

2018 TRANSMISSION

Automatic Transmission - 9T45 (M3U) Or 9T50 (M3D M3H) - Description And Operation - Equinox & Terrain

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 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.

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

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. Refer to the vehicle owner's manual for specific DSC operating instructions.

Transmission Abbreviations

A/C

Air Conditioning

AC

Alternating Current

AT

Automatic Transmission

CC

Climate Control

DC

Direct Current

DIC

Driver Information Center

DLC

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

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

Vehicle Speed Sensor

WOT

Wide Open Throttle

TRANSMISSION IDENTIFICATION INFORMATION

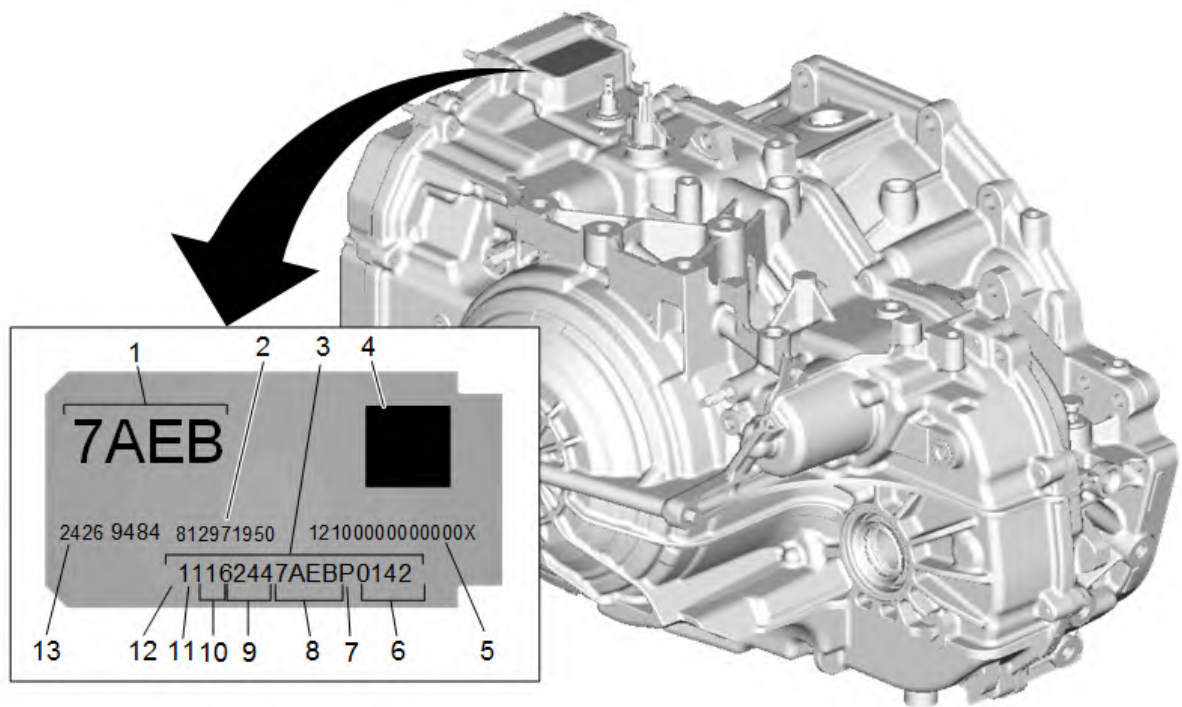


Fig. 1: Identifying Transmission Identification Label
Courtesy of GENERAL MOTORS COMPANY

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

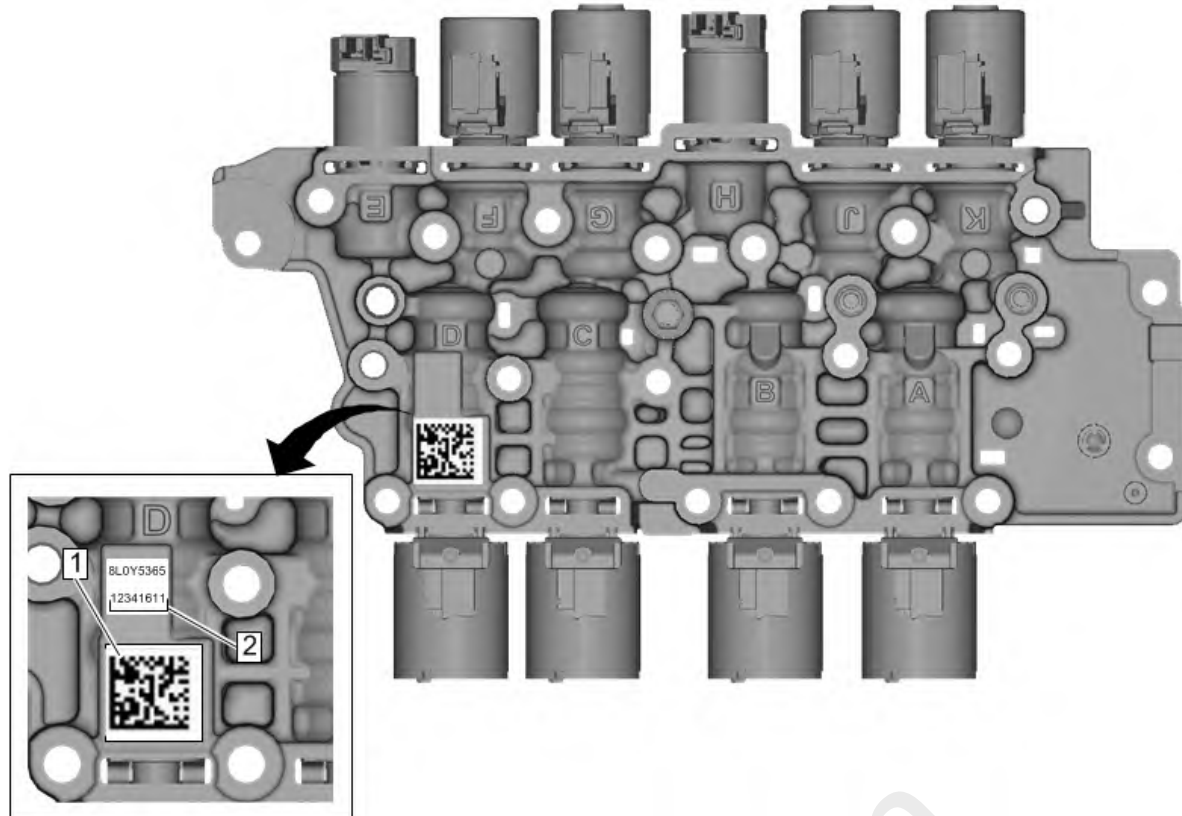


Fig. 2: Identifying Control Valve Solenoid Body Identification Label
Courtesy of GENERAL MOTORS COMPANY

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

TRANSMISSION GENERAL DESCRIPTION

The Hydra-matic 9T50 is a fully automatic, 9-speed, transverse mounted, electronic-controlled transmission. It consists primarily of a 4-element torque converter, a compound planetary gear set, friction and mechanical clutch assemblies, and a hydraulic pressurization and control system.

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 9 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 TCM commands shift solenoids and variable bleed pressure control solenoids to control shift timing and feel. The TCM also controls the apply and release of the torque converter clutch which allows the engine to deliver the maximum fuel efficiency without sacrificing vehicle performance. All the solenoids, are packaged into a self-contained control valve solenoid body assembly.

The hydraulic system primarily consists of a chain driven pump, a control valve body assembly and case. 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 7 multiple disc clutches. The multiple disc clutches combine with one away clutch to deliver 10 different gear ratios, 9 forward and one reverse, through the gear sets. The gear sets then transfer torque through the transfer drive gear, transfer driven gear and differential assembly.

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

PARK (P)

This position locks the front 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)

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 9 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.

Driver Shift Control (DSC) or Electronic Range Selection (ERS)

This position (M - Manual/L - Low) allows the driver to utilize the DSC/ERS system. When the shift selector lever is moved to this position, the driver may select upshifts or downshifts by using the paddle switches located on the steering wheel/shifter. An upshift is requested by pushing either + button. Refer to the vehicle owner's manual for more specific DSC/ERS information.

TRANSMISSION COMPONENT AND SYSTEM DESCRIPTION

The mechanical components of the 9T50 are as follows:

- Torque Converter Assembly
- Automatic Transmission Fluid Pump
- 1-2-3-4-5-6 Clutch
- 2-9 Clutch
- 3-8 Clutch
- 4th Clutch
- 5-7-Reverse Clutch
- 6-7-8-9 Clutch
- Control Valve Solenoid Body Assembly
- Control Valve Body Assembly
- Drive Sprocket, Driven Sprocket And Link Assembly
- Front Differential Carrier
- Overdrive and Reaction with Input Internal Gear Carrier
- Reaction Sun Gear Assembly
- Output Carrier Assembly

The electrical components of the 9T50 are as follows:

- Automatic Transmission Output Speed Sensor
- Automatic Transmission Input Speed Sensor
- Manual Shift Detent Lever with Shaft Position Switch
- Control Valve Solenoid Body Assembly
 - 2 pressure control (PC) solenoids

- 4 linear force (LF) solenoids
- 4 variable force (VF) solenoids

For more information refer to: [Electronic Component Description](#).

MANUAL MODE DESCRIPTION AND OPERATION

Manual Mode Shifting Operation

Electronic Range Select (ERS) Mode

ERS or manual mode allows you to choose the top-gear limit of the transmission and the vehicle's speed while driving downhill or towing a trailer. The vehicle has an electronic shift position indicator within the instrument cluster. When using the ERS mode a number will display next to the L, indicating the current gear that has been selected.

To use this feature:

1. Transmission Range - L.
2. Press the Plus (+) or Minus (-) to increase or decrease the gear range available.

When you shift from Drive (D) to Low (L), the transmission will shift to a pre-determined lower gear range. The highest gear range available for this pre-determined range is displayed next to L in Driver Information Center (DIC). The number displayed in the DIC is the highest gear that the transmission will be allowed to operate in. This means that all gears below that number are available. For example when fourth (4) is shown next to the L, first (1) through 4 gears are automatically shifted by the vehicle. The transmission will not shift into fifth (5) until the plus (+) is used or you shift back into Drive (D).

While in Low (L), the transmission will prevent shifting to a lower gear range if the engine speed is too high. You have a brief period of time to slow the vehicle. If vehicle speed is not reduced within the time allowed, the lower gear range shift will not be completed. You must further slow the vehicle, then press the minus (-) button to the desired lower gear range.

In manual mode, the K71 Transmission Control Module will always have final authority of when to allow an upshift or downshift. The upshift or downshift into the appropriate gear is 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 upshift to a higher if it would result in too low of engine RPM.

TRANSMISSION ADAPTIVE FUNCTIONS

The 9 Speed FWD 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 input speed sensor (ISS), intermediate speed sensor and the 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).

SERVICE TRANSMISSION

This message displays if there is a problem with the transmission.

SHIFT DENIED

This message displays when attempting to use the automatic transmission manual mode to shift to too low or too high of a gear.

SHIFT TO PARK

This message displays when the transmission needs to be shifted to P (Park). This may appear when turning the ignition off or removing the key from the vehicle if the vehicle is not in P (Park).

TRANSMISSION HOT - IDLE ENGINE

This message displays and a chime sounds if the transmission fluid in the vehicle gets hot. Driving with the transmission fluid temperature high can cause damage to the vehicle. Stop the vehicle and let it idle to allow the transmission to cool. This message clears when the fluid temperature reaches a safe level.

ELECTRONIC COMPONENT DESCRIPTION

Common Electronic Component Description

Transmission Control Module

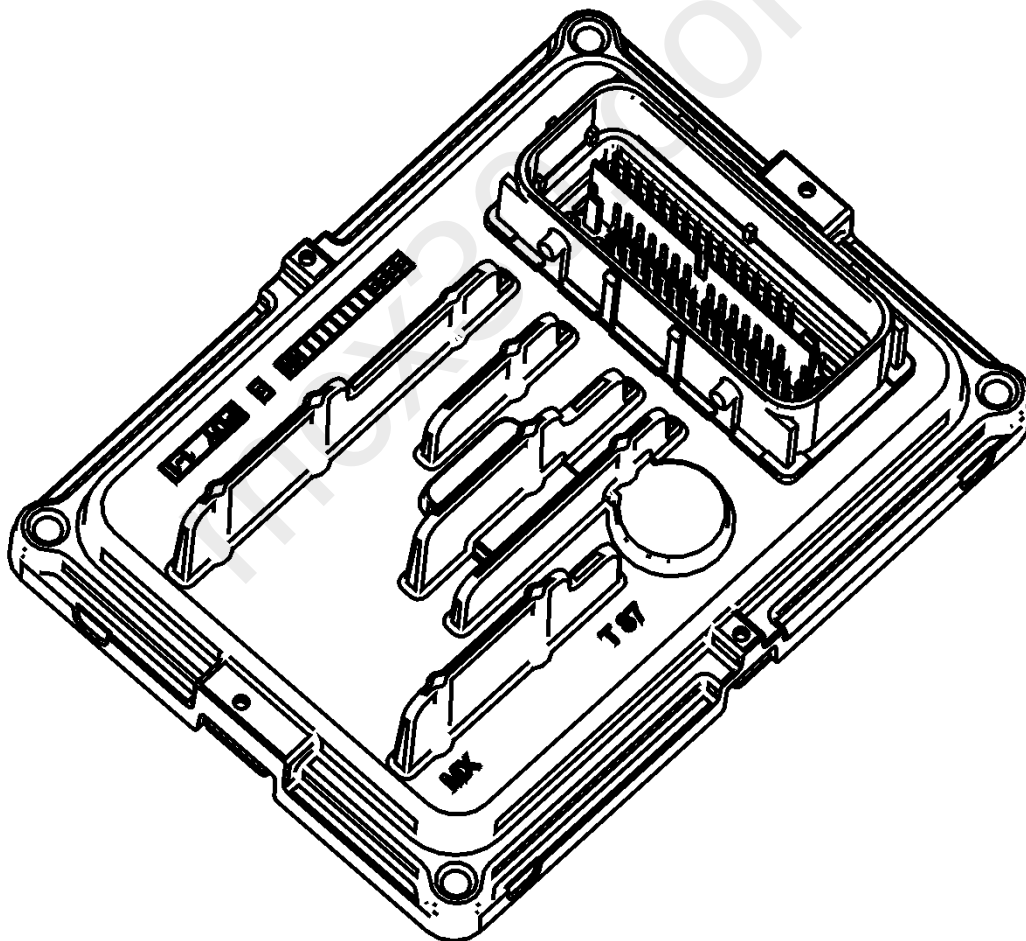


Fig. 3: Transmission Control Module

Courtesy of GENERAL MOTORS COMPANY

The Transmission Control Module (TCM) for this transmission is a stand alone controller mounted in a bracket to the side cover of the transmission assembly. The TCM has one 66 way connector to interface with vehicle electrical system, transmission assembly and other vehicle control modules. The TCM receives and sends various input and output signals from a number of switches and sensors within the

transmission and throughout the vehicle. In addition, the TCM is part of a network of other control modules on the vehicle. This network of control modules will share information with each other, over a common serial data communications line. Based upon the TCM software/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. The TCM will command a 2-3 shift when the accelerator pedal position is below a certain calibrated value. When the pedal position is above this calibrated value, the TCM will command 2-4 shift.

Transmission Control Solenoid Valves

The 9 speed transmission could contain a maximum of twelve individual solenoids - RPO dependent - installed in various bore locations on the lower control valve body assembly and transmission case. Eight of the twelve solenoid valves are used to control pressure regulation and direction of transmission fluid. The four ON/OFF solenoid valves are only used to direct transmission fluid.

The normal operating current range for these solenoid valves is between 0 - 1.2 amps. If the TCM detects an electrical circuit malfunction or excessive current flow, the TCM will turn OFF the high side driver to that solenoid and set a DTC. The high side driver will reset when the circuit fault is corrected and the ignition switch is cycled.

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

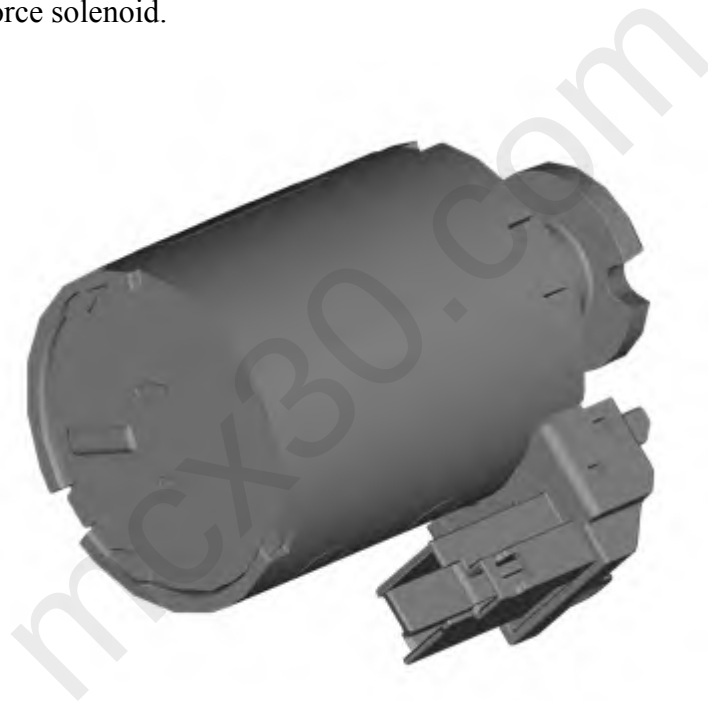


Fig. 4: Normally Low - Linear Solenoid

Courtesy of GENERAL MOTORS COMPANY

Normally Low - Linear Solenoids

- A normally low linear solenoid actuator is an electro-mechanical device that converts electrical power into a mechanic pushing or pulling force or motion.
- When energized, the solenoid armature applies force to the face of a pressure regulating spool valve.
- The solenoid actuator applies minimum force with minimum current applied to the solenoid coil.
- The solenoid actuator applies maximum force with maximum current applied to the solenoid coil.
- Transmission control solenoid valves 2 and 5 are normally low.

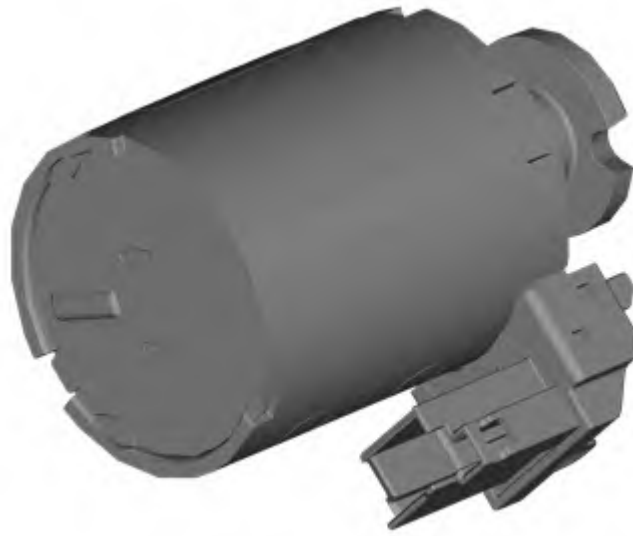


Fig. 5: Normally Low - Linear Solenoid
Courtesy of GENERAL MOTORS COMPANY

Normally High - Linear Solenoids

- A normally high linear solenoid actuator is an electro-mechanical device that converts electrical power into a mechanic pushing or pulling force or motion.
- When energized, the solenoid armature applies force to the face of a pressure regulating spool valve.
- The solenoid actuator applies maximum force with minimum current applied to the solenoid coil.
- The solenoid actuator applies minimum force with maximum current applied to the solenoid coil.
- Transmission control solenoid valves 1 and 6 are normally high.

Normally Low - Variable Force Solenoid

A normally low variable force solenoid is an electro-mechanically operated valve. The valve is controlled by an electric current through the solenoid coil.

- The solenoid valve varies the control pressure depending on the current applied to the solenoid coil.
- The solenoid valve control pressure is low with no or minimum current applied to the solenoid coil.
- The solenoid valve control pressure increases with increasing current applied to the solenoid coil.
- Transmission control solenoid valves 3, 4, and 8 are of the normally low design.



Fig. 6: Normally High - Variable Force Solenoid
Courtesy of GENERAL MOTORS COMPANY

Normally High - Variable Force Solenoid

- A normally high variable force solenoid is an electro-mechanically operated valve. The valve is controlled by an electric current through the solenoid coil.
- The solenoid valve varies the control pressure depending on the current applied to the solenoid coil.
- The solenoid valve control pressure is high with no or minimum current applied to the solenoid coil.
- The solenoid valve control pressure decreases with increasing current applied to solenoid coil.
- Transmission control solenoid valve 7 is a normally high solenoid.



Fig. 7: ON/OFF Solenoid
Courtesy of GENERAL MOTORS COMPANY

ON/OFF Solenoids

- The ON/OFF solenoid valve is an electro-mechanically operated valve. The valve is controlled by an electric current through the solenoid coil.

- This solenoid is normally closed solenoid that is controlled ON (fully open) or OFF (fully closed).
- Transmission control solenoid valves 9, 10, 11 & 12 are ON/OFF solenoids.

Solenoid Characterization

Transmission control solenoid valves 1-8 are pressure regulating valves. Each solenoid valve is tested after assembly to determine the output fluid pressure at certain electrical values, applied to the coil winding. This information is referred to as solenoid current/pressure data points. The solenoid valves are tested two ways, with an increasing and then a decreasing electrical current applied to the coil winding. The resultant current versus pressure data points are saved and assigned a file number. This file number is marked on the solenoid valve housing end or on the valve body itself. The solenoid 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 either the new or existing solenoid valve performance data, depending on what component is replaced.

- Transmission assembly - program the TCM with the new data file stored on the TIS web site for all pressure regulating solenoid valves.
- Lower control valve body assembly with solenoid valves - program the TCM with the new data file stored on the TIS web site for all pressure regulating solenoid valves.
- Transmission Control Module - program the TCM with the existing data file stored on the TIS web site for all pressure regulating solenoid valves.
- One or more solenoids - program the TCM with the new data file stored on the TIS web site for all pressure regulating solenoid valves that were replaced.

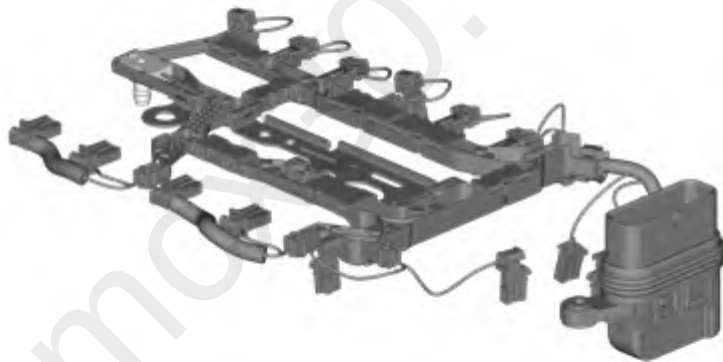


Fig. 8: Transmission Fluid Temperature Sensor
Courtesy of GENERAL MOTORS COMPANY

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 in the transmission fluid pan. As the temperature of the fluid increase, the resistance of the sensor decreases, varying the voltage on the signal circuit. The transmission fluid 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 that has the sensor attached to it.



Fig. 9: Transmission Input and Intermediate Speed Sensors
 Courtesy of GENERAL MOTORS COMPANY

Transmission Input and Intermediate Speed Sensors

The input and intermediate speed sensors are housed together in one component assembly. The sensor is mounted on the exterior of the transmission case. Each sensor is triggered by a separate reluctor ring inside the transmission case. The input and intermediate speed sensors are both hall-effect type sensors. The TCM supplies a single 9 V reference circuit to power up both sensors. Each sensor has an independent signal circuit that returns to the TCM. The TCM uses the signals to determine the rotational speed of the input shaft and the reaction gear set. As the rotational speed of the reluctor wheel increases, the frequency of the speed signal increases. The transmission control module uses this information along with the output speed sensor signal to determine transmission line pressure, shift patterns, correct gear ratio and torque converter clutch slip speed.

- The input reluctor ring is part of the 5-7-R and 6-7-9 clutch subassembly.
- The intermediate reluctor ring is part of the 3-8 and 5-7-R clutch hub assembly.



Fig. 10: Automatic Transmission Output Speed Sensor
 Courtesy of GENERAL MOTORS COMPANY

Automatic Transmission Output Speed Sensor

The output speed sensor assembly is a two wire hall-effect type sensor. The sensor is mounted on the interior of the transmission case. The TCM supplies a 9 V reference circuit and signal circuit to the output speed sensor. As the rotational speed of the output carrier assembly increases, the frequency of the output speed sensor signal increases. The reluctor ring is part of the Park gear assembly, which is splined to the transmission output shaft. The TCM used the output speed sensor signal along with the input and intermediate speed sensor signals to determine transmission line pressure, shift patterns, correct gear ratio and the torque converter clutch slip speed.

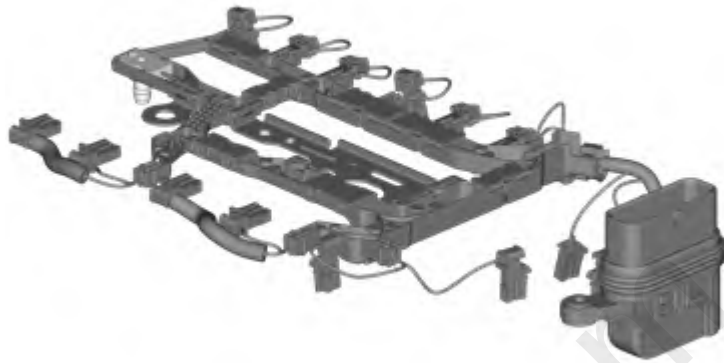


Fig. 11: Automatic Transmission Wiring Harness
Courtesy of GENERAL MOTORS COMPANY

Automatic Transmission Wiring Harness

The transmission internal wire harness is serviced by replacement only. No repairs to the internal wire harness should be attempted.



Fig. 12: Automatic Transmission Auxiliary Fluid Accumulator
Courtesy of GENERAL MOTORS COMPANY

Automatic Transmission Auxiliary Fluid Accumulator - 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 transmission control module (TCM) supplies a control circuit to the accumulator solenoid. When the engine control module (ECM) requests an auto start event, a serial data message is sent to the TCM, to command the solenoid ON. This allows captured pressurized fluid to exit the accumulator to apply the clutches for a 1st gear start.

Non-ETRS Electronic Component Description

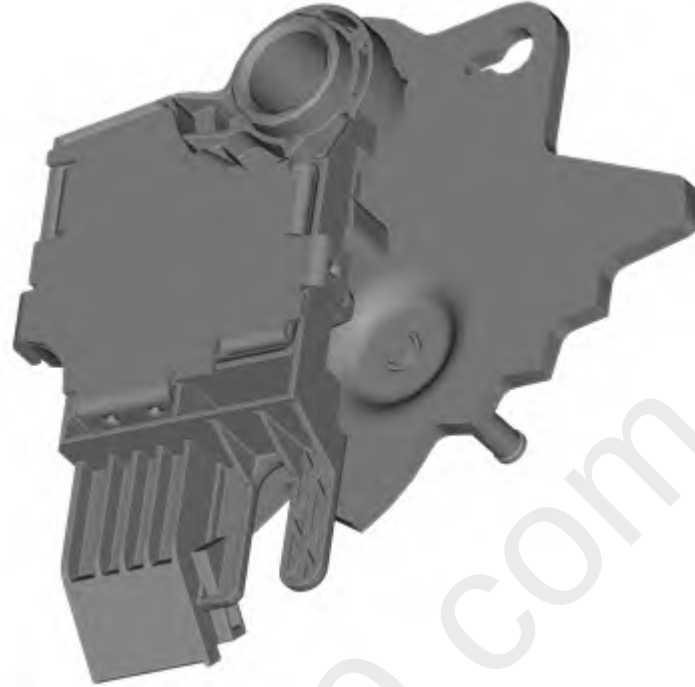


Fig. 13: Transmission Range Sensor
Courtesy of GENERAL MOTORS COMPANY

Transmission Range Sensor

The transmission range sensor is a hall-effect that has two PWM output signal circuits. The engine control module (ECM) supplies a 5 V reference circuit and a low reference circuit to the transmission range sensor. Sensor 1 signal circuit is an input to the TCM. Sensor 2 signal circuit is an input to the ECM. Each transmission gear range position has different duty cycle values of the PWM signal. The TCM uses the information from sensor 1 signal to determine what transmission gear range the vehicle operator has selected and apply the clutches for that gear. The ECM uses the information from sensor 2 signal to determine if the transmission is in park or neutral to enable the starter motor for engine cranking.

ETRS Equipped Electronic Component Description

Transmission Range Control Valve Switch

The transmission range control valve switch is a linear hall effect sensor that changes current flow based on magnetic field position relative to the sensor. The transmission control module (TCM) supplies a 9 V reference circuit to the transmission range control valve switch. Sensor signal circuit is an input to the TCM. The sensor signal circuit toggles between 0.8V and 2V based on valve position.

Park Inhibit Solenoid Actuator

The park inhibit solenoid actuator (PISA) is an actuator that when energized, will lock the park servo in the applied position, holding the parking pawl out of the park position.

Transmission Park Valve Switch

The transmission park valve switch is a linear hall effect sensor that changes current flow based on magnetic field position relative to the sensor. The transmission control module (TCM) supplies a 9 V

reference circuit to the transmission park valve switch. Sensor 1 signal circuit and sensor 2 signal circuits both toggle between 0.8V and 2V based on valve position. There are two sensors within the component to serve as a redundancy for safety.

ETRS Component Name Correlation Chart

Component Code	Function	Scan Tool Parameter - in TCM unless specified	Units
B13 Transmission Fluid Temperature Sensor	Oil Temperature	Transmission Fluid Temperature	Degrees
B14A Transmission Output Shaft Speed Sensor	Output Shaft Speed - Park Gear	Transmission OSS	RPM
"B14E Transmission Input/Intermediate Shaft Speed Sensor - Includes B14C Input Shaft Speed Sensor and B14D Intermediate Shaft Speed Sensor"	Input Shaft Speed -	Transmission ISS	RPM
	Intermediate Shaft Speed	Transmission Intermediate Speed Sensor	RPM
B280 Automatic Transmission Accumulator Solenoid Valve	Accumulator - Autostop	Transmission Accumulator Solenoid Valve Command - ECM	On/Off
B315A Transmission Range Control Valve 1 Position Switch	Mode Valve 1/A Position Sensor	Transmission Range Sensor 1	Volts
B315B Transmission Range Control Valve 2 Position Switch	Mode Valve 2/B Position Sensor	Transmission Range Sensor 2	Volts
B316 Transmission Park Valve Position Switch	Park Valve Position Sensor 1	Transmission Park Valve Position Sensor 1	Volts
	Park Valve Position Sensor 2	Transmission Park Valve Position Sensor 2	Volts
Q77A Transmission Control Solenoid Valve 1	CB123456 - LFS	Transmission Control Solenoid Valve 1	Pressure
Q77B Transmission Control Solenoid Valve 2	CB29 - LFS	Transmission Control Solenoid Valve 2	Pressure
Q77C Transmission Control Solenoid Valve 3	CB38 - VFS	Transmission Control Solenoid Valve 3	Pressure
Q77D Transmission Control Solenoid Valve 4	C4 - VFS	Transmission Control Solenoid Valve 4	Pressure
Q77E Transmission Control Solenoid Valve 5	C57R - LFS	Transmission Control Solenoid Valve 5	Pressure
Q77F Transmission Control Solenoid Valve 6	SOWC - C5789 - LFS	Transmission Control Solenoid Valve 6	Pressure
Q77G Transmission Control Solenoid Valve 7	Line - VFS	Transmission Control Solenoid Valve 7	Pressure
Q77H Transmission Control Solenoid Valve 8	TCC - VFS	Transmission Control Solenoid Valve 8	Pressure
Q77J Transmission Control Solenoid Valve 9	Clutch Select	Transmission Control Solenoid Valve 9	On/Off
Q77K Transmission Control Solenoid Valve 10	Accumulator Pressure Release	Transmission Control Solenoid Valve 10	On/Off
M123 Transmission Park Valve Lock Solenoid Actuator	Park Inhibit Solenoid Actuator	Transmission Control Solenoid Valve 11	On/Off
LFS - Linear Force Solenoid VFS - Variable Force Solenoid			

ETRS System Operation

Park:

Solenoids F and G are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. Line pressure is directed by the transmission range control valves to the park on hydraulic circuit, which is used to assist the park servo return spring in overcoming the park servo apply fluid. Solenoid F prevents line pressure from entering the 1 Rev/6789C hydraulic circuit.

Reverse:

- Solenoids D, E, G, and PISA are on. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves.
- Solenoid D shuttles the transmission range control valve 2, allowing line pressure to enter the reverse hydraulic circuit feeding the clutch selector valve. The clutch selector valve directs the reverse fluid to the SOWC Servo which holds the SOWC during reverse. Solenoid E directs line pressure to the 57R Clutch.

Neutral (commanded with speed below a certain threshold):

- Solenoids F, G, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. If shifting from Park to Neutral, solenoids C and D are on for 350 ms or less which shuttles the transmission range control valves, applying the park servo which disengages the parking pawl.
- If shifting to neutral from reverse or drive, the PISA is held on and the mode valves are returned to their default positions. Hydraulically, the system is in a Park state at this time. However, because the PISA was held on during the shift from R/D to Neutral, the parking pawl remains disengaged.

Neutral Shift (for unique conditions):

- Solenoids C, D, F, G, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost. Solenoid F prevents line pressure from entering the 1 Rev/6789C hydraulic circuit.
- Solenoid C shuttles the transmission range control valve 1 to allow line pressure to enter the Feed 1 hydraulic circuit which applies the park servo, disengaging the parking pawl. Solenoid D shuttles the transmission range control valve 2, preventing Feed 1 fluid from entering the drive hydraulic circuit.

