

2017 TRANSMISSION

Automatic Transmission - 6T70 (M7W) - Component Locator - Impala

COMPONENT LOCATOR

DISASSEMBLED VIEWS

Case and Associated Parts

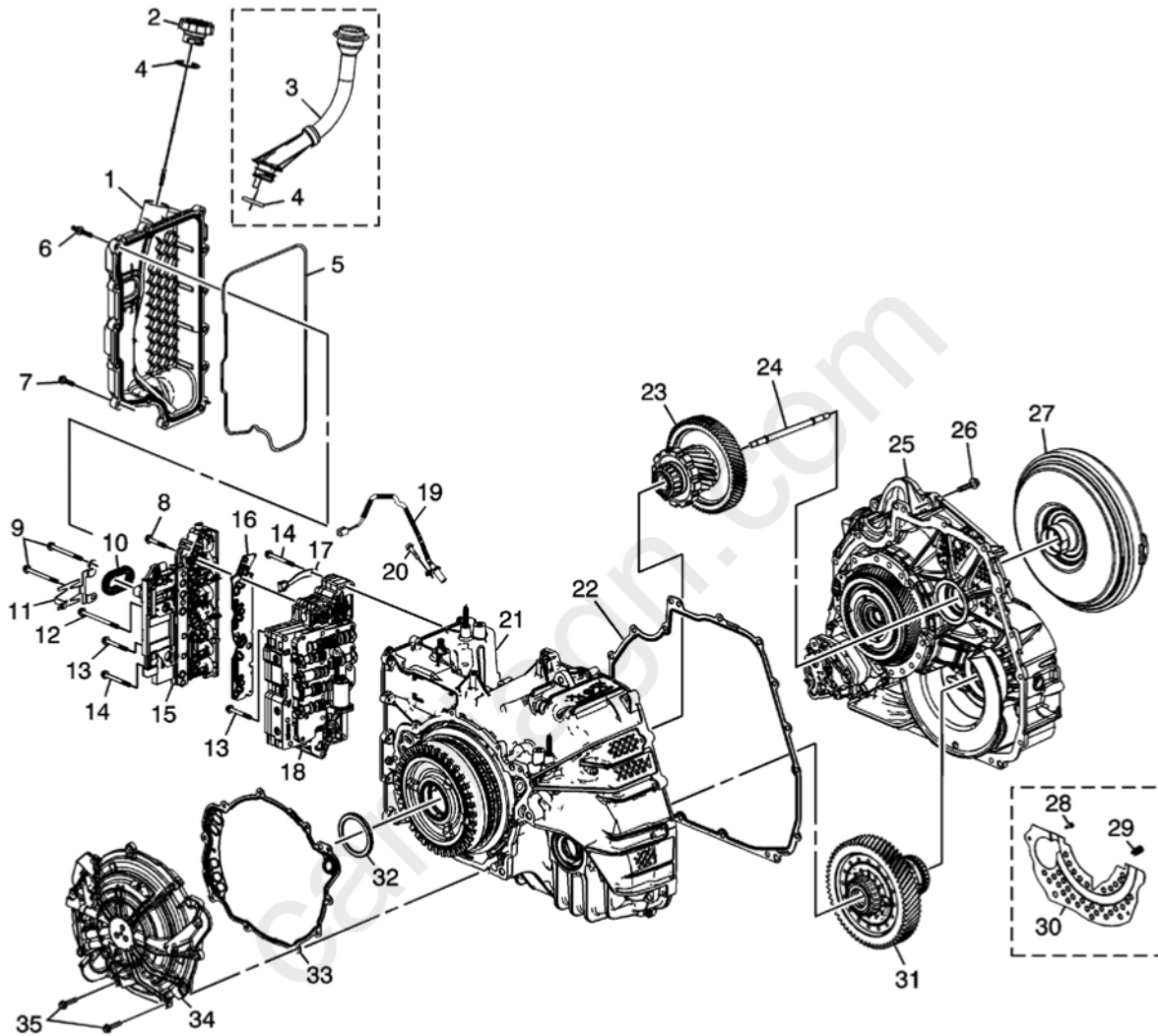


Fig. 1: Identifying Case & Associated Parts

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Control Valve Body Cover Assembly
2	Transmission Fluid Level Indicator Assembly
3	Fluid Level Indicator Tube - Model Dependent
4	Fluid Level Indicator Tube Seal - Model Dependent
5	Control Valve Body Cover Assembly Gasket
6	Control Valve Body Cover Stud
7	Control Valve Body Cover Bolt
8	Control Valve Body Bolt
9	Control Valve Body Bolt
10	Control Valve Body Cover Wiring Connector Hole Seal
11	Control Solenoid Valve Spring
12	Control Valve Body Bolt

Callout	Component Name
13	Control Valve Body Bolt
14	Control Valve Body Bolt
15	Control Solenoid (w/Body and TCM) Valve Assembly
16	Control Solenoid (w/Body and TCM) Filter Plate Assembly
17	Manual Shaft Detent Assembly
18	Control Valve Body Assembly
19	A/Trans Output Speed Sensor Assembly
20	A/Trans Output Speed Sensor Bolt
21	A/Trans Case Assembly
22	Torque Converter Housing Outer Seal
23	Front Differential Drive Pinion (w/Transfer Gear) Gear Assembly
24	Front Differential Drive Pinion Gear Lube Tube
25	Torque Converter and Support and A/Trans Fluid Pump Housing Assembly
26	Torque Converter and Differential Housing Bolt
27	Torque Converter Assembly
28	Dust Cover Push Pin - Model Dependent
29	Dust Cover Bolt - Model Dependent
30	Dust Cover - Model Dependent
31	Front Differential Carrier Assembly
32	Input Shaft Thrust Bearing Assembly
33	A/Trans Case Cover Gasket
34	A/Trans Case Cover Assembly
35	A/Trans Case Cover Assembly Bolt

Transmission Case Assembly

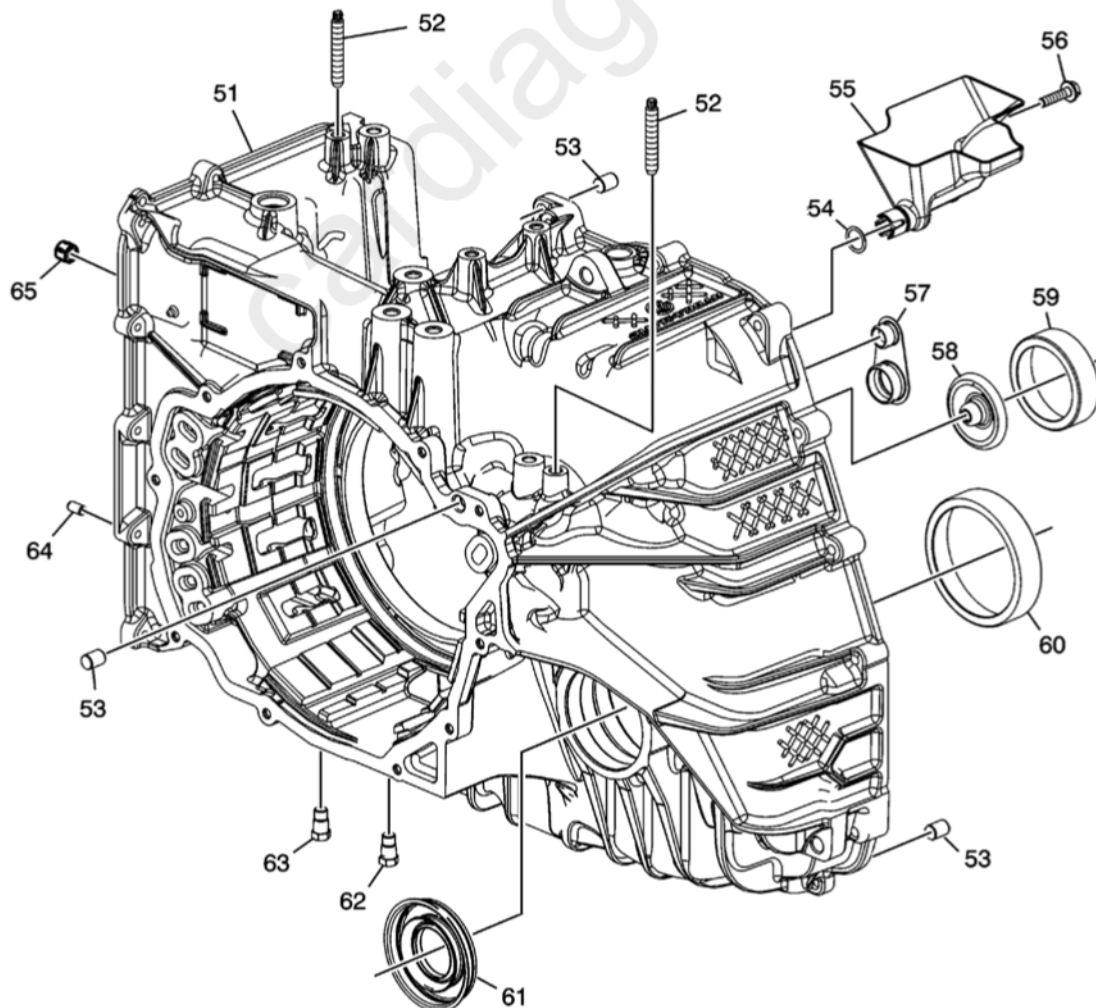


Fig. 2: Transmission Case Assembly
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
51	A/Trans Case Assembly
52	Transmission Fluid Cooler Pipe Stud
53	Transmission Case Cover Locator Pin
54	A/Trans Fluid Trough O-Ring Seal
55	A/Trans Fluid Trough Assembly
56	A/Trans Fluid Trough Bolt
57	A/Trans Pump Fluid Outlet Seal Assembly
58	Front Differential Drive Pinion Gear Lube Dam
59	Front Differential Drive Pinion Gear Bearing Cup
60	Front Differential Carrier Bearing Cup
61	Front Wheel Drive Shaft Oil Seal Assembly
62	A/Trans Fluid Press Test Hole Plug
63	A/Trans Fluid Level Hole Plug
64	Control Valve Body Locator Pin
65	1 - 2 - 3 - 4 Clutch Fluid Passage Seal

Torque Converter, Support and Fluid Pump Housing Assembly

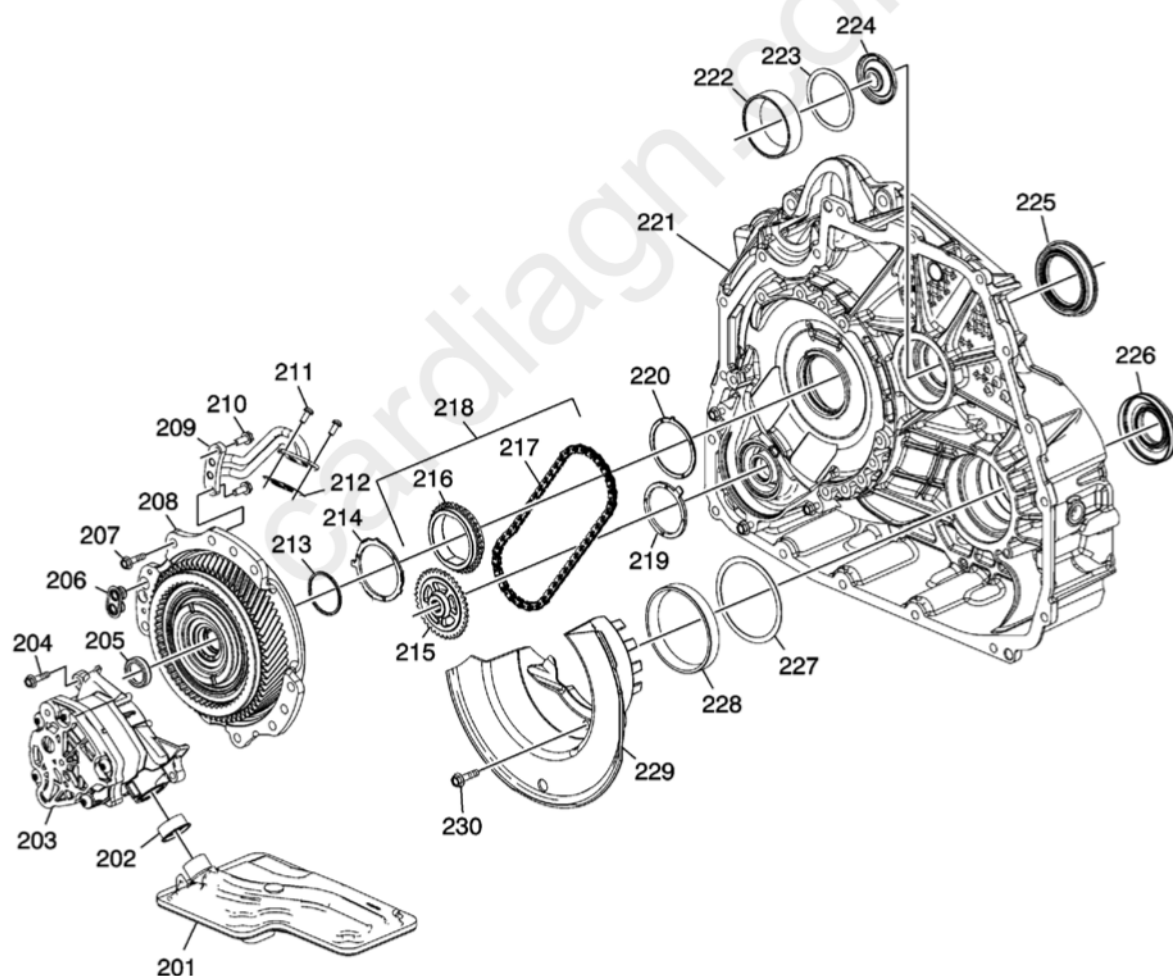


Fig. 3: Identifying Torque Converter, Support & Fluid Pump Housing Assembly Components
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
201	A/Trans Fluid Filter Assembly
202	Filter Neck Seal

Callout	Component Name
203	A/Trans Fluid Pump Assembly
204	A/Trans Fluid Pump Bolt
205	Front Differential Transfer Drive Gear Support Seal Assembly
206	Front Differential Transfer Drive Gear Support Torque Converter Fluid Seal Assembly
207	Front Differential Transfer Drive Gear Support Bolt
208	Front Differential Transfer Drive Gear Support Assembly
209	Front Differential Transfer Drive Gear Fluid Passage Tube Assembly
210	Front Differential Transfer Drive Gear Fluid Passage Tube Bolt
211	Front Differential Transfer Drive Gear Fluid Passage Tube Bolt
212	Front Differential Transfer Drive Gear Support Fluid Passage Tube Gasket
213	Front Differential Transfer Drive Gear Support Seal
214	Drive Sprocket Thrust Washer
215	Oil Pump Drive Link Driven Sprocket
216	Oil Pump Drive Link Drive Sprocket
217	Drive Link
218	Drive Link Assembly
219	Drive Sprocket Thrust Washer
220	Drive Sprocket Thrust Washer
221	Torque Converter and Differential Housing Assembly
222	Front Differential Drive Pinion Gear Bearing Cup
223	Front Differential Drive Pinion Gear Bearing Thrust Washer
224	Front Differential Drive Pinion Gear Lube Dam
225	Torque Converter Fluid Seal Assembly
226	Front Wheel Drive Shaft Oil Seal Assembly
227	Front Differential Bearing Thrust Washer
228	Front Differential Carrier Bearing Cup
229	Front Differential Carrier Baffle
230	Front Differential Carrier Baffle Bolt

Control Valve Body Assembly

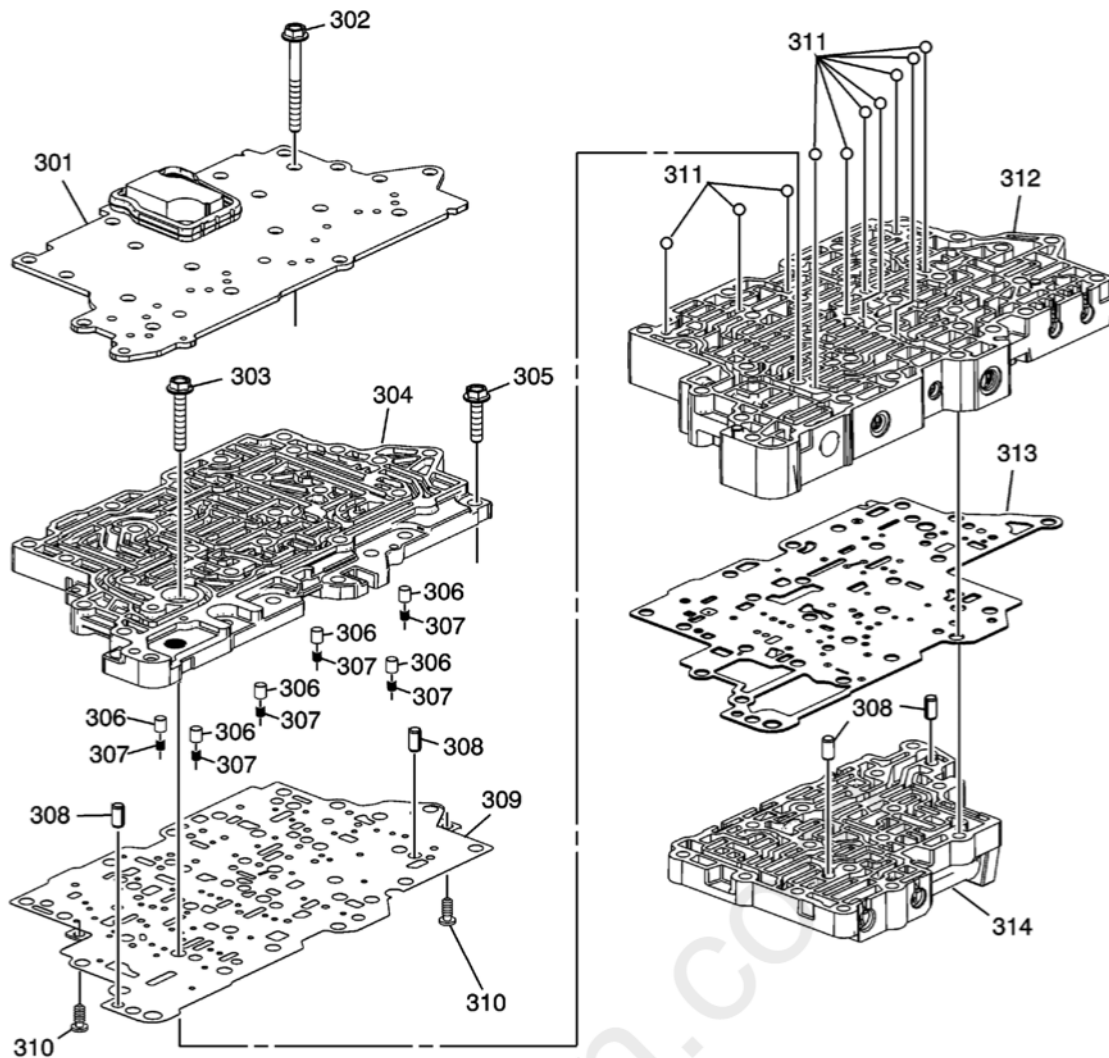


Fig. 4: Control Valve Body Assembly
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
301	Control Valve Channel Upper Plate Assembly
302	Control Valve Body Bolt
303	Control Valve Body Bolt
304	Control Valve Channel Plate
305	Control Valve Body Bolt
306	Actuator Feed Accumulator Piston
307	Actuator Feed Accumulator Spring
308	Control Valve Body Locator Pin
309	Control Valve Upper Body Spacer Plate Assembly
310	Control Valve Body Spacer Plate Retainer
311	Control Valve Body Ball Check Valve
312	Control Valve Upper Body Assembly
313	Control Valve Lower Body Spacer Plate Assembly
314	Control Valve Lower Body

Upper Valve Body Assembly

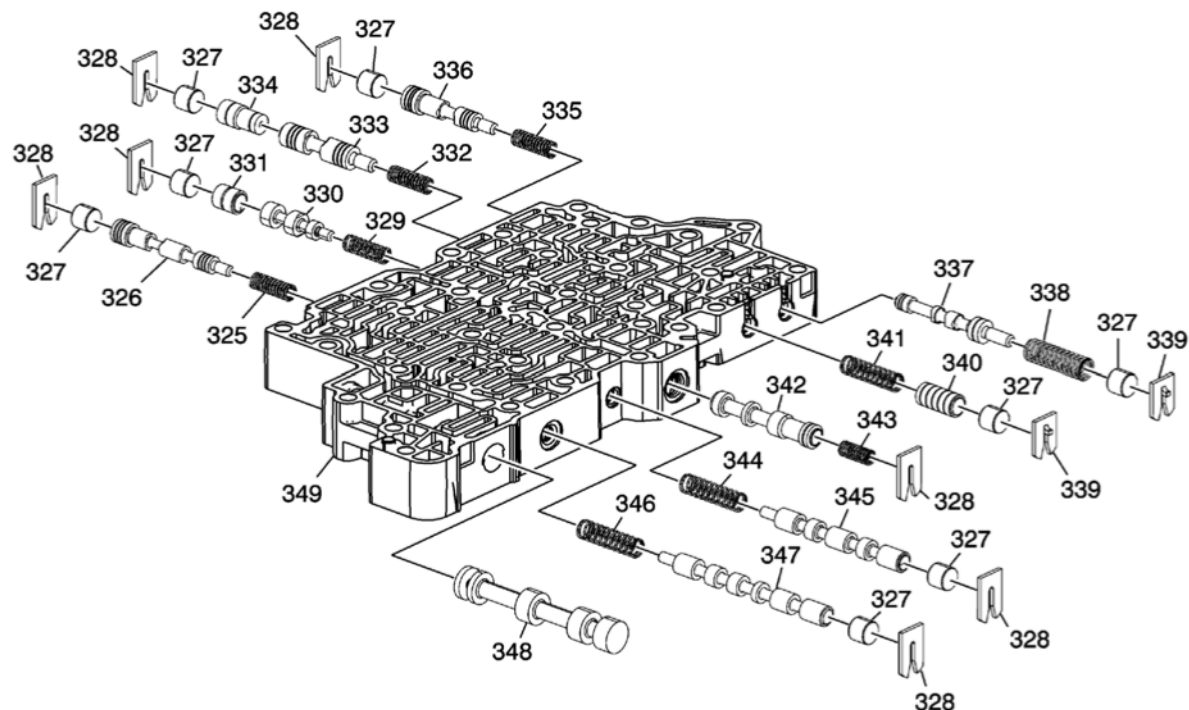


Fig. 5: Upper Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
325	Low and Reverse and 4 - 5 - 6 Clutch Regulator Valve Spring
326	Low and Reverse and 4 - 5 - 6 Clutch Regulator Valve
327	Pressure Regulator Valve Bore Plug
328	Torque Converter Clutch Valve Spring Retainer
329	Torque Converter Clutch Regulator Apply Valve Spring
330	Torque Converter Clutch Regulator Apply Valve
331	Torque Converter Clutch Regulator Apply Shuttle Valve
332	2 - 6 Clutch Regulator Valve Spring
333	2 - 6 Clutch Regulator Valve
334	2 - 6 Clutch Regulator Valve Gain Valve
335	3 - 5 - Reverse Clutch Regulator Valve Spring
336	3 - 5 - Reverse Clutch Regulator Valve
337	Pressure Regulator Valve
338	Pressure Regulator Valve Spring
339	Pressure Regulator Valve Bore Plug Retainer
340	Isolator Valve
341	Isolator Valve Spring
342	Torque Converter Clutch Control Valve
343	Torque Converter Clutch Control Valve Spring
344	Clutch Select Solenoid Valve #3 Spring
345	Clutch Select Solenoid #3 Valve
346	Clutch Select Solenoid Valve #2 Spring
347	Clutch Select Solenoid #2 Valve
348	Manual Valve
349	Control Valve Upper Body

Lower Valve Body Assembly

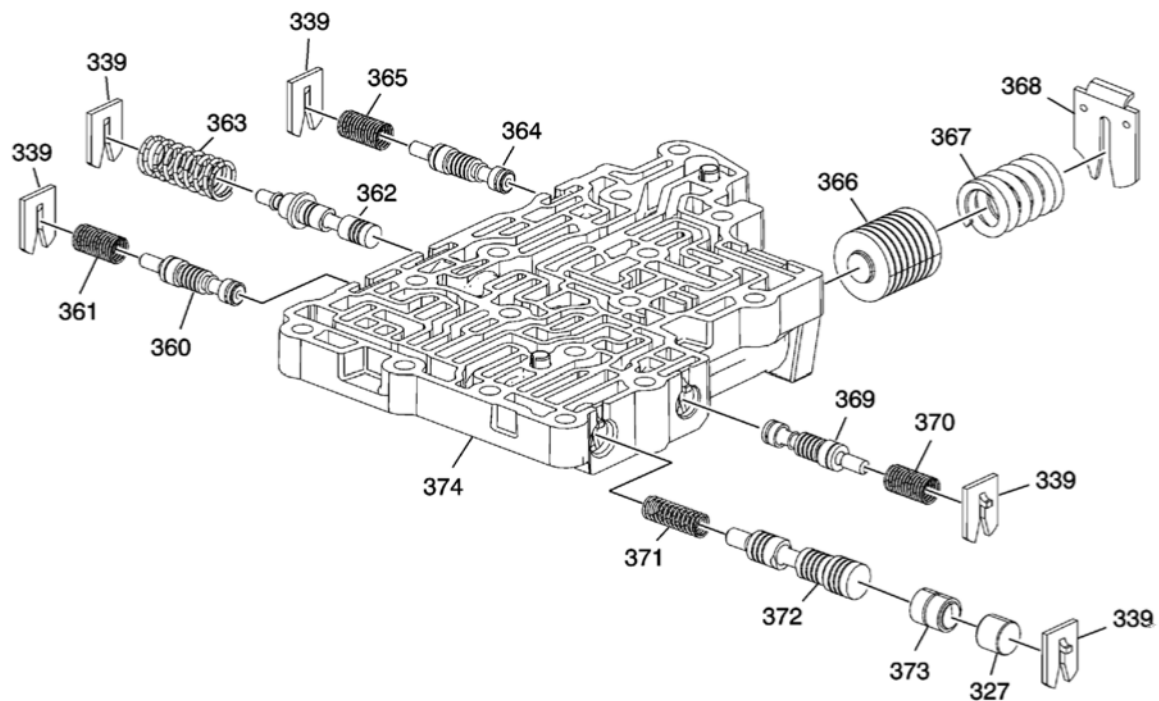


Fig. 6: Lower Valve Body Assembly
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
327	1 - 2 - 3 - 4 Clutch Regulator Valve Bore Plug
339	Actuator Feed Limit Valve Spring Retainer
360	4 - 5 - 6 Clutch Boost Valve
361	4 - 5 - 6 Clutch Boost Valve Spring
362	Actuator Feed Limit Valve
363	Actuator Feed Limit Valve Spring
364	3 - 5 - Reverse Clutch Boost Valve
365	3 - 5 - Reverse Clutch Boost Valve Spring
366	4 - 5 - 6 Clutch Accumulator Piston
367	4 - 5 - 6 Clutch Accumulator Piston Spring
368	4 - 5 - 6 Clutch Accumulator Piston Retainer
369	1 - 2 - 3 - 4 Clutch Boost Valve
370	1 - 2 - 3 - 4 Clutch Boost Valve Spring
371	1 - 2 - 3 - 4 Clutch Regulator Valve Spring
372	1 - 2 - 3 - 4 Clutch Regulator Valve
373	Default Override 1 - 2 - 3 - 4 Clutch Valve
374	Control Valve Lower Body

A/Trans Case Cover, 2 - 6 and Low Reverse Pistons

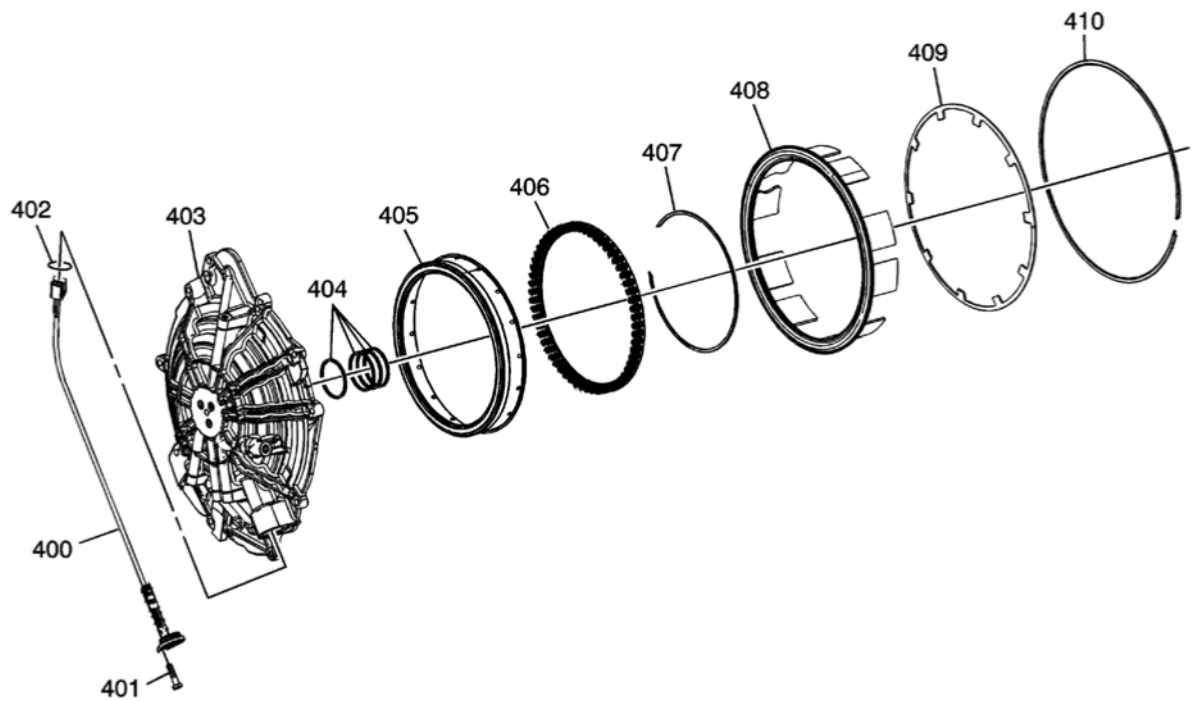


Fig. 7: Identifying A/T Case Cover, 2-6 & Low Reverse Pistons & Retainer Rings
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
400	A/Trans Input Speed Sensor Assembly
401	A/Trans Input Speed Sensor Bolt
402	ISS O-Ring Seal
403	A/Trans Case Cover Assembly
404	3 - 5 - Reverse and 4 - 5 - 6 Clutch Fluid Seal Ring
405	2 - 6 Clutch Piston
406	2 - 6 Clutch Spring Assembly
407	2 - 6 Clutch Spring Retainer Ring
408	Low and Reverse Clutch Piston Assembly
409	Low and Reverse Clutch Spring
410	Low and Reverse Clutch Spring Retainer Ring

3 - 5 Reverse Clutch Assembly

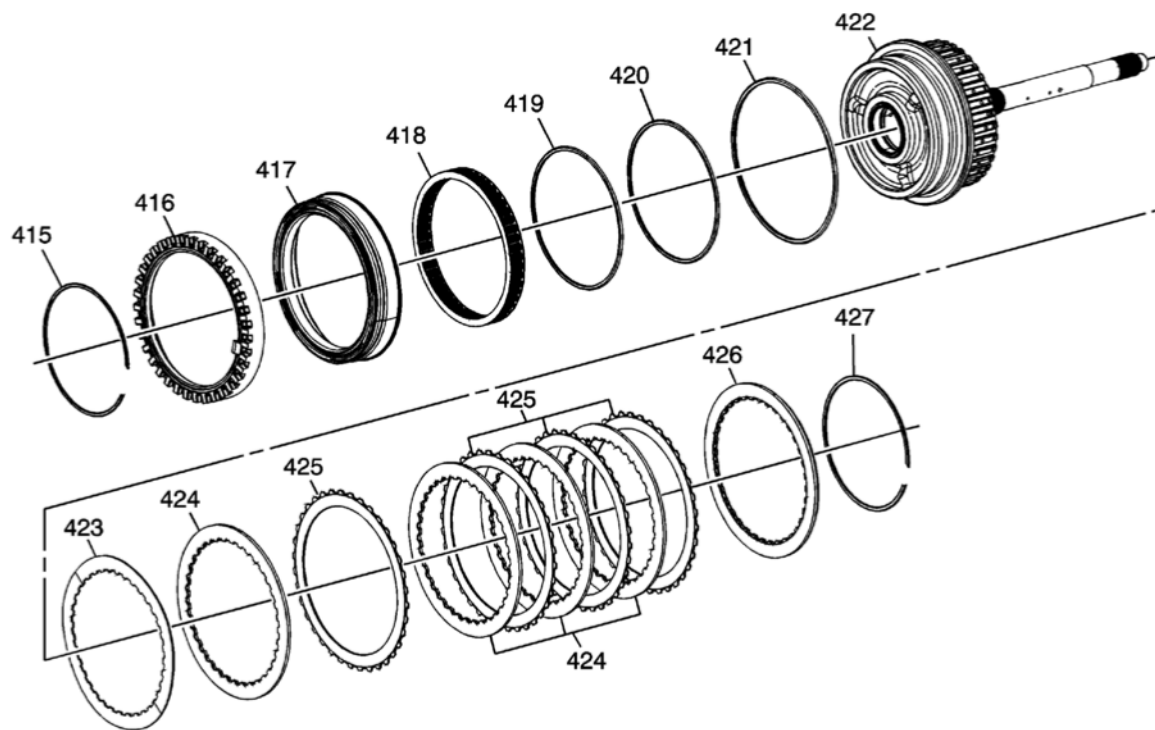


Fig. 8: Identifying 3-5 Reverse Clutch Assembly Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
415	A/Trans Input Shaft Speed Sensor Reluctor Ring Retainer Ring
416	A/Trans Input Shaft Speed Sensor Reluctor Wheel
417	3 - 5 - Reverse Clutch Piston
418	3 - 5 - Reverse Clutch Spring
419	3 - 5 - Reverse Clutch Piston Inner Seal
420	3 - 5 - Reverse Clutch Piston Inner Seal
421	3 - 5 - Reverse Clutch Piston Dam Seal
422	3 - 5 - Reverse and 4 - 5 - 6 Clutch Housing Assembly
423	3 - 5 - Reverse Clutch (Waved) Plate
424	3 - 5 - Reverse Clutch Plate
425	3 - 5 - Reverse Clutch (w/Friction Material) Plate Assembly
426	3 - 5 - Reverse Clutch Backing Plate
427	3 - 5 - Reverse Clutch Backing Plate Retainer Ring

4 - 5 - 6 Clutch Assembly

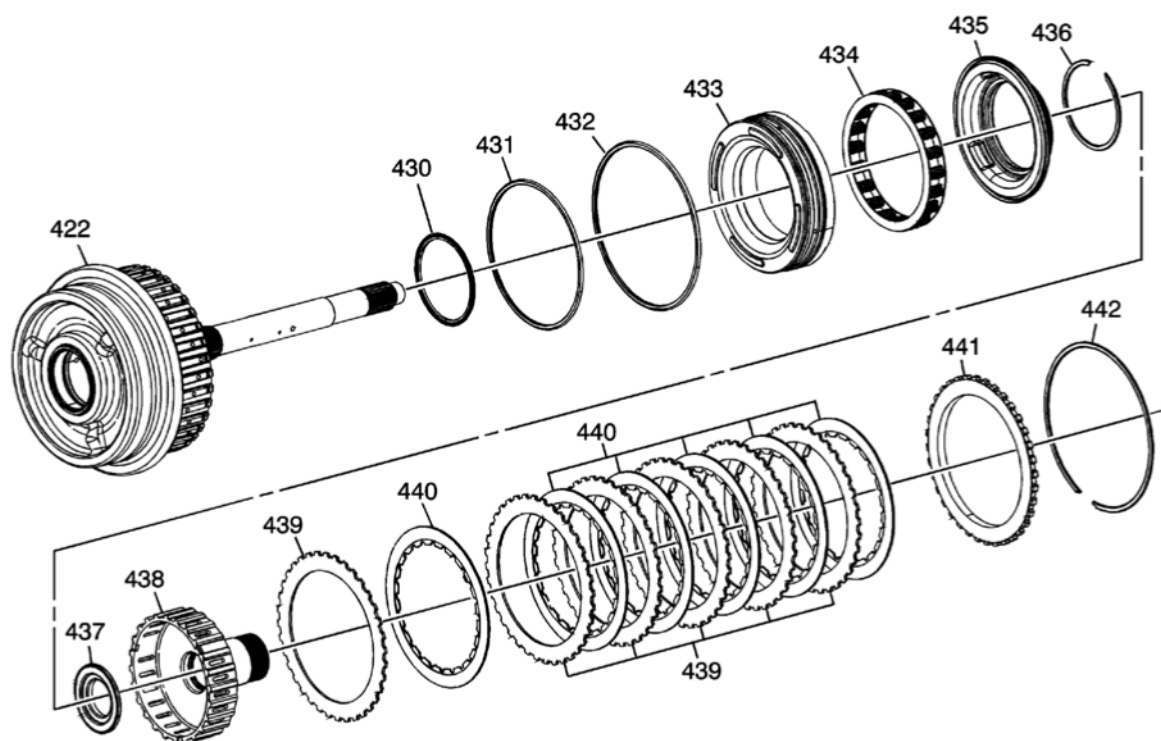


Fig. 9: Identifying 4-5-6 Clutch Assembly Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
422	3 - 5 - Reverse and 4 - 5 - 6 Clutch Housing Assembly
430	4 - 5 - 6 Clutch Piston Inner Seal
431	4 - 5 - 6 Clutch Piston Outer Seal
432	4 - 5 - 6 Clutch Piston Outer Seal
433	4 - 5 - 6 Clutch Piston
434	4 - 5 - 6 Clutch Spring
435	4 - 5 - 6 Clutch Piston Fluid Dam
436	4 - 5 - 6 Clutch Dam Retainer Ring
437	4 - 5 - 6 Clutch Hub Thrust Bearing Assembly
438	Reaction Carrier Hub Assembly
439	4 - 5 - 6 Clutch Plate
440	4 - 5 - 6 Clutch (w/Friction Material) Plate Assembly
441	4 - 5 - 6 Clutch Backing Plate
442	4 - 5 - 6 Clutch Backing Plate Retainer Ring

2 - 6, Low and Reverse and 1 - 2 - 3 - 4 Clutch Plate Assemblies

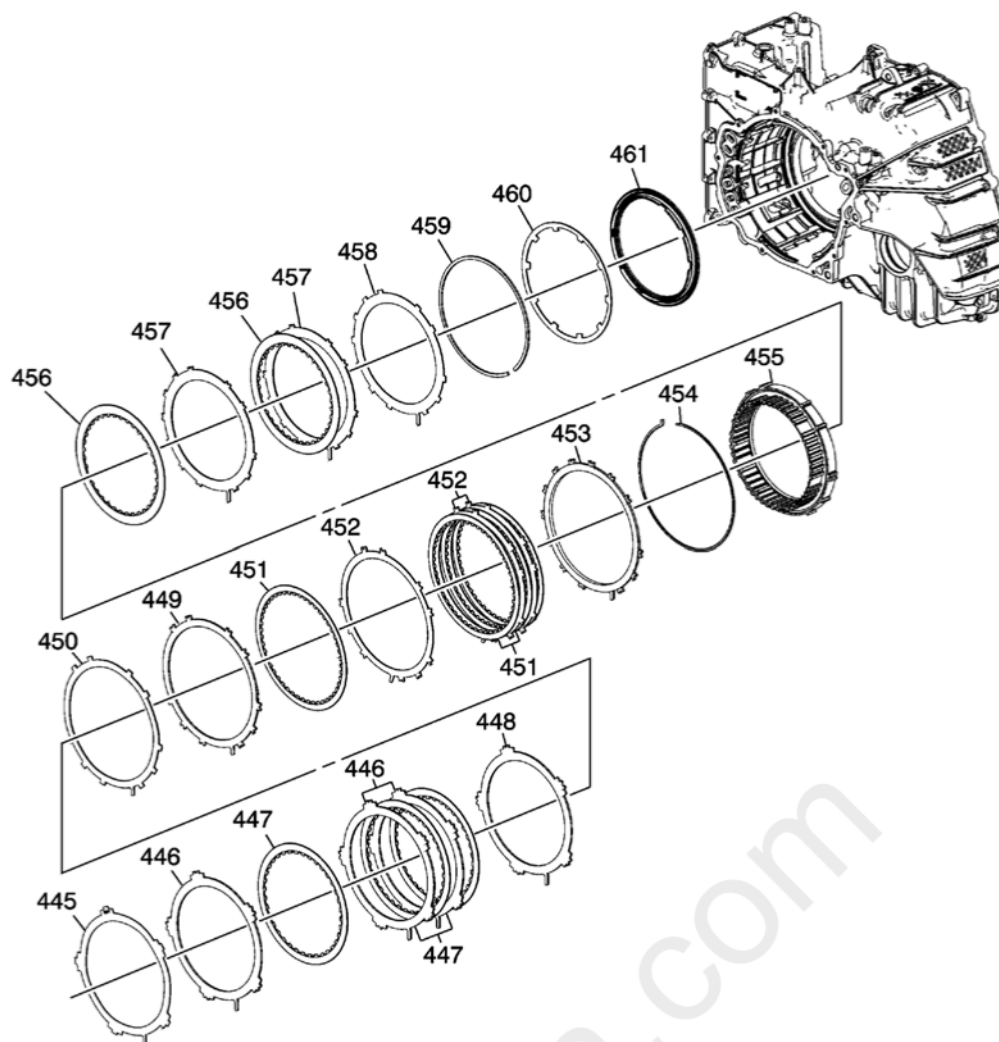


Fig. 10: Identifying 2-6, Low & Reverse & 1-2-3-4 Clutch Plate Assemblies
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
445	2 - 6 Clutch Cushion Spring
446	2 - 6 Clutch Plate
447	2 - 6 Clutch (w/Friction Material) Plate Assembly
448	2 - 6 Clutch Backing Plate
449	Low and Reverse Clutch Apply Plate
450	Low and Reverse Clutch Cushion (Waved) Spring
451	Low and Reverse Clutch (w/Friction Material) Plate Assembly
452	Low and Reverse Clutch Plate
453	Low and Reverse Clutch Backing Plate
454	Low and Reverse Clutch Retainer Ring
455	Low and Reverse Clutch Assembly (OWC)
456	1 - 2 - 3 - 4 Clutch (w/Friction Material) Plate Assembly
457	1 - 2 - 3 - 4 Clutch Plate
458	1 - 2 - 3 - 4 Clutch (Waved) Plate
459	1 - 2 - 3 - 4 Clutch Spring Retainer Ring
460	1 - 2 - 3 - 4 Clutch Spring
461	1 - 2 - 3 - 4 Clutch Piston

Input, Output and Reaction Gearsets

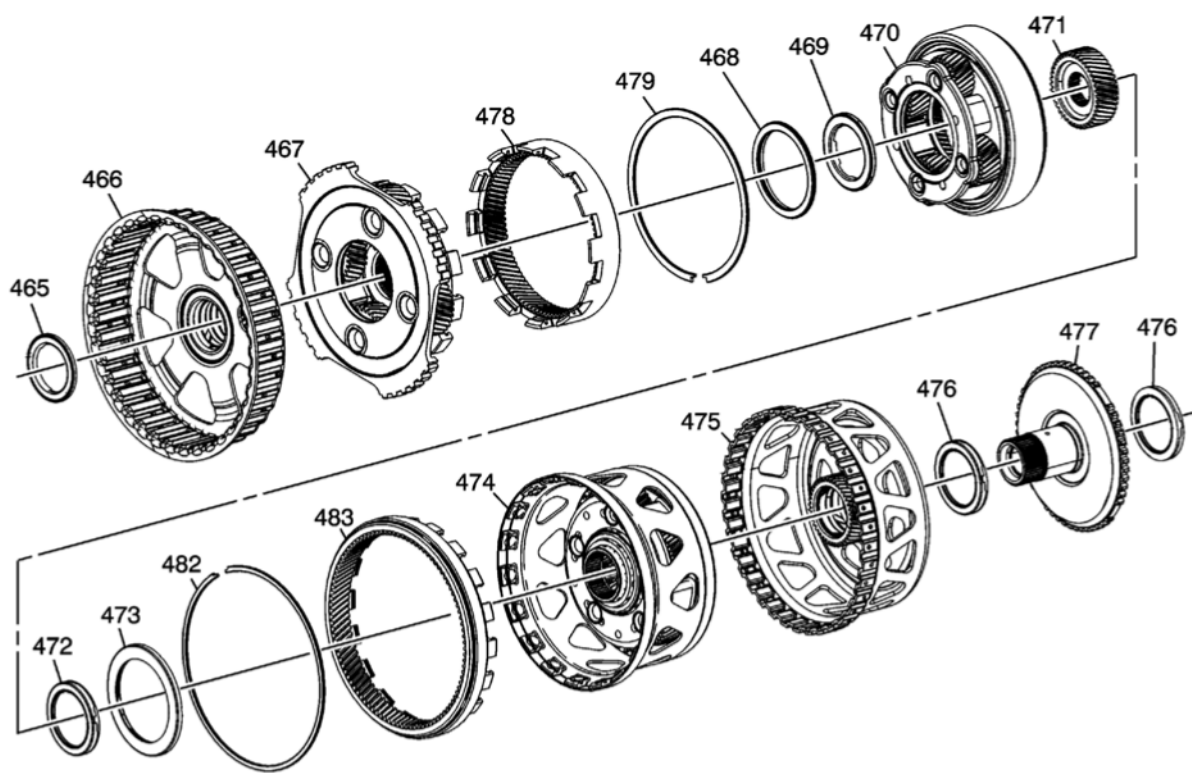


Fig. 11: Identifying Input, Output & Reaction Gearsets
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
465	2 - 6 Clutch Hub Thrust Bearing
466	Reaction Sun Gear Assembly
467	Reaction Carrier Assembly
468	Input Carrier Thrust Bearing Assembly
469	Input Sun Gear Thrust Bearing Assembly
470	Input Carrier Assembly
471	Input Sun Gear
472	Output Carrier Thrust Bearing Assembly
473	Output Carrier Thrust Bearing Assembly
474	Output Carrier Assembly
475	Output Sun Gear Assembly
476	Front Differential Transfer Drive Gear Input Hub Bearing Assembly
477	Output Carrier Transfer Drive Gear Hub Assembly
478	Input Internal Gear
479	Input Internal Gear Retaining Ring
482	Reaction Internal Gear Retaining Ring
483	Reaction Carrier Internal Gear

Front Differential Transfer Drive Gear Assembly

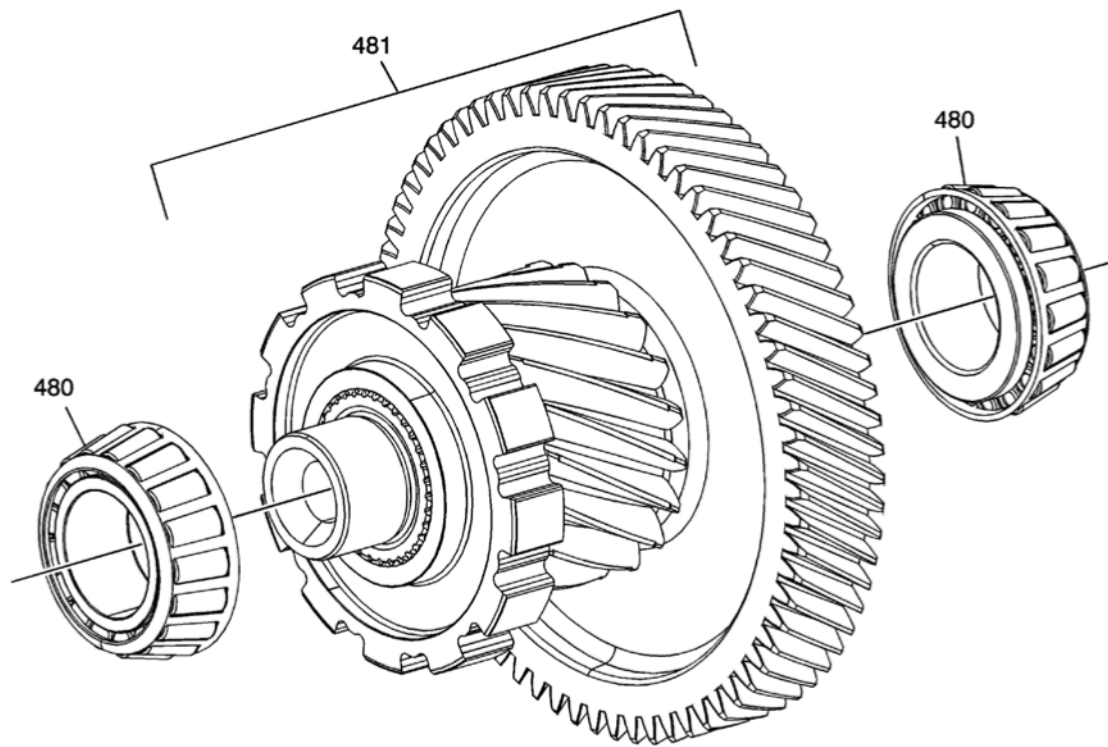


Fig. 12: Identifying Front Differential Transfer Drive Gear Assembly Components
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
480	Front Differential Drive Pinion Gear Bearing Assembly
481	Front Differential Drive Pinion (w/Transfer Gear) Gear Assembly

Front Differential Carrier Assembly

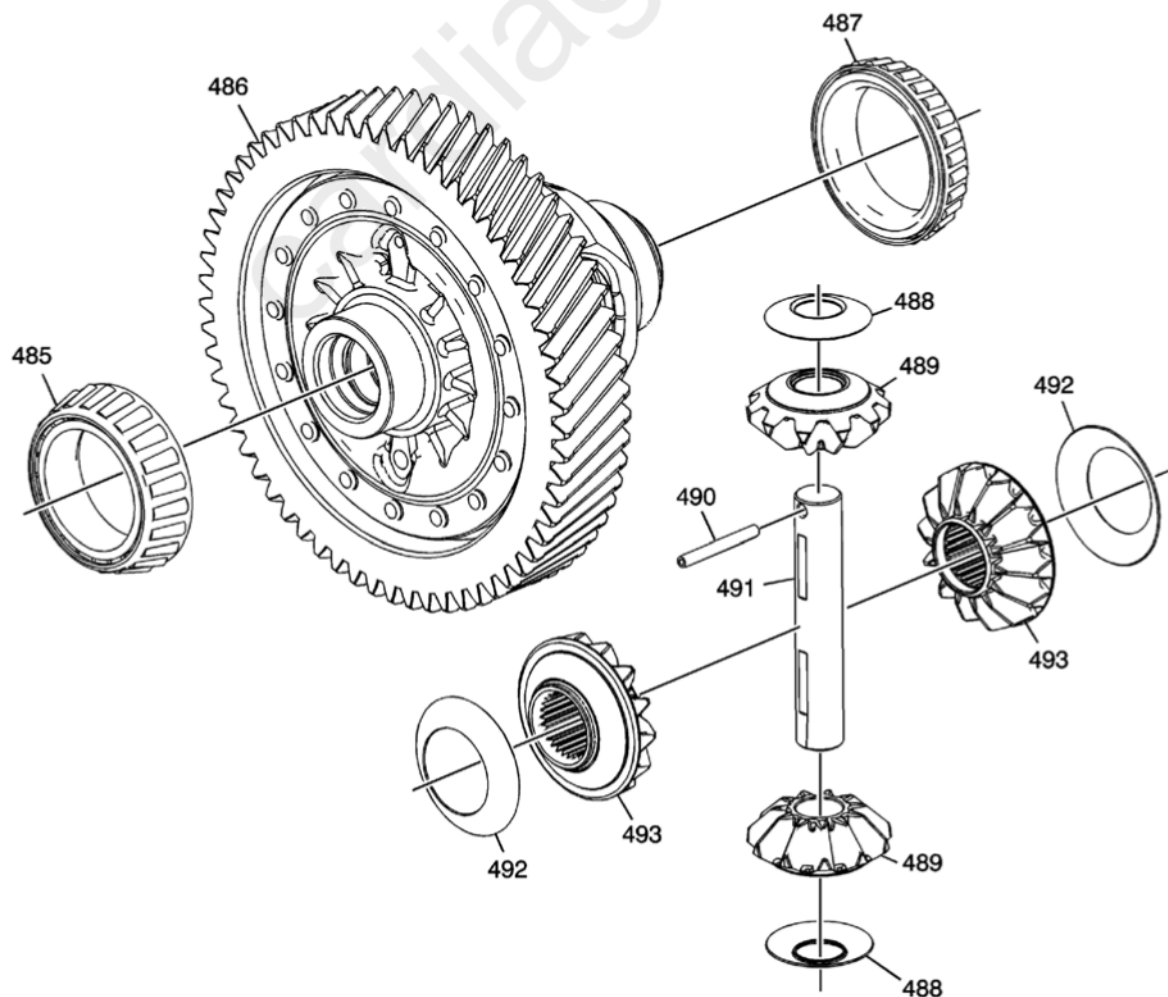


Fig. 13: Identifying Front Differential Carrier Assembly Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
485	Front Differential Carrier Bearing Assembly
486	Front Differential Carrier Assembly
487	Front Differential Carrier Bearing Assembly
488	Front Differential Carrier Thrust Washer
489	Front Differential Pinion Gear
490	Front Differential Pinion Gear Shaft Retainer
491	Front Differential Pinion Gear Shaft
492	Front Differential Side Gear Thrust Washer
493	Front Differential Side Gear

Park System Components

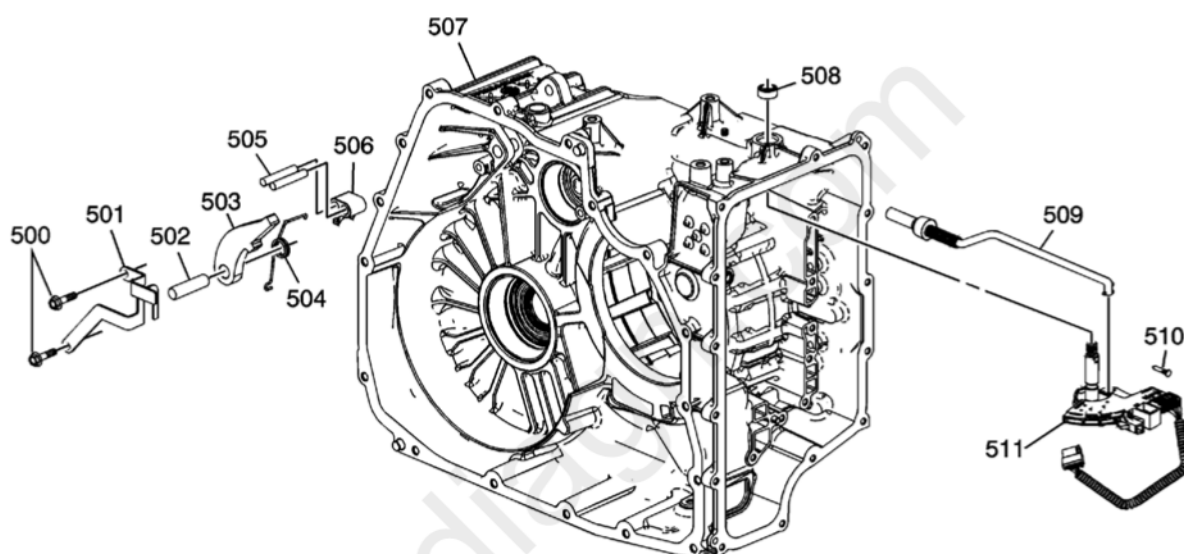


Fig. 14: Identifying Park System Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
500	Park Pawl Actuator Bracket Bolt
501	Park Pawl Actuator Bracket
502	Park Pawl Shaft
503	Park Pawl
504	Park Pawl Spring
505	Park Pawl Actuator Guide Pin
506	Park Pawl Actuator Guide
507	A/Trans Case Assembly
508	Manual Shift Shaft Seal
509	Park Pawl Actuator Assembly
510	Manual Shift Shaft Pin
511	Manual Shift Detent (w/Shaft Position Switch) Lever Assembly

COMPONENT LOCATION

Component Locations

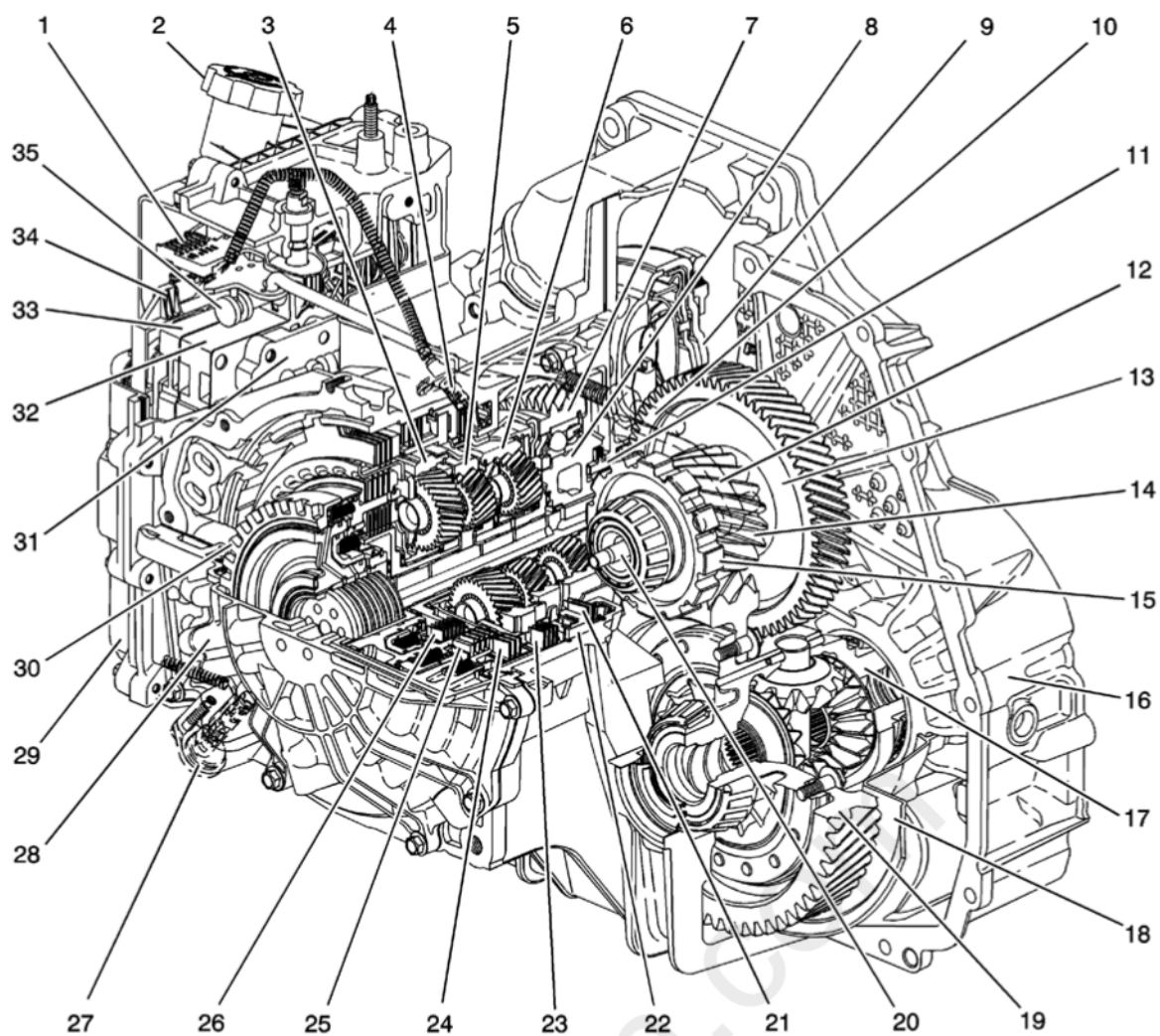


Fig. 15: Identifying A/T Component Locations
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Manual Shift Detent Lever Assembly (w/Shaft Position Switch)
2	Trans Fluid Level Indicator
3	Reaction Carrier Assembly
4	Output Speed Sensor
5	Input Carrier Assembly
6	Output Carrier Assembly
7	Front Differential Transfer Drive Gear
8	Front Differential Transfer Drive Gear Support Assembly
9	Torque Converter Assembly
10	Park Pawl Actuator Assembly
11	Fluid Pump Drive Link Assembly
12	Park Pawl
13	Front Differential Transfer Driven Gear
14	Front Differential Drive Pinion Gear
15	Park Gear
16	Torque Converter and Support and Fluid Pump Housing Assembly
17	Front Differential Carrier Assembly
18	Front Differential Carrier Baffle
19	Front Differential Ring Gear
20	Front Differential Drive Pinion Gear Lube Tube
21	1 - 2 - 3 - 4 Clutch Assembly
22	Low and Reverse Clutch Assembly (OWC)
23	Low and Reverse Clutch

Callout	Component Name
24	2 - 6 Clutch Assembly
25	3 - 5 - Reverse Clutch Assembly
26	4 - 5 - 6 Clutch Assembly
27	Input Speed Sensor
28	Case Cover Assembly
29	Control Valve Body Cover
30	Input Shaft Speed Sensor Reluctor Wheel
31	Control Valve Lower Body Assembly
32	Control Valve Upper Body Assembly
33	Control Valve Channel Plate Assembly
34	Control Solenoid Valve Assembly (w/Body and TCM)
35	Manual Valve

BUSHING, BEARING, AND WASHER LOCATIONS

Bushing and Bearing Locations

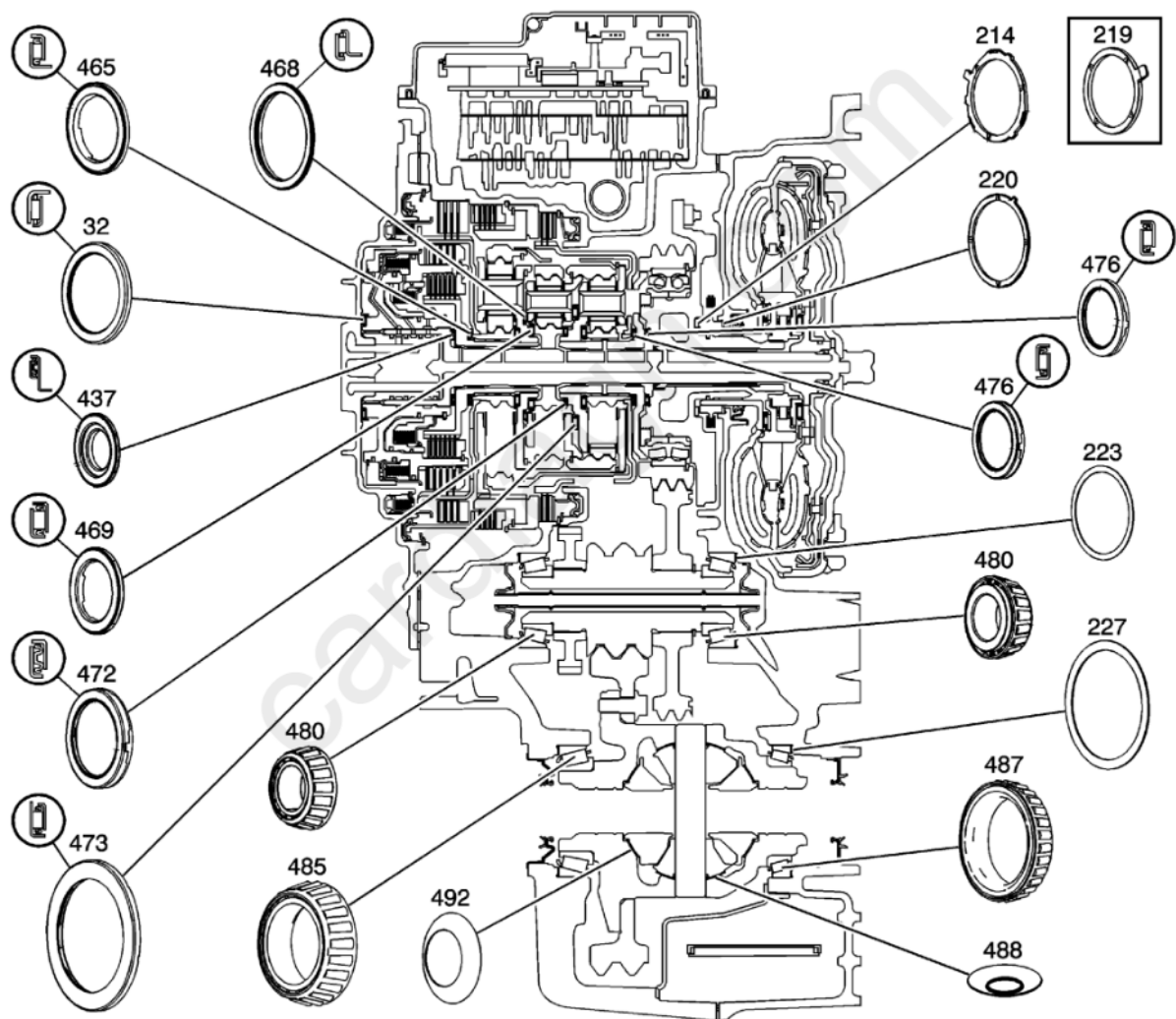


Fig. 16: Identifying Bushing & Bearing Locations

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
32	Input Shaft Thrust Bearing Assembly
214	Drive Sprocket Thrust Washer
219	Drive Sprocket Thrust Washer
220	Drive Sprocket Thrust Washer
223	Front Differential Drive Pinion Gear Bearing Thrust Washer
227	Front Differential Bearing Thrust Washer

Callout	Component Name
437	4 - 5 - 6 Clutch Hub Thrust Bearing Assembly
465	2 - 6 Clutch Hub Thrust Bearing
468	Input Carrier Thrust Bearing Assembly
469	Input Sun Gear Thrust Bearing Assembly
472	Output Carrier Thrust Bearing Assembly
473	Output Carrier Thrust Bearing Assembly
476	Front Differential Transfer Drive Gear Input Hub Bearing Assembly
480	Front Differential Drive Pinion Gear Bearing Assembly
485	Front Differential Carrier Bearing Assembly
487	Front Differential Carrier Bearing Assembly
488	Front Differential Carrier Thrust Washer
492	Front Differential Side Gear Thrust Washer

SEAL LOCATIONS

Seal Locations #1

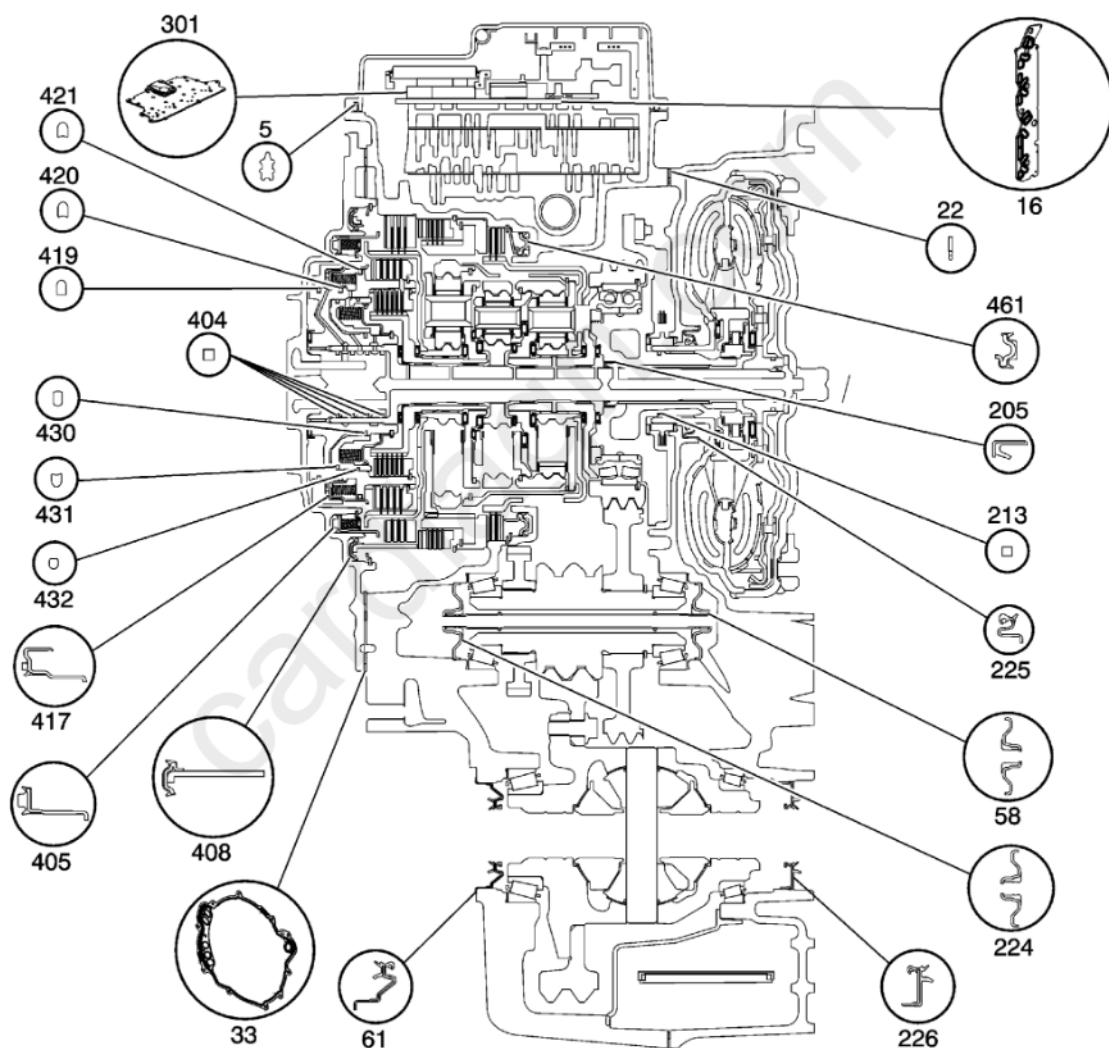


Fig. 17: Seal Locations (1 Of 2)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
5	Control Valve Body Cover Assembly Gasket
16	Control Solenoid (w/Body and TCM) Filter Plate Assembly
22	Torque Converter Housing Outer Seal
33	A/Trans Case Cover Gasket
58	Front Differential Drive Pinion Gear Lube Dam
61	Front Wheel Drive Shaft Oil Seal Assembly

Callout	Component Name
205	Front Differential Transfer Drive Gear Support Seal Assembly
213	Front Differential Transfer Drive Gear Support Seal
224	Front Differential Drive Pinion Gear Lube Dam
225	Torque Converter Fluid Seal Assembly
226	Front Wheel Drive Shaft Oil Seal Assembly
404	3 - 5 - Reverse and 4 - 5 - 6 Clutch Fluid Seal Ring
405	2 - 6 Clutch Piston
408	Low and Reverse Clutch Piston Assembly
417	3 - 5 - Reverse Clutch Piston
419	3 - 5 - Reverse Clutch Piston Inner Seal
420	3 - 5 - Reverse Clutch Piston Inner Seal
421	3 - 5 - Reverse Clutch Piston Dam Seal
430	4 - 5 - 6 Clutch Piston Inner Seal
431	4 - 5 - 6 Clutch Piston Outer Seal
432	4 - 5 - 6 Clutch Piston Outer Seal
461	1 - 2 - 3 - 4 Clutch Piston

Seal Locations #2

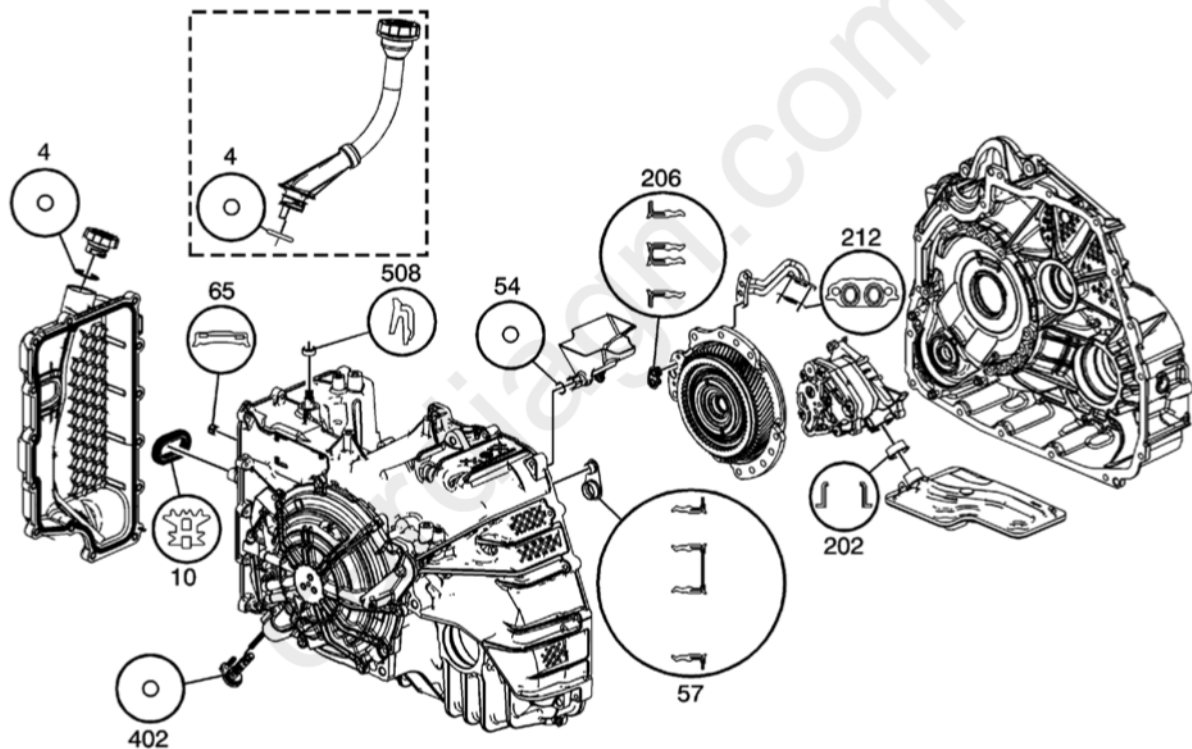


Fig. 18: Identifying Seal Locations (2 Of 2)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
4	Fluid Level Indicator Tube Seal - Model Dependent
10	Control Valve Body Cover Wiring Connector Hole Seal
54	A/Trans Fluid Trough O-Ring Seal
57	A/Trans Pump Fluid Outlet Seal Assembly
65	1 - 2 - 3 - 4 Clutch Fluid Passage Seal
202	Filter Neck Seal
206	Front Differential Transfer Drive Gear Support Torque Converter Fluid Seal Assembly
212	Front Differential Transfer Drive Gear Support Fluid Passage Tube Gasket
402	ISS O-Ring Seal
508	Manual Shift Shaft Seal

BALL CHECK VALVE LOCATIONS

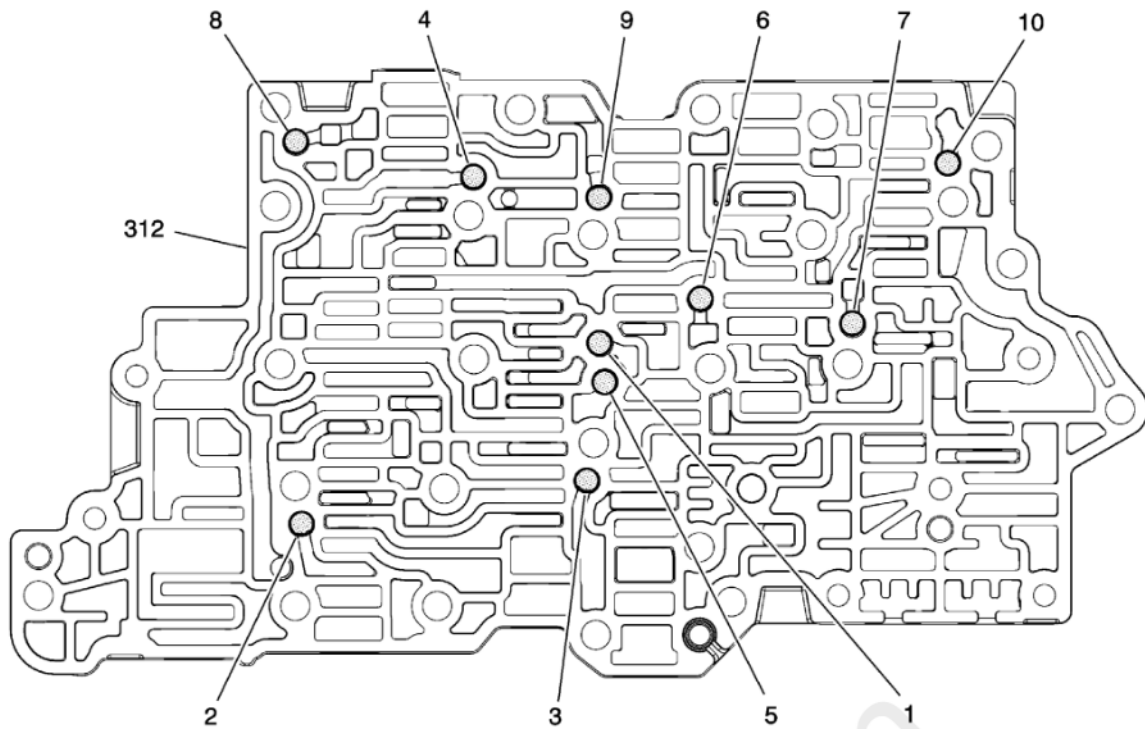


Fig. 19: Ball Check Valve Locations

Courtesy of GENERAL MOTORS COMPANY

I.D.	Input Oil	Input Oil	Output Oil
1	Drive 1 - 6	DRV B	26/1234 CL Feed
2	Solenoid 1	Reverse	CSV2 Enable
3	Solenoid 2	456	CSV3 Enable
4	Latch Feed	456	CSV2 Latch
5	Drive 1 - 6	35 Rev FD	35 Rev Supply
6	2 - 6/1234	-	1234 Clutch Feed
7	35R Supply	-	35R Clutch Feed
8	Low/Rev Supply	-	Low/Rev Clutch Feed
9	456 Clutch Supply	-	456 Clutch Feed
10	Compensator Feed	-	Exhaust Backfeed

2017 TRANSMISSION

Automatic Transmission - 6T70 (M7W) - Description and Operation - Impala

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

CCDIC

Climate Control Driver Information Center

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

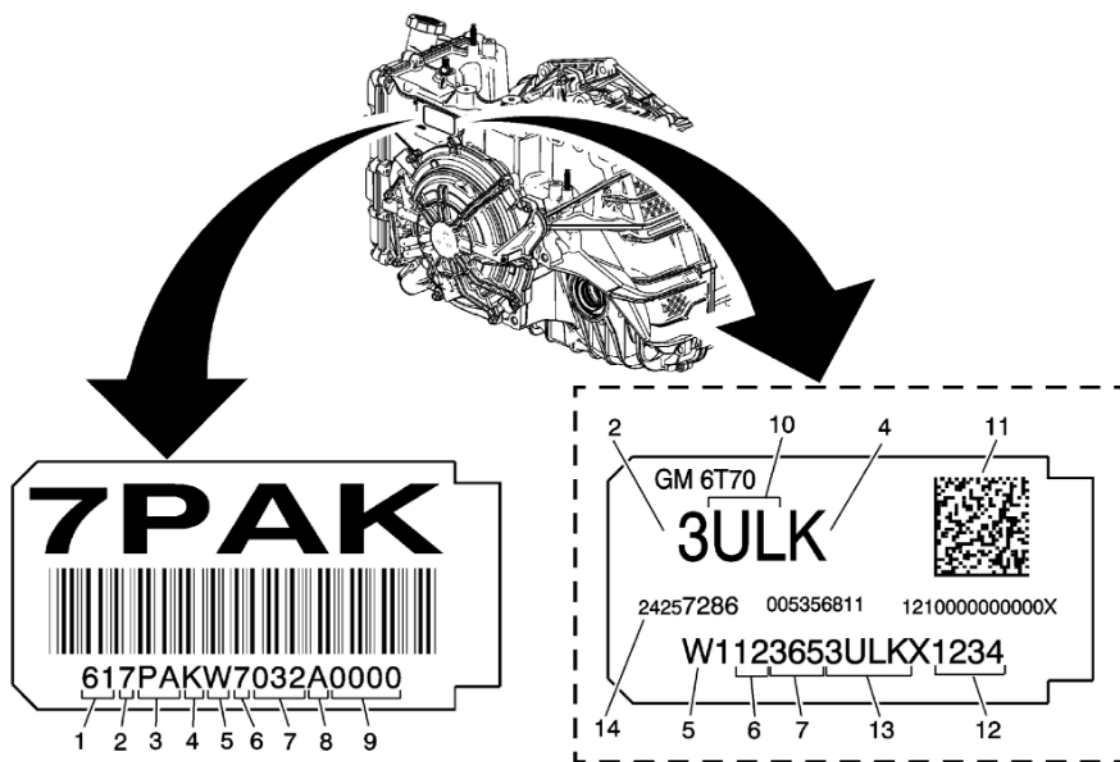


Fig. 1: Transmission Identification Label
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Code for Automatic Transmission
2	Model Year
3	Model for Transmission
4	Transmission Family
5	Source Code for Plant
6	Calendar Year
7	Julian Date
8	Shift/Line (A/B)
9	Numeric sequence starting at 0001 @ 12:01 AM each day
10	Model Code
11	Machine Readable Matrix
12	Sequential Serial Number
13	Broadcast Code
14	Transmission Assembly Number

Source Code for Plant

- 4 - Ramos Arizpe, Mexico
- J - Windsor, 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
- S - Silao, Mexico

TRANSMISSION GENERAL DESCRIPTION

The Hydra-matic 6T70/75 is a fully automatic, 6-speed, front-wheel drive, 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 vane-type pump, 2 control valve body assemblies, transfer drive gear support 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

The mechanical components of the 6T70/75 are as follows:

- A torque converter with an electronically controlled capacity clutch (ECCC)
- Off axis chain driven vane-type fluid pump assembly
- Input sun gear and carrier assembly
- 4 - 5 - 6 and 3 - 5 reverse clutch assembly with turbine shaft
- Low and reverse clutch (one way clutch) assembly
- Control valve body assembly
- Front differential transfer drive gear support assembly
- Front differential transfer drive gear assembly
- Front differential carrier assembly
- Case cover assembly

The electrical components of the 6T70/75 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
 - Torque converter clutch (TCC) pressure control solenoid
 - 2 shift solenoids
 - Transmission fluid temperature sensor

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

TOW/HAUL MODE DESCRIPTION AND OPERATION

Tow/haul mode is a function within the vehicle's software/calibration that optimizes transmission gear selection for operation during towing or with heavy loads. This optimization includes improving acceleration performance during launches, reducing shift busyness, assisting brake performance and speed control during engine braking situations, and improving vehicle speed control while requiring less throttle pedal activity.

In general, tow/haul mode maintains lower gears longer and increases shift pressures. It is designed to be most effective when the vehicle and trailer combined weight is at least 75% of the vehicle's Gross Combined Weight Rating (GCWR). Operation of tow/haul in a lightly loaded or non-loaded vehicle will not cause damage. However, there is no benefit to the selection of tow/haul when the vehicle is unloaded, and use of tow/haul mode during unloaded driving conditions will decrease fuel economy and may generate shift feel concerns.

TRANSMISSION ADAPTIVE FUNCTIONS

The 6T70/75 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

Control Solenoid (W/Body and TCM) Valve Assembly

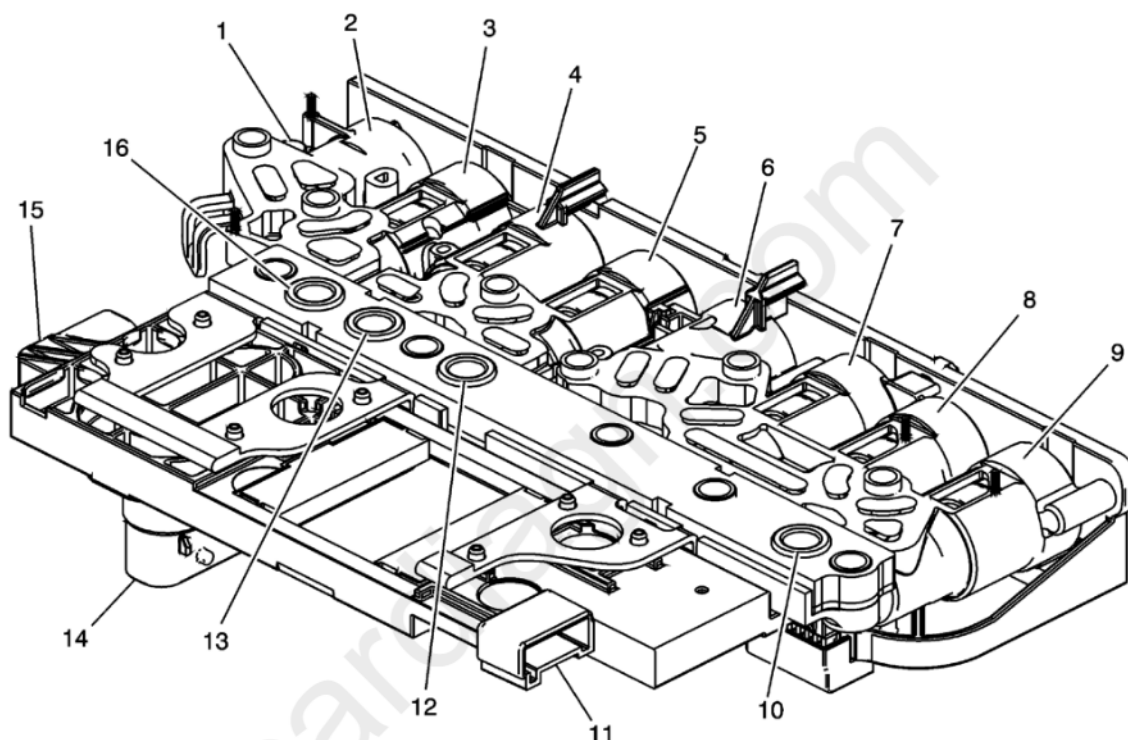


Fig. 2: Identifying Control Solenoid (W/Body & TCM) Valve Assembly Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Control Solenoid Valve Assembly X3 (ISS)
2	Shift Solenoid 1
3	Pressure Control Solenoid 3 (R1/456)
4	Pressure Control Solenoid 5 (1234)
5	Torque Converter Clutch (TCC) Pressure Control Solenoid
6	Shift Solenoid 2
7	Pressure Control Solenoid 2 (35R)
8	Pressure Control Solenoid 4 (26)
9	Line Pressure Control Solenoid
10	Transmission Fluid Pressure (TFP) Switch 5 (35R)
11	Control Solenoid Valve Assembly X2 (IMS)
12	Transmission Fluid Pressure (TFP) Switch 3 (26)
13	Transmission Fluid Pressure (TFP) Switch 4 (456/R1)
14	Control Solenoid Valve Assembly X1
15	Control Solenoid Valve Assembly X4 (OSS)

Callout	Component Name
16	Transmission Fluid Pressure (TFP) Switch 5 (35R)

The control solenoid (w/body and TCM) valve assembly contains the following components:

- Transmission control module (TCM)
- Clutch pressure control solenoids (Clutch PC Sol)
- Shift solenoids (SS)
- Line pressure control solenoid (Line PC Sol)
- Torque converter clutch pressure control solenoid (TCC PC Sol)
- Transmission fluid temperature sensor (TFT Sensor)
- TCM temperature sensor
- Power-up temperature sensor
- Transmission fluid pressure switches (TFP Sw)

These components are not serviced separately. The control solenoid (w/body and TCM) 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 (w/body and TCM) valve assembly bolts directly to the lower and upper valve body assemblies inside the transmission. The control solenoid (w/body and TCM) valve assembly connects to the engine harness 20-way connector.

Manual Shift Detent Lever with Shaft Position Switch Assembly (IMS)

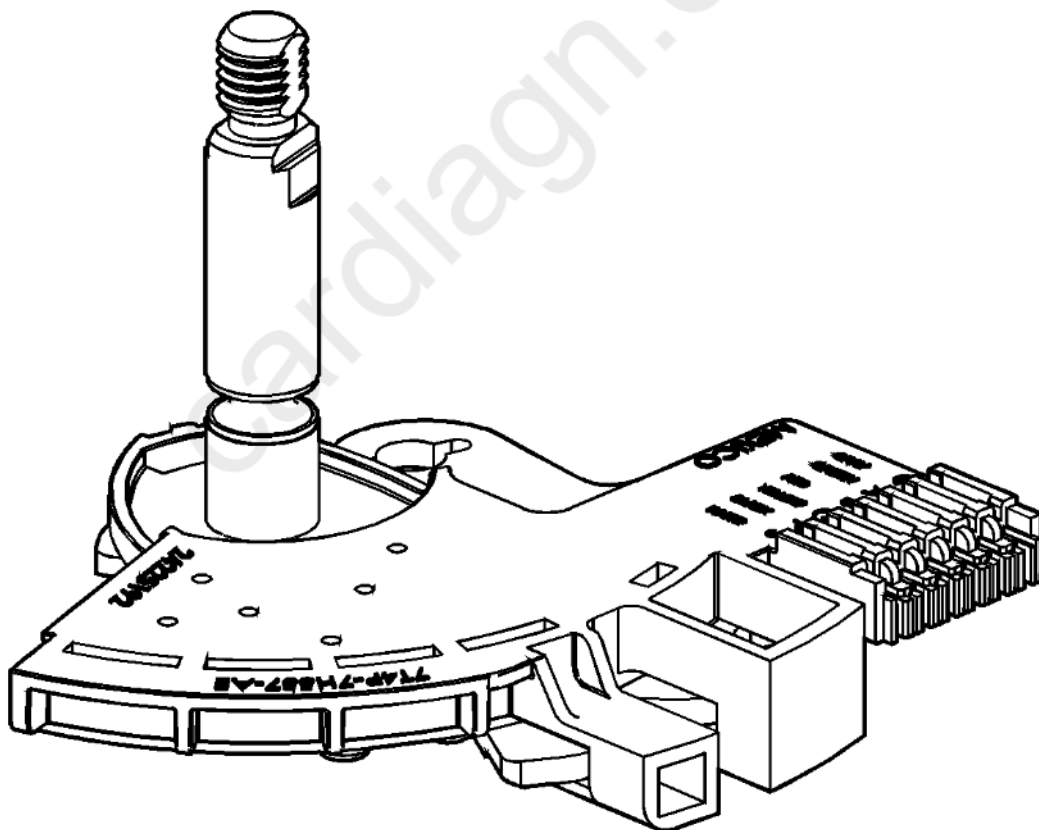


Fig. 3: Identifying Manual Shift Detent Lever with Shaft Position Switch

Courtesy of GENERAL MOTORS COMPANY

The transmission shaft position switch assembly is a sliding contact switch attached to the manual shift detent lever assembly inside the transmission case. The five inputs to the TCM from the transmission manual shift shaft switch assembly indicate the transmission gear selector lever position. This

information is used for engine controls as well as determining the transmission shift patterns. The state of each input is available for display on the scan tool. The five input parameters represented are Signal A, Signal B, Signal C, Signal P (Parity) and Signal N (P/N Start). The transmission shaft position switch assembly is connected to the Control Solenoid (W/Body and TCM) Valve Assembly via the Control Solenoid Valve Assembly X2 (IMS) connector.

Input Speed Sensor (ISS)

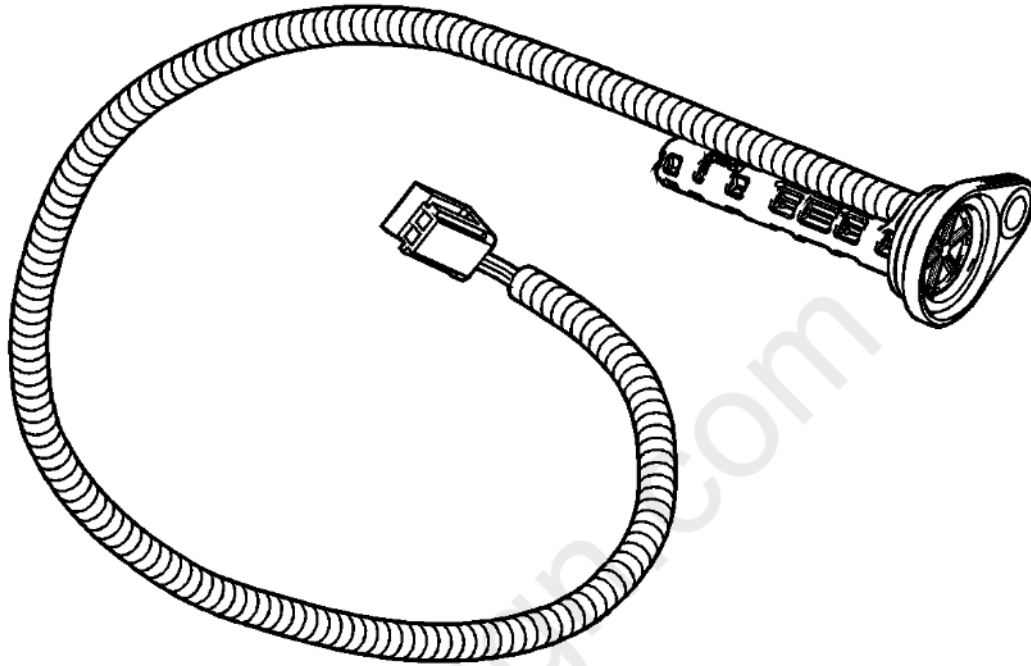


Fig. 4: Identifying Input Speed Sensor (ISS)
Courtesy of GENERAL MOTORS COMPANY

The input speed sensor (ISS) is a hall-effect type sensor. The ISS mounts to the transmission case cover assembly and connects to the control solenoid (w/body and TCM) valve assembly through a wire harness and connector. The sensor faces the 3-5-R clutch piston housing machined teeth surface. The sensor receives 8.3 - 9.3 volts on the ISS/OSS Supply Voltage circuit from the TCM. As the 3-5-R/4-5-6 clutch piston housing rotates, the sensor produces a signal frequency based on the machined surface of the 3-5-R/4-5-6 clutch piston housing. This signal is transmitted through the ISS signal circuit to the control solenoid (w/body and TCM) valve assembly. The TCM uses the ISS signal to determine line pressure, transmission shift patterns, torque converter clutch (TCC) slip speed and gear ratio. The input speed sensor (ISS) is connected to the Control Solenoid (W/Body and TCM) Valve Assembly via the Control Solenoid Valve Assembly X3 (ISS) connector.

Output Speed Sensor (OSS)

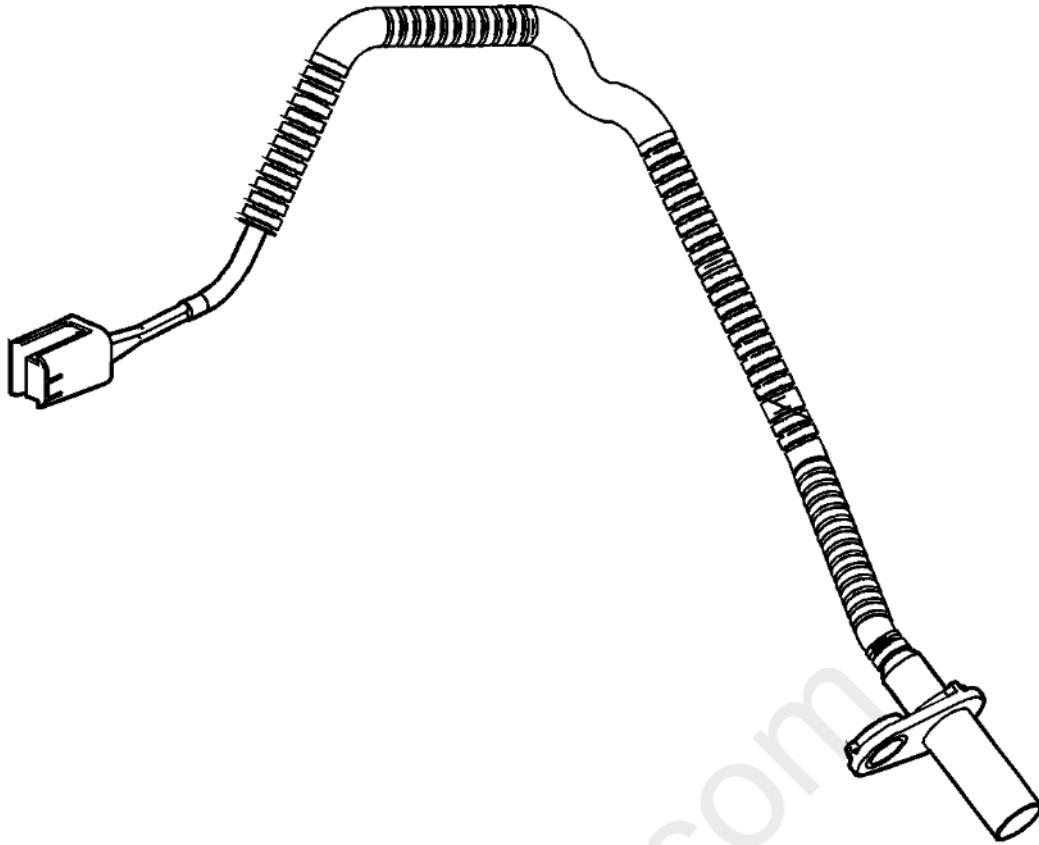


Fig. 5: Identifying Output Speed Sensor (OSS)
Courtesy of GENERAL MOTORS COMPANY

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 (w/body and TCM) valve assembly through a wire harness and connector. The sensor faces the Park gear machined teeth surface. The sensor receives 8.3 - 9.3 volts on the ISS/OSS supply voltage circuit from the TCM. As the front differential transfer drive gear assembly rotates, the sensor produces a signal frequency based on the machined surface of the Park gear. This signal is transmitted through the OSS signal circuit to the TCM. The TCM uses the OSS signal to determine line pressure, transmission shift patterns, torque converter clutch (TCC) slip speed and gear ratio. The output speed sensor (OSS) is connected to the Control Solenoid (W/Body and TCM) Valve Assembly via the Control Solenoid Valve Assembly X4 (OSS) connector.

AUTOMATIC TRANSMISSION INLINE 20-WAY CONNECTOR DESCRIPTION

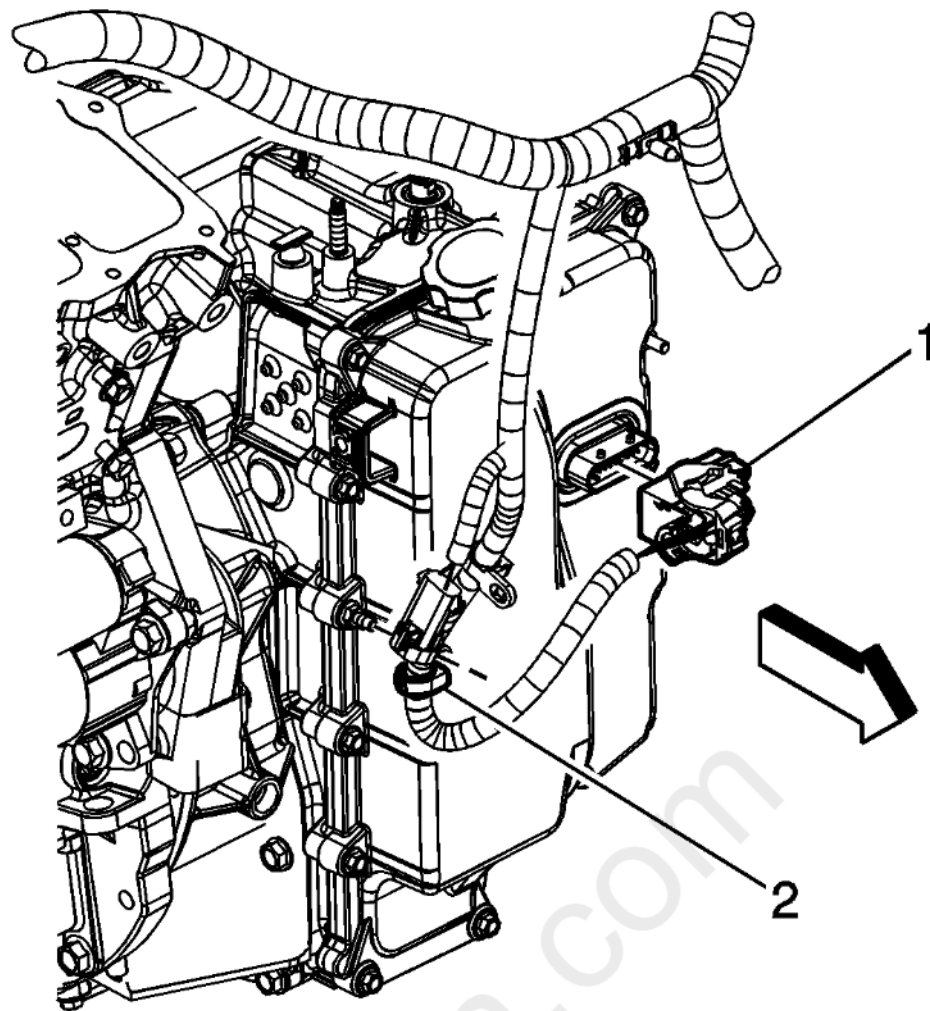


Fig. 6: Identifying Wire Harness Retainer & TCM Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

The transmission electrical connector is an important part of the transmission operating system. Any interference with the electrical connection can cause the transmission to set diagnostic trouble codes or affect proper operation. The following items can affect the electrical connection:

- Bent pins in the connector from rough handling during connection and disconnection
- Wires backing away from the pins or coming uncrimped, in the external wiring harness
- Dirt contamination entering the connector when disconnected
- Transmission fluid leaking into the connector, wicking up into the external wiring harness and degrading the wire insulation
- Moisture intrusion in the connector
- Low pin retention in the external connector from excessive connection and disconnection of the wiring connector assembly
- Pin corrosion from contamination
- Damaged connector assembly

Remember the following points:

- Limit twisting or wiggling the connector during removal. Bent pins can occur.
- Do not pry the connector off with a screwdriver or other tool.
- Whenever the transmission external wiring connector is disconnected from the internal harness and the engine is operating, DTCs will set. Clear these DTCs after reconnecting the external connector.

NON-SHIFTING CLUTCH FUNCTION VERIFICATION DESCRIPTION

The 6T70/75 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.

CRUISE GRADE BRAKING DESCRIPTION

Purpose

- Cruise grade braking assists when driving on a downhill grade.
- It maintains vehicle speed by automatically implementing a shift schedule that uses the engine and the transmission to slow the vehicle.

Activation

- This feature is internal to the vehicle's software/calibration and requires no customer action to activate.
- Cruise grade braking is not available in Range Selection Mode.

Function

- Automatic downshifting to assist in speed control will activate when vehicle speed has increased from the set point by a certain amount. Multiple downshift may be commanded depending on the amount of deviation of vehicle speed to the set speed. As vehicle speed slows and approaches the original set speed, upshifts will be commanded to return to a normal operating condition.
- At some speeds and on some downhill grades, the transmission may not be able to command a gear low enough to slow the vehicle to the set point without overspeeding the engine.
- In this case the transmission will command all available downshifts, but if further engine braking is desired, the driver must press the brake pedal to slow the vehicle enough so additional downshift(s) can be commanded.
- Pressing the brake pedal has the normal effect of cancelling cruise control operation and in this case a transition to Normal - Powertrain Braking is completed.
- As always, if cruise control operation was cancelled through usage of the brake pedal, it must be reinitiated by tapping either the Set or Resume Cruise switches.

PARK - ENGINE RUNNING

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

R1/456 Pressure Control (PC) Solenoid 3

The R1/456 pressure control solenoid (PCS) is energized (HIGH) allowing actuator feed limit fluid to enter the PCS R1/456 CL fluid circuit. PCS R1/456 CL fluid is then routed through orifice #22 to the 4-5-6 clutch boost valve and through orifice #21 to the R1/ 456 clutch regulator valve.

R1/456 Clutch Regulator Valve

PCS R1/456 CL fluid at the R1/4-5-6 clutch regulator valve moves the valve against R1/4-5-6 clutch regulator spring force and R1/FDBK fluid. This allows line pressure to pass through the valve and enter the R1/456CL FD circuit. R1/456CL FD is then routed to clutch select valve 2.

Shift Solenoid 1

Shift solenoid 1 is energized (ON) allowing actuator feed limit fluid to enter the solenoid 1 circuit. Solenoid 1 fluid is routed to the #2 ball check valve and through orifice #10 to the torque converter clutch (TCC) regulator valve and shuttle valve (SHTL).

TCC Regulator Valve and Shuttle Valve

Solenoid 1 fluid is routed to the TCC regulator valve and shuttle valve and moves the valve against TCC regulator valve spring force.

#2 Ball Check Valve

Solenoid 1 fluid seats the #2 ball check valve against the reverse fluid passage and fluid is forced through orifice #15 into the CSV2 enable fluid circuit.

Clutch Select Valve 2

CSV2 enable fluid is routed to the clutch select valve 2 and moves the valve against clutch select valve 2 spring force. This allows R1/456 CL FD fluid to pass through the valve and enter the R1 supply circuit. R1 Supply fluid is then routed into the R1 fluid circuit and, through orifice #18. R1 fluid is then routed to the low & reverse clutch assembly in preparation for a shift into low or reverse gear.

Shift Solenoid 2

Shift solenoid 2 is energized (ON) allowing actuator feed limit fluid to enter the solenoid 2 fluid circuit and is then routed to the #3 ball check valve and through orifice #13 to the clutch select valve #3.

3-5 Reverse Clutch Regulator Valve

Actuator feed limit fluid is routed through the valve and into the PS2 fluid passage. PS2 fluid is then sent to the normally closed #2 pressure switch and opens the switch.

#3 Ball Check Valve

Solenoid 2 fluid seats the #3 ball check valve against 456 CL fluid passage and fluid is forced through orifice #13 into the CSV3 enable fluid circuit. CSV3 enable fluid is then routed to the clutch select valve 3.

Clutch Select Valve #3

CSV3 enable fluid moves the clutch select valve 3 against clutch select valve 3 spring force.

Compensator Blow Off

Line pressure is routed through orifice #17 to the compensator feed circuit. Compensator feed fluid enters the compensator blow off circuit and fills the 4 - 5 - 6 dam piston area.

Park - Engine Running

R1 supply fluid passes through orifice #18 and unseats check ball #8. R1 supply fluid enters the low & reverse clutch piston circuit and moves the piston against the spring force to apply the low & reverse

clutch plates.

#5 Ball Check Valve

The 3-5 clutch reverse feed fluid seats #5 ball check valve against the drive 1-6 circuit allowing 3-5 clutch reverse feed fluid to enter the 3-5 reverse supply circuit. The 3-5 reverse supply fluid is then routed to #7 ball check valve and through orifice #16 where it enters the 3-5 reverse feed circuit. The 3-5 reverse feed passes through orifice #34 and then is routed to the 3-5 reverse clutch regulator valve.

3-5 Reverse Clutch Applies

35R Pressure Control Solenoid 2

The 35R pressure control solenoid 2 is energized (HIGH) allowing actuator feed limit fluid to enter the PCS 3-5 reverse clutch circuit. PCS 3-5 reverse clutch fluid is then routed through orifice #36 to the 3-5 reverse clutch regulator valve and through orifice #37 to the 3-5 reverse boost valve.

3-5 Reverse Clutch Regulator Valve

PCS 3-5 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 3-5 reverse clutch feedback fluid. This allows 3-5 reverse feed to pass through the valve and enter the 3-5 reverse clutch circuit. The 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch and the 3-5 reverse boost valve. PS2 fluid from pressure switch 2 exhausts through the valve allowing the switch to close.

3-5 Reverse Boost Valve

PCS 3-5 reverse clutch fluid pressure acts on a differential area moving the 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 3-5 reverse clutch fluid passes through the valve and enters the 3-5 reverse clutch feedback circuit. As PCS 3-5 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 3-5 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 3-5 clutch reverse feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch

The 3-5 reverse clutch fluid enters the 3-5R/456 clutch housing to move the piston against spring force and compensator feed fluid to apply the 3-5 reverse clutch plates.

Reverse

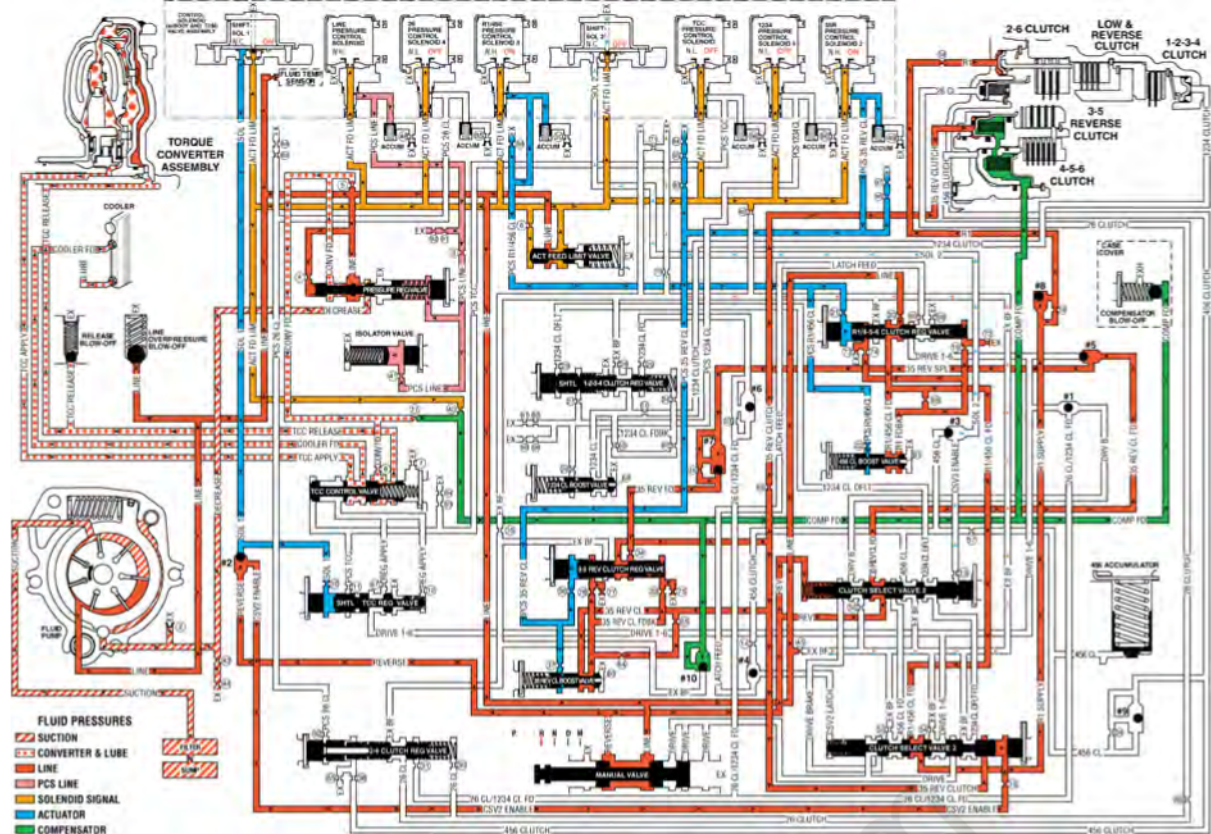


Fig. 8: Fluid Hydraulic Diagram - Reverse
Courtesy of GENERAL MOTORS COMPANY

NEUTRAL - ENGINE RUNNING

When the gear selector is moved to the Neutral (N) position, the hydraulic and electrical system operation is identical to Park (P) range. However, if Neutral is selected after the vehicle was operating in Reverse (R), the normally high 35R pressure control solenoid 2 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 and drive fluid circuits. The reverse fluid from the #2 ball check valve and clutch select valve 3 is opened to an exhaust passage at the manual valve.

35R Pressure Control Solenoid 2

The 35R pressure control solenoid 2 is commanded OFF allowing PCS 3-5 reverse clutch fluid from the 3-5 reverse clutch boost valve and 3-5 reverse clutch regulator valve to exhaust.

3-5 Reverse Clutch Boost Valve

The 3-5 reverse boost valve spring force moves the valve to allow 3-5 reverse clutch feedback fluid from the 3-5 reverse clutch regulator valve to enter the 3-5 reverse clutch circuit and exhaust.

3-5 Reverse Clutch Regulator Valve

The 3-5 reverse clutch regulator valve spring force moves the valve to allow 3-5 reverse clutch fluid from the 3-5 reverse clutch and clutch select valve 2 to pass through the valve and enter the 35 reverse clutch feed circuit through orifice #16 past check ball #5 to clutch select valve 3 to exhaust back fill circuit to exhaust.

3-5 Reverse Clutch

The 3-5 reverse clutch spring force moves the 3-5 reverse clutch piston to release the 3-5 reverse clutch plates and force 3-5 reverse clutch fluid to exhaust from the 3-5/4-5-6 reverse clutch housing. The 3-5

reverse clutch fluid is then routed to the 3-5 reverse clutch regulator valve allowing the 3-5 reverse clutch to release.

Clutch Select Valve 3

When reverse fluid exhausts through the manual valve, CSV3 enable fluid moves the valve against clutch select valve 3 spring force. The 3-5 reverse feed fluid is routed into the exhaust back fill circuit and exhausts.

Neutral - Engine Running

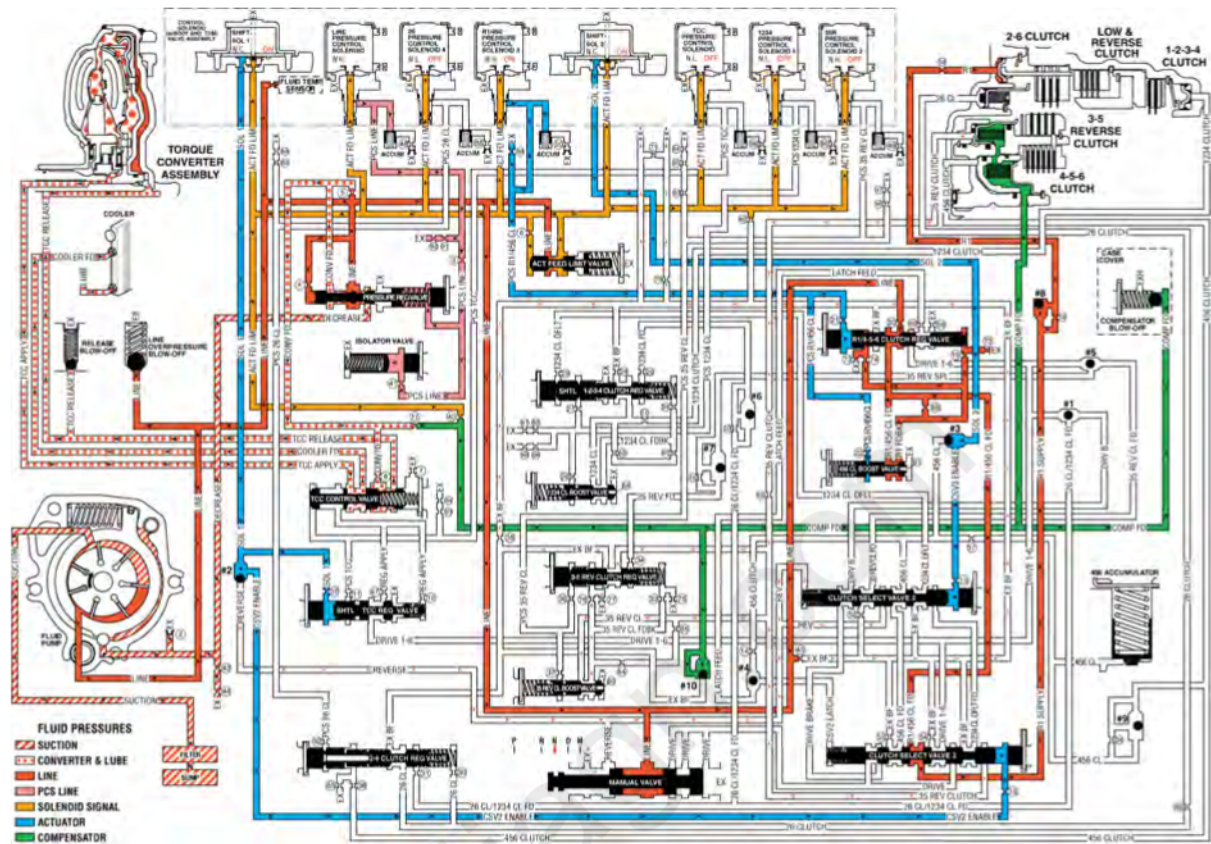


Fig. 9: Fluid Hydraulic Diagram - Neutral - Engine Running
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIRST GEAR ENGINE BRAKING

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-low 1234 pressure control solenoid 5 is commanded ON and in the engine braking mode the following changes occur within the hydraulic circuits:

Fluid Pressure is Directed to the 1-2-3-4 Clutch and the Low & Reverse Clutch to Provide Engine Braking

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 2.

Clutch Select Valve 2

Drive fluid at the clutch select valve 2 passes through the valve and enters the drive brake circuit. Drive brake fluid is then routed to the clutch select valve 3.

Clutch Select Valve 3

Drive brake fluid at the clutch select valve 3 passes through the valve and enters the Drive B fluid circuit. Drive B fluid is then routed to #1 ball check valve.

#1 Ball Check Valve

Drive B fluid seats the #1 ball check valve against drive 1-6 fluid to force drive B fluid into the 26/1234 feed passage. The 26/ 1234 feed fluid is routed through orifice #31 and, to the 2-6 clutch regulator valve. The 26/1234 feed fluid passes through the 2-6 clutch regulator valve and enters the pressure switch 3 (PS3) fluid circuit. PS3 fluid is then routed to the normally closed pressure switch 3 and opens the switch.

#6 Ball Check Valve

26/1234 feed fluid unseats the #6 ball check valve allowing 26/1234 feed fluid to enter the 1234 clutch feed circuit. The 1234 clutch feed fluid is routed through orifice #25 and then to the 1-2-3-4 clutch regulator valve.

1-2-3-4 Clutch Applies

1234 Pressure Control Solenoid 5

The 1234 pressure control solenoid 5 is commanded ON allowing actuator feed limit to enter the PCS 1234 clutch fluid circuit. PCS 1234 clutch fluid is then routed through orifice #27 to the 1-2-3-4 clutch regulator valve. PCS1234 clutch fluid is also routed through orifice #29 and then to the 1-2-3-4 clutch boost valve.

1-2-3-4 Clutch Regulator Valve

PCS1234 clutch fluid moves the 1-2-3-4 clutch regulator valve against 1-2-3-4 clutch regulator valve spring force to allow 1234 clutch feed fluid to pass through the valve and enter the 1234 clutch fluid circuit. The 1234 clutch fluid is then routed to the 1234 clutch boost valve and the 1-2-3-4 clutch.

1-2-3-4 Clutch Boost Valve

PCS1234 clutch fluid pressure acts on a differential area moving the 1234 clutch boost valve against the 1234 clutch boost valve spring. The 1234 clutch fluid passes through the valve and enters the 1234 clutch feedback circuit. As PCS 1234 clutch fluid pressure is increased to a given value, the 1234 clutch boost valve opens the 1234 clutch feedback circuit to exhaust. This results in the 1234 clutch regulator valve moving to the full feed position sending full 26 CL/1234 CL feed pressure (full line pressure) to the clutch.

1-2-3-4 Clutch

The 1234 clutch fluid enters the 1234 clutch to move the piston against spring force to apply the 1-2-3-4 clutch plates.

Drive Range, First Gear Engine Braking

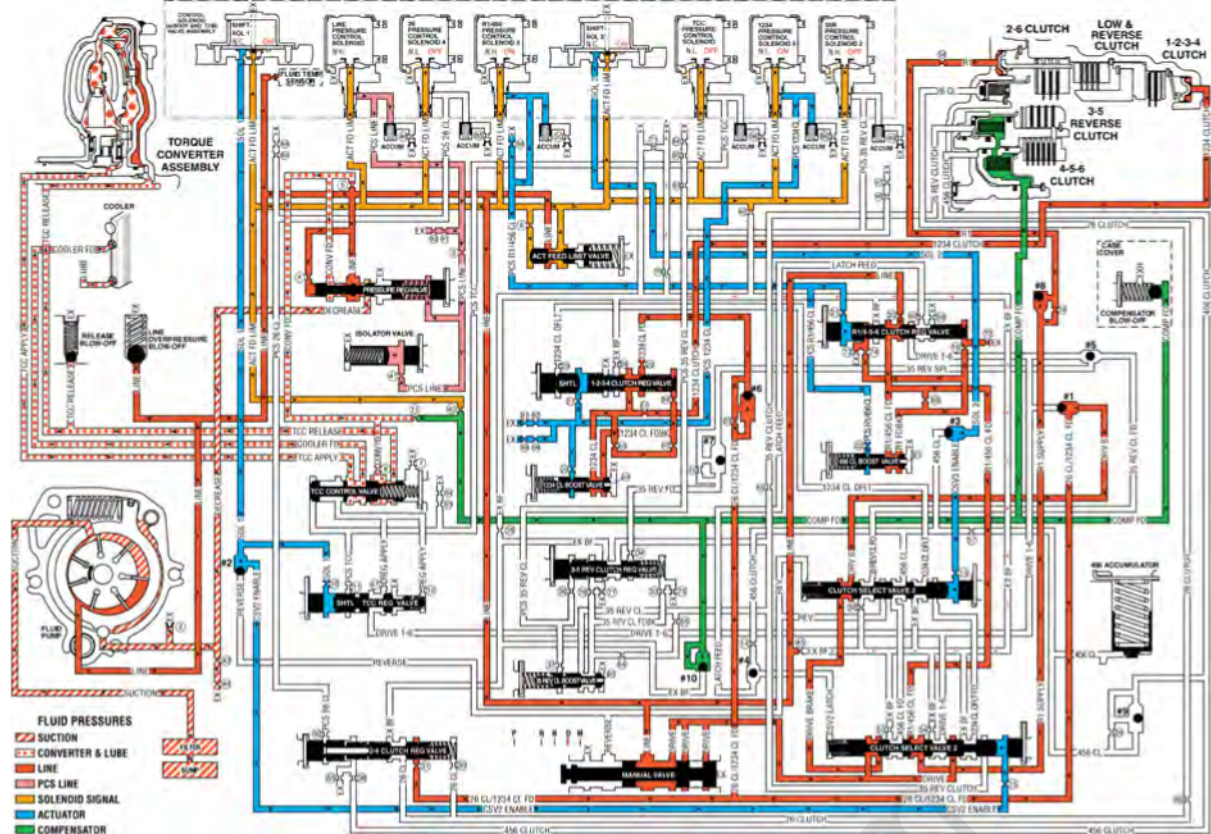


Fig. 10: Fluid Hydraulic Diagram - Drive Range, First Gear Engine Braking
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIRST GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, throttle position sensor and other vehicle sensors to determine the precise moment to deenergize or "turn off" shift solenoid 1 and command OFF the normally-high R1/456 pressure control solenoid 3.

Low & Reverse Clutch Releases

Shift Solenoid 1

When shift solenoid 1 is "turned OFF", CSV2 enable fluid from the clutch select valve 2 passes by the #2 ball check valve and enters the solenoid 1 fluid circuit. Solenoid 1 fluid from the #2 ball check valve and TCC regulator valve is then routed to the solenoid where it exhausts.

Clutch Select Valve 2

Clutch select valve 2 (CSV2) enable fluid is exhausted from the clutch select valve 2 and clutch select valve 2 spring force moves the valve to the released position. With clutch select valve 2 in the released position, drive fluid from the manual valve passes through the valve and enters the drive 1-6 fluid circuit. Drive 1-6 fluid then feeds the R1/456 and 35 reverse clutch regulator valves and the TCC regulator valve.

R1/456 Pressure Control Solenoid 3

The R1/456 pressure control solenoid 3 is commanded OFF allowing PCS R1/456 fluid from the R1/456 clutch regulator valve and 456 clutch boost valve to exhaust.

R1/456 Clutch Regulator Valve

R1/456 clutch regulator valve spring force moves the valve to exhaust the R1/456 clutch feed circuit and allow drive 1-6 fluid to enter the PS4 fluid circuit. PS4 fluid is then routed to the normally-closed pressure switch 4 and opens the switch. PS4 fluid is also routed to the #4 ball check valve and flows into the CSV2 latch fluid circuit.

#4 Ball Check Valve

26 Pressure Control Solenoid 4

The 26 pressure control solenoid 4 is commanded ON, allowing actuator feed limit fluid to enter the pressure control solenoid (PCS) 26 clutch fluid circuit. PCS 26 clutch fluid is then routed through orifice #32 to the 2-6 clutch regulator valve.

2-6 Clutch Regulator Valve

PCS 26 clutch fluid moves the 2-6 clutch regulator valve assembly against the 2-6 clutch regulator valve spring force to allow 26 clutch/1234 clutch feed fluid to pass through the valve. The 26 clutch/1234 clutch feed fluid is routed into the 26 clutch fluid circuit where it passes through orifice #46 and then to the spring end of the 2-6 clutch regulator valve, and to the 2-6 clutch within the case cover.

2-6 Clutch

The 26 clutch fluid from the 2-6 clutch regulator valve is routed through the case cover and 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.

Drive Range, Second Gear

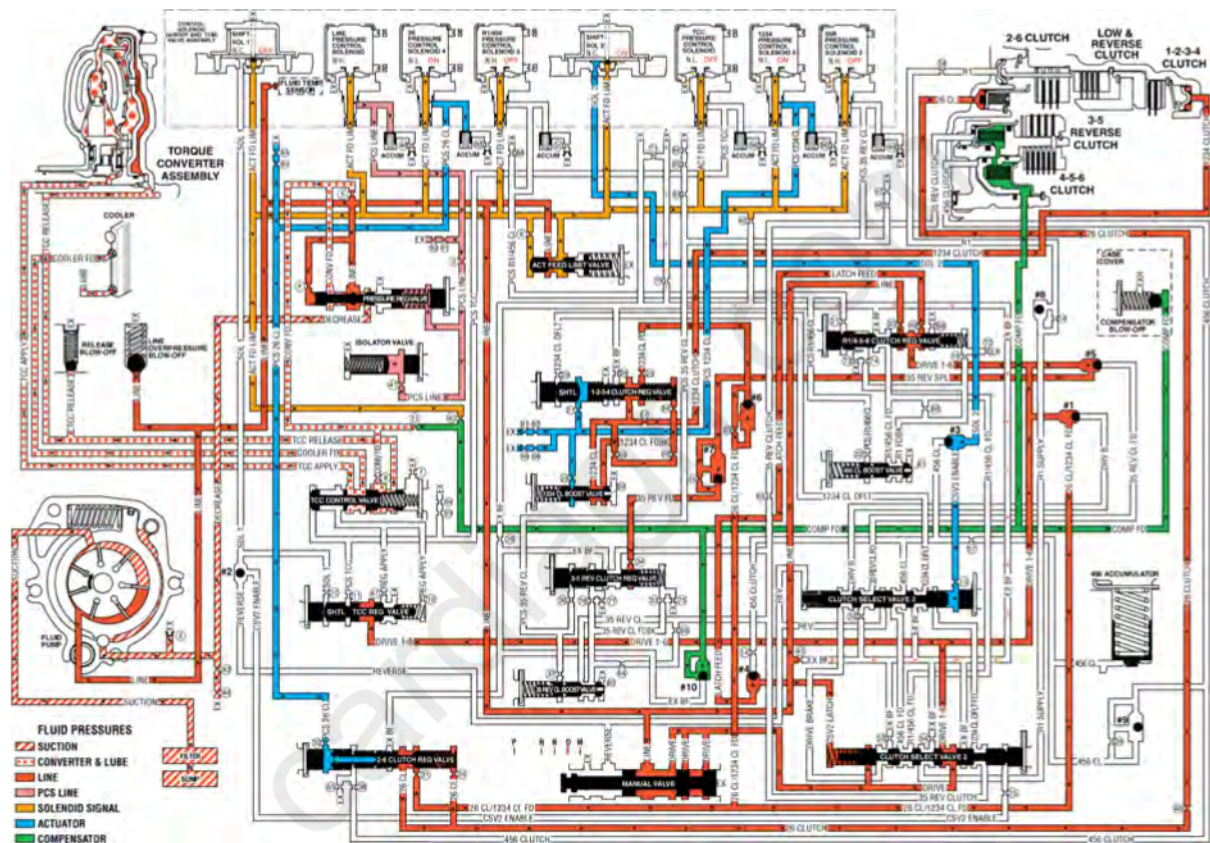


Fig. 12: Fluid Hydraulic Diagram - Drive Range, First Gear

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, THIRD GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command OFF the normally-low 26 pressure control solenoid 4. At the same time the 35R pressure control solenoid 2 is also commanded ON to regulate 3-5 clutch apply.

3-5 Reverse Clutch Applies

35R Pressure Control Solenoid 2

The 35R pressure control solenoid 2 is commanded ON allowing actuator feed fluid to enter the pressure control solenoid (PCS) 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #36 and then to the 3-5 reverse clutch regulator valve. PCS 35 reverse clutch fluid is also routed through orifice #37 and then to the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Boost Valve

PCS 35 reverse clutch fluid pressure acts on a differential area moving the 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 35 reverse clutch fluid passes through the valve and enters the 35 reverse clutch feedback circuit. As PCS 35 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 35 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 35 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 35 reverse clutch feedback fluid. This allows 35 reverse feed to pass through the valve and enter the 35 reverse clutch circuit. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS2 fluid from the pressure switch 2 exhausts through the valve allowing the switch to close.

3-5 Reverse Clutch

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

2-6 Clutch Releases

26 Pressure Control Solenoid 4

The 26 pressure control solenoid 4 is commanded OFF allowing PCS 26 clutch fluid from the 2-6 clutch regulator valve to exhaust. The 26 clutch/1234 clutch feed fluid at the 2-6 clutch regulator valve passes through the valve and enters the PS3 fluid circuit. PS3 fluid is then routed to pressure switch 3 and opens the normally-closed switch.

2-6 Clutch Regulator Valve

The 2-6 clutch regulator valve spring force moves the valve to allow 26 clutch fluid from the 2-6 clutch to pass through the valve and enter the exhaust backfill fluid circuit.

2-6 Clutch

The 2-6 clutch spring force moves the 2-6 clutch piston to release the 2-6 clutch plates and forces 26 clutch fluid to exhaust. The 26 clutch fluid is routed through the 2-6 clutch regulator valve where it enters the exhaust backfill fluid circuit and is exhausted.

Drive Range, Third Gear

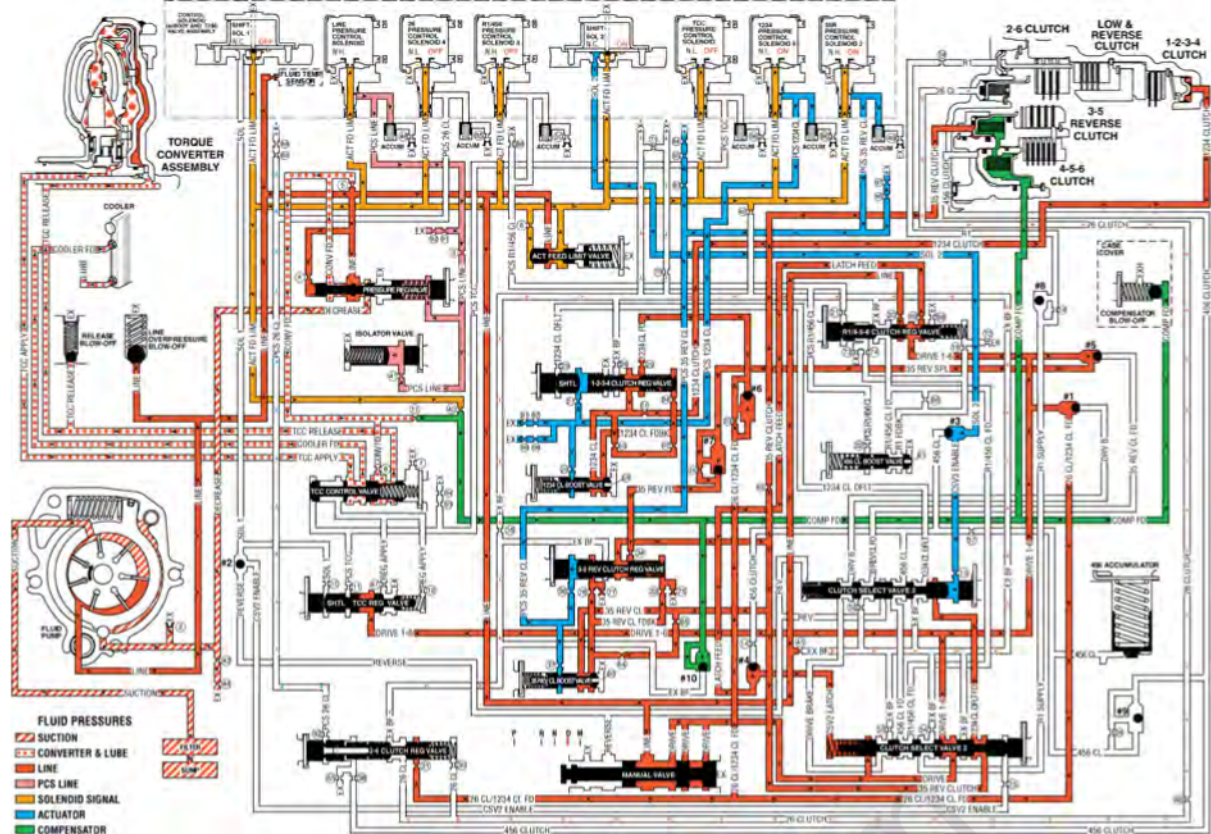


Fig. 13: Fluid Hydraulic Diagram - Drive Range, Third Gear
 Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, THIRD GEAR DEFAULT

If the transmission is in 1st, 2nd or 3rd gear during a transmission electrical component failure, the transmission will default to 3rd gear. All solenoids will default to their normal state. If the torque converter clutch was applied, it will release. This default action will enable the vehicle to be safely driven to a service center.

1-2-3-4 Clutch Stays Applied

Shift Solenoid 2

Shift solenoid 2 defaults to its normally-closed state (OFF), and SOL 2 fluid exhausts through the solenoid.

Clutch Select Valve 3

Solenoid 2 fluid pressure no longer holds the clutch select valve 3 open. When the valve moves back to the closed position, it opens the 1234 clutch default fluid circuit, and 1234 default fluid is routed to the 1-2-3-4 clutch regulator valve.

1-2-3-4 Clutch Regulator Valve

With the absence of PCS 1234 clutch fluid, due to the default state of the 1234 pressure control solenoid 5, the 1-2-3-4 regulator valve would close from spring force. However, the 1234 clutch default fluid enters behind the 1-2-3-4 regulator shuttle valve and keeps the valve in the open position.

1-2-3-4 Clutch

With the 1-2-3-4 clutch regulator valve still held in the open position, the 1-2-3-4 clutch will stay applied.

3-5 Reverse Clutch Applied or Applies

35R Pressure Control Solenoid 2

The normal state for the 35R pressure control solenoid 2 is ON, therefore PSC 3-5 reverse clutch fluid will still be routed to the 3-5 reverse clutch regulator valve and the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Regulator Valve

PCS 3-5 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 3-5 reverse clutch feedback fluid. This allows 3-5 reverse feed to pass through the valve and enter the 3-5 reverse clutch circuit. 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS2 fluid from the pressure switch 2 exhausts through the valve, allowing the switch to close.

3-5 Reverse Clutch Boost Valve

PCS 3-5 reverse clutch fluid pressure acts on a differential area moving the 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 3-5 reverse clutch fluid passes through the valve and enters the 3-5 reverse clutch feedback circuit. As PCS 3-5 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 3-5 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 3-5 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch

The 3-5 reverse clutch fluid enters the 3-5 reverse/456 clutch housing to move the piston against spring force to apply the 3-5 reverse clutch plates.

Drive Range, Third Gear Default

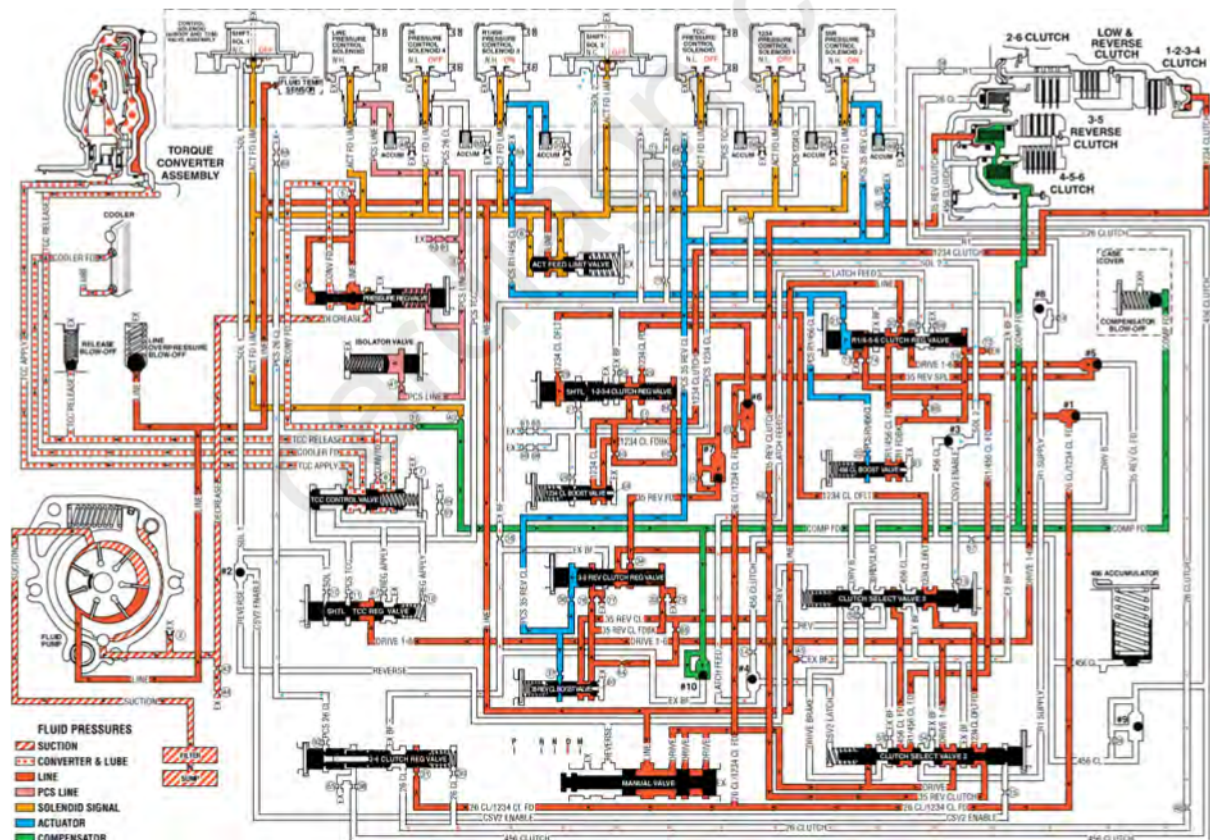


Fig. 14: Fluid Hydraulic Diagram - Drive Range, Third Gear Default

Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FOURTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command OFF the normally-high 35R pressure control solenoid 2. At the same time the normally-low R1/456 pressure control solenoid 3 is commanded ON to regulate 4-5-6 clutch apply.

4-5-6 Clutch Applies

R1/456 Pressure Control Solenoid 3

The R1/456 pressure control solenoid 3 (PCS) is commanded ON allowing actuator feed fluid to enter the PCS R1/456 clutch fluid circuit. PCS R1/456 clutch fluid is routed through orifice #21 to the R1/456 clutch regulator valve and, through orifice #22 to the R1/456 clutch boost valve.

R1/456 Clutch Regulator Valve

PCS R1/456 clutch fluid moves the R1/456 clutch regulator valve against R1/456 clutch regulator valve spring force to allow line fluid to pass through the valve and enter the R1/456 clutch feed circuit. R1/456 clutch feed is then routed to the 4-5-6 clutch boost valve and clutch select valve 2.

4-5-6 Clutch Boost Valve

PCS R1/456 clutch fluid pressure acts on a differential area moving the R1/456 clutch boost valve against the R1/456 clutch boost valve spring. R1/456 clutch fluid passes through the valve and enters the R1/456 clutch feedback circuit. As PCS R1/456 clutch fluid pressure is increased to a given value, the R1/456 clutch boost valve opens the R1/456 clutch feedback circuit to exhaust. This results in the R1/456 clutch regulator valve moving to the full feed position, sending full line pressure to the clutch.

Clutch Select Valve 2

R1/456 clutch feed fluid passes through the clutch select valve 2 and enters the 456 clutch feed circuit. The 456 clutch feed fluid is routed to the clutch select valve 3 where it passes through the valve and enters the 456 clutch fluid circuit. The 456 clutch fluid is routed to the 4-5-6 clutch, the 4-5-6 accumulator, #9 ball check valve and to the #4 ball check valve. The 456 clutch fluid seats the #9 ball check valve and routes fluid through orifice #39. The 456 clutch fluid passes through orifice #14, seats #4 ball check valve against the PS4 fluid circuit and routes fluid to the CSV2 latch circuit.

4-5-6 Clutch

The 456 clutch fluid enters the 4-5-6 clutch housing to move the piston against spring force, combined with force from the compensator to apply the 4-5-6 clutch plates.

3-5 Reverse Clutch Releases

35R Pressure Control Solenoid 2

The 35R pressure control solenoid 2 is commanded OFF, allowing PCS 35 reverse clutch fluid from the 3-5 reverse clutch boost valve and the 3-5 reverse clutch regulator valve to exhaust through the solenoid.

3-5 Reverse Clutch Boost Valve

The 3-5 reverse boost valve spring force moves the valve to allow 35 reverse clutch feedback fluid from the 3-5 reverse clutch regulator valve to enter the 35 reverse clutch fluid circuit and exhaust.

#9 Ball Check Valve

The 456 clutch fluid pressure seats #9 ball check valve to force fluid through orifice #39 and applies the 456 clutch.

3-5 Reverse Clutch Regulator Valve

The 3-5 reverse clutch regulator valve spring force moves the valve to allow 35 reverse clutch fluid from the 3-5 reverse clutch to pass through the valve and enter the exhaust backfill fluid circuit. The 35 reverse clutch fluid then enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted.

3-5 Reverse Clutch

The 3-5 reverse clutch spring force combined with force from the compensator move the 3-5 reverse clutch piston to release the 3-5 clutch plates and forces 35 reverse clutch fluid to exhaust from 3-5

reverse/456 clutch housing. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch regulator valve and exhausted.

#4 Ball Check Valve

The 456 clutch fluid pressure passes through orifice #14 to seat #4 ball check valve against PS4 fluid passage. The 456 clutch fluid is then directed into the CSV2 latch circuit.

456 Accumulator

The 456 clutch fluid enters the 456 accumulator to move the piston against spring force to cushion the 456 clutch piston apply.

Drive Range, Fourth Gear

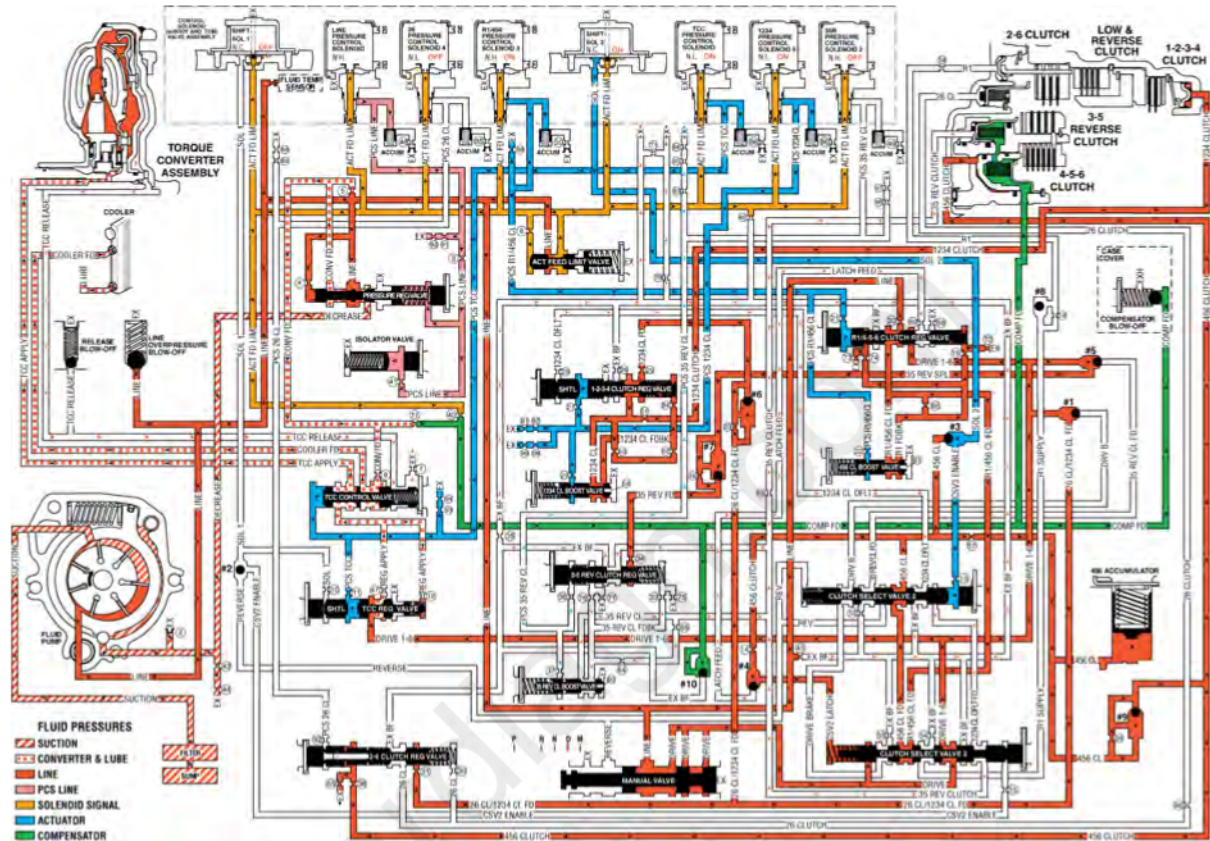


Fig. 15: Fluid Hydraulic Diagram - Drive Range, Fourth Gear
Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIFTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-high 35R pressure control solenoid 2. At the same time the normally-low 1234 pressure control solenoid 5 is commanded OFF.

