DESCRIPTION AND OPERATION

DEFINITIONS AND ABBREVIATIONS

Throttle Positions

Engine Braking

A condition where the engine is used to slow the vehicle by manually downshifting during a zero throttle coastdown.

Full Throttle Detent Downshift

A quick apply of the accelerator pedal to its full travel, forcing a downshift.

Heavy Throttle

Approximately 3/4 of accelerator pedal travel, 75 percent throttle position.

Light Throttle

Approximately 1/4 of accelerator pedal travel, 25 percent throttle position.

Medium Throttle

Approximately 1/2 of accelerator pedal travel, 50 percent throttle position.

Minimum Throttle

The least amount of throttle opening required for an upshift.

Wide Open Throttle (WOT)

Full travel of the accelerator pedal, 100 percent throttle position.

Zero Throttle Coastdown

A full release of the accelerator pedal while the vehicle is in motion and in drive range.

Shift Condition Definitions

Bump

A sudden and forceful apply of a clutch or a band.

Chuggle

A bucking or jerking. This condition may be most noticeable when the converter clutch is engaged. It is similar to the feel of towing a trailer.

Delayed

A condition where a shift is expected but does not occur for a period of time. This could be described as a clutch or band engagement that does not occur as quickly as expected during a part throttle or wide open throttle apply of the accelerator, or during manual downshifting to a lower range. This term is also defined as LATE or EXTENDED.

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Double Bump - Double Feel

Two sudden and forceful applies of a clutch or a band.

Early

A condition where the shift occurs before the car has reached proper speed. This condition tends to labor the engine after the upshift.

End Bump

A firmer feel at the end of a shift than at the start of the shift. This is also defined as END FEEL or SLIP BUMP.

Firm

A noticeably quick apply of a clutch or band that is considered normal with a medium to heavy throttle. This apply should not be confused with HARSH or ROUGH.

Flare

A quick increase in engine RPM along with a momentary loss of torque. This most generally occurs during a shift. This condition is also defined as SLIPPING.

Harsh - Rough

A more noticeable apply of a clutch or band than FIRM. This condition is considered undesirable at any throttle position.

Hunting

A repeating quick series of upshifts and downshifts that causes a noticeable change in engine RPM, such as a 4 - 3 - 4 shift pattern. This condition is also defined as BUSYNESS.

Initial Feel

A distinctly firmer feel at the start of a shift than at the finish of the shift.

Late

A shift that occurs when the engine RPM is higher than normal for a given amount of throttle.

Shudder

A repeating jerking condition similar to CHUGGLE but more severe and rapid. This condition may be most noticeable during certain ranges of vehicle speed.

Slipping

A noticeable increase in engine RPM without a vehicle speed increase. A slip usually occurs during or after initial clutch or band apply.

Soft

A slow, almost unnoticeable clutch or band apply with very little shift feel.

Surge

A repeating engine related condition of acceleration and deceleration that is less intense than CHUGGLE.

Tie-Up

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A condition where two opposing clutch and/or bands are attempting to apply at the same time causing the engine to labor with a noticeable loss of engine RPM.

Noise Conditions

Drive Link Noise

A whine or growl that increases or fades with vehicle speed, and is most noticeable under a light throttle acceleration. It may also be noticeable in PARK or NEUTRAL operating ranges with the vehicle stationary.

Final Drive Noise

A hum related to vehicle speed which is most noticeable under a light throttle acceleration.

Planetary Gear Noise

A whine related to vehicle speed, which is most noticeable in FIRST gear, SECOND gear, FOURTH gear or REVERSE. The condition may become less noticeable, or go away, after an upshift.

Pump Noise

A high pitched whine that increases in intensity with engine RPM. This condition may also be noticeable in all operating ranges with the vehicle stationary or moving.

Torque Converter Noise

A whine usually noticed when a vehicle is stopped, and the transmission is in DRIVE or REVERSE. The noise will increase with engine RPM.

Driver Shift Control

Driver shift control (DSC) allows the driver to change gears similar to a manual transmission.

Transmission Abbreviations

A/C

Air Conditioning

AC

Alternating Current

AT

Automatic Transmission

CCDIC

Climate Control Driver Information Center

DC

Direct Current

DIC

Driver Information Center

DLC

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Data Link Connector

DMM

Digital Multimeter

DSC:

Driver Shift Control

DTC

Diagnostic Trouble Code

EBTCM

Electronic Brake/Traction Control Module

ECCC

Electronically-Controlled Capacity Clutch

ECT

Engine Coolant Temperature

EMI

Electromagnetic Interference

IAT

Intake Air Temperature

IGN

Ignition

IMS

Internal Mode Switch

ISS

Input Speed Sensor

MAP

Manifold Absolute Pressure

MIL

Malfunction Indicator Lamp

NC

Normally Closed

NO

Normally Open

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OBD

On Board Diagnostic

OSS

Output Speed Sensor

PC

Pressure Control

PCM

Powertrain Control Module

PCS

Pressure Control Solenoid

PS

Pressure Switch

PWM

Pulse Width Modulation

RPM

Revolutions Per Minute

SS

Shift Solenoid

STL

Service Transmission Lamp

TAP

Transmission Adaptive Pressure

TCC

Torque Converter Clutch

TFP

Transmission Fluid Pressure

TFT

Transmission Fluid Temperature

TP

Throttle Position

VSS

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Vehicle Speed Sensor

WOT

Wide Open Throttle

TRANSMISSION IDENTIFICATION INFORMATION



1. Broadcast Code
2. Source DUNS Number
3. Transmission Unique Number (TUN)
4. 2D Machine Readable Matrix
5. VPPS Code
6. Part Sequence Number
7. Site ID
8. Broadcast Code
9. Julian Date
10. Year of Build
11. Shift ID
12. Line Plant ID
13. GM Part Number

CONTROL VALVE SOLENOID BODY IDENTIFICATION INFORMATION



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NOTE: **The entire 16-digit part unique number (PUN) is required to perform the transmission control solenoid valve characterization reprogramming. Q77 Transmission Control Solenoid Valve Characterization Programming (8L45) .**

1. Data Matrix
2. Part Unique Number (PUN)

TRANSMISSION GENERAL DESCRIPTION

The Hydra-matic 8-Speed RWD is a fully automatic, 8-speed, rear-wheel drive, electronic-controlled transmission. The eight speed ratios are generated using four simple planetary gearsets, 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 gearsets. The three rotating clutches have been located forward of the gearsets 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.

The transmission architecture features a case with integral bell housing for enhanced powertrain stiffness. A unique pump drive design allows for off-axis packaging very low in the transmission. The pump is a binary vane type which effectively allows for two pumps in the packaging size of one. This design and packaging strategy not only enables low parasitic losses and optimum priming capability but also provides for ideal oil routing to the controls system, with the pump located in the valve body itself. The transmission control module (TCM) is externally mounted, enabling packaging and powertrain integration flexibility. The controller makes use of three speed sensors which provide for enhanced shift response and accuracy.

The 4-element torque converter contains a pump, a turbine, a pressure plate splined to the turbine, and a stator assembly. The torque converter acts as a fluid coupling to smoothly transmit power from the engine to the transmission. It also hydraulically provides additional torque multiplication when required. The pressure plate, when applied, provides a mechanical direct drive coupling of the engine to the transmission.

The planetary gear sets provide the 8 forward gear ratios and reverse. Changing gear ratios is fully automatic and is accomplished through the use of a transmission control module (TCM). The TCM receives and monitors various electronic sensor inputs and uses this information to shift the transmission at the optimum time.

The hydraulic system primarily consists of an off-axis chain-driven binary vane-type pump located in the valve body, and 2 control valve body assemblies. The pump maintains the working pressures needed to stroke the clutch pistons that apply or release the friction components. These friction components, when applied or released, support the automatic shifting qualities of the transmission.

The friction components used in this transmission consist of 5 multiple disc clutches. The multiple disc clutches deliver 9 different gear ratios, 8 forward and one reverse, through the gear sets. The gear sets then transfer torque through the output shaft.

The transmission may be operated in any of the following gear ranges:

PARK (P)

This position locks the rear wheels and prevents the vehicle from rolling either forward or backward. PARK is the best position to use when starting the vehicle. Because the transmission utilizes a shift lock control system, it is necessary to fully depress the brake pedal before shifting out of PARK. For safety reasons, use the parking brake in addition to the PARK position.

REVERSE (R)

This position allows the vehicle to be operated in a rearward direction.

NEUTRAL (N)

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This position allows the engine to be started and operated while driving the vehicle. If necessary, you may select this position in order to restart the engine with the vehicle moving. This position should also be used when towing the vehicle.

DRIVE (D)

Drive range should be used for all normal driving conditions for maximum efficiency and fuel economy. Drive range allows the transmission to operate in each of the 8 forward gear ratios. Downshifts to a lower gear, or higher gear ratio, are available for safe passing by depressing the accelerator or by manually selecting a lower gear in the manual mode range.

MANUAL (M) SPORT MODE (S)

This position allows the driver to utilize the Driver Shift Control (DSC) system, or manual mode. When the shift selector lever is moved to the M/S position, the driver may select upshifts or downshifts by using the paddle switches located on the steering wheel. An upshift is requested by pushing either + button forward. A downshift is requested by pulling either + button rearward toward the driver.
To protect the engine or transmission from damage, the TCM will only allow you to shift into a gear appropriate for engine speed and vehicle speed.

TRANSMISSION COMPONENT AND SYSTEM DESCRIPTION

The mechanical components of the 8-Speed RWD are as follows:

- A torque converter with an electronically controlled capacity clutch (ECCC). ECCC was developed to reduce the possibility of noise, vibration, or chuggle caused by TCC apply. In a torque converter with ECCC, the pressure plate does not always fully lock to the torque converter cover. Instead, the pressure plate maintains a small amount of slippage. In RWD 8-Speed transmissions, this slippage can range from 0 - 50 RPM. Full lockup (0 RPM slip) is still available on some applications. TCC may apply in 1st trough 8th gear. The specific TCC apply points and the amount of clutch slippage are determined by a number of operating conditions, including throttle position, vehicle speed, gear, as well as specific vehicle application. Transmission fluid temperature will also affect TCC apply points.
- Binary Vane-Type Fluid Pump Assembly
- 1 - 3 - 5 - 6 - 7 Clutch Assembly
- 2 - 3 - 4 - 6 - 8 and 4 - 5 - 6 - 7 - 8 Reverse Clutch Assembly
- Direct/Overdrive Internal Gear Assembly
- Direct/Overdrive Carrier Assembly
- Input Internal Gear Assembly
- Input Carrier Assembly
- Input Sun Gear Assembly
- Reaction Internal Gear and 1 - 2 - 3 - 4 - 5 Reverse Hub Assembly
- Reaction Carrier Assembly with Output Internal Gear Assembly
- Output Carrier Assembly
- Output Shaft
- Control Valve Body Assembly

The electrical components of the 8-Speed RWD are as follows:

- Input and Output Speed Sensor Assembly
- Manual Shift Shaft Position Switch
- Control Solenoid Valve Body, which contains the following components:
  - 8 Transmission Control Solenoids
  - Torque Converter Clutch (TCC) Control Solenoid
  - Default Control Solenoid

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- 1 - 2 - 3 - 4 - 5 Reverse Boost Solenoid

MANUAL MODE DESCRIPTION AND OPERATION

Transmission Gear Shift Lever

Manual Mode operation can be entered into when the shift lever is place in Manual (M) position. When manual mode is selected, the letter M of the PRNDM display will illuminate to indicate the transmission is in manual mode.

Transmission Manual Shift Switch - Up/Down

The transmission manual shift switch is mounted on the transmission gear shift lever handle. The manual shift switch is a momentary type that has three positions. The three positions are neutral or open, plus (+) for upshifts and minus (-) for downshifts. When selecting a gear, a number 1 through 6 for 6L transmission and 1 through 8 for 8L transmissions, will be displayed next to the letter M on the instrument panel, to indicate the current gear the operator has selected.

The transmission manual shift switch is an input signal to the body control module. The upshift or downshift signal commands are processed and sent out on the serial data line from the body control module to the engine control module and transmission control module.

Transmission Control Module

In manual mode, the Transmission Control Module will always have final authority of when to allow an upshift or downshift. The Transmission Control Module only allows an upshift or downshift into the appropriate gear based on engine RPM, vehicle speed and other control parameters. The transmission will not automatically downshift to the next lower gear if it would cause an engine over speed condition or an upshift if it would result in too low of engine RPM.

If the Transmission Control Module prevents an upshift or downshift for any reason, a SHIFT DENIED message will be displayed on the instrument cluster.

Manual Mode Shifting Operation

1. With the engine running, place the shift lever in Manual (M) position. The letter M of PRNDM display will illuminate to indicate Manual Mode. A number will be illuminated next to the letter M to indicate the current gear selected.
2. Momentary pressing the Transmission Manual Shift Switch - plus (+) will command the transmission to the next higher gear. The current number indicated on the PRNDM display will change to a number to indicate the gear that the vehicle operator has selected, and if conditions are appropriate, commands the Transmission Control Module to upshift to that gear.
3. Momentary pressing the Transmission Manual Shift Switch - minus (-) will command the transmission to the next lower gear. The current number indicated on the PRNDM display will change to a number to indicate the gear that the vehicle operator has selected, and if conditions are appropriate, commands the Transmission Control Module to downshift to that gear.
4. To exit Manual Mode, place the shift lever in Drive (D) position.

TRANSMISSION ADAPTIVE FUNCTIONS

The Hydra-MaticB® 8 - Speed RWD transmission utilizes a line pressure control system during upshifts to compensate for new transmission build variation and the normal wear of transmission components. New transmission to transmission variation and normal wear of the apply components within the transmission over time can cause shift time (the time required to apply a clutch) to be longer or shorter than desired. In order to compensate for these changes, the transmission control module (TCM) adjusts the pressure commands to the various pressure control (PC) solenoids, to maintain the originally calibrated shift timing. The automatic adjusting process is referred to as "adaptive learning" and it is used to ensure consistent shift feel plus increase transmission durability. The TCM monitors the A/T input speed sensor (ISS) and the A/T output speed sensor

(OSS) during commanded shifts to determine if a shift is occurring too fast (harsh) or too slow (soft) and adjusts the corresponding PC solenoid signal to maintain the set shift feel.

The purpose of the adapt function is to automatically compensate the shift quality for the various vehicle shift control systems. The adapt function is a continuous process that will help to maintain optimal shift quality throughout the life of the vehicle.

TRANSMISSION INDICATORS AND MESSAGES

The following transmission related indicators and messages may be displayed on the Instrument Panel Cluster (IPC). Also, the malfunction indicator lamp (MIL) may be illuminated, indicating a powertrain DTC has set, along with an IPC message. If a DTC is set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

Service Transmission

This message displays if there is a problem with the transmission or a DTC has been set.

Shift Denied - Manual Mode

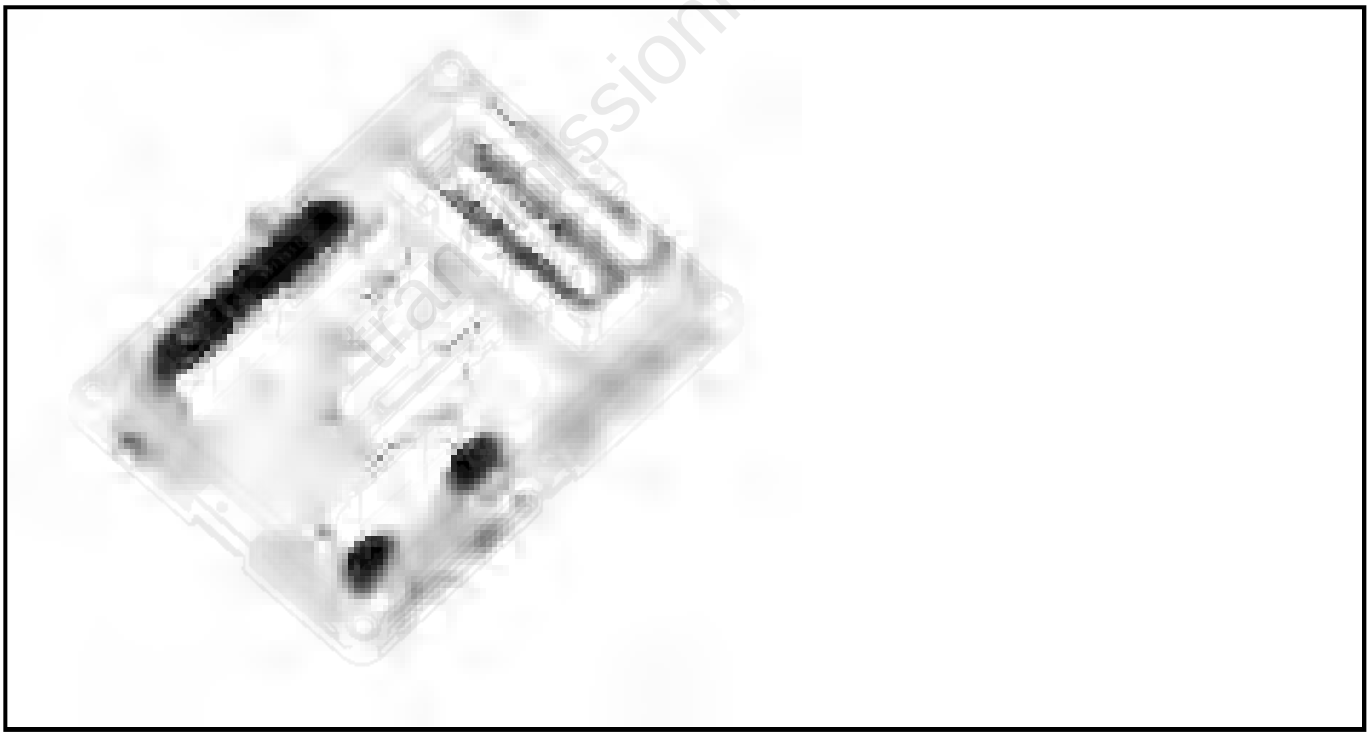
This message displays when attempting to shift to a gear not appropriate for the vehicle speed and engine RPM.

Transmission Hot

This message displays when the transmission control module (TCM) detects a transmission fluid temperature of 132B°C (270B°F) or greater for 5 seconds.