Neutral High (commanded with speed above a certain threshold):

- Solenoids D, F, G, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost. Solenoid F prevents line pressure from entering the 1 Rev/6789C hydraulic circuit.
- Solenoid D shuttles transmission range control valve 1 which allows Feed 0 fluid to enter the Reverse hydraulic circuit which applies the park servo, disengaging the parking pawl. The clutch selector valve is shuttled to prevent reverse fluid from applying any clutches.

Drive - 1st Gear - Lock - Engine Braking:

- Solenoids C, F, G, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost. Solenoid F prevents line pressure from entering the 1 Rev/6789C hydraulic circuit.
- Solenoid C shuttles the transmission control valve 1 allowing line pressure to enter Feed 1 hydraulic circuit, which directs fluid to the transmission control valve 2. The transmission control valve 2 directs Feed 1 fluid to the Drive hydraulic circuit. The Drive fluid passes through Solenoid A and into the 123456C Clutch assembly.

Drive - 1st Gear - Freewheel:

- Solenoids C, G, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional

parking pawl engagement if hydraulic pressure at the park servo is lost. Solenoid F allows line pressure to enter the 1 Rev/6789C hydraulic circuit.

- Solenoid C shuttles the transmission control valve 1 allowing line pressure to enter Feed 1 hydraulic circuit, which directs fluid to the transmission control valve 2. The transmission control valve 2 directs Feed 1 fluid to the Drive hydraulic circuit. The Drive fluid passes through Solenoid A and into the 123456C Clutch assembly.

Drive - 2nd Gear:

- Solenoids B, C, F, G, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost. Solenoid F prevents line pressure from entering the 1 Rev/6789C hydraulic circuit.
- Solenoid C shuttles the transmission control valve 1 allowing line pressure to enter Feed 1 hydraulic circuit, which directs fluid to the transmission control valve 2. The transmission control valve 2 directs Feed 1 fluid to the Drive hydraulic circuit. The Drive fluid passes through Solenoid A and into the 123456C Clutch assembly.
- Solenoid B allows Drive fluid to enter the 29C hydraulic circuit, applying the 29C Clutch assembly.

Drive - 3rd Gear:

- Solenoids C, F, G, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost. Solenoid F prevents line pressure from entering the 1 Rev/6789C hydraulic circuit.
- Solenoid C is PWM in order to create a pressure high enough to shuttle the transmission range control valve 1 and the 38C regulator valve. This allows Drive fluid to enter the clutch selector valve, which directs Drive fluid into the Drive 2 hydraulic circuit. The 38C Regulator valve directs Drive 2 fluid into the 38C hydraulic circuit applying the 38C Clutch assembly.
- The transmission control valve 1 allows line pressure to enter Feed 1 hydraulic circuit, which directs fluid to the transmission control valve 2. The transmission control valve 2 directs Feed 1 fluid to the Drive hydraulic circuit. The Drive fluid passes through Solenoid A and into the 123456C Clutch assembly.

Drive - 4th Gear:

- Solenoids C, D, F, G, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost. Solenoid F prevents line pressure from entering the 1 Rev/6789C hydraulic circuit.
- Solenoid C shuttles the transmission control valve 1 allowing line pressure to enter Feed 1 hydraulic circuit, which directs fluid to the transmission control valve 2. The transmission control valve 2 directs Feed 1 fluid to the Drive hydraulic circuit. The Drive fluid passes through Solenoid A and into the 123456C Clutch assembly.
- Solenoid D is PWM in order to create a pressure high enough to shuttle the transmission range control valve 1 and 4th Clutch regulator valve. This allows Drive fluid to enter the clutch selector valve, which directs Drive fluid into the Drive 2 hydraulic circuit. The 4th Clutch Regulator valve directs Drive 2 fluid into the 4th Clutch hydraulic circuit applying the 4C Clutch assembly.

Drive - 5th Gear:

- Solenoids C, E, F, G, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost. Solenoid F prevents line pressure from entering the 1 Rev/6789C hydraulic circuit.
- Solenoid C shuttles the transmission control valve 1 allowing line pressure to enter Feed 1 hydraulic circuit, which directs fluid to the transmission control valve 2. The transmission control valve 2 directs Feed 1 fluid to the Drive hydraulic circuit. The Drive fluid passes through Solenoid A and into the 123456C Clutch assembly.

- Drive 2 fluid enters the 57R Clutch Feed hydraulic circuit. Solenoid E allows 57R Clutch Feed to apply the 57RC Clutch Assembly.

Drive - 6th Gear:

- Solenoids C, G, H, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost.
- Line pressure is now able to flow through Solenoid F into the 1 Rev/6789C Clutch Feed hydraulic circuit. 1 Rev/6789C Clutch Feed fluid is directed into 6789C Clutch hydraulic circuit by the Clutch Selector Valve, which applies the 6789C Clutch Assembly.
- Solenoid C shuttles the transmission control valve 1 allowing line pressure to enter Feed 1 hydraulic circuit, which directs fluid to the transmission control valve 2. The transmission control valve 2 directs Feed 1 fluid to the Drive hydraulic circuit. The Drive fluid passes through Solenoid A and into the 123456C Clutch assembly.
- Solenoid H allows line pressure to enter the TCC VFS Hydraulic circuit, shuttling TCC Control Valve and TCC Reg Apply Valve.

Drive - 7th Gear:

- Solenoids A, C, E, G, H, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost.
- Line pressure is now able to flow through Solenoid F into the 1 Rev/6789C Clutch Feed hydraulic circuit. 1 Rev/6789C Clutch Feed fluid is directed into 6789C Clutch hydraulic circuit by the Clutch Selector Valve, which applies the 6789C Clutch Assembly.
- Solenoid C shuttles the transmission control valve 1 allowing line pressure to enter Feed 1 hydraulic circuit, which directs fluid to the transmission control valve 2. The transmission control valve 2 directs Feed 1 fluid to the Drive hydraulic circuit. Solenoid A does not allow Drive fluid to enter the 123456C Feed hydraulic circuit.
- Solenoid H allows line pressure to enter the TCC VFS Hydraulic circuit, shuttling TCC Control Valve and TCC Reg Apply Valve.
- Drive 2 fluid enters the 57R Clutch Feed hydraulic circuit. Solenoid E allows 57R Clutch Feed to apply the 57RC Clutch Assembly.

Drive - 8th Gear:

- Solenoids A, C, G, H, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost.
- Solenoid C is PWM in order to create a pressure high enough to shuttle the transmission range control valve 1 and the 38C regulator valve. This allows Drive fluid to enter the clutch selector valve, which directs Drive fluid into the Drive 2 hydraulic circuit. The 38C Regulator valve directs Drive 2 fluid into the 38C hydraulic circuit applying the 38C Clutch assembly. Solenoid A does not allow Drive fluid to enter the 123456C Feed hydraulic circuit.
- Solenoid H allows line pressure to enter the TCC VFS Hydraulic circuit, shuttling TCC Control Valve and TCC Reg Apply Valve.
- Line pressure is now able to flow through Solenoid F into the 1 Rev/6789C Clutch Feed hydraulic circuit. 1 Rev/6789C Clutch Feed fluid is directed into 6789C Clutch hydraulic circuit by the Clutch Selector Valve, which applies the 6789C Clutch Assembly.

Drive - 9th gear:

- Solenoids A, B, C, G, H, and PISA are on. Solenoid G shuttles the mode enable valve to provide line pressure to transmission range control valves. The PISA is held on to prevent an unintentional parking pawl engagement if hydraulic pressure at the park servo is lost.
- Solenoid C shuttles the transmission control valve 1 allowing line pressure to enter Feed 1 hydraulic circuit, which directs fluid to the transmission control valve 2. The transmission control valve 2 directs Feed 1 fluid to the Drive hydraulic circuit. Solenoid A does not allow Drive fluid to enter the 123456C Feed hydraulic circuit.

- Solenoid H allows line pressure to enter the TCC VFS Hydraulic circuit, shutting TCC Control Valve and TCC Reg Apply Valve.
- Solenoid B allows Drive fluid to enter the 29C hydraulic circuit, applying the 29C Clutch assembly.

9TXX ETRS Component Application Chart

Solenoid Application Chart

Range	Gear	Solenoids								
		A	B	C	D	E	F	G	H	PISA
Park	Park	Off	Off	Off	Off	Off	On	On	Off	Off
Reverse	Reverse	Off	Off	Off	On	On	Off	On	Off	On
Neutral	Neutral	Off	Off	Off*	Off*	Off	On	On	Off	On
	Neutral Shift	Off	Off	On	On	Off	On	On	Off	On
	Neutral High	Off	Off	Off	On	Off	On	On	Off	On
Drive	1 - Lock - Engine Braking	Off	Off	On	Off	Off	On	On	Off	On
	1 - Freewheel	Off	Off	On	Off	Off	Off	On	Off	On
	2	Off	On	On	Off	Off	On	On	Off	On
	3	Off	Off	On	Off	Off	On	On	Off	On
	4	Off	Off	On	On	Off	On	On	Off	On
	5	Off	Off	On	Off	On	On	On	Off	On
	6	Off	Off	On	Off	Off	Off	On	On	On
	7	On	Off	On	Off	On	Off	On	On	On
	8	On	Off	On	Off	Off	Off	On	On	On
	9	On	On	On	Off	Off	Off	On	On	On

* On/Stroked for ≤ 350 ms in order to apply park servo, releasing the parking pawl when shifting from PARK to Neutral

Electronically Controlled Valve Application Chart

Range	Gear	Mode Valves		
		Mode Enable Valve	Transmission Range Mode Valve 1	Transmission Range Mode Valve 2
Park	Park	On	Default	Default
Reverse	Reverse	On	Default	Stroked
Neutral	Neutral	On	Default*	Default*
	Neutral Shift	On	Stroked	Stroked
	Neutral High	On	Default	Stroked
Drive	1	On	Stroked	Default
	2	On	Stroked	Default
	3	On	Stroked	Default
	4	On	Stroked	Default
	5	On	Stroked	Default
	6	On	Stroked	Default
	7	On	Stroked	Default
	8	On	Stroked	Default
	9	On	Stroked	Default

* On/Stroked for ≤ 350 ms in order to apply park servo, releasing the parking pawl when shifting from PARK to Neutral

Hydraulic Component Application Chart

Range	Gear	Clutch/Servo							
		Park Servo	Selective One-way Clutch Servo	123456C	29C	38C	4C	57RC	6789C

Range	Gear	Clutch/Servo							
		Park Servo	Selective One-way Clutch Servo	123456C	29C	38C	4C	57RC	6789C
Park	Park	Released	Released	Released	Released	Released	Released	Released	Released
Reverse	Reverse	Applied	Applied	Released	Released	Released	Released	Applied	Released
Neutral	Neutral	Released	Released	Released	Released	Released	Released	Released	Released
	Neutral Shift	Applied	Applied	Released	Released	Released	Released	Released	Released
	Neutral High	Applied	Applied	Released	Released	Released	Released	Released	Released
Drive	1 - Lock (Engine Braking)	Applied	Applied	Applied	Released	Released	Released	Released	Released
	1 - Freewheel	Applied	Released	Applied	Released	Released	Released	Released	Released
	2	Applied	Released	Applied	Applied	Released	Released	Released	Released
	3	Applied	Released	Applied	Released	Applied	Released	Released	Released
	4	Applied	Released	Applied	Released	Released	Applied	Released	Released
	5	Applied	Released	Applied	Released	Released	Released	Applied	Released
	6	Applied	Released	Applied	Released	Released	Released	Released	Applied
	7	Applied	Released	Released	Released	Released	Released	Applied	Applied
	8	Applied	Released	Released	Released	Applied	Released	Released	Applied
	9	Applied	Released	Released	Applied	Released	Released	Released	Applied
Applied/Released = Hydraulic pressure applied/released on the component									

MECHANICAL POWERFLOW FROM THE TORQUE CONVERTER TO THE TURBINE SHAFT - ENGINE RUNNING

The mechanical power flow in the Hydra-matic 9T45/50/60/65 transmission begins at the point of connection between the torque converter and the engine flywheel. When the engine is running, the torque converter cover (pump) is forced to rotate at engine speed. As the torque converter rotates it multiplies engine torque and transmits it to the turbine shaft (547). The turbine shaft provides the primary link to the mechanical operation of the transmission.

The Hydra-matic 9T45/50/60/65 automatic transmission requires a constant supply of pressurized fluid to cool and lubricate all of the components throughout the unit. It also requires a holding force to be applied to the clutches during the various gear range operations. The automatic transmission fluid pump assembly (315), and the control valve solenoid body assembly (8) provide for the pressurization and distribution of fluid throughout the transmission.

1. Power from the Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Power to Drive the Fluid Pump

The drive sprocket (304) is splined (keyed) to the torque converter hub. The drive link (305) is driven by the drive sprocket (304) and in turn drives the driven sprocket (302). The fluid pump drive shaft is splined to the driven sprocket, therefore when the engine is running, the transmission fluid pump is operating.

3. Fluid Coupling Drives the Turbine

Transmission fluid inside the torque converter assembly (14) creates a fluid coupling which in turn drives the torque converter turbine.

4. Turbine Shaft Driven

As the torque converter turbine rotates, the turbine shaft (547), which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

Mechanical Powerflow from The Torque Converter To The Turbine Shaft - Engine Running

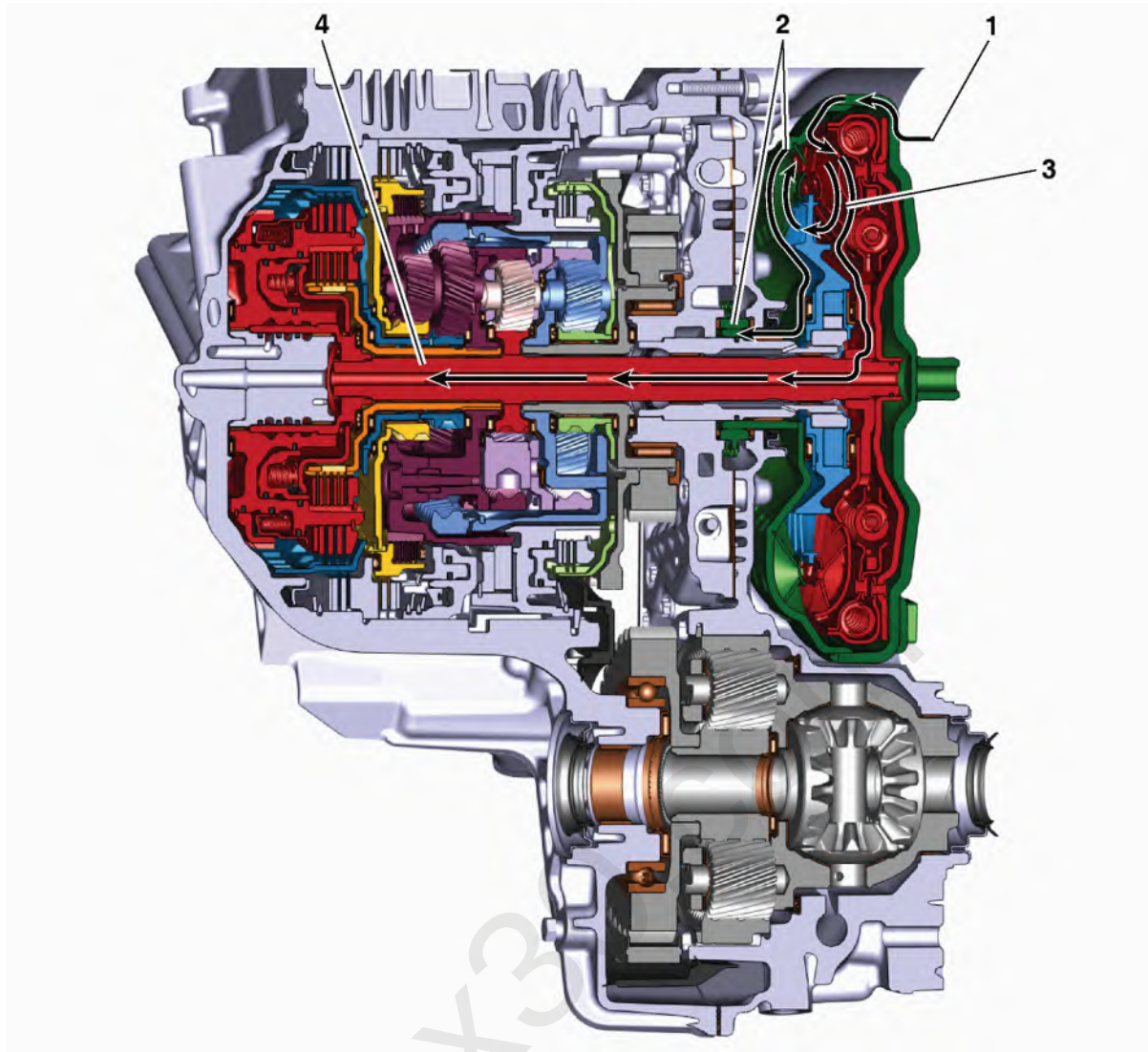


Fig. 14: Mechanical Powerflow From Torque Converter To Turbine Shaft - Engine Running Hydraulic Diagram

Courtesy of GENERAL MOTORS COMPANY

PARK - ENGINE RUNNING (HYDRAULIC CIRCUITS WITHOUT ETRS)

When the gear selector 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 Reverse & 6789 Regulator Valve

The 1 Reverse & 6-7-8-9 solenoid is energized which applies pressure against the 1 Reverse & 6-7-8-9 Regulator Valve spring force. This allows line fluid to be blocked from entering the 1 REV/6789 FEED fluid circuit.

Park - Engine Running

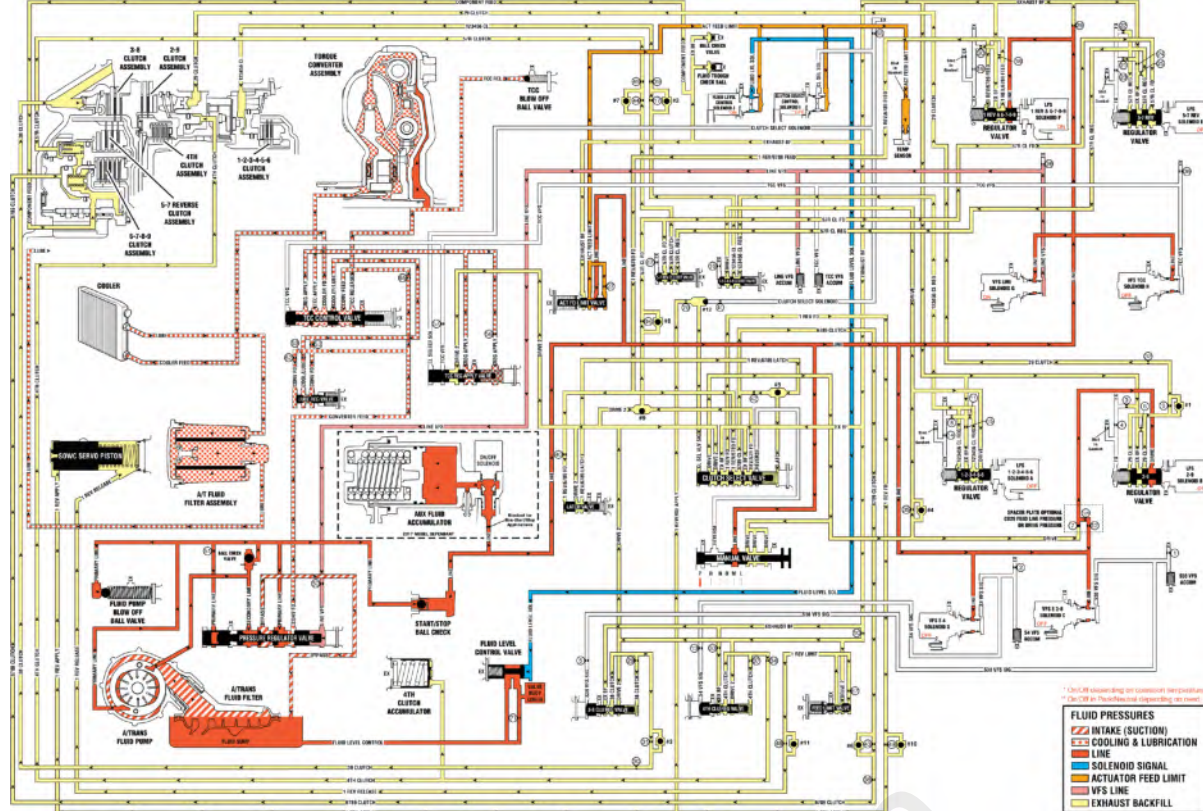


Fig. 15: Park - Engine Running Hydraulic Diagram (Without ETRS)

Courtesy of GENERAL MOTORS COMPANY

PARK - ENGINE RUNNING (HYDRAULIC CIRCUITS WITH ETRS)

When the gear selector 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

VFS Line Solenoid

VFS line solenoid is energized allowing RANGE FEED fluid to enter the LINE VFS fluid circuit. LINE VFS fluid is routed to the ETRS mode enable valve.

ETRS Mode Enable Valve

LINE VFS fluid is routed to the ETRS mode enable valve applying pressure against ETRS mode enable valve spring force. This allows LINE fluid to be directed into the RANGE FEED fluid circuit. RANGE FEED fluid is then directed to the mode 1 ETRS valve.

Mode 1 ETRS Valve

RANGE FEED fluid is routed to the mode 1 ETRS valve and into the FEED 0 fluid circuit.

Mode 2 ETRS Valve

FEED 0 fluid is routed to the mode 2 ETRS valve and into the PARK ON fluid circuit. PARK ON fluid is directed to the ball check valve #14 and #15.

Ball Check Valve #14

PARK ON fluid is routed to the ball check valve #14. The ball check valve is seated by PARK ON fluid pressure.

Ball Check Valve #15

PARK ON fluid is routed to the ball check valve #15 applying pressure against the ball check valve spring force.

The input carrier assembly drives the output carrier assembly (555) pinions.

5. Output Carrier Assembly Held

The output carrier assembly (555) is splined to, and held by, the output carrier transfer drive gear hub (502). The output internal gear (input carrier assembly) (552) drives the output carrier assembly (555) pinions, which then drives the output sun gear (522).

6. Power Flow Terminated At The Output Sun Gear

Without the 1-2-3-4-5-6 clutch applied, torque cannot be transferred from the output sun gear (522), thus power flow is terminated.

7. Torque from Wheels to Front Differential Carrier Pinions

Torque from the vehicle travels through the wheels to the front differential carrier (238), and is transferred to the front differential carrier sun gear (240), which is splined to driven sprocket (241).

8. Park Gear Held/Power Flow Terminated at Front Differential Drive Pinion Gear Assembly

The park lock gear is held by the park pawl (715). The park lock gear is splined to the output carrier transfer drive gear hub (502). Therefore power flow is terminated at the output carrier transfer drive gear hub (502).

9. Drive Sprocket Held

The drive sprocket (234) is in mesh with the drive link (233), which is in mesh with and held by the driven sprocket (241).

Park - Engine Running

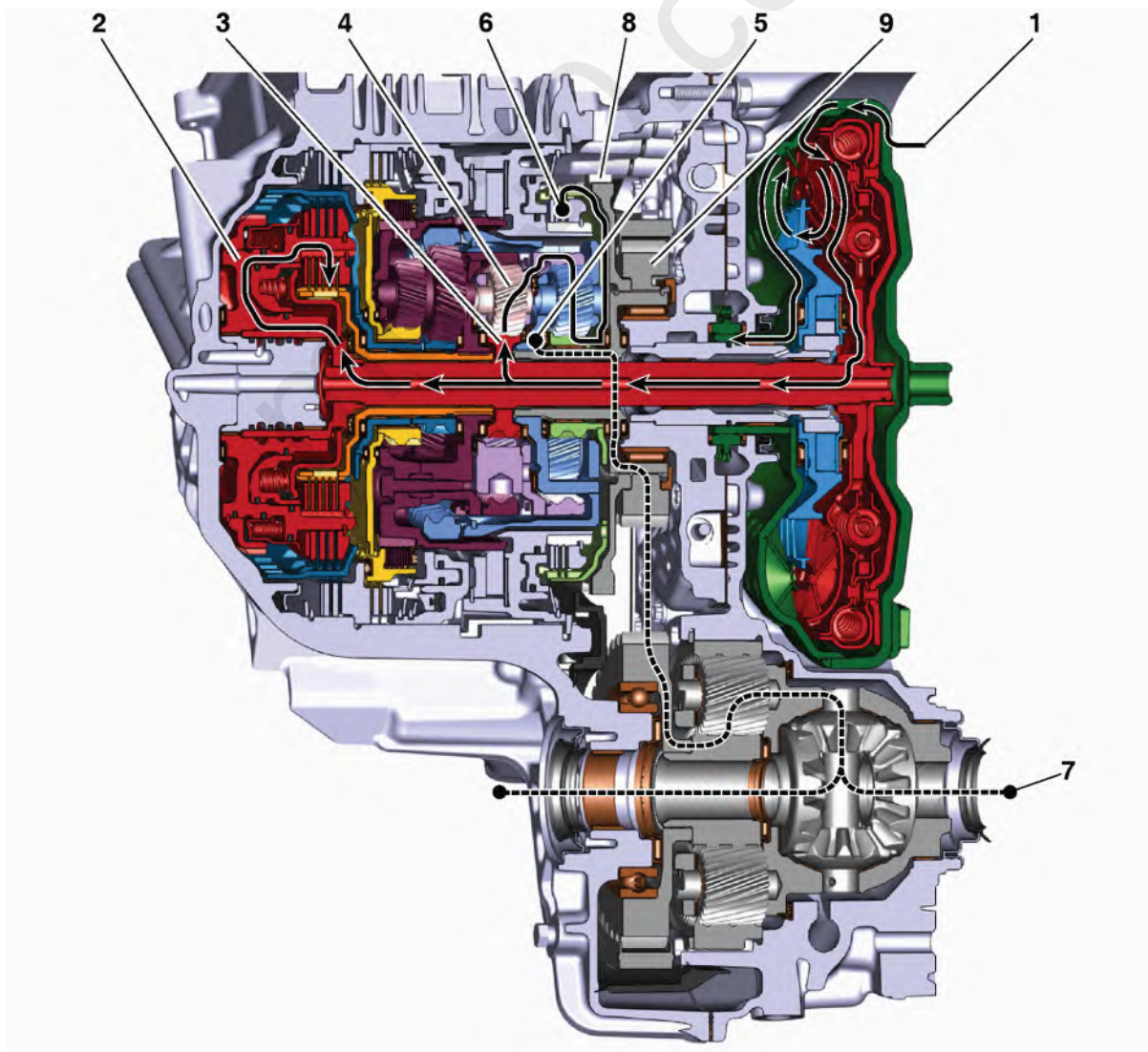


Fig. 17: Park - Engine Running Mechanical Powerflow Diagram

Courtesy of GENERAL MOTORS COMPANY

REVERSE (HYDRAULIC CIRCUITS WITHOUT ETRS)

When the gear selector is moved to the Reverse (R) position (from the Park position) the 5-7 reverse solenoid and clutch select control solenoid is commanded ON and the 1 reverse & 6-7-8-9 solenoid is commanded OFF 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 clutch select valve.

Clutch Select Control Solenoid

The clutch select control solenoid energizes allowing ACTUATOR FEED LIMIT fluid to enter the CLUTCH SELECT SOLENOID fluid circuit. CLUTCH SELECT SOLENOID fluid is routed to the TCC regulator apply valve and the clutch select valve.

#12 Ball Check Valve and Clutch Select Valve

CLUTCH SELECT SOLENOID fluid is routed thru orifice #41 and seating the #12 ball check valve against the 1 REVERSE APPLY fluid passage allowing fluid to be directed into the CLUTCH SELECT VALVE SIGNAL fluid circuit to the clutch select valve applying pressure against clutch select valve spring force. REVERSE fluid from the manual valve is routed to the clutch select valve which is directed into the REV/57R FEED fluid circuit. REV/57R FEED fluid is directed to the #9 ball check valve.

#9 Ball Check Valve

REV/57R FEED fluid seats the #9 ball check valve against the DRIVE 2 fluid circuit allowing REV/57R FEED to enter the 57R CLUTCH FEED fluid circuit. The 57R CLUTCH FEED fluid is routed thru orifice #46 and to the #8 ball check valve.

#8 Ball Check Valve

The 57R CLUTCH FEED fluid seats the #8 ball check valve and is forced thru orifice #46. 57R CLUTCH FEED fluid is routed to the 5-7 reverse clutch boost valve and to the 5-7 reverse regulator valve.

5-7 Reverse Clutch Boost Valve

The 57R CLUTCH FEED fluid seats the #8 ball check valve and is forced thru orifice #46. 57R CLUTCH FEED fluid is routed to the 5-7 reverse clutch boost valve awaiting valve shift.

5-7 Reverse Regulator Valve

The 57R CLUTCH FEED fluid is routed to the 5-7 reverse regulator valve awaiting valve shift.

5-7 Reverse Clutch Applies

5-7 Reverse Solenoid

The 5-7 reverse solenoid energizes applying pressure against the 5-7 reverse regulator valve spring force. This allows 57R CLUTCH FEED fluid to enter the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid is routed to the 5-7 reverse clutch boost valve.

5-7 Reverse Clutch Boost Valve

57R CLUTCH REGULATOR fluid is routed to the 5-7 reverse clutch boost valve and into the 57R CLUTCH fluid circuit. 57R CLUTCH fluid seats ball check valve #7 and is forced thru orifice #44 and #45 to the 5-7 reverse clutch assembly.

5-7 Reverse Clutch Assembly

The VFS S4 solenoid is energized at low pressure allowing LINE fluid to enter the S4 VFS SIGNAL fluid circuit. S4 VFS SIGNAL fluid is directed to the mode 2 ETRS valve and 4th clutch regulator

valve.

Mode 2 ETRS Valve

S4 VFS SIGNAL fluid is routed to the mode 2 ETRS valve applying pressure against mode 2 ETRS valve spring force. This allows FEED 0 fluid to be directed into the REVERSE fluid circuit. REVERSE fluid is then directed to the #17 ball check valve and the clutch selector valve.

4th Clutch Regulator Valve

S4 VFS SIGNAL fluid is routed to the 4th clutch regulator valve applying pressure against 4th clutch regulator valve spring force. Pressure on the 4th clutch regulator valve is low enough to not apply the 4th clutch.

#17 Ball Check Valve

REVERSE fluid seats the #17 ball check valve against the FEED 1 fluid circuit. The REVERSE fluid seats the #16 ball check valve and is routed thru orifice #80 into the PARK OFF fluid circuit. PARK OFF fluid is directed to the park release servo piston.

Park Release Servo Piston

PARK OFF fluid is directed to the park release servo piston applying pressure against park release servo piston spring force. The park inhibit solenoid is then energized on.

Clutch Select Control Solenoid

The clutch select control solenoid energizes allowing ACTUATOR FEED LIMIT fluid to enter the CLUTCH SELECT SOLENOID fluid circuit. CLUTCH SELECT SOLENOID fluid is routed to the TCC regulator apply valve and the clutch selector valve.

Clutch Selector Valve and #12 Ball Check Valve

CLUTCH SELECT SOLENOID fluid is routed thru orifice #41 and seats the #12 ball check valve against the 1 REVERSE APPLY fluid circuit which allows CLUTCH SELECT SOLENOID fluid to enter the CLUTCH SELECT VALVE SIGNAL fluid circuit. CLUTCH SELECT VALVE SIGNAL fluid circuit is directed to the clutch selector valve applying pressure against clutch selector valve spring force. REVERSE fluid from the mode 2 ETRS valve is routed to the clutch selector valve which is directed into the REV/57R FEED fluid circuit. REV/57R FEED fluid is directed to the #9 ball check valve.

#9 Ball Check Valve

REV/57R FEED fluid seats the #9 ball check valve against the DRIVE 2 fluid circuit allowing REV/57R FEED to enter the 57R CLUTCH FEED fluid circuit. The 57R CLUTCH FEED fluid is routed thru orifice #46 and to the #8 ball check valve.

#8 Ball Check Valve

The 57R CLUTCH FEED fluid seats the #8 ball check valve and is forced thru orifice #46. 57R CLUTCH FEED fluid is routed to the 5-7 reverse clutch boost valve and to the 5-7 reverse regulator valve.

5-7 Reverse Clutch Boost Valve

The 57R CLUTCH FEED fluid seats the #8 ball check valve and is forced thru orifice #46. 57R CLUTCH FEED fluid is routed to the 5-7 reverse clutch boost valve awaiting valve shift.

5-7 Reverse Regulator Valve

The 57R CLUTCH FEED fluid is routed to the 5-7 reverse regulator valve awaiting valve shift.

5-7 Reverse Clutch Applies

5-7 Reverse Solenoid

The 5-7 reverse solenoid energizes applying pressure against the 5-7 reverse regulator valve spring force. This allows 57R CLUTCH FEED fluid to enter the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid is routed to the 5-7 reverse clutch boost valve.

5-7 Reverse Clutch Boost Valve

57R CLUTCH REGULATOR fluid is routed to the 5-7 reverse clutch boost valve and into the 57R CLUTCH fluid circuit. 57R CLUTCH fluid seats ball check valve #7 and is forced thru orifice #44 and #45 to the 5-7 reverse clutch assembly.

5-7 Reverse Clutch Assembly

57R CLUTCH fluid is directed into the 5-7 rev clutch piston spring force which applies holding force to the 5-7 rev clutch plates.

SOWC Servo Piston Applies

Reverse & 6-7-8-9 Solenoid

The 1 reverse & 6-7-8-9 solenoid de-energizes releasing pressure against the 1 reverse & 6-7-8-9 regulator valve spring force. This allows LINE fluid to enter the 1 REV/6789 FEED fluid circuit. 1 REV/6789 FEED fluid is routed thru orifice #40 to the latch valve and to the clutch select valve.

Clutch Selector Valve

1 REV/6789 FEED fluid is routed thru the clutch select valve into the 1 REVERSE FEED fluid circuit. 1 REVERSE FEED fluid seats ball check valve #10 and is forced thru orifice #49 into the 1 REVERSE APPLY fluid circuit. 1 REVERSE APPLY fluid is directed to the SOWC servo piston.

