All-New 8L90 8-Speed Transmission

During the development of the all-new, GM-developed Hydra-Matic 8L90 8-speed automatic transmission (RPO M5U), offered on the 2015 Corvette, Silverado, Sierra, Yukon, Yukon XL, and Escalade, more than 550 computer-aided engineering analyses were made to ensure strength, durability, performance and refinement.

In the Corvette Stingray, the results are a paddle-shift that delivers world-class shift times rivaling the best dual-clutch designs. While in the Silverado and Sierra, the new transmission delivers 11 percent greater torque capacity than the 6L80 6-speed transmission it replaces.

**TIP:** The transmission is currently on exchange through the GM Product Quality Center (PQC). No transmission repairs, internal or external, are allowed at this time. If diagnosis has determined the need for any repair to the transmission, contact the PQC to discuss the information/diagnostics that led to the need to repair the transmission assembly before performing any repairs.

**Architecture**

The eight speed ratios of the 8-speed transmission are generated using four simple planetary gear sets, two brake clutches, and three rotating clutches. The resultant on-axis transmission architecture utilizes a "squashed" torque converter, an off-axis pump and four close coupled gear sets. The three rotating clutches have been located forward of the gear sets to minimize the length of oil feeds which provides for enhanced shift response. There are different variants of the transmission, all based on torque capacity. Architecture is common between the variants, and component differences are primarily related to size.

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The Transmission Control Module (TCM) is externally mounted. It makes use of three speed sensors that provide for enhanced shift response and accuracy. The TCM receives and monitors various electronic sensor inputs to execute hundreds of calculations and commands every 6.25 milliseconds.

The 4-element torque converter contains a pump, a turbine, a pressure plate splined to the turbine, and a stator assembly. The hydraulic system primarily consists of an off-axis chain-driven binary vane-type pump located in the valve body, and two control valve body assemblies.

The 8-speed transmission uses three rotating clutches. Clutch compensators are fed by lubrication oil rather than the dedicated and regulated feed design of the 6L80 transmission. This design reduces the number of rotating oil seals and oil channels within the turbine shaft and adds the capability of rapid discharge of oil in the compensators during clutch apply for greater control.

Transmission Control Module
The TCM has one 66-way connector to interface with vehicle electrical system, transmission assembly and other vehicle control modules. Based upon the calibrations and input information the TCM receives, it always has final authority of when to allow an upshift or downshift whether in manual mode operation or in drive position for automatic shifting.

Transmission Solenoid Valves
The 8L90 transmission contains a total of nine individual solenoids in the lower control valve body assembly. Seven of the nine solenoid valves are used to control pressure regulation and direction of transmission fluid and the two on/off solenoid valves are only used to direct transmission fluid.

There are three variations of pressure regulating solenoid valves used on this transmission: high pressure normally low; high pressure normally high; and low pressure normally high, variable force.

- High Pressure indicates the solenoid valve is controlling or directing line pressure.
- Low Pressure indicates the solenoid valve is directing a pressurized fluid that is less than line pressure.
- Normally Low is when no current is applied to the solenoid valve coil, the variable restriction is closed, resulting in no or low pressure.
- Normally High is when no current is applied to the solenoid valve coil, the variable restriction is open, resulting in maximum or high pressure.
- The Variable Force Solenoid Valve can increase or decrease the amount of pressurized fluid based on the amount of current applied to solenoid valve coil.

Pressure Regulating Solenoid Valves
Pressure regulating solenoid valves regulate hydraulic fluid pressure based on current flow through the solenoid valve coil windings. They are operated by a 12V high side driver and a low side driver, both internal to the TCM. Current is controlled by turning the low side on and off. If the TCM detects a malfunction, it turns off the high side driver to that solenoid and sets a DTC.

Transmission control solenoid valves 1, 5, and 6 are low pressure, normally high, variable force solenoid valves; increased current results in a decrease in fluid pressure.

Transmission control solenoid valve 4 is a high pressure, normally high, variable force solenoid valve; increased current results in a decrease in fluid pressure.

Transmission control solenoid valves 8 and 9 are normally low, on/off solenoids. These solenoids only direct hydraulic fluid pressure when commanded on.

Solenoid Characterization
Transmission control solenoids 1–7 are pressure regulating valves. Each individual solenoid valve is tested after assembly to determine the output fluid pressure at certain electrical current values, applied to coil windings.

The current versus pressure data points are assigned a file number, which is marked on the solenoid valve housing end. The performance data file is stored on the Techline Information System (TIS) website and is programmed and stored in the vehicle’s TCM.

TIP: Replacing any of the following components will require the TCM to be programmed with the new or existing solenoid valve performance data.

