SPECIFICATIONS

TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR SPECIFICATIONS

Transmission Fluid Temperature (TFT) Sensor Specifications

Temperature	Temperature	Resistance
F°	C°	ohm
-40	-40	12370
104	40	964
212	100	155

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Component Description	Ref No.	Qty	Bolt Size	Specification	
				Metric	English
1st/2nd Clutch Shaft Intermediate Bearing Retainer	133	1 bolt	M6x1.0x20 mm	12 N.m	106 lb in
1st/2nd Clutch Shaft Lube Fluid Pipe Retainer	123	1 bolt	M6x1.0x12 mm	12 N.m	106 lb in
1st/2nd Clutch Shaft Retaining Nut	721	1 nut	26 mm nut	178 N.m	132 lb ft
3rd Clutch Accumulator Piston Bore Cover	418	2 bolts	M6x1.0x30 mm	12 N.m	106 lb in
3rd Clutch Fluid Passage Switch	25	-	Thread in Sensor	20 N.m	14 lb ft
4th Clutch Fluid Passage Switch	5	-	Thread in Sensor	20 N.m	14 lb ft
Accumulator Valve Body	483	3 bolts	M6x1.0x85 mm	12 N.m	106 lb in
	482	4 bolts	M6x1.0x95 mm		
	476	2 bolts	M6x1.0x110 mm		
	479	1 bolt	M6x1.0x125 mm		
	478	1 bolt	M6x1.0x140 mm		
Automatic Transmission Case Plug	111	7 plugs	8 mm	18 N.m	13 lb ft
	147	1 plug	10 mm	26 N.m	20 lb ft
Automatic Transmission Fluid Baffle	125	2 bolts	M6x1.0x12 mm	12 N.m	106 lb in
Automatic Transmission Fluid Filter	930	1 bolt	M6x1.0x25 mm	12 N.m	106 lb in
Automatic Transmission Fluid Filter Cover	58	2 bolts	M6x1.0x20 mm	12 N.m	106 lb in

Automatic Transmission Fluid Passage Test Hole Plug	67	5 plugs	8 mm	18 N.m	13 lb ft
Automatic Transmission Fluid Temperature Sensor	21	1 bolt	M6x1.9x18 mm	12 N.m	106 lb in
Automatic Transmission Range Selector Lever	49	1 nut	8 mm	12 N.m	106 lb in
Automatic Transmission Range Selector Lever Cable Bracket	81	1 stud	M6x1.0x28 mm	12 N.m	106 lb in
Automatic Transmission Range Selector Lever Position Switch Shield	64	1 bolt	M6x1.0x16 mm	12 N.m	106 lb in
Clutch Pressure Control Solenoid	17	5 bolts	M6x1.0x25 mm	12 N.m	106 lb in
	16	1 bolt	M6x1.0x55 mm	12 N.m	106 lb in
Control Valve Body	221	2 bolts	M6x1.0x40 mm	12 N.m	106 lb in
	222	2 bolts	M6x1.0x40 mm	12 N.m	106 lb in
	223	3 bolts	M6x1.25x32 mm	18 N.m	13 lb ft
	224	3 bolts	M6x1.0x20 mm	12 N.m	106 lb in
Engine Wiring Harness Bracket	39	1 bolt	M6x1.0x12 mm	12 N.m	106 lb in
Fluid Drain Plug	104	1	18 x 1.5 mm	49 N.m	36 lb ft
Fluid Fill Plug	19	1	24 x 1.5 mm	44 N.m	33 lb ft
Front Differential Carrier, AWD	906	12 bolts left hand thread	M10x1.0x35 mm	101 N.m	75 lb ft
Front Differential Carrier, FWD	096	12 bolts left hand thread	M10x1.0x24 mm	167 N.m	123 lb ft
Front Transmission Mount Bracket Top Nut	-	-	-	90 N.m	64 lb ft
Front Transmission Mount Bracket-to-Transmission Bolts	-	-	-	50 N.m	37 lb ft
Front Transmission Mount-to-Frame Rail Bolts	-	-	-	50 N.m	37 lb ft
Generator Positive Cable Nut	-	-	-	12 N.m	106 lb in
Input Speed Sensor	29	1 bolt	M6x1.0x18 mm	12 N.m	106 lb in
Intermediate Steering Shaft-to-Gear Pinch Bolt	-	-	-	34 N.m	25 lb ft
Lower Transaxle-to-Engine Bolts	-	-	-	64 N.m	47 lb ft
Lube Pipe with Retainer	60	1 bolt	M6x1.0x12 mm	12 N.m	106 lb in

Mainshaft Case Cover Rear	97	3 bolts	M8x1.25x21 mm	19 N.m	14 lb ft
Mainshaft Retainer Nut	110	1 nut	26 mm	178 N.m	132 lb ft
Output Shaft Rear Access Cover	94	2 bolts	M6x1.0x20 mm	12 N.m	106 lb in
Output Shaft Retaining Nut	516	1 left hand thread nut	24 mm	167 N.m	123 lb ft
Output Speed Sensor	32	1 bolt	M6x1.0x18 mm	12 N.m	106 lb in
Park/Neutral Position Switch	44	2 bolts	M6x1.0x16 mm	12 N.m	106 lb in
Park/Neutral Position Switch Locknut	46	1 nut	16 mm	12 N.m	106 lb in
Park Pawl Stop Lever	946	1 bolt	M6x1.0x25 mm	12 N.m	106 lb in
Pressure Regulator Valve Spring Cap Guide	416	1 bolt	M6x1.0x30 mm	12 N.m	106 lb in
Rear Transmission Mount Bracket-to-Engine Bolts	-	-	-	110 N.m	81 lb ft
Rear Transmission Mount-to-Bracket Through Bolt	-	-	-	110 N.m	81 lb ft
Rear Transmission Mount-to-Frame Bolts	-	-	-	50 N.m	37 lb ft
Regulator Valve Body	411	2 bolts	M6x1.0x35 mm	12 N.m	106 lb in
	412	1 bolt	M6x1.0x55 mm	12 N.m	106 lb in
	413	4 bolts	M6x1.0x70 mm	12 N.m	106 lb in
	414	1 bolt	M6x1.0x80 mm	12 N.m	106 lb in
Reverse Idler Gear Retainer Plate	532	2 bolts	M8x1.25x35 mm	26 N.m	20 lb ft
Reverse Idler Rear Access Hole Plug	102	1 plug	20 mm	49 N.m	36 lb ft
Reverse Shift Fork Retainer	926	1 bolt	M6x1.0x20 mm	14 N.m	10 lb ft
Servo Valve Body	312	1 bolt	M6x1.0x60 mm	12 N.m	106 lb in
Shift Cable Bracket Bolts	-	-	-	10 N.m	89 lb in
Shift Control Assembly-to-Bracket Bolts	-	-	-	25 N.m	18 lb ft
Shift Control Solenoid Valves	467	3 bolts	M6x1.0x16 mm	12 N.m	106 lb in
Stabilizer Link Nuts	-	-	-	65 N.m	48 lb ft
Starter Cable Nut	-	-	-	12 N.m	106 lb in
Steering Gear-to-Frame Bolts	-	-	-	110	81 lb ft

				N.m	
TCC Pressure Control Solenoid Valve	6	1 bolt	M6x1.0x30 mm	12 N.m	106 lb in
TCC Solenoid Valve	467	1 bolt	M6x1.0x16 mm	12 N.m	106 lb in
TOC Lines Bracket Bolt	-	-	-	7 N.m	62 lb in
TOC Line-to-Radiator Fitting	-	-	-	16 N.m	12 lb ft
Torque Converter Housing	107	1 bolt	M10x1.25x80 mm	44 N.m	33 lb ft
	106	12 bolts	M10x1.25x90 mm	44 N.m	33 lb ft
	106	2 bolts	M10x1.25x90 mm	39 N.m	29 lb ft
	90	2 bolts	M10x1.25x100 mm	44 N.m	33 lb ft
	91	5 bolts	M10x1.25x70 mm	44 N.m	33 lb ft
	92	1 bolt	M10x1.25x50 mm	44 N.m	33 lb ft
Torque Converter Inspection Cover Bolts	-	-	-	12 N.m	106 lb in
Torque Converter-to-Flywheel Bolts	-	-	-	12 N.m	106 lb in
Transmission Fluid Baffle	928	1 bolt	M6x1.0x80 mm	12 N.m	106 lb in
	929	1 bolt	M6x1.0x95 mm	12 N.m	106 lb in
Transmission Fluid Cooler Pipe Bracket	51	1 bolt	M6x1.0x14 mm	12 N.m	106 lb in
Transmission Fluid Cooler Pipe Fitting	61	2 fittings	-	20 N.m	14 lb ft
Transmission Fluid Fill Tube	36	1 bolt	M6x1.0x14 mm	12 N.m	106 lb in
Transmission Lifting Eye	89	2 bolts	M10x1.25x140 mm	44 N.m	33 lb ft
Transmission Lifting Eye Bolt	87	2 bolts	M8x1.25x20 mm	25 N.m	18 lb ft
Transmission Wiring Harness	1	1 bolt	M10x1.0x20 mm	12 N.m	106 lb in
Transmission-to-Engine Mounting Bolts	-	-	-	64 N.m	47 lb ft

SEALERS, ADHESIVES, AND LUBRICANTS

Sealers, Adhesives, and Lubricants

		GM Part Number	

Application	Type of Material	United States	Canada
Automatic Transmission Fluid (ATF)-Z1	Lubricant	22717466	-
Reverse Idler Gear Access Hole Plug	Threadlocker	12345382	10953489
*Note: Always use ATF-Z1. Using another fluid than ATF-Z1 can affect shift quality.			

TRANSMISSION GENERAL SPECIFICATIONS

Transmission General Specifications

Name	5AT
RPO Codes	MJ7/MJ8
Vehicle Platform	Z Saturn
Torque Converter Stall Speed	Standard or New: 2,400 RPM Service Limit: 2,250-2,550 RPM
Transmission Fluid Type	ATF-Z1
Position Quadrant	P, R, N, D, I, L

FLUID CAPACITY SPECIFICATIONS

Fluid Capacity Specifications

	Specification			
	AWD		FWD	
Application	Metric (Liters)	English (Quarts)	Metric (Liters)	English (Quarts)
ATF at Overhaul	8.1	8.6	8.6	9.1
ATF at Drain / Refill	4.1	4.3	4.5	4.8
Use ATF-Z1				

RANGE REFERENCE

Range Reference

Range	Gear	Shift Sol. A	Shift Sol. B	Shift Sol. C	1st 1-Way Clutch	Coast Clutch	2nd Clutch	3rd Clutch	4th Clutch	5th Clutch	Servo Valve
Park	N	OFF	ON	OFF	-	-	-	-	-	-	RVS
R	R	OFF	ON	OFF	-	-	-	-	-	-	RVS
	R	OFF	ON	ON	-	-	-	-	-	-	RVS
	N	ON	ON	ON	-	-	-	-	-	-	FWD
N	N	OFF	ON	OFF	-	-	-	-	-	-	FWD/RVS
D/I	1	ON	ON	ON	APPLIED	-	A**	-	-	-	FWD
	1-2	ON	ON	ON	APPLIED*	-	A	-	-	-	FWD
	2	ON	ON	OFF	APPLIED*	-	APPLIED	-	-	-	FWD
	2-3	OFF	ON	OFF	APPLIED*	-	A	B	-	-	FWD
	3	OFF	ON	ON	APPLIED*	-	-	APPLIED	-	-	FWD

	3-4	OFF	OFF	ON	APPLIED*	-	-	B	A	-	FWD
	4	OFF	OFF	OFF	APPLIED*	-	-	-	APPLIED	-	FWD
	4-5	ON	OFF	OFF	APPLIED*	-	-	-	A	B	FWD
	5	ON	OFF	ON	APPLIED*	-	-	-	-	APPLIED	FWD
L	1	ON	ON	ON	APPLIED	B	A**	-	-	-	FWD
	1-2	ON	ON	ON	APPLIED*	B	A	-	-	-	FWD
	2	ON	ON	OFF	APPLIED*	-	APPLIED	-	-	-	FWD

- APPLIED* = Applied 1-Way Clutch
- A = Controlled by Clutch Pressure Control Solenoid A Directly
- A** = Solenoid De-energized
- B = Controlled by Clutch Pressure Control Solenoid B Directly

SHIFT SOLENOID VALVE STATE AND GEAR RATIO

Shift Solenoid Valve State

Shift Status	Solenoid Valve 1	Solenoid Valve 2	Solenoid Valve 3
Park	OFF	ON	OFF
Neutral	OFF	ON	OFF
1st	ON	ON	ON
1st-2nd	ON	ON	ON
2nd	ON	ON	OFF
2nd-3rd	OFF	ON	OFF
3rd	OFF	ON	ON
3rd-4th	OFF	OFF	ON
4th	OFF	OFF	OFF
4th-5th	ON	OFF	OFF
5th	ON	OFF	ON

Gear Ratios

Gear	Ratio
1st	2.185
2nd	1.270
3rd	1.023
4th	0.729
5th	0.530
Reverse	1.888
Final	4.058

SHIFT SPEED

Shift Speed

-	% of TPS	TPS Voltage	km/h	mph
1st - 2nd	7.5	0.8V	15-17 km/h	9-11 mph
	44	2.25V	43-47 km/h	27-29 mph
	100	4.5V	64-70 km/h	40-43 mph
2nd-3rd	7.5	0.8V	31-34 km/h	19-21 mph
	44	2.25V	71-77 km/h	44-48 mph
	100	4.5V	107-113 km/h	66-70 mph
3rd-4th	7.5	0.8V	41-47 km/h	25-29 mph
	44	2.25V	103-109 km/h	64-68 mph
	100	4.5V	163-169 km/h	101-105 mph
4th-5th	7.5	0.8V	72-78 km/h	45-48 mph
	44	2.25V	136-142 km/h	84-88 mph
	100	4.5V	-	-
TCC Applied	7.5	0.8V	78-82 km/h	48-51 mph
	44	2.25V	143-149 km/h	89-93 mph
	100	4.5V	213-219 km/h	132-136 mph
TCC OFF	7	0.75V	73-77 km/h	45-48 mph
	44	2.25V	126-132 km/h	78-82 mph
	100	4.5V	193-199 km/h	120-124 mph
5th-4th	7	0.75V	58-62 km/h	36-39 mph
	44	2.25V	103-109 km/h	64-68 mph
	100	4.5V	-	-
4th-3rd	7	0.75V	27-31 km/h	17-19 mph
	44	2.25V	66-72 km/h	41-45 mph
	100	4.5V	142-148 km/h	88-92 mph
3rd-2nd	7	0.75V	15-17 km/h	9-11 mph
	44	2.25V	36-42 km/h	22-26 mph
	100	4.5V	93-99 km/h	58-61 mph
2nd-1st	7	0.75V	15-17 km/h	9-11 mph
	44	2.25V	15-17 km/h	9-11 mph
	100	4.5V	47-53 km/h	29-33 mph
Transmission RPO				MJ7, MJ8
Engine RPO				L66

TRANSMISSION RANGE SWITCH LOGIC

Transmission Range Switch Logic

Shift Lever Position	P Signal	R Signal	N Signal	D Signal	I Signal	L Signal	FWD Signal
Park (P)	LOW	HI	HI	HI	HI	HI	HI
Reverse (R)	HI	LOW	HI	HI	HI	HI	HI
Neutral (N)	HI	HI	LOW	HI	HI	HI	HI

Drive (D)	HI	HI	HI	LOW	HI	HI	LOW
Intermediate (I)	HI	HI	HI	HI	LOW	HI	LOW
Low (L)	HI	HI	HI	HI	HI	LOW	HI
HI = Ignition Voltage LOW = 0 Volts							

LINE PRESSURE

Line Pressure

Application	Fluid Pressure Test Port	Shift Lever Position	Command Gear	Engine Speed	Pressure	
					Standard or New	Service Limit
Line (A)	1	P or N	-	2,000 RPM	900-960 kPa 130-140 psi	850 kPa 120 psi
Coast Clutch	7	D	-	2000 RPM	760-830 kPa 110-120 psi	710 kPa 100 psi
1st Clutch	6	D	1	2000 RPM	890-970 kPa 130-140 psi	840 kPa 120 psi
2nd Clutch	4	D	2	2000 RPM	890-970 kPa 130-140 psi	840 kPa 120 psi
3rd Clutch	3	D	3	2000 RPM	890-970 kPa 130-140 psi	840 kPa 120 psi
4th Clutch	5	D	4	2000 RPM	890-970 kPa 130-140 psi	840 kPa 120 psi
5th Clutch	2	D	5	2000 RPM	890-970 kPa 130-140 psi	840 kPa 120 psi
Reverse	2	R	Reverse	2000 RPM	890-970 kPa 130-140 psi	840 kPa 120 psi

COMPONENT RESISTANCE

Component Resistance

Component	Pass Through Pins	Resistance 20° C (68° F)	Resistance 100° C (212° F)	Resistance to Ground - Case
3rd Clutch Pressure Switch	-	infinityohm	infinityohm	Greater than 10 M ohm
4th Clutch Pressure Switch	-	infinityohm	infinityohm	Greater than 10 M ohm
Automatic Transmission Input Shaft Speed Sensor	-	infinityohm	infinityohm	Greater than 10 M ohm
Automatic Transmission Output Shaft Speed Sensor	-	infinityohm	infinityohm	Greater than 10 M ohm

Clutch Pressure Control Solenoid Valve 1	-	3-9 ohm	4-10 ohm	Greater than 250 K ohm
Clutch Pressure Control Solenoid Valve 2	-	3-9 ohm	4-10 ohm	Greater than 250 K ohm
Shift Solenoid Valve 1	-	19-24 ohm	24-31 ohm	-
Shift Solenoid Valve 2	-	19-24 ohm	24-31 ohm	-
Shift Solenoid Valve 3	-	19-24 ohm	24-31 ohm	-
TCC Enable Control Solenoid Valve	-	19-24 ohm	24-31 ohm	-
TCC Pressure Control Solenoid Valve	-	3-9 ohm	4-10 ohm	Greater than 250 K ohm
*Transmission Fluid Temperature (TFT) Sensor	-	1850-1950 ohm	164-190 ohm	Greater than 20 M ohm
IMPORTANT: The resistance of this device is dependent on the temperature. Therefore, the resistance varies far more than any other device.				

FLUID PUMP SPECIFICATIONS

Fluid Pump Specifications

Application	Standard or New		Service Limit	
	Metric	**English**	**Metric**	**English**
Driven Gear I.D.	14.016-14.034 mm	0.5518-0.5525 in	When worn or damaged	
Driven Gear Shaft O.D.	13.980-13.990 mm	0.5504-0.5508 in	When worn or damaged	
Gear-to Body Clearance				
• Drive Gear	0.210-0.265 mm	0.008-0.010 in	-	
• Driven Gear	0.070-0.125 mm	0.003-0.005 in	-	
Gear-to Body Thrust Clearance	0.03-0.06 mm	0.001-0.002 in	0.07 mm	0.003 in

SHIM SIZE SPECIFICATIONS

1st Clutch Selective Backing Plate (701)

Mark	Thickness	
	Metric	**English**
1	3.1 mm	0.122 in
2	3.2 mm	0.126 in
3	3.3 mm	0.130 in
4	3.4 mm	0.134 in
5	3.5 mm	0.138 in
6	3.6 mm	0.142 in
7	3.7 mm	0.146 in
8	3.8 mm	0.150 in

9	3.9 mm	0.154 in

2nd Clutch Selective Backing Plate (740)

Mark	Thickness	
	Metric	English
1	2.1 mm	0.083 in
2	2.2 mm	0.087 in
3	2.3 mm	0.091 in
4	2.4 mm	0.094 in
5	2.5 mm	0.098 in
6	2.6 mm	0.102 in
7	2.7 mm	0.106 in
8	2.8 mm	0.110 in
9	2.9 mm	0.114 in

3rd Clutch Selective Backing Plate (811)

Mark	Thickness	
	Metric	English
1	2.1 mm	0.083 in
2	2.2 mm	0.087 in
3	2.3 mm	0.091 in
4	2.4 mm	0.094 in
5	2.5 mm	0.098 in
6	2.6 mm	0.102 in
7	2.7 mm	0.106 in
8	2.8 mm	0.110 in
9	2.9 mm	0.114 in

4th Clutch Selective Backing Plate (609)

Mark	Thickness	
	Metric	English
1	2.1 mm	0.083 in
2	2.2 mm	0.087 in
3	2.3 mm	0.091 in
4	2.4 mm	0.094 in
5	2.5 mm	0.098 in
6	2.6 mm	0.102 in
7	2.7 mm	0.106 in
8	2.8 mm	0.110 in
9	2.9 mm	0.114 in

5th/Reverse Clutch Selective Backing Plate (625)

Mark	Thickness	
	Metric	English
1	2.1 mm	0.083 in
2	2.2 mm	0.087 in
3	2.3 mm	0.091 in
4	2.4 mm	0.094 in
5	2.5 mm	0.098 in
6	2.6 mm	0.102 in
7	2.7 mm	0.106 in
8	2.8 mm	0.110 in
9	2.9 mm	0.114 in

Output Shaft, 1st Driven Gear, Selective Spacer, 56 mm (518)

Mark	Thickness	
	Metric	English
A	1.525 mm	0.0600 in
B	1.505 mm	0.0593 in
C	1.485 mm	0.0585 in
D	1.465 mm	0.0577 in
E	1.445 mm	0.0569 in
F	1.425 mm	0.0561 in
G	1.405 mm	0.0553 in

Output Shaft, 3rd/4th Driven Gear, Selective Spacer, 50.2 mm (501)

No.	Thickness	
	Metric	English
A	3.95 mm	0.1555 in
B	3.97 mm	0.1563 in
C	3.99 mm	0.1571 in
D	4.01 mm	0.1579 in
E	4.03 mm	0.1587 in
F	4.05 mm	0.1594 in
G	4.07 mm	0.1602 in
H	4.09 mm	0.1610 in
I	4.11 mm	0.1618 in
J	4.13 mm	0.1626 in
K	4.15 mm	0.1634 in
L	4.17 mm	0.1642 in
M	4.19 mm	0.1650 in
N	4.21 mm	0.1657 in

O	4.23 mm	0.1665 in
P	4.25 mm	0.1673 in
Q	4.27 mm	0.1681 in
R	4.29 mm	0.1689 in
S	4.31 mm	0.1697 in
T	4.33 mm	0.1705 in
U	4.35 mm	0.1713 in

1st/2nd Clutch Shaft, 1st Gear, Selective Washer, 52 mm (722)

	Thickness	
No.	Metric	English
A	2.705 mm	0.107 in
B	2.680 mm	0.106 in
C	2.655 mm	0.105 in
D	2.630 mm	0.104 in
E	2.605 mm	0.103 in
F	2.580 mm	0.102 in
G	2.555 mm	0.101 in
H	2.530 mm	0.100 in
I	2.505 mm	0.099 in
J	2.480 mm	0.098 in
K	2.455 mm	0.097 in
L	2.430 mm	0.096 in
M	2.405 mm	0.095 in

1st/2nd Clutch Shaft, Installed Height, Selective Thrust Shim, 65 mm (74)

	Thickness	
No.	Metric	English
OA	0.80 mm	0.031 in
A	0.84 mm	0.033 in
B	0.88 mm	0.035 in
C	0.92 mm	0.036 in
D	0.96 mm	0.038 in
E	1.00 mm	0.039 in
F	1.04 mm	0.041 in
G	1.08 mm	0.043 in
H	1.12 mm	0.044 in
I	1.16 mm	0.046 in
J	1.20 mm	0.047 in
K	1.24 mm	0.049 in
L	1.28 mm	0.050 in

M	1.32 mm	0.052 in
N	1.36 mm	0.054 in
O	1.40 mm	0.055 in
P	1.44 mm	0.057 in
Q	1.48 mm	0.058 in
R	1.52 mm	0.060 in
S	1.56 mm	0.061 in
T	1.60 mm	0.063 in
U	1.64 mm	0.065 in
V	1.68 mm	0.066 in
W	1.72 mm	0.068 in
X	1.76 mm	0.069 in
Y	1.80 mm	0.071 in
Z	1.84 mm	0.072 in
AA	1.88 mm	0.074 in
AB	1.92 mm	0.076 in
AC	1.96 mm	0.077 in
AD	2.00 mm	0.079 in
AE	2.04 mm	0.080 in
AF	2.08 mm	0.082 in
AG	2.12 mm	0.083 in
AH	2.16 mm	0.085 in
AI	2.20 mm	0.087 in
AJ	2.24 mm	0.088 in
AK	2.28 mm	0.090 in
AL	2.32 mm	0.091 in

3rd Clutch Shaft, 3rd Gear Clearance, Splined Selective Washer, 53 mm (800)

	Thickness	
No.	**Metric**	**English**
A	3.995 mm	0.1573 in
B	4.015 mm	0.1581 in
C	4.035 mm	0.1589 in
D	4.055 mm	0.1596 in
E	4.075 mm	0.1604 in
F	4.095 mm	0.1612 in
G	4.115 mm	0.1620 in
H	4.135 mm	0.1628 in
I	4.155 mm	0.1636 in
J	4.175 mm	0.1644 in
K	4.195 mm	0.1652 in

L	4.215 mm	0.1659 in
M	4.235 mm	0.1667 in
N	4.255 mm	0.1675 in

3rd Clutch Shaft, Installed Height, Selective Washer, 26.5 mm (809)

No.	Thickness	
	Metric	**English**
A	1.05 mm	0.041 in
B	1.13 mm	0.044 in
C	1.21 mm	0.048 in
D	1.29 mm	0.051 in
E	1.37 mm	0.054 in
F	1.45 mm	0.057 in
G	1.53 mm	0.060 in
H	1.61 mm	0.063 in
I	1.69 mm	0.067 in
J	1.77 mm	0.070 in
K	1.85 mm	0.073 in
L	1.93 mm	0.076 in
M	2.01 mm	0.079 in
N	2.09 mm	0.082 in

Front Differential, Rotational Torque, Selective Shim, 85 mm (910)

No.	Thickness	
	Metric	**English**
A	1.350 mm	0.0531 in
B	1.375 mm	0.0541 in
C	1.400 mm	0.0551 in
D	1.425 mm	0.0561 in
E	1.450 mm	0.0571 in
F	1.475 mm	0.0581 in
G	1.500 mm	0.0591 in
H	1.525 mm	0.0600 in
I	1.550 mm	0.0610 in
J	1.575 mm	0.0620 in
K	1.600 mm	0.0630 in
L	1.625 mm	0.0640 in
M	1.650 mm	0.0650 in
N	1.675 mm	0.0659 in
O	1.700 mm	0.0669 in
P	1.725 mm	0.0679 in

Q	1.750 mm	0.0689 in
R	1.775 mm	0.0699 in
S	1.800 mm	0.0709 in
T	1.825 mm	0.0719 in
U	1.850 mm	0.0728 in
V	1.875 mm	0.0738 in
W	1.900 mm	0.0748 in
X	1.925 mm	0.0758 in
Y	1.950 mm	0.0768 in
Z	1.975 mm	0.0778 in
AA	2.000 mm	0.0787 in
AB	2.025 mm	0.0797 in
AC	2.050 mm	0.0807 in
AD	2.075 mm	0.0817 in
AE	2.100 mm	0.0827 in
AF	2.125 mm	0.0837 in
AG	2.150 mm	0.0846 in
AH	2.175 mm	0.0856 in
AI	2.200 mm	0.0866 in
AJ	2.225 mm	0.0876 in
AK	2.250 mm	0.0886 in
AL	2.275 mm	0.0896 in
AM	2.300 mm	0.0906 in
AN	2.325 mm	0.0915 in
AO	2.350 mm	0.0925 in

Transfer Case Driven Gear with Shaft, Installed Height, Selective Shim, 28.5 mm (912)

No.	Thickness	
	Metric	**English**
A	1.82 mm	0.0717 in
B	1.84 mm	0.0724 in
C	1.86 mm	0.0732 in
D	1.88 mm	0.0740 in
E	1.90 mm	0.0748 in
F	1.92 mm	0.0756 in
G	1.94 mm	0.0764 in
H	1.96 mm	0.0772 in
I	1.98 mm	0.0780 in
J	2.00 mm	0.0787 in
K	2.02 mm	0.0795 in
L	2.04 mm	0.0803 in

M	2.06 mm	0.0811 in
N	2.08 mm	0.0819 in
O	2.10 mm	0.0827 in
P	2.12 mm	0.0835 in
Q	2.14 mm	0.0843 in
R	2.16 mm	0.0850 in
S	2.18 mm	0.0858 in
T	2.20 mm	0.0866 in
U	2.22 mm	0.0874 in
V	2.24 mm	0.0882 in
W	2.26 mm	0.0890 in
X	2.28 mm	0.0898 in
Y	2.30 mm	0.0906 in
Z	2.32 mm	0.0913 in
AA	2.34 mm	0.0921 in

TRANSMISSION CLEARANCE SPECIFICATIONS

Clutch

	Standard or New		Service Limit	
Application	**Metric**	**English**	**Metric**	**English**
Clutch Backing-Plate-to-Top-Disc Clearance				
• 1st Clutch	-		1.1-1.3 mm	0.043-0.051 in
• 2nd Clutch	-		1.0-1.2 mm	0.039-0.047 in
• 3rd Clutch	-		0.7-0.9 mm	0.028-0.035 in
• 4th, 5th Clutch	-		0.55-0.75 mm	0.022-0.030 in
• 1st-Hold Clutch	-		0.6-1.0 mm	0.024-0.039 in
Clutch Plate Thickness				
• 1st Clutch	1.6 mm	0.06 in	When discolored	
• 2nd Clutch	1.8 mm	0.07 in	When discolored	
• 3rd, 4th, 5th Clutch	2.0 mm	0.079 in	When discolored	
• 1st-Hold Clutch	1.8 mm	0.07 in	When discolored	
Clutch Return Spring Free Length				
• 1st Clutch	68.3 mm	2.69 in	66.3 mm	2.61 in
• 2nd Clutch	48.3 mm	1.90 in	46.3 mm	1.82 in
• 3rd Clutch	52.0 mm	2.05 in	50.0 mm	1.97 in
• 4th Clutch	37.7 mm	1.48 in	35.7 mm	1.41 in
	37.4 mm	1.47 in	35.4 mm	1.39 in

• 5th Clutch				

Stator Shaft (404)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
I.D. at Mainshaft Sealing Ring Contact Area	31.000-31.025 mm	1.220-1.221 in	31.05 mm	1.222 in
I.D. at Needle Bearing Contact Area				
• Automatic Transmission Fluid Pump Side	31.000-31.025 mm	1.220-1.221 in	-	
• Torque Converter Side	27.000-27.021 mm	1.063-1.064 in	When worn or damaged	

Reverse Shift Fork (924)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
Reverse Shift Fork	5.90-6.00 mm	0.220-0.236 in	5.4 mm	0.213 in

Regulator Valve Body (422)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
Mainshaft Sealing Ring Contact I.D.	31.000-31.025 mm	1.220-1.221 in	31.05 mm	1.222 in
Shift Fork Shaft Bore I.D.	14.000-14.010 mm	0.5512-0.5516 in	-	
Shift Fork Shaft/Secondary Valve	37.000-37.039 mm	1.4567-1.4582 in	37.045 mm	1.4585 in

Main Control Valve Body (203)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
Third Shaft Sealing Ring Contact I.D.	35.000-35.025 mm	1.3780-1.3789 in	35.05 mm	1.3799 in

1st/2nd Clutch Shaft, Apply Fluid Collar (129)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
1st/2nd Clutch Shaft Sealing Ring	29.000-29.021	1.1417-1.1426	29.05 mm	1.1437 in

Contact	mm	in		

Mainshaft (640)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
5th Gear Axial Clearance	0.10-0.22 mm	0.004-0.009 in	-	
5th Gear Collar Diameter at Needle Bearing Contact Area	39.975-39.991 mm	1.5738-1.5744 in	When worn or damaged	
5th Gear Collar Flange Thickness	5.15-5.30 mm	0.203-0.209 in	When worn or damaged	
5th Gear Collar Length	48.7-48.8 mm	1.917-1.921 in	-	
5th Gear I.D.	46.000-46.016 mm	1.8110-1.8116 in	When worn or damaged	
Diameter at Stator Shaft Needle Bearing Contact Area	22.984-23.000 mm	0.9049-0.9055 in	When worn or damaged	
Sealing Ring Groove Width	2.025-2.060 mm	0.080-0.081 in	2.08 mm	0.082 in
Sealing Ring Thickness	1.90-1.96 mm	0.074-0.077 in	1.85 mm	0.073 in

Output Shaft (535)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
Axial Clearance of Gears				
• 2nd Driven Gear	0.005-0.040 mm	0.0002-0.0016 in	-	
• 5th Driven Gear	0.12-0.27 mm	0.0047-0.0106 in	-	
• 1st/2nd Idler Gear	0.005-0.040 mm	0.0002-0.0016 in	-	
• Reverse Driven Gear	0.10-0.25 mm	0.0039-0.0098 in	-	
Cotter Thickness	1.99-2.02 mm	0.078-0.080 in	-	
Diameter at Bearing Contact Area				
• 5th gear	34.975-34.991 mm	1.3770-1.3776 in	When worn or damaged	
• Torque Converter Housing Bearing	40.505-40.515 mm	1.5947-1.5951 in	When worn or damaged	

Diameter of 2nd Gear at Needle Bearing Contact Area	56.975-56.991 mm	2.2431-2.2437 in	When worn or damaged
I.D of Gears			
• 5th Gear	41.000-41.0016 mm	1.6142-1.6148 in	When worn or damaged
• Idler Gear	65.000-65.019 mm	2.5590-2.5598 in	When worn or damaged
• Reverse Gear	46.000-46.016 mm	1.8110-1.8116 in	When worn or damaged
Reverse Gear Collar O.D.	39.979-40.000 mm	1.5740-1.5748 in	When worn or damaged
Reverse Selector Hub O.D.	55.885-55.900 mm	2.200-2.201 in	When worn or damaged
Thrust Washer Thickness - 35 x 47 mm	5.97-6.00 mm	0.2350-0.2362 in	When worn or damaged

1st/2nd Clutch Shaft (755)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
1st Gear Collar Length	63.3-63.4 mm	2.4921-2.4961 in	-	
ATF Feed Pipe O.D.				
• 1st Clutch	11.47-11.48 mm	0.4516-0.4520 in	11.45 mm	0.4508 in
• 1st Hold Clutch	5.97-5.98 mm	0.2350-0.2354 in	5.95 mm	0.2343 in
Axial Clearance of Gears				
• 1st Drive Gear	0.085-0.130 mm	0.0033-0.0051 in	-	
• 2nd Gear	0.06-0.23 mm	0.0024-0.0091 in	-	
Diameter at Bearing Contact Area				
• 2nd gear	43.986-43.999 mm	1.7317-1.7322 in	When worn or damaged	
• Torque Converter Housing Bearing	32.002-32.015 mm	1.2599-1.2604 in	When worn or damaged	
• Torque Converter Housing Bearing - Shaft End Side	28.592-28.608 mm	1.1257-1.1263 in	When worn or damaged	
Diameter of 1st Gear Collar at Needle Bearing Contact Area	38.975-38.991 mm	1.5344-1.5351 in	When worn or damaged	
Feed Pipe Bushing I.D.				
	11.518-11.530	0.4535-		

• 1st Clutch	mm	0.4539 in	11.545 mm	0.4545 in
• 1st Hold Clutch	6.018-6.030 mm	0.2369-0.2374 in	6.045 mm	0.2380 in
I.D. of Gears				
• 1st Gear	44.000-44.016 mm	1.7323-1.7329 in	When worn or damaged	
• 2nd Gear	50.00-50.02 mm	1.9685-1.9693 in	When worn or damaged	
Sealing Ring Groove Width	2.025-2.060 mm	0.080-0.081 in	2.08 mm	0.082 in
Sealing Ring Thickness	1.91-1.97 mm	0.075-0.078 in	1.86 mm	0.073 in

3rd Clutch Shaft (830)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
Axial Clearance of 3rd Gear	0.005-0.045 mm	0.0002-0.0018 in	-	
Cotter Thickness	2.99-3.02 mm	0.1177-0.1189 in	-	
I.D. of 3rd Gear	36.000-36.016 mm	1.4173-1.4179 in	When worn or damaged	
Sealing Ring Groove Width	2.025-2.060 mm	0.080-0.081 in	2.08 mm	0.082 in
Sealing Ring Thickness	1.89-1.95 mm	0.0744-0.0768 in	1.84 mm	0.0724 in

Reverse Idler Gear (533)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
Axial Clearance	0.07-0.38 mm	0.003-0.015 in	-	
Gear Shaft O.D.	13.99-14.00 mm	0.5508-0.5512 in	When worn or damaged	
I.D. of Reverse Idler Gear	18.007-18.020 mm	0.7089-0.7094 in	When worn or damaged	
I.D. of Transmission Housing at Gear Shaft Contact Area	14.006-14.024 mm	0.5514-0.5521 in	-	
Thrust Washer Thickness				
• Holder Side	0.97-1.05 mm	0.038-0.041 in	-	
• Transmission Housing	0.97-1.05 mm	0.038-0.041 in	-	

Main Control Valve Body Springs (250)

	Standard or New			

Application	Wire Diameter	O.D.	Free Length	No. of Coils
Cooler Check Valve Spring	0.6 mm (0.024 in)	5.8 mm (0.228 in)	14.5 mm (0.571 in)	6.8
CPC Valve C Spring	0.7 mm (0.028 in)	6.1 mm (0.240 in)	17.8 mm (0.701 in)	7.9
Lock-up Shift Valve Spring	0.9 mm (0.035 in)	7.6 mm (0.299 in)	63.0 mm (2.48 in	22.4
Lock-Up Timing Valve Spring	0.65 mm (0.026 in)	6.6 mm (0.260 in)	34.8 mm (1.370 in)	15.6
Lubrication Control Valve Spring	0.7 mm (0.028 in)	7.7 mm (0.303 in)	28.8 mm (1.134 in	10.4
Modulator Valve Spring	1.6 mm (0.063 in)	10.4 mm (0.409 in)	33.5 mm (1.319 in)	9.8
Relief Valve Spring	1.1 mm (0.043 in)	8.6 mm (0.339 in)	32.1 mm (1.264 in)	11.2
Shift Valve A Spring	0.8 mm (0.031 in)	6.6 mm (0.260 in)	49.1 mm (1.933 in)	21.7
Shift Valve B Spring	0.8 mm (0.031 in)	6.6 mm (0.260 in)	49.1 mm (1.933 in)	21.7
Shift Valve D Spring	0.7 mm (0.028 in)	6.6 mm (0.260 in)	32.3 mm (1.268 in)	13.4
Shift Valve E Spring	0.8 mm (0.031 in)	7.1 mm (0.280 in)	49.0 mm (1.929 in)	17.2
Torque Converter Check Valve Spring	1.1 mm (0.043 in)	8.6 mm (0.339 in)	35.0 mm (1.378 in)	12.6

Servo Control Valve Body Springs (325)

Application	Standard or New			
	Wire Diameter	O.D.	Free Length	No. of Coils
CPC Valve A Spring	0.7 mm (0.028 in)	6.1 mm (0.240 in)	17.8 mm (0.701 in)	7.9
Kick-Down Valve Spring	0.8 mm (0.031 in)	6.6 mm (0.26 in)	49.1 mm (1.933 in)	21.7
Reverse CPC Valve Spring	0.7 mm (0.028 in)	6.1 mm (0.240 in)	17.8 mm (0.701 in)	7.9
Servo Control Valve Spring	0.7 mm (0.028 in)	6.6 mm (0.260 in)	35.7 mm (1.406 in)	17.2
Shift Valve C Spring	0.8 mm (0.031 in)	6.6 mm (0.260 in)	49.1 mm (1.933 in)	21.7

Regulator Valve Body Springs (430)

Application	Standard or New			
	Wire Diameter	O.D.	Free Length	No. of Coils
3rd Accumulator Spring	3.1 mm (0.122 in)	19.6 mm (0.772 in)	41.4 mm (1.63 in)	5.5
Lock-Up Control Valve Spring	0.7 mm (0.028 in)	6.6 mm (0.26 in)	42.9 mm (1.689 in)	14.2
	0.8 mm (0.031 in)	6.6 mm (0.26 in)	44.3 mm (1.744 in)	25.5
Regulator Valve Spring A	1.9 mm (0.075 in)	14.7 mm (0.579 in)	80.6 mm (3.173 in)	16.1

Regulator Valve Spring B	1.4 mm (0.055 in)	8.8 mm (0.346 in)	44.0 mm (1.7321 in)	12.0
Stator Reaction Spring	5.5 mm (0.217 in)	37.4 mm (1.472 in)	30.3 mm (1.193 in)	2.1

Accumulator Valve Body Springs (495)

Application	Standard or New			
	Wire Diameter	O.D.	Free Length	No. of Coils
1st Accumulator Spring A	2.2 mm (0.087 in)	17.7 mm (0.697 in)	77.6 mm (3.055 in)	12.1
1st Accumulator Spring B	2.0 mm (0.079 in)	11.1 mm (0.437 in)	49.0 mm (1.929 in)	10.0
1st Hold Accumulator Spring	2.0 mm (0.079 in)	13.1 mm (0.516 in)	42.9 mm (1.689 in)	9.8
2nd Accumulator Spring	3.1 mm (0.122 in)	19.6 mm (0.772 in)	53.4 mm (2.102 in)	7.5
4th Accumulator Spring	3.0 mm (0.118 in)	19.6 mm (0.772 in)	45.3 mm (1.783 in)	6.4
5th Accumulator Spring A	2.2 mm (0.087 in)	16.4 mm (0.646 in)	75.7 mm (2.980 in)	14.2
5th Accumulator Spring B	2.0 mm (0.079 in)	10.0 mm (0.394 in)	45.5 mm (1.791 in)	11.6

Front Differential Assembly (919)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
Automatic Transmission	18.000-18.025 mm	0.7087-0.7096 in	-	
Carrier-to-Output Shaft Clearance	18.000-18.025 mm	0.7087-0.7096 in	0.13 mm	0.005 in
Carrier-to-Intermediate Shaft Clearance	0.045-0.06 mm	0.002-0.004 in	-	
Tapered Roller Bearing Staring Torque New Bearing 3.9-5.1 N.m (35-45 lb in)	0.080-0.126 mm	0.003-0.005 in	-	-
Carrier-to-Pinion Shaft Clearance	0.013-0.054 mm	0.0005-0.0021 in	0.1 mm	0.004 in
Driveshaft Contact Area I.D.	30.025-30.055 mm	1.182-1.183 in	-	

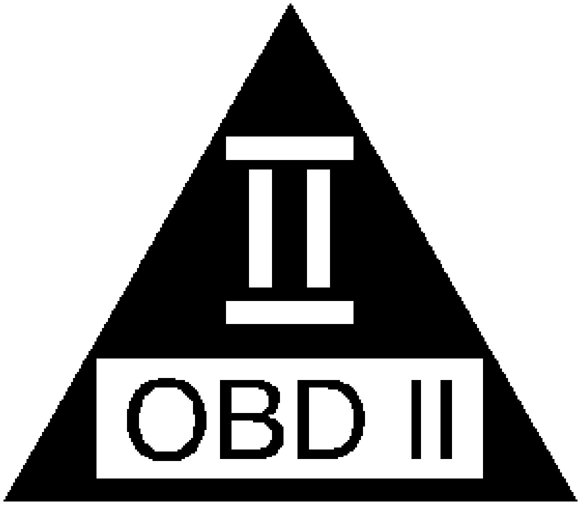
Front Differential Pinion Gear (956)

Application	Standard or New		Service Limit	
	Metric	English	Metric	English
Backlash	0.175-0.275 mm	0.007-0.011 in	-	
I.D.	18.042-18.066 mm	0.7103-0.7113 in	-	
Pinion Gear-to-Pinion Shaft Clearance	0.055-0.095 mm	0.0022-0.0037 in	0.12 mm	0.005 in

SCHEMATIC AND ROUTING DIAGRAMS

AUTOMATIC TRANSMISSION SCHEMATIC ICONS

Automatic Transmission Schematic Icons

Icon	Icon Definition
	**NOTE:** **The OBD II symbol is used on the circuit diagrams in order to alert the technician that the circuit is essential for proper OBD II emission control circuit operation. Any circuit which fails and causes the malfunction indicator lamp (MIL) to turn ON, or causes emissions-related component damage, is identified as an OBD II circuit.**

AUTOMATIC TRANSMISSION CONTROLS SCHEMATICS

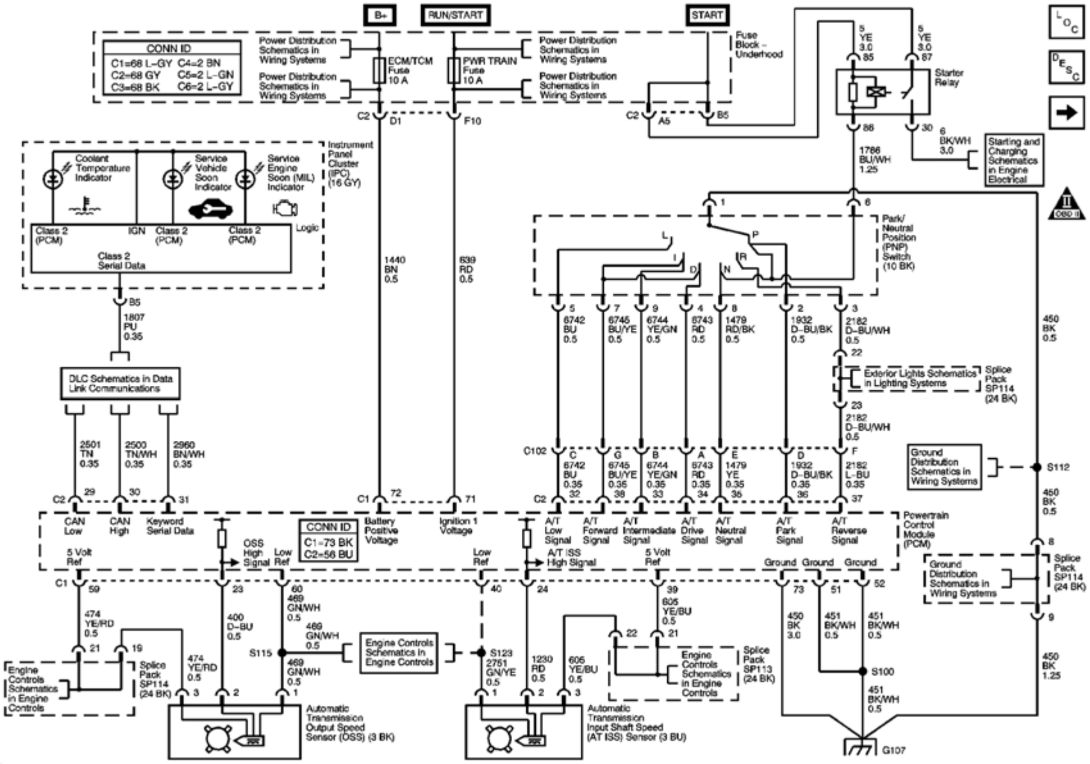
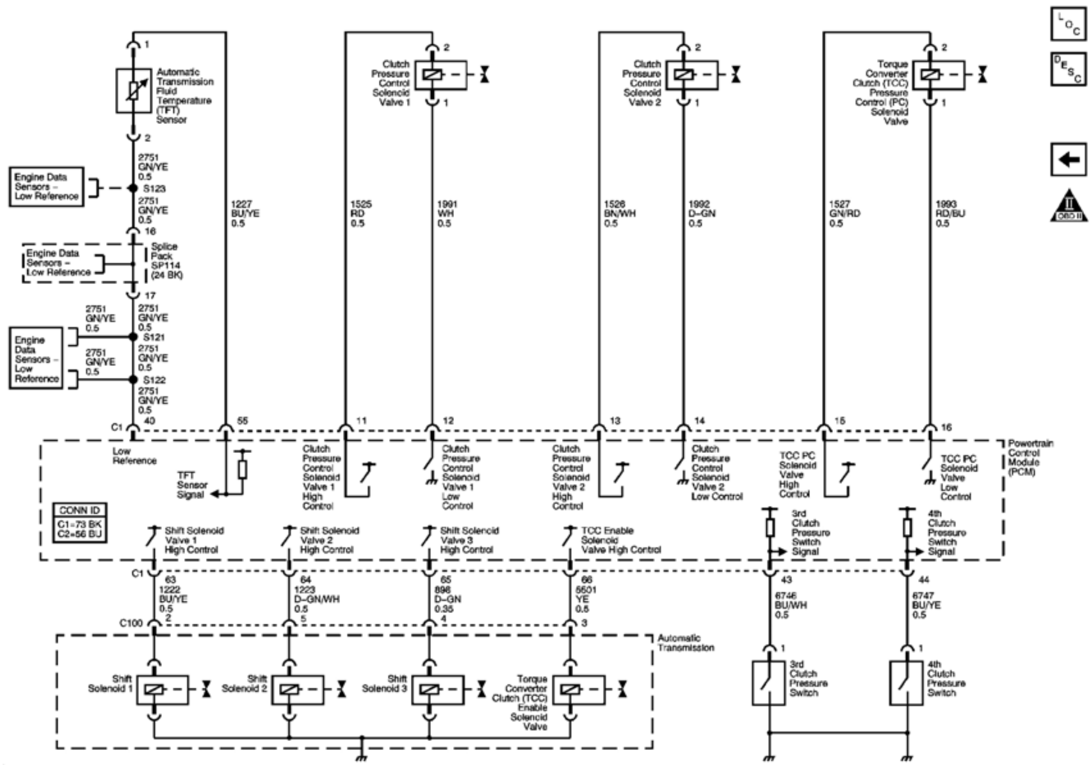


Fig. 1: Power, Ground, PNP Switch, And Communication Data Schematics

Courtesy of GENERAL MOTORS CORP.



<u>Fig. 2: Solenoids, Switches, And Sensors Schematics</u>
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

AUTOMATIC TRANSMISSION ELECTRONIC COMPONENT VIEWS

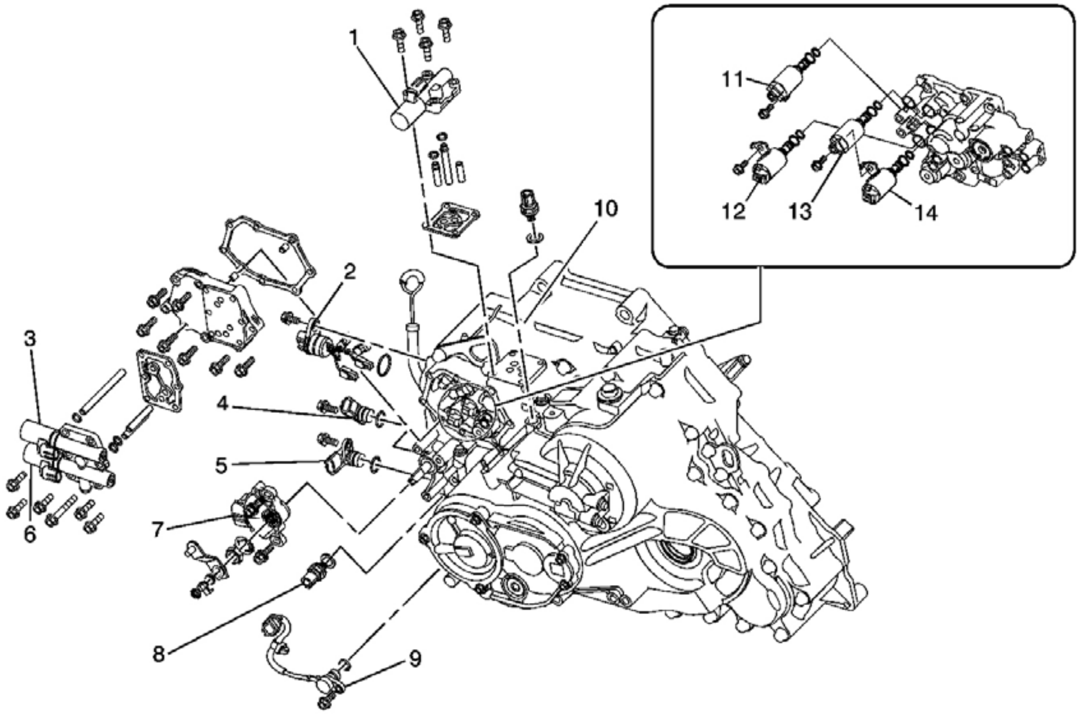


Fig. 3: Electrical Component Locations View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 3

Callout	Component Name
1	Solenoid - TCC Lock-Up Pressure Control
2	Harness Assembly - Automatic Transmission Wiring
3	Solenoid - Automatic Transmission Clutch Pressure Control "A" (1)
4	Sensor - Input Speed
5	Sensor - Output Speed
6	Solenoid - Automatic Transmission Clutch Pressure Control "B" (2)
7	Switch - Park/Neutral Position
8	Switch - 3rd Clutch Fluid Pressure
9	Sensor - Automatic Transmission Fluid Temperature, w/Harness
10	Switch - 4th Clutch Fluid Pressure
11	Solenoid - Shift Control "A" (1)
12	Solenoid - Shift Control "B" (2)
13	Solenoid - Shift Control "C" (3)
14	Solenoid - Torque Converter Clutch

DISASSEMBLED VIEWS

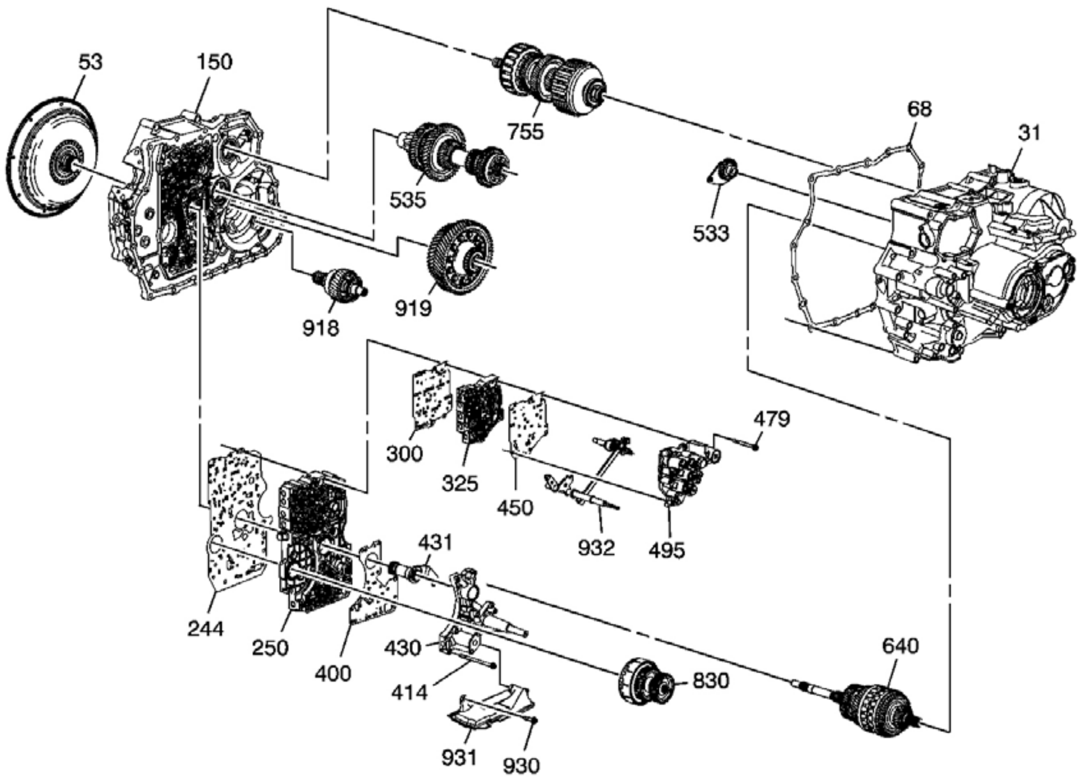
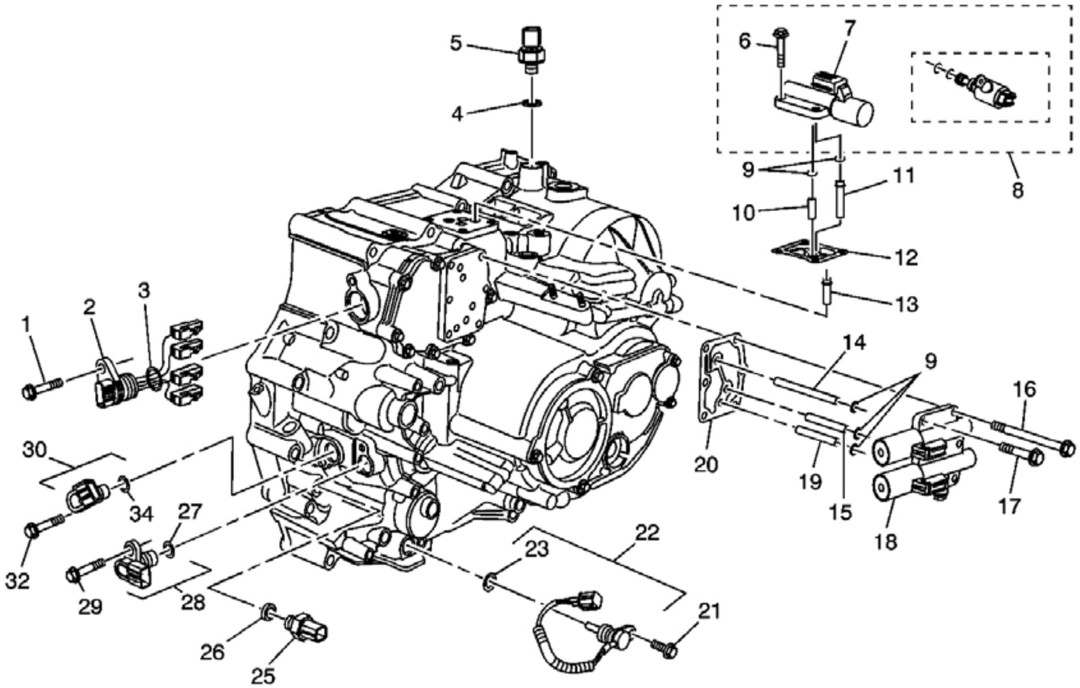


Fig. 4: Case And Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
31	Transmission Case Assembly
53	Torque Converter Clutch (TCC) Assembly
68	Torque Converter Housing Gasket
150	Torque Converter Housing Assembly
244	Main Control Valve Body Plate Assembly Spacer
250	Main Control Valve Body Assembly
300	Servo Valve Body Spacer Plate
325	Servo Valve Body Assembly
400	Regulator Valve Body Spacer Plate
414	Regulator Valve Body Flanged Bolt
430	Regulator Valve Body with Shift Fork Assembly
431	Stator Shaft and Torque Arm Assembly
450	Accumulator Valve Body Spacer Plate
479	Accumulator Valve Body Flanged Bolt
495	Accumulator Valve Body Assembly

533	Reverse Idler Gear Assembly
535	Output Shaft Assembly
640	Mainshaft Assembly
755	1st and 2nd Clutch Shaft Assembly
830	3rd Clutch Shaft Assembly
918	Transfer Gear with Shaft Assembly
919	Front Differential Assembly
930	Fluid Filter Assembly Flanged Mount Bolt
931	Fluid Filter Assembly
932	Manual Shift Shaft, Detent Lever, and Actuator with Linkage Assembly



<u>Fig. 5: Sensor/Solenoid Component View</u>
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Automatic Transmission Wiring Harness Connector Bolt - M6 x 20 mm
2	Automatic Transmission Wiring Harness Assembly
3	Automatic Transmission Wiring Connector O-Ring Seal - 23.3 x 2.4 mm
4	4th Clutch Pressure Switch Seal - 10 mm
5	4th Clutch Pressure Switch Assembly
6	TCC Pressure Control Solenoid Valve Bolt - M6 x 30 mm

7	TCC Pressure Control Solenoid Valve
8	TCC Pressure Control Solenoid and Apply Solenoid Valve Kit
9	Fluid Pipe Seal - 7.7 x 2.3 mm
9	Fluid Pipe Seal - 7.7 x 2.3 mm
10	TCC Pressure Control Solenoid Valve Apply Fluid Pipe - 8 x 36 mm
11	TCC Pressure Control Solenoid Valve Fluid Feed Pipe - 8 x 53 mm
12	TCC Pressure Control Solenoid Valve Gasket
13	TCC Pressure Control Solenoid Valve Fluid Drain Pipe - 8 x 25.2 mm
14	Clutch Pressure Control Solenoid Valve Fluid Pipe - 8 x 105 mm
15	Clutch Pressure Control Solenoid Valve Fluid Pipe - 8 x 58.3 mm
16	Clutch Pressure Control Solenoid Valve Bolt - M6 x 55 mm
17	Clutch Pressure Control Solenoid Valve Bolt - M6 x 25 mm
18	Clutch Pressure Control Solenoid Valve
19	Clutch Pressure Control Solenoid Valve Fluid Feed Pipe - 8 x 58.3 mm
20	Clutch Pressure Control Solenoid Valve Gasket
21	Automatic Transmission Fluid Temperature Sensor Bolt - M6 x 18 mm
22	Automatic Transmission Fluid Temperature Sensor
23	Automatic Transmission Fluid Temperature Sensor O-Ring Seal - 12 x 2.4 mm
25	3rd Clutch Pressure Switch
26	3rd Clutch Pressure Switch Seal
27	Automatic Transmission Input Speed Sensor O-Ring Seal - 16 x 2.1 mm
28	Automatic Transmission Input Speed Sensor
29	Automatic Transmission Input Speed Sensor Bolt - M6 x 18 mm
30	Automatic Transmission Output Speed Sensor Assembly
32	Automatic Transmission Output Speed Sensor Bolt - M6 x 18 mm
34	Automatic Transmission Output Speed Sensor O-Ring Seal - 16 x 2.1 mm

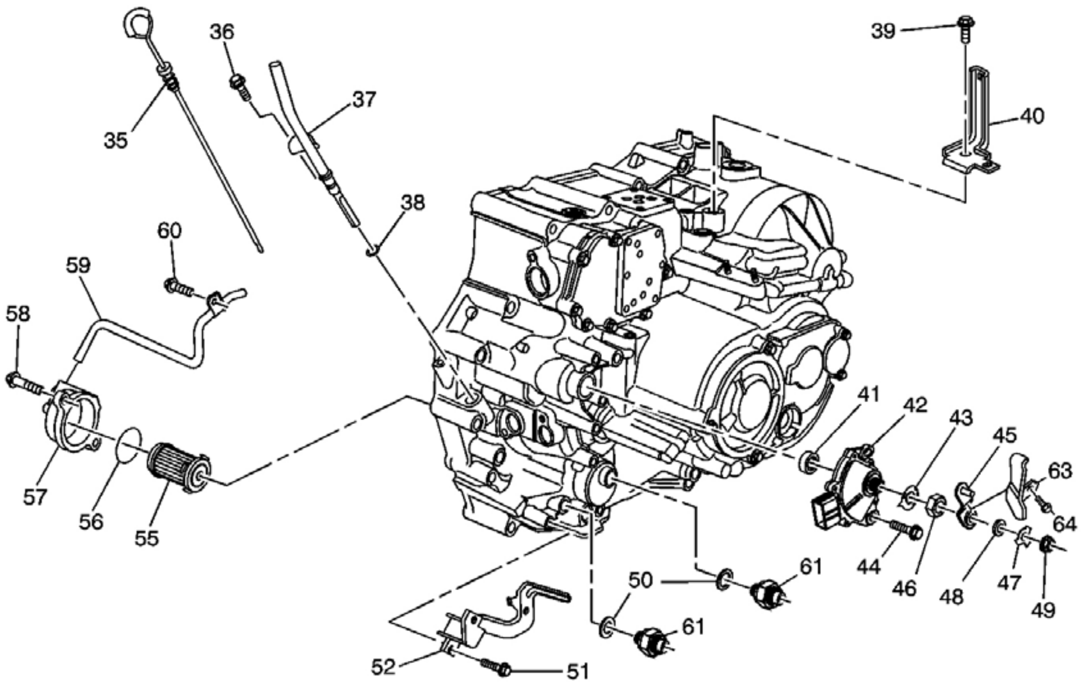


Fig. 6: Oil Level Gage/Position Sensor Component View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
35	Transmission Fluid Level Indicator
36	Transmission Fluid Fill Tube Bolt - M6 x 14 mm
37	Transmission Fluid Fill Tube Assembly
38	Transmission Fluid Fill Tube O-Ring Seal - 8.5 x 1.9 mm
39	Engine Wiring Harness Bracket Bolt - M6 x 12 mm
40	Engine Wiring Harness Bracket
41	Manual Shift Shaft Seal - 12 x 22 x 7 mm
42	Park/Neutral Position Switch
43	Park/Neutral Position Switch Washer - 16 mm
44	Park/Neutral Position Switch Bolt - M6 x 16 mm
45	Automatic Transmission Range Selector Lever Assembly
46	Park/Neutral Position Switch Nut - 16 mm
47	Automatic Transmission Range Selector Lever Washer - 8 mm
48	Automatic Transmission Range Selector Lever Washer - 8 mm
49	Automatic Transmission Range Selector Lever Nut - 8 mm
50	Transmission Fluid Cooler Pipe Fitting Seal - 12 mm
51	Transmission Fluid Cooler Pipe Bracket Bolt - M6 x 14 mm

52	Transmission Fluid Cooler Pipe Bracket
55	Automatic Transmission Fluid Filter
56	Automatic Transmission Fluid Filter Cover Seal - 37.7 x 3.5 mm
57	Automatic Transmission Fluid Filter Cover
58	Automatic Transmission Fluid Filter Cover Bolt - M6 x 20 mm
59	Lube Fluid Pipe
60	Lube Fluid Pipe Retainer Bolt - M6 x 12 mm
61	Transmission Fluid Cooler Pipe Fitting
61	Transmission Fluid Cooler Pipe Fitting
63	Automatic Transmission Range Selector Level Link Cover
64	Automatic Transmission Range Selector Lever Position Switch Shield Bolt - M6 x 16 mm

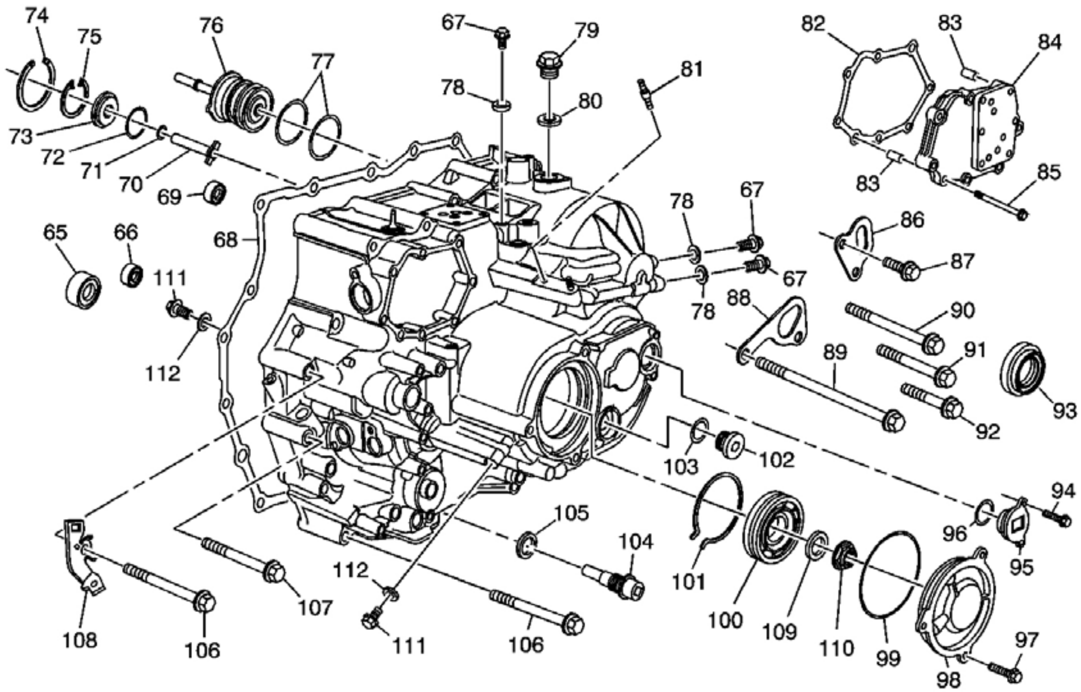


Fig. 7: Transmission Case Component View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 7

Callout	Component Name
65	3rd Clutch Shaft Rear Bearing - 20 x 41 x 17/16 mm
66	Manual Shift Shaft Bearing - 12 x 24 x 6 mm
67	Automatic Transmission Fluid Pressure Test Hole Plug - 8 mm
67	Automatic Transmission Fluid Pressure Test Hole Plug - 8 mm
67	Automatic Transmission Fluid Pressure Test Hole Plug - 8 mm

68	Torque Converter Housing Gasket
69	Park Pawl Actuator Bearing - 9 x 20 x 6 mm
70	Coast Clutch Apply Fluid Pipe
71	Coast Clutch Apply Fluid Guide Plate Inner Seal - 11 x 1.9 mm
72	Coast Clutch Apply Fluid Guide Plate Outer Seal - 34 x 1.9 mm
73	Coast Clutch Apply Fluid Pipe Guide Plate
74	1st/2nd Clutch Shaft Selective Shim - 65 mm
75	Coast Clutch Apply Fluid Pipe Guide Plate Retainer Ring - 40 mm
76	1st and Coast Clutch Apply Fluid Collar
77	1st and Coast Clutch Apply Fluid Collar Seal - 43.5 x 2.2 mm
78	Automatic Transmission Fluid Pressure Test Hole Plug Seal - 8 mm
78	Automatic Transmission Fluid Pressure Test Hole Plug Seal - 8 mm
78	Automatic Transmission Fluid Pressure Test Hole Plug Seal - 8 mm
79	Transmission Fluid Fill Plug
80	Transmission Fluid Fill Plug Washer - 24 mm
81	Automatic Transmission Range Selector Lever Cable Bracket Stud - M6 x 28 mm
82	Clutch Pressure Control Solenoid Manifold Gasket
83	Clutch Pressure Control Solenoid Manifold Locating Pin - 8 x 14 mm
83	Clutch Pressure Control Solenoid Manifold Locating Pin - 8 x 14 mm
84	Clutch Pressure Control Solenoid Manifold
85	Clutch Pressure Control Solenoid Manifold Bolt - M6 x 35 mm
86	Transmission Lifting Eye
87	Transmission Lifting Eye Bolt - M8 x 20 mm
88	Transmission Lifting Eye
89	Transmission Lifting Eye Bolt - M10 x 140 mm
90	Torque Converter Housing Bolt - M10 x 100 mm
91	Torque Converter Housing Bolt - M10 x 70 mm
92	Torque Converter Housing Bolt - M10 x 50 mm
93	Front Wheel Drive Shaft Oil Seal - 40 x 56 x 9 mm
94	Output Shaft Access Rear Cover Bolt - M6 x 20 mm
95	Output Shaft Access Rear Cover
96	Output Shaft Access Rear Seal Cover - 28 x 2.2 mm
97	Mainshaft Rear Case Cover Rear Bolt - M8 x 21 mm
98	Mainshaft Case Rear Cover
99	Mainshaft Case Rear Seal - 104 x 2.2 mm
100	Mainshaft Rear Bearing - 29 x 82 x 17/15.5 mm
101	Mainshaft Bearing Retainer Ring - 82 mm
102	Reverse Idler Gear Access Hole Plug - 20 mm
103	Reverse Idler Gear Access Hole Plug Seal - 20 mm
104	Transmission Fluid Drain Plug - 18 mm
105	Transmission Fluid Drain Plug Washer - 18 mm

106	Torque Converter Housing Bolt - M10 x 90 mm
106	Torque Converter Housing Bolt - M10 x 90 mm
107	Torque Converter Housing Bolt - M10 x 80 mm
108	Automatic Transmission Wire Harness Bracket
109	Mainshaft Washer - 29 x 40 x 3.9 mm
110	Mainshaft Retainer Nut - 26 mm
111	Automatic Transmission Case Plug - 8 mm
111	Automatic Transmission Case Plug - 8 mm
112	Automatic Transmission Case Plug Seal - 8 mm

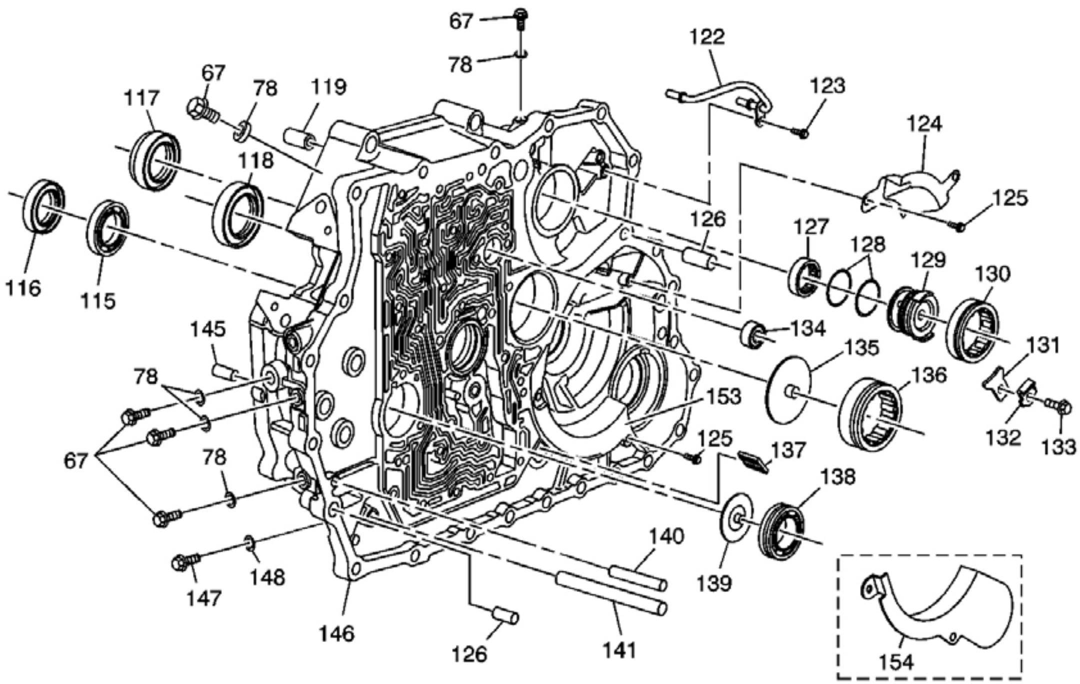


Fig. 8: Torque Converter Housing Component View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 8

Callout	Component Name
67	Automatic Transmission Fluid Pressure Test Hole Plug - 8 mm
67	Automatic Transmission Fluid Pressure Test Hole Plug - 8 mm
67	Automatic Transmission Fluid Pressure Test Hole Plug - 8 mm
78	Automatic Transmission Fluid Pressure Test Hole Seal - 8 mm
78	Automatic Transmission Fluid Pressure Test Hole Seal - 8 mm
78	Automatic Transmission Fluid Pressure Test Hole Seal - 8 mm
78	Automatic Transmission Fluid Pressure Test Hole Seal - 8 mm

115	Torque Converter Bearing - 42 x 68 x 7.5 mm
116	Torque Converter Fluid Seal - 46 x 70 x 8 mm
117	Front Wheel Drive Shaft Oil Seal - 35 x 54 x 8 mm
118	Transfer Case Input Shaft Seal - 48 x 65 x 7.5 mm
119	Transmission Case Locating Pin - 14 x 20 mm
122	1st and 2nd Clutch Shaft Lube Feed Pipe
123	1st and 2nd Clutch Shaft Fluid Pipe Retainer Bolt - M6 x 12 mm
124	Automatic Transmission Fluid Baffle
125	Automatic Transmission Fluid Baffle Bolt - M6 x 12 mm
125	Automatic Transmission Fluid Baffle Bolt - M6 x 12 mm
126	Transmission Case Locating Pin - 14 x 25 mm
126	Transmission Case Locating Pin - 14 x 25 mm
127	1st and 2nd Clutch Shaft Front Bearing - 29 x 39 x 9.5 mm
128	1st and 2nd Clutch Shaft Lube Feed Collar Seal - 36.5 x 2.0 mm
129	1st and 2nd Clutch Shaft Lube Feed Collar
130	1st and 2nd Clutch Shaft Intermediate Bearing - 32 x 63 x 19 mm
131	1st and 2nd Clutch Shaft Intermediate Bearing Retainer
132	1st and 2nd Clutch Shaft Intermediate Bearing Bolt Retainer - 6 mm
133	1st and 2nd Clutch Shaft Intermediate Bearing Retainer Bolt - M6 x 20 mm
134	Park Pawl Actuator Shaft Front Bearing - 12 x 24 x 6 mm
135	Output Shaft Lube Feed Plate
136	Output Shaft Front Bearing - 40.5 x 74 x 21 mm
137	Transmission Magnetic Chip Collector
138	3rd Clutch Shaft Front Bearing - 28 x 52 x 12.8 mm
139	3rd Clutch Shaft Lube Feed Plate
140	3rd Clutch Apply Fluid Pipe - 5 x 57.5 mm
141	Transmission Fluid Cooler Pipe - 10 x 123 mm
145	Transmission Case Locating Pin - 10 x 20 mm
146	Torque Converter Housing
147	Automatic Transmission Case Plug - 10 mm
148	Automatic Transmission Case Plug Seal - 10 mm
153	Automatic Transmission Fluid Baffle - AWD Only
154	Automatic Transmission Fluid Baffle - FWD Only

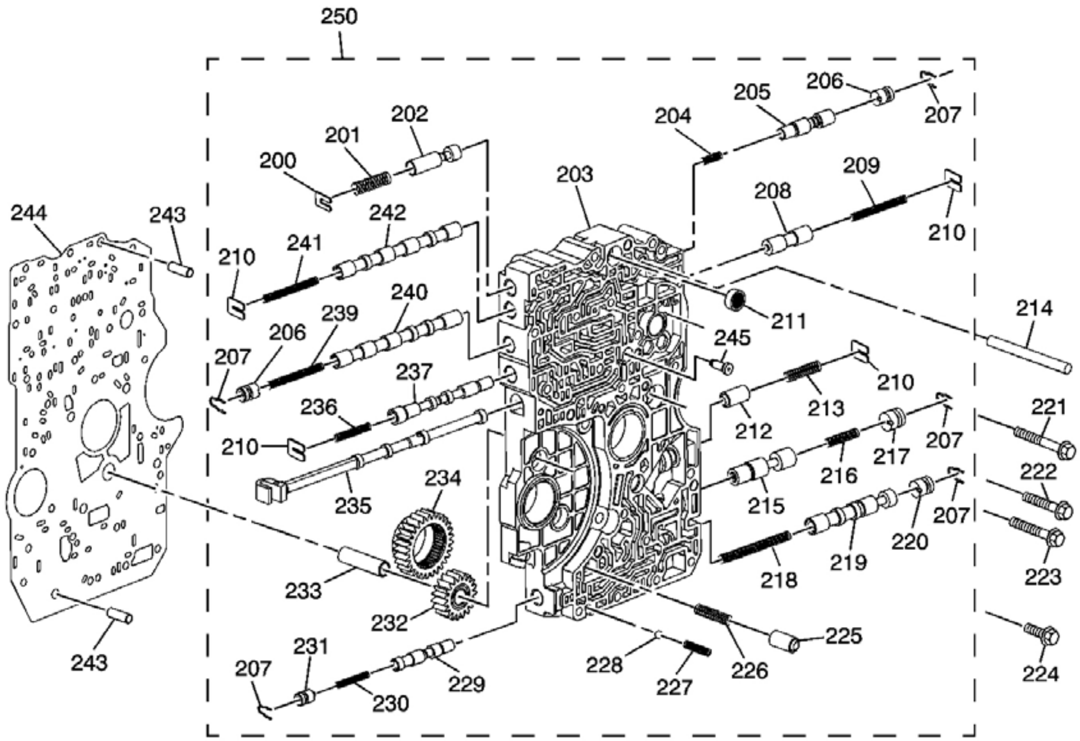
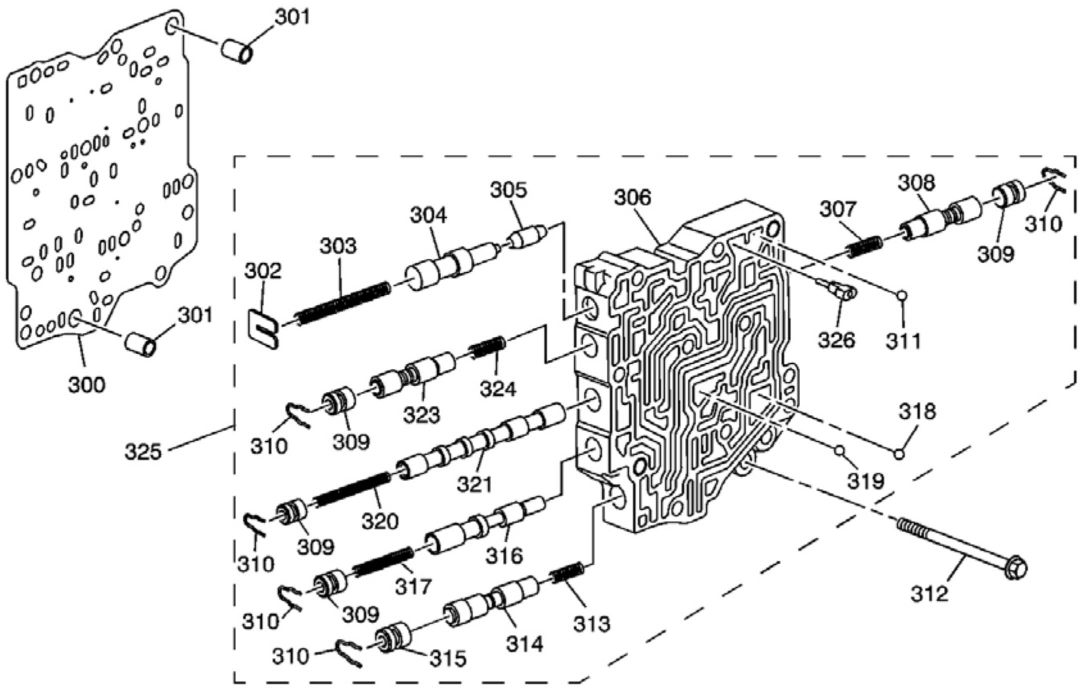


Fig. 9: Main Control Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 9

Callout	Component Name
200	Modulator Valve Spring Retainer
201	Modulator Valve Return Spring - 33.5 mm (1.319 in)
202	Modulator Valve
203	Control Valve Body
204	CPC Valve Return Spring - 17.8 mm (0.701 in)
205	CPC Valve
206	Body Valve Bore Plug - 12 mm, Double Groove Design
206	Body Valve Bore Plug - 12 mm, Double Groove Design
207	Body Valve Bore Plug Retainer Clip
207	Body Valve Bore Plug Retainer Clip
208	E Shift Valve
209	E Shift Valve Return Spring - 49 mm (1.929 in)
210	Body Valve Spring Retainer
210	Body Valve Spring Retainer
211	Transmission Fluid Filter

212	Relief Valve
213	Valve Relief Return Spring - 32.1 mm (1.264 in)
214	4th Clutch Apply Fluid Pipe - 8 x 62 mm
215	Lubrication Control Valve
216	Valve Lubrication Control Return Spring - 29.9 mm (1.177 in)
217	Body Valve Bore Plug - 15 mm
218	Valve Lock-up Shift Return Spring - 63 mm (2.480 in)
219	Lock-up Shift Valve
220	Body Valve Bore Plug - 14 mm
221	Control Valve Body Bolt - M6 x 40 mm
222	Control Valve Body Bolt - M6 x 30 mm
223	Control Valve Body Bolt - M6 x 32 mm
224	Control Valve Body Bolt - M6 x 20 mm
225	Torque Converter Check Valve
226	Valve Torque Converter Check Return Spring - 35.1 mm (1.382 in)
227	Oil Cooler Check Ball Return Spring - 14.5 mm (0.571 in)
228	Transmission Fluid Cooler Check Ball Valve - 7/32 inch
229	Lock-up Timing Valve
230	Valve Lock-up Timing Return Spring - 34.8 mm (1.370 in)
231	Valve Body Bore Plug - 12 mm, Single Groove Design
232	Automatic Transmission Fluid Pump Driven Gear
233	Automatic Transmission Fluid Pump Driven Gear Pin
234	Automatic Transmission Fluid Pump Drive Gear
235	Manual Valve
236	D Shift Valve Return Spring - 33.7 mm (1.327 in)
237	D Shift Valve
239	B Shift Valve Return Spring - 49.1 mm (1.933 in)
240	B Shift Valve
241	A Shift Valve Return Spring - 49.1 mm (1.933 in)
242	A Shift Valve
243	Spacer Plate Locating Pin - 8 x 14 mm
243	Spacer Plate Locating Pin - 8 x 14 mm
244	Control Valve Body Spacer Plate
245	Lubrication Control Valve
250	Control Valve Body Assembly



<u>Fig. 10: Servo Control Valve Body Assembly</u>
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 10

Callout	Component Name
300	Servo Valve Body Spacer Plate
301	Spacer Plate Locating Pin - 8 x 14 mm
301	Spacer Plate Locating Pin - 8 x 14 mm
302	Body Valve Spring Retainer
303	Kick Down Valve Return Spring - 49.1 mm (1.933 in)
304	Kick Down Valve
305	Kick Down Short Valve
306	Servo Valve Body
307	CPC Valve B, Return Spring - 17.8 mm (0.701 in)
308	CPC Valve B Valve
309	Body Valve Bore Plug - 12 mm
309	Body Valve Bore Plug - 12 mm
310	Body Valve Bore Plug Retainer Clip
310	Body Valve Bore Plug Retainer Clip
311	Valve 1st Clutch Accumulator Check - 7/32 in
312	Servo Valve Body Bolt - M6 x 60 mm
313	Reverse CPC Valve Return Spring - 17.8 mm (0.701 in)

314	Reverse CPC Valve
315	Body Valve Bore Plug - 14 mm
316	Servo Valve Control Valve
317	Servo Valve Control Valve Return Spring - 35.7 mm (1.406 in)
318	1st Clutch Check Valve - 7/32 inch
319	2nd Clutch Check Valve - 7/32 inch
320	Shift Valve C Return Spring - 49.1 mm (1.933 in)
321	Shift C Valve
323	CPC A Valve
324	CPC Valve A Return Spring - 17.8 mm (0.701 in)
325	Servo Valve Body
326	1st Accumulator Choke

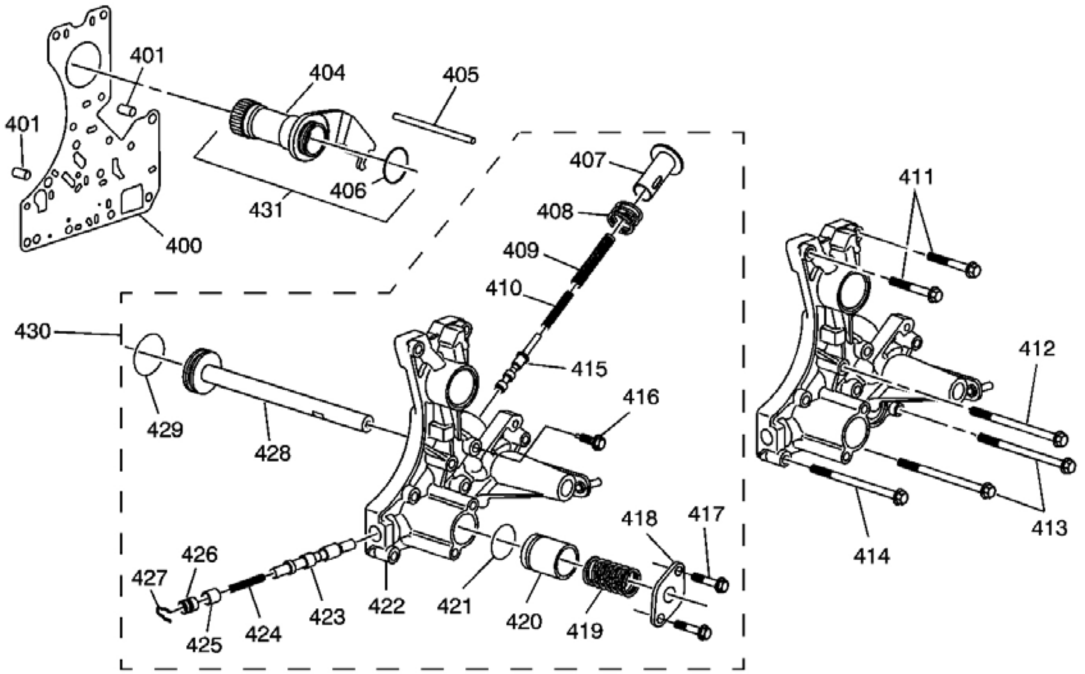


Fig. 11: Regulator Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 11

Callout	Component Name
400	Regulator Valve Body Spacer Plate
401	Spacer Plate Locating Pin - 8 x 14 mm
401	Spacer Plate Locating Pin - 8 x 14 mm
404	Stator Shaft

405	Stator Shaft Travel Stop Pin - 7 x 71 mm
406	Stator Shaft O-Ring Seal - 32.5 x 1.8 mm
407	Pressure Regulator Valve Spring Cap
408	Stator Reaction Spring - 30.0 mm (1.193 in)
409	Regulator Valve Outer Spring - 80.6 mm (3.173 in)
410	Regulator Valve Inner Spring - 44.0 mm (1.732 in)
411	Regulator Valve Body Bolt - M6 x 35 mm
412	Regulator Valve Body Bolt - M6 x 55 mm
413	Regulator Valve Body Bolt - M6 x 70 mm
414	Regulator Valve Body Bolt - M6 x 80 mm
415	Pressure Regulator Valve
416	Pressure Regulator Valve Spring Cap Guide Bolt - M6 x 30 mm
417	3rd Accumulator Piston Bore Cover Bolt - M6 x 30 mm
418	3rd Accumulator Piston Bore Cover
419	3rd Clutch Accumulator Piston Return Spring - 41.4 mm (1.630 in)
420	3rd Clutch Accumulator Piston
421	3rd Clutch Accumulator Piston Seal - 21.2 x 2.4 mm
422	Regulator Valve Body
423	TCC Lock-Up Control Valve
424	TCC Lock-Up Control Valve Return Spring - 42.9 mm (1.689 in)
425	TCC Lock-Up Control Valve Spacer
426	Valve Body Bore Plug - 15 mm
427	Body Valve Bore Plug Retainer Clip
428	Reverse Shift Fork Shaft
429	Reverse Shift Fork Shaft Seal - 31 x 2.7 mm
430	Regulator Valve Body Assembly
431	Stator Shaft and Torque Arm Assembly

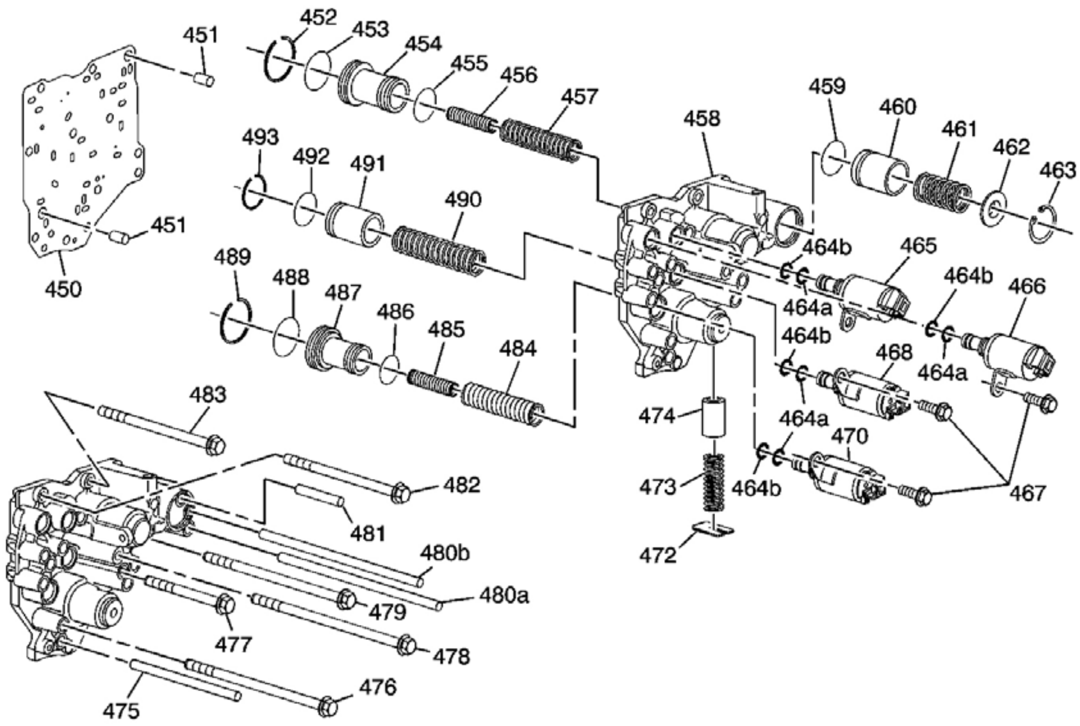
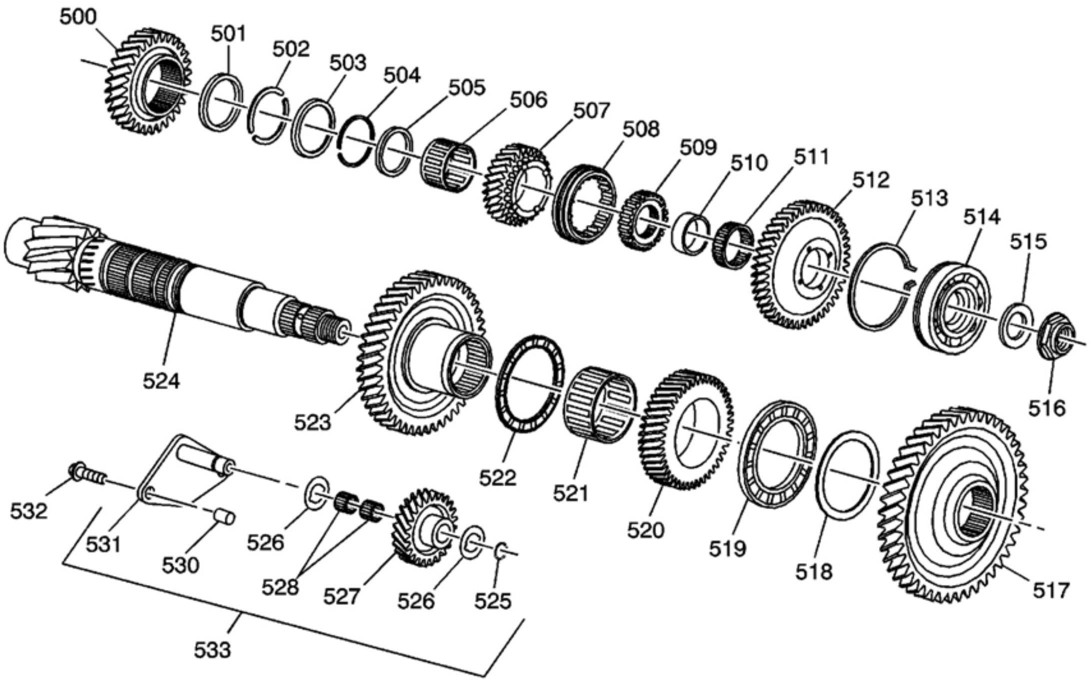


Fig. 12: Accumulator Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 12

Callout	Component Name
450	Accumulator Valve Body Spacer Plate
451	Spacer Plate Locating Pin - 8 x 14 mm
451	Spacer Plate Locating Pin - 8 x 14 mm
452	5th Clutch Accumulator Piston Retainer Ring - 36 mm
453	5th Clutch Accumulator Piston Outer Seal - 29 x 2.4 mm
454	5th Clutch Accumulator Piston
455	5th Clutch Accumulator Piston Inner Seal - 21.2 x 2.4 mm
456	5th Clutch Accumulator Piston Inner Spring - 45.5 mm (1.791 in)
457	5th Clutch Accumulator Piston Outer Spring - 75.7 mm (2.980 in)
458	Accumulator Valve Body
459	4th Clutch Accumulator Piston Seal - 21.2 x 2.4 mm
460	4th Clutch Accumulator Piston
461	4th Clutch Accumulator Piston Spring - 45.3 mm (1.783 in)
462	4th Clutch Accumulator Spring Cover
463	4th Clutch Accumulator Spring Cover Retainer Ring - 28 mm
464a	Shift Solenoid Valve O-Ring Seal - 9.6 x 1.9 mm

464a	Shift Solenoid Valve O-Ring Seal - 9.6 x 1.9 mm
464a	Shift Solenoid Valve O-Ring Seal - 9.6 x 1.9 mm
464b	Shift Solenoid Valve O-Ring Seal - 7.6 x 1.9 mm
464b	Shift Solenoid Valve O-Ring Seal - 7.6 x 1.9 mm
464b	Shift Solenoid Valve O-Ring Seal - 7.6 x 1.9 mm
465	C Shift Solenoid Valve
466	A Shift Solenoid Valve
467	Shift Solenoid Valve Bolt - M6 x 16 mm
468	TCC Solenoid Valve
470	B Shift Solenoid Valve
472	Coast Clutch Accumulator Valve Retainer
473	Coast Clutch Accumulator Valve Spring - 42.9 mm (1.689 in)
474	Coast Clutch Accumulator Valve
475	Mainshaft Lube Fluid Pipe - 8 x 85 mm
476	Accumulator Valve Body Bolt - M6 x 110 mm
477	Accumulator Valve Body Bolt - M6 x 60 mm
478	Accumulator Valve Body Bolt - M6 x 140 mm
479	Accumulator Valve Body Bolt - M6 x 125 mm
480a	1st Clutch Control Fluid Pipe - 8 x 151.5 mm
480b	Coast Clutch Control Fluid Pipe - 8 x 151.5 mm
481	4th Clutch Control Fluid Pipe - 8 x 40 mm
482	Accumulator Valve Body Bolt - M6 x 95 mm
483	Accumulator Valve Body Bolt - M6 x 85 mm
484	1st Clutch Accumulator Piston Outer Spring
485	1st Clutch Accumulator Piston Inner Spring
486	1st Clutch Accumulator Piston Inner Seal - 18.3 x 2.4 mm
487	1st Clutch Accumulator Piston
488	1st Clutch Accumulator Piston Outer Seal - 29 x 2.4 mm
489	1st Clutch Accumulator Piston Retainer Ring - 36 mm
490	2nd Clutch Accumulator Piston Spring - 53.4 mm (2.102 in)
491	2nd Clutch Accumulator Piston
492	2nd Clutch Accumulator Piston Seal - 21.2 x 2.4 mm
493	2nd Clutch Accumulator Piston Retainer Ring - 26 mm



<u>Fig. 13: Output Shaft Components View</u>
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 13

Callout	Component Name
500	3rd/4th Driven Gear
501	3rd/4th Driven Gear Selective Spacer - 52 mm
502	3rd/4th Driven Gear Retainer Ring - 39 mm
503	3rd/4th Driven Gear Retainer Ring Cap
504	3rd/4th Driven Gear Retainer Ring Cap Retainer Ring
505	5th Driven Gear Spacer - 35 mm x 47 mm x 6 mm
506	5th Driven Gear Inner Bearing - 35 mm x 21 mm x 46 mm
507	5th Driven Gear
508	5th/Reverse Synchronizer Ring
509	5th/Reverse Synchronizer Hub
510	Reverse Driven Gear Inner Bearing Race - 31 mm x 40 mm x 14.5 mm
511	Reverse Drive Gear Inner Bearing - 40 mm x 46 mm x 14.5 mm
512	Reverse Driven Gear
513	Output Shaft Retainer Ring - 93 mm
514	Output Shaft Rear Bearing - 31 mm x 93 mm x 19 mm
515	Output Shaft Washer - 24 mm
516	Output Shaft Retainer Nut - 24 mm

517	1st Driven Gear
518	1st Driven Gear Selective Spacer - 56 mm
519	1st/2nd Idler Gear End Bearing - 56 mm x 87.5 mm x 5.5 mm
520	1st/2nd Idler Gear
521	1st/2nd Idler Gear Inner Bearing - 57 mm x 65 mm x 28.7 mm
522	1st/2nd Idler Gear End Bearing - 65 mm x 83 mm x 4.5 mm
523	2nd Driven Gear
524	Output Shaft
525	Reverse Idler Gear Retainer Ring - 14 mm
526	Reverse Idler Gear Washer - 14 mm x 30 mm x 1 mm
526	Reverse Idler Gear Washer - 14 mm x 30 mm x 1 mm
527	Reverse Idler Gear
528	Reverse Idler Gear Inner Bearing - 14 mm x 18 mm x 15 mm
530	Reverse Idler Gear Retaining Plate Sleeve - 10 mm x 16 mm
531	Reverse Idler Gear Retainer Plate
532	Reverse Idler Gear Retainer Plate Bolt - M8 x 1.0 x 35 mm
533	Reverse Idler Gear Assembly

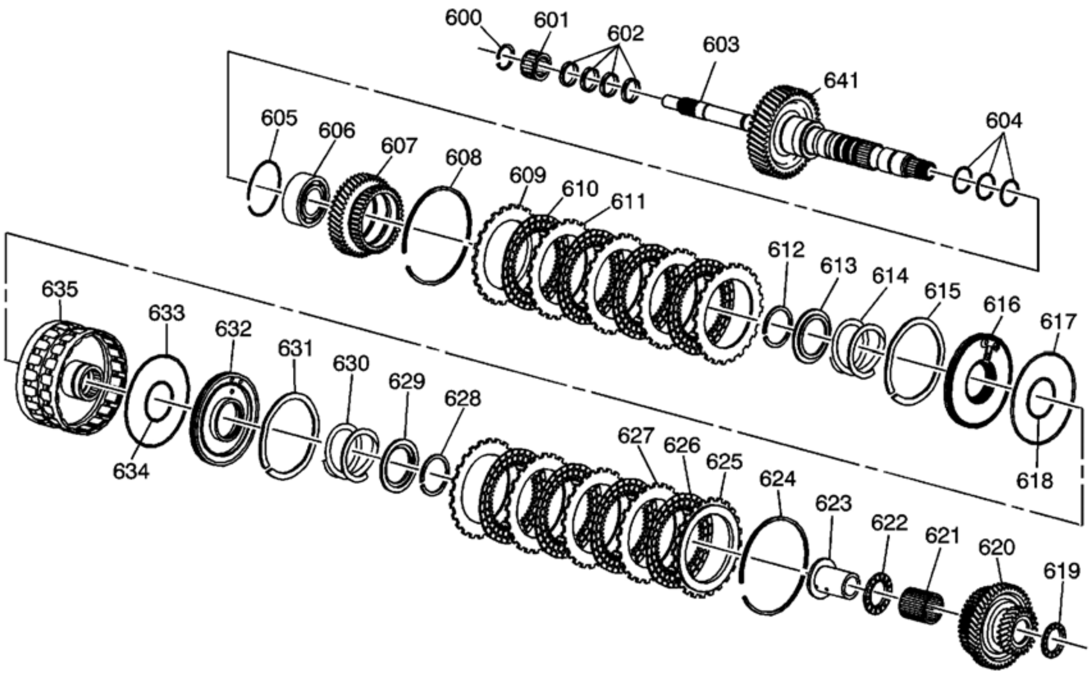


Fig. 14: Mainshaft Components View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 14

Callout	Component Name

600	Mainshaft Front Bearing Retainer Ring - 23 mm
601	Mainshaft Front Bearing - 23 mm x 31 mm x 21.8 mm
602	Mainshaft Fluid Passage Seal - 31 mm
603	Mainshaft
604	4th /5th Reverse Clutch Housing Fluid passage O-ring Seal - 33 mm x 1.9 mm
605	4th Drive Gear and Hub Bearing Retainer Ring - 81 mm
606	4th Drive Gear and Clutch Hub Bearing - 38 mm x 78 mm x 37/27 mm
607	4th Drive with Clutch Hub Gear
608	4th Clutch Backing Plate Retainer Ring - 137 mm
609	4th Clutch Selective Backing Plate
610	4th Clutch Fiber Plate Assembly
611	4th Clutch Steel Plate
612	4th Clutch Piston Retainer Ring - 44 mm
613	4th Clutch Piston Retainer Cap
614	4th Clutch Piston Return Spring
615	4th Clutch Waved Plate
616	4th Clutch Piston
617	4th Clutch Piston Outer Seal - 119.1 mm x 2.3 mm
618	4th Clutch Piston Inner Seal - 44.1 mm x 2.2 mm
619	5th/Reverse Drive Gear and Clutch Hub End Bearing - 40 mm x 53 mm x 2.5 mm
620	5th/Reverse Drive Gear with Clutch Hub Gear
621	5th/Reverse Drive Gear and Clutch Hub Inner Bearing - 40 mm x 46 mm x 34 mm
622	5th/Reverse Drive Gear and Clutch Hub End Bearing - 40 mm x 59 mm x 3 mm
623	5th/Reverse Drive Gear and Clutch Hub Bearing Race - 33 mm x 40 mm x 48.7 mm
624	5th/Reverse Clutch Backing Plate Retainer Ring - 137 mm
625	5th/Reverse Clutch Selective Backing Plate
626	5th/Reverse Clutch Fiber Plate Assembly
627	5th/Reverse Clutch Steel Plate
628	5th/Reverse Clutch Piston Retainer Ring - 44 mm
629	5th/Reverse Clutch Piston Retainer Cap
630	5th/Reverse Clutch Piston Return Spring
631	5th/Reverse Clutch Waved Plate
632	5th/Reverse Clutch Piston Assembly
633	5th/Reverse Clutch Piston Outer Seal - 119.1 mm x 2.3 mm
634	5th/Reverse Clutch Piston Inner Seal - 44.1 mm x 2.2 mm
635	4th/5th/Reverse Clutch Housing Assembly
641	1st, 2nd, and 3rd Drive Gear

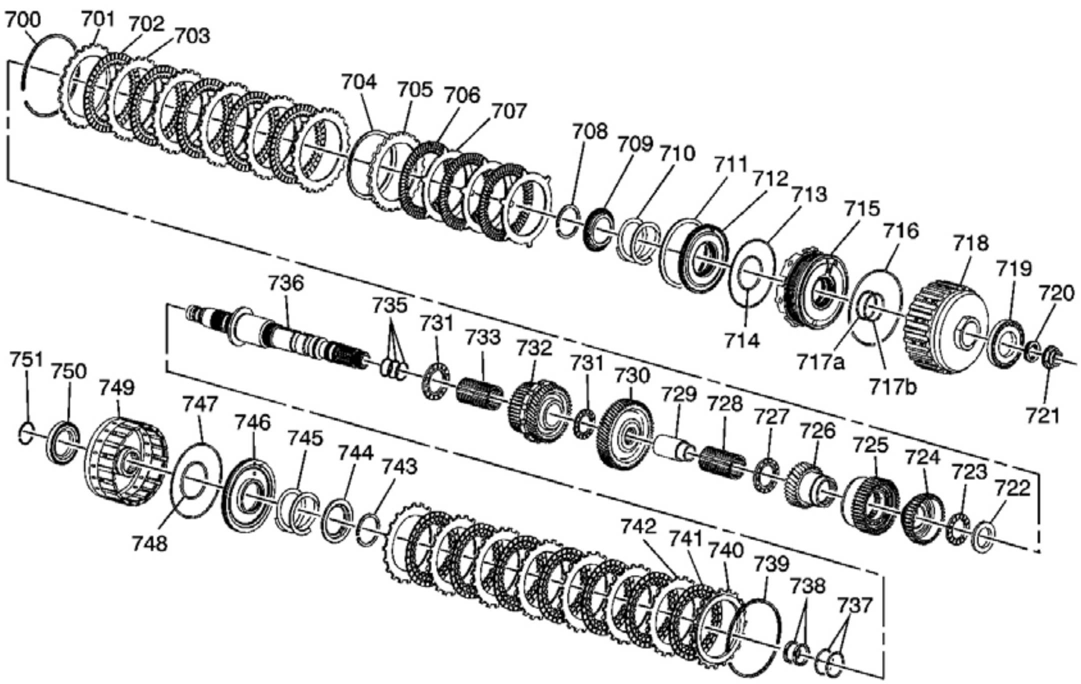


Fig. 15: 1st And 2nd Clutch Shaft Components View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 15

Callout	Component Name
700	1st Clutch Backing Plate Retainer Ring - 141 mm
701	1st Clutch Selective Backing Plate
702	1st Clutch Fiber Plate Assembly
703	1st Clutch Steel Plate
704	1st Clutch Spring Plate
705	Coast Clutch Backing Plate
706	Coast Clutch Fiber Plate Assembly
707	Coast Clutch Steel Plate
708	1st and Coast Clutch Piston Retainer Ring - 44 mm
709	1st and Coast Clutch Piston Retainer Cap
710	1st and Coast Clutch Piston Return Spring
711	Coast Clutch Spring Plate
712	Coast Clutch Piston Assembly
713	Coast Clutch Piston Outer Seal - 110 x 2.2 mm
714	Coast Clutch Piston Inner Seal - 52.1 x 2.2 mm
715	1st Clutch Piston
716	1st Clutch Piston Outer Seal - 119 x 2.3 mm

717a	1st Clutch Piston Inner Seal - 44.1 x 2.2 mm
717b	1st Clutch Piston Inner Seal - 45.1 x 2.2 mm
718	1st/Coast Clutch Housing Assembly
719	1st/2nd Clutch Shaft Rear Bearing - 29 x 65 x 9 mm
720	1st/2nd Clutch Shaft Retainer Nut Washer - 29 x 40 x 3.9 mm
721	1st/2nd Clutch Shaft Retainer Nut - 26 mm
722	1st/Coast Clutch Hub Bearing Selective Race - 52 mm
723	1st/Coast Clutch Hub End Bearing - 40 x 57 x 2.5 mm
724	Coast Clutch Hub
725	Coast Sprag with 1st Clutch Hub Sprag Assembly
726	1st Drive Gear
727	1st Drive Gear End Bearing - 43.5 x 61.5 x 2.5 mm
728	1st Drive Gear Inner Bearing - 39 x 44 x 47 mm
729	1st Drive Gear Inner Bearing Race - 32 x 39 x 63.3 mm
730	1st/2nd Clutch Shaft Drive Gear
731	2nd Drive Gear End Bearing - 44 x 66 x 3.5 mm
731	2nd Drive Gear End Bearing - 44 x 66 x 3.5 mm
732	2nd Drive Gear with Clutch Hub and Park Gear Assembly
733	2nd Drive Gear Inner Bearing - 44 x 50 x 42 mm
735	1st/Coast Clutch Housing Fluid Passage Seal - 26.7 x 1.9 mm
736	1st/2nd Clutch Shaft
737	2nd Clutch Housing Fluid Passage Seal - 31.2 x 1.9 mm
738	1st/2nd Clutch Shaft Fluid Passage Seal - 29 mm, Square Cut
739	2nd Clutch Backing Plate Retainer Ring - 129 mm
740	2nd Clutch Selective Backing Plate
741	2nd Clutch Fiber Plate Assembly
742	2nd Clutch Steel Plate
743	2nd Clutch Piston Retainer Ring - 42 mm
744	2nd Clutch Piston Retainer Cap
745	2nd Clutch Piston Return Spring
746	2nd Clutch Piston
747	2nd Clutch Piston Outer Seal - 114 x 2.2 mm
748	2nd Clutch Piston Inner Seal - 42.8 x 2.2 mm
749	2nd Clutch Housing Assembly
750	2nd Clutch Housing Thrust Bearing - 46 x 62.95 x 4.62 mm
751	2nd Clutch Housing Retainer Ring - 32 mm

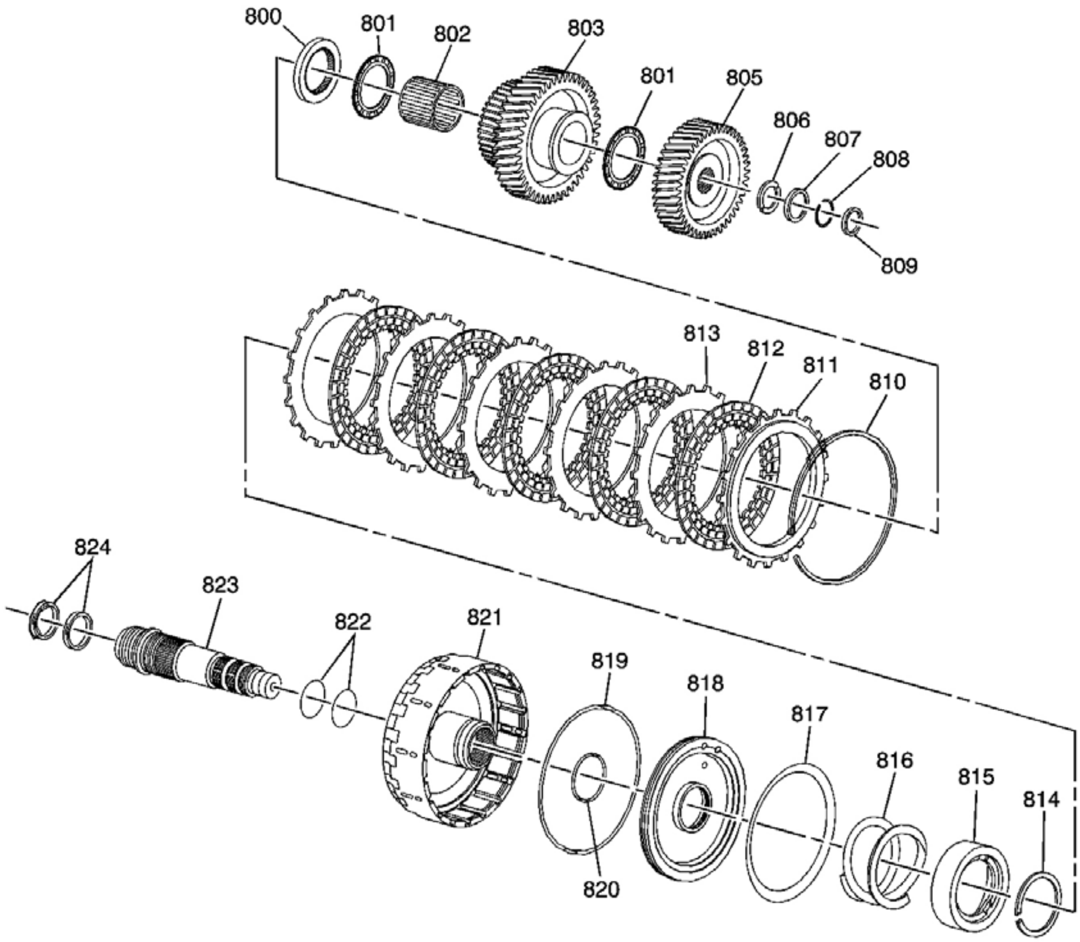


Fig. 16: 3rd Clutch Shaft Component View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 16

Callout	Component Name
800	3rd Drive Gear and Clutch Hub End Bearing Selective Race - 53 mm
801	3rd Drive Gear and Clutch Hub End Bearing - 30 x 52 x 3 mm
801	3rd Drive Gear and Clutch Hub End Bearing - 30 x 52 x 3 mm
802	3rd Drive Gear and Clutch Hub Inner Bearing - 30 x 36 x 32 mm
803	3rd Drive with Clutch Hub Gear
805	3rd Driven Gear
806	3rd Driven Gear Retainer Ring - 19.8 mm
807	3rd Driven Gear Retainer Ring Cap
808	3rd Driven Gear Retainer Ring Cap Retainer Ring - 24 mm
809	3rd Clutch Shaft Selective Washer - 26.5 mm
810	3rd Clutch Backing Plate Retainer Ring - 137 mm

811	3rd Clutch Selective Backing Plate
812	3rd Clutch Fiber Plate Assembly
813	3rd Clutch Steel Plate
814	3rd Clutch Piston Retainer Ring - 42 mm
815	3rd Clutch Piston Return Spring Cup
816	3rd Clutch Piston Return Spring
817	3rd Clutch Spring Plate
818	3rd Clutch Piston
819	3rd Clutch Piston Outer Seal - 116.7 x 2.2 mm
820	3rd Clutch Piston Inner Seal - 41.8 x 2.2 mm
821	3rd Clutch Housing Assembly
822	3rd Clutch Housing Fluid Passage Seal - 26.7 x 1.9 mm
823	3rd Clutch Shaft
824	3rd Clutch Shaft Fluid Passage Seal - 35 mm, Square Cut

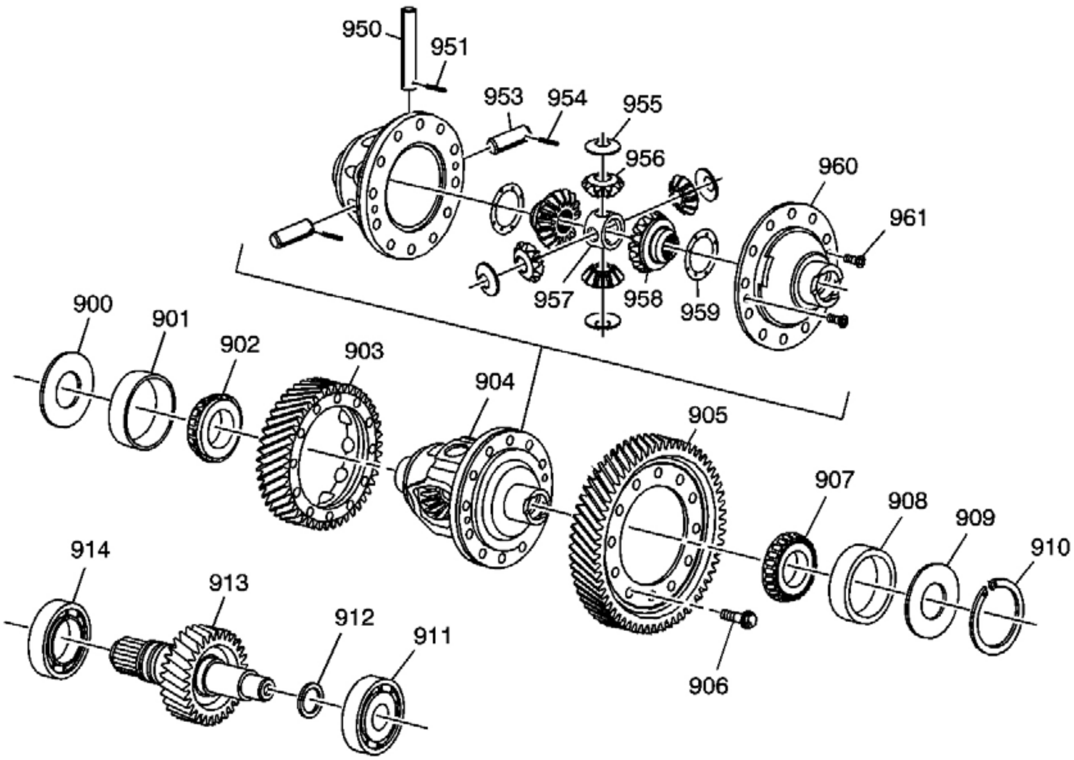


Fig. 17: Front Differential Assembly
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 17

Callout	Component Name

900	Front Differential Bearing Spacer - 46 x 80 x 1 mm
901	Front Differential Bearing Race
902	Front Differential Bearing - 40 x 80 x 21.25 mm
903	Input Drive Gear - AWD Only
904	Front Differential Assembly
905	Front Differential Final Ring Gear
906	Front Differential Carrier Bolt Left Hand Thread
907	Front Differential Bearing - 45 x 85 x 19.7 mm
908	Front Differential Bearing Race
909	Front Differential Bearing Spacer - 46 x 85 x 1 mm
910	Front Differential Bearing Selective Shim - 85 mm diameter
911	Transfer Case Input Gear with Input Shaft Bearing - 22 x 76 x 19 mm
912	Transfer Case Input Gear with Input Shaft Selective Shim - 28.5 mm diameter
913	Transfer Case Input Gear with Input Shaft Gear
914	Transfer Case Input Gear with Input Shaft Bearing - 40 x 80 x 16.5 mm
950	Front Differential Pinion Shaft
951	Front Differential Pinion Shaft Retaining Pin
953	Front Differential Side Pinion Shaft (2)
954	Front Differential Side Pinion Shaft Retainer Pin (2)
955	Front Differential Side Pinion Shaft Washer (4)
956	Front Differential Pinion Gear (4)
957	Front Differential Side Pinion Shaft Holder
958	Front Differential Side Gear (2)
959	Front Differential Side Gear Washer (2)
960	Front Differential Carrier Cover
961	Front Differential Carrier Cover Bolt (2), Phillips Head

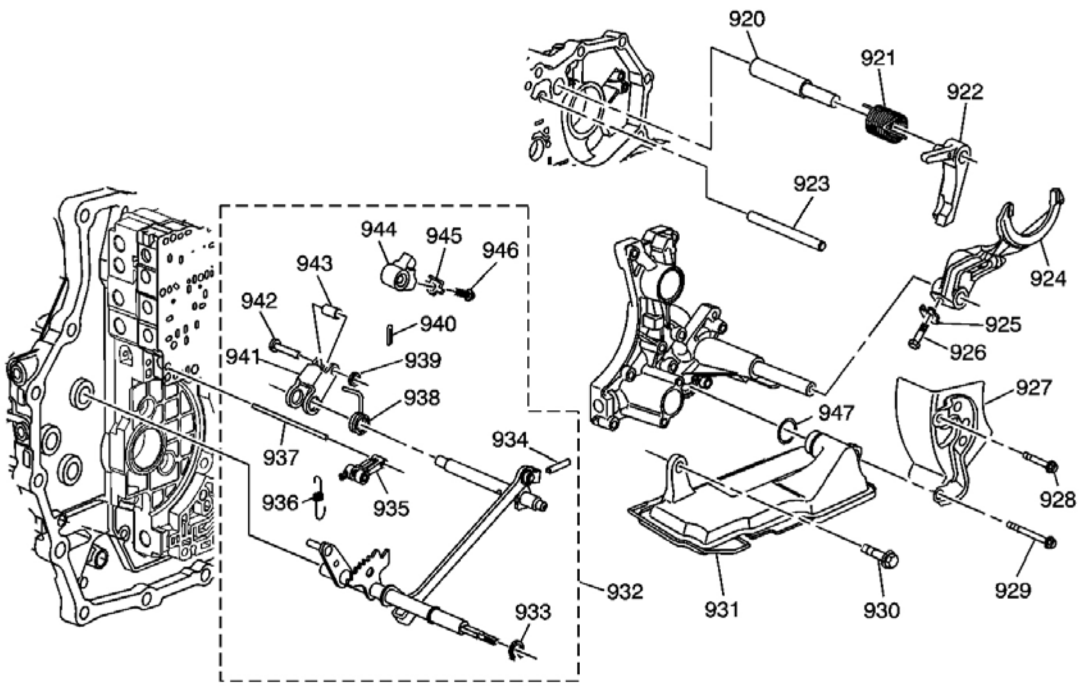


Fig. 18: Shift Components View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 18

Callout	Component Name
920	Park Pawl Shaft
921	Park Pawl Actuator Spring
922	Park Pawl
923	Park Pawl Stop Lever Pin - 8 x 73 mm
924	Reverse Shift Fork
925	Reverse Shift Fork Washer
926	Reverse Shift Fork Retainer Bolt - M6 x 30 mm
927	Automatic Transmission Fluid Baffle
928	Transmission Fluid Baffle Bolt - M6 x 80 mm
929	Transmission Fluid Baffle Bolt - M6 x 95 mm
930	Automatic Transmission Fluid Filter Bolt
931	Automatic Transmission Fluid Filter
932	Manual Shift Shaft Assembly
933	Manual Shaft Retainer Ring - 12 mm
934	Park Pawl Actuator Shaft Hole Pin - 4 x 18 mm
935	Manual Shift Shaft Detent Roller Assembly
936	Manual Shift Shaft Detent Roller Spring

937	Manual Shift Shaft Detent Roller Pin
938	Park Pawl Actuator Spring
939	Park Pawl Actuator Roller Pin Washer - 6 mm
940	Park Pawl Actuator Roller Pin Retainer Pin - 1.6 x 12 mm
941	Park Pawl Actuator
942	Park Pawl Actuator Roller Pin - 6 mm
943	Park Pawl Actuator Roller
944	Parking Pawl Stop Lever
945	Park Pawl Stop Lever Washer - 6 mm
946	Park Pawl Stop Lever Bolt - M6 x 25 mm
947	Automatic Transmission Fluid Filter O-ring Seal - 21.8 x 1.9 mm

COMPONENT LOCATION

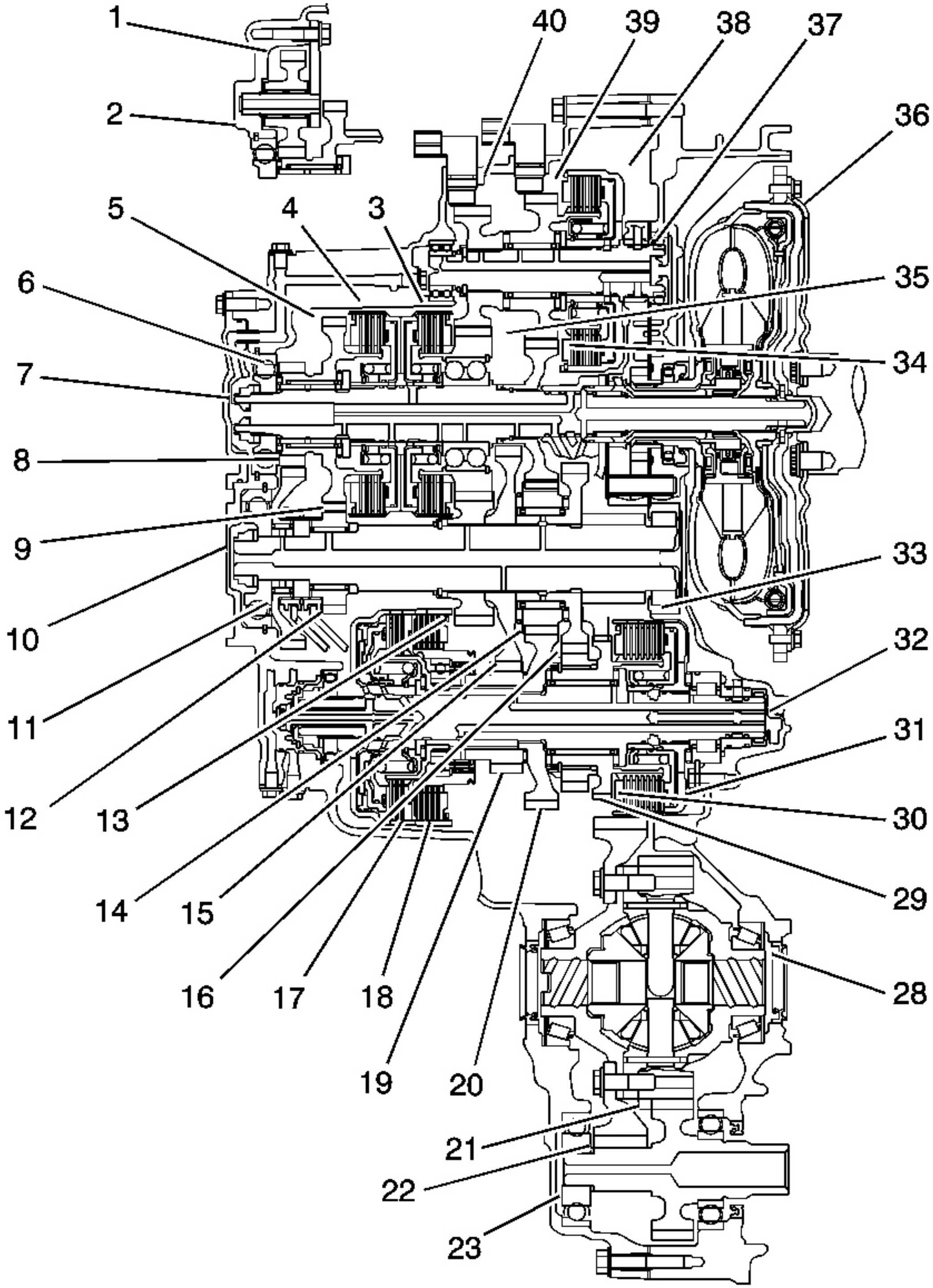


Fig. 19: Major Components View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 19

Callout	Component Name
1	Reverse Idler Gear
2	Reverse Idler Gear Shaft
3	4th Clutch Assembly
4	5th Clutch Assembly
5	Mainshaft 5th Gear
6	Mainshaft Reverse Gear
7	Mainshaft Assembly
8	Output Shaft Reverse Gear
9	Reverse Selector Hub
10	Output Shaft Assembly
11	Reverse Shift Fork
12	Output Shaft 5th Gear
13	Output Shaft 4th Gear
14	Output Shaft Idler Gear
15	Output Shaft 1st Gear
16	Output Shaft 2nd Gear
17	Coast Clutch Assembly
18	1st Clutch Assembly
19	1st - 2nd Clutch Shaft 1st Gear
20	1st - 2nd Clutch Shaft Drive Gear
21	Transfer Drive Gear
22	Final Driven Gear
23	Transfer Output Shaft
28	Front Differential Assembly
29	1st - 2nd Clutch Shaft 2nd Gear
30	Park Gear
31	2nd Clutch Assembly
32	1st - 2nd Clutch Shaft Assembly
33	Final Drive Gear
34	Mainshaft 3rd Gear
35	Mainshaft 4th Gear
36	Torque Converter Assembly
37	3rd Clutch Shaft
38	3rd Clutch Assembly
39	3rd Clutch Shaft 3rd Gear
40	3rd Clutch Shaft 4th Gear

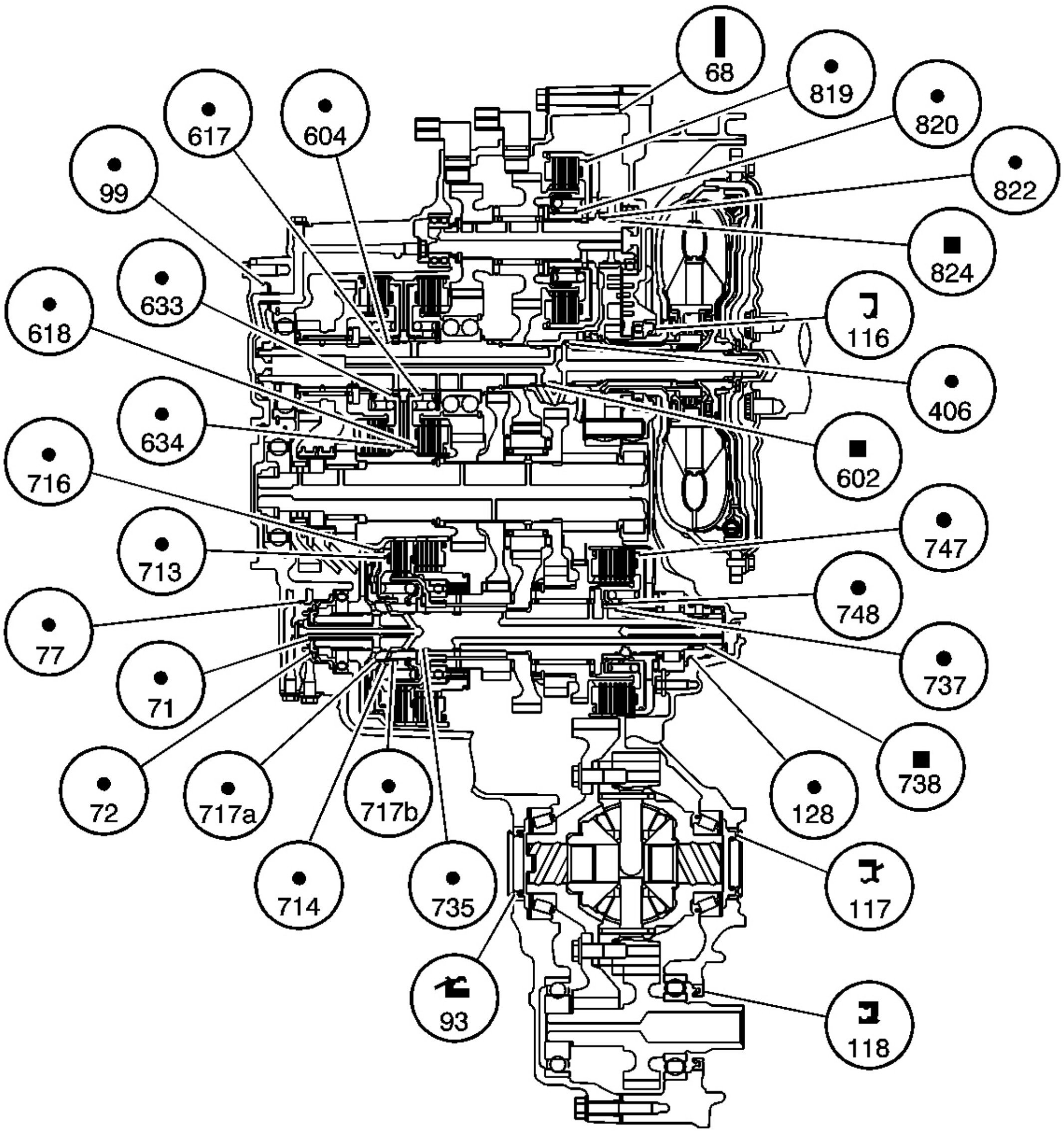


Fig. 20: Seal Locations View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 20

Callout	Component Name
68	Torque Converter Housing Gasket
71	Coast Clutch Apply Fluid Pipe Guide Plate Inner O-ring Seal - 11 x 1.9 mm
72	Coast Clutch Apply Fluid Pipe Guide Plate Outer O-ring Seal - 34 x 1.9 mm
77	1st Coast Clutch Apply Fluid Collar O-ring Seal - 43.5 x 2.2 mm
93	Front Wheel Drive Shaft Fluid Seal - 40 x 56 x 9 mm

99	Mainshaft Rear Cover O-ring Seal - 104 x 2.2 mm
116	Torque Converter Seal - 46 x 70 x 8 mm
117	Front Wheel Drive Shaft Oil Seal - 35 x 54 x 8 mm
118	Transfer Case Input Shaft Seal - 48 x 65 x 7.5 mm
128	1st/2nd Lube Feed Collar O-ring Seal - 36.5 x 2.0 mm
406	Stator Shaft O-ring Seal - 32.5 x 1.8 mm
602	Mainshaft Fluid Passage Seal - 31 mm, Square Cut
604	4th/5th/Reverse Clutch Housing Fluid Passage O-ring Seal - 33 x 1.9 mm
617	4th Clutch Piston Outer O-ring Seal - 119.1 x 2.3 mm
618	4th Clutch Piston Inner O-ring Seal - 44.1 x 2.2 mm
633	5th/Reverse Clutch Piston Outer O-ring Seal - 119.1 x 2.3 mm
634	5th/Reverse Clutch Piston Inner O-ring Seal - 44.1 x 2.2 mm
713	Coast Clutch Piston Outer O-ring Seal - 110 x 2.2 mm
714	Coast Clutch Piston Inner O-ring Seal - 52.1 x 2.2 mm
716	1st Clutch Piston Outer O-ring Seal - 119 x 2.3 mm
717a	1st Clutch Piston Front Inner O-ring Seal - 44.1 x 2.2 mm
717b	1st Clutch Piston Rear Inner O-ring Seal - 45.1 x 2.2 mm
735	1st/Coast Clutch Housing Fluid Passage O-ring Seal - 26.7 x 1.9 mm
737	2nd Clutch Housing Fluid Passage O-ring Seal - 31.2 x 1.9 mm
738	1st/2nd Clutch Shaft Fluid Passage O-ring Seal - 29 mm, Square Cut
747	2nd Clutch Piston Outer O-ring Seal - 114 x 2.2 mm
748	2nd Clutch Piston Inner O-ring Seal - 42.8 x 2.2 mm
819	3rd Clutch Piston Outer O-ring Seal - 116.7 x 2.2 mm
820	3rd Clutch Piston Inner O-ring Seal - 41.8 x 2.2 mm
822	3rd Clutch Housing Fluid Passage O-ring Seal - 26.7 x 1.9 mm
824	3rd Clutch Shaft Fluid Passage O-ring Seal - 35 mm, Square Cut

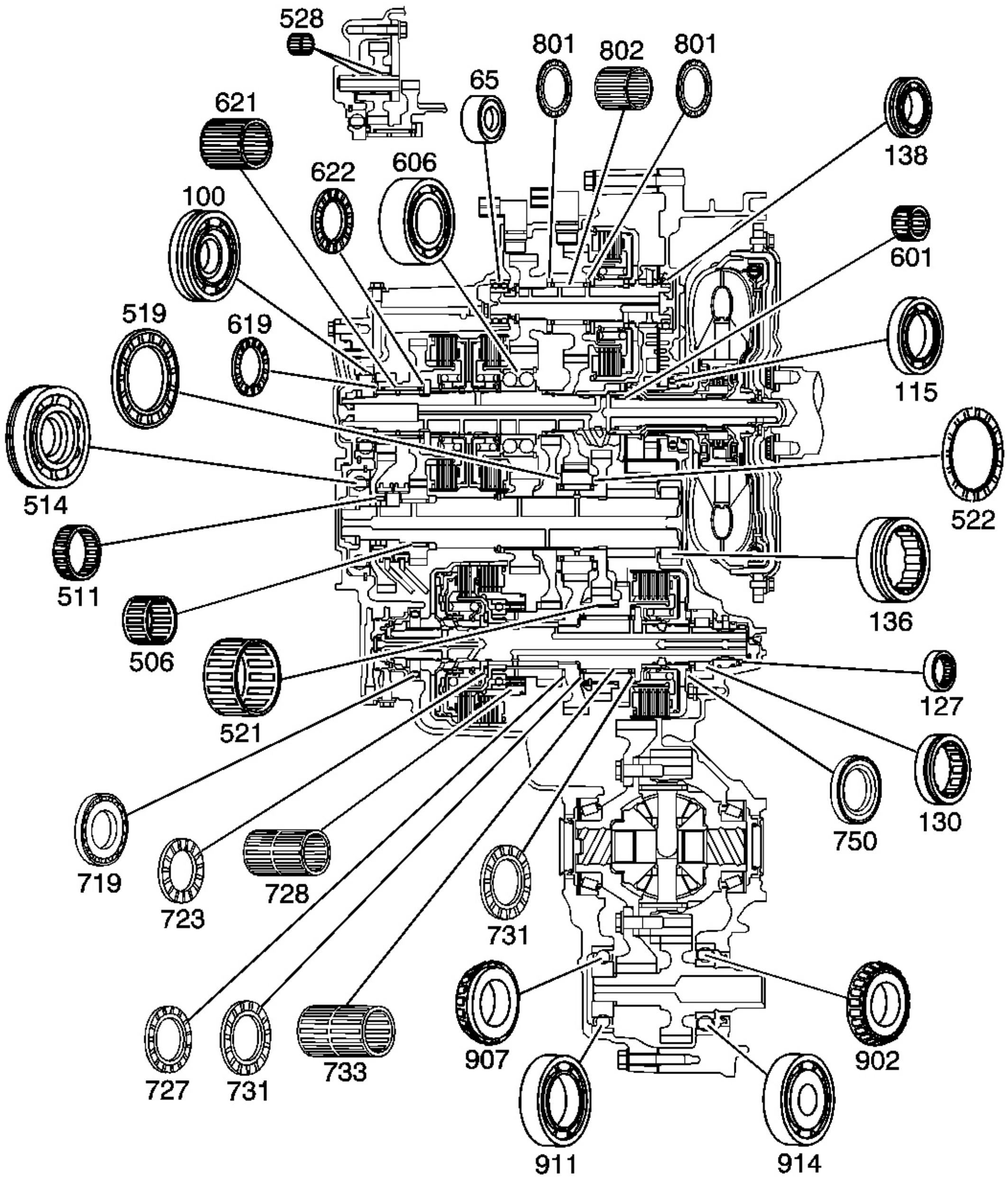


Fig. 21: Bearing Locations View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 21

Callout	Component Name
65	3rd Clutch Shaft Rear Bearing - 20 x 41 x 17/16 mm
100	Mainshaft Rear Bearing - 29 x 82 x 17 x 15.5 mm
115	Torque Converter Bearing - 42 x 68 x 7.5 mm

127	1st/2nd Clutch Shaft Front Bearing - 29 x 39 x 9.5 mm
130	1st/2nd Clutch Shaft Intermediate Bearing - 32 x 63 x 19 mm
136	Output Shaft Front Bearing - 40.5 x 74 x 21 mm
138	3rd Clutch Shaft Front Bearing - 28 x 52 x 12.8 mm
506	5th Driven Gear Inner Bearing - 35 x 21 x 46 mm
511	Reverse Driven Gear Inner Bearing - 40 x 46 x 14.5 mm
514	Output Shaft Rear Bearing - 31 x 93 x 19 mm
519	1st/2nd Idler Gear Thrust Bearing - 56 x 87.5 x 5.5 mm
521	1st/2nd Idler Gear Inner Bearing - 47 x 65 x 28.7 mm
522	2nd Driven Gear Thrust Bearing - 65 x 83 x 4.5 mm
528	Reverse Idler Gear Inner Bearing - 14 x 18 x 15 mm
601	Mainshaft Front Bearing - 23 x 31 x 21.8 mm
606	4th Drive Gear and Clutch Hub Bearing - 38 x 78 x 37/27 mm
619	5th/Reverse Drive Gear and Hub Thrust Bearing - 40 x 53 x 2.5 mm
621	5th/Reverse Drive Gear and Clutch Hub Inner Bearing - 40 x 46 x 34 mm
622	5th/Reverse Drive Gear and Hub Thrust Bearing - 40 x 59 x 3 mm
719	1st/2nd Clutch Shaft Rear Bearing - 29 x 65 x 9 mm
723	1st/Coast Clutch Hub Thrust Bearing - 40 x 57 x 2.5 mm
727	1st Drive Gear Thrust Bearing - 43.5 x 61.5 x 2.5 mm
728	1st Drive Gear Inner Bearing
731	2nd Drive Gear Thrust Bearing - 44 x 66 x 3.5 mm
733	2nd Drive Gear Inner Bearing - 44 x 50 x 42 mm
750	2nd Clutch Housing Thrust Bearing - 46 x 62.95 x 4.62 mm
801	3rd Drive Gear and Clutch Hub Thrust Bearing - 30 x 52 x 3 mm
802	3rd Drive Gear and Clutch Hub Inner Bearing - 30 x 36 x 32 mm
902	Front Differential Front Bearing - 40 x 80 x 21.25 mm
907	Front Differential Rear Bearing - 45 x 85 x 19.7 mm
911	Transfer Case Input Gear Front Bearing - 22 x 76 x 19 mm, AWD Only
914	Transfer Case Input Gear Rear Bearing - 40 x 80 x 16.5 mm, AWD Only

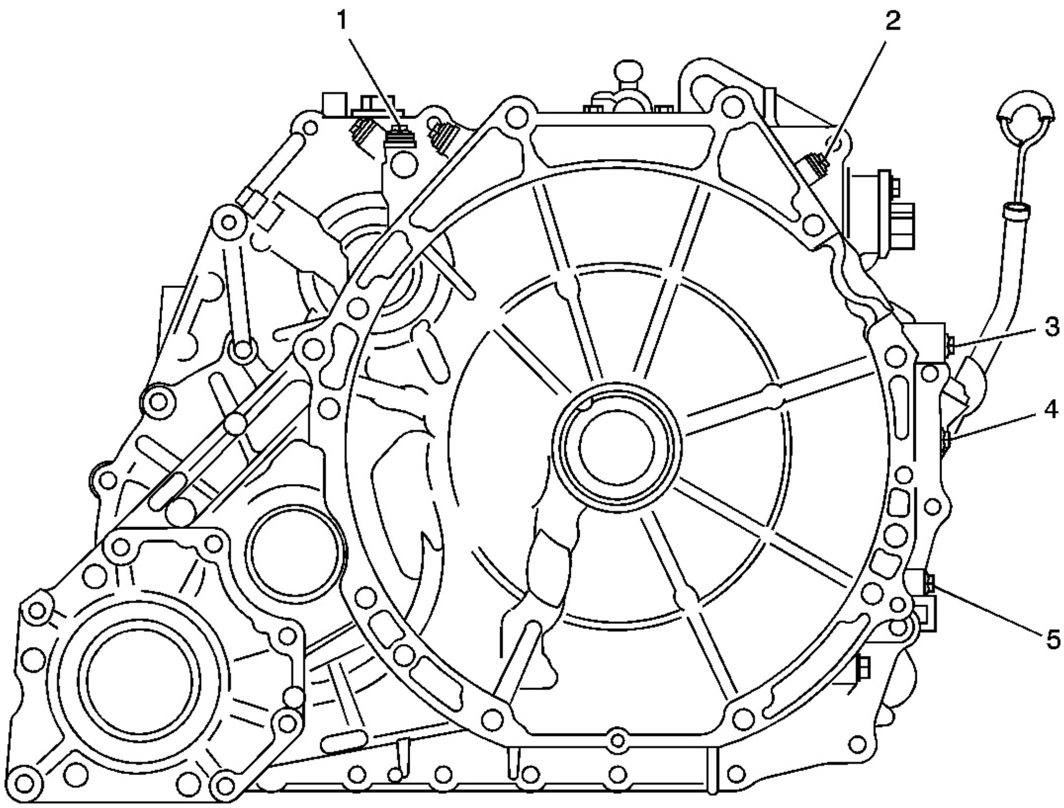


Fig. 22: Pressure Tap Locations - Torque Converter Housing
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 22

Callout	Component Name
1	2nd Clutch
2	1st Clutch Accumulator
3	5th Clutch
4	Line Pressure
5	3rd Clutch

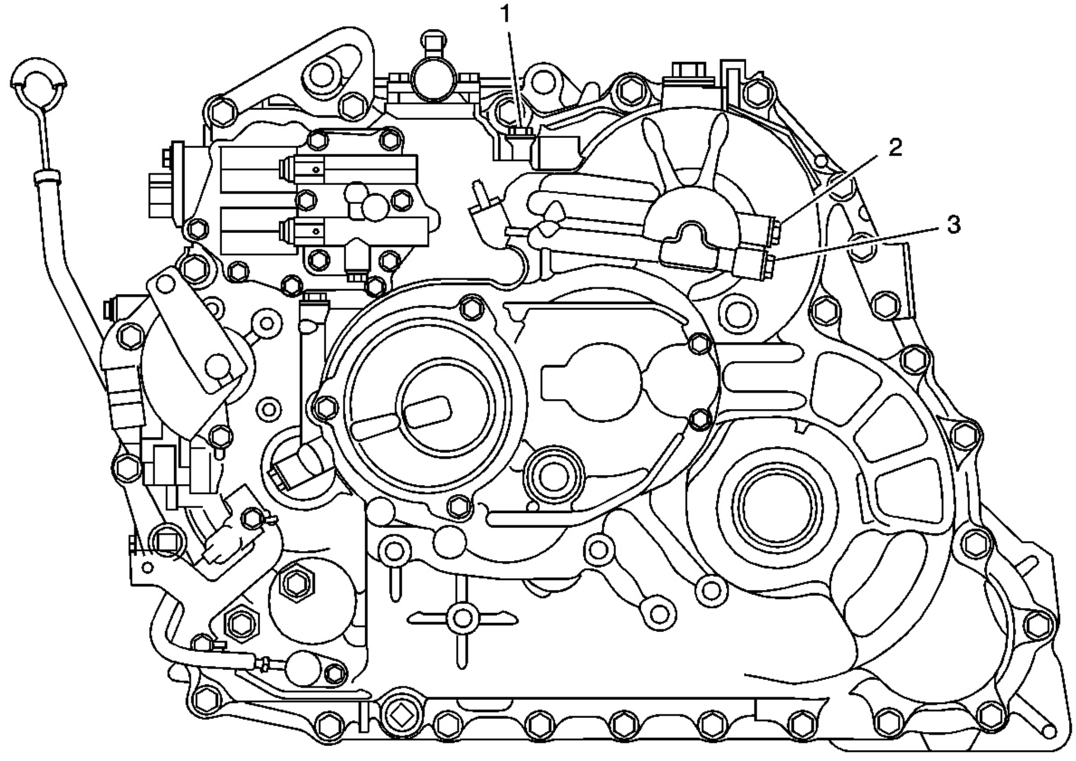


Fig. 23: Pressure Tap Location - Transmission Case
Courtesy of GENERAL MOTORS CORP.