SOWC Servo Piston

1 REVERSE APPLY fluid is directed into the SOWC servo piston applying pressure against piston spring force.

Reverse

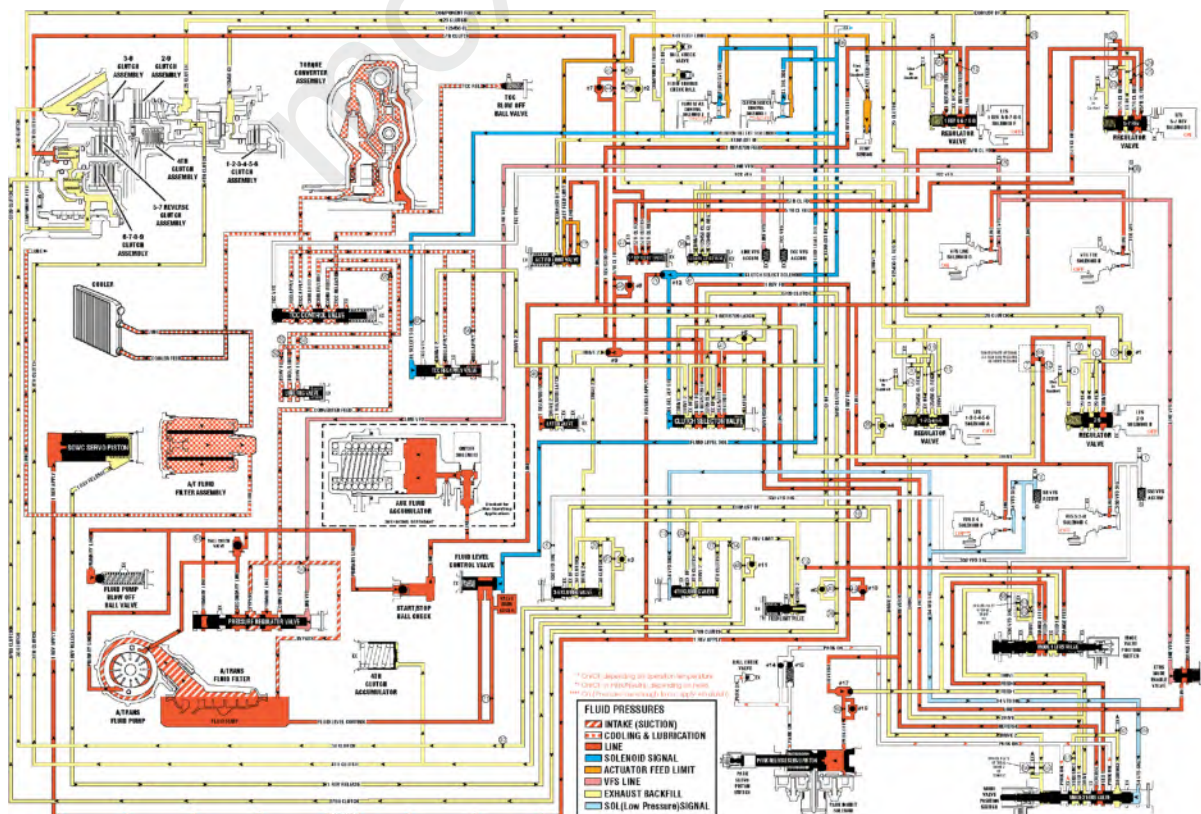


Fig. 19: Reverse Hydraulic Diagram (With ETRS).

Courtesy of GENERAL MOTORS COMPANY

REVERSE (MECHANICAL POWERFLOW)

In Reverse (R), torque from the engine is multiplied through the torque converter assembly (14), the transmission gear sets, and the front differential carrier assembly (238), thereby sending power to the vehicle's drive axles. The planetary gear sets operate in reduction and also reverse the direction of input torque. The gear ratio for Reverse gear range is 2.960:1. When the gear selector lever is moved into the Reverse (R) gear range, the parking pawl (715) disengages from the parking gear (232) allowing the drive sprocket (234) and connected components to rotate. The manual shift detent lever (709) and manual valve (452) are also moved into the Reverse gear position in order to channel the transmission fluid.

1. Power From The Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Turbine Shaft Driven

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driving

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. Input Carrier Assembly Driven

The input carrier assembly drives the output carrier assembly (555) pinions.

5. 5-7-Reverse Clutch Applied

The 5-7-reverse clutch plates (578-582) are applied and connect the 3-5-reverse and 6-7-8-9 clutch housing (530) to the 3-8 and 5-7-reverse clutch hub (534).

6. 1- Reverse and 1-2-3-4-5-6 Clutch Piston Applied

The 1- reverse and 1-2-3-4-5-6 clutch piston is applied and holds the overdrive carrier (546)

7. Overdrive Carrier Held

The overdrive carrier (546) is held by the 1- Reverse and 1-2-3-4-5-6 Clutch Piston housing (590).

8. 3-8 and 5-7-Reverse Clutch Hub Driving

With the overdrive carrier (546) held by the 1- Reverse and 1-2-3-4-5-6 Clutch Piston housing (590), the 3-8 and 5-7-reverse clutch hub (534) drives the overdrive carrier assembly pinion gears.

9. Output Carrier Assembly Drive

The overdrive carrier (546) pinion gears are in mesh with, and drive, the internal gear (output carrier assembly) (555) in the direction opposite of torque converter rotation to achieve reversal of direction.

10. Output Carrier Transfer Drive Gear Hub Driven

The output carrier transfer drive gear hub (502) is splined to, and driven by, the output carrier assembly (555).

11. Drive Sprocket Driving

The drive sprocket (234), splined to and driven by the output carrier transfer drive gear hub (502), drives the drive link (233) which drives the driven sprocket (241).

12. Driven Sprocket Driven

The driven sprocket (241), driven by the drive link (233), is splined to the front differential carrier sun gear (240).

13. Front Differential Carrier Sun Gear Driving

The front differential carrier sun gear (240), is in mesh with, and drives, the front differential carrier (238), thus transferring power to the front differential carrier and to the drive axles.

Reverse

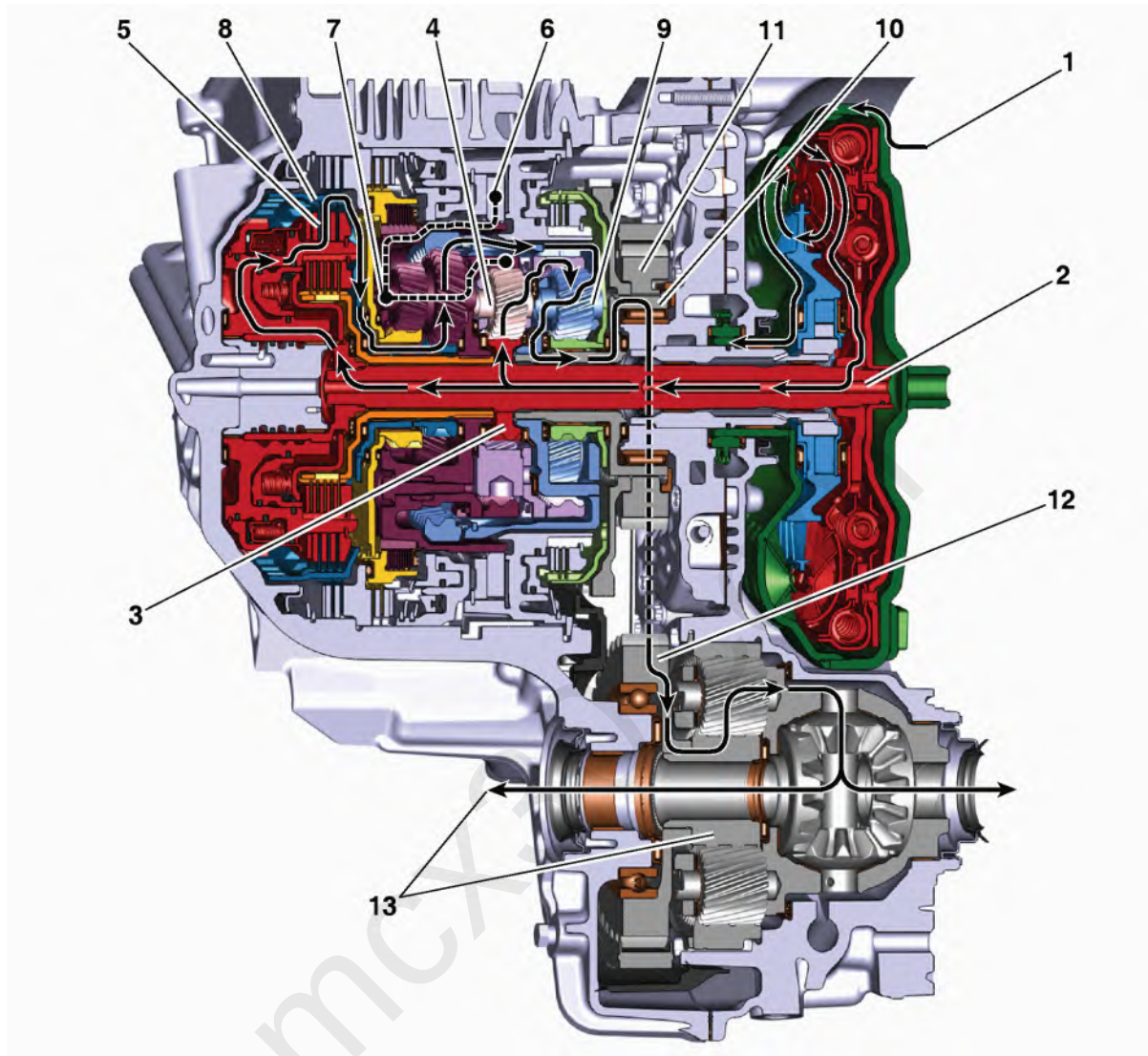


Fig. 20: Reverse Mechanical Powerflow Diagram

Courtesy of GENERAL MOTORS COMPANY

NEUTRAL - ENGINE RUNNING (HYDRAULIC CIRCUITS WITHOUT ETRS)

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 5-7 reverse solenoid and clutch select control solenoid is commanded OFF and the 1 reverse & 6-7-8-9 solenoid is commanded ON and the following changes would occur in the hydraulic system.

5-7 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 clutch select valve is opened to an exhaust passage at the manual valve.

Clutch Select Control Solenoid

The clutch select control solenoid is signaled off allowing CLUTCH SELECT SOLENOID fluid to exhaust from the TCC regulator apply valve and the clutch select valve.

Clutch Select Valve

The clutch selector valve spring pressure shifts the valve to allow CLUTCH SELECT VALVE SIGNAL fluid to seat the #12 ball check valve allowing CLUTCH SELECT VALVE SIGNAL fluid to be exhausted thru orifice #41 into the CLUTCH SELECT SOLENOID fluid circuit which is routed thru orifice #68 and exhausted thru the EXHAUST fluid circuit.

TCC Regulator Apply Valve

The TCC regulator apply valve spring pressure shifts the valve to allow CLUTCH SELECT SOLENOID fluid to be exhausted thru orifice #68 and exhausted thru the EXHAUST fluid circuit.

#9 Ball Check Valve

REV/57R FEED fluid releases and unseats the #9 ball check valve against the DRIVE 2 fluid circuit allowing REV/57R FEED to exhaust into the EX BACKFILL fluid circuit.

5-7 Reverse Solenoid

The 5-7 reverse solenoid de-energizes releasing pressure against the 5-7 reverse regulator valve spring force. This blocks 57R CLUTCH FEED fluid from entering the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid is exhausted thru orifice #25 and #24 into the EX BACKFILL fluid circuit and thru orifice #21 into the EXHAUST fluid circuit.

5-7 Reverse Clutch Assembly

The 5-7 reverse clutch is released allowing 57R CLUTCH fluid to exhaust thru orifice #45 and #44 to the 5-7 clutch boost valve into the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid continues thru orifice #22 into the EXHAUST fluid circuit.

SOWC Servo Piston Releases

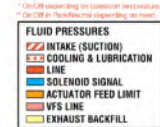
1 Reverse & 6-7-8-9 Solenoid

The 1 reverse & 6-7-8-9 solenoid energizes applying pressure against the 1 reverse & 6-7-8-9 regulator valve spring force. This blocks LINE fluid from entering the 1 REV/6789 FEED fluid circuit. 1 REV/6789 FEED fluid is routed to the EXHAUST BACKFILL fluid circuit and thru orifice #20 into the EXHAUST fluid circuit.

SOWC Servo Piston

The SOWC servo piston is released. 1 REVERSE APPLY fluid is exhausted thru orifice #49 into the 1 REVERSE FD fluid circuit and directed thru the clutch select valve into the EXHAUST BACKFILL fluid circuit.

Neutral - Engine Running



Courtesy of GENERAL MOTORS COMPANY

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 5-7 reverse solenoid and clutch select control solenoid is commanded OFF and the 1 reverse & 6-7-8-9 solenoid and VFS-S3 - 8 solenoid is commanded ON and the following changes would occur in the hydraulic system.

VFS S3-8 Solenoid

Mode 1 ETRS Valve

#17 Ball Check Valve

FEED 1 fluid seats the #17 ball check valve against the REVERSE fluid circuit. The FEED 1 fluid seats the #16 ball check valve and is routed thru orifice #80 into the PARK OFF fluid circuit. PARK OFF fluid is directed to the park release servo piston.

PARK OFF fluid is directed to the park release servo piston applying pressure against park release servo piston spring force. The park inhibit solenoid is then energized on.

S38 VFS SIGNAL fluid is routed to the 3-8 clutch regulator valve applying pressure against 3-8 clutch regulator valve spring force. Pressure on the 3-8 clutch regulator valve is low enough to not apply the 3-

8 clutch.

Clutch Select Control Solenoid

The clutch select control solenoid is signaled off allowing CLUTCH SELECT SOLENOID fluid to exhaust from the TCC regulator apply valve and the clutch select valve.

Clutch Selector Valve

The clutch selector valve spring pressure shifts the valve to allow CLUTCH SELECT VALVE SIGNAL fluid to seat the #12 ball check valve allowing CLUTCH SELECT VALVE SIGNAL fluid to be exhausted thru orifice #41 into the CLUTCH SELECT SOLENOID fluid circuit which is routed thru orifice #68 and exhausted thru the EXHAUST fluid circuit.

TCC Regulator Apply Valve

The TCC regulator apply valve spring pressure shifts the valve to allow CLUTCH SELECT SOLENOID fluid to be exhausted thru orifice #68 and exhausted thru the EXHAUST fluid circuit

5-7 Reverse Solenoid

The 5-7 reverse solenoid de-energizes releasing pressure against the 5-7 reverse regulator valve spring force. This blocks 57R CLUTCH FEED fluid from entering the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid is exhausted thru orifice #25 and #24 into the EX BACKFILL fluid circuit and thru orifice #21 into the EXHAUST fluid circuit.

5-7 Reverse Clutch Assembly

The 5-7 reverse clutch is released allowing 57R CLUTCH fluid to exhaust thru orifice #45 and #44 to the 5-7 clutch boost valve into the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid continues thru orifice #22 into the EXHAUST fluid circuit.

SOWC Servo Piston Releases

1 Reverse & 6-7-8-9 Solenoid

The 1 reverse & 6-7-8-9 solenoid energizes applying pressure against the 1 reverse & 6-7-8-9 regulator valve spring force. This blocks LINE fluid from entering the 1 REV/6789 FEED fluid circuit. 1 REV/6789 FEED fluid is routed to the EXHAUST BACKFILL fluid circuit and thru orifice #20 into the EXHAUST fluid circuit.

SOWC Servo Piston

The SOWC servo piston is released. 1 REVERSE APPLY fluid is exhausted thru orifice #49 into the 1 REVERSE FD fluid circuit and directed thru the clutch select valve into the EXHAUST BACKFILL fluid circuit.

Neutral - Engine Running

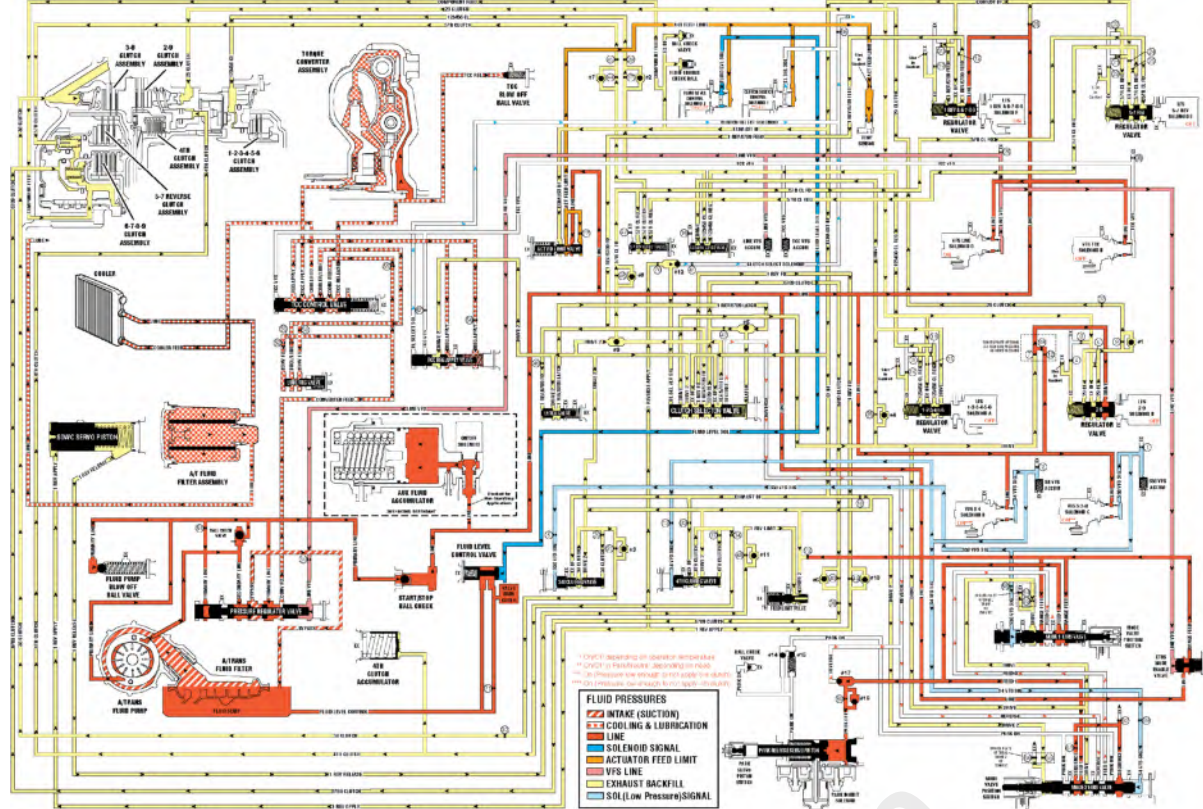


Fig. 22: Neutral - Engine Running Hydraulic Diagram (With ETRS).
Courtesy of GENERAL MOTORS COMPANY

NEUTRAL - ENGINE RUNNING (MECHANICAL POWERFLOW)

When the gear selector lever is placed in the Neutral (N) position, the mechanical power flow through the transmission is similar to Park gear range. The primary difference is that the park pawl (715) is not engaged with the park gear (232), which allows the drive sprocket (234) to rotate freely in either direction. Assuming that the vehicle is on level ground, the weight of the vehicle (transferred through the drive axles) holds the front differential carrier (238), thus power flow does not travel to the drive sprocket (234). Under these conditions, power flow through the transmission is the same as in Park. The manual shift detent lever (709) and manual valve (452) are moved into the Neutral (N) range position.

1. Power From The Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Turbine Shaft Driven

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driven

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. Input Carrier Assembly Driven

The input carrier assembly drives the output carrier assembly (555) pinions.

5. Output Carrier Assembly Held

The output carrier assembly (555) is splined to, and held by, the output carrier transfer drive gear hub (502). The output internal gear (input carrier assembly) (552) drives the output carrier assembly (555) pinions, which then drives the output sun gear (522).

6. Power Flow Terminated At The Output Sun Gear

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 clutch select valve, 2-9 regulator valve, 1-2-3-4-5-6 regulator valve and 1-2-3-4-5-6 clutch boost valve.

Clutch Select Valve

DRIVE fluid is directed thru the clutch select valve and into the DRIVE 2 fluid circuit which is directed to the 3-8 clutch regulator valve, 4th clutch regulator valve, feed limit valve, TCC regulator apply valve and latch valve.

Latch Valve

DRIVE 2 fluid is directed thru the latch valve and into the 1 REV/6789 LATCH fluid circuit which is directed to the #5 ball check valve.

#5 Ball Check Valve

1 REV/6789 LATCH fluid seats the #5 ball check valve against the 6789 CLUTCH fluid circuit allowing 1 REV/6789 LATCH fluid to enter the LATCH fluid circuit. LATCH fluid is directed to the clutch select valve applying pressure with the clutch select valve spring force.

1-2-3-4-5-6 Clutch Applies

1-2-3-4-5-6 Solenoid

The 1-2-3-4-5-6 solenoid is de-energized allowing drive fluid to enter the 1-2-3-4-5-6 regulator valve and enter the 123456 CLUTCH REGULATOR fluid circuit. 123456 CLUTCH REGULATOR fluid is directed to the 1-2-3-4-5-6 clutch boost valve.

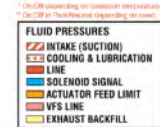
1-2-3-4-5-6 Clutch Boost Valve

123456 CLUTCH REGULATOR fluid is directed thru the 1-2-3-4-5-6 clutch boost valve and into the 123456 CLUTCH fluid circuit. 123456 CLUTCH fluid seats the ball check valve #2 and is forced thru orifice #17, #39. 123456 CLUTCH fluid is then directed to the 1-2-3-4-5-6 clutch assembly.

1-2-3-4-5-6 Clutch Assembly

123456 CLU fluid is directed to the 1-2-3-4-5-6 clutch assembly housing. 123456 CLU fluid moves the piston against spring force to apply holding of the 1-2-3-4-5-6 clutch plates.

Drive Range, First Gear



DRIVE RANGE, FIRST GEAR (HYDRAULIC CIRCUITS WITH ETRS)

Fluid Pressure Is Directed To The 1-2-3-4-5-6 Clutch Assembly

The VFS S4 solenoid is energized off. Spring pressure shifts the 4th clutch regulator valve and the mode 2 ETRS valve to allow S4 VFS SIG fluid to exhaust thru orifice #2.

DRIVE fluid is directed thru the clutch selector valve and into the DRIVE 2 fluid circuit which is directed to the 3-8 clutch regulator valve, 4th clutch regulator valve, feed limit valve, TCC regulator apply valve, latch valve, #9 ball check valve and mode 2 ETRS valve.

DRIVE 2 fluid is directed thru the latch valve and into the 1 REV/6789 LATCH fluid circuit which is directed to the #5 ball check valve.

1 REV/6789 LATCH fluid seats the #5 ball check valve against the 6789 CLUTCH fluid circuit allowing 1 REV/6789 LATCH fluid to enter the LATCH fluid circuit. LATCH fluid is directed to the clutch select valve applying pressure with the clutch select valve spring force.

DRIVE 2 fluid is directed thru orifice #65 and into the mode 2 ETRS valve applying pressure with the mode 2 ETRS valve spring force.

1-2-3-4-5-6 Clutch Applies

1-2-3-4-5-6 Solenoid

The 1-2-3-4-5-6 solenoid is de-energized allowing drive fluid to enter the 1-2-3-4-5-6 regulator valve and enter the 123456 CLUTCH REGULATOR fluid circuit. 123456 CLUTCH REGULATOR fluid is directed to the 1-2-3-4-5-6 clutch boost valve.

1-2-3-4-5-6 Clutch Boost Valve

123456 CLUTCH REGULATOR fluid is directed thru the 1-2-3-4-5-6 clutch boost valve and into the 123456 CLUTCH fluid circuit. 123456 CLUTCH fluid seats the ball check valve #2 and is forced thru orifice #17, #39. 123456 CLUTCH fluid is then directed to the 1-2-3-4-5-6 clutch assembly.

1-2-3-4-5-6 Clutch Assembly

123456 CLU fluid is directed to the 1-2-3-4-5-6 clutch assembly housing. 123456 CLU fluid moves the piston against spring force to apply holding of the 1-2-3-4-5-6 clutch plates.

Drive Range, First Gear

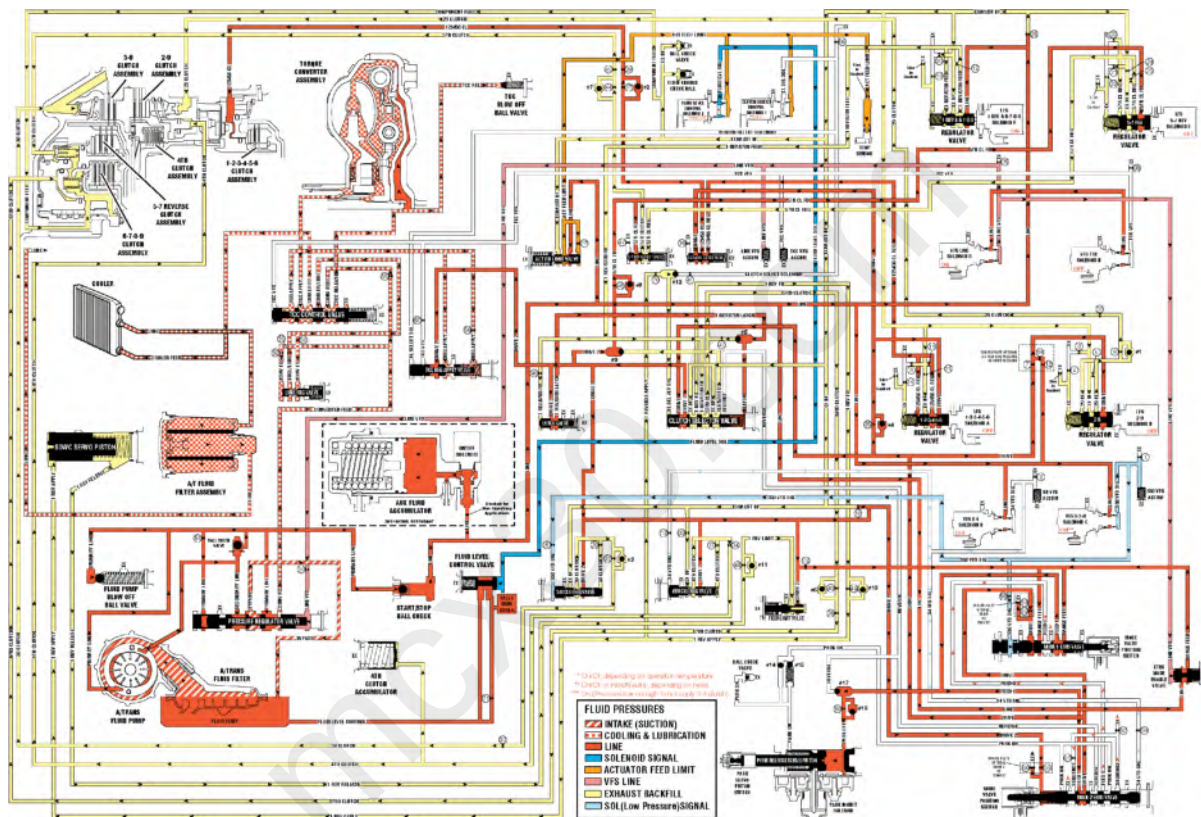


Fig. 25: Drive Range, First Gear Hydraulic Diagram (With ETRS).
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIRST GEAR (MECHANICAL POWERFLOW)

In Drive Range (D) - First Gear, torque from the engine is multiplied through the torque converter and transmission gear sets to the vehicle's drive axles. The planetary gear sets operate in reduction to achieve a First gear starting ratio of 4.689:1.

1. Power From The Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Turbine Shaft Driven

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driving

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. Input Carrier Assembly Driven

The input carrier assembly pinions walk around the input internal gear (overdrive carrier) (546) and drive the input carrier assembly (552).

5. 1-2-3-4-5-6 Clutch Assembly Applied

The 1-2-3-4-5-6 clutch plates (591-600), splined to the output sun gear (522) and the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590), are applied and hold the output sun gear (522) stationary.

6. Output Sun Gear Held

With the 1-2-3-4-5-6 clutch applied, the output sun gear (522) is held stationary to the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590).

7. Output Carrier Assembly Driven

The output internal gear (input carrier assembly) (552) drives the output carrier assembly pinions, which then drive the output carrier assembly (555) around the stationary output sun gear (522).

8. 1-reverse and 1-2-3-4-5-6 clutch piston Holding

The input carrier assembly (552) pinion gears attempt to drive the overdrive carrier (546) in the direction opposite of engine rotation, but the carrier is held stationary by the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590). When the throttle is released, however, the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590) will overrun, allowing the vehicle to coast, at least briefly, until the TCM determines that engine braking is required. At that time, the 1-reverse and 1-2-3-4-5-6 clutch piston will apply and hold the 1-reverse and 1-2-3-4-5-6 clutch piston housing inner race.

9. Overdrive Carrier Held

The overdrive carrier (546) is held by the 1- Reverse and 1-2-3-4-5-6 Clutch Piston housing (590).

10. Output Carrier Transfer Drive Gear Hub Driven

The output carrier transfer drive gear hub (502) is splined to, and driven by, the output carrier assembly (555).

11. Drive Sprocket Driving

The drive sprocket (234), splined to and driven by the output carrier transfer drive gear hub (502), drives the drive link (233) which drives the driven sprocket (241).

12. Driven Sprocket Driven

The driven sprocket (241), driven by the drive link (233), is splined to the front differential carrier sun gear (240).

13. Front Differential Carrier Sun Gear Driving

The front differential carrier sun gear (240), is in mesh with, and drives, the front differential carrier (238), thus transferring power to the front differential carrier and to the drive axles.

Drive Range, First Gear

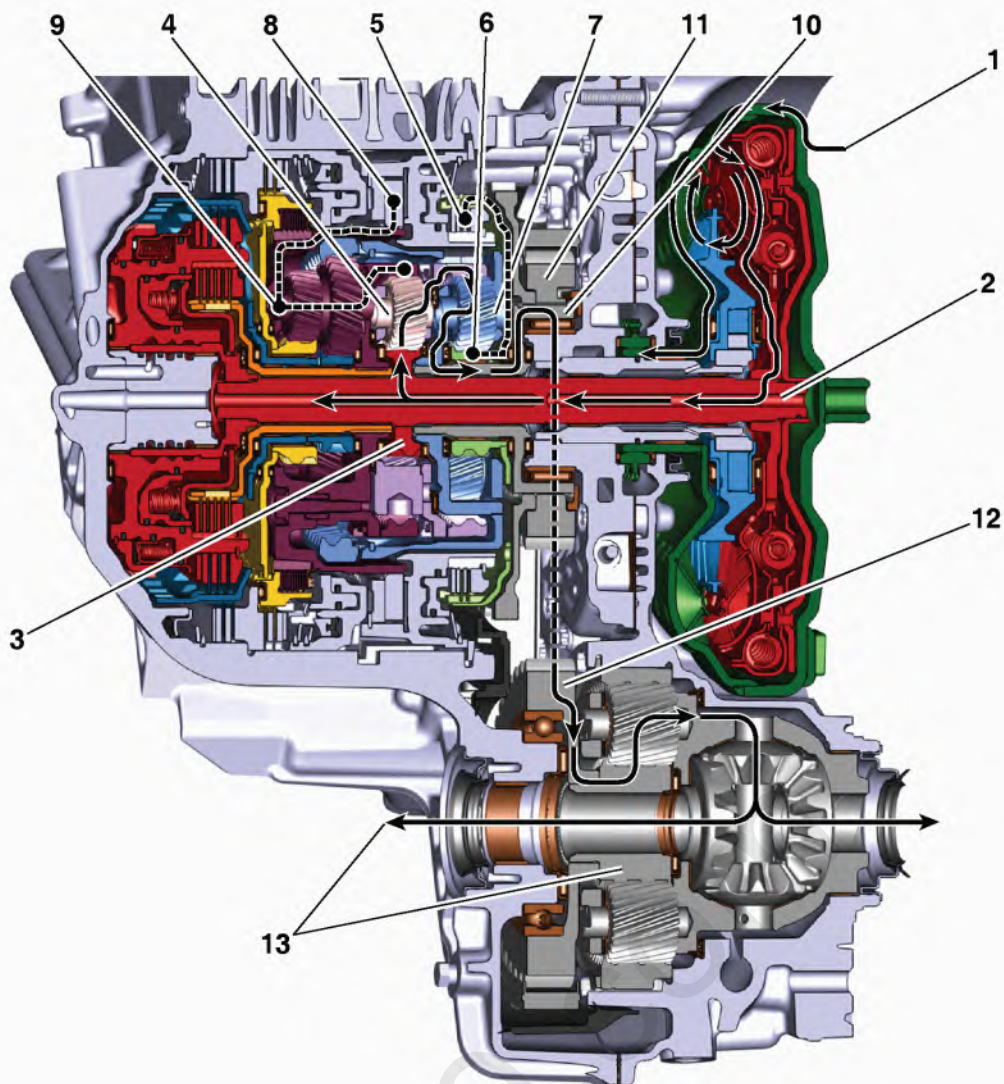


Fig. 26: Drive Range, First Gear Mechanical Powerflow Diagram

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SECOND GEAR (HYDRAULIC CIRCUITS WITHOUT ETRS)

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 2-9 solenoid.

2-9 Clutch Applies

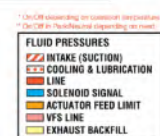
2-9 Solenoid

The 2-9 solenoid energizes allowing drive fluid to enter the 2-9 regulator valve and enter the 2-9 CLUTCH fluid circuit. 2-9 CLUTCH fluid seats ball check valve #1 then is forced thru orifice #9 and #32 to the 2-9 clutch assembly.

2-9 Clutch Assembly

29 CLUTCH fluid is directed to the 2-9 clutch assembly housing. 29 CLUTCH fluid moves the piston against spring force to apply holding of the 2-9 clutch plates.

Drive Range, Second Gear



Courtesy of GENERAL MOTORS COMPANY

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 2-9 solenoid.