ELECTRONIC COMPONENT DESCRIPTION

Transmission Control Module



The Transmission Control Module (TCM) for this transmission is a standalone controller mounted to the vehicle. The TCM has one 66 way connector to interface with vehicle electrical system, transmission assembly and other vehicle control modules. The TCM sends and receives various input and output signals from a number of switches and sensors internal and external to the transmission. In addition, the TCM is part of a network of other control modules on the vehicle. The network of control modules will share information with each other, over a common serial data communications line. Based upon the calibrations and input information

the TCM receives, it will always have 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

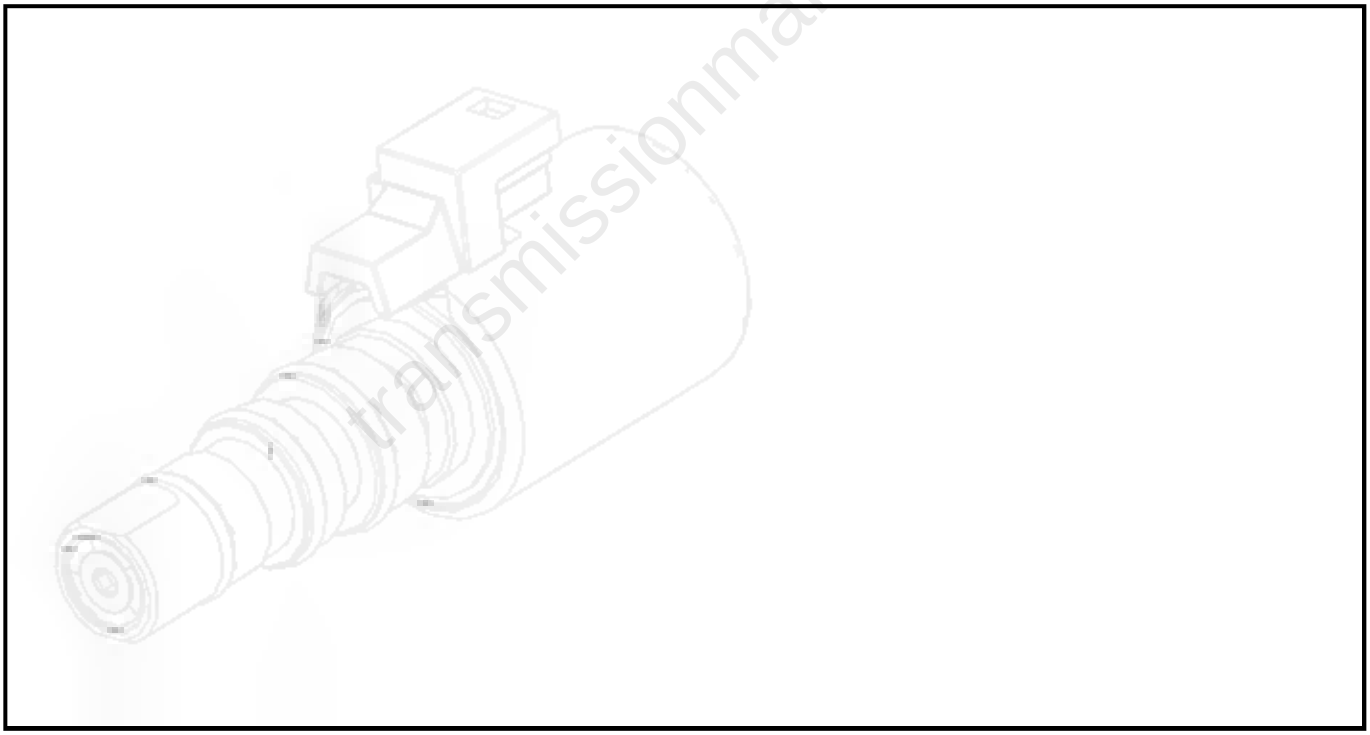
The 8L45/90 transmission contains a total of nine individual solenoids installed in various bore locations on the lower control valve body assembly. Seven of the nine solenoid valves are used to control pressure regulation and direction of transmission fluid and the two ON/OFF solenoid valves are only used to direct transmission fluid.

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

- 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 = When no current is applied to the solenoid valve coil the variable restriction is closed, resulting in no or low pressure.
- Normally High = When no current is applied to the solenoid valve coil the variable restriction is open, resulting in maximum or high pressure.
- Variable Force Solenoid Valve = This type of solenoid can increase or decrease the amount of pressurized fluid based on the amount of current applied to solenoid valve coil.

Pressure Regulating Solenoid Valves

High Pressure, Normally Low, Variable Force Solenoid Valves



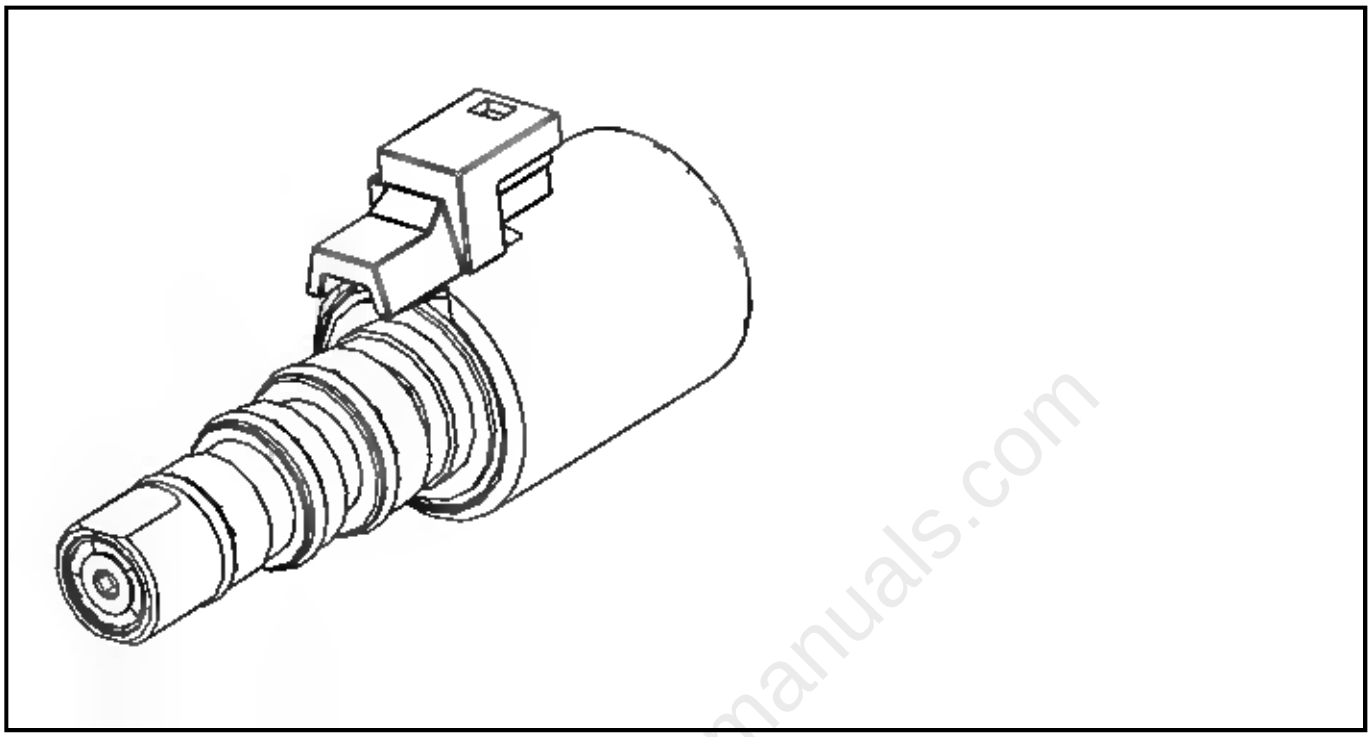
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Transmission Control Solenoid Valves 2, 3, and 7 are high pressure, normally low, variable force solenoid valves. This type of solenoid valve regulates hydraulic fluid pressure based on current flow through the solenoid valve coil windings. Each solenoid valve receives 12 V from a high side driver internal to the TCM. Each solenoid valve has a control circuit to an individual low side driver internal to the TCM, which turns ON and OFF to control the amount of current. As an increasing current is applied to the solenoid coil windings, the force imparted to the armature overcomes the armature spring pressure resulting in an increase in fluid pressure to the controlled element. The normal operating current range for these solenoid valves is between 0 - 1.2 A. If the TCM detects an electrical circuit malfunction or excessive current flow, the TCM turn off the high side

driver to that solenoid and sets a DTC. The high side driver will reset when the circuit fault is corrected and the ignition switch is cycled.

Nominal resistance of a variable force solenoid is 5.1 Ohms +/-.3 Ohms @ 20C (68F). As the temperature of the solenoid windings increase, the resistance will also increase. When the solenoid temperature is at 100C (212F), the resistance value will be approximately 6.7 Ohms +/-.4 Ohms.

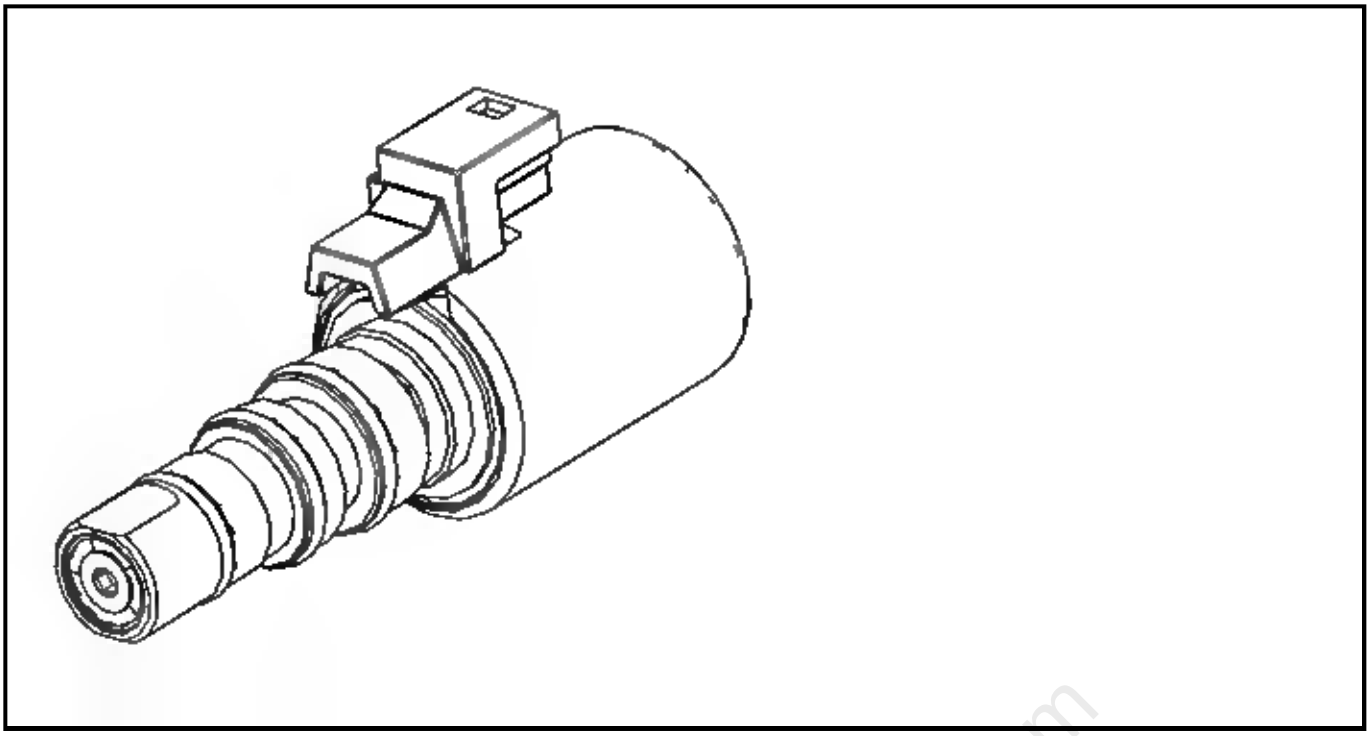
Low Pressure Normally High, Variable Force Solenoid Valves



Transmission Control Solenoid Valves 1, 5, and 6 are low pressure, normally high, variable force solenoid valves. This type of solenoid valve regulates hydraulic fluid pressure based on current flow through the solenoid valve coil windings. Each solenoid valve receives 12 V from a high side driver internal to the TCM. Each solenoid valve has a control circuit to an individual low side driver internal to the TCM, which turns ON and OFF to control the amount current. As an increasing current is applied to the coil windings, the force imparted to the armature overcomes the low fluid pressure acting on the armature resulting in a decrease in fluid pressure to the controlled element. The normal operating current range for these solenoids is between 0 - 1.2 A. If the TCM detects an electrical circuit malfunction or excessive current flow, the TCM turns off the high side driver to that solenoid valve and sets a DTC. The high side driver will reset when the circuit fault is corrected and the ignition switch is cycled.

Nominal resistance of a variable force solenoid is 5.1 Ohms +/-.3 Ohms @ 20C (68F). As the temperature of the solenoid windings increase, the resistance will also increase. When the solenoid temperature is at 100C (212F), the resistance value will be approximately 6.7 Ohms +/-.4 Ohms.

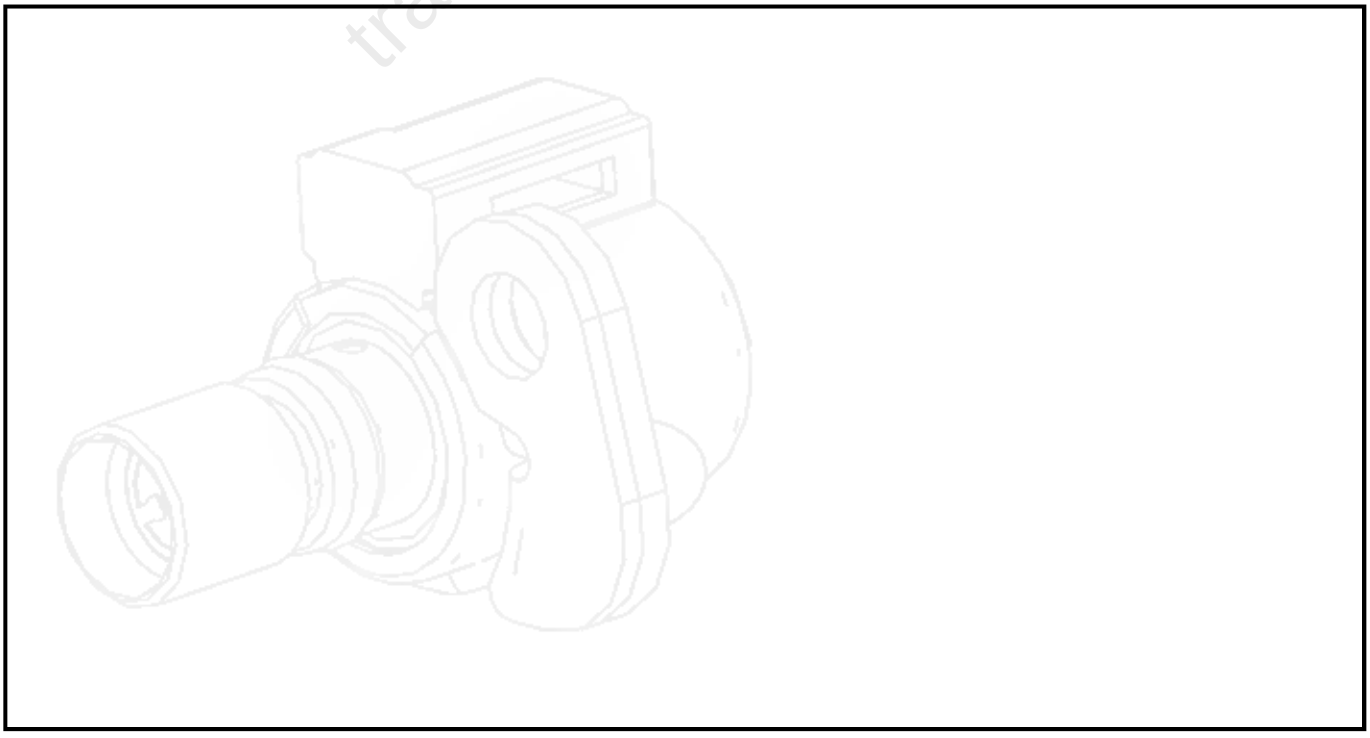
High Pressure Normally High, Variable Force Solenoid Valve



Transmission Control Solenoid Valve 4 is a high pressure, normally high, variable force solenoid valve. This type of solenoid valve regulates hydraulic fluid pressure based on current flow through the solenoid valve coil windings. Each solenoid receives 12 V from a high side driver internal to the TCM. This solenoid has a control circuit to an individual low side driver internal to the TCM, which turns ON and OFF to control the amount of current. As an increasing current is applied to the coil windings, the force imparted to the armature overcomes the high fluid pressure acting on the solenoid valve armature resulting in a decrease in fluid pressure to the controlled element. The normal operating current range for this solenoid is between 0 - 1.2 A. If the TCM detects an electrical circuit malfunction or excessive current flow, the TCM turns off the high side driver to that solenoid and sets a DTC. The high side driver will reset when the circuit fault is corrected and the ignition switch is cycled.

Nominal resistance of a variable force solenoid is 5.1 Ohms +/-.3 Ohms @ 20C (68F). As the temperature of the solenoid windings increase, the resistance will also increase. When the solenoid temperature is at 100C (212F), the resistance value will be approximately 6.7 Ohms +/-.4 Ohms.

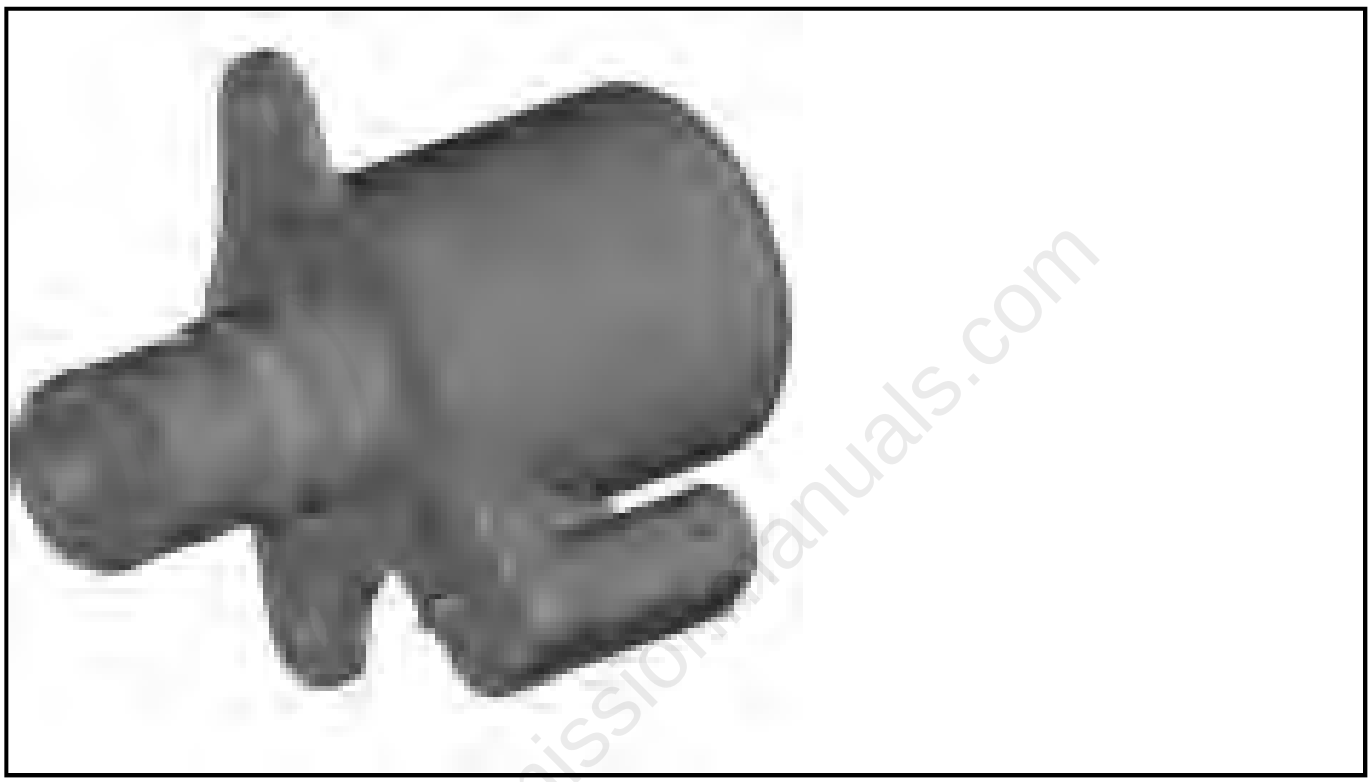
ON/OFF Solenoid Valves



Transmission Control Solenoid Valve 8 and 9 are normally low, ON/OFF solenoids. These solenoids only direct hydraulic fluid pressure when commanded ON. Each solenoid receives 12 V from a high side driver internal to the TCM. Each solenoid valve has a control circuit to an individual low side driver internal to the TCM. The normal operating current range for these solenoids is between 0 - 1 A. If the TCM detects an electrical circuit malfunction or excessive current flow, the TCM turns off the high side driver to that solenoid and sets a DTC. The high side driver will reset when the circuit fault is corrected and the ignition switch is cycled.