3-5 Reverse Clutch Applies

35R Pressure Control Solenoid 2

The 35R pressure control solenoid 2 is commanded ON, allowing actuator feed fluid to enter the PCS 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #36 and then to the 3-5 reverse clutch regulator valve. PCS 35 reverse clutch fluid is also routed through orifice #37 and then to the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Boost Valve

PCS 35 reverse clutch fluid pressure acts on a differential area moving the PCS 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 35 reverse clutch fluid passes through the valve and enters the 35 reverse clutch feedback circuit. As PCS 35 reverse clutch fluid pressure is

increased to a given value, the 3-5 reverse clutch boost valve opens the 35 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 35 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 35 reverse clutch feedback fluid. This allows 35 reverse feed to pass through the valve and enter the 35 reverse clutch circuit. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS2 fluid from the pressure switch 2 exhausts through the valve allowing the switch to close.

Clutch Select Valve 2

The 35 reverse clutch fluid passes through the clutch select valve 2 and enters the 1234 clutch default feed fluid circuit. The 1234 clutch default feed fluid is then routed to the clutch select valve 3.

3-5 Reverse Clutch

The 35 reverse clutch fluid enters the 3-5 reverse/456 clutch housing to move the piston against spring force combined with force from the compensator to apply the 3-5 reverse clutch plates.

1-2-3-4 Clutch Releases

1234 Pressure Control Solenoid 5

The 1234 pressure control solenoid 5 is commanded OFF, allowing PCS 1234 clutch fluid from the 1-2-3-4 clutch regulator valve and 1-2-3-4 clutch boost valve to exhaust.

1-2-3-4 Clutch Regulator Valve

The 1-2-3-4 clutch regulator valve spring force moves the valve to allow 1234 clutch feed fluid from the 1-2-3-4 clutch to pass through the valve and enter the exhaust backfill fluid circuit. The 1234 clutch fluid then enters the exhaust backfill fluid circuit and is routed through orifice #26 where excess pressure is exhausted. Also, 1234 clutch regulator valve spring force moves the valve to allow 1234 clutch feed fluid to pass through the valve and enter the PS1 fluid circuit. PS1 fluid is then routed to pressure switch 1 and opens the normally-closed switch.

1-2-3-4 Clutch Boost Valve

The 1-2-3-4 clutch boost valve spring force moves the valve to allow 1234 clutch feedback fluid from the 1-2-3-4 clutch regulator valve to enter the 1234 clutch circuit and exhaust.

1-2-3-4 Clutch

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

Drive Range, Fifth Gear

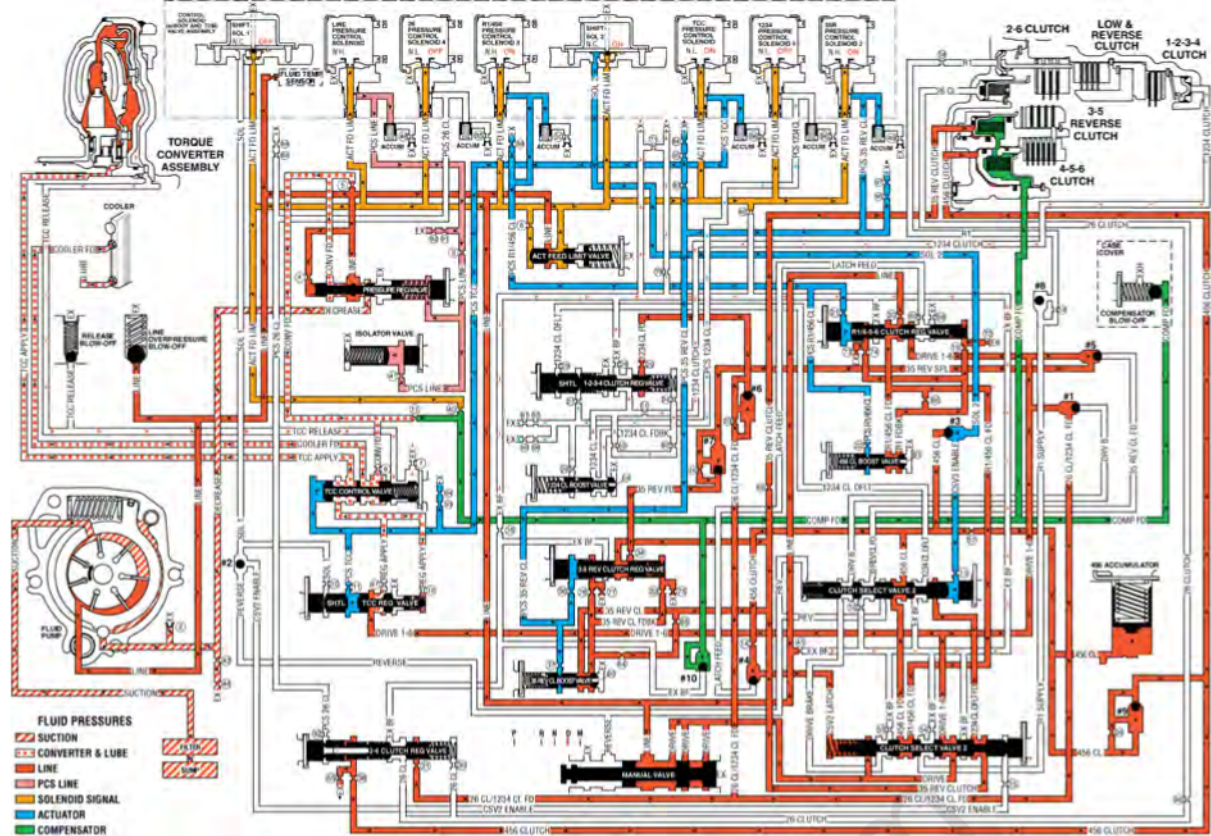


Fig. 16: Fluid Hydraulic Diagram - Drive Range, Fifth Gear
 Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, FIFTH GEAR DEFAULT

If the transmission is in 4th, 5th or 6th gear during a transmission electrical component failure, the transmission will default to 5th gear. All solenoids will default to their normal state. If the torque converter clutch was applied, it will release. The transmission will stay in 5th gear default range until the ignition has been turned off or transmission shifted to reverse. When the vehicle is restarted, and shifted back into drive, the transmission will then operate in the 3rd gear default range. This default action will enable the vehicle to be safely driven to a service center.

3-5 Reverse Clutch Applies

35R Pressure Control Solenoid 2

The 35R pressure control solenoid 2 defaults to ON, allowing actuator feed fluid to enter the pressure control solenoid (PCS) 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #36 and then to the 3-5 reverse clutch regulator valve. PCS 35 reverse clutch fluid is also routed through orifice #37 and then to the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Boost Valve

PCS 3-5 reverse clutch fluid pressure acts on a differential area moving the PCS 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 3-5 reverse clutch fluid passes through the valve and enters the 3-5 reverse clutch feedback circuit. As PCS 3-5 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 3-5 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 3-5 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch Regulator Valve

PCS 3-5 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 3-5 reverse clutch feedback fluid. This allows 3-5 reverse feed to pass through the valve and enter the 3-5 reverse clutch circuit. The 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS2 fluid from the pressure switch 2 exhausts through the valve, allowing the switch to close.

3-5 Reverse Clutch

The 3-5 reverse clutch fluid enters the 3-5 reverse/456 clutch housing to move the piston against spring force to apply the 3-5 reverse clutch plates.

Clutch Select Valve 3

Once the clutch select valve 3 is moved to the ON position in 4th gear, it will remain in this position throughout the 5th gear default range, until the ignition has been turned OFF. When the ignition is OFF, fluid will exhaust from the valve, thus when the vehicle is restarted, the transmission will then be in the 3rd gear default range.

1-2-3-4 Clutch Releases or 2-6 Clutch Releases

1234 Pressure Control Solenoid 5

If the transmission was in 4th gear when an electrical condition commands a protection mode, the 1234 pressure control solenoid 5 defaults to the OFF position, allowing PCS 1234 clutch fluid from the 1-2-3-4 clutch, the 1-2-3-4 clutch regulator valve and 1- 2-3-4 clutch boost valve to exhaust.

2-6 26 Pressure Control Solenoid 4

If the transmission was in 6th gear when an electrical condition commands a protection mode, the 26 pressure control solenoid 4 defaults to the OFF position, allowing PCS 26 clutch fluid from the 2-6 clutch regulator valve, and the 2-6 clutch to exhaust.

Torque Converter Clutch Releases

TCC Pressure Control Solenoid

The torque converter clutch (TCC) pressure control solenoid will default to it's normal state, OFF. PCS TCC fluid will exhaust from the TCC control valve, and spring force will shuttle the valve to the off position. TCC apply fluid will then be routed to the cooler, and TCC release fluid will be routed to the torque converter for complete TCC release.

1234 Clutch Regulator Valve

The 1234 clutch regulator valve spring force moves the valve to allow 1234 clutch feed fluid to enter the PS1 fluid circuit which opens PS1 switch. The 1234 clutch fluid passes through orifice #51 to the 1234 clutch regulator valve, through orifice #26 and enters the exhaust backfill circuit.

Drive Range, Fifth Gear Default

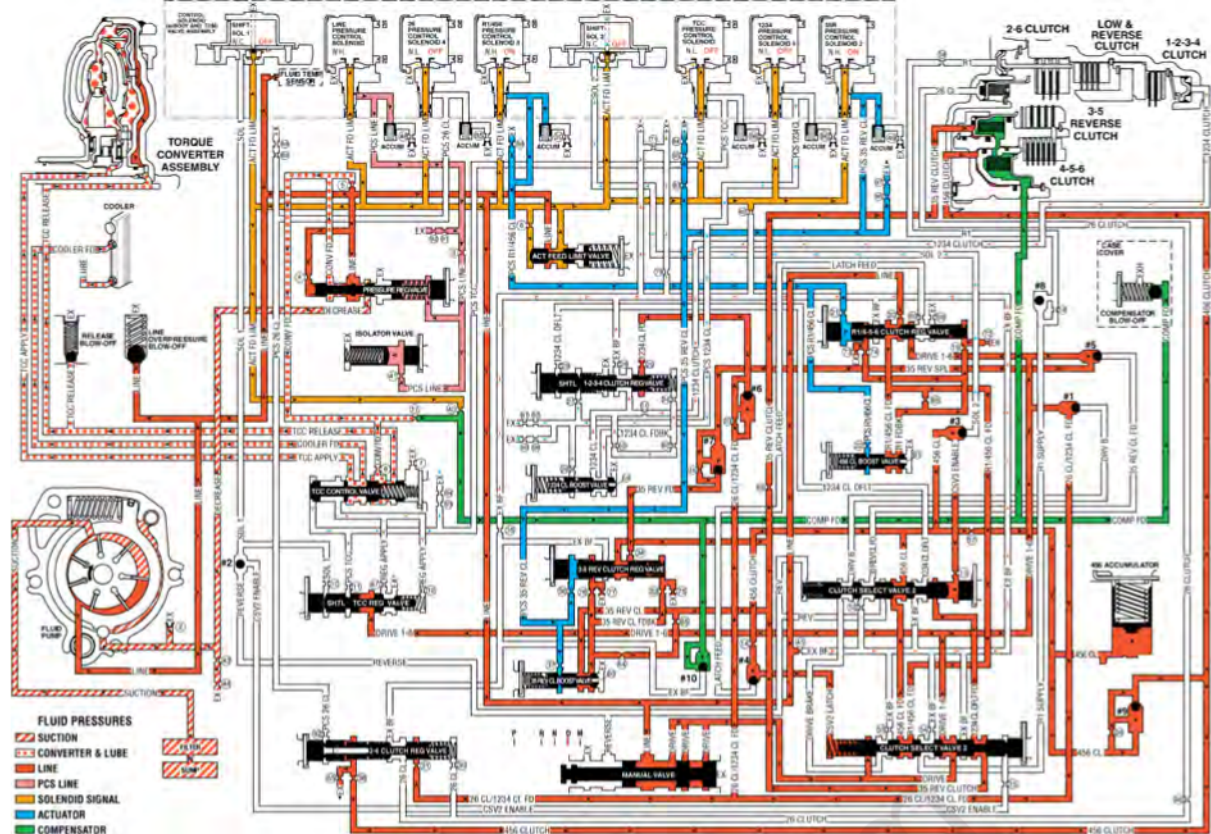


Fig. 17: Fluid Hydraulic Diagram - Drive Range, Fifth Gear Default
 Courtesy of GENERAL MOTORS COMPANY

DRIVE RANGE, SIXTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-low 26 pressure control solenoid 4 (PCS). At the same time the normally-high 35R pressure control solenoid 2 is commanded OFF.

2-6 Clutch Applies

26 Pressure Control Solenoid 4

The 26 pressure control solenoid 4 is commanded ON, allowing actuator feed fluid to enter the PCS 26 clutch fluid circuit. PCS 26 fluid is routed through orifice #32 and then to the 2-6 clutch regulator valve.

2-6 Clutch Regulator Valve

PCS 26 clutch fluid moves the 2-6 clutch regulator valve assembly against the 2-6 clutch regulator valve spring force to allow 26 clutch/1234 clutch feed fluid to pass through the valve. The 26 clutch/1234 clutch feed fluid is routed into the 26 clutch fluid circuit where it passes through orifice #46 and then to the spring end of the 2-6 clutch regulator valve, and to the 2-6 clutch.

2-6 Clutch

The 26 clutch fluid from the 2-6 clutch regulator valve is routed 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.

3-5 Clutch Releases

35R Pressure Control Solenoid 2

The 35R pressure control solenoid 2 is commanded OFF, allowing PCS 35 reverse clutch fluid from the 3-5 reverse clutch boost valve and the 3-5 reverse clutch regulator valve to exhaust through the solenoid.

3-5 Reverse Clutch Boost Valve

The 3-5 reverse boost valve spring force moves the valve to allow 35 reverse clutch feedback fluid from the 3-5 reverse clutch regulator valve to enter the 35 reverse clutch circuit and exhaust.

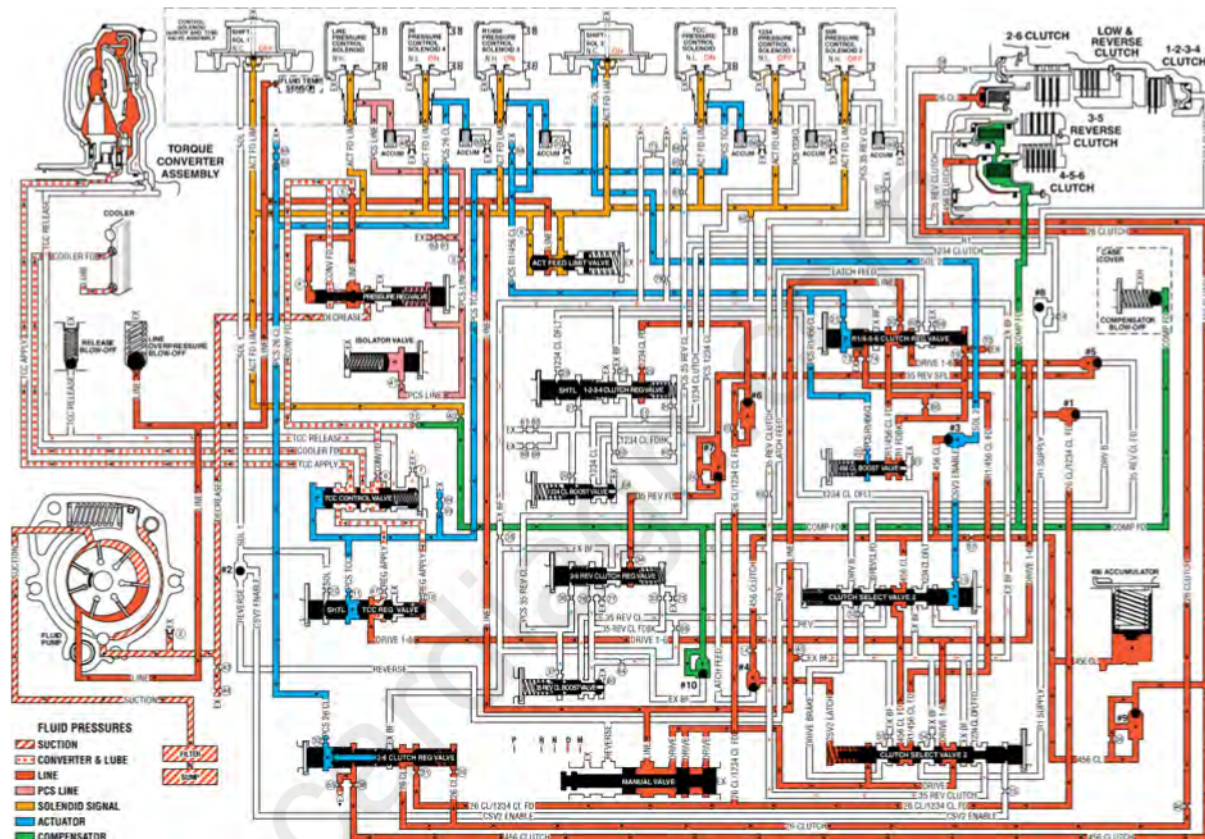
3-5 Reverse Clutch Regulator Valve

The 3-5 reverse clutch regulator valve spring force moves the valve to allow actuator feed limit fluid to pass through the valve and enter the PS2 fluid circuit which opens PS2. The 35 reverse clutch fluid then enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted.

3-5 Reverse Clutch

The 3-5 reverse clutch spring force moves the 3-5 reverse clutch piston to release the 3-5 clutch plates and forces 35 reverse clutch fluid to exhaust from 3-5 reverse/456 clutch housing. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch regulator valve where it exhaust excess pressure.

Drive Range, Sixth Gear



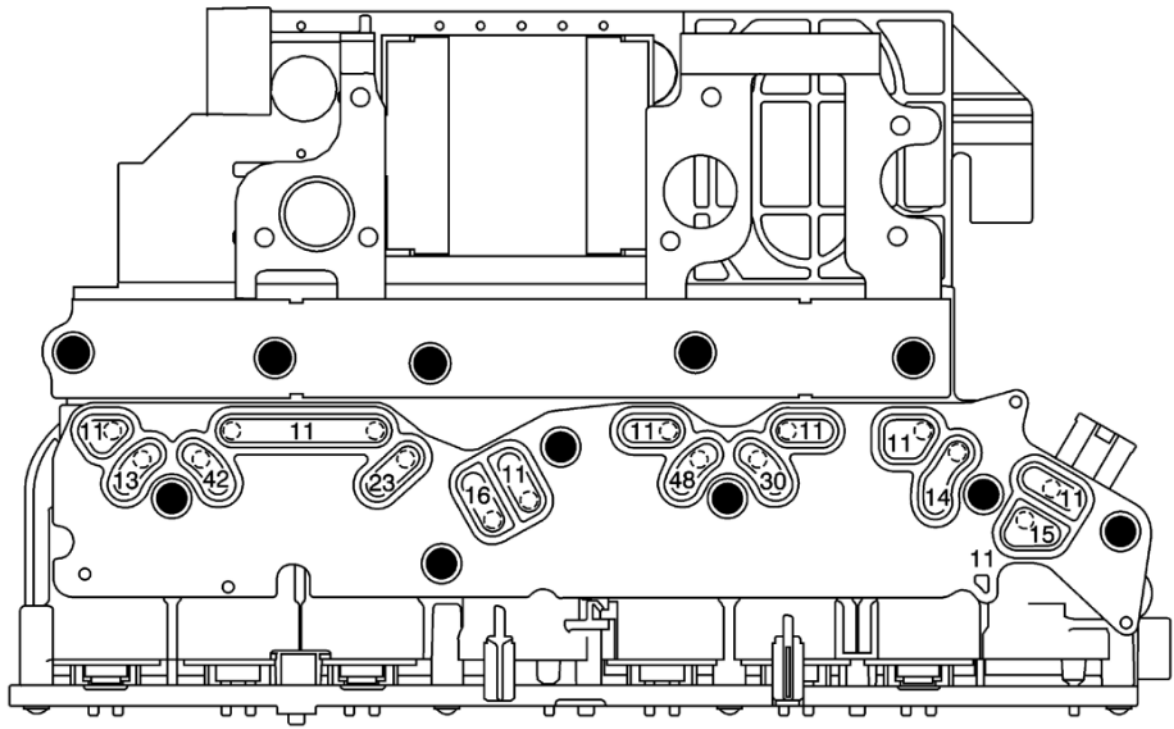


Fig. 19: Control Solenoid (w/Body and TCM) Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
11	Actuator Feed Limit
13	PCS Line
14	PCS R1/456 Clutch
15	Solenoid 1
16	Solenoid 2
23	PCS 35 Reverse Clutch
30	PCS 1234 Clutch
42	PCS 26 Clutch
48	PCS TCC

Control Valve Channel Upper Plate Assembly

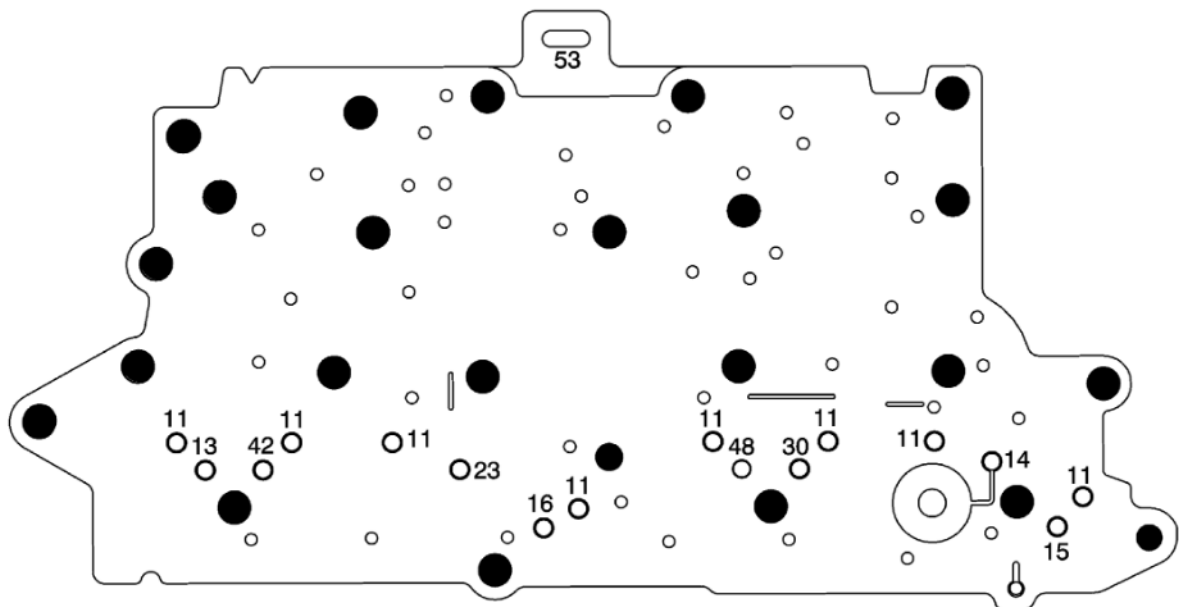


Fig. 20: Control Valve Channel Upper Plate Assembly
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
11	Actuator Feed Limit
13	PCS Line
14	PCS R1/456 Clutch
15	Solenoid 1
16	Solenoid 2
23	PCS 35 Reverse Clutch
30	PCS 1234 Clutch
42	PCS 26 Clutch
48	PCS TCC
53	Void

Control Valve Channel Plate - Upper Plate Side

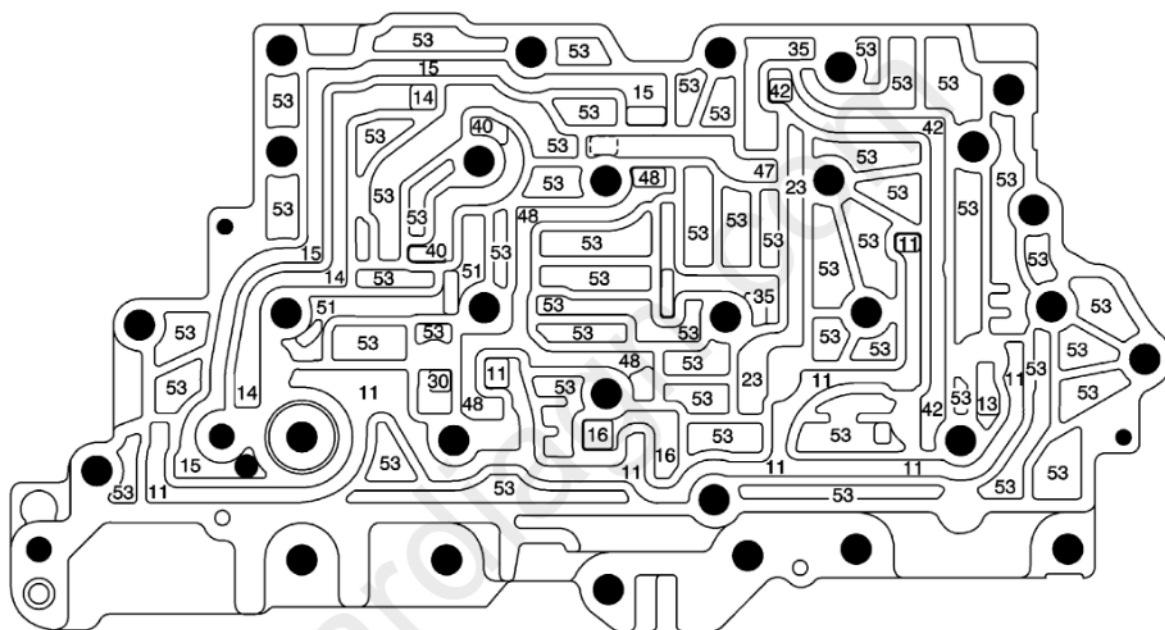


Fig. 21: Control Valve Channel Plate - Upper Plate Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
11	Actuator Feed Limit
13	PCS Line
14	PCS R1/456 Clutch
15	Solenoid 1
16	Solenoid 2
23	PCS 35 Reverse Clutch
30	PCS 1234 Clutch
35	Exhaust
40	Latch Feed
42	PCS 26 Clutch
47	456 Clutch
48	PCS TCC
51	Exhaust
53	Void

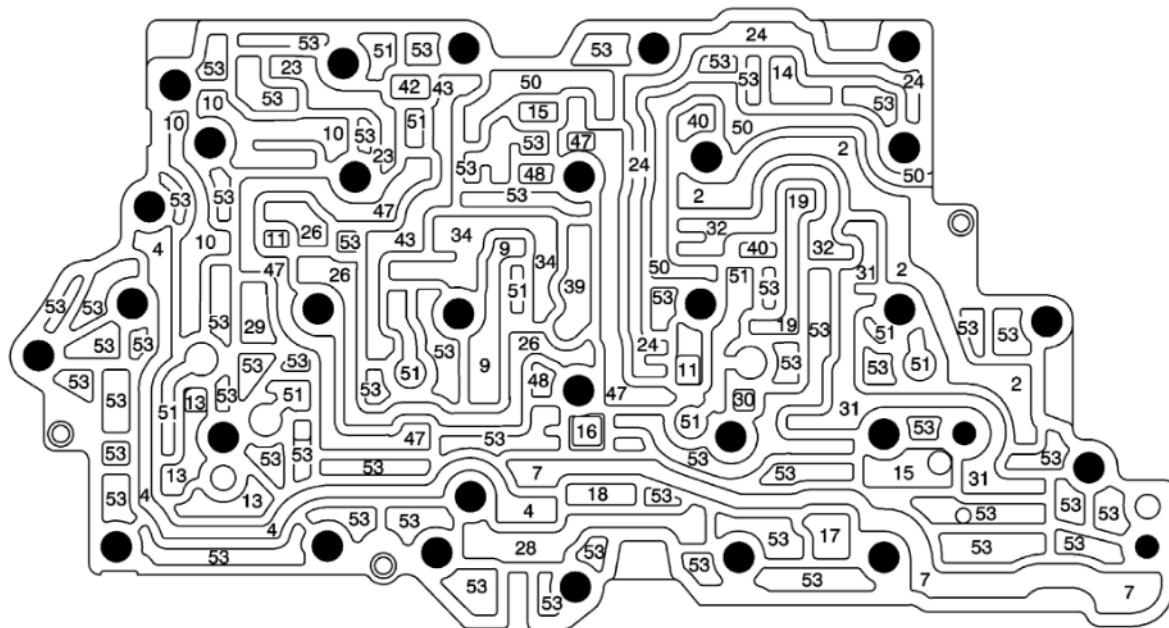


Fig. 22: Control Valve Channel Plate - Upper Body Spacer Plate Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
4	Converter Feed
7	Cooler Feed
9	Regulated Apply
10	Compensator Feed
11	Actuator Feed Limit
13	PCS Line
14	PCS R1/456 Clutch
15	Solenoid 1
16	Solenoid 2
17	CSV2 Enable
18	CSV3 Enable
19	R1/456 Clutch Feed
23	PCS 35 Reverse Clutch
24	Reverse
26	35 Reverse Supply
28	35 Reverse Clutch
29	35 Reverse Clutch Feedback
30	PCS 1234 Clutch
31	Drive
32	Drive Brake
34	26 Clutch/1234 Clutch Feed
39	Drive 1 - 6
40	Latch Feed
42	PCS 26 Clutch
43	26 Clutch
47	456 Clutch
48	PCS TCC

Callout	Component Name
50	Exhaust Backfill
51	Exhaust
53	Void

Control Valve Upper Body Spacer Plate Assembly

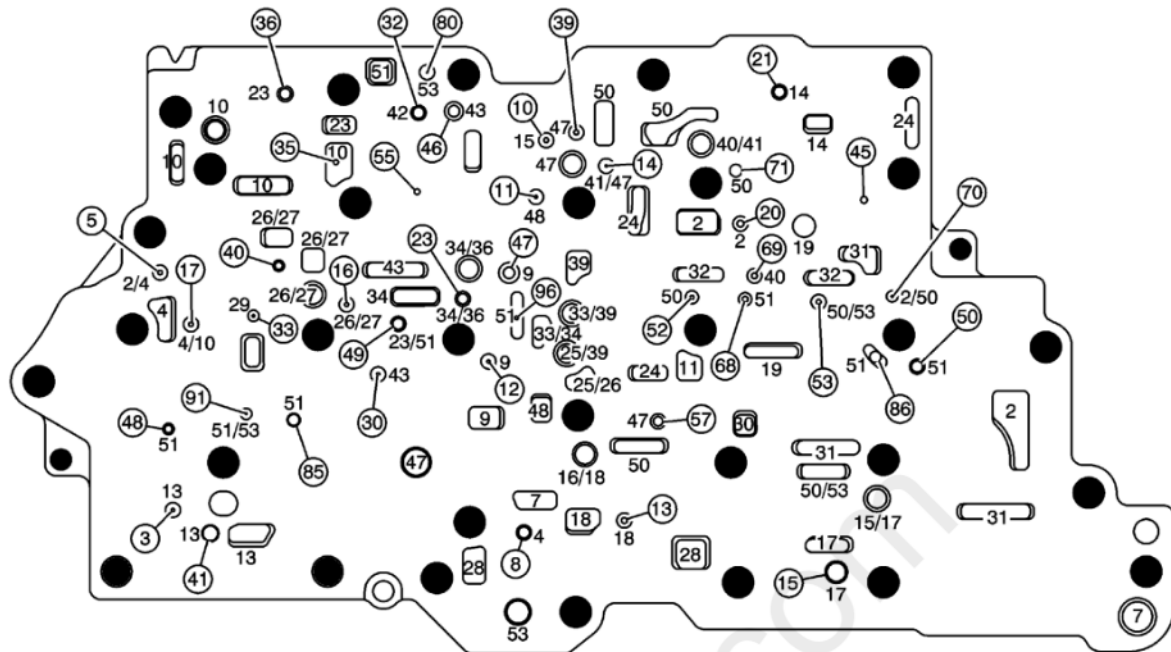


Fig. 23: Control Valve Upper Body Spacer Plate Assembly
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
3	Decrease
4	Converter Feed
5	TCC Release
7	Cooler Feed
8	Lube
9	Regulated Apply
10	Compensator Feed
11	Actuator Feed Limit
13	PCS Line
14	PCS R1/456 Clutch
15	Solenoid 1
16	Solenoid 2
17	CSV2 Enable
18	CSV3 Enable
19	R1/456 Clutch Feed
20	R1 Feedback
21	R1 Supply
23	PCS 35 Reverse Clutch
24	Reverse
25	35 Reverse Clutch Feed
26	35 Reverse Supply
27	35 Reverse Feed

Callout	Component Name
28	35 Reverse Clutch
29	C35 Reverse Feedback
30	PCS 1234 Clutch
31	Drive
32	Drive Brake
33	Drive B
34	26 Clutch/1234 Clutch Feed
36	1234 Clutch Feed
39	Drive 1 - 6
40	Latch Feed
41	CSV2 Latch
42	PCS 26 Clutch
43	26 Clutch Feedback
45	1234 Clutch Default
46	456 Clutch Feed
47	456 Clutch
48	PCS TCC
50	Exhaust Backfill
51	Exhaust
53	Void

Control Valve Upper Body Assembly - Upper Body Spacer Plate Side

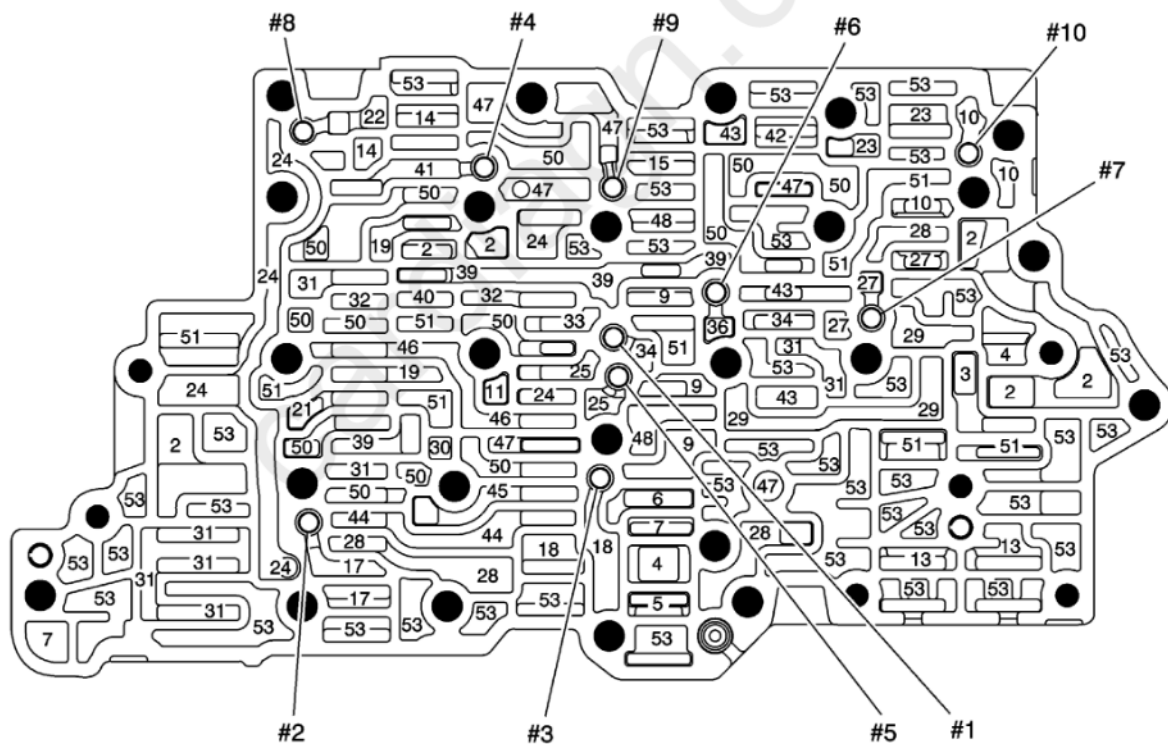


Fig. 24: Control Valve Upper Body Assembly - Upper Body Spacer Plate Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
3	Decrease
4	Converter Feed
5	TCC Release
6	TCC Apply
7	Cooler Feed

Callout	Component Name
9	Regulated Apply
10	Compensator Feed
11	Actuator Feed Limit
13	PCS Line
14	PCS R1/456 Clutch
15	Solenoid 1
17	CSV2 Enable
18	CSV3 Enable
19	R1/456 Clutch Feed
21	R1 Supply
22	R1
23	PCS 35 Reverse Clutch
24	Reverse
25	35 Reverse Clutch Feed
27	35 Reverse Feed
28	35 Reverse Clutch
29	35 Reverse Clutch Feedback
30	PCS 1234 Clutch
31	Drive
32	Drive Brake
33	Drive B
34	26 Clutch/1234 Clutch Feed
36	1234 Clutch Feed
39	Drive 1 - 6
40	Latch Feed
41	CSV2 Latch
42	PCS 26 Clutch
43	26 Clutch
44	1234 Clutch Default Feed
45	1234 Clutch Default
46	456 Clutch Feed
47	456 Clutch
48	PCS TCC
50	Exhaust Backfill
51	Exhaust
53	Void

Control Valve Upper Body Assembly - Lower Body Spacer Plate Side

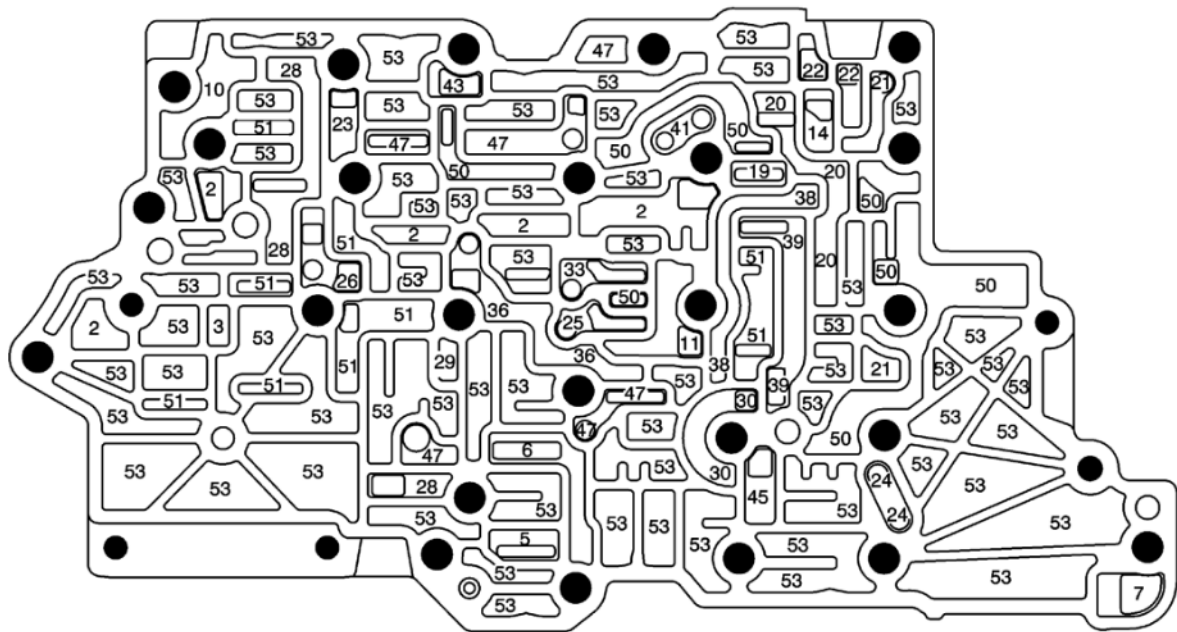


Fig. 25: Control Valve Upper Body Assembly - Lower Body Spacer Plate Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
3	Decrease
5	TCC Release
6	TCC Apply
7	Cooler Feed
10	Compensator Feed
11	Actuator Feed Limit
14	PCS R1/456 Clutch
19	R1/456 Clutch Feed
20	R1/456 Feedback
21	R1 Supply
22	R1
23	PCS 35 Reverse Clutch
24	Reverse
25	35 Reverse Clutch Feed
26	35 Reverse Supply
28	35 Reverse Clutch
29	35 Reverse Clutch Feedback
30	PCS 1234 Clutch
33	Drive B
36	1234 Clutch Feed
38	1234 Clutch Feedback
39	Drive 1 - 6
41	CSV2 Latch
43	26 Clutch
45	1234 Clutch Default
47	456 Clutch
50	Exhaust Backfill
51	Exhaust
53	Void

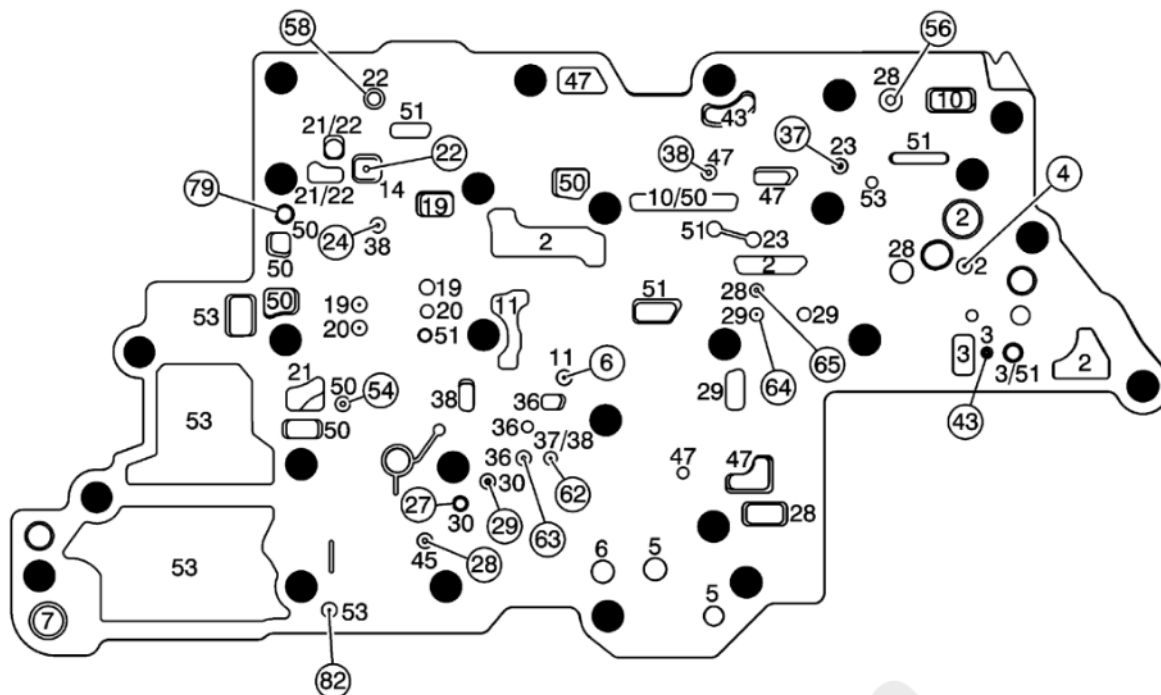


Fig. 26: Control Valve Lower Body Spacer Plate Assembly

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
3	Decrease
5	TCC Release
6	TCC Apply
10	Compensator Feed
11	Actuator Feed Limit
14	PCS R1/456 Clutch
19	R1/456 Clutch Feed
20	R1 Feedback
21	R1 Supply
22	R1
23	PCS 35 Reverse Clutch
27	35 Reverse Feed
28	35 Reverse Clutch
29	35 Reverse Clutch Feedback
30	PCS 1234 Clutch
36	1234 Clutch Feed
37	1234 Clutch
38	1234 Clutch Feedback
43	26 Clutch Feedback
45	1234 Clutch Default
47	456 Clutch
50	Exhaust Backfill
51	Exhaust
53	Void

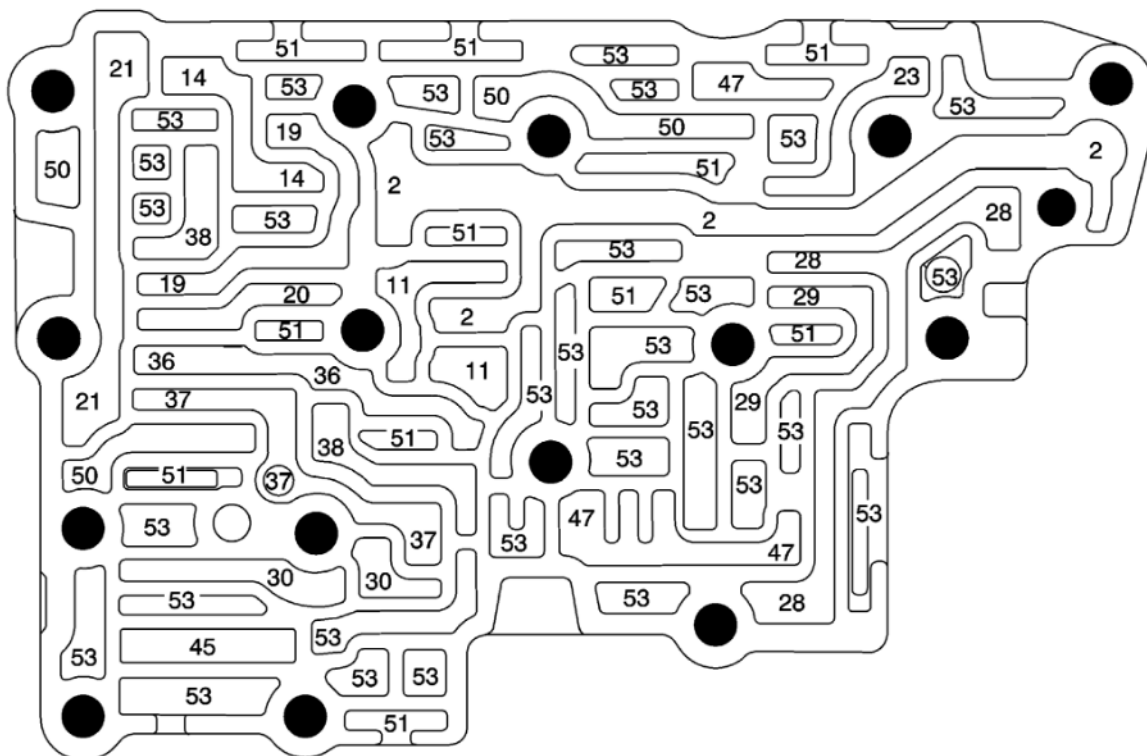


Fig. 27: Control Valve Lower Body
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
11	Actuator Feed Limit
14	PCS R1/456 Clutch
19	R1/456 Clutch Feed
20	R1 Feedback
21	R1 Supply
23	PCS 35 Reverse Clutch
28	35 Reverse Clutch
29	35 Reverse Clutch Feedback
30	PCS 1234 Clutch
36	1234 Clutch Feed
37	1234 Clutch
38	1234 Clutch Feedback
45	1234 Clutch Default
47	456 Clutch
50	Exhaust Backfill
51	Exhaust
53	Void

A/Trans Case Assembly - Control Valve Body Side

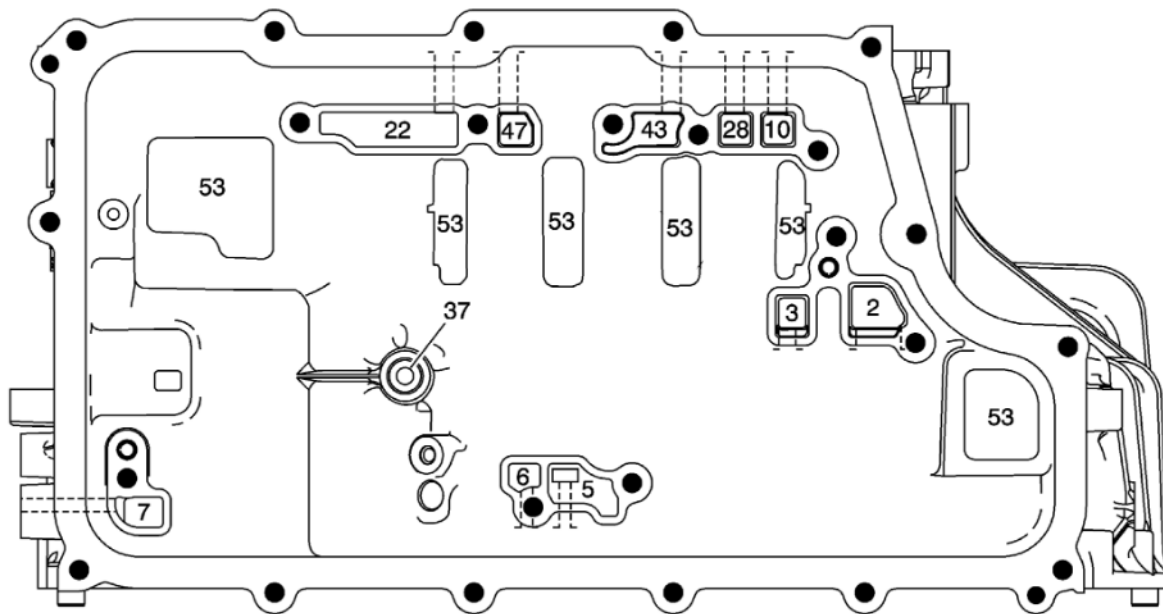


Fig. 28: A/Trans Case Assembly - Control Valve Body Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
3	Decrease
5	TCC Release
6	TCC Apply
7	Cooler Feed
10	Compensator Feed
22	R1
28	35 Reverse Clutch
37	1234 Clutch
43	26 Clutch
47	456 Clutch
53	Void

A/Trans Case Assembly - Torque Converter and Differential Housing Side

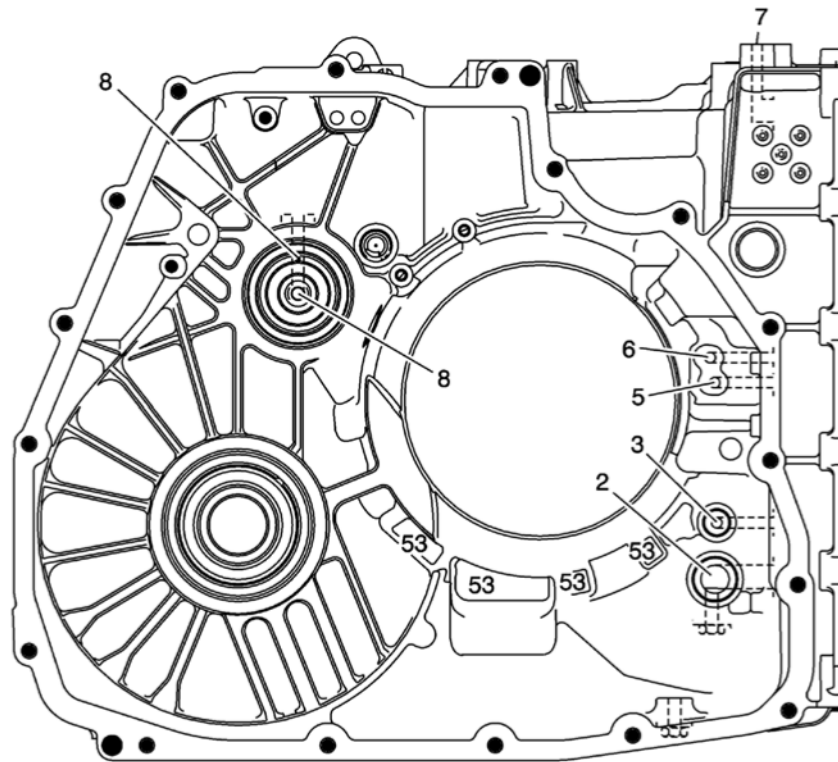


Fig. 29: A/Trans Case Assembly - Torque Converter And Differential Housing Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line
3	Decrease
5	TCC Release
6	TCC Apply
7	Cooler Feed
8	Lube
53	Void

A/Trans Case Assembly Case Cover Side

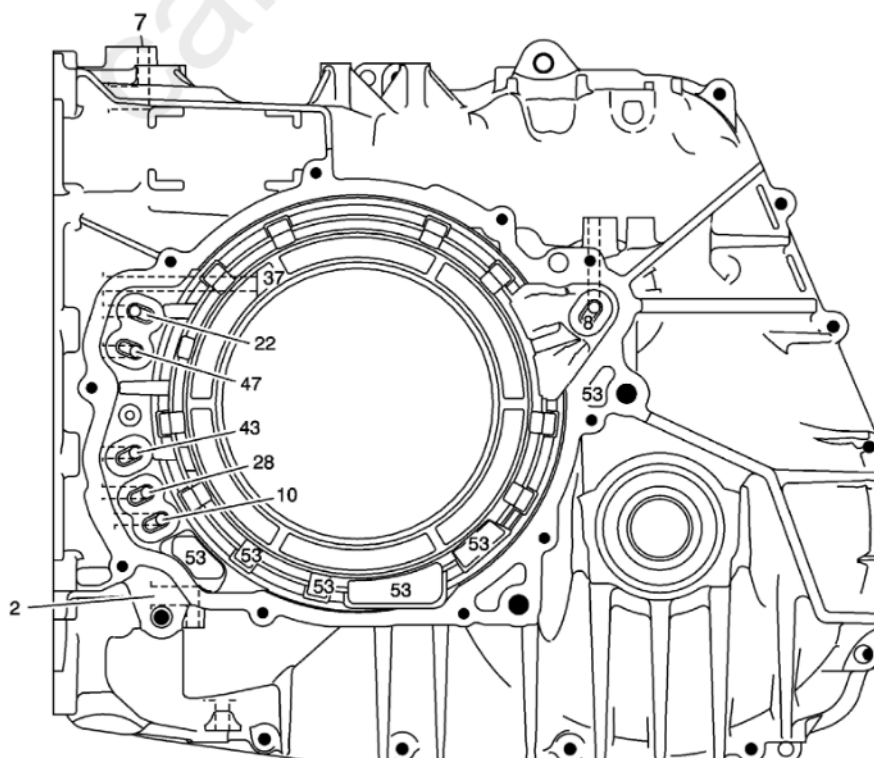


Fig. 30: A/Trans Case Assembly Case Cover Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
2	Line (to valve body)
7	Cooler Feed
8	Lube
10	Compensator Feed
22	R1
28	35 Reverse Clutch
37	1234 Clutch
43	26 Clutch
47	456 Clutch
53	Void

A/Trans Case Cover Assembly

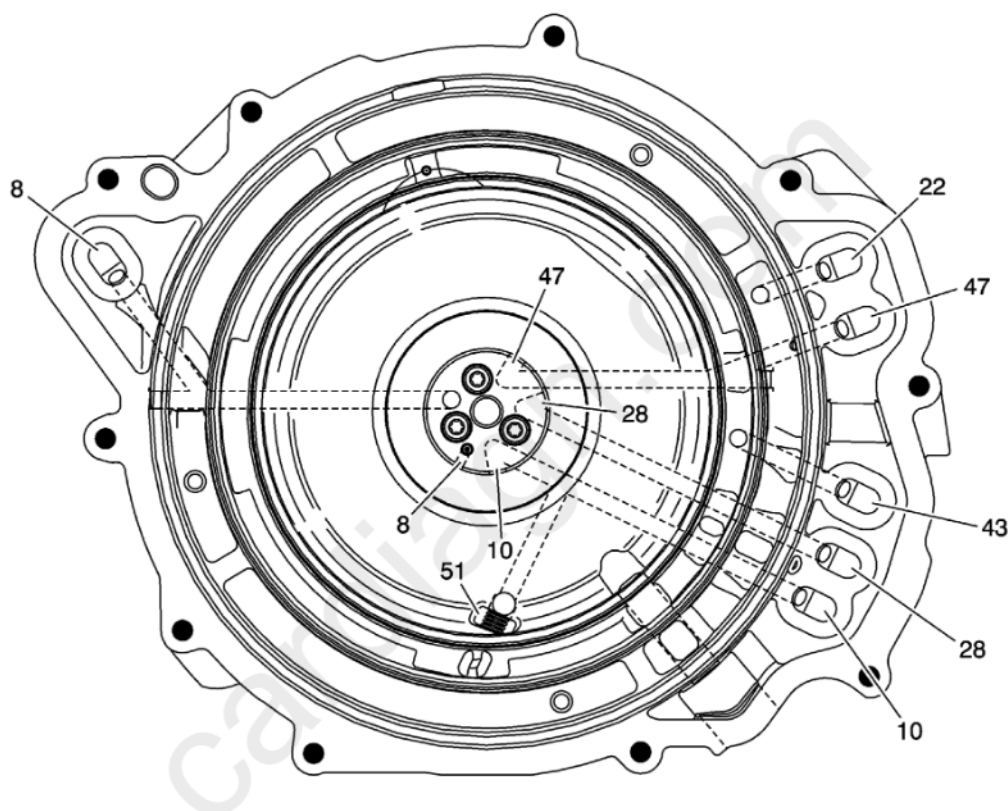


Fig. 31: Automatic Trans Case Cover Assembly
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
8	Lube
10	Compensator Feed
22	R1
28	35 Reverse Clutch
43	26 Clutch
47	456 Clutch
51	Compensator Feed Exhaust

Front Differential Transfer Drive Gear Support - Case Side

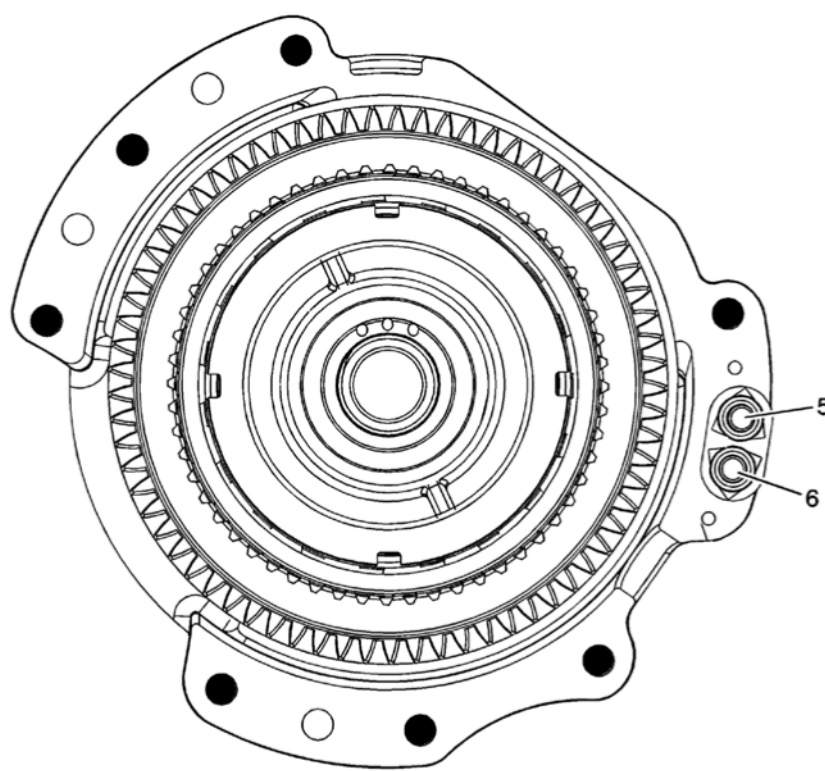


Fig. 32: Identifying Front Differential Transfer Drive Gear Support Fluid Passages - Case Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
5	TCC Release
6	TCC Apply

Front Differential Transfer Drive Gear Support - Torque Converter and Differential Housing Side

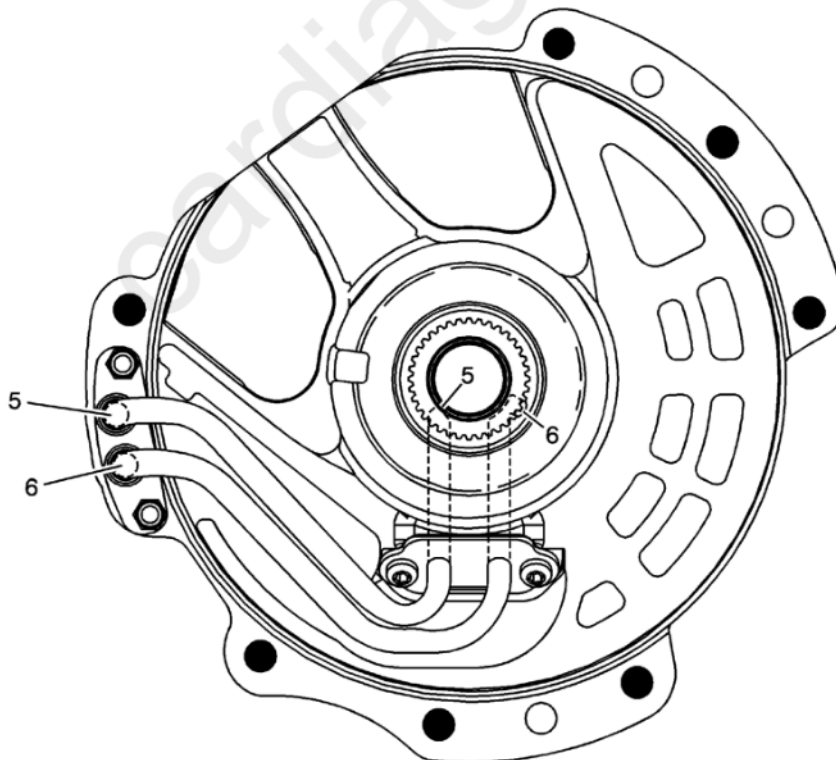


Fig. 33: Identifying Front Differential Transfer Drive Gear Support Fluid Passages - Torque Converter & Differential Housing Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
5	TCC Release
6	TCC Apply

2017 TRANSMISSION

Automatic Transmission - 6T70 (M7W) - Diagnostic Information and Procedures - Impala

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC P0601, P0603, P0604, OR P062F: CONTROL MODULE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

NOTE: DTCs P0601, P0602, P0603, P0604 or P062F could set in other control modules. Verify the DTCs are set in the transmission control module (TCM).

DTC P0601

Control Module Read Only Memory Performance

DTC P0602

Control Module Not Programmed

DTC P0603

Control Module Long Term Memory Reset

DTC P0604

Control Module Random Access Memory Performance

DTC P062F

Control Module Long Term Memory Performance

Circuit/System Description

This is an internal fault detection of the control solenoid valve assembly. This fault is handled inside the control solenoid valve assembly and no external circuits are involved.

Conditions for Running the DTC

Ignition voltage is between 8.6 volts and 18.0 volts.

Conditions for Setting the DTC

P0601

Read only memory (ROM) test has failed 5 or greater times.

P0602

TCM has not been programmed and is unable to detect the start program.

P0603

TCM has detected a memory checksum error.

P0604

TCM has detected a random access memory (RAM) test error 5 or greater times.

P062F

TCM has detected a non-volatile memory error during power-down.

Action Taken When the DTC Sets

P0601, P0603, P0604, or P062F

- DTCs P0601, P0603, P0604, and P062F are Type A DTCs.
- TCM limits the transmission to Reverse and 5th gear operation.
- TCM commands maximum line pressure.
- TCM forces the torque converter clutch (TCC) OFF.
- TCM freezes transmission adaptive functions.
- TCM commands the high side driver OFF.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.

P0602

- DTC P0602 is a Type C DTC.
- TCM limits the transmission to Reverse and 5th gear operation.
- TCM commands maximum line pressure.
- TCM forces the torque converter clutch (TCC) OFF.
- TCM freezes transmission adaptive functions.
- TCM commands the high side driver OFF.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.

Conditions for Clearing the DTC

P0601, P0603, P0604, or P062F

DTCs P0601, P0603, P0604, and P062F are Type A DTCs.

P0602

DTC P0602 is a Type C DTC.

Reference Information

Description and Operation

Electronic Component Description for control solenoid valve assembly

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

CAUTION: Before programming a control module, the following must be

observed, or control module damage may occur:

- The TIS terminal, MDI, and/or scan tool must have the latest software.
- The vehicle battery must be fully charged. The battery voltage should be between 12 - 14 volts.
- The TIS terminal, MDI, and/or scan tool connections must be secure.
- A battery charger must NOT be connected to the battery when programming a control module.

1. Ignition OFF for 1 minute.
2. Ignition ON.
3. Verify with a scan tool, that DTC P0602 is not set.

- **If DTC P0602 is set**

Program the K71 transmission control module. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Programming and Setup \(6T70/6T75\)](#) . If the DTC resets, replace the Q8 control solenoid valve assembly. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Replacement](#) .

- **If DTC P0602 is not set**

4. Verify with a scan tool that DTC P0601, P0603, P0604, or P062F is not set.

- **If DTC P0601, P0603, P0604, or P062F is set**

Replace the Q8 control solenoid valve assembly.

- **If DTC P0601, P0603, P0604 or P062F is not set**

5. After performing the above steps, verify that the DTC does not reset by operating the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. If the vehicle passes the Circuit/System Verification procedure, refer to [Testing for Intermittent Conditions and Poor Connections](#) .

Repair Instructions

NOTE: Perform the [Reset Transmission Adapts](#) any time a transmission related component is serviced.

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[Control Module References](#) for control solenoid valve assembly replacement, setup, and programming

DTC P0634: CONTROL MODULE OVERTEMPERATURE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0634

Control Module Overtemperature

Circuit/System Description

The transmission control module (TCM) temperature sensor is located inside of the control solenoid valve assembly which has no serviceable components. The TCM monitors the TCM temperature sensor

for over temperature protection.

Conditions for Running the DTC

- Ignition voltage is between 8.6 - 32 V.
- TCM temperature is between 0 - 170°C (32 - 338°F) for 0.25 s.

Conditions for Setting the DTC

Condition 1

TCM detects an internal temperature condition of 146°C (295°F) or greater for 5 s.

Condition 2

Ignition voltage is 18 V or greater and the TCM detects an internal temperature of 50°C (122°F) or greater for 2 s.

Action Taken When the DTC Sets

- DTC P0634 is a Type A DTC.
- TCM limits the transmission to Reverse and 3rd or 5th gear operation.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM inhibits neutral idle.
- TCM commands maximum line pressure.
- TCM requests reduced engine torque.
- TCM shuts down.

Conditions for Clearing the DTC

DTC P0634 is a Type A DTC.

Diagnostic Aids

During a road test, the TCM temperature should steadily increase to a normal operating temperature, and then stabilize.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

Description and Operation

- [Transmission General Description](#)
- [Transmission Component and System Description](#)
- [Electronic Component Description](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Engine Coolant Temperature parameter was less than 125Â° C (257Â° F) when DTC set by reviewing the scan tool Freeze Frame/Failure Records.
 - **If 125Â° C (257Â° F) or greater**
Refer to Engine Overheating .
 - **If less than 125Â° C (257Â° F)**
3. Verify the transmission fluid level and condition is correct. Refer to Transmission Fluid Level and Condition Check.
 - **If the transmission fluid level and condition is not correct**
Repair as necessary.
 - **If the transmission fluid level and condition is correct**
4. Clear the TCM DTCs with a scan tool.
5. Operate the vehicle until normal engine temperature is reached.
6. Verify the scan tool Transmission Fluid Temperature parameter is less than 140Â° C (284Â° F).
 - **If 140Â° C (284Â° F) or greater**
 1. Ignition OFF.
 2. Verify the conditions listed below do not exist:
 - Obstructions to the airflow to the radiator or transmission
 - Radiator damage
 - Transmission cooler damage
 - Transmission cooler pipe kinked or damaged
 - If a condition exists, repair or replace as necessary.
 - If no condition exists, refer to Transmission Fluid Cooler Flow Test and Flushing (6T40/6T45) .
 - **If less than 140Â° C (284Â° F)**
7. Verify DTC P0634 does not set.
 - **If the DTC sets**
Replace the Q8 Control Solenoid Valve Assembly.
 - **If the DTC does not set**
8. Operate the vehicle within the conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Record data.
9. Verify the DTC does not set.
 - **If the DTC sets**
Replace the Q8 Control Solenoid Valve Assembly.
 - **If the DTC does not set**
10. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection](#)
- [Transmission Fluid Cooler Outlet Pipe Replacement \(LFX\) Transmission Fluid Cooler Outlet Pipe Replacement \(LCV\)](#)
- [Transmission Fluid Cooler Inlet Pipe Replacement \(LFX\) Transmission Fluid Cooler Inlet Pipe Replacement \(LCV\)](#)
- [Transmission Fluid Cooler Pipe Connector Replacement - Radiator](#)
- [Control Module References](#) for Control Solenoid Valve Assembly replacement, programming, and setup

DTC P0658 OR P0659: ACTUATOR HIGH CONTROL CIRCUIT GROUP 1 LOW/HIGH VOLTAGE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0658

Actuator High Control Circuit Group 1 Low Voltage

DTC P0659

Actuator High Control Circuit Group 1 High Voltage

Circuit/System Description

The transmission control module (TCM) high side driver 1 is located inside of the control solenoid valve assembly, which has no serviceable components. The high side driver 1 provides power to the pressure control solenoids and shift solenoids.

Conditions for Running the DTC

P0658

- DTC P0658 is not set.
- High side driver 1 is enabled.

P0659

- DTC P0659 is not set.
- Ignition transitions from OFF to ON

Conditions for Setting the DTC

P0658

TCM detects an internal open or short to ground in the high side driver 1 circuit for 1 s.

P0659

TCM detects an internal short to voltage on the high side driver 1 for 1 s.

Action Taken When the DTC Sets

P0658

- DTC P0658 is a Type A DTC.
- TCM turns the high side driver OFF.
- TCM turns OFF all solenoids.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM commands the torque converter clutch (TCC) OFF.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM limits the transmission to Reverse and 5th gear operation.
- TCM requests a reduced torque value based on input speed.

P0659

DTC P0659 is a Type C DTC.

Conditions for Clearing the DTC

- DTC P0658 is a Type A DTC.
- DTC P0659 is a Type C DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool High Side Driver 1 parameter displays ON.
 - **If ON is not displayed**
Refer to Circuit/System Testing.
 - **If ON is displayed**
3. Engine Running, and transmission in Park.
4. Verify the scan tool parameters listed below do not display Malfunction:
 - High Side Driver 1 Circuit Low Voltage Test Status
 - High Side Driver 1 Circuit Open Test Status
 - High Side Driver 1 Circuit High Voltage Test Status
 - **If Malfunction is displayed**
Refer to Circuit/System Testing.
 - **If Malfunction is not displayed**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **If the DTC does not set**
7. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Inspection**
 - **If contaminated**
Repair as necessary
 - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid listed in the **Control Solenoid Valve and Transmission Control Module Assembly Inspection**.
 - **If the resistance is not within range**
Replace the Q8 Control Solenoid Valve Assembly.
 - **If the resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect the **DT 47825-20** adapter harness between the vehicle wire harness electrical connector and the Q8 Control Solenoid Valve Assembly electrical connector. Ignition ON.
6. Verify the scan tool parameters listed below do not display Malfunction:
 - High Side Driver 1 Circuit Low Voltage Test Status
 - High Side Driver 1 Circuit Open Test Status
 - High Side Driver 1 Circuit High Voltage Test Status
 - **If Malfunction is displayed**
Replace the Q8 Control Solenoid Valve Assembly.

- If Malfunction is not displayed

7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for Control Solenoid Valve Assembly replacement, programming, and setup.

DTC P0667, P0668, OR P0669: CONTROL MODULE TEMPERATURE SENSOR

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0667

Control Module Temperature Sensor Performance

DTC P0668

Control Module Temperature Sensor Circuit Low Voltage

DTC P0669

Control Module Temperature Sensor Circuit High Voltage

Circuit/System Description

The transmission control module (TCM) temperature sensor is located inside of the control solenoid valve assembly, which has no serviceable components. The TCM temperature sensor provides the temperature of the TCM. This temperature reading is used in various shifting and diagnostic routines in the TCM software. This fault is handled inside the TCM and no external circuits are involved.

Conditions for Running the DTC

P0667

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0658, P0668, P0669, P06AD, P06AE, P0712, P0713, P0716, P0717, P0722, P0723, P0962, P0963, P0966, P0967, P0970, P0971, P215C, P2720, P2721, P2729, or P2730 is not set.
- Brake torque is not active.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is between 8.6 - 32 V.
- Engine torque signal is valid.
- Accelerator pedal position signal is valid.

P0668

- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is between 8.6 - 32 V.

P0669

- DTC P0716, P0717, P0722, or P0723 is not set.

- Engine speed is 400 - 7, 500 RPM.
- Ignition voltage is between 8.6 - 32 V.

Conditions for Setting the DTC

P0667

- TCM detects a 20 - 50Â°C (36 - 90Â°F) or greater difference between the transmission fluid temperature and TCM substrate temperature, which depends on the average of the transmission fluid temperature, TCM substrate temperature, and TCM power up temperature.
- TCM detects an 8 - 10Â°C (14 - 18Â°F) or greater difference between the TCM power up temperature and TCM substrate temperature, which depends on the average of the transmission fluid temperature, TCM substrate temperature, and TCM power up temperature.
- Above conditions have to be met for 5 min within a 6 min period.

P0668

TCM temperature is -249Â°C (-416Â°F) or less for 1 min.

P0669

TCM temperature is 249Â°C (480Â°F) or greater for 1 min.

Action Taken When the DTC Sets

- DTCs P0667, P0668, and P0669 are Type B DTCs.
- TCM defaults the TCM substrate temperature to a calculated temperature based on the TCM power up temperature.

Conditions for Clearing the DTC

DTCs P0667, P0668, and P0669 are Type B DTCs.

Diagnostic Aids

The TCM temperature sensor is located inside of the control solenoid valve assembly and its output should resemble that of the transmission fluid temperature sensor output. During a road test, the TCM temperature should steadily increase to a normal operating temperature, and then stabilize.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

Description and Operation

- [Transmission General Description](#)
- [Transmission Component and System Description](#)
- [Electronic Component Description](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool TCM Temperature parameter is between -249 and +249Â°C (-416 and +480Â°F).
 - **If not between -249 and +249Â°C (-416 and +480Â°F)**
Replace the Q8 Control Solenoid Valve Assembly.
 - **If between -249 and +249Â°C (-416 and +480Â°F)**
3. Verify the scan tool TCM Temperature parameter increases greater than 2Â°C (3.5Â°F) after operating the vehicle at 64 km/h (40 mph) for 10 min.
 - **If the temperature does not increase greater than 2Â°C (3.5Â°F)**
Replace the Q8 Control Solenoid Valve Assembly
 - **If the temperature increases greater than 2Â°C (3.5Â°F)**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
5. Verify the DTC does not set.
 - **If the DTC sets**
Replace the Q8 Control Solenoid Valve Assembly
 - **If the DTC does not set**
6. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repairs.

- Perform the Reset Transmission Adapts following all transmission repairs.
- Control Module References for Control Solenoid Valve Assembly replacement, programming, and setup.

DTC P06AC-P06AE: CONTROL MODULE POWER UP TEMPERATURE SENSOR

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DTC Descriptors

DTC P06AC

Control Module Power Up Temperature Sensor Performance

DTC P06AD

Control Module Power Up Temperature Sensor Circuit Low Voltage

DTC P06AE

Circuit/System Description

The transmission control module (TCM) power up temperature sensor is located inside of the control solenoid valve assembly, which has no serviceable components. The TCM power up temperature sensor provides the temperature of the TCM when the TCM power is ON. This temperature reading is used in various shifting and diagnostic routines and also to protect the control solenoid valve assembly and TCM. This fault is handled inside the TCM and no external circuits are involved.

Conditions for Running the DTC

P06AC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0658, P0668, P0669, P06AD, P06AE, P0712, P0713, P0716, P0717, P0722, P0723, P0962, P0963, P0966, P0967, P0970, P0971, P215C, P2720, P2721, P2729, or P2730 is not set.
- Engine speed is 400-7, 500 RPM for 5 s.
- Ignition voltage is between 8.6 - 32 V.
- Brake torque is not active.
- Engine torque signal is valid.
- Accelerator pedal position signal is valid.

P06AD

- DTC P0716, P0717, P0722, or P0723 is not set.
- Engine speed is 400-7, 500 RPM for 5 s.
- Ignition voltage is between 8.6 - 32 V.

P06AE

- Engine speed is 400-7, 500 RPM for 5 s.
- Ignition voltage is between 8.6 - 32 V.

Conditions for Setting the DTC

P06AC

- TCM detects a 20-50Â° C (36-90Â°F) or greater difference between the transmission fluid temperature and TCM power up temperature, which depends on the average of transmission fluid temperature, TCM substrate temperature, and TCM power up temperature.
- TCM detects an 8-10Â° C (14-18Â°F) or greater difference between the TCM substrate temperature and TCM power up temperature, which depends on the average of the transmission fluid temperature, TCM substrate temperature, and TCM power up temperature.
- Above conditions have to be met for 5 min. within a 6 min. period.

P06AD

TCM power up temperature is -59Â°C (-74Â°F) or less for 1 min.

P06AE

TCM power up temperature is 164Â°C (327Â°F) or greater for 1 min.

Action Taken When the DTC Sets

- DTC P06AC, P06AD, P06AE are Type B DTCs.
- TCM defaults the TCM power up temperature to a calculated temperature based on the TCM substrate temperature.

Conditions for Clearing the DTC

DTC P06AC, P06AD, P06AE are Type B DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description** for control solenoid valve assembly

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, clear the DTCs with a scan tool.
2. Operate the vehicle at 64 km/h (40 mph) for 10 min.
3. Verify DTC P06AC, P06AD, or P06AE is not set.
 - **If any of the DTCs are set**

Replace the Q8 Control Solenoid Valve Assembly.
 - **If none of the DTCs are set.**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
5. Verify the DTC does not set.
 - **If the DTC sets**

Replace the Q8 Control Solenoid Valve Assembly.
 - **If the DTC does not set**
6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Perform the **Reset Transmission Adapts** following all transmission repairs.

- [Control Module References](#) for Control Solenoid Valve Assembly replacement, programming, and setup.

DTC P0711-P0713: TRANSMISSION FLUID TEMPERATURE SENSOR

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0711

Transmission Fluid Temperature Sensor Performance

DTC P0712

Transmission Fluid Temperature Sensor Circuit Low Voltage

DTC P0713

Transmission Fluid Temperature Sensor Circuit High Voltage

Circuit/System Description

The transmission fluid temperature sensor is located inside of the transmission control module (TCM) assembly which has no serviceable components. The transmission fluid temperature sensor provides transmission fluid temperature to the TCM. This fault is handled inside the TCM and no external circuits are involved.

Conditions for Running the DTC

P0711

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0658, P0668, P0669, P06AD, P06AE, P0712, P0713, P0716, P0717, P0722, P0723, P0962, P0963, P0966, P0967, P0970, P0971, P215C, P2720, P2721, P2729, or P2730 is not set.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is greater than 8.5 V.
- Brake torque is not active.
- Engine torque signal is valid.
- Throttle position signal is valid.

P0712 and P0713

- DTC P0716, P0717, P0722, or P0723 is not set.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is greater than 8.5 V.

Conditions for Setting the DTC

P0711

- TCM detects a 20 - 50Â° C (36 - 90Â° F) or greater difference between the transmission fluid temperature and the TCM substrate temperature, which depends on the average of the transmission fluid temperature, TCM substrate temperature, and TCM power up temperature.
- TCM detects a 20 - 50Â° C (36 - 90Â° F) or greater difference between the transmission fluid temperature and the TCM power up temperature, which depends on the average of the transmission fluid temperature, TCM substrate temperature, and TCM power up temperature.

- Above conditions have to be met for 5 min within a 6 min period.

P0712

Transmission fluid temperature is -74°C (-101°F) or lower for 1 min.

P0713

Transmission fluid temperature is 174°C (345°F) or greater for 1 min.

Action Taken When the DTC Sets

- DTCs P0711, P0712, and P0713 are Type B DTCs.
- TCM defaults to a calculated transmission fluid temperature based on the TCM Temperature.

Conditions for Clearing the DTC

DTCs P0711, P0712, and P0713 are Type B DTCs.

Diagnostic Aids

The TCM temperature sensor is located inside of the control solenoid valve assembly and its output should resemble that of the transmission fluid temperature sensor's output. During a road test, the transmission fluid temperature should steadily increase to a normal operating temperature, and then stabilize.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

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- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

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- **Electronic Component Description**

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- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine idling at the normal operating temperature.
2. Verify the scan tool Transmission Fluid Temperature parameter is between -74 and $+174^{\circ}\text{C}$ (-101 and $+345^{\circ}\text{F}$).

- **If not between -74 and +174Â° C (-101 and +345Â° F)**

Replace the Q8 Control Solenoid Valve Assembly.

- **If between -74 and +174Â° C (-101 and +345Â° F)**

3. Verify the scan tool Transmission Fluid Temperature parameter increases greater than 2Â° C (3.6Â° F) after operating the vehicle at 64 km/h (40 mph) for 10 min.

- **If the temperature does not increase greater than 2Â° C (3.6Â° F)**

Replace the Q8 Control Solenoid Valve Assembly.

- **If the temperature increases greater than 2Â° C (3.6Â° F)**

4. Verify the scan tool Transmission Fluid Temperature and the TCM Temperature parameters are within 20Â° C (36Â° F).

- **If the temperatures are not within 20Â° C (36Â° F)**

1. Ignition OFF, remove the control valve body cover. Refer to [Control Valve Body Cover Replacement](#).

2. Verify the heat sink on the control valve channel upper plate and the control solenoid valve spring are in place and undamaged.

- If the heat sink on the control valve channel upper plate or the control solenoid valve spring are damaged, replace as necessary
- If the heat sink on the control valve channel upper plate and the control solenoid valve spring are in place and undamaged, replace the Q8 Control Solenoid Valve Assembly

- **If the temperatures are within 20Â° C (36Â° F)**

5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

6. Verify the DTC does not set.

- **If the DTC sets**

Replace the Q8 Control Solenoid Valve Assembly.

- **If the DTC does not set**

7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Valve Lower Body and Upper Body Replacement](#) for control valve channel upper plate assembly and control solenoid valve spring replacement.
- [Control Module References](#) for Control Solenoid Valve Assembly replacement, programming, and setup.

DTC P0716 OR P0717: INPUT SPEED SENSOR

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0716

Input Speed Sensor Performance

Input Speed Sensor Circuit No Signal

Diagnostic Fault Information

Circuit	Short to Ground	Open	Short to Voltage	Signal Performance
8.6 V Reference	P0716, P0717	P0716, P0717	-	P0716
Signal	P0716, P0717	P0716, P0717	P0716, P0717	P0716

Typical Scan Tool Data

Transmission ISS

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running, normal operating temperature, transmission in PARK Parameter Normal Range: 450 - 7000 RPM			
8.6 V Reference	0 RPM	0 RPM	-
Signal	0 RPM	0 RPM	0 RPM

ISS/OSS Supply Voltage

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running, normal operating temperature Parameter Normal Range: OK			
8.6 V Reference	Out of Range	OK	Out of Range
Signal	OK	OK	OK

Circuit/System Description

The input shaft speed (ISS) sensor is a hall-effect type sensor. The ISS sensor mounts to the inside of the automatic transmission case assembly and connects to the control solenoid valve assembly through a 2-wire harness and connector. The sensor faces the reluctor wheel which is attached to the 4-5-6 clutch and 3-5-R clutch housing. The sensor receives 8.3 - 9.3 volts on the ISS supply voltage circuit from the transmission control module (TCM). As the 4-5-6 clutch and 3-5-R clutch housing rotates, the sensor produces a signal frequency based on the teeth of the reluctor wheel. This signal is transmitted through the ISS sensor signal circuit to the TCM. The TCM uses the ISS sensor signal to determine line pressure, transmission shift patterns, torque converter clutch (TCC) slip speed, and gear ratio.

Conditions for Running the DTC

P0716

- DTC P0101, P0102, P0103, P0121, P0122, P0123, P0717, P0752, P0973, or P0974 is not set.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is greater than 8.5 V.
- Engine torque signal is valid.
- Throttle position signal is valid.
- Vehicle speed is 10 km/h (6 mph) or greater.

P0717

- DTC P0101, P0102, P0103, P0722, or P0723 is not set.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is greater than 8.5 V.
- Vehicle speed is 16 km/h (10 mph) or greater.
- Engine torque is 50 N.m (37 lb ft) or greater.
- Engine torque signal is valid.

Conditions for Setting the DTC

P0716

TCM detects the transmission input shaft speed signal dropped greater than 1350 RPM for 1 s.

P0717 - Condition 1

TCM detects the transmission input shaft speed signal is less than 33 RPM for 5 s.

P0717 - Condition 2

The TCM detects that P0722 set and the Transmission input speed is less than 1000 RPM for 5 s.

Action Taken When the DTC Sets

- DTCs P0716 and P0717 are Type A DTCs.
- TCM freezes transmission adaptive functions.
- TCM commands the high side driver OFF.
- TCM commands TCC OFF.
- TCM commands maximum line pressure.
- TCM disables neutral idle.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- Torque management is enabled.
- TCM limits the transmission to Reverse and 3rd or 5th gear operation.

Conditions for Clearing the DTC

DTCs P0716 and P0717 are Type A DTCs.

Diagnostic Aids

If the scan tool ISS/OSS supply voltage parameter is out of range, the fault could also be caused by the transmission output shaft speed sensor.

Damage or misalignment of the 4-5-6 clutch and 3-5-R clutch housing reluctor machined teeth surface may cause a speed sensor malfunction.

Reference Information

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- **[Wiring Repairs](#)**

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool ISS/OSS Supply Voltage parameter displays OK.
 - **IF OK is not displayed**

Refer to Circuit/System Testing.
 - **If OK is displayed**
3. Engine idling, transmission in Park, parking brake applied, and drive wheels chocked.
4. Verify the scan tool Transmission ISS parameter changes or does not drop out while varying the engine speed.
 - **If the Transmission ISS does not vary with engine speed or drops out**

Refer to Circuit/System Testing.
 - **If the Transmission ISS varies with engine speed and does not drop out**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **If the DTC does not set**
7. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF, remove the control valve body cover.
2. Connect the vehicle wire harness electrical connector to the Q8 Control Solenoid Valve Assembly electrical connector.
3. Disconnect the B14C Transmission Input Shaft Speed Sensor wiring harness connector from the Q8 Control Solenoid Valve Assembly.
4. Ignition ON.
5. Test for 8.3 - 9.3 V between the ISS sensor supply voltage circuit terminal A at the Q8 Control Solenoid Valve Assembly, and ground at the transmission case.
 - **If not between 8.3 - 9.3 V**
 1. Ignition OFF, disconnect the B14A Transmission Output Shaft Speed Sensor wiring harness connector from the Q8 Control Solenoid Valve Assembly. Ignition ON.
 2. Test for 8.3 - 9.3 V between the OSS sensor supply voltage circuit terminal A X3 at the Q8 Control Solenoid Valve Assembly, and ground at the transmission case.
 - If not between 8.3-9.3 V, replace the Q8 Control Solenoid Valve Assembly.
 - If between 8.3-9.3 V, replace the B14A Transmission Output Shaft Speed Sensor.
 - **If between 8.3 - 9.3 V**
6. Verify the scan tool Transmission ISS parameter is between 495-505 RPM when performing the input shaft speed test. Refer to Control Solenoid Valve and Transmission Control Module Assembly Input Shaft Speed/Output Shaft Speed Input Test.

- **If not between 495 - 505 RPM**

Replace the Q8 Control Solenoid Valve Assembly.

- **If between 495 - 505 RPM**

7. Verify there is no damage to the reluctor, which is attached to the 4-5-6 clutch and 3-5-R clutch housing assembly, or misalignment between the B14C Transmission Input Shaft Speed Sensor and reluctor.

- **If the reluctor is damaged or misaligned**

Repair or replace as necessary.

- **If the reluctor is not damaged or misaligned**

8. Replace the B14C Transmission Input Shaft Speed Sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Input Speed Sensor Replacement](#)
- [Output Speed Sensor Replacement](#)
- [Control Valve Body Cover Replacement](#)
- [Control Module References](#) for Control Solenoid Valve Assembly replacement, programming, and setup.

DTC P0722 OR P0723: OUTPUT SPEED SENSOR

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0722

Output Speed Sensor Circuit No Signal

DTC P0723

Output Speed Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
8.6 V Referene	P0722, P0723	P0722, P0723	-	P0723
Signal	P0722, P0723	P0722, P0723	P0722, P0723	P0723

Typical Scan Tool Data

Transmission OSS

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running, normal operating temperature Parameter Normal Range: 0 - 7, 000 RPM			
8.6 V Reference	0 RPM	0 RPM	0 - 7000 RPM
Signal	0 RPM	0 RPM	0 RPM

ISS/OSS Supply Voltage

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Key ON, Engine OFF or Engine running, normal operating temperature Parameter Normal Range: OK			
8.6 V	Out of Range	OK	Out of Range
Signal	OK	OK	OK

Circuit/System Description

The automatic transmission output shaft speed (OSS) sensor is a hall-effect type sensor. The sensor faces the front differential transfer drive gear. The sensor receives 8.3 - 9.3 volts on the OSS sensor supply voltage circuit from the transmission control module (TCM). As the output shaft rotates, the sensor produces a signal frequency based on the machined surface of the output shaft. This signal is transmitted through the OSS sensor signal circuit to the TCM. The TCM uses the OSS sensor signal to calculate output shaft speed to determine commanded line pressure, transmission shift patterns, torque converter clutch (TCC) slip speed and gear ratio.

Conditions for Running the DTC

P0722

- DTC P0101, P0102, P0103, P0121, P0122, P0123, P0716, P0717, or P0723 is not set.
- Selected range is not PARK or NEUTRAL.
- Transmission input speed is 1, 000 RPM or greater.
- Engine speed is 3, 200 RPM or greater.
- Throttle position is 5 % or greater.
- Throttle position signal is valid.
- Engine torque is 35 N.m (26 lb ft) or greater.
- Engine torque signal is valid.
- Transmission fluid temperature is -40Â°C (-40Â°F) or greater.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is greater than 8.5 V.

P0723

- DTC P0101, P0102, P0103, P0121, P0122, P0123, P0973, P0974, P0976, or P0977 is not set.
- Greater than 5 s since last transmission upshift or downshift.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is greater than 8.5 V.

Conditions for Setting the DTC

P0722

Transmission output speed is 35 RPM or less for 4.0 s.

P0723

- Transmission output speed is 105 RPM or greater for 0.2 s.
- TCM detects the transmission output shaft speed dropped greater than 650 RPM for 1.5 s.

Action Taken When the DTC Sets

- DTCs P0722 and P0723 are Type A DTCs.
- TCM freezes transmission adaptive functions.
- TCM turns the high side driver OFF.
- TCM commands maximum line pressure.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.

- TCM limits the transmission to Reverse and 3rd or 5th gear operation.

Conditions for Clearing the DTC

DTCs P0722 and P0723 are Type A DTCs.

Diagnostic Aids

- Damage or misalignment of the front differential transfer drive gear teeth surface or metallic debris on the face of the sensor may cause a speed sensor malfunction.
- Proper torque of the OSS mounting bolt is critical to proper OSS operation.
- If the scan tool ISS/OSS Supply Voltage indicates out of range, the fault could also be caused by the transmission input shaft speed sensor.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool ISS/OSS Supply Voltage parameter displays OK.
 - **If OK is not displayed**
Refer to Circuit/System Testing.
 - **If OK is displayed**
3. Verify the scan tool Transmission OSS parameter changes with vehicle speed or does not drop out while operating the vehicle at 16-32 km/h (10-20 mph).
 - **If the Transmission OSS does not vary with vehicle speed or drops out**
Refer to Circuit/System Testing.
 - **If the Transmission OSS varies with vehicle speed and does not drop out**

4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
5. Verify the DTC does not set
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **If the DTC does not set**
6. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF, remove the control valve body cover.
2. Connect the vehicle wire harness electrical connector to the Q8 Control Solenoid Valve Assembly electrical connector.
3. Disconnect the B14A Transmission Output Shaft Speed Sensor wiring harness connector from the Q8 Control Solenoid Valve Assembly.
4. Ignition ON.
5. Test for 8.3-9.3 V between the OSS sensor supply voltage circuit terminal A at the Q8 Control Solenoid Valve Assembly, and ground at the transmission case.
 - **If not between 8.3-9.3 V**
 1. Ignition OFF, disconnect the B14C Transmission Input Shaft Speed Sensor wiring harness connector from the Q8 Control Solenoid Valve Assembly. Ignition ON.
 2. Test for 8.3-9.3 V between the OSS sensor supply voltage circuit terminal A X4 electrical connector at the Q8 Control Solenoid Valve Assembly, and ground at the transmission case.
 - If not between 8.3-9.3 V, replace the Q8 Control Solenoid Valve Assembly.
 - If between 8.3-9.3 V, replace the B14C Transmission Input Shaft Speed Sensor.
 - **If between 8.3-9.3 V**
6. Verify the scan tool Transmission OSS parameter is between 256-266 RPM when performing the output shaft speed test. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Input Shaft Speed/Output Shaft Speed Input Test](#).
 - **If not between 256 - 266 RPM**

Replace the Q8 Control Solenoid Valve Assembly.
 - **If between 256 - 266 RPM**
7. Verify there is no damage to the front differential transfer drive gear teeth surface or misalignment with the B14A Transmission Output Shaft Speed Sensor.
 - **If the front differential transfer drive gear is damaged or is misaligned**

Repair or replace as necessary.
 - **If the front differential transfer drive gear is not damaged or misaligned.**
8. Replace the B14A Transmission Output Shaft Speed Sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Valve Body Cover Replacement](#) .
- [Output Speed Sensor Replacement](#)
- [Input Speed Sensor Replacement](#)
- [Control Module References](#) for Control Solenoid Valve Assembly replacement, programming, and setup

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

NOTE: The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.

DTC P0741

Torque Converter Clutch (TCC) System Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P0742

Torque Converter Clutch (TCC) System Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

The torque converter clutch (TCC) pressure control solenoid is part of the control solenoid valve assembly which has no serviceable components. The TCC pressure control solenoid is a normally low pressure control solenoid. The TCC pressure control solenoid regulates transmission fluid to the TCC regulator valve in the lower valve body and the TCC control valve in the pump cover. When vehicle operating conditions are appropriate to apply the converter clutch, the transmission control module (TCM) will increase current flow to the TCC pressure control solenoid, thereby increasing pressure directed to the TCC control valve. The increase in fluid pressure moves the TCC control valve to the apply position, and moves the TCC regulator apply valve to the regulating position. The TCC regulator valve regulates TCC apply fluid pressure proportional to TCC solenoid pressure. When the TCC is fully applied, the engine is coupled directly to the transmission. TCC release is accomplished by the TCM decreasing current flow to the TCC PC solenoid. This results in decreasing the apply pressure which allows the TCC control valve to move to the release position. The TCM calculates torque converter slip speed based on the speed signal from the input shaft speed sensor and the engine speed provided by the engine control module.

Conditions for Running the DTC**P0741**

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, P0742, P2763, or P2764 is not set.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is greater than 8.5 V.
- Transmission fluid temperature is between -6.7 to +130Â°C (20 - 266Â°F).
- Throttle position is 8.5 % or greater.
- Engine torque is 50 N.m (36 lb ft) or greater.
- Engine torque signal is valid.
- Throttle position signal is valid.
- TCM detects the transmission gear ratios listed below for the commanded gear when TCC is commanded ON:
 - 2nd gear ratio is between 2.67 - 3.07.
 - 3rd gear ratio is between 1.71 - 1.97.
 - 4th gear ratio is between 1.32 - 1.51.

- 5th gear is between 0.93 - 1.07.
- 6th gear is between 0.69 - 0.79.

P0742

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, P0741, P2763, or P2764 is not set.
- Commanded range is 2nd gear or higher.
- Ignition voltage is 8.5 V or greater.
- Transmission fluid temperature is between 18 - 130°C (64 - 266°F).
- Throttle position is 5 % or greater.
- Engine torque is 80 N.m (59 lb ft) or greater.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Vehicle speed is 1 km/h (0.6 mph) or greater.
- Engine speed is 500 RPM or greater
- Engine torque signal is valid.
- Throttle position signal is valid.
- TCC is commanded OFF.

Conditions for Setting the DTC

P0741

- TCC Pressure command is 800 kPa (116 psi) or greater for 2 s.
- TCM detects TCC slip of 50 RPM or greater for 5 s.
- The above conditions must occur 3 times.

P0742

TCM detects the TCC slip between -50 and +13 RPM for 2.5 s when the TCC is commanded OFF. This condition must occur 6 times.

Action Taken When the DTC Sets

P0741

- DTC P0741 is a Type B DTC.
- TCM inhibits 6th gear.
- TCM commands TCC OFF.
- TCM forces hot mode shift pattern.

P0742

- DTC P0742 is a Type A DTC.
- TCM freezes transmission adaptive functions.
- TCM forces hot mode shift pattern.
- TCM commands the TCC ON.

Conditions for Clearing the DTC

P0741

DTC P0741 is a Type B DTC.

P0742

DTC P0742 is a Type A DTC.

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE: If other DTCs are set, diagnose those DTCs first.

1. Engine idling, transmission in the Park, parking brake applied, and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to [Transmission Fluid Level and Condition Check](#).
 - **If the transmission fluid level and condition is not correct**
Repair as necessary.
 - **If the transmission fluid level and condition is correct**
3. Ignition ON, clear the TCM DTCs with a scan tool.
4. Verify DTC P0741 or P0742 does not set while performing a road test. Refer to [Road Test](#).
 - **If DTC P0741 or P0742 sets**
Refer to Circuit/System Testing.
 - **If DTC P0741 or P0742 did not set**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **If the DTC does not set**
7. All OK.

1. Engine idling at the normal operating temperature.
2. Verify the transmission line pressures are within the specified range. Refer to [Line Pressure Check](#), and [Solenoid Valve Pressure](#).
 - **If the pressures are not within range**
Refer to [Fluid Pressure High or Low](#).
 - **If the pressures are within range**
3. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
4. Verify the pressure changes for all solenoids when performing the solenoid test. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test](#).
 - **If the pressure does not change**
Replace the Q8 Control Solenoid Valve Assembly.
 - **If the pressure changes**
5. Verify the mechanical conditions listed below do not exist. Repair or replace as necessary.

P0741 - Upper Valve Body

Release exhaust port/orifice plugged or blocked.

P0741 or P0742 - Upper Valve Body

Torque converter clutch regulator valve stuck/sticking - debris, binding, damaged valve, or scored bore.

P0741 - Channel Plate and Spacer Plate

Oil channels or orifices blocked by debris.

P0741 - Torque Converter

- Torque converter clutch delamination or material worn off.
- Converter bolts too long damaging the clutch apply surface.
- Damaged seal.

P0741 - Support

Damaged seal.

P0741 or P0742 - Transmission Case Cover

- Pressure release blow-off not seating/sealing.
- Damaged spring.

P0741 - Turbine Shaft

O-ring seal cut or damaged

P0741 or P0742 Q8 Control Solenoid Valve Assembly

- Torque converter clutch pressure control solenoid stuck OFF or leaking.
- Torque converter clutch pressure control solenoid stuck ON.
- Control signal fluid supply leak due to valve body filter plate assembly cracked, or damaged gasket seal.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Torque Converter Removal](#)
- [Torque Converter and Differential Housing, Front Differential Transfer Drive Gear, and Front Differential Carrier Removal](#) , and [Torque Converter and Differential Housing Installation](#)
- [Torque Converter Installation](#)
- [Control Valve Lower Body and Upper Body Replacement](#)
- [Control Module References](#) for Control Solenoid Valve Assembly replacement, programming, and setup.

DTC P0751 OR P0752: SHIFT SOLENOID VALVE 1 PERFORMANCE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

NOTE: The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the **Circuit/System Verification and Circuit/System Testing** to identify the cause.

DTC P0751

Shift Solenoid Valve 1 Performance - Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P0752

Shift Solenoid Valve 1 Performance - Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

Shift solenoid valve 1 is part of the control solenoid valve assembly, which has no serviceable components. The solenoid operates by the transmission control module (TCM) turning the low side driver ON or OFF. When the shift solenoid valve 1 is commanded OFF, the plunger forces the metering ball against the actuator feed limit seat, blocking the flow and any existing pressure is exhausted through the exhaust port. When the shift solenoid valve 1 is commanded ON, the internal plunger moves, allowing the metering valve to move away from the actuator feed limit seat and against the exhaust seat, creating signal fluid pressure. The signal fluid pressure acts against the clutch select valve 2 to overcome the valve spring force, moving the valve to the apply position. Fluid pressure from the R1/4-5-6 regulator valve flows through clutch select valve 2 and is directed to either the low and reverse clutch or the 4-5-6 clutch, depending on the position of clutch select valve 2.

Conditions for Running the DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- Ignition voltage is greater than 8.5 V.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Throttle position signal is valid.
- Engine torque signal is valid.
- High side driver is enabled.
- Output shaft speed is 36 RPM or greater, or the throttle position is 0.5 % or greater.
- Transmission fluid temperature is -6.6Â°C (20Â°F) or greater.

Conditions for Setting the DTC

P0751

- Commanded gear is 1st.
- TCM detects gear ratio 1.34 - 1.48.
- Gear slip is 400 RPM or greater for 2 s.
- Above conditions have to occur 8 times.

P0752

- Commanded gear is 3rd
- Transmission has achieved 1st or 2nd.
- Gear slip is 400 RPM or greater for 3 s.
- TCM commands 4th gear if above conditions exist and detects a gear ratio of 4.26 - 4.71 for 3 s.
- The conditions listed above have to occur 5 times.

Action Taken When the DTC Sets

P0751

- DTC P0751 is a Type B DTC.
- TCM inhibits 1st gear.
- TCM inhibits neutral idle.

P0752

- DTC P0752 is a Type A DTC.
- TCM freezes transmission adaptive functions.
- TCM commands maximum line pressure.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM commands second gear if output speed is less than 1,350 RPM, or neutral if output speed is 1,350 RPM or greater.
- TCM inhibits neutral idle.

Conditions for Clearing the DTC

- DTC P0751 is a Type B DTC.
- DTC P0752 is a Type A DTC.

Diagnostic Aids

Before performing a road test, configure and setup the scan tool for snapshot mode. This allows you to display, monitor, and verify multiple transmission data parameters at one time, after the road test.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

Description and Operation

- [Transmission General Description](#)

- [Transmission Component and System Description](#)
- [Electronic Component Description](#)
- [Drive Range, First Gear](#)
- [Drive Range, Third Gear](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

NOTE: If other DTCs are set, diagnose those DTCs first.

1. Engine idling at the normal operating temperature, gear selector in the Park position, parking brake applied, and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to [Transmission Fluid Level and Condition Check](#).
 - **If the transmission fluid level and condition is not correct**
Repair as necessary
 - **If the transmission fluid level and condition is correct**
3. From a stop, accelerate to 72 km/h (45 mph) with the scan tool Calculated Throttle Position greater than 15 %. Perform this test 8 times.
4. Verify DTC P0751 or P0752 did not set.
 - **If DTC P0751 or P0752 set**
Refer to Circuit/System Testing.
 - **If DTC P0751 or P0752 did not set**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Engine idling at the normal operating temperature.
2. Verify the transmission line pressures are within the specified range. Refer to [Line Pressure Check](#), and [Solenoid Valve Pressure](#).
 - **If the pressures are not within range**
Refer to [Fluid Pressure High or Low](#).

- **If the pressures are within range**

3. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.

4. Verify the pressure changes for all solenoids when performing the solenoid test. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test](#).

- **If the pressure does not change**

Replace the Q8 Control Solenoid Valve Assembly.

- **If the pressure changes**

5. Verify the mechanical conditions listed below do not exist. Repair or replace as necessary.

P0751 - Upper Control Valve Body

- Clutch select valve 2 bore plug undersized causing a leak - plug should be a valve fit in the bore.
- Check ball #2 - missing, damaged or malformed, or damage to the seat causing leakage.

P0751 or P0752 - Upper Control Valve Body

Clutch select valve 2 stuck from debris, sediment, binding, or a scored bore.

P0751 or P0752 - Channel Plate and Spacer Plate

Oil channels or orifices blocked by debris.

P0751 - Lower Control Valve Body Assembly

Actuator feed limit circuit supply fluid to solenoid restricted or not available from debris, stuck limit valve or sediment blockage.

P0751 or P0752 - Q8 Control Solenoid Valve Assembly

- Shift solenoid valve 1 stuck OFF or leaking.
- Shift solenoid valve 1 stuck ON.
- Valve body filter plate assembly cracked, blocked, or damaged gasket seal.
- Pressure control solenoid valve 3 stuck ON, stuck OFF, or leaking. Low and Reverse, and 4-5-6 regulator valve stuck or sticking from debris, sediment, binding or scored bore.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P0756: SHIFT SOLENOID VALVE 2 PERFORMANCE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

NOTE: The DTC listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.

DTC P0756

Circuit/System Description

Shift solenoid valve 2 is part of the control solenoid valve assembly, which has no serviceable components. Shift solenoid valve 2 is a normally closed solenoid valve and controls fluid to the clutch select valve 3. The transmission control module (TCM) operates the solenoid by turning the low side driver ON or OFF. When the shift solenoid valve 2 is commanded OFF, the plunger forces the metering ball against the actuator feed limit seat, blocking the flow and any existing pressure is exhausted through the exhaust port. When shift solenoid valve 2 is commanded ON, the internal plunger moves and allows the metering ball to move away from the feed seat and against the exhaust seat, creating signal fluid pressure. The signal fluid acts against the clutch select valve 3 to overcome the valve spring force, moving it to the apply position. Shift solenoid valve 2 is commanded OFF in Reverse, and commanded ON in Park, Neutral, Drive 1 Engine Braking, and Drive 1 - 6 gear ranges.

Conditions for Running the DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- High side driver is enabled.
- Ignition voltage is greater than 8.5 V.
- Throttle position signal is valid.
- Transmission fluid temperature is -6.6°C (20°F) or greater.
- Output shaft speed is 36 RPM or greater, or the throttle position is 0.5 percent or greater

Conditions for Setting the DTC

- Commanded Gear is 1st locked.
- Gearbox Slip is 400 RPM or greater for 3 s.
- If above conditions exist, the TCM commands second gear. If the gear ratio is between 2.72 - 3.01 for 1 s, the counter will increment. DTC will set after 3 occurrences.

Action Taken When the DTC Sets

- DTC P0756 is a Type A DTC.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM commands second gear if output speed is less than 1, 350 RPM, or neutral if output speed is 1, 350 RPM or greater.

Conditions for Clearing the DTC

DTC P0756 is a Type A DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

- [Transmission General Description](#)
- [Transmission Component and System Description](#)
- [Electronic Component Description](#)
- [Drive Range, First Gear Engine Braking](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

NOTE: If other DTCs are set, diagnose those DTCs first.

1. Engine idling, transmission in Park, with parking brake applied and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to [Transmission Fluid Level and Condition Check](#).
 - **If the transmission fluid level and condition is not correct**
Repair as necessary.
 - **If the transmission fluid level and condition is correct**
3. Ignition ON, clear the TCM DTCs with a scan tool.
4. Engine running, brakes applied, transmission gear shift selector in Reverse. Shift to Drive and accelerate to 56 km/h (35 mph) with the scan tool Calculated Throttle Position greater than 15 %. Perform this test 5 consecutive times.
5. Verify DTC P0756 did not set.
 - **If DTC P0756 sets**
Refer to Circuit/System Testing.
 - **If DTC P0756 did not set**
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
7. Verify the DTC does not set.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **If the DTC does not set**
8. All OK.

Circuit/System Testing

1. Engine idling at the normal operating temperature.
2. Verify the transmission line pressures are within the specified range. Refer to [Line Pressure Check](#), and [Solenoid Valve Pressure](#).

- If the pressures are not within range

Refer to [Fluid Pressure High or Low](#).

- If the pressures are within range

3. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.

4. Verify the pressure changes for all solenoids when performing the solenoid test. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test](#).

- If the pressure does not change

Replace the Q8 Control Solenoid Valve Assembly.

- If the pressure changes

5. Verify the mechanical conditions listed below do not exist. Repair or replace as necessary.

Upper Control Valve Body

- Clutch select valve 3 stuck from debris, sediment, binding or scored bore
- Clutch select valve 3 bore plug undersized causing a leak - plug should be a valve fit in the bore.
- Check ball #3 - missing, damaged or malformed, or damage to the seat causing leakage.
- Check ball #1 - missing, damaged or malformed, or damage to the seat causing leakage.

Lower Control Valve Body Assembly

Actuator feed limit circuit supply fluid to solenoid restricted or not available from debris, stuck limit valve or sediment blockage.

Channel Plate and Spacer Plate

Oil channels or orifices blocked by debris.

Mechanical Diode

Broken or not capable of holding torque.

Pump Assembly

Fluid pump vanes or fluid pump rotor broken

Pump Seal

Seal is torn or cut, causing a small leak that is overcome with enough speed and pump capacity.

Q8 Control Solenoid Valve Assembly

- Shift solenoid 2 not pressurizing - stuck OFF or leaking.
- Valve body filter plate assembly cracked, blocked, or damaged gasket seal.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Valve Upper Body Assembly Cleaning and Inspection](#)
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P0776 OR P0777: PRESSURE CONTROL SOLENOID VALVE 2

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.

- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

NOTE: The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.

DTC P0776

Pressure Control Solenoid Valve 2 Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P0777

Pressure Control Solenoid Valve 2 Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

Clutch pressure control solenoid valve 2 is part of the control solenoid valve assembly, which has no serviceable components. Pressure control solenoid valve 2 regulates transmission fluid pressure to the 3-5-Reverse clutch regulator valve which controls pressure to the 3-5-Reverse clutch. The transmission control module (TCM) calculates gear ratio based on the speed signals from the input shaft speed (ISS) sensor and the output shaft speed (OSS) sensor. The TCM compares the expected transmission gear ratio to the calculated gear ratio for each commanded gear.

Conditions for Running the DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- Ignition voltage is greater than 8.5 V.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Transmission fluid temperature is -6.7°C (20°F) or greater.
- Transmission output speed is 36 RPM or greater, or the accelerator pedal position is 0.5 % or greater.
- Throttle position signal is valid.
- High side driver is enabled.
- Engine torque is 20 N.m (15 lb ft) or greater - DTC P0777 only.

Conditions for Setting the DTC

P0776

TCM has detected an incorrect gear ratio or neutral condition when the 3-5-Reverse clutch is commanded ON. This condition must occur 3 times.

P0777

TCM has detected an incorrect gear ratio change when the 3-5-Reverse clutch is commanded OFF during a shift or when 3rd gear ratio is detected in 1st gear. This condition must occur 3 times.

Action Taken When the DTC Sets

P0776

- DTC P0776 is a Type A DTC.
- TCM commands maximum line pressure.
- TCM inhibits Tap Up/Down function.
- TCM freezes transmission adaptive functions.
- TCM inhibits manual shifting of forward gears.

- TCM limits the transmission to Reverse, 2nd, and 4th gear operation.
- TCM inhibits auto grade braking.
- TCM inhibits neutral idle.

P0777

- DTC P0777 is a Type A DTC.
- TCM commands maximum line pressure.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM freezes transmission adaptive functions.
- TCM limits the transmission to 3rd gear and Reverse operation.
- TCM inhibits auto grade braking.
- TCM inhibits neutral idle.

Conditions for Clearing the DTC

DTCs P0776 and P0777 are Type A DTCs.

Diagnostic Aids

Before performing a road test, configure and setup the scan tool for snapshot mode. This will allow you to display, monitor, and verify multiple transmission data parameters at one time, after the road test.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **[COMPONENT CONNECTOR END VIEWS - INDEX](#)**
- **[INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)**

Description and Operation

- **[Transmission General Description](#)**
- **[Reverse](#)**
- **[Drive Range, Third Gear](#)**
- **[Drive Range, Fifth Gear](#)**

Electrical Information Reference

- **[Circuit Testing](#)**
- **[Connector Repairs](#)**
- **[Testing for Intermittent Conditions and Poor Connections](#)**
- **[Wiring Repairs](#)**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

WARNING: Refer to **Parking Brake and Drive Wheels Warning** .

NOTE: If other DTCs are set, diagnose those DTCs first.

1. Engine idling, transmission in Park, parking brake applied, and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to [Transmission Fluid Level and Condition Check](#).

- **If the transmission fluid level and condition is not correct**

Repair as necessary.

- **If the transmission fluid level and condition is correct**

3. Ignition ON, clear the TCM DTCs with a scan tool.
4. Verify DTC P0776 or P0777 does not set while performing a road test. Refer to [Road Test](#).

- **If DTC P0776 or P0777 sets**

Refer to Circuit/System Testing.

- **If DTC P0776 or P0777 does not set**

5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

6. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set**

7. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Engine idling at the normal operating temperature
2. Verify the transmission line pressures are within the specified range. Refer to [Line Pressure Check](#), and [Solenoid Valve Pressure](#).

- **If the pressures are not within range**

Refer to [Fluid Pressure High or Low](#).

- **If the pressures are within range**

3. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
4. Verify the pressure changes for all solenoids when performing the solenoid test. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test](#).

- **If the pressure does not change**

Replace the Q8 Control Solenoid Valve Assembly.

- **If the pressure changes**

5. Verify the mechanical conditions listed below do not exist. Repair or replace as necessary.

DTC P0776 or P0777 - Upper Control Valve Body Assembly

3-5-R regulator valve stuck/sticking - debris, binding, damaged valve, or scored bore.

DTC P0776 or P0777 - Lower Control Valve Body Assembly

- Actuator feed limit circuit supply fluid to solenoid restricted from debris, a stuck limit valve or sediment blockage.
- 3-5-R clutch boost valve - binding or scored bore - can cause harsh shifts.

DTC P0776 or P0777 - Q8 Control Solenoid Valve Assembly

- Clutch pressure control solenoid 2 stuck ON or stuck OFF.
- Control solenoid valve filter plate assembly, blocked or damaged gasket seal.

DTC P0776 - Channel Plate and Spacer Plate

Oil channels or orifices blocked by debris.

DTC P0776 or P0777 - Transmission Fluid Pump

- Fluid pump housing vanes/rotor/slide damaged/scored.
- Transmission pump fluid outlet seal assembly damaged/leaking.

DTC P0776 - Transmission Cooling/Lubrication

- Oil filter or filter seal loose, plugged, or damaged.
- Restriction/leak in oil to air cooler/radiator.
- Restricted/leaking/kinked/damaged transmission oil cooler lines.
- Restriction/leak in transmission fluid pump assembly.

DTC P0776 - Torque Converter Assembly

Torque converter overstressed due to high temperature, fluid boiled out.

DTC P0776 - 4-5-6 and 3-5-R Clutch Housing Assembly

- 3-5-R clutch backing plate retaining ring not seated or wave plate broken.
- 3-5-R piston seal torn, cut, or rolled.
- 4-5-6 and 3-5-R clutch housing assembly inner/outer seal damaged or dam pressure too high.

DTC P0776 or P0777 - Automatic Transmission Case Cover

Blow off regulator ball stuck.

DTC P0776 or P0777

3-5-R and 4-5-6 clutch fluid seal rings damaged, worn, or leaking.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P0796 OR P0797: PRESSURE CONTROL SOLENOID VALVE 3

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

NOTE: The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.

DTC P0796

DTC P0797**Pressure Control Solenoid Valve 3 Stuck On - Transmission Hydraulic/Mechanical Performance****Circuit/System Description**

Clutch pressure control solenoid 3 is part of the control solenoid valve assembly, which has no serviceable components. Pressure Control solenoid 3 regulates transmission fluid pressure to the R1/4-5-6 clutch regulator valve which controls pressure to the low and reverse clutch and the 4-5-6 clutch. The transmission control module (TCM) calculates gear ratio based on the speed signals from the input speed shaft (ISS) sensor and the output shaft speed (OSS) sensor. The TCM compares the expected transmission gear ratio to the calculated gear ratio for each commanded gear.

Conditions for Running the DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- Ignition voltage is greater than 8.5 V.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Output speed is 36 RPM or greater, or the accelerator pedal position is 0.5 % or greater.
- Throttle position signal is valid.
- High side driver is enabled.
- Transmission fluid temperature is -6.7°C (20°F) or greater.
- Engine torque is 20 N.m (15 lb ft) or greater when 1st gear is commanded-DTC P0797 only.

Conditions for Setting the DTC**P0796**

The TCM has detected an incorrect gear ratio or neutral condition when the low and reverse clutch or the 4-5-6 clutch is commanded ON. This condition must occur 3 times.

P0797

The TCM has detected an incorrect gear ratio change when the low and reverse clutch or the 4-5-6 clutch is commanded OFF during a shift or when 4th gear ratio is detected in 1st gear. This condition must occur 3 times.

Action Taken When the DTC Sets**P0796**

- DTC P0796 is a Type A DTC.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM limits the transmission to Reverse, 1st, and 3rd gear operation.
- TCM inhibits auto grade braking.
- TCM inhibits neutral idle.

P0797

- DTC P0797 is a Type A DTC.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.

- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM limits the transmission to Reverse and 4th gear operation.
- TCM inhibits neutral idle.
- TCM requests a reduced engine torque based on input speed.
- TCM inhibits auto grade braking.

Conditions for Clearing the DTC

DTCs P0796 and P0797 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

Description and Operation

- [Transmission General Description](#)
- [Transmission Component and System Description](#)
- [Electronic Component Description](#)
- [Reverse](#)
- [Drive Range, First Gear Engine Braking](#)
- [Drive Range, Fourth Gear](#)
- [Drive Range, Fifth Gear](#)
- [Drive Range, Sixth Gear](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

WARNING: Refer to [Parking Brake and Drive Wheels Warning](#) .

NOTE: If other DTCs are set, diagnose those DTCs first.

1. Engine idling, transmission in Park, parking brake applied, and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to [Transmission Fluid Level and Condition Check](#).
 - If the transmission fluid level and condition is not correct

Repair as necessary.

- **If the transmission fluid level is condition is correct**

3. Ignition ON, clear the TCM DTCs with a scan tool.

4. Verify DTC P0796 or P0797 does not set while performing a road test. Refer to [Road Test](#).

- **If DTC P0796 or P0797 sets**

Refer to Circuit/System Testing.

- **If DTC P0796 or P0797 does not set**

5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

6. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set**

7. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Engine idling at the normal operating temperature.

2. Verify the transmission line pressures are within the specified range. Refer to [Line Pressure Check](#), and [Solenoid Valve Pressure](#).

- **If the pressures are not within range**

Refer to [Fluid Pressure High or Low](#).

- **If the pressures are within range**

3. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.

4. Verify the pressure changes for all solenoids when performing the solenoid test. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test](#).

- **If the pressure does not change**

Replace the Q8 Control Solenoid Valve Assembly.

- **If the pressure changes**

5. Verify the mechanical conditions listed below do not exist. Repair or replace as necessary.

P0796 or P0797 - Control Valve Upper Body Assembly

4-5-6 regulator valve stuck/sticking from debris, binding, damaged valve, or scored bore.

P0796 - Channel Plate and Spacer Plate

Channel Plate and spacer plate oil channels or orifices blocked by debris.

P0796 - Lower Control Valve Body Assembly

- Actuator feed limit circuit supply fluid to solenoid restricted or not available from debris, stuck limit valve, or sediment blockage.
- 4-5-6 clutch boost valve binding or a scored bore which can also cause harsh shifts.
- 4-5-6 clutch accumulator piston leaking, cracked, or broken.

P0796 or P0797 - Input Shaft Support

Input shaft support 3-5-R and 4-5-6 clutch fluid seal rings damaged, worn, or leaking.

P0796 or P0797 - Q8 Control Solenoid Valve Assembly

- Clutch pressure control solenoid valve 3 stuck ON or stuck OFF.
- Control solenoid filter plate assembly cracked, blocked, or damaged gasket seal.

P0796 - 4-5-6 Clutch Housing Assembly

- 4-5-6 clutch piston assembly damaged or leaking.
- 4-5-6 clutch inner/outer seal damaged.
- Dam pressure too high

P0796 - Automatic Transmission Case Cover

Blow off regulator ball stuck.

P0796 - Transmission Cooling/Lubrication

- Restriction/leak in oil to air cooler/radiator.
- Restricted/leaking/kinked/damaged transmission oil cooler lines.
- Restriction/leak in transmission fluid pump assembly.

P0796 - Torque Converter Assembly

Fluid pump or torque converter overstressed due to high temperature of fluid boiled out.

P0796 - 4-5-6 Reaction Carrier Hub Assembly

4-5-6 reaction carrier hub/shaft - broken hub weld.

P0796 - Automatic Transmission Fluid Filter Assembly

Oil filter or filter seal loose or damaged

P0796 - Automatic Transmission Fluid Pump

Pump fluid outlet seal assembly damaged/leaking.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P0815, P0816, OR P0826: UP AND DOWN SHIFT SWITCH

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0815

Upshift Switch Circuit

DTC P0816

Downshift Switch Circuit

DTC P0826

Up and Down Shift Switch Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0826	P0826	P0826	-
Ground	-	-	-	-

Typical Scan Tool Data

Driver Shift Request

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Signal	Inactive	Inactive	Inactive
Ground	-	-	-

Circuit/System Description

When the shift lever is placed in the M position, electronic range select or manual mode, which allows for the selection of the range of gears available, is activated. This is also known as the tap shift function. Manual mode allows the vehicle operator to increase the highest transmission gear available by pressing the plus (+) button or decrease the highest gear available by pressing the minus (-) button. The body control module (BCM) supplies a signal circuit to the shift controller. The shift controller has switches connected to a resistor array. A voltage drop occurs across the resistor network. When the plus or minus button is pushed, a corresponding voltage drop occurs across the resistor network. This voltage drop is monitored by the BCM. The BCM will send the request to the transmission control module (TCM) to increase or decrease the available gear ranges. The TCM will not allow a downshift if the engine would be compromised by overspeeding.

Conditions for Running the DTC

P0815 or P0816

- DTC P0826, P1761, P182E, P1876, P1877, or P1915 is not set.
- Time since the range change is 1 s or greater.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.

P0826

- DTC P1761 is not set.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.

Conditions for Setting the DTC

P0815 - Condition 1

TCM detects an upshift request for 1 s in Park or Neutral.

P0815 - Condition 2

TCM detects an upshift request for 10 min in any forward range.

P0816 - Condition 1

TCM detects a downshift request for 1 s in Park or Neutral.

P0816 - Condition 2

TCM detects a downshift request for 10 min in any forward range.

P0826

TCM detects an invalid voltage on the Tap up/Tap down signal circuit for 1 min.

Action Taken When the DTC Sets

- DTCs P0815, P0816, and P0826 are Type C DTCs.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.

Conditions for Clearing the DTC

DTCs P0815, P0816, and P0826 are Type C DTCs.

Diagnostic Aids

A high resistance in the signal circuit may not set a DTC. Symptoms could include an inoperative manual mode Tap Up/Down, or a Tap Down shift when the Tap/Up button is pressed.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

Description and Operation

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- [Transmission Component and System Description](#)
- [Electronic Component Description](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

WARNING: Refer to [Parking Brake and Drive Wheels Warning](#) .

1. Ignition ON, engine OFF, Transmission Shift Lever in the M or manual mode position.
2. Verify the scan tool Up and Down Shift Switch or Driver Shift Request parameter displays Upshift when pressing the plus (+) switch, Downshift when pressing the minus (-) switch, and Inactive when neither switch is pressed.
 - **If the parameter does not display the correct value**

Refer to Circuit/System Testing

- **If the parameter displays the correct value**

3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

4. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set.**

5. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the S3 Transmission Shift Lever. It may take up to 2 min for all vehicle systems to power down.

2. Test for less than 10 Ω between the ground circuit terminal 2 and ground.

- **If 10 Ω or greater**

1. Ignition OFF.

2. Test for less than 2 Ω in the ground circuit end to end.

- If greater than 2 Ω , repair the Open/High resistance in the circuit
- If less than 2 Ω , repair the ground connection

- **If less than 10 Ω**

3. Ignition ON.

4. Test for 11 - 13 V between the signal circuit terminal 3 and ground.

- **If not between 11 - 13 V**

1. Ignition OFF, disconnect the connector at the BCM.

2. Test for infinite resistance between the signal circuit and ground.

- If less than infinite resistance, repair the short to ground in the circuit
- If infinite resistance

1. Test for less than 2 Ω in the signal circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the BCM.

- **If between 11 - 13 V**

5. Ignition OFF, connect the harness connector at the S3 Transmission Shift Lever, Ignition ON, transmission shift lever in the M or manual mode position.

6. Test for voltage between the S3 Transmission Shift Lever connector signal circuit terminal 3 and ground, by back probing the connector, for the conditions listed below:

- 2.0 - 4.6 V - Plus button pressed
- 5.1 - 7.3 V - Minus button pressed
- 8.0 - 10.6 V - Neither button pressed
- **If voltage values are not correct**

Replace the S3 Transmission Shift Lever

- **If voltage values are correct**

7. Replace the K9 Body Control Module.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Transmission Control Lever Knob Replacement](#)
- [Control Module References](#) for BCM or control solenoid valve assembly replacement, programming, and setup.

DTC P0851: PARK/NEUTRAL POSITION SWITCH CIRCUIT LOW VOLTAGE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0851

Park/Neutral Position Switch Circuit Low Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0851	-	-	-
Ground	-	-	-	-

Typical Scan Tool Data

Park/Neutral Position Switch

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Engine running, normal operating temperature Parameter Normal Range: 12 Volts = In-Gear, 0 Volts = Park/Neutral			
Signal	Park/Neutral	In-Gear	In-Gear
Ground	-	In-Gear	-

Circuit/System Description

The transmission manual shift shaft switch assembly, also known as the transmission internal mode switch, is a sliding contact switch attached to the manual shift shaft inside the transmission case. The park/neutral position switch is integrated into the transmission internal mode switch and connects to the transmission control module (TCM) lead-frame through a short wire harness. The circuit uses the TCM as a pass-through connector only. The park/neutral signal is sent from the park/neutral switch directly to the engine control module (ECM) and is used for engine start enable.

Conditions for Running the DTC

- DTC P182E is not set.
- Ignition voltage is 8 - 32 V.
- Engine speed is running. Vehicle speed is 10 km/h (6 mph) or greater.
- Throttle position is 8 % or greater.

Conditions for Setting the DTC

ECM detects the park/neutral switch signal equals 0 V for 4 s.

Action Taken When the DTC Sets

- DTC P0851 is a Type C DTC.
- ECM uses the indicated transmission range from the TCM to prevent engine start-up with the transmission in reverse or a forward range.

Conditions for Clearing the DTC

DTC P0851 is a Type C DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC P182E or P1915 is not set.
 - **If any of the DTCs are set**

Refer to **DTC P182E or P1915**.
 - **If none of the DTCs are set**
3. Verify the gear shift lever position matches the scan tool TCM Internal Mode Switch parameter while slowly moving the gear shift lever from Park through all ranges.
 - **If the gear shift lever position does not match the Internal Mode Switch parameter**

Adjust or replace the range selector lever cable as necessary.
 - **If the gear shift lever position matches the Internal Mode Switch parameter**
4. Verify the scan tool engine control module Park/Neutral Position Switch parameter displays Park/Neutral when in Park or Neutral and In-Gear when in Reverse or Drive.
 - **If the Park/Neutral Position Switch parameter is not as specified**

Refer to Circuit/System Testing.

- **If the Park/Neutral Position Switch parameter is as specified**

5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

6. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set**

7. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF, disconnect the X1 harness connector at the Q8 Control Solenoid Valve Assembly harness connector at the automatic transmission.
2. Install the **DT-47825-20** Adapter Harness to the vehicle harness connector.

NOTE: All testing in steps 3 through 5 will be performed at the **DT-47825-20** Adapter Harness connector.

3. Test for less than 5 Ω between the ground circuit terminal 18 and ground.

- **If 5 Ω or greater**

1. Ignition OFF.

2. Test for less than 2 Ω in the ground circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , repair the open/high resistance in the ground connection.

- **If less than 5 Ω**

4. Ignition ON.

5. Test for 11 - 13 V between signal circuit terminal 20 and ground.

- **If not between 11 - 13 V**

1. Ignition OFF, remove the harness connector at the K20 Engine Control Module.

2. Test for infinite resistance between signal circuit terminal 20 and ground.

- If less than infinite resistance, repair the short to ground in the circuit.
- If infinite resistance.

1. Test for less than 2 Ω in the signal circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

- **If between 11 - 13 V**

6. Ignition OFF, transmission in Park, disconnect the **DT-47825-20** Adapter Harness from the vehicle wire harness.

7. Connect the **DT-47825-20** Adapter Harness to the Q8 Control Solenoid Valve Assembly X1 connector.

NOTE: The ignition will need to be ON momentarily to shift from Park.

8. Test for less than 10 Ω between the Park/Neutral signal circuit terminal 20 and ground circuit terminal 18 with the transmission in Park and Neutral.

- **If 10 Ω or greater**

1. Disconnect the **DT-47825-20** Adapter Harness and remove the transmission control valve body cover.

2. Install the **DT-47825-20** Adapter Harness to the Q8 Control Solenoid Valve Assembly X1 connector.
3. Disconnect the B15 Transmission Internal Mode Switch electrical connector from the Q8 Control Solenoid Valve Assembly.
4. Test for less than 10 Ω between Park/Neutral signal circuit terminal 20 and terminal A at the Q8 Control Solenoid Valve Assembly X2 connector.
 - If 10 Ω or greater, replace the Q8 Control Solenoid Valve Assembly.
 - If less than 10 Ω , replace the B15 Transmission Internal Mode Switch.
- **If less than 10 Ω**
9. Test for infinite resistance between the Park/Neutral signal circuit terminal 20 and ground circuit terminal 18 with the transmission in Reverse and Drive.
 - **If less than infinite resistance**
 1. Disconnect the **DT-47825-20** Adapter Harness and remove the transmission control valve body cover.
 2. Install the **DT-47825-20** Adapter Harness to the Q8 Control Solenoid Valve Assembly X1 connector.
 3. Disconnect the B15 Transmission Internal Mode Switch electrical connector from the Q8 Control Solenoid Valve Assembly.
 4. Test for infinite resistance between the Park/Neutral signal circuit terminal 20 and ground circuit terminal 18.
 - If less than infinite resistance, replace the Q8 Control Solenoid Valve Assembly.
 - If infinite resistance, replace the B15 Transmission Internal Mode Switch.
 - **If infinite resistance**
10. Replace the K20 Engine Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Manual Shift Detent Lever with Shaft Position Switch Assembly Replacement](#)
- [Range Selector Lever Cable Adjustment](#)
- [Control Valve Body Cover Replacement](#)
- [Control Module References](#) for ECM or control solenoid valve assembly replacement, programming, or setup.

DTC P0961-P0963: LINE PRESSURE CONTROL SOLENOID VALVE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0961

Line Pressure Control Solenoid Valve Performance

DTC P0962

Line Pressure Control Solenoid Valve Control Circuit Low Voltage

DTC P0963

Line Pressure Control Solenoid Valve Control Circuit High Voltage

Circuit/System Description

The line pressure control solenoid is part of the control solenoid valve assembly which has no serviceable components. The normally high line pressure control solenoid regulates and directs the line pressure control solenoid oil pressure to the pressure regulator valve. Increasing line pressure control solenoid pressure increases transmission line pressure. The transmission control module (TCM) varies the current to the line pressure control solenoid by controlling the amount of time the low side driver is ON and OFF. Decreasing the ON time, decreases the current to the line pressure control solenoid, which increases line pressure control solenoid oil pressure by closing OFF the solenoid exhaust port. Increasing the current to the line pressure control solenoid decreases line pressure control oil pressure by opening the solenoid exhaust port. Line pressure control solenoid power is supplied by the TCM through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.

Conditions for Setting the DTC

P0961

TCM detects an internal electrical malfunction of the line pressure control solenoid where the measured line pressure control solenoid current does not equal the commanded line pressure control solenoid current for 5 s.

P0962

TCM detects a short to ground on the line pressure control solenoid control circuit for 2 s.

P0963

TCM detects an open or a short to voltage on the line pressure control solenoid control circuit for 5 s.

Action Taken When the DTC Sets

P0961 or P0963

- DTCs P0961 and P0963 are Type B DTCs.
- TCM freezes transmission adaptive functions.
- TCM commands maximum line pressure.

P0962

- DTC P0962 is a Type A DTC.
- TCM limits the transmission to Reverse and 3rd or 5th gear operation.
- TCM inhibits the torque converter clutch (TCC).
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM turns the high side driver OFF.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM enables torque management.

Conditions for Clearing the DTC

- DTCs P0961 and P0963 are Type B DTCs.
- DTC P0962 is a Type A DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
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- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

WARNING: Refer to **Parking Brake and Drive Wheels Warning** .

1. Engine running, transmission in Park. Move the gear shift lever into each gear position and back into Park position.
2. Verify the scan tool parameters listed below do not display Malfunction:
 - Line Pressure Control Solenoid Valve Performance Test Status
 - Line Pressure Control Solenoid Valve Control Circuit Low Voltage Test Status
 - Line Pressure Control Solenoid Valve Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.
 - **If Malfunction is not displayed**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.

- If the DTC does not set

5. All OK.

Circuit/System Testing

NOTE: You must perform the **Circuit/System Verification** first.

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris and clean as necessary. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).
 - **If contaminated**
Repair as necessary.
 - **If not contaminated**
3. Verify the resistance of each solenoid is within the specified range for listed in the [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).
 - **If the resistance is not within range**
Replace the Q8 Control Solenoid Valve Assembly.
 - **If the resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect the **DT-47825-20** adapter harness between the vehicle harness connector and the Q8 Control Solenoid Valve Assembly connector. Ignition ON.
6. Verify the scan tool parameters listed below do not display Malfunction:
 - Line Pressure Control Solenoid Valve Performance Test Status
 - Line Pressure Control Solenoid Valve Control Circuit Low Voltage Test Status
 - Line Pressure Control Solenoid Valve Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**
Replace the Q8 Control Solenoid Valve Assembly.
 - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P0965-P0967: PRESSURE CONTROL SOLENOID VALVE 2

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0965

Pressure Control Solenoid Valve 2 Performance

DTC P0966

Pressure Control Solenoid Valve 2 Control Circuit Low Voltage

DTC P0967

Pressure Control Solenoid Valve 2 Control Circuit High Voltage

Circuit/System Description

Pressure control solenoid 2 is part of the control solenoid valve assembly which has no serviceable components. The normally high pressure control solenoid 2 regulates and directs oil 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. The transmission control module (TCM) varies the current to the pressure control solenoid 2 by controlling the amount of time the low side driver is ON and OFF. Decreasing the current to the pressure control solenoid 2 increases pressure control solenoid 2 oil pressure by closing OFF the solenoid exhaust port. Increasing the current to the pressure control solenoid 2 decreases pressure control solenoid 2 oil pressure by opening the solenoid exhaust port. Power to pressure control solenoid 2 is supplied by the TCM through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.

Conditions for Setting the DTC

P0965

TCM detects an internal electrical performance malfunction of the pressure control solenoid 2 control circuit where the measured pressure control solenoid 2 current does not equal the commanded pressure control solenoid 2 current for 5 s.

P0966

TCM detects a short to ground on the pressure control solenoid 2 control circuit for 1 s.

P0967

TCM detects an open or short to voltage on the pressure control solenoid 2 control circuit for 1 s.

Action Taken When the DTC Sets

P0965

- DTC P0965 is a Type C DTC.
- TCM freezes transmission adaptive functions on the 3-5-Reverse clutch.

P0966

- DTC P0966 is a Type A DTC.
- TCM limits the transmission to Reverse and 3rd or 5th gear operation.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM turns the high side driver OFF.
- TCM forces the torque converter clutch (TCC) OFF.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM enables torque management.

P0967

- DTC P0967 is a Type A DTC.
- TCM limits the transmission to Reverse and 3rd gear operation.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.

Conditions for Clearing the DTC

- DTC P0965 is a Type C DTC.
- DTCs P0966 and P0967 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to [Special Tools](#) .

Circuit/System Verification

1. Operate the vehicle in second gear long enough to ensure at least a 3Â°C (5Â°F) rise in TCM temperature, then operate the vehicle in Park for 5 s.
2. Operate the vehicle in Drive range. Allow the transmission to shift through all forward gear ranges.
3. Verify the scan tool parameters listed below do not display Malfunction:
 - Pressure Control Solenoid Valve 2 Performance Test Status

- Pressure Control Solenoid Valve 2 Control Circuit Low Voltage Test Status
- Pressure Control Solenoid Valve 2 Control Circuit High Voltage Test Status
- **If Malfunction is displayed**

Refer to Circuit/System Testing.

- **If Malfunction is not displayed**

4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

5. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set**

6. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.

2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris and clean as necessary. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).

- **If contaminated**

Repair as necessary.

- **If not contaminated**

3. Verify the resistance is within the specified range for each solenoid listed in the [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).

- **If the resistance is not within range**

Replace the Q8 Control Solenoid Valve Assembly.

- **If the resistance is within range**

4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.

5. Connect the **DT-47825-20** adapter harness between the vehicle harness connector and the Q8 Control Solenoid Valve Assembly connector. Ignition ON.

6. Verify the scan tool parameters listed below do not display Malfunction:

- Pressure Control Solenoid Valve 2 Performance Test Status
- Pressure Control Solenoid Valve 2 Control Circuit Low Voltage Test Status
- Pressure Control Solenoid Valve 2 Control Circuit High Voltage Test Status
- **If Malfunction is displayed**

Replace the Q8 Control Solenoid Valve Assembly.

- **If Malfunction is not displayed**

7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.

- [Control Module References](#) for Control Solenoid Valve Assembly replacement, programming, and setup.

DTC P0969-P0971: PRESSURE CONTROL SOLENOID VALVE 3

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0969

Pressure Control Solenoid Valve 3 Performance

DTC P0970

Pressure Control Solenoid Valve 3 Control Circuit Low Voltage

DTC P0971

Pressure Control Solenoid Valve 3 Control Circuit High Voltage

Circuit/System Description

Pressure control solenoid 3 is part of the control solenoid valve assembly which has no serviceable components. The normally high pressure control solenoid 3 regulates and directs oil pressure to the R1/4-5-6 regulator valve. Increasing pressure control solenoid 3 pressure increases pressure to the low and reverse clutch or 4-5-6 clutch, depending on the position of the clutch select valve 2. The transmission control module (TCM) varies current to pressure control Solenoid 3 by controlling the time the low side driver is ON and OFF. Decreasing the current to pressure control solenoid 3 increases oil pressure by closing off the solenoid exhaust port. Increasing the current to the pressure control solenoid 3 decreases oil pressure by opening the exhaust port. Power is supplied to the pressure control solenoid 3 by the TCM through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.

Conditions for Setting the DTC

P0969

TCM detects an internal electrical performance malfunction of the clutch pressure control solenoid 3 control circuit where the measured clutch pressure control solenoid 3 currents does not equal the commanded clutch pressure control solenoid 3 current for 5 s.

P0970

TCM detects a short to ground on the clutch pressure control solenoid 3 control circuit for 1 s.

P0971

TCM detects an open or short to voltage on the clutch pressure control solenoid 3 control circuit for 1 s.

Action Taken When the DTC Sets

P0969

- DTC P0969 is a Type C DTC.
- TCM freezes transmission adaptive functions to the low and reverse clutch and 4-5-6 clutch.

P0970 or P0971

- DTCs P0970 and P0971 are Type A DTCs.
- TCM limits the transmission to Reverse and 3rd or 5th gear operation.
- TCM inhibits the torque converter clutch (TCC).
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM turns the high side driver OFF.
- TCM enables torque management.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.

Conditions for Clearing the DTC

- DTC P0969 is a Type C DTC.
- DTCs P0970 and P0971 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Operate the vehicle in second gear long enough to ensure at least a 3A°C (5A°F) rise in TCM temperature, then operate the vehicle with transmission in Park for 5 s.
2. Operate the vehicle in Drive range. Allow the transmission to shift through all forward gear ranges.
3. Verify the scan tool parameters listed below do not display Malfunction:
 - Pressure Control Solenoid Valve 3 Performance Test Status
 - Pressure Control Solenoid Valve 3 Control Circuit Low Voltage Test Status
 - Pressure Control Solenoid Valve 3 Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.
 - **If Malfunction is not displayed**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
5. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **If the DTC does not set**
6. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris and clean as necessary. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).
 - **If contaminated**

Repair as necessary.
 - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid listed in the [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).
 - **If the resistance is not within range**

Replace the Q8 Control Solenoid Valve Assembly.
 - **If the resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect the **DT-47825-20** adapter harness between the vehicle harness connector and the Q8 Control Solenoid Valve Assembly connector. Ignition ON.
6. Verify the scan tool parameters listed below do not display Malfunction:
 - Pressure Control Solenoid Valve 3 Performance Test Status
 - Pressure Control Solenoid Valve 3 Control Circuit Low Voltage Test Status
 - Pressure Control Solenoid Valve 3 Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Replace the Q8 Control Solenoid Valve Assembly.
 - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P0973 OR P0974: SHIFT SOLENOID VALVE 1

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0973

Shift Solenoid Valve 1 Control Circuit Low Voltage

DTC P0974

Shift Solenoid Valve 1 Control Circuit High Voltage

Circuit/System Description

Shift solenoid 1 is part of the control solenoid valve assembly, which has no serviceable components. Shift Solenoid 1 is a normally closed (NC) ON/OFF solenoid and is controlled by the transmission control module (TCM) through a low side driver. When the shift solenoid 1 is energized (ON), shift solenoid 1 fluid pressure is directed to the clutch select valve 2, which allows the valve to overcome the spring pressure and move to the applied position. Power to the shift solenoid 1 is supplied by the TCM through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

- Engine speed is 400 - 7,500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.

Conditions for Setting the DTC

P0973

TCM detects a short to ground on the shift solenoid 1 control circuit for 2 s.

P0974

TCM detects an open or a short to power on the shift solenoid 1 control circuit for 2 s.

Action Taken When the DTC Sets

P0973

- DTC P0973 is a Type A DTC.
- TCM limits the transmission to Reverse and 3rd gear operation.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.

- TCM inhibits auto grade braking

P0974

- DTC P0974 is a Type B DTC.
- TCM inhibits 1st gear.

Conditions for Clearing the DTC

- DTC P0973 is a Type A DTC.
- DTC P0974 is a Type B DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

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- [Transmission General Description](#)
- [Transmission Component and System Description](#)
- [Electronic Component Description](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to [Special Tools](#) .

Circuit/System Verification

1. Operate the vehicle in second gear long enough to ensure at least a 3Â°C (5Â°F) rise in TCM temperature, then operate the vehicle in Park for 5 s.
2. Place the gear selector in Reverse for 5 s and then idle the engine with the gear selector in Park for 5 s.
3. Verify the scan tool parameters listed below do not display Malfunction.
 - Shift Solenoid Valve 1 Control Circuit Low Voltage Test Status
 - Shift Solenoid Valve 1 Control Circuit Open Test Status
 - Shift Solenoid Valve 1 Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.

- **If Malfunction is not displayed**

4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

5. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set**

6. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.

2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris and clean as necessary. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).

- **If contaminated**

Repair as necessary.

- **If not contaminated**

3. Verify the resistance is within the specified range for each solenoid listed in the [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).

- **If the resistance is not within range**

Replace the Q8 Control Solenoid Valve Assembly.

- **If the resistance is within range**

4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.

5. Connect the **DT-47825-20** adapter harness between the vehicle harness connector and the Q8 Control Solenoid Valve Assembly connector. Ignition ON.

6. Verify the scan tool parameters listed below do not display Malfunction:

- Shift Solenoid Valve 1 Control Circuit Low Voltage Test Status
- Shift Solenoid Valve 1 Control Circuit Open Test Status
- Shift Solenoid Valve 1 Control Circuit High Voltage Test Status
- **If Malfunction is displayed**

Replace the Q8 Control Solenoid Valve Assembly.

- **If Malfunction is not displayed**

7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P0976 OR P0977: SHIFT SOLENOID VALVE 2

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0976

Shift Solenoid Valve 2 Control Circuit Low Voltage

DTC P0977

Shift Solenoid Valve 2 Control Circuit High Voltage

Circuit/System Description

Shift solenoid 2 is part of the control solenoid valve assembly, which has no serviceable components. Shift solenoid 2 is a normally closed ON/OFF solenoid and is controlled by the transmission control module (TCM) through a low side driver. When the shift solenoid 2 is energized, fluid pressure is directed to the clutch select valve 3, which allows the valve to overcome the spring pressure and move to the applied position. Power to the shift solenoid 2 is supplied by the TCM through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.

Conditions for Setting the DTC

P0976

TCM detects a short to ground on the shift solenoid 2 control circuit for 2 s.

P0977

TCM detects an open or short to power on the shift solenoid 2 control circuit for 2 s.

Action Taken When the DTC Sets

P0976

- DTC P0976 is a Type C DTC.
- TCM freezes transmission adaptive functions.

P0977

- DTC P0977 is a Type A DTC.
- TCM limits the transmission to Reverse and 3rd gear operation.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM inhibits Tap Up/Down function
- TCM inhibits manual shifting of forward gears

Conditions for Clearing the DTC

- DTC P0976 is a Type C DTC.
- DTC P0977 is a Type A DTC.

Reference Information

[Automatic Transmission Controls Schematics](#)

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

Description and Operation

- [Transmission General Description](#)
- [Transmission Component and System Description](#)
- [Electronic Component Description](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to [Special Tools](#) .

Circuit/System Verification

1. Operate the vehicle in 3rd gear long enough to ensure at least a 3Â°C (5Â°F) rise in TCM temperature.
2. Place the gear selector in Reverse for 5 s and then idle the engine with the gear selector in Park for 5 s.
3. Verify the scan tool parameters listed below do not display Malfunction:
 - Shift Solenoid Valve 2 Control Circuit Low Voltage Test Status
 - Shift Solenoid Valve 2 Control Circuit Open Test Status
 - Shift Solenoid Valve 2 Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.