TCM – Program the new TCM with the existing solenoid data files stored on the TIS website for all seven pressure regulating solenoid valves

One or more solenoid valves – Program the TCM with the new data file for only the individual pressure regulating solenoid valves that were replaced

Lower Control Valve Body Assembly with Solenoid Valves – Program the TCM with the new data files stored on the TIS website for all pressure regulating solenoid valves

Transmission Assembly – Program the TCM with the new data files stored on the TIS website for all pressure regulating solenoid valves

Speed Sensors
The TCM uses the input speed sensor signal along with the intermediate and output speed sensor signals to determine transmission line pressure, shift patterns, torque converter clutch slip speed and the correct gear ratio.

The speed sensors are two wire hall-effect type sensors. The TCM supplies a 9V
signal circuit and a low reference circuit to the input speed sensor. The speed sensor produces a square wave signal.

Transmission Fluid Temperature Sensor

The transmission fluid temperature sensor measures the temperature of the fluid in the transmission fluid pan. It is a 2-wire negative temperature coefficient thermistor. The TCM supplies a 5V signal circuit and a low reference circuit to the transmission fluid temperature sensor.

The transmission fluid temperature sensor is part of the transmission internal wire harness assembly and has no serviceable parts.

Reprogramming Procedures for the 8L90 8-Speed Transmission

Several reprogramming procedures must be performed after replacement of some components on the new 8L90 8-speed transmission available on the 2015 Corvette, Silverado, Sierra, Yukon, Yukon XL, and Escalade. These procedures are covered in detail in the appropriate Service Information. In addition, the reprogramming procedures also will be used on other transmission applications in future GM models.

Solenoid Valve Characterization Reprogramming

Characterization reprogramming is a new programming procedure. If characterization is not completed when required, shift quality can be less than optimal and may cause the customer to return with a shift concern.

The solenoids in the 8-speed transmission require unique performance characteristic data in order to function at maximum efficiency. This data is programmed and stored in the vehicle’s Transmission Control Module (TCM). When a transmission assembly, TCM, or solenoids are replaced during service, the performance characteristic data for the solenoids must be retrieved from the Techline Information System (TIS) website server (the cloud) and programmed into the TCM.

If the transmission fluid temperature sensor is faulty, the internal transmission wire harness assembly must be replaced.

Internal Mode Switch (IMS)

The IMS contains six separate switches in one assembly. One mechanical switch circuit is for the Park/Neutral position switch, which is used for engine starting. The other five electronic switches are called the transmission range switches and are used to indicate the current gear position the vehicle operator has selected. The IMS switch assembly is mounted on the interior left side of the transmission case.

Thanks to Mike Johnston

Reprogramming ensures that the characteristic data relationship is properly matched between the solenoids, valve body, and transmission.

Solenoid Characterization Reprogramming Procedure

1. Document the new Transmission Unique Number (TUN) or Part Unique Number (PUN) as required.
2. Log in to TIS2Web/SPS.
3. Type the Vehicle Identification Number (VIN).
5. Select the applicable service procedure performed — currently only replacing transmissions (Replace Transmission button) and replacing the TCM (Refresh Characterization button) are allowed — and provide the necessary TUN or PUN.

At this point, the system will read the VIN from the Engine Control Module (ECM) using the Multiple Diagnostic Interface (MDI) and then retrieve the applicable genealogy data tree for the given TUN/PUN from the cloud. This data tree accesses the original characterization data so that it may be updated with the new component information. The TCM is updated with the correct solenoid characterization data, and the cloud is updated with the new genealogy relationship.

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Transmission Service Fast Learn

The Transmission Service Fast Learn procedure has been a required programming procedure on some current 6-speed transmissions.

Transmission Service Fast Learn is a procedure that is performed after any 8-speed transmission repair. The procedure performs a series of tests which allow the TCM to learn individual clutch apply pressures. These learned pressure values are used by the TCM for clutch control and timing of shifts. A scan tool is used to perform the Transmission Service Fast Learn procedure.

The Transmission Service Fast Learn procedure must be performed when any of the following repairs has been made to the transmission:

- Pressure regulating solenoid replacement
- Valve body repair or replacement
- Any service/repair in response to a shift quality concern
- Any internal transmission service, repair, overhaul, or replacement
- Torque converter replacement
- TCM replacement
- Transmission assembly replacement

Failure to perform the procedure may result in poor transmission performance, DTCs being set, or customer dissatisfaction.

Transmission Service Fast Learn Procedure

1. If a pressure regulating solenoid, TCM or transmission assembly was replaced, perform the Solenoid Valve Characterization Reprogramming.
2. With the ignition on, clear the DTCs with a scan tool.
3. Turn the ignition off and make sure all vehicle systems turn off. It may take up to two minutes for all vehicle control modules to power down.

TIP: If the transmission fluid temperature is not between 167°F (75°C) and 185°F (85°C), the scan tool will not allow you to perform the Service Fast Learn procedure.

