
- A default condition caused by certain DTCs that result in maximum line pressure to prevent clutch slippage.
- Incomplete adapting or incorrect adapting-Repeat maneuver multiple times to see if shift quality improves. If it does not, refer to the service procedures for Harsh Garage Shift.

NOTE: 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
- Incorrect line pressure-Investigate Line PC Sol. Pressure Cmd. kPa (psi), also perform Line Pressure Check.
- Cold transmission fluid temperature (TFT)-Use the scan tool to determine TFT.
- Selector linkage-Inspect and adjust as necessary.
- Incomplete adapting or incorrect adapting-Repeat maneuver multiple times to see if delay improves. If it does not, refer to the service procedures for Harsh First and Reverse Shift.

6. Monitor transmission range on the scan tool, transmission data list.
 1. Apply the brake pedal and ensure the parking brake is set.
 2. Move the gear selector through all ranges.

3. Pause 2 to 3 seconds in each range.
4. Return gear selector to PARK.
5. Verify that all selector positions match the scan tool display.
7. Check throttle position input.
 1. Apply the brake pedal and ensure the parking brake is set.
 2. Ensure the gear selector is in PARK.
 3. Monitor the scan tool Calc. Throttle Position while increasing and decreasing engine speed with the throttle pedal. The scan tool Calc. Throttle Position percentage 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 TCM calculates the upshift points based primarily on 2 inputs: throttle position and vehicle speed. When the TCM determines that conditions are met for a shift to occur, the TCM commands the shift by varying current to the appropriate PC solenoids to control oncoming and offgoing clutch pressures.

Perform the following steps:

1. Monitor the following scan tool parameters:
 - Calc. Throttle Position
 - Vehicle Speed
 - Engine Speed
 - Transmission ISS
 - Transmission OSS
 - Commanded Gear
 - TCC PC Sol. Pressure Cmd.
 - TCC Slip Speed
 - TFP Switch 1
 - TFP Switch 3
 - TFP Switch 4
 - TFP Switch 5
 - PC Sol. 2 Pressure Cmd.
 - PC Sol. 3 Pressure Cmd.
 - PC Sol. 4 Pressure Cmd.
 - PC Sol. 5 Pressure Cmd.
 - Shift Solenoid 1 and 2
2. Place the gear selector in the DRIVE position.
3. Accelerate the vehicle using a steady throttle position between 15 and 20 percent. Hold the throttle

steady.

4. As the transmission upshifts, there should be a noticeable shift feel or engine speed change within 1 to 2 seconds of the commanded gear change. The PC solenoid pressure command should change to "YES" for the oncoming clutch and the PC solenoid pressure command should change to "NO" for the offgoing clutch.
5. Note any harsh, soft or delayed shifts or slipping. Note any noise or vibration.
6. The TCC feel may not be noticeable. In many applications the TCC will apply after the 1-2 shift and TCC events will not be easily detected using engine speed.

NOTE: This transmission is equipped with an electronically controlled capacity clutch (ECCC), which allows operation of the clutch without fully locking to the torque converter cover. The clutch maintains a small amount of slippage, approximately 20 RPM, in 2nd, 3rd, 4th, 5th, and 6th gears, depending on the vehicle application. ECCC was developed to reduce the possibility of noise, vibration or chugle caused by TCC apply. Full lockup is available at highway speeds on some applications.

7. Monitor TCC PC solenoid pressure command while driving and check TCC slip speed when the pressure command indicates that the TCC is commanded to apply:

When the TCC applies, slip speed should be controlled to below 100 RPM when the transmission is not shifting and the throttle is held steady. If the TCC slip exceeds this value for more than 6 seconds after the TCC PC Sol. Pressure Command indicates that the TCC is commanded on:

- Check for DTCs.
- Refer to **Torque Converter Diagnosis.**

PART THROTTLE STEP-IN DOWNSHIFTS

1. Place the gear selector in the DRIVE position.
2. Accelerate the vehicle at light throttle (5-15 percent) until 3rd gear is just achieved.
3. Quickly increase throttle angle until commanded gear indicates that a downshift to 2nd gear is commanded.
4. Verify that the transmission downshifts within 2 seconds of the throttle movement.
5. Repeat steps 2 to 4 at higher speed to achieve 4th gear and then step in to command a 4th gear to 3rd gear downshift.
6. Repeat steps 2 to 4 at higher speed to achieve 5th gear and then step in to command a 5th to 4th gear downshift.
7. Repeat steps 2 to 4 at higher speed to achieve 6th gear and then step in to command a 6th gear to 5th gear downshift.
8. Note any harsh, soft or delayed shifts or slipping. Note any noise or vibration.

MANUAL DOWNSHIFTS

Manual downshift testing is not required since all vehicles equipped are also equipped with some form of Driver Shift Control(DSC). The TCM will automatically override DSC downshifts to protect the transmission from damage.

Coasting Downshifts

1. Place the gear selector in the DRIVE position.
2. Accelerate the vehicle to 6th gear with the TCC applied.
3. Release the throttle and apply the brakes
4. Verify that the downshifts occur as commanded by monitoring gear ratio, which should change after commanded gear changes.

MANUAL GEAR RANGE SELECTION

This application does not utilize manual forward gear ranges.

Reverse

Perform the following test using a 10-15 percent throttle position.

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.

Driver Shift Control (DSC)

Refer to the owner's manual for specific instructions on the type of DSC available in this application. Utilize the DSC to ensure that the transmission responds appropriately to driver's commands. The TCM will upshift automatically when maximum engine speed is achieved and will protect from any downshift which may cause excessive engine RPMs.

TORQUE CONVERTER DIAGNOSIS

TORQUE CONVERTER STATOR

The torque converter stator roller clutch can have 2 different malfunctions.

- The stator assembly freewheels in both directions.
- The stator assembly remains locked up in both directions.

POOR ACCELERATION AT LOW SPEED - STATOR ROLLER CLUTCH FREEWHEELS AT ALL TIMES

If the stator is freewheeling at all times, the vehicle tends to have poor acceleration from a standstill and at speeds below 48-55 km/h (30-34 mph). At speeds above 48-55 km/h (30-34 mph), the vehicle may act normally.

For poor acceleration at low speeds, 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 - STATOR ROLLER CLUTCH IS LOCKED UP AT ALL TIMES

If the stator is locked up at all times, performance is normal when accelerating from a standstill. Engine RPM and vehicle speed are limited or restricted at speeds above 48-55 km/h (30-34 mph). Visual examination of the converter may reveal a blue color from overheating.

TORQUE CONVERTER BEARING NOISE

NOTE: Do not confuse this noise with pump whine noise, which is usually noticeable in all gear ranges. Pump whine will vary with line pressure.

Torque converter whine is noticed 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 there is no slip speed across the bearings.

Perform a stall test to verify that the noise is actually coming from the torque converter:

1. Place your foot on the brake.
2. Put the gear selector in DRIVE.

CAUTION: You may damage the transmission if you depress the accelerator for more than 6 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

The torque converter clutch (TCC) is applied by fluid pressure, which is controlled by a TCC pressure control (PC) solenoid. This solenoid is part of the control solenoid valve assembly, which is located inside the automatic transmission assembly. The solenoid is controlled through a combination of computer controlled switches and sensors. Electronically controlled capacity clutch (ECCC) is controlled slip across the TCC.

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 should only occur during the apply, release, or ECCC conditions of the converter clutch. Shudder should never occur after the TCC is fully locked (approximately 0 RPM slip).

IF SHUDDER OCCURS DURING TCC APPLY, RELEASE, AND ECCC

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:

- The clutch is not engaging completely.
- The clutch is not releasing completely.
- The clutch is releasing and applying rapidly and continuously.

One of the following conditions may be causing the TCC Shudder to occur:

- Leaking turbine shaft/TCC seals
- A restricted release orifice
- A distorted clutch or converter cover due to long flexplate to converter bolts
- Defective friction material on the TCC plate

IF SHUDDER OCCURS AFTER TCC HAS LOCKED

Engine problems may go unnoticed under light throttle and load, but they become noticeable after the TCC has locked when going up a hill or accelerating.

Refer to **Symptoms - Engine Controls** in order to avoid misdiagnosis of TCC shudder and the unnecessary disassembly of a transmission or the unnecessary replacement of a torque converter.

TORQUE CONVERTER VIBRATION TEST

NOTE: **The Noise and Vibration Analysis procedure should be performed prior to performing this test.**

INDEXING TORQUE CONVERTER

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 flexplate balance.

1. Remove the torque converter bolts.
2. Rotate the torque converter one bolt position from the original marked position.

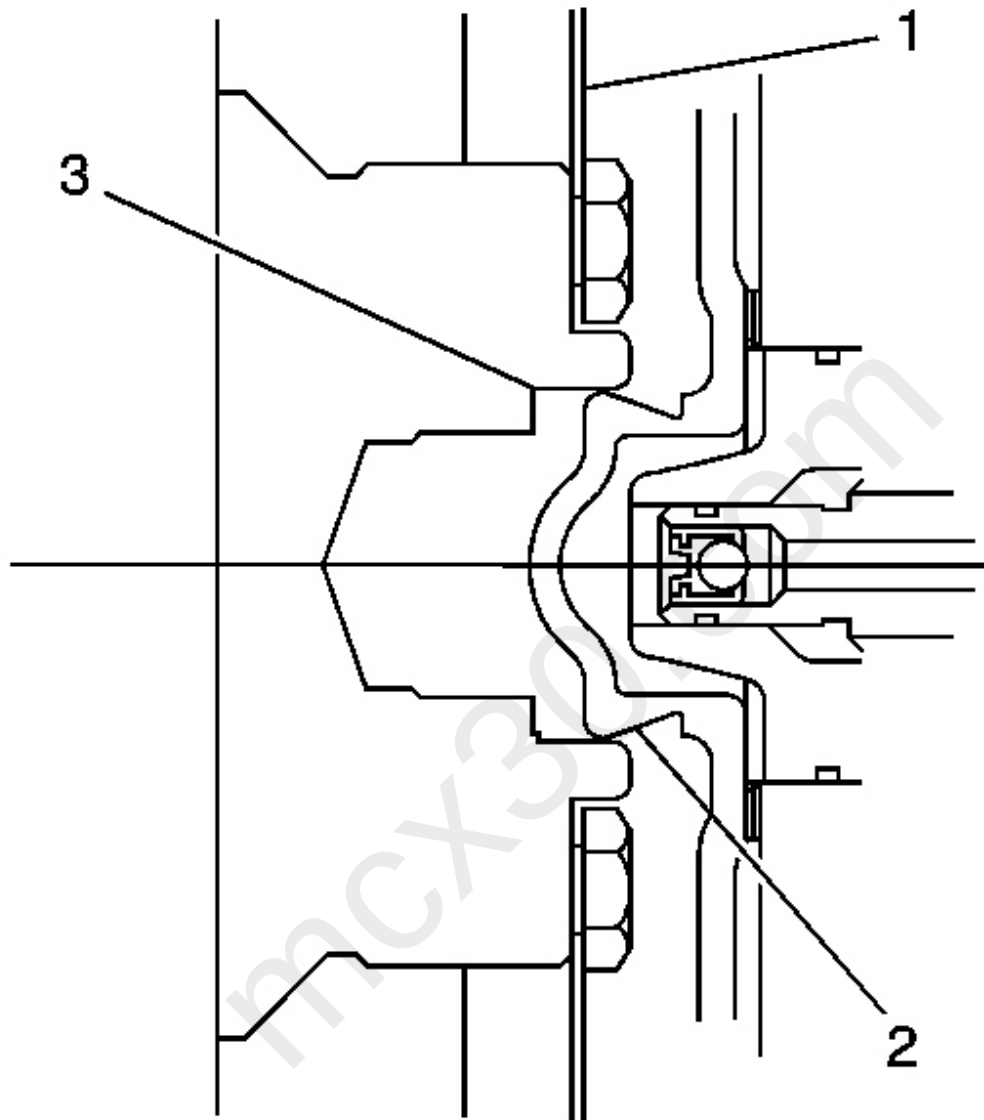


Fig. 7: View Of Torque Converter Hub In Engine Crankshaft
Courtesy of GENERAL MOTORS CORP.

CAUTION: When installing the torque converter to the flexplate, make sure to use specified bolts. DO NOT use longer bolts. Using longer bolts will result in deformation of the torque converter cover and cause internal damage.

CAUTION: Refer to Fastener Caution .

3. Align the torque converter pilot (2) in the engine crankshaft (3). Install the torque converter to flexplate bolts, and tighten according to **Fastener Tightening Specifications** .
4. Lower the vehicle.
5. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration.

Repeat this procedure until the best possible balance is obtained.

6. Install the torque converter access cover and bolts (if equipped) and tighten according to **Fastener Tightening Specifications** .