- **If Malfunction is not displayed**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 5. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set**
6. All OK.

NOTE: You must perform the **Circuit/System Verification** first.

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris and clean as necessary. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).
 - **If contaminated**
Repair as necessary.
 - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid listed in the [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).
 - **If the resistance is not within range**
Replace the Q8 Control Solenoid valve Assembly.
 - **If the resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect the **DT-47825-20** adapter harness between the vehicle harness connector, and the Q8 Control Solenoid Valve Assembly connector. Ignition ON.
6. Verify the scan tool parameters listed below do not display Malfunction:
 - Shift Solenoid Valve 2 Control Circuit Low Voltage Test Status
 - Shift Solenoid Valve 2 Control Circuit Open Test Status
 - Shift Solenoid Valve 2 Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**
Replace the Q8 Control Solenoid Valve Assembly.
 - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P175F: ACCELERATION SENSOR SIGNAL MESSAGE COUNTER INCORRECT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P175F

Acceleration Sensor Signal Message Counter Incorrect

Circuit/System Description

The Multi-Axis Acceleration sensor sends the amount or rate of acceleration to the Electronic Brake Control Module. To improve vehicle performance and transmission shift feel, the Electronic Brake Control Module is constantly sending the Transmission Control Module serial data messages with information regarding the rate of vehicle acceleration. The Transmission Control Module sets this code when it detects a discrepancy in the structure of the message, causing the signal message integrity to be questioned.

Conditions for Running the DTC

- The engine speed is between 400 - 7, 500 RPM for 5 s.
- No other CAN errors are present.

Conditions for Setting the DTC

The Transmission Control Module detects an error in the rolling count value that does not match with the rolling count value sent by the Electronic Brake Control Module.

Action Taken When the DTC Sets

DTC P175F is a Type C DTC.

Conditions for Clearing the DTC

DTC P175F is a Type C DTC.

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Circuit/System Verification

NOTE:

- DTC P175F is an informational DTC.
- Diagnose all other Q8 Control Solenoid Valve Assembly and K17 Electronic Brake Control Module DTCs prior to DTC P175F.

1. Verify with a scan tool, there are no other Q8 Control Solenoid Valve Assembly or K17 Electronic Brake Control Module DTCs set.

- If a DTC is set

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- If a DTC is not set

2. Complete the diagnosis by looking for a CAN fault. Refer to [Scan Tool Does Not Communicate with High Speed GMLAN Device](#)

- If a CAN circuit fault is found

Repair as necessary.

- If a CAN circuit fault is not found

3. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

DTC P1761: UP AND DOWN SHIFT SWITCH SIGNAL MESSAGE COUNTER INCORRECT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.

- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P1761

Up and Down Shift Switch Signal Message Counter Incorrect

Circuit/System Description

When the shift lever is placed in the M position, electronic range select or manual mode, which allows for the selection of the range of gears available, is activated. This is also known as the tap shift function. The manual mode allows the vehicle operator to increase the highest range attainable by pressing the plus (+) button or decrease the highest attainable range by pressing the minus (-) button. The body control module (BCM) supplies a signal circuit to the shift controller. The shift controller has switches connected to a resistor array. A voltage drop occurs across the resistor network. When the plus or minus button is pushed, a corresponding voltage drop occurs across the resistor network. This voltage drop is monitored by the BCM. The BCM will send the request to the transmission control module (TCM) to increase or decrease the available gear ranges. The BCM internal counter increments each time the tap shift signal status is sent and the BCM sends the rolling count with the tap shift signal status. The TCM counter increments each time the tap shift signal status is received. The DTC will set if the rolling count value of the TCM does not match the rolling count sent from the BCM.

Conditions for Running the DTC

- TCM receives the Tap Up and Tap Down message from the BCM.
- Engine speed is 400 - 7, 500 RPM for 5 s.

Conditions for Setting the DTC

TCM detects an error in the rolling count value that does not match with the BCM count, 3 times within 10 s.

Action Taken When the DTC Sets

- DTC P1761 is a Type C DTC.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.

Conditions for Clearing the DTC

DTC P1761 is a Type C DTC.

Reference Information

Schematic Reference

- [Body Control System Schematics](#)
- [Automatic Transmission Controls Schematics](#)
- [Data Communication Schematics](#)

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

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- [Transmission Component and System Description](#)
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- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

NOTE:

- DTC P1761 is an informational DTC.
- Diagnose all other body control module DTCs prior to DTC P1761.

1. Verify there are no other body control module or communication DTCs set.

- If a DTC is set

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- If a DTC is not set

2. Complete the diagnosis by looking for a CAN circuit fault. Refer to [Scan Tool Does Not Communicate with High Speed GMLAN Device](#) .

- If a CAN circuit fault is found

Repair as necessary.

- If a CAN circuit fault is not found

3. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for Control Solenoid Valve Assembly replacement, programming, and setup

DTC P182E OR P1915: INTERNAL MODE SWITCH

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P182E

Internal Mode Switch Indicates Invalid Range

DTC P1915

Internal Mode Switch Does Not Indicate Park/Neutral During Start

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal A	P182E	P1915	P1915	P182E, P1915
Signal B	P1915	P182E	P182E	P182E, P1915
Signal C	P1915	P182E	P182E	P182E, P1915
Signal P	P182E	P1915	P1915	P182E, P1915
Ground	-	P182E	P182E	P182E, P1915

Typical Scan Tool Data

Internal Mode Switch A/B/C/P

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON, range selector in Park			
Parameter Normal Range: Low High High Low			
Signal A	Low	High	High
Signal B	Low	High	High
Signal C	Low	High	High
Signal P	Low	High	High

Circuit/System Description

The manual shift detent lever with shaft position switch assembly, or internal mode switch assembly, is a sliding contact switch attached to the manual shift detent lever within the transmission. The 4 inputs to the transmission control module (TCM), from the switch, indicate the position selected by the transmission manual shaft. The input voltage at the TCM is high when the switch is open and low when the switch is closed to ground. The state of each input is displayed on the scan tool as the internal mode switch A/B/C/P parameter. The internal mode switch input parameters represented are transmission range Signal A, Signal B, Signal C, and Signal P.

The park/neutral position switch is integrated into the transmission internal mode switch. The circuit uses the TCM as a pass-through connector only.

The park/neutral signal is sent from the park/neutral switch directly to the engine control module (ECM) and is used for engine start enable.

Conditions for Running the DTC

P182E

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0401, P042E, P0716, P0717, P0722, or P0723 is not set.
- Engine speed is 400 - 7500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.
- Engine torque signal is valid.

P1915

- DTC P0722, P0723, or P1915 is not set.
- Transmission output shaft speed is 90 RPM or less.
- Ignition voltage was 5 V or greater, and has not dropped below 2 V.

Conditions for Setting the DTC

P182E

Internal mode switch does not indicate a valid Park, Reverse, Neutral or Drive Range gear position for 7 s.

P1915

Internal mode switch does not indicate Park or Neutral during the following sequence:

- Engine speed is 50 RPM or less for 0.25 s or greater.
- Engine speed is 50 - 480 RPM for 0.07 s or greater.
- Engine speed is 525 RPM or greater and the transmission input speed is 200 RPM or greater for 1.25 s.

Action Taken When the DTC Sets

- DTCs P182E and P1915 are Type A DTCs.
- TCM commands maximum line pressure.
- TCM forces the torque converter clutch (TCC) OFF.
- TCM turns all the solenoids OFF.
- TCM freezes transmission adaptive functions.
- TCM limits the transmission to Reverse and 5th gear operation.
- Torque management is enabled.
- TCM turns the high side driver OFF.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.

Conditions for Clearing the DTC

DTCs P182E and P1915 are Type A DTCs.

Diagnostic Aids

Under certain driving conditions, DTC P182E could set due to an intermittent low voltage fault on the park/neutral signal circuit, before conditions for setting DTC P0851 are met. Reference Information

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
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Electrical Information Reference

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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to [Special Tools](#).

Circuit/System Verification

1. Verify the range selector lever cable is adjusted correctly. Refer to [Range Selector Lever Cable Adjustment](#).
 - **If cable adjustment is not correct**
Repair as necessary.
 - **If cable adjustment is correct**
2. Ignition ON.
3. Verify the scan tool transmission control module Internal Mode Switch A/B/C/P parameter matches the [Transmission Internal Mode Switch Logic](#) table for each gear shift lever position.
 - **If the parameter does not match**
Refer to Circuit/System Testing.
 - **If the parameter matches**
4. Verify the scan tool engine control module Park/Neutral Position Switch parameter displays Park/Neutral with the gear shift lever in Park or Neutral and In Gear when in Reverser or Drive.
 - **If Park/Neutral or In Gear is not displayed**
Refer to Circuit/System Testing.
 - **If Park/Neutral and In Gear is displayed**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **If the DTC does not set**
7. All OK.

Circuit/System Testing

NOTE:

- **You must perform Circuit/System Verification first.**

1. Ignition OFF, remove the control valve body cover.
2. Connect the vehicle harness connector to the Q8 Control Solenoid Valve Assembly.
3. Disconnect the B15 Transmission Internal Mode Switch connector at the Q8 Control Solenoid Valve Assembly.
4. Ignition ON.
5. Verify the scan tool transmission control module Internal Mode Switch A/B/C/P parameter displays High High High High.
 - **If High High High High is not displayed**
Replace the Q8 control solenoid valve assembly.
 - **If High High High High is displayed**

6. Verify the scan tool engine control module Park/Neutral Position Switch parameter displays In Gear.
 - **If In Gear is not displayed**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the neutral start signal circuit and ground at the vehicle harness K20 Engine Control Module connector.
 - If less than infinite resistance, repair the short to ground on the circuit
 - If infinite resistance, replace the K20 Engine Control Module
 - **If In Gear is displayed**
7. Install a 3 A fused jumper wire between the low reference circuit terminal A and each signal circuit listed below one at a time at the Q8 Control Solenoid Valve Assembly.
 - Signal A - terminal E
 - Signal B - terminal D
 - Signal C - terminal C
 - Signal P - terminal B
8. Verify the scan tool TCM A/B/C/P displays 1 Low and 3 High when a signal circuit is grounded.
 - **If 1 Low and 3 High is not displayed**

Replace the Q8 control solenoid valve assembly.
 - **If 1 Low and 3 High is displayed**
9. Connect a 3 A fused jumper wire between park/neutral switch signal circuit terminal F and low reference circuit terminal A at the Q8 Control Solenoid Valve Assembly.
10. Verify the scan tool engine control module Park/Neutral Position Switch parameter displays Park/Neutral.
 - **If Park/Neutral is not displayed**
 1. Ignition OFF, disconnect the connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the signal circuit end to end
 - If 2 Ω or greater, repair the open/high resistance in the circuit
 - If less than 2 Ω , replace the K20 Engine Control Module
 - **If Park/Neutral is displayed**
11. Replace the B15 Transmission Internal Mode Switch.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Valve Body Cover Replacement](#)
- [Control Solenoid Valve and Transmission Control Module Assembly Replacement](#)
- [Manual Shift Detent Lever with Shaft Position Switch Assembly Replacement](#)
- [Range Selector Lever Cable Adjustment](#)
- [Control Module References](#) for ECM or control solenoid valve assembly replacement, programming, and setup.

DTC P2714 OR P2715: PRESSURE CONTROL SOLENOID VALVE 4

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

NOTE:

The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.

DTC P2714

Pressure Control Solenoid Valve 4 Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P2715

Pressure Control Solenoid Valve 4 Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

Pressure control solenoid 4 is part of the control solenoid valve assembly which has no serviceable components. Pressure control solenoid 4 regulates transmission fluid pressure to the 2-6 clutch regulator valve which controls pressure to the 2-6 clutch. The transmission control module (TCM) calculates gear ratio based on the speed signals from the input shaft speed (ISS) sensor and the output shaft speed (OSS) sensor. The TCM compares the expected transmission gear ratio to the calculated gear ratio for each commanded gear.

Conditions for Running the DTC**P2714**

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- Ignition voltage is between 8.6-32 V.
- Output speed is 36 RPM or greater, or accelerator pedal position is 0.5 % or greater.
- Throttle position signal is valid.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Transmission fluid temperature is -6.7°C (20°F) or greater.
- High side driver is enabled.

P2715

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- Ignition voltage is 8.6-32.0 V.
- High side driver is enabled.
- Transmission fluid temperature is -6.7°C (20°F) or greater.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Transmission output shaft speed is 36 RPM or greater, or the accelerator pedal position is 0.5 % or greater.
- Commanded and attained range is not 1st gear.

Conditions for Setting the DTC**P2714**

TCM has detected an incorrect gear ratio or neutral condition when the 2-6 clutch is commanded ON. This condition must occur 3 times.

P2715

TCM has detected an incorrect gear ratio change when the 2-6 clutch is commanded OFF during a shift or, when 2nd gear ratio is detected in 1st gear. This condition must occur 3 times.

Action Taken When the DTC Sets

- DTCs P2714 and P2715 are Type A DTCs.
- TCM commands maximum line pressure.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM freezes transmission adaptive functions.
- TCM limits the transmission to Reverse and 3rd gear operation - P2714 only.
- TCM inhibits auto grade braking.
- TCM inhibits neutral idle.
- TCM limits the transmission to Reverse and 2nd gear operation - P2715 only.

Conditions for Clearing the DTC

DTCs P2714 and P2715 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

Description and Operation

- [Transmission General Description](#)
- [Transmission Component and System Description](#)
- [Electronic Component Description](#)
- [Drive Range, First Gear](#)
- [Drive Range, Sixth Gear](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

WARNING: Refer to [Parking Brake and Drive Wheels Warning](#) .

NOTE: If other DTCs are set, diagnose those DTCs first.

1. Engine idling with transmission in Park, with parking brake applied and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to [Transmission Fluid Level and Condition Check](#).
 - If the transmission fluid level and condition is not correct

Repair as necessary.

- **If the transmission fluid level and condition is correct**

3. Ignition ON, clear the TCM DTCs with a scan tool.

4. Verify DTC P2714 or P2715 does not set while performing a road test. Refer to [Road Test](#).

- **If DTC P2714 or P2715 sets**

Refer to Circuit/System Testing.

- **If DTC P2714 or P2715 does not set**

5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

6. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **If DTC does not set**

7. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Verify the transmission line pressures are within the specified range. Refer to [Line Pressure Check](#), and [Solenoid Valve Pressure](#).

- **If the pressures are not within range**

Refer to [Fluid Pressure High or Low](#).

- **If the pressures are within range**

2. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.

3. Verify the pressure changes for all solenoids when performing the solenoid test. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test](#).

- **If the pressure does not change**

Replace the Q8 Control Solenoid Valve Assembly.

- **If the pressure changes**

4. Verify the conditions listed below do not exist. Repair or replace as necessary.

P2714 or P2715 Control Valve Upper Body Assembly

2-6 clutch regulator valve stuck/sticking - debris, binding, damaged valve, or scored bore.

P2714

Actuator feed limit circuit supply fluid to solenoid restricted or not available - debris or sediment blockage.

P2714 or P2715 Channel Plate and Spacer Plate

Oil channels or orifices blocked by debris.

P2714 or P2715 Control Solenoid Valve Assembly

- Clutch pressure control solenoid 4 stuck ON or stuck OFF.
- Control signal fluid supply leak - valve body filter plate assembly cracked or damaged gasket seal.
- Clutch pressure control solenoid 2 stuck OFF.

P2714 or P2715 Automatic Transmission Case Cover

- 2-6 clutch return spring retaining ring not seated in groove.
- 2-6 clutch piston assembly seal damaged or leaking.
- 2-6 clutch plates worn or damaged.

P2714 Automatic Transmission Fluid Pump Assembly

- Fluid pump housing/vanes/rotor/slide damaged/scored.
- A/Trans pump fluid outlet seal assembly damaged/leaking.

P2714 Automatic Transmission Fluid Filter Assembly

Oil filter or filter seal loose or damaged.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Valve Lower Body and Upper Body Replacement](#)
- [Reaction Carrier Hub and 2-6 Clutch Plate Removal](#)
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P2719-P2721: PRESSURE CONTROL SOLENOID VALVE 4

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P2719

Pressure Control Solenoid Valve 4 Performance

DTC P2720

Pressure Control Solenoid Valve 4 Control Circuit Low Voltage

DTC P2721

Pressure Control Solenoid Valve 4 Control Circuit High Voltage

Circuit/System Description

Pressure control solenoid 4 is part of the control solenoid valve assembly which has no serviceable components. The normally low pressure control solenoid 4 regulates and directs oil pressure to the 2-6 clutch regulator valve. Increasing pressure control solenoid 4 pressure increases pressure to the 2-6 clutch. The transmission control module (TCM) varies current to the pressure control solenoid 4 by controlling the amount of time the low side driver is ON and OFF. Increasing the ON time increases current to the clutch pressure control solenoid 4. Increasing current to pressure control solenoid 4 increases oil pressure by closing off the solenoid exhaust port. Decreasing the current to the pressure control solenoid 4 decreases oil pressure by opening the exhaust port. Pressure control solenoid 4 power is supplied by the TCM through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.

Conditions for Setting the DTC

P2719

TCM detects an internal electrical performance malfunction on the clutch pressure control 4 control circuit where the measured pressure control solenoid 4 current does not equal the commanded clutch pressure control solenoid 4 current for 5 s.

P2720

TCM detects a short to ground on the clutch pressure control solenoid 4 control circuit for 1 s.

P2721

TCM detects an open or short to voltage on the clutch pressure control solenoid 4 control circuit for 1 s.

Action Taken When the DTC Sets

P2719

- DTC P2719 is a Type C DTC.
- TCM freezes transmission adaptive functions on the 2-6 clutch.

P2720

- DTC P2720 is a Type A DTC.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM commands 2nd gear if the transmission is in a forward gear and the output speed is less than 1350 RPM, or neutral if the output speed is 1, 350 RPM or greater.

P2721

- DTC P2721 is a Type A DTC.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM limits the transmission to Reverse and 3rd gear operation.

Conditions for Clearing the DTC

- DTC P2719 is a Type C DTC.
- DTCs P2720 and P2721 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

- [Transmission General Description](#)
- [Transmission Component and System Description](#)
- [Electronic Component Description](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to [Special Tools](#) .

[Circuit/System Verification](#)

1. Operate the vehicle in second gear long enough to ensure at least a 3Â°C (5Â°F) rise in TCM temperature, then operate the vehicle in Park for 5 s.
2. Operate the vehicle in Drive range. Allow the transmission to shift through all forward gear ranges.
3. Verify the scan tool parameters listed below do not display Malfunction:
 - Pressure Control Solenoid Valve 4 Performance Test Status
 - Pressure Control Solenoid Valve 4 Control Circuit Low Voltage Test Status
 - Pressure Control Solenoid Valve 4 Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.
 - **If Malfunction is displayed**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
5. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing
 - **If the DTC does not set**
6. All OK.

[Circuit/System Testing](#)

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris and clean as necessary. Refer to [Control Solenoid Valve and Transmission Control Module Assembly](#)

Inspection.

- **If contaminated**

Repair as necessary.

- **If not contaminated**

3. Verify the resistance is within the specified range for each solenoid listed in the **Control Solenoid Valve and Transmission Control Module Assembly Inspection.**

- **If the resistance is not within range**

Replace the Q8 Control Solenoid Valve Assembly

- **If the resistance is within range.**

4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.

5. Connect the **DT-47825-20** adapter harness between the vehicle harness connector, and the Q8 Control Solenoid Valve Assembly connector. Ignition ON.

6. Verify the scan tool parameters listed below do not display Malfunction:

- Pressure Control Solenoid Valve 4 Performance Test Status
- Pressure Control Solenoid Valve 4 Control Circuit Low Voltage Test Status
- Pressure Control Solenoid Valve 4 Control Circuit High Voltage Test Status
- **If Malfunction is displayed**

Replace the Q8 Control Solenoid Valve Assembly.

- **If Malfunction is not displayed**

7. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repairs.

- Perform the **Reset Transmission Adapts** following all transmission repairs.
- **Control Module References** for control solenoid valve assembly replacement, programming, and setup.

DTC P2723 OR P2724: PRESSURE CONTROL SOLENOID VALVE 5

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

NOTE: The DTCs listed below set due to a transmission hydraulic/mechanical condition. Perform the Circuit/System Verification and Circuit/System Testing to identify the cause.

DTC P2723

Pressure Control Solenoid Valve 5 Stuck Off - Transmission Hydraulic/Mechanical Performance

DTC P2724

Pressure Control Solenoid Valve 5 Stuck On - Transmission Hydraulic/Mechanical Performance

Circuit/System Description

Pressure control solenoid 5 is part of the control solenoid valve assembly which has no serviceable components. Pressure control solenoid 5 regulates the transmission fluid pressure to the 1-2-3-4 clutch regulator valve, which controls pressure to the 1-2-3-4 clutch. The transmission control module (TCM) calculates gear ratio based on the speed signals from the input shaft speed (ISS) sensor and the output shaft speed (OSS) sensor. The TCM compares the expected transmission gear ratio to the calculated gear ratio for each commanded gear.

Conditions for Running the DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P042E, P0716, P0717, P0722, P0723, or P182E is not set.
- Ignition voltage is between 8.6 - 32 V.
- High side driver is enabled.
- Output speed is 36 RPM or greater, or the accelerator pedal position is 0.5 % or greater.
- Throttle position signal is valid.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Transmission fluid temperature is -6.7°C (20°F) or greater.

Conditions for Setting the DTC

P2723

TCM has detected an incorrect gear ratio or neutral condition when the 1-2-3-4 clutch is commanded ON. This condition must occur 3 times.

P2724

TCM has detected an incorrect gear ratio change when the 1-2-3-4 clutch is commanded OFF during a shift. This condition must occur 3 times.

Action Taken When the DTC Sets

P2723

- DTC P2723 is a Type A DTC.
- TCM freezes transmission adaptive functions.
- TCM commands maximum line pressure.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- Torque management is enabled.
- TCM inhibits auto grade braking.
- TCM limits the transmission to Reverse and fifth gear operation.

P2724

- DTC P2724 is a Type A DTC.
- TCM freezes transmission adaptive functions.
- TCM commands maximum line pressure.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM inhibits auto grade braking.
- TCM limits the transmission to Reverse, first, or third gear operation.

Conditions for Clearing the DTC

DTCs P2723 and P2724 are Type A DTCs.

Diagnostic Aids

Before performing a road test, configure and setup the scan tool for snapshot mode. This will allow you to display, monitor, and verify multiple transmission data parameters at one time, after the road test.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

Description and Operation

- [Transmission General Description](#)
- [Transmission Component and System Description](#)
- [Electronic Component Description](#)
- [Drive Range, First Gear Engine Braking](#)
- [Drive Range, Second Gear](#)
- [Drive Range, Third Gear](#)
- [Drive Range, Fourth Gear](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

WARNING: Refer to [Parking Brake and Drive Wheels Warning](#) .

NOTE: If other DTCs are set, diagnose those DTCs first.

1. Engine idling, transmission in Park, with parking brake applied and drive wheels chocked.
2. Verify the transmission fluid level and condition is correct. Refer to [Transmission Fluid Level and Condition Check](#).
 - **If the transmission fluid level and condition is not correct**
Repair as necessary.
 - **If the transmission fluid level and condition is correct**
3. Ignition ON, clear the TCM DTCs with a scan tool.
4. Verify DTC P2723 or P2724 does not set while performing a road test. Refer to [Road Test](#).
 - **If DTC P2723 or P2724 sets**
Refer to Circuit/System Testing.
 - **If DTC P2723 or P2724 does not set**

5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame//Failure Records data.
6. Verify the does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Engine idling at the normal operating temperature.
2. Verify the transmission line pressures are within the specified range. Refer to **Line Pressure Check**, and **Solenoid Valve Pressure**.
 - **If the pressures are not within range**

Refer to **Fluid Pressure High or Low**.
 - **If the pressures are within range**
3. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
4. Verify the pressure changes for all solenoids when performing the solenoid test. Refer to **Control Solenoid Valve and Transmission Control Module Assembly Solenoid Performance Test**.
 - **If the pressure change does not occur**

Replace the Q8 Control Solenoid Valve Assembly.
 - **If the pressure changes**
5. Verify the conditions listed below do not exist. Repair or replace as necessary.

DTC P2723 Control Valve Upper Body Assembly

Manual shift detent (w/shaft position switch) lever assembly not engaged with manual shaft.

DTC P2723 Control Valve Upper Body Assembly

Clutch select valve 3 stuck OFF from debris, binding, damaged valve, or scored bore.

DTC P2723 or P2724 Lower Control Valve Body Assembly

- Actuator feed limit circuit supply fluid to solenoid restricted or not available from debris or sediment blockage.
- 1-2-3-4 clutch boost valve binding or scored bore which can also cause harsh shifts.
- 1-2-3-4 clutch regulator valve stuck/sticking from debris, binding, damaged valve, or scored bore.

DTC P2723 or P2724 Control Solenoid Valve Assembly

- Clutch pressure control solenoid 5 stuck ON or stuck OFF.
- Clutch pressure control solenoid 2 stuck OFF.
- Control solenoid filter plate assembly blocked, or damaged gasket seal.

DTC P2723 Channel Plate and Spacer Plate

Channel plate and spacer plate oil channels or orifices blocked by debris.

DTC P2723 1-2-3-4 Clutch Assembly

- 1-2-3-4 clutch piston cracked/damaged/leaking.
- 1-2-3-4 clutch backing plate retaining ring not seated/oriented, causing clutch pack/piston over travel.

DTC P2723 Low and Reverse Clutch Assembly

- Low and reverse clutch assembly will not hold torque.
- Low and reverse clutch assembly friction plate support face cracked/damaged.

DTC P2723 Automatic Transmission Case

Transmission case 1-2-3-4 clutch fluid passage seal damaged/leaking.

DTC P2723 Automatic Transmission Fluid Pump

- Fluid pump housing vanes/rotor/slide damaged/scored.
- Fluid pump outlet seal assembly damaged/leaking.

DTC P2723 Torque Converter Assembly

Fluid pump or torque converter overstressed due to high temperatures.

DTC P2723 Automatic Transmission Fluid Filter Assembly

Oil filter or filter seal loose or damaged.

DTC P2723 Reaction Sun Gear Assembly

- Reaction sun gear broke away from shell.
- Input sun gear missing or broken.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Valve Lower Body and Upper Body Replacement](#)
- [Low and Reverse Clutch and 1-2-3-4 Clutch Plate Removal](#)
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P2728-P2730: PRESSURE CONTROL SOLENOID VALVE 5

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P2728

Pressure Control Solenoid Valve 5 Performance

DTC P2729

Pressure Control Solenoid Valve 5 Control Circuit Low Voltage

DTC P2730

Pressure Control Solenoid Valve 5 Control Circuit High Voltage

Circuit/System Description

Pressure solenoid 5 is part of the control solenoid valve assembly which has no serviceable components. The normally low pressure control solenoid 5 regulates and directs oil pressure to the 1-2-3-4 clutch

regulator valve. Increasing pressure control solenoid 5 pressure increases pressure to the 1-2-3-4 clutch. The transmission control module (TCM) varies the current to the pressure control solenoid 5 by controlling the amount of time the low side driver is ON and OFF. Decreasing the current to pressure control solenoid 5 decreases pressure control solenoid 5 oil pressure by opening the solenoid exhaust port. Increasing the current to pressure control solenoid 5 increases pressure control solenoid 5 oil pressure by closing OFF the solenoid exhaust port. Pressure control solenoid 5 power is supplied by the TCM through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC

- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.

Conditions for Setting the DTC

P2728

TCM detects an internal electrical performance malfunction of the pressure control solenoid 5 control circuit where the measured pressure control solenoid 5 current does not equal the commanded pressure control solenoid 5 current for 5 s.

P2729

TCM detects a short to ground on the pressure control solenoid 5 control circuit for 1 s.

P2730

TCM detects an open or short to voltage on the pressure control solenoid 5 control circuit for 1 s.

Action Taken When the DTC Sets

P2728

- DTC P2728 is a Type C DTC.
- TCM freezes transmission adaptive functions on the 1-2-3-4 clutch.

P2729

- DTC P2729 is a Type A DTC.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM limits the transmission to Reverse, 1st and 3rd gear operation.

P2730

- DTC P2730 is a Type A DTC.
- TCM inhibits the TCC.
- TCM forces the high side driver OFF.
- TCM commands maximum line pressure.
- TCM freezes transmission adaptive functions.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- Torque management in enabled.
- TCM limits the transmission to Reverse and 3rd or 5th gear operation.

Conditions for Clearing the DTC

- DTC P2728 is a Type C DTC.
- DTCs P2729 and P2730 are Type A DTCs.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Operate the vehicle in second gear long enough to ensure at least a 3Â°C (5Â°F) rise in TCM temperature.
2. Operate the vehicle in Drive range. Allow the transmission to shift through all forward gear ranges.
3. Verify the scan tool parameters listed below do not display Malfunction:
 - Pressure Control Solenoid Valve 5 Performance Test Status
 - Pressure Control Solenoid Valve 5 Control Circuit Low Voltage Test Status
 - Pressure Control Solenoid Valve 5 Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.

- **If Malfunction is not displayed**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 5. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set**

6. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris and clean as necessary. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).
 - **If contaminated**
Repair as necessary.
 - **If not contaminated**
3. Verify the resistance is within the specified range for each solenoid listed in the [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).
 - **If the resistance is not within range**
Replace the Q8 Control Solenoid Valve Assembly.
 - **If the resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect the **DT-47825-20** adapter harness between the vehicle harness connector, and the Q8 Control Solenoid Valve Assembly connector. Ignition ON.
6. Verify the scan tool parameters listed below do not display Malfunction:
 - Pressure Control Solenoid Valve 5 Performance Test Status
 - Pressure Control Solenoid Valve 5 Control Circuit High Voltage Test Status
 - Pressure Control Solenoid Valve 5 Control Circuit Low Voltage Test Status
 - **If Malfunction is displayed**
Replace the Q8 Control Solenoid Valve Assembly.
 - **If Malfunction is not displayed**
7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

DTC P2762, P2763, OR P2764: TORQUE CONVERTER CLUTCH (TCC) PRESSURE CONTROL SOLENOID VALVE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P2762

DTC P2763

Torque Converter Clutch (TCC) Pressure Control Solenoid Valve Control Circuit High Voltage

DTC P2764

Torque Converter Clutch (TCC) Pressure Control Solenoid Valve Control Circuit Low Voltage

Circuit/System Description

The torque converter clutch (TCC) pressure control solenoid is part of the control solenoid valve assembly which has no serviceable components. The normally low TCC pressure control solenoid regulates oil pressure to the TCC regulator valve and TCC control valve. Increasing TCC pressure control solenoid oil pressure increases oil pressure to the torque converter to apply the clutch. The transmission control module (TCM) varies the current to the TCC pressure control solenoid by controlling the amount of time the low side driver is ON and OFF. Increasing current to the TCC pressure control solenoid increases oil pressure by closing OFF the solenoid exhaust port. Decreasing current to the TCC pressure control solenoid decreases oil pressure by opening up the solenoid exhaust port. TCC pressure control solenoid power is supplied by the TCM through a high side driver. The high side driver protects the circuit and components from excessive current flow. If excessive current flow is detected, the high side driver will turn OFF. When the fault is corrected, the high side driver will reset.

Conditions for Running the DTC**P2762**

- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.

P2763 and P2764

- DTC P0658 or P0659 is not set.
- Engine speed is 400 - 7, 500 RPM for 5 s.
- Ignition voltage is 8.6 - 32 V.
- High side driver is enabled.

Conditions for Setting the DTC**P2762**

TCM detects an internal electrical performance malfunction of the TCC pressure control solenoid control circuit where the measured TCC pressure control solenoid current does not equal the commanded TCC pressure control solenoid for 5 s.

P2763

TCM detects an open/high resistance or short to voltage on the TCC pressure control solenoid control circuit for 5 s.

P2764

TCM detects a short to ground on the TCC pressure control solenoid control circuit for 5 s.

Action Taken When the DTC Sets**P2762**

DTC P2762 is a Type C DTC.

P2763

- DTC P2763 is a Type B DTC.

- TCM inhibits 6th gear.
- TCM forces TCC OFF.
- TCM commands the hot mode shift pattern.

P2764

- DTC P2764 is a Type A DTC.
- TCM inhibits TCC.
- TCM freezes transmission adaptive functions.
- TCM commands maximum line pressure.
- TCM inhibits Tap Up/Down function.
- TCM inhibits manual shifting of forward gears.
- TCM limits the transmission to Reverse and 5th gear operation.
- Torque management is enabled.
- TCM commands the high side driver OFF.

Conditions for Clearing the DTC

- DTC P2762 is a Type C DTC.
- DTC P2763 is a Type B DTC.
- DTC P2764 is a Type A DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-20 Adapter Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Operate the vehicle in second gear long enough to ensure at least a 3Â°C (5Â°F) rise in TCM temperature.
2. Operate the vehicle in Drive range and ensure TCC is commanded ON for 1 min.
3. Verify the scan tool parameters listed below do not display Malfunction:
 - TCC Pressure Control Solenoid Valve Control Circuit Status
 - TCC Pressure Control Solenoid Valve Control Circuit Low Voltage Test Status
 - TCC Pressure Control Solenoid Valve Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.
 - **If Malfunction is not displayed**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
5. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **If the DTC does not set**
6. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF, remove the Q8 Control Solenoid Valve Assembly.
2. Verify the Q8 Control Solenoid Valve Assembly is not contaminated with any debris and clean as necessary. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).
 - **If contaminated**

Repair as necessary.
 - **If not contaminated.**
3. Verify the resistance is within the specified range for each solenoid listed in the [Control Solenoid Valve and Transmission Control Module Assembly Inspection](#).
 - **If the resistance is not within range**

Replace the Q8 Control Solenoid Valve Assembly.
 - **If the resistance is within range**
4. Place the Q8 Control Solenoid Valve Assembly on a clean work surface near the transmission assembly.
5. Connect the **DT-47825-20** adapter harness between the vehicle harness connector, and the Q8 Control Solenoid Valve Assembly connector. Ignition ON.
6. Verify the scan tool parameters listed below do not display Malfunction:
 - TCC Pressure Control Solenoid Valve Control Circuit Status
 - TCC Pressure Control Solenoid Valve Control Circuit Low Voltage Test Status
 - TCC Pressure Control Solenoid Valve Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Replace the Q8 Control Solenoid Valve Assembly.
 - **If Malfunction is not displayed**

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repairs.

- Perform the [Reset Transmission Adapts](#) following all transmission repairs.
- [Control Module References](#) for control solenoid valve assembly replacement, programming, and setup.

SYMPTOMS - AUTOMATIC TRANSMISSION

NOTE: Use the symptom tables only if the following conditions are met:

- Refer to [Diagnostic Starting Point - Vehicle](#) .
- There are no DTCs set.
- The control modules can communicate via the serial data link.
- Review the system operation in order to familiarize yourself with the system functions. Refer to [Transmission General Description](#) , and [Transmission Component and System Description](#) .

Visual/Physical Inspection

Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to [Testing for Intermittent Conditions and Poor Connections](#) .

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- Fluid Diagnosis
 - [Transmission Fluid Level and Condition Check](#)
 - [Fluid Pressure High or Low](#)
 - [Automatic Transmission Fluid Leaks](#)
 - [Fluid Leak Diagnosis](#)
- Noise and Vibration Diagnosis
 - [Whine/Growl Noise](#)
 - [Noise and Vibration Analysis](#)
 - [Torque Converter Diagnosis](#)
- Range Performance Diagnosis
 - [No Park](#)
 - [No Drive in All Ranges](#)
 - [No Reverse Gear](#)
- Shift Quality Feel Diagnosis
 - [Harsh Garage Shift](#)
 - [Harsh or Late First, Second, Third, and Fourth Shift](#)
 - [Harsh First and Reverse Shift](#)
 - [Harsh or Late Second and Sixth Shift](#)
 - [Harsh or Late Third, Fifth, and Reverse Shift](#)
 - [Harsh Fourth, Fifth, and Sixth Shift](#)
- Shift Pattern

- No First and Reverse Gears
- No First, Second, Third, and Fourth Gear
- No Second and Sixth Gear
- No Fourth, Fifth, and Sixth Gear
- No Third, Fifth, and Reverse Gear
- Torque Converter Diagnosis
 - Torque Converter Diagnosis
 - No Torque Converter Clutch Apply
 - No Torque Converter Clutch Release
- Symptom Not Found or No Symptom Detected
 - Transmission Fluid Level and Condition Check
 - Road Test
 - Line Pressure Check

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY INSPECTION

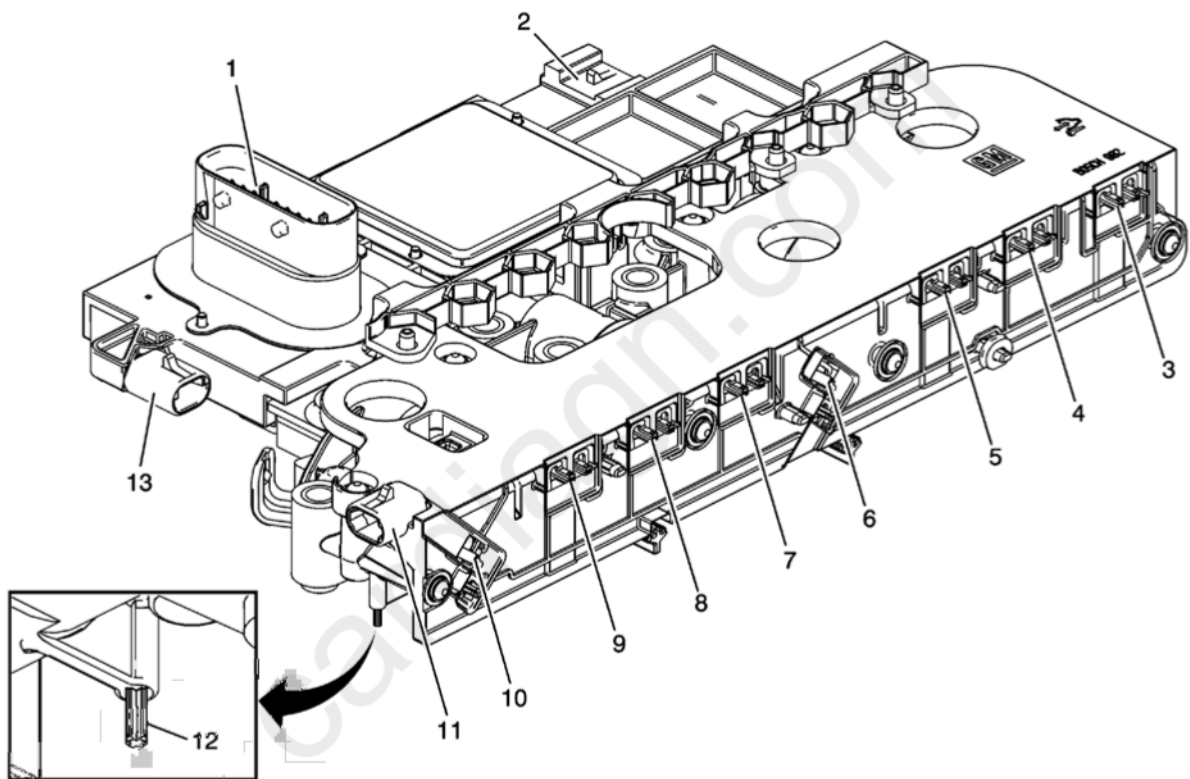


Fig. 1: Identifying Control Solenoid Valve & Transmission Control Module Assembly
 Courtesy of GENERAL MOTORS COMPANY

1. Inspect the control solenoid valve assembly connectors and pins (1, 2, 11, 13) for the following conditions:
 - Damage
 - Bent pins
 - Debris
 - Broken retaining tab
 - Contamination
2. Ensure no metallic debris is inside the connectors near the terminal pins.
3. Inspect the control solenoid valve assembly solenoid leads (3) for contamination or metallic debris.
4. Inspect the 4 control solenoid valve assembly filter plate retaining tabs (12) for cracks and ensure proper tension when filter plate is attached.

Solenoid Name	Illustration Number of Solenoid Lead	Expected Resistance (Ohms)
Line Pressure Control Solenoid	3	4.5 - 5.2 Ω
Pressure Control Solenoid 2 (PCS2)	5	4.5 - 5.2 Ω
Pressure Control Solenoid 3 (PCS3)	9	4.5 - 5.2 Ω
Pressure Control Solenoid 4 (PCS4)	4	4.5 - 5.2 Ω
Pressure Control Solenoid 5 (PCS5)	8	4.5 - 5.2 Ω
Shift Solenoid 1 (SS1)	10	22 - 25 Ω
Shift Solenoid 2 (SS2)	6	22 - 25 Ω
Torque Converter Clutch (TCC) Pressure Control Solenoid	7	4.5 - 5.2 Ω

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY INPUT SHAFT SPEED/OUTPUT SHAFT SPEED INPUT TEST

Special Tools

- EL 35616 GM-Approved Terminal Test Kit
- EL 38522 Variable Signal Generator

For equivalent regional tools, refer to [Special Tools](#) .

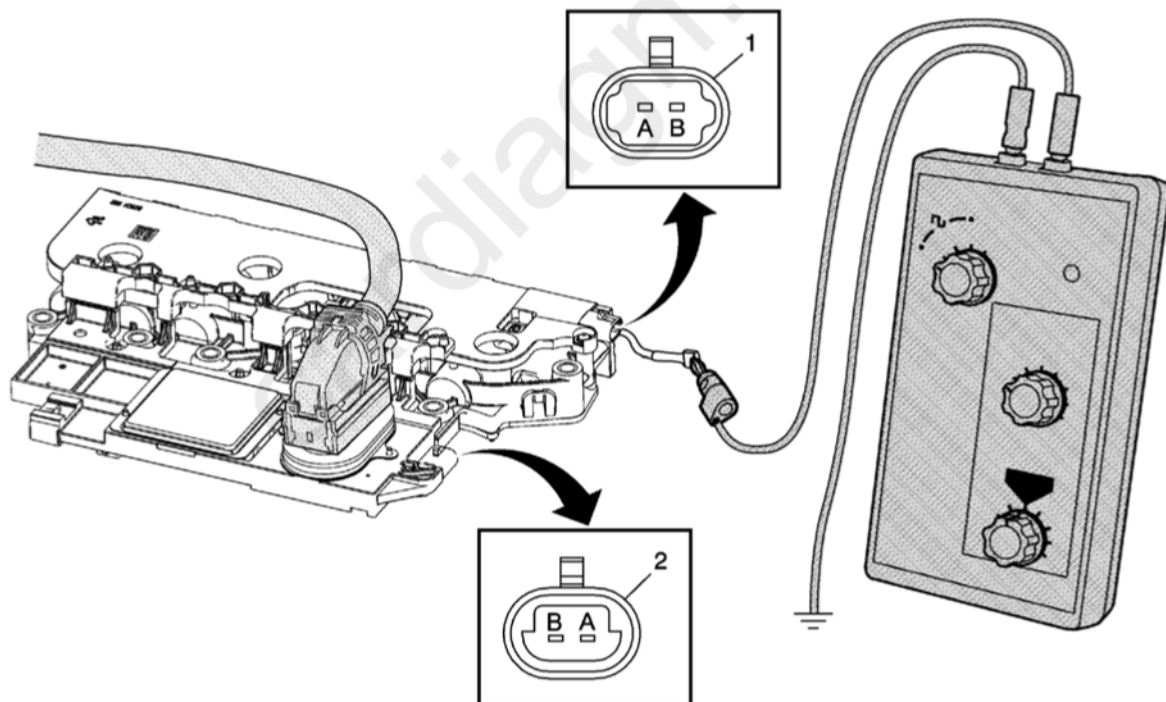


Fig. 2: Identifying Special Tools - J 38522 And J 35616
Courtesy of GENERAL MOTORS COMPANY

The purpose of this test is to provide a simulated input/output speed sensor (ISS/OSS) signal to the control solenoid valve assembly ISS/OSS input circuits.

Transmission Input Speed Sensor

1. Ignition OFF, disconnect the ISS wiring harness connector X3 (1) from the control solenoid valve assembly.
2. Ignition ON, test for 8.3 - 9.3 volts at terminal A.

- If not within the specified range, replace the control solenoid valve assembly. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Replacement](#) .
3. Ignition OFF, using the **EL 35616** terminal test kit, connect the **EL38522** variable signal generator red lead to the ISS signal circuit terminal B on the TCM.
 4. Connect the black lead from the **EL 38522** variable signal generator to ground.
 5. Set the **EL 38522** variable signal generator to 5 volts, the frequency to 300 Hz, and the percent duty cycle to 50 or the normal position.
 6. Ignition ON, verify with a scan tool the Transmission ISS parameter is between 495 - 505 RPM.
- If not within the specified range, replace the control solenoid valve assembly. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Replacement](#) .

Transmission Output Speed Sensor

1. Ignition OFF, disconnect the OSS wiring harness connector X4 (2) from the control solenoid valve assembly.
2. Ignition ON, test for 8.3 - 9.3 volts at terminal A.
 - If not within the specified range, replace the control solenoid valve assembly. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Replacement](#) .
3. Ignition OFF, using the **EL 35616** terminal test kit, connect the **EL 38522** variable signal generator red lead to the OSS signal circuit terminal B on the TCM.
4. Connect the black lead from the **EL 38522** variable signal generator to ground.
5. Set the **EL 38522** variable signal generator to 5 volts, the frequency to 300 Hz, and the percent duty cycle to 50 or the normal position.
6. Ignition ON, verify with a scan tool the Transmission OSS parameter is between 256 - 266 RPM.
 - If not within the specified range, replace the control solenoid valve assembly. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Replacement](#) .

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY SOLENOID PERFORMANCE TEST

Special Tools

- **DT-47825-100** Solenoid Test Plate
- **DT-47825-20** Adapter Harness

For equivalent regional tools, refer to [Special Tools](#) .

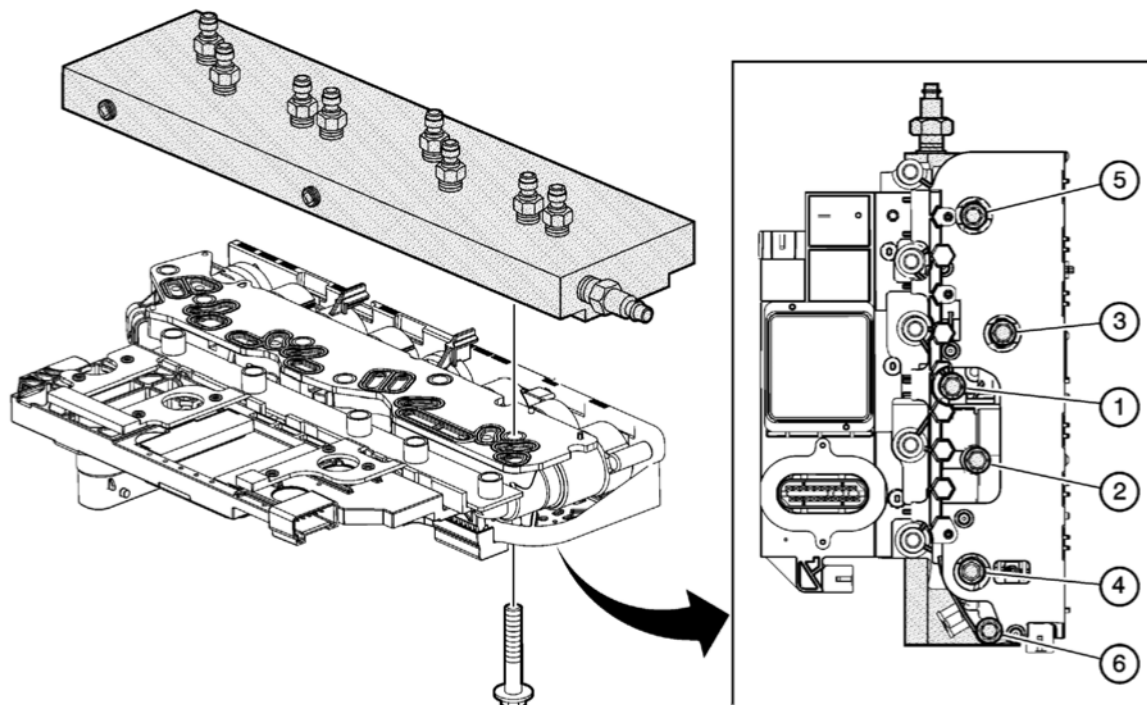


Fig. 3: Control Solenoid Valve Assembly Solenoids
Courtesy of GENERAL MOTORS COMPANY

The purpose of this procedure is to test the functionality of the control solenoid valve assembly solenoids for a gross stuck open or stuck closed condition. The **DT-47825-100** test plate is bolted to the control solenoid valve assembly on the valve body mounting surface. Pressurized air is passed into the aluminum test plate, through the control solenoid valve assembly solenoid passage and back to a pressure gauge on the test plate. The pressure gauge indicates open if air pressure is passed through the solenoid, or closed if the solenoid is unable to pass air through. A scan tool is used to command the solenoids ON and OFF. While watching the pressure gauge, one can determine the valve functionality. The recommended shop air pressure for this test is 90 - 100 psi.

1. Ignition Off
2. Remove the Q8 Control Solenoid Valve assembly from the transmission. Refer to: [Control Solenoid Valve and Transmission Control Module Assembly Replacement](#)

CAUTION: Refer to [Fastener Caution](#) .

NOTE: Drain the Q8 Control Solenoid Valve Assembly of excess transmission fluid before attaching to test block and use caution when attaching air to test block air inlet.

3. Bolt the **DT-47825-100** test plate to the control solenoid valve assembly on the valve body mounting surface. Use the bolts and washers supplied with the tool to attach the test plate. Tighten the bolts to 5 N.m (44 lb in) using a center out alternating torque sequence.
4. Install the pressure gauge to the affected solenoid air port. Reference the Control Solenoid Valve Assembly Solenoid Performance Test Plate to Component Identification table.
5. Regulate the shop air pressure to 310 - 345 kpa (45 - 50 psi) and connect the line to the **DT-47825-100** test plate air inlet port.
6. Connect a 3 A fused jumper from signal circuit terminal B X2 to low reference terminal A X2 or chassis ground and another 3 A fused jumper from signal circuit terminal E X2 to low reference terminal A X2 or chassis ground.
7. Connect the **DT-47825-20** harness to the vehicle and control solenoid valve assembly.
8. Ignition - On / Vehicle - In Service Mode
9. Verify the scan tool parameter: Internal Mode Switch A/B/C/P=Low High High Low
 - If not the specified state

- **If the specified state**

10. Verify DTC P182E is not set.

- **If DTC P182E is set**

1. Clear the DTCs
2. Ignition Off
3. Wait for transmission control module to power down.
4. Ignition - On / Vehicle - In Service Mode
5. Verify DTC <p01> is not set.

- **If DTC P182E is not set**

NOTE:

- **If the solenoid valve is stuck, no pressure change will occur.**
- **Release the air pressure in the gauge between pressurization tests.**
- **Some solenoids will leak air during the test. Only pay attention to the pressure gauge change during the test.**

11. Verify the pressure gauge changes when commanding the appropriate solenoid On and Off with a scan tool. Repeat test as necessary.

Control Solenoid Valve Assembly Solenoid Performance Test Plate to Component Identification

Component	Port On Test Plate	Commanded State	
		ON	OFF
PC Solenoid 2, 35R	C	Full pressure to gauge	No pressure to gauge
PC Solenoid 3, R1/456	G	Full pressure to gauge	No pressure to gauge
PC Solenoid 4, 2-6	B	Full pressure to gauge	No pressure to gauge
PC Solenoid 5, 1234	F	Full pressure to gauge	No pressure to gauge
Shift Solenoid 1	H	Full pressure to gauge	No pressure to gauge
Shift Solenoid 2	D	Full pressure to gauge	No pressure to gauge
Line Pressure Control Solenoid	A	Command to highest setting, full pressure to gauge	Command to lowest setting, below 620.5 kPa (90 psi) to gauge
TCC PC Solenoid	E	Full pressure to gauge	No pressure to gauge

NOTE:

With the key ON, engine OFF (KOEO), the transmission control module (TCM) will normally cycle some of the transmission solenoids On and Off to facilitate keeping the ports and solenoids clean and free of debris. This dither function is a normal activity and will cause the valves to cycle open and closed quickly when the TCM is powered up. This can cause the psi gauge to flicker high and low as the valves open and close. This may cause some air to exit the ports where the psi gauge is not connected as those solenoids cycle on and off.

RESET TRANSMISSION ADAPTS

The Reset Transmission Adapts is a procedure for automatic transmissions in which the shift pressure learn values of each individual clutch is reset to zero or a base calibrated value, in the transmission control module (TCM).

Once the transmission adapts are set to zero or a calibrated value, the vehicle is then road test under various drive cycle events for the TCM to relearn shift pressure values for the best possible shift feel in all gear ranges.

The Reset Transmission Adapts procedure must be performed when one of the following repairs have been made to the transmission. Failure to perform the procedure after one of the following repairs may result in poor transmission performance, DTCs being set, or customer dissatisfaction.

- Transmission internal service, repair or overhaul
- Valve body repair or replacement
- Control solenoid valve assembly replacement
- Any service/repair in response to a shift quality concern

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustments, programming or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Ignition OFF, all vehicle systems OFF, this may take up to 2 minutes.

NOTE: Do not cycle or turn the ignition switch OFF until directed to do so below.

5. Ignition ON, engine running, with a scan tool Reset Transmission Adapts.
6. Perform the [Road Test](#).
7. Ignition OFF for 2 minutes.

TRANSMISSION FLUID LEVEL AND CONDITION CHECK

This procedure checks both the transmission fluid level, as well as the condition of the fluid itself.

CAUTION: Use Dexron® VI transmission fluid only. Failure to use the proper fluid may result in transmission internal damage.

NOTE: Ensure the transmission has enough fluid in it to safely start the vehicle without damaging the transmission. With the vehicle off there must be at least enough fluid to wet the end of the dipstick bullet. This will ensure that there is enough fluid in the sump to fill the components once the vehicle is started.

Level Checking Procedure

1. Park the vehicle on a level surface, apply the parking brake and place the shift lever in PARK (P).
2. Start the engine.
3. Depress the brake pedal and move the shift lever through each gear range, pausing for about 3 seconds in each range. Then move the shift lever back to PARK (P).
4. Allow the engine to idle 500 - 800 rpm for at least 1 minute. Release the brake pedal.
5. Keep the engine running and observe the transmission fluid temperature (TFT) using the Driver Information Center or a scan tool.

NOTE: If the fluid temperature is below the specified range, perform the following procedure to raise the fluid temperature to the specified range.

6. If the TFT reading is not within the required temperature ranges, allow the vehicle to cool, or operate the vehicle until the appropriate TFT is reached.

Drive the vehicle in second gear until the fluid temperature is within the specified range.

NOTE: Check the transmission fluid level when the TFT is between 180°F and 200°F (82°C and 93°C). The fluid level rises as fluid temperature increases, so it is important to ensure the transmission fluid temperature is within range.

7. Remove the dipstick and wipe it with a clean rag or paper towel.
8. Inspect the fluid color. The fluid should be red or dark brown.

- If the fluid color is very dark or black and has a burnt odor, inspect the fluid for excessive metal particles or other debris. A small amount of "friction" material is a "normal" condition. If large pieces and/or metal particles are noted in the fluid, flush the oil cooler and cooler lines and overhaul the transmission. If there are no signs of transmission internal damage noted, replace the fluid, repair the oil cooler, and flush the cooler lines.
- Fluid that is cloudy or milky or appears to be contaminated with water indicates engine coolant or water contamination. Refer to [Engine Coolant/Water in Transmission](#).

9. Install the dipstick and tighten. Wait three seconds and then remove it again.

NOTE: Always check the fluid level at least twice. Consistent readings are important to maintaining proper fluid level. If inconsistent readings are noted, inspect the transmission vent assembly to ensure it is clean and unclogged.

NOTE: It is not necessary to get the fluid level all the way up to the MAX mark. Anywhere within the crosshatch band is acceptable.

10. Check both sides of the dipstick and read the lower level.

11. Install and remove the dipstick again to verify the reading.

12. If the fluid level is not within the crosshatch band, and the transmission temperature is between 180°F and 200°F (82°C and 93°C), add or drain fluid as necessary to bring the level into the crosshatch band. If the fluid level is low, add only enough fluid to bring the level into the crosshatch band.

NOTE: Do not add more than one pint (0.5L) at a time without rechecking the level. Once the oil is on the dipstick bullet, it will not take much more fluid to raise the fluid level into the crosshatch band. Do not overfill. Also, if the fluid level is low, inspect the transmission for leaks. Refer to [Fluid Leak Diagnosis](#).

13. If the fluid level is in the acceptable range, install the dipstick.

14. If the fluid was changed, reset the transmission oil life monitor if applicable.

Fluid Condition Inspection

- Inspect the fluid color. The fluid should be red in color. The fluid may also turn brown from normal use, and does not always indicate contamination.

NOTE: Fluid that is very dark or black and has a burnt odor usually indicates contamination or overheating.

- If the fluid color is very dark or black and has a burnt odor, inspect the fluid for excessive metal particles or other debris which may indicate transmission damage. Refer to [Road Test](#) to verify transmission operation. Change the transmission fluid if no other conditions are found.
- Fluid that is cloudy or milky or appears to be contaminated with water indicates engine coolant or water contamination. Refer to [Engine Coolant/Water in Transmission](#).

LINE PRESSURE CHECK

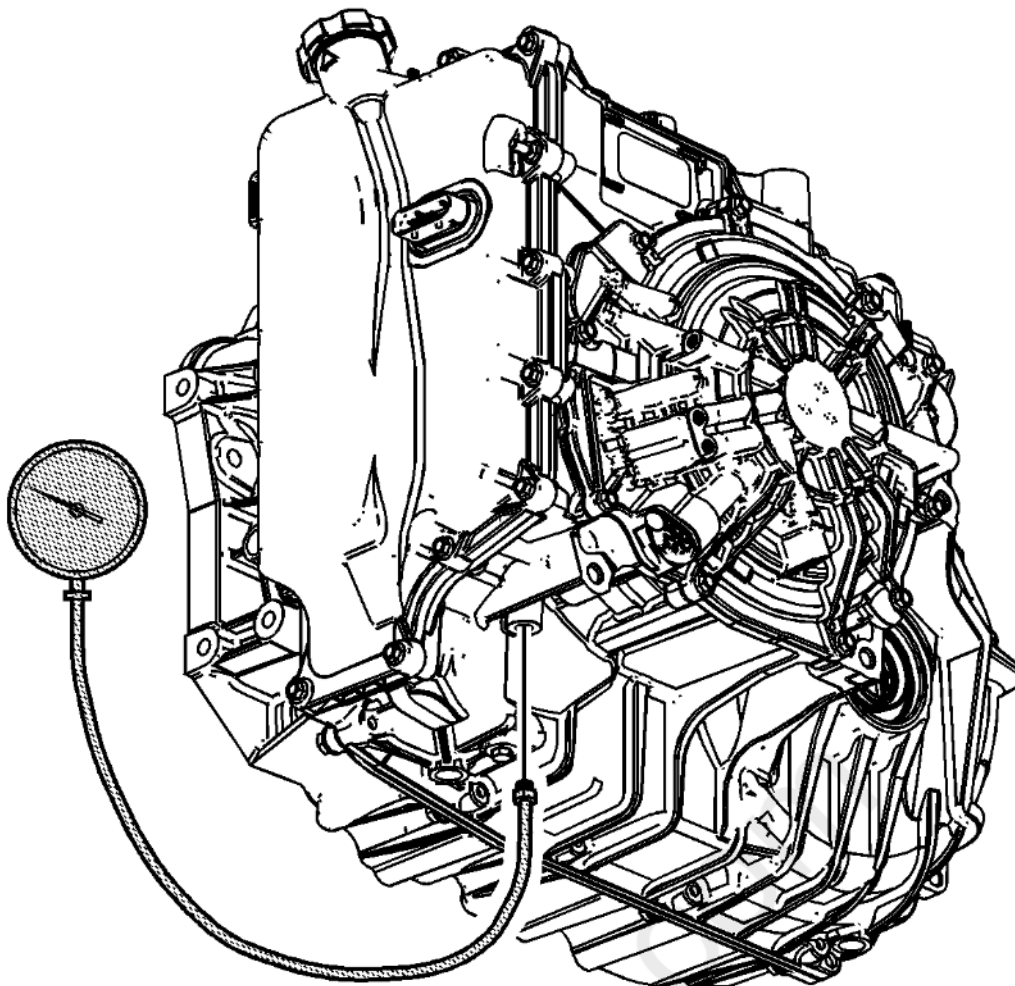


Fig. 4: Identifying Special Tool - J 21867

Courtesy of GENERAL MOTORS COMPANY

Special Tools

DT 21867-A Pressure Gauge

For equivalent regional tools, refer to [Special Tools](#) .

WARNING: Keep the brakes applied at all times in order to prevent unexpected vehicle motion. Personal injury may result if the vehicle moves unexpectedly.

1. Install a scan tool.
2. Start the engine.
3. Inspect the transmission for the proper fluid level. Refer to [Transmission Fluid Level and Condition Check](#).
4. Use the scan tool to inspect for any active or stored diagnostic trouble codes.
5. Inspect the manual linkage at the transmission for proper function.
6. Turn the engine OFF.
7. Remove the line pressure test hole plug.
8. Install the **DT 21867-A** pressure gauge.
9. Access the Scan Tool Transmission Output Controls for the Line PC Solenoid.
10. Start the engine.

NOTE: In order to achieve accurate line pressure readings, the following procedure must be performed at least 3 times in order to gather uniform pressure readings.

The scan tool is only able to control the line PC solenoid in PARK and NEUTRAL with engine speeds below 1500 RPM. This protects the clutches from extreme high or low line pressures.

11. Use the scan tool to increase and decrease the Line PC Solenoid in increments of approximately 200 KPa (29 psi). The scan tool commands the increment values automatically.
12. Allow the pressure to stabilize between increments.
13. Compare the pressure readings on the **DT 21867-A** pressure gauge to the actual pressure values in the solenoid valve pressure chart. Refer to [Solenoid Valve Pressure](#) .
14. If the pressure readings vary greatly, refer to [Fluid Pressure High or Low](#).
15. Turn the engine OFF.
16. Remove the **DT 21867-A** pressure gauge.

CAUTION: Refer to [Fastener Caution](#) .

17. Install the line pressure test hole plug and tighten to 12 N.m (106 lb in).

ROAD TEST

The following test provides a method of evaluating the condition of the automatic transmission. The test is structured so that most driving conditions would be achieved. The test is divided into the following parts:

- Electrical Function Check
- Upshift Control and Torque Converter Clutch (TCC) Apply
- Part Throttle Step-In Downshifts
- Manual Downshifts
- Coasting Downshifts
- Manual Gear Range Selection
 - REVERSE
 - Driver Shift Control

NOTE: Complete the test in the sequence given. Incomplete testing cannot guarantee an accurate evaluation.

Before the road test, ensure the following:

- The engine is performing properly.
- Transmission fluid level is correct. Refer to [Transmission Fluid Level and Condition Check](#).
- Tire pressure is correct.

During the road test:

- Perform the test only when traffic conditions permit.
- Operate the vehicle in a controlled, safe manner.
- Observe all traffic regulations.
- View the scan tool data while conducting this test.

Take along qualified help in order to operate the vehicle safely.

- Observe any unusual sounds or smells.

After the road test, check the following:

- Inspect for proper transmission fluid level. Refer to [Transmission Fluid Level and Condition Check](#).
- Inspect for any diagnostic trouble codes (DTCs) that may have set during the testing. Refer to the applicable DTC.

- Monitor the scan tool data for any abnormal readings or data.
- Inspect for fluid leaks. Refer to [Fluid Leak Diagnosis](#).

Electrical Function Check

Perform this procedure first in order to ensure the electronic transmission components are functioning properly. If these components are not checked, a simple electrical condition could be misdiagnosed.

1. Connect the scan tool.
2. Ensure the gear selector is in PARK and set the parking brake.
3. Start the engine.
4. Verify that the following scan tool data can be obtained and is functioning properly.

Refer to [Control Module References](#) for typical data values. Data that is questionable may indicate a concern.

- Engine Speed
- Transmission ISS
- Transmission OSS
- Vehicle Speed
- IMS
- Commanded Gear
- Gear Ratio
- Line PC Sol. Pressure Cmd.
- Brake Switch
- ECT, Engine Data List
- Trans. Fluid Temp.
- TCM Temperature
- Calc. Throttle Position
- Ignition Voltage
- TFP Switch 1
- TFP Switch 3
- TFP Switch 4
- TFP Switch 5
- PC Sol. 2 Pressure Cmd.
- PC Sol. 3 Pressure Cmd.
- PC Sol. 4 Pressure Cmd.
- PC Sol. 5 Pressure Cmd.
- Shift Solenoid 1
- Shift Solenoid 2
- TCC PC Sol. Duty Cycle
- TCC Slip Speed

5. Check the garage shifts.

1. Apply the brake pedal and ensure the parking brake is set.
2. Move the gear selector through the following ranges:
 1. PARK to REVERSE
 2. REVERSE to NEUTRAL
 3. NEUTRAL to DRIVE
 4. DRIVE to REVERSE
 5. REVERSE to DRIVE
3. Pause 2 to 3 seconds in each gear position.

4. Verify the gear engagements are immediate (less than 2 seconds to complete if trans fluid temperature is above 20Â°C) and not harsh. Note that these shifts may be almost imperceptible in some applications. Using the scan tool to monitor Transmission ISS achieving 0 RPM can be used to check delay in these cases.

NOTE: Harsh engagement may be caused by any of the following conditions:

- High engine idle speed - Compare engine idle speed to desired idle speed.
- Incorrect line pressure - Investigate Line PC Sol. Pressure Cmd. kPa (psi), also perform [Line Pressure Check](#).
- A default condition caused by certain DTCs that result in maximum line pressure to prevent clutch slippage.
- Incomplete adapting or incorrect adapting - Repeat maneuver multiple times to see if shift quality improves. If it does not, refer to the service procedures for [Harsh Garage Shift](#), and for [Harsh First and Reverse Shift](#).

NOTE: Delayed engagement may be caused by any of the following conditions:

- Low idle speed - Compare engine idle speed to desired idle speed.
- Low fluid level
- Incorrect line pressure - Investigate Line PC Sol. Pressure Cmd. kPa (psi), also perform [Line Pressure Check](#).
- Cold transmission fluid temperature (TFT) - Use the scan tool to determine TFT.
- Selector linkage - Inspect and adjust as necessary.
- Incomplete adapting or incorrect adapting - Repeat maneuver multiple times to see if delay improves. If it does not, refer to the service procedures for [Harsh First and Reverse Shift](#).

6. Monitor transmission range on the scan tool, transmission data list.

1. Apply the brake pedal and ensure the parking brake is set.
2. Move the gear selector through all ranges.
3. Pause 2 to 3 seconds in each range.
4. Return gear selector to PARK.
5. Verify that all selector positions match the scan tool display.

7. Check throttle position input.

1. Apply the brake pedal and ensure the parking brake is set.
2. Ensure the gear selector is in PARK.
3. Monitor the scan tool Calc. Throttle Position while increasing and decreasing engine speed with the throttle pedal. The scan tool Calc. Throttle Position percentage should increase and decrease with engine speed.

If any of the above checks do not perform properly, record the result for reference after completion of the road test.

Upshift Control and Torque Converter Clutch (TCC) Apply

The TCM calculates the upshift points based primarily on 2 inputs: throttle position and vehicle speed. When the TCM determines that conditions are met for a shift to occur, the TCM commands the shift by varying current to the appropriate PC solenoids to control oncoming and offgoing clutch pressures.

Perform the following steps:

1. Monitor the following scan tool parameters:

- Calc. Throttle Position
- Vehicle Speed
- Engine Speed
- Transmission ISS
- Transmission OSS
- Commanded Gear
- TCC PC Sol. Pressure Cmd.
- TCC Slip Speed
- TFP Switch 1
- TFP Switch 3
- TFP Switch 4
- TFP Switch 5
- PC Sol. 2 Pressure Cmd.
- PC Sol. 3 Pressure Cmd.
- PC Sol. 4 Pressure Cmd.
- PC Sol. 5 Pressure Cmd.
- Shift Solenoid 1 and 2

2. Place the gear selector in the DRIVE position.

3. Accelerate the vehicle using a steady throttle position between 15 and 20 percent. Hold the throttle steady.

4. As the transmission upshifts, there should be a noticeable shift feel or engine speed change within 1 to 2 seconds of the commanded gear change. The PC solenoid pressure command should change to "YES" for the oncoming clutch and the PC solenoid pressure command should change to "NO" for the offgoing clutch.

5. Note any harsh, soft or delayed shifts or slipping. Note any noise or vibration.

6. The TCC feel may not be noticeable. In many applications the TCC will apply after the 1-2 shift and TCC events will not be easily detected using engine speed.

NOTE: This transmission is equipped with an electronically controlled capacity clutch (ECCC), which allows operation of the clutch without fully locking to the torque converter cover. The clutch maintains a small amount of slippage, approximately 20 RPM, in 2nd, 3rd, 4th, 5th, and 6th gears, depending on the vehicle application. ECCC was developed to reduce the possibility of noise, vibration or chugle caused by TCC apply. Full lockup is available at highway speeds on some applications.

7. Monitor TCC PC solenoid pressure command while driving and check TCC slip speed when the pressure command indicates that the TCC is commanded to apply:

When the TCC applies, slip speed should be controlled to below 100 RPM when the transmission is not shifting and the throttle is held steady. If the TCC slip exceeds this value for more than 6 seconds after the TCC PC Sol. Pressure Command indicates that the TCC is commanded ON:

- Check for DTCs.
- Refer to [Torque Converter Diagnosis](#).

Part Throttle Step-In Downshifts

1. Place the gear selector in the DRIVE position.

2. Accelerate the vehicle at light throttle (5 - 15 percent) until 3rd gear is just achieved.

3. Quickly increase throttle angle until commanded gear indicates that a downshift to 2nd gear is commanded.

4. Verify that the transmission downshifts within 2 seconds of the throttle movement.

5. Repeat steps 2 to 4 at higher speed to achieve 4th gear and then step in to command a 4th gear to 3rd gear downshift.
6. Repeat steps 2 to 4 at higher speed to achieve 5th gear and then step in to command a 5th gear to 4th gear downshift.
7. Repeat steps 2 to 4 at higher speed to achieve 6th gear and then step in to command a 6th gear to 5th gear downshift.
8. Note any harsh, soft or delayed shifts or slipping. Note any noise or vibration.

Manual Downshifts

Manual downshift testing is not required since all vehicles equipped are also equipped with some form of Driver Shift Control (DSC). The TCM will automatically override DSC downshifts to protect the transmission from damage.

Coasting Downshifts

1. Place the gear selector in the DRIVE position.
2. Accelerate the vehicle to 6th gear with the TCC applied.
3. Release the throttle and apply the brakes
4. Verify that the downshifts occur as commanded by monitoring gear ratio, which should change after commanded gear changes.

Manual Gear Range Selection

This application does not utilize manual forward gear ranges.

Reverse

Perform the following test using a 10 - 15 percent throttle position.

1. With the vehicle stopped, move the gear selector to REVERSE.
2. Slowly accelerate the vehicle.
3. Verify that there is no noticeable slip, noise or vibration.

Driver Shift Control (DSC)

Refer to the owner's manual for specific instructions on the type of DSC available in this application. Utilize the DSC to ensure that the transmission responds appropriately to driver's commands. The TCM will upshift automatically when maximum engine speed is achieved and will protect from any downshift which may cause excessive engine RPM.

TORQUE CONVERTER DIAGNOSIS

Torque Converter Stator

The torque converter stator roller clutch can have 2 different malfunctions.

- The stator assembly freewheels in both directions.
- The stator assembly remains locked up in both directions.

Poor Acceleration at Low Speed - Stator Roller Clutch Freewheels at All Times

If the stator is freewheeling at all times, the vehicle tends to have poor acceleration from a standstill and at speeds below 48 - 55 km/h (30 - 34 mph). At speeds above 48 - 55 km/h (30 - 34 mph), the vehicle may act normally.

For poor acceleration at low speeds, you should first determine that the exhaust system is not blocked, and the transmission is in First gear when starting out. If the engine freely accelerates to high RPM in NEUTRAL, you can assume that the engine and the exhaust system are normal. Check for poor performance in DRIVE and REVERSE to help determine if the stator is freewheeling at all times.

Poor Acceleration at High Speed - Stator Roller Clutch is Locked Up at All Times

If the stator is locked up at all times, performance is normal when accelerating from a standstill. Engine RPM and vehicle speed are limited or restricted at speeds above 48 - 55 km/h (30 - 34 mph). Visual examination of the converter may reveal a blue color from overheating.

Torque Converter Bearing Noise

NOTE: Do not confuse this noise with pump whine noise, which is usually noticeable in all gear ranges. Pump whine will vary with line pressure.

Torque converter whine is noticed when the vehicle is stopped and the transmission is in DRIVE or REVERSE. This noise will increase as you increase the engine RPM. The noise will stop when the vehicle is moving or when you apply the torque converter clutch, because there is no slip speed across the bearings.

Perform a stall test to verify that the noise is actually coming from the torque converter:

1. Place your foot on the brake.
2. Put the gear selector in DRIVE.

CAUTION: You may damage the transmission if you depress the accelerator for more than 6 seconds.

3. Depress the accelerator to approximately 1, 200 RPM for no more than six seconds.

A torque converter noise will increase under this load.

Torque Converter Clutch

The torque converter clutch (TCC) is applied by fluid pressure, which is controlled by a TCC pressure control (PC) solenoid. This solenoid is part of the control solenoid valve assembly, which is located inside the automatic transmission assembly. The solenoid is controlled through a combination of computer controlled switches and sensors. Electronically controlled capacity clutch (ECCC) is controlled slip across the TCC.

Torque Converter Clutch Shudder

The key to diagnosing torque converter clutch (TCC) shudder is to note when it happens and under what conditions. TCC shudder should only occur during the apply, release, or ECCC conditions of the converter clutch. Shudder should never occur after the TCC is fully locked (approximately 0 RPM slip).

If Shudder Occurs During TCC Apply, Release, and ECCC

If the shudder occurs while the TCC is applying, the problem can be within the transmission or the torque converter. Something is causing one of the following conditions to occur:

- The clutch is not engaging completely.
- The clutch is not releasing completely.
- The clutch is releasing and applying rapidly and continuously.

One of the following conditions may be causing the TCC Shudder to occur:

- Leaking turbine shaft/TCC seals
- A restricted release orifice
- A distorted clutch or converter cover due to long flexplate to converter bolts
- Defective friction material on the TCC plate

If Shudder Occurs After TCC has Locked

Engine problems may go unnoticed under light throttle and load, but they become noticeable after the TCC has locked when going up a hill or accelerating.

Refer to [Symptoms - Engine Controls](#) in order to avoid misdiagnosis of TCC shudder and the unnecessary disassembly of a transmission or the unnecessary replacement of a torque converter.

Torque Converter Vibration Test

NOTE: The [Noise and Vibration Analysis](#) procedure should be performed prior to performing this test.

Indexing Torque Converter

To determine and correct a torque converter vibration, the following procedure may have to be performed several times to achieve the best possible torque converter to flexplate balance.

1. Remove the torque converter bolts.
2. Rotate the torque converter one bolt position from the original marked position.

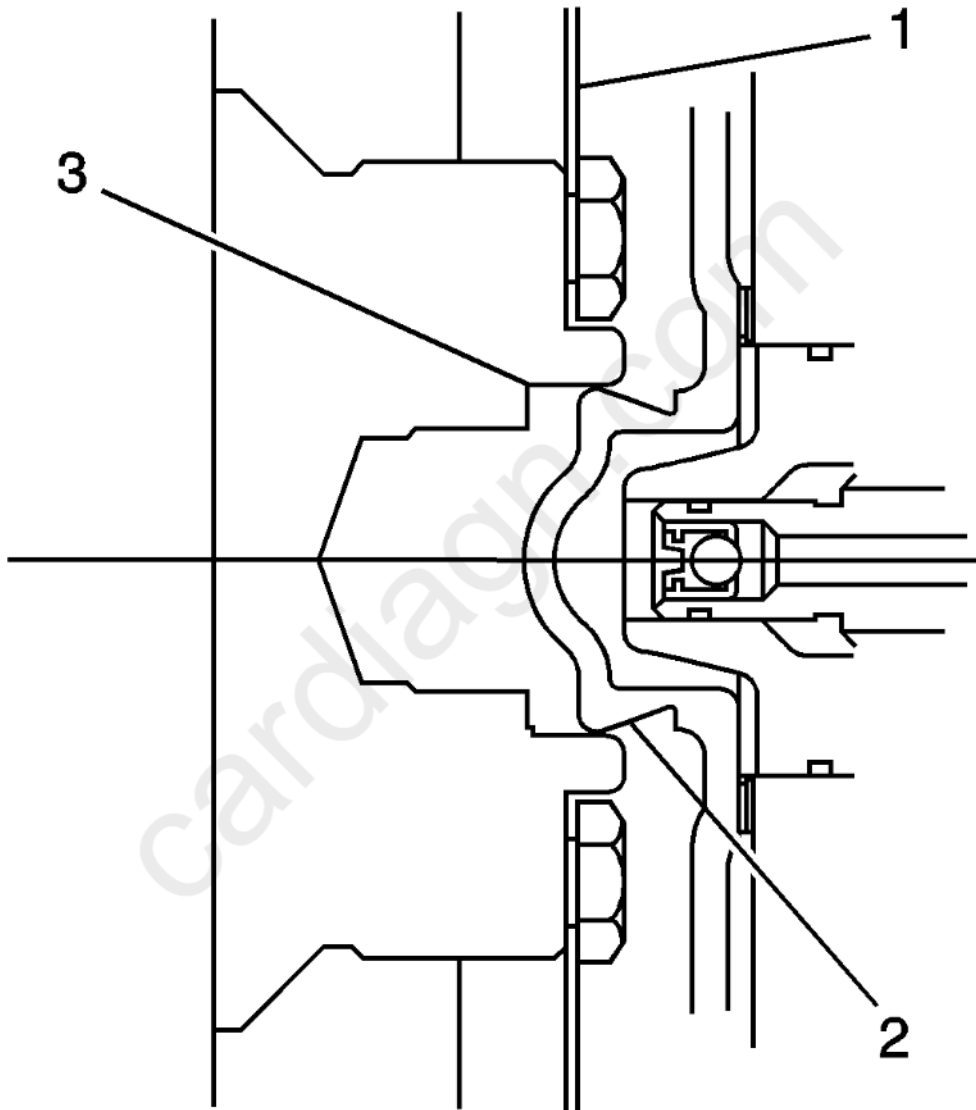


Fig. 5: View Of Torque Converter Hub In Engine Crankshaft
Courtesy of GENERAL MOTORS COMPANY

CAUTION: When installing the torque converter to the flexplate, make sure to use specified bolts. DO NOT use longer bolts. Using longer bolts will result in deformation of the torque converter cover and cause internal damage.

CAUTION: Refer to [Fastener Caution](#) .

3. Align the torque converter pilot (2) in the engine crankshaft (3). Install the torque converter to flexplate bolts, and tighten according to [Fastener Specifications \(On Vehicle\)](#) [Fastener Specifications \(Off Vehicle\)](#) .

4. Lower the vehicle.

5. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration.

Repeat this procedure until the best possible balance is obtained.

6. Install the torque converter access cover and bolts (if equipped) and tighten according to [Fastener Specifications \(On Vehicle\)](#), [Fastener Specifications \(Off Vehicle\)](#) .

Torque Converter Replacement Guide

Condition	Action
- Transmission Fluid Oxidized/Discolored - Clutch Fiber Material	Do not replace the torque converter. Refer to Transmission Fluid Level and Condition Check .
Transmission Fluid Contaminated with Metal Particles	NOTE: Do not replace the torque converter for clutch system or gearset component damage. Fine metallic debris or clutch plate material that is suspended in the fluid will not cause damage to the internal torque converter components nor any internal transmission components.
Harsh Gear Shifts	Do not replace the torque converter. Refer to Symptoms - Automatic Transmission .
Noise - Whine	- Refer to Symptoms - Automatic Transmission. - Do not replace the torque converter if noise is present in Neutral/Park. Refer to Symptoms - Engine Mechanical .
Vibration - Out of Balance	Refer to Torque Converter Vibration Test in this procedure.
No Drive/Slips in Drive	Do not replace the torque converter until completing all engine and transmission diagnostics.
Idle Surge/Rough Idle	Do not replace the torque converter. Refer to Symptoms - Engine Controls
TCC Apply/Release Shudder	Do not replace the torque converter. Refer to Torque Converter Clutch Shudder in this procedure.
TCC Chuggle	Do not replace the torque converter. Refer to Symptoms - Engine Controls .
DTC P0741 - TCC Stuck OFF/High Slip - Intermittent Only	Do not replace the torque converter. Refer to DTC P0741 or P0742 diagnostic table.
DTC P0741 - TCC Stuck OFF/High Slip	Do not replace the torque converter. Refer to DTC P0741 or P0742 diagnostic table.
DTC P0742 - TCC Stuck ON	Do not replace the torque converter. Refer to DTC P0741 or P0742 diagnostic table.

Condition	Action
Transmission Fluid Contaminated with Sludge/Metal Particles as a result of: • Engine Coolant/Oil • Pump damage • Drive sprocket support damage • Turbine/stator shaft damage • Internal converter damage with no damage found in the transmission	Replace the torque converter.
Poor Acceleration above 48 km/h (30 mph) - Good Launch	Do not replace the torque converter until completing all engine and transmission diagnostics. • Refer to Torque Converter Stator in this procedure. • Refer to Symptoms - Engine Controls .
Poor Launch - Good Acceleration above 48 km/h (30 mph)	Do not replace the torque converter until completing all engine and transmission diagnostics. • Refer to Torque Converter Stator in this procedure. • Refer to Symptoms - Engine Controls .
Stripped Converter Bolt Holes	• Replace the torque converter. • Inspect flexplate and refer to Lower Engine Noise, Regardless of Engine Speed .
Torque Converter Pilot Damaged	Replace the torque converter.
Torque Converter Hub surface is damaged - scored, raised/transferred metal.	Replace the torque converter.
External Leaks in the weld areas - hub, lug or closure weld.	Replace the torque converter.
Broken/Cracked Flexplate	Replace the torque converter.
Torque Converter Discolored/Overheated	Replace the torque converter.

CLUTCH PLATE DIAGNOSIS

Composition Plates

Dry the plates and inspect the plates for the following conditions:

- Pitting
- Flaking
- Delamination - splitting or separation of bonded clutch material
- Wear
- Glazing
- Cracking
- Charring
- Chips or metal particles embedded in the lining

Replace a composition plate which shows any of these conditions.

Steel Plates

Wipe the plates dry and check the plates for heat discoloration. If the surfaces are smooth, even if color smear is indicated, you can reuse the plate. If the plate is discolored with heat spots or if the surface is scuffed, replace the plate.

Causes of Burned Clutch Plates

The following conditions can result in a burned clutch plate:

- Incorrect usage of clutch or apply plates
- Engine coolant or water in the transmission fluid
- A cracked clutch piston
- Damaged or missing seals
- Low line pressure
- Valve body conditions
 - The valve body face is not flat.
 - Porosity in between channels.
 - The valve train retainers are improperly installed.
 - The checkballs are misplaced.
- The Teflon® seal rings are worn or damaged.

ENGINE COOLANT/WATER IN TRANSMISSION

CAUTION: The antifreeze or water will deteriorate the seals, gaskets and the glue that bonds the clutch material to the pressure plate. Both conditions may cause damage to the transmission.

If antifreeze or water has entered the transmission, perform the following:

1. Disassemble the transmission.
2. Replace all of the rubber type seals. The coolant will attack the seal material which will cause leakage.
3. Replace the composition-faced clutch plate assemblies. The facing material may separate from the steel center portion.
4. Replace all of the nylon parts - washers.
5. Replace the torque converter.
6. Thoroughly clean and rebuild the transmission, using new gaskets and oil filter.
7. Flush the cooler lines after the transmission cooler has been properly repaired or replaced.
8. Inspect the rubber hose portion of the oil cooler lines for damage, if applicable. Refer to [Transmission Fluid Cooler Flow Test and Flushing Transmission Fluid Cooler Flow Test and Flushing \(6T40/6T45\)](#).

FLUID LEAK DIAGNOSIS

General Method

1. Verify that the leak is transmission fluid.

CAUTION: Do not clean using brake cleaner or other reactive solvents as these solvents can damage rubber gaskets, seals and bushings.

2. Thoroughly clean the suspected leak area using a rag.

NOTE: Do not idle vehicle, this will not actuate transmission systems, and do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis.

3. Operate the vehicle for 15 - 20 minutes under city driving conditions until normal operating temperatures are reached.
4. Park the vehicle over clean paper or cardboard.
5. Shut OFF the engine.
6. Look for fluid spots on the paper.
7. Make the necessary repairs.

Powder Method

CAUTION: Do not clean using brake cleaner or other reactive solvents as these solvents can damage rubber gaskets, seals and bushings.

1. Thoroughly clean the suspected leak area using a rag.
2. Apply an aerosol type leak tracing powder to the suspected leak area.

NOTE: Do not idle vehicle, this will not actuate transmission systems, and do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis.

3. Operate the vehicle for 15 - 20 minutes under city driving conditions until normal operating temperatures are reached.
4. Shut OFF the engine.
5. Inspect the suspected leak area.
6. Trace the leak path through the powder in order to find the source of the leak.
7. Make the necessary repairs.

Dye and Black Light Method

A fluid dye and black light kit is available from various tool manufacturers.

1. Follow the manufacturer's instructions in order to determine the amount of dye to use.
2. Operate the vehicle for 24 km (15 mi) or until normal operating temperatures are reached.
3. Detect the leak with the black light.
4. Make the necessary repairs.

Find the Cause of the Leak

Pinpoint the leak and trace the leak back to the source. You must determine the cause of the leak in order to repair the leak properly. For example, if you replace a gasket, but the sealing flange is bent, the new gasket will not repair the leak. You must also repair the bent flange. Before you attempt to repair a leak, check for the following conditions, and make repairs as necessary:

Gaskets

- Fluid level/pressure is too high
- Plugged vent or drain-back holes
- Improperly tightened fasteners
- Dirty or damaged threads
- Warped flanges or sealing surface
- Scratches, burrs, or other damage to the sealing surface
- Damaged or worn gasket
- Cracking or porosity of the component
- Improper sealant used, where applicable
- Incorrect gasket

Seals

- Fluid level/pressure is too high
- Plugged vent or drain-back holes
- Damaged seal bore
- Damaged or worn seal
- Improper installation
- Cracks in component
- Manual shaft or output shaft surface is scratched, nicked, or damaged
- Loose or worn bearing causing excess seal wear

Possible Points of Fluid Leaks

Transmission Case Cover and/or Valve Body Cover

- Incorrectly tightened bolts
- Improperly installed or damaged gasket/seal
- Damaged mounting face
- Incorrect gasket seal

Case Leak

- Damaged input speed sensor seal
- Damaged manual shaft seal
- Loose or damaged oil cooler lines/seals
- Worn or damaged axle shaft oil seal
- Loose line pressure pipe plug or fluid level pipe plug
- Porous casting
- Warped torque converter housing
- Damaged converter housing to case seal

Leak at the Torque Converter End

- Converter leak in the weld area
- Converter seal lip cut. Check the converter hub for damage
- Converter seal bushing moved forward and damaged
- Converter seal garter spring missing from the seal
- Porous casting of the torque converter housing

Leak at the Vent

- Overfilled system
- Water or coolant in the fluid; The fluid will appear milky
- Transmission case porous
- Incorrect fluid level indicator causing an overfilled system
- Plugged vent

Leak Inspection Points

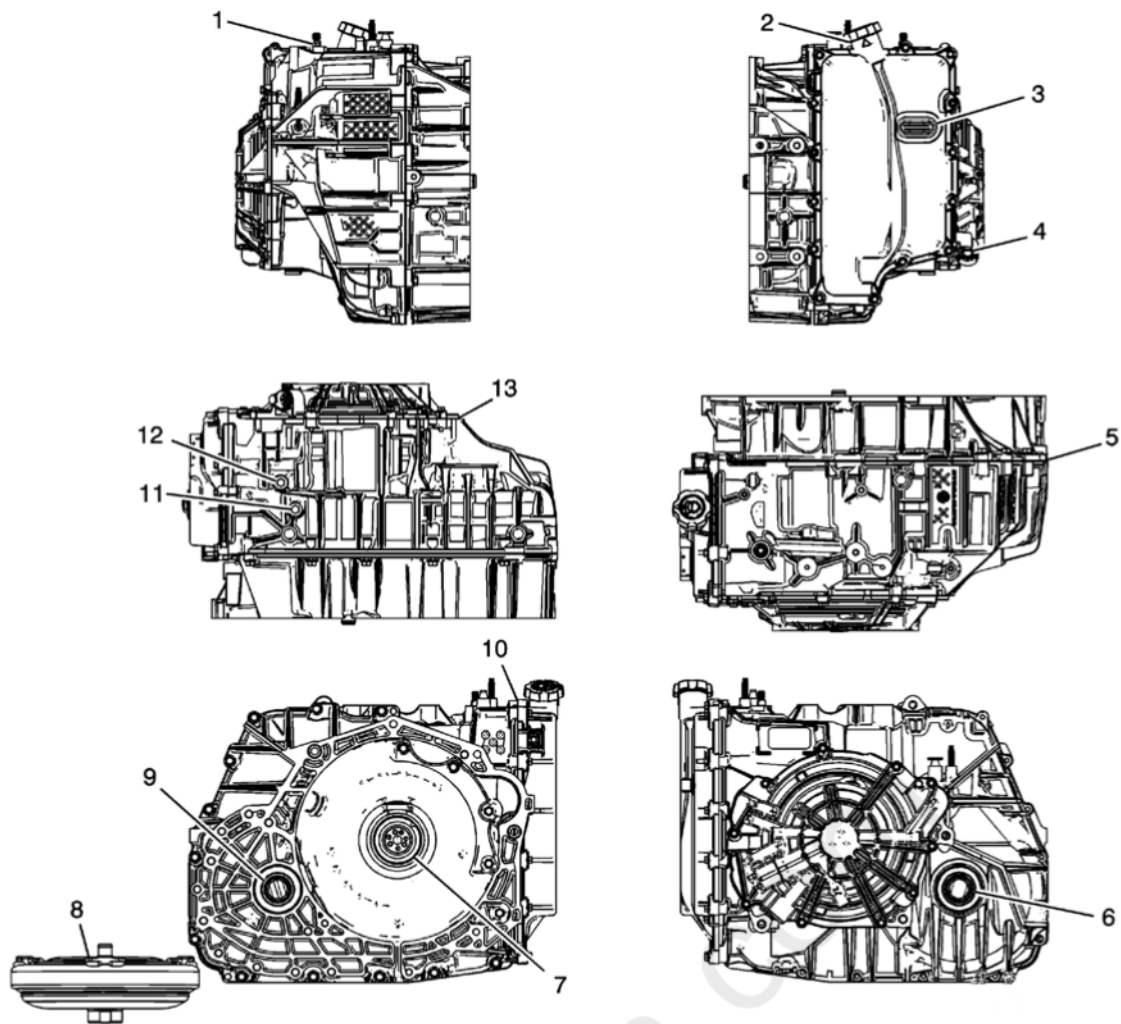


Fig. 6: Identifying Leak Inspection Points
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Manual Shift Shaft Seal
2	Automatic Transmission Vent
3	Control Valve Body Cover Wiring Connector Hole Seal
4	Input Speed Sensor Seal
5	Converter Housing to Case Joint
6	Front Wheel Drive Shaft Oil Seal Assembly - Case
7	Torque Converter Fluid Seal Assembly
8	Torque Converter Assembly
9	Front Wheel Drive Shaft Oil Seal Assembly - Torque Converter Housing
10	Control Valve Body Cover Assembly Gasket
11	Fluid Level Hole Plug
12	Fluid Pressure Hole Plug
13	Case Cover Gasket

CASE POROSITY REPAIR

Some external leaks are caused by case porosity in non-pressurized areas.

1. Thoroughly clean the area to be repaired with a cleaning solvent. Air dry the area.

WARNING: Epoxy adhesive may cause skin irritations and eye damage. Read and follow all information on the container label as provided by the manufacturer.

2. Using instructions from the manufacturer, mix a sufficient amount of an epoxy to make the repair.

3. Apply the epoxy. A clean, dry soldering acid brush can be used to clean the area and also to apply the epoxy cement. Make certain that the area to be repaired is fully covered.
4. Allow the epoxy cement to cure for three hours before assembling the components.
5. Repeat the fluid leak diagnosis procedures.

BUSHING AND MATING SHAFT INSPECTION

NOTE: Proper bushing and corresponding mating shaft inspection should be performed before replacing the bushing, shaft, and in some cases, the component which houses the bushing. Thoroughly clean and dry the bushing and shaft surfaces before inspecting for damage.

Any of the following bushing conditions require replacement of the bushing and/or housing:

- Discoloration due to heat distress
- Misalignment or displacement of bushing as a result of spinning in housing
- Medium to heavy scoring that can be easily detected with fingernail. Light scoring is a normal condition.
- Debris embedded into the bushing lining material
- Obvious damage, including excessive and uneven wear
- Excessive polishing. Minor polishing of the bushing is an indication of normal wear and does not require replacement.

Any of the following conditions require replacement of the bushing's mating shaft:

- Discoloration due to heat distress
- Rough surface finish that can be easily detected with finger
- Obvious shaft abnormalities, including warping or uneven surfaces
- Obvious damage or cracking

NOISE AND VIBRATION ANALYSIS

A noise or vibration that is noticeable when the vehicle is in motion MAY NOT be the result of the transmission.

If noise or vibration is noticeable in PARK and NEUTRAL with the engine at idle, but is less noticeable as RPM increases, the vibration may be a result of poor engine performance.

- Vibration may also be caused by a small amount of water inside the converter.
- Inspect the engine and transmission mounts for damage and loose bolts.
- Inspect the transmission case mounting holes for the following conditions:
 - Missing bolts, nuts, and studs
 - Stripped threads
 - Cracks
- Inspect the flywheel for the following conditions:
 - Missing or loose bolts
 - Cracks
 - Imbalance
- Inspect the torque converter for the following conditions:
 - Missing or loose bolts or lugs
 - Missing or loose balance weights
 - Imbalance caused by heat distortion or fluid contamination
- If the noise or vibration is noticeable in PARK and NEUTRAL with the engine at idle, but is more noticeable as RPM increases, the vibration may be an engine imbalance or a transmission imbalance. Refer to [**Torque Converter Diagnosis**](#).

WHINE/GROWL NOISE

Checks	Causes
Front Differential Drive Pinion Gear Assembly (23)	• Inspect for worn wheel bearings or axles. • Inspect for proper Taper Roller Bearing Pre-load • Inspect for loose or worn transfer Driven Gear
Differential Assembly (486)	• Inspect for worn wheel bearings or axles. • Inspect for proper Taper Roller Bearing Pre-load • Inspect for worn or damaged Side Gear Thrust Washer (492) or Pinion Gear Thrust Washer (488) • Inspect for loose or worn Side Gear Axle Splines
Input Carrier Assembly (470)	• Inspect for worn or damaged Pinion Gear Thrust Washers and Bushings • Inspect for worn or damaged Pinion Gears, Pins or Needle Bearings • Inspect for loose Hub and Ring Gear
Output Carrier Assembly (474)	• Inspect for worn or damaged Pinion Gear Thrust Washers and Bushings • Inspect for worn or damaged Pinion Gears, Pins or Needle Bearings • Inspect for loose Hub and Ring Gear
Reaction Carrier Assembly (467)	• Inspect for worn or damaged Pinion Gear Thrust Washers and Bushings • Inspect for worn or damaged Pinion Gears, Pins or Needle Bearings • Inspect for loose hub and Ring Gear
Fluid Pump Assembly (203)	• Inspect for proper fluid level • Inspect for loose or worn Drive Link Assembly (218) • Inspect for worn Driven Sprocket Thrust Washer (214) or Drive Sprocket Thrust Washers (219, 220) • Inspect for leaking Transfer Drive Gear Support Seal (213), Pump Fluid Outlet Seal Assembly (57) or Filter Seal (202) • Inspect for worn or damaged Fluid Pump Shaft Splines
3 - 5 - Reverse Clutch Assembly	• Inspect for inadequate Clutch Plate Clearance • Inspect for loose or worn Clutch Plate Splines (423 - 425) • Inspect for loose or worn Clutch Spring Retainer (427) • Inspect for loose Speed Sensor Reluctor Wheel (416) or Retainer (415)

Checks	Causes
4 - 5 - 6 Clutch Assembly	• Inspect for inadequate Clutch Plate Clearance • Inspect for loose or worn Clutch Plate Splines (449, 440) • Inspect for loose or worn Clutch Spring Retainer (442) • Inspect for loose or worn 3 - 5 - Reverse/4 - 5 - 6 Clutch Housing Bushing
1 - 2 - 3 - 4 Clutch Assembly	• Inspect for inadequate Clutch Plate Clearance • Inspect for loose or worn Clutch Plate Splines (456 - 458) • Inspect for loose or worn Clutch Spring Retainer (459)
Low and Reverse Clutch Assembly (OWC) (455)	• Inspect for loose or worn Splines (455) • Inspect for loose or worn Retainer (454)
Low and Reverse Clutch	• Inspect for inadequate Clutch Plate Clearance • Inspect for loose or worn Clutch Plate Splines (449 - 452) • Inspect for loose or worn Clutch Spring Retainer (410)
2 - 6 Clutch Assembly	• Inspect for inadequate Clutch Plate Clearance • Inspect for loose or worn Clutch Plate Splines (445 - 447) • Inspect for loose or worn Clutch Spring Retainer (407)
Case Assembly (51)	• Inspect for loose or broken Transmission Mount Bolts • Inspect for loose Torque Converter and Differential Housing Bolts (26) • Inspect for loose or broken Fluid Trough Bolts (56)

AUTOMATIC TRANSMISSION FLUID LEAKS

Checks	Causes
Torque Converter (27)	Inspect for damage.
Case Assembly (21)	• Inspect for porosity or damage on the sealing surfaces • Inspect for loose Oil Cooler Line Bolts or damaged Oil Cooler Line Seals • Inspect for damaged Manual Shift Shaft Seal (58) • Inspect for damaged or worn Axle Seal (61) or Axle Seal Slinger on the axle shafts • Inspect for loose Pressure Test Plug (62) and Fluid Level Plug (63)

Checks	Causes
Torque Converter Housing Assembly (221)	- Inspect for damaged Torque Converter Housing Assembly (25) - Inspect for porosity or damage on the sealing surfaces - Inspect for damaged Torque Converter Housing Seal (22) - Inspect for damaged or worn Torque Converter Fluid Seal (225) - Inspect for loose Torque Converter and Differential Housing Bolts (26) - Inspect for damaged or worn Axle Seal (226) or Axle Seal Slingers on the axle shafts
Case Cover assembly (34)	- Inspect for porosity or damage on the sealing surface - Inspect for damaged Case Cover Gasket (33) - Inspect for loose Case Cover Assembly Bolts (35) - Inspect for loose Input Speed Sensor (ISS) Bolt (401) - Inspect for damaged Input Speed Sensor (ISS) Seal (402) - Inspect for loose, damaged or leaking Case Cover Assembly bore plugs
Valve Body Cover Assembly (1)	- Inspect for damaged or warped Valve Body Cover Assembly (1) - Inspect for damaged Valve Body Cover Gasket (5) - Inspect for loose Valve Body Cover Bolts (7) and Valve Body Cover Studs (6) - Inspect for damaged or improperly installed Wire Connector Hole Seal (10) - Inspect for damaged or worn Fluid Level Indicator Seal - Inspect for plugged vent holes in the Fluid Level Indicator (2)

SHIFT INDICATOR INDICATES WRONG GEAR SELECTION

Checks	Causes
Shift Cable	- Inspect for damage. - Verify proper attachment to shifter. - Verify cable is locked into shifter bracket. - Verify cable is properly attached to the transmission. - Verify that the cable is locked into the transmission bracket.
Manual Shaft	- Verify shift lever is properly attached to the manual shaft. - Verify manual shaft is not twisted or damaged.
Manual Shift Detent Lever with Shaft Position Switch Assembly, IMS	Verify proper operation. Refer to Transmission Internal Mode Switch Logic .

NO PARK

Checks	Causes
Front Differential Drive Pinion (w/Transfer Gear) Gear Assembly (481)	• Inspect for broken or stripped Park Gear splines • Inspect for broken or worn Park Gear
Front Differential Carrier Assembly (486)	Inspect for damaged, broken or loose Front Differential Ring Gear
Output Carrier Transfer Drive Gear Hub Assembly (477)	• Inspect for worn, stripped or broken splines • Inspect for disengaged hub to Transfer Drive Gear
Reaction Carrier Assembly (467)	• Inspect for worn, stripped or broken splines • Inspect for disengaged to the Output Sun Gear (475)
Case Assembly (507)	• Inspect for broken or damaged Case • Inspect for loose or stripped Park Pawl Actuator Bracket Bolts (500) • Inspect for broken or bent Park Pawl Actuator Bracket (501) • Inspect for broken or missing Park Pawl Actuator Guide Pin (505) or Manual Shaft Pin (510) • Inspect for broken, loose or misaligned Park Pawl Guide (506) • Inspect for binding or broken Park Pawl (503) or Actuator Assembly (509)
Manual Shift Detent Lever Assembly (511)	Inspect for broken or disengaged Manual Valve Link Pin

HARSH GARAGE SHIFT

Checks	Causes
Input Carrier Assembly (470)	Inspect for worn or stripped ring gear splines
Case Assembly (51)	• Check the engine for diagnostic codes. If the engine controller signals the transmission that engine torque is inaccurate, the transmission will command high line pressure. • Check line pressure at idle is below 800 kPa. • Inspect for stuck valves in the lower valve body, particularly the boost valves. • Inspect for damaged or fatigued 1-2-3-4 clutch wave plate (458) and low and reverse clutch wave plate (450). • Inspect for stripped or worn splines on 1-2-3-4 clutch plate (456). • Inspect for improperly positioned or plugged low reverse piston (408) air bleed. • Inspect for correct fluid level.
Low and Reverse Clutch Assembly (OWC) (455)	Inspect for stripped or sheared internal and external splines on the low and reverse clutch assembly (455).

NO DRIVE IN ALL RANGES

Checks	Causes

Checks	Causes
For an explanation of which clutches are applied during the transmission gear ranges, refer to Range Reference .	
Case Assembly (51)	• Inspect for cracked or broken Case (51) • Inspect for stripped or sheared splines • Inspect for binding Manual Shift Detent Lever Assembly (511) • Inspect for missing Manual Shift Shaft Pin (510) • Inspect for interference or binding Park Pawl Actuator Assembly (509) • Inspect for disengaged or broken 1 - 2 - 3 - 4 Clutch Piston Spring Retainer (459) • Inspect for loose or damaged case bushing. • Inspect for missing Lube Orifice Plug
Torque Converter (29)	• Inspect for stripped or sheared splines on Turbine Shaft • Inspect for missing Torque Converter to Flywheel bolts.
Torque Converter Housing (221)	• Inspect for loose, missing or broken Torque Converter and Differential Housing bolts (26). • Inspect for loose, missing or broken Fluid Pump bolts (204).
35R/456 Housing Assembly (422)	• Inspect for damaged or broken Input Shaft Thrust Bearing Assembly (32) • Inspect for stripped, sheared or loose splines on the Input Shaft to the 3 - 5 Reverse/4 - 5 - 6 Clutch Housing (422)
Oil Pump Assembly (203)	• Inspect for fluid leaks / improper fluid level • Inspect for disengaged, worn, binding or failed Drive Sprocket (216), Driven Sprocket (215) or Drive Link (217) • Inspect for leaking Fluid Outlet Seal Assembly (57) • Inspect for damaged or worn Drive (219, 220) and Driven Sprocket Thrust Washers (214) • Inspect for loose or missing Oil Pump Bolts (204) • Inspect for stripped or sheared splines on the Oil Pump Shaft or Driven Sprocket (215) • Inspect for damaged, clogged or improperly installed Oil Filter Assembly (201) • Inspect for damaged or leaking Oil Filter Neck Seal (202)
Low & Reverse Clutch Assembly (455)	Inspect for stripped or sheared splines to the Reaction Carrier (467)

Checks	Causes
Input Carrier Assembly (470)	• Inspect for stripped or sheared splines to ring gear • Inspect for improperly installed carrier pinion gear pins • Inspect for damaged or broken Pinion Gears. • Inspect for stripped or sheared splines on the Input Sun Gear (471). • Inspect for damaged or broken Output Internal Gear. • Inspect for broken or disengaged Output Internal Gear Retainer Ring. • Inspect for damaged or broken Input Carrier Thrust Bearing Assembly (468) and Output Carrier Thrust Bearing Assembly (473). • Inspect for damaged or broken Input Carrier Thrust Bearings (469, 472).
Reaction Carrier Assembly (467)	• Inspect for stripped or sheared Reaction Carrier Assembly (467) splines. • Inspect for damaged or broken Input Carrier Thrust Bearings (468). • Inspect for damaged or broken Pinion Gear teeth. • Inspect for damaged or broken Reaction Internal Gear teeth. • Inspect for disengaged or broken Reaction Internal Gear retainer ring.
Reaction Sun Gear Assembly (466)	• Inspect for damaged or broken weld at Sun Gear. • Inspect for loose or worn Reaction Sun Gear Assembly bushing.
Output Carrier Assembly (474)	• Inspect for stripped or sheared splines to reaction internal ring gear. • Inspect for damaged or broken Input Sun Gear Thrust Bearings (472). • Inspect for damaged or broken Pinion Gear teeth. • Inspect for damaged or broken Input Carrier Thrust Bearings (473). • Inspect for broken or damaged Output Internal Gear.
Output Sun Gear Assembly (475)	• Inspect for stripped or sheared Output Sun Gear Assembly (475) splines. • Inspect for broken Output Sun Gear Assembly (4755) hub or weld.
Low and Reverse Clutch Assembly (455)	Inspect for disengaged or broken Low and Reverse Clutch Assembly (455).

Checks	Causes
Differential Carrier Assembly (486)	- Inspect for stripped or sheared splines on Differential Side Gear. - Inspect for stripped or sheared splines Differential Carrier to PTU (AWD only). - Inspect for damaged or broken Pinion Gear teeth. - Inspect for broken, worn or damaged Final Drive Inner and Outer Thrust Washers (492).
Control Solenoid (w/Body and TCM) Valve Assembly	- Check that the Manual Valve (348) is engaged with Manual Shift Detent Lever Assembly (511). - Inspect the Control Solenoid (w/Body and TCM) Valve Assembly (15) and verify that it is functioning properly. Refer to Control Solenoid Valve and Transmission Control Module Assembly Inspection.

NO FIRST AND REVERSE GEARS

Checks	Causes
Low and Reverse Clutch Assembly (455)	- Inspect for disengaged or broken low and reverse clutch retainer (454). - Inspect for stripped or sheared splines on low and reverse clutch (455).
Low and Reverse Clutch	- Inspect for stripped or sheared splines on low and reverse clutch plates (449 - 453). - Inspect for damaged, deformed or improper surface finish on the low and reverse clutch plates (449 - 453).
Case Cover Assembly (403)	- Inspect for disengaged or broken low and reverse clutch piston spring retainer (410). - Inspect for worn, damaged or debonding low and reverse clutch piston seals (408). - Inspect for broken or deformed low and reverse clutch piston (408). - Inspect for improperly position or too large bleed hole in low and reverse piston (408). - Inspect for porosity or improper finish on the case cover. - Inspect for broken or fatigued low and reverse clutch piston return spring (409).

NO FIRST, SECOND, THIRD, AND FOURTH GEAR

Checks	Causes

Checks	Causes
1-2-3-4 Clutch Assembly	- Inspect for damaged or worn 1-2-3-4 clutch plates (456 - 458). - Inspect for damaged or broken 1-2-3-4 clutch piston (461) and piston seals damaged, worn or delaminating. - Inspect for broken or binding 1-2-3-4 clutch piston return spring (460). - Inspect for broken or disengaged 1-2-3-4 clutch piston return spring retainer (459). - Inspect for broken or fatigued 1-2-3-4 clutch wave plate (458).
Output Sun Gear Assembly (457)	Inspect for stripped or sheared splines on the output sun gear shell.
Reaction Carrier Assembly (467)	- Inspect for stripped or sheared splines on the input ring gear. - Inspect for disengaged or broken input ring gear retainer.
Output Carrier Assembly (474)	- Low/reverse clutch assembly (OWC) (455) splines sheared or broken. - Inspect for disengaged or broken reaction ring gear retainer.
Case Assembly (51)	Inspect for worn or damaged case splines or retainer ring grooves.

NO SECOND AND SIXTH GEAR

Checks	Causes
2-6 Clutch Assembly	- Inspect for damaged or worn 2-6 clutch plates (445 - 447). - Inspect for damaged, worn, broken, improper surface finish or sheared splines on the 2-6 clutch backing plate (448).
Reaction Carrier Assembly (467)	- Inspect for stripped or sheared splines on the input ring gear. - Inspect for disengaged or broken input ring gear retainer.
Case Cover Assembly (403)	- Inspect for damaged or broken 2-6 clutch piston (405) and piston seals damaged, worn or delaminating. - Inspect for broken or binding 2-6 clutch piston return spring (406). - Inspect for broken or disengaged 2-6 clutch piston return spring retainer (407). - Inspect for damaged, worn or improper surface finish in the piston bore (403).
Case Assembly (51)	Inspect for stripped or sheared splines (51).

HARSH OR LATE FIRST, SECOND, THIRD, AND FOURTH SHIFT

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Checks	Causes
1-2-3-4 Clutch Assembly	• Inspect for damaged or broken 1-2-3-4 clutch piston (461) and piston seals damaged, worn or leaking. • Inspect for fatigued or binding 1-2-3-4 clutch piston return spring (460). • Inspect for improper surface finish on 1-2-3-4 clutch plates (456 - 458). • Inspect for broken or fatigued 1-2-3-4 clutch waved plate (458).
Case	Inspect for leaking or damaged 1-2-3-4 clutch fluid passage seal (65).

HARSH FIRST AND REVERSE SHIFT

Checks	Causes
Case Cover Assembly (403)	Inspect for plugged or improperly positioned low and reverse piston (408) air bleed.
Low and Reverse Clutch	• Inspect for improper surface finish on low and reverse clutch plates (449 - 453). • Inspect for damaged or worn low and reverse clutch plates (452). • Inspect for damaged low and reverse clutch backing plate (453). • Inspect for worn splines on backing plate (453). • Inspect for damaged low and reverse clutch piston assembly (408), spring (409), and spring retaining ring (410). • Inspect for fatigued or binding low and reverse clutch piston return spring (409). • Inspect for broken low and reverse clutch wave plate (449).
Lower Valve Body	Inspect for stuck 4-5-6 clutch boost valve.

NO THIRD, FIFTH, AND REVERSE GEAR

Checks	Causes

Checks	Causes
3-5-Reverse Clutch Assembly	- Inspect for damaged, worn or stripped splines on 3-5-reverse clutch plates (423 - 426), backing plate (426). - Inspect for sheared or stripped splines on 3-5-rev/4-5-6 housing to turbine shaft (422). - Inspect for damage, improper surface finish, porosity, deformed or unbalanced 3-5-rev/4-5-6 housing (422). - Inspect for damaged, worn, loose or seized hub bushing in the 3-5-rev/4-5-6 housing. - Inspect for broken, porous or improper surface finish or plugged oil passages of the 3-5-rev/4-5-6 housing (422). - Inspect for failure of the Input shaft thrust bearing (32). - Inspect for disengaged or broken 3-5-reverse clutch backing plate retainer (427). - Inspect for disengaged or broken 3-5-reverse backing plate (426). - Inspect for damaged, worn or leaking 3-5-reverse clutch piston seals (419 - 421). - Inspect for damaged or broken 3-5-rev/4-5-6 clutch housing (422). - Inspect for warped, damaged, improper surface finish or debonding 3-5-reverse clutch piston (417). - Inspect for broken or fatigued 3-5-reverse clutch spring (418). - Inspect for disengaged or broken speed sensor retractor retainer (415). - Inspect for broken speed sensor retractor wheel (416). - Inspect for seized input shaft thrust bearing (32).
Reaction Carrier (467)	- Inspect for broken or disengaged input internal gear retainer. - Inspect for stripped or sheared splines on the input internal gear.
Output Carrier (474)	Inspect for stripped or sheared splines for the reaction internal ring gear.
4-5-6 Clutch Assembly	- Inspect for plugged or missing 4-5-6 piston dam oil feed hole. - Inspect for leaking 4-5-6 piston dam.

HARSH OR LATE SECOND AND SIXTH SHIFT

Checks	Causes
2 - 6 Clutch Assembly	- Inspect for worn or improper surface finish on the 2 - 6 Clutch Plates (446, 447) and Backing Plate (448) - Inspect for fatigued 2 - 6 Clutch Piston Cushion Spring (445)

Checks	Causes
Case Cover Assembly (403)	- Inspect for damaged or broken 2 - 6 Clutch Piston (405) and piston seals damaged, worn or delaminating - Inspect for fatigued 2 - 6 Clutch Piston Return Spring (406)

NO FOURTH, FIFTH, AND SIXTH GEAR

Checks	Causes
4-5-6 Clutch Assembly	- Inspect for damaged or broken 4-5-6 clutch piston (433) and piston seals (430 - 432). - Inspect for broken or disengaged 4-5-6 backing plate retainer (442). - Inspect for damaged or broken 4-5-6 clutch dam piston (435) and piston seals damaged, worn or delaminating. - Inspect for broken or disengaged 4-5-6 clutch dam retainer (436). - Inspect for sheared or stripped splines on the reaction carrier hub (438). - Inspect for sheared or stripped splines on 3-5-rev/4-5-6 housing to turbine shaft (422). - Inspect for loose, worn or damaged 3-5-rev/4-5-6 housing bushing. - Inspect for broken, porous or improper surface finish or plugged oil passages of the 3-5-rev/4-5-6 housing (422). - Inspect for failure of the input shaft thrust bearing (32). - Inspect for damaged, stripped or sheared splines on 4-5-6 clutch plates (439 - 441). - Inspect for broken or fatigued 4-5-6 clutch piston return spring (434).

HARSH OR LATE THIRD, FIFTH, AND REVERSE SHIFT

Checks	Causes
3 - 5 - Reverse Clutch Assembly	- Inspect for improper surface finish on 3 - 5 - Reverse Clutch Plates (423 - 426), Backing Plate (426) - Inspect for plugged or restricted oil passages and air bleed of the 3 - 5 - Rev/4 - 5 - 6 Housing (422) - Inspect for damaged, worn or leaking 3 - 5 - Reverse Clutch Piston Seals (419 - 421) - Inspect for warped 3 - 5 - Rev/4 - 5 - 6 Clutch Housing (422) - Inspect for fatigued 3 - 5 - Reverse Clutch Waved Plate (423)

HARSH FOURTH, FIFTH, AND SIXTH SHIFT

Checks	Causes

Checks	Causes
4-5-6 Clutch Assembly	- Inspect for leaking 4-5-6 clutch piston (433) and piston seals (430 - 432). - Inspect for plugged or restricted 4-5-6 piston dam air bleed. - Inspect for fatigued 4-5-6 clutch piston spring (434). - Inspect for leaking 4-5-6 clutch dam seals (435). - Inspect for improper surface finish on 4-5-6 clutch plates (439 - 441). - Inspect for porous, improper surface finish, seal groove damage or plugged or restricted oil passages of the 3-5-rev/4-5-6 housing (422). - Inspect for leaking or damaged 4-5-6 piston dam (435).

NO TORQUE CONVERTER CLUTCH APPLY

Checks	Causes
Torque Converter Assembly (27)	- Inspect for damaged Torque Converter Clutch Seal (inside converter assembly). - Diagnose Torque Converter Assembly for possible internal damage. Refer to Torque Converter Diagnosis.
Upper Valve Body Assembly (349)	Inspect for worn, damaged or sticking TCC Regulator Apply (330) and TCC Regulator Apply Shuttle (331) Valves.
Transfer Drive Gear Support Assembly (208)	Inspect for worn or damaged Transfer Drive Gear Support Seal (213).
Torque Converter Housing Assembly (221)	Inspect for leaking or damaged Torque Converter Fluid Seal Assembly (225).

NO TORQUE CONVERTER CLUTCH RELEASE

Checks	Causes
Torque Converter Assembly (27)	Diagnose Torque Converter Assembly for possible internal damage. Refer to Torque Converter Diagnosis .
Upper Valve Body Assembly (349)	Inspect for worn, damaged or sticking TCC Regulator Apply (330) and TCC Regulator Apply Shuttle (331) Valves.

HARSH TORQUE CONVERTER CLUTCH APPLY, OR INOPERATIVE OR NO ELECTRONICALLY CONTROLLED CAPACITY CLUTCH CONTROL

Checks	Causes
Torque Converter Assembly (27)	- Inspect for leaking or damaged Torque Converter Clutch Hub Seal. - Diagnose Torque Converter Assembly for possible internal damage. Refer to Torque Converter Diagnosis.
Drive Gear Support Assembly (208)	Inspect for leaking Drive Gear Support Seal (213).

NO REVERSE GEAR

Checks	Causes

Checks	Causes
Low and Reverse Clutch Assembly (455)	- Inspect for disengaged or broken low and reverse clutch retainer (454). - Inspect for stripped or sheared splines on low and reverse clutch (455).
Low and Reverse Clutch	- Inspect for stripped or sheared splines on low and reverse clutch plates (449 - 453). - Inspect for damaged, deformed or improper surface finish on the low and reverse clutch plates (449 - 453).
3 - 5 - Reverse Clutch Assembly	- Inspect for damaged, worn or stripped splines on 3 - 5 - Reverse Clutch Plates (423 - 426), Backing Plate (426) - Inspect for sheared or stripped splines on 3 - 5 - Rev/4 - 5 - 6 Housing to Turbine Shaft (422) - Inspect for damage, improper surface finish, porosity, deformed or unbalanced 3 - 5 - Rev/4 - 5 - 6 Housing (422) - Inspect for damaged, worn, loose or seized hub bushing in the 3 - 5 - Rev/4 - 5 - 6 Housing - Inspect for broken, porous or improper surface finish or plugged oil passages of the 3 - 5 - Rev/4 - 5 - 6 Housing (422) - Inspect for failure of the Input Shaft Thrust Bearing (32) - Inspect for disengaged or broken 3 - 5 - Reverse Clutch Backing Plate Retainer (427) - Inspect for damaged, worn or leaking 3 - 5 - Reverse Clutch Piston Seals (419 - 421) - Inspect for damaged or broken 3 - 5 - Rev/4 - 5 - 6 Clutch Housing (422) - Inspect for warped, damaged, improper surface finish or debonding 3 - 5 - Reverse Clutch Piston (417) - Inspect for broken or fatigued 3 - 5 - Reverse Clutch Spring (418) - Inspect for disengaged or broken Speed Sensor Reluctor Retainer (415) - Inspect for broken Speed Sensor Reluctor Wheel (416) - Inspect for seized Input Shaft Thrust Bearing (32)

FLUID PRESSURE HIGH OR LOW

Checks	Causes
Fluid Pump Assembly (203)	- Inspect for loose fluid pump bolts (204). - Inspect for leaking or damaged fluid pump outlet seals (57) and oil filter seal (202). - Inspect for improperly installed or damaged oil filter (201). - Inspect for sticking line pressure blow off valve.

Checks	Causes
Front Differential Drive Gear Support Assembly (208)	• Inspect for leaking or damaged drive gear support torque converter seal assembly (206) or fluid passage tube gasket (212). • Inspect for leaking or damaged drive gear support fluid passage tube assembly (209).
Upper Valve Body Assembly (312)	• Inspect for leaking or damaged upper valve body assembly (309) gasket. • Inspect for worn, sticking or damaged pressure regulator valve (337) or pressure regulator valve spring (338).
Lower Valve Body Assembly (313)	Inspect for leaking or damaged lower valve body assembly (313) gasket.
Control Valve (w/Body and TCM) Valve Assembly (15)	• Inspect for leaking or damaged filter plate assembly seals (16). • Verify VBS operation in not stuck high or low.
Filter Assembly	Inspect for damaged, restricted, or mis-installed fluid filter assembly.
Case Assembly (51)	Inspect for missing lube oil circuit orifice or baffle (229).

Automatic Transmission - 6T70 (M7W) - Repair Instructions - Off Vehicle - Impala

REPAIR INSTRUCTIONS - OFF VEHICLE

LIFT PLATE AND HOLDING FIXTURE INSTALLATION

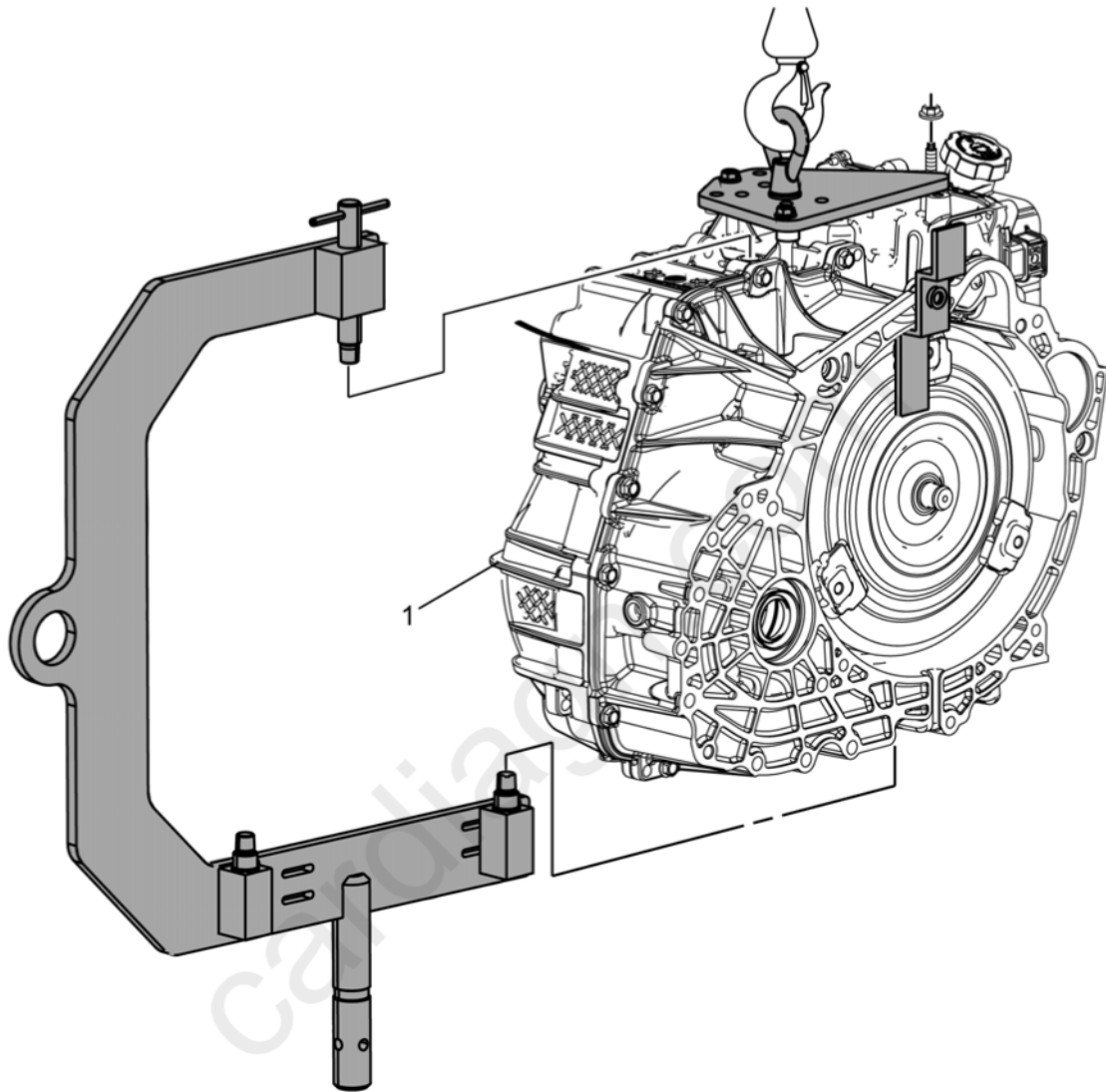


Fig. 1: Identifying Lift Plate & Holding Fixture

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
1	Â WARNING: Handle with care, the transmission assembly weighs over 90.7 kg (200 lbs). Bodily injury could occur if not handled properly. WARNING: Lock pin must be secured into the bench fixture to hold the transmission and prevent bodily injury. CAUTION: Refer to Fastener Caution . Procedure 1. Install DT-47811-A Lift Plate 2. Tighten bolts and nut to 12 N.m (106 lb in) 3. Raise the transmission with an overhead hoist in order to install the holding fixture. 4. Adjust mounting block on DT-46625 Transmission Holding Fixture to match bosses on case, then tighten bolts to 13 N.m (10 lb ft) 5. Ensure the DT-3289-20 Holding Fixture is mounted to a bench that is properly supported and will support the weight of the transmission assembly without tipping. 6. Install lock pin for DT-3289-20 Holding Fixture. Special Tools • DT-3289-20 Holding Fixture • DT-46625 Transmission Holding Fixture • DT-47811-A Transmission Lift Plate For equivalent regional tools, refer to Special Tools .

TORQUE CONVERTER REMOVAL

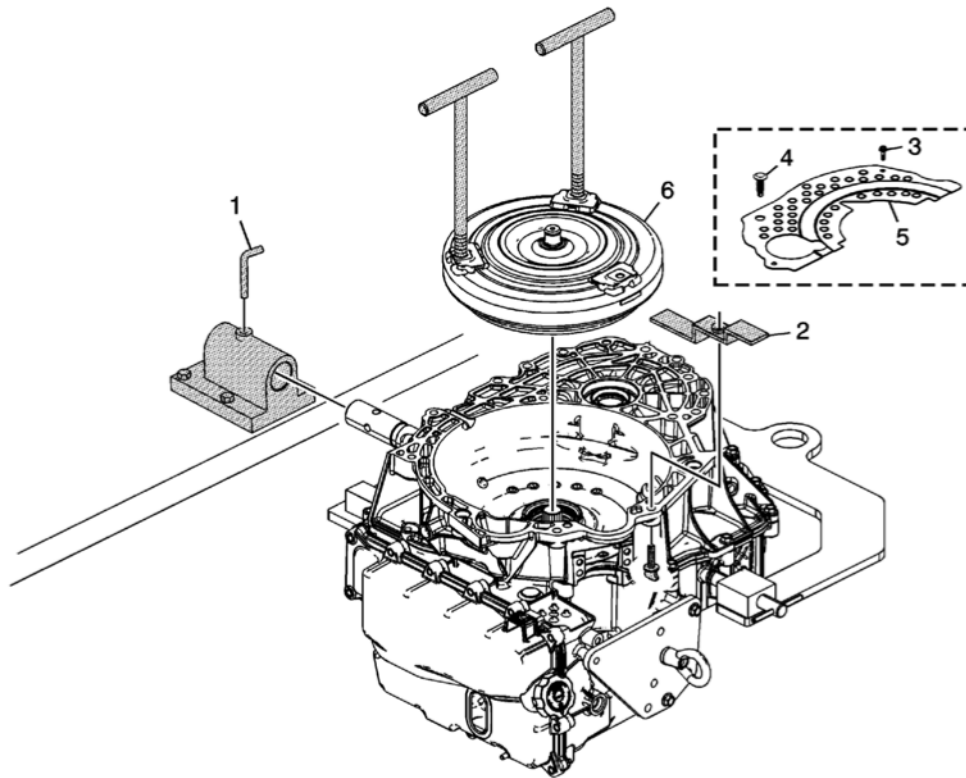


Fig. 2: View Of Torque Converter

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Lock Pin WARNING: Lock pin must be secured into the bench fixture to hold the transmission and prevent bodily injury. NOTE: Ensure the DT 3289-20 holding fixture is mounted to a bench that is properly supported and will support the weight of the transmission assembly without tipping. DT-39890 holding fixture adapter adapter and an engine stand can be used as an alternative method for supporting the transmission assembly during repairs. Special Tools • DT 3289-20 Holding Fixture • DT-39890 Transmission Holding Fixture Adapter For equivalent regional tools, refer to Special Tools .
2	DT 21366 Converter Holding Strap For equivalent regional tools, refer to Special Tools .
3	Dust Cover Bolts M10 x 25, model dependent (Qty: 2)
4	Dust Cover Push Pin, model dependent
5	Dust Cover, model dependent

Callout	Component Name
6	Torque Converter Assembly CAUTION: Only install the lift assist handles until it stops. Do not tighten. Over tightening the lift assist handles can cause damage to the torque converter. NOTE: Failure to raise the torque converter straight up could damage the torque converter clutch lip seal inside the torque converter clutch assembly. Special Tools DT 46409 Torque Converter Lifting Handles For equivalent regional tools, refer to Special Tools .

CONTROL VALVE BODY ASSEMBLY REMOVAL

Control Valve Body Cover Removal

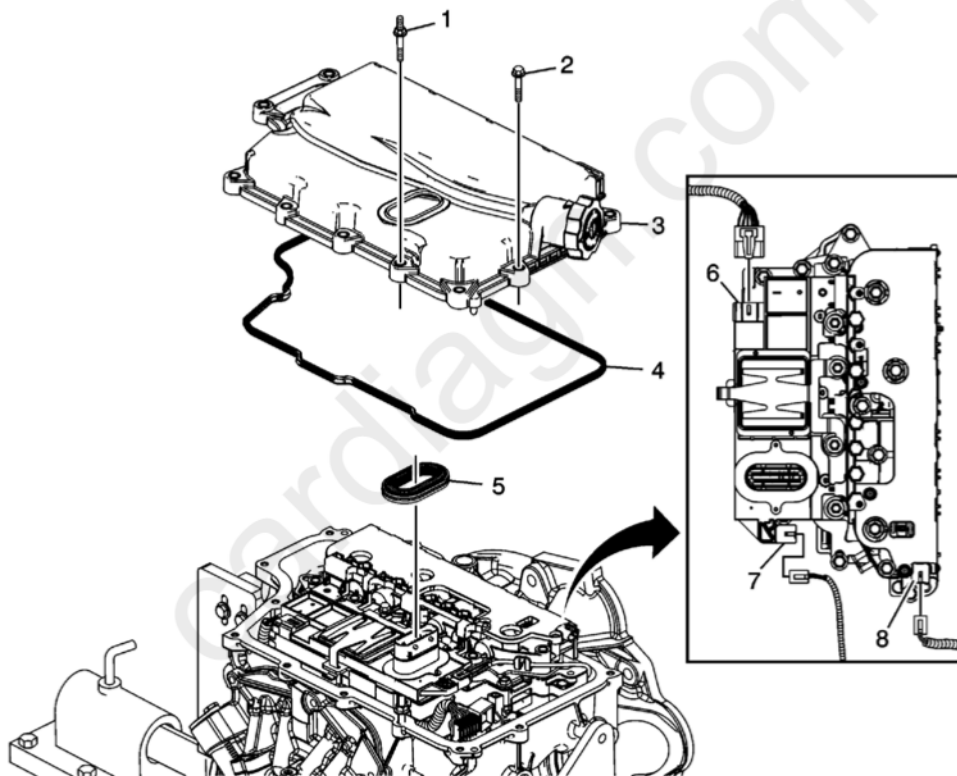


Fig. 3: Control Valve Body Assembly

Courtesy of GENERAL MOTORS COMPANY

Control Valve Body Cover Removal

Callout	Component Name
1	Control Valve Body Cover Stud M6 x 30 (Qty: 3)
2	Control Valve Body Cover Bolt M6 x 30 (Qty: 11)
3	Control Valve Body Cover
4	Control Valve Body Cover Gasket
	NOTE: Do not re-use the valve body cover gasket.

Callout	Component Name
5	Control Valve Body Cover Wiring Connector Hole Seal CAUTION: Support the control solenoid valve assembly around the connector when removing the seal. Excessive pulling force can damage the internal electrical connections.
6	Shift Position Switch Connector
7	Output Speed Sensor Connector
8	Input Speed Sensor Connector

Control Solenoid (w/Body and TCM) Valve Assembly Removal

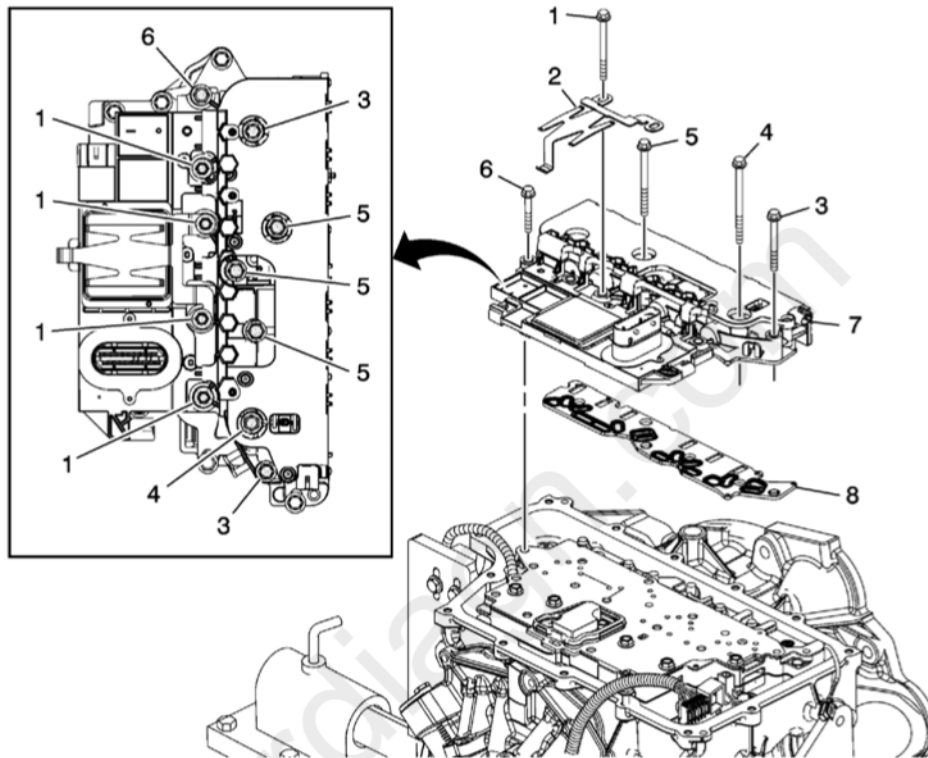


Fig. 4: Control Solenoid (W/ Body and TCM) Valve Assembly Components
Courtesy of GENERAL MOTORS COMPANY

Control Solenoid (w/Body and TCM) Valve Assembly Removal

Callout	Component Name
1	Control Valve Body Bolt M6 x 80 (Qty: 4)
2	Control Solenoid Valve Spring
3	Control Valve Body Bolt M6 x 65 (Qty: 2)
4	Control Valve Body Bolt M6 x 42 (Qty: 1)
5	Control Valve Body Bolt M6 x 95 (Qty: 3)
6	Control Valve Body Bolt M6 x 55 (Qty: 1)
7	Control Solenoid (w/Body and TCM) Valve Assembly

Callout	Component Name
8	Control Solenoid Valve Assembly Filter Plate CAUTION: Use care when removing or installing the filter plate assembly. A broken or missing retaining tab may not adequately secure the filter plate to the control solenoid valve assembly, resulting in possible damage or contamination. NOTE: Discard the filter plate, it is not reusable.

Control Valve Body Assembly and Output Speed Sensor Removal

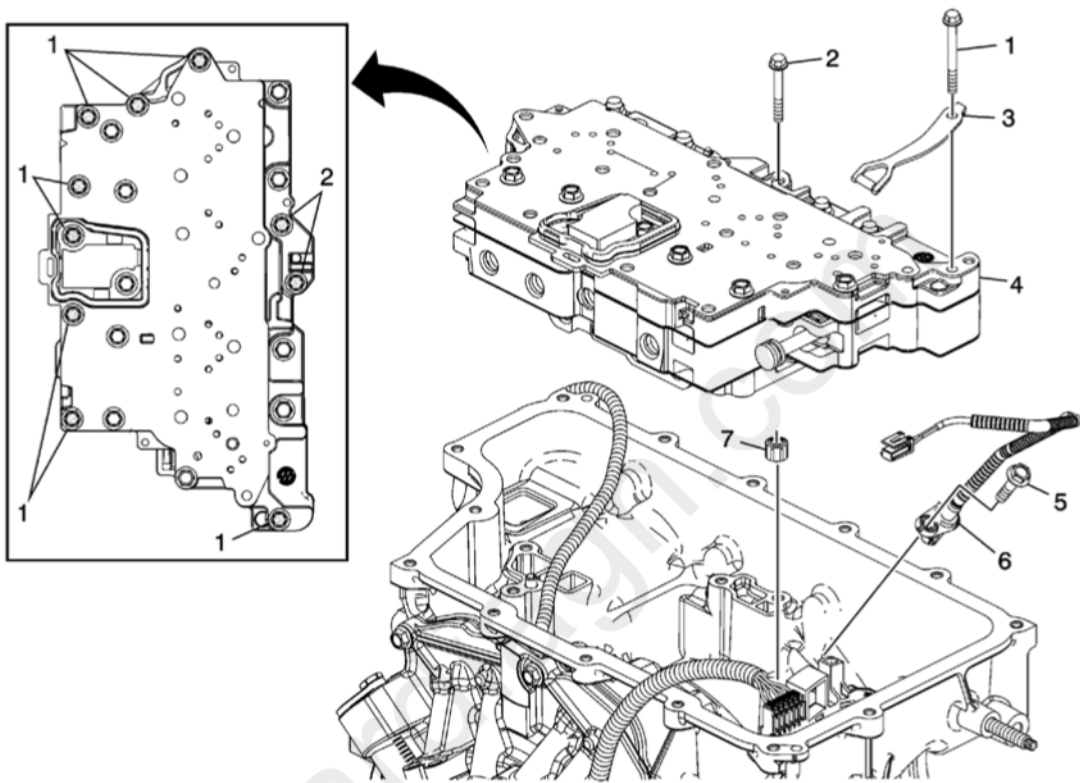


Fig. 5: Control Valve Body Assembly And Output Speed Sensor
 Courtesy of GENERAL MOTORS COMPANY

Control Valve Body Assembly and Output Speed Sensor Removal

Callout	Component Name
1	Control Valve Body Bolt M6 x 65 (Qty: 8)
2	Control Valve Body Bolt M6 x 55 (Qty: 2)
3	Manual Shaft Detent Assembly
4	Control Valve Body Assembly
5	A/Trans Output Speed Sensor Bolt M6 x 25
6	A/Trans Output Speed Sensor
7	1 - 2 - 3 - 4 Clutch Fluid Passage Seal NOTE: The seal is not reusable.

CASE COVER AND 3-5-REVERSE AND 4-5-6 CLUTCH HOUSING REMOVAL

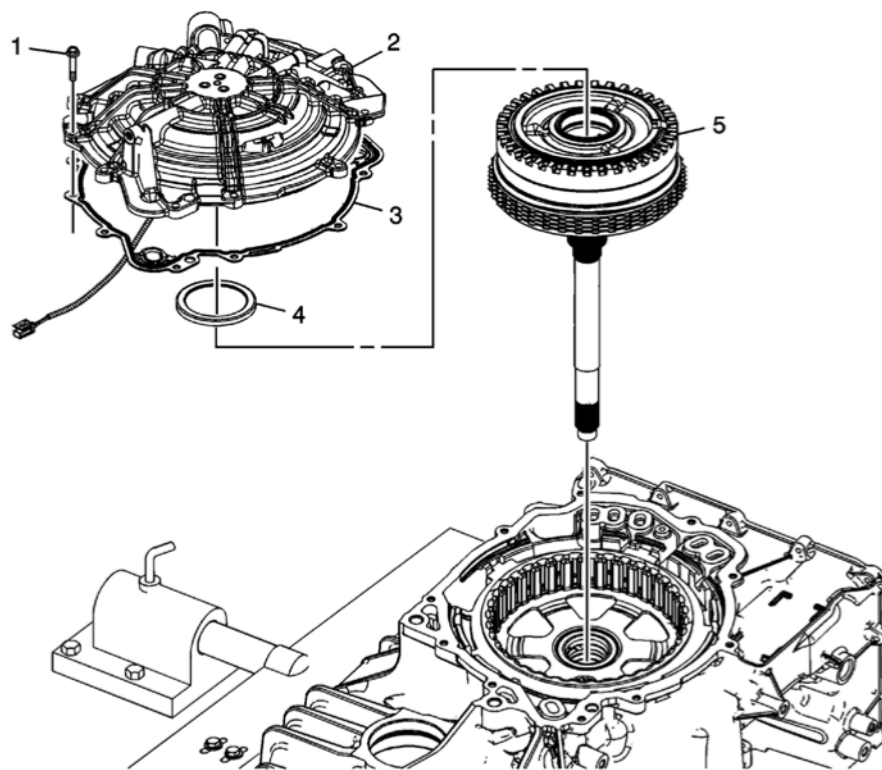


Fig. 6: Identifying Case Cover, 3-5-Reverse & 4-5-6 Clutch Housing
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	A/Trans Case Cover Assembly Bolt M6 x 30 (Qty: 10)
2	A/Trans Case Cover Assembly CAUTION: Use care when pulling the input speed sensor wire harness through the case to avoid damaging the harness.
3	A/Trans Case Cover Gasket NOTE: The gasket is not reusable.
4	Input Shaft Thrust Bearing Assembly NOTE: The bearing may be stuck to the case cover.
5	3 - 5 Rev/4 - 5 - 6 Clutch Housing Assembly

REACTION CARRIER HUB AND 2-6 CLUTCH PLATE REMOVAL

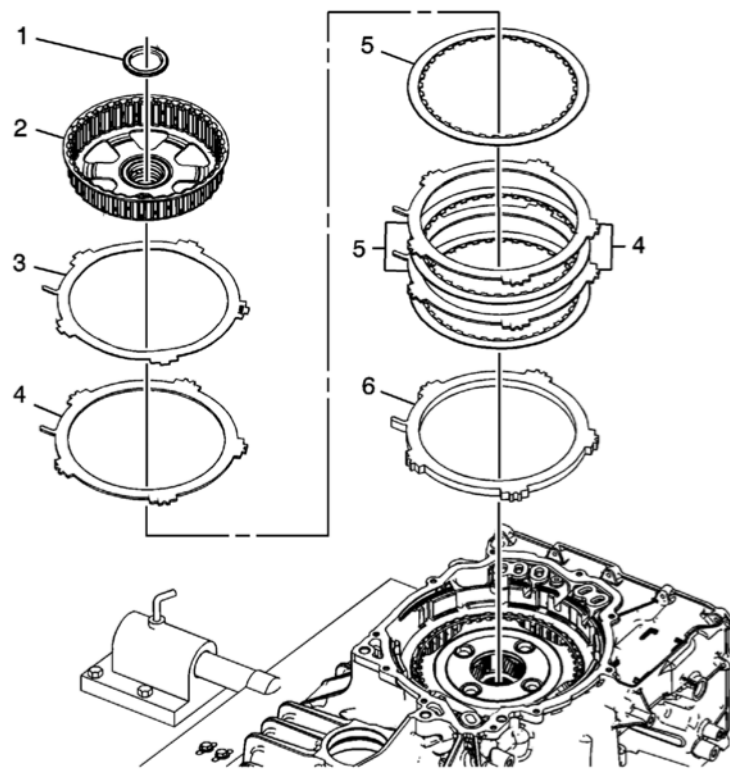


Fig. 7: Identifying Reaction Carrier Hub & 2-6 Clutch Plate

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	2 - 6 Clutch Hub Thrust Bearing Assembly NOTE: The 2 - 6 clutch hub thrust bearing assembly may be stuck to the reaction carrier hub assembly.
2	Reaction Sun Gear Assembly
3	2 - 6 Clutch Cushion Spring
4	2 - 6 Clutch Plate (Qty: 3)
5	2 - 6 Clutch (w/Friction Material) Plate Assembly (Qty: 3)
6	2 - 6 Clutch Backing Plate

INPUT, REACTION, AND OUTPUT CARRIER REMOVAL

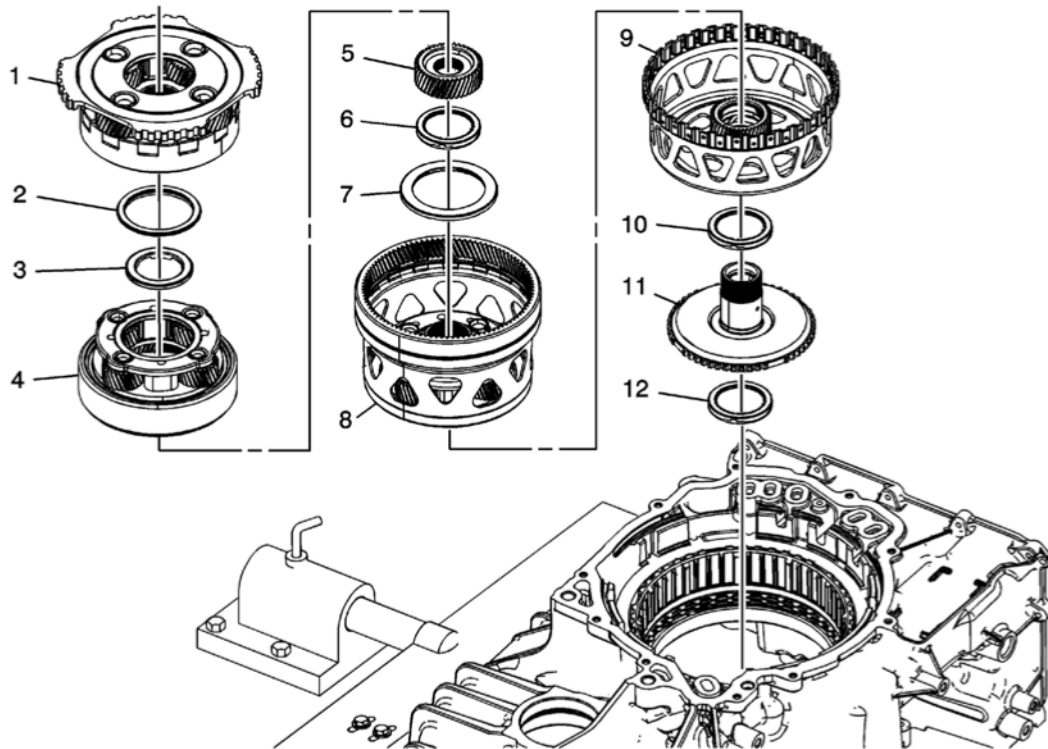


Fig. 8: View Of Input, Reaction & Output Carriers
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Reaction (w/Input Internal Gear) Carrier Assembly
2	Input Carrier Thrust Bearing Assembly
3	Input Sun Gear Thrust Bearing Assembly
4	Input (w/Output Internal Gear) Carrier Assembly
5	Input Sun Gear
6	Output Carrier Thrust Bearing Assembly
7	Output Carrier Thrust Bearing Assembly
8	Output Carrier Assembly
9	Output Sun Gear Assembly
10	Front Differential Transfer Drive Gear Input Hub Bearing Assembly
11	Output Carrier Transfer Drive Gear Hub Assembly
12	Output Carrier Transfer Drive Gear Hub Bearing Assembly
	NOTE: The bearing may be stuck to the support assembly.