4. With the engine running, shift the transmission to the Drive position with the brake applied. Perform the Service Fast Learn procedure with a scan tool. In GDS 2, go to Module Diagnostics > Transmission Control Module > Configuration/Reset Functions > Transmission Service Fast Learn. Follow the instructions on the scan tool.

5. Turn the Ignition off for two minutes.

Thanks to Mike Johnston

Headlamp Performance

On some 2014 Sierra 1500 and 2015 Sierra models, poor headlamp performance may be noticed when driving in very dark rural areas. While the headlamps meet all Federal (FMVSS) requirements, some owners may request better headlamp performance.

When addressing headlamp performance conditions, normal diagnostics should be performed first. Verify that all headlamps operate properly, that headlamp adjustment is correct, and that there is not any headlamp mounting damage or concerns with the lens (e.g., haziness, cloudiness). Repair any headlamp conditions. If an owner still has a concern, perform the following calibration and bulb repairs.

Build Dates

For vehicles built before December 23, 2014, at Flint Assembly (11th VIN Digit “F”), before January 13, 2015, at Silao Assembly (11th VIN Digit “G”) or before January 16, 2015, at Ft. Wayne Assembly (11th VIN Digit “Z”), reprogram the BCM with the latest calibration available in TIS2Web starting on January 12, 2015. The new BCM calibration will increase the voltage to the headlamp bulbs in both the low beam and high beam settings.

All vehicles built after these build dates have the new BCM calibration and the BCM reprogramming does not need to be performed.

Headlamp Bulb

Next, replace both headlamp bulbs with updated bulb part number 23342527. Verify the correct bulb is being installed by confirming the correct markings on the bulb as shown.

When installing the new headlamp bulbs, do not touch the glass. Make sure the bulbs are fully seated into the headlight housing. If the bulb is not properly installed, it can lead to an incorrect light pattern.

The beam pattern photo shows the low beam pattern of a properly installed bulb on a Sierra (one lamp with the opposite lamp blocked) on a wall/aiming screen at 25 feet (7.62 m). Each block division is approximately 10.5 inches (26.67 cm).

Headlamp Aiming

After bulb replacement, refer to the appropriate Service Information for the Headlamp Aiming procedure.

TIP: The bulb replacement and the calibration change should be performed at the same time. Performing these repairs at the same time will show a dramatic improvement.

(Thanks to Jim Will)
HVAC System Operation during a Remote Vehicle Start

The HVAC system, heated seats, and rear defogger operate differently during a remote start on 2015 Colorado and Canyon models equipped with Remote Start (RPO BTV or S6P) depending on which HVAC system is used. Here are the details about system operation during a remote start for each system.

**Vehicles Equipped with C68 Auto HVAC System**

- **If the ambient air temperature is 50°F (10°C) or lower:**

  **During a Remote Start**
  - HVAC Mode – Defrost with full blower (Blower speed will change as coolant temperature increases.
  - Heated Seats – Will turn on with no indication on the buttons. The heated seat option must have first been turned on in the Vehicle Settings menu prior to the remote start event.
  - Rear Defogger – Will turn on.

  **When Ignition Key Transitions to Run**
  - HVAC Mode – Last setting before ignition key was turned off.
  - Heated Seats – Will turn off. Driver will have to turn heated seat back on if heated seat operation is desired.
  - Rear Defogger – Stays on until it automatically times out.

  **If the ambient air temperature is between 50°F (10°C) and 69°F (20°C):**

  **During a Remote Start**
  - HVAC Mode – Last setting before ignition key was turned off.

**Vehicles Equipped with C67 HVAC System**

- **If the ambient air temperature is 50°F (10°C) or lower:**

  **During a Remote Start**
  - HVAC Mode – Last setting before ignition key was turned off.
  - Heated Seats – Will turn on with no indication on the buttons. The heated seat option must have first been turned on in the Vehicle Settings menu prior to the remote start event.
  - Rear Defogger – Will turn on.

  **When Ignition Key Transitions to Run**
  - HVAC Mode – Last setting before ignition key was turned off.
  - Heated Seats – Will turn off. Driver will have to turn heated seat back on if heated seat operation is desired.
  - Rear Defogger – Stays on until it automatically times out.

