

2018 TRANSMISSION

Automatic Transmission - 6T40 (MNH MNK) Or 6T45 (MHG) - Description And Operation

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

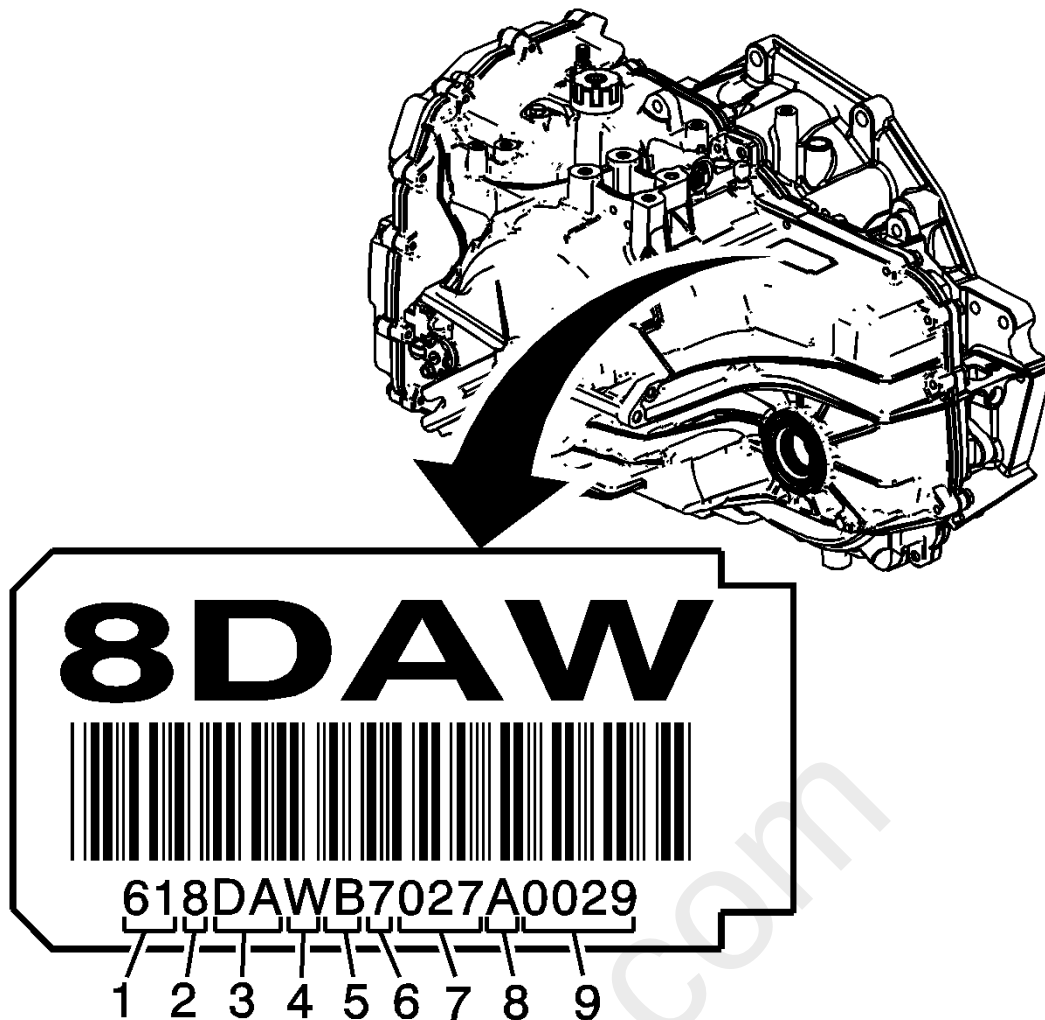


Fig. 1: Identifying Transmission Identification Information Plate

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Code for Automatic Transmission
2	Model Year
3	Model for Transmission
4	Transmission Family
5	Source Code for Plant
6	Calender Year
7	Julian Date
8	Shift/Line (A/B)
9	Numeric sequence starting at 0001 @ 12:01 AM each day

Source Code for Plant

- 4 - Ramos Arizpe, Mexico
- H - N.mpsilanti, Michigan
- J - Windsor, Ontario
- K - St. Catharines, Ontario
- S - Strasbourg, France
- W - Warren, Michigan
- Y - Toledo, Ohio
- R - Boryeong, Korea
- M - N.man Tai, Shan Dong, China
- P - San Luis Potosi, Mexico

TRANSMISSION GENERAL DESCRIPTION (GEN 3)

The Hydra-matic 6T30/35/40/45/50 is a fully automatic, 6-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. There are 2 variants of the transmission, based on torque capacity. Architecture is common between the variants, and component differences are primarily related to size.

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 6 forward gear ratios and reverse. Changing gear ratios is fully automatic and is accomplished through the use of a transmission control module (TCM) located inside the transmission. 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, including the TCM, are packaged into a self-contained control solenoid valve assembly.

The hydraulic system primarily consists of a gear-type 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 5 multiple disc clutches. The multiple disc clutches combine with one way clutch to deliver 7 different gear ratios, 6 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 6 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 (GEN 3)

The mechanical components of the 6T30/40/45/50 are as follows:

- A torque converter with an electronically controlled capacity clutch (ECCC)
- Gear-type fluid pump assembly
- 1 - 2 - 3 - 4 and low and reverse clutch housing assembly
- 4 - 5 - 6 and 3 - 5 reverse clutch housing assembly
- 2 - 6 clutch assembly
- Low and reverse clutch (one way clutch) assembly
- Control valve body assembly
- Drive sprocket, driven sprocket and link assembly
- Front differential carrier assembly
- Input Carrier Assembly
- Reaction Carrier Assembly
- Output Carrier Assembly

The electrical components of the 6T30/40/45/50 are as follows:

- Output speed sensor assembly
- Input speed sensor assembly
- Manual shift shaft with internal mode switch
- Control solenoid valve assembly, which contains the following components:
 - Transmission control module (TCM)
 - 5 variable bleed line pressure control (PC) solenoids
 - Transmission fluid pressure (TFP) switch assembly
 - Torque converter clutch (TCC) pressure control solenoid
 - shift solenoid
 - Transmission fluid temperature sensor

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

MANUAL MODE DESCRIPTION AND OPERATION (EQUINOX)

K9 Body Control Module

The K9 Body Control Module provides a signal circuit to the S2 Transmission Manual Shift Switch.

K71 Transmission Control Module

The control module receives information from a variety of sensors, switches and serial data information from other control modules. This information is used to control a combination of solenoid valves to obtain the correct line pressure, gear ratio and torque converter clutch operation.

S2 Transmission Manual Shift Switch

The S2 Transmission Manual Shift Switch contains 2 switches connected to a resistor network and is an integral part of the transmission control lever knob. When the plus (+) or minus (-) button is pressed, a specific resistance is generated.

S3 Transmission Shift Lever

Allows the selection of Park, Reverse, Neutral, Drive, and Manual Mode operation. The S3 Transmission Shift Lever is connected to the range selector cable which moves the automatic transmission range selector lever.

Circuit System Description

The K9 Body Control Module provides the signal circuit to the S2 Transmission Manual Shift Switch and the ground circuit is connected to chassis ground. The K9 Body Control Module monitors the voltage on the signal circuit. The voltage drop across the S2 Transmission Manual Shift Switch changes when the plus (+) or minus (-) button is pressed. The K9 Body Control Module communicates the shift request to the K71 Transmission Control Module via serial data.

Manual Mode Shifting Operation

Electronic Range Select Mode

Electronic Range Select Mode, also known as manual mode, allows for the range of gear positions. This mode allows the driver to choose the top gear limit of the transmission and is used when driving downhill or towing a trailer to limit the top gear and vehicle speed.

To use this feature:

1. Move the shift lever to L (Low) for Manual Mode.
2. Press the Plus (+) or Minus (-) on the shift lever to increase or decrease the gear range available.

When you shift from Drive (D) to 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 or M in the 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 4 is shown next to the L, first (1) through fourth (4) gears are automatically shifted by the transmission. The transmission will not shift into fifth (5) until the plus (+) is pressed or the S3 transmission shift lever is moved back into Drive (D).

While in manual mode, the K71 Transmission Control Module will prevent shifting to a lower gear range if the engine speed is too high. The driver has 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.

MANUAL MODE DESCRIPTION AND OPERATION (TERRAIN)

K9 Body Control Module

The K9 Body Control Module input circuit has an internal resistor connected to 12 V, which is the signal circuit to the S2 Transmission Manual Shift Switch. The K9 Body Control Module monitors the voltage on the circuit.

K71 Transmission Control Module

The control module receives information from a variety of sensors, switches and serial data information from other control modules. This information is used to control a combination of solenoid valves to obtain the correct line pressure, gear ratio and torque converter clutch operation.

S2 Transmission Manual Shift Switch

The S2 Transmission Manual Shift Switch has an internal resistor ladder network connected to 2 switches. A specific resistance is generated dependent on the position of the switches. The S2 Transmission Manual Shift Switch is located on the front shift console.

Circuit System Description

The K9 Body Control Module provides a signal circuit to the S3 Transmission Manual Shift Switch. The ground circuit for the S2 Transmission Manual switch is connected to chassis ground. The K9 Body Control Module monitors the voltage on the signal circuit to the S2 Transmission Manual Shift Switch. The voltage drop across the S2 Transmission Manual Shift Switch changes when the plus (+) or minus (-) button is pressed. The K9 Body Control Module communicates the shift request to the K71 Transmission Control Module via serial data.

Manual Mode Shifting Operation

Electronic Range Select Mode

Electronic Range Select Mode, also known as Manual Mode, allows for the range of gears available. This mode allows the driver to choose the top gear limit of the transmission and is used when driving downhill or towing a trailer to limit the top gear and vehicle speed.

To use this feature:

1. Press the L (Low) button located on the front shift console.
2. Press the Plus (+) or Minus (-) button located on the front shift console to increase or decrease the gear range available.

When the L (Low) button is pressed, 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 the 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 also available. For example, when 4 is shown next to the L, first (1) through fourth (4) gears are automatically shifted by the transmission. The transmission will not shift into fifth (5) until the plus (+) is pressed or the Drive (D) is selected.

While in manual mode, the K71 Transmission Control Module will prevent shifting to a lower gear range if the engine speed is too high. The driver has 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 attain the desired lower gear range.

TRANSMISSION ADAPTIVE FUNCTIONS

The 6T30/40/45/50 transmission utilizes a line pressure control system during upshifts to compensate for the normal wear of transmission components. As the apply components within the transmission wear or change over time, shift time (the time required to apply a clutch) increase or decreases. In order to compensate for these changes, the transmission control module (TCM) adjusts the pressure commands to the various PC solenoids, to maintain the originally calibrated shift timing. The automatic adjusting process is referred to as "adaptive learning" and it is used to ensure consistent shift feel plus increase transmission durability. The TCM monitors the A/T input speed sensor (ISS) and the A/T output speed sensor (OSS) during commanded shifts to determine if a shift is occurring too fast (harsh) or too slow (soft) and adjusts the corresponding pressure control (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). For a complete listing and description of all vehicle indicators and messages, refer to [Indicator/Warning Message Description and Operation](#).

"TRANSMISSION HOT IDLE ENGINE"

This message is displayed when the TCM detects a transmission fluid temperature (TFT) equal to or greater than 132°C (270°F) for 5 seconds.

"SERVICE TRANSMISSION"

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

ELECTRONIC COMPONENT DESCRIPTION

Q8 Control Solenoid Valve Assembly

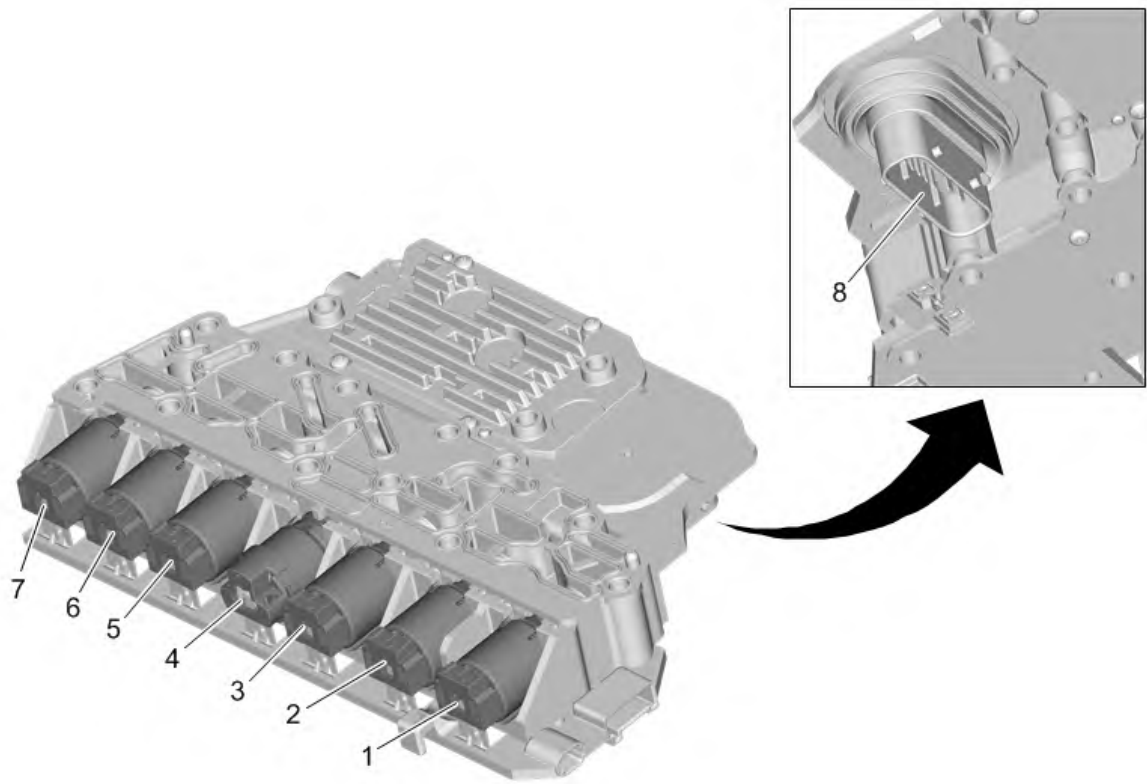


Fig. 2: Q8 Control Solenoid Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Q27C Pressure Control Solenoid Valve 3 (R-1/4-5-6)
2	Q27E Pressure Control Solenoid Valve 5 (1-2-3-4)
3	Q39A Torque Converter Clutch Pressure Control Solenoid Valve
4	Q32A Shift Solenoid Valve 1 (On/Off)
5	Q27B Pressure Control Solenoid Valve 2 (3-5-R)
6	Q27D Pressure Control Solenoid Valve 4 (2-6)
7	Q27A Pressure Control Solenoid Valve 1 (Line Pressure)
8	Pass Through Connector

The Q8 control solenoid valve assembly contains the following components:

- Transmission control module (TCM)
- Clutch pressure control solenoid valves
- Shift solenoid valve
- Line pressure control solenoid valve
- Torque converter clutch pressure control solenoid valve
- Transmission fluid temperature sensor
- TCM temperature sensor
- Power-up temperature sensor

These components are not serviced separately. The control solenoid valve assembly utilizes a lead-frame system to connect these components electrically to the TCM. No wires are used for these components. The control solenoid valve assembly bolts directly to the lower and upper valve body assemblies inside the transmission. The control solenoid valve assembly connects to the engine harness with a 14-way connector.

Pressure Control Solenoid Valve - Normally Low

A normally low solenoid valve has minimum pressure with no current. As the current increases, the pressure increases.

Pressure Control Solenoid Valve - Normally High

A normally high solenoid valve has maximum pressure with no current. As the current increases, the pressure decreases.

On/Off Solenoid Valve - Normally Closed

A normally closed On-Off Solenoid valve blocks the flow of fluid with no current. When voltage is applied, the solenoid valve allows fluid to flow.

Circuit/System Description - Solenoid Valves

The solenoid valves receive 12 volts from a high side driver internal to the TCM. The high side driver protects the circuit and components from excessive current flow. The TCM supplies a control circuit to each of the solenoid valves. Each control circuit has a low side driver. Control of the On/Off solenoid valve is accomplished by turning the low side driver On or Off. The TCM controls the current to the pressure control solenoids by controlling the amount of time the low side driver is On and Off.

Q27A Pressure Control Solenoid Valve 1

Pressure control solenoid valve 1 is a normally high pressure control solenoid that is used to control line pressure. The solenoid valve regulates and directs pressure to the pressure regulator valve. Increasing pressure to the regulator valve increases the line pressure.

Q27B Pressure Control Solenoid Valve 2

Pressure control solenoid valve 2 is a normally low pressure control solenoid valve. The solenoid valve regulates and directs fluid pressure to the 3-5-reverse clutch regulator valve. Increasing pressure to the 3-5-reverse clutch regulator valve increases pressure to the 3-5-reverse clutch.