2-9 Solenoid

The 2-9 solenoid energizes allowing drive fluid to enter the 2-9 regulator valve and enter the 2-9 CLUTCH fluid circuit. 2-9 CLUTCH fluid seats ball check valve #1 then is forced thru orifice #9 and #32 to the 2-9 clutch assembly.

29 CLUTCH fluid is directed to the 2-9 clutch assembly housing. 29 CLUTCH fluid moves the piston against spring force to apply holding of the 2-9 clutch plates.

Drive Range, Second Gear

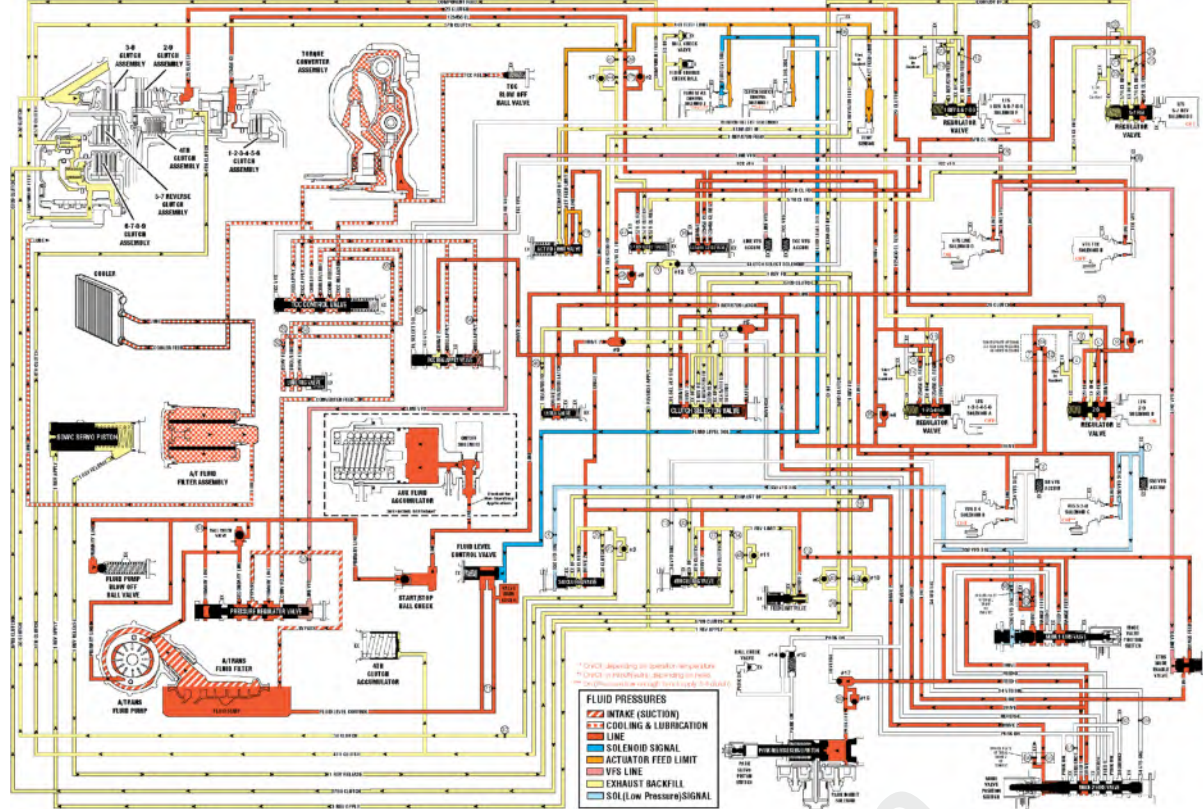


Fig. 28: Drive Range, Second Gear Hydraulic Diagram (With ETRS).

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SECOND GEAR (MECHANICAL POWERFLOW)

As vehicle speed increases, input signals from the transmission speed sensors (input and output), throttle position (TP) sensor, and other vehicle sensors are sent to the transmission control module (TCM). The TCM processes this information to determine the precise moment to shift the transmission into Second gear. In Second gear, the planetary gear sets continue to operate in reduction at a gear ratio of 3.306:1.

1. Power From The Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Turbine Shaft Driven

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driving

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. Input Carrier Assembly Driven

The input carrier assembly pinions walk around the input internal gear (overdrive carrier) (546) and drive the input carrier assembly (552).

5. Output Carrier Assembly Driven

The output internal gear (input carrier assembly) (552) drives the output carrier assembly pinions, which then drive the output carrier assembly (555) around the stationary output sun gear (522).

6. 2-9 Clutch Assembly Applied

The 2-9 clutch plates (517-519), splined to the 2-9 and 4th clutch hub (619) and the 2-9 and 4th clutch piston housing (520), are applied and hold the 2-9 and 4th clutch hub (619) stationary.

7. Overdrive Carrier Driven

The overdrive internal gear (output carrier assembly) (555), drives the overdrive carrier (546) large pinion gears. The overdrive carrier (546) small pinion is also driven around the 2-9 and 4th clutch hub (539) by the input carrier assembly (552) pinion gears in mesh with the input internal gear, to provide reduction through the gearsets.

8. 1-2-3-4-5-6 Clutch Assembly Applied

The 1-2-3-4-5-6 clutch plates (591-600), splined to the output sun gear (522) and the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590), are applied and hold the output sun gear (522) stationary.

9. Output Sun Gear Held

With the 1-2-3-4-5-6 clutch applied, the output sun gear (522) is held stationary to the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590).

10. Output Carrier Transfer Drive Gear Hub Driven

The output carrier transfer drive gear hub (502) is splined to, and driven by, the output carrier assembly (555).

11. Drive Sprocket Driving

The drive sprocket (234), splined to and driven by the output carrier transfer drive gear hub (502), drives the drive link (233) which drives the driven sprocket (241).

12. Driven Sprocket Driven

The driven sprocket (241), driven by the drive link (233), is splined to the front differential carrier sun gear (240).

13. Front Differential Carrier Sun Gear Driving

The front differential carrier sun gear (240), is in mesh with, and drives, the front differential carrier (238), thus transferring power to the front differential carrier and to the drive axles.

Drive Range, Second Gear

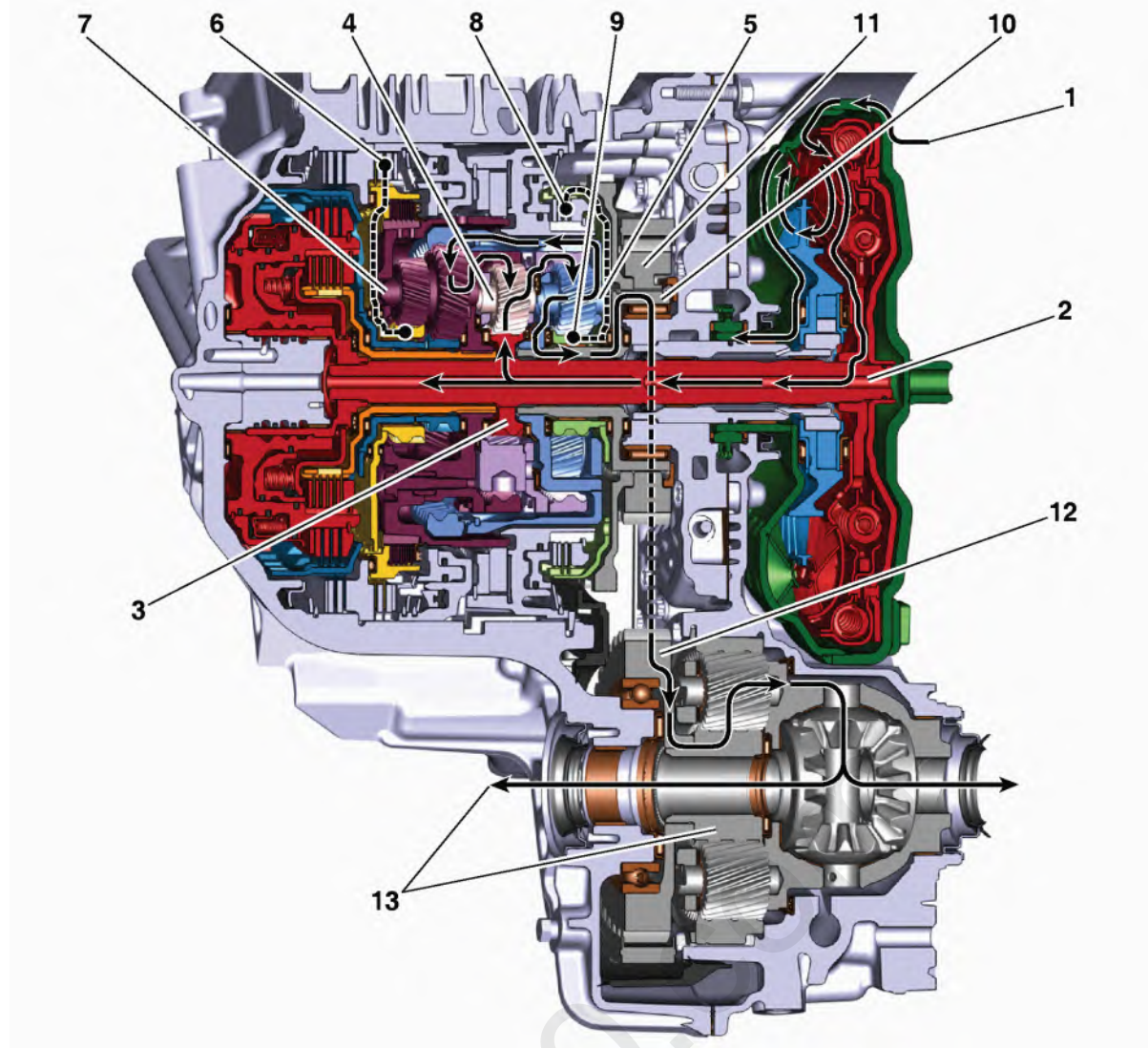


Fig. 29: Drive Range, Second Gear Mechanical Powerflow Diagram

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, THIRD GEAR (HYDRAULIC CIRCUITS WITHOUT ETRS)

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 2-9 solenoid. At the same time the S3-8 solenoid is also commanded ON to regulate 3-8 clutch apply.

3-8 Clutch Applies

S3-8 Solenoid

The S3-8 solenoid is energized allowing line fluid to enter the S38 VFS SIG fluid circuit. S38 VFS SIG fluid is directed to the 3-8 clutch regulator valve.

3-8 Clutch Regulator Valve

S38 VFS SIG fluid is directed thru orifice #5 and into the 3-8 clutch regulator valve where it applies pressure against the 3-8 clutch regulator valve spring force. This allows DRIVE 2 fluid to enter the 38 CLUTCH fluid circuit. 38 CLUTCH fluid seats ball check valve #3 then is forced thru orifice #31 and #30 to the 3-8 clutch assembly.

3-8 Clutch Assembly

38 CLUTCH fluid is directed to the 3-8 clutch assembly. 3-8 CLUTCH fluid moves the piston against spring force to apply holding of the 3-8 clutch plates.

2-9 Clutch Releases

2-9 Solenoid

2-9 Solenoid

The 2-9 solenoid is energized off allowing 29 CLUTCH fluid to exhaust. Spring pressure shifts the valve to allow 29 CLUTCH fluid to exhaust into EX BACKFILL from the 2-9 clutch assembly.

2-9 Clutch Assembly

The 2-9 clutch is released allowing 29 CLUTCH fluid to exhaust thru the 2-9 solenoid.

Drive Range, Third Gear

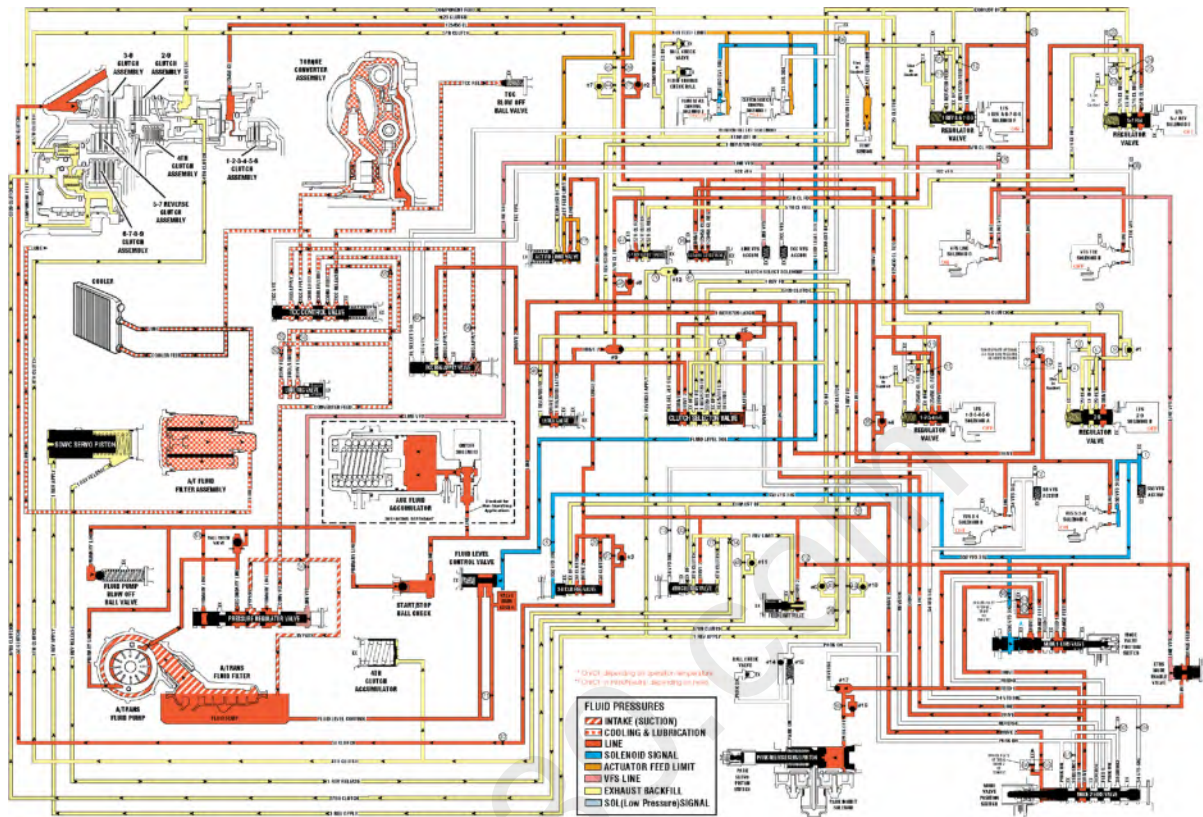


Fig. 31: Drive Range, Third Gear Hydraulic Diagram (With ETRS).
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, THIRD GEAR (MECHANICAL POWERFLOW)

As vehicle speed increases, input signals from the transmission speed sensors (input and output), throttle position (TP) sensor, and other vehicle sensors are sent to the transmission control module (TCM). The TCM processes this information to determine the precise moment to shift the transmission into Third gear. In Third gear, the planetary gear sets continue to operate in reduction at a gear ratio of 3.012:1.

1. Power From The Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Turbine Shaft Driven

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driving

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. Input Carrier Assembly Driven

The input carrier assembly pinions walk around the input internal gear (overdrive carrier) (546) and drive the input carrier assembly (552).

5. Output Carrier Assembly Driven

The output internal gear (input carrier assembly) (552) drives the output carrier assembly pinions, which then drive the output carrier assembly (555) around the stationary output sun gear (522).

6. 3-8 Clutch Assembly Applied

The 3-8 clutch plates (510-514, 535, 536), splined to the 3-8 and 5-7-reverse clutch hub (534) and the transmission case (19), are applied and hold the 3-8 and 5-7-reverse clutch hub (534) stationary.

7. Overdrive Carrier Driven

The overdrive internal gear (output carrier assembly) (555), drives the overdrive carrier (546) large pinion gears. The overdrive carrier (546) large pinion is also driven around the 3-8 and 5-7-reverse clutch hub (534) by the input carrier assembly (552) pinion gears in mesh with the input internal gear, to provide reduction through the gearsets.

8. 1-2-3-4-5-6 Clutch Assembly Applied

The 1-2-3-4-5-6 clutch plates (591-600), splined to the output sun gear (522) and the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590), are applied and hold the output sun gear (522) stationary.

9. Output Sun Gear Held

With the 1-2-3-4-5-6 clutch applied, the output sun gear (522) is held stationary to the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590).

10. Output Carrier Transfer Drive Gear Hub Driven

The output carrier transfer drive gear hub (502) is splined to, and driven by, the output carrier assembly (555).

11. Drive Sprocket Driving

The drive sprocket (234), splined to and driven by the output carrier transfer drive gear hub (502), drives the drive link (233) which drives the driven sprocket (241).

12. Driven Sprocket Driven

The driven sprocket (241), driven by the drive link (233), is splined to the front differential carrier sun gear (240).

13. Front Differential Carrier Sun Gear Driving

The front differential carrier sun gear (240), is in mesh with, and drives, the front differential carrier (238), thus transferring power to the front differential carrier and to the drive axles.

Drive Range, Third Gear

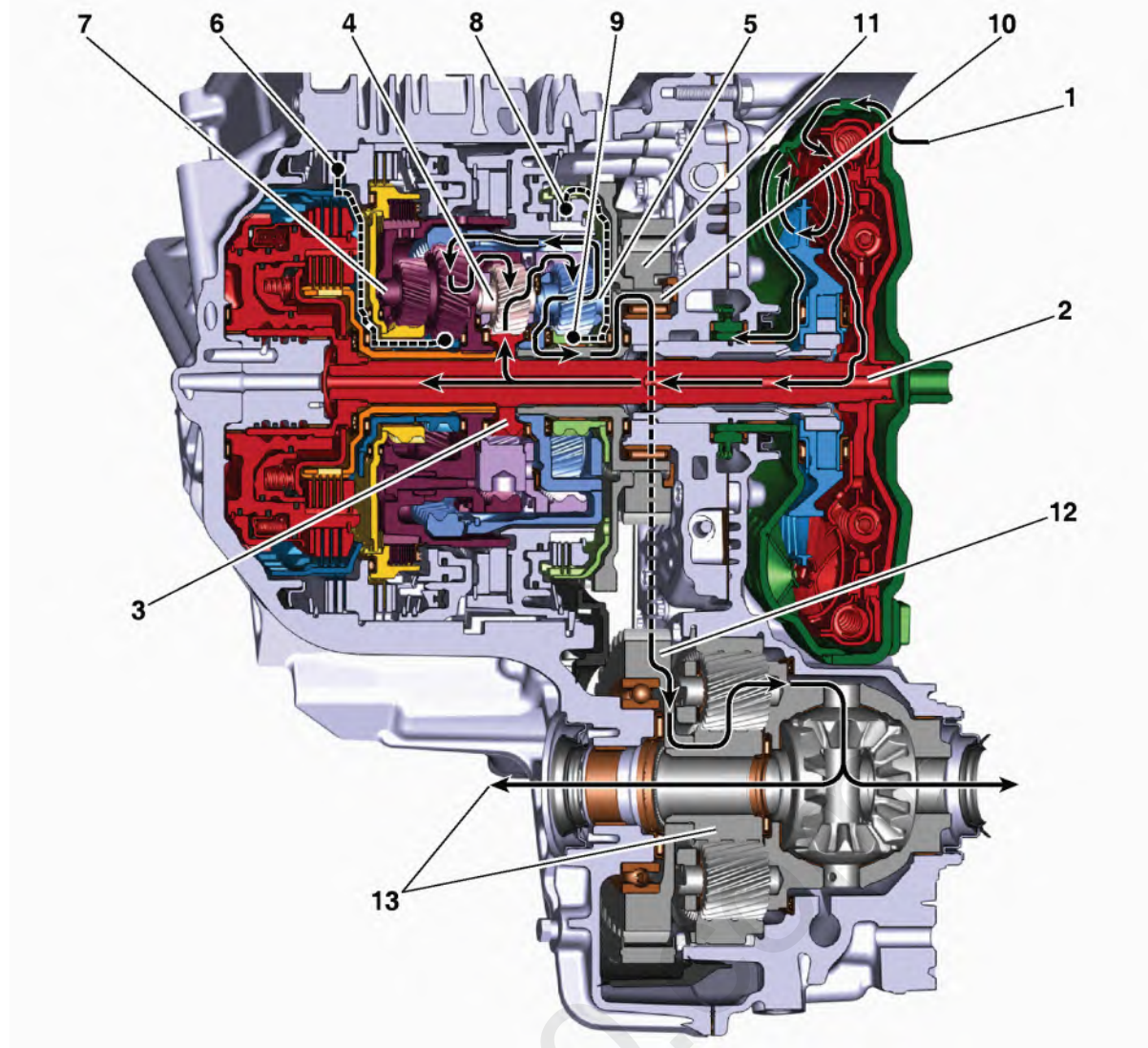


Fig. 32: Drive Range, Third Gear Mechanical Powerflow Diagram
 Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FOURTH GEAR (HYDRAULIC CIRCUITS WITHOUT ETRS)

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 S38 solenoid. At the same time the S4 solenoid is commanded ON to regulate 4th clutch apply.

4th Clutch Applies

S4 Solenoid

The S4 solenoid is energized allowing line fluid to enter the S4 VFS SIG fluid circuit. S4 VFS SIG fluid is directed to the 4th clutch regulator valve.

4th Clutch Regulator Valve

S4 VFS SIG fluid is directed thru orifice #13 and into the 4th clutch regulator valve where it applies pressure against the 4th clutch regulator valve spring force. This allows DRIVE 2 fluid to enter the 4TH CLUTCH fluid circuit. 4TH CLUTCH fluid is directed thru orifice #34 and to the 4th clutch accumulator and 4th clutch assembly.

4th Clutch Accumulator

4TH CLUTCH fluid is directed thru orifice #34 and into the 4th clutch accumulator where it applies pressure against the 4th clutch accumulator spring force.

4th Clutch Assembly

S4 VFS SIG fluid is directed thru orifice #13 and into the 4th clutch regulator valve where it applies pressure against the 4th clutch regulator valve spring force. This allows DRIVE 2 fluid to enter the 4TH CLUTCH fluid circuit. 4TH CLUTCH fluid is directed thru orifice #34 and to the 4th clutch accumulator and 4th clutch assembly.

4th Clutch Accumulator

4TH CLUTCH fluid is directed thru orifice #34 and into the 4th clutch accumulator where it applies pressure against the 4th clutch accumulator spring force.

4th Clutch Assembly

4TH CLUTCH fluid is directed to the 4th clutch assembly. 4TH CLUTCH fluid moves the piston against spring force to apply holding of the 4th clutch plates.

3-8 Clutch Releases

VFS S3-8 Solenoid

The S3-8 solenoid is commanded to low pressure allowing the 3-8 clutch regulator valve to shift enough to prevent pressurized DRIVE 2 fluid from entering the 38 CLUTCH fluid passage and engaging the 3-8 clutch.

3-8 Clutch Assembly

The 3-8 clutch is released allowing 38 CLUTCH fluid to exhaust thru the 3-8 clutch regulator valve.

Drive Range, Fourth Gear

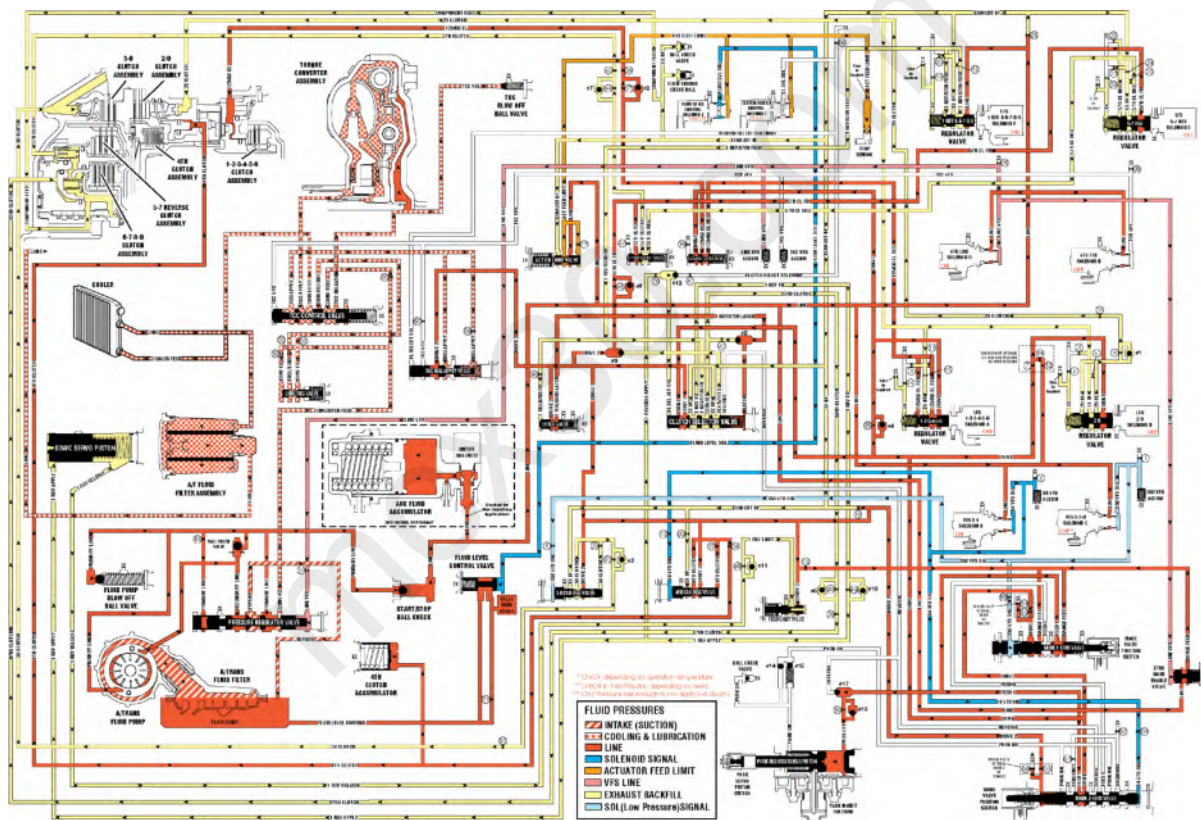


Fig. 34: Drive Range, Fourth Gear Hydraulic Diagram (With ETRS)

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FOURTH GEAR (MECHANICAL POWERFLOW)

As vehicle speed increases, input signals from the transmission speed sensors (input and output), throttle position (TP) sensor, and other vehicle sensors are sent to the transmission control module (TCM). The TCM processes this information to determine the precise moment to shift the transmission into Fourth gear. In Fourth gear, the planetary gear sets continue to operate in reduction at a gear ratio of 2.446:1.

1. Power From The Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Turbine Shaft Driven

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driving

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. Input Carrier Assembly Driven

The input carrier assembly pinions walk around the input internal gear (overdrive carrier) (546) and drive the input carrier assembly (552).

5. Output Carrier Assembly Driven

The output internal gear (input carrier assembly) (552) drives the output carrier assembly pinions, which then drive the output carrier assembly (555) around the stationary output sun gear (522).

6. 4th Clutch Assembly Applied

The 4th clutch plates (620-622), splined to the overdrive carrier (546) and the 2-9 and 4th clutch hub (619), are applied and hold the overdrive carrier (546) which rotate at the same speed and direction.

7. Overdrive Carrier Driven

The overdrive internal gear (output carrier assembly) (555), drives the overdrive carrier (546) large pinion gears. The overdrive carrier (546) with the 2-9 and 4th clutch hub (539) is also driven by the input carrier assembly (552) pinion gears in mesh with the input internal gear, to provide reduction through the gearsets.

8. 1-2-3-4-5-6 Clutch Assembly Applied

The 1-2-3-4-5-6 clutch plates (591-600), splined to the output sun gear (522) and the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590), are applied and hold the output sun gear (522) stationary.

9. Output Sun Gear Held

With the 1-2-3-4-5-6 clutch applied, the output sun gear (522) is held stationary to the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590).

10. Output Carrier Transfer Drive Gear Hub Driven

The output carrier transfer drive gear hub (502) is splined to, and driven by, the output carrier assembly (555).

11. Drive Sprocket Driving

The drive sprocket (234), splined to and driven by the output carrier transfer drive gear hub (502), drives the drive link (233) which drives the driven sprocket (241).

12. Driven Sprocket Driven

The driven sprocket (241), driven by the drive link (233), is splined to the front differential carrier sun gear (240).

13. Front Differential Carrier Sun Gear Driving

The front differential carrier sun gear (240), is in mesh with, and drives, the front differential carrier (238), thus transferring power to the front differential carrier and to the drive axles.

Drive Range, Fourth Gear

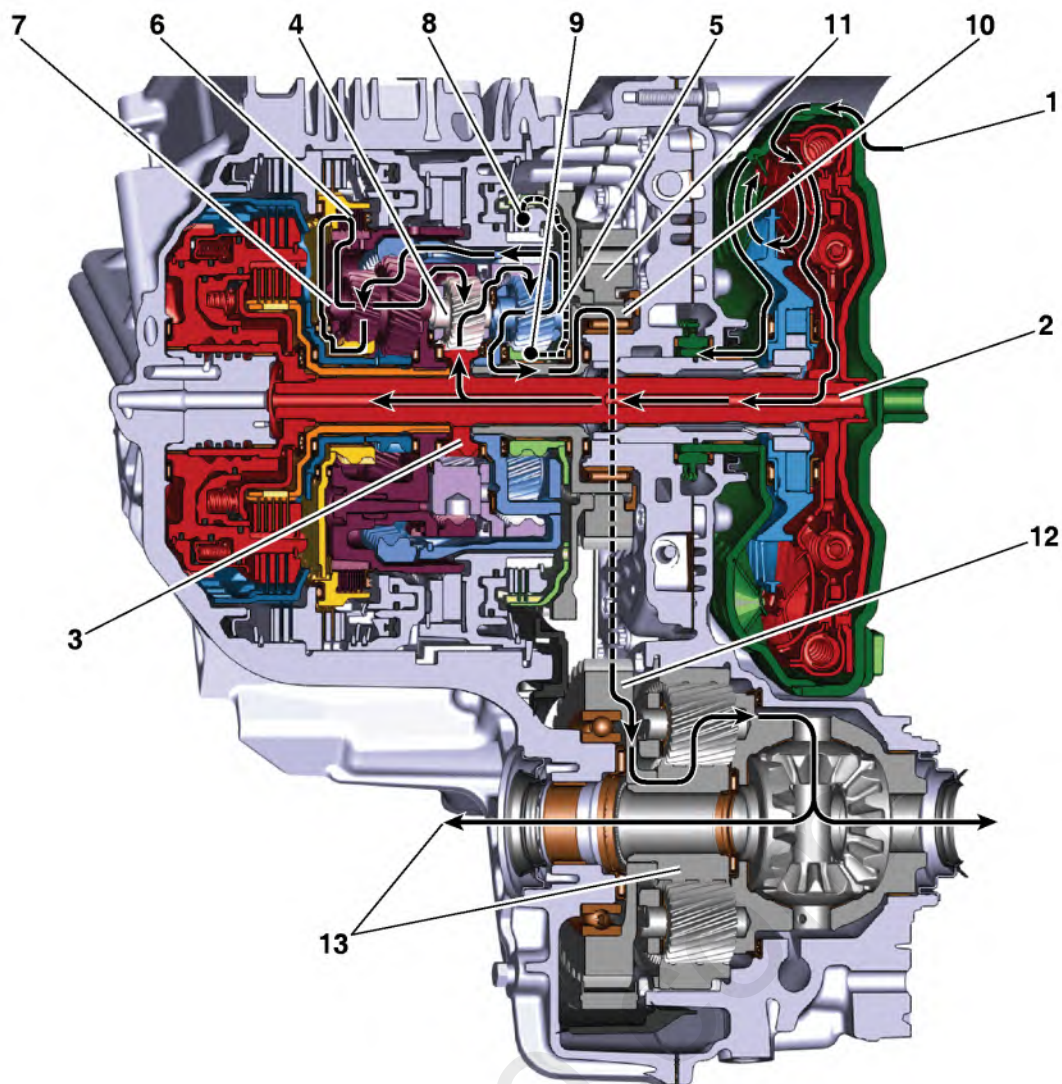


Fig. 35: Drive Range, Fourth Gear Mechanical Powerflow Diagram
 Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIFTH GEAR (HYDRAULIC CIRCUITS WITHOUT ETRS)

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 5-7 reverse solenoid. At the same time the S4 solenoid is commanded OFF.

5-7 Reverse Clutch Applies

5-7 Reverse Solenoid

The 5-7 reverse solenoid energizes applying pressure against the 5-7 reverse regulator valve spring force. This allows 57R CLUTCH FEED fluid to enter the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid is routed to the 5-7 reverse clutch boost valve.

5-7 Reverse Clutch Boost Valve

57R CLUTCH REGULATOR fluid is routed to the 5-7 reverse clutch boost valve and into the 57R CLUTCH fluid circuit. 57R CLUTCH fluid seats ball check valve #7 and is forced thru orifice #44 and #45 to the 5-7 reverse clutch assembly.

5-7 Reverse Clutch Assembly

57R CLUTCH fluid is directed into the 5-7 rev clutch piston spring force which applies holding force to the 5-7 rev clutch plates.

4th Clutch Releases

S4 Solenoid

S4 Solenoid

The S4 solenoid is energized off allowing S4 VFS SIG fluid to exhaust thru orifice #2. Spring pressure shifts the 4th clutch regulator valve to allow 4TH CLUTCH fluid to exhaust into EX BACKFILL from the 4th clutch assembly.

4th Clutch Assembly

The 4th clutch is released allowing 4TH CLUTCH fluid to exhaust thru the 4th clutch regulator valve.