Nominal resistance of an On/Off solenoid is 12.0 Ohms +/-.3 Ohms @ 20C (68F). As the temperature of the solenoid windings increase, the resistance will also increase. When the solenoid temperature is at 100C (212F), the resistance value will be approximately 15.8 Ohms +/-.4 Ohms.

Transmission Fluid Pressure Accumulator Solenoid Valve - If Equipped



The Transmission Fluid Pressure Accumulator Solenoid Valve is part of the Stop/Start system on the vehicle. The automatic transmission auxiliary fluid accumulator is used to supply transmission fluid line pressure to the appropriate clutches for an auto start event. Attached to the accumulator is a normally closed ON/OFF solenoid. When the ignition is ON, the engine control ignition relay supplies 12 V to the accumulator solenoid. To complete the circuit, the engine control module (ECM) supplies a control circuit to the accumulator solenoid. When the ECM requests an auto start event, the solenoid is commanded ON, allowing captured pressurized fluid to exit the accumulator to apply the clutches for a 1st gear start.

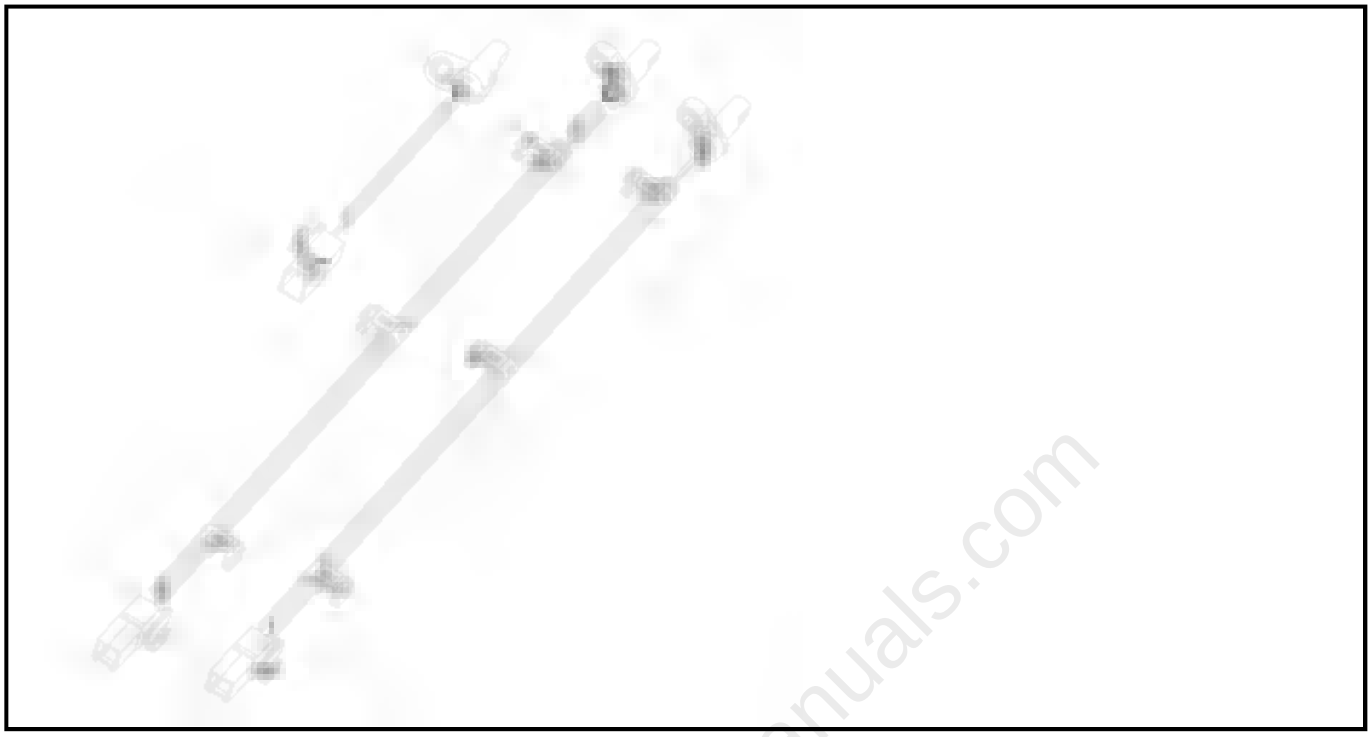
Solenoid Characterization

Transmission Control Solenoid Valves 1 - 7 are pressure regulating valves. Each solenoid valve is tested after assembly to determine the output fluid pressure at certain electrical current values, applied to coil windings. This information is refer to as solenoid current/pressure data points. The solenoid valves are tested two ways, with an increasing and decreasing electrical current applied to the coil windings. The resultant current versus pressure data points are saved and assigned a file number. The file number is marked on the solenoid valve housing end. The performance data file is stored on the TIS web site. This data file is programmed and stored in the vehicle's TCM. 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 web site for all 7 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 web site for all pressure regulating solenoid valves
- Transmission Assembly - program the TCM with the new data files stored on the TIS web site for all pressure regulating solenoid valves

Speed Sensors



Input Speed Sensor

The input speed sensor assembly is a two wire hall-effect type sensor. The TCM supplies a 9 V signal circuit and a low reference circuit to the input speed sensor. The input speed sensor produces a square wave signal by toggling the 9 V signal circuit low and high based on the leading and trailing edges on the outside diameter of the 1-3-5-6-7 clutch housing. As the rotational speed of the 1-3-5-6-7 clutch housing increases, the frequency of the input speed sensor signal increases. 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.

Intermediate Speed Sensor

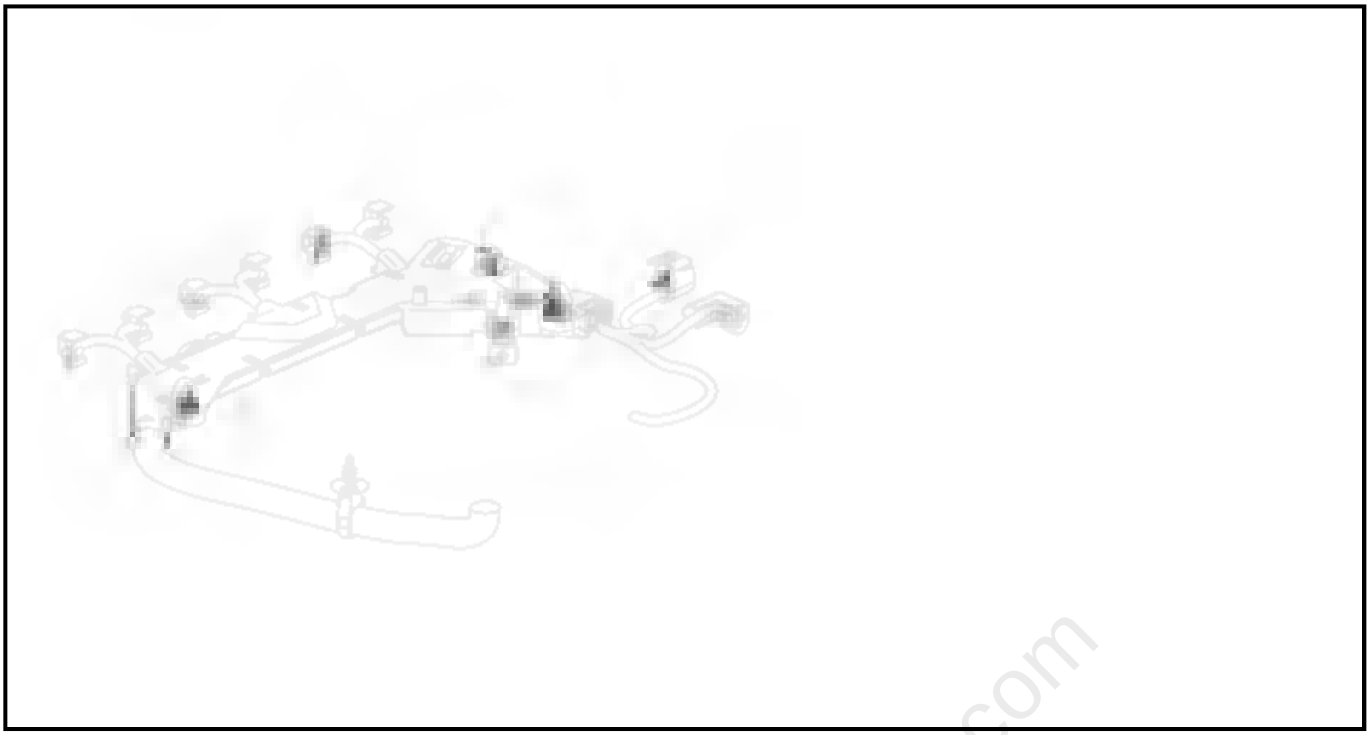
The intermediate speed sensor assembly is a two wire hall-effect type sensor. The TCM supplies a 9 V signal circuit and a low reference circuit to the intermediate speed sensor. The intermediate speed sensor produces a square wave signal by toggling the 9 V signal circuit low and high based on the leading and trailing edges on the outside diameter of the reaction carrier/output internal gear assembly. As the rotational speed of the reaction carrier/output internal gear assembly increases, the frequency of the intermediate speed sensor signal increases. The TCM uses the intermediate speed sensor signal along with the input and output speed sensor signals to determine transmission line pressure, shift patterns, torque converter clutch slip speed and the correct gear ratio.

Output Speed Sensor

The output speed sensor assembly is a two wire hall-effect type sensor. The TCM supplies a 9 V signal circuit and a low reference circuit to the output speed sensor. The output speed sensor produces a square wave signal by toggling the 9 V signal circuit low and high based on the leading and trailing edges on the outside diameter of the output carrier assembly. As the rotational speed of the output carrier assembly increases, the frequency of the output speed sensor signal increases. The TCM uses the output speed sensor signal along with the input and intermediate speed sensor signals to determine transmission line pressure, shift patterns, torque converter clutch slip speed and the correct gear ratio.

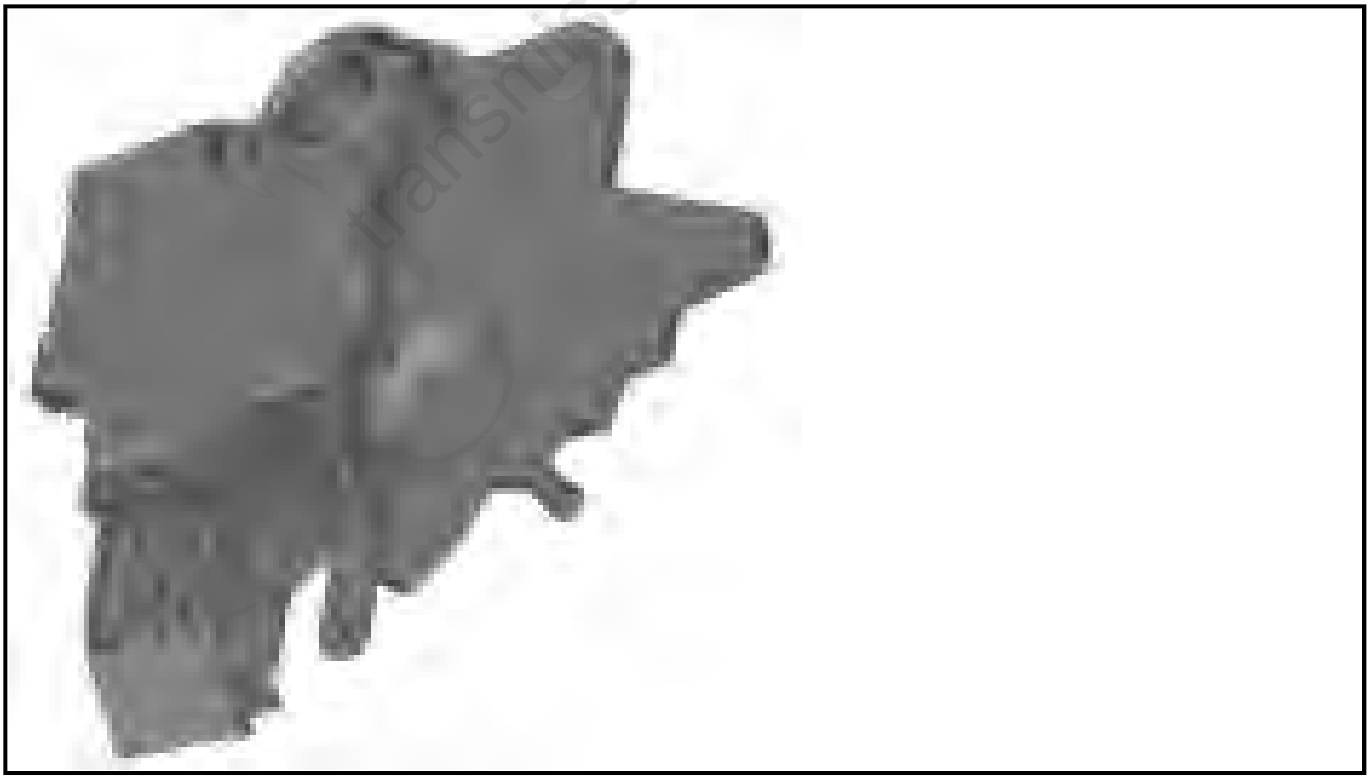
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Transmission Fluid Temperature Sensor



The transmission fluid temperature sensor 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 measures the temperature of the fluid the in the transmission fluid pan. As the temperature of the fluid increases, the resistance of the sensor decreases, varying the voltage on the signal circuit. 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, then replace the internal transmission wire harness assembly that has the temp sensor attached to it.

B303 Transmission Range Sensor



B303 is a hall-effect sensor that has two signal circuits with inversely proportional PWM duty cycle outputs.

- Transmission Range Sensor 1 is an input to the TCM, used to determine what transmission gear range the vehicle operator has selected and apply the clutches for that gear.
- Transmission Range Sensor 2 is an input to the ECM, used to determine if the transmission is in park or neutral - for starter motor operation.

PARK - ENGINE RUNNING

When the gear selector lever is in the Park (P) position, fluid is drawn into the pump through the transmission fluid filter assembly, from the transmission fluid pan assembly. Line pressure is then directed to the following valves:

Fluid Pressure Directed in Preparation for a Shift

Manual Valve

Mechanically controlled by the gear selector lever, the manual valve is in the Park (P) position and prevents line pressure from the pressure regulator valve from entering the reverse and drive circuits.

1 - 2 - 7 - 8 Reverse Control Solenoid Valve Assembly

The 1-2-7-8 reverse control solenoid is energized (HIGH) allowing actuator feed fluid to enter the S1 VFS SIG fluid circuit which applies fluid pressure against the S1 VFS ACCUM spring force and against the 1278R control valve spring force. This allows line fluid to pass through into the 1278R CLUTCH fluid circuit.

1 - 2 - 7 - 8 Reverse Clutch Assembly

1278R CLU fluid is routed to the 1278 reverse clutch piston to hold the piston against spring force which holds the 1278R clutch plates.

#14 Ball Check Valve

Line fluid travels through the 1278R control valve orifice #40 into the 1278R CLU FDBK fluid circuit and into the #14 ball check valve unseating the ball allowing fluid into the ACT FEED circuit.

1 - 2 - 3 - 4 - 5 Reverse Control Solenoid Valve Assembly

The 1-2-3-4-5 reverse control solenoid is energized (HIGH) allowing actuator feed fluid to enter the S2 VFS SIG fluid circuit which applies fluid pressure against the S2 VFS ACCUM spring force and against the 12345R control valve spring force. This allows line fluid to pass through into the 12345R CLUTCH fluid circuit.

1 - 2 - 3 - 4 - 5 Reverse Clutch Assembly

12345R CLU fluid is routed to the 12345 reverse clutch piston to hold the piston against spring force which holds the 12345R clutch plates.

Park - Engine Running

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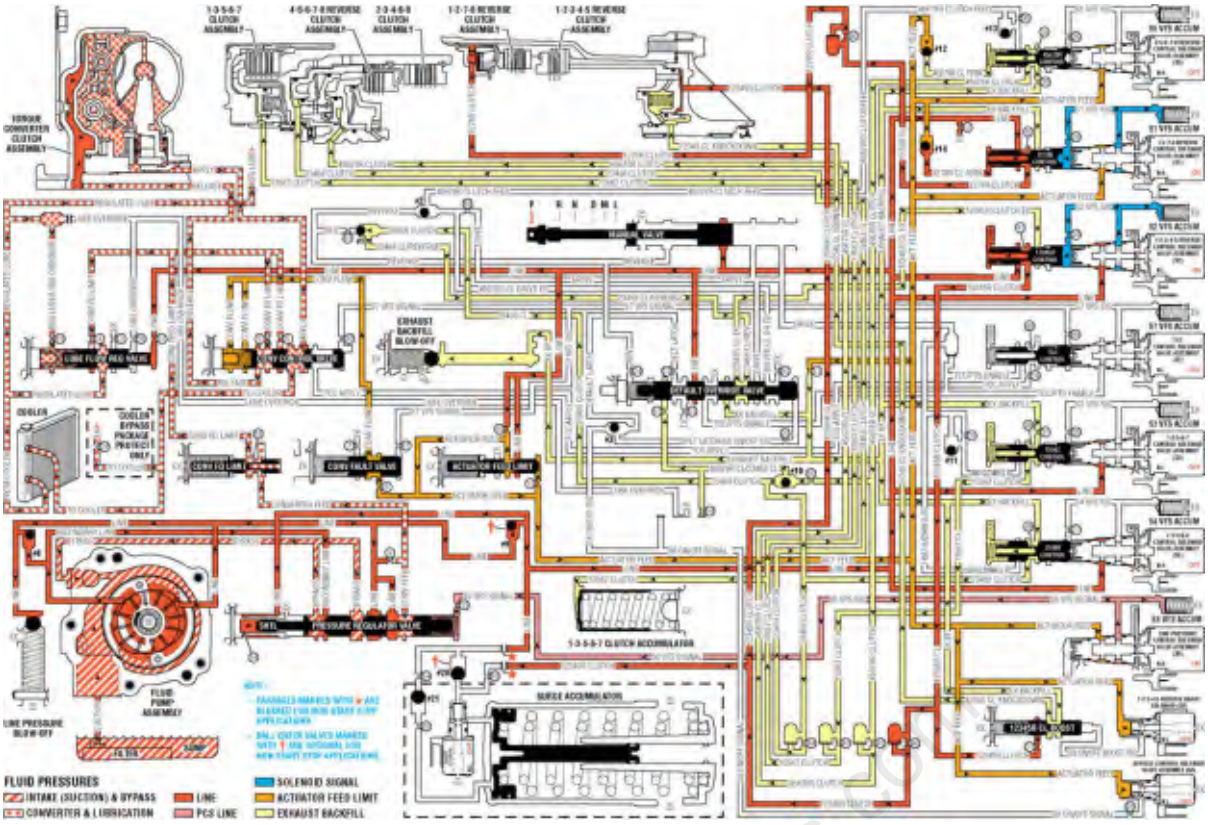


Fig. 1: Identifying Park - Engine Running Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

REVERSE

When the gear selector lever is moved to the Reverse (R) position (from the Park position) the normally high 4-5-6-7-8 reverse control solenoid valve and the 1-2-3-4-5 reverse boost solenoid is commanded ON and the following changes occur in the transmission's hydraulic and electrical systems:

Fluid Pressure Directed in Preparation for a Shift

Manual Valve

With the manual valve in the reverse position, line pressure is directed into the reverse fluid circuit to the default override valve, #1 ball check valve and the #2 ball check valve.

Default Override Valve

Reverse fluid from the manual valve is routed to the default override valve to combine with the default override valve springforce to keep the valve in the off position.