Torque Converter Replacement Guide

Condition	Action
• Transmission Fluid Oxidized/Discolored • Clutch Fiber Material	Do not replace the torque converter. Refer to <u>Transmission Fluid Level and Condition Check</u> .
Transmission Fluid Contaminated with Metal Particles	NOTE: Do not replace the torque converter for clutch system or gearset component damage. Fine metallic debris or clutch plate material that is suspended in the fluid will not cause damage to the internal torque converter components nor any internal transmission components.
Harsh Gear Shifts	Do not replace the torque converter. Refer to <u>Symptoms - Automatic Transmission</u> .
Noise-Whine	• Refer to <u>Symptoms - Automatic Transmission</u>. • Do not replace the torque converter if noise is present in Neutral/Park. Refer to <u>Symptoms - Engine Mechanical</u> .
Vibration-Out of Balance	Refer to Torque Converter Vibration Test in this procedure.
No Drive/Slips in Drive	Do not replace the torque converter until completing all engine and transmission diagnostics.
Idle Surge/Rough Idle	Do not replace the torque converter. Refer to <u>Symptoms - Engine Controls</u>
TCC Apply/Release Shudder	Do not replace the torque converter. Refer to Torque Converter Clutch Shudder in this procedure.
TCC Chuggle	Do not replace the torque converter. Refer to <u>Symptoms - Engine Controls</u> .
DTC P0741-TCC Stuck OFF/High Slip-Intermittent	Do not replace the torque converter.

Only	Refer to <u>DTC P0741 or P0742</u> diagnostic table.
DTC P0741-TCC Stuck OFF/High Slip	Do not replace the torque converter. Refer to <u>DTC P0741 or P0742</u> diagnostic table.
DTC P0742-TCC Stuck ON	Do not replace the torque converter. Refer to <u>DTC P0741 or P0742</u> diagnostic table.
Transmission Fluid Contaminated with Sludge/Metal Particles as a result of: • Engine Coolant/Oil • Pump damage • Drive sprocket support damage • Turbine/stator shaft damage • Internal converter damage with no damage found in the transmission	Replace the torque converter.
Poor Acceleration above 48 km/h (30 mph) - Good Launch	Do not replace the torque converter until completing all engine and transmission diagnostics. • Refer to Torque Converter Stator in this procedure. • Refer to <u>Symptoms - Engine Controls</u> .
Poor Launch - Good Acceleration above 48 km/h (30 mph)	Do not replace the torque converter until completing all engine and transmission diagnostics. • Refer to Torque Converter Stator in this procedure. • Refer to <u>Symptoms - Engine Controls</u> .
Stripped Converter Bolt Holes	• Replace the torque converter. • Inspect flexplate and refer to <u>Lower Engine Noise, Regardless of Engine Speed</u> .
Torque Converter Pilot Damaged	Replace the torque converter.
Torque Converter Hub surface is damaged - scored, raised/transferred metal.	Replace the torque converter.
External Leaks in the weld areas - hub, lug or closure weld.	Replace the torque converter.
Broken/Cracked Flexplate	Replace the torque converter.
Torque Converter Discolored/Overheated	Replace the torque converter.

CLUTCH PLATE DIAGNOSIS

COMPOSITION PLATES

Dry the plates and inspect the plates for the following conditions:

- Pitting
- Flaking
- Delamination-splitting or separation of bonded clutch material
- Wear
- Glazing
- Cracking
- Charring
- Chips or metal particles embedded in the lining

Replace a composition plate which shows any of these conditions.

STEEL PLATES

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 or apply plates
- Engine coolant or water 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 in between channels.
 - The valve train retainers are improperly installed.
 - The checkballs are misplaced.
 - Malfunctioning valves.
- The Teflon® seal rings are worn or damaged.

ENGINE COOLANT/WATER IN TRANSMISSION

CAUTION: The antifreeze or water will deteriorate the seals, gaskets and the glue that bonds the clutch material to the pressure plate. Both conditions may cause damage to the transmission.

If antifreeze or water has entered 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.
8. Inspect the rubber hose portion of the oil cooler lines for damage, if applicable. Refer to **Transmission Fluid Cooler Flushing and Flow Test**.

FLUID LEAK DIAGNOSIS

GENERAL METHOD

1. Verify that the leak is transmission fluid.

CAUTION: Do not clean using brake cleaner or other reactive solvents as these solvents can damage rubber gaskets, seals and bushings.

2. Thoroughly clean the suspected leak area using a rag.

NOTE: Do not idle vehicle, this will not actuate transmission systems, and do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis.

3. Operate the vehicle for 15-20 minutes under city driving conditions 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

CAUTION: Do not clean using brake cleaner or other reactive solvents as these solvents can damage rubber gaskets, seals and bushings.

1. Thoroughly clean the suspected leak area using a rag.
2. Apply an aerosol type leak tracing powder to the suspected leak area.

NOTE: Do not idle vehicle, this will not actuate transmission systems, and do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis.

3. Operate the vehicle for 15-20 minutes under city driving conditions 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. Operate the vehicle for 24 km (15 mi) or until normal operating temperatures are reached.
3. Detect the leak with the black light.
4. Make the necessary repairs.

FIND THE CAUSE OF THE LEAK

Pinpoint the leak and trace the leak 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 shaft or output shaft surface is scratched, nicked, or damaged
- Loose or worn bearing causing excess seal wear

POSSIBLE POINTS OF FLUID LEAKS

Transmission Valve Body Cover

- Incorrectly tightened bolts
- Improperly installed or damaged gasket/seal
- Damaged mounting face
- Incorrect gasket seal

Case Leak

- Damaged input speed sensor seal
- Damaged manual shaft seal
- Loose or damaged oil cooler lines/seals
- Worn or damaged axle shaft oil seal
- Loose line pressure pipe plug or fluid level pipe plug
- Porous casting
- Warped torque converter housing
- Damaged converter housing to case seal

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 torque converter housing

Leak at the Vent

- Overfilled system
- Water or coolant in the fluid; The fluid will appear milky
- Transmission case porous

- Incorrect fluid level indicator causing an overfilled system
- Plugged vent

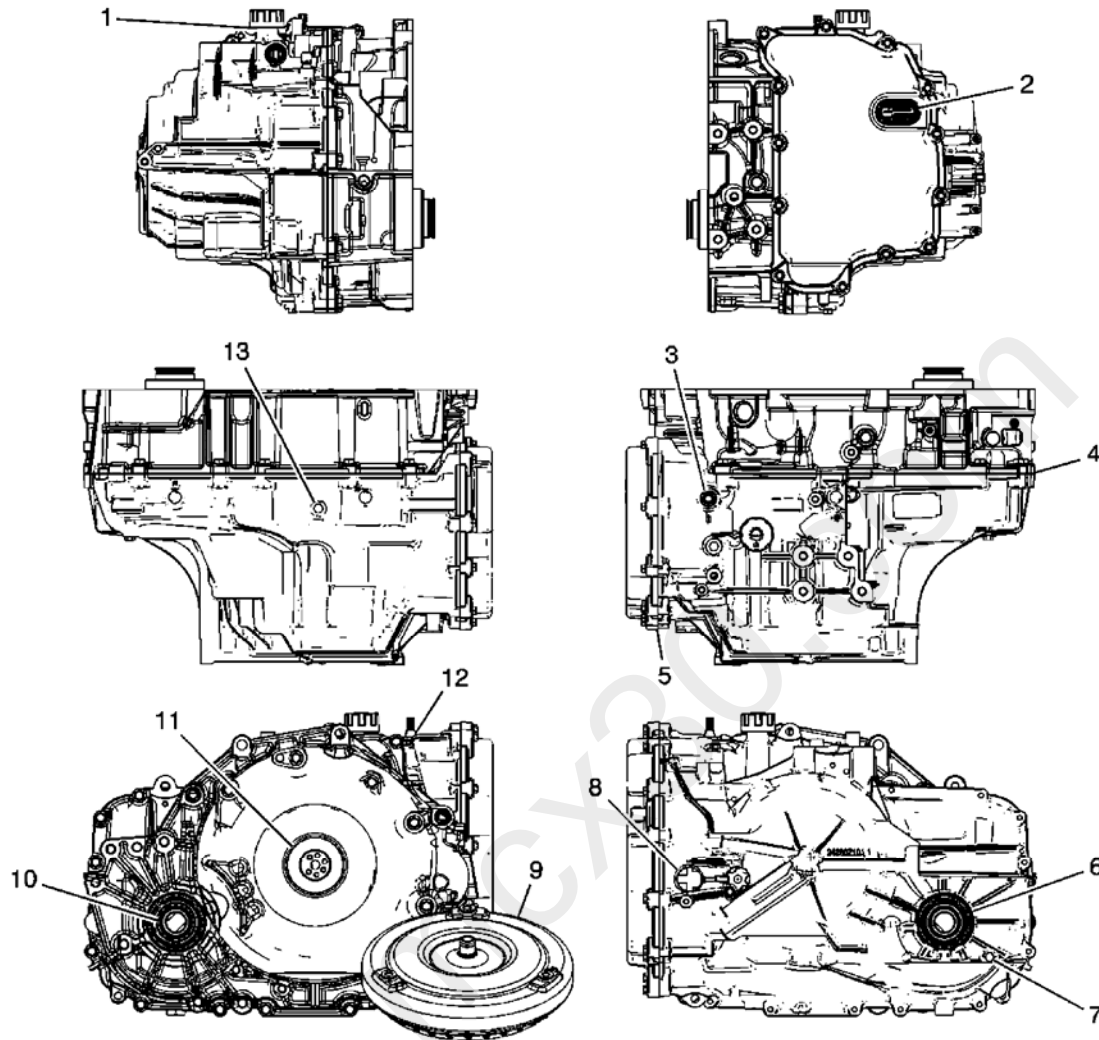


Fig. 8: Identifying Leak Inspection Points
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Fill Cap Seal
2	Control Valve Body Cover Hole Seal
3	Line Pressure Tap Plug
4	Converter Housing to Case Joint
5	Control Valve Body Cover Gasket
6	Drive Shaft Oil Seal Assembly
7	Oil Level Plug

8	A/Trans Input Speed Sensor Assembly O-Ring Seal
9	Torque Converter Assembly
10	Front Wheel Drive Shaft Oil Seal Assembly
11	Torque Converter Fluid Seal Assembly
12	Manual Shift Shaft Seal
13	Drain Plug

CASE POROSITY REPAIR

Some external leaks are caused by case porosity in non-pressurized areas.

1. Thoroughly clean the area to be repaired with a cleaning solvent. Air dry the area.

WARNING: 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 an epoxy to make the repair.
3. Apply the epoxy. A clean, dry soldering acid brush can be used 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 assembling the components.
5. Repeat the fluid leak diagnosis procedures.

TRANSMISSION FLUID COOLER FLUSHING AND FLOW TEST

GM studies indicate that plugged or restricted transmission oil coolers and pipes cause insufficient transmission lubrication and elevated operating temperatures which can lead to premature transmission failure. Many repeat repair cases could have been prevented by following published procedures for transmission oil cooler flushing and flow checking. This procedure includes flow checking and flushing the auxiliary transmission oil cooler, if equipped.

NOTE: Use the J-45096: Flush and Flow Test Tool or equivalent to flush and flow test the transmission oil cooler and the oil cooler pipes after the transaxle is removed for repairs.

Only GM Goodwrench DEXRON®VI automatic transmission fluid should be used when doing a repair on a GM transmission.

Time allowance for performing the cooler flow checking and flushing procedure has been included in the appropriate labor time guide operations since the 1987 model year. The service procedure steps for oil cooler flushing and flow testing are as follows:

COOLER FLOW CHECK AND FLUSHING STEPS

1. Machine Set-up
2. Determine Minimum Flow Rate
3. Back Flush
4. Forward Flush
5. Flow Test
6. Code Recording Procedure
7. Clean-up

Special Tools

- **J-45096:** Transmission Oil Cooling System Flush and Flow Test Tool
- **J-45096-50:** Transmission Cooler Flush Adapter
- Shop air supply with water/oil filters, regulator and pressure gauge - minimum 90 psi
- Eye protection
- Rubber gloves

MACHINE SET-UP

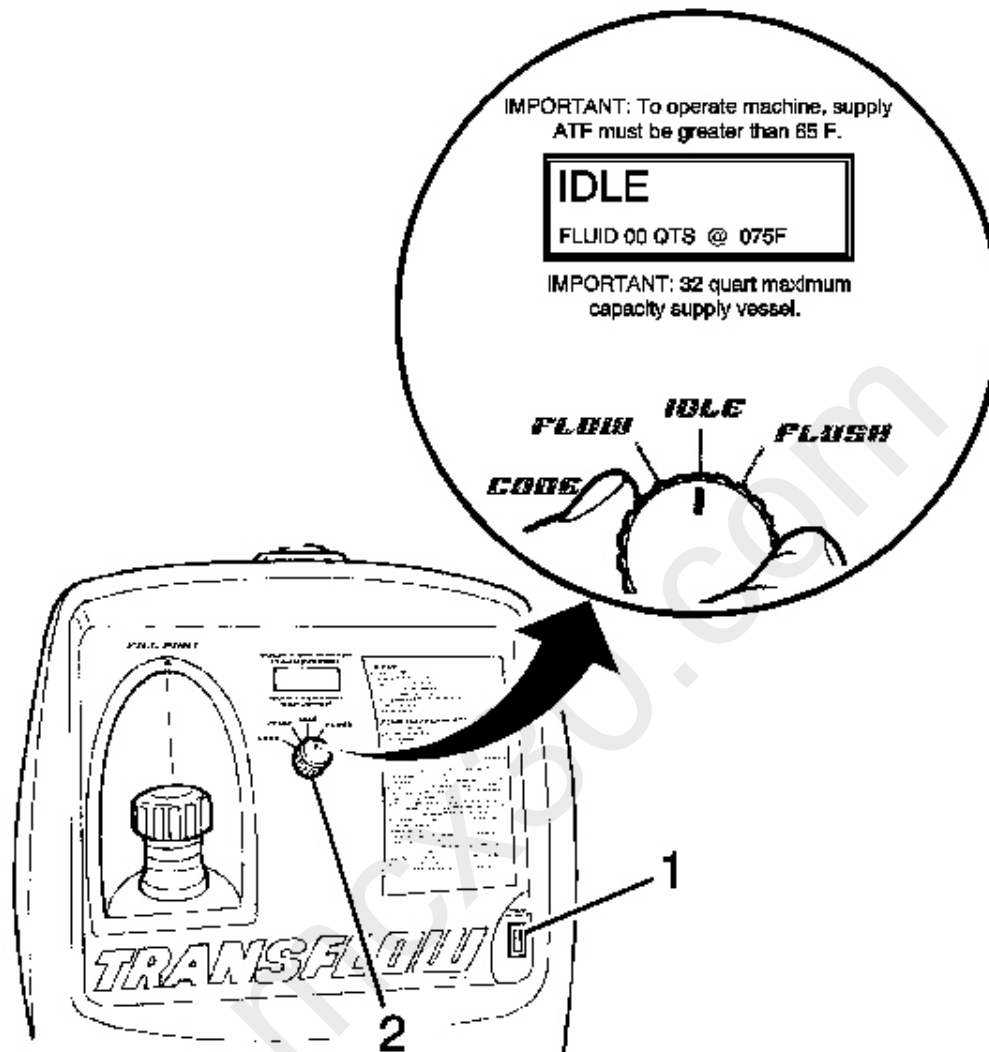


Fig. 9: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS CORP.