Drive Range, Fifth Gear

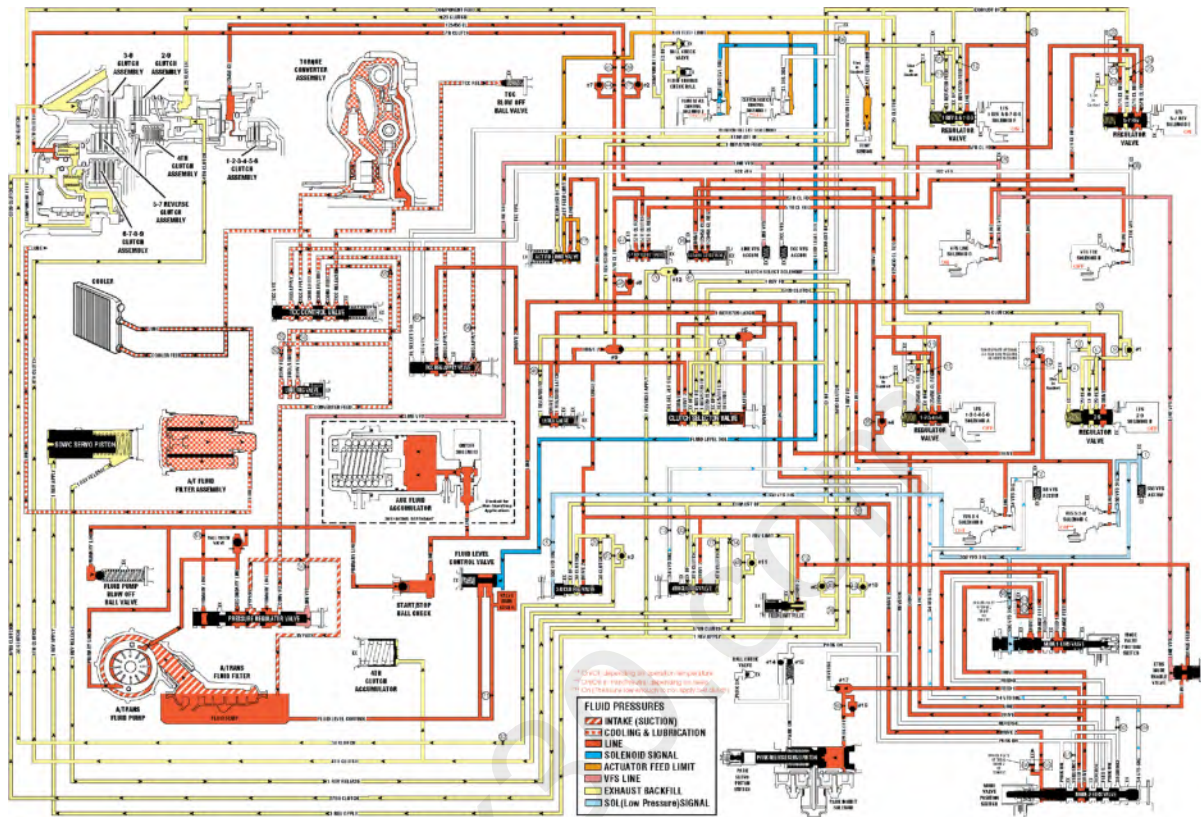


Fig. 37: Drive Range, Fifth Gear Hydraulic Diagram (With ETRS)

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIFTH GEAR (MECHANICAL POWERFLOW)

As vehicle speed increases, input signals from the transmission speed sensors (input and output), throttle position (TP) sensor, and other vehicle sensors are sent to the transmission control module (TCM). The TCM processes this information to determine the precise moment to shift the transmission into Fifth gear. In Fifth gear, the planetary gear sets continue to operate in reduction at a gear ratio of 1.923:1.

1. Power From The Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Turbine Shaft Driven

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driving

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. Input Carrier Assembly Driven

The input carrier assembly (552) pinions walk around the input internal gear (overdrive carrier) (546) and drive the input carrier assembly (552).

5. Output Carrier Assembly Driven

The output internal gear (input carrier assembly) (552) drives the output carrier assembly pinions, which then drive the output carrier assembly (555) around the stationary output sun gear (522).

6. 5-7-Reverse Clutch Assembly Applied

The 5-7-reverse clutch plates (578-582), splined to the 5-7-reverse and 6-7-8-9 clutch housing (530) and the 3-8 and 5-7-reverse clutch hub (534), are applied and drive the 3-8 and 5-7-reverse clutch hub (534).

7. Overdrive Carrier Driving

The 3-8 and 5-7-reverse clutch hub (534) is meshed with and drives the overdrive carrier (546). The overdrive carrier (546) large pinion gears are driven around the overdrive internal gear (output carrier assembly) (555), to provide reduction through the gearsets.

8. 1-2-3-4-5-6 Clutch Assembly Applied

The 1-2-3-4-5-6 clutch plates (591-600), splined to the output sun gear (522) and the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590), are applied and hold the output sun gear (522) stationary.

9. Output Sun Gear Held

With the 1-2-3-4-5-6 clutch applied, the output sun gear (522) is held stationary to the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590).

10. Output Carrier Transfer Drive Gear Hub Driven

The output carrier transfer drive gear hub (502) is splined to, and driven by, the output carrier assembly (555).

11. Drive Sprocket Driving

The drive sprocket (234), splined to and driven by the output carrier transfer drive gear hub (502), drives the drive link (233) which drives the driven sprocket (241).

12. Driven Sprocket Driven

The driven sprocket (241), driven by the drive link (233), is splined to the front differential carrier sun gear (240).

13. Front Differential Carrier Sun Gear Driving

The front differential carrier sun gear (240), is in mesh with, and drives, the front differential carrier (238), thus transferring power to the front differential carrier and to the drive axles.

Drive Range, Fifth Gear

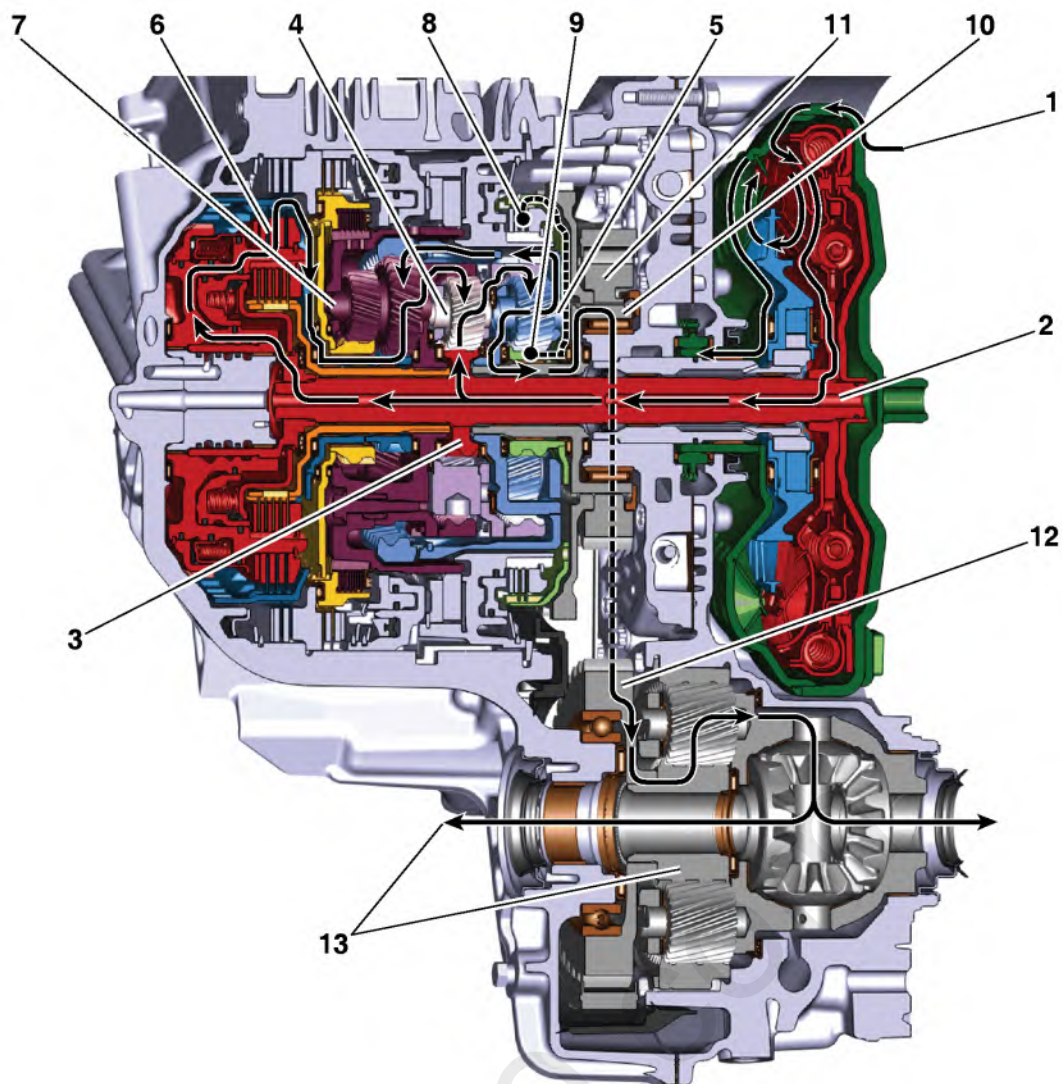


Fig. 38: Drive Range, Fifth Gear Mechanical Powerflow Diagram
 Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SIXTH GEAR (HYDRAULIC CIRCUITS WITHOUT ETRS)

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 1 rev & 6789 solenoid. At the same time the 5-7 reverse solenoid is commanded OFF.

1 Reverse & 6-7-8-9 Clutch Applies

1 Reverse & 6-7-8-9 Solenoid

The 1 reverse & 6-7-8-9 solenoid de-energizes releasing pressure against the 1 reverse & 6-7-8-9 regulator valve spring force. This allows LINE fluid to enter the 1 REV/6789 FEED fluid circuit. 1 REV/6789 FEED fluid is routed thru orifice #40 to the latch valve and to the clutch select valve.

Latch Valve

1 REV/6789 FEED fluid is directed into the latch valve applying pressure against the latch valve spring force. This blocks DRIVE 2 fluid from entering 1 REV/6789 LATCH fluid circuit.

Clutch Select Valve

1 REV/6789 FEED fluid is routed thru the clutch select valve into the 6789 CLUTCH fluid circuit. 6789 CLUTCH fluid is directed thru orifice #42 and to ball check valve #5 and the 6789 clutch assembly.

#5 Ball Check Valve

6789 clutch fluid seats the #5 ball check valve against the 1 REV/6789 LATCH fluid circuit allowing 1 REV/6789 FD fluid to enter the LATCH fluid circuit. LATCH fluid is directed to the clutch select valve

applying pressure with the clutch select valve spring force.

6-7-8-9 Clutch Assembly

6789 CLUTCH fluid seats ball check valve #6 then forced thru orifice #43 and #36 to the 6-7-8-9 clutch assembly. 6789 CLUTCH fluid is directed into the 6-7-8-9 clutch piston spring force which applies holding force to the 6-7-8-9 clutch plates.

5-7 Reverse Clutch Releases

5-7 Reverse Solenoid

The 5-7 reverse solenoid de-energizes releasing pressure against the 5-7 reverse regulator valve spring force. This blocks 57R CLUTCH FEED fluid from entering the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid is exhausted thru orifice #25 and #24 into the EX BACKFILL fluid circuit and thru orifice #21 into the EXHAUST fluid circuit.

5-7 Reverse Clutch Assembly

The 5-7 reverse clutch is released allowing 57R CLUTCH fluid to exhaust thru orifice #45 and #44 to the 5-7 clutch boost valve into the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid continues thru orifice #22 into the EXHAUST fluid circuit.

Torque Converter Clutch (TCC) Applies

Torque Converter Clutch (TCC) Solenoid

The TCC solenoid is commanded ON, allowing LINE fluid to enter the TCC VFS fluid circuit. TCC VFS fluid is directed to the TCC VFS accumulator and thru orifice #57 to the TCC regulator apply valve and to the TCC control valve.

TCC Regulator Apply Valve

TCC VFS fluid, at the TCC regulator apply valve, opposes TCC regulator apply valve spring force and orificed regulated apply fluid pressure to regulate DRIVE 2 fluid into the REGULATED APPLY fluid circuit. REGULATED APPLY fluid is routed to the TCC control valve and through orifice #56 to the spring end of the TCC regulator apply valve.

TCC Control Valve

TCC VFS fluid moves the TCC control valve against TCC control valve spring force, allowing REGULATED APPLY fluid to pass through the valve into the TCC APPLY fluid circuit and apply the torque converter clutch. TCC release fluid passes through the TCC control valve and is exhausted.

Drive Range, Sixth Gear

6789 CLUTCH fluid seats ball check valve #6 then forced thru orifice #43 and #36 to the 6-7-8-9 clutch assembly. 6789 CLUTCH fluid is directed into the 6-7-8-9 clutch piston spring force which applies holding force to the 6-7-8-9 clutch plates.

5-7 Reverse Solenoid

The 5-7 reverse solenoid de-energizes releasing pressure against the 5-7 reverse regulator valve spring force. This blocks 57R CLUTCH FEED fluid from entering the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid is exhausted thru orifice #25 and #24 into the EX BACKFILL fluid circuit and thru orifice #21 into the EXHAUST fluid circuit.

5-7 Reverse Clutch Assembly

The 5-7 reverse clutch is released allowing 57R CLUTCH fluid to exhaust thru orifice #45 and #44 to the 5-7 clutch boost valve into the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid continues thru orifice #22 into the EXHAUST fluid circuit.

Torque Converter Clutch (TCC) Applies

Torque Converter Clutch (TCC) Solenoid

The TCC solenoid is commanded ON, allowing LINE fluid to enter the TCC VFS fluid circuit. TCC VFS fluid is directed to the TCC VFS accumulator and thru orifice #57 to the TCC regulator apply valve and to the TCC control valve.

TCC Regulator Apply Valve

TCC VFS fluid, at the TCC regulator apply valve, opposes TCC regulator apply valve spring force and orificed regulated apply fluid pressure to regulate DRIVE 2 fluid into the REGULATED APPLY fluid circuit. REGULATED APPLY fluid is routed to the TCC control valve and through orifice #56 to the spring end of the TCC regulator apply valve.

TCC Control Valve

TCC VFS fluid moves the TCC control valve against TCC control valve spring force, allowing REGULATED APPLY fluid to pass through the valve into the TCC APPLY fluid circuit and apply the torque converter clutch. TCC release fluid passes through the TCC control valve and is exhausted.

Drive Range, Sixth Gear

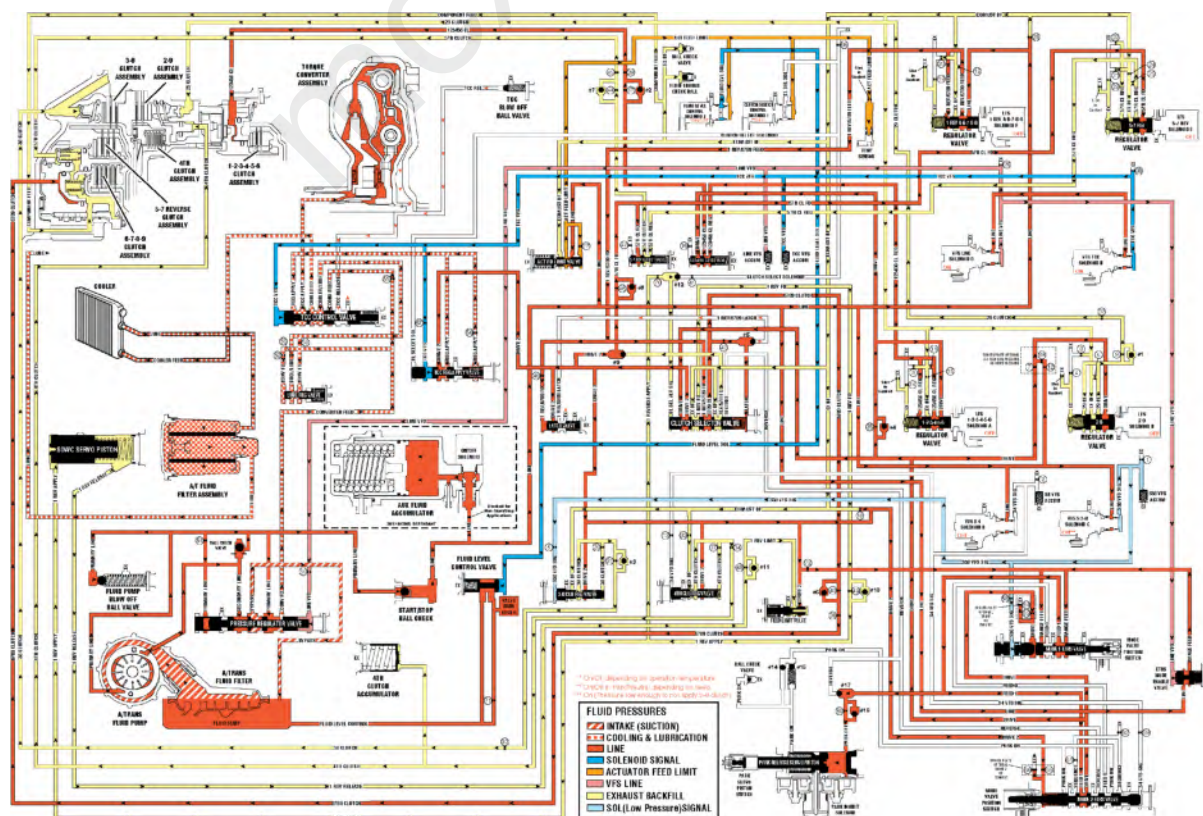


Fig. 40: Drive Range, Sixth Gear Hydraulic Diagram (With ETRS)

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SIXTH GEAR (MECHANICAL POWERFLOW)

As vehicle speed increases, input signals from the transmission speed sensors (input and output), throttle position (TP) sensor, and other vehicle sensors are sent to the transmission control module (TCM). The TCM processes this information to determine the precise moment to shift the transmission into Sixth gear. In Sixth gear, the planetary gear sets continue to operate in reduction at a gear ratio of 1.446:1.

1. Power From The Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Turbine Shaft Driven

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driving

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. Input Carrier Assembly Driven

The input carrier assembly (552) pinions walk around the input internal gear (overdrive carrier) (546) and drive the input carrier assembly (552).

5. Output Carrier Assembly Driven

The output internal gear (input carrier assembly) (552) drives the output carrier assembly pinions, which then drive the output carrier assembly (555) around the stationary output sun gear (522).

6. 6-7-8-9 Clutch Assembly Applied

The 6-7-8-9 clutch plates (570-577), splined to the 5-7-reverse and 6-7-8-9 clutch housing (530) and the reaction carrier hub (532), are applied and drive the reaction carrier hub (532).

7. Overdrive Carrier Driving

The 3-8 and 5-7-reverse clutch hub (534) is splined to and drives the overdrive carrier (546). The overdrive carrier (546) large pinion gears are driven around the overdrive internal gear (output carrier assembly) (555), to provide reduction through the gearsets.

8. 1-2-3-4-5-6 Clutch Assembly Applied

The 1-2-3-4-5-6 clutch plates (591-600), splined to the output sun gear (522) and the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590), are applied and hold the output sun gear (522) stationary.

9. Output Sun Gear Held

With the 1-2-3-4-5-6 clutch applied, the output sun gear (522) is held stationary to the 1-reverse and 1-2-3-4-5-6 clutch piston housing (590).

10. Output Carrier Transfer Drive Gear Hub Driven

The output carrier transfer drive gear hub (502) is splined to, and driven by, the output carrier assembly (555).

11. Drive Sprocket Driving

The drive sprocket (234), splined to and driven by the output carrier transfer drive gear hub (502), drives the drive link (233) which drives the driven sprocket (241).

12. Driven Sprocket Driven

The driven sprocket (241), driven by the drive link (233), is splined to the front differential carrier sun gear (240).

13. Front Differential Carrier Sun Gear Driving

The front differential carrier sun gear (240), is in mesh with, and drives, the front differential carrier (238), thus transferring power to the front differential carrier and to the drive axles.

Drive Range, Sixth Gear

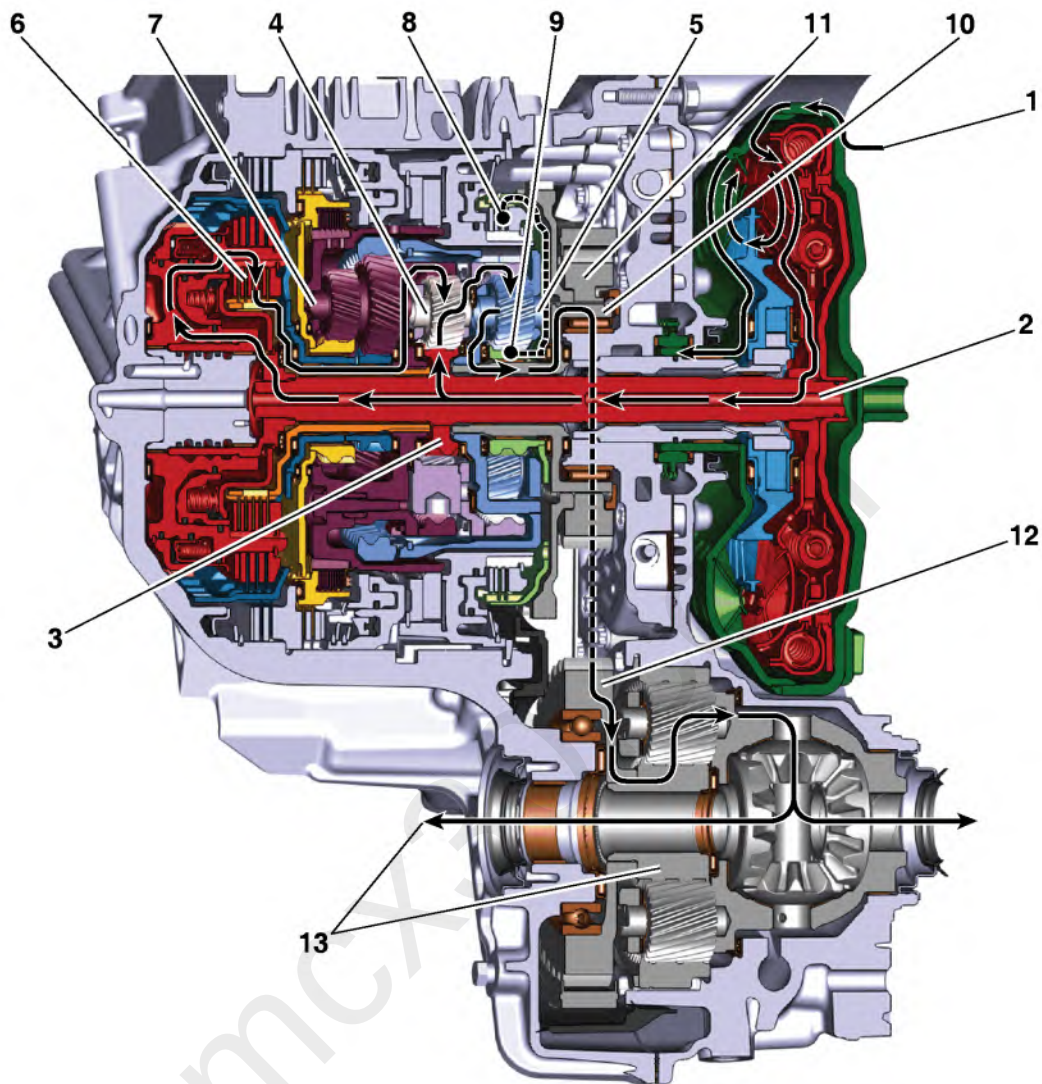


Fig. 41: Drive Range, Sixth Gear Mechanical Powerflow Diagram

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SEVENTH GEAR (HYDRAULIC CIRCUITS WITHOUT ETRS)

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 5-7 reverse solenoid. At the same time the 1-2-3-4-5-6 solenoid is commanded ON.

5-7 Reverse Clutch Applies

5-7 Reverse Solenoid

The 5-7 reverse solenoid energizes applying pressure against the 5-7 reverse regulator valve spring force. This allows 57R CLUTCH FEED fluid to enter the 57R CLUTCH REGULATOR fluid circuit. 57R CLUTCH REGULATOR fluid is routed to the 5-7 reverse clutch boost valve.

5-7 Reverse Clutch Boost Valve

57R CLUTCH REGULATOR fluid is routed to the 5-7 reverse clutch boost valve and into the 57R CLUTCH fluid circuit. 57R CLUTCH fluid seats ball check valve #7 and is forced thru orifice #44 and

The 5-7 reverse solenoid energizes applying pressure against the 5-7 reverse regulator valve spring force. This allows 57R CLUTCH FEED fluid to enter the 57R CLUTCH REGULATOR fluid circuit.

Drive Range - Seventh Gear is used to maximize engine efficiency and fuel economy under most driving conditions. Input signals from the transmission speed sensors (input and output), throttle position (TP) sensor, and other vehicle sensors, are used by the TCM to determine the precise moment to shift the transmission into Seventh gear. In Seventh gear, the planetary gear sets rotate as a unit (direct drive), allowing the transfer gears to provide a 1.000:1 gear ratio to the front differential carrier (238).

1. Power From The Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Turbine Shaft Driven

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driving

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. 5-7-Reverse Clutch Assembly Applied

The 5-7-reverse clutch plates (578-582), splined to the 5-7-reverse and 6-7-8-9 clutch housing (530) and the 3-8 and 5-7-reverse clutch hub (534), are applied and drive the 3-8 and 5-7-reverse clutch hub (534).

5. 6-7-8-9 Clutch Assembly Applied

The 6-7-8-9 clutch plates (570-577), splined to the 5-7-reverse and 6-7-8-9 clutch housing (530) and the reaction carrier hub (532), are applied and drive the reaction carrier hub (532).

6. Overdrive Carrier Driving

With both the 3-8 and 5-7-reverse clutch hub (534) and the reaction carrier hub (532) driving at converter turbine speed, the overdrive carrier pinions act as wedges and provide direct drive to the overdrive internal gear (output carrier assembly) (555).

7. Input Carrier Assembly Driven

With both the input internal gear (overdrive carrier assembly) (546) and the input sun gear (551) driving at converter turbine speed, the input carrier pinions act as wedges to obtain direct drive through the input carrier assembly (552).

8. Output Carrier Assembly Driving

With both the overdrive carrier (546) and the input carrier assembly (552) driving at converter turbine speed, the output carrier assembly (555) rotates as a unit, providing direct drive to the output carrier transfer drive gear hub (502).

9. Output Carrier Transfer Drive Gear Hub Driven

The output carrier transfer drive gear hub (502) is splined to, and driven by, the output carrier assembly (555).

10. Drive Sprocket Driving

The drive sprocket (234), splined to and driven by the output carrier transfer drive gear hub (502), drives the drive link (233) which drives the driven sprocket (241).

11. Driven Sprocket Driven

The driven sprocket (241), driven by the drive link (233), is splined to the front differential carrier sun gear (240).

12. Front Differential Carrier Sun Gear Driving

The front differential carrier sun gear (240), is in mesh with, and drives, the front differential carrier (238), thus transferring power to the front differential carrier and to the drive axles.

Drive Range, Seventh Gear

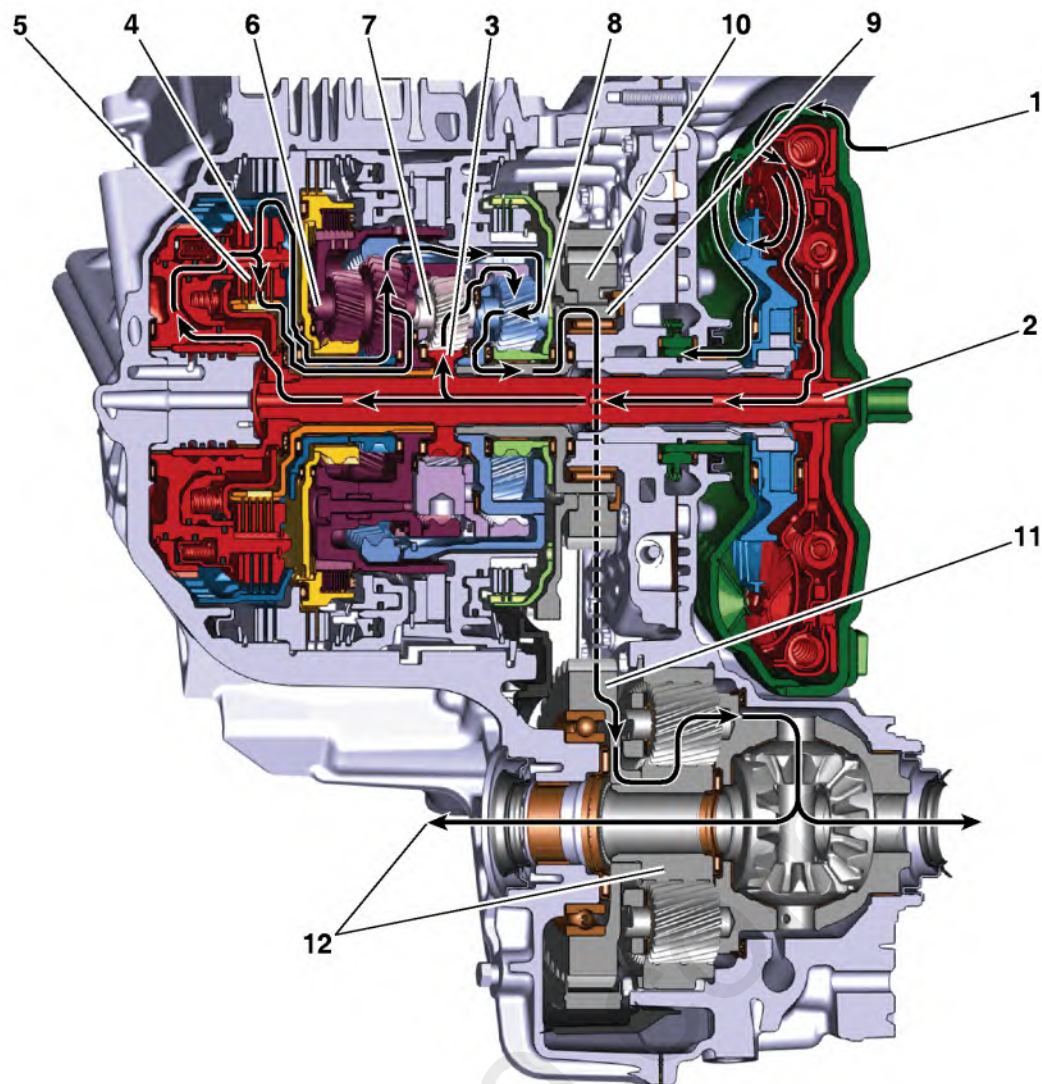


Fig. 44: Drive Range, Seventh Gear Mechanical Powerflow Diagram
 Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, EIGHTH GEAR (HYDRAULIC CIRCUITS WITHOUT ETRS)

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 S3-8 solenoid. At the same time the 5-7 reverse solenoid is commanded OFF.

3-8 Clutch Applies

S3-8 Solenoid

The S3-8 solenoid is energized allowing line fluid to enter the S38 VFS SIG fluid circuit. S38 VFS SIG fluid is directed to the 3-8 clutch regulator valve.

3-8 Clutch Regulator Valve

S38 VFS SIG fluid is directed thru orifice #5 and into the 3-8 clutch regulator valve where it applies pressure against the 3-8 clutch regulator valve spring force. This allows DRIVE 2 fluid to enter the 38 CLUTCH fluid circuit. 38 CLUTCH fluid seats ball check valve #3 then is forced thru orifice #31 and #30 to the 3-8 clutch assembly.

3-8 Clutch Assembly

38 CLUTCH fluid is directed to the 3-8 clutch assembly. 3-8 CLUTCH fluid moves the piston against spring force to apply holding of the 3-8 clutch plates.

5-7 Reverse Clutch Releases

5-7 Reverse Solenoid

S38 VFS SIG fluid is directed thru orifice #5 and into the 3-8 clutch regulator valve where it applies pressure against the 3-8 clutch regulator valve spring force. This allows DRIVE 2 fluid to enter the 38 CLUTCH fluid circuit. 38 CLUTCH fluid seats ball check valve #3 then is forced thru orifice #31 and #30 to the 3-8 clutch assembly.

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driving

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. 6-7-8-9 Clutch Assembly Applied

The 6-7-8-9 clutch plates (570-577), splined to the 5-7-reverse and 6-7-8-9 clutch housing (530) and the reaction carrier hub (532), are applied and drive the reaction carrier hub (532).

5. 3-8 Clutch Assembly Applied

The 3-8 clutch plates (510-514, 535, 536), splined to the 3-8 and 5-7-reverse clutch hub (534) and the transmission case (19), are applied and hold the 3-8 and 5-7-reverse clutch hub (534) stationary.

6. Overdrive Carrier Driving

The overdrive carrier (546) large pinion gears are driven around the stationary 3-8 and 5-7-reverse clutch hub (534), and over drive the overdrive internal gear (output carrier assembly) (555).

7. Input Carrier Assembly Driven

With both the input internal gear (overdrive carrier assembly) (546) and the input sun gear (551) driving at converter turbine speed, the input carrier pinions act as wedges to obtain direct drive to obtain direct drive to the output internal gear, which drives the output carrier assembly (555) pinions.

8. Output Carrier Assembly Driving

The output carrier assembly (555) is splined to, and drives the output carrier transfer drive gear hub (502).

9. Output Carrier Transfer Drive Gear Hub Driven

The output carrier transfer drive gear hub (502) is splined to, and driven by, the output carrier assembly (555).

10. Drive Sprocket Driving

The drive sprocket (234), splined to and driven by the output carrier transfer drive gear hub (502), drives the drive link (233) which drives the driven sprocket (241).

11. Driven Sprocket Driven

The driven sprocket (241), driven by the drive link (233), is splined to the front differential carrier sun gear (240).

12. Front Differential Carrier Sun Gear Driving

The front differential carrier sun gear (240), is in mesh with, and drives, the front differential carrier (238), thus transferring power to the front differential carrier and to the drive axles.