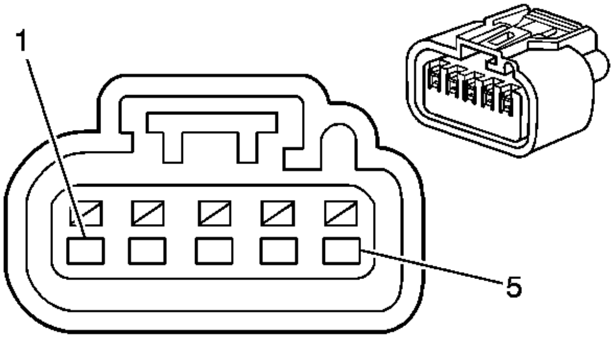
Callouts For Fig. 23

Callout	Component Name
1	4th Clutch
2	1st Clutch
3	Coast Clutch

VISUAL IDENTIFICATION

AUTOMATIC TRANSMISSION INLINE HARNESS CONNECTOR END VIEW

Shift Solenoid Harness Terminal Identification

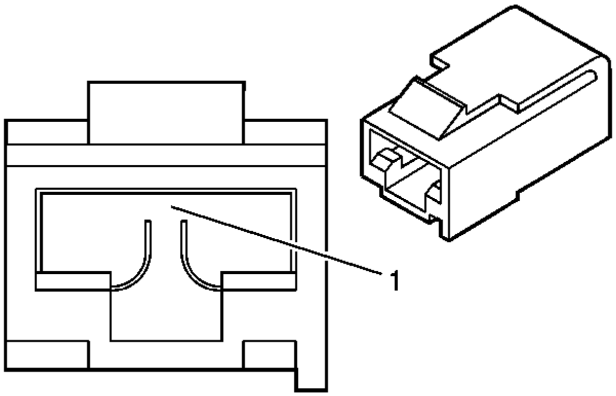


Connector Part Information		• 66105326 • 5-Way F M/P 150 (BK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	-	-	Not Used
2	BU/YE	1222	Shift Solenoid (SS) Valve 1 High Control
3	YE	5501	TCC Enable Solenoid Valve High Control
4	D-GN	898	Shift Solenoid (SS) Valve 3 High Control
5	D-GN/WH	1223	Shift Solenoid (SS) Valve 2 High Control

COMPONENT LOCATOR

AUTOMATIC TRANSMISSION INTERNAL CONNECTOR END VIEWS

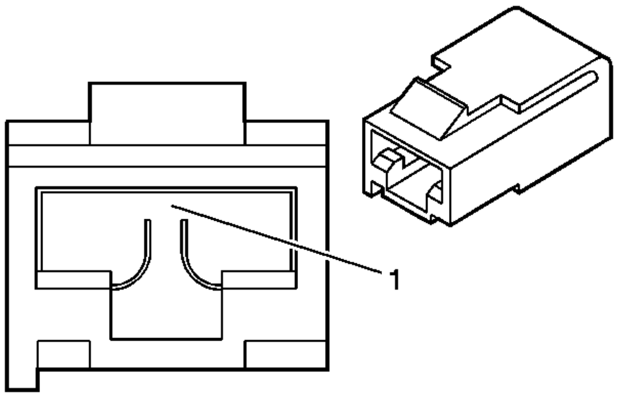
Shift Control A Solenoid Terminal Identification



Connector Part Information		Conn 1-Way F (BN)	

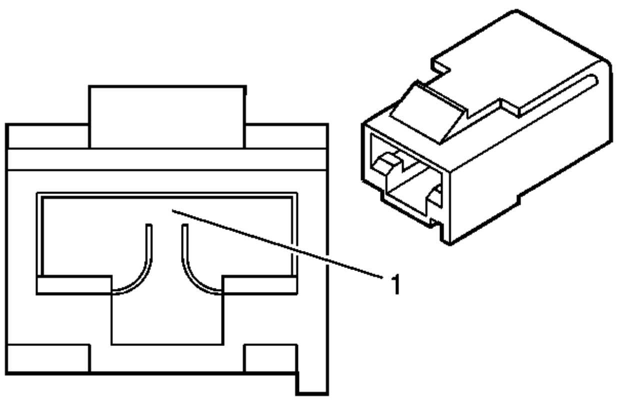
Pin	Wire Color	Circuit No.	Function
1	PK	1222	Shift Solenoid Valve 1 High Control

Shift Control B Solenoid Terminal Identification



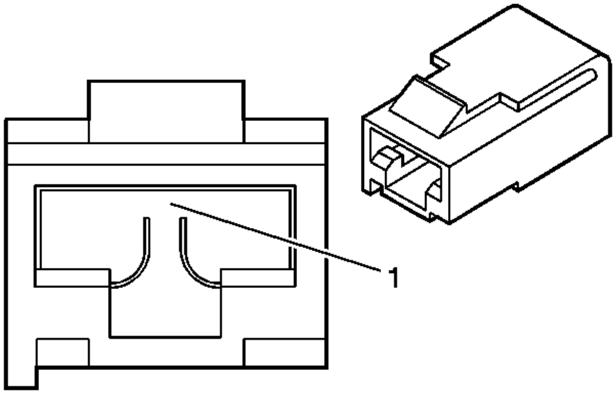
Connector Part Information		Conn 1-Way F (BK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	OG	-	Shift Solenoid Valve 2 High Control

Shift Control C Solenoid Terminal Identification



Connector Part Information		Conn 1-Way F (BN)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	L-GN	-	Shift Solenoid Valve 3 High Control

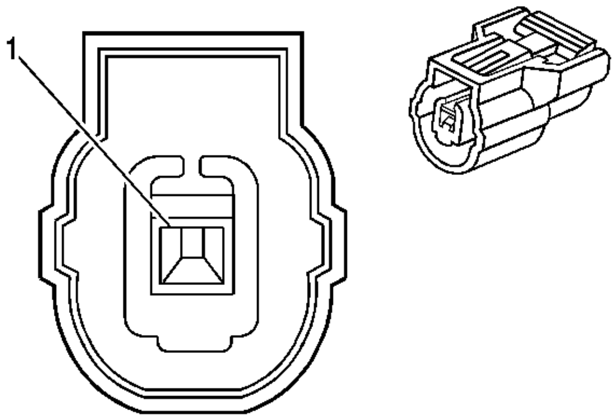
Torque Converter Clutch (TCC) Solenoid Terminal Identification



Connector Part Information	Conn 1-Way F (BK)		
Pin	Wire Color	Circuit No.	Function
1	YE	-	Torque Converter Clutch (TCC) Enable Solenoid Valve

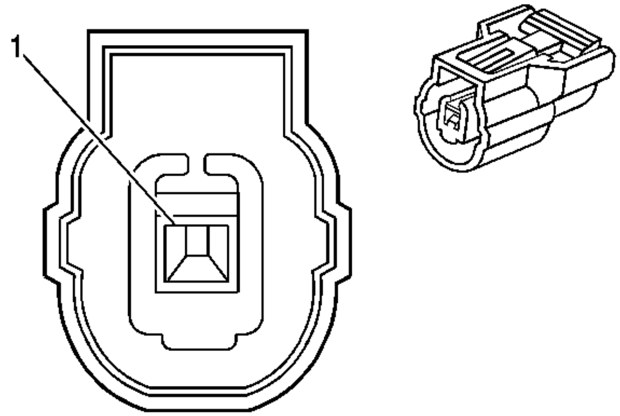
AUTOMATIC TRANSMISSION RELATED CONNECTOR END VIEWS

3rd Clutch Pressure Switch Terminal Identification



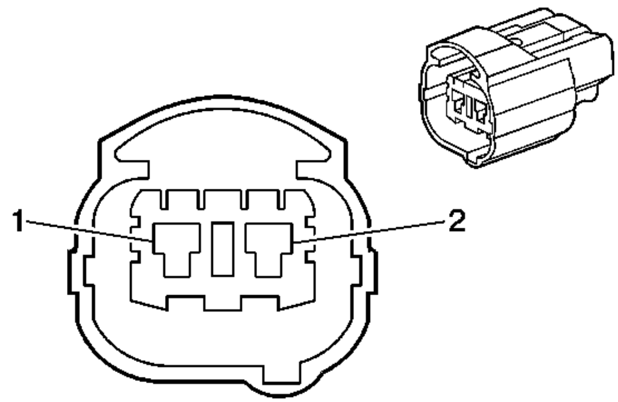
Connector Part Information	• 61890591 • 1-Way F M/P 150 BK		
Pin	Wire Color	Circuit No.	Function
1	BU/WH	6746	3rd Clutch Pressure Switch Signal

4th Clutch Pressure Switch Terminal Identification



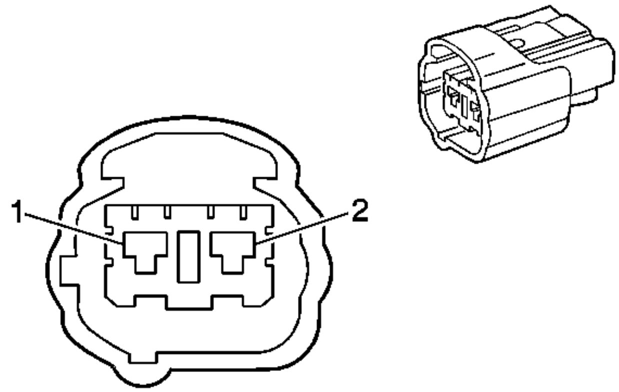
Connector Part Information	• 61891113 • 1-Way F M/P 150 BK		
Pin	**Wire Color**	**Circuit No.**	**Function**
1	BU/YE	6747	4th Clutch Pressure Switch Signal

Clutch Pressure Control Solenoid Valve 1 Harness Terminal Identification



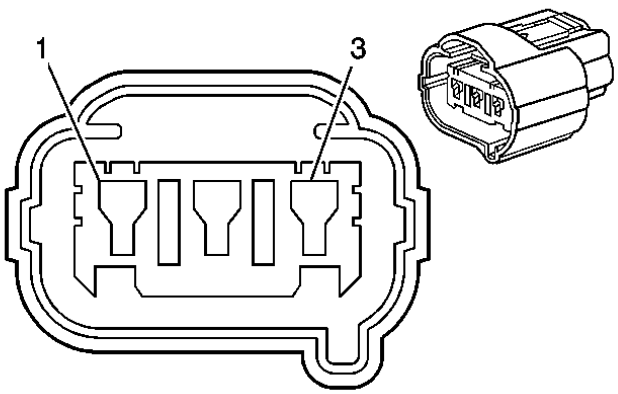
Connector Part Information	• 61890552 • 2-Way F M/P 150 (BK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
1	WH	1991	Clutch Pressure Control Solenoid Valve 1 Low Control
2	RD	1525	Clutch Pressure Control Solenoid Valve 1 High Control

Clutch Pressure Control Solenoid Valve 2 Harness Terminal Identification



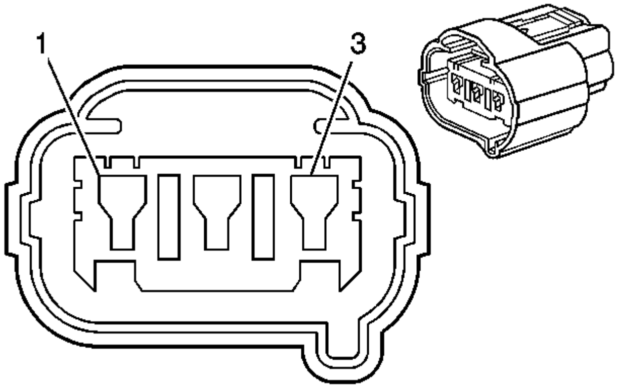
Connector Part Information		• **61890593** • **2-Way F M/P 150 (BK)**	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	D-GN	1992	Clutch Pressure Control Solenoid Valve 2 Low Control
2	BN/WH	1526	Clutch Pressure Control Solenoid Valve 2 High Control

Input Speed Sensor (ISS) Harness Terminal Identification



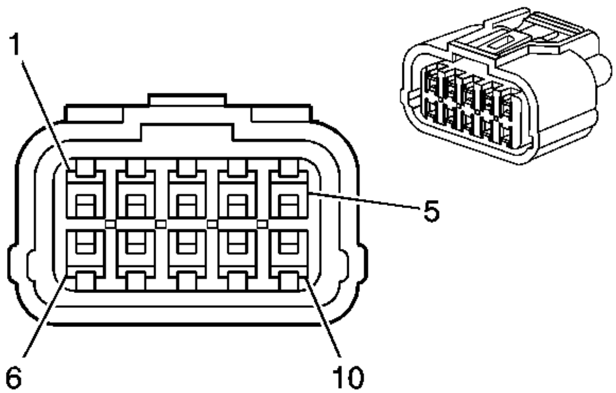
Connector Part Information		• **61890958** • **3-Way M M/P 150 (BK)**	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	GN/YE	2751	Low Reference
2	RD	1230	ISS High Signal
3	YE/BU	605	5 Volt Reference

Output Speed Sensor (OSS) Harness Terminal Identification



Connector Part Information		• 61890596 • 3-Way M M/P 150 (BK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	GN/WH	469	Low Reference
2	D-BU	400	OSS High Signal
3	YE/RD	474	5 Volt Reference

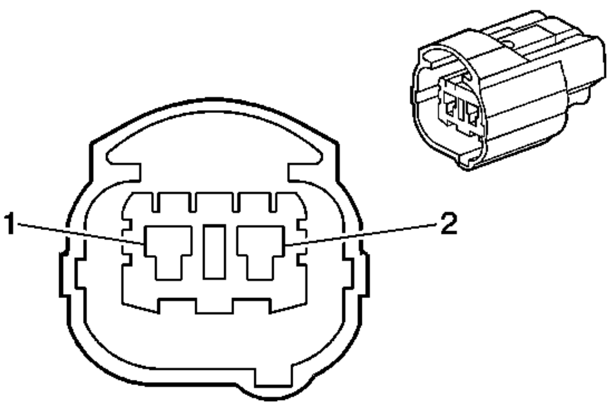
Park Neutral Position (PNP) Switch Terminal Identification



Connector Part Information		• 61890616 • 10-Way F M/P 150 (BK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	BK	450	Ground
2	D-BU/BK	1932	A/T Park Signal

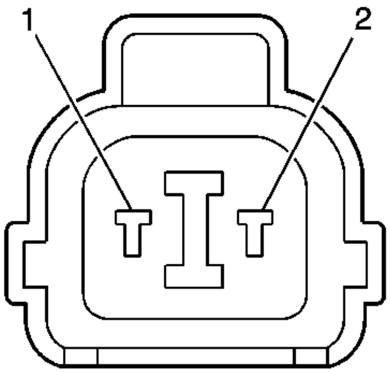
3	D-BU/WH	2182	A/T Reverse Signal
4	RD	6743	A/T Drive Signal
5	BU	6742	A/T Low Signal
6	BU/WH	1786	Ignition Lock Cylinder Control Actuator Signal
7	BU/YE	6745	A/T Forward Signal
8	RD/BK	1479	A/T Neutral Signal
9	YE/GN	6744	A/T Intermediate Signal
10	-	-	Not Used

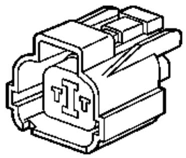
Torque Converter Clutch (TCC) Pressure Control (PC) Solenoid Valve Harness Terminal Identification



Connector Part Information		• 61890552 • 2-Way F M/P 150 (BK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	RD/BU	1993	Clutch Pressure Control Solenoid Valve 3 Low Control
2	GN/RD	1527	Clutch Pressure Control Solenoid Valve 3 High Control

Transmission Fluid Temperature (TFT) Sensor Harness Terminal Identification





Connector Part Information		• 61890129 • 2-Way M M/P 150 (BK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	BU/YE	1227	TFT Sensor Signal
2	GN/YE	2751	Low Reference

DESCRIPTION AND OPERATION

PARK - ENGINE RUNNING

Distribution of Hydraulic Pressure

As the engine turns, the automatic transmission fluid (ATF) pump starts to operate. ATF is drawn through the ATF filter and discharged into the hydraulic circuit. ATF flowing from the ATF pump becomes line pressure that is regulated by the regulator valve. Torque converter pressure, from the regulator valve, enters the torque converter through the lock-up shift valve and is discharged from the torque converter. The torque converter check valve prevents torque converter pressure from rising.

The powertrain control module (PCM) controls the shift solenoid valves ON and OFF. The shift solenoid valves control shift solenoid pressure to the shift valves. Applying shift solenoid pressure to the shift valves moves the position of the shift valve, and switches the port of hydraulic pressure. The PCM also controls the automatic transmission clutch pressure control (AT CPC) solenoid valves A and B.

The AT CPC solenoid valves A and B regulate the AT CPC solenoid pressure and apply the AT CPC solenoid pressure to CPC valves A and B. When shifting between upper gear and lower gear, the clutch is engaged by pressure from the CPC pressure mode.

The PCM controls one of the shift solenoid (SS) valves to move the position of the shift valve. This movement switches the port of the CPC and line pressure. Line pressure is then applied to the clutch, and the CPC pressure is intercepted.

When shifting is completed, the clutch is engaged with line pressure.

Hydraulic Pressure at the Ports

Port No.	Type of Pressure	Port No.	Type of Pressure	Port No.	Type of Pressure
1	Line	5N	CPC A or Line	56	LS A
2	Line	5D	CPC B or Line	57	LS B
3	Line	5G	CPC B or Line	58	LS C
3'	Reverse CPC or Line	5K	CPC B or Line	90	Torque Converter
3"	Reverse CPC or Line	6	Modulate	90'	Torque Converter
4	Line	SA	SH A	91	Torque Converter
4'	Line	SB	SH B	91'	Torque Converter
4"	Line	SC	SH C	92	Torque Converter
4A	CPC A	LA	LC A	93	ATF cooler
4B	CPC B	9	Line	94	Torque Converter
4C	CPC C	10	1st Clutch	95	Lubrication
5B	CPC A	15	1st Hold Clutch	95'	Lubrication
5C	CPC B	20	2nd Clutch	96	Torque Converter
5H	CPC B	25	Line	97	Torque Converter
5J	CPC B	30	3rd Clutch	99	Suction
5A	CPC A or Line	40	4th Clutch	X	Drain
5E	CPC A or Line	50	5th Clutch	HX	High Position Drain
5F	CPC A or Line	51	5th Clutch	hX	High Position drain
5M	CPC A or Line	55	CPC C or Line	AX	Air Drain

- CPC: Clutch Pressure Control Pressure
- SH: Shift Solenoid Pressure
- LS A: AT CPC Solenoid A Pressure
- LS B: AT CPC Solenoid B Pressure
- LS C: AT CPC Solenoid C Pressure
- LC: Torque Converter Clutch Solenoid Pressure

P Position

Shift solenoid (SS) valve C is turned OFF by the PCM, and SH C pressure (SC) is applied to the right side of the reverse CPC valve. Then the reverse CPC valve is moved to the left side to uncover the port leading line pressure (3) to the servo valve. Line pressure (3') passes through the servo valve and flows to the manual valve. Line pressure (3") is intercepted at the manual valve, and is not applied to the clutches.

When used, "left" or "right" indicates direction on the hydraulic circuit.

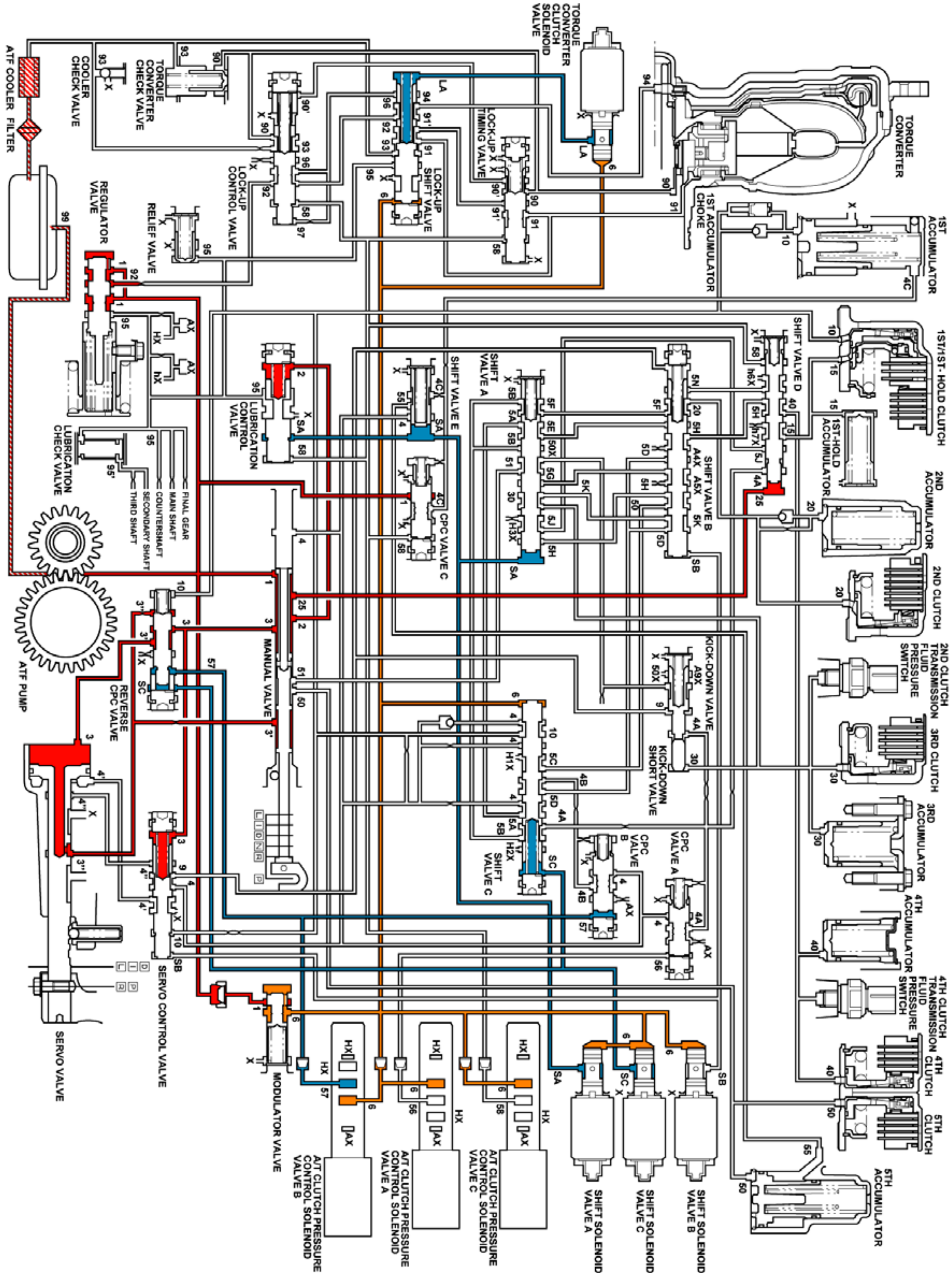


Fig. 24: Park - Engine Running
Courtesy of GENERAL MOTORS CORP.

REVERSE

Distribution of Hydraulic Pressure

As the engine turns, the automatic transmission fluid (ATF) pump starts to operate. ATF is drawn through the ATF filter and discharged into the hydraulic circuit. ATF flowing from the ATF pump becomes line pressure that is regulated by the regulator valve. Torque converter pressure, from the regulator valve, enters the torque converter through the lock-up shift valve and is discharged from the torque converter. The torque converter check valve prevents torque converter pressure from rising.

The powertrain control module (PCM) controls the shift solenoid valves ON and OFF. The shift solenoid valves control shift solenoid pressure to the shift valves. Applying shift solenoid pressure to the shift valves moves the position of the shift valve, and switches the port of hydraulic pressure. The PCM also controls the automatic transmission clutch pressure control (AT CPC) solenoid valves A and B.

The AT CPC solenoid valves A and B regulate the AT CPC solenoid pressure and apply the AT CPC solenoid pressure to CPC valves A and B. When shifting between upper gear and lower gear, the clutch is engaged by pressure from the CPC pressure mode.

The PCM controls one of the shift solenoid (SS) valves to move the position of the shift valve. This movement switches the port of the CPC and line pressure. Line pressure is then applied to the clutch, and the CPC pressure is intercepted.

When shifting is completed, the clutch is engaged with line pressure.

Hydraulic Pressure at the Ports

Port No.	Type of Pressure	Port No.	Type of Pressure	Port No.	Type of Pressure
1	Line	5N	CPC A or Line	56	LS A
2	Line	5D	CPC B or Line	57	LS B
3	Line	5G	CPC B or Line	58	LS C
3'	Reverse CPC or Line	5K	CPC B or Line	90	Torque Converter
3"	Reverse CPC or Line	6	Modulate	90'	Torque Converter
4	Line	SA	SH A	91	Torque Converter
4'	Line	SB	SH B	91'	Torque Converter
4"	Line	SC	SH C	92	Torque Converter
4A	CPC A	LA	LC A	93	ATF cooler
4B	CPC B	9	Line	94	Torque Converter
4C	CPC C	10	1st Clutch	95	Lubrication
5B	CPC A	15	1st Hold Clutch	95'	Lubrication
5C	CPC B	20	2nd Clutch	96	Torque Converter
5H	CPC B	25	Line	97	Torque Converter
5J	CPC B	30	3rd Clutch	99	Suction
5A	CPC A or Line	40	4th Clutch	X	Drain
5E	CPC A or Line	50	5th Clutch	HX	High Position Drain
5F	CPC A or Line	51	5th Clutch	hX	High Position drain
5M	CPC A or Line	55	CPC C or Line	AX	Air Drain

- CPC: Clutch Pressure Control Pressure
- SH: Shift Solenoid Pressure
- LS A: AT CPC Solenoid A Pressure
- LS B: AT CPC Solenoid B Pressure
- LS C: AT CPC Solenoid C Pressure
- LC: Torque Converter Clutch Solenoid Pressure

R Position: Driving in Reverse Gear

The PCM turns shift solenoid (SS) valve C OFF. SS valve A stays OFF and SS valve B stays ON. SS valve C is turned OFF, and SH C pressure (SC) is applied to the right side of the reverse CPC valve. Then the reverse CPC valve moves to the left side, creating full line pressure. Line pressure to the 5th clutch is the same as when shifting to the R position, and 5th clutch pressure increases. The 5th clutch is engaged with line pressure.

Reverse Inhibitor Control

When R position is selected, while the vehicle is moving forward at speeds over 6 mph (10 km/h), the PCM outputs to turn the SS valves A and C ON, and SS valve B stays ON. The reverse CPC valve is moved to the right side and covers the port to stop the line pressure (3') to the servo valve. Line pressure (3') is not applied to the servo valve, and the 5th clutch pressure (50) is not applied to the 5th clutch, as a result, power is not transmitted to the reverse direction.

When used, "left" or "right" indicates direction on the hydraulic circuit.

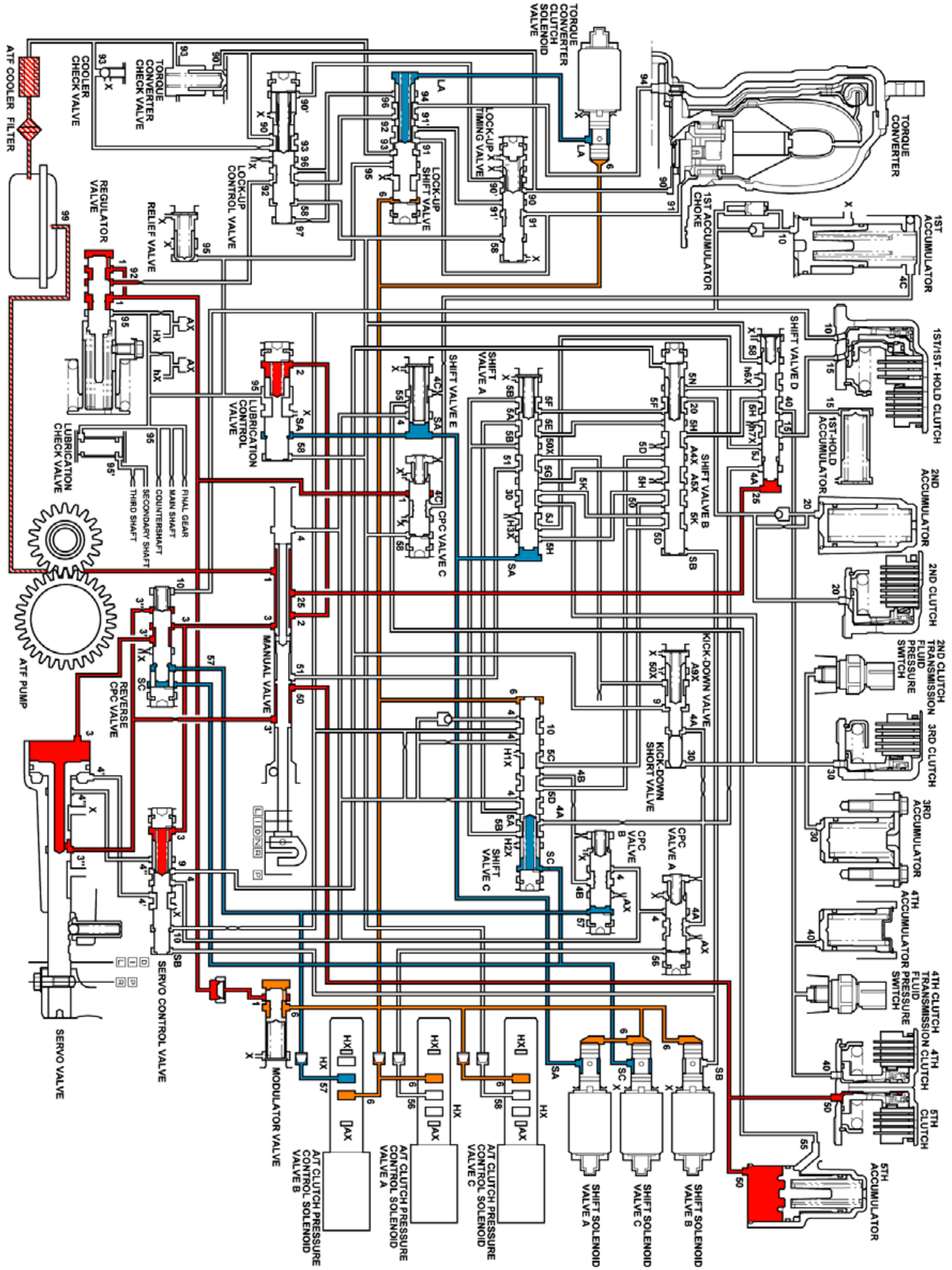


Fig. 25: Reverse
Courtesy of GENERAL MOTORS CORP.

NEUTRAL - ENGINE RUNNING

Distribution of Hydraulic Pressure

As the engine turns, the automatic transmission fluid (ATF) pump starts to operate. ATF is drawn through the ATF filter and discharged into the hydraulic circuit. ATF flowing from the ATF pump becomes line pressure that is regulated by the regulator valve. Torque converter pressure, from the regulator valve, enters the torque converter through the lock-up shift valve and is discharged from the torque converter. The torque converter check valve prevents torque converter pressure from rising.

The powertrain control module (PCM) controls the shift solenoid valves ON and OFF. The shift solenoid valves control shift solenoid pressure to the shift valves. Applying shift solenoid pressure to the shift valves moves the position of the shift valve, and switches the port of hydraulic pressure. The PCM also controls the automatic transmission clutch pressure control (AT CPC) solenoid valves A and B.

The AT CPC solenoid valves A and B regulate the AT CPC solenoid pressure and apply the AT CPC solenoid pressure to CPC valves A and B. When shifting between upper gear and lower gear, the clutch is engaged by pressure from the CPC pressure mode.

The PCM controls one of the shift solenoid (SS) valves to move the position of the shift valve. This movement switches the port of the CPC and line pressure. Line pressure is then applied to the clutch, and the CPC pressure is intercepted.

When shifting is completed, the clutch is engaged with line pressure.

Hydraulic Pressure at the Ports

Port No.	Type of Pressure	Port No.	Type of Pressure	Port No.	Type of Pressure
1	Line	5N	CPC A or Line	56	LS A
2	Line	5D	CPC B or Line	57	LS B
3	Line	5G	CPC B or Line	58	LS C
3'	Reverse CPC or Line	5K	CPC B or Line	90	Torque Converter
3"	Reverse CPC or Line	6	Modulate	90'	Torque Converter
4	Line	SA	SH A	91	Torque Converter
4'	Line	SB	SH B	91'	Torque Converter
4"	Line	SC	SH C	92	Torque Converter
4A	CPC A	LA	LC A	93	ATF cooler
4B	CPC B	9	Line	94	Torque Converter
4C	CPC C	10	1st Clutch	95	Lubrication
5B	CPC A	15	1st Hold Clutch	95'	Lubrication
5C	CPC B	20	2nd Clutch	96	Torque Converter
5H	CPC B	25	Line	97	Torque Converter
5J	CPC B	30	3rd Clutch	99	Suction
5A	CPC A or Line	40	4th Clutch	X	Drain
5E	CPC A or Line	50	5th Clutch	HX	High Position Drain
5F	CPC A or Line	51	5th Clutch	hX	High Position drain
5M	CPC A or Line	55	CPC C or Line	AX	Air Drain

- CPC: Clutch Pressure Control Pressure
- SH: Shift Solenoid Pressure
- LS A: AT CPC Solenoid A Pressure
- LS B: AT CPC Solenoid B Pressure
- LS C: AT CPC Solenoid C Pressure
- LC: Torque Converter Clutch Solenoid Pressure

N Position

The PCM controls the shift solenoid valves. The condition of the shift solenoid valves and position of the shift valves is as follows:

- Shift solenoid valve A is turned OFF, and shift valve A is moved to the left side.
- Shift solenoid valve B is turned ON, and shift valve B remains in the right side.
- Shift solenoid valve C is turned OFF, and shift valve C remains in the left side.

Line pressure (1) passes through the manual valve and becomes line pressure (25). Line pressure (25) stops at shift valve D. Line pressure (1) also flows to the modulator valve and becomes modulator pressure (6). Modulator pressure (6) flows to the SS valves, the AT CPC solenoid valves A and B, and the AT CPC solenoid valve C. Under this condition, hydraulic pressure is not applied to the clutches.

When used, "left" or "right" indicates direction on the hydraulic circuit.

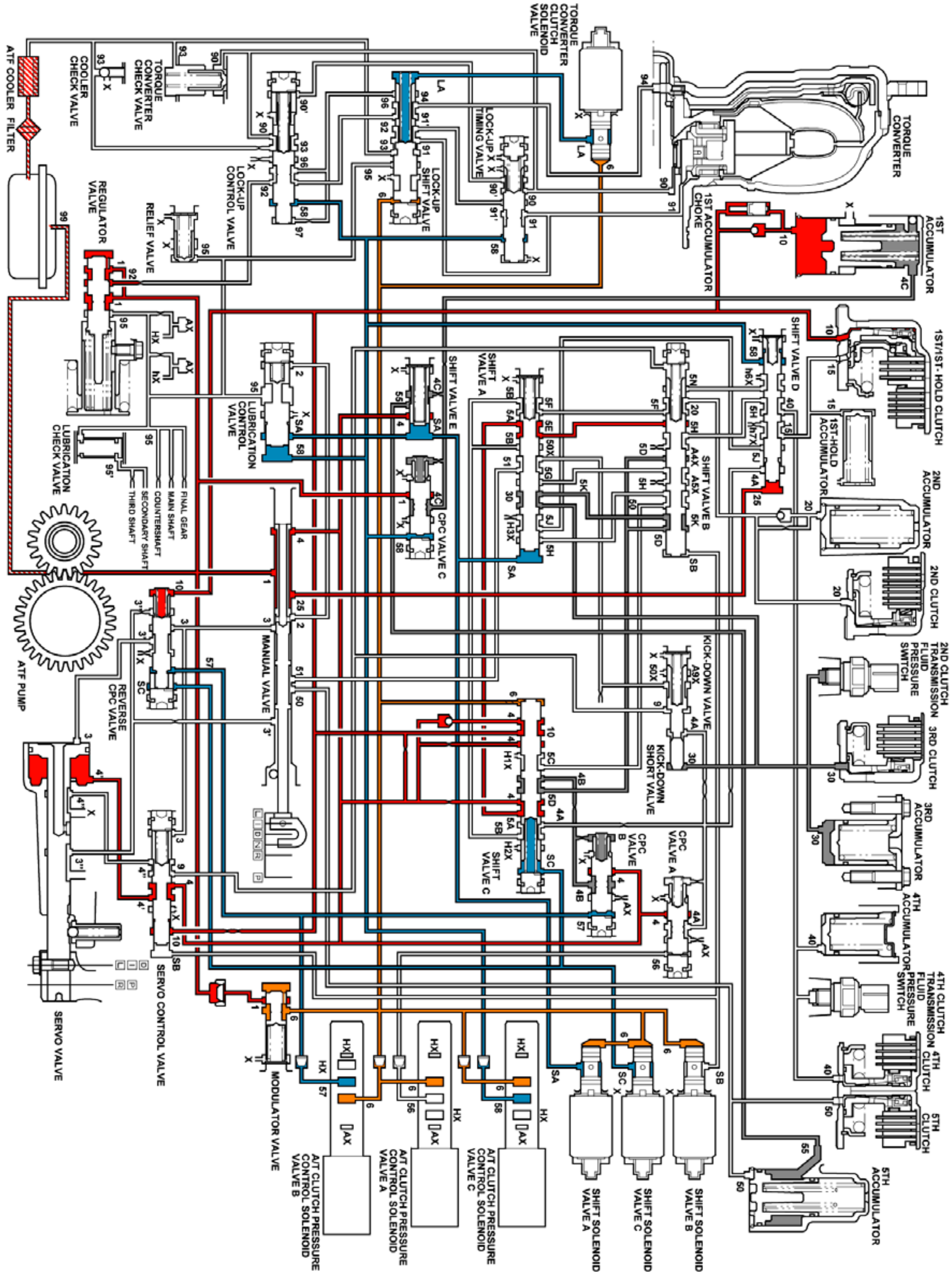


Fig. 26: Neutral - Engine Running
Courtesy of GENERAL MOTORS CORP.

DRIVE OR INTERMEDIATE - FIRST GEAR

Distribution of Hydraulic Pressure

As the engine turns, the automatic transmission fluid (ATF) pump starts to operate. ATF is drawn through the ATF filter and discharged into the hydraulic circuit. ATF flowing from the ATF pump becomes line pressure that is regulated by the regulator valve. Torque converter pressure, from the regulator valve, enters the torque converter through the lock-up shift valve and is discharged from the torque converter. The torque converter check valve prevents torque converter pressure from rising.

The powertrain control module (PCM) controls the shift solenoid valves ON and OFF. The shift solenoid valves control shift solenoid pressure to the shift valves. Applying shift solenoid pressure to the shift valves moves the position of the shift valve, and switches the port of hydraulic pressure. The PCM also controls the automatic transmission clutch pressure control (AT CPC) solenoid valves A and B.

The AT CPC solenoid valves A and B regulate the AT CPC solenoid pressure and apply the AT CPC solenoid pressure to CPC valves A and B. When shifting between upper gear and lower gear, the clutch is engaged by pressure from the CPC pressure mode.

The PCM controls one of the shift solenoid (SS) valves to move the position of the shift valve. This movement switches the port of the CPC and line pressure. Line pressure is then applied to the clutch, and the CPC pressure is intercepted.

When shifting is completed, the clutch is engaged with line pressure.

Hydraulic Pressure at the Ports

Port No.	Type of Pressure	Port No.	Type of Pressure	Port No.	Type of Pressure
1	Line	5N	CPC A or Line	56	LS A
2	Line	5D	CPC B or Line	57	LS B
3	Line	5G	CPC B or Line	58	LS C
3'	Reverse CPC or Line	5K	CPC B or Line	90	Torque Converter
3"	Reverse CPC or Line	6	Modulate	90'	Torque Converter
4	Line	SA	SH A	91	Torque Converter
4'	Line	SB	SH B	91'	Torque Converter
4"	Line	SC	SH C	92	Torque Converter
4A	CPC A	LA	LC A	93	ATF cooler
4B	CPC B	9	Line	94	Torque Converter
4C	CPC C	10	1st Clutch	95	Lubrication
5B	CPC A	15	1st Hold Clutch	95'	Lubrication
5C	CPC B	20	2nd Clutch	96	Torque Converter
5H	CPC B	25	Line	97	Torque Converter
5J	CPC B	30	3rd Clutch	99	Suction
5A	CPC A or Line	40	4th Clutch	X	Drain
5E	CPC A or Line	50	5th Clutch	HX	High Position Drain
5F	CPC A or Line	51	5th Clutch	hX	High Position drain
5M	CPC A or Line	55	CPC C or Line	AX	Air Drain

- CPC: Clutch Pressure Control Pressure
- SH: Shift Solenoid Pressure
- LS A: AT CPC Solenoid A Pressure
- LS B: AT CPC Solenoid B Pressure
- LS C: AT CPC Solenoid C Pressure
- LC: Torque Converter Clutch Solenoid Pressure

D or I Position: Driving in 1st gear

The PCM turns SS valve A and C ON, and SS valve B stays ON. SH A pressure (SA) in the right side of shift valve A and E is released, and shift valve A and E are moved to the right side. SH C pressure (SC) in the right side of shift valve C is released, and modulator pressure (6) is applied to the left side of shift valve C. Shift valve C is moved to the right side. These valve movements release CPC C pressure (4C) from the back of the 1st accumulator and the 3rd clutch, and the 1st clutch is engaged securely.

When used, "left" or "right" indicates direction on the hydraulic circuit.

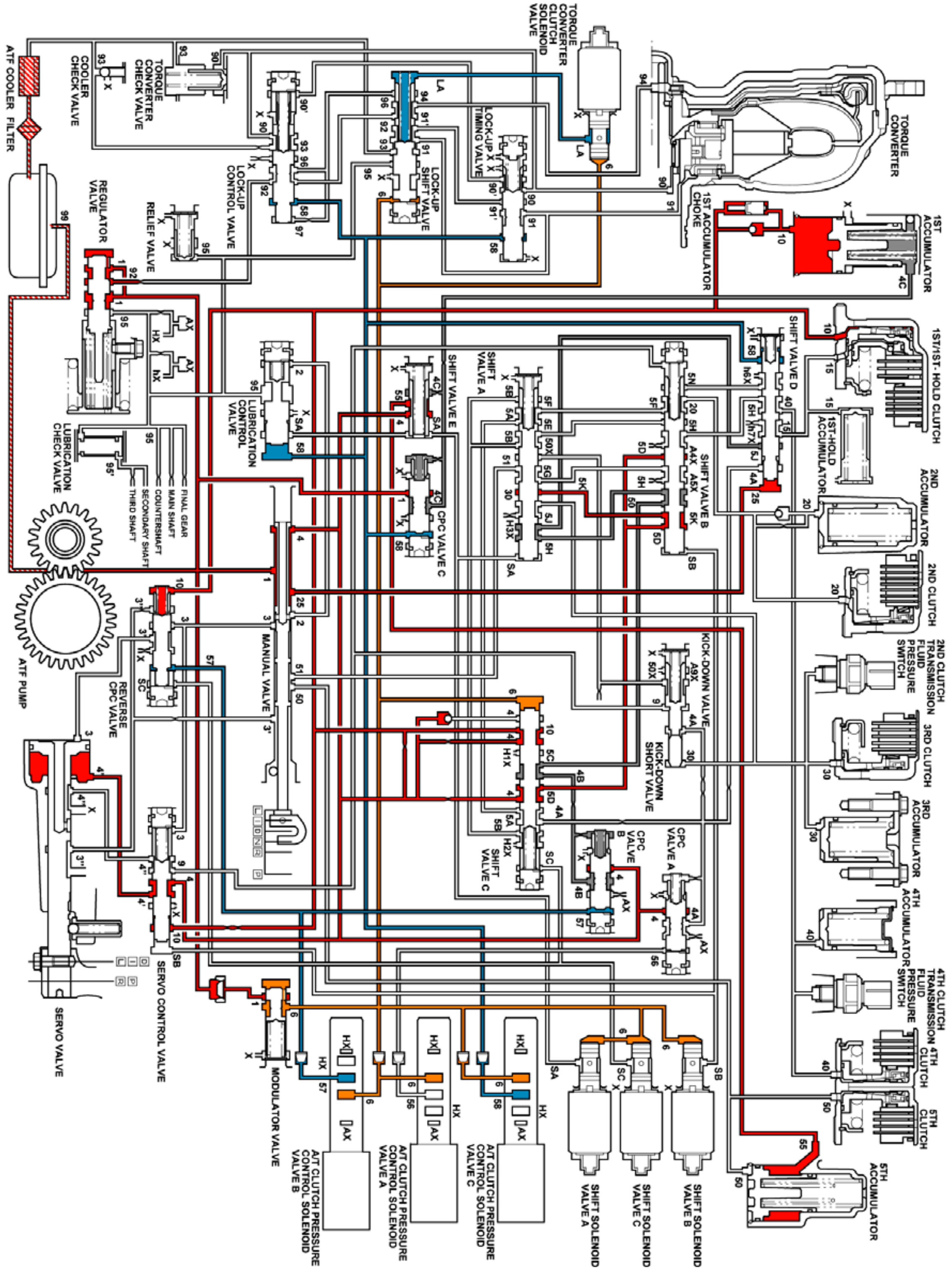


Fig. 27: Drive Or Intermediate - First Gear
Courtesy of GENERAL MOTORS CORP.

DRIVE OR INTERMEDIATE - SECOND GEAR

Distribution of Hydraulic Pressure

As the engine turns, the automatic transmission fluid (ATF) pump starts to operate. ATF is drawn through the ATF filter and discharged into the hydraulic circuit. ATF flowing from the ATF pump becomes line pressure that is regulated by the regulator valve. Torque converter pressure, from the regulator valve, enters the torque converter through the lock-up shift valve and is discharged from the torque converter. The torque converter check valve prevents torque converter pressure from rising.

The powertrain control module (PCM) controls the shift solenoid valves ON and OFF. The shift solenoid valves control shift solenoid pressure to the shift valves. Applying shift solenoid pressure to the shift valves moves the position of the shift valve, and switches the port of hydraulic pressure. The PCM also controls the automatic transmission clutch pressure control (AT CPC) solenoid valves A and B.

The AT CPC solenoid valves A and B regulate the AT CPC solenoid pressure and apply the AT CPC solenoid pressure to CPC valves A and B. When shifting between upper gear and lower gear, the clutch is engaged by pressure from the CPC pressure mode.

The PCM controls one of the shift solenoid (SS) valves to move the position of the shift valve. This movement switches the port of the CPC and line pressure. Line pressure is then applied to the clutch, and the CPC pressure is intercepted.

When shifting is completed, the clutch is engaged with line pressure.

Hydraulic Pressure at the Ports

Port No.	Type of Pressure	Port No.	Type of Pressure	Port No.	Type of Pressure
1	Line	5N	CPC A or Line	56	LS A
2	Line	5D	CPC B or Line	57	LS B
3	Line	5G	CPC B or Line	58	LS C
3'	Reverse CPC or Line	5K	CPC B or Line	90	Torque Converter
3"	Reverse CPC or Line	6	Modulate	90'	Torque Converter
4	Line	SA	SH A	91	Torque Converter
4'	Line	SB	SH B	91'	Torque Converter
4"	Line	SC	SH C	92	Torque Converter
4A	CPC A	LA	LC A	93	ATF cooler
4B	CPC B	9	Line	94	Torque Converter
4C	CPC C	10	1st Clutch	95	Lubrication
5B	CPC A	15	1st Hold Clutch	95'	Lubrication
5C	CPC B	20	2nd Clutch	96	Torque Converter
5H	CPC B	25	Line	97	Torque Converter
5J	CPC B	30	3rd Clutch	99	Suction
5A	CPC A or Line	40	4th Clutch	X	Drain
5E	CPC A or Line	50	5th Clutch	HX	High Position Drain
5F	CPC A or Line	51	5th Clutch	hX	High Position drain
5M	CPC A or Line	55	CPC C or Line	AX	Air Drain

- CPC: Clutch Pressure Control Pressure
- SH: Shift Solenoid Pressure
- LS A: AT CPC Solenoid A Pressure
- LS B: AT CPC Solenoid B Pressure
- LS C: AT CPC Solenoid C Pressure
- LC: Torque Converter Clutch Solenoid Pressure

D or I Position: Driving in 2nd gear

The PCM turns shift solenoid (SS) valve C OFF, and SS valve A and B stays ON. SS valve C is turned OFF, and SH C pressure (SC) is applied to the right side of shift valve C. Then shift valve C is moved to the left side to switch the port of line pressure and CPC pressure. 2nd clutch pressure is changed to line pressure mode, and the 2nd clutch is engaged securely. The 1st clutch is also engaged. No power is transmitted because of the one-way clutch.

When used, "left" or "right" indicates direction on the hydraulic circuit.

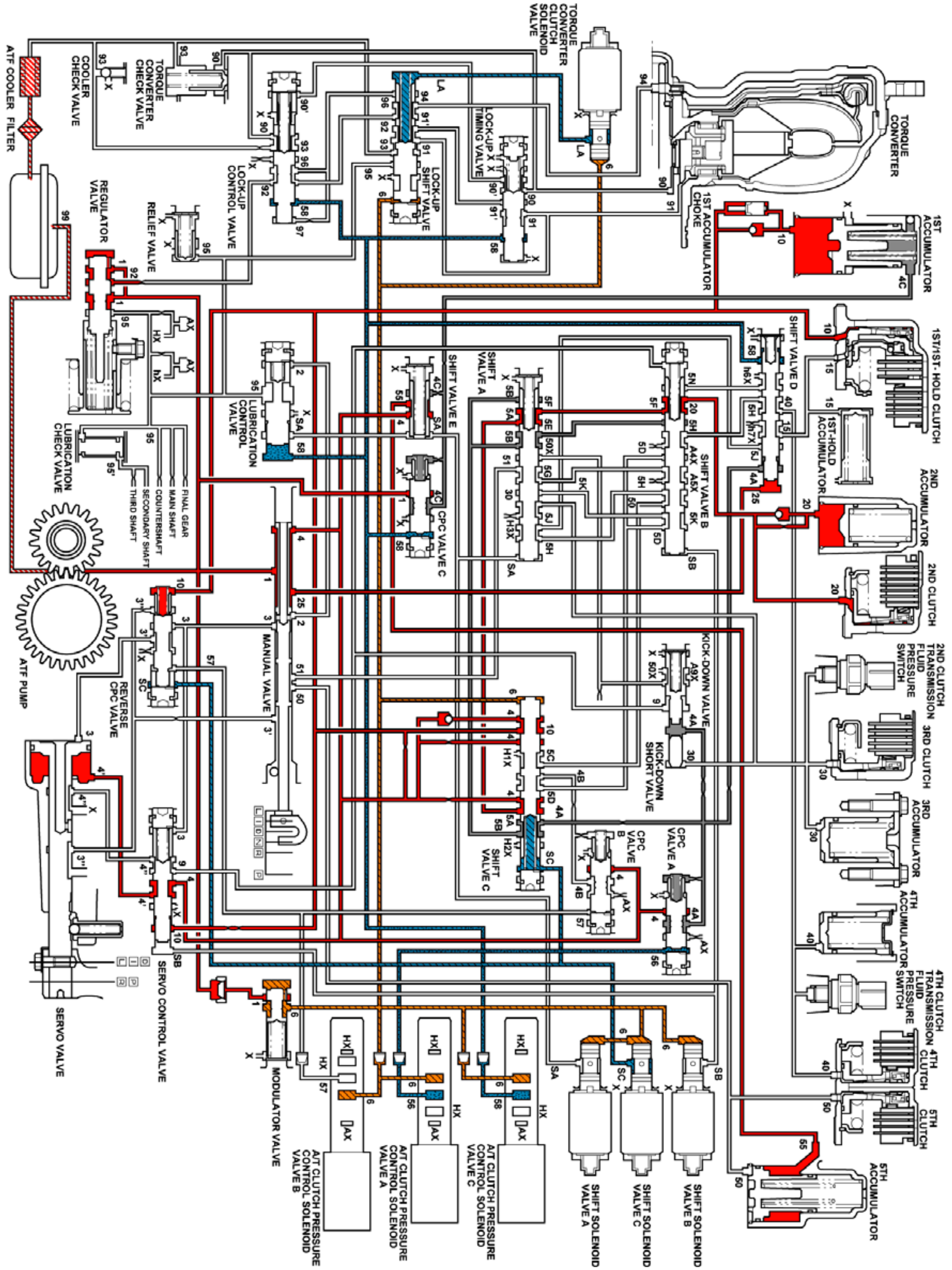


Fig. 28: Drive Or Intermediate - Second Gear
Courtesy of GENERAL MOTORS CORP.

DRIVE OR INTERMEDIATE - THIRD GEAR

Distribution of Hydraulic Pressure

As the engine turns, the automatic transmission fluid (ATF) pump starts to operate. ATF is drawn through the ATF filter and discharged into the hydraulic circuit. ATF flowing from the ATF pump becomes line pressure that is regulated by the regulator valve. Torque converter pressure, from the regulator valve, enters the torque converter through the lock-up shift valve and is discharged from the torque converter. The torque converter check valve prevents torque converter pressure from rising.

The powertrain control module (PCM) controls the shift solenoid valves ON and OFF. The shift solenoid valves control shift solenoid pressure to the shift valves. Applying shift solenoid pressure to the shift valves moves the position of the shift valve, and switches the port of hydraulic pressure. The PCM also controls the automatic transmission clutch pressure control (AT CPC) solenoid valves A and B.

The AT CPC solenoid valves A and B regulate the AT CPC solenoid pressure and apply the AT CPC solenoid pressure to CPC valves A and B. When shifting between upper gear and lower gear, the clutch is engaged by pressure from the CPC pressure mode.

The PCM controls one of the shift solenoid (SS) valves to move the position of the shift valve. This movement switches the port of the CPC and line pressure. Line pressure is then applied to the clutch, and the CPC pressure is intercepted.

When shifting is completed, the clutch is engaged with line pressure.

Hydraulic Pressure at the Ports

Port No.	Type of Pressure	Port No.	Type of Pressure	Port No.	Type of Pressure
1	Line	5N	CPC A or Line	56	LS A
2	Line	5D	CPC B or Line	57	LS B
3	Line	5G	CPC B or Line	58	LS C
3'	Reverse CPC or Line	5K	CPC B or Line	90	Torque Converter
3"	Reverse CPC or Line	6	Modulate	90'	Torque Converter
4	Line	SA	SH A	91	Torque Converter
4'	Line	SB	SH B	91'	Torque Converter
4"	Line	SC	SH C	92	Torque Converter
4A	CPC A	LA	LC A	93	ATF cooler
4B	CPC B	9	Line	94	Torque Converter
4C	CPC C	10	1st Clutch	95	Lubrication
5B	CPC A	15	1st Hold Clutch	95'	Lubrication
5C	CPC B	20	2nd Clutch	96	Torque Converter
5H	CPC B	25	Line	97	Torque Converter
5J	CPC B	30	3rd Clutch	99	Suction
5A	CPC A or Line	40	4th Clutch	X	Drain
5E	CPC A or Line	50	5th Clutch	HX	High Position Drain
5F	CPC A or Line	51	5th Clutch	hX	High Position drain
5M	CPC A or Line	55	CPC C or Line	AX	Air Drain

- CPC: Clutch Pressure Control Pressure
- SH: Shift Solenoid Pressure
- LS A: AT CPC Solenoid A Pressure
- LS B: AT CPC Solenoid B Pressure
- LS C: AT CPC Solenoid C Pressure
- LC: Torque Converter Clutch Solenoid Pressure

D or I Position: Driving in 3rd gear

The PCM turns shift solenoid (SS) valve C ON, and controls AT CPC solenoid valve A to release LS A pressure (56) in CPC valve A. SS valve A keeps OFF, and B stays ON. The release of LS A pressure (56) in CPC valve A releases CPC A pressure in the 2nd clutch pressure circuit. SS valve C is turned ON, and SH C pressure (SC) in the right side of shift valve C is released. SS valve C is then moved to the right side to switch the port of line pressure and CPC pressure. The 3rd clutch pressure is changed to line pressure mode, and the 3rd clutch is engaged securely. The 1st clutch is also engaged. No power is transmitted because of the one-way clutch.

When used, "left" or "right" indicates direction on the hydraulic circuit.

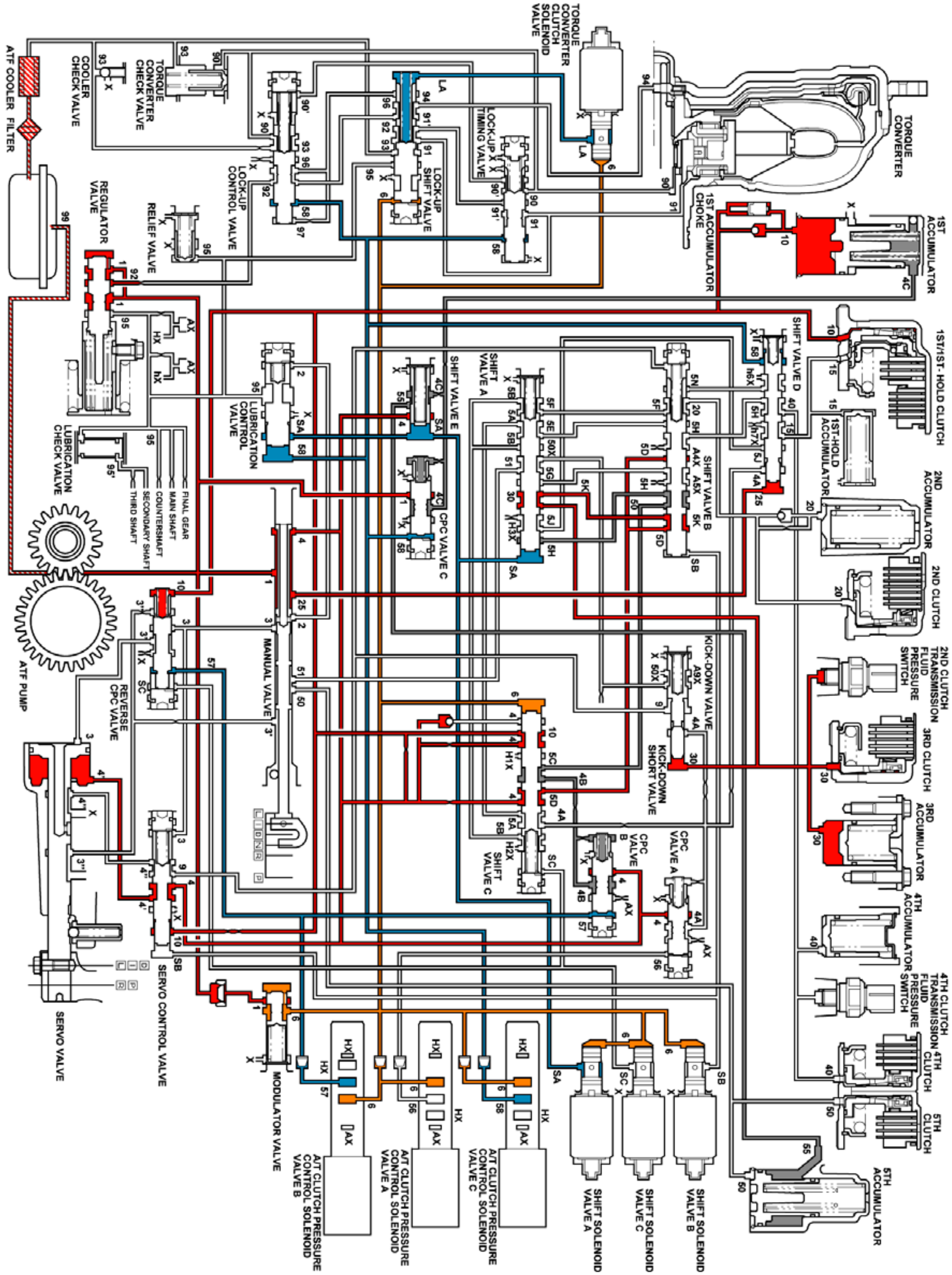


Fig. 29: Drive Or Intermediate - Third Gear

Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE - FOURTH GEAR

Distribution of Hydraulic Pressure

As the engine turns, the automatic transmission fluid (ATF) pump starts to operate. ATF is drawn through the ATF filter and discharged into the hydraulic circuit. ATF flowing from the ATF pump becomes line pressure that is regulated by the regulator valve. Torque converter pressure, from the regulator valve, enters the torque converter through the lock-up shift valve and is discharged from the torque converter. The torque converter check valve prevents torque converter pressure from rising.

The powertrain control module (PCM) controls the shift solenoid valves ON and OFF. The shift solenoid valves control shift solenoid pressure to the shift valves. Applying shift solenoid pressure to the shift valves moves the position of the shift valve, and switches the port of hydraulic pressure. The PCM also controls the automatic transmission clutch pressure control (AT CPC) solenoid valves A and B.

The AT CPC solenoid valves A and B regulate the AT CPC solenoid pressure and apply the AT CPC solenoid pressure to CPC valves A and B. When shifting between upper gear and lower gear, the clutch is engaged by pressure from the CPC pressure mode.

The PCM controls one of the shift solenoid (SS) valves to move the position of the shift valve. This movement switches the port of the CPC and line pressure. Line pressure is then applied to the clutch, and the CPC pressure is intercepted.

When shifting is completed, the clutch is engaged with line pressure.

Hydraulic Pressure at the Ports

Port No.	Type of Pressure	Port No.	Type of Pressure	Port No.	Type of Pressure
1	Line	5N	CPC A or Line	56	LS A
2	Line	5D	CPC B or Line	57	LS B
3	Line	5G	CPC B or Line	58	LS C
3'	Reverse CPC or Line	5K	CPC B or Line	90	Torque Converter
3"	Reverse CPC or Line	6	Modulate	90'	Torque Converter
4	Line	SA	SH A	91	Torque Converter
4'	Line	SB	SH B	91'	Torque Converter
4"	Line	SC	SH C	92	Torque Converter
4A	CPC A	LA	LC A	93	ATF cooler
4B	CPC B	9	Line	94	Torque Converter
4C	CPC C	10	1st Clutch	95	Lubrication
5B	CPC A	15	1st Hold Clutch	95'	Lubrication
5C	CPC B	20	2nd Clutch	96	Torque Converter
5H	CPC B	25	Line	97	Torque Converter
5J	CPC B	30	3rd Clutch	99	Suction
5A	CPC A or Line	40	4th Clutch	X	Drain
5E	CPC A or Line	50	5th Clutch	HX	High Position Drain
5F	CPC A or Line	51	5th Clutch	hX	High Position drain
5M	CPC A or Line	55	CPC C or Line	AX	Air Drain

- CPC: Clutch Pressure Control Pressure
- SH: Shift Solenoid Pressure
- LS A: AT CPC Solenoid A Pressure
- LS B: AT CPC Solenoid B Pressure
- LS C: AT CPC Solenoid C Pressure
- LC: Torque Converter Clutch Solenoid Pressure

D Position: Driving in 4th gear

The PCM turns shift solenoid (SS) valve C OFF, and controls AT CPC solenoid valve B to release LS B pressure (57) in CPC valve B. SS valve A and B stay OFF. The release of LS B pressure (57) in CPC valve B releases CPC B pressure in the 3rd clutch pressure circuit. SS valve C is turned OFF, and SH C pressure (SC) is applied to the right side of shift valve C. Shift valve C is then moved to the left side to switch the port of line pressure and CPC pressure. Line pressure (4), from the manual valve, becomes 4th clutch pressure (40) at shift valve D, via shift valve C, A, and B, and flows to the 4th clutch. The 4th clutch pressure is changed to line pressure mode by switching the position of shift valve C, and the 4th clutch is engaged securely. The 1st clutch is also engaged. No power is transmitted because of the one-way clutch.

When used, "left" or "right" indicates direction on the hydraulic circuit.

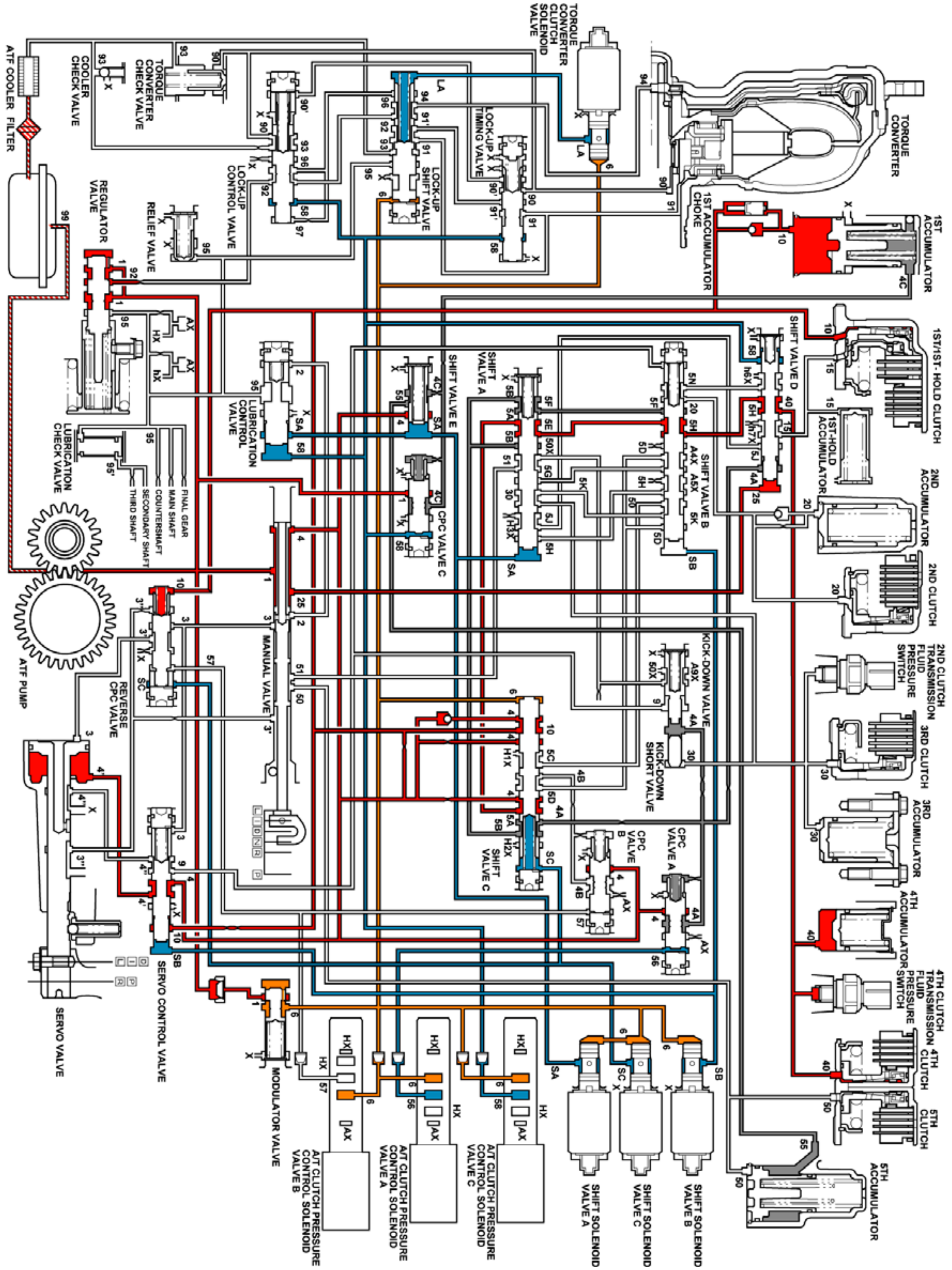


Fig. 30: Drive Range - Fourth Gear
Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE FIFTH GEAR - TCC RELEASED

Distribution of Hydraulic Pressure

As the engine turns, the automatic transmission fluid (ATF) pump starts to operate. ATF is drawn through the ATF filter and discharged into the hydraulic circuit. ATF flowing from the ATF pump becomes line pressure that is regulated by the regulator valve. Torque converter pressure, from the regulator valve, enters the torque converter through the lock-up shift valve and is discharged from the torque converter. The torque converter check valve prevents torque converter pressure from rising.

The powertrain control module (PCM) controls the shift solenoid valves ON and OFF. The shift solenoid valves control shift solenoid pressure to the shift valves. Applying shift solenoid pressure to the shift valves moves the position of the shift valve, and switches the port of hydraulic pressure. The PCM also controls the automatic transmission clutch pressure control (AT CPC) solenoid valves A and B.

The AT CPC solenoid valves A and B regulate the AT CPC solenoid pressure and apply the AT CPC solenoid pressure to CPC valves A and B. When shifting between upper gear and lower gear, the clutch is engaged by pressure from the CPC pressure mode.

The PCM controls one of the shift solenoid (SS) valves to move the position of the shift valve. This movement switches the port of the CPC and line pressure. Line pressure is then applied to the clutch, and the CPC pressure is intercepted.

When shifting is completed, the clutch is engaged with line pressure.

Hydraulic Pressure at the Ports

Port No.	Type of Pressure	Port No.	Type of Pressure	Port No.	Type of Pressure
1	Line	5N	CPC A or Line	56	LS A
2	Line	5D	CPC B or Line	57	LS B
3	Line	5G	CPC B or Line	58	LS C
3'	Reverse CPC or Line	5K	CPC B or Line	90	Torque Converter
3"	Reverse CPC or Line	6	Modulate	90'	Torque Converter
4	Line	SA	SH A	91	Torque Converter
4'	Line	SB	SH B	91'	Torque Converter
4"	Line	SC	SH C	92	Torque Converter
4A	CPC A	LA	LC A	93	ATF cooler
4B	CPC B	9	Line	94	Torque Converter
4C	CPC C	10	1st Clutch	95	Lubrication
5B	CPC A	15	1st Hold Clutch	95'	Lubrication
5C	CPC B	20	2nd Clutch	96	Torque Converter
5H	CPC B	25	Line	97	Torque Converter
5J	CPC B	30	3rd Clutch	99	Suction
5A	CPC A or Line	40	4th Clutch	X	Drain
5E	CPC A or Line	50	5th Clutch	HX	High Position Drain
5F	CPC A or Line	51	5th Clutch	hX	High Position drain
5M	CPC A or Line	55	CPC C or Line	AX	Air Drain

- CPC: Clutch Pressure Control Pressure
- SH: Shift Solenoid Pressure
- LS A: AT CPC Solenoid A Pressure
- LS B: AT CPC Solenoid B Pressure
- LS C: AT CPC Solenoid C Pressure
- LC: Torque Converter Clutch Solenoid Pressure

D Position: Driving in 5th gear

The PCM turns shift solenoid (SS) valve C ON, and controls AT CPC solenoid valve A to release LS A pressure (56) in CPC valve A. SS valve A stays ON, and B stays OFF. The release of LS A pressure (56) in CPC valve A releases CPC A pressure in the 4th clutch pressure circuit. SS valve C is turned ON, and SH C pressure (SC) in the right side of shift valve C is released. SS C is then moved to the right side to switch the port of line pressure and CPC pressure. Line pressure (4), from the manual valve, becomes 5th clutch pressure (50) at the manual valve, via shift valve C, B, and A, and flows to the 5th clutch. The 5th clutch pressure is changed to line pressure mode by switching the position of shift valve C. The 5th clutch is engaged securely, and the 1st clutch is also engaged. No power is transmitted because of the one-way clutch.

When used, "left" or "right" indicates direction on the hydraulic circuit.

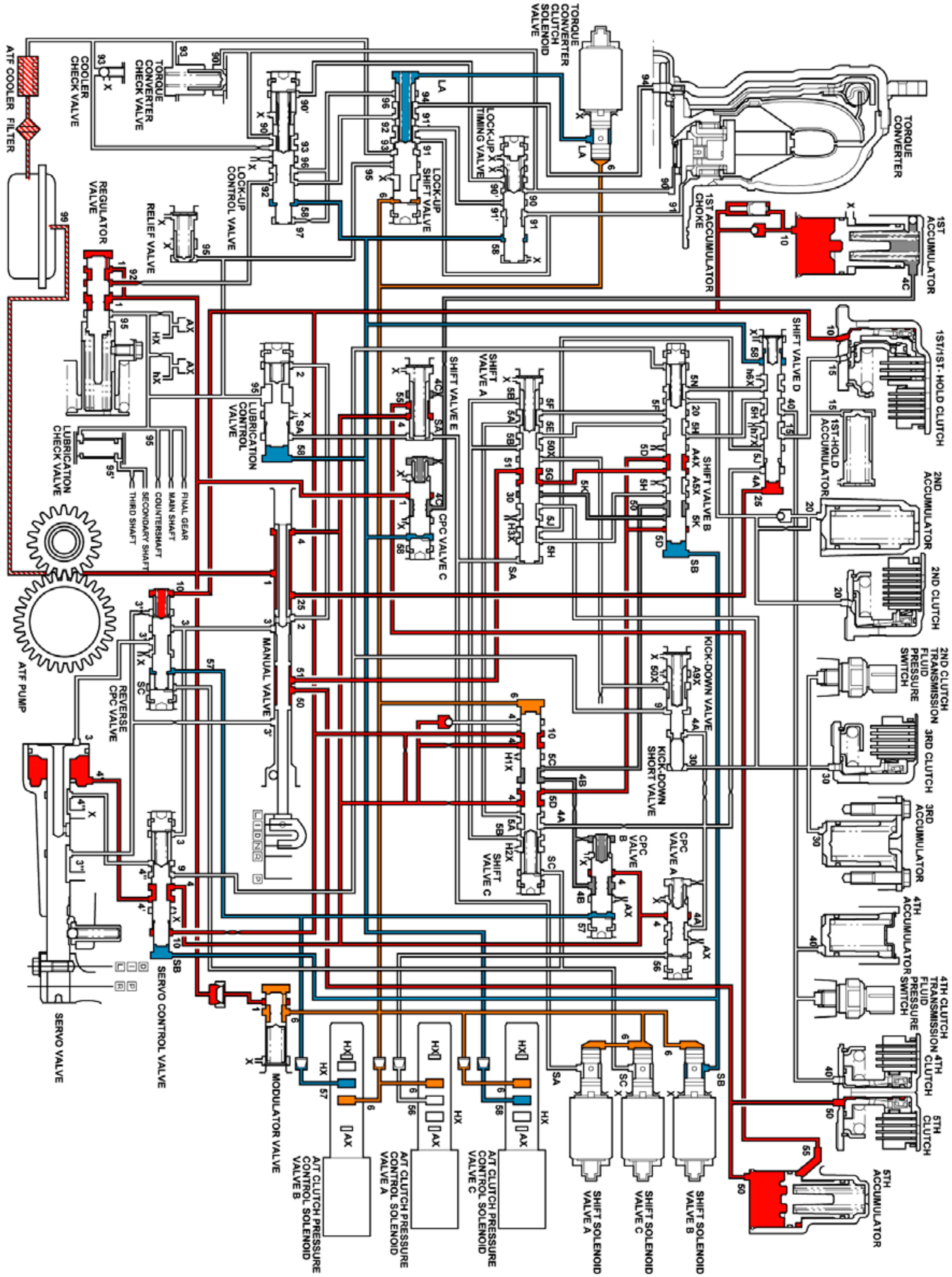


Fig. 31: Drive Range Fifth Gear - TCC Released
Courtesy of GENERAL MOTORS CORP.

LOW RANGE - FIRST GEAR

Distribution of Hydraulic Pressure

As the engine turns, the automatic transmission fluid (ATF) pump starts to operate. ATF is drawn through the ATF filter and discharged into the hydraulic circuit. ATF flowing from the ATF pump becomes line pressure that is regulated by the regulator valve. Torque converter pressure, from the regulator valve, enters the torque converter through the lock-up shift valve and is discharged from the torque converter. The torque converter check valve prevents torque converter pressure from rising.

The powertrain control module (PCM) controls the shift solenoid valves ON and OFF. The shift solenoid valves control shift solenoid pressure to the shift valves. Applying shift solenoid pressure to the shift valves moves the position of the shift valve, and switches the port of hydraulic pressure. The PCM also controls the automatic transmission clutch pressure control (AT CPC) solenoid valves A and B.

The AT CPC solenoid valves A and B regulate the AT CPC solenoid pressure and apply the AT CPC solenoid pressure to CPC valves A and B. When shifting between upper gear and lower gear, the clutch is engaged by pressure from the CPC pressure mode.

The PCM controls one of the shift solenoid (SS) valves to move the position of the shift valve. This movement switches the port of the CPC and line pressure. Line pressure is then applied to the clutch, and the CPC pressure is intercepted.

When shifting is completed, the clutch is engaged with line pressure.

Hydraulic Pressure at the Ports

Port No.	Type of Pressure	Port No.	Type of Pressure	Port No.	Type of Pressure
1	Line	5N	CPC A or Line	56	LS A
2	Line	5D	CPC B or Line	57	LS B
3	Line	5G	CPC B or Line	58	LS C
3'	Reverse CPC or Line	5K	CPC B or Line	90	Torque Converter
3"	Reverse CPC or Line	6	Modulate	90'	Torque Converter
4	Line	SA	SH A	91	Torque Converter
4'	Line	SB	SH B	91'	Torque Converter
4"	Line	SC	SH C	92	Torque Converter
4A	CPC A	LA	LC A	93	ATF cooler
4B	CPC B	9	Line	94	Torque Converter
4C	CPC C	10	1st Clutch	95	Lubrication
5B	CPC A	15	1st Hold Clutch	95'	Lubrication
5C	CPC B	20	2nd Clutch	96	Torque Converter
5H	CPC B	25	Line	97	Torque Converter
5J	CPC B	30	3rd Clutch	99	Suction
5A	CPC A or Line	40	4th Clutch	X	Drain
5E	CPC A or Line	50	5th Clutch	HX	High Position Drain
5F	CPC A or Line	51	5th Clutch	hX	High Position drain
5M	CPC A or Line	55	CPC C or Line	AX	Air Drain

- CPC: Clutch Pressure Control Pressure
- SH: Shift Solenoid Pressure
- LS A: AT CPC Solenoid A Pressure
- LS B: AT CPC Solenoid B Pressure
- LS C: AT CPC Solenoid C Pressure
- LC: Torque Converter Clutch Solenoid Pressure

L Position: 1st-Hold Gear

The PCM controls the shift solenoid (SS) valves and the AT CPC solenoid valve A and B.

The condition of the SS valves and the position of the shift valves are as follows:

- SS valve A is turned ON, and shift valve A is in the right side.
- SS valve B is turned ON, and shift valve B is in the right side.
- SS valve C is turned ON, and shift valve C is moved to the right side by modulator pressure (6).

The PCM also controls AT CPC solenoid valve B to apply LS B pressure (57) to CPC valve B. Line pressure (4) from the manual valve becomes 1st clutch pressure (10) at shift valve C. 1st clutch pressure (10) is applied to the 1st clutch, and the 1st clutch is engaged. Line pressure (4) also flows to CPC valve B, and becomes CPC B pressure (4B). CPC B pressure (4B) becomes 1st-hold clutch pressure (15) at shift valve D, via shift valves C, B, and A. 1st-hold clutch pressure (15) is applied to the 1st-hold clutch, and the 1st-hold clutch is engaged.

When used, "left" or "right" indicates direction on the hydraulic circuit.

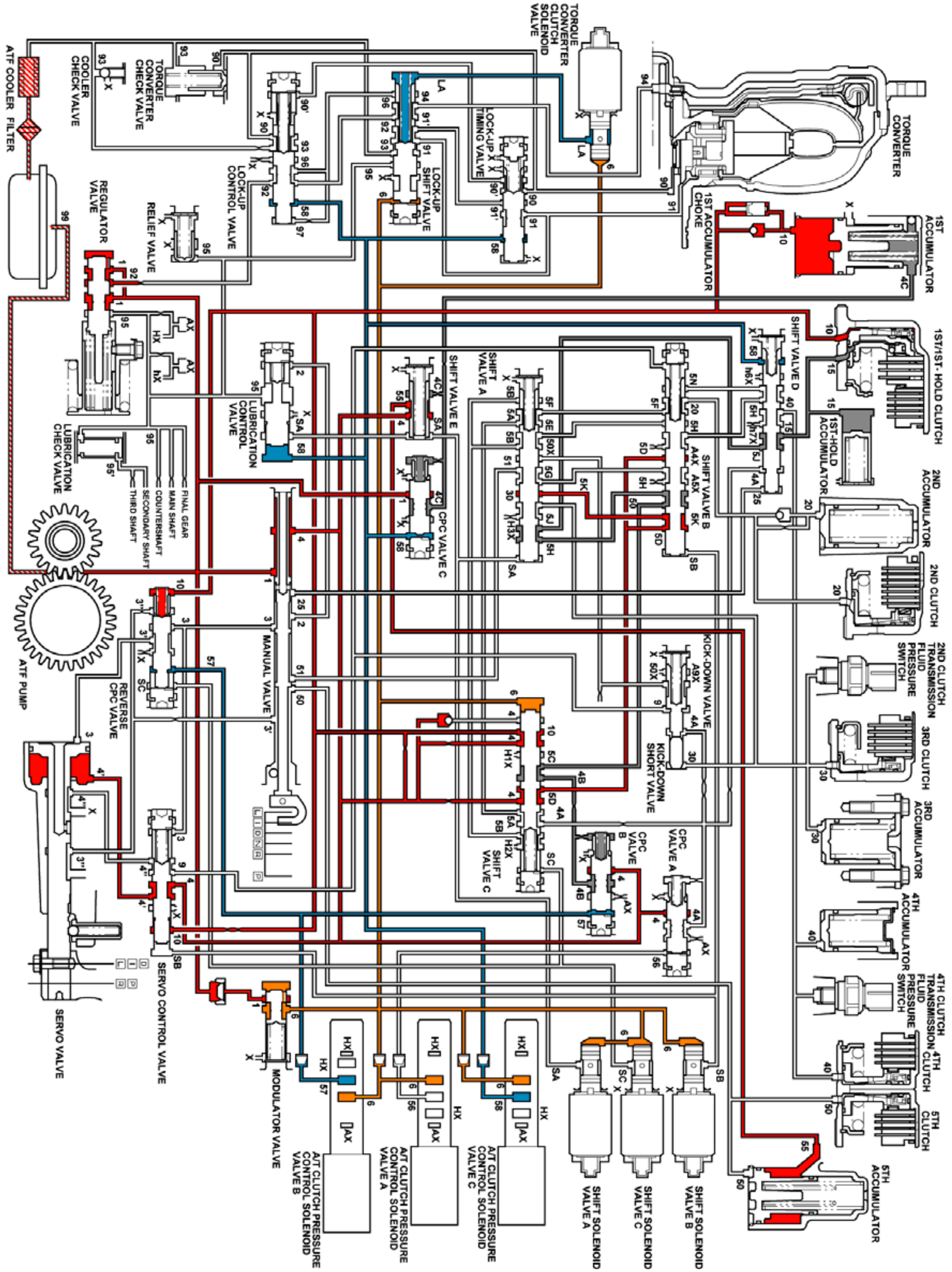


Fig. 32: Low Range - First Gear
Courtesy of GENERAL MOTORS CORP.

LOW RANGE - SECOND GEAR

Distribution of Hydraulic Pressure

As the engine turns, the automatic transmission fluid (ATF) pump starts to operate. ATF is drawn through the ATF filter and discharged into the hydraulic circuit. ATF flowing from the ATF pump becomes line pressure that is regulated by the regulator valve. Torque converter pressure, from the regulator valve, enters the torque converter through the lock-up shift valve and is discharged from the torque converter. The torque converter check valve prevents torque converter pressure from rising.

The powertrain control module (PCM) controls the shift solenoid valves ON and OFF. The shift solenoid valves control shift solenoid pressure to the shift valves. Applying shift solenoid pressure to the shift valves moves the position of the shift valve, and switches the port of hydraulic pressure. The PCM also controls the automatic transmission clutch pressure control (AT CPC) solenoid valves A and B.

The AT CPC solenoid valves A and B regulate the AT CPC solenoid pressure and apply the AT CPC solenoid pressure to CPC valves A and B. When shifting between upper gear and lower gear, the clutch is engaged by pressure from the CPC pressure mode.

The PCM controls one of the shift solenoid (SS) valves to move the position of the shift valve. This movement switches the port of the CPC and line pressure. Line pressure is then applied to the clutch, and the CPC pressure is intercepted.

When shifting is completed, the clutch is engaged with line pressure.

Hydraulic Pressure at the Ports

Port No.	Type of Pressure	Port No.	Type of Pressure	Port No.	Type of Pressure
1	Line	5N	CPC A or Line	56	LS A
2	Line	5D	CPC B or Line	57	LS B
3	Line	5G	CPC B or Line	58	LS C
3'	Reverse CPC or Line	5K	CPC B or Line	90	Torque Converter
3"	Reverse CPC or Line	6	Modulate	90'	Torque Converter
4	Line	SA	SH A	91	Torque Converter
4'	Line	SB	SH B	91'	Torque Converter
4"	Line	SC	SH C	92	Torque Converter
4A	CPC A	LA	LC A	93	ATF cooler
4B	CPC B	9	Line	94	Torque Converter
4C	CPC C	10	1st Clutch	95	Lubrication
5B	CPC A	15	1st Hold Clutch	95'	Lubrication
5C	CPC B	20	2nd Clutch	96	Torque Converter
5H	CPC B	25	Line	97	Torque Converter
5J	CPC B	30	3rd Clutch	99	Suction
5A	CPC A or Line	40	4th Clutch	X	Drain
5E	CPC A or Line	50	5th Clutch	HX	High Position Drain
5F	CPC A or Line	51	5th Clutch	hX	High Position drain
5M	CPC A or Line	55	CPC C or Line	AX	Air Drain

- CPC: Clutch Pressure Control Pressure
- SH: Shift Solenoid Pressure
- LS A: AT CPC Solenoid A Pressure
- LS B: AT CPC Solenoid B Pressure
- LS C: AT CPC Solenoid C Pressure
- LC: Torque Converter Clutch Solenoid Pressure

L Position: Driving in 2nd Gear

The PCM turns shift solenoid (SS) valve C OFF, and SS valve A and B stay ON. SS valve C is turned OFF, and SH C pressure (SC) is applied to the right side of shift valve C. Shift valve C is then moved to the left side, to switch the port of line pressure and CPC pressure. 2nd clutch pressure is changed to line pressure mode, and the 2nd clutch is engaged securely. The 1st clutch is also engaged. No power is transmitted because of the one-way clutch. The LS A pressure (56) from the AT CPC solenoid valve A is applied to the right side of the CPC valve A, and the line pressure (4) is changed to the CPC A pressure (4A) at the CPC valve A. The CPC A pressure is supplied to the shift valve D, which moves the shift valve D to the left and cuts the L/H clutch pressure (15) to the 1st-hold clutch and the 1st-hold accumulator.

When used, "left" or "right" indicates direction on the hydraulic circuit.

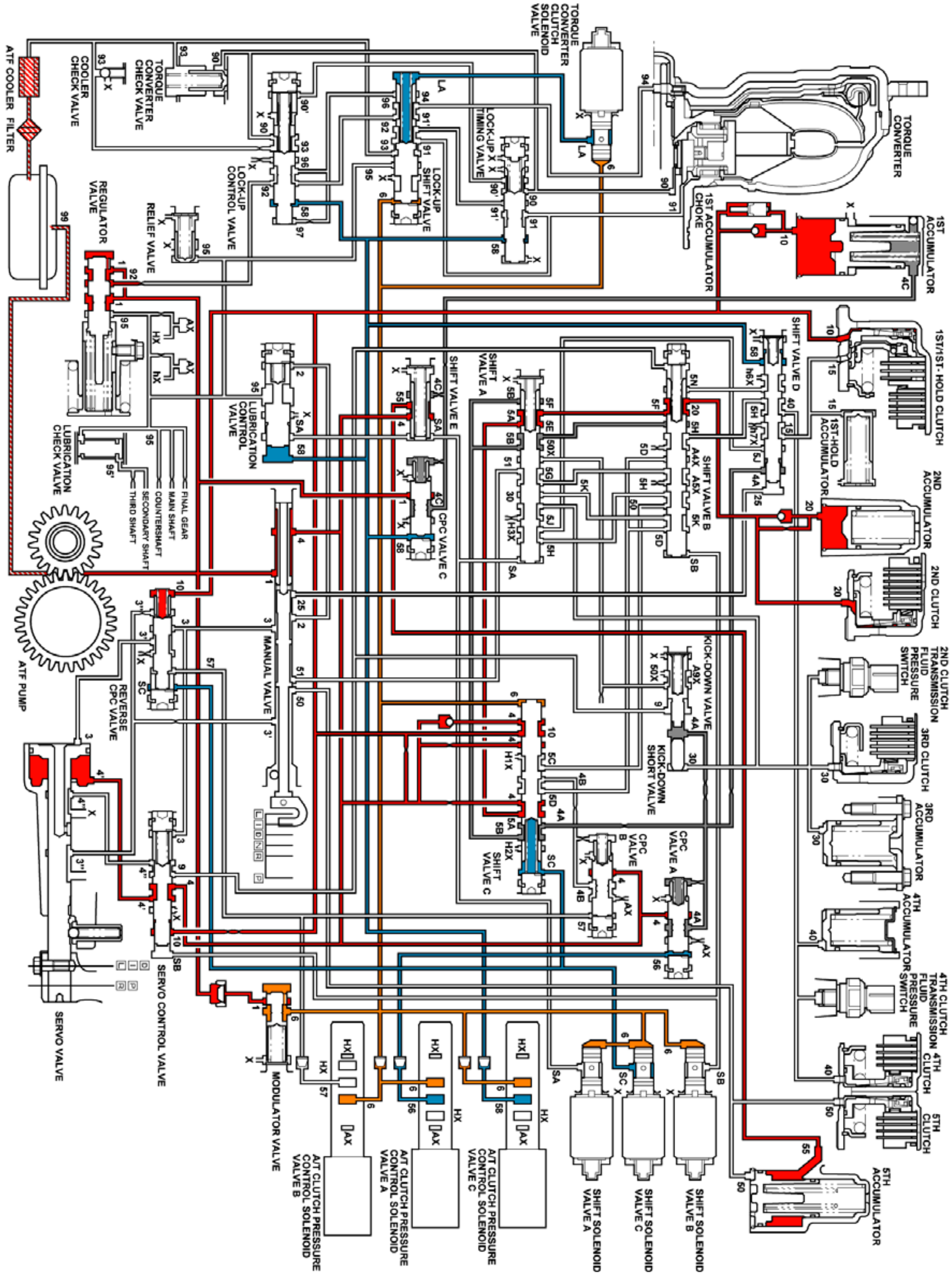


Fig. 33: Low Range - Second Gear
Courtesy of GENERAL MOTORS CORP.

FLUID PASSAGES

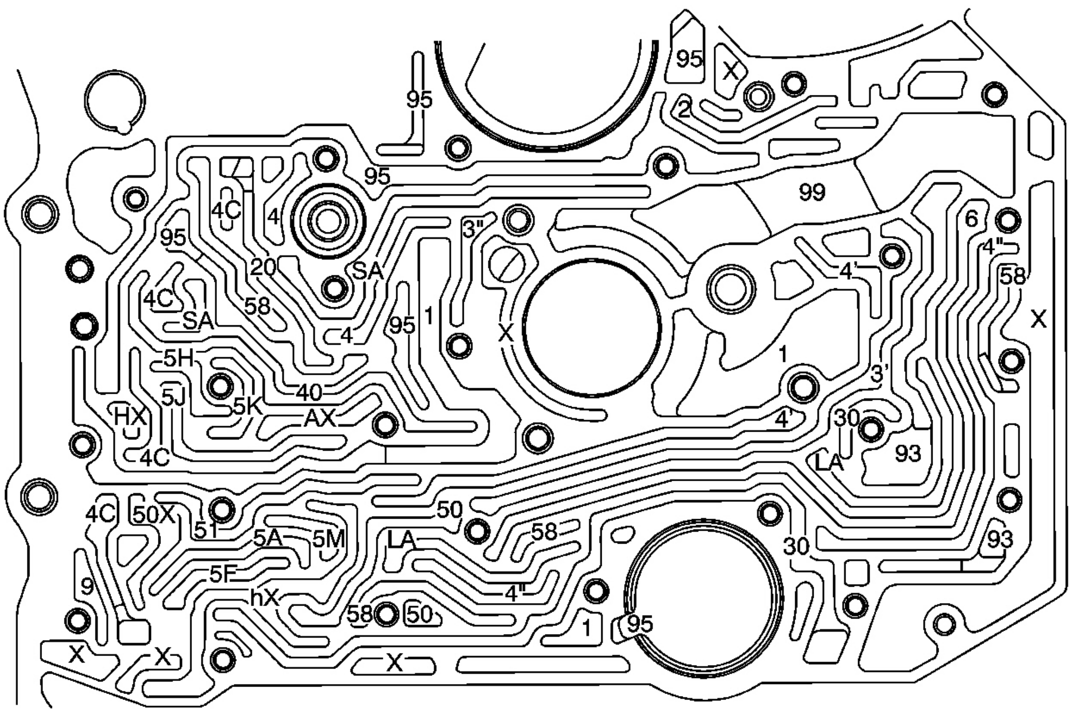


Fig. 34: Torque Converter Case Fluid Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 576

Callout	Component Name
1	Line
3	Reverse CPC or Line
4	Line
4	Line
4	Line
4c	CPC TCC
5a	CPC A or Line
5f	CPC A or Line
5h	CPC B
5j	CPC B
5k	CPC B or Line
5m	CPC A or Line
6	Modulate
9	Line
20	2nd Clutch
30	3rd Clutch

40	4th Clutch
50	5th Clutch
51	5th Clutch
58	LS C
93	ATF Cooler
95	Lubrication
95	Lubrication
99	Suction
ax	Air Drain
hx	High Position Drain
hx	High Position Drain
la	LC A
sa	SH A
x	Drain
x	Drain

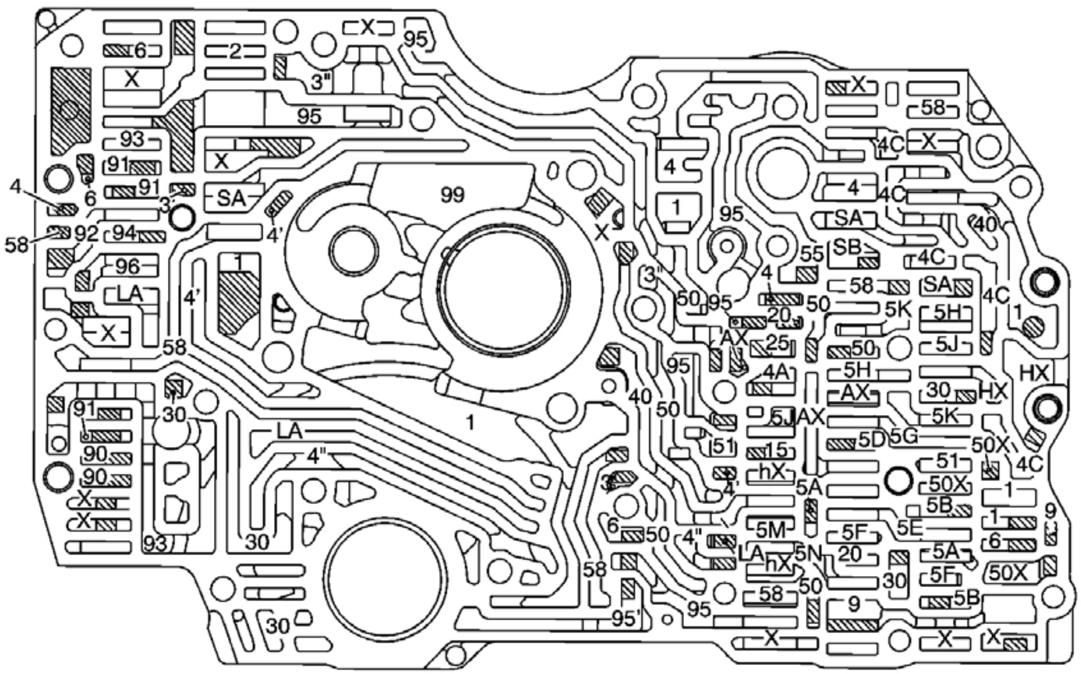


Fig. 35: Main Valve Body Fluid Passages - Torque Converter Case Side
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 577

Callout	Component Name
1	Line

2	Line
3	Reverse CPC or Line
3	Reverse CPC or Line
4	Line
4	Line
4	Line
4a	CPC A
4c	CPC TCC
5b	CPC A
5c	CPC B
5h	CPC B
5j	CPC B
5a	CPC A or Line
5e	CPC A or Line
5f	CPC A or Line
5m	CPC A or Line
5n	CPC A or Line
5d	CPC B or Line
5g	CPC B or Line
5k	CPC B or Line
6	Modulate
9	Line
15	Coast Clutch
20	2nd Clutch
25	Line
30	3rd Clutch
40	4th Clutch
50	5th Clutch
51	5th Clutch
55	CPC TCC or Line
58	LS C
90	Torque Converter
90	Torque Converter
91	Torque Converter
91	Torque Converter
92	Torque Converter
93	ATF Cooler
94	Torque Converter
95	Lubrication
95	Lubrication
96	Torque Converter

99	Suction
x	Drain
hx	High Position Drain
hx	High Position Drain
ax	Air Drain
sa	SH A
sb	SH B
la	LC A
la	LC A

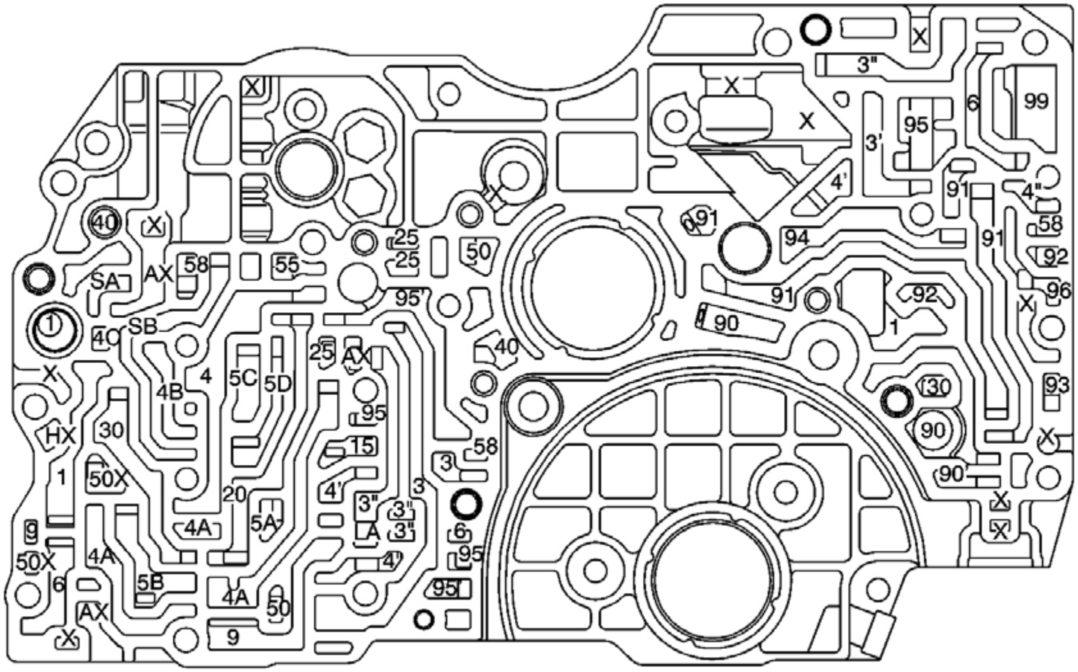


Fig. 36: Main Valve Body Fluid Passages - Regulator Body Side
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 578

Callout	Component Name
1	Line
3	Line
3	Reverse CPC or Line
3	Reverse CPC or Line
4	Line
4	Line
4	Line

4a	CPC A
4b	CPC B
4c	CPC TCC
5a	CPC A or Line
5b	CPC A
5c	CPC B
5d	CPC B or Line
6	Modulate
9	Line
15	Coast Clutch
20	2nd Clutch
25	Line
30	3rd Clutch
40	4th Clutch
50	5th Clutch
55	CPC TCC or Line
58	LS C
90	Torque Converter
90	Torque Converter
91	Torque Converter
91	Torque Converter
92	Torque Converter
93	ATF Cooler
94	Torque Converter
95	Lubrication
95	Lubrication
96	Torque Converter
99	Suction
ax	Air Drain
hx	High Position Drain
la	LC A
sa	SH A
sb	SH B
x	Drain

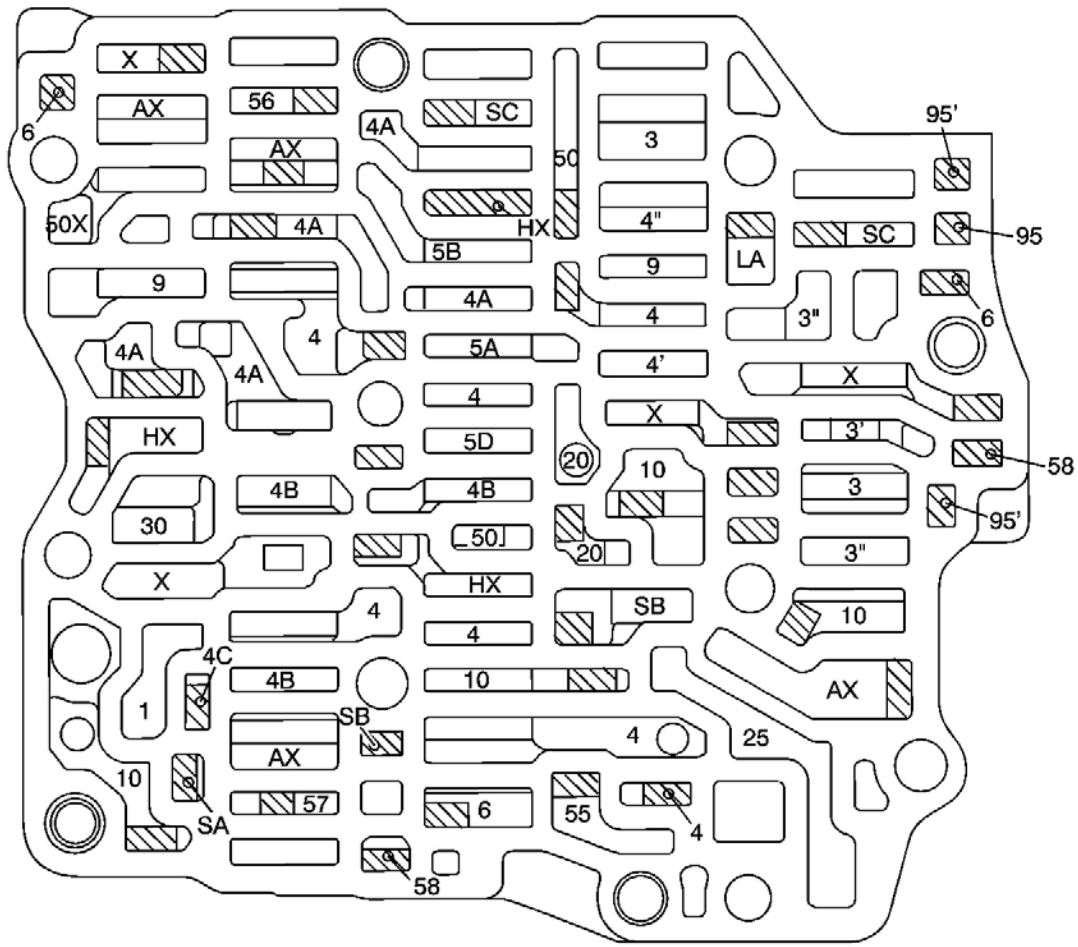


Fig. 37: Secondary Valve Body Fluid Passages - Main Valve Body Side
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 579

Callout	Component Name
1	Line
3	Line
3	Reverse CPC or Line
3	Reverse CPC or Line
4	Line
4	Line
4	Line
4a	CPC A
4b	CPC B
4c	CPC TCC

5a	CPC A or Line
5b	CPC A
5c	CPC B
5d	CPC B or Line
6	Modulate
9	Line
10	1st Clutch
15	Coast Clutch
20	2nd Clutch
25	Line
30	3rd Clutch
50	5th Clutch
55	CPC TCC or Line
56	LSA
57	LSB
58	LSC
95	Lubrication
95	Lubrication
ax	Air Drain
hx	High Position Drain
la	LC A
sa	SH A
sb	SH B
sc	SH C
x	Drain

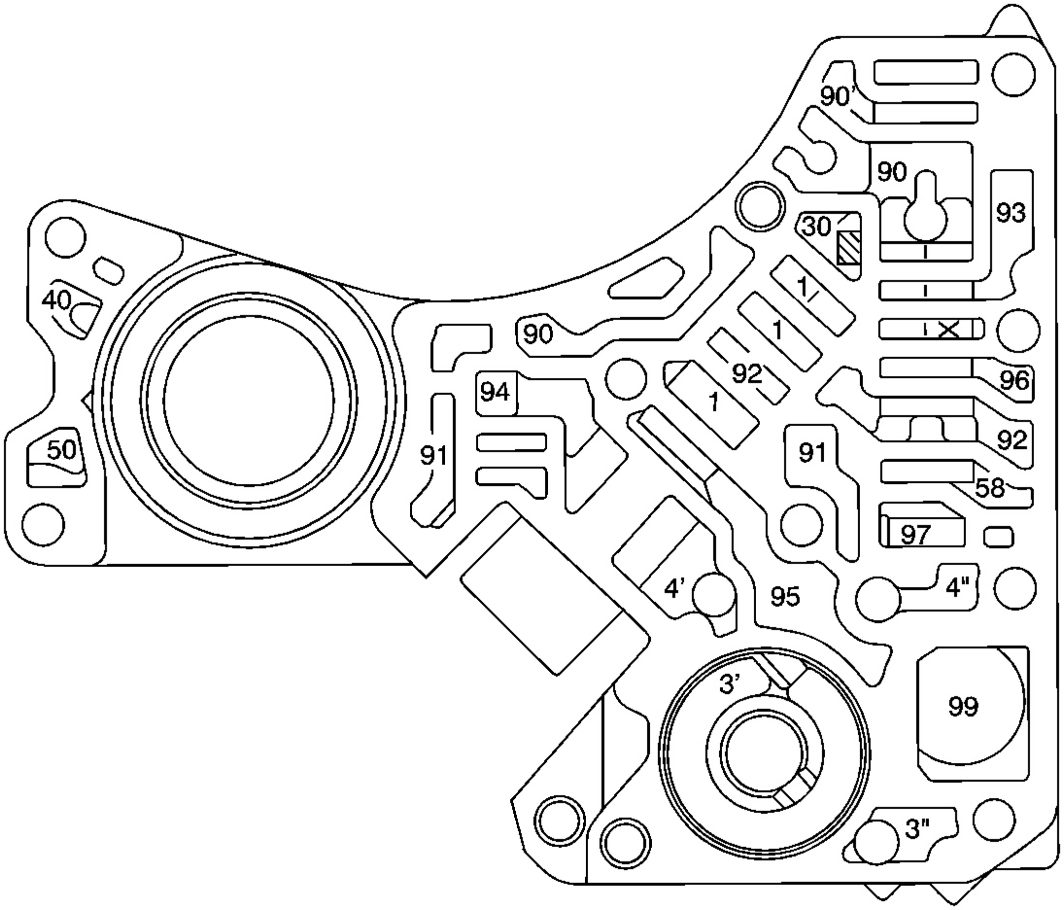


Fig. 38: Regulator Body Fluid Passages - Main Valve Body Side
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 580

Callout	Component Name
1	Line
3	Reverse CPC or Line
3	Reverse CPC or Line
4	Line
4	Line
30	3rd Clutch
40	4th Clutch
50	5th Clutch
58	LS C
90	Torque Converter
90	Torque Converter

91	Torque Converter
92	Torque Converter
93	ATF Cooler
94	Torque Converter
95	Lubrication
96	Torque Converter
97	Torque Converter
99	Suction
x	Drain

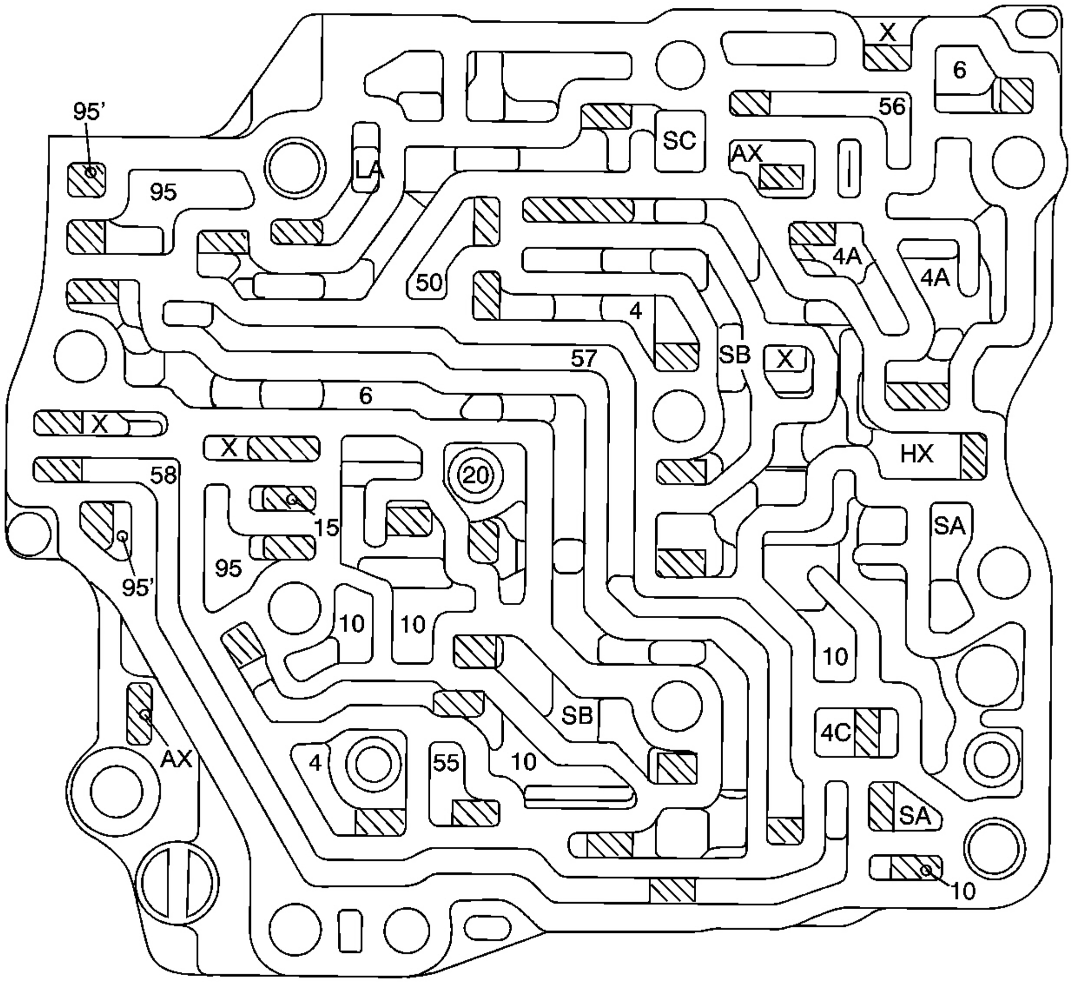


Fig. 39: Secondary Valve Body Fluid Passages - Accumulator Body Side
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 581

Callout	Component Name
4	Line
4a	CPC A
4c	CPC TCC
6	Modulate
10	1st Clutch
15	Coast Clutch
20	2nd Clutch
50	5th Clutch
55	CPC TCC or Line
56	LS A
57	LS B
58	LS C
95	Lubrication
91	Torque Converter
95	Lubrication
ax	Air Drain
hx	High Position Drain
la	LC A
sa	SH A
sb	SH B
sc	SH C
x	Drain

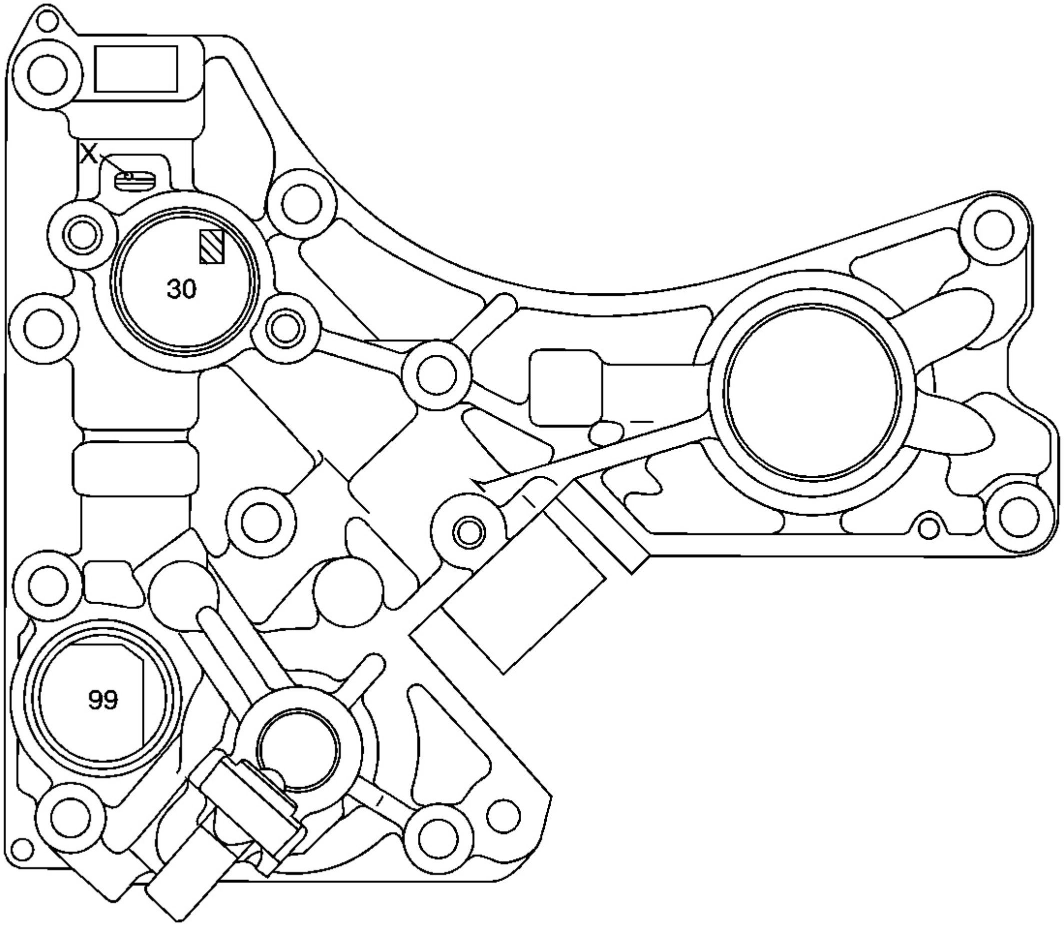


Fig. 40: Regulator Body Fluid Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 582

Callout	Component Name
30	3rd Clutch
99	Suction
x	Drain

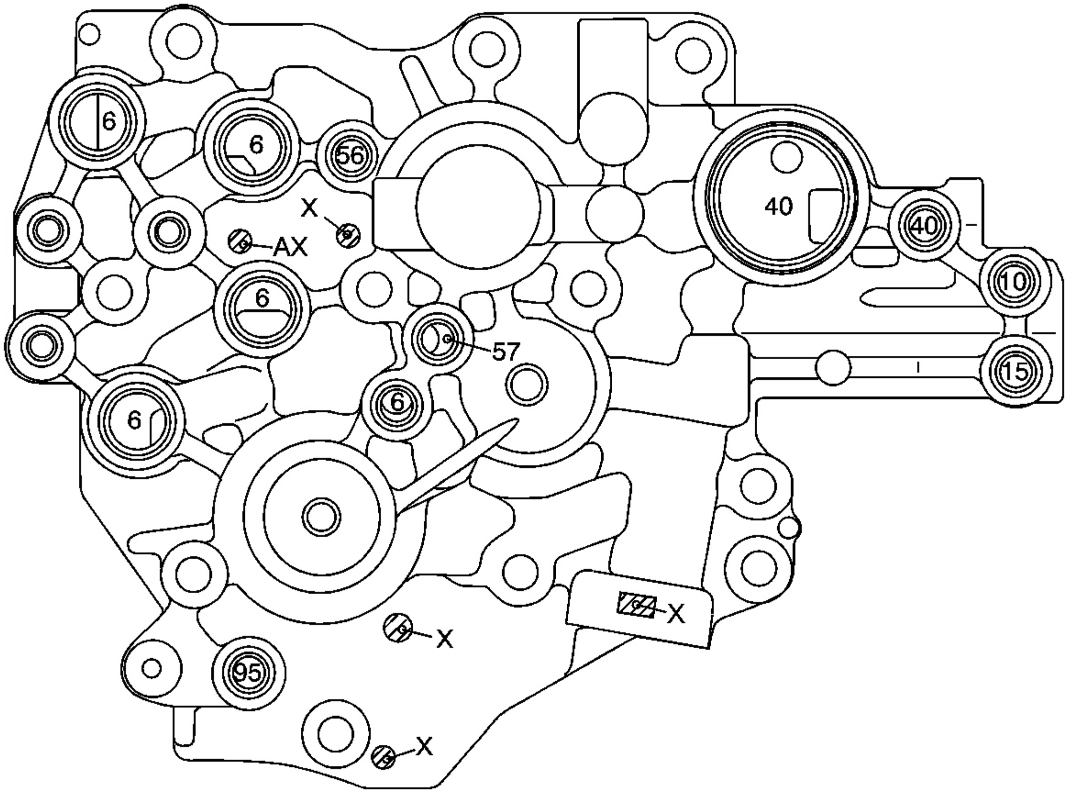


Fig. 41: Accumulator Body Fluid Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 583

Callout	Component Name
6	Modulate
10	1st Clutch
15	Coast Clutch
40	4th Clutch
56	LS A
57	LS B
95	Lubrication
ax	Air Drain
x	Drain

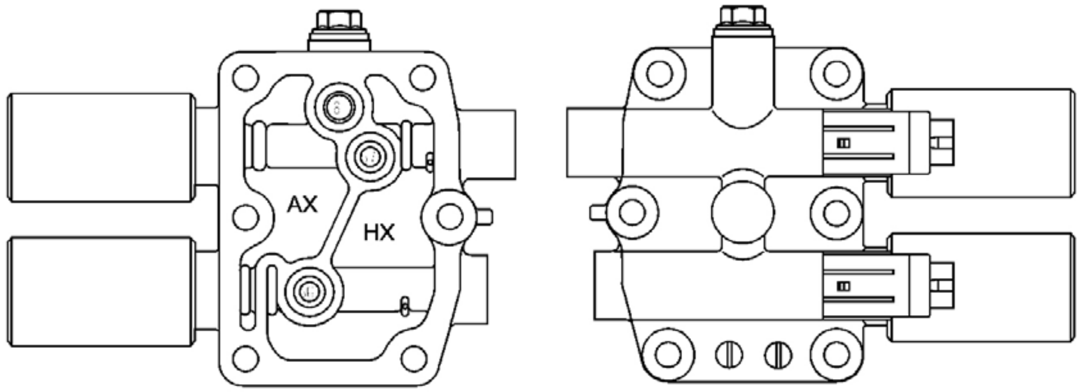


Fig. 42: AT Clutch Pressure Control Solenoid Valve Fluid Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 584

Callout	Component Name
6	Modulate
56	LS A
57	LS B
ax	Air Drain
hx	High Position Drain

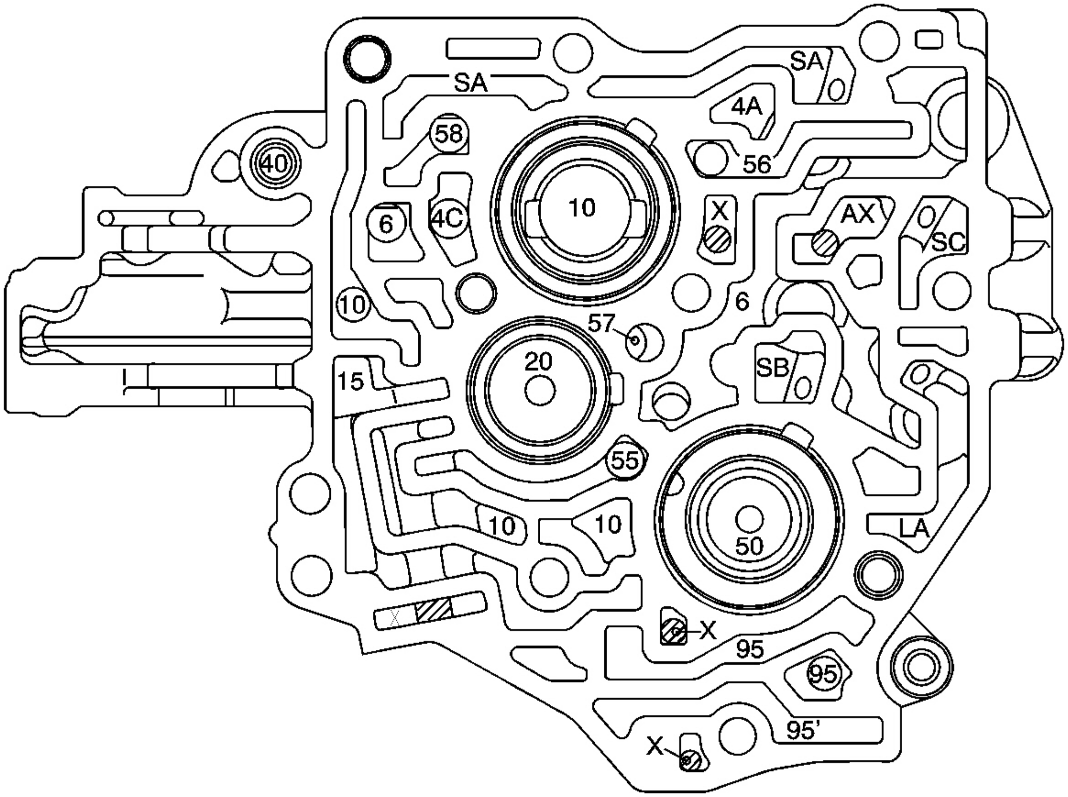


Fig. 43: Accumulator Body Fluid Passages - Secondary Valve Body Side
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 585

Callout	Component Name
4a	CPC A
4c	CPC TCC
6	Modulate
9	Line
10	1st Clutch
15	Coast Clutch
20	2nd Clutch
40	4th Clutch
50	5th Clutch
55	CPC TCC or Line
56	LS A
57	LS B
58	LS C
95	Lubrication

95	Lubrication
ax	Air Drain
la	LC A
sa	SH A
sb	SH B
sc	SH C
x	Drain

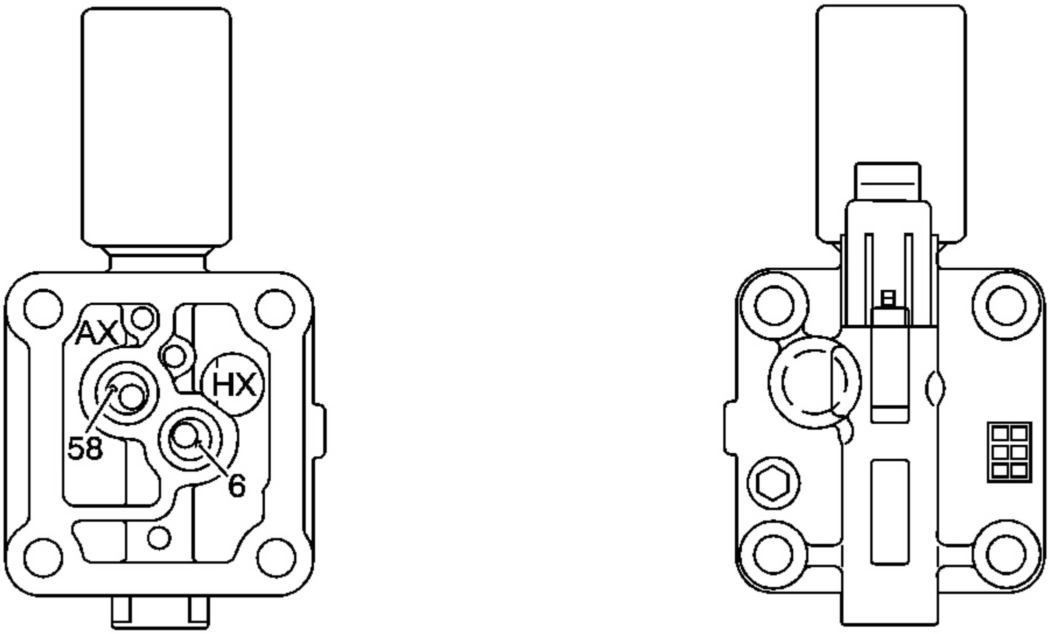


Fig. 44: Lock Up Solenoid Valve Fluid Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 586

Callout	Component Name
6	Modulate
58	LS C
ax	Air Drain
hx	High Position Drain

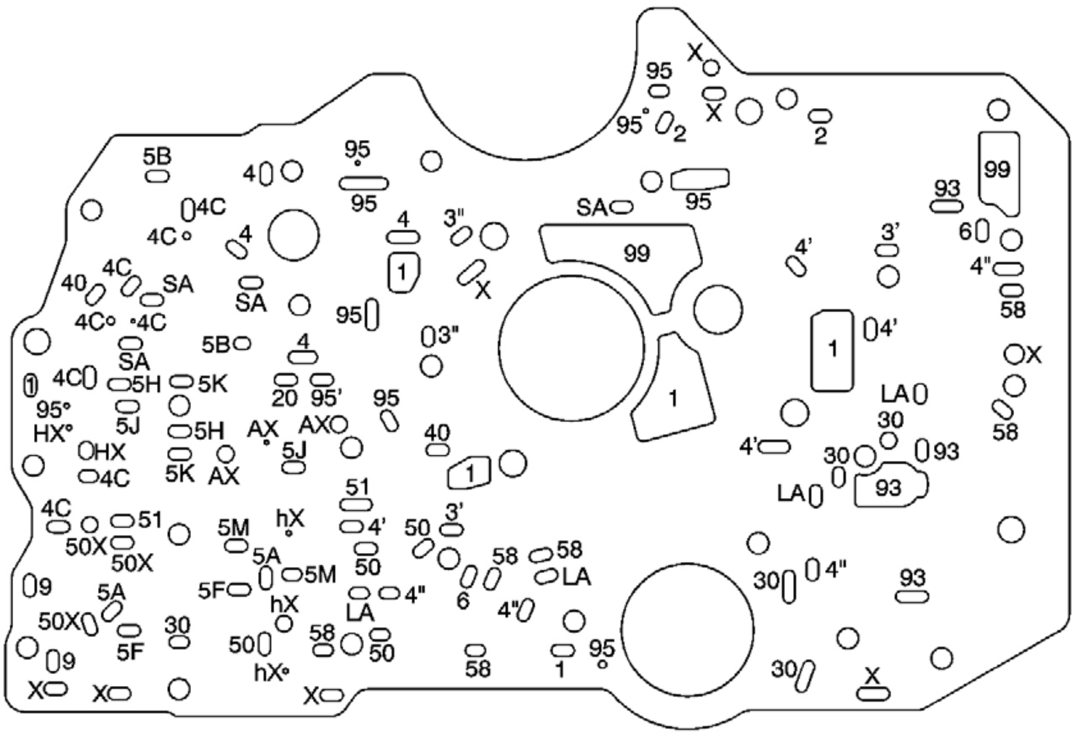


Fig. 45: Main Separator Plate Fluid Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 587

Callout	Component Name
1	Line
2	Line
3	Reverse CPC or Line
3	Reverse CPC or Line
4	Line
4	Line
4	Line
4c	CPC TCC
5a	CPC A or Line
5f	CPC A or Line
5h	CPC B
5j	CPC B
5k	CPC B or Line
5m	CPC A or Line
6	Modulate

9	Line
20	2nd Clutch
30	3rd Clutch
40	4th Clutch
50	5th Clutch
51	5th Clutch
58	LS C
93	ATF Cooler
95	Lubrication
95	Lubrication
99	Suction
ax	Air Drain
hx	High Position Drain
hx	High Position Drain
la	LC A
sa	SH A
x	Drain
x	Drain

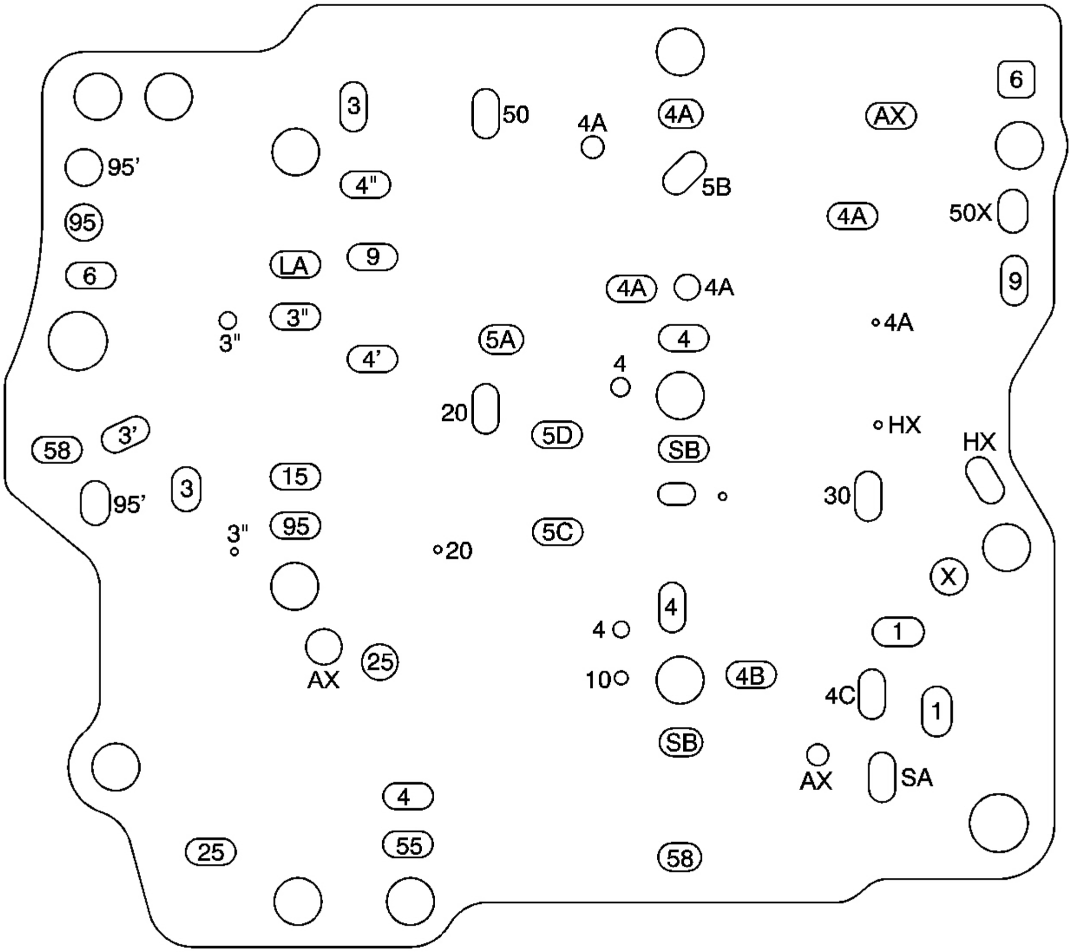


Fig. 46: Secondary Separator Plate Fluid Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 588

Callout	Component Name
1	Line
3	Line
3	Reverse CPC or Line
3	Reverse CPC or Line
4	Line
4	Line
4	Line
4a	CPC A
4b	CPC B
4c	CPC TCC

5a	CPC A or Line
5b	CPC A
5c	CPC B
5d	CPC B or Line
6	Modulate
9	Line
10	1st Clutch
15	Coast Clutch
20	2nd Clutch
25	Line
30	3rd Clutch
50	5th Clutch
55	CPC TCC or Line
58	LS C
95	Lubrication
95	Lubrication
ax	Air Drain
hx	High Position Drain
la	LC A
sa	SH A
sb	SH B
sc	SH C
x	Drain

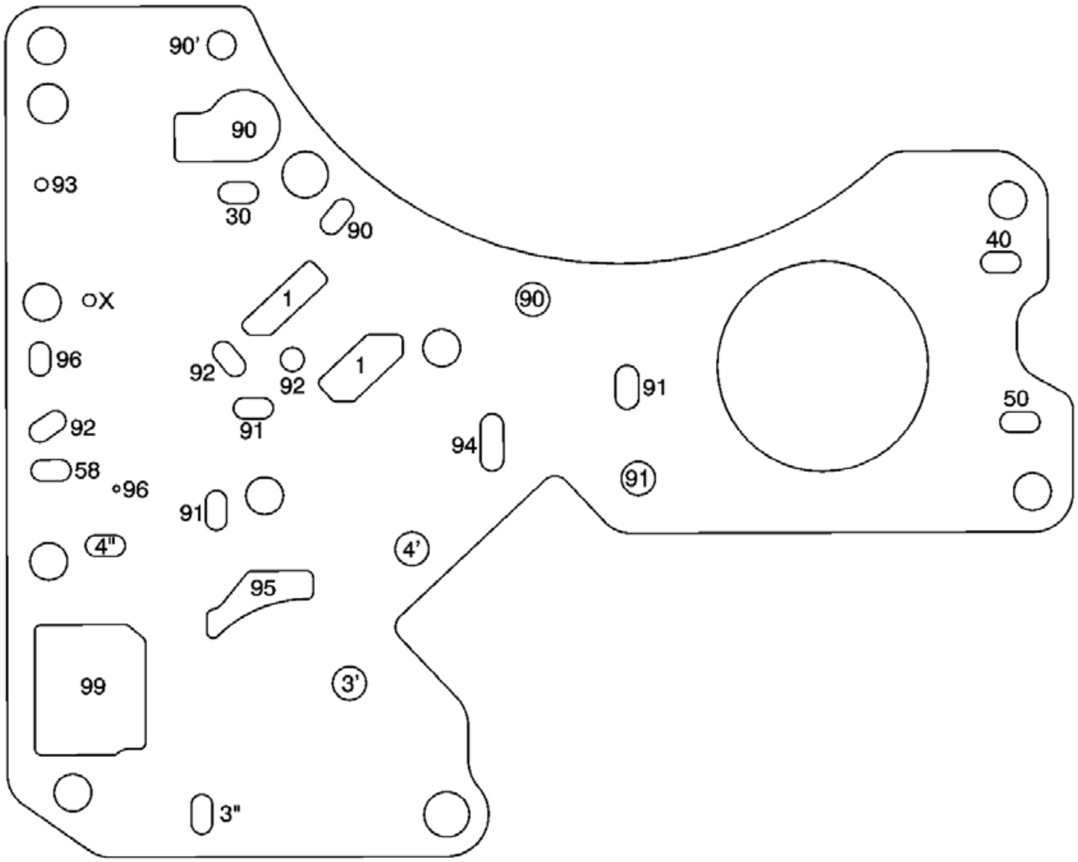


Fig. 47: Regulator Separating Plate Fluid Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 589

Callout	Component Name
1	Line
3	Reverse CPC or Line
3	Reverse CPC or Line
4	Line
4	Line
30	3rd Clutch
40	Clutch
50	5th Clutch
58	LS C
90	Torque Converter
91	Torque Converter
92	Torque Converter

93	ATF Cooler
94	Torque Converter
95	Lubrication
96	Torque Converter
99	Suction
90	Torque Converter
x	Drain

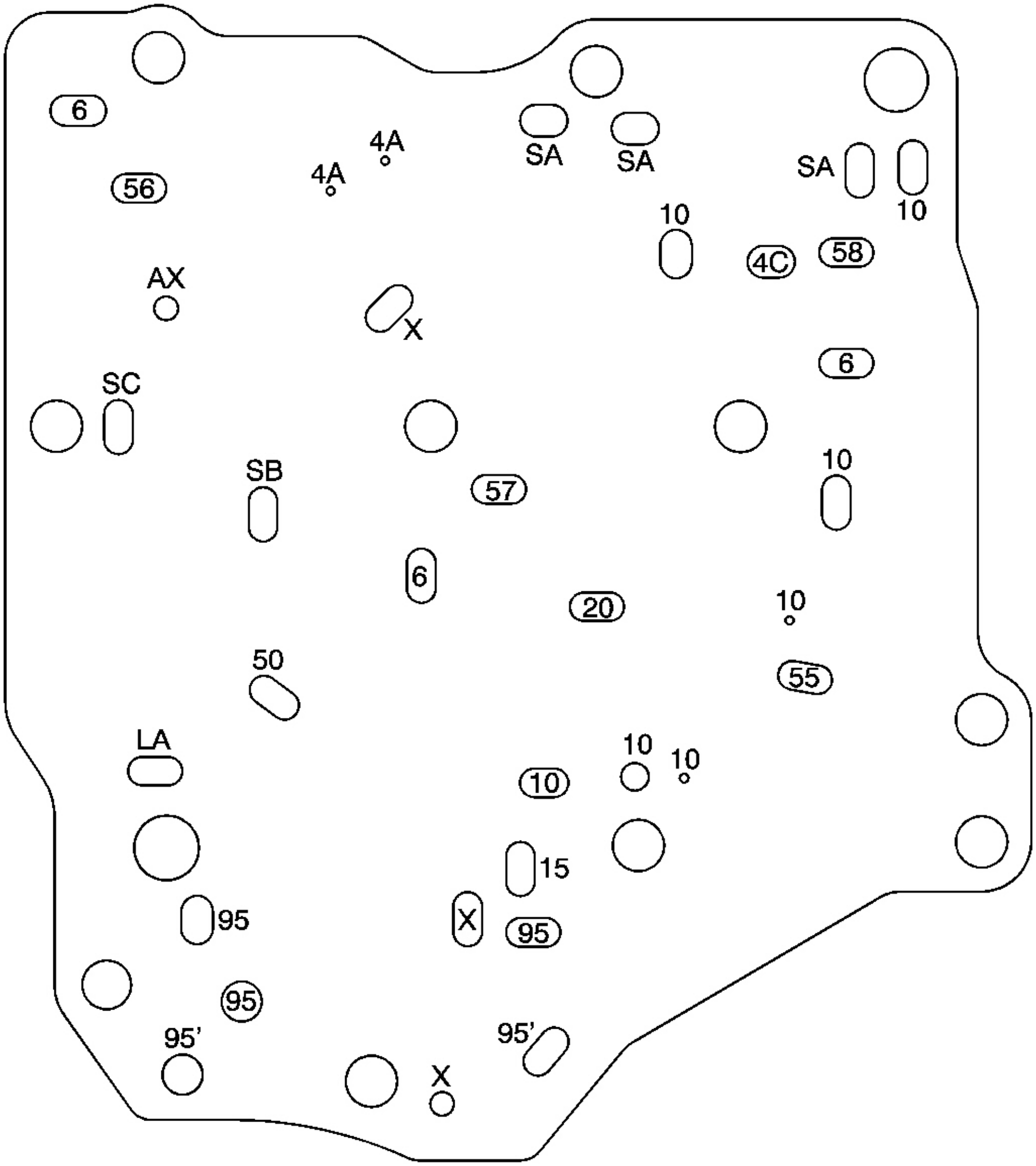


Fig. 48: Accumulator Separator Plate Fluid Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 590

Callout	Component Name
4a	CPC A
4c	CPC TCC
6	Modulate
10	1st Clutch
15	Coast Clutch
20	2nd Clutch
50	5th Clutch
55	CPC TCC or Line
56	LS A
57	LS B
58	LS C
95	Lubrication
95	Lubrication
ax	Air Drain
la	LC A
sa	SH A
sb	SH B
sc	SH C
x	Drain

TRANSMISSION GENERAL INFORMATION

How to Use This Section

This section provides the following information:

- General diagnosis information on transmissions
- Procedures for diagnosing the Hydra-Matic(R) transmission

When you diagnose any condition of the Hydra-Matic(R) transmission, begin with Diagnostic Starting Point. This procedure indicates the proper path of diagnosing the transmission by describing the basic checks. This procedure will then refer you to the locations of specific checks. After you have determined the cause of a condition, refer to Repair Instructions for repair procedures. If the faulty component is not serviceable without removing the transmission from the vehicle, refer to Unit Repair for repair information.

