

2007 Cadillac Escalade

2007 TRANSMISSION Automatic Transmission - 6L50/6L80/6L90 - Avalanche, Escalade, Suburban, Tahoe & Yukon

2007 TRANSMISSION

Automatic Transmission - 6L50/6L80/6L90 - Avalanche, Escalade, Suburban, Tahoe & Yukon

SYMPTOMS - AUTOMATIC TRANSMISSION

IMPORTANT: 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 Checking
 - Fluid Pressure High or Low
 - Automatic Transmission Fluid Leaks
 - Fluid Leak Diagnosis
- Noise and Vibration Diagnosis
 - Whine/Growl Noise That Changes with Vehicle Speed
 - Noise in First or Reverse Gear
 - Noise in First, Second, Third, Fourth, Fifth, or Reverse Gear
 - Noise in First, Second, Sixth, or Reverse Gear
 - Noise in Second or Sixth Gear
 - Noise During 3-4 or 4-3 Shifts
 - Noise in Fourth, Fifth, or Sixth Gear

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- Vibration
- Vibration in Second, Third, Fourth, Fifth or Sixth Gear
- Flexplate/Torque Converter Vibration Test
- Noise and Vibration Analysis
- Range Performance Diagnosis
 - No Park or Drive
 - No Drive in All Ranges
 - No Reverse Gear
 - No Drive or Reverse Gear
- Shift Quality Feel Diagnosis
 - Harsh Garage Shift
 - Harsh, Soft, Delayed or Slipping First or Reverse Gear
 - Harsh, Soft, Delayed or Slipping 1-2-3-4 Shift
 - Harsh, Soft, Delayed or Slipping 4-5-6 Shift
 - Harsh, Soft, Delayed or Slipping Third, Fifth, or Reverse Gear
 - Harsh, Soft, Delayed or Slipping Second or Sixth Gear
- Shift Pattern
 - No First Gear
 - No First and Reverse Gears
 - No First, Second, Third, and Fourth Gear
 - No First, Second, Third, Fourth, Fifth, or Reverse Gear
 - No Second and Sixth Gear
 - No First, Second, Sixth, or Reverse Gear
 - No Fourth, Fifth, and Sixth Gear
 - No Third, Fifth, and Reverse Gear
 - Stuck in Second or Sixth Gear
 - Stuck in First or 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 Checking
 - Road Test
 - Line Pressure Check

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE

ASSEMBLY INSPECTION

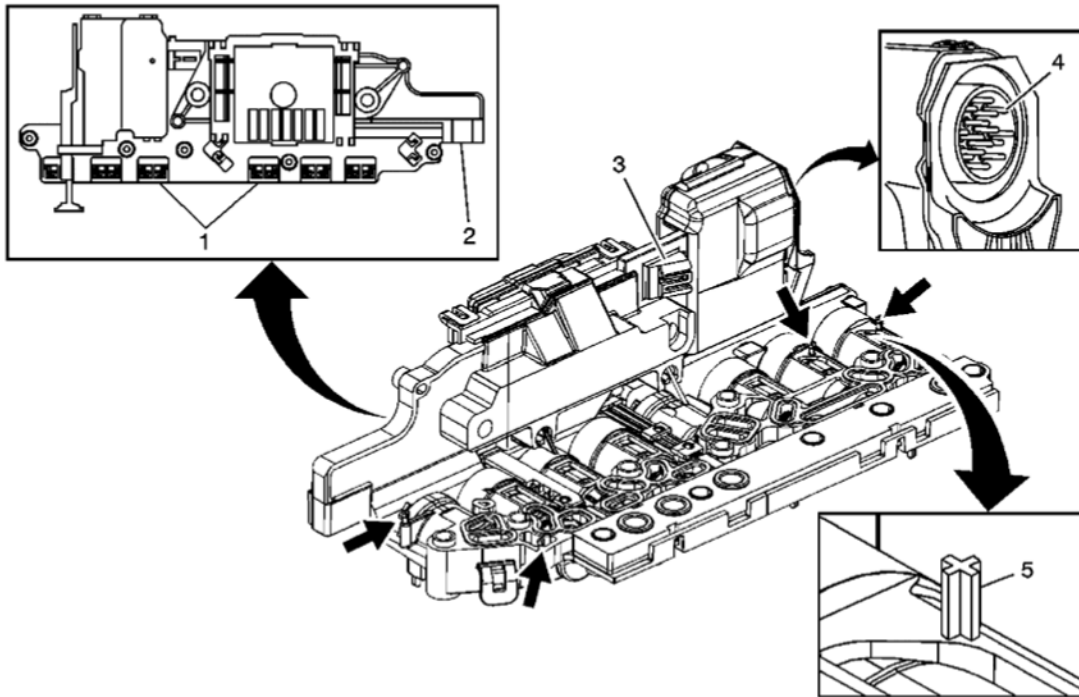


Fig. 1: Identifying Control Solenoid Valve & Transmission Control Module Assembly
 Courtesy of GENERAL MOTORS CORP.

1. Inspect the control solenoid (w/body and TCM) valve assembly connectors and pins (2, 3, 4) 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 (w/body and TCM) valve assembly solenoid leads (1) for contamination or metallic debris.
4. Inspect the 4 control solenoid (w/body and TCM) 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

Tools Required

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

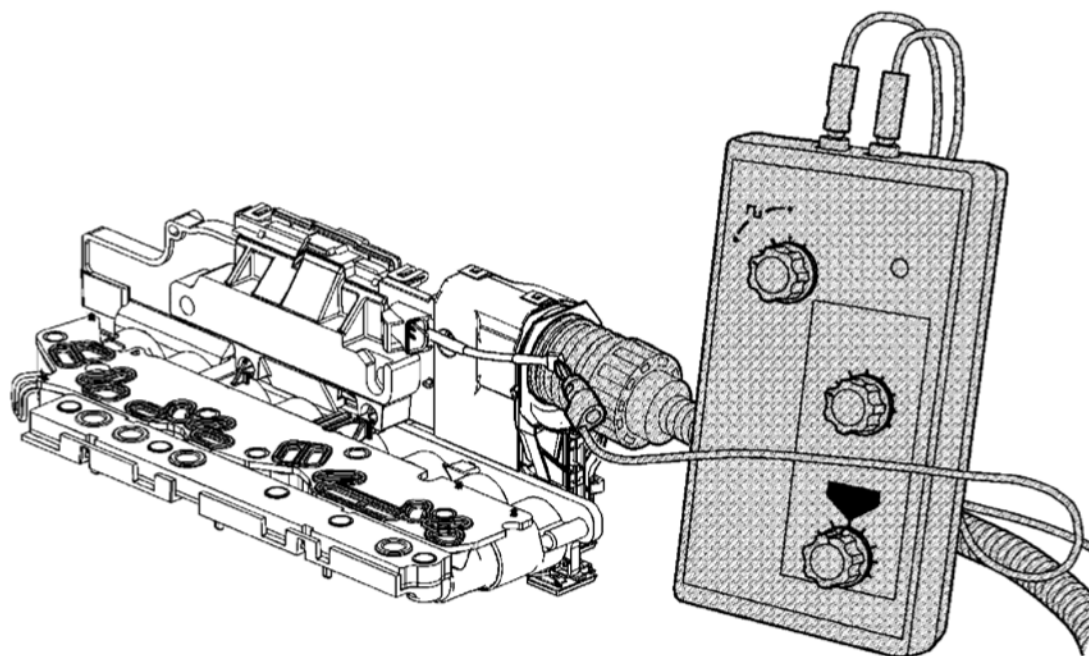


Fig. 2: Identifying J 35616 & J 38522
Courtesy of GENERAL MOTORS CORP.

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

1. Disconnect the ISS/OSS wiring harness connector from the control solenoid (w/body and TCM) valve assembly.
 2. Using the **J 35616** , connect the **J 38522** to the affected ISS or OSS signal circuit on the control solenoid (w/body and TCM) valve assembly.
 1. Set the **J 38522** Signal to 5 volts, the Frequency to 120 and the Percent Duty Cycle to 50.
 2. Ignition On, observe either the scan tool parameter ISS Signal or OSS Signal.
 3. The signal parameter should display between 100-400 RPM.
- If the signal display is not in this range, the control solenoid (w/body and TCM) valve assembly is not reading the input signal correctly and is faulty.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY CLEANING

The control solenoid (w/body and TCM) valve assembly cleaning procedure is a specific software based

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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. The transmission fluid is drained and refilled with new fluid, and then the cleaning procedure is performed. When the cleaning procedure is completed, the DTC enable criteria is run again, and retested to see if the DTC concern has been corrected.

IMPORTANT: The fluid pan must be removed in order to drain the fluid.

1. Drain and refill the transmission fluid. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement** .
2. Operate the transmission to achieve 70°-90°C (158°-194°F).
3. With a scan tool, select the Service Cleaning Procedure. Initiate the cleaning procedure.
4. When the cleaning procedure is completed, shut OFF the ignition for 30 seconds.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY SOLENOID PERFORMANCE TEST

TOOLS REQUIRED

DT-47825 Control Solenoid Test Plate. See **Special Tools** .

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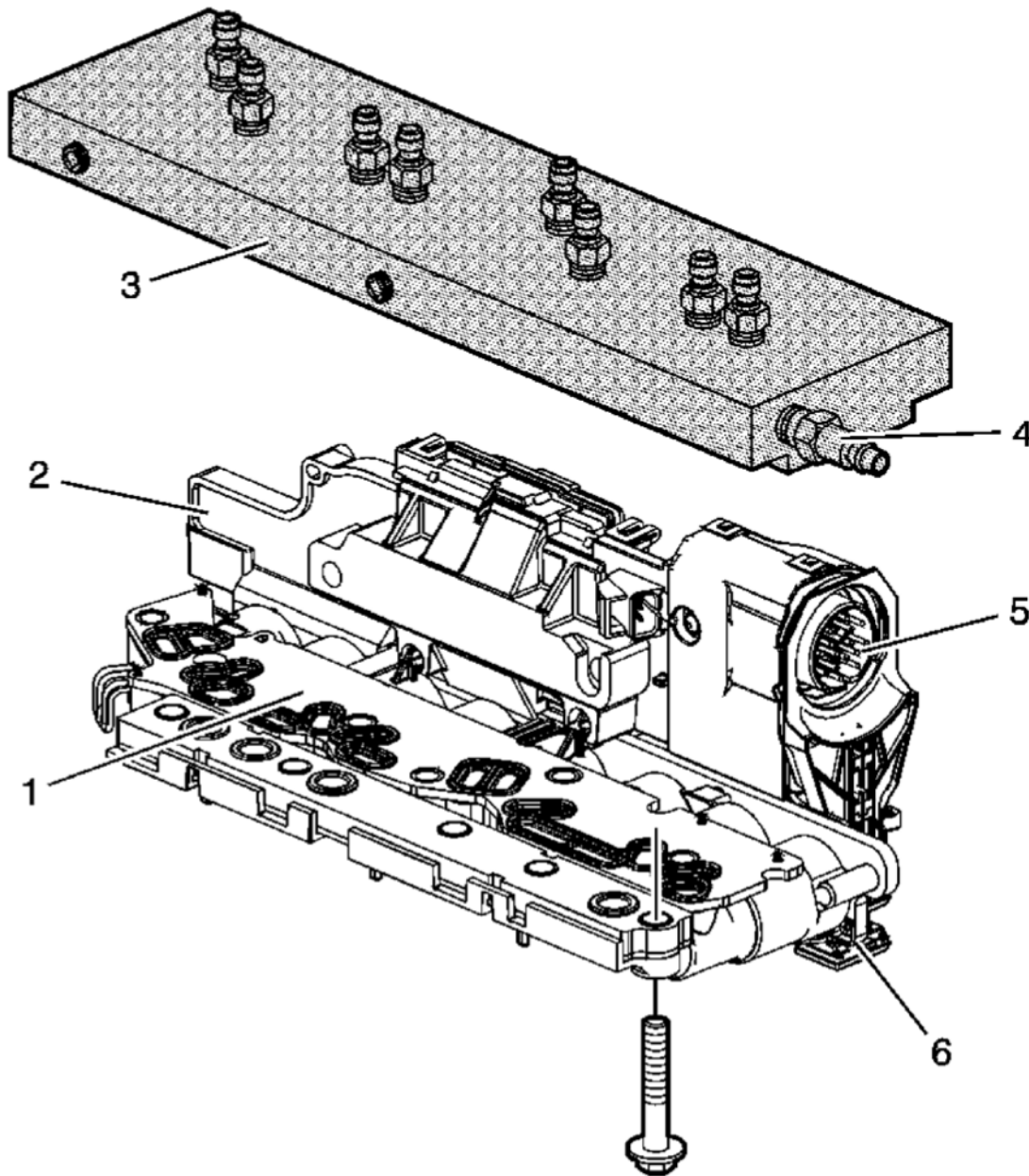


Fig. 3: View Of Control Solenoid (w/Body & TCM) Valve Assembly With Control Solenoid Test Plate
Courtesy of GENERAL MOTORS CORP.

The purpose of this procedure is to test the functionality of the control solenoid (w/body and TCM) valve assembly solenoids for a gross stuck open or stuck closed condition. **DT-47825** is bolted to the control solenoid (w/body and TCM) valve assembly on the valve body mounting surface. See **Special Tools** . Pressurized air is passed into the aluminum test block, through the control solenoid (w/body and TCM) valve assembly solenoid passage and back to a pressure gage on the test block. The pressure gage 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 gage, one can determine the valve functionality. The

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recommended shop air pressure for this test is 90-100 psi.

1. Remove the control solenoid (w/body and TCM) valve assembly from the transmission.
2. Bolt the **DT-47825** to the control solenoid (w/body and TCM) valve assembly on the valve body mounting surface. See **Special Tools** . Use the bolts and washers supplied with the tool to attach the test block. Tighten the bolts to 5 N.m (44 lb in).
3. Install the pressure gage to the affected solenoid air port. Reference component to air port table.
4. Connect the shop air pressure line to the **DT-47825** air psi inlet port. See **Special Tools** .