LOW AND REVERSE CLUTCH PLATE REMOVAL

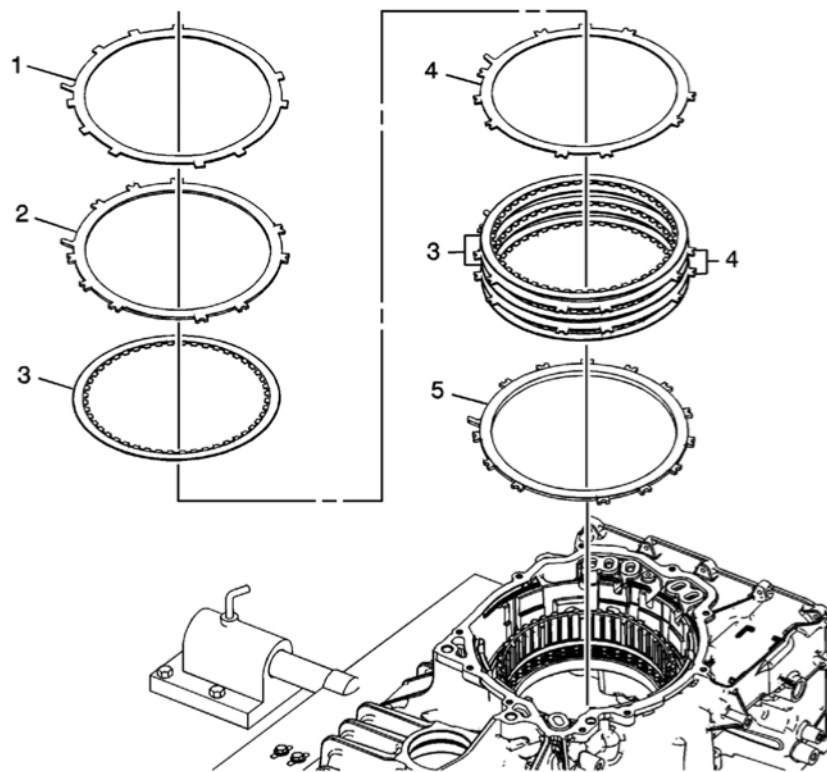


Fig. 9: Identifying Low & Reverse Clutch Plate
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Low and Reverse Clutch Cushion (Waved) Spring
2	Low and Reverse Clutch Apply Plate
3	Low and Reverse Clutch (w/Friction Material) Plate Assembly (Qty: 2)
4	Low and Reverse Clutch Plate (Qty: 3)
5	Low and Reverse Clutch Backing Plate

LOW AND REVERSE CLUTCH AND 1-2-3-4 CLUTCH PLATE REMOVAL

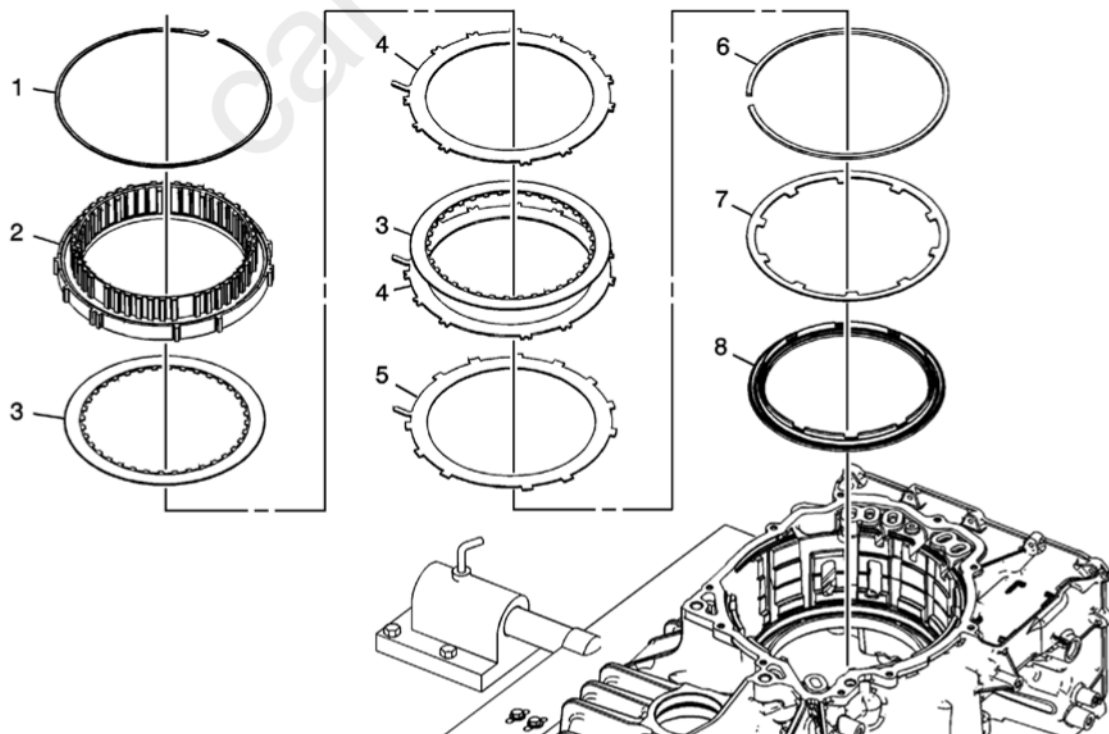


Fig. 10: Identifying Low, Reverse Clutch & 1-2-3-4 Clutch Plates
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Low and Reverse Clutch Retainer Ring
2	Low and Reverse Clutch Assembly
3	1 - 2 - 3 - 4 Clutch (w/Friction Material) Plate Assembly (Qty: 2)
4	1 - 2 - 3 - 4 Clutch Plate (Qty: 2)
5	1 - 2 - 3 - 4 Clutch (Waved) Plate
6	1 - 2 - 3 - 4 Clutch Spring Retainer Ring
7	1 - 2 - 3 - 4 Clutch Spring
	1 - 2 - 3 - 4 Clutch Piston
8	NOTE: • Use pliers to remove the piston. • Inspect the piston seals for damage and/or wear. The piston is reusable.

TORQUE CONVERTER AND DIFFERENTIAL HOUSING, FRONT DIFFERENTIAL TRANSFER DRIVE GEAR, AND FRONT DIFFERENTIAL CARRIER REMOVAL

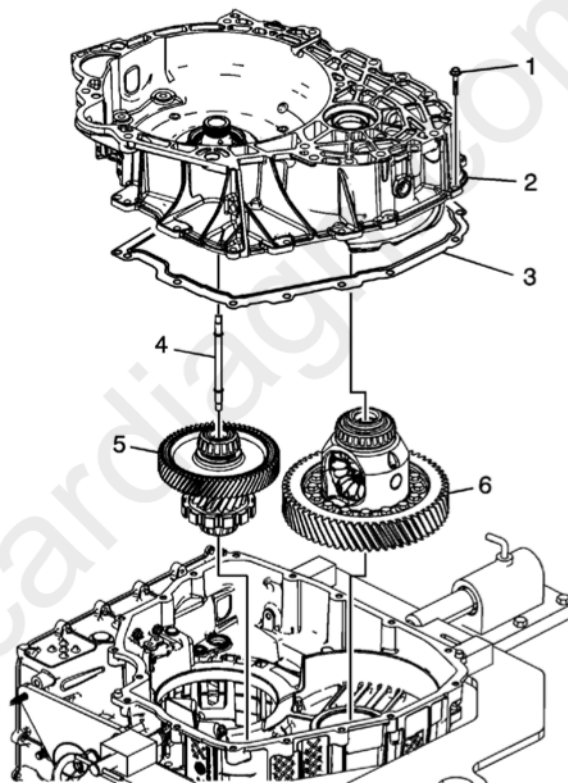


Fig. 11: Identifying Torque Converter, Differential Housing, Front Differential Transfer Drive Gear & Front Differential Carrier

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Torque Converter and Differential Housing Bolt M8 x 35 (Qty: 17)
2	Torque Converter, Support and A/Trans Fluid Pump Housing Assembly
	Torque Converter Housing Outer Seal
3	NOTE: The seal is not reusable.
4	Front Differential Drive Pinion Gear Lube Tube
5	Front Differential Drive Pinion (w/Transfer Gear) Gear Assembly
6	Front Differential Carrier Assembly

FLUID TROUGH REMOVAL

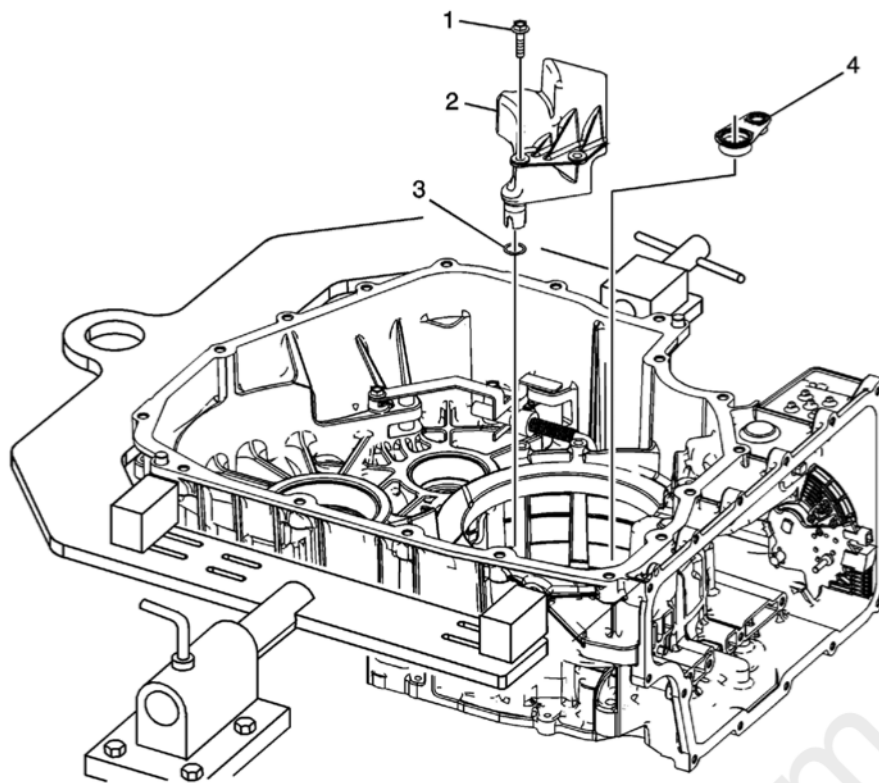


Fig. 12: Identifying Fluid Trough

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	A/Trans Fluid Trough Bolt M6 x 25 (Qty: 1)
2	A/Trans Fluid Trough
3	A/Trans Fluid Trough (O-Ring) Seal
4	A/Trans Fluid Pump Outlet Seal Assembly NOTE: The seal assembly is not reusable.

MANUAL SHIFT DETENT LEVER WITH SHAFT POSITION SWITCH ASSEMBLY AND PARK PAWL ACTUATOR REMOVAL

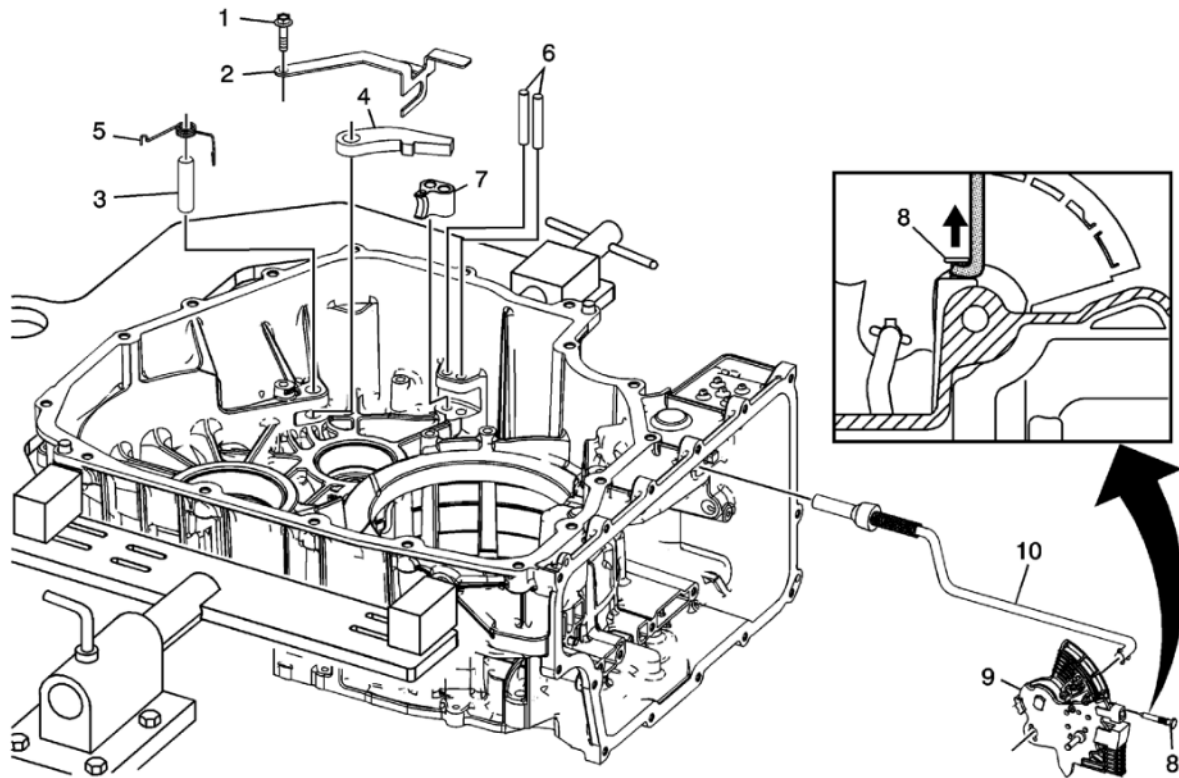


Fig. 13: Identifying Manual Shift Detent Lever With Shaft Position Switch Assembly & Park Pawl Actuator

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Park Pawl Actuator Bracket Bolt M6 x 25 (Qty: 2)
2	Park Pawl Actuator Bracket
3	Park Pawl Shaft
4	Park Pawl
5	Park Pawl Spring
6	Park Pawl Actuator Guide Pin
7	Park Pawl Actuator Guide
8	Manual Shift Detent Lever Pin NOTE: • Use a small nail puller or other suitable tool. • Discard the pin. The pin is not reusable. Special Tools • DT 23129 Universal Seal Remover • GE 6125-1B Slide Hammer with Adapter For equivalent regional tools, refer to Special Tools .
9	Manual Shaft Detent (w/Shift Position Switch) Lever Assembly NOTE: Rotate the assembly counterclockwise so the actuator rod will fit through the case opening.
10	Park Pawl Actuator Assembly

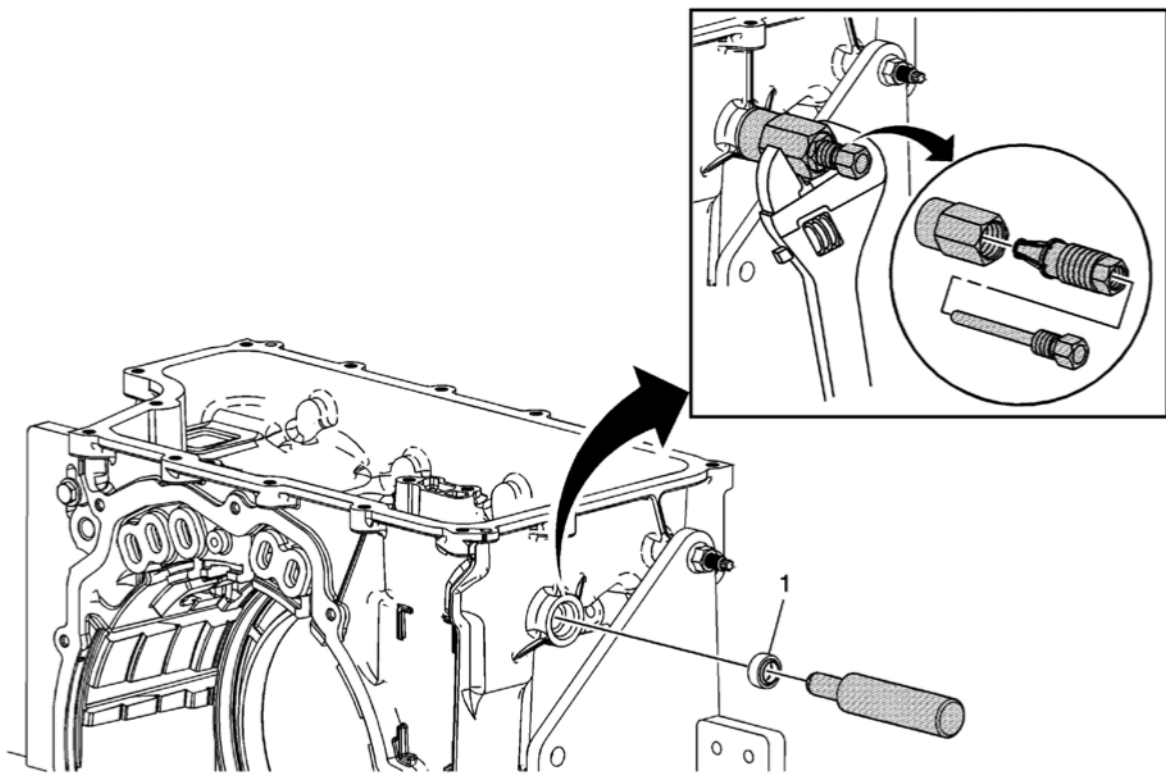


Fig. 14: Identifying Manual Shift Shaft Seal
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Manual Shift Shaft Seal Special Tools • DT 45201 Cooler Line Seal Remover • DT 46626 Seal Installer
	For equivalent regional tools, refer to Special Tools .

FRONT WHEEL DRIVE SHAFT SEAL REPLACEMENT - CASE SIDE

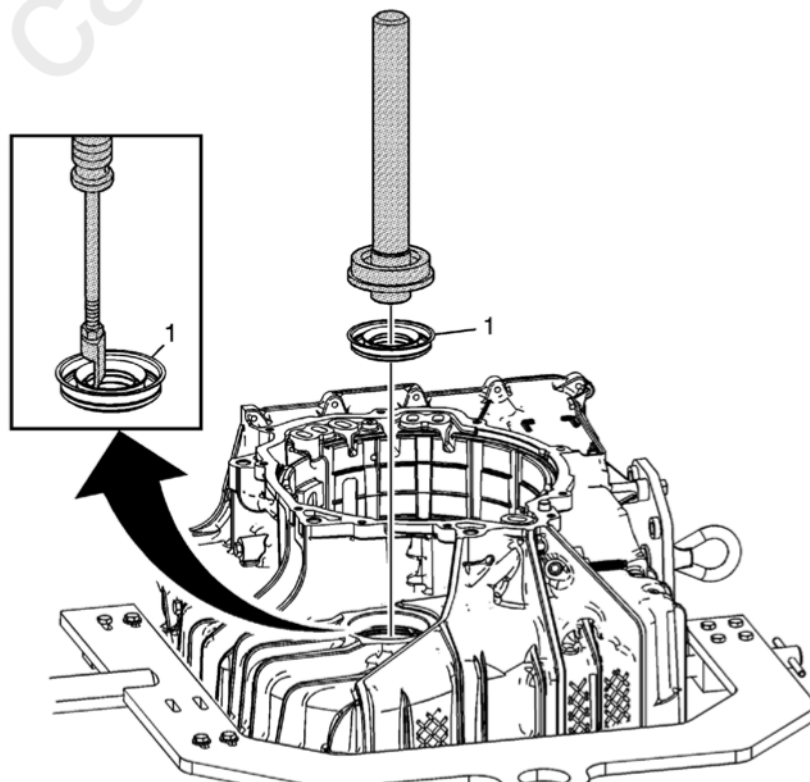


Fig. 15: Identifying Front Wheel Drive Shaft Oil Seal
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Front Wheel Drive Shaft Oil Seal Assemble NOTE: Use the flat side of J 46629-A seal installer to seat the seal to the case surface. Special Tools • DT 23129 Universal Seal Remover • DT 46629-A Seal Installer • GE 6125-1B Slide Hammer • GE 8092 Driver Handle For equivalent regional tools, refer to Special Tools .

FRONT DIFFERENTIAL CARRIER BEARING CUP REPLACEMENT - CASE SIDE

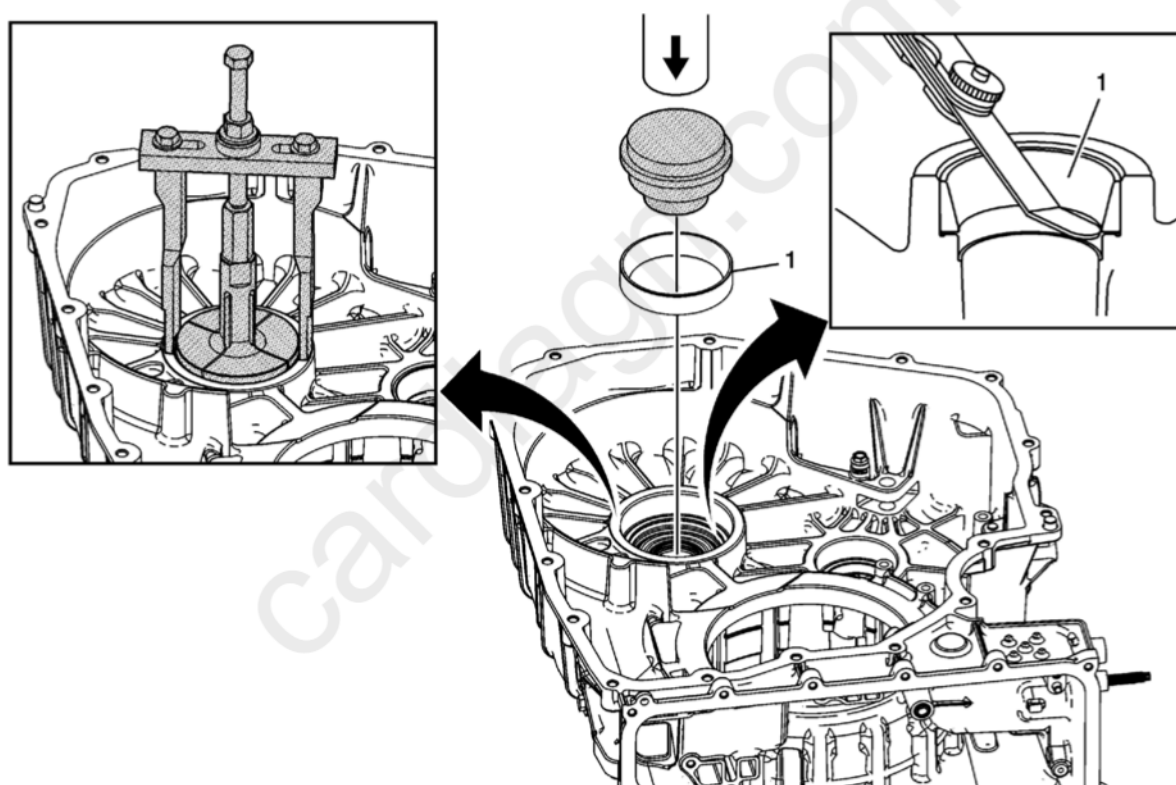


Fig. 16: Identifying Front Differential Carrier Bearing Cup
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
1	Front Differential Bearing Cup CAUTION: Support the back side of the case before installing the bearing cup. Apply a light coating of transmission fluid to the bore before pressing the cup into position. Install the bearing cup until it stops moving. Applying excessive pressure to the bearing cup once it is seated could cause damage to the case casting. CAUTION: An unseated or improperly installed bearing cup will result in premature bearing failure. Visually inspect the bearing cup to insure there is "no gap" between the case, thrust washer, and the bearing cup. Use of a feeler gauge may assist in identifying a bearing cup that is not fully seated. CAUTION: Failure to apply the lubricant will cause damage to the bolt and nut threads. CAUTION: There are first and second design front differential bearing cups. First design bearing cups are manufactured by Timken. Second design bearing cups are manufactured by NSK. Second design bearing cups require DT-45087-A cup installer. If installing second design bearing cups, second design front differential carrier bearings must be used. All four parts must be kept as a set to prevent damage to the transmission. NOTE: • Tighten DT-47927-2 which is part of DT-47927 cup remover until it fits snugly on the bearing cup. • Adjust DT 45124 removal bridge so it sits on the torque converter housing surface just beyond the bearing cup opening. • Apply the extreme pressure lubricant DT 23444-A extreme press lubricant to the puller bolt threads to prevent damage to the bolt threads during bearing cup removal. • Hold the puller bridge bolt and turn the nut to remove the bearing cup. Special Tools • DT 23444-A Extreme Press Lubricant - 1/4 Ounce Tube • DT-45087 Bearing Cup Installer • DT-45087-A Bearing Cup Installer • DT 45124 Removal Bridge • DT-47927 Bearing Cup Remover For equivalent regional tools, refer to Special Tools .

FRONT DIFFERENTIAL DRIVE PINION GEAR BEARING CUP AND LUBRICANT DAM REPLACEMENT

Removal

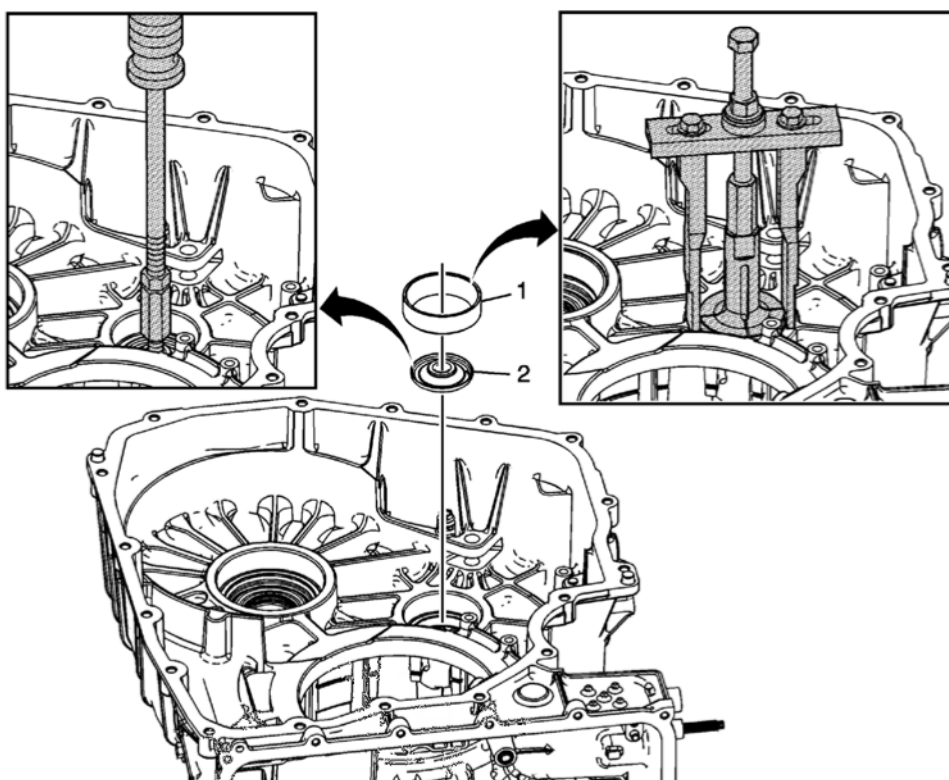


Fig. 17: Identifying Front Differential Drive Pinion Gear Bearing Cup & Lube Dam
 Courtesy of GENERAL MOTORS COMPANY

Removal

Callout	Component Name
1	Front Differential Drive Pinion Gear Bearing Cup CAUTION: Failure to apply the lubricant will cause damage to the bolt and nut threads. NOTE: • Tighten DT-45094 cup remover until it fits snugly on the bearing cup. • Adjust DT 45124 removal bridge so it sits on the case surface just beyond the bearing cup opening. • Apply the extreme pressure lubricant DT 23444-A extreme press lubricant to the puller bolt threads to prevent damage to the bolt threads during bearing cup removal. • Hold the puller bridge nut and turn the bolt to remove the bearing cup. Special Tools • DT 23444-A Extreme Press Lubricant - 1/4 Ounce Tube • DT-45094 Bearing Cup Remover • DT 45124 Removal Bridge For equivalent regional tools, refer to Special Tools .

Callout	Component Name
2	Front Differential Drive Pinion Gear Lube Dam Special Tools • DT-48055 Lube Dam Removal • GE 6125-1B Slide Hammer with Adapter For equivalent regional tools, refer to Special Tools .

Installation

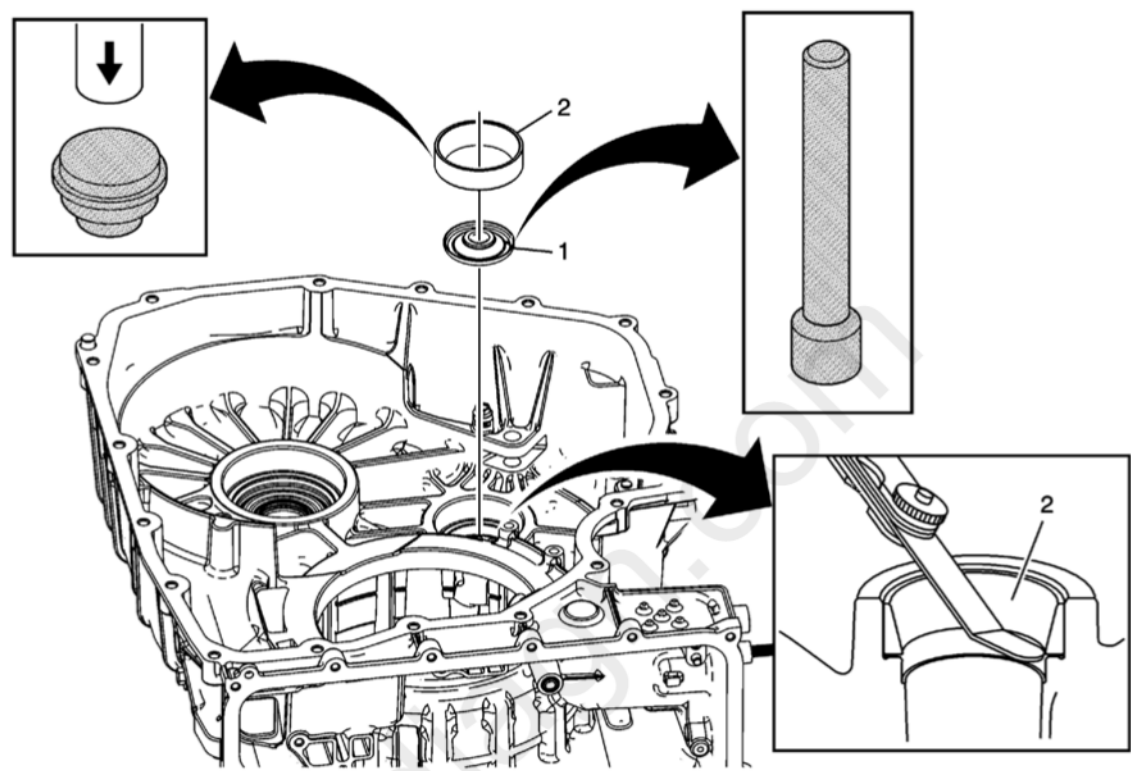


Fig. 18: View Of Front Differential Drive Pinion Gear Bearing Cup & Lube Dam
 Courtesy of GENERAL MOTORS COMPANY

Installation

Callout	Component Name
1	Front Differential Drive Pinion Gear Lube Dam Special Tools • DT-46630 Lube Dam Installer • GE 8092 Driver Handle For equivalent regional tools, refer to Special Tools .

Callout	Component Name
2	Front Differential Drive Pinion Gear Bearing Cup CAUTION: Support the back side of the case before installing the bearing cup. Apply a light coating of transmission fluid to the bore before pressing the cup into position. Install the bearing cup until it stops moving. Applying excessive pressure to the bearing cup once it is seated could cause damage to the case casting. CAUTION: An unseated or improperly installed bearing cup will result in premature bearing failure. Visually inspect the bearing cup to insure there is "no gap" between the case, thrust washer, and the bearing cup. Use of a feeler gauge may assist in identifying a bearing cup that is not fully seated. Special Tools DT-45087 Bearing Cup Installer For equivalent regional tools, refer to Special Tools .

TRANSMISSION CASE CLEANING AND INSPECTION

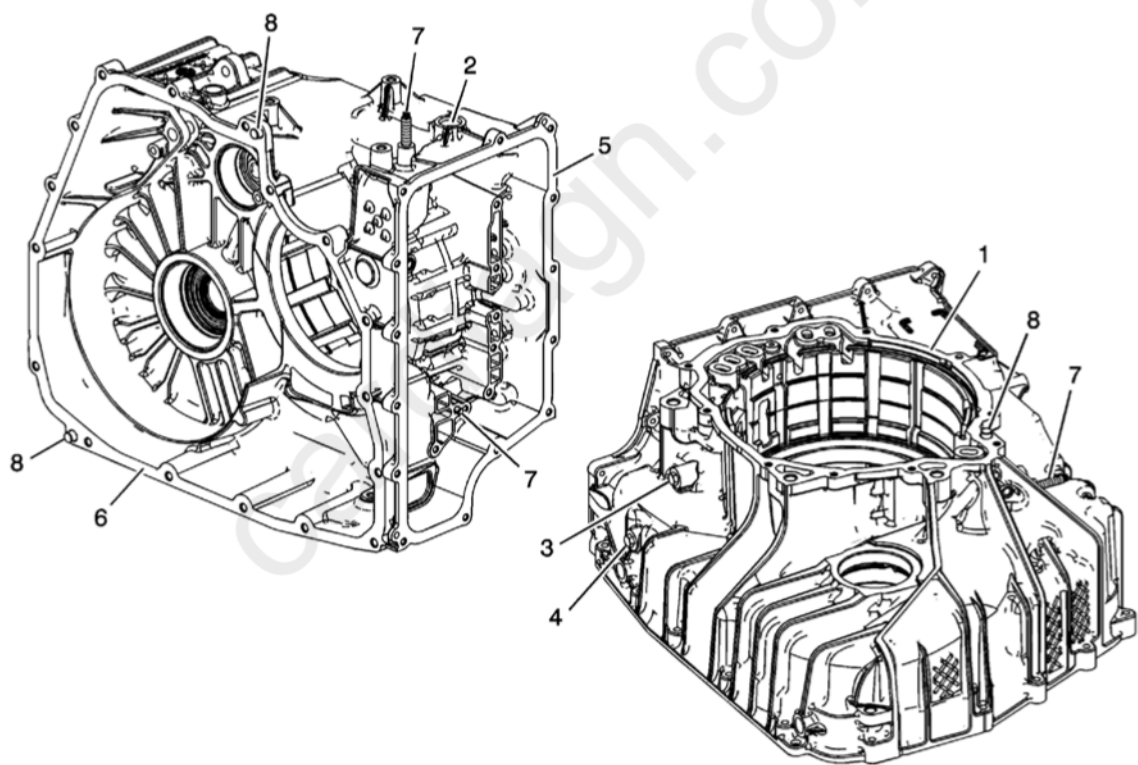


Fig. 19: Identifying Transmission Case Components
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
CAUTION: Do not use abrasive pads or bristle devices to clean the sealing surfaces. Abrasive pads produce a fine grit that can effect transmission function. Abrasive pads can also remove enough metal to create oil leaks.	
CAUTION: After cleaning the transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components. Lint from the towels can cause component failure.	
CAUTION: Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.	
Preliminary Procedures 1. Thoroughly clean the transmission case assembly, including case threads, with clean solvent. 2. Clean gasket sealing surfaces. Remove all residual gasket material. 3. Inspect all threaded holes. If necessary, repair any thread damage.	
1	Case Cover Sealing Surface
2	Manual Shift Shaft Seal Surface NOTE: Refer to Manual Shift Shaft Seal Replacement .
3	Fluid Pressure Test Plug
4	Fluid Drain Plug
5	Control Valve Body Cover Sealing Surface
6	Torque Converter Housing Sealing Surface
7	Transmission Fluid Cooler Pipe Stud M8 x 30.5 (Qty: 2) CAUTION: Refer to Fastener Caution . Tighten 12 N.m (106 lb in)
8	Transmission Case Cover Locator Pin Procedure Inspect the locating pins to be fully seated in case.

MANUAL SHIFT DETENT LEVER WITH SHAFT POSITION SWITCH ASSEMBLY AND PARK PAWL ACTUATOR INSTALLATION

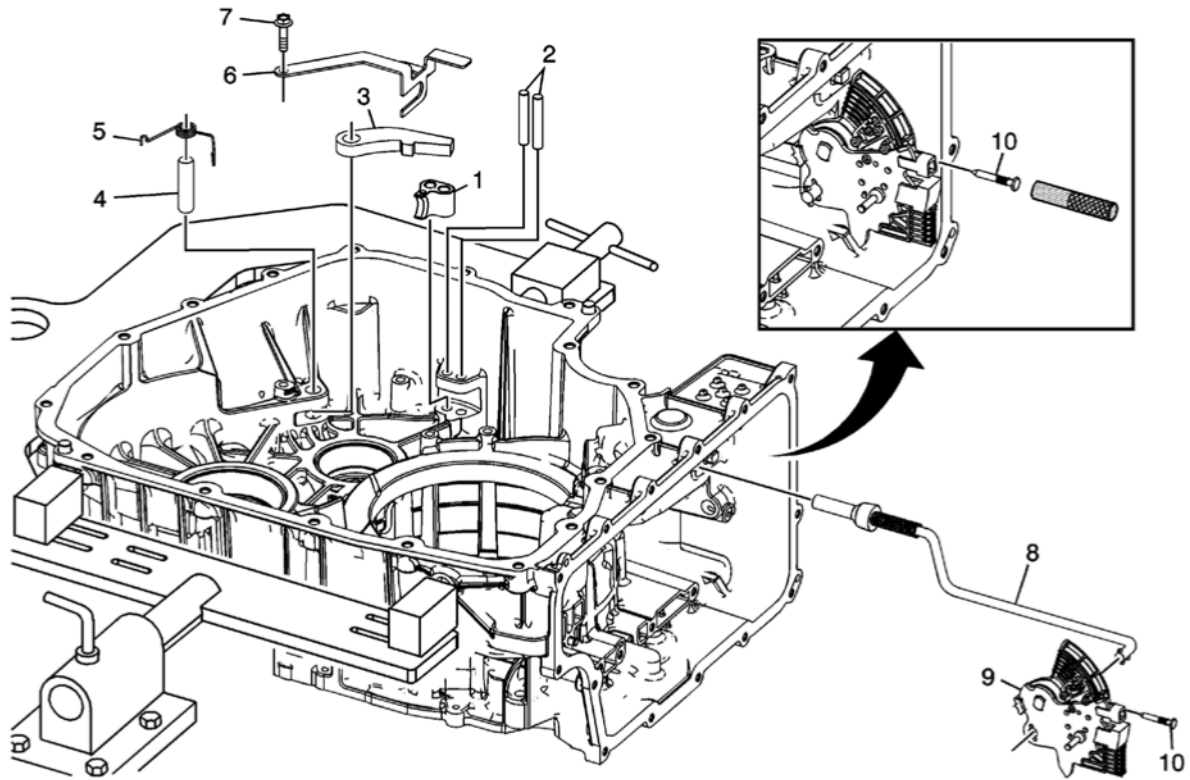


Fig. 20: Identifying Manual Shift Detent Lever With Shaft Position Switch Assembly & Park Pawl Actuator

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Park Pawl Actuator Guide
2	Park Pawl Actuator Guide Pin
3	Park Pawl
4	Park Pawl Shaft
5	Park Pawl Spring
6	Park Pawl Actuator Bracket
7	Park Pawl Actuator Bracket Bolt M6 x 25 (Qty: 2) CAUTION: Refer to Fastener Caution . Tighten 12 N.m (106 lb in).
8	Park Pawl Actuator Assembly NOTE: Install the park pawl actuator assembly onto the detent lever assembly.
9	Manual Shaft Detent (w/Shift Position Switch) Lever Assembly NOTE: • Rotate the assembly clockwise so the actuator rod will fit through the case opening. • Lubricate shaft with ATF to prevent damage to the manual shift shaft seal.

Callout	Component Name
10	Manual Shift Shaft Pin CAUTION: Use J 41229 to install the manual shaft pin at the correct height in order to properly secure the manual shaft. If you install the pin too deep, the case bore may crack. Procedure 1. Use a NEW pin to ensure proper engagement to the case. 2. Inspect pin installed height is within 6.5 - 7.5 mm (0.25 - 0.30 in). Special Tools DT 41229 Manual Shaft Pin Installer For equivalent regional tools, refer to Special Tools .

FLUID TROUGH INSTALLATION

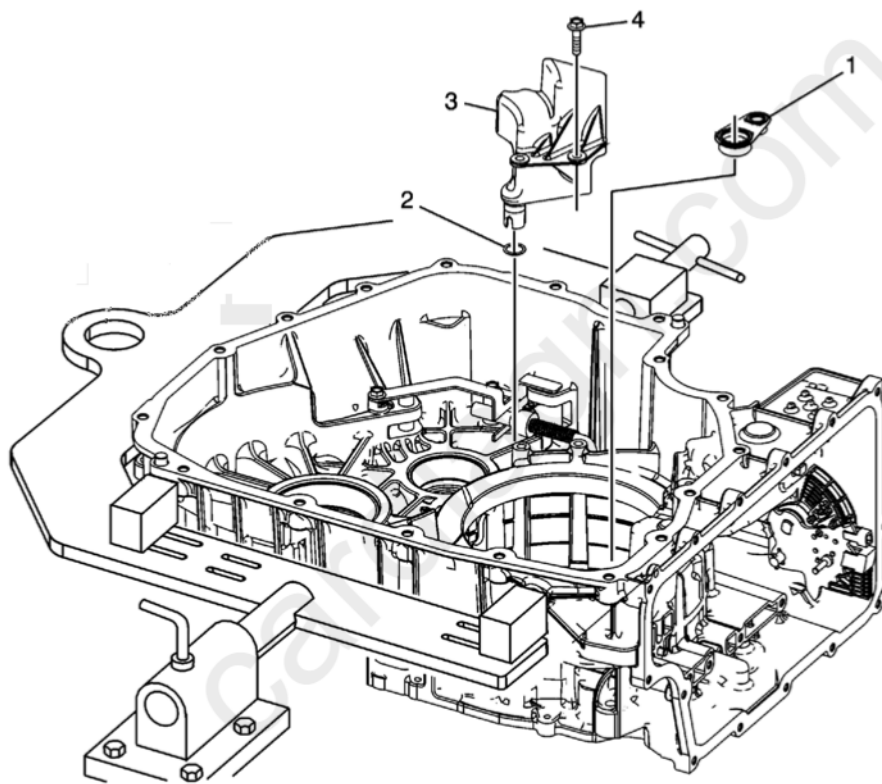


Fig. 21: Identifying Fluid Trough Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	A/Trans Fluid Pump Outlet Seal Assembly
2	A/Trans Fluid Trough (O-ring) Seal
3	A/Trans Fluid Trough
4	A/Trans Fluid Trough Bolt M6 x 25 (Qty: 1) CAUTION: Refer to Fastener Caution . Tighten 12 N.m (106 lb in).

TORQUE CONVERTER AND DIFFERENTIAL HOUSING ASSEMBLY DISASSEMBLE

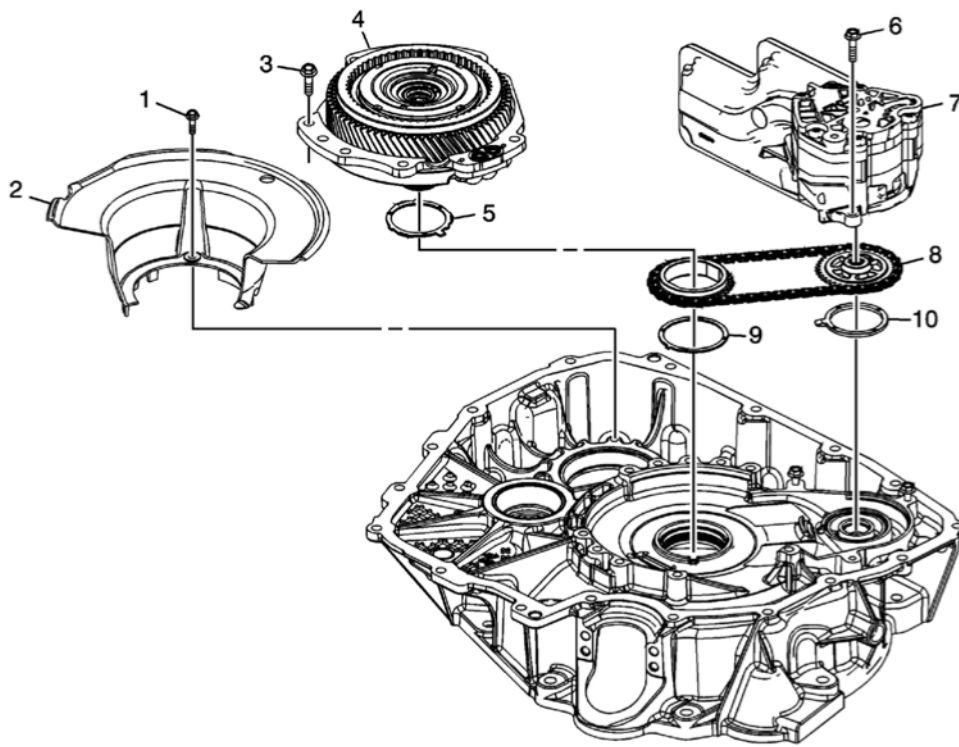


Fig. 22: Identifying Torque Converter & Differential Housing Assembly Components
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Front Differential Carrier Baffle Bolt M6 x 25
2	Front Differential Carrier Baffle
3	Front Differential Transfer Drive Gear Support Bolt M8 x 25 (Qty: 9)
4	Front Differential Transfer Drive Gear Support Assembly
5	Drive Sprocket Thrust Washer
6	A/Trans Fluid Pump Bolt M6 x 25 (Qty: 3)
7	A/Trans Fluid Pump Assembly
8	Drive Link Assembly NOTE: Link and sprockets will be removed as an assembly.
9	Drive Sprocket Thrust Washer NOTE: Drive sprocket thrust washer may be stuck to the torque converter housing.
10	Driven Sprocket Thrust Washer

FRONT DIFFERENTIAL CARRIER BEARING CUP AND WASHER REPLACEMENT - TORQUE CONVERTER HOUSING SIDE

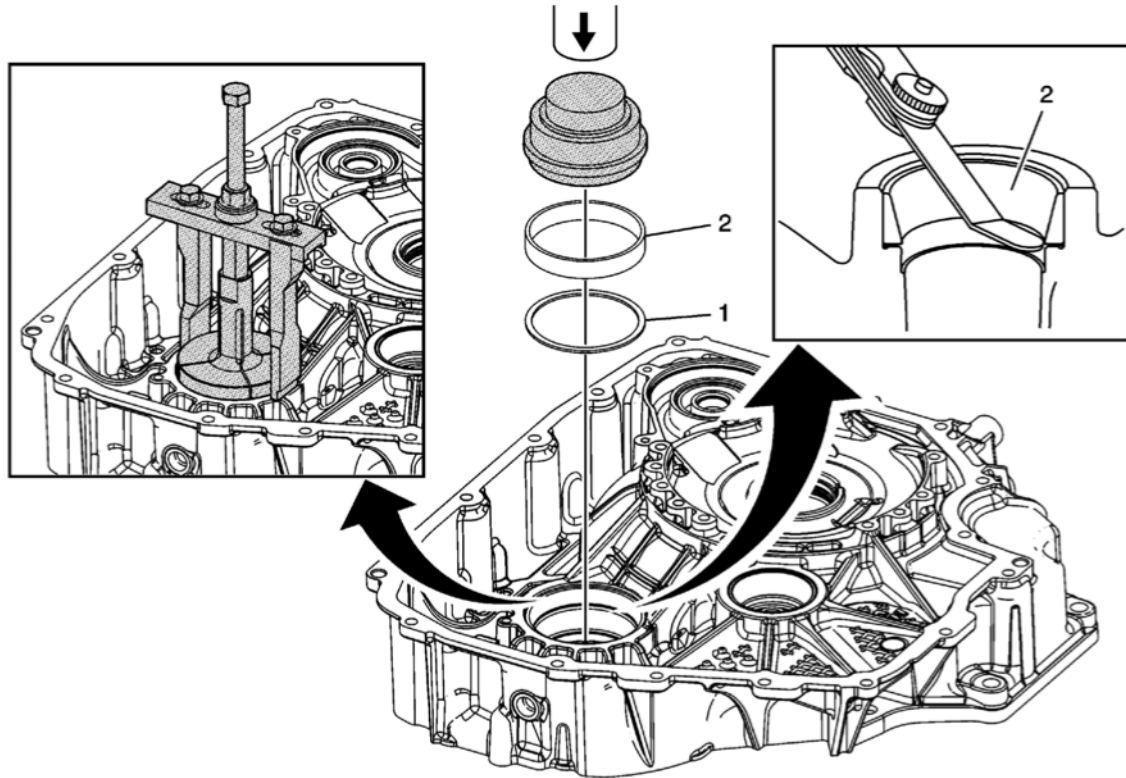


Fig. 23: Identifying Front Differential Carrier Bearing Cup & Washer

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures - Do not install the bearing cup until after the selective washer measurement has been performed. - Install the correct differential bearing washer as determined by the thrust washer measurement procedure. Refer to <u>Front Differential Drive Pinion Gear Bearing Thrust Washer and Front Differential Bearing Washer Measurement</u>.	
1	Front Differential Bearing Thrust Washer

Callout	Component Name
2	Front Differential Carrier Bearing Cup CAUTION: Support the back side of the torque converter housing before installing the bearing cup. Apply a light coating of transmission fluid to the bore before pressing the cup into position. Install the bearing cup until it stops moving. Applying excessive pressure to the bearing cup once it is seated could cause damage to the torque converter housing casting. CAUTION: An unseated or improperly installed bearing cup will result in premature bearing failure. Visually inspect the bearing cup to insure there is "no gap" between the converter housing, thrust washer, and the bearing cup. Use of a feeler gauge may assist in identifying a bearing cup that is not fully seated. CAUTION: Failure to apply the lubricant will cause damage to the bolt and nut threads. CAUTION: There are first and second design front differential bearing cups. First design bearing cups are manufactured by Timken. Second design bearing cups are manufactured by NSK. Second design bearing cups require DT-45087-A cup installer. If installing second design bearing cups, second design front differential carrier bearings must be used. All four parts must be kept as a set to prevent damage to the transmission. Procedure 1. Tighten DT 47927-1 which is part of DT-47927 bearing cup remover until it fits snugly on the bearing cup. 2. Adjust DT 45124 remover bridge so it sits on the torque converter housing surface just beyond the bearing cup opening. 3. Apply the extreme pressure lubricant supplied with DT 23444-A extreme press lubricant to the puller bolt threads to prevent damage to the bolt threads during bearing cup removal. 4. Hold the puller bridge bolt and turn the nut to remove the bearing cup. Special Tools • DT 23444-A Extreme Press Lubricant - 1/4 Ounce Tube • DT-45087 Bearing Cup Installer • DT-45087-A Bearing Cup Installer • DT 45124 Remover Bridge • DT-47927 Bearing Cup Remover For equivalent regional tools, refer to Special Tools .

FRONT DIFFERENTIAL DRIVE PINION BEARING CUP, WASHER, AND LUBRICANT DAM REPLACEMENT - TORQUE CONVERTER HOUSING SIDE

Bearing Cup, Washer and Lubricant Dam Removal

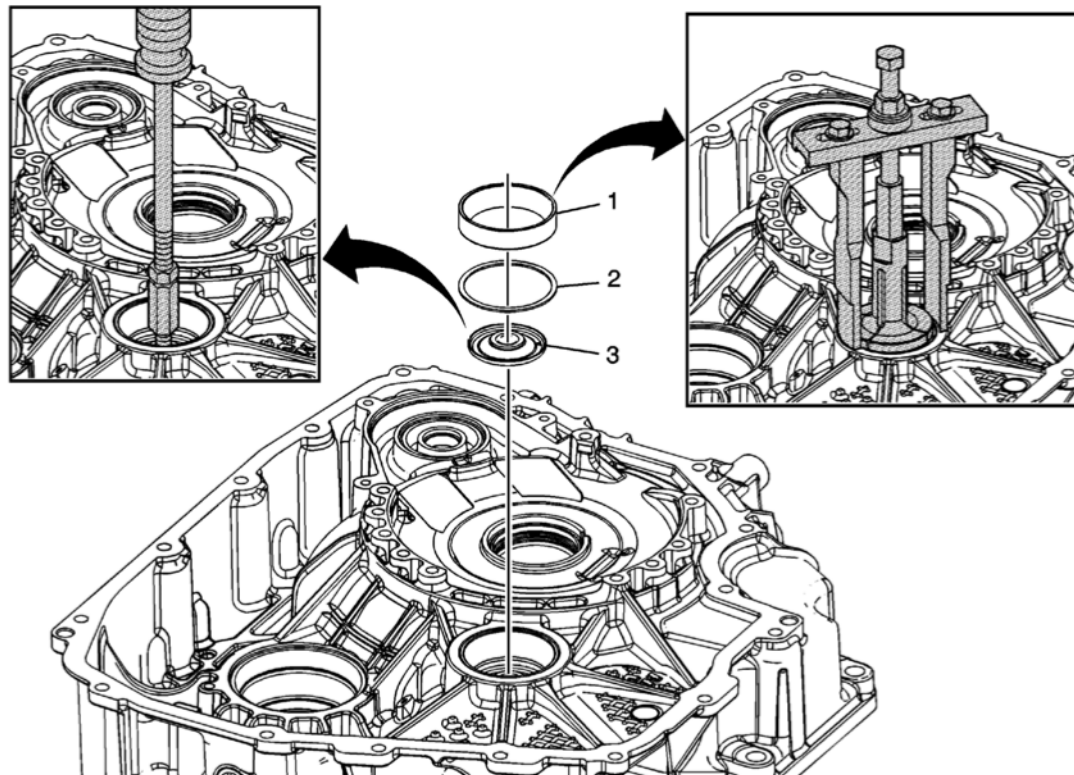


Fig. 24: View Of Front Differential Drive Pinion Bearing Cup, Washer & Lube Dam
 Courtesy of GENERAL MOTORS COMPANY

Bearing Cup, Washer and Lubricant Dam Removal

Callout	Component Name
Preliminary Procedure Do not install the bearing cup until after the selective washer measurement has been performed.	
1	Front Differential Drive Pinion Gear Bearing Cup CAUTION: Failure to apply the lubricant will cause damage to the bolt and nut threads. Procedure 1. Tighten DT-45094 bearing cup remover until it fits snugly on the bearing cup. 2. Adjust DT 45124 removal bridge so it sits on the torque converter housing surface just beyond the bearing cup opening. 3. Apply the extreme pressure lubricant DT 23444-A extreme press lubricant to the puller bolt threads to prevent damage to the bolt threads during bearing cup removal. 4. Hold the puller bridge bolt and turn the nut to removal the bearing cup. Special Tools • DT 23444-A Extreme Press Lubricant - 1/4 Ounce Tube • DT-45087 Transfer Shaft and Differential Bearing Cup Installer • DT-45094 Bearing Cup Remover • DT 45124 Removal Bridge • DT-47927 Bearing Cup Remover For equivalent regional tools, refer to Special Tools .
2	Front Differential Drive Pinion Gear Bearing Thrust Washer

Callout	Component Name
3	Front Differential Drive Pinion Gear Lube Dam Special Tools • DT-48055 Lube Dam Remover • GE 6125-1B Slide Hammer with Adapter or equivalent For equivalent regional tools, refer to Special Tools .

Bearing Cup, Washer and Lubricant Dam Installation

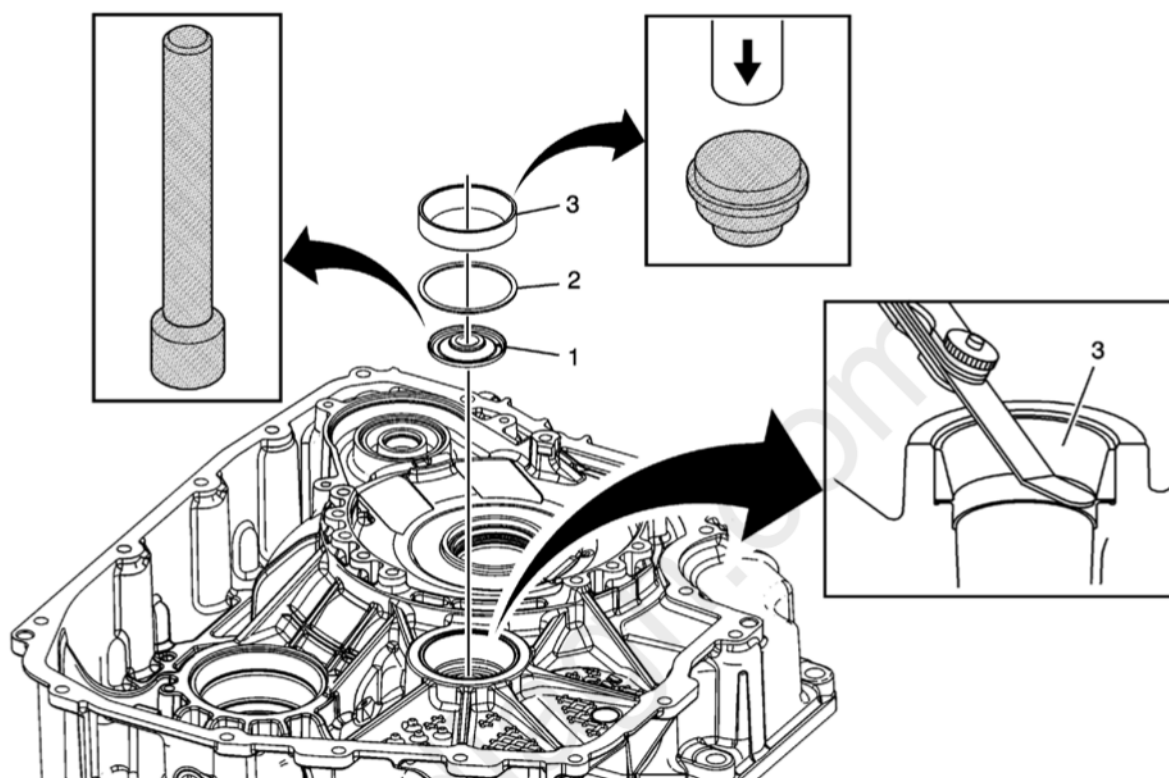


Fig. 25: Identifying Front Differential Drive Pinion Bearing Cup, Washer & Lube Dam
 Courtesy of GENERAL MOTORS COMPANY

Bearing Cup, Washer and Lubricant Dam Installation

Callout	Component Name
Preliminary Procedure Do not install the bearing cup until after the selective washer measurement has been performed.	
1	Front Differential Drive Pinion Gear Lube Dam Special Tools • DT-46630 Lube Dam Installer • GE 8092 Driver Handle For equivalent regional tools, refer to Special Tools .
2	Front Differential Drive Pinion Gear Bearing Thrust Washer NOTE: Install the correct drive pinion gear bearing thrust washer as determined by the thrust washer measurement procedure. Refer to Front Differential Drive Pinion Gear Bearing Thrust Washer and Front Differential Bearing Washer Measurement .

Callout	Component Name
3	Front Differential Drive Pinion Gear Bearing Cup CAUTION: Support the back side of the torque converter housing before installing the bearing cup. Apply a light coating of transmission fluid to the bore before pressing the cup into position. Install the bearing cup until it stops moving. Applying excessive pressure to the bearing cup once it is seated could cause damage to the torque converter housing casting. CAUTION: An unseated or improperly installed bearing cup will result in premature bearing failure. Visually inspect the bearing cup to insure there is "no gap" between the converter housing, thrust washer, and the bearing cup. Use of a feeler gauge may assist in identifying a bearing cup that is not fully seated. Special Tools DT-45087 Bearing Cup Installer For equivalent regional tools, refer to Special Tools.

FRONT WHEEL DRIVE SHAFT SEAL REPLACEMENT - TORQUE CONVERTER HOUSING SIDE

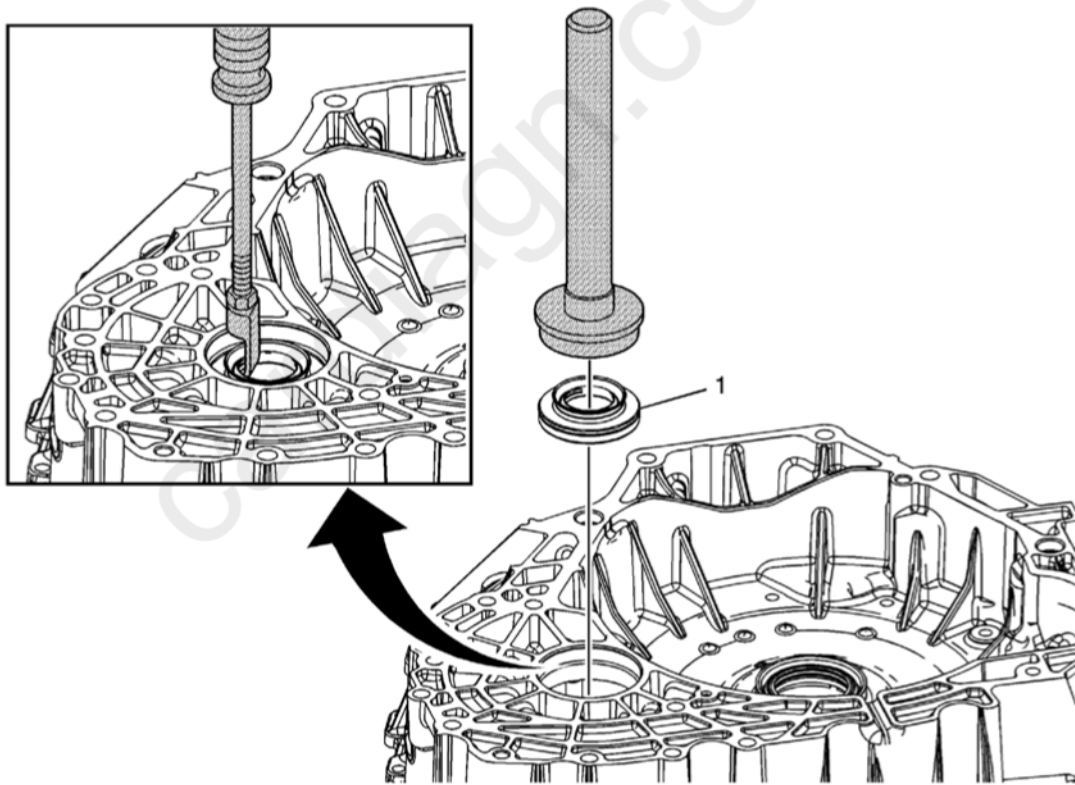


Fig. 26: Identifying Front Wheel Drive Shaft Oil Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
1	Torque Converter - Front Wheel Drive Shaft Oil Seal Assembly NOTE: Use the open side of DT 46629-A seal installer to avoid seal lip damage and to install the seal to the proper depth. Special Tools • DT 23129 Universal Seal Remover • DT 46629-A Seal Installer • GE 6125-1B Slide Hammer with Adapter • GE 8092 Driver Handle For equivalent regional tools, refer to Special Tools .

TORQUE CONVERTER HOUSING CLEANING AND INSPECTION

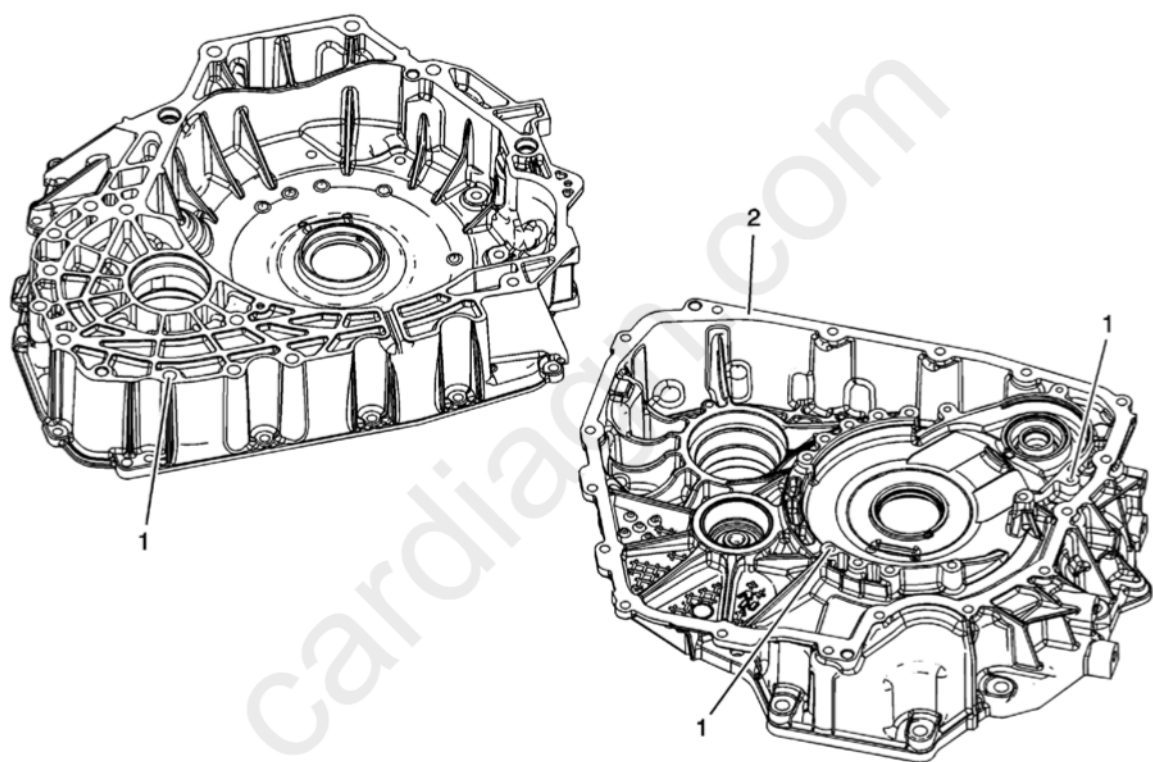


Fig. 27: Identifying Torque Converter Housing
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
1	Torque Converter Fluid Seal CAUTION: Support the back side of the torque converter housing while installing the seal. Install the seal until it stops moving. Applying excessive pressure to the seal once it is seated could cause damage to the torque converter housing casting. Special Tools • DT 23129 Universal Seal Remover • DT 49861 Seal Installer • GE 6125-1B Slide Hammer with Adapter or equivalent For equivalent regional tools, refer to Special Tools .

FRONT DIFFERENTIAL TRANSFER DRIVE GEAR SUPPORT ASSEMBLY DISASSEMBLE

Seal Removal

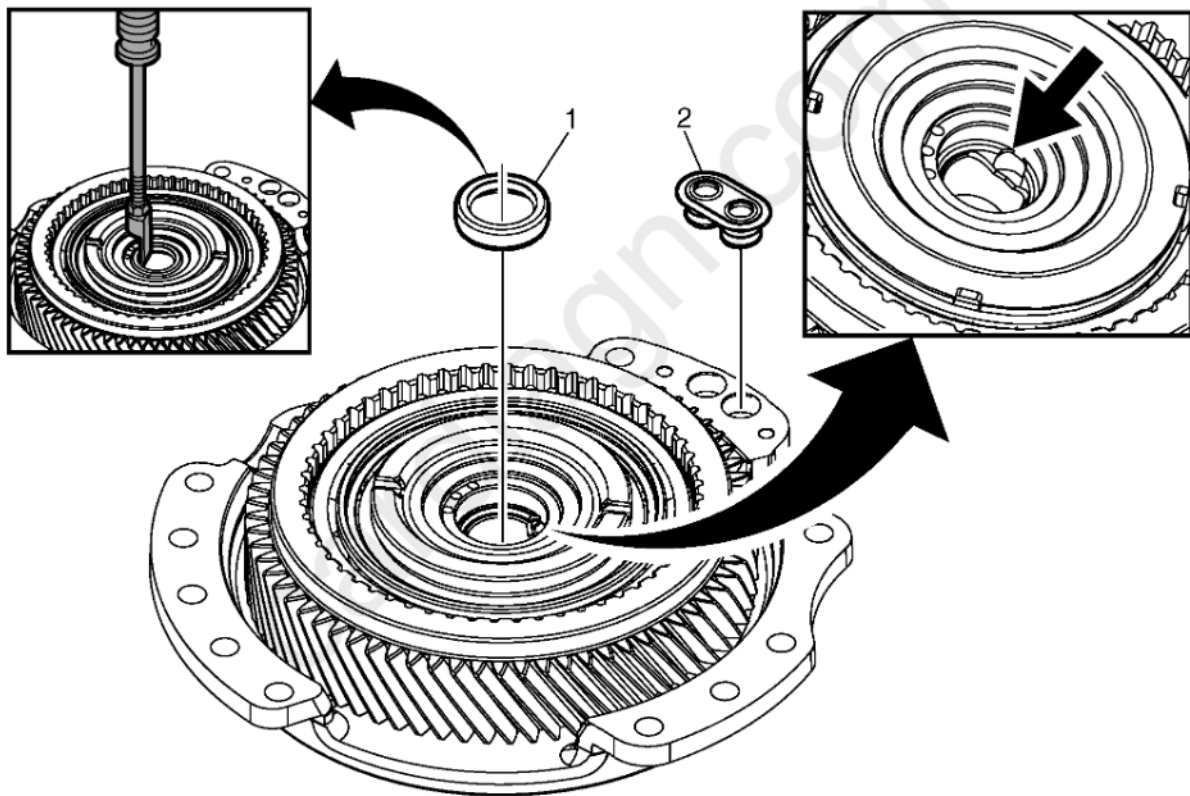


Fig. 29: Identifying Front Differential Transfer Drive Gear Support Seal

Courtesy of GENERAL MOTORS COMPANY

Seal Removal

Callout	Component Name

Callout	Component Name
CAUTION: Do not remove the transfer drive gear bearing retaining nut. The drive gear and bearing are not serviceable. Removing the retaining nut will damage the support.	
Preliminary Procedure 1. Inspect the support assembly for damage or wear to the splines, bushings, machined surfaces and threaded holes. 2. Inspect the transfer drive gear for damage or wear. 3. Inspect the transfer drive gear bearing assembly for proper operation. 4. The bearing should roll smoothly and quietly.	
NOTE: The bushing inside the front differential transfer drive gear support may appear broken. This is the normal appearance of the bushing.	

	Front Differential Transfer Drive Gear Support Seal
1	Special Tools • DT 23129 Universal Seal Remover • GE 6125-1B Slide Hammer with Adapter or equivalent For equivalent regional tools, refer to Special Tools .
2	Front Differential Transfer Drive Gear Support Torque Converter Fluid Seal Assembly

Fluid Passage Tube Removal

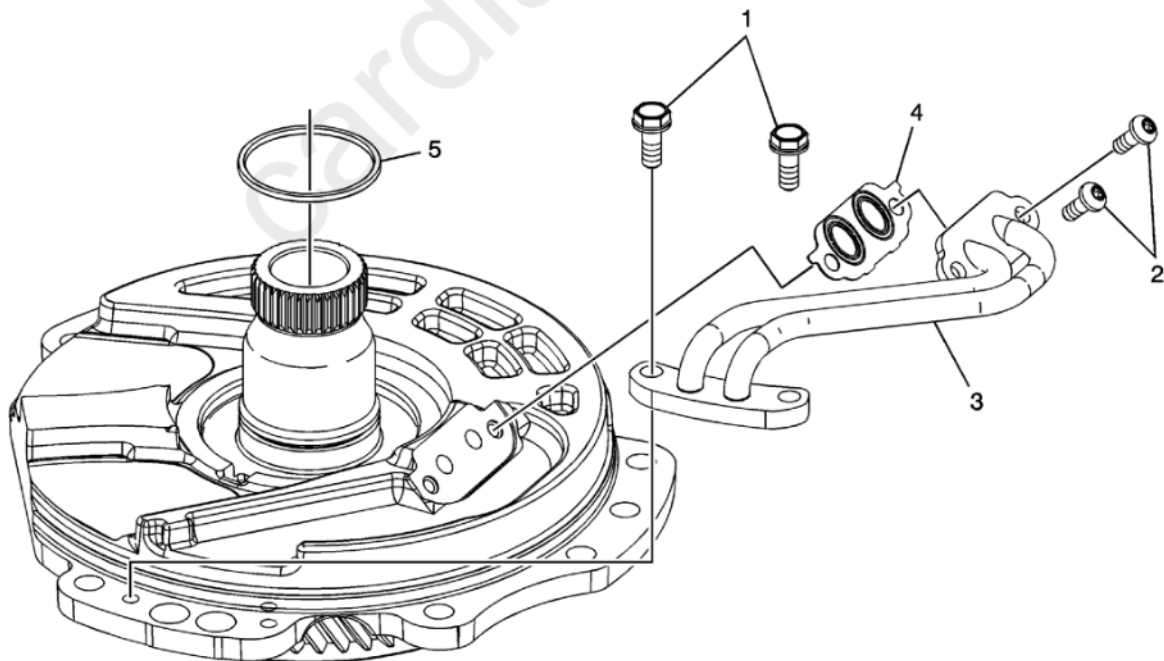


Fig. 30: Identifying Fluid Passage Tube Assembly
Courtesy of GENERAL MOTORS COMPANY

Fluid Passage Tube Removal

Callout	Component Name

Callout	Component Name
CAUTION: Do not remove the transfer drive gear bearing retaining nut. The drive gear and bearing are not serviceable. Removing the retaining nut will damage the support.	
Preliminary Procedures 1. Inspect the support assembly for damage or wear to the splines, bushings, machined surfaces and threaded holes. 2. Inspect the transfer drive gear for damage or wear. 3. Inspect the transfer drive gear bearing assembly for proper operation. 4. The bearing should roll smoothly and quietly.	
1	Front Differential Transfer Drive Gear Fluid Passage Tube Bolt M6 x 15 (Qty: 2)
2	Front Differential Transfer Drive Gear Fluid Passage Tube Bolt M5 x 12 (Qty: 2)
3	Fluid Passage Tube Assembly NOTE: Inspect the tubes for damage, wear or cracked welds.
4	Front Differential Transfer Drive Gear Support Fluid Passage Tube Gasket
5	Front Differential Transfer Drive Gear Support Seal

FRONT DIFFERENTIAL TRANSFER DRIVE GEAR SUPPORT ASSEMBLY ASSEMBLE

Drive Support Seal Installation

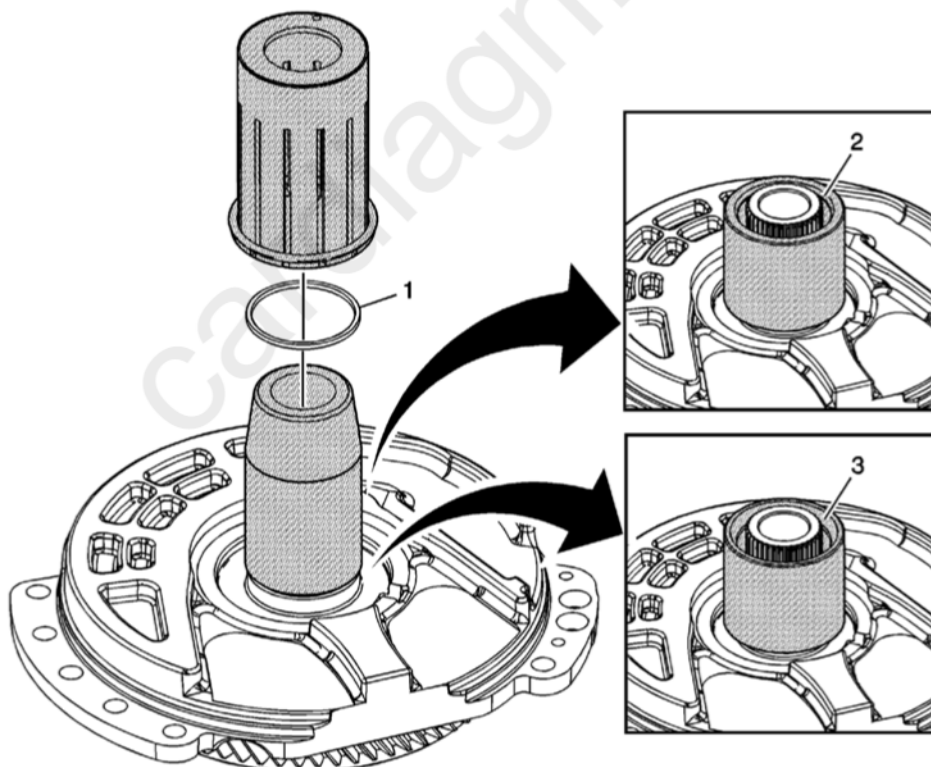


Fig. 31: Identifying Front Differential Transfer Drive Gear Support Seal

Courtesy of GENERAL MOTORS COMPANY

Drive Support Seal Installation

Callout	Component Name

Callout	Component Name
1	Front Differential Transfer Drive Gear Support Seal NOTE: A NEW seal must be installed. Special Tools DT-46624 Support Seal Installer For equivalent regional tools, refer to Special Tools .
2	Small Chamfer Faces Up CAUTION: To avoid damaging the seal, first place DT 46624 - 1 with the small chamfer end facing up and leave in place for at least 60 seconds.
3	Large Chamfer Faces Up NOTE: Turn DT 46624-1 which is part of DT-46624 seal installer, over with the large chamfer end facing up for 60 seconds to ensure that the seal has been properly sized.

Fluid Passage Tube Installation

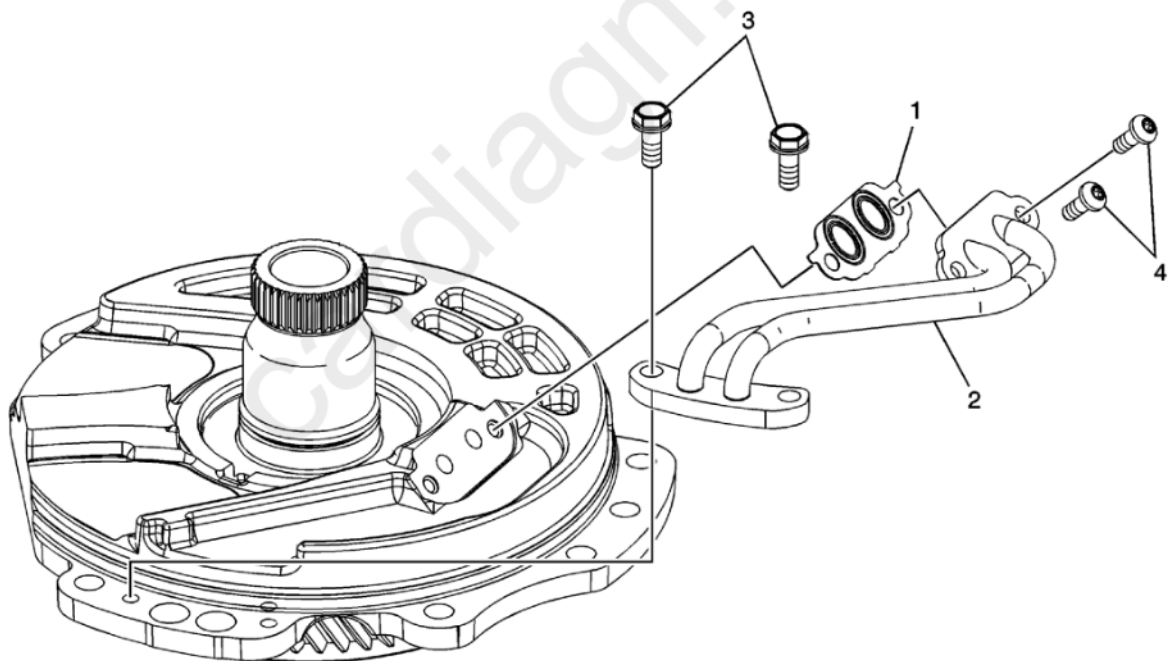


Fig. 32: Identifying Front Differential Transfer Drive Gear Support Fluid Passage Tube
Courtesy of GENERAL MOTORS COMPANY

Fluid Passage Tube Installation

Callout	Component Name
1	Front Differential Transfer Drive Gear Support Fluid Passage Tube Gasket
2	Fluid Passage Tube Assembly

Callout	Component Name
CAUTION: After cleaning the transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components. Lint from the towels can cause component failure.	
CAUTION: Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.	
Preliminary Procedure The fluid pump assembly is not serviceable.	
1	Filter Neck Seal NOTE: Install a NEW filter neck seal. Special Tools 28585 Snap ring Remover or equivalent For equivalent regional tools, refer to Special Tools .
2	A/Trans Fluid Filter Assembly NOTE: Install a NEW fluid filter assembly.
3	Fluid Pump Drive Shaft NOTE: - Inspect the fluid pump drive shaft splines for damage or wear. - Rotate the fluid pump drive shaft for free operation.

FRONT DIFFERENTIAL DRIVE PINION GEAR BEARING THRUST WASHER AND FRONT DIFFERENTIAL BEARING WASHER MEASUREMENT

Differential Thrust Washer Gauge Installation

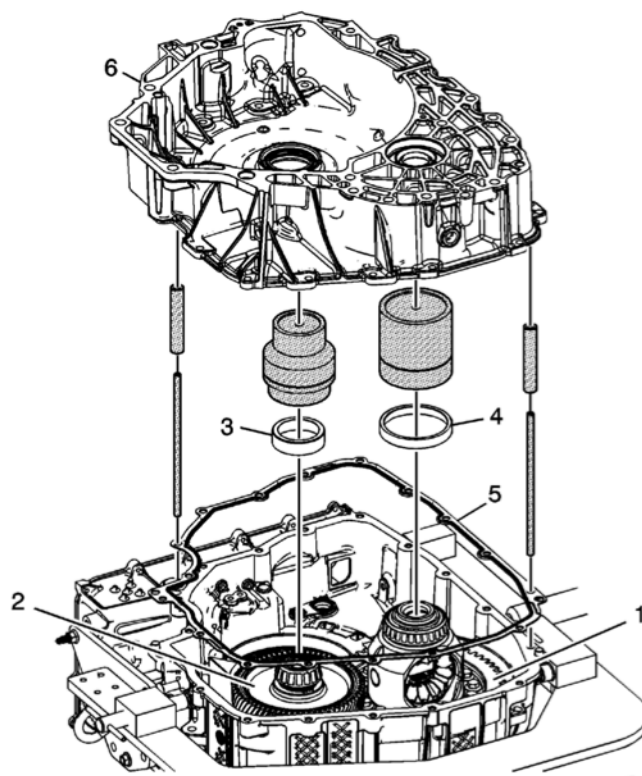


Fig. 35: Identifying Differential Thrust Washer Gauge

Courtesy of GENERAL MOTORS COMPANY

Differential Thrust Washer Gauge Installation

Callout	Component Name
1	Front Differential Carrier Assembly NOTE: Install the differential assembly and the pinion gear assembly together to avoid interference with the gears during installation.
2	Front Differential Drive Pinion (w/Transfer Gear) Gear Assembly NOTE: Install the differential assembly and the pinion gear assembly together to avoid interference with the gears during installation.
3	Front Differential Drive Pinion Gear Bearing Cup NOTE: After placing the bearing cup on the gear, place DT 47800-2 which is part of DT-47800 selection gauge kit, onto the bearing cup. Special Tools DT-47800 Thrust Washer Selection Gauge Kit For equivalent regional tools, refer to Special Tools .
4	Front Differential Carrier Bearing Cup NOTE: After placing the bearing cup on the gear, place DT 47800-1 which is part of DT-47800 selection gauge kit, onto the bearing cup. Special Tools DT-47800 Thrust Washer Selection Gauge Kit For equivalent regional tools, refer to Special Tools .

Callout	Component Name
1	Spacer Bolt M8 x 127 (Qty: 8) CAUTION: Refer to Fastener Caution . Procedure 1. Install the remaining spacers evenly at every other bolt hole. 2. Remove the DT 47800-6 which is part of DT-47800 selection gauge kit, guide pins and install spacer bolts in all bolt holes at spacer locations. 3. Tighten the bolts in sequence. Tighten 7 N.m (62 lb in) Special Tools DT-47800 Thrust Washer Selection Gauge Kit For equivalent regional tools, refer to Special Tools .
2	Front Differential Carrier Assembly CAUTION: If the bearings are not properly seated into the bearing cups, the washer selection will be inaccurate and the bearing pre-load will be set too low. Low bearing pre-load will cause premature failure of the front differential drive pinion gear. Procedure Rotate the differential assembly 10 revolutions to allow the bearings to seat into the cups. NOTE: Differential rotating tool DT-47793 differential rotating tool can be used to rotate the differential from the case side. Special Tools DT-47793 Differential Rotating Tool For equivalent regional tools, refer to Special Tools .

Differential Thrust Washer Selection

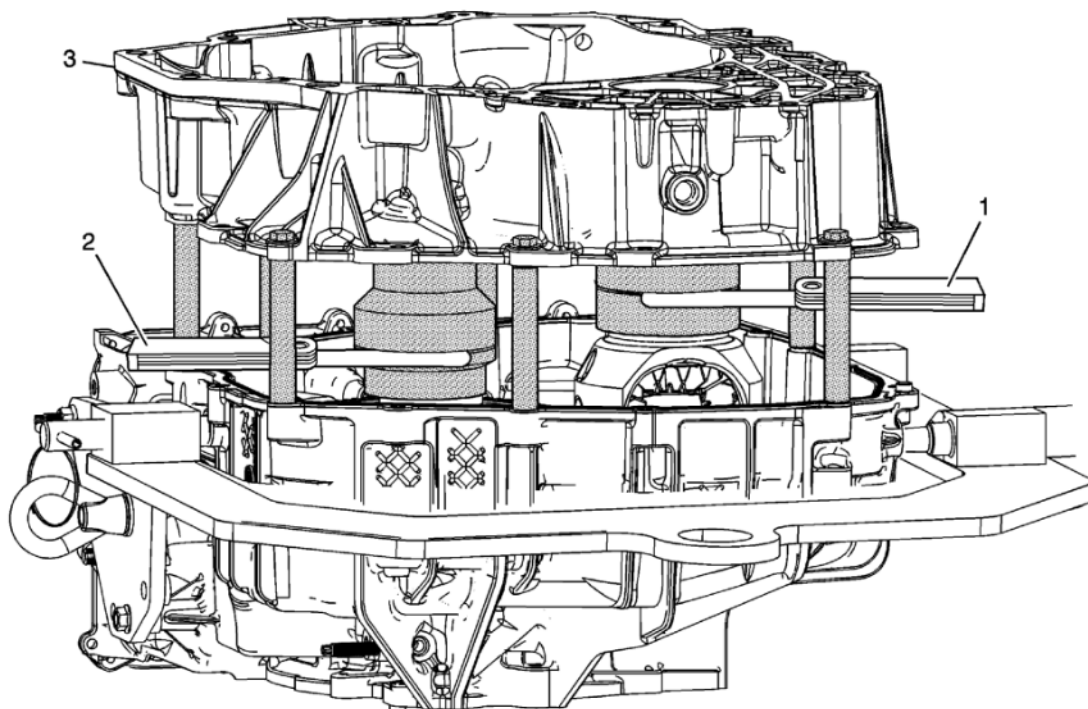


Fig. 37: Identifying Differential Thrust Washer Selection
 Courtesy of GENERAL MOTORS COMPANY

Differential Thrust Washer Selection

Callout	Component Name
CAUTION: Improper thrust washer selection can cause insufficient taper bearing pre-load which will cause premature failure of the front differential drive pinion gear.	
1	Front Differential Bearing Washer Procedure Place DT 47800-7 in the gap in DT 47800-2 which are both part of DT-47800 selection gauge kit, to determine the proper thrust washer. Choose the correct thrust washer. Refer to Taper Bearing Preload Selective Specifications . NOTE: • Continue trying different sizes of DT 47800-7 which is part of DT-47800 selection gauge kit, until the gauge will no longer fit into the gap. The correct thrust washer size is equal to the largest blade gauge that fits into the gap. • Match the size of the correct DT 47800-7 blade which is part of DT-47800 selection gauge kit, to the color code in the thrust washer specification chart. The washer color coding is on the outside diameter of the washer. • The gap in DT 47800-2 which are both part of DT-47800 selection gauge kit may not be even. Hold the top of the gauge and rotate the bottom of the gauge to even out the gap. Take two gap measurements 180 degrees apart. Average the two measurements and select the thrust washer that is closest to the average. • The washer color coding is on the outside diameter of the washer. Special Tools DT-47800 Thrust Washer Selection Gauge Kit For equivalent regional tools, refer to Special Tools .

Callout	Component Name
2	Front Differential Drive Pinion Gear Bearing Thrust Washer Procedure Place DT 47800-7 in the gap in DT 47800-1 which are both part of DT-47800 selection gauge kit, to determine the proper thrust washer. Choose the correct thrust washer. Refer to Taper Bearing Preload Selective Specifications . NOTE: • Continue trying different sizes of DT 47800-7 which is part of DT-47800 selection gauge kit, until the gauge will no longer fit into the gap. The correct thrust washer size is equal to the largest gauge that fits into the gauge. • Match the size of the correct DT 47800-7 blade which is part of DT-47800 selection gauge kit to the color code in the thrust washer selection chart. • The gap in DT 47800-1 which is part of DT-47800 selection gauge kit may not be even. Hold the top of the gauge and rotate the bottom of the gauge to even out the gap. Take two gap measurements 180 degrees apart. Average the two measurements and select the thrust washer that is closest to the average. • The washer color coding is on the outside diameter of the washer. Special Tools DT-47800 Thrust Washer Selection Gauge Kit For equivalent regional tools, refer to Special Tools .
3	Torque Converter and Support and A/Trans Fluid Pump Housing Assembly Procedure 1. Remove DT 47800-3 which are both part of DT-47800 selection gauge kit, bolts and spacers. 2. Remove the torque converter housing. 3. Remove DT 47800-1 and DT 47800-2 which are both part of DT-47800 selection gauge kit. 4. Remove the torque converter housing seal. 5. Remove the pinion gear and differential bearing cups. 6. Install the bearing cups and thrust washers into the torque converter housing per the replacement procedures. Refer to Front Differential Carrier Bearing Cup and Washer Replacement - Torque Converter Housing Side, and Front Differential Drive Pinion Bearing Cup, Washer, and Lubricant Dam Replacement - Torque Converter Housing Side. NOTE: DT 47800-1 and DT 47800-2 which are both part of DT-47800 selection gauge kit, may stick in the torque converter housing. Be careful not to drop the gauges. Special Tools DT-47800 Thrust Washer Selection Gauge Kit For equivalent regional tools, refer to Special Tools .

TORQUE CONVERTER AND DIFFERENTIAL HOUSING ASSEMBLY ASSEMBLE

Pump Assembly Installation

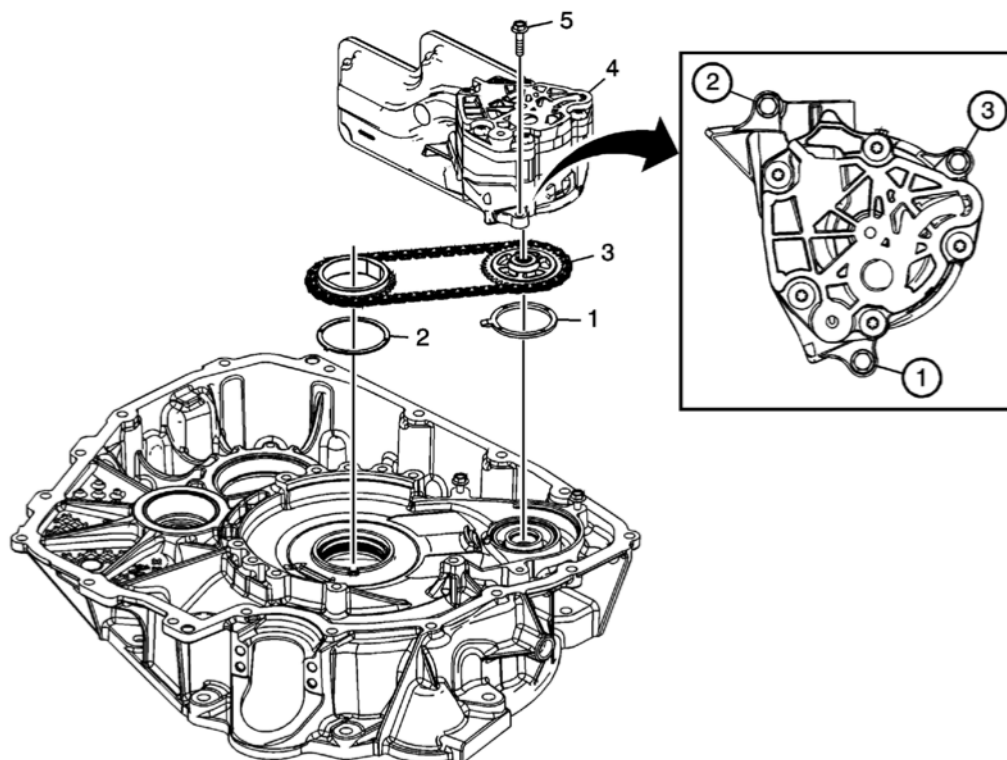


Fig. 38: View Of Pump Assembly

Courtesy of GENERAL MOTORS COMPANY

Pump Assembly Installation

Callout	Component Name
1	Driven Sprocket Thrust Washer
2	Drive Sprocket Thrust Washer
3	Install Drive Link Assembly NOTE: Install as an assembly.
4	A/Trans Fluid Pump Assembly NOTE: Rotating the drive sprocket and link assembly while installing the oil pump will aid in aligning the driven sprocket and oil pump drive shaft splines.
5	A/Trans Fluid Pump Bolt M6 x 25 (Qty: 3) CAUTION: Refer to Fastener Caution . Procedure: Tighten in sequence shown. Tighten 12 N.m (106 lb in).

Transfer Drive Gear Assembly Installation

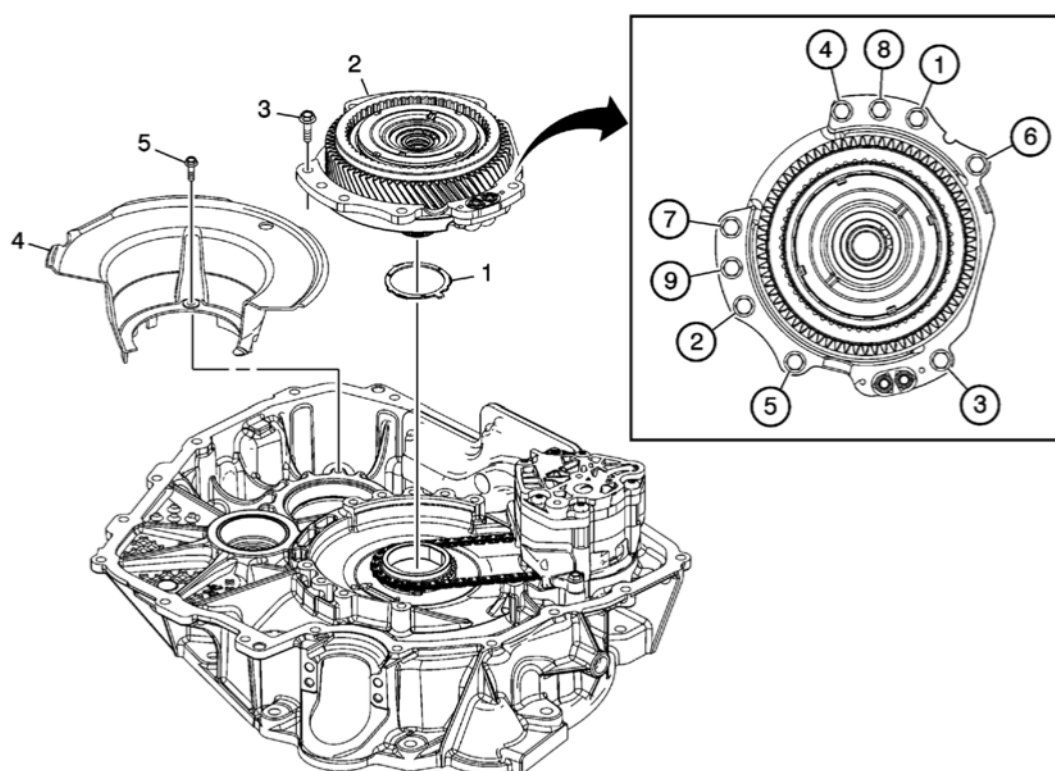


Fig. 39: View of Transfer Drive Gear Assembly
 Courtesy of GENERAL MOTORS COMPANY

Transfer Drive Gear Assembly Installation

Callout	Component Name
1	Drive Sprocket Thrust Washer
2	Front Differential Transfer Drive Gear Support Assembly
3	Front Differential Transfer Drive Gear Support Bolt M8 x 25 (Qty: 9) CAUTION: Refer to Fastener Caution . Procedure Tighten in sequence shown. Tighten 10 N.m (89 lb in) plus 50 degrees $\hat{A}$ $\pm$ 4 degrees. Special Tools: EN 45059 Angle Meter For equivalent regional tools, refer to Special Tools .
4	Front Differential Carrier Baffle
5	Front Differential Carrier Baffle Bolt M6 x 25 Tighten 12 N.m (106 lb in).

FRONT DIFFERENTIAL DRIVE PINION GEAR BEARING REPLACEMENT

Removal

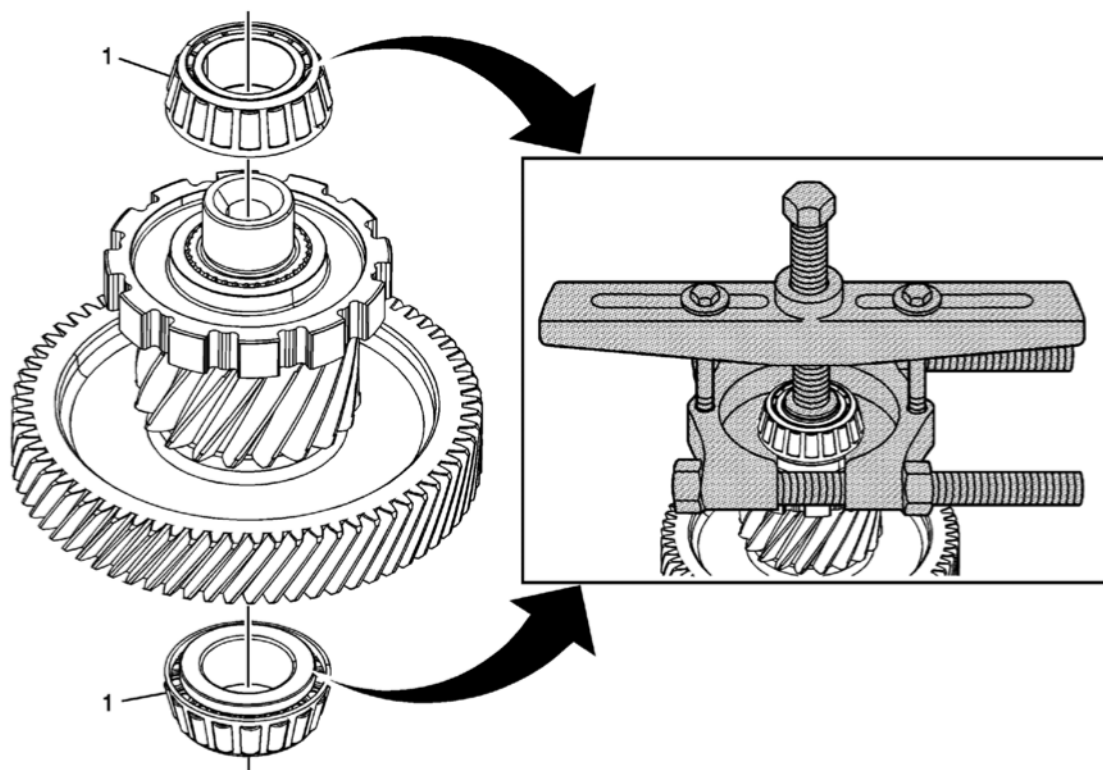


Fig. 40: View Of Front Differential Drive Pinion Gear Bearing

Courtesy of GENERAL MOTORS COMPANY

Removal

Callout	Component Name
1	Front Differential Drive Pinion Gear Bearing NOTE: • When removing the front differential drive pinion gear bearing use DT 41816-2 step plate. • Use DT 8433-1 puller bar or equivalent with bolts 2 - 3/8 x 3 x 24. Special Tools • DT 8433-1 Puller Bar or equivalent • DT 22912-B Split Plate Bearing Remover or equivalent • DT 41816-2 Step Plate For equivalent regional tools, refer to Special Tools .

Installation

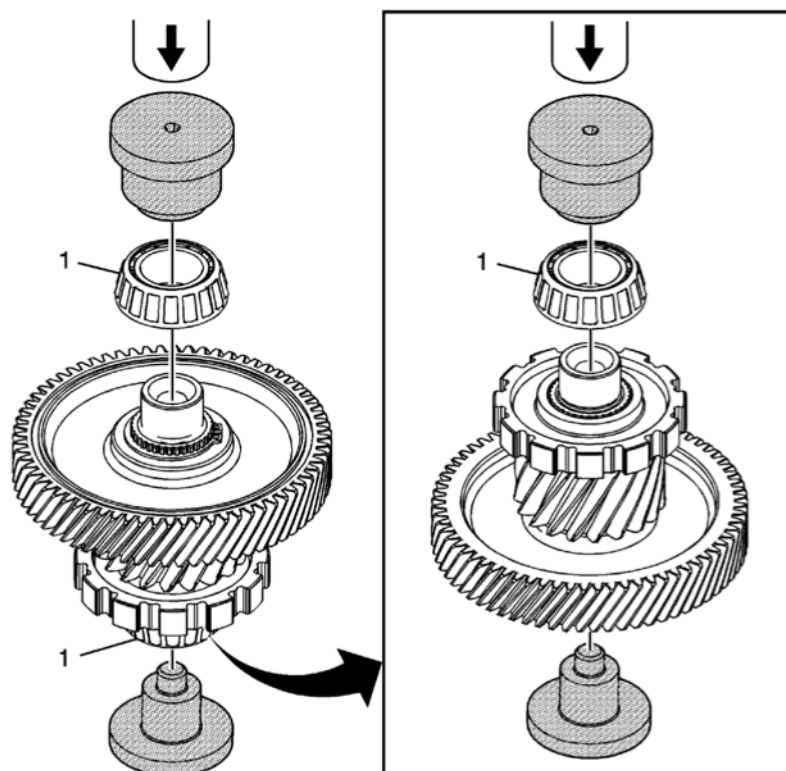


Fig. 41: Identifying Front Differential Drive Pinion Gear Bearing

Courtesy of GENERAL MOTORS COMPANY

Installation

Callout	Component Name
1	Front Differential Drive Pinion Gear Bearing CAUTION: Pressing against the bearing assembly can damage the bearing and cause premature bearing failure. Special Tools DT-47928 Bearing Installer For equivalent regional tools, refer to Special Tools .

FRONT DIFFERENTIAL CARRIER BEARING REPLACEMENT

Removal

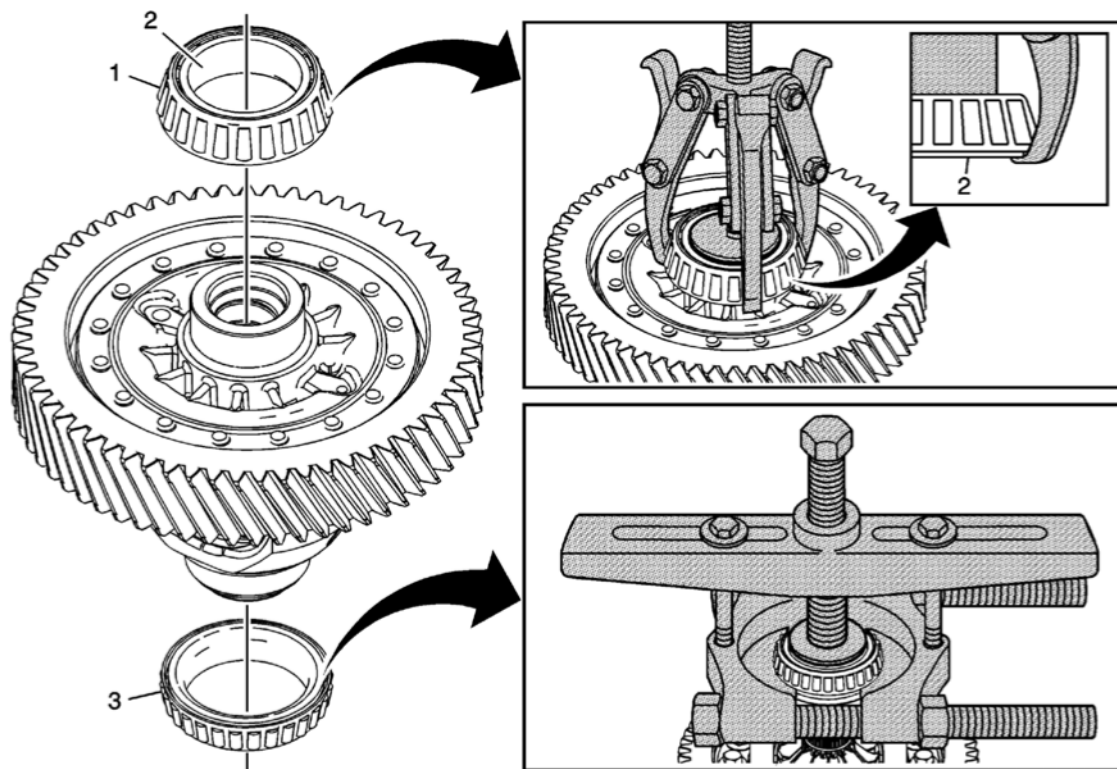


Fig. 42: Identifying Front Differential Carrier Bearing
 Courtesy of GENERAL MOTORS COMPANY

Removal

Callout	Component Name
1	Front Differential Carrier Bearing Assembly Special Tools • DT-41816 Three Legged Puller • DT 41816-2 Step Plate For equivalent regional tools, refer to Special Tools .
2	Inner Race NOTE: Ensure all 3 legs of the puller make contact with the inner race of the bearing.

Callout	Component Name
3	Front Differential Carrier Bearing Assembly NOTE: • AWD differential may need longer bolts, 2 - 3/8 x 5 x 24 thread bolts. • When removing the front differential carrier bearing assembly use DT 41816-2 step plate. Special Tools • DT 8433-1 Puller Bar or equivalent • DT 22912-B Split Plate Bearing Remover or equivalent • DT 41816-2 Step Plate For equivalent regional tools, refer to Special Tools .

Installation

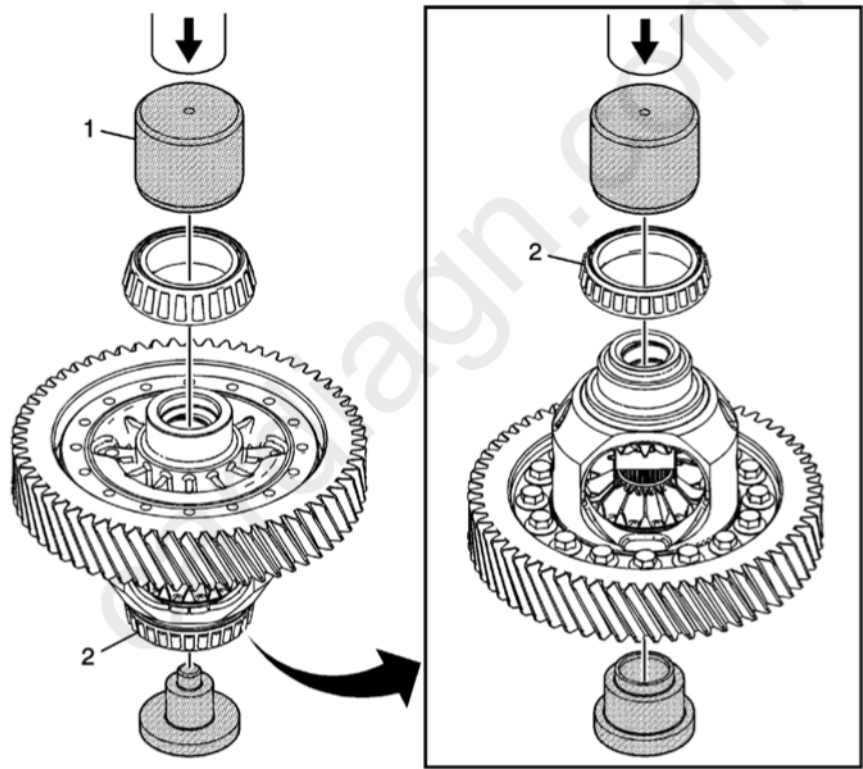


Fig. 43: View Of Front Differential Carrier Bearing
 Courtesy of GENERAL MOTORS COMPANY

Installation

Callout	Component Name

Callout	Component Name
1	Front Differential Carrier Bearing Assembly CAUTION: Pressing against the bearing assembly can damage the bearing and cause premature bearing failure. CAUTION: There are first and second design front differential carrier bearings. First design bearings have twenty eight rollers and are manufactured by Timken. Second design bearings have 30 rollers and are manufactured by NSK. If installing second design bearings, second design front differential carrier bearing cups must be used. All four parts must be kept as a set to prevent damage to the transmission. Special Tools DT-47928 Bearing Installer For equivalent regional tools, refer to Special Tools .
2	Front Differential Carrier Bearing Assembly CAUTION: Pressing against the bearing assembly can damage the bearing and cause premature bearing failure. CAUTION: There are first and second design front differential carrier bearings. First design bearings have twenty eight rollers and are manufactured by Timken. Second design bearings have 30 rollers and are manufactured by NSK. If installing second design bearings, second design front differential carrier bearing cups must be used. All four parts must be kept as a set to prevent damage to the transmission. Special Tools DT-47928 Bearing Installer For equivalent regional tools, refer to Special Tools .

FRONT DIFFERENTIAL CARRIER CLEANING AND INSPECTION

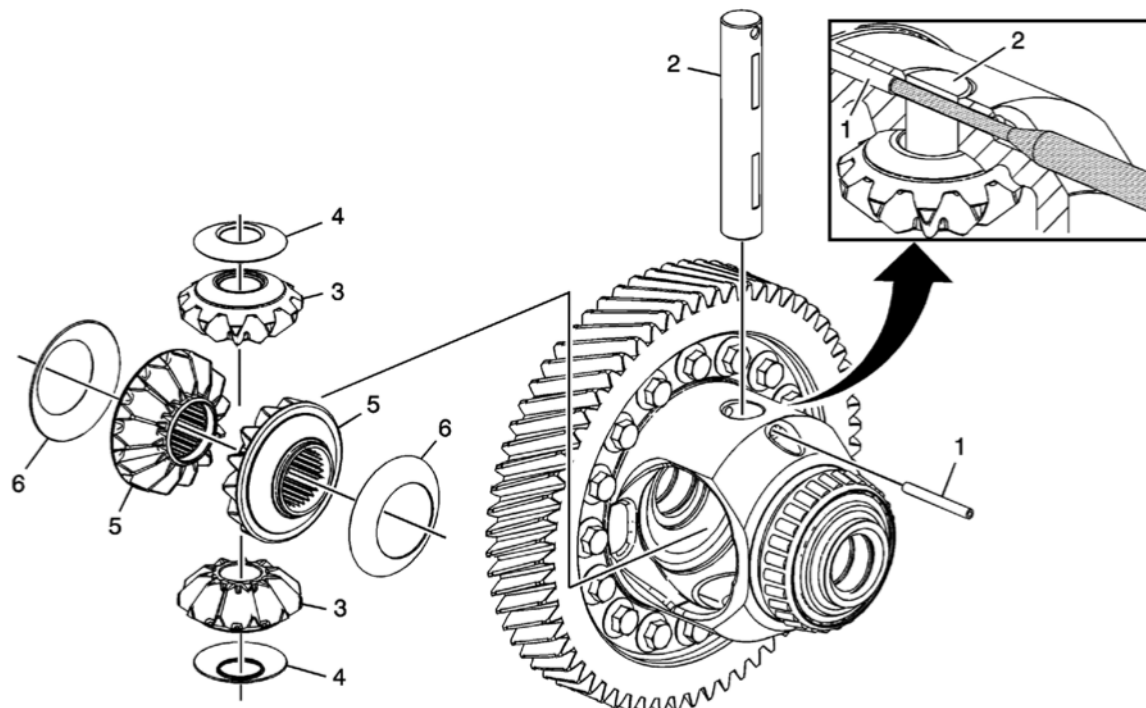


Fig. 44: Identifying Front Differential Carrier Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
CAUTION: After cleaning the transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components. Lint from the towels can cause component failure.	
CAUTION: Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.	
CAUTION: Keep the thrust washers with gear it was matched to. The thrust washers are selective sizes and it is difficult to identify the proper washer thickness. Improper assembly can cause premature failure of the differential assembly.	
Preliminary Procedure Clean and inspect the differential assembly, pinion gears and thrust washers for scoring, wear or damage. The differential assembly is only serviced as an assembly.	
1	Front Differential Pinion Gear Shaft Retainer NOTE: Discard and use a new retainer. Special Tools 3/16 in (5 mm) 7 in Punch or equivalent For equivalent regional tools, refer to Special Tools .
2	Front Differential Pinion Gear Shaft
3	Front Differential Pinion Gears
4	Front Differential Carrier Thrust Washers
5	Front Differential Pinion Side Gears
6	Front Differential Side Gear Thrust Washer

FRONT DIFFERENTIAL DRIVE PINION GEAR AND CARRIER INSTALLATION

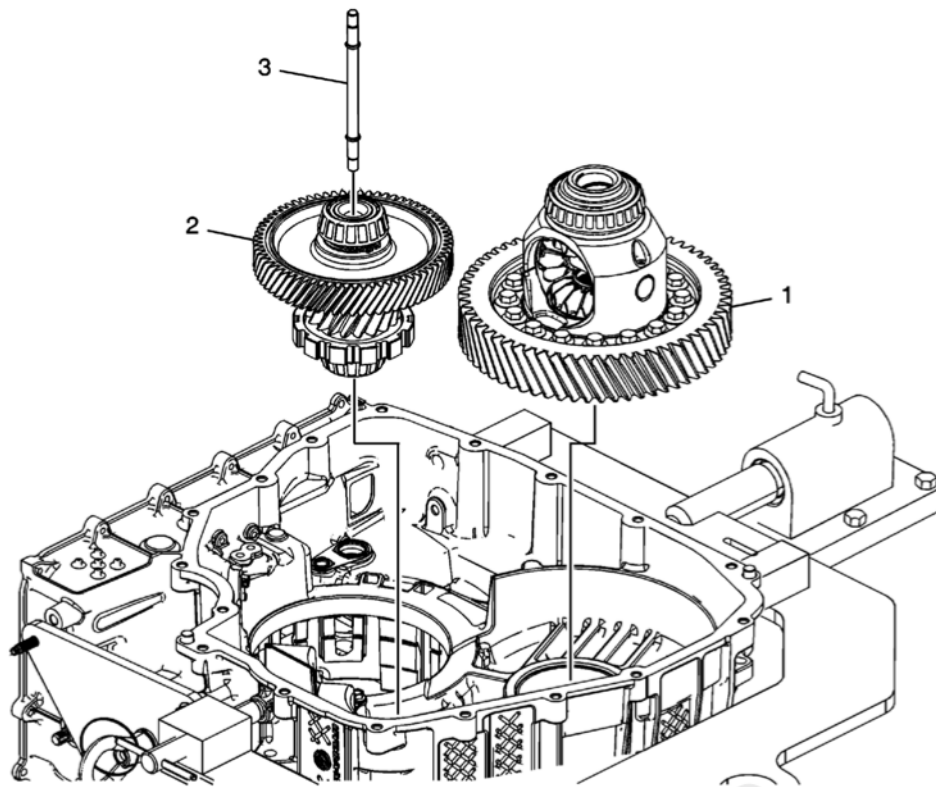


Fig. 45: Identifying Front Differential Carrier Assembly
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Front Differential Carrier Assembly NOTE: Install the differential assembly and the pinion gear assembly together to avoid interference with the gears during installasion.
2	Front Differential Drive Pinion (w/Transfer Gear) Gear Assembly
3	Front Differential Drive Pinion Gear Lube Tube

TORQUE CONVERTER AND DIFFERENTIAL HOUSING INSTALLATION

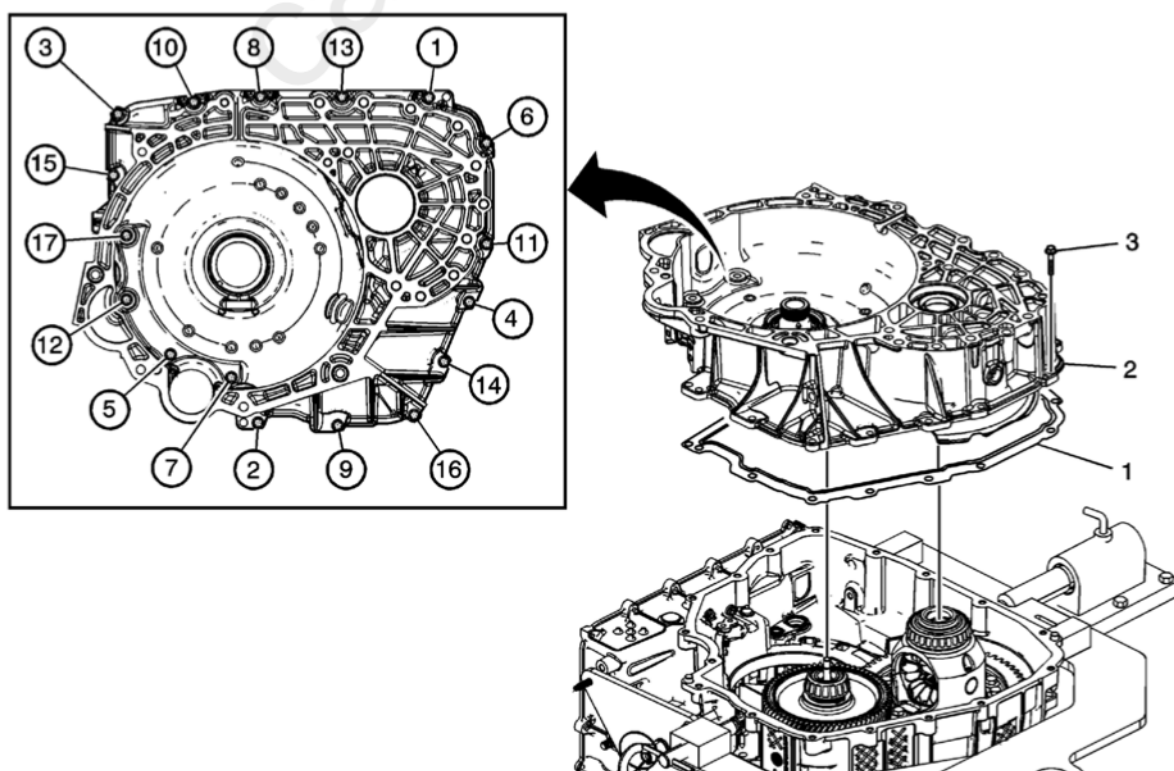


Fig. 46: Identifying Torque Converter & Differential Housing
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Torque Converter Housing Outer Seal
2	Torque Converter and Support and A/Trans Fluid Pump Housing Assembly
3	Torque Converter and Differential Housing Bolts M8 x 35 (Qty: 17) CAUTION: Some bolt torques specifications are different. Over tightening the bolts at the 12, 15 and 17 positions in the sequence could cause damage to the case threads. CAUTION: Refer to Fastener Caution . Procedure: Tighten in sequence shown. Tighten • Bolts 1 - 11, 13 - 14 and 16 to 36 N.m (27 lb ft) • Bolts 12, 15 and 17 to 30 N.m (22 lb ft)

FRONT DIFFERENTIAL CARRIER PRELIMINARY ROTATIONAL TORQUE MEASUREMENT

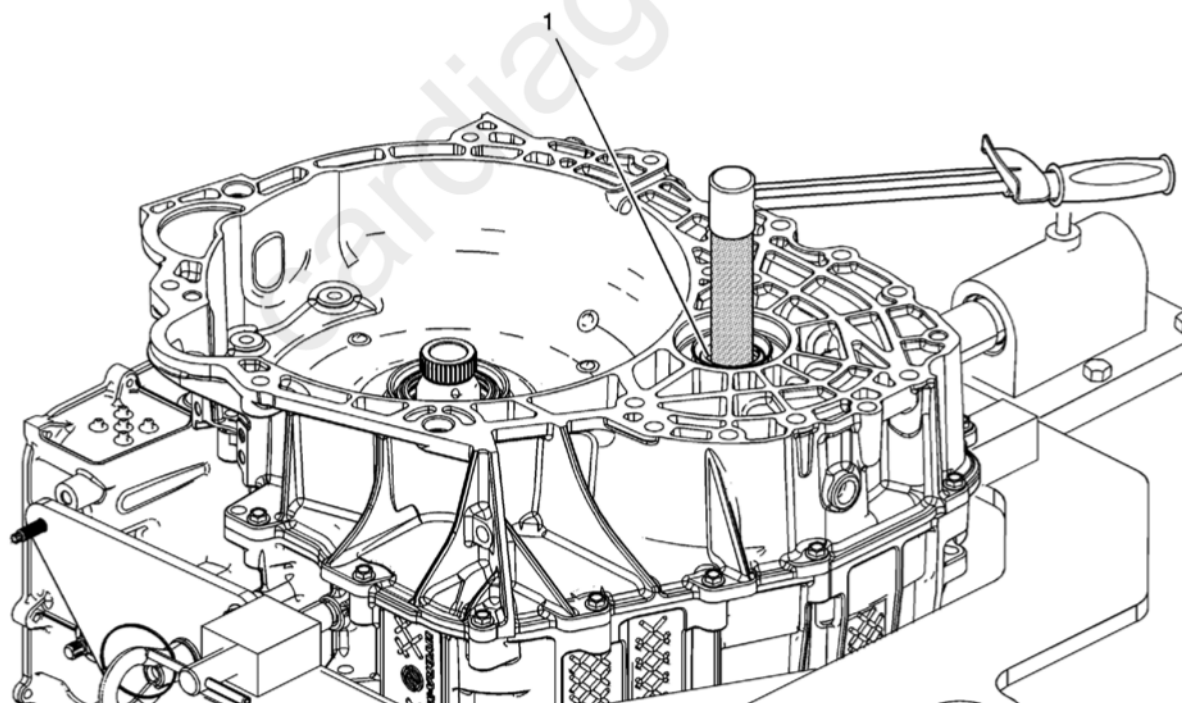


Fig. 47: Front Differential Carrier Preliminary Rotational Torque Measurement Tool
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
1	Front Differential Carrier Assembly CAUTION: Low bearing pre-load will cause premature failure of the front differential drive pinion gear. CAUTION: Refer to Fastener Caution . NOTE: • If the turning torque is not within specifications, the transfer gear assembly and differential bearing thrust washer is incorrect and must be corrected. Refer to Front Differential Drive Pinion Gear Bearing Thrust Washer and Front Differential Bearing Washer Measurement. • Use a dial or beam torque wrench with DT-47793 differential rotating tool to measure turning torque. Tighten 4 - 12 N.m (35 - 106 lb in) Special Tools DT-47793 Differential Rotating Tool For equivalent regional tools, refer to Special Tools .

1-2-3-4 CLUTCH PLATE AND LOW AND REVERSE CLUTCH INSTALLATION

Piston and Spring Installation

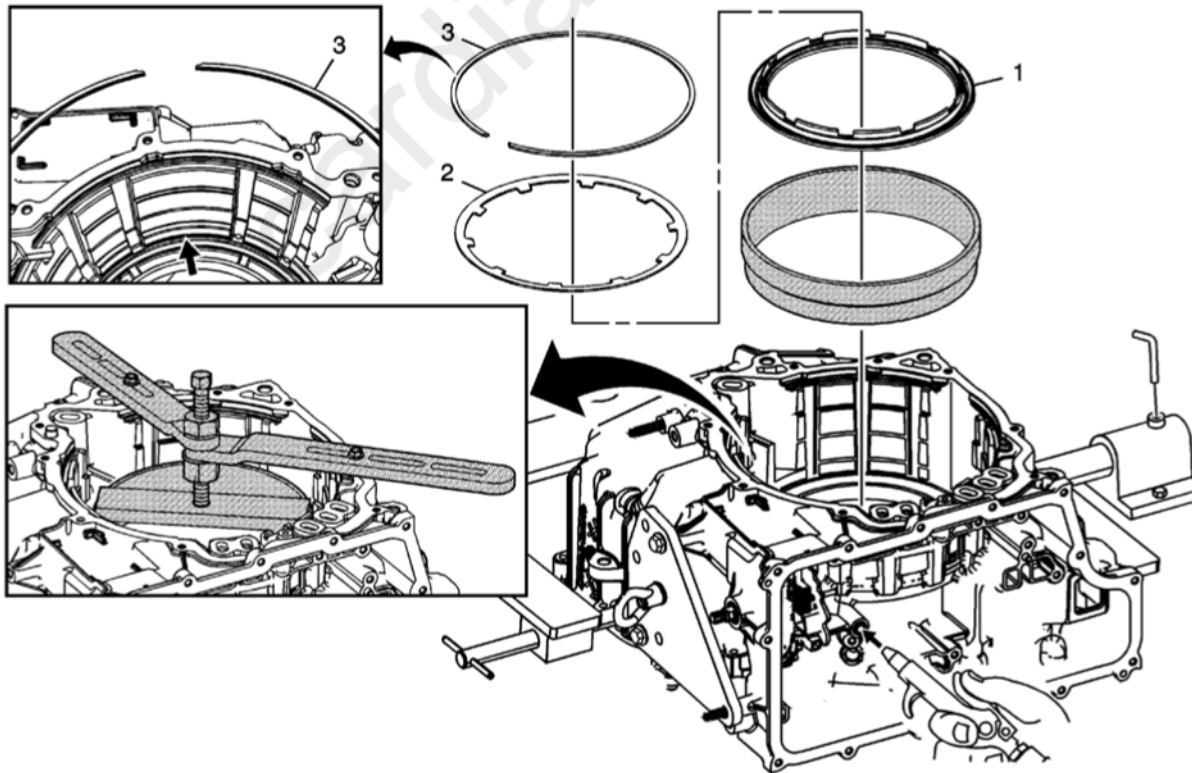


Fig. 48: Identifying 1-2-3-4 Clutch Components

Courtesy of GENERAL MOTORS COMPANY

Piston and Spring Installation

Callout	Component Name

Callout	Component Name
1	1-2-3-4 Clutch Piston NOTE: DT-46623 seal protector prevents the piston seal lip from damage during installation. Apply a thin coat of ATF to the I.D. of DT-46623 seal protector to ease the installation of the piston. Special Tools DT-46623 Piston Seal Protector For equivalent regional tools, refer to Special Tools .
2	1-2-3-4 Clutch Spring
3	1-2-3-4 Clutch Spring Retainer Ring CAUTION: Refer to Fastener Caution . Procedure: 1. The retainer opening should be supported by a spline tooth of the case. 2. Install DT-46632 spring compressor and DT-48056 spring compressor bridge and retain to the case using 2 case cover assembly bolts. 3. Turn the DT-48056 spring compressor bridge compressor bolt to compress the 1-2-3-4 Clutch Spring until the retaining ring groove is exposed. 4. Push retainer ring into the groove. 5. Remove DT-48056 spring compressor bridge and DT-46632 spring compressor. 6. Air check the piston operation by applying air to the 1-2-3-4 clutch feed passage in the case. 7. Excessive air leaks indicate damage to the clutch piston seal. Tighten 12 N.m (9 lb ft). Special Tools • DT-48056 Spring Compressor Bridge • DT-46632 Piston Spring Compressor For equivalent regional tools, refer to Special Tools .

1-2-3-4 Clutch Plates and Low Reverse Clutch Installation

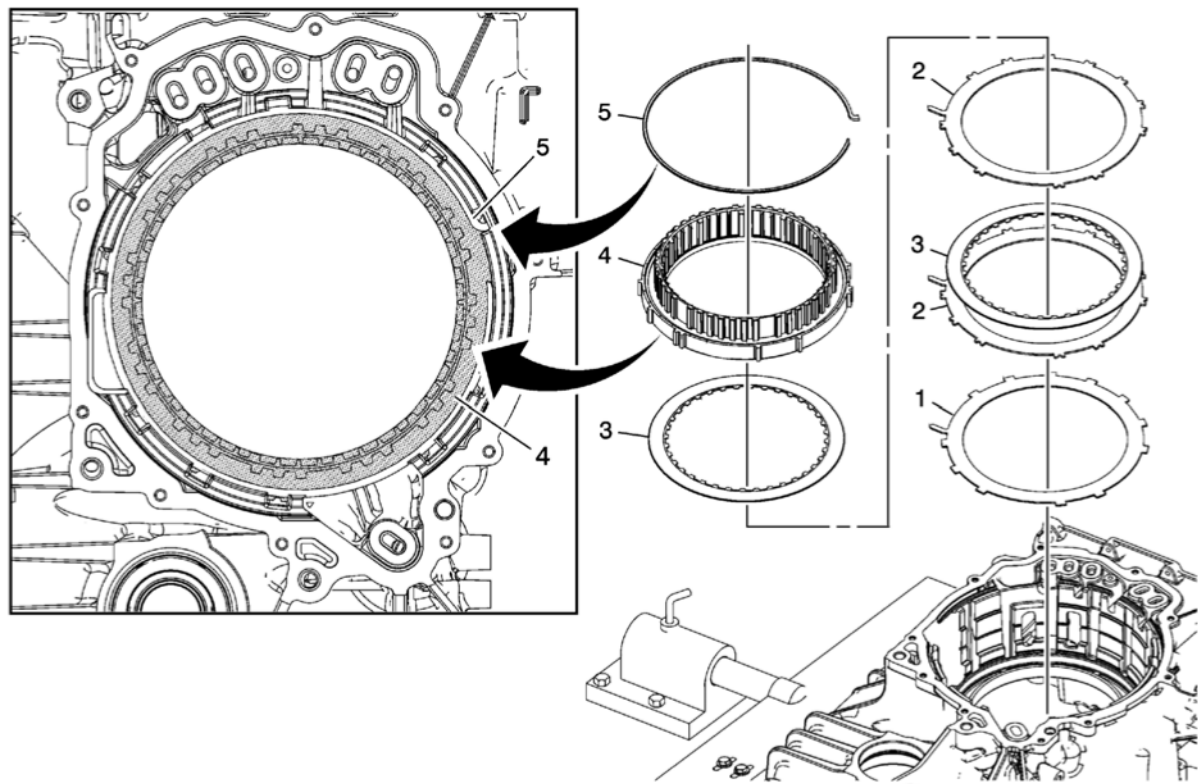


Fig. 49: Identifying 1-2-3-4 Clutch Plates & Low Reverse Clutch Installation Order
 Courtesy of GENERAL MOTORS COMPANY

1-2-3-4 Clutch Plates and Low Reverse Clutch Installation

Callout	Component Name
1	1-2-3-4 Clutch (Waved) Plate NOTE: The tab on the clutch plate faces the bottom of the case.
2	1-2-3-4 Clutch Plate (Qty: 2) NOTE: The tab on the clutch plate faces the bottom of the case.
3	1-2-3-4 Clutch (w/Friction Material) Plate Assembly (Qty: 2)
4	Low and Reverse Clutch Assembly NOTE: The low and reverse clutch assembly should rotate freely in one direction and lock in the opposite direction. Rotate the clutch assembly and listen/feel for the ratchet of the clutch in it's designed rotational direction.
5	Low and Reverse Clutch Retaining Ring NOTE: The tab needs to go in groove at about 2 o'clock and snap ring opening needs to face 3 o'clock.

Low and Reverse Clutch Plate Installation

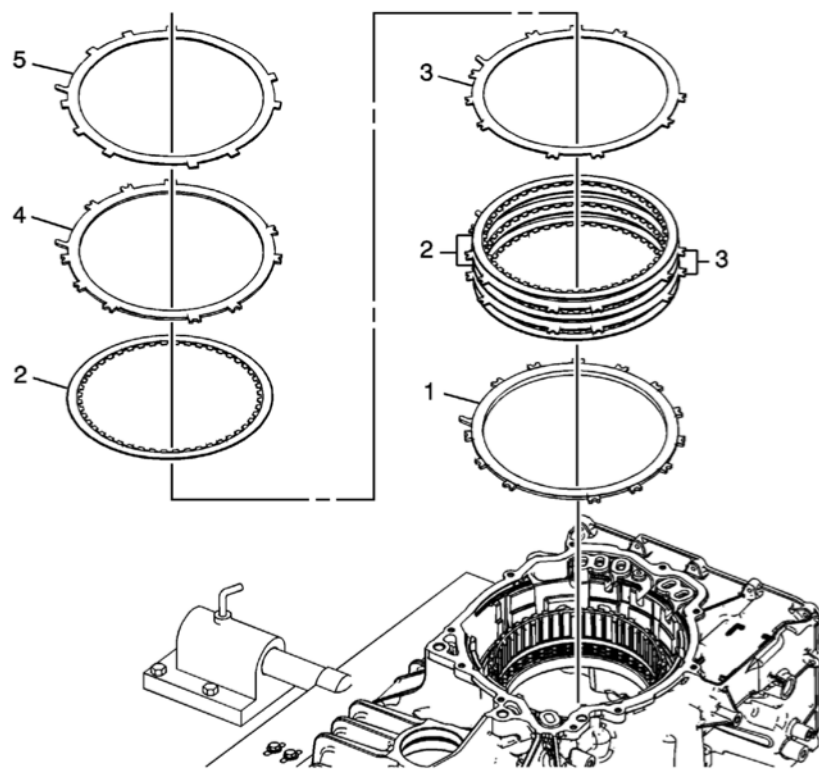


Fig. 50: Identifying Low & Reverse Clutch Plate
 Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Plate Installation

Callout	Component Name
1	Low and Reverse Clutch Backing Plate NOTE: The tab on the clutch plate faces the bottom of the case.
2	Low and Reverse Clutch (w/Friction Material) Plate Assembly (Qty: 4)
3	Low and Reverse Clutch Plate (Qty: 3) NOTE: The tab on the clutch plate faces the bottom of the case.
4	Low and Reverse Clutch Apply Plate NOTE: The tab on the clutch plate faces the bottom of the case.
5	Low and Reverse Clutch Cushion (Waved) Spring NOTE: The tab on the clutch plate faces the bottom of the case.

REACTION CARRIER CLEANING AND INSPECTION

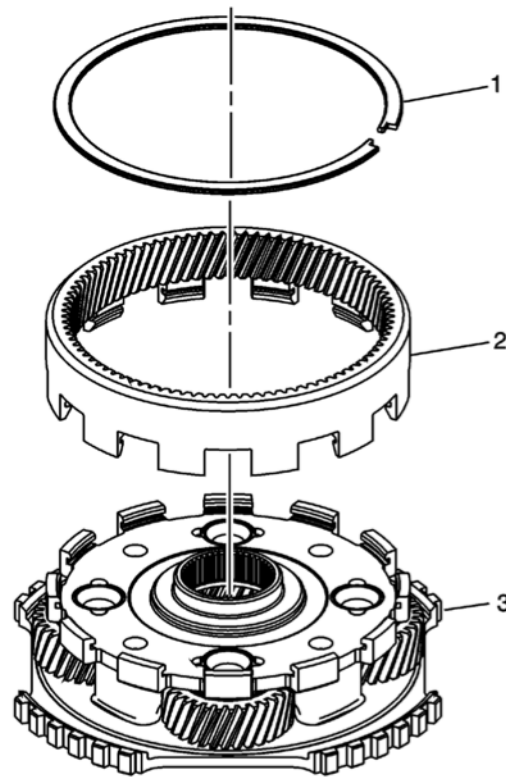


Fig. 51: View Of Reaction Carrier Assembly & Components

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Clean and Inspect the carrier as an assembly. If wear or damage is found disassemble to replace the affected component.	
1	Input Internal Gear Retaining Ring
2	Input Internal Gear
3	Reaction Carrier Assembly

OUTPUT CARRIER CLEANING AND INSPECTION

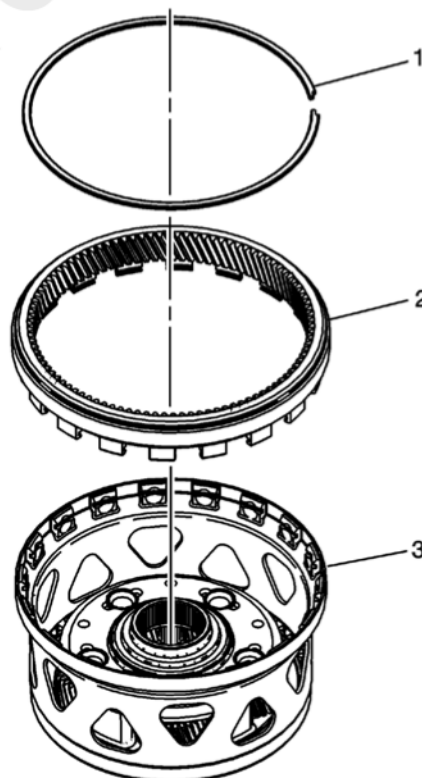


Fig. 52: View Of Output Carrier Components

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Clean and Inspect the carrier as an assembly. If wear or damage is found disassemble to replace the affected component.	
1	Reaction Internal Gear Retaining Ring
2	Reaction Carrier Internal Gear
3	Output Carrier Assembly

INPUT, REACTION, AND OUTPUT CARRIER INSTALLATION

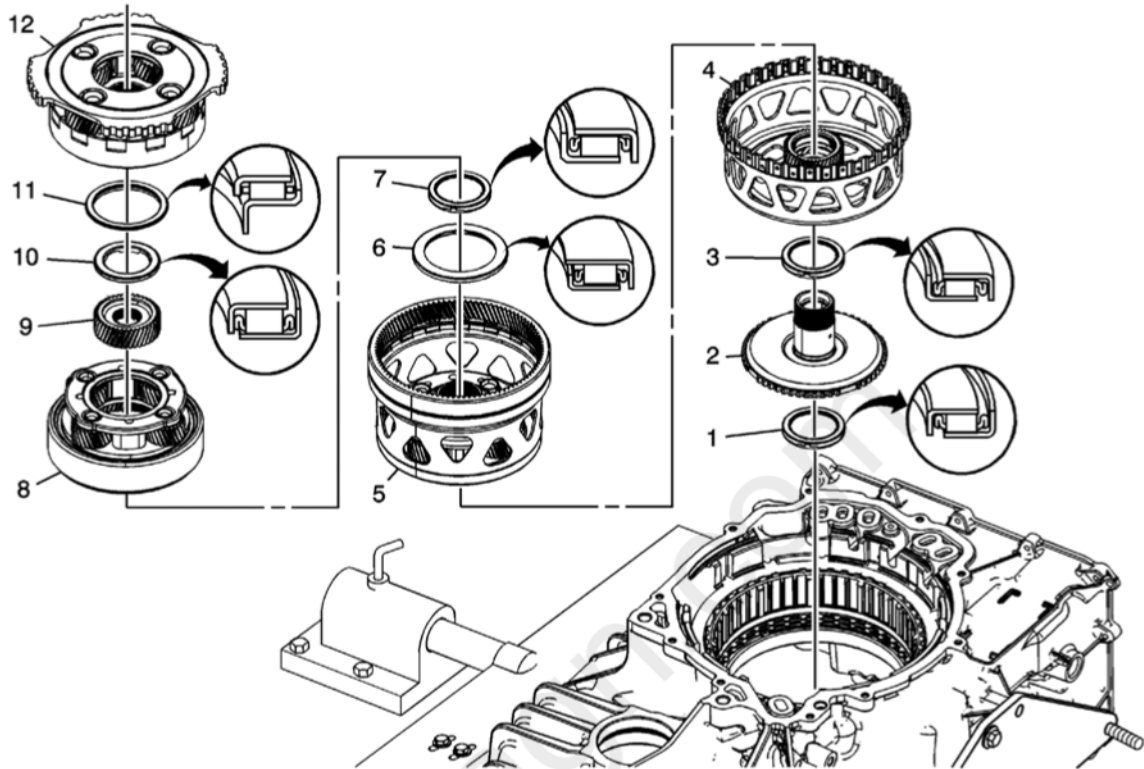


Fig. 53: Identifying Input, Reaction & Output Carrier

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Note location of the orientation lip on bearings. All thrust bearings can only be assembled one way.	
1	Input Shaft Thrust Bearing Assembly
2	Output Carrier Transfer Drive Gear Hub Assembly
3	Front Differential Transfer Drive Gear Input Hub Bearing Assembly
4	Output Sun Gear Assembly
5	Output Carrier Assembly
6	Output Carrier Thrust Bearing Assembly
7	Output Carrier Thrust Bearing Assembly
8	Input (w/Output Internal Gear) Carrier Assembly
9	Input Sun Gear
10	Input Sun Gear Thrust Bearing Assembly
11	Input Carrier Thrust Bearing Assembly
12	Reaction (w/Input Internal Gear) Carrier Assembly

2-6 CLUTCH PLATE INSTALLATION

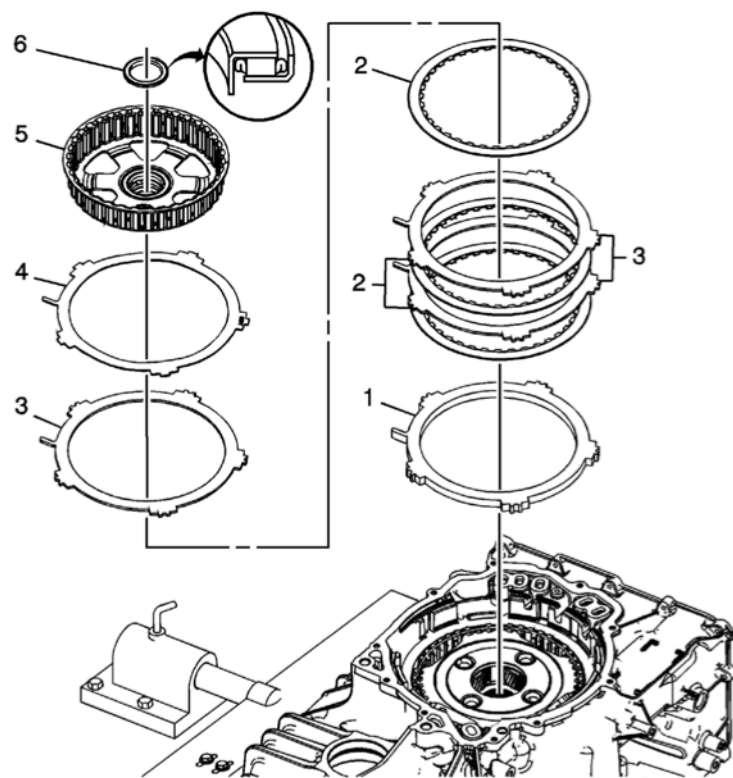


Fig. 54: Identifying 2-6 Clutch Plate

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	2 - 6 Clutch Backing Plate NOTE: The tab on the clutch plate faces the bottom of the case.
2	2 - 6 Clutch (w/Friction Material) Plate Assembly (Qty: 3)
3	2 - 6 Clutch Plate (Qty: 3) NOTE: The tab on the clutch plate faces the bottom of the case.
4	2 - 6 Clutch Cushion Spring
5	Reaction Sun Gear Assembly
6	2 - 6 Clutch Hub Thrust Bearing Assembly NOTE: Note location of the orientation lip on bearing. All thrust bearings can only be assembled one way.