Basic Knowledge

NOTE: **Do not, under any circumstances, attempt to diagnose a powertrain condition**

without basic knowledge of this powertrain. If you perform diagnostic procedures without this basic knowledge, you may incorrectly diagnose the condition or damage the powertrain components.

You must be familiar with some basic electronics in order to use this section of the service manual. You should also be able to use the following special tools:

- A Digital Multimeter (DMM)
- A circuit tester
- Jumper wires or leads
- A line pressure gauge set

Diagnosis

NOTE: If you probe a wire with a sharp instrument and do not properly seal the wire afterward, the wire corrodes and an open circuit results.

Diagnostic test probes are now available that allow you to probe individual wires without leaving the wire open to the environment. These probe devices are inexpensive and easy to install, and they permanently seal the wire from corrosion.

DEFINITIONS AND ABBREVIATIONS

Throttle Positions

Engine Braking

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

Full Throttle Detent Downshift

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

Heavy Throttle

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

Light Throttle

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

Medium Throttle

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

Minimum Throttle

The least amount of throttle opening required for an upshift.

Wide Open Throttle (WOT)

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

Zero Throttle Coastdown

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

Shift Condition Definitions

Bump

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

Chuggle

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

Delayed

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

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.

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

Diagnostic Link Connector

DMM

Digital Multimeter

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

PNP

Park/Neutral Position

PWM

Pulse Width Modulation

RPM

Revolutions Per Minute

SS

Shift Solenoid

STL

Service Transmission Lamp

TAP

Transmission Adaptive Pressure

TCC

Torque Converter Clutch

TCM

Transmission Control Module

TFP

Transmission Fluid Pressure

TFT

Transmission Fluid Temperature

TP

Throttle Position

TV

Throttle Valve

VCM

Vehicle Control Module

VSS

Vehicle Speed Sensor

WOT

Wide Open Throttle

TRANSMISSION IDENTIFICATION INFORMATION

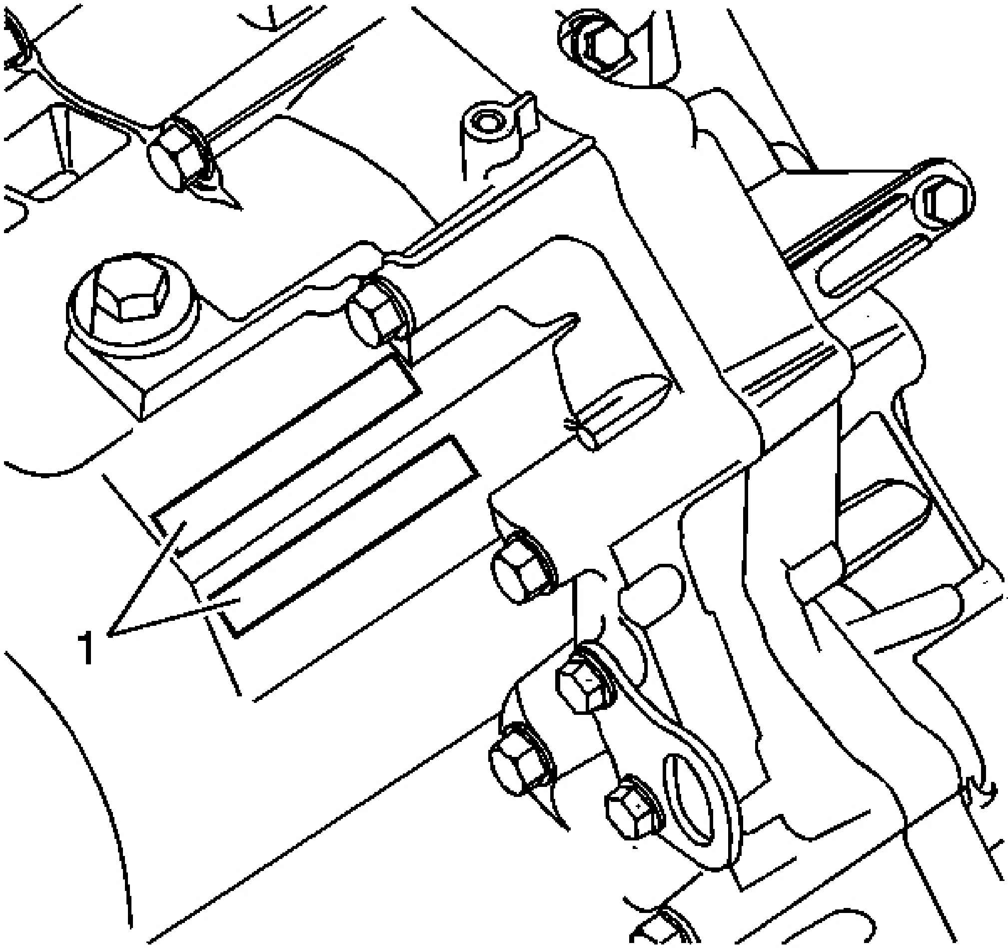


Fig. 49: Transmission Identification Information
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 591

Callout	Component Name
1	ID Tag

Transaxle (2WD)

MDRA 1000001

On the tag (1), the first 4 digits indicate transmission type, and the last 7 digits indicate serial number.

Transaxle (4WD)

MDPA 1000001

On the tag (1), the first 4 digits indicate transmission type, and the last 7 digits indicate serial number.

TRANSMISSION SYSTEM DESCRIPTION AND OPERATION

Gear Operation

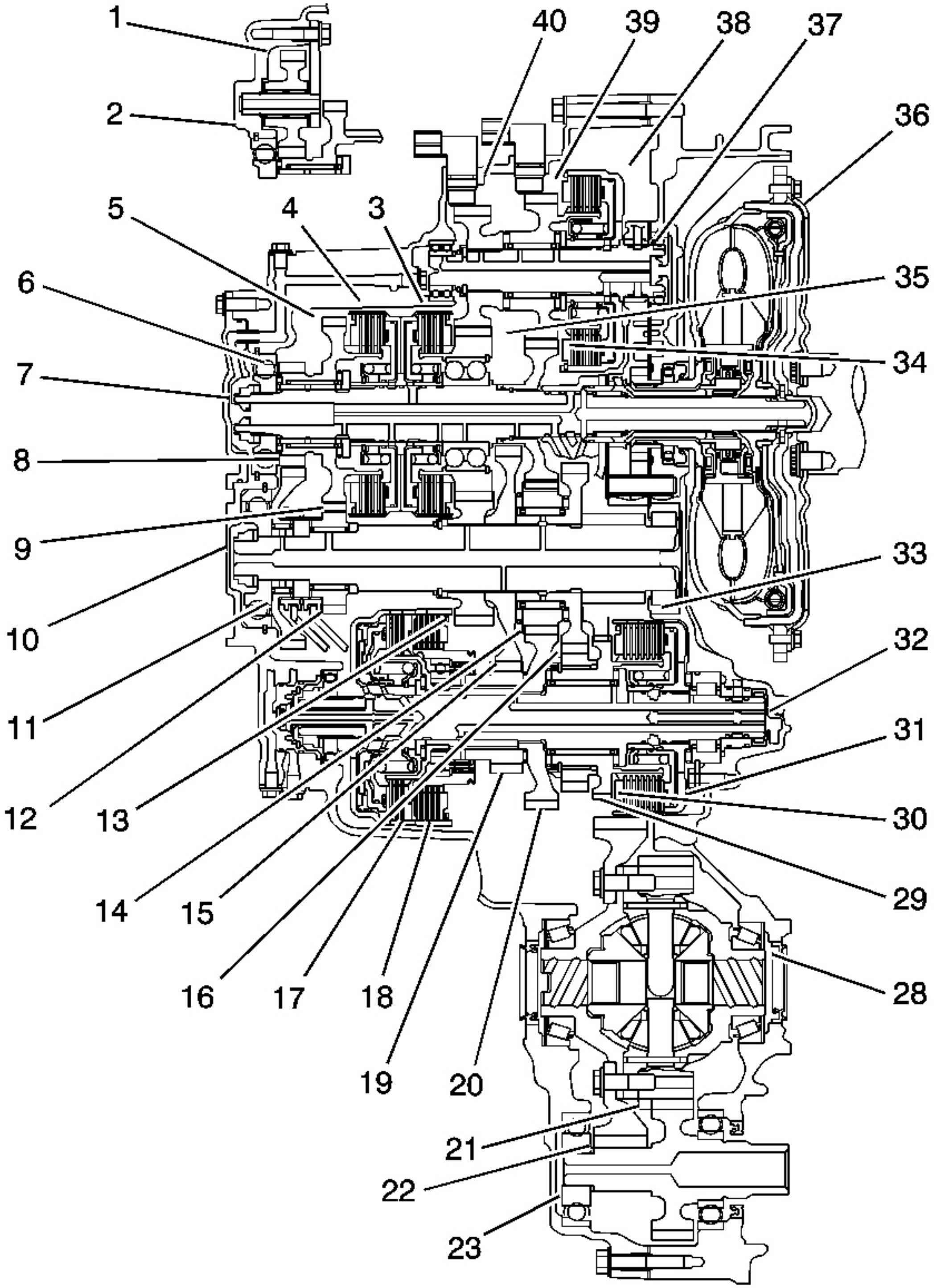


Fig. 50: Gear Operation
Courtesy of GENERAL MOTORS CORP.

Gears on the Mainshaft (7):

- 4th gear (35) is engaged/disengaged with the mainshaft (7) by the 4th clutch (3).
- 5th gear (5) is engaged/disengaged with the mainshaft (7) by the 5th clutch (4).
- Reverse gear (6) is engaged/disengaged with the mainshaft (7) by the 5th clutch (4).
- 3rd gear (34) is splined with the mainshaft (7) and rotates with the mainshaft (7).

Gears on the Output Shaft (10):

- Final gear is integral with the output shaft (10).
- 1st gear (15), 2nd gear (16), and 4th gear (13) are splined with the output shaft (10), and rotate with the output shaft (10).
- 5th gear (12) and reverse gear (8) rotate freely from the output shaft (10). The reverse selector engages 5th gear (12) and reverse gear (8) with the reverse selector hub (9). The reverse selector hub (9) is splined to the output shaft (10) so 5th gear (12) and reverse gear (8) engage with the output shaft (10).
- Idler gear (4) is located over the 2nd gear (16), and rotates freely from the output shaft (10).

Gears on the 1st/2nd Clutch Shaft (32):

- 1st gear (19) is engaged/disengaged with the 1st/2nd clutch shaft (32) by the 1st clutch (18). 1st gear (19) is engaged with the 1st/2nd clutch shaft (32) by the one-way clutch and the coast clutch (17) when decelerating for engine braking.
- 2nd gear (29) is engaged/disengaged with the 1st/2nd clutch shaft (32) by the 2nd clutch (31).
- Drive gear (20) is splined with the 1st/2nd clutch shaft (32), and rotates with the 1st/2nd clutch shaft (32).
- Park gear (30) is integral with the 2nd gear (29).

Gears on the 3rd Clutch Shaft (37):

- 3rd gear (39) is engaged/disengaged with the 3rd clutch shaft (37) by the 3rd clutch (38).
- 4th gear (40) is splined with the 3rd gear (39).

PNDI Power Flow

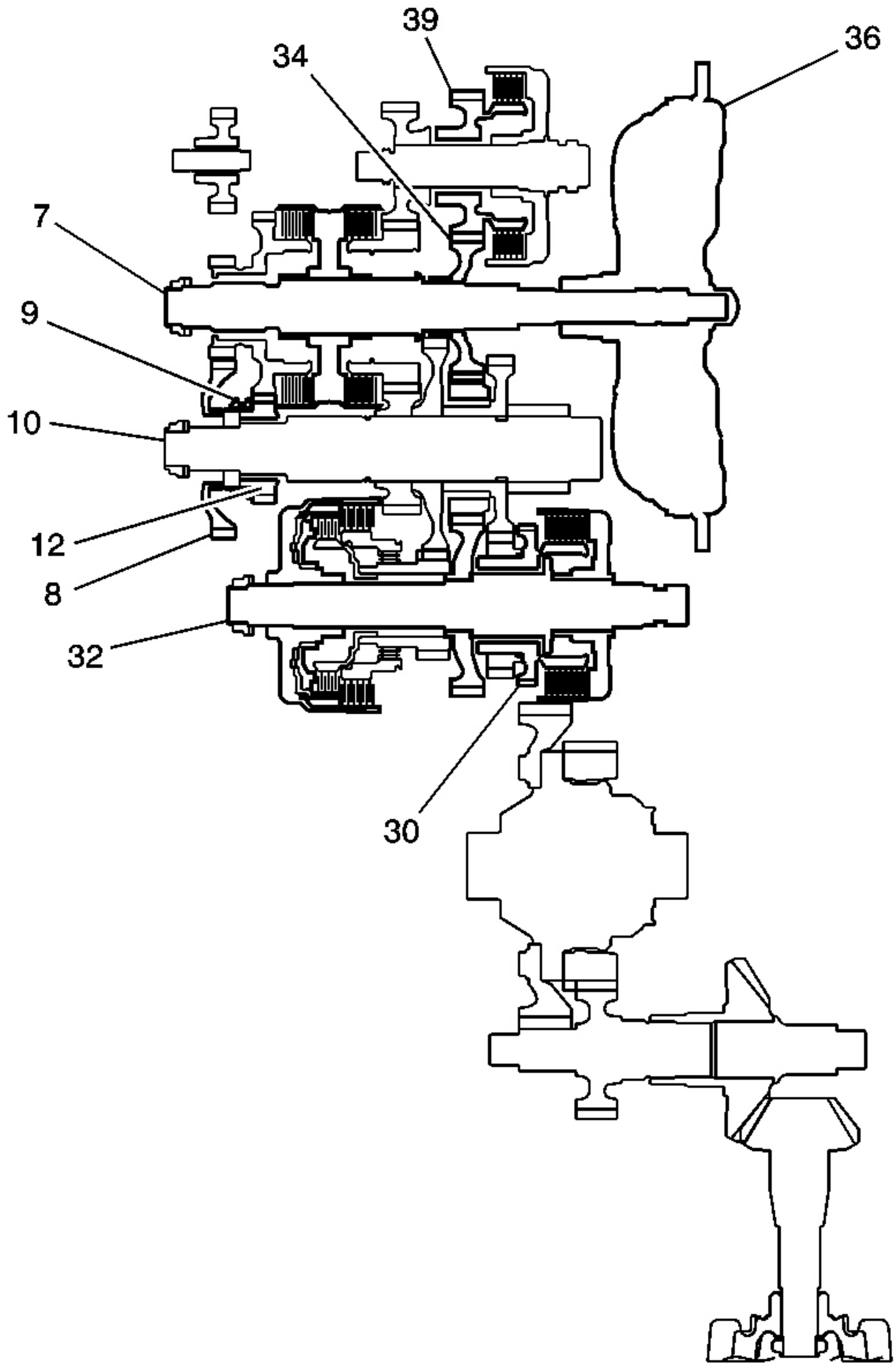


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Fig. 51: PNDI Power Flow
Courtesy of GENERAL MOTORS CORP.

P Position

Hydraulic pressure is not applied to the clutches. Power is not transmitted to the output shaft (10). The park pawl interlocking the park gear (30) locks the output shaft (10).

N Position

Engine power transmitted from the mainshaft (7) drives the mainshaft 3rd gear (34), the 3rd shaft 3rd gear (39), but hydraulic pressure is not applied to the clutches. Power is not transmitted to the output shaft (10). In the N position, the position of the reverse selector differs according to whether the shift lever was shifted from the D or P position in the following ways:

- When shifted from the D position, the reverse selector engages with the output shaft 5th gear (12) and the reverse selector hub (9), and the output shaft 5th gear (12) engages with the output shaft (10).
- When shifted from the R position, the reverse selector engages with the output shaft reverse gear (8) and the reverse selector hub (9), and the reverse gear (8) engages with the output shaft (10).

D or I Position

In the D position the optimum gear is automatically selected from the 1st, 2nd, 3rd, 4th, and 5th gears, and in the I position the optimum gear is automatically selected from the 1st, 2nd and 3rd gears according to conditions such as the balance between the throttle opening and vehicle speed.

1st Gear Power Flow

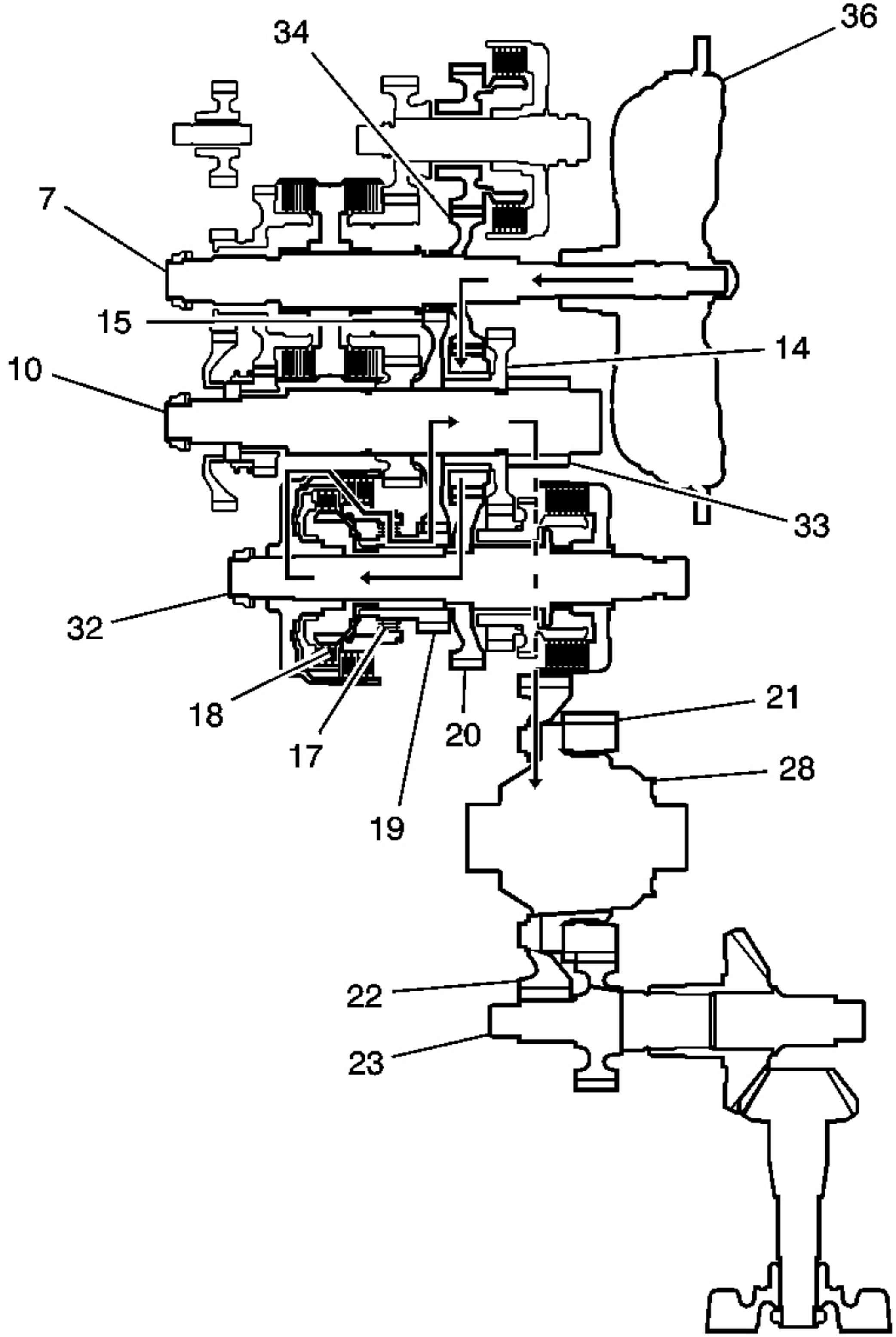
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Fig. 52: 1st Gear Power Flow
Courtesy of GENERAL MOTORS CORP.

- Hydraulic pressure is applied to the 1st clutch (18), then the 1st clutch (18) engages the 1st/2nd clutch shaft 1st gear (19) with the 1st/2nd clutch shaft (32) by the coast/one-way clutch (17).
- The mainshaft 3rd gear (34) drives the 1st/2nd clutch shaft (32) via the output shaft idler gear (14) and the 1st/2nd clutch shaft drive gear (20).
- The 1st/2nd clutch shaft 1st gear (19) drives the output shaft 1st gear (15) and the output shaft (10).
- IF AWD, power is transmitted to the final drive gear (33), which in turn drives the final driven gear (22) and the transfer drive gear (21). Then the transfer output shaft (23) drives the transfer case hypoid drive gear/shaft and the transfer output shaft/hypoid gear.
- If FWD, power is transmitted to the final drive gear (33) which in turn drives the final driven gear (22), which turns the front differential assembly (28).

2nd Gear Power Flow

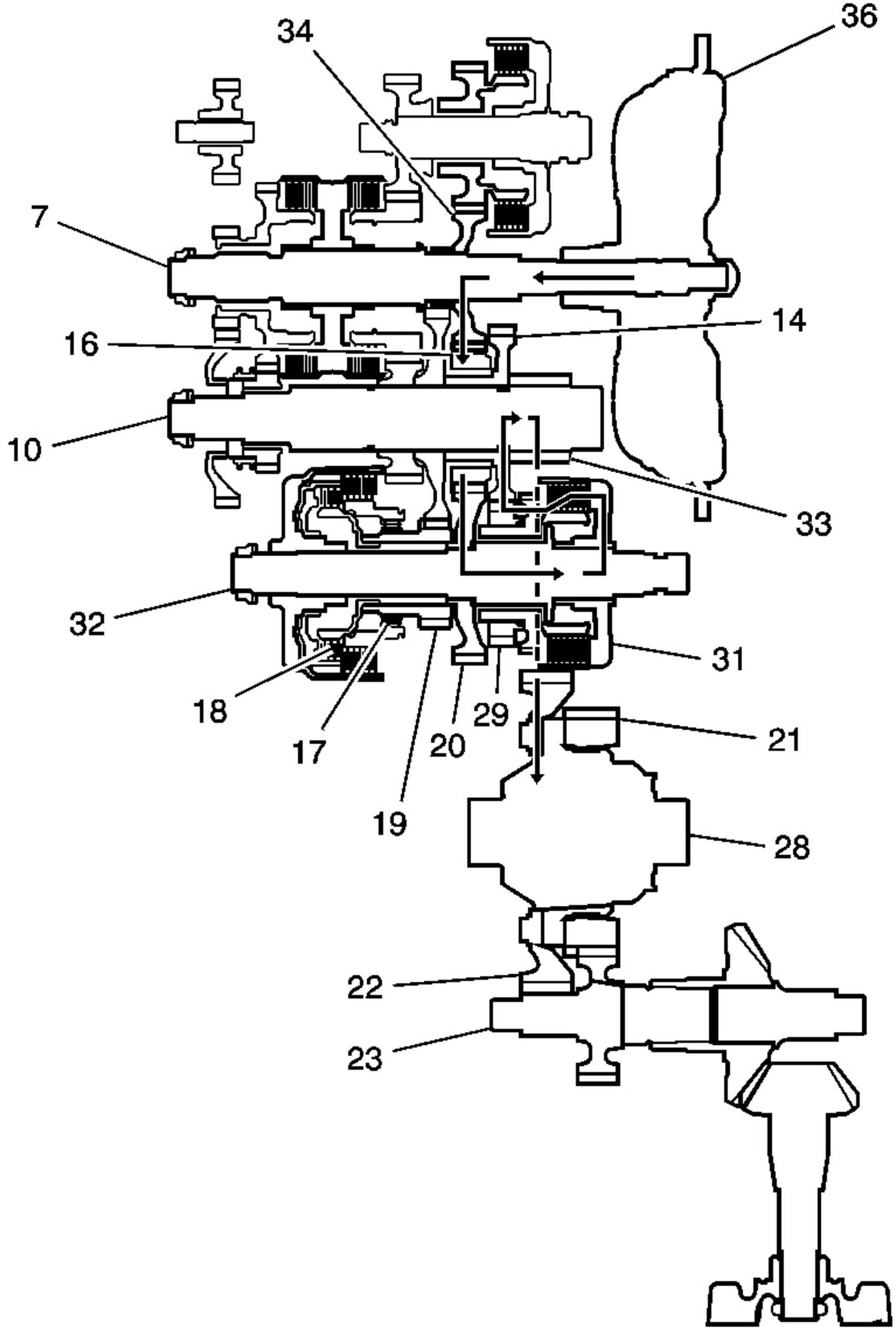
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Fig. 53: 2nd Gear Power Flow
Courtesy of GENERAL MOTORS CORP.

- Hydraulic pressure is applied to the 2nd clutch (31), then the 2nd clutch (31) engages the 1st/2nd clutch shaft 2nd gear (29) with the 1st/2nd clutch shaft (32).
- The mainshaft 3rd gear (34) drives the 1st/2nd clutch shaft (32) via the output shaft idler gear (14) and the 1st/2nd clutch shaft drive gear (20).
- The 1st/2nd clutch shaft 2nd gear (29) drives the output shaft 2nd gear (16) and the output shaft (10).
- IF AWD, power is transmitted to the final drive gear (33), which in turn drives the final driven gear (22) and the transfer drive gear (21). Then the transfer output shaft (23) drives the transfer case hypoid drive gear/shaft and the transfer output shaft/hypoid gear.
- If FWD, power is transmitted to the final drive gear (33) which in turn drives the final driven gear (22), which turns the front differential assembly (28).
- Hydraulic pressure is also applied to the 1st clutch (18), but since the rotation speed of 2nd gear (16) exceeds that of 1st gear (19), power from 1st gear (19) is cut off at the coast/one-way clutch (17).

3rd Gear Power Flow

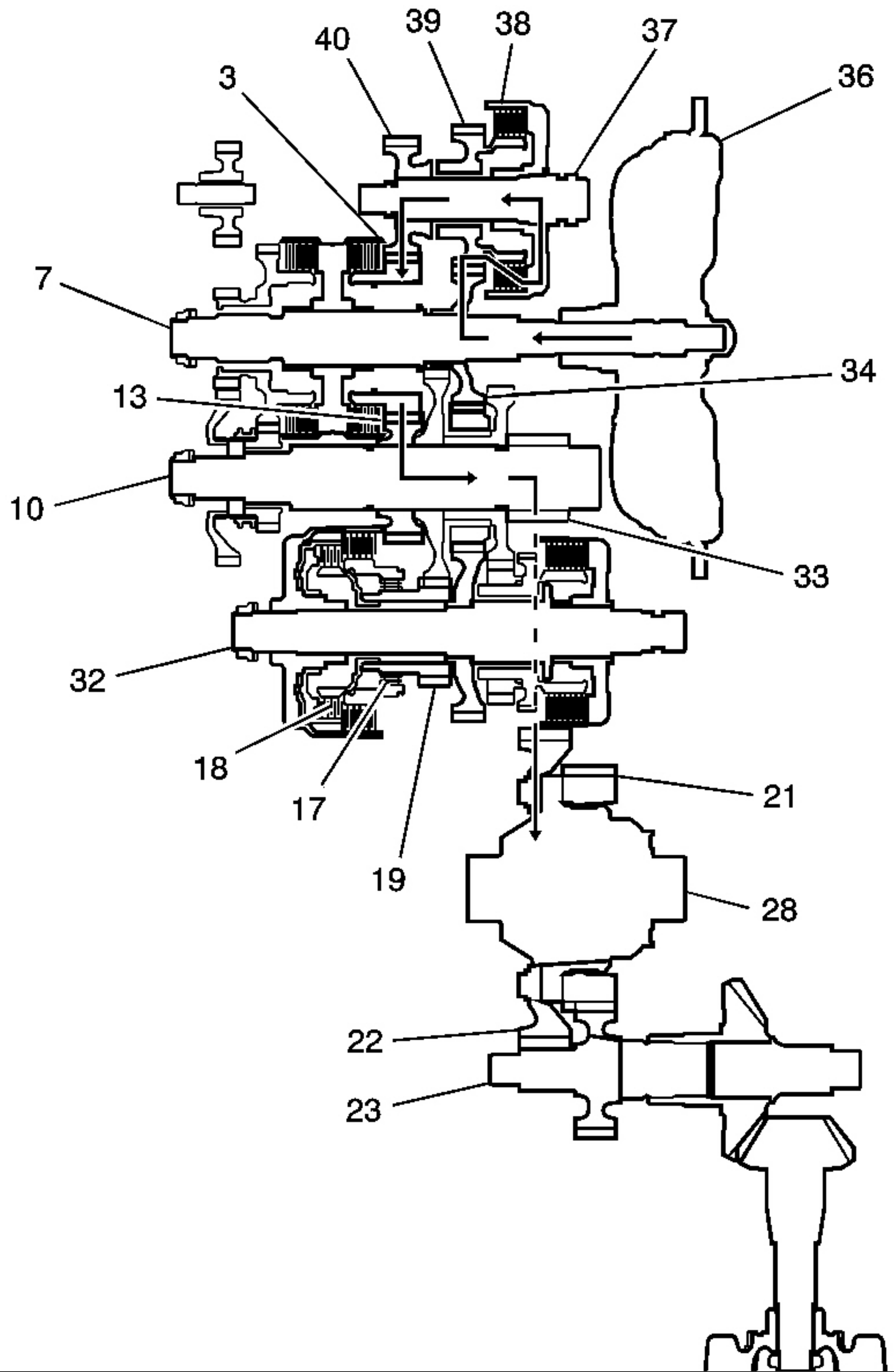

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Fig. 54: 3rd Gear Power Flow
Courtesy of GENERAL MOTORS CORP.

- Hydraulic pressure is applied to the 3rd clutch (38), then the 3rd clutch (38) engages the third shaft 3rd gear (39) with the third shaft (37).
- The mainshaft 3rd gear (34) drives the third shaft 4th gear (40) via the 3rd gear (39) and the 3rd clutch (38).
- The 3rd shaft 4th gear (40) drives the output shaft 4th gear (13) and the output shaft (10) via the mainshaft 4th gear (34).
- IF AWD, power is transmitted to the final drive gear (33), which in turn drives the final driven gear (22) and the transfer drive gear (21). Then the transfer output shaft (23) drives the transfer case hypoid drive gear/shaft and the transfer output shaft/hypoid gear.
- If FWD, power is transmitted to the final drive gear (33) which in turn drives the final driven gear (22), which turns the front differential assembly (28).
- Hydraulic pressure is also applied to the 1st clutch (18), but since the rotation speed of 3rd gear (34) exceeds that of 1st gear (19), power from 1st gear (19) is cut off at the coast/one-way clutch (17).

4th Gear Power Flow

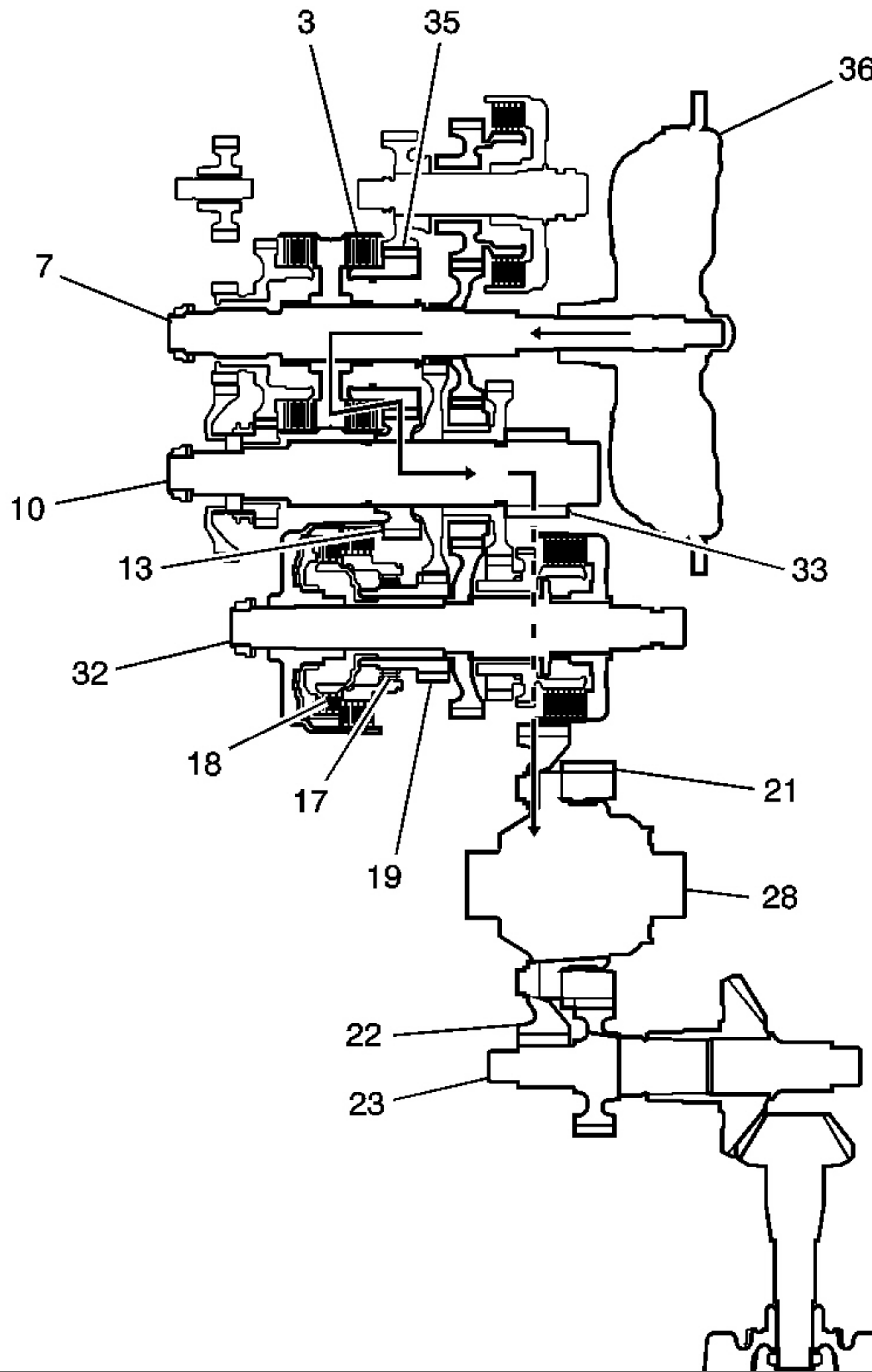

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Fig. 55: 4th Gear Power Flow
Courtesy of GENERAL MOTORS CORP.

- Hydraulic pressure is applied to the 4th clutch (3), then the 4th clutch (3) engages the mainshaft 4th gear (35) with the mainshaft (7).
- The mainshaft 4th gear (35) drives the output shaft 4th gear (13) and the output shaft (10).
- IF AWD, power is transmitted to the final drive gear (33), which in turn drives the final driven gear (22) and the transfer drive gear (21). Then the transfer output shaft (23) drives the transfer case hypoid drive gear/shaft and the transfer output shaft/hypoid gear.
- If FWD, power is transmitted to the final drive gear (33) which in turn drives the final driven gear (22), which turns the front differential assembly (28).
- Hydraulic pressure is also applied to the 1st clutch (18), but since the rotation speed of 4th gear (35) exceeds that of 1st gear (19), power from 1st gear (19) is cut off at the coast/one-way clutch (17).

5th Gear Power Flow

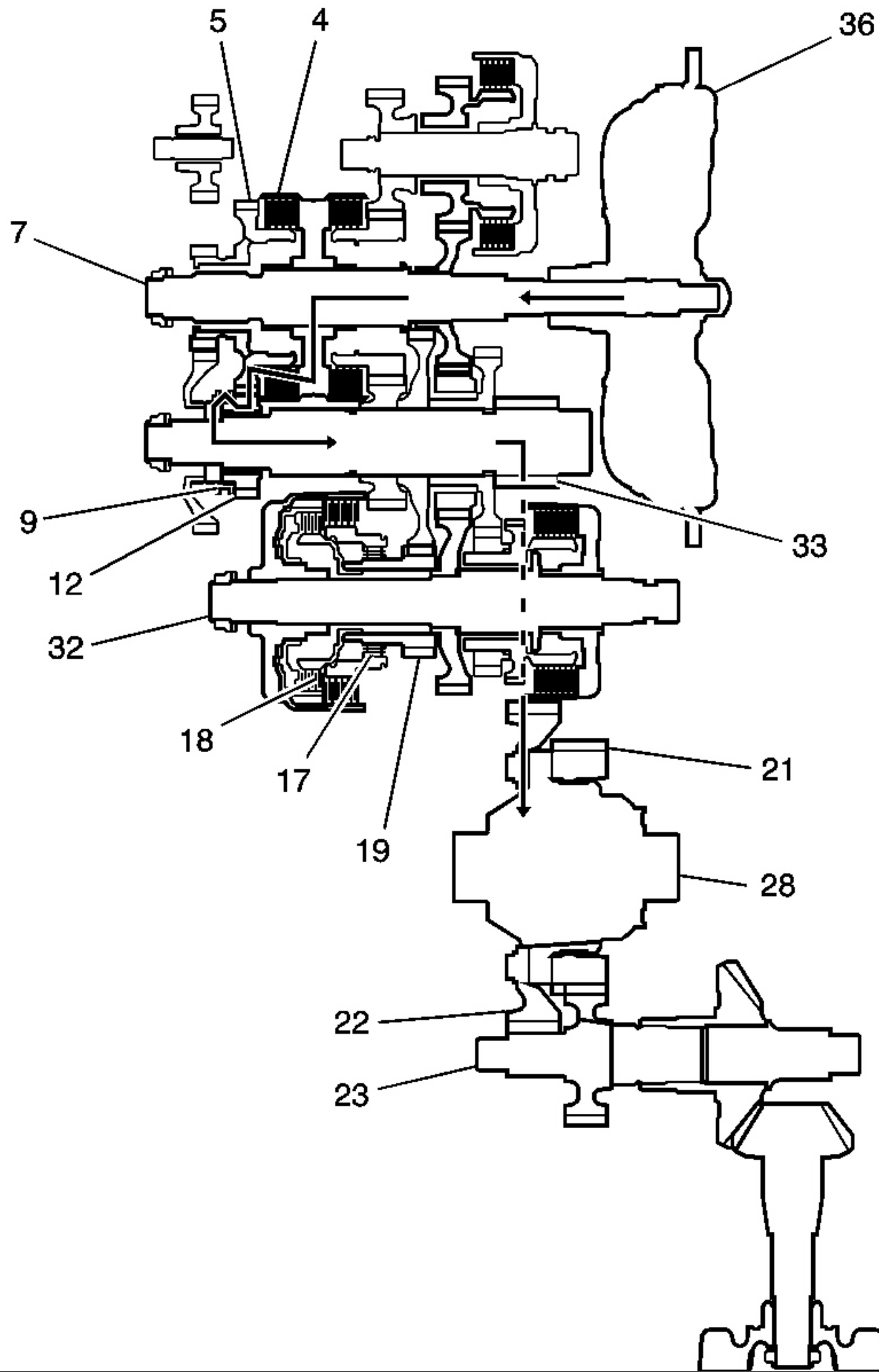
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Fig. 56: 5th Gear Power Flow
Courtesy of GENERAL MOTORS CORP.

- Hydraulic pressure is also applied to the 5th clutch (4), then the 5th clutch (4) engages the mainshaft 5th gear (5) with the mainshaft (7).
- The mainshaft 5th gear (5) drives the output shaft 5th gear (12), which drives the reverse selector hub (9) and the output shaft.
- IF AWD, power is transmitted to the final drive gear (33), which in turn drives the final driven gear (22) and the transfer drive gear (21). Then the transfer output shaft (23) drives the transfer case hypoid drive gear/shaft and the transfer output shaft/hypoid gear.
- If FWD, power is transmitted to the final drive gear (33) which in turn drives the final driven gear (22), which turns the front differential assembly (28).
- Hydraulic pressure is also applied to the 1st clutch (18), but since the rotation speed of 5th gear (12) exceeds that of 1st gear (19), power from 1st gear (19) is cut off at the coast/one-way clutch (17).

L Gear Power Flow

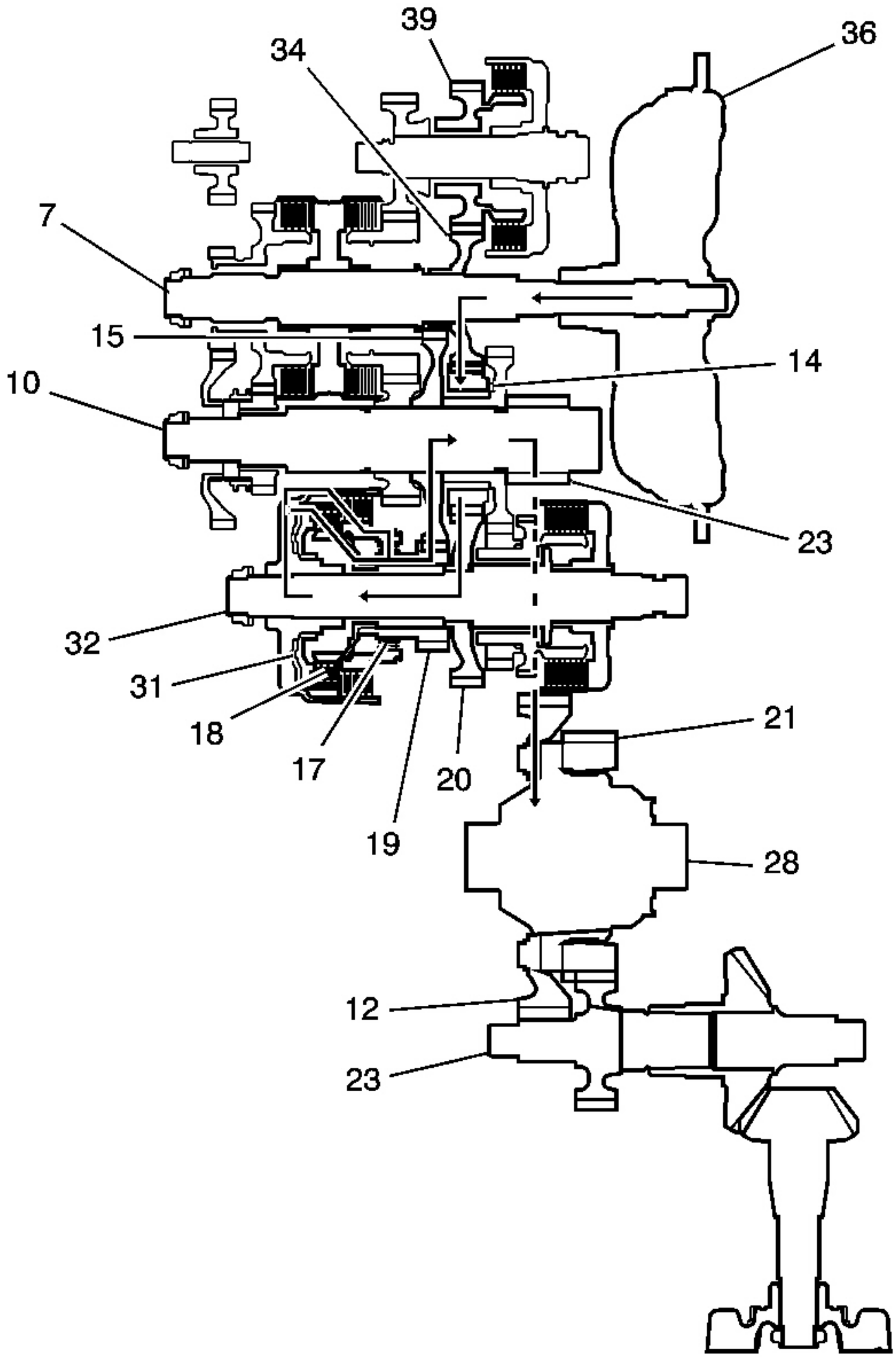

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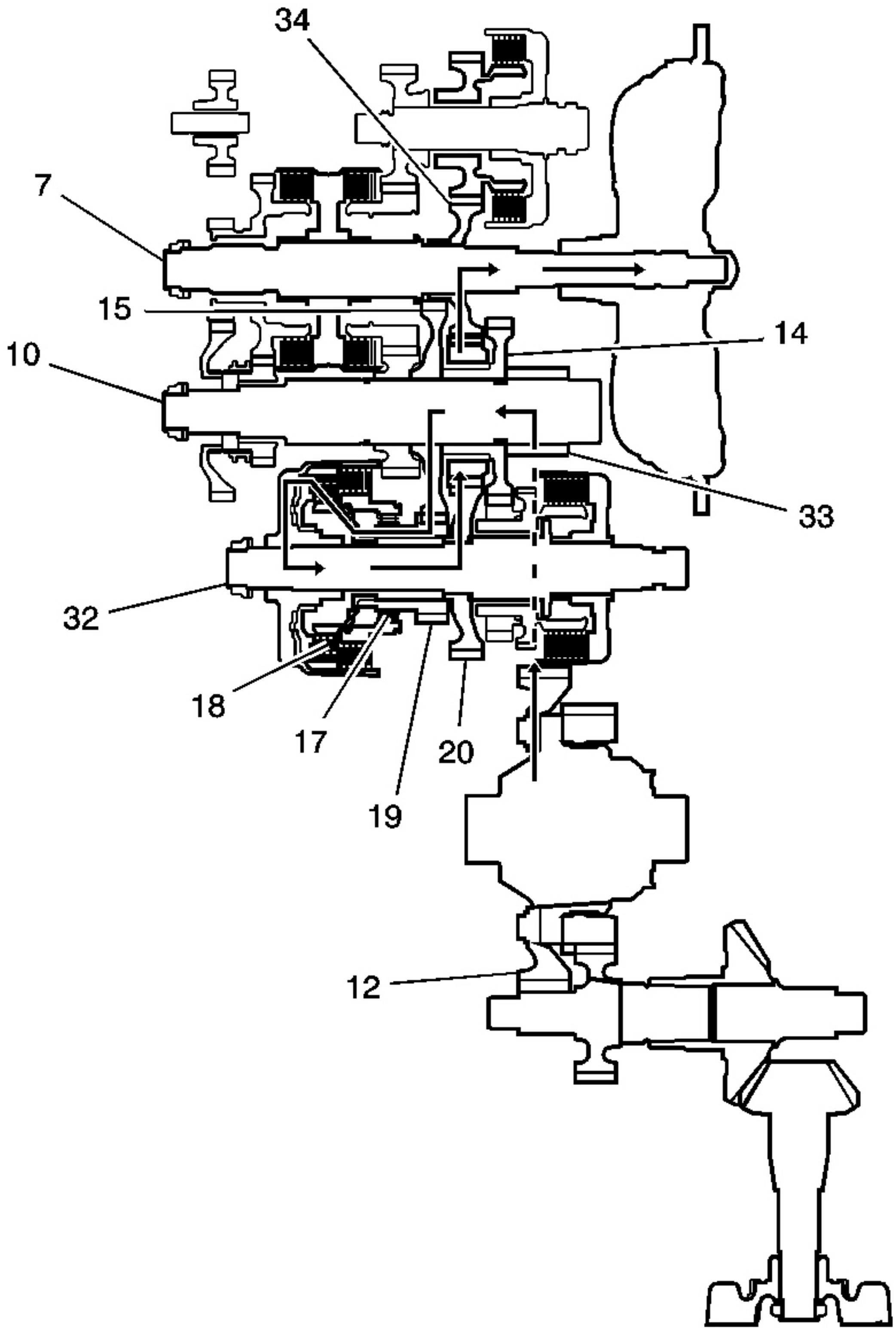
Fig. 57: L Gear Power Flow
Courtesy of GENERAL MOTORS CORP.

In the L position, the optimum gear is automatically selected between 1st and 2nd. In the 1st gear in L range, however, the hydraulic pressure is applied to the coast/one-way clutch (17) in addition to the 1st clutch (18). The power flow of 2nd gear is the same as the other forward ranges. The power flow in the 1st gear when accelerating is as follows:

- Hydraulic pressure is applied to the 1st clutch (18), then the 1st clutch (18) engages the 1st/2nd clutch shaft 1st gear (19) with the 1st/2nd clutch shaft (32) by the coast/one-way clutch (17).
- Hydraulic pressure is also applied to the coast/one-way clutch (17), and the coast/one-way clutch (17) engages the 1st/2nd clutch shaft 1st gear (19) with the 1st/2nd clutch shaft (32).
- The mainshaft 3rd gear (34) drives the 1st/2nd clutch shaft (32) via the counter shaft idler gear (14) and the 1st/2nd clutch shaft drive gear (20).
- The 1st/2nd clutch shaft 1st gear (19) drives the output shaft 1st gear (15) and the output shaft (10).
- IF AWD, power is transmitted to the final drive gear (33), which in turn drives the final driven gear (22) and the transfer drive gear (21). Then the transfer output shaft (23) drives the transfer case hypoid drive gear/shaft and the transfer output shaft/hypoid gear.
- If FWD, power is transmitted to the final drive gear (33) which in turn drives the final driven gear (22), which turns the front differential assembly (28).

L Gear Power Flow - Deceleration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19
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Fig. 58: L Gear Power Flow - Deceleration
Courtesy of GENERAL MOTORS CORP.

The Power flow when decelerating is as follows:

- Hydraulic pressure is applied to the 1st clutch (18) and the coast/one-way clutch (17). Rolling resistance from the road surface goes through the front wheels to the final drive gear (33), then to the output shaft idler gear (14).
- The coast/one-way clutch (17) disengages because the application of torque is reversed.
- The counterforce conveyed to the 1st/2nd clutch shaft drive gear turns the mainshaft 3rd gear (34) via the output shaft idler gear (14). As a result, engine braking can be obtained with 1st gear.

R Gear Power Flow

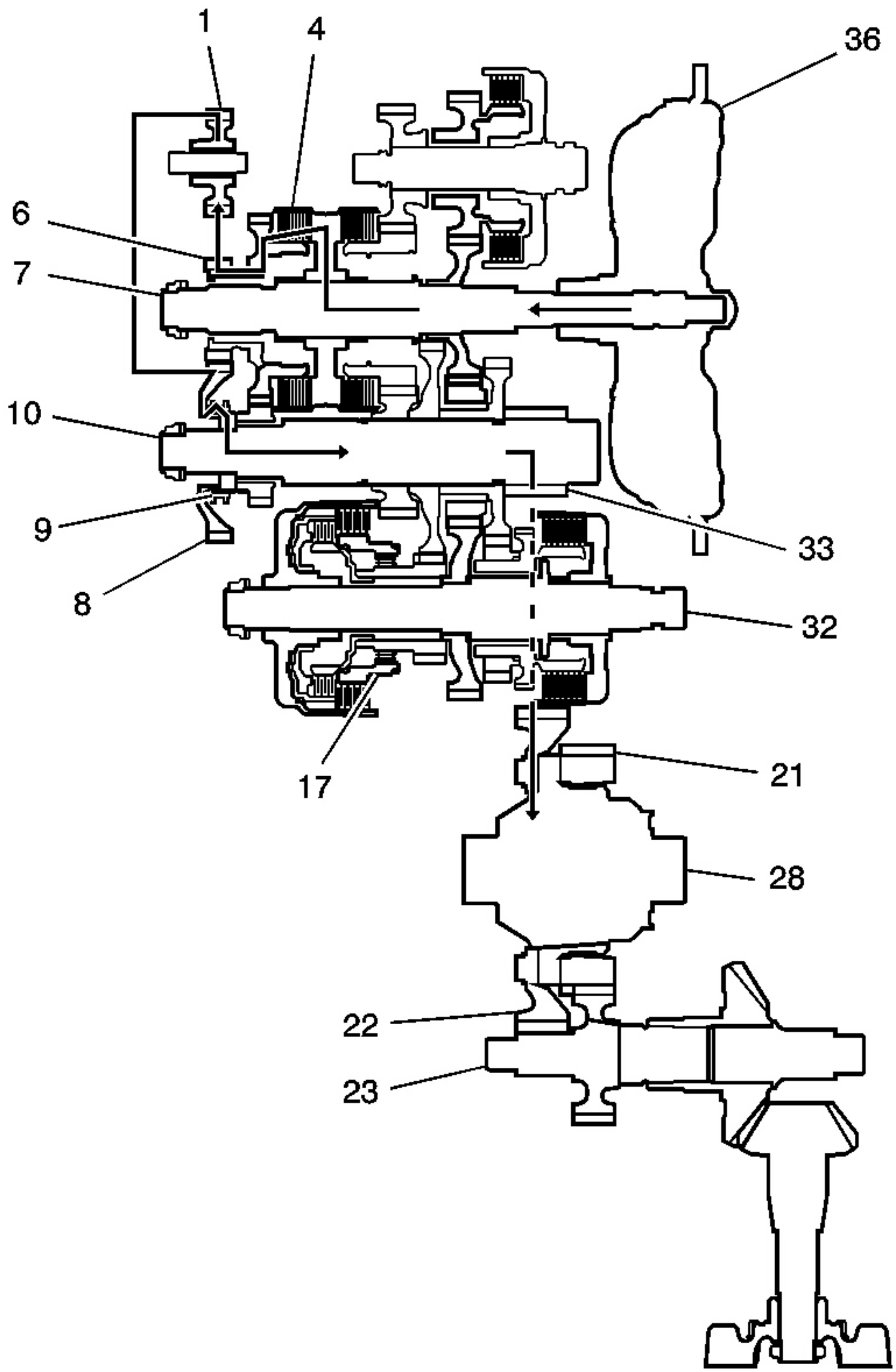
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Fig. 59: R Gear Power Flow
Courtesy of GENERAL MOTORS CORP.

- Hydraulic pressure is also applied to the 5th clutch (4), then the 5th clutch (4) engages the mainshaft reverse gear (6) with the mainshaft (7).
- The mainshaft reverse gear (6) drives the output shaft reverse gear (8) via the reverse idler gear (1).
- The rotation direction of the output shaft reverse gear (8) is changed via the reverse idler gear (1).
- The output shaft reverse gear (8) drives the output shaft (10) via the reverse selector, which drives the reverse selector hub (9).
- IF AWD, power is transmitted to the final drive gear (33), which in turn drives the final driven gear (22) and the transfer drive gear (21). Then the transfer output shaft (23) drives the transfer case hypoid drive gear/shaft and the transfer output shaft/hypoid gear.
- If FWD, power is transmitted to the final drive gear (33) which in turn drives the final driven gear (22), which turns the front differential assembly (28).

TRANSMISSION COMPONENT AND SYSTEM DESCRIPTION

Gear Operation

Gears on the Main Shaft Assembly (640)

- The 4th drive gear is part of the 4th drive gear and clutch hub assembly (607). It is engaged and disengaged from the mainshaft (641) by the 4th clutch assembly which is a part of the 4th/5th reverse clutch assembly (643).
- The 5th drive gear is part of the 5th/reverse drive gear and clutch hub assembly (636). It is engaged and disengaged from the mainshaft (641) by the 5th clutch assembly which is a part of the 4th/5th reverse clutch assembly (643).
- The reverse drive gear is part of the 5th/reverse drive gear and clutch hub assembly (636). It is engaged and disengaged from the mainshaft (641) by the 5th clutch assembly which is a part of the 4th/5th reverse clutch assembly (643).
- The 1st/2nd/3rd drive gear (603) is splined with the mainshaft (641) and rotates at the same RPM as the mainshaft.

Gears on the Output Shaft Assembly (535)

- The final gear is integral with the output shaft (524).
- The 1st driven gear (517), 2nd driven gear (523), and the 3rd/4th driven gear (500) are splined with the output shaft (524), and rotate at the same RPM as the output shaft.
- The 5th driven gear (507) and the reverse driven gear (512) rotate freely from the output shaft (524).
- The reverse shift fork (924) engages the 5th driven gear and the reverse driven gear (512) by moving the 5th/reverse synchronizer ring (508) on the output shaft (524).
- The 5th/reverse synchronizer hub (509) is splined to the output shaft (524) so that the 5th gear and the reverse driven gear (512) engage with the output shaft (524).
- The 1st/2nd idler gear (520) is located above the 2nd driven gear (523) and rotates freely from the output

shaft (524).

Gears on the 1st/2nd Clutch Shaft Assembly (755)

- The 1st drive gear is engaged and disengaged with the 1st/2nd clutch shaft (736) by the 1st clutch assembly. The 1st drive gear is engaged with the 1st/2nd clutch shaft (736) by the coast sprag assembly (725) and the coast clutch assembly when decelerating for engine braking.
- The 2nd drive gear (732), is engaged and disengaged with the 1st/2nd clutch shaft (736) by the 2nd clutch assembly (756).
- The 1st/2nd drive gear (730) is splined with the 1st/2nd clutch shaft (736), and rotates with the 1st/2nd clutch shaft (736).
- The park gear is part of the 2nd drive gear and clutch hub assembly (732).

Gears on the 3rd Clutch Shaft Assembly (830)

- The 3rd drive gear is part of the 3rd drive gear and clutch hub assembly (803) and is engaged and disengaged with the 3rd clutch shaft (823) by the 3rd clutch assembly (831).
- The 3rd driven gear (805), is splined with the 3rd clutch shaft (823) and rotates at the same RPM as the 3rd clutch shaft (823).

Electronic Control System

Functional Diagram

The electronic control system consists of the PCM, sensors, and solenoid valves. Shifting and lock-up are electronically controlled for comfortable driving under all conditions. The PCM receives input signals from the sensors, switches, and other control units, performs processing data, and outputs signals for the engine control system and AT control system. The AT control system includes shift control, grade logic control, clutch pressure control, and lock-up control is stored in the PCM. The PCM switches the shift solenoid valves and the AT CPC solenoid valves to control shifting transmission gears and lock-up TCC.

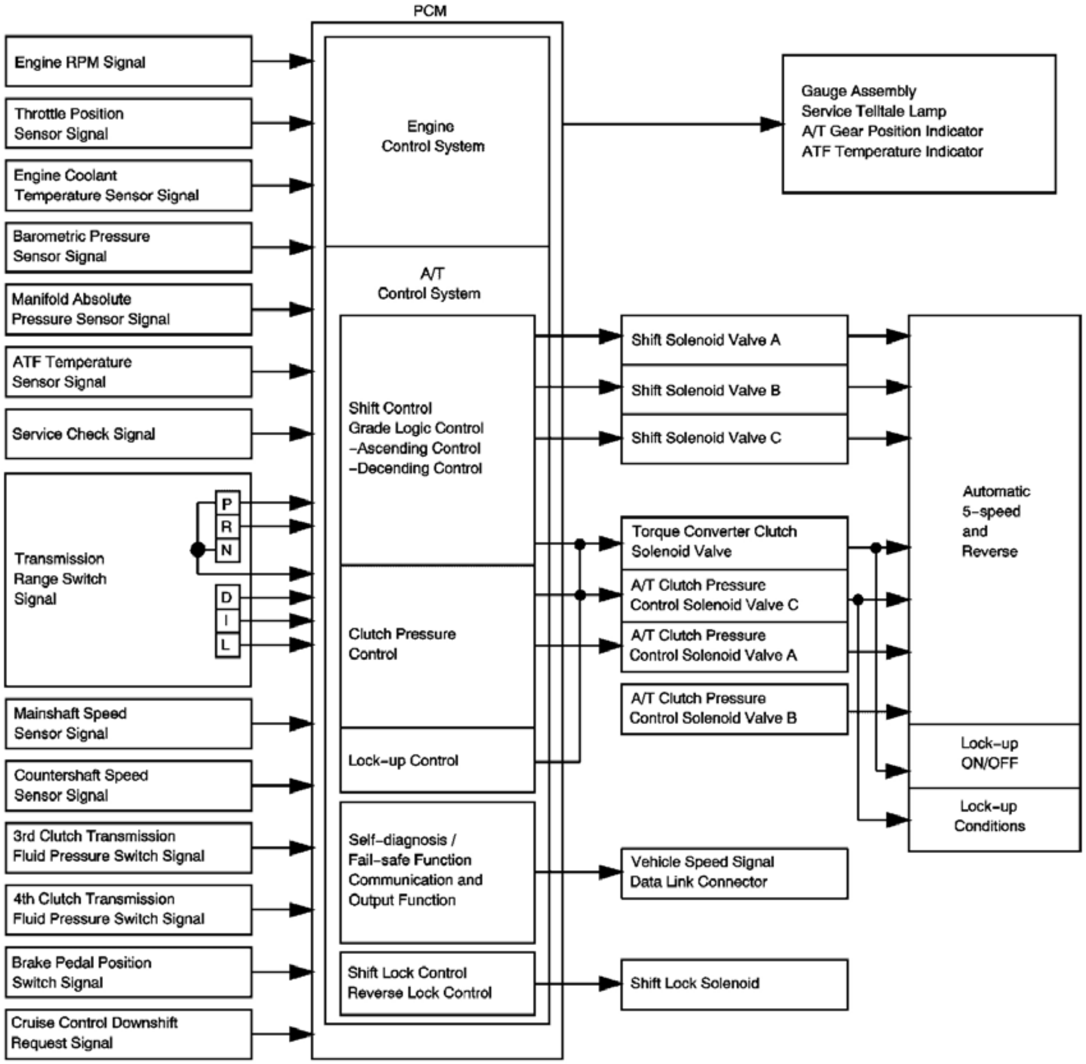


Fig. 60: Functional Diagram
Courtesy of GENERAL MOTORS CORP.

Shift Control

The PCM instantly determines which gear should be selected by various signals sent from sensors and switches, and it actuates the SS valves A, B, and C to control shifting.

Grade logic control system has been adopted to control shifting in the D, I and L positions. The PCM compares actual driving conditions with memorized driving conditions, based on the input from the throttle position sensor, the engine coolant temperature sensor, the barometric pressure sensor, the brake pedal position switch signal, and the shift lever position signal, to control shifting while the vehicle is ascending or descending a slope.

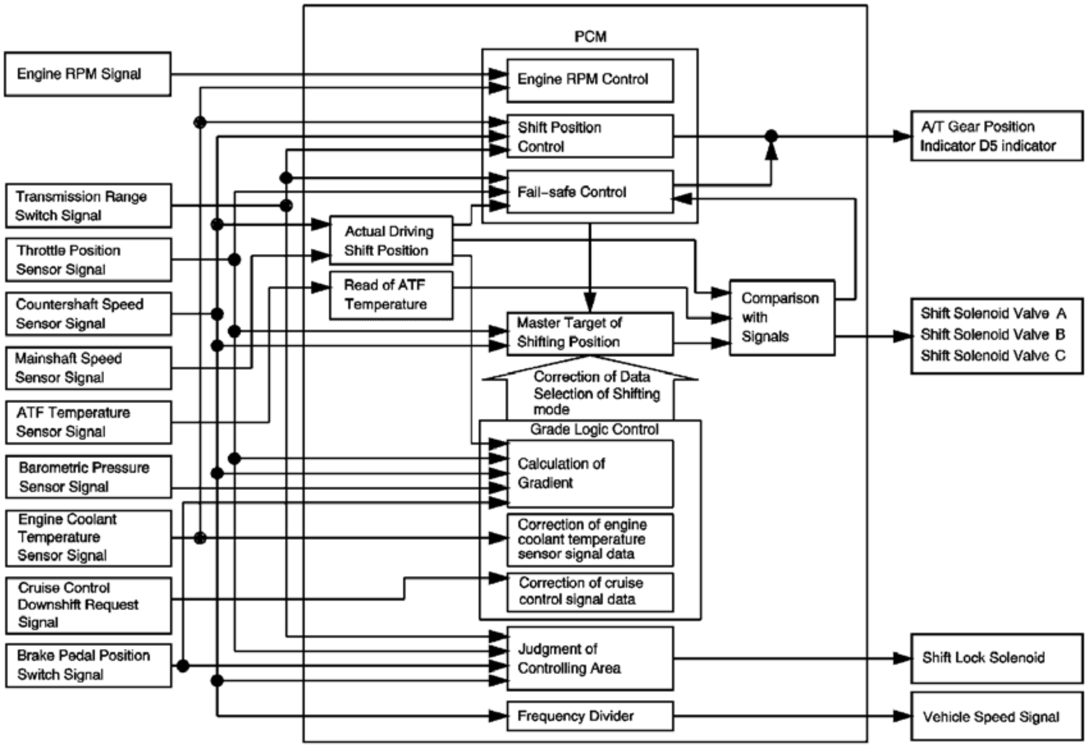


Fig. 61: Shift Control
Courtesy of GENERAL MOTORS CORP.

Ascending Control

When the PCM determines that the vehicle is climbing a hill in the D, I and L positions, the system extends the engagement area of 2nd gear, 3rd gear, and 4th gear. This prevents the transmission from frequently shifting between 2nd and 3rd gears, between 3rd and 4th gears, and between 4th and 5th gears. The vehicle can run smooth and have more power when needed.

Shift schedules stored in the PCM between 2nd and 3rd gears, between 3rd and 4th gears, and between 4th and 5th gears, enable the PCM to automatically select the most suitable gear according to the magnitude of a gradient.

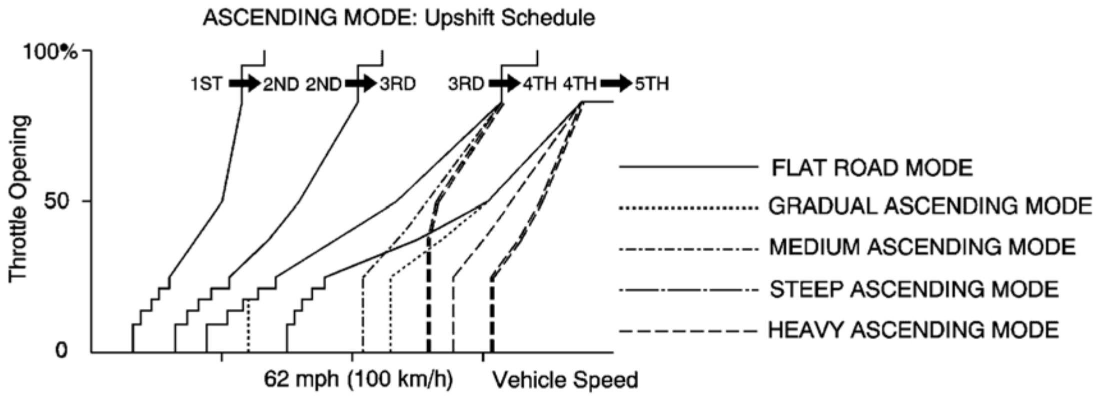


Fig. 62: Ascending Control
Courtesy of GENERAL MOTORS CORP.

Descending Control

When the PCM determines that the vehicle is going down a hill in the D, I and L positions, the shift-up speed when the throttle is closed from 4th to 5th gear, 3rd to 4th gear, and from 2nd to 3rd becomes faster than the set speed for flat road driving to widen the 4th gear, 3rd gear, and 2nd gear driving areas.

This, in combination with engine braking from the deceleration lock-up, achieves smooth driving when the vehicle is descending. There are three descending modes with different 4th gear driving areas, 3rd gear driving areas, and 2nd gear driving areas according to the magnitude of a gradient stored in the PCM. When the vehicle is in 5th or 4th gear and you are decelerating while applying the brakes on a steep hill, the transmission will downshift to a lower gear. When you accelerate, the transmission will then return to a higher gear.

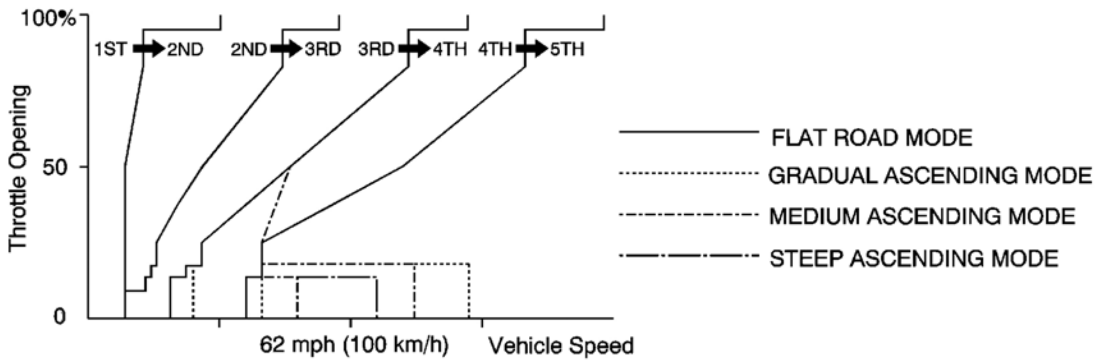


Fig. 63: Descending Control
Courtesy of GENERAL MOTORS CORP.

Deceleration Control

When the vehicle goes around a corner and needs to decelerate first and then accelerate, the PCM sets the data for deceleration control to reduce the number of times the transmission shifts. When the vehicle is decelerating from speeds above 27 mph (43 km/h), the PCM shifts the transmission from 5th or 4th to 2nd earlier than normal to cope with upcoming acceleration.

Clutch Pressure Control

The PCM actuates the AT CPC solenoid valves A, B, and C to control the clutch pressure. When shifting between lower and higher gears, the clutch pressure regulated by the AT CPC solenoid valves A, B, and C engages and disengages the clutch smoothly.

The PCM receives input signals from the various sensors and switches, performs processing data, and outputs a current to the AT CPC solenoid valves A, B, and C.

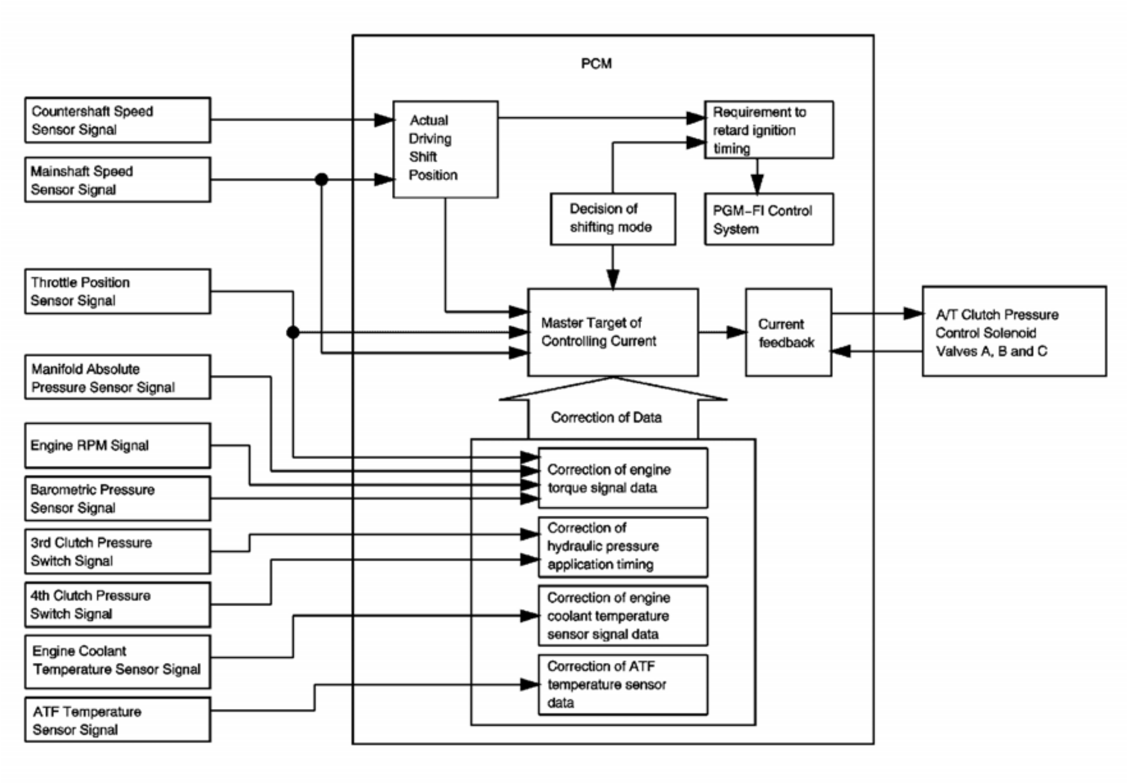


Fig. 64: Deceleration Control
Courtesy of GENERAL MOTORS CORP.

TCC Lock-Up Control

The TCC solenoid valve controls the hydraulic pressure to switch the lock-up shift valve and lock-up ON and OFF. The PCM actuates the TCC solenoid valve and the AT CPC solenoid valve ON, the condition of the lock-up starts. The AT CPC solenoid valve C regulates and apply the hydraulic pressure to the lock-up control valve to control the volume of the lock-up.

The lock-up mechanism operates in the D position in 2nd, 3rd, 4th, and 5th gears, in the I position in 2nd and 3rd gears, and in the L position in 2nd gear.

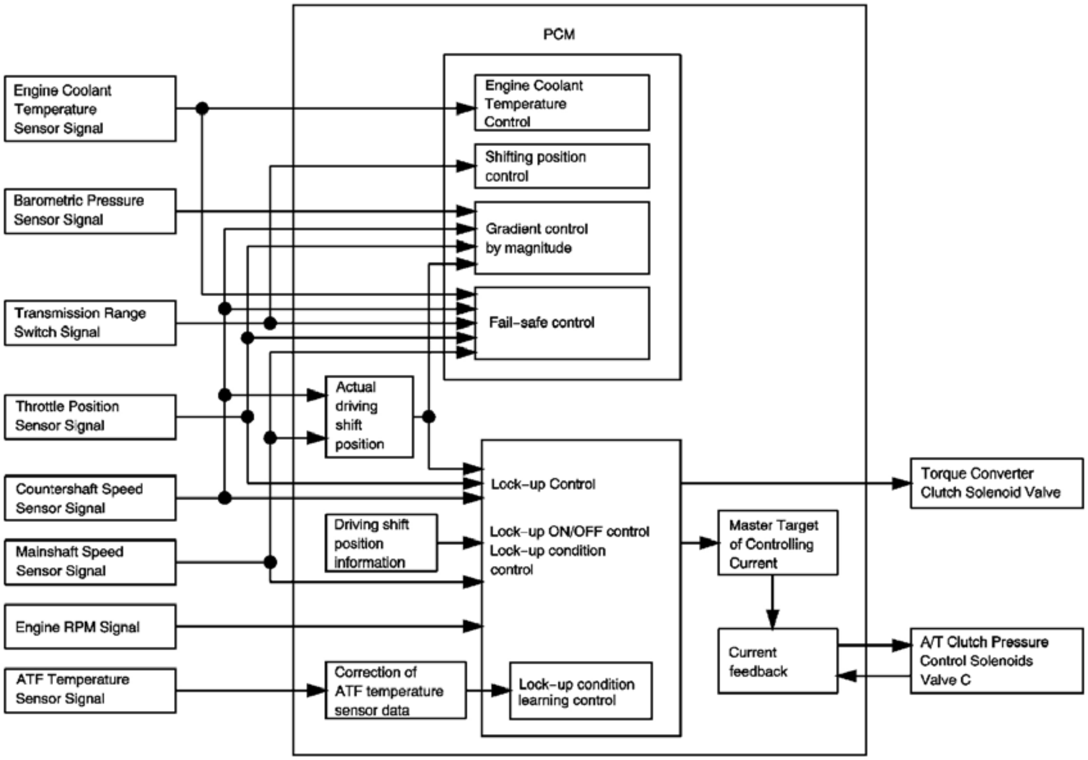


Fig. 65: TCC Lock-Up Control
Courtesy of GENERAL MOTORS CORP.

Torque Converter Lock-Up System

The lock-up mechanism of the TCC operates in the D position in 2nd, 3rd, 4th, and 5th gears, in the I position in 2nd and 3rd gears, and in the L position in 2nd gear. The pressurized fluid is drained from the back of the torque converter through a fluid passage, causing the TCC piston (2) to be held against the torque converter cover (1).

As this takes place, the mainshaft (3) rotates at the same speed as the engine crankshaft. Together with the hydraulic control, the PCM optimizes the timing and amount of the lock-up mechanism. When the TCC solenoid valve is turned on by the PCM, the TCC solenoid valve pressure switches the lock-up shift valve lock-up on and off. The AT CPC solenoid valve C and the lock-up control valve control the amount of lock-up.

TCC Lock-Up ON - Engaging the TCC

Fluid in the chamber between the torque converter cover (1) and the TCC piston (2) is drained off, and fluid entered from the chamber between the pump and stator exerts pressure through the TCC piston (2) against the torque converter cover (1). The TCC piston (2) engages with the torque converter cover (1); TCC lock-up ON, and the mainshaft (3) rotates at the same rpm as the engine.

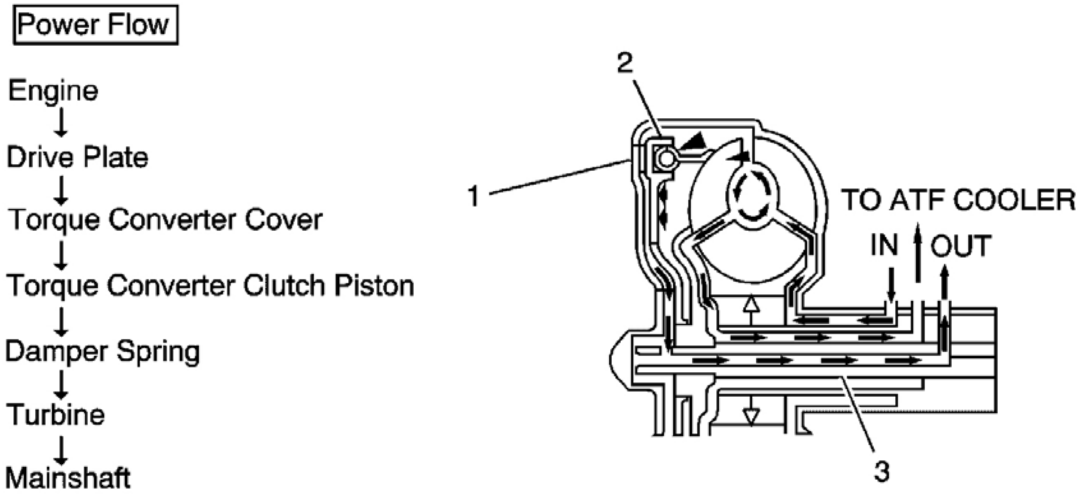


Fig. 66: TCC Lock-Up ON - Engaging the TCC
Courtesy of GENERAL MOTORS CORP.

TCC Lock-Up OFF - Disengaging the TCC

Fluid entered from the chamber between the torque converter cover (1) and the TCC piston passes through the torque converter and goes out from the chambers between the turbine (2) and the stator, and between the pump (3) and the stator. As a result, the TCC piston moves away from the torque converter cover (1), and the TCC lock-up is released; TCC lock-up OFF.

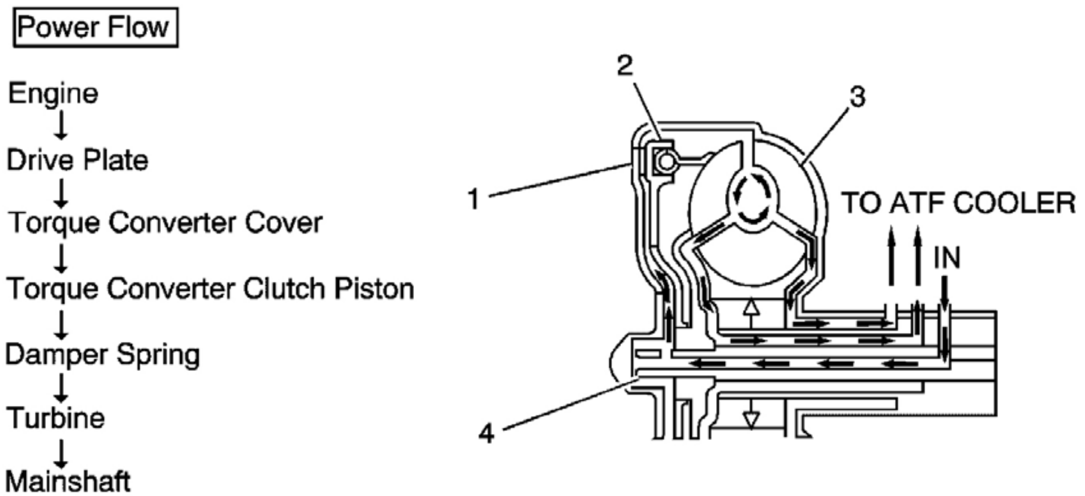


Fig. 67: TCC Lock-Up OFF - Disengaging the TCC
Courtesy of GENERAL MOTORS CORP.

No Lock-Up

TCC solenoid valve is turned OFF by the PCM. The lock-up shift valve receives LC pressure (LA) on the left side, and modulator pressure (6) on the right side. The lock-up shift valve is in the right side to uncover the port leading torque converter pressure (92) to the left side of the torque converter. Torque converter pressure (92) becomes torque converter pressure (94), and enters into the left side of the torque converter to disengage the lock-up clutch. The lock-up clutch is OFF.

When used, "left" or "right" indicates direction on the hydraulic circuit.

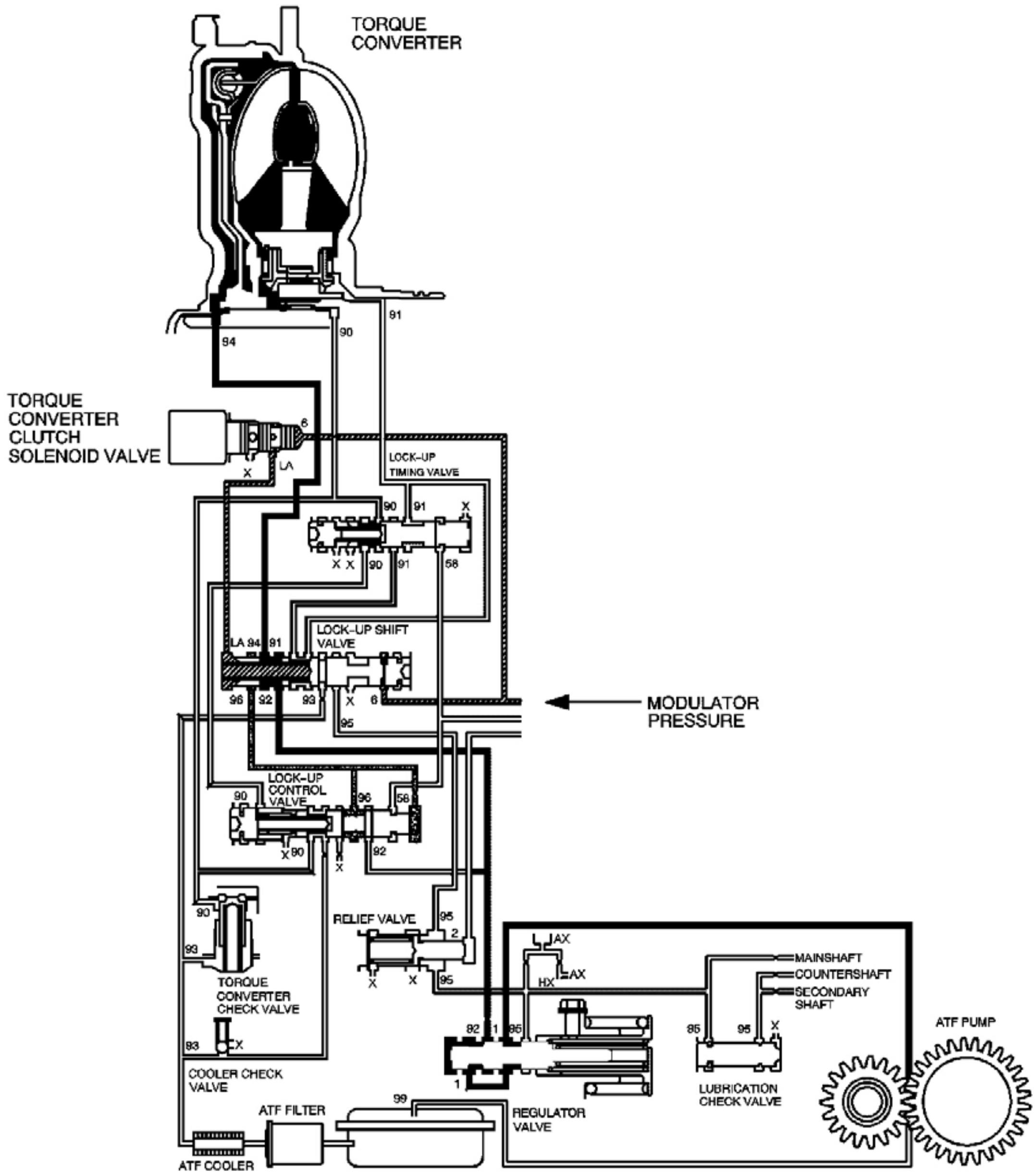


Fig. 68: No Lock-Up
Courtesy of GENERAL MOTORS CORP.

Partial Lock-Up

As the speed of the vehicle reaches the prescribed value, the TCC solenoid valve is turned ON by the PCM to release LC pressure (LA) in the left cavity of the lock-up shift valve. Modulator pressure (6) is applied to the right side of the lock-up shift valve, and then the lock-up shift valve is moved in the left side to switch the port leading torque converter pressure to the right side of the torque converter. Torque converter pressure (91) is applied to the right side of the torque converter to engage the lock-up clutch.

The PCM also controls AT CPC solenoid valve C, and LS C pressure (58) is applied to the lock-up control valve and the lock-up timing valve. When LS C pressure (58) is lower, torque converter pressure (91) from the lock-up timing valve is lower. The lock-up clutch is engaged partially. LS C pressure (58) increases, and the lock-up timing valve is moved to the left side to uncover the port leading torque converter pressure to high. The lock-up clutch is then engaged securely. Under this condition, the lock-up clutch is engaged by pressure from the right side of the torque converter; this condition is partial lock-up.

When used, "left" or "right" indicates direction on the hydraulic circuit.

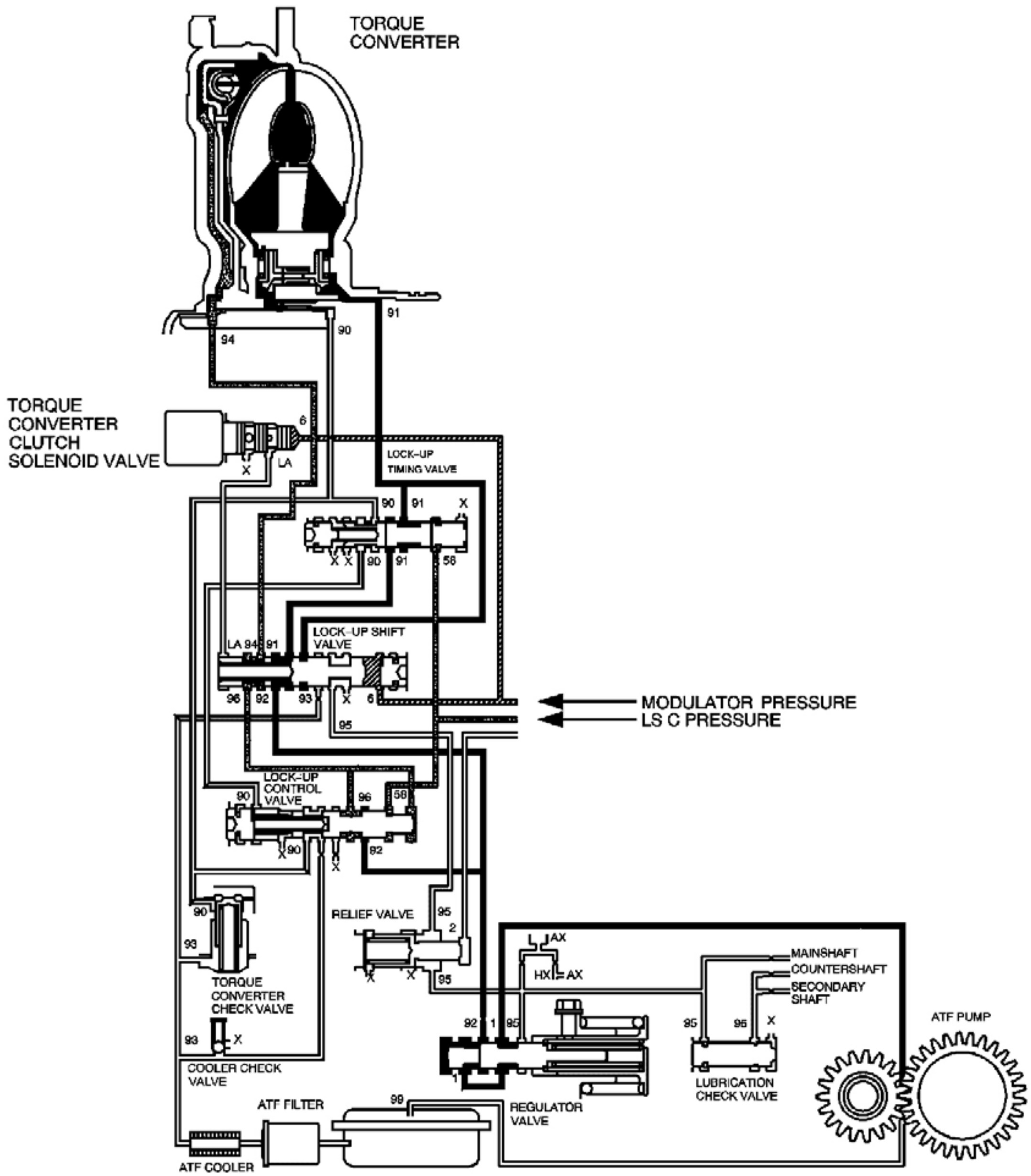


Fig. 69: Partial Lock-Up
Courtesy of GENERAL MOTORS CORP.

Full Lock-Up

When the vehicle speed further increases, the PCM controls AT CPC solenoid valve C to increase LS C pressure (58). The LS C pressure (58) is applied to the lock-up control valve and the lock-up timing valve, and moves them to the left side. Under this condition, torque converter back pressure is fully released, causing the lock-up clutch to be fully engaged.

When used, "left" or "right" indicates direction on the hydraulic circuit.

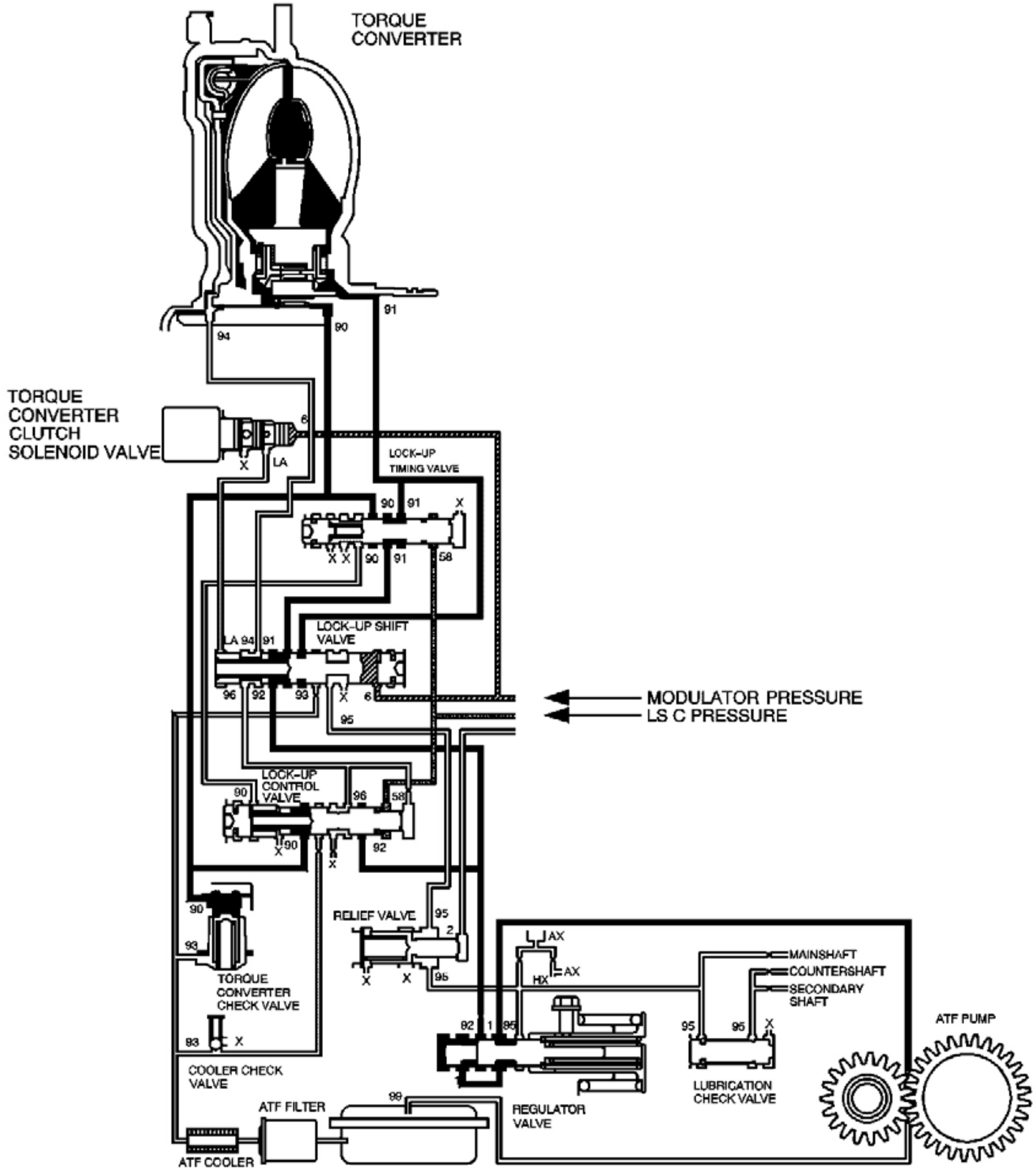


Fig. 70: Full Lock-Up
Courtesy of GENERAL MOTORS CORP.

ELECTRONIC COMPONENT DESCRIPTION

Transaxle Inputs

TCC Brake Switch

The TCC Brake switch sends a signal to the powertrain control module (PCM) when the brake pedal is depressed. The switch is normally open when the brake pedal is in the released position. When the brake pedal is depressed, the switch is closed. If the torque converter clutch (TCC) is engaged when the brake pedal is depressed, the PCM will disengage the TCC.

Transmission Fluid Temperature (TFT) Sensor

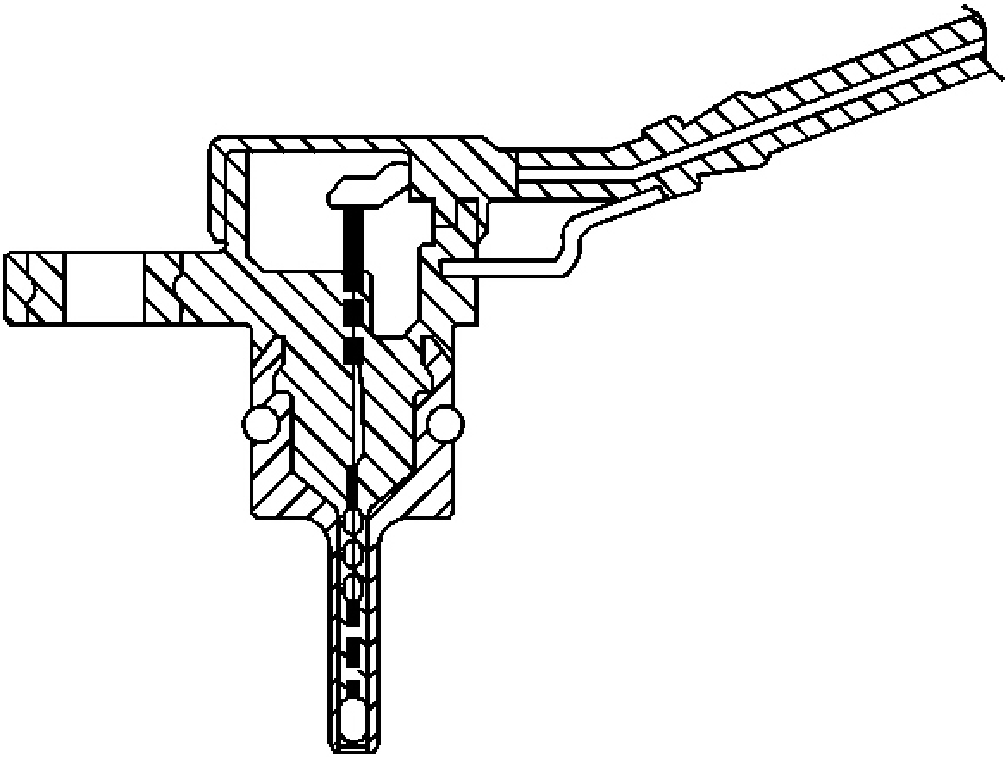


Fig. 71: Transmission Fluid Temperature (TFT) Sensor
Courtesy of GENERAL MOTORS CORP.

The automatic transmission fluid temperature (TFT) sensor is a thermistor. The powertrain control module (PCM) supplies a 5 volt reference signal to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM senses a high signal voltage. As the transmission fluid warms, the sensor resistance lowers and the PCM senses lower voltage. The PCM uses the TFT reading in order to control the torque converter clutch (TCC), line pressure adjustments, and temperature compensated shifts. Refer to **Transmission Fluid Temperature (TFT) Sensor Specifications**

Input Speed Sensor (ISS)

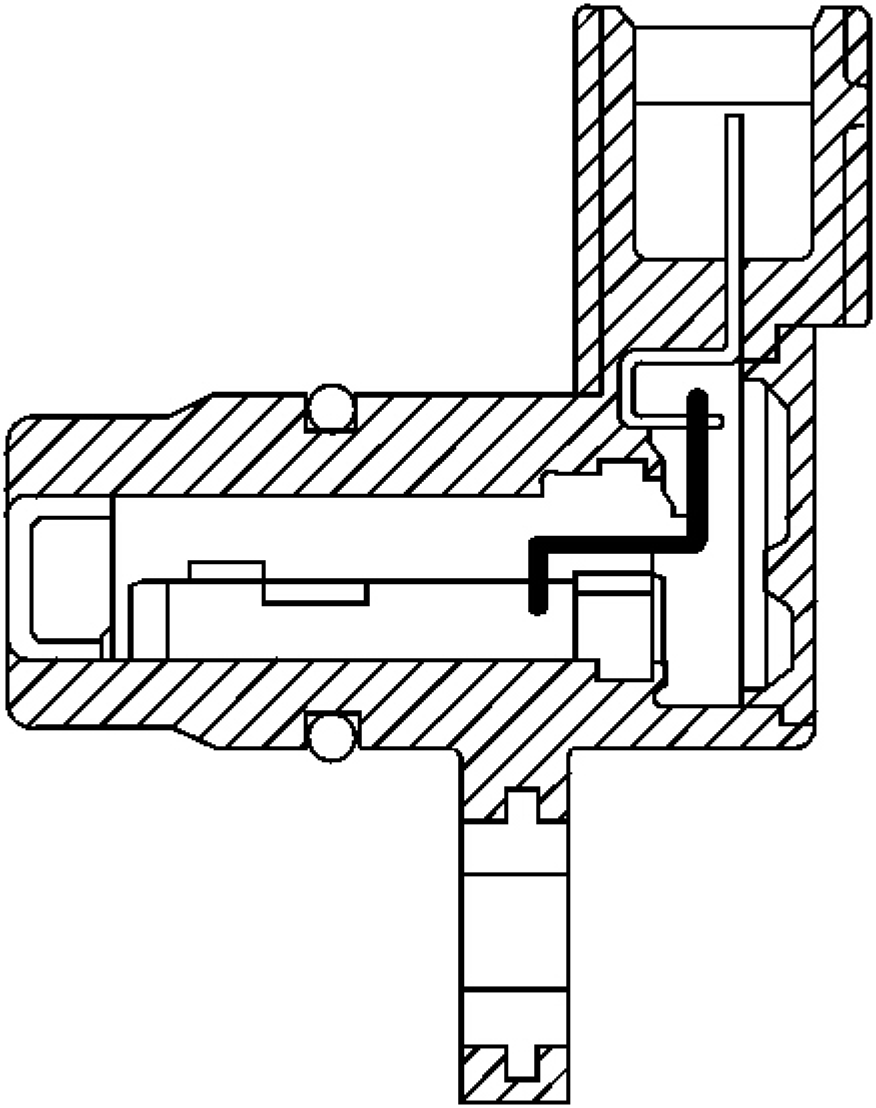


Fig. 72: Input Speed Sensor (ISS)
Courtesy of GENERAL MOTORS CORP.

The automatic transmission input shaft speed (AT ISS) sensor is a three-wire magnetic pick-up sensor that is mounted externally to the transmission. The AT ISS utilizes the main idler gear teeth, located on the mainshaft, to generate a voltage signal of varying frequency that corresponds to the rotational speed of the mainshaft. The AT ISS signal is sent to the powertrain control module (PCM) and is used to calculate the vehicle speed. Simultaneously, the automatic transmission output speed shaft (AT OSS) sensor signal is used to calculate the vehicle speed. The PCM compares the vehicle speed calculated from both speed sensors and uses this comparison for diagnosis of the speed sensors.

Output Speed Sensor (OSS)

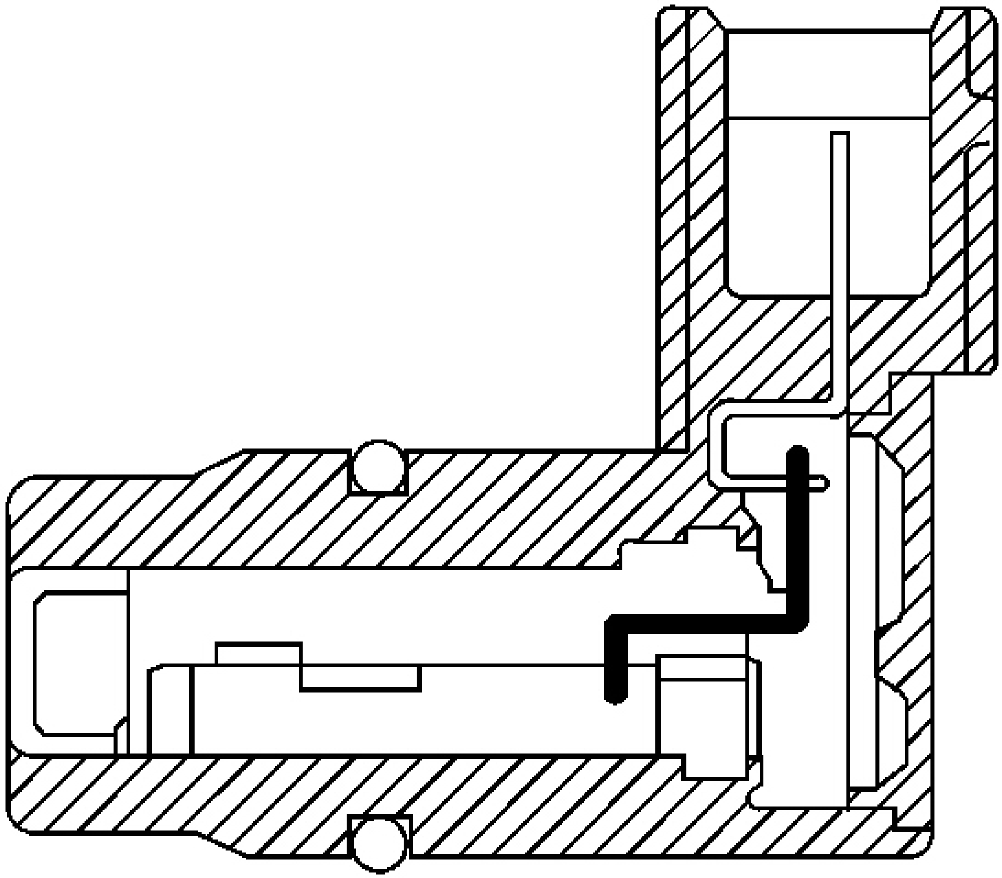


Fig. 73: Output Speed Sensor (OSS)
Courtesy of GENERAL MOTORS CORP.

The automatic transmission output shaft speed (AT OSS) sensor is a three-wire magnetic pick-up sensor that is mounted externally to the transmission. The OSS utilizes the gear teeth, located on the output shaft, to generate a voltage signal of varying frequency that corresponds to the rotational speed of the output shaft. The OSS signal is sent to the PCM and is used to calculate the vehicle speed. Simultaneously, the automatic transmission input shaft speed sensor (AT ISS) signal is used to calculate the vehicle speed. The PCM compares the vehicle speed calculated from both speed sensors and uses this comparison for diagnosis of the speed sensors.

Park/Neutral Position (PNP) Switch

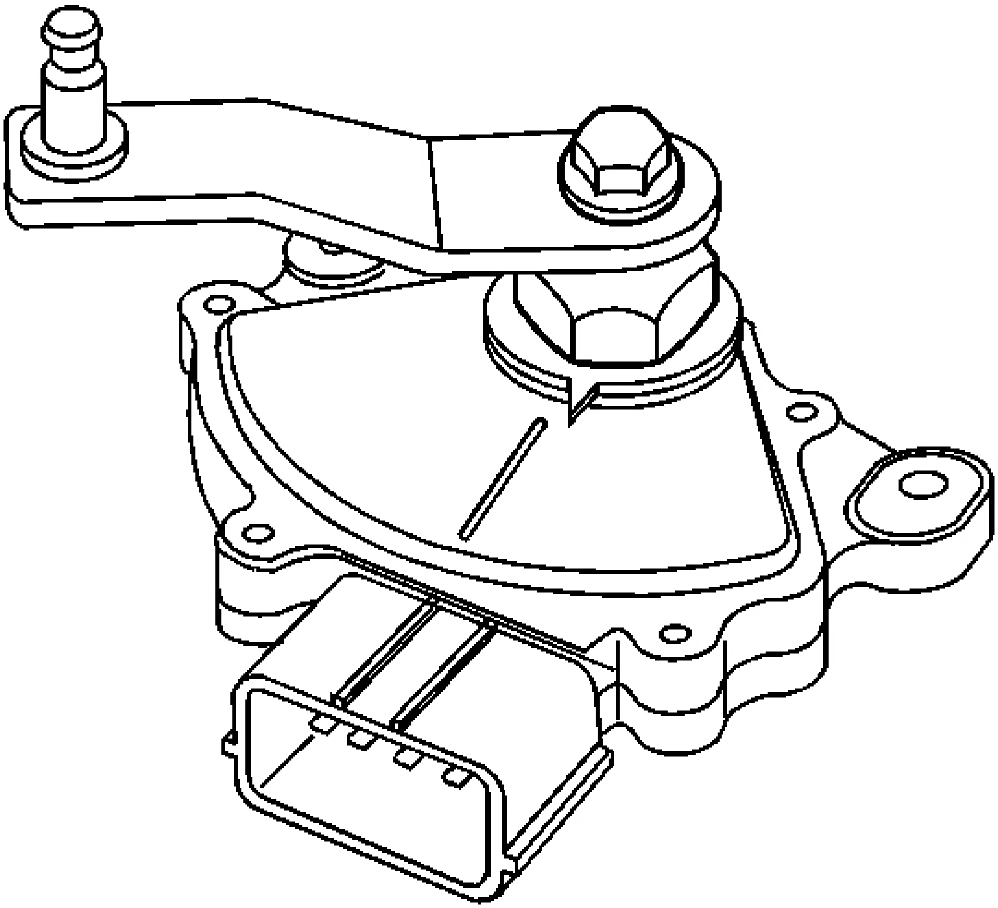


Fig. 74: Park/Neutral Position (PNP) Switch
Courtesy of GENERAL MOTORS CORP.

The park/neutral position switch assembly and is mounted on the transmission manual shaft. The transmission range (TR) switch is part of the park/neutral position switch assembly. The TR switch is a multi-signal switch. The powertrain control module (PCM) supplies ignition voltage to the TR switch on 7 signal circuits, P, R, N, D, I, L, and Forward Range. Each gear selector lever position grounds one or more of the signal circuits in a unique pattern. In order to determine the gear range selected by the driver, the PCM compares the voltage combination on the signal circuits to a TR switch combination table stored in memory. Refer to **Transmission Range Switch Logic** .

Transaxle Outputs

Torque Converter Clutch (TCC) Enable Solenoid

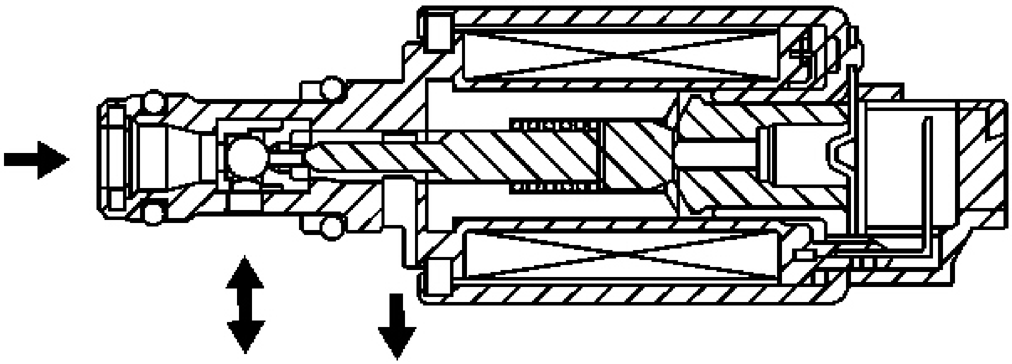


Fig. 75: Torque Converter Clutch (TCC) Enable Solenoid
Courtesy of GENERAL MOTORS CORP.

The torque converter clutch (TCC) enable solenoid valve is used with the lock-up shift valve, lock-up control valve and lock-up timing valve in order to control TCC apply and release in response to the powertrain control module (PCM) commands. When it is energized, it allows the fluid pressure from the TCC pressure control (PC) solenoid valve to be exhausted. When it is de-energized, it allows the fluid pressure to apply to the lock-up shift valve. The PCM has an internal diagnostic circuit to monitor the voltage level to the TCC enable solenoid valve, and receives a return signal.

Shift Solenoid Valve A,B,C (1, 2, 3)

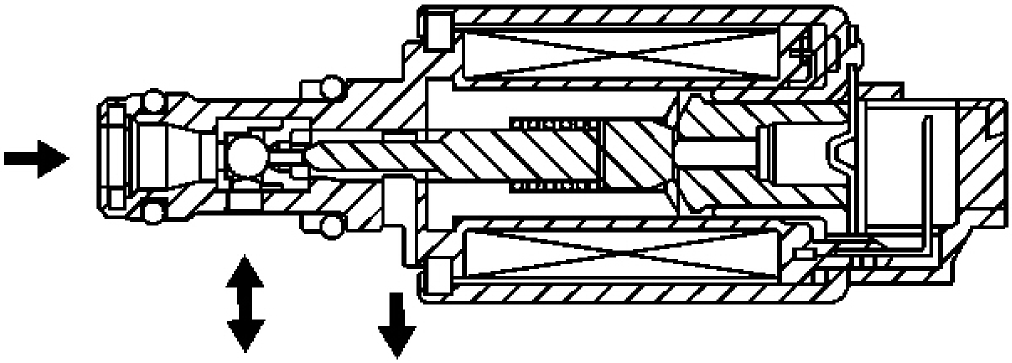


Fig. 76: Shift Solenoid Valve A,B,C (1, 2, 3)
Courtesy of GENERAL MOTORS CORP.

The shift solenoid (SS) valves are normally open valves that mounts into the transmission case. The SS valves control the modulator pressure to the shift valves, as commanded by the powertrain control module (PCM). The SS valves are all identical. These SS valves work together in a combination of ON and OFF sequences in order control various shift valves. The PCM uses numerous inputs to determine which solenoid state combination the transmission should be in. Refer to **Shift Solenoid Valve State and Gear Ratio** .

Clutch Pressure Control (CPC) Solenoid Valve A, B (1,2) and TCC Pressure Control Solenoid

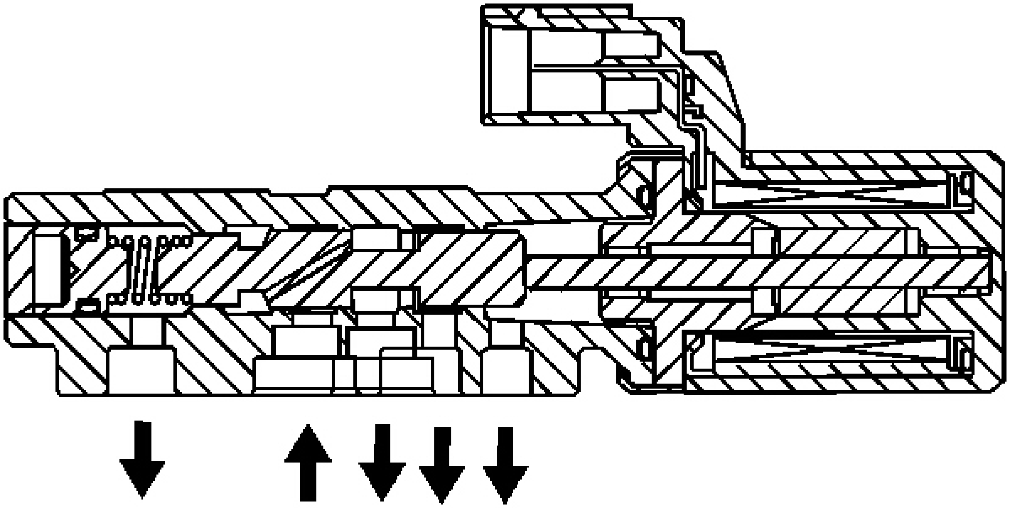


Fig. 77: Clutch Pressure Control (CPC) Solenoid Valve A, B (1,2) and TCC Pressure Control Solenoid
Courtesy of GENERAL MOTORS CORP.

- The clutch pressure control (PC) solenoid valve 1 regulates modulator pressure based on the current flow commanded from the powertrain control module (PCM). The PCM outputs varying amount of amperage as necessary for gear change, and the PC solenoid valves supply oil pressure proportional to the current to the PC valve 1. The PCM monitors the current flowing through the solenoid and performs feedback control.
- The clutch pressure control (PC) solenoid valve 2 regulates modulator pressure based on the current flow commanded from the powertrain control module (PCM). The PCM outputs varying amount of amperage as necessary for gear change, and the PC solenoid valves supply oil pressure proportional to the current to the PC valve 2. The PCM monitors the current flowing through the solenoid and performs feedback control.
- The TCC pressure control (PC) solenoid valve regulates modulator pressure based on the current flow commanded from the powertrain control module (PCM). The PCM outputs varying amount of amperage as necessary for TCC application, and the PC solenoid valves supply oil pressure proportional to the current to the PC valve 2. The PCM monitors the current flowing through the solenoid and performs feedback control.

The PCM measures the current amperage flowing through the PC solenoid valves and uses feedback control to compensate the difference between the actual current amperage and the commanded amperage.

3rd Clutch Oil Pressure Switch

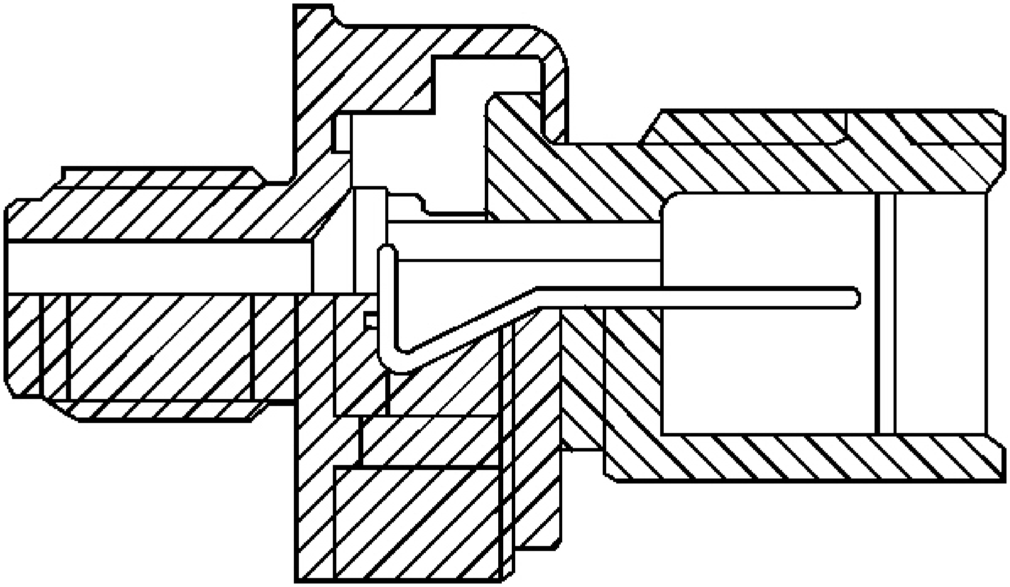


Fig. 78: 3rd Clutch Oil Pressure Switch
Courtesy of GENERAL MOTORS CORP.

The 3rd clutch pressure switch is located in the hydraulic passage to the 3rd clutch. When oil pressure is supplied to the 3rd clutch, the switch is grounded. When oil pressure is not supplied, the switch is open. The PCM receives the signal from the 3rd clutch pressure switch to detect the fluid pressure status, in order to reduce the shift shock upon shifting to 3rd gear, 2nd to 3rd, or 4th to 3rd.

4th Clutch Oil Pressure Switch

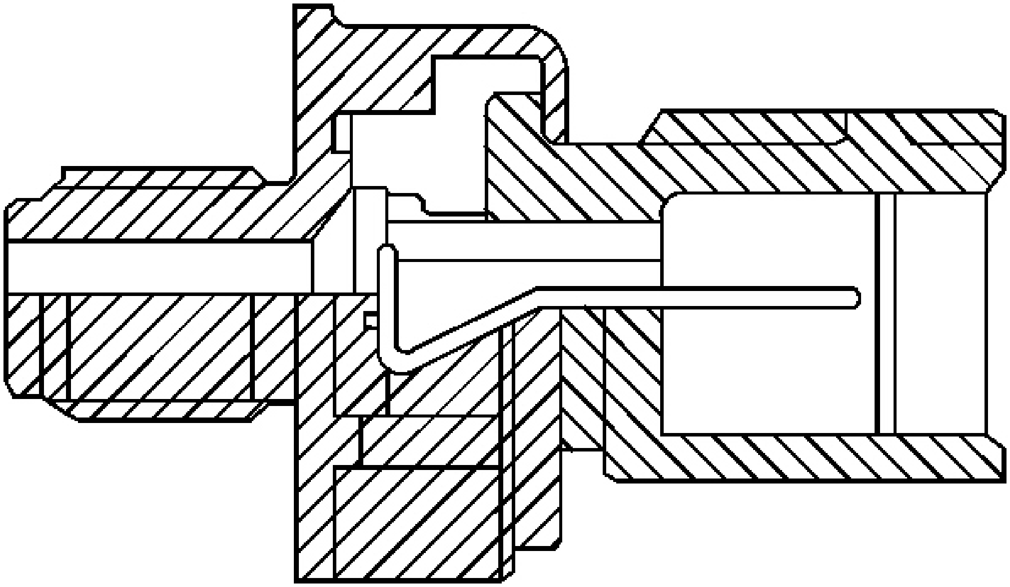


Fig. 79: 4th Clutch Oil Pressure Switch
Courtesy of GENERAL MOTORS CORP.

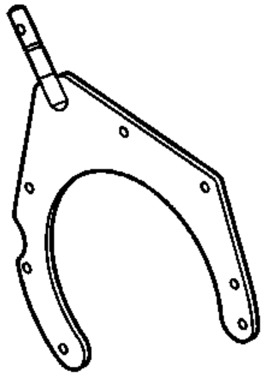
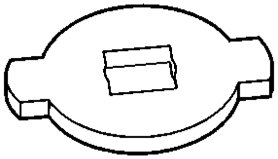
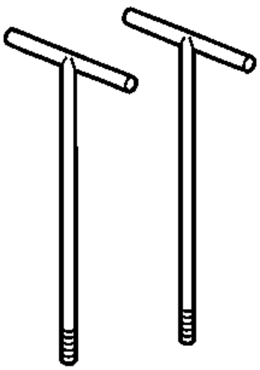
The 4th clutch pressure switch is located in the hydraulic passage to the 4th clutch. When oil pressure is supplied to the 4th clutch, the switch is grounded, LOW. When oil pressure is not supplied, the switch is open, HI. The PCM receives the signal from the 4th clutch pressure switch to detect the fluid pressure status, in order to reduce the shift shock when shifting into 4th gear, from 3rd to 4th or 5th to 4th.