Q27C Pressure Control Solenoid Valve 3

Pressure control solenoid valve 3 is a normally high pressure control solenoid valve. The solenoid valve regulates and directs fluid pressure to the R1/4-5-6 regulator valve. Increasing pressure to the R1/4-5-6 regulator valve increases pressure to the low and reverse clutch or the 4-5-6 clutch, depending on the position of the clutch select valve.

Q27D Pressure Control Solenoid Valve 4

Pressure control solenoid valve 4 is a normally low pressure control solenoid valve. The solenoid valve regulates and directs fluid pressure to the 2-6 clutch regulator valve. Increasing pressure to the 2-6 regulator valve increases pressure to the 2-6 clutch.

Q27E Pressure Control Solenoid Valve 5

Pressure control solenoid valve 5 is a normally high pressure control solenoid valve. The solenoid valve regulates and directs fluid pressure to the 1-2-3-4 clutch. Increasing pressure to the 1-2-3-4 regulator valve increases pressure to the 1-2-3-4 clutch.

Q32A Shift solenoid Valve 1

Shift solenoid valve 1 is a normally closed On/Off solenoid valve. When commanded On, the solenoid valve directs fluid to the clutch select valve, which moves the valve in the stroked position. Fluid pressure from the R1/4-5-6 regulator valve is directed through the clutch select valve to the R1 clutch in the stroked position. When shift solenoid valve 1 is commanded Off, the clutch select valve returns to the normal position. This allows fluid from the R1/4-5-6 regulator valve to be directed to the 4-5-6 clutch.

Temperature Sensor

The temperature sensor is a negative temperature coefficient thermistor. As temperature increases, the resistance of the sensor decreases.

Circuit/System Description - Temperature Sensor

The TCM provides a signal circuit for each of the temperature sensors, and a low reference circuit. The signal circuit input to the control module has an internal resistance connected to a 5 V reference. As the

temperature sensor resistance changes, the voltage drop across the temperature sensor changes. The TCM monitors the voltage and calculates the temperature of the sensor.

The B13 Transmission Fluid Temperature sensor is located so it contacts the transmission fluid. The transmission fluid temperature is one of the inputs the TCM uses to determine correct transmission control.

The TCM temperature and power up temperature sensors are located internal to the TCM. The TCM will shut down to prevent damage if excessive temperature is detected.

B15 Transmission Internal Mode Switch

Circuit/System Description - B15 Transmission Internal Mode Switch

The transmission internal mode switch is a sliding contact switch with 5 switches. The TCM provides a signal circuit to 4 of the contacts represented as Signal A, Signal B, Signal C, and Signal P. The TCM also provides a low reference signal. The four signal inputs to the TCM indicate the position of the transmission manual shaft. The input signal at the TCM is High when the switch contact is open, and Low when the switch contact is closed to the low reference.

One contact switch is used by the ECM to determine if the transmission is in park or neutral for engine start enable. The ECM provides a signal circuit to the neutral start switch. The Q8 Control Solenoid Valve Assembly provides a pass through connection. The park/neutral switch is closed when the transmission is in neutral or park, and open when the transmission is in reverse or a forward range

Input Speed Sensor (ISS)

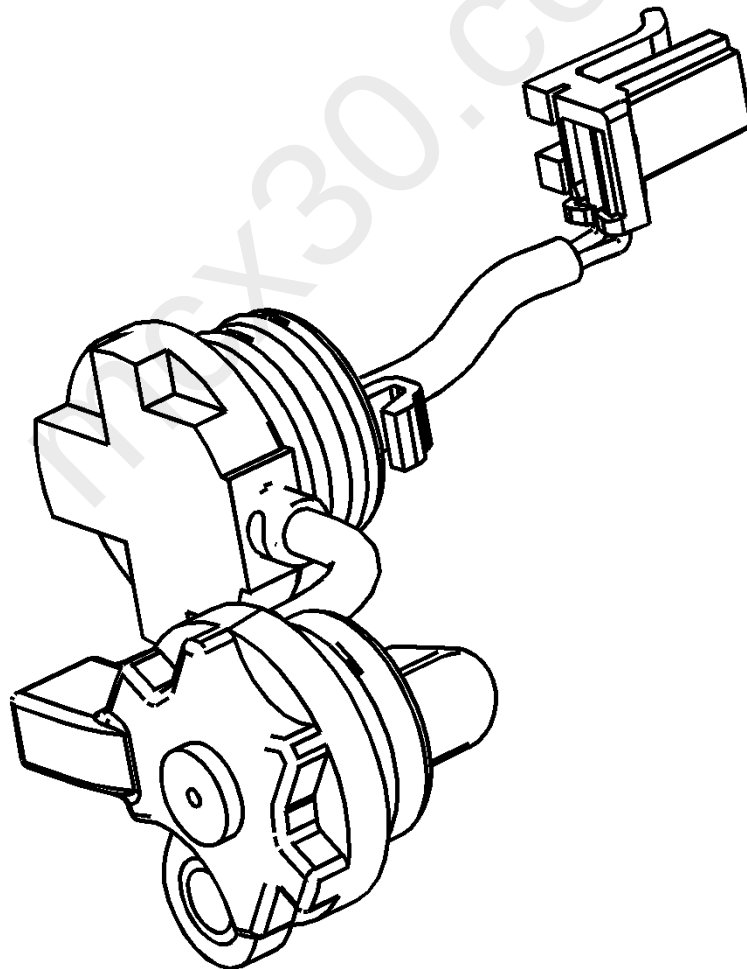


Fig. 3: View Of Input Speed Sensor (ISS).

Courtesy of GENERAL MOTORS COMPANY

The input speed sensor (ISS) is a hall-effect type sensor. The ISS mounts to the transmission case assembly and connects to the control solenoid valve assembly through a wire harness and connector. The

sensor faces the 3-5-R clutch piston housing machined teeth surface. The 3-5-R/4-5-6 rotates together with the turbine shaft.

Circuit/System Description - ISS

The TCM provides an 8.6 volt reference circuit and a signal circuit to the ISS. As the 3-5-R/4-5-6 clutch housing rotates, the sensor detects the change in the magnetic field as the machined teeth pass the sensor. The sensor produces a signal frequency based on the rotational speed of the housing. The TCM uses the signal to determine turbine shaft speed. The turbine shaft speed is one of the inputs the TCM uses to determine correct line pressure, transmission shift patterns, torque converter clutch slip speed and gear ratio.

Output Speed Sensor (OSS)

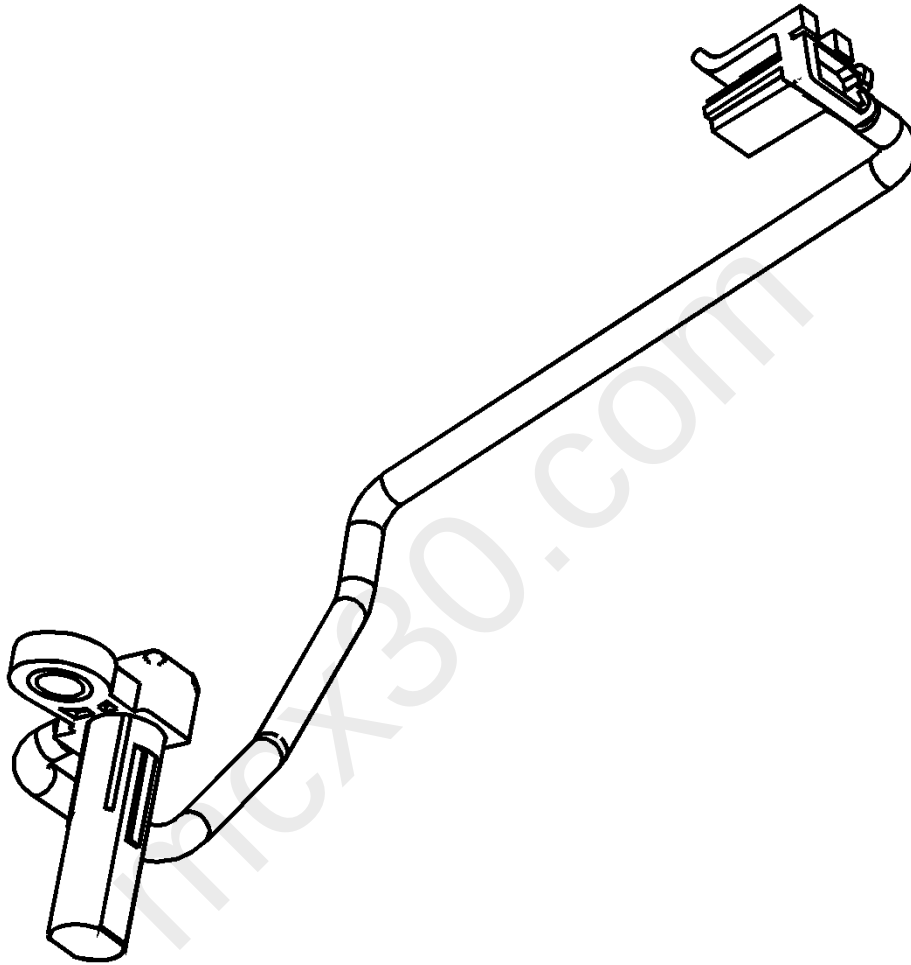


Fig. 4: View Of Output Speed Sensor (OSS)

Courtesy of GENERAL MOTORS COMPANY

The output speed sensor (OSS) is a hall-effect type sensor. The OSS mounts to the transmission case below the control valve body assembly and connects to the control solenoid valve assembly through a wire harness and connector. The sensor faces the Park gear machined teeth surface. The Park gear rotates together with the output shaft.

Circuit/System Description - OSS

The TCM provides an 8.6 volt reference circuit and a signal circuit to the output speed sensor. As the park gear rotates, the sensor detects the change in the magnetic field as the park gear teeth pass the sensor. The sensor produces a signal frequency based on the rotational speed of the gear. The TCM uses the signal to determine output shaft speed. Output shaft speed is one of the inputs the TCM uses to determine correct line pressure, transmission shift patterns, torque converter clutch slip speed and gear ratio.

NON-SHIFTING CLUTCH FUNCTION VERIFICATION DESCRIPTION

The 6T30/40/45/50 transmission uses a pressure control system to apply and release clutches during shifts. The transmission control module (TCM) controls pressure commands to the pressure control solenoids.

As normal wear of the transmission clutches occur, the TCM performs a clutch function verification. The TCM momentarily commands a clutch on at a low pressure. The clutch function verification is conducted on smooth roads when the transmission is not shifting and engine torque is consistent and positive.

When a clutch function verification is occurring, a slight bump or drag may be detected momentarily. The clutch function verification will occur a few times over several minutes and will not repeat again for a thousand or more miles. This is a normal condition and no repair attempts should be performed.

The clutch function verification will be performed sooner for a particular clutch if the TCM detects it is producing frequent poor shift control.

PARK - ENGINE RUNNING (GEN 3)

When the gear selector lever is in the Park (P) position, fluid is drawn into the pump through the transmission fluid filter 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 fluid circuits.

Actuator Feed Limit Valve

Line pressure is regulated through the valve into the actuator feed limit circuit. Actuator feed limit fluid passes through orifice #10 to a differential area to move the valve against actuator feed limit valve spring pressure. Actuator feed limit fluid is routed to the pressure control solenoids, the shift solenoid, and to the #4 ball check valve.

TCC Regulated Apply Valve

Shift solenoid fluid is routed to the TCC regulated apply valve and moves the valve against TCC regulated apply valve spring force.

Default Override Valve

Shift solenoid fluid is routed to the default override valve and moves the valve against default override valve spring force.

Low and Reverse Clutch Applies

R1/456 Pressure Control (PC) Solenoid

The R1/456 PC solenoid is energized (ON) allowing actuator feed limit fluid to enter the PCS R1/456 clutch fluid circuit. PCS R1/456 clutch fluid is then routed through orifice #11 to the R1/4-5-6 clutch regulator valve, and through orifice #34 to the R1/4-5-6 clutch boost valve.

R1/4-5-6 Clutch Regulator Valve

PCS R1/456 clutch fluid at the R1/4-5-6 clutch regulator valve, opposes R1/4-5-6 clutch regulator spring force and orificed R1/456 clutch feedback fluid pressure to regulate line pressure into the R1/456 clutch feed circuit. R1/456 clutch feed fluid is routed to the R1/4-5-6 clutch boost valve and to the clutch select valve.

R1/4-5-6 Clutch Boost Valve

PCS R1/456 clutch fluid pressure acts on a differential area, moving the R1/4-5-6 clutch boost valve against R1/4-5-6 clutch boost valve spring force, to regulate R1/456 clutch feed fluid into the R1/456 clutch feedback circuit. As PCS R1/456 clutch fluid pressure is increased to a given value, the R1/4-5-6 clutch boost valve opens the R1/456 clutch feedback circuit to exhaust backfill. This results in the R1/4-5-6 clutch regulator valve moving to the full feed position, sending full R1/456 clutch feed pressure (full line pressure) to the low and reverse clutch.

Shift Solenoid

The shift solenoid is energized (ON) allowing actuator feed limit fluid to enter the shift solenoid circuit. Shift solenoid fluid is routed to the clutch select valve through orifice #13, to the TCC regulated apply valve through orifice #14, and through orifice #44 to the default override valve.

Clutch Select Valve

Shift solenoid fluid is routed to the clutch select valve and moves the valve against clutch select valve spring force. This allows R1/456 clutch feed fluid to pass through the valve and enter the R1 circuit. R1 fluid is then routed through orifice #42 to the low and reverse clutch assembly in preparation for a shift into low or reverse gear.

Low and Reverse Clutch

R1/456 fluid enters the transmission case assembly and moves the low and reverse clutch piston against spring force to apply the low and reverse clutch plates. In Park range, the low and reverse clutch has no effect. However, when Reverse or a forward range is selected, only one apply device has to be energized, which helps create a smooth starting motion.

Accumulator

PCS R1/456 clutch fluid is also routed to an accumulator valve. The accumulator valve is used to dampen any pressure irregularities occurring in the PCS R1/456 clutch fluid circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

Park - Engine Running - Gen 3

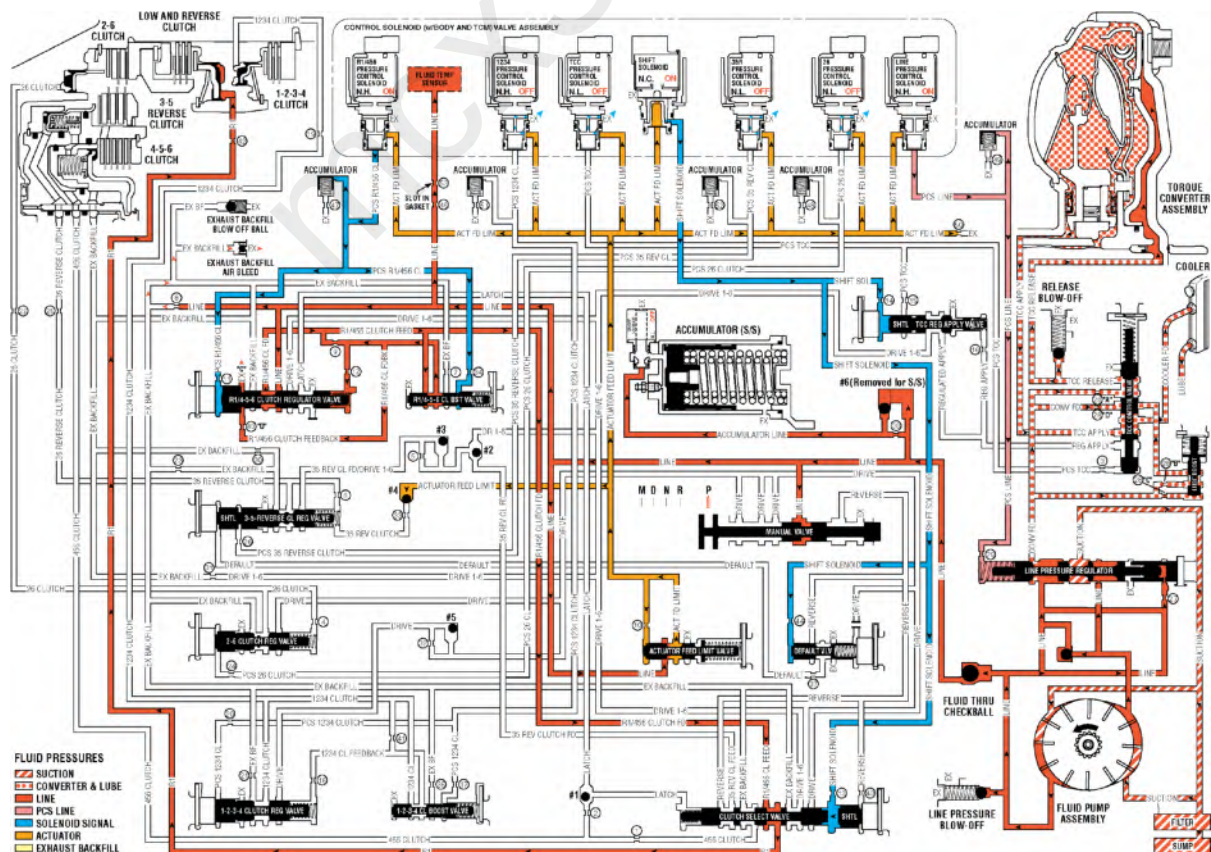


Fig. 5: Park -- Engine Running -- Gen 3 Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

REVERSE (GEN 3)

When the gear selector lever is moved to the Reverse (R) position (from the Park position) the normally-low 35R pressure control solenoid is commanded ON and the following changes occur in the transmission's hydraulic and electrical systems:

3-5-Reverse Clutch Applies

Manual Valve

With the manual valve in the reverse position, line pressure is directed into the reverse fluid circuit. Reverse fluid is then routed to the clutch select valve and to the default override valve.