3-5-REVERSE AND 4-5-6 CLUTCH HOUSING DISASSEMBLE

Reluctor Wheel and Piston Removal

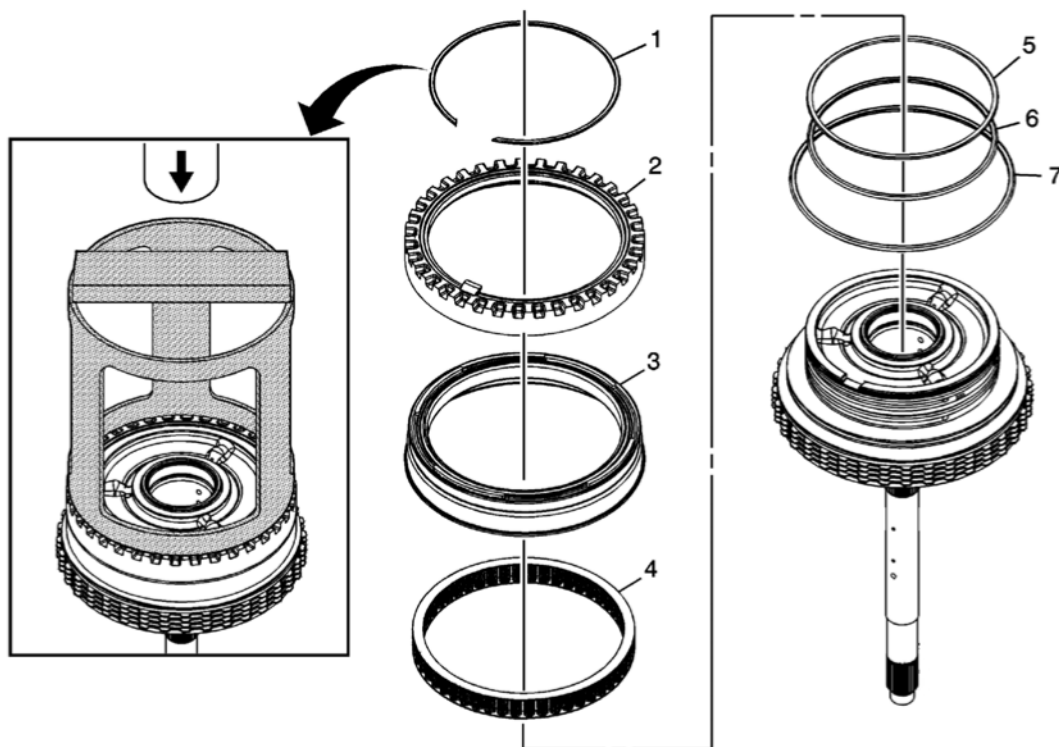


Fig. 55: View Of Input Shaft Speed Sensor Reluctor Wheel Piston & 3-5 Reverse Clutch Piston
 Courtesy of GENERAL MOTORS COMPANY

Reluctor Wheel and Piston Removal

Callout	Component Name
1	A/Trans Input Shaft Speed Sensor Reluctor Ring Retaining Ring CAUTION: Compress the reluctor wheel just enough to clear the retainer. Over compressing the reluctor wheel will break the alignment tab and the clutch housing. Special Tools DT-47694 Piston Spring Compressor For equivalent regional tools, refer to Special Tools .
2	A/Trans Input Shaft Speed Sensor Reluctor Wheel
3	3 - 5 Reverse Clutch Piston NOTE: Inspect piston seals for damage and/or wear. Piston is reusable.
4	3 - 5 Reverse Clutch Spring Assembly
5	3 - 5 Reverse Clutch Piston Inner Seal (Orange)
6	3 - 5 Reverse Clutch Piston Inner Seal (Black)
7	3 - 5 Reverse Clutch Piston Dam Seal

Clutch Plate Removal

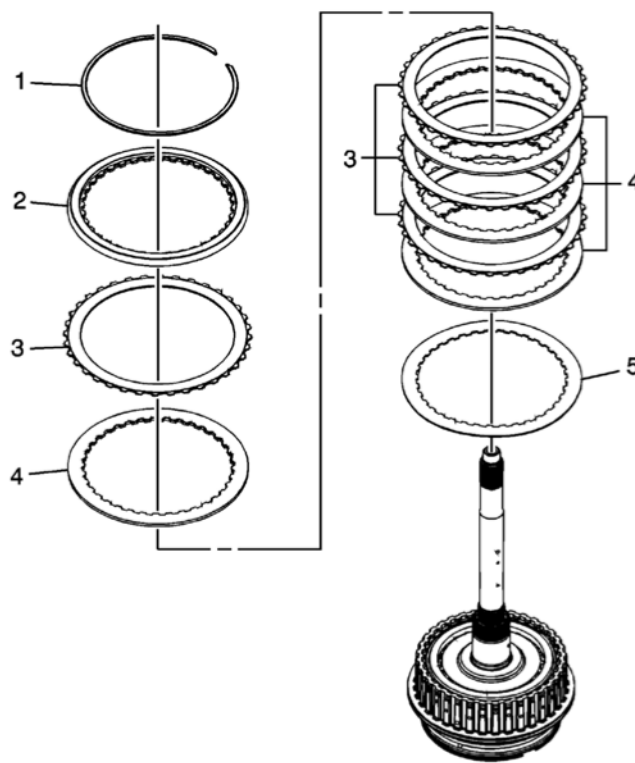


Fig. 56: View Of 3-5 Reverse Clutch Plates
Courtesy of GENERAL MOTORS COMPANY

Clutch Plate Removal

Callout	Component Name
1	3 - 5 Reverse Clutch Backing Plate Retaining Ring
2	3 - 5 Reverse Clutch Backing Plate
3	3 - 5 Reverse Clutch (w/Friction Material) Plate Assembly (Qty: 4)
4	3 - 5 Reverse Clutch Plate (Qty: 4)
5	3 - 5 Reverse Clutch (Waved) Plate

4 - 5 - 6 Clutch Hub Removal

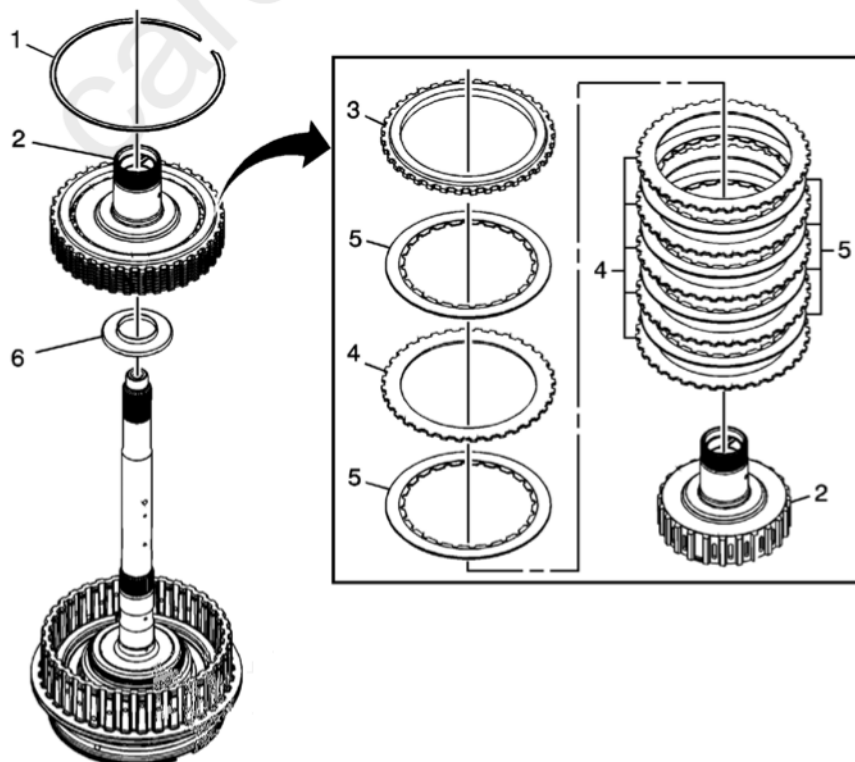


Fig. 57: View Of Reaction Carrier Hub Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	4 - 5 - 6 Backing Plate Retaining Ring NOTE: Gently push down on the backing plate to get enough clearance between the backing plate and retainer.
2	Reaction Carrier Hub Assembly NOTE: The clutch plates will come out of the housing with the hub assembly.
3	4 - 5 - 6 Clutch Backing Plate
4	4 - 5 - 6 Clutch Plate (Qty: 6)
5	4 - 5 - 6 Clutch (w/Friction Material) Plate Assembly (Qty: 6)
6	4 - 5 - 6 Clutch Hub Thrust Bearing Assembly NOTE: The bearing may stick to the reaction carrier hub.

The diagram illustrates the assembly of the rear wheel hub and brake components. It shows the following steps:

1. The hub assembly is shown with the brake disc and the hub flange.
2. The brake disc is shown with the hub flange.
3. The brake disc is shown with the hub flange.
4. The brake disc is shown with the hub flange.
5. The brake disc is shown with the hub flange.
6. The brake disc is shown with the hub flange.
7. The brake disc is shown with the hub flange.

4 - 5 - 6 Clutch Piston Removal

Callout	Component Name

Callout	Component Name
1	4 - 5 - 6 Clutch Dam Retaining Ring Special Tools • DT-47693 Dam Protector • GE 8059 Snap Ring Pliers-Parallel Jaw or equivalent For equivalent regional tools, refer to Special Tools .
2	4 - 5 - 6 Clutch Piston Fluid Dam Procedure: 1. Place the 3 - 5 - R and 4 - 5 - 6 clutch housing onto the case cover assembly. 2. Apply shop air to the 4 - 5 - 6 clutch feed hole using a rubber tipped air gun to dislodge the dam piston and the 4 - 5 - 6 clutch piston from the clutch housing.
3	4 - 5 - 6 Clutch Spring Assembly
4	4 - 5 - 6 Clutch Piston
5	4 - 5 - 6 Clutch Piston Outer Seal (Stepped)
6	4 - 5 - 6 Clutch Piston Outer Seal (Rounded)
7	4 - 5 - 6 Clutch Piston Inner Seal

3-5-REVERSE AND 4-5-6 CLUTCH HOUSING ASSEMBLE

4-5-6 Clutch Piston Installation

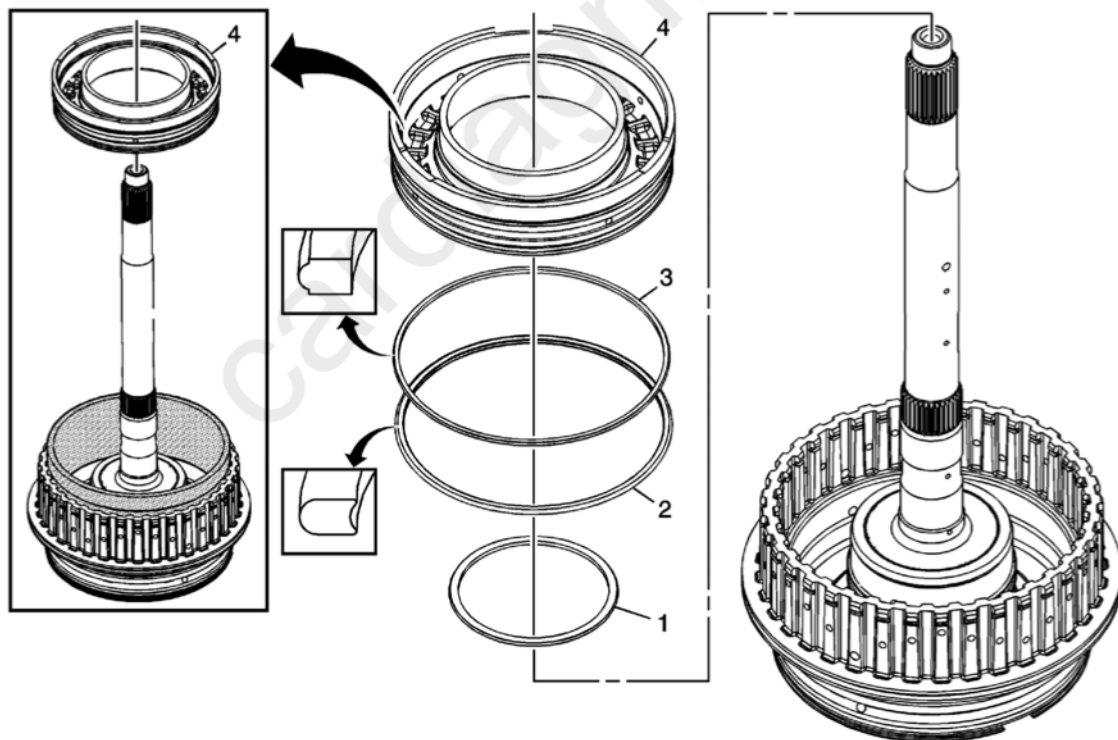


Fig. 59: Identifying 4-5-6 Clutch Piston

Courtesy of GENERAL MOTORS COMPANY

4-5-6 Clutch Piston Installation

Callout	Component Name
1	4-5-6 Clutch Piston Inner Seal
2	4-5-6 Clutch Piston Outer Seal (Rounded)
3	4-5-6 Clutch Piston Outer Seal (Stepped) (Orange)

Callout	Component Name
4	4-5-6 Clutch Piston NOTE: DT-47859 outer seal protector prevents the piston seal lip from damage during installation. Apply a thin coat of ATF to the I.D. of DT-47859 outer seal protector to ease the installation of the piston. Special Tools DT-47859 Piston Outer Seal Protector For equivalent regional tools, refer to Special Tools .

4-5-6 Clutch Dam Installation

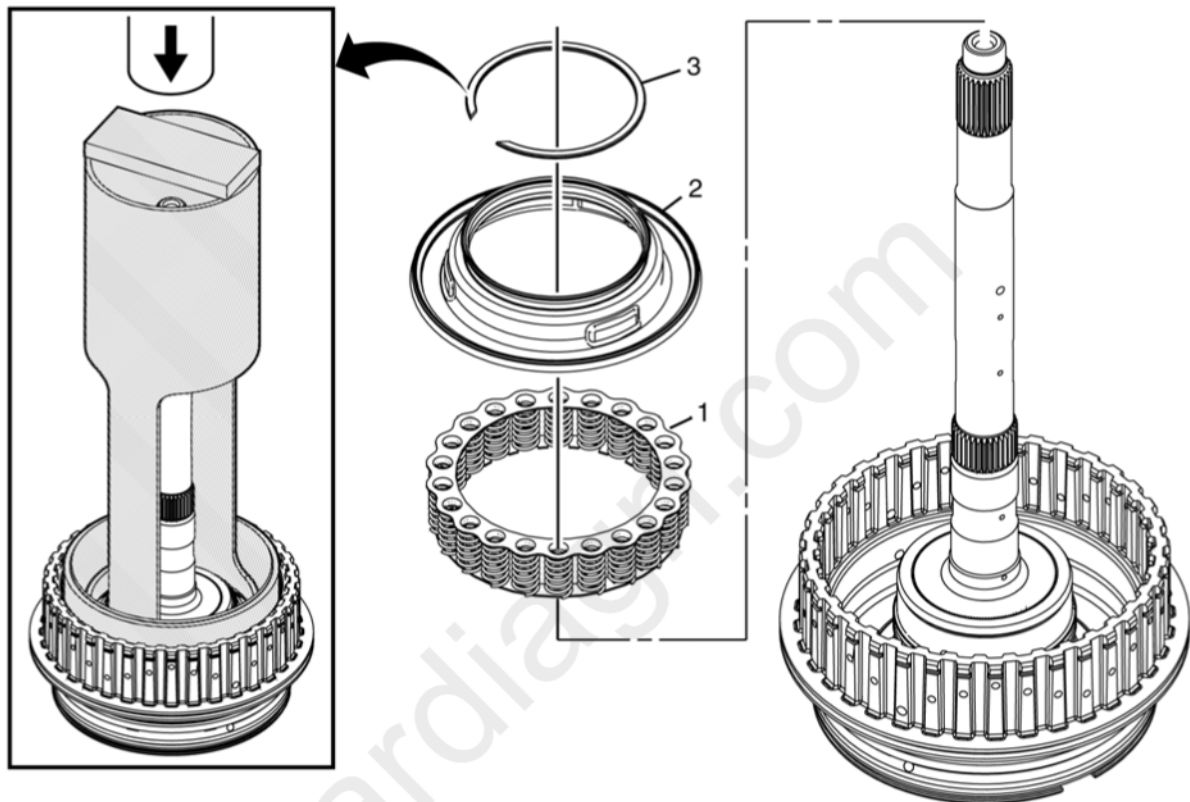


Fig. 60: View Of 4-5-6 Clutch Dam

Courtesy of GENERAL MOTORS COMPANY

4 - 5 - 6 Clutch Dam Installation

Callout	Component Name
1	4-5-6 Clutch Spring NOTE: Ensure the spring is installed in the correct orientation as shown.
2	4-5-6 Clutch Piston Fluid Dam NOTE: DT 47693-1 which is part of DT-47693 dam protector prevents the dam seal lip from damage during installation. Apply a thin coat of ATF to the I.D. of DT 47693-1 which is part of DT-47693 dam protector to ease the installation of the dam. Special Tools DT-47693 Dam Protector For equivalent regional tools, refer to Special Tools .

Callout	Component Name
3	4-5-6 Clutch Dam Retaining Ring Special Tools - DT 47693-2 Clutch Spring Compressor which is part of DT-47693 Dam Protector GE 8059 Snap Ring Pliers-Parallel Jaw or equivalent For equivalent regional tools, refer to Special Tools .

4-5-6 Clutch Plates Installation

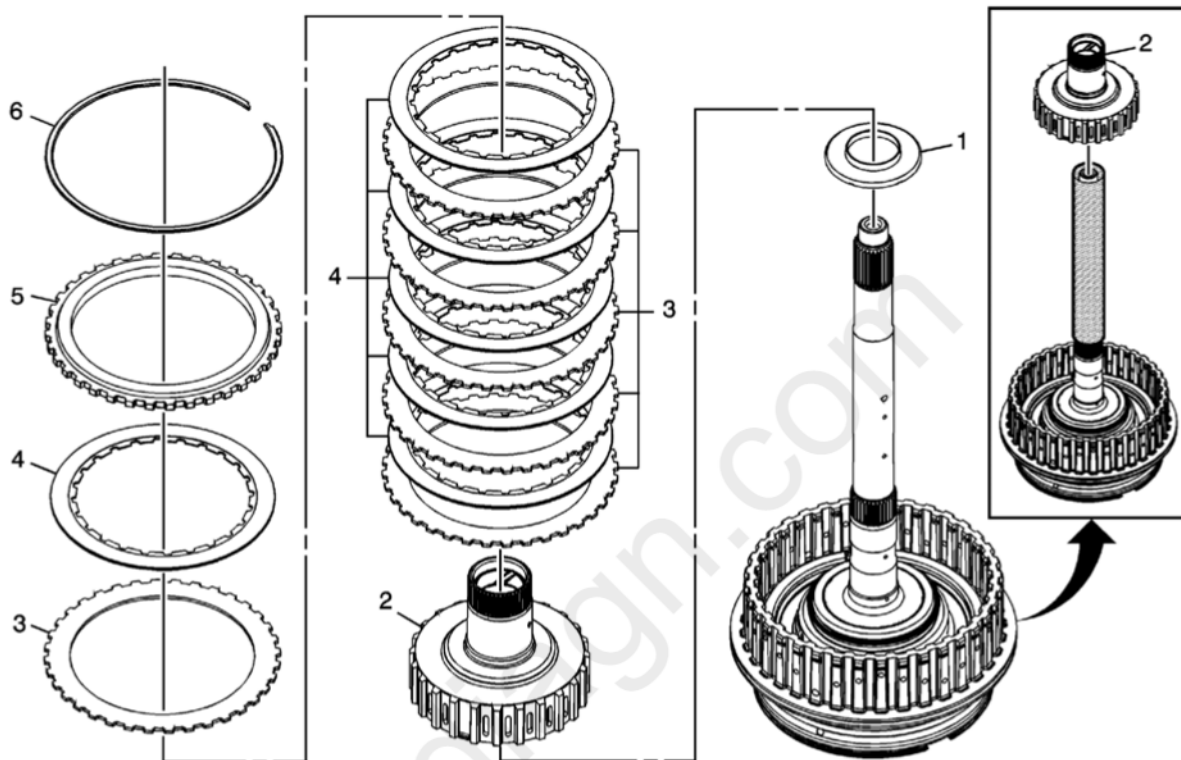


Fig. 61: Locating 4-5-6 Clutch Plates
 Courtesy of GENERAL MOTORS COMPANY

4-5-6 Clutch Plates Installation

Callout	Component Name
1	4-5-6 Clutch Hub Thrust Bearing NOTE: Note location of the orientation lip on bearing. All thrust bearings can only be assembled one way.
2	Reaction Carrier Hub Assembly CAUTION: Failure to use DT 48551 could cause damage to the hub assembly bushings which could cause premature transmission failure. Special Tools DT-48551 Reaction Hub Bushing Protector For equivalent regional tools, refer to Special Tools .
3	4-5-6 Clutch Plate (Qty: 6)
4	4-5-6 Clutch (w/Friction Material) Plate Assembly (Qty: 6)

Callout	Component Name
5	4-5-6 Clutch Backing Plate
6	4-5-6 Clutch Backing Plate Retaining Ring NOTE: Gently push down on the backing plate to get enough clearance between the backing plate and retainer.

3-5 Reverse Clutch Plates Installation

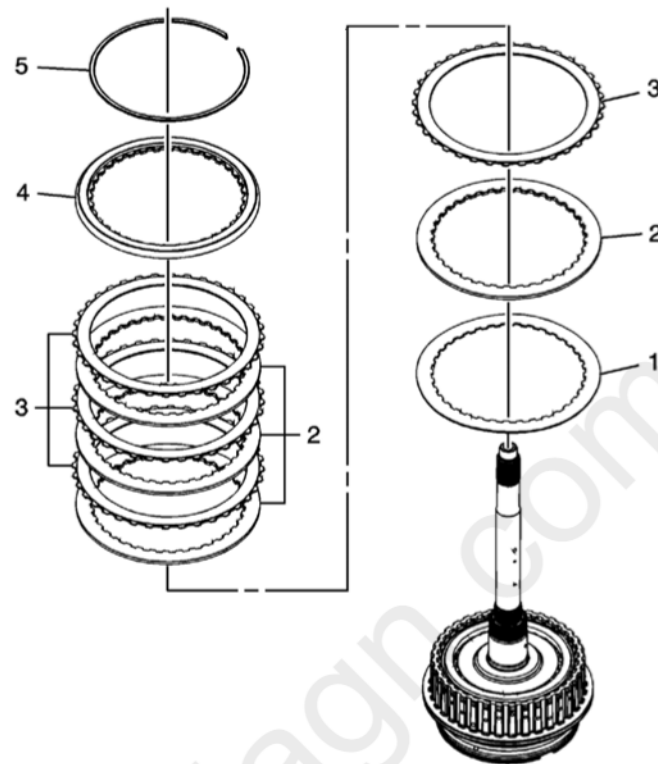


Fig. 62: Identifying 3-5 Reverse Clutch Plates
Courtesy of GENERAL MOTORS COMPANY

3-5 Reverse Clutch Plates Installation

Callout	Component Name
1	3-5 Reverse Clutch (Waved) Plate
2	3-5 Reverse Clutch Plate (Qty: 4)
3	3-5 Reverse Clutch (w/Friction Material) Plate Assembly (Qty: 4)
4	3-5 Reverse Clutch Backing Plate
5	3-5 Reverse Clutch Backing Plate Retaining Ring

Piston and Reluctor Wheel Installation

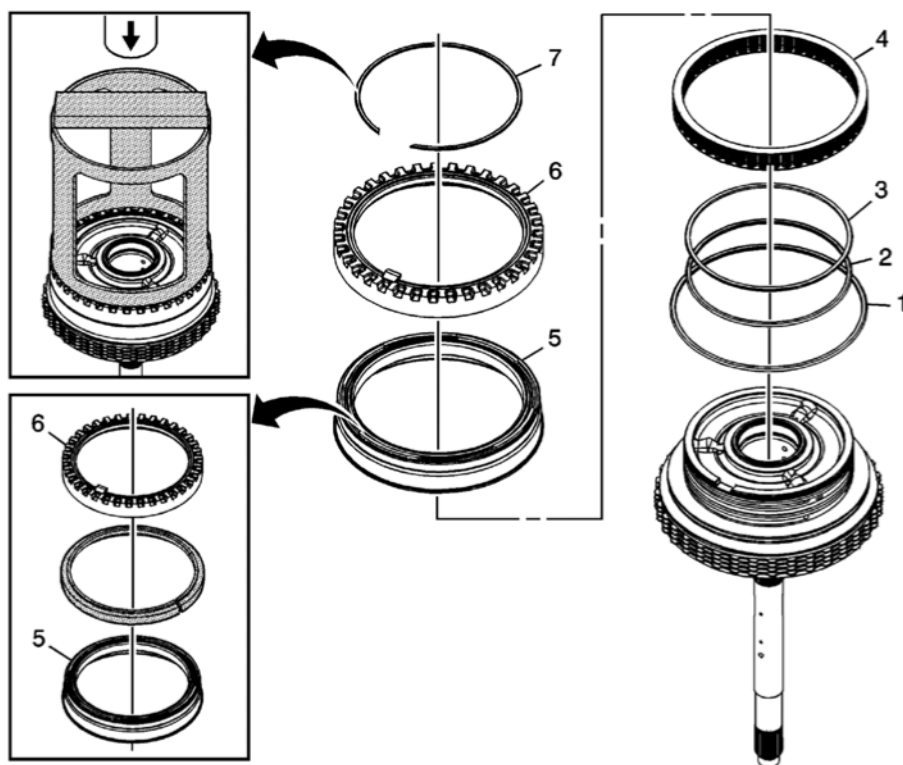


Fig. 63: View Of Piston & Reluctor Wheel
Courtesy of GENERAL MOTORS COMPANY

Piston and Reluctor Wheel Installation

Callout	Component Name
1	3-5 Reverse Clutch Piston Dam Seal
2	3-5 Reverse Clutch Piston Inner Seal (Black) NOTE: Apply a thin coat of ATF to the seal to ease the installation of the piston.
3	3-5 Reverse Clutch Piston Inner Seal (Orange) NOTE: Apply a thin coat of ATF to the seal to ease the installation of the piston.
4	3-5 Reverse Clutch Spring Assembly
5	3-5 Reverse Clutch Piston NOTE: - DT-46622 seal protector prevents the piston seal lip from damage during installation. Apply a thin coat of ATF to the I.D. of DT-46622 seal protector to ease the installation of the piston. - Install DT-46622 seal protector onto the speed sensor reluctor wheel. Push the 3 - 5 Reverse Clutch piston into the reluctor wheel until it stops against J-46622 seal protector. Remove DT-46622 seal protector by separating it at the opening. Special Tools DT-46622 Piston Seal Protector For equivalent regional tools, refer to Special Tools .
6	A/Trans Input Shaft Speed Sensor Reluctor Wheel

Callout	Component Name
7	A/Trans Input Shaft Speed Sensor Reluctor Wheel Retaining Ring CAUTION: Compress the reluctor wheel just enough to clear the retainer ring groove. Over compressing the reluctor wheel will break the alignment tab and the clutch housing. Special Tools DT-47694 Piston Spring Compressor For equivalent regional tools, refer to Special Tools .

3-5-R and 4-5-6 Clutch Piston Air Check

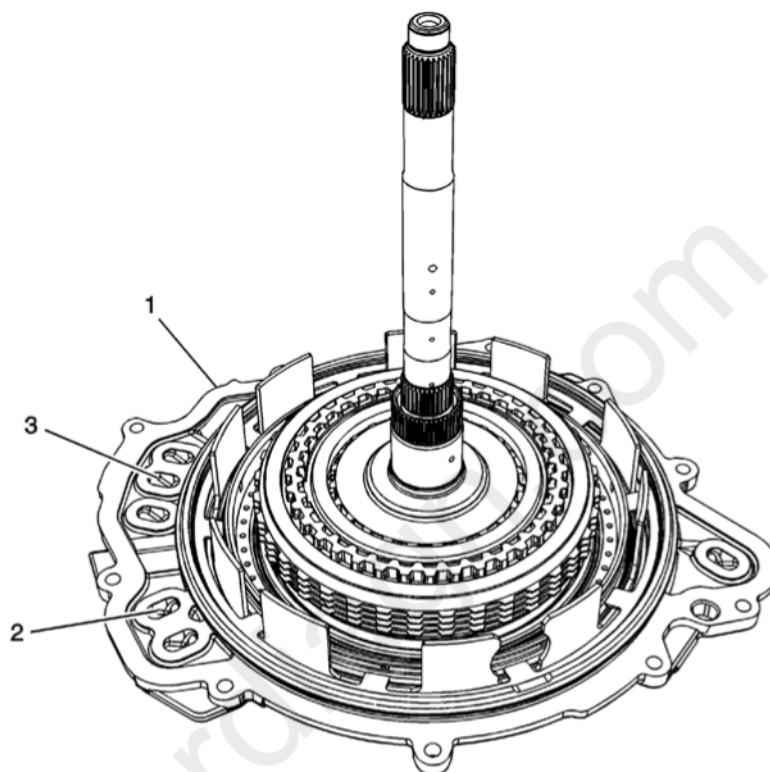


Fig. 64: View of 35R and 4-5-6 Clutch Piston Air Check

Courtesy of GENERAL MOTORS COMPANY

3-5-R and 4-5-6 Clutch Piston Air Check

Callout	Component Name
1	Case Cover Assembly NOTE: The fluid seal rings should be in place and not damaged.

Callout	Component Name
2	4-5-6 Clutch Feed Fluid Passage CAUTION: Regulate the air pressure to 40 psi maximum. High pressure could cause the piston to over travel and damage the piston seals. Procedure 1. Apply shop air to the 4-5-6 clutch feed passage. 2. Observe the 4-5-6 piston movement. NOTE: Minimal piston movement and excessive air leaking could indicate damage to the 4-5-6 piston seals or improper assembly.
3	3-5 Rev Clutch Feed Fluid Passage CAUTION: Regulate the air pressure to 40 psi maximum. High pressure could cause the piston to over travel and damage the piston seals. Procedure 1. Apply shop air to the 3-5-Rev clutch feed passage. 2. Observe the 3-5-Rev piston movement. NOTE: Minimal piston movement and excessive air leaking could indicate damage to the 3-5-Rev piston seals or improper assembly.

3-5-REVERSE AND 4-5-6 CLUTCH HOUSING INSTALLATION

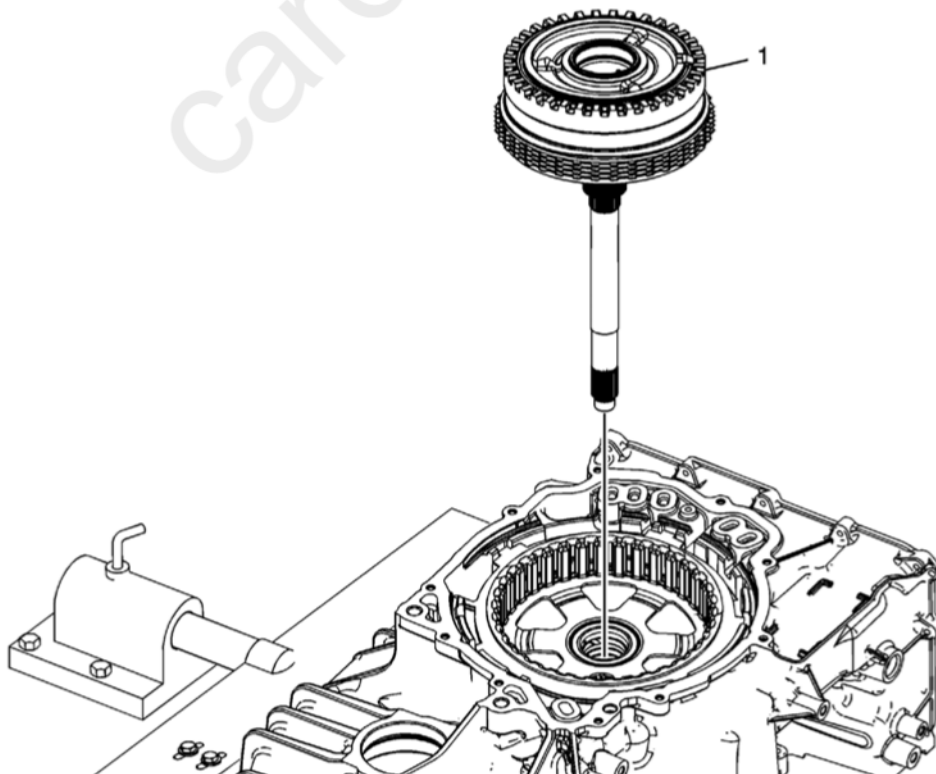


Fig. 65: Identifying 3-5 Reverse & 4-5-6 Clutch Housing
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	3 - 5 Reverse and 4 - 5 - 6 Clutch Assembly NOTE: Rotate the assembly back and forth to align the 3 - 5 reverse clutch plates with the reaction sun gear housing.

CASE COVER ASSEMBLY DISASSEMBLE

ISS Removal

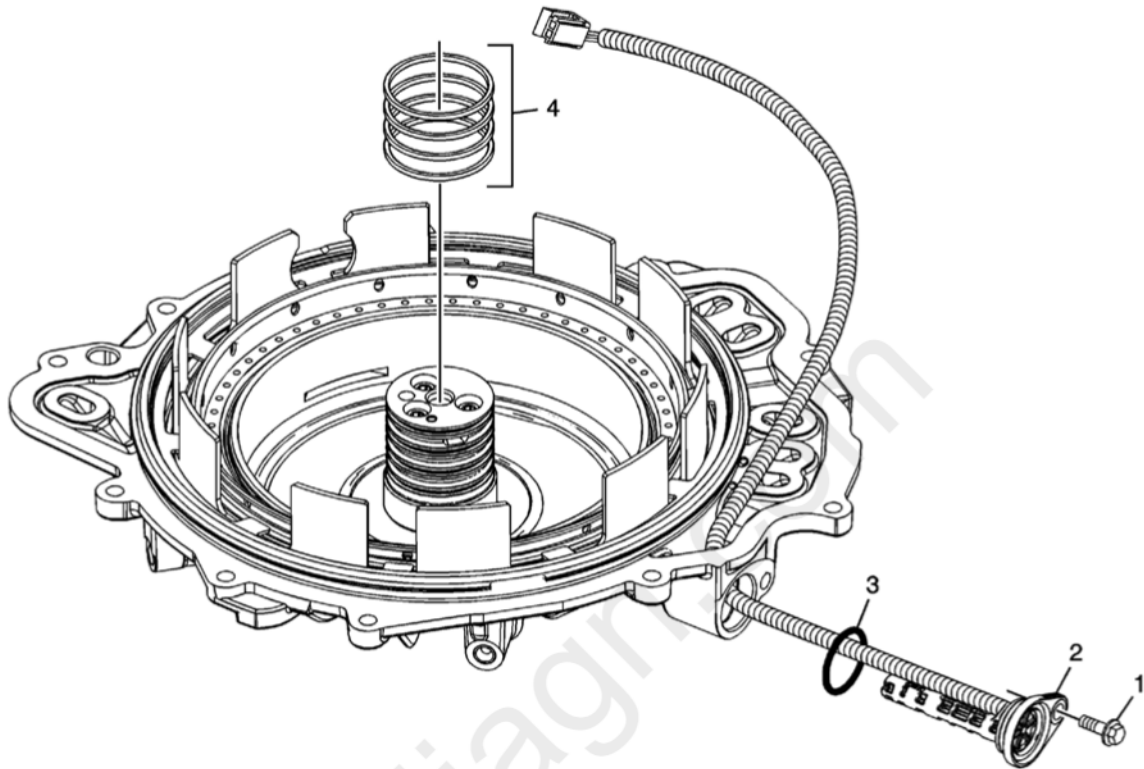


Fig. 66: View Of 3-5 Reverse & 4-5-6 Clutch Fluid Seal Ring
Courtesy of GENERAL MOTORS COMPANY

ISS Removal

Callout	Component Name
1	A/Trans Input Speed Sensor Bolt M6 x 25
2	A/Trans Input Speed Sensor
3	A/Trans Input Speed Sensor Seal NOTE: Discard the seal.
4	3 - 5 Reverse and 4 - 5 - 6 Clutch Fluid Seal Ring NOTE: Discard the seals.

Low and Reverse Clutch Piston Removal

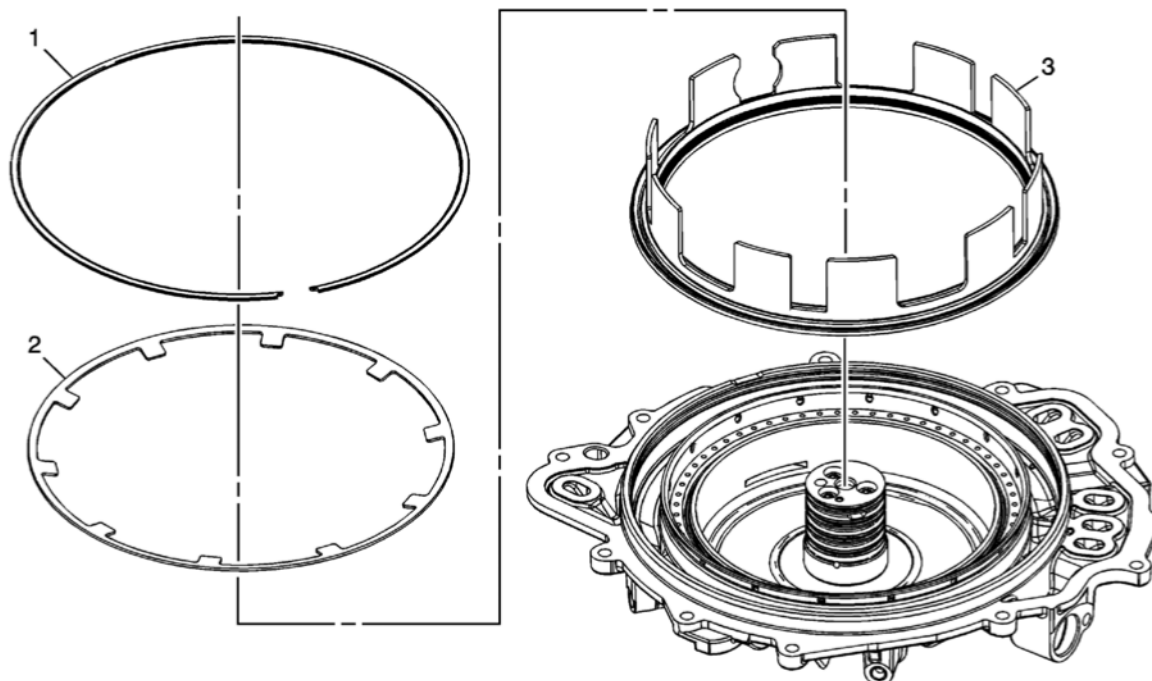
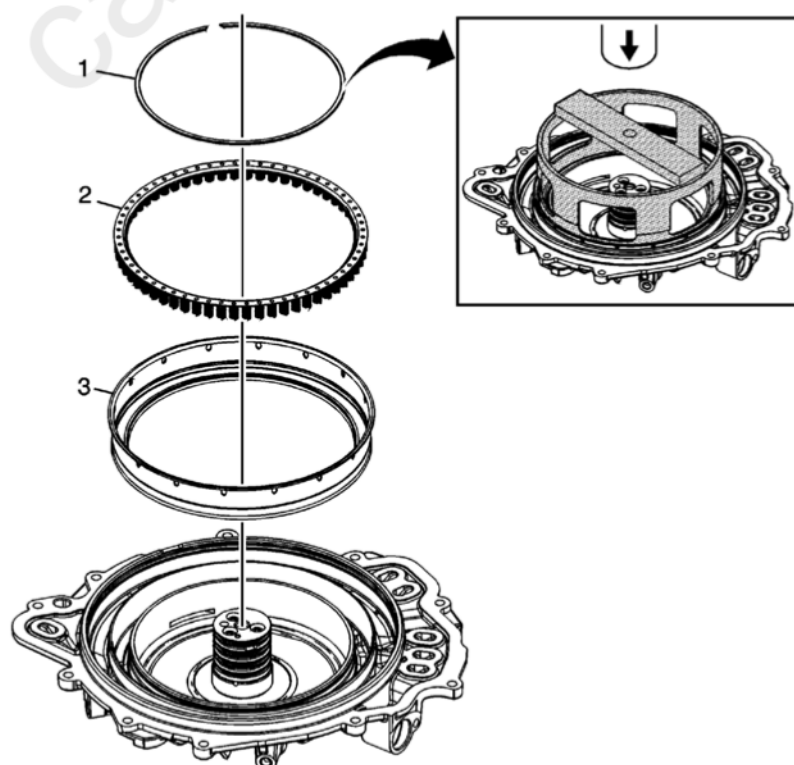


Fig. 67: Identifying Low & Reverse Clutch Piston
 Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Piston Removal

Callout	Component Name
1	Low and Reverse Clutch Spring Retaining Ring
2	Low and Reverse Clutch Spring
3	Low and Reverse Clutch Piston Assembly NOTE: Inspect piston seals for damage and/or wear. Piston is reusable.

2 - 6 Clutch Piston Removal



Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	2 - 6 Clutch Spring Retaining Ring Special Tools DT-46632 Spring Compressor For equivalent regional tools, refer to <u>Special Tools</u> .
2	2 - 6 Clutch Spring Assembly
3	2 - 6 Clutch Piston NOTE: Inspect piston seals for damage and/or wear. Piston is reusable.

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
CAUTION: After cleaning the transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components. Lint from the towels can cause component failure.	
CAUTION: Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.	
Preliminary Procedures 1. Thoroughly clean the case cover assembly, including threads, with clean solvent. 2. Clean gasket sealing surfaces. Remove all residual gasket material. 3. Inspect all threaded holes. If necessary, repair any thread damage.	
1	Gasket Sealing Surface
2	Fluid Passages
3	Piston Bores
4	Cover to Case Passages
5	A/Trans Input Speed Sensor Assembly Bore
6	Cover Casting
7	Passage Cup Plugs
8	Input Shaft Support Bolts CAUTION: Refer to Fastener Caution . Procedure Tightened bolts in sequence. Tighten 12 N.m (106 lb in).

CASE COVER ASSEMBLY ASSEMBLE

Fluid Seal Ring Installation

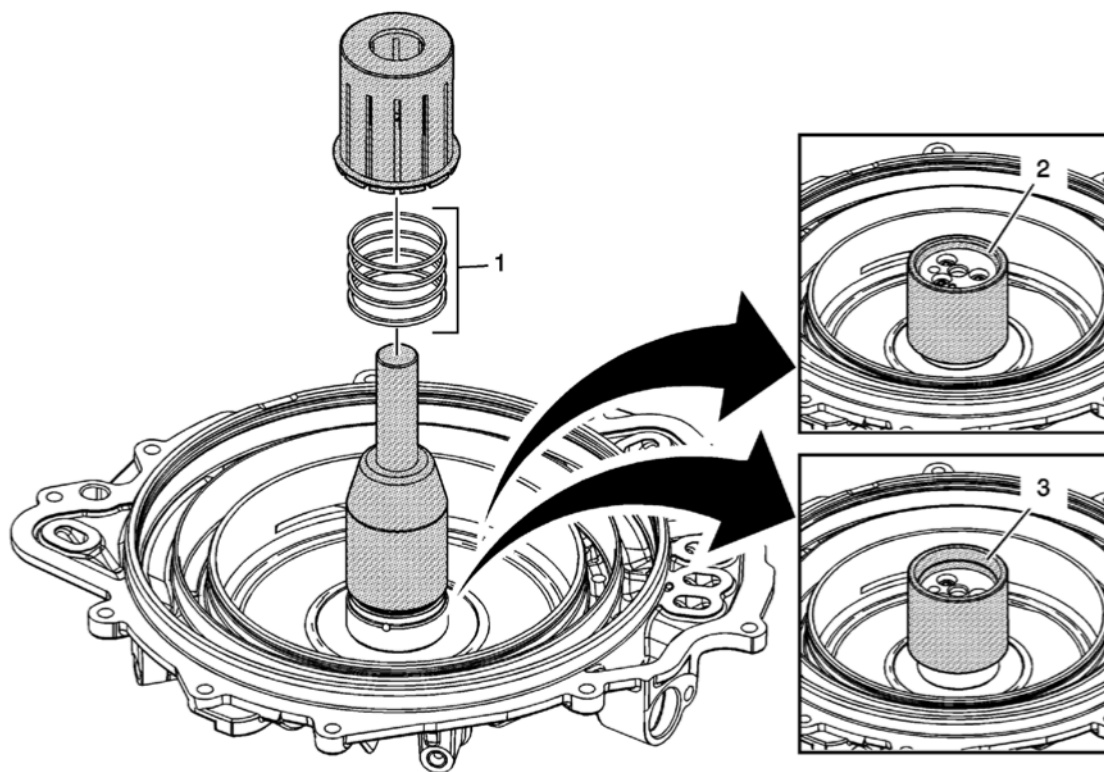


Fig. 70: Identifying Fluid Seal Ring

Courtesy of GENERAL MOTORS COMPANY

Fluid Seal Ring Installation

Callout	Component Name
1	3 - 5 Reverse and 4 - 5 - 6 Clutch Fluid Seal Ring Procedure 1. Place DT 46620-3 which is part of DT-46620 seal installer over the case cover hub and adjust it so that only the bottom seal ring is exposed. 2. Place a NEW fluid seal ring onto DT 46620-3 which is part of DT-46620 seal installer. 3. Use DT 46620-2 which is part of DT-46620 seal installer to push the fluid seal ring down over DT 46620-3 which is part of DT-46620 seal installer into the hub ring groove. 4. Repeat the above steps to install all 4 seal rings, adjusting DT 46620-3 which is part of DT-46620 seal installer to the appropriate ring groove. Special Tools DT-46620 Seal Installer For equivalent regional tools, refer to Special Tools .
2	Small Chamfer Up CAUTION: Do not force the seal installer down over the seals as this will roll and damage the seals. The large chamfer is designed to fit over the over stretched seal. Use a hand to help shrink the seal if the seal installer is difficult to install over the seal rings. Procedure Install DT 46620-1 which is part of DT-46620 seal installer with the large chamfer end down over the fluid seal rings and leave DT 46620-1 which is part of DT-46620 seal installer on the seals for at least 60 seconds.

Callout	Component Name
3	Large Chamfer Up Procedure 1. Install DT 46620-1 which is part of DT-46620 seal installer with the small chamfer end facing down for at least 60 seconds. This will properly size the bottom seal ring. 2. Leaving DT 46620-1 which is part of DT-46620 seal installer on the fluid seal rings for an extended period of time could cause a fluid leak on the initial clutch piston circuit until the seal rings warm up and expand to the proper dimension.

2 - 6 Clutch Piston Installation

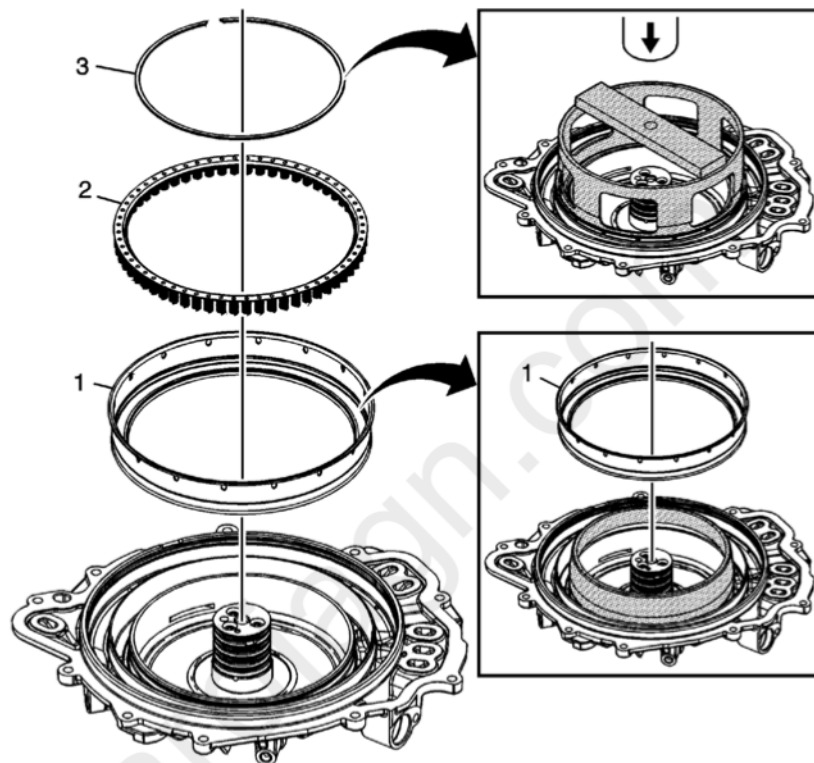


Fig. 71: View Of 2-6 Clutch Piston

Courtesy of GENERAL MOTORS COMPANY

2 - 6 Clutch Piston Installation

Callout	Component Name
1	2 - 6 Clutch Piston Procedure DT-46621 seal protector prevents the piston seal lip from damage over the retaining ring groove during installation. Apply a thin coat of ATF to the O.D. of DT-46621 seal protector to ease the installation of the piston. Special Tools DT-46621 Seal Protector For equivalent regional tools, refer to Special Tools .
2	2 - 6 Clutch Spring Assembly

Callout	Component Name
3	2 - 6 Clutch Spring Assembly Procedure 1. Install the retaining ring with the opening positioned to the top of the case cover. 2. Place the retainer ring inside DT-46632 spring compressor prior to placing DT-46632 spring compressor onto the spring. Special Tools DT-46632 Spring Compressor For equivalent regional tools, refer to Special Tools .

Low and Reverse Clutch Piston Installation

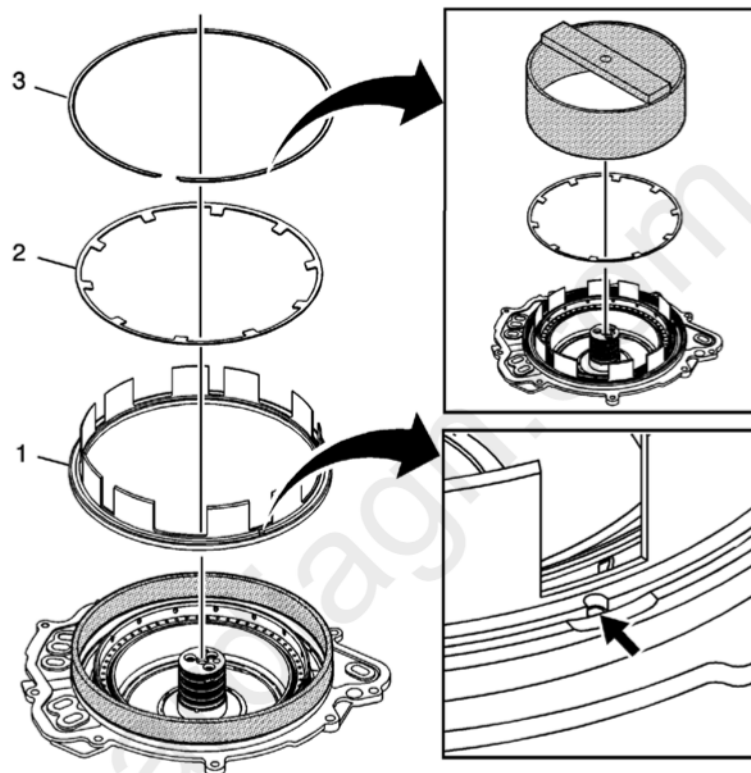


Fig. 72: Identifying Low & Reverse Clutch Piston
Courtesy of GENERAL MOTORS COMPANY

Low and Reverse Clutch Piston Installation

Callout	Component Name
1	Low and Reverse Clutch Piston Assembly Procedure 1. Install the L/R piston with the air bleed positioned at the alignment feature on the cover, using DT-46628-1 seal protector. This will orient the piston fingers with the openings in the case. 2. DT-46628-1 seal protector prevents the piston seal lip from damage during installation. Apply a thin coat of ATF to the I.D. of DT-46628-1 seal protector to ease the installation of the piston. Special Tools DT-46628-1 Piston Seal Protector For equivalent regional tools, refer to Special Tools .
2	Low and Reverse Clutch Spring

Callout	Component Name
3	Low and Reverse Clutch Spring Retaining Ring NOTE: Do not align the retainer opening with other retaining ring openings. Special Tools DT-46628-2 Spring Compressor For equivalent regional tools, refer to Special Tools .

2-6 and Low-Reverse Piston Function Inspection

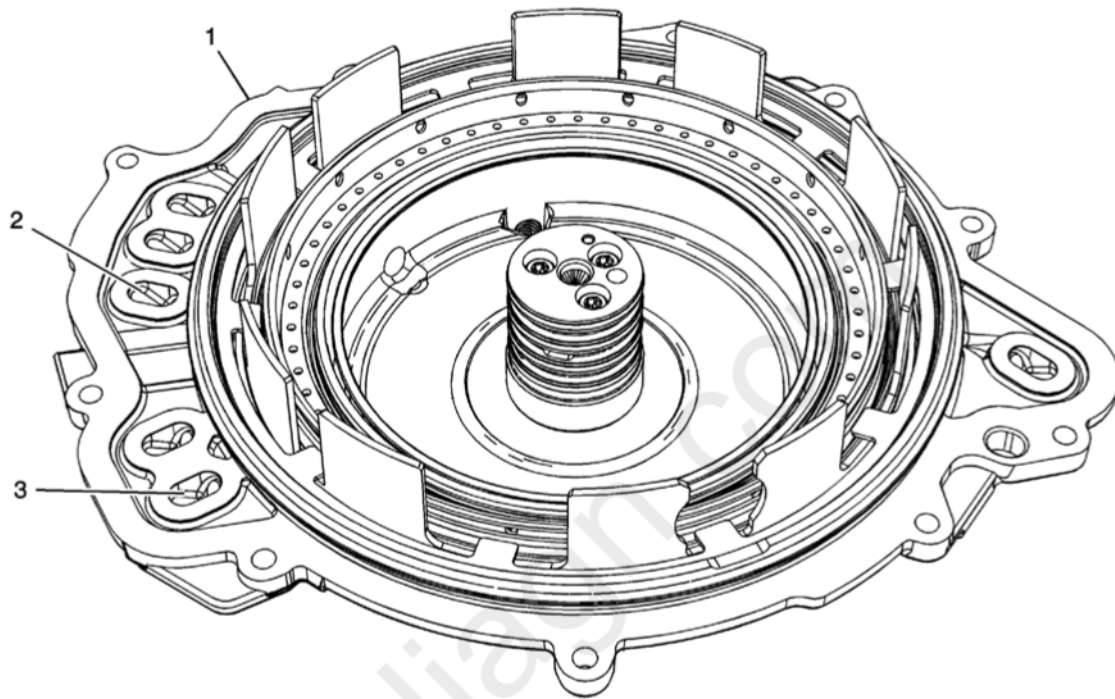


Fig. 73: 2-6 and Low-Reverse Piston Function Inspection

Courtesy of GENERAL MOTORS COMPANY

2-6 and Low-Reverse Piston Function Inspection

Callout	Component Name
1	Case Cover Assembly NOTE: The fluid seal rings should be in place and not damaged.
2	2-6 Clutch Feed Passage CAUTION: Regulate the air pressure to 40 psi maximum. High pressure could cause the piston to over travel and damage the piston seals. Procedure Apply shop air to the 2-6 clutch feed. Observe the 2-6 piston movement. NOTE: Minimal piston movement and excessive air leaking could indicate damage to the 2-6 piston seals or improper assembly.

Callout	Component Name
3	A/Trans Input Speed Sensor Bolt M6 x 25 CAUTION: Refer to Fastener Caution . Procedure Apply threadlocker or equivalent to the input speed sensor bolt. Refer to Adhesives, Fluids, Lubricants, and Sealers . NOTE: The seal is coated with a dry lubricant. If the coating is missing, lubricate the seal with automatic transmission fluid prior to installation. Tighten 9 N.m (7 lb ft)

CASE COVER ASSEMBLY INSTALLATION

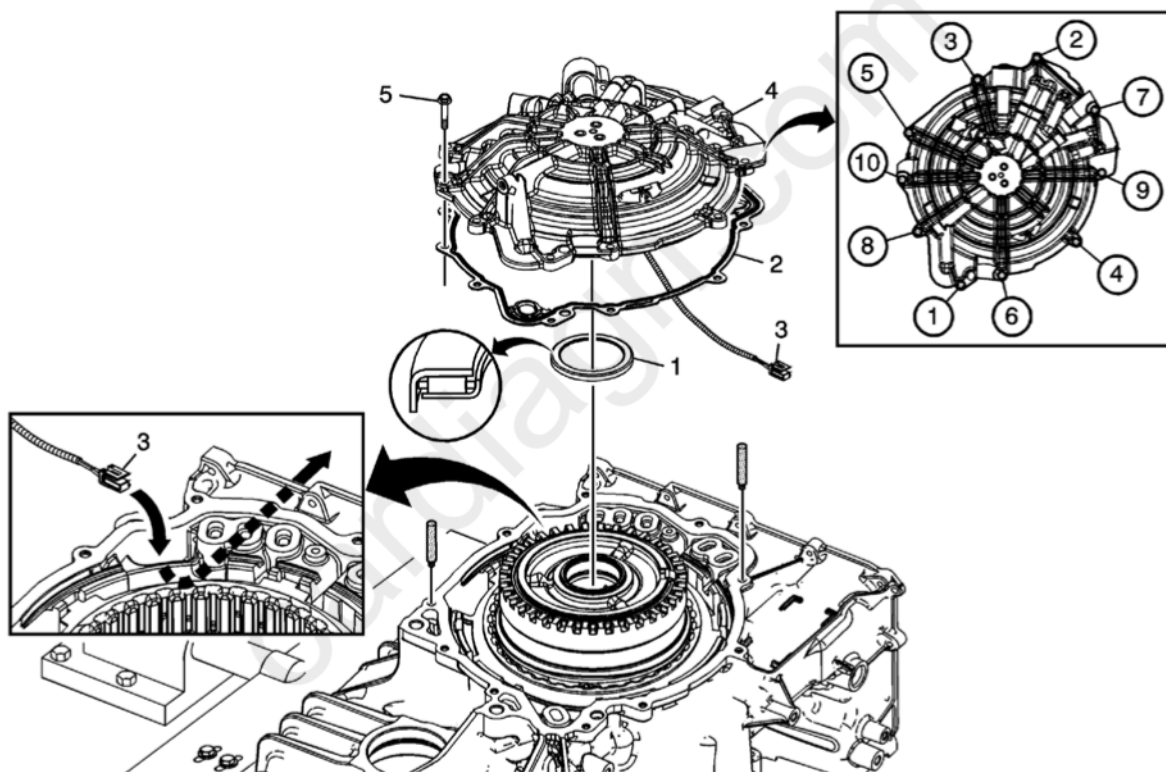


Fig. 75: Identifying Case Cover Assembly Components

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Input Shaft Thrust Bearing NOTE: Note location of the orientation lip on bearing. All thrust bearings can only be assembled one way.
2	A/Trans Case Cover Gasket
3	Input Speed Sensor Wire Harness NOTE: Route the input speed sensor wire harness through the case passage.

Callout	Component Name
4	A/Trans Case Cover Assembly Procedure 1. Use guide pins to install the case cover assembly to prevent damage to the input shaft thrust bearing. 2. Pull the input speed sensor wire harness through the case passage while lowering the cover assembly onto the case. Special Tools 39068 Guide Pins For equivalent regional tools, refer to Special Tools .
5	A/Trans Case Cover Assembly Bolt M6 x 30 (Qty: 10) CAUTION: Refer to Fastener Caution . Procedure Tighten in sequence shown. Tighten 12 N.m (106 lb in)

FRONT DIFFERENTIAL CARRIER FINAL ROTATIONAL TORQUE MEASUREMENT

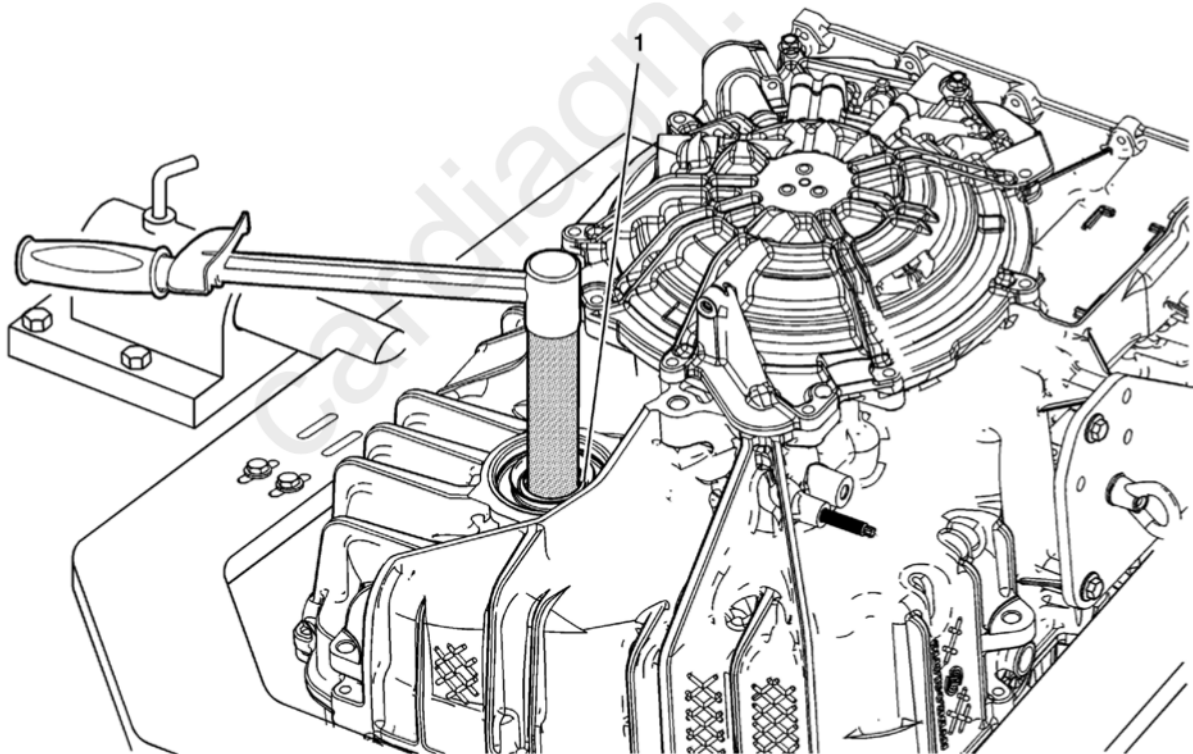


Fig. 76: Front Differential Carrier Final Rotational Torque Measurement

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
1	Front Differential Carrier Assembly CAUTION: Low bearing pre-load will cause premature failure of the front differential drive pinion gear. CAUTION: Refer to Fastener Caution . NOTE: • If the turning torque is not within specifications, the transfer gear assembly and differential bearing thrust washer is incorrect and must be corrected. Refer to Front Differential Drive Pinion Gear Bearing Thrust Washer and Front Differential Bearing Washer Measurement. • Use a dial or beam torque wrench with DT-47793 differential rotating tool to measure turning torque. Tighten 14 - 22 N.m (10 - 16 lb ft) Special Tools DT-47793 Differential Rotating Tool For equivalent regional tools, refer to Special Tools .

CONTROL VALVE BODY ASSEMBLY DISASSEMBLE

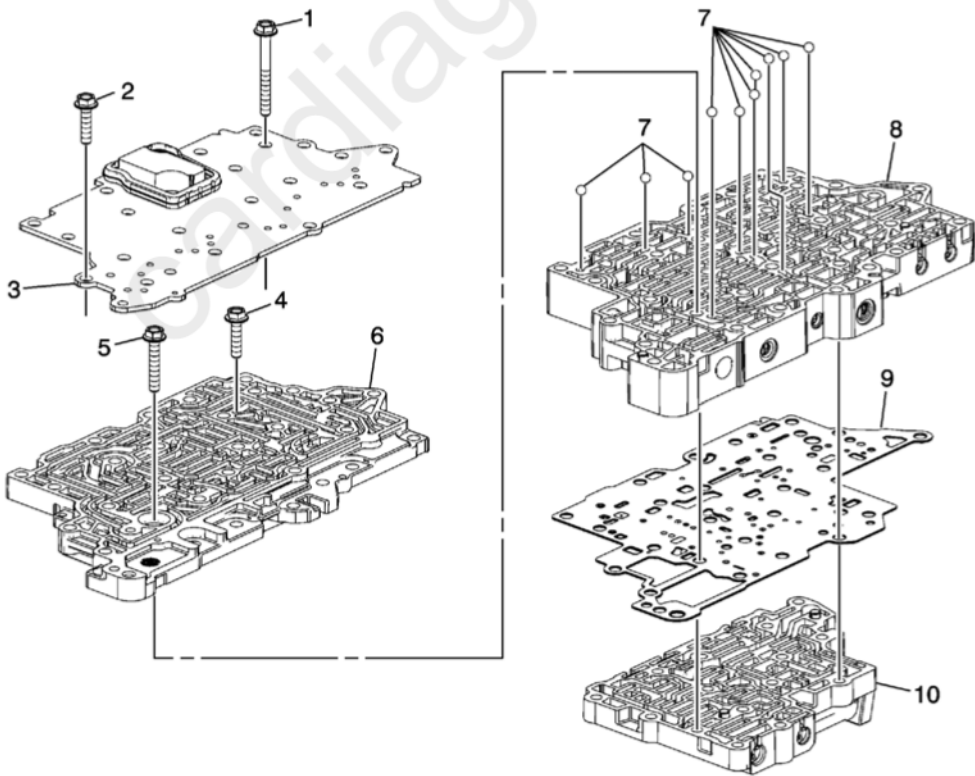


Fig. 77: Control Valve Body Assembly
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Control Valve Body Bolt M6 x 65 (Qty: 5)
2	Control Valve Body Bolt M6 x 35 (Qty: 3)

Callout	Component Name
WARNING: Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.	
CAUTION: After cleaning the transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components. Lint from the towels can cause component failure.	
CAUTION: Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.	
Preliminary Procedure Clean and inspect all valve components and the valve body. The control valve lower body is replaceable only as an assembly.	
1	4 - 5 - 6 Clutch Boost Valve Train
2	Accumulator Feed Limit Valve Train
3	3 - 5 Reverse Clutch Boost Valve Train
4	4 - 5 - 6 Clutch Accumulator Piston Assembly
5	1 - 2 - 3 - 4 Clutch Boost Valve Train
6	1 - 2 - 3 - 4 Clutch Regulator Valve Train
7	Control Valve Body Locating Pins (Qty: 2)
	NOTE: Inspect Valve Body locating pins for proper installed height of 4.25 mm (0.17 in).

CONTROL VALVE UPPER BODY ASSEMBLY CLEANING AND INSPECTION

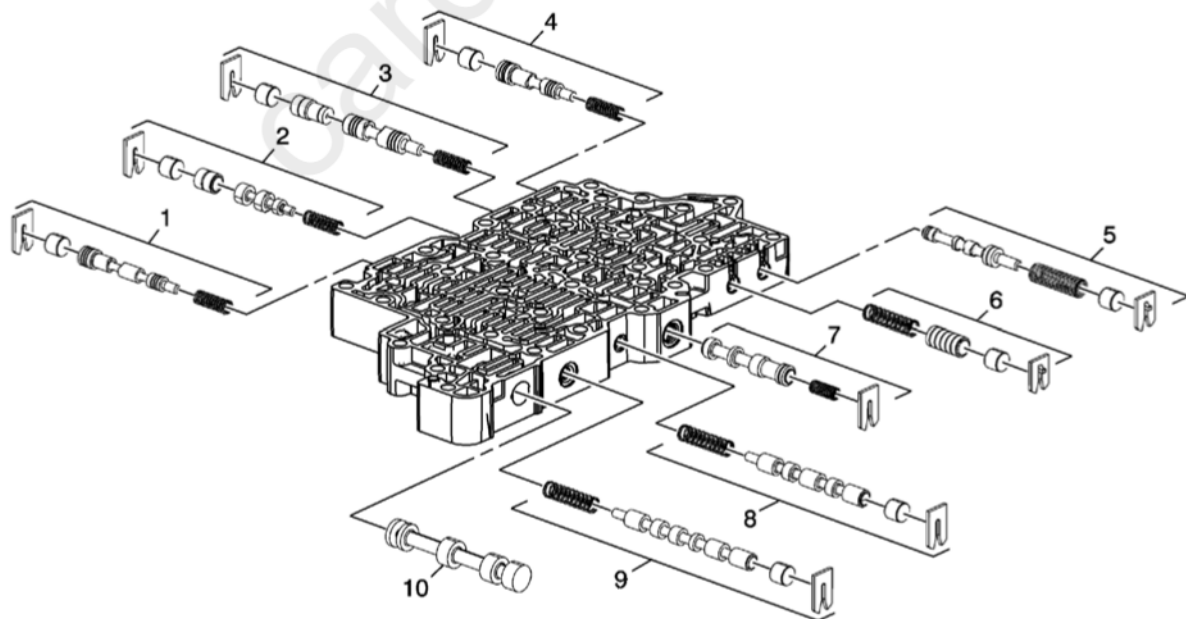


Fig. 79: Control Valve Upper Body Assembly Cleaning and Inspection
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
WARNING: Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.	
CAUTION: After cleaning the transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components. Lint from the towels can cause component failure.	
CAUTION: Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.	
Preliminary Procedure Clean and inspect all valve components and the valve body. The control valve upper body is replaceable only as an assembly.	
1	1st Reverse and 4 - 5 - 6 Clutch Regulator Valve Train
2	TCC Regulator Apply Valve Train
3	2 - 6 Clutch Regulator Valve Train
4	3 - 5 Reverse Clutch Regulator Valve Train
5	Pressure Regulator Valve Train
6	Isolator Valve Train
7	TCC Control Valve Train
8	Clutch Select Solenoid #3 Valve Train
9	Clutch Select Solenoid #2 Valve Train
10	Manual Valve

CONTROL VALVE CHANNEL PLATE CLEANING AND INSPECTION

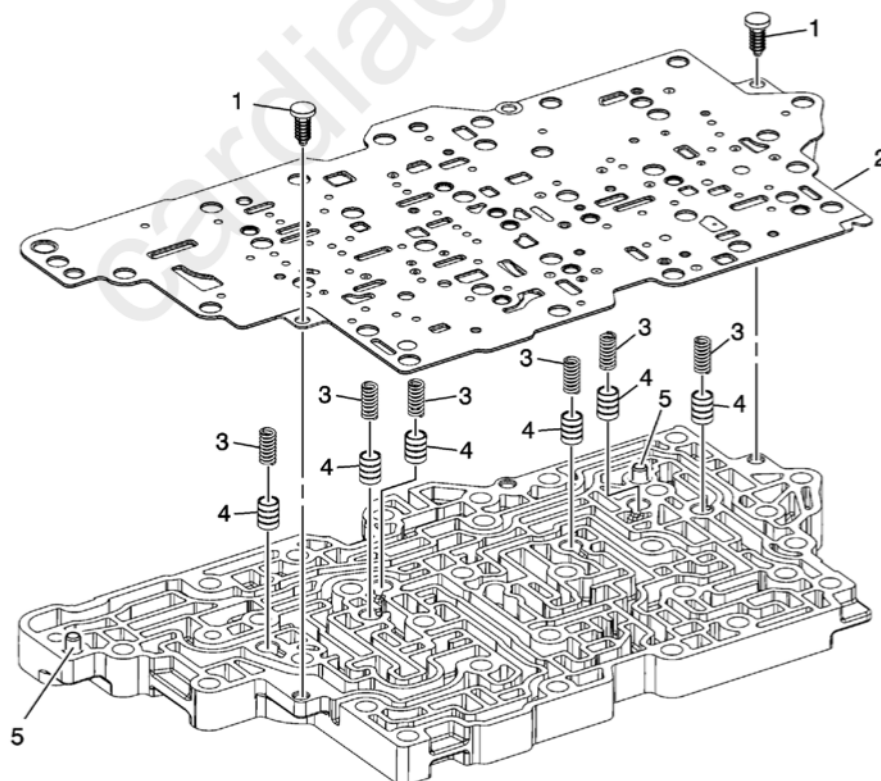


Fig. 80: Control Valve Channel Plate Cleaning and Inspection
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
1	Control Valve Lower Body Spacer Plate Assembly CAUTION: Do not use the old spacer plate. Install a NEW spacer plate. Reusing an old spacer plate may cause internal transmission leaks and transmission damage. NOTE: Inspect the upper channel plate bolt through holes for damage or brinelling. Any damage around the PCS switch feed holes could cause leakage around the PCS switch seals. Replace as necessary.
2	Control Valve Upper Body Assembly
3	Control Valve Body Ball Check Valve (Qty: 10) CAUTION: Do not use any type of grease or other material to hold the check ball valves in place during assembly. Grease will cause the valves to not operate properly, resulting in damage to the transmission.
4	Control Valve Channel Plate Assembly
5	Control Valve Body Bolt 6 x 55 (Qty: 1) CAUTION: Refer to Fastener Caution . Tighten 12 N.m (9 lb ft)

Channel Plate and Upper Channel Plate Assemble

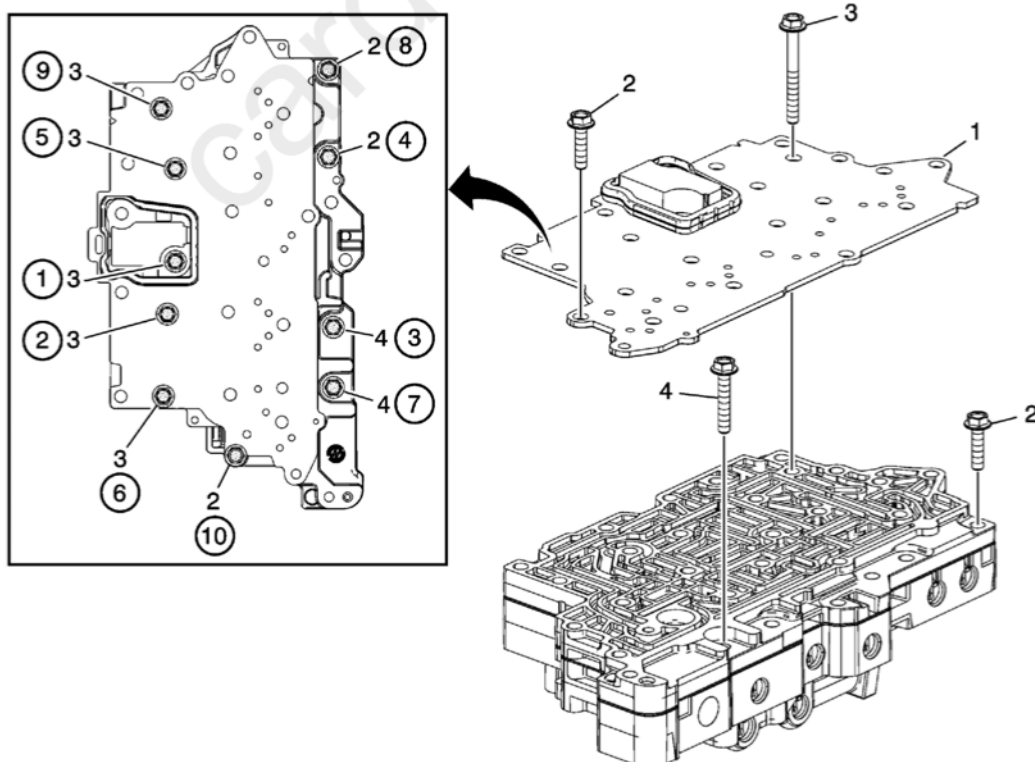


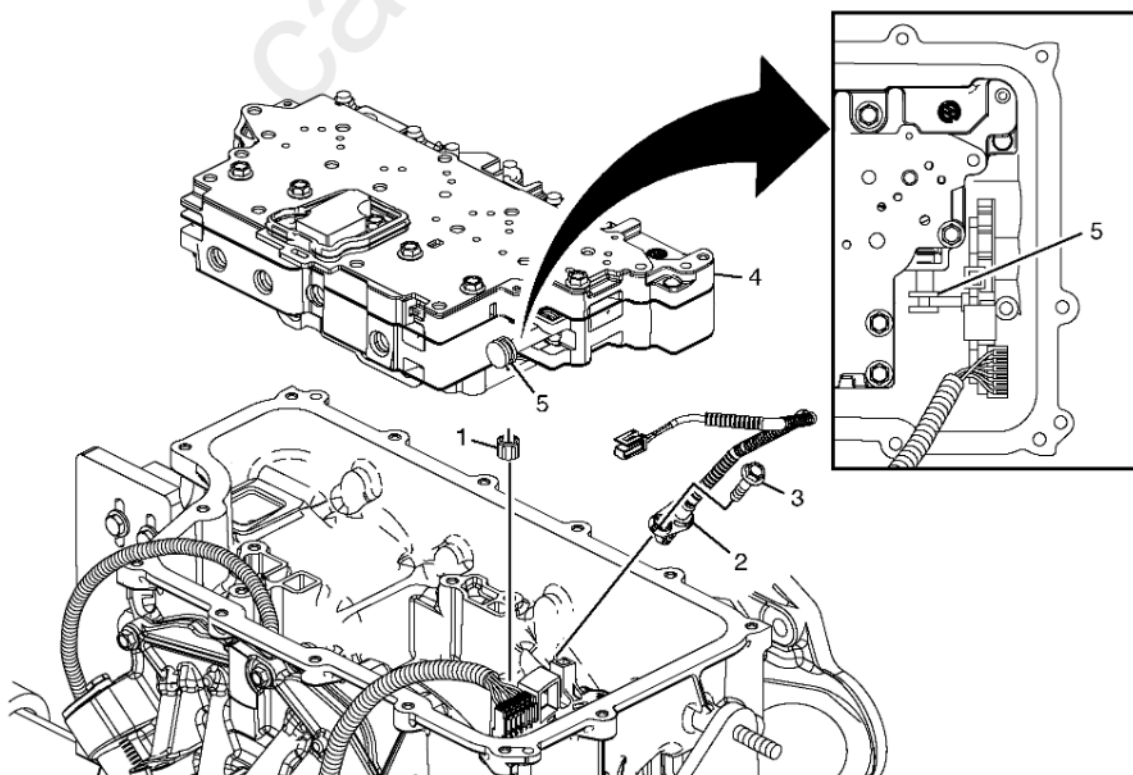
Fig. 82: Channel Plate And Upper Channel Plate
Courtesy of GENERAL MOTORS COMPANY

Channel Plate and Upper Channel Plate Assemble

Callout	Component Name
1	Control Valve Channel Upper Plate Assembly NOTE: - Inspect the upper channel plate bolt pass through holes for damage or burnelling. Any damage near the PCS feed holes could cause leaking around the PCS switch seal. Replace as necessary. - The TCU pin gasket is not serviceable. If the gasket is damaged, the control valve channel upper plate assembly must be replaced.
2	Control Valve Body Bolt M6 x 35 (Qty: 3) CAUTION: Refer to Fastener Caution . Procedure Hand tighten for alignment, then tighten in sequence, after all bolts are installed. Tighten 12 N.m (9 lb ft)
3	Control Valve Body Bolt M6 x 65 (Qty: 5) Procedure Tighten in sequence. Tighten 12 N.m (9 lb ft)
4	Control Valve Body Bolt M6 x 55 (Qty: 2) Procedure Tighten in sequence. Tighten 12 N.m (9 lb ft)

CONTROL VALVE BODY ASSEMBLY INSTALLATION

Output Speed Sensor and Valve Body Installation



Output Speed Sensor and Valve Body Installation

Callout	Component Name
1	1 - 2 - 3 - 4 Clutch Fluid Passage Seal
2	A/Trans Output Speed Sensor Assembly
3	A/Trans Output Speed Sensor Assembly Bolt M6 x 25 CAUTION: Refer to Fastener Caution . Tighten 12 N.m (9 lb ft)
4	Control Valve Body Assembly NOTE: Ensure the input speed sensor wiring harness is routed properly as shown and not trapped under the control valve body assembly.
5	Manual Valve NOTE: - Align the manual valve to the detent lever assembly. - Removing the manual shaft assembly pin will aid in aligning the manual valve to the detent lever. Install the manual shaft pin after the valve body assembly is installed using DT 41229 pin installer, if it was not installed previously. Refer to Manual Shift Detent Lever with Shaft Position Switch Assembly and Park Pawl Actuator Removal. Special Tools DT 41229 Manual Shaft Pin Installer For equivalent regional tools, refer to Special Tools .

Control Valve Body Bolts Installation

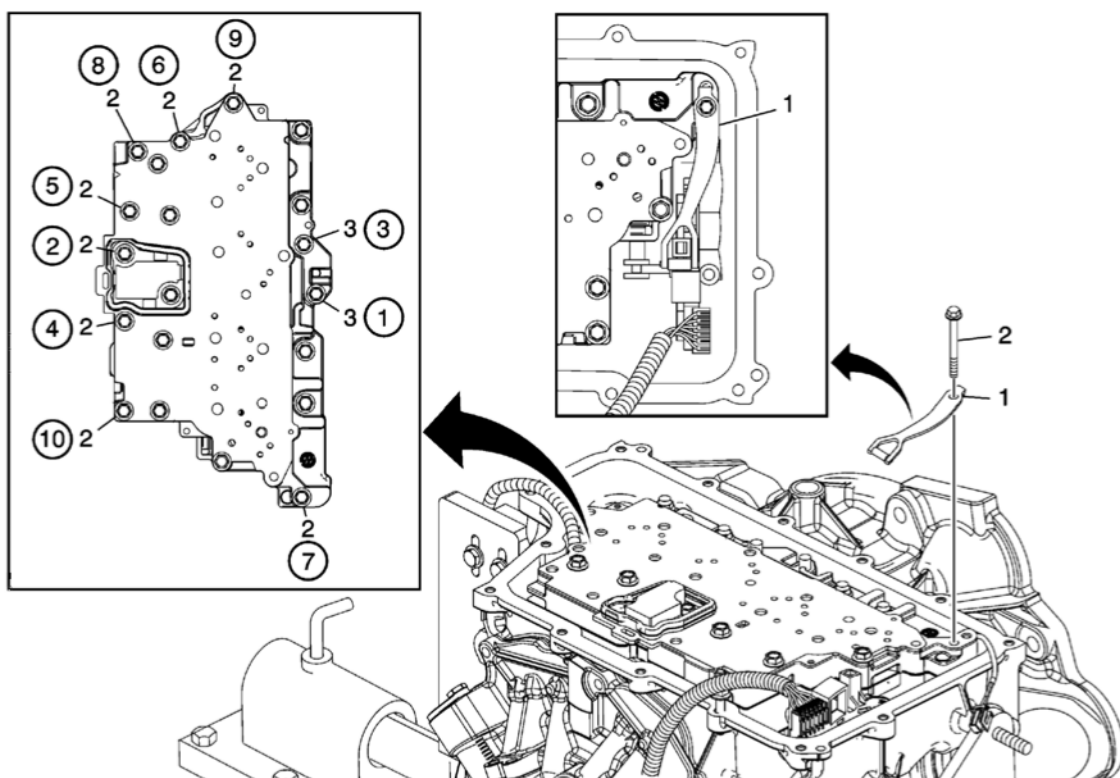


Fig. 84: Control Valve Body Bolt Tightening Sequence
 Courtesy of GENERAL MOTORS COMPANY

Control Valve Body Bolts Installation

Callout	Component Name
1	Manual Shaft Detent Assembly NOTE: Ensure proper alignment of the detent assembly to the detent lever assembly with position switch while tightening the bolt. The detent assembly can move and hit the valve body assembly that could cause improper engagement with the detent lever assembly.
2	Control Valve Body Bolt M6 x 65 (Qty: 8) CAUTION: Refer to Fastener Caution . Procedure Tighten in sequence. Tighten 12 N.m (9 lb ft).
3	Control Valve Body Bolt M6 x 55 (Qty: 2) Procedure Tighten in sequence. Tighten 12 N.m (9 lb ft).

Filter Plate Installation

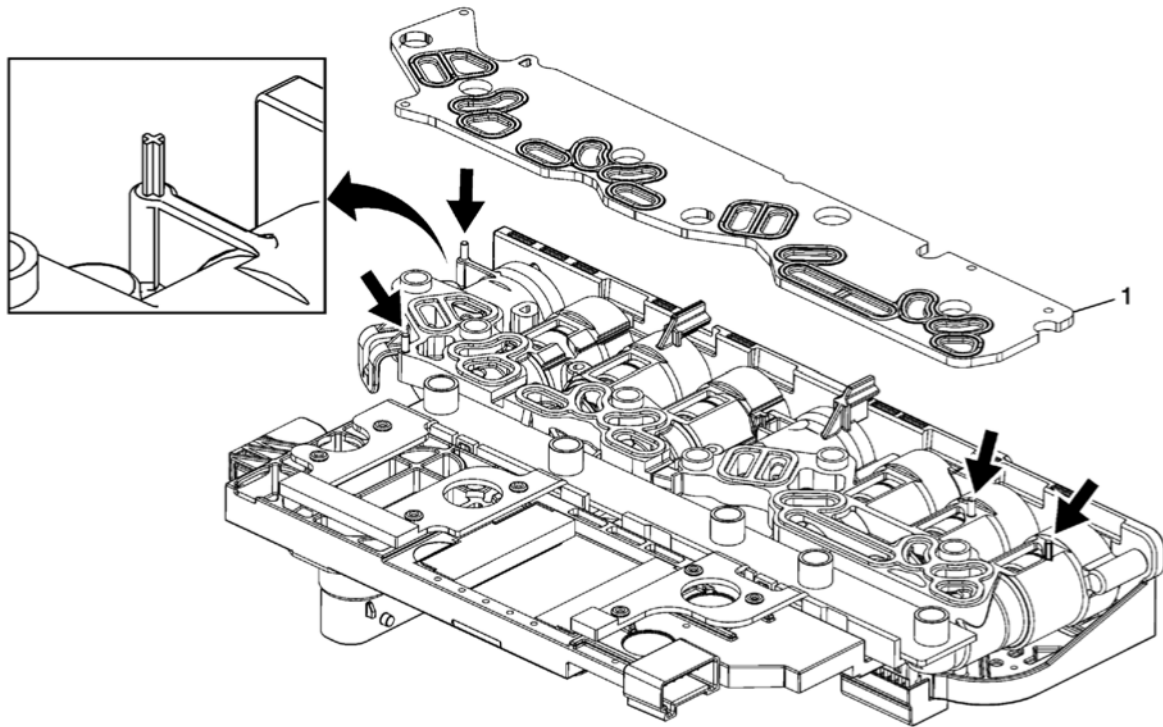


Fig. 85: Filter Plate

Courtesy of GENERAL MOTORS COMPANY

Filter Plate Installation

Callout	Component Name
1	Control Solenoid Valve Assembly Filter Plate CAUTION: Use care when removing or installing the filter plate assembly. A broken or missing retaining tab may not adequately secure the filter plate to the control solenoid valve assembly, resulting in possible damage or contamination. NOTE: Install a NEW filter plate to prevent fluid leaks past the oil seals.

Control Solenoid (w/Body and TCM) Valve Assembly Installation

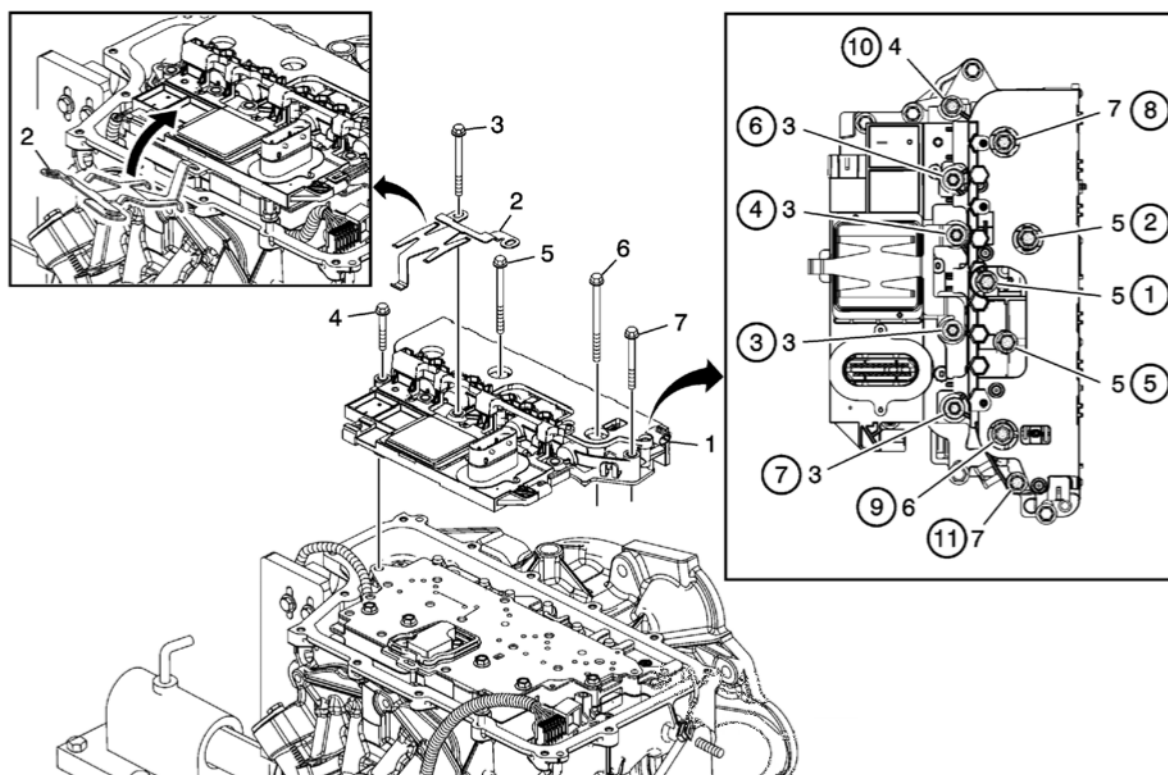


Fig. 86: Control Solenoid (w/Body and TCM) Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

Control Solenoid (w/Body and TCM) Valve Assembly Installation

Callout	Component Name
CAUTION: Refer to Fastener Caution .	
Preliminary Procedure Install all bolts before tightening, then tighten in sequence to 12 N.m (9 lb ft).	
1	Control Solenoid (w/Body and TCM) Valve Assembly CAUTION: Do not drop the control solenoid with body and transmission control module (TCM) valve assembly. Internal damage can occur if the control solenoid with body and TCM valve assembly is dropped. DO NOT reuse the control solenoid with body and TCM valve assembly if it is dropped.
2	Control Solenoid Valve Spring NOTE: - If the control solenoid spring is missing or improperly installed, the TCM may overheat causing the TCM to shut down. The transmission will default to 3rd or 5th gear. - Insert tab of spring into slot on spacer plate, then rotate into position.
3	Control Valve Body Bolt M6 x 80 (Qty: 4)
4	Control Valve Body Bolt M6 x 55 (Qty: 1)
5	Control Valve Body Bolt M6 x 95 (Qty: 3)
6	Control Valve Body Bolt M6 x 42 (Qty: 1)
7	Control Valve Body Bolt M6 x 65 (Qty: 2)

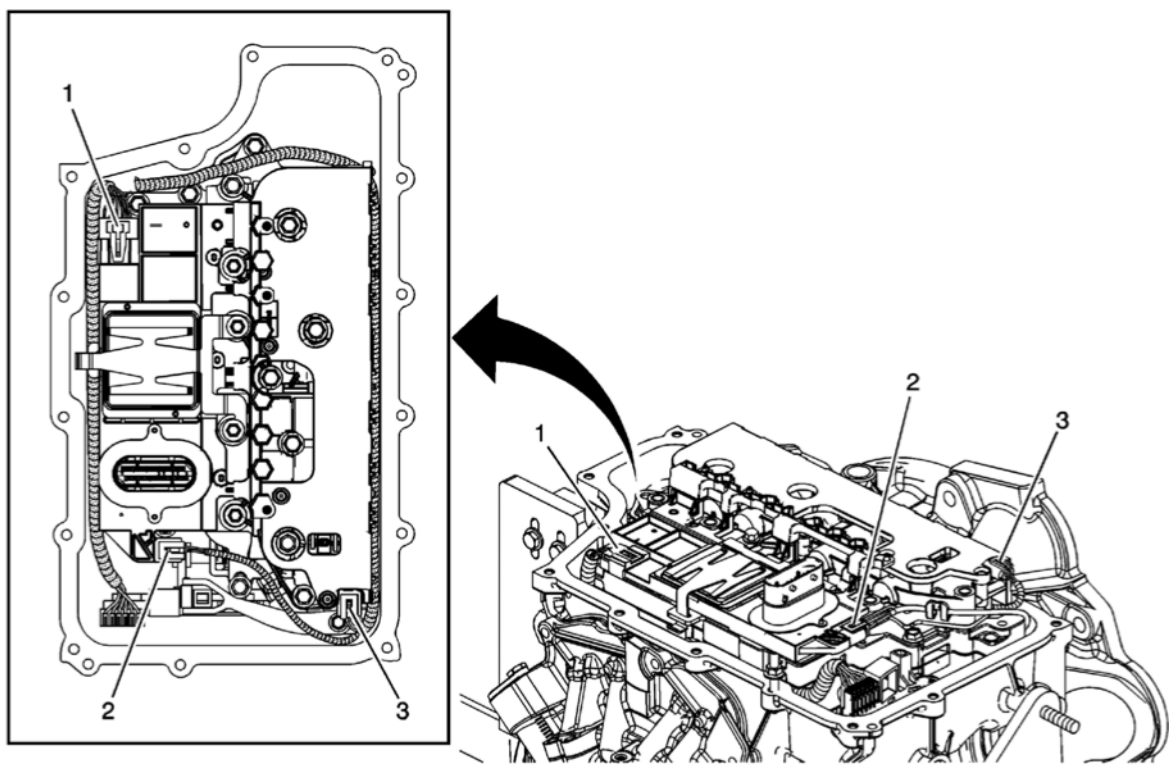


Fig. 87: Identifying Wire Routing & Connector Locations

Courtesy of GENERAL MOTORS COMPANY

Wire Routing and Connector Locations

Callout	Component Name
Preliminary Procedure	
Route all wires as shown.	
1	Shift Position Switch Connector
2	Output Speed Sensor Connector
3	Input Speed Sensor Connector

Control Valve Body Cover Installation

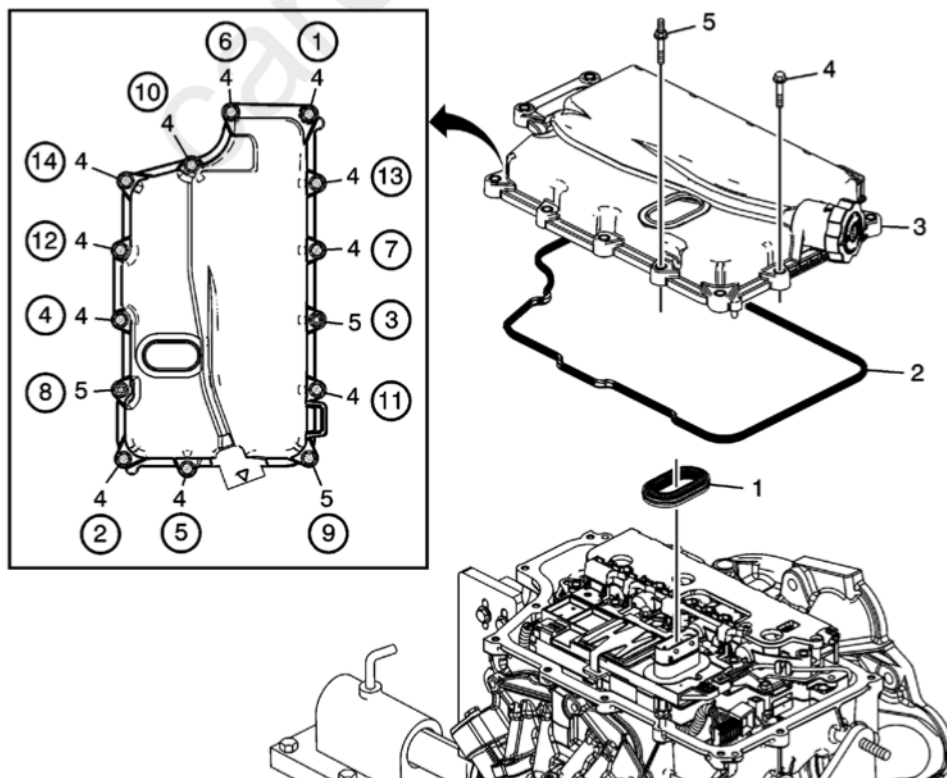
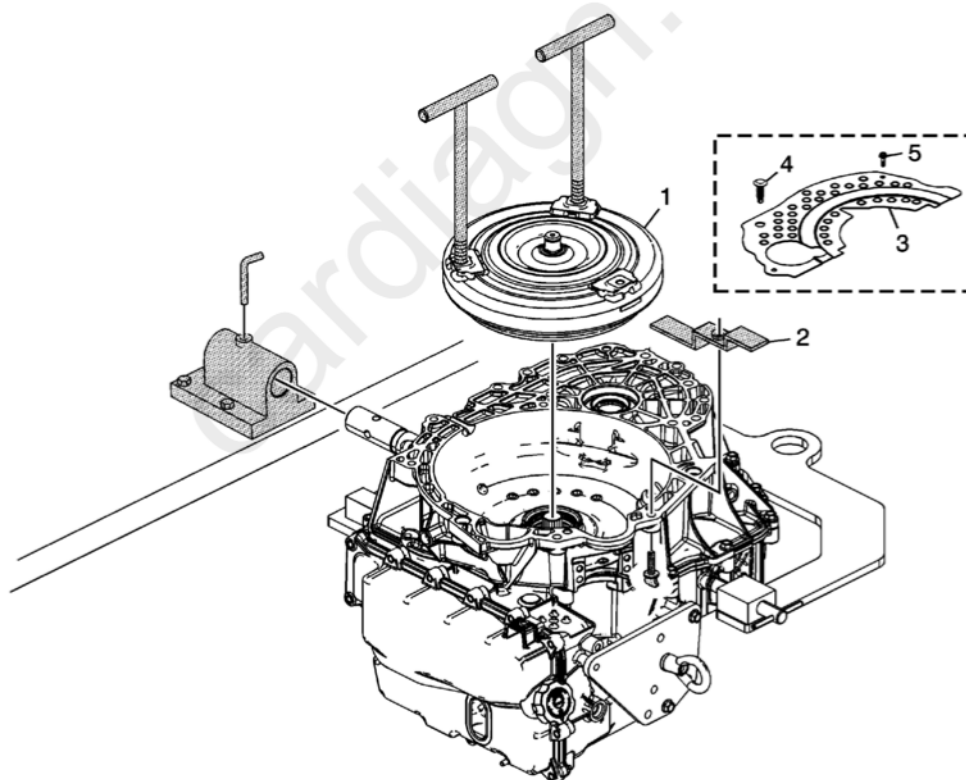


Fig. 88: Control Valve Body Cover Assembly Bolt Tightening Sequence

Courtesy of GENERAL MOTORS COMPANY

Control Valve Body Cover Installation

Callout	Component Name
1	Control Valve Body Cover Wiring Connector Hole Seal NOTE: Holes in the seal must face down.
2	Control Valve Body Cover Assembly Gasket
3	Control Valve Body Cover Assembly
4	Control Valve Body Cover Bolt M6 x 30 (Qty: 11) CAUTION: Refer to Fastener Caution . Procedure Tighten in sequence. Tighten 12 N.m (9 lb ft).
5	Control Valve Body Cover Stud M6 x 30 (Qty: 3) Procedure Tighten in sequence. Tighten 12 N.m (9 lb ft).

TORQUE CONVERTER INSTALLATION**Fig. 89: View Of Torque Converter**

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
1	Torque Converter Assembly CAUTION: Lower the torque converter straight down. Failure to lower the torque converter straight down could damage the torque converter clutch lip seal inside the torque converter clutch assembly. Special Tools DT 46409 Torque Converter Lifting Handles For equivalent regional tools, refer to Special Tools .
2	DT 21366 Converter Holding Strap WARNING: The torque converter must be held to the torque converter housing by a retaining device such as shipping brackets. Without the retaining device, the torque converter may slide forward, disengaging the oil pump, or may fall completely out of the transmission causing personal injury and/or property damage.
3	Dust Cover - Model Dependant
4	Dust Cover Push Pin - Model Dependant (Qty: 2)
5	Dust Cover Bolt - Model Dependant CAUTION: Refer to Fastener Caution . Tighten 75 N.m (37 lb ft)

LIFT PLATE AND HOLDING FIXTURE REMOVAL

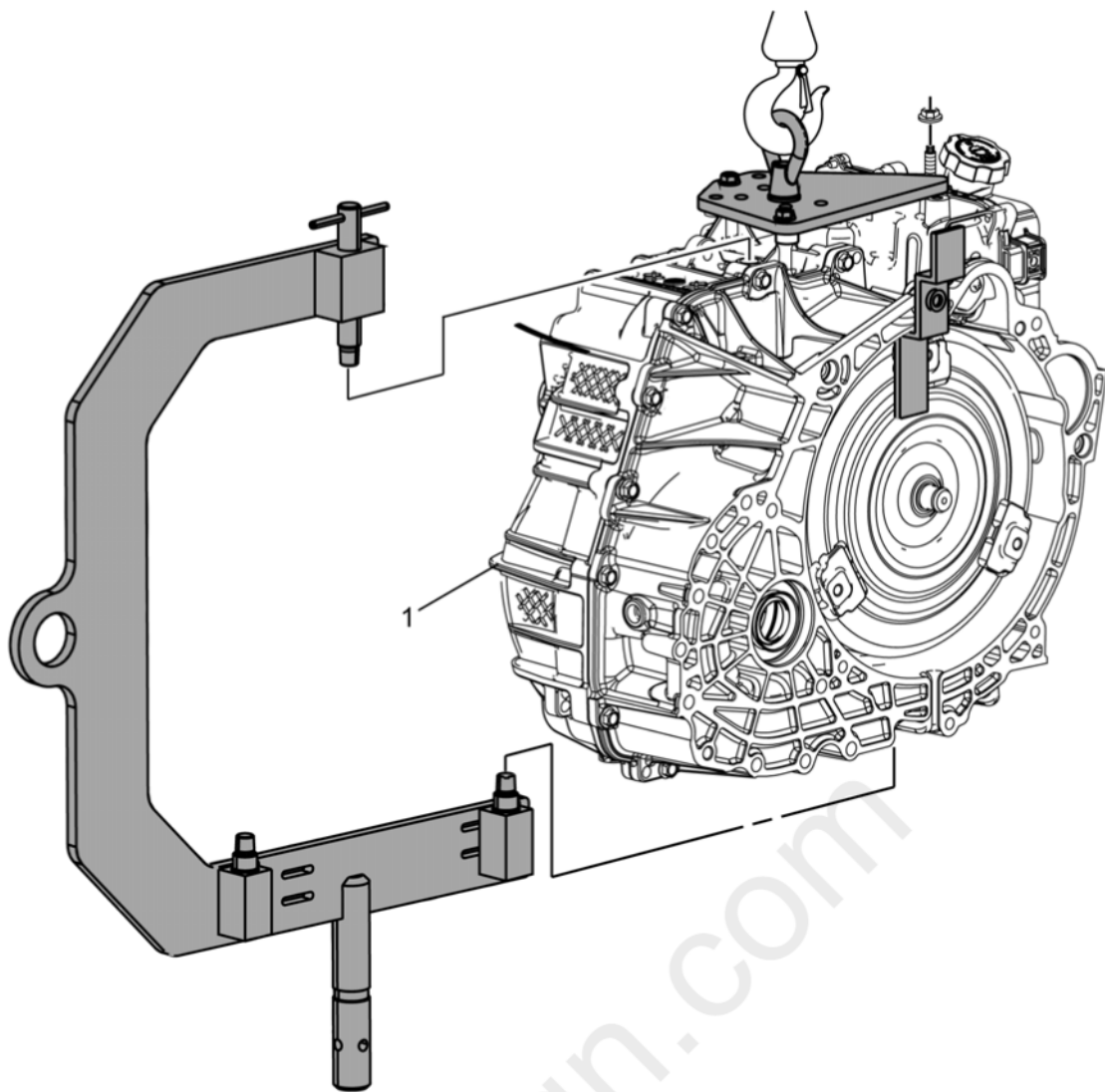


Fig. 90: Identifying Lift Plate & Holding Fixture
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
1	A WARNING: Handle with care, the transmission assembly weighs over 90.7 kg (200 lbs). Bodily injury could occur if not handled properly. CAUTION: Refer to Fastener Caution . Procedure 1. Install DT-47811-A Lift Plate 2. Tighten bolts and nut to 12 N.m (106 lb in) 3. Remove lock pin for DT-3289-20 Holding Fixture. 4. Raise the transmission with an overhead hoist in order to remove the DT-46625 Transmission Holding Fixture. 5. Lower the transmission assembly onto the transmission jack in order to remove the DT-47811-A Lift Plate. Special Tools • DT-3289-20 Holding Fixture • DT-46625 Transmission Holding Fixture • DT-47811-A Transmission Lift Plate For equivalent regional tools, refer to Special Tools .

2017 TRANSMISSION

Automatic Transmission - 6T70 (M7W) - Repair Instructions - On Vehicle - Impala

REPAIR INSTRUCTIONS - ON VEHICLE

CONNECTOR RECONNECTION - AUTOMATIC TRANSMISSION

Special Tools

EL-35616 Terminal Test Probe Kit

For equivalent regional tools, refer to [Special Tools](#).

When the condition is not currently present, but is indicated in DTC history, the cause may be intermittent. An intermittent may also be the cause when there is a customer complaint, but the symptom cannot be duplicated. Refer to the Symptom Table of the system that is suspect of causing the condition before trying to locate an intermittent condition.

Most intermittent conditions are caused by faulty electrical connections or wiring. Inspect for the following items:

- Loose, corroded, or painted terminal stud/fastener
- Wiring broken inside the insulation
- Poor connection between the male and female terminal at a connector
- A terminal not seated all the way into the connector body
- Poor terminal to wire connection - Some conditions which fall under this description are poor crimps, poor solder joints, crimping over the wire insulation rather than the wire itself, and corrosion in the wire to terminal contact area, etc.
- Pierced or damaged insulation can allow moisture to enter the wiring causing corrosion. The conductor can corrode inside the insulation, with little visible evidence. Look for swollen and stiff sections of wire in the suspect circuits.
- Wiring which has been pinched, cut, or its insulation rubbed through may cause an intermittent open or short as the bare area touches other wiring or parts of the vehicle.
- Wiring that comes in contact with hot or exhaust components
- Refer to [Inducing Intermittent Fault Conditions](#) in order to duplicate the conditions required, in order to verify the customer concern.
- Refer to [Testing for Electrical Intermittents](#) for test procedures to detect intermittent open, high resistance, short to ground, and short to voltage conditions.
- Refer to [Scan Tool Snapshot Procedure](#) for advanced intermittent diagnosis and Vehicle Data Recorder operation.

Testing for Terminal Fretting

Some intermittent conditions can be caused by wire terminal fretting corrosion. Fretting corrosion is a build-up of insulating, oxidized wear debris that can form when there is a small motion between electrical contacts. The oxidized wear debris can pile up enough at the electrical contact spots that the electrical resistance across the connection increases. Movement between the contacting surfaces as small as 10 to 100 microns can cause fretting. To put this in perspective, a sheet of paper is about 100 microns thick, so fretting motion is small and hard to see. Vibration and thermal expansion/contraction are the main sources that create fretting motion. Since vehicles vibrate and can experience large temperature swings, they are a good source for fretting motion. Tin, copper, nickel, and iron surfaces are all susceptible to fretting corrosion. Fretting corrosion can be difficult to see but it looks like small, dark smudges on the terminals contact surface.

To correct a fretting condition disconnect the suspect connector and add dielectric grease/lubricant (Nyogel 760G or equivalent, meeting GM specification 9986087) to both sides of the connector

terminals. Then reconnect the connector and wipe away any excess lubricant. This will correct the additional terminal contact resistance due to the terminal fretting corrosion.

Testing for Proper Terminal Contact

It is important to test terminal contact at the component and any inline connectors before replacing a suspect component. Mating terminals must be inspected to ensure good terminal contact. A poor connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination may be caused by the connector halves being improperly connected. A missing or damaged connector seal, damage to the connector itself, or exposing the terminals to moisture and dirt can also cause contamination. Contamination, usually in the underhood or underbody connectors, leads to terminal corrosion, causing an open circuit or intermittently open circuit.

Deformation is caused by probing the mating side of a connector terminal without the proper adapter. Always use the **EL-35616** kit when probing connectors. Other causes of terminal deformation are improperly joining the connector halves, or repeatedly separating and joining the connector halves. Deformation, usually to the female terminal contact tang, can result in poor terminal contact causing an open or intermittently open circuit.

Testing for Proper Terminal Contact in Bussed Electrical Centers

It is very important to use the correct test adapter when testing for proper terminal contact of fuses and relays in a bussed electrical center. Use the **EL-35616** kit to test for proper terminal contact. Failure to use the **EL-35616** kit can result in improper diagnosis of the bussed electrical center.

Follow the procedure below in order to test terminal contact:

1. Separate the connector halves.
2. Visually inspect the connector halves for contamination. Contamination may result in a white or green build-up within the connector body or between terminals. This causes high terminal resistance, intermittent contact, or an open circuit. An underhood or underbody connector that shows signs of contamination should be replaced in its entirety: terminals, seals, and connector body.
3. Using an equivalent male terminal/terminated lead, verify that the retention force is significantly different between a known good terminal and the suspect terminal. Replace the female terminal in question.

Flat Wire Connectors

There are no serviceable parts for flat wire connectors on the harness side or the component side.

Follow the procedure below in order to test terminal contact:

1. Remove the component in question.
2. Visually inspect each side of the connector for signs of contamination. Avoid touching either side of the connector as oil from your skin may be a source of contamination as well.
3. Visually inspect the terminal bearing surfaces of the flat wire circuits for splits, cracks, or other imperfections that could cause poor terminal contact. Visually inspect the component side connector to ensure that all of the terminals are uniform and free of damage or deformation.
4. Insert the appropriate adapter into the flat wire harness connector in order to test the circuit in question.

Control Module/Component Voltage and Grounds

Poor voltage or ground connections can cause widely varying symptoms.

- Test all control module voltage supply circuits. Many vehicles have multiple circuits supplying voltage to a control module. Other components in the system may have separate voltage supply circuits that may also need to be tested. Inspect connections at the module/component connectors, fuses, and any intermediate connections between the voltage source and the module/component. A

test lamp or a DMM may indicate that voltage is present, but neither tests the ability of the circuit to carry sufficient current. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) , and [Power Distribution Schematics](#) .

- Test all control module ground and system ground circuits. The control module may have multiple ground circuits. Other components in the system may have separate grounds that may also need to be tested. Inspect grounds for clean and tight connections at the grounding point (screw or stud). Inspect the connections at the component and in splice packs, where applicable. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) , and [Ground Distribution Schematics](#) .

Temperature Sensitivity

- An intermittent condition may occur when a component/connection reaches normal operating temperature. The condition may occur only when the component/connection is cold, or only when the component/connection is hot.
- Freeze Frame, Failure Records, Snapshot, or Vehicle Data Recorder data may help with this type of intermittent condition, where applicable.
- If the intermittent is related to heat, review the data for a relationship with the following:
 - High ambient temperatures
 - Underhood/engine generated heat
 - Circuit generated heat due to a poor connection, or high electrical load
 - Higher than normal load conditions, towing, etc.
- If the intermittent is related to cold, review the data for the following:
 - Low ambient temperatures - In extremely low temperatures, ice may form in a connection or component. Inspect for water intrusion.
 - The condition only occurs on a cold start.
 - The condition goes away when the vehicle warms up.
- Information from the customer may help to determine if the trouble follows a pattern that is temperature related.
- If temperature is suspected of causing an intermittent fault condition, attempt to duplicate the condition. Refer to [Inducing Intermittent Fault Conditions](#) in order to duplicate the conditions required.

Electromagnetic Interference and Electrical Noise

Some electrical components/circuits are sensitive to electromagnetic interference or other types of electrical noise. Inspect for the following conditions:

- A mis-routed harness that is too close to high voltage/high current devices such as secondary ignition components, motors, generator etc. - These components may induce electrical noise on a circuit that could interfere with normal circuit operation.
- Electrical system interference caused by a malfunctioning relay, or a control module driven solenoid or switch - These conditions can cause a sharp electrical surge. Normally, the condition will occur when the malfunctioning component is operating.
- Installation of non-factory or aftermarket add on accessories such as lights, 2-way radios, amplifiers, electric motors, remote starters, alarm systems, cell phones, etc. - These accessories may create interference in other circuits while operating and the interference would disappear when the accessory is not operating. Refer to [Checking Aftermarket Accessories](#) .
- Test for an open diode across the A/C compressor clutch and for other open diodes. Some relays may contain a clamping diode.
- The generator may be allowing AC noise into the electrical system.

Incorrect Control Module

- There are only a few situations where reprogramming a control module is appropriate:
 - A new service control module is installed.
 - A control module from another vehicle is installed.

- Revised software/calibration files have been released for this vehicle.

NOTE: DO NOT re-program the control module with the SAME software/calibration files that are already present in the control module. This is not an effective repair for any type of concern.

- Verify that the control module contains the correct software/calibration. If incorrect programming is found, reprogram the control module with the most current software/calibration. Refer to [Control Module References](#) for replacement, setup, and programming.

MANUAL SHIFT DETENT LEVER WITH SHAFT POSITION SWITCH ASSEMBLY REPLACEMENT

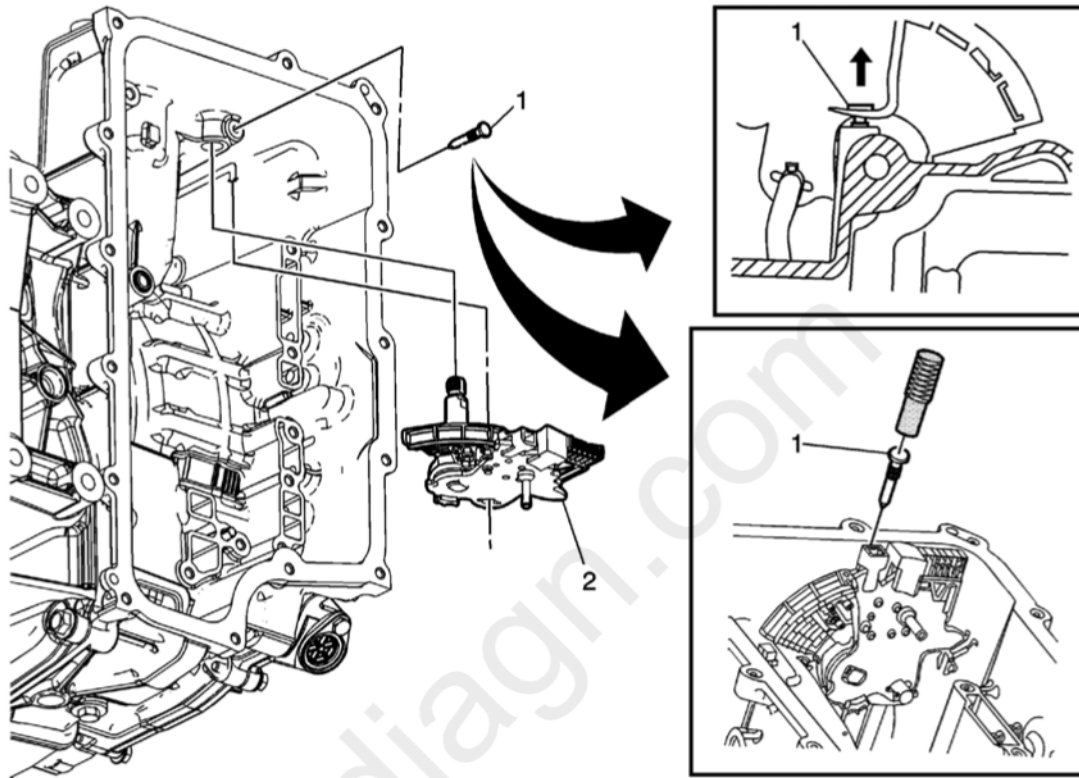


Fig. 1: Manual Shift Detent Lever With Shaft Position Switch Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures	
1. Remove the transmission range selector lever. 2. Remove the lower control valve body. Refer to Control Valve Lower Body and Upper Body Replacement.	

Callout	Component Name
1	Manual Shaft Detent Lever Pin CAUTION: Use J 41229 to install the manual shaft pin at the correct height in order to properly secure the manual shaft. If you install the pin too deep, the case bore may crack. NOTE: • Use a small nail puller to remove the pin. Discard the pin. It is not reusable. • Use J-41229 installer to install the pin. Inspect that the pin installed height is within 6.5 - 7.5 mm (0.25 - 0.30 in). Special Tools J-41229 Manual Shaft Pin Installer For equivalent regional tools, refer to Special Tools .
2	Manual Shaft Detent Lever Assembly (w/Shift Position Switch) Procedure 1. Removal: Partly lower the manual shaft detent lever assembly (w/shift position switch) in order to rotate the detent lever and disconnect the park actuator rod. Then fully remove the manual shaft detent lever assembly from the transmission case. 2. Installation: Partly install the manual shaft detent lever assembly (w/shift position switch). Rotate the detent lever and connect the park actuator rod. Then fully install the manual shaft detent lever assembly in the transmission case. 3. Lubricate the manual shaft with automatic transmission fluid (ATF) to prevent damage to the manual shift shaft seal. NOTE: Do not pull the park actuator rod end out beyond the machined oil passage surface in the case. A no park condition will exist if the park pawl actuator assembly is pulled out of the transmission too far and the actuator rod disengages from the park pawl. The transmission assembly will require disassembly to re-install the actuator rod over the park pawl.

TRANSMISSION CONTROL LEVER KNOB REPLACEMENT

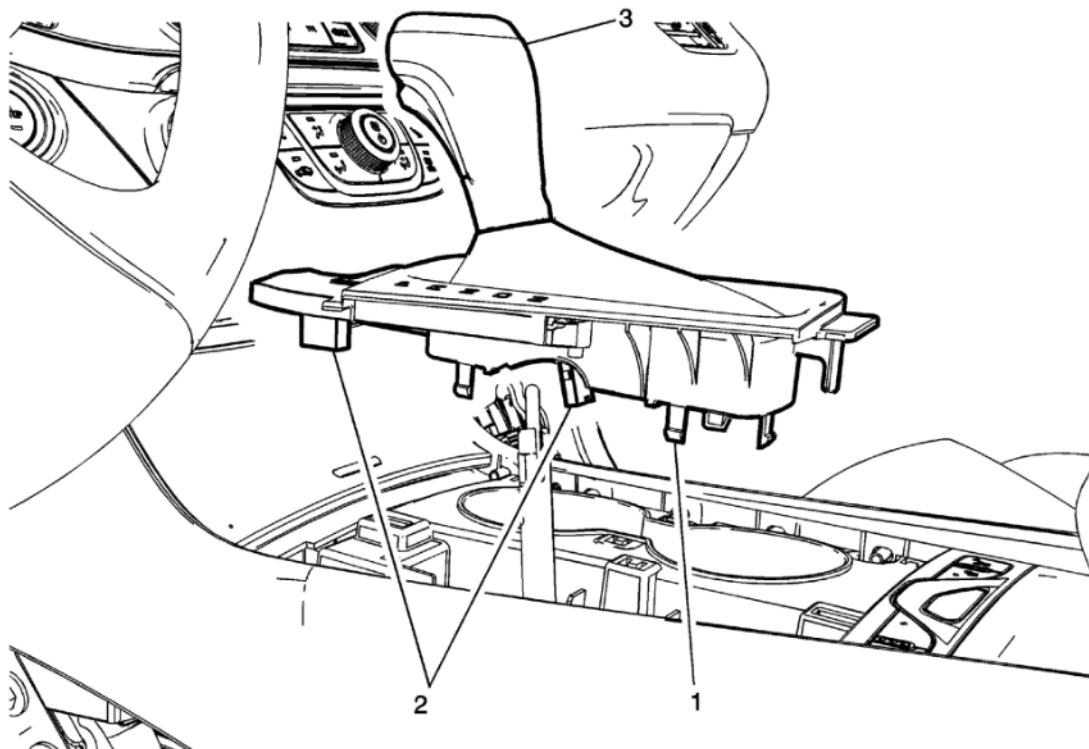


Fig. 2: Transmission Control Lever Knob, Retainers & Electrical Connectors

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Chock the wheels, then place the transmission in Neutral. Remove the front floor console cup holder trim plate. Refer to Front Floor Console Cup Holder Plate Replacement .	
1	Transmission Control Lever Knob Retainer (Qty: 6) Procedure Using a flat-bladed plastic trim tool, release the retaining clips securing the control lever boot.
2	Electrical connector (Qty: 2)
3	Transmission Control Lever Knob NOTE: • The control lever boot and knob are replaced as an assembly. • To remove the knob, pull upward and twist. NOTE: If the knob cannot be released by twisting and pulling, perform the following steps: 1. Raise the shift boot, then pull out the tabs on both sides to release the boot from the shift knob. 2. Using a pick tool, remove the chrome ring from the shift knob. 3. Using a pick tool, remove the shift knob U-clip, then remove the knob.

TRANSMISSION CONTROL REPLACEMENT

Removal Procedure

1. Set the park brake and chock the wheels.
2. Remove the shift knob from the transmission control. Refer to [Transmission Control Lever Knob Replacement](#) .
3. Remove the left front floor console extension panel. Refer to [Front Floor Console Extension Replacement - Left Side](#) .

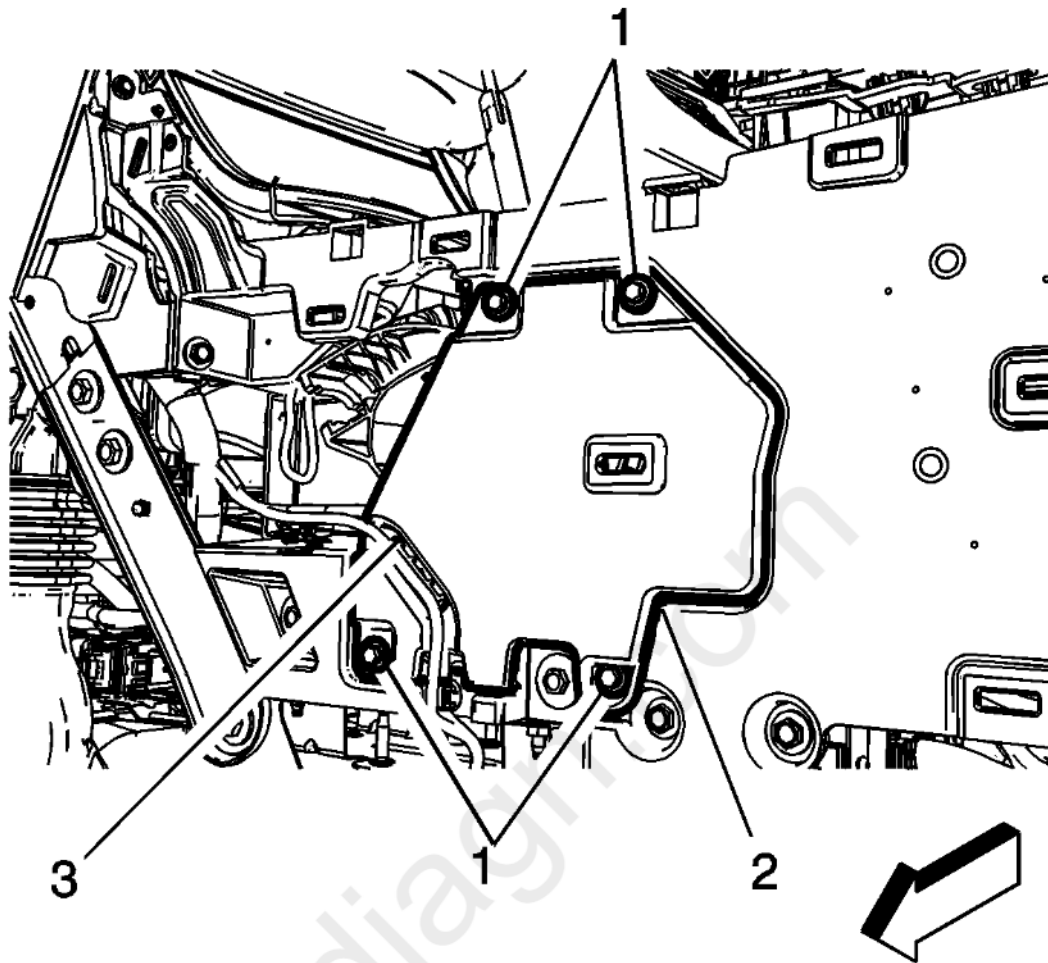


Fig. 3: Access Plate, Fasteners & Wiring Harness
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect the wiring harness (3) from the access plate.
5. Remove the access plate fasteners (1), then the access plate (2) from the console.

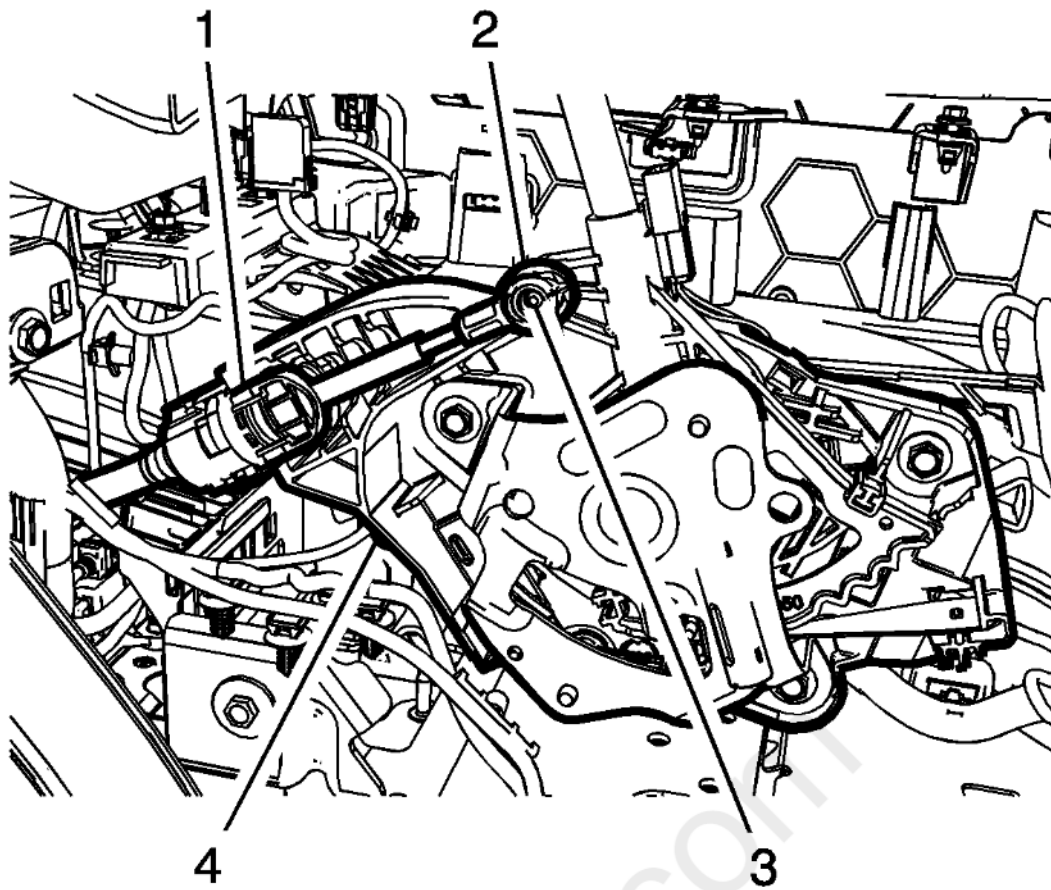


Fig. 4: Transmission Range Selector Cable Retainer, Terminal, Shift Lever Pin & Control Lever Base

Courtesy of GENERAL MOTORS COMPANY

6. Disconnect the transmission range selector lever cable terminal (2) from the shift lever pin (3).
7. Release the transmission range selector lever cable retainer (1) and remove the transmission range selector cable from the transmission control lever base (4).

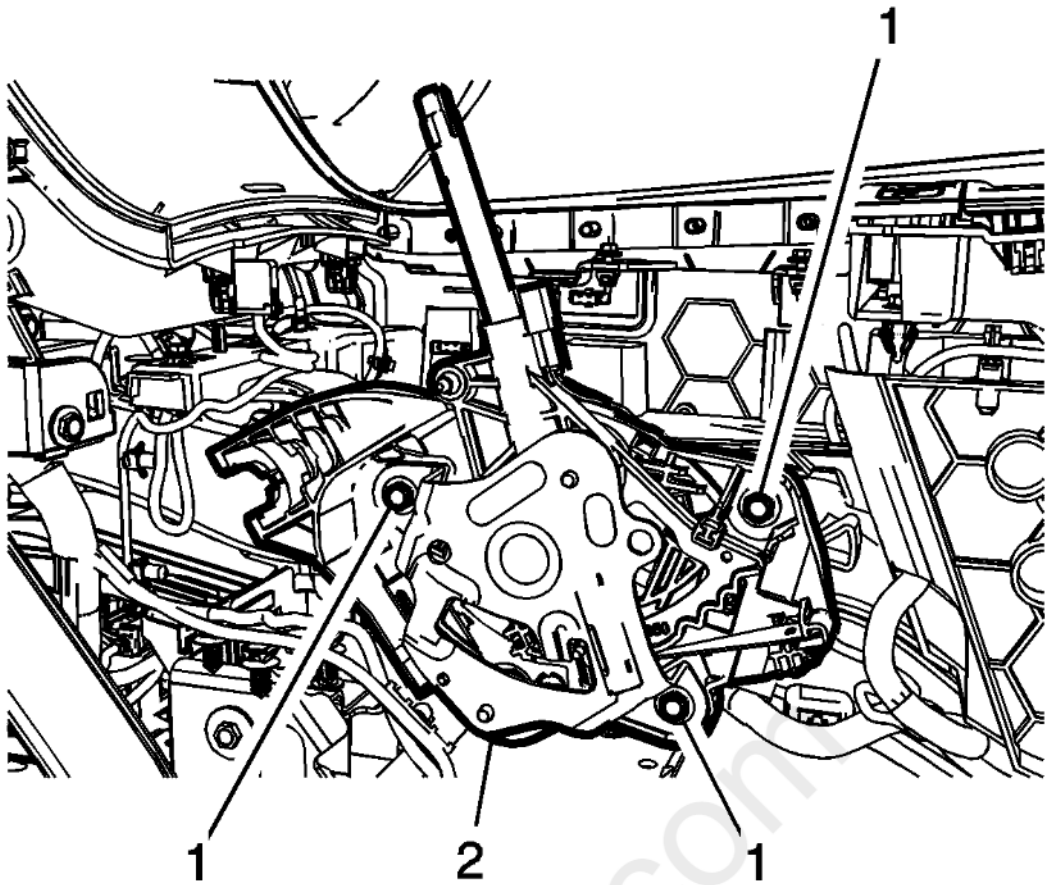


Fig. 5: Transmission Shift Control & Fasteners

Courtesy of GENERAL MOTORS COMPANY

8. Remove the transmission shift control fasteners (1).
9. Remove the transmission shift control (2).
10. Disconnect the electrical connector from the rear of the transmission control.

Installation Procedure

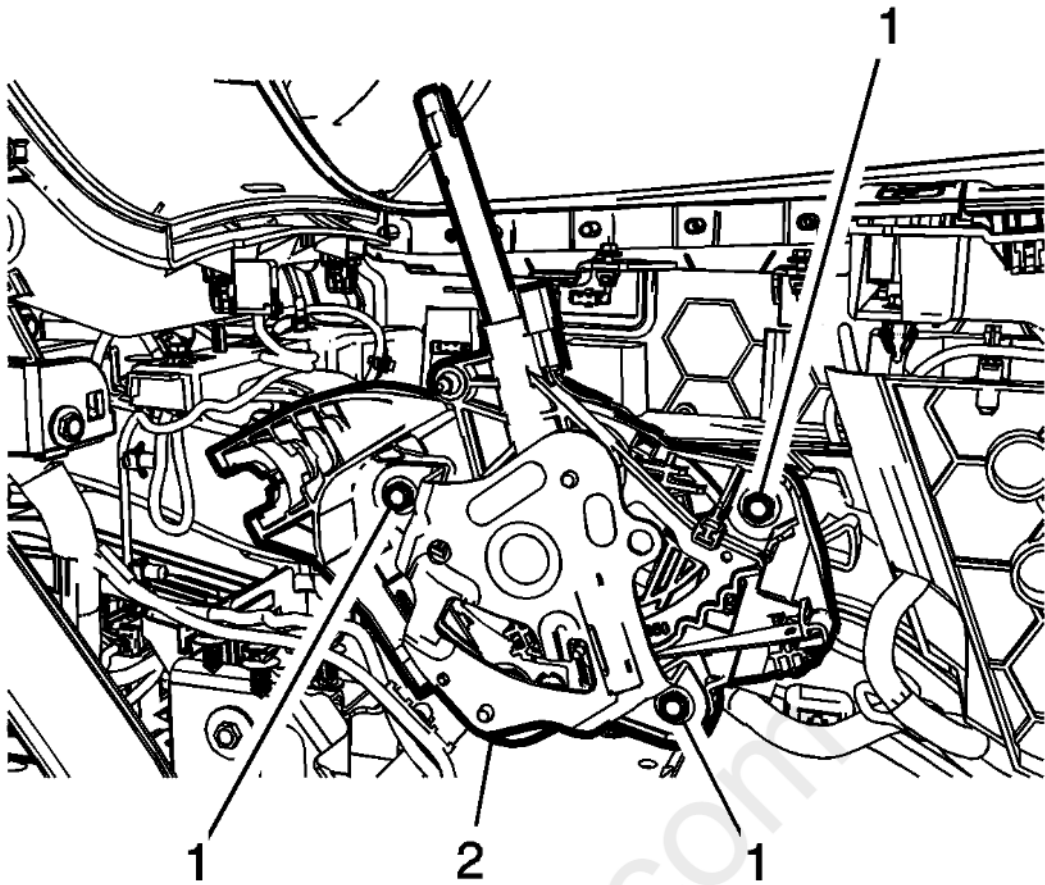


Fig. 6: Transmission Shift Control & Fasteners

Courtesy of GENERAL MOTORS COMPANY

1. Connect the electrical connector to the rear of the transmission control.
2. Install the transmission shift control (2).

CAUTION: Refer to **Fastener Caution** .

3. Install the transmission shift control bolts (1) and tighten to 25 N.m (18 lb ft).

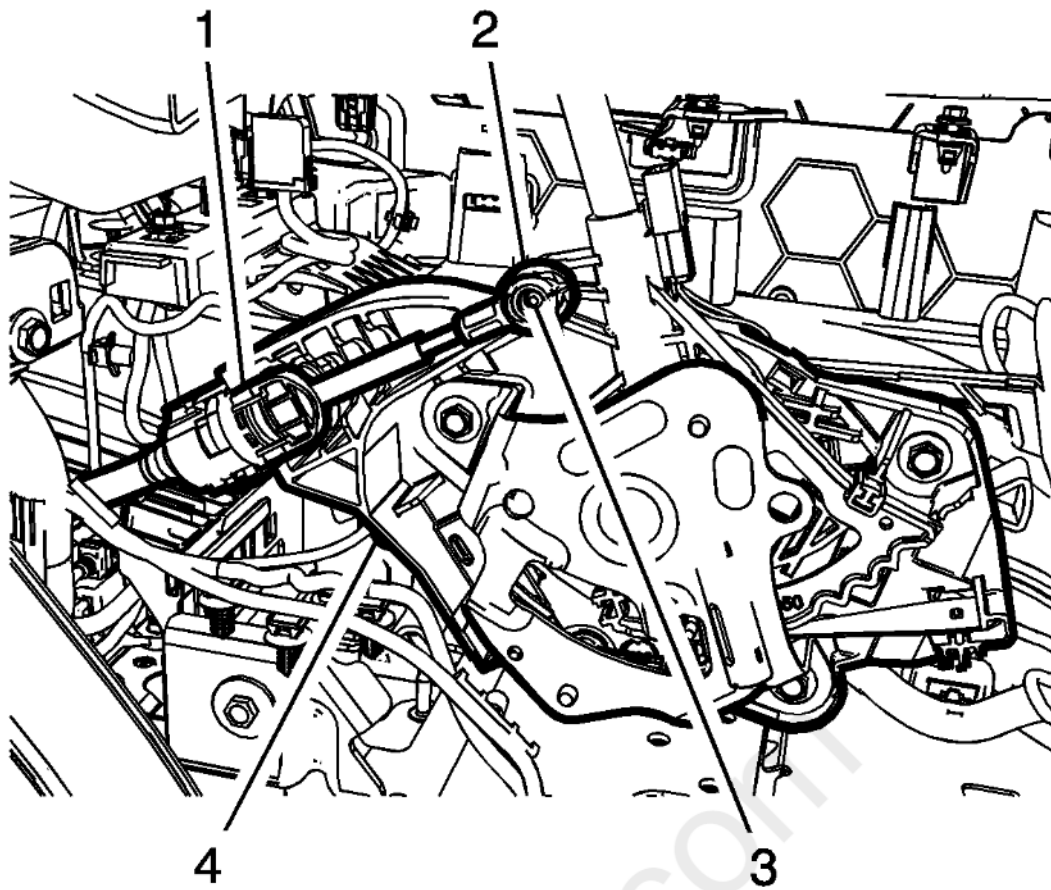


Fig. 7: Transmission Range Selector Cable Retainer, Terminal, Shift Lever Pin & Control Lever Base

Courtesy of GENERAL MOTORS COMPANY

WARNING: After installing the transmission range selector shift cable, pull up and push down on ALL connections to verify that the connections are fully seated and properly engaged. Failure to perform this task can result in the vehicle not being able to shift into PARK causing potential vehicle damage and bodily injury.

4. Install the transmission range selector lever cable retainer (1) to the shift lever base. (4).
5. Install the transmission range selector lever cable terminal (2) to the shift lever pin (3).

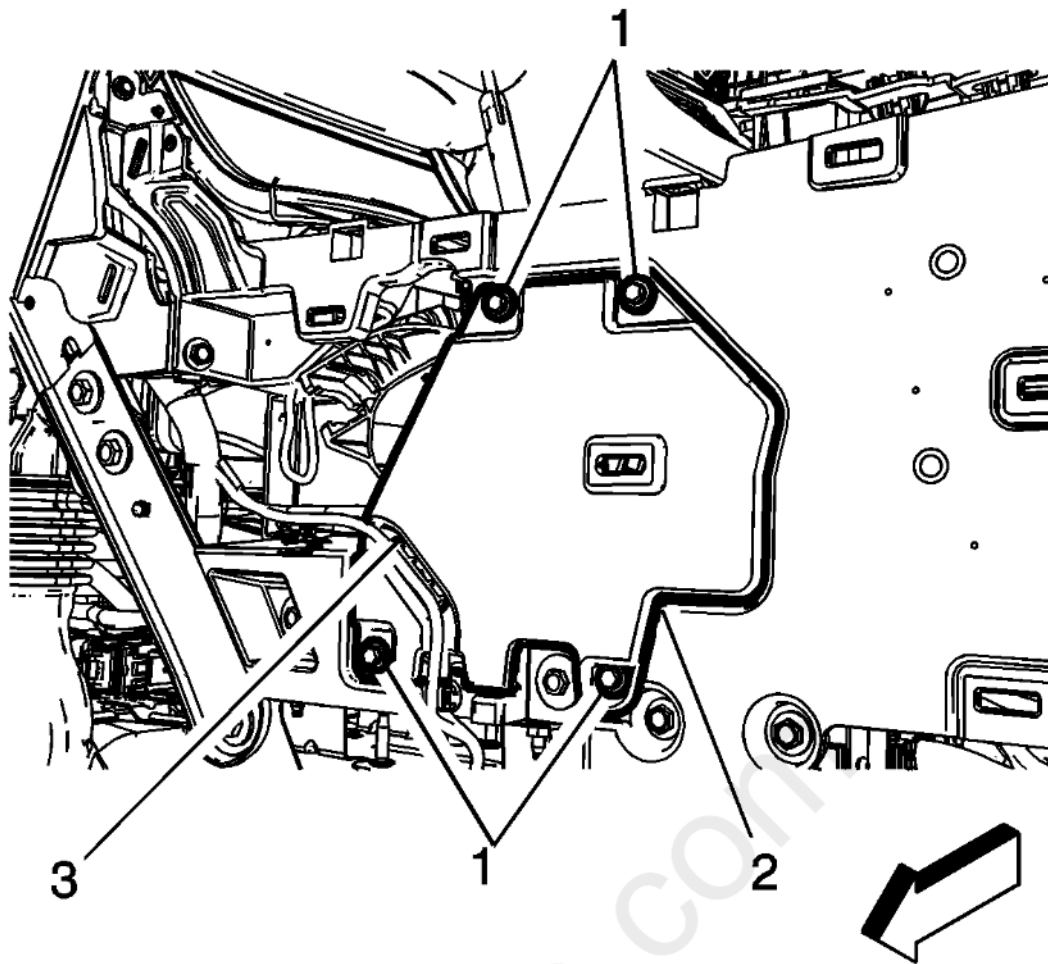


Fig. 8: Access Plate, Fasteners & Wiring Harness

Courtesy of GENERAL MOTORS COMPANY

6. Position the access plate (2) to the console, then install the fasteners (1).
7. Connect the wiring harness (3) to the access plate.
8. Install the left front floor console extension panel. Refer to [Front Floor Console Extension Replacement - Left Side](#).
9. Install the shift knob to the transmission control. Refer to [Transmission Control Lever Knob Replacement](#).

AUTOMATIC TRANSMISSION RANGE SELECTOR LEVER REPLACEMENT

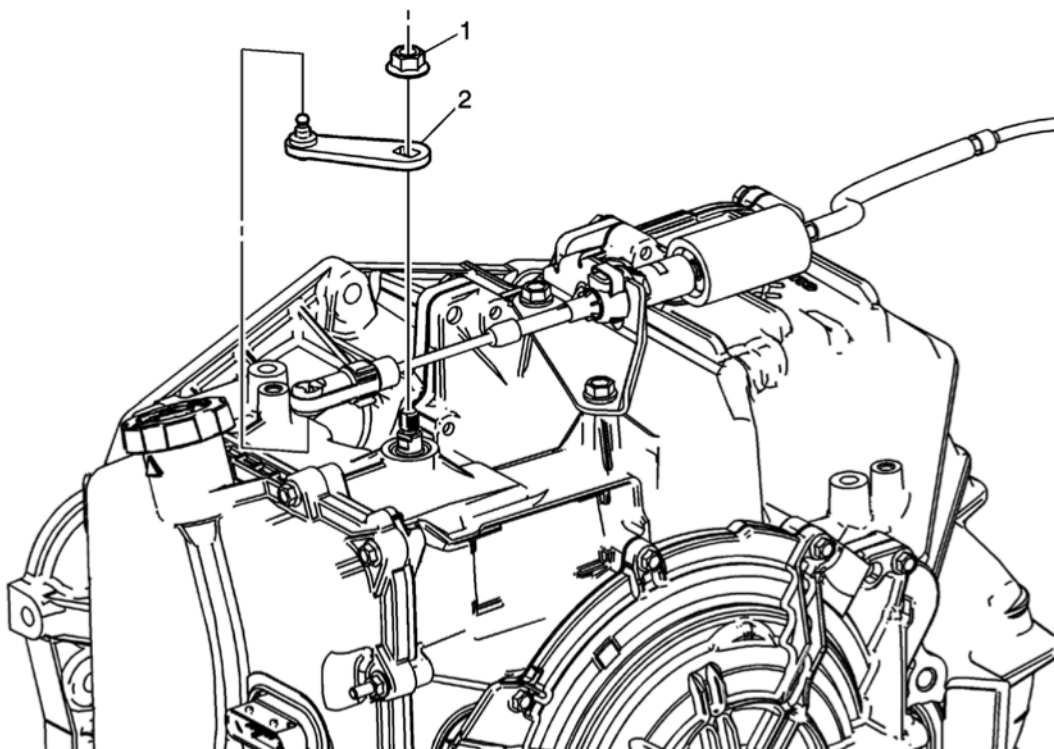


Fig. 9: Automatic Transmission Range Selector Lever

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures - Set the park brake and chock the wheels. WARNING: After installing the transmission range selector shift cable, pull up and push down on ALL connections to verify that the connections are fully seated and properly engaged. Failure to perform this task can result in the vehicle not being able to shift into PARK causing potential vehicle damage and bodily injury. - Disconnect the range selector cable from the range selector lever.	
1	Transmission Range Selector Lever Nut WARNING: Hold the transmission range selector lever while removing or installing the lever retaining nut. Failure to hold the lever can cause damage to the transmission internal park system components which could allow the vehicle to roll when placed in the park position. CAUTION: Refer to Fastener Caution . Tighten 20 N.m (15 lb ft)
2	Transmission Range Selector Lever

RANGE SELECTOR LEVER CABLE REPLACEMENT

Removal Procedure

1. Set the park brake and chock the wheels.
2. Reposition the engine control module out of the way without disconnecting the electrical connector(s). Refer to [Engine Control Module Replacement \(LFX\)](#).