Drive Range, Eighth Gear

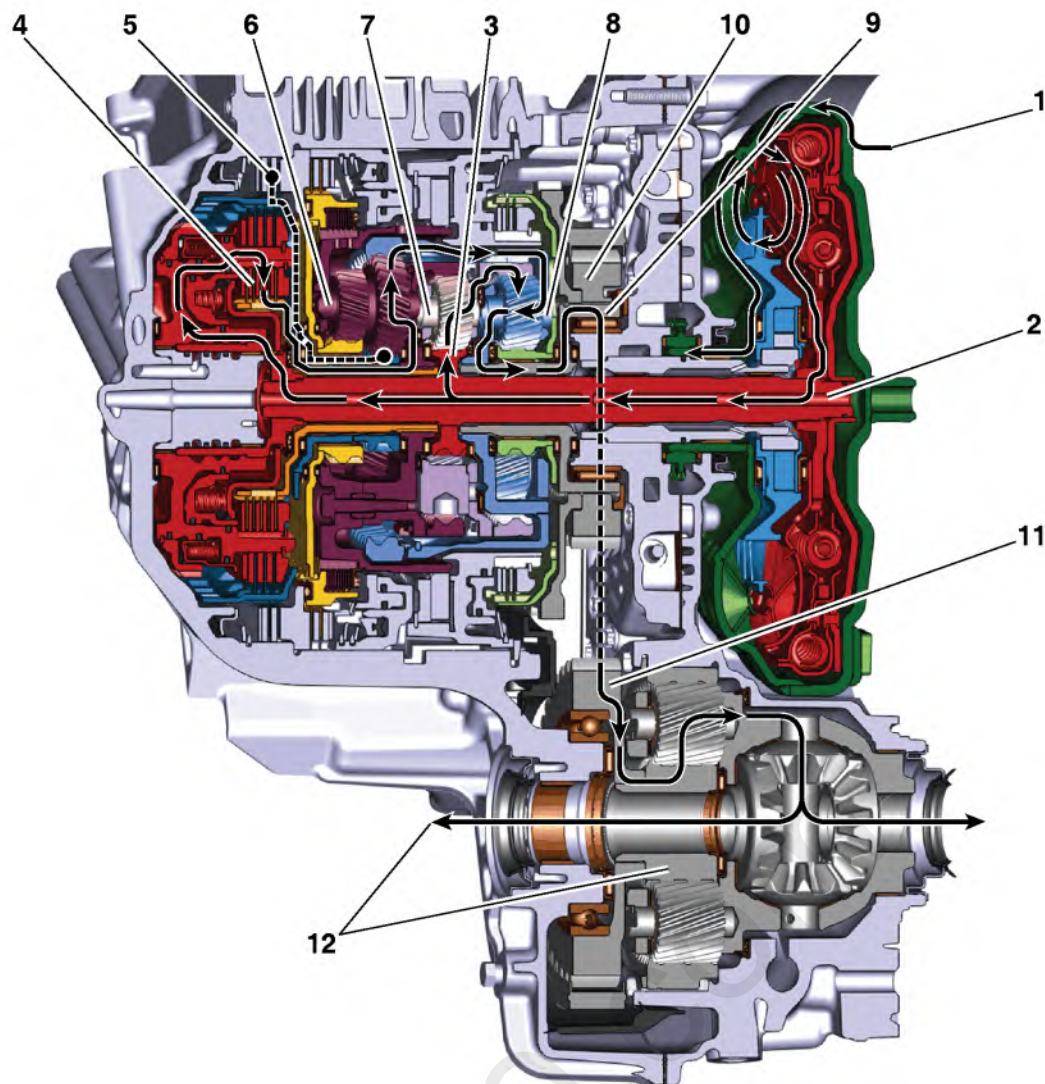


Fig. 47: Drive Range, Eighth Gear Mechanical Powerflow Diagram
 Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, NINTH GEAR (HYDRAULIC CIRCUITS WITHOUT ETRS)

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 2-9 solenoid. At the same time the S3-8 solenoid is commanded OFF.

2-9 Clutch Applies

2-9 Solenoid

The 2-9 solenoid energizes allowing drive fluid to enter the 2-9 regulator valve and enter the 2-9 CLUTCH fluid circuit. 2-9 CLUTCH fluid seats ball check valve #1 then is forced thru orifice #9 and #32 to the 2-9 clutch assembly.

2-9 Clutch Assembly

29 CLUTCH fluid is directed to the 2-9 clutch assembly housing. 29 CLUTCH fluid moves the piston against spring force to apply holding of the 2-9 clutch plates.

3-8 Clutch Releases

S3-8 Solenoid

The S3-8 solenoid is energized off allowing S38 VFS SIG fluid to exhaust thru orifice #1. Spring pressure shifts the 3-8 clutch regulator valve to allow 38 CLUTCH fluid to exhaust into EX BACKFILL from the 3-8 clutch assembly.

3-8 Clutch Assembly

The 3-8 clutch is released allowing 38 CLUTCH fluid to exhaust thru the 3-8 clutch regulator valve.

Drive Range, Ninth Gear

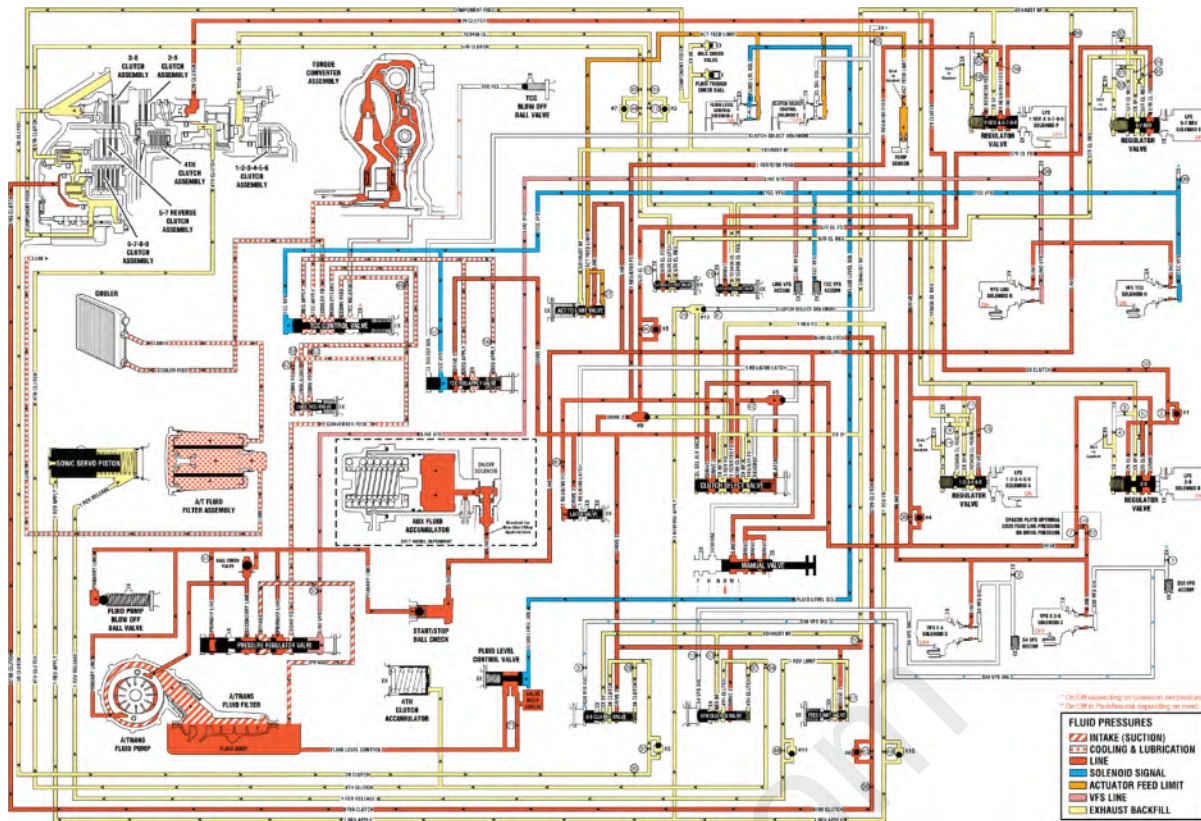


Fig. 48: Drive Range, Ninth Gear Hydraulic Diagram (Without ETRS).

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, NINTH GEAR (HYDRAULIC CIRCUITS WITH ETRS)

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 2-9 solenoid. At the same time the S3-8 solenoid is commanded to low pressure.

2-9 Clutch Applies

2-9 Solenoid

The 2-9 solenoid energizes allowing drive fluid to enter the 2-9 regulator valve and enter the 2-9 CLUTCH fluid circuit. 2-9 CLUTCH fluid seats ball check valve #1 then is forced thru orifice #9 and #32 to the 2-9 clutch assembly.

2-9 Clutch Assembly

29 CLUTCH fluid is directed to the 2-9 clutch assembly housing. 29 CLUTCH fluid moves the piston against spring force to apply holding of the 2-9 clutch plates.

3-8 Clutch Releases

VFS S3-8 Solenoid

The S3-8 solenoid is commanded to low pressure allowing the 3-8 clutch regulator valve to shift enough to prevent pressurized DRIVE 2 fluid from entering the 38 CLUTCH fluid passage and engaging the 3-8 clutch.

3-8 Clutch Assembly

The 3-8 clutch is released allowing 38 CLUTCH fluid to exhaust thru the 3-8 clutch regulator valve.

Drive Range, Ninth Gear

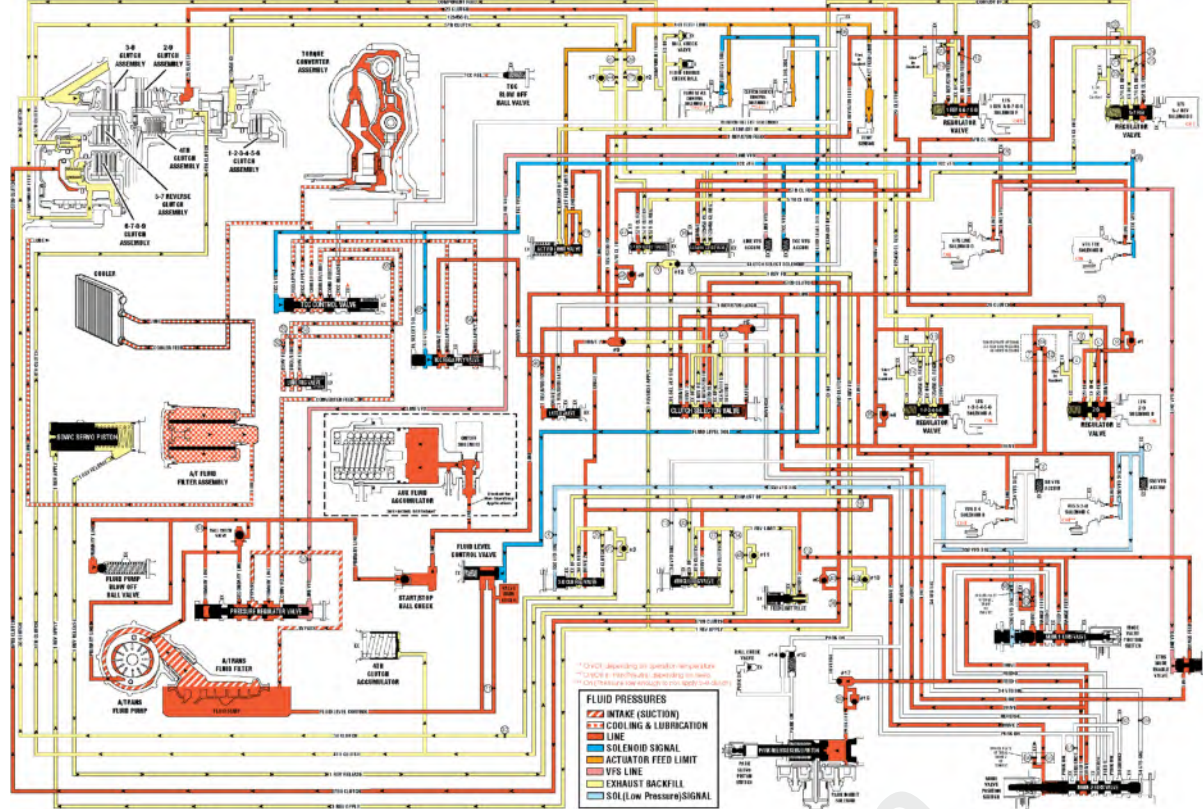


Fig. 49: Drive Range, Ninth Gear Hydraulic Diagram (With ETRS)
 Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, NINTH GEAR (MECHANICAL POWERFLOW)

Drive Range - Ninth Gear is used to maximize engine efficiency and fuel economy beyond Eighth gear calibrations. Input signals from the transmission speed sensors (input and output), throttle position (TP) sensor, and other vehicle sensors, are used by the TCM to determine the precise moment to shift the transmission into Ninth gear. In Ninth gear, the planetary gear sets rotate in overdrive, providing a 0.617:1 gear ratio between the torque converter turbine and the front differential carrier assembly (238).

1. Power From The Engine

Torque from the engine is transferred to the transmission through the engine flywheel which is bolted to the torque converter assembly (14).

2. Turbine Shaft Driven

As the torque converter turbine rotates, the 5-7-reverse and 6-7-8-9 clutch housing (530) and the turbine shaft (547) which is splined to the torque converter turbine, is also forced to rotate at turbine speed.

3. Input Sun Gear Driving

The input sun gear (551), which is splined to the turbine shaft (547), drives the input carrier assembly (552) pinion gears.

4. 6-7-8-9 Clutch Assembly Applied

The 6-7-8-9 clutch plates (570-577), splined to the 5-7-reverse and 6-7-8-9 clutch housing (530) and the reaction carrier hub (532), are applied and drive the reaction carrier hub (532).

5. 2-9 Clutch Assembly Applied

The 2-9 clutch plates (517-519), splined to the 2-9 and 4th clutch hub (619) and the 2-9 and 4th clutch piston housing (520), are applied and hold the 2-9 and 4th clutch hub (619) stationary.

6. Overdrive Carrier Driving

The overdrive carrier (546) small pinion gears are driven around the stationary 2-9 and 4th clutch hub (539), and over drive the overdrive internal gear (output carrier assembly) (555).

7. Input Carrier Assembly Driven

With both the input internal gear (overdrive carrier assembly) (546) and the input sun gear (551) driving at converter turbine speed, the input carrier pinions act as wedges to obtain direct drive to obtain direct drive to the output internal gear, which drives the output carrier assembly (555) pinions.

8. Output Carrier Assembly Driving

The output carrier assembly (555) is splined to, and drives the output carrier transfer drive gear hub (502).

9. Output Carrier Transfer Drive Gear Hub Driven

The output carrier transfer drive gear hub (502) is splined to, and driven by, the output carrier assembly (555).

10. Drive Sprocket Driving

The drive sprocket (234), splined to and driven by the output carrier transfer drive gear hub (502), drives the drive link (233) which drives the driven sprocket (241).

11. Driven Sprocket Driven

The driven sprocket (241), driven by the drive link (233), is splined to the front differential carrier sun gear (240).

12. Front Differential Carrier Sun Gear Driving

The front differential carrier sun gear (240), is in mesh with, and drives, the front differential carrier (238), thus transferring power to the front differential carrier and to the drive axles.

Drive Range, Ninth Gear

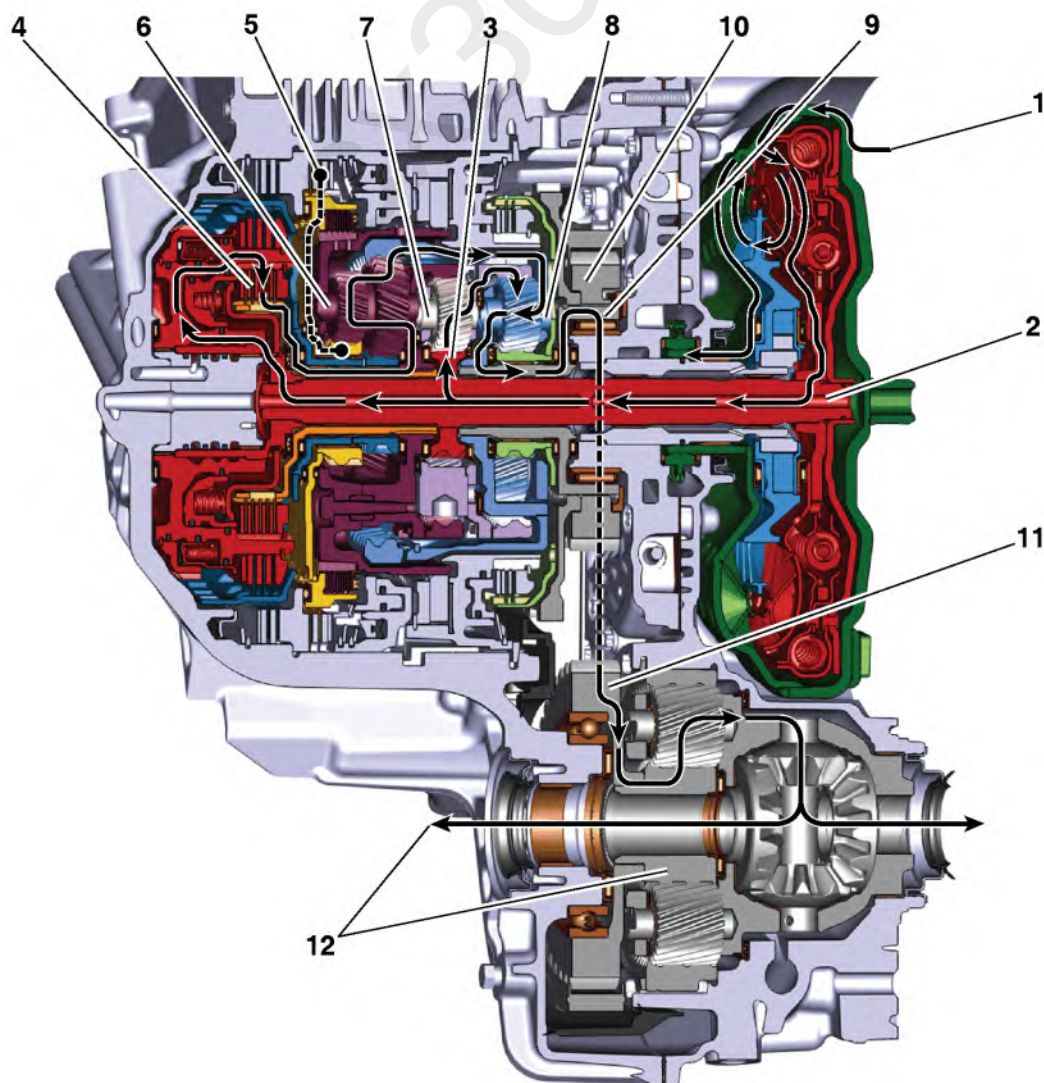


Fig. 50: Drive Range, Ninth Gear Mechanical Powerflow Diagram
 Courtesy of GENERAL MOTORS COMPANY

FLUID PASSAGES (HYDRAULIC CIRCUITS WITHOUT ETRS)

Control Valve Solenoid Body - Fluid Pan Side

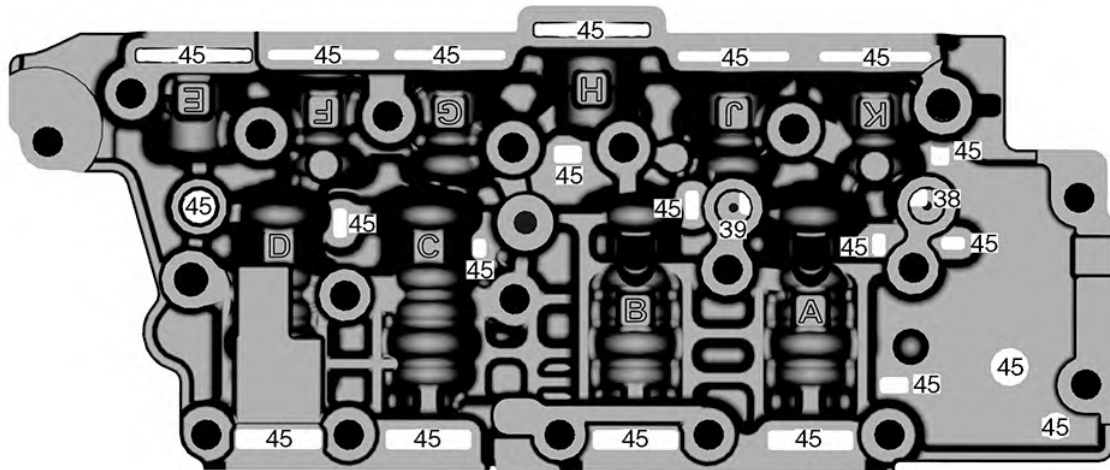


Fig. 51: Control Valve Solenoid Body Fluid Passages - Fluid Pan Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
38	S38 Variable Force Solenoid Valve Signal
39	S4 Variable Force Solenoid Valve Signal
45	Exhaust

Control Valve Solenoid Body - Control Valve Body Side

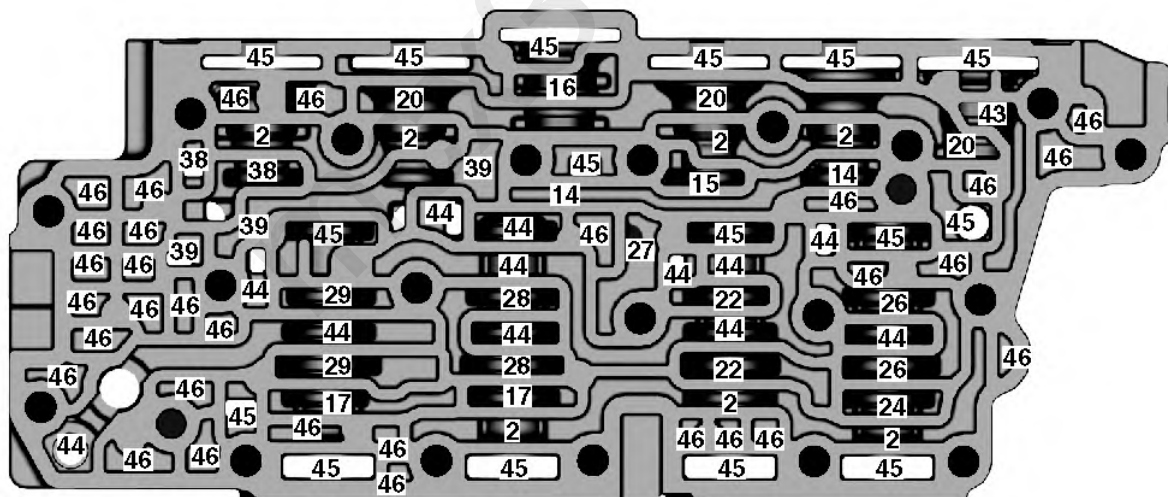


Fig. 52: Control Valve Solenoid Body Fluid Passages - Control Valve Body Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
18	Drive 2
20	Actuator Feed Limit
22	1-Reverse/6-7-8-9 Feed

Callout	Component Name
24	5-7-Reverse Clutch Feed
26	5-7-Reverse Clutch Regulator
27	1-2-3-4-5-6 Clutch
28	1-2-3-4-5-6 Clutch Regulator
29	2-9 Clutch
38	S38 Variable Force Solenoid Valve Signal
39	S4 Variable Force Solenoid Valve Signal
44	Exhaust Backfill
45	Exhaust
46	Void

Control Valve Body Spacer Plate - Control Valve Solenoid Side

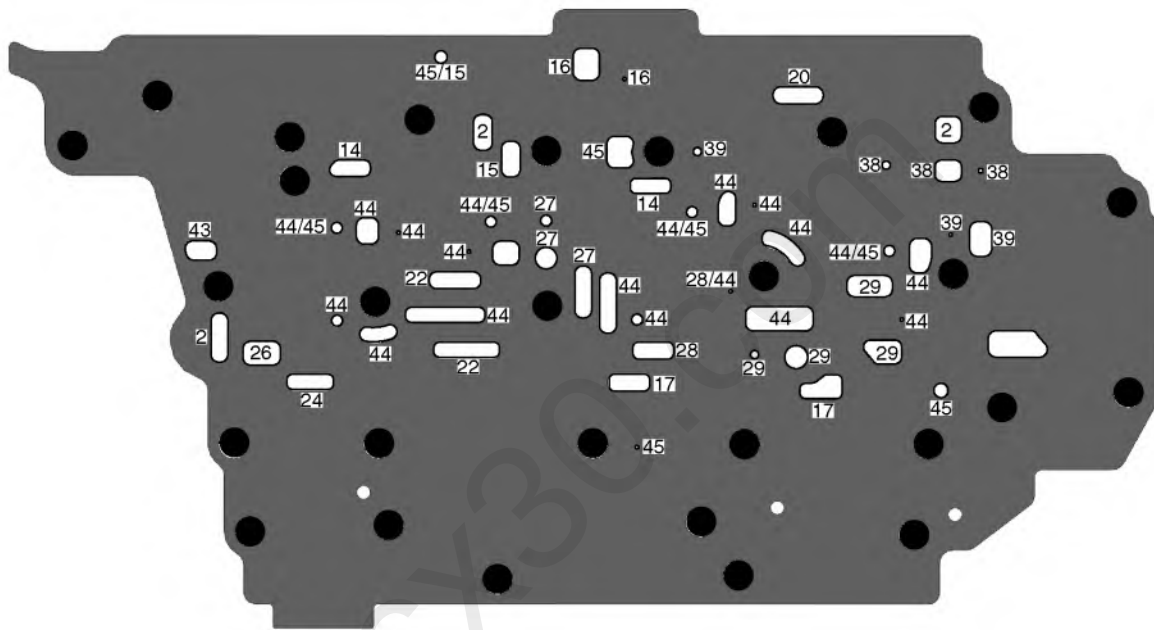


Fig. 53: Control Valve Solenoid Body Spacer Plate Fluid Passages - Control Valve Solenoid Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
20	Actuator Feed Limit
22	1-Reverse/6-7-8-9 Feed
24	5-7-Reverse Clutch Feed
26	5-7-Reverse Clutch Regulator
27	1-2-3-4-5-6 Clutch
28	1-2-3-4-5-6 Clutch Regulator
29	2-9 Clutch
38	S38 Variable Force Solenoid Valve Signal
39	S4 Variable Force Solenoid Valve Signal
43	Fluid Level Solenoid
44	Exhaust Backfill

Callout	Component Name
45	Exhaust

Control Valve Body - Control Valve Solenoid Body Side

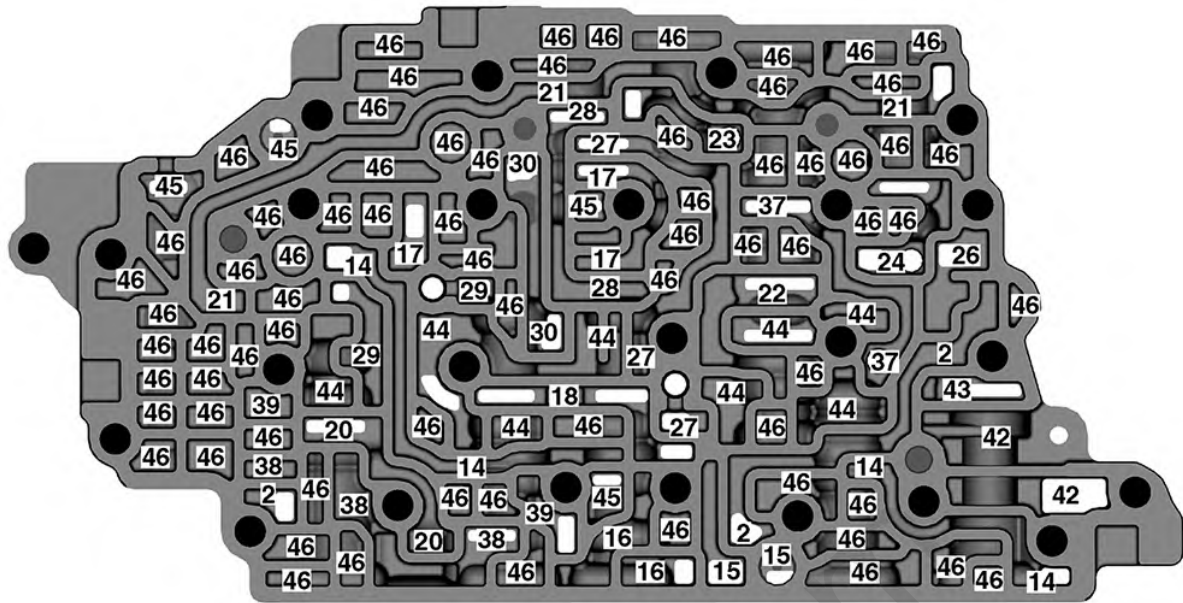


Fig. 54: Control Valve Body Fluid Passages - Control Valve Solenoid Body Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
18	Drive 2
20	Actuator Feed Limit
21	Component Feed
22	1-Reverse/6-7-8-9 Feed
23	1-Reverse/6-7-8-9 Latch
24	5-7-Reverse Clutch Feed
26	5-7-Reverse Clutch Regulator
27	1-2-3-4-5-6 Clutch
28	1-2-3-4-5-6 Clutch Regulator
29	2-9 Clutch
30	3-8 Clutch
37	Reverse/5-7-Reverse Feed
38	S38 Variable Force Solenoid Valve Signal
39	S4 Variable Force Solenoid Valve Signal
43	Fluid Level Solenoid
44	Exhaust Backfill
45	Exhaust
46	Void

Control Valve Body - Case Side

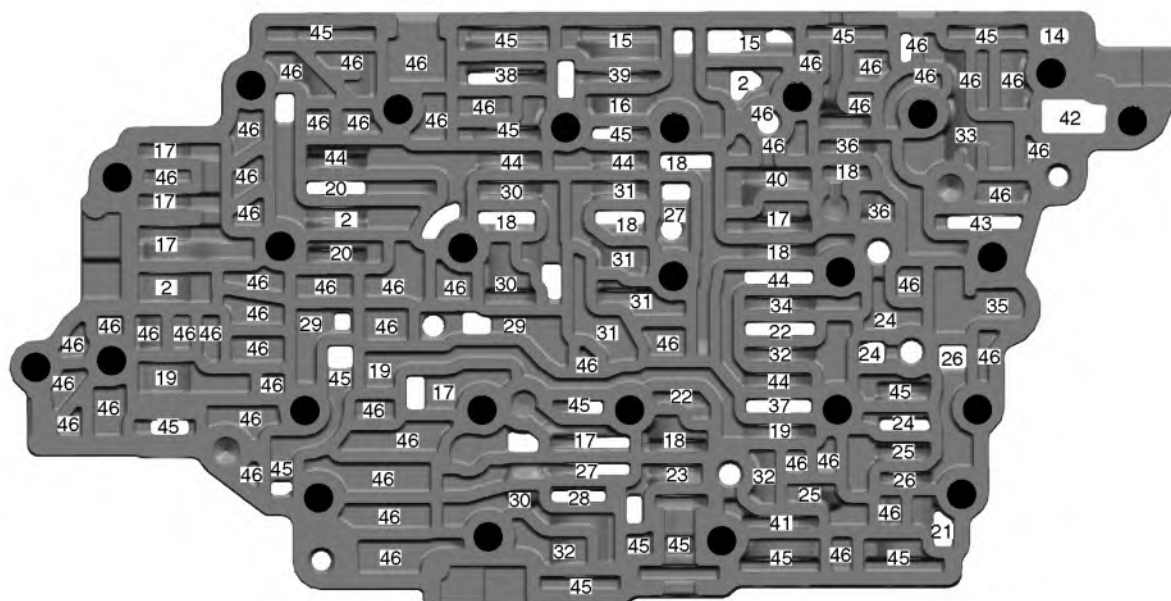


Fig. 55: Control Valve Body Fluid Passages - Case Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
18	Drive 2
19	Reverse
20	Actuator Feed Limit
21	Component Feed
22	1-Reverse/6-7-8-9 Feed
23	1-Reverse/6-7-8-9 Latch
24	5-7-Reverse Clutch Feed
25	5-7-Reverse Clutch
26	5-7-Reverse Clutch Regulator
27	1-2-3-4-5-6 Clutch
28	1-2-3-4-5-6 Clutch Regulator
29	2-9 Clutch
30	3-8 Clutch
31	4th Clutch
32	6-7-8-9 Clutch
33	1-Reverse Apply
34	1-Reverse Feed
35	1-Reverse Release
36	1-Reverse Limit
37	Reverse/5-7-Reverse Feed
38	S38 Variable Force Solenoid Valve Signal
39	S4 Variable Force Solenoid Valve Signal
40	Clutch Select Valve Signal
41	Latch

Callout	Component Name
42	Fluid Level Control
43	Fluid Level Solenoid
44	Exhaust Backfill
45	Exhaust
46	Void