1. Verify that the main power switch (1) is in the OFF position.
2. Place the main function switch (2) in the IDLE position.

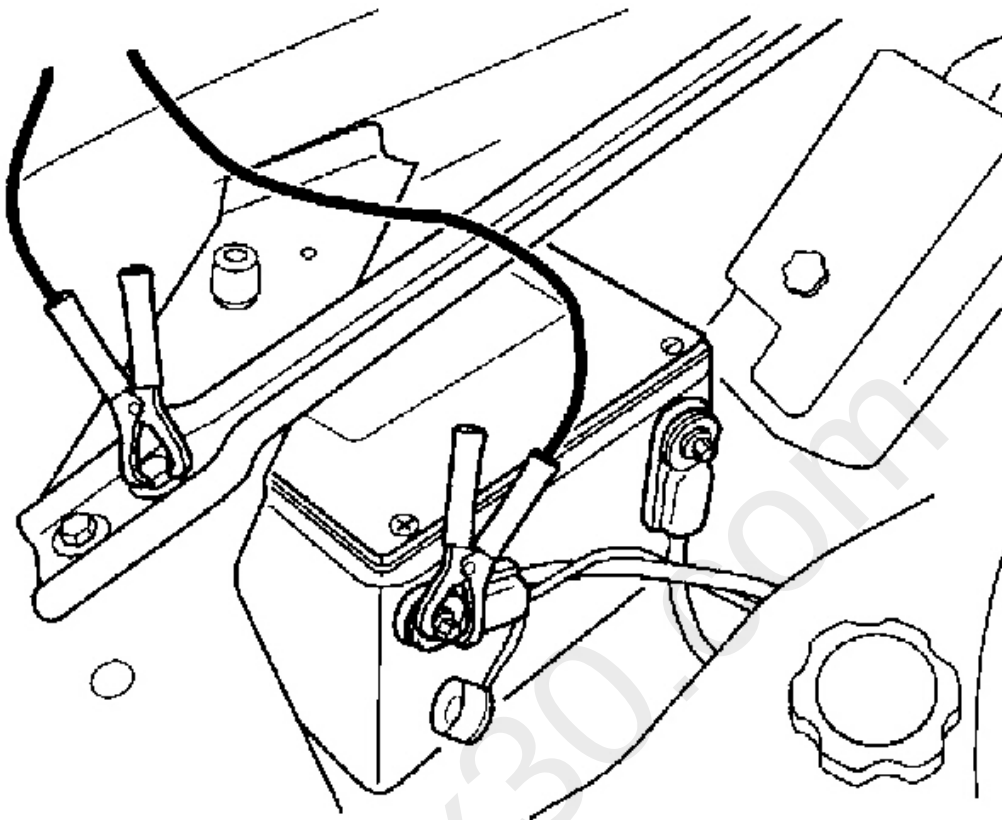


Fig. 10: Connecting To 12V DC Power Source
Courtesy of GENERAL MOTORS CORP.

3. Connect **J-45096**: tool to the vehicle 12V DC power source by connecting the red battery clip to the positive, +, battery post on the vehicle and connect the negative lead to a known good chassis ground.
4. Turn the main power switch to the ON position.

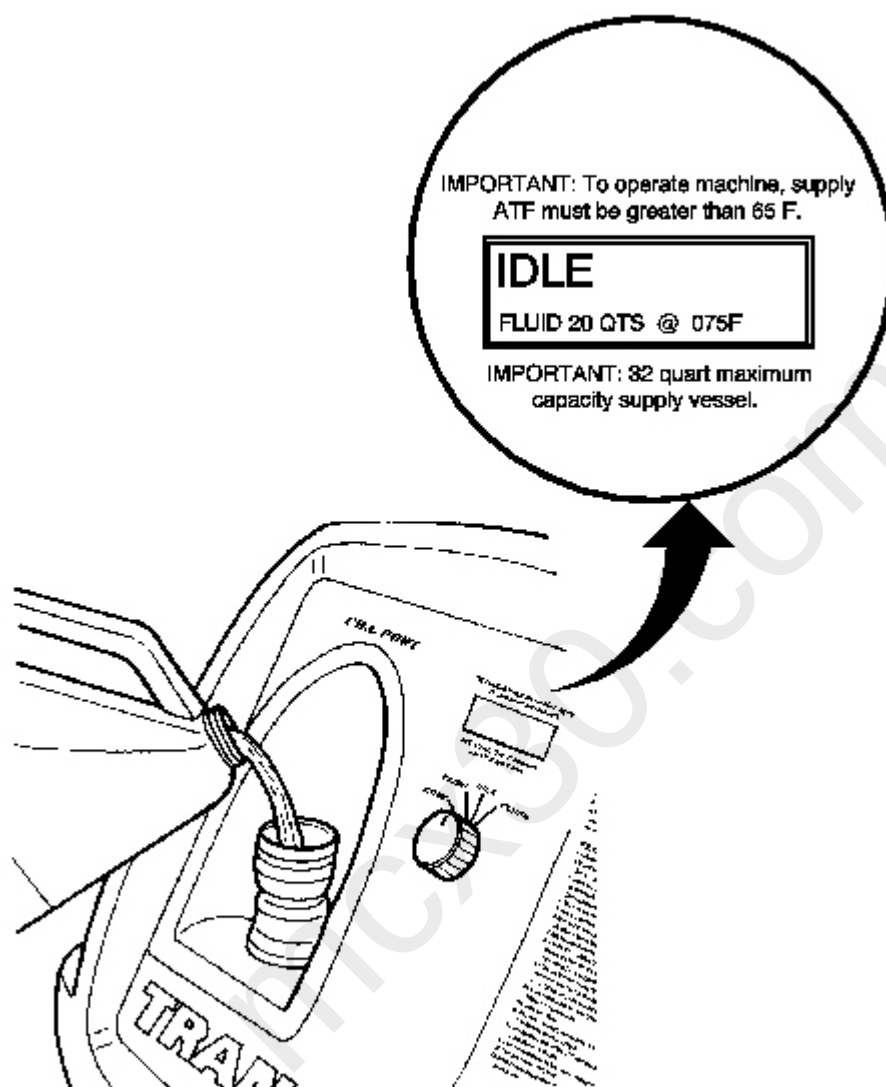


Fig. 11: Filling Supply Tank With Transmission Fluid
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not overfill the supply vessel. Damage to the unit may result. To verify the fluid level, view the LCD screen display while filling the unit, to ensure the fluid level does not exceed 30 L (32 qt).

5. Fill the supply tank with Dexron®VI through the fill port.
6. Reinstall and tighten the fill cap.

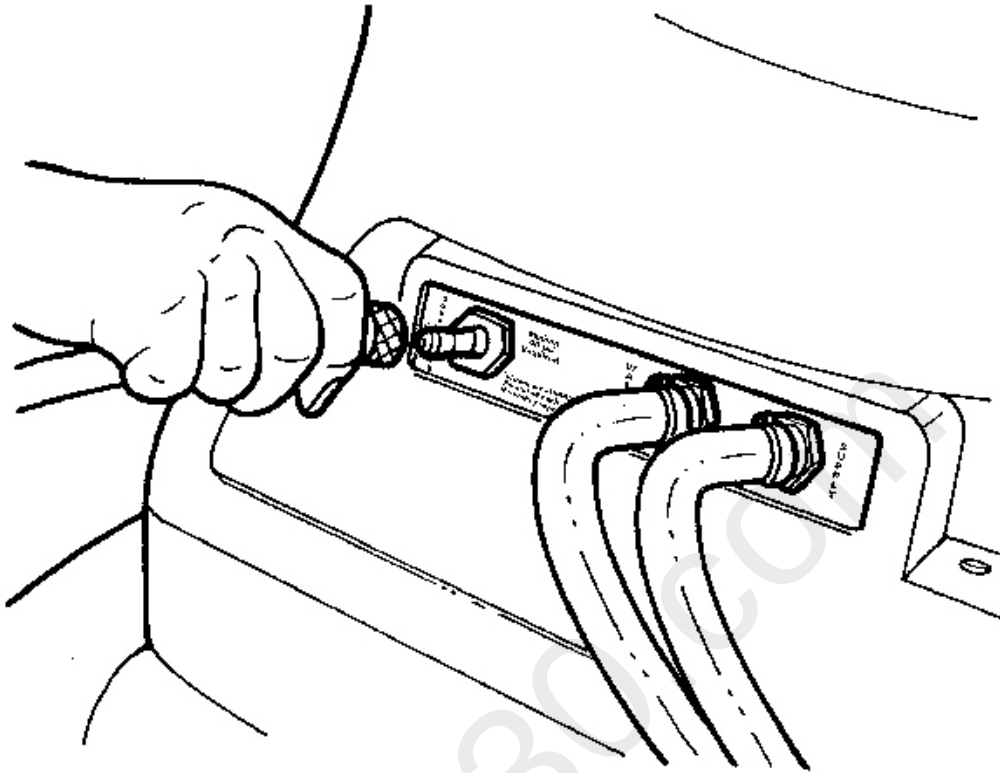


Fig. 12: Applying Shop Air Supply Hose To Quick-Disconnect
Courtesy of GENERAL MOTORS CORP.

7. Connect a shop air supply hose to the quick-disconnect on the rear panel marked SUPPLY AIR.

DETERMINE MINIMUM FLOW RATE

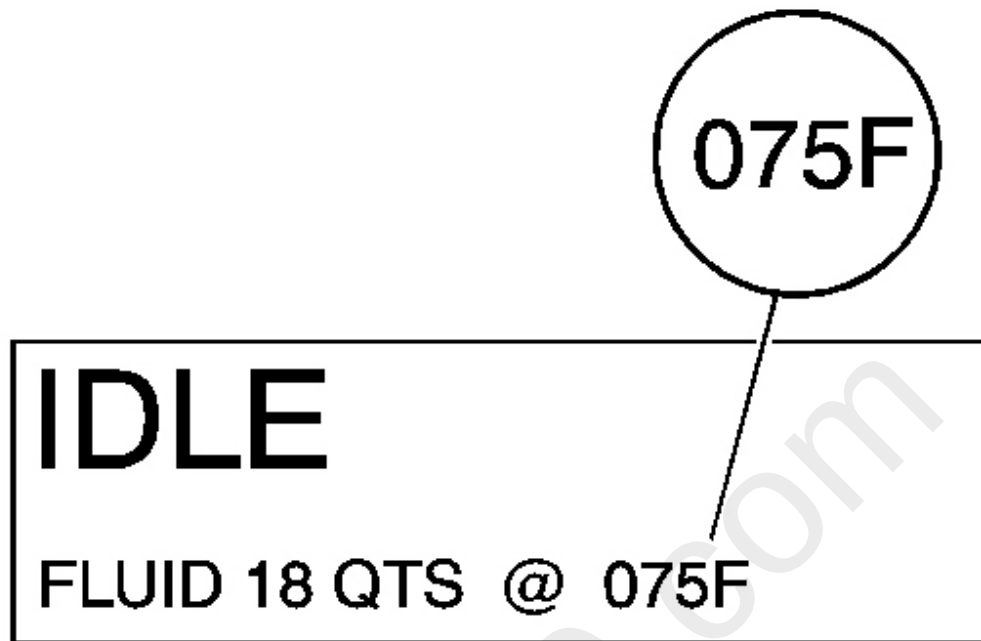


Fig. 13: Identifying Machine Display Of Automatic Transmission Fluid Temperature
Courtesy of GENERAL MOTORS CORP.