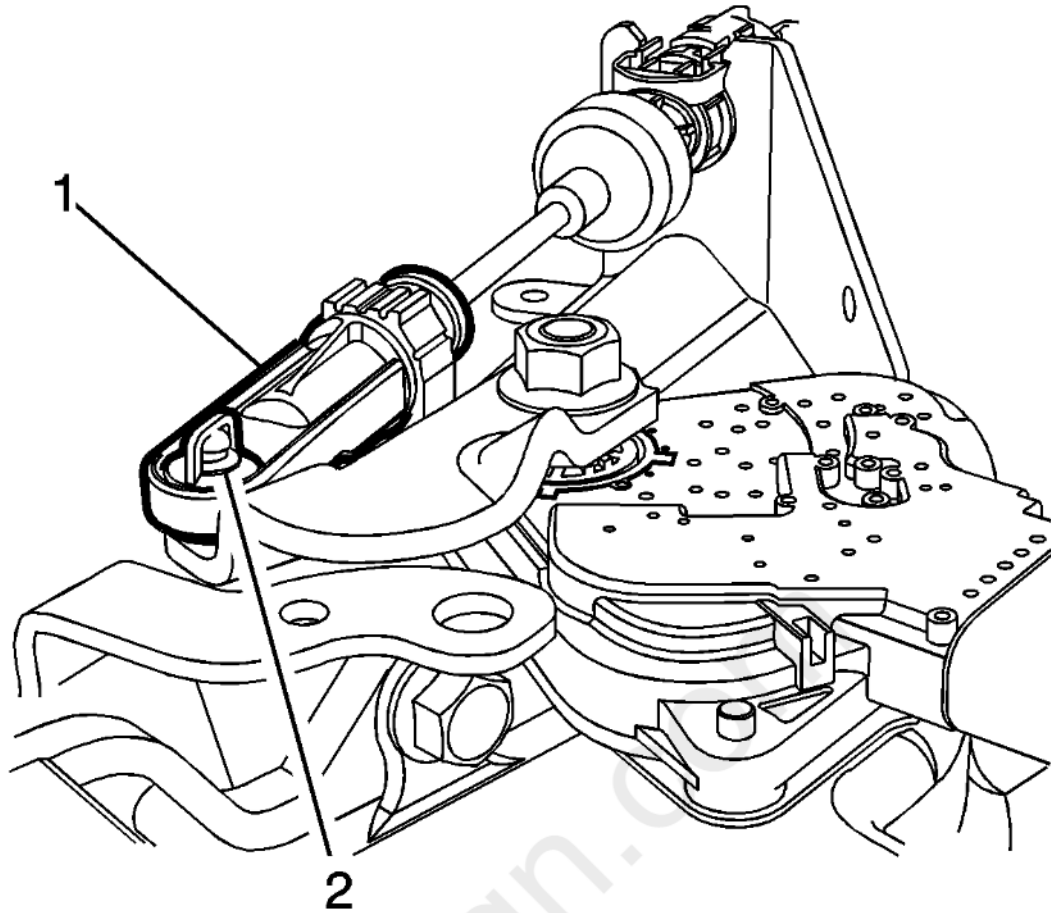


Fig. 10: Transmission Range Selector Lever Cable Terminal And Lever Pin
Courtesy of GENERAL MOTORS COMPANY

3. Disconnect the transmission range selector lever cable terminal (1) from the transmission manual shift lever pin (2).

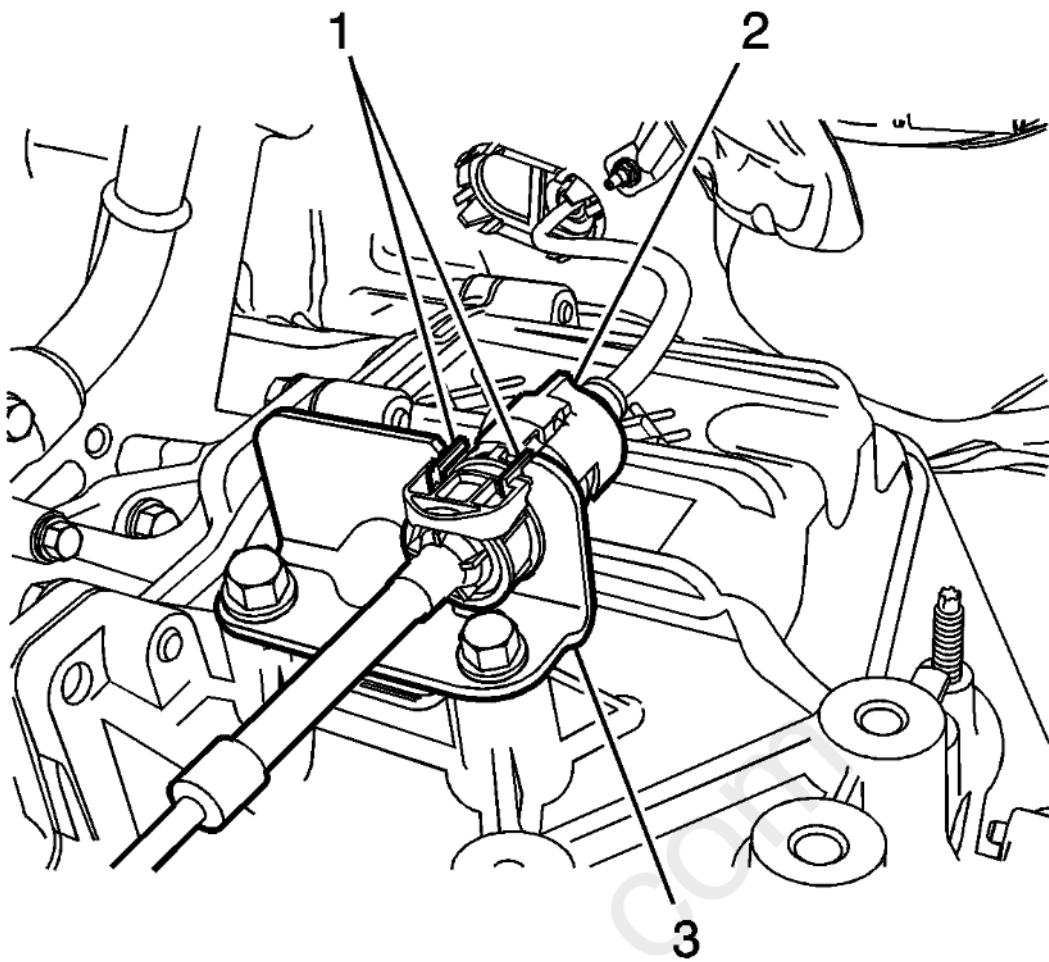


Fig. 11: Transmission Range Selector Lever Cable & Cable Bracket

Courtesy of GENERAL MOTORS COMPANY

4. Press the locking tabs inward (1) in order to release the transmission range selector lever cable (2) from the cable bracket (3).
5. Remove the left front floor console extension panel. Refer to **Front Floor Console Extension Replacement - Left Side**.

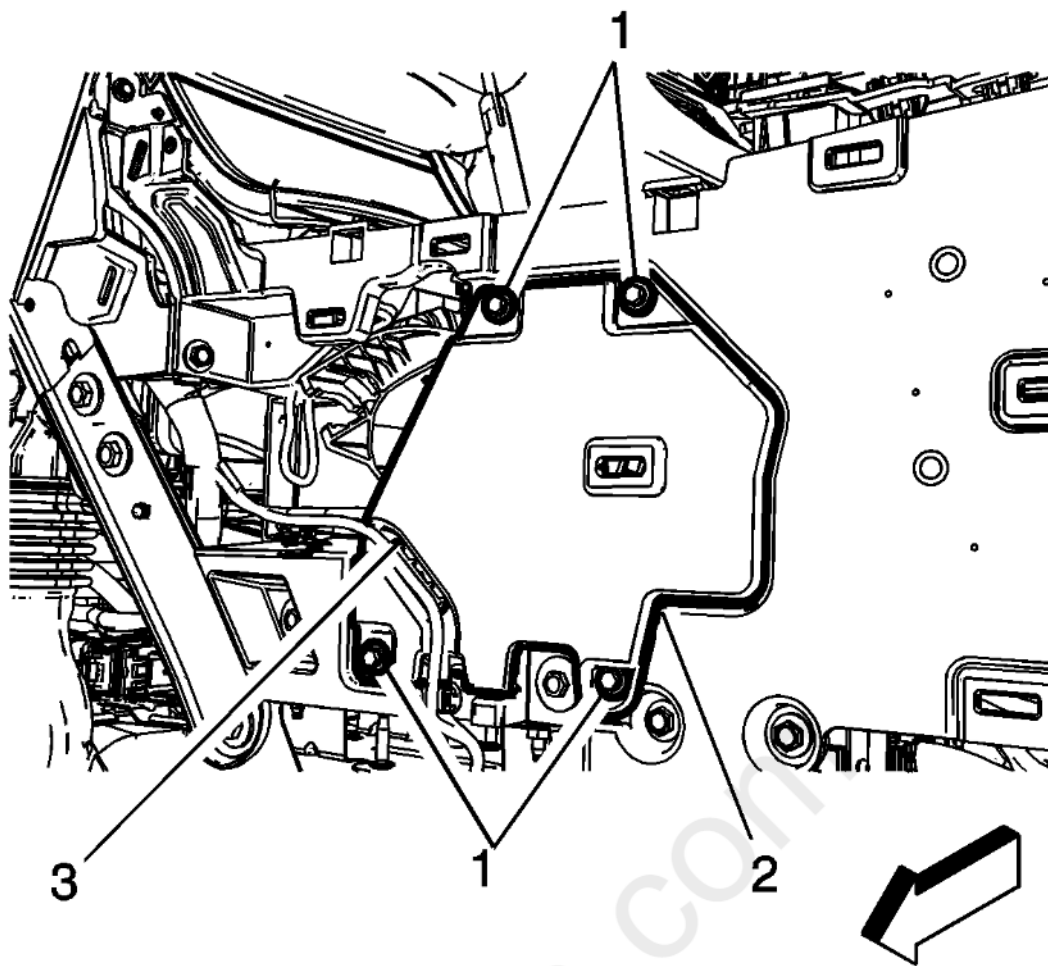


Fig. 12: Access Plate, Fasteners & Wiring Harness

Courtesy of GENERAL MOTORS COMPANY

6. Disconnect the wiring harness (3) from the access plate.
7. Remove the access plate fasteners (1), then the access plate (2) from the console.

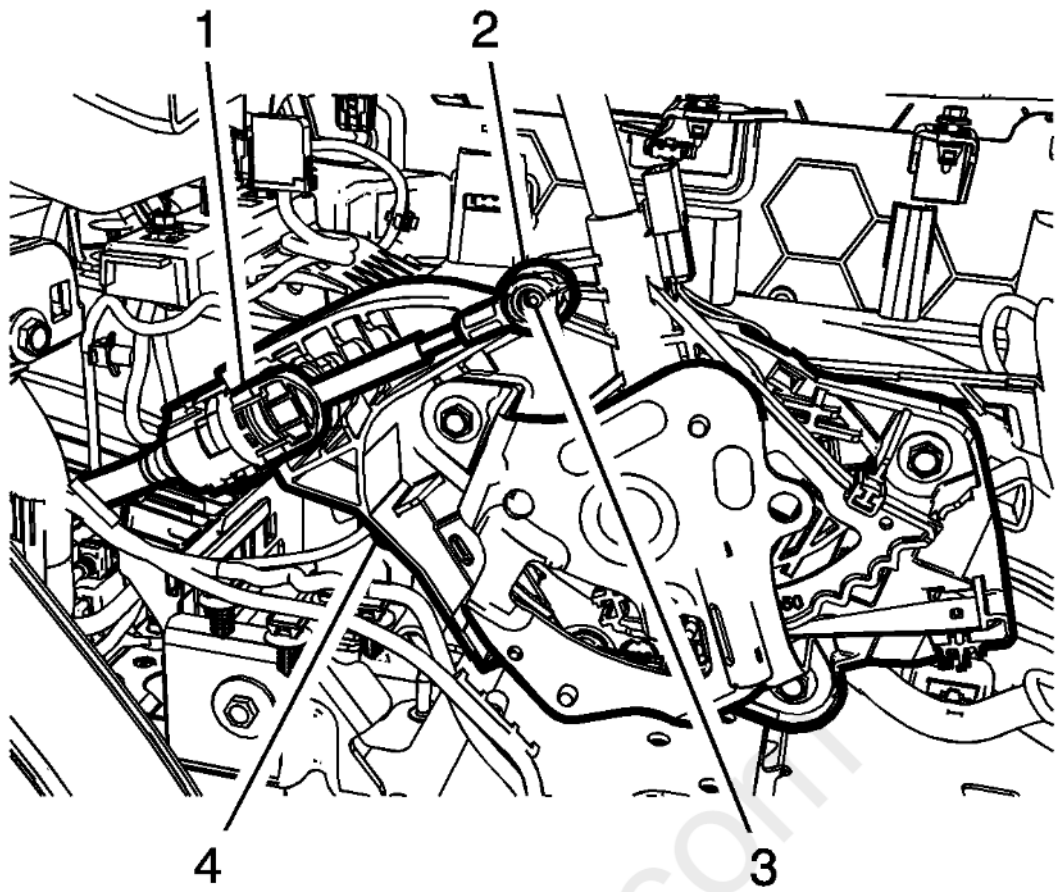


Fig. 13: Transmission Range Selector Cable Retainer, Terminal, Shift Lever Pin & Control Lever Base

Courtesy of GENERAL MOTORS COMPANY

8. Disconnect the transmission range selector lever cable terminal (2) from the shift lever pin (3).

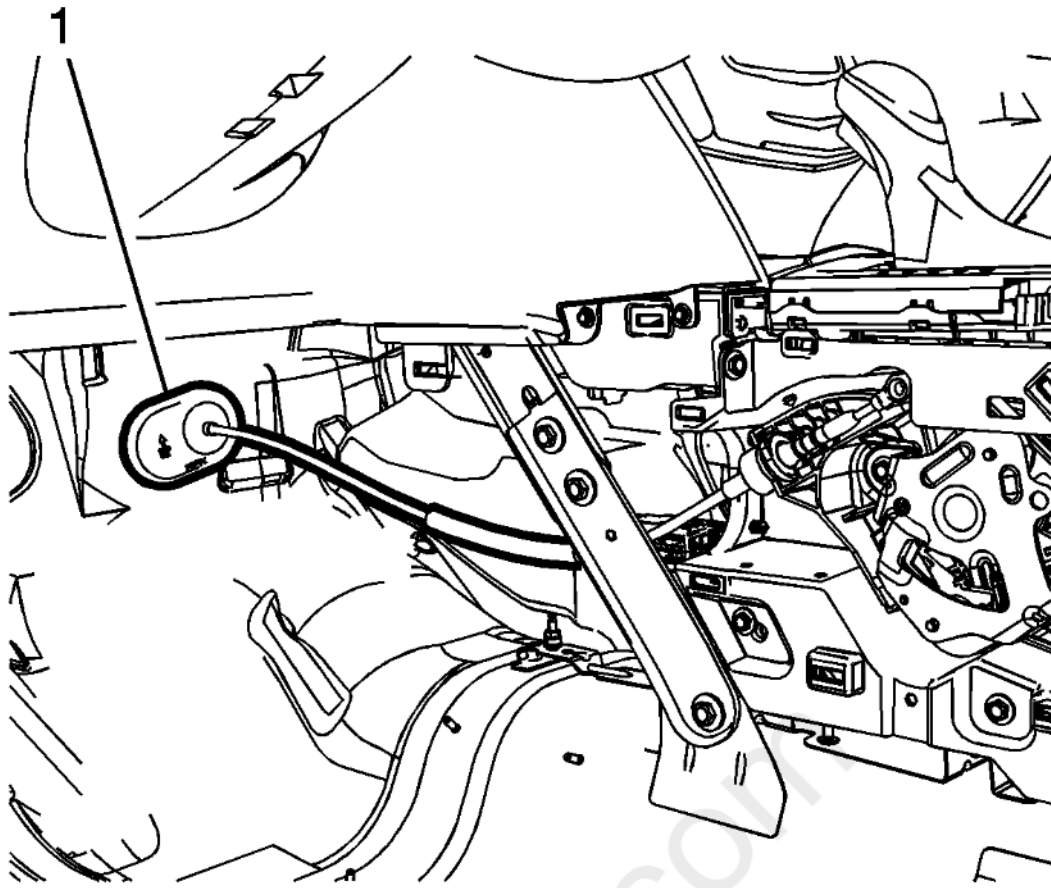


Fig. 14: Transmission Range Selector Lever Cable Grommet
Courtesy of GENERAL MOTORS COMPANY

9. Remove the transmission range selector lever cable grommet (1) from the cowl panel.
10. Remove the transmission range selector lever cable from the vehicle.

Installation Procedure

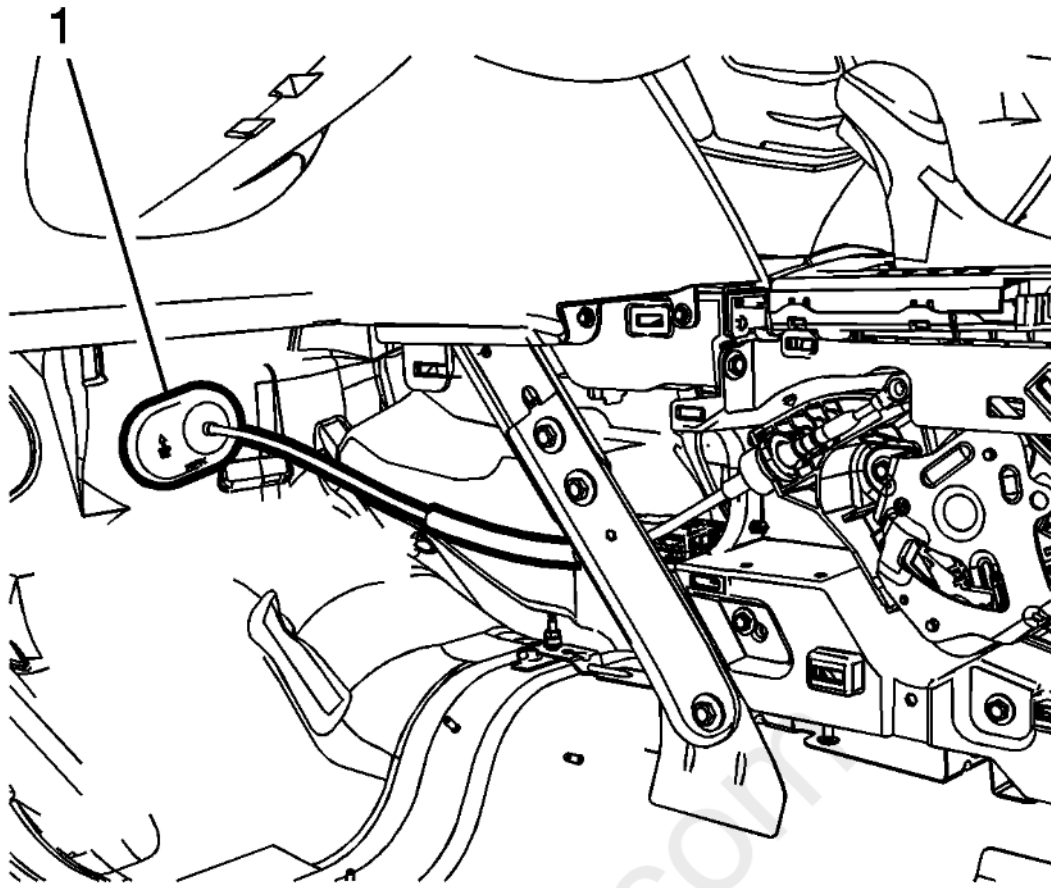


Fig. 15: Transmission Range Selector Lever Cable Grommet

Courtesy of GENERAL MOTORS COMPANY

1. Install the transmission range selector lever cable to the vehicle.
2. Install the transmission range selector lever cable grommet (1) to the cowl panel.

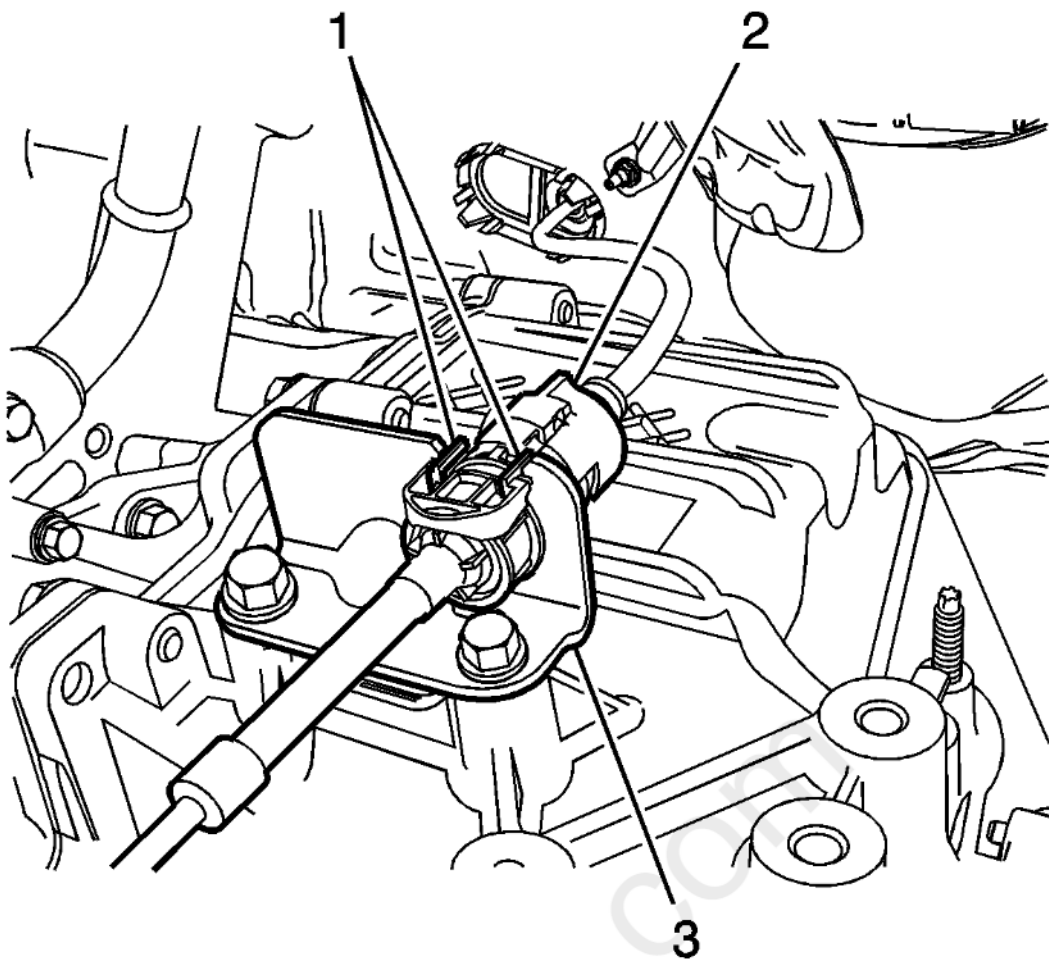


Fig. 16: Transmission Range Selector Lever Cable & Cable Bracket

Courtesy of GENERAL MOTORS COMPANY

3. Install the transmission range selector lever cable (2) to the cable bracket (3).

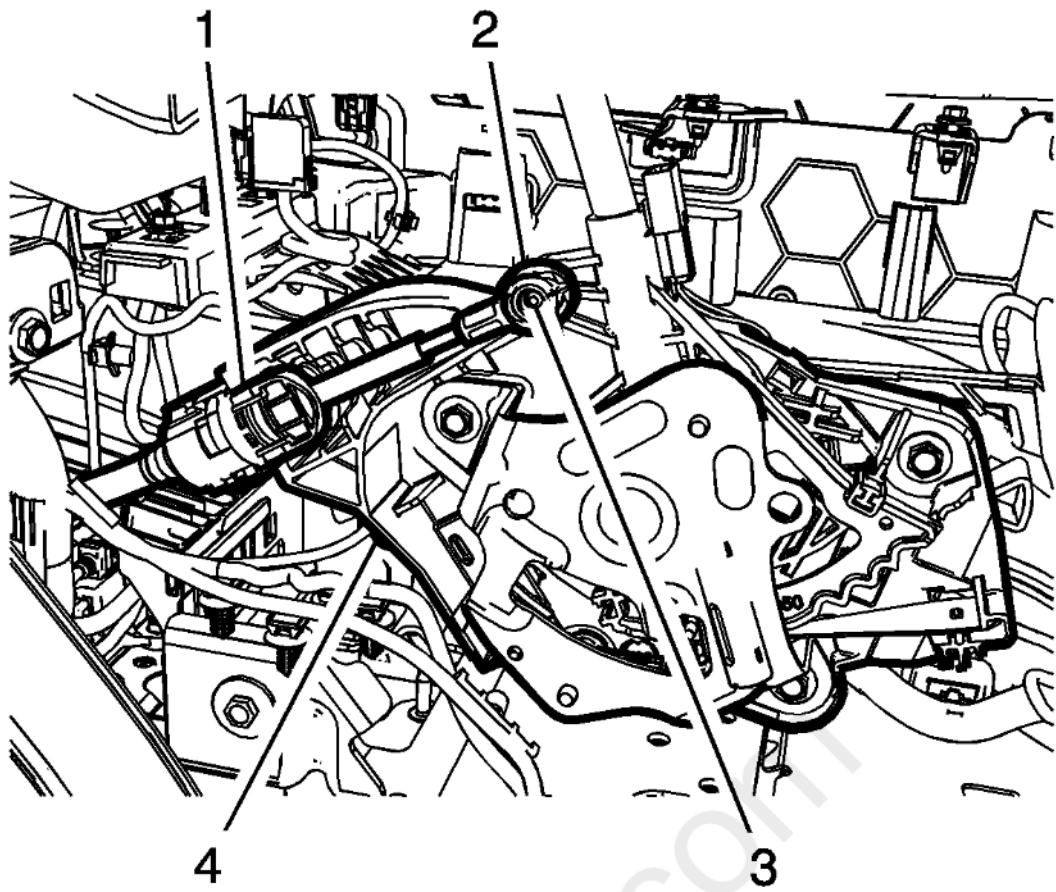


Fig. 17: Transmission Range Selector Cable Retainer, Terminal, Shift Lever Pin & Control Lever Base

Courtesy of GENERAL MOTORS COMPANY

4. Install the transmission range selector lever cable retainer (1) to the shift lever base. (4).
5. Ensure the transmission control is in the Park position, then install the transmission range selector lever cable terminal (2) to the shift lever pin (3).

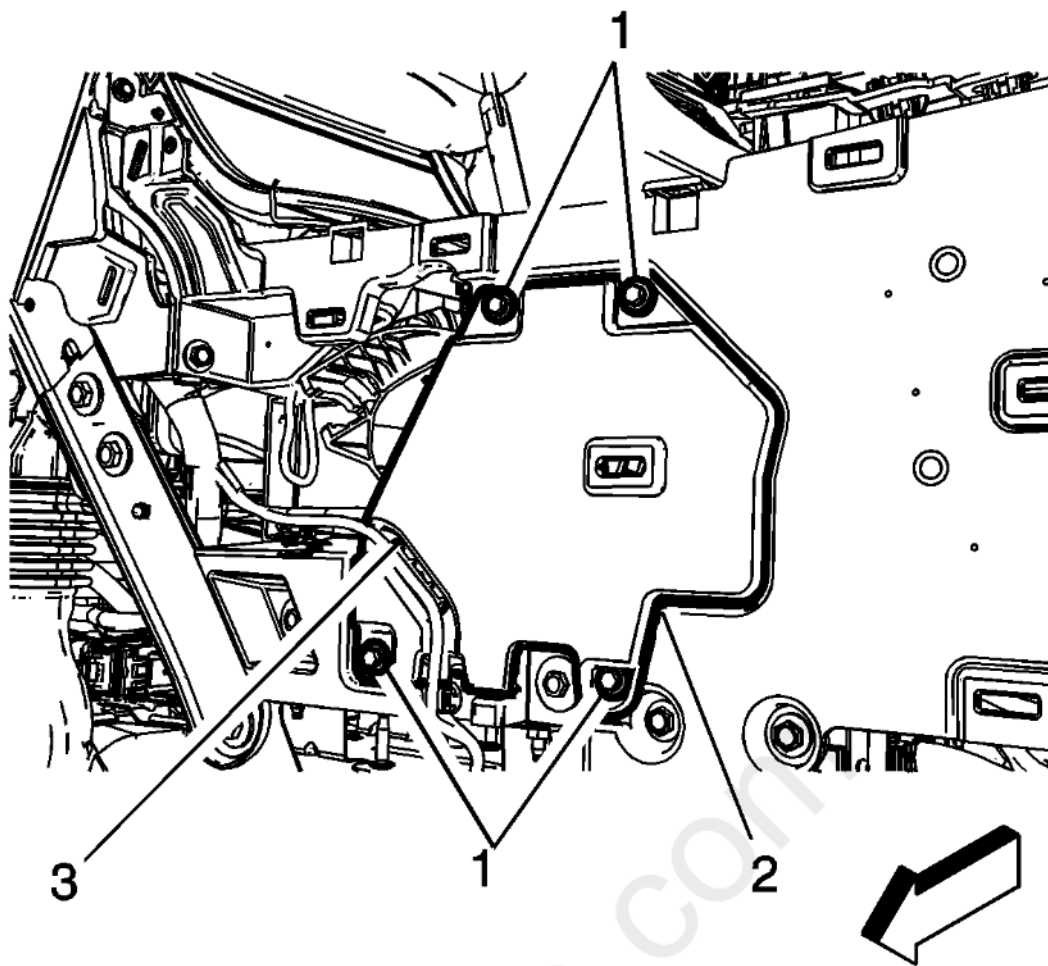


Fig. 18: Access Plate, Fasteners & Wiring Harness

Courtesy of GENERAL MOTORS COMPANY

6. Position the access plate (2) to the console, then install the fasteners (1).
7. Connect the wiring harness (3) to the access plate.

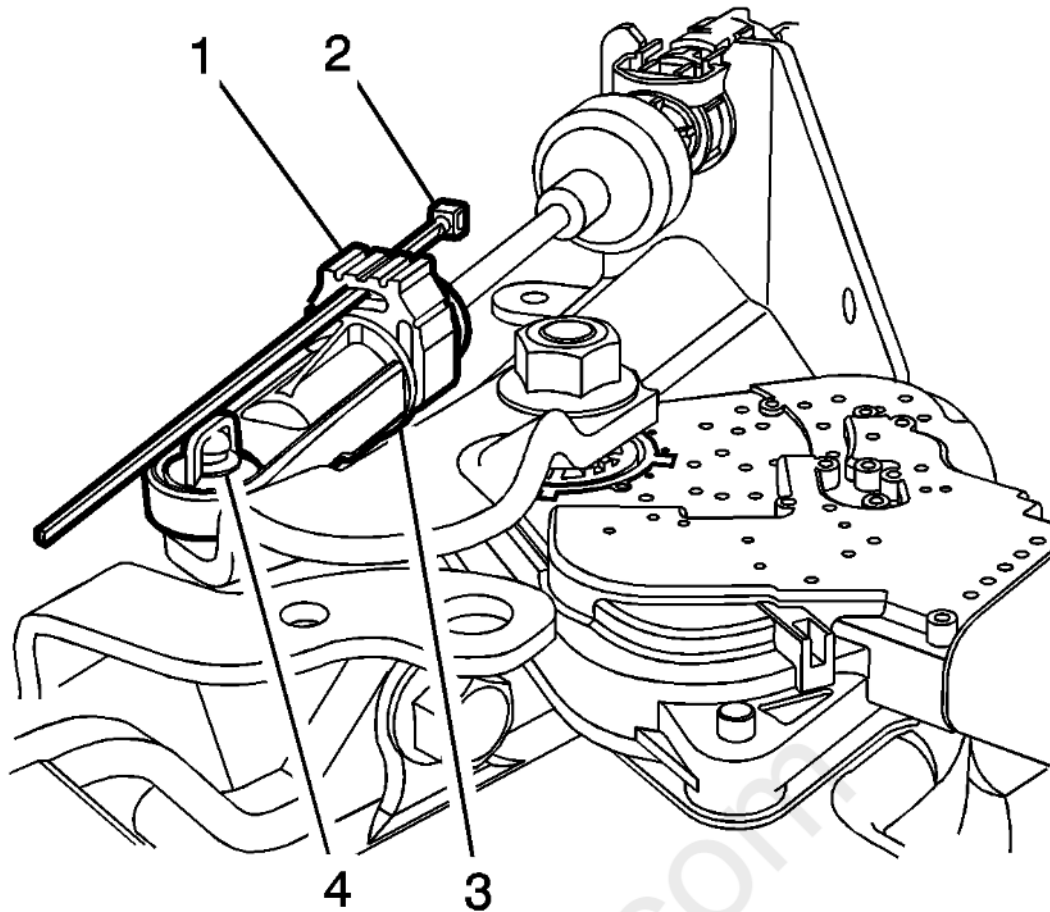


Fig. 19: Range Selector Lever Cable Terminal And Transmission Manual Shift Lever Pin
Courtesy of GENERAL MOTORS COMPANY

WARNING: After installing the transmission range selector shift cable, pull up and push down on ALL connections to verify that the connections are fully seated and properly engaged. Failure to perform this task can result in the vehicle not being able to shift into PARK causing potential vehicle damage and bodily injury.

8. Connect the transmission range selector lever cable terminal (4) to the transmission manual shift lever pin.

NOTE: Ensure that the shift lever and the transmission control are in the Park positions.

9. Secure the shift cable lock into place. Remove the lock retainer (2), if installing a NEW cable. Ensure that the lock (1) is properly seated.
10. Place the engine control module back to it's installed position. Refer to [Engine Control Module Replacement \(LFX\)](#) .
11. Install the left front floor console extension panel. Refer to [Front Floor Console Extension Replacement - Left Side](#) .

RANGE SELECTOR LEVER CABLE ADJUSTMENT

The shift cable on this vehicle does not require an adjustment.

RANGE SELECTOR LEVER CABLE BRACKET REPLACEMENT

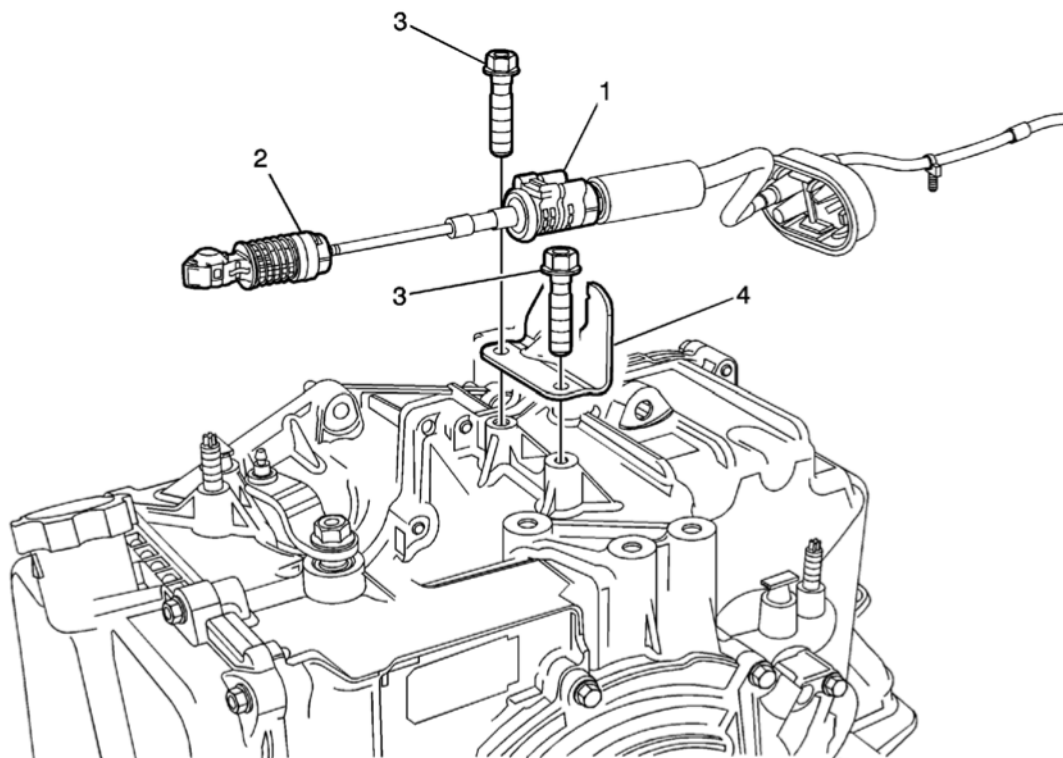


Fig. 20: Range Selector Lever Cable Bracket
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Set the park brake and chock the wheels. 2. Remove the battery tray. Refer to Battery Tray Replacement.	
1	Transmission Range Selector Lever Cable Retaining Lock
2	Transmission Range Selector Lever Cable
3	Transmission Range Selector Lever Cable Bracket Bolt CAUTION: Refer to Fastener Caution . Tighten 25 N.m (18 lb ft)
4	Transmission Range Selector Lever Cable Bracket Procedure Adjust the cable. Refer to Range Selector Lever Cable Adjustment .

TRANSMISSION FLUID DRAIN AND FILL

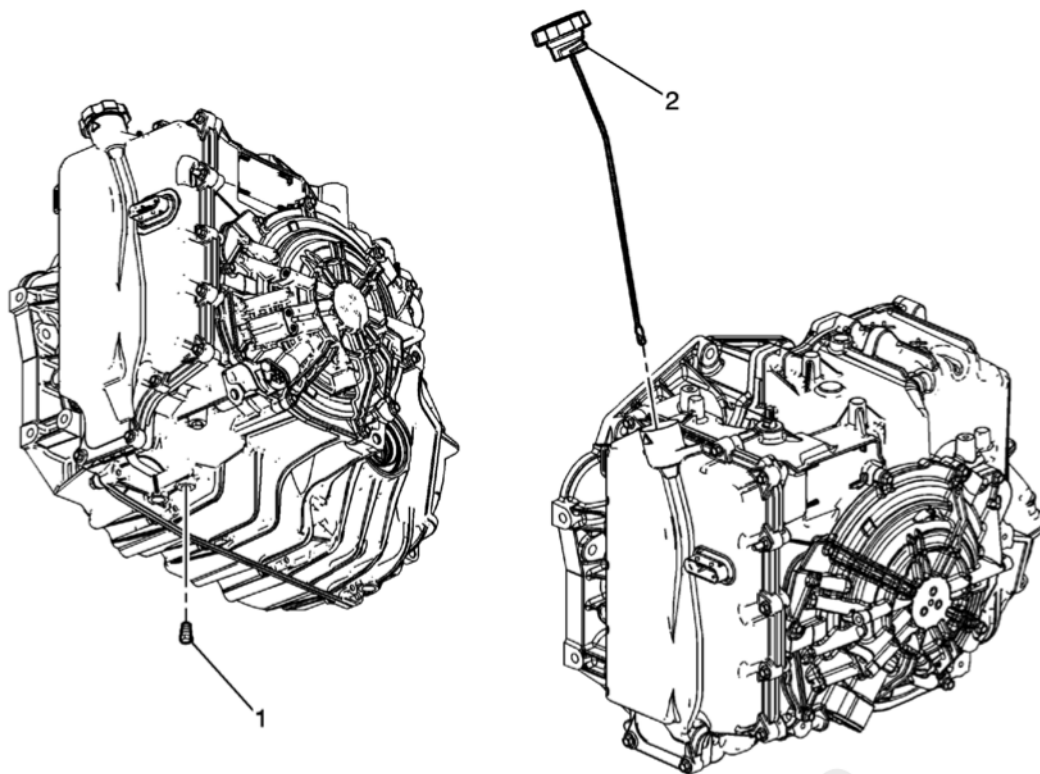


Fig. 21: Fluid Level Indicator And Drain Plug
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Raise the vehicle. Refer to Lifting and Jacking the Vehicle .	
1	Fluid Drain Plug CAUTION: Refer to Fastener Caution . NOTE: Place a drain pan capable of containing more than 5 quarts of fluid under the transmission before removing the plug to drain the fluid. Tighten 12 N.m (106 lb in)
2	Fluid Level Indicator NOTE: • Transmission will require approximately 5 quarts of fluid. • Fill the transmission with fluid. Refer to Transmission Fluid Level and Condition Check .

AUTOMATIC TRANSMISSION FLUID PRESSURE TEST HOLE PLUG REPLACEMENT

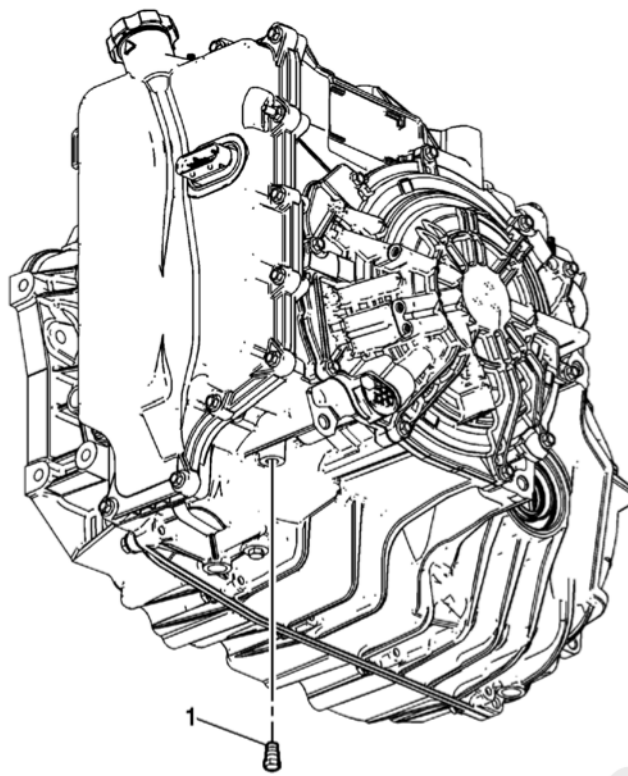


Fig. 22: Automatic Transmission Fluid Pressure Test Hole Plug
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Raise the vehicle. Refer to Lifting and Jacking the Vehicle .	
1	Fluid Pressure Test Plug CAUTION: Refer to Fastener Caution . Tighten 12 N.m (106 lb in)

FRONT WHEEL DRIVE SHAFT SEAL REPLACEMENT - LEFT SIDE

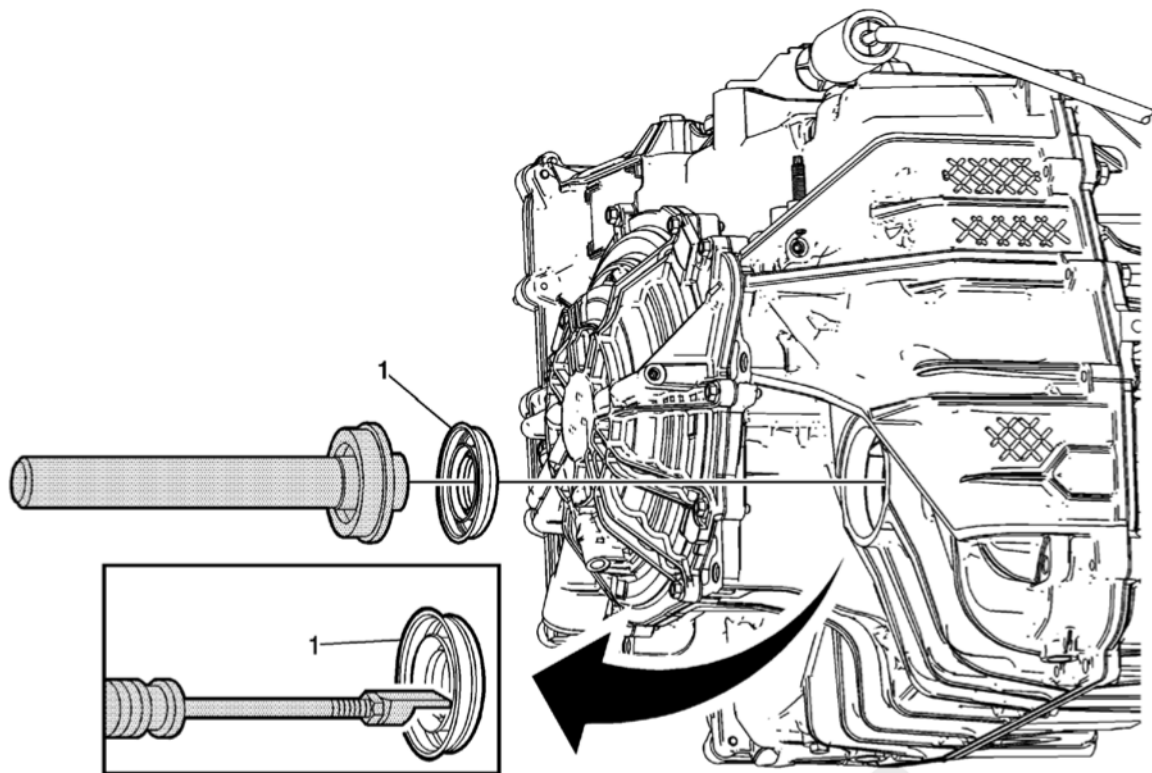


Fig. 23: Front Wheel Drive Shaft Oil Seal - Left Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Remove the left wheel drive shaft. Refer to Front Wheel Drive Shaft Replacement - Left Side .	
	Left Front Wheel Drive Shaft Oil Seal NOTE: • For seal removal use J-6125-1B hammer with J-23129 remover. • For seal installation use J-8092 handle with J-46629-A installer.
1	Special Tools • J-6125-1B Slide Hammer • J-8092 Driver Handle • J-23129 Universal Seal Remover • J-46629-A Axle Seal Installer
	For equivalent regional tools, refer to Special Tools .

FRONT WHEEL DRIVE SHAFT SEAL REPLACEMENT - RIGHT SIDE

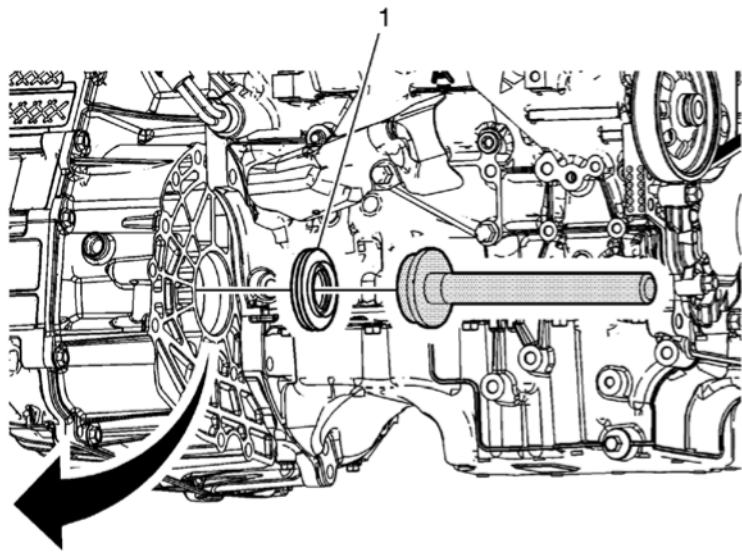
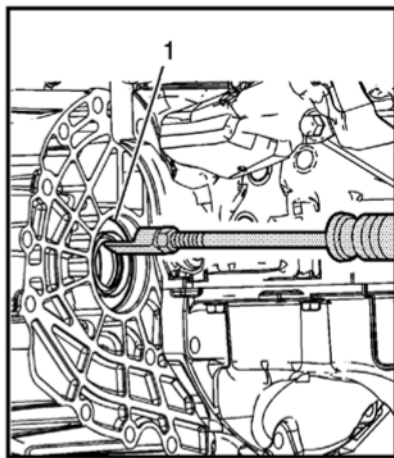


Fig. 24: Front Wheel Drive Shaft Oil Seal - Right Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Remove the intermediate drive shaft. Refer to Front Wheel Drive Intermediate Shaft Replacement (LFX with M7W) .	
	Right Front Wheel Drive Shaft Oil Seal NOTE: • For seal removal use J-6125-1B hammer with J-23129 remover. • For seal installation use J-8092 handle with J-46629-A installer.
1	Special Tools • J-6125-1B Slide Hammer • J-8092 Driver Handle • J-23129 Universal Seal Remover • J-46629-A Axle Seal Installer
	For equivalent regional tools, refer to Special Tools .

MANUAL SHIFT SHAFT AND SEAL REPLACEMENT

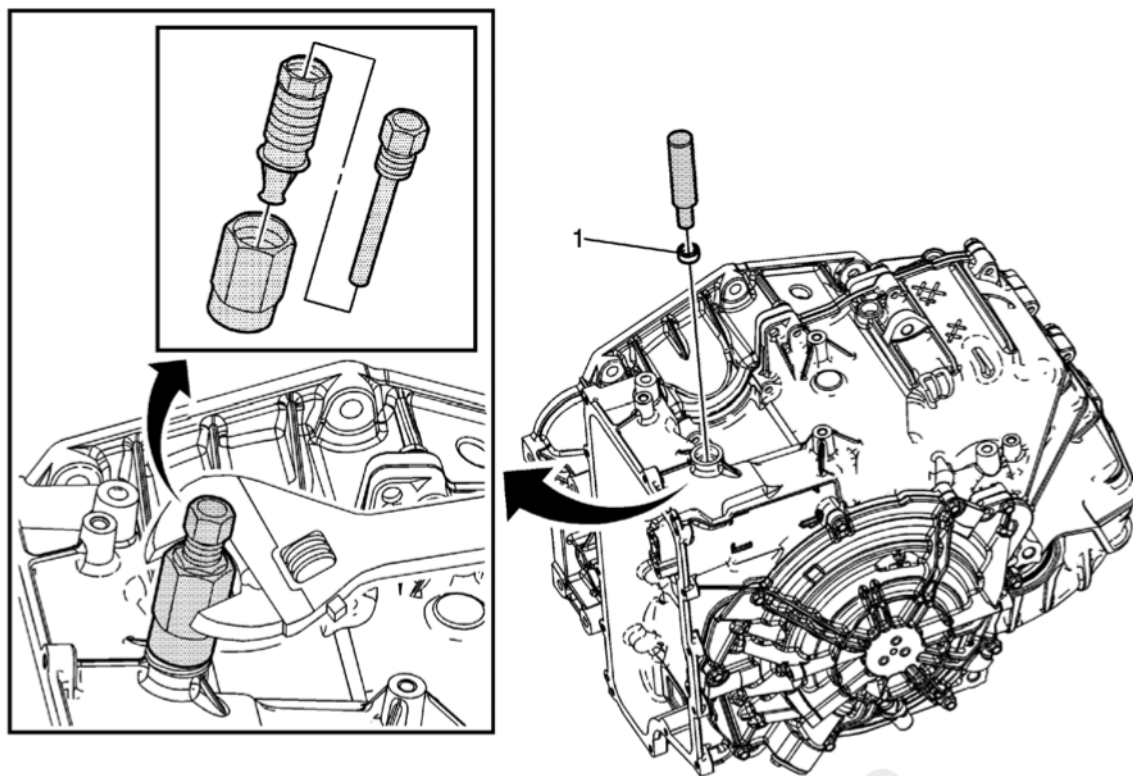


Fig. 25: Manual Shift Shaft And Seal
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Remove the battery tray. Refer to Battery Tray Replacement . 2. Remove the manual shift and position switch assembly. Refer to Manual Shift Detent Lever with Shaft Position Switch Assembly Replacement.	
1	Manual Shift Shaft Seal NOTE: • For seal removal use J-45201 remover. • For seal installation use J-46626 installer. • Lubricate the manual shaft with automatic transmission fluid (ATF) to prevent damage to the manual shift shaft seal. Special Tools • J-45201 Cooler Line Seal Remover • J-46626 Seal Installer For equivalent regional tools, refer to Special Tools .

CONTROL VALVE BODY COVER REPLACEMENT

Removal Procedure

1. Disconnect the negative battery cable. Refer to [Battery Negative Cable Disconnection and Connection](#) .

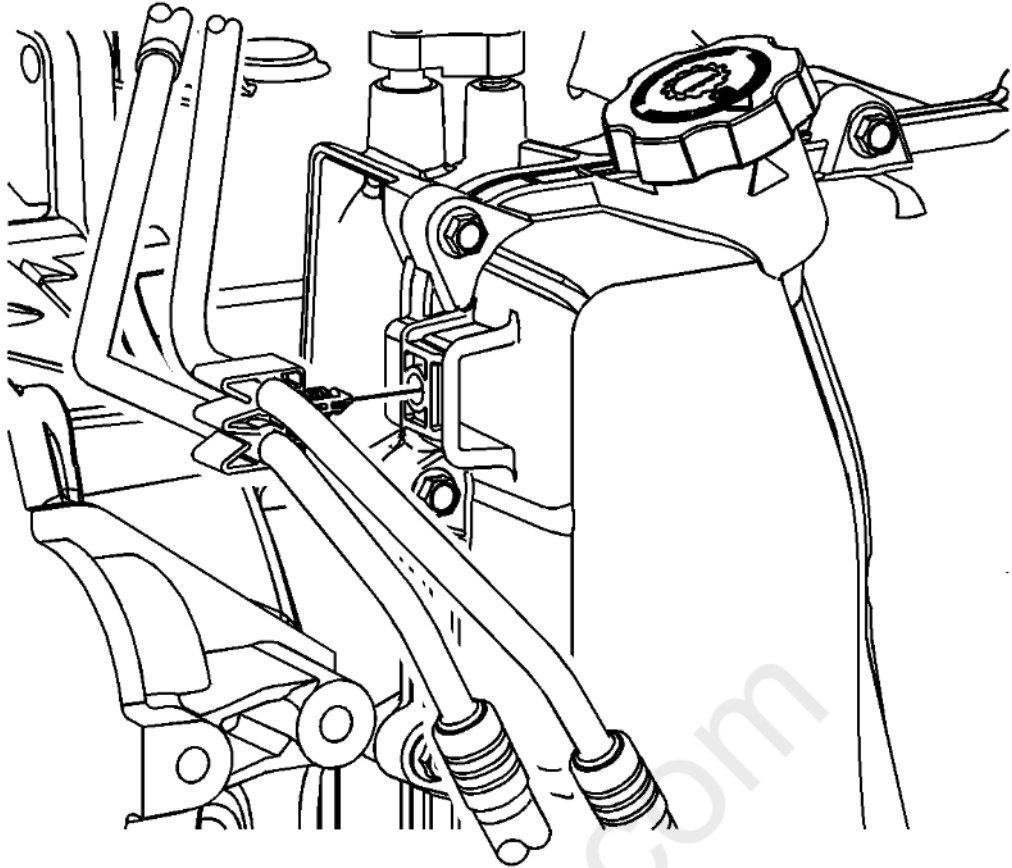


Fig. 26: Oil Cooler Inlet And Outlet Hoses

Courtesy of GENERAL MOTORS COMPANY

2. Remove the transmission fluid cooler inlet and outlet pipes. Refer to **Transmission Fluid Cooler Outlet Pipe Replacement (LFX)** , and **Transmission Fluid Cooler Inlet Pipe Replacement (LFX)** .
3. Remove secondary air injection pump, if equipped. Refer to **Secondary Air Injection Pump Replacement** .
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
5. Drain the transmission. Refer to **Transmission Fluid Drain and Fill**.

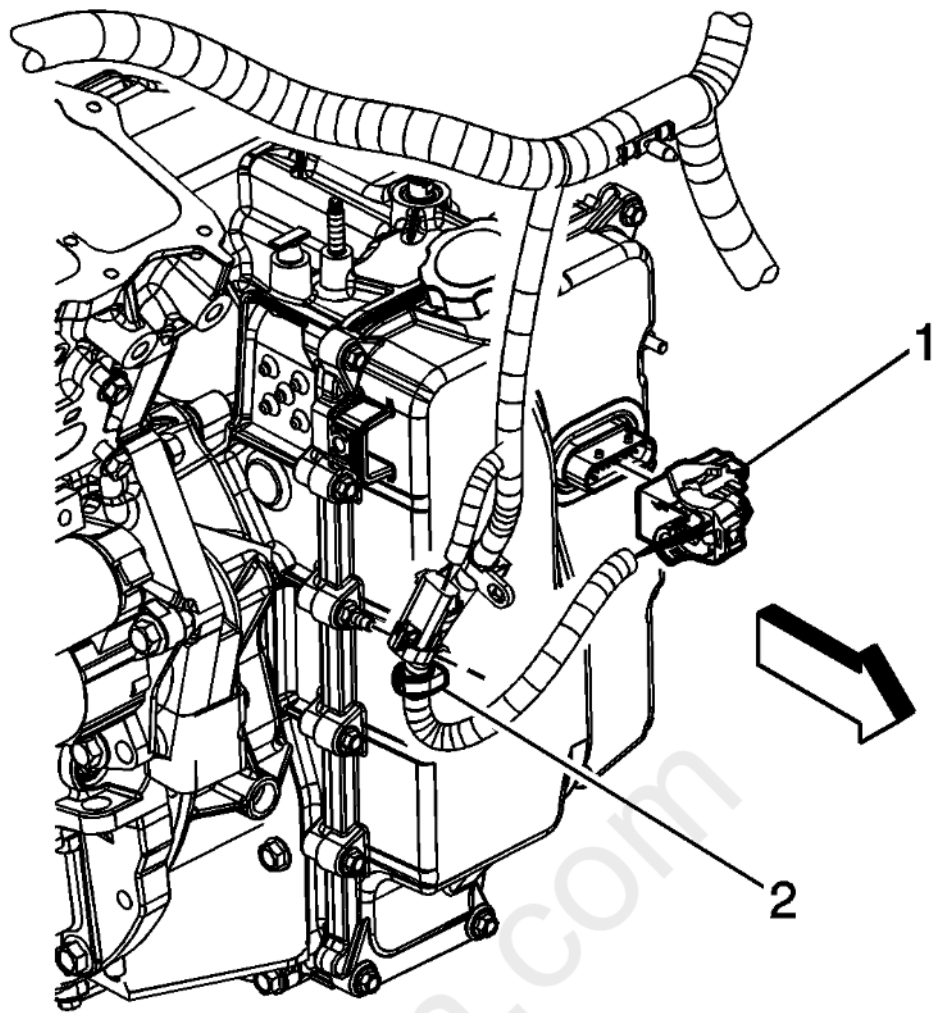


Fig. 27: Wire Harness Retainer And TCM Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

6. Remove the wire harness retainer (2) from the control valve body cover stud, if equipped.
7. Disconnect the control valve body transmission control module (TCM) electrical connector (1).

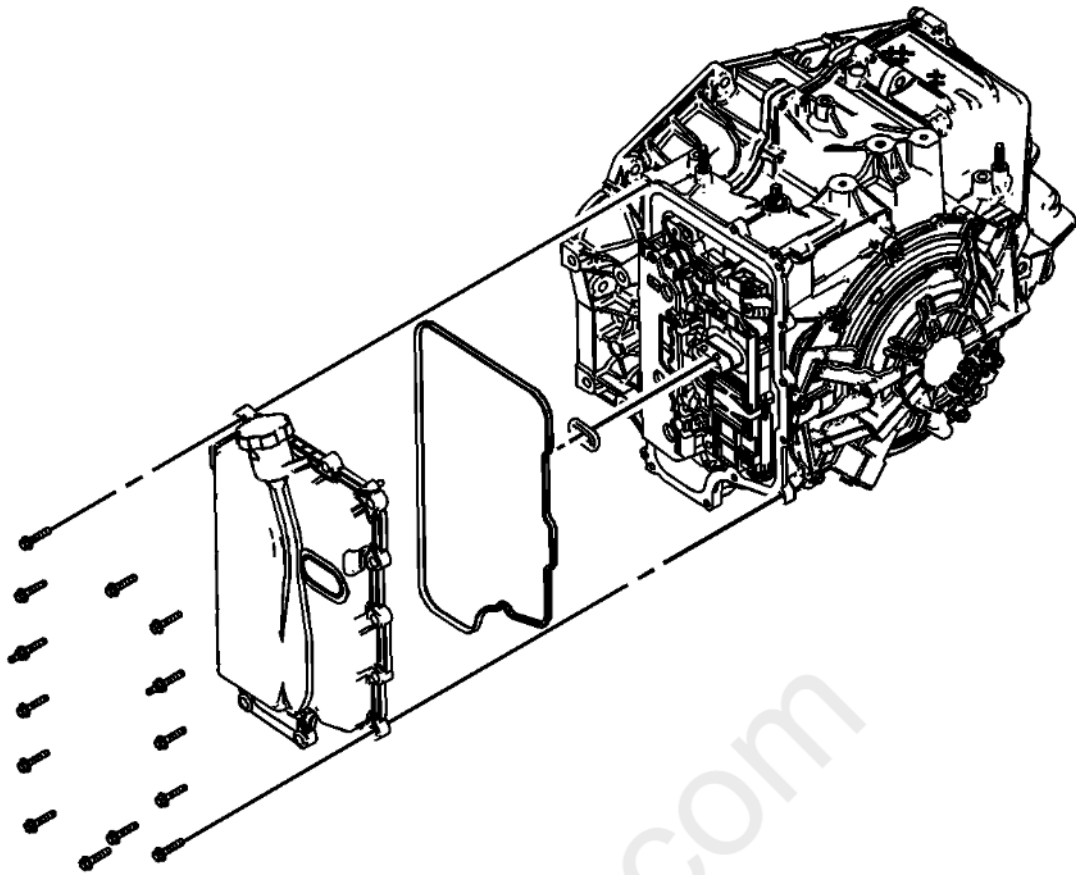


Fig. 28: Control Valve Body Cover Studs And Bolts

Courtesy of GENERAL MOTORS COMPANY

8. Remove the 2 control valve body cover studs M6 x 30.
9. Remove the 12 control valve body cover bolts M6 x 30.
10. Support the transmission with a transmission jack.
11. Remove the control valve body cover.
12. Remove the control valve body cover gasket.

CAUTION: Support the control solenoid valve assembly around the connector when removing the seal. Excessive pulling force can damage the internal electrical connections.

13. Remove the control valve body cover wiring connector hole seal.
14. Remove all traces of the old gasket material. Clean the transmission case and control valve body cover gasket surfaces.

Installation Procedure

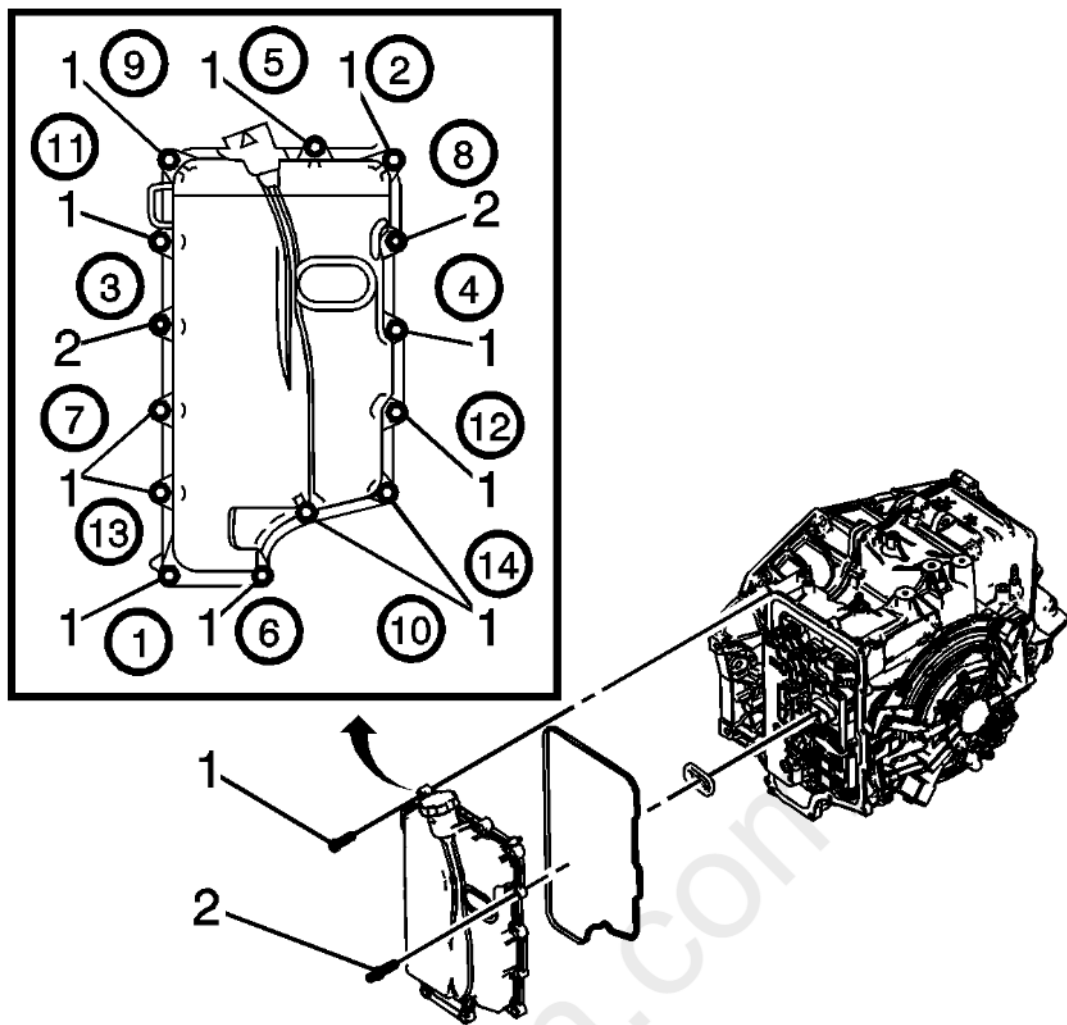


Fig. 29: Control Valve Body Cover, Gasket, Bolts And Studs With Tightening Sequence
 Courtesy of GENERAL MOTORS COMPANY

NOTE: The holes in the control valve body cover wiring connector hole seal must face toward the control solenoid valve assembly. If the holes face toward the valve body cover, there is a potential for a leak around the seal.

1. Install the control valve body cover wiring connector hole seal.
2. Install the control valve body cover gasket to the control valve body cover.
3. Install the control valve body cover.

CAUTION: Refer to [Fastener Caution](#) .

NOTE: Install all control valve body cover bolts and studs by hand then torque all bolts and studs in sequence.

4. Install the 12 control valve body cover bolts (1) M6 x 30 and tighten in sequence to 12 N.m (106 lb in).
5. Install the 2 control valve body cover studs (2) M6 x 30 and tighten in sequence to 12 N.m (106 lb in).

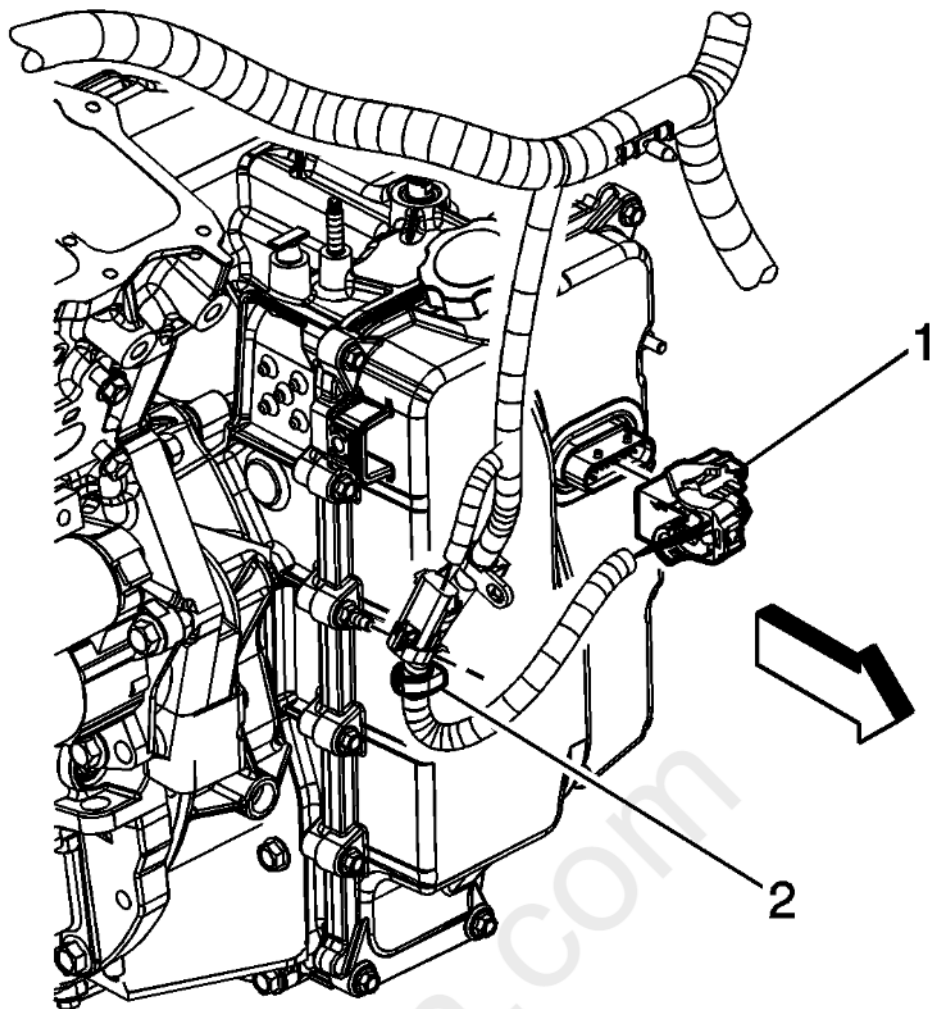


Fig. 30: Wire Harness Retainer And TCM Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

6. Connect the control valve body TCM electrical connector (1).
7. Install the wire harness retainer (2) to the control valve body cover stud. Tighten the nut to 12 N.m (106 lb in).
8. Lower the vehicle.

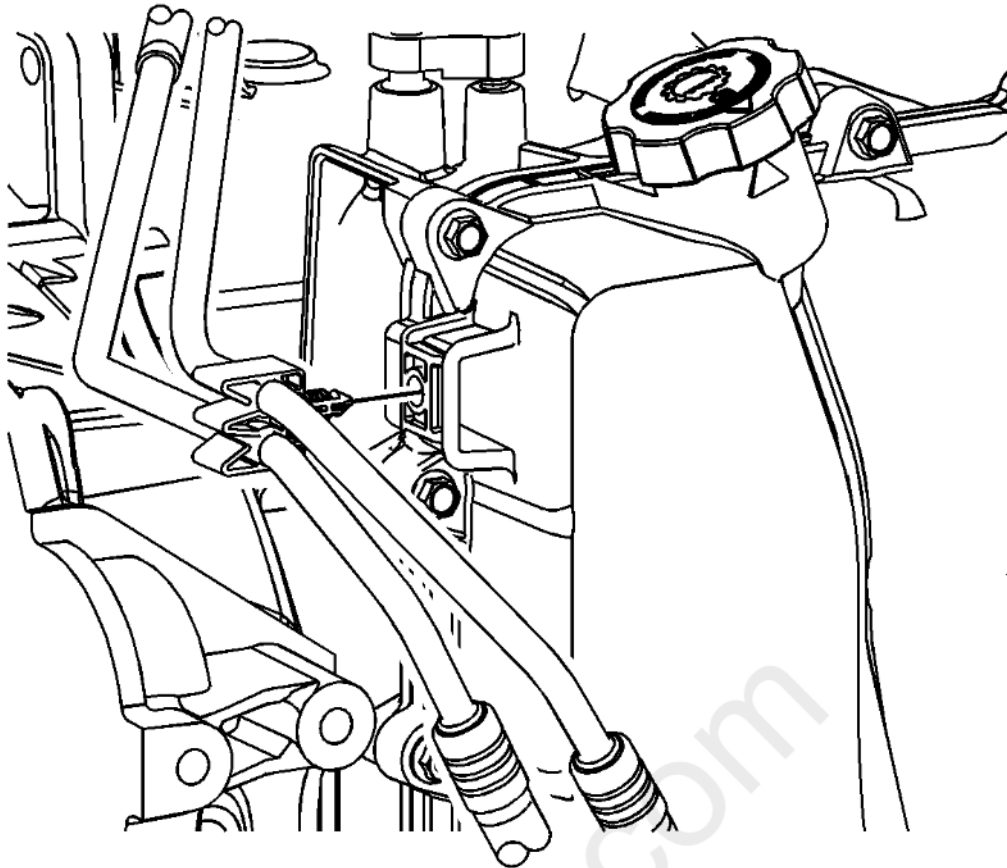


Fig. 31: Oil Cooler Inlet And Outlet Hoses

Courtesy of GENERAL MOTORS COMPANY

9. Install the transmission fluid cooler inlet and outlet pipes. Refer to [**Transmission Fluid Cooler Outlet Pipe Replacement \(LFX\)**](#) , and [**Transmission Fluid Cooler Inlet Pipe Replacement \(LFX\)**](#) .
10. Install secondary air injection pump, if equipped. Refer to [**Secondary Air Injection Pump Replacement**](#) .
11. Connect the negative battery cable. Refer to [**Battery Negative Cable Disconnection and Connection**](#) .
12. Fill the transmission. Refer to [**Transmission Fluid Drain and Fill**](#).
13. Check for leaks.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY REPLACEMENT

Removal Procedure

1. Remove the control valve body cover. Refer to [**Control Valve Body Cover Replacement**](#).

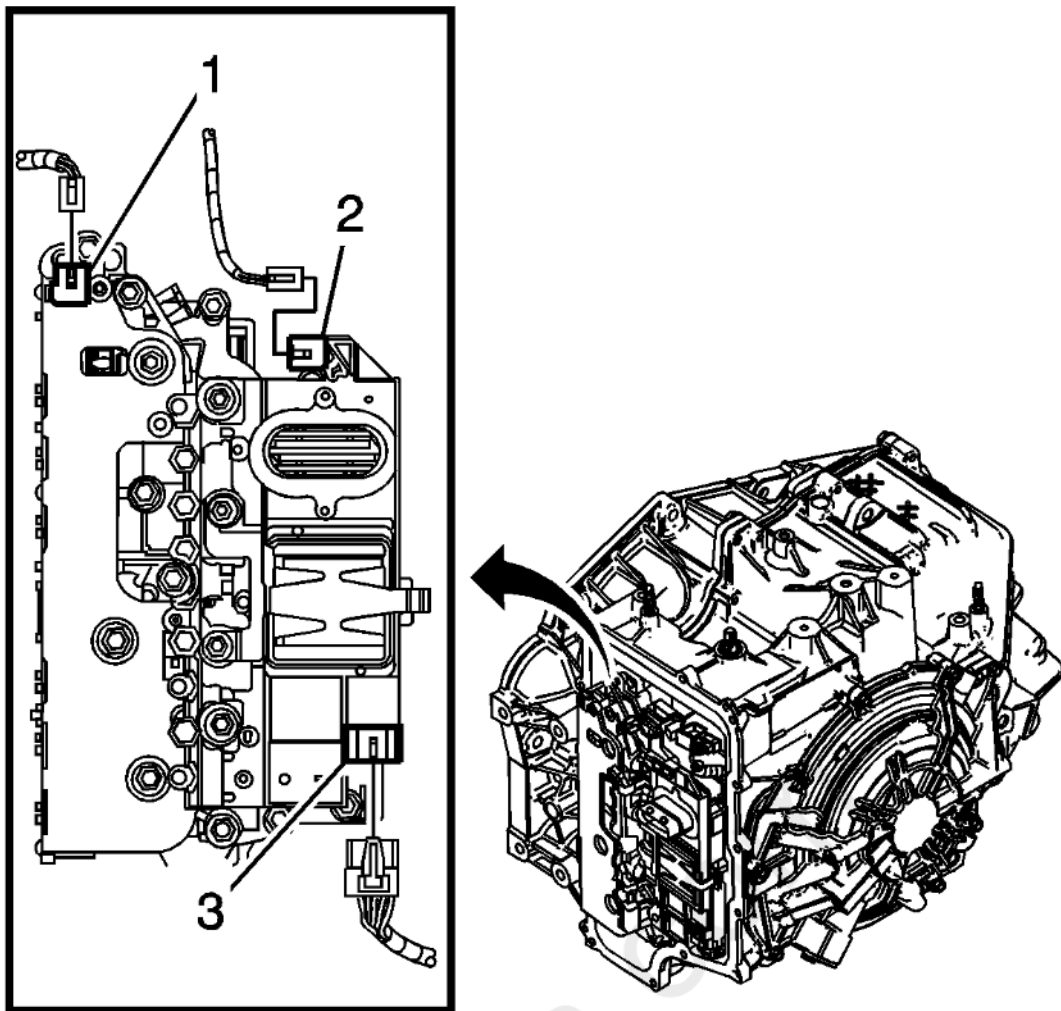


Fig. 32: Speed Sensor And Shift Position Switch Electrical Connectors

Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the input speed sensor electrical connector (1).
3. Disconnect the output speed sensor electrical connector (2).
4. Disconnect the shift position switch electrical connector (3).

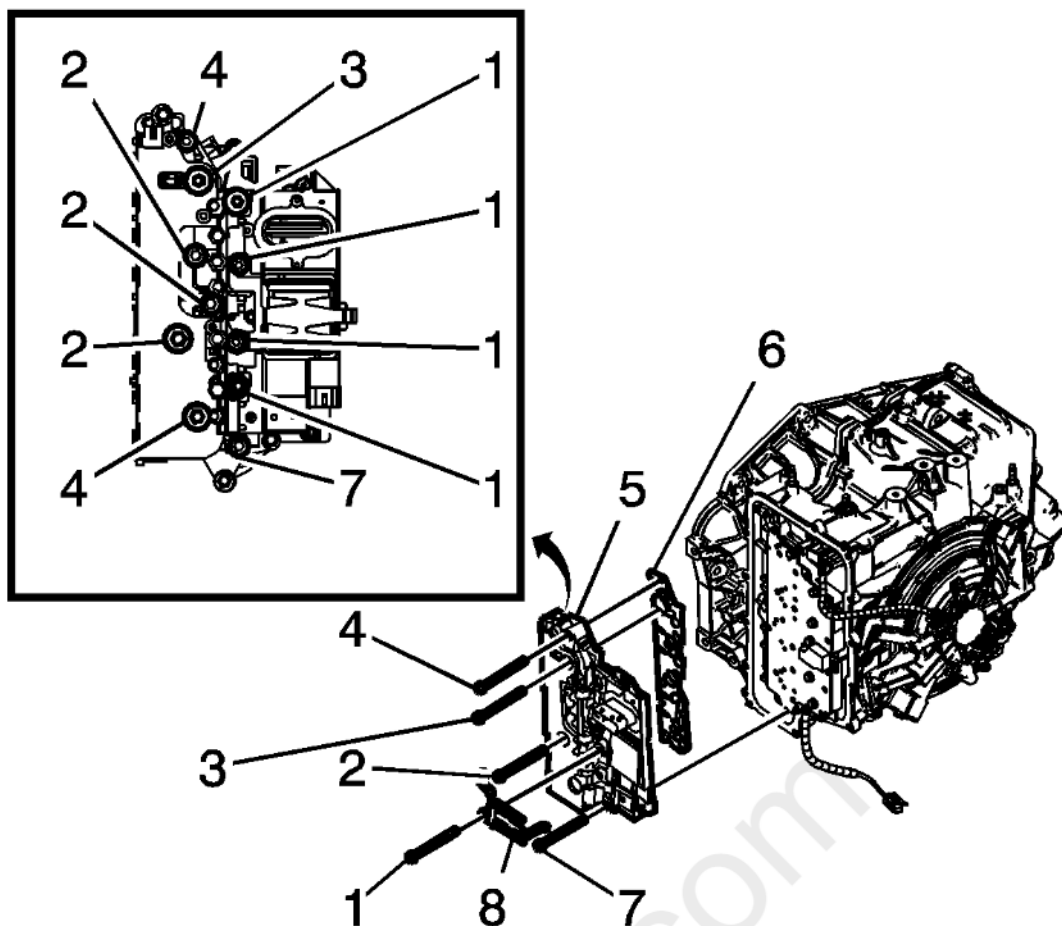


Fig. 33: Identifying Control Valve Body Components

Courtesy of GENERAL MOTORS COMPANY

5. Remove the 4 control valve body bolts (1) M6 x 80.
6. Position the control solenoid valve spring (8) to the side. Spring will be released with the removal of the control valve body assembly.
7. Remove the 2 control valve body bolts (4) M6 x 65.
8. Remove the control valve body bolt (3) M6 x 42.
9. Remove the 3 control valve body bolts (2) M6 x 95.
10. Remove the control valve body bolt (7) M6 x 55.
11. Remove the control solenoid valve body and transmission control module (TCM) assembly (5).

CAUTION: Use care when removing or installing the filter plate assembly. A broken or missing retaining tab may not adequately secure the filter plate to the control solenoid valve assembly, resulting in possible damage or contamination.

12. Remove the control solenoid valve assembly filter plate (6).
 - Discard the filler plate. It is not reusable.
 - Inspect the upper channel plate bolt holes for damage, peening or burnelling. Any damage around the bolt holes near the pressure control switch (PCS) feed holes could cause leakage around the PCS seals. Replace the upper channel plate as necessary.

Installation Procedure

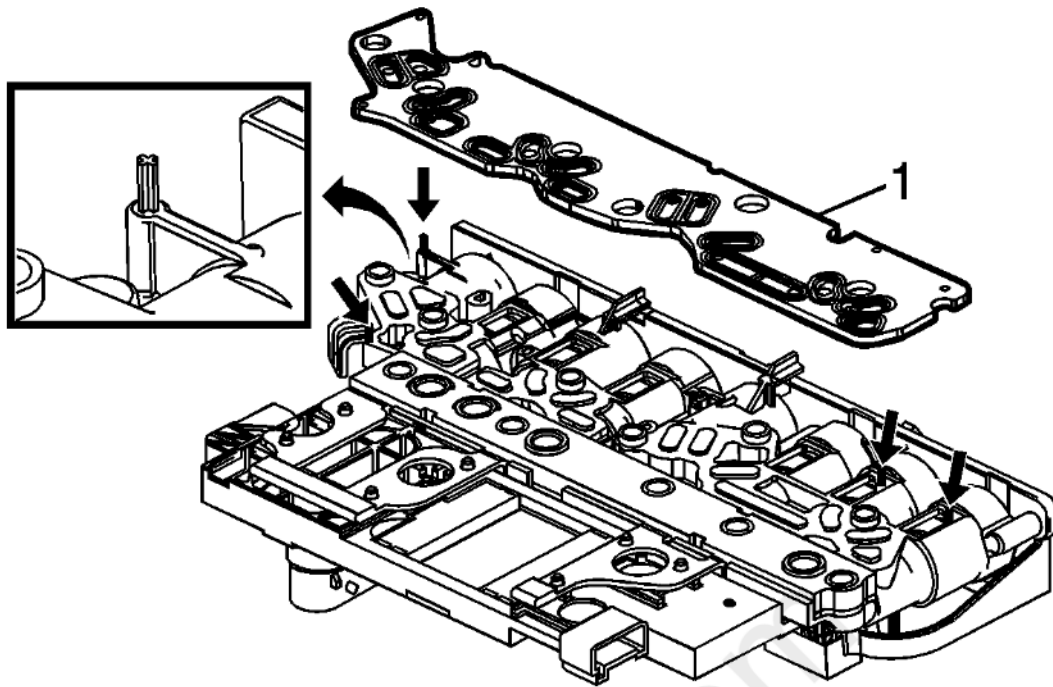


Fig. 34: Control Solenoid Valve Assembly Filter Plate

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Use care when removing or installing the filter plate assembly. A broken or missing retaining tab may not adequately secure the filter plate to the control solenoid valve assembly, resulting in possible damage or contamination.

1. Install a NEW control solenoid valve assembly filter plate (1).

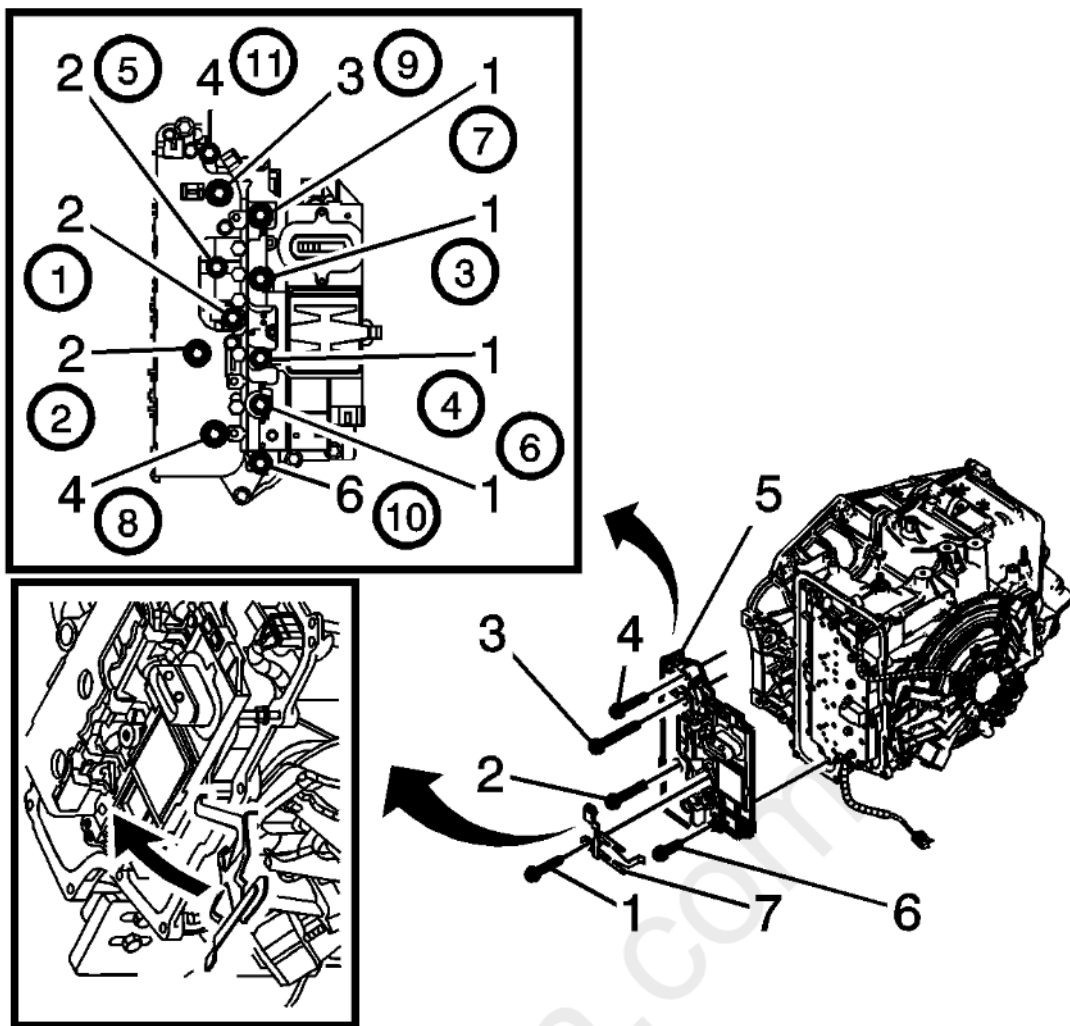


Fig. 35: Control Solenoid Valve Body And TCM Assembly With Bolt Tightening Sequence
 Courtesy of GENERAL MOTORS COMPANY

2. Install the control solenoid valve body and TCM assembly (5).
3. Rotate the control solenoid valve spring (7) into position.

CAUTION: Refer to **Fastener Caution** .

NOTE: Install all bolts before tightening, then tighten in specified sequence.

4. Install the 4 control valve body bolts (1) M6 x 80.
5. Install the control valve body bolt (6) M6 x 55.
6. Install the 3 control valve body bolts (2) M6 x 95.
7. Install the control valve body bolt (3) M6 x 42.
8. Install the 2 control valve body bolts (4) M6 x 65.
9. Tighten all valve body bolts in specified sequence to 12 N.m (106 lb in).

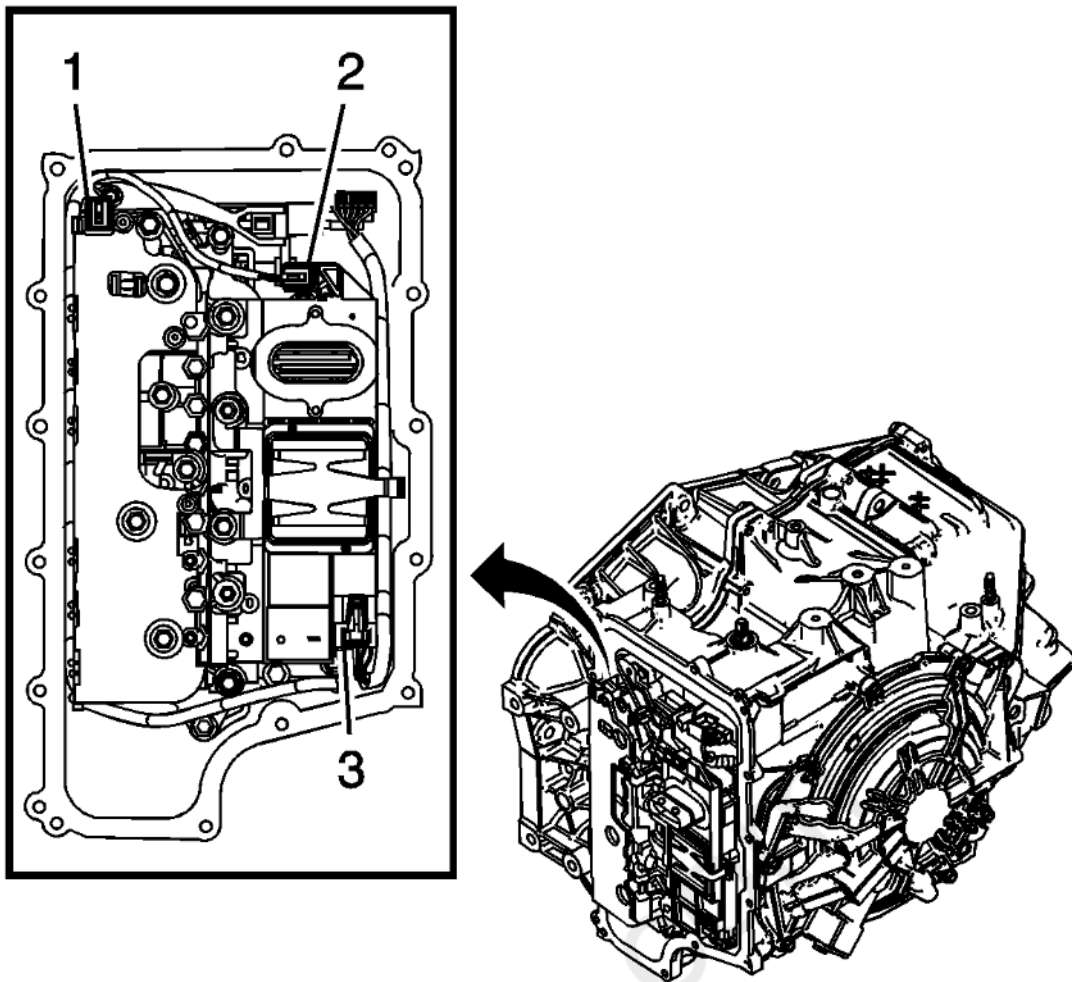


Fig. 36: Speed Sensor And Shift Position Switch Electrical Connectors

Courtesy of GENERAL MOTORS COMPANY

10. Connect the input speed sensor electrical connector (1).
11. Connect the output speed sensor electrical connector (2).
12. Connect the shift position switch electrical connector (3).
13. Install the control valve body cover. Refer to [Control Valve Body Cover Replacement](#).
14. For transmission control module programming and setup. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Programming and Setup \(6T70/6T75\)](#).

CONTROL VALVE LOWER BODY AND UPPER BODY REPLACEMENT

Removal Procedure

1. Remove the control valve body cover. Refer to [Control Valve Body Cover Replacement](#).

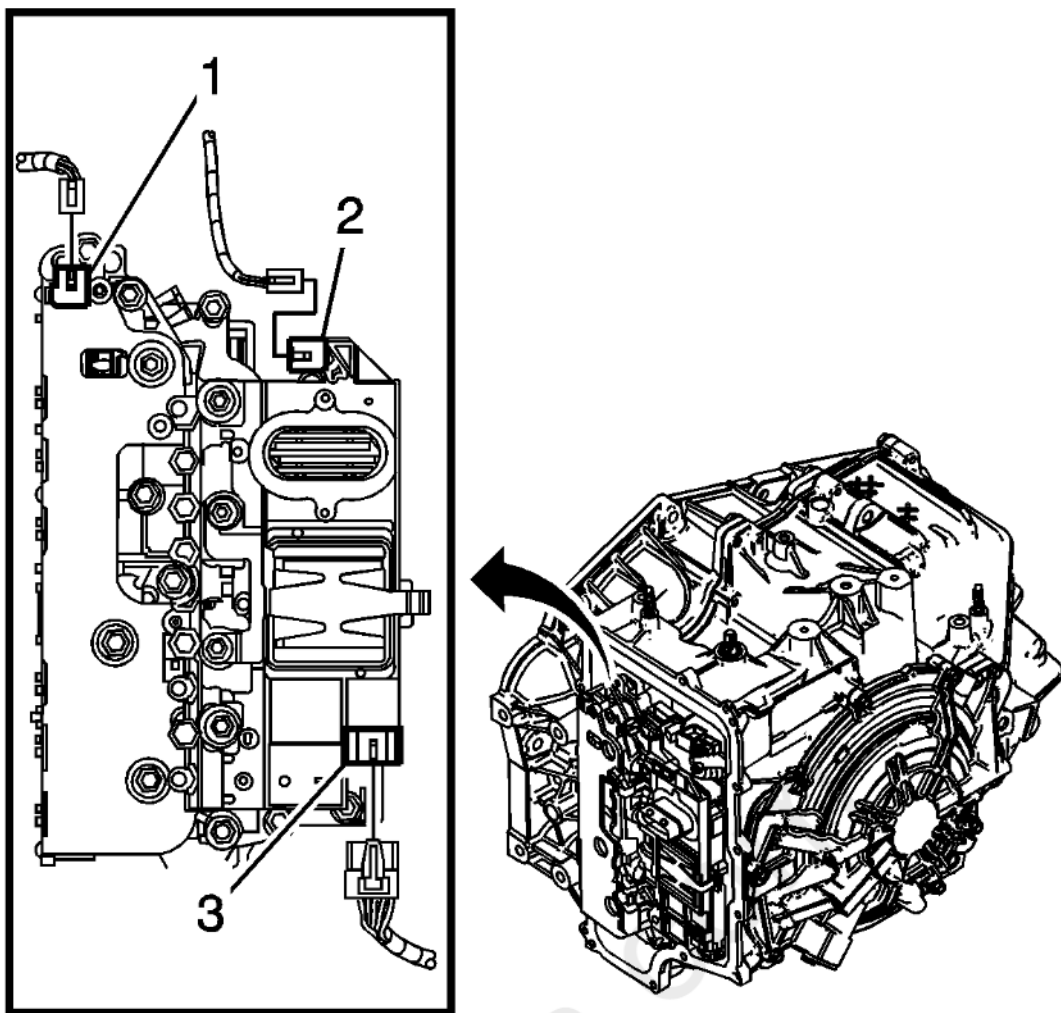


Fig. 37: Speed Sensor And Shift Position Switch Electrical Connectors

Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the input speed sensor electrical connector (1).
3. Disconnect the output speed sensor electrical connector (2).
4. Disconnect the shift position switch electrical connector (3).

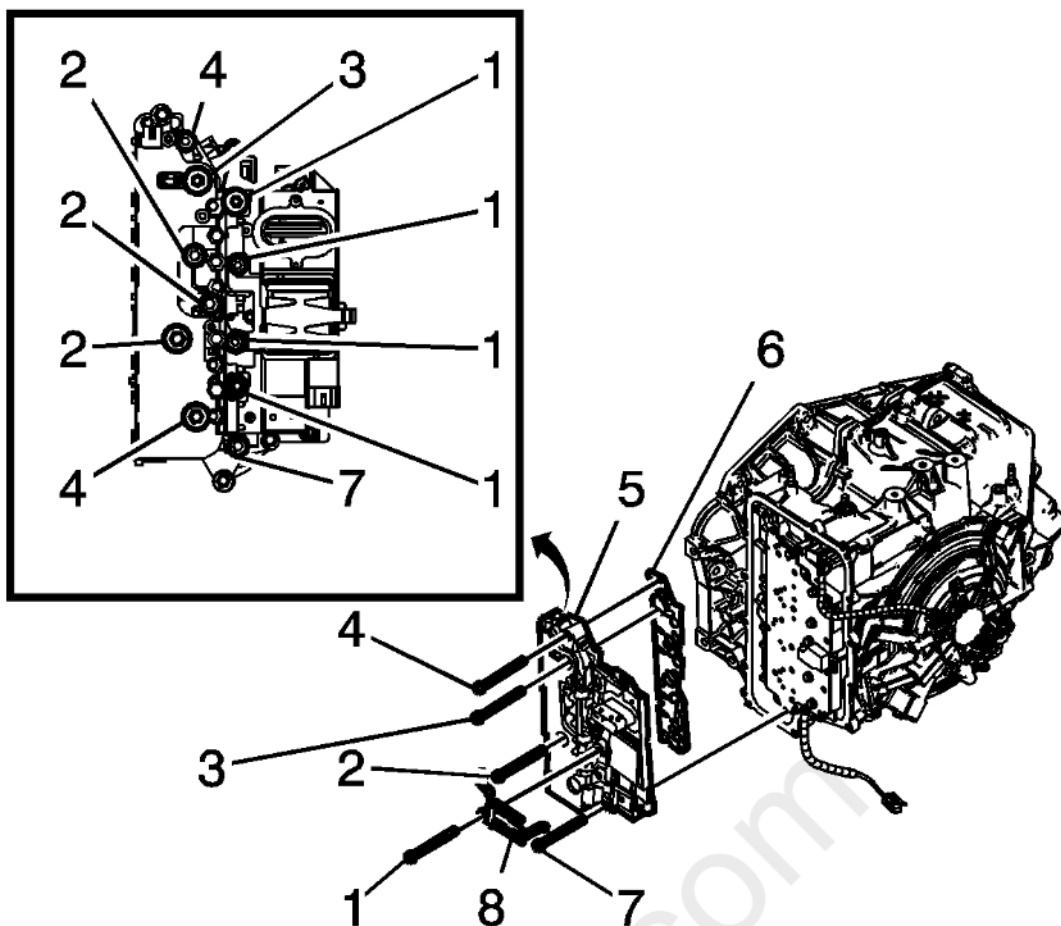


Fig. 38: Identifying Control Valve Body Components

Courtesy of GENERAL MOTORS COMPANY

5. Remove the 4 control valve body bolts (1) M6 x 80.
6. Position the control solenoid valve spring (8) to the side. Spring will be released with removal of lower control valve body.
7. Remove the 2 control valve body bolts (4) M6 x 65.
8. Remove the control valve body bolt (3) M6 x 42.
9. Remove the 3 control valve body bolts (2) M6 x 95.
10. Remove the control valve body bolt (7) M6 x 55.
11. Remove the control solenoid valve body and transmission control module (TCM) assembly (5).

CAUTION: Use care when removing or installing the filter plate assembly. A broken or missing retaining tab may not adequately secure the filter plate to the control solenoid valve assembly, resulting in possible damage or contamination.

12. Remove the control solenoid valve body assembly filter plate (6).
 - Discard the filler plate. It is not reusable.
 - Inspect the pressure switch manifold seals for damage or contamination. Replace the control solenoid valve assembly as necessary.
 - Inspect the upper channel plate bolt holes for damage, peening or burnelling. Any damage around the bolt holes near the PCS switch feed holes could cause leakage around the PCS switch seals. Replace the upper channel plate as necessary.

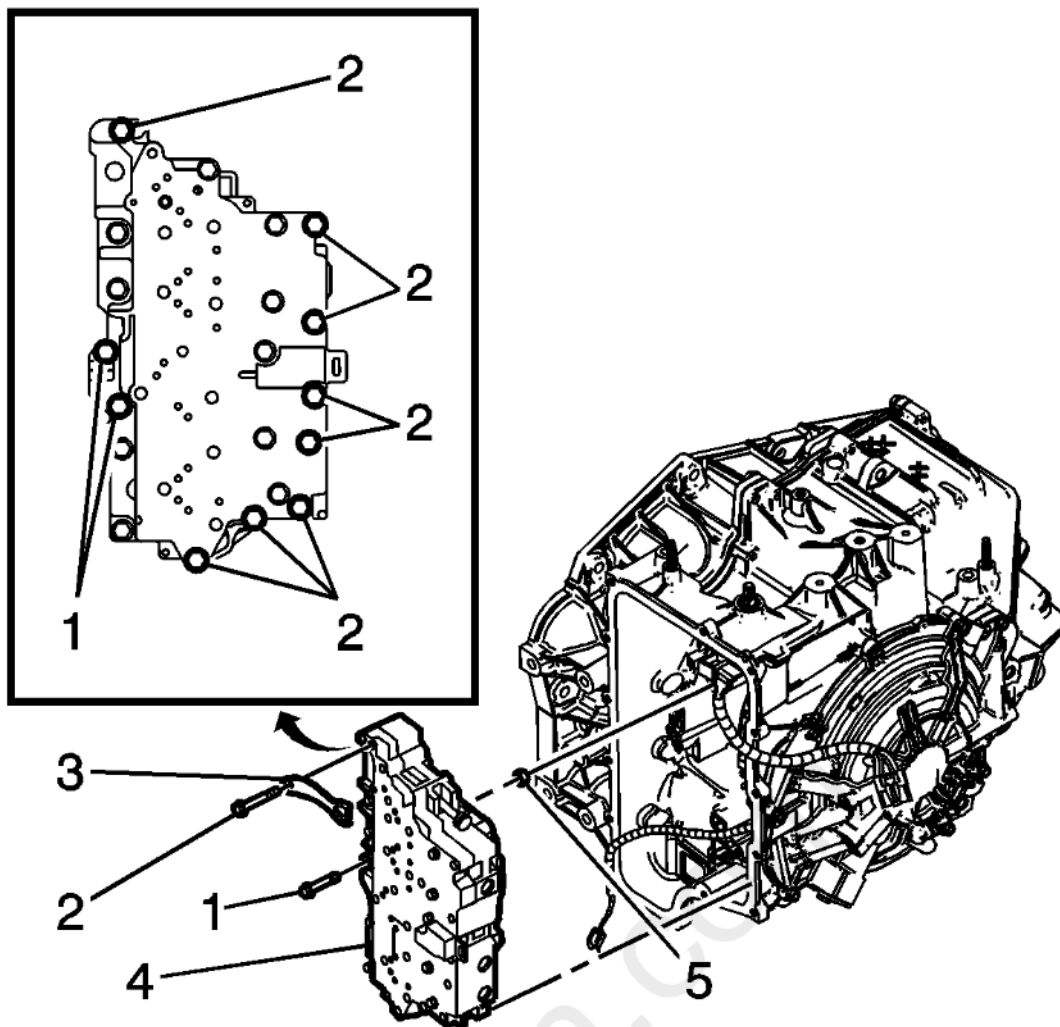


Fig. 39: Identifying Control Valve Body Components

Courtesy of GENERAL MOTORS COMPANY

13. Remove the 8 control valve body bolts (2) M6 x 65.
14. Remove the 2 control valve body bolts (1) M6 x 55.
15. Remove the manual shaft detent assembly (3).
16. Remove the control valve body assembly (4).
17. The control solenoid valve spring can now be fully removed from the lower control valve body assembly.

NOTE: The clutch fluid passage seal is not reusable.

18. Remove the 1-2-3-4 clutch fluid passage seal (5).

Installation Procedure

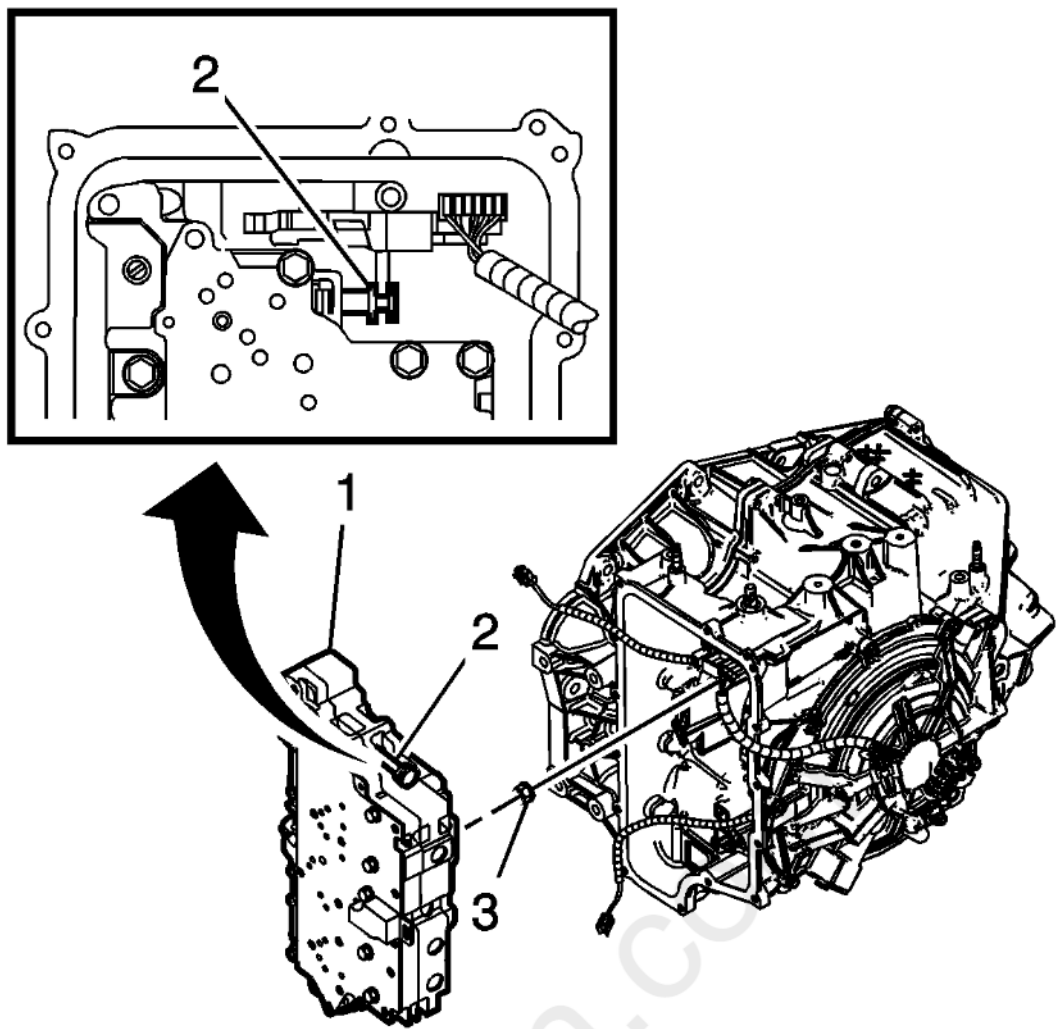


Fig. 40: Identifying Control Valve Body Components

Courtesy of GENERAL MOTORS COMPANY

NOTE: The clutch fluid passage seal is not reusable.

1. Install a NEW 1-2-3-4 clutch fluid passage seal (3).

NOTE:

- Ensure the control solenoid valve spring is attached to the lower control valve body assembly.
- Align the manual valve (2) to the detent lever assembly while installing the lower control valve body assembly.

2. Install the control valve body assembly (1).

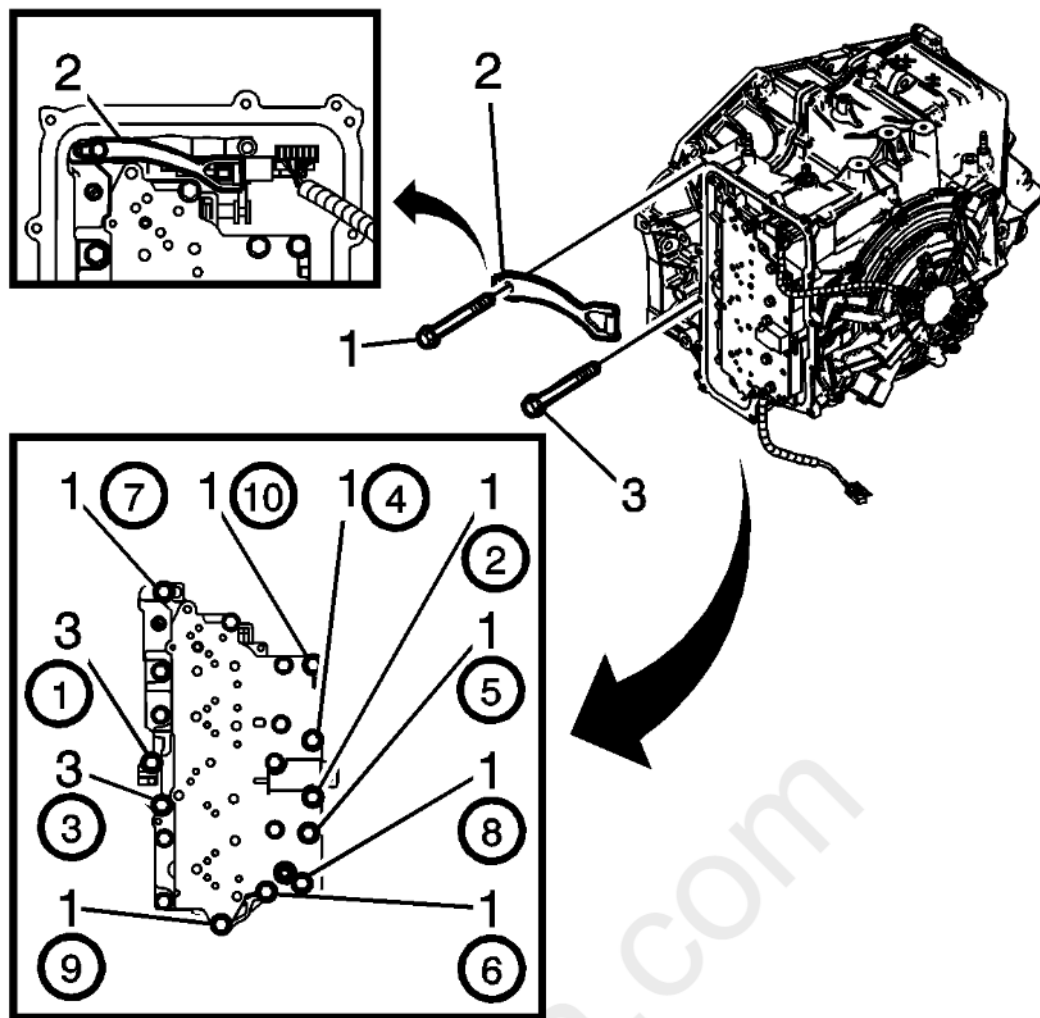


Fig. 41: Manual Shaft Detent Assembly And Control Valve Body Bolts Tightening Sequence
 Courtesy of GENERAL MOTORS COMPANY

NOTE: Ensure proper alignment of the detent assembly to the detent lever assembly with position switch while tightening the bolt. The detent assembly can move and hit the valve body assembly that could cause improper engagement with the detent lever assembly.

3. Install the manual shaft detent assembly (2).

CAUTION: Refer to [Fastener Caution](#) .

NOTE: Install all bolts before tightening, then tighten in specified sequence.

4. Install the 8 control valve body bolts (1) M6 x 65 and tighten to 12 N.m (106 lb in).

5. Install the 2 control valve body bolts (3) M6 x 55 and tighten to 12 N.m (106 lb in).

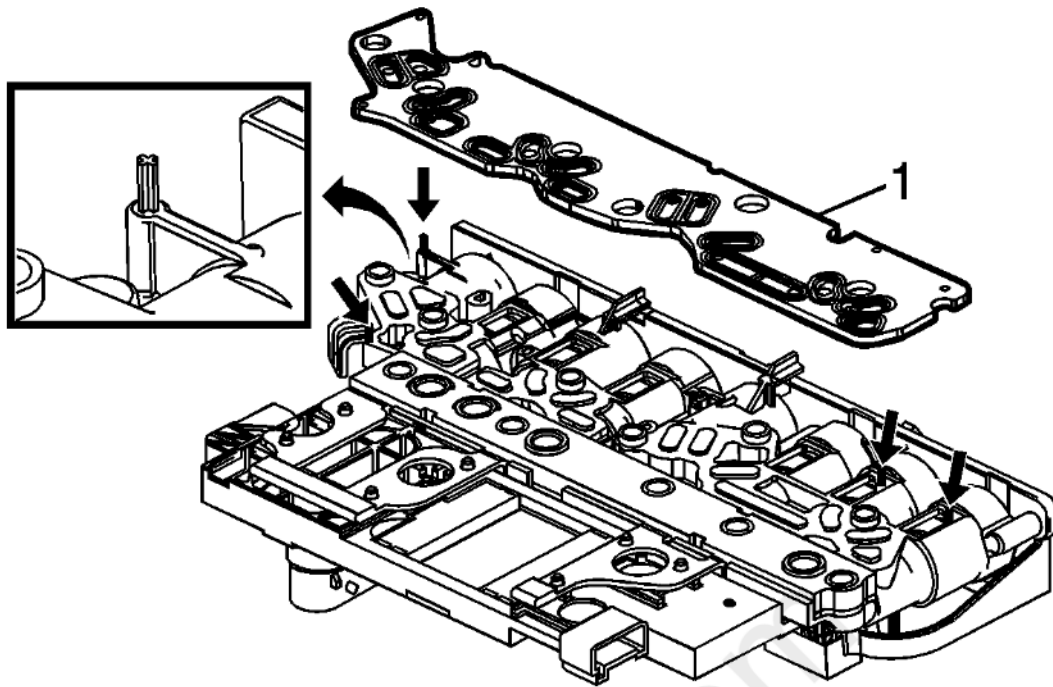


Fig. 42: Control Solenoid Valve Assembly Filter Plate

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Use care when removing or installing the filter plate assembly. A broken or missing retaining tab may not adequately secure the filter plate to the control solenoid valve assembly, resulting in possible damage or contamination.

6. Install a NEW control solenoid valve assembly filter plate (1).

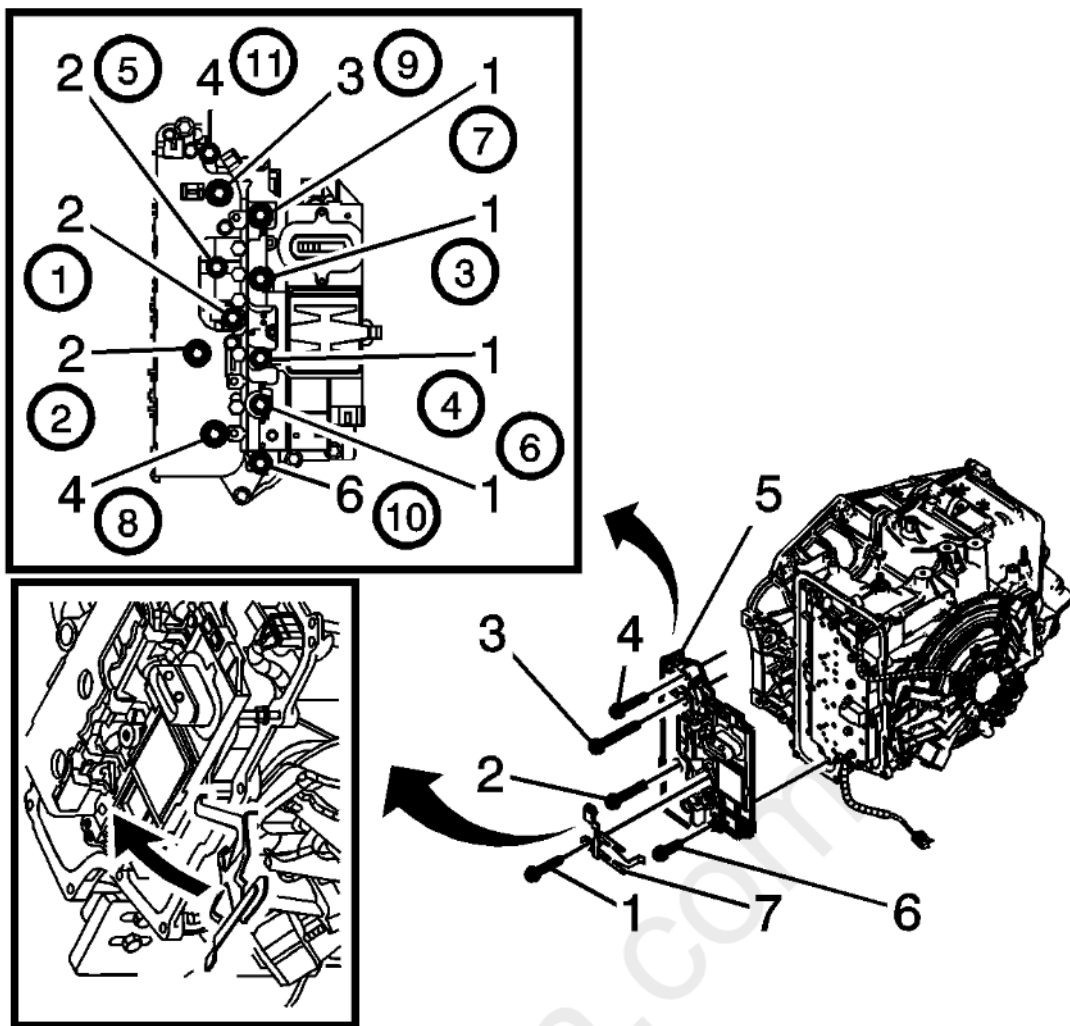


Fig. 43: Control Solenoid Valve Body And TCM Assembly With Bolt Tightening Sequence
 Courtesy of GENERAL MOTORS COMPANY

7. Install the control solenoid valve body and TCM assembly (5).
8. Rotate the control solenoid valve spring (7) into position.

NOTE: Install all bolts before tightening, then tighten in specified sequence.

9. Install the 4 control valve body bolts (1) M6 x 80.
10. Install the control valve body bolt (6) M6 x 55.
11. Install the 3 control valve body bolts (2) M6 x 95.
12. Install the control valve body bolt (3) M6 x 42.
13. Install the 2 control valve body bolts (4) M6 x 65.
14. Tighten all valve body bolts in specified sequence to 12 N.m (106 lb in).

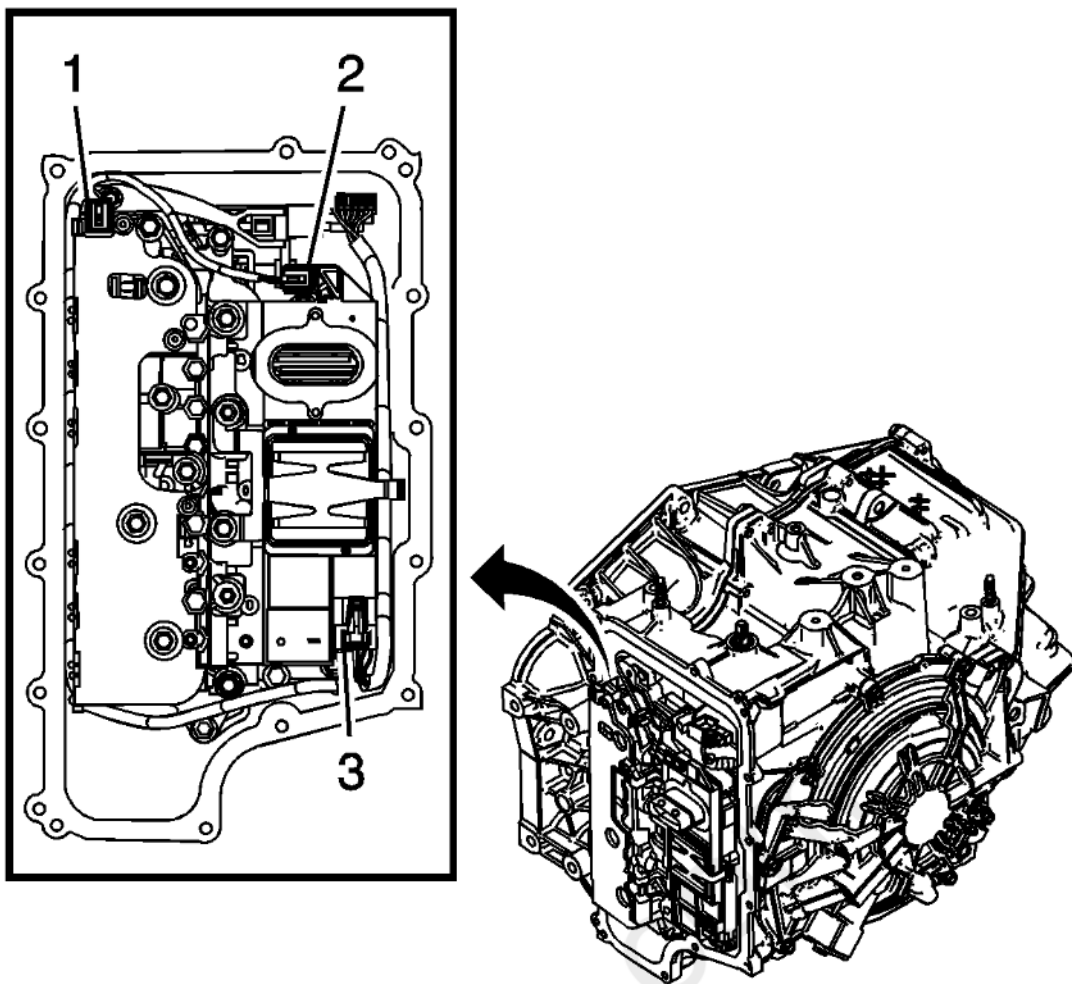


Fig. 44: Speed Sensor And Shift Position Switch Electrical Connectors

Courtesy of GENERAL MOTORS COMPANY

15. Connect the input speed sensor electrical connector (1).
16. Connect the output speed sensor electrical connector (2).
17. Connect the shift position switch electrical connector (3).
18. Install the control valve body cover. Refer to [Control Valve Body Cover Replacement](#).
19. For transmission control module programming and setup. Refer to [Control Solenoid Valve and Transmission Control Module Assembly Programming and Setup \(6T70/6T75\)](#).

TORQUE CONVERTER REPLACEMENT

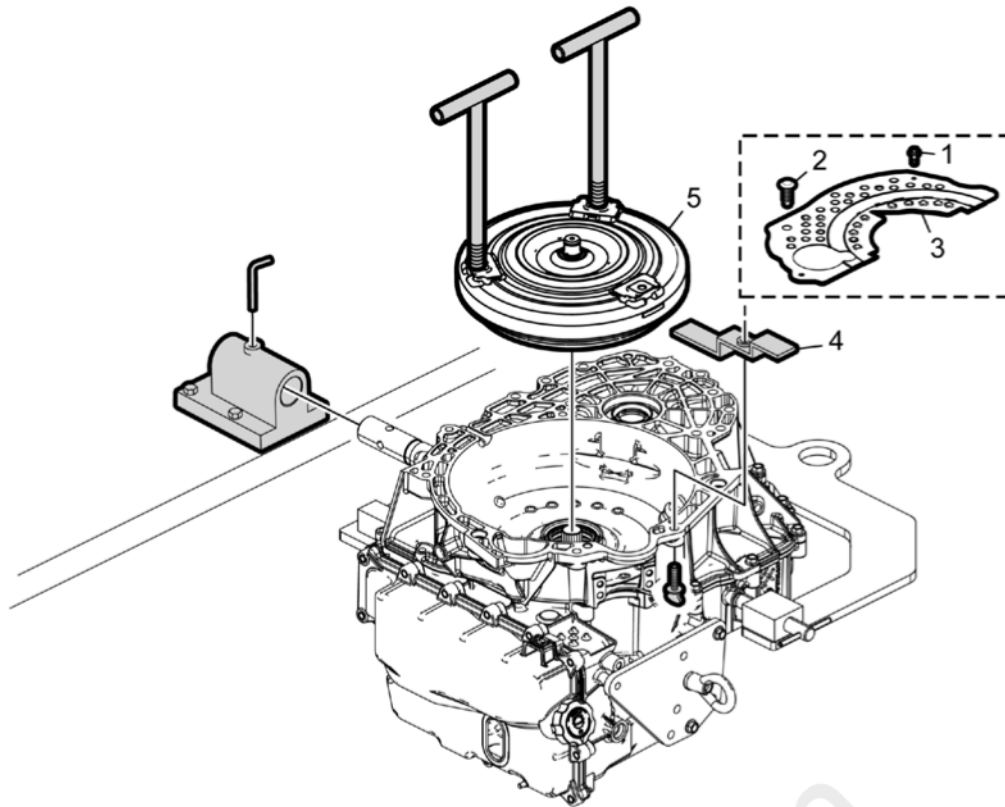


Fig. 45: Torque Converter & Mounting Components

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Remove the transmission. Refer to Transmission Replacement. 2. Position the transmission assembly so the torque converter is facing up.	
1	Dust Cover Bolt M10 x 25, Model Dependent (Qty: 2)
2	Dust Cover Push Pin, Model Dependent
3	Dust Cover, Model Dependent
4	Converter Holding Strap WARNING: The torque converter must be held to the torque converter housing by a retaining device such as shipping brackets. Without the retaining device, the torque converter may slide forward, disengaging the oil pump, or may fall completely out of the transmission causing personal injury and/or property damage. Special Tools DT-21366 Converter Holding Strap For equivalent regional tools, refer to Special Tools .

Callout	Component Name
5	Torque Converter Assembly CAUTION: Only install the lift assist handles until it stops. Do not tighten. Over tightening the lift assist handles can cause damage to the torque converter. CAUTION: Lower the torque converter straight down. Failure to lower the torque converter straight down could damage the torque converter clutch lip seal inside the torque converter clutch assembly. CAUTION: Failure to raise the torque dampener assembly straight up could damage the torque dampener clutch lip seal inside the torque dampener clutch assembly. Special Tools DT-46409 Torque Converter Lifting Handles For equivalent regional tools, refer to Special Tools .

OUTPUT SPEED SENSOR REPLACEMENT

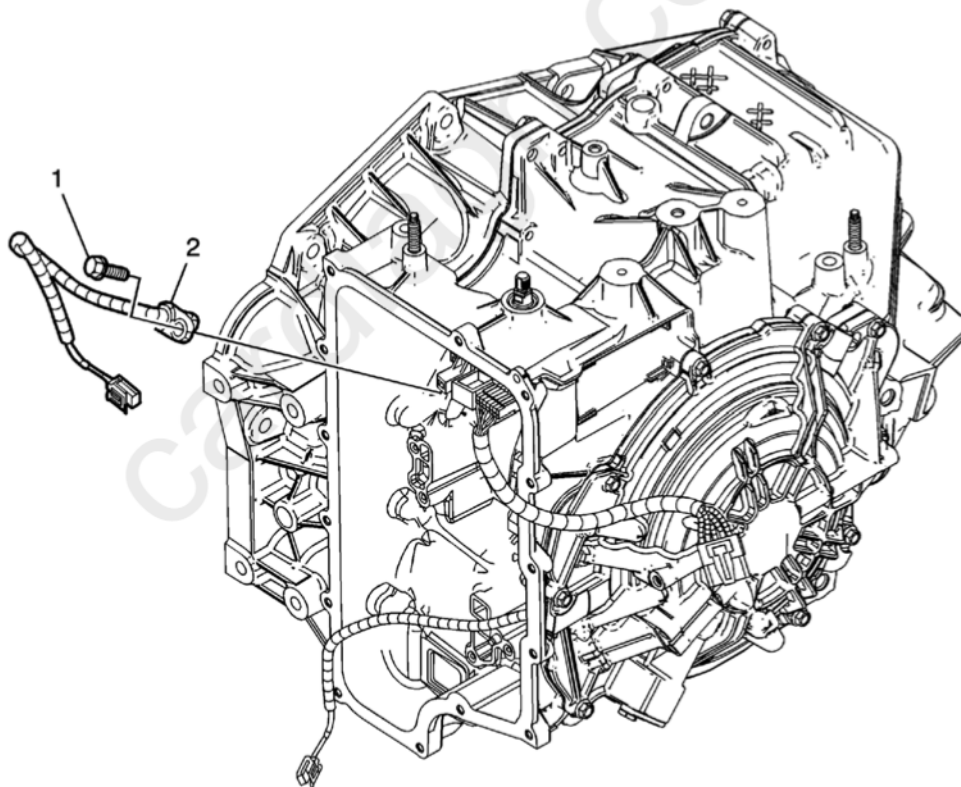


Fig. 46: Output Speed Sensor

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Remove the control valve lower body and upper body. Refer to Control Valve Lower Body and Upper Body Replacement.	

Callout	Component Name
1	Output Speed Sensor Bolt M6 x 25 CAUTION: Refer to Fastener Caution . Tighten 12 N.m (106 lb in)
2	Output Speed Sensor Procedure Perform the service fast learn adapt procedure. NOTE: After an internal transmission repair or internal part replacement the service fast learn adapt procedure should be performed.

INPUT SPEED SENSOR REPLACEMENT

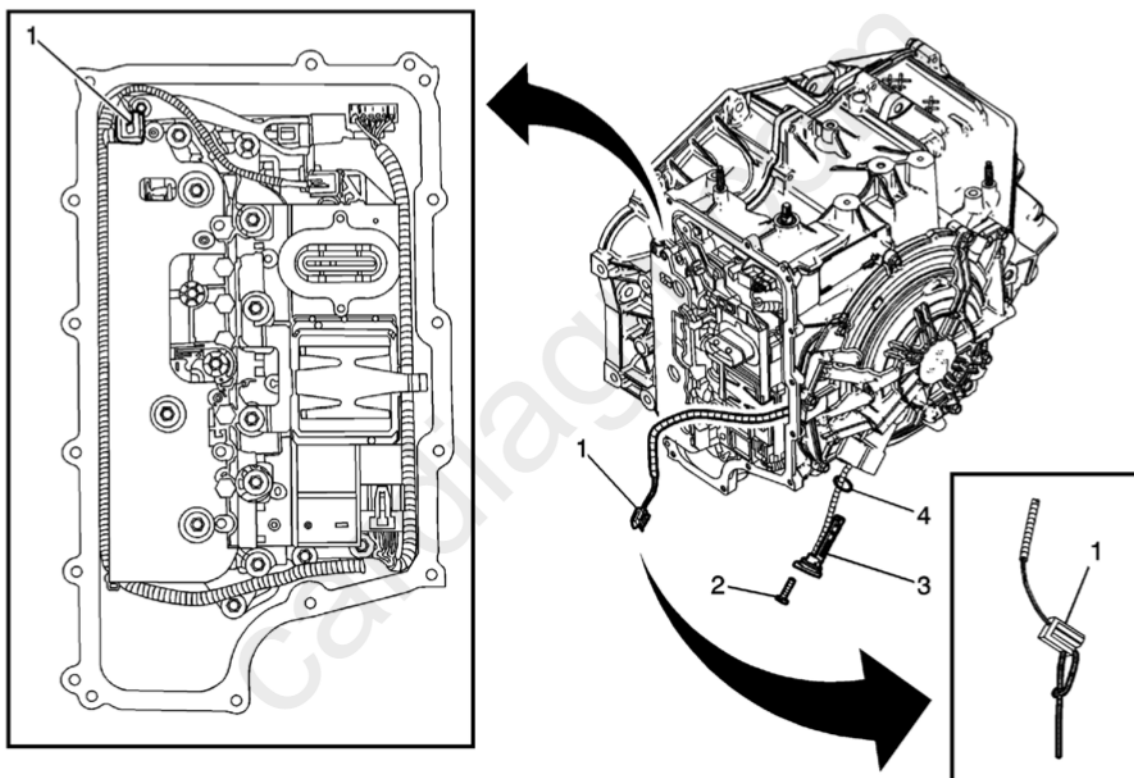


Fig. 47: Input Speed Sensor Components

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Drain the transmission, refill when repair is completed. Refer to Transmission Fluid Drain and Fill. 3. Remove the left front compartment splash shield. Refer to Front Compartment Splash Shield Replacement 4. Remove the transmission front mount. Refer to Transmission Front Mount Replacement. 5. Remove the control valve body cover. Refer to Control Valve Body Cover Replacement. 6. Perform the service fast learn adapt procedure.	

Callout	Component Name
1	Input Speed Sensor (ISS) Wire Harness Procedure Attach the DT-47734 tether to the ISS electrical connector locking tab before removal of old ISS to assist in installation of the new ISS. Special Tools DT-47734 Speed Sensor Harness Tether For equivalent regional tools, refer to Special Tools .
2	Input Speed Sensor Bolt M6 x 25 CAUTION: Refer to Fastener Caution . Procedure Apply threadlocker to the input speed sensor bolt. Refer to Adhesives, Fluids, Lubricants, and Sealers for the recommended threadlock material. Tighten 9 N.m (80 lb in)
3	Input Speed Sensor NOTE: After an internal transmission repair or internal part replacement the service fast learn adapt procedure should be performed.
4	Input Speed Sensor Seal

TRANSMISSION BRACE REPLACEMENT

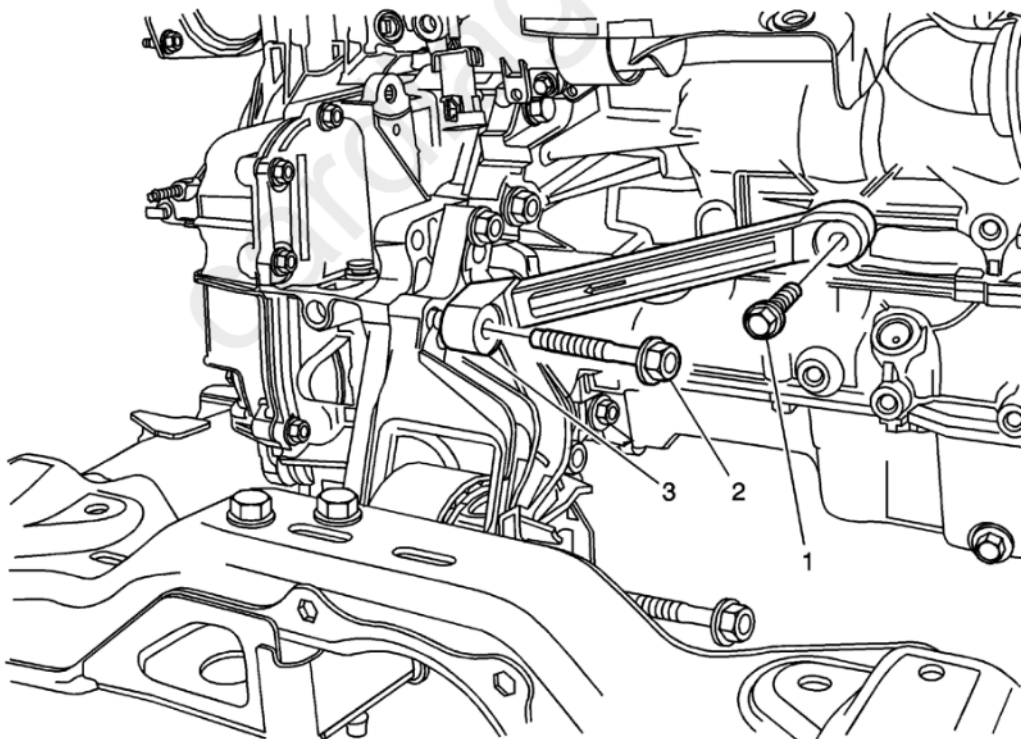


Fig. 48: Transmission Brace & Bolts

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle. 2. Support the transaxle with a transaxle jack.	
1	Transaxle Brace Bolt CAUTION: Refer to Fastener Caution . Tighten 50 N.m (37 lb ft)
2	Transaxle Brace Bolt Tighten 100 N.m (74 lb ft)
3	Transaxle Brace

TRANSMISSION MOUNT REPLACEMENT - LEFT SIDE

Removal Procedure

1. Remove the battery tray. Refer to [Battery Tray Replacement](#).
2. Install the engine support fixture. Refer to [Engine Support Fixture](#).
3. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).

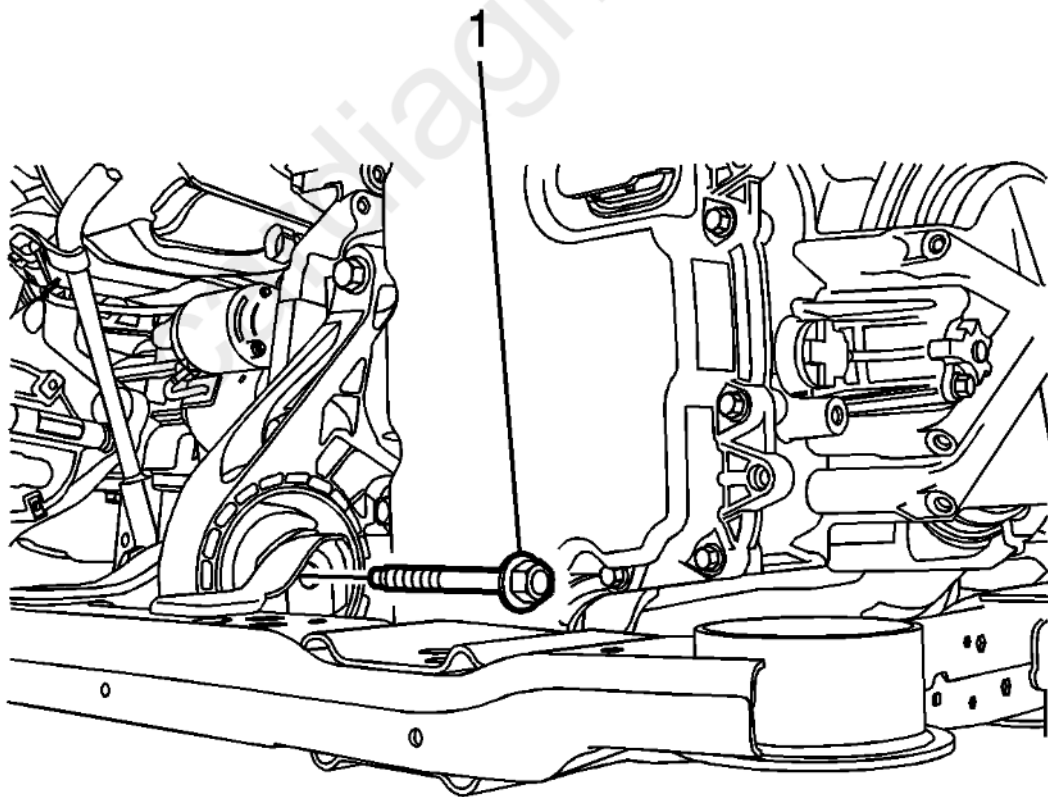


Fig. 49: Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS COMPANY

4. Remove the front transmission mount through bolt (1).

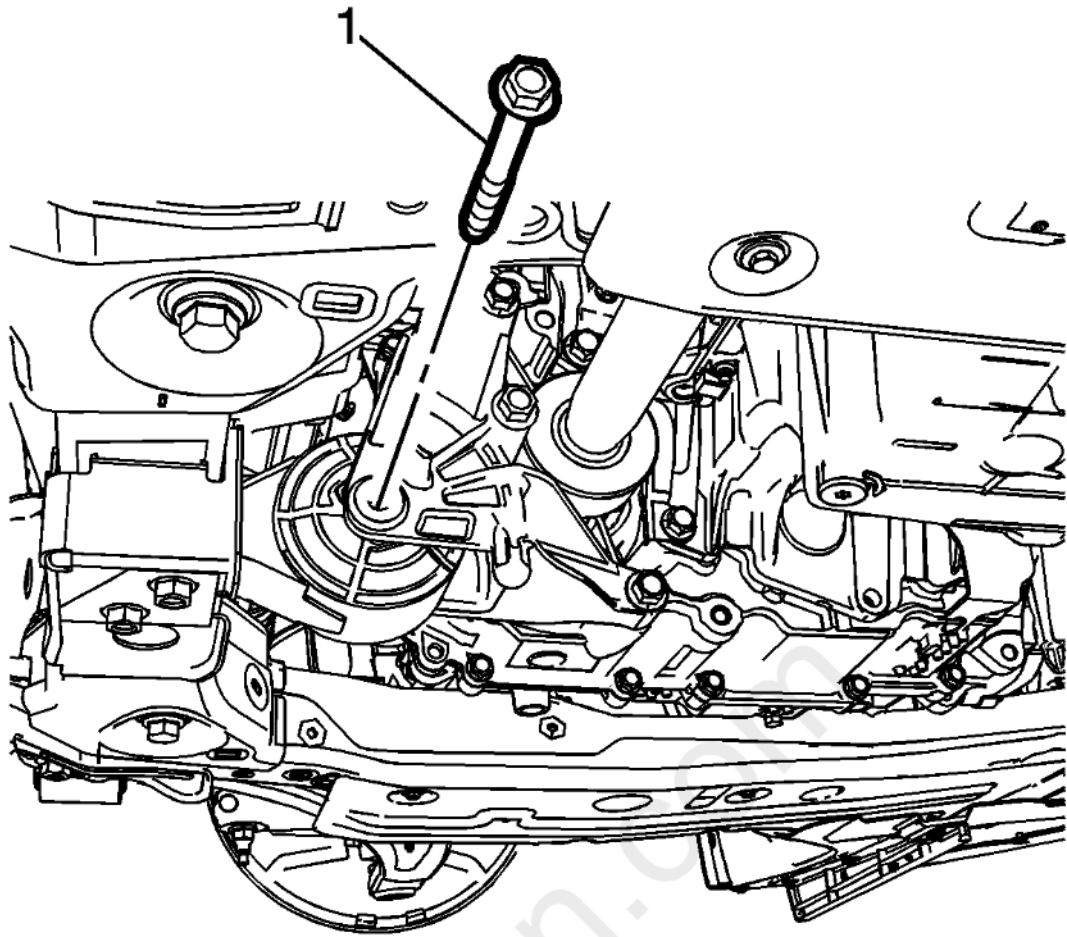


Fig. 50: Rear Transmission Mount Through Bolt

Courtesy of GENERAL MOTORS COMPANY

5. Remove the rear transmission mount through bolt (1).

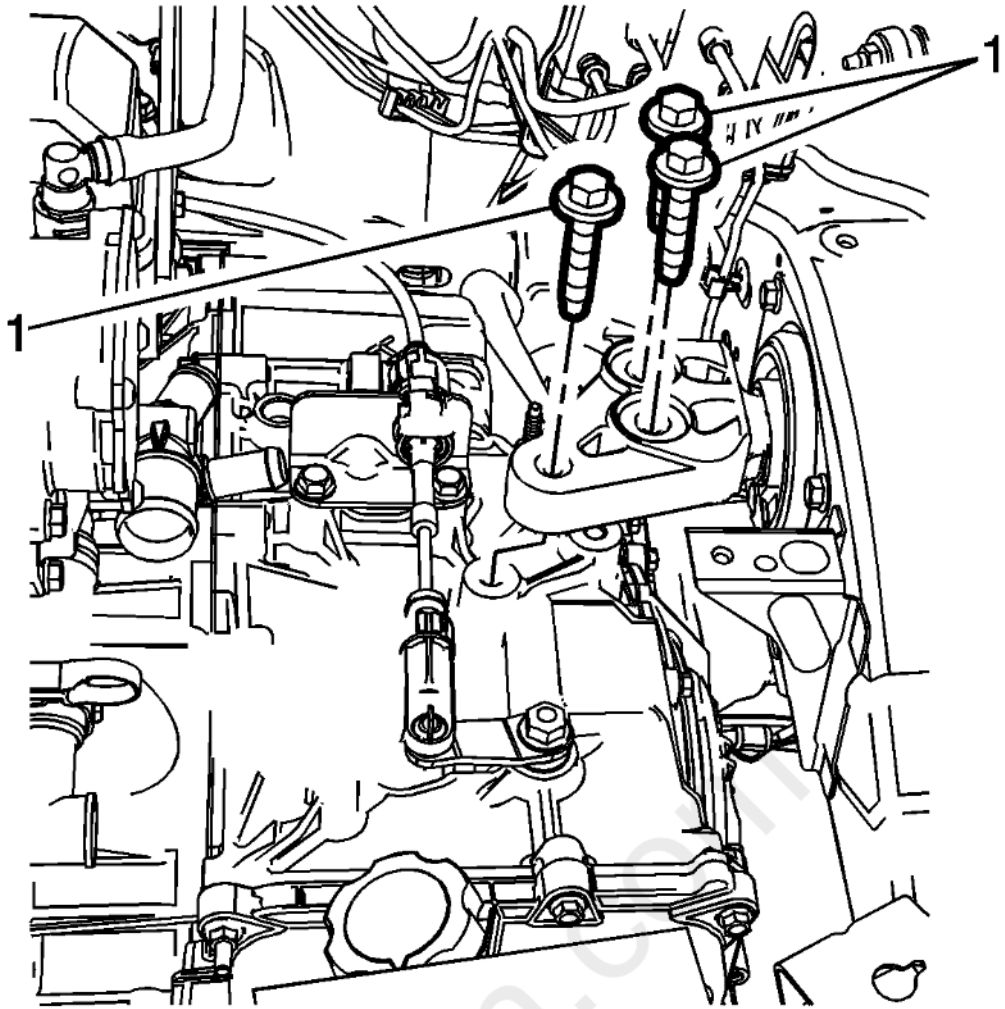


Fig. 51: Transmission Mount To Transmission Bolts

Courtesy of GENERAL MOTORS COMPANY

6. Remove the transmission mount to transmission bolts (1).

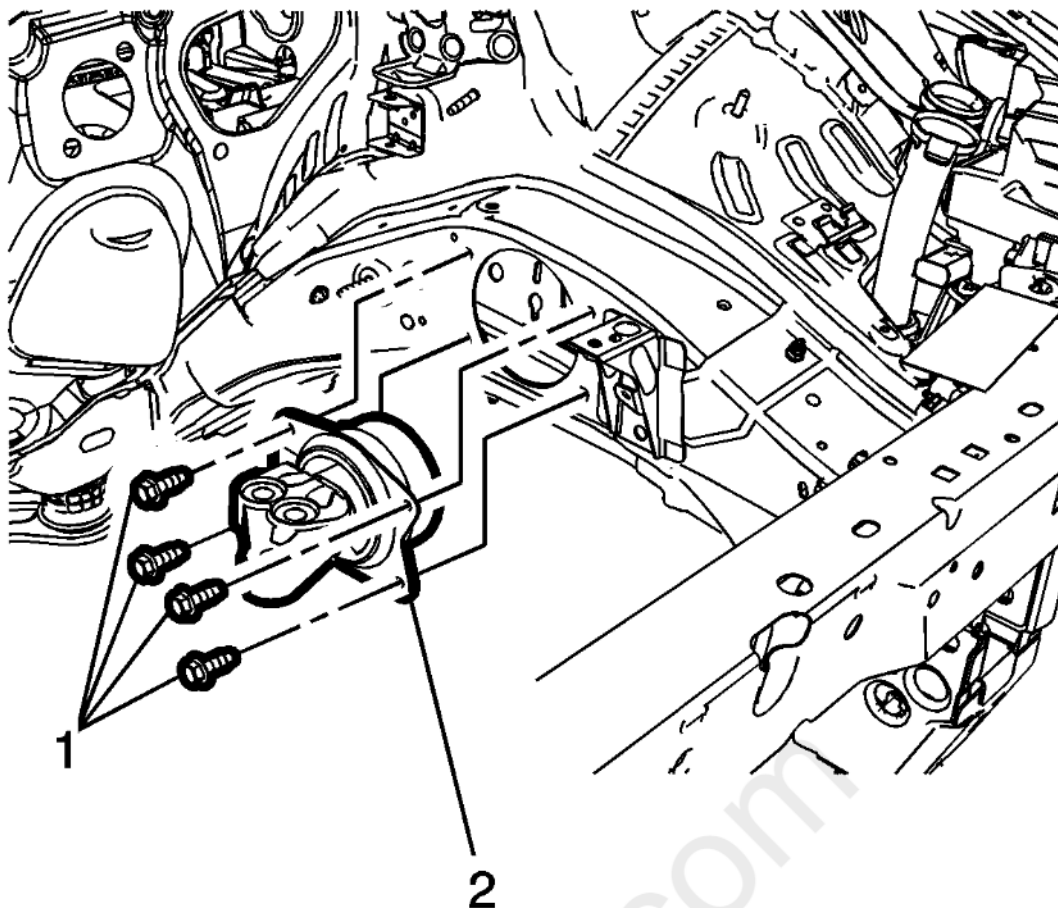


Fig. 52: Left Transmission Mount And Bolts

Courtesy of GENERAL MOTORS COMPANY

7. Using the engine support, lower the transmission enough to provide clearance for the left transmission mount.
8. Remove the transmission mount to frame rail bolts (1).
9. Remove the left transmission mount (2).