Control Valve Body Spacer Plate - Case Side

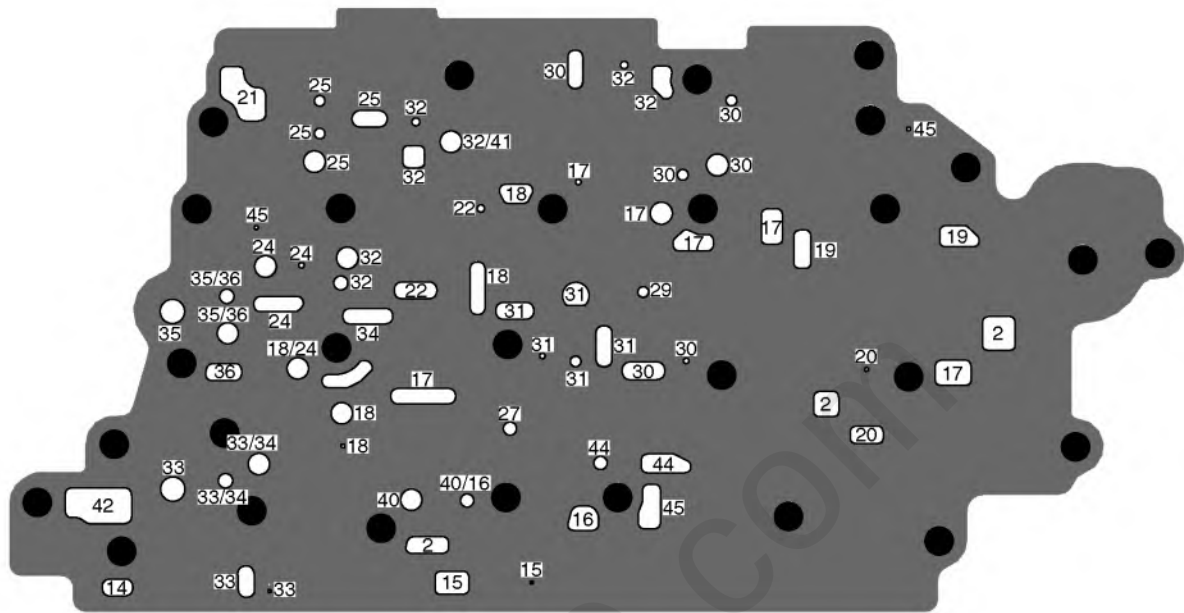


Fig. 56: Control Valve Solenoid Body Spacer Plate Fluid Passages - Case Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
18	Drive 2
19	Reverse
20	Actuator Feed Limit
21	Component Feed
22	1-Reverse/6-7-8-9 Feed
23	1-Reverse/6-7-8-9 Latch
24	5-7-Reverse Clutch Feed
25	5-7-Reverse Clutch
26	5-7-Reverse Clutch Regulator
27	1-2-3-4-5-6 Clutch
30	3-8 Clutch
31	4th Clutch
32	6-7-8-9 Clutch
33	1-Reverse Apply
34	1-Reverse Feed
35	1-Reverse Release

Callout	Component Name
36	1-Reverse Limit
40	Clutch Select Valve Signal
41	Latch
42	Fluid Level Control
44	Exhaust Backfill
45	Exhaust

Automatic Transmission Case - Control Valve Body Side

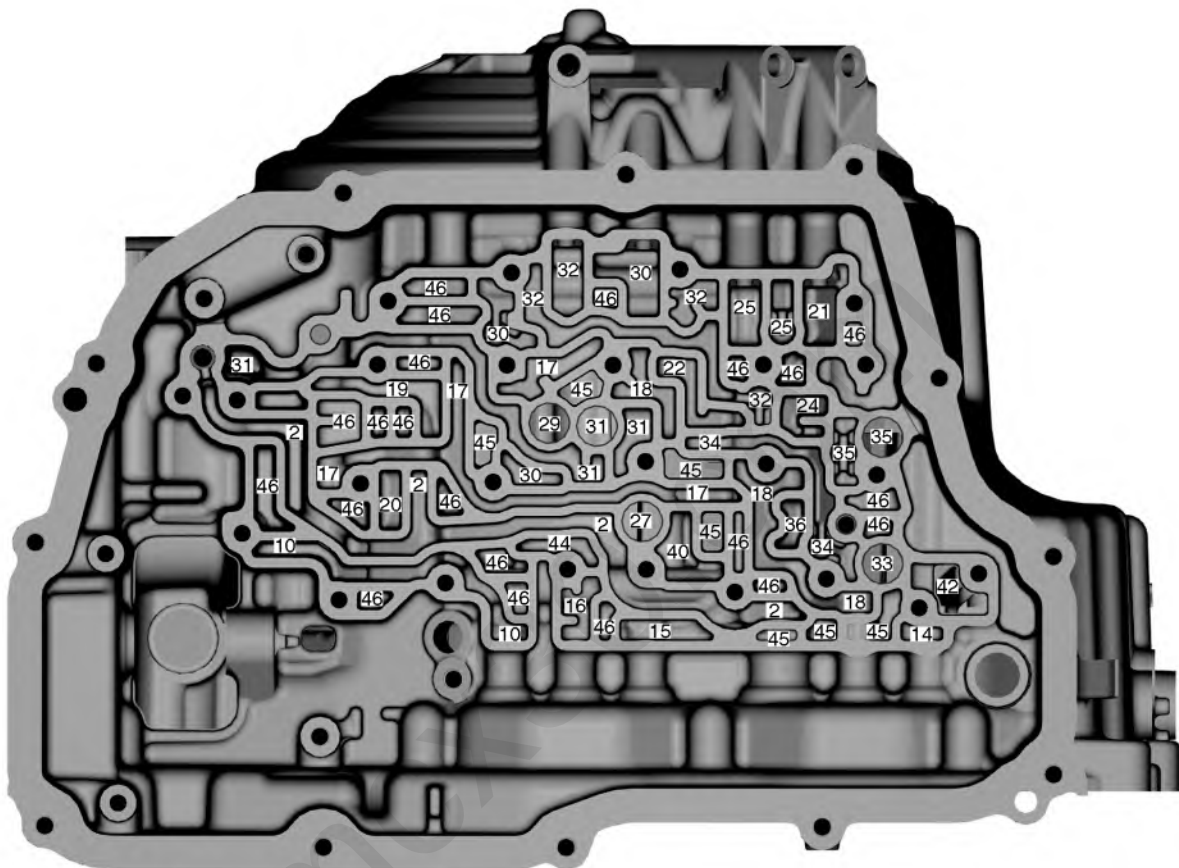


Fig. 57: Automatic Transmission Case Fluid Passages - Control Valve Body Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
10	Cooler Feed
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
18	Drive 2
19	Reverse
20	Actuator Feed Limit
21	Component Feed
22	1-Reverse/6-7-8-9 Feed
24	5-7-Reverse Clutch Feed
25	5-7-Reverse Clutch

Callout	Component Name
27	1-2-3-4-5-6 Clutch
29	2-9 Clutch
30	3-8 Clutch
31	4th Clutch
32	6-7-8-9 Clutch
33	1-Reverse Apply
34	1-Reverse Feed
35	1-Reverse Release
36	1-Reverse Limit
40	Clutch Select Valve Signal
42	Fluid Level Control
44	Exhaust Backfill
45	Exhaust
46	Void

Automatic Transmission Case - Torque Converter Housing Side

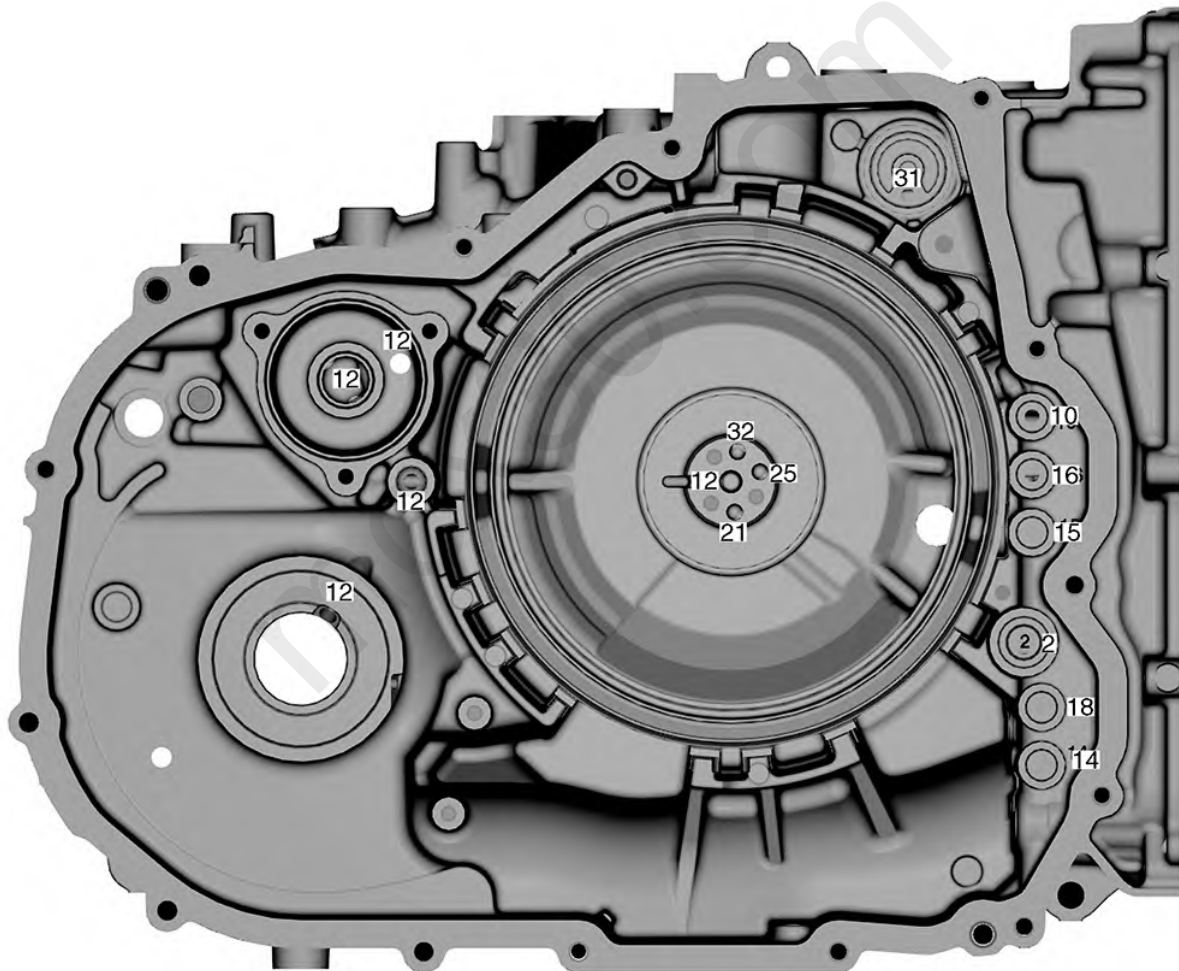


Fig. 58: Automatic Transmission Case Fluid Passages - Torque Converter Housing Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
10	Cooler Feed
12	Lube
14	Line VFS
15	TCC VFS

Callout	Component Name
16	Clutch Select Solenoid
18	Drive 2
21	Component Feed
25	5-7-Reverse Clutch
31	4th Clutch
32	6-7-8-9 Clutch

Torque Converter Housing - Automatic Transmission Case Side

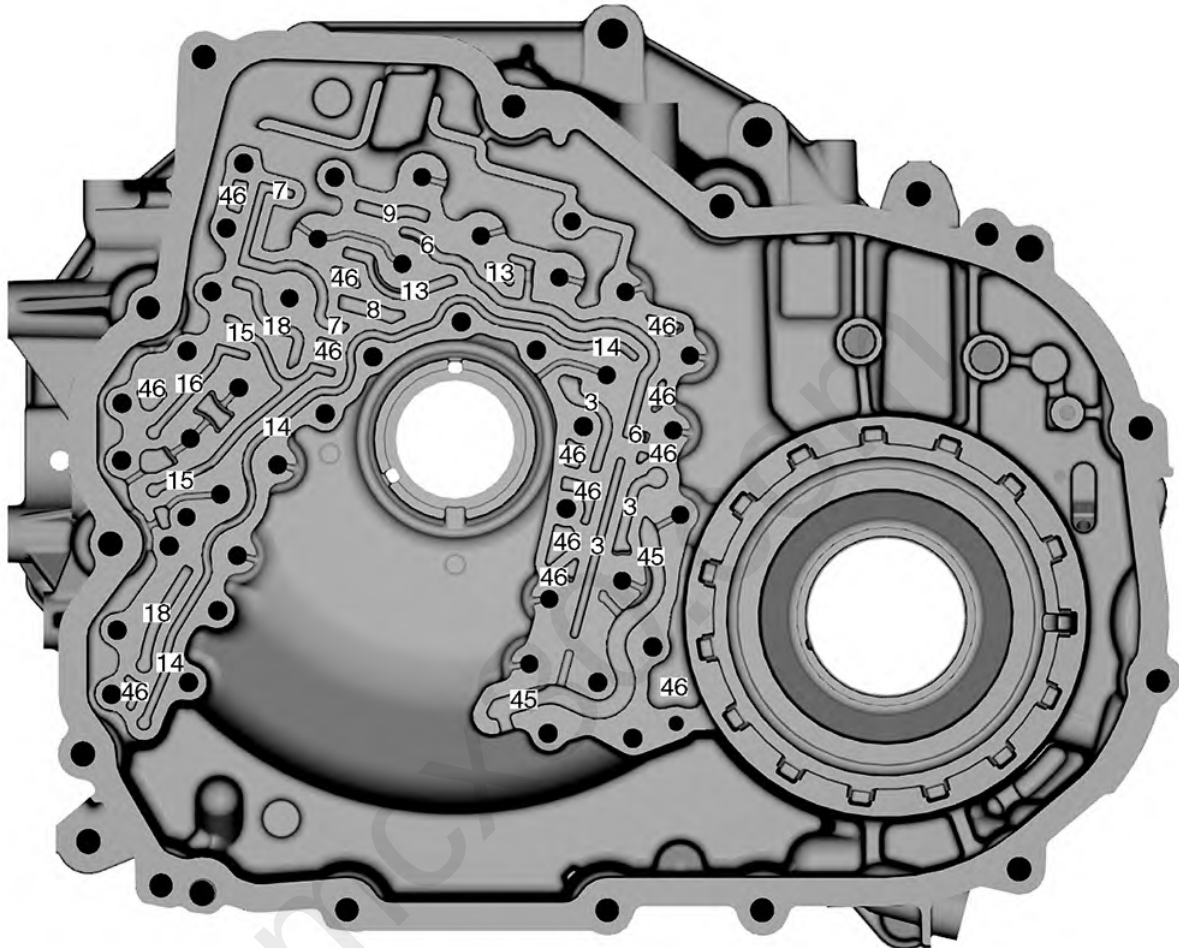


Fig. 59: Torque Converter Housing Fluid Passages - Automatic Transmission Case Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
3	Primary Line
6	Converter Feed
7	Regulator Apply
8	TCC Apply
9	TCC Release
13	Cooler/Lube
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
18	Drive 2
46	Void

Auxiliary Control Valve Body Spacer Plate - Drive Sprocket Support Side

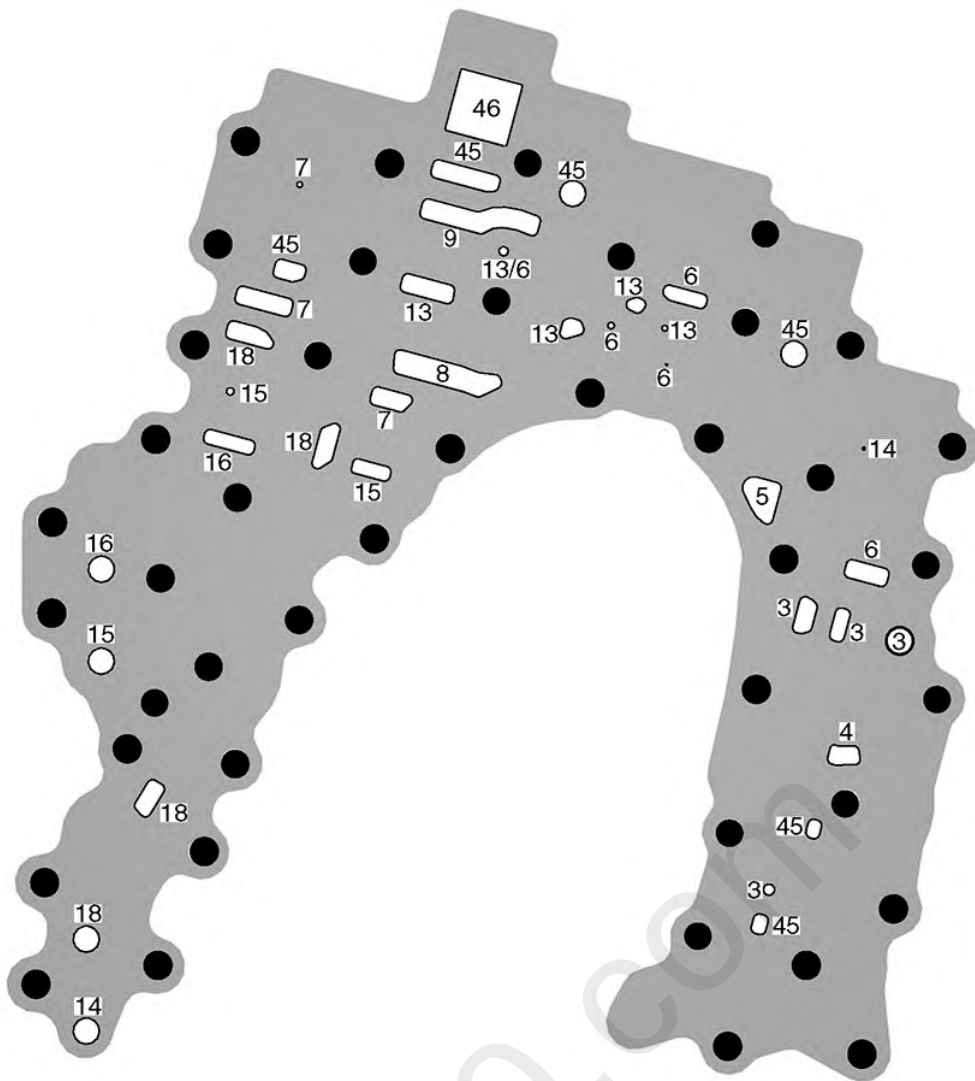


Fig. 60: Auxiliary Control Valve Body Spacer Plate Fluid Passages - Drive Sprocket Support Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
3	Primary Line
4	Secondary Line
5	Bypass
6	Converter Feed
7	Regulator Apply
8	TCC Apply
9	TCC Release
13	Cooler/Lube
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
18	Drive 2
45	Exhaust
46	Void

Drive Sprocket Support - Torque Converter Housing Side

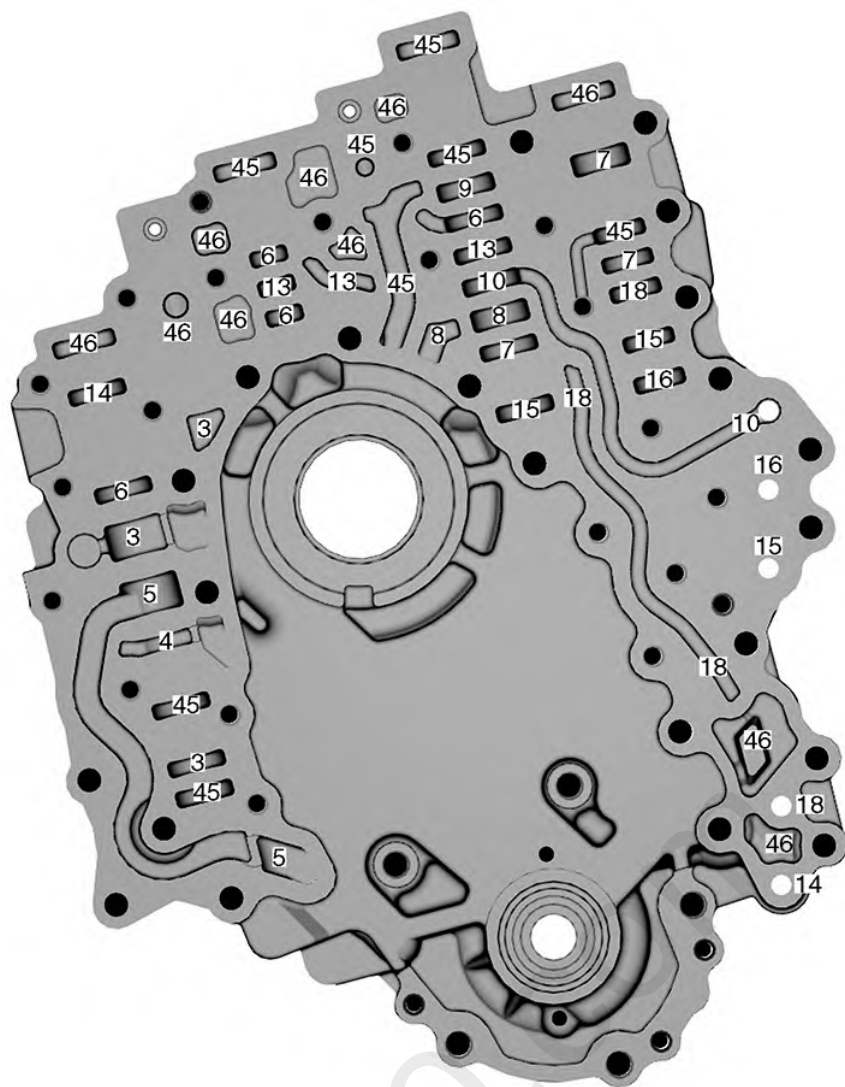


Fig. 61: Drive Sprocket Support Fluid Passages - Torque Converter Housing Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
3	Primary Line
4	Secondary Line
5	Bypass
6	Converter Feed
7	Regulator Apply
8	TCC Apply
9	TCC Release
10	Cooler Feed
13	Cooler/Lube
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
18	Drive 2
45	Exhaust
46	Void

Drive Sprocket Support - Automatic Transmission Fluid Pump Side

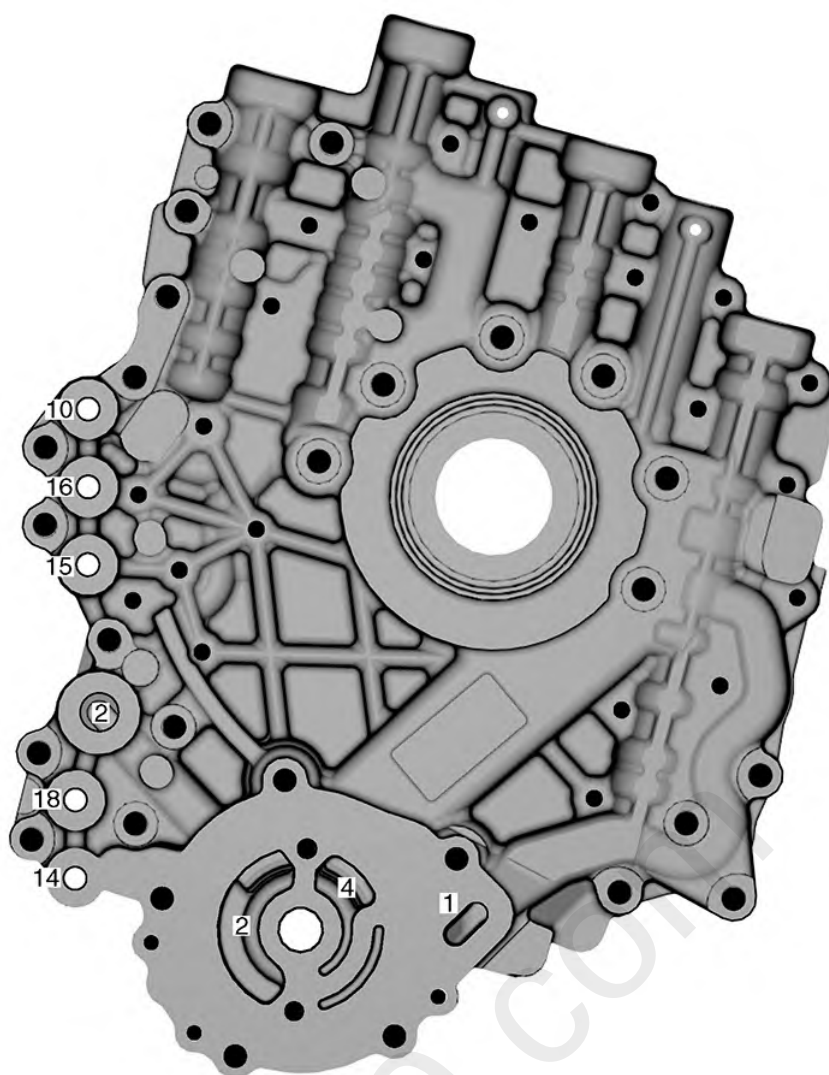


Fig. 62: Drive Sprocket Support Fluid Passages - Automatic Transmission Fluid Pump Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction
2	Line
4	Secondary Line
10	Cooler Feed
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
18	Drive 2

Automatic Transmission Fluid Pump Gasket - Drive Sprocket Support Side

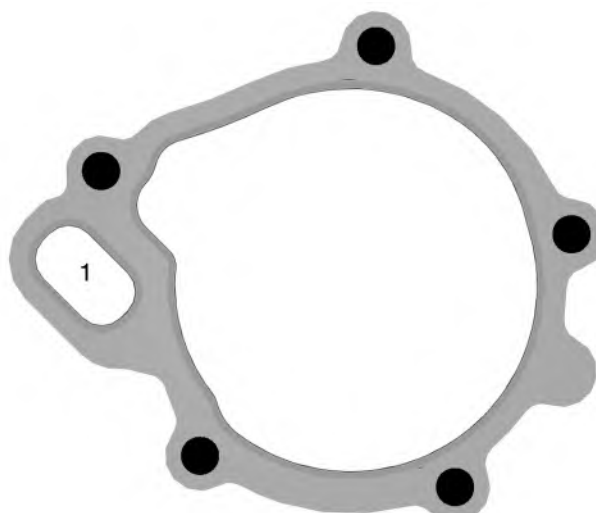


Fig. 63: Automatic Transmission Fluid Pump Gasket Fluid Passages - Drive Sprocket Support Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction

Automatic Transmission Fluid Pump - Drive Sprocket Support Side

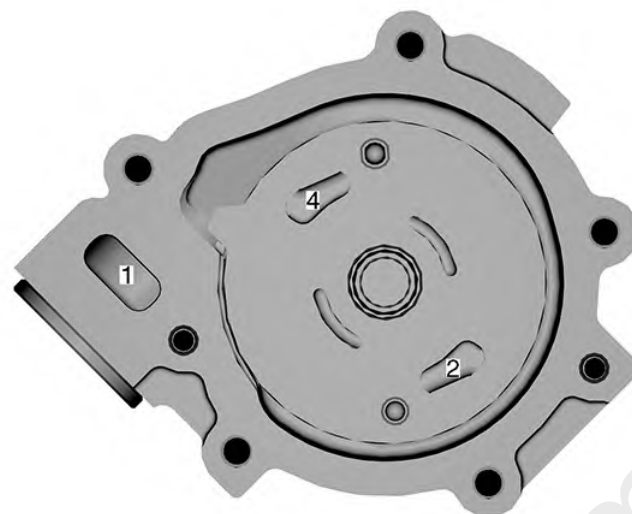


Fig. 64: Automatic Transmission Fluid Pump Fluid Passages - Drive Sprocket Support Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction
2	Line
4	Secondary Line

FLUID PASSAGES (HYDRAULIC CIRCUITS WITH ETRS)

Control Valve Solenoid Body - Fluid Pan Side

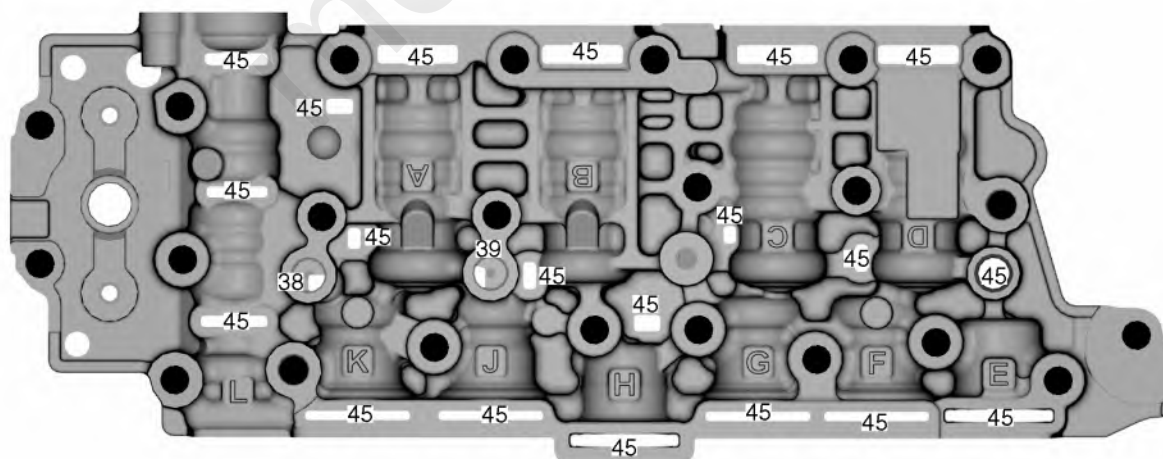


Fig. 65: Control Valve Solenoid Body Fluid Passages - Fluid Pan Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
38	S38 Variable Force Solenoid Valve Signal
39	S4 Variable Force Solenoid Valve Signal
45	Exhaust

Control Valve Solenoid Body - Control Valve Body Side

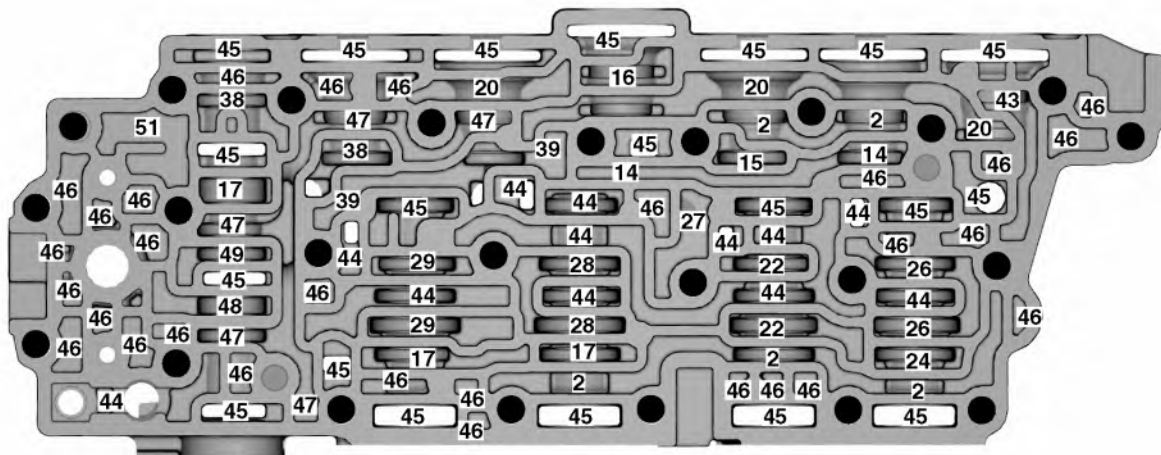


Fig. 66: Control Valve Solenoid Body Fluid Passages - Control Valve Body Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
18	Drive 2
20	Actuator Feed Limit
22	1-Reverse/6-7-8-9 Feed
24	5-7-Reverse Clutch Feed
26	5-7-Reverse Clutch Regulator
27	1-2-3-4-5-6 Clutch
28	1-2-3-4-5-6 Clutch Regulator
29	2-9 Clutch
38	S38 Variable Force Solenoid Valve Signal
39	S4 Variable Force Solenoid Valve Signal
44	Exhaust Backfill
45	Exhaust
46	Void

Control Valve Body Spacer Plate - Control Valve Solenoid Side

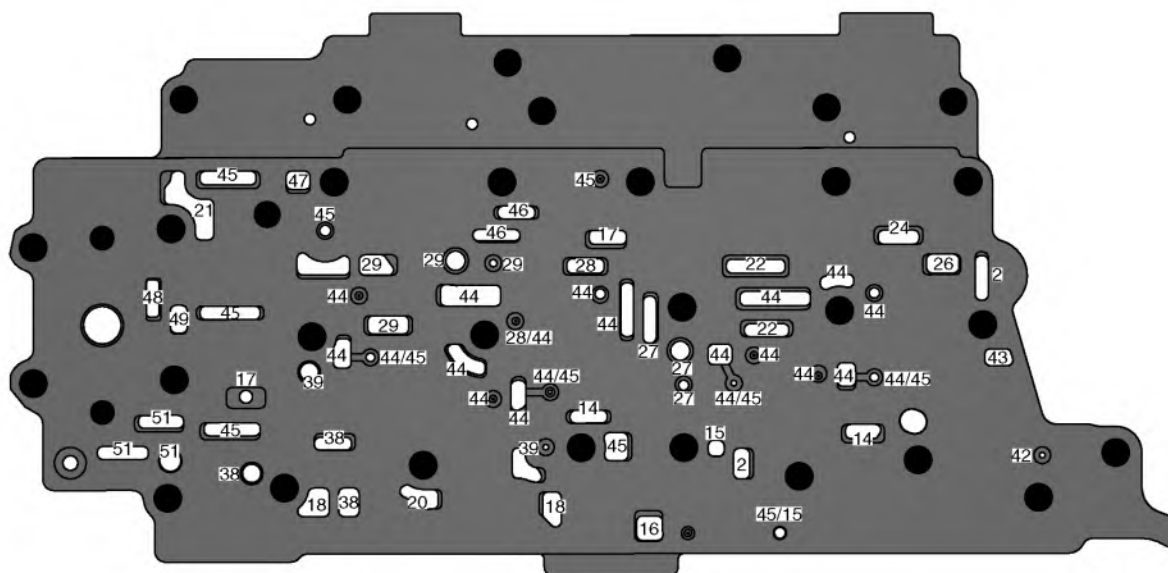


Fig. 67: Control Valve Body Spacer Plate Fluid Passages - Control Valve Solenoid Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
20	Actuator Feed Limit
22	1-Reverse/6-7-8-9 Feed
24	5-7-Reverse Clutch Feed
26	5-7-Reverse Clutch Regulator
27	1-2-3-4-5-6 Clutch
28	1-2-3-4-5-6 Clutch Regulator
29	2-9 Clutch
38	S38 Variable Force Solenoid Valve Signal
39	S4 Variable Force Solenoid Valve Signal
43	Fluid Level Solenoid
44	Exhaust Backfill
45	Exhaust
46	Void
47	Range Feed
48	Feed 1
49	Feed 0
51	Park On