Clutch Select Valve

Reverse fluid is routed to a differential area of the clutch select shuttle valve and assists shift solenoid fluid, present at the valve from Park position, in holding the clutch select valve against clutch select valve spring force. Reverse fluid passes through the clutch select valve into the 35 reverse clutch feed circuit and is routed to the #2 ball check valve. R1/456 clutch feed fluid, present at the valve from Park position, continues to pass through the valve into the R1 circuit in order to keep the low and reverse clutch applied.

#2 Ball Check Valve

3-5 reverse fluid seats the #2 ball check valve against the drive 1-6 fluid passage, and enters the 35 reverse/drive 1-6 circuit. 35 reverse/drive 1-6 fluid is routed to the #3 ball check valve.

#3 Ball Check Valve

35 reverse/drive 1-6 fluid unseats the #3 ball check valve and is routed to the 3-5-reverse clutch regulator valve.

35R Pressure Control (PC) Solenoid

The 35R PC solenoid is energized (ON), allowing actuator feed limit fluid to enter the PCS 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is then routed through orifice #26 to the 3-5-reverse clutch regulator valve.

3-5-Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid, at the 3-5-reverse clutch regulator valve, opposes 3-5-reverse clutch regulator valve spring force and orificed 35 reverse clutch feedback fluid pressure to regulate 35 reverse clutch feed/drive 1-6 pressure into the 35 reverse clutch circuit. 35 reverse clutch fluid is then routed through orifice #25 to the 3-5-reverse clutch, and through orifice #33 to the #4 ball check valve.

3-5-Reverse Clutch

35 reverse clutch fluid enters the 3-5-reverse and 4-5-6 clutch housing assembly to move the 3-5-reverse clutch piston against spring force to apply the 3-5-reverse clutch plates.

#4 Ball Check Valve

35 reverse clutch feed fluid unseats the #4 ball check valve, allowing excess pressure to pass into the actuator feed limit circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

Accumulator

PCS 35 reverse clutch fluid is also routed to an accumulator valve. The accumulator valve is used to dampen any pressure irregularities occurring in the PCS 35 reverse clutch fluid circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

Fluid Pressure Directed in Preparation for a Possible Default Action

Reverse fluid is directed to the default override valve in preparation for Reverse (R) range operation in the event of a transmission default action. If a transmission electrical component malfunction occurs, all solenoids will default to their normal state. The shift solenoid will default to its normally-closed state

(OFF), and shift solenoid fluid will exhaust, allowing default override valve spring force to move the default override valve to the released position. With the default override valve in the released position, reverse fluid pressure passes through the valve into the default circuit and is routed to the 3-5-reverse clutch regulator shuttle valve. Default fluid pressure replaces exhausting PCS 35 reverse clutch fluid pressure to keep the 3-5-reverse clutch regulator valve in the applied position, and allow continued Reverse (R) range operation. Refer to Drive Range - Fourth Gear Default for a complete description of the default actions that occur during an electrical component malfunction.

Reverse - Gen 3

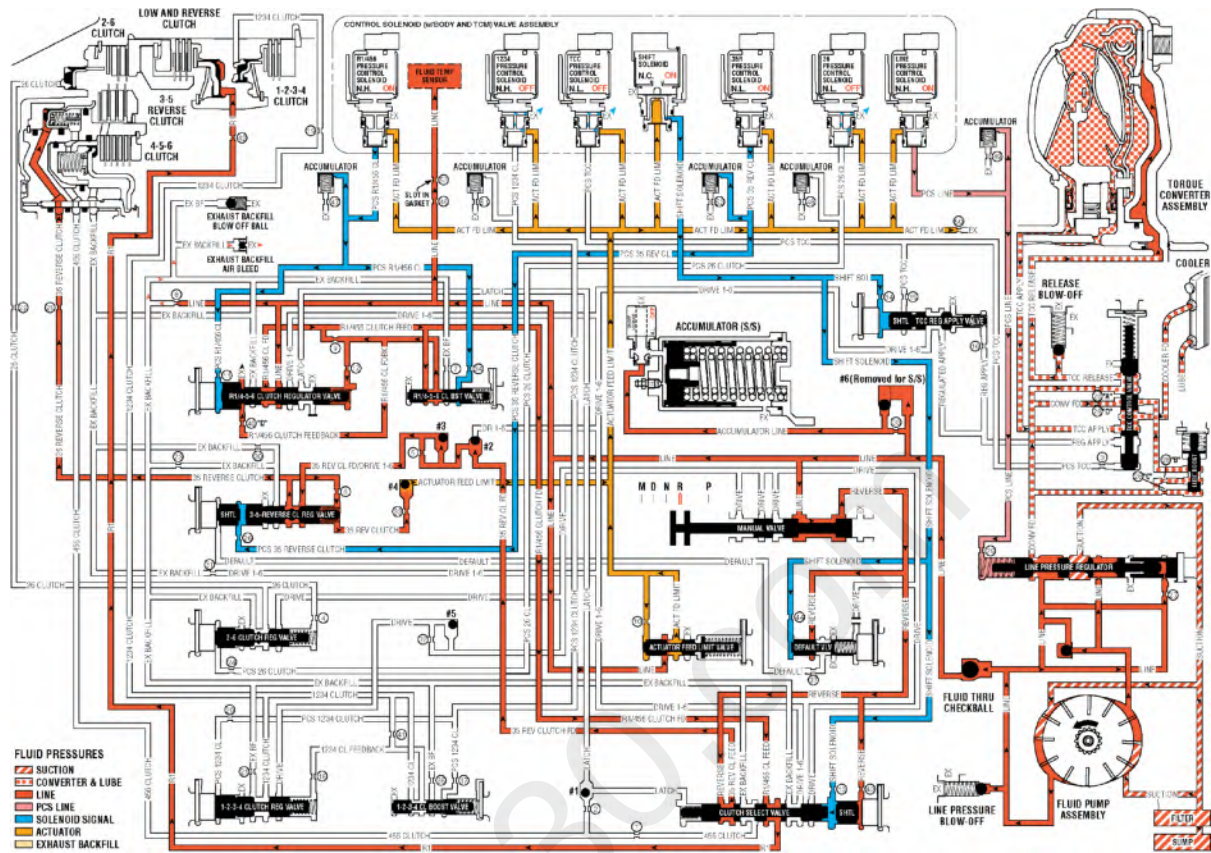


Fig. 6: Reverse -- Gen 3 Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

NEUTRAL - ENGINE RUNNING (GEN 3)

When the gear selector is moved to the Neutral (N) position, the hydraulic and electrical system operation is identical to Park (P) range. However, if Neutral is selected after the vehicle was operating in Reverse (R), the normally-low 35R pressure control solenoid is commanded OFF and the following changes would occur in the hydraulic system.

3-5 Reverse Clutch Releases

Manual Valve

The manual valve is moved to the Neutral position and blocks line pressure from entering the reverse fluid circuit. Reverse fluid, from the 3-5-reverse clutch regulator valve, the clutch select valve, and the default override valve is opened to an exhaust passage at the manual valve.

35R Pressure Control Solenoid

The 35R PC solenoid is commanded OFF allowing PCS 35 reverse clutch fluid from the 3-5-reverse clutch regulator valve to exhaust.

3-5-Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid exhausts, allowing 3-5-reverse clutch regulator valve spring force to move the 3-5-reverse clutch regulator valve to the released position. This allows exhausting 35 reverse clutch fluid pressure to pass into the exhaust backfill circuit in order to assist the 3-5-reverse clutch piston spring to quickly release the 3-5-reverse clutch.

3-5-Reverse Clutch

3-5-reverse clutch spring force, assisted by exhaust backfill pressure, moves the 3-5-reverse clutch piston to release the 3-5-reverse clutch plates and force 35 reverse clutch fluid to exhaust from the 3-5-reverse and 4-5-6 clutch housing assembly. The exhausting 35 reverse clutch fluid pressure is routed to the 3-5-reverse clutch regulator valve where it enters the exhaust backfill circuit.

Clutch Select Valve

When reverse fluid exhausts from the clutch select shuttle valve, shift solenoid fluid continues to hold the clutch select valve against clutch select valve spring force allowing 35 reverse clutch feed fluid to exhaust into the reverse circuit.

Neutral - Engine Running - Gen 3

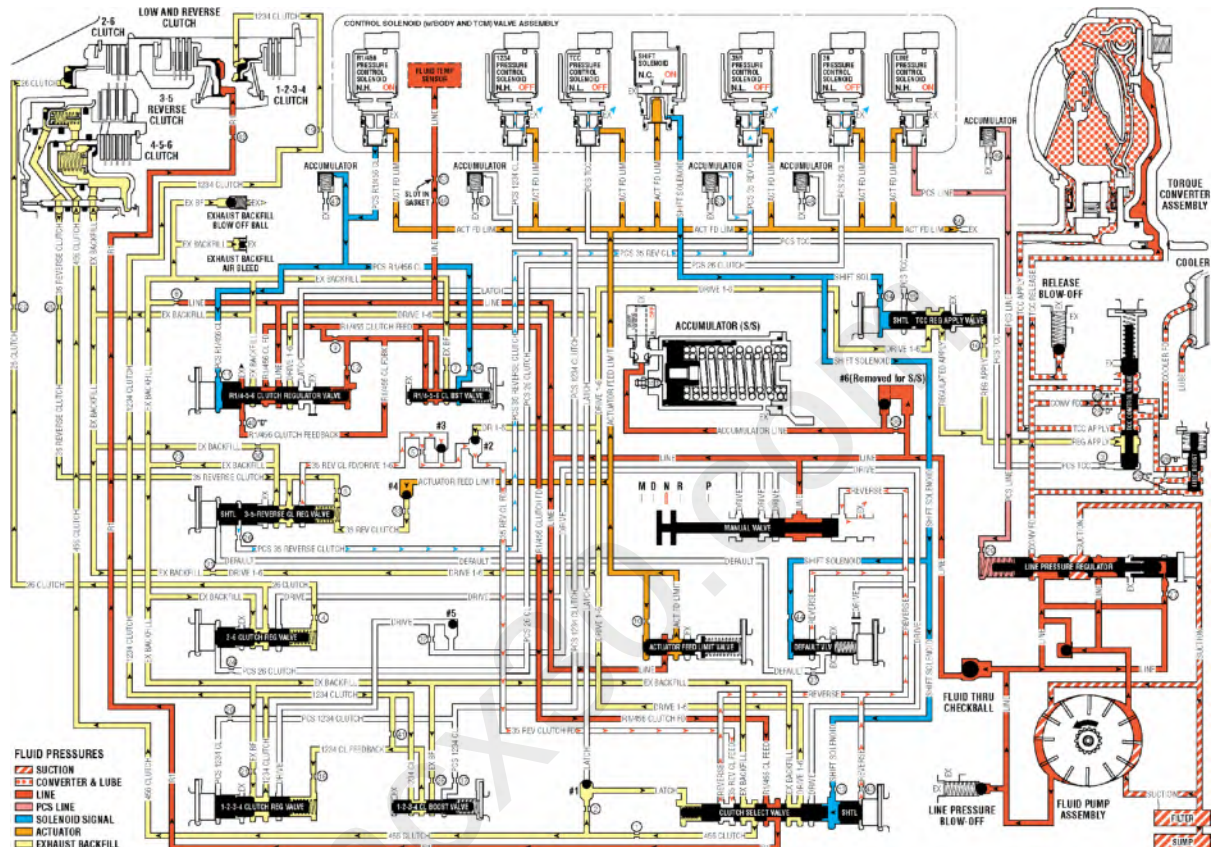


Fig. 7: Neutral -- Engine Running -- Gen 3 Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIRST GEAR ENGINE BRAKING (GEN 3)

Note: Some models of the 6T30/40/45/50 automatic transmission are equipped with an electric auxiliary fluid pump for use in hybrid vehicles (BAS+). Hybrid vehicles do not require internal combustion engine (ICE) operation at all times. After a successful engine start, the hybrid powertrain control module (HPCM) may turn OFF the engine (Auto Stop) when not required for the current vehicle conditions. The engine will remain OFF while in Auto Stop mode, until such time that vehicle conditions require the engine to run. During Auto Stop mode the main fluid pump is no longer driven by the engine, and the auxiliary fluid pump is commanded ON to provide hydraulic fluid pressure to operate the transmission. This functional description of Drive Range - First Gear (Engine Braking), and its accompanying hydraulic circuit, is written for a non-hybrid transmission. For a hybrid (BAS+) transmission, the description and illustration are the same, with the exception that, when the engine is OFF, the main fluid pump is not operating and the auxiliary fluid pump is ON.

When the gear selector lever is moved to the Drive (D) range from the Neutral (N) position, the transmission will provide engine braking. In this operating range, the normally-high 1234 pressure control solenoid is commanded ON and, in the engine braking mode, the following changes occur within the hydraulic circuits.

1-2-3-4 Clutch Applies

Manual Valve

The manual valve is moved to the Drive (D) position and allows line fluid pressure to enter the drive fluid circuit. Drive fluid is then routed to the clutch select valve, the #5 ball check valve, and to the 2-6 clutch regulator valve.

#5 Ball Check Valve

Drive fluid unseats the #5 ball check valve and is routed to the 1-2-3-4 clutch regulator valve.

1234 Pressure Control (PC) Solenoid

The 1234 PC solenoid is commanded ON allowing actuator feed limit fluid to enter the PCS 1234 clutch fluid circuit. PCS 1234 clutch fluid is then routed through orifice #20 to the 1-2-3-4 clutch regulator valve, and through orifice #17 to the 1-2-3-4 clutch boost valve.

1-2-3-4 Clutch Regulator Valve

PCS 1234 clutch fluid, at the 1-2-3-4 clutch regulator valve, opposes 1-2-3-4 clutch regulator valve spring force and 1234 clutch feedback fluid pressure to regulate drive fluid pressure into the 1234 clutch fluid circuit. The 1234 clutch fluid is then routed to the 1-2-3-4 clutch boost valve and through orifice #19 to the 1-2-3-4 clutch.

1-2-3-4 Clutch Boost Valve

PCS 1234 clutch fluid pressure acts on a differential area, moving the 1-2-3-4 clutch boost valve against 1-2-3-4 clutch boost valve spring force, to regulate 1234 clutch fluid into the 1234 clutch feedback circuit. As PCS 1234 clutch fluid pressure is increased to a given value, the 1-2-3-4 clutch boost valve opens the 1234 clutch feedback circuit to exhaust backfill. This results in the 1-2-3-4 clutch regulator valve moving to the full feed position, sending full 1234 clutch feed pressure (full line pressure) to the 1-2-3-4 clutch.

1-2-3-4 Clutch

The 1234 clutch fluid enters the transmission case assembly and moves the 1-2-3-4 clutch piston against spring force to apply the 1-2-3-4 clutch plates.

Accumulator

PCS 1234 clutch fluid is also routed to an accumulator valve. The accumulator valve is used to dampen any pressure irregularities occurring in the PCS 1234 clutch fluid circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

Low and Reverse Clutch Remains Applied to Provide Engine Braking

Clutch Select Valve

Shift solenoid fluid, present at the valve from Park position, continues to hold the clutch select valve against clutch select valve spring force. R1/456 clutch feed fluid, also present at the valve from Park position, continues to pass into the R1 circuit to feed the low and reverse clutch. Drive fluid is present at the valve in preparation for a change of gears.

Low and Reverse Clutch

The low and reverse clutch remains applied until just before the 1-2 shift in order to provide engine braking.