1. From the machine display, identify the temperature of the automatic transmission fluid that is stored in the supply vessel of **J-45096:** tool.

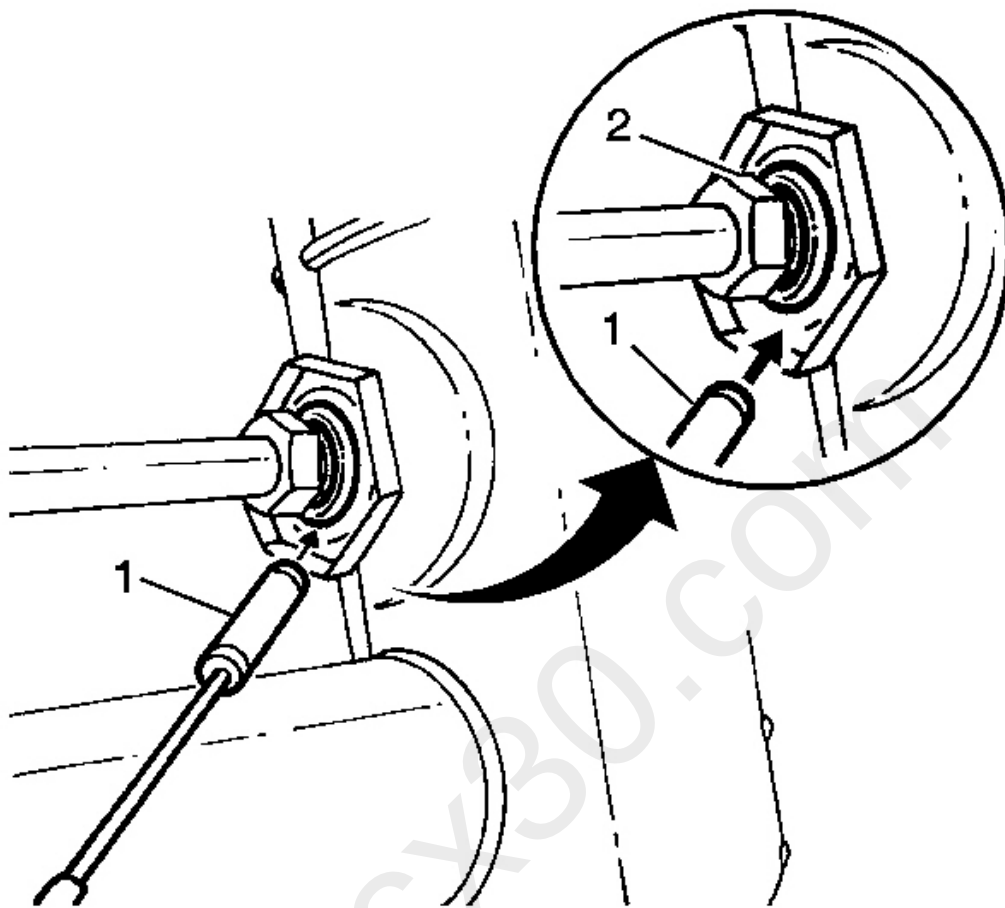


Fig. 14: Identifying Transmission Oil Cooler Metal Composition
Courtesy of GENERAL MOTORS CORP.

2. Determine whether the transmission oil cooler is steel or aluminum by using a magnet (1) at the cooler flange (2) at the radiator.
3. Refer to the table below. Using the temperature from step 1, locate on either the Steel MINIMUM Flow Rate table or the Aluminum MINIMUM Flow Rate table the minimum flow rate in gallons per minutes (GPM). Record the minimum flow rate in GPMs and the supply fluid temperature for further reference.

Example

- Fluid temperature: 75°F
- Cooler type: Steel

The MINIMUM flow rate for this example would be 0.8 GPM.

4. Inspect transmission oil cooler lines for damage or kinks that could cause restricted oil flow. Repair as needed and refer to the appropriate GM service manual procedures.

Minimum Flow Rate in Gallons Per Minute (gpm)

Temperature Range	Steel	Aluminum
65-66°F	0.6 gpm	0.5 gpm
67-70°F	0.7 gpm	0.6 gpm
71-75°F	0.8 gpm	0.7 gpm
76-80°F	0.9 gpm	0.8 gpm
81-84°F	1.0 gpm	0.9 gpm
85-89°F	1.1 gpm	1.0 gpm
90-94°F	1.2 gpm	1.1 gpm
95-98°F	1.3 gpm	1.2 gpm
99-103°F	1.4 gpm	1.3 gpm
104-108°F	1.5 gpm	1.4 gpm
109-112°F	1.6 gpm	1.5 gpm
113-117°F	1.7 gpm	1.6 gpm
118-120°F	1.8 gpm	1.7 gpm

BACK FLUSH PROCEDURE

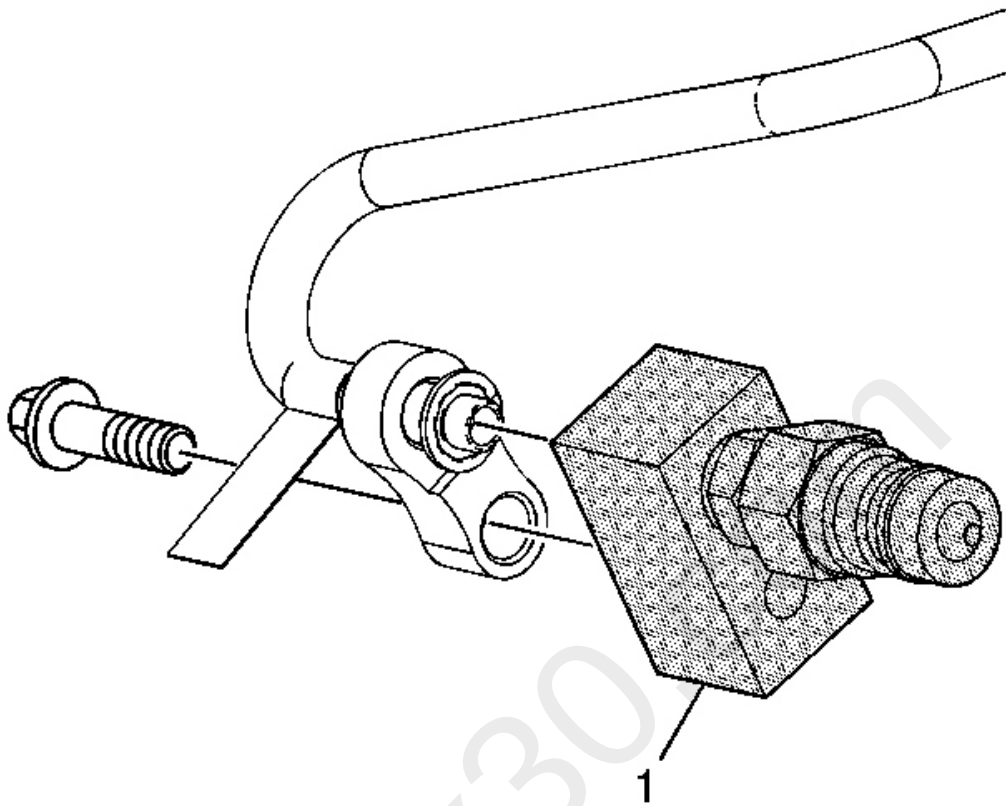


Fig. 15: Identifying Cooler Flush Adapter
Courtesy of GENERAL MOTORS CORP.

1. Connect the **J-45096-50: Cooler Flush Adapter (1)** to the vehicle transmission oil cooler supply and return lines at the transmission.

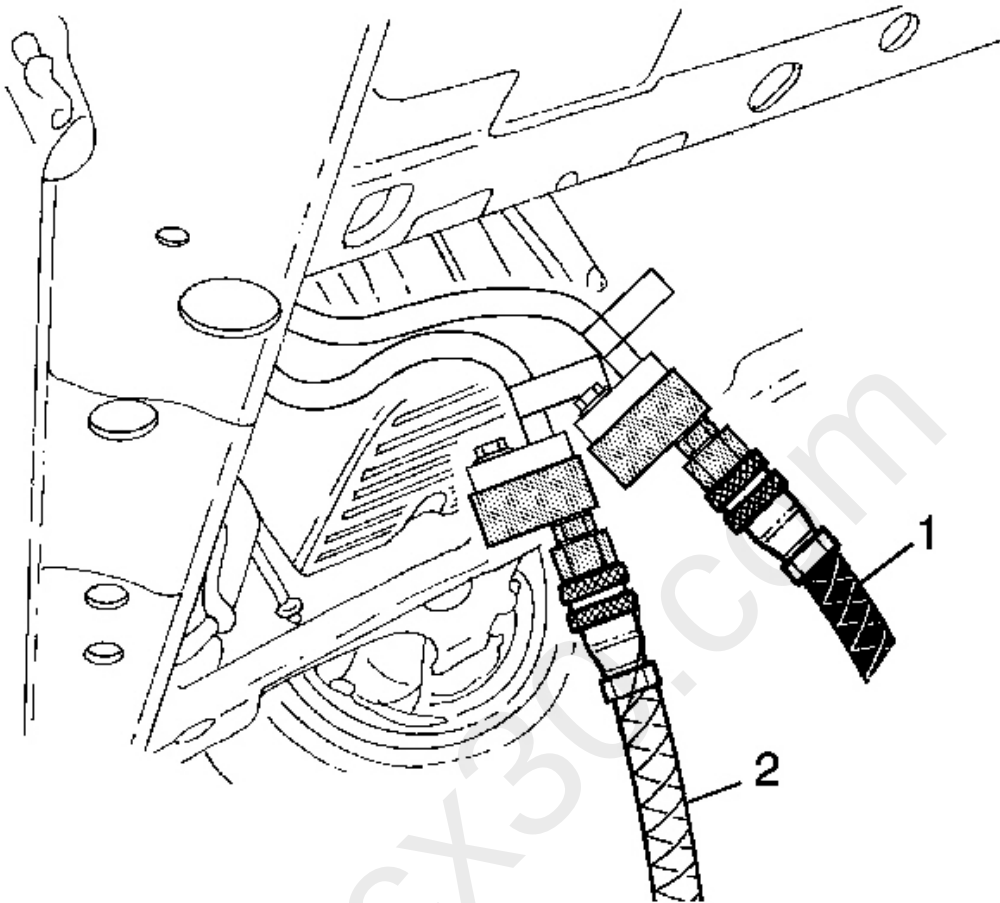


Fig. 16: View Of Black Supply Hose & Clear Waste Hose
Courtesy of GENERAL MOTORS CORP.

2. Connect the black supply hose (1) to the return line, top connector of the transmission, and the clear waste hose (2) to the feed line, bottom connector of the transmission, to the vehicle cooler lines. This is the reverse flow - backflush direction.

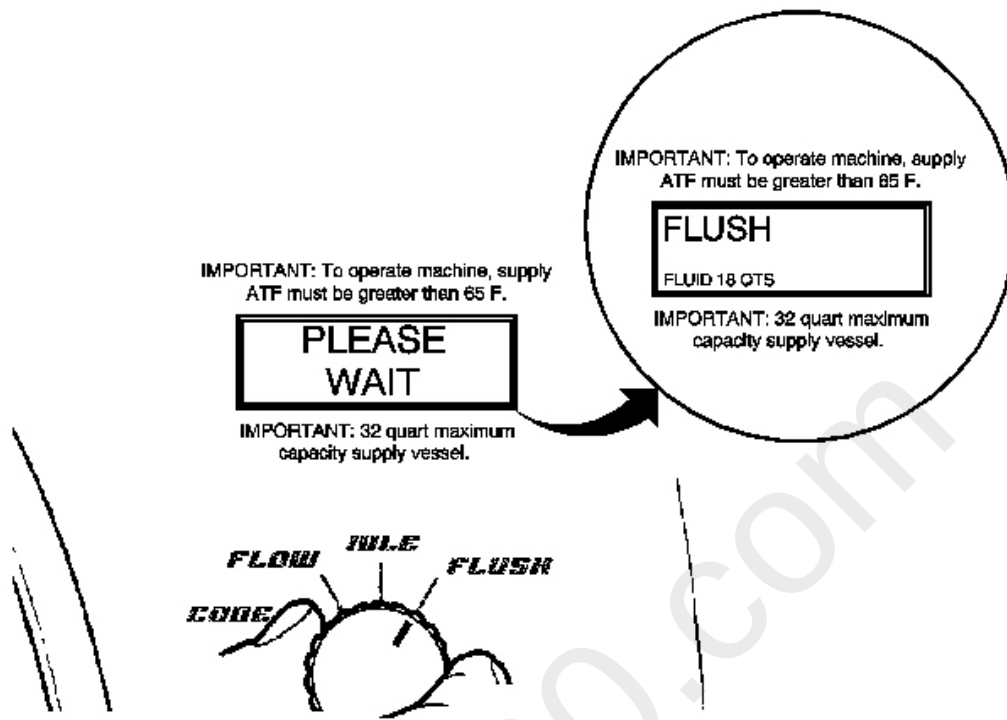


Fig. 17: Setting Main Function Switch To FLUSH Position
Courtesy of GENERAL MOTORS CORP.