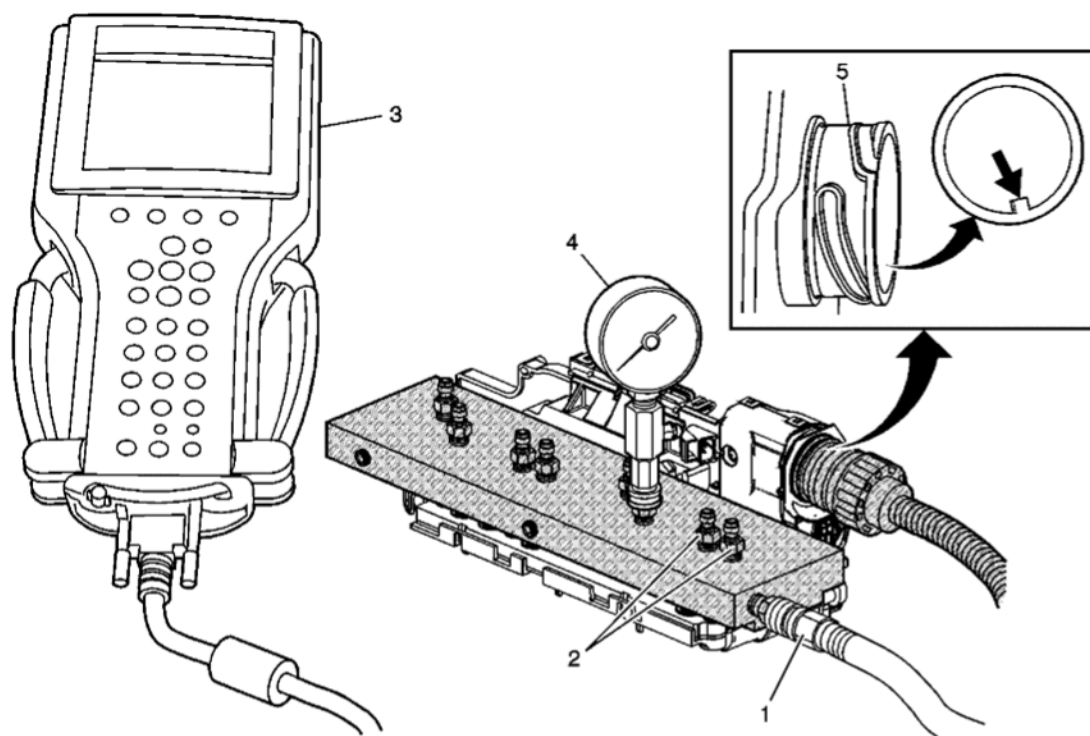


Fig. 4: Identifying Solenoid Testing Procedure
Courtesy of GENERAL MOTORS CORP.

5. Ignition ON, with a scan tool command the solenoid in question On and Off. Watch the air pressure gage 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 gage with a result of pressure reading on the gage. 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 gage between pressurization tests.

Control Solenoid (w/Body and TCM) Valve Assembly Solenoid Performance Test Block to Component Identification

COMPONENT	PORT ON TEST BLOCK	Key On, Engine Off (KOEO) Normal State

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PC Solenoid 1	G	No PSI flow to gauge
PC Solenoid 2	C	No PSI flow to gauge
PC Solenoid 3	A	Full PSI flow to gauge
PC Solenoid 4	B	No PSI flow to gauge
PC Solenoid 5	F	No PSI flow to gauge
Shift Solenoid 1	H	Full PSI flow to gauge
Shift Solenoid 2	D	No PSI flow to gauge
TCC PC Solenoid	E	No PSI flow to gauge

IMPORTANT: 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 gage to flicker high and low as the valves open and close. This may cause some air to exit the ports where the psi gage is not connected as those solenoids cycle on and off.

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

SERVICE FAST LEARN ADAPTS

Service Fast Learn Adapts 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, Service Fast Learn Adapts translates it into the adaptive data cells, which the TCM uses for clutch control during shifts. The scan tool provides initiation of the Service Fast Learn Adapts procedure. This procedure is to be used following transmission repair.

The Service Fast Learn Adapts 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 (w/body and TCM) 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 Service Fast Learn Adapts procedure:

- Drive wheels are blocked
- Parking brake is applied

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- **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 Service Fast Learn Adapts by selecting the following commands:
 1. F3: Special Function
 2. F1: Transmission Output Controls
 3. Service Fast Learn Adapts

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

2. Use the scan tool to perform the Service Fast Learn Adapts procedure.

IMPORTANT: There are 3 stages required to successfully complete the Service Fast Learn Adapts procedure:

1. **PARK test setup**
2. **DRIVE mode**
3. **REVERSE mode**

These stages are automatically initiated and controlled by the scan tool. As the procedure is being performed, the scan tool data display will provide operator instructions. Follow the scan tool instructions as required. The following are brief descriptions of each of the 3 different stages.

PARK TEST SETUP

While the transmission is in PARK, Service Fast Learn Adapts will prepare for test cycles. The test preparation will include the diagnostic criteria checks, safety checks, vehicle status checks, and then will perform internal transmission test preparation functions such as clutch air purging. The scan tool will instruct the operator to select park and apply the brake only.

DRIVE MODE

CAUTION: Block the wheels before selecting DRIVE. While in DRIVE, if the Scan Tool loses communication or becomes disconnected, the vehicle could move forward. Failure to block the wheels could result in personal injury or property damage.

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Once the PARK setup has completed, the scan tool instructs the driver to select DRIVE. Once DRIVE is selected, the TCM engages the individual clutches to learn the clutch volume, full feed fill thresholds, and pressure offsets. The TCM will only cycle through this test once. Running the Service Fast Learn Adapts procedure multiple times will give the same results and is not necessary.

REVERSE MODE

CAUTION: Block the wheels before selecting REVERSE. While in REVERSE, if the Scan Tool loses communication or becomes disconnected, the vehicle could move backward. Failure to block the wheels could result in personal injury or property damage.

Next, the scan tool instructs the driver to select REVERSE. The TCM engages the individual clutches to learn the clutch volume, full feed fill thresholds, and pressure offsets. The TCM will only cycle through this test one time. Running the Service Fast Learn Adapts procedure multiple times will give the same results.

IMPORTANT: When the Service Fast Learn Adapts procedure is completed, the transmission will remain in a neutral state.

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 Service Fast Learn Adapts procedure.

Troubleshooting

If the Service Fast Learn Adapts 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 1500 RPM while in Park Test Setup or at entrance of the test modes.
- Park/Neutral position switch is properly adjusted and functioning.
- Line pressure control is able to provide 1000 kPa and is within specifications.
- Vehicle is not moving, or vibrating excessively.
- Clutches are properly assembled.

TOW/HAUL SWITCH/INDICATOR ALWAYS ON OR INOPERATIVE

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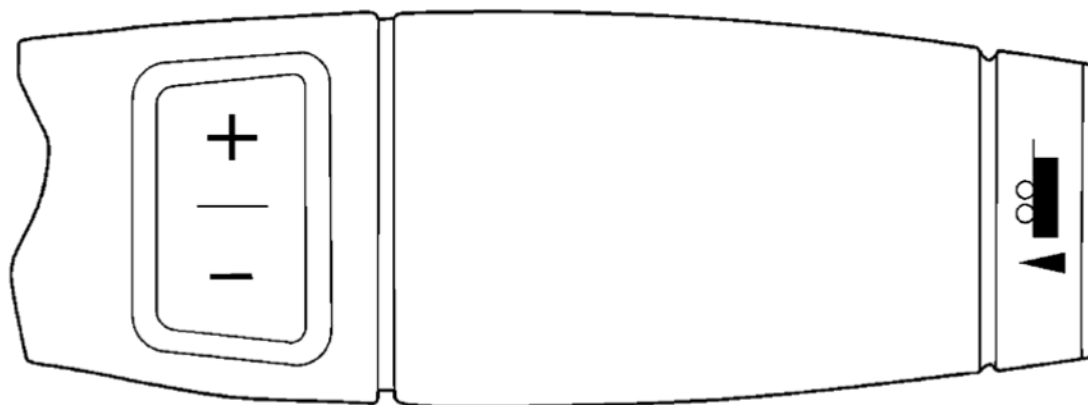


Fig. 5: View Of Tow/Haul Switch/Indicator
Courtesy of GENERAL MOTORS CORP.

CIRCUIT/SYSTEM DESCRIPTION

Tow/haul mode enables the operator to achieve enhanced shift performance when towing or hauling a load. When tow/haul mode is selected, the tow/haul switch input signal to the body control module (BCM) is momentarily toggled to zero volts. This signals the powertrain control module (PCM) to extend the length of time between upshifts and increase transmission line pressure. Cycling the tow/haul switch again disables tow/haul mode and returns the transmission to a normal shift pattern. The tow/haul switch is a momentary switch and is normally open. The internal spring in the switch will always cause the switch state to return to open when not held in to the closed position.

DIAGNOSTIC AIDS

If the electrical circuit checks are OK and the tow/haul shift pattern is not occurring, there may be a mechanical/hydraulic condition that prevents tow/haul operation. Refer to **Symptoms - Automatic Transmission**.

REFERENCE INFORMATION

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **Automatic Transmission Inline 16-Way Connector End View**
- **Automatic Transmission Internal Connector End Views**
- **Automatic Transmission Related Connector End Views**
- **Data Communication Connector End Views**

Scan Tool Reference

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- Scan Tool Output Controls
- Scan Tool Data List
- Scan Tool Data Definitions

DTC Type Reference

- Diagnostic Trouble Code (DTC) Type Definitions
- Diagnostic Trouble Code (DTC) List/Type

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections

CIRCUIT/SYSTEM VERIFICATION

With a scan tool observe the Tow/Haul switch parameter in Body Controls data list, operate the Tow/Haul switch several times, and observe the parameter as you operate the switch with the transmission in Drive. The parameter should toggle between Active and Inactive when the switch is operated.

CIRCUIT/SYSTEM TESTING

1. Ignition Off, transmission in Park or Neutral, disconnect the Tow/Haul switch connector.
2. Test for less than 1 Ohm of resistance between the Tow/Haul switch signal circuit terminal B and ground.
 - If greater than the specified range, test the ground circuit for an Open/High resistance.
3. Ignition On, verify the scan tool parameter Park/Neutral displays Inactive.
 - If not the specified value, test the signal circuit for a short to ground. If the circuit tests normal, replace the BCM.
4. Install a fused jumper between the signal circuit and ground. Verify the scan tool parameter displays Active.
 - If not the specified value, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the BCM.
5. If all circuits test normal, replace the Tow/Haul switch.

COMPONENT TESTING

1. Ignition Off, transmission in Park or Neutral, disconnect the transmission Tow/Haul switch assembly.
2. Test for infinite resistance between the Tow/Haul switch with the switch in the Open position.
 - If not the specified value, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the Tow/Haul switch assembly.

REPAIR PROCEDURES

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Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Body Control Module (BCM) assembly replacement. Refer to **Control Module References** for replacement, setup, and programming.
- Perform the **Shift Lever Replacement**.

TRANSMISSION FLUID CHECKING

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

NOTE: Always use the proper automatic transmission fluid listed. Using incorrect automatic transmission fluid may damage the vehicle.

Before checking the fluid level, perform the following:

1. Start the engine and park the vehicle on a level surface. Keep the engine running.
2. Apply the parking brake and place the shift lever in PARK (P).
3. 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).
4. Allow the engine to idle 500-800 rpm for at least 1 minute. Slowly release the brake pedal.
5. Keep the engine running and observe the transmission fluid temperature (TFT) using the Driver Information Center (DIC) or a scan tool.
6. Using the TFT reading, determine and perform the appropriate check procedure. If the TFT reading is not within the required temperature ranges, allow the vehicle to cool, or operate the vehicle until the appropriate TFT is reached.

COLD CHECK PROCEDURE

IMPORTANT: Use this procedure only as a reference to determine if the transmission has enough fluid to be operated safely until a hot check procedure can be made. The hot check procedure is the most accurate method to check the fluid level. Perform the hot check procedure at the first opportunity. Use this cold check procedure to check fluid level when the TFT is between 80°F and 90°F (27°C and 32°C).

1. Locate the transmission dipstick at the rear of the engine compartment, on the passenger's side of the vehicle.
2. Flip the handle up, and then pull out the dipstick and wipe it with a clean rag or paper towel.
3. Install the dipstick by pushing it back in all the way, wait three seconds and then pull it back out again.

IMPORTANT: 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 assembly to ensure it is clean and unclogged.

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4. Check both sides of the dipstick, and read the lower level. Repeat the check procedure to verify the reading.
5. Inspect the color of the fluid on the dipstick. Refer to **Fluid Condition Inspection** in this procedure.
6. If the fluid level is below the COLD check band, add only enough fluid as necessary to bring the level into the COLD band. It does not take much fluid, generally less than one pint (0.5L). Do not overfill.
7. If the fluid level is in the acceptable range, push the dipstick back in all the way, then flip the handle down to lock the dipstick in place.
8. Perform a hot check at the first opportunity after the transmission reaches a normal operating temperature between 160°F to 200°F (71°C to 93°C).

HOT CHECK PROCEDURE

IMPORTANT: Use this procedure to check the transmission fluid level when the TFT is between 160°F and 200°F (71°C and 93°C). The hot check procedure is the most accurate method to check the fluid level. The hot check should be performed at the first opportunity in order to verify the cold check. The fluid level rises as fluid temperature increases, so it is important to ensure the transmission temperature is within range.

1. Locate the transmission dipstick at the rear of the engine compartment, on the passenger's side of the vehicle.
2. Flip the handle up, and then pull out the dipstick and wipe it with a clean rag or paper towel.
3. Install the dipstick by pushing it back in all the way, wait three seconds and then pull it back out again.

IMPORTANT: 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 assembly to ensure it is clean and unclogged.

4. Check both sides of the dipstick, and read the lower level. Repeat the check procedure to verify the reading.
5. Inspect the color of the fluid on the dipstick. Refer to **Fluid Condition Inspection**.
6. A safe operating fluid level is within the HOT crosshatch band on the dipstick. If the fluid level is not within the HOT band, and the TFT is between 160°F and 200°F (71°C and 93°C), add or drain fluid as necessary to bring the level into the HOT band. If the fluid level is low, add only enough fluid to bring the level into the HOT band. It does not take much fluid, generally less than one pint (0.5L). Do not overfill. Also, if the fluid level is low, inspect the transmission for leaks. Refer to **Fluid Leak Diagnosis**.
7. If the fluid level is in the acceptable range, push the dipstick back in all the way, then flip the handle down to lock the dipstick in place.
8. If applicable and if the vehicle is equipped, reset the transmission oil life monitor only if the fluid was changed.

FLUID CONDITION INSPECTION

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 and inside of the bottom pan for excessive metal particles or other debris. A small amount of "friction" material in the bottom pan is a "normal" condition. If large pieces and/or metal particles are noted in the fluid or bottom pan, flush the oil cooler and cooler lines and overhaul the transmission. If there are no signs of transmission internal damage noted, replace the fluid filter assembly, 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** .