Installation Procedure

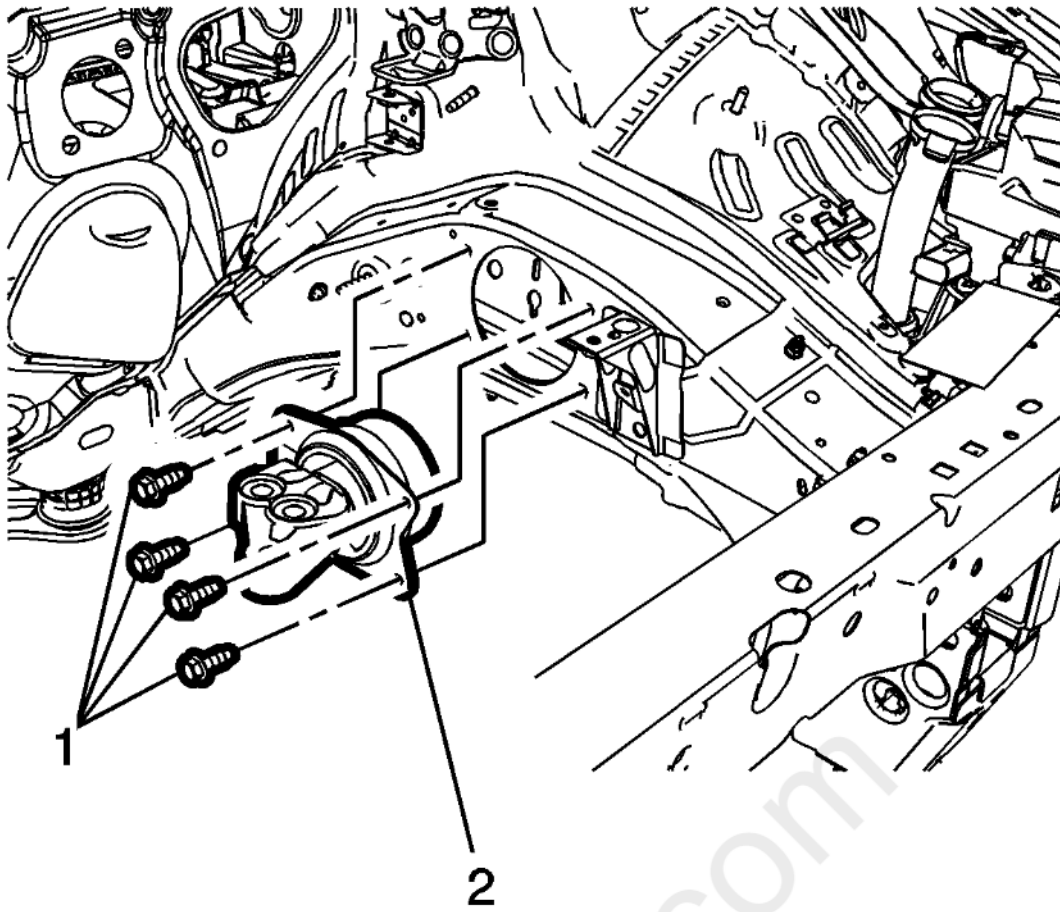


Fig. 53: Left Transmission Mount And Bolts
Courtesy of GENERAL MOTORS COMPANY

1. Install the left transmission mount (2).

CAUTION: Refer to **Fastener Caution** .

2. Install the transmission mount to frame rail bolts (1) and tighten to 22 N.m (16 lb ft).
3. Using the engine support, raise the transmission until the transmission contacts the left transmission mount.

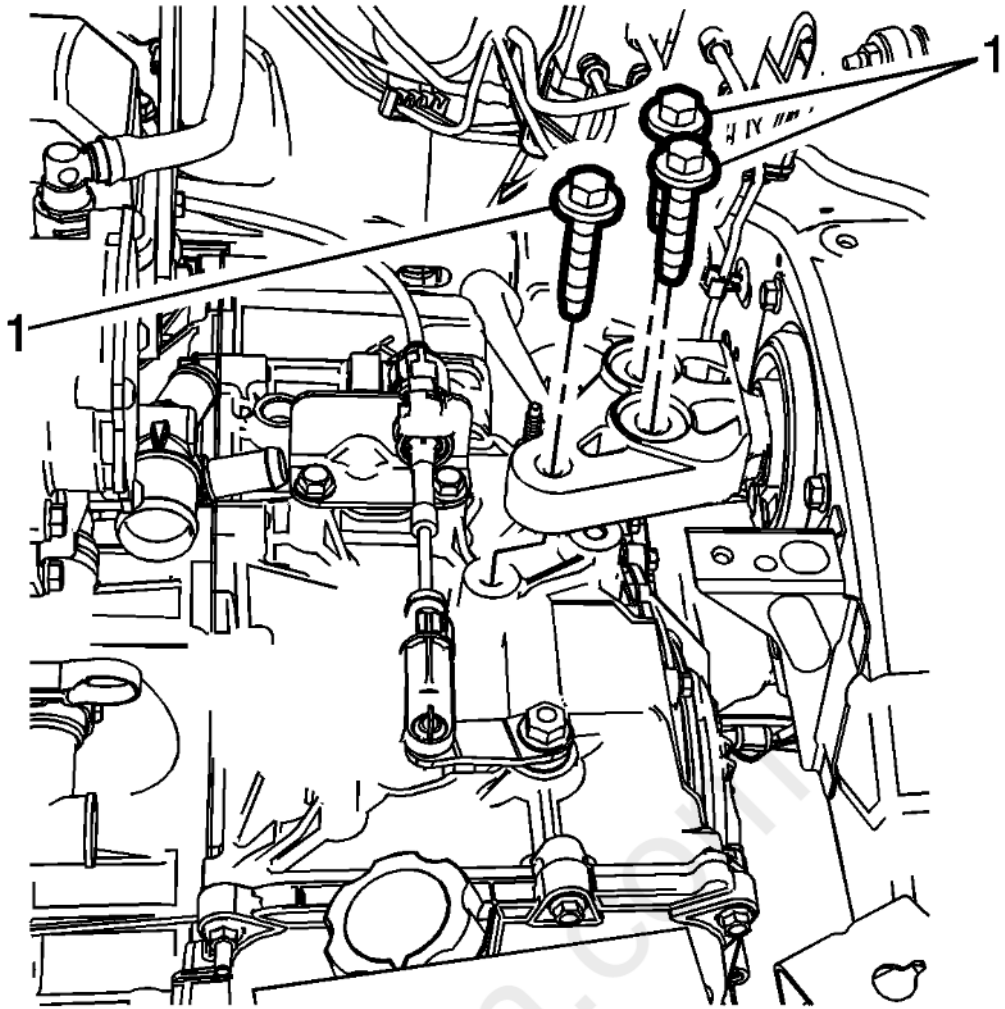


Fig. 54: Transmission Mount To Transmission Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE: DO NOT reuse the old bolts. Always use NEW bolts when reinstalling the mount.

4. Install the transmission mount to transmission bolts (1) and tighten to 50 N.m (37 lb ft) plus 60 - 75 degrees.
5. Raise the vehicle.

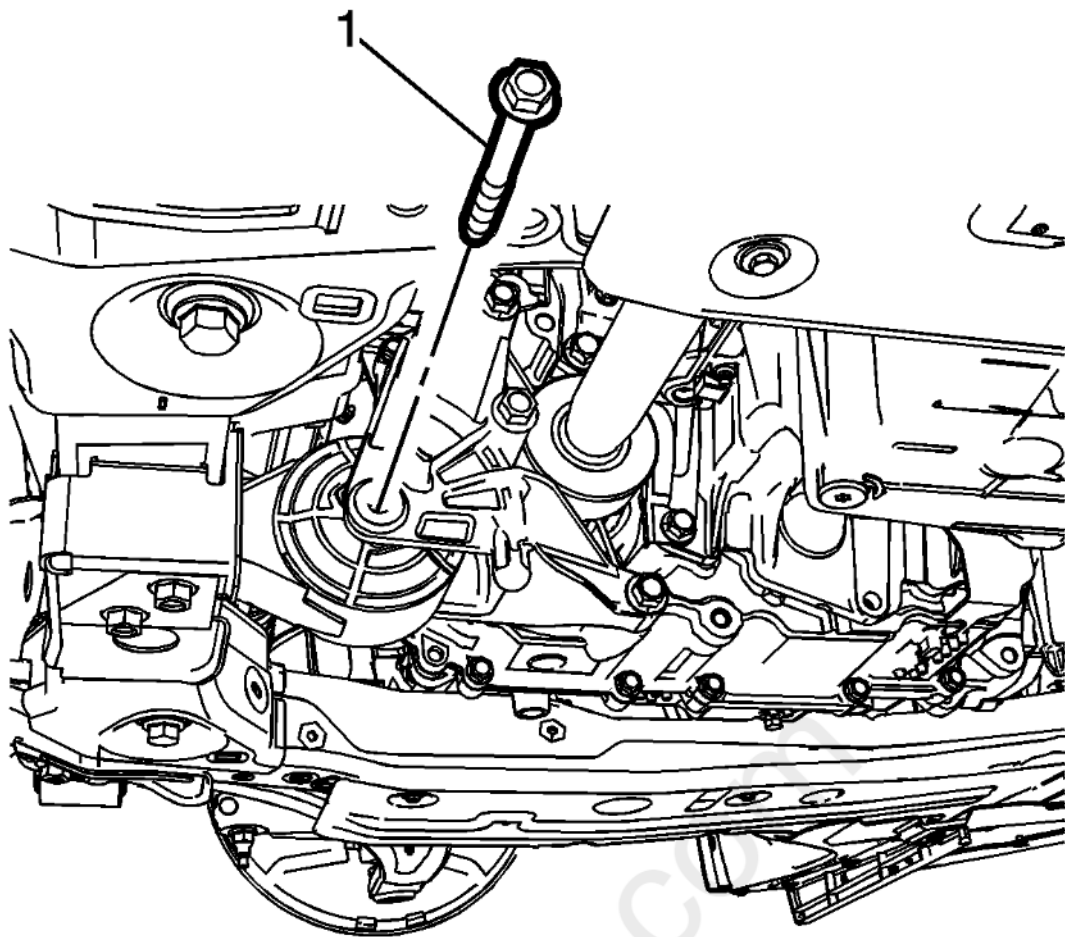


Fig. 55: Rear Transmission Mount Through Bolt

Courtesy of GENERAL MOTORS COMPANY

6. Install the rear transmission mount through bolt (1) and tighten to 105 N.m (77 lb ft).

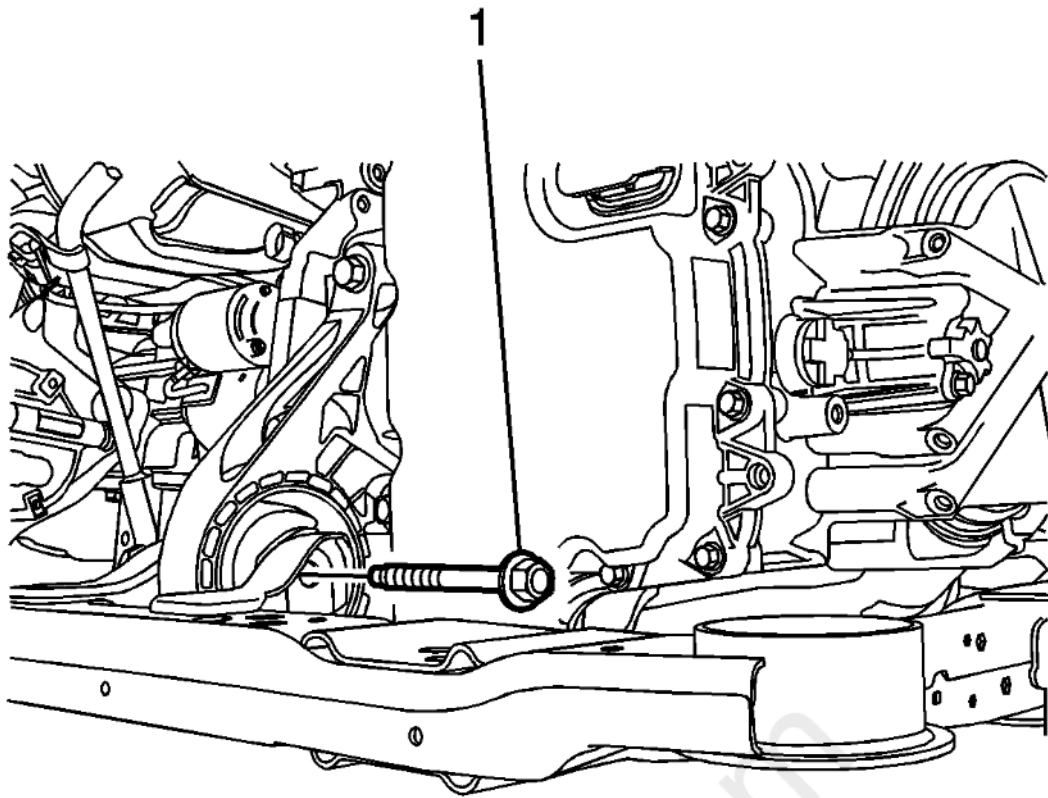


Fig. 56: Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS COMPANY

7. Install the front transmission mount through bolt (1) and tighten to 100 N.m (74 lb ft).
8. Lower the vehicle.
9. Remove the engine support fixture.
10. Install the battery box. Refer to [Battery Tray Replacement](#) .

TRANSMISSION FRONT MOUNT REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .

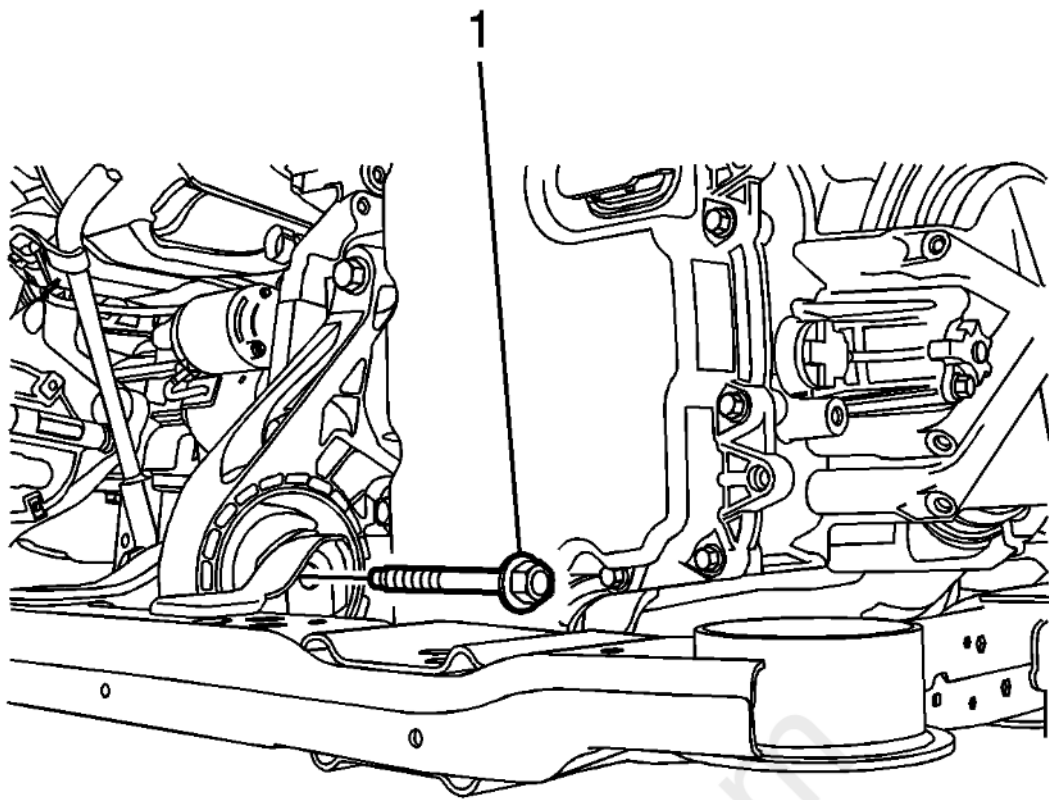


Fig. 57: Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS COMPANY

2. Remove the front transaxle mount through bolt (1).
3. Support the transmission with a suitable jack.

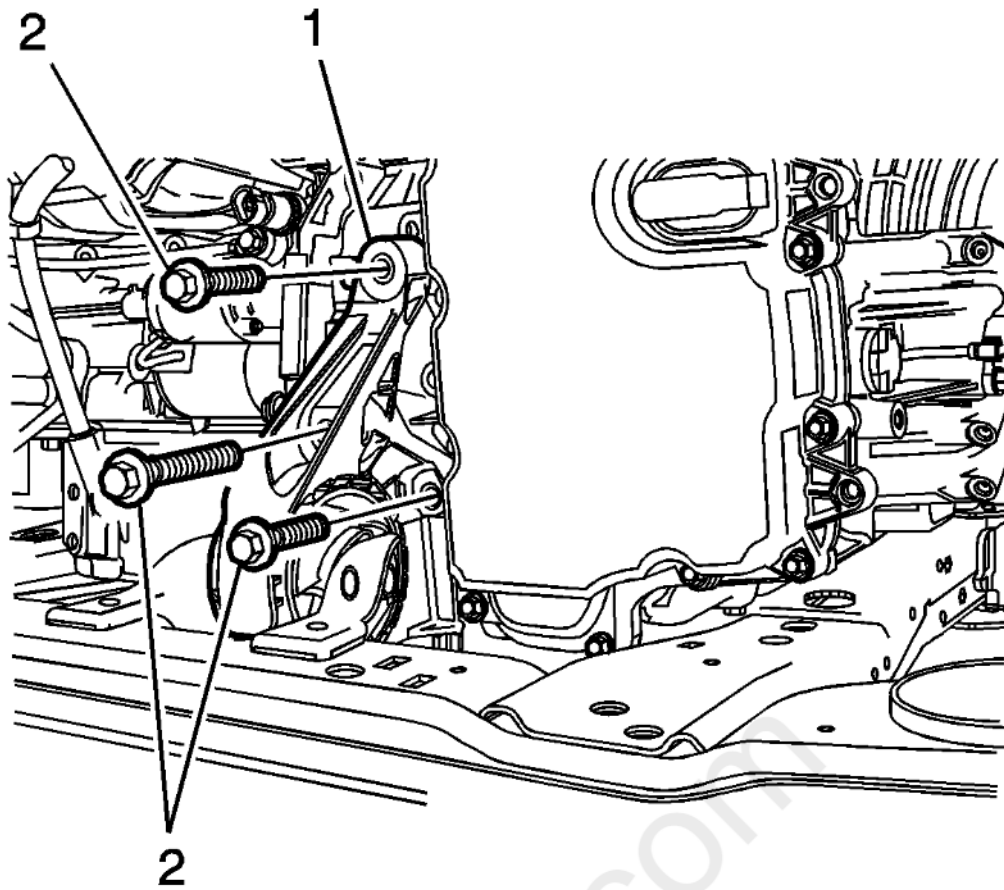


Fig. 58: Transmission Mount And Attachment Bolts

Courtesy of GENERAL MOTORS COMPANY

4. Remove and discard the three transaxle mount-to-transaxle attachment bolts (2).
5. Remove the transaxle mount (1) from the vehicle.

Installation Procedure

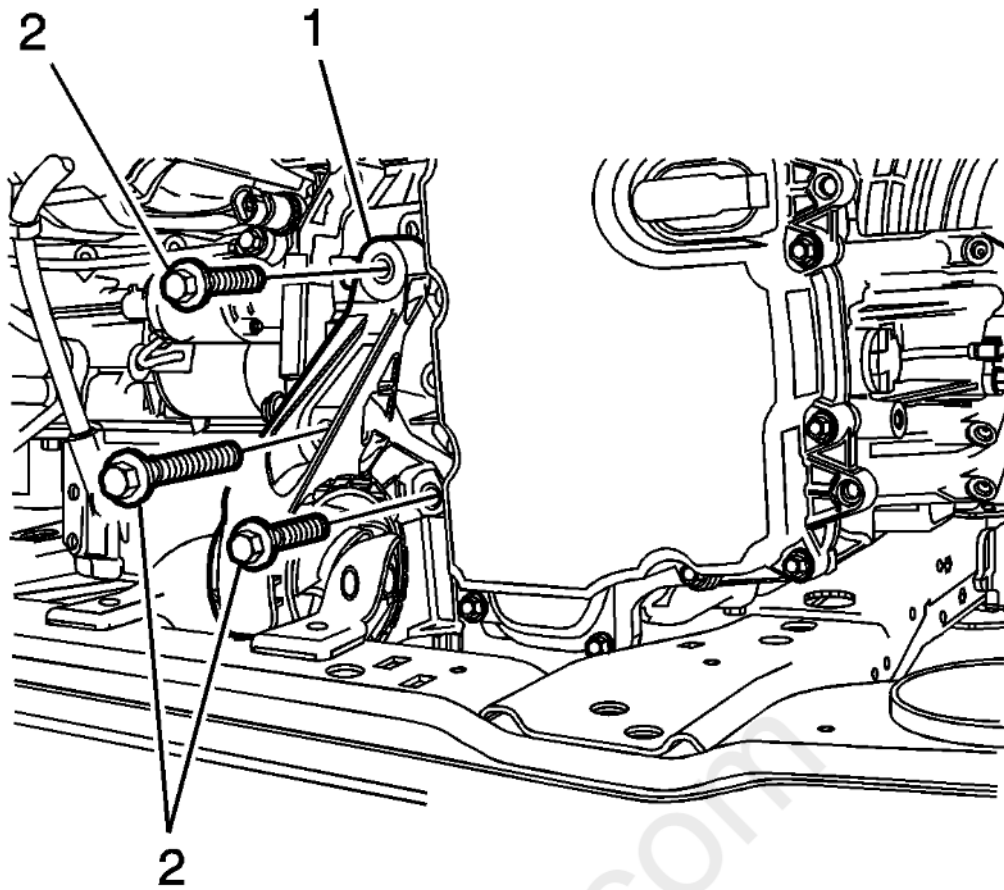


Fig. 59: Transmission Mount And Attachment Bolts
Courtesy of GENERAL MOTORS COMPANY

1. Install the transaxle mount (1).

CAUTION: Refer to **Fastener Caution** .

2. Install the NEW transaxle mount bolts (2) and tighten to 62 N.m (46 lb ft).

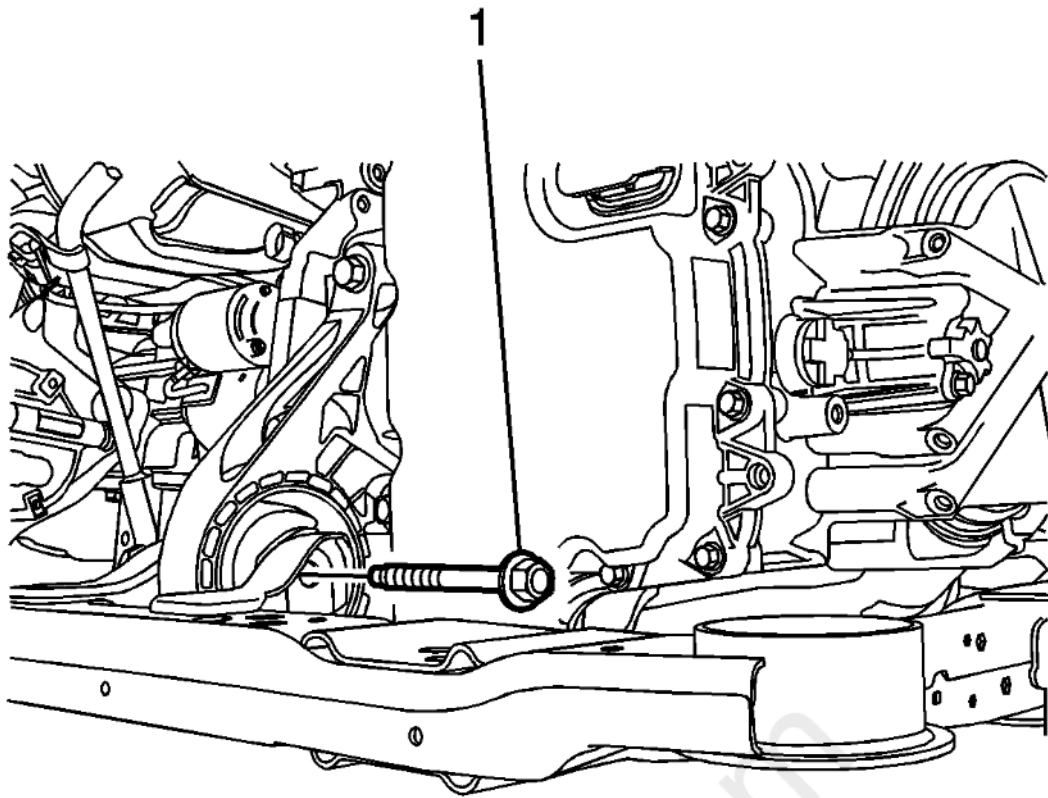


Fig. 60: Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS COMPANY

3. Install the transaxle mount through bolt (1) and tighten to 105 N.m (77 lb ft).
4. Remove the jack from the transmission.
5. Lower the vehicle.

TRANSMISSION REAR MOUNT REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the exhaust front pipe assembly. Refer to [Front Pipe Replacement \(LFX\)](#) .
3. Using a suitable jack stand, support the rear of the powertrain.

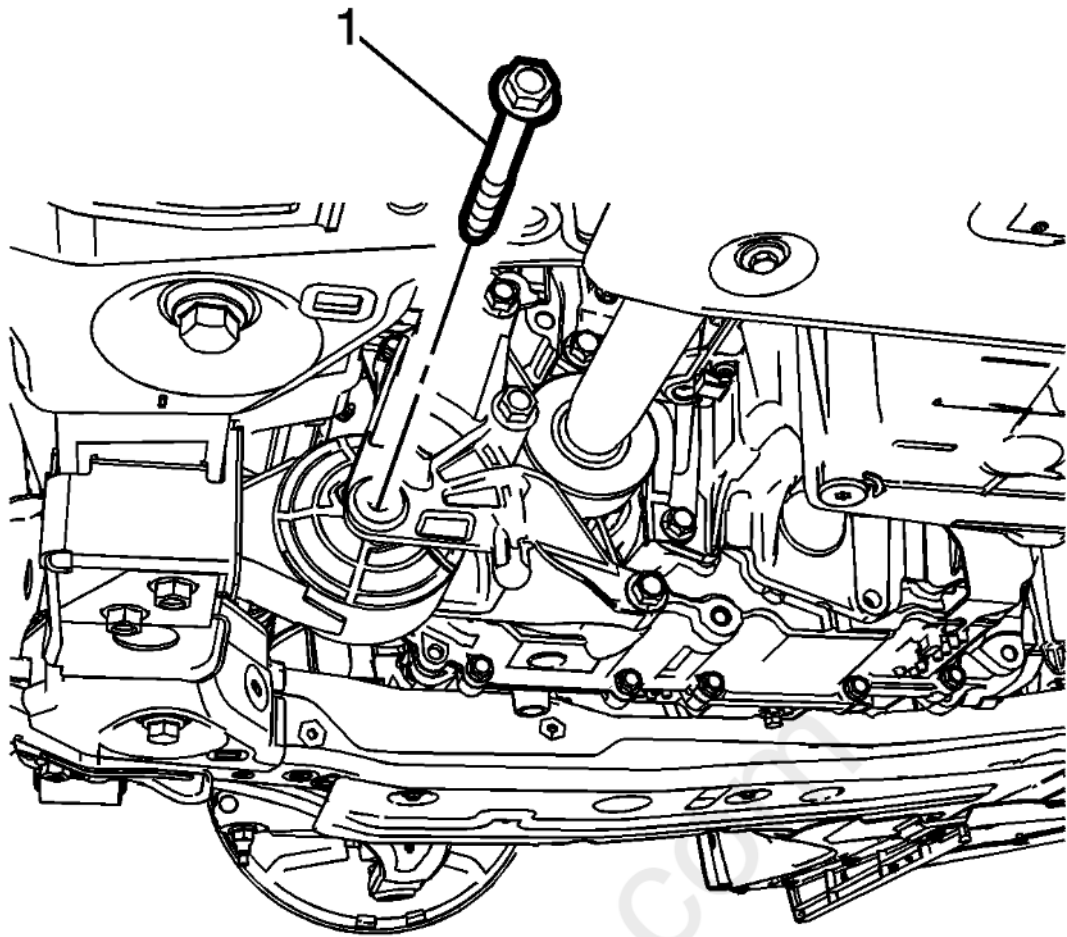


Fig. 61: Rear Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS COMPANY

4. Remove the transmission mount to bracket through bolt (1).

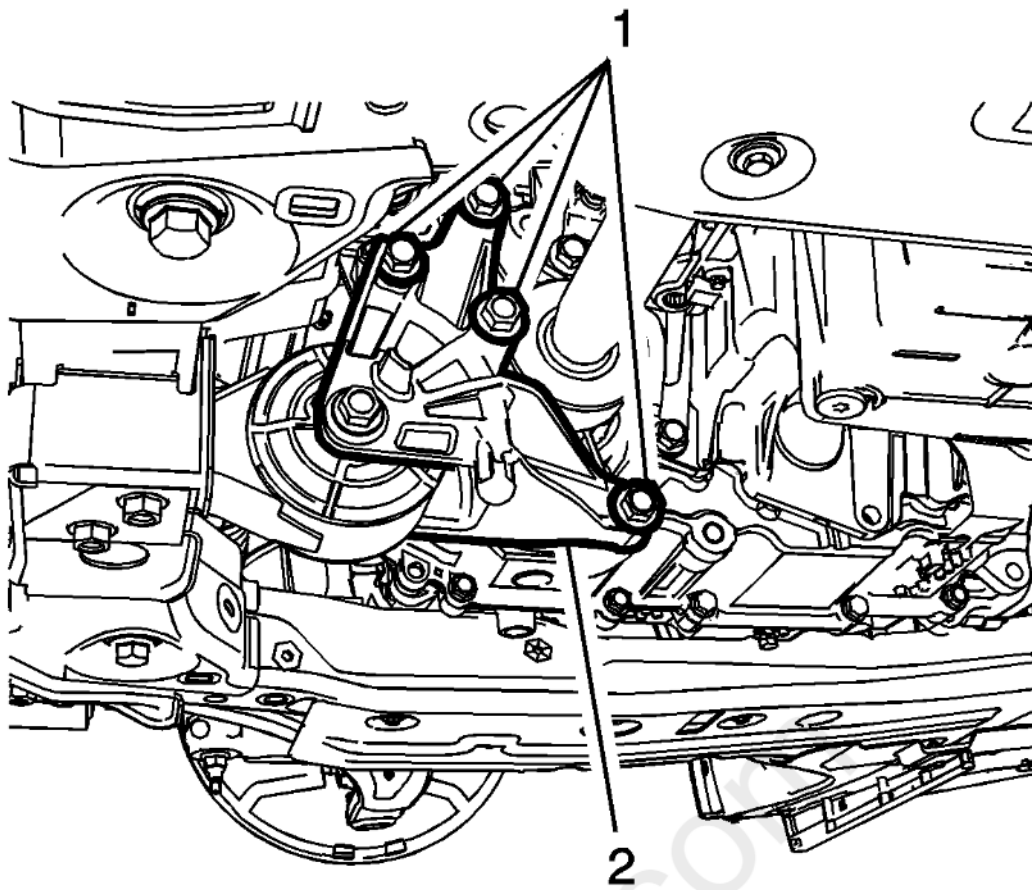


Fig. 62: Four Transmission Mount Bracket Fasteners

Courtesy of GENERAL MOTORS COMPANY

5. Remove the four transmission mount bracket fasteners (1).

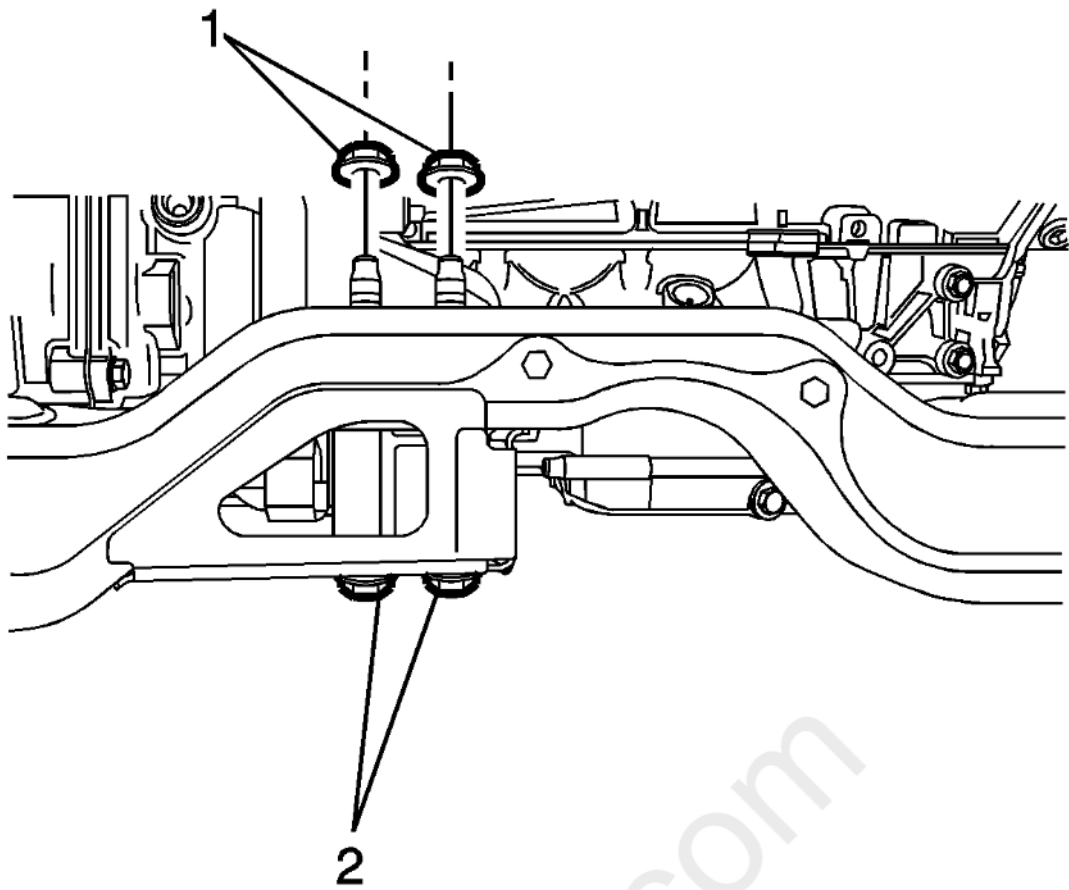


Fig. 63: Rear Mount To Frame Fasteners

Courtesy of GENERAL MOTORS COMPANY

6. Remove the rear mount to frame fasteners (1, 2), then remove the mount and bracket from the vehicle.

Installation Procedure

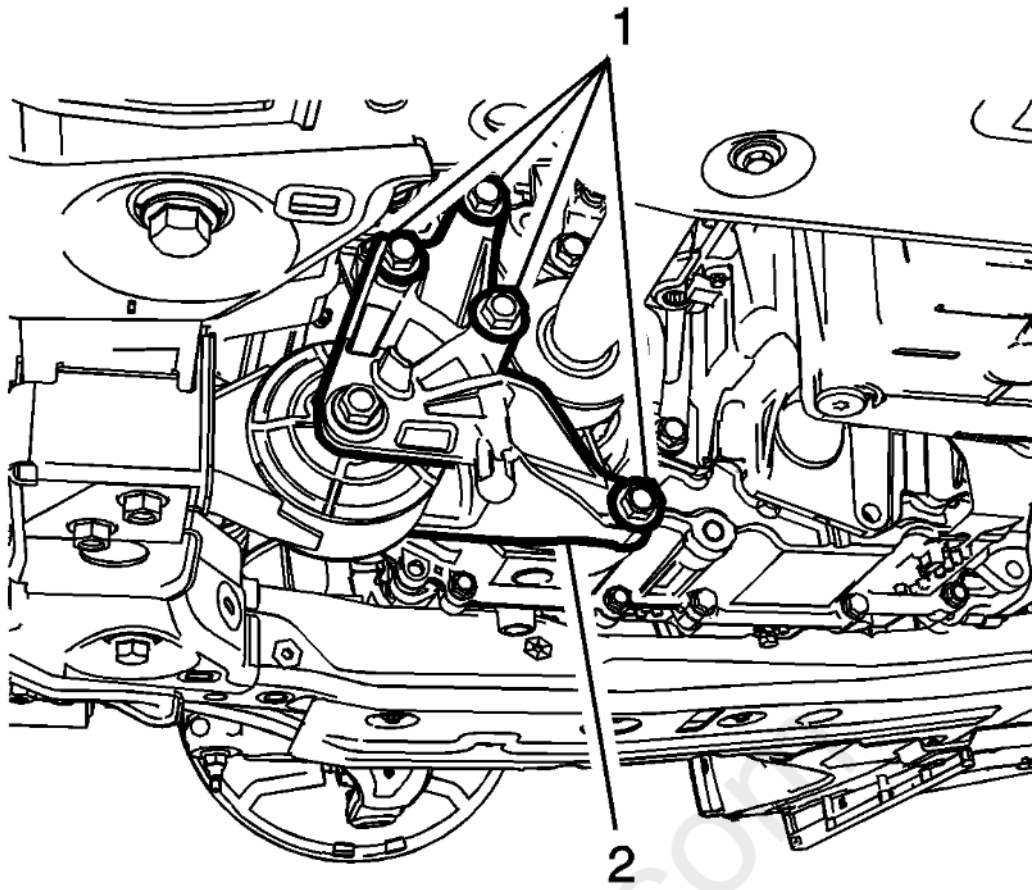


Fig. 64: Four Transmission Mount Bracket Fasteners

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

1. Install the four transmission mount bracket to transmission fasteners (1) and tighten to 100 N.m (74 lb ft).

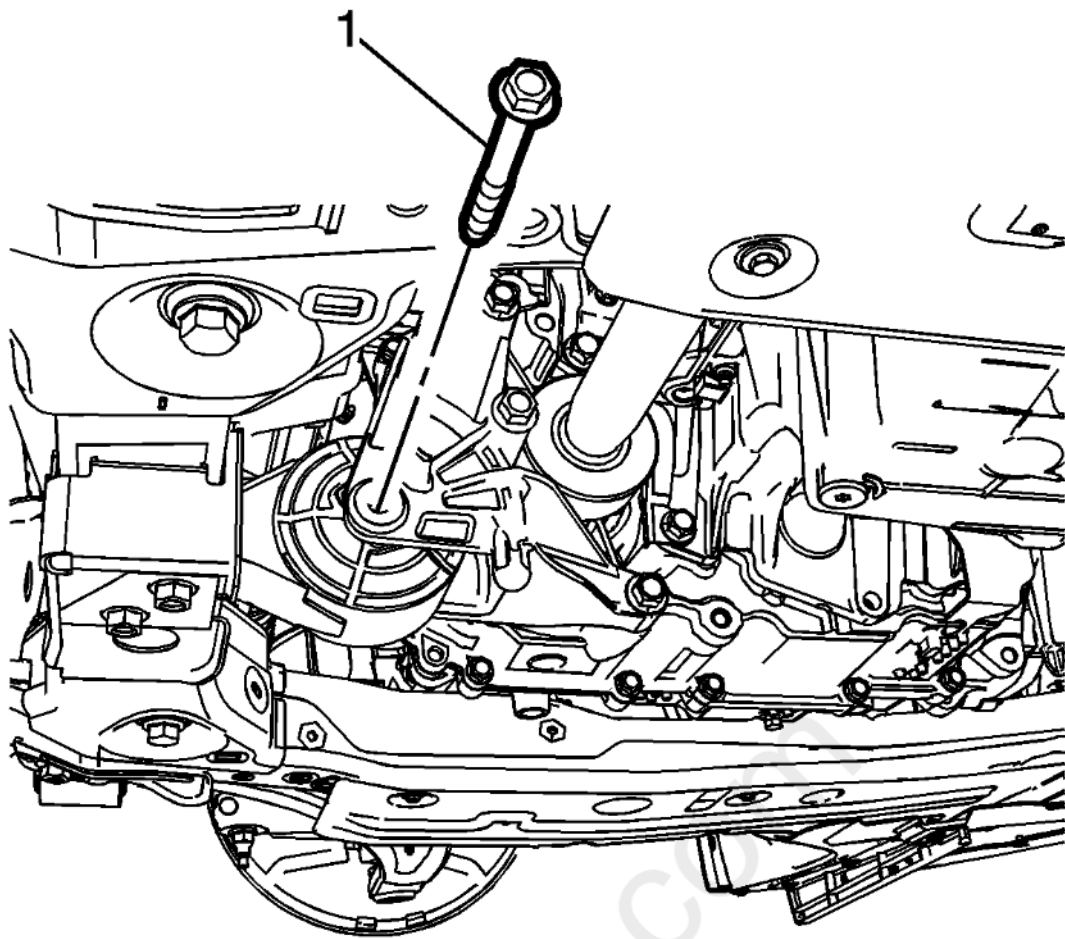


Fig. 65: Rear Transmission Mount Through Bolt

Courtesy of GENERAL MOTORS COMPANY

2. Install the transmission mount to bracket through bolt (1) and tighten to 105 N.m (77 lb ft).

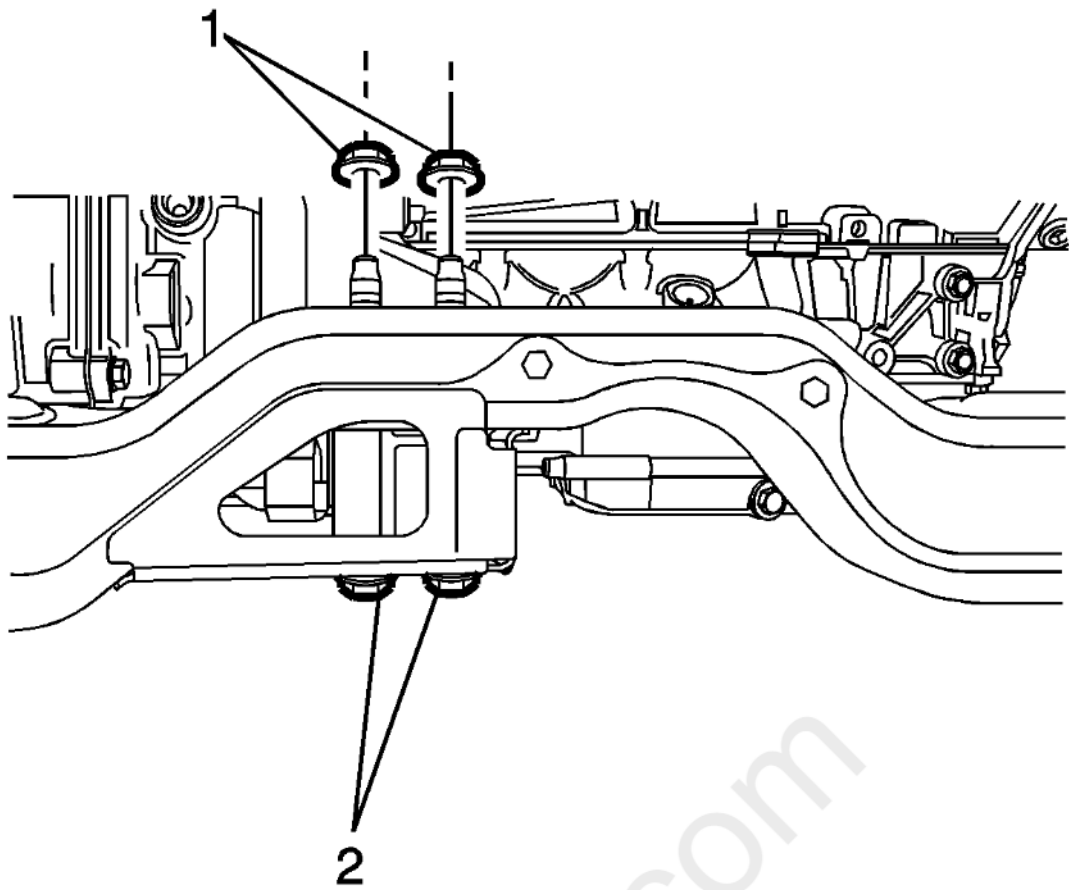


Fig. 66: Rear Mount To Frame Fasteners
Courtesy of GENERAL MOTORS COMPANY

NOTE: Use NEW bolts only.

3. Install the rear mount to frame fasteners (1, 2) and tighten to 100 N.m (74 lb ft) plus 120 - 130 degrees.
4. Remove the jack stand.
5. Install the exhaust front pipe assembly. Refer to [Front Pipe Replacement \(LFX\)](#) .
6. Lower the vehicle.

TRANSMISSION REAR MOUNT BRACKET REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Using a suitable jack stand, support the rear of the powertrain.

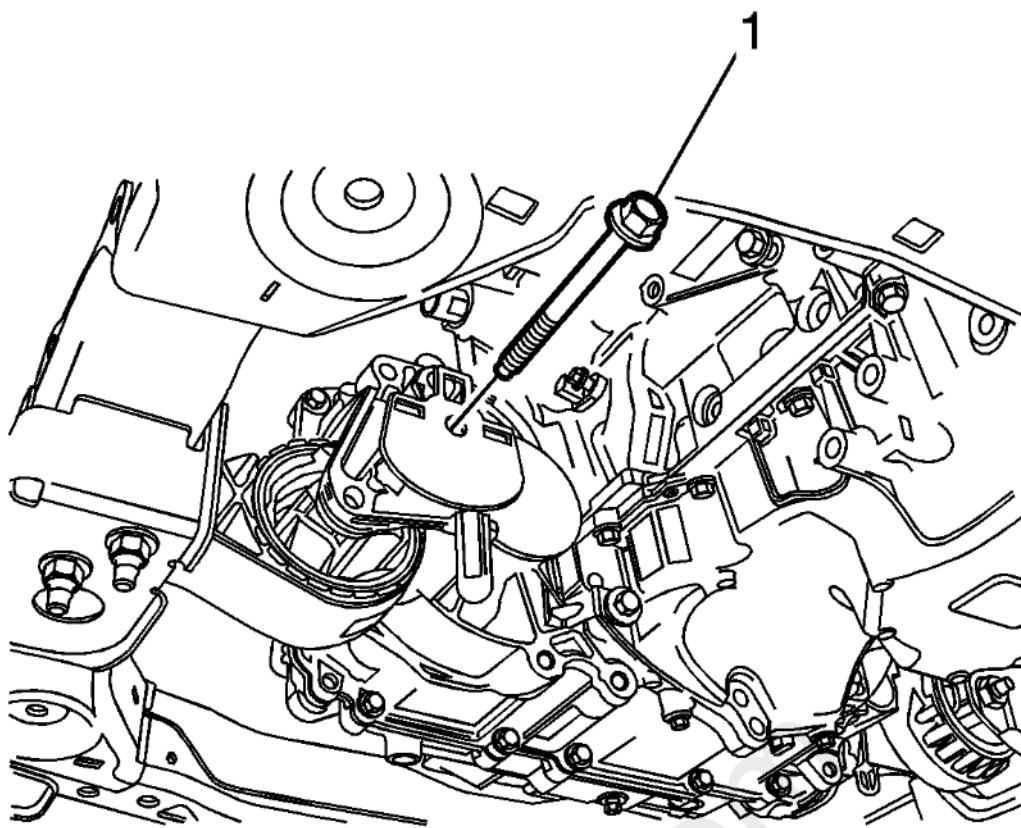


Fig. 67: Rear Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS COMPANY

3. Remove the transmission mount to bracket through bolt (1).

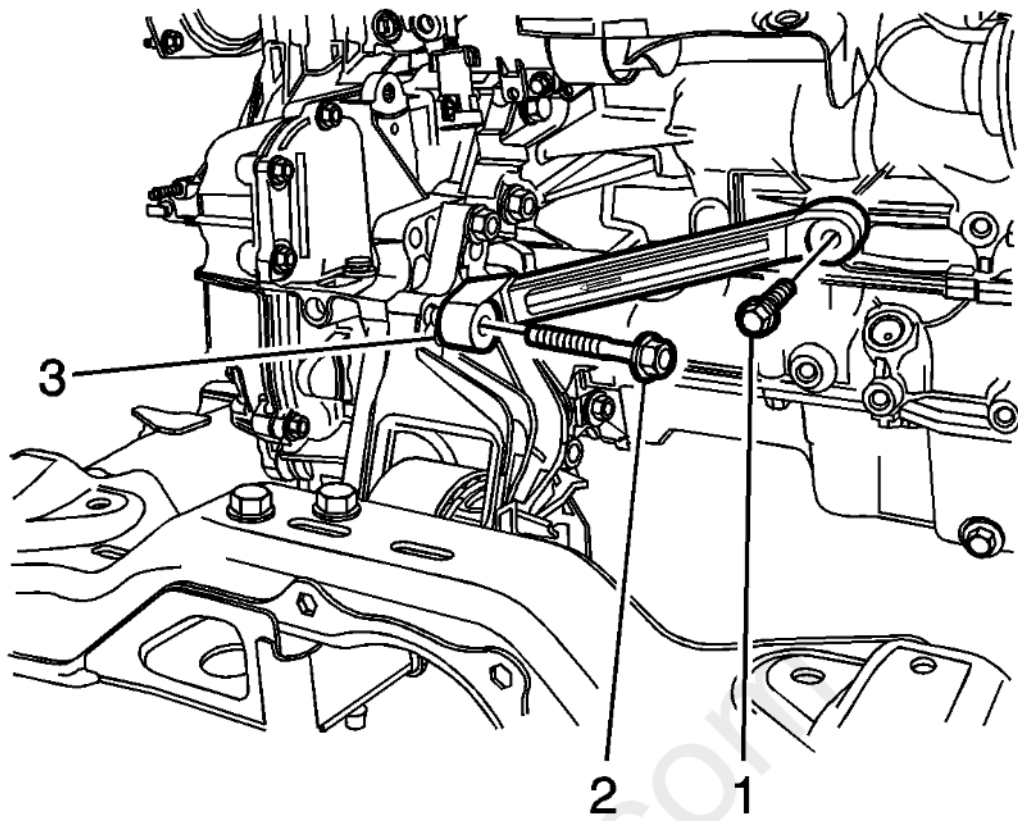


Fig. 68: Transmission Brace And Bolts

Courtesy of GENERAL MOTORS COMPANY

4. Remove the transaxle brace bolt (1), then loosen bolt (2) until it no longer engages the transaxle.
5. Remove the transaxle brace (3) with bolt (2) still retained in the brace.

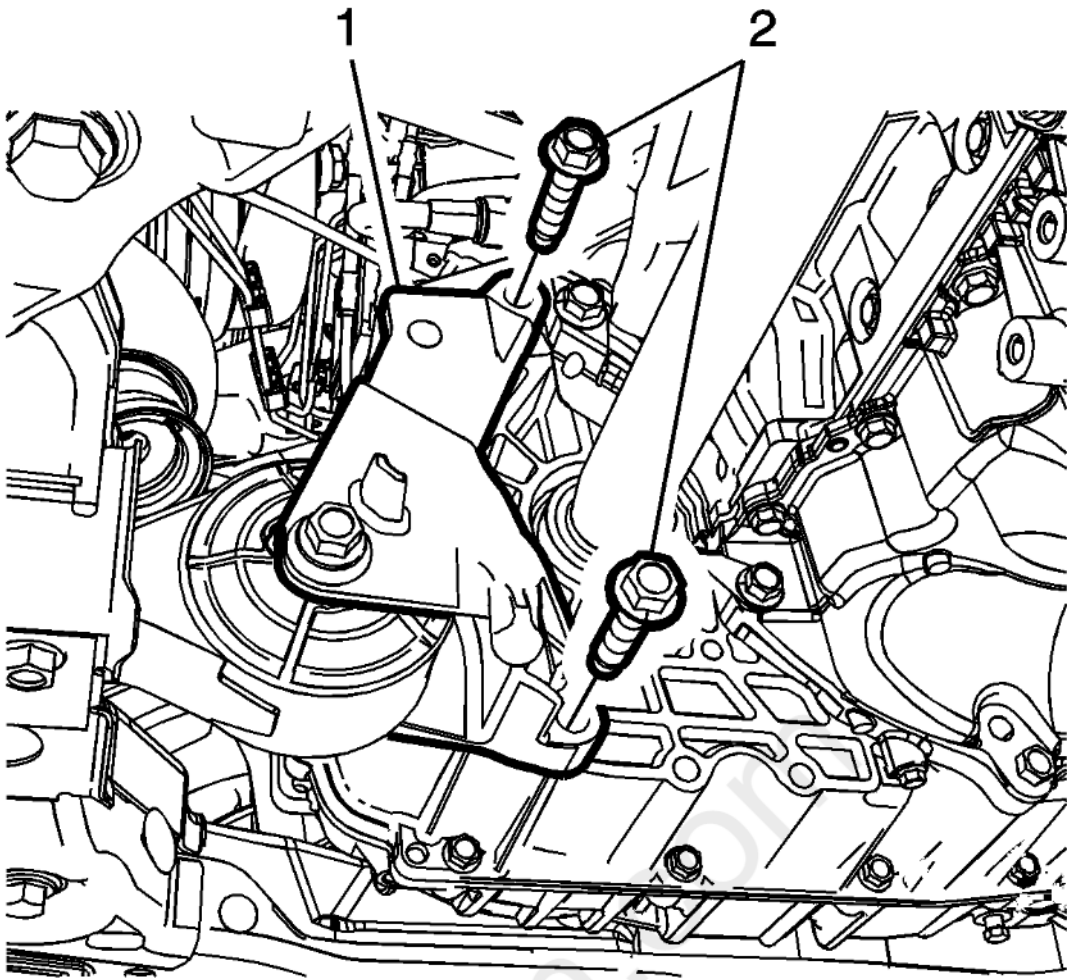


Fig. 69: Transmission Mount & Bolts

Courtesy of GENERAL MOTORS COMPANY

6. Remove the transmission mount (1) to transmission bolts (2).

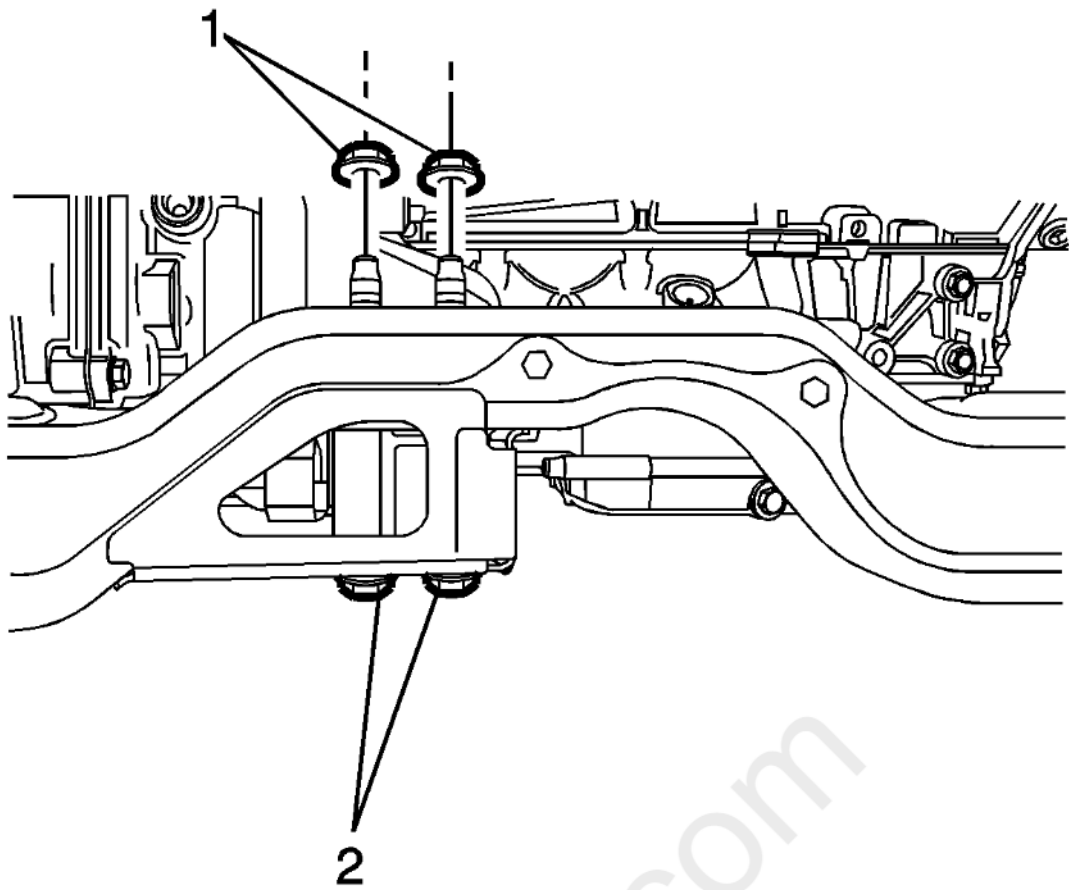


Fig. 70: Rear Mount To Frame Fasteners
Courtesy of GENERAL MOTORS COMPANY

7. Remove the rear mount to frame fasteners (1, 2), then remove the mount and bracket from the vehicle.

Installation Procedure

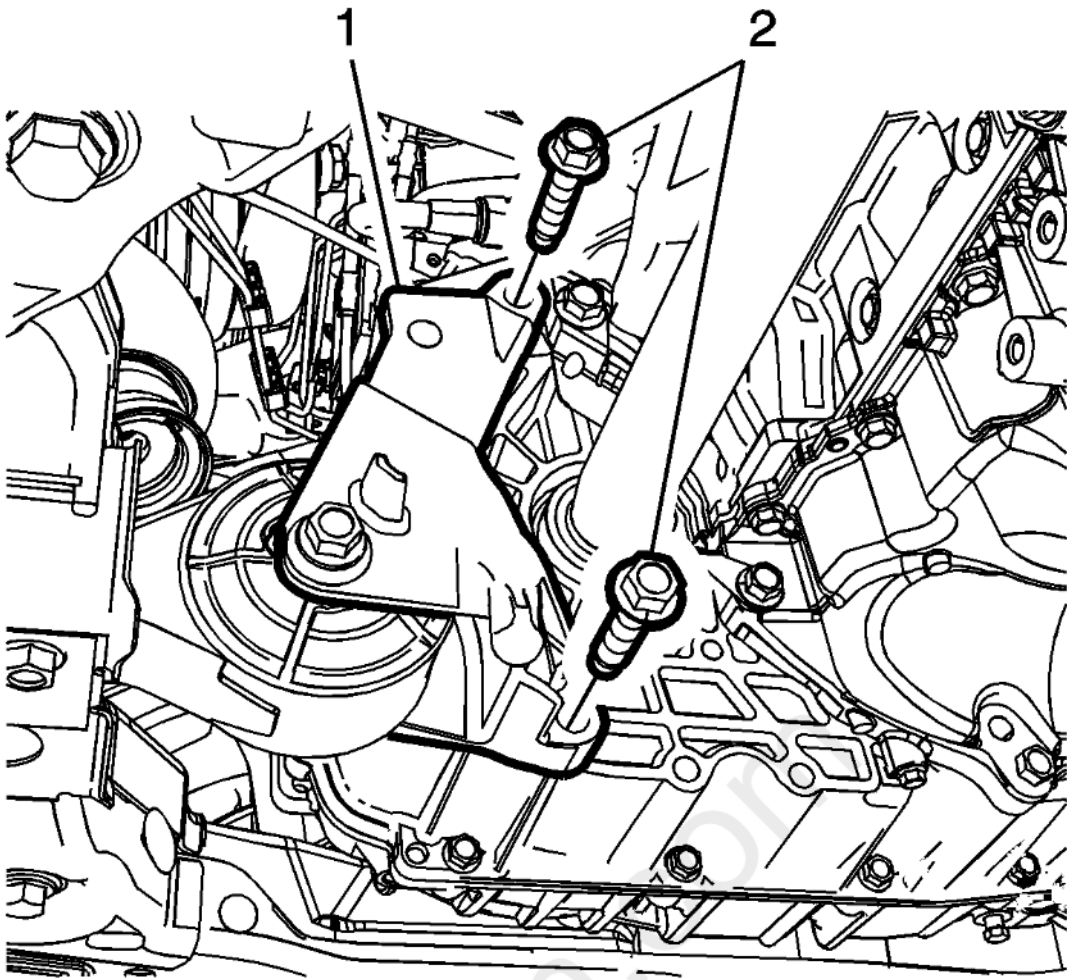


Fig. 71: Transmission Mount & Bolts

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

1. Install the transmission mount bracket to transmission bolts (2) and tighten to 100 N.m (74 lb ft).

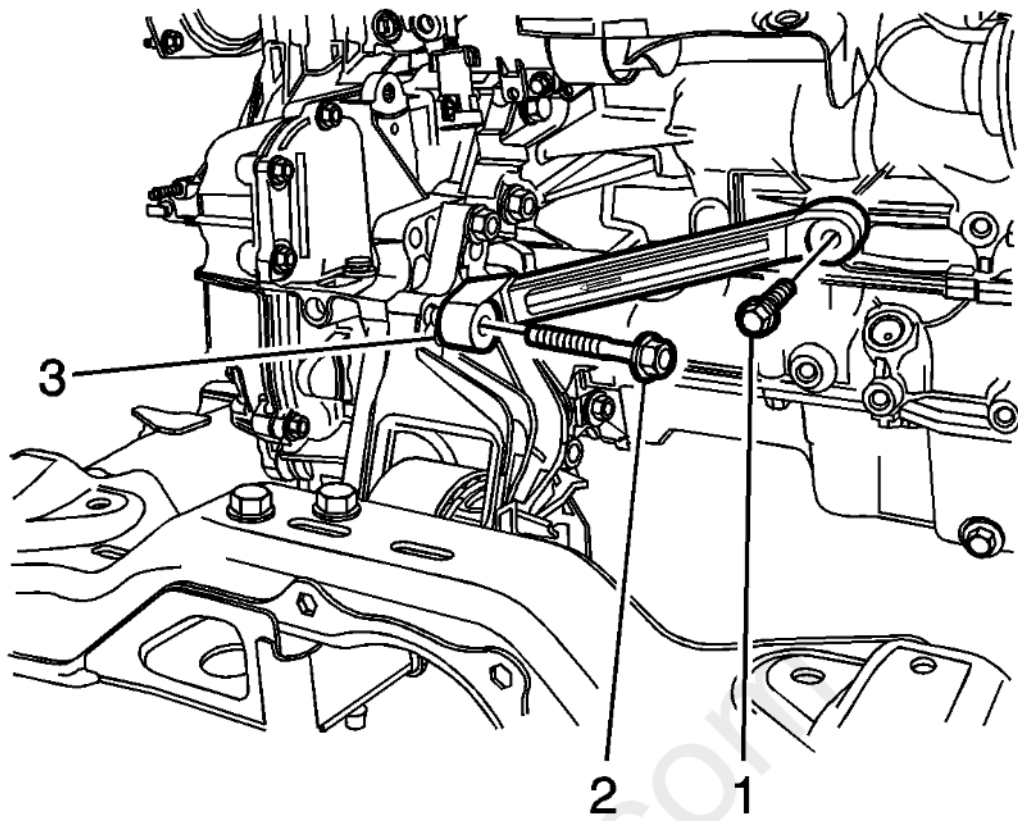


Fig. 72: Transmission Brace And Bolts

Courtesy of GENERAL MOTORS COMPANY

2. Install the transaxle brace (3) with bolt (2) seated in the brace.
3. Install the transaxle brace bolt (1) and tighten to 50 N.m (37 lb ft).
4. Tighten brace bolt (2) to 100 N.m (74 lb ft).

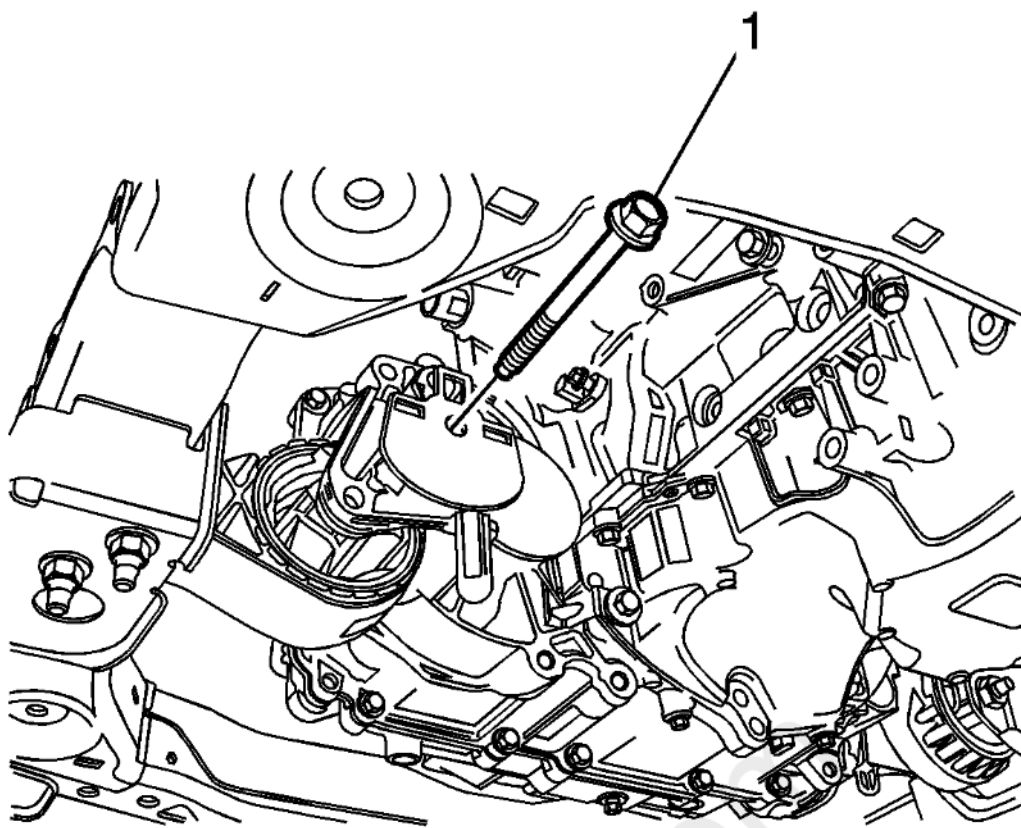


Fig. 73: Rear Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS COMPANY

5. Install the transmission mount to bracket through bolt (1) and tighten to 105 N.m (77 lb ft).

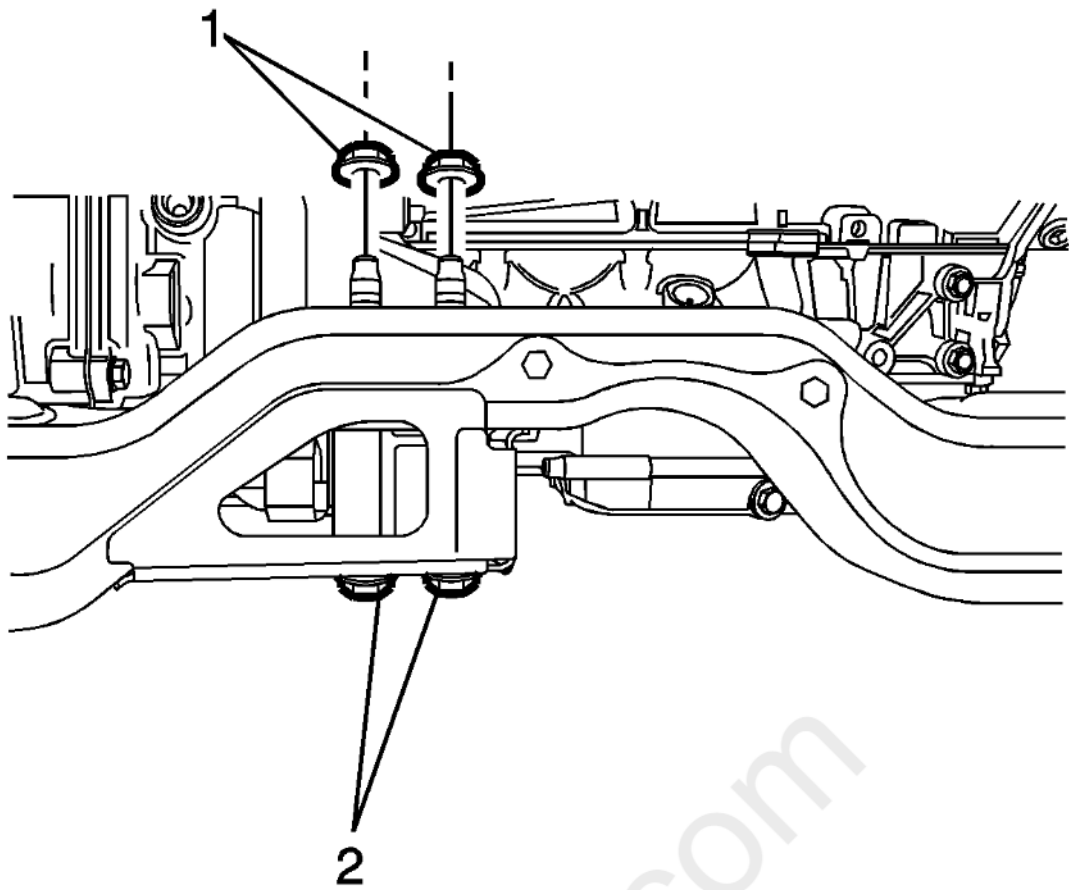


Fig. 74: Rear Mount To Frame Fasteners
Courtesy of GENERAL MOTORS COMPANY

NOTE: Use NEW bolts only.

6. Install the rear mount to frame fasteners (1, 2) and tighten to 100 N.m (74 lb ft) plus 120 - 130 degrees.
7. Remove the jack stand.
8. Lower the vehicle.

TRANSMISSION REPLACEMENT

Removal Procedure

1. Remove the battery tray. Refer to [Battery Tray Replacement](#) .
2. Remove the transmission range select lever cable and bracket.
3. Drain the transmission fluid. Refer to [Transmission Fluid Drain and Fill](#).

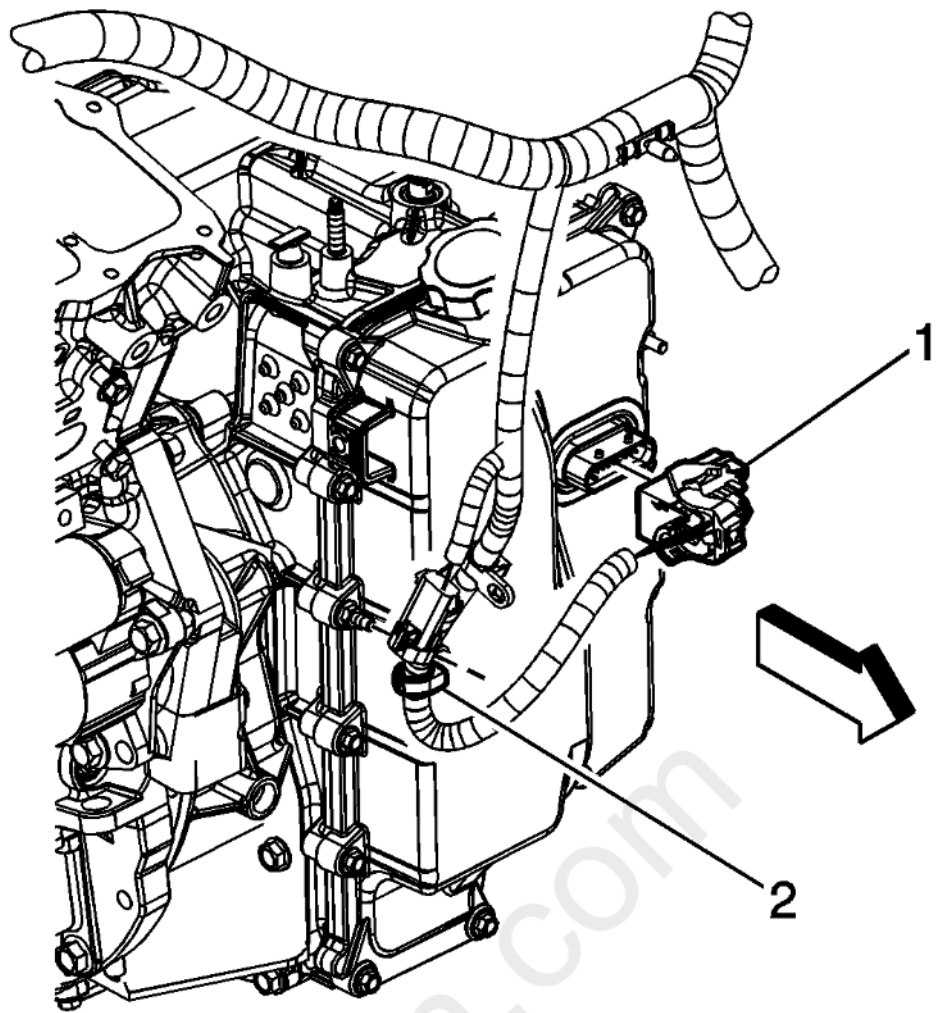


Fig. 75: Wire Harness Retainer And TCM Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

4. Remove the wire harness retainer (2) from the control valve body cover stud.
5. Disconnect the control valve body transmission control module (TCM) electrical connector (1).

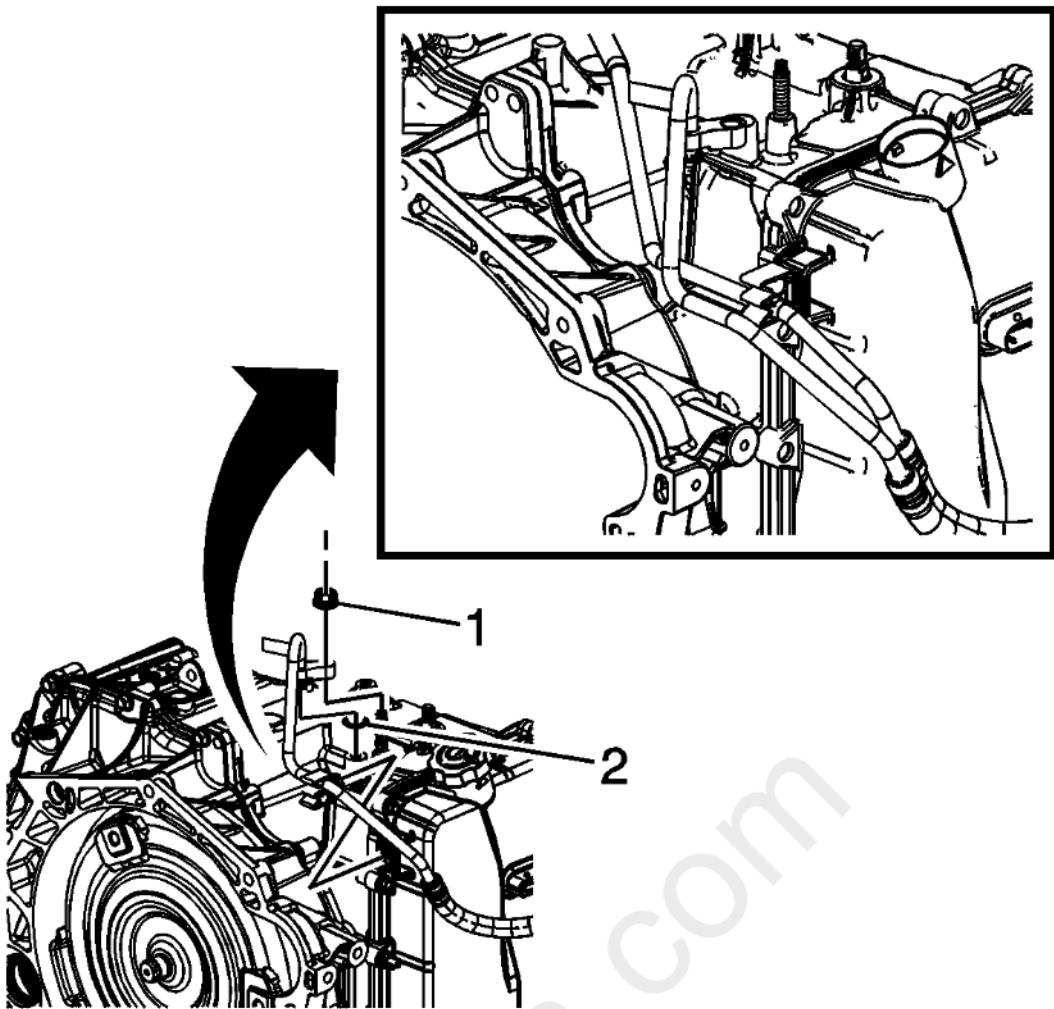


Fig. 76: Transmission Fluid Cooler Inlet Hose Retaining Nut And Seal

Courtesy of GENERAL MOTORS COMPANY

6. Remove the transmission fluid cooler pipe retainer nut (1).
7. Remove the transmission fluid cooler inlet hose and seal (2) from the transmission.
8. Plug and/or cap the hose and transmission to prevent contamination.

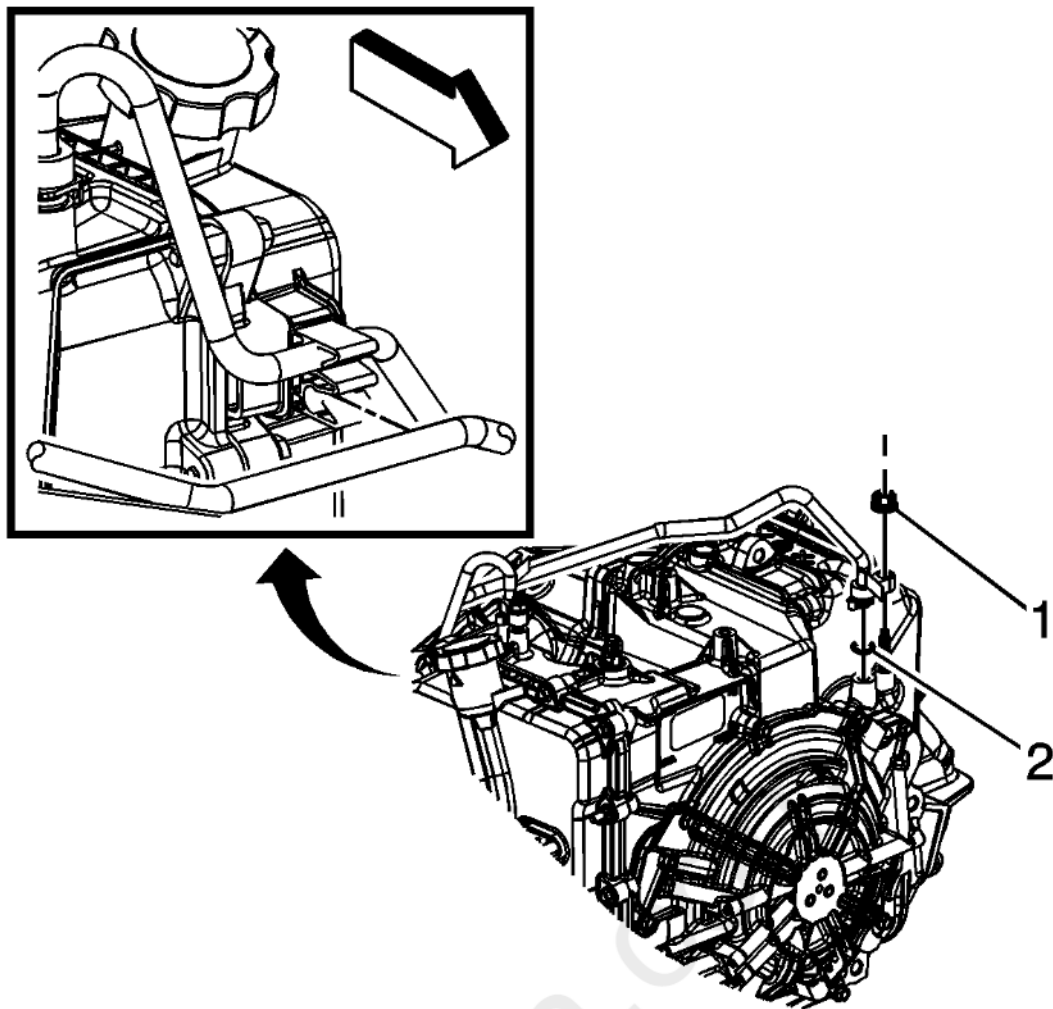


Fig. 77: Transmission Fluid Cooler Outlet Hose Retaining Nut And Seal
Courtesy of GENERAL MOTORS COMPANY

9. Remove the transmission fluid cooler pipe retainer nut (1).
10. Remove the transmission fluid cooler outlet hose and seal (2) from the transmission.
11. Plug and/or cap the hose and transmission to prevent contamination.
12. Disconnect both pipes from the retainer.
13. Install the engine support fixture. Refer to [Engine Support Fixture](#) .
14. Remove the rear transmission mount from the transmission. Refer to [Transmission Rear Mount Replacement](#).
15. Remove the front transmission mount from the transmission. Refer to [Transmission Front Mount Replacement](#).
16. Remove the left transmission mount from the transmission. Refer to [Transmission Mount Replacement - Left Side](#).

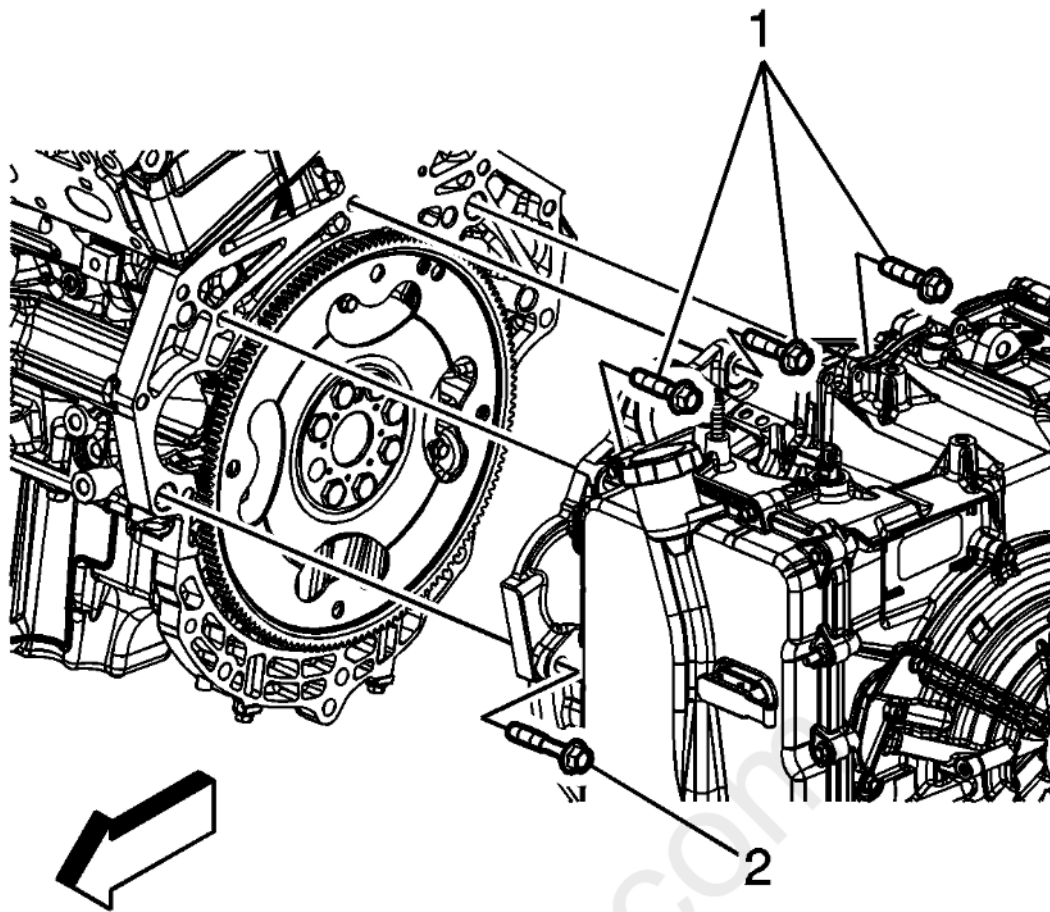


Fig. 78: Upper Transmission To Engine Bolts

Courtesy of GENERAL MOTORS COMPANY

17. Remove the upper transmission to engine bolts (1, 2).
18. Remove the frame. Refer to [**Drivetrain and Front Suspension Frame Replacement**](#).
19. Disconnect the left wheel drive shaft from the transmission. Refer to [**Front Wheel Drive Shaft Replacement - Left Side**](#).
20. Remove the intermediate drive shaft. Refer to [**Front Wheel Drive Intermediate Shaft Replacement \(LFX with M7W\)**](#).

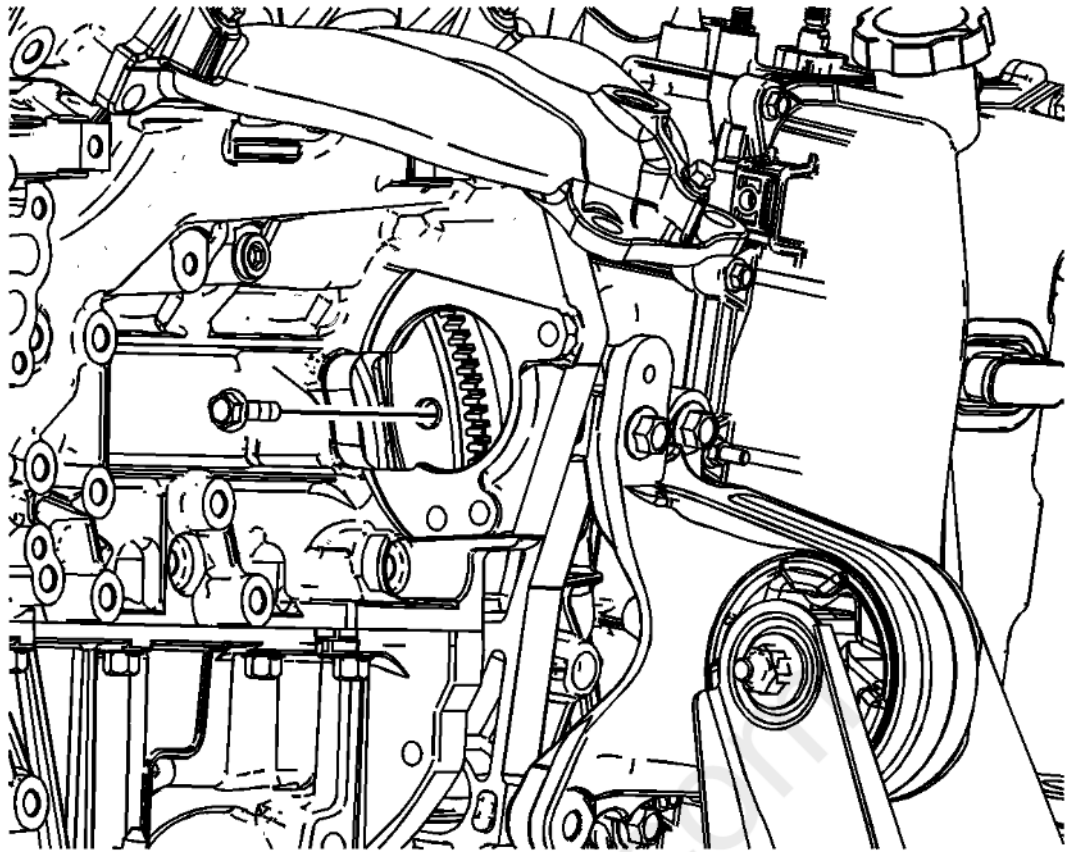


Fig. 79: Torque Converter To Flywheel Bolts

Courtesy of GENERAL MOTORS COMPANY

21. Remove the starter. Refer to **Starter Replacement (LFX)**.
22. Mark the relationship of the flywheel to the torque converter for reassembly.
23. Remove the torque converter to flywheel bolts.
24. Use a transmission jack in order to support the transmission.

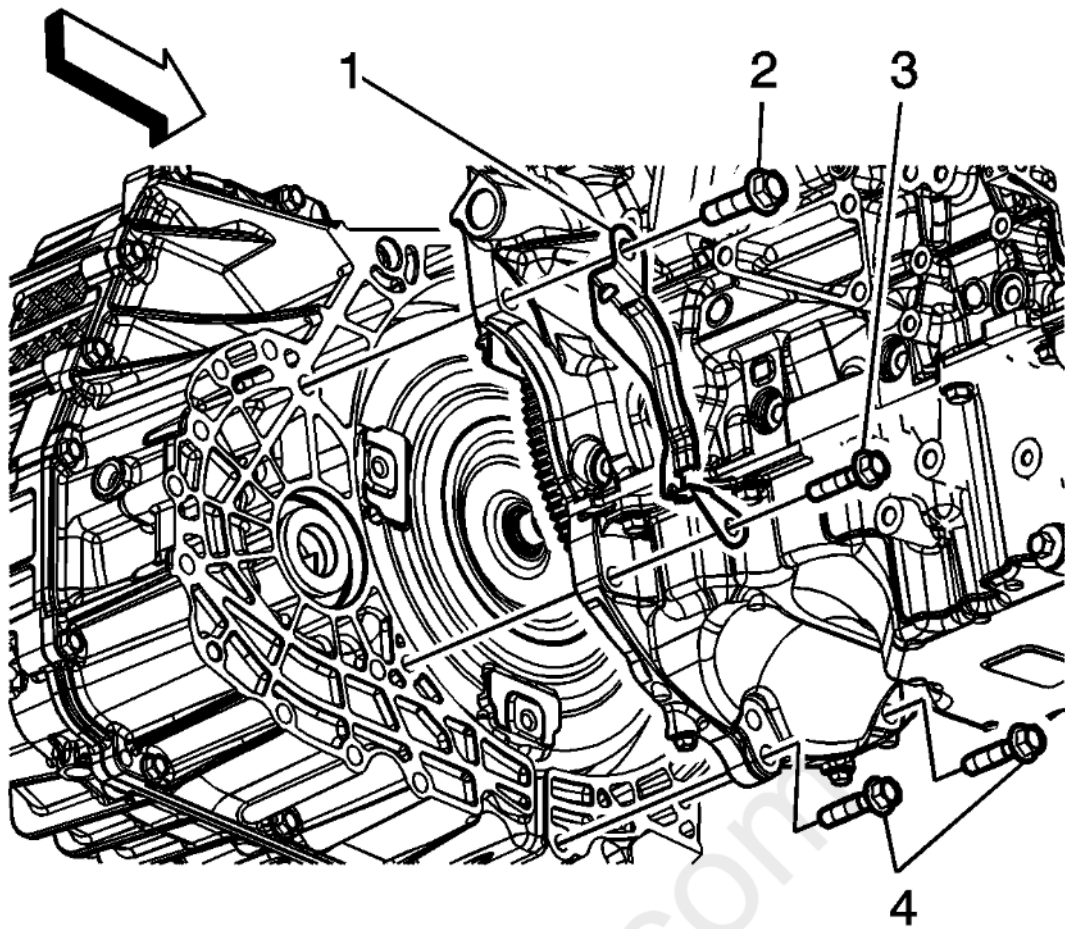


Fig. 80: Flywheel Inspection Cover, Bolts And Transmission Bolts
Courtesy of GENERAL MOTORS COMPANY

25. Remove the flywheel inspection cover bolts (2, 3).
26. Remove the flywheel inspection cover (1).
27. Remove the remaining transmission bolts (4).

NOTE: Ensure the torque converter remains securely in place on the transmission input shaft while separating and removing the transmission.

28. Separate the transmission from the engine.
29. Lower the transmission with the transmission jack far enough to remove the transmission.
30. Flush and flow test the transmission oil cooler and lines. Refer to **Transmission Fluid Cooler Flow Test and Flushing**.

Installation Procedure

1. Raise the transmission with the transmission jack and position the transmission to the engine.

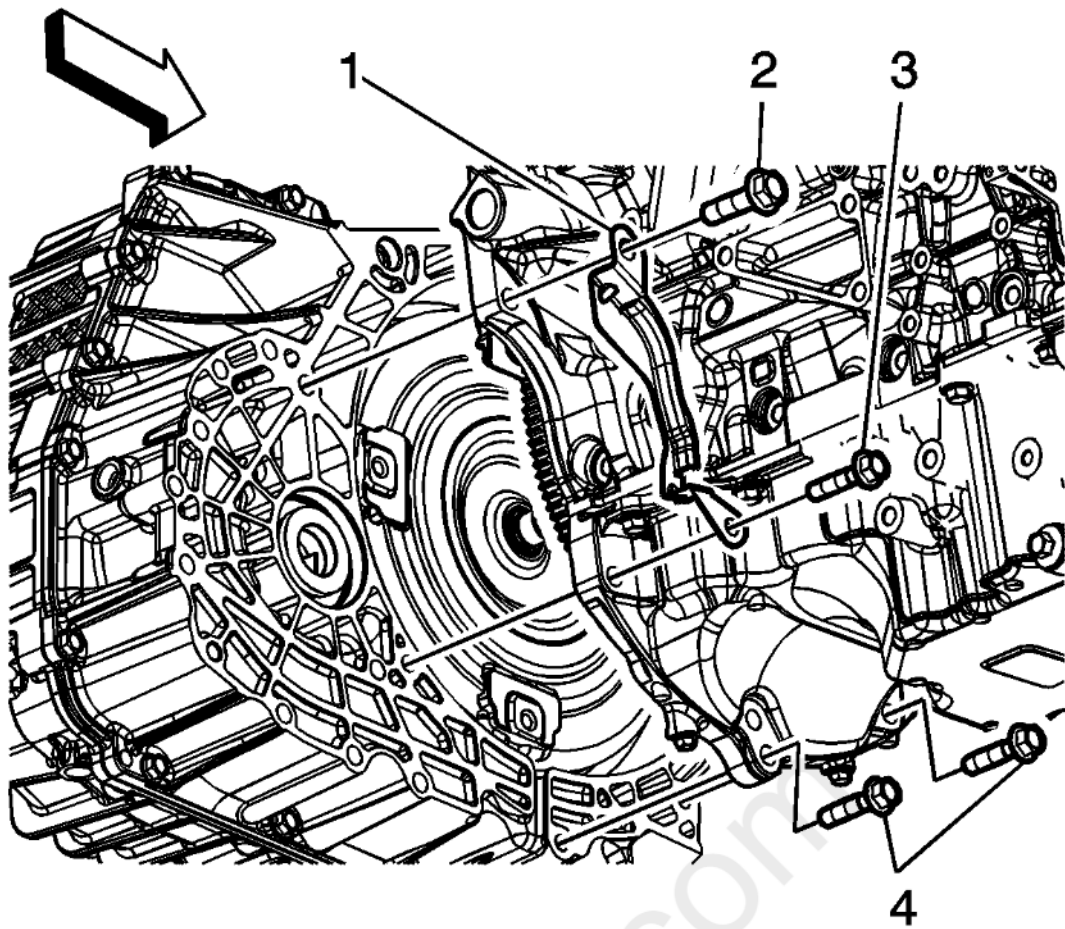


Fig. 81: Flywheel Inspection Cover, Bolts And Transmission Bolts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

2. Install the transmission bolts (4) and tighten to 75 N.m (55 lb ft).
3. Install the flywheel inspection cover (1).
4. Install the flywheel inspection cover bolts (2, 3) and tighten to 75 N.m (55 lb ft).
5. Remove the transmission jack.

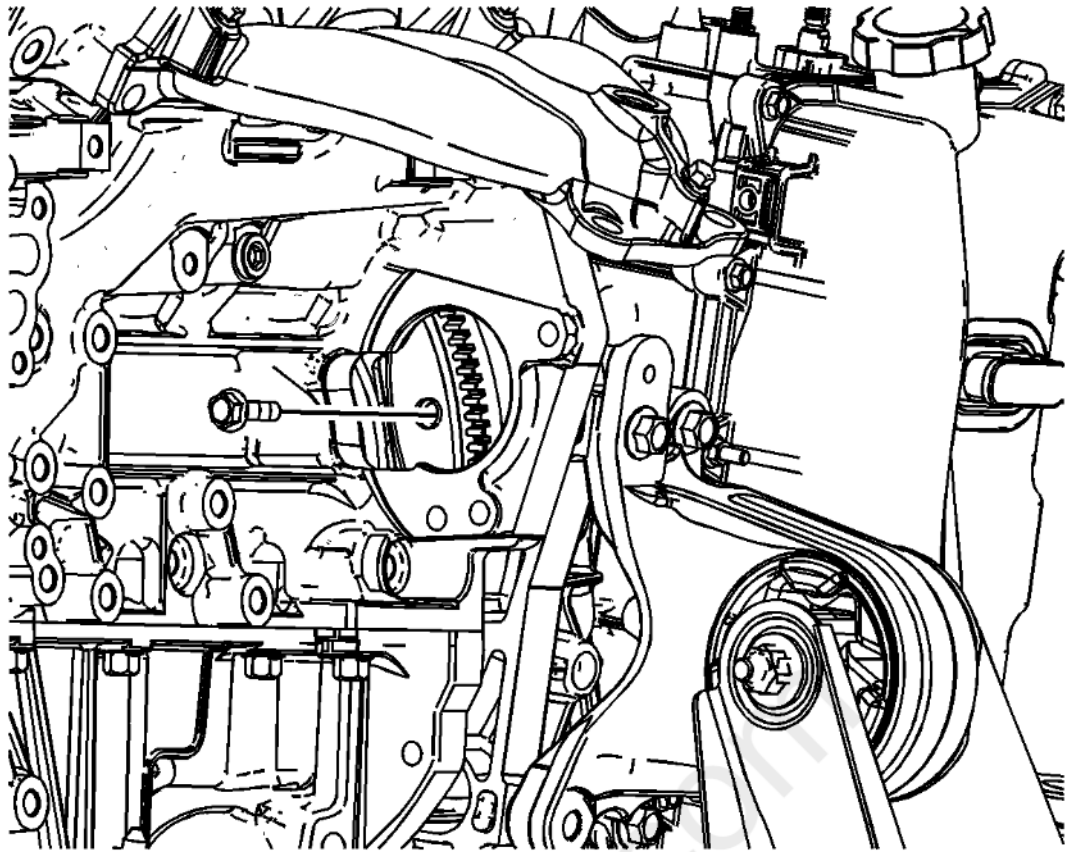


Fig. 82: Torque Converter To Flywheel Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE: If reusing the torque converter bolts, clean the threads and apply threadlocker to the threads prior to installation. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#) for the recommended threadlock material.

6. Install the torque converter to flywheel bolts and tighten to 62 N.m (46 lb ft).
7. Install the starter. Refer to [Starter Replacement \(LFX\)](#).
8. Install the front transmission mount to the transmission. Refer to [Transmission Front Mount Replacement](#).
9. Install the rear transmission mount to the transmission. Refer to [Transmission Rear Mount Replacement](#).
10. Install the left transmission mount to the transmission. Refer to [Transmission Mount Replacement - Left Side](#).
11. Install the intermediate drive shaft. Refer to [Front Wheel Drive Intermediate Shaft Replacement \(LFX with M7W\)](#).
12. Install the left wheel drive shaft to the transmission. Refer to [Front Wheel Drive Shaft Replacement - Left Side](#).
13. Install the frame. Refer to [Drivetrain and Front Suspension Frame Replacement](#).

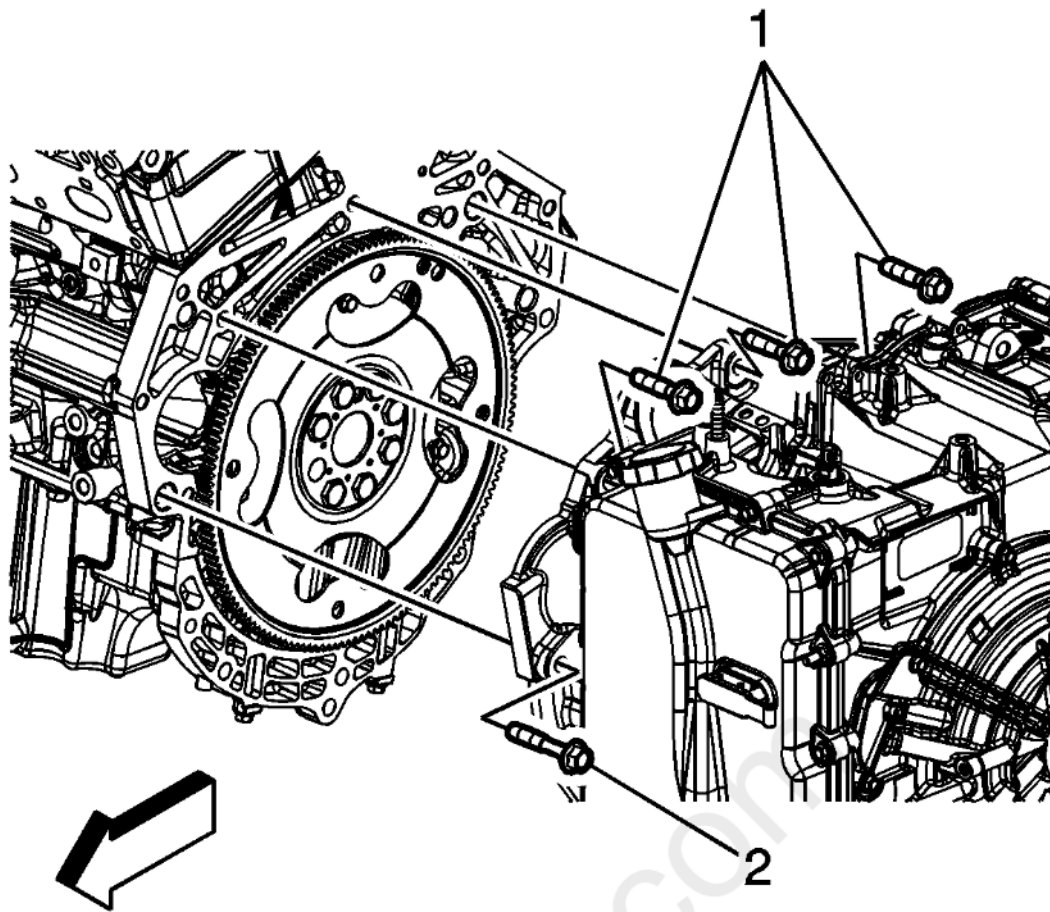


Fig. 83: Upper Transmission To Engine Bolts

Courtesy of GENERAL MOTORS COMPANY

14. Install the upper transmission to engine bolt (1, 2) and tighten to 75 N.m (55 lb ft).
15. Remove the engine support fixture.

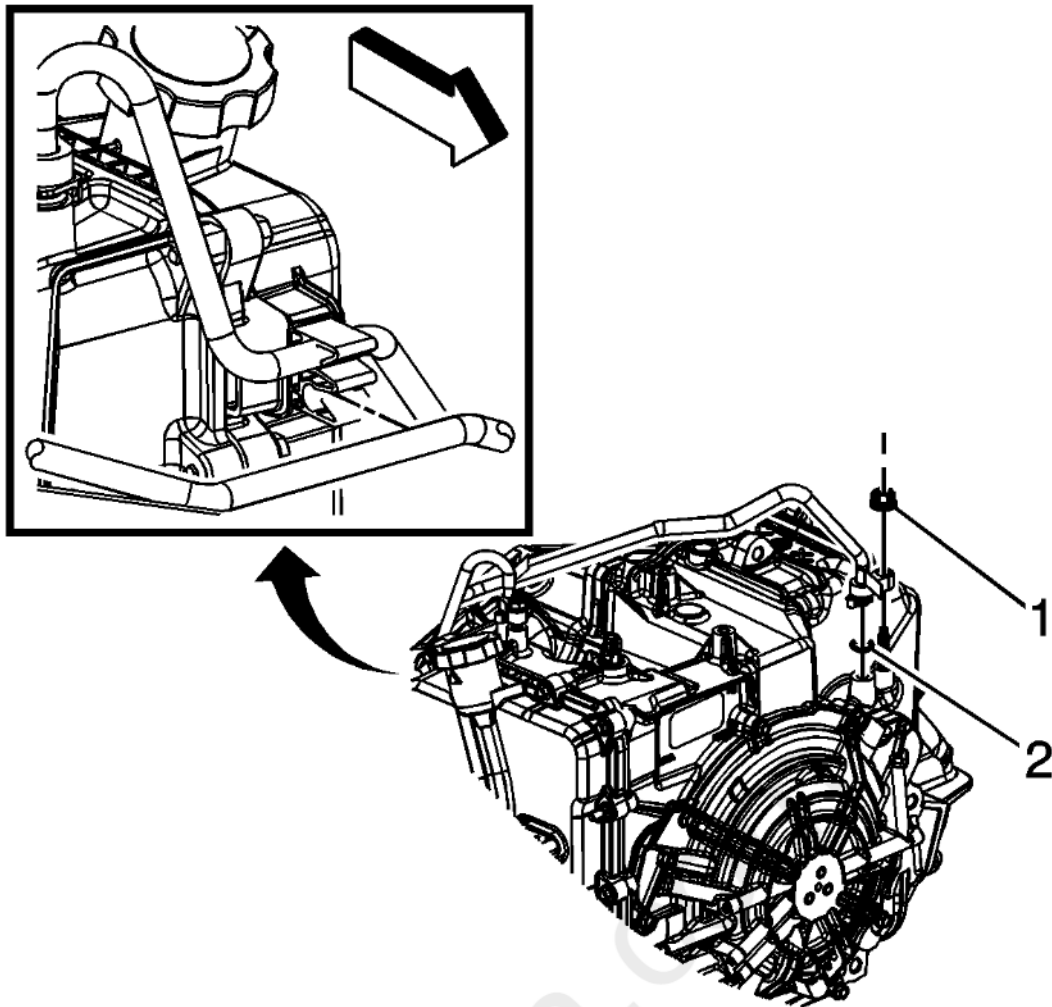


Fig. 84: Transmission Fluid Cooler Outlet Hose Retaining Nut And Seal

Courtesy of GENERAL MOTORS COMPANY

16. Install the transmission fluid cooler outlet hose and seal (2) to the transmission.
17. Install the transmission fluid cooler pipe retainer nut (1) and tighten to 22 N.m (16 lb ft).

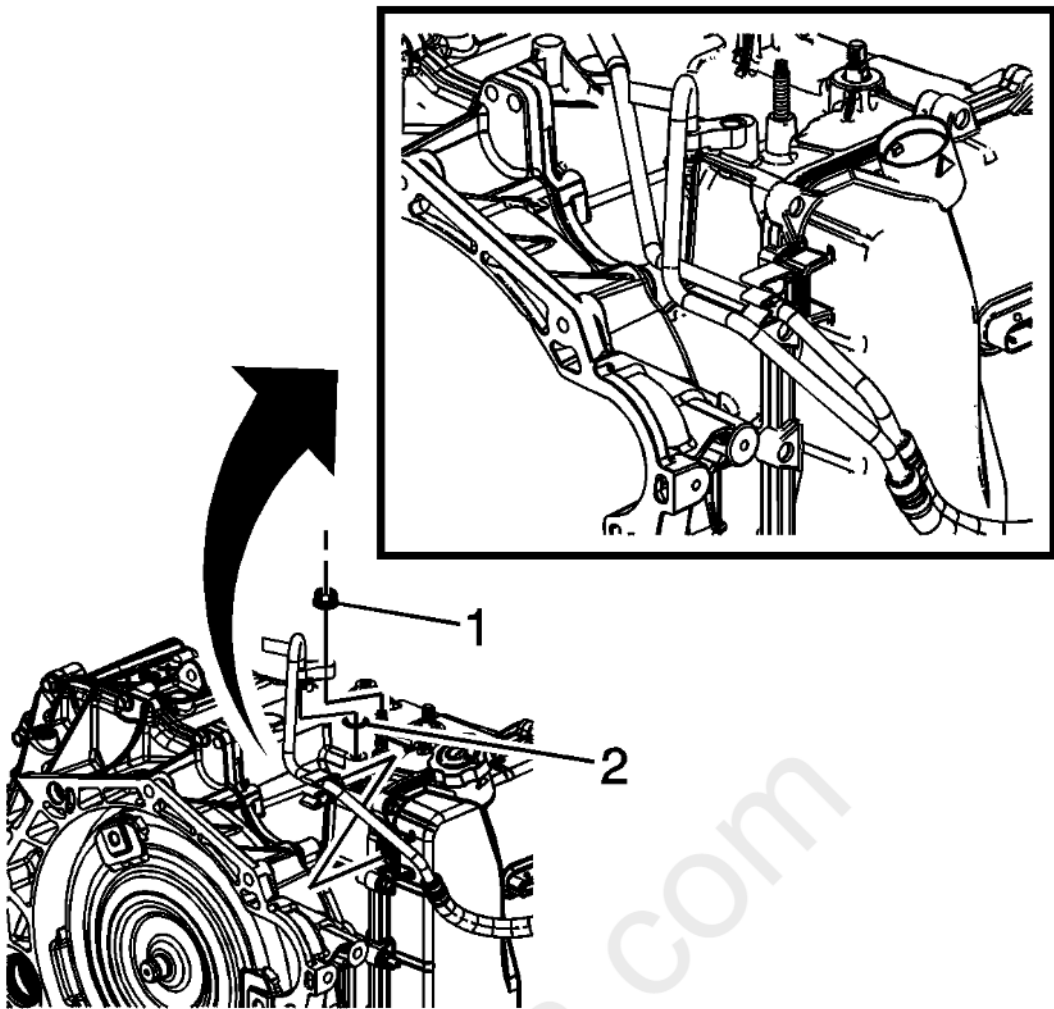


Fig. 85: Transmission Fluid Cooler Inlet Hose Retaining Nut And Seal

Courtesy of GENERAL MOTORS COMPANY

18. Install the transmission fluid cooler inlet hose and seal (2) to the transmission.
19. Install the transmission fluid cooler pipe retainer nut (1) and tighten to 22 N.m (16 lb ft).

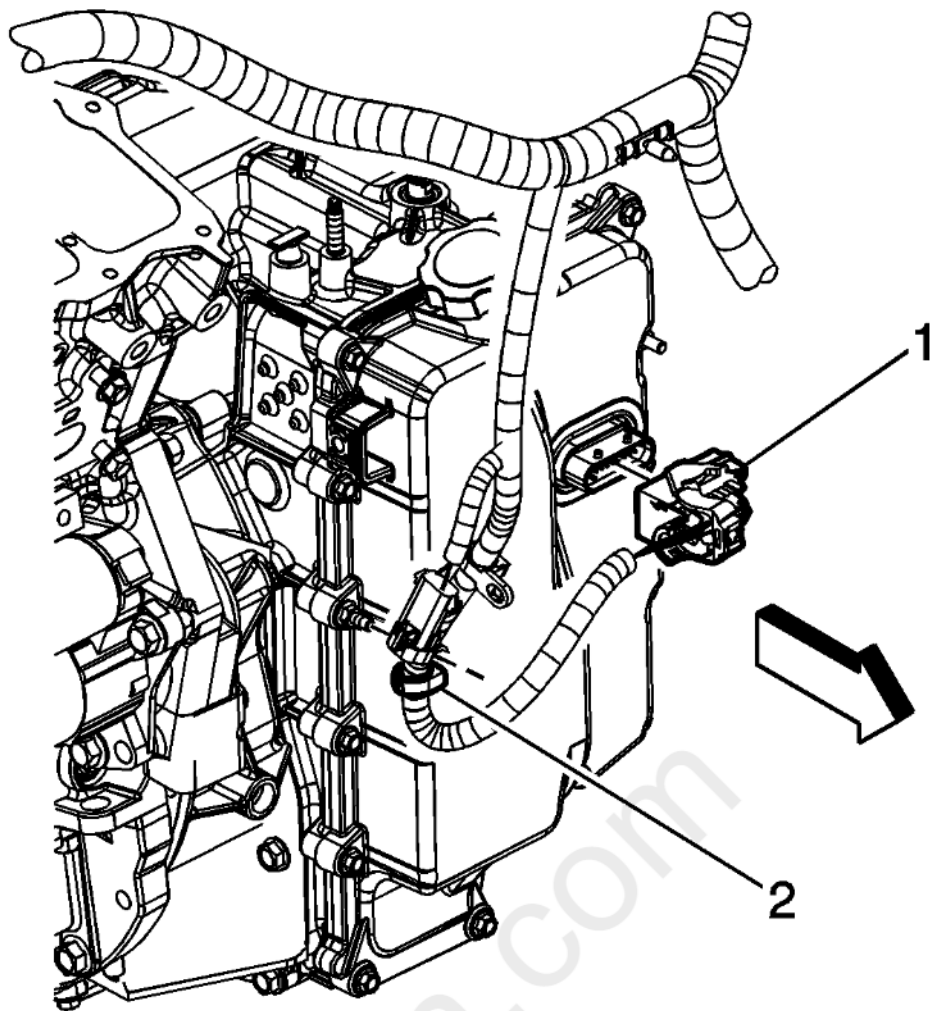


Fig. 86: Wire Harness Retainer And TCM Electrical Connector
 Courtesy of GENERAL MOTORS COMPANY

20. Connect the control valve body TCM electrical connector (1).
21. Install the wire harness retainer (2) to the control valve body cover stud and tighten the nut to 12 N.m (106 lb in).
22. Install the transmission range select lever cable and bracket.
23. Install the battery tray. Refer to [Battery Tray Replacement](#).
24. Adjust the automatic transmission range selector lever cable. Refer to [Range Selector Lever Cable Adjustment](#).
25. Fill the transmission with fluid. Refer to [Transmission Fluid Drain and Fill](#).
26. If a NEW TCM has been installed into the vehicle, the NEW module needs to be reprogrammed. Refer to [Service Programming System \(SPS\)](#).

NOTE: The Reset Transmission Adapts procedure must be performed when one of the following repairs have been made to the vehicle. Failure to perform the procedure after one of the following repairs may result in poor transmission performance, as well as transmission DTCs being set:

- Transmission internal service/overhaul
- Valve body repair or replacement
- Control solenoid valve assembly replacement
- TCM software/calibration update
- Any service in response to a shift quality concern

27. Perform the Reset Transmission Adapts. Refer to [Transmission Adaptive Values Learn](#).

2017 TRANSMISSION

Automatic Transmission - 6T70 (M7W) - Schematic and Routing Diagrams - Automatic Transmission Controls Schematics - Impala

SCHEMATIC WIRING DIAGRAMS

AUTOMATIC TRANSMISSION CONTROLS WIRING SCHEMATICS

Power, Ground, Serial Data, and MIL

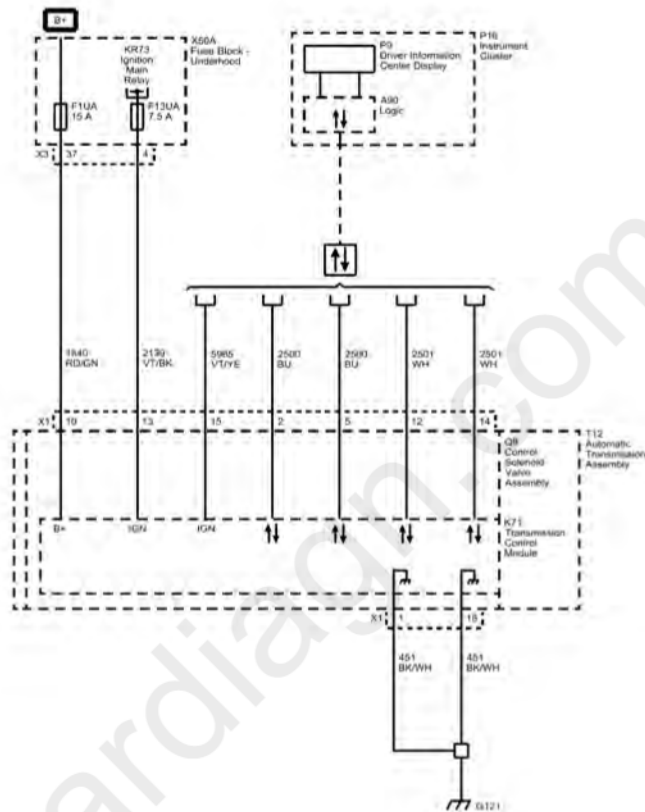


Fig. 1: Power, Ground, Serial Data, and MIL
Courtesy of GENERAL MOTORS COMPANY

Speed and Temperature Sensors, Valve Position, Pressure and Shift Controls

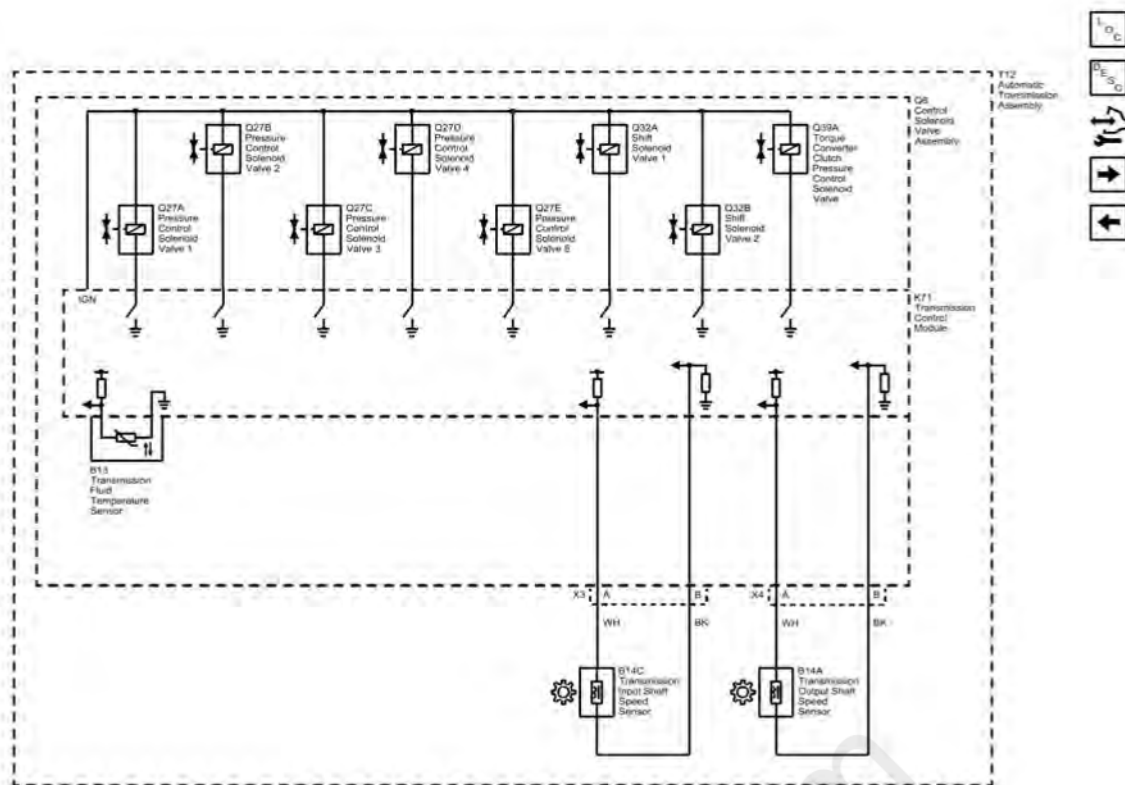


Fig. 2: Speed and Temperature Sensors, Valve Position, Pressure and Shift Controls
Courtesy of GENERAL MOTORS COMPANY

Internal Mode Switch and Manual Shift Controls

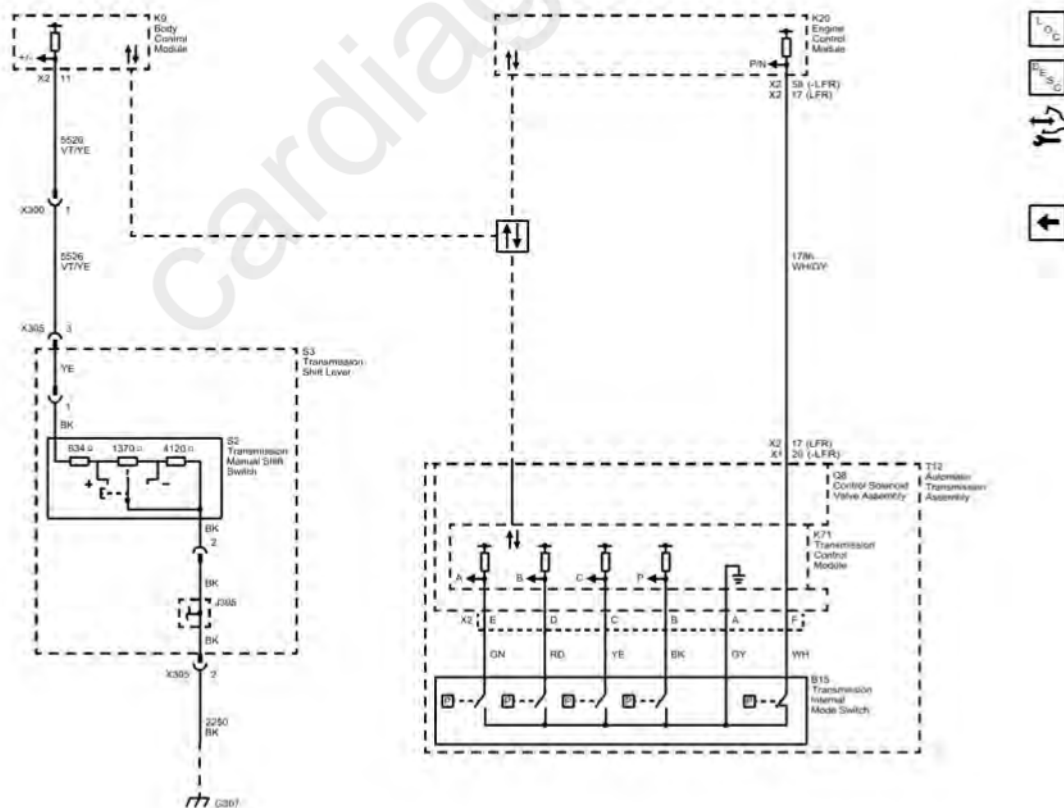


Fig. 3: Internal Mode Switch and Manual Shift Controls
Courtesy of GENERAL MOTORS COMPANY

2017 TRANSMISSION

Automatic Transmission - 6T70 (M7W) - Special Tools and Equipment - Special Tools - Impala

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/Description
	DT 3289-20 J 3289-20 KM-113-2-A Holding Fixture

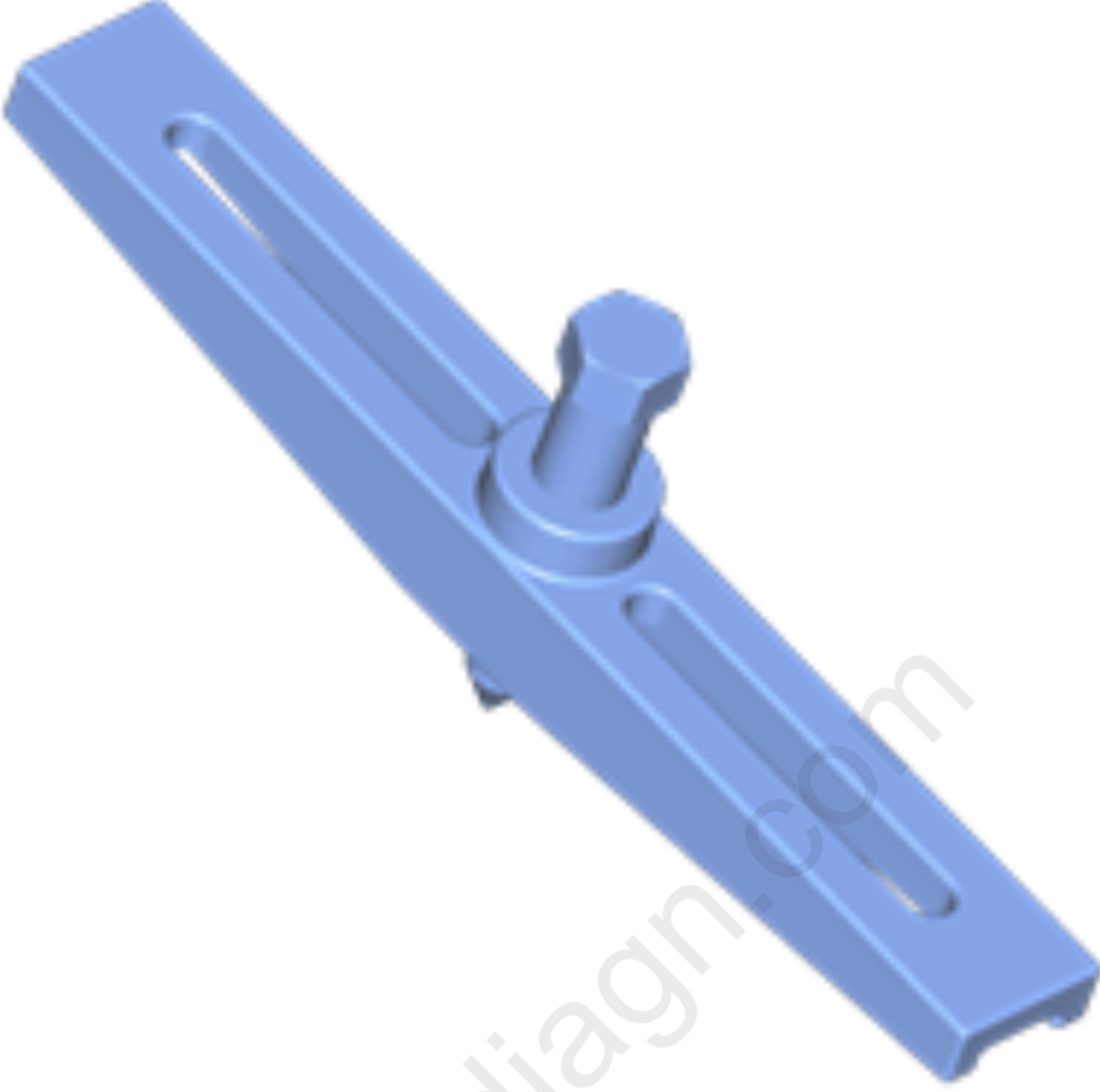
Illustration	Tool Number/Description
	DT 8433-1 J 8433-1 Puller Bar

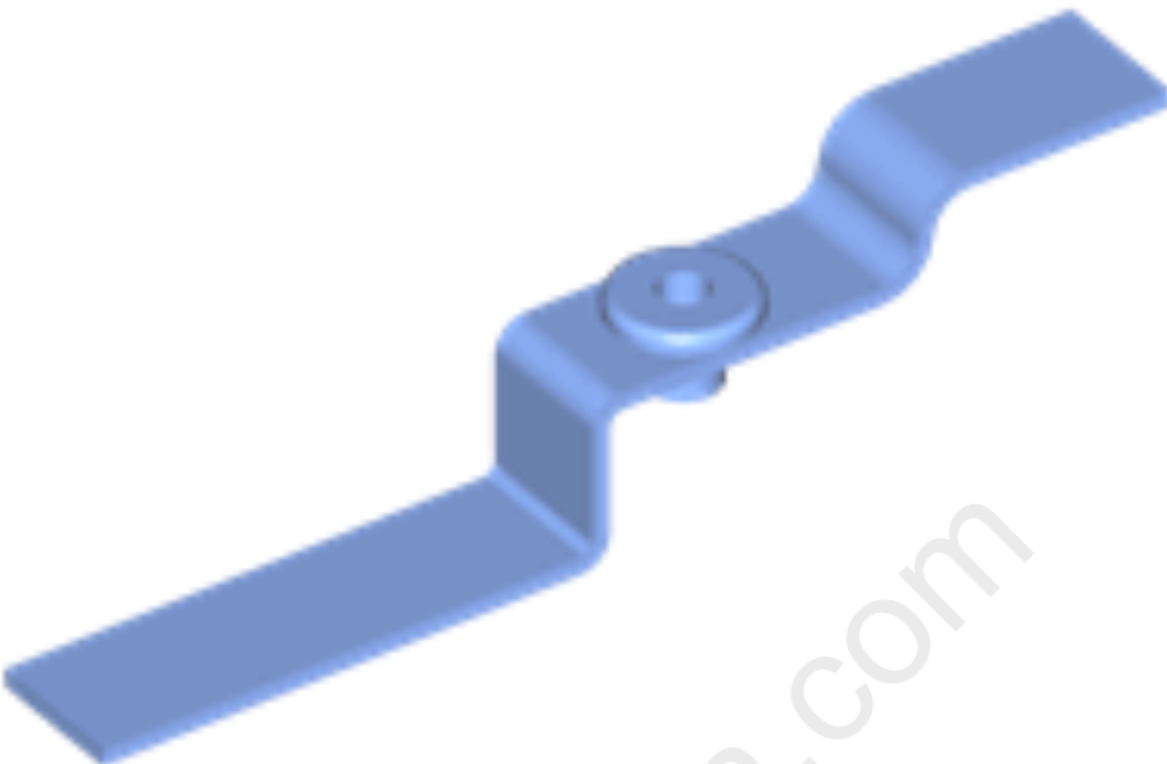
Illustration	Tool Number/Description
	DT 21366 J 21366 Converter Holding Strap
	DT 21867-A J 21867-A Pressure Gauge

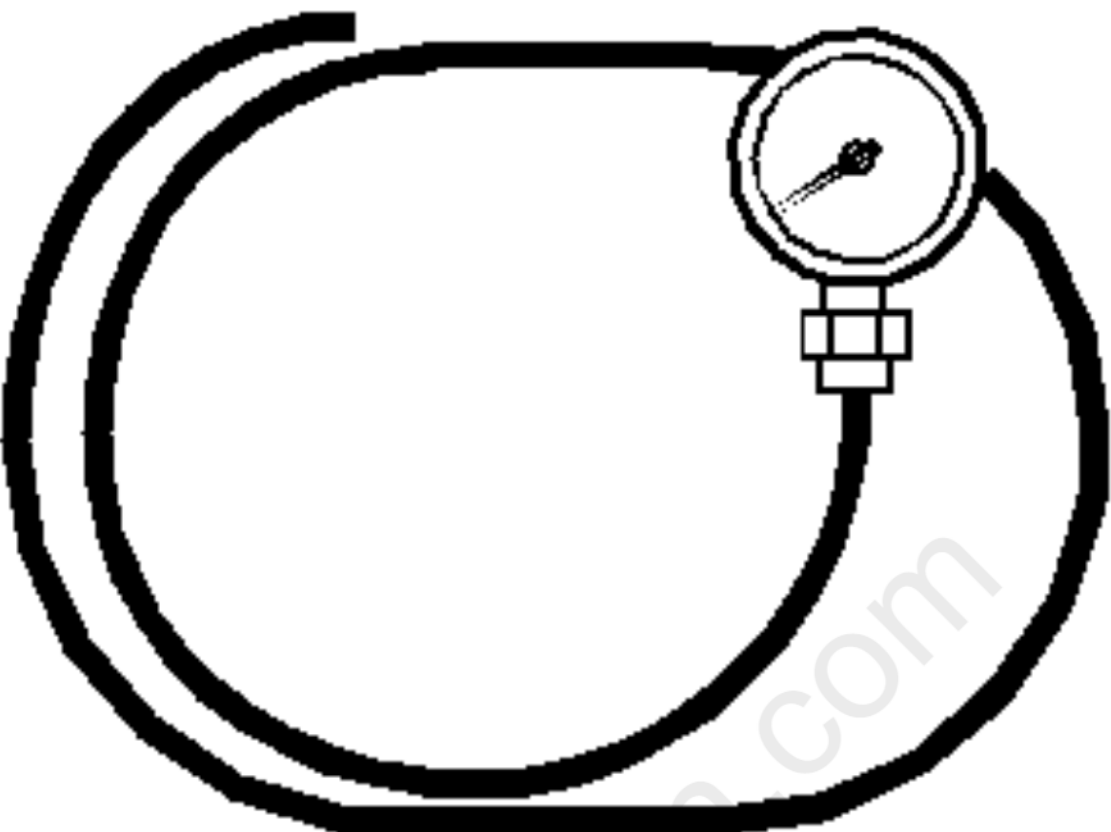
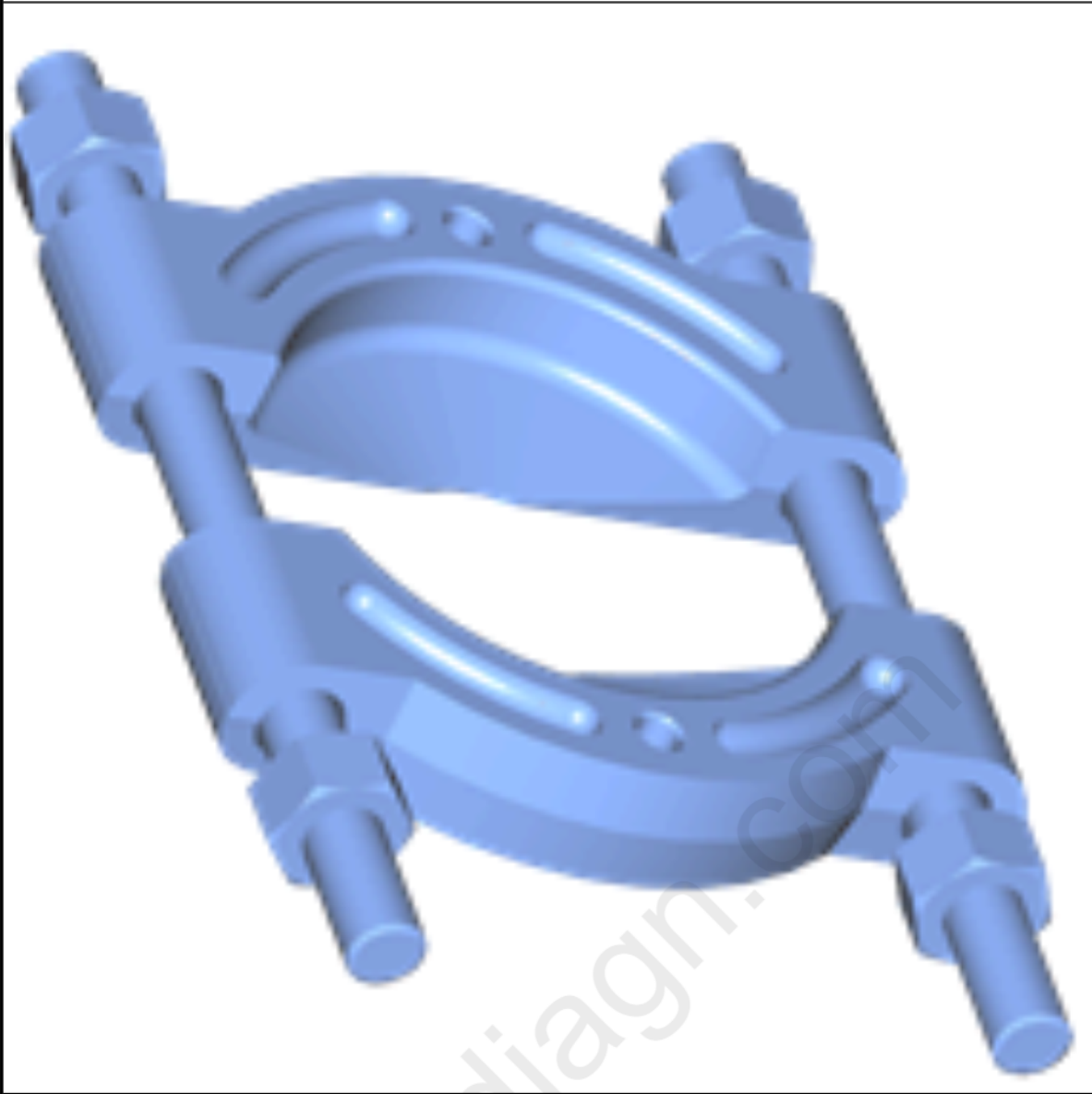
Illustration	Tool Number/Description
	

Illustration	Tool Number/Description
	DT 22912-B J 22912-B Split Plate Bearing Remover

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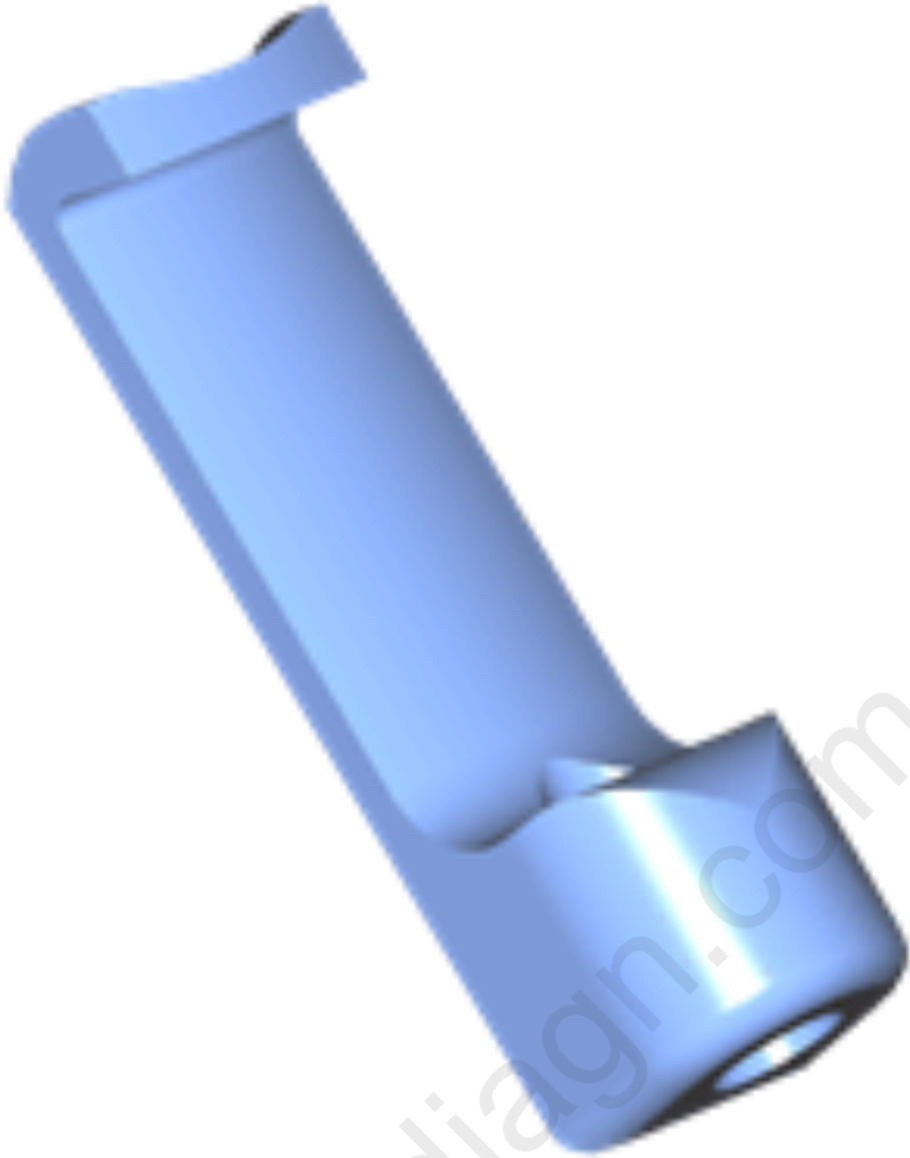
Illustration	Tool Number/Description
	DT 23129 J 23129 KM-586 Universal Seal Remover
	DT 23444-A J 23444-A Extreme Press Lubricant - 1/4 Ounce Tube

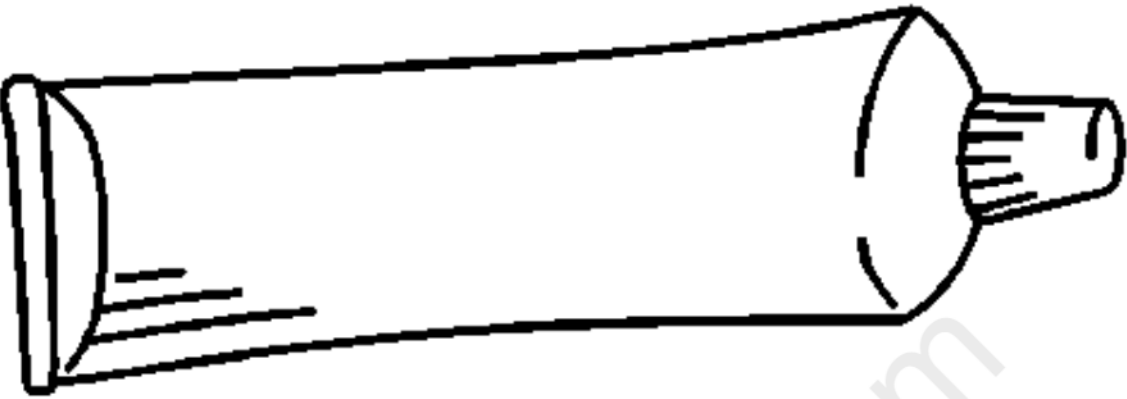
Illustration	Tool Number/Description
 A line drawing of a long, tapered medical instrument, possibly a catheter or probe. It has a flared, bell-shaped end on the left and a small, ribbed, cylindrical connector on the right. The main body is long and tapers slightly towards the right. A faint watermark 'cardiagn.com' is visible diagonally across the lower half of the illustration.	