Drive Range, First Gear Engine Braking - Gen 3

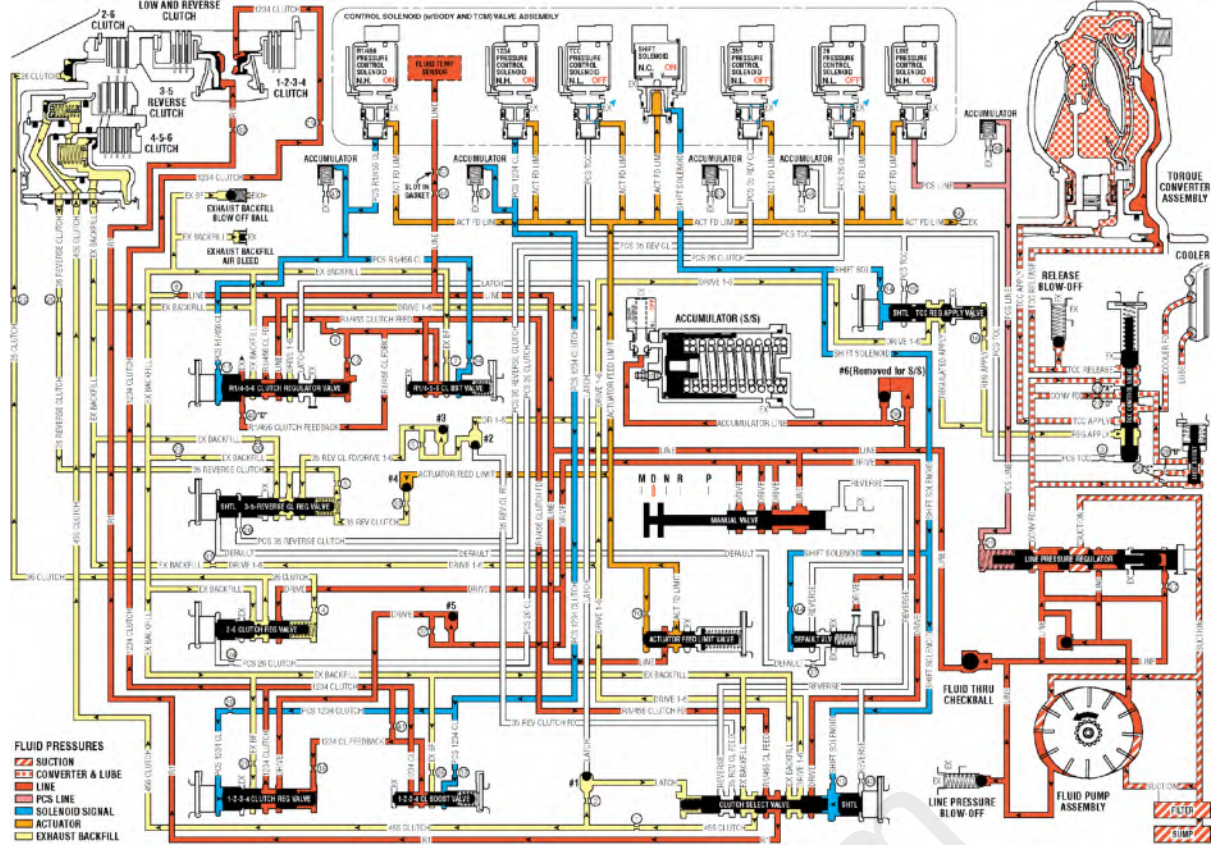


Fig. 8: Drive Range, First Gear Engine Braking -- Gen 3 Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIRST GEAR (GEN 3)

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, throttle position sensor and other vehicle sensors to determine the precise moment to de-energize or "turn OFF" the shift solenoid, and to command OFF the normally-high R1/456 pressure control solenoid.

Low & Reverse Clutch Releases

Shift Solenoid

The shift solenoid is commanded OFF allowing shift solenoid fluid pressure to exhaust from the clutch select valve, the default override valve, and the TCC regulator apply valve.

Clutch Select Valve

Shift solenoid fluid is exhausted from the clutch select valve and clutch select valve spring force moves the valve to the released position. This allows R1 fluid pressure to pass through the valve into the exhaust backfill circuit. Drive fluid from the manual valve passes through the clutch select valve and enters the drive 1-6 fluid circuit. Drive 1-6 fluid is routed to the R1/4-5-6 clutch regulator valve, the 3-5-reverse clutch regulator valve, and the TCC regulator apply valve.

Low and Reverse Clutch

Low and reverse clutch spring force moves the low and reverse clutch piston to release the low and reverse clutch plates and force R1 fluid to exhaust from the case assembly. The exhausting R1 fluid is routed to the clutch select valve where it enters the exhaust backfill circuit.

Fluid Pressure Directed in Preparation for a Shift

R1/456 Pressure Control (PC) Solenoid

The R1/456 PC solenoid is commanded OFF allowing PCS R1/456 clutch fluid to exhaust from the R1/4-5-6 clutch regulator valve and the R1/4-5-6 clutch boost valve.

R1/4-5-6 Clutch Regulator Valve

R1/4-5-6 clutch regulator valve spring force moves the valve to the released position, allowing R1/456 clutch feed fluid to enter the exhaust backfill circuit, and drive 1-6 fluid to enter the latch fluid circuit. Latch fluid is routed to the #1 ball check valve.

#1 Ball Check Valve

Latch fluid pressure seats the #1 ball check valve against the 456 clutch fluid circuit. Latch fluid is then directed to the clutch select valve. Latch fluid combines with clutch select valve spring force and holds the valve in this position during all six forward gear ranges.

#2 Ball Check Valve

Drive 1-6 fluid pressure seats the #2 ball check valve against the 35 reverse clutch feed fluid passage, and is directed into the 35 reverse clutch feed/drive 1-6 circuit. 35 reverse clutch feed/drive 1-6 fluid is routed to the #3 ball check valve.

#3 Ball Check Valve

35 reverse clutch feed/drive 1-6 fluid pressure unseats the #3 ball check valve and is directed to the 3-5-reverse clutch regulator valve.

Fluid Pressure Directed in Preparation for Torque Converter Clutch (TCC) Apply

TCC Regulator Apply Valve

Drive 1-6 fluid is routed to the TCC regulator apply valve in preparation for TCC apply.

Drive Range, First Gear - Gen 3

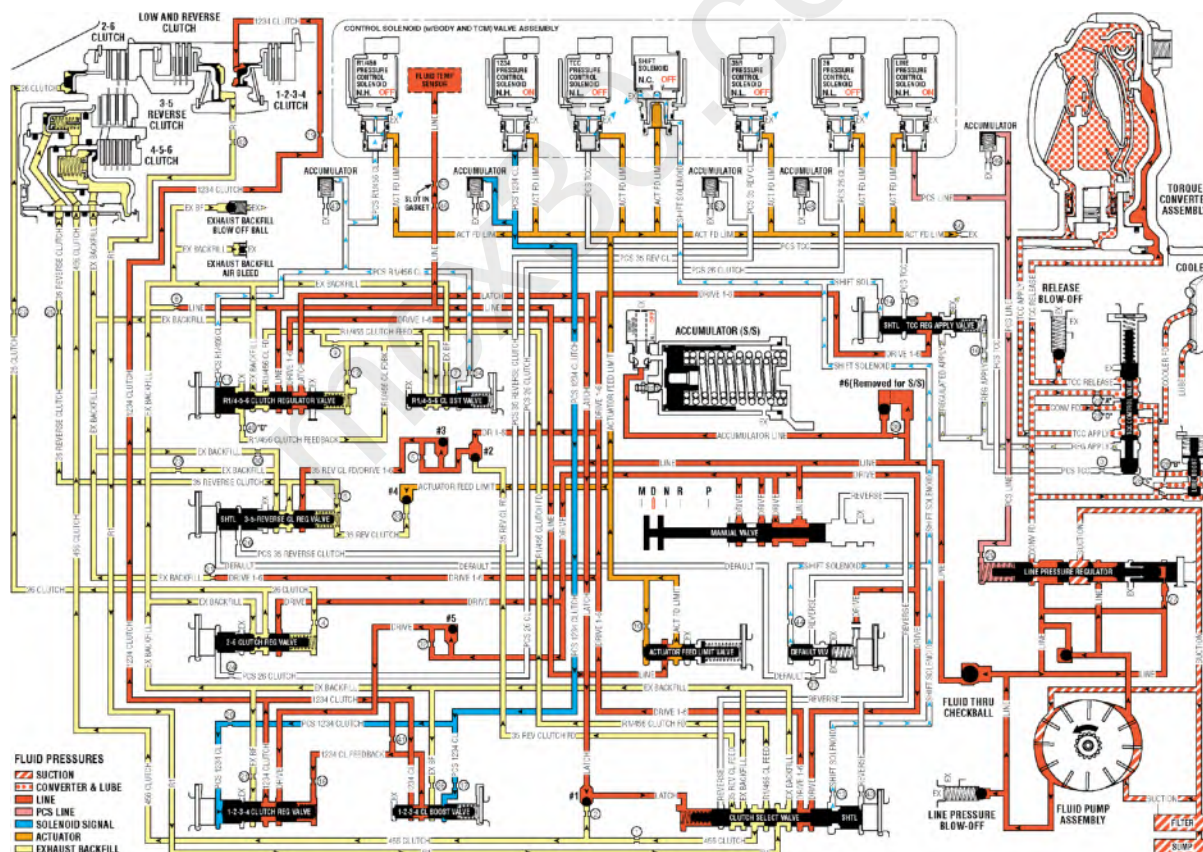


Fig. 9: Drive Range, First Gear -- Gen 3 Hydraulic Diagram

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SECOND GEAR (GEN 3)

As vehicle speed increases and operating conditions become appropriate, the transmission control module (TCM) processes input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-low 26 pressure control solenoid and shift the transmission into Second gear. The manual valve remains in the Drive (D) position and line pressure continues to feed the drive fluid circuit.

26 Pressure Control (PC) Solenoid

The 26 PC solenoid is commanded ON, allowing actuator feed limit fluid to enter the PCS 26 clutch fluid circuit. PCS 26 clutch fluid is then routed through orifice #24 to the 2-6 clutch regulator valve.

2-6 Clutch Regulator Valve

PCS 26 clutch fluid, at the 2-6 clutch regulator valve, opposes 2-6 clutch regulator valve spring force and orificed 26 clutch fluid pressure to regulate drive fluid pressure into the 26 clutch circuit. 26 clutch fluid is then routed through orifice #22 to the 2-6 clutch assembly in the transmission case, and through orifice #4 to the spring end of the 2-6 clutch regulator valve.

2-6 Clutch

The 26 clutch fluid from the 2-6 clutch regulator valve is routed through the transmission case to the 2-6 clutch piston assembly. The 26 clutch fluid pressure moves the piston against 2-6 clutch spring force to apply the 2-6 clutch plates.

Accumulator

PCS 26 clutch fluid is also routed to an accumulator valve. The accumulator valve is used to dampen any pressure irregularities occurring in the PCS 26 clutch fluid circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

Drive Range, Second Gear - Gen 3

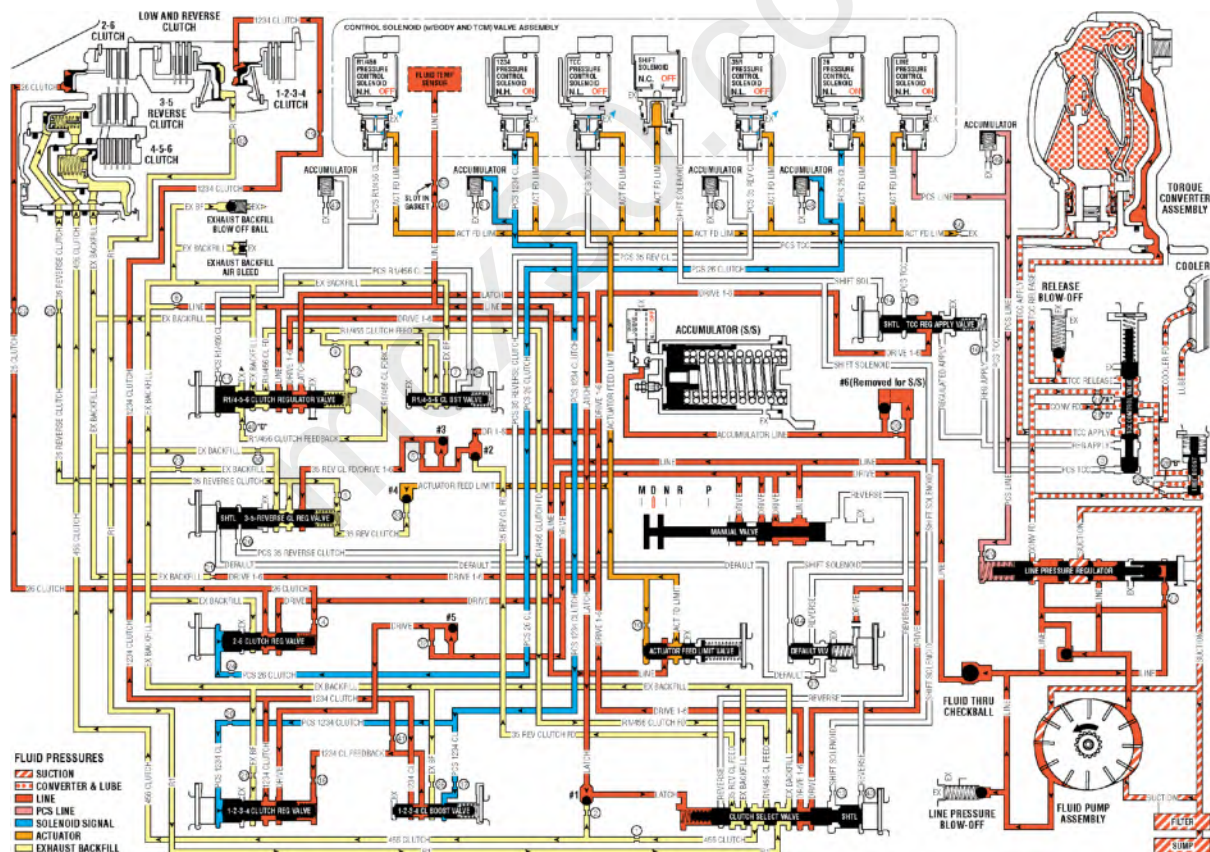


Fig. 10: Drive Range, Second Gear -- Gen 3 Hydraulic Diagram

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, THIRD GEAR (GEN 3)

As vehicle speed increases and operating conditions become appropriate, the transmission control module (TCM) processes input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command OFF the normally-low 26 pressure control solenoid. At the same time the 35R pressure control solenoid is also commanded ON to regulate 3-5 clutch apply, and the transmission shifts into Third gear. The manual valve remains in the Drive (D) position and line pressure continues to feed the drive fluid circuit.

3-5-Reverse Clutch Applies

35R Pressure Control (PC) Solenoid

The 35R PC solenoid is commanded ON, allowing actuator feed limit fluid to enter the PCS 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #26 to the 3-5-reverse clutch regulator valve.

3-5-Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid, at the 3-5-reverse clutch regulator valve, opposes 3-5-reverse clutch regulator valve spring force and 35 reverse clutch feedback fluid pressure to regulate 35 reverse clutch feed/drive 1-6 pressure into the 35 reverse clutch circuit. The 35 reverse clutch fluid is then routed through orifice #25 to the 3-5-reverse clutch assembly, through orifice #6 to the spring end of the 3-5-reverse clutch regulator valve and through orifice #33 to the #4 ball check valve.

3-5-Reverse Clutch

35 reverse clutch fluid enters the 3-5-reverse and 4-5-6 clutch housing assembly to move the 3-5-reverse clutch piston against spring force and exhaust backfill fluid pressure to apply the 3-5-reverse clutch plates.

#4 Ball Check Valve

35 reverse clutch feed fluid unseats the #4 ball check valve, allowing excess pressure to pass into the actuator feed limit circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

Accumulator

PCS 35 reverse clutch fluid is also routed to an accumulator valve. The accumulator valve is used to dampen any pressure irregularities occurring in the PCS 35 reverse clutch fluid circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

2-6 Clutch Releases

26 Pressure Control (PC) Solenoid

The 26 PC solenoid is commanded OFF, allowing PCS 26 clutch fluid to exhaust from the 2-6 clutch regulator valve.

2-6 Clutch Regulator Valve

2-6 clutch regulator valve spring force moves the valve to the released position, allowing 26 clutch fluid from the 2-6 clutch to pass through the valve and enter the exhaust backfill fluid circuit.

2-6 Clutch

2-6 clutch spring force moves the 2-6 clutch piston to release the 2-6 clutch plates and force 26 clutch fluid to exhaust from the transmission case assembly. The exhausting 26 clutch fluid pressure is routed to the 2-6 clutch regulator valve where it enters the exhaust backfill fluid circuit.