LINE PRESSURE CHECK

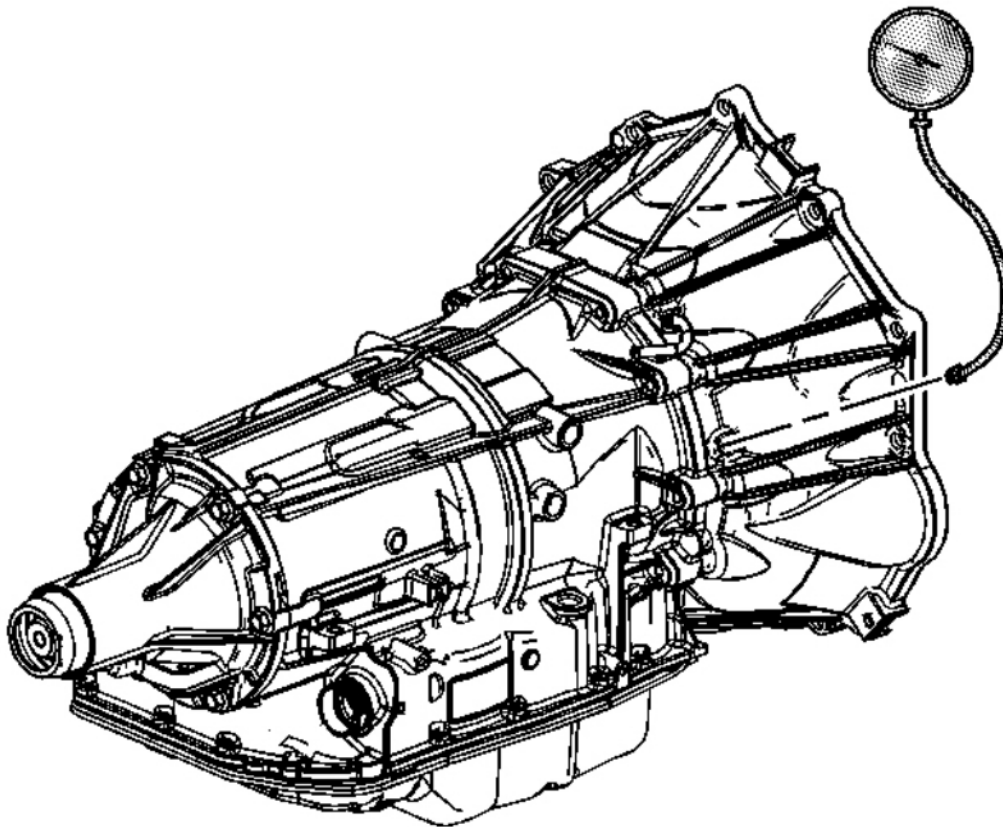


Fig. 6: View Of Transmission & J 21867 Pressure Gage
Courtesy of GENERAL MOTORS CORP.

TOOLS REQUIRED

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J 21867 Pressure Gage

CAUTION: 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 Checking.
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.

IMPORTANT: You may need to remove or disconnect components in order to gain access to the transmission line pressure test hole plug.

7. Remove the line pressure test hole plug.
8. Install the J 21867 .
9. Access the Scan Tool Transmission Output Controls for the Line PC Solenoid.
10. Start the engine.

IMPORTANT: In order to achieve accurate line pressure readings, the following procedure must be performed at least three 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 your pressure readings on the scan tool to those indicated on the J 21867 .
14. If the pressure readings vary greatly, refer to Fluid Pressure High or Low.
15. Turn the engine OFF.
16. Remove the J 21867 .

NOTE: Refer to Fastener Notice .

17. Install the line pressure test hole plug.

Tighten: Tighten the pressure plug to 11 N.m (97 lb in).

ROAD TEST

IMPORTANT: 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 Detent Downshifts
- Manual Downshifts
- Coasting Downshifts
- Manual Gear Range Selection
 - REVERSE
 - Driver Shift Control

IMPORTANT: Complete the test in the sequence given. Incomplete testing cannot guarantee an accurate evaluation.

Before the road test, ensure the following:

- The engine is performing properly.
- Transmission fluid level is correct. Refer to Transmission Fluid Checking.
- 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 Checking.
- Inspect for any diagnostic trouble codes (DTCs) that may have set during the testing. Refer to the applicable DTC.

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- 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 **Scan Tool Data List** 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.
- TCC 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

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- TCC PC Sol. Duty Cycle
 - TCC Slip Speed
5. Monitor the TCC Brake Switch parameter while applying and releasing the brake pedal. The scan tool should display:
 - Open when the brake pedal is applied.
 - Closed when the brake pedal is released.
 6. 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
 3. Pause 2 to 3 seconds in each gear position.
 4. Verify the gear engagements are immediate and not harsh.

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

- **High engine idle speed-Compare engine idle speed to desired idle speed.**
- **Commanded low pressure control (PC) solenoid current-Investigate PC Sol. Pressure Cmd. kPa (psi) for all solenoids. High pressure will cause harsh shifts.**
- **A default condition caused by certain DTCs that result in maximum line pressure to prevent clutch slippage.**

IMPORTANT: Soft or delayed engagement may be caused by any of the following conditions:

- **Low idle speed-Compare engine idle speed to desired idle speed.**
- **Low fluid level**
- **Commanded high PC solenoid current-Investigate PC Sol. Pressure Cmd. kPa (psi) for all solenoids. Low pressure will cause soft or delayed shifts.**
- **Cold transmission fluid temperature (TFT)-Use the scan tool to determine TFT.**
- **Selector linkage-Inspect and adjust as necessary.**

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

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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.
8. 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 closing or opening the ground circuit for the appropriate solenoid.

Perform the following steps:

1. Refer to **Shift Speed** table in this section and choose a throttle position of 12.5 percent or 25 percent. All throttle positions shown should be tested to cover the normal driving range.
2. 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 Pressure Actual
 - 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.

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- PC Sol. 5 Pressure Cmd.
 - Shift Solenoid 1 and 2
3. Place the gear selector in the DRIVE position.
 4. Accelerate the vehicle using the chosen throttle position. Hold the throttle steady.
 5. 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 TCC feel may not be noticeable. Look for 100-300 RPM engine speed change.
 6. Compare the shift speeds to the Shift Speed table. Refer to **Shift Speed** . Shift speeds may vary slightly due to TFT or other operating variables, including hydraulic delays in responding to electronic controls.
 - Note any harsh, soft or delayed shifts or slipping.
 - Note any noise or vibration.

IMPORTANT: This transmission is equipped with an electronically controlled capacity clutch (ECCC), which does not allow the clutch to fully lock 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 chuggle caused by TCC apply. Full lockup is available at highway speeds on some applications.

IMPORTANT: The TCC will not engage until the engine is in closed loop operation and the vehicle speed is as shown in the Shift Speed table. Refer to **Shift Speed** . The vehicle must be in a near-cruise condition, not accelerating or coasting, and on a level road surface.

7. Monitor TCC PC solenoid current while driving and make sure the current rises when the TCC is commanded to apply.
 - When the TCC applies there should be a noticeable drop in engine speed and a drop in slip speed to below 100 RPM. If the TCC apply can not be detected:
 - Check for DTCs.
 - Refer to **Torque Converter Diagnosis**.
 - Apply and release the brake pedal. The TCC will release on most applications.

PART THROTTLE DETENT DOWNSHIFT

1. Place the gear selector in the DRIVE position.
2. Accelerate the vehicle to 64-88 km/h (40-55 mph) in 6th gear.
3. Quickly increase throttle angle to between 25-30 percent.
4. Verify the following:
 - The TCC releases.
 - The transmission downshifts immediately.

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MANUAL DOWNSHIFTS

Manual downshift testing is not required for vehicles equipped with Driver Shift Control (DSC). The TCM and shift solenoids 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 the following:
 - The TCC releases (on most applications).
 - Downshifts occur as commanded.

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 DSC. 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

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.

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 at all times.

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POOR ACCELERATION AT LOW SPEED

If the stator is freewheeling at all times, the vehicle tends to have poor acceleration from a standstill. At speeds above 50-55 km/h (30-35 mph), the vehicle may act normally. For poor acceleration, you should first determine that the exhaust system is not blocked, and the transmission is in First gear when starting out.

If the engine freely accelerates to high RPM in NEUTRAL, you can assume that the engine and the exhaust system are normal. Check for poor performance in DRIVE and REVERSE to help determine if the stator is freewheeling at all times.

POOR ACCELERATION AT HIGH SPEED

If the stator is locked up at all times, performance is normal when accelerating from a standstill. Engine RPM and vehicle speed are limited or restricted at high speeds. Visual examination of the converter may reveal a blue color from overheating.

If the converter has been removed, you can check the stator roller clutch by inserting a finger into the splined inner race of the roller clutch and trying to turn the race in both directions. You should be able to freely turn the inner race clockwise, but you should have difficulty in moving the inner race counterclockwise or you may be unable to move the race at all.

NOISE

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

You may notice a torque converter whine when the vehicle is stopped and the transmission is in DRIVE or REVERSE. This noise will increase as you increase the engine RPM. The noise will stop when the vehicle is moving or when you apply the torque converter clutch, because both halves of the converter are turning at the same speed.

Perform a stall test to make sure the noise is actually coming from the converter:

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

NOTE: 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 SHUDDER

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The key to diagnosing torque converter clutch (TCC) shudder is to note when it happens and under what conditions.

TCC shudder which is caused by the transmission should only occur during the apply or the release of the converter clutch. Shudder should never occur after the TCC plate is fully applied.

IF SHUDDER OCCURS DURING TCC APPLY OR RELEASE

If the shudder occurs while the TCC is applying, the problem can be within the transmission or the torque converter. Something is causing one of the following conditions to occur:

- Something is not allowing the clutch to become fully engaged.
- Something is not allowing the clutch to release.
- The clutch is releasing and applying at the same time.

One of the following conditions may be causing the problem to occur:

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

IF SHUDDER OCCURS AFTER TCC HAS APPLIED

If shudder occurs after the TCC has applied, most of the time there is nothing wrong with the transmission.

The TCC is not likely to slip after the TCC has been applied. Engine problems may go unnoticed under light throttle and load, but they become noticeable after the TCC apply when going up a hill or accelerating. This is due to the mechanical coupling between the engine and the transmission.

Once TCC is applied, there is no torque converter (fluid coupling) assistance. Engine or driveline vibrations could be unnoticeable before TCC engagement.

Inspect the following components in order to avoid misdiagnosis of TCC shudder. An inspection will also avoid the unnecessary disassembly of a transmission or the unnecessary replacement of a torque converter.

- Spark plugs-Inspect for cracks, high resistance or a broken insulator.
- Plug wires-Look in each end. If there is red dust (ozone) or a black substance (carbon) present, then the wires are bad. Also look for a white discoloration of the wire. This indicates arcing during hard acceleration.
- Coil-Look for a black discoloration on the bottom of the coil. This indicates arcing while the engine is misfiring.
- Fuel injector-The filter may be plugged.
- Vacuum leak-The engine will not get a correct amount of fuel. The mixture may run rich or lean depending on where the leak occurs.

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- EGR valve-The valve may let in too much or too little unburnable exhaust gas and could cause the engine to run rich or lean.
- MAP/MAF sensor-Like a vacuum leak, the engine will not get the correct amount of fuel for proper engine operation.
- Carbon on the intake valves-Carbon restricts the proper flow of air/fuel mixture into the cylinders.
- Flat cam-Valves do not open enough to let the proper fuel/air mixture into the cylinders.
- Oxygen sensor-This sensor may command the engine too rich or too lean for too long.
- Fuel pressure-This may be too low.
- Engine mounts-Vibration of the mounts can be multiplied by TCC engagement.
- Axle joints-Check for vibration.
- TP Sensor-The TCC apply and release depends on the TP Sensor in many engines. If the TP Sensor is out of specification, TCC may remain applied during initial engine loading.
- Cylinder balance-Bad piston rings or poorly sealing valves can cause low power in a cylinder.
- Fuel contamination-This causes poor engine performance.

Replace the torque converter if any of the following conditions exist:

- External leaks appear in the hub weld area.
- The converter hub is scored or damaged.
- The converter pilot is broken, damaged, or fits poorly into the crankshaft.
- You discover steel particles after flushing the cooler and the cooler lines.
- The pump is damaged, or you discover steel particles in the converter.
- The vehicle has TCC shudder and/or no TCC apply. Replace the torque converter only after all hydraulic and electrical diagnoses have been made. The converter clutch material may be glazed.
- The converter has an imbalance which cannot be corrected. Refer to **Flexplate/Torque Converter Vibration Test**.
- The converter is contaminated with engine coolant which contains antifreeze or water.
- An internal failure occurs in the stator roller clutch.
- You notice excessive end play.
- Overheating produces heavy debris in the clutch or converter ballooning.
- You discover steel particles or clutch lining material in the fluid filter or on the magnet, when no internal parts in the unit are worn or damaged. This condition indicates that lining material came from the converter.

Do not replace the torque converter if you discover any of the following symptoms:

- The oil has an odor or the oil is discolored, even though metal or clutch facing particles are not present.
- The threads in one or more of the converter bolt holds are damaged. Correct the condition with a new thread inset.
- Transmission failure did not display evidence of damaged or worn internal parts, steel particles or clutch plate lining material in the unit and inside the fluid filter.

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- The vehicle has been exposed to high mileage only. An exception may exist where the lining of the torque converter clutch dampener plate has seen excess wear by vehicles operated in heavy and/or constant traffic, such as taxi, delivery, or police use.

FLEXPLATE/TORQUE CONVERTER VIBRATION TEST

ISOLATING VIBRATION

NOTE: Some engine/transaxle combinations cannot be balanced in this manner due to restricted access or limited clearances between the torque converter bolts and the engine. Ensure that the bolts do not bottom out in the lug nuts or the torque converter cover which could dent and cause internal damage.

To isolate and correct a flywheel or torque converter vibration, separate the torque converter from the flywheel to determine if vibration is in the engine or transmission.

1. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration.
2. Turn the engine OFF.
3. Raise and suitably support the vehicle. Refer to Lifting and Jacking the Vehicle .
4. Remove the transmission converter cover bolts and the cover.
5. Mark the relationship of the converter to the flywheel.
6. Remove the bolts attaching the converter to the flywheel.
7. Slide the torque converter away from the flywheel.
8. Rotate the flywheel and torque converter to inspect for defects or missing balance weights.
9. Lower the vehicle.
10. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration. Refer to Diagnostic Starting Point - Vibration Diagnosis and Correction .
11. Turn the engine OFF.

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 flywheel balance.

1. Raise and suitably support the vehicle. Refer to Lifting and Jacking the Vehicle .
2. Rotate the torque converter one bolt position.