Illustration	Tool Number/Description
	DT 28585 J 28585 Snap Ring Remover

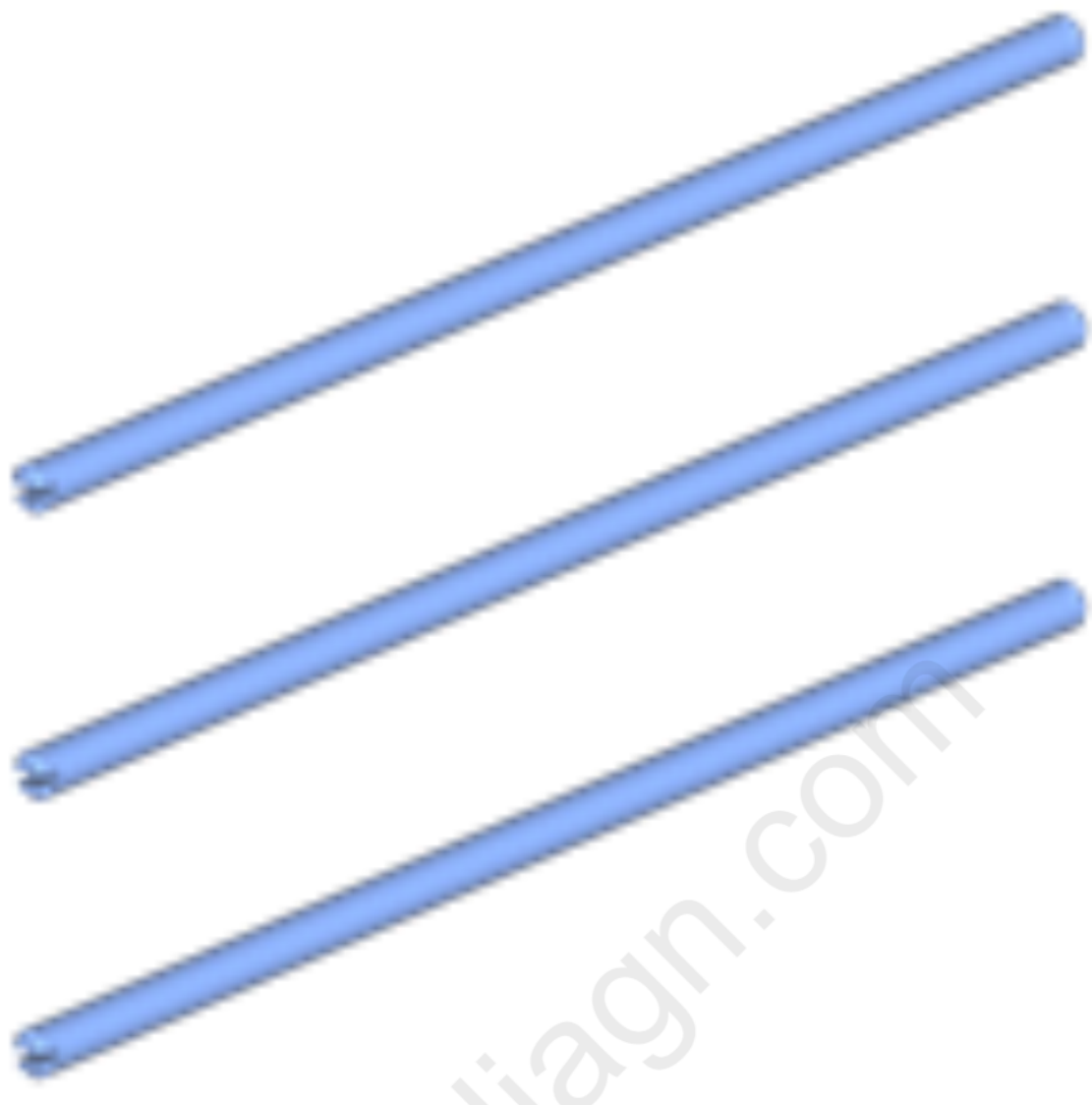
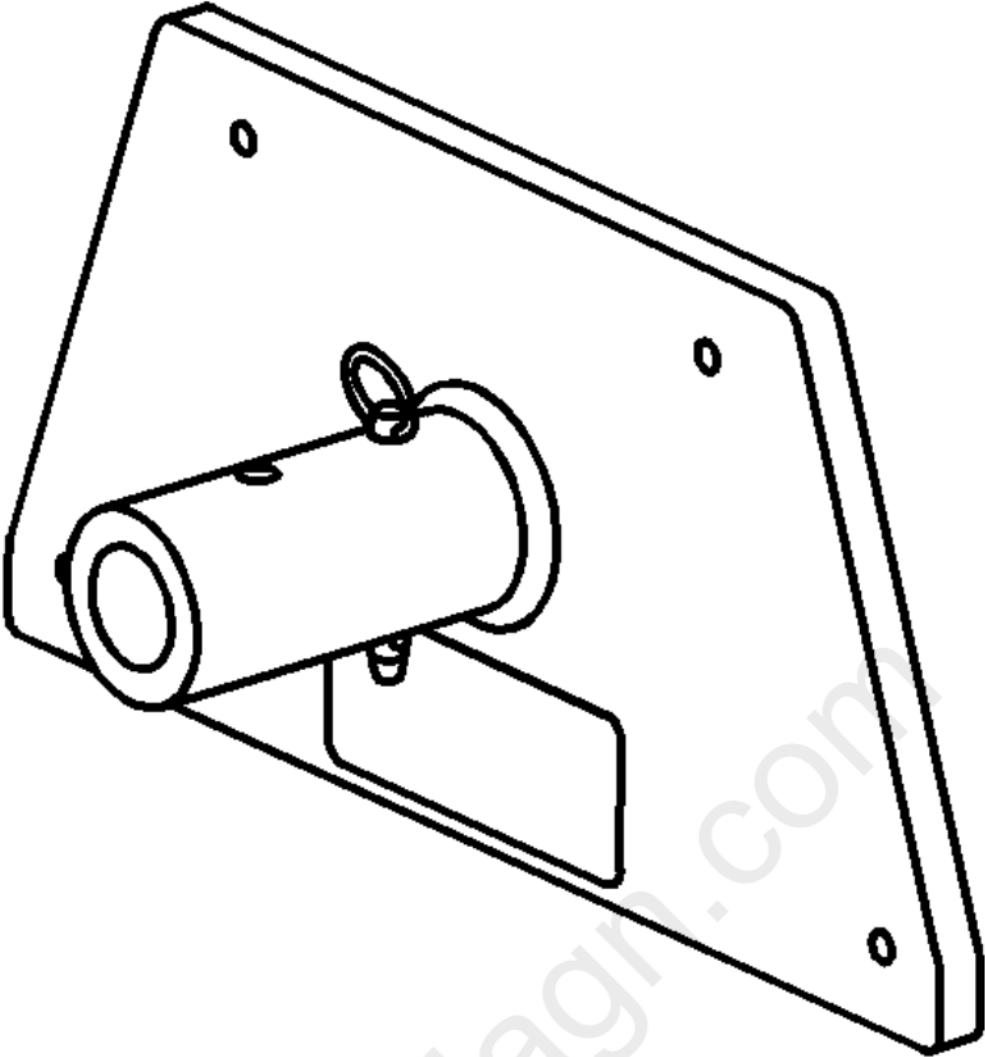
Illustration	Tool Number/Description
 The illustration shows three identical blue cylindrical pins arranged diagonally from the top-left to the bottom-right. Each pin has a slightly wider, flanged end at the bottom-left. A large, light gray watermark 'cardiagn.com' is oriented diagonally across the entire page, passing through the pins.	DT 39068 J 39068 Valve Body Guide Pins (3)

Illustration	Tool Number/Description
	DT 39890 J 39890 Holding Fixture Adapter

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Illustration	Tool Number/Description
 A 3D rendering of a blue, hollow cylindrical tool. It is positioned diagonally, with the top-left end closer to the viewer and the bottom-right end further away. The cylinder has a smooth, metallic-looking finish with subtle shading to indicate its three-dimensional form. A faint, diagonal watermark reading 'cardiagn.com' is visible across the lower half of the cylinder.	DT 41229 J 41229 Manual Shaft Pin Installer

Illustration	Tool Number/Description
	DT 41816 J 41816 Three Legged Puller
	DT 41816-2 J 41816-2 Crankshaft End Protector

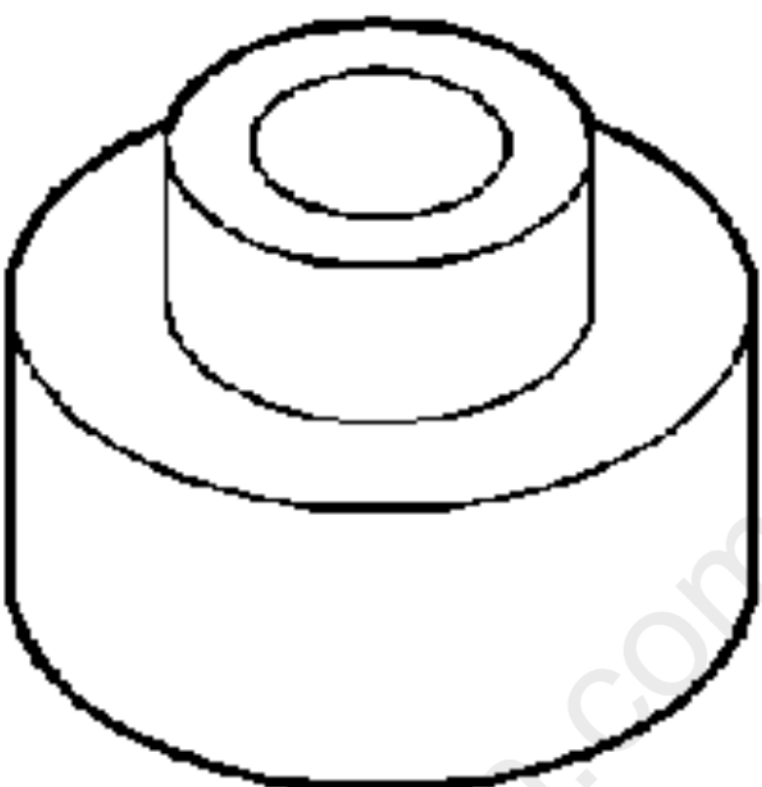
Illustration	Tool Number/Description
 A line drawing of a medical device, possibly a catheter or probe. It consists of a large, hollow cylindrical base with a smaller, hollow cylindrical tip protruding from the center. The drawing is a simple black and white line art. A faint watermark 'cardiaghi.com' is visible across the image.	

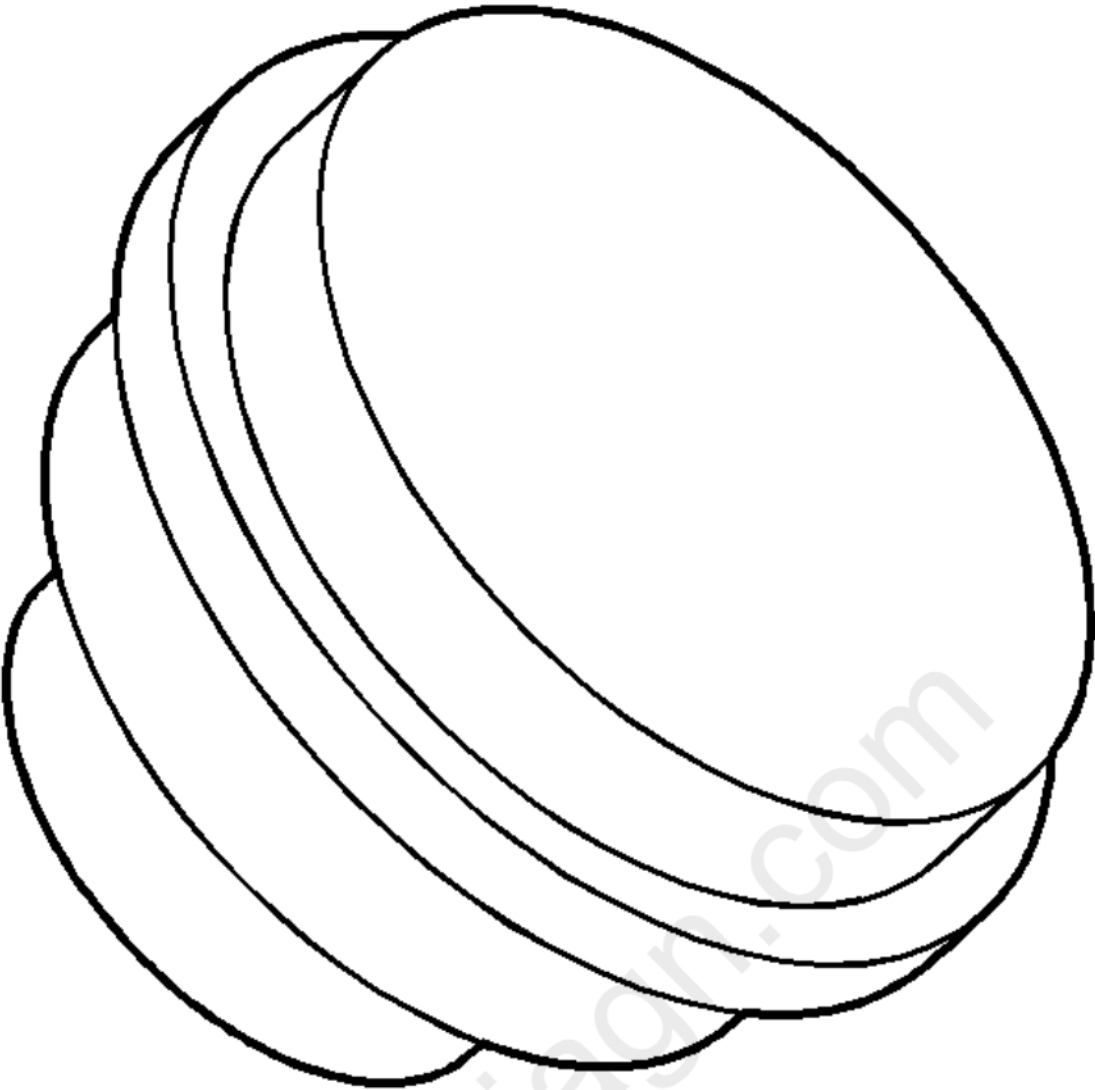
Illustration	Tool Number/Description
	DT 45087 J 45087 Bearing Cup Installer

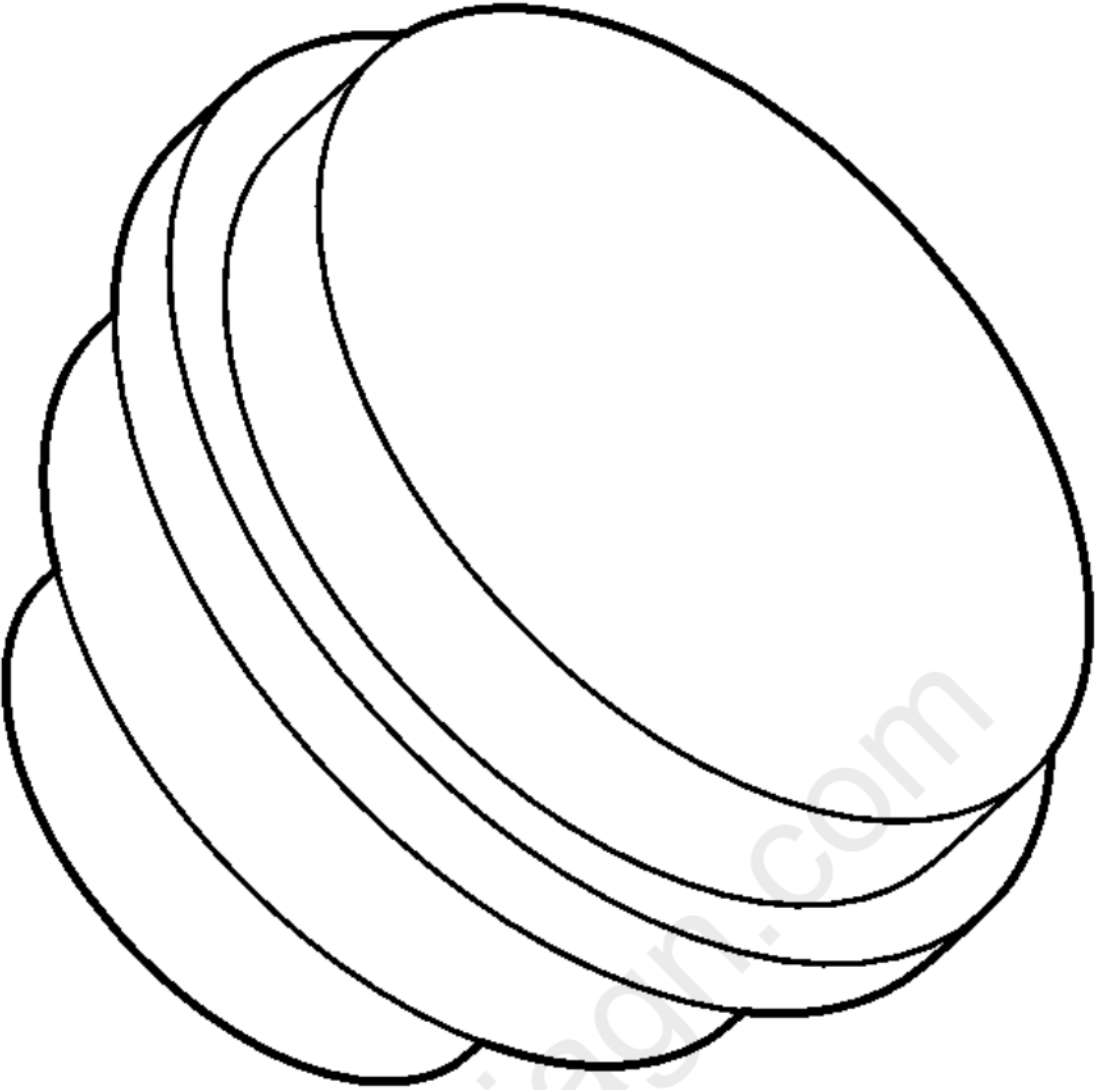
Illustration	Tool Number/Description
	DT 45087-A Bearing Cup Installer

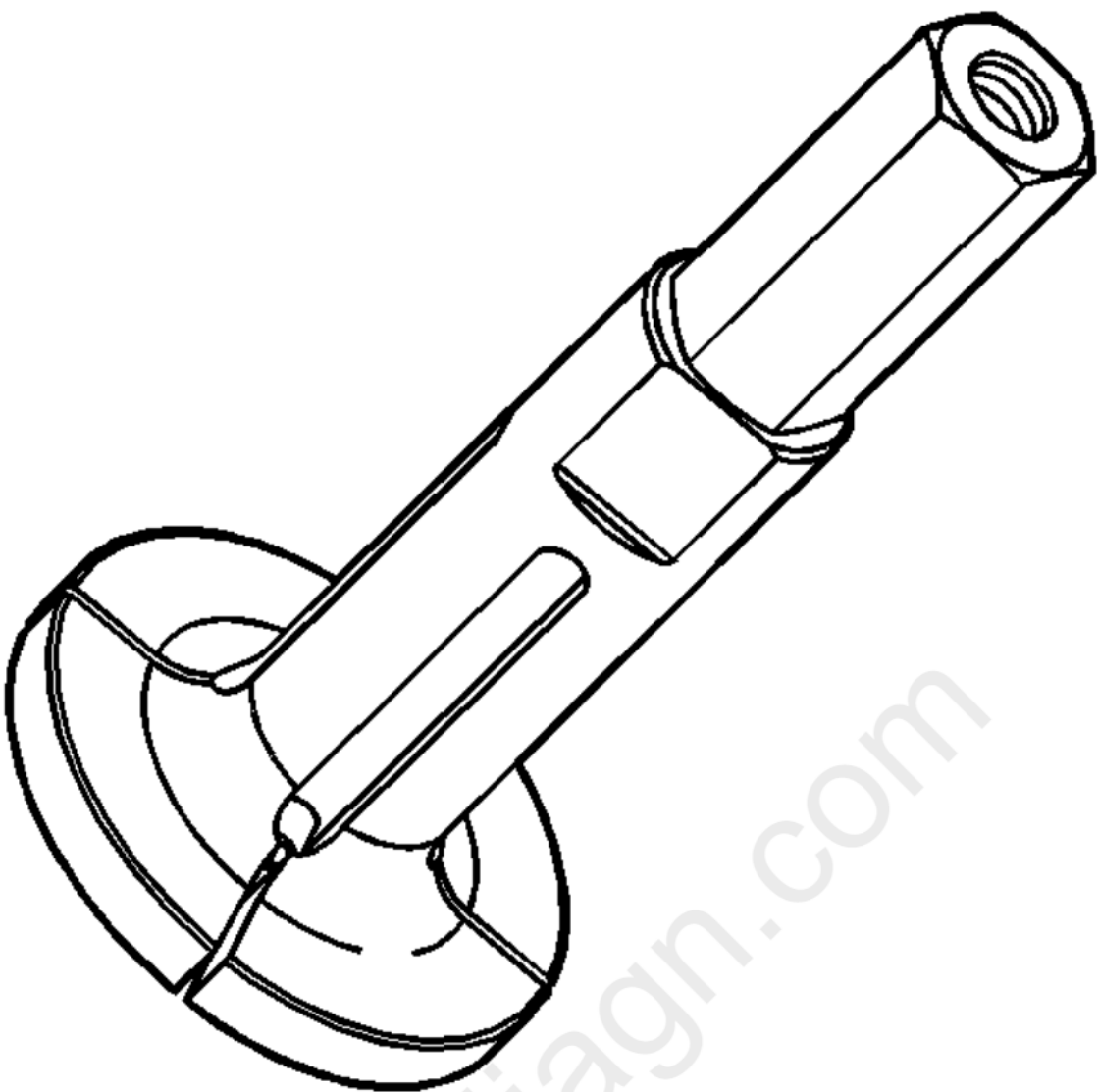
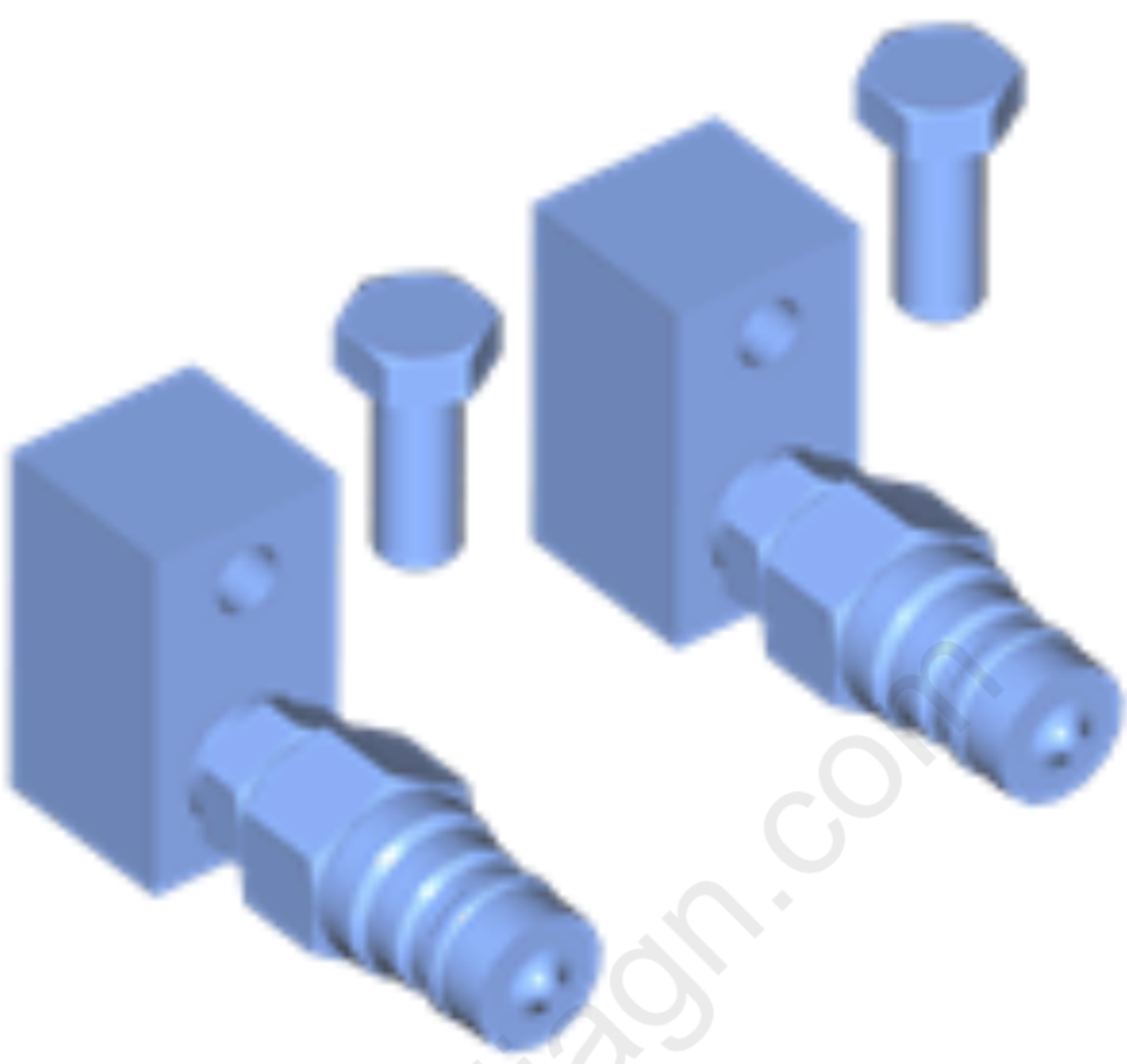
Illustration	Tool Number/Description
	DT 45094 J 45094 Bearing Cup Remover
	DT 45096 J 45096 Transmission Oil Cooling System Flush and Flow Test Tool



Illustration	Tool Number/Description
 DT 45096-50 J 45096-50 Transmission Cooler Flush Adapter	

cardiagn.com

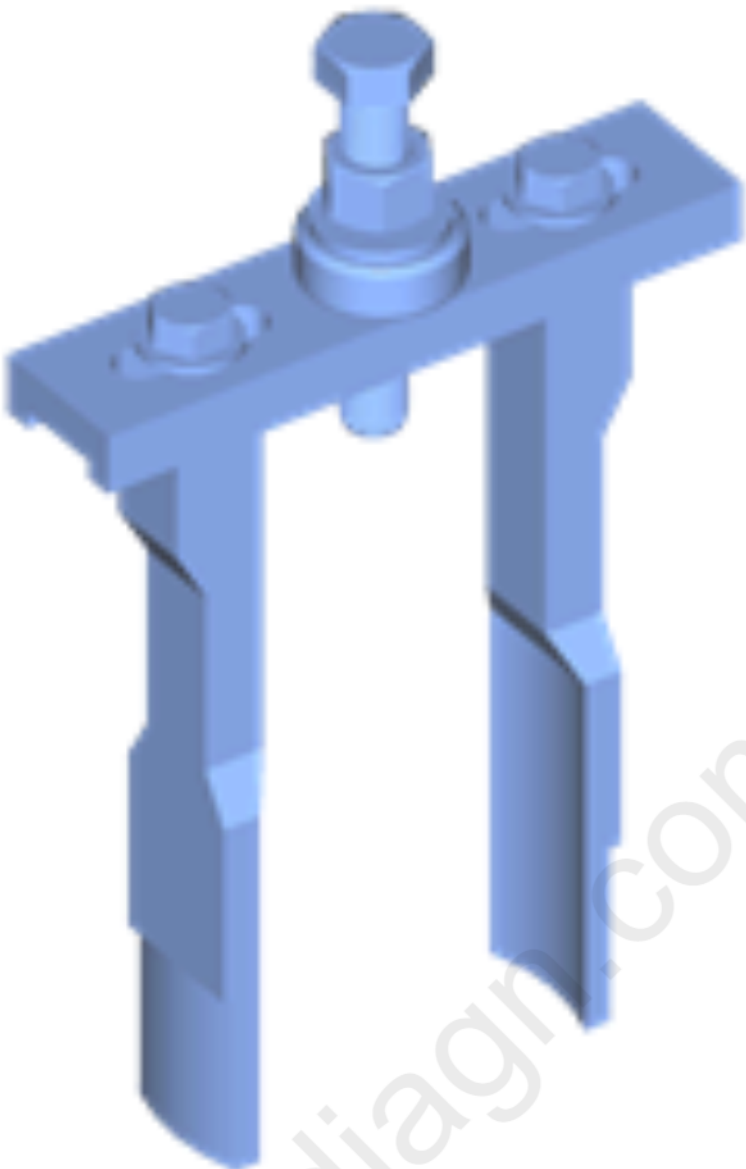
Illustration	Tool Number/Description
	DT 45124 J 45124 Removal Bridge

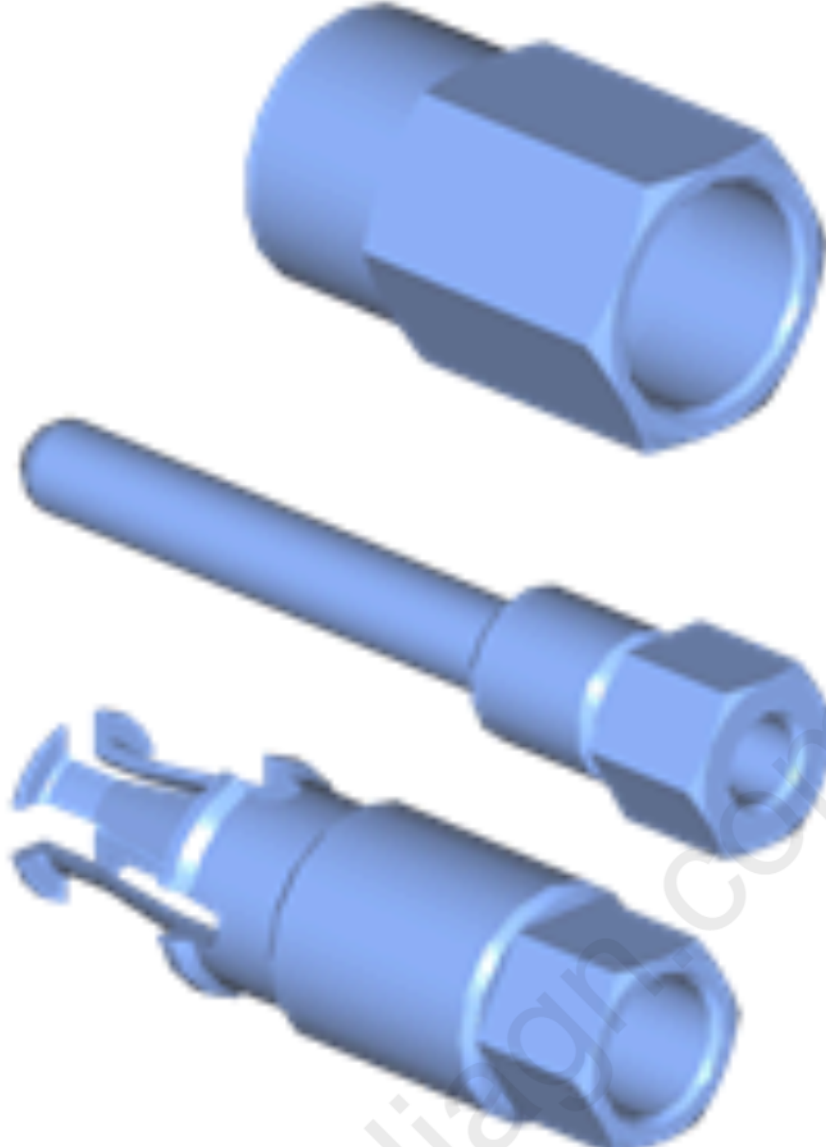
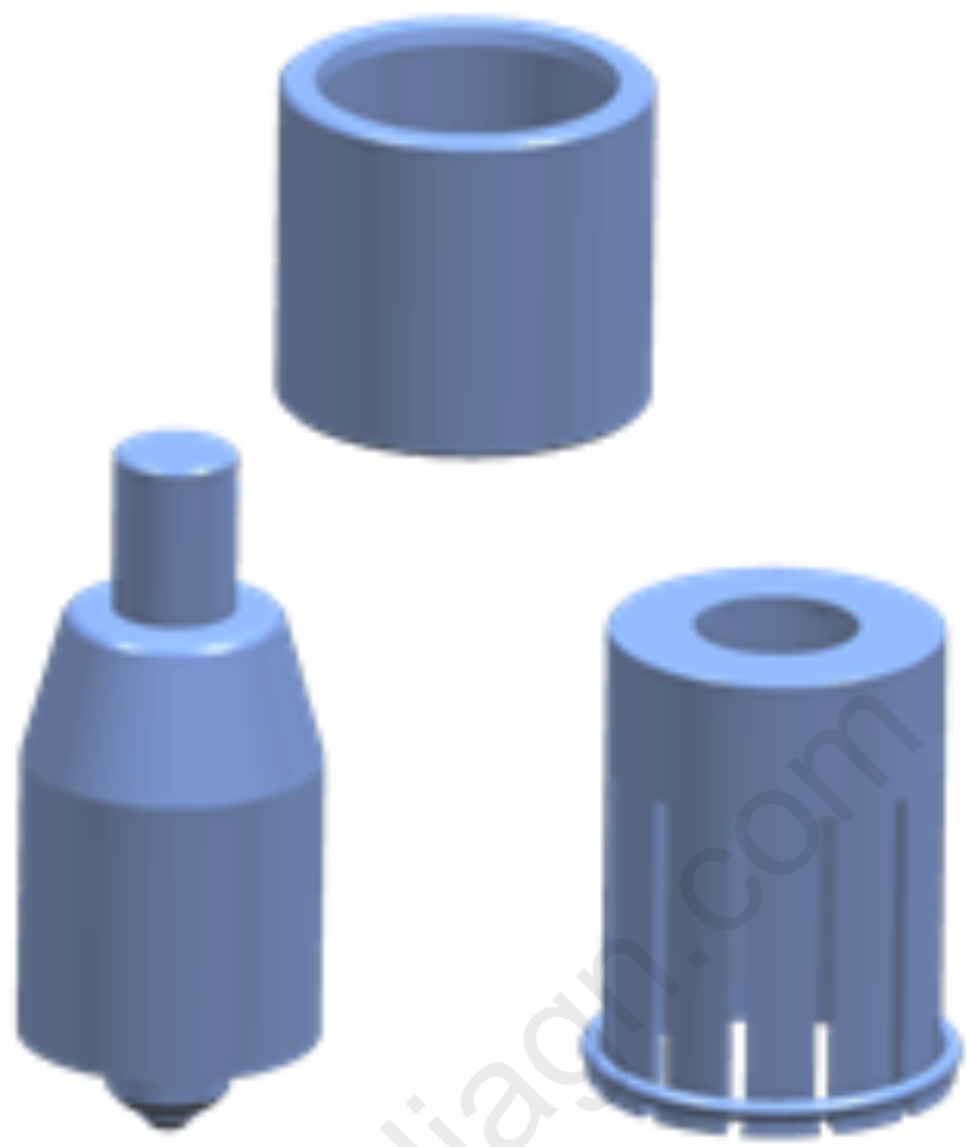
Illustration	Tool Number/Description
	DT 45201 DT 48203 J 45201 Cooler Line Seal Remover

Illustration	Tool Number/Description
	DT 45341 J 45341 Rear Wheel Drive Shaft Removal Tool

cardiagn.com

Illustration	Tool Number/Description
 The illustration shows two identical blue T-shaped lifting handles. Each handle consists of a long, cylindrical shaft and a shorter, wider cylindrical crossbar at one end. They are positioned diagonally, with the top handle slightly to the right of the bottom one. A large, light gray watermark 'cardiacsn.com' is oriented diagonally across the lower half of the image.	DT 46409 J 46409 KM-922 Torque Converter Lifting Handles

Illustration	Tool Number/Description
	DT 46620 J 46620 Seal Installer

cardiacm.com

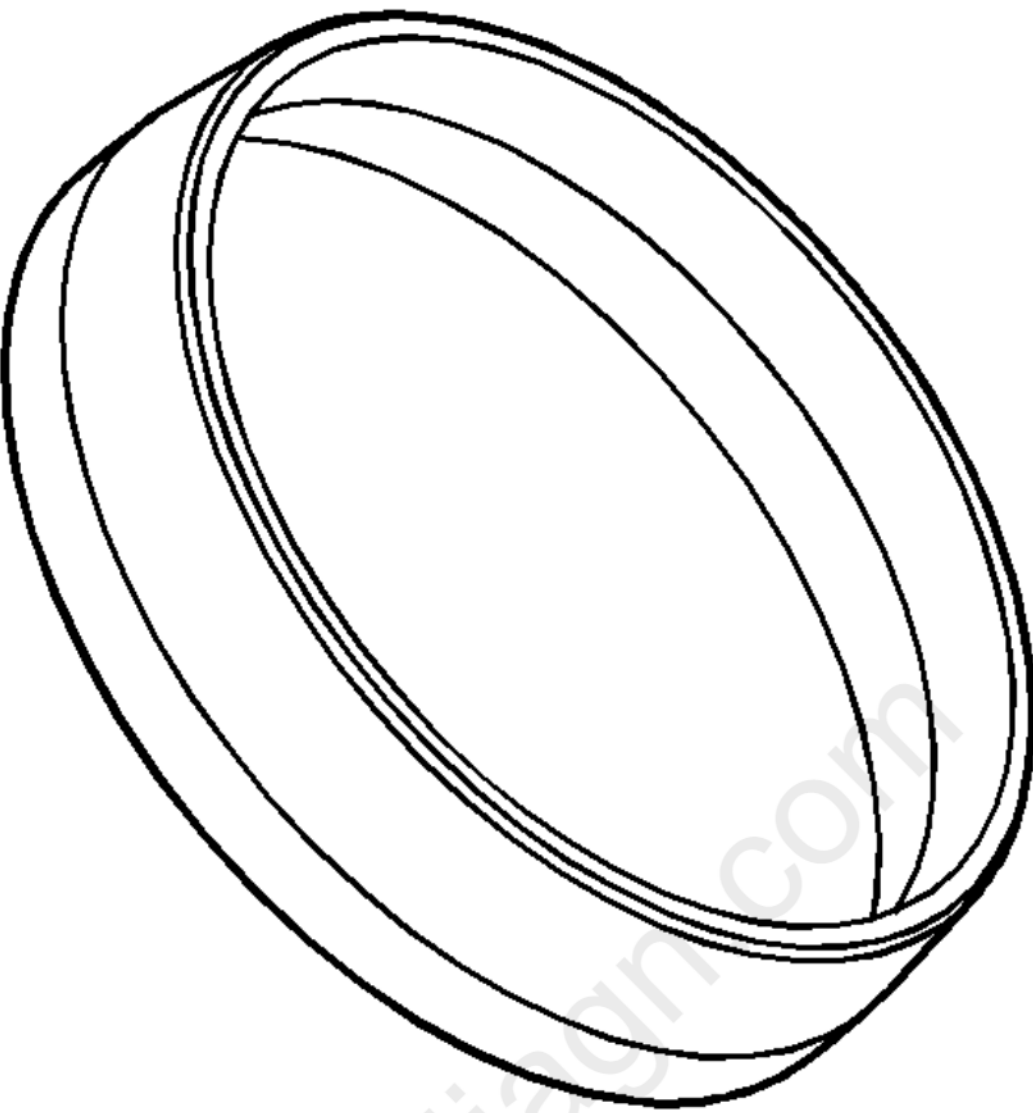
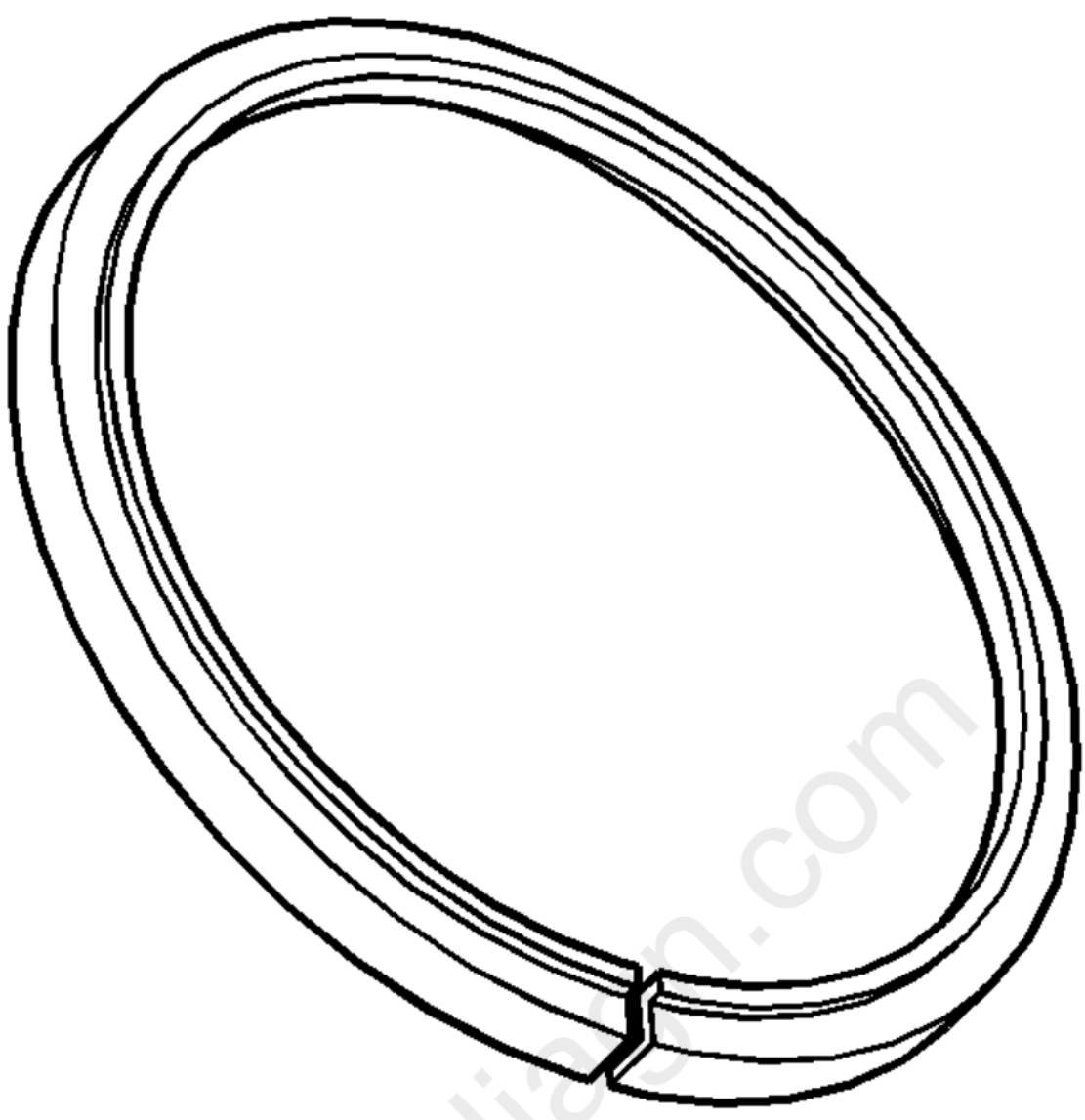
Illustration	Tool Number/Description
	DT 46621 J 46621 Piston Seal Protector

Illustration	Tool Number/Description
	DT 46622 J 46622 Piston Seal Protector

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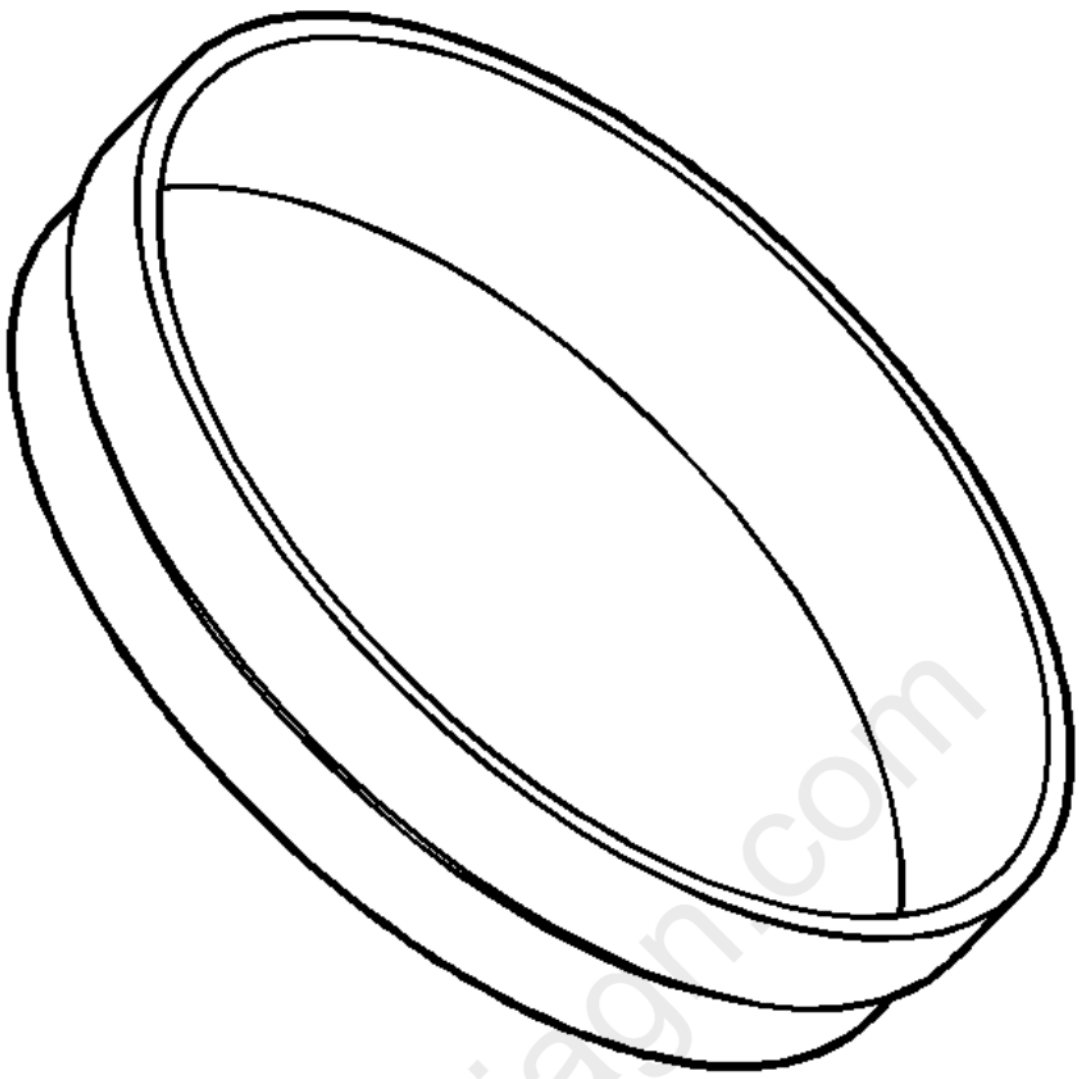
Illustration	Tool Number/Description
	DT 46623 J 46623 Piston Seal Protector

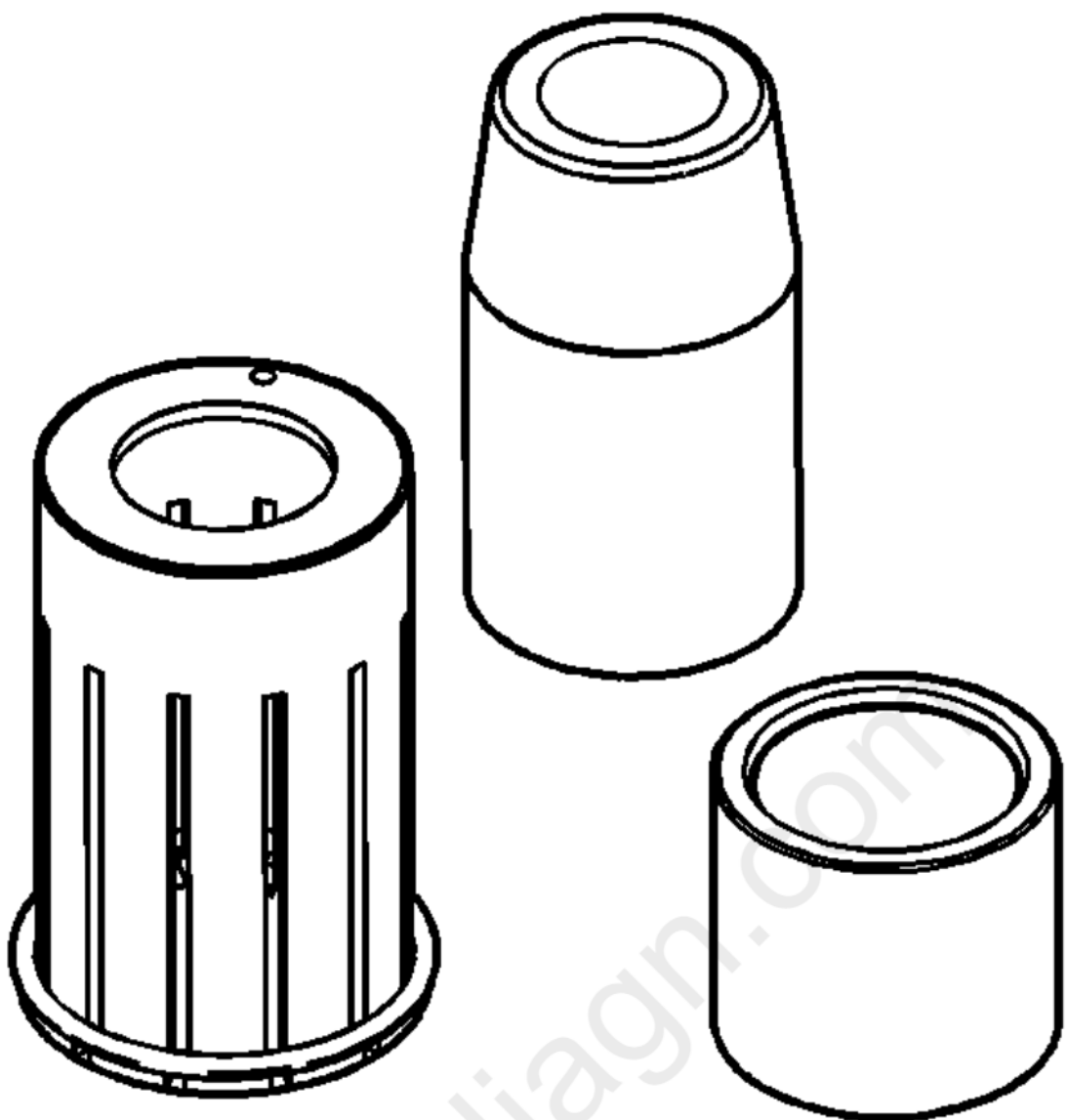
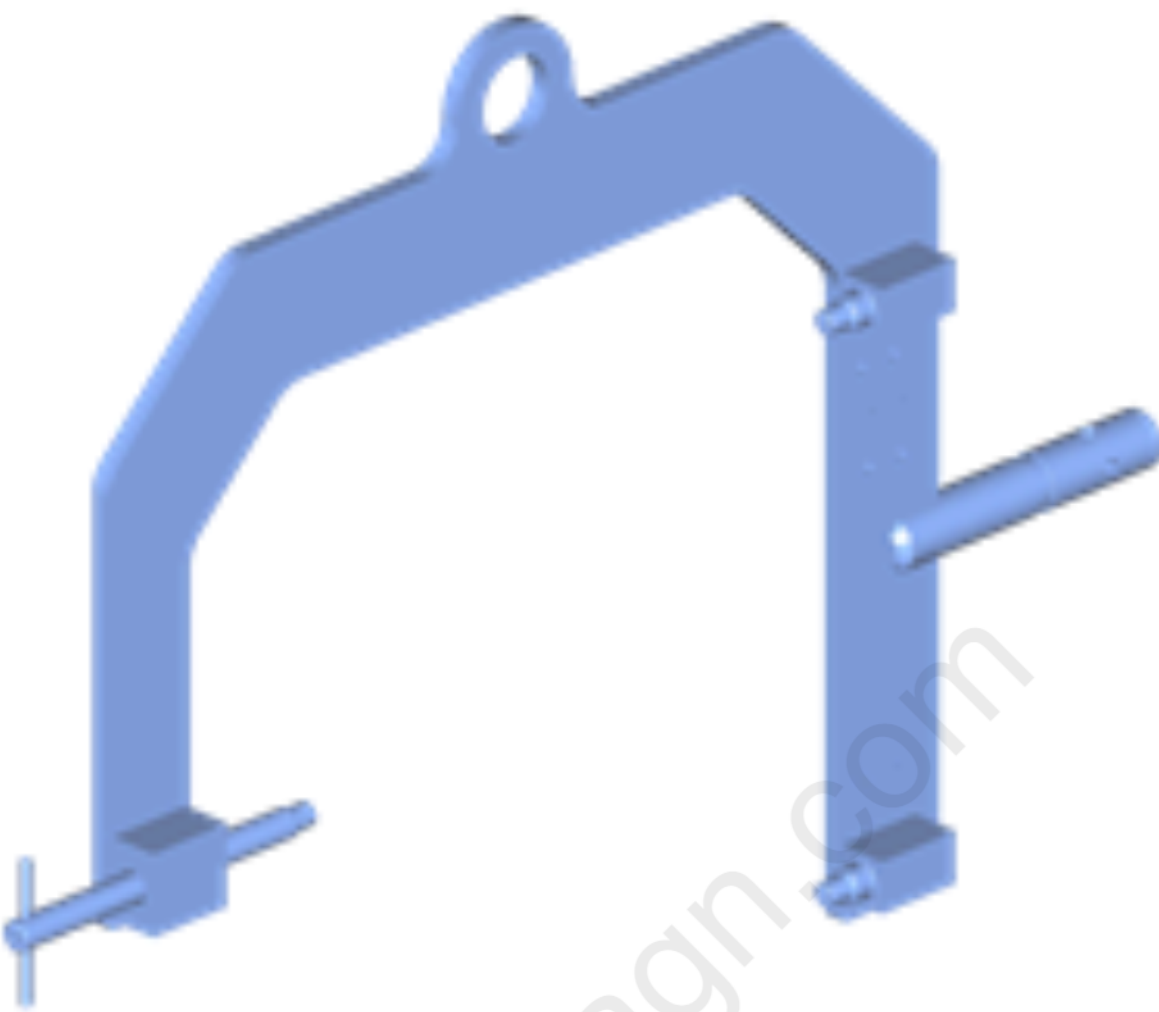
Illustration	Tool Number/Description
 The illustration shows three mechanical components. On the left is a large cylindrical flange with a central bore and internal splines. In the center is a tall, tapered sleeve with a flange at the top. On the right is a smaller cylindrical flange. A diagonal watermark 'cardiagn.com' is visible across the bottom right of the illustration area.	DT 46624 J 46624 Seal Installer

Illustration	Tool Number/Description
	DT 46625 J 46625 Transmission Holding Fixture

cardiagn.com

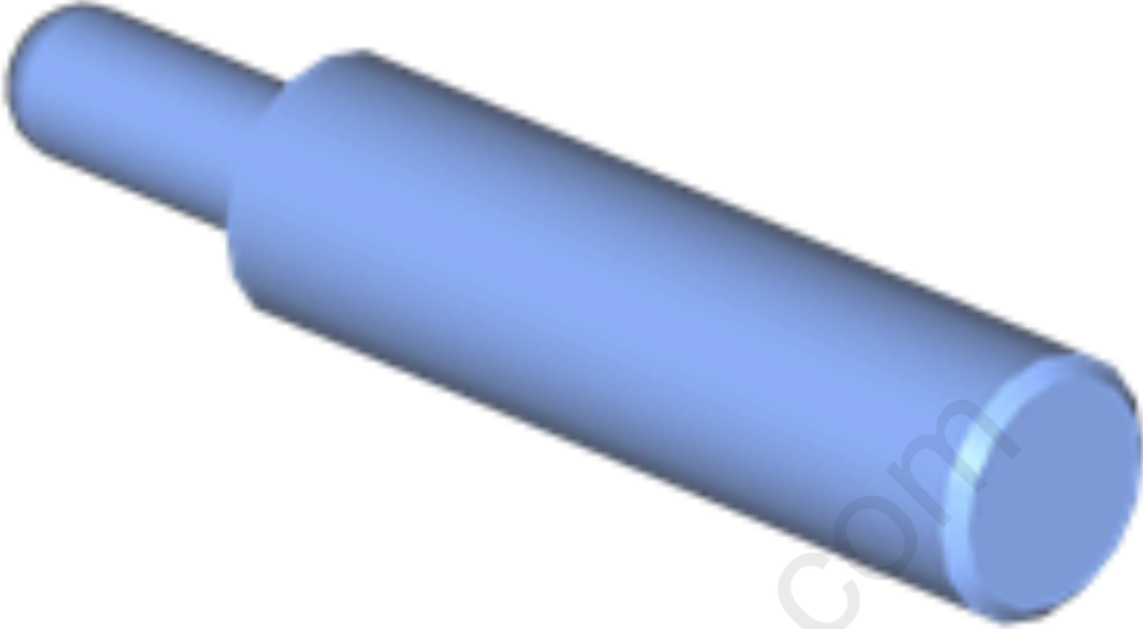
Illustration	Tool Number/Description
	DT 46626 J 46626 Seal Installer

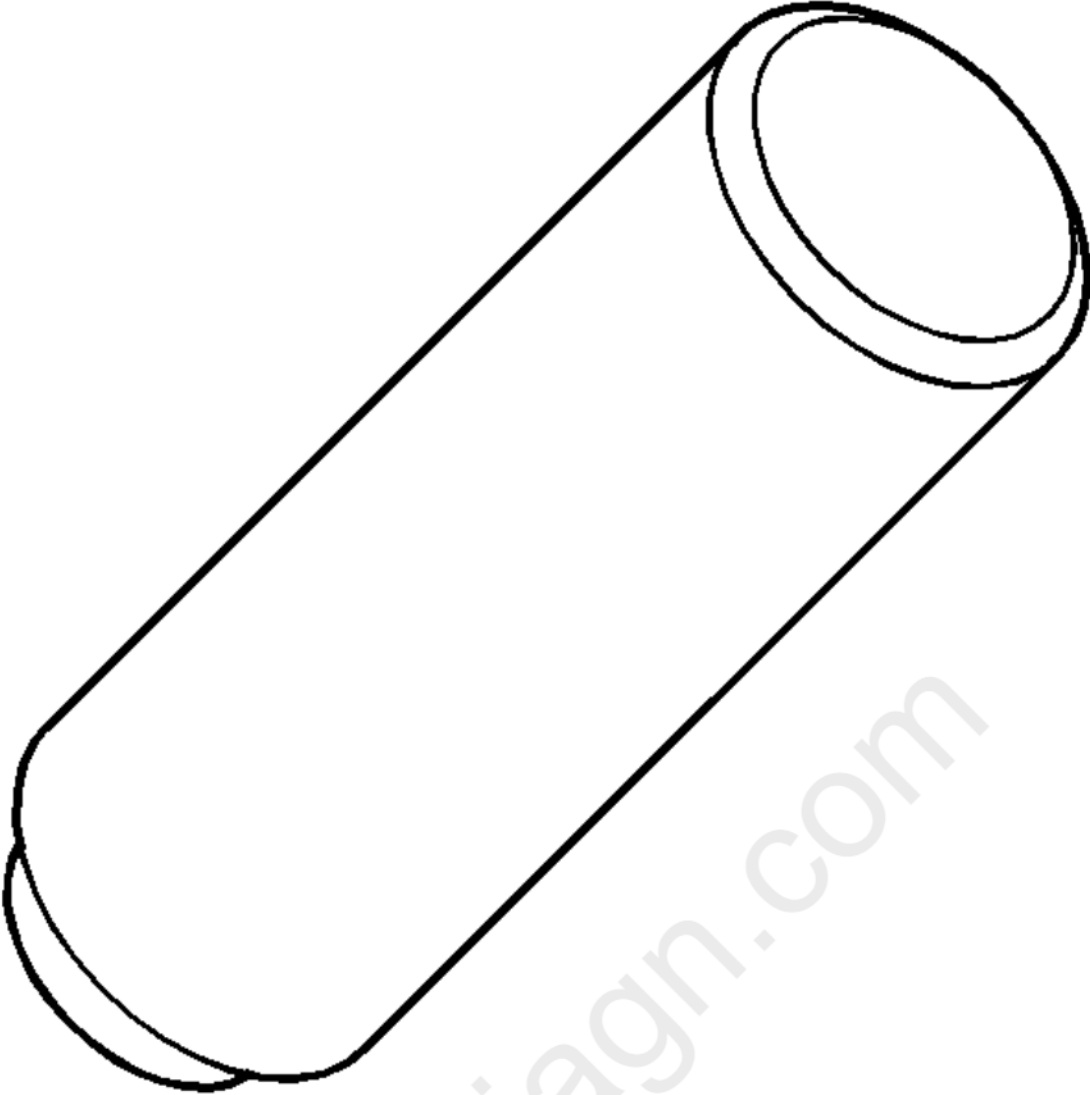
Illustration	Tool Number/Description
	DT 46627-A J 46627-A Seal Installer

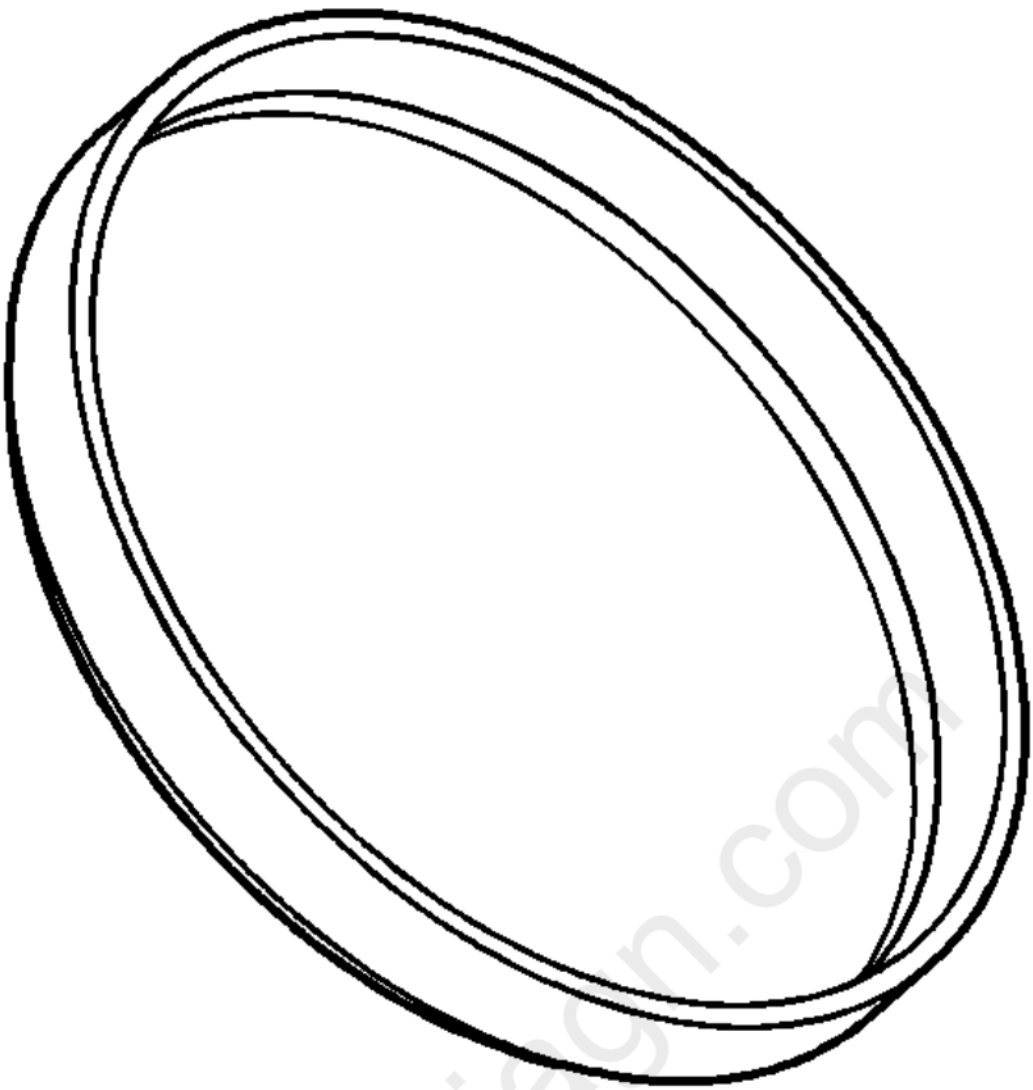
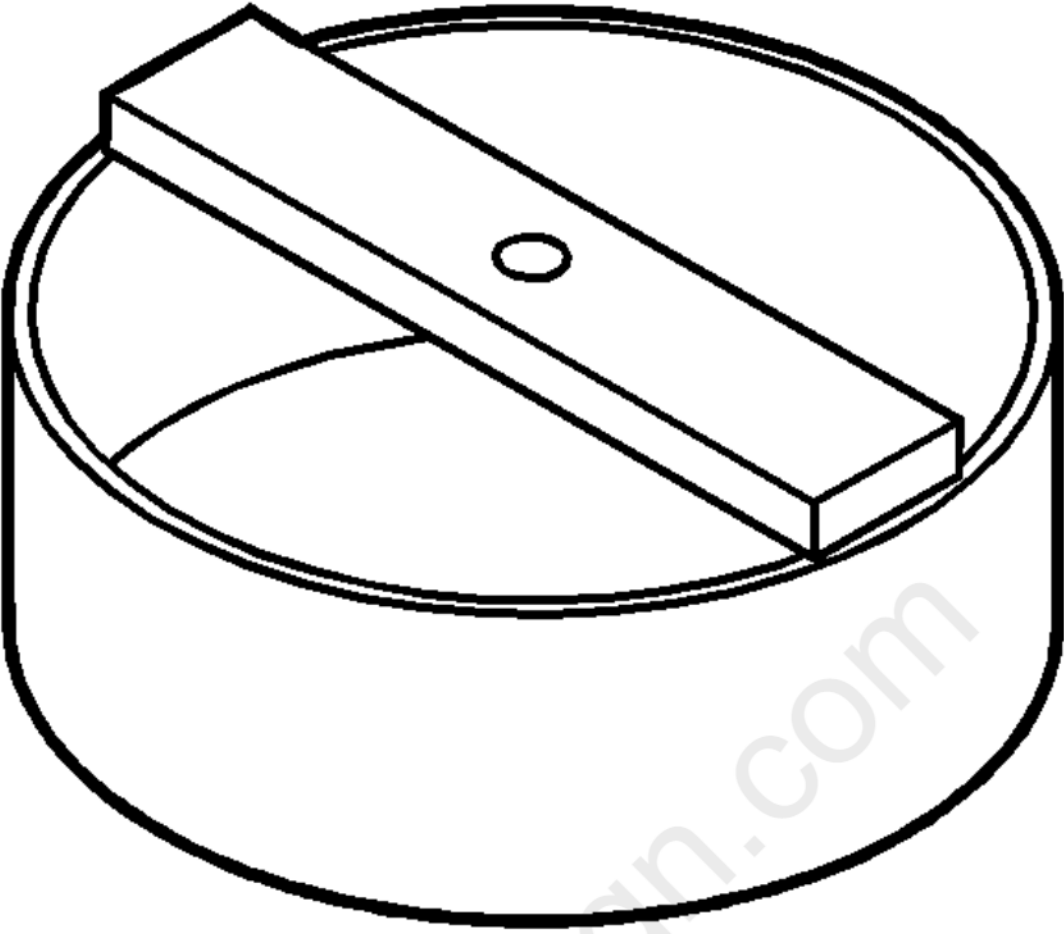
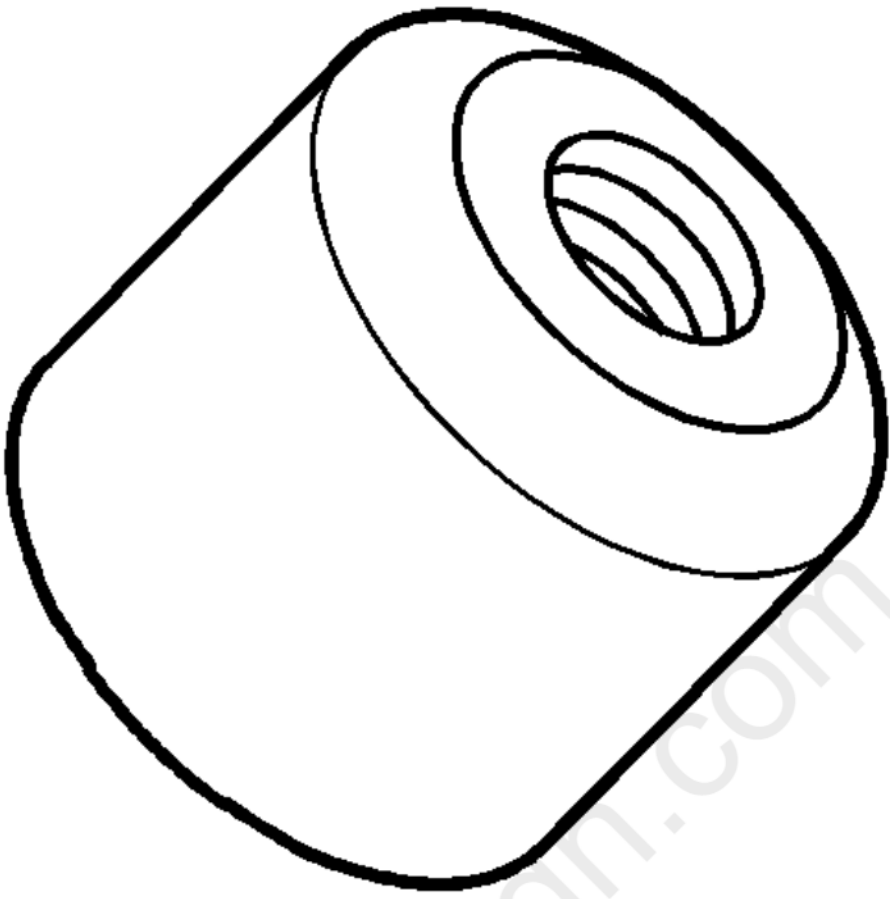
Illustration	Tool Number/Description
	DT 46628-1 J 46628-1 Piston Seal Protector

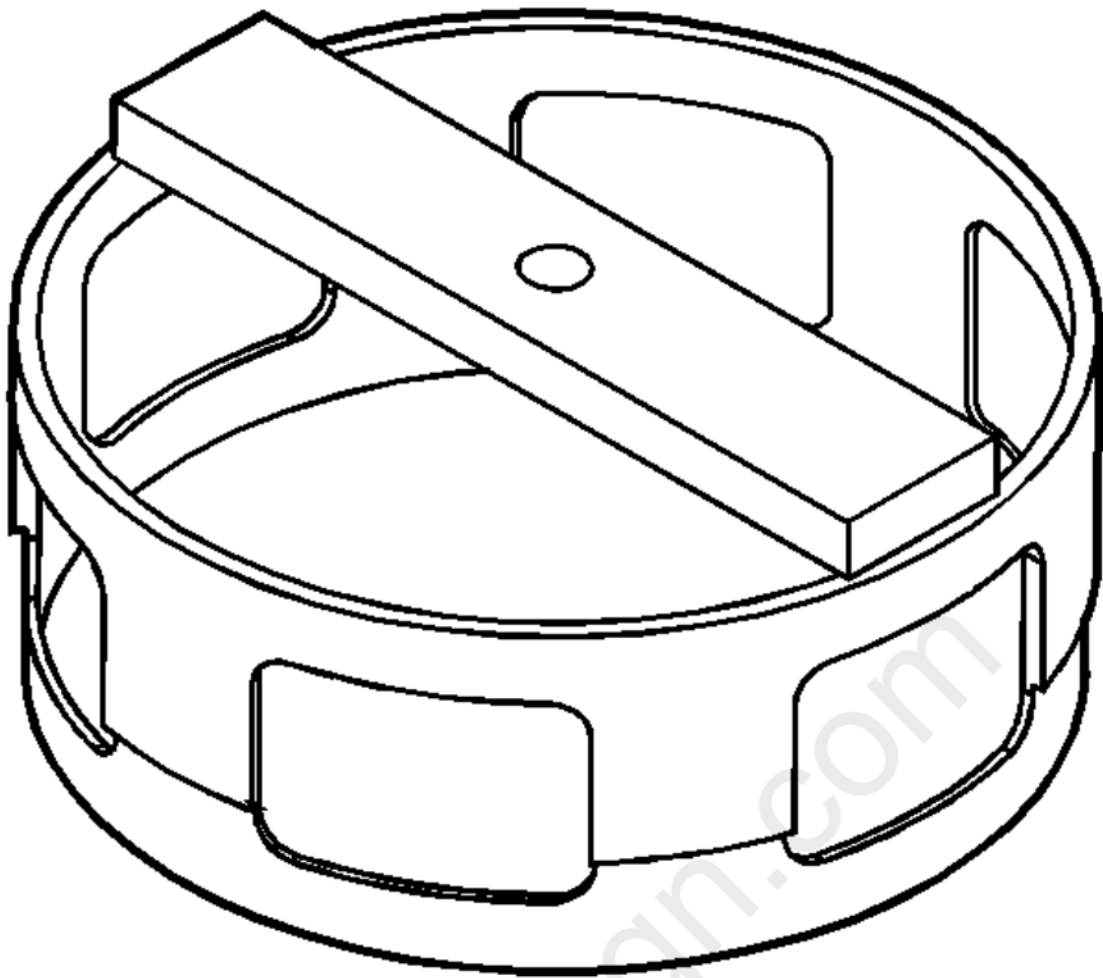
Illustration	Tool Number/Description
	DT 46628-2 J 46628-2 Spring Compressor

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Illustration	Tool Number/Description
	DT 46629-A J 46629-A Seal Installer

Illustration	Tool Number/Description
	DT 46630 J 46630 Lube Dam Installer

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Illustration	Tool Number/Description
	DT 46632 J 46632 Spring Compressor

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Illustration	Tool Number/Description
	DT 47693 Dam Protector

Illustration	Tool Number/Description
	DT 47694 Piston Spring Compressor

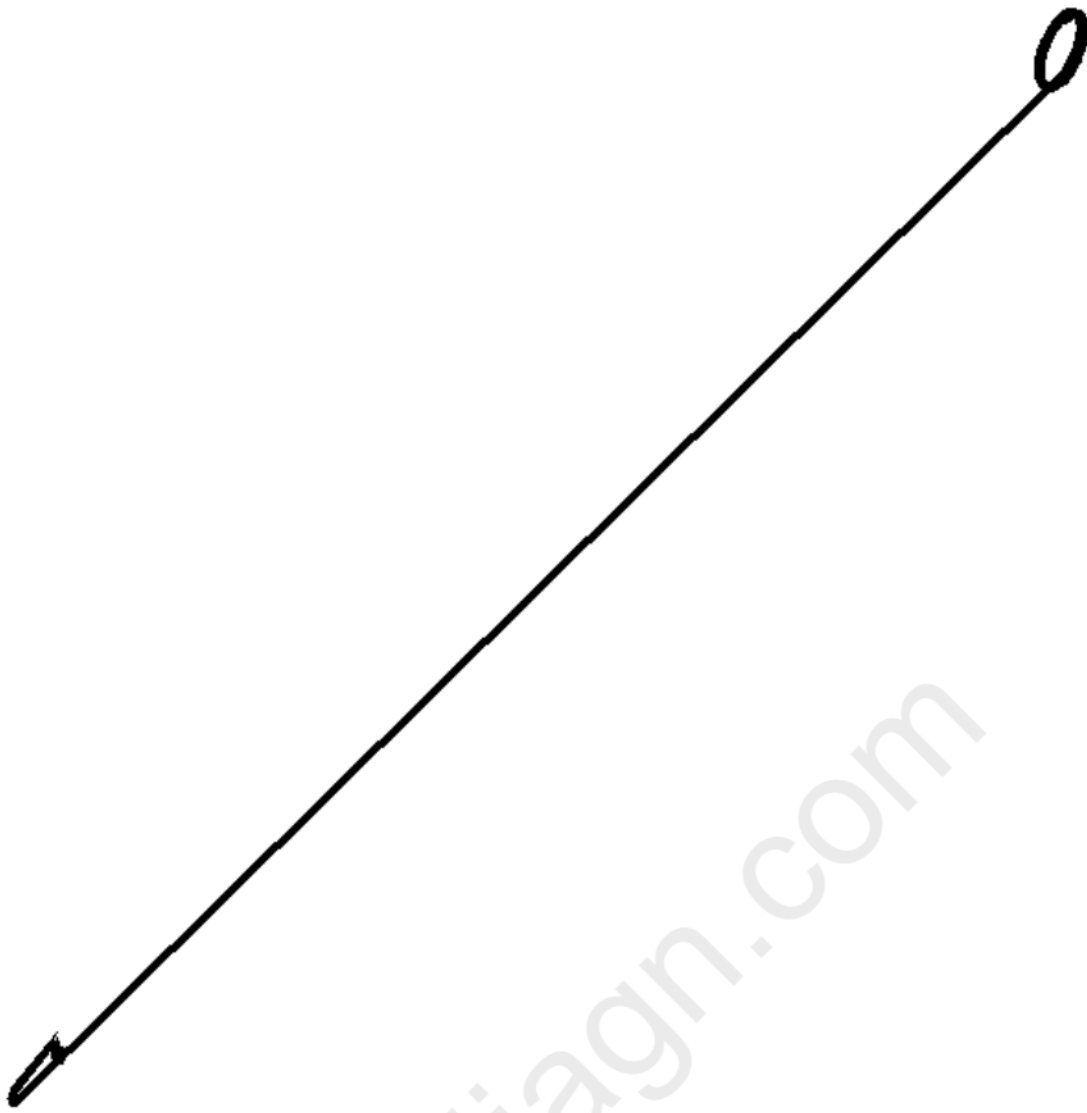
Illustration	Tool Number/Description
 cardiagn.com	DT 47734 Speed Sensor Harness Tether

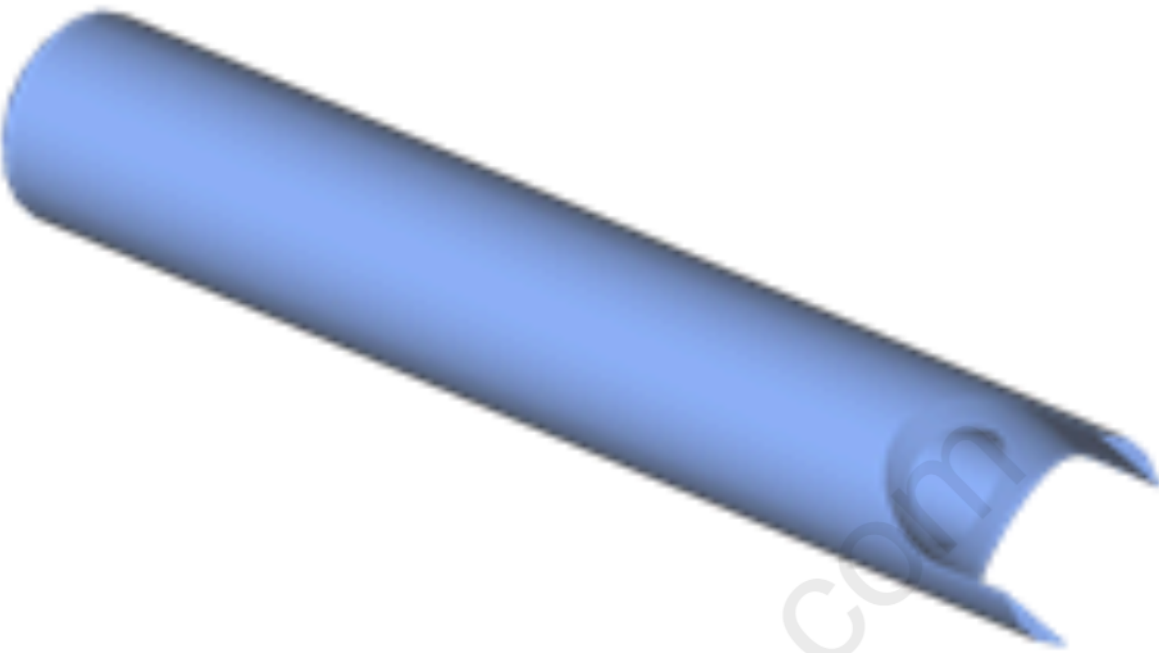
Illustration	Tool Number/Description
 A 3D rendering of a blue, cylindrical medical instrument. The instrument is oriented diagonally from the top-left towards the bottom-right. The tip of the instrument is curved and features two sharp, pointed prongs or lobes, resembling a pair of forceps or a specialized catheter tip. The surface of the cylinder is smooth with a slight gradient, suggesting a metallic or plastic material. A faint watermark 'cardiagn.com' is visible across the lower half of the image.	DT 47793 Differential Rotating Tool

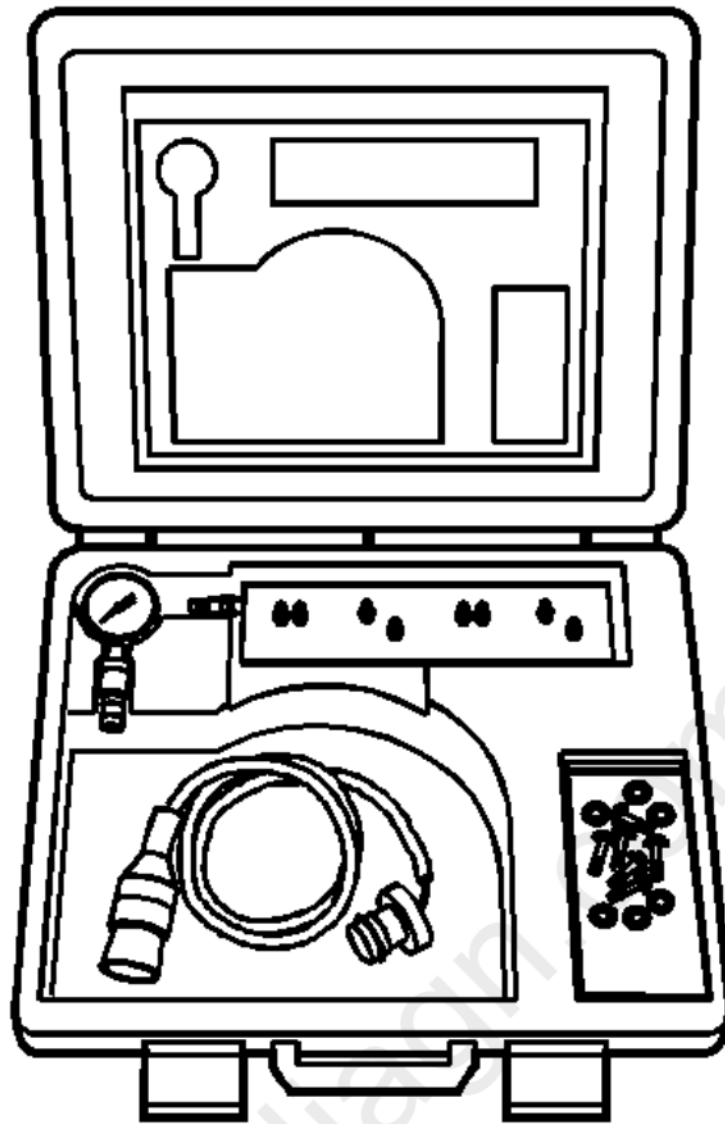
Illustration	Tool Number/Description
	DT 47800 Shim Selection Gauge

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Illustration	Tool Number/Description
	DT 47811-A Lift Plate

Illustration

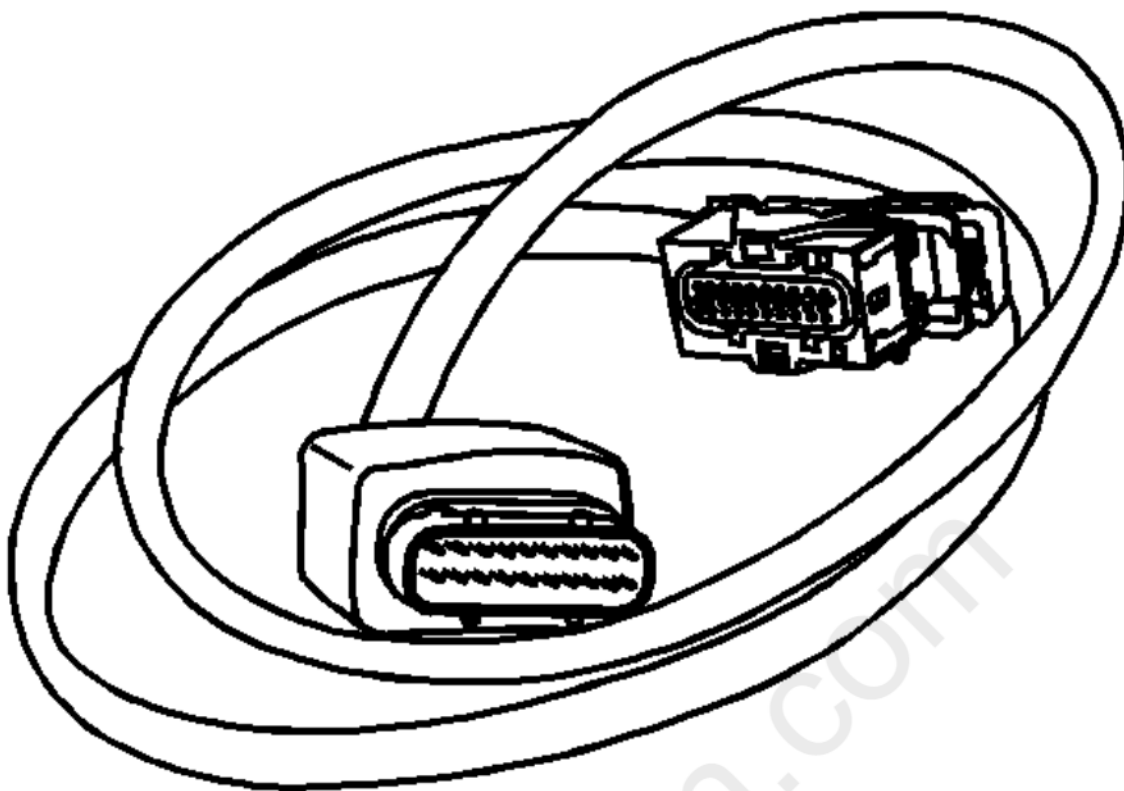
Tool
Number/Description



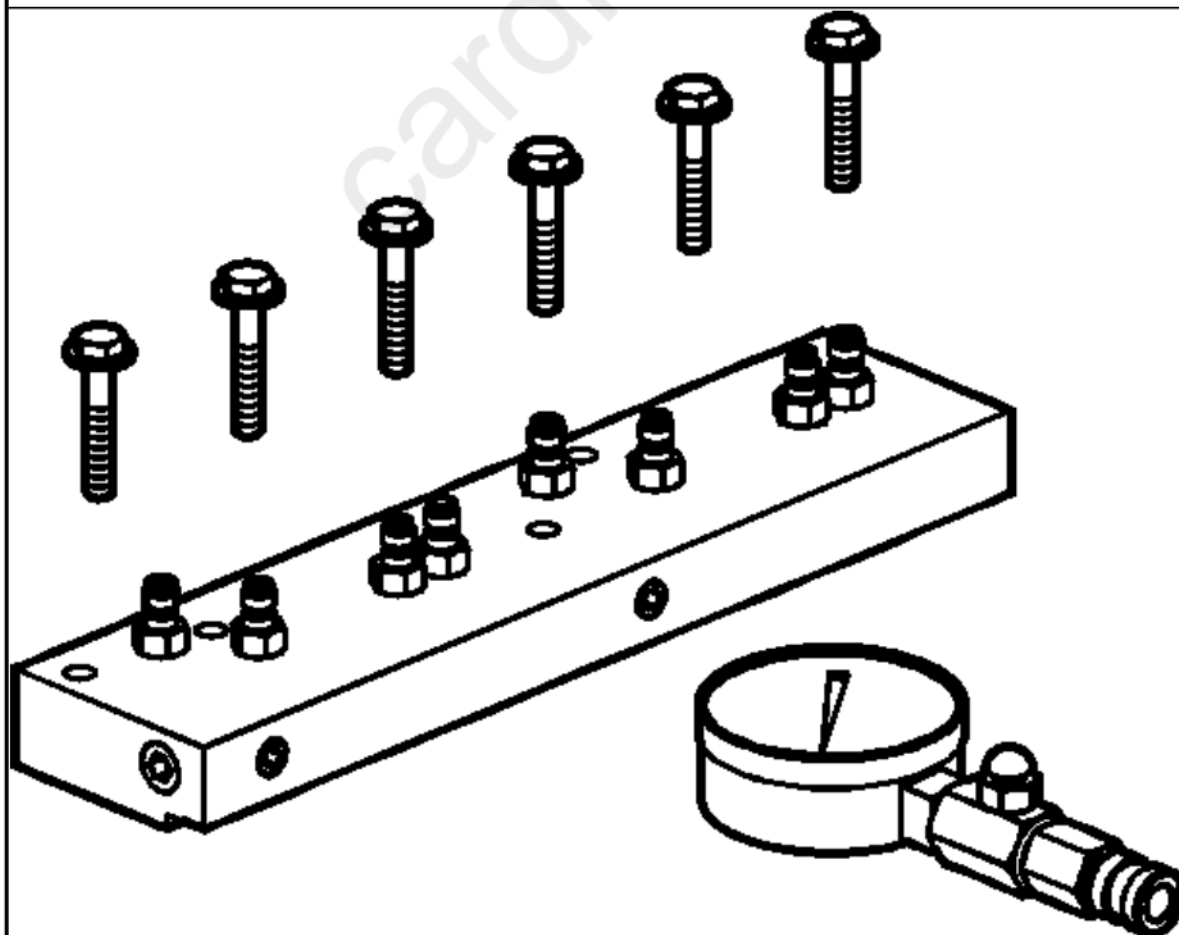
DT 47825
Control Solenoid Test
Plate

Illustration

Tool
Number/Description



DT 47825-20
Adapter Harness



DT 47825-100
Solenoid Test Plate

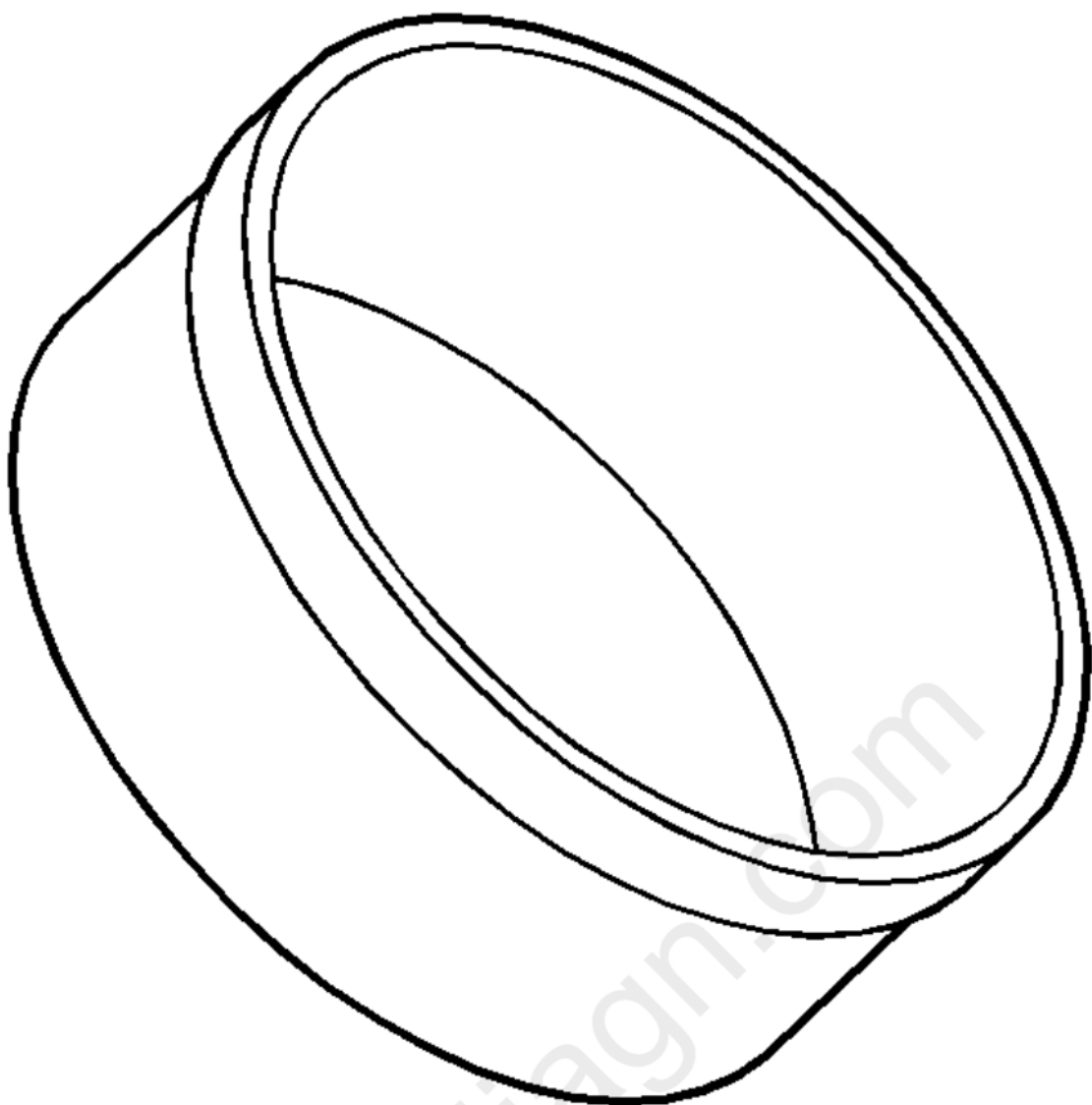
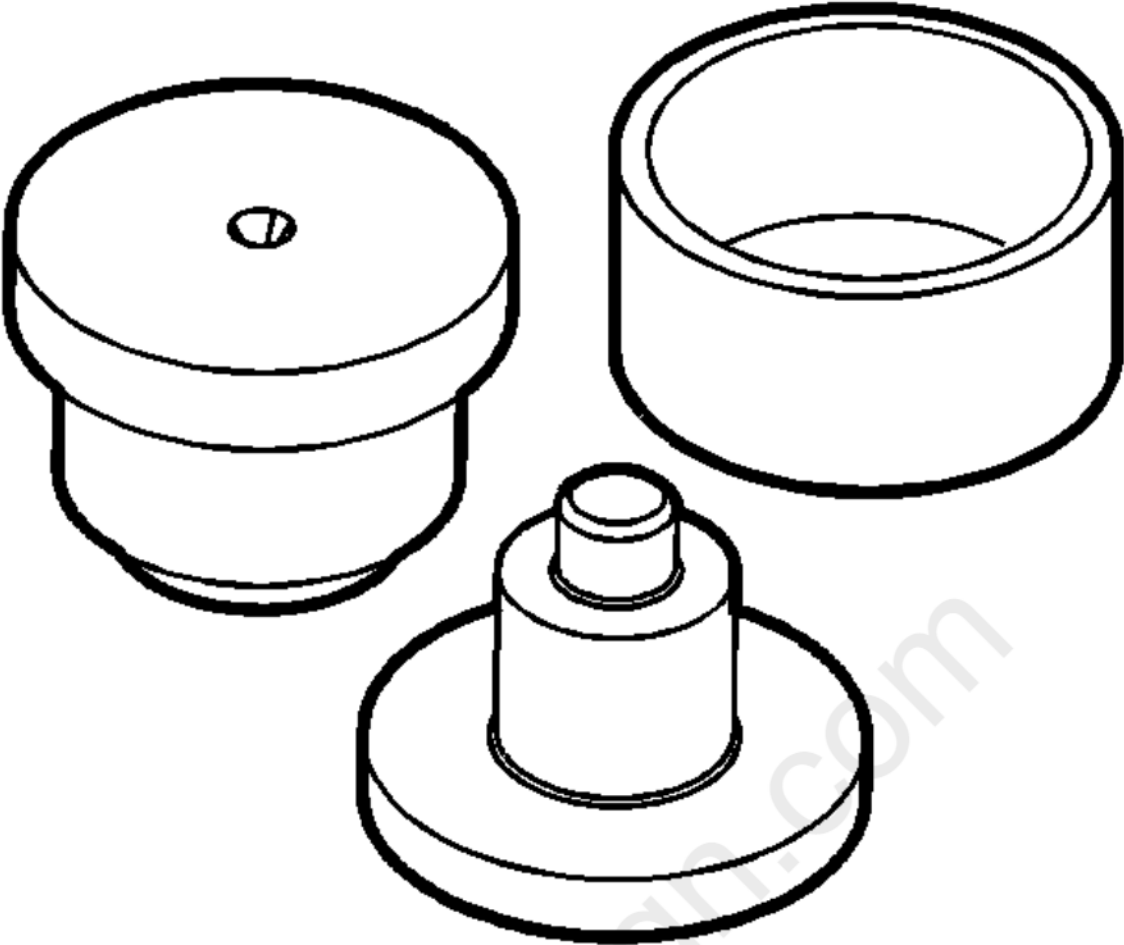
Illustration	Tool Number/Description
	DT 47859 Piston Outer Seal Protector

Illustration	Tool Number/Description
	DT 47927 Bearing Cup Remover

cardiaagn.com

Illustration	Tool Number/Description
 The illustration shows three mechanical components. The top-left part is a cylindrical cap with a central circular hole. The top-right part is a large, hollow cylindrical sleeve. The bottom-center part is a smaller assembly consisting of a central shaft with a small cylindrical protrusion at the top, mounted on a larger circular base flange.	DT 47928 Bearing Installer

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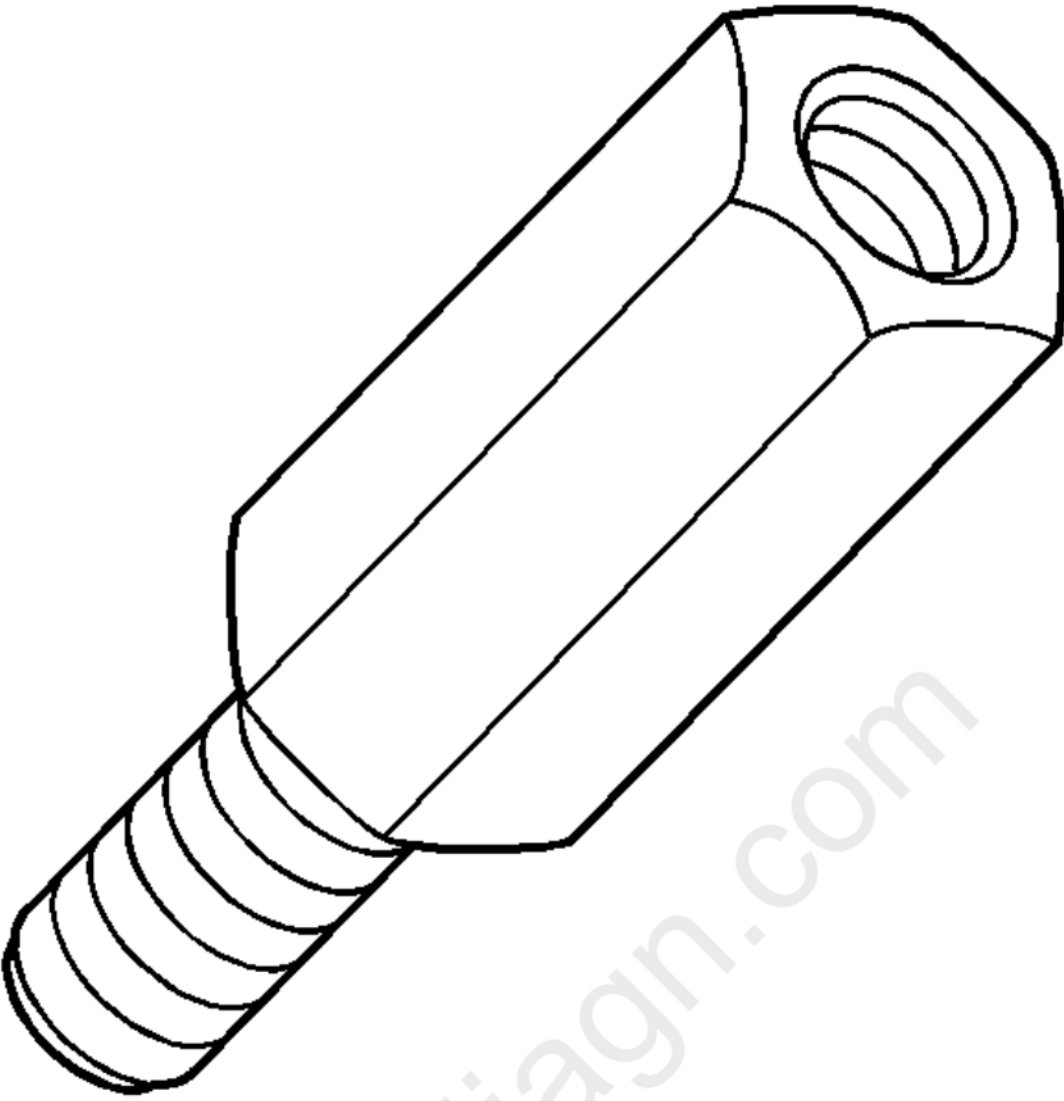
Illustration	Tool Number/Description
	DT 48055 Lube Dam Remover

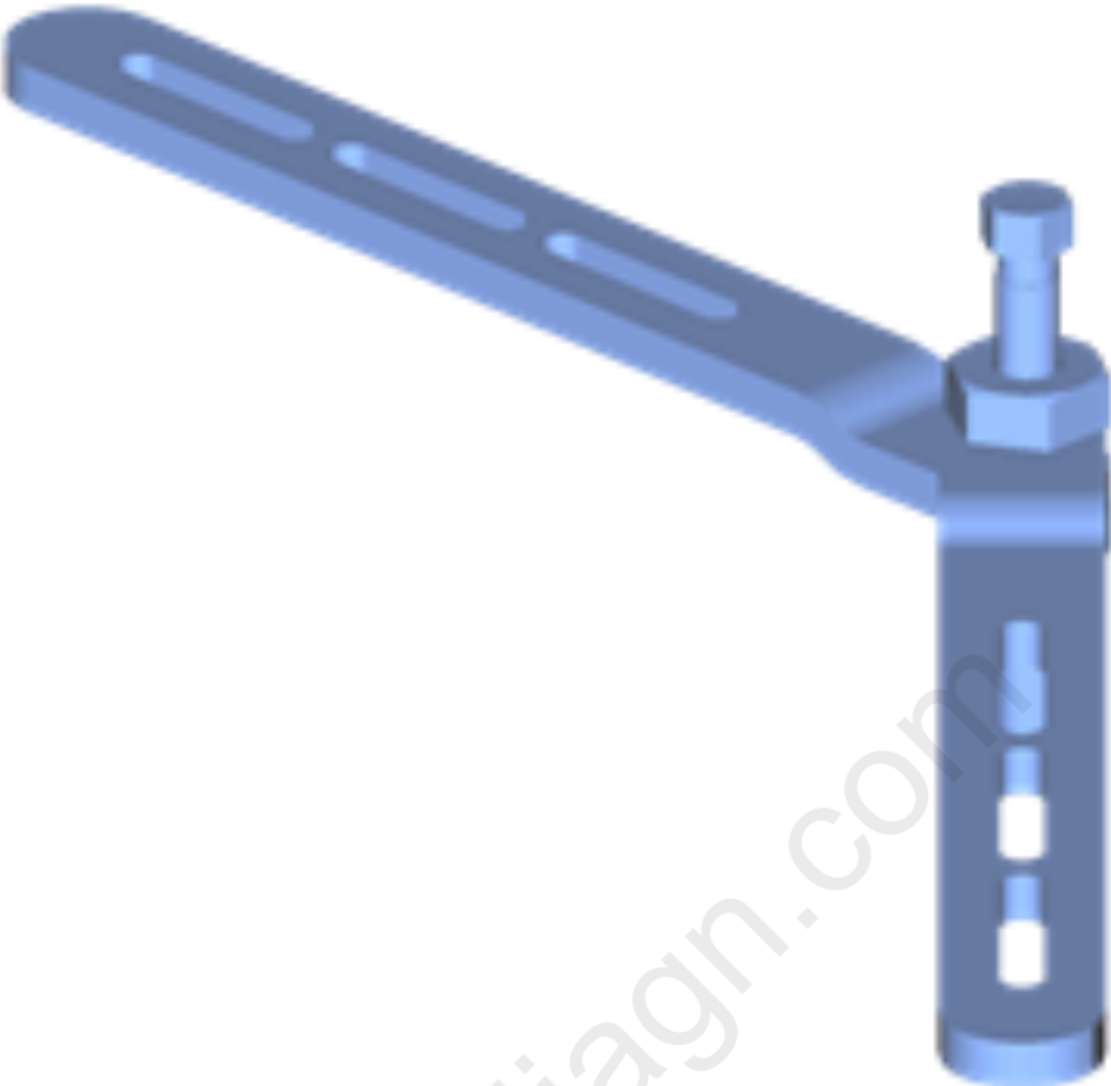
Illustration	Tool Number/Description
 A 3D rendering of a blue metal tool, identified as a Spring Compressor Bridge. The tool consists of a long, angled handle with three finger loops and a vertical bridge component. The bridge has a central threaded rod with a nut at the top. The tool is shown against a white background with a faint watermark 'cardiagn.com'.	DT 48056 Spring Compressor Bridge

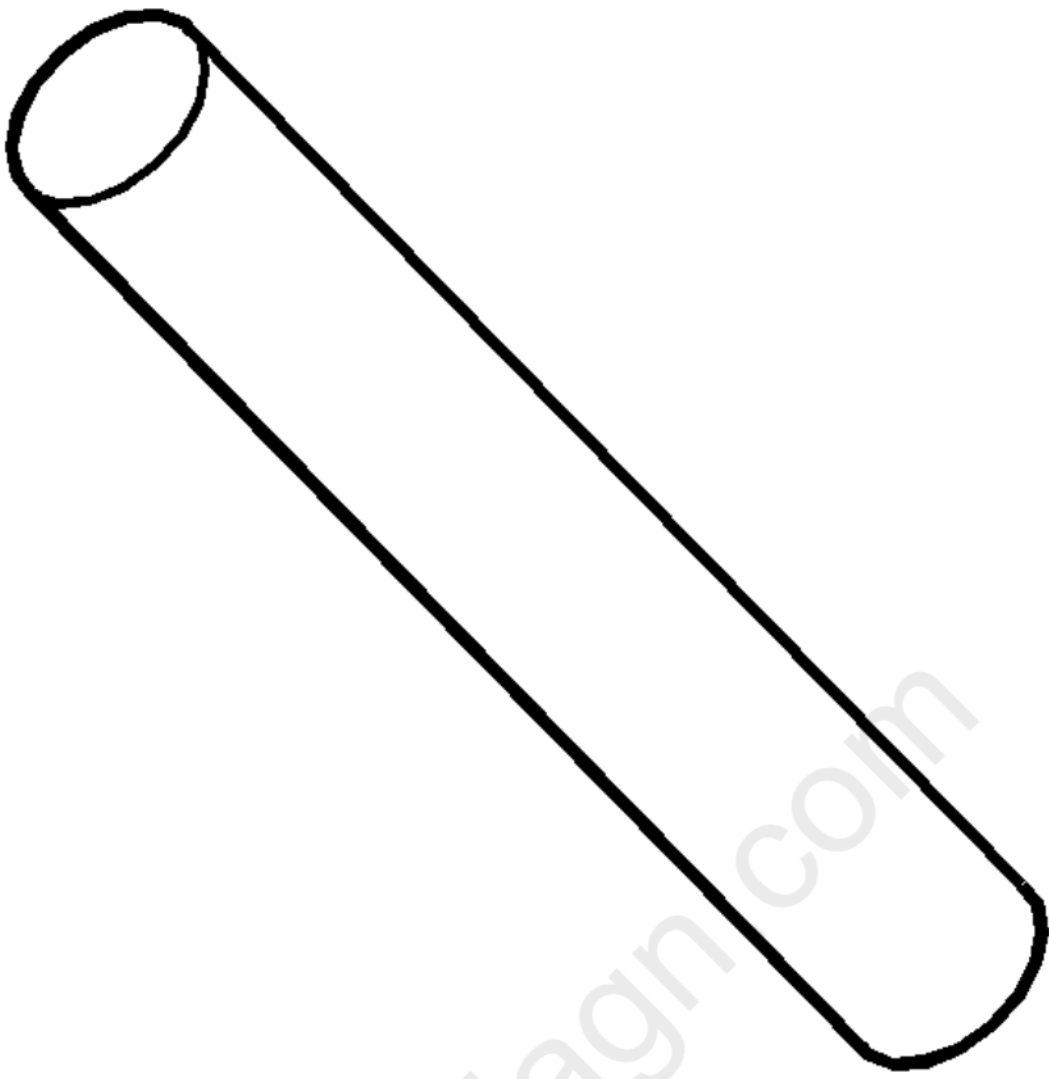
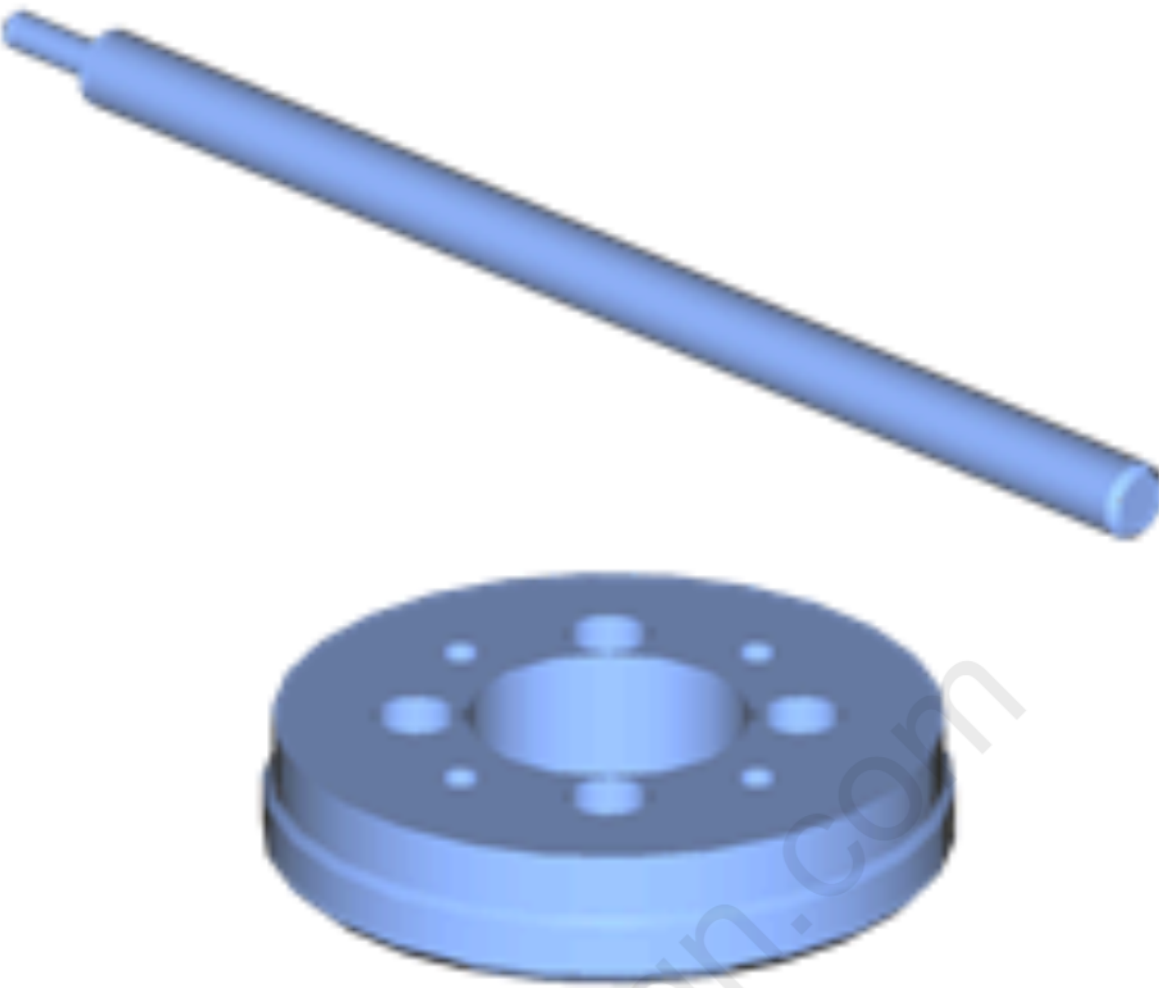
Illustration	Tool Number/Description
	DT 48551 Reaction Hub Bushing Protector
cardiagn.com	

Illustration	Tool Number/Description
	DT 49131 Seal Staking Tool

cardiagn.com

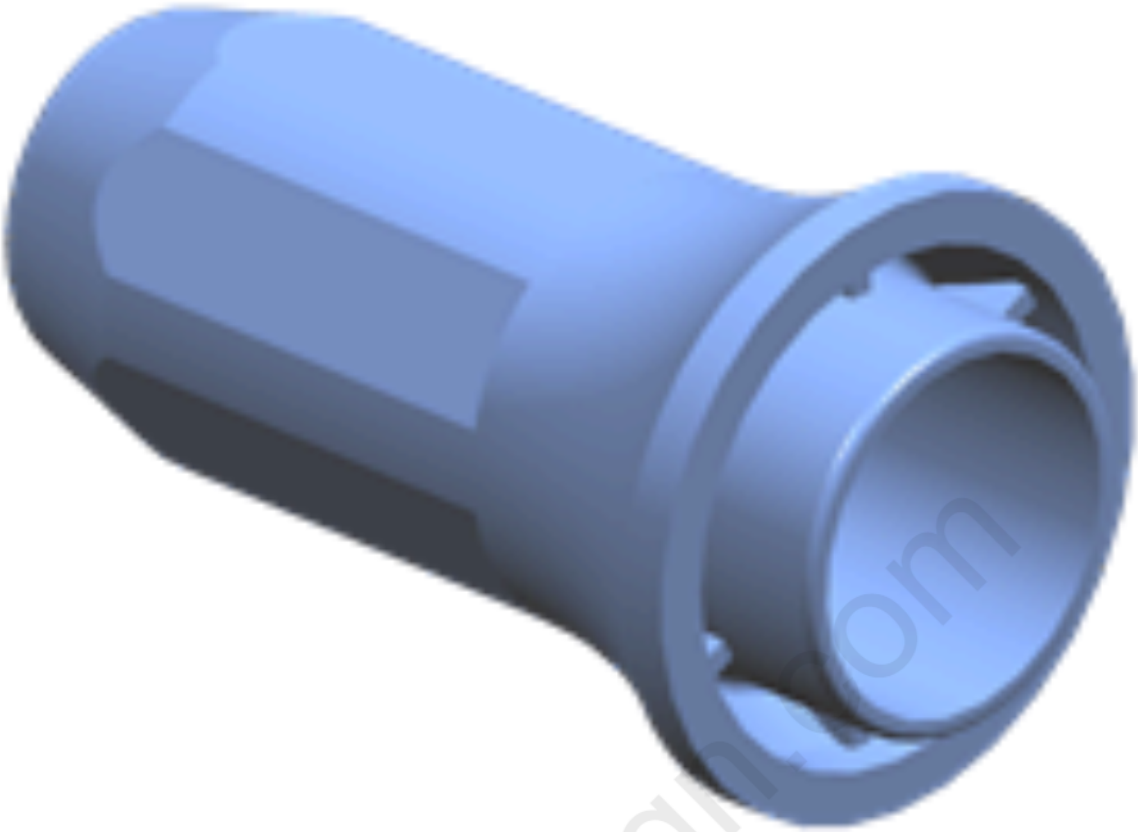
Illustration	Tool Number/Description
 A 3D rendering of a blue, cylindrical medical device. The device has a hexagonal grip section on the left and a larger, flared section on the right. The flared section has a central opening. A watermark 'cardiagn.com' is visible diagonally across the image.	DT 49861 Seal Installer

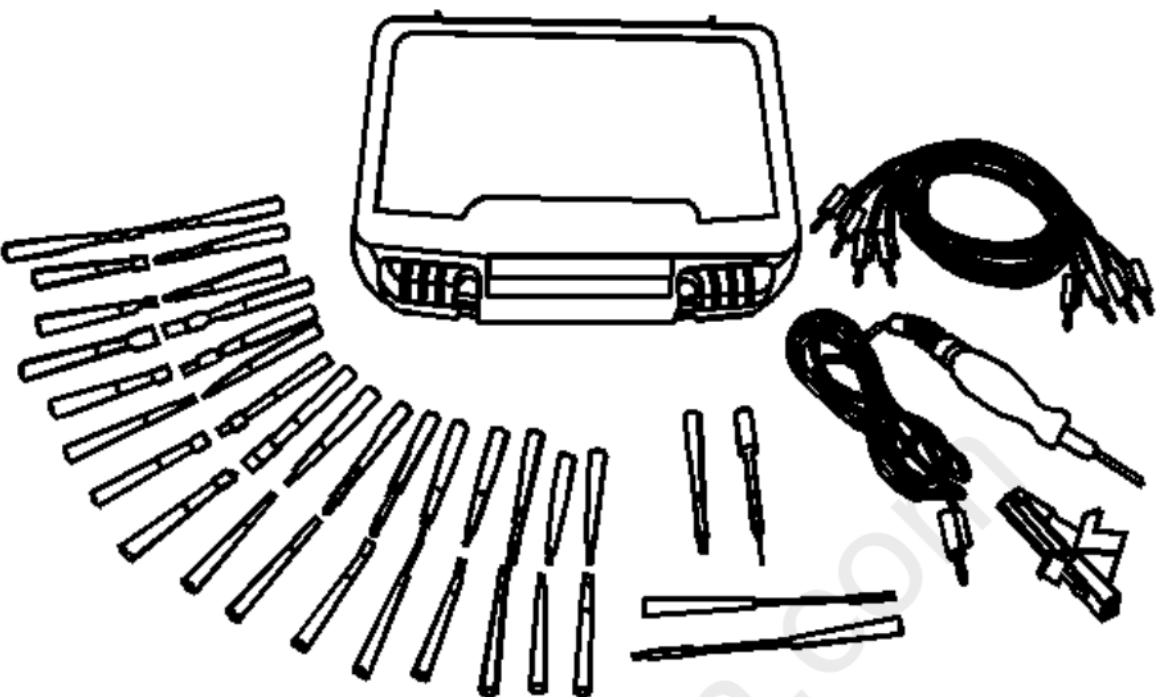
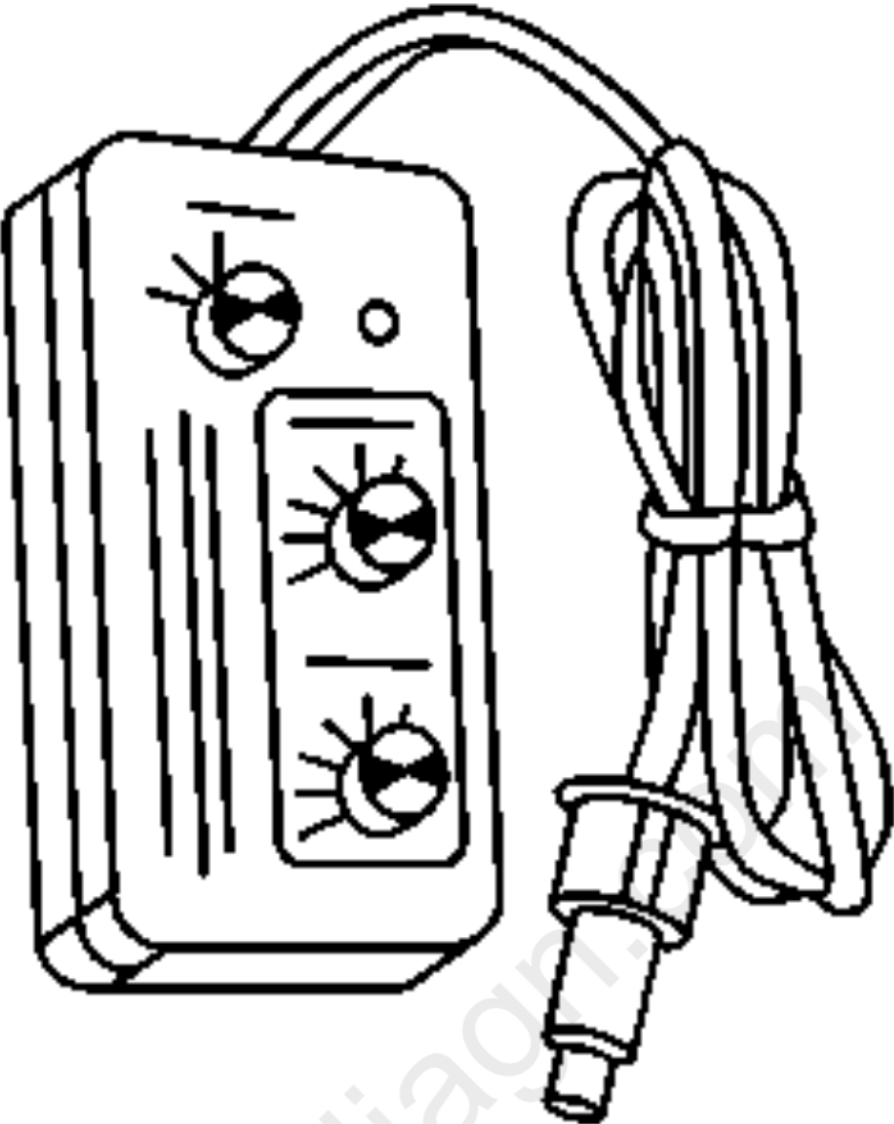
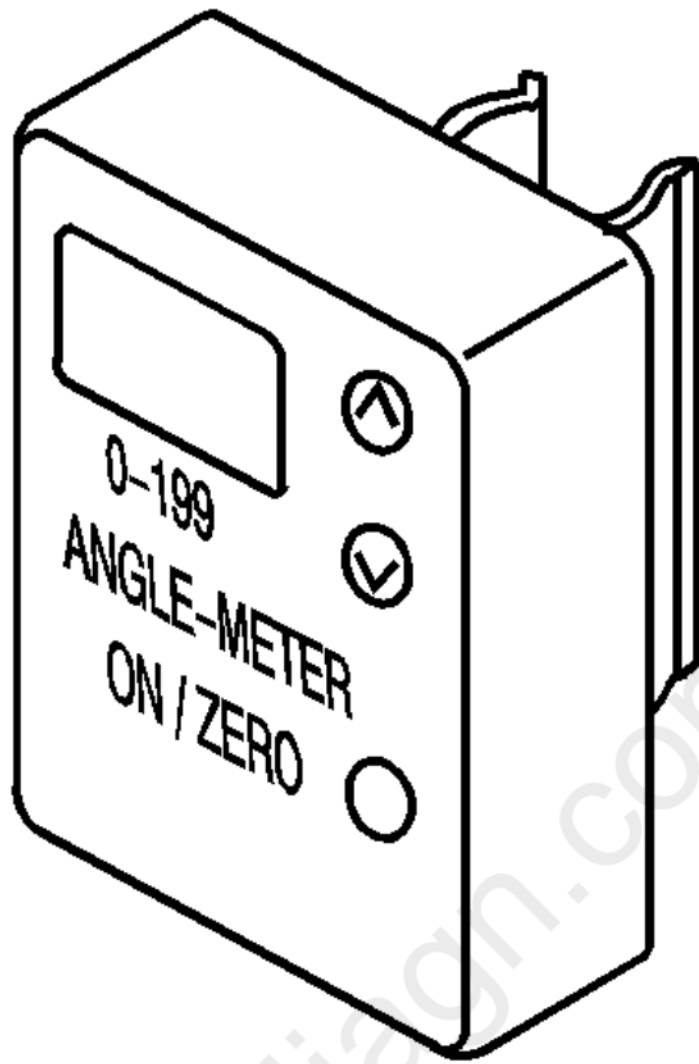
Illustration	Tool Number/Description
	EL 35616 J 35616 GM-Approved Terminal Test Kit
	EL 38522 J 38522 Variable Signal Generator

Illustration	Tool Number/Description
 A line drawing of a medical device, possibly a defibrillator or a similar emergency medical equipment. The device has a rectangular control panel with three large, circular buttons or indicators arranged vertically. Each button has a symbol resembling a stylized 'E' or a lightning bolt. To the left of these buttons are several vertical lines, possibly representing a display or a series of indicators. A cable is connected to the top of the device, and it ends in a specialized connector with a cylindrical base and a pointed tip. The cable is coiled and secured with a strap. A faint watermark 'Cardiac' is visible across the image.	

Illustration

Tool
Number/Description



EN 45059
J 45059
Angle Meter

Illustration	Tool Number/Description
	GE 6125-1B J 6125-1B J 6125-B KM-J-7004 Slide Hammer with Adapter
	GE 8059 J 8059 KM-396 Snap Ring Plier - Parallel Jaw

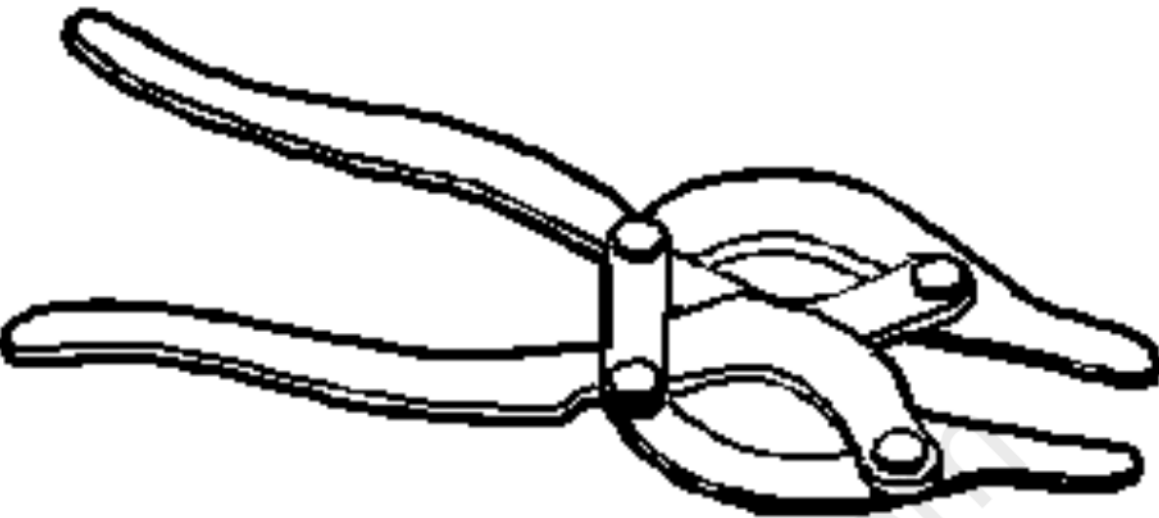
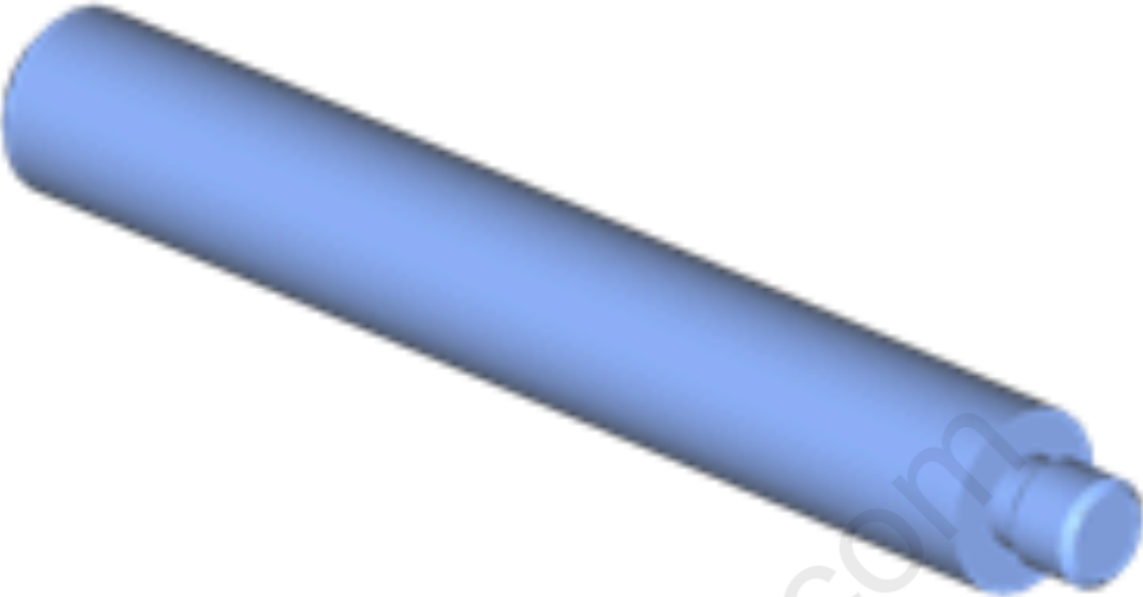
Illustration	Tool Number/Description
	

Illustration	Tool Number/Description
	GE 8092 J 8092 KM-J-8092 Driver Handle

2017 TRANSMISSION

Automatic Transmission - 6T70 (M7W) - Specifications - Impala

SPECIFICATIONS

FASTENER SPECIFICATIONS (ON VEHICLE)

Single Use Non-Threaded Fasteners/Components

NOTE: <i>All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.</i>	
Application	
Front Wheel Drive Shaft Seal - Left	
Front Wheel Drive Shaft Seal - Right	

Single Use Threaded Fastener/Component Tightening Specifications

NOTE: <i>All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.</i>	
Application	Specification
	Metric (English)
Transmission Mount Bolt - Left Side to Transmission	
• First Pass:	50 N.m (37 lb ft)
• Final Pass:	60-75 Degrees
Transmission Rear Mount to Cradle Bolts - FWD	
• First Pass:	100 N.m (74 lb ft)
• Final Pass:	120-130 Degrees

Reusable Threaded Fastener Tightening Specifications

NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Application	Specification
	Metric (English)
Control Valve Assembly (with TCM and Body) to Case Bolt - M6x1.0x42	12 N.m (106 lb in)
Control Valve Assembly (with TCM and Body) to Case Bolt - M6x1.0x55	12 N.m (106 lb in)
Control Valve Assembly (with TCM and Body) to Case Bolt - M6x1.0x65	12 N.m (106 lb in)
Control Valve Assembly (with TCM and Body) to Case Bolt - M6x1.0x80	12 N.m (106 lb in)
Control Valve Body Assembly Bolt - M6x1.0x35	12 N.m (106 lb in)

NOTE:

All fasteners listed in this table can be reused after removal.

Application	Specification
	Metric (English)
Control Valve Body Assembly Bolt - M6x1.0x55	12 N.m (106 lb in)
Control Valve Body Assembly Bolt - M6x1.0x65	12 N.m (106 lb in)
Control Valve Body Cover Bolt - M6x1.0x30	12 N.m (106 lb in)
Control Valve Body Cover Bolt - M6x1.0x95	12 N.m (106 lb in)
Control Valve Body to Case Bolt - M6x1.0x55	12 N.m (106 lb in)
Fluid Cooler Fitting at Radiator	38 N.m (28 lb ft)
Fluid Cooler Pipe Nut	22 N.m (17 lb ft)
Fluid Level Hole Plug	12 N.m (106 lb in)
Fluid Pressure Test Hole Plug	12 N.m (106 lb in)
Flywheel Cover Bolt	10 N.m (89 lb in)
Input Speed Sensor Bolt	9 N.m (80 lb in)
Manual Shift Position Switch Screw	3.5 N.m (31 lb in)
Output Speed Sensor Bolt	12 N.m (106 lb in)
Torque Converter to Flywheel Bolt	62 N.m (46 lb ft)
Transaxle Front Brace Bolts	50 N.m (37 lb ft)
Transaxle Rear Brace Bolts	100 N.m (74 lb ft)
Transaxle Range Switch Bolt	20 N.m (15 lb ft)
Transaxle Range Switch Lever Nut	35 N.m (26 lb ft)
Transaxle Shift Control Nut	8 N.m (71 lb in)
Transaxle to Engine Bolt	75 N.m (55 lb ft)
Transmission Cooler Pipe Stud - External Torx	12 N.m (106 lb in)
Transmission Front Mount Through Bolt	100 N.m (74 lb ft)
Transmission Front Mount To Transmission Bolts	62 N.m (46 lb ft)
Transmission Mount Bolt - Left Side to Body	22 N.m (17 lb ft)
Transmission Mount Nut - Left Side to Body	22 N.m (17 lb ft)
Transmission Rear Mount Through Bolt	105 N.m (77 lb ft)
Transmission Rear Mount to Cradle Short Bolts - AWD	100 N.m (74 lb ft)
Transmission Rear Mount to Cradle Long Bolt - AWD	62 N.m (46 lb ft)
Transmission Rear Mount to Transmission Through Bolt	100 N.m (74 lb ft)

FASTENER SPECIFICATIONS (OFF VEHICLE)

Single Use Non-Threaded Fasteners/Components

Application
NOTE: <i>All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.</i>
1-2-3-4 Clutch Fluid Passage Seal
3-5-Reverse and 4-5-6 Clutch Fluid Seal Ring
Accumulator Bypass Valve Seal
Automatic Transmission Fluid Accumulator Pipe Seal (Qty: 2)
Automatic Transmission Fluid Filter
Automatic Transmission Fluid Filter Seal
Automatic Transmission Fluid Pump Gasket
Automatic Transmission Fluid Pump Pressure Plate Seal
Automatic Transmission Fluid Pump Seal
Automatic Transmission Input Speed Sensor Seal

Application

Control Solenoid Valve Assembly Filter Plate
Control Valve Body Cover Wiring Connector Hole Seal
Control Valve Body Gasket
Control Valve Lower Body Spacer Plate Assembly
Front Differential Pinion Gear Shaft Retainer
Front Differential Transfer Drive Gear Support Seal
Input Speed Sensor Assembly Seal (Qty: 3)
Low and Reverse Clutch Fluid Passage Seal
Manual Shaft Detent Lever Hub Pin
Manual Shift Detent Lever Pin
Manual Shift Shaft Pin
Park Pawl Actuator Guide Assembly Seal
Park Pawl Actuator Guide Pin
Torque Converter Housing Gasket
Turbine Shaft Retainer Ring

Reusable Threaded Fastener Tightening Specifications

Application	Ref No.*	Quantity	Size	Specification
				Metric (English)
NOTE: All fasteners listed in this table can be reused after removal.				
Automatic Transmission Case Cover Bolt	18	10	M6x1.0x30	12 N.m (106 lb ft)
Automatic Transmission Fluid Pump Bolt	1	3	M6x1.0x25	12 N.m (106 lb in)
Automatic Transmission Fluid Trough Bolt	11	1	M6x1.0x25	12 N.m (106 lb in)
Control Valve Body Bolt	19, 21	3	M6x1.0x55	12 N.m (106 lb in)
Control Valve Body Bolt	20	3	M6x1.0x35	12 N.m (106 lb in)
Control Valve Body Bolt	22	5	M6x1.0x65	12 N.m (106 lb in)
Control Valve Body Bolt@Transmission Case	23	2	M6x1.0x55	12 N.m (106 lb in)
Control Valve Body Bolt@Transmission Case	24	8	M6x1.0x65	12 N.m (106 lb in)
Control Valve Body Bolt@Transmission Case	25	1	M6x1.0x42	12 N.m (106 lb in)
Control Valve Body Bolt@Transmission Case	26	1	M6x1.0x55	12 N.m (106 lb in)
Control Valve Body Bolt@Transmission Case	27	2	M6x1.0x65	12 N.m (106 lb in)
Control Valve Body Bolt@Transmission Case	28	4	M6x1.0x80	12 N.m (106 lb in)
Control Valve Body Bolt@Transmission Case	29	3	M6x1.0x95	12 N.m (106 lb in)
Control Valve Body Cover Bolt	30	12	M6x1.0x30	12 N.m (106 lb in)
Control Valve Body Cover Stud	31	2	M6x1.0x30	12 N.m (106 lb in)
Fluid Pressure Test Hole Plug	12	1	1/8" - 27 NPTF	12 N.m (106 lb in)
Automatic Transmission Fluid Level Hole Plug	13	1	1/8" - 27 NPTF	12 N.m (106 lb in)
Front Differential Carrier Baffle Bolt	6	1	M6x1.0x25	12 N.m (106 lb in)

Application	Ref No.*	Quantity	Size	Specification
				Metric (English)
Front Differential Transfer Drive Gear Support Bolt				
• First Pass:	5	9	M8x1.25x25	10 N.m (89 lb in)
• Final Pass:	5	9	M8x1.25x25	50 degrees
Input Shaft Support Bolt (Torx)	N/A	3	M6x1.0x50	12 N.m (106 lb in)
Input Speed Sensor Bolt	17	1	M6x1.0x25	9 N.m (80 lb in)
Output Speed Sensor Bolt	14	1	M6x1.0x25	12 N.m (106 lb in)
Park Pawl Actuator Bracket Bolt	10	2	M6x1.0x25	12 N.m (106 lb in)
Front Differential Transfer Drive Gear Fluid Passage Tube Bolt	2	2	M5x0.8x12	7 N.m (62 lb in)
Front Differential Transfer Drive Gear Fluid Passage Tube Bolt	3	2	M6x1.0x15	12 N.m (106 lb in)
Torque Converter and Differential Housing Bolt	8	14	M8x1.25x35	36 N.m (27 lb ft)
Torque Converter and Differential Housing Bolt	9	3	M8x1.25x35	30 N.m (22 lb ft)
Transmission Fluid Cooler Pipe Stud	15	2	M8x1.25x30.5	12 N.m (106 lb in)
*Reference number refers to the component callout number in Disassembled Views				

APPROXIMATE FLUID CAPACITIES

Application	Specification	
	Metric	English
6T70/6T75/6T80		
Valve Body Cover Removal - Approximate Capacity	5.0 - 7.0 liters	5.3 - 7.4 quarts
Fluid Change - Drain Plug - Approximate Capacity	4.0 - 6.0 liters	4.2 - 6.3 quarts
Overhaul - Approximate Capacity	7.0 - 9.0 liters	7.4 - 9.5 quarts

TRANSMISSION GENERAL SPECIFICATIONS

Name	6T70/6T75/6T80
RPO Codes	6T70 - MH2, M7W (2WD), MH4, M7U (4WD) 6T75 - MY9, M7V (2WD), MH6, M7X (4WD), 6T80 - MHM (2WD)
Production Location	Warren Michigan (USA), Ramos, Mexico
Transaxle Drive	Front Wheel Drive, All Wheel Drive
Reverse Gear Ratio	2.88
1st Gear Ratio	4.484
2nd Gear Ratio	2.872
3rd Gear Ratio	1.842
4th Gear Ratio	1.414
5th Gear Ratio	1.000
6th Gear Ratio	0.742
Effective Final Drive Gear Ratio	2.77/3.16/3.39
Torque Converter Size - Diameter of Torque Converter Turbine	246 mm
Pressure Taps	Line Pressure

Name	6T70/6T75/6T80
Transaxle Fluid Type	DEXRON VI [®]
Transaxle Fluid Capacity	9.0 L/9.5 qts Quarts
Transaxle Type: 6	Six Forward Gears
Transaxle Type: T	Transverse Mount
Transaxle Type: 70/75/80	Product Series
Position Quadrant	P, R, N, D, * *(Refer to the applicable owner's manual)
Case Material	Die Cast Aluminum
Transaxle Net Weight	104 kg
Maximum Trailer Towing Capacity	N/A
Maximum Gross Vehicle Weight (GVW)	4, 000 lbs

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Application	Type of Material	GM Part Number	
		United States	Canada
Automatic Transmission Fluid	DEXRON [®] VI	88861037	19264717
Input Speed Sensor	Threadlock	12345382	10953489
Torque Converter Bolts	Threadlock	12345382	10953489

TAPER BEARING PRELOAD SELECTIVE SPECIFICATIONS

Front Differential Drive Pinion Gear and Differential Thrust Washer Selection Chart

Thrust Washer O.D. Color Code	Washer Thickness	
	Metric	English
Brown	0.494 mm	0.020 in
Purple	0.545 mm	0.022 in
Black	0.596 mm	0.024 in
Pink	0.647 mm	0.026 in
Dark Blue	0.698 mm	0.028 in
Light Green	0.749 mm	0.030 in
Plain	0.800 mm	0.032 in
White	0.851 mm	0.034 in
Light Blue	0.902 mm	0.036 in
Orange	0.953 mm	0.038 in
White/Black	1.004 mm	0.040 in
White/Orange	1.055 mm	0.042 in
White/Light Green	1.106 mm	0.044 in

RANGE REFERENCE

Range	Park	Reverse	Neutral	Drive						
				1st Braking	1st	2nd	3rd	4th	5th	6th
1 - 2 - 3 - 4 Clutch	-	-	-	Applied	Applied	Applied	Applied	Applied	-	-
3 - 5 Reverse Clutch	-	Applied	-	-	-	-	Applied	-	Applied	-
4 - 5 - 6 Clutch	-	-	-	-	-	-	-	Applied	Applied	Applied
2 - 6 Clutch	-	-	-	-	-	Applied	-	-	-	Applied

Range	Park	Reverse	Neutral	Drive						
				1st Braking	1st	2nd	3rd	4th	5th	6th
Low and Reverse Clutch	Applied*	Applied	Applied*	Applied	-	-	-	-	-	-
Low Clutch Assembly (OWC)	-	-	-	Holding	Holding	-	-	-	-	-

* = Applied with NO load

SHIFT SOLENOID VALVE STATE AND GEAR RATIO

Gear	Shift SOL 1	Shift SOL 2	1 - 2 - 3 - 4 CL PC SOL 5 N.L.	2 - 6 CL PC SOL 4 N.L.	3 - 5 REV CL PC SOL 2 N.H.	LOW REV 4 - 5 - 6 CL PC SOL 3 N.H.	Gear Ratio
Park	ON	ON	OFF	OFF	OFF	ON	-
Reverse	ON	OFF	OFF	OFF	ON	ON	2.88
Neutral	ON	ON	OFF	OFF	OFF	ON	-
1st Braking	ON	ON	ON	OFF	OFF	ON	4.484
1st	OFF	ON	ON	OFF	OFF	OFF	4.484
2nd	OFF	ON	ON	ON	OFF	OFF	2.872
3rd	OFF	ON	ON	OFF	ON	OFF	1.842
4th	OFF	ON	ON	OFF	OFF	ON	1.414
5th	OFF	ON	OFF	OFF	ON	ON	1.000
6th	OFF	ON	OFF	ON	OFF	ON	0.742

Effective Final Drive Ratio - 6T70/75/80 - 2.77/3.16/3.39
 For shift solenoids 1 and 2, "ON" = Solenoid Energized (Pressurized) "OFF" = Solenoid De-energized (No Pressure).
 For pressure control solenoids, "ON" = Pressurized, "OFF" = No Pressure

SHIFT SPEED

Shift @ TP	km/h	mph	OSS (RPM)
1 - 2 @ 12.5	18	11.2	400
2 - 3 @ 12.5	34	21.1	755
3 - 4 @ 12.5	46	28.6	1021
4 - 5 @ 12.5	60	37.3	1332
5 - 6 @ 12.5	74	46.0	1643
6 - 5 @ 12.5	69	42.9	1532
5 - 4 @ 12.5	69	42.9	1532
4 - 3 @ 12.5	43	26.7	955
3 - 2 @ 12.5	16	9.9	355
2 - 1 @ 12.5	16	9.9	355
1 - 2 @ 25	36	22.4	799
2 - 3 @ 25	59	36.7	1310
3 - 4 @ 25	78	48.5	1732
4 - 5 @ 25	94	58.4	2087
5 - 6 @ 25	150	93.2	3331
6 - 5 @ 25	69	42.9	1532
5 - 4 @ 25	52	32.3	1155
4 - 3 @ 25	43	26.7	955
3 - 2 @ 25	16	9.9	355

Shift @ TP	km/h	mph	OSS (RPM)
2 - 1 @ 25	16	9.9	355

NOTE: Shift speed points are affected by many different vehicle and transmission operating conditions. The table above represents shift speed points calibrated at specific throttle angles during normal operating conditions and a temperature range between 0 - 130Â°C (32 - 266Â°F). These shift speed points are also based on an effective final drive ratio of 2.77, and assume a production-intent tire size. The table below illustrates a number of different variables that influence these shift speed points. Based on a given operating condition, these variables may override the normal shift speed points. To assist in monitoring the different variables, the respective scan tool data parameter is also listed.

Shift Speed Variables

Scan Tool Parameter	Shift Speed Variables
Calc. Throttle Position	Calc. Throttle Position (TP) is one of the most important inputs in the transmission shift pattern logic. A very low TP angle will impact the shift pattern by causing upshifts. A very high TP angle will impact the shift pattern by causing downshifts.
Commanded Gear	Based on numerous inputs, the transmission control module (TCM) selects the optimum gear. Once the TCM commands a gear, the pressure control solenoids are activated to hydraulically control engagement of the proper clutch.
Cruise	When cruise control is activated, the shift pattern is altered to reduce excessive shifting.
ECT	Shift speed points may be offset to enhance engine coolant temperature (ECT) warm-up. Also, operating the vehicle at higher engine speeds will reduce the time to warm the ECT and the TFT.
Engine Speed	To protect against an over speed condition, engine speed is monitored. If the engine speed becomes too high, an upshift will occur.
Engine Torque	Engine torque is used to predict vehicle operating conditions, in order to determine the optimum gear and provide for a smoother ride.
IMS	The internal mode switch (IMS) indicates the position of the transmission manual valve. The operator controls this valve by moving the gear range selector. Therefore, the possible gears may be limited by this valve position.
TCC PC Sol. Duty Cycle	The torque converter clutch (TCC) pressure control (PC) solenoid duty cycle indicates when the TCC has been engaged.
TCC Slip Speed	The TCC Slip Speed indicates the difference between engine speed and transmission input speed. The TCC is locked when slip speed is at or near zero, and may be controlling slip when at lower slip speeds.
TFP Switch 1, 3, 4 or 5	The transmission fluid pressure (TFP) switch is used to indicate if fluid pressure to a specific clutch has been applied or released.
Trans. Fluid Temp.	A lower TFT will extend shift speeds, a higher TFT, or hot mode condition, will invoke shorter shift speeds in order to establish a shift pattern required to cool the TFT.
Transmission Hot Mode	If the TFT becomes too hot, a hot mode shift pattern is used. The hot mode shift pattern will invoke lower shift speed points to establish a shift pattern necessary to cool the TFT.
Transmission OSS	The transmission output speed sensor (OSS) is one of the most important inputs into the transmission shift pattern logic. A very low transmission output speed will impact the shift pattern by causing downshifts. A very high transmission output speed will impact the shift pattern by causing upshifts.

TRANSMISSION INTERNAL MODE SWITCH LOGIC

Gear Selector Position	Signal A	Signal B	Signal C	Signal P
Park	LOW	HI	HI	LOW
Park/Reverse	LOW	LOW	HI	LOW
Reverse	LOW	LOW	HI	HI
Reverse/Neutral	HI	LOW	HI	HI
Neutral	HI	LOW	HI	LOW
Neutral/Drive 6	HI	LOW	LOW	LOW
Drive 6	HI	LOW	LOW	HI
Drive 6/Drive 4	LOW	LOW	LOW	HI
Drive 4	LOW	LOW	LOW	LOW
Drive 4/Drive 3	LOW	HI	LOW	LOW
Drive 3	LOW	HI	LOW	HI
Drive 3/Drive 2	HI	HI	LOW	HI
Drive 2	HI	HI	LOW	LOW
Open	HI	HI	HI	HI
Invalid	HI	HI	HI	LOW
Invalid	LOW	HI	HI	HI

HI = Ignition voltage
LOW = 0 volts

SOLENOID VALVE PRESSURE

Line PC Solenoid Valve Pressure

Requested Pressure (kPa)	Actual Pressure	
	Metric	English
200	620 - 830 kPa	90 - 120 psi
300	830 - 1,035 kPa	120 - 150 psi
400	1,070 - 1,275 kPa	155 - 185 psi
500	1,275 - 1,480 kPa	185 - 215 psi
600	1,515 - 1,725 kPa	220 - 250 psi
700	1,725 - 1,930 kPa	250 - 280 psi