Drive Range, Third Gear - Gen 3

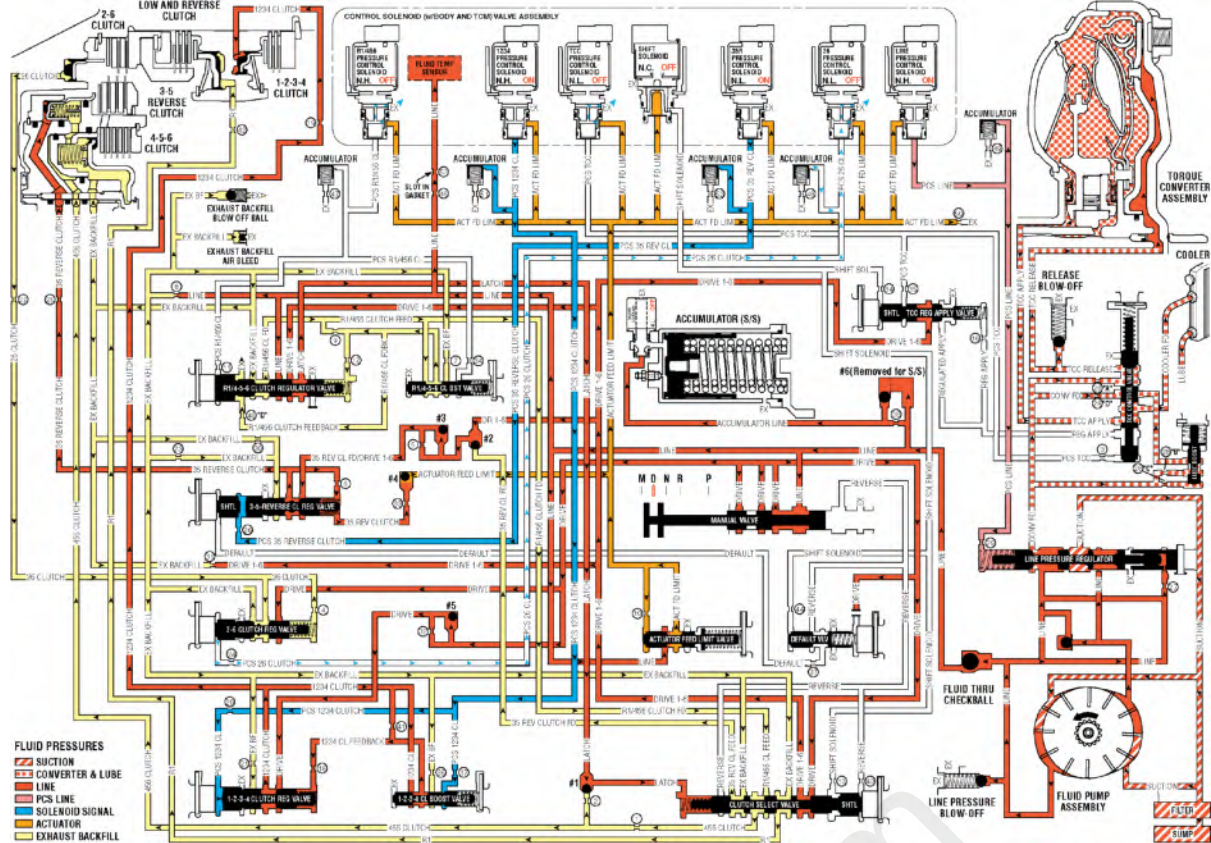


Fig. 11: Drive Range, Third Gear -- Gen 3 Hydraulic Diagram
 Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FOURTH GEAR (GEN 3)

As vehicle speed increases, the transmission control module (TCM) processes input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command OFF the normally-low 35R pressure control solenoid. At the same time, the normally-high R1/456 pressure control solenoid is commanded ON to regulate 4-5-6 clutch apply and the transmission shifts into Fourth gear.

4-5-6 Clutch Applies

R1/456 Pressure Control (PC) Solenoid

The R1/456 PC solenoid is commanded ON allowing actuator feed limit fluid to enter the PCS R1/456 clutch fluid circuit. PCS R1/456 clutch fluid is routed through orifice #11 to the R1/4-5-6 clutch regulator valve, and through orifice #34 to the R1/4-5-6 clutch boost valve.

R1/4-5-6 Clutch Regulator Valve

PCS R1/456 clutch fluid, at the R1/4-5-6 clutch regulator valve, opposes R1/4-5-6 clutch regulator valve spring force and orificed R1/456 clutch feed fluid pressure to regulate line pressure into the R1/456 clutch feed circuit. R1/456 clutch feed fluid is then routed to the clutch select valve, the R1/4-5-6 clutch boost valve, and through orifices #9 and #12 to the spring end of the R1/4-5-6 clutch regulator valve. When the R1/4-5-6 clutch regulator valve is in this position, latch fluid exhausts through the valve allowing 456 clutch fluid to shuttle the #1 ball check valve.

R1/4-5-6 Clutch Boost Valve

PCS R1/456 clutch fluid pressure acts on a differential area, moving the R1/4-5-6 clutch boost valve against R1/4-5-6 clutch boost valve spring force, to regulate R1/456 feed clutch fluid into the R1/456 clutch feedback circuit. As PCS R1/456 clutch fluid pressure is increased to a given value, the R1/4-5-6 clutch boost valve opens the R1/456 clutch feedback circuit to exhaust backfill. This results in the R1/4-5-6 clutch regulator valve moving to the full feed position, sending full R1/456 clutch feed pressure (full line pressure) to the 4-5-6 clutch.

#1 Ball Check Valve

Orificed 456 clutch fluid pressure seats the #1 ball check valve against the exhausting latch fluid passage. 456 clutch fluid is then directed into the latch circuit to replace the exhausting latch pressure and is routed to the clutch select valve. Latch fluid combines with clutch select valve spring force and holds the valve in this position during all six forward gear ranges.

Clutch Select Valve

R1/456 clutch feed fluid passes through the clutch select valve and enters the 456 clutch circuit. 456 clutch fluid is routed to the 4-5-6 clutch assembly, and through orifice #2 to the #1 ball check valve.

4-5-6 Clutch

456 clutch fluid enters the 3-5-reverse and 4-5-6 clutch housing assembly, and moves the 4-5-6 clutch piston against spring force and exhaust backfill pressure to apply the 4-5-6 clutch plates.

Accumulator

PCS R1/456 clutch fluid is also routed to an accumulator valve. The accumulator valve is used to dampen any pressure irregularities occurring in the PCS R1/456 clutch fluid circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

3-5-Reverse Clutch Releases

35R Pressure Control (PC) Solenoid

The 35R PC solenoid is commanded OFF allowing PCS 35 reverse clutch fluid from the 3-5-reverse clutch regulator valve to exhaust.

3-5-Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid exhausts, allowing 3-5-reverse clutch regulator valve spring force to move the 3-5-reverse clutch regulator valve to the released position. This allows exhausting 35 reverse clutch fluid pressure to pass into the exhaust backfill circuit in order to assist the 3-5-reverse clutch piston spring to quickly release the 3-5-reverse clutch.

3-5-Reverse Clutch

3-5-reverse clutch spring force, assisted by exhaust backfill pressure, moves the 3-5-reverse clutch piston to release the 3-5-reverse clutch plates and force 35 reverse clutch fluid to exhaust from the 3-5-reverse and 4-5-6 clutch housing assembly. The exhausting 35 reverse clutch fluid pressure is routed to the 3-5-reverse clutch regulator valve where it enters the exhaust backfill feed circuit.

Torque Converter Clutch (TCC) Applies

Torque Converter Clutch (TCC) Pressure Control (PC) Solenoid

The TCC PC solenoid is commanded ON, allowing actuator feed limit fluid to enter the PCS TCC fluid circuit. PCS TCC fluid is routed through orifice #15 to the TCC regulator apply valve and through orifice #3 to the TCC control valve.

TCC Regulator Apply Valve

PCS TCC fluid, at the TCC regulator apply valve, opposes TCC regulator apply valve spring force and orificed regulated apply fluid pressure to regulate drive 1-6 fluid into the regulated apply circuit. Regulated apply fluid is routed to the TCC control valve and through orifice #16 to the spring end of the TCC regulator apply valve.

TCC Control Valve

PCS TCC 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. Converter feed fluid passes through orifice #28 to the TCC control valve, replacing TCC apply fluid, to supply the cooler feed circuit. TCC release fluid passes through the TCC control valve and is exhausted.

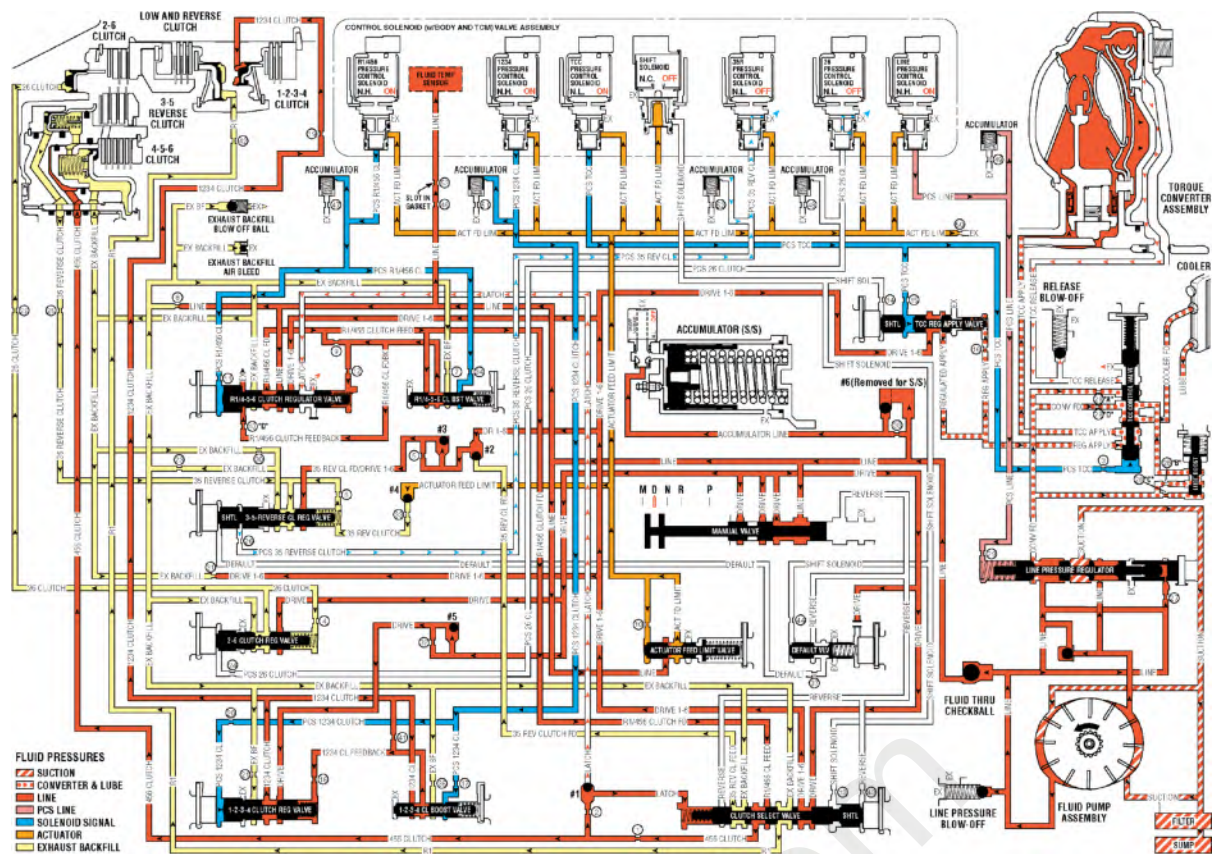


Fig. 12: Drive Range, Fourth Gear -- Gen 3 Hydraulic Diagram

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FOURTH GEAR DEFAULT (GEN 3)

If the transmission encounters an electrical component malfunction, the transmission will default to Fourth gear. All solenoids will default to their normal state. If the torque converter clutch is applied, it will release. The transmission will remain in Drive Range - Fourth Gear Default until the condition is corrected. Reverse (R) range can also still be selected. This default action enables the vehicle to be safely driven to a service center.

1-2-3-4 Clutch Applies or Remains Applied

1234 Pressure Control (PC) Solenoid

The 1234 PC solenoid defaults to its normally-high state (ON), allowing actuator feed limit fluid to enter the PCS 1234 clutch fluid circuit. PCS 1234 clutch fluid is routed through orifice #20 to the 1-2-3-4 clutch regulator valve, and through orifice #17 to the 1-2-3-4 clutch boost valve. If the transmission is operating in Fifth or Sixth gear when an electrical malfunction occurs, the 1-2-3-4 clutch will apply. If the transmission is operating in First, Second, Third or Fourth gear when the electrical malfunction occurs, the 1-2-3-4 clutch remains applied.

1-2-3-4 Clutch Boost Valve

PCS 1234 clutch fluid pressure acts on a differential area, moving the 1-2-3-4 clutch boost valve against 1-2-3-4 clutch boost valve spring force, to block 1234 clutch fluid from entering the 1234 clutch feedback circuit, and opening the 1234 clutch feedback circuit to exhaust backfill. This results in the 1-2-3-4 clutch regulator valve moving to the full feed position, sending full 1234 clutch feed pressure (full line pressure) to the 1-2-3-4 clutch.

1-2-3-4 Clutch Regulator Valve

PCS 1234 clutch fluid moves the 1-2-3-4 clutch regulator valve, against 1-2-3-4 clutch regulator valve spring force, to the applied position. This allows drive fluid pressure to pass through the valve into the 1234 clutch fluid circuit. The 1234 clutch fluid is then routed to the 1-2-3-4 clutch boost valve and through orifice #19 to the 1-2-3-4 clutch.

1-2-3-4 Clutch

1234 clutch fluid enters the transmission case assembly and moves the 1-2-3-4 clutch piston against spring force to apply the 1-2-3-4 clutch plates.

Accumulator

PCS 1234 clutch fluid is also routed to an accumulator valve. The accumulator valve is used to dampen any pressure irregularities occurring in the PCS 1234 clutch fluid circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

4-5-6 Clutch Applies or Remains Applied

R1/456 Pressure Control (PC) Solenoid

The R1/456 PC solenoid defaults to its normally-high state (ON), allowing actuator feed limit fluid to enter the PCS R1/456 clutch fluid circuit. PCS R1/456 clutch fluid is routed through orifice #11 to the R1/4-5-6 clutch regulator valve, and through orifice #34 to the R1/4-5-6 clutch boost valve. If the transmission is operating in First, Second or Third gear when an electrical malfunction occurs, the 4-5-6 clutch will apply. If the transmission is operating in Fourth, Fifth or Sixth gear when the electrical malfunction occurs, the 4-5-6 clutch remains applied.

R1/4-5-6 Clutch Boost Valve

PCS R1/456 clutch fluid pressure acts on a differential area, moving the R1/4-5-6 clutch boost valve against R1/4-5-6 clutch boost valve spring force, to block R1/456 clutch feed fluid from entering the R1/456 clutch feedback circuit, and opening the R1/456 clutch feedback circuit to exhaust backfill. This results in the R1/4-5-6 clutch regulator valve moving to the full feed position, sending full R1/456 clutch feed pressure (full line pressure) to the 4-5-6 clutch.

R1/4-5-6 Clutch Regulator Valve

PCS R1/456 clutch fluid moves the R1/4-5-6 clutch regulator valve, against R1/4-5-6 clutch regulator valve spring force, to the applied position. This allows line fluid pressure to pass through the valve into the R1/456 clutch feed circuit. R1/456 clutch feed fluid is then routed to the clutch select valve, the R1/4-5-6 clutch boost valve, and through orifices #9 and #12 to the spring end of the R1/4-5-6 clutch regulator valve. When the R1/4-5-6 clutch regulator valve is in this position, latch fluid exhausts through the valve allowing 456 clutch fluid to shuttle the #1 ball check valve.

#1 Ball Check Valve

Orificed 456 clutch fluid pressure seats the #1 ball check valve against the exhausting latch fluid passage. 456 clutch fluid is then directed into the latch circuit to replace the exhausting latch pressure and is routed to the clutch select valve. Latch fluid combines with clutch select valve spring force and holds the valve in this position during all six forward gear ranges.

Clutch Select Valve

R1/456 clutch feed fluid passes through the clutch select valve and enters the 456 clutch circuit. 456 clutch fluid is routed to the 4-5-6 clutch assembly, and through orifice #2 to the #1 ball check valve.

4-5-6 Clutch

456 clutch fluid enters the 3-5-reverse and 4-5-6 clutch housing assembly, and moves the 4-5-6 clutch piston against spring force and exhaust backfill pressure to apply the 4-5-6 clutch plates.

Accumulator

PCS R1/456 clutch fluid is also routed to an accumulator valve. The accumulator valve is used to dampen any pressure irregularities occurring in the PCS R1/456 clutch fluid circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

3-5-Reverse Clutch Releases

3-5-Reverse Clutch Applies

35R Pressure Control (PC) Solenoid

The 35R PC solenoid is commanded ON, allowing actuator feed limit fluid to enter the PCS 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #26 to the 3-5-reverse clutch regulator valve.