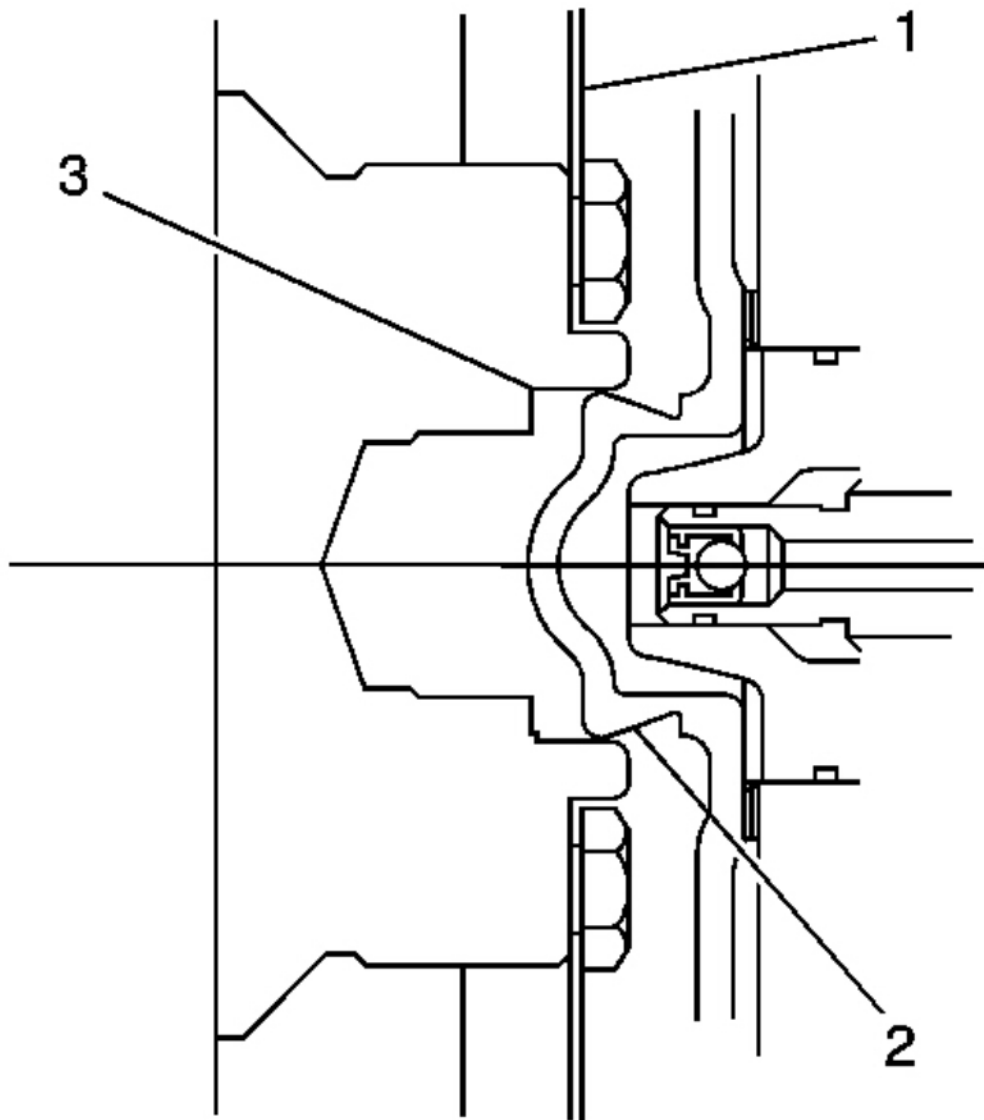


Fig. 7: View Of Torque Converter Hub In Engine Crankshaft
Courtesy of GENERAL MOTORS CORP.

3. Align the torque converter hub (2) in the engine crankshaft (3) and install the torque converter to flywheel bolts.
4. Lower the vehicle.
5. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration. Refer

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to Noise and Vibration Analysis .

Repeat this procedure until you obtain the best possible balance.

6. Install the transmission converter cover bolts and the cover.

VIBRATION

Vibration

Checks	Causes
Lug bolts for the Torque Converter (1)	Inspect for loose torque converter (1) lug bolts.
Input Sun Gear Thrust Washer (55)	Inspect for wear or damage.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect for wear or damage.
2-6 and 3-5-R Clutch Hub Thrust Bearing Assembly (65)	Inspect the bearing for wear or damage.
Output Carrier Assembly (68)	• Inspect the carrier assembly for damaged pinion gears, thrust washers, pins, and rollers. • Inspect for a worn or damaged center support roller bearing assembly (485). • Inspect for damaged thrust bearings (486, 488). • Inspect the carrier assembly for damaged output carrier rear sun gear thrust bearing (captured).
Output Carrier Thrust Bearing Assembly (69)	Inspect the bearing for wear or damage.
Output Shaft Thrust Bearing Assembly (71)	Inspect the bearing for wear or damage.
1-2-3-4 Clutch Hub Thrust Bearing Assembly (63)	Inspect the bearing for wear or damage.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect the bearing for wear or damage.

NOISE AND VIBRATION ANALYSIS

A noise or vibration that is noticeable when the vehicle is in motion MAY NOT be the result of the transmission.

If noise or vibration is noticeable in PARK and NEUTRAL with the engine at idle, but is less noticeable as RPM increases, the cause may be from poor engine performance.

- Vibration may also be caused by a small amount of water inside the converter.
- Inspect the tires for the following conditions:

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- Uneven wear
- Imbalance
- Mixed sizes
- Mixed radial and bias ply
- Inspect the suspension components for the following conditions:
 - Alignment wear or damage
 - Loose fasteners
 - Driveline damage or wear
- 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

WHINE/GROWL NOISE THAT CHANGES WITH VEHICLE SPEED

Whine/Growl Noise That Changes with Vehicle Speed

Checks	Causes
2-6 and 3-5-R Clutch Hub Thrust Bearing Assembly (65)	Inspect the bearing for wear or damage.
Output Carrier Assembly (68)	● Inspect the carrier assembly for damaged pinion gears, thrust washers, pins, and rollers. ● Inspect for a damaged center support roller bearing assembly (485). ● Inspect for damaged thrust bearings (486, 488). ● Inspect for damaged sun gears (487, 489). ● Inspect the carrier assembly for damaged output carrier rear sun gear thrust bearing (captured). ● Inspect for damaged or stripped splines on the output carrier assembly.
Output Carrier Thrust Bearing	

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Assembly (69)	Inspect the bearing for wear or damage.
Output Shaft Assembly (70)	- Inspect for damaged internal gears (495, 497). - Inspect the output carrier bushing (498) for damage or wear.
Output Shaft Thrust Bearing Assembly (71)	Inspect the bearing for wear or damage.
Input Sun Gear Thrust Washer (55)	Inspect the washer for wear or damage.
Input Sun Gear Thrust Bearing (54)	Inspect the bearing for wear or damage.
Input Sun Gear (53)	Inspect for spline wear or damage.
Input Carrier Assembly (52)	Inspect the carrier assembly for damaged pinion gears, thrust washers, pins, and rollers.
1-2-3-4 Clutch Hub Thrust Bearing Assembly (63)	Inspect the bearing for wear or damage.
2-6 and 3-5-R Clutch (with Output Carrier Outer Sun Gear Shaft) Hub Assembly (64)	Inspect the output carrier inner sun gear shaft bushings (60 and 62) for damage or wear.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect the bearing for wear or damage.
Fluid Filter Assembly (26)	- Inspect for damaged or restricted fluid filter assembly (26) - Inspect for damaged fluid filter seal assembly (25) or improper sealing interface (leaks, fluid aeration).
Automatic Transmission Fluid Pump Seal (5)	Inspect for worn or damaged seal.

NOISE IN FIRST OR REVERSE GEAR

Noise in First or Reverse Gear

Checks	Causes
Center Support with 2-6 Low and Reverse Clutch Assembly (67)	- Inspect for damaged or worn low and reverse clutch plates (463-465). - Inspect for damaged low and reverse clutch backing plate (462). Inspect for worn splines on backing plate. - Inspect for damaged low and reverse clutch backing plate retaining ring (461). - Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459). - Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. - Inspect for cut, worn, or damaged low clutch sprag seal (468).
	Inspect for damaged or stripped splines on the output carrier

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Output Carrier Assembly (68) | assembly.

NOISE IN FIRST, SECOND, THIRD, FOURTH, FIFTH, OR REVERSE GEAR

Noise in First, Second, Third, Fourth, Fifth, or Reverse Gear

Checks	Causes
Input Carrier Assembly (52)	Inspect thrust washers, pinion gears, and pins for wear or damage.
Input Sun Gear (53)	Inspect for damaged sun gear.
1-2-3-4 and 3-5-R Clutch Assembly (51)	Inspect for worn or damaged clutch bearing (428).

NOISE IN FIRST, SECOND, SIXTH, OR REVERSE GEAR

Noise in First, Second, Sixth, or Reverse Gear

Checks	Causes
Center Support with 2-6 Low and Reverse Clutch Assembly (67)	Inspect for worn or damaged output carrier outer sun gear shaft front and rear bushings (458 and 460).
Output Carrier Assembly (68)	Inspect for a worn or damaged center support roller bearing assembly (485).

NOISE IN SECOND OR SIXTH GEAR

Noise in Second or Sixth Gear

Checks	Causes
Center Support with 2-6 Low and Reverse Clutch Assembly (67)	• Inspect for damaged or worn output carrier outer sun gear shaft front bushing (458). • Inspect for damaged or worn output carrier outer sun gear shaft rear bushing (460). • Inspect for damaged 2-6 clutch backing plate (451). Inspect for worn splines on backing plate. • Inspect for damaged 2-6 clutch backing plate retaining ring (450). • Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support assembly (459).

NOISE DURING 3-4 OR 4-3 SHIFTS

Noise During 3-4 or 4-3 Shifts

Checks	Causes
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly	• Inspect hub assembly (475), dampener (476), and apply plate (477) for wear or damage.

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(58)

- Inspect for damaged or worn 4-5-6 clutch backing plate (432).

NOISE IN FOURTH, FIFTH, OR SIXTH GEAR

Noise in Fourth, Fifth, or Sixth Gear

Checks	Causes
Input Sun Gear Thrust Washer (55)	Inspect for wear or damage.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect for wear or damage.
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	• Inspect for damaged or worn 4-5-6 clutch backing plate (432). • Inspect for improper selective 4-5-6 clutch backing plate retaining ring (431).

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

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- 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 is between channels.
 - The valve bushing clips are improperly installed.
 - The checkballs are misplaced.
- The Teflon® seal rings are worn or damaged.

ENGINE COOLANT/WATER IN TRANSMISSION

NOTE: **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.

FLUID LEAK DIAGNOSIS

GENERAL METHOD

1. Verify that the leak is transmission fluid.
2. Thoroughly clean the suspected leak area.
3. Operate the vehicle for 24 km (15 mi), or until normal operating temperatures are reached.
4. Park the vehicle over clean paper or cardboard.
5. Shut OFF the engine.
6. Look for fluid spots on the paper.
7. Make the necessary repairs.

POWDER METHOD

1. Thoroughly clean the suspected leak area with solvent.
2. Apply an aerosol type powder, such as foot powder, to the suspected leak area.
3. Operate the vehicle for 24 km (15 mi), or until normal operating temperatures are reached.
4. Shut OFF the engine.
5. Inspect the suspected leak area.
6. Trace the leak path through the powder in order to find the source of the leak.
7. Make the necessary repairs.

DYE AND BLACK LIGHT METHOD

A fluid dye and black light kit is available from various tool manufacturers.

1. Follow the manufacturer's instructions in order to determine the amount of dye to use.
2. Detect the leak with the black light.
3. Make the necessary repairs.

FIND THE CAUSE OF THE LEAK

Pinpoint the leak and trace 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

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- Damaged seal bore
- Damaged or worn seal
- Improper installation
- Cracks in component
- Manual or output shaft surface is scratched, nicked, or damaged
- Loose or worn bearing causing excess seal wear

POSSIBLE POINTS OF FLUID LEAKS

Transmission Oil Pan

- Incorrectly tightened oil pan bolts
- Improperly installed or damaged oil pan gasket
- Damaged oil pan or mounting face
- Incorrect oil pan gasket

Case Leak

- Damaged vehicle speed sensor seal
- Damaged manual shaft seal
- Loose or damaged oil cooler connector fittings
- Worn or damaged propeller shaft oil seal
- Loose line pressure pipe plug
- Porous casting warped torque converter housing

Leak at the Torque Converter End

- Converter leak in the weld area
- Converter seal lip cut. Check the converter hub for damage
- Converter seal bushing moved forward and damaged
- Converter seal garter spring missing from the seal
- Porous casting of the transmission case or the oil pump

Leak at the Vent Pipe

- Overfilled system
- Water or coolant in the fluid; The fluid will appear milky
- Transmission case porous
- Incorrect fluid level indicator
- Plugged vent
- Drain-back holes plugged

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- Mispositioned oil pump to case gasket, if equipped

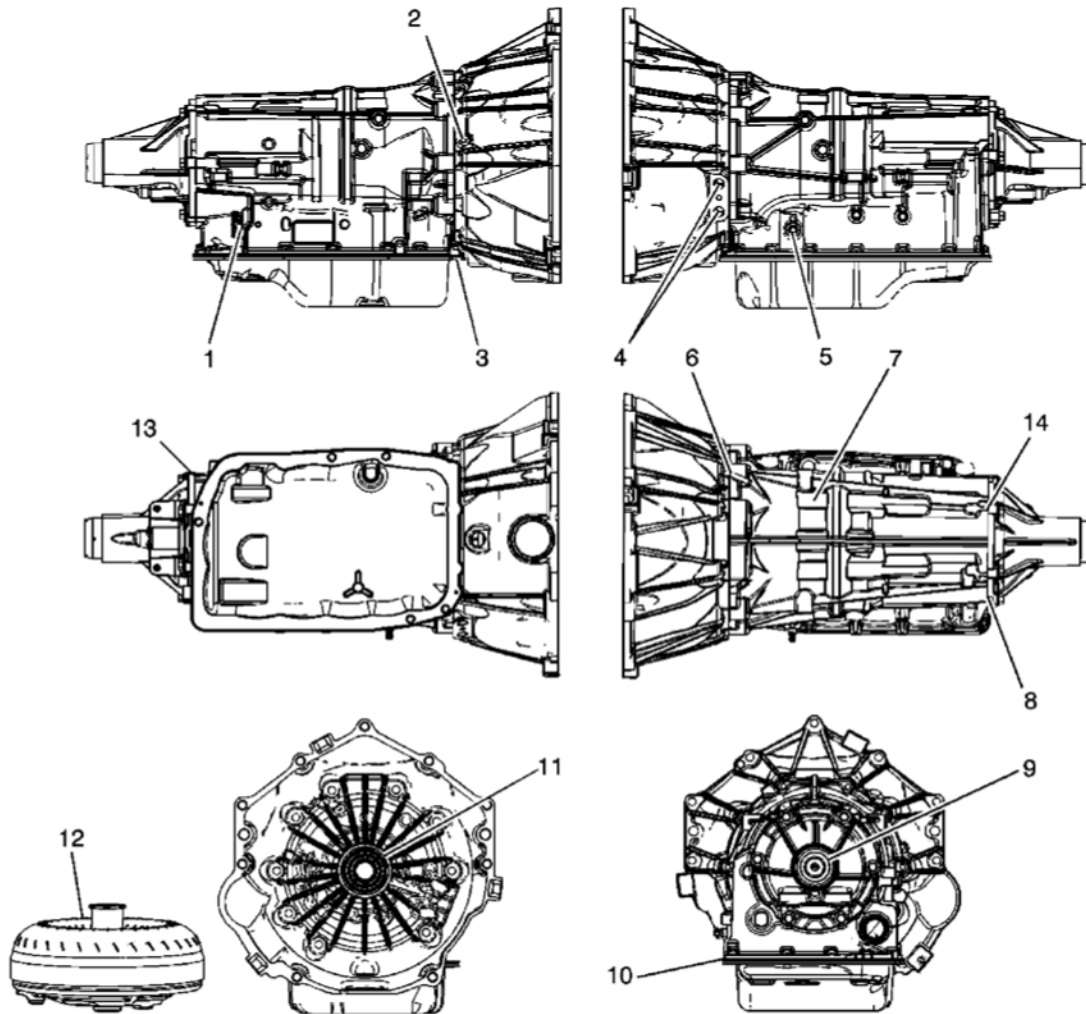


Fig. 8: Leak Inspection Points

Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 8

Callout	Component Name
1	Automatic Transmission Electrical Connector Passage Sleeve
2	Line Pressure Test Hole Plug
3	Converter Housing to Case Joint
4	Trans Fluid Cooler Pipe Fitting Seals
5	Manual Shift Shaft Seal
6	Automatic Transmission Vent Pipe
7	Transmission Case Assembly
8	A/Trans Case Extension Seal - 2WD Models

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9	Prop Shaft Front Slip Yoke Oil Seal - 2WD Models
10	A/Trans Fluid Pan Gasket
11	Torque Converter Fluid Seal Assembly
12	Torque Converter Assembly
13	Case Extension to Case Joint
14	Output Shaft Seal Assembly - 4WD Models

CASE POROSITY REPAIR

Some external leaks are caused by case porosity in non-pressurized areas. You can usually repair these leaks with the transmission in the vehicle.