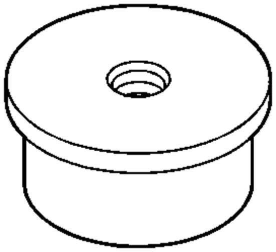
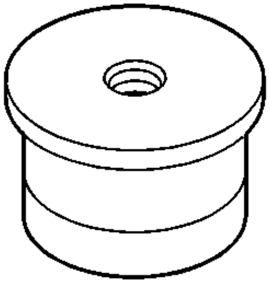
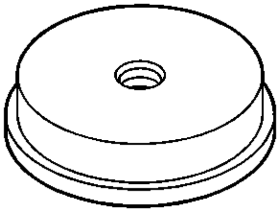
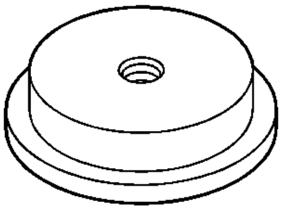
SPECIAL TOOLS AND EQUIPMENT

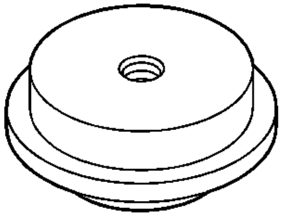
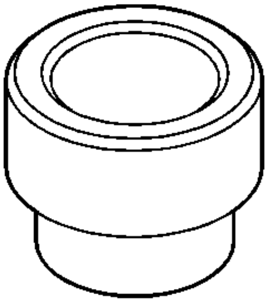
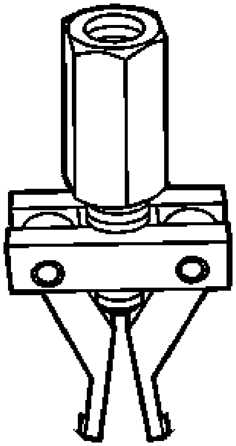
SPECIAL TOOLS

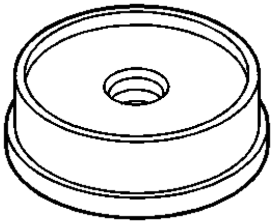
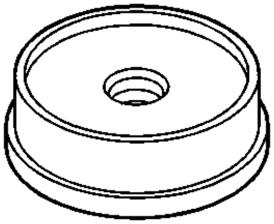
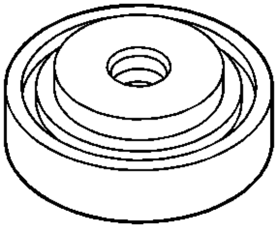
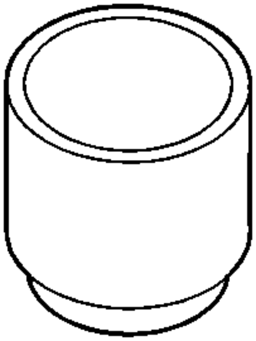
Special Tools

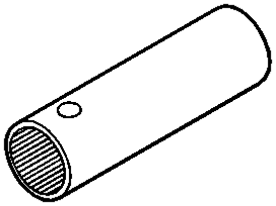
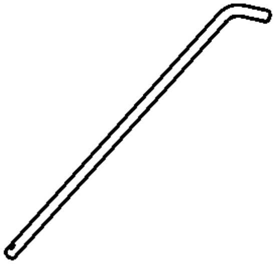
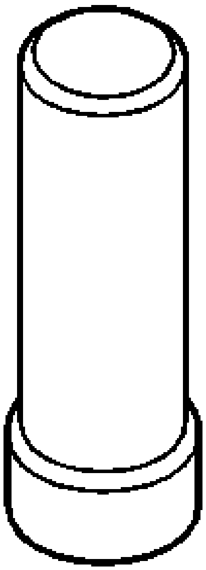
Illustration	Tool Number/Description
	DT 46238 Holding Fixture

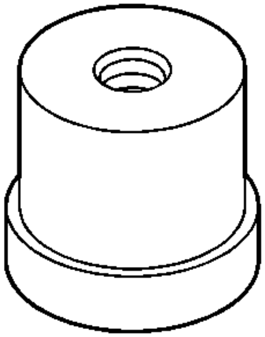
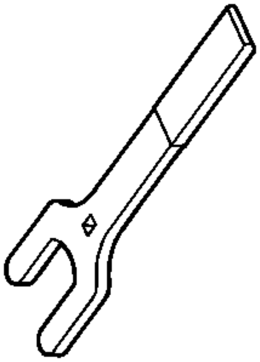
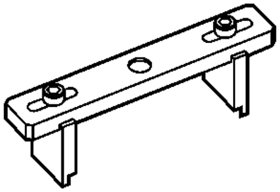
	
	DT 46410 Rotational Torque Tool
	DT 46411 6 mm T-Handle
	DT 46412 Driver

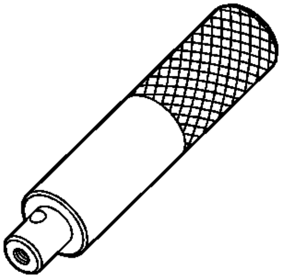
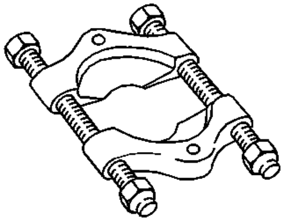
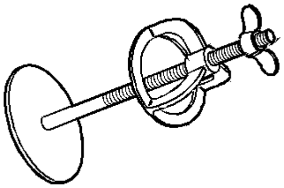
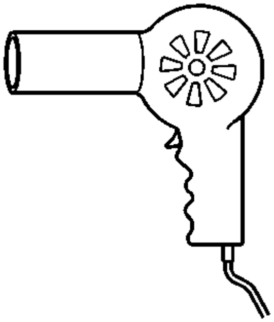
	
	DT 46413 Driver
	DT 46414 Driver
	DT 46415 Driver

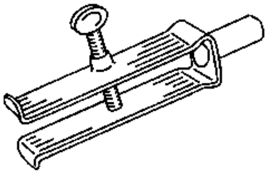
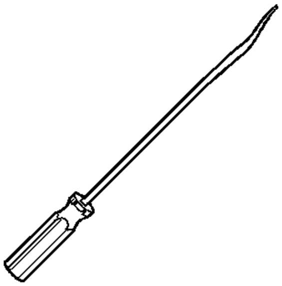
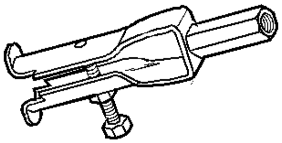
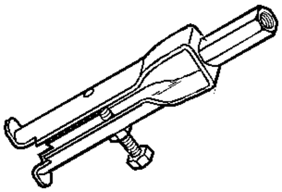
	DT 46417 Driver
	DT 46418 Driver
	DT 46424 Bearing Puller
	DT 46427

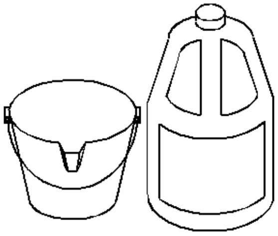
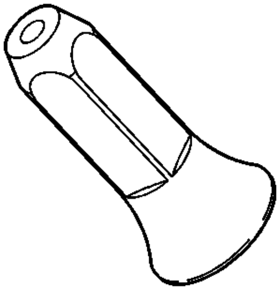
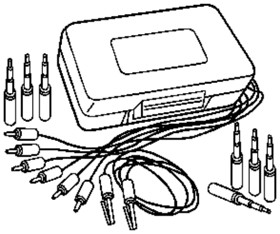
	Driver
	DT 46428 Driver
	DT 46429 Oil Seal Driver
	DT 46432 Driver

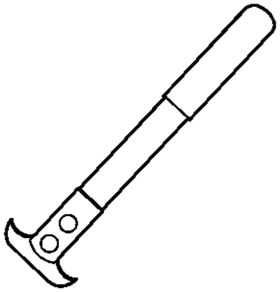
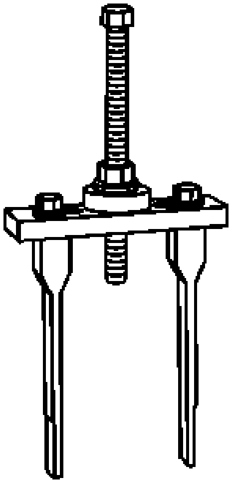
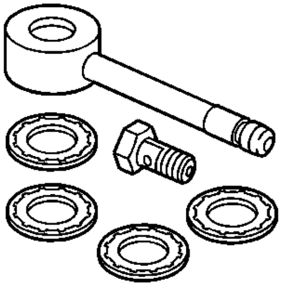
	DT 46434 Mainshaft Socket
	DT 46435 Mainshaft Socket Handle
	DT 46509 Tube Style Driver

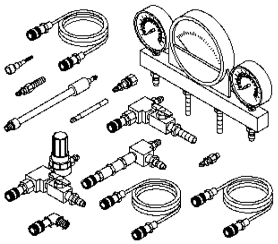
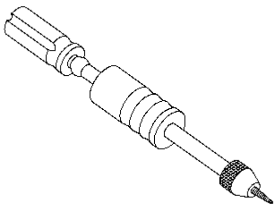
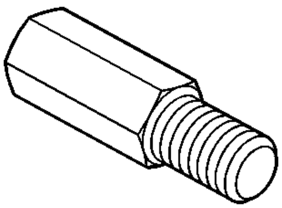
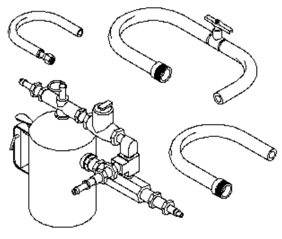
	DT 46516 Driver
	DT 46540 Wrench
	DT 46666 Compressor
	EN 46342 Driver Handle

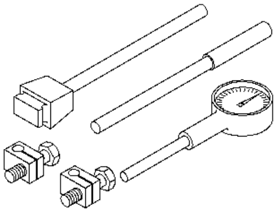
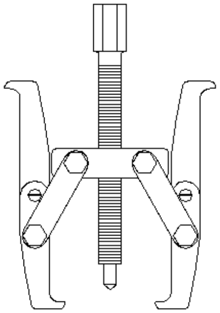
	
	J 22912-01 Split Plate Bearing Puller
	J 23327 Spring Compressor
	J 25070 Heat Gun

	J 26941 Bushing and Bearing Remover - 3-4 in
	J 28585 Snap Ring Remover
	J 29369-1 Bushing and Bearing Remover
	J 29369-2 Bushing and Bearing Remover - 2-3 in
	J 35944-20 Cooler Flushing Fluid

	
	J 36346 Fascia Retainer Remover
	J 43068 Axle Seal Installer
	J 43907 Connector Test Adapter Kit
	J 45000 Seal Remover

	
	J 45124 Removable Bridge
	J 45542 Transmission Line Pressure Adapter

	SA9127E Gage Bar Set
	SA9133T Axle Seal Puller
	SA9133T-1 Axle Seal Puller Adapter
	SA9165T Oil Cooler Line Flusher

	SA9179NE Dial Indicator
	SA9211T-2 Fifth Gear Remover

DIAGNOSTIC INFORMATION & PROCEDURES

DIAGNOSTIC STARTING POINT - AUTOMATIC TRANSMISSION

Begin the system diagnosis with **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66). The Powertrain OBD System Check provides the following information:

- The identification of the control module or modules which commands the system.
- The ability of the control module or modules to communicate through the serial data circuit.
- The identification and status of stored diagnostic trouble codes (DTCs).

The use of **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66) identifies the correct procedure for diagnosing the system and the procedure location.

Symptoms

When it has been determined through **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66) that no DTCs are present, begin symptom diagnosis by reviewing the **Transmission Component and System Description** . Reviewing the Transmission Component and System Description information enables you to understand the operation of the system. This helps you determine if the condition described by the customer is normal or if a malfunction exists. If it is determined that a malfunction exists, identify the concern by referring to **Symptoms - Automatic Transmission** . **Symptoms - Automatic Transmission** provides common diagnostic categories which relate directly to diagnostic information or procedures.

DIAGNOSTIC SYSTEM CHECK - AUTOMATIC TRANSMISSION

Circuit Description

The Diagnostic System Check - Automatic Transmission is an organized approach to identify a condition created by an automatic transmission. The Diagnostic System check is the diagnostic starting point for an automatic transmission concern. The Diagnostic System Check directs you to the next logical step for diagnosing a transmission concern. Perform this check only if there is a driveability concern or if you have been directed here from another service information section.

Follow the table to help reduce diagnostic time and help prevent unnecessary replacement of good parts.

Diagnostic Aids

IMPORTANT:	• **Do not clear the DTC unless directed by a diagnostic procedure. Clearing the DTC will erase all Freeze Frame and Failure Records stored in PCM memory.**

- **Poor engine performance can sometimes be diagnosed as a transmission driveability condition. In order to avoid misdiagnosis of the automatic transmission, always perform Diagnostic System Check - Engine Controls in Engine Controls - 3.5L (L66).**

- Use a scan tool that is known to function correctly. If necessary, test the scan tool on another vehicle.
- Ensure the scan tool contains the most current file available.
- The scan tool will display a loss of communication error message under the following conditions:
  - PCM power is interrupted
  - The ignition switch is turned OFF
  - The battery voltage level is very low
  - A poor connection at the data link connector (DLC)

Test Description

The numbers below refer to the step numbers on the diagnostic table.

1: This step determines if the scan tool is receiving power through the DLC connector.

2: The MIL should illuminate whenever the ignition is ON and the engine is not running.

3: This step determines if the PCM is transmitting serial data to the DLC and that the data circuit is not open or shorted.

4: This step determines if a DTC is current or stored in history.

Diagnostic System Check - Automatic Transmission

Step	Action	Values	Yes	No
1	1. Install a scan tool. **IMPORTANT:** • **Check for applicable service bulletins before proceeding with this test. Perform this test only if there is a driveability complaint or if you have been directed to this table from another section in the service information.** • **Do not turn the ignition OFF when performing this diagnostic procedure. Do not clear the DTCs unless instructed by this diagnostic procedure.** 2. Turn ON the ignition, with the engine OFF.	-		Go to **Diagnostic Starting Point - Data Link Communications** in Data Link

	Does the scan tool turn ON?		Go to **Step 2**	Communications
2	Is the MIL ON?	-	Go to **Step 3**	Go to **Malfunction Indicator Lamp (MIL) Inoperative** in Engine Controls - 3.5L (L66)
3	Attempt to establish communication with the PCM. Does the scan tool communicate with the PCM?	-	Go to **Step 4**	Go to **Diagnostic Starting Point - Data Link Communications** in Data Link Communications
4	**IMPORTANT:** **Diagnostic Trouble Codes (DTCs), engine performance, and transmission default actions can greatly affect the transmission performance. Ensure that these items are not the cause of a transmission concern.** Use the scan tool Capture Info function in order to save or capture, Store Info, any DTC Information.Are there any DTCs present?	-	Go to **Diagnostic Trouble Code (DTC) List/Type**	Go to **Symptoms - Automatic Transmission**

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selections	Description
TCC PC Solenoid	TCC PC Sol. Electrical	• The PCM commands the duty cycle of the TCC pressure control solenoid. The duty cycle is represented by a percentage of ON, energized, time. Approximately 90-100 percent duty cycle represents an ON, energized, commanded state. Zero percent represents an OFF, non-energized, commanded state. The scan tool TCC PC Sol. Duty Cycle parameter should match the commanded state. • The TCC PC Sol. Electrical output control can be performed when the ignition is ON, and the engine is OFF. There are no limits to this control. The solenoid remains ON, 90-100 percent duty cycle, until commanded OFF, zero percent duty cycle, and vice versa. When the output control is exited, the solenoid duty cycle is determined by the PCM. • The TCC PC Sol. Electrical output control is not allowed when the engine is running. When the engine is running "Output control not allowed while engine is running" is displayed.
	TCC PC Sol. Functional	The PCM performs an automated functional test of the TCC pressure control solenoid. In order to perform the test, the engine must be running at normal operating temperature and the gear selector must be in Low range

<table>
<tr><td></td><td></td><td>with the brakes applied. If any of these conditions are not met during the test, the test will be aborted.</td></tr>
<tr><td>TCC Enable Solenoid</td><td>-</td><td>

- The PCM commands the TCC enable solenoid valve ON and OFF. The scan tool TCC Enable Solenoid parameter should match the commanded state.
- The TCC Enable Sol. Functional output control can be performed when the engine is running. The following control limits apply:
  - The TCC enable solenoid may not be commanded ON, if the engine speed is below a calibrated value. If the solenoid is commanded ON, when the engine speed is too low, the message "Engine speed too low" appears on the scan tool display.
  - The TCC enable solenoid may not be commanded ON, if the vehicle speed is below a calibrated value. If the solenoid is commanded ON, when the vehicle speed is too low, the message "Vehicle speed too low" appears on the scan tool display.
  - The TCC enable solenoid may not be commanded ON, if the engine is not running. If the solenoid is commanded ON, when the engine is not running, the message "Engine speed not detected" appears on the scan tool display.

</td></tr>
<tr><td rowspan="3">Shift Solenoid</td><td>Shift Solenoid 1</td><td rowspan="3">

- The PCM commands the 1, 2 and 3 shift solenoid valves ON and OFF.
- When the ignition is ON, and the engine is OFF, there are no limits to this control. The solenoid remains ON until commanded OFF, and vice versa. When the output control is exited, the solenoid state is determined by the PCM.
- The shift solenoid output control is not allowed when the engine is running. When the engine is running "Output control not allowed while engine is running" is displayed.

</td></tr>
<tr><td>Shift Solenoid 2</td></tr>
<tr><td>Shift Solenoid 3</td></tr>
<tr><td>Shift Transmission</td><td>-</td><td>The PCM commands upshifts and downshifts. The scan tool Commanded Gear parameter should match the commanded state. When the engine is running and the transmission is in D, there are no limits to this control. The scan tool shift solenoid states change to match the Commanded Gear selected. When the engine is running, the following control limits apply:

- The PCM does not allow a shift if it will cause the engine RPM to exceed a calibrated limit. If a gear is requested and the engine speed is too high, the message "Engine speed too high" appears on the scan tool display.
- The PCM does not allow a 3-2 or 2-1 downshift if the vehicle speed exceeds a calibrated limit. If either downshift is requested and the vehicle speed is too high, the message "Vehicle speed too high" appears on the scan tool display.

</td></tr>
</table>

<table>
<tr><td></td><td></td><td>The PCM does not allow a 4-3 downshift if the vehicle speed exceeds a calibrated limit. If a 4-3 downshift is requested and the vehicle speed is too high, the message "Vehicle speed too high" appears on the scan tool display.
The PCM does not allow an upshift if the vehicle speed exceeds a calibrated limit. If an upshift is requested and the vehicle speed is too high, the message "Vehicle speed too high" appears on the scan tool display.</td></tr>
<tr><td>Clutch PC Sol. 1</td><td rowspan="2">Electrical</td><td rowspan="2">The PCM commands the amperage, current, to the clutch pressure control solenoid in order to control clutch apply/release pressure. As the amperage increases, the pressure decreases. As the amperage decreases, the pressure increases. The amperage range is 0.00-1.10 and may be commanded in one-tenth amp increments.
When the ignition is ON, and the engine is OFF, the reference, commanded, amperage may be controlled within calibrated limits. The scan tool parameter "Clutch PC Sol. Ref. Current" changes, but the parameter "Clutch PC Sol. Actual Current" does not change. The reference current remains until commanded otherwise.
When the engine is running, the following control limits apply:
When the transmission range is PARK or NEUTRAL, the reference, commanded, amperage may be controlled within calibrated limits. The engine speed must be less than 1,500 RPM. If the engine speed is greater than 1,500 RPM, the message "TR in park/neutral and engine speed over 1,500 RPM" appears on the scan tool display. Both the scan tool parameters "Clutch PC Sol. Ref. Current" and "Clutch PC Sol. Actual Current" change. Both current readings remain until commanded otherwise.
When the transmission range is not PARK or NEUTRAL, the reference amperage can only be controlled less than the current determined by the PCM. The PCM does not allow a value to be selected that may cause damage to the transmission. If the requested amperage is more than allowed by the PCM, the message "Requested current for the Clutch PC Solenoid is too high" appears on the scan tool display.</td></tr>
<tr><td>Clutch PC Sol. 2</td></tr>
<tr><td>Clutch PC Sol. 1</td><td rowspan="2">Functional</td><td rowspan="2">The PCM performs an automated functional test of the clutch pressure control solenoid.
In order to perform the test, the engine must be running at normal operating temperature and the gear selector must be in DRIVE range with the brakes applied. If any of these conditions are not met during the test, the test will be aborted.
Transmission range DTCs must not be active. If a transmission range DTC is active, the message "Engine running with transmission DTC present" appears on the scan tool display.</td></tr>
<tr><td></td></tr>
</table>

Clutch PC Sol. 2			• The transmission must be in DRIVE. If the transmission is not in DRIVE, the message "Transmission must be in drive" appears on the scan tool display. • The brake pedal must be applied. If the brake pedal is not applied, the message "Brake pedal must be applied" appears on the scan tool display.

SCAN TOOL DATA LIST

Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
1-2 Shift Time	F0, F2	Seconds	0.75-2.50
2-3 Shift Time	F0, F2	Seconds	0.75-2.50
3-4 Shift Time	F0, F2	Seconds	0.75-2.50
4-5 Shift Time	F0, F2	Seconds	0.75-2.50
APP Angle	F0, F1, F2	%	0
Clutch PC Sol. 1 Actual Current	F0, F3	mA	Varies
Clutch PC Sol. 1 CKT Status	F0, F3	OK, Open/Short to GND, Short to Volts	OK
Clutch PC Sol. 1 Ref. Current	F0, F3	mA	Varies
Clutch PC Sol. 1 Test Results	F0	Not Ran, Pass, Sol. Failed, TFP 2 Failed, TFP Failed	Pass
Clutch PC Sol. 1 Test Status	F0	Not Ran, In Progress, Complete, User Aborted, PCM Aborted	Complete
Clutch PC Sol. 2 Actual Current	F0, F3	mA	Varies
Clutch PC Sol. 2 CKT Status	F0, F3	OK, Open/Short to GND, Short to Volts	OK
Clutch PC Sol. 2 Ref. Current	F0, F3	mA	Varies
Clutch PC Sol. 2 Test Results	F0	Not Ran, Pass, Sol. Failed, TFP 2 Failed, TFP Failed	Pass
Clutch PC Sol. 2 Test Status	F0	Not Ran, In Progress, Complete, User Aborted, PCM Aborted	Complete
Commanded Gear	F0, F1, F2, F3	Park/Neutral, Reverse, 1, 2, 3, 4, 5	Park/Neutral
Cruise	F0	Enabled/Disabled	Disabled
ECT	F0, F1, F2	°C (°F)	85-105 °C (184-220 °F)
Engine Run Time	F0, F2	Hours:Minutes:Seconds	Varies

Engine Speed	F0, F1, F2	RPM	660-780
Engine Torque	F0, F1, F2	N.m (lb ft)	Varies
Gear Ratio	F0, F1, F2, F3	Ratio	3.97
Gear Slip Ratio	F0	Ratio	Varies
Ignition Voltage	F0, F2, F3	Volts	12.6-14.5
Last Shift Time	F0, F2	Seconds	0-6.375
Shift Sol. 1 CKT Status	F0, F3	OK, Open/Short to Volts, Short to GND	OK
Shift Sol. 2 CKT Status	F0, F3	OK, Open/Short to Volts, Short to GND	OK
Shift Sol. 3 CKT Status	F0, F3	OK, Open/Short to Volts, Short to GND	OK
Shift Solenoid 1	F0, F2, F3	On/Off	Off
Shift Solenoid 2	F0, F2, F3	On/Off	On
Shift Solenoid 3	F0, F2, F3	On/Off	Off
TCC Brake Switch	F0, F1, F2, F3	Open/Closed	Closed
TCC Enable Sol. CKT Status	F0, F2, F3	OK, Open/Short to GND, Short to Volts	OK
TCC Enable Solenoid	F1, F3	On/Off	Off
TCC PC Sol. Actual Current	F0, F1, F3	mA	Varies
TCC PC Sol. CKT Status	F0, F1, F3	OK, Open/Short to GND, Short to Volts	OK
TCC PC Sol. Ref. Current	F0, F1, F3	mA	Varies
TCC Slip Speed	F0, F1, F2	RPM	Varies
TCC Sol. Test Results	F3	Not Ran, Pass, Sol. Failed, TFP 2 Failed, TFP Failed	Pass
TCC Sol. Test Status	F3	Not Ran, In Progress, Complete, User Aborted, PCM Aborted	Complete
TFP Switch 3	F0, F1, F2	HI/LOW	HI
TFP Switch 4	F0, F1, F2	HI/LOW	HI
Torque Converter Efficiency	F0, F1	%	Varies
TR Sw.	F0, F1, F2	Park, Reverse, Neutral, Drive, Intermediate, Low, Invalid	Park
TR Sw. D/I/L	F0, F1, F2	HI/LOW	L/H/H
TR Sw. Forward Range	F0, F1, F2	HI/LOW	LOW
TR Sw. P/R/N	F0, F1, F2	HI/LOW	H/H/H
Trans. Fluid Temp.	F0, F1, F2	°C (°F)	Varies
Transmission Hot Mode	F0, F1, F2, F3	On/Off	Off
Transmission ISS	F0, F1, F2	RPM	Varies

Transmission OSS	F0, F1, F2	RPM	0
Vehicle Speed	F0, F1, F2	km/h (mph)	0
F0: Transmission Data F1: TCC Data F2: Shift Data F3: Solenoid Data			

SCAN TOOL DATA DEFINITIONS

1-2 Shift Time

This parameter displays the actual time of the last adaptable 1-2 shift. The shift time is based on the gear ratio change after the commanded 1-2 shift.

2-3 Shift Time

This parameter displays the actual time of the last adaptable 2-3 shift. The shift time is based on the gear ratio change after the commanded 2-3 shift.

3-4 Shift Time

This parameter displays the actual time of the last adaptable 3-4 shift. The shift time is based on the gear ratio change after the commanded 3-4 shift.

4-5 Shift Time

This parameter displays the actual time of the last adaptable 4-5 shift. The actual shift time is obtained by measuring the time required for the input shaft to decelerate from the previous ratio to the current ratio.

APP Angle

This parameter displays the position of the accelerator pedal. A display of 0 percent indicates that the accelerator pedal is fully released. A display of 100 percent indicates that the accelerator is fully depressed. The value indicated may not correspond to the TP angle value.

Clutch PC Sol. 1 Actual Current

This parameter displays the actual current flow through the clutch pressure control (PC) solenoid valve circuit which is measured by the control module. High current flow results in low line pressure. Low current flow results in high line pressure.

Clutch PC Sol. 1 CKT Status

This parameter displays whether an open, short to voltage or short to ground exists in the clutch pressure control (PC) solenoid 1 feedback signal circuit. The scan tool displays OK, Open/Short to volts, Short to GND.

Clutch PC Sol. 1 Ref. Current

This parameter displays the commanded current of the clutch pressure control (PC) solenoid valve circuit. High current results in low line pressure. Low current results in high line pressure.

Clutch PC Sol. 1 Test Results

This parameter displays results of the solenoid functional test. The scan tool displays Not Ran, Pass, Sol. Failed, TFP 3 Failed, or TFP 4 Failed.

Clutch PC Sol. 1 Test Status

This parameter displays the status of the solenoid test run by the PCM. The scan tool displays Not Ran, In Progress, Complete, User Aborted, or PCM Aborted.

Clutch PC Sol. 2 Actual Current

This parameter displays the actual current flow through the clutch pressure control (PC) solenoid valve circuit which is measured by the control module. High current flow results in low line pressure. Low current flow results in high line pressure.

Clutch PC Sol. 2 CKT Status

This parameter displays whether an open, short to voltage or short to ground exists in the clutch pressure control (PC) solenoid 2 feedback signal circuit. The scan tool displays OK, Open/Short to volts, Short to GND.

Clutch PC Sol. 2 Ref. Current

This parameter displays the commanded current of the clutch pressure control (PC) solenoid valve circuit. High current results in low line pressure. Low current results in high line pressure.

Clutch PC Sol. 2 Test Results

This parameter displays results of the solenoid functional test. The scan tool displays Not Ran, Pass, Sol. Failed, TFP 3 Failed, or TFP 4 Failed.

Clutch PC Sol. 2 Test Status

This parameter displays the status of the solenoid test run by the PCM. The scan tool displays Not Ran, In Progress, Complete, User Aborted, or PCM Aborted.

Commanded Gear

This parameter displays the current commanded state of the shift solenoid valves. The scan tool displays 1, 2, 3, 4 or 5.

Cruise

This parameter displays the commanded state of the cruise control system. The scan tool displays ENABLED or DISABLED. When the display indicates ENABLED, the PCM is allowing cruise control operation. When the display indicates DISABLED, the PCM has disabled cruise control operation. When the cruise control display is ENABLED, shift patterns will be altered for 2-3 and 3-4 upshifts or 4-3 and 3-2 downshifts.

ECT

This parameter displays the input signal from the engine coolant temperature (ECT) sensor. ECT is high at 151°C (304°F) when the signal voltage is low, 0 volt. ECT is low at -40°C (-40°F) when the signal voltage is high, 5 volt.

Engine Run Time

This parameter displays a measure in Hr:Min:Sec of the length of time the engine has been operating. When the ignition is cycled to OFF, the value is reset to zero.

Engine Speed

This parameter displays the rotational speed of the engine expressed as revolutions per minute.

Engine Torque

This parameter displays a calculated value based on engine load, throttle position, mass air flow, and other engine inputs. This parameter is accurate to within 20 N.m (15 ft lb) of actual measured engine torque.

Gear Ratio

This parameter displays the actual transmission gear ratio. The scan tool displays the gear ratio calculated from the automatic transmission input shaft speed sensor (AT ISS) and the automatic transmission output shaft speed sensor (AT OSS) inputs.

Gear Slip Ratio

This parameter displays the calculated transmission gear slip ratio. The gear slip ratio is determined by comparing the calculated gear ratio to the desired gear ratio.

Ignition Voltage

This parameter displays the system voltage measured at the ignition feed.

Last Shift Time

This parameter displays the actual time of the last upshift. This value is only accurate if the shift was adaptable.

Shift Sol. 1 CKT Status

This parameter displays whether an open, short to voltage or ground exists in the shift solenoid valve 1 feedback signal circuit. The scan tool displays OK, Open/Short to Volts, Short to GND.

Shift Sol. 2 CKT Status

This parameter displays whether an open or short to voltage or ground exists in the 2-3, 3-4 shift solenoid valve (S2) feedback signal circuit. The scan tool displays OK, Open/Short to Volts, or Short to GND.

Shift Sol. 3 CKT Status

This parameter displays whether an open or short to voltage or ground exists in the 1-2, 2-3, reverse, shift solenoid valve (S3) feedback signal. The scan tool displays OK, Open/Short to Volts, or Short to GND.

Shift Solenoid 1

This parameter displays the commanded state of the reverse, 1st shift solenoid valve (S1). The scan tool displays On/Off.

Shift Solenoid 2

This parameter displays the commanded state of the 2-3, 3-4 shift solenoid valve (S2). The scan tool displays On/Off.

Shift Solenoid 3

This parameter displays the commanded state of the 1-2, 2-3, reverse shift solenoid valve (S3). The scan tool displays On/Off.

TCC Brake Switch

This parameter displays the status of the TCC brake switch circuit input. OPEN indicates a zero voltage input, brake pedal applied. CLOSED indicates a voltage input, brake pedal released. The scan tool displays OPEN or CLOSED.

TCC Enable Sol. CKT Status

This parameter displays whether an open or short to ground or voltage exist in the TCC solenoid valve feedback signal. If the TCC solenoid is commanded OFF, the scan tool will display open or short to ground. If the TCC solenoid is commanded ON, the scan tool will display short to voltage. If no circuit fault is present, the scan tool will display OK.

TCC Enable Solenoid

This parameter displays the commanded state of the TCC solenoid. Yes indicates a commanded energized state, current is flowing through the solenoid. No indicates a commanded non-energized state, current is not flowing through the solenoid. This commanded state occurs at various vehicle speeds between applications. The scan tool displays Yes or No.

TCC PC Sol. Actual Current

This parameter displays the actual current of the torque converter clutch (TCC) lock up pressure control (PC) solenoid valve circuit. The scan tool displays current flow in amps. A reading of 0.00 amps, no current flowing, indicates a low TCC apply pressure. A reading of 1.10 amps, a high flow of current, indicates a high TCC apply pressure.

TCC PC Sol. CKT Status

This parameter displays whether an open or short to voltage or ground exists in the torque converter clutch (TCC) pressure control (PC) solenoid valve feedback signal circuit. The scan tool displays OK, Open/Short to Volts, Short to GND.

TCC PC Sol. Ref. Current

This parameter displays the commanded reference current flow of the torque converter clutch (TCC) lock up pressure control (PC) solenoid valve circuit. The scan tool displays current flow in amps. A reading of 0.00 amps, no current flow, indicates an actual high commanded apply pressure. A reading of 1.10 amps, a high flow of current, indicates a high commanded TCC apply pressure.

TCC PC Sol. Test Results

This parameter displays results of the solenoid functional test. The scan tool displays Not Ran, Pass, Sol. Failed, TFP 2 Failed, or TFP Failed 3.

TCC PC Sol. Test Status

This parameter displays the status of the solenoid test run by the PCM. The scan tool displays Not Ran, In Progress, Complete, User Aborted, or PCM Aborted.

TCC Slip Speed

This parameter displays the difference between transmission input speed and engine speed. A negative value indicates the engine speed is less than the input speed, deceleration. A positive value indicates the engine speed is greater than the input speed, acceleration. A value of zero indicates the engine speed is equal to the input speed, TCC applied.

TFP Switch 3

This parameter displays the state of the 3rd clutch oil pressure switch. The scan tool displays HI/LOW.

TFP Switch 4

This parameter displays the state of the 4th clutch oil pressure switch. The scan tool displays HI/LOW.

Torque Converter Efficiency

This parameter displays a ratio of 0.00:1 to 2:1. The ratio is calculated by multiplying the speed ratio by a value related to the "K factor" of the torque converter. The "K factor" is the looseness or tightness of the torque converter for a given torque. The nearer the torque converter is to full coupling, i.e. 1:1, the closer the torque converter efficiency number will be to 1.

TR Sw.

This parameter displays the decoded status of the four A/B/C/P inputs from the transmission range switch. The scan tool displays Park, Reverse, Neutral, Drive, Intermediate, Low, and invalid. If a valid combination of inputs is not detected, invalid will be displayed.

TR Sw. Forward Range

This parameter displays the status of the four inputs from the transmission range switch. The scan tool displays HI/LOW. HI indicates an ignition voltage input to the control module. LOW indicates a zero voltage input to the control module.

TR Sw. D/I/L

This parameter displays the status of the inputs from the transmission range switch. The scan tool displays HI/LOW. HI indicates an ignition voltage input to the control module. LOW indicates a zero voltage input to the control module.

TR Sw. P/R/N

This parameter displays the status of the inputs from the transmission range switch. The scan tool displays HI/LOW. HI indicates an ignition voltage input to the control module. LOW indicates a zero voltage input to the control module.

Trans. Fluid Temp.

This parameter displays the input signal of the transmission fluid temperature sensor. Transmission fluid temperature is high, 151°C (304°F), when signal voltage is low, 0 volt. Transmission fluid temperature is low, -40°C (-40°F), when signal voltage is high, 5 volt.

Transmission Hot Mode

This parameter displays the automatic transmission fluid temperature (TFT) and displays On or Off. Off indicates that the TFT has not exceeded 130°C (266°F). On indicates that the TFT has exceeded 130°C (266°F) and has not cooled to 120°C (248°F) for greater that 5 seconds. These numbers are approximate and differ with transmissions.

Transmission ISS

This parameter displays the rotational speed of the transmission input shaft. The scan tool displays input shaft speed as revolutions per minute (RPM).

Transmission OSS

This parameter displays the rotational speed of the transmission output shaft. The scan tool displays output shaft speed as revolutions per minute (RPM). On four-wheel drive applications, the transfer case output shaft speed is measured.

Vehicle Speed

This parameter displays the speed at which the vehicle is traveling. The scan tool displays vehicle speed as kilometers per hour (km/h), miles per hour (MPH). The vehicle speed is calculated based on the input signal from the automatic transmission output shaft speed sensor.

DIAGNOSTIC TROUBLE CODE (DTC) TYPE DEFINITIONS

The DTC Type Definitions contain the characteristics for all types of DTCs. Each DTC type may or may not be found in this section. The DTC type is based on the action that the PCM takes when storing DTC information, and whether or not the PCM illuminates a service lamp or displays a message on a driver information center (DIC). The DTC descriptions in the Diagnostic Trouble Code List/Type below are listed in numeric order and indicate the DTC types for domestic and export vehicle applications. Each DTC is categorized into one of the following types:

Type A

This DTC is emissions related. The PCM stores the DTC in History, Freeze Frame and Failure Records during the first trip in which the conditions for setting the DTC are met. The PCM also illuminates the malfunction indicator lamp (MIL) during the first trip in which the conditions for setting the DTC are met.

Type B

This DTC is emissions related. The PCM stores the DTC in Failure Records during the first trip in which the conditions for setting the DTC are met. The PCM stores the DTC in History and Freeze Frame during the second consecutive trip in which the conditions for setting the DTC are met. The PCM also illuminates the MIL during the second consecutive trip in which the conditions for setting the DTC are met.

Type C

This DTC is non-emissions related. The PCM stores the DTC in History and Failure Records during the first trip in which the conditions for setting the DTC are met. The PCM does not store the DTC in Freeze Frame and does not illuminate the MIL. For some type C DTCs, a message may be displayed on a DIC, if equipped. For other type C DTCs, a separate service lamp, other than the MIL, may be illuminated. Type C DTCs that do not display a message on the DIC or illuminate a separate service lamp were formerly referred to as type D.

The service information contained in this manual refers to the domestic, federal, calibration package. Domestic calibrations apply to vehicles sold in the United States, Canada and Japan. Export calibrations exist for both leaded and unleaded vehicles. DTC types may change for some export vehicles, and some DTCs may be turned off for leaded export vehicles. Differences between domestic and export calibrations are not reflected on DTC support information pages. DTC types for export calibrations are referenced only in the Diagnostic Trouble Code List/Type.

DIAGNOSTIC TROUBLE CODE (DTC) LIST/TYPE

Diagnostic Trouble Code (DTC) List/Type

DTC Description	DTC Type
DTC P0218	C
DTC P0501	A
DTC P0502	A
DTC P0503	B
DTC P0705	A
DTC P0706	B
DTC P0711	C
DTC P0712	C
DTC P0713	C
DTC P0716	A
DTC P0717	A
DTC P0718	B
DTC P0731	C
DTC P0732	C
DTC P0733	C
DTC P0734	C
DTC P0735	C
DTC P0741	B
DTC P0746	B
DTC P0747	B
DTC P0751	B
DTC P0752	B
DTC P0756	B
DTC P0757	B
DTC P0761	B
DTC P0762	B
DTC P0776	B
DTC P0777	B
DTC P0780	B
DTC P0847	C
DTC P0848	C

DTC P0872	C
DTC P0873	C
DTC P0962	A
DTC P0963	A
DTC P0966	A
DTC P0967	A
DTC P0973	A
DTC P0974	A
DTC P0976	A
DTC P0977	A
DTC P0979	A
DTC P0980	A
DTC P2763	A
DTC P2764	A
DTC P2769	A
DTC P2770	A

TROUBLESHOOTING

SYMPTOMS - AUTOMATIC TRANSMISSION

Symptoms - Automatic Transmission

Diagnostic Category	Diagnostic Information
The following table consists of eight diagnostic categories that are located in the left hand column. Using this column, choose the appropriate category based on the operating conditions of the vehicle or transmission. After selecting a category, use the right hand column to locate the specific symptom diagnostics information.	
Fluid Diagnosis: This category contains the following topics: • Fluid condition - appearance, contaminants, smell, overheating • Line pressure - high or low • Fluid leaks	• Refer to **Transmission Fluid Checking Procedure** . • Refer to **Line Pressure Check Procedure** . • Refer to **Fluid Leak Diagnosis** . • Refer to **Automatic Transmission Oil Cooler Flushing and Flow Test** . • Refer to **Engine Coolant/Water in Transmission** .
Noise and Vibration Diagnosis: This category contains the following topics: • Noise - drive gear, final drive, whine, growl, hum, rattle, knock, clunk • Vibration	• Refer to **Noise in All Ranges** . • Refer to **Vibration at Idle** . • Refer to **Vibration in All Shift Lever Positions** .
Range Performance Diagnosis: This category contains the following topics: • No Park • No Reverse or slips • No Drive or slips • No engine braking • Range selector displays incorrect range	• Refer to **Stall Speed Test** . • Refer to **No Forward and Reverse** . • Refer to **No Drive in Forward Ranges** . • Refer to **No Reverse, or Forward Movement In Reverse** . • Refer to **High Stall Speed in Drive, Intermediate and Low** . • Refer to **Stall Speed High in Reverse** . • Refer to **Range Selector Displays Incorrect Range** . • Refer to **Vehicle Does Not Move in Low Range** . • Refer to **Low Stall Speed** . • Refer to **Shift Lever Does Not Operate Smoothly** .

	• Refer to **Transmission Does Not Shift into Park** . • Refer to **Shift Indicator Indicates Wrong Gear Selection** .
Shift Quality Feel Diagnosis: This category contains the following topics: • Harsh shifts • Soft shifts • Harsh engagement • Delayed engagement	• Refer to **Harsh Shifts** . • Refer to **Harsh 1-2 or 2-1 Shift Feel** . • Refer to **Harsh or Soft 2-3/3-2 Shift Feel** . • Refer to **Harsh or Soft 3-4/4-3 Shift Feel** . • Refer to **Harsh Shift 4 to 5, or 5 to 4** . • Refer to **Delay in Shifting from Neutral to Drive and Intermediate Ranges** . • Refer to **Delayed Engagement into Reverse** . • Refer to **Poor Acceleration, Flares on Start Off in Drive, Intermediate and Reverse** .
Shift Pattern: This category contains the following topics: • No upshift • No downshift	• Refer to **Transmission Does Not Shift** . • Refer to **Forward Motion in Neutral** . • Refer to **Shift Lever Does Not Operate Smoothly** . • Refer to **Transmission Does Not Shift into Park** . • Refer to **Shift Indicator Indicates Wrong Gear Selection** .
Shift Speed Diagnosis: This category consists of the following topic: Inaccurate or inconsistent shift points	• Refer to **Erratic Shift Quality** . • Refer to **Shift Speed Too Low** .
Torque Converter Diagnosis: This category contains the following topics: • Torque converter diagnosis • TCC does not apply • TCC does not release • TCC apply/release quality	• Refer to **Torque Converter Clutch (TCC) Not Disengaging** . • Refer to **Harsh Torque Converter Clutch (TCC) Apply or Release** . • Refer to **No Torque Converter Clutch (TCC) Apply** . • Refer to **Vehicle Does Not Accelerate More Than 31 mph (50 km/h)** . • Refer to **Torque Converter Diagnosis Procedure** .
Symptom Can Not Be Duplicated or Symptom Not Found: This category contains the following topics: • Transmission fluid diagnosis • Line pressure diagnosis	• Refer to **Transmission Fluid Checking Procedure** . • Refer to **Line Pressure Check Procedure** . • Refer to **Road Test Procedure** .

- Road testing

RANGE SELECTOR DISPLAYS INCORRECT RANGE

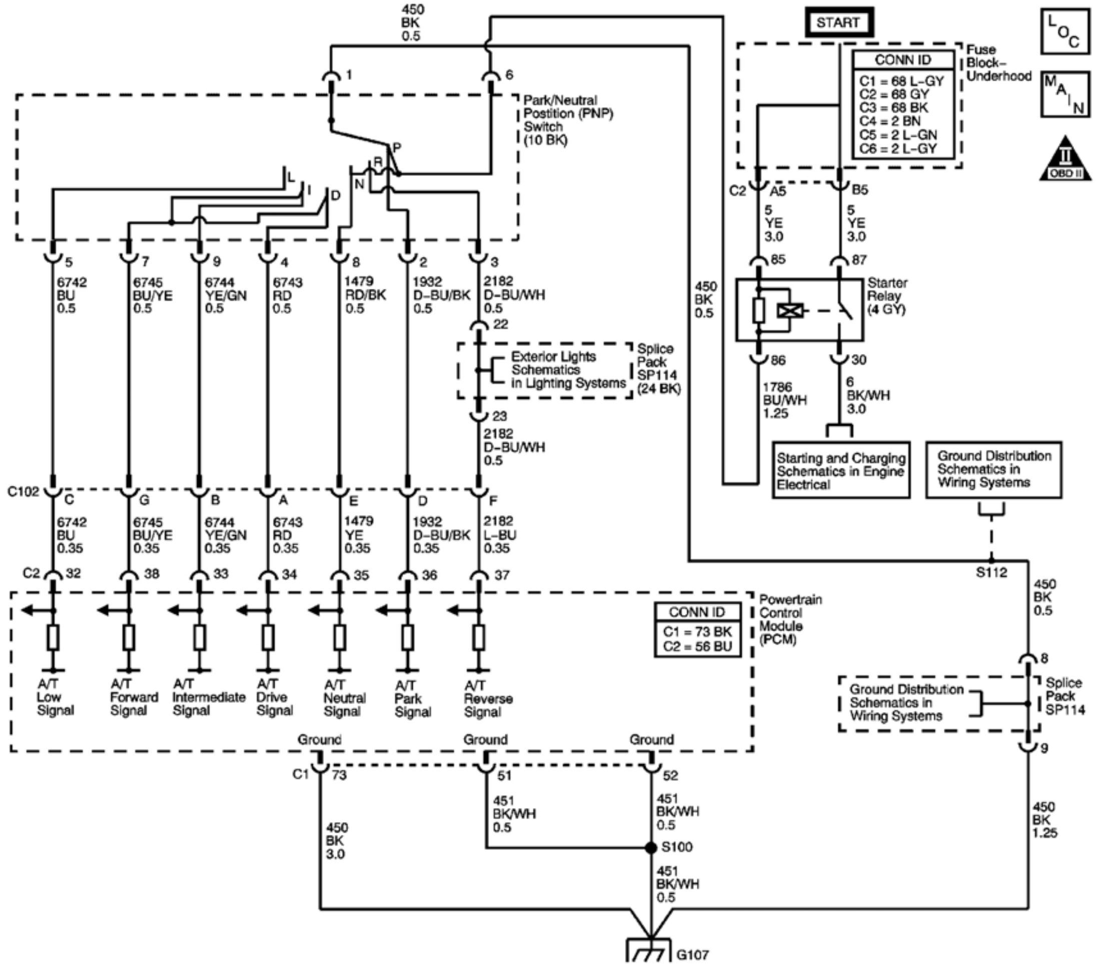


Fig. 1: Range Selector Displays Incorrect Range Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission range (TR) switch is part of the park/neutral position (PNP) switch assembly and is mounted on the transmission manual shaft. The TR switch is a multi-signal switch. The powertrain control module (PCM) supplies ignition voltage to the TR switch on 7 signal circuits, P, R, N, D, I, L, and Forward Range. Each gear selector lever position grounds one or more of the signal circuits in a unique pattern. In order to determine the gear range selected by the driver, the PCM compares the voltage combination on the signal circuits to a TR switch combination table stored in memory. Refer to **Transmission Range Switch Logic** .

Diagnostic Aids

- Inspect the connectors at the PCM, the TR switch, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a shorted TR switch wire.
- Inspect for a faulty TR switch.
- Inspect for an internal fault of the PCM.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: By disconnecting the TR switch, the ground path for all TR switch circuits would be removed and the PCM should recognize all circuits as open. The scan tool should display HI for all range signals.

6: This step tests the TR switch wiring for an open or lack of signal voltage from the PCM.

7: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal park should change to LOW.

8: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal reverse should change to LOW.

9: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal neutral should change to LOW.

10: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal drive should change to LOW.

11: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal intermediate should change to LOW.

12: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal forward should change to LOW.

13: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal low should change to LOW.

Range Selector Displays Incorrect Range

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Select TR Sw. parameter on the scan tool.			

2	4. With the scan tool observe the TR Sw. parameter display while selecting transmission ranges: P, R, N, D, I, L. Does TR Sw. parameter display match each transmission range selection?	-	Go to **Intermittent Conditions** in Engine Controls - 3.5L (L66)	Go to **Step 3**
3	1. Inspect the PNP switch assembly for the following conditions: • Damage • Loose or missing mounting hardware • Proper adjustment Refer to **Park/Neutral Position Switch Replacement** . 2. Inspect the shift cable for the following conditions: • Damaged or stretched cable • Proper adjustment Did you find and correct a condition?	-	Go to **Step 20**	Go to **Step 4**
4	With the scan tool, observe the TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. Does the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters indicate HI for all range signal states?	-	Go to **Step 17**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Disconnect the TR switch 10-way connector. 3. Turn ON the ignition, with the engine OFF. Does the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters indicate HI for all range signal states?	-	Go to **Step 6**	Go to **Step 14**
	1. Using the DMM and the **J-35616** connector test adapter kit, measure the voltage from the TR switch park signal circuit 10-way connector to ground. 2. Measure the voltage from the TR switch reverse signal circuit 10-way connector to			

6	ground. 3. Measure the voltage from the TR switch neutral signal circuit 10-way connector to ground. 4. Measure the voltage from the TR switch drive signal circuit 10-way connector to ground. 5. Measure the voltage from the TR switch intermediate signal circuit 10-way connector to ground. 6. Measure the voltage from the TR switch forward signal circuit 10-way connector to ground. 7. Measure the voltage from the TR switch low signal circuit 10-way connector to ground. Does the voltage measure within the specified value at all circuits?	10-12 V	Go to **Step 7**	Go to **Step 15**
7	Connect a 3 amp fused jumper wire from the TR switch park signal circuit 10-way connector to ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L, and the TR Sw. Forward Range parameters. When the TR switch park signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 8**
8	Connect a 3 amp fused jumper wire from the TR switch reverse signal circuit 10-way connector to ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch reverse signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 9**
9	Connect a 3 amp fused jumper wire from the TR switch neutral signal circuit 10-way connector to ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch neutral signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 10**
	Connect a 3 amp fused jumper wire from the TR switch drive signal circuit 10-way connector to			

10	ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch drive signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 11**
11	Connect a 3 amp fused jumper wire from the TR switch intermediate signal circuit 10-way connector to ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch intermediate signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 12**
12	Connect a 3 amp fused jumper wire from the TR switch forward signal circuit 10-way connector to ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch forward signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 13**
13	Connect a 3 amp fused jumper wire from the TR switch low signal circuit 10-way connector to ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch low signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 18**
14	Test the TR switch signal circuits that did not indicate HI for a short to ground. Refer to **Testing for Short to Ground** and**Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 19**
15	Test the TR switch signal circuits that did not indicate proper voltage for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 19**
16	Test the affected TR switch signal circuits for a shorted together condition. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 19**
	Test the TR switch ground circuit for an open.			

17	Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 18**
18	Replace the TR switch. The TR switch is part of the PNP switch. Refer to **Park/Neutral Position Switch Replacement** . Did you complete the replacement?	-	Go to **Step 20**	-
19	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM setup procedure. Did you complete the replacement?	-	Go to **Step 20**	-
20	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Start the engine and select gear ranges P, R, N, D, I, L. 4. Road test the vehicle. 5. Select Specific DTC. 6. Enter DTC P0705. Has the test run and passed?	-	Go to **Step 21**	Go to **Step 2**
21	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

NO FORWARD AND REVERSE

No Forward and Reverse

Condition	Action
DEFINITION: Engine runs, but vehicle does not move in any gear	
• Low ATF level • Shift cable broken or out	• Inspect the ATF level and ATF cooler lines for leakage and loose connections. Flush the ATF cooler lines, if necessary.

- of adjustment - Joint in the shift cable and the transmission, or body, worn - ATF pump worn or binding - Regulator valve stuck or the spring worn - ATF filter clogged - Mainshaft worn or damaged - Final drive gears worn or damaged - Park mechanism inoperative - Transmission-to-engine assembly error - Axle disengaged	- Inspect for a loose shift cable at the shift lever and transmission control shaft. - Improper alignment of the ATF pump and the torque converter housing may cause an ATF pump seizure. The symptoms are mostly an RPM related ticking noise or a high pitched squeak. - Inspect the line pressure. - If the filter is clogged, find the damaged components that caused debris. - Inspect the front differential pinion gears for wear. Replace the front differential assembly, if the differential pinion gears are worn. - Thoroughly clean the transmission, replace the ATF filter, and flush the cooler and lines. - Replace the torque converter. - Do not damage the torque converter housing when replacing the main ball bearing. Applying torque to the main valve body may damage the ATF pump. Use the proper tools. This results in an ATF pump seizure, if not detected. - Install the mainshaft front seal flush with the torque converter housing. If the seal is installed down into the torque converter housing until the seal bottoms out, the seal will block the fluid return passage and result in damage.

NO DRIVE IN FORWARD RANGES

No Drive in Forward Ranges

Condition	Action
DEFINITION: Vehicle moves in R, but not in D, I or L position.	
1st gear one-way clutch inoperative 1st gear worn or damaged 1st clutch inoperative 1st accumulator inoperative - Idle gears worn or damaged	- Inspect the 1st clutch pressure. - Inspect the 1st/2nd clutch shaft and the 1st/coast clutch assembly for wear and damage. - Inspect the clutch piston and the O-rings. - Inspect the spring retainer for wear and damage. - Inspect the clutch backing-plate-to-top-disc clearance. If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance.

VEHICLE DOES NOT MOVE IN LOW RANGE

Vehicle Does Not Move in Low Range

Condition	Action
DEFINITION: Vehicle moves in D, I and R, but not in the L position	
• Coast clutch accumulator inoperative • Coast clutch inoperative	• Inspect the coast clutch pressure. • Inspect the 1st/2nd clutch shaft and the 1st/coast clutch assembly for wear and damage. • Inspect the coast clutch piston and the O-rings. • Inspect the spring retainer for wear and damage. • Inspect the clutch backing plate-to-top disc clearance. If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance.

NO REVERSE, OR FORWARD MOVEMENT IN REVERSE

No Reverse, or Forward Movement In Reverse

Condition	Action
DEFINITION: Vehicle moves in D, I and L, but not in the R position, or the vehicle moves forward in the R position	
• Reverse shift fork shaft stuck • Modulator valve inoperative • Reverse CPC valve inoperative • 5th accumulator inoperative • 5th clutch inoperative • Reverse gears worn or damaged	• Inspect the line pressure and the 5th clutch pressure. • Inspect for a missing reverse shift fork bolt on the reverse shift fork shaft. • If the ATF filter is clogged with particles of steel or aluminum, inspect the ATF pump. If the ATF pump is in satisfactory condition, and no cause for the contamination is found, replace the torque converter. • Inspect the reverse synchronizer gear teeth chamfers, • Inspect the engagement teeth chamfers of the output shaft 5th gear and reverse gear. Replace the reverse gears and the reverse synchronizer if they are worn or damaged. • Replace the mainshaft 5th gear, the reverse idler gear, and the output shaft 5th gear, if the transmission makes clicking, grinding, or whirring noises. • Inspect the clutch piston, the clutch piston check valve, and the O-rings. • Inspect the clutch piston spring retainer for wear and damage. • Inspect the clutch backing plate-to-top disc clearance. If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clearance with the clutch backing plate.

POOR ACCELERATION, FLARES ON START OFF IN DRIVE, INTERMEDIATE AND REVERSE

Poor Acceleration, Flares on Start Off in Drive, Intermediate and Reverse

Condition	Action
DEFINITION: Poor acceleration; flares on start-off in the D, I, and R positions	
• Low ATF level • Shift cable broken or out of adjustment • ATF pump worn or binding • Regulator valve stuck or the spring worn • ATF filter clogged • Torque converter check valve inoperative	• Inspect the ATF level and the ATF cooler lines for leakage and loose connections. Flush the ATF cooler lines, if necessary. • Inspect for a loose shift cable at the shift lever and the transmission control lever. • Inspect the line pressure. • Improper alignment of the ATF pump and the torque converter housing may cause an ATF pump seizure. The symptom is mostly an RPM ticking noise or a high-pitched squeak. • Do not damage the torque converter housing when replacing the mainshaft front bearing. Applying torque to the main control body may damage the ATF pump. This results in an ATF pump seizure if not detected. Use the proper tools.

HIGH STALL SPEED IN DRIVE, INTERMEDIATE AND LOW

High Stall Speed in Drive, Intermediate and Low

Condition	Action
DEFINITION: Poor acceleration; flares on start-off in the D and I positions; stall speed high in the D, I and L positions	
• 1st accumulator inoperative • 1st clutch inoperative • Low fluid level • ATF pump output low • Restricted ATF filter • Regulator valve stuck • Slipping clutch	• Inspect the 1st clutch pressure. • Inspect the clutch piston and the O-rings. • Inspect the spring retainer for wear and damage. • Inspect the clutch backing-plate-to-top-disc clearance. If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance. • Inspect the ATF level. • Inspect the ATF filter for being restricted. • Inspect the regulator valve for being stuck.

STALL SPEED HIGH IN REVERSE

Stall Speed High in Reverse

Condition	Action
DEFINITION: Poor acceleration; flares on start-off in the R position; stall speed high in the R position	

- Shift solenoid valve C inoperative - Shift cable broken or out of adjustment - Reverse CPC valve inoperative 5th accumulator inoperative 5th clutch inoperative 5th clutch slipping	- Inspect the MIL. - Scan for stored DTCs. - Inspect for loose connectors. - Inspect the O-ring, and the shift solenoid valve for seizure. - Inspect for a loose shift cable at the shift lever and the transmission control lever. - Inspect the 5th clutch pressure. - Inspect the clutch piston and the O-rings. - Inspect the spring retainer for wear and damage. - Inspect for a slipping 5th clutch. - Inspect the clutch backing-plate- to-top-disc clearance. If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance.

LOW STALL SPEED

Low Stall Speed

Condition	Action
DEFINITION: Poor acceleration; flares on start-off in the D, I and R positions; stall speed test results are low or below specification	
- TCC solenoid valve inoperative - Torque converter one-way clutch inoperative - Torque converter one-way clutch slipping - Engine output low - Engine throttle valve closed - Lock-up clutch piston inoperative - Lock-up shift valve inoperative	- Inspect for a stuck lock-up valve in the valve body. - Perform an engine output/diagnostic test to determine if the engine is operating to specification.

VIBRATION AT IDLE

Vibration at Idle

Condition	Action
DEFINITION: Engine idle vibration	
Low ATF level	Set the base idle RPM in gear, to the specified idle speed. If the

- TCC solenoid valve inoperative - Drive/flex plate inoperative - Transmission is improperly assembled - Engine output low - Lock-up clutch piston inoperative - ATF pump worn or binding - Lock-up shift valve inoperative	condition persists, adjust the engine and transmission mounts. Refer to **Engine Mount Inspection** in Engine Mechanical - 3.5L (L66) and **Automatic Transmission Mount Replacement - Rear** . - Inspect the ATF level and the ATF cooler lines for leakage and loose connections. Flush the ATF cooler lines, if necessary. - Perform an engine output/diagnostic test to determine if the engine is operating to specification

FORWARD MOTION IN NEUTRAL

Forward Motion in Neutral

Condition	Action
DEFINITION: Vehicle moves in the N position	
- Excessive ATF - Foreign material in the valve body spacer plate orifice - Fluid pressure relief valve inoperative - Lubrication control valve inoperative - Coast clutch inoperative 1st clutch inoperative 2nd clutch inoperative 3rd clutch inoperative 4th clutch inoperative 5th clutch inoperative	- Inspect the ATF level. Drain if necessary. - Inspect all clutch pressures. - Inspect the clutch piston, the clutch piston check valve, and the O-rings. - Inspect the spring retainer for wear and damage. - Inspect the clutch backing plate-to-top disc clearance. If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance. - Inspect for incorrect Clutch backing plate clearance. - Inspect for Internal bearing seized up, worn, or damaged. - Inspect for thrust washer seized up, worn, or damaged.

DELAY IN SHIFTING FROM NEUTRAL TO DRIVE AND INTERMEDIATE RANGES

Delay in Shifting from Neutral to Drive and Intermediate Ranges

Condition	Action
DEFINITION: Late shift from the N position to D and I positions or excessive shock felt when shifting into gear	
• Shift solenoid valve C inoperative • 1st clutch, pressure control solenoid inoperative • 2nd clutch, pressure control solenoid inoperative • TCC lock-up, pressure control solenoid inoperative • Shift cable broken or out of adjustment • Joint in the shift cable and the transmission or the body worn • Input speed sensor inoperative • Output shaft speed sensor inoperative • ATF temperature sensor inoperative • CPC valve A inoperative • CPC valve B inoperative • CPC valve C stuck • Foreign material in the spacer plate orifice • Shift valve C inoperative • Shift valve E inoperative • Servo control valve inoperative • 1st accumulator inoperative • 1st check ball stuck • One-way check ball stuck • 1st clutch inoperative	• Inspect the MIL indicator for loose connectors. • Inspect the O-ring and the shift solenoid valve for seizure. • Inspect the valve body gasket of the AT clutch pressure control solenoid. • Inspect the ATF feed pipes for wear and damage. • Inspect the CPC valves if the AT clutch pressure control solenoid valve is stuck. • Inspect for a loose shift cable at the shift lever and the transmission control lever. • Inspect the 1st clutch pressure. • Inspect the clutch piston, the clutch piston check valve, and the O-rings. • Inspect the clutch piston return spring retainer for wear and damage. • Inspect the clutch backing-plate-to-top-disc clearance. • If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. • If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance.

DELAYED ENGAGEMENT INTO REVERSE

Delayed Engagement into Reverse

Condition	Action
DEFINITION: Late shift from the N position to the R position, or excessive shock when shifting into gear	
• Shift solenoid valve C inoperative • 2nd clutch, pressure control solenoid inoperative • TCC lock-up, pressure control solenoid inoperative • Shift cable broken or out of adjustment • Joint in the shift cable and the transmission or the body worn • Input speed sensor inoperative • Output shaft speed sensor inoperative • ATF temperature sensor inoperative • Reverse shift fork shaft stuck • CPC valve C stuck • Reverse CPC valve inoperative • Foreign material in the spacer plate orifice • Shift valve E inoperative • 5th accumulator inoperative • 5th clutch inoperative	• Inspect the MIL indicator for loose connectors. • Inspect the O-ring, and the shift solenoid valve for seizure. • Inspect the valve body gasket of the AT clutch pressure control solenoid. • Inspect the ATF feed pipes for wear and damage. • Inspect the CPC valves if the AT clutch pressure control solenoid valve is stuck. • Inspect for a loose shift cable at the shift lever and the transmission control shaft. • Inspect the 5th clutch pressure. • Inspect the clutch piston, the clutch piston check valve, and the O-rings. • Inspect the clutch piston return spring retainer for wear and damage. • Inspect the clutch backing-plate-to-top-disc clearance. • If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance.

TRANSMISSION DOES NOT SHIFT

Transmission Does Not Shift

Condition	Action
DEFINITION: No up shift or down shift	
• Input speed sensor inoperative	• Inspect the MIL indicator for loose connectors.

• Output shaft speed sensor inoperative • Modulator valve inoperative	• Inspect the line pressure.

ERRATIC SHIFT QUALITY

Erratic Shift Quality

Condition	Action
DEFINITION: Erratic shifting of gears: Does not shift into the D and I positions; starts off in 5th gear	
• Shift solenoid B inoperative • Shift valve B inoperative	• Inspect the MIL indicator for loose connectors. • Inspect the O-ring and the shift solenoid valve for seizure.
DEFINITION: Erratic shifting gears: Does not shift into the D, I and L positions; starts off in 3rd gear.	
• Shift solenoid A inoperative • Shift valve A inoperative	• Inspect the MIL indicator for loose connectors. • Inspect the O-ring and the shift solenoid valve for seizure.

HARSH SHIFTS

Harsh Shifts

Condition	Action
DEFINITION: Excessive shock or flares on all upshifts and downshifts	
• 1st clutch, pressure control solenoid inoperative • Input speed sensor inoperative • Output shaft speed sensor inoperative • ATF temperature sensor inoperative • CPC valve A inoperative • Foreign material in the spacer plate orifice	• Inspect the MIL indicator for loose connectors. • Inspect the valve body gasket of the AT clutch pressure control solenoid and ATF feed pipes for wear and damage. • Inspect the CPC valves if the AT clutch pressure control solenoid valve is stuck. • Inspect the sensor O-rings.

HARSH 1-2 OR 2-1 SHIFT FEEL

Harsh 1-2 or 2-1 Shift Feel

Condition	Action
DEFINITION: Excessive shock, or flares on 1-2 upshift or 2-1 downshift	
• Foreign material in the spacer plate orifice • 2nd accumulator inoperative	• Inspect the 1st and the 2nd clutch pressures. • Inspect the clutch piston and the O-rings. • Inspect the clutch piston return spring retainer for wear and damage. • Inspect the clutch backing-plate-to-top-disc clearance. If the clearance is

• 2nd check ball stuck • 2nd clutch inoperative	out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance

HARSH OR SOFT 2-3/3-2 SHIFT FEEL

Harsh or Soft 2-3/3-2 Shift Feel

Condition	Action
DEFINITION: Excessive shock, or flares on 2-3 upshift or 3-2 downshift	
• Shift solenoid valve C inoperative • 2nd clutch, pressure control solenoid inoperative • 3rd clutch transmission fluid pressure switch inoperative • CPC valve B inoperative • Foreign material in the spacer plate orifice • Shift valve C inoperative • 2nd accumulator inoperative • 3rd accumulator inoperative • 2nd check ball stuck • 2nd clutch inoperative • 3rd clutch inoperative	• Inspect the MIL indicator for loose connectors. • Inspect the O-rings, and the shift solenoid valve for seizure. • Inspect for a clogged orifice in the transmission fluid pressure switch connector. If the orifice is clogged, remove it and clean the connector. • Inspect the 2nd and the 3rd clutch pressures. • Inspect the clutch piston and the O-rings. • Inspect the clutch piston return spring retainer for wear and damage. • Inspect the clutch backing-plate-to-top-disc clearance. If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance.

HARSH OR SOFT 3-4/4-3 SHIFT FEEL

Harsh or Soft 3-4/4-3 Shift Feel

Condition	Action
DEFINITION: Excessive shock, or flares on 3-4 upshift or 4-3 downshift	
• Shift solenoid valve	• Inspect the MIL indicator for loose connectors.

• C inoperative • 2nd clutch, pressure control solenoid inoperative • 4th clutch transmission fluid pressure switch inoperative • CPC valve B inoperative • Foreign material in the spacer plate orifice • Shift valve C inoperative • 3rd accumulator inoperative • 4th accumulator inoperative • 3rd clutch inoperative • 4th clutch inoperative	• Inspect the O-rings, and the shift solenoid valve for seizure. • Inspect for a clogged orifice in the transmission fluid pressure switch connector. If the orifice is clogged, remove it and clean the connector. • Inspect the 3rd and the 4th clutch pressures. • Inspect the clutch piston and the O-rings. • Inspect the clutch piston return spring retainer for wear and damage. • Inspect the clutch backing-plate-to-top-disc clearance. If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance.

HARSH SHIFT 4 TO 5, OR 5 TO 4

Harsh Shift 4 to 5, or 5 to 4

Condition	Action
DEFINITION: Excessive shock, or flares on 4-5 upshift or 5-4 downshift	
• Shift solenoid valve C inoperative • 2nd clutch, pressure control solenoid inoperative • TCC lock-up, pressure control solenoid inoperative • CPC valve B inoperative • CPC valve C inoperative • Foreign material in	• Inspect the MIL indicator for loose connectors • Inspect the O-rings, and the shift solenoid valve for seizure. • Inspect the 4th and the 5th clutch pressures. • Inspect the clutch piston and the O-rings. • Inspect the clutch piston return spring retainer for wear and damage. • Inspect the clutch backing-plate-to-top-disc clearance. If the clearance is out of tolerance, inspect the clutch discs and plates for wear and damage. If the discs and plates are worn or damaged, replace the discs and plates as a set. If the discs and plates are in satisfactory condition, adjust the clutch backing plate clearance.

the valve body spacer plate orifice • Shift valve C inoperative • Shift valve E inoperative • Kick-down valve or the kick-down short valve inoperative • 4th accumulator inoperative • 5th accumulator inoperative • 4th clutch inoperative • 5th clutch inoperative	

NOISE IN ALL RANGES

Noise in All Ranges

Condition	Action
DEFINITION: Noise from the transmission in all shift lever positions	
• ATF pump worn or binding • Idler gears worn or damaged • Thrust washer seized up, worn, or damaged • RPM related ticking noise • High-pitched squeak	Inspect for proper alignment of the ATF pump and the torque converter housing. Improper alignment of the ATF pump and the torque converter housing may cause an ATF pump seizure.

VEHICLE DOES NOT ACCELERATE MORE THAN 31 MPH (50 KM/H)

Vehicle Does Not Accelerate More Than 31 mph (50 km/h)

Condition	Action
DEFINITION: Vehicle does not accelerate greater than 31 mph (50 km/h)	
• Torque converter one-way clutch inoperative • Base engine concern	• Replace the torque converter assembly. • Inspect the engine for proper operation. Use a scan tool to display any stored DTCs.

VIBRATION IN ALL SHIFT LEVER POSITIONS

Vibration in All Shift Lever Positions

Condition	Action
DEFINITION: Vibration in all shift lever positions	
• Drive/flex plate inoperative or the transmission is improperly assembled • Base engine concern	• Set the base idle RPM in gear, to the specified idle speed. If the conditions persist, adjust the engine and the transmission mounts. Refer to **Engine Mount Replacement - Right** in Engine Mechanical - 3.5L (L66), **Transmission Mount Replacement - Front** , and **Transmission Mount Inspection** . • Inspect the stall speed. • Inspect the engine for proper operation. Use a scan tool to display any stored DTCs.

SHIFT LEVER DOES NOT OPERATE SMOOTHLY

Shift Lever Does Not Operate Smoothly

Condition	Action
DEFINITION: Shift lever does not operate smoothly	
• Transmission range switch inoperative or out of adjustment • Shift cable broken or out of adjustment • Joint in the shift cable and the transmission, or in the body, worn • Internal transaxle concern	• Inspect the MIL indicator for loose connectors. • Inspect the transmission range switch. Replace the transmission range switch if faulty. Adjust the transmission range switch and the shift cable, if not adjusted properly. • Inspect for a loose shift cable at the shift lever and the transmission control shaft. • Inspect the manual shift shaft lever and the bearings for binding or improper assembly.

TRANSMISSION DOES NOT SHIFT INTO PARK

Transmission Does Not Shift into Park

Condition	Action
DEFINITION: Transmission does not shift into the P position	
• Shift cable broken or out of adjustment • Joint in the shift cable and the transmission or the body worn • Park mechanism inoperative	• Inspect for a loose shift cable at the shift lever and the transmission shaft. • Inspect the park pawl, the control shaft, and the park lever link for wear and damage. • Inspect the control shaft lever pin for disengagement from the manual valve guide.

TORQUE CONVERTER CLUTCH (TCC) NOT DISENGAGING

Torque Converter Clutch (TCC) Not Disengaging

Condition	Action
DEFINITION: TCC Lock-up clutch does not disengage	
• Torque converter clutch solenoid valve inoperative • TCC lock-up, pressure control solenoid inoperative • TCC lock-up clutch piston inoperative • TCC lock-up shift valve inoperative • TCC lock-up control valve inoperative • TCC lock-up timing valve inoperative	• Inspect the MIL indicator for loose connectors. • Inspect the TCC lock-up pressure control solenoid body gasket for wear and damage. • If the TCC lock-up pressure control solenoid is stuck, inspect the CPC valves.

HARSH TORQUE CONVERTER CLUTCH (TCC) APPLY OR RELEASE

Harsh Torque Converter Clutch (TCC) Apply or Release

Condition	Action
DEFINITION: TCC Lock-up clutch does not operate smoothly	
• Torque converter clutch solenoid valve inoperative • TCC lock-up pressure control solenoid inoperative • Lock-up clutch piston inoperative • Torque converter check valve inoperative • TCC lock-up shift valve inoperative • TCC lock-up control valve inoperative • TCC lock-up timing valve inoperative • Transaxle is filled with unapproved ATF	• Inspect the MIL indicator for loose connectors. • Inspect the TCC lock-up pressure control solenoid body gasket for wear and damage. • If the TCC lock-up pressure control solenoid is stuck, inspect the CPC valves. • Center/neutralize all engine mounts. • Drain the transaxle assembly. Flush the system and fill with Honda approved ATF.

NO TORQUE CONVERTER CLUTCH (TCC) APPLY

No Torque Converter Clutch (TCC) Apply

Condition	Action
DEFINITION: TCC Lock-up clutch does not engage	

• Torque converter clutch solenoid valve inoperative • TCC lock-up pressure control solenoid inoperative • Input speed sensor inoperative • Output shaft speed sensor inoperative • TCC lock-up clutch piston inoperative • Torque converter check valve inoperative • TCC lock-up shift valve inoperative • TCC lock-up control valve inoperative	• Inspect the MIL indicator for loose connectors. • Inspect the TCC lock-up pressure control solenoid body gasket for wear and damage. • If the TCC lock-up pressure control solenoid is stuck, inspect the CPC valves.

SHIFT INDICATOR INDICATES WRONG GEAR SELECTION

Shift Indicator Indicates Wrong Gear Selection

Condition	Action
DEFINITION: AT gear position indicator does not indicate shift lever positions	
• Transmission range switch inoperative or out of adjustment • Shift cable broken or out of adjustment • Joint in the shift cable and the transmission or the body worn	• Inspect the MIL indicator for loose connectors. • Inspect the transmission range switch. Replace the transmission range switch, if faulty. Adjust the transmission range switch and the shift cable, if not adjusted properly. • Inspect for a loose shift cable at the shift lever and the transmission control shaft.

SHIFT SPEED TOO LOW

Shift Speed Too Low

Condition	Action
DEFINITION: Engine RPM does not increase to high speed, and the transmission upshifts during low RPM condition with the engine at normal operating temperature	
VTEC rocker arms inoperative	Inspect the engine rocker arms. Refer to **Valve Rocker Arm and Shaft Cleaning and Inspection** .

TRANSMISSION FLUID CHECKING PROCEDURE

Procedure:

IMPORTANT:

- **Keep all foreign particles out of the transmission.**
- **Turn the engine OFF when checking fluid level.**

1. Warm the engine to normal operating temperature - until the electric radiator fan turns on at least once.
2. Park the vehicle on a level surface.
3. Depress the brake pedal and move the shift lever through the gear ranges, pausing a few seconds in each gear.
4. Turn OFF the engine.

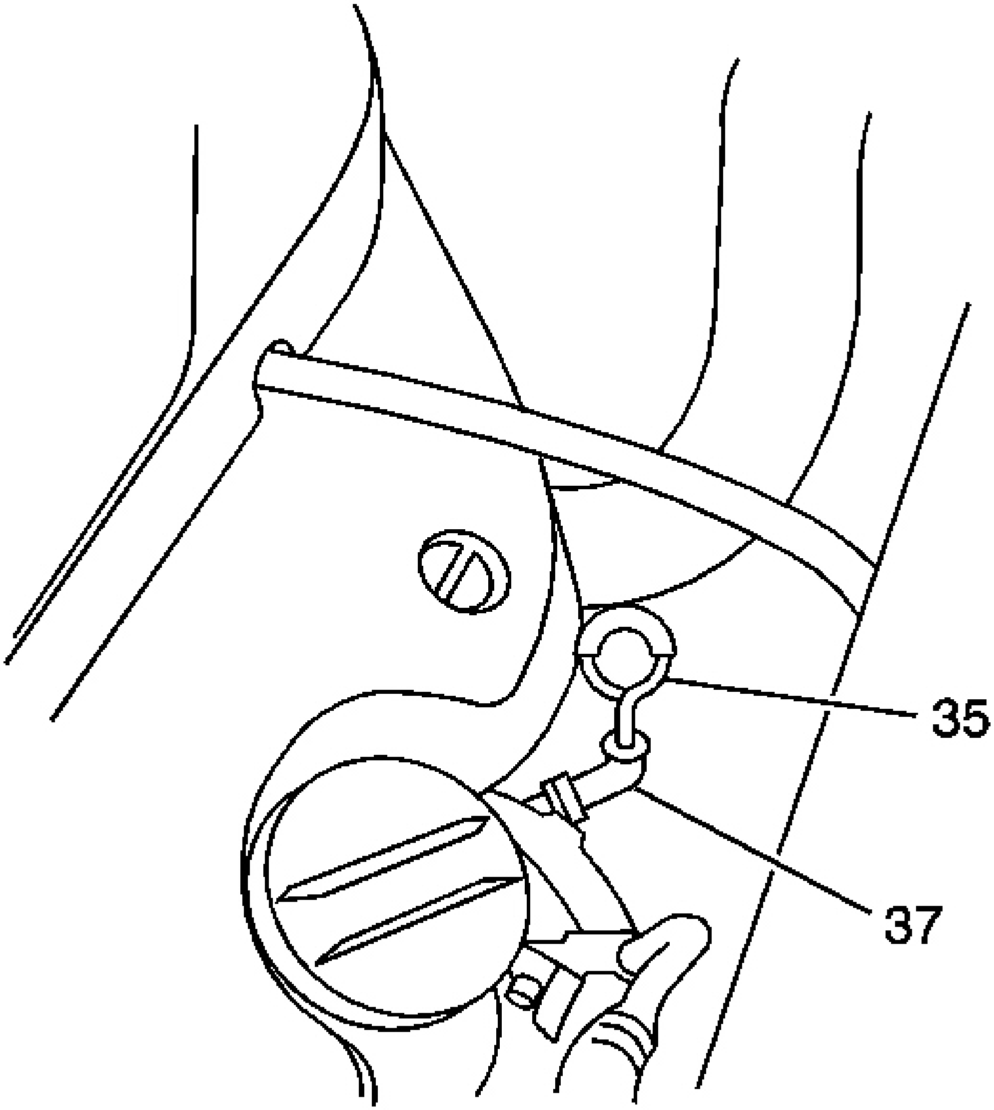


Fig. 2: Fluid Level Indicator & ATF Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

5. Remove the fluid level indicator (35) located at the rear of the engine compartment with the black loop, from the automatic transmission fluid (ATF) level indicator tube (37).
6. Wipe the fluid level indicator (35) with a clean cloth.

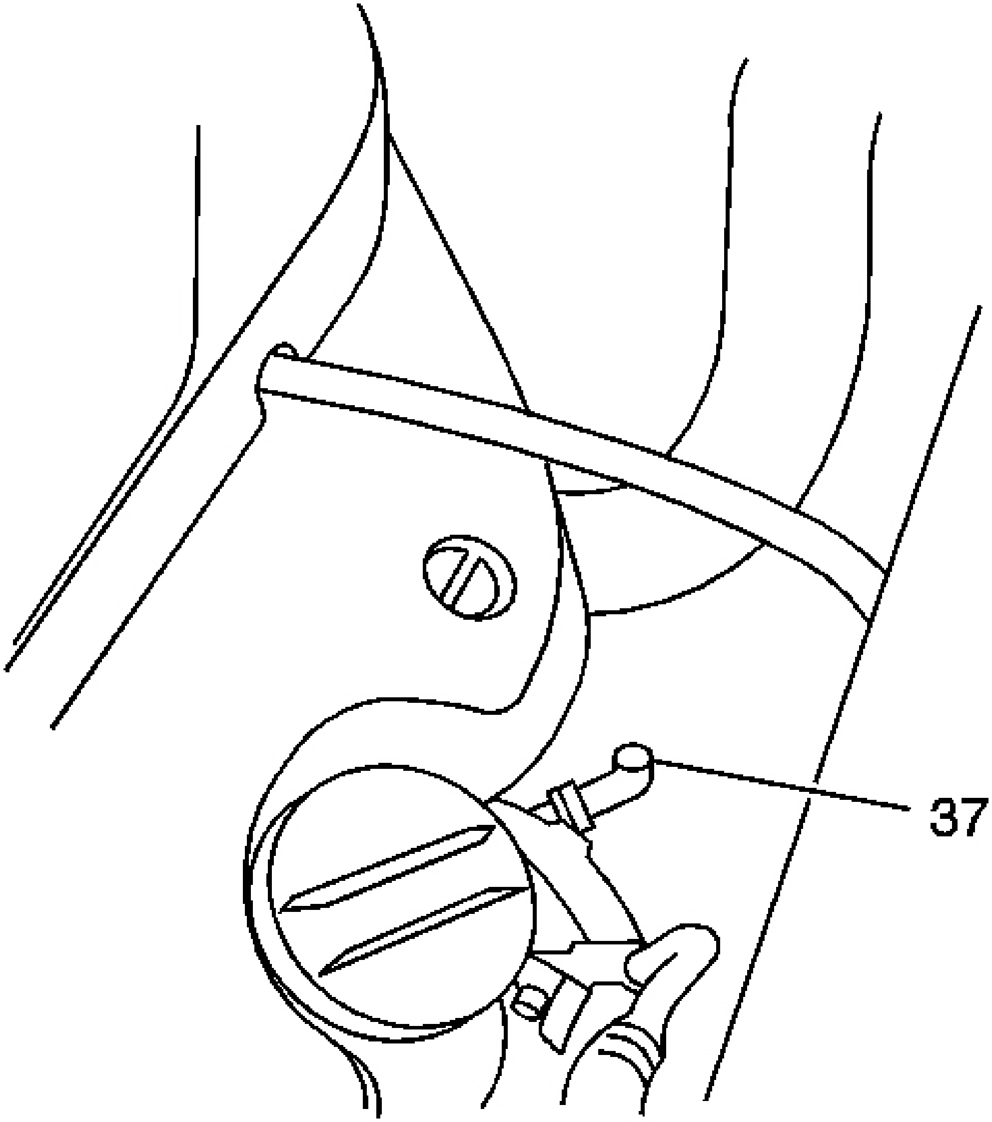


Fig. 3: Fluid Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

7. Insert the fluid level indicator (35) into the fluid level indicator tube (37).

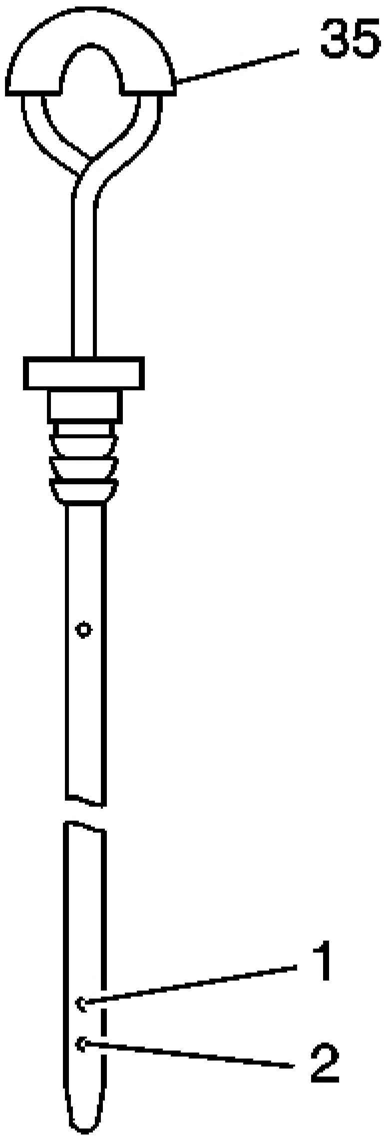


Fig. 4: Fluid Level Indicator & Lower/Upper Mark
Courtesy of GENERAL MOTORS CORP.

8. Remove the fluid level indicator (35) and inspect the fluid level. The fluid level should be between the upper mark (1) and the lower mark (2).
9. If the fluid level is below the lower mark (2), inspect for fluid leaks at the transmission, the hose and line joints, and at the cooler lines. If the fluid level is above the upper mark (1), determine the cause of the

overfill condition and correct as needed.

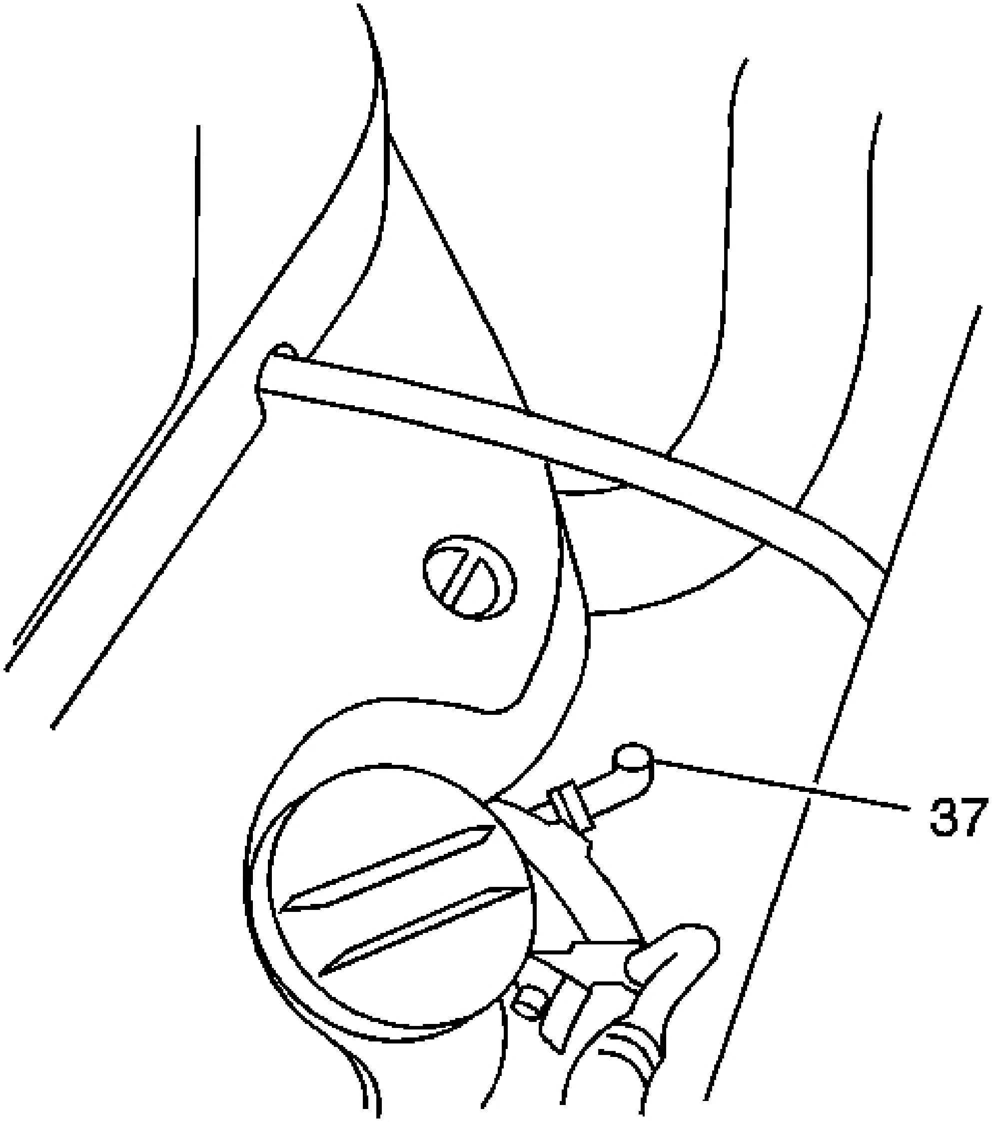


Fig. 5: Fluid Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Always use the specified ATF. If specified ATF is not used, shift quality is affected.**

- **Only add enough ATF to bring the fluid level to the upper mark on the fluid level indicator (35).**

10. When adding less than 946 ml (1 qt) of ATF, insert a funnel into the fluid level indicator tube (37), and add the correct amount of ATF to bring the level to the upper mark.
11. When adding more than 946 ml (1 qt) of ATF, open the transmission fluid fill plug (79) located on top of the transmission case section (31).
12. Insert the fluid level indicator back into the fluid level indicator tube (37).

LINE PRESSURE CHECK PROCEDURE

Tools Required

- **J 45542** Transmission Line Pressure Adapter
- **SA9127E** Gage Bar Set

CAUTION: One or more of the following guidelines may apply when performing specific required tests in the work stall:

- **When a test requires spinning the drive wheels with the vehicle jacked up, adhere to the following precautions:**
  - **Do not exceed 56 km/h (35 mph) when spinning one drive wheel with the other drive wheel stopped. This limit is necessary because the speedometer indicates only one-half the actual vehicle speed under these conditions. Personal injury may result from excessive wheel spinning.**
  - **If all of the drive wheels are spinning at the same speed, do not exceed 112 km/h (70 mph). Personal injury may result from excessive wheel spinning.**
  - **All persons should stay clear of the rotating components and the balance weight areas in order to avoid possible personal injury.**
  - **When running an engine in the repair stall for an extended period of time, use care not to overheat the engine and the transmission.**
- **When a test requires jacking up the vehicle and running with the wheels and brake rotors removed, adhere to the following precautions:**
  - **Support the suspension at normal ride height.**
  - **Do not apply the brake with the brake rotors removed.**
  - **Do not place the transmission in PARK with the drive axles spinning.**
  - **Turn Off the ignition in order to stop the powertrain components**

from spinning.

IMPORTANT: Ensure the area around the fluid pressure test hole plug is clean before removing the plug. Do not allow dust or other foreign particles to enter the fluid pressure test hole.

1. Inspect the transmission fluid level to ensure that the level is correct. Refer to **Transmission Fluid Checking Procedure** .
2. Raise the vehicle and correctly support. All four wheels will rotate. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Start the engine and allow the engine to idle until the fan operates.
4. Install a scan tool.
5. In order to connect to desired fluid pressure test hole plug the following is required:
   - Line pressure - Accessible from under the vehicle.
   - 5th clutch or reverse clutch - Remove the O2 wire harness bracket.
   - 3rd clutch - Accessible from under the vehicle.
   - 2nd clutch - Accessible from the topside of the transmission.
   - 4th clutch - Disconnect the 4th clutch pressure switch connector. Remove the wire harness bracket bolt.
   - 1st clutch or coast clutch - Remove the left side splash shield. Refer to **Splash Shield Replacement - Engine** in Body Front End.

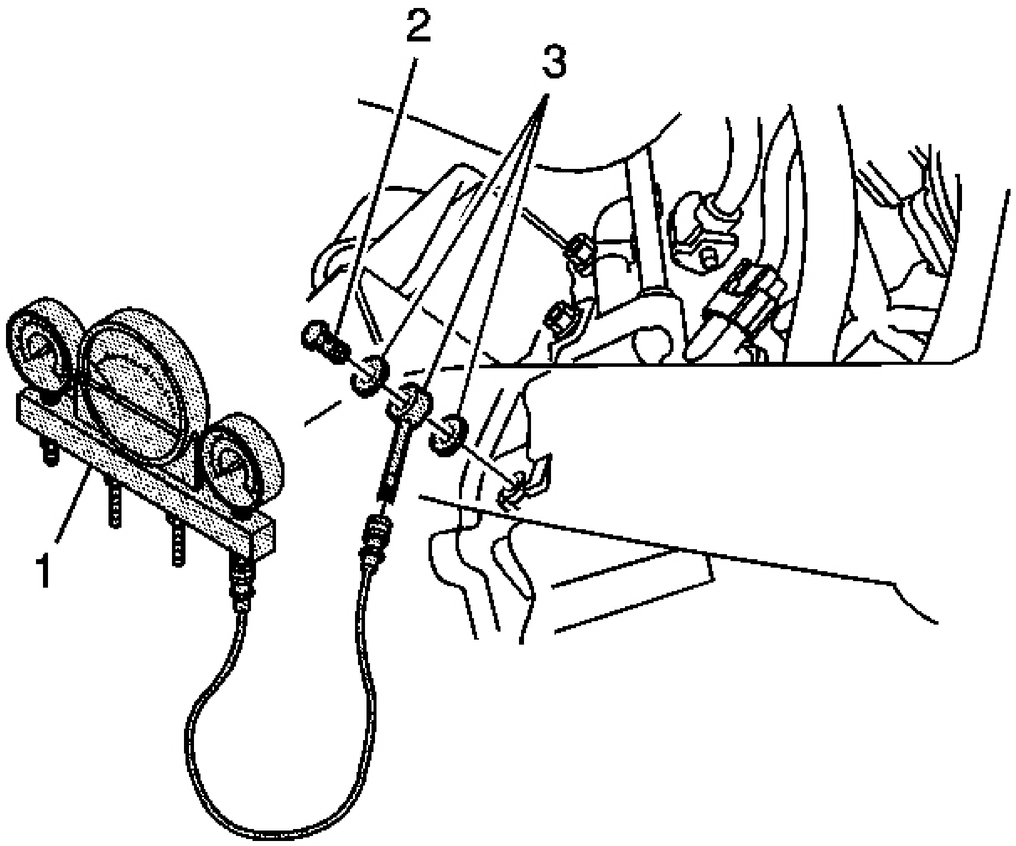


Fig. 6: J 45542, J 45542-3 & SA9127E
Courtesy of GENERAL MOTORS CORP.

6. Install the **J 45542** (3) using the J 45542-3 bolt (2) and 2 sealing washers to the desired fluid pressure test hole recommended in the symptom tables.
7. Connect the **SA9127E** (1) to the **J 45542** (3).
8. When the test is completed, remove the **J 45542** .
9. Install the fluid pressure test hole plug with a new seal. Do not use the seal again.

   Tighten: Tighten the test hole plug to 18 N.m (13 lb ft)

Fluid Pressure Test Hole Plugs - Transmission Case

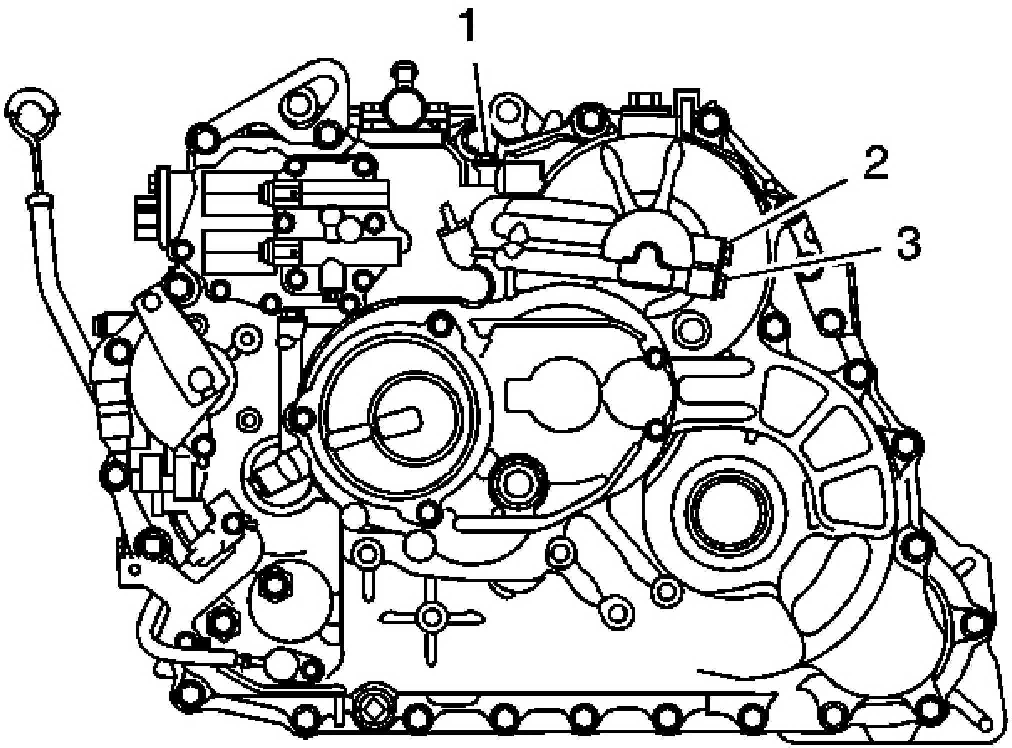


Fig. 7: Fluid Pressure Test Hole Plugs - Transmission Case
Courtesy of GENERAL MOTORS CORP.

1. 4th Clutch
2. 1st Clutch
3. Coast Clutch

Fluid Pressure Test Hole Plugs - Torque Converter Housing

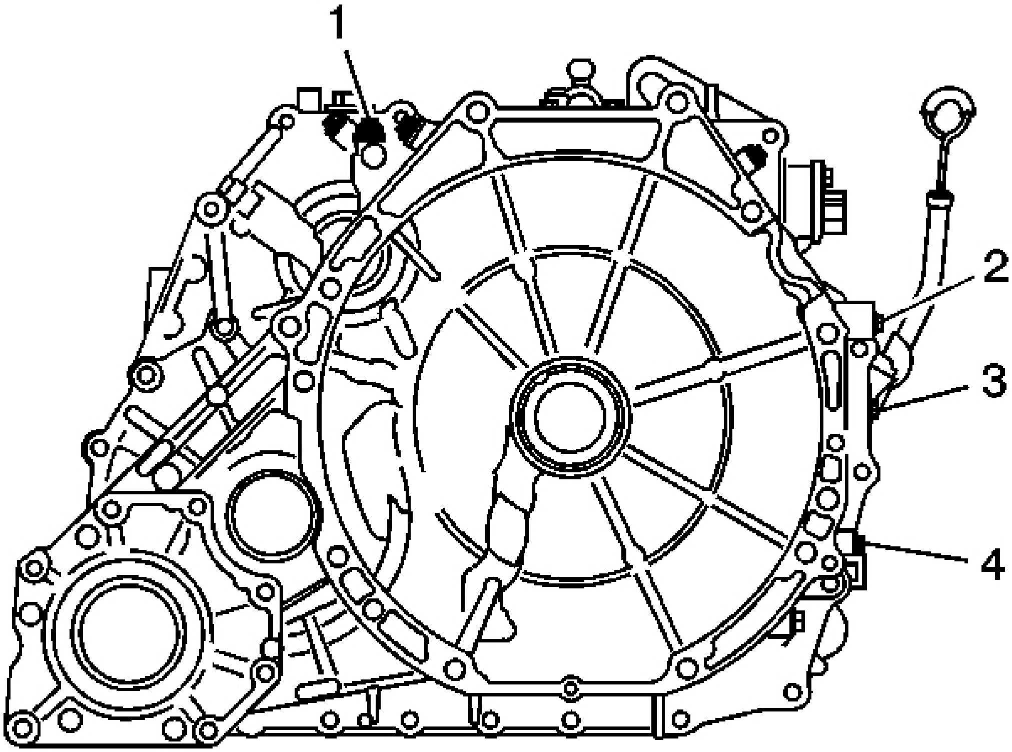


Fig. 8: Fluid Pressure Test Hole Plugs - Torque Converter Housing
Courtesy of GENERAL MOTORS CORP.

1. 2nd Clutch
2. 5th Clutch and Reverse Clutch
3. Line Pressure
4. 3rd Clutch

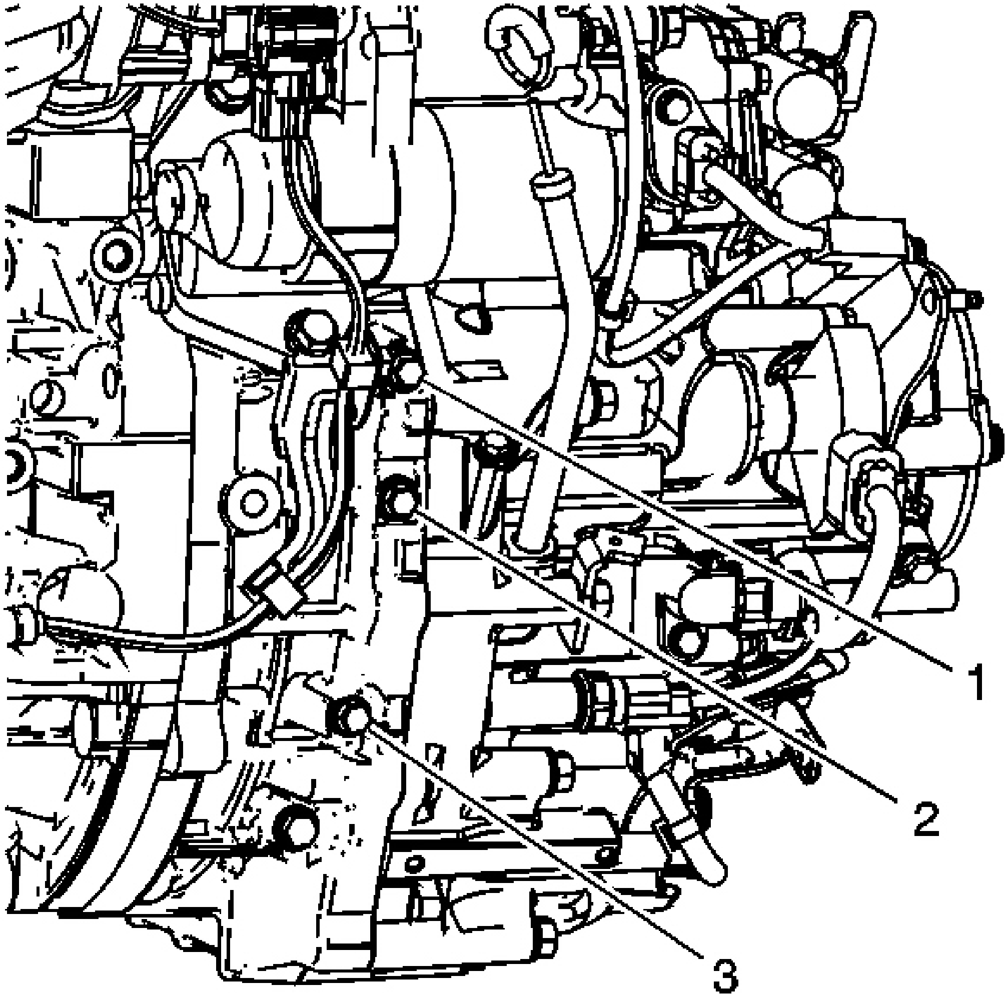


Fig. 9: Line Pressure Test & Fluid Pressure Test Hole Plugs
Courtesy of GENERAL MOTORS CORP.

Line Pressure Test

1. Remove the fluid pressure test hole plug (1).
2. Connect the **J 45542** and the **SA9127E** .
3. Start the engine and operate at 2,000 RPM in the PARK or NEUTRAL position.

IMPORTANT: If the transmission is not in the PARK or NEUTRAL position the gage may have a higher pressure reading.

4. Measure the line pressure reading and compare the measurement to the following specifications:

   Specifications:
   - Standard: 900-960 kPa (130-140 psi)
   - Service Limit: 850 kPa (120 psi)

5. If the pressure reading is below the service limit, inspect for the following conditions:
   - Low fluid level
   - Restriction in the automatic transmission filter
   - Faulty torque converter check valve
   - Automatic transmission fluid pump worn or damaged
   - Torque converter faulty
   - Regulator valve body for the following conditions:
     - weak spring
     - stuck valves
     - leaking O-ring seals

5th Clutch Pressure Test

1. Remove the fluid pressure test hole plug (2).
2. Connect the **J 45542** and the **SA9127E** .
3. Shift the transmission into Drive.
4. Using the scan tool, command the transmission to shift into 5th gear.
5. Increase the engine speed to 2,000 RPM.
6. Measure the 5th clutch pressure reading and compare to the following specifications:

   Specifications:
   - Standard: 890-970 kPa (130-140 psi)
   - Service Limit: 840 kPa (120 psi)

7. If the pressure reading is below the service limit, refer to the table at the end of this procedure for a possible cause.

3rd Clutch Pressure Test

1. Remove the fluid pressure test hole plug (3).
2. Connect the **J 45542** and the **SA9127E** .
3. Shift the transmission into Drive.
4. Using the scan tool, command the transmission to shift into 3rd gear.
5. Increase the engine speed to 2,000 RPM.

6. Measure the 3rd clutch pressure reading and compare to the following specifications:

   Specifications:
   - Standard: 890-970 kPa (130-140 psi)
   - Service Limit: 840 kPa (120 psi)

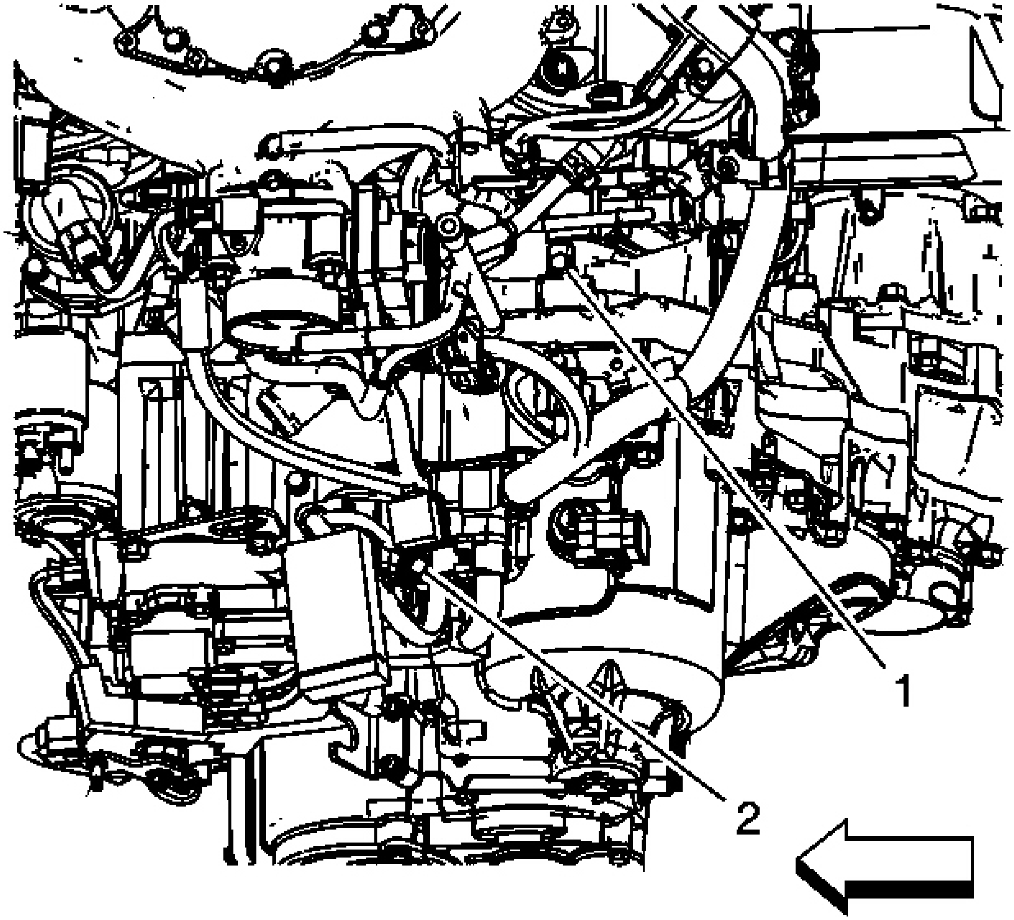
7. If the pressure reading is below the service limit, refer to the table at the end of this procedure for a possible cause.

Reverse Clutch Pressure Test

1. Remove the fluid pressure test hole plug (2).
2. Connect the **J 45542** and the **SA9127E** .
3. Shift the transmission into Reverse.
4. Increase the engine speed to 2,000 RPM.
5. Measure the 2nd clutch pressure reading and compare to the following specifications:

   Specifications:
   - Standard: 890-970 kPa (130-140 psi)
   - Service Limit: 840 kPa (120 psi)

6. If the pressure reading is below the service limit, refer to the table at the end of this procedure for a possible cause.



<u>**Fig. 10: 2nd Clutch Pressure Test & Fluid Pressure Test Hole Plugs**</u>
Courtesy of GENERAL MOTORS CORP.

2nd Clutch Pressure Test

1. Remove the fluid pressure test hole plug (1).
2. Connect the **J 45542** and the **SA9127E** .
3. Shift the transmission into Drive.
4. Using the scan tool, command the transmission to shift into 2nd gear.
5. Increase the engine speed to 2,000 RPM.
6. Measure the 2nd clutch pressure reading and compare to the following specifications:

   Specifications:

- Standard: 890-970 kPa (130-140 psi)
- Service Limit: 840 kPa (120 psi)

7. If the pressure reading is below the service limit, refer to the table at the end of this procedure for a possible cause.

4th Clutch Pressure Test

1. Remove the fluid pressure test hole plug (2).
2. Connect the **J 45542** and the **SA9127E** .
3. Shift the transmission into Drive.
4. Using the scan tool, command the transmission to shift into 4th gear.
5. Increase the engine speed to 2,000 RPM.
6. Measure the 4th clutch pressure reading and compare to the following specifications:

   Specifications:
   - Standard: 890-970 kPa (130-140 psi)
   - Service Limit: 840 kPa (120 psi)

7. If the pressure reading is below the service limit, refer to the table at the end of this procedure for a possible cause.

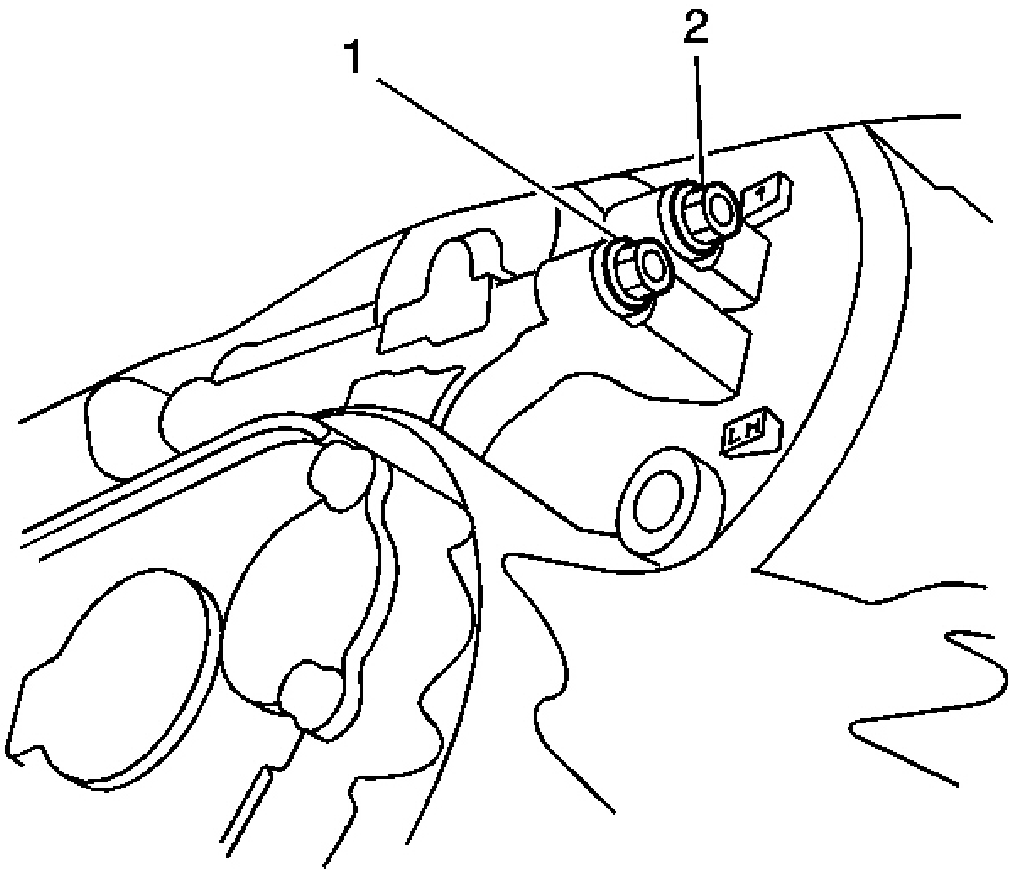


Fig. 11: 1st Clutch Pressure Test & Fluid Pressure Test Hole Plugs
Courtesy of GENERAL MOTORS CORP.

1st Clutch Pressure Test

1. Remove the fluid pressure test hole plug (2).
2. Connect the **J 45542** and the **SA9127E** .
3. Shift the transmission into Drive.
4. Using the scan tool, command the transmission to shift into 1st gear.
5. Increase the engine speed to 2,000 RPM.
6. Measure the 1st clutch pressure reading and compare to the following specifications:

   Specifications:

   - Standard: 890-970 kPa (130-140 psi)

- Service Limit: 840 kPa (120 psi)

7. If the pressure reading is below the service limit, inspect for the following conditions:
   - Faulty 1st clutch piston check valve
   - 1st clutch piston O-ring seals worn or damaged
   - Scored or worn clutch hub piston bore
   - 1st or 2nd clutch shaft fluid passage O-ring seals worn or damaged

Coast Clutch Pressure Test

1. Remove the fluid pressure test hole plug (1).
2. Connect the **J 45542** and the **SA9127E** .
3. Shift the transmission into Drive.
4. Using the scan tool, command the transmission to shift into 1st gear.
5. Increase the engine speed to 2,000 RPM.
6. Measure the coast clutch pressure reading and compare to the following specifications:

   Specifications:
   - Standard: 760-830 kPa (110-120 psi)
   - Service Limit: 710 kPa (100 psi)

7. If the pressure reading is below the service limit, inspect for the following conditions:
   - Faulty coast clutch piston check valve
   - coast clutch piston O-ring seals faulty
   - Scored or worn clutch hub piston bore
   - 1st or clutch housing fluid passage O-ring seals faulty

Line Pressure Check Procedure

Condition	Probable Cause
No or low line pressure	• Torque converter • ATF pump • Regulator valve • Torque converter check valve • Low fluid level • Clogged ATF filter
No or low 1st clutch pressure	• 1st clutch • O-rings
No or low 2nd clutch pressure	• 2nd clutch • O-rings

No or low 3rd clutch pressure	• 3rd clutch • O-rings
No or low 4th clutch pressure	• 4th clutch • O-rings
No or low 5th clutch pressure	• 5th clutch • O-rings
No or low 5th clutch pressure in the Reverse position	• Servo valve • 5th clutch • O-rings
No or low coast clutch pressure	• 1st hold clutch • O-rings

ROAD TEST PROCEDURE

1. Warm the engine to normal operating temperature - until the radiator fan turns on.
2. Apply the parking brake and block both rear wheels.
3. Start the engine, and shift to the D position, while pressing the brake pedal.
4. Press the accelerator pedal, and release it suddenly. The engine should not stall.
5. Repeat step 2-4 in all shift lever positions.
6. Connect the scan tool.
7. Test-drive the vehicle on a flat road in the D position.
8. Listen for abnormal noise and clutch slippage.
9. While driving, check that shift points occur at the proper speeds, by monitoring the throttle position sensor voltage with the scan tool. Compare your shift point speeds and voltage to those in Shift Speed. Refer to **Shift Speed** .

TORQUE CONVERTER DIAGNOSIS PROCEDURE

The torque converter clutch (TCC) is applied by fluid pressure, which is controlled by a PWM solenoid valve. This solenoid valve is located inside of the automatic transmission assembly. The solenoid valve is controlled through a combination of computer controlled switches and sensors.

Torque Converter Stator

The torque converter stator roller clutch can have two different malfunctions.

- The stator assembly freewheels in both directions.
- The stator assembly remains locked up at all times.

Poor Acceleration at Low Speed

If the stator is freewheeling at all times, the vehicle tends to have poor acceleration from a standstill. At speeds above 50-55 km/h (30-35 mph), the vehicle may act normally. For poor acceleration, 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

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 high speeds. Visual examination of the converter may reveal a blue color from overheating.

If the converter has been removed, you can inspect the stator roller clutch by inserting a finger into the splined inner race of the roller clutch and trying to turn the race in both directions. You should be able to freely turn the inner race clockwise, but you should have difficulty in moving the inner race counterclockwise or you may be unable to move the race at all.

Whine Noise

IMPORTANT: Do not confuse this noise with pump whine noise, which is usually noticeable in PARK, NEUTRAL and all other gear ranges. Pump whine will vary with line pressure.

You may notice a torque converter whine 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 both halves of the converter are turning at the same speed.

Perform a stall test to make sure the noise is actually coming from the converter:

1. Place your foot on the brake.
2. Put the gear selector in DRIVE.

   NOTE: 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 Shudder

The key to diagnosing Torque Converter Clutch (TCC) shudder is to note when it happens and under what conditions.

TCC shudder which is caused by the transmission should only occur during the apply or the release of the converter clutch. Shudder should never occur after the TCC plate is fully applied.

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:

- Something is not allowing the clutch to become fully engaged.
- Something is not allowing the clutch to release.
- The clutch is releasing and applying at the same time.

One of the following conditions may be causing the condition to occur:

- Leaking turbine shaft seals
- A restricted release orifice
- A distorted clutch or housing surface due to long converter bolts
- Defective friction material on the TCC plate

If Shudder Occurs After TCC has Applied

IMPORTANT: If shudder occurs after the TCC has applied, most of the time there is nothing wrong with the transmission.

As mentioned above, the TCC is not likely to slip after the TCC has been applied. Engine problems may go unnoticed under light throttle and load, but they become noticeable after the TCC apply when going up a hill or accelerating. This is due to the mechanical coupling between the engine and the transmission.

Once TCC is applied, there is no torque converter, fluid coupling, assistance. Engine or driveline vibrations could be unnoticeable before TCC engagement.

Inspect the following components in order to avoid misdiagnosis of TCC shudder. An inspection will also avoid the unnecessary disassembly of a transmission or the unnecessary replacement of a torque converter.

- Spark plugs

  Inspect for cracks, high resistance or a broken insulator.

- Plug wires

  Look in each end. If there is red dust, ozone, or a black substance, carbon, present, the wires are bad. Also look for a white discoloration of the wire. This indicates arcing during hard acceleration.

- Coil

  Look for a black discoloration on the bottom of the coil. This indicates arcing while the engine is misfiring.

- Fuel injector

  The filter may be plugged.

- Vacuum leak

  The engine will not get a correct amount of fuel. The mixture may run rich or lean depending on where the leak occurs.

- EGR valve

  The valve may let in too much or too little unburnable exhaust gas and could cause the engine to run rich or lean.

- MAP/MAF sensor

  Like a vacuum leak, the engine will not get the correct amount of fuel for proper engine operation.

- Carbon on the intake valves

  Carbon restricts the proper flow of air/fuel mixture into the cylinders.

- Flat cam

  Valves do not open enough to let the proper fuel/air mixture into the cylinders.

- Oxygen sensor

  This sensor may command the engine too rich or too lean for too long.

- Fuel pressure

  This may be too low.

- Engine mounts

  Vibration of the mounts can be multiplied by TCC engagement.

- Axle joints

  Check for vibration.

- TP Sensor

  The TCC apply and release depends on the TP sensor in many engines. If the TP sensor is out of specification, TCC may remain applied during initial engine loading.

- Cylinder balance

  Bad piston rings or poorly sealing valves can cause low power in a cylinder.

- Fuel contamination

  This causes poor engine performance.

Torque Converter Evaluation and Diagnosis

Replace the torque converter if any of the following conditions exist:

- External leaks appear in the hub weld area.
- The converter hub is scored or damaged.
- The converter pilot is broken, damaged, or fits poorly into the crankshaft.
- You discover steel particles after flushing the cooler and the cooler lines.
- The pump is damaged, or you discover steel particles in the converter.
- The vehicle has TCC shudder and/or no TCC apply. Replace the torque converter only after all hydraulic and electrical diagnoses have been made. The converter clutch material may be glazed.
- The converter has an imbalance which cannot be corrected.
- The converter is contaminated with engine coolant which contains antifreeze.
- An internal failure occurs in the stator roller clutch.
- You notice excessive end play.
- Overheating produces heavy debris in the clutch.
- You discover steel particles or clutch lining material in the fluid filter or on the magnet, when no internal parts in the unit are worn or damaged. This condition indicates that lining material came from the converter.

Do Not Replace the Torque Converter if you discover any of the following symptoms:

- The oil has an odor or the oil is discolored, even though metal or clutch facing particles are not present.
- The threads in one or more of the converter bolt holds are damaged. Correct the condition with a new thread insert.
- Transmission failure did not display evidence of damaged or worn internal parts, steel particles or clutch plate lining material in the unit and inside the fluid filter.
- The vehicle has been exposed to high mileage only. An exception may exist where the lining of the torque converter clutch dampener plate has seen excess wear by vehicles operated in heavy and/or constant traffic, such as taxi, delivery, or police use.

STALL SPEED TEST

IMPORTANT:	• **Do not test stall speed for more than 10 seconds at a time.**

- **Stall speed tests should be used for diagnostic purposes only.**
- **Stall speed should be the same in D, I, L and R positions.**
- **Do not test stall speed with the automatic transmission pressure gage installed.**

1. Engage the parking brake firmly, and block all four wheels.
2. Connect the scan tool.
3. Ensure the A/C switch is OFF.
4. After the engine has warmed to normal operating temperature and the radiator fan turns on, shift to the D position.
5. Fully press the brake pedal and accelerator pedal for 6-8 seconds, and note the engine speed. Do not move the shift lever while raising engine speed.

   Specification: 2400 RPM +/- 150 RPM

6. Allow 2 minutes for cooling, then repeat the test in the I, L, and R positions.
7. If the measurements are out of service limit, refer to **High Stall Speed in Drive, Intermediate and Low** , **Stall Speed High in Reverse** and **Low Stall Speed** .

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 is between channels.
  - The valve bushing clips are improperly installed.
  - The checkballs are misplaced.
- The Teflon(R) seal rings are worn or damaged.

ENGINE COOLANT/WATER IN TRANSMISSION

NOTE: 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.

FLUID LEAK DIAGNOSIS

General Method

1. Verify that the leak is transmission fluid.
2. Thoroughly clean the suspected leak area.
3. Operate the vehicle for 24 km (15 mi), or 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

1. Thoroughly clean the suspected leak area with solvent.
2. Apply an aerosol type powder, such as foot powder, to the suspected leak area.
3. Operate the vehicle for 24 km (15 mi), or 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. Detect the leak with the black light.
3. 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 or output shaft surface is scratched, nicked, or damaged
- Loose or worn bearing causing excess seal wear

Possible Points of Fluid Leaks

Torque Converter Housing (150)

- The torque converter housing to transmission case housing is improperly torqued.
- The torque converter sealing surface is damaged.
- the torque converter housing gasket (68) is missing, improperly installed or damaged.
- The front wheel drive shaft oil seal (117) is missing, worn or damaged, or there is a housing sealing surface concern.
- The transfer case input shaft seal is missing, worn or damaged, or there is a sealing surface concern.
- The automatic transmission fluid case plug (120,144) is loose or the 8 mm sealing washer (121, 143) is missing or damaged.
- The torque converter seal (116) is damaged, missing, or there is a sealing surface concern.
- The torque converter housing porosity

Transmission Case Housing (31)

- Manual shift shaft seal (41) is damaged, missing, or there is a sealing surface concern
- Clutch pressure control solenoid cover (84) is improperly torqued, or there is a sealing surface concern
- Clutch pressure control solenoid cover gasket (82) is missing, improperly installed or damaged
- Fluid level indicator tube, O-ring seal (38) is missing, worn, damaged, or there is a sealing surface concern
- 3rd clutch fluid pressure sensor (25) is loose or the 10 mm sealing washer (4) is missing, or there is a sealing surface concern
- 4th clutch fluid pressure sensor is loose or the 10 mm sealing washer (4) is missing, or there is a sealing surface concern
- Input speed sensor O-ring seal (27) is missing, worn, damaged, or there is a sealing surface concern
- Output speed sensor O-ring seal (27) is missing, worn, damaged, or there is a sealing surface concern
- Automatic transmission fluid temperature sensor O-ring seal (23) is missing, loose, or there is a sealing surface concern
- Fluid fill plug (79) is loose, missing, or the 24 mm sealing washer (80) is missing, damaged, or there is a sealing surface concern

- Automatic transmission wiring harness O-ring seal (3) is missing or damaged, or there is a sealing surface concern
- TCC lock-up pressure control solenoid (7) is improperly torqued or there is a sealing surface concern
- TCC lock-up pressure control solenoid gasket (12) is missing or damaged, or there is a sealing surface concern
- Automatic transmission clutch pressure control solenoid valve assembly (18) is improperly torqued or there is a sealing surface concern
- Automatic transmission clutch pressure control solenoid gasket (20) is missing, improperly installed or damaged
- Mainshaft rear case cover (98) is improperly torqued, improperly installed, or there is a sealing surface concern
- Mainshaft rear case cover O-ring seal (99) is missing or damaged
- Transaxle oil cooler pipe fitting(s) (50) are loose or there is a sealing surface concern
- Transaxle oil cooler sealing washer (XX) is missing, damaged, or there is a sealing surface concern
- Transmission fluid drain plug (104) is loose or there is a sealing surface concern
- Transmission fluid drain plug 18 mm sealing washer (105) is missing, damaged, or there is a sealing surface concern

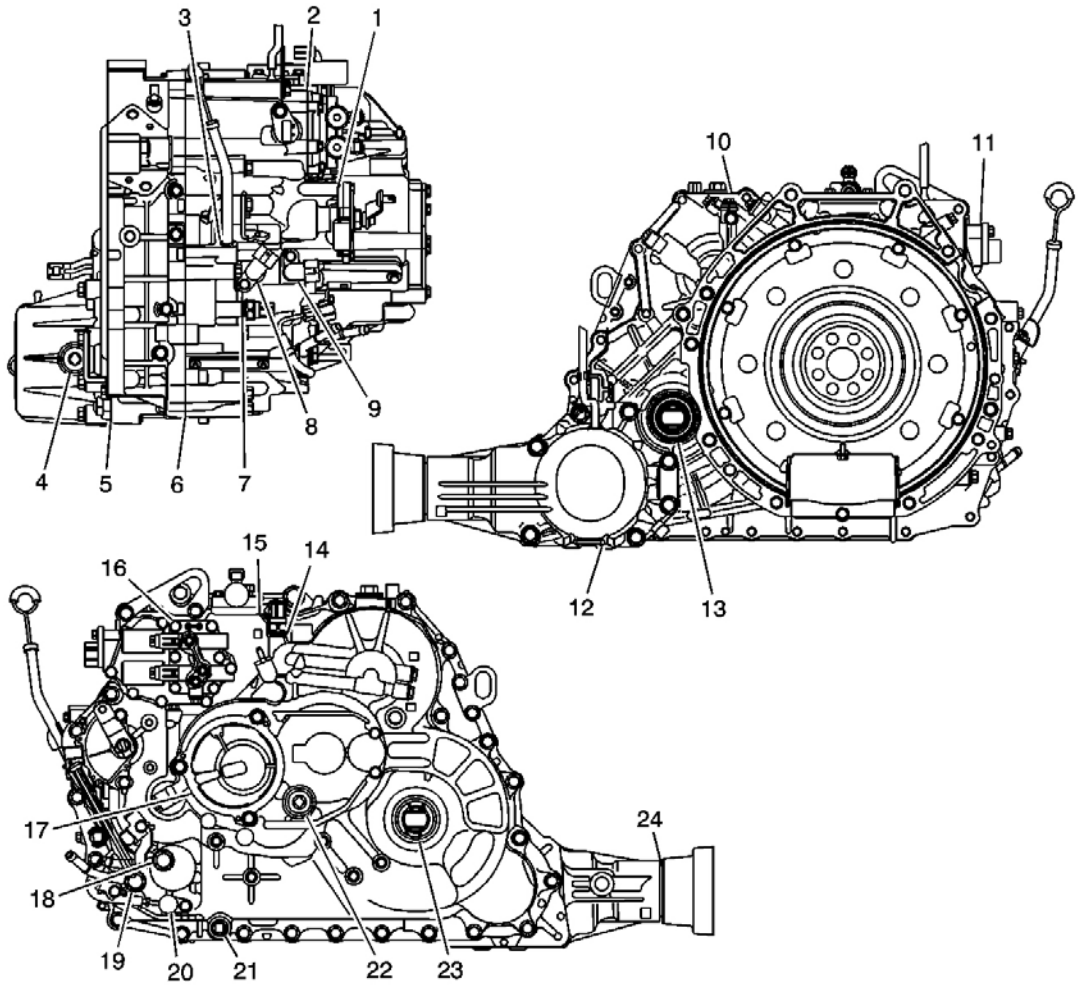


Fig. 12: Possible Fluid Leak Points
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 77

Callout	Component Name
1	Shift Position Sensor Seals - Transmission Housing
2	Solenoid Valve Cover Gasket - Transmission Housing
3	Dipstick Guide Pipe O-Ring - Transmission Housing
4	Transfer Drain Plug Washer - Transfer Housing
5	Transfer Output Shaft Oil Seal, Transfer Hypoid Drive Gear Oil Seal and Transfer Cover O-Ring - Transfer Housing
6	Torque Converter Housing Packing - Torque Converter Housing
7	Oil Pressure Sensor O-Ring - Transmission Housing
8	Speed Sensor O-Ring - Transmission Housing
9	Speed Sensor O-Ring - Transmission Housing

10	Oil Filler Bolt Washer - Transmission Housing
11	Solenoid Wire Harness O-Ring - Transmission Housing
12	Transfer Drain Plug Washer - Transfer Housing
13	Axle Shaft Seal - Torque Converter Housing
14	Oil Pressure Sensor O-Ring - Transmission Housing
15	Solenoid Valve Assembly Packing - Transmission Housing
16	Solenoid Valve Assembly Packing - Transmission Housing
17	Side Cap O-Ring - Transmission Housing
18	Oil Cooler Pipe Washer - Transmission Housing
19	Oil Cooler Pipe Washer - Transmission Housing
20	Automatic Transmission Fluid Temperature Sensor O-Ring - Transmission Housing
21	Drain Plug Washer - Transmission Housing
22	Drain Plug Washer - Transmission Housing
23	Axle Shaft Seal - Transmission Housing
24	Transfer Output Shaft - Hypoid Gear - Oil Seal - Transfer Housing

CASE POROSITY REPAIR

Some external leaks are caused by case porosity in non-pressurized areas. You can usually repair these leaks with the transmission in the vehicle.

1. Thoroughly clean the area to be repaired with a cleaning solvent. Air dry the area.

CAUTION: 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. While the transmission case is still hot, apply the epoxy. You can use a clean, dry soldering acid brush 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 starting the engine.
5. Repeat the fluid leak diagnosis procedures.

AUTOMATIC TRANSMISSION OIL COOLER FLUSHING AND FLOW TEST

Tools Required

- **J 35944-22** Cooler Flushing Fluid
- **SA9165T** Oil Cooler Line Flusher

IMPORTANT: This procedure should be performed before installing the transaxle.

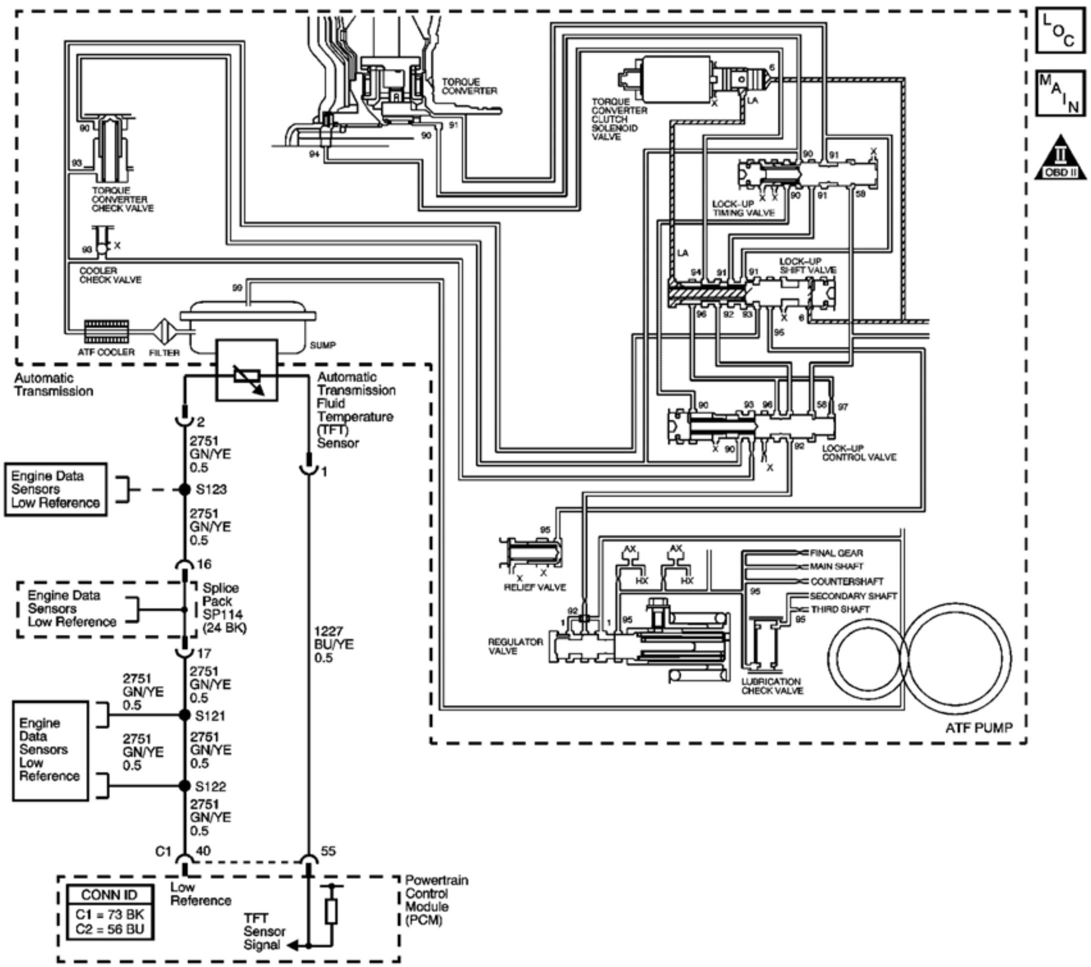
1. Inspect the equipment for wear and cracks before using it. Replace any worn or cracked components.
2. Using the measuring cup, fill the **SA9165T** with 0.7 oz (21 oz), approximately 2/3 full of **J 35944-22** . Do not substitute with any other fluid. Follow the handling procedure on the fluid container.
3. Secure the flusher filler cap, and pressurize the flusher with compressed air to 550-829 kPa (5.6-8.45 kgf/cm, 80-120 psi). The air line should be equipped with a water trap to ensure a dry air system.
4. Hang the flusher under the vehicle.
5. Attach the flusher discharge hose to the return line of the ATF cooler using a clamp.
6. Connect the drain hose to the inlet line on the ATF cooler using a clamp. Securely clamp the opposite end of the drain hose to a bucket or floor drain.
7. With the water and air valves off, attach the water and air supplies to the flusher. Use hot water, if available.
8. Turn on the water valve for 10 seconds. If water does not flow through the cooler, it is completely plugged, cannot be flushed, and must be replaced.
9. Depress the trigger to mix the flushing fluid into the water flow. Use the wire clip to hold the trigger down.
10. While flushing with the water and flushing fluid for 2 minutes, turn the air valve on for 5 seconds every 15-20 seconds to create a surging action.

    Specification: Maximum air pressure: 845 kPa (8.45 kgf/cm, 120 psi)

11. Turn the water valve off. Release the trigger, then reverse the hoses to the cooler so you can flush in the opposite direction. Repeat steps 8-10.
12. Release the trigger, and rinse the cooler with water for 1 minute.
13. Turn the water valve and the water supply off.
14. Turn the air valve on for 2 minutes, or until no moisture is visible leaving the drain hose. Residual moisture in the cooler or lines can damage the transaxle.
15. Remove the flusher from the cooler line. Attach the drain hose to an ATF container.
16. Install the transaxle, and leave the drain hose attached to the cooler line.
17. Ensure the transaxle is in position. Fill the transaxle with ATF, and run the engine for 30 seconds or until approximately 32 oz (1 qt) is discharged.
18. Remove the drain hose, and connect the cooler return hose to the transaxle.
19. Fill the transaxle with ATF, to the proper level.

DIAGNOSIS

DTC P0218



<u>Fig. 1: DTC P0218 Schematics</u>
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The torque converter is the primary source of heat in the transmission. In order to prevent overheating of the torque converter and the automatic transmission fluid, the powertrain control module (PCM) monitors the transmission fluid temperature (TFT), torque converter slip, ambient temperature, and various other conditions. The PCM uses the information it monitors to estimate the torque converter temperature. If the PCM detects a high TFT, or estimates the temperature of the torque converter to exceed a predetermined temperature, DTC P0218 sets. DTC P0218 is a type C DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, or P0118.
- No TFT DTCs P0711, P0712, or P0713.
- The system voltage is 11 volts or greater.

Conditions for Setting the DTC

- The TFT is 150° C (302° F) or greater.
- The estimated temperature of the torque converter is greater than a predetermined temperature.
- The torque converter slip ratio is greater than a predetermined slip.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM flashes the CHECK COOLANT TEMP indicator.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0218 in PCM history.

Conditions for Clearing the CHECK COOLANT TEMP Indicator/DTC

- The PCM turns the CHECK COOLANT TEMP indicator OFF when the condition no longer exists.
- A scan tool can clear the CHECK COOLANT TEMP/DTC.

Diagnostic Aids

- Inspect for vehicle overloading.
- Inspect for excessive trailer towing.
- Inspect for extensive stalling condition, by racing the engine while in gear and the vehicle stopped.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step tests for low fluid level, which can cause high transmission fluid temperatures.
3: This step inspects for transmission cooling restrictions.

DTC P0218

Step	Action	Yes	No
	Did you perform the Diagnostic System Check -		Go to **Diagnostic System**

1	Engine Controls?	Go to **Step 2**	**Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the PCM.** • **Using the Clear DTC Info function erases stored DTCs in the PCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Inspect the transmission cooling system for the following conditions: • Air flow restrictions • Air flow blockage • Debris • Damaged cooler lines 2. Repair any of the above conditions as necessary. Did you find and correct a condition?	Go to **Step 7**	Go to **Step 4**
4	1. Inspect the oil cooler pipe system for the following conditions: • Restrictions, bends in oil cooler lines • Leaking seals • Restricted oil cooler 2. Repair any of the above conditions as necessary. Did you find and correct a condition?	Go to **Step 7**	Go to **Step 5**
5	Did you perform the Line Pressure Check Procedure?	Go to **Step 6**	Go to **Line Pressure Check Procedure**

6	Inspect the torque converter for stator damage. Refer to **Torque Converter Diagnosis Procedure** . Did you find and correct the condition?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the conditions for running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P0218. Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0501

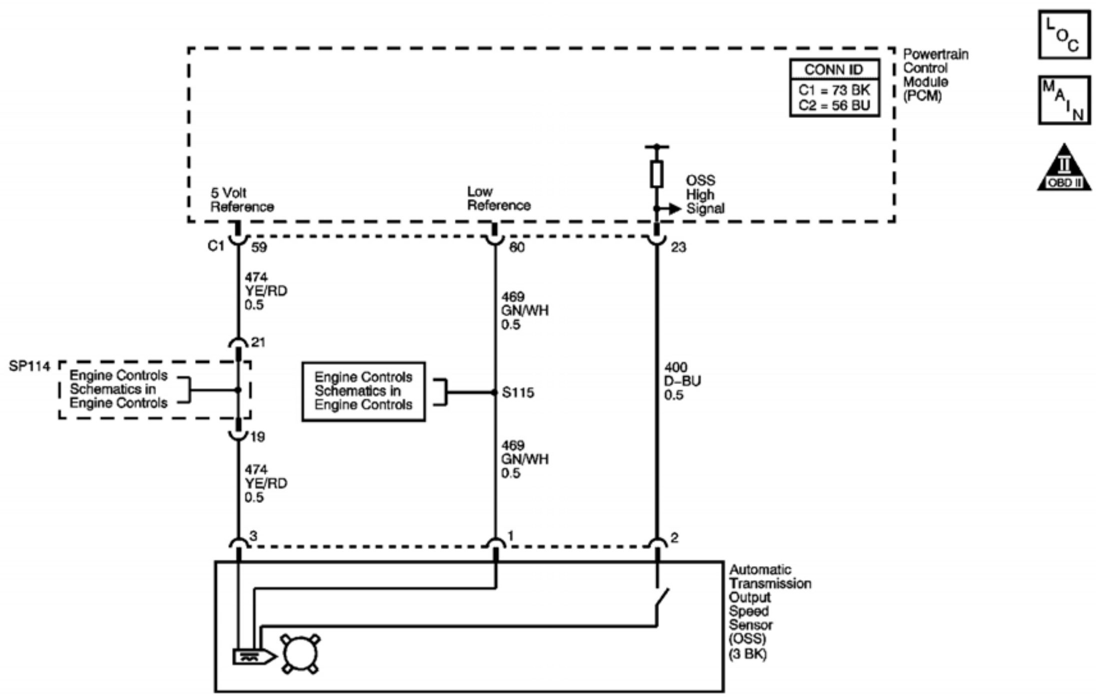


Fig. 2: DTC P0501 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission output shaft speed (AT OSS) sensor is a three-wire magnetic pick-up sensor that is mounted externally to the transmission. The OSS utilizes the gear teeth, located on the output shaft, to generate a voltage signal of varying frequency that corresponds to the rotational speed of the output shaft. The OSS signal is sent to the PCM and is used to calculate output shaft speed and vehicle speed. Simultaneously, the automatic transmission input shaft speed (AT ISS) sensor signal is used to calculate the input shaft speed and the vehicle speed. The PCM compares the vehicle speed calculated from both speed sensors and uses this comparison for diagnosis of the speed sensors. If the PCM detects the OSS calculated vehicle speed is 6 times or greater than the ISS calculated vehicle speed, DTC P0501 sets. DTC P0501 is a type A DTC.