3. Turn the main function switch to the FLUSH position. Allow the machine to operate for 30 seconds.

IMPORTANT: To operate machine, supply
ATF must be greater than 65 F.

IDLE

FLUID 16 QTS @ 075F

IMPORTANT: 32 quart maximum
capacity supply vessel.

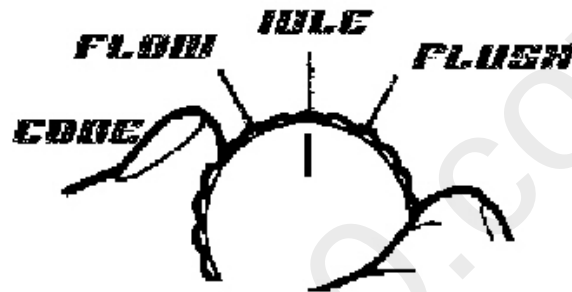


Fig. 18: Setting Main Function Switch To IDLE Position
Courtesy of GENERAL MOTORS CORP.

4. Turn the main function switch to the IDLE position and allow the supply vessel pressure to dissipate.

FORWARD FLUSH

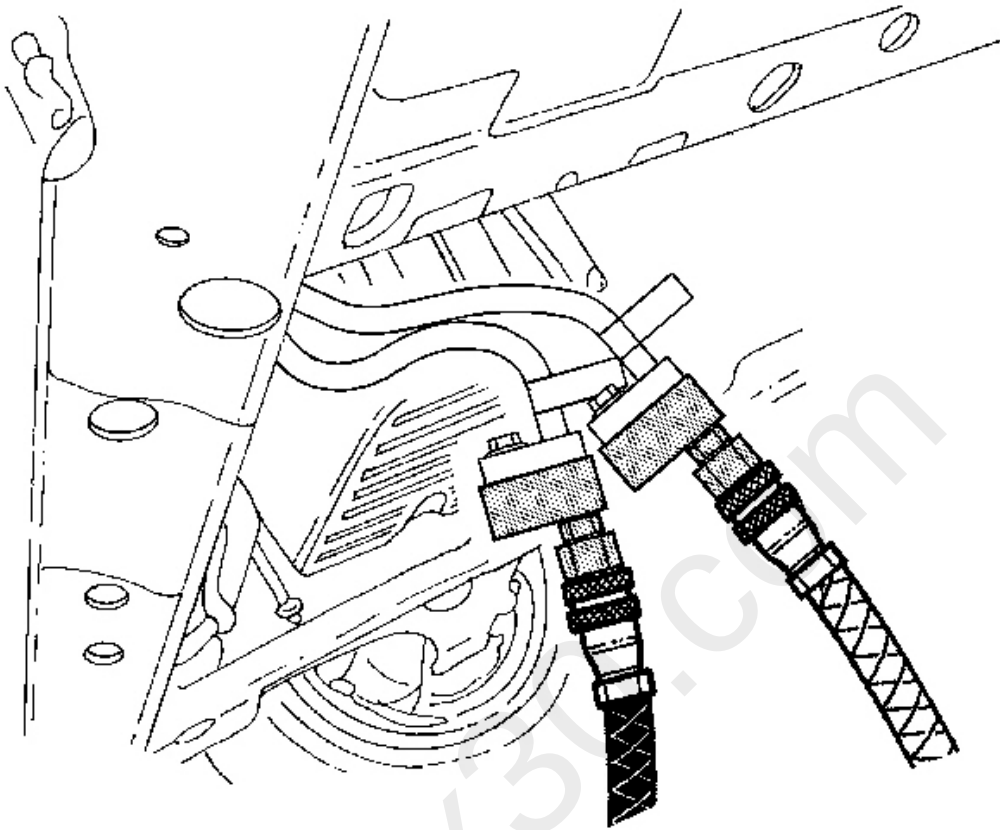


Fig. 19: View Of Supply & Waste Hoses
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the supply and waste hoses from the vehicle cooler lines. Reverse the supply and waste hoses to provide a normal flow direction.

IMPORTANT: To operate machine, supply
ATF must be greater than 65 F.

FLUSH

FLUID 18 QTS

IMPORTANT: 32 quart maximum
capacity supply vessel.

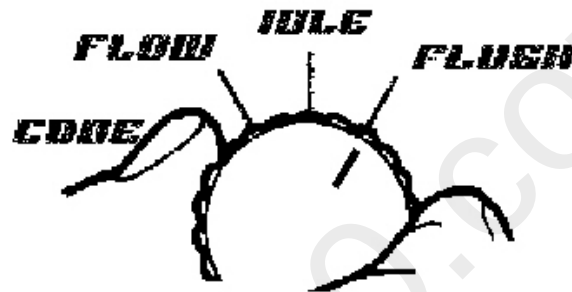


Fig. 20: Setting Main Function Switch To FLUSH Position
Courtesy of GENERAL MOTORS CORP.

2. Turn the main function switch to the FLUSH position and allow machine to operate for 30 seconds.

FLOW TEST

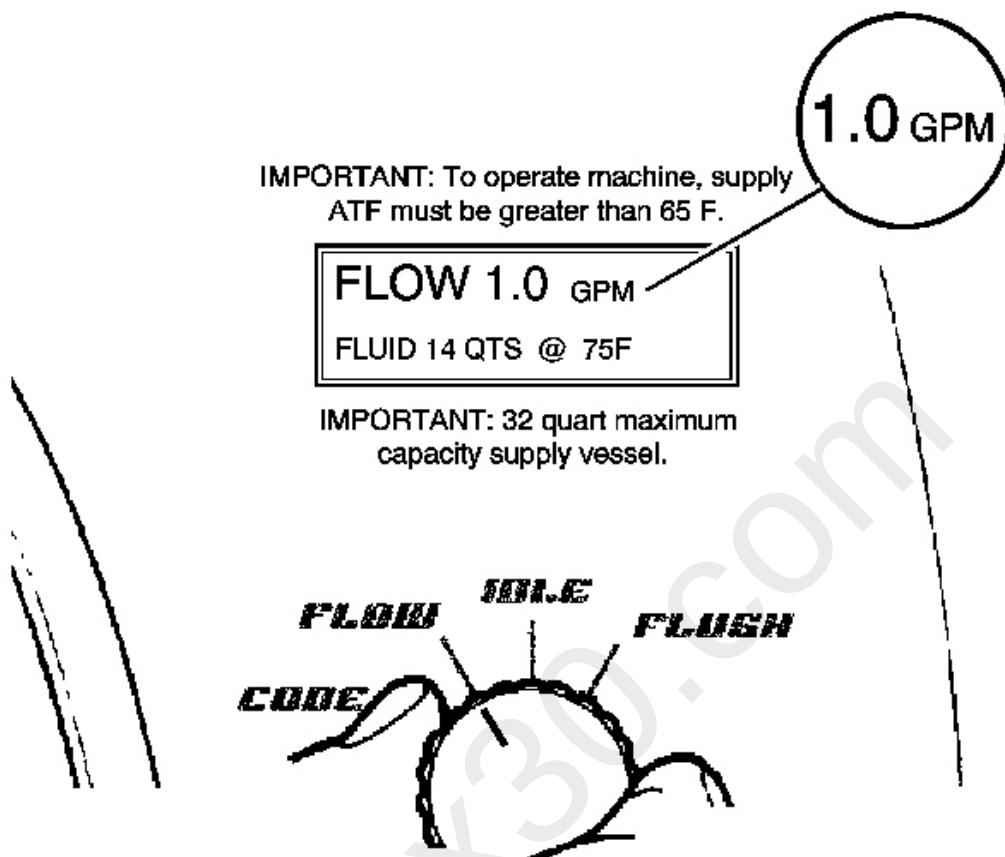


Fig. 21: Setting Main Function Switch To FLOW Position
Courtesy of GENERAL MOTORS CORP.

NOTE: If the flow rate is less than 0.5 gpm, the LCD displays an error message. Refer to the Troubleshooting section of the operation manual.

1. Turn the main function switch to the FLOW position and allow the oil to flow for 15 seconds. Observe and note the flow rate; this is the TESTED flow rate.
2. Compare the TESTED flow rate to the MINIMUM flow rate information previously recorded.
 - If the TESTED flow rate is equal to or greater than the MINIMUM flow rate recorded, the oil cooling system is functioning properly. Perform code recording procedure.
 - If the TESTED flow rate is less than the MINIMUM flow rate previously recorded, repeat the back flush and forward flush procedures.
3. If the TESTED flow rate is less than the MINIMUM flow rate after the second test, perform code recording procedure.

1. Replace the transmission oil cooler.
2. Reconnect supply and waste hoses to the cooler lines in the normal flow direction. Perform flow test.
3. Perform code recording procedure.

CODE RECORDING PROCEDURE

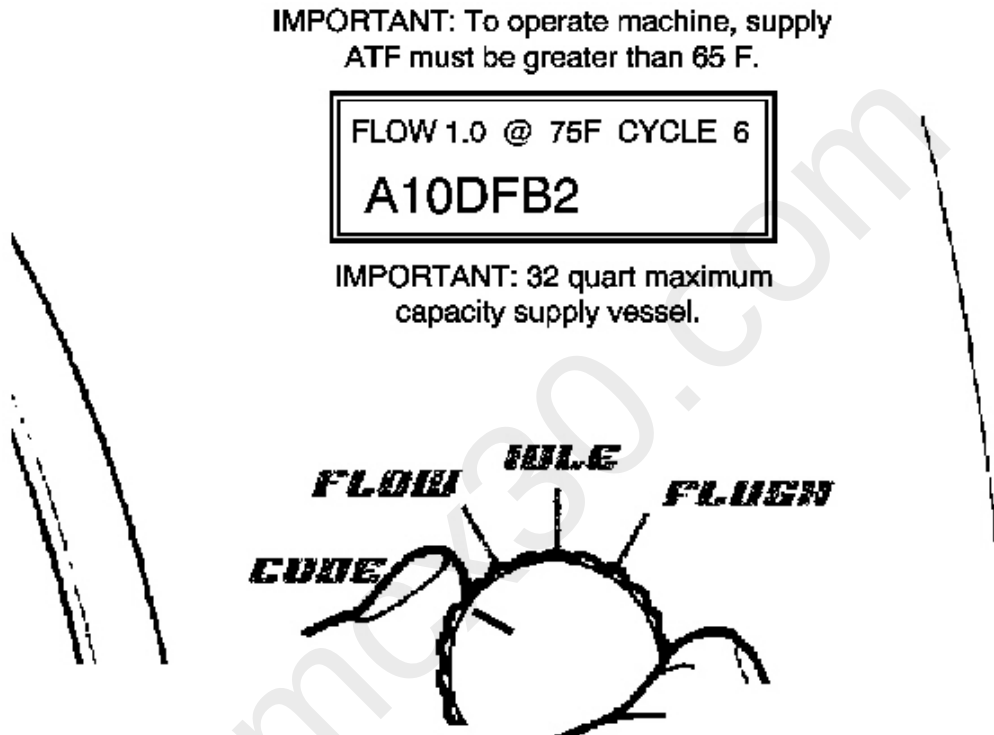


Fig. 22: Setting Main Function Switch To CODE Position
Courtesy of GENERAL MOTORS CORP.

1. Turn the main function switch to the CODE position.

NOTE:

- If power is interrupted prior to the recording of the seven-character code, the code will be lost and the flow rate test will need to be repeated.
- The flow test must run for a minimum of 8-10 seconds and be above 0.5 GPM for a code to be generated.