#1 Ball Check Valve

Reverse fluid passes through orifice #61 to seat the #1 ball check valve against the 23468 CLU fluid circuit allowing REV fluid to enter the 23468 CL/REV fluid circuit. The 23468 CL/REV fluid is routed to the default override valve. The 23468 CL/REV fluid passes through the default override valve and into the 12345R CL EX fluid circuit. The 12345R CL EX fluid is directed to the 12345R control valve.

#2 Ball Check Valve

Reverse fluid seats the #2 ball check valve against the 45678R CL DRIVE FD fluid circuit allowing reverse fluid to be routed into the 45678 CLU FD fluid circuit. The 45678 CLU FEED fluid is directed to the #13 ball check valve and through orifice #35 to the 45678R control valve.

4 - 5 - 6 - 7 - 8 Reverse Clutch Applies

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4 - 5 - 6 - 7 - 8 Reverse Control Solenoid

The 4-5-6-7-8 reverse control solenoid is energized allowing ACT FEED to enter the S5 VFS SIG fluid circuit which applies fluid pressure against the S5 VFS Accum spring force and through orifice #34 to the 45678R control valve spring force. This allows 45678R CLU FD fluid to enter the 45678R CLU fluid circuit. 45678R CL FD fluid also enters orifice #34 which is in the 45678R control valve. Fluid then enters the 45678R CL FDBK fluid circuit unseating the #12 ball check valve allowing 45678R CL FDBK fluid into the ACT FD fluid circuit.

#10 Ball Check Valve

45678R CLU fluid enters orifice #55 and unseats #10 ball check valve against the 23468 CLU fluid circuit. This allows 45678R CL fluid to enter the 45678R CL/23468 CL fluid circuit. 45678R CL/23468 CL fluid passes through orifice #56 and into the lube override enable valve. 45678R CL/23468 CL fluid applies pressure against the lube override enable valve spring force. 45678R CL/23468 CL fluid also passes through orifice #57 and into the default override valve.

4 - 5 - 6 - 7 - 8 Reverse Clutch Assembly

45678R CLU fluid is directed through orifice #42 into the 4-5-6-7-8 rev clutch piston spring force which applies holding force to the 4-5-6-7-8 rev clutch plates.

1 - 2 - 3 - 4 - 5 Reverse Clutch Applied

1 - 2 - 3 - 4 - 5 Reverse Boost Solenoid

The 1-2-3-4-5 reverse boost solenoid is energized allowing ACT FD fluid to enter the S8 ON/OFF BOOST SIG fluid circuit.

1 - 2 - 3 - 4 - 5 Reverse Clutch Boost Valve

S8 ON/OFF BOOST SIG fluid enters the 12345R clutch boost valve appling pressure against the 12345R clutch boost valve spring force. This allows 12345R CLU fluid through orifice #33 into the 12345R clu boost valve then into the 12345 CL KNOCKDOWN fluid circuit.

1 - 2 - 3 - 4 - 5 Reverse Clutch

12345 CL KNOCKDOWN fluid enters the 1-2-3-4-5 rev clu piston appling force with the 1-2-3-4-5 rev clutch piston return spring.

Reverse

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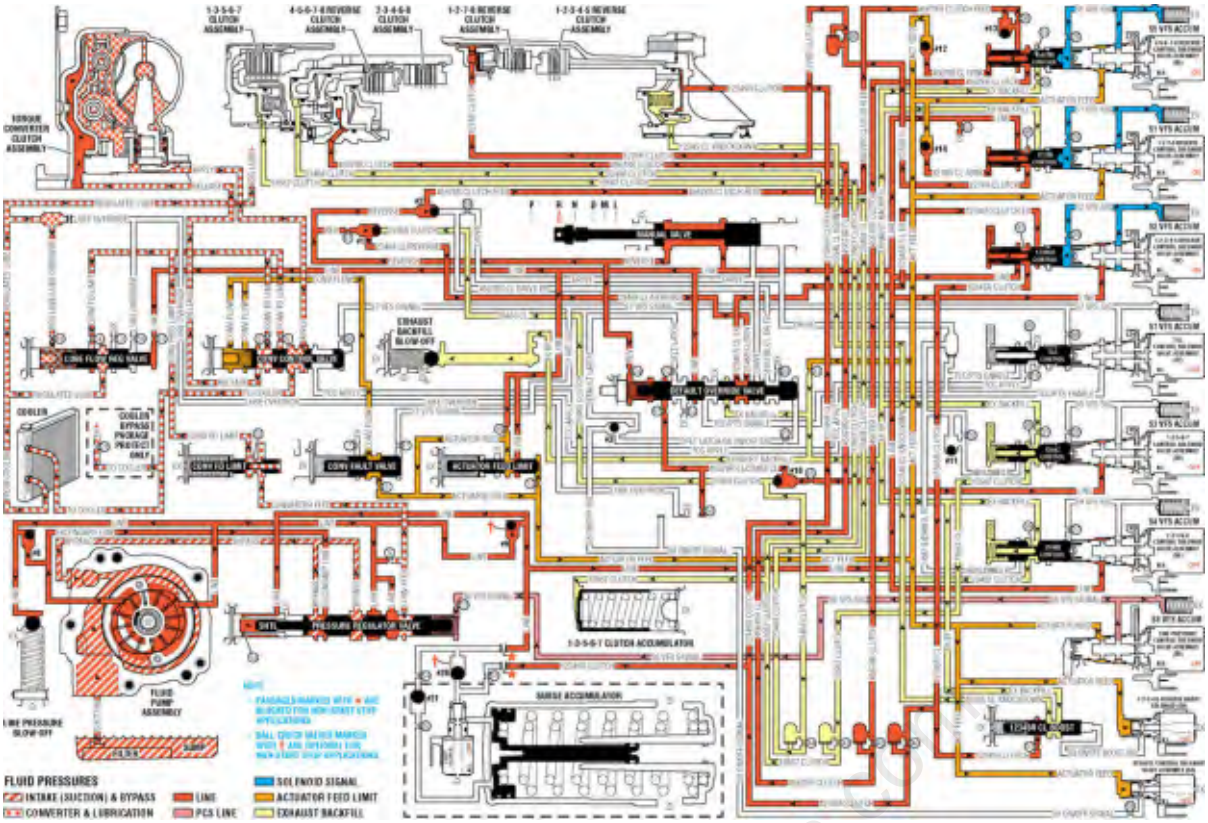


Fig. 2: Identifying Reverse Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

NEUTRAL - ENGINE RUNNING

When the gear selector is moved to the Neutral (N) position, the hydraulic and electrical system operation is identical to Park (P) range. However, if Neutral is selected after the vehicle was operating in Reverse (R), the normally high 4-5-6-7-8 reverse control solenoid and normaly low 1-2-3-4-5 reverse boost solenoid is commanded OFF and the following changes would occur in the hydraulic system:

4 - 5 - 6 - 7 - 8 Reverse Clutch Releases

Manual Valve

The manual valve is moved to the Neutral position and blocks line pressure from entering the reverse and drive fluid circuits. The reverse fluid from the default override valve, #1 and #2 ball check valve is opened to a exhaust passage at the manual valve.

4 - 5 - 6 - 7 - 8 Reverse Control Solenoid

The 4-5-6-7-8 reverse control solenoid is commanded off. The 45678 rev cont valve spring force moves the valve to allow S5 VFS SIG fluid to exhaust through the 45678 rev control solenoid. This also allows 45678R CL FDBK and 45678R CLUTCH fluid to exhaust into the EX BACKFILL fluid circuit.

1 - 2 - 3 - 4 - 5 Reverse Boost Solenoid

The 1-2-3-4-5 reverse boost solenoid is commanded off. This allows S8 ON/OFF BOOST SIGNAL fluid to exhaust through the 1-2-3-4-5 rev boost solenoid.

1 - 2 - 3 - 4 - 5 Reverse Clutch Boost Valve

The 12345R clutch boost valve spring force moves the valve to allow EX BACKFILL fluid to enter 12345 CL KNOCKDOWN. When REV fluid is exhausted the #1 ball check valve seats against the REV circuit allowing 23468 CLU fluid to enter 23468 CL/REV circuit.

#10 Ball Check Valve

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When 45678R CLUTCH fluid is exhausted the #10 ball check valve unseats allowing 23468 CLUTCH fluid to enter the 45678R CL/23468 CL fluid circuit which is directed through orifice #56 to the lube override enable valve and through orifice #57 to the default override valve.

4 - 5 - 6 - 7 - 8 Reverse Clutch Assembly

45678R CLUTCH fluid is exhausted from the 4-5-6-7- 8 reverse clutch assembly through orifice #42. 45678R CLUTCH fluid continues to the 45678R control valve where it is directed thru orifice #30 into EX BACKFILL.

Neutral - Engine Running

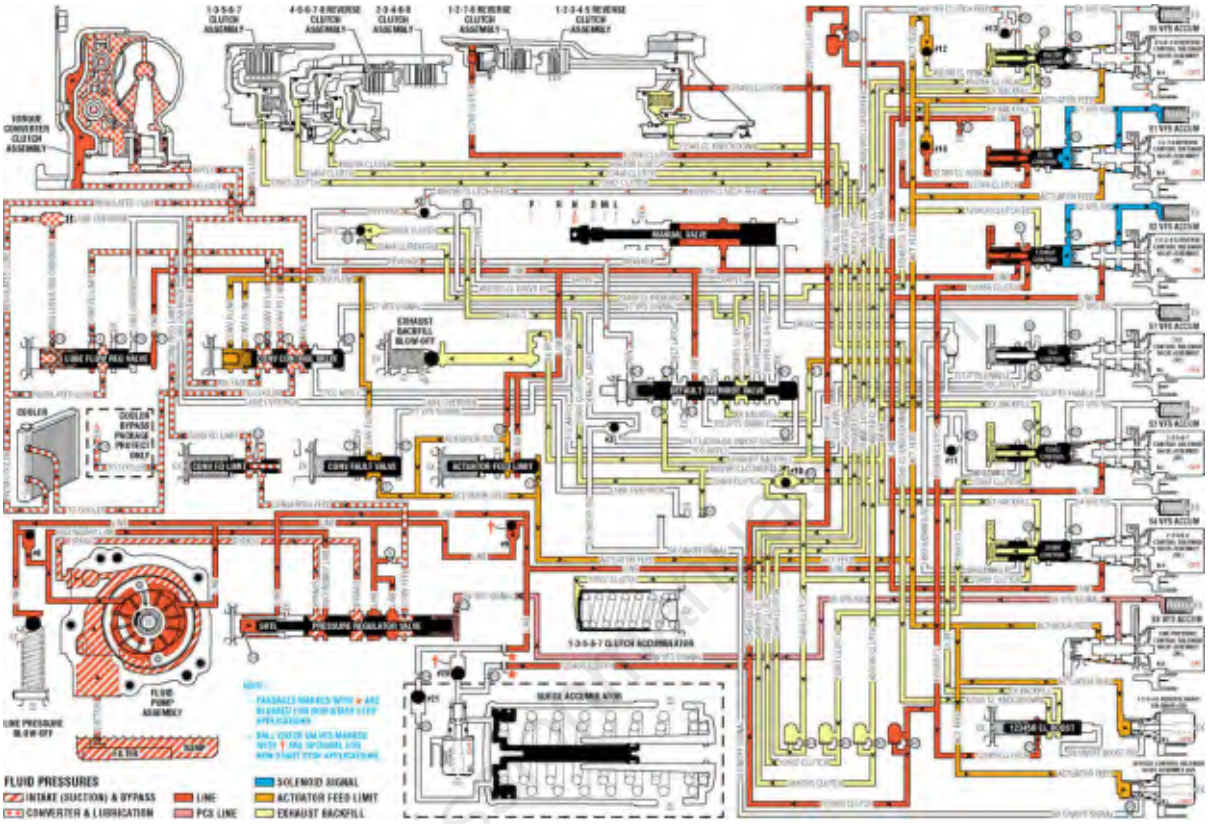


Fig. 3: Identifying Neutral - Engine Running Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIRST GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, throttle position sensor and other vehicle sensors to determine the precise moment to energize or "turn on" 1-2-3-5-7 control solenoid and command ON the normally-low 1-2-3-4-5 reverse boost solenoid and default control solenoid.

Fluid Pressure is Directed to the 1 - 3 - 5 - 6 - 7 Clutch Assembly

Manual Valve

The manual valve is moved to the drive position and allows line fluid pressure to enter the drive fluid circuit. Drive fluid is then routed to the default override valve.

#2 Ball Check Valve

Drive fluid is directed thru orifice #59 into the 45678R CL DR FD fluid circuit which seats the #2 ball check valve against the reverse circuit allowing fluid to enter the 45678R CLUTCH FEED circuit. 45678R CLU FEED fluid is directed thru orifice #35 then to the 45678R control valve.

1 - 3 - 5 - 6 - 7 Clutch Applies

1 - 3 - 5 - 6 - 7 Control Solenoid Valve Assembly

The 1-3-5-6-7 control solenoid is energized allowing line fluid to enter the S3 VFS SIG fluid circuit which applies fluid pressure against the S3 VFS SIG accumulator spring force and against the 13567 control valve spring force. This allows 13567 CL/23468 CL FD fluid to enter the 13567 clutch fluid circuit and thru the 13567 control valve orifice #38 to FDBK.

1 - 3 - 5 - 6 - 7 Clutch Accumulator

13567 CLU fluid is directed thru orifice #43 and into the 1-3- 5-6-7 clutch accumulator where it applies pressure against the 1-3-5-6-7 clutch accumulator spring force.

1 - 3 - 5 - 6 - 7 Clutch Assembly

13567 CLU fluid is also directed to the 1-3-5-6-7 clutch assembly housing. 13567 CLU fluid moves the piston against spring force to apply holding of the 1-3-5-6-7 clutch plates.

1 - 2 - 3 - 4 - 5 Reverse Boost Solenoid

The 1-2-3-4-5 rev boost solenoid is energized allowing ACT FD fluid to enter the S9 ON/OFF BOOST SIG fluid circuit.

1 - 2 - 3 - 4 - 5 Reverse Clutch Boost Valve

S9 ON/OFF BOOST SIG fluid enters the 12345R clu boost valve appling pressure against the 12345R clu boost valve spring force. This allows 12345R CLU fluid through orifice #33 into the 12345R clu boost valve then into the 12345 CL KNOCKDOWN fluid circuit.

1 - 2 - 3 - 4 - 5 Reverse Clutch

12345 CL KNOCKDOWN fluid enters the 1-2-3-4-5 rev clu piston appling force with the 1-2-3-4-5 rev clu piston return spring.

Default Control Solenoid

The default control solenoid valve is energized allowing ACT FEED fluid to enter the S8 ON/OFF SIG fluid circuit. S8 ON/ OFF SIG fluid passes thru orifice #58 into the lube override enable valve and to the #3 ball check valve.

#3 Ball Check Valve

The S8 ON/OFF SIG fluid seats the #3 ball check valve against the DEFAULT LATCH circuit allowing S8 ON/OFF SIG fluid to enter the DFLT LATCH /S8 ON/OFF SIG circuit. DFLT LATCH/S8 ON/OFF SIG fluid passes thru orifice #23 to enter the default override valve applying pressure against the default override valve spring force. This allows DRIVE fluid to enter the 45678R CL DR FD circuit which seats the #2 ball check valve against the REV circuit.

Drive Range, First Gear

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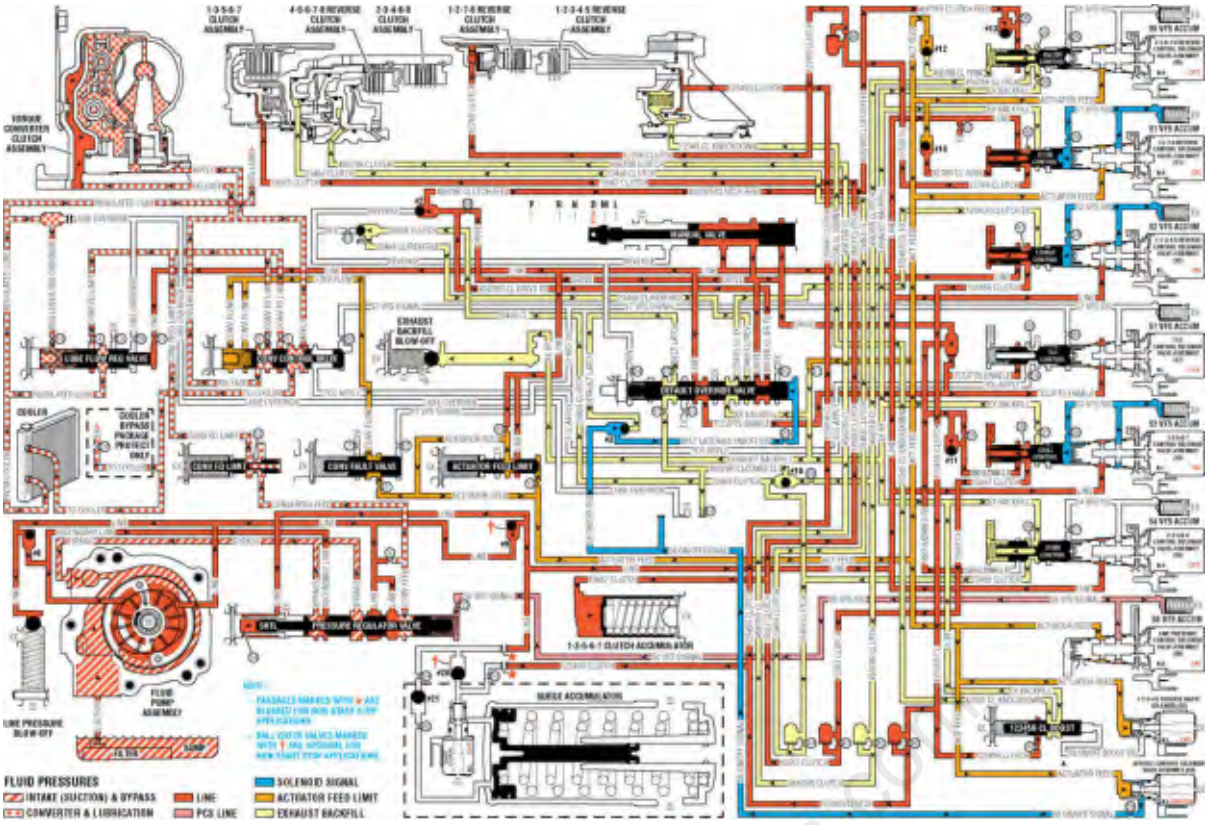


Fig. 4: Identifying Drive Range, First Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SECOND GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-low pressure control solenoid 4.

2 - 3 - 4 - 6 - 8 Clutch Applies

CB26 Pressure Control Solenoid 4

The 2-3-4-6-8 control solenoid energizes allowing line fluid to enter the S4 VFS SIG fluid circuit which applies pressure against the S4 vfs accum spring force and against the 23468 control valve spring force. This allows 13567 CL/23468 CL FD fluid to enter the 23468 CLU fluid circuit. 13567 CL/23468 CL FD fluid also passes thru the 23468 control valve orifice #39 into FDBK. 23468 CLUTCH fluid is directed to the #10 ball check valve and thru orifice #44 to the 23468 clutch assembly housing.

#10 Ball Check Valve

The 23468 CLU fluid seats the #10 ball check valve against the 45678R CLU fluid circuit. 23468 CLU fluid is also directed to the #1 ball check valve.

#1 Ball Check Valve

23468 CLU fluid seats the #1 ball check valve against the REV fluid circuit. This allows 23468 CLU fluid to enter the 23468 C/REV fluid circuit which is directed to the default override valve.