Conditions for Running the DTC

- No TR Switch DTCs P0705 or P0706.
- No AT ISS DTCs P0716 or P0717.
- No Clutch PC Solenoid 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- The ignition voltage is greater than 11 volts.
- The engine speed is 500 RPM or greater for 5 seconds.
- The vehicle speed is greater than 20 km/h (13 mph).
- The commanded gear is greater than 1st.
- The selected range is D, I, or L.
- The transmission is not shifting.

Conditions for Setting the DTC

The ratio of the vehicle speed calculated from the OSS signal, divided by the vehicle speed calculated from the ISS signal is 6.0 or greater for 10 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the commanded gears to 2nd and 3rd gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.

- The PCM stores DTC P0501 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the connectors at the PCM, the OSS, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a disconnected output shaft speed sensor connector.
- Inspect for an open or shorted output shaft speed sensor wire.
- Inspect for a faulty output shaft sensor.
- Inspect for an internal fault of PCM.

DTC P0501

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs.			

2	**NOTE:** **Support the lower control arms in the normal horizontal position in order to avoid damage to the drive axles. Do not operate the vehicle in gear with the wheels hanging down at full travel.** 5. Raise the drive wheels. 6. Start and idle the engine. 7. Place the transmission in 1st gear. 8. Monitor the Transmission OSS parameter on the scan tool. 9. With the drive wheels rotating, increase and decrease the throttle position. Does the scan tool indicate Transmission OSS parameter increasing when wheel speed increases?	-	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the OSS. 3. Turn ON the ignition with the engine OFF. 4. Using the DMM, measure the voltage of the OSS 5 volt reference circuit to ground. Does the voltage measure near the specified value?	5 V	Go to **Step 4**	Go to **Step 7**
4	Measure the voltage from the OSS 5 volt reference circuit to the OSS low reference circuit. Does the voltage measure near the specified value?	5 V	Go to **Step 5**	Go to **Step 8**
5	Measure the voltage from the OSS high signal circuit to the OSS low reference circuit. Does the voltage measure near the specified value?	5 V	Go to **Step 9**	Go to **Step 6**
6	Test the OSS high signal circuit for the following conditions: • An open • A short to ground • A short to voltage	-		

	Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?		Go to **Step 12**	Go to **Step 11**
7	**IMPORTANT:** **The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Power Distribution Schematics in Wiring Systems for complete circuit distribution.** Test the OSS 5 volt reference circuit for the following conditions: • An open • A short to ground • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
8	Test the OSS low reference circuit for an open or short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
9	1. Remove the OSS sensor. Refer to **Output Speed Sensor Replacement** . 2. Inspect the OSS and the transmission for the following conditions: • Incorrect OSS • Damaged OSS • Incorrect OSS installation • OSS rotor damage 3. Repair any of the above conditions. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 10**
10	Replace the OSS. Refer to **Output Speed Sensor Replacement** . Did you complete the repair?	-	Go to **Step 12**	-
	Replace the PCM.			

11	Refer to **Powertrain Control Module (PCM) Replacement** Engine Controls - 3.5L (L66). Did you complete the repair?	-	Go to **Step 12**	-
12	In order to verify your repair, perform the following procedure: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle. 4. Ensure the vehicle speed is greater than 20 km/h (12 mph) for at least 10 seconds. 5. Select specific DTC. 6. Enter DTC P0501. Has the test run and passed?	-	Go to **Step 13**	Go to **Step 2**
13	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0502

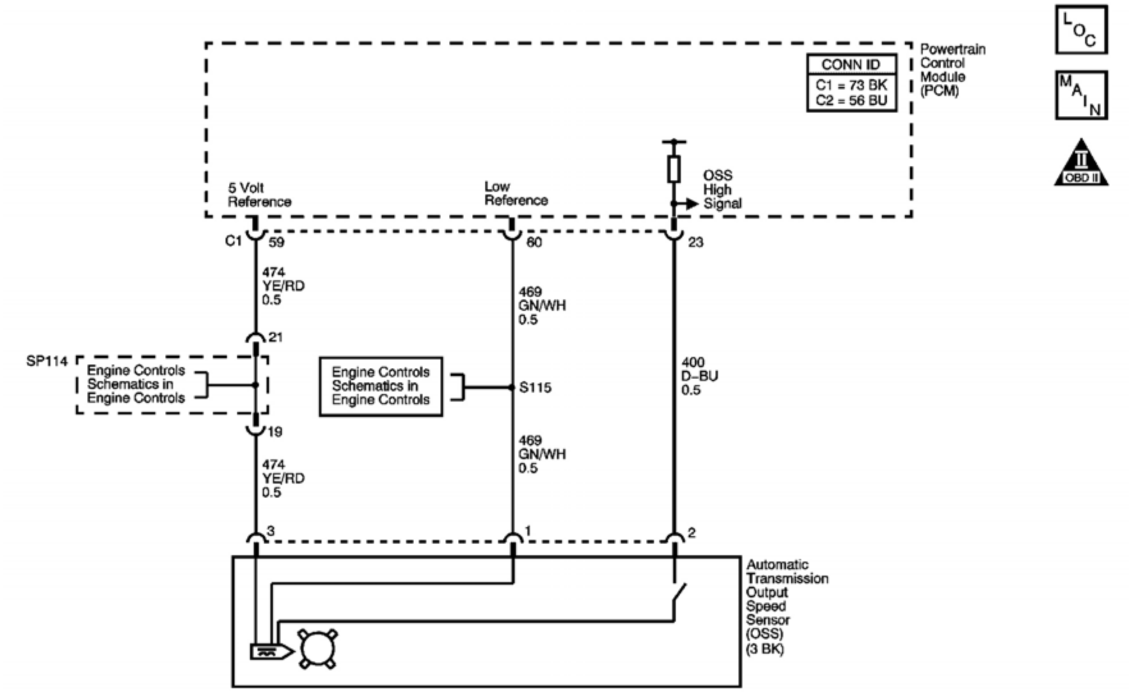


Fig. 3: DTC P0502 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission output shaft speed (AT OSS) sensor is a three-wire magnetic pick-up sensor that is mounted externally to the transmission. The OSS utilizes the gear teeth, located on the output shaft, to generate a voltage signal of varying frequency that corresponds to the rotational speed of the output shaft. The OSS signal is sent to the PCM and is used to calculate the vehicle speed. Simultaneously, the automatic transmission input shaft speed sensor (AT ISS) signal is used to calculate the vehicle speed. The PCM compares the vehicle speed calculated from both speed sensors and uses this comparison for diagnosis of the speed sensors. If the PCM detects a low OSS calculated vehicle speed and a high ISS calculated vehicle speed for 10 seconds, DTC P0502 sets. DTC P0502 is a type A DTC.

Conditions for Running the DTC

- No TR Switch DTCs P0705 or P0706.
- No AT ISS DTCs P0716 or P0717.
- No Clutch PC Solenoid 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.

- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC enable solenoid DTCs P2769 or P2770.
- The ignition voltage is greater than 11 volts.
- The engine speed is 500 RPM or greater.
- The vehicle speed is greater than 20 km/h (13 mph).
- The commanded gear is greater than 1st.
- The selected range is D, I, or L.

Conditions for Setting the DTC

The AT ISS calculated vehicle speed is 20 km/h (12 mph) or greater while the AT OSS calculated vehicle speed is 2 km/h (1 mph) or less for 10 seconds or greater.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the commanded gears to 2nd and 3rd gears.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0502 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the connectors at the PCM, the AT OSS, and all other circuit connecting points for an intermittent condition. Refer to Testing for **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a disconnected AT OSS connector.
- Inspect for an open or shorted AT OSS wire.
- Inspect for a faulty AT OSS.
- Inspect for an internal fault of the PCM.

DTC P0502

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. **NOTE:** **Support the lower control arms in the normal horizontal position in order to avoid damage to the drive axles. Do not operate the vehicle in gear with the wheels hanging down at full travel.** 5. Raise the drive wheels. 6. Start and idle the engine. 7. Place the transmission in 1st gear. 8. Monitor the Transmission OSS parameter on the scan tool. 9. With the drive wheels rotating, increase and decrease the throttle position. Does the scan tool indicate Transmission OSS parameter increasing when wheel speed increases?	-	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)	Go to **Step 3**
	1. Turn OFF the ignition. 2. Disconnect the OSS. 3. Turn ON the ignition with the engine OFF.			

3	4. Using the DMM, measure the voltage of the OSS 5 volt reference circuit to ground. Does the voltage measure near the specified value?	5 V	Go to **Step 4**	Go to **Step 7**
4	Measure the voltage from the OSS 5 volt reference circuit to the OSS low reference circuit. Does the voltage measure near the specified value?	5 V	Go to **Step 5**	Go to **Step 8**
5	Measure the voltage from the OSS high signal circuit to the OSS low reference circuit. Does the voltage measure near the specified value?	5 V	Go to **Step 9**	Go to **Step 6**
6	Test the OSS high signal circuit for the following conditions: • An open • A short to ground • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
7	**IMPORTANT:** **The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Power Distribution Schematics in Wiring Systems for complete circuit distribution.** Test the OSS 5 volt reference circuit for the following conditions: • An open • A short to ground • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
	Test the OSS low reference circuit for an open or short to voltage.			

8	Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
9	1. Remove the OSS sensor. Refer to **Output Speed Sensor Replacement** . 2. Inspect the OSS and the transmission for the following conditions: • An incorrect OSS • A damaged OSS • Incorrect OSS installation • OSS rotor damage 3. Repair any of the above conditions. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 10**
10	Replace the OSS. Refer to **Output Speed Sensor Replacement** . Did you complete the repair?	-	Go to **Step 12**	-
11	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** Engine Controls - 3.5L (L66). Did you complete the repair?	-	Go to **Step 12**	-
12	In order to verify your repair, perform the following procedure: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle. 4. Ensure the vehicle speed is greater than 20 km/h (12 mph) for at least 10 seconds. 5. Select specific DTC. 6. Enter DTC P0502. Has the test run and passed?	-	Go to **Step 13**	Go to **Step 2**
13	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0503

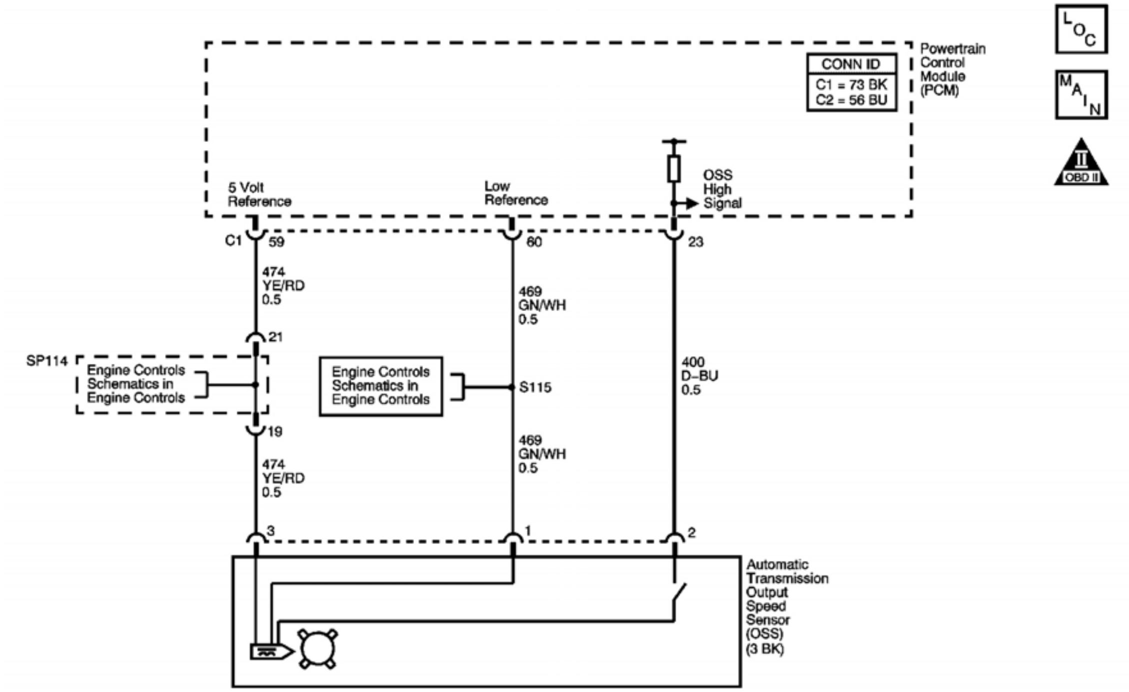


Fig. 4: DTC P0503 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission output shaft speed (AT OSS) sensor is attached externally to the transmission case. The OSS utilizes the gear teeth located on the output shaft, to generate a voltage signal of a different frequency, corresponding to the rotation speed. This signal is sent to the PCM and is used in the measurement of AT OSS signal. A fault is detected if the PCM monitors that the AT OSS signal fluctuates. When a fault is detected, DTC P0503 sets. DTC P0503 is a type B DTC.

Conditions for Running the DTC

- No ISS DTCs P0716 or P0717.
- No Clutch PC Solenoid 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.

- No TR Switch DTCs P0705 or P0706.
- The ignition voltage is greater than 11 volts.
- The engine speed is 500 RPM or greater.
- The vehicle speed is greater than 20 km/h (13 mph).
- The selected range is D, I, or L.
- The transmission is not shifting.

Conditions for Setting the DTC

The change in the OSS sensor speed is greater than 6 km/h (4 mph), within 10 milliseconds, and has occurred 6 times within 500 milliseconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0503 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the connectors at the PCM, the output speed sensor, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a faulty output shaft speed sensor.
- Inspect for an internal fault of the PCM.

DTC P0503

Step	Action	Values	Yes	No
	Did you perform the Diagnostic System Check			Go to **Diagnostic**

1	- Engine Controls?	-	Go to **Step 2**	**System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. **NOTE:** **Support the lower control arms in the normal horizontal position in order to avoid damage to the drive axles. Do not operate the vehicle in gear with the wheels hanging down at full travel.** 5. Raise the drive wheels. 6. Start and idle the engine. 7. Place the transmission in 1st gear. 8. Monitor the Transmission OSS parameter on the scan tool. 9. With the drive wheels rotating, increase and decrease the throttle position. Does the scan tool indicate Transmission OSS parameter increasing when wheel speed increases?	-	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the OSS. 3. Turn ON the ignition with the engine OFF. 4. Using the DMM, measure the voltage of the OSS 5 volt reference circuit to ground.	5 V		

	Does the voltage measure near the specified value?		Go to **Step 4**	Go to **Step 7**
4	Measure the voltage from the OSS 5 volt reference circuit to the OSS low reference circuit. Does the voltage measure near the specified value?	5 V	Go to **Step 5**	Go to **Step 8**
5	Measure the voltage from the OSS high signal circuit to the OSS low reference circuit. Does the voltage measure near the specified value?	5 V	Go to **Step 9**	Go to **Step 6**
6	Test the OSS high signal circuit for the following conditions: • An open • A short to ground • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
7	**IMPORTANT:** **The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Power Distribution Schematics in Wiring Systems for complete circuit distribution.** Test the OSS 5 volt reference circuit for the following conditions: • An open • A short to ground • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
8	Test the OSS low reference circuit for an open or short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**

9	1. Remove the OSS sensor. Refer to **Output Speed Sensor Replacement** . 2. Inspect the OSS and the transmission for the following conditions: • An incorrect OSS • A damaged OSS • Incorrect OSS installation • OSS rotor damage 3. Repair any of the above conditions. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 10**
10	Replace the OSS. Refer to **Output Speed Sensor Replacement** . Did you complete the repair?	-	Go to **Step 12**	-
11	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** Engine Controls - 3.5L (L66). Did you complete the repair?	-	Go to **Step 12**	-
12	In order to verify your repair, perform the following procedure: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle. 4. Ensure the vehicle speed is greater than 5 km/h (3 mph) for at least 3 seconds. 5. Select specific DTC. 6. Enter DTC P0503. Has the test run and passed?	-	Go to **Step 13**	Go to **Step 2**
13	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0705

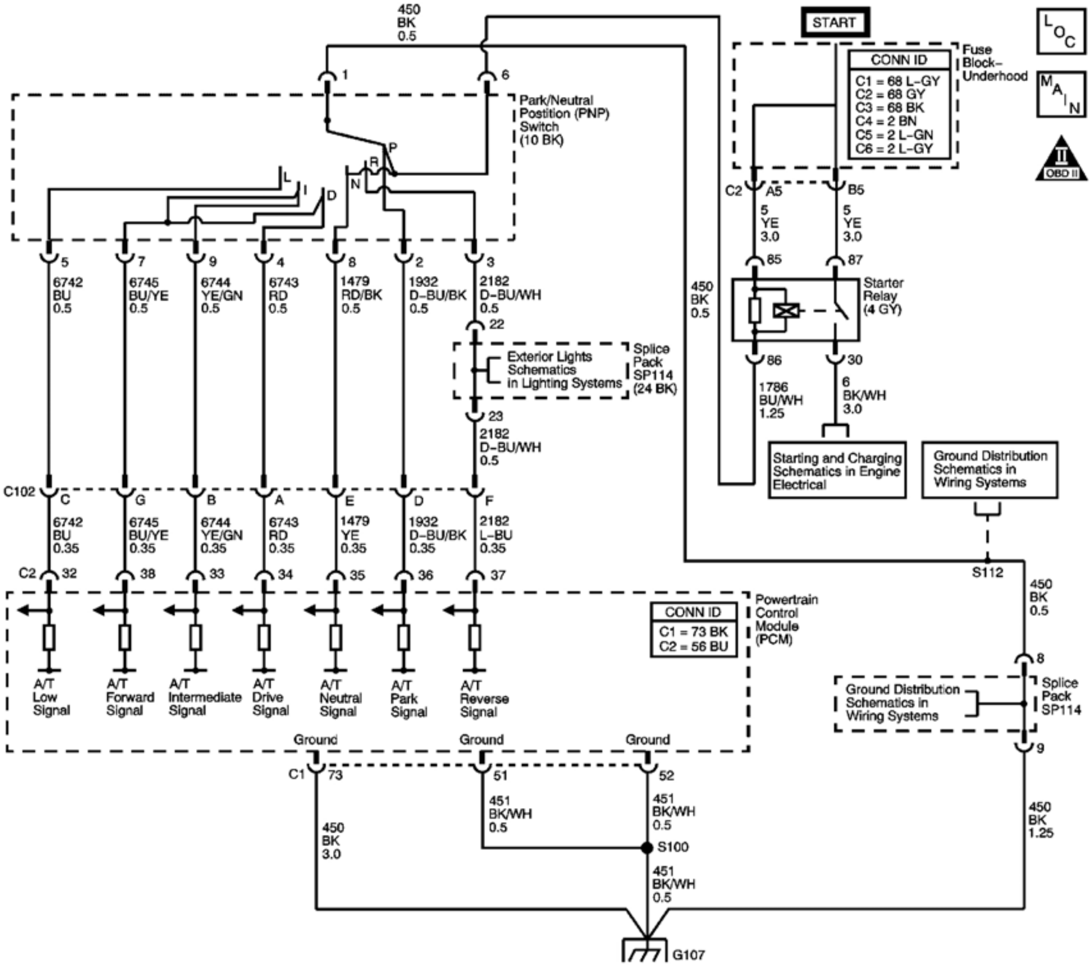


Fig. 5: DTC P0705 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission range (TR) switch is part of the park/neutral position switch assembly and is mounted on the transmission manual shaft. The TR switch is a multi-signal switch. The powertrain control module (PCM) supplies ignition voltage to the TR switch on 7 signal circuits, P, R, N, D, I, L, and Forward Range. Each gear selector lever position grounds one or more of the signal circuits in a unique pattern. In order to determine the gear range selected by the driver, the PCM compares the voltage combination on the signal circuits to a TR switch combination table stored in memory. Refer to **Transmission Range Switch Logic** . When the PCM detects an invalid combination of TR switch signals, DTC P0705 sets. DTC P0705 is a type A DTC.

Refer to **Range Reference** .

Conditions for Running the DTC

System voltage is 11 volts or greater.

Conditions for Setting the DTC

- Incorrect combination of 2 or more transmission range switch signals, with the TR Sw. Forward Range signal input LOW at the same time, for 1 second or greater.
- The TR Sw. Forward Range signal input is LOW when P, R, N or L gear range is selected, for 1 second or greater.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 2nd and 3rd gears.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0705 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the connectors at the PCM, the output speed sensor, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a shorted TR switch wire.
- Inspect for a faulty TR switch.
- Inspect for an internal fault of the PCM.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: By disconnecting the TR switch, the ground path for all TR switch circuits are removed and the PCM should recognize all circuits as open. The scan tool should display HI for all range signals.

6: This step tests the TR switch wiring for an open or lack of signal voltage from the PCM.

7: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal park should change to LOW.

8: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal reverse should change to LOW.

9: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal neutral should change to LOW.

10: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal drive should change to LOW.

11: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal intermediate should change to LOW.

12: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal forward should change to LOW.

13: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal low should change to LOW.

DTC P0705

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Select TR Sw. parameter on the scan tool. 4. With the scan tool observe the TR Sw. parameter display while selecting transmission ranges: P, R, N, D, I, L. Does TR Sw. parameter display match each transmission range selection?	-	Go to **Intermittent Conditions** in Engine Controls - 3.5L (L66)	Go to **Step 3**
3	1. Inspect the PNP switch assembly for the following conditions: • Damage • Loose or missing mounting hardware • Proper adjustment Refer to **Park/Neutral Position Switch Replacement** . 2. Inspect the shift cable for the following conditions:	-		

	• Damaged or stretched cable • Proper adjustment Did you find and correct a condition?		Go to **Step 20**	Go to **Step 4**
4	With the scan tool, observe the TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. Do the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters indicate HI for all range signal states?	-	Go to **Step 17**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Disconnect the TR switch 10-way connector. 3. Turn ON the ignition, with the engine OFF. Do the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters indicate HI for all range signal states?	-	Go to **Step 6**	Go to **Step 14**
6	1. Using the DMM and the**J-35616** connector test adapter kit, measure the voltage from the TR switch park signal circuit 10-way connector to ground. 2. Measure the voltage from the TR switch reverse signal circuit 10-way connector to ground. 3. Measure the voltage from the TR switch neutral signal circuit 10-way connector to ground. 4. Measure the voltage from the TR switch drive signal circuit 10-way connector to ground. 5. Measure the voltage from the TR switch intermediate signal circuit 10-way connector to ground. 6. Measure the voltage from the TR switch forward signal circuit 10-way connector to ground. 7. Measure the voltage from the TR switch low signal circuit 10-way connector to ground. Does the voltage measure within the specified	10-12 V		

	value at all circuits?		Go to **Step 7**	Go to **Step 15**
7	Connect a 3 amp fused jumper wire from the TR switch park signal circuit 10-way connector to ground, while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch park signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 8**
8	Connect a 3 amp fused jumper wire from the TR switch reverse signal circuit 10-way connector to ground, while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch reverse signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 9**
9	Connect a 3 amp fused jumper wire from the TR switch neutral signal circuit 10-way connector to ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch neutral signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 10**
10	Connect a 3 amp fused jumper wire from the TR switch drive signal circuit 10-way connector to ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch drive signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 11**
11	Connect a 3 amp fused jumper wire from the TR switch intermediate signal circuit 10-way connector to ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch intermediate signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 12**
12	Connect a 3 amp fused jumper wire from the TR switch forward signal circuit 10-way connector to ground while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters.	-		

	When the TR switch forward signal circuit is grounded, do any other signal circuits indicate LOW?		Go to **Step 16**	Go to **Step 13**
13	Connect a 3 amp fused jumper wire from the TR switch low signal circuit 10-way connector to ground, while monitoring the scan tool TR Sw. P/R/N, TR Sw. D/I/L and the TR Sw. Forward Range parameters. When the TR switch low signal circuit is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 16**	Go to **Step 18**
14	Test the TR switch signal circuits that did not indicate HI for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 19**
15	Test the TR switch signal circuits that did not indicate proper voltage for an open. Refer to **Testing for Continuity** and**Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 19**
16	Test the affected signal circuits of the TR switch for a shorted together condition. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 19**
17	Test the TR switch ground circuit for an open. Refer to **Testing for Continuity** and**Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 18**
18	Replace the TR switch. The TR switch is part of the park/neutral position switch. Refer to **Park/Neutral Position Switch Replacement** . Did you complete the replacement?	-	Go to **Step 20**	-
19	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM setup procedure. Did you complete the replacement?	-	Go to **Step 20**	-
	Perform the following procedure in order to			

20	verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Start the engine and select gear ranges P, R, N, D, I, L. 4. Road test the vehicle. 5. Select Specific DTC. 6. Enter DTC P0705. Has the test run and passed?	-	Go to **Step 21**	Go to **Step 2**
21	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0706

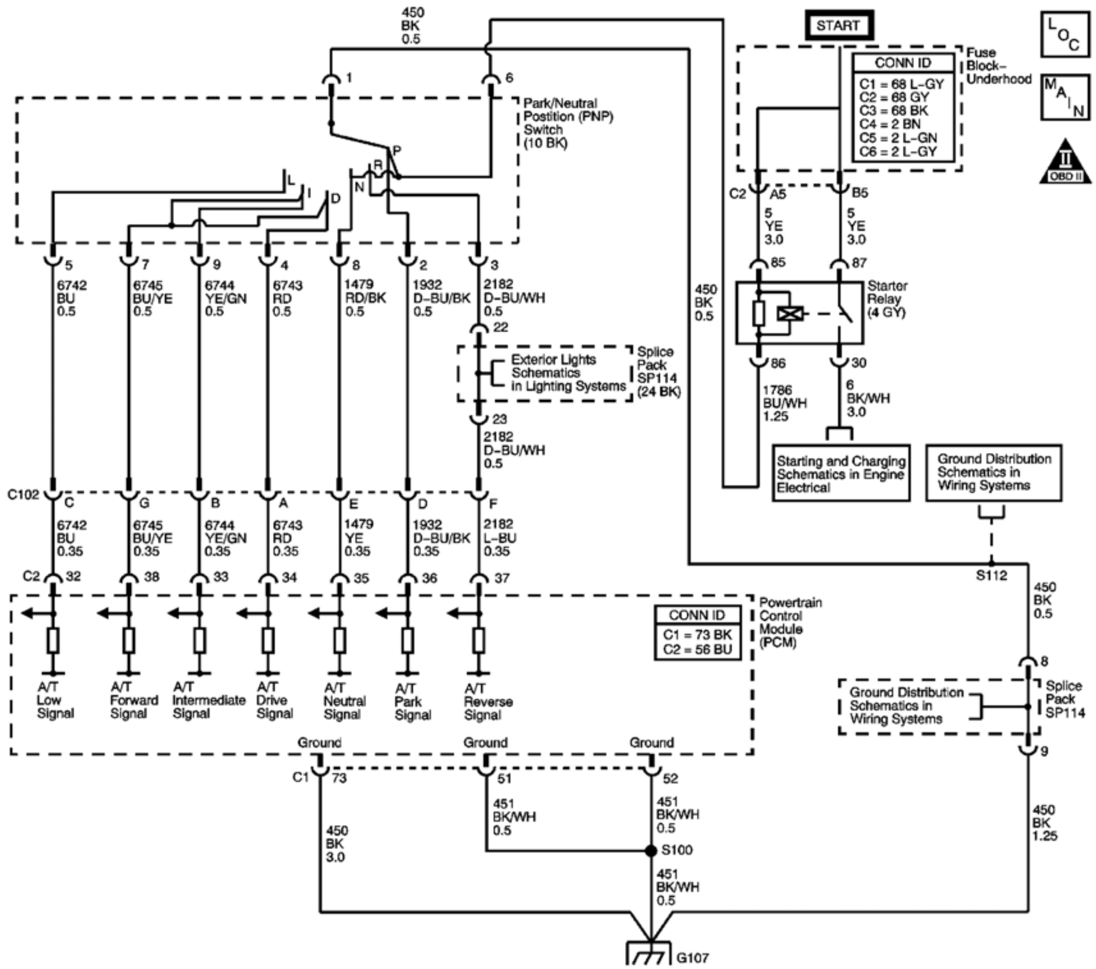


Fig. 6: DTC P0706 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission range (TR) switch is part of the park/neutral position switch assembly and is mounted on the transmission manual shaft. The TR switch is a multi-signal switch. The powertrain control module (PCM) supplies ignition voltage to the TR switch on 7 signal circuits, P, R, N, D, I, L, and Forward Range. Each gear selector lever position grounds one or more of the signal circuits in a unique pattern. In order to determine the gear range selected by the driver, the PCM compares the voltage combination on the signal circuits to a TR switch combination table stored in memory. Refer to **Transmission Range Switch Logic** . The TR forward signal is grounded when the transmission range selector is in the D or I position. When the PCM detects that the TR forward signal is open or shorted to voltage while driving, with the transmission range selector in the D or I position, DTC P0706 sets. DTC P0706 is a type B DTC.

Refer to **Range Reference** .

Conditions for Running the DTC

- No VSS DTCs P0501 or P0502.
- No TR Switch Circuit DTC P0705.
- System voltage is greater than 11 volts.

Conditions for Setting the DTC

The forward signal circuit is high during a driving cycle. The vehicle, during this driving cycle, accelerates from less than 9 km/h (6 mph) to more than 48 km/h (30 mph) and then decelerates to less than 9 km/h (6 mph) while the range selector is in the D or I position.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0706 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the connectors at the PCM, the output speed sensor, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a disconnected TR switch connector.
- Inspect for an open FWD switch wire.
- Inspect for a faulty TR switch.
- Inspect for a shift linkage incorrectly adjusted.
- Inspect for an internal fault of the PCM.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

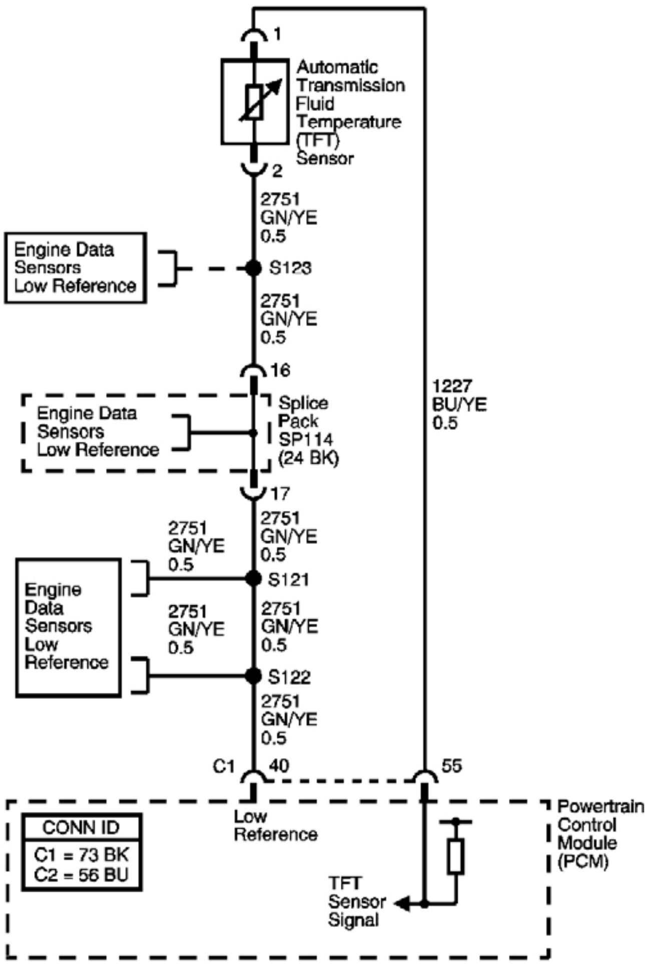
4: This step tests the TR switch wiring for an open or lack of signal voltage from the PCM.

DTC P0706

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Select TR Sw. Forward Range on the scan tool. 4. With the scan tool, observe the TR Sw. Forward Range display while selecting transmission ranges D and I. Does the TR Sw. Forward Range parameter remain LOW in D and I ranges?	Go to **Intermittent Conditions** in Engine Controls - 3.5L (L66)	Go to **Step 3**
3	1. Inspect the PNP switch assembly for the following conditions: • Damage • Loose or missing mounting hardware • Proper adjustment Refer to **Park/Neutral Position Switch Replacement** . 2. Inspect the shift cable for the following conditions: • Damaged or stretched cable • Proper adjustment Did you find and correct a condition?	Go to **Step 9**	Go to **Step 4**
4	1. Disconnect the TR switch. 2. Connect a 3 amp fused jumper wire from the TR switch forward signal circuit 10-way connector to ground, while monitoring the scan tool TR Sw. Forward Range parameters. When the TR switch forward signal circuit is grounded, does the TR Sw. Forward Range		

	parameter indicate LOW?	Go to **Step 6**	Go to **Step 5**
5	Test the TR switch forward signal circuit for an open or short to voltage. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 8**
6	Test the TR switch ground circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
7	Replace the TR switch. The TR switch is part of the park/neutral position switch. Refer to **Park/Neutral Position Switch Replacement** . Did you complete the replacement?	Go to **Step 9**	-
8	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM setup procedure. Did you complete the replacement?	Go to **Step 9**	-
9	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Start the engine and select gear ranges P, R, N, D, I, L. 4. Road test the vehicle. 5. Select Specific DTC. 6. Enter DTC P0706. Has the test run and passed?	Go to **Step 10**	Go to **Step 2**
10	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0711



<u>Fig. 7: DTC P0711 Schematics</u>
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission fluid temperature (TFT) sensor is a thermistor. The powertrain control module (PCM) supplies a 5 volt reference signal to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM senses a high signal voltage. As the transmission fluid warms, the sensor resistance lowers and the PCM senses lower voltage. The PCM uses the TFT reading in order to control the torque converter clutch (TCC), line pressure adjustments, and temperature compensated shifts. When the PCM detects no voltage change in the TFT sensor circuit, DTC P0711 sets. DTC P0711 is a type C DTC.

Conditions for Running the DTC

The following conditions must be met for 5 minutes or greater.

<u>Case 1 - Temperature Stuck Low</u>

- No ECT DTC P0116, P0117, or P0118.
- No VSS DTCs P0501 or P0502.
- No TFT DTCs P0712 or P0713.
- The system voltage is 11 volts or greater.
- ECT is less than 35° C (95° F) at engine startup, then ECT is greater than 70° C (158° F).
- TFT at engine start-up is -20° C (-4° F) or below: TFT does not exceed -20° C (-4° F) with all the enable conditions are met.
- TFT at engine start-up is -20° C (-4° F) or more: TFT does not change more than 5° C (9° F) with all the enable conditions are met.
- The vehicle speed is 30 km/h (19 mph) or greater.
- The APP angle is 10% or greater.

Case 2 - Temperature Stuck High

- No ECT DTC P0116, P0117, or P0118.
- No VSS DTCs P0501 or P0502.
- No TFT DTCs P0712 or P0713.
- The system voltage is 11 volts or greater.
- ECT is greater than 70° C (158° F) at last ignition, 35° C (95° F) or less at engine start-up, then ECT is greater than 70° C (158° F).
- TFT is 110° C (230° F) or greater at last ignition and at engine start-up, for 20 seconds.

Conditions for Setting the DTC

Case 1

The change in TFT is less than 5° C (9° F) since start-up, for 5 minutes after the conditions for running the DTC are met.

Case 2

The change in TFT is less than 5° C (9° F) since start-up, for 20 seconds after the conditions for running the DTC are met.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM illuminates the SVS Lamp.
- The PCM ignores the input from TFT sensor and uses the default values.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0711 in PCM history.

Conditions for Clearing the SVS Lamp/DTC

- The PCM turns OFF the SVS lamp when the condition no longer exists.
- A scan tool can clear the SVS lamp DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the TFT sensor, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a shorted TFT sensor wire.
- Inspect for a faulty TFT sensor.
- Inspect for an internal fault of the PCM.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: This step determines if the PCM or the TFT sensor is causing a steady, unchanging TFT reading.

DTC P0711

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	-	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM.**	-		

	3. Record the DTC Failure Records. 4. Clear the DTC. 5. Select Trans. Fluid Temp. on the scan tool. 6. Drive the vehicle and observe the scan tool for the following condition: The TFT does not change greater than 5° C (9° F) in 5 minutes and 20 seconds since start-up. Did the condition occur?		Go to **Step 4**	Go to **Intermittent Conditions** in Engine Controls-3.5L (L66)
4	1. Turn OFF the ignition. 2. Disconnect the TFT sensor. 3. Turn ON the ignition, with the engine OFF. Did the scan tool display a condition in which the Trans. Fluid Temp. does not change by greater than the specified value in 5 minutes and 20 seconds since start-up?	5° C (9° F)	Go to **Step 6**	Go to **Step 5**
5	Replace the TFT sensor. Refer to **Transmission Fluid Temperature (TFT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 7**	-
6	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). Did you complete the replacement?	-	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle and ensure the following conditions are met: • The TFT is between -30 and +143° C (-22 and +289° F). • The TFT changes by greater than 2° C (4° F) since start-up for 5 minutes. 4. Select Specific DTC.	-		

	5. Enter DTC P0711. Has the test run and passed?		Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0712

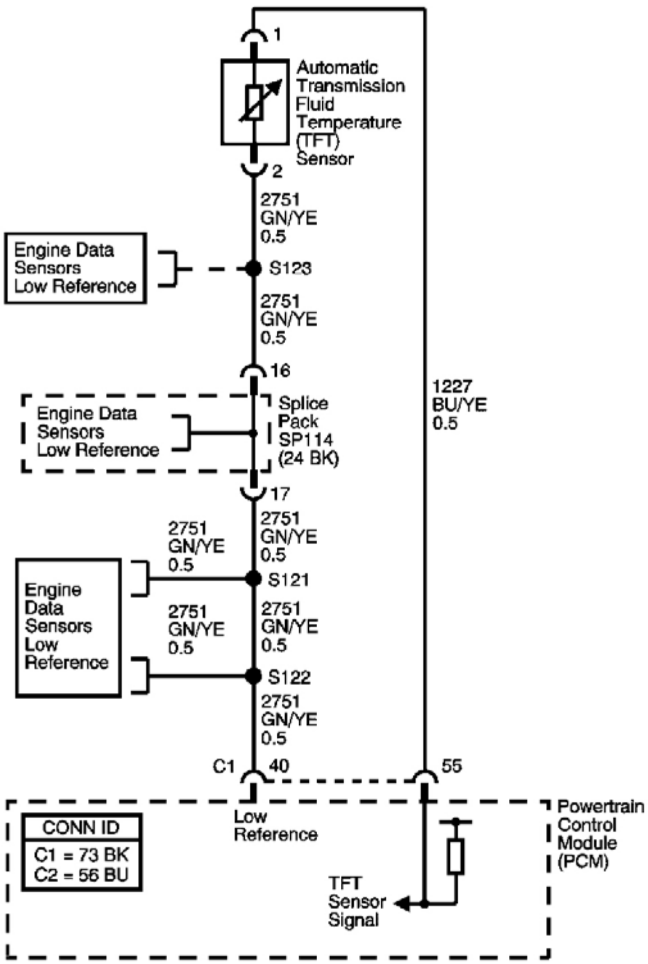


Fig. 8: DTC P0712 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission fluid temperature (TFT) sensor is a thermistor. The powertrain control module (PCM) supplies a 5 volt reference signal to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM senses a high signal voltage. As the transmission fluid warms, the sensor resistance lowers and the PCM senses lower voltage. The PCM uses the TFT reading in order to control the torque converter clutch (TCC), line pressure adjustments, and temperature compensated shifts. When the PCM detects a continuous short to ground in the TFT circuit or the TFT sensor, DTC P0712 sets. DTC P0712 is a type C DTC.

Conditions for Running the DTC

- No TFT DTC P0711.
- The system voltage is 11 volts or greater.

Conditions for Setting the DTC

The TFT sensor voltage is 0.07 V or less for at least 10 seconds.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM illuminates the SVS Lamp.
- The PCM flashes the Coolant Temp indicator.
- The PCM ignores the input from TFT sensor and uses the default values.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0712 in PCM history.

Conditions for Clearing the SVS Lamp/DTC

- The PCM turns OFF the SVS lamp when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the TFT sensor, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a shorted TFT sensor wire.
- Inspect for a faulty TFT sensor.
- Inspect for an internal fault of the PCM.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

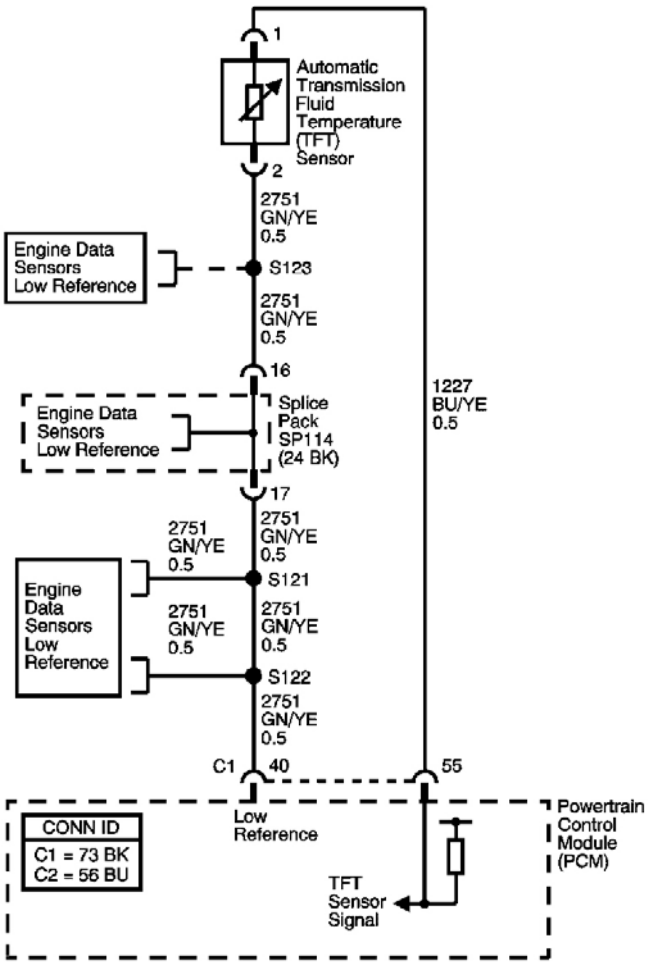
> **2:** This step verifies DTC P0712, by indicating a short to ground. If the scan tool does not display a transmission fluid temperature equal to or greater than 159° C (318° F), then the DTC is intermittent.
>
> **3:** This step isolates the PCM and the engine wiring harness. If the scan tool displays a transmission fluid temperature less than -29° C (-20° F), then the PCM and the engine wiring harness are not damaged.

DTC P0712

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Select Trans. Fluid Temp. on scan tool. Does the scan tool display a Trans. Fluid Temp. less than the specified value?	159° C (318° F)	Go to **Intermittent Conditions** in Engine Controls - 3.5L (L66)	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the TFT sensor. Additional DTCs may set. 3. Turn ON the ignition, with the engine OFF. Does the scan tool display a Trans. Fluid Temp. less than the specified value?	-29° C (-20° F)	Go to **Step 5**	Go to **Step 4**
	Test the TFT sensor signal circuit for a short to ground.			

4	Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 7**	Go to **Step 6**
5	Replace the TFT sensor. Refer to **Transmission Fluid Temperature (TFT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 7**	-
6	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). Did you complete the replacement?	-	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Turn ON the ignition with the engine OFF. • The Trans. Fluid Temp. must be between -20 and +110° C (-4 and +230° F) for 10 seconds. 4. Select Specific DTC. 5. Enter DTC P0712. Has the test run and passed?	-	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0713



<u>Fig. 9: DTC P0713 Schematics</u>
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission fluid temperature (TFT) sensor is a thermistor. The powertrain control module (PCM) supplies a 5 volt reference signal to the sensor. When the transmission fluid is cold, the sensor resistance is high and the PCM senses a high signal voltage. As the transmission fluid warms, the sensor resistance lowers and the PCM senses lower voltage. The PCM uses the TFT reading in order to control the torque converter clutch (TCC), line pressure adjustments, and temperature compensated shifts. When the PCM detects a continuous open or short to voltage in the TFT circuit or in the TFT sensor, DTC P0713 sets. DTC P0713 is a type C DTC.

Conditions for Running the DTC

- No TFT DTC P0711.

- The system voltage is 11 volts or greater.

Conditions for Setting the DTC

The TFT sensor voltage is 4.93 V or greater for at least 10 seconds.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM illuminates the SVS Lamp.
- The PCM ignores the input from TFT sensor and uses the default values.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0712 in PCM history.

Conditions for Clearing the SVS Lamp/DTC

- The PCM turns OFF the service vehicle soon (SVS) lamp when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the TFT sensor, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for open or shorted to voltage TFT sensor wires.
- Inspect for an open TFT sensor connector.
- Inspect for a faulty TFT sensor.
- Inspect for an internal fault of the PCM.

Test Description

The number below refers to the step number on the diagnostic table.

5: This step tests the TFT sensor signal circuit for being shorted to voltage, which would be the cause for the open in the TFT sensor.

DTC P0713

Step	Action	Values	Yes	No
	Did you perform the Diagnostic System			Go to **Diagnostic**

1	Check - Engine Controls?	-	Go to **Step 2**	**System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the DTC Failure Records. Using the Clear Info function erases the Failure Records from the PCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Select Trans. Fluid Temp. on the scan tool. Does the scan tool display a Trans. Fluid Temp. less than the specified value?	-29° C (-20° F)	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls-3.5L (L66)
3	1. Turn OFF the ignition. 2. Disconnect the TFT sensor. Additional DTCs may set. 3. Using the DMM and the **J-35616** connector test adapter kit, measure the resistance of the TFT sensor. Refer to **Testing for Continuity** in Wiring Systems.Does the resistance measure less than the specified value?	100 K ohm	Go to **Step 4**	Go to **Step 5**
4	1. Test the TFT sensor signal circuit for an open or short to 5 volts. 2. Test the TFT sensor low reference circuit for an open or short to 5 volts. Refer to **Testing for Continuity** and**Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 8**	Go to **Step 7**
5	Test the TFT sensor signal circuit for a short to voltage. Refer to **Testing for a Short to Voltage**	-		

	and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?		Go to **Step 6**	Go to **Step 6**
6	Replace the TFT sensor. Refer to **Transmission Fluid Temperature (TFT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 8**	-
7	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). Did you complete the replacement?	-	Go to **Step 8**	-
8	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Turn ON the ignition, with the engine OFF. • The Trans. Fluid Temp. must be -20 - +110° C (-4 - +230° F) for 10 seconds. 4. Select Specific DTC. 5. Enter DTC P0713. Has the test run and passed?	-	Go to **Step 9**	Go to **Step 2**
9	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0716

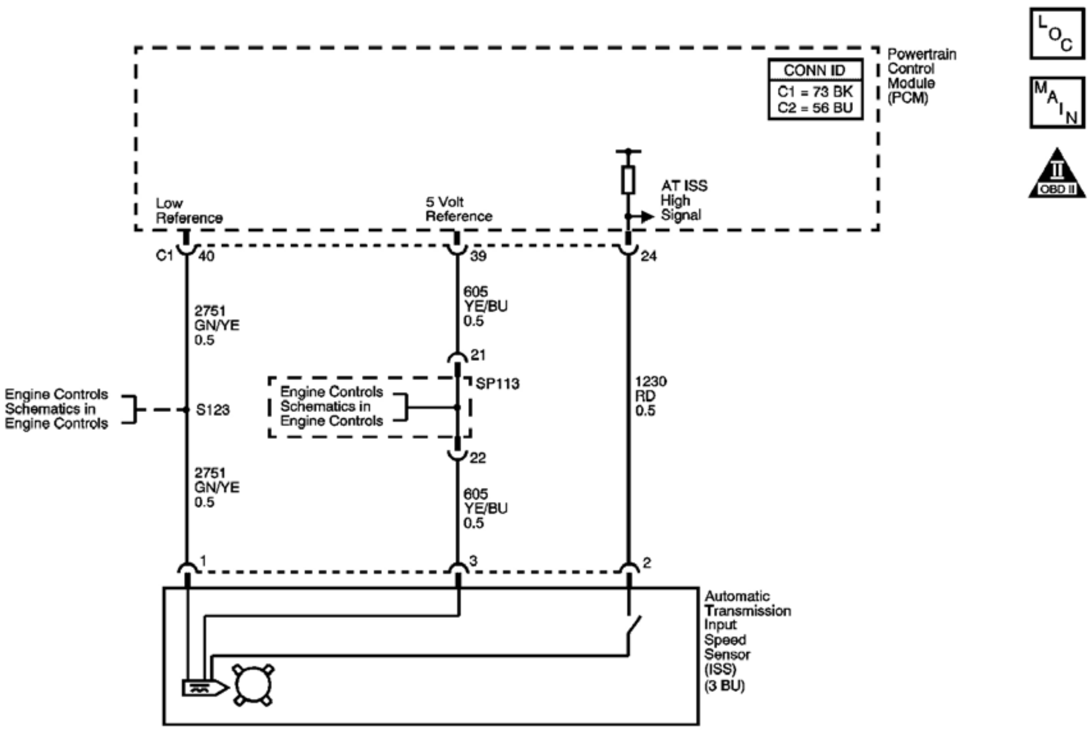


Fig. 10: DTC P0716 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission input shaft speed (AT ISS) sensor is a three-wire magnetic pick-up sensor that is mounted externally to the transmission. The AT ISS utilizes the main idler gear teeth, located on the mainshaft, to generate a voltage signal of varying frequency that corresponds to the rotational speed of the output shaft. The AT ISS signal is sent to the powertrain control module (PCM) and is used to calculate the vehicle speed. Simultaneously, the automatic transmission output speed shaft (AT OSS) sensor signal is used to calculate the vehicle speed. The PCM compares the vehicle speed calculated from both speed sensors and uses this comparison for diagnosis of the speed sensors.

If the PCM detects the OSS calculated vehicle speed is 6 times or greater than the ISS calculated vehicle speed, DTC P0716 sets. DTC P0716 is a type A DTC.

Conditions for Running the DTC

- No VSS DTCs P0501 or P0502.
- No TR Switch DTCs P0705 or P0706.
- No ISS DTC P0717.
- No Clutch PC Solenoid 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.

- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- The system voltage is 11 volts or greater.
- The vehicle speed is 20 km/h (13 mph) or greater.
- The transmission is not shifting.

Conditions for Setting the DTC

The ratio of the vehicle speed calculated from the OSS signal, divided by the vehicle speed calculated from the ISS signal is 6.0 or greater for 10 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 2nd and 3rd gears.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0716 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the AT ISS, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a disconnected AT ISS connector.
- Inspect for an open or shorted AT ISS wire.
- Inspect for a faulty AT ISS.
- Inspect for an internal fault of the PCM.

DTC P0716

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Start and idle the engine. 6. Monitor the Transmission ISS parameter on the scan tool. Does the scan tool indicate a Transmission ISS parameter increase while the engine speed increases?	-	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the AT ISS. 3. Turn the ignition ON, with the engine OFF. 4. Using the DMM, measure the voltage of the AT ISS 5 volt reference circuit to ground. Does the voltage measure near the specified value?	5 V	Go to **Step 4**	Go to **Step 7**
4	Measure the voltage from the AT ISS 5 volt reference circuit to the AT ISS low reference circuit. Does the voltage measure near the specified value?	5 V	Go to **Step 5**	Go to **Step 8**
	Measure the voltage from the ISS high signal circuit to the ISS low reference circuit.			

<table>
<tr><td>5</td><td>Does the voltage measure near the specified value?</td><td>5 V</td><td>Go to Step 9</td><td>Go to Step 6</td></tr>
<tr><td>6</td><td>Test the AT ISS high signal circuit for the following conditions:
An open
A short to ground
A short to voltage
Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems.
Did you find and correct the condition?</td><td>-</td><td>Go to Step 12</td><td>Go to Step 11</td></tr>
<tr><td>7</td><td>IMPORTANT:
The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to <u>Power Distribution Schematics</u> in Wiring Systems for complete circuit distribution.

Test the AT ISS 5 volt reference circuit for the following conditions:
An open
A short to ground
A short to voltage
Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems.Did you find and correct the condition?</td><td>-</td><td>Go to Step 12</td><td>Go to Step 11</td></tr>
<tr><td>8</td><td>Test the AT ISS low reference circuit for an open or a short to voltage.
Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> in Wiring Systems.
Did you find and correct the condition?</td><td>-</td><td>Go to Step 12</td><td>Go to Step 11</td></tr>
<tr><td>9</td><td>Remove the AT ISS sensor.

Refer to <u>Input Speed Sensor Replacement</u> .

Inspect the AT ISS and the transmission for the following conditions:
An incorrect AT ISS
A damaged AT ISS</td><td>-</td><td></td><td></td></tr>
</table>

	- Incorrect AT ISS installation - AT ISS rotor damage 3. Repair any of the above conditions as necessary. Did you find and correct the condition?		Go to **Step 12**	Go to **Step 10**
10	Replace the AT ISS. Refer to **Input Speed Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
11	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** Engine Controls - 3.5L (L66). Did you complete the replacement?	-	Go to **Step 12**	-
12	Perform the following procedure In order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle. 4. Ensure the vehicle speed is greater than 20 km/h (13 mph) for at least 10 seconds. 5. Select specific DTC. 6. Enter DTC P0716. Has the test run and passed?	-	Go to **Step 13**	Go to **Step 2**
13	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)	System OK

DTC P0717

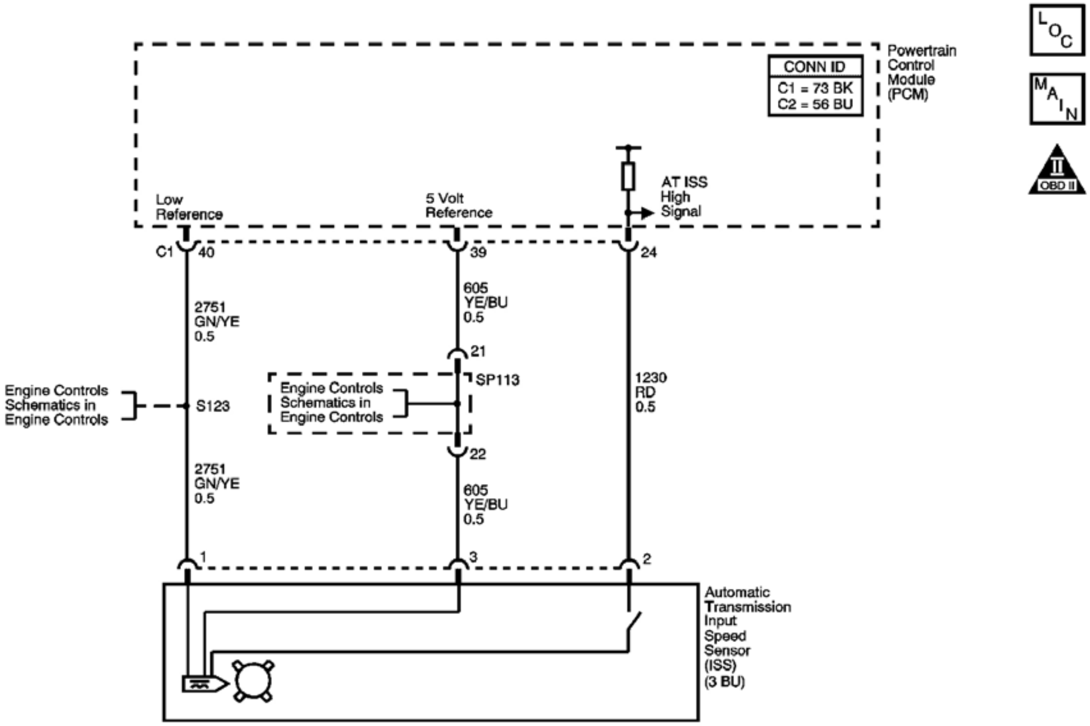


Fig. 11: DTC P0717 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission input shaft speed (AT ISS) sensor is a three-wire magnetic pick-up sensor that is mounted externally to the transmission. The AT ISS utilizes the main idler gear teeth, located on the mainshaft, to generate a voltage signal of varying frequency that corresponds to the rotational speed of the automatic transmission output speed shaft (AT OSS) sensor. The AT ISS signal is sent to the powertrain control module (PCM) and is used to calculate the vehicle speed. Simultaneously, the signal from the AT OSS is used to calculate the vehicle speed. The PCM compares the vehicle speed calculated from both speed sensors and uses this comparison for diagnosis of the speed sensors. If the PCM detects a low AT ISS speed and a high AT OSS calculated vehicle speed for 10 seconds, DTC P0717 sets. DTC P0717 is a type A DTC.

Conditions for Running the DTC

- No VSS DTCs P0501 or P0502.
- No TR Switch DTCs P0705 or P0706.
- No ISS DTC P0717.
- No Clutch PC Solenoid 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.

- No SS 3 DTCs P0979 or P0980.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- The system voltage is 11 volts or greater.
- The vehicle speed is 13 mph (20 km/h) or greater.
- The transmission is not shifting.

Conditions for Setting the DTC

The vehicle speed calculated from the AT OSS is 20 km/h (12 mph) or greater, while the vehicle speed calculated from the AT ISS is 2 km/h (1 mph) or less, for 10 seconds or greater.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 2nd and 3rd gears.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0717 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the AT ISS, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a disconnected AT ISS connector.
- Inspect for an open or shorted AT ISS wire.
- Inspect for a faulty AT ISS.
- Inspect for an internal fault of the PCM.

DTC P0717

Step	Action	Values	Yes	No
	Did you perform the Diagnostic System Check - Engine Controls?			Go to **Diagnostic System Check -**

1		-	Go to **Step 2**	**Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Start and idle the engine. 6. Monitor the Transmission ISS parameter on the scan tool. Does the scan tool indicate an increase in the Transmission ISS parameter while the engine speed increases?	-	Go to **Diagnostic System Check - Engine Controls** in Engine Controls- 3.5L (L66)	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the AT ISS. 3. Turn ON the ignition with the engine OFF. 4. Using the DMM, measure the voltage of the AT ISS 5 volt reference circuit to ground. Does the voltage measure near the specified value?	5 V	Go to **Step 4**	Go to **Step 7**
4	Measure the voltage from the AT ISS 5 volt reference circuit to the AT ISS low reference circuit. Does the voltage measure near the specified value?	5 V	Go to **Step 5**	Go to **Step 8**
5	Measure the voltage from the ISS high signal circuit to the ISS low reference circuit. Does the voltage measure near the specified value?	5 V	Go to **Step 9**	Go to **Step 6**
	Test the AT ISS high signal circuit for the			

6	following conditions: • An open • A short to ground • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
7	**IMPORTANT:** **The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Power Distribution Schematics in Wiring Systems for complete circuit distribution.** Test the AT ISS 5 volt reference circuit for the following conditions: • An open • A short to ground • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
8	Test the AT ISS low reference circuit for an open or a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
9	1. Remove the AT ISS sensor. Refer to **Input Speed Sensor Replacement** . 2. Inspect the AT ISS and the transmission for the following conditions: • An incorrect AT ISS • A damaged AT ISS • Incorrect AT ISS installation • AT ISS rotor damage 3. Repair any of the above conditions as	-		

	necessary. Did you find and correct the condition?		Go to **Step 12**	Go to **Step 10**
10	Replace the AT ISS. Refer to **Input Speed Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
11	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** Engine Controls - 3.5L (L66). Did you complete the replacement?	-	Go to **Step 12**	-
12	Perform the following procedure In order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle. 4. Ensure the vehicle speed is greater than 20 km/h (13 mph) for at least 10 seconds. 5. Select specific DTC. 6. Enter DTC P0717. Has the test run and passed?	-	Go to **Step 13**	Go to **Step 2**
13	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0718

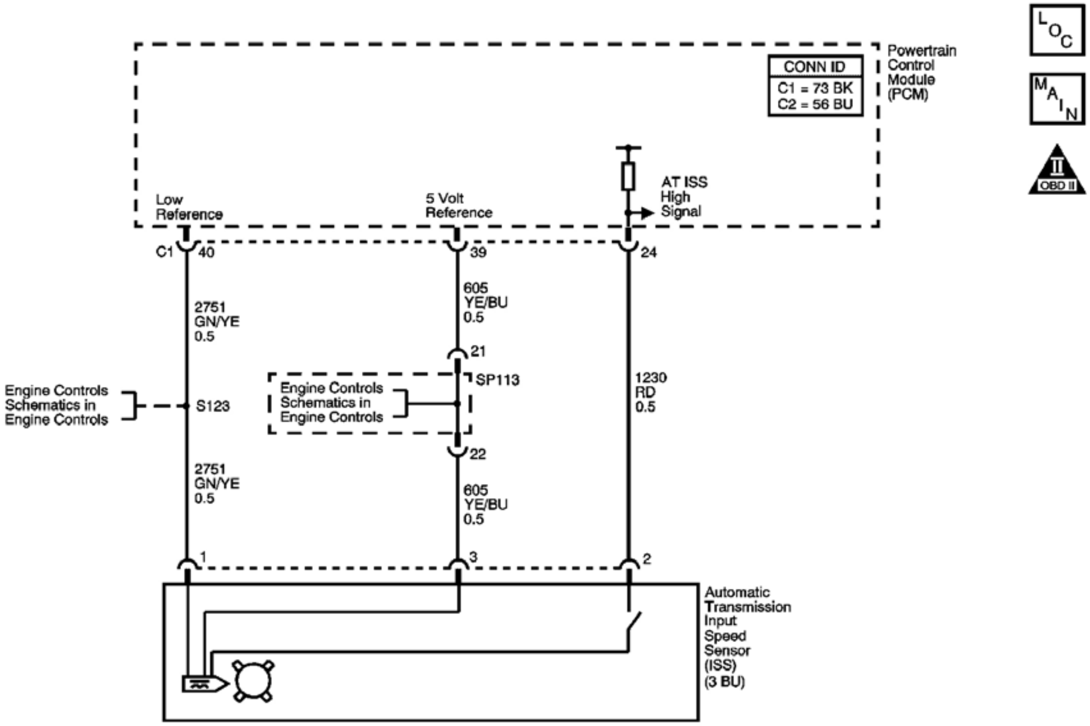


Fig. 12: DTC P0718 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission input shaft speed (AT ISS) sensor is a three-wire magnetic pick-up sensor that is mounted externally to the transmission. The AT ISS sensor utilizes the main idler gear teeth, located on the mainshaft, to generate a voltage signal of varying frequency, that corresponds to the rotational speed of the mainshaft. The AT ISS signal is sent to the powertrain control module (PCM) and is used to calculate the vehicle speed. Simultaneously, the signal from the automatic transmission output shaft speed (AT OSS) sensor is used to calculate the vehicle speed. The PCM compares the vehicle speed calculated from both speed sensors and uses this comparison for diagnosis of the speed sensors. If the PCM detects an unreasonably large change in the AT ISS speed, in a short period of time, DTC P0718 sets. DTC P0718 is a type B DTC.

Conditions for Running the DTC

- No VSS DTCs P0501 or P0502.
- No TR Switch DTCs P0705 or P0706.
- No Clutch PC Solenoid 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.

- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- The system voltage is 11 volts or greater.
- The vehicle speed is 20 km/h (13 mph) or greater.
- The transmission is not shifting.
- The AT OSS intermittent failure is not being detected.

Conditions for Setting the DTC

The vehicle speed calculated from the AT ISS fluctuates by 6 km/h (4 mph) or greater in a 0.01 second period and has occurred 6 times during 0.5 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0718 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the connectors at the PCM, the AT ISS, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a loose AT ISS connector.
- Inspect for an intermittent open or shorted AT ISS wire.
- Inspect for a faulty AT ISS.
- Inspect for an internal fault of the PCM.

DTC P0718

Step	Action	Values	Yes	No

1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Start and idle the engine. 6. Monitor the Transmission ISS parameter on the scan tool. Does the scan tool indicate an increase in the Transmission ISS parameter while the engine speed increases?	-	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the AT ISS. 3. Turn ON the ignition, with the engine OFF. 4. Using the DMM, measure the voltage of the AT ISS 5 volt reference circuit to ground. Does the voltage measure near the specified value?	5 V	Go to **Step 4**	Go to **Step 7**
4	Measure the voltage from the AT ISS 5 volt reference circuit to the AT ISS low reference circuit. Does the voltage measure near the specified value?	5 V	Go to **Step 5**	Go to **Step 8**
5	Measure the voltage from the ISS high signal circuit to the ISS low reference circuit. Does the voltage measure near the specified	5 V		

	value?		Go to **Step 9**	Go to **Step 6**
6	Test the AT ISS high signal circuit for the following conditions: • An open • A short to ground • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
7	**IMPORTANT:** **The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Power Distribution Schematics in Wiring Systems for complete circuit distribution.** Test the AT ISS 5 volt reference circuit for the following conditions: • An open • A short to ground • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
8	Test the AT ISS low reference circuit for an open or a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
9	1. Remove the AT ISS sensor. Refer to **Input Speed Sensor Replacement** . 2. Inspect the AT ISS and the transmission for the following conditions: • An incorrect AT ISS • A damaged AT ISS • Incorrect AT ISS installation	-		

	• AT ISS rotor damage 3. Repair any of the above conditions as necessary. Did you find and correct the condition?		Go to **Step 12**	Go to **Step 10**
10	Replace the AT ISS. Refer to **Input Speed Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
11	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** Engine Controls - 3.5L (L66). Did you complete the replacement?	-	Go to **Step 12**	-
12	Perform the following procedure In order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle. 4. Ensure the vehicle speed is greater than 20 km/h (13 mph) for at least 10 seconds. 5. Select specific DTC. 6. Enter DTC P0718. Has the test run and passed?	-	Go to **Step 13**	Go to **Step 2**
13	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0731

Circuit Description

While driving in 1st gear, line pressure is supplied to the 1st clutch piston, the 1st clutch engages and the shaft and 1st gear rotate together to transmit drive force. The oil pressure is supplied to the 1st clutch via the suction filter, oil pump, main regulator, manual valve, shift valve, feed pipe and clutch piston. The powertrain control module (PCM) calculates the automatic transmission input shaft speed (AT ISS) sensor to automatic transmission output shaft speed (AT OSS) sensor ratio. When the calculated ratio is incorrect for 1st gear, while the PCM is commanding 1st gear, the PCM determines it is a fault and DTC P0731 sets. DTC P0731 is a type C DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, or P0118.
- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTCs P0705 or P0706.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Performance DTCs P0746, P0747, P0776, or P0777.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0761, P0757, or P0762.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- The system voltage is 11 volts or greater.
- The vehicle speed is 2 km/h (1 mph)-12 km/h (8 mph).
- The engine speed is 1,000 RPM or greater.
- The transmission is in D, I, or L range.

Conditions for Setting the DTC

- The actual gear ratio is 1.2 times greater than, or 0.75 times less than the known 1st gear ratio for 12 seconds or greater.
- The vehicle speed calculated from mainshaft speed sensor is more than 11 km/h (7 mph) while the vehicle speed calculated from the output shaft speed sensor is less than 2 km/h (1 mph) for 3 seconds or more.
- The actual gear ratio is correct to the known gear ratio for 3 seconds or more.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM illuminates the service vehicle soon (SVS) lamp during the second consecutive trip in which the Conditions for Setting the DTC are met.

- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0731 in PCM history.

Conditions for Clearing the SVS Lamp/DTC

- The PCM turns OFF the SVS lamp when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a shift control system malfunction.
- Inspect for a worn 1st clutch.
- Inspect for an insufficient automatic transmission fluid pump output.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for low fluid level, which may cause slipping and result in an incorrect gear ratio.

4: This step verifies that the correct gear ratios occur for commanded gears.

5: This step tests for low line pressure.

DTC P0731

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Visually inspect the transmission cooling system for fluid leaks. 2. Repair any leaks as necessary. Refer to **Fluid Leak Diagnosis** .Did you find and correct a condition?	-	Go to **Step 8**	Go to **Step 3**
3	Did you perform the Transmission Fluid Checking Procedure?	-	Go to **Step 4**	Go to **Transmission Fluid Checking Procedure**

<table>
<tr><td>4</td><td>Install a scan tool.
Turn ON the ignition, with the engine OFF. IMPORTANT: Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM. <ol start="3">
Record the DTC Failure Records.
Clear the DTC.
Use the scan tool snapshot mode in order to record Gear Ratio and Gear Slip Ratio.
Drive the vehicle in 1st gear, with the TP greater than 10%, and the vehicle speed greater than 12 km/h (8 mph) for 20 seconds or greater.
Record the Gear Ratio and Gear Slip Ratio. Is the Gear Slip Ratio within the specified range? </td><td>1.2:1-0.75:1</td><td>Go to Diagnostic Aids</td><td>Go to Step 5</td></tr>
<tr><td>5</td><td>Did you perform the Line Pressure Check Procedure?</td><td>-</td><td>Go to Step 6</td><td>Go to <u>Line Pressure Check Procedure</u></td></tr>
<tr><td>6</td><td>Inspect the 1st clutch plates for the following conditions:
Slipping
Dragging
Damage Refer to <u>1st/2nd Clutch Shaft Disassemble</u> . Repair any of the above items as necessary. Did you complete the repair? </td><td>-</td><td>Go to Step 7</td><td>-</td></tr>
<tr><td></td><td>Change the transmission fluid and filter.</td><td></td><td></td><td></td></tr>
</table>

7	Refer to **Transmission Fluid Replacement** . 2. Inspect the transmission fluid for the correct level. 3. Add new fluid as necessary. Did you complete the above procedures?	-	Go to **Step 8**	-
8	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 1st gear, with the throttle greater than 10%, in order to obtain a gear slip ratio of 1.2:1-0.75:1 for 20 seconds. 4. Select Specific DTC. 5. Enter DTC P0731. Has the test run and passed?	-	Go to **Step 9**	Go to **Step 2**
9	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0732

Circuit Description

While driving in 2nd gear, line pressure is supplied to the 2nd clutch piston, the 2nd clutch engages and the shaft and 2nd gear rotate together to transmit drive force. Oil pressure is supplied to the 2nd clutch via the suction filter, oil pump, main regulator, manual valve, shift valve, feed pipe and clutch piston. The powertrain control module (PCM) calculates the mainshaft speed to output shaft speed ratio. When the calculated ratio is incorrect for 2nd gear, while the PCM is commanding 2nd gear, DTC P0732 sets. DTC P0732 is a type C DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, P0118.
- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTCs P0705 or P0706.

- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Performance DTCs P0746, P0747, P0776, or P0777.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0761, P0757, or P0762.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- The system voltage is 11 volts or greater.
- The vehicle speed is 12 km/h (8 mph) or greater.
- The engine speed is 1,000 RPM or greater.
- The transmission is in D range.
- The commanded gear is 2nd.

Conditions for Setting the DTC

The actual gear ratio is 1.2 times greater than, or 0.75 times less than the known 2nd gear ratio for 12 seconds or greater.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM illuminates the service vehicle soon (SVS) lamp during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0732 in PCM history.

Conditions for Clearing the SVS Lamp/DTC

- The PCM turns OFF the SVS lamp when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.

- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a shift control system malfunction.
- Inspect for a worn 2nd clutch.
- Inspect for insufficient automatic transmission fluid pump output.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for low fluid level, which may cause slipping and result in an incorrect gear ratio.

4: This step verifies that the correct gear ratios occur for commanded gears.

5: This step tests for low line pressure.

DTC P0732

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Visually inspect the transmission cooling system for fluid leaks. 2. Repair any leaks as necessary. Refer to **Fluid Leak Diagnosis** .Did you find and correct a condition?	-	Go to **Step 8**	Go to **Step 3**
3	Did you perform the Transmission Fluid Checking Procedure?	-	Go to **Step 4**	Go to **Transmission Fluid Checking Procedure**
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM.**			

4	3. Record the DTC Failure Records. 4. Clear the DTC. 5. Use the scan tool snapshot mode in order to record Gear Ratio and Gear Slip Ratio. 6. Drive the vehicle in 2nd gear, with the TP greater than 10%, and the vehicle speed greater than 12 km/h (8 mph) for 20 seconds or greater. 7. Record the Gear Ratio and Gear Slip Ratio. Is the Gear Slip Ratio within the specified range?	1.2:1-0.75:1	Go to Diagnostic Aids	Go to **Step 5**
5	Did you perform the Line Pressure Check Procedure?	-	Go to **Step 6**	Go to **Line Pressure Check Procedure**
6	1. Inspect the 2nd clutch plates for the following conditions: • Slipping • Dragging • Damage Refer to **2nd Clutch Inspection** . 2. Repair any of the above items as necessary. Did you complete the repair?	-	Go to **Step 7**	-
7	1. Change the transmission fluid and filter. Refer to **Transmission Fluid Replacement** . 2. Inspect the transmission fluid for the correct level. 3. Add new fluid as necessary. Did you complete the above procedures?	-	Go to **Step 8**	-
	Perform the following procedure in order to verify the repair:			

8	1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle, with the throttle greater than 10%, in order to obtain a gear ratio of 1.2:1-0.75:1 for 20 seconds. 4. Select Specific DTC. 5. Enter DTC P0732. Has the test run and passed?	-	Go to **Step 9**	Go to **Step 2**
9	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0733

Circuit Description

While driving in 3rd gear, line pressure is supplied to the 3rd clutch piston, the 3rd clutch engages and the shaft and 3rd gear rotate together to transmit drive force. Oil pressure is supplied to the 3rd clutch via the suction filter, oil pump, main regulator, manual valve, shift valve, feed pipe and clutch piston. The powertrain control module (PCM) calculates the mainshaft speed to output shaft speed ratio. When the calculated ratio is incorrect for 3rd gear, while the PCM is commanding 3rd gear, DTC P0733 sets. DTC P0733 is a type C DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, P0118.
- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTCs P0705 or P0706.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Performance DTCs P0746, P0747, P0776, or P0777.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0761, P0757, or P0762.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962, or P0963.
- No Clutch PC Solenoid 2 DTCs P0966, or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.

- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- The system voltage is 11 volts or greater.
- The vehicle speed is 12 km/h (8 mph) or greater.
- The engine speed is 1,000 RPM or greater.
- The transmission is in D range.
- The commanded gear is 3rd.

Conditions for Setting the DTC

The actual gear ratio is 1.2 times greater than, or 0.75 times less than the known 3rd gear ratio for 12 seconds or greater.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM illuminates the service vehicle soon (SVS) lamp during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0733 in PCM history.

Conditions for Clearing the SVS Lamp/DTC

- The PCM turns OFF the SVS lamp when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a shift control system malfunction.
- Inspect for a worn 3rd clutch.
- Inspect for an insufficient automatic transmission fluid pump output.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for low fluid level, which may cause slipping and result in an incorrect gear ratio.

4: This step verifies that the correct gear ratios occur for commanded gears.

5: This step tests for low line pressure.

DTC P0733

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Visually inspect the transmission cooling system for fluid leaks. 2. Repair any leaks as necessary. Refer to **Fluid Leak Diagnosis** .Did you find and correct a condition?	-	Go to **Step 8**	Go to **Step 3**
3	Did you perform the Transmission Fluid Checking Procedure?	-	Go to **Step 4**	Go to **Transmission Fluid Checking Procedure**
4	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Use the scan tool snapshot mode in order to record Gear Ratio and Gear Slip Ratio. 6. Drive the vehicle in 3rd gear, with the TP greater than 10% and the vehicle speed greater than 12 km/h (8 mph) for 20 seconds or greater. 7. Record the Gear Ratio and Gear Slip Ratio.	1.2:1-0.75:1		

	Is the Gear Slip Ratio within the specified range?		Go to Diagnostic Aids	Go to **Step 5**
5	Did you perform the Line Pressure Check Procedure?	-	Go to **Step 6**	Go to **Line Pressure Check Procedure**
6	1. Inspect the 3rd clutch plates for the following conditions: • Slipping • Dragging • Damage Refer to **3rd Clutch Inspection** . 2. Repair any of the above items as necessary. Did you complete the repair?	-	Go to **Step 7**	-
7	1. Change the transmission fluid and filter. Refer to **Transmission Fluid Replacement** . 2. Inspect the transmission fluid for the correct level. 3. Add new fluid as necessary. Did you complete the above procedures?	-	Go to **Step 8**	-
8	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 3rd gear, with the throttle greater than 10%, in order to obtain a gear ratio of 1.2:1-0.75:1 for 20 seconds. 4. Select Specific DTC. 5. Enter DTC P0733. Has the test run and passed?	-	Go to **Step 9**	Go to **Step 2**

9	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0734

Circuit Description

While driving in 4th gear, line pressure is supplied to the 4th clutch piston, the 4th clutch engages and the shaft and 4th gear rotate together to transmit drive force. Oil pressure is supplied to the 4th clutch via the suction filter, oil pump, main regulator, manual valve, shift valve, feed pipe and clutch piston. The powertrain control module (PCM) calculates the mainshaft speed to output shaft speed ratio. When the calculated ratio is incorrect for 4th gear, while the PCM is commanding 4th gear, DTC P0734 sets. DTC P0734 is a type C DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, P0118.
- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTCs P0705 or P0706.
- No AT ISS DTCs P0716, P0717 or P0718.
- No Clutch PC Performance DTCs P0746, P0747, P0776, or P0777.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0761, P0757, or P0762.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- The system voltage is 11 volts or greater.
- The vehicle speed is 12 km/h (8 mph) or greater.
- The engine speed is 1,000 RPM or greater.
- The transmission is in D range.

- The commanded gear is 4th.

Conditions for Setting the DTC

The actual gear ratio is 1.2 times greater than, or 0.75 times less than the known 4th gear ratio for 12 seconds or greater.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM illuminates the service vehicle soon (SVS) lamp during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0734 in PCM history.

Conditions for Clearing the SVS Lamp/DTC

- The PCM turns OFF the SVS lamp when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a shift control system malfunction.
- Inspect for a worn 4th clutch.
- Inspect for an insufficient automatic transmission fluid pump output.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for low fluid level, which may cause slipping and result in an incorrect gear ratio.
4: This step verifies that the correct gear ratios occur for commanded gears.
5: This step tests for low line pressure.

DTC P0734

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-		Go to **Diagnostic System Check - Engine Controls** in

			Go to **Step 2**	Engine Controls - 3.5L (L66)
2	1. Visually inspect the transmission cooling system for fluid leaks. 2. Repair any leaks as necessary. Refer to **Fluid Leak Diagnosis** .Did you find and correct a condition?	-	Go to **Step 8**	Go to **Step 3**
3	Did you perform the Transmission Fluid Checking Procedure?	-	Go to **Step 4**	Go to **Transmission Fluid Checking Procedure**
4	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Use the scan tool snapshot mode in order to record Gear Ratio and Gear Slip Ratio. 6. Drive the vehicle in 4th gear, with the TP greater than 10% and the vehicle speed greater than 12 km/h (8 mph) for 20 seconds or greater. 7. Record the Gear Ratio and Gear Slip Ratio. Is the Gear Slip Ratio within the specified range?	1.2:1-0.75:1	Go to Diagnostic Aids	Go to **Step 5**
5	Did you perform the Line Pressure Check Procedure?	-	Go to **Step 6**	Go to **Line Pressure Check Procedure**
	1. Inspect the 4th clutch plates for the following conditions: • Slipping • Dragging • Damage			

6	Refer to **4th and 5th/Reverse Clutch Inspection** . 2. Repair any of the above items as necessary. Did you complete the repair?	-	Go to **Step 7**	-
7	1. Change the transmission fluid and filter. Refer to **Transmission Fluid Replacement** . 2. Inspect the transmission fluid for the correct level. 3. Add new fluid as necessary. Did you complete the above procedures?	-	Go to **Step 8**	-
8	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle, with the throttle greater than 10%, in order to obtain a gear ratio of 1.2:1-0.75:1 for 20 seconds. 4. Select Specific DTC. 5. Enter DTC P0734. Has the test run and passed?	-	Go to **Step 9**	Go to **Step 2**
9	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0735

Circuit Description

While driving in 5th gear, line pressure is supplied to the 5th clutch piston, the 5th clutch engages and the shaft and 5th gear rotate together to transmit drive force. Oil pressure is supplied to the 5th clutch via the suction filter, oil pump, main regulator, manual valve, shift valve, feed pipe and clutch piston. The powertrain control module (PCM) calculates the mainshaft speed to output shaft speed ratio. When the calculated ratio is incorrect for 5th gear, while the PCM is commanding 5th gear, DTC P0735 sets. DTC P0735 is a type C DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, P0118.
- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTCs P0705 or P0706.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Performance DTCs P0746, P0747, P0776, or P0777.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0761, P0757, or P0762.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- The system voltage is 11 volts or greater.
- The vehicle speed is 12 km/h (8 mph) or greater.
- The engine speed is 1,000 RPM or greater.
- The transmission is in D range.
- The commanded gear is 5th.

Conditions for Setting the DTC

The actual gear ratio is 1.2 times greater than, or 0.75 times less than the known 5th gear ratio for 12 seconds or greater.

Action Taken When the DTC Sets

- The PCM does not illuminate the malfunction indicator lamp (MIL).
- The PCM illuminates the service vehicle soon (SVS) lamp during the second consecutive trip in which the Conditions for Setting the DTC are met.

- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0735 in PCM history.

Conditions for Clearing the SVS Lamp/DTC

- The PCM turns OFF the SVS lamp when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a shift control system malfunction.
- Inspect for a worn 5th clutch.
- Inspect for an Insufficient automatic transmission fluid pump output.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for low fluid level, which may cause slipping and result in an incorrect gear ratio.

4: This step verifies that the correct gear ratios occur for commanded gears.

5: This step tests for low line pressure.

DTC P0735

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Visually inspect the transmission cooling system for fluid leaks. 2. Repair any leaks as necessary. Refer to **Fluid Leak Diagnosis** .Did you find and correct a condition?	-	Go to **Step 8**	Go to **Step 3**
3	Did you perform the Transmission Fluid Checking Procedure?	-	Go to **Step 4**	Go to **Transmission Fluid Checking Procedure**

4	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear Info function erases the Failure Records from the PCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Use the scan tool snapshot mode in order to record Gear Ratio and Gear Slip Ratio. 6. Drive the vehicle in 5th gear, with the TP greater than 10% and the vehicle speed greater than 12 km/h (8 mph) for 20 seconds or greater. 7. Record the Gear Ratio and Gear Slip Ratio. Is the Gear Slip Ratio within the specified range?	1.2:1-0.75:1	Go to Diagnostic Aids	Go to **Step 5**
5	Did you perform the Line Pressure Check Procedure?	-	Go to **Step 6**	Go to **Line Pressure Check Procedure**
6	1. Inspect the 5th clutch plates for the following conditions: • Slipping • Dragging • Damage Refer to **4th and 5th/Reverse Clutch Inspection** . 2. Repair any of the above items as necessary. Did you complete the repair?	-	Go to **Step 7**	-
	1. Change the transmission fluid and filter.			

7	Refer to **Transmission Fluid Replacement** . 2. Inspect the transmission fluid for correct level. 3. Add new fluid as necessary. Did you complete the above procedures?	-	Go to **Step 8**	-
8	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear, with the throttle greater than 10%, in order to obtain a gear ratio of 1.2:1-0.75:1 for 20 seconds. 4. Select Specific DTC. 5. Enter DTC P0735. Has the test run and passed?	-	Go to **Step 9**	Go to **Step 2**
9	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0741

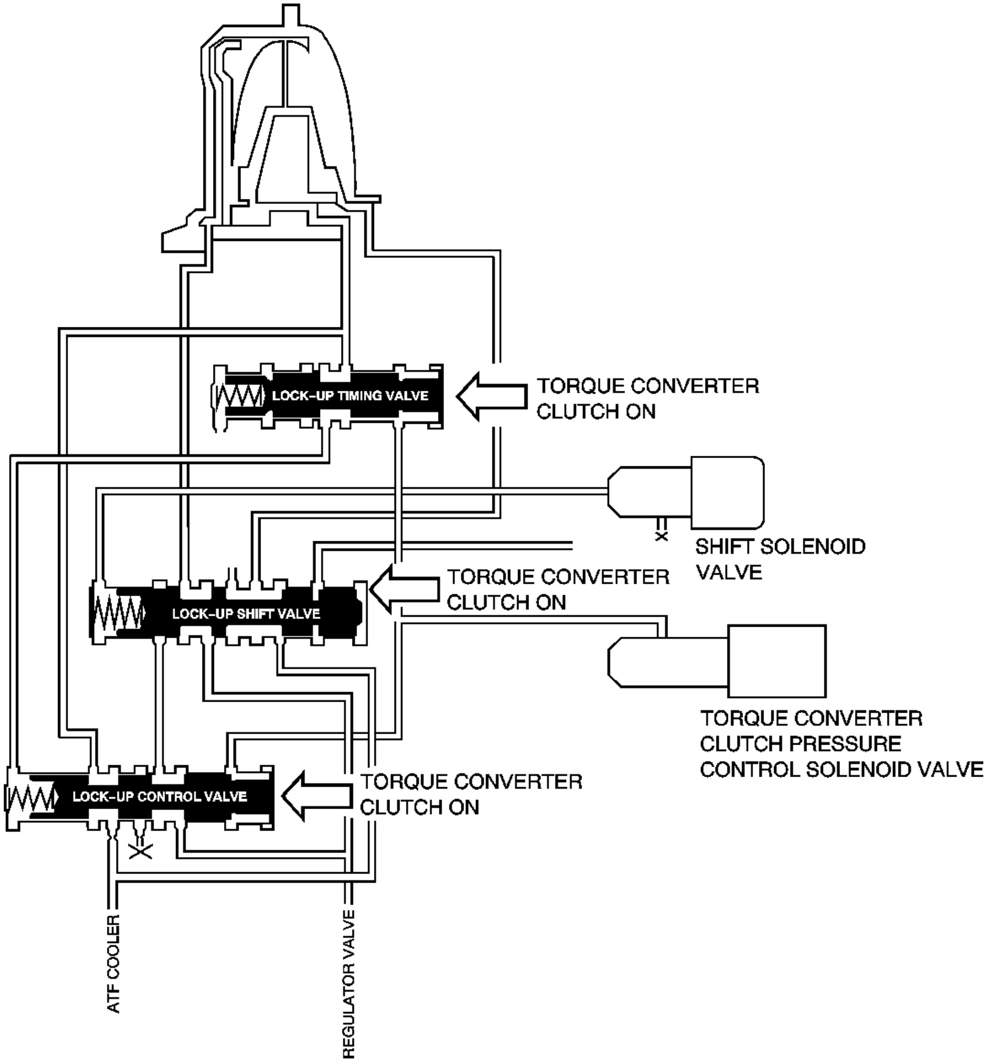


Fig. 13: DTC P0741 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The torque converter clutch (TCC) power transfer capacity is controlled by the balance of automatic transmission fluid (ATF) supply, and discharges to and from the torque converter. As hydraulic pressure in the internal pressure side increases, the power transfer capacity of the TCC increases. The direction of hydraulic pressure supply is switched by TCC solenoid valve and the lock-up shift valve. When the powertrain control module (PCM) commands the TCC enable solenoid valve ON, 12 V, the ATF is supplied from the internal pressure side. When the PCM commands the TCC enable solenoid valve OFF, 0 V, the ATF is supplied from the back pressure side. The balance of internal pressure and back pressure is controlled by the combination of the clutch pressure control (PC) solenoid valve, the lock-up control valve and the lock-up timing valve. The

TCC PC solenoid valve maximizes the TCC power transfer capacity when the PCM command is ON, 100%, and it minimizes the TCC power transfer capacity when the PCM command is OFF, 0%. If the proportion of engine speed and transmission input speed is not approximately 1, while the PCM is commanding the TCC enable solenoid valve and the TCC PC solenoid valve ON, a fault is detected and DTC P0741 sets. DTC P0741 is a type B DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, P0118.
- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTCs P0705, or P0706.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Performance DTCs P0746, P0747, P0776, or P0777.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0761, P0757, or P0762.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962, or P0963.
- No Clutch PC Solenoid 2 DTCs P0966, or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- The system voltage is 11 volts or greater.
- The engine coolant temperature (ECT) is 70-100° C (158-212° F).
- The commanded gear is 5th.
- The TCC is enabled.
- The vehicle is at a steady speed of 80 km/h (50 mph)-120 km/h (75 mph) for greater than 20 seconds.

Conditions for Setting the DTC

The TCC slip ratio to the APP angle is as follows:

- If the throttle angle is 18.4%, the Torque Converter Efficiency must be less than 93 or greater than 102.
- If the throttle angle is 15.6%, the Torque Converter Efficiency must be less than 95 or greater than 102.
- If the throttle angle is 13.2%, the Torque Converter Efficiency must be less than 96 or greater than 102.

- If the throttle angle is 6.2%, the Torque Converter Efficiency must be less than 98 or greater than 102.
- If the throttle angle is 3.1%, the Torque Converter Efficiency must be less than 98 or greater than 102.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0741 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a mechanical failure of the TCC.
- Inspect for a mechanical failure of the TCC PC solenoid valve.
- Inspect for a mechanical failure of the TCC enable solenoid valve.
- Inspect for a stuck lock-up shift valve.
- Inspect for a stuck lock-up control valve.
- Inspect for a stuck lock-up timing valve.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

3: This step verifies that the TCC engages when commanded ON by the scan tool.

4: During the TCC enable solenoid valve operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0741

Step	Action	Values	Yes	No
	Did you perform the Diagnostic System Check - Engine Controls?			Go to **Diagnostic System Check -**

1		-	Go to **Step 2**	**Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	-	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Using the scan tool, command the TCC PC solenoid functional test ON. Does the TCC PC Solenoid Functional Test Status display complete?	-	Go to Diagnostic Aids	Go to **Step 4**
4	1. Turn ON the ignition, with the engine OFF. 2. With a scan tool, command the TCC enable solenoid valve ON and OFF. Does the TCC enable solenoid valve click with each command?	-	Go to **Step 5**	Go to **Step 6**
	1. Inspect for the following conditions: • The TCC PC solenoid valve for being stuck Refer to **Torque Converter Clutch (TCC) Solenoid Replacement** . • The lock-up shift valve for being stuck in the TCC release position • The lock-up control valve for			

5	being stuck in the TCC release position • The pressure regulator valve for being stuck due to sediment or binding • The TCC fluid circuits for leaks Refer to **Main Control Valve Body Assembly Overhaul** . • A faulty TCC Refer to **Torque Converter Diagnosis Procedure** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	-	Go to **Step 7**	-
6	Replace the TCC enable solenoid valve. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	-	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle at a steady speed of 72 km/h (45 mph) on a level road. • With the TCC commanded ON and engaged, the Torque Converter Efficiency must be within the specified range. 4. Select Specific DTC. 5. Enter DTC P0741. Has the test run and passed?	93-102 %	Go to **Step 8**	Go to **Step 2**
	With the scan tool, observe the stored information, capture info and DTC info.		Go to **Diagnostic Trouble Code**	

8	Does the scan tool display any DTCs that you have not diagnosed?	-	**(DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0746

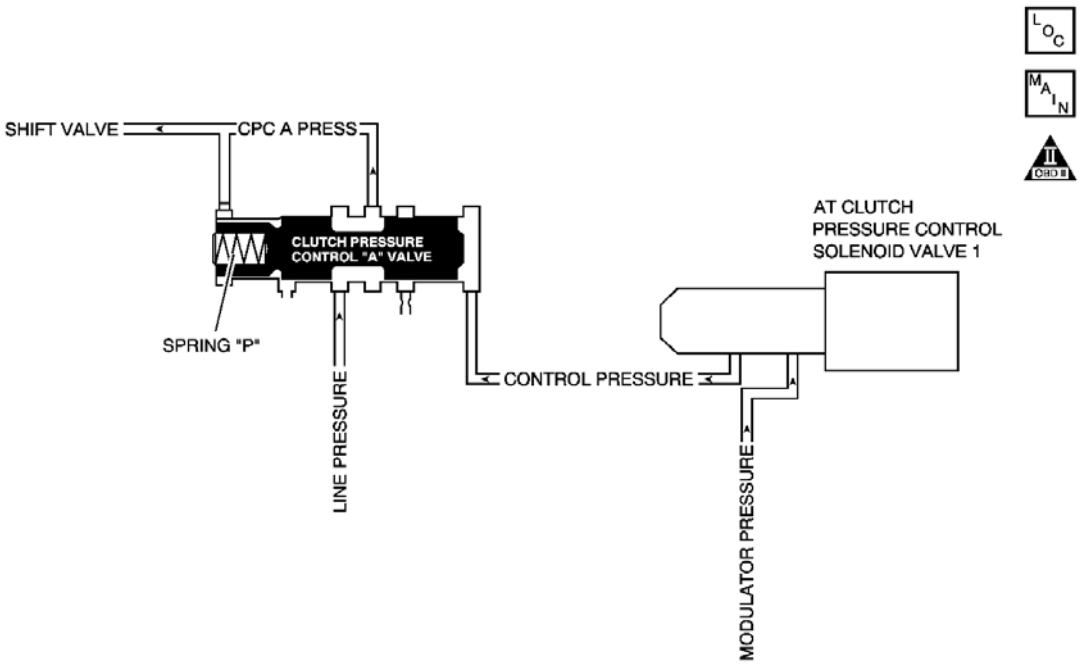


Fig. 14: DTC P0746 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission (AT) clutch pressure control (PC) solenoid valve 1 is attached to the exterior of the transmission case. Upon receiving a linear current signal from the powertrain control module (PCM), it converts the modulated pressure to a regulated control pressure and supplies it for use in the pressure regulation, using the spring P at the clutch PC valve. The linear current from the PCM is output to the clutch of an appropriate gear position as determined by the shift schedule, so that a clutch control pressure appropriate for the driving condition is supplied. When the linear current from the PCM is on the high current side, the AT clutch PC solenoid valve 1 operates and the pressure regulated control pressure shifts to the high pressure side, ON. When the linear current is on the low voltage side, the AT clutch PC solenoid valve 1 stops operating and the pressure regulated control pressure shifts to the low pressure side, OFF. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault and DTC P0746 sets. DTC P0746 is a type B DTC.

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Performance DTC P0747.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0761, P0757, or P0762.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- The system voltage is 11 volts or greater.
- The engine coolant temperature (ECT) is 10° C (50° F) or greater.
- The transmission fluid temperature (TFT) is -20° C (-4° F) or greater.
- Start the engine and drive so that the transmission shifts from 1st to 5th gear.

Conditions for Setting the DTC

Case 1

The gear remains in 1st gear in response to a 1-2 upshift command.

Case 2

The engine speed rises abnormally in all upshift except 1-2 upshift operations.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM limits the transmission shift to 4th gear
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0746 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM limits the transmission to 4th gear.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for an AT clutch PC solenoid valve stuck OFF.
- Inspect for a stuck clutch PC solenoid valve 1.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

4: During the clutch PC solenoid valve 1 operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0746

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure		

	Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn ON the ignition, with the engine OFF. 2. With a scan tool, command the clutch PC solenoid 1 Functional test ON. Does the Clutch PC Solenoid 1 Functional Test Status display complete?	Go to **Step 5**	Go to **Step 6**
5	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The clutch PC solenoid valve 1 fluid circuits for leaks Refer to **Main Control Valve Body Assembly Overhaul** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 7**	-
6	Replace the clutch PC solenoid valve 1. Refer to **A/B Clutch Pressure Control Solenoid Assembly Replacement** . Did you complete the replacement?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). 4. Select Specific DTC. 5. Enter DTC P0746. Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
	With the scan tool, observe the stored information, capture info and DTC info.	Go to **Diagnostic Trouble Code**	

8	Does the scan tool display any DTCs that you have not diagnosed?	**(DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0747

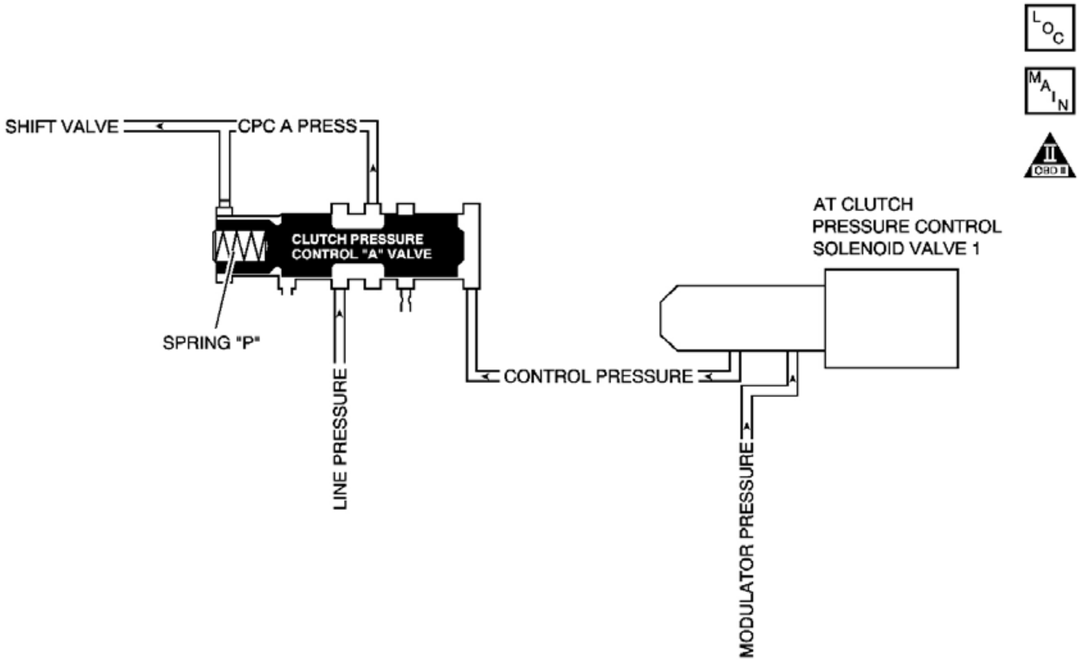


Fig. 15: DTC P0747 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission (AT) clutch pressure control (PC) solenoid valve 1 is mounted to the transmission case. Upon receiving a linear current signal from the powertrain control module (PCM), the PC solenoid valve 1 converts the modulated pressure to a regulated control pressure and supplies it for use in the pressure regulation using the spring P at the clutch PC valve. The linear current from the PCM is output to the clutch of an appropriate gear position, as determined by the shift schedule, so that a clutch PC appropriate for the driving condition is supplied. When the linear current from the PCM is on the high current side, the AT clutch PC solenoid valve 1 operates and the pressure regulation control pressure shifts to the high pressure side, ON. When the linear current is on the low voltage side, the AT clutch PC solenoid valve 1 stops operating and the pressure regulated control pressure shifts to the low pressure side, OFF. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault and DTC P0747 sets. DTC P0747 is a type B DTC.

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No DTC P0705.
- No AT ISS DTCs P0716, P0717, or P0718.
- No DTC P0746.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0757, P0761, or P0762.
- No Clutch PC Solenoid 2 P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- The system voltage is 11 volts or greater.
- The transmission fluid temperature (TFT) is -25° C (-13° F) or greater.
- Start the engine and drive so that the transmission shifts from 1st to 5th gear.

Conditions for Setting the DTC

Case 1

The gear remains in the 2nd gear in response to a 2-3 upshift command.

Case 2

The gear remains in the 4th gear in response to a 4-5 upshift command.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- One of the following actions occur:
  - Case 1

    The PCM limits the transmission shift to 1st and 2nd gears.

- Case 2

  The PCM limits the transmission shift to 4th gear.

- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0747 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for an AT clutch PC solenoid valve 1 stuck ON.
- Inspect for a stuck clutch PC solenoid valve 1.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

4: During the clutch PC solenoid valve 1 operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0747

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:**		

3	**Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn ON the ignition with the engine OFF. 2. With a scan tool, command the clutch PC solenoid 1 Functional test ON. Does the Clutch PC Solenoid 1 Functional Test Status display complete?	Go to **Step 5**	Go to **Step 6**
5	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The clutch PC solenoid valve 1 fluid circuits for leaks Refer to **Main Control Valve Body Assembly Overhaul** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 7**	-
6	Replace the clutch PC solenoid valve 1. Refer to **A/B Clutch Pressure Control Solenoid Assembly Replacement** . Did you complete the replacement?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). 4. Select Specific DTC.		

	5. Enter DTC P0747. Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0751

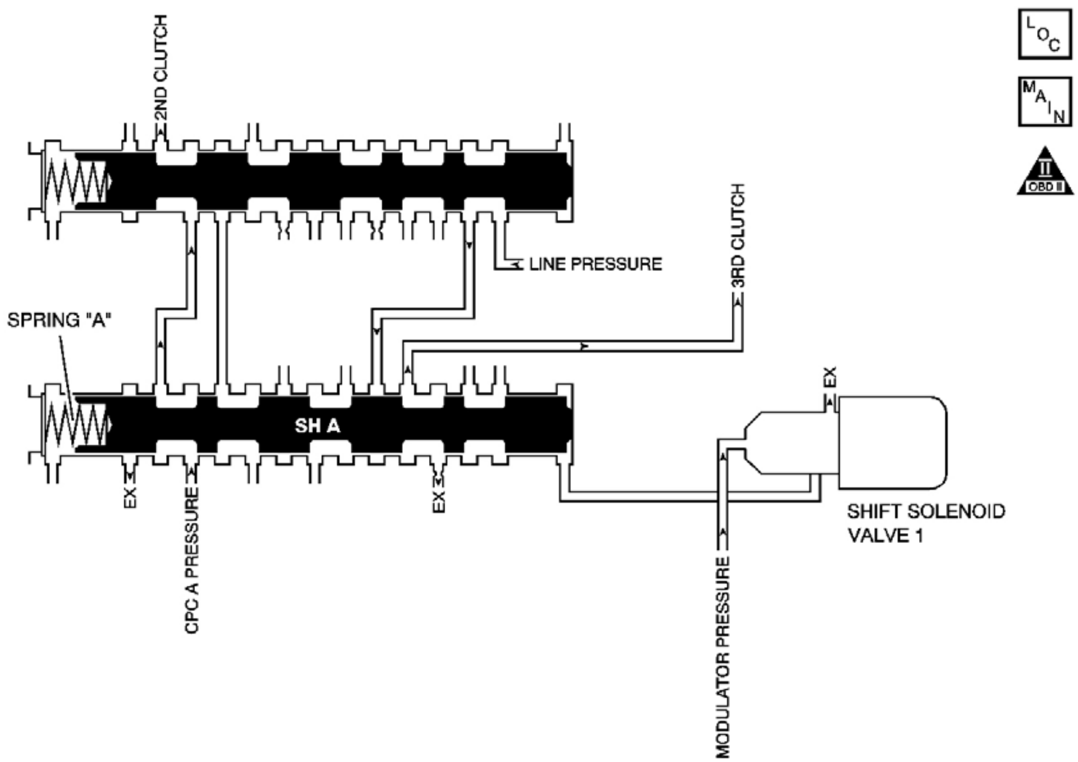


Fig. 16: DTC P0751 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) 1 is mounted to the transmission case and is used to supply or cut off the modulated pressure to the shift valve A, according to the powertrain control module (PCM) command. The signal from the PCM is output, so that a clutch control pressure is supplied to the clutch of an appropriate gear position as determined by the shift schedule. When the PCM commands the SS 1 ON, the modulated pressure is not supplied to shift valve A, and shift valve A is pushed by the reactive force of spring A. When the PCM command is OFF, the modulated pressure is supplied to the valve. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault and DTC P0751 sets. DTC P0751 is a type B DTC.

Refer to **Shift Solenoid Valve State and Gear Ratio** .

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No DTC P0705.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTC P0746 or P0747.
- No SS Valve Performance DTCs P0752, P0756, P0757, P0761, or P0762.
- No Clutch PC Solenoid 2 P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC solenoid DTCs P2763 or P2764.
- No TCC enable solenoid DTCs P2769 or P2770.
- No TAC communication DTC U0107.
- The system voltage is 11 volts or greater.
- The transmission fluid temperature (TFT) is -13° (-25° C) or greater.
- Start the engine and drive so that the transmission shifts from 1st to 5th gear.
- The APP is greater than 5%.

Conditions for Setting the DTC

- The gear shifts to 3rd gear in response to a 1-2 upshift command.
- The gear remains in 4th gear in response to a 4-5 upshift command, when there is no history indicating a short shift time at a preceding 3-4 upshift operation.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.

- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0751 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a stuck OFF shift solenoid 1.
- Inspect for a stuck shift valve A.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

4: During the SS valve 1 operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0751

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and**		

3	**Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn ON the ignition, with the engine OFF. 2. With a scan tool, command the Shift Solenoid 1 ON and OFF. Does the SS valve 1 click with each command?	Go to **Step 5**	Go to **Step 6**
5	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The SS valve 1 fluid circuits for leaks • The shift valve A for being stuck • The shift valve E for being stuck Refer to **Main Control Valve Body Assembly Overhaul** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 7**	-
6	Replace the SS valve 1. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). 4. Select Specific DTC. 5. Enter DTC P0751.		

	Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0752

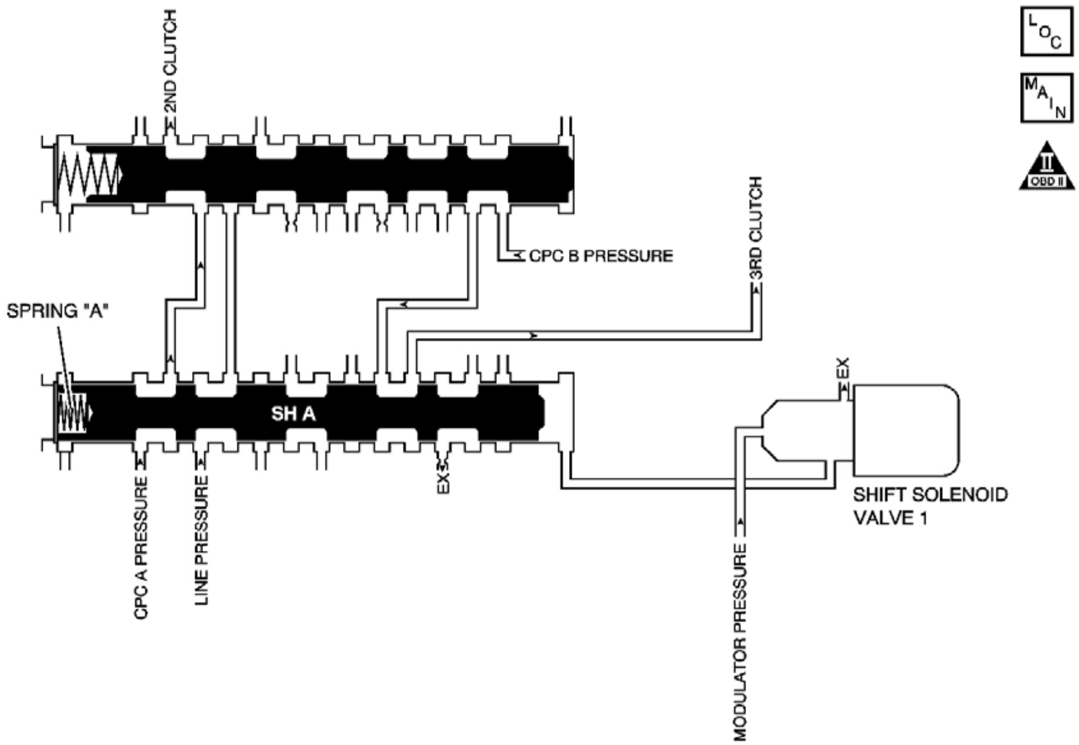


Fig. 17: DTC P0752 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) valve 1 is mounted to the transmission case and is used to supply or cut off the modulated pressure to the shift valve A, according to the powertrain control module (PCM) command. The signal from the PCM is output, so that a clutch control pressure is supplied to the clutch of an appropriate gear position, as determined by the shift schedule. When the PCM command to the shift solenoid valve 1 is ON, the modulated pressure is not supplied to the shift valve A, and the shift valve A is pushed by the reactive force of spring A. When the PCM command is OFF, the modulated pressure is supplied to the valve. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault and DTC P0752 is set. DTC P0752 is a type B DTC.

Refer to **Shift Solenoid Valve State and Gear Ratio** .

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No DTC P0705.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTC P0746, or P0747.
- No SS Valve Performance DTCs P0751, P0756, P0757, P0761, or P0762.
- No Clutch PC Solenoid 2 P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- The system voltage is 11 volts or greater.
- The transmission fluid temperature (TFT) is -25° C (-13° F) or greater.
- Start the engine and drive so that the transmission shifts from 1st to 5th gear.

Conditions for Setting the DTC

The gear remains in 2nd, in response to a 2-3 upshift command, when there is no history indicating a 2nd gear response to a 1st gear command.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM limits the transmission to 4th gear.

- The PCM stores DTC P0752 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a stuck ON shift solenoid 1.
- Inspect for a stuck shift valve A.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

4: During the SS valve 1 operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0752

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.**		

	3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn ON the ignition, with the engine OFF. 2. With a scan tool, command the Shift Solenoid 1 ON and OFF. Does the SS valve 1 click with each command?	Go to **Step 5**	Go to **Step 6**
5	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The SS valve 1 fluid circuits for leaks • The shift valve A for being stuck • The shift valve E for being stuck Refer to **Main Control Valve Body Assembly Overhaul** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 7**	-
6	Replace the SS valve 1. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). 4. Select Specific DTC. 5. Enter DTC P0752. Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
	With the scan tool, observe the stored information,	Go to **Diagnostic**	

8	capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	**Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0756

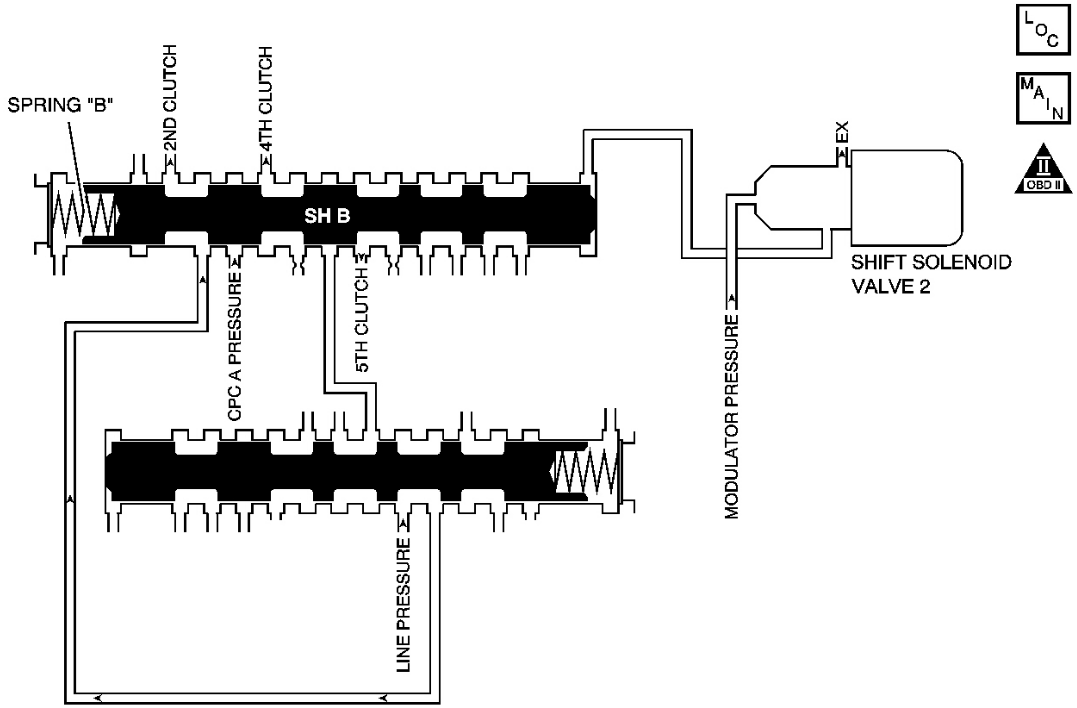


Fig. 18: DTC P0756 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) valve 2 is mounted to the transmission case and is used to supply or limit the modulated pressure to the shift valve B, according to the PCM command. The powertrain control module (PCM) provides an output signal to SS valve 2, which supplies clutch control pressure to the clutch of an appropriate gear position, as determined by the shift schedule. When the PCM commands the shift solenoid 2 ON, the modulated pressure is not supplied to shift valve B and shift valve B is pushed by the reactive force of spring B. When the PCM command is OFF, the modulated pressure is supplied to the valve. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault and DTC P0756 sets. DTC P0756 is a type B DTC.

Refer to **Shift Solenoid Valve State and Gear Ratio** .

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTC P0705 or P0706.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTC P0746 or P0747.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0757, P0761, or P0762.
- No Clutch PC Solenoid 2 DTC P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTCs P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- System voltage is greater than 11 volts.
- Start the engine and drive so that the transmission shifts from 1st to 5th gear.

Conditions for Setting the DTC

DTC P0756 is set when all of the following conditions are met:

- The transmission shifts to 5th in response to a 1st gear command.
- The transmission shifts to 4th in response to a 2nd gear command.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0756 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a stuck ON shift solenoid 2.
- Inspect for a stuck shift valve B.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

4: During the SS valve 2 operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0756

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above		

	80 km/h (50 mph). Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn ON the ignition with the engine OFF. 2. With a scan tool, command the shift solenoid 2 ON and OFF. Does the SS valve 2 click with each command?	Go to **Step 5**	Go to **Step 6**
5	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The SS valve 2 fluid circuits for leaks • The shift valve B for being stuck • The shift valve E for being stuck Refer to **Main Control Valve Body Assembly Overhaul** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 7**	-
6	Replace the SS valve 2. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle at speeds above 80 km/h (50 mph) in 5th gear. 4. Select Specific DTC. 5. Enter DTC P0756. Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0757

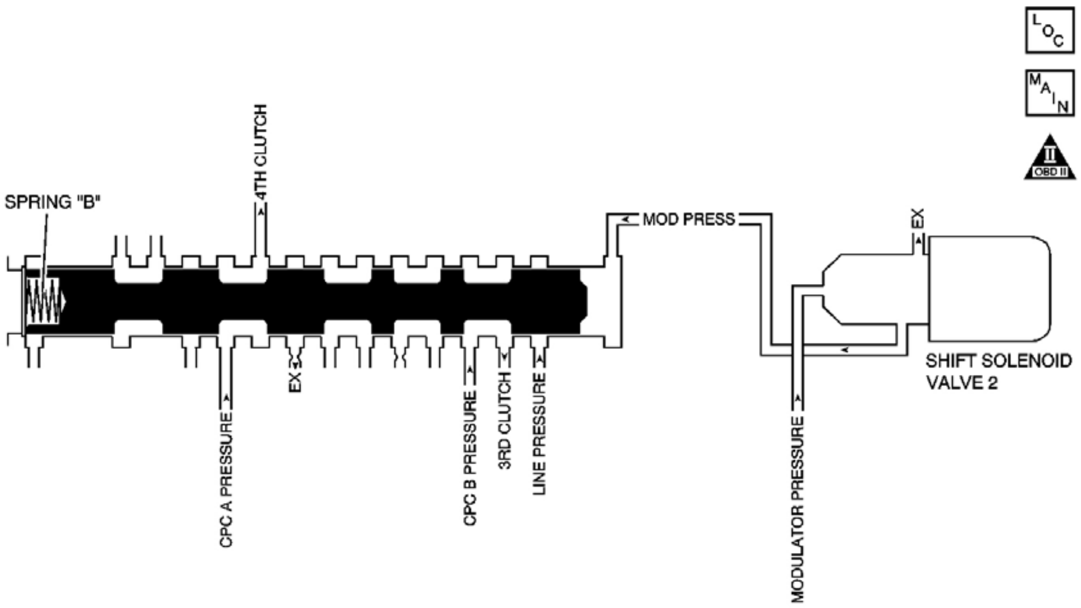


Fig. 19: DTC P0757 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) valve 2 is mounted to the transmission case and is used to supply or limit the modulated pressure to the shift valve B, according to the PCM command. The powertrain control module (PCM) provides an output signal to SS valve 2, which supplies clutch control pressure to the clutch of an appropriate gear position, as determined by the shift schedule. When the PCM commands the shift solenoid 2 ON, the modulated pressure is not supplied to the shift valve B, and the shift valve B is pushed by the reactive force of spring B. When the PCM command is OFF, the modulated pressure is supplied to the valve. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault and DTC P0757 sets. DTC P0757 is a type B DTC.

Refer to **Shift Solenoid Valve State and Gear Ratio** .

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTC P0705.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTC P0746 or P0747.

- No SS Valve Performance DTCs P0751, P0752, P0756, P0761, or P0762.
- No Clutch PC Solenoid 2 P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- System voltage is greater than 11 volts.
- The TFT is greater than -25° C (-13° F).
- Start the engine and drive so that the transmission shifts from 1st to 5th gear.

Conditions for Setting the DTC

The gear remains in 3rd, in response to a 3-4 upshift command, when there is no history indicating a short shift time at a preceding 2-3 and 4-5 upshift operation.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM limits the transmission shift to 1st, 2nd and 3rd gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0757 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a stuck ON SS 2.
- Inspect for a stuck shift valve B.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

4: During the SS valve 2 operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0757

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn ON the ignition with the engine OFF. 2. With a scan tool, command the shift solenoid 2 ON and OFF. Does the SS valve 2 click with each command?	Go to **Step 5**	Go to **Step 6**

5	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The SS valve 2 fluid circuits for leaks • The shift valve B for being stuck • The shift valve E for being stuck Refer to **Main Control Valve Body Assembly Overhaul** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 7**	-
6	Replace the SS valve 2. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). 4. Select Specific DTC. 5. Enter DTC P0757. Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0761

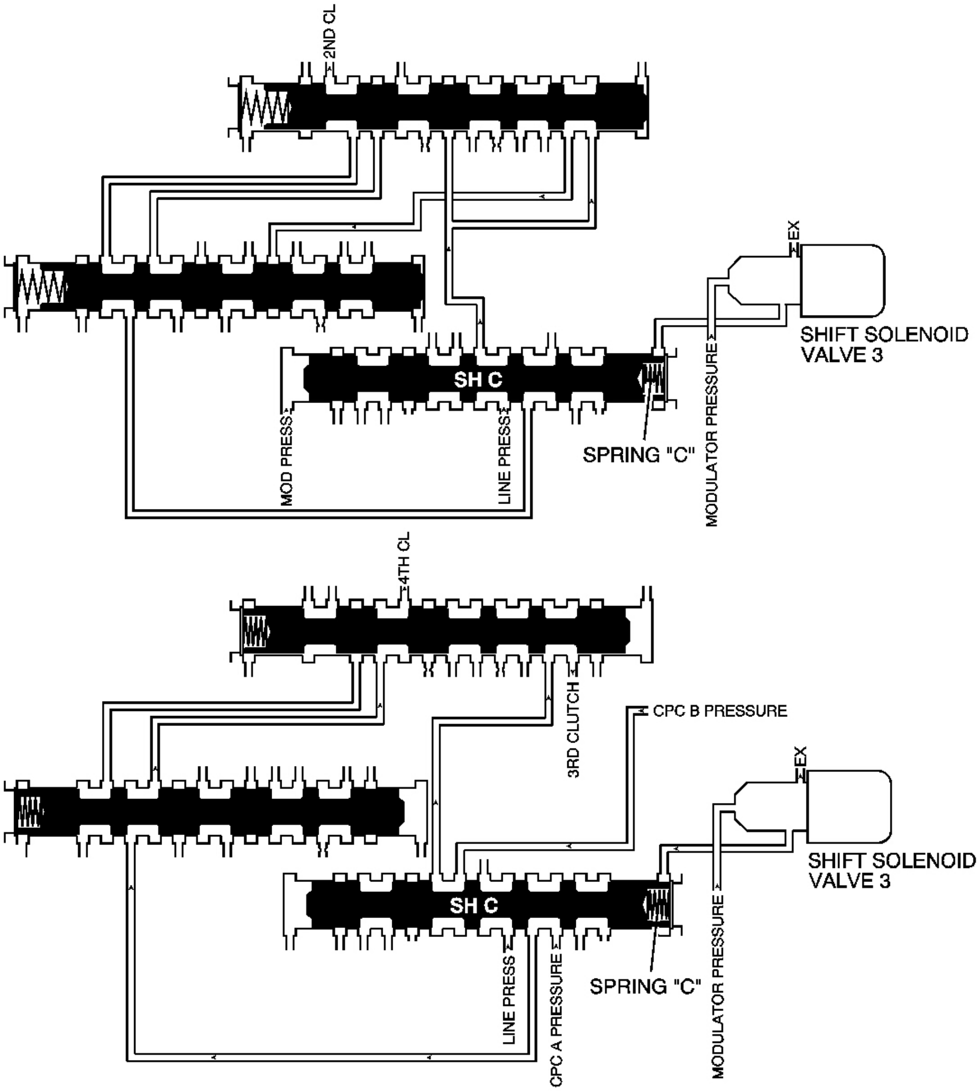


Fig. 20: DTC P0761 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) 3 is mounted to the transmission case and is used to supply or cut off the modulated pressure to the shift valve C according to the PCM command. The signal from the PCM is output so that a clutch control pressure is supplied to the clutch, of an appropriate gear position, as determined by the shift schedule. When the PCM command to the SS 3 is ON, the modulated pressure is not supplied to the shift valve C, and the shift valve C is pushed by the reactive force of spring C. When the PCM command is OFF, the modulated pressure is supplied to the valve. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault and DTC P0761 sets. DTC P0761 is a type B DTC.

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTC P0705.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTC P0746 or P0747.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0757, or P0762.
- No Clutch PC Solenoid 2 P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- System voltage is greater than 11 volts.
- Start the engine and drive so that the transmission shifts from 1st to 5th gear.

Conditions for Setting the DTC

The transmission shifts to the 2nd gear in response to a 1st gear command and the 3-4 upshift time is 0.8 second or less.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0761 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.

- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a stuck ON SS 3.
- Inspect for a stuck shift valve C.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

4: During the SS valve 3 operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0761

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph).		

	Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn ON the ignition with the engine OFF. 2. With a scan tool, command the shift solenoid 3 ON and OFF. Does the SS valve 3 click with each command?	Go to **Step 5**	Go to **Step 6**
5	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The SS valve 3 fluid circuits for leaks • The shift valve C for being stuck • The shift valve E for being stuck Refer to **Main Control Valve Body Assembly Overhaul** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 7**	-
6	Replace the SS valve 3. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). 4. Select Specific DTC. 5. Enter DTC P0761. Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DIAGNOSIS

DTC P0762

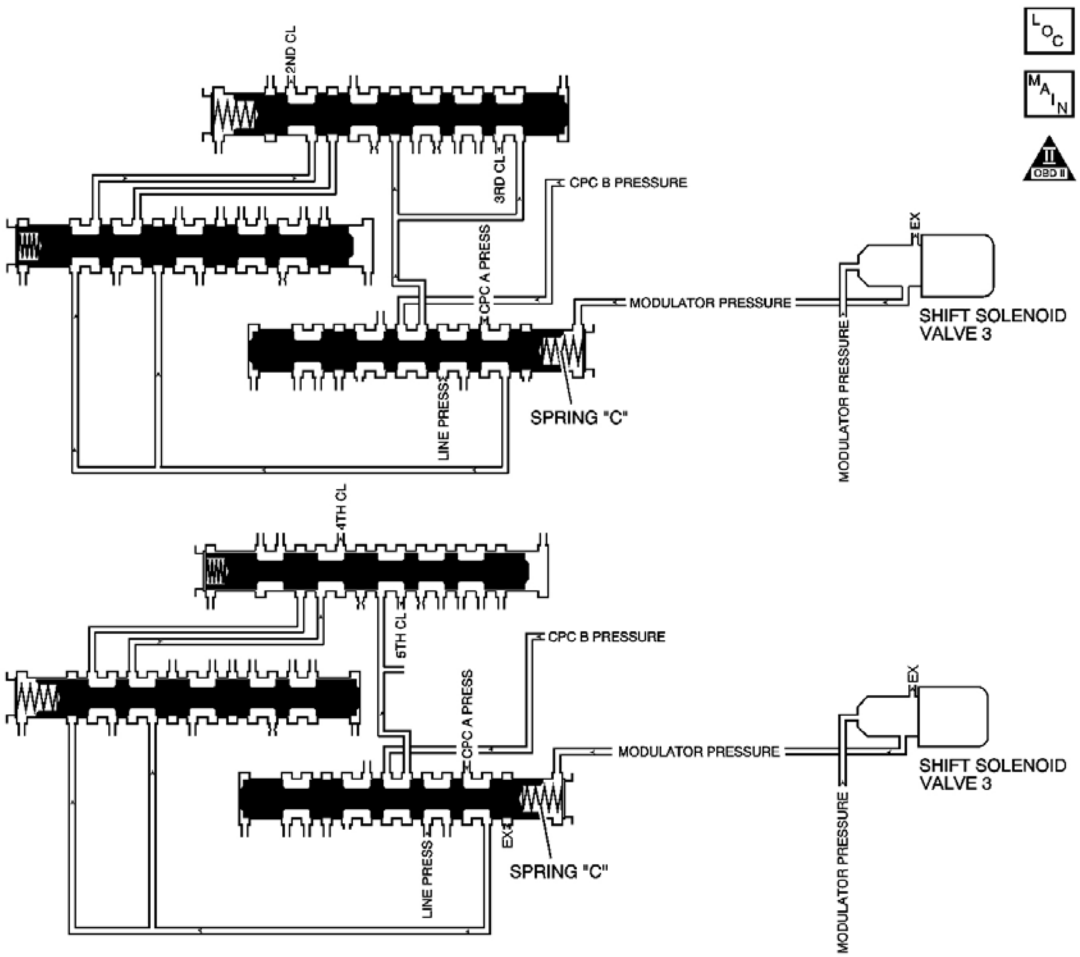


Fig. 1: DTC P0762 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) 3 is mounted to the transmission case and is used to supply or cut off the modulated pressure to the shift valve C, according to the PCM command. The signal from the PCM is output, so that clutch control pressure is supplied to the clutch of an appropriate gear position, as determined by the shift schedule. When the PCM command to the SS 3 is ON, the modulated pressure is not supplied to the shift valve C, and the shift valve C is pushed by the reactive force of spring C. When the PCM command is OFF, the modulated pressure is supplied to the valve. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault and DTC P0762 sets. DTC P0762 is a type B DTC.

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTC P0705.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTCs P0746 or P0747.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0757, or P0761.
- No Clutch PC Solenoid 2 DTCs P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- TFT is -25°C (-13°F) or greater.
- System voltage is greater than 11 volts.
- Start the engine and drive so that the transmission shifts from 1st to 5th gear.

Conditions for Setting the DTC

The 2-3 upshift time is 0.8 second or less and the 4-5 upshift time is 0.8 second or less.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0762 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a stuck ON shift solenoid 3.
- Inspect for a stuck shift valve C.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

4: During the SS valve 3 operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0762

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records.		

	4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn ON the ignition, with the engine OFF. 2. With a scan tool, command the shift solenoid 3 ON and OFF. Does the SS valve 3 click with each command?	Go to **Step 5**	Go to **Step 6**
5	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The SS valve 3 fluid circuits for leaks • The shift valve C for being stuck • The shift valve E for being stuck Refer to **Main Control Valve Body Assembly Overhaul** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 7**	-
6	Replace the SS valve 3. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). 4. Select Specific DTC. 5. Enter DTC P0762. Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have	Go to **Diagnostic Trouble Code (DTC) Type(s)** in	

	not diagnosed?	Engine Controls - 3.5L (L66)	System OK

DTC P0776

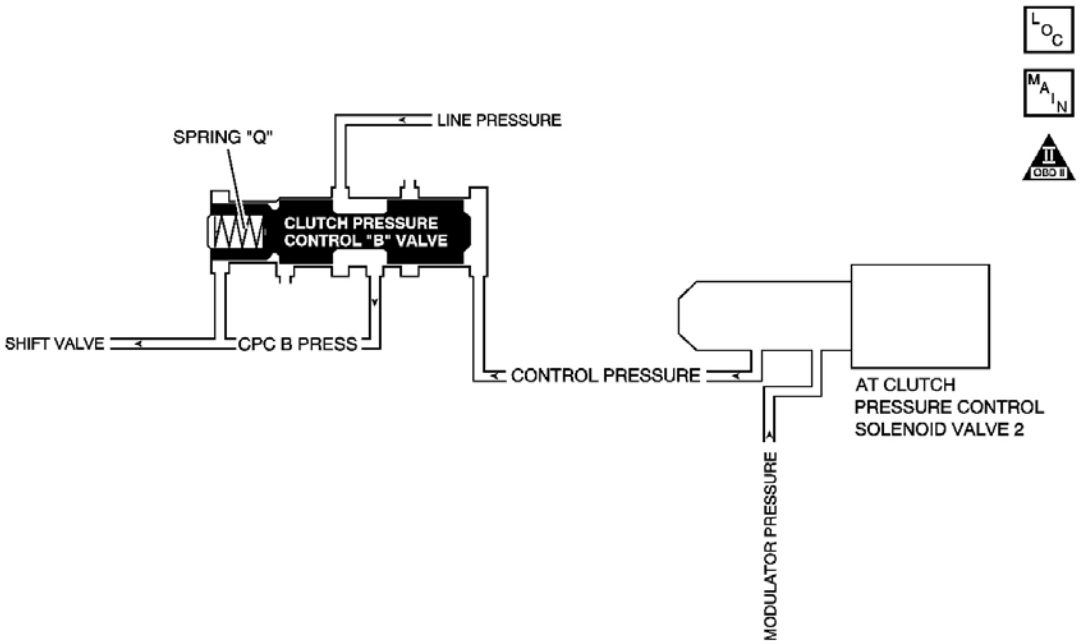


Fig. 2: DTC P0776 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission (AT) clutch pressure control (PC) solenoid valve 2 is mounted to the transmission case. Upon receiving a linear current from the PCM, the AT clutch PC solenoid valve 2 converts the modulated pressure to a regulated control pressure, and supplies it for use in the pressure regulation, using the spring P at the clutch pressure control valve. The linear current from the PCM is output to the clutch of an appropriate gear position, as determined by the shift schedule, so that a clutch control pressure appropriate for the driving condition is supplied. When the linear current from the PCM is on the high current side, linear solenoid 2 operates and the pressure regulation control pressure shifts to the low pressure side, OFF. When the linear current is on the low voltage side, linear solenoid 2 stops operating and the pressure regulation control pressure shifts to the high pressure side, ON. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault of the linear solenoid and DTC P0776 is set. DTC P0776 is a type B DTC.

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.

- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTC P0705.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTCs P0746 or P0747.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0757, or P0761.
- No Clutch PC Solenoid 2 DTC P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- System voltage is greater than 11 volts.
- TFT is -25°C (-13°F) or greater.
- Start the engine and drive so that the transmission shifts from 1st to 5th gear.

Conditions for Setting the DTC

The gear remains in 3rd, in response to a 3-4 upshift command.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM limits the transmission shift to 1st, 2nd and 3rd.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0776 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.

- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a stuck OFF AT clutch pressure control solenoid valve 2.
- Inspect for a stuck CPC valve B.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

4: During the clutch PC solenoid valve 2 operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0776

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids

4	1. Turn ON the ignition with the engine OFF. 2. With a scan tool, command the Clutch PC Solenoid 2 Functional test ON. Does the Clutch PC Solenoid 2 Functional Test Status display complete?	Go to **Step 5**	Go to **Step 6**
5	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The clutch PC solenoid valve 2 fluid circuits for leaks Refer to **Main Control Valve Body Assembly Overhaul** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 7**	-
6	Replace the clutch PC solenoid valve 2. Refer to **Torque Converter Clutch (TCC) Solenoid Replacement** . Did you complete the replacement?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). 4. Select Specific DTC. 5. Enter DTC P0776. Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0777

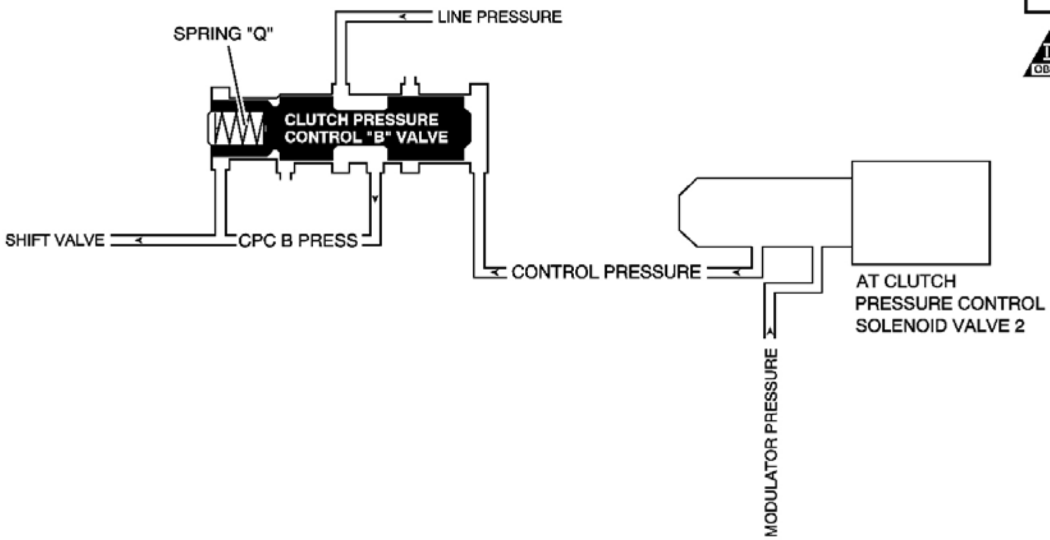


Fig. 3: DTC P0777 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission (AT) clutch pressure control (PC) solenoid valve 2 is mounted to the transmission case. Upon receiving a linear current from the PCM, the AT clutch PC solenoid valve 2 converts the modulated pressure to a regulated control pressure, and supplies it for use in the pressure regulation using the spring P at the clutch pressure control valve. The linear current from the PCM is output to the clutch of an appropriate gear position, as determined by the shift schedule, so that a clutch control pressure appropriate for the driving condition is supplied. When the linear current from the PCM is on the high current side, linear solenoid 2 operates and the pressure regulation control pressure shifts to the low pressure side, OFF. When the linear current is on the low voltage side, linear solenoid 2 stops operating and the pressure regulation control pressure shifts to the high pressure side, ON. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault of the linear solenoid and DTC P0777 sets. DTC P0777 is a type B DTC.

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTC P0705.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTCs P0746 or P0747.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0757, or P0761.

- No Clutch PC Solenoid 2 DTC P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch Pressure Control Solenoid Electrical DTCs P0962 or P0963.
- No Clutch Pressure Control Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- System voltage is greater than 11 volts.
- Engine coolant temperature is 10°C (50°F).
- TFT is -20°C (-4°F) or greater.
- Start the engine and drive so that the transmission shifts from 1st to 5th gear.