- **If the ambient air temperature is 69°F (20°C) or higher:**

  **During a Remote Start**
  - HVAC Mode – (Cold) medium to high blower speed

  **When Ignition Key Transitions to Run**
  - HVAC Mode – Last setting before ignition key was turned off.

(Thanks to Charles Hensley)

Diagnosis of Various HVAC Conditions

On some 2015 ATS, CTS, XTS, Corvette, Colorado, Canyon, Silverado 1500, Sierra 1500, and 2015 Escalade, Silverado 2500/3500, Sierra 2500/3500, Tahoe, Suburban, and Yukon models with the 2015 mid-year RPO AVF, any of the following HVAC conditions may be present:

- HVAC control panel is inoperative (does not light or respond as expected)
- HVAC controls are stuck in an incorrect operating state (for example, regardless of the temperature setting, it only blows full cold air, or the blower may not respond)
- A/C compressor is inoperative or does not follow commands
- Recirculation is inoperative or does not follow commands
- Rear defogger is inoperative or does not follow commands
- Heated seats are inoperative or do not follow commands (applies to Cadillac and Corvette models only)
- Battery Saver Message is on intermittently or flashing on and off
- Any related HVAC DTCs are set: B0163, B0183, B1405, B0173, B0178, B0509, B0514, B0519, B3583, B3933, B0193, B0208, B0223, B0228, B0233, B0408, B0413, B0418, B0423, B0428, B0433, B1395, B3531, B374A, B3782, B393B

If any of these conditions are present, reprogram the K33 HVAC Control Module with the updated calibration available in TIS2Web starting on January 17, 2015. If the HVAC condition(s) are not corrected after reprogramming the HVAC Control Module, perform normal diagnostics following the appropriate Service Information.

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**Accelerator Pedal Detent**

As the accelerator pedal is applied approximately 3/4 of the way on some 2015 Escalade, Silverado, Sierra and Yukon Denali models equipped with the 8-speed automatic transmission (RPO M5U), a detent/click may be noticed with a feel of increased resistance in the pedal.

The accelerator pedal design has changed for vehicles equipped with the 8-speed automatic transmission. The new accelerator pedal design has a built-in detent position near the last 1/4 of pedal travel to provide tactile feedback to the operator. This design is intended to help minimize transmission downshifting, allowing for improved fuel economy and smoother operation.

Applying the accelerator pedal down to the detent will allow a more relaxed acceleration rate. When pressing the pedal through the detent, the transmission will downshift aggressively, enabling an increased acceleration rate.

Do not replace any parts for this condition. This is a normal operating characteristic of the vehicle and no repair attempts should be performed.

(/topics) Thanks to Jim Will

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**Weather Conditions’ Effect on High-Performance Brakes**

Some 2012–2015 Camaro SS, Camaro ZL1; 2013–2016 ATS; 2014–2016 CTS (VIN A); 2014–2015 Camaro Z/28, Caprice PPV, Corvette, and SS models may be hard to move after the vehicle has been parked for a period of time. A crunch sound right before the vehicle starts to move may be heard.

This condition may be due to the brake pads freezing to the vehicle's rotors. Do not replace any brake components for this condition.

High performance brake components have a tendency to lightly bind, often noted as resistance, and then lightly clunk when attempting to move the vehicle forward or rearward after a cold soak. This is usually noticed after parking, when the brakes have been wet, such as when driving in the rain or just after a car wash. This is expected of high performance brakes with high friction pads and does not affect the operation or performance of the brakes.

If a residual roughness is felt when braking, it can be easily cleaned by applying the brakes several times until the roughness is gone. If washing the vehicle prior to long-term storage, it is recommended that the vehicle be driven and the brakes applied several times before storing the vehicle.

(topics) Thanks to Matt Bierlein

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**Correct Replacement Oil Filter**

Beginning in 2012, the V6 engine (RPOs LFW, LFX, LLT) available in 2012-2016 Enclave, LaCrosse; 2012 SRX; 2013-2016 SRX, XTS; 2012-2013 Captiva (VIN L), Impala; 2012-2016 Equinox, Traverse; 2014-2016 Captiva (VIN L), Impala (VIN W), Impala (VIN 1); and 2012-2016 Acadia and Terrain (excluding police vehicles with RPO 9C1, 9C3) was redesigned with tighter engine tolerances. The oil pressure was increased to accommodate these tighter tolerances. As a result, the oil filter specifications of the production oil filter and the service oil filter were also improved to meet the new engine requirements.

When servicing these V6 engines, it’s important to use the recommended replacement ACDelco PF63E oil filter (GM #19330000) to ensure proper engine oil filtration and engine performance.

These V6 engines are factory built with an ACDelco PF64 oil filter, which may be confused with the ACDelco PF48 oil filter because both oil filters have the same appearance and oil can size. However, these two oil filters have different internal specifications. The OEM PF64 oil filter has a much higher bypass valve rating that matches the service oil filter requirement of the PF63E, which was specifically chosen to match the performance demands of these engines.

The ACDelco PF64 oil filter installed by the factory meets the specifications of the ACDelco PF63E — but due to the length of the ACDelco PF63E oil filter can, the engine plant cannot build with it because it currently interferes with the assembly line process.

(topics) Thanks to Randy McCrite

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