#3 Ball Check Valve

Default Latch fluid seats the #3 ball check valve against the S8 ON/OFF SIG fluid circuit. Allowing DEFAULT LATCH fluid to enter the DFLT LATCH/S8 ON/OFF SIG fluid circuit. DFLT LATCH/S8 ON/OFF SIG fluid passes thru orifice #23 to enter the default override valve applying pressure against the default override valve

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spring force. This allows DRIVE fluid to enter the 45678R CL DR FD circuit which seats the #2 ball check valve against the REV circuit.

2 - 3 - 4 - 6 - 8 Clutch Assembly

The 23468 CLU fluid passes thru orifice #44 continuing to the 2-3-4-6-8 clutch assembly housing. 23468 CLUTCH fluid applies pressure against the 23468 clutch piston which applies holding pressure to the 2-3-4-6-8 clutch plates.

1 - 3 - 5 - 6 - 7 Clutch Releases

1 - 3 - 5 - 6 - 7 Control Solenoid

The 1-3-5-6-7 control solenoid is signaled off allowing S3 VFS SIG fluid to exhaust. Spring pressure shifts the valve to allow 13567 CLUTCH fluid to exhaust into EX BACKFILL from the 1-3-5-6-7 clutch accumulator and the 1-3-5-6-7 clutch assembly housing.

Default Control Solenoid

The default control solenoid is signaled off allowing S8 ON/ OFF SIGNAL fluid to exhaust.

Drive Range, Second Gear

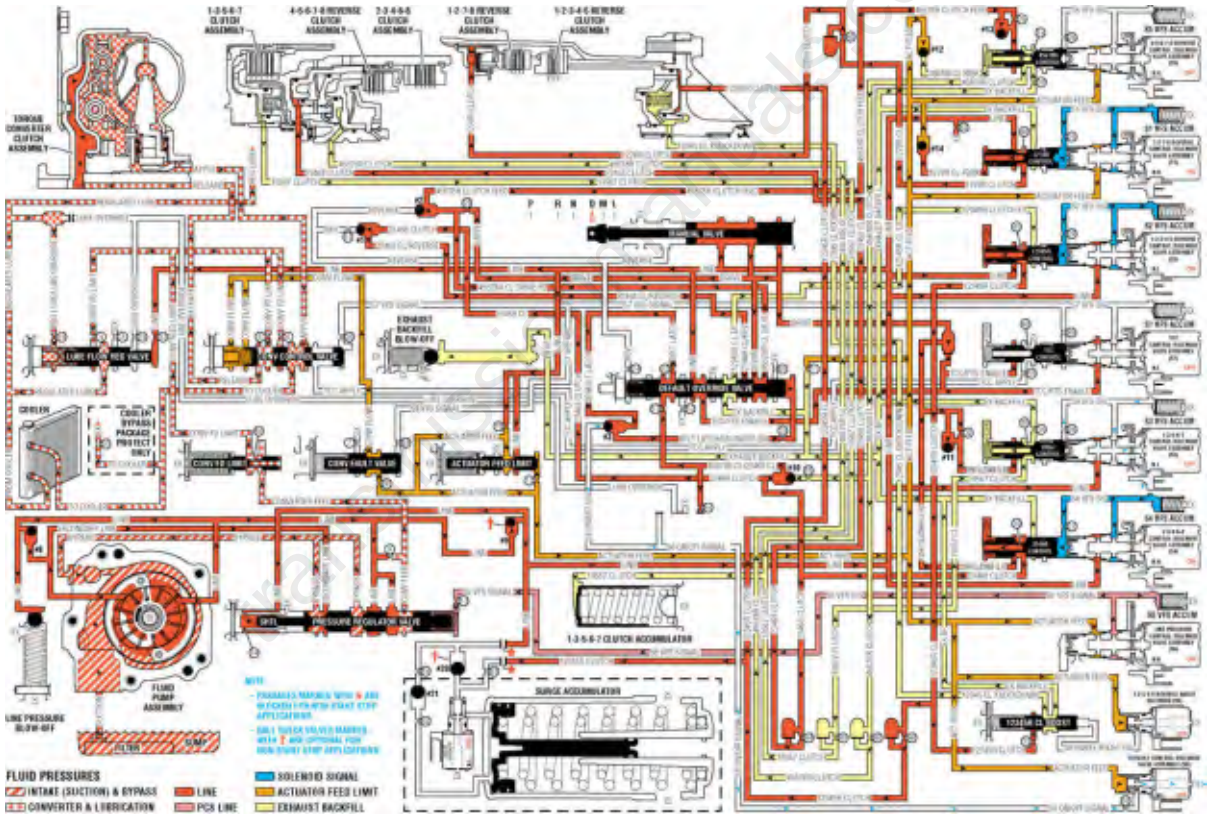


Fig. 5: Identifying Drive Range, Second Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, THIRD GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command OFF the normally-high 1-2- 7-8 reverse control solenoid. At the same time the 1-3-5-6-7 control solenoid is also commanded ON to regulate 1-3-5-6-7 clutch apply.

1 - 3 - 5 - 6 - 7 Clutch Applies

1 - 3 - 5 - 6 - 7 Control Solenoid Valve Assembly

The 1-3-5-6-7 control solenoid is energized allowing line fluid to enter the S3 VFS SIG fluid circuit which applies fluid pressure against the S3 VFS SIG accumulator spring force and against the 13567 control valve spring force. This allows 13567 CL/23468 CL FD fluid to enter the 13567 clutch fluid circuit and thru the 13567 control valve orifice #38 to FDBK.

1 - 3 - 5 - 6 - 7 Clutch Accumulator

13567 CLU fluid is directed thru orifice #43 and into the 1-3- 5-6-7 clutch accumulator where it applies pressure against the 1-3-5-6-7 clutch accumulator spring force.

1 - 3 - 5 - 6 - 7 Clutch Assembly

13567 CLU fluid is also directed to the 1-3-5-6-7 clutch assembly housing. 13567 CLU fluid moves the piston against spring force to apply holding of the 1-3-5-6-7 clutch plates.

1 - 2 - 7 - 8 Clutch Releases

1 - 2 - 7 - 8 Reverse Control Solenoid

The 1-2-7-8 reverse control solenoid is signaled off allowing S1 VFS SIG fluid to exhaust and the 1278R control valve to shift do to the 1278R control valve spring force. 1278R CLU fluid exhaust into the EX BACKFILL fluid circuit from the release of the 1-2-7-8R clutch assembly plates.

Drive Range, Third Gear

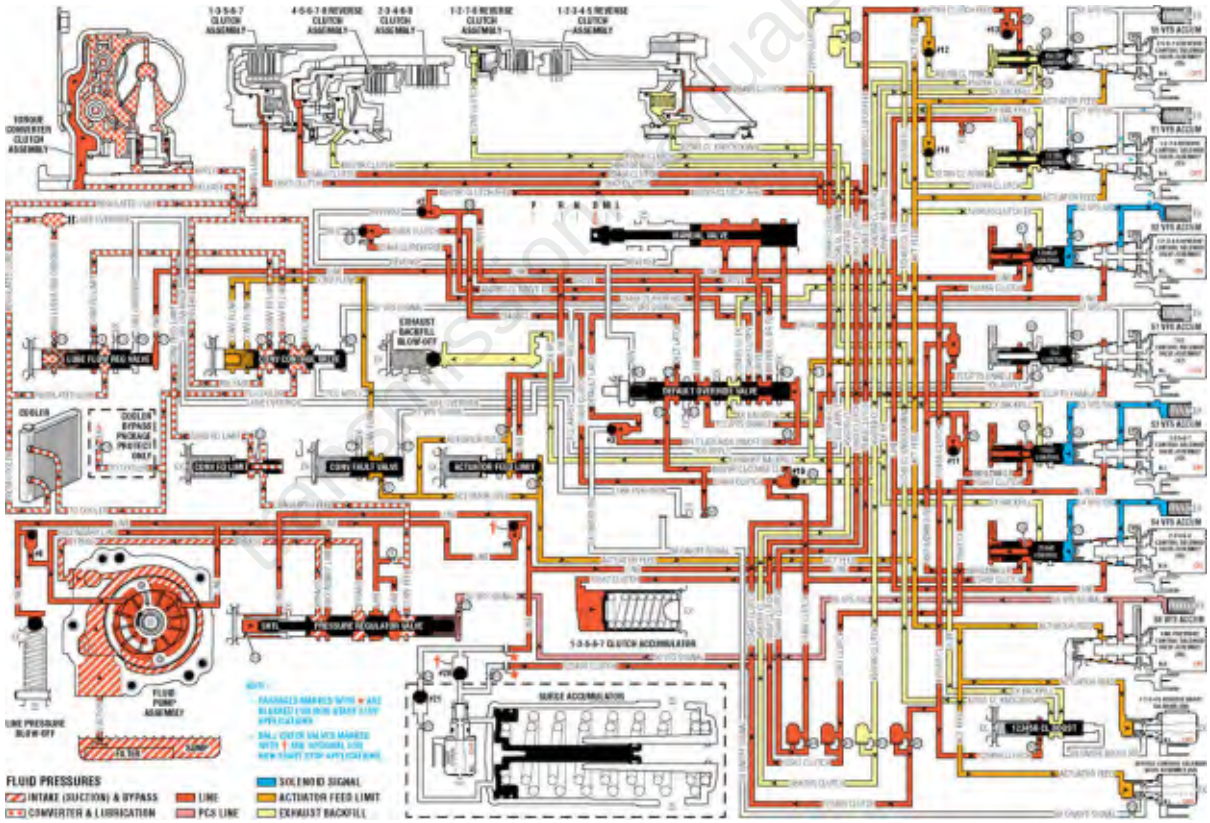


Fig. 6: Identifying Drive Range, Third Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FOURTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command OFF the normally-low 1-3- 5-6-7 control solenoid. At the same time the normally-high 4-5-6-7-8 reverse control solenoid is commanded ON to regulate 4-5-6-7-8 reverse clutch apply.

4-5-6 - 7 - 8 Reverse Clutch Applies

4 - 5 - 6 - 7 - 8 Reverse Control Solenoid

The 4-5-6-7-8 reverse control solenoid is energized allowing ACT FEED to enter the S3 VFS SIG fluid circuit which applies fluid pressure against the S3 VFS Accum spring force and through orifice #34 to the 45678R control valve spring force. This allows 45678R CLU FD fluid to enter the 45678R CLU fluid circuit. 45678R CL FD fluid also enters orifice #34 which is in the 45678R control valve. Fluid then enters the 45678R CL FDBK fluid circuit unseating the #12 ball check valve allowing 45678R CL FDBK fluid into the ACT FD fluid circuit.

#10 Ball Check Valve

45678R CLU fluid enters orifice #55 and unseats #10 ball check valve. This allows 45678R CL fluid to enter the 45678R CL/23468 CL fluid circuit. 45678R CL/23468 CL fluid passes through orifice #56 and into the lube override enable valve. 45678R CL/23468 CL fluid applies pressure against the lube override enable valve spring force. 45678R CL/23468 CL fluid also passes through orifice #57 and into the default override valve.

4 - 5 - 6 - 7 - 8 Reverse Clutch Assembly

45678R CLU fluid is directed through orifice #42 into the 4-5-6- 7-8 rev clutch piston spring force which applies holding force to the 4-5-6-7-8 rev clutch plates.

Default Control Solenoid

The default control solenoid valve is energized allowing ACT FEED fluid to enter the S8 ON/OFF SIG fluid circuit. S8 ON/OFF SIG fluid passes thru orifice #58 thru the lube override enable valve and into the LUBE OVERRIDE fluid circuit which continues to the lube flow regulator valve. S8 ON/OFF SIG fluid is also directed to the #3 ball check valve.

1 - 3 - 5 - 6 - 7 Clutch Releases

1 - 3 - 5 - 6 - 7 Control Solenoid

The 1-3-5-6-7 control solenoid is signaled off allowing S3 VFS SIG fluid to exhaust. Spring pressure shifts the valve to allow 13567 CLUTCH fluid to exhaust into EX BACKFILL from the 1-3-5-6-7 clutch accumulator and the 1-3-5-6-7 clutch assembly housing.

1 - 3 - 5 - 6 - 7 Clutch Assembly

The 1-3-5-6-7 clutch is released allowing 13567 CLUTCH fluid to exhaust thru the 1-3-5-6-7 control solenoid.

1 - 3 - 5 - 6 - 7 Clutch Accumulator

The 1-3-5-6-7 clutch accumulator is released allowing 13567 CLUTCH fluid to exhaust thru the 1-3-5-6-7 control solenoid.

Drive Range, Fourth Gear

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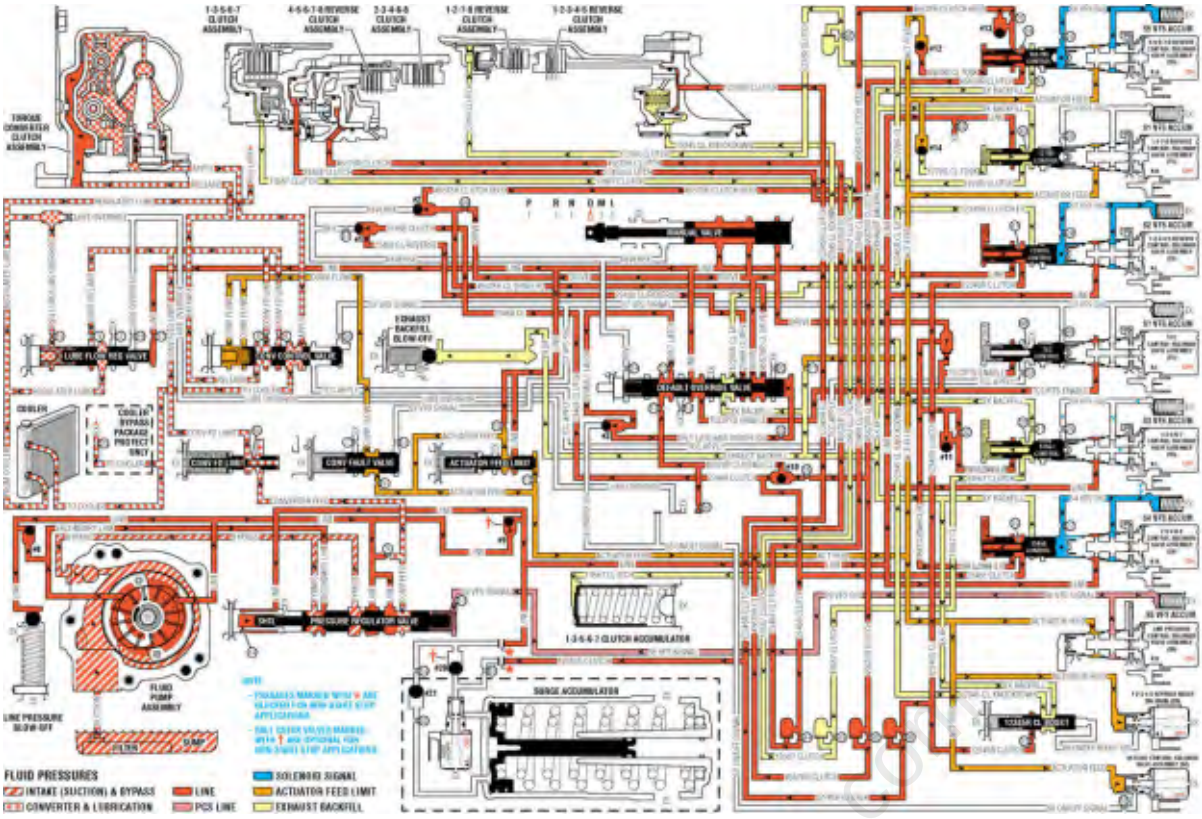


Fig. 7: Identifying Drive Range, Fourth Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIFTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-low 1-3-5-6- 7 control solenoid. At the same time the normally-high 2-3-4-6-8 control solenoid is commanded OFF.

1 - 3 - 5 - 6 - 7 Clutch Applies

1 - 3 - 5 - 6 - 7 Control Solenoid Valve Assembly

The 1-3-5-6-7 control solenoid is energized allowing line fluid to enter the S3 VFS SIG fluid circuit which applies fluid pressure against the S3 VFS SIG accumulator spring force and against the 13567 control valve spring force. This allows

13567 CL/23468 CL FD fluid to enter the 13567 clutch fluid circuit and thru the 13567 control valve orifice #38 to FDBK.

1 - 3 - 5 - 6 - 7 Clutch Accumulator

13567 CLU fluid is directed thru orifice #43 and into the 1-3-5-6-7 clutch accumulator where it applies pressure against the 1-3-5-6-7 clutch accumulator spring force.

1 - 3 - 5 - 6 - 7 Clutch Assembly

13567 CLU fluid is also directed to the 1-3-5-6-7 clutch assembly housing. 13567 CLU fluid moves the piston against spring force to apply holding of the 1-3-5-6-7 clutch plates.

2 - 3 - 4 - 6 - 8 Clutch Releases

2 - 3 - 4 - 6 - 8 Control Solenoid

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The 2-3-4-6-8 control solenoid is signaled off allowing S4 VFS SIG fluid to exhaust. Spring pressure shifts the valve to allow 23468 CLUTCH fluid to exhaust into EX BACKFILL from the 2-3-4-6-8 clutch assembly housing.

2 - 3 - 4 - 6 - 8 Clutch Assembly

The 2-3-4-6-8 clutch is released allowing 23468 CLUTCH fluid to exhaust thru the 2-3-4-6-8 control solenoid.

Drive Range, Fifth Gear

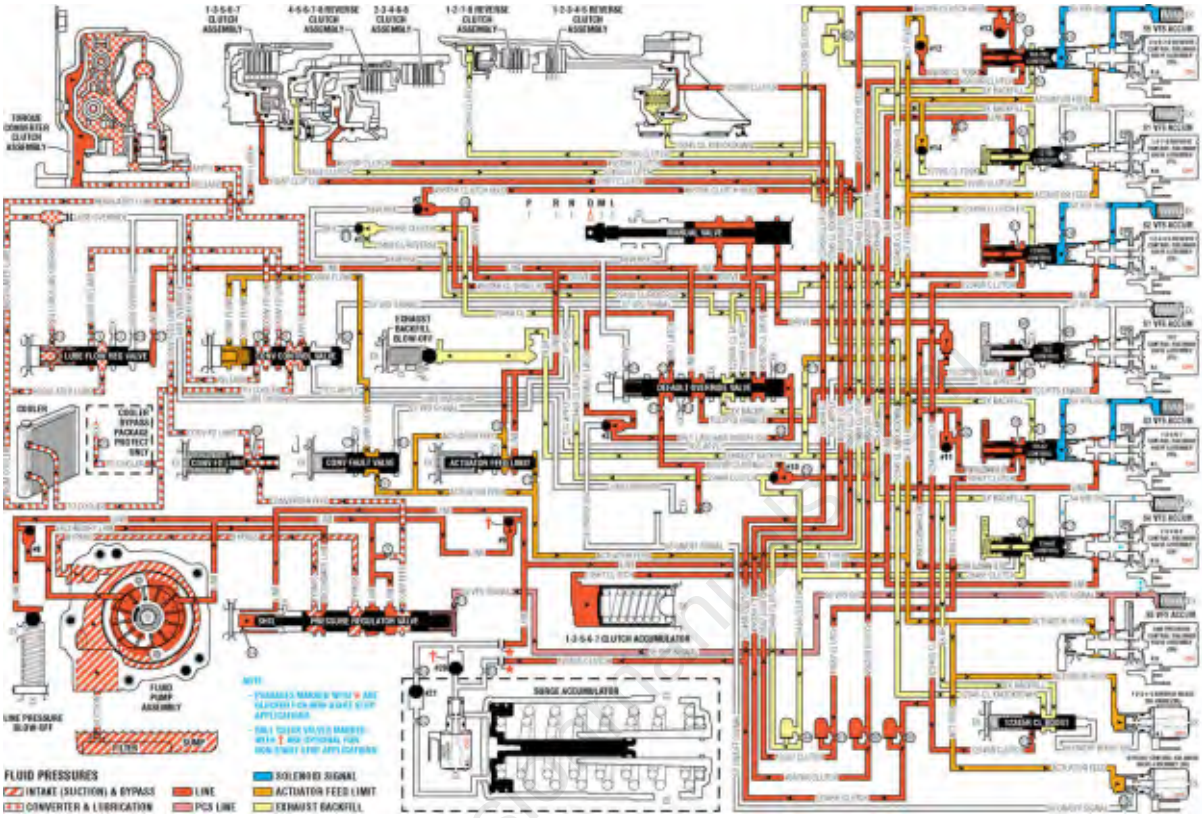


Fig. 8: Identifying Drive Range, Fifth Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SIXTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-high 2-3-4-6-8 control solenoid. At the same time the normally-low 1-2-3-4-5 reverse control solenoid and the normally-low 1-2-3-4-5 reverse boost solenoid is commanded OFF.