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

CAUTION: Epoxy adhesive may cause skin irritations and eye damage. Read and follow all information on the container label as provided by the manufacturer.

2. Using instructions from the manufacturer, mix a sufficient amount of an epoxy to make the repair.
3. While the transmission case is still hot, apply the epoxy. You can use a clean, dry soldering acid brush to clean the area and also to apply the epoxy cement. Make certain that the area to be repaired is fully covered.
4. Allow the epoxy cement to cure for three hours before starting the engine.
5. Repeat the fluid leak diagnosis procedures.

AUTOMATIC TRANSMISSION OIL COOLER FLUSHING AND FLOW TEST (J 45096)

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.

IMPORTANT: Use the J 45096 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:

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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

Tools Required

- **J 45096** Transmission Oil Cooling System Flush and Flow Test Tool
- **J 45096-30** Transmission Cooler Flush Adapter. See **Special Tools** .
- Shop air supply with water/oil filters, regulator and pressure gage - minimum 90 psi
- Eye protection
- Rubber gloves

MACHINE SET-UP

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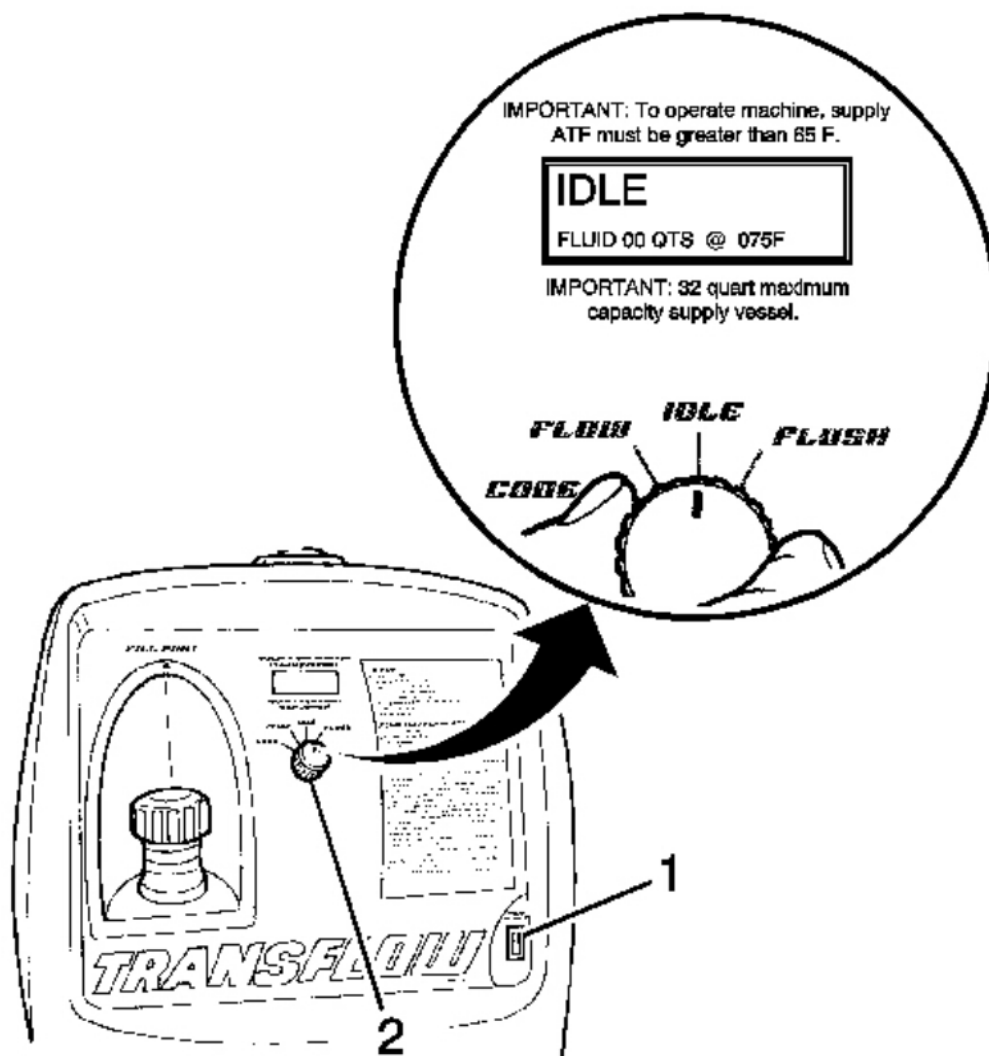


Fig. 9: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS CORP.

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

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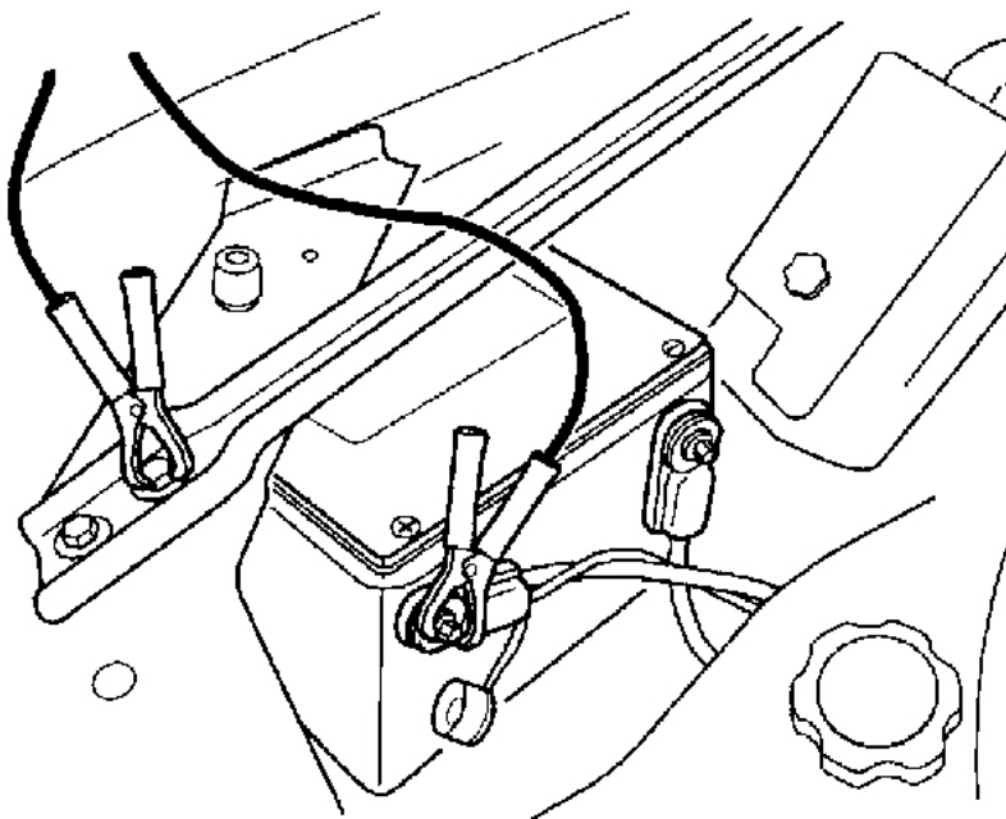


Fig. 10: Connecting To 12V DC Power Source
Courtesy of GENERAL MOTORS CORP.

3. Connect **J 45096** 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.

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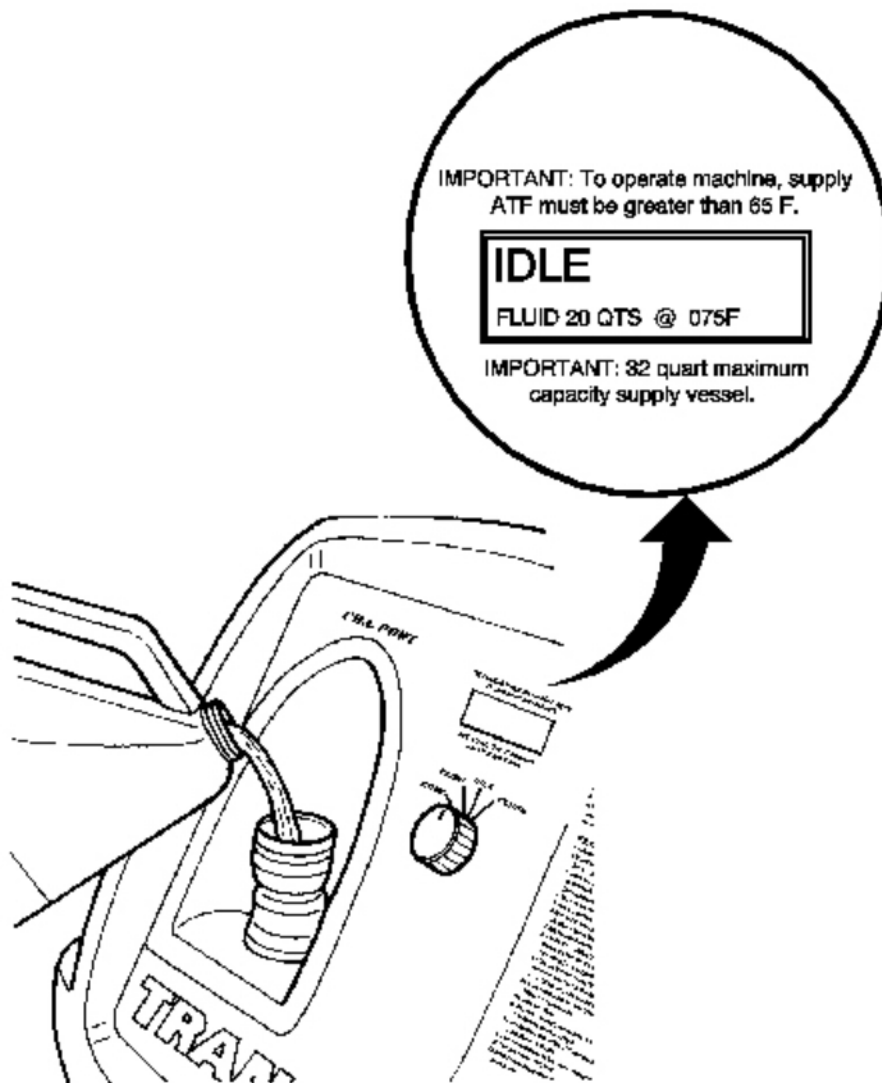


Fig. 11: Filling Supply Tank With Transmission Fluid

Courtesy of GENERAL MOTORS CORP.

NOTE: 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.

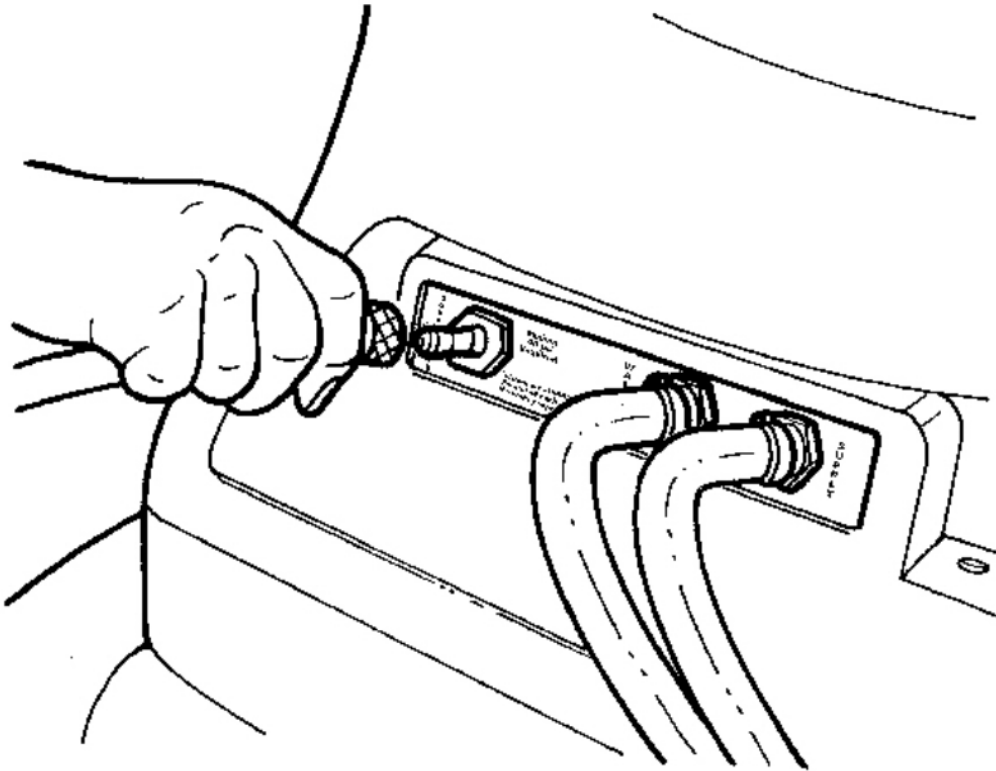


Fig. 12: Applying Shop Air Supply Hose To Quick-Disconnect
Courtesy of GENERAL MOTORS CORP.