Control Valve Body - Control Valve Solenoid Body Side

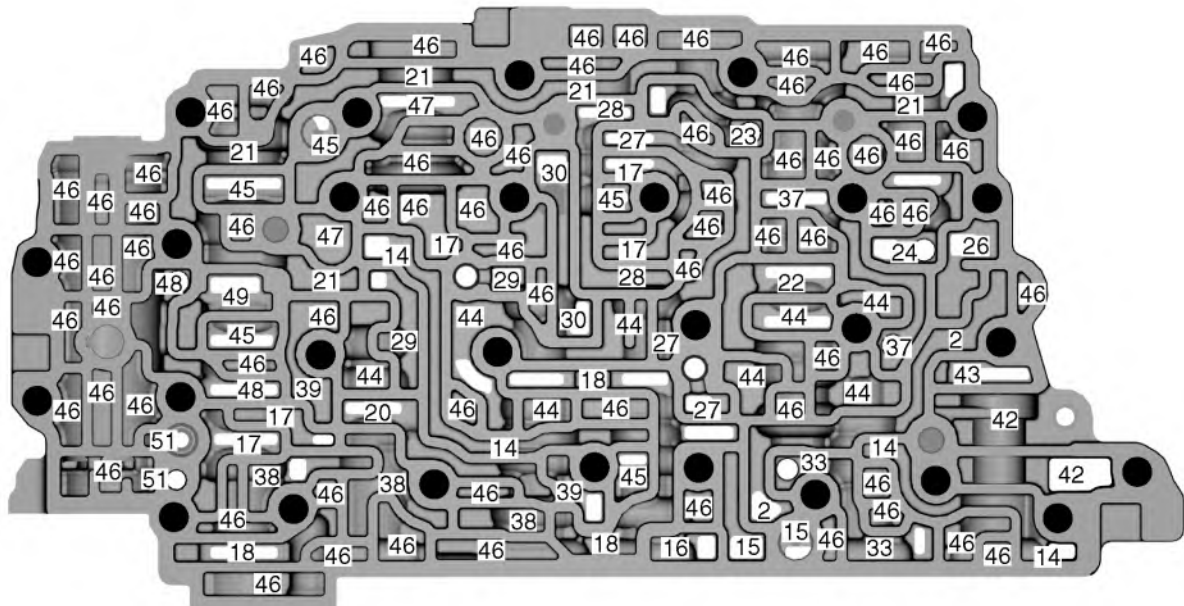


Fig. 68: Control Valve Body Fluid Passages - Control Valve Solenoid Body Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
18	Drive 2
20	Actuator Feed Limit
21	Component Feed
22	1-Reverse/6-7-8-9 Feed
23	1-Reverse/6-7-8-9 Latch
24	5-7-Reverse Clutch Feed
26	5-7-Reverse Clutch Regulator
27	1-2-3-4-5-6 Clutch
28	1-2-3-4-5-6 Clutch Regulator
29	2-9 Clutch
30	3-8 Clutch
37	Reverse/5-7-Reverse Feed
38	S38 Variable Force Solenoid Valve Signal
39	S4 Variable Force Solenoid Valve Signal
43	Fluid Level Solenoid
44	Exhaust Backfill
45	Exhaust
46	Void
47	Range Feed
48	Feed 1
49	Feed 0
51	Park On

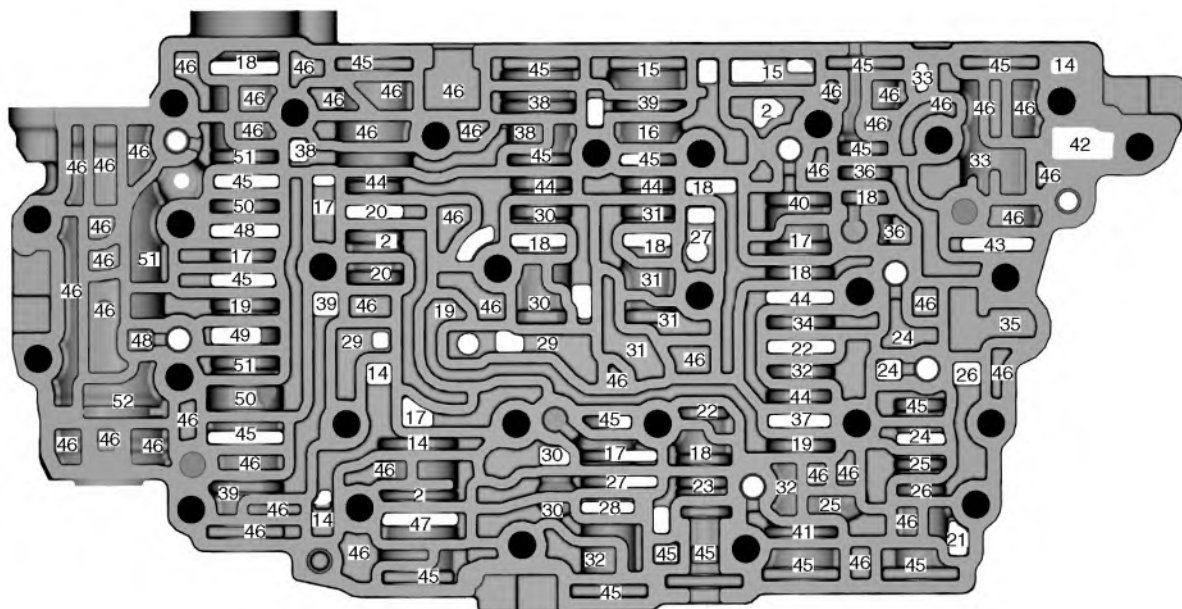


Fig. 69: Control Valve Body Fluid Passages - Case Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
18	Drive 2
19	Reverse
20	Actuator Feed Limit
21	Component Feed
22	1-Reverse/6-7-8-9 Feed
23	1-Reverse/6-7-8-9 Latch
24	5-7-Reverse Clutch Feed
25	5-7-Reverse Clutch
26	5-7-Reverse Clutch Regulator
27	1-2-3-4-5-6 Clutch
28	1-2-3-4-5-6 Clutch Regulator
29	2-9 Clutch
30	3-8 Clutch
31	4th Clutch
32	6-7-8-9 Clutch
33	1-Reverse Apply
34	1-Reverse Feed
35	1-Reverse Release
36	1-Reverse Limit
37	Reverse/5-7-Reverse Feed
38	S38 Variable Force Solenoid Valve Signal
39	S4 Variable Force Solenoid Valve Signal
40	Clutch Select Valve Signal
41	Latch

Callout	Component Name
42	Fluid Level Control
43	Fluid Level Solenoid
44	Exhaust Backfill
45	Exhaust
46	Void
47	Range Feed
48	Feed 1
49	Feed 0
50	Sequence
51	Park On
52	Park Off

Control Valve Body Spacer Plate - Case Side

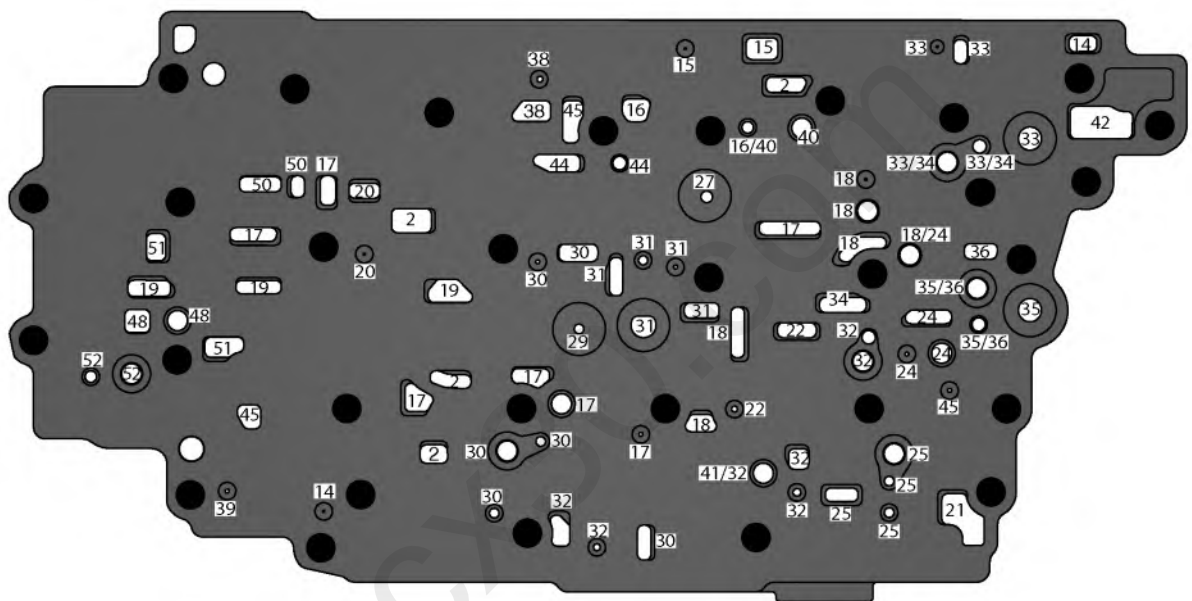


Fig. 70: Control Valve Body Spacer Plate Fluid Passages - Case Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
18	Drive 2
19	Reverse
20	Actuator Feed Limit
21	Component Feed
22	1-Reverse/6-7-8-9 Feed
23	1-Reverse/6-7-8-9 Latch
24	5-7-Reverse Clutch Feed
25	5-7-Reverse Clutch
26	5-7-Reverse Clutch Regulator
27	1-2-3-4-5-6 Clutch

Callout	Component Name
30	3-8 Clutch
31	4th Clutch
32	6-7-8-9 Clutch
33	1-Reverse Apply
34	1-Reverse Feed
35	1-Reverse Release
36	1-Reverse Limit
40	Clutch Select Valve Signal
41	Latch
42	Fluid Level Control
44	Exhaust Backfill
45	Exhaust
48	Feed 1
50	Sequence
51	Park On
52	Park Off

Automatic Transmission Case - Control Valve Body Side

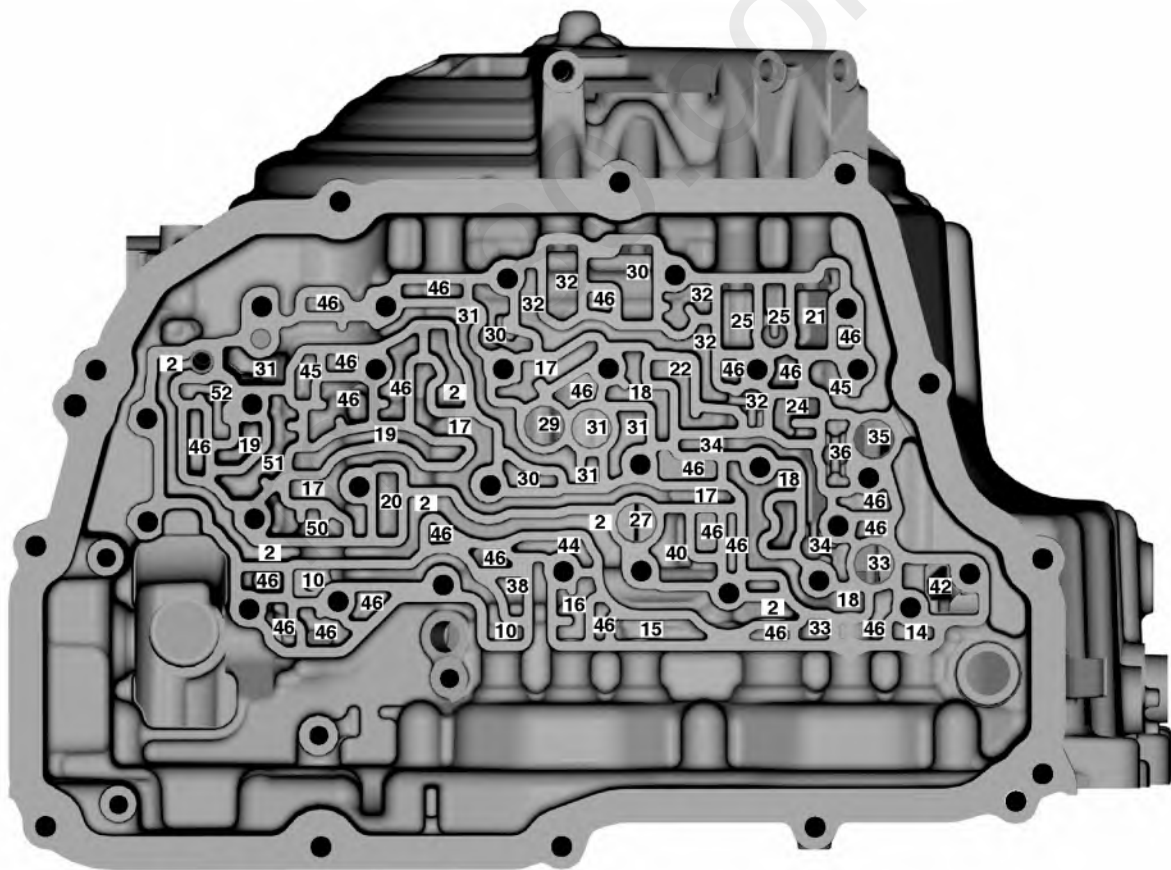


Fig. 71: Automatic Transmission Case Fluid Passages - Control Valve Body Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
10	Cooler Feed
14	Line VFS

Callout	Component Name
15	TCC VFS
16	Clutch Select Solenoid
17	Drive
18	Drive 2
19	Reverse
20	Actuator Feed Limit
21	Component Feed
22	1-Reverse/6-7-8-9 Feed
24	5-7-Reverse Clutch Feed
25	5-7-Reverse Clutch
27	1-2-3-4-5-6 Clutch
29	2-9 Clutch
30	3-8 Clutch
31	4th Clutch
32	6-7-8-9 Clutch
33	1-Reverse Apply
34	1-Reverse Feed
35	1-Reverse Release
36	1-Reverse Limit
40	Clutch Select Valve Signal
42	Fluid Level Control
44	Exhaust Backfill
45	Exhaust
46	Void
50	Sequence
51	Park On
52	Park Off

Automatic Transmission Case - Torque Converter Housing Side

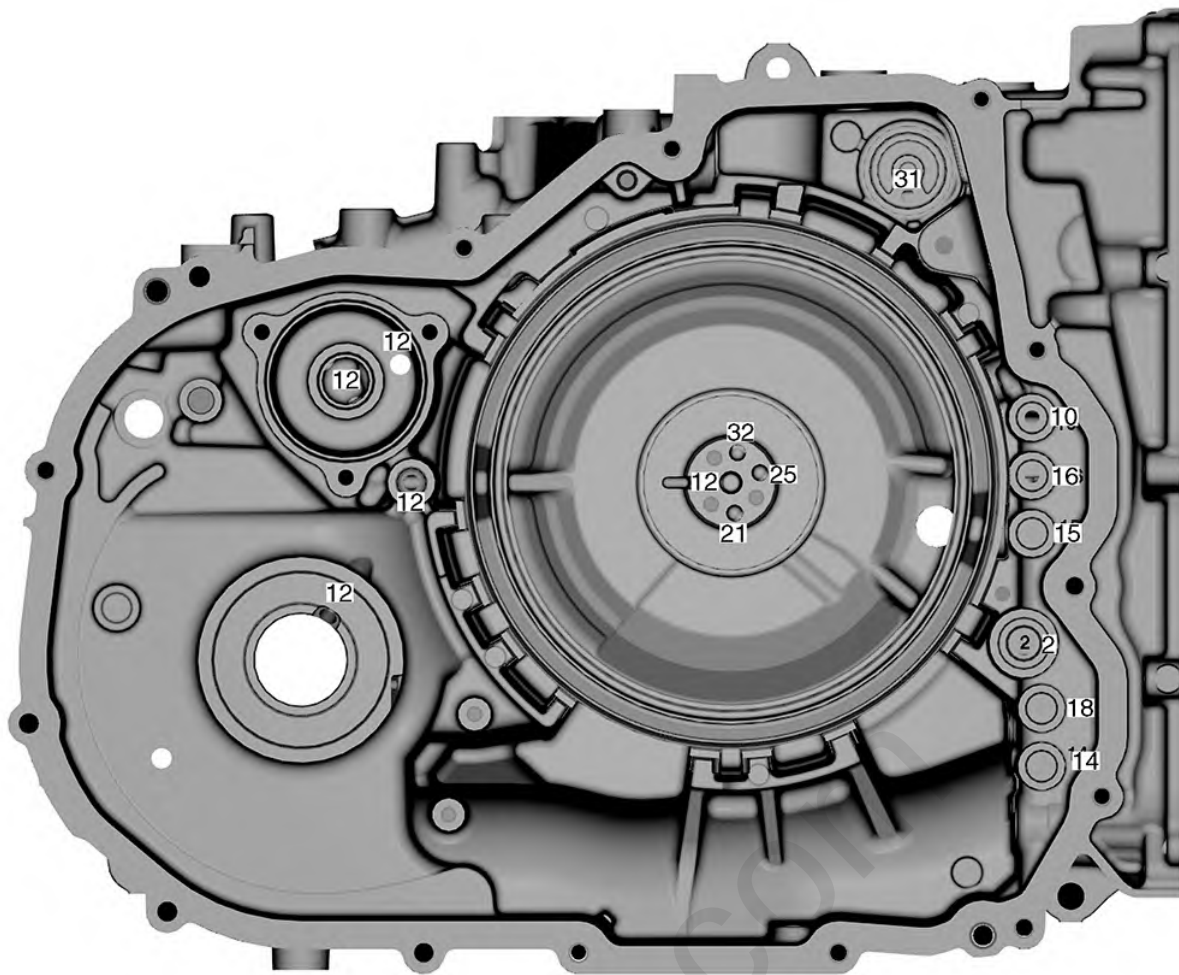


Fig. 72: Automatic Transmission Case Fluid Passages - Torque Converter Housing Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
10	Cooler Feed
12	Lube
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
18	Drive 2
21	Component Feed
25	5-7-Reverse Clutch
31	4th Clutch
32	6-7-8-9 Clutch

Torque Converter Housing - Automatic Transmission Case Side

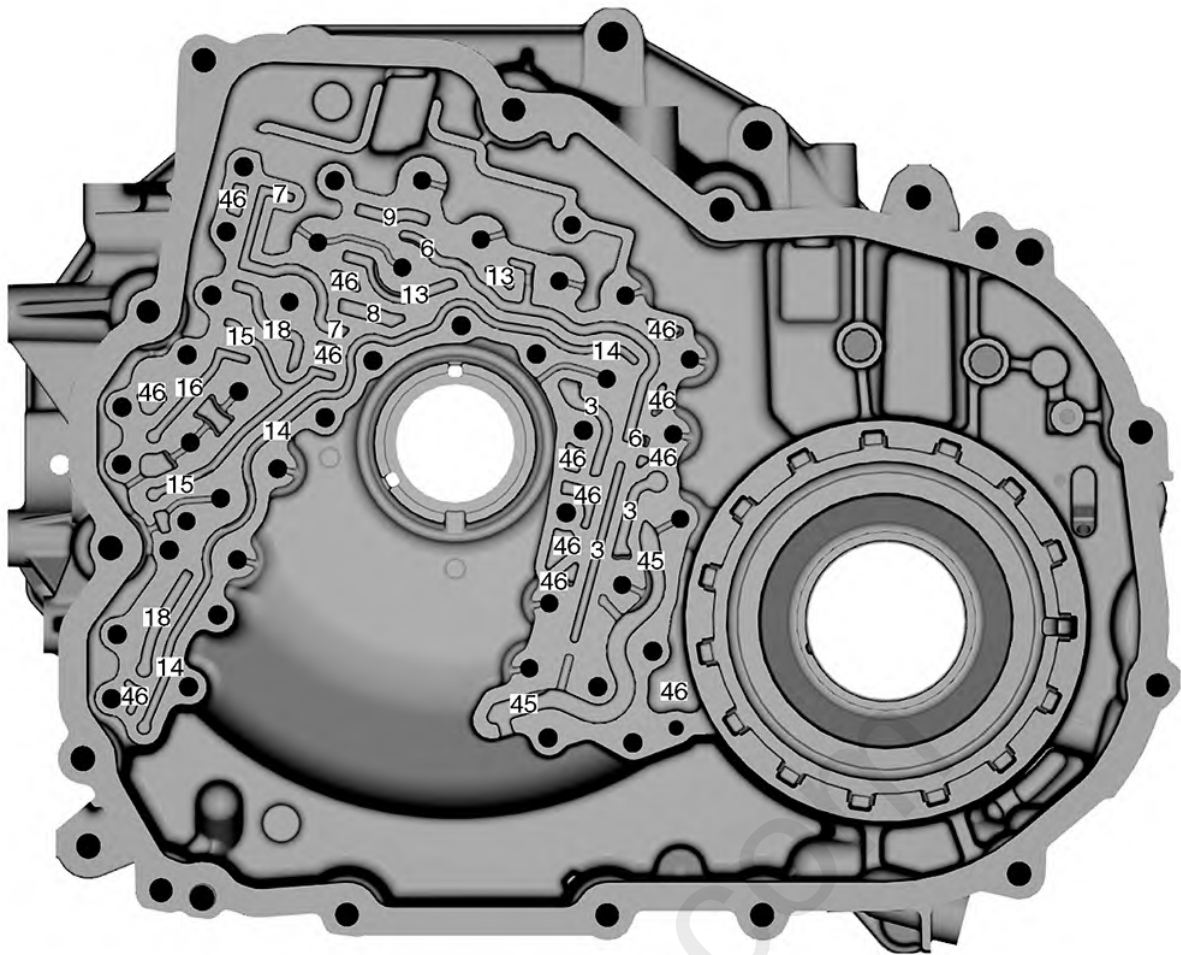


Fig. 73: Torque Converter Housing Fluid Passages - Automatic Transmission Case Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
3	Primary Line
6	Converter Feed
7	Regulator Apply
8	TCC Apply
9	TCC Release
13	Cooler/Lube
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
18	Drive 2
46	Void

Auxiliary Control Valve Body Spacer Plate - Drive Sprocket Support Side

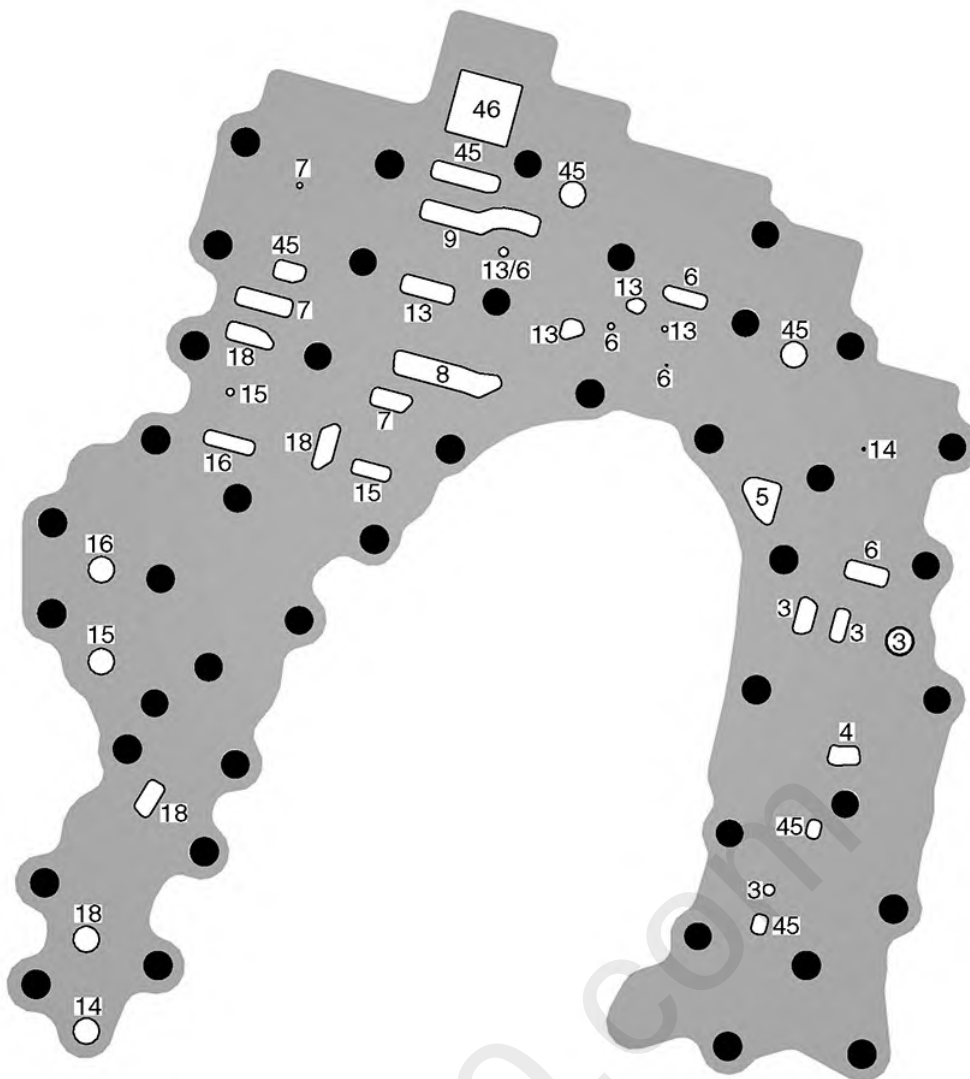


Fig. 74: Auxiliary Control Valve Body Spacer Plate Fluid Passages - Drive Sprocket Support Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
3	Primary Line
4	Secondary Line
5	Bypass
6	Converter Feed
7	Regulator Apply
8	TCC Apply
9	TCC Release
13	Cooler/Lube
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
18	Drive 2
45	Exhaust
46	Void

Drive Sprocket Support - Torque Converter Housing Side

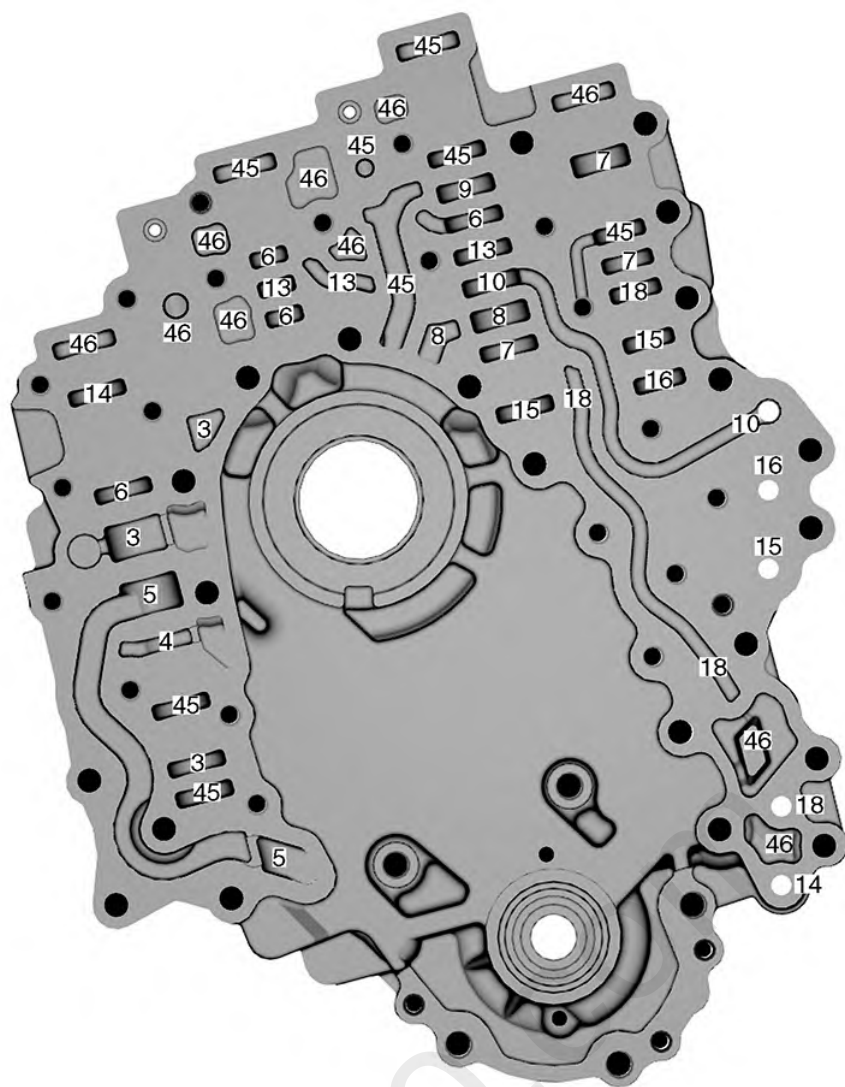


Fig. 75: Drive Sprocket Support Fluid Passages - Torque Converter Housing Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
3	Primary Line
4	Secondary Line
5	Bypass
6	Converter Feed
7	Regulator Apply
8	TCC Apply
9	TCC Release
10	Cooler Feed
13	Cooler/Lube
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
18	Drive 2
45	Exhaust
46	Void

Drive Sprocket Support - Automatic Transmission Fluid Pump Side

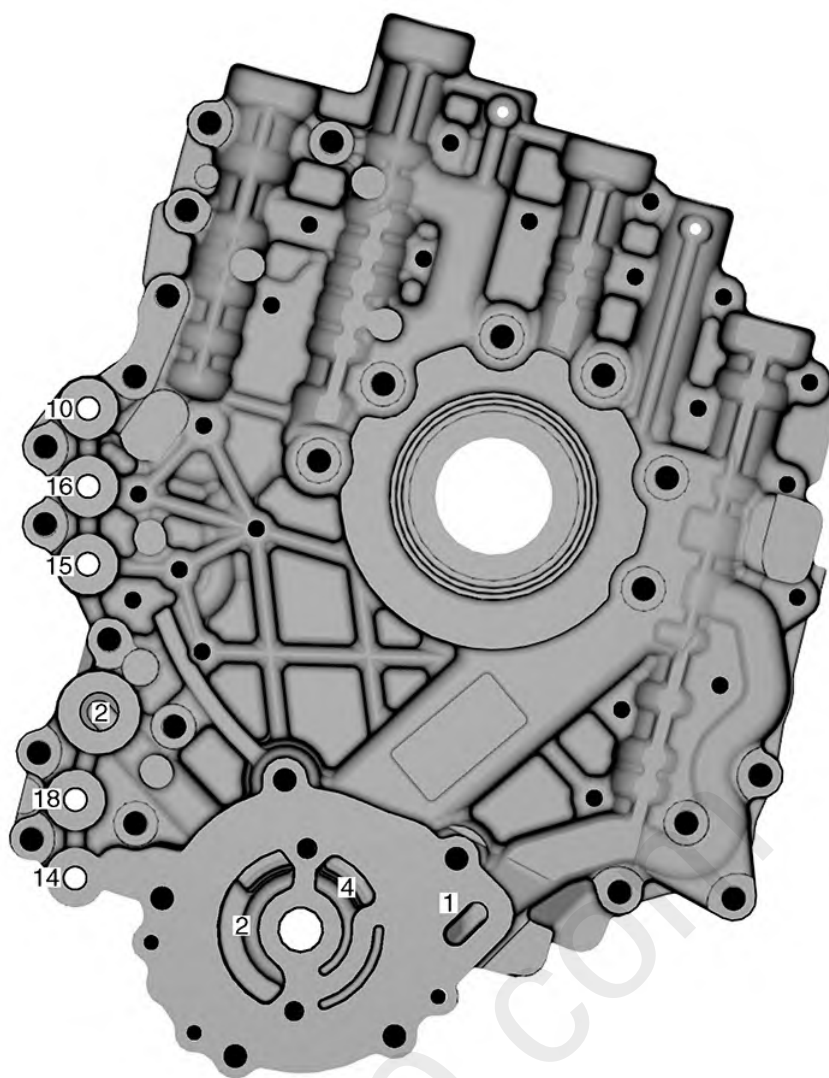


Fig. 76: Drive Sprocket Support Fluid Passages - Automatic Transmission Fluid Pump Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction
2	Line
4	Secondary Line
10	Cooler Feed
14	Line VFS
15	TCC VFS
16	Clutch Select Solenoid
18	Drive 2

Automatic Transmission Fluid Pump Gasket - Drive Sprocket Support Side

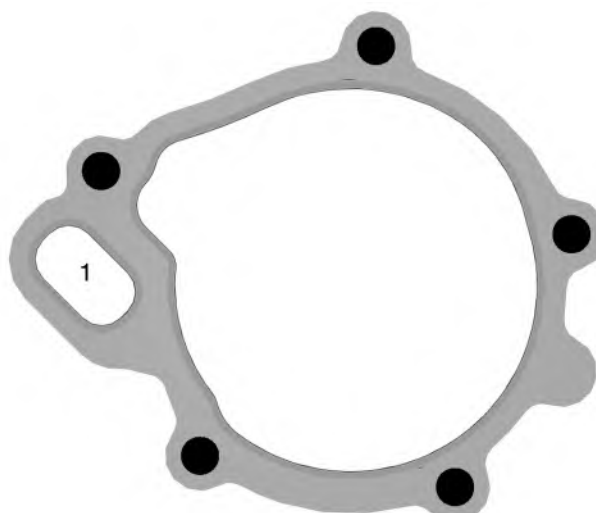


Fig. 77: Automatic Transmission Fluid Pump Gasket Fluid Passages - Drive Sprocket Support Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction

Automatic Transmission Fluid Pump - Drive Sprocket Support Side

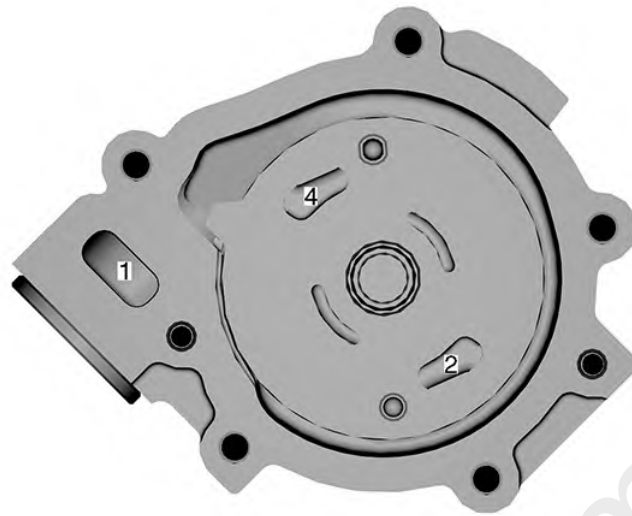


Fig. 78: Automatic Transmission Fluid Pump Fluid Passages - Drive Sprocket Support Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction
2	Line
4	Secondary Line