2 - 3 - 4 - 6 - 8 Clutch Applies

2 - 3 - 4 - 6 - 8 Control Solenoid

The 2-3-4-6-8 control solenoid energizes allowing line fluid to enter the S4 VFS SIG fluid circuit which applies pressure against the S4 vfs accum spring force and against the 23468 control valve spring force. This allows 13567 CL/23468 CL FD fluid to enter the 23468 CLU fluid circuit. 13567 CL/23468 CL FD fluid also passes thru the 23468 control valve orifice #39 into FDBK. 23468 CLUTCH fluid is directed to the #10 ball check valve and thru orifice #44 to the 23468 clutch assembly housing.

2 - 3 - 4 - 6 - 8 Clutch Assembly

The 23468 CLU fluid passes thru orifice #44 continuing to the 2-3-4-6-8 clutch assembly housing. 23468 CLUTCH fluid applies pressure against the 23468 clutch piston which applies holding pressure to the 2-3-4-6-8 clutch plates.

1 - 2 - 3 - 4 - 5 Clutch Releases

1 - 2 - 3 - 4 - 5 Control Solenoid

The 1-2-3-4-5 control solenoid is signaled off allowing S2 VFS SIG fluid to exhaust. Spring pressure shifts the valve to allow 12345R CLUTCH fluid to exhaust into 12345R CLUTCH EX fluid circuit from the 12345R clutch boost and the 1-2-3-4-5 reverse clutch assembly housing.

1 - 2 - 3 - 4 - 5 Reverse Clutch Assembly

The 1-2-3-4-5 reverse clutch is released allowing 12345R CLUTCH fluid to exhaust thru the 1-2-3-4-5 reverse control solenoid.

1 - 2 - 3 - 4 - 5 Reverse Boost Solenoid

The 1-2-3-4-5 reverse boost solenoid is commanded off. This allows S9 ON/OFF BOOST SIGNAL fluid to exhaust through the 1-2-3-4-5 rev boost solenoid.

1 - 2 - 3 - 4 - 5 Reverse Clutch Boost Valve

The 12345R clutch boost valve spring force moves the valve to allow 12345 CL KNOCKDOWN fluid from the 1-2-3-4- 5 reverse clutch housing to exhaust into the 12345R clutch boost valve then into the EX BACKFILL fluid circuit.

Drive Range, Sixth Gear

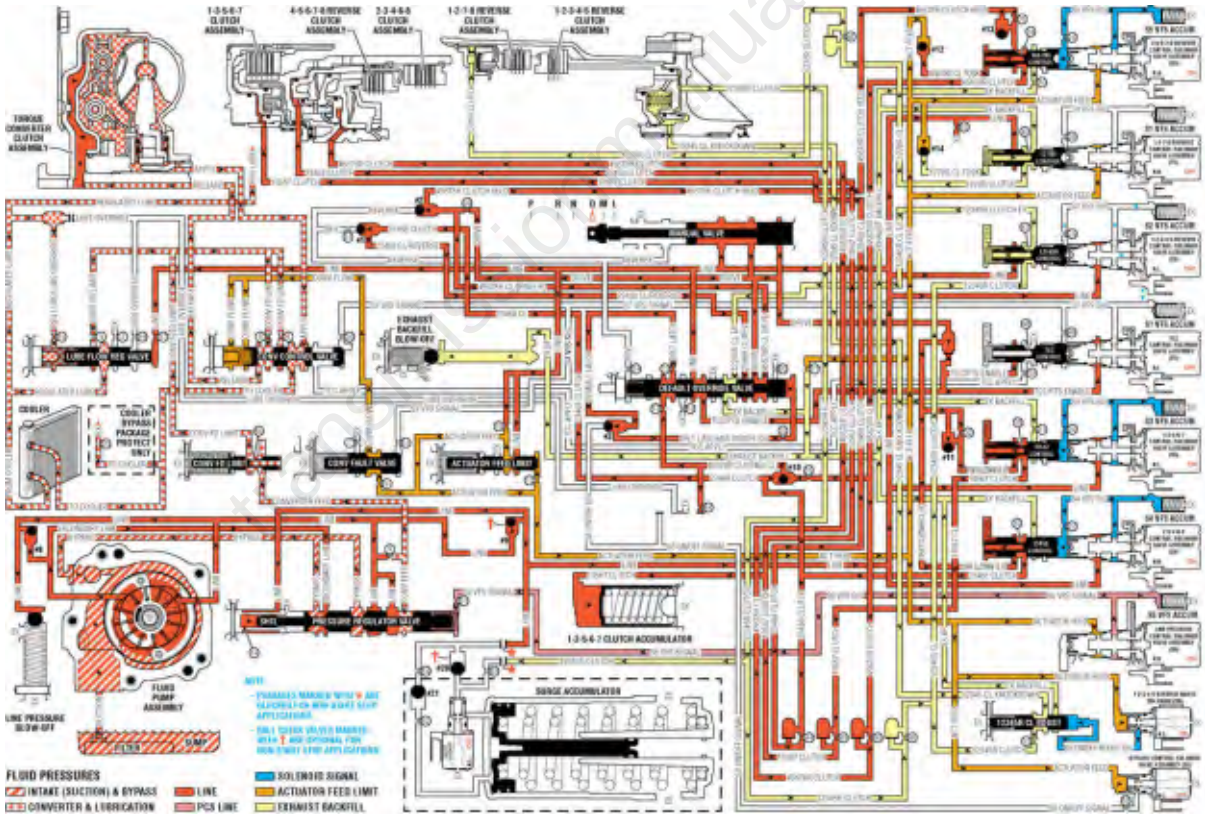


Fig. 9: Identifying Drive Range, Sixth Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SEVENTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-high 1-2-7-8 reverse control solenoid. At the same time the normally-high 2-3-4-6-8 control solenoid is commanded OFF.

1 - 2 - 7 - 8 Reverse Clutch Applies

1 - 2 - 7 - 8 Reverse Control Solenoid Valve Assembly

The 1-2-7-8 reverse control solenoid is energized (HIGH) allowing actuator feed fluid to enter the S1 VFS SIG fluid circuit which applies fluid pressure against the S1 VFS ACCUM spring force and against the 1278R control valve spring force. This allows line fluid to pass through into the 1278R CLUTCH fluid circuit.

1 - 2 - 7 - 8 Reverse Clutch Assembly

1278R CLU fluid is routed to the 1278 reverse clutch piston to hold the piston against spring force which holds the 1278R clutch plates.

#14 Ball Check Valve

Line fluid travels through the 1278R control valve orifice #40 into the 1278R CLU FDBK fluid circuit and into the #14 ball check valve unseating the ball allowing fluid into the ACT FEED circuit.

2 - 3 - 4 - 6 - 8 Clutch Releases

2 - 3 - 4 - 6 - 8 Control Solenoid

The 2-3-4-6-8 control solenoid is signaled off allowing S4 VFS SIG fluid to exhaust. Spring pressure shifts the valve to allow 23468 CLUTCH fluid to exhaust into EX BACKFILL from the 2-3-4-6-8 clutch assembly housing.

2 - 3 - 4 - 6 - 8 Clutch Assembly

The 2-3-4-6-8 clutch is released allowing 23468 CLUTCH fluid to exhaust thru the 2-3-4-6-8 control solenoid.

Drive Range, Seventh Gear

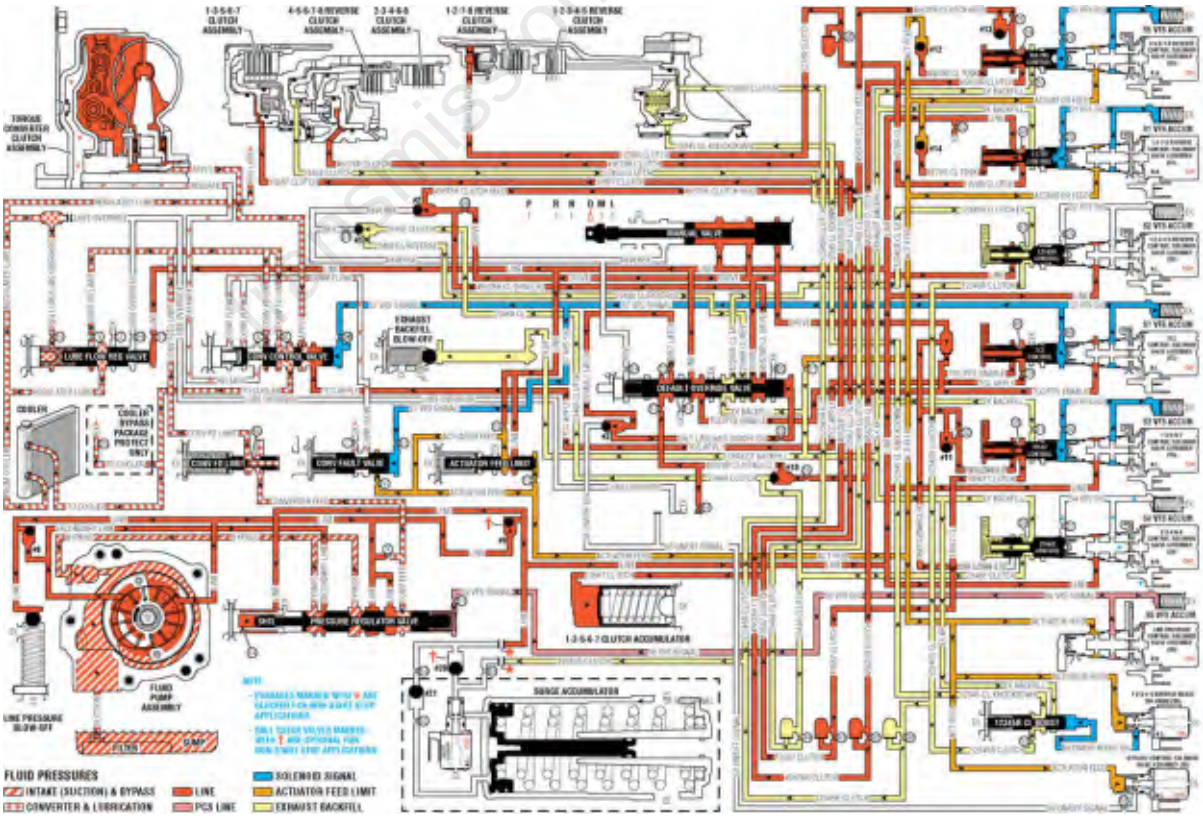


Fig. 10: Identifying Drive Range, Seventh Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, EIGHTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-high 2-3-4-6-8 control solenoid. At the same time the normally-low 1-3-5-6-7 control solenoid is commanded OFF.

2 - 3 - 4 - 6 - 8 Clutch Applies

2 - 3 - 4 - 6 - 8 Control Solenoid

The 2-3-4-6-8 control solenoid energizes allowing line fluid to enter the S4 VFS SIG fluid circuit which applies pressure against the S4 vfs accum spring force and against the 23468 control valve spring force. This allows 13567 CL/23468 CL FD fluid to enter the 23468 CLU fluid circuit. 13567 CL/23468 CL FD fluid also passes thru the 23468 control valve orifice #39 into FDBK. 23468 CLUTCH fluid is directed to the #10 ball check valve and thru orifice #44 to the 23468 clutch assembly housing.

2 - 3 - 4 - 6 - 8 Clutch Assembly

The 23468 CLU fluid passes thru orifice #44 continuing to the 2-3-4-6-8 clutch assembly housing. 23468 CLUTCH fluid applies pressure against the 23468 clutch piston which applies holding pressure to the 2-3-4-6-8 clutch plates.

1 - 3 - 5 - 6 - 7 Clutch Releases

1 - 3 - 5 - 6 - 7 Control Solenoid

The 1-3-5-6-7 control solenoid is signaled off allowing S3 VFS SIG fluid to exhaust. Spring pressure shifts the valve to allow 13567 CLUTCH fluid to exhaust into EX BACKFILL from the 1-3-5-6-7 clutch accumulator and the 1-3-5-6-7 clutch assembly housing.

1 - 3 - 5 - 6 - 7 Clutch Assembly

The 1-3-5-6-7 clutch is released allowing 13567 CLUTCH fluid to exhaust thru the 1-3-5-6-7 control solenoid.

1 - 3 - 5 - 6 - 7 Clutch Accumulator

The 1-3-5-6-7 clutch accumulator is released allowing 13567 CLUTCH fluid to exhaust thru the 1-3-5-6-7 control solenoid.

Drive Range, Eighth Gear

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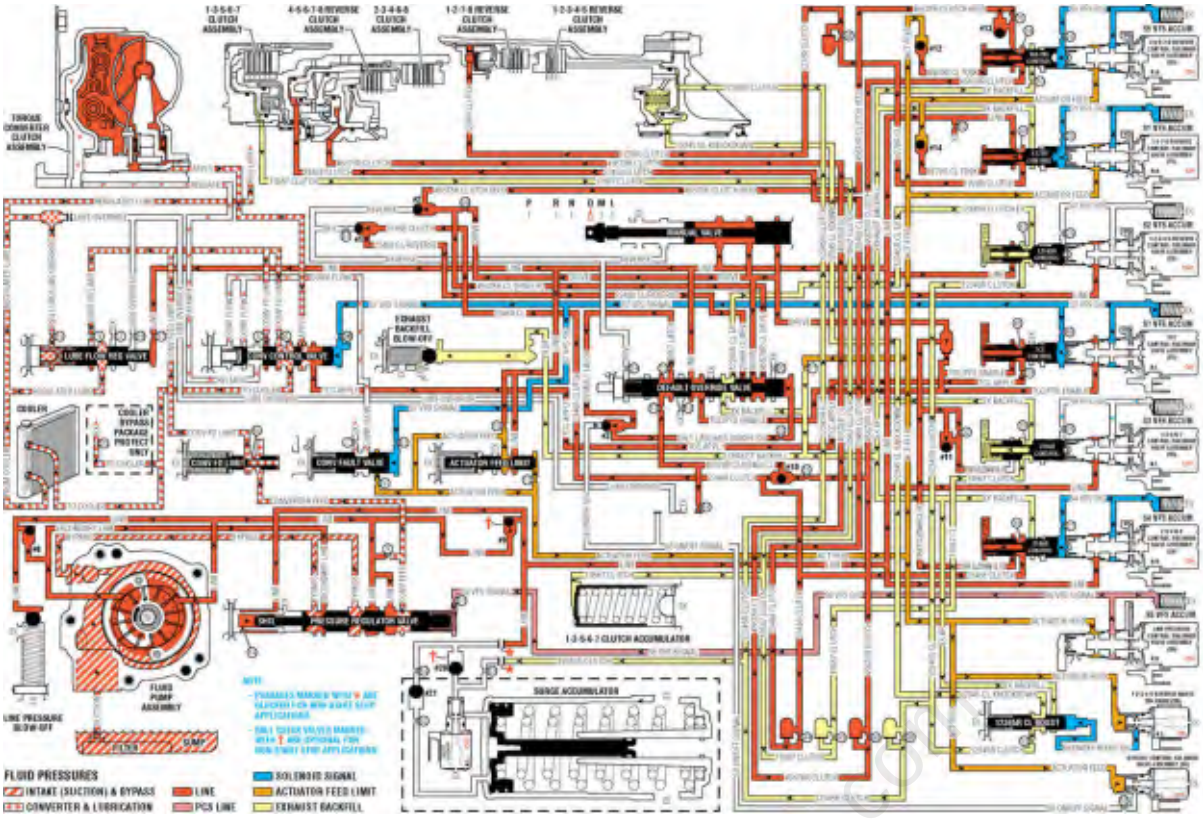


Fig. 11: Identifying Drive Range, Eighth Gear Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

FLUID PASSAGES

Stator Shaft Support - Front Cover Side

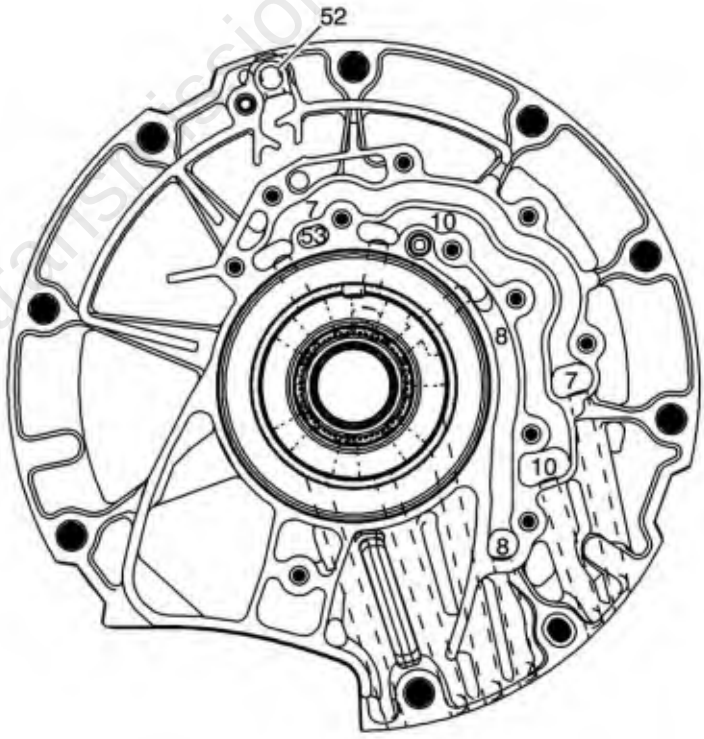


Fig. 12: Identifying Stator Shaft Support Fluid Passages - Front Cover Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
7	Release

Callout	Component Name
8	Apply
10	From Cooler
52	Vent
53	Void

Stator Shaft Support - Case Assembly Side

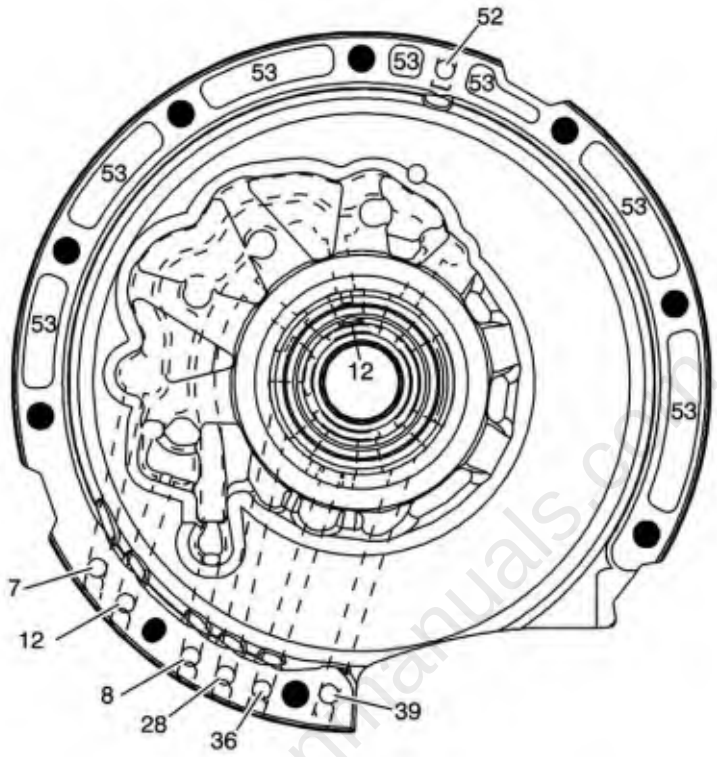


Fig. 13: Identifying Stator Shaft Support Fluid Passages - Case Assembly Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
7	Release
8	Apply
12	Regulated Lube
28	45678R Clutch
36	13567 Clutch
39	23468 Clutch
52	Vent
53	Void