Conditions for Setting the DTC

The engine speed rises abnormally in all upshift operations except 1-2 upshift.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0777 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect for a stuck ON AT clutch PC solenoid valve 2.
- Inspect for a stuck CPC valve B.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

> **2:** This step inspects the transmission fluid to ensure that it is at the proper level.
>
> **4:** During the clutch PC solenoid valve 2 operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

DTC P0777

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn ON the ignition with the engine OFF. 2. With a scan tool, command the clutch PC solenoid 2 Functional test ON. Does the Clutch PC Solenoid 2 Functional Test		

	Status display complete?	Go to **Step 5**	Go to **Step 6**
5	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The clutch PC solenoid valve 2 fluid circuits for leaks Refer to **Main Control Valve Body Assembly Overhaul** . 2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 7**	-
6	Replace the clutch PC solenoid valve 2. Refer to **Torque Converter Clutch (TCC) Solenoid Replacement** . Did you complete the replacement?	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). 4. Select Specific DTC. 5. Enter DTC P0777. Has the test run and passed?	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0780

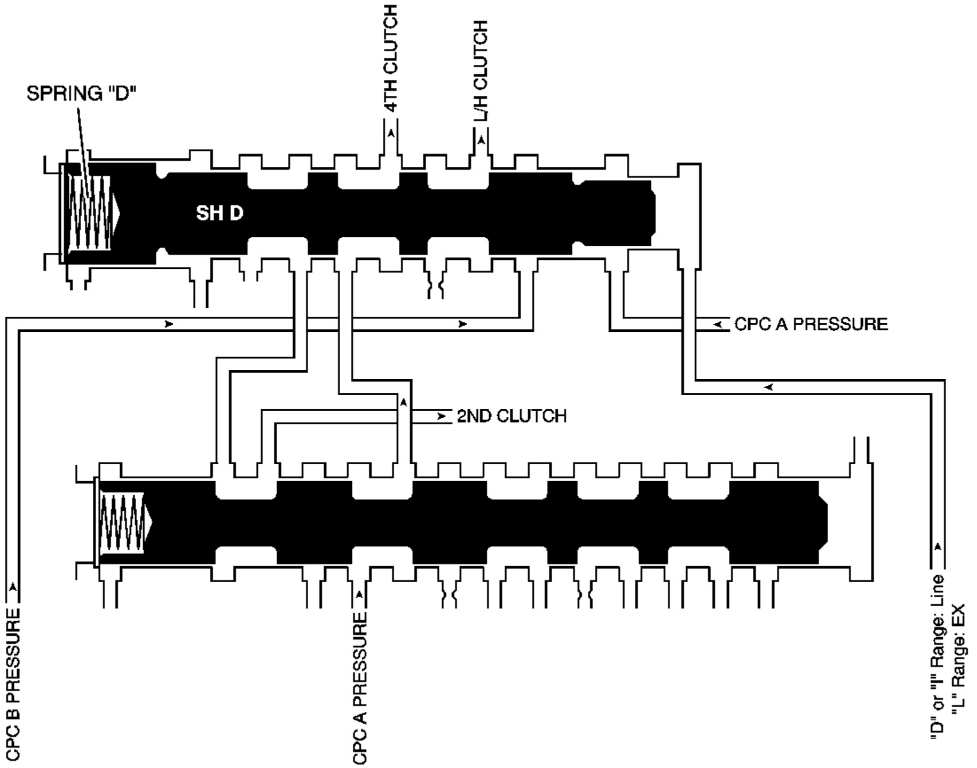


Fig. 4: DTC P0780 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

Shift valve D is incorporated into the control circuit inside the transmission. When the shift lever is in D or I range, line pressure is supplied to shift valve D, and clutch control pressure A is supplied to the 4th clutch. When the shift lever is in L range, the shift valve D is pushed by the spring D and the clutch control pressure B is supplied to the L/H clutch. Shift valve D operates upon rise in the line pressure or clutch control pressure A. Shift valve D is pushed back by the reactive force of spring D when the line pressure or clutch control pressure A drops. The PCM monitors mainshaft to output shaft speed ratio in the gear positions determined by the shift schedule. When the incorrect ratio for the commanded gear is detected, the PCM determines it as a fault and DTC P0780 sets. DTC P0780 is a type B DTC.

Conditions for Running the DTC

- No TP DTCs P0122, P0123, P0222, or P0223.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTC P0705.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTCs P0746 or P0747.

- No SS Valve Performance DTCs P0751, P0752, P0756, P0757, or P0761.
- No Clutch PC Solenoid 2 DTCs P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, P2112, or P2553.
- No APP DTC P2122, P2123, P2127, P2128, P2135, or P2138.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- No TAC Communication DTC U0107.
- System voltage is greater than 11 volts.
- Transmission fluid temperature is -25°C (-13°F) or greater.

Conditions for Setting the DTC

The transmission downshifts from 3rd to 2nd in response to a 3-4 upshift command.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The PCM limits the transmission shift to 2nd and 3rd gears.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0780 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

Inspect for a stuck shift valve D.

Test Description

The number below refers to the step number on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

DTC P0780

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	Did you perform the Transmission Fluid Checking Procedure?	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). Does the DTC reset?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Inspect for the following conditions: • The pressure regulator valve for being stuck due to sediment or binding • The shift valve D hydraulic fluid circuits for damage • The shift valve D for being stuck Refer to **Main Control Valve Body Assembly Overhaul** .		-

	2. Repair any of the above conditions as necessary. Did you complete the repair?	Go to **Step 5**	
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 5th gear at speeds above 80 km/h (50 mph). 4. Select Specific DTC. 5. Enter DTC P0780. Has the test run and passed?	Go to **Step 6**	Go to **Step 2**
6	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0847

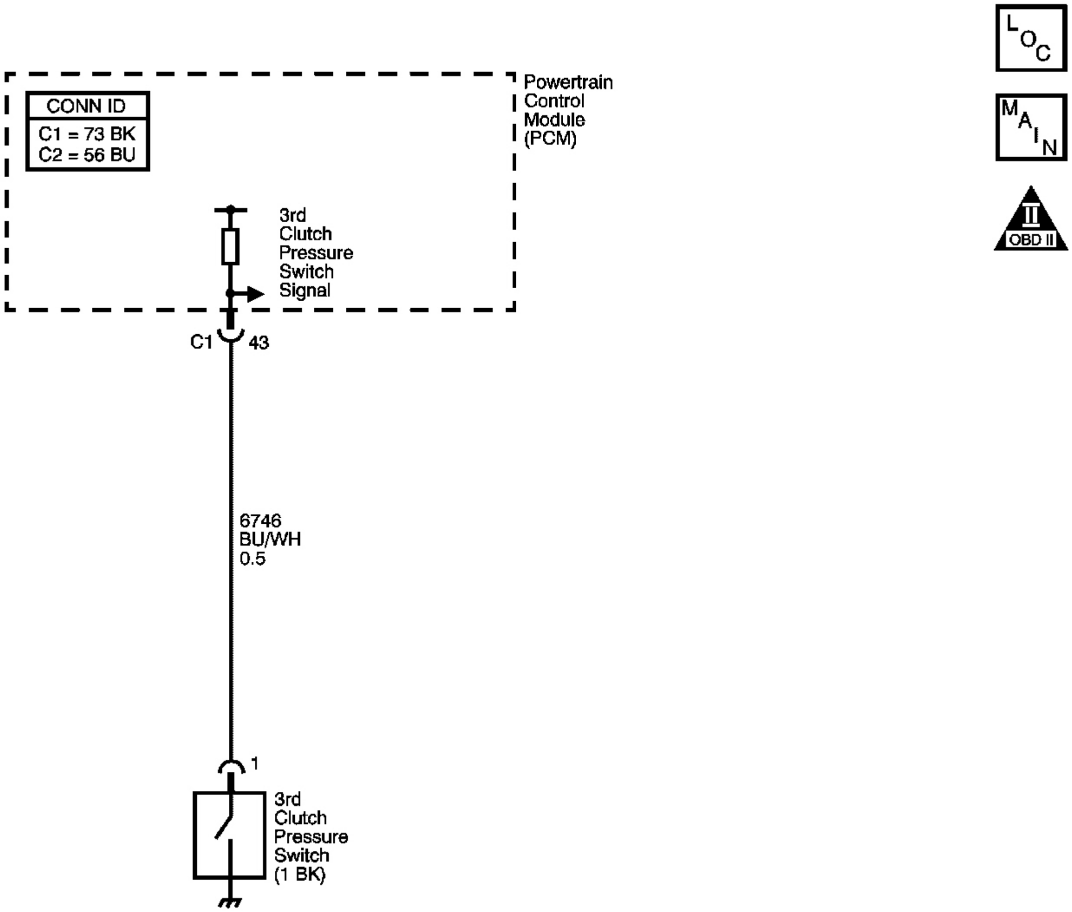


Fig. 5: DTC P0847 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The 3rd clutch pressure switch is located in the hydraulic passage to the 3rd clutch. When oil pressure is supplied to the 3rd clutch, the switch is grounded. When oil pressure is not supplied, the switch is open. The PCM receives the signal from the 3rd clutch pressure switch to detect the fluid pressure status, in order to reduce the shift shock upon shifting to 3rd gear, 2nd to 3rd, or 4th to 3rd. If the 3rd clutch pressure switch is ON and the gear ratio indicates 4th gear, the PCM determines it is a fault and DTC P0847 sets. DTC P0847 is a type C DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, P0118.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTC P0706.

- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTCs P0746 or P0747.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0757, P0761, or P0762.
- No Clutch PC Solenoid 2 DTC P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No 3rd Clutch Pressure Switch DTC P0848.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, or P2112.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- System voltage is greater than 10 volts.
- The transmission is in D range 4th gear for 2 second or greater.

Conditions for Setting the DTC

The 3rd clutch pressure switch is ON when the transmission is in 4th gear, for 2 seconds or greater.

Action Taken When the DTC Sets

- The PCM illuminates the service vehicle soon (SVS) lamp.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0847 in PCM history.

Conditions for Clearing the SVS lamp/DTC

- The PCM turns OFF the SVS during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the connectors at the PCM, the transmission fluid pressure switch, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a shorted transmission fluid pressure switch 2 circuit.
- Inspect for a transmission fluid pressure switch 2 stuck ON.
- Inspect for an internal fault of the PCM.

DTC P0847

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 4th gear D range for 10 seconds. 6. Stop the vehicle. 7. Select Specific DTC. 8. Enter DTC P0847. Does DTC P0847 run and fail?	Go to **Step 3**	Go to Diagnostic Aids
3	1. Turn OFF the ignition. 2. Disconnect the 3rd clutch pressure switch connector. 3. Turn ON the ignition, with the engine OFF. 4. With a scan tool, observe the TFP Switch 3 parameter.		

	Does the scan tool display HI?	Go to **Step 6**	Go to **Step 4**
4	Test the signal circuit of the 3rd clutch pressure switch for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 5**
5	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
6	Inspect for poor connections at the 3rd clutch pressure switch harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 8**
7	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 9**	-
8	Replace the 3rd clutch pressure switch. Refer to **3rd Clutch Pressure Switch Replacement** . Did you complete the replacement?	Go to **Step 9**	-
9	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle in 4th gear D range for 10 seconds. • Stop the vehicle. 4. Select Specific DTC. 5. Enter DTC P0847. Has the test run and passed?	Go to **Step 10**	Go to **Step 2**

10	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0848

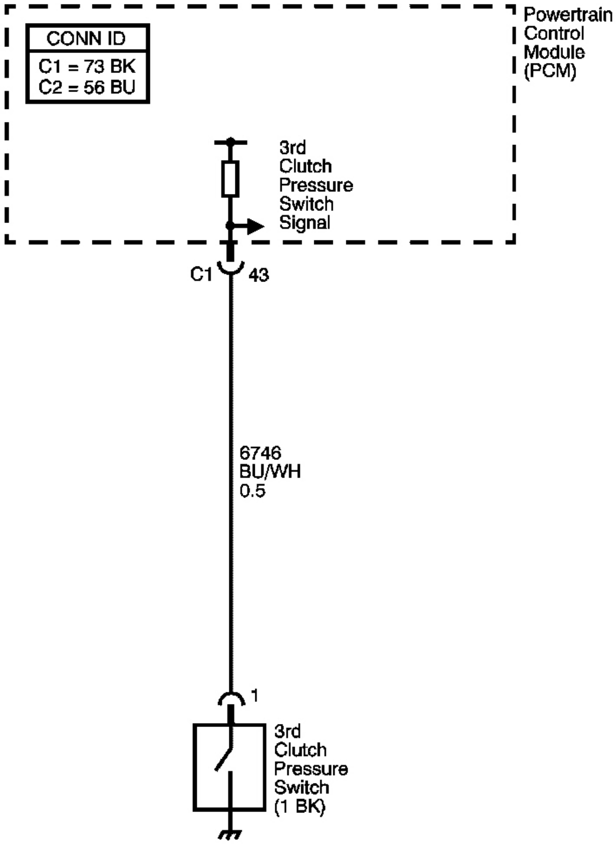


Fig. 6: DTC P0848 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The 3rd clutch pressure switch is located in the hydraulic passage to 3rd clutch. When oil pressure is supplied to the 3rd clutch, the switch is grounded, LOW. When oil pressure is not supplied, the switch is open, HI. The PCM receives the signal from the 3rd clutch pressure switch to detect the fluid pressure status, in order to reduce the shift shock upon shifting to 3rd gear, either from 2nd to 3rd or 4th to 3rd. If the 3rd clutch pressure switch is OFF when the gear ratio indicated is 3rd gear, the PCM determines it as a fault and DTC P0848 sets. DTC P0848 is a type C DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, P0118.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTCs P0705 or P0706.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTCs P0746 or P0747.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0757, P0761, or P0762.
- No Clutch PC Solenoid 2 DTCs P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, or P2112.
- No Minimum Idle Position DTC P2176.
- No TCC PC solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- The transmission is in D range 3rd gear for 2 seconds or greater.
- System voltage is greater than 11 volts.

Conditions for Setting the DTC

The 3rd clutch pressure switch is OFF when the transmission is in 3rd gear for 2 seconds or greater.

Action Taken When the DTC Sets

- The PCM illuminates the service vehicle soon (SVS) lamp.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0848 in PCM history.

Conditions for Clearing the SVS lamp/DTC

- The PCM turns OFF the SVS during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power

down the PCM.

Diagnostic Aids

- Inspect the connectors at the PCM, the transmission fluid pressure switch, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect the 3rd clutch pressure switch for a disengaged connector.
- Inspect the 3rd clutch pressure switch for an open circuit.
- Inspect the 3rd clutch pressure switch for a stuck OFF condition.
- Inspect for an internal fault of the PCM.

DTC P0848

<table>
<tr><th>Step</th><th>Action</th><th>Yes</th><th>No</th></tr>
<tr><td>1</td><td>Did you perform the Diagnostic System Check - Engine Controls?</td><td>Go to Step 2</td><td>Go to Diagnostic System Check - Engine Controls in Engine Controls - 3.5L (L66)</td></tr>
<tr><td>2</td><td>1. Install a scan tool.
2. Turn ON the ignition, with the engine OFF.

IMPORTANT:
Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.

3. Record the DTC Freeze Frame and Failure Records.
4. Clear the DTC.
5. Drive the vehicle in 3rd gear I range for 10 seconds.
6. Stop the vehicle.
7. Select Specific DTC.
8. Enter DTC P0848.

Does DTC P0848 run and fail?</td><td>Go to Step 3</td><td>Go to Diagnostic Aids</td></tr>
<tr><td></td><td>1. Turn OFF the ignition.
2. Disconnect the 3rd clutch pressure switch</td><td></td><td></td></tr>
</table>

3	connector. 3. Connect a 3 amp fused jumper wire between the 3rd clutch pressure switch signal circuit and a good ground. 4. Turn ON the ignition, with the engine OFF. 5. With a scan tool, observe the TFP Switch 3 parameter. Does the scan tool display LOW?	Go to **Step 6**	Go to **Step 4**
4	Test the 3rd clutch pressure switch signal circuit for an open or a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 5**
5	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
6	Inspect for poor connections at the 3rd clutch pressure switch harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 8**
7	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 9**	-
8	Replace the 3rd clutch pressure switch. Refer to **3rd Clutch Pressure Switch Replacement** . Did you complete the replacement?	Go to **Step 9**	-
9	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle in 3rd gear I range		

	for 10 seconds. • Stop the vehicle. 4. Select Specific DTC. 5. Enter DTC P0848. Has the test run and passed?	Go to **Step 10**	Go to **Step 2**
10	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0872

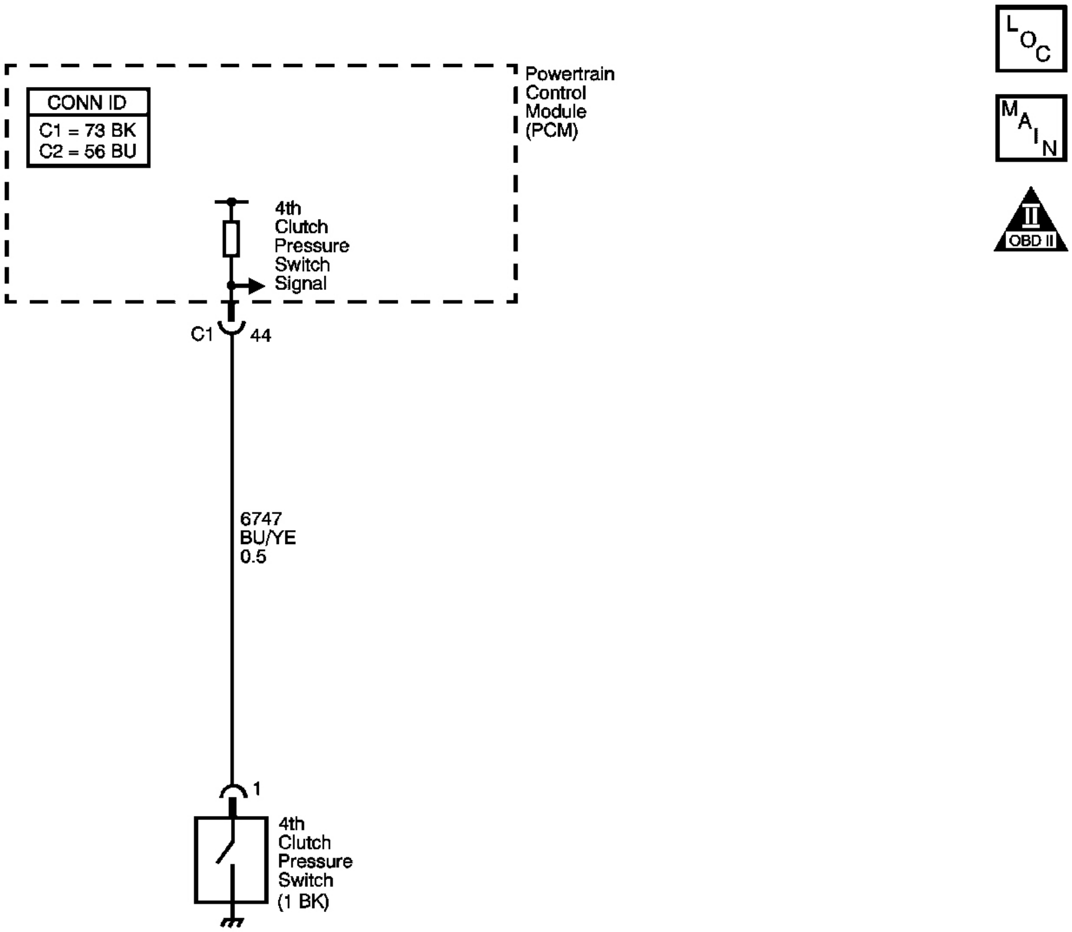


Fig. 7: DTC P0872 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The 4th clutch pressure switch is located in the hydraulic passage to the 4th clutch. When oil pressure is supplied to the 4th clutch, the switch is grounded, LOW. When oil pressure is not supplied, the switch is open, HI. The PCM receives the signal from the 4th clutch pressure switch to detect the fluid pressure status, in order to reduce the shift shock when shifting into 4th gear, from 3rd to 4th or 5th to 4th. If the 4th clutch pressure switch is ON when the gear ratio is not 4th gear, the PCM determines it is a fault and DTC P0872 sets. DTC P0872 is a type C DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, P0118.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTCs P0705 or P0706.
- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTCs P0746, or P0747.
- No SS Valve Performance DTCs P0751, P0752, P0756, P0757, P0761, or P0762.
- No Clutch PC Solenoid 2 DTCs P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No 4th Clutch Pressure Switch DTC P0873.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, or P2112.
- No Minimum Idle Position DTC P2176.
- No TCC PC solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- System voltage is greater than 10 volts.
- The transmission is in D range 5th gear for 2 seconds or greater.

Conditions for Setting the DTC

The 4th clutch pressure switch is OFF when the transmission is in 5th gear for 2 seconds or greater.

Action Taken When the DTC Sets

- The PCM illuminates the service vehicle soon (SVS) lamp.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0872 in PCM history.

Conditions for Clearing the SVS lamp/DTC

- The PCM turns OFF the SVS lamp when the condition no longer exists.
- A scan tool can clear the DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the connectors at the PCM, the transmission fluid pressure switch, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect the 4th clutch pressure switch wires for a shorted condition.
- Inspect the 4th clutch pressure switch for a stuck ON condition.
- Inspect for an internal fault of the PCM.

DTC P0872

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 5th gear D range for 10 seconds. 6. Stop the vehicle.		

	7. Select Specific DTC. 8. Enter DTC P0872. Does DTC P0872 run and fail?	Go to **Step 3**	Go to Diagnostic Aids
3	1. Turn OFF the ignition. 2. Disconnect the 4th clutch pressure switch connector. 3. Turn ON the ignition, with the engine OFF. 4. With a scan tool, observe the TFP Switch 4 parameter. Does the scan tool display HI?	Go to **Step 6**	Go to **Step 4**
4	Test the 4th clutch pressure switch signal circuit for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 5**
5	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
6	Inspect for poor connections at the 4th clutch pressure switch harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 8**
7	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 9**	-
8	Replace the 4th clutch pressure switch. Refer to **4th Clutch Pressure Switch Replacement** . Did you complete the replacement?	Go to **Step 9**	-
	Perform the following procedure in order to verify the repair: 1. Select DTC.		

9	2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle in 5th gear D range for 10 seconds. • Stop the vehicle. 4. Select Specific DTC. 5. Enter DTC P0872. Has the test run and passed?	Go to **Step 10**	Go to **Step 2**
10	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0873

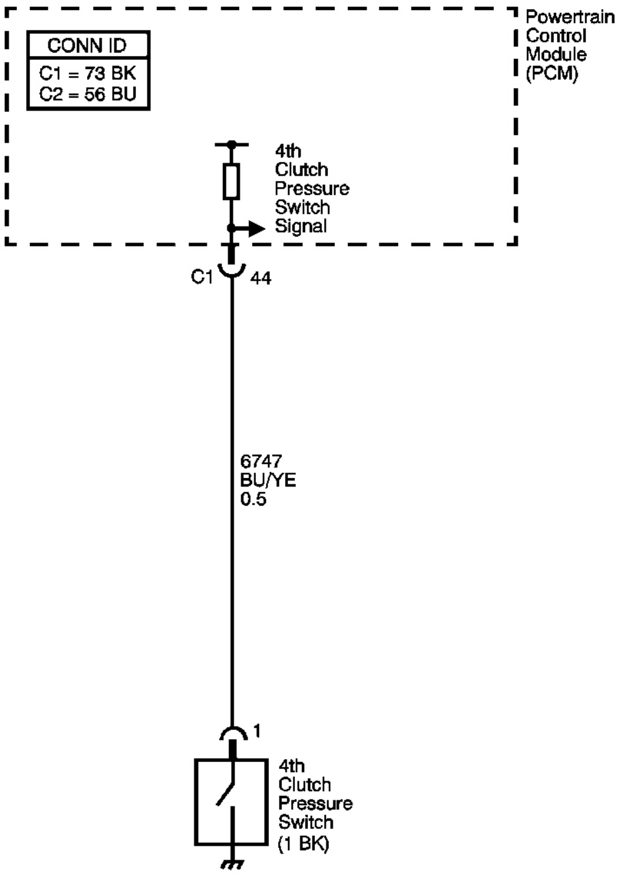


Fig. 8: DTC P0873 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The 4th clutch pressure switch is located in the hydraulic passage to the 4th clutch. When oil pressure is supplied to the 4th clutch, the switch is grounded, LOW. When oil pressure is not supplied, the switch is open, HI. The PCM receives the signal from the 4th clutch pressure switch to detect the fluid pressure status, in order to reduce the shift shock when shifting into 4th gear, from 3rd to 4th or 5th to 4th. If the 4th clutch pressure switch is OFF when the gear ratio is 4th gear, the PCM determines it is a fault and DTC P0873 sets. DTC P0873 is a type C DTC.

Conditions for Running the DTC

- No ECT DTCs P0116, P0117, P0118.
- No VSS DTCs P0501, P0502, or P0503.
- No TR Switch DTCs P0705 or P0706.

- No AT ISS DTCs P0716, P0717, or P0718.
- No Clutch PC Solenoid 1 DTCs P0746 or P0747.
- No Shift Solenoid Valve Performance DTCs P0751, P0752, P0756, P0757, P0761, or P0762.
- No Clutch PC Solenoid 2 DTCs P0776 or P0777.
- No Incorrect Shift Pattern DTC P0780.
- No Clutch PC Solenoid Electrical DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TAC DTCs P2101, P2108, P2111, or P2112.
- No Minimum Idle Position DTC P2176.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- System voltage is greater than 10 volts.
- The transmission is in D range 4th gear for 2 seconds or greater.

Conditions for Setting the DTC

The 4th clutch pressure switch is OFF when the transmission is in 4th gear, for 2 seconds or greater.

Action Taken When the DTC Sets

- The PCM illuminates the service vehicle soon (SVS) lamp.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Failure Records.
- The PCM stores DTC P0873 in PCM history.

Conditions for Clearing the SVS lamp/DTC

- The PCM turns OFF the SVS lamp when the condition no longer exists.
- A scan tool can clear the DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The PCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the connectors at the PCM, the transmission fluid pressure switch, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.

- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect the 4th clutch pressure switch for a disengaged connector.
- Inspect the 4th clutch pressure switch for open wires.
- Inspect the 4th clutch pressure switch for a stuck OFF condition.
- Inspect for an internal fault of the PCM.

DTC P0873

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the PCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Drive the vehicle in 4th gear D range for 10 seconds. 6. Stop the vehicle. 7. Select Specific DTC. 8. Enter DTC P0873. Does DTC P0873 run and fail?	Go to **Step 3**	Go to Diagnostic Aids
3	1. Turn OFF the ignition. 2. Disconnect the 4th clutch pressure switch connector. 3. Connect a 3 amp fused jumper wire between the 4th clutch pressure switch signal circuit and a good ground. 4. Turn ON the ignition, with the engine OFF. 5. With a scan tool, observe the TFP Switch 4		

	parameter. Does the scan tool display LOW?	Go to **Step 6**	Go to **Step 4**
4	Test the 4th clutch pressure switch signal circuit for an open or a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 5**
5	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
6	Inspect for poor connections at the 4th clutch pressure switch harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 8**
7	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 9**	-
8	Replace the 4th clutch pressure switch. Refer to **4th Clutch Pressure Switch Replacement** . Did you complete the replacement?	Go to **Step 9**	-
9	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Drive the vehicle in 4th gear D range for 10 seconds. • Stop the vehicle. 4. Select Specific DTC. 5. Enter DTC P0873.		

	Has the test run and passed?	Go to **Step 10**	Go to **Step 2**
10	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0962

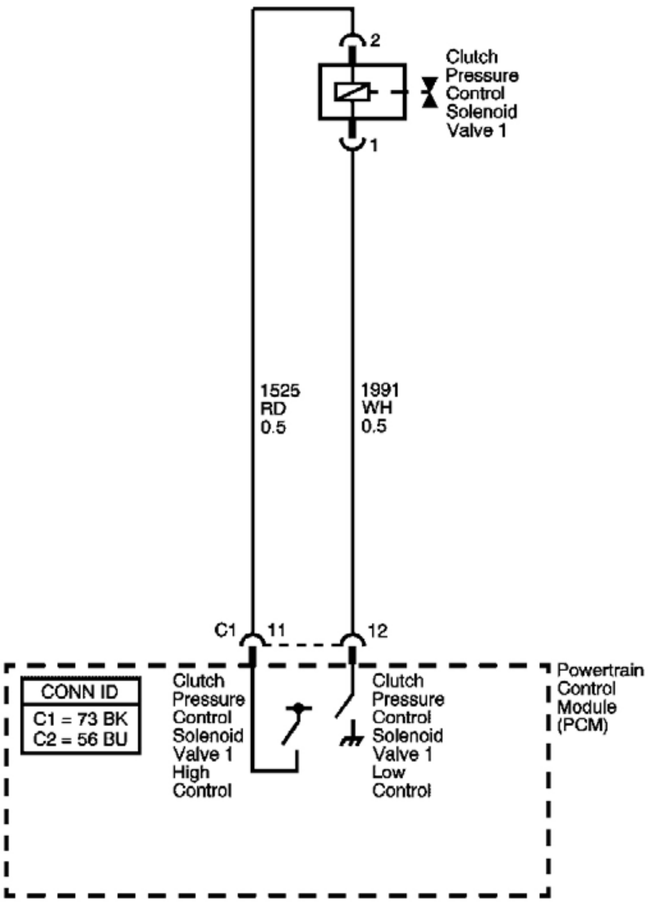


Fig. 9: DTC P0962 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The clutch pressure control (PC) solenoid valve 1 regulates modulator pressure based on the current flow from the powertrain control module (PCM). The PCM outputs varying amount of amperage as necessary for gear change, and the clutch PC solenoid valve 1 supplies oil pressure proportional to the current to the clutch PC solenoid valve 1. The PCM monitors the current flowing through the solenoid and performs feedback control. If the current is not within the specified range for a given duty output, a fault is detected and DTC P0962 is set. DTC P0962 is a type A DTC.

Conditions for Running the DTC

- No Clutch PC Solenoid Valve 1 DTCs P0746 or P0747.
- No Shift Solenoid Valve Performance DTC P0751.
- No Clutch PC Solenoid Valve 2 DTC P0777.
- No Clutch PC Solenoid Valve 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TCC PC Solenoid Valve DTCs P2763 or P2764.
- No TCC Enable Solenoid Valve DTCs P2769 or P2770.
- System voltage is greater than 11 volts.
- The engine is running for 1 second or greater.

Conditions for Setting the DTC

- The clutch PC solenoid valve 1 current flow is 0.2 amp or less at 57-89% duty cycle.
- The clutch PC solenoid valve 1 current flow is 0.4 amp or less at 90% or greater duty cycle.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0962 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the AT clutch PC solenoid valve 1, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.

- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a faulty AT clutch PC solenoid valve 1.
- Inspect for a PCM internal fault.

DTC P0962

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Start the engine and idle for 1 minute. 6. Select Specific DTC. 7. Enter DTC P0962 Has the test run and passed?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the clutch pressure solenoid valve 1. 3. Connect a test lamp between the clutch pressure solenoid valve 1 low control circuit and the clutch pressure solenoid valve 1 high control circuit. 4. Turn ON the ignition, with the engine OFF. Does the test lamp illuminate for 1 second?	Go to **Step 8**	Go to **Step 4**
4	Test the clutch pressure solenoid valve 1 low control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems.		

	Did you find and correct the condition?	Go to **Step 11**	Go to **Step 5**
5	Test the clutch pressure solenoid valve 1 low control circuit for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 6**
6	Test the clutch pressure solenoid valve 1 high control circuit for an open or a short to ground. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 7**
7	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 10**
8	Inspect for poor connections at the clutch pressure solenoid valve 1. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 9**
9	Replace the clutch pressure solenoid valve 1. Refer to **A/B Clutch Pressure Control Solenoid Assembly Replacement** . Did you complete the replacement?	Go to **Step 11**	-
10	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 11**	-
11	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Start the engine and idle for 1 minute. 4. Select Specific DTC. 5. Enter DTC P0962.		

	Has the test run and passed?	Go to **Step 12**	Go to **Step 2**
12	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0963

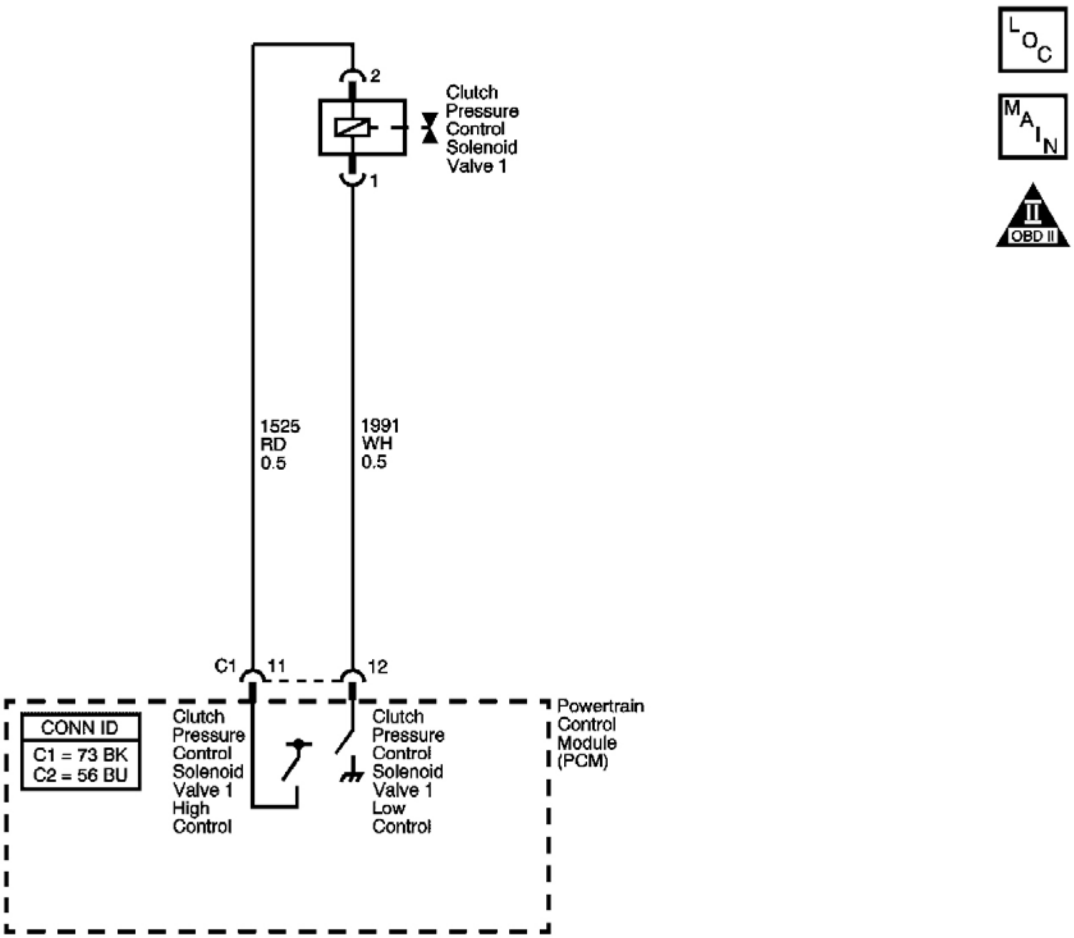


Fig. 10: DTC P0963 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The clutch pressure control (PC) solenoid valve 1 regulates modulator pressure based on the current flow from the powertrain control module (PCM). The PCM outputs varying amount of amperage, as necessary for gear change. The clutch PC solenoid valve 1 supplies oil pressure proportional to the current to the clutch PC solenoid valve 1. The PCM monitors the current flowing through the solenoid and performs feedback control. If the current is not within the specified range for a given duty output, a fault is detected and DTC P0963 sets. DTC P0963 is a type A DTC.

Conditions for Running the DTC

- No Clutch PC Solenoid 1 DTCs P0746 or P0747.
- No Shift Solenoid Valve Performance DTC P0751.
- No Clutch PC Solenoid 2 DTC P0777.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- System voltage is greater than 11 volts.
- The engine is running for 1 second or greater.

Conditions for Setting the DTC

- The clutch PC solenoid valve 1 current flow is 0.6 amp or greater at 12% duty cycle or less.
- The clutch PC solenoid valve 1 current flow is 0.9 amp or greater at 13-27% duty cycle.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0963 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the AT clutch PC solenoid valve 1, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor**

Connections in Wiring Systems.

- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a faulty AT clutch PC solenoid valve 1.
- Inspect for a PCM internal fault.

DTC P0963

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Control?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Start the engine and idle for 1 minute. 6. Select Specific DTC. 7. Enter DTC P0963. Has the test run and passed?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the clutch PC solenoid valve 1. 3. Connect a test lamp between the clutch PC solenoid valve 1 low control circuit and the clutch PC solenoid valve 1 high control circuit. 4. Turn ON the ignition, with the engine OFF. Does the test lamp illuminate for 1 second?	Go to **Step 9**	Go to **Step 4**
4	Test the clutch PC solenoid valve 1 low control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring		

	Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 5**
5	Test the clutch PC solenoid valve 1 low control circuit for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 6**
6	Test the clutch PC solenoid valve 1 high control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 7**
7	Test the clutch PC solenoid valve 1 high control circuit for a short to any other circuit. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 8**
8	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 11**
9	Inspect for poor connections at the clutch PC solenoid valve 1. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 10**
10	Replace the clutch PC solenoid valve 1. Refer to **A/B Clutch Pressure Control Solenoid Assembly Replacement** . Did you complete the replacement?	Go to **Step 12**	-
11	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 12**	-
	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info.		

12	3. Start the engine and idle for 1 minute. 4. Select Specific DTC. 5. Enter DTC P0963. Has the test run and passed?	Go to **Step 13**	Go to **Step 2**
13	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0966

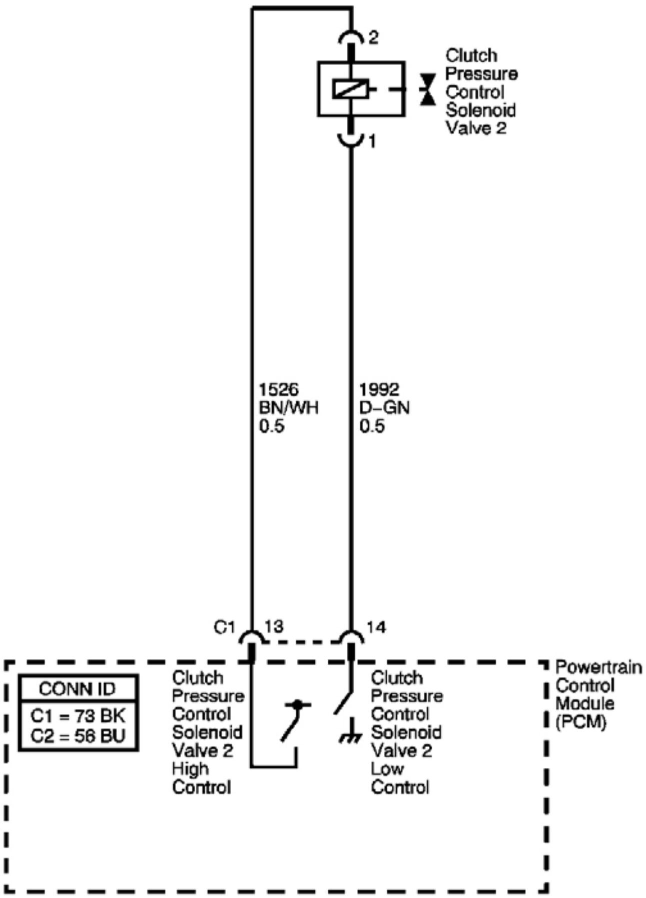


Fig. 11: DTC P0966 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The clutch pressure control (PC) solenoid valve 2 regulates modulator pressure based on the current flow from the powertrain control module (PCM). The PCM outputs varying amounts of amperage, as necessary for gear change, and the clutch PC solenoid valve 2 supplies oil pressure, proportional to the current, to the clutch PC solenoid valve 2 and the reverse clutch PC valve. The PCM monitors the current flowing through the solenoid and performs feedback control. If the current is not within the specified range for a given duty output, a fault is detected and DTC P0966 sets. DTC P0966 is a type A DTC.

Conditions for Running the DTC

- No Clutch PC Solenoid Valve 1 DTCs P0746 or P0747.
- No Shift Solenoid Valve Performance DTC P0751.
- No Clutch PC Solenoid Valve 2 DTC P0777.
- No Clutch PC Solenoid Valve 2 DTCs P0962 or P0963.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TCC PC Solenoid Valve DTCs P2763 or P2764.
- No TCC Enable Solenoid Valve DTCs P2769 or P2770.
- System voltage is greater than 11 volts.
- The engine is running for 1 second or greater.

Conditions for Setting the DTC

- The clutch PC solenoid valve 2 current flow is 0.2 amp or less at 57-89% duty cycle.
- The clutch PC solenoid valve 2 current flow is 0.4 amp or less at 90% or greater duty cycle.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0966 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the AT clutch PC solenoid valve 2, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a faulty AT clutch PC solenoid valve 2
- Inspect for a PCM internal fault.

DTC P0966

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Control?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Start the engine and idle for 1 minute. 6. Select Specific DTC. 7. Enter DTC P0966 Has the test run and passed?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the clutch pressure solenoid valve 2. 3. Connect a test lamp between the clutch pressure solenoid valve 2 low control circuit and the clutch pressure solenoid valve 2 high control circuit. 4. Turn ON the ignition, with the engine OFF.		

	Does the test lamp illuminate for 1 second?	Go to **Step 8**	Go to **Step 4**
4	Test the clutch pressure solenoid valve 2 low control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 5**
5	Test the clutch pressure solenoid valve 2 low control circuit for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 6**
6	Test the clutch pressure solenoid valve 2 high control circuit for an open or a short to ground. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 7**
7	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 10**
8	Inspect for poor connections at the clutch pressure solenoid valve 2. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 9**
9	Replace the clutch pressure solenoid valve 2. Refer to **A/B Clutch Pressure Control Solenoid Assembly Replacement** . Did you complete the replacement?	Go to **Step 11**	-
10	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 11**	-
	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info.		

11	3. Start the engine and idle for 1 minute. 4. Select Specific DTC. 5. Enter DTC P0966. Has the test run and passed?	Go to **Step 12**	Go to **Step 2**
12	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0967

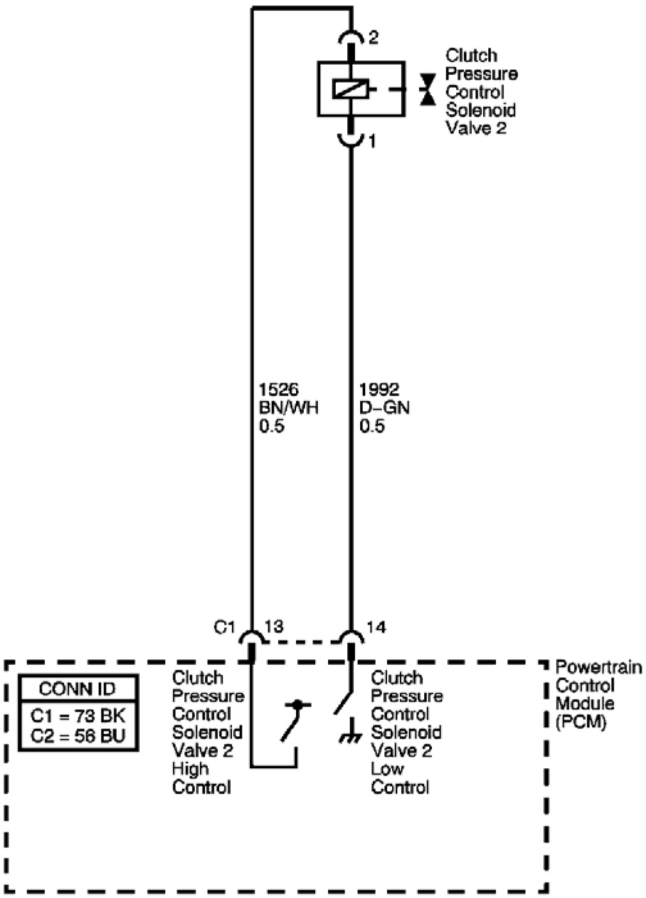


Fig. 12: DTC P0967 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The clutch pressure control (PC) solenoid valve 2 regulates modulator pressure, based on the current flow from the powertrain control module (PCM). The PCM outputs varying amount of amperage, as necessary for gear change, and the clutch PC solenoid valve 2 supplies oil pressure proportional to the current to the clutch PC solenoid valve 2 and the reverse clutch PC valve. The PCM monitors the current flowing through the solenoid and performs feedback control. If the current is not within the specified range for a given duty output, a fault is detected and DTC P0967 sets. DTC P0967 is a type A DTC.

Conditions for Running the DTC

- No Clutch PC Solenoid 1 DTCs P0746 or P0747.
- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid 2 DTC P0777.
- No Clutch PC Solenoid 2 DTCs P0962 or P0963.
- No SS 1 DTCs P0973 or P0974.
- No Clutch PC Solenoid DTC P0966.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- System voltage is greater than 11 volts.
- The engine is running for 1 second or greater.

Conditions for Setting the DTC

- The clutch PC solenoid valve 2 current flow is 0.6 amp or greater at 12% duty cycle or less.
- The clutch PC solenoid valve 2 current flow is 0.9 amp or greater at 13-27% duty cycle.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0967 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an

emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the AT clutch PC solenoid valve 2, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a faulty AT clutch PC solenoid valve 2
- Inspect for a PCM internal fault.

DTC P0967

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Control?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Start the engine and idle for 1 minute. 6. Select Specific DTC. 7. Enter DTC P0967. Has the test run and passed?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the clutch PC solenoid valve 2. 3. Connect a test lamp between the clutch PC solenoid valve 2 low control circuit and the clutch PC solenoid valve 2 high control circuit. 4. Turn ON the ignition, with the engine		

	OFF. Does the test lamp illuminate for 1 second?	Go to **Step 9**	Go to **Step 4**
4	Test the clutch PC solenoid valve 2 low control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 5**
5	Test the clutch PC solenoid valve 2 low control circuit for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 6**
6	Test the clutch PC solenoid valve 2 high control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 7**
7	Test the clutch PC solenoid valve 2 high control circuit for a short to any other circuit. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 8**
8	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 11**
9	Inspect for poor connections at the clutch PC solenoid valve 2. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 10**
10	Replace the clutch PC solenoid valve 2. Refer to **A/B Clutch Pressure Control Solenoid Assembly Replacement** . Did you complete the replacement?	Go to **Step 12**	-
11	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure.		-

	Did you complete the replacement?	Go to **Step 12**	
12	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Start the engine and idle for 1 minute. 4. Select Specific DTC. 5. Enter DTC P0967. Has the test run and passed?	Go to **Step 13**	Go to **Step 2**
13	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0973

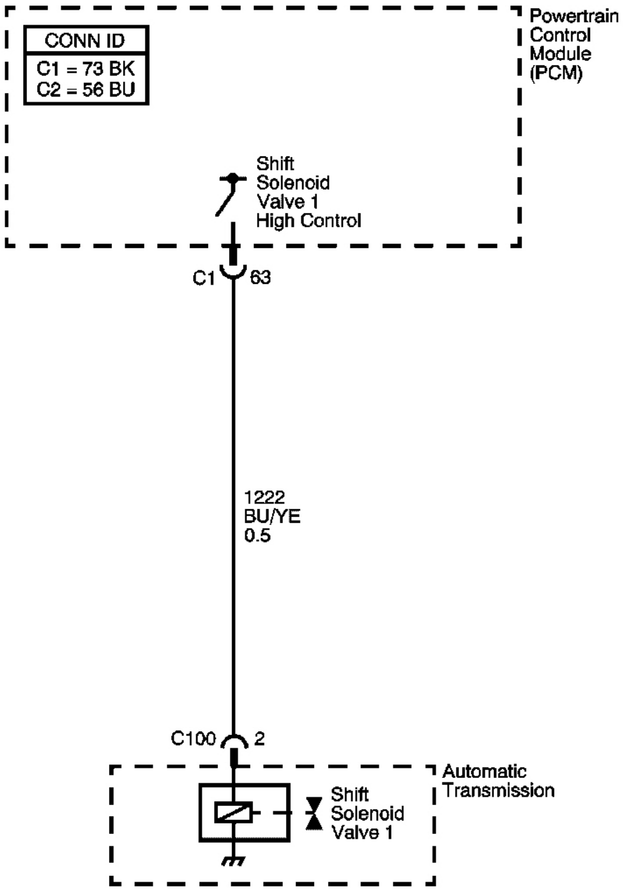


Fig. 13: DTC P0973 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) valve 1 is a normally open valve that mounts into the transmission case. The SS valve 1 controls the modulator pressure to the shift valve 1, as commanded by the powertrain control module (PCM). When the PCM energizes the SS valve 1, it closes the passage to the shift valve 1, and the modulator pressure is exhausted. When the PCM de-energizes the SS valve 1, it allows the modulator pressure to apply to the shift valve 1. The PCM has a diagnosis circuit inside, to monitor the voltage level to the SS valve 1, and receives a return signal. When the PCM detects a short to ground on the SS valve 1 high control circuit, DTC P0973 sets. DTC P0973 is a type A DTC.

Refer to **Shift Solenoid Valve State and Gear Ratio** .

Conditions for Running the DTC

- No Clutch PC Solenoid Valve 1 DTCs P0746 or P0747.
- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid Valve 2 DTC P0777.
- No Clutch PC Solenoid Valve 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid Valve 2 DTCs P0966 or P0967.
- No SS Valve 1 DTC P0974.
- No SS Valve 2 DTCs P0976 or P0977.
- No SS Valve 3 DTCs P0979 or P0980.
- No TCC PC Solenoid Valve DTCs P2763 or P2764.
- No TCC Enable Solenoid Valve DTCs P2769 or P2770.
- System voltage is greater than 11 volts.
- The engine is running.
- The vehicle is in D range 1st gear for 1 second or greater.

Conditions for Setting the DTC

The PCM detects a short to ground on the SS valve 1 high control circuit for 1 second or more.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0973 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the SS valve 1, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a shorted SS valve 1 wire.

- Inspect for a faulty SS valve 1.
- Inspect for a PCM internal fault.

DTC P0973

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. With a scan tool observe the Shift Sol. 1 CKT Status parameter. Does the Shift Sol. 1 CKT Status parameter display OK?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the transmission inline 5-way connector. 3. With a test lamp connected to a good ground, probe the shift solenoid valve 1 control circuit on the engine side of the inline 5-way connector. 4. Turn ON the ignition, with the engine OFF. Does the test lamp illuminate for 1 second?	Go to **Step 4**	Go to **Step 5**
4	Test the shift solenoid valve 1 high control circuit internal transmission harness for a short to ground. Refer to **Testing for Short to Ground** in Wiring Systems. Did you find a condition?	Go to **Step 8**	Go to **Step 6**
	Test the shift solenoid valve 1 high control circuit		

5	for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 7**
6	Inspect for poor connections at the transmission inline 5-way connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 9**
7	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 10**
8	Replace the transmission internal solenoid harness. Refer to **Transmission Wiring Harness Extension Replacement** . Did you complete the repair?	Go to **Step 11**	-
9	Replace the shift solenoid valve 1. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 11**	-
10	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 11**	-
11	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in D range 1st gear for 10 seconds. 4. Select Specific DTC. 5. Enter DTC P0973. Has the test run and passed?	Go to **Step 12**	Go to **Step 2**
12	With the scan tool, observe the stored information, capture info. and DTC info.	Go to **Diagnostic Trouble Code (DTC)**	

	Does the scan tool display any DTCs that you have not diagnosed?	Type(s) in Engine Controls - 3.5L (L66)	System OK

DTC P0974

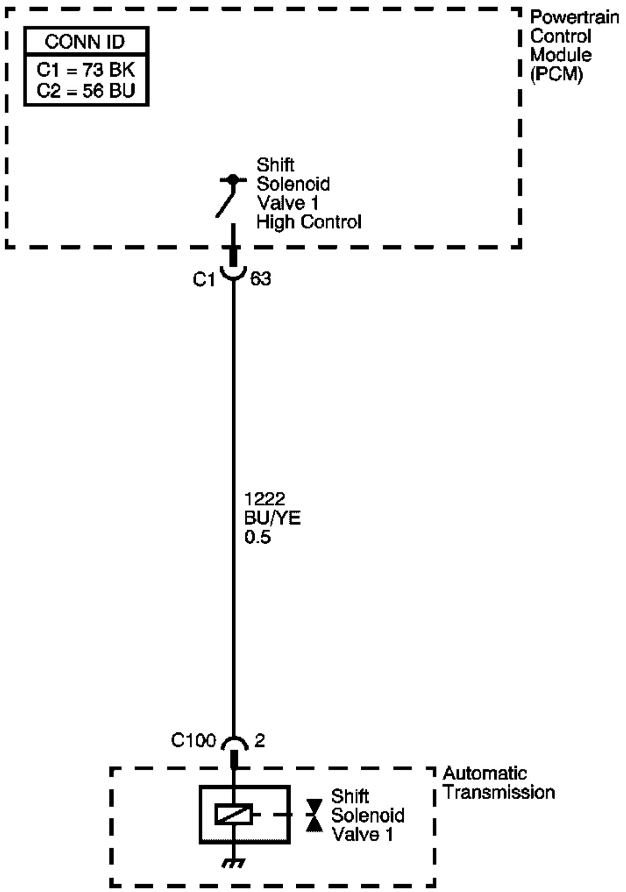


Fig. 14: DTC P0974 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) valve 1 is a normally open valve that mounts into the transmission case. The SS valve 1 controls the modulator pressure to the shift valve 1, as commanded by the powertrain control module (PCM). When the PCM energizes the SS valve 1, it closes the passage to the shift valve 1 and the modulator pressure is exhausted. When the PCM de-energizes the SS valve A, it allows the modulator pressure to apply to the shift valve 1. The PCM has a diagnosis circuit inside to monitor the voltage level to the SS valve 1, and receives a return signal. When the PCM detects an open or short to voltage on the SS valve 1 high control circuit, DTC

P0974 sets. DTC P0974 is a type A DTC.

Refer to **Shift Solenoid Valve State and Gear Ratio** .

Conditions for Running the DTC

- No Clutch PC Solenoid 1 DTCs P0746 or P0747.
- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid 2 DTC P0777.
- No Clutch PC Solenoid 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS Valve 1 DTC P0973.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- System voltage is greater than 11 volts.
- The engine is running.
- The vehicle is in P range for 1 second or greater.

Conditions for Setting the DTC

The PCM detects an open or short to voltage on the SS valve 1 high control circuit for 1 second or greater.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- If the SS valve 1 circuit is open, the PCM limits the transmission shift to 4th gear.
- If the SS valve 1 circuit is shorted to voltage, the PCM limits the transmission shift to 5th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0974 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the SS valve 1, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a disconnected SS valve 1 connector.
- Inspect for an open or shorted to voltage SS valve 1 wire.
- Inspect for a faulty SS valve 1.
- Inspect for a PCM internal fault.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step verifies that the PCM is providing voltage to the shift solenoid valve 1.

4: This step tests for an open or short to another circuit within the transmission.

5: This step tests for short voltage to the shift solenoid valve 1.

6: This step tests for an open in the shift solenoid valve 1 high control circuit.

DTC P0974

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. With a scan tool observe the Shift Sol. 1 CKT Status parameter. Does the Shift Sol. 1 CKT Status parameter display OK?	Go to Diagnostic Aids	Go to **Step 3**
	1. Turn OFF the ignition.		

3	2. Disconnect the transmission inline 5-way connector. 3. With a test lamp connected to a good ground, probe the shift solenoid valve 1 control circuit on the engine side of the inline 5-way connector. 4. Turn ON the ignition, with the engine OFF. Does the test lamp illuminate for 1 second?	Go to **Step 4**	Go to **Step 5**
4	Test the shift solenoid valve 1 internal transmission harness high control circuit for an open or short to another circuit. Refer to **Testing for Continuity** in Wiring Systems. Did you find a condition?	Go to **Step 10**	Go to **Step 8**
5	Does the test lamp remain illuminated?	Go to **Step 7**	Go to **Step 6**
6	Test the shift solenoid valve 1 control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 9**
7	Test the shift solenoid valve 1 high control circuit for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 9**
8	Inspect for poor connections at the shift solenoid valve 1. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 11**
9	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 12**
10	Replace the transmission internal solenoid harness. Refer to **Transmission Wiring Harness Extension Replacement** . Did you complete the repair?	Go to **Step 13**	-
11	Replace the shift solenoid valve 1. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 13**	-
	IMPORTANT: **Always perform the PCM set up procedure.**		

12	1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 13**	-
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Idle the engine in PARK for 10 seconds. 4. Select Specific DTC. 5. Enter DTC P0974. Has the test run and passed?	Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0976

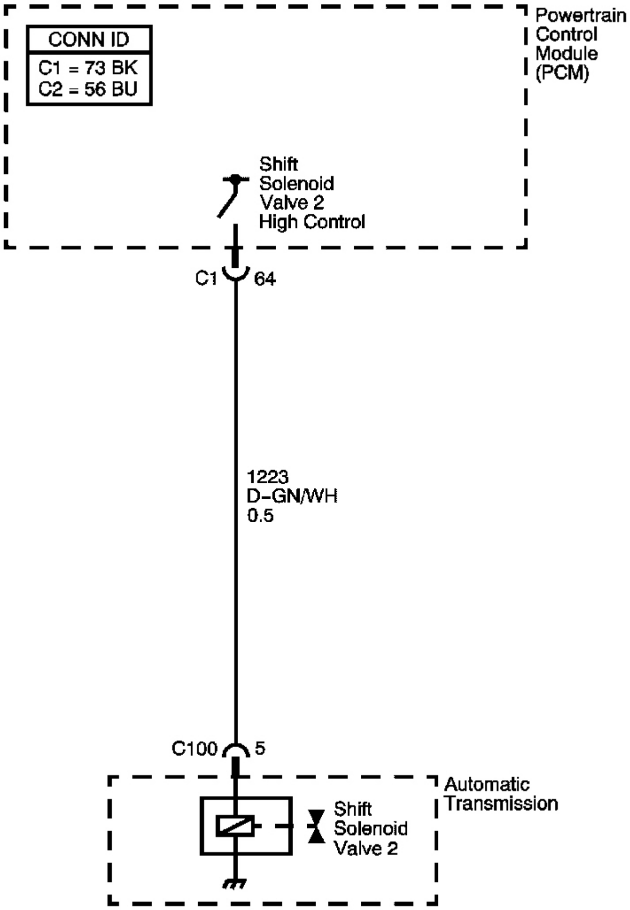


Fig. 15: DTC P0976 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) valve 2 is a normally open valve that mounts into the transmission case. The SS valve 2 controls the modulator pressure to the shift valve 2, as commanded by the powertrain control module (PCM). When the PCM energizes the SS valve 2, it closes the passage to the shift valve 2, and the modulator pressure is exhausted. When the PCM de-energizes the SS valve 2, it allows the modulator pressure to apply to the shift valve 2. The PCM has a diagnosis circuit inside, to monitor the voltage level to the SS valve 2, and receives a return signal. When the PCM detects a short to ground on the SS valve 2 high control circuit, DTC P0976 sets. DTC P0976 is a type A DTC.

Refer to **Shift Solenoid Valve State and Gear Ratio** .

Conditions for Running the DTC

- No Clutch PC Solenoid Valve 1 DTCs P0746 or P0747.
- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid Valve 2 DTC P0777.
- No Clutch PC Solenoid Valve 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid Valve 2 DTCs P0966 or P0967.
- No SS Valve 1 DTCs P0973 or P0974.
- No SS Valve 2 DTC P0977.
- No SS Valve 3 DTCs P0979 or P0980.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- System Voltage is greater than 11 volts.
- The engine is running.
- The vehicle is in D range for 1 second or greater.

Conditions for Setting the DTC

The PCM detects a short to ground on the SS valve 2 high control circuit for 1 second or greater.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0976 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the SS valve 2, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a shorted SS valve 2 circuit.

- Inspect for a faulty SS valve 2.
- Inspect for a PCM internal fault.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step verifies that the PCM is providing voltage to the shift solenoid valve 2.
4: This step tests for an open in the ground circuit to the shift solenoid valve 2.

DTC P0976

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. With a scan tool observe the Shift Sol. 2 CKT Status parameter. Does the Shift Sol. 2 CKT Status parameter display OK?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the transmission inline 5-way connector. 3. With a test lamp connected to a good ground, probe the shift solenoid valve 2 control circuit on the engine side of the inline 5-way connector. 4. Turn ON the ignition, with the engine OFF.		

	Does the test lamp illuminate for 1 second?	Go to **Step 4**	Go to **Step 5**
4	Test the shift solenoid valve 2 high control circuit internal transmission harness for a short to ground. Refer to **Testing for Short to Ground** in Wiring Systems. Did you find a condition?	Go to **Step 8**	Go to **Step 6**
5	Test the shift solenoid valve 2 high control circuit for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 7**
6	Inspect for poor connections at the transmission inline 5-way connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 9**
7	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 10**
8	Replace the transmission internal solenoid harness. Refer to **Transmission Wiring Harness Extension Replacement** . Did you complete the repair?	Go to **Step 11**	-
9	Replace the shift solenoid valve 2. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 11**	-
10	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 11**	-
11	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Idle the engine in PARK for 10 seconds. 4. Select Specific DTC.		

	5. Enter DTC P0976. Has the test run and passed?	Go to **Step 12**	Go to **Step 2**
12	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0977

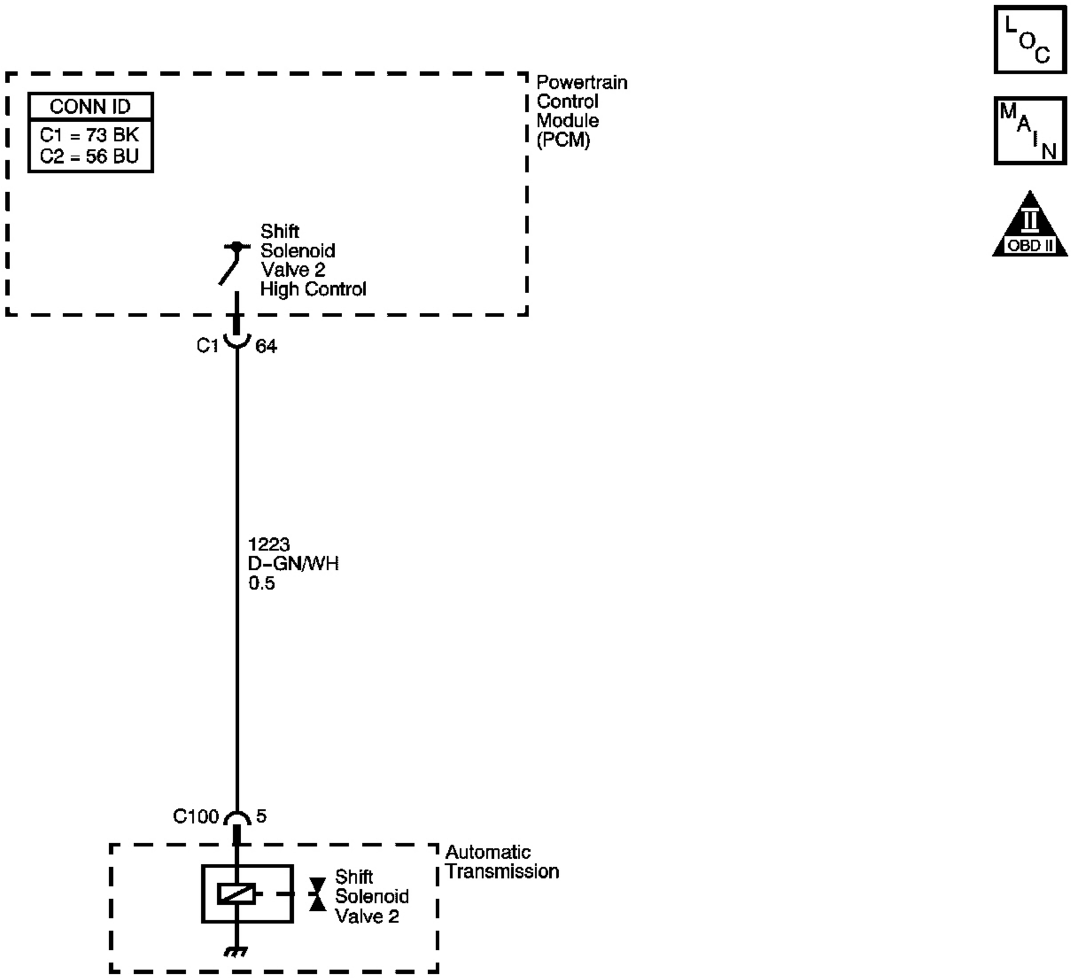


Fig. 16: DTC P0977 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) valve 2 is a normally open valve that mounts into the transmission case. The SS valve 2 controls the modulator pressure to the shift valve 2 as commanded by the powertrain control module (PCM). When the PCM energizes the SS valve 2, it closes the passage to the shift valve 2, and the modulator pressure is exhausted. When the PCM de-energizes the SS valve B, it allows the modulator pressure to apply to the shift valve 2. The PCM has a diagnosis circuit inside, to monitor the voltage level to the SS valve 2, and receives a return signal. When the PCM detects an open or short to voltage on the SS valve 2 high control circuit, DTC P0977 sets. DTC P0977 is a type A DTC.

Refer to **Shift Solenoid Valve State and Gear Ratio** .

Conditions for Running the DTC

- No Clutch PC Solenoid Valve 1 DTCs P0746 or P0747.
- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid Valve 2 DTC P0777.
- No Clutch PC Solenoid Valve 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid Valve 2 DTCs P0966 or P0967.
- No SS Valve 1 DTCs P0973 or P0974.
- No SS Valve 2 DTC P0976.
- No SS Valve 3 DTCs P0979 or P0980.
- No TCC PC Solenoid Valve DTCs P2763 or P2764.
- No TCC Enable Solenoid Valve DTCs P2769 or P2770.
- System voltage is greater than 11 volts.
- The engine is running.
- The vehicle is in D range for 1 second or greater.

Conditions for Setting the DTC

The PCM detects an open or short to voltage on the SS valve 2 high control circuit for 1 second or greater.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- If the SS valve 2 circuit is open, the PCM limits the transmission shift to 4th gear.
- If the SS valve 2 circuit is shorted to voltage, the PCM limits the transmission shift to 3rd gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0977 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.

- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the SS valve 2, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect for a disconnected SS valve 2 connector.
- Inspect for a shorted SS valve 2 circuit.
- Inspect for a faulty SS valve 2.
- Inspect for a PCM Internal fault.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step verifies that the PCM is providing voltage to the shift solenoid valve 2.

4: This step tests for an open or short to another circuit within the transmission.

5: This step tests for short voltage to the shift solenoid valve 2.

6: This step tests for an open in the shift solenoid valve 2 high control circuit.

DTC P0977

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Drive the vehicle in 4th gear D range for 10 seconds.		

	6. With a scan tool observe the Shift Sol. 2 CKT Status parameter. Does the Shift Sol. 2 CKT Status parameter display OK?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the transmission inline 5-way connector. 3. With a test lamp connected to a good ground, probe the shift solenoid valve 2 control circuit on the engine side of the inline 5-way connector. 4. Turn ON the ignition, with the engine OFF. Does the test lamp illuminate for 1 second?	Go to **Step 4**	Go to **Step 5**
4	Test the shift solenoid valve 2 high control circuit internal transmission harness for an open or short to another circuit. Refer to **Testing for Continuity** in Wiring Systems. Did you find a condition?	Go to **Step 10**	Go to **Step 8**
5	Does the test lamp remain illuminated?	Go to **Step 7**	Go to **Step 6**
6	Test the shift solenoid valve 2 control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 9**
7	Test the shift solenoid valve 2 high control circuit for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 9**
8	Inspect for poor connections at the shift solenoid valve 2. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 11**
9	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 12**
10	Replace the transmission internal solenoid harness. Refer to **Transmission Wiring Harness Extension Replacement** .		-

	Did you complete the repair?	Go to **Step 13**	
11	Replace the shift solenoid valve 2. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 13**	-
12	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 13**	-
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in 4th gear D range for 10 seconds. 4. Select Specific DTC. 5. Enter DTC P0977. Has the test run and passed?	Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0979

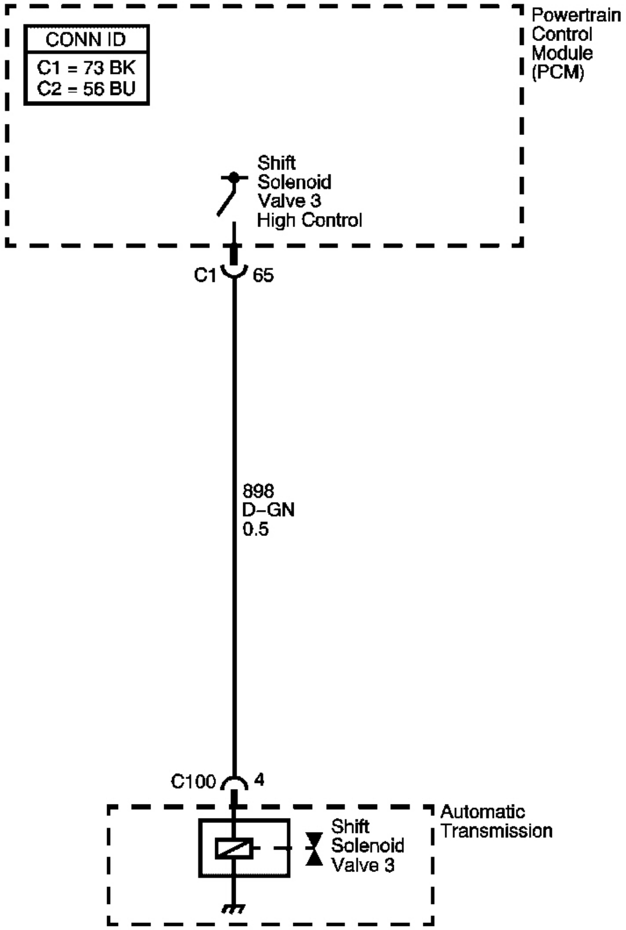


Fig. 17: DTC P0979 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) valve 3 is a normally open valve that mounts into the transmission case. The SS valve 3 controls the modulator pressure to the shift valve 3, as commanded by the powertrain control module (PCM). When the PCM energizes the SS valve 3, it closes the passage to the shift valve 3, and the modulator pressure is exhausted. When the PCM de-energizes the SS valve 3, it allows the modulator pressure to apply to the shift valve 3. The PCM has a diagnosis circuit inside, to monitor the voltage level to the SS valve 3, and receives a return signal. When the PCM detects a short to ground on the SS valve 3 high control circuit, DTC P0979 sets. DTC P0979 is a type A DTC.

Refer to **Shift Solenoid Valve State and Gear Ratio** .

Conditions for Running the DTC

- No Clutch PC Solenoid Valve 1 DTCs P0746 or P0747.
- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid Valve 2 DTC P0777.
- No Clutch PC Solenoid Valve 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid Valve 2 DTCs P0966 or P0967.
- No SS Valve 1 DTCs P0973 or P0974.
- No SS Valve 2 DTCs P0976 or P0977.
- No SS Valve 3 DTC P0980.
- No TCC PC Solenoid DTCs P2763 or P2764.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- System voltage is greater than 11 volts.
- The engine is running.
- The vehicle is in D range for 1 second or greater.

Conditions for Setting the DTC

The PCM detects a short to ground on the SS valve 3 high control circuit for 1 second or greater.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0979 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the SS valve 3, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a shorted SS valve 3 circuit.

- Inspect for a faulty SS valve 3.
- Inspect for a PCM internal fault.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step verifies that the PCM is providing voltage to the shift solenoid valve 3.

4: This step tests for an open in the ground circuit to the shift solenoid valve 3.

DTC P0979

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. With a scan tool observe the Shift Sol. 3 CKT Status parameter. Does the Shift Sol. 3 CKT Status parameter display OK?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the transmission inline 5-way connector. 3. With a test lamp connected to a good ground, probe the shift solenoid valve 3 control circuit on the engine side of the inline 5-way connector. 4. Turn ON the ignition, with the engine OFF.		

	Does the test lamp illuminate for 1 second?	Go to **Step 4**	Go to **Step 5**
4	Test the shift solenoid valve 3 high control circuit internal transmission harness for a short to ground. Refer to **Testing for Short to Ground** in Wiring Systems. Did you find a condition?	Go to **Step 8**	Go to **Step 6**
5	Test the shift solenoid valve 3 high control circuit for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 7**
6	Inspect for poor connections at the transmission inline 5-way connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 9**
7	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 10**
8	Replace the transmission internal solenoid harness. Refer to **Transmission Wiring Harness Extension Replacement** . Did you complete the repair?	Go to **Step 11**	-
9	Replace the shift solenoid valve 3. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 11**	-
10	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 11**	-
11	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in D range 1st gear for 10 seconds.		

	4. Select Specific DTC. 5. Enter DTC P0979. Has the test run and passed?	Go to **Step 12**	Go to **Step 2**
12	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P0980

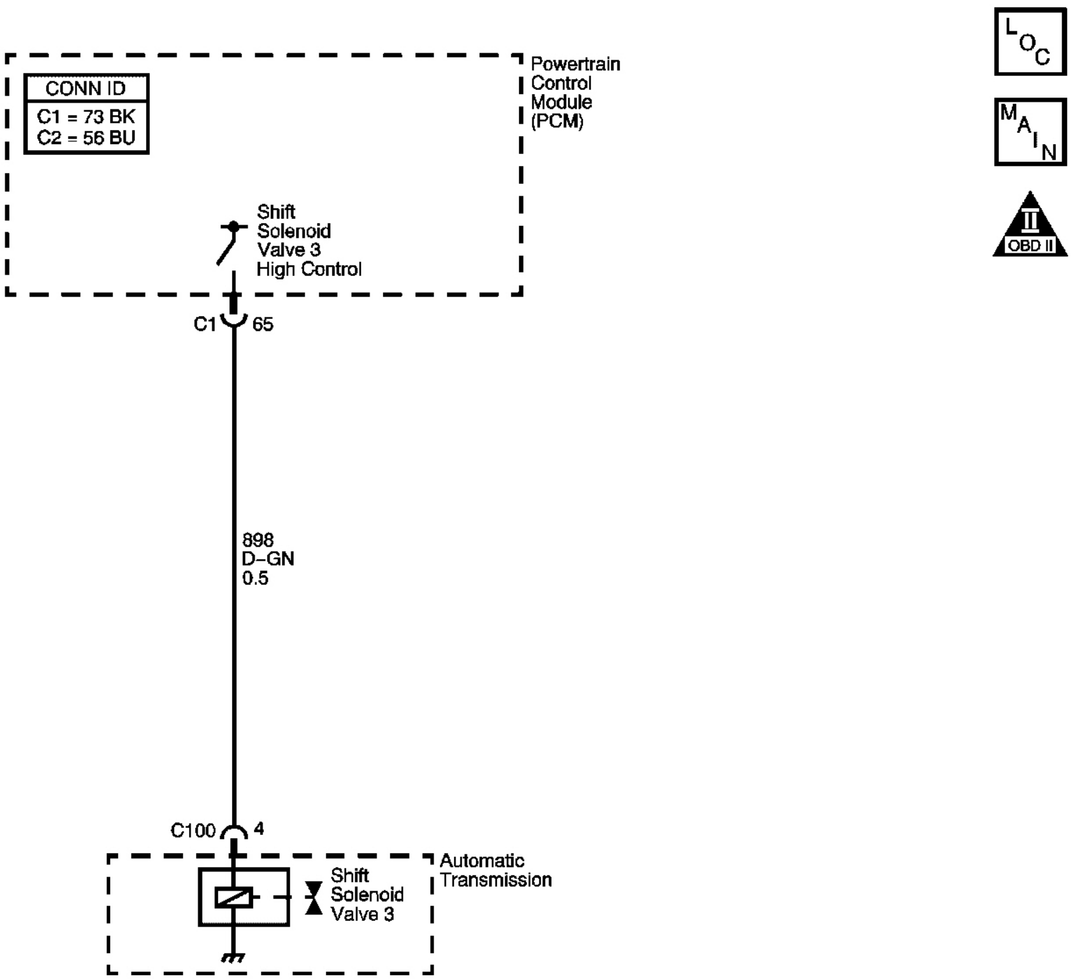


Fig. 18: DTC P0980 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The shift solenoid (SS) valve 3 is a normally open valve that mounts into the transmission case. The SS valve 3 controls the modulator pressure to the shift valve 3, as commanded by the powertrain control module (PCM). When the PCM energizes the SS valve 3, it closes the passage to the shift valve 3, and the modulator pressure is exhausted. When the PCM de-energizes the SS valve 3, it allows the modulator pressure to apply to the shift valve 3. The PCM has a diagnosis circuit inside, to monitor the voltage level to the SS valve 3, and receives a return signal. When the PCM detects an open or short to voltage on the SS valve 3 high control circuit, DTC P0980 sets. DTC P0980 is a type A DTC.

Refer to **Shift Solenoid Valve State and Gear Ratio** .

Conditions for Running the DTC

- No Clutch PC Solenoid Valve 1 DTCs P0746 or P0747.
- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid Valve 2 DTC P0777.
- No Clutch PC Solenoid Valve 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid Valve 2 DTCs P0966 or P0967.
- No SS Valve 1 DTCs P0973 or P0974.
- No SS Valve 2 DTCs P0976 or P0977.
- No TCC PC Solenoid Valve DTCs P2763 or P2764.
- No TCC Enable Solenoid Valve DTCs P2769 or P2770.
- System voltage is greater than 11 volts

Conditions for Setting the DTC

The PCM detects an open or short to voltage on the SS valve 3 high control circuit for 1 second or greater.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- If the SS valve 3 circuit is open, the PCM limits the transmission shift to 4th gear.
- If the SS valve 3 circuit is shorted to voltage, the PCM limits the transmission shift to 3rd gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P0980 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.

- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the SS valve 3, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for an open or shorted to voltage SS valve 3 circuit.
- Inspect for a faulty SS valve 3.
- Inspect for a PCM internal fault.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step verifies that the PCM is providing voltage to the shift solenoid valve 3.

4: This step tests for an open or short to another circuit within the transmission.

5: This step tests for short voltage to the shift solenoid valve 3.

6: This step tests for an open in the shift solenoid valve 3 high control circuit.

DTC P0980

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. With a scan tool observe the Shift Sol. 3 CKT Status parameter.		

	Does the Shift Sol. 3 CKT Status parameter display OK?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the transmission inline 5-way connector. 3. With a test lamp connected to a good ground, probe the shift solenoid valve 3 control circuit on the engine side of the inline 5-way connector. 4. Turn ON the ignition, with the engine OFF. Does the test lamp illuminate for 1 second?	Go to **Step 4**	Go to **Step 5**
4	Test the shift solenoid valve 3 high control circuit internal transmission harness for an open or short to another circuit. Refer to **Testing for Continuity** in Wiring Systems. Did you find a condition?	Go to **Step 10**	Go to **Step 8**
5	Does the test lamp remain illuminated?	Go to **Step 7**	Go to **Step 6**
6	Test the shift solenoid valve 3 control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 9**
7	Test the shift solenoid valve 3 high control circuit for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 9**
8	Inspect for poor connections at the shift solenoid valve 3. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 11**
9	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 12**
10	Replace the transmission internal solenoid harness. Refer to **Transmission Wiring Harness Extension Replacement** . Did you complete the repair?	Go to **Step 13**	-
11	Replace the shift solenoid valve 3. Refer to **Accumulator Valve Body Assembly Overhaul** .		-

	Did you complete the replacement?	Go to **Step 13**	
12	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 13**	-
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Idle the engine in PARK for 10 seconds. 4. Select Specific DTC. 5. Enter DTC P0980. Has the test run and passed?	Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P2763

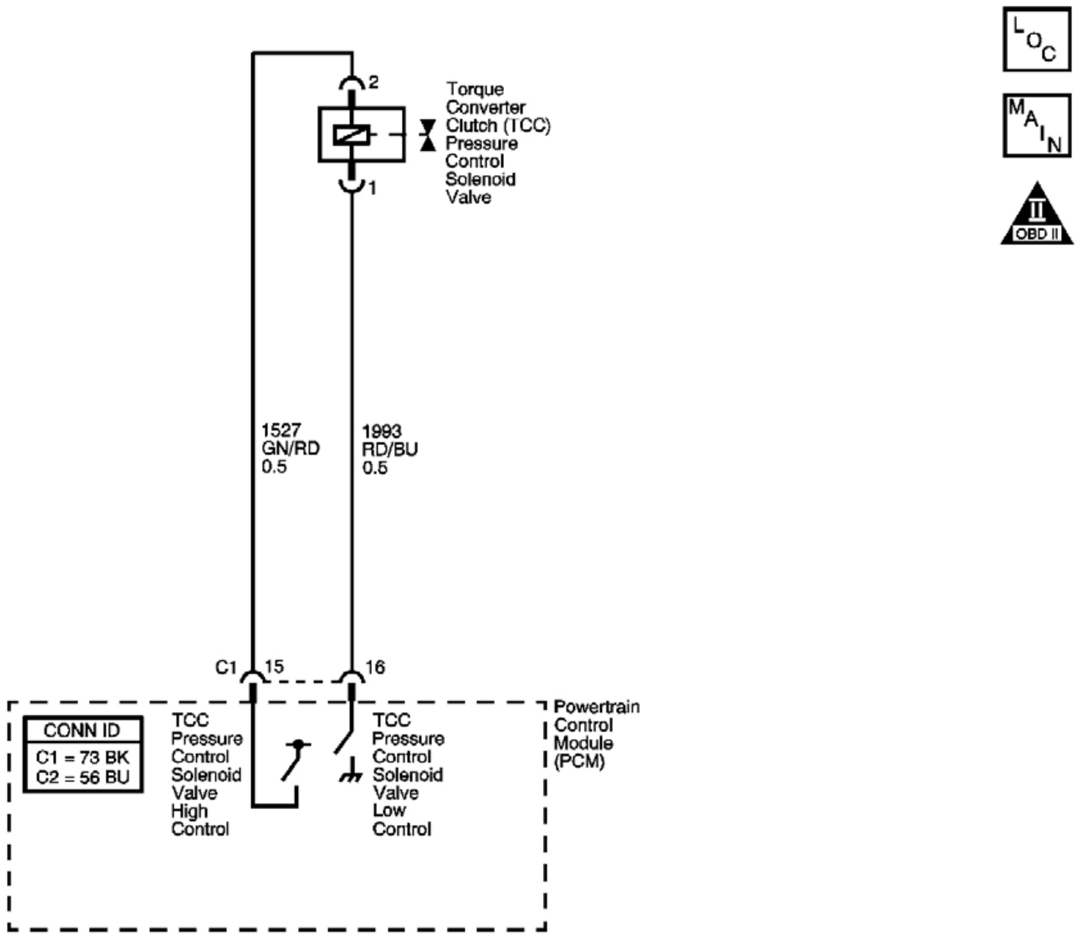


Fig. 19: DTC P2763 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The torque converter clutch (TCC) pressure control (PC) solenoid valve regulates modulator pressure, based on the current flow from the powertrain control module (PCM). The PCM outputs a varying amount of amperage, as necessary for TCC application, and the TCC PC solenoid valve supplies oil pressure proportional to the current to the TCC PC solenoid valve and the lock-up timing valve. The PCM monitors the current flowing through the solenoid valve and performs feedback control. If the current is not within the specified range for a given duty output, DTC P2763 sets. DTC P2763 is a type A DTC.

Conditions for Running the DTC

- No Clutch PC Solenoid Valve 1 DTCs P0746 or P0747.
- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid Valve 2 DTC P0777.

- No Clutch PC Solenoid Valve 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid Valve 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TCC PC Solenoid DTC P2764.
- No TCC Enable Solenoid Valve DTCs P2769 or P2770.
- System voltage is greater than 11 volts

Conditions for Setting the DTC

- TCC PC solenoid current flow is 0.6 amp or greater at 12% or less TCC duty cycle.
- TCC PC solenoid current flow is 0.9 amp or greater at 13-27% TCC duty cycle.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P2763 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the TCC PC solenoid valve, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a disconnected TCC PC solenoid valve connector.
- Inspect for an open or shorted TCC PC solenoid valve wires.
- Inspect for a faulty TCC PC solenoid valve.
- Inspect for a PCM internal fault.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

> **3:** This step tests for voltage at the coil side of the TCC PC solenoid valve.
>
> **5:** This step tests for a short to voltage on the low control circuit of the TCC PC solenoid valve.

DTC P2763

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Control?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Start the engine and idle for 1 minute. 6. Select Specific DTC. 7. Enter DTC P2763. Has the test run and passed?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the TCC PC solenoid valve. 3. Connect a test lamp between the TCC PC solenoid valve low control circuit and the TCC PC solenoid valve high control circuit. 4. Turn ON the ignition, with the engine OFF. Does the test lamp illuminate for 1 second?	Go to **Step 9**	Go to **Step 4**
4	Test the TCC PC solenoid valve low control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring		

	Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 5**
5	Test the TCC PC solenoid valve low control circuit for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 6**
6	Test the TCC PC solenoid valve high control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 7**
7	Test the TCC PC solenoid valve high control circuit for a short to voltage or any other circuit. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 8**
8	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 11**
9	Inspect for poor connections at the TCC PC solenoid valve. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 10**
10	Replace the TCC PC solenoid valve. Refer to **A/B Clutch Pressure Control Solenoid Assembly Replacement** . Did you complete the replacement?	Go to **Step 12**	-
11	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 12**	-
	Perform the following procedure in order to verify the repair: 1. Select DTC.		

12	2. Select Clear Info. 3. Start the engine and idle for 10 seconds. 4. Select Specific DTC. 5. Enter DTC P2763. Has the test run and passed?	Go to **Step 13**	Go to **Step 2**
13	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P2764

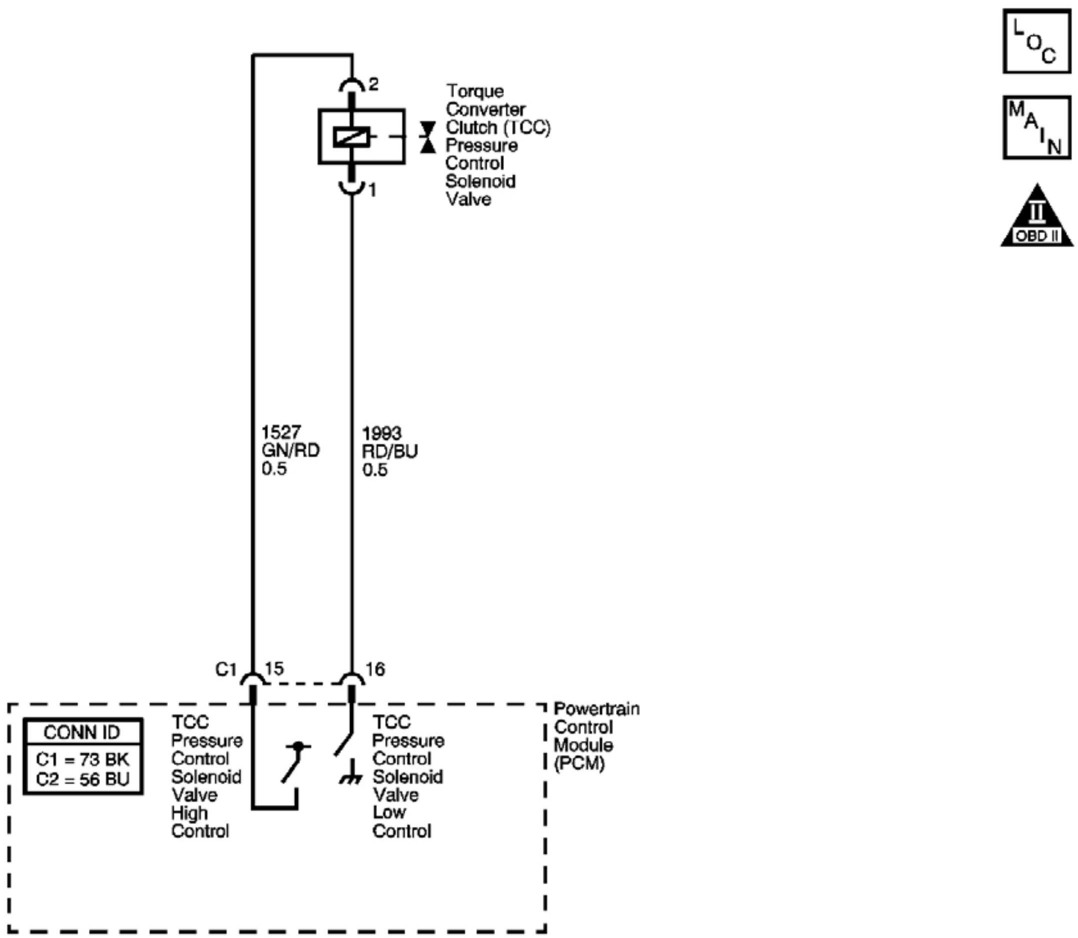


Fig. 20: DTC P2764 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The torque converter clutch (TCC) pressure control (PC) solenoid valve regulates modulator pressure, based on the current flow from the powertrain control module (PCM). The PCM outputs a varying amount of amperage, as necessary for TCC application. The TCC PC solenoid supplies oil pressure proportional to the current to the TCC PC solenoid and the lock-up timing valve. The PCM monitors the current flowing through the solenoid and performs feedback control. If the current is not within the specified range for a given duty output, DTC P2764 sets. DTC P2764 is a type A DTC.

Conditions for Running the DTC

- No Clutch PC Solenoid 1 DTCs P0746 or P0747.
- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid 2 DTC P0777.
- No Clutch PC Solenoid 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid 2 DTCs P0966 or P0967.
- No SS 1 DTCs P0973 or P0974.
- No SS 2 DTCs P0976 or P0977.
- No SS 3 DTCs P0979 or P0980.
- No TCC Enable Solenoid DTCs P2769 or P2770.
- System voltage is greater than 11 volts

Conditions for Setting the DTC

- TCC PC solenoid valve current flow is 0.2 amp or less at 57-89% TCC duty cycle.
- TCC PC solenoid valve current flow is 0.4 amp or less at 90% or greater TCC duty cycle.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P2764 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the TCC PC solenoid, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a faulty TCC PC solenoid.
- Inspect for a PCM internal fault.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for voltage at the coil side of the TCC PC solenoid valve.

4: This step verifies that the PCM is providing ground to the TCC PC solenoid valve.

5: This step tests for constant ground to the TCC PC solenoid valve.

DTC P2764

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Control?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. Start the engine and idle for 1 minute. 6. Select Specific DTC. 7. Enter DTC P2764. Has the test run and passed?	Go to Diagnostic Aids	Go to **Step 3**
	1. Turn OFF the ignition.		

3	2. Disconnect the TCC PC solenoid valve. 3. Connect a test lamp between the TCC PC solenoid valve low control circuit and the TCC PC solenoid valve high control circuit. 4. Turn ON the ignition, with the engine OFF. Does the test lamp illuminate for 1 second?	Go to **Step 6**	Go to **Step 4**
4	Test the TCC PC solenoid valve low control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 5**
5	Test the TCC PC solenoid valve low control circuit for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 7**
6	Inspect for poor connections at the TCC PC solenoid valve. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 9**
7	Test the TCC PC solenoid valve high control circuit for an open or a short to ground. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 8**
8	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 10**
9	Replace the TCC PC solenoid valve. Refer to **A/B Clutch Pressure Control Solenoid Assembly Replacement** . Did you complete the replacement?	Go to **Step 11**	-
10	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure.		-

	Did you complete the replacement?	Go to **Step 11**	
11	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Start the engine and idle for 1 minute. 4. Select Specific DTC. 5. Enter DTC P2764. Has the test run and passed?	Go to **Step 12**	Go to **Step 2**
12	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls-3.5L (L66)	System OK

DTC P2769

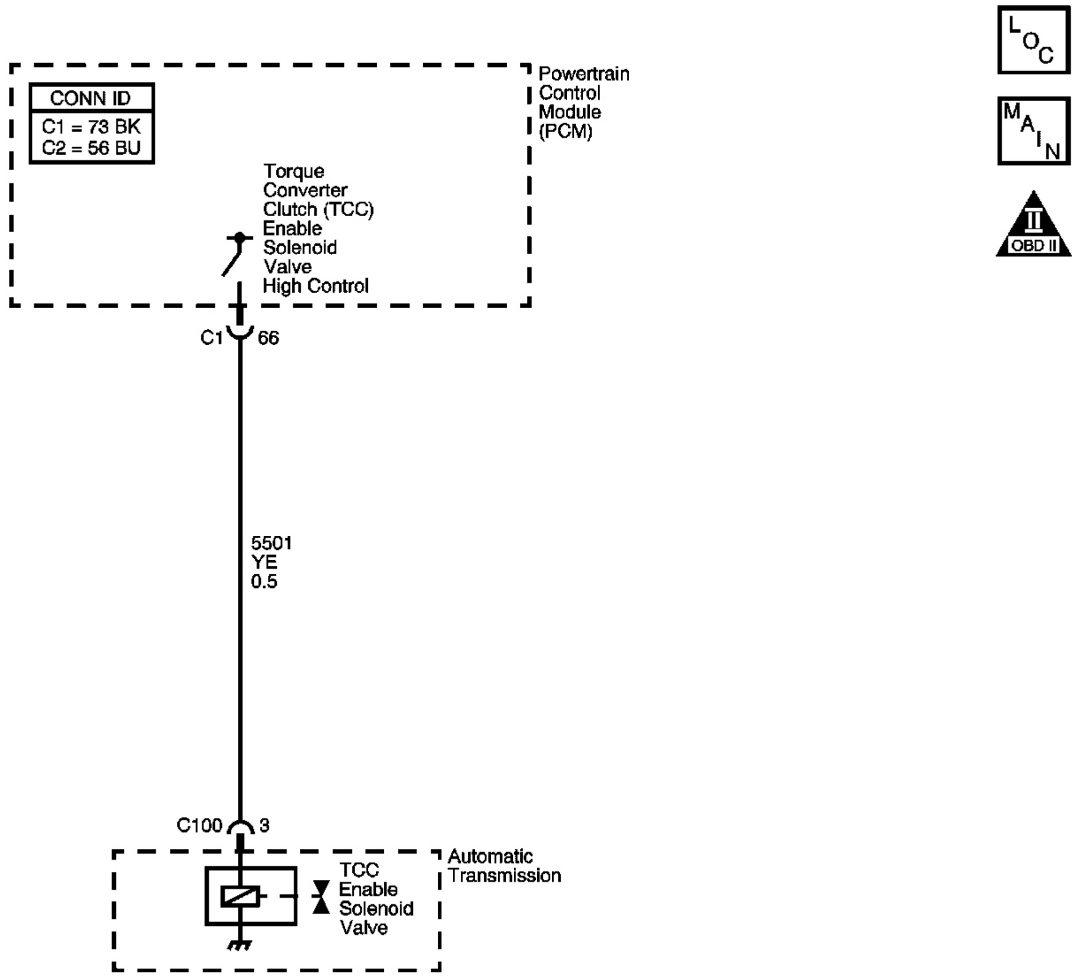


Fig. 21: DTC P2769 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The torque converter clutch (TCC) enable solenoid valve is used with the lock-up shift valve, lock-up control valve and lock-up timing valve in order to control TCC apply and release in response to the powertrain control module (PCM) commands. When it is energized, it allows the fluid pressure from the TCC pressure control (PC) solenoid valve to be exhausted. When it is de-energized, it allows the fluid pressure to apply to the lock-up shift valve. The PCM has an internal diagnostic circuit to monitor the voltage level to the TCC enable solenoid valve, and receives a return signal. When the PCM detects a short to ground on the TCC enable solenoid valve high control circuit, DTC 2769 sets. DTC P2769 is a type A DTC.

Conditions for Running the DTC

- No Clutch PC Solenoid Valve 1 DTCs P0746 or P0747.

- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid Valve 2 DTC P0777.
- No Clutch PC Solenoid Valve 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid Valve 2 DTCs P0966 or P0967.
- No SS Valve 1 DTCs P0973 or P0974.
- No SS Valve 2 DTCs P0976 or P0977.
- No SS Valve 3 DTCs P0979 or P0980.
- No TCC PC Solenoid Valve DTCs P2763 or P2764.
- No TCC Enable Solenoid DTC P2770.
- System voltage is greater than 11 volts.

Conditions for Setting the DTC

The PCM detects a short to ground on the TCC enable solenoid valve high control circuit for 1 second or greater.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P2769 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the TCC enable solenoid valve, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a disconnected TCC enable solenoid valve connector.
- Inspect for an open TCC enable solenoid valve wire.
- Inspect for a faulty TCC enable solenoid valve.

- Inspect for a PCM internal fault.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

> **2:** During the TCC enable solenoid valve operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.
>
> **3:** This step verifies that the PCM is providing voltage to the TCC enable solenoid valve.
>
> **4:** This step tests for an open in the ground circuit to the TCC enable solenoid valve.

DTC P2769

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTCs. 5. With a scan tool observe the TCC Enable Sol. CKT Status parameter. Does the TCC Enable Sol. CKT Status parameter display OK?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the transmission inline 5-way connector. 3. With a test lamp connected to a good ground, probe the TCC enable solenoid valve control circuit on the engine side of the inline 5-way connector. 4. Turn ON the ignition, with the engine OFF.		

	Does the test lamp illuminate for 1 second?	Go to **Step 4**	Go to **Step 5**
4	Test the TCC enable solenoid valve high control circuit internal transmission harness for a short to ground. Refer to **Testing for Short to Ground** in Wiring Systems. Did you find a condition?	Go to **Step 8**	Go to **Step 6**
5	Test the TCC enable solenoid valve high control circuit for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 7**
6	Inspect for poor connections at the transmission inline 5-way connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 9**
7	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 11**	Go to **Step 10**
8	Replace the transmission internal solenoid harness. Refer to **Transmission Wiring Harness Extension Replacement** . Did you complete the repair?	Go to **Step 11**	-
9	Replace the TCC enable solenoid valve. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 11**	-
10	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 11**	-
11	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle at normal operating temperature at speeds of 80-120 km/h (50-70 mph) to enable the TCC.		

	4. Select Specific DTC. 5. Enter DTC P2769. Has the test run and passed?	Go to **Step 12**	Go to **Step 2**
12	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

DTC P2770

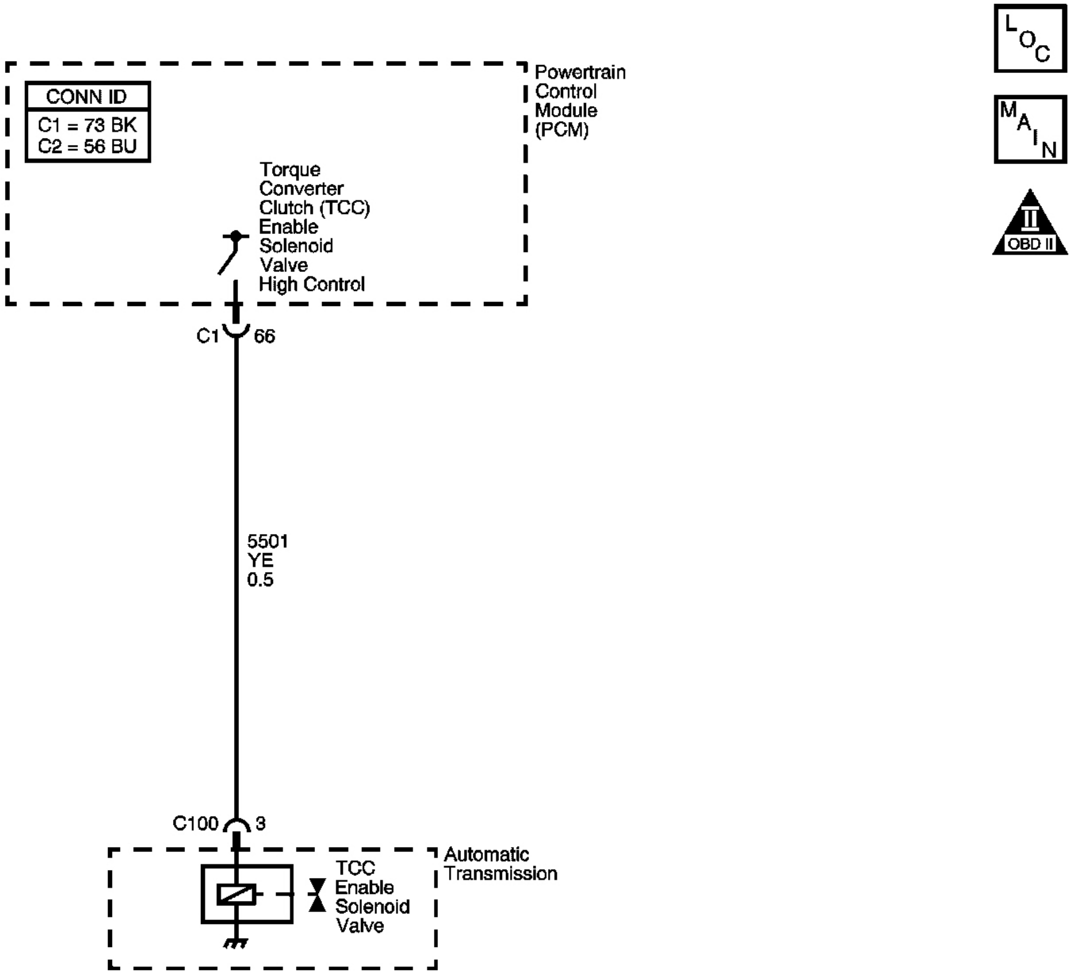


Fig. 22: DTC P2770 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The torque converter clutch (TCC) enable solenoid valve is used with the lock-up shift valve, lock-up control valve and lock-up timing valve, in order to control TCC apply and release in response to PCM commands. When it is energized, it allows the fluid pressure from the TCC pressure control (PC) solenoid valve to be exhausted. When it is de-energized, it allows the fluid pressure to apply to the lock-up shift valve. The PCM has a diagnosis circuit inside, to monitor the voltage level to the TCC enable solenoid valve, and receives a return signal. When the PCM detects an open or short to voltage on the TCC enable solenoid valve high control circuit, DTC 2770 sets. DTC P2770 is a type A DTC.

Conditions for Running the DTC

- No Clutch PC Solenoid Valve 1 DTCs P0746, or P0747.
- No SS Valve Performance DTC P0751.
- No Clutch PC Solenoid Valve 2 DTC P0777.
- No Clutch PC Solenoid Valve 1 DTCs P0962 or P0963.
- No Clutch PC Solenoid Valve 2 DTCs P0966 or P0967.
- No SS Valve 1 DTCs P0973 or P0974.
- No SS Valve 2 DTCs P0976 or P0977.
- No SS Valve 3 DTCs P0979 or P0980.
- No TCC PC Solenoid Valve DTCs P2763 or P2764.
- No TCC Enable Solenoid DTC P2769.
- System voltage is greater than 11 volts.

Conditions for Setting the DTC

The PCM detects an open or short to voltage on the TCC enable solenoid valve high control circuit for 1 second or greater.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL).
- The PCM limits the transmission shift to 4th gear.
- The PCM records the operating conditions when the Conditions for Setting the DTC are met. The PCM stores this information as Freeze Frame and Failure Records.
- The PCM stores DTC P2770 in PCM history.

Conditions for Clearing the MIL/DTC

- The PCM turns OFF the MIL during the third consecutive trip in which the diagnostic test runs and passes.
- A scan tool can clear the MIL/DTC.
- The PCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an

emission related diagnostic fault occurring.

Diagnostic Aids

- Inspect the connectors at the PCM, the TCC enable solenoid valve, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- Inspect for a disconnected TCC enable solenoid valve connector.
- Inspect for an open TCC enable solenoid valve circuit.
- Inspect for a faulty TCC enable solenoid valve.
- Inspect for a PCM internal fault.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: During the TCC enable solenoid valve operation, listen for an audible click. Command the ON and the OFF states. Repeat the commands as necessary.

3: This step verifies that the PCM is providing voltage to the TCC enable solenoid valve.

4: This step tests for an open or short to another circuit within the transmission.

5: This step tests for short voltage to the TCC enable solenoid valve.

6: This step tests for an open in the TCC enable solenoid valve high control circuit.

DTC P2770

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 3.5L (L66)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** **Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.** 3. Record the DTC Freeze Frame and Failure Records.		

	4. Clear the DTCs. 5. With a scan tool observe the TCC Enable Sol. CKT Status parameter. Does the TCC Enable Sol. CKT Status parameter display OK?	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the transmission inline 4-way connector. 3. With a test lamp connected to a good ground, probe the TCC enable solenoid valve control circuit on the engine side of the inline 4-way connector. 4. Turn ON the ignition, with the engine OFF. Does the test lamp illuminate for 1 second?	Go to **Step 4**	Go to **Step 5**
4	Test the TCC enable solenoid valve high control circuit internal transmission harness for an open or short to another circuit. Refer to **Testing for Continuity** in Wiring Systems. Did you find a condition?	Go to **Step 10**	Go to **Step 8**
5	Does the test lamp remain illuminated?	Go to **Step 7**	Go to **Step 6**
6	Test the TCC enable solenoid valve control circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 9**
7	Test the TCC enable solenoid valve high control circuit for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 9**
8	Inspect for poor connections at the TCC enable solenoid valve. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 11**
9	Inspect for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 13**	Go to **Step 12**
	Replace the transmission internal solenoid		

10	harness. Refer to **Transmission Wiring Harness Extension Replacement** . Did you complete the repair?	Go to **Step 13**	-
11	Replace the TCC enable solenoid valve. Refer to **Accumulator Valve Body Assembly Overhaul** . Did you complete the replacement?	Go to **Step 13**	-
12	**IMPORTANT:** **Always perform the PCM set up procedure.** 1. Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** in Engine Controls - 3.5L (L66). 2. Perform the PCM set up procedure. Did you complete the replacement?	Go to **Step 13**	-
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Idle the engine in PARK for 10 seconds. 4. Select Specific DTC. 5. Enter DTC 2770. Has the test run and passed?	Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info. and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) Type(s)** in Engine Controls - 3.5L (L66)	System OK

SPECIFICATIONS

TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR SPECIFICATIONS

Transmission Fluid Temperature (TFT) Sensor Specifications

Temperature °F	Temperature °C	Minimum Resistance ohm	Nominal Resistance ohm	Maximum Resistance ohm
-40	-40	90636	100707	110778
-22	-30	47416	52684	57952
-4	-20	25809	28677	31545
14	-10	14558	16176	17794
32	0	8481	9423	10365
50	10	5104	5671	6238
68	20	3164	3515	3867
86	30	2013	2237	2461
104	40	1313	1459	1605
122	50	876	973	1070
140	60	600	667	734
158	70	420	467	514
176	80	299	332	365
194	90	217	241	265
212	100	159	177	195
230	110	119	132	145
248	120	89.9	99.9	109.9
266	130	69.1	76.8	84.5
284	140	53.8	59.8	65.8
302	150	42.5	47.2	51.9

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Description of Usage	Ref No.*	Qty	Size	Specification	
				Metric	English
Axle Shaft Hub Nut	-	-	-	205 N.m	151 lb ft
B+ Cable to Starter Nut	-	-	-	10 N.m	89 lb in
Battery Cooling Box Cover Screws	-	-	-	2 N.m	18 lb in
Battery Hold Down Screw	-	-	-	15 N.m	11 lb ft
Battery Terminal Bolts	-	-	-	17 N.m	13 lb ft

Battery Tray Bracket Screws	-	-	-	16N.m	12 lb ft
Bearing Retainer Bolts - 8 mm	-	-	-	5 N.m	44 lb in
Bearing Retainer Bolts - 10 mm	-	-	-	9 N.m	80 lb in
Bearing Retainer Nuts	-	-	-	11 N.m	97 lb in
Bracket-to-Engine Bolts	-	-	-	35 N.m	26 lb ft
Case Assembly Bolts	-	-	-	28 N.m	21 lb ft
Case Cover to Case Assembly	108	12	M8x1.25x40	28 N.m	21 lb ft
Control Valve Body Cover to Case Assembly	60	17	M6x1.0x25	11 N.m	97 lb in
Control Valve Body to Case Assembly	79	3	M5x0.8x78	8 N.m	71 lb in
Control Valve Body to Case Assembly	71	15	M6x1.0x80	15 N.m	11 lb ft
Drive Pulley Bearing Retainer - Nut	101	3	M6x1.0	11 N.m	97 lb in
Drive Pulley Cover to Case Cover	105	4	M6x1.0x25	11 N.m	97 lb in
Drive Shaft Bolts	-	-	-	30 N.m	22 lb ft
Drive Shaft Fasteners	-	-	-	25 N.m	18 lb ft
Driven Pulley Bearing Retainer	112	6	M6x1.0x25	5 N.m	44 lb in
Driven Pulley Cover/Case Cover to Case Assembly	115	2	M8x1.25x50	28 N.m	21 lb ft
Driven Pulley Cover to Case Cover	105	4	M6x1.0x25	11 N.m	97 lb in
Engine Control Module Connector Bolt	-	-	-	4 N.m	35 lb in
Fluid Baffle	12	3	M6x1.0x17	11 N.m	97 lb in
Fluid Baffle - Bottom to Case Assembly	58	1	M5x0.8x13	11 N.m	97 lb in
Fluid Fill Lower Tube Assembly	52	1	3/8-18 NPTFx75	20 N.m	15 lb ft
Fluid Fill Lower Tube Assembly Plug	53	1	1/8-27 NPTFx10.7	11 N.m	97 lb in
Fluid Pressure Test Hole Plug	55	1	1/8-27 NPTFx15.8	9 N.m	80 lb in
Fluid Pump to Case Assembly	19	2	M6x1.0x55	11 N.m	97 lb in
Fluid Pump to Case Assembly	20	2	M6x1.0x70	11 N.m	97 lb in
Frame-to-Body Bolts	-	-	-	150 N.m	111 lb ft
Front Axle Shaft Hub Nut	-	-	-	205 N.m	151 lb ft
Front Axle to Knuckle Nut	-	-	-	205 N.m	151 lb ft
Front Pitch Restrictor Bolts	-	-	-	50 N.m	37 lb ft
Input and Output Speed Sensor Assembly to Case	75	2	M6x1.0x17	11 N.m	97 lb in
Junction Block Bracket Bolt	-	-	-	25 N.m	18 lb ft
Junction Block Bracket Nuts	-	-	-	10 N.m	89 lb in
Lower Control Arm Ball Stud to Knuckle Nut	-	-	-	10 N.m+ 150 degrees	89 lb in+ 150 degrees
Lower Control Arm Nut	-	-	-	10 N.m+ 150 degrees	89 lb in+ 150 degrees

Lower Control Arm to Knuckle Nut	-	-	-	10 N.m+ 150 degrees	89 lb in+ 150 degrees
Lower Stabilizer Nut	-	-	-	65 N.m	48 lb ft
Lube Oil Pipe to Case Assembly	75	1	M6x1.0x17	11 N.m	97 lb in
Manual Shaft Detent Assembly Bolts	-	-	-	11 N.m	97 lb in
Manual Shift Shaft - Nut	46	1	M10x1.5	30 N.m	22 lb ft
Oil Cooler Line Assembly Nut	-	-	-	7 N.m	62 lb in
Park/Neutral Position Switch	38	2	M6x1.0x16	11 N.m	97 lb in
Park/Neutral Position Switch Lever Nut	-	-	-	16 N.m	12 lb ft
Power Take-Off Bracket Bolts	-	-	-	60N.m	44 lb ft
Power Take-Off Unit Bolts	-	-	-	60N.m	44 lb ft
Rack and Pinion Bolts	-	-	-	110 N.m	81 lb ft
Rear Pitch Restrictor Through	-	-	-	110 N.m	81 lb ft
S Terminal Nut	-	-	-	5 N.m	44 lb in
Shift Cable Retaining Nut	-	-	-	10 N.m	89 lb in
Shift Control Nuts	-	-	-	25 N.m	18 lb ft
Stabilizer Bar Link Nut	-	-	-	65 N.m	48 lb ft
Starter Bolts	-	-	-	40 N.m	30 lb ft
Through Bolt	-	-	-	110 N.m	81 lb in
Tie Rod End Nut	-	-	-	50 N.m	37 lb ft
Tie Rod Installation Tool	-	-	-	40 N.m	30 lb ft
Tie Rod to Knuckle Installation Tool	-	-	-	40 N.m	30 lb ft
Torque Converter and Differential Housing Assembly to Case Assembly	5	22	M8x1.25x35	28 N.m	21 lb ft
Torque Converter Bolts	-	-	-	65 N.m	48 lb ft
Torque Converter-to-Flexplate Bolts	-	-	-	60 N.m	44 lb ft
Transmission Cooler Line Nut	-	-	-	7 N.m	62 lb in
Transmission Cooler Lines	-	-	-	16 N.m	12 lb ft
Transmission to Engine Bolts	-	-	-	75 N.m	55 lb ft
Transaxle Lower Tube Assembly	-	-	-	20 N.m	15 lb ft
Transaxle Lower Tube Plug	-	-	-	11 N.m	97 lb in
Transaxle Mount Bolts - Upper Left	-	-	-	50 N.m	37 lb ft
Transaxle Oil Cooler Line Assembly Nut	-	-	-	7 N.m	62 lb in
Transaxle Range Switch Bolts	-	-	-	11 N.m	97 lb in
Transaxle Range Switch Lever Nut	-	-	-	16 N.m	12 lb ft
Transaxle-to-Engine Bolts	-	-	-	75 N.m	55 lb ft
Valve Assembly	-	-	-	12 N.m	106 lb in
Valve Body Assembly Bolts	-	-	-	8 N.m	71 lb in
Valve Body Cover Bolts	-	-	-	11 N.m	97 lb in
Wheel Nuts	-	-	-	125 N.m	92 lb ft
*Reference number refers to the callout number on the disassembled views.					

SEALERS, ADHESIVES, AND LUBRICANTS

Sealers, Adhesives, and Lubricants

Application	Type of Material	GM Part Number
Torque Converter and Differential Housing Assembly to Transmission Case Assembly Mating Surface	Sealant	22722716
Case Cover Assembly to Transmission Case Assembly Mating Surface	Sealant	22722716

TRANSMISSION GENERAL SPECIFICATIONS

Transmission General Specifications

Name	Hydra-Matic VT25-E
RPO Codes	M75(2WD)/M16(F4WD)
Production Location	Hungary
Transaxle Drive	Transverse - Mounted Front Wheel Drive
Forward Ratio Spread	0.44-2.61:1
Reverse Ratio Spread	2.15:1
Overall Ratio Spread	5.9:1
Torque Converter Size (Diameter of Torque Converter Turbine)	225 mm
Pressure Taps	Line Pressure
Transaxle Fluid Type	DEX-CVT(R) and Automatic Transmission Additive
Transaxle Fluid Capacity (Approximate)	Dry: 8.07 L (8.53 qts)
Transaxle Type: V	Continuously Variable
Transaxle Type: T	Transverse Mount
Transaxle Type: 25	Product Series
Transaxle Type: E	Electronic Controls
Final Drive Ratio	3.52
Transfer Gear Ratio	1.41
Effective Gear Ratio	4.97
Six Position Quadrant	P, R, N, D, I, L
Case Material	Die Cast Aluminum
Transaxle Weight Wet	VT25-E 2WD 83 kg (183.0 lbs)
	VT25-E F4WD 83.5 kg (184.1 lbs)
Maximum Trailer Towing Capacity	680 kg (1500 lbs)
Maximum Gross Vehicle Weight (GVW)	2100 kg (4360 lbs)

FLUID CAPACITY SPECIFICATIONS

Fluid Capacity Specifications

Application	Specification	
	Metric	English
Overhaul	8.07 liters	8.53 quarts

END PLAY SPECIFICATIONS

End Play Specifications

Application	Specification	
	Metric	English
Torque Converter	0.1-0.5 mm	0.004-0.020 in
Input Shaft Carrier Pinion	0.14-0.65 mm	0.01-0.026 in
Belt Assembly - between elements	2.0 mm or less	0.079 in or less

FORWARD CLUTCH BACKING PLATE SPECIFICATIONS

Forward Clutch Backing Plate Specifications

Recorded Measurement	Backing Plate Identification
5.159-5.399 mm (0.203-0.213 in)	B
5.400-5.641 mm (0.213-0.222 in)	C
5.642-5.882 mm (0.222-0.232 in)	D
5.883-6.124 mm (0.232-0.241 in)	E
6.125-6.365 mm (0.241-0.251 in)	F
6.366-6.607 mm (0.251-0.260 in)	G

REVERSE CLUTCH BACKING PLATE SPECIFICATIONS (FLAT CLUTCH PLATE DESIGN-I.D. SPLINE)

Flat Clutch Plate Design - I.D. Spline

Recorded Measurement	Backing Plate Identification
5.476-5.947 mm (0.216-0.234 in)	J
5.948-6.420 mm (0.234-0.253 in)	K
6.421-6.892 mm (0.253-0.271 in)	L

REVERSE CLUTCH BACKING PLATE SPECIFICATIONS (WAVE CLUTCH PLATE DESIGN-I.D.

SPLINE)

Wave Clutch Plate Design - I.D. Spline

Recorded Measurement	Backing Plate Identification
5.118-5.325 mm (0.201-0.209 in)	F
5.326-5.533 mm (0.210-0.217 in)	G
5.534-5.574 mm (0.218-0.225 in)	H
5.741-5.948 mm (0.226-0.234 in)	J
5.949-6.156 mm (0.235-0.242 in)	K
6.157-6.363 mm (0.243-0.251 in)	L

RANGE REFERENCE

Range Reference

Range	Controller State	Solenoids				Forward Clutch	Reverse Clutch
		Neutral Idle/TCC ON/OFF	Neutral Idle/TCC Clutch Control	Line Pressure Control	Radio Control Motor		
Park	-	OFF	Low	Variable	Low	-	-
Reverse	R	OFF	Variable	Variable	Variable	-	Applied
Neutral	-	OFF	Low	Variable	Low	-	-
Drive	TCC Released	OFF	Variable	Variable	Variable	Applied	-
	TCC Applied	ON	Variable	Variable	Variable	Applied	-
	Neutral Idle	OFF	High	Variable	Low	Applied	-

RATIO VS SPEED

Ratio from Stop

Throttle Angle	Output Speed (RPM)											
-	192.25	384.75	577	769.5	1154.25	1538.75	1923.5	2308.25	2693	3077.75	3462.5	3847.25
6.25	0.37	0.38	0.39	0.39	0.48	0.58	0.66	0.74	0.80	0.84	0.91	0.97
12.5	0.37	0.38	0.39	0.39	0.48	0.58	0.66	0.75	0.80	0.84	0.91	0.97
18.75	0.37	0.38	0.39	0.39	0.48	0.58	0.68	0.74	0.80	0.84	0.91	0.97
25	0.37	0.38	0.39	0.39	0.48	0.58	0.67	0.74	0.81	0.84	0.91	0.97

31.25	0.37	0.38	0.39	0.39	0.46	0.53	0.62	0.69	0.77	0.84	0.91	0.97
37.5	0.37	0.38	0.39	0.39	0.43	0.47	0.58	0.66	0.74	0.80	0.87	0.93
43.75	0.37	0.38	0.39	0.39	0.43	0.47	0.55	0.64	0.72	0.78	0.84	0.89
50	0.37	0.38	0.39	0.39	0.43	0.47	0.55	0.62	0.69	0.75	0.81	0.86
56.25	0.37	0.38	0.39	0.39	0.43	0.47	0.55	0.61	0.68	0.73	0.79	0.82
62.5	0.37	0.38	0.39	0.39	0.43	0.47	0.55	0.61	0.68	0.74	0.78	0.83
68.75	0.37	0.38	0.39	0.39	0.43	0.47	0.55	0.61	0.68	0.73	0.78	0.83
75	0.37	0.38	0.39	0.39	0.43	0.47	0.55	0.61	0.68	0.73	0.79	0.82
81.25	0.37	0.38	0.39	0.39	0.43	0.47	0.55	0.61	0.66	0.72	0.76	0.80
87.5	0.37	0.38	0.39	0.39	0.43	0.47	0.53	0.57	0.64	0.69	0.74	0.78
93.75	0.37	0.38	0.39	0.39	0.43	0.47	0.53	0.58	0.64	0.69	0.74	0.78
99.99	0.37	0.38	0.39	0.39	0.43	0.47	0.50	0.54	0.58	0.62	0.68	0.75

Ratio Steady State

Throttle Angle	Output Speed (RPM)											
-	192.25	384.75	577	769.5	1154.25	1538.75	1923.5	2308.25	2693	3077.75	3462.5	3847.25
6.25	0.38	0.38	0.48	0.62	0.91	1.15	1.37	1.60	1.70	1.83	1.82	1.81
12.5	0.38	0.38	0.48	0.62	0.91	1.15	1.37	1.60	1.69	1.82	1.82	1.81
18.75	0.38	0.38	0.48	0.62	0.91	1.15	1.36	1.58	1.65	1.77	1.78	1.81
25	0.38	0.38	0.48	0.56	0.82	1.03	1.20	1.35	1.46	1.59	1.68	1.73
31.25	0.38	0.38	0.38	0.52	0.74	0.92	1.07	1.21	1.33	1.47	1.59	1.64
37.5	0.38	0.38	0.38	0.47	0.67	0.83	0.97	1.13	1.23	1.37	1.48	1.55
43.75	0.38	0.38	0.38	0.44	0.62	0.76	0.88	1.01	1.12	1.25	1.33	1.42
50	0.38	0.38	0.38	0.43	0.57	0.70	0.81	0.94	1.03	1.14	1.21	1.30
56.25	0.38	0.38	0.38	0.42	0.55	0.67	0.77	0.87	0.95	1.05	1.13	1.22
62.5	0.38	0.38	0.38	0.41	0.52	0.63	0.72	0.79	0.87	0	-	-

TRANSMISSION RANGE SWITCH LOGIC

Transmission Range Switch Logic

Gear Select	Signal Circuits			
	A	B	C	P
P	HI	LOW	LOW	HI
R	HI	HI	LOW	LOW
N	LOW	HI	LOW	HI
D	LOW	HI	HI	LOW
I	HI	HI	HI	HI
L	HI	LOW	HI	LOW

- HI = Ignition voltage
- LOW = 0 voltage

LINE PRESSURE

Line Pressure

Pressure Control Solenoid Current - Amps	Engine Speed - RPM	Approximate Line Pressure	
		Metric	English
0.2	1300 - 1400	4495-5502 kPa	652-798 psi
1.0	Idle	1048-1848 kPa	152-268 psi

COMPONENT RESISTANCE

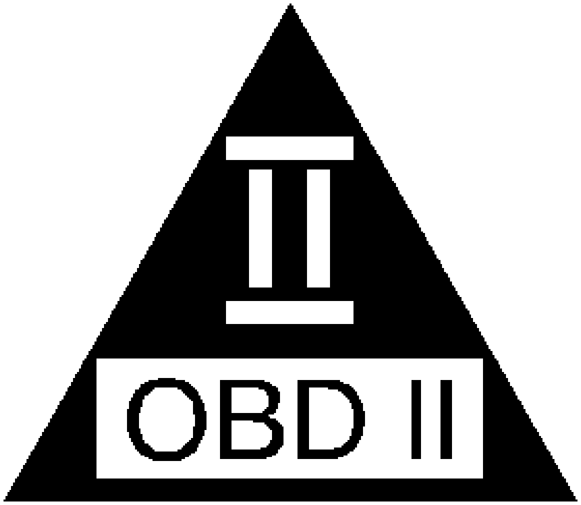
Component Resistance

Component Resistance	Connector Pins	Resistance 20°C (68°F)	Resistance to Ground (Case)
Automatic Transmission Input (Shaft) Speed Sensor	2, 3	1,000-2,000 ohm	Greater than 50 K ohm
Automatic Transmission Output (Shaft) Speed Sensor	4, 5	1,000-2,000 ohm	Greater than 50 K ohm
Ratio Control Motor Coil - PWR to Either Coil	19 to 10, 17, 18, or 20	20-30 ohm	Greater than 50 K ohm
Ratio Control Motor Coil - Coil to Coil	10, 17, 18, 20	40-60 ohm	Greater than 50 K ohm
Transmission Fluid Pressure Sensor PWR to Signal	11, 12	Greater than 1 M ohm	Greater than 50 K ohm
Transmission Fluid Pressure Sensor PWR to GRD	1, 11	Greater than 1 M ohm	Greater than 50 K ohm
Transmission Fluid Pressure Sensor Signal to GRD	1, 12	6,000-10,000 ohm	Greater than 50 K ohm
Line Pressure Control Solenoid Valve	15, 16	3.3-4.3 ohm	Greater than 500 K ohm
Torque Converter Clutch (TCC) Enable Solenoid Valve	8, 9	18-22 ohm	Greater than 500 K ohm
Torque Converter Clutch (TCC) Pressure Control Solenoid Valve	6, 7	3.3-4.3 ohm	Greater than 500 K ohm
*Transmission Fluid Temperature (TFT) Sensor	13, 14	3,164-3,867 ohm	Greater than 500 K ohm
IMPORTANT: ***The resistance of this device is necessarily dependent on the temperature. Therefore the resistance will vary far more than any other device.**			

SCHEMATIC AND ROUTING DIAGRAMS

AUTOMATIC TRANSMISSION SCHEMATIC ICONS

Automatic Transmission Schematic Icons

<table>
<tr><th>Icon</th><th>Icon Definition</th></tr>
<tr><td>
</td><td>NOTE:
The OBD II symbol is used on the circuit diagrams in order to alert the technician that the circuit is essential for proper OBD II emission control circuit operation. Any circuit which fails and causes the malfunction indicator lamp (MIL) to turn ON, or causes emissions-related component damage, is identified as an OBD II circuit.</td></tr>
<tr><td></td><td>IMPORTANT:
Twisted-pair wires provide an effective "shield" that helps protect sensitive electronic components from electrical interference. If the wires were covered with shielding, install new shielding.
In order to prevent electrical interference from degrading the performance of the connected components, you must maintain the proper specification when making any repairs to the twisted-pair wires shown :
The wires must be twisted a minimum of 10 turns per 31 cm (12 in) as measured anywhere along the length of the wires
The outside diameter of the twisted wires must not exceed 6.0 mm</td></tr>
</table>

AUTOMATIC TRANSMISSION CONTROLS SCHEMATICS

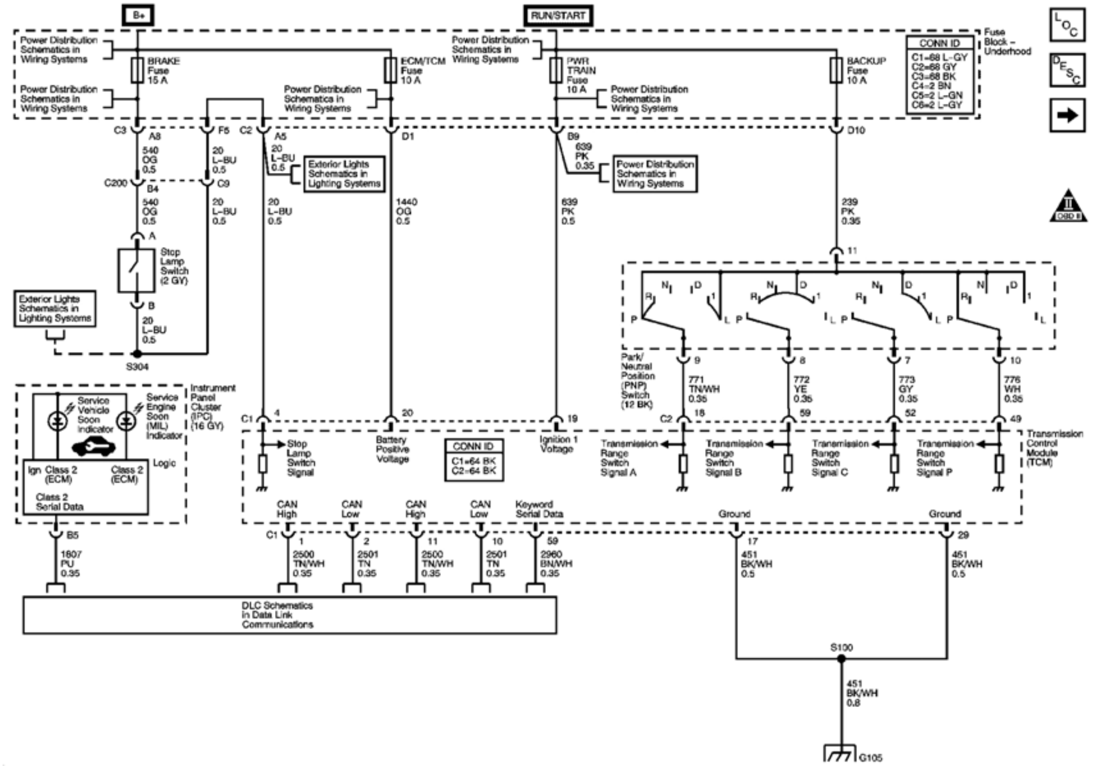


Fig. 1: Power, Ground, Serial Data, And Switch Signals Schematics
Courtesy of GENERAL MOTORS CORP.

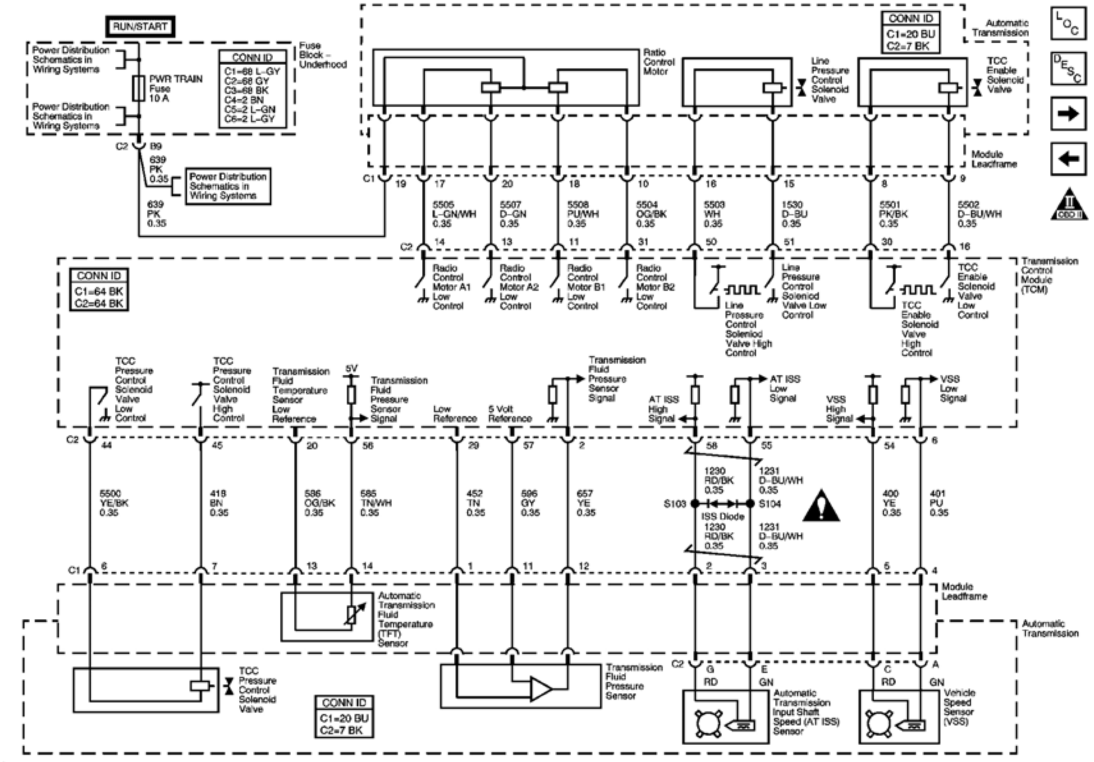


Fig. 2: Sensors And Solenoids Schematics - Late Production
Courtesy of GENERAL MOTORS CORP.