3-5-Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid, at the 3-5-reverse clutch regulator valve, opposes 3-5-reverse clutch regulator valve spring force and 35 reverse clutch feedback fluid pressure to regulate 35 reverse clutch feed/drive 1-6 pressure into the 35 reverse clutch circuit. The 35 reverse clutch fluid is then routed through orifice #25 to the 3-5-reverse clutch assembly, through orifice #6 to the spring end of the 3-5-reverse clutch regulator valve and through orifice #33 to the #4 ball check valve.

3-5-Reverse Clutch

35 reverse clutch fluid enters the 3-5-reverse and 4-5-6 clutch housing assembly to move the 3-5-reverse clutch piston against spring force and exhaust backfill fluid pressure to apply the 3-5-reverse clutch plates.

#4 Ball Check Valve

35 reverse clutch feed fluid unseats the #4 ball check valve, allowing excess pressure to pass into the actuator feed limit circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

Accumulator

PCS 35 reverse clutch fluid is also routed to an accumulator valve. The accumulator valve is used to dampen any pressure irregularities occurring in the PCS 35 reverse clutch fluid circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

1-2-3-4 Clutch Releases

1234 Pressure Control (PC) Solenoid

The 1234 PC solenoid is commanded OFF, allowing PCS 1234 clutch fluid to exhaust from the 1-2-3-4 clutch regulator valve and the 1-2-3-4 clutch boost valve.

1-2-3-4 Clutch Regulator Valve

1-2-3-4 clutch regulator valve spring force moves the valve to the released position, allowing 1234 clutch fluid pressure from the 1-2-3-4 clutch to pass through the valve and enter the exhaust backfill circuit. The exhausting 1234 clutch fluid pressure is routed through orifice #21 in order to help control the release of the 1-2-3-4 clutch.

1-2-3-4 Clutch Boost Valve

1-2-3-4 clutch boost valve spring force moves the 1-2-3-4 clutch boost valve to the released position, allowing 1234 clutch feedback fluid pressure to exhaust from the 1-2-3-4 clutch regulator valve into the 1234 clutch circuit.

1-2-3-4 Clutch

1-2-3-4 clutch spring force moves the 1-2-3-4 clutch piston to release the 1-2-3-4 clutch plates and force 1234 clutch fluid to exhaust from the transmission case assembly. The exhausting 1234 clutch fluid is routed to the 1-2-3-4 clutch regulator valve where it enters the exhaust backfill circuit.

Drive Range, Fifth Gear - Gen 3

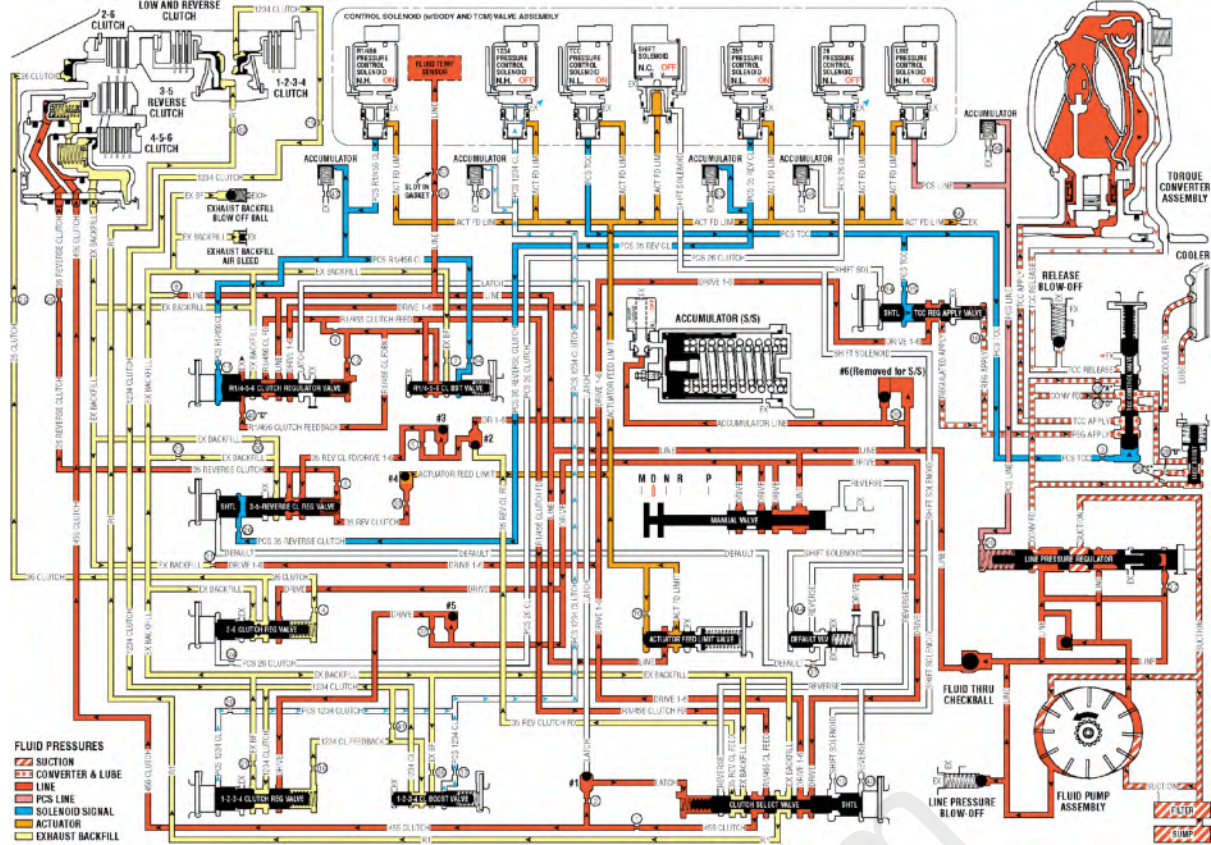


Fig. 14: Drive Range, Fifth Gear -- Gen 3 Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SIXTH GEAR (GEN 3)

As vehicle speed increases, the transmission control module (TCM) processes input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-low 26 pressure control solenoid. At the same time, the normally-low 35R pressure control solenoid is commanded OFF and the transmission shifts into Sixth gear.

2-6 Clutch Applies

26 Pressure Control (PC) Solenoid

The 26 PC solenoid is commanded ON, allowing actuator feed limit fluid to enter the PCS 26 clutch fluid circuit. PCS 26 clutch fluid is then routed through orifice #24 to the 2-6 clutch regulator valve.

2-6 Clutch Regulator Valve

PCS 26 clutch fluid, at the 2-6 clutch regulator valve, opposes 2-6 clutch regulator valve spring force and orificed 26 clutch fluid pressure to regulate drive fluid pressure into the 26 clutch circuit. 26 clutch fluid is then routed through orifice #22 to the 2-6 clutch assembly in the transmission case, and through orifice #4 to the spring end of the 2-6 clutch regulator valve.

2-6 Clutch

The 26 clutch fluid from the 2-6 clutch regulator valve is routed through the transmission case to the 2-6 clutch piston assembly. The 26 clutch fluid pressure moves the piston against 2-6 clutch spring force to apply the 2-6 clutch plates.

Accumulator

PCS 26 clutch fluid is also routed to an accumulator valve. The accumulator valve is used to dampen any pressure irregularities occurring in the PCS 26 clutch fluid circuit. This helps to control clutch apply fluid pressure and clutch apply feel.

3-5 Reverse Clutch Releases

35R Pressure Control (PC) Solenoid

The 35R PC solenoid is commanded OFF allowing PCS 35 reverse clutch fluid from the 3-5-reverse clutch regulator valve to exhaust.

3-5-Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid exhausts, allowing 3-5-reverse clutch regulator valve spring force to move the 3-5-reverse clutch regulator valve to the released position. This allows exhausting 35 reverse clutch fluid pressure to pass into the exhaust backfill circuit in order to assist the 3-5-reverse clutch piston spring to quickly release the 3-5-reverse clutch.

3-5-Reverse Clutch

3-5-reverse clutch spring force, assisted by exhaust backfill pressure, moves the 3-5-reverse clutch piston to release the 3-5-reverse clutch plates and force 35 reverse clutch fluid to exhaust from the 3-5-reverse and 4-5-6 clutch housing assembly. The exhausting 35 reverse clutch fluid pressure is routed to the 3-5-reverse clutch regulator valve where it enters the exhaust backfill circuit.

Drive Range, Sixth Gear - Gen 3

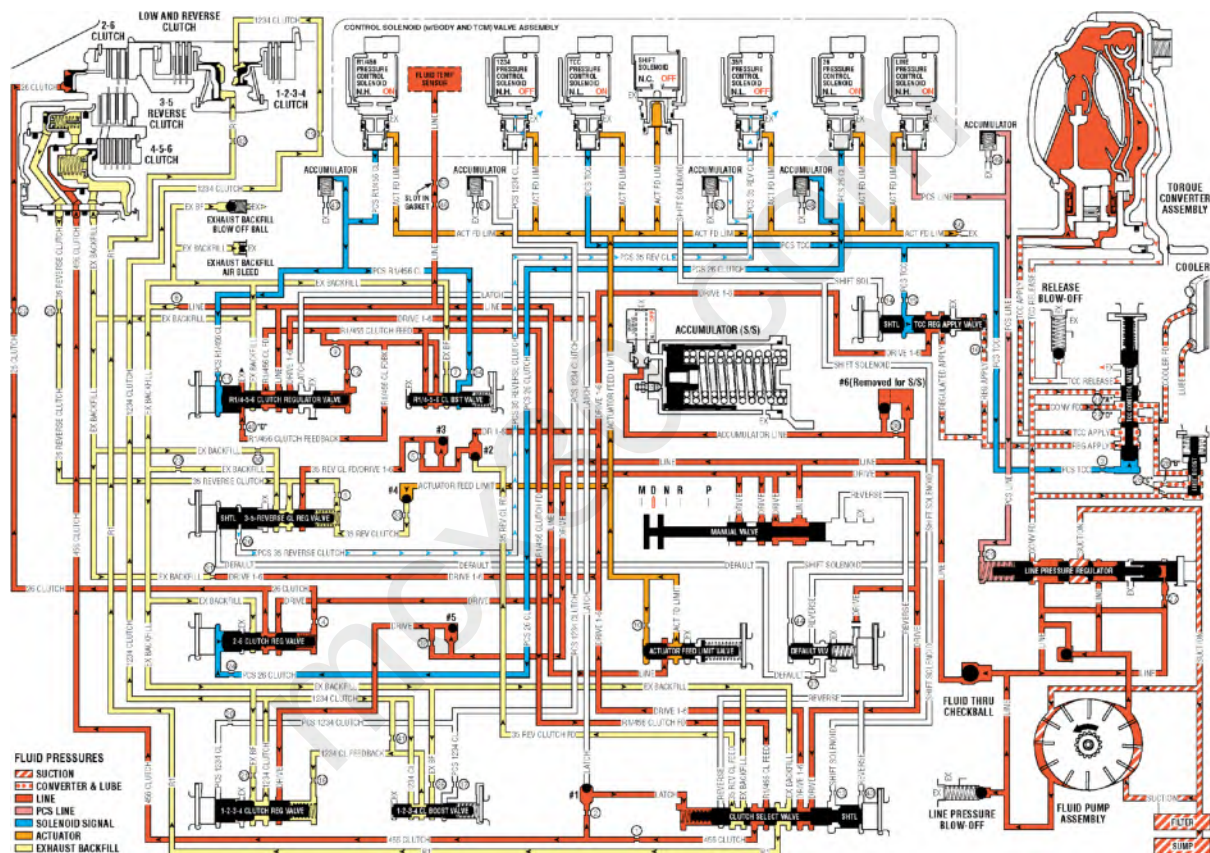


Fig. 15: Drive Range, Sixth Gear -- Gen 3 Hydraulic Diagram
Courtesy of GENERAL MOTORS COMPANY

FLUID PASSAGES (GEN 3)

Torque Converter and Differential Housing - Case Side

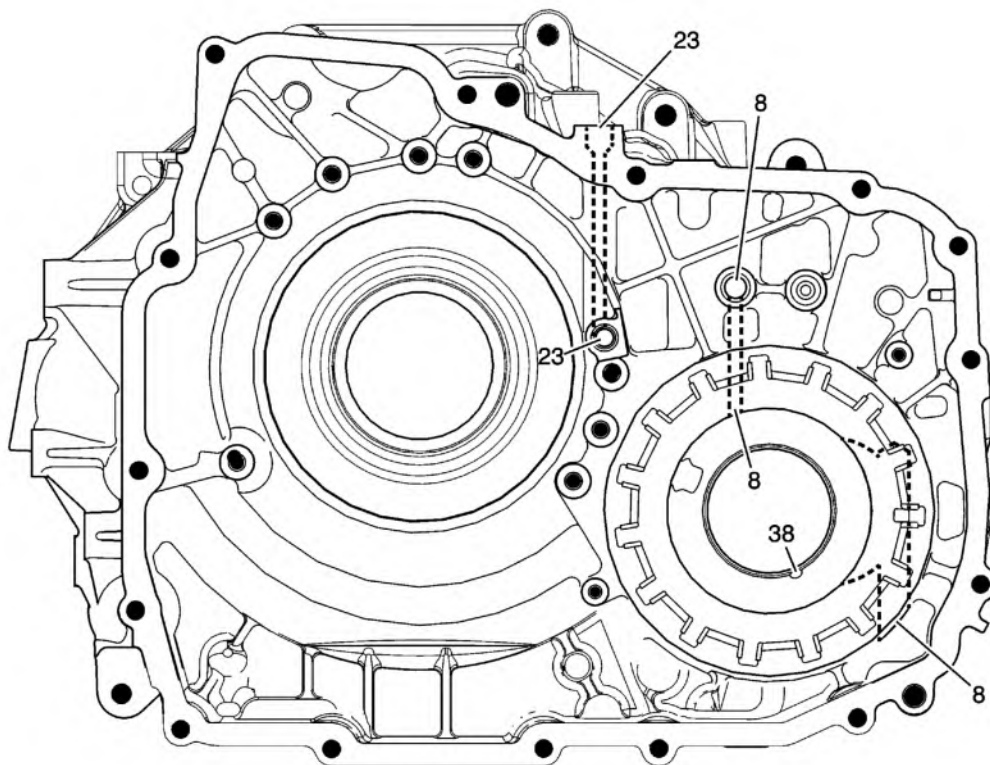


Fig. 16: Torque Converter and Differential Housing -- Case Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
8	Lube
23	Auxiliary Suction (BAS+ Only)
38	Seal Drainback

Fluid Pump Body - Fluid Pump Cover Side

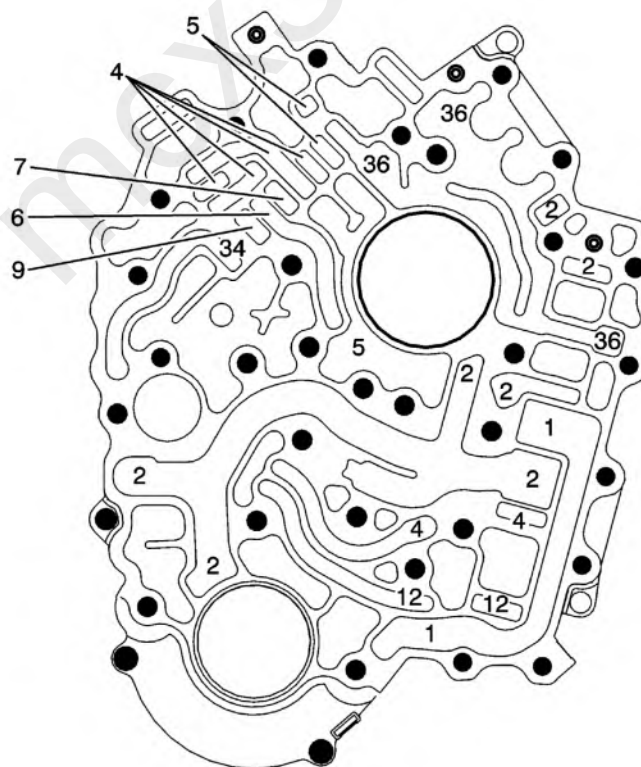


Fig. 17: Fluid Pump Body -- Fluid Pump Cover Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction

Callout	Component Name
2	Line
4	Converter Feed
5	TCC Release
6	TCC Apply
7	Cooler Feed
9	Regulated Apply
12	PCS Line
34	PCS TCC
36	Exhaust