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

DETERMINE MINIMUM FLOW RATE

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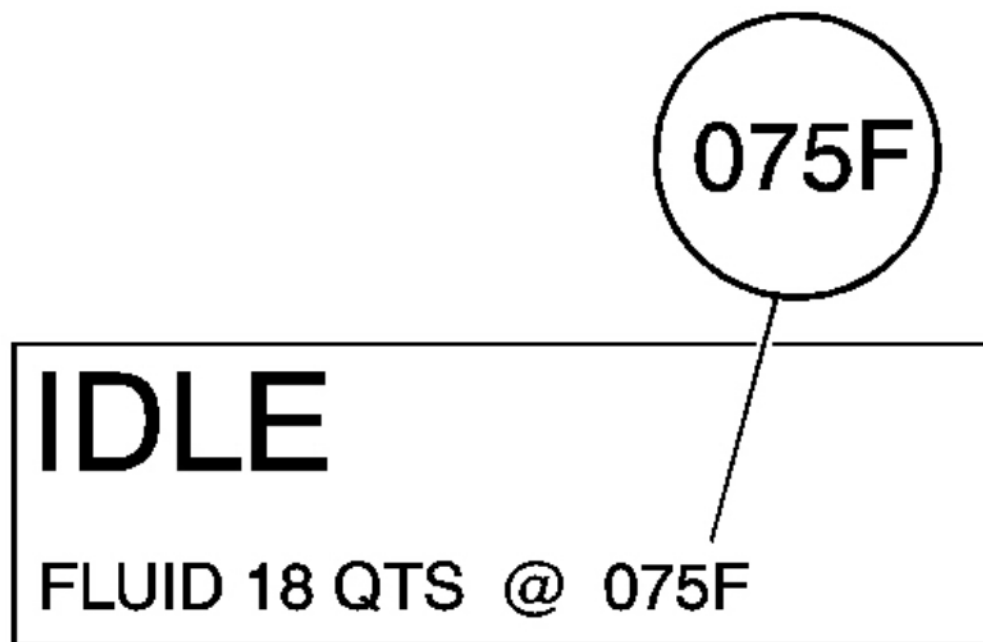


Fig. 13: Identifying Machine Display Of Automatic Transmission Fluid Temperature
Courtesy of GENERAL MOTORS CORP.

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

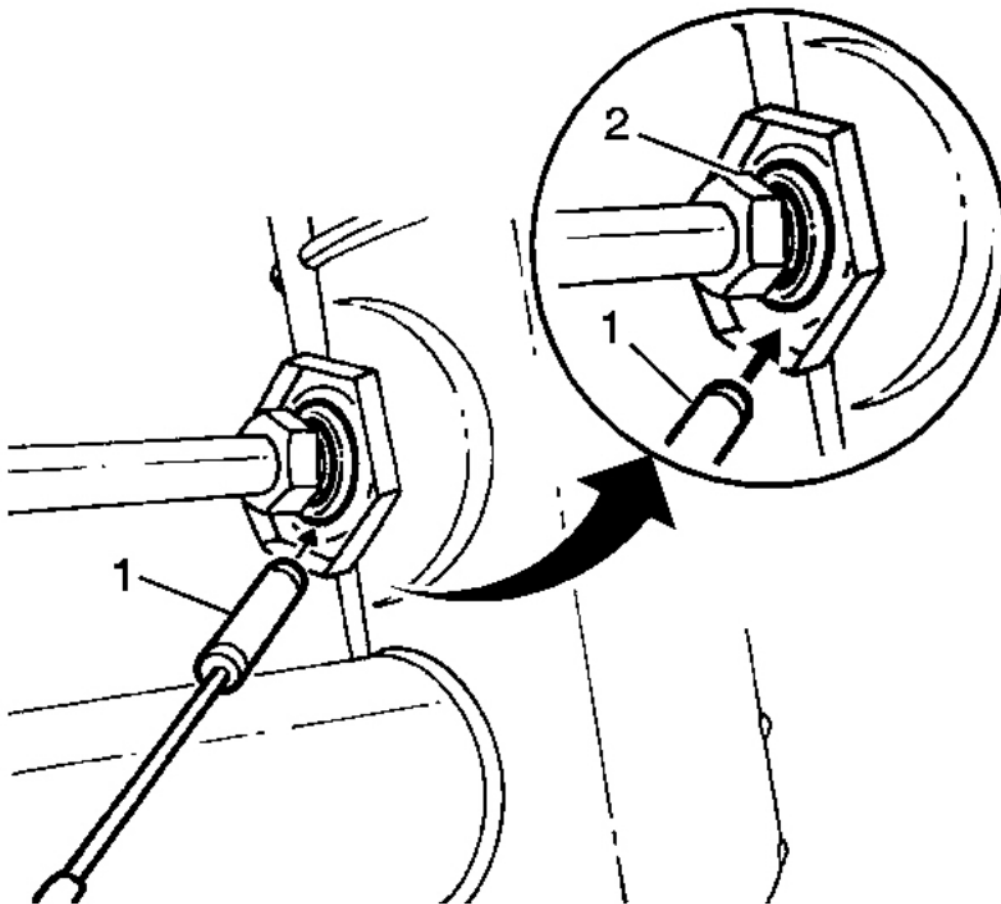


Fig. 14: Identifying Transmission Oil Cooler Metal Composition
Courtesy of GENERAL MOTORS CORP.

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.

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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

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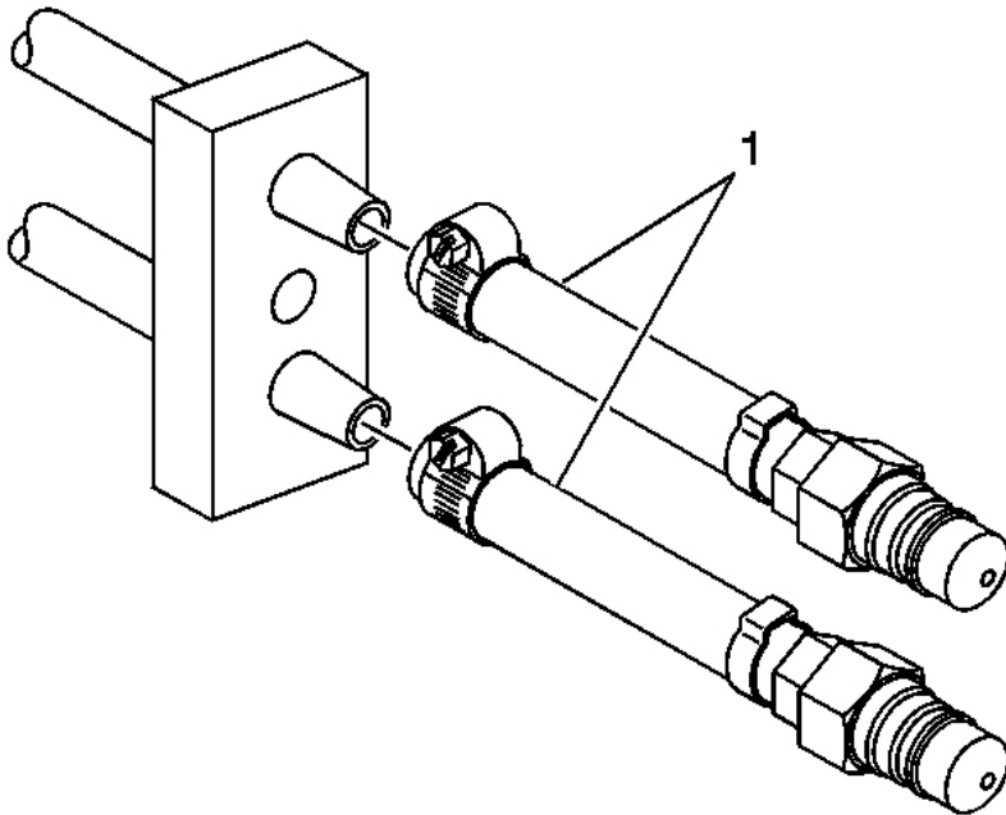


Fig. 15: Identifying Transmission Oil Cooler Supply & Return Lines
Courtesy of GENERAL MOTORS CORP.

1. Connect the **J 45096-30** (1) to the vehicle transmission oil cooler supply and return lines at the transmission. See **Special Tools** .

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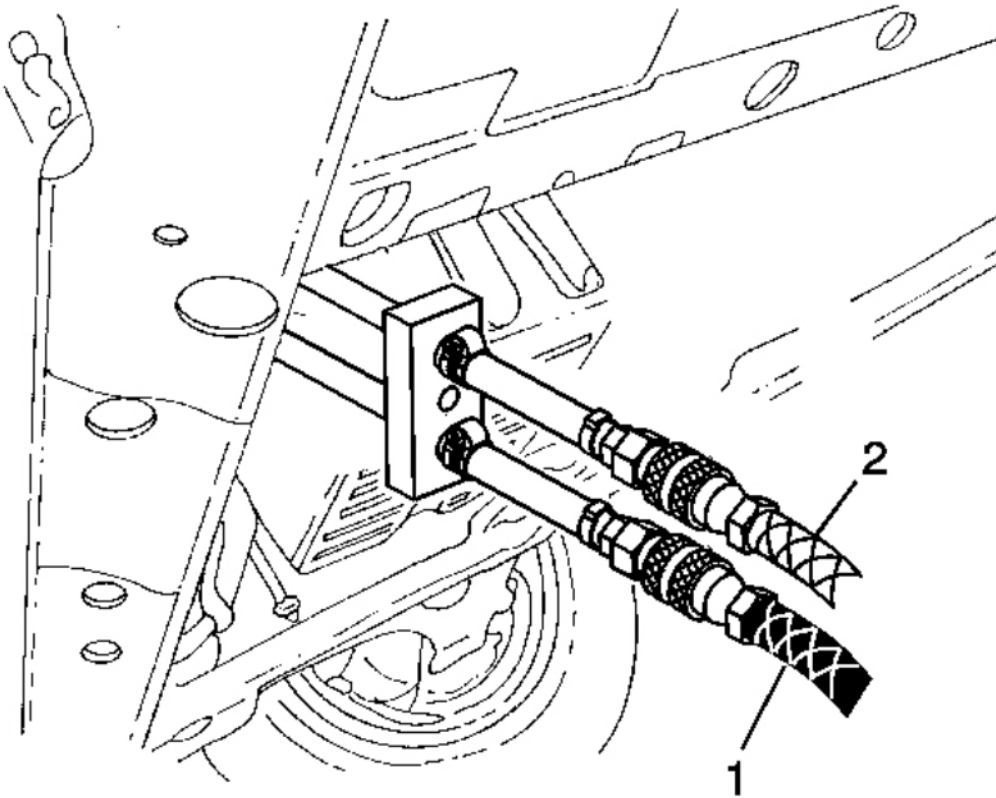


Fig. 16: Identifying Black Supply Hose & Clear Waste Hose
Courtesy of GENERAL MOTORS CORP.

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.

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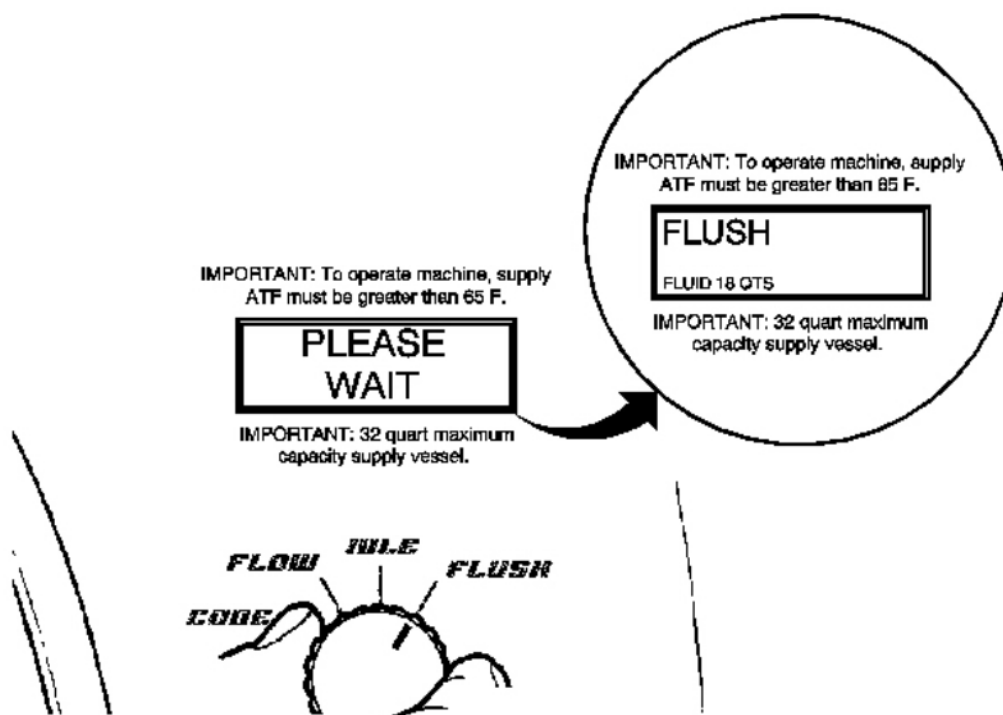


Fig. 17: Setting Main Function Switch To FLUSH Position
Courtesy of GENERAL MOTORS CORP.

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

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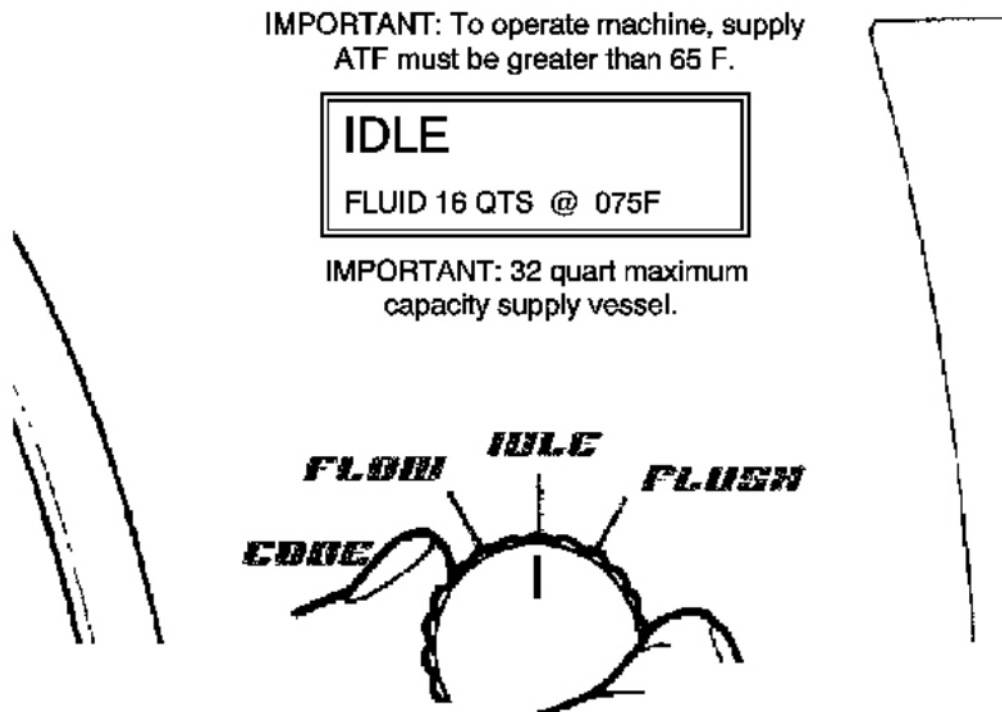


Fig. 18: Setting Main Function Switch To IDLE Position
Courtesy of GENERAL MOTORS CORP.