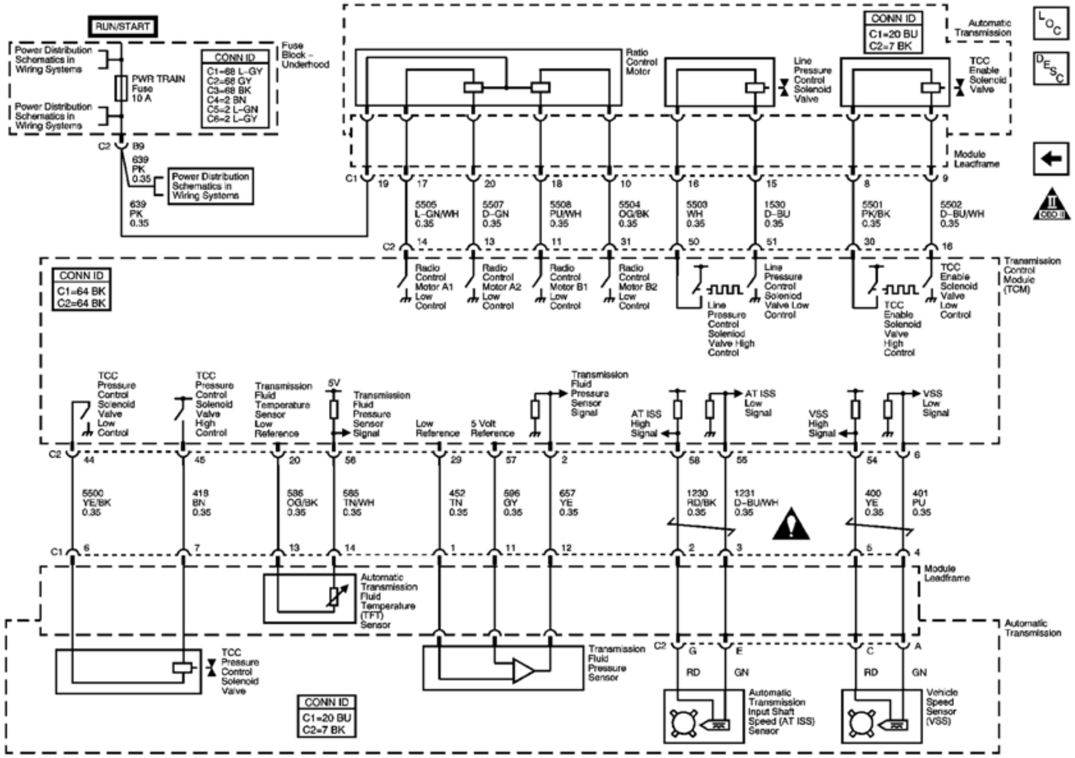


Fig. 3: Sensors And Solenoids Schematics - Early Production
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

AUTOMATIC TRANSMISSION ELECTRONIC COMPONENT VIEWS

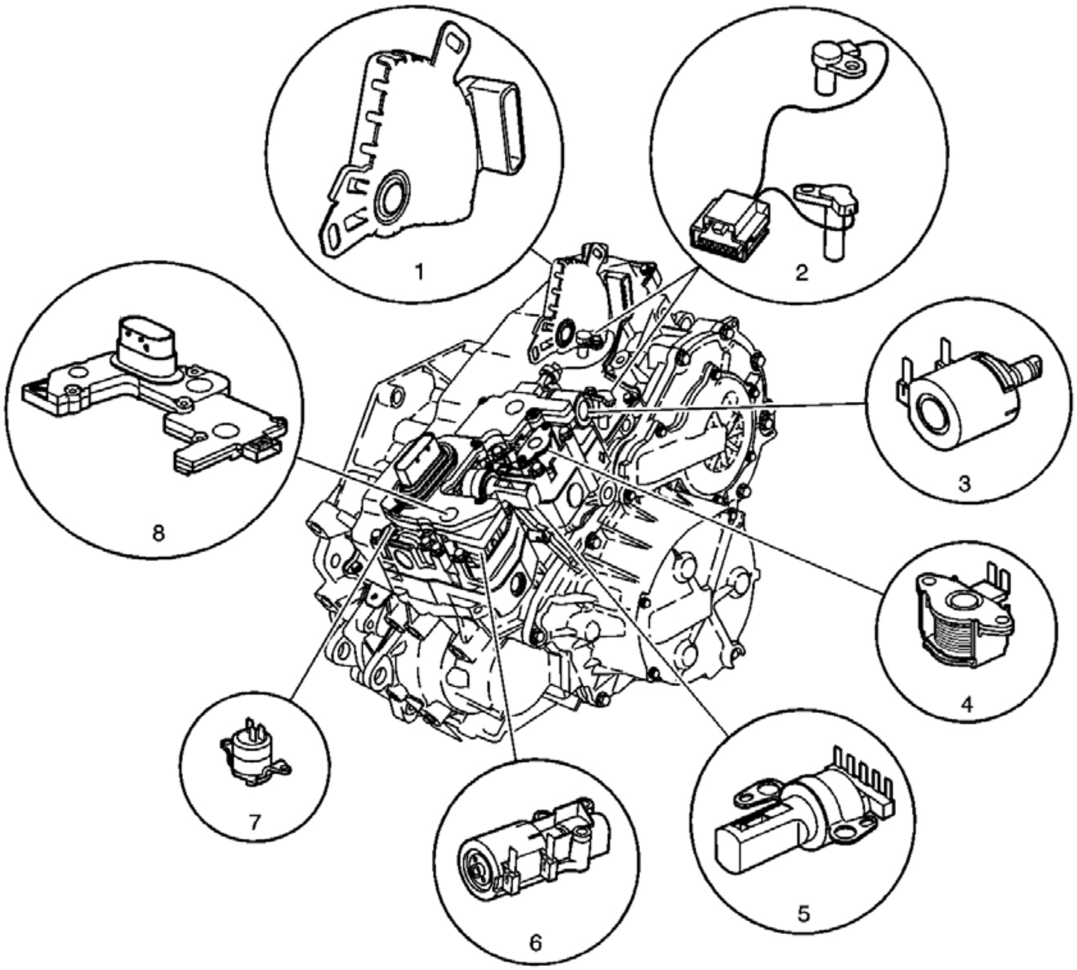


Fig. 4: Automatic Transmission Electronic Component Locations
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
1	Park/Neutral Position Switch Assembly (39)
2	Automatic Transmission Input and Output Speed Sensor Assembly (74)
3	TCC Pressure Control Solenoid Valve
4	TCC Enable Solenoid Valve
5	Ratio Control Motor
6	Line Pressure Control Solenoid Valve
7	Transmission Fluid Pressure Sensor
8	Module Leadframe

DISASSEMBLED VIEWS

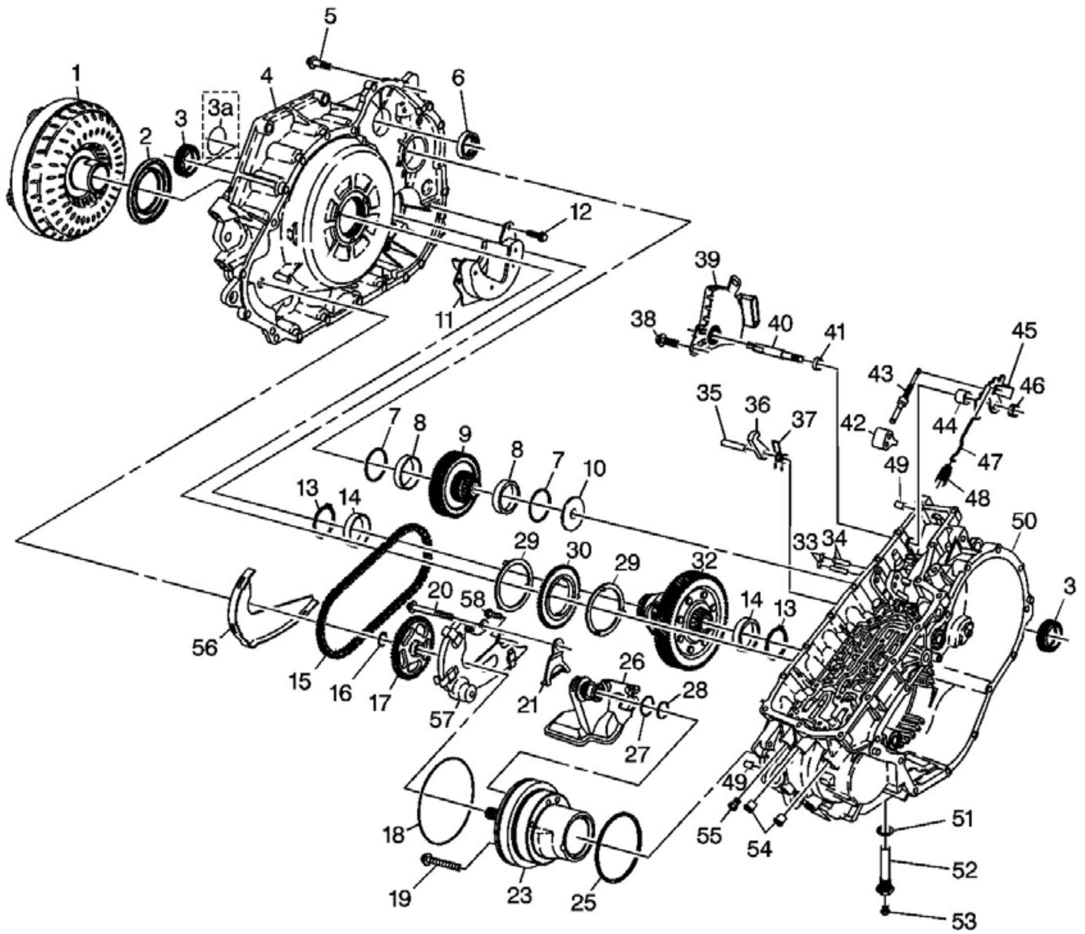


Fig. 5: Case And Components -1 Of 2
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Torque Converter Assembly
2	Torque Converter and Differential Housing Seal Assembly
3	Front Wheel Drive Shaft Oil Seal Assembly - 2WD
3a	Front Wheel Drive Shaft Oil O-Ring Seal - F4WD
4	Torque Converter and Differential Housing Assembly - Model Specific
5	Torque Converter and Differential Housing Bolt/Screw - M8 x 1.25 x 35
6	Variable Driven Pulley Bearing Assembly
7	Front Differential Drive Pinion Gear Shim
8	Front Differential Drive Pinion Gear Bearing Cup
9	Front Differential Drive Pinion Gear Assembly
10	Automatic Transmission Case Plug

11	Transmission Fluid Baffle
12	Transmission Fluid Baffle Bolt/Screw - M6 x 1.0 x 17
13	Front Differential Bearing Shim
14	Front Differential Carrier Bearing Cup
15	Drive Link Assembly
16	Driven Sprocket Retaining Ring
17	Driven Sprocket
18	Automatic Transmission Fluid Pump O-Ring Seal
19	Automatic Transmission Fluid Pump Bolt/Screw - M6 x 1.0 x 55
20	Bolt/Screw - M6 x 1.0 x 70
21	Automatic Transmission Fluid Filter Retainer
23	Automatic Transmission Fluid Pump Assembly
25	Automatic Transmission Fluid Pump Seal
26	Automatic Transmission Fluid Filter Assembly
27	Automatic Transmission Fluid Filter O-Ring Seal
28	Automatic Transmission Fluid Filter O-Ring Seal
29	Drive Sprocket Thrust Washer
29	Drive Sprocket Thrust Washer
30	Drive Sprocket
32	Front Differential Carrier Assembly
33	Park Pawl Shaft Hole Plug
34	Park Pawl Actuator Guide Pin
35	Park Pawl Reaction Pin
36	Park Pawl
37	Park Pawl Spring
38	Park/Neutral Position Switch Assembly Bolt/Screw - M6 x 1.0 x 18.4
39	Park/Neutral Position Switch Assembly
40	Manual Shift Shaft
41	Manual Shift Shaft Seal Assembly
42	Park Pawl Actuator Guide
43	Park Pawl Actuator Assembly
44	Manual Shift Shaft Retainer
45	Manual Shaft Detent Lever
46	Manual Shift Shaft Nut
47	Manual Valve Link
48	Manual Valve Link Spring
49	Transmission Case Locator Pin
50	Automatic Transmission Case Assembly
51	Transmission Fluid Fill Lower Tube Seal
52	Transmission Fluid Fill Lower Tube
53	Transmission Fluid Fill Lower Tube Plug

54	Transmission Fluid Cooler Pipe Fitting Seal
55	Automatic Transmission Fluid Pressure Test Hole Plug
56	Transmission Fluid Baffle - Top
57	Transmission Fluid Baffle - Bottom
58	Transmission Fluid Baffle Bolt/Screw - M5 x 0.8 x 13

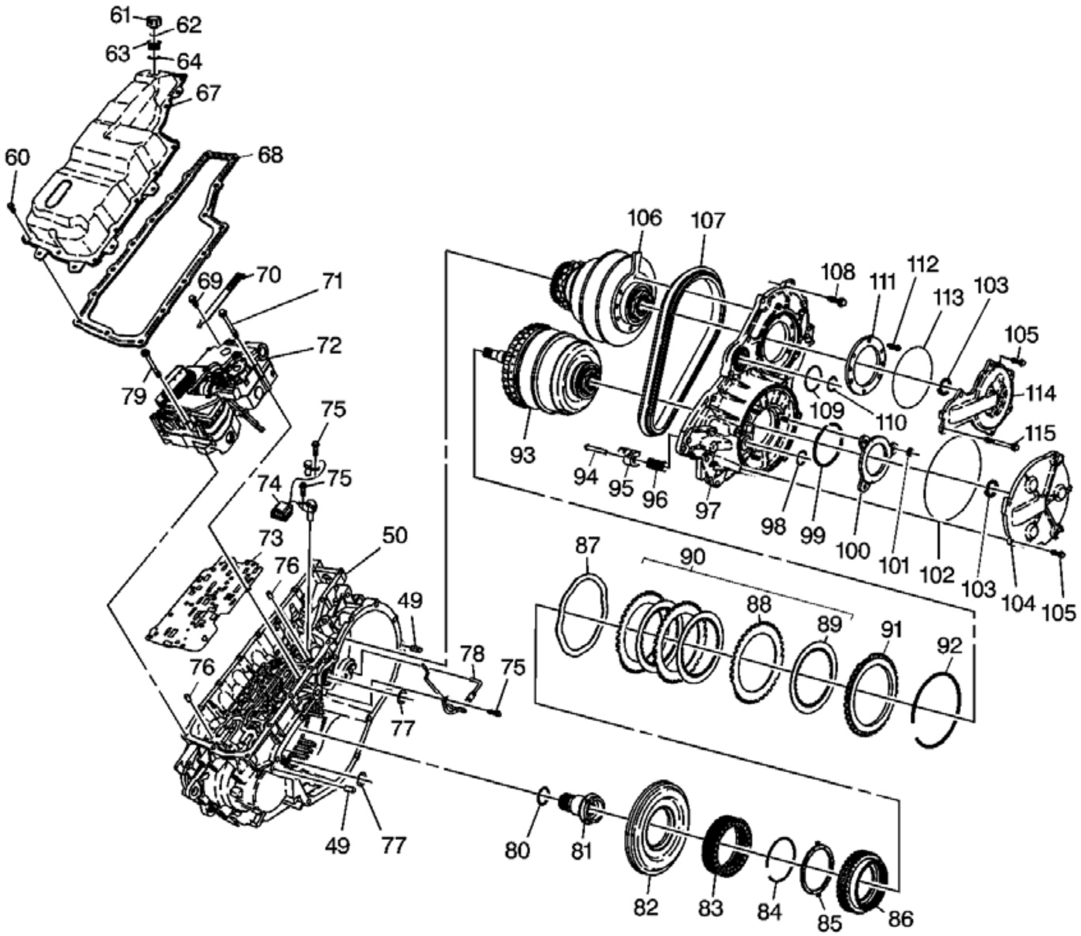


Fig. 6: Case And Components - 2 Of 2
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
49	Transmission Case Locator Pin
50	Automatic Transmission Case Assembly
60	Control Valve Body Cover Bolt/Screw - M6 x 1.0 x 25
61	Automatic Transmission Vent Cap
62	Automatic Transmission Vent Cap O-Ring

63	Automatic Transmission Vent Cap Insert
64	Automatic Transmission Vent Cap Insert O-Ring
67	Control Valve Body Cover
68	Control Valve Body Cover Gasket
69	Manual Shaft Detent Assembly Bolt/Screw - M6 x 1.0 x 30
70	Manual Shaft Detent Assembly
71	Control Valve Body Bolt/Screw - M6 x 1.0 x 80
72	Control Valve Body Assembly
73	Control Valve Body Spacer - with Gasket - Plate
74	Automatic Transmission Input and Output Speed Sensor Assembly
75	Bolt/Screw - M6 x 1.0 x 17
76	Control Valve Body Locator Pin
77	Automatic Transmission Case Cover - O-Ring - Seal
78	Lube Oil Pipe
79	Control Valve Body Bolt/Screw - M5 x 0.8 x 78
80	Stator Shaft Seal
81	Stator Shaft Assembly
82	Reverse Clutch Piston Assembly
83	Reverse Clutch Spring Assembly
84	Reverse Clutch Spring Retaining Ring
85	Reverse Clutch Hub Thrust Washer
86	Reverse Clutch - with Input Internal Gear - Hub Assembly
87	Reverse Clutch - Waved - Plate
88	Reverse Clutch Plate Assembly - Spline OD
89	Reverse Clutch Plate Assembly - Spline ID
90	Reverse Clutch Plate Set
91	Reverse Clutch Backing Plate
92	Reverse Clutch Backing Plate Retaining Ring
93	Variable Drive Pulley Assembly
94	Variable Drive Pulley Follower Pin
95	Variable Drive Pulley Follower
96	Variable Drive Pulley Follower Spring
97	Automatic Transmission Case Cover Assembly
98	Variable Drive Pulley Opening Cover Seal
99	Variable Drive Pulley Bearing Retaining Ring
100	Variable Drive Pulley Bearing Retainer
101	Variable Drive Pulley Bearing Retainer Nut - M6 x 1.0
102	Variable Drive Pulley Opening Cover Seal
103	Automatic Transmission Case Cover Seal
104	Variable Drive Pulley Opening Cover
105	Variable Pulley Opening Cover Bolt/Screw - M6 x 1.0 x 25

106	Variable Driven Pulley Assembly
107	Variable Drive Belt Assembly
108	Automatic Transmission Case Cover Bolt/Screw - M8 x 1.25 x 40
109	Variable Driven Pulley Opening Cover Seal
110	Automatic Transmission Case Cover - O-Ring - Seal
111	Variable Driven Pulley Bearing Retainer - Selective
112	Variable Driven Pulley Bearing Retainer Bolt/Screw - M6 x 1.0 x 25
113	Variable Driven Pulley Opening Cover Seal
114	Variable Driven Pulley Opening Cover
115	Variable Driven Pulley Opening Cover Bolt/Screw - M8 x 1.25 x 50

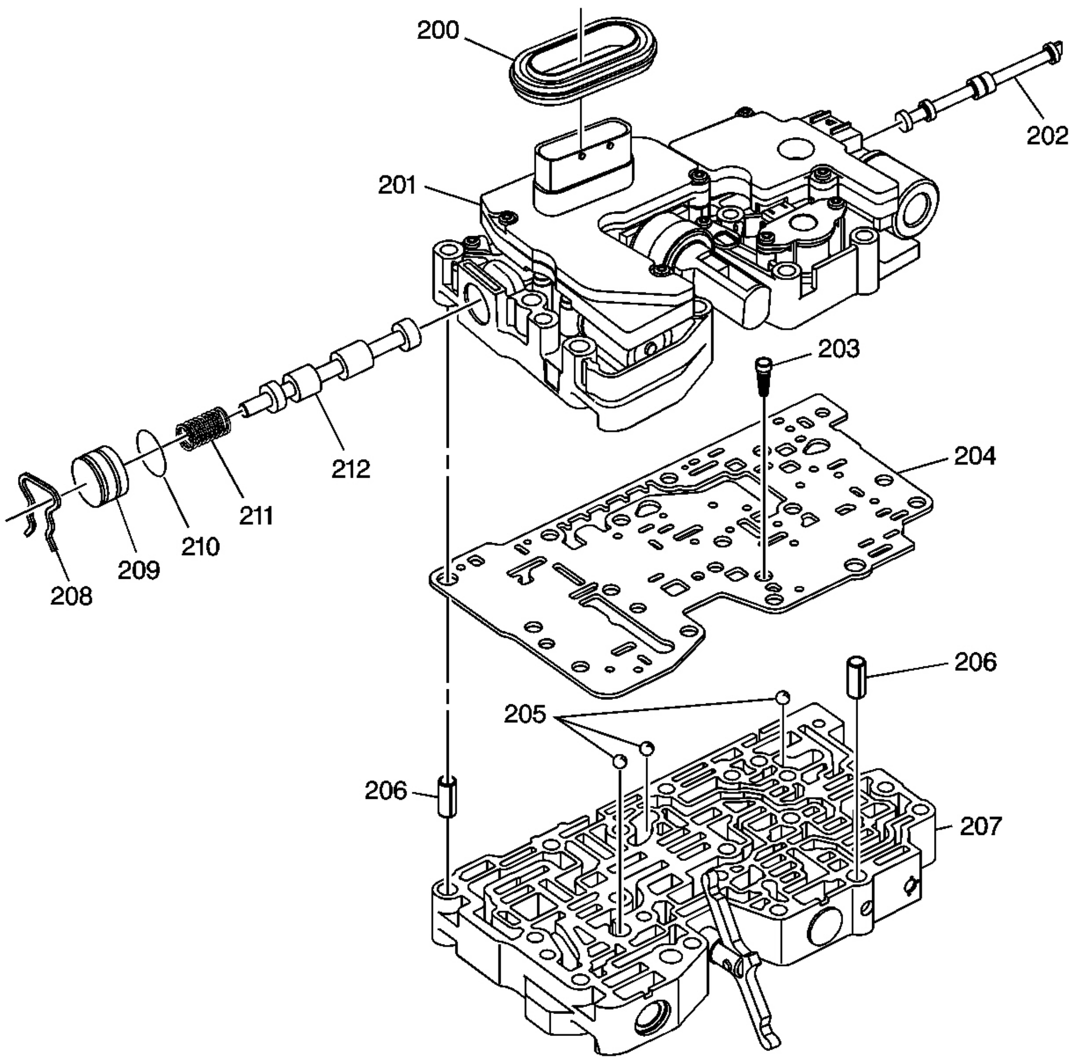


Fig. 7: Control Valve Body And Solenoid Assembly

Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 7

Callout	Component Name
200	Control Valve Body Cover Wiring Connector Hole Seal
201	Control Solenoid Valve Assembly
202	Manual Valve
203	Automatic Transmission Fluid Pump Pressure Screen Assembly
204	Control Valve Body Spacer - with Gasket - Plate Assembly
205	Control Valve Body Ball Check Valve
206	Control Solenoid Valve Locator Pin
207	Control Valve Body Assembly
208	Bore Plug Retainer
209	Bore Plug
210	Bore Plug Seal
211	Line 2 Pressure Regulator Valve Spring
212	Line 2 Pressure Regulator Valve

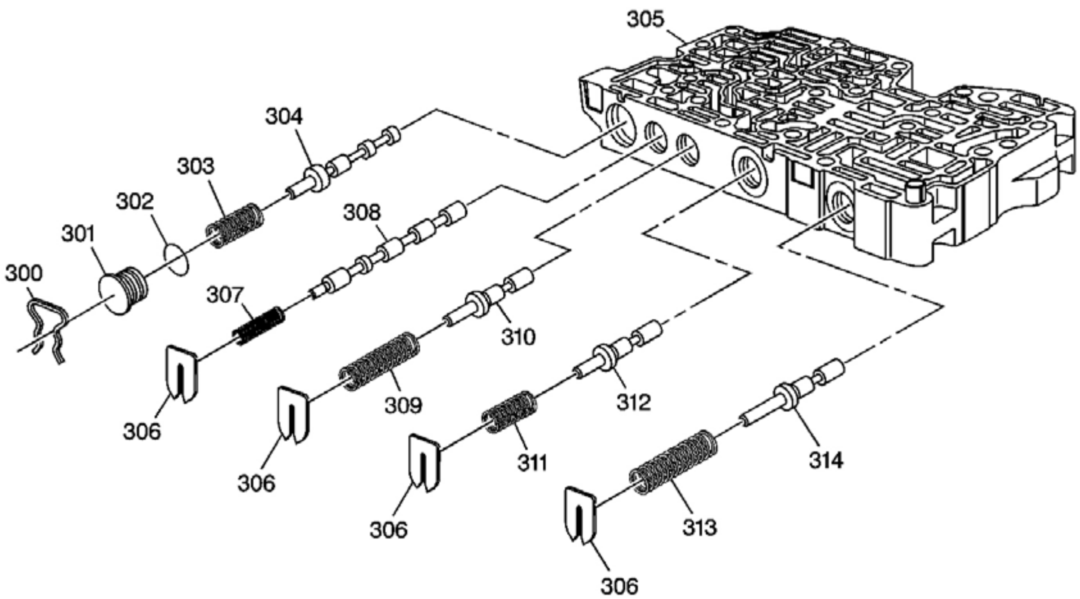


Fig. 8: Control Valve Body Disassembled View - 1 of 2
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 8

Callout	Component Name
300	Bore Plug Retainer

301	Bore Plug
302	Bore Plug Seal
303	Forward and Reverse Clutch Valve Spring
304	Forward and Reverse Clutch Valve
305	Control Valve Body
306	Valve Spring Seat
307	TCC Control Valve Spring
308	TCC Control Valve
309	Line Limit Valve Spring
310	Line Limit Valve
311	Actuator Feed Limit Valve Spring
312	Actuator Feed Limit Valve
313	Primary Limit Valve Spring
314	Primary Limit Valve

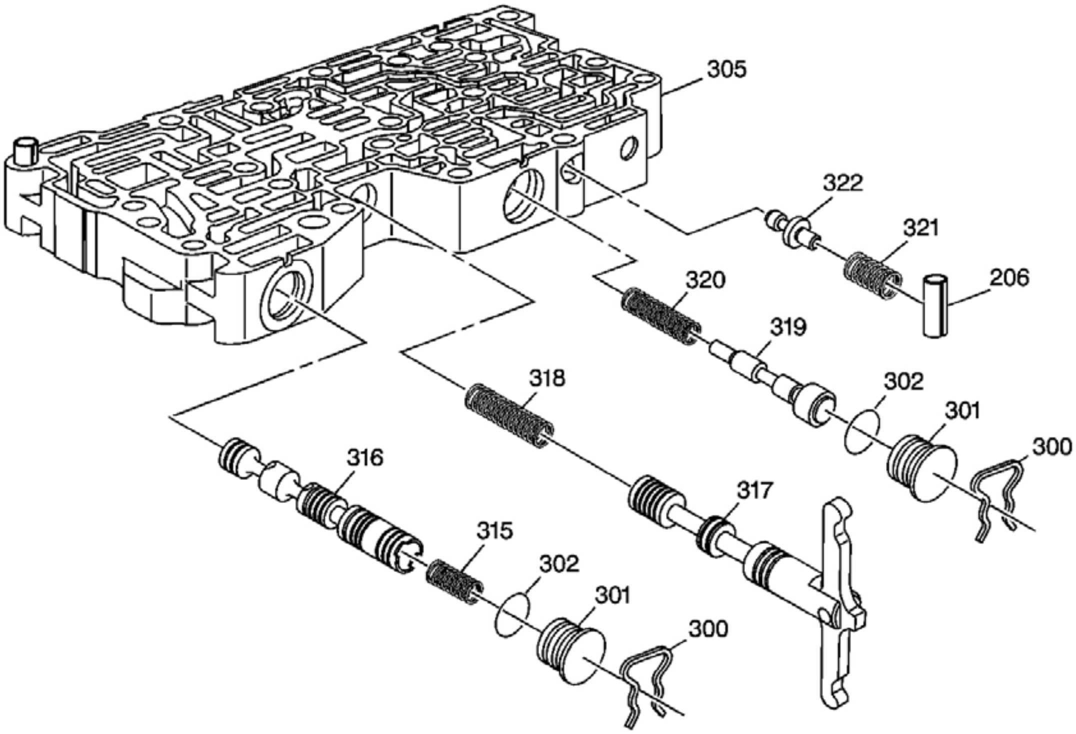
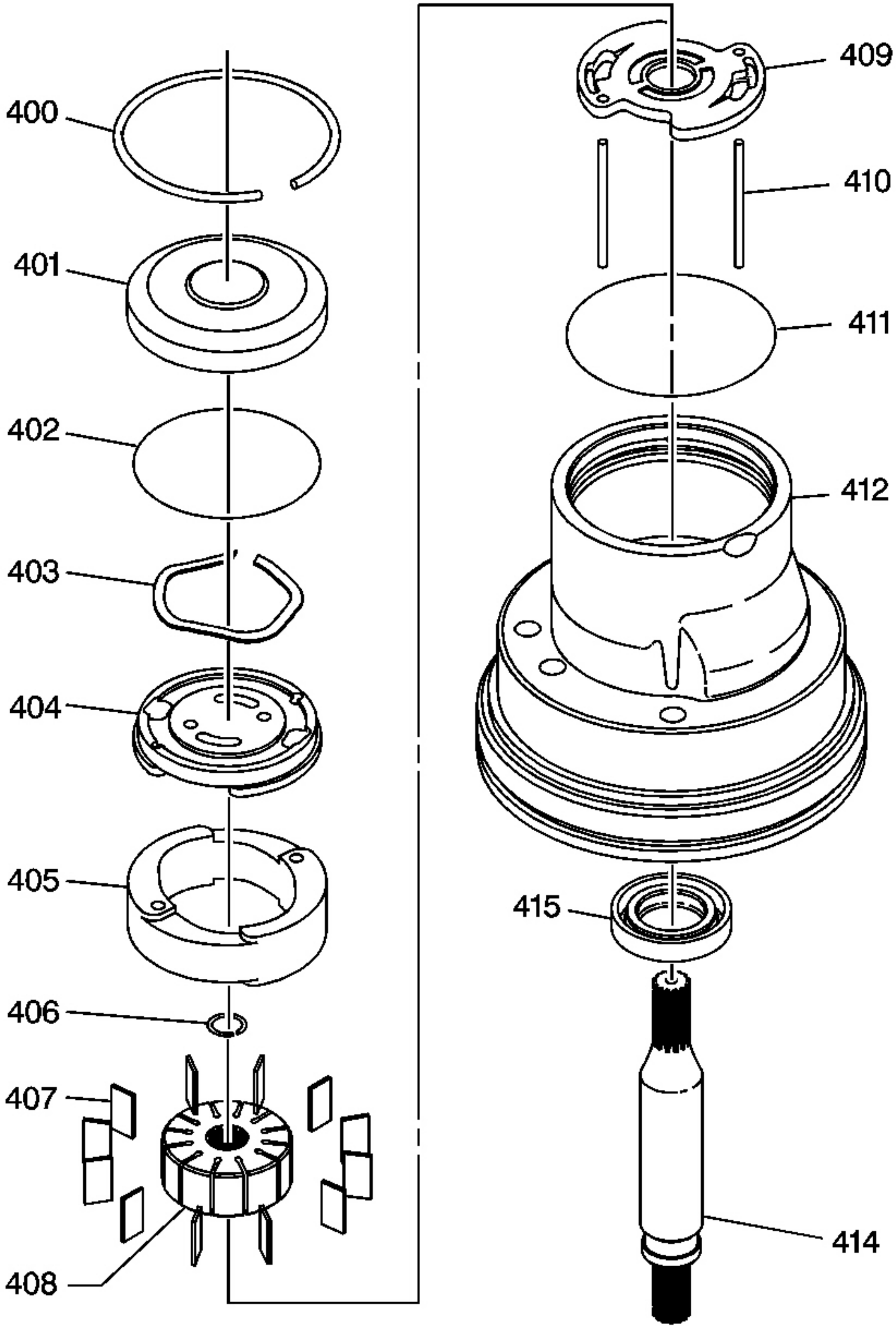


Fig. 9: Control Valve Body Disassembled View - 2 of 2
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 9

Callout	Component Name

206	Control Solenoid Valve Locator Pin
300	Bore Plug Retainer
301	Bore Plug
302	Bore Plug Seal
305	Control Valve Body
315	Line 1 Pressure Regulator Valve Spring
316	Line 1 Pressure Regulator Valve
317	Variable Ratio Control Valve Lever Assembly
318	Variable Ratio Control Valve Spring
319	TCC Regulator Valve
320	TCC Regulator Apply Valve Spring
321	Clutch Boost Valve Spring
322	Clutch Boost Valve



400
401
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Fig. 10: Transmission Fluid Pump Disassembled View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 10

Callout	Component Name
400	End Cover Retaining Ring
401	Pump End Cover
402	Pump End Cover O-Ring Seal
403	Pressure Plate Spring
404	Pressure Plate
405	Cam Ring
406	Pump Drive Shaft Retaining Ring
407	Pump Rotor Vane
408	Pump Rotor
409	Pump Thrust Plate
410	Cam Ring Dowel Pin
411	Pump O-Ring Seal - Inner
412	Pump Housing
414	Pump Drive Shaft
415	Pump Drive Shaft Seal

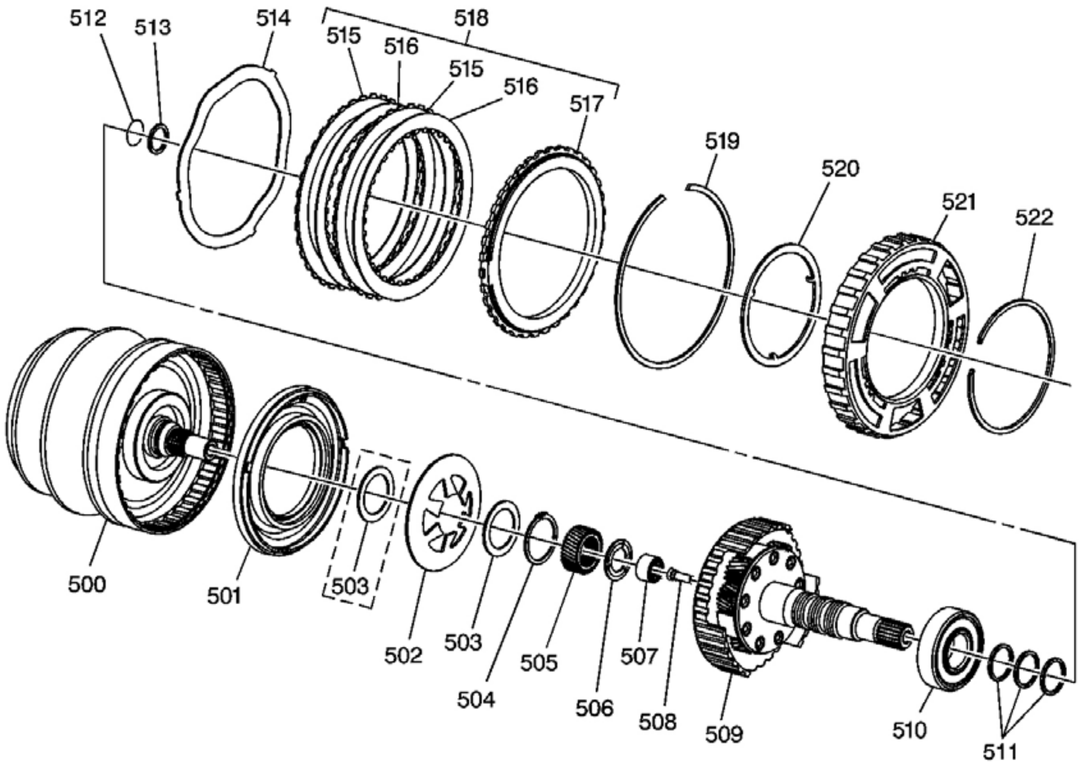


Fig. 11: Input Shaft and Forward Clutch Assembly
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 11

Callout	Component Name
500	Variable Drive Pulley Assembly
501	Forward Clutch Piston Assembly
502	Forward Clutch Piston - Belleville - Spring
503	Forward Clutch Spring Washer - Some Models
503	Forward Clutch Spring Washer - Some Models
504	Forward Clutch Piston Spring Retaining Ring
505	Sun Gear
506	Sun Gear Thrust Washer
507	Input Shaft Bearing Assembly - Inner
508	Input Shaft Fluid Passage Sleeve
509	Input Shaft Assembly
510	Input Shaft Bearing Assembly - Outer
511	Input Shaft Fluid Seal Ring
512	Input Shaft - O-Ring - Seal
513	Input Shaft - Split Spiral - Fluid Seal Ring

514	Forward Clutch - Waved - Plate
515	Forward Clutch Plate Assembly - Spline OD
515	Forward Clutch Plate Assembly - Spline OD
516	Forward Clutch Plate Assembly - Spline ID
516	Forward Clutch Plate Assembly - Spline ID
517	Forward Clutch Backing Plate
518	Forward Clutch Plate Set
519	Forward Clutch Backing Plate Retaining Ring
520	Input Internal Gear Thrust Washer
521	Automatic Transmission Input Shaft Speed Sensor Reluctor Ring Assembly
522	Automatic Transmission Input Shaft Speed Sensor Reluctor Ring Retaining Ring

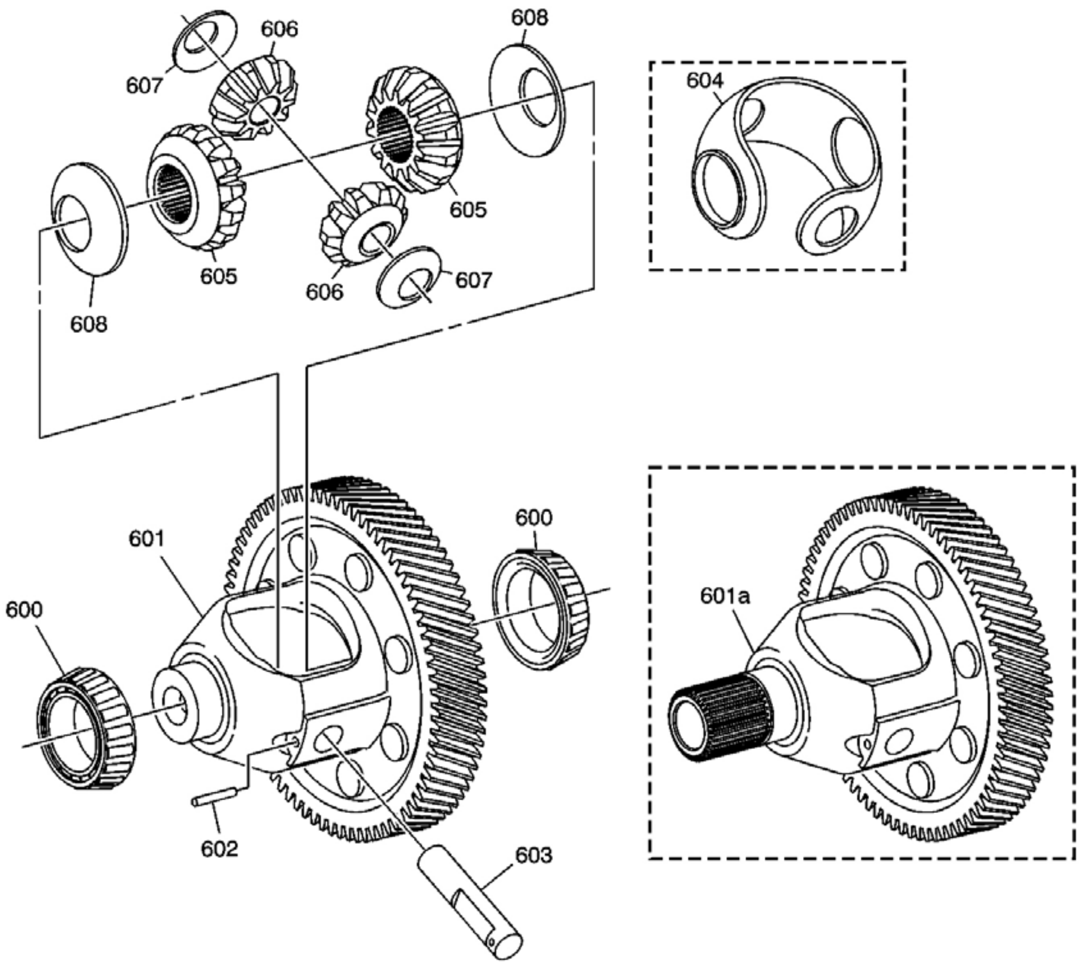


Fig. 12: Front Differential Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 12

Callout	Component Name
600	Front Differential Carrier Bearing Assembly
600	Front Differential Carrier Bearing Assembly
601	Front Differential Carrier Assembly - 2WD
601a	Front Differential Carrier Assembly - F4WD
602	Front Differential Pinion Gear Shaft Pin
603	Front Differential Pinion Shaft
604	Front Differential Carrier Thrust Washer - Some Models
605	Front Differential Side Gear
605	Front Differential Side Gear
606	Front Differential Pinion Gear
606	Front Differential Pinion Gear
607	Front Differential Pinion Gear Thrust Washer - Some Models
607	Front Differential Pinion Gear Thrust Washer - Some Models
608	Front Differential Side Gear Thrust Washer - Some Models
608	Front Differential Side Gear Thrust Washer - Some Models

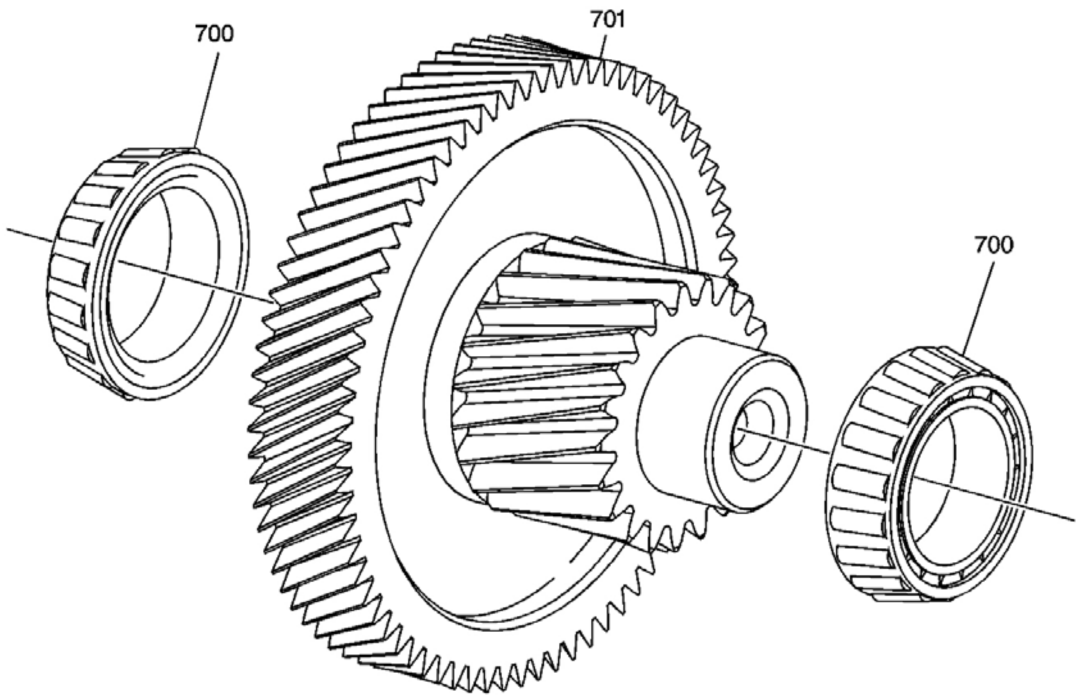


Fig. 13: Front Differential Transfer Gear Assembly
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 13

Callout	Component Name
700	Front Differential Drive Pinion Gear Bearing Assembly
701	Front Differential Drive Pinion Gear and Transfer Gear Assembly

COMPONENT LOCATION

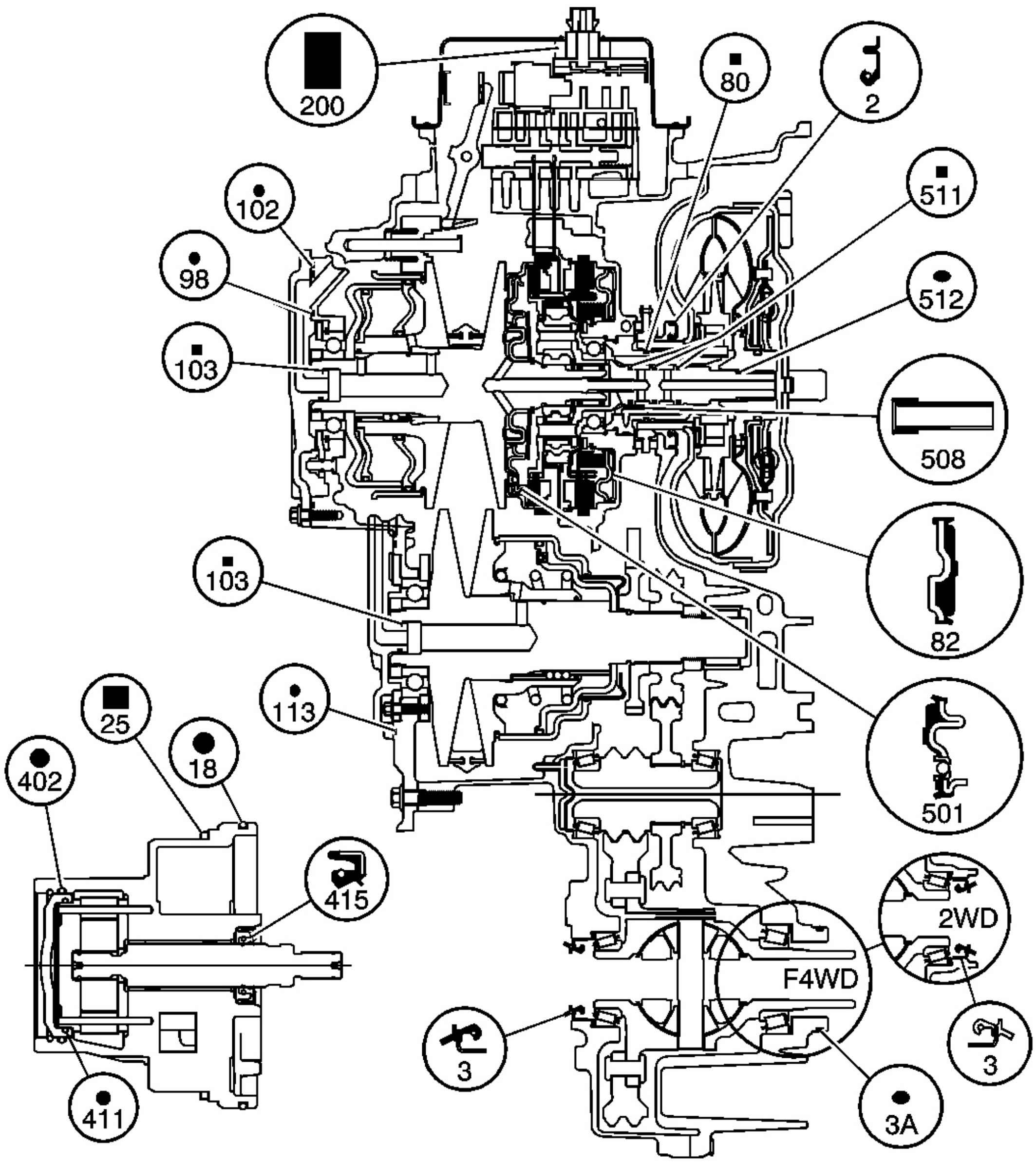


Fig. 14: Exploded View Of Seal Locations
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 14

Callout	Component Name
2	Torque Converter and Differential Housing Seal Assembly
3	Front Wheel Drive Shaft Oil Seal Assembly - 2WD
3	Front Wheel Drive Shaft Oil Seal Assembly - 2WD
3a	Front Wheel Drive Shaft Oil O-Ring Seal - F4WD
18	Automatic Transmission Fluid Pump O-ring Seal
25	Automatic Transmission Fluid Pump Seal
80	Slator Shaft Seal
82	Reverse Clutch Piston Assembly
98	Variable Drive Pulley Opening Cover Seal
102	Variable Drive Pulley Opening Cover Seal
103	Automatic Transmission Case Cover Seal
103	Automatic Transmission Case Cover Seal
113	Variable Driven Pulley Opening Cover Seal
200	Control Valve Body Cover Wiring Connector Hole Seal
402	Pump End Cover O-ring Seal
411	Pump O-ring Seal - Inner
415	Pump Drive Shaft Seal
501	Forward Clutch Piston Assembly
508	Input Shaft Fluid Passage Sleeve
511	Input Shaft Fluid Seal Ring
512	Input Shaft - O-Ring - Seal Ring

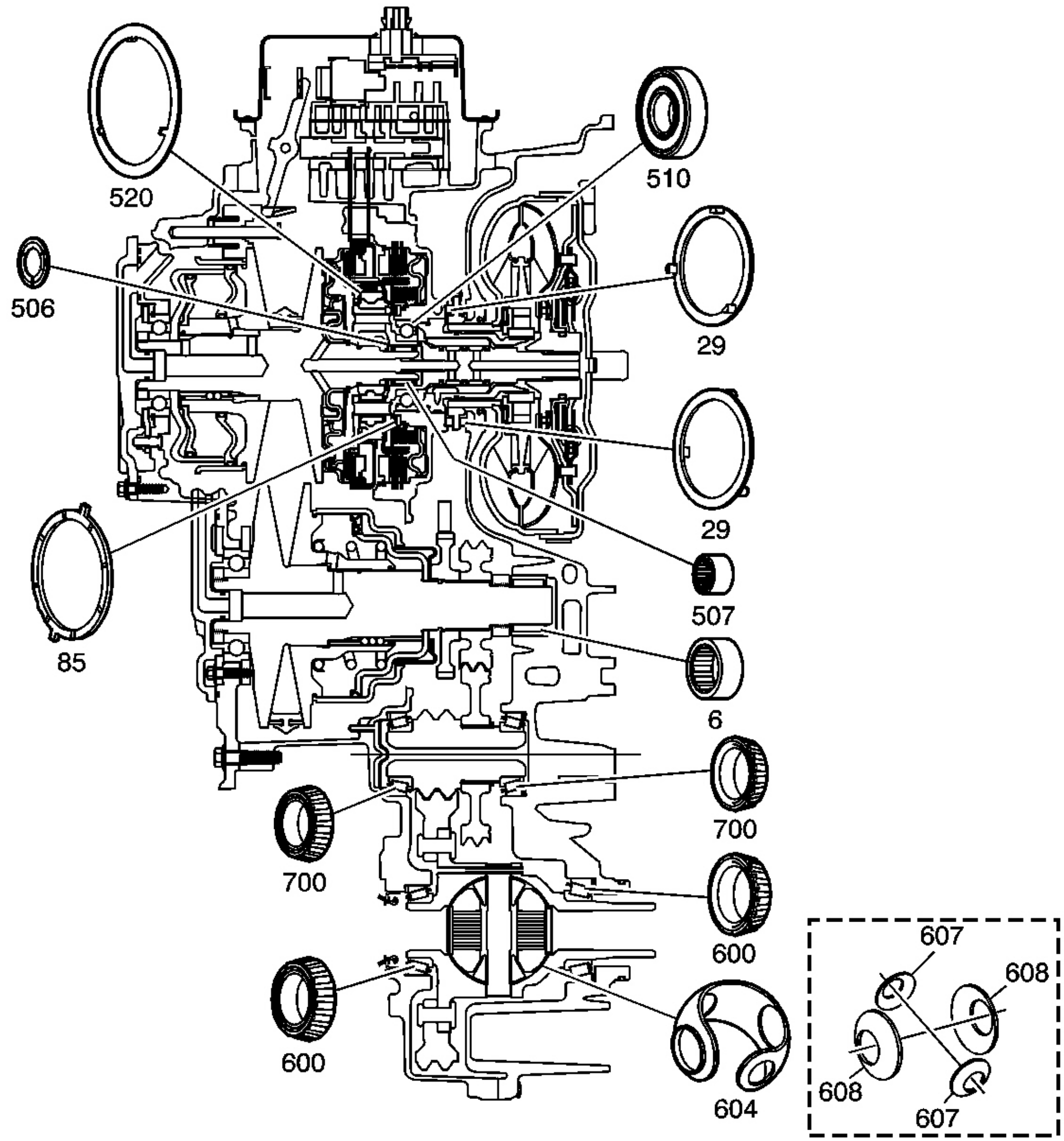


Fig. 15: Exploded View Of Bearing Locations
Courtesy of GENERAL MOTORS CORP.

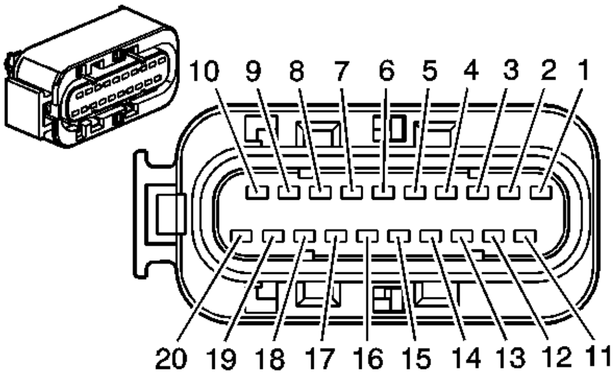
Callouts For Fig. 15

Callout	Component Name
6	Variable Driven Pulley Bearing Assembly
29	Drive Sprocket Thrust Washer
85	Reverse Clutch Hub Thrust Washer
506	Sun Gear Thrust Washer
507	Input Shaft Bearing Assembly - Inner

510	Input Shaft Bearing Assembly - Outer
520	Input Internal Gear Thrust Washer
600	Front Differential Carrier Bearing Assembly
600	Front Differential Carrier Bearing Assembly
604	Front Differential Carrier Thrust Washer - Some Models
607	Front Differential Pinion Gear Thrust Washer - Some Models
607	Front Differential Pinion Gear Thrust Washer - Some Models
608	Front Differential Side Gear Thrust Washer - Some Models
608	Front Differential Side Gear Thrust Washer - Some Models
700	Front Differential Drive Pinion Gear Bearing Assembly
700	Front Differential Drive Pinion Gear Bearing Assembly

AUTOMATIC TRANSMISSION INLINE HARNESS CONNECTOR END VIEW

AT Inline Harness 20-way Connector, Engine Side Terminal Identification

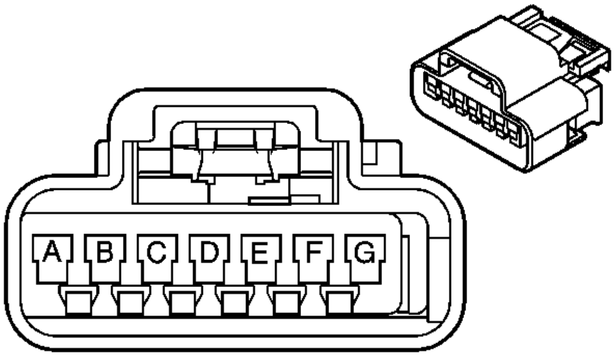


Connector Part Information			• **15355506** • **CONN 20F GT 150 SLD (L-BU)**
Cavity	**Wire Color**	**Circuit No.**	**Function**
1	BK	452	Low Reference
2	RD/BK	1230	ISS High Signal
3	D-BU/WH	1231	ISS Low Signal
4	YE	400	OSS High Signal
5	PU	401	OSS Low Signal
6	YE/BK	5500	TCC Pressure Control Solenoid Valve Low Control
7	BN	418	TCC Pressure Control Solenoid Valve High Control
8	PK/BK	5501	TCC Enable Solenoid Valve High Control
9	D-BU/WH	5502	TCC Enable Solenoid Valve Low Control
10	OG/BK	5504	Ratio Control Motor B2 Low Control

11	GY	596	5-Volt Reference
12	YE	657	Transmission Fluid Pressure Sensor Signal
13	OG/BK	586	Transmission Fluid Temperature Sensor Low Reference
14	TN/WH	585	Transmission Fluid Temperature Sensor Signal
15	D-BU	1530	Line Pressure Control Solenoid Valve High Control
16	WH	5503	Line Pressure Control Solenoid Valve Low Control
17	L-GN/WH	5505	Ratio Control Motor A1 Low Control
18	PU/WH	5506	Ratio Control Motor B1 Low Control
19	PK	639	Ignition 1 Voltage
20	D-GN	5507	Ratio Control Motor A2 Low Control

AUTOMATIC TRANSMISSION INTERNAL CONNECTOR END VIEWS

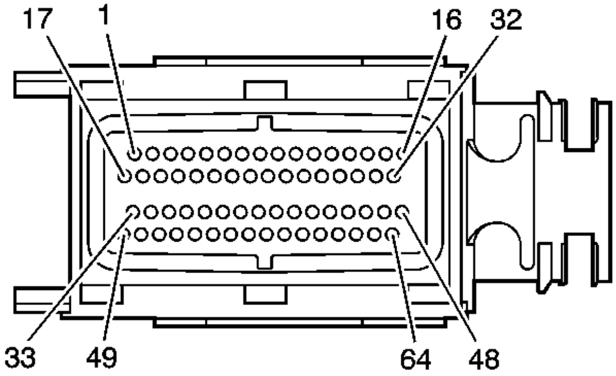
Speed Sensor Harness 7-Way Connector Terminal Identification



Connector Part Information		• **15355108** • **CONN 7-way F GT 150 Series (BK)**	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	GN	401	OSS Low Signal
B	-	-	Not Used
C	RD	400	OSS High Signal
D	-	-	Not Used
E	GN	1231	ISS Low Signal
F	-	-	Not Used
G	RD	1230	ISS High Signal

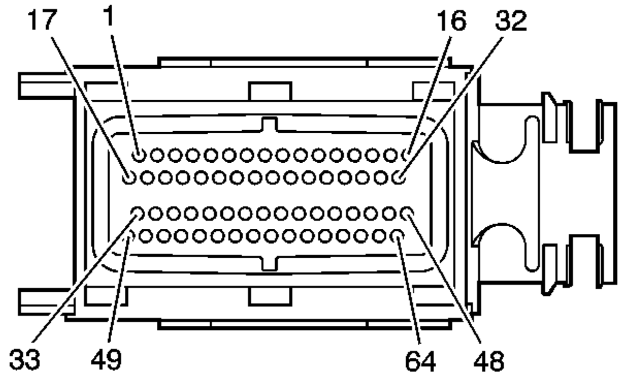
AUTOMATIC TRANSMISSION RELATED CONNECTOR END VIEWS

Transmission Control Module Harness 64-Way C1 Connector Terminal Identification



Connector Part Information		• 1928403513 • CONN 64-way F Micro 64 Series (BK)	
Cavity	**Wire Color**	**Circuit No.**	**Function**
1	TN/WH	2500	High Speed GM LAN Serial Data Bus +
2	TN	2501	High Speed GM LAN Serial Data Bus-
3	-	-	Not Used
4	L-BU	20	Stop Lamp Switch Signal
5-9	-	-	Not Used
10	TN	2501	High Speed GM LAN Serial Data Bus-
11	TN/ WH	2500	High Speed GM LAN Serial Data Bus +
12-16	-	-	Not Used
17	BK/ WH	451	Ground
18	-	-	Not Used
19	PK	639	Ignition 1 Voltage
20	OG	1440	Battery Positive Voltage
21-28	-	-	Not Used
29	BK/ WH	451	Ground
30-58	-	-	Not Used
59	BN/WH	2960	Keyword Serial Data
60-64	-	-	Not Used

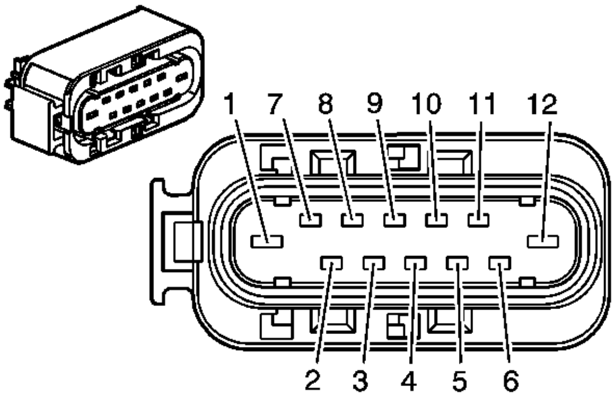
Transmission Control Module Harness 64-Way C2 Connector Terminal Identification



Connector Part Information	• 1928403514 • CONN 64-way F Micro 64 Series (BK)		
Cavity	**Wire Color**	**Circuit No.**	**Function**
1	-	-	Not Used
2	YE	657	Transmission Fluid Pressure Sensor Signal
3-5	-	-	Not Used
6	PU	401	OSS Low Signal
7-10	-	-	Not Used
11	PU/WH	5506	Ratio Control Motor B1 Low Control
12	-	-	Not Used
13	D-GN	5507	Ratio Control Motor A2 Low Control
14	L-GN/WH	5505	Ratio Control Motor A1 Low Control
15	-	-	Not Used
16	D-BU/ WH	5502	TCC Enable Solenoid Valve Low Control
17	-	-	Not Used
18	TN/WH	771	Transmission Range Switch Signal A
19	-	-	Not Used
20	OG/BK	586	Transmission Fluid Temperature Sensor Low Reference
21-28	-	-	Not Used
29	TN	452	Low Reference
30	PK/ BK	5501	TCC Enable Solenoid Valve High Control
31	OG/BK	5504	Ratio Control Motor B2 Low Control
32-43	-	-	Not Used
44	YE/ BK	5500	TCC Pressure Control Solenoid Valve Low Control
45	BN	418	TCC Pressure Control Solenoid Valve High Control
46-48	-	-	Not Used
49	WH	776	Transmission Range Switch Signal P
50	WH	5503	Line Pressure Control Solenoid Valve Low Control

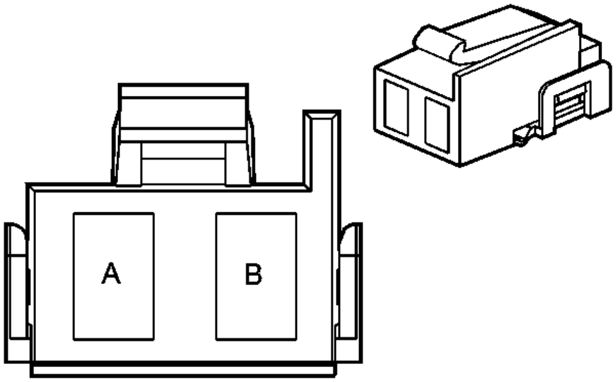
51	D-BU	1530	Line Pressure Control Solenoid Valve High Control
52	GY	773	Transmission Range Switch Signal C
53	-	-	Not Used
54	YE	400	OSS High Signal
55	D-BU/WH	1231	ISS Low Signal
56	TN/WH	585	Transmission Fluid Temperature Sensor Signal
57	GY	596	5-Volt Reference
58	RD/BK	1230	ISS High Signal
59	YE	772	Transmission Range Switch Signal B
60-64	-	-	Not Used

Park/Neutral Position Switch Harness 12-Way Connector Terminal Identification



Connection Part Information		• 15366680 • CONN 7-way F GT 150, 280 Series Sealed (BK)	
Cavity	**Wire Color**	**Circuit No.**	**Function**
1	YE	5	Crank Voltage
2-3	-	-	Not Used
4	L-GN	24	Backup Lamp Supply Voltage
5	-	-	Not Used
6	PK	239	Ignition 1 Voltage
7	GY	773	Transmission Range Switch Signal C
8	YE	772	Transmission Range Switch Signal B
9	TN/WH	771	Transmission Range Switch Signal A
10	WH	776	Transmission Range Switch Signal P
11	PK	239	Ignition 1 Voltage
12	PU	6	Starter Solenoid Crank Voltage

Brake Stop Lamp Switch Harness 2-Way Connector Terminal Identification



Connector Part Information		• 12033701 • CONN 2-way F Metri-Pack 480 Series (GY)	
Cavity	**Wire Color**	**Circuit No.**	**Function**
A	OG	540	Battery Positive Voltage
B	L-BU	20	Stop Lamp Switch Signal

REPAIR INSTRUCTIONS

TRANSMISSION FLUID REPLACEMENT

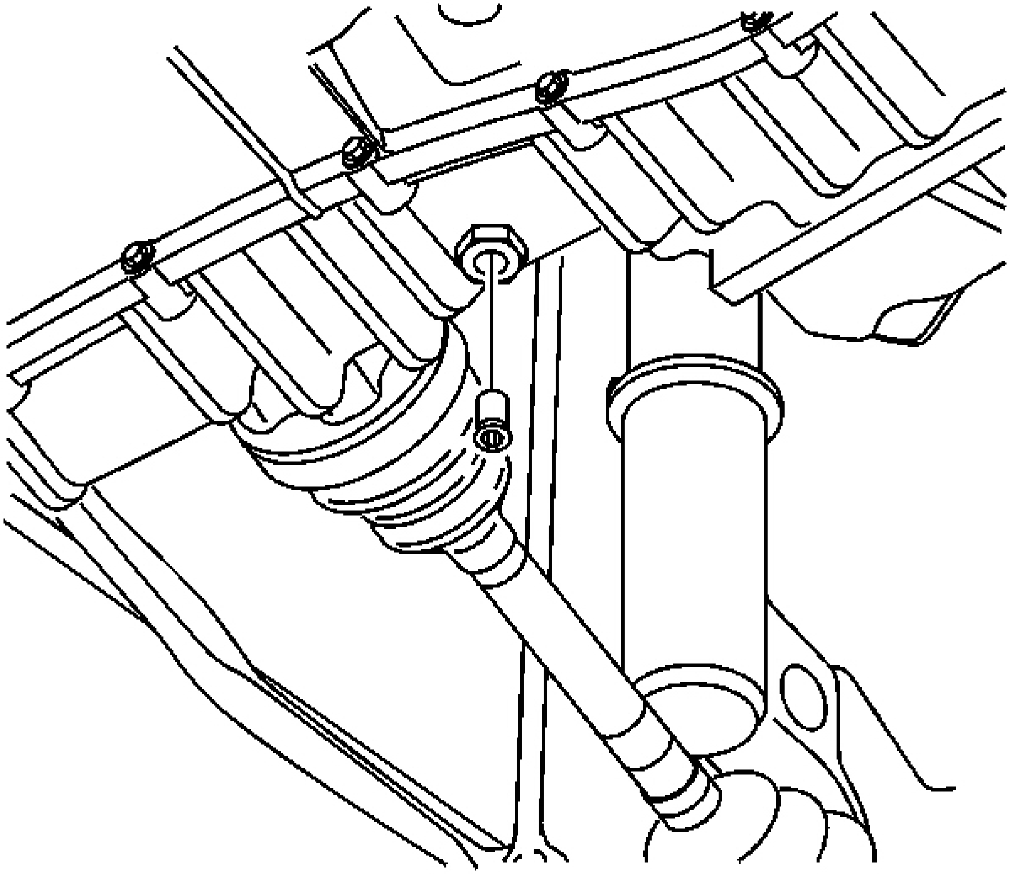


Fig. 16: Lower Tube Assembly & Drain Plug
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Place a drain pan under the transmission.
3. Remove the lower tube assembly drain plug.

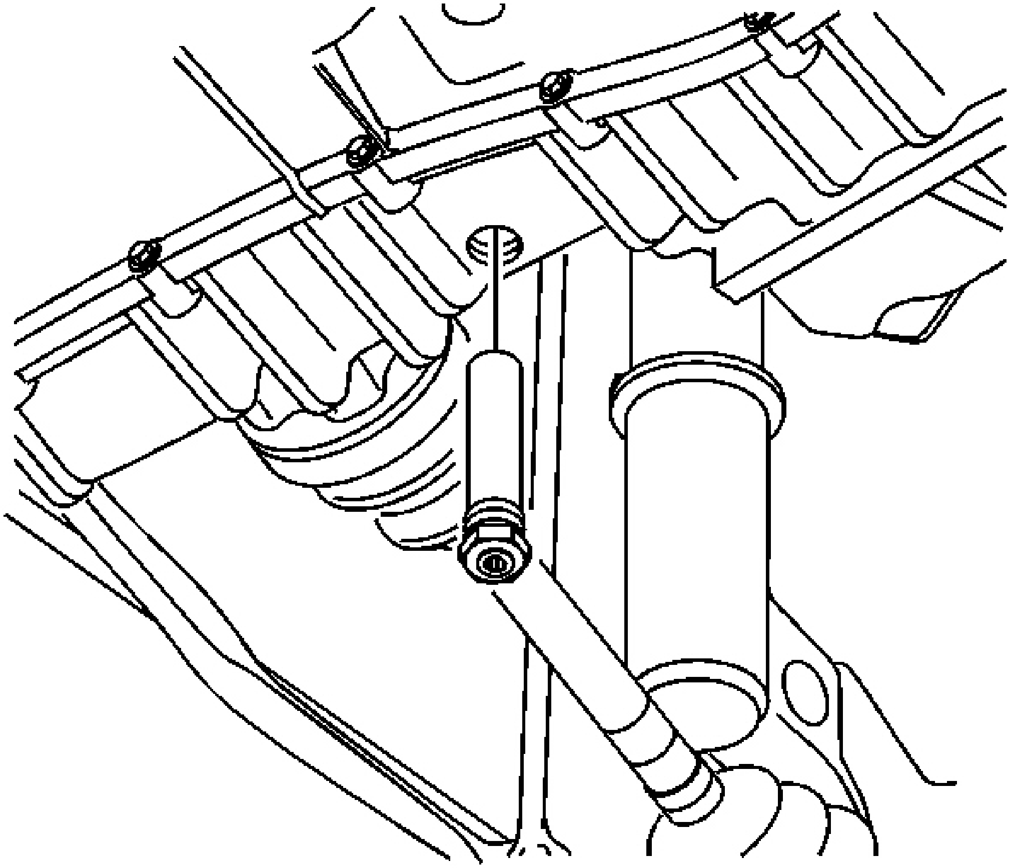


Fig. 17: Lower Tube Assembly & Transmission
Courtesy of GENERAL MOTORS CORP.

4. Remove the lower tube assembly from the transmission. Allow the fluid to completely drain.

NOTE: Refer to Fastener Notice in Cautions and Notices.

5. Install the lower tube assembly into the transmission.

Tighten: Tighten the assembly to 20 N.m (15 lb ft).

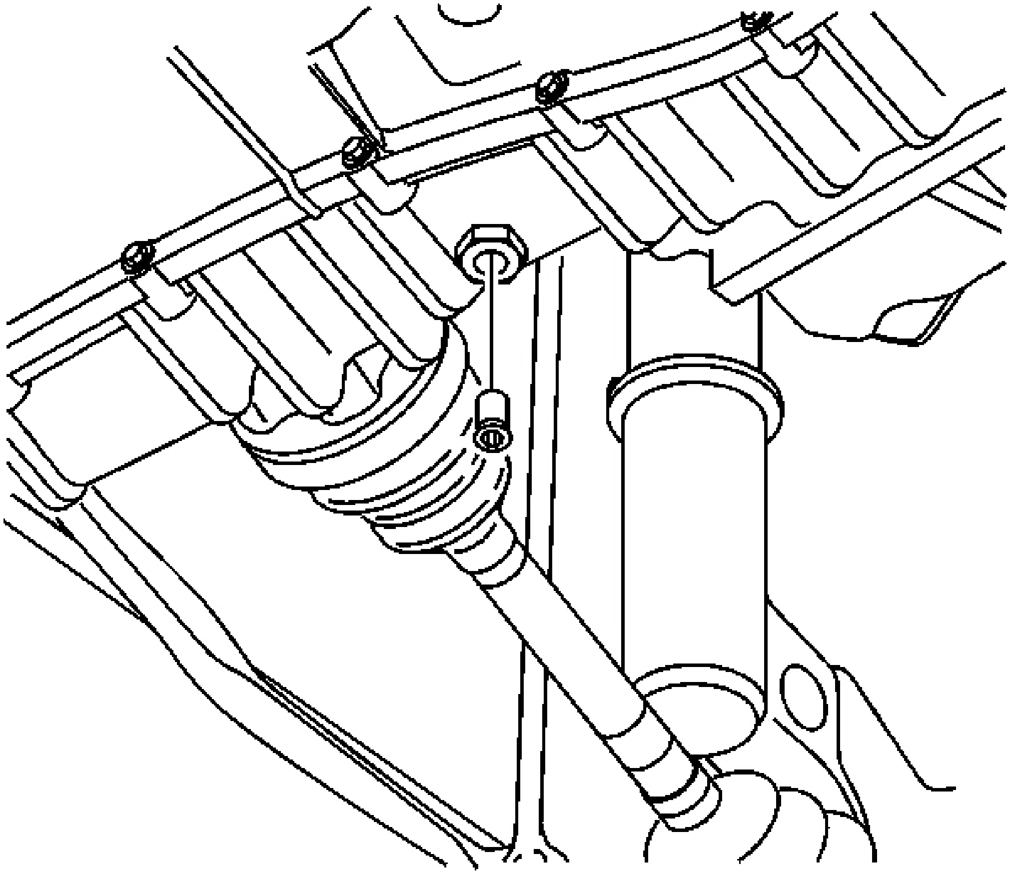


Fig. 18: Lower Tube Assembly & Drain Plug
Courtesy of GENERAL MOTORS CORP.

6. Temporarily install the original lower tube plug. Do not tighten.
7. Lower the vehicle.

IMPORTANT: Do not use ATF P/N 21005966 or P/N 21019223. These fluids are not compatible with this transmission.

8. Fill the transmission to the proper level with Saturn DEX-CVT(R) Fluid P/N 22688912. Refer to **Transmission Fluid Checking Procedure** and **Fluid Capacity Specifications** .
9. Install a scan tool.
10. With the vehicle on a flat and level surface, start the vehicle.
11. Circulate the fluid through the transmission using the following procedure:

1. With the brake applied, shift the transmission from the PARK (P) to REVERSE (R) for 10 seconds.
2. Shift the transmission to DRIVE (D) for 10 seconds.
3. Shift the transmission to PARK (P), allowing the engine to remain running.

12. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
13. Remove the lower tube assembly drain plug and discard.
14. Perform the following procedure to assure proper fluid level:
    - If the fluid drains down at a steady stream from the opening, allow the fluid to drain until it stops.
    - If no fluid or a very small amount of fluid drains, add fluid to the transmission until a steady stream starts to drain. Stop adding fluid immediately. Allow the fluid to drain until it stops.
15. Install a new lower tube assembly plug and clean any excess fluid from the transmission.

    Tighten: Tighten the plug to 11 N.m (97 lb in).

16. Lower the vehicle.

    IMPORTANT: Do not remove the lower tube assembly drain plug.

17. With the scan tool, record the TRANS FLUID TEMP.
    - If the TRANS FLUID TEMP is 20°C (68°F) or less, add 0.47 liter (0.5 qt) of fluid to the transmission.
    - If the TRANS FLUID TEMP is 40°C (104°F), add 0.71 liter (0.75 qt) of fluid to the transmission.
    - If the TRANS FLUID TEMP is 60°C (140°F), add 0.95 liter (1.0 qt) of fluid to the transmission.
    - If the TRANS FLUID TEMP is 80°C (176°F), add 1.2 liter (1.25 qt) of fluid to the transmission.
18. Turn OFF the ignition.
19. Add Saturn DEX-CVT(R) additive P/N 22697447 to the transmission using the provided applicator. Inject the entire contents into the transmission.

SHIFT CONTROL REPLACEMENT

Tools Required

J 36346 Fascia Retainer Remover

Removal Procedure

IMPORTANT: All shiftier cable and park lock cable clips are one time usage only. Any service repair requiring cables to be disconnected from the transaxle control cable bracket or shiftier assembly will require a cable clip replacement.

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 8** in SIR.
2. Remove the console. Refer to **Console Replacement** in Instrument Panel, Gages, and Console.

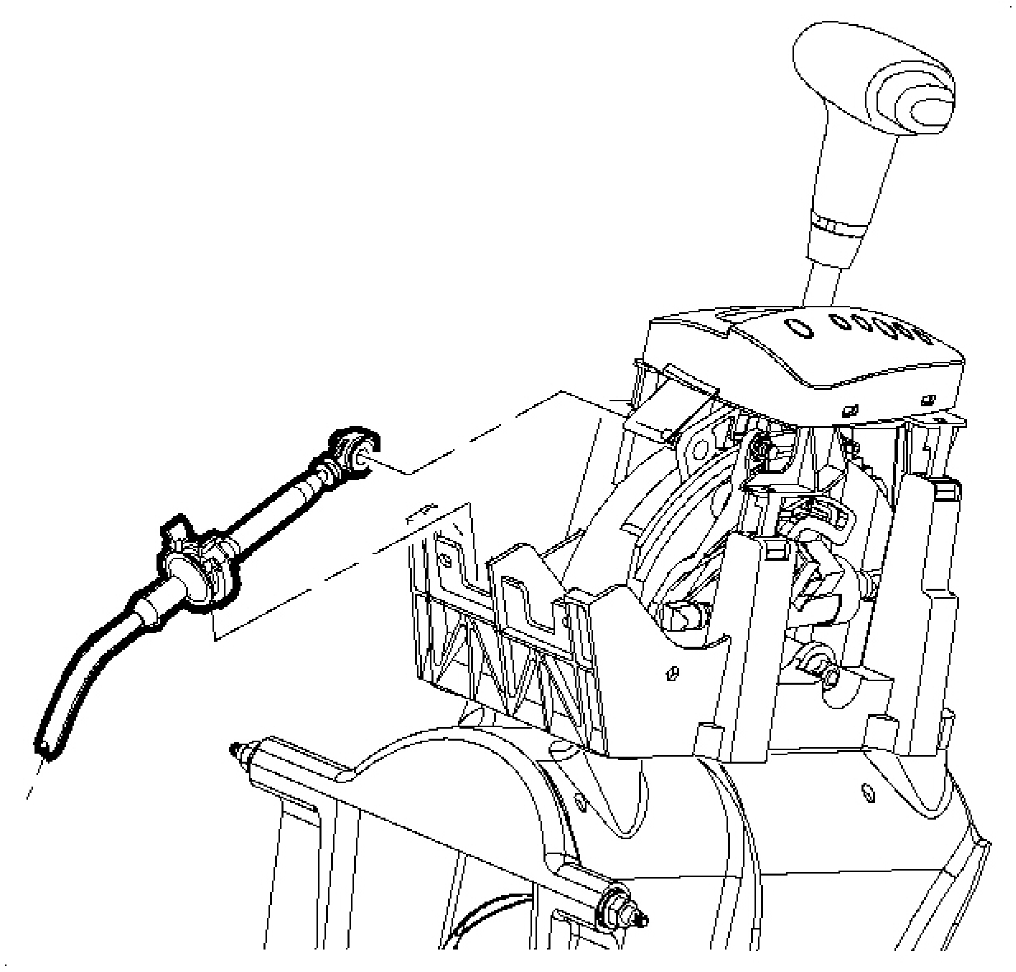


Fig. 19: Shiftier Cable Retainer Clip, Cable & Control Assembly
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 36346** , disconnect the shiftier cable from the control assembly pin.
4. Remove the shiftier cable retainer clip and remove the cable from the control assembly. Discard the clip.

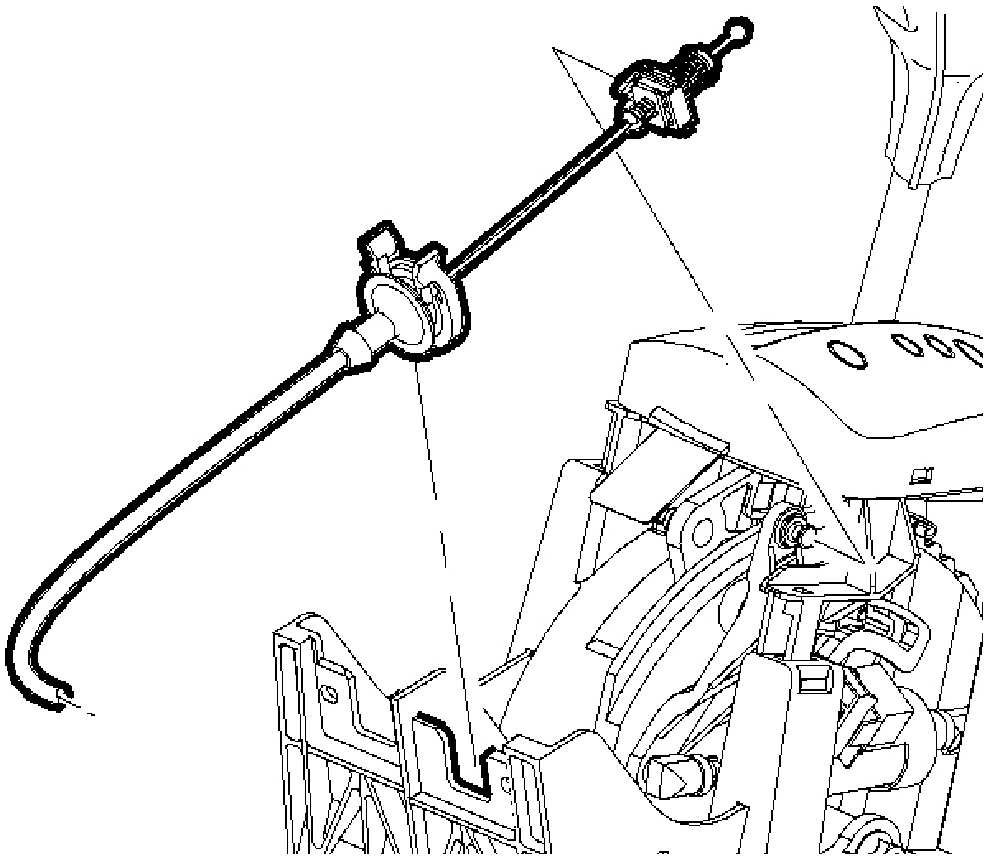


Fig. 20: Park Lock Cable Assembly & Control Assembly
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the park lock cable assembly from the pin on the control assembly.
6. Depress the tab on the park lock cable and remove the cable from the control assembly. Discard the park lock cable clip.

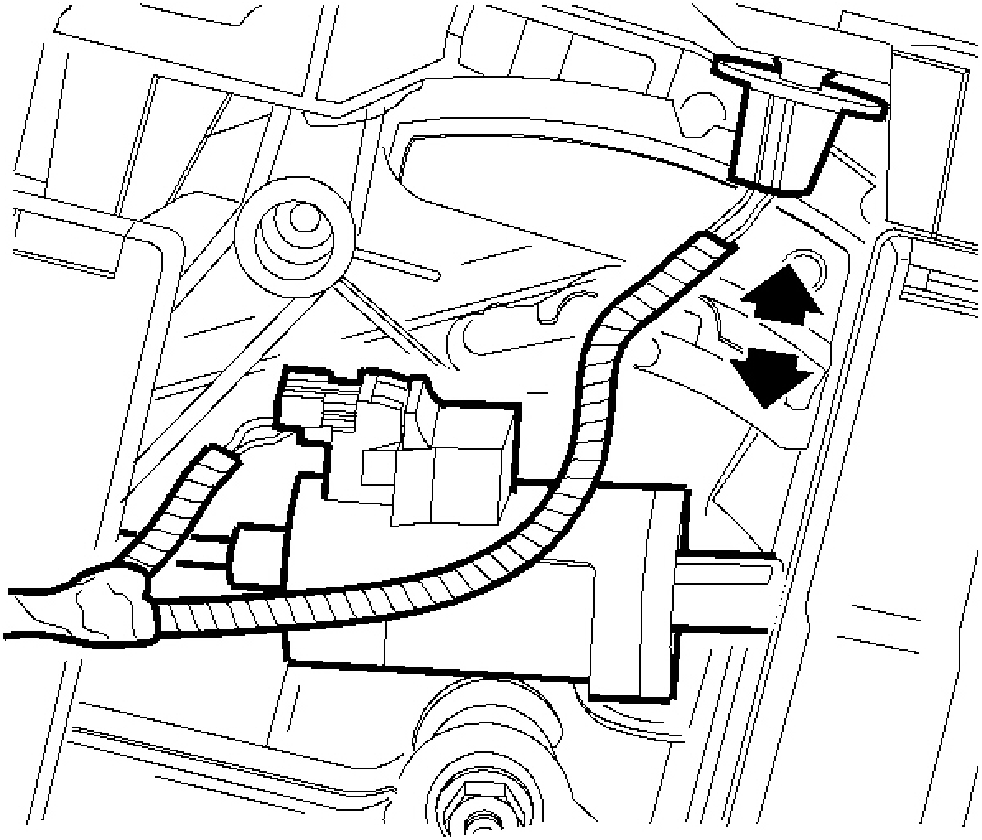


Fig. 21: Indicator Bulb
Courtesy of GENERAL MOTORS CORP.

7. Remove the indicator bulb by rotating the bulb a 1/4 turn and pulling out.

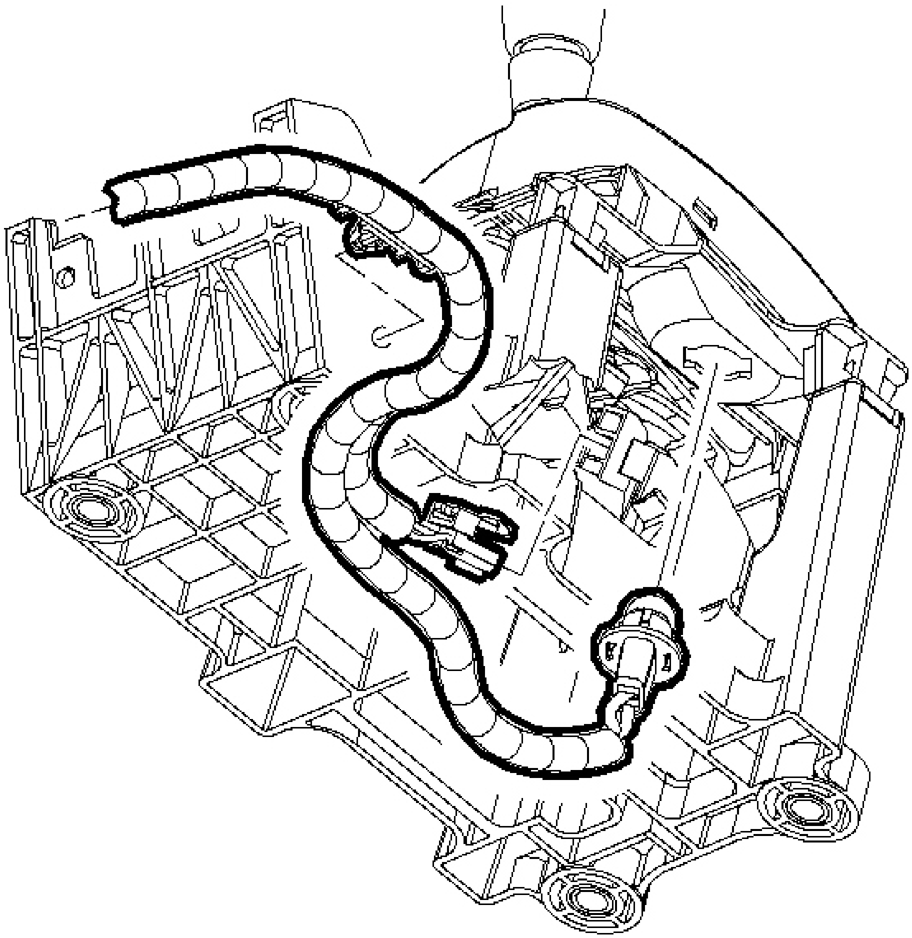


Fig. 22: Control Assembly Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the control assembly electrical connectors.

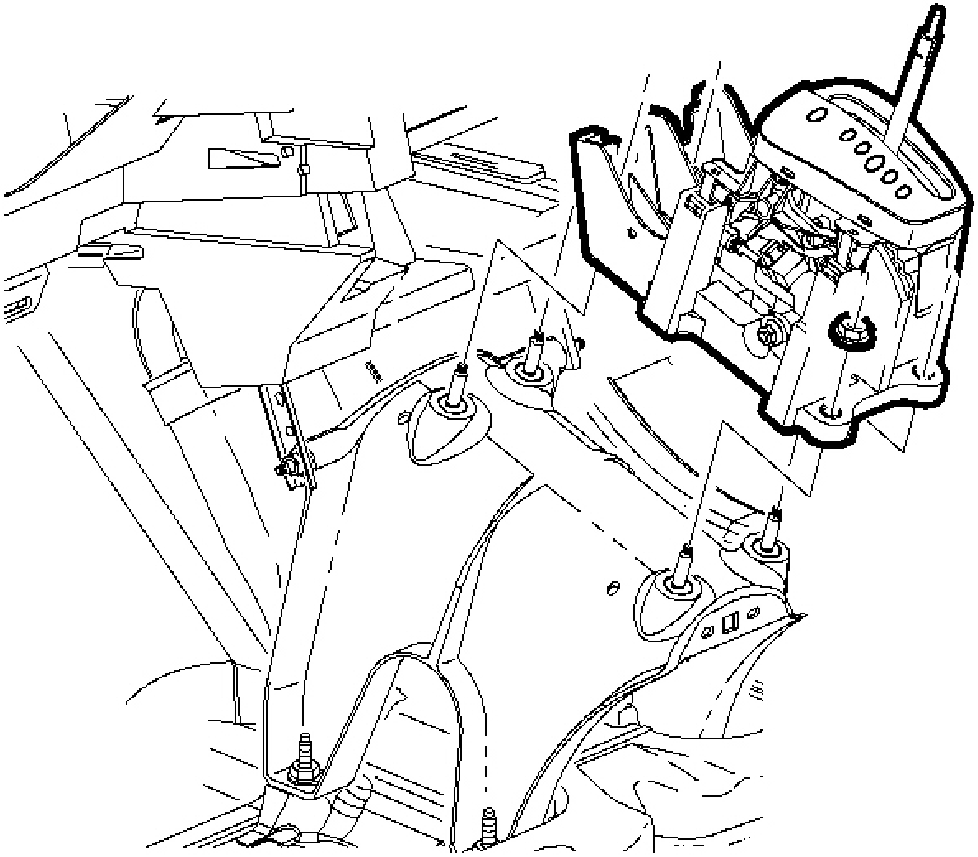


Fig. 23: Control Assembly & Nuts
Courtesy of GENERAL MOTORS CORP.

9. Remove the nuts from the control assembly.
10. Remove the control assembly and replace if necessary.

Installation Procedure

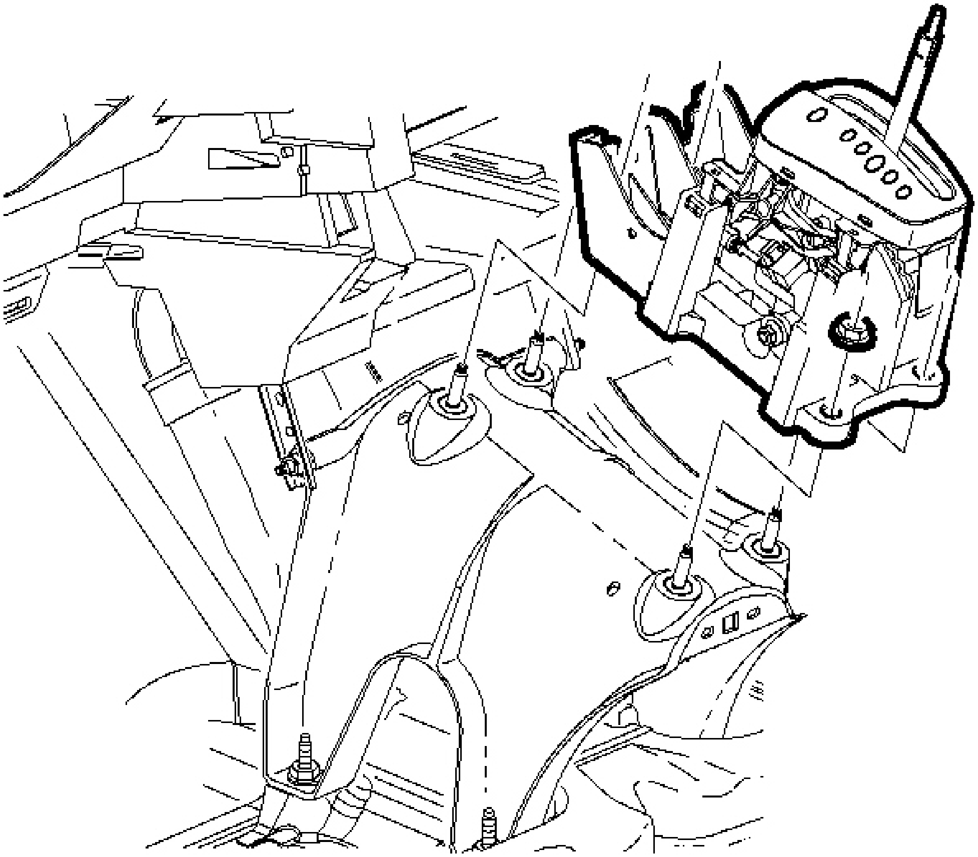


Fig. 24: Control Assembly & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the control assembly.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the control assembly bolts.

Tighten: Tighten the control assembly to bracket bolts to 25 N.m (18 lb ft).

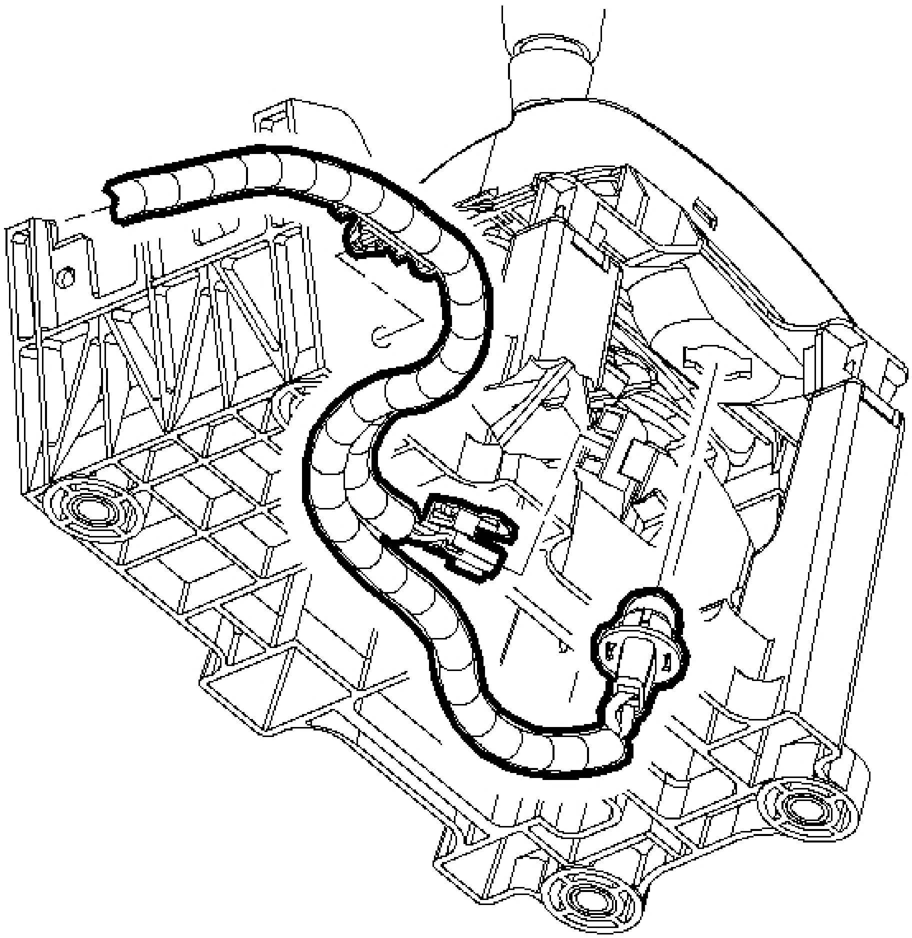


Fig. 25: Control Assembly Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

3. Connect the control assembly electrical connectors.

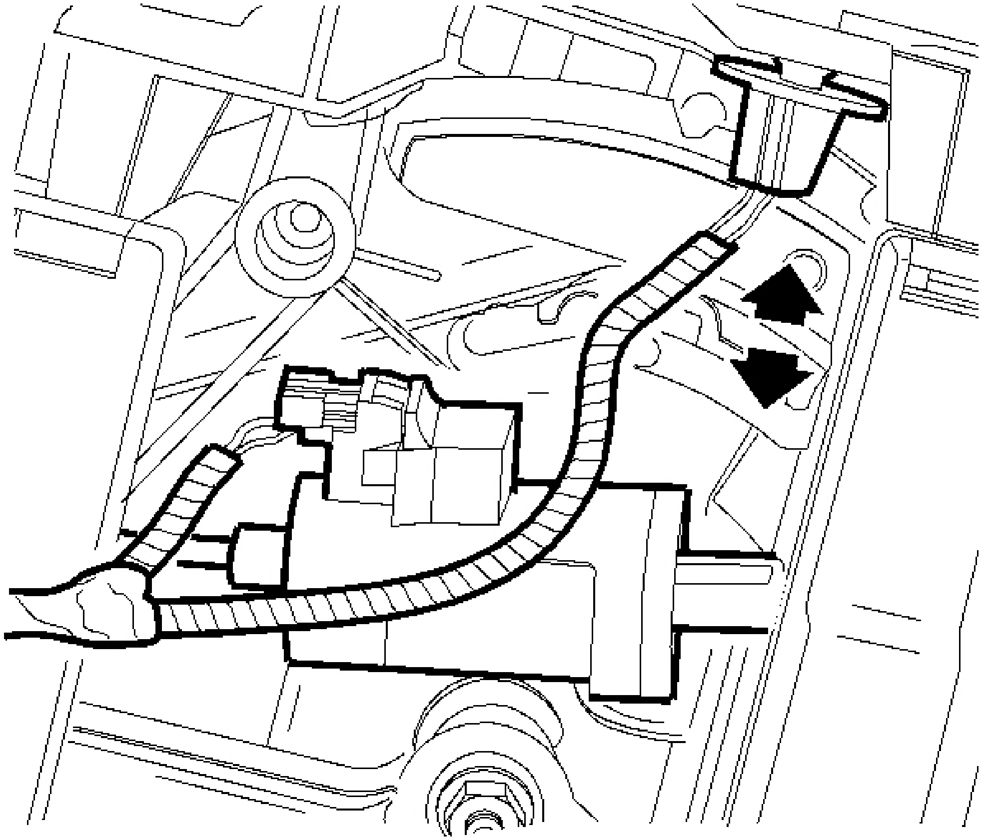


Fig. 26: Indicator Bulb
Courtesy of GENERAL MOTORS CORP.

4. Install the indicator bulb by inserting and rotating one-quarter turn.

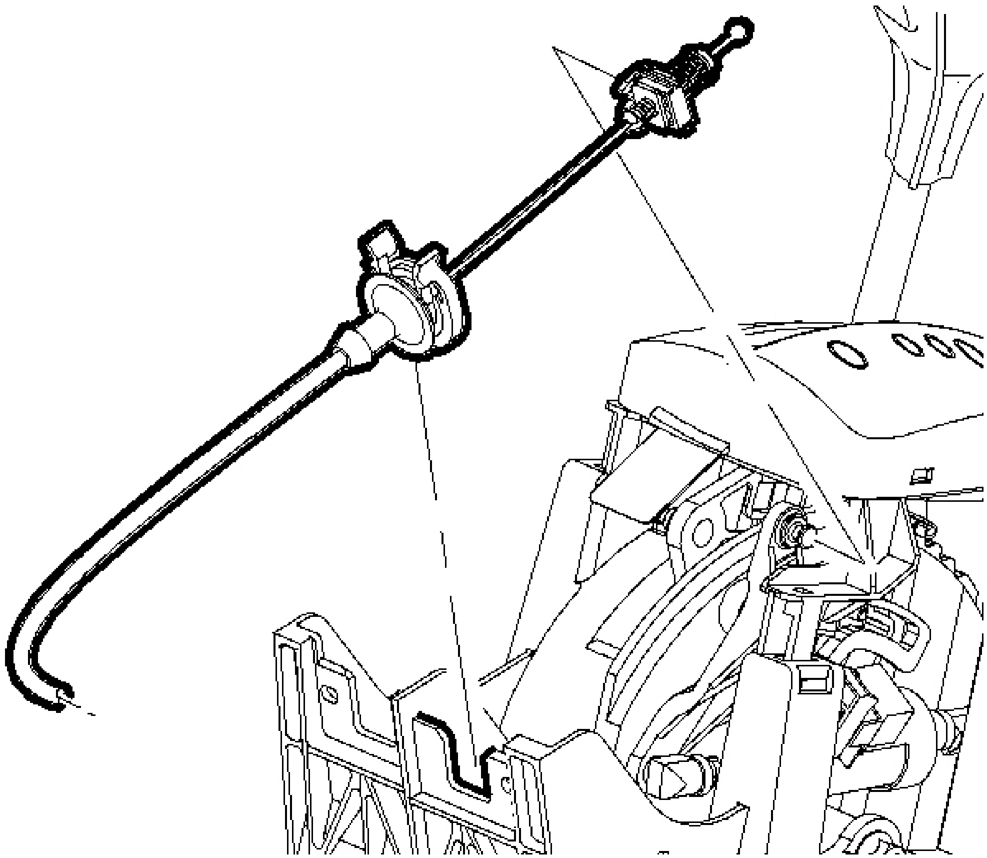


Fig. 27: Park Lock Cable Assembly & Control Assembly
Courtesy of GENERAL MOTORS CORP.

5. Install the park lock cable onto the control assembly using a new clip.
6. Connect the park lock cable onto the control assembly pin.

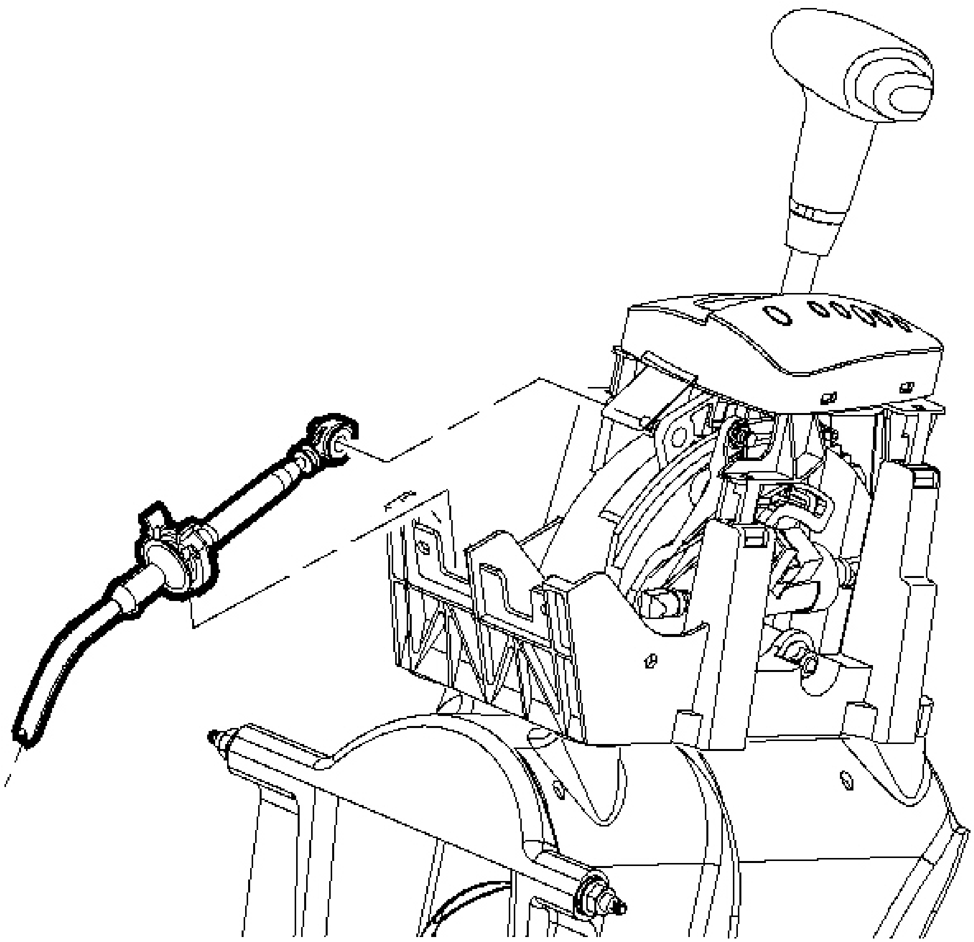


Fig. 28: Shiftier Cable Retainer Clip, Cable & Control Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The secondary clip is not required for service. Make sure the shiftier cable is fully engaged into the shiftier control.

7. Install the shiftier cable onto the control assembly. Secure with a new shiftier cable retainer clip.
8. Connect the shiftier cable onto the control assembly pin.
9. Install the console. Refer to **Console Replacement** in Instrument Panel, Gages, and Console.
10. Enable SIR system. Refer to **SIR Disabling and Enabling Zone 8** in SIR.

SHIFT CABLE REPLACEMENT

Tools Required

J 36346 Fascia Retainer Remover

Removal Procedure

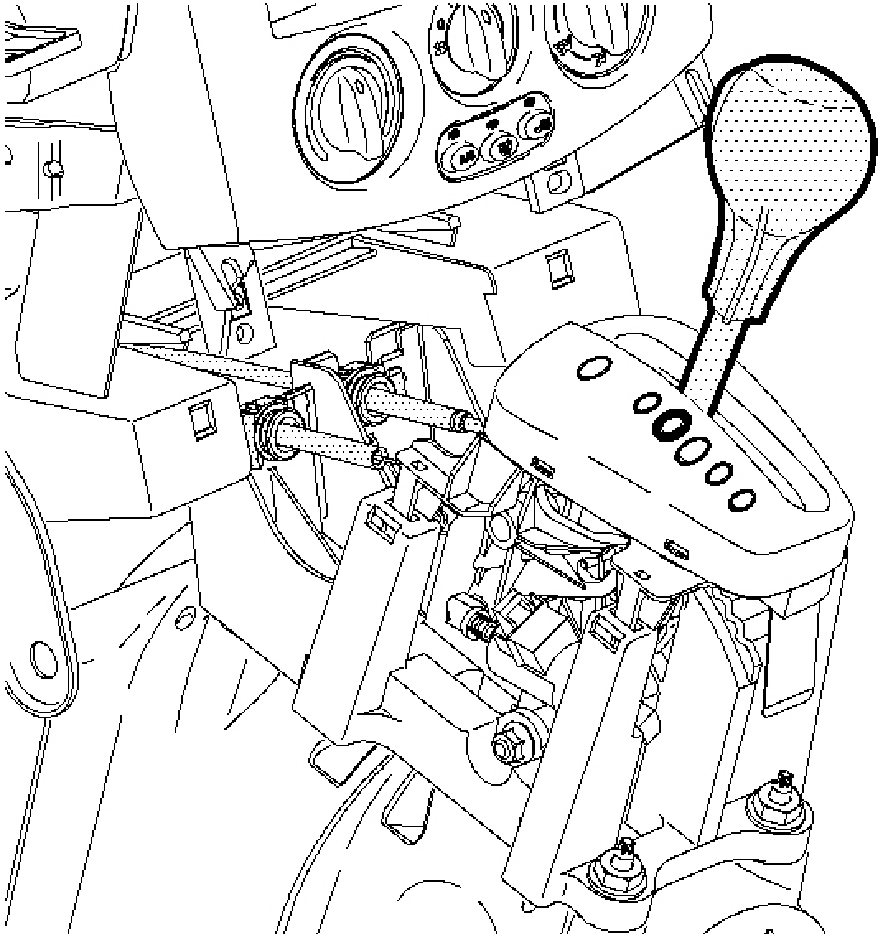


Fig. 29: Control Assembly In N - Neutral Position
Courtesy of GENERAL MOTORS CORP.

CAUTION: Ensure that the vehicle is properly supported and squarely positioned. To help avoid personal injury when a vehicle is on a hoist, provide additional support for the vehicle on the opposite end from which the components are being removed.

IMPORTANT: All shiftier cable and park lock cable clips are one time usage only. Any service repair requiring cables to be disconnected from the transaxle control cable bracket or shiftier assembly will require a cable clip replacement.

1. Move the control assembly into the N - Neutral position.
2. Remove the battery. Refer to **Battery Replacement** in Engine Electrical.
3. Remove the battery tray and bracket. Refer to **Battery Tray Replacement (L61)** or **Battery Tray Replacement (L66)** in Engine Electrical.
4. Remove the console. Refer to **Console Replacement** in Instrument Panel, Gages, and Console.

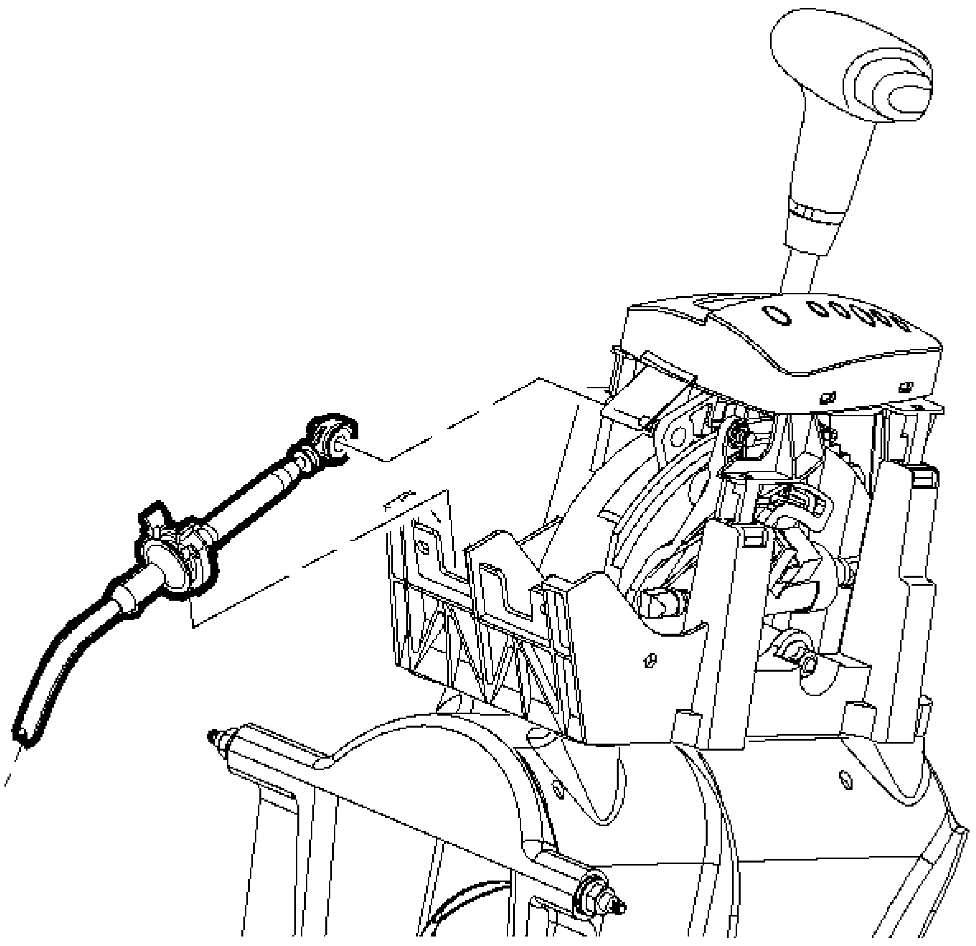


Fig. 30: Shiftier Cable Retainer Clip, Cable & Control Assembly

Courtesy of GENERAL MOTORS CORP.

5. Using the **J 36346** , disconnect the control cable from the control assembly lever.
6. Depress the control cable retainer clip tabs and remove the cable from the control assembly. Discard the clip.

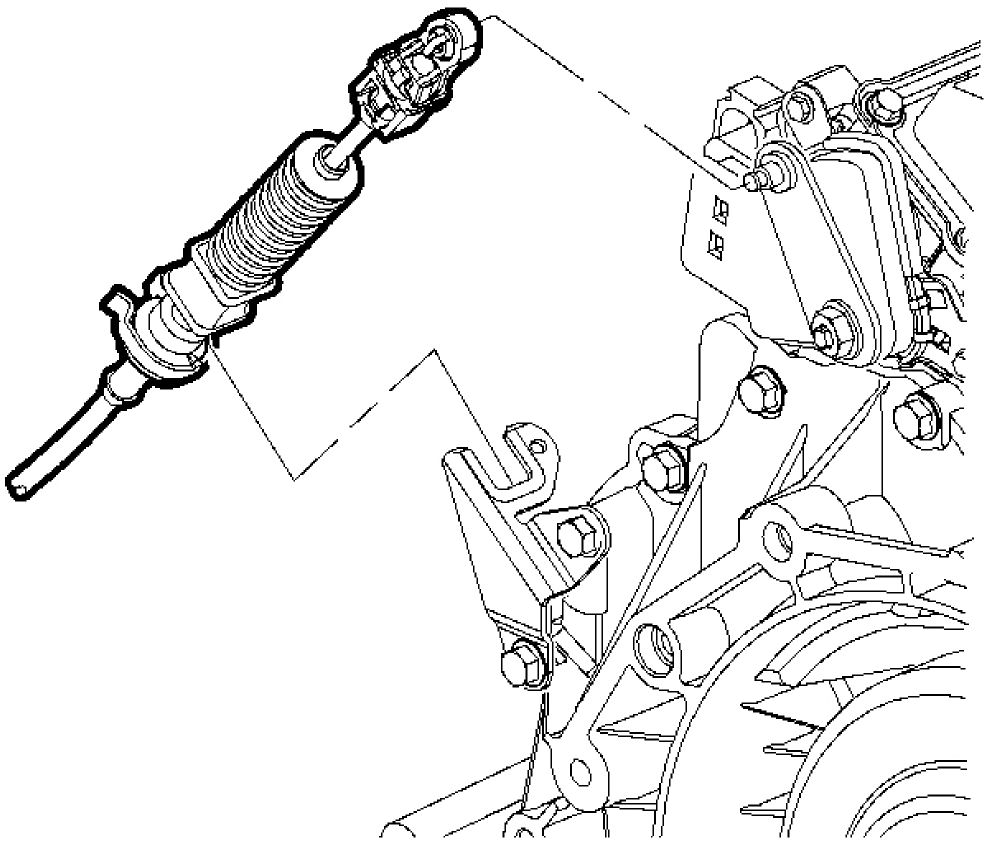


Fig. 31: Control Cable & Transaxle Range Switch Lever
Courtesy of GENERAL MOTORS CORP.

NOTE:	**The control cable must be disconnected from the transaxle range switch lever prior to disconnecting it from the control cable bracket. Otherwise damage to the manual shift shaft may result, requiring transaxle disassembly.**

7. Using the **J 36346** , disconnect the control cable from the transaxle range switch lever.

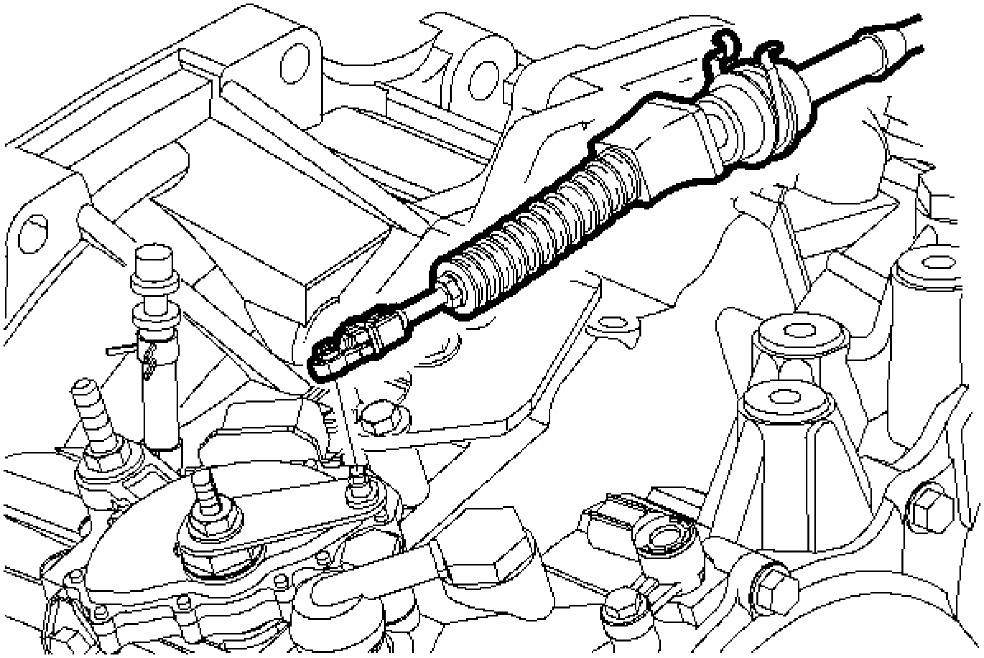


Fig. 32: Control Cable Retainer Clip Tabs, Cable & Control Cable Bracket
Courtesy of GENERAL MOTORS CORP.

8. Depress the control cable retainer clip tabs and remove the cable from the control cable bracket. Discard the clip.

> **CAUTION: Ensure that the vehicle is properly supported and squarely positioned. To help avoid personal injury when a vehicle is on a hoist, provide additional support for the vehicle on the opposite end from which the components are being removed.**

IMPORTANT: For VT25-E transaxles, perform steps 11-13.

9. Position the vehicle on the hoist and raise the vehicle.

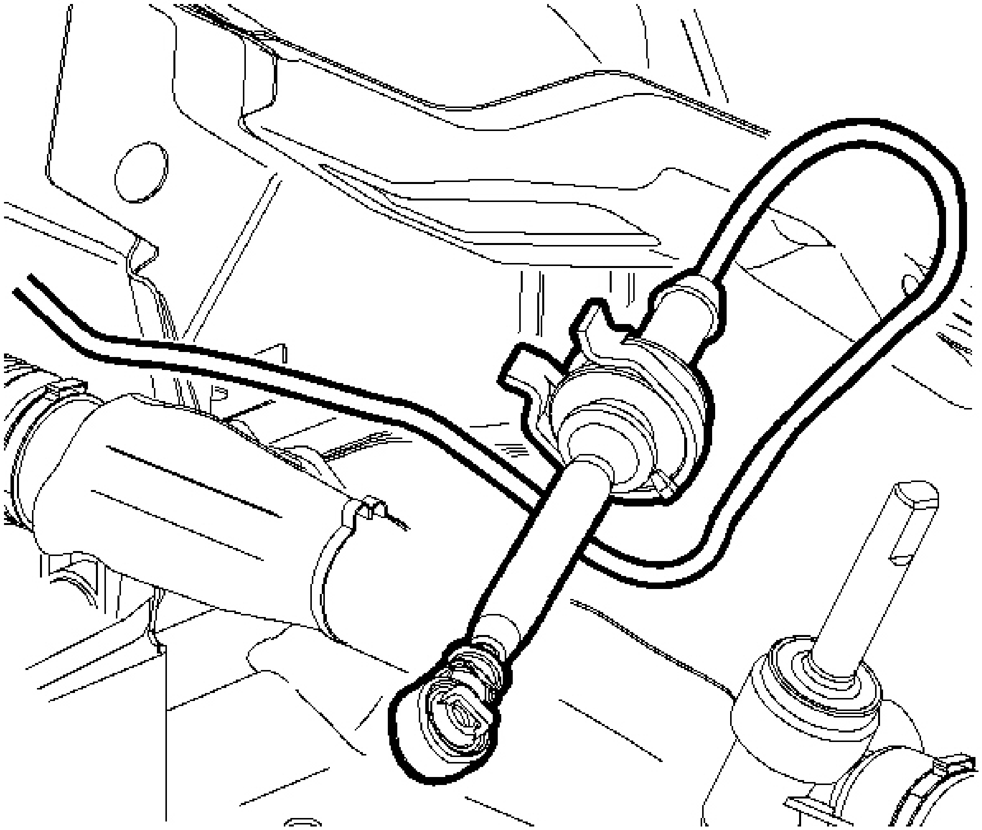


Fig. 33: Cable-To-Steering Gear Assembly & Retaining Clip
Courtesy of GENERAL MOTORS CORP.

10. Remove the control cable from the cable-to-steering gear assembly retaining clip.
11. Lower the vehicle

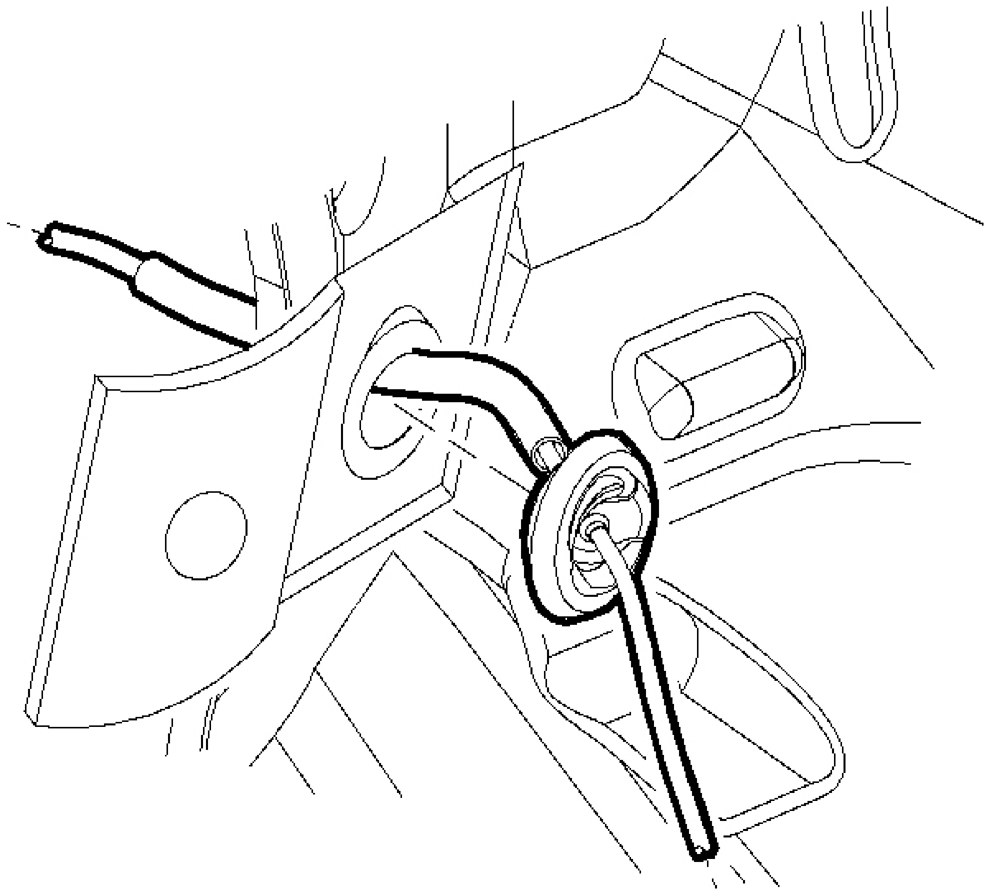


Fig. 34: Control Cable Grommet & Dash Panel
Courtesy of GENERAL MOTORS CORP.

12. Remove the control cable grommet from the dash panel.
13. Remove the control cable from the vehicle.

Installation Procedure

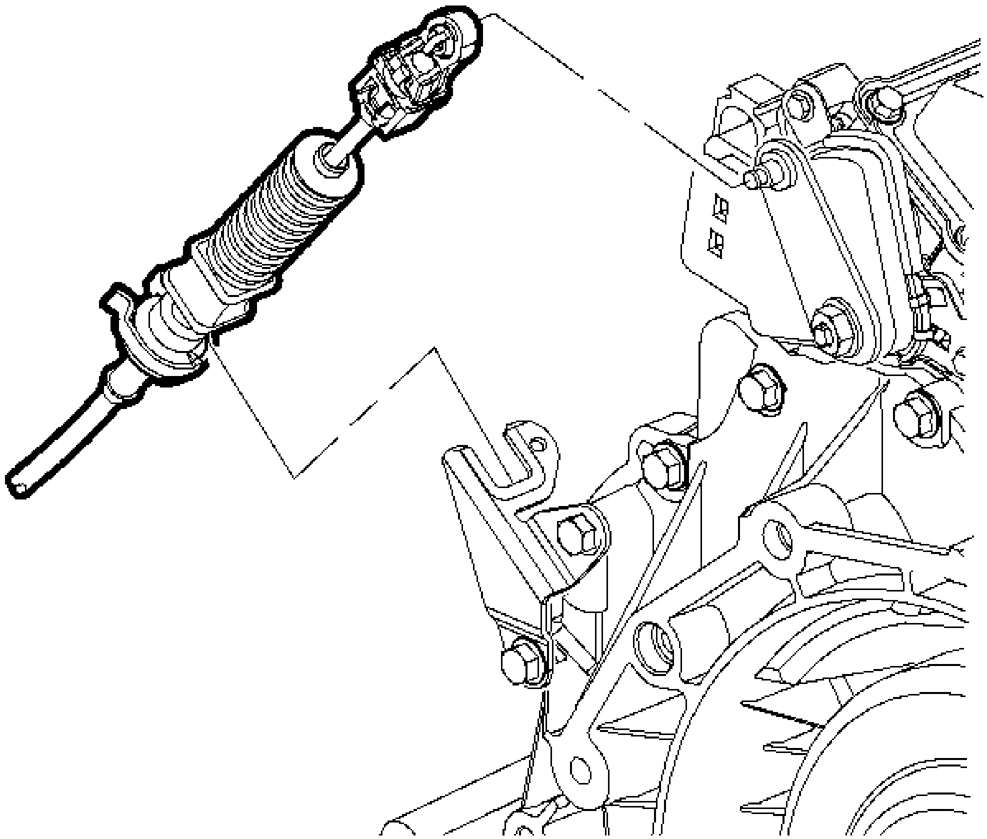


Fig. 35: Control Cable & Transaxle Range Switch Lever
Courtesy of GENERAL MOTORS CORP.

1. Route the control cable through the cable bracket.

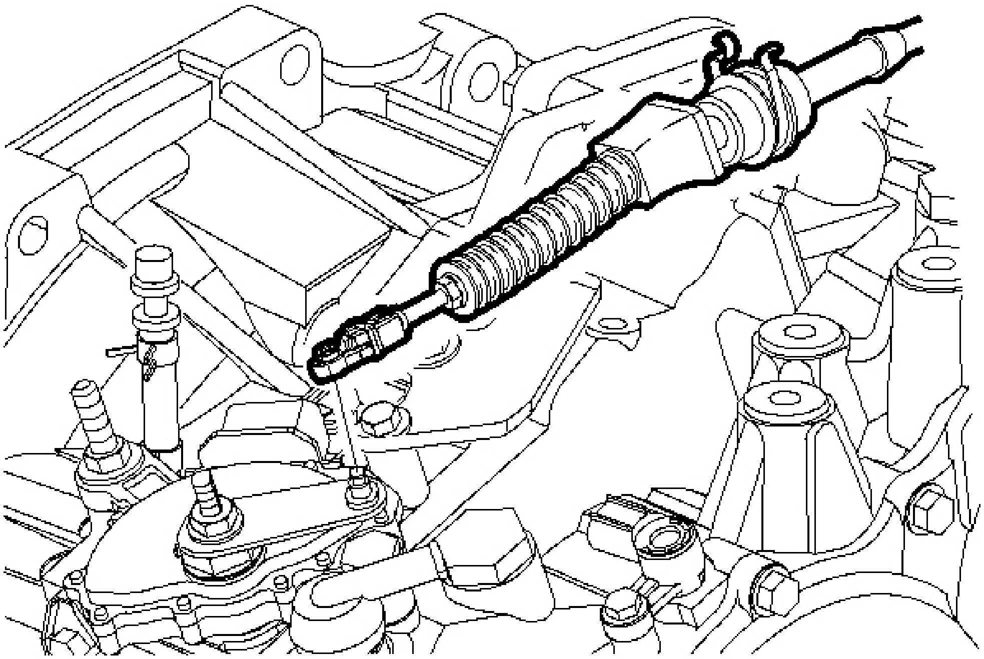


Fig. 36: Control Cable Retainer Clip Tabs, Cable & Control Cable Bracket
Courtesy of GENERAL MOTORS CORP.

2. Secure the cable to the bracket with a new control cable retainer clip. An audible snap will be heard when properly installed.
3. With the transaxle range switch lever located in N - Neutral, snap the cable end fitting onto the ball stud of the lever. An audible snap will be heard when properly installed.

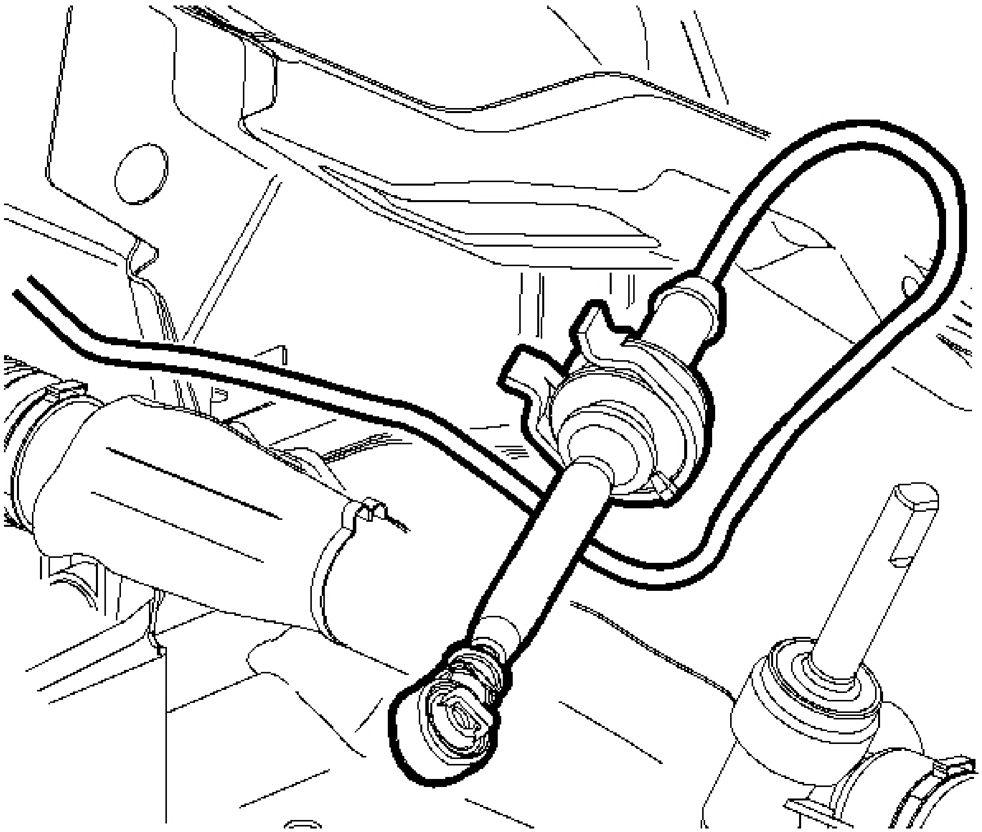


Fig. 37: Cable-To-Steering Gear Assembly & Retaining Clip
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: For the VT25-E transaxle, perform steps 4-6.

4. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
5. Route the cable along the steering gear assembly into the clip and up into the dash panel.
6. Lower the vehicle.

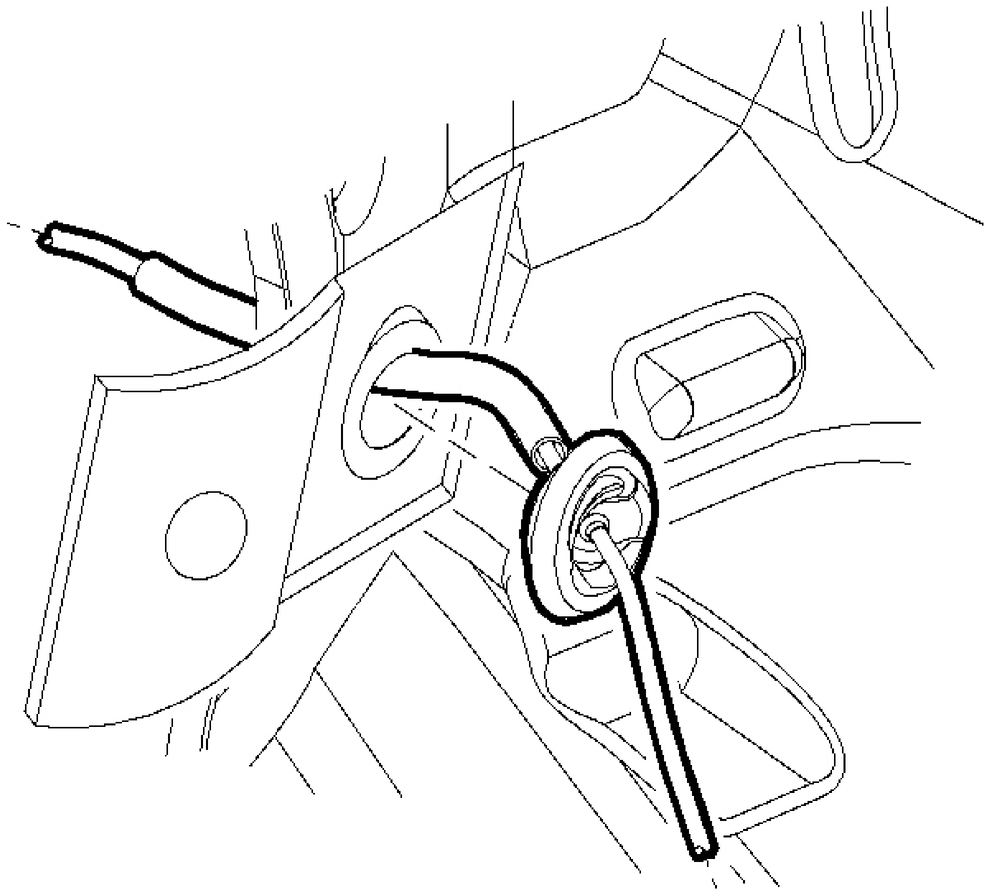


Fig. 38: Control Cable Grommet & Dash Panel
Courtesy of GENERAL MOTORS CORP.

7. Secure the control cable grommet by pressing the cable into the pass-thru hole in the dash panel.

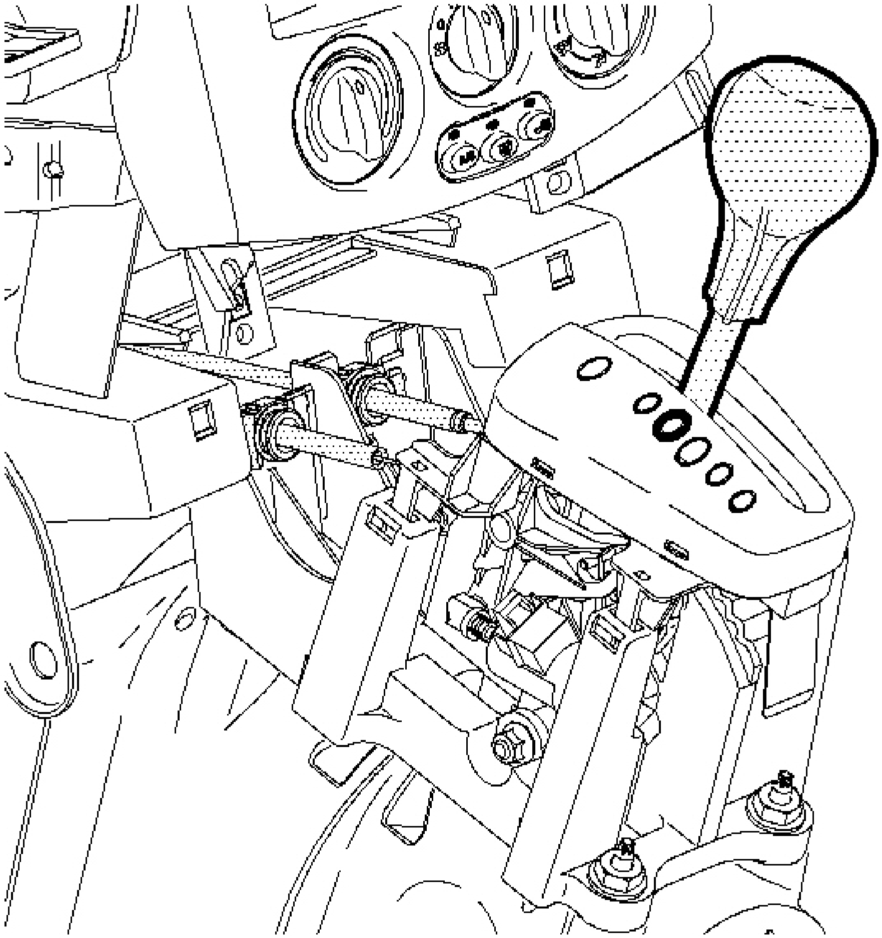


Fig. 39: Control Assembly In N - Neutral Position
Courtesy of GENERAL MOTORS CORP.

8. Make sure the control assembly is in the N - Neutral position.

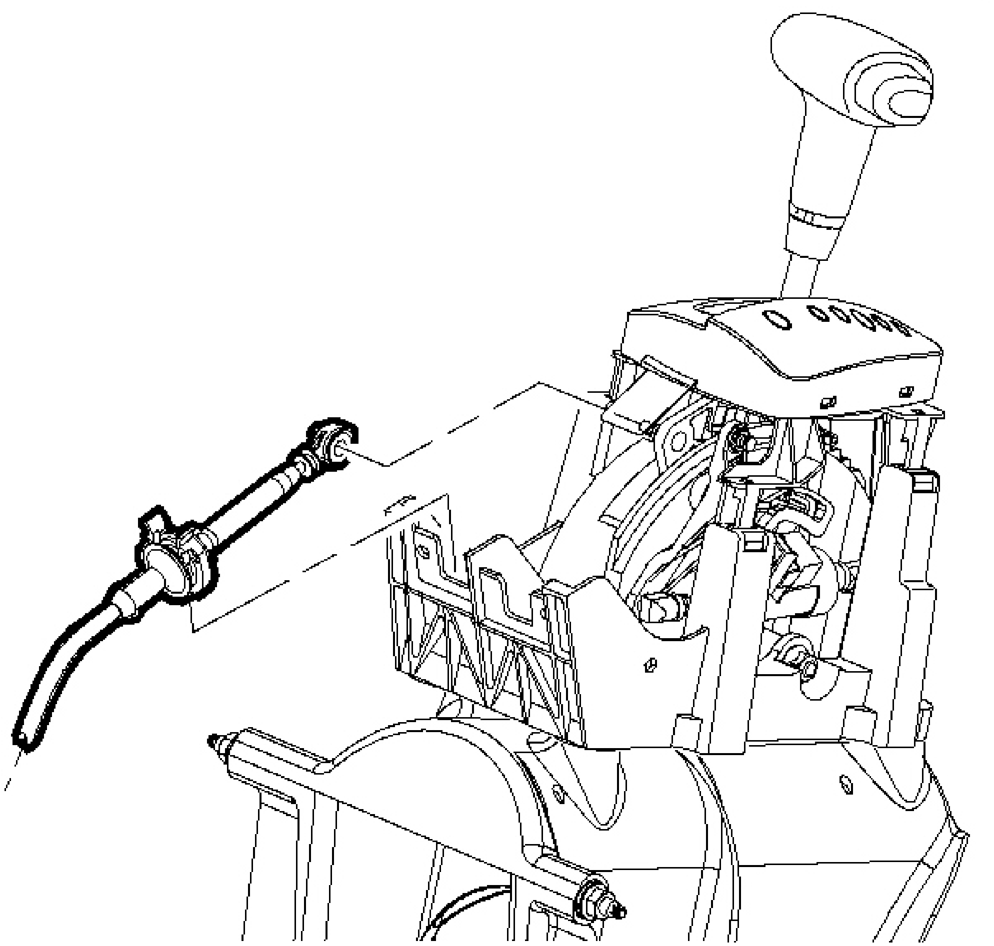


Fig. 40: Shiftier Cable Retainer Clip, Cable & Control Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The secondary clip is not required for service. Make sure the shiftier cable is fully engaged into the shiftier cable.

9. Connect the control cable to the control assembly. Secure with a new control cable retainer clip.
10. Install the control cable onto the control assembly lever.
11. Adjust the control cable assembly. Refer to **Shift Cable Adjustment** .
12. Install the console. Refer to **Console Replacement** in Instrument Panel, Gages, and Console.
13. Install the battery tray and bracket. Refer to **Battery Tray Replacement (L61)** or **Battery Tray Replacement (L66)** in Engine Electrical.

14. Install the battery. Refer to **Battery Replacement** in Engine Electrical.

SHIFT CABLE ADJUSTMENT

Tools Required

J 36346 Fascia Retainer Remover

Adjustment Procedure

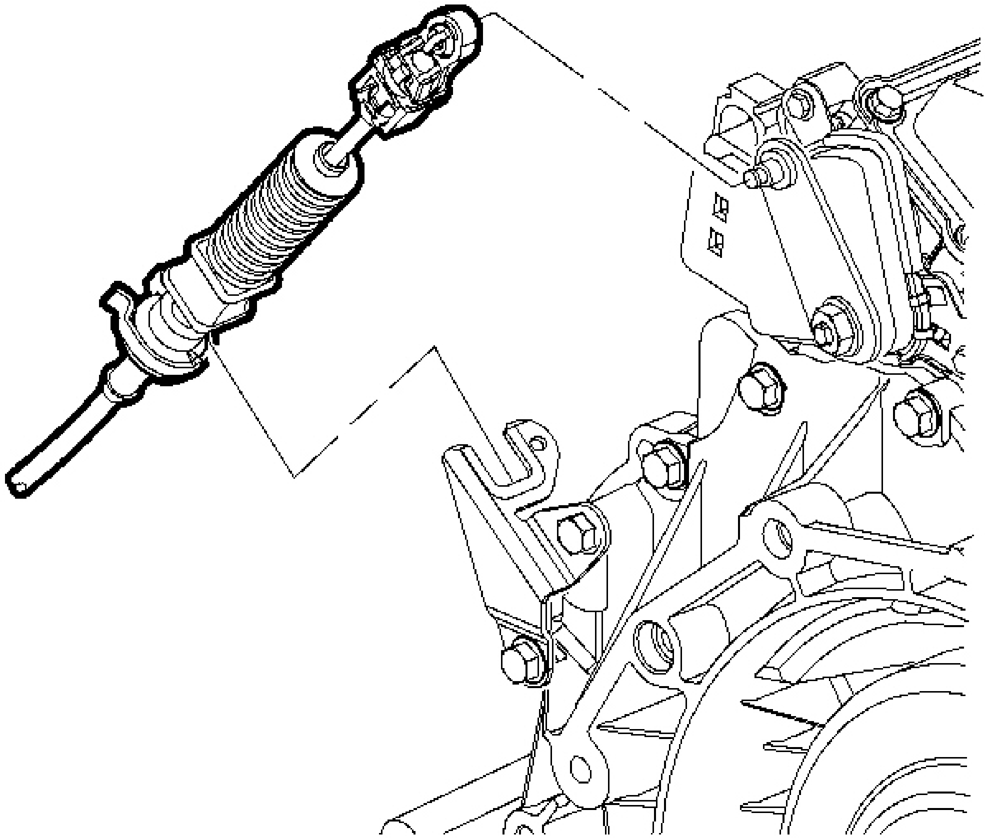


Fig. 41: Control Cable & Transaxle Range Switch Lever
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: All shifter cable and park lock cable clips are one time usage only. Any service repair requiring cables to be disconnected from the transaxle control cable bracket or shifter assembly will require a cable clip replacement.