Fluid Pump Cover - Fluid Pump Side

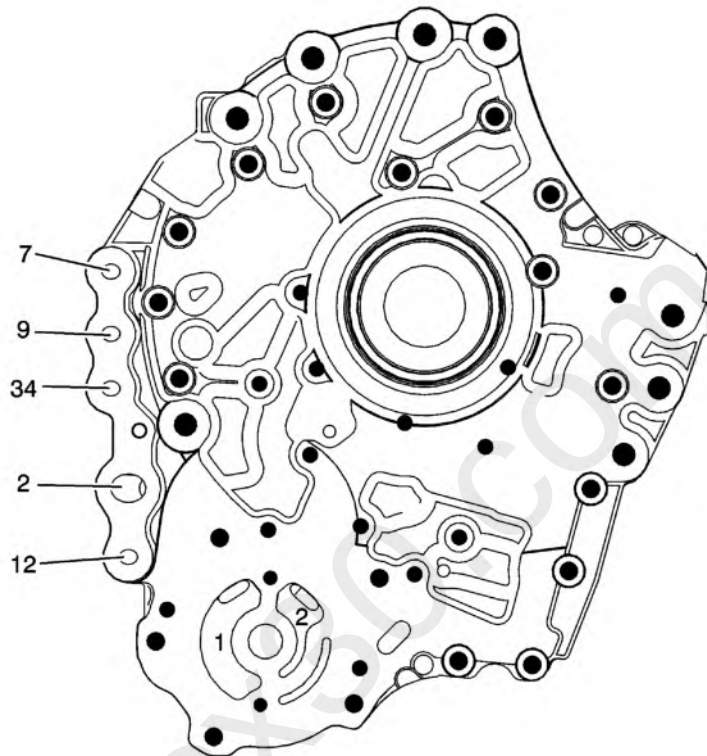


Fig. 18: Fluid Pump Cover -- Fluid Pump Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction
2	Line
7	Cooler Feed
9	Regulated Apply
12	PCS Line
34	PCS TCC

Fluid Pump Cover - Fluid Pump Body Side

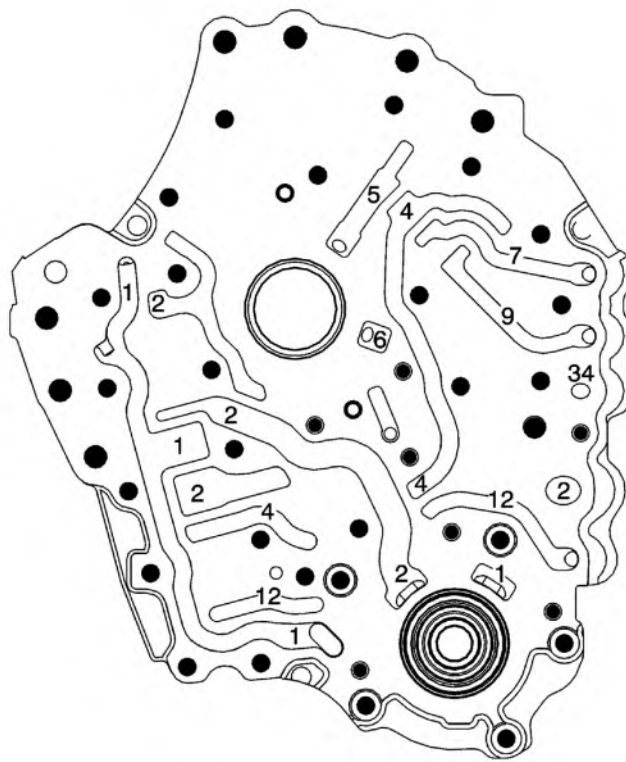


Fig. 19: Fluid Pump Cover -- Fluid Pump Body Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction
2	Line
4	Converter Feed
5	TCC Release
6	TCC Apply
7	Cooler Feed
9	Regulated Apply
12	PCS Line
34	PCS TCC

Fluid Pump Transfer Plate Body

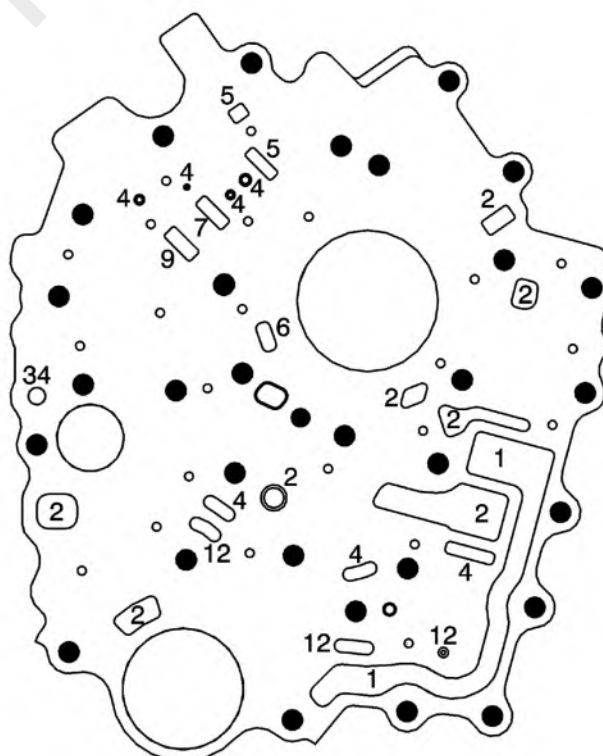


Fig. 20: Fluid Pump Transfer Plate Body.
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Suction
2	Line
4	Converter Feed
5	TCC Release
6	TCC Apply
7	Cooler Feed
9	Regulated Apply
12	PCS Line
34	PCS TCC

Case - Torque Converter and Differential Housing Side

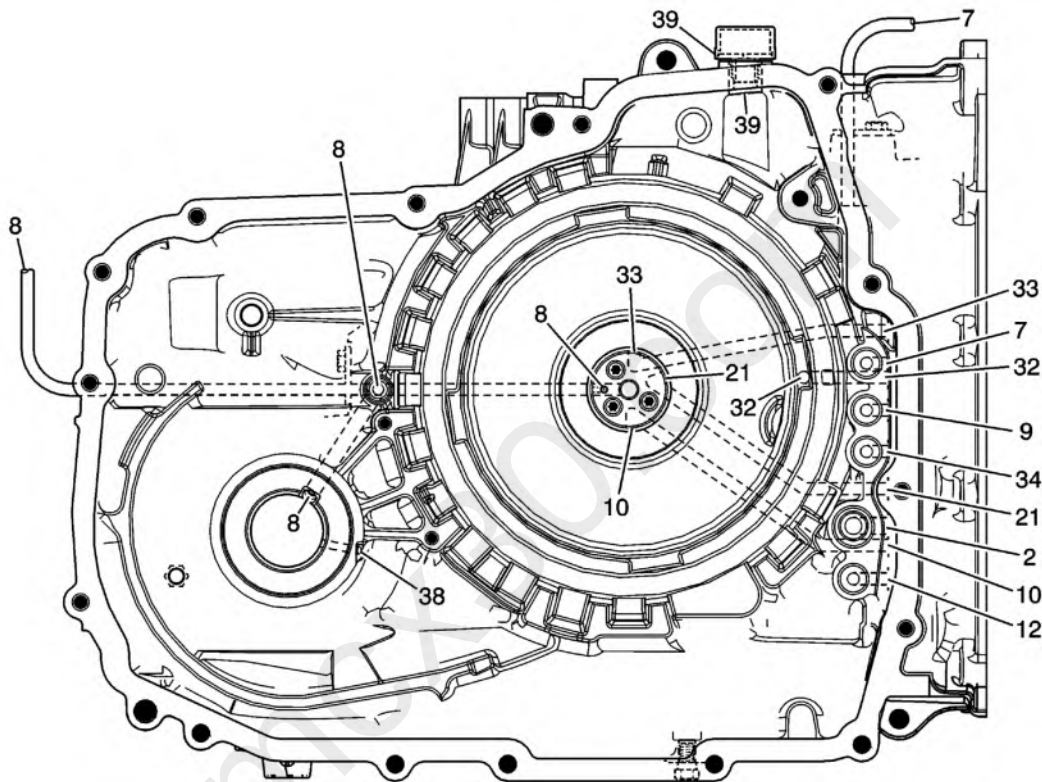


Fig. 21: Case -- Torque Converter and Differential Housing Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
7	Cooler Feed
8	Lube
9	Regulated Apply
10	Exhaust Backfill
12	PCS Line
21	35 Reverse Clutch
32	26 Clutch
33	456 Clutch
34	PCS TCC
38	Seal Drainback
39	Vent

Case - Control Valve Body Side

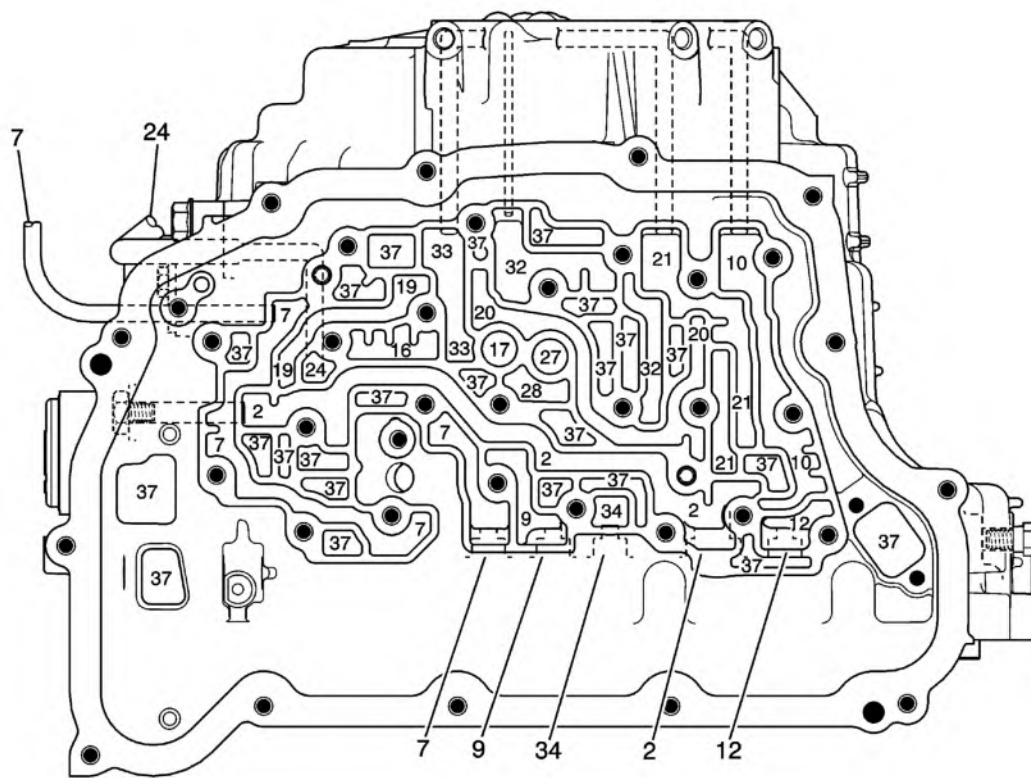


Fig. 22: Case - Control Valve Body Side Components Name
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
7	Cooler Feed
9	Regulated Apply
10	Exhaust Backfill
12	PCS Line
16	R1/456 Clutch Feedback
17	R1
19	Reverse
20	35 Reverse Clutch Feed
21	35 Reverse Clutch
24	Auxiliary Line (BAS+ Only)
27	1234 Clutch
28	1234 Clutch Feedback
32	26 Clutch
33	456 Clutch
34	PCS TCC
37	Void

Control Valve Body Spacer Plate Assembly - Case Side

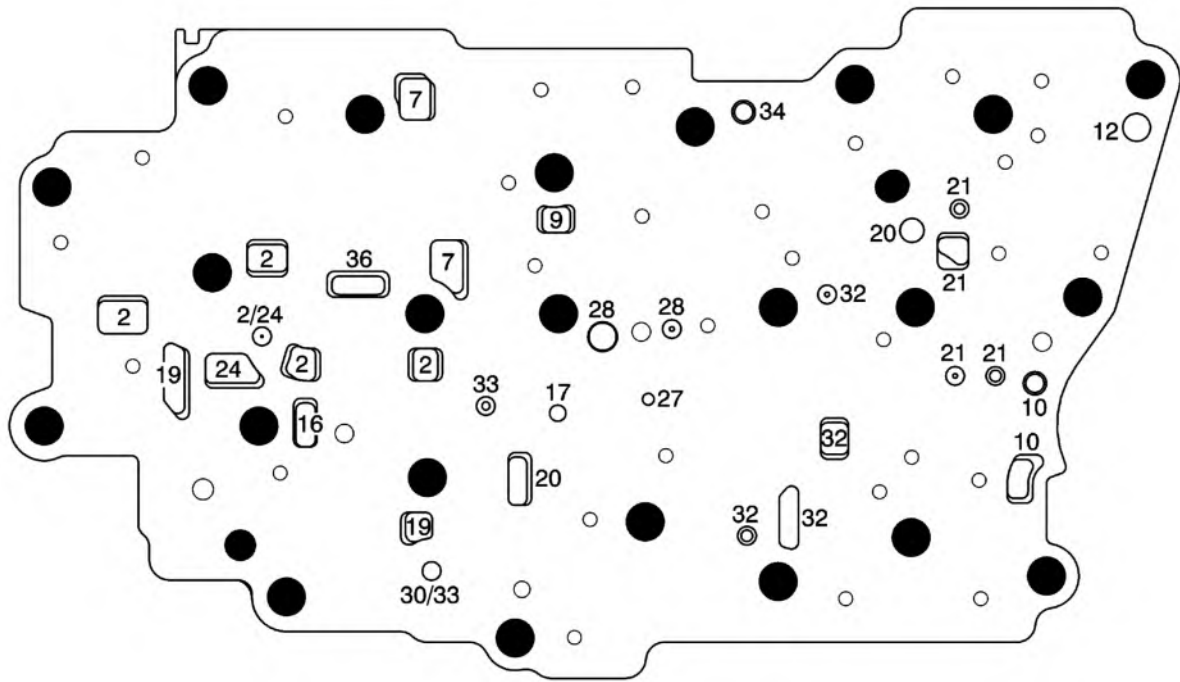


Fig. 23: Control Valve Body Spacer Plate Assembly - Case Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
7	Cooler Feed
9	Regulated Apply
10	Exhaust Backfill
12	PCS Line
16	R1/456 Clutch Feedback
17	R1
19	Reverse
20	35 Reverse Clutch Feed
21	35 Reverse Clutch
24	Auxiliary Line (BAS+ Only)
27	1234 Clutch
28	1234 Clutch Feedback
30	Latch
32	26 Clutch
33	456 Clutch
34	PCS TCC
36	Exhaust

Control Valve Body - Case Side

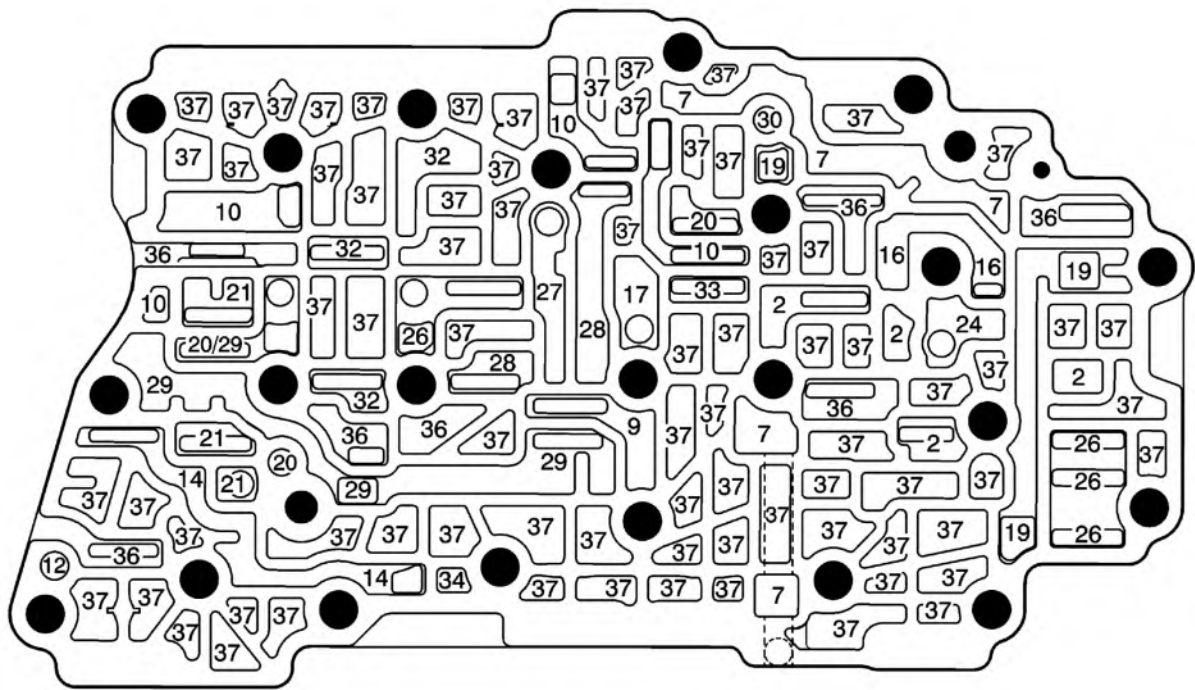


Fig. 24: Control Valve Body - Case Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
7	Cooler Feed
9	Regulated Apply
10	Exhaust Backfill
12	PCS Line
14	Shift Solenoid
16	R1/456 Clutch Feedback
17	R1
19	Reverse
20	35 Reverse Clutch Feed
21	35 Reverse Clutch
24	Auxiliary Line (BAS+ Only)
26	Drive
27	1234 Clutch
28	1234 Clutch Feedback
29	Drive 1-6
30	Latch
32	26 Clutch
33	456 Clutch
34	PCS TCC
36	Exhaust
37	Void