Case Assembly - Stator Shaft Support Side

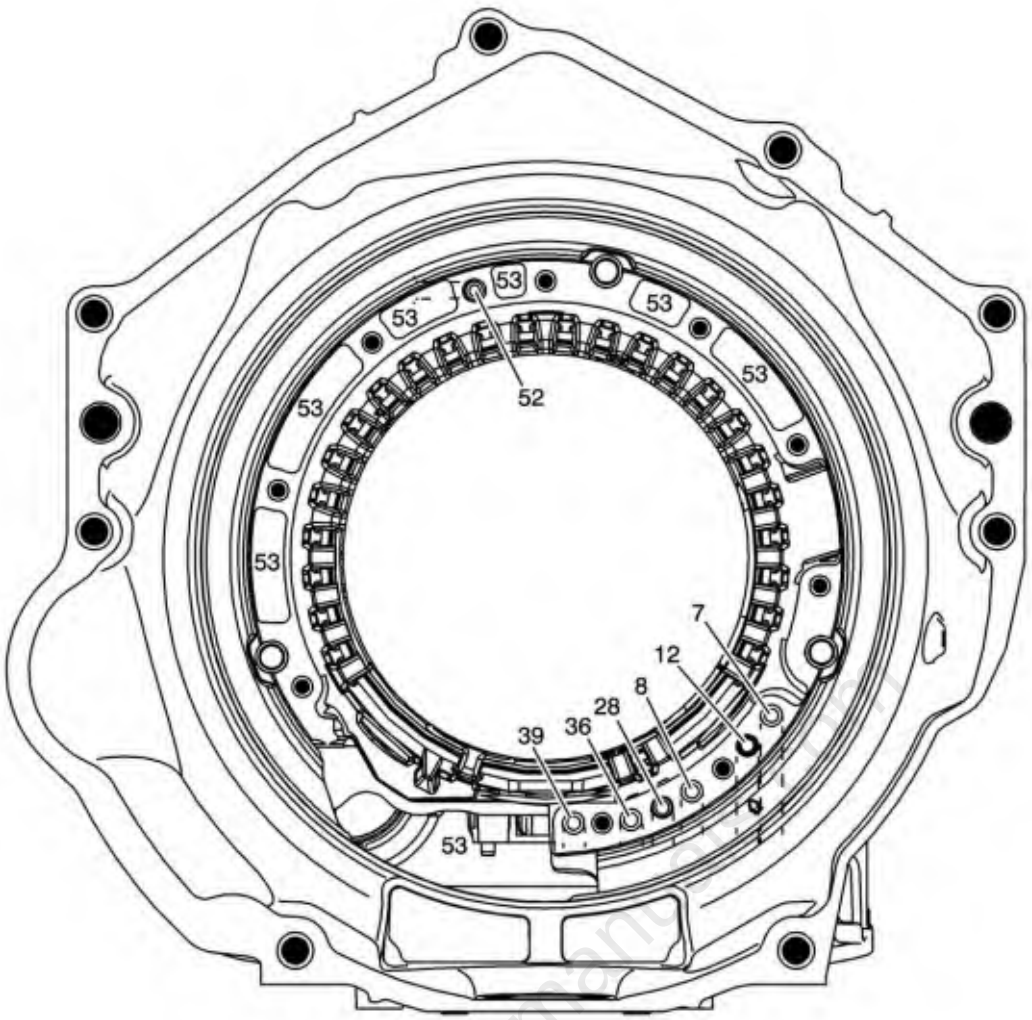


Fig. 14: Identifying Case Assembly Fluid Passages - Stator Shaft Support Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
7	Release
8	Apply
12	Regulated Lube
28	45678R Clutch
36	13567 Clutch
39	23468 Clutch
52	Vent
53	Void

Case Assembly - Case Extension Side

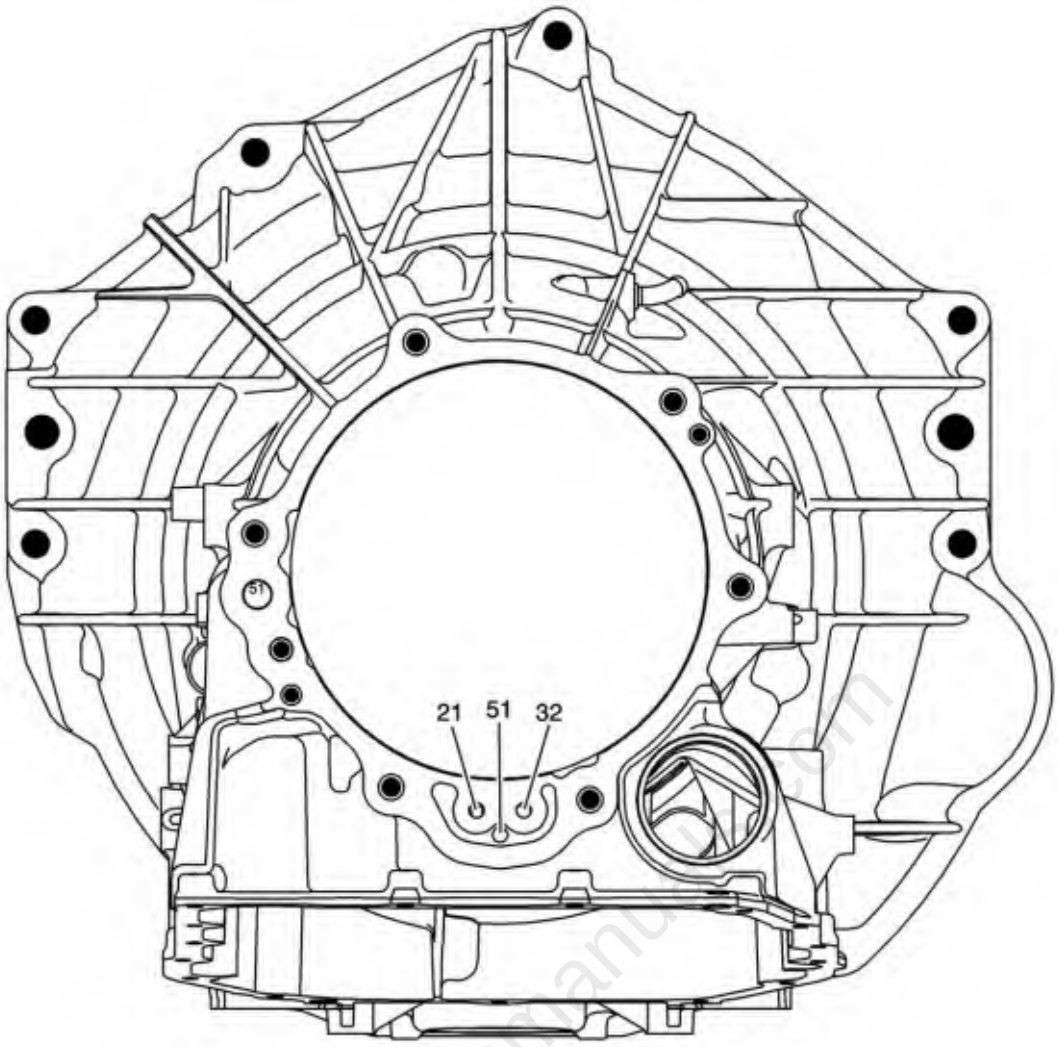


Fig. 15: Identifying Case Assembly Fluid Passages - Case Extension Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
21	12345R Clutch
32	12345 Clutch Knockdown
51	Void

Case Extension Seal - Case Assembly Side



Fig. 16: Identifying Case Extension Seal Fluid Passages - Case Assembly Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
21	12345R Clutch
32	12345 Clutch Knockdown

Case Extension - Case Assembly Side

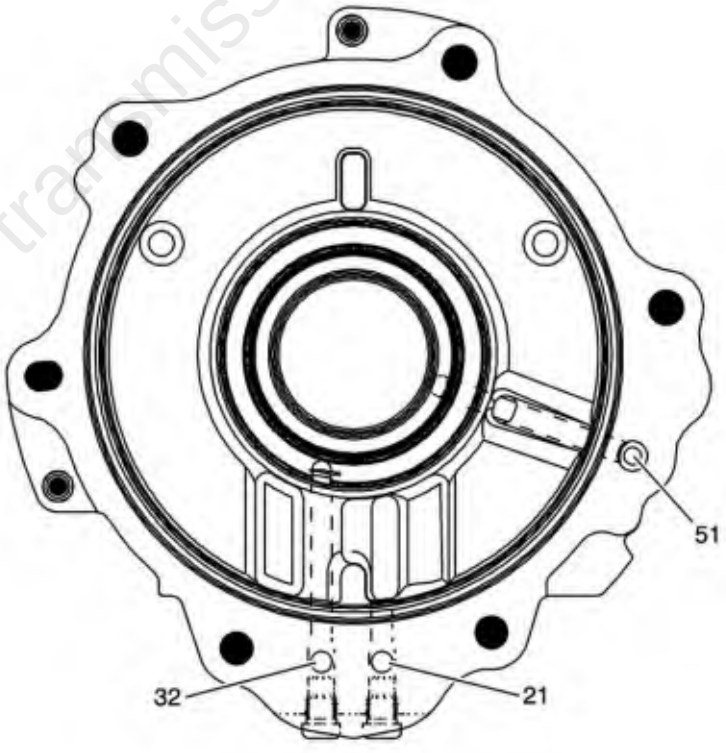


Fig. 17: Identifying Case Extension Fluid Passages - Case Assembly Side
Courtesy of GENERAL MOTORS COMPANY

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Callout	Component Name
21	12345R Clutch
32	12345 Clutch Knockdown
51	Void

Control Valve Upper Body Assembly - Fluid Pump Side

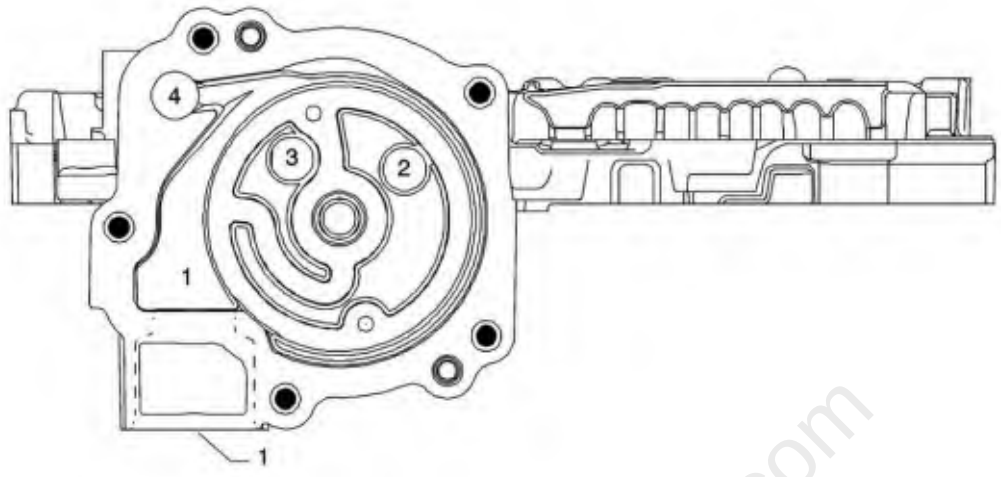


Fig. 18: Identifying Control Valve Upper Body Assembly Fluid Passages - Fluid Pump Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Trans Case Locator Pin
1	Suction
2	Line
3	Secondary Line
4	Bypass

Case Assembly - Control Valve Upper Body Assembly Side

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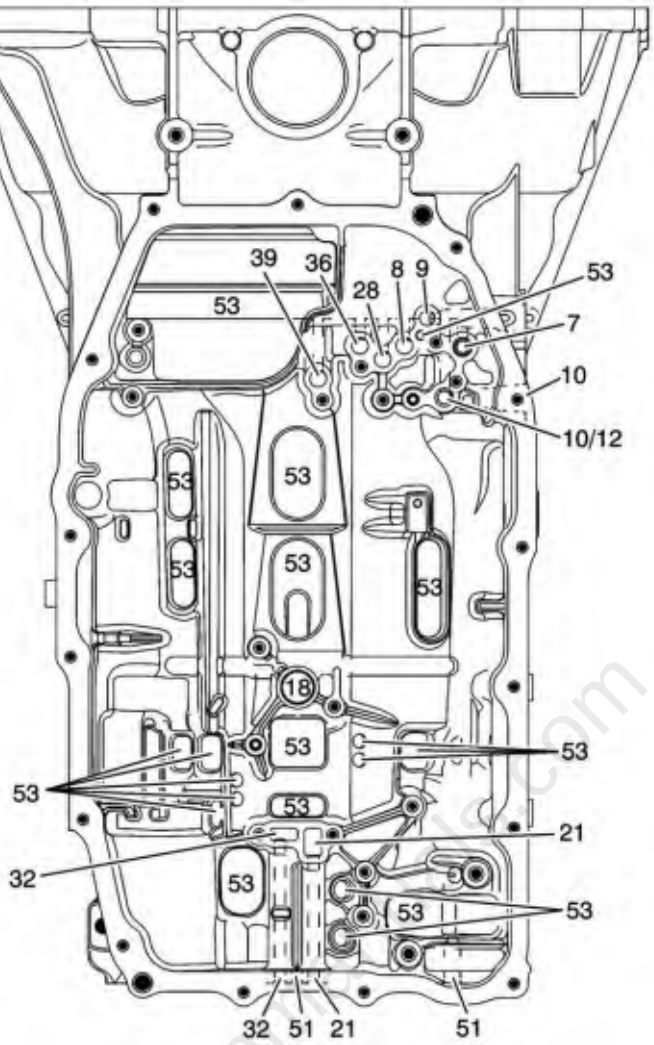


Fig. 19: Identifying Case Assembly Fluid Passages - Control Valve Upper Body Assembly Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
7	Release
8	Apply
9	To Cooler
10	From Cooler
12	Regulated Lube
18	1278R Clutch
21	12345R Clutch
28	45678R Clutch
32	12345 Clutch Knockdown
36	13567 Clutch
39	23468 Clutch
51	Void
53	Void

Control Valve Upper Body Assembly - Case Assembly Side

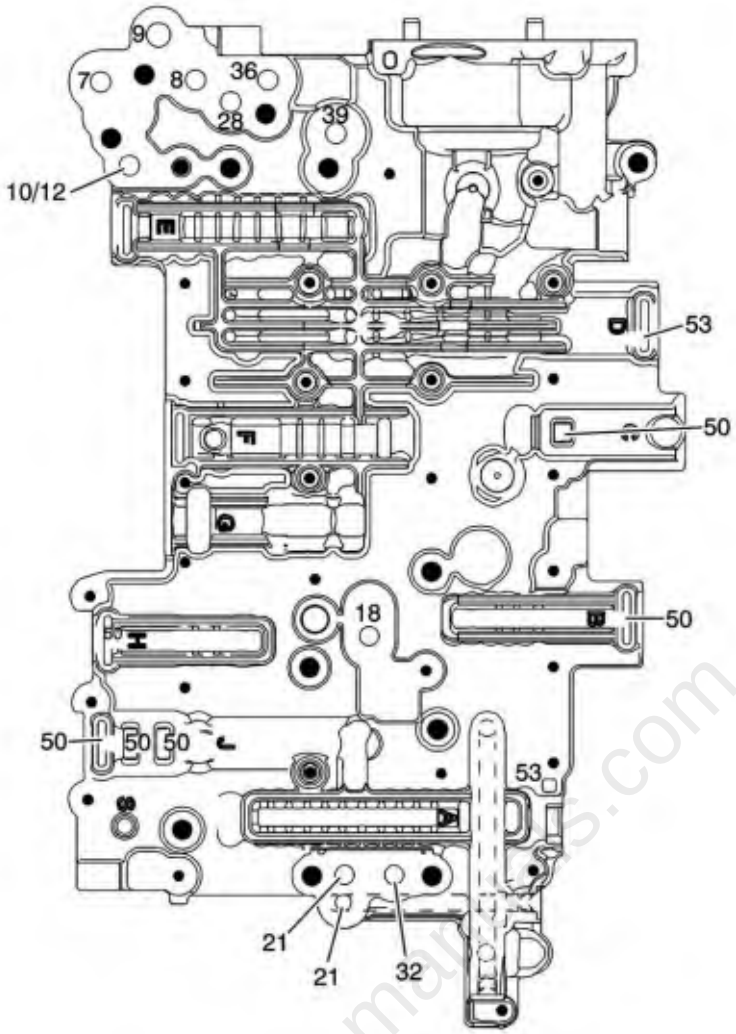


Fig. 20: Identifying Control Valve Upper Body Assembly Fluid Passages - Case Assembly Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
7	Release
8	Apply
9	To Cooler
10	From Cooler
12	Regulated Lube
18	1278R Clutch
21	12345R Clutch
28	45678R Clutch
32	12345 Clutch Knockdown
36	13567 Clutch
39	23468 Clutch
50	Exhaust
53	Void

Control Valve Upper Body Assembly - Control Valve Solenoid Body Side

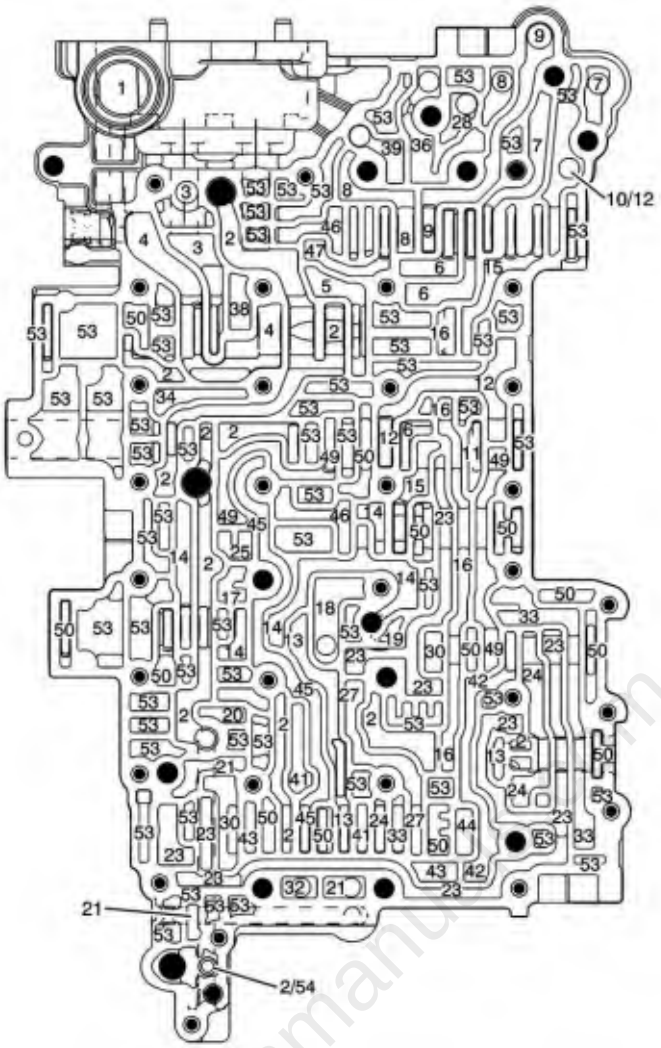


Fig. 21: Identifying Control Valve Upper Body Assembly Fluid Passages - Control Valve Solenoid Body Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction
2	Line
3	Secondary Line
4	Bypass
5	Converter Feed
6	Converter Feed Limit
7	Release
8	Apply
9	To Cooler
10	From Cooler
11	From Cooler/Lube Override
12	Regulated Lube
13	Exhaust Backfill
14	Actuator Feed
15	Converter Flow
16	S6 VFS Signal (PCS Line)
17	S1 VFS Signal
18	1278R Clutch
19	1278R Clutch Feedback