2. Record TESTED flow rate, temperature, cycle and seven-character flow code information on repair order.

CLEAN-UP

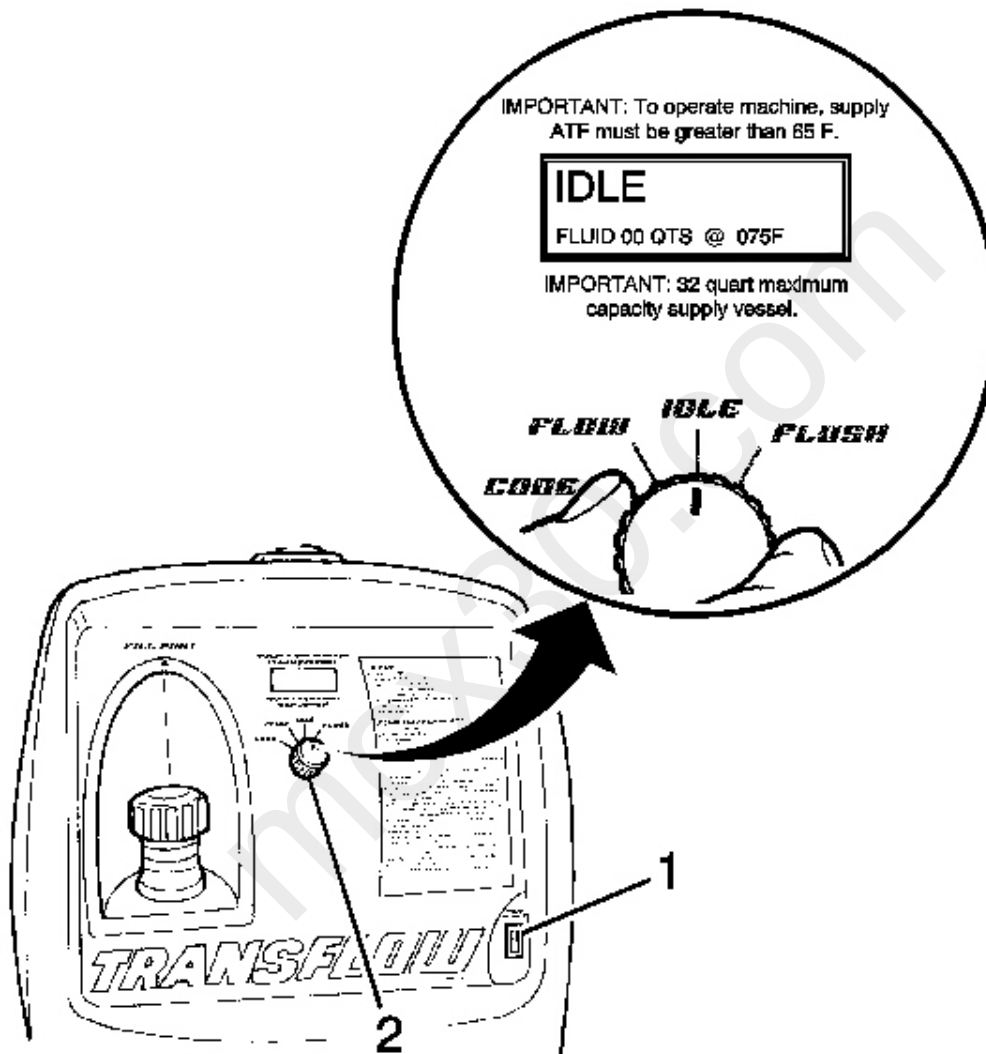


Fig. 23: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS CORP.

1. Turn the main function switch (2) to the IDLE position and allow the supply vessel pressure to dissipate.
2. Turn the main power switch (1) to the OFF position.

NOTE: A small amount of water may drain from the bottom of the unit when the air supply is disconnected. This is a normal operation of the built-in water separator.

3. Disconnect the supply and waste hoses and the 12-volt power source from the vehicle.

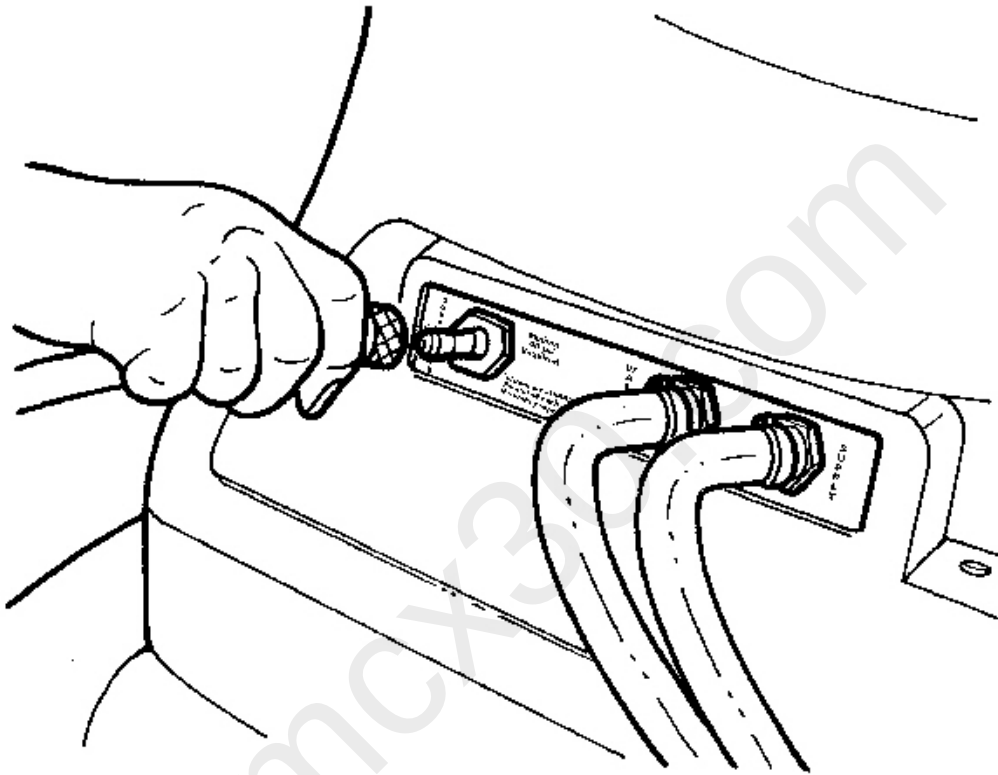


Fig. 24: Applying Shop Air Supply Hose To Quick-Disconnect
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the air supply hose from J-45096: tool.
5. Dispose of the waste ATF in accordance with all applicable federal, state, and local requirements.

BUSHING AND MATING SHAFT INSPECTION

NOTE: Proper bushing and corresponding mating shaft inspection should be performed before replacing the bushing, shaft, and in some cases, the component which houses the bushing. Thoroughly clean and dry the bushing and shaft surfaces before inspecting for damage.

Any of the following bushing conditions require replacement of the bushing and/or housing:

- Discoloration due to heat distress
- Misalignment or displacement of bushing as a result of spinning in housing
- Medium to heavy scoring that can be easily detected with fingernail. Light scoring is a normal condition.
- Debris embedded into the bushing lining material
- Obvious damage, including excessive and uneven wear
- Excessive polishing. Minor polishing of the bushing is an indication of normal wear and does not require replacement.

Any of the following conditions require replacement of the bushing's mating shaft:

- Discoloration due to heat distress
- Rough surface finish that can be easily detected with finger
- Obvious shaft abnormalities, including warping or uneven surfaces
- Obvious damage or cracking

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 vibration may be a result of poor engine performance.

- Vibration may also be caused by a small amount of water inside the converter.
- Inspect the engine and transmission mounts for damage and loose bolts.
- Inspect the transmission case mounting holes for the following conditions:
 - Missing bolts, nuts, and studs
 - Stripped threads
 - Cracks
- Inspect the flywheel for the following conditions:
 - Missing or loose bolts
 - Cracks
 - Imbalance
- Inspect the torque converter for the following conditions:
 - Missing or loose bolts or lugs
 - Missing or loose balance weights
 - Imbalance caused by heat distortion or fluid contamination
- If the noise or vibration is noticeable in PARK and NEUTRAL with the engine at idle, but is more noticeable as RPM increases, the vibration may be an engine imbalance or a transmission imbalance.

Refer to **Torque Converter Diagnosis.**

WHINE/GROWL NOISE

Checks	Causes
Differential Assembly (232)	• Inspect for worn or damaged Side Gear Thrust Washer) or Pinion Gear Thrust Washer • Inspect for loose or worn Side Gear Axle Splines • Inspect for damaged or worn Side Gear • Inspect for worn or damaged Final Drive Inner and Outer Washers (584) • Inspect for loose, damaged or worn Front Differential Carrier Thrust Bearings, (228, 231, 233) • Inspect for broken, worn or disengaged Final Drive Pinion Pin Retainer (581) • Inspect for damaged or worn Pinion Gears
Drive Link Assembly (225)	• Inspect for worn, loose or damaged links • Inspect for broken, worn or loose Drive Link Lube Scoop (60)
Drive Sprocket Assembly (224)	• Inspect for improper Drive Sprocket (224) tooth surface finish • Inspect for broken or damaged Drive Sprocket (224) teeth • Inspect for worn or damaged Drive Sprocket Thrust Bearings (223, 556) • Inspect for worn or damaged Output Carrier Transfer Drive Gear Hub Assembly splines (222) • Inspect for loose, worn or damaged Output Carrier Transfer Drive Gear Hub Assembly bushing
Driven Sprocket Assembly (229)	• Inspect for worn, binding or damaged Driven Sprocket Bearing Assembly (228) • Inspect for worn or damaged Driven Sprocket Ball Bearing Assembly • Inspect for improper Driven Sprocket (229) tooth surface finish • Inspect for broken or damaged Driven Sprocket (229) teeth
Input Carrier Assembly (570)	• Inspect for pitted/spalled Pinion Gear teeth • Inspect for worn or damaged Pinion Gear Thrust Washers and Bushings • Inspect for worn or damaged Pinion Gears, Pins or Needle Bearings • Inspect for loose or broken Hub and Ring Gear

	• Inspect for loose or broken Output Internal Gear Retainer • Inspect for loose or worn Sun Gear Thrust Bearings (569, 572)
Output Carrier Assembly (574)	• Inspect for worn or damaged Pinion Gear Thrust Washers and Bushings • Inspect for worn or damaged Pinion Gears, Pins or Needle Bearings • Inspect for loose Hub and Ring Gear
Output Sun Gear Assembly (555)	• Inspect for worn or damaged Output Sun Gear Thrust Bearing (556) • Inspect for loose, worn or damaged Output Sun Gear bushing • Inspect for worn or damaged Output Sun Gear teeth
Reaction Carrier Assembly (567)	• Inspect for worn or damaged Pinion Gear Thrust Washers and Bushings • Inspect for worn or damaged Pinion Gears, Pins or Needle Bearings • Inspect for loose hub and Ring Gear • Inspect for worn or damaged Reaction Carrier Thrust Bearings (565)
Reaction Sun Gear Assembly (566)	Inspect for loose, worn or damaged Reaction Sun Gear Assembly bushing
Fluid Pump Assembly (201)	1. Inspect for proper fluid level 2. Inspect for leaking Pump Fluid Outlet Seal Assembly (24) or Filter Seal
3-5-Reverse Clutch Assembly	• Inspect for inadequate Clutch Plate Clearance • Inspect for stripped or sheared Clutch Plate Splines (508-510) • Inspect for loose or worn Backing Plate Retainer (511) • Inspect for loose Speed Sensor Reluctor Wheel (501) or Retainer (500)
4-5-6 Clutch Assembly	• Inspect for inadequate Clutch Plate Clearance • Inspect for stripped or sheared Clutch Plate Splines (425-428) • Inspect for loose or worn Clutch Dam Retainer (524) • Inspect for loose or worn 3-5-Reverse/4-5-6 Clutch Housing Bushing
1-2-3-4 Clutch Assembly	• Inspect for inadequate Clutch Plate Clearance • Inspect for stripped or sheared Clutch Plate Splines (557-559) • Inspect for loose or worn Clutch Spring Retainer (561)
Low and Reverse Clutch Assembly	• Inspect for stripped or sheared Low and Reverse Clutch Assembly (543) splines

(OWC) (543)	Inspect for non-rotating Low and Reverse Clutch Assembly (543)
Low and Reverse Clutch	- Inspect for inadequate Clutch Plate Clearance - Inspect for stripped or sheared Clutch Plate Splines (545-547) - Inspect for loose or worn Clutch Spring Retainer (548)
2-6 Clutch Assembly	- Inspect for inadequate Clutch Plate Clearance - Inspect for stripped or sheared Clutch Plate Splines (540-542) - Inspect for loose or worn Clutch Spring Retainer (537)
Case Assembly (50)	- Inspect for loose or broken Transmission Mount Bolts - Inspect for loose Torque Converter and Differential Housing Bolts (26) - Inspect for loose, worn or damaged differential bushing - Inspect for loose or broken Input Shaft Support Bolts (57) - Inspect for loose or broken Front Differential Carrier Baffle Bolts (61) - Inspect for stripped or sheared splines - Inspect for loose, worn or damaged bushing
Torque Converter Housing Assembly (208)	- Inspect for loose or broken Front Differential Ring Gear Retainer (206) - Inspect for loose, worn or damaged differential bushing - Inspect for loose or broken Pinion Gear Shaft Retainer Pin - Inspect for loose or broken Front Differential Carrier Baffle Bolts (204) - Inspect for loose or broken Fluid Pump Bolts (200) - Inspect for loose Torque Converter and Differential Housing Bolts (26) - Inspect for loose, worn or damaged bushing
Control Valve Body Cover Assembly (2)	Inspect for loose, missing or broken Valve Body Cover Bolts (1)
Torque Converter (28)	- Inspect for improper alignment of Torque Converter to the Crankshaft - Inspect for ballooning of the Torque Converter
Differential Carrier Assembly (232)	- Inspect for worn or damaged Differential Carrier (582) - Inspect for worn or damaged Pinion Pins (583) - Inspect for broken, worn or damaged Differential Sun Gear Bearing (231) or Driven Sprocket Bearing (228) - Inspect for worn or damaged Differential Side Gear teeth, Final Drive Pinion Gear (586) teeth or Final Drive Sun Gear (230) teeth

- Inspect for worn or damaged Differential Side Gear Thrust Washers or Final Drive Inner and Outer Washers (584)
- Inspect for worn or damaged Final Drive Rollers (585)
- Inspect for broken or damaged Differential Pinion Gear Shaft Retainer

AUTOMATIC TRANSMISSION FLUID LEAKS

Checks	Causes
Torque Converter (28)	Inspect for damage
Case Assembly (50)	• Inspect for cracked or broken Case (50) • Inspect for porosity or damage on the sealing surfaces • Inspect for loose Oil Cooler Line Bolts or damaged Oil Cooler Line Seals • Inspect for damaged Manual Shift Shaft Seal (604) • Inspect for damaged or worn Axle Seal (65) or Axle Seal Slinger on the axle shafts • Inspect for plugged Vent Cap (52) • Inspect for loose Pressure Test Plug (51), Drain Plug (64) and Fluid Level Plug (63) • Inspect for damaged Park Pawl Actuator Guide Seal (605) • Inspect for damaged or worn Input Speed Sensor Seals (19)
Torque Converter Housing Assembly (208)	• Inspect for damaged Torque Converter Housing Assembly (208) • Inspect for porosity or damage on the sealing surfaces • Inspect for damaged Torque Converter Housing Seal (23) • Inspect for damaged or worn Torque Converter Fluid Seal (301) • Inspect for loose Torque Converter and Differential Housing Bolts (26) • Inspect for damaged or worn Axle Seal (209) or Axle Seal Slings on the axle shafts • Inspect for loose, missing or damaged Fluid Fill Tube Plug Assembly (27) • Inspect for damaged Torque Converter and Differential Housing Seal (202)
Valve Body Cover Assembly (2)	• Inspect for damaged or warped Valve Body Cover Assembly (2) • Inspect for damaged or improperly installed Valve Body Cover Gasket (3)

- Inspect for loose Valve Body Cover Bolts (1)
- Inspect for damaged or improperly installed Wire Connector Hole Seal (5)

SHIFT INDICATOR INDICATES WRONG GEAR SELECTION

Checks	Causes
Shift Cable	• Inspect for damage. • Verify proper attachment to shifter. • Verify cable is locked into shifter bracket. • Verify cable is properly attached to the transmission. • Verify that the cable is locked into the transmission bracket.
Manual Shaft	• Verify shift lever is properly attached to the manual shaft. • Verify manual shaft is not twisted or damaged.
Manual Shift Detent Lever with Shaft Position Switch Assembly, IMS	Verify proper operation. Refer to <u>Transmission Internal Mode Switch Logic</u> .