Control Valve Body - Channel Plate Side

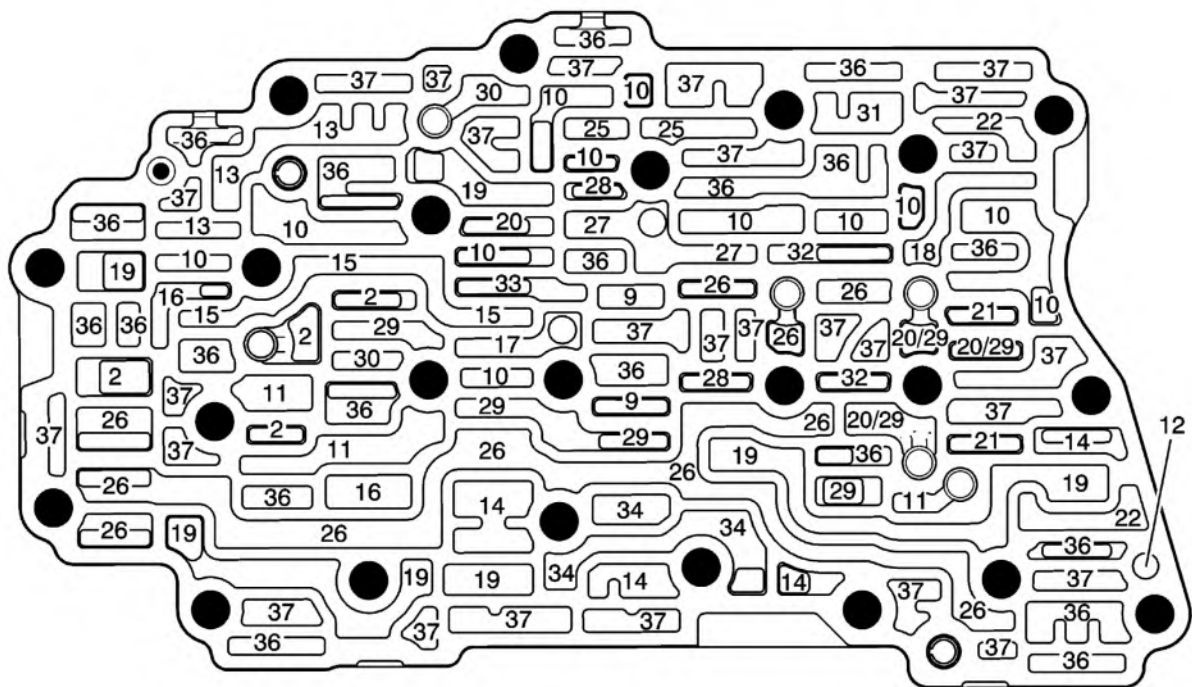


Fig. 25: Control Valve Body - Channel Plate Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
9	Regulated Apply
10	Exhaust Backfill
11	Actuator Feed Limit
12	PCS Line
13	PCS R1/456 Clutch
14	Shift Solenoid
15	R1/456 Clutch Feed
16	R1/456 Clutch Feedback
17	R1
18	PCS 35 Reverse Clutch
19	Reverse
20	35 Reverse Clutch Feed
21	35 Reverse Clutch
22	Default
25	PCS 1234 Clutch
26	Drive
27	1234 Clutch
28	1234 Clutch Feedback
29	Drive 1-6
30	Latch
31	PCS 26 Clutch
32	26 Clutch
33	456 Clutch
34	PCS TCC
36	Exhaust
37	Void

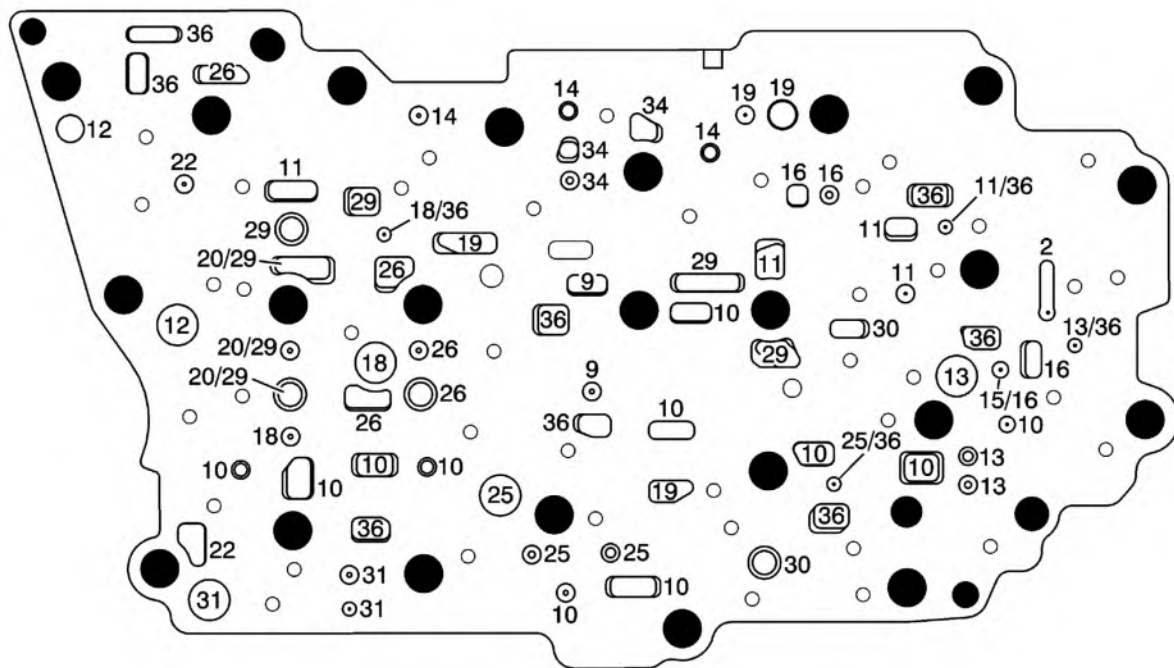


Fig. 26: Channel Plate to Valve Body Spacer Plate Assembly - Channel Plate Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
9	Regulated Apply
10	Exhaust Backfill
11	Actuator Feed Limit
12	PCS Line
13	PCS R1/456 Clutch
14	Shift Solenoid
15	R1/456 Clutch Feed
16	R1/456 Clutch Feedback
18	PCS 35 Reverse Clutch
19	Reverse
20	35 Reverse Clutch Feed
22	Default
25	PCS 1234 Clutch
26	Drive
29	Drive 1-6
30	Latch
31	PCS 26 Clutch
34	PCS TCC
36	Exhaust

Channel Plate - Control Valve Body Side

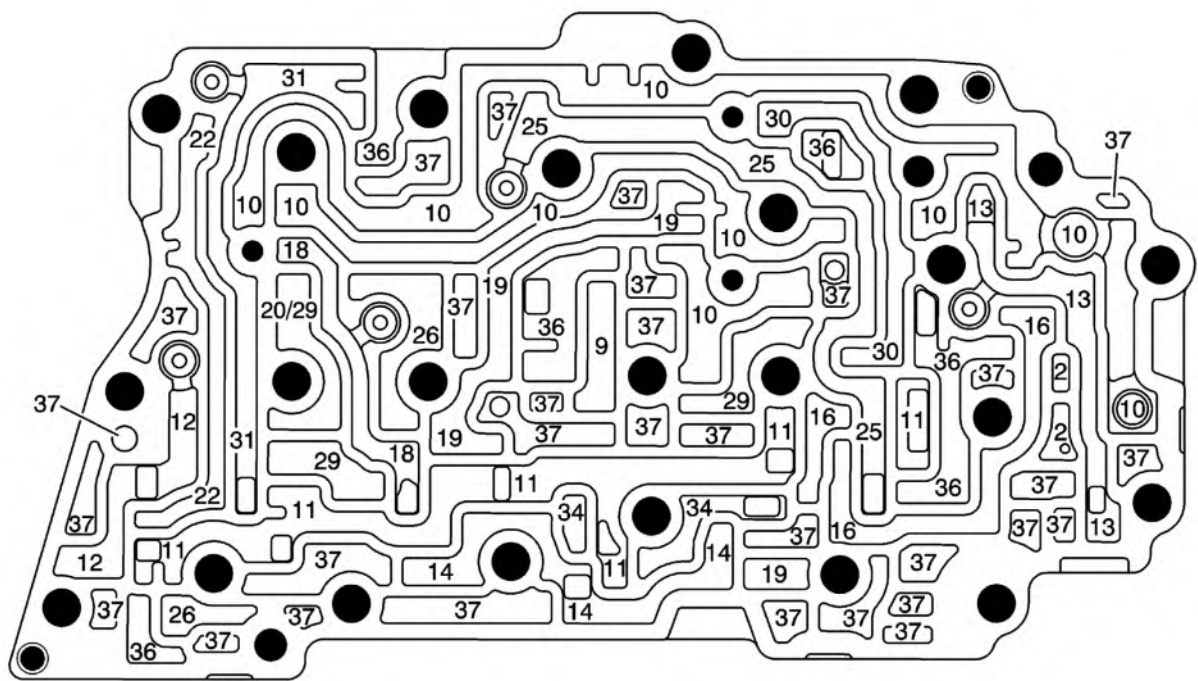


Fig. 27: Channel Plate - Control Valve Body Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
9	Regulated Apply
10	Exhaust Backfill
11	Actuator Feed Limit
12	PCS Line
13	PCS R1/456 Clutch
14	Shift Solenoid
16	R1/456 Clutch Feedback
18	PCS 35 Reverse Clutch
19	Reverse
20	35 Reverse Clutch Feed
22	Default
25	PCS 1234 Clutch
26	Drive
29	Drive 1-6
30	Latch
31	PCS 26 Clutch
34	PCS TCC
36	Exhaust
37	Void

Channel Plate - Control Solenoid (w/Body and TCM) Valve Assembly Side

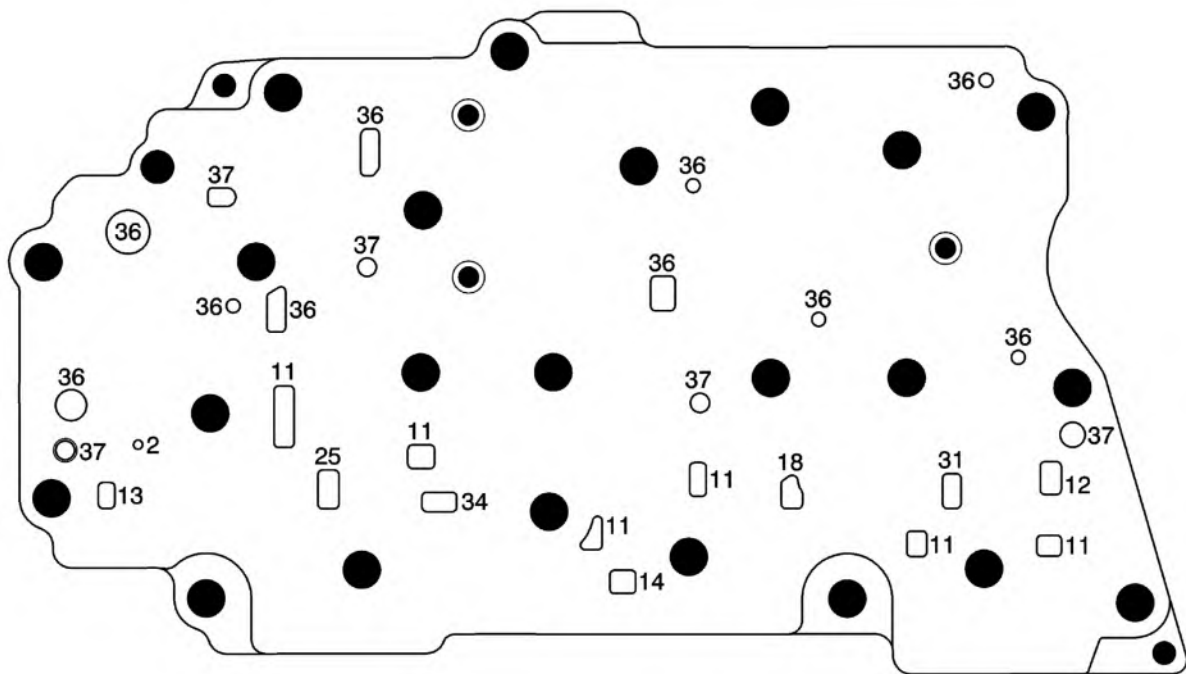


Fig. 28: Channel Plate - Control Solenoid (w/Body and TCM) Valve Assembly Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
11	Actuator Feed Limit
12	PCS Line
13	PCS R1/456 Clutch
14	Shift Solenoid
18	PCS 35 Reverse Clutch
25	PCS 1234 Clutch
31	PCS 26 Clutch
34	PCS TCC
36	Exhaust
37	Void

Control Solenoid (w/Body and TCM) Valve Assembly - Channel Plate Side

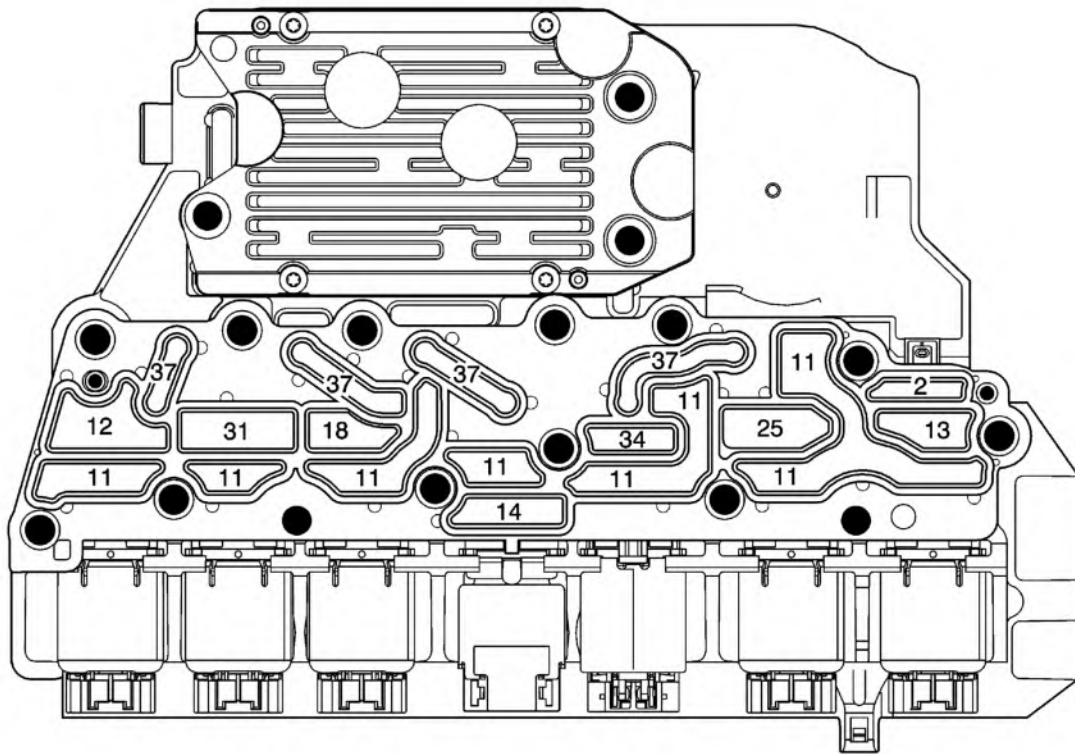


Fig. 29: Control Solenoid (w/Body and TCM) Valve Assembly - Channel Plate Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
11	Actuator Feed Limit
12	PCS Line
13	PCS R1/456 Clutch
14	Shift Solenoid
18	PCS 35 Reverse Clutch
25	PCS 1234 Clutch
31	PCS 26 Clutch
34	PCS TCC
37	Void