2015 Corvette: GM TechLink: All New 8L90 8-Speed Automatic Transmission

Subject: All New 8L90 8-Speed Automatic Transmission
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During the development of the all-new, GM-developed Hydra-Matic 8L90 8-speed automatic transmission (RPO M5U) (Fig 1), offered on the 2015 Corvette, Silverado, Sierra, Yukon, Yukon XL, and Escalade, more than 550 computer-aided engineering analysis 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.

Fig 1

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. (Fig. 2) 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.

Fig 2

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. (Fig. 3)

Fig 3

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 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 2, 3, and 7 are high pressure, normally low, variable force solenoid valves; increased current results in increased fluid pressure.

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 solenoid valves 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 9 V 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 5 V 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. 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*