NO PARK

Checks	Causes
Differential Carrier Assembly (232)	• Inspect for damaged or broken Front Differential Assembly (232). • Inspect for damaged or broken Front Differential Side Gear or Pinion Gear. • Inspect for damaged or broken Front Differential Pinion Gear Shaft. • Inspect for damaged or broken Front Differential Pinion Gear Shaft Pin. • Inspect for worn, stripped or sheared Front Differential Side Gear splines. • Inspect for damaged or broken Final Drive Sun, Pinion or Ring Gear. • Inspect for worn, stripped or sheared Final Drive Sun Gear splines.
Output Carrier Transfer Drive Gear Hub Assembly (222)	• Inspect for broken Drive Gear Hub (222). • Inspect for worn, stripped or sheared Drive Gear hub (222) splines. • Inspect for disengaged or broken Park Gear Retainer Ring (220).

	• Inspect for damaged or broken park Gear (221). • Inspect for disengaged or broken Drive Sprocket Retainer Ring (227).
Drive Link Assembly (225)	• Inspect for broken, worn or damaged Drive Link Assembly (225). • Inspect for broken, worn or damaged Drive Sprocket (224). • Inspect for broken, worn or damaged Driven Sprocket Assembly (229). • Inspect for worn, stripped or sheared Driven Sprocket splines. • Inspect for broken Drive Gear Hub (222).
Case Assembly (50)	• Inspect for broken or damaged Case. • Inspect for broken or bent Park Pawl Shaft (600). • Inspect for broken or missing Park Pawl Actuator Guide Pin (603) or Manual Shaft Pin (611). • Inspect for broken or missing Manual Shaft Detent Lever Pin (610). • Inspect for broken or missing Manual Shift Shaft Pin (611). • Inspect for damaged or broken Manual Shift Detent Lever Shaft (608). • Inspect for loose, damaged or broken Detent Lever Spring Assembly (17). • Inspect for broken, loose or misaligned Park Pawl Actuator Guide (606). • Inspect for binding, bent or broken Park Pawl (602) or Actuator Assembly (607).

HARSH GARAGE SHIFT

Checks	Causes
Input Carrier Assembly (570)	Inspect for worn or stripped Output Internal Gear Splines
Low-Reverse and 1-2-3-4 Clutch Housing (551)	• Inspect for damaged or fatigued 1-2-3-4 Clutch Wave Plate (557) and Low and Reverse Clutch Wave Plate (547). Refer to <u>Clutch Plate Diagnosis</u>. • Inspect for stripped or sheared splines on 1-2-3-4 Clutch Plate (546). Refer to <u>Clutch Plate Diagnosis</u>. • Inspect for improperly positioned or plugged Low Reverse Piston (550) air bleed • Inspect for correct fluid level
Low and Reverse Clutch Assembly (OWC) (543)	Inspect for stripped or sheared internal and external splines on Low and Reverse Clutch Assembly (543)

NO DRIVE IN ALL RANGES

Checks	Causes
Case Assembly (50)	• Inspect for cracked or broken Case (50). • Inspect for stripped or sheared splines. • Inspect for binding Manual Shift Detent Lever Assembly (609). • Inspect for missing Manual Shift Shaft Pin (611). • Inspect for missing Manual Shaft Lever Pin (610). • Inspect for interference or binding Park Pawl Actuator Assembly (607). • Inspect for broken or disengaged 1-2-3-4 Clutch Backing Plate Retainer Ring (561). • Inspect for loose or damaged case bushing. • Inspect A/Trans Fluid Pump Seal Assembly (25) for damage.
Torque Converter (28)	• Inspect for stripped or sheared splines on Turbine Shaft. • Inspect for missing Torque Converter to Flywheel bolts. • Inspect for damaged or disengaged Torque Converter Hub to Oil Pump Drive Gear.
Torque Converter Housing (208)	• Inspect for stripped or sheared Differential Ring Gear splines. • Inspect for broken or disengaged Differential Ring Gear Retainer (206). • Inspect for loose, missing or broken Torque Converter and Differential Housing bolts (26). • Inspect for loose, missing or broken Fluid Pump bolts (200).
35R/456 Housing Assembly (516)	• Inspect for damaged or broken Input Shaft Thrust Bearing Assembly (538). • Inspect for stripped or sheared splines on the Input Shaft to the 3-5 Reverse/4-5-6 Clutch Housing (516).
Oil Pump Assembly (201)	• Inspect for fluid leaks / improper fluid level. • Inspect for leaking Fluid Outlet Seal Assembly (24). • Inspect for loose or missing Oil Pump Bolts (200). • Inspect for damaged, restricted or improperly installed Oil Filter Assembly (203). • Inspect for damaged or leaking Oil Filter Neck Seal. • Inspect for broken or seized Fluid Pump Drive Gear (315) and Fluid Pump Driven Gear (316).
Low & Reverse Clutch Assembly (543)	Inspect for stripped or sheared splines to the Reaction Carrier (567).

Input Carrier Assembly (570)	• Inspect for stripped or sheared castle splines to ring gear. • Inspect for improperly installed carrier pinion gear pins. • Inspect for damaged or broken Pinion Gears. • Inspect for stripped or sheared splines on the Input Sun Gear (571). • Inspect for damaged or broken Output Internal Gear. • Inspect for broken or disengaged Output Internal Gear Retainer Ring. • Inspect for damaged or broken Input Carrier Thrust Bearing Assembly (568) and Output Carrier Thrust Bearing Assembly (573). • Inspect for damaged or broken Input Carrier Thrust Bearings (569, 572).
Reaction Carrier Assembly (567)	• Inspect for stripped or sheared Reaction Carrier Assembly (567) splines. • Inspect for damaged or broken Input Carrier Thrust Bearings (568). • Inspect for damaged or broken Pinion Gear teeth. • Inspect for damaged or broken Reaction Internal Gear teeth. • Inspect for disengaged or broken Reaction Internal Gear retainer ring.
Reaction Sun Gear Assembly (566)	• Inspect for damaged or broken weld at Sun Gear. • Inspect for loose or worn Reaction Sun Gear Assembly bushing.
Output Carrier Assembly (574)	• Inspect for stripped or sheared splines to reaction internal ring gear. • Inspect for damaged or broken Input Sun Gear Thrust Bearings (572). • Inspect for damaged or broken Pinion Gear teeth. • Inspect for damaged or broken Input Carrier Thrust Bearings (573). • Inspect for broken or damaged Output Internal Gear.
Output Sun Gear Assembly (555)	• Inspect for stripped or sheared Output Sun Gear Assembly (555) splines. • Inspect for broken Output Sun Gear Assembly (555) hub or weld.
Low-Reverse and 1-2-3-4 Clutch Housing (551)	Inspect for disengaged or broken 1-2-3-4 Clutch Piston Spring Retainer (554).
	• Inspect for broken, worn or damaged Drive Link Assembly (225).

Drive Link Assembly (225)	• Inspect for broken, worn or damaged Drive Sprocket (224). • Inspect for broken, worn or damaged Driven Sprocket Assembly (229). • Inspect for broken Drive Gear Hub (222).
Differential Carrier Assembly (232)	• Inspect for stripped or sheared splines on Differential Side Gear. • Inspect for stripped or sheared splines Final Drive Sun Gear (230). • Inspect for stripped or sheared splines Differential Carrier to PTU (AWD only). • Inspect for stripped broken or disengaged Final Drive Retainer (581). • Inspect for damaged or broken Pinion Gear teeth. • Inspect for damaged or broken Final Drive Rollers (585). • Inspect for broken, worn or damaged Final Drive Inner and Outer Thrust Washers (584).
Control Solenoid (w/Body and TCM) Valve Assembly	Check that the Manual Valve (432) is engaged with Manual Shift Detent Lever Assembly (609).

NO FIRST AND REVERSE GEARS

Checks	Causes
Low and Reverse Clutch Assembly (543)	• Inspect for stripped or sheared internal or external splines on Low and Reverse Clutch Assembly (543) • Inspect for broken or disengaged retainer ring
Low and Reverse Clutch	• Inspect for stripped or sheared splines on Low and Reverse Clutch Plates (545-547) • Inspect for damaged, deformed or improper surface finish on the Low and Reverse Clutch Plates (545-547) • Inspect for stripped or sheared splines on Low and Reverse Clutch Backing Plate (544) • Inspect for worn, damaged or debonding Low and Reverse Clutch Piston Seals (550) • Inspect for broken or fatigued Low and Reverse Clutch Piston Return Spring (549)
Low-Reverse and 1-2-3-4 Clutch Housing (551)	• Inspect for disengaged or broken Low and Reverse Clutch Piston Spring Retainer (548) • Inspect for broken or deformed Low and Reverse Clutch Piston (550) • Inspect for damaged or improper surface finish in the piston bore

NO FIRST, SECOND, THIRD, AND FOURTH GEAR

Checks	Causes
1-2-3-4 Clutch Assembly	- Inspect for damaged, stripped or sheared splines on 1-2-3-4 Clutch Plates (557-559), Backing Plate (560). - Inspect for damaged or broken 1-2-3-4 Clutch Piston (552) and Piston Seals damaged, worn or delaminating. - Inspect for broken or fatigued 1-2-3-4 Clutch Piston Return Spring (553). - Inspect for broken or disengaged 1-2-3-4 Clutch Piston Return Spring Retainer (554). - Inspect for broken or fatigued 1-2-3-4 Clutch Waved Plate (557). - Inspect for disengaged or broken 1-2-3-4 Clutch Backing Plate Retainer (561). - Inspect for broken, porous or improper surface finish or plugged oil passages of the Low-Reverse/1-2-3-4 Clutch Housing (551). - Inspect for worn or damaged Low-Reverse/ 1-2-3-4 Clutch Housing (551) splines.
Output Sun Gear Assembly (555)	Inspect for stripped or sheared splines on the Output Sun Gear shell.
Reaction Carrier Assembly (567)	- Inspect for stripped or sheared splines on the Input Ring Gear - Inspect for disengaged or broken Input Ring Gear Retainer.
Output Carrier Assembly (574)	- Low/Reverse Clutch Assembly (OWC) (543) splines stripped or sheared. - Inspect for disengaged or broken Reaction Ring Gear Retainer.
Case Assembly (50)	- Inspect for leaking or damaged 1-2-3-4 and Low-Reverse Clutch Fluid Passage Seals (67). - Inspect for worn or damaged case splines or retainer ring grooves.
Input Sun Gear (571)	Inspect for damaged gear teeth and damaged splines.
Turbine Shaft (517)	Inspect for damaged splines to the Input Shaft Sun Gear.
Control Valve Body Assembly	Inspect 1-2-3-4 Clutch Regulator Valve (417) and 1-2-3-4 Clutch Boost Valve (414) for debris and stickyness.
Control Solenoid (w/Body and TCM) Valve Assembly	Check 1234 PC Solenoid 5 for proper operation. Refer to <u>Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test</u> .