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

FORWARD FLUSH

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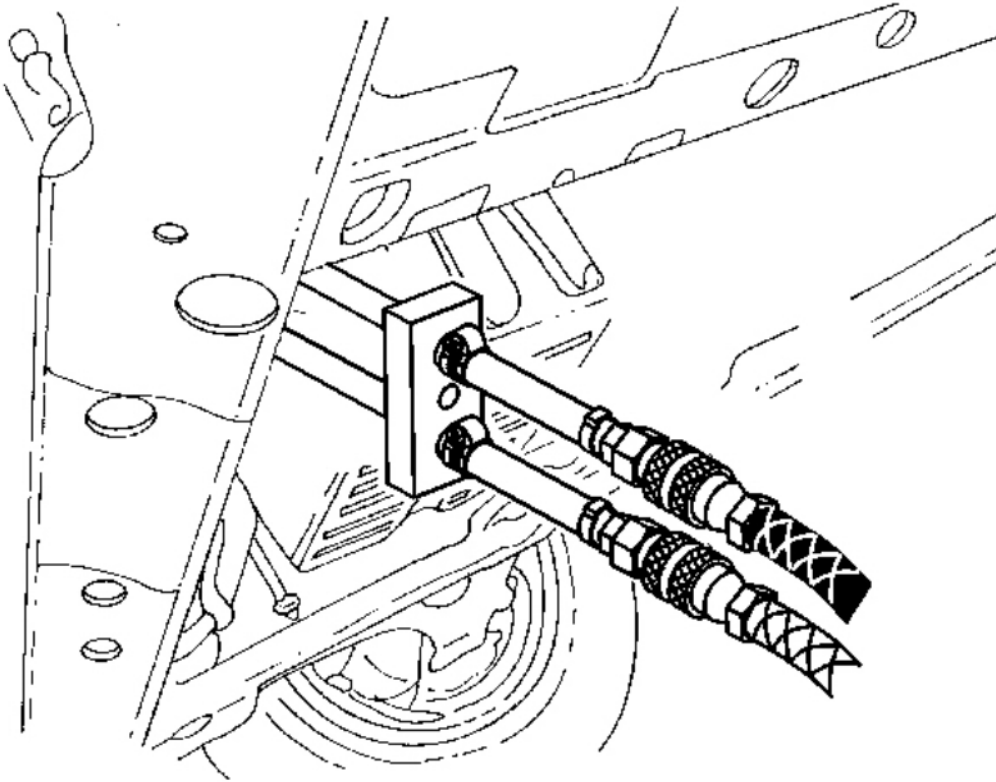


Fig. 19: Identifying Black Supply Hose & Clear Waste Hose
Courtesy of GENERAL MOTORS CORP.

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

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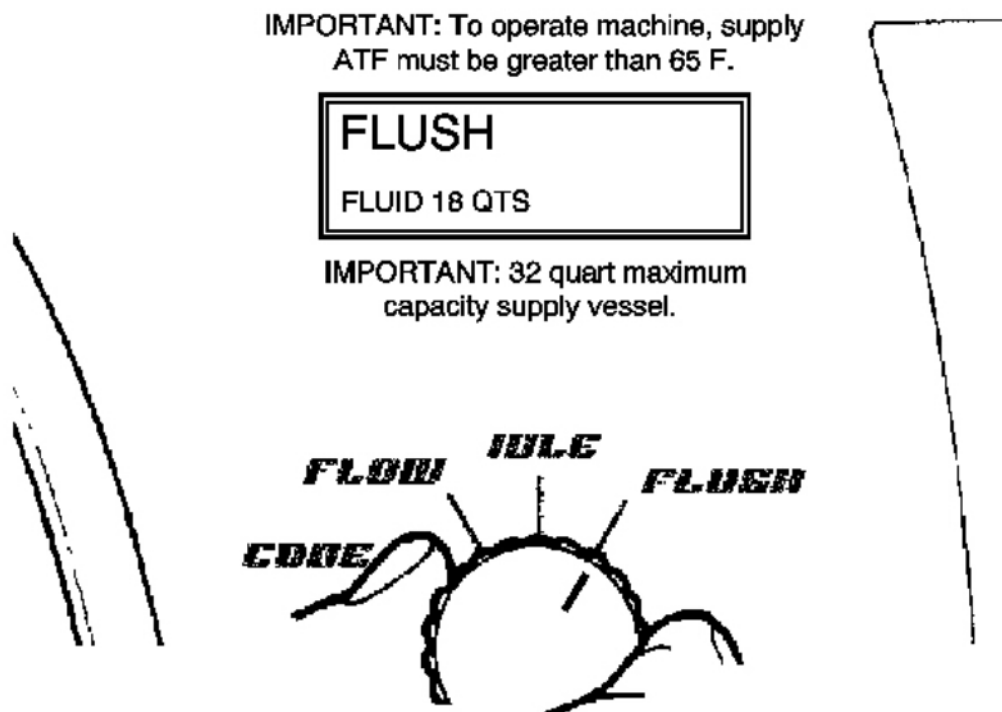


Fig. 20: Setting Main Function Switch To FLUSH Position
Courtesy of GENERAL MOTORS CORP.

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

FLOW TEST

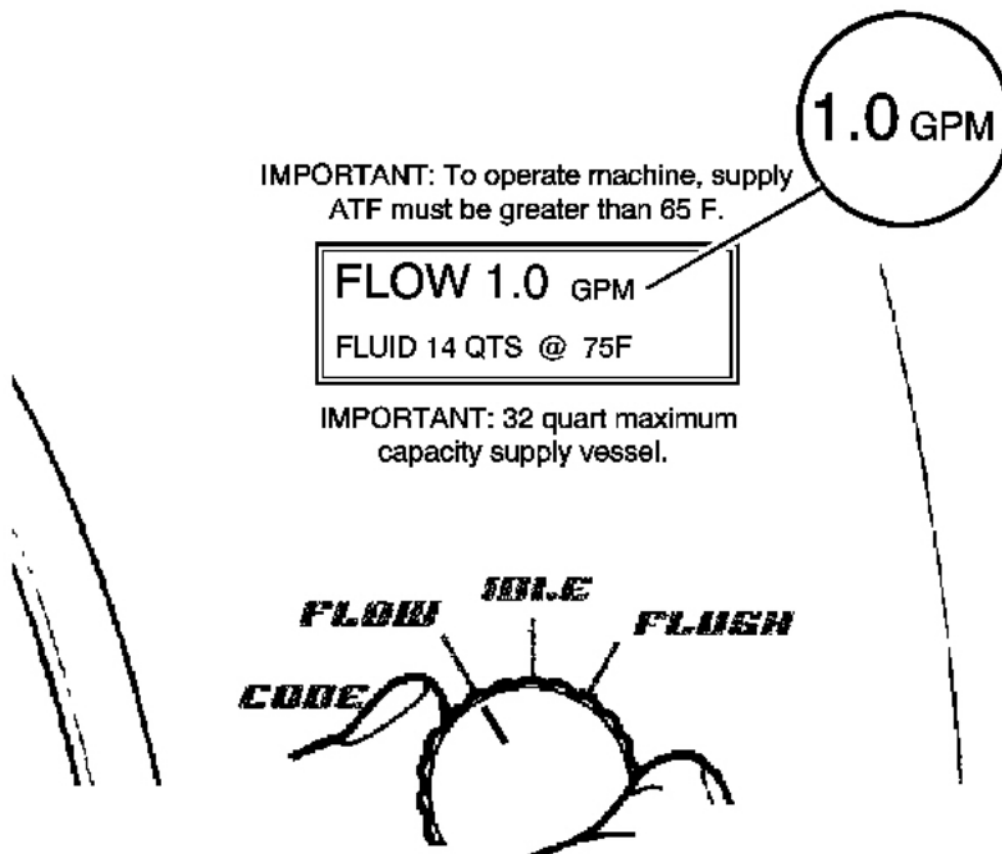


Fig. 21: Setting Main Function Switch To FLOW Position

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: 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.

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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

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

FLOW 1.0 @ 75F CYCLE 6

A10DFB2

IMPORTANT: 32 quart maximum capacity supply vessel.

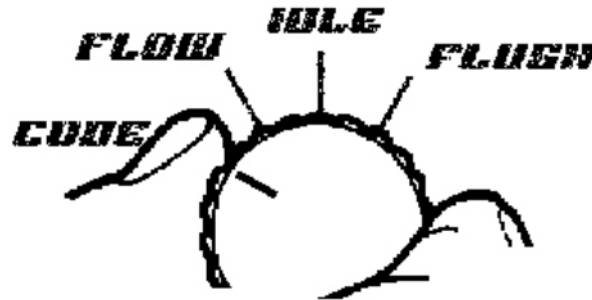


Fig. 22: Setting Main Function Switch To CODE Position
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT:

- 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.

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

CLEAN-UP

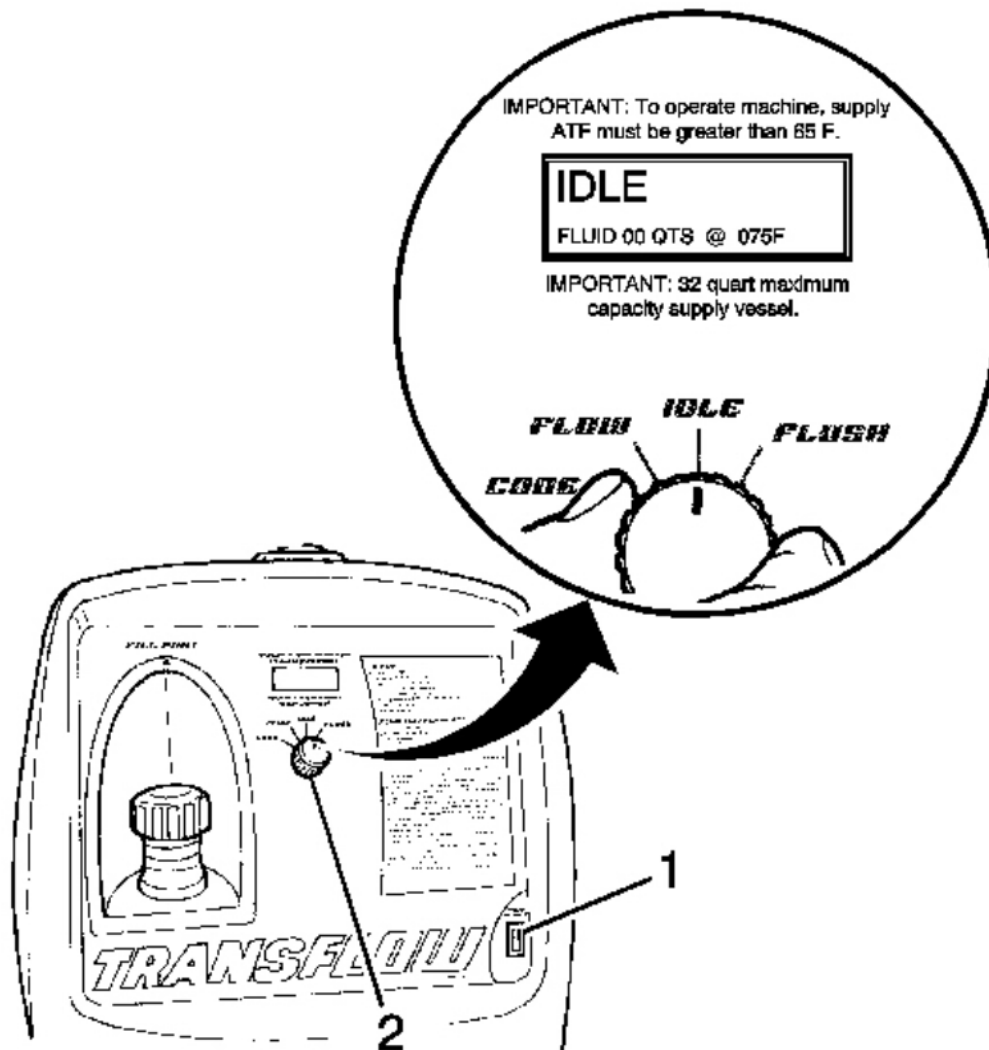


Fig. 23: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS CORP.

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.

IMPORTANT: 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.

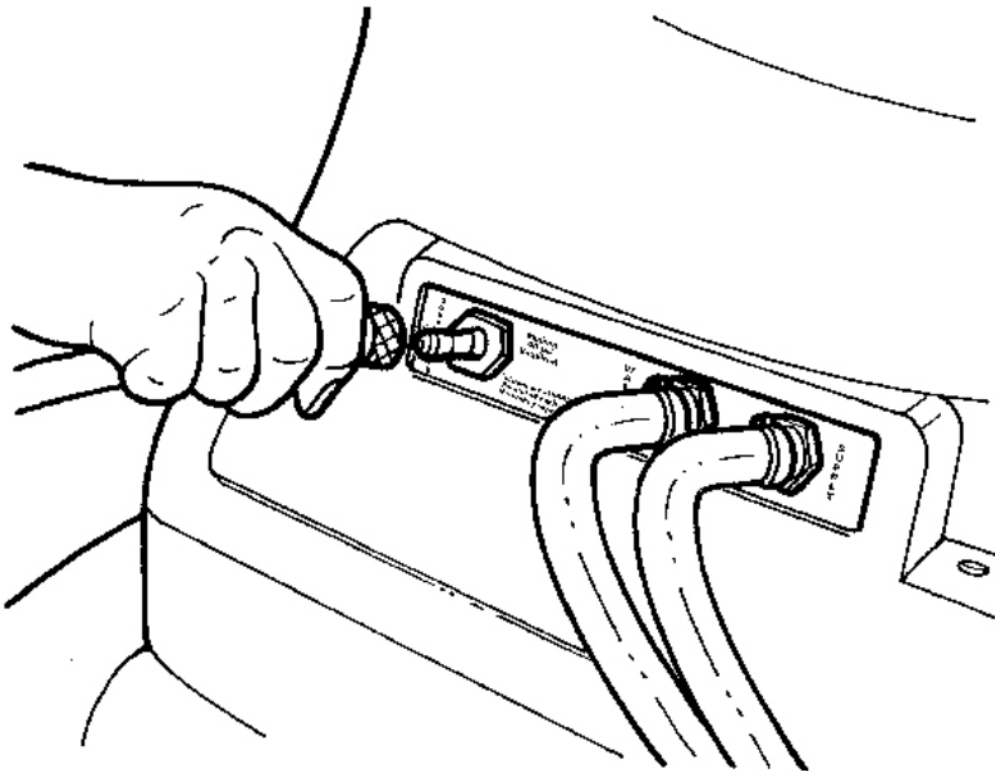


Fig. 24: Applying Shop Air Supply Hose To Quick-Disconnect
Courtesy of GENERAL MOTORS CORP.