Callout	Component Name
20	S2 VFS Signal
21	12345R Clutch
23	Reverse
24	23468 Clutch/Reverse
25	S5 VFS Signal
27	45678R Clutch Drive Feed
28	45678R Clutch
30	45678R Clutch/23468 Clutch
32	12345 Clutch Knockdown
33	Drive
34	S3 VFS Signal
36	13567 Clutch
38	S4 VFS Signal
39	23468 Clutch
41	12345R Clutch Exhaust
42	S8 ON/OFF Signal
43	Default Latch
44	Default Latch/S9 ON/OFF Signal
45	TCC PTS Enable
46	S7 VFS Signal
47	TCC Apply
49	Lube Override
50	Exhaust
53	Void
54	Auxiliary Fluid signal

Control Valve Body Spacer Plate Assembly - Control Valve Upper Body Side

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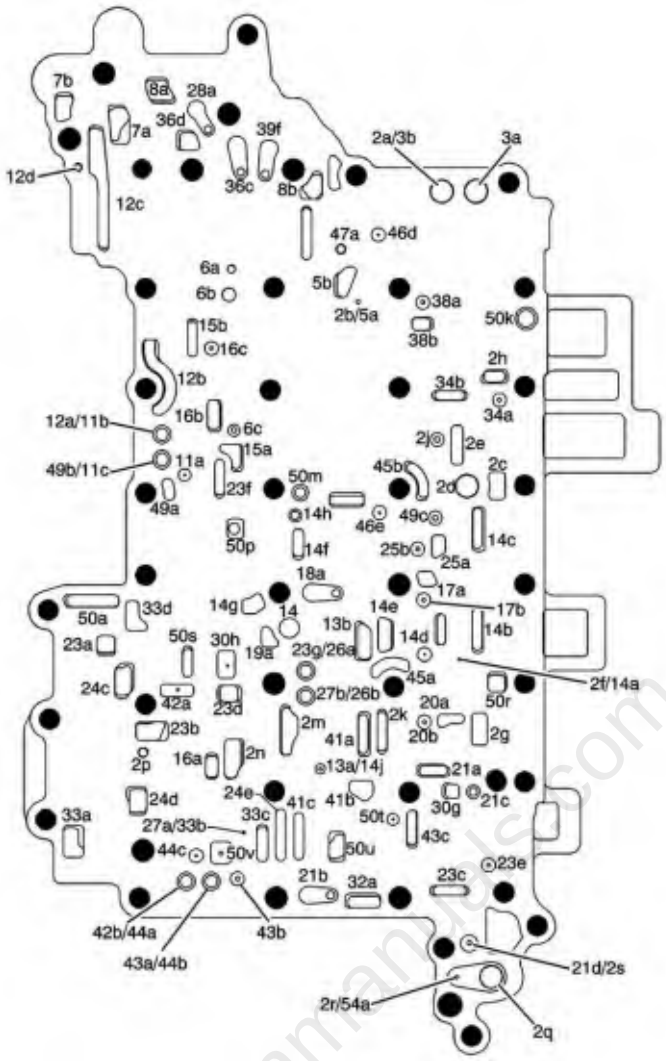


Fig. 22: Identifying Control Valve Body Spacer Plate Assembly Fluid Passages - Control Valve Upper Body Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2a	Line
2b	Line
2c	Line
2d	Line
2e	Line
2f	Line
2g	Line
2h	Line
2j	Line
2k	Line
2m	Line
2n	Line
2p	Line
2q	Line
2r	Line
2s	Line
3a	Secondary Line
3b	Secondary Line
5a	Converter Feed

Callout	Component Name
5b	Converter Feed
6a	Converter Feed Limit
6b	Converter Feed Limit
6c	Converter Feed Limit
7a	Release
7b	Release
8a	Apply
8b	Apply
11a	From Cooler/Lube Override
11b	From Cooler/Lube Override
11c	From Cooler/Lube Override
12a	Regulated Lube
12b	Regulated Lube
12c	Regulated Lube
12d	Regulated Lube
13a	Exhaust Backfill
13b	Exhaust Backfill
14	Actuator Feed
14a	Actuator Feed
14b	Actuator Feed
14c	Actuator Feed
14d	Actuator Feed
14e	Actuator Feed
14f	Actuator Feed
14g	Actuator Feed
14h	Actuator Feed
14j	Actuator Feed
15a	Converter Flow
15b	Converter Flow
16a	S6 VFS Signal (PCS Line)
16b	S6 VFS Signal (PCS Line)
16c	S6 VFS Signal (PCS Line)
17a	S1 VFS Signal
17b	S1 VFS Signal
18a	1278R Clutch
19a	1278R Clutch Feedback
20a	S2 VFS Signal
20b	S2 VFS Signal
21a	12345R Clutch
21b	12345R Clutch
21c	12345R Clutch
21d	12345R Clutch
23a	Reverse
23b	Reverse
23c	Reverse
23d	Reverse
23e	Reverse
23f	Reverse

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Callout	Component Name
23g	Reverse
24c	23468 Clutch /Reverse
24d	23468 Clutch /Reverse
24e	23468 Clutch /Reverse
25a	S5 VFS Signal
25b	S5 VFS Signal
26a	45678R Clutch Feed
26b	45678R Clutch Feed
27a	45678R Clutch Drive Feed
27b	45678R Clutch Drive Feed
28a	45678R Clutch
30g	45678R Clutch/23468 Clutch
30h	45678R Clutch/23468 Clutch
32a	12345 Clutch Knockdown
33a	Drive
33b	Drive
33c	Drive
33d	Drive
34a	S3 VFS Signal
34b	S3 VFS Signal
36c	13567 Clutch
36d	13567 Clutch
38a	S4 VFS Signal
38b	S4 VFS Signal
39f	23468 Clutch
41a	12345R Clutch Exhaust
41b	12345R Clutch Exhaust
41c	12345R Clutch Exhaust
42a	S8 ON/OFF Signal
42b	S8 ON/OFF Signal
43a	Default Latch
43b	Default Latch
43c	Default Latch
44a	Default Latch/S9 ON/OFF Signal
44b	Default Latch/S9 ON/OFF Signal
44c	Default Latch/S9 ON/OFF Signal
45a	TCC PTS Enable
45b	TCC PTS Enable
46d	S7 VFS Signal
46e	S7 VFS Signal
47a	TCC Apply
49a	Lube Override
49b	Lube Override
49c	Lube Override
50a	Exhaust
50k	Exhaust
50m	Exhaust
50p	Exhaust

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Callout	Component Name
50r	Exhaust
50s	Exhaust
50t	Exhaust
50u	Exhaust
50v	Exhaust
54a	Auxiliary Fluid Signal

Control Valve Solenoid Body - Control Valve Upper Body Side

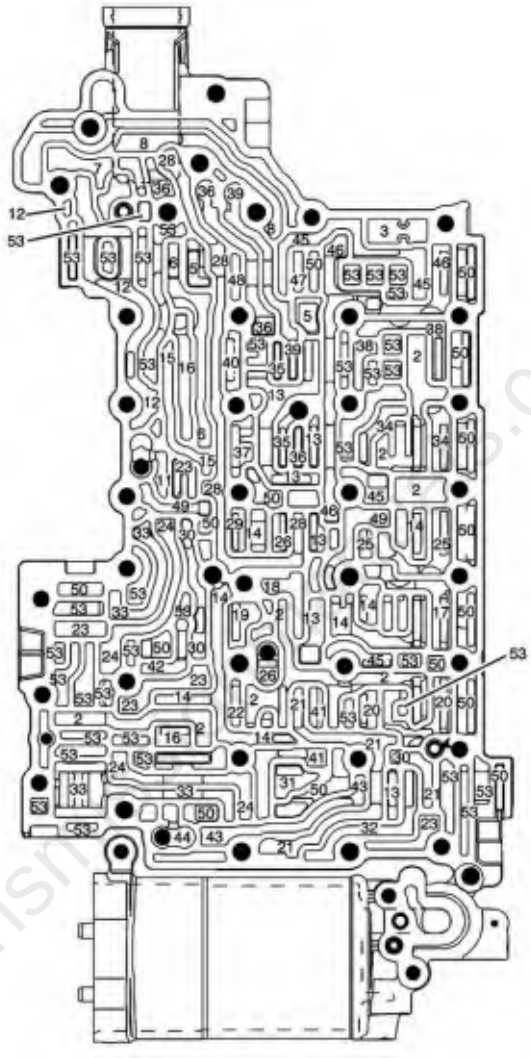


Fig. 23: Identifying Control Valve Solenoid Body Fluid Passages - Control Valve Upper Body Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
3	Secondary Line
5	Converter Feed
6	Converter Feed Limit
7	Release
8	Apply
11	From Cooler/Lube Override
12	Regulated Lube
13	Exhaust Backfill
14	Actuator Feed

Callout	Component Name
15	Converter Flow
16	S6 VFS Signal (PCS Line)
17	S1 VFS Signal
18	1278R Clutch
19	1278R Clutch Feedback
20	S2 VFS Signal
22	12345R Clutch Feedback
21	12345R Clutch
23	Reverse
24	23468 Clutch/Reverse
25	S5 VFS Signal
26	45678R Clutch Feed
27	45678R Clutch Drive Feed
28	45678R Clutch
29	45678R Clutch Feedback
30	45678R Clutch/23468 Clutch
31	S9 ON/OFF Boost Signal
32	12345 Clutch Knockdown
33	Drive
34	S3 VFS Signal
35	13567 Clutch Feed
36	13567 Clutch
37	13567 Clutch Feedback
38	S4 VFS Signal
39	23468 Clutch
40	23468 Clutch Feedback
41	12345R Clutch Exhaust
42	S8 ON/OFF Signal
43	Default Latch
44	Default Latch/S9 ON/OFF Signal
45	TCC PTS Enable
46	S7 VFS Signal
47	TCC Apply
48	TCC Apply Feedback
49	Lube Override
50	Exhaust
53	Void
54	Auxiliary Fluid Signal

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Control Valve Solenoid Body - Control Valve Channel Plate Side

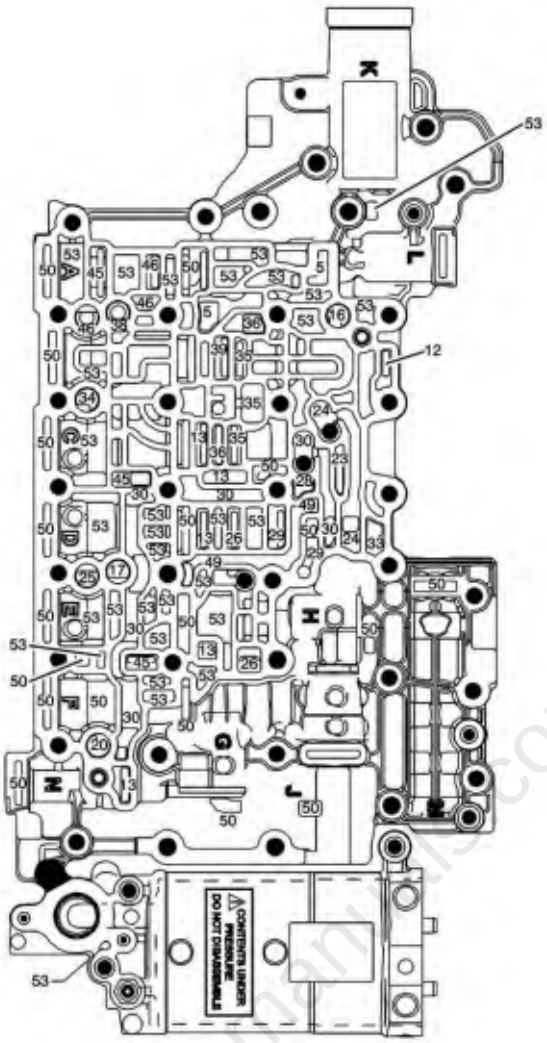


Fig. 24: Identifying Control Valve Solenoid Body Fluid Passages - Control Valve Channel Plate Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
5	Converter Feed
12	Regulated Lube
13	Exhaust Backfill
16	S6 VFS Signal (PCS Line)
17	S1 VFS Signal
20	S2 VFS Signal
23	Reverse
24	23468 Clutch/Reverse
25	S5 VFS Signal
26	45678R Clutch Feed
28	45678R Clutch
29	45678R Clutch Feedback
30	45678R Clutch/23468 Clutch
33	Drive
34	S3 VFS Signal
35	13567 Clutch Feed
36	13567 Clutch
38	S4 VFS Signal
39	23468 Clutch
45	TCC PTS Enable

Callout	Component Name
46	S7 VFS Signal
49	Lube Override
50	Exhaust
53	Void
54	Auxiliary Fluid Signal

Control Valve Channel Plate Spacer Plate Assembly - Control Valve Solenoid Body Side

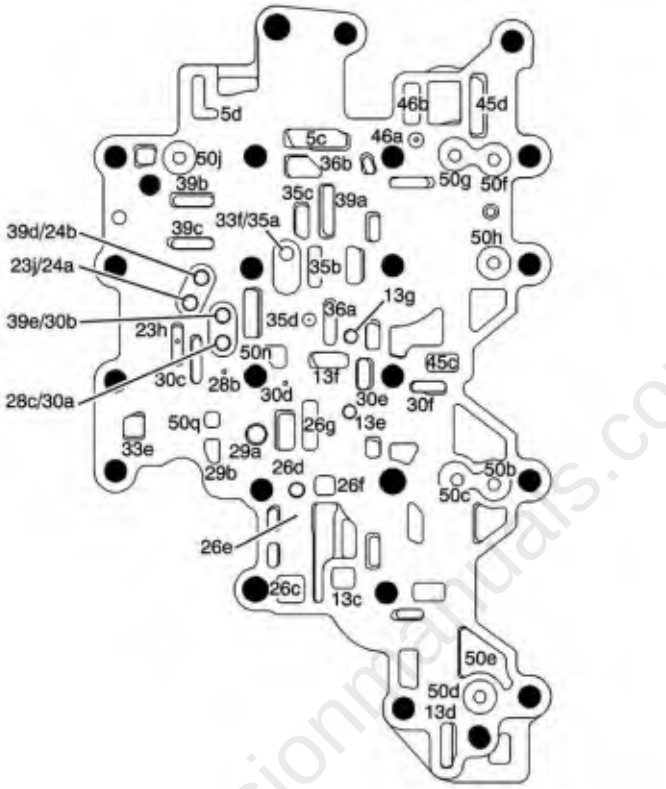


Fig. 25: Identifying Control Valve Channel Plate Spacer Plate Assembly Fluid Passages - Control Valve Solenoid Body Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
5c	Converter Feed
5d	Converter Feed
13c	Exhaust Backfill
13d	Exhaust Backfill
13e	Exhaust Backfill
13f	Exhaust Backfill
13g	Exhaust Backfill
23h	Reverse
23j	Reverse
24a	23468 Clutch/Reverse
24b	23468 Clutch/Reverse
26c	45678R Clutch Feed
26d	45678R Clutch Feed
26e	45678R Clutch Feed
26f	45678R Clutch Feed
26g	45678R Clutch Feed
28b	45678R Clutch

Callout	Component Name
28c	45678R Clutch
29a	45678R Clutch Feedback
29b	45678R Clutch Feedback
30a	45678R Clutch/23468 Clutch
30b	45678R Clutch/23468 Clutch
30c	45678R Clutch/23468 Clutch
30d	45678R Clutch/23468 Clutch
30e	45678R Clutch/23468 Clutch
30f	45678R Clutch/23468 Clutch
33e	Drive
33f	Drive
35b	13567 Clutch Feed
35c	13567 Clutch Feed
35d	13567 Clutch Feed
36a	13567 Clutch
36b	13567 Clutch
39a	23468 Clutch
39b	23468 Clutch
39c	23468 Clutch
39d	23468 Clutch
39e	23468 Clutch
45c	TCC PTS Enable
45d	TCC PTS Enable
46a	S7 VFS Signal
46b	S7 VFS Signal
50b	Exhaust
50c	Exhaust
50d	Exhaust
50e	Exhaust
50f	Exhaust
50g	Exhaust
50h	Exhaust
50j	Exhaust
50n	Exhaust
50q	Exhaust

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Control Valve Channel Plate - Control Valve Solenoid Body Side

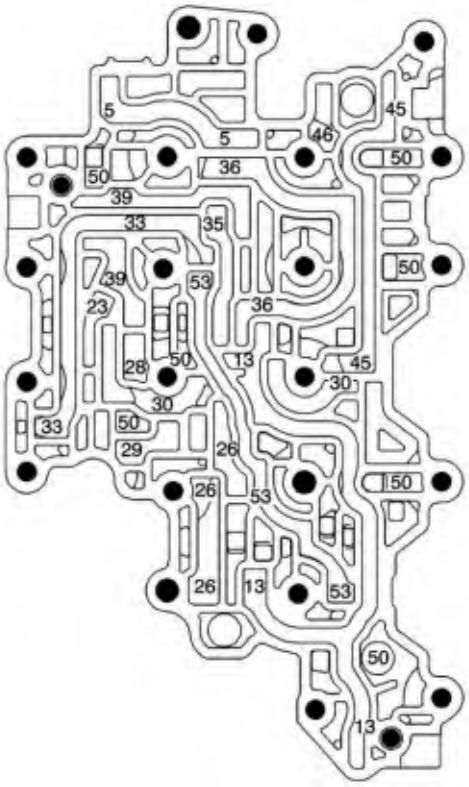


Fig. 26: Identifying Control Valve Channel Plate Fluid Passages - Control Valve Solenoid Body Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
5	Converter Feed
13	Exhaust Backfill
23	Reverse
26	45678R Clutch Feed
28	45678R Clutch
29	45678R Clutch Feedback
30	45678R Clutch/23468 Clutch
33	Drive
35	13567 Clutch Feed
36	13567 Clutch
39	23468 Clutch
45	TCC PTS Enable
46	S7 VFS Signal
50	Exhaust
53	Void

Control Valve Channel Plate - Fluid Pan Side

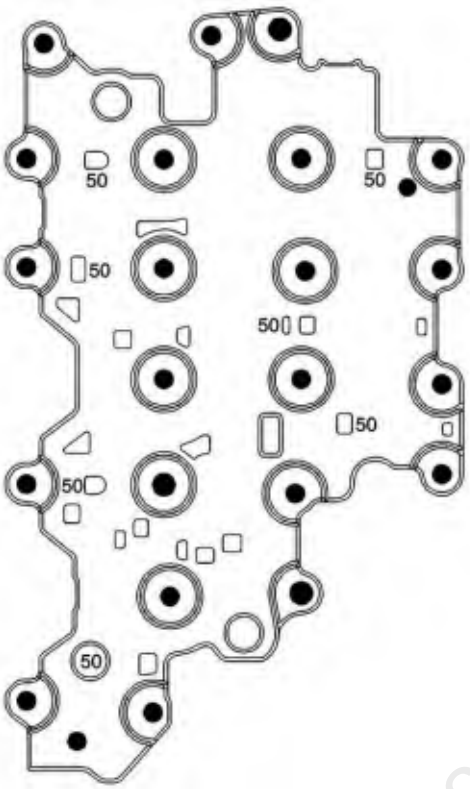


Fig. 27: Identifying Control Valve Channel Plate Fluid Passages - Fluid Pan Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
50	Exhaust

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