NO SECOND AND SIXTH GEAR

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Checks	Causes
2-6 Clutch Assembly	• Inspect for damaged or worn 2-6 Clutch Plates (540-542). • Inspect for damaged, worn, broken, improper surface finish or sheared splines on the Low-Reverse Clutch Assembly (543). • Inspect for damaged or broken 2-6 Clutch Piston (535) and piston seals damaged, worn or delaminating. • Inspect for broken or binding 2-6 clutch Piston Return Spring (536).
Reaction Carrier Assembly (567)	• Inspect for stripped or sheared splines on the Input Ring Gear. • Inspect for disengaged or broken Input Ring Gear Retainer.
Reaction Sun Gear Assembly (566)	• Inspect for damaged or broken Reaction Sun Gear Assembly hub. • Inspect for damaged or broken sun gear weld. • Inspect for loose or worn Reaction Sun Gear Assembly bushing.
Case Assembly (50)	• Inspect for stripped or sheared splines. • Inspect for broken or disengaged 2-6 Clutch Piston Return Spring Retainer (537). • Inspect for damaged, worn, or improper surface finish in the piston bore.
Output Carrier Assembly (574)	Inspect for reaction ring gear damage or missing ring gear snap ring.
Control Valve Body Assembly	Inspect 2-6 Clutch Regulator Valve (419) for debris and stickyness.
Control Solenoid (w/Body and TCM) Valve Assembly	Check 2-6 PC Solenoid 4 for proper operation. Refer to <u>Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test</u> .

HARSH OR LATE FIRST, SECOND, THIRD, AND FOURTH SHIFT

Checks	Causes
Low-Reverse and 1-2-3-4 Clutch Housing (551)	• Inspect for damaged or broken 1-2-3-4 Clutch Piston (552) and piston seals damaged, worn or leaking. • Inspect for fatigued or binding 1-2-3-4 Clutch Piston Return Spring (553). • Inspect for improper surface finish on 1-2-3-4 Clutch Plates (557-559). Refer to <u>Clutch Plate Diagnosis</u>. • Inspect for broken or fatigued 1-2-3-4 Clutch Waved Plate (557). • Inspect for plugged or restricted Low-Reverse and 1-2-3-4

	Clutch Piston Housing (551) air bleed.
Case Assembly (50)	• Inspect for leaking or loose fitting Fluid Check Valve (55). • Inspect for leaking or damaged 1-2-3-4 and Low-Reverse Clutch Fluid Passage Seals (67).

HARSH FIRST AND REVERSE SHIFT

Checks	Causes
Low-Reverse and 1-2-3-4 Clutch Housing (551)	Inspect for plugged or restricted Low-Reverse/1-2-3-4 Clutch Piston Housing (551) air bleed
Low and Reverse Clutch	• Inspect for improper surface finish on Low and Reverse Clutch Plates (545-547) • Inspect for broken or fatigued Low and Reverse Clutch Apply Plate (547) • Inspect for damaged or broken Low and Reverse Clutch Piston (550) and piston seals damaged, worn or leaking • Inspect for fatigued or binding Low and Reverse Clutch Piston Return Spring (549)

NO THIRD, FIFTH, AND REVERSE GEAR

Checks	Causes
3-5 Reverse Clutch Assembly	• Inspect for damaged, stripped or sheared splines on 3-5 Reverse Clutch Plates (507-509), Backing Plate (510) • Inspect for sheared or stripped splines on 3-5 Rev/4-5-6 Housing (516) to Turbine Shaft (517) • Inspect for damage, improper surface finish, porosity, deformed or unbalanced 3-5 Rev/4-5-6 Housing (516) • Inspect for damaged, worn, loose or seized hub bushing in the 3-5 Rev/4-5-6 Housing • Inspect for broken, porous or improper surface finish or plugged oil passages of the 3-5 Rev/4-5-6 Housing (516) • Inspect for failure of the Input Shaft Thrust Bearing (538) • Inspect for disengaged or broken 3-5 Reverse Clutch Backing Plate (511) • Inspect for damaged, worn or leaking 3-5 Reverse Clutch Piston Seals (504-506) • Inspect for damaged or broken 3-5 Rev/4-5-6 Clutch Housing (516) • Inspect for warped, damaged, improper surface finish or debonding 3-5 Reverse Clutch Piston (502)

	• Inspect for broken or fatigued 3-5 Reverse Clutch Spring (503) • Inspect for disengaged or broken Speed Sensor Reluctor Retainer (500) • Inspect for worn, broken or damaged Speed Sensor Reluctor Wheel (501)
Reaction Sun Gear Assembly (566)	Inspect for stripped or sheared splines
Reaction Carrier (567)	• Inspect for broken or disengaged Input Internal Gear Retainer • Inspect for stripped or sheared splines on the Input Internal Gear
Output Carrier (574)	Inspect for stripped or sheared splines for the Reaction Internal Ring Gear
4-5-6 Clutch Assembly	• Inspect for plugged or missing 4-5-6 Piston Dam Oil Feed hole • Inspect for leaking 4-5-6 Piston Dam

HARSH OR LATE SECOND AND SIXTH SHIFT

Checks	Causes
2-6 Clutch Assembly	• Inspect for worn or improper surface finish on the 2-6 Clutch Plates (540-542) • Inspect for fatigued 2-6 Clutch Piston Apply Plate (540) • Inspect for plugged, restricted or incorrect orientation of the 2-6 Clutch Piston (535) air bleed
Case Assembly (50)	• Inspect for damaged or broken 2-6 Clutch Piston (535) and piston seals damaged, worn or delaminating • Inspect for fatigued 2-6 Clutch Piston Return Spring (536)

NO FOURTH, FIFTH, AND SIXTH GEAR

Checks	Causes
4-5-6 Clutch Assembly	• Inspect for damaged, stripped or sheared splines on 4-5-6 Clutch Plates (526-528), Backing Plate (529) • Inspect for broken or fatigued 4-5-6 Clutch Waved Plate (525) • Inspect for damaged or broken 4-5-6 Clutch Piston (520) and Piston Seals (518, 519, 521) • Inspect for broken or fatigued 4-5-6 Piston Return Spring (522) • Inspect for broken or disengaged 4-5-6 Backing Plate Retainer (532)

	• Inspect for damaged or broken 4-5-6 Clutch Dam Piston (523) and piston seals damaged, worn or delaminating • Inspect for broken or disengaged 4-5-6 Clutch Dam Retainer (524) • Inspect for stripped or sheared splines on the Reaction Carrier Hub (531) • Inspect for stripped or sheared splines on 3-5 Rev/4-5-6 Housing to Turbine Shaft (516) • Inspect for loose, worn or damaged 3-5 Rev/4-5-6 Housing Bushing • Inspect for broken, porous or improper surface finish or plugged oil passages of the 3-5 Rev/4-5-6 Housing (516)
Transmission Case Assembly	Inspect the input shaft support (56) for missing or damaged fluid ring seals (58).
Control Valve Body Assembly	Inspect the reverse and 4-5-6 regulator valve (411) and ball check valve (404) for debris and stickyness.
Control Solenoid (w/Body and TCM) Valve Assembly	Check the pressure control solenoid 3 (R1/456) for proper operation. Refer to <u>Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test</u> .

HARSH OR LATE THIRD, FIFTH, AND REVERSE SHIFT

Checks	Causes
3-5 Reverse Clutch Assembly	• Inspect for damaged splines or improper surface finish on 3-5 Reverse Clutch Plates (507-509), Backing Plate (510) • Inspect for damaged, worn or leaking 3-5 Reverse Clutch Piston Seals (504-506) • Inspect for warped 3-5 Rev/4-5-6 Clutch Housing (516) • Inspect for broken or fatigued 3-5 Reverse Clutch Waved Plate (507)

HARSH FOURTH, FIFTH, AND SIXTH SHIFT

Checks	Causes
4-5-6 Clutch Assembly	• Inspect for leaking or damaged 4-5-6 Clutch Piston (520) and Piston Seals (518, 519, 521) • Inspect for plugged or restricted 4-5-6 Piston Dam air bleed • Inspect for leaking or damaged 4-5-6 Clutch Dam (523) • Inspect for plugged or restricted Dam oil feed hole in the 4-5-6 Piston (520) • Inspect for fatigued 4-5-6 Clutch Piston Spring (522)

- Inspect for leaking 4-5-6 Clutch Dam Seals (523)
- Inspect for improper surface finish on 4-5-6 Clutch Plates (525-528)
- Inspect for fatigued 4-5-6 Clutch Waved Plate (525)
- Inspect for porous, improper surface finish, seal groove damage or plugged or restricted oil passages of the 3-5 Rev/4-5-6 Housing (516)

NO TORQUE CONVERTER CLUTCH APPLY

Checks	Causes
Torque Converter Assembly (28)	• Inspect for damaged Torque Converter Clutch Seal (inside converter assembly). • Diagnose Torque Converter Assembly for possible internal damage. Refer to <u>Torque Converter Diagnosis</u>.
Valve Body Assembly (433)	Inspect for worn, damaged or sticking TCC Regulator Apply (425) and TCC Regulator Apply Shuttle (426) Valves. Refer to <u>Control Solenoid Valve and Transmission Control Module Assembly Inspection</u> .
Oil Pump Assembly (201)	Inspect for worn or damaged Torque Converter Fluid Seal Assembly (301).
Torque Converter Housing Assembly (29)	Inspect for leaking or damaged Torque Converter Fluid Seal Assembly (301), Torque Converter Fluid Seal Assembly (319) and A/Trans Fluid Pump Assembly (201).

NO TORQUE CONVERTER CLUTCH RELEASE

Checks	Causes
Torque Converter Assembly (28)	Diagnose Torque Converter Assembly for possible internal damage. Refer to <u>Torque Converter Diagnosis</u> .
Valve Body Assembly (433)	Inspect for worn, damaged or sticking TCC Regulator Apply (425) and TCC Regulator Apply Shuttle (426) Valves.

HARSH TORQUE CONVERTER CLUTCH APPLY, OR INOPERATIVE OR NO ELECTRONICALLY CONTROLLED CAPACITY CLUTCH CONTROL

Checks	Causes
Torque Converter Assembly (28)	• Inspect for leaking or damaged Torque Converter Clutch Hub Seal. • Diagnose Torque Converter Assembly for possible internal damage. Refer to <u>Torque Converter Diagnosis</u>.
	Inspect for worn, damaged or sticking TCC Regulator Apply (425)

NO REVERSE GEAR

Checks	Causes
Control Solenoid (w/Body and TCM) Valve Assembly	Check the 35R PC Solenoid 2 for proper operation. Refer to <u>Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test</u> .
Control Valve Body Assembly	- Inspect the 3-5-Reverse Clutch Regulator Valve (421) and Control Valve Body Ball Check Valve (404) for debris and stickyness. - Inspect the Clutch Select Valve (428) and the Actuator Feed Limit Valve (430) for debris and stickyness.
Transmission Case Assembly	Inspect the Input Shaft Support (56) for missing or damaged Fluid Seal Rings (58).
3-5 Reverse Clutch Assembly	- Inspect for damaged, stripped or sheared splines on 3-5 Reverse Clutch Plates (507-509), Backing Plate (510). - Inspect for stripped or sheared splines on 3-5 Rev/4-5-6 Housing to Turbine Shaft (516). - Inspect for damage, improper surface finish, porosity, deformed or unbalanced 3-5 Rev/4-5-6 Housing (516). - Inspect for damaged, worn, loose or seized hub bushing in the 3-5 Rev/4-5-6 Housing. - Inspect for broken, porous or improper surface finish or plugged oil passages of the 3-5 Rev/4-5-6 Housing (516). - Inspect for failure of the Input Shaft Thrust Bearing (538). - Inspect for disengaged or broken 3-5 Reverse Clutch Backing Plate Retainer (511). - Inspect for damaged, worn or leaking 3-5 Reverse Clutch Piston Seals (504-506). - Inspect for damaged or broken 3-5 Rev/4-5-6 Clutch Housing (516). - Inspect for warped, damaged, improper surface finish or debonding 3-5 Reverse Clutch Piston (502). - Inspect for broken or fatigued 3-5 Reverse Clutch Spring (503). - Inspect for disengaged or broken Speed Sensor Reluctor Retainer (500). - Inspect for broken Speed Sensor Reluctor Wheel (501).

FLUID PRESSURE HIGH OR LOW

Checks	Causes
Fluid Pump Assembly (201)	• Inspect for loose fluid pump bolts (204). • Inspect for leaking or damaged fluid pump outlet seals (24) and oil filter seal. • Inspect for improperly installed, restricted or damaged oil filter (203). • Inspect for sticking line pressure blow off valve (304). • Inspect for worn, sticking or damaged pressure regulator valve (309) or pressure regulator valve spring (308). • Inspect for damaged or restricted oil ports in the oil pump body (303).
Torque Converter Housing (208)	• Inspect for missing or restricted differential lube oil circuit orifice. • Inspect for missing front differential carrier baffle (205).
Control Solenoid Valve Assembly (w/Body and TCM) (7)	• Inspect for leaking or damaged filter plate assembly seals (8). • Verify VBS operation is not stuck high or low.
Case Assembly (50)	• Inspect for proper fluid level. • Inspect for missing lube oil circuit orifice or front differential carrier baffle (62). • Inspect for leaking or damaged valve body spacer plate assembly (12). • Inspect for damaged or leaking fluid check valve (55). • Inspect for leaking, damaged or broken fluid level control valve (13).
Torque Converter Assembly (28)	• Inspect for damaged torque converter clutch seal (inside converter assembly). • Inspect for damaged or disengaged torque converter hub to oil pump drive gear.