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

AUTOMATIC TRANSMISSION FLUID LEAKS

Automatic Transmission Fluid Leaks

Checks	Causes
Torque Converter (1)	Inspect for damage.

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Torque Converter Housing (203)	Inspect for porosity or damage.
Automatic Transmission Fluid Pump Seal (5)	Inspect for cut, wear, or damage.

NO PARK OR DRIVE

No Park or Drive

Checks	Causes
Output Shaft Assembly (70)	Inspect for a broken or damaged output shaft. Inspect for worn splines.

HARSH GARAGE SHIFT

Harsh Garage Shift

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	Inspect for damaged or worn 1-2-3-4 clutch plates (408-410).

NO DRIVE IN ALL RANGES

No Drive in All Ranges

Checks	Causes
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	- Inspect for damaged or worn 4-5-6 clutch backing plate (432). - Inspect for damaged 4-5-6 clutch (with turbine shaft) housing assembly (441).
Output Carrier Assembly (68)	- Inspect the carrier assembly for damaged pinion gears, thrust washers, pins, and rollers. - Inspect for damaged thrust bearings (486 and 488). - Inspect for damaged sun gears (487 and 489). - Inspect the carrier assembly for damaged output carrier rear sun gear thrust bearing (captured).
Output Carrier Thrust Bearing Assembly (69)	Inspect the bearing for wear or damage.
Output Shaft Assembly (70)	Inspect for damaged internal gears (495 and 497).
Input Sun Gear Thrust Washer (55)	Inspect the washer for wear or damage.
Input Sun Gear Thrust Bearing (54)	Inspect the bearing for wear or damage.
Input Sun Gear (53)	Inspect for spline wear or damage.
Input Carrier Assembly (52)	Inspect carrier assembly for damaged pinion gears, thrust washers, pins, and rollers.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect the bearing for wear or damage.

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Fluid Filter Assembly (26)	• Inspect for damaged or restricted fluid filter assembly (26). • Inspect for damaged fluid filter seal assembly (25) or improper sealing interface, leaks, and fluid aeration.
Automatic Transmission Fluid Pump Seal (5)	Inspect for worn or damaged seal.

NO DRIVE OR REVERSE GEAR

No Drive or Reverse Gear

Checks	Causes
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for damaged 4-5-6 clutch (with turbine shaft) housing assembly (441). • Inspect for damaged or distorted turbine shaft.
1-2-3-4 Clutch (with Output Carrier Inner Sun Gear Shaft) Hub Assembly (61)	Inspect for damaged or distorted shaft on hub assembly.
2-6 and 3-5-R Clutch (with Output Carrier Outer Sun Gear Shaft) Hub Assembly (64)	• Inspect for damaged or distorted shaft on hub assembly. • Inspect the output carrier inner sun gear shaft bushings (60 and 62) for damage or wear.

NO FIRST GEAR

No First Gear

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for cut, worn, or damaged low clutch sprag seal (468).

NO FIRST AND REVERSE GEARS

No First and Reverse Gears

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or worn low and reverse clutch plates (463 and 465). • Inspect for damaged low and reverse clutch backing plate (462). Inspect for worn splines on backing plate. • Inspect for damaged low and reverse clutch backing plate retaining ring (461). • Inspect for damaged low and reverse clutch piston assembly

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	(470), spring (469), spring retaining ring (466), and center support assembly (459). • Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for cut, worn, or damaged low clutch sprag seal (468).
Output Carrier Assembly (68)	Inspect for damaged or stripped splines on the output carrier assembly.

HARSH, SOFT, DELAYED OR SLIPPING FIRST OR REVERSE GEAR

Harsh, Soft, Delayed or Slipping First or Reverse Gear

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or worn low and reverse clutch plates (463 and 465). • Inspect for damaged low and reverse clutch backing plate (462). Inspect for worn splines on backing plate. • Inspect for damaged low and reverse clutch backing plate retaining ring (461). • Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459). • Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for cut, worn, or damaged low clutch sprag seal (468).

STUCK IN FIRST OR REVERSE GEAR

Stuck in First or Reverse Gear

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or worn low and reverse clutch plates (463 and 465). • Inspect for damaged low and reverse clutch backing plate (462). Inspect for worn splines on backing plate. • Inspect for damaged low and reverse clutch backing plate retaining ring (461). • Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459).

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- Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise.
- Inspect for cut, worn, or damaged low clutch sprag seal (468).

NO FIRST, SECOND, THIRD, AND FOURTH GEAR

No First, Second, Third, and Fourth Gear

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for damaged or worn 1-2-3-4 clutch plates (408-410). • Inspect for damaged 1-2-3-4 clutch piston (414), piston housing (417), spring (413), and dam assembly (412). • Inspect for damaged 1-2-3-4 clutch piston dam retaining ring (411). • Inspect for cut, worn, or damaged 1-2-3-4 clutch piston seal (416), inner seal (423), and housing seals (424 and 425). • Inspect for improper selective 1-2-3-4 clutch backing plate retaining ring (429). • Inspect for damaged 1-2-3-4 clutch backing plate (407). Inspect for worn splines on the backing plate.
1-2-3-4 Clutch (with Output Carrier Inner Sun Gear Shaft) Hub Assembly (61)	Inspect for damaged splines on the hub assembly.

HARSH, SOFT, DELAYED OR SLIPPING 1-2-3-4 SHIFT

Harsh, Soft, Delayed or Slipping 1-2-3-4 Shift

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for damaged or worn 1-2-3-4 clutch plates (408-410). • Inspect for damaged 1-2-3-4 clutch piston (414), piston housing (417), spring (413), and dam assembly (412). • Inspect for damaged 1-2-3-4 clutch piston dam retaining ring (411). • Inspect for cut, worn, or damaged 1-2-3-4 clutch piston seal (416), inner seal (423), and housing seals (424 and 425). • Inspect for improper selective 1-2-3-4 clutch backing plate retaining ring (429). • Inspect for damaged 1-2-3-4 clutch backing plate (407). Inspect for worn splines on the backing plate.

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NO FIRST, SECOND, THIRD, FOURTH, FIFTH, OR REVERSE GEAR

No First, Second, Third, Fourth, Fifth, or Reverse Gear

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for improper selective 3-5-R clutch backing plate retaining ring (400). • Inspect for improper selective 1-2-3-4 clutch backing plate retaining ring (429). • Inspect for worn or damaged clutch bearing (428).

NO FIRST, SECOND, SIXTH, OR REVERSE GEAR

No First, Second, Sixth, or Reverse Gear

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for a damaged center support assembly (459). • Inspect for worn or damaged output carrier outer sun gear shaft front and rear bushing (458 and 460).
Center Support Retaining Ring (66)	Inspect for damage.
Output Carrier Assembly (68)	Inspect for a worn or damaged center support roller bearing assembly (485).
2-6 and 3-5-R Clutch Hub Thrust Bearing Assembly (65)	Inspect the bearing for wear or damage.

NO SECOND AND SIXTH GEAR

No Second and Sixth Gear

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or worn 2-6 clutch plates (452 and 454). • Inspect for damaged 2-6 clutch backing plate (451). Inspect for worn splines on backing plate. • Inspect for damaged 2-6 clutch backing plate retaining ring (450). • Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support assembly (459).

HARSH, SOFT, DELAYED OR SLIPPING SECOND OR SIXTH GEAR

Harsh, Soft, Delayed or Slipping Second or Sixth Gear

Checks	Causes
Center (with 2-6 Low and Reverse	• Inspect for damaged or worn 2-6 clutch plates (452 and 454).

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Clutch) Support Assembly (67)

- Inspect for damaged 2-6 clutch backing plate (451). Inspect for worn splines on backing plate.
- Inspect for damaged 2-6 clutch backing plate retaining ring (450).
- Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support assembly (459).

STUCK IN SECOND OR SIXTH GEAR

Stuck in Second or Sixth Gear

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or worn 2-6 clutch plates (452 and 454). • Inspect for damaged 2-6 clutch backing plate (451). Inspect for worn splines on backing plate. • Inspect for damaged 2-6 clutch backing plate retaining ring (450). • Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support assembly (459).

VIBRATION IN SECOND, THIRD, FOURTH, FIFTH OR SIXTH GEAR

Vibration in Second, Third, Fourth, Fifth or Sixth Gear

Checks	Causes
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	Inspect hub assembly (475), dampener (476), and apply plate (477) for wear or damage.

NO THIRD, FIFTH, AND REVERSE GEAR

No Third, Fifth, and Reverse Gear

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for damaged or worn 3-5-R clutch plates (402-404). • Inspect for damaged 3-5-R clutch piston (421), apply ring (405), and spring (420). • Inspect for cut, worn, or damaged 3-5-R clutch piston dam O-ring seal (418), inner seal (419), and outer seal (422). • Inspect for improper selective 3-5-R clutch backing plate retaining ring (400). • Inspect for damaged 3-5-R clutch backing plate (401).

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Inspect for worn splines on the backing plate.

HARSH, SOFT, DELAYED OR SLIPPING THIRD, FIFTH, OR REVERSE GEAR

Harsh, Soft, Delayed or Slipping Third, Fifth, or Reverse Gear

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for damaged or worn 3-5-R clutch plates (402-404). • Inspect for damaged 3-5-R clutch piston (421), apply ring (405), and spring (420). • Inspect for cut, worn, or damaged 3-5-R clutch piston dam O-ring seal (418), inner seal (419), and outer seal (422). • Inspect for improper selective 3-5-R clutch backing plate retaining ring (400). • Inspect for damaged 3-5-R clutch backing plate (401). Inspect for worn splines on the backing plate.

NO FOURTH, FIFTH, AND SIXTH GEAR

No Fourth, Fifth, and Sixth Gear

Checks	Causes
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for damaged or worn clutch plates (433-435). • Inspect for damaged piston (439), piston dam (437), dam retaining ring (436), and clutch spring (438). • Inspect for improper selective 4-5-6 clutch backing plate retaining ring (431). • Inspect for cut, worn, or damaged turbine shaft fluid seal rings (442). • Inspect for damaged or distorted turbine shaft.
Control Valve Upper Body Assembly (304)	Inspect the 1/Reverse band and 4-5-6 clutch regulator valve (327) and spring (326) for wear or damage.
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	Inspect the hub assembly (475), dampener (476), and apply plate (477) for wear or damage.
Output Carrier Assembly (68)	Inspect for damaged or stripped internal splines on the output carrier assembly.

HARSH, SOFT, DELAYED OR SLIPPING 4-5-6 SHIFT

Harsh, Soft, Delayed or Slipping 4-5-6 Shift

Checks	Causes
4-5-6 (with Turbine Shaft) Clutch	• Inspect for damaged or worn clutch plates (433-435).

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Assembly (56)

- Inspect for damaged piston (439), piston dam (437), dam retaining ring (436), and clutch spring (438).
- Inspect for improper selective 4-5-6 clutch backing plate retaining ring (431).
- Inspect for cut, worn, or damaged turbine shaft fluid seal rings (442).

NO TORQUE CONVERTER CLUTCH APPLY

No Torque Converter Clutch Apply

Checks	Causes
Torque Converter Assembly (1)	Diagnose torque converter for possible internal damage.
Fluid Pump Cover Assembly (219)	• Inspect for worn, damaged, or sticking converter feed limit valve (220) and spring (221). • Inspect for worn, damaged, or sticking TCC control valve (227) and spring (226). • Inspect for damaged stator shaft.
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking torque converter clutch (TCC) regulator apply valve (355).
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for damaged turbine shaft. • Inspect for damaged turbine shaft O-ring seal.

NO TORQUE CONVERTER CLUTCH RELEASE

No Torque Converter Clutch Release

Checks	Causes
Torque Converter Assembly (1)	Diagnose torque converter for possible internal damage.
Fluid Pump Cover Assembly (219)	• Inspect for worn, damaged, or sticking converter feed limit valve (220) and spring (221). • Inspect for worn, damaged, or sticking torque converter clutch (TCC) control valve (227) and spring (226).
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking TCC regulator apply valve (355).

NO REVERSE GEAR

No Reverse Gear

Checks	Causes
Control Valve Upper Body Assembly (304)	• Inspect for worn, damaged, or sticking 3-5 reverse regulator valve (336) and valve spring (326). • Inspect for damaged or missing #5 checkball.

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Control Valve Lower Body
Assembly (307)

Inspect for worn, damaged, or sticking clutch select solenoid valve
3 (352) and valve spring (353).

FLUID PRESSURE HIGH OR LOW

Fluid Pressure High or Low

Checks	Causes
Torque Converter Housing with Fluid Pump Assembly (2)	• Inspect for worn, sticking, or damaged pressure regulator valve (233). • Inspect for worn, sticking, or damaged pressure regulator valve outer spring (234). • Inspect for worn, sticking, or damaged pressure regulator valve inner spring (235). • Inspect for worn, sticking, or damaged isolator valve (236) and sleeve (237). • Inspect for worn, sticking, or damaged pressure relief ball valve (225). • Inspect for worn, sticking, or damaged pressure relief ball valve spring (224). • Inspect for damaged or porous pump cover assembly (219). Inspect for pump surfaces not flat. • Inspect for excessive fluid pump rotor (217) clearance or damage. Ensure proper selective rotor is being utilized. • Inspect for damaged fluid pump slide (212). Ensure proper selective slide is being utilized. • Inspect for worn, sticking, or damaged fluid pump slide outer spring (211). • Inspect for worn or damaged fluid pump slide seal (213), seal support (214), pivot pin (215), fluid seal ring (209), and O-ring seal (210). • Inspect for worn or damaged fluid pump vane rings (207) and rotor guide (208).
Control Valve Upper Body Assembly (321)	• Inspect for worn, sticking, or damaged actuator feed limit valve (325) and spring (324). • Inspect for worn, sticking, or damaged clutch boost valve (329) and spring (330).
Fluid Filter Assembly (26)	• Inspect for damaged or restricted fluid filter assembly (26). • Inspect for damaged fluid filter seal assembly (25).