1. Move the control assembly into the N - Neutral position.

NOTE: The control cable must be disconnected from the transaxle range switch lever prior to disconnecting it from the control cable bracket. Otherwise damage to the manual shift shaft may result, requiring transaxle disassembly.

2. Using the Fascia Retainer Remover **J 36346** , disconnect the control cable from the transaxle range switch lever.

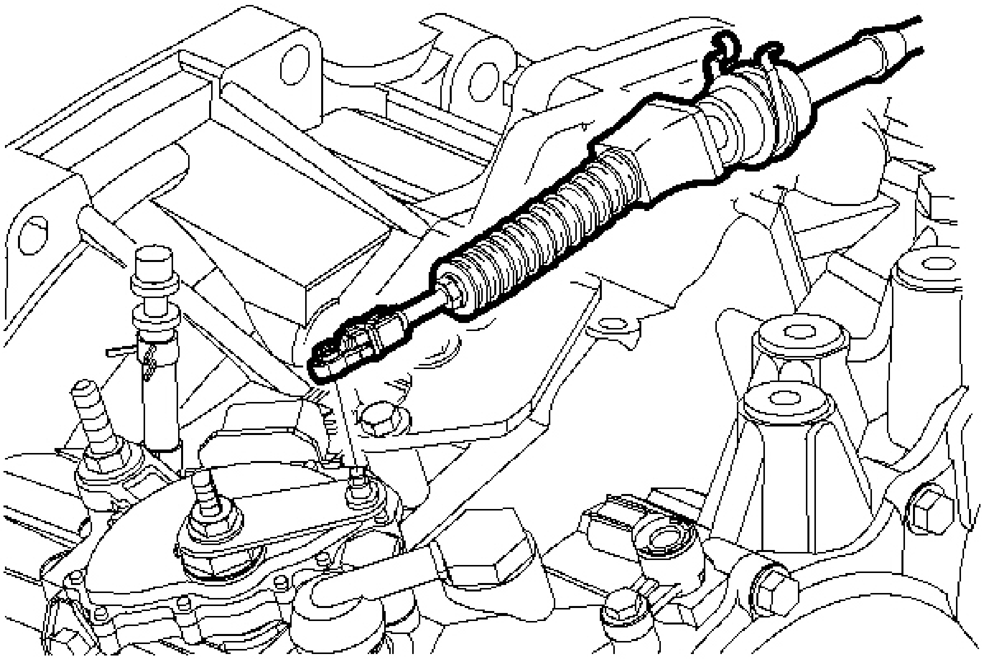


Fig. 42: Control Cable Retainer Clip Tabs, Cable & Control Cable Bracket
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the control cable from the control cable bracket by depressing the control cable retainer clip tabs and pulling up. Discard the clip.

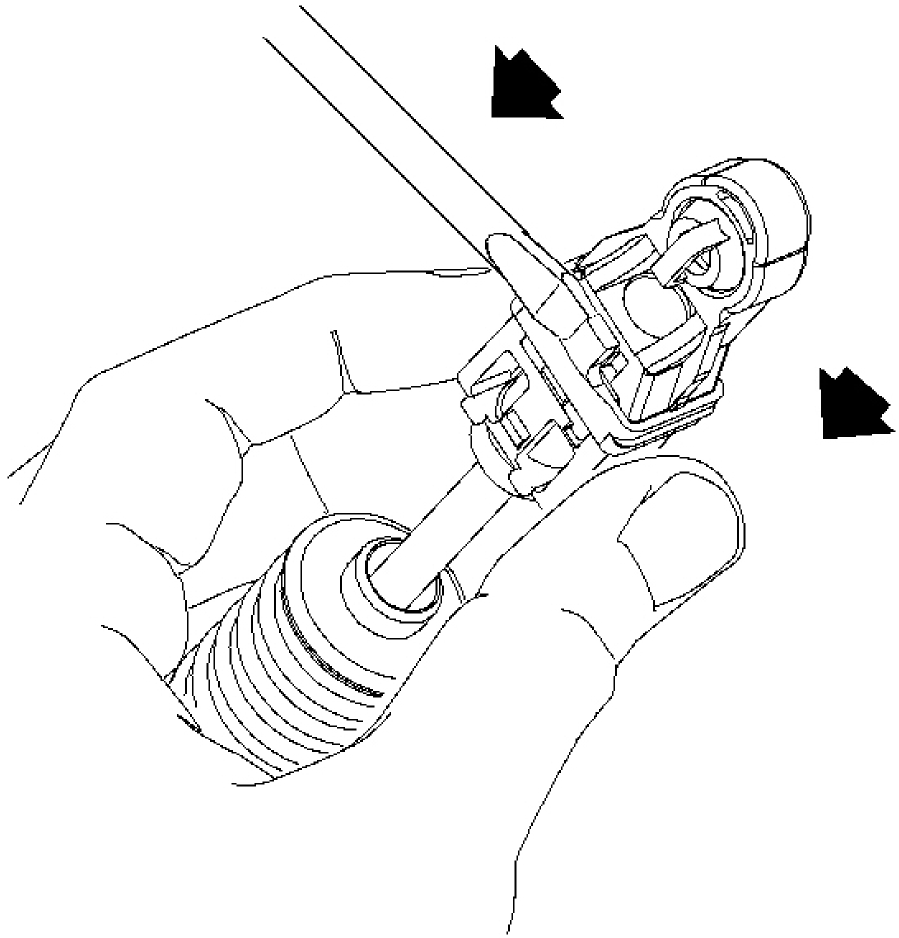


Fig. 43: Releasing The Control Cable Assembly Adjustment Lock
Courtesy of GENERAL MOTORS CORP.

4. Release the control cable assembly adjustment lock.
5. Slide the black tab back.

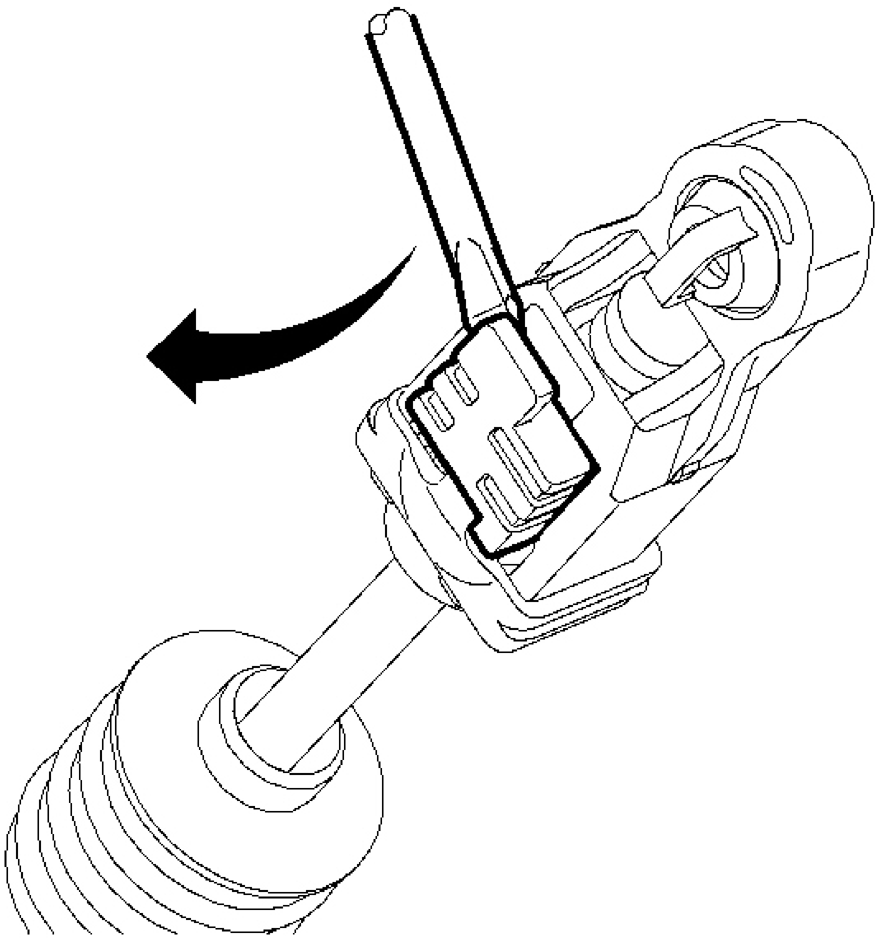


Fig. 44: Inserting A Screwdriver Into Slot Under White Tab
Courtesy of GENERAL MOTORS CORP.

6. Insert a screwdriver into the slot under the white tab and pull up on the white tab.

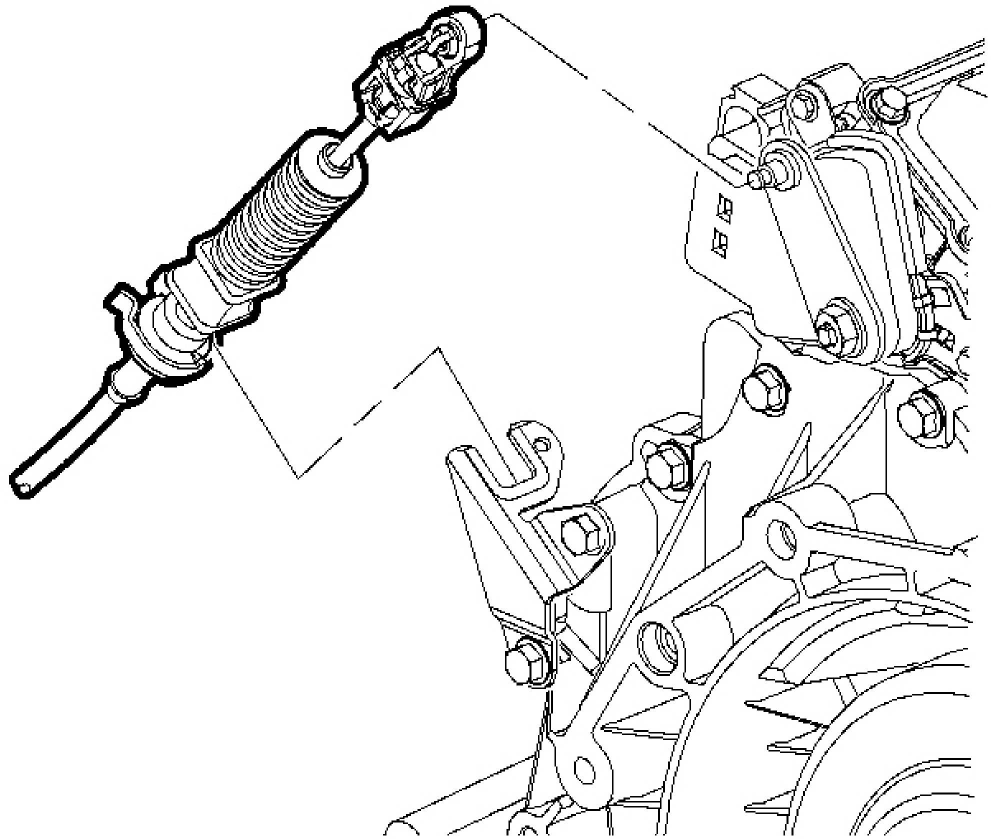


Fig. 45: Control Cable & Transaxle Range Switch Lever
Courtesy of GENERAL MOTORS CORP.

7. Install the control cable into the control cable bracket. Secure with a new control cable retainer clip. An audible snap will be heard when properly installed.

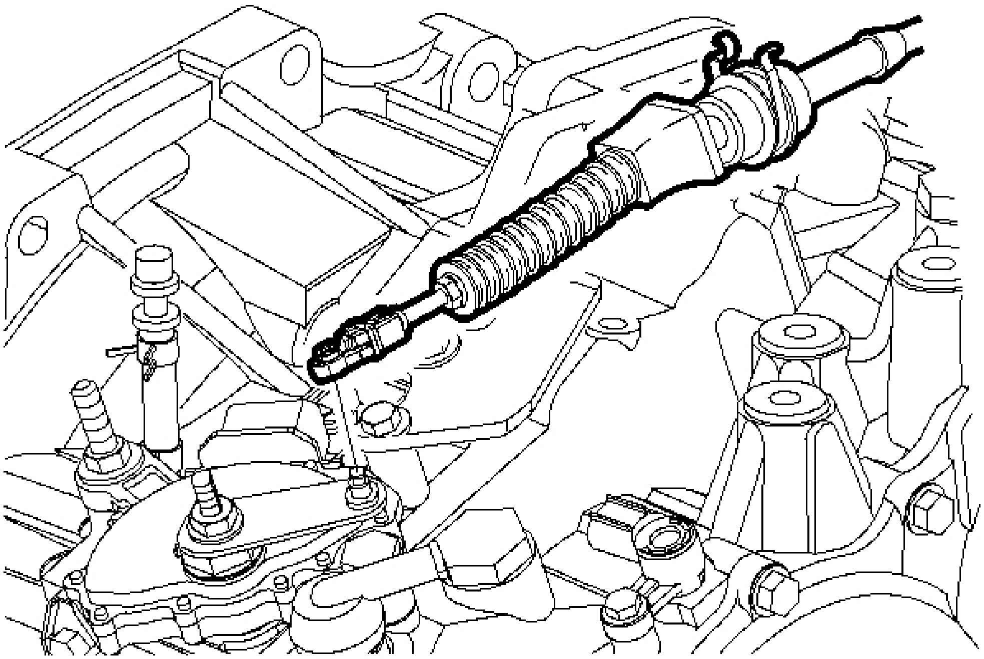


Fig. 46: Control Cable Retainer Clip Tabs, Cable & Control Cable Bracket
Courtesy of GENERAL MOTORS CORP.

8. Snap the cable end fitting onto the ball stud of the transaxle range switch lever. An audible snap will be heard when properly installed.

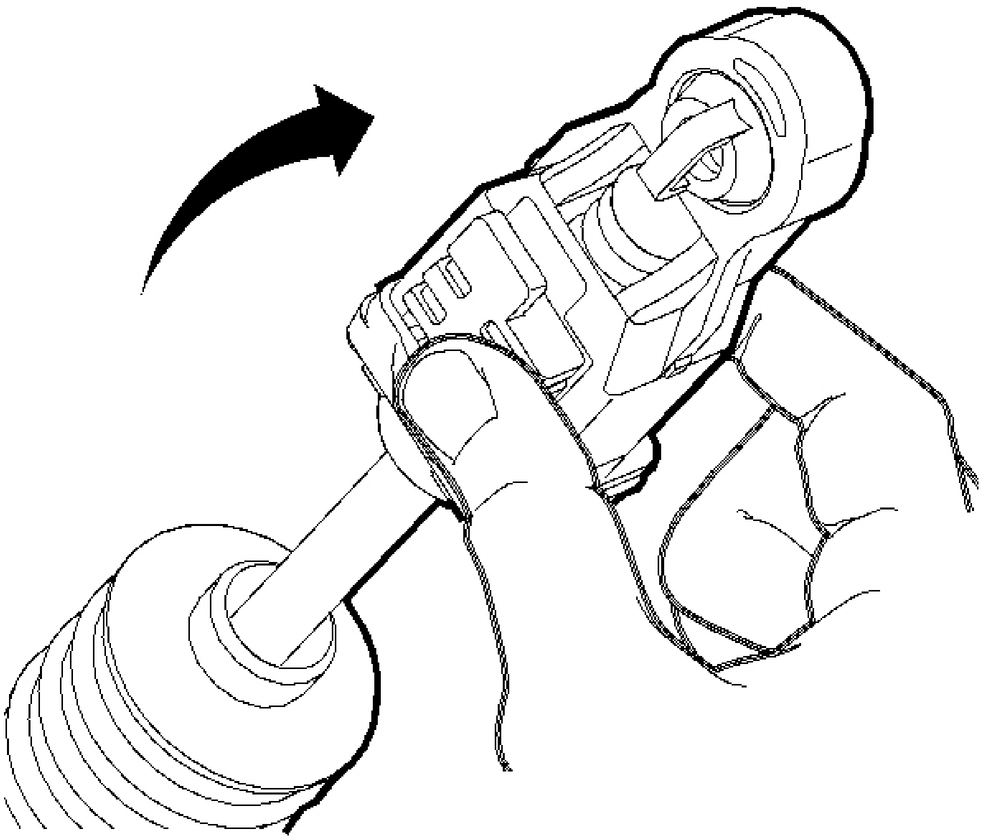


Fig. 47: Locking The Control Cable Adjustment Tab
Courtesy of GENERAL MOTORS CORP.

9. Lock the control cable adjustment tab.
10. Push down on the white tab to secure in place.

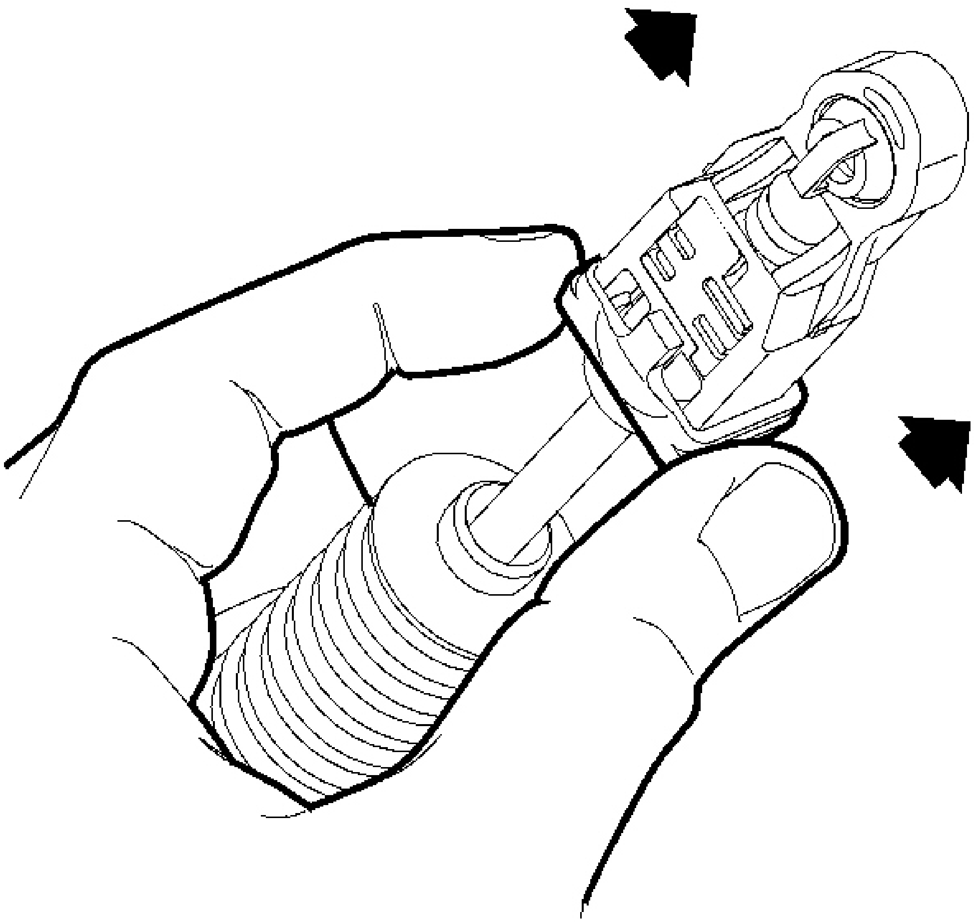


Fig. 48: Sliding The Black Tab Over The White Tab
Courtesy of GENERAL MOTORS CORP.

11. Slide the black tab over the white tab to lock in place.
12. Verify proper operation.

PARK LOCK CABLE REPLACEMENT

Removal Procedure

IMPORTANT: All shifter cable and park lock cable clips are one time usage only. Any service repair requiring cables to be disconnected from the transaxle control cable bracket or shifter assembly will require a cable clip

replacement.

1. Disable the SIR system. Refer to **SIR Disabling and Enabling Zone 8** in Restraints.
2. Remove the console. Refer to **Console Replacement** removal procedure in Body and Accessories.
3. Remove the lock cylinder bezel from the steering column shroud by carefully prying with a thin bladed screwdriver.

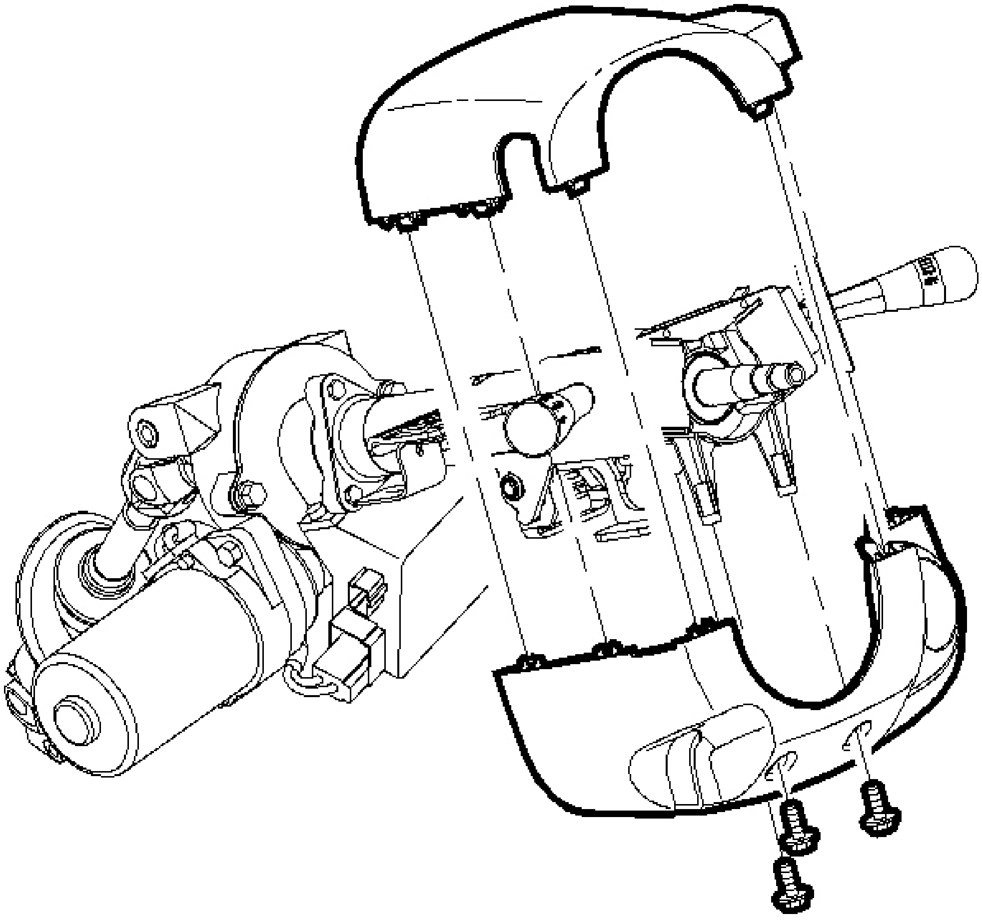


Fig. 49: Shroud Fasteners, Steering Column Upper & Lower Shroud Panels
Courtesy of GENERAL MOTORS CORP.

4. Remove the shroud fasteners and remove the steering column upper and lower shroud panels.
5. Make sure the key is in the OFF position.

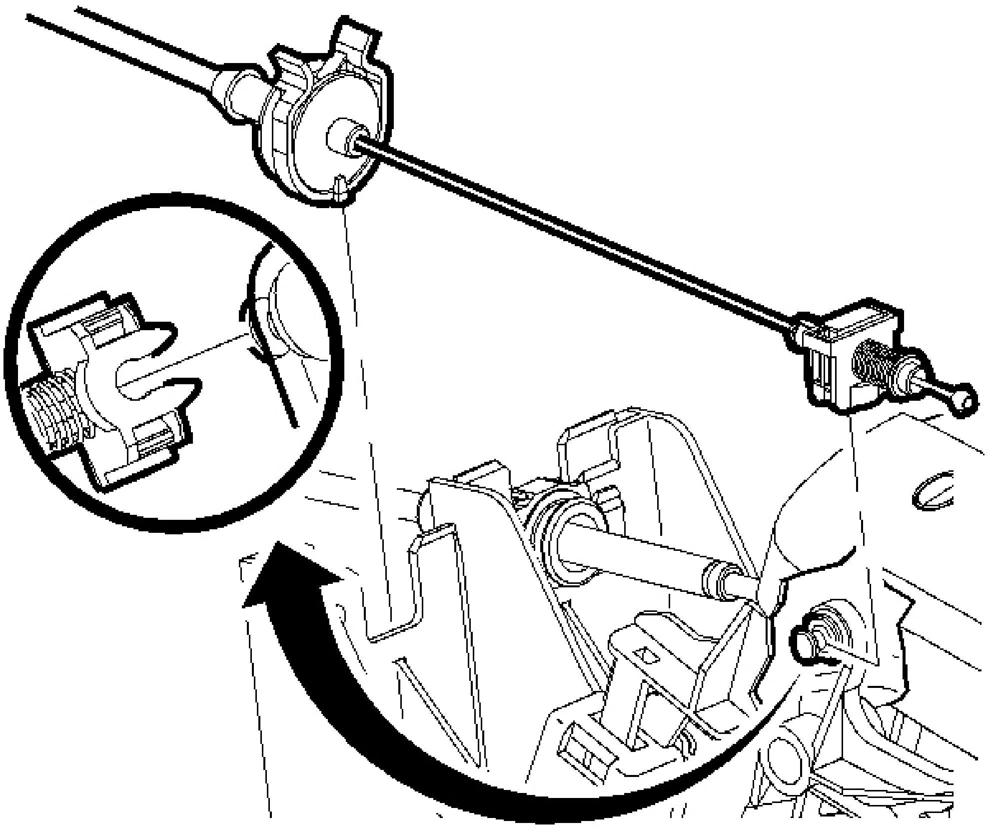


Fig. 50: Park Lock Cable Clip & Control Assembly
Courtesy of GENERAL MOTORS CORP.

6. Squeeze the tabs on the park lock cable clip and pull upward to disengage from the control assembly. Discard the clip.

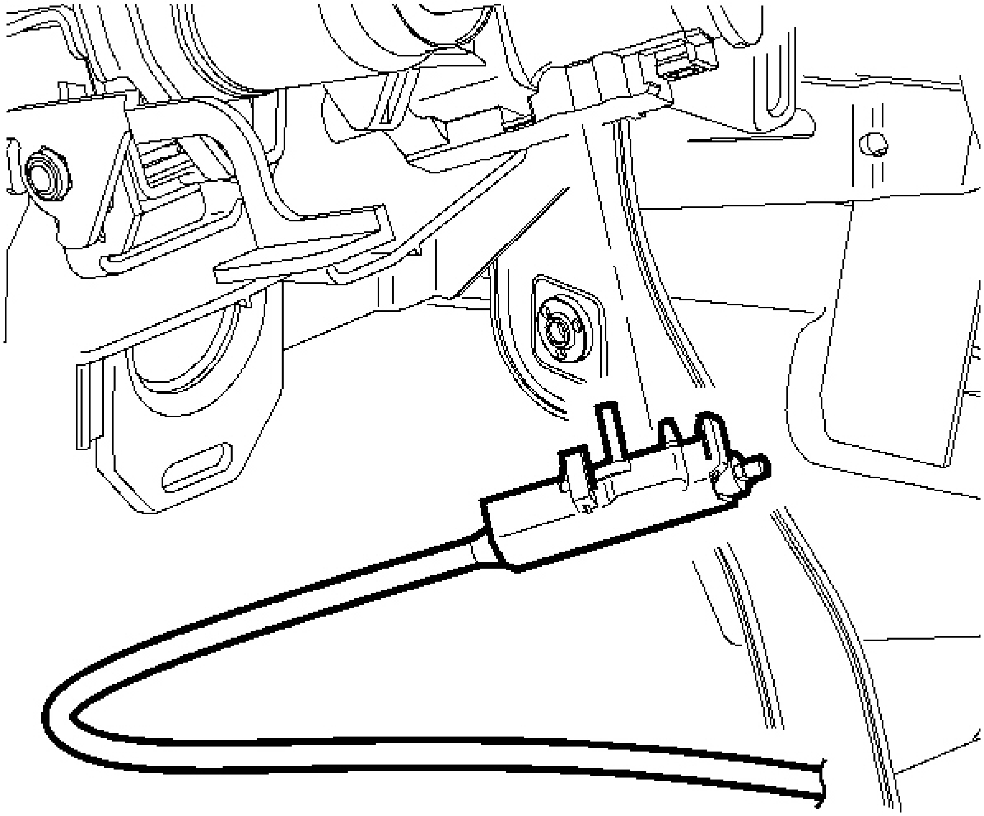


Fig. 51: Park Lock Cable Assembly & Ignition Module
Courtesy of GENERAL MOTORS CORP.

7. Disengage the retaining tabs and remove the park lock cable assembly from the ignition module.
8. Remove the park lock cable from the control assembly.
9. Remove the park lock cable assembly from the vehicle and note routing.

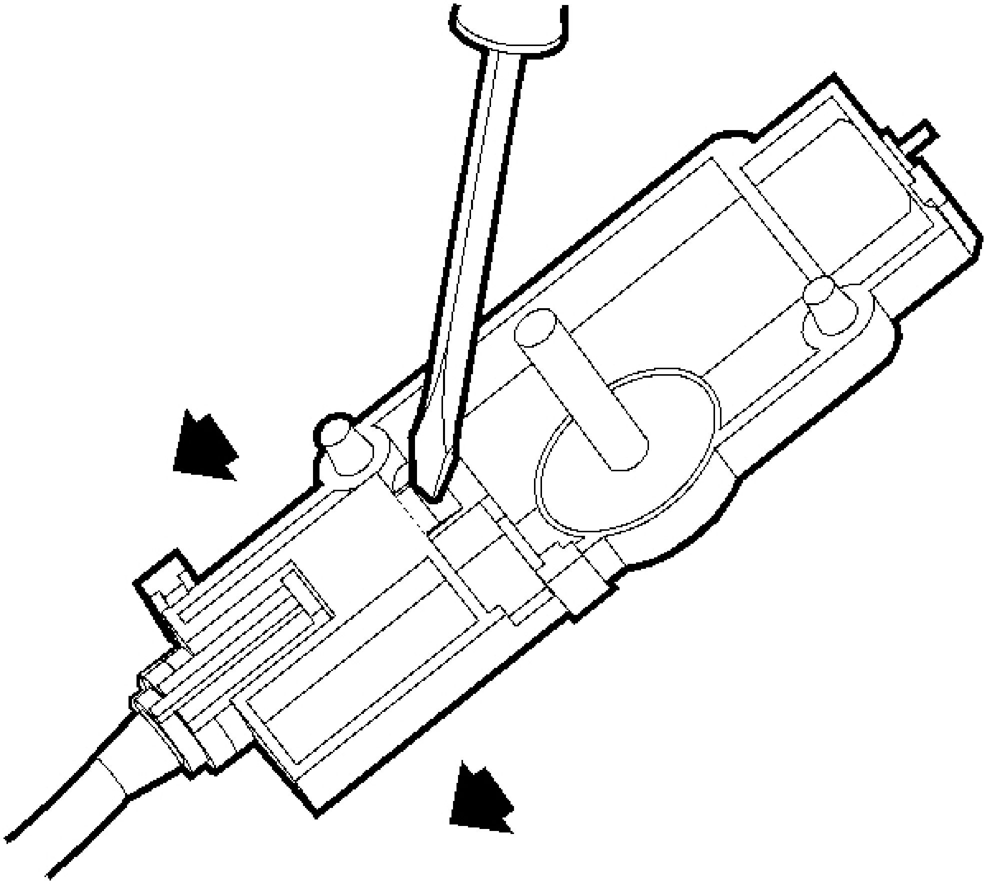


Fig. 52: Pushing Black Tab To Release End Fitting Using A Screwdriver
Courtesy of GENERAL MOTORS CORP.

10. Using a screwdriver, push on the black tab to release the end fitting. Discard the end fitting.

Installation Procedure

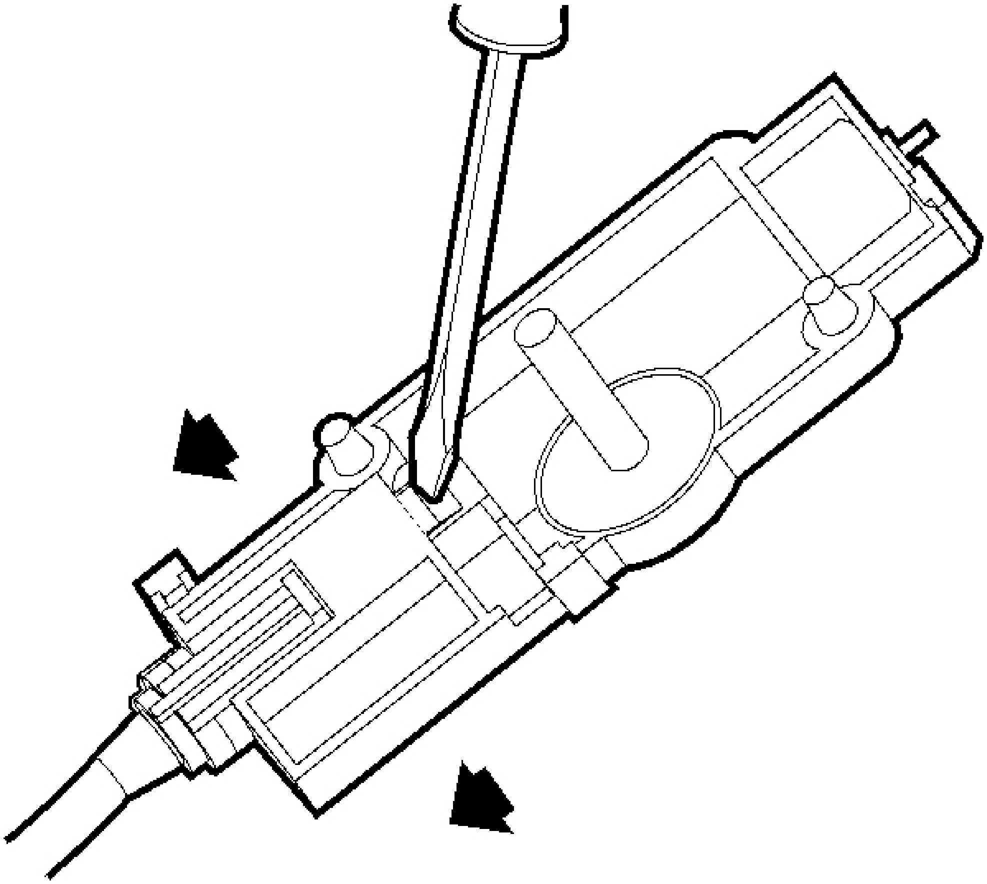


Fig. 53: Pushing Black Tab To Release End Fitting Using A Screwdriver
Courtesy of GENERAL MOTORS CORP.

1. Install a new end fitting on the park lock cable.

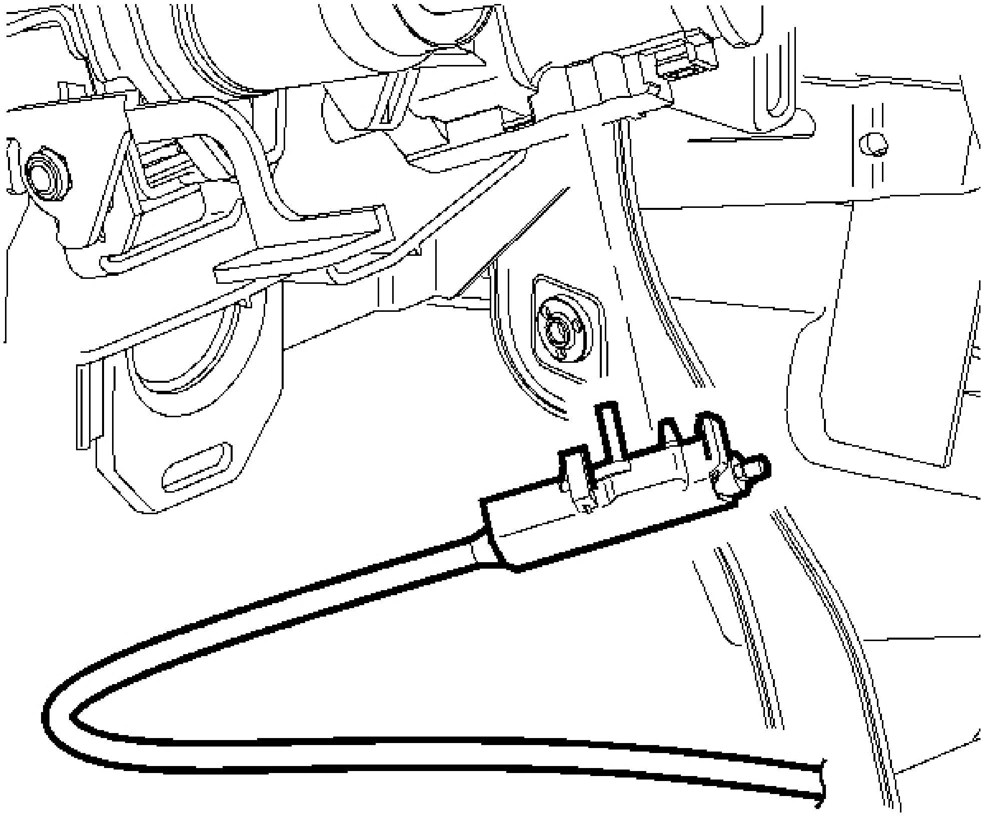


Fig. 54: Park Lock Cable Assembly & Ignition Module
Courtesy of GENERAL MOTORS CORP.

2. Snap the park lock cable assembly onto the ignition module.

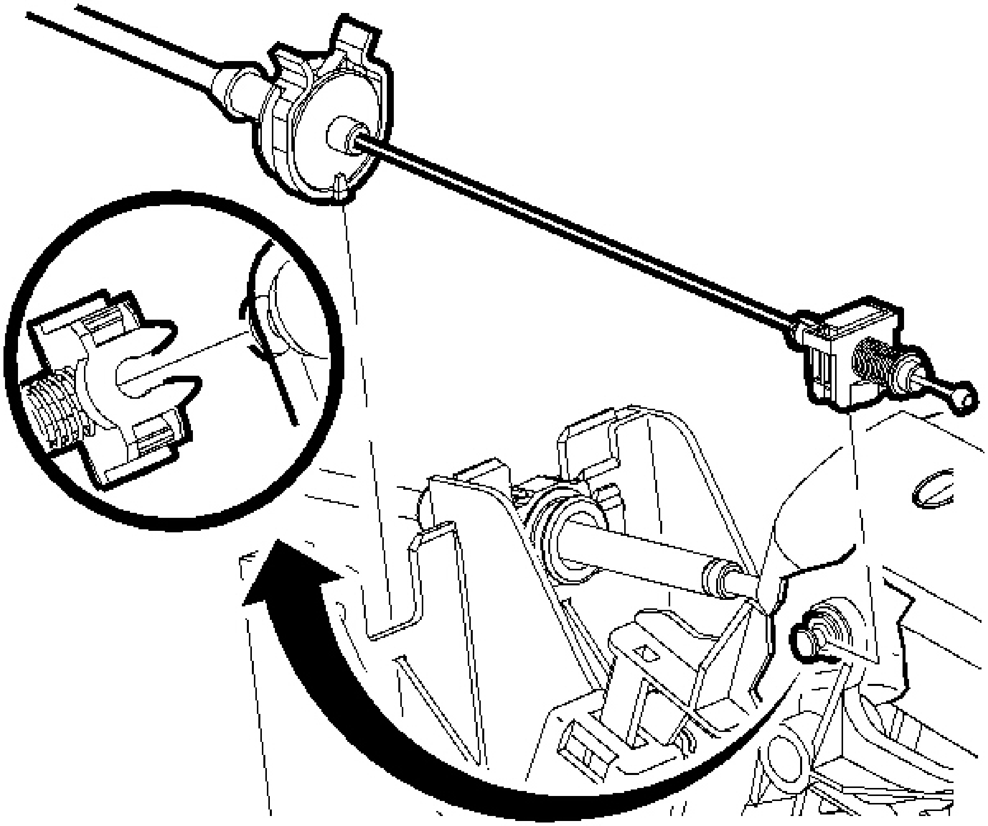


Fig. 55: Park Lock Cable Clip & Control Assembly
Courtesy of GENERAL MOTORS CORP.

3. Install the park lock cable onto the control assembly, using a new clip.

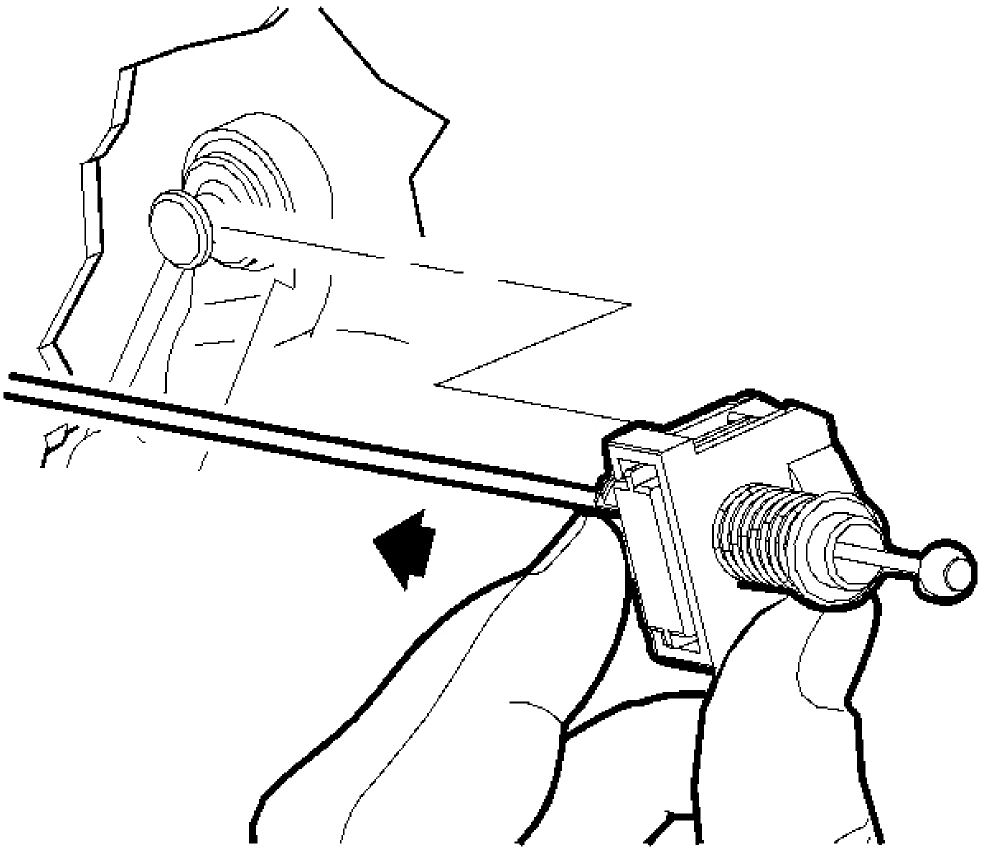
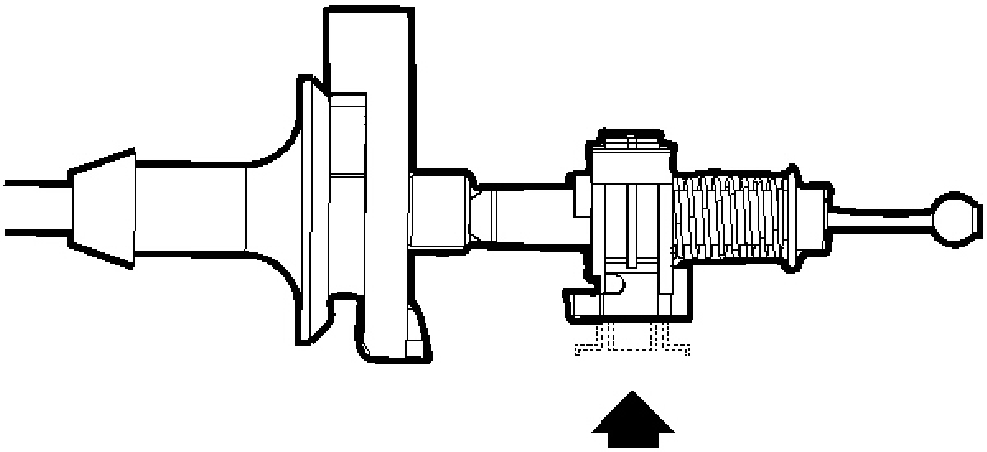


Fig. 56: Park Lock Cable End Terminal & Control Assembly
Courtesy of GENERAL MOTORS CORP.

4. Install the park lock cable end terminal onto the control assembly by aligning the cable fitting to the pin and pushing forward. When installing, be sure not to install the cable end fitting on an angle or push down on the cable portion as this may cause cable to misadjust.



<u>Fig. 57: Lock Cylinder Bezel & Steering Column Shroud</u>
Courtesy of GENERAL MOTORS CORP.

5. Verify the control assembly is in the P - Park position. Lock the adjuster piece into place by pushing in on the tab.

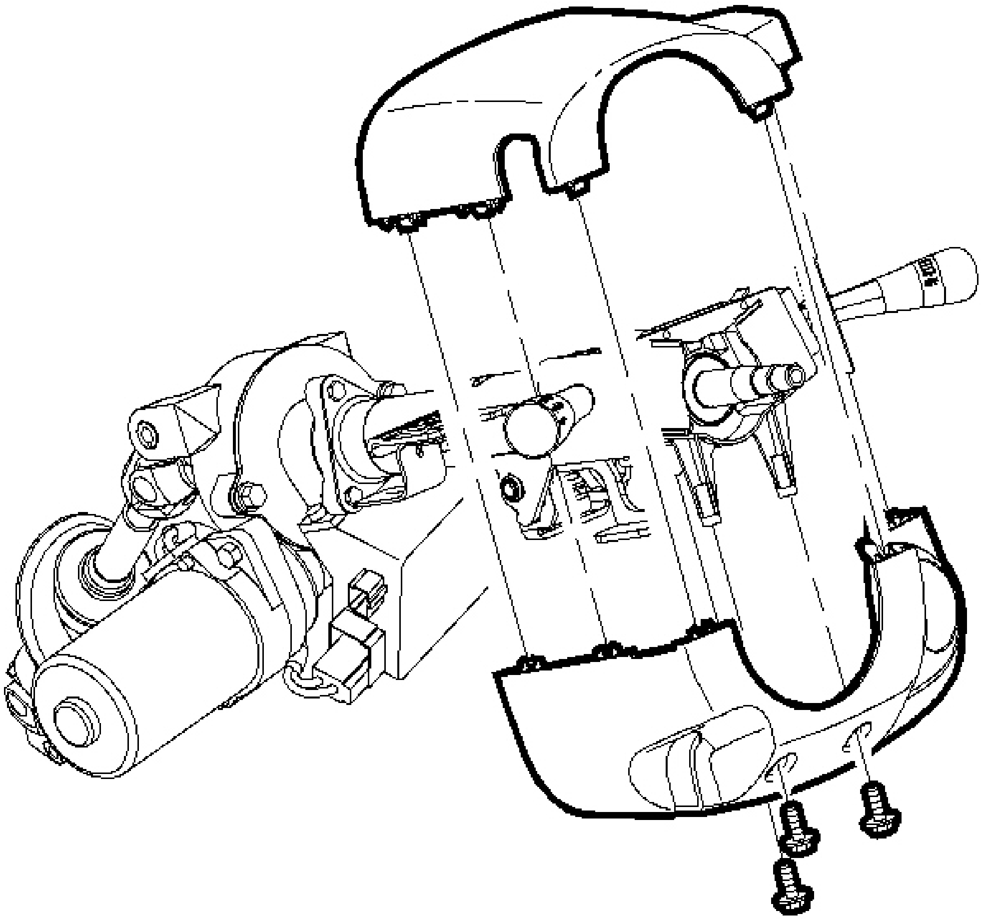


Fig. 58: Shroud Fasteners, Steering Column Upper & Lower Shroud Panels
Courtesy of GENERAL MOTORS CORP.

6. Install the shroud fasteners and install the steering column upper and lower shroud panels.
7. Install the lock cylinder bezel onto the steering column shroud.
8. Install the console. Refer to **Console Replacement** procedure in Body and Accessories.
9. Enable the SIR system. Refer to **SIR Disabling and Enabling Zone 8** .

PARK LOCK CABLE ADJUSTMENT

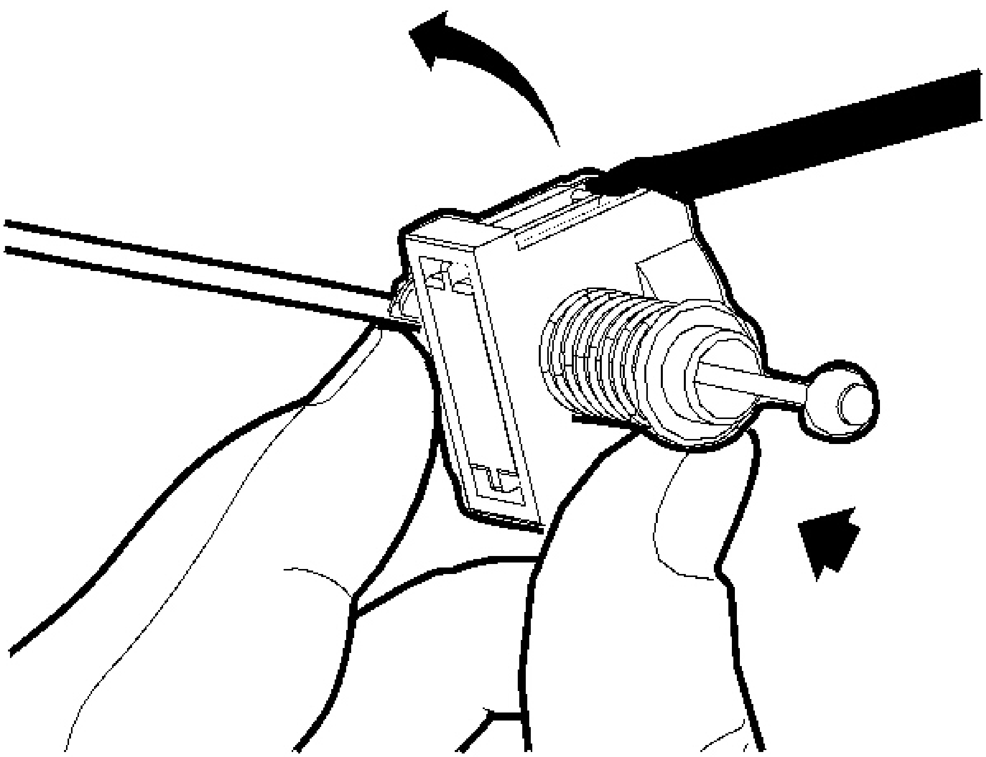


Fig. 59: Releasing The Adjuster Piece
Courtesy of GENERAL MOTORS CORP.

1. Release the adjuster piece by gently prying up on the adjuster locks and unlocking the tab, indicated by arrows.

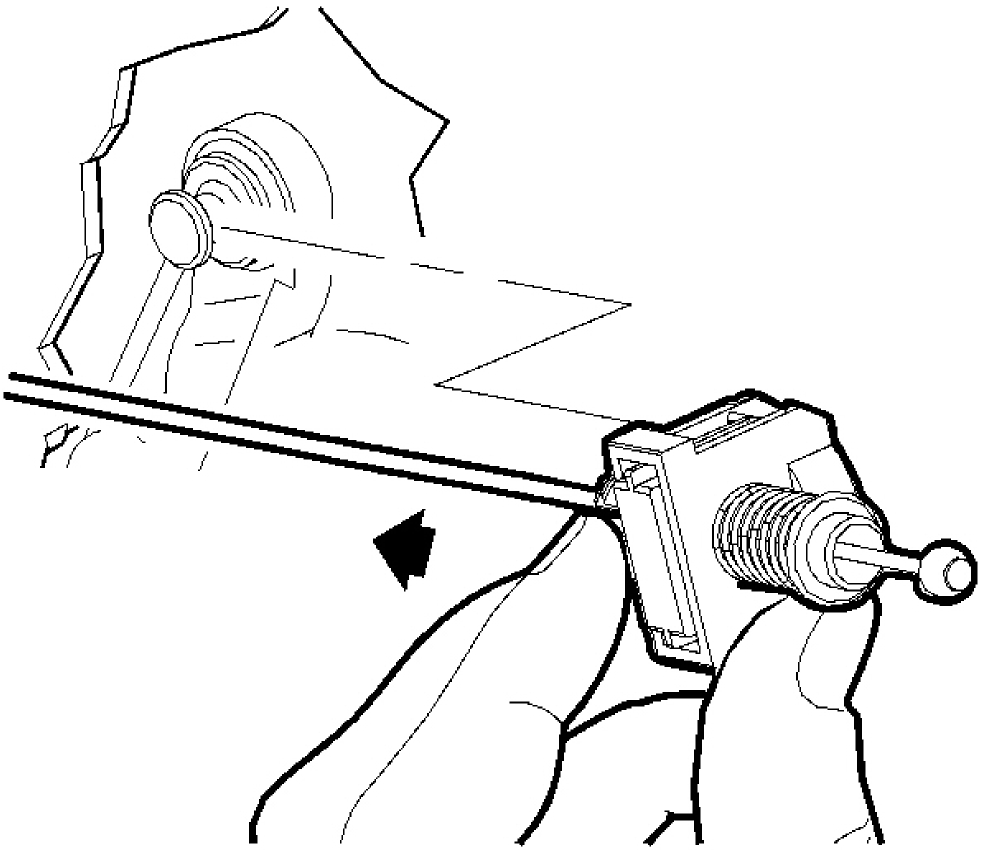


Fig. 60: Park Lock Cable End Terminal & Control Assembly
Courtesy of GENERAL MOTORS CORP.

2. Install the park lock cable end terminal on the control assembly aligning the cable fitting to the pin and pushing forward. When installing be sure not to install the cable end fitting on an angle or push down on the cable portion as this may cause cable to misadjust.

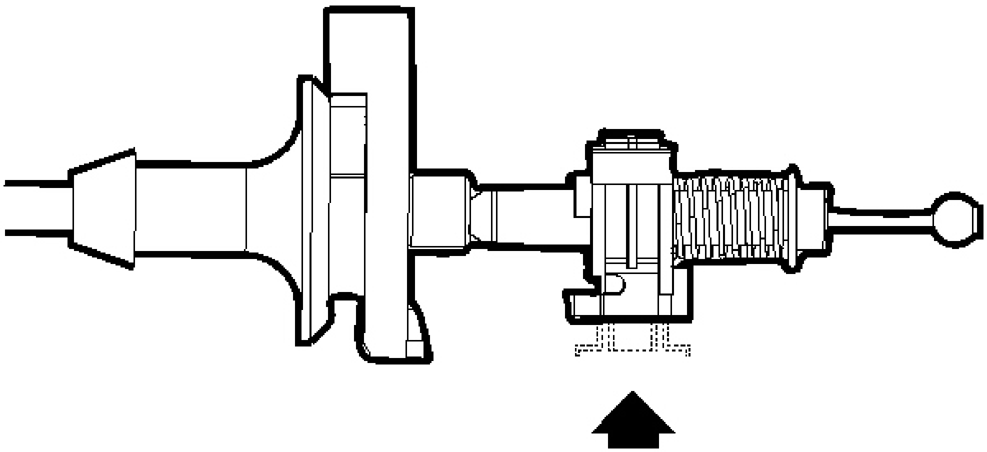


Fig. 61: Lock Cylinder Bezel & Steering Column Shroud
Courtesy of GENERAL MOTORS CORP.

3. Remove the lock cylinder bezel from the steering column shroud by carefully prying with a thin bladed screwdriver.

Park Lock Cable Assembly Operation Inspection

1. Set the parking brake.
2. With the ignition key removed from the ignition lock cylinder and the control shift lever is in the P - Park position, depress the control shift lever button to move the control shift lever out of the P - Park position.
    - If the control shift lever can be shifted out of the P - Park position, refer to **Park Lock Cable Replacement** procedure in this section.

- If the control shift lever cannot be shifted out of P - Park position, proceed to the next step.

3. Insert the ignition key into the ignition lock cylinder assembly and turn to the RUN position.
4. Depress the brake pedal and depress the control shift lever button and move the control shift lever out of the P - Park position.
5. Release the brake pedal. With the control shift lever out of the P - Park position, attempt to turn the ignition to the LOCK position. Make sure the ignition key is pushed inward toward the steering column when it is rotated toward the LOCK position.
    - If the ignition key can be turned to the LOCK position with the control shift lever out of the P - Park position, refer to **Park Lock Cable Replacement** procedure in this section.
    - If the ignition key cannot be turned to the LOCK position with the control shift lever out of the P - Park position, the park lock cable assembly is properly adjusted. Proceed to the next step.
6. Depress the control shift lever button. Move the control shift lever to the P - Park position.
7. Turn the ignition key to the ON position and then to the OFF position.
8. Make sure the ignition key is removable.
    - If the ignition key can be removed from the ignition lock cylinder assembly, proceed to the next step.
    - If the ignition key cannot be removed from the ignition lock cylinder assembly, refer to **Park Lock Cable Replacement** procedure in this section.
9. Turn the ignition key to the LOCK position.
10. Remove the ignition key from the ignition lock cylinder assembly.

TRANSMISSION CONTROL MODULE (TCM) REPLACEMENT

Removal Procedure

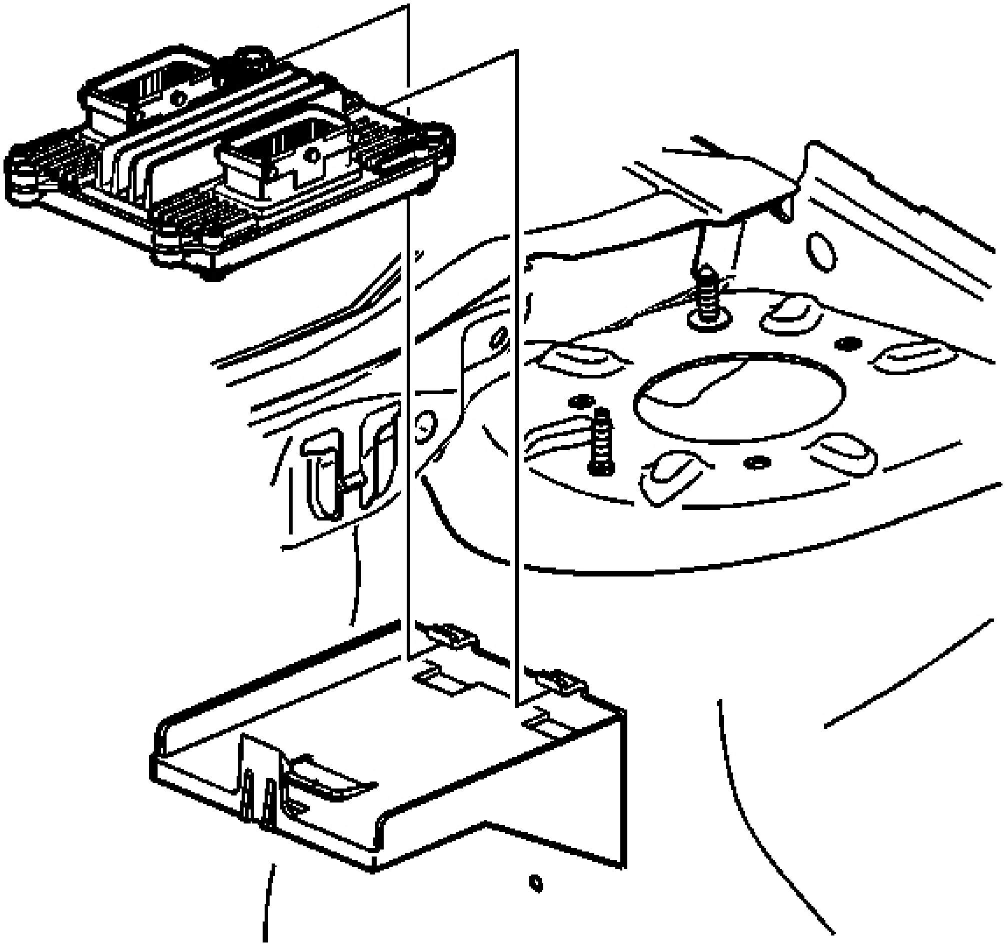


Fig. 62: TCM & TCM Bracket
Courtesy of GENERAL MOTORS CORP.

1. Turn the ignition off.
2. Disconnect J1 and J2 transmission control module (TCM) electrical connectors.
3. Pull the retaining tang from the TCM and rotate the TCM up.
4. Remove the TCM from the TCM bracket.

Installation Procedure

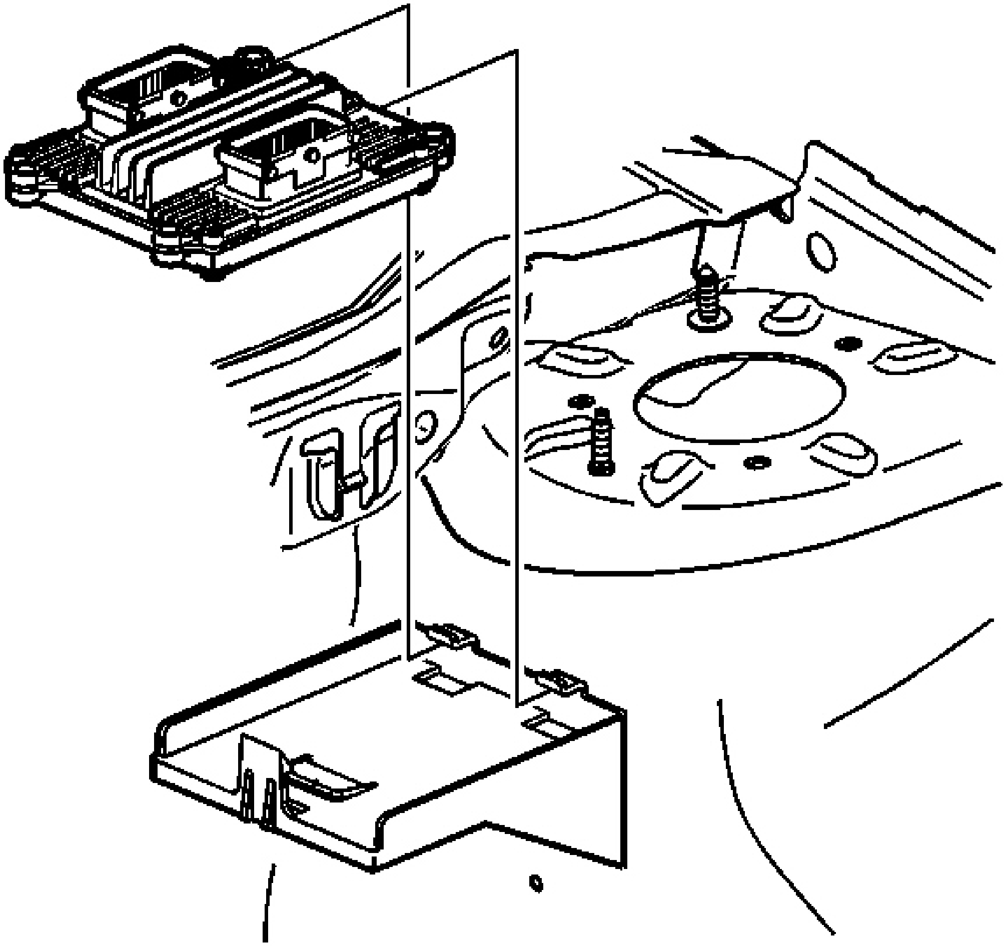


Fig. 63: TCM & TCM Bracket
Courtesy of GENERAL MOTORS CORP.

1. Install the TCM.
2. Connect J1 and J2 TCM electrical connectors.

IMPORTANT: DTC P0602 sets with all service TCMs. When the TCM is reprogrammed with the correct software and calibrations, DTC P0602 will be erased.

3. Program the TCM with the correct calibration. Refer to **Transmission Control Module Reprogramming Procedures** .

TRANSMISSION CONTROL MODULE REPROGRAMMING PROCEDURES

TCM Programming Procedures

1. The transmission control module (TCM) must be programmed with the proper software/calibrations. Ensure that the following conditions exist in order to prepare for TCM programming:
    - The battery is fully charged.
    - The ignition switch is in the RUN position.
    - The Techline equipment cable connection at the data link connector (DLC) is secure.
2. Program the TCM using the latest software matching the vehicle. Refer to up-to-date Techline equipment user instructions.
3. If the TCM fails to program, proceed as follows:
    - Ensure that the TCM connection is OK.
    - Inspect the Techline equipment for the latest software version.
    - Attempt to program the TCM. If the TCM still cannot be programmed properly, replace the TCM.

PARK/NEUTRAL POSITION SWITCH REPLACEMENT

Tools Required

- **J 36346** Fascia Retainer Remover
- **J 44810** Transaxle Range Switch Alignment. See **Special Tools and Equipment** .

Removal Procedure

CAUTION: Do not tip the battery over a 45 degree angle or acid could spill causing serious personal injury.

IMPORTANT: Record all pre-set radio stations.

1. Remove the battery. Refer to **Battery Replacement** .

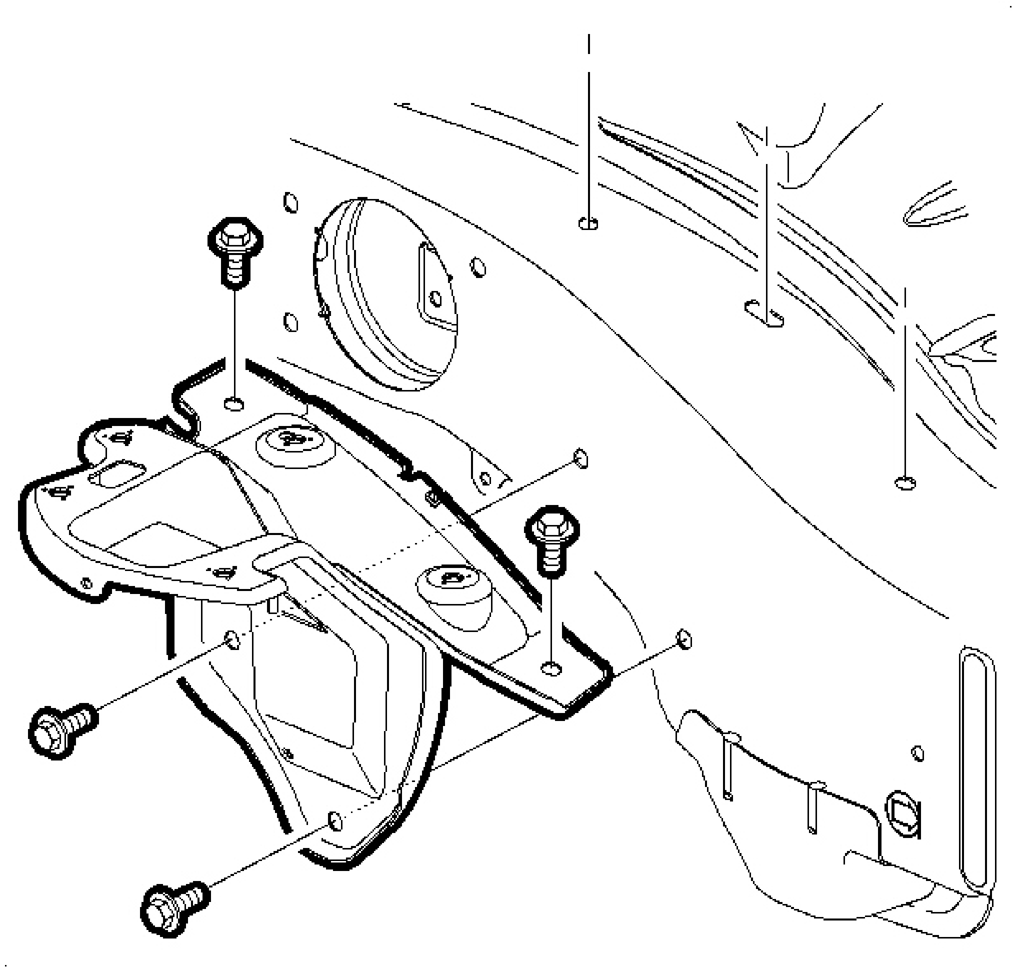


Fig. 64: Battery Tray Bracket & Screws
Courtesy of GENERAL MOTORS CORP.

2. Loosen the battery tray bracket screws and remove the battery tray bracket.
3. Apply the parking brake and place the control shift lever in (N) Neutral.

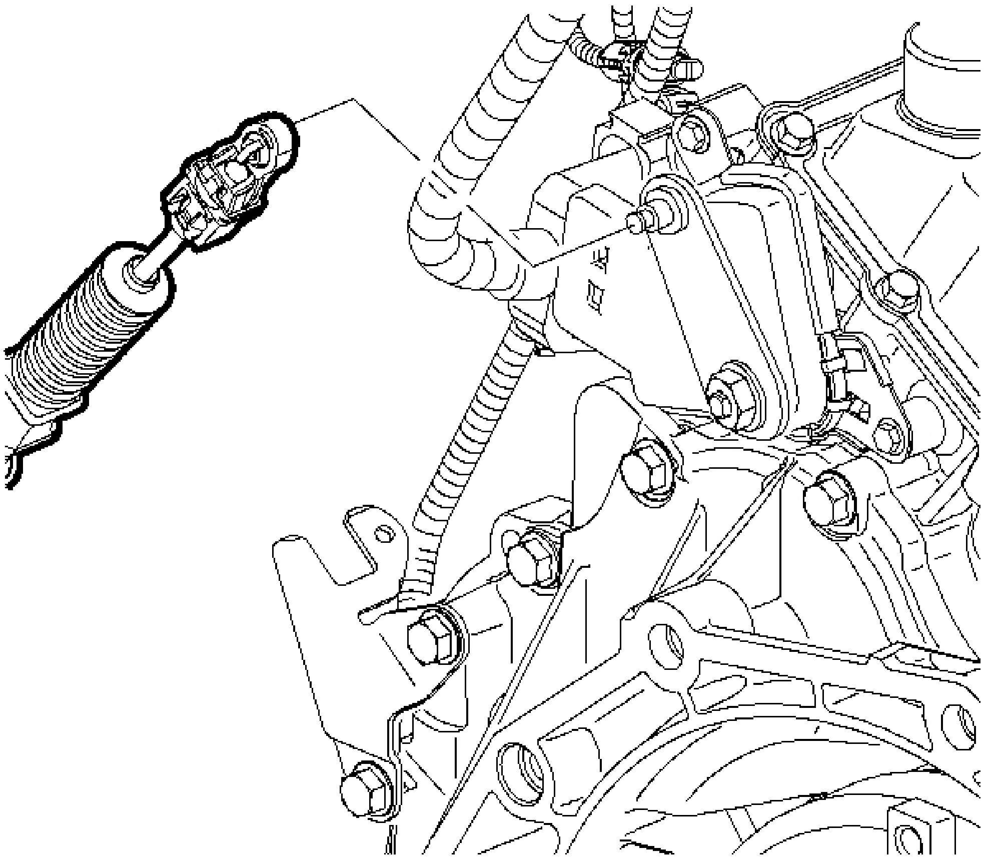


Fig. 65: Control Cable Assembly & Transaxle Range Switch Lever
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The transaxle manual shaft must be in (N) Neutral position prior to re-installing the range switch.

4. Using the Fascia Retainer Remover **J 36346** , remove the control cable assembly from the transaxle range switch lever.
5. Disconnect the electrical connectors from the transaxle range switch.

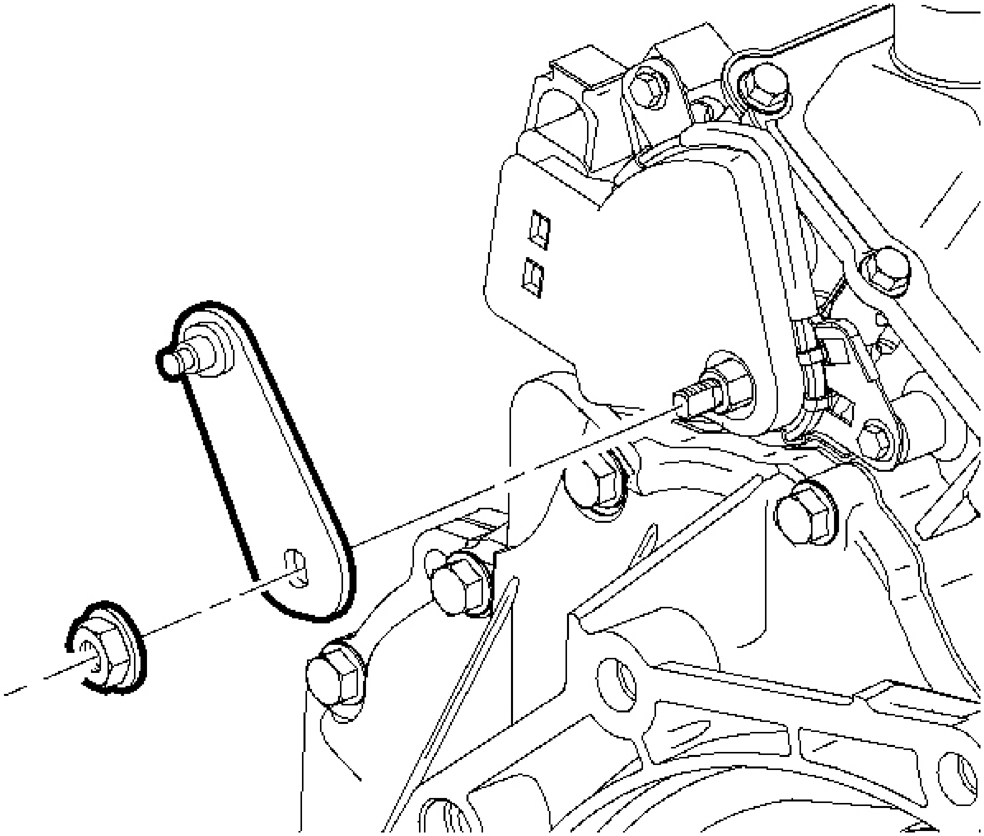


Fig. 66: Transaxle Range Switch Lever Nut & Lever
Courtesy of GENERAL MOTORS CORP.

6. Remove the transaxle range switch lever nut and lever.

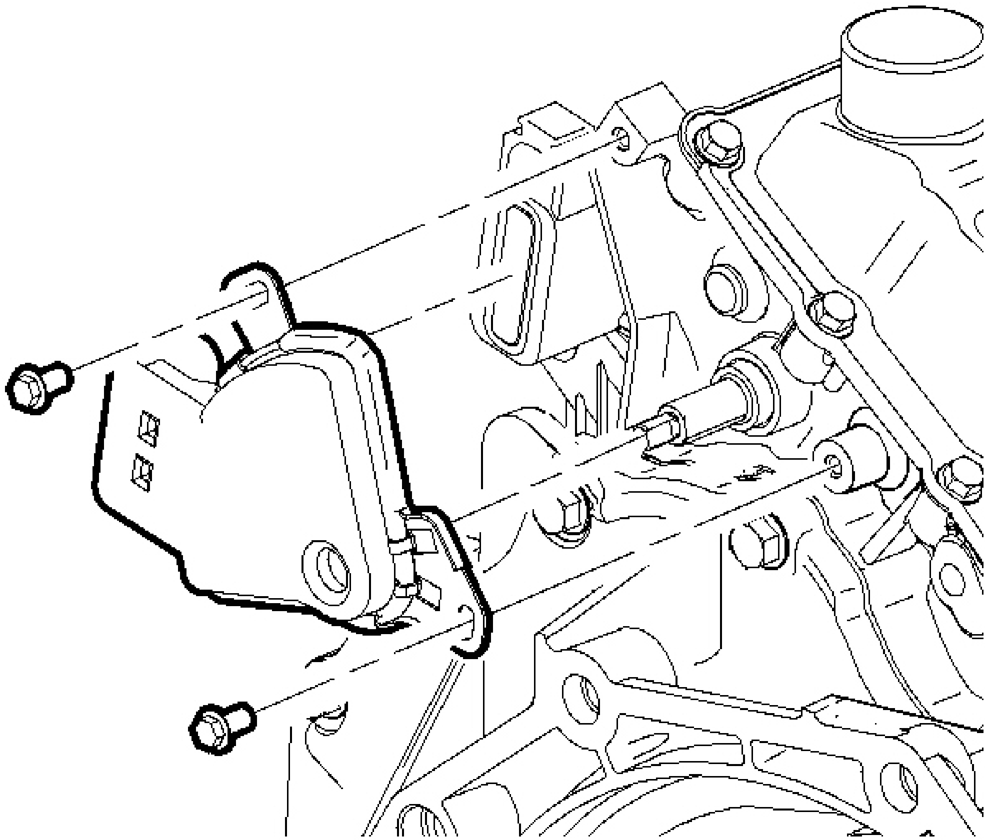


Fig. 67: Transaxle Shift Shaft & Flats
Courtesy of GENERAL MOTORS CORP.

7. Remove the transaxle range switch bolts and remove the switch.

Installation Procedure

(USING OLD SWITCH)

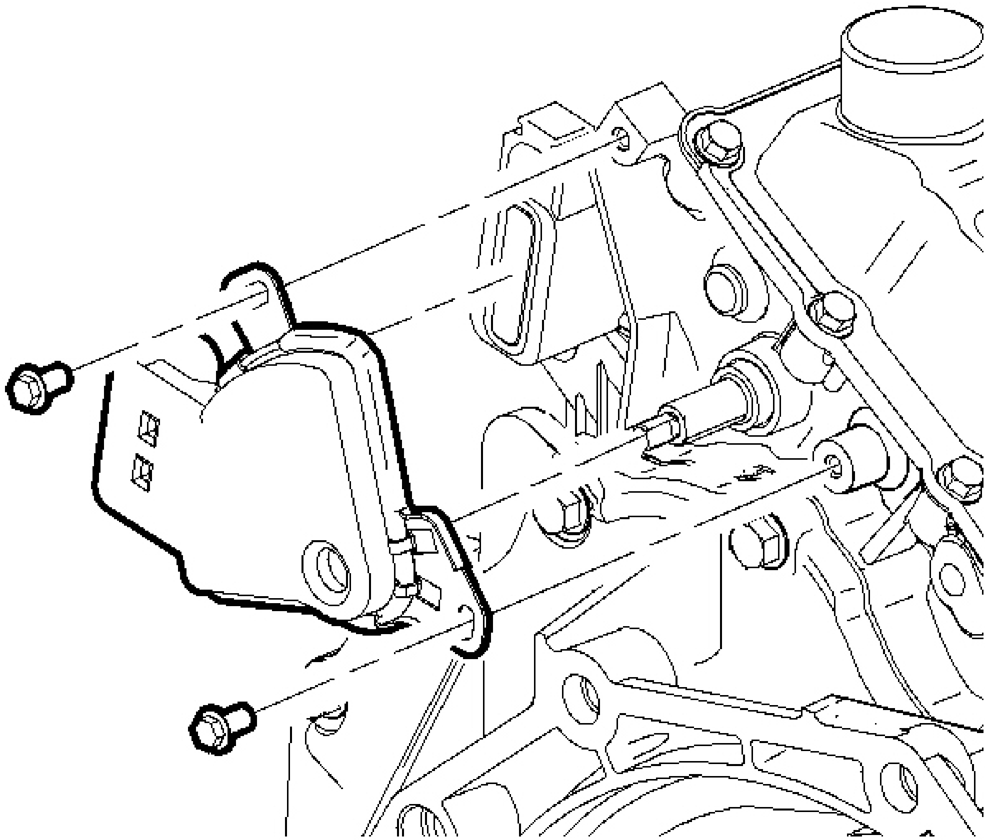


Fig. 68: Transaxle Shift Shaft & Flats
Courtesy of GENERAL MOTORS CORP.

1. Make sure the transaxle manual shaft is in (N) Neutral position.
2. Align the flats on the transaxle shift shaft with the flats on the transaxle range switch and install the switch.
3. Loosely install the transaxle range switch bolts.

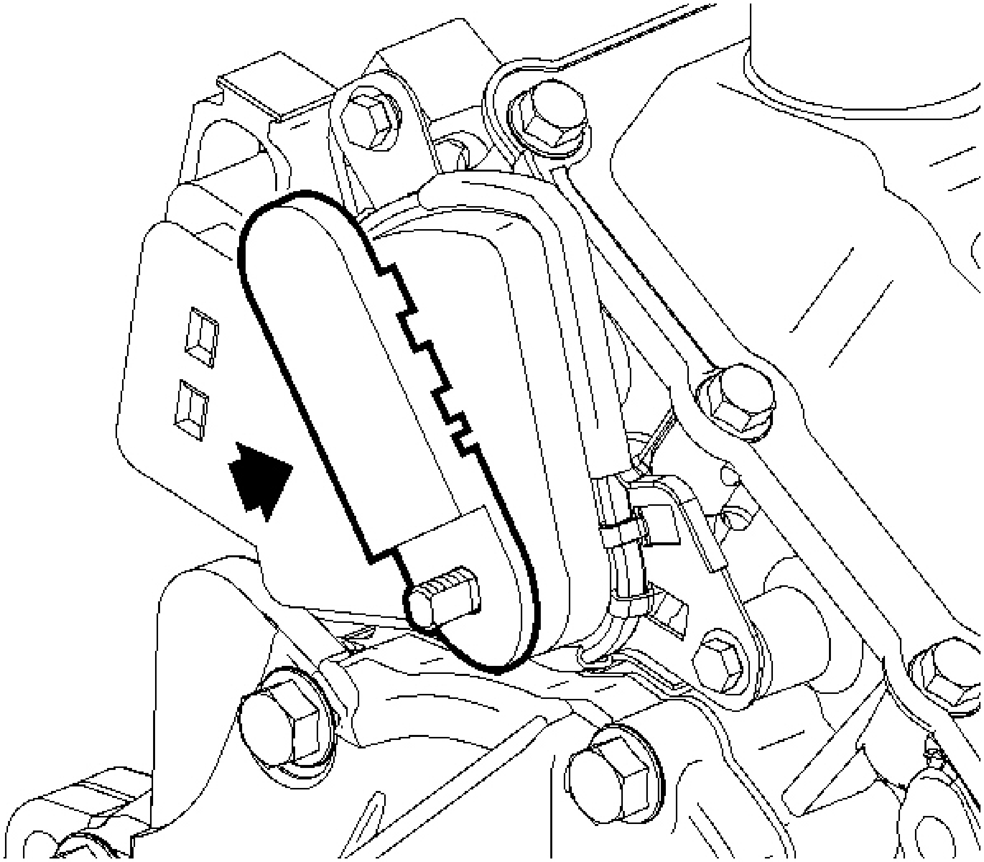


Fig. 69: Transaxle Range Switch
Courtesy of GENERAL MOTORS CORP.

4. Insert the Transaxle Range Switch Alignment**J 44810** as shown and rotate the switch until the tool drops into position. See **Special Tools and Equipment** . The switch is aligned when the pin on the tool drops into the hole on the transaxle range switch.

NOTE: Refer to Fastener Notice in Cautions and Notices.

5. Tighten the transaxle range switch bolts.

Tighten: Tighten the transaxle range switch bolts to 11 N.m (8 lb ft).

6. Remove the alignment tool.

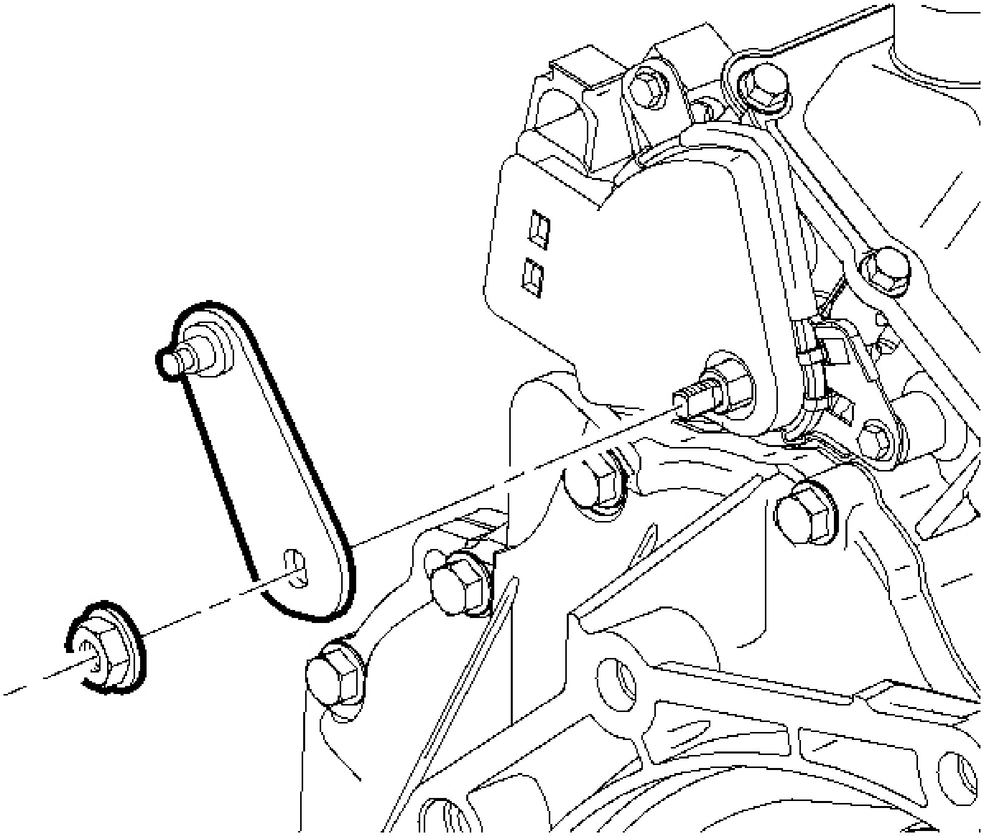


Fig. 70: Transaxle Range Switch Lever Nut & Lever
Courtesy of GENERAL MOTORS CORP.

7. Install the transaxle range switch lever and nut.

   Tighten: Tighten the transaxle range switch lever nut to 16 N.m (12 lb ft).

8. Connect the transaxle range switch electrical connectors.
9. Install the control cable assembly to the transaxle range switch lever and verify proper operation.

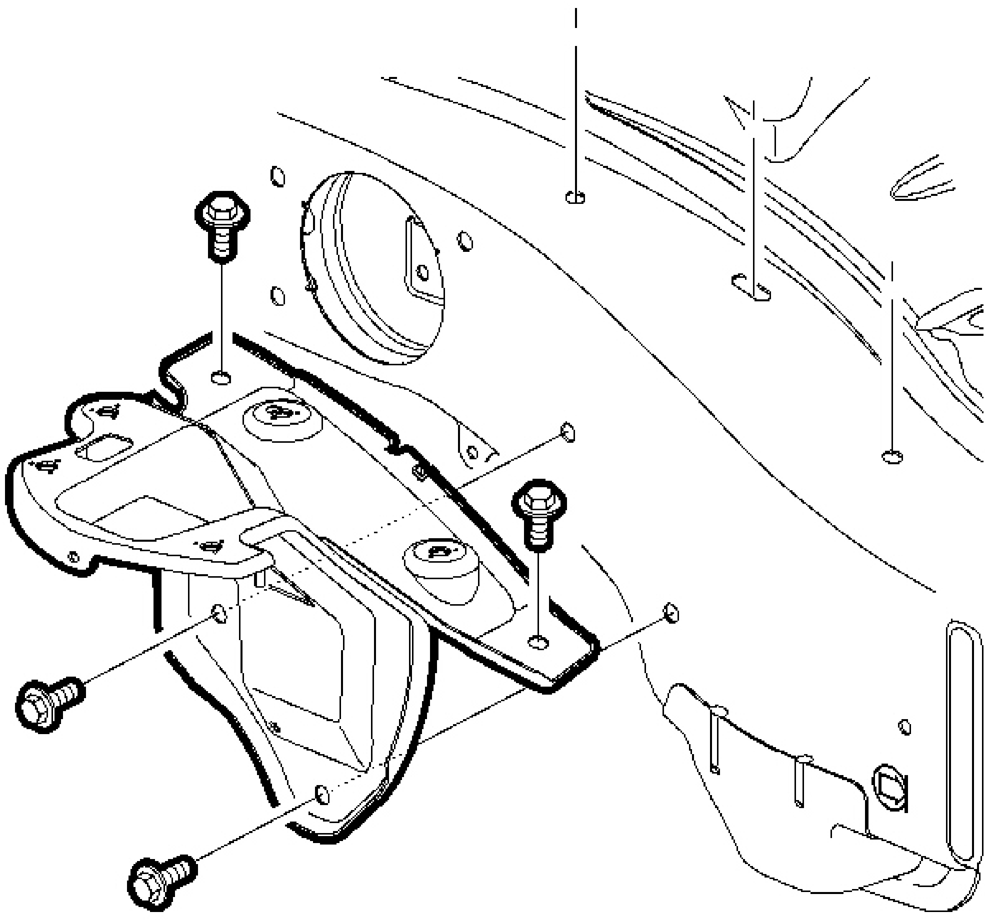


Fig. 71: Battery Tray Bracket & Screws
Courtesy of GENERAL MOTORS CORP.

10. Install the battery tray bracket.
11. Position the battery tray bracket and tighten the screws.

    Tighten: Tighten the battery tray bracket screws to 16 N.m (12 lb ft).

12. Install the battery. Refer to **Battery Replacement** .
13. After adjusting the switch, verify the engine only starts in (P) Park or (N) Neutral. Using the scan tool, monitor the TR Sw. to verify the selected position matches the scan tool. Move the selector through all positions. If the engine starts in any other position, readjust the switch.

Installation Procedure

(USING NEW SWITCH)

1. Make sure the transaxle manual shaft is in (N) Neutral position.

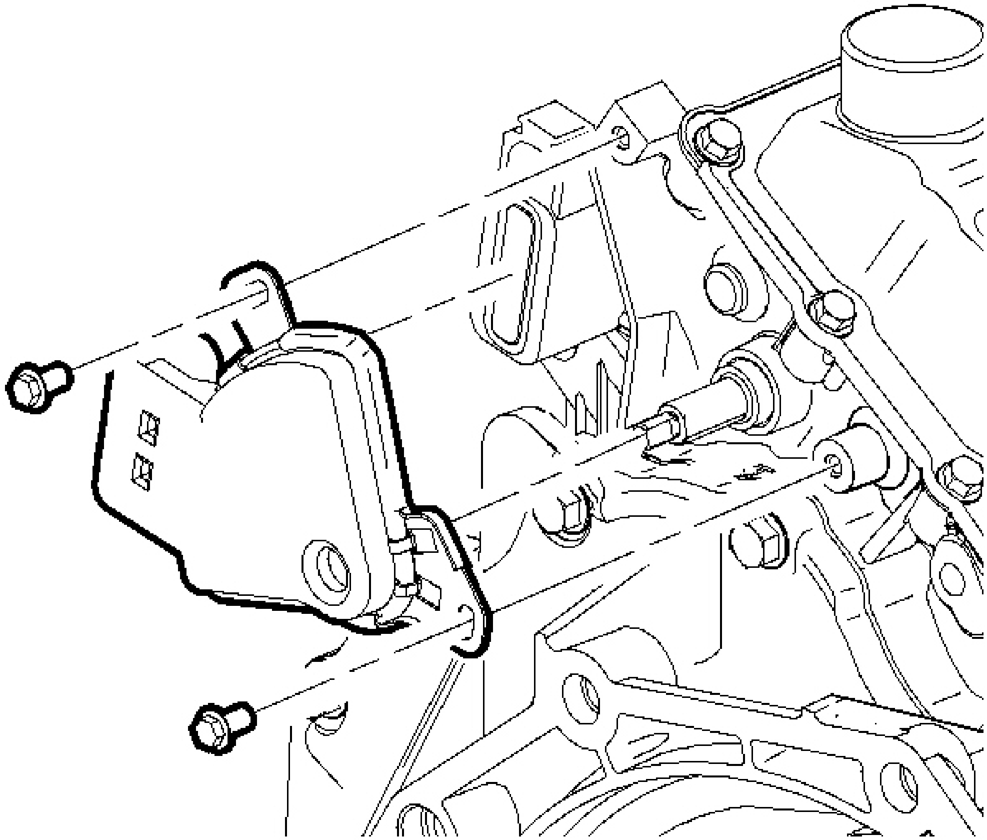


Fig. 72: Transaxle Shift Shaft & Flats
Courtesy of GENERAL MOTORS CORP.

2. Align the flats on the transaxle shift shaft with the flats on the transaxle range switch and install the switch.
3. Tighten the transaxle range switch bolts.

Tighten: Tighten the transaxle range switch bolts to 11 N.m (8 lb ft).

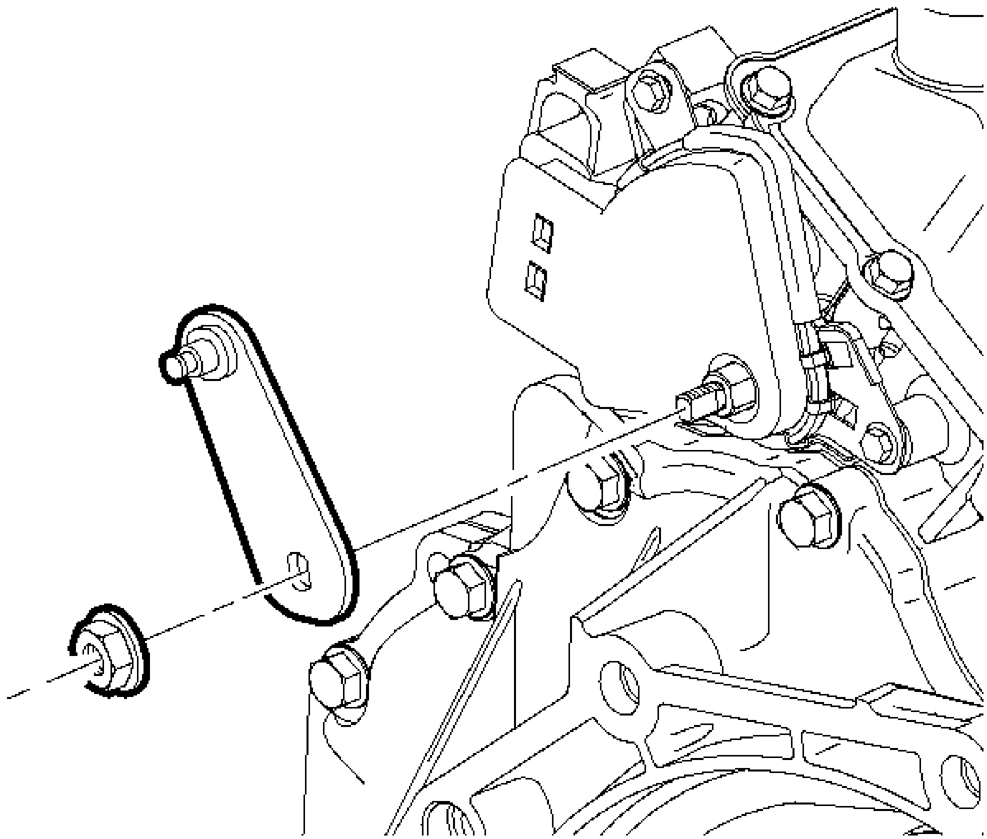


Fig. 73: Transaxle Range Switch Lever Nut & Lever
Courtesy of GENERAL MOTORS CORP.

4. Install the transaxle range switch lever and nut.

   Tighten: Tighten the transaxle range switch lever nut to 16 N.m (12 lb ft).

5. Connect the transaxle range switch electrical connectors.

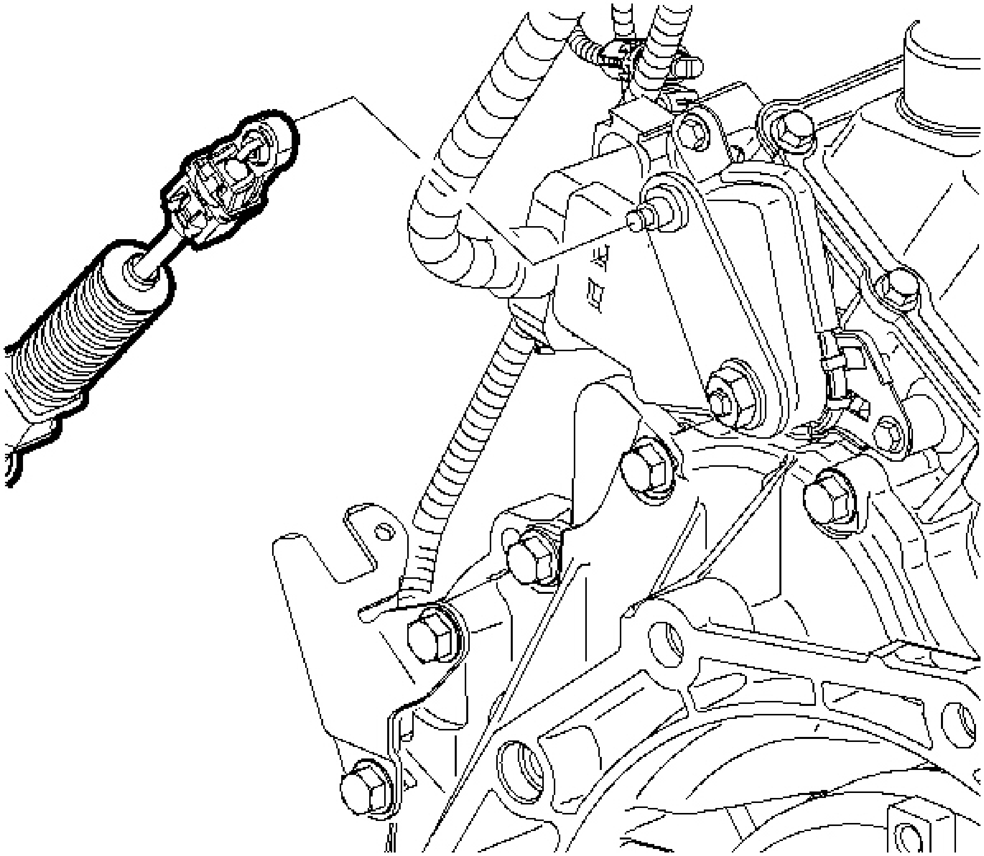


Fig. 74: Control Cable Assembly & Transaxle Range Switch Lever
Courtesy of GENERAL MOTORS CORP.

6. Install the control cable assembly to the transaxle range switch lever.

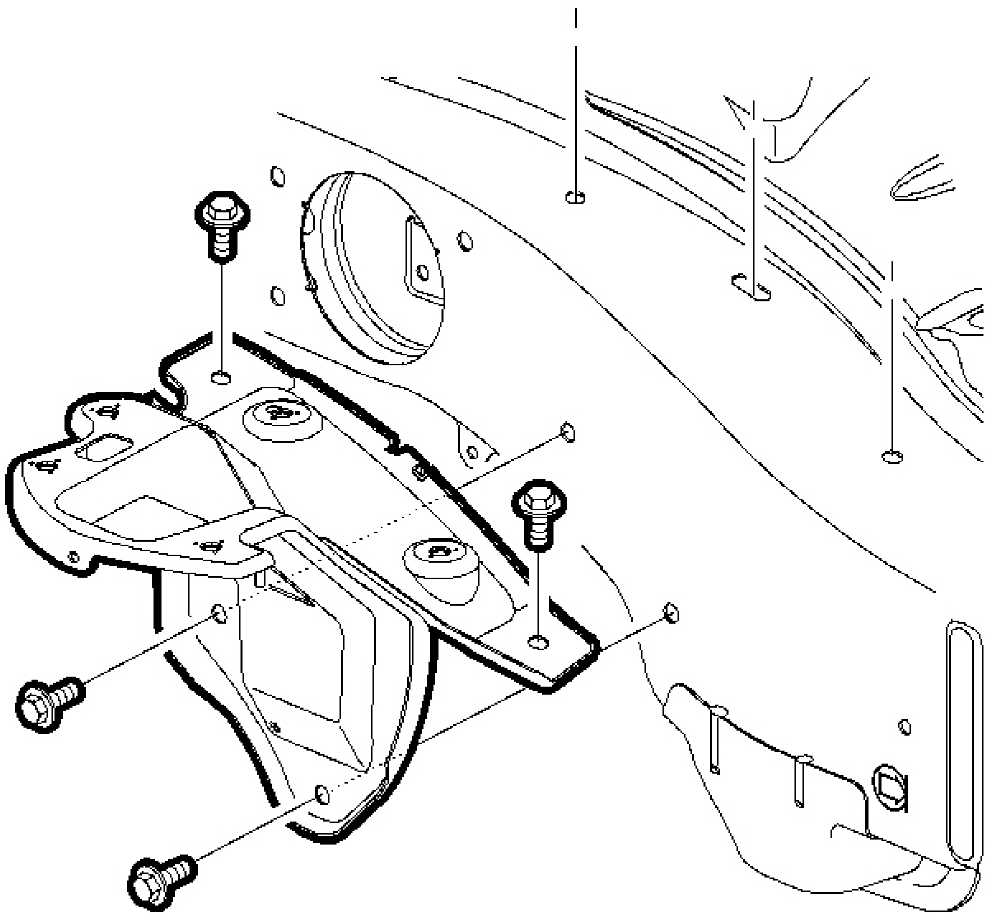


Fig. 75: Battery Tray Bracket & Screws
Courtesy of GENERAL MOTORS CORP.

7. Install the battery tray bracket.
8. Position the battery tray bracket and tighten the screws.

   Tighten: Tighten the battery tray bracket screws to 16 N.m (12 lb ft).

9. Install the battery. Refer to **Battery Replacement** .
10. Insert the battery and tighten the battery hold-down screw.

    Tighten: Tighten the battery hold-down screw to 15 N.m (11 lb ft).

11. After adjusting the switch, verify the engine only starts in (P) Park or (N) Neutral. Using the scan tool, monitor the TR Sw. to verify the selected position matches the scan tool. Move the selector through all positions. If the engine starts in any other position, readjust the switch.

PARK/NEUTRAL POSITION SWITCH ADJUSTMENT

Tools Required

- **J 36346** Fascia Retainer Remover
- **J 44810** Transaxle Range Switch Alignment Tool. See **Special Tools and Equipment** .

Adjustment Procedure

1. Shift the transaxle into (N) Neutral position.

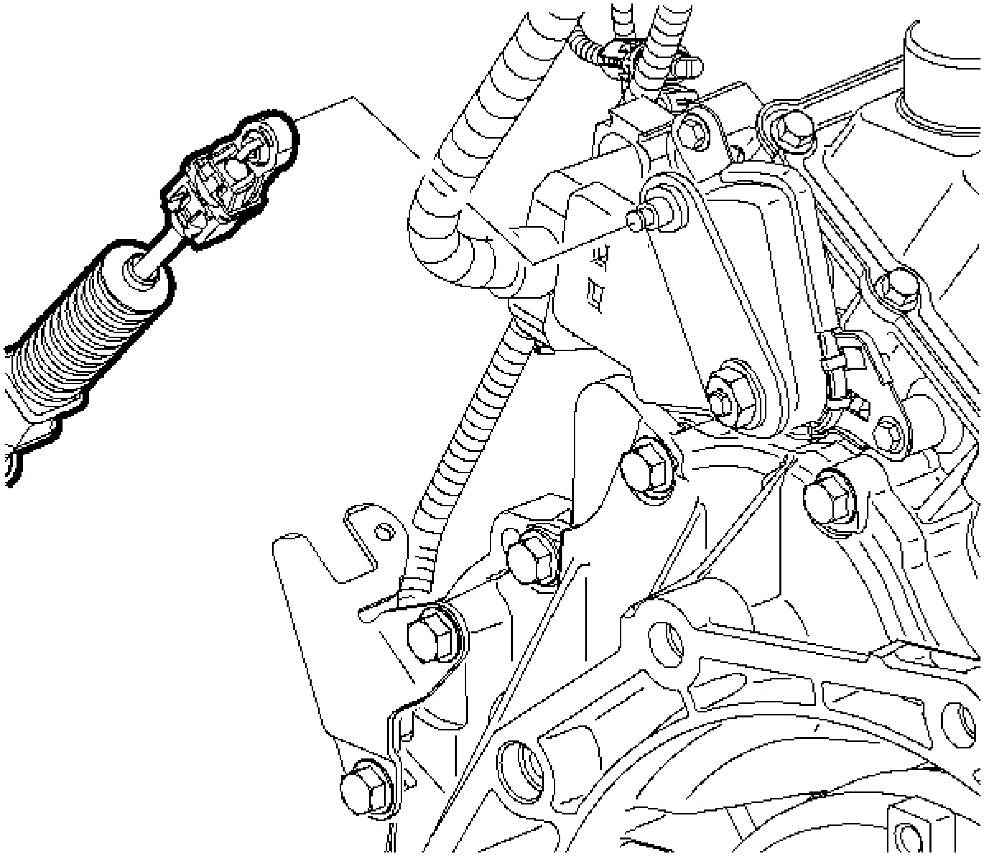


Fig. 76: Control Cable Assembly & Transaxle Range Switch Lever
Courtesy of GENERAL MOTORS CORP.

2. Using the **J 36346** , remove the control cable assembly from the transaxle range switch lever.

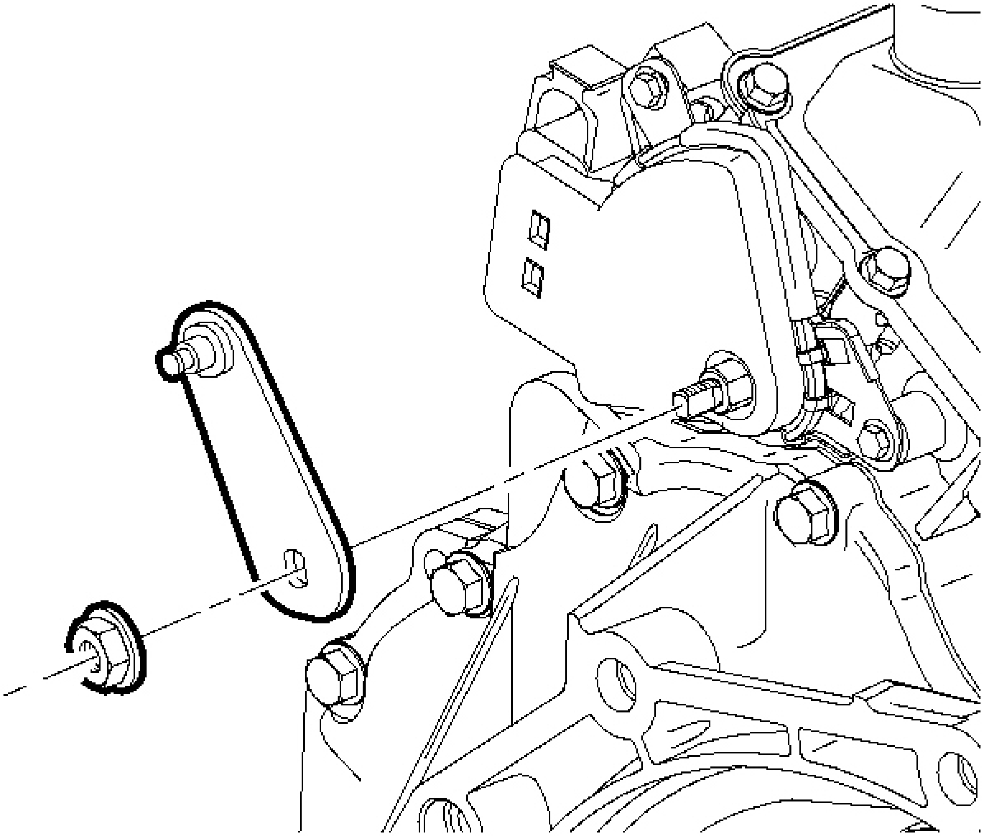


Fig. 77: Transaxle Range Switch Lever Nut & Lever
Courtesy of GENERAL MOTORS CORP.

3. Remove the transaxle range switch lever nut and lever.
4. Loosen the transaxle range switch bolts.

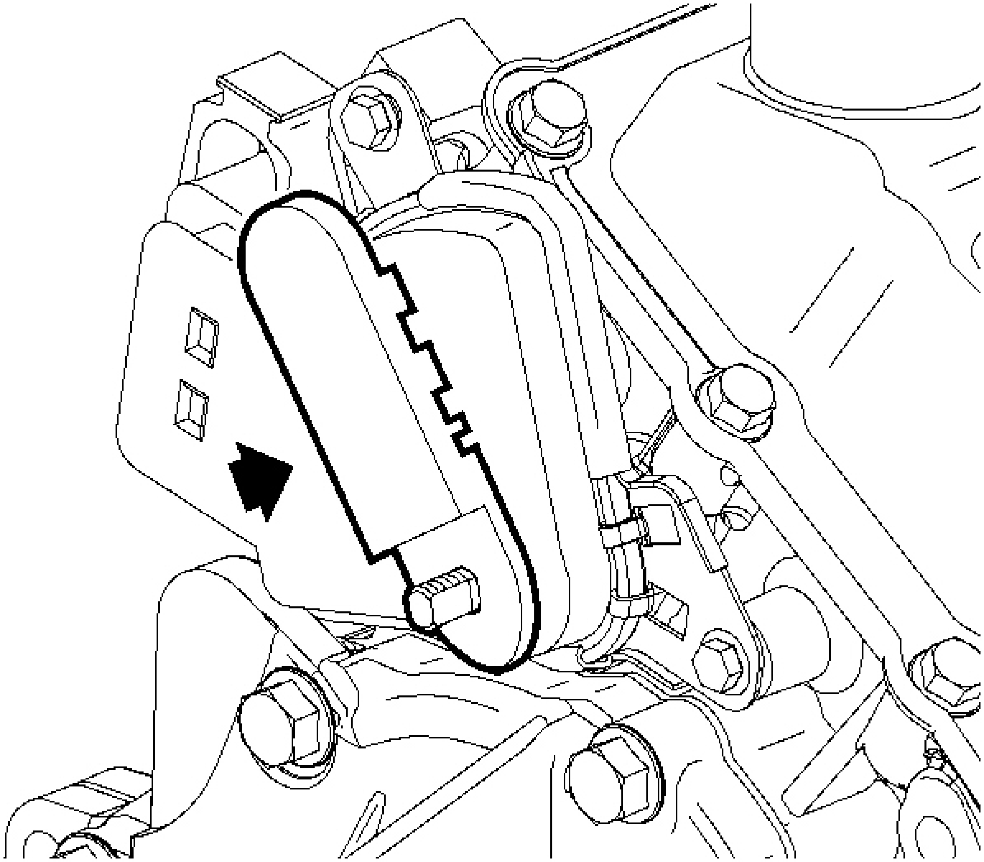


Fig. 78: Transaxle Range Switch
Courtesy of GENERAL MOTORS CORP.

5. Insert the **J 44810** as shown and rotate the switch until the tool drops into position. See **Special Tools and Equipment** . The switch is aligned when the pin on the tool drops into the hole on the transaxle range switch.

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

6. Tighten the transaxle range switch bolts.

Tighten: Tighten the transaxle range switch bolts to 11 N.m (8 lb ft).

7. Remove the alignment tool.

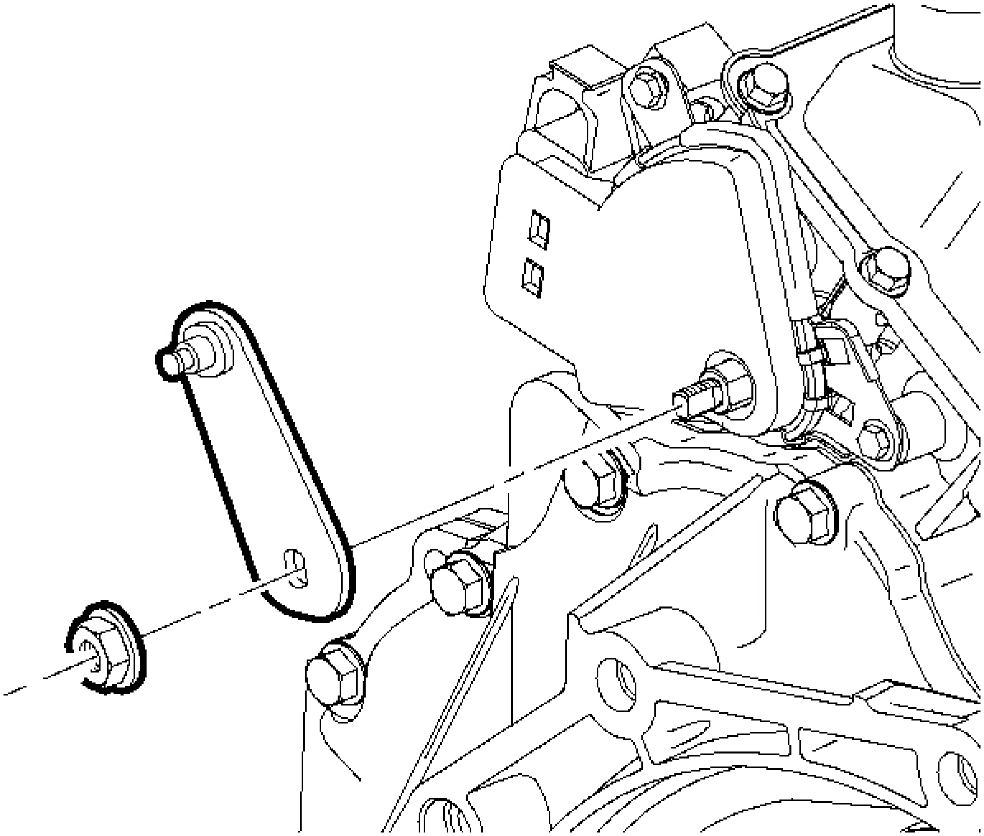


Fig. 79: Transaxle Range Switch Lever Nut & Lever
Courtesy of GENERAL MOTORS CORP.

8. Install the transaxle range switch lever and nut.

   Tighten: Tighten the transaxle range switch lever nut to 16 N.m (12 lb ft).

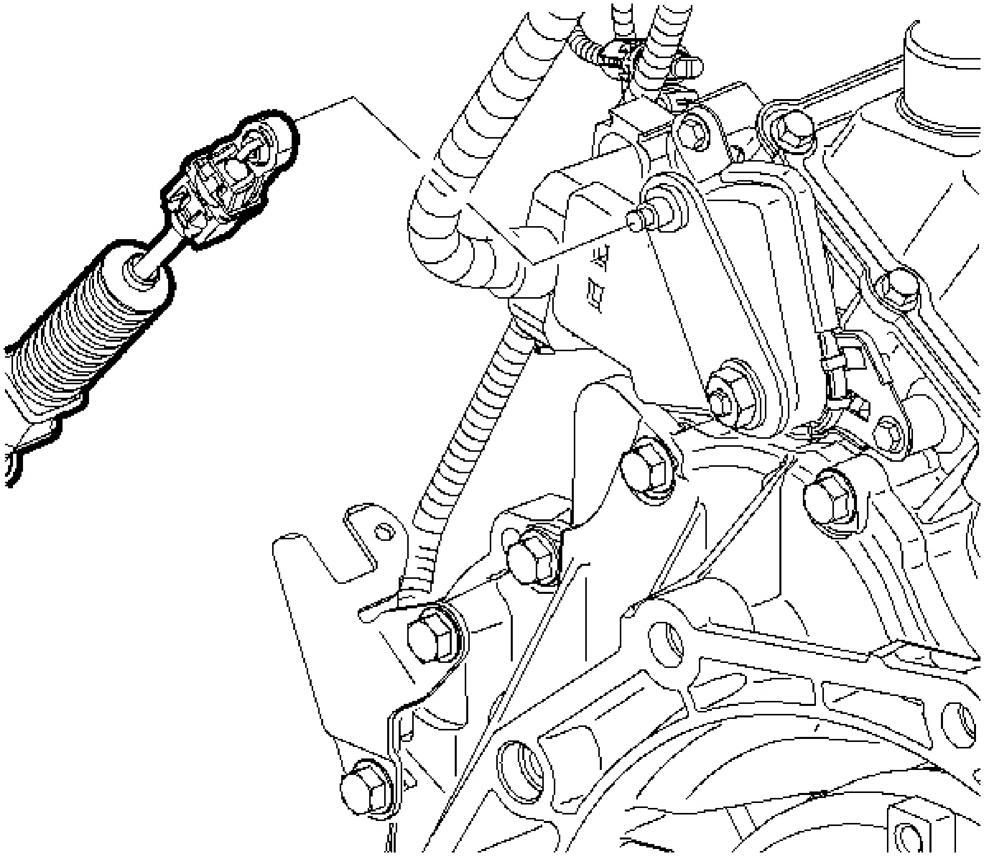


Fig. 80: Control Cable Assembly & Transaxle Range Switch Lever
Courtesy of GENERAL MOTORS CORP.

9. Install the control cable assembly to transaxle range switch lever.
10. After adjusting the switch, verify the engine only starts in (P) Park or (N) Neutral. Using the scan tool, monitor the TR Sw. to verify the selected position matches the scan tool. Move the selector through all positions. If the engine starts in any other position, readjust the switch.

VARIABLE DRIVEN COVER REPLACEMENT

Removal Procedure

1. Install the engine support fixture. Refer to **Engine Support Fixture** .

2. Remove the transmission mount to the transmission bolts. Refer to **Transmission Mount Replacement - Side** .
3. Remove the variable driven cover bolts.

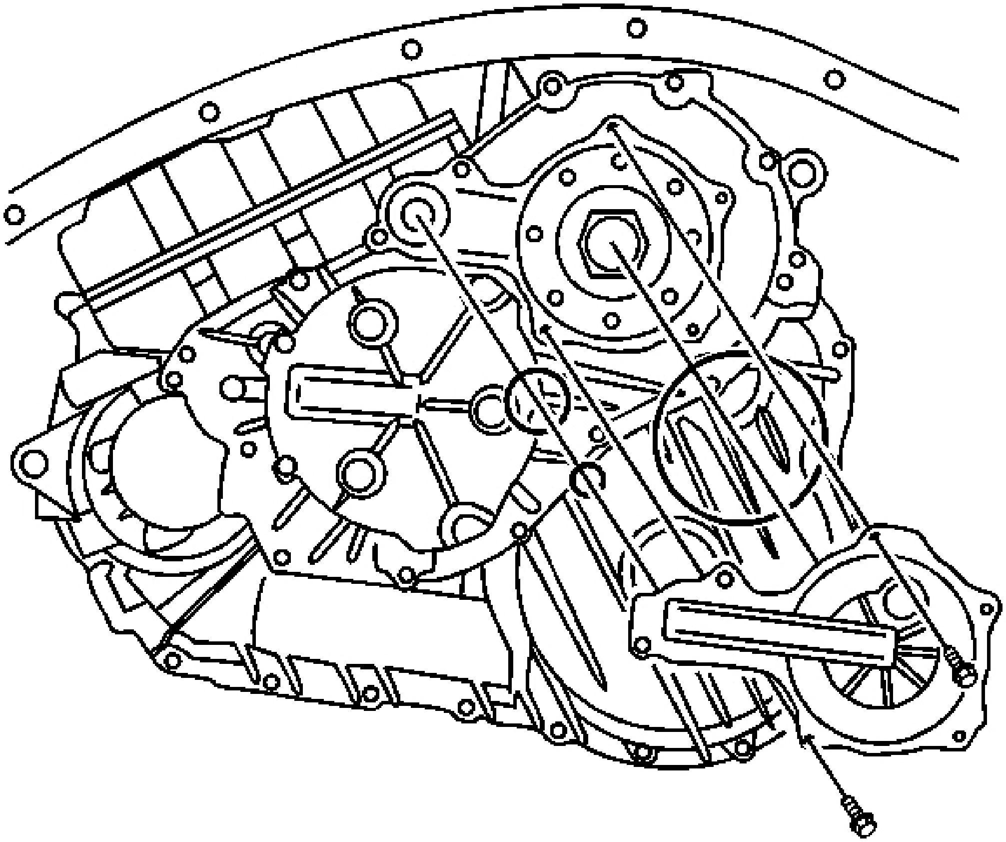


Fig. 81: Outer Variable Driven Cover Seal & Transmission
Courtesy of GENERAL MOTORS CORP.

4. Remove the variable driven cover from the transmission.
5. Remove the outer variable driven cover seal from the transmission and discard.
6. Remove the variable driven cover seals and discard.

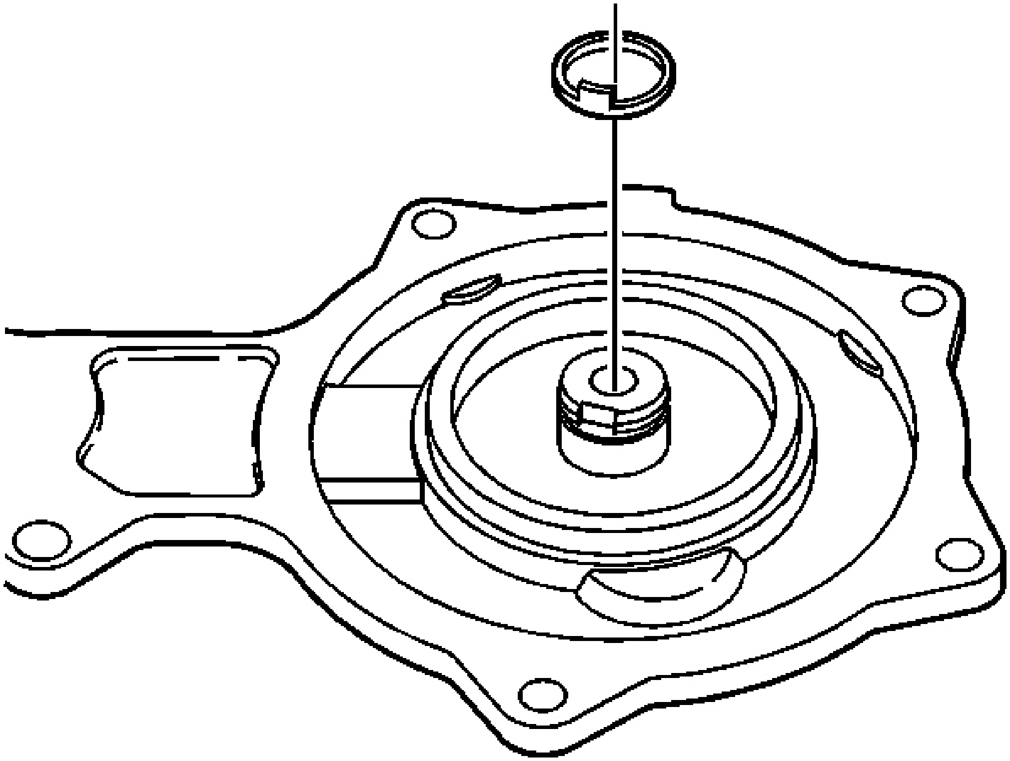


Fig. 82: Variable Driven Cover & Cover Seal
Courtesy of GENERAL MOTORS CORP.

7. Inspect the variable driven cover and cover seal for damage and replace as necessary.

Installation Procedure

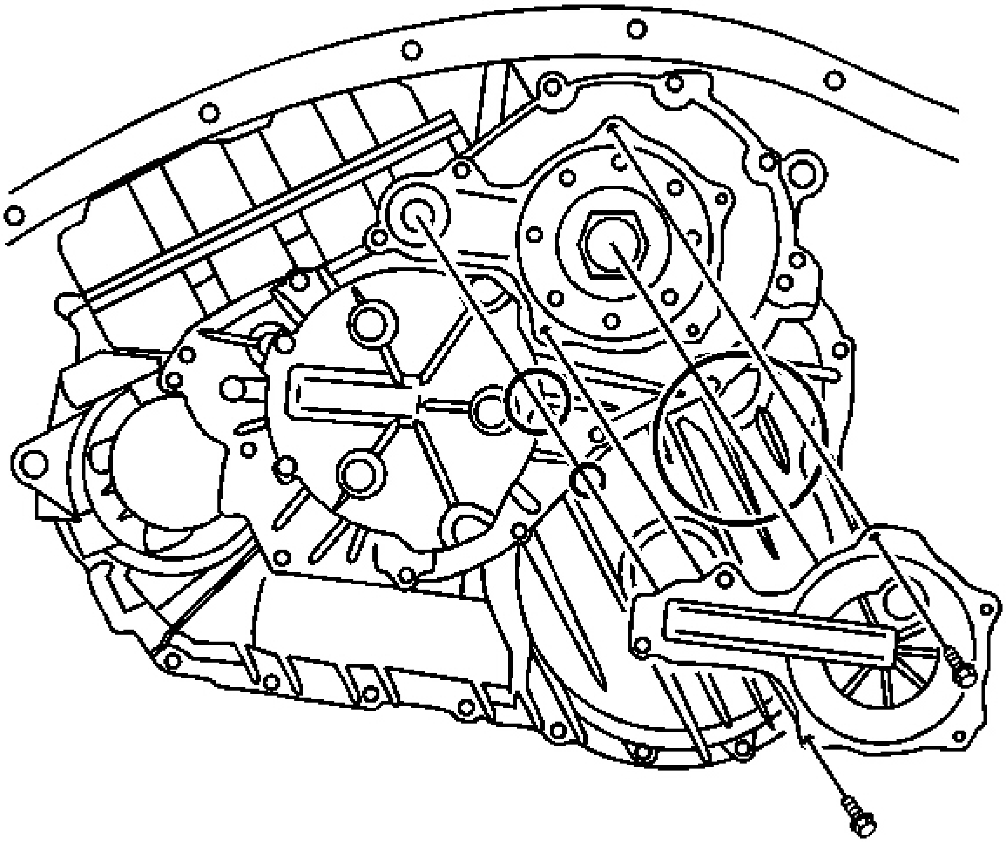


Fig. 83: Outer Variable Driven Cover Seal & Transmission
Courtesy of GENERAL MOTORS CORP.

1. Install two new variable driven cover seals.
2. Install a new outer variable driven cover seal.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the variable driven cover to the transmission.

   Tighten: Tighten the variable driven cover bolts to 11 N.m (97 lb in).

4. Install the transmission mount to the transmission bolts. Refer to **Transmission Mount Replacement - Side** .
5. Remove the engine support fixture.

VARIABLE DRIVE COVER REPLACEMENT

Removal Procedure

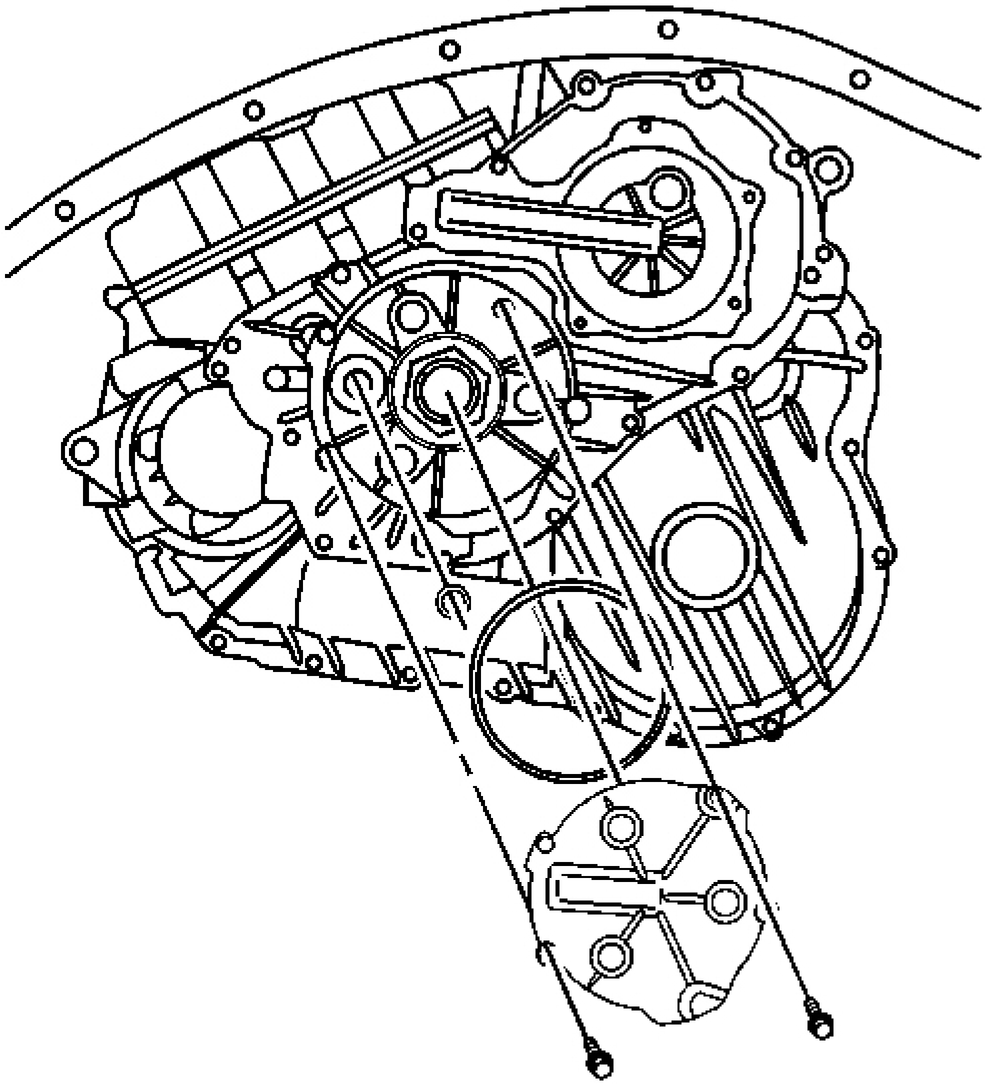


Fig. 84: Drive Pulley Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the bolts from the drive pulley cover.

2. Remove the drive pulley cover.
3. Remove the variable drive pulley opening cover seal, outer, and discard.
4. Remove the variable drive pulley opening cover seal and discard.

Installation Procedure

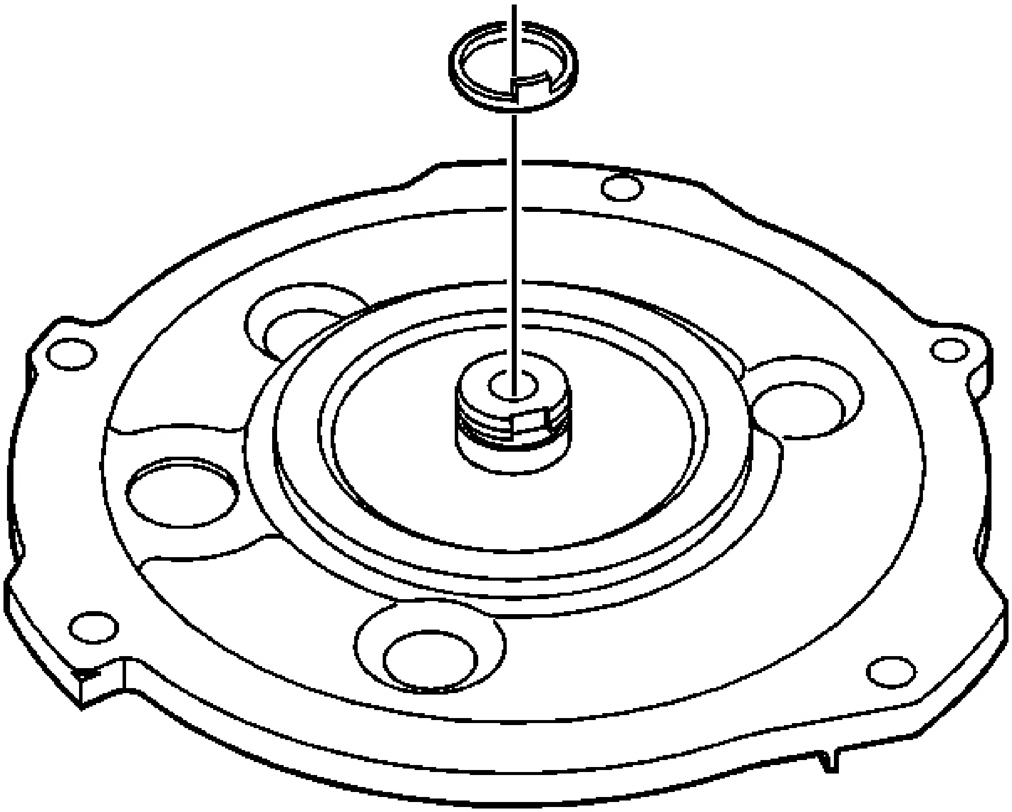


Fig. 85: Inspecting Case Cover Seal On Drive Pulley Cover For Damage
Courtesy of GENERAL MOTORS CORP.

1. Inspect the case cover seal on the drive pulley cover for damage. Replace if necessary.

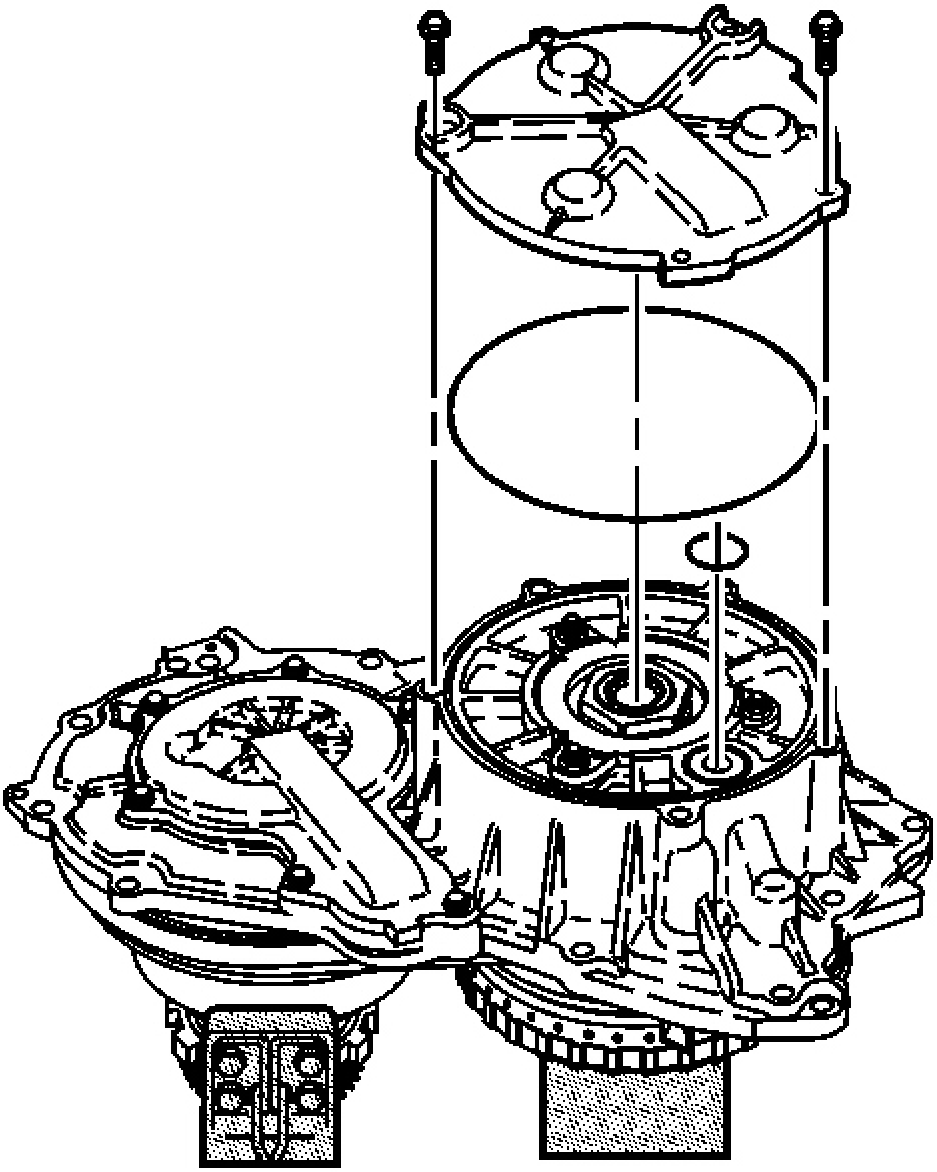


Fig. 86: Drive Pulley Cover, Bolts & Case Cover Assembly
Courtesy of GENERAL MOTORS CORP.

2. Install a new variable drive pulley opening cover seal.
3. Install a new variable drive pulley opening cover seal, outer.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the drive pulley cover and bolts to the case cover assembly.

   Tighten: Tighten the bolts to 11 N.m (97 lb in).

INPUT AND OUTPUT SPEED SENSOR REPLACEMENT

Removal Procedure

1. Remove the Control Valve body assembly. Refer to **Control Valve Body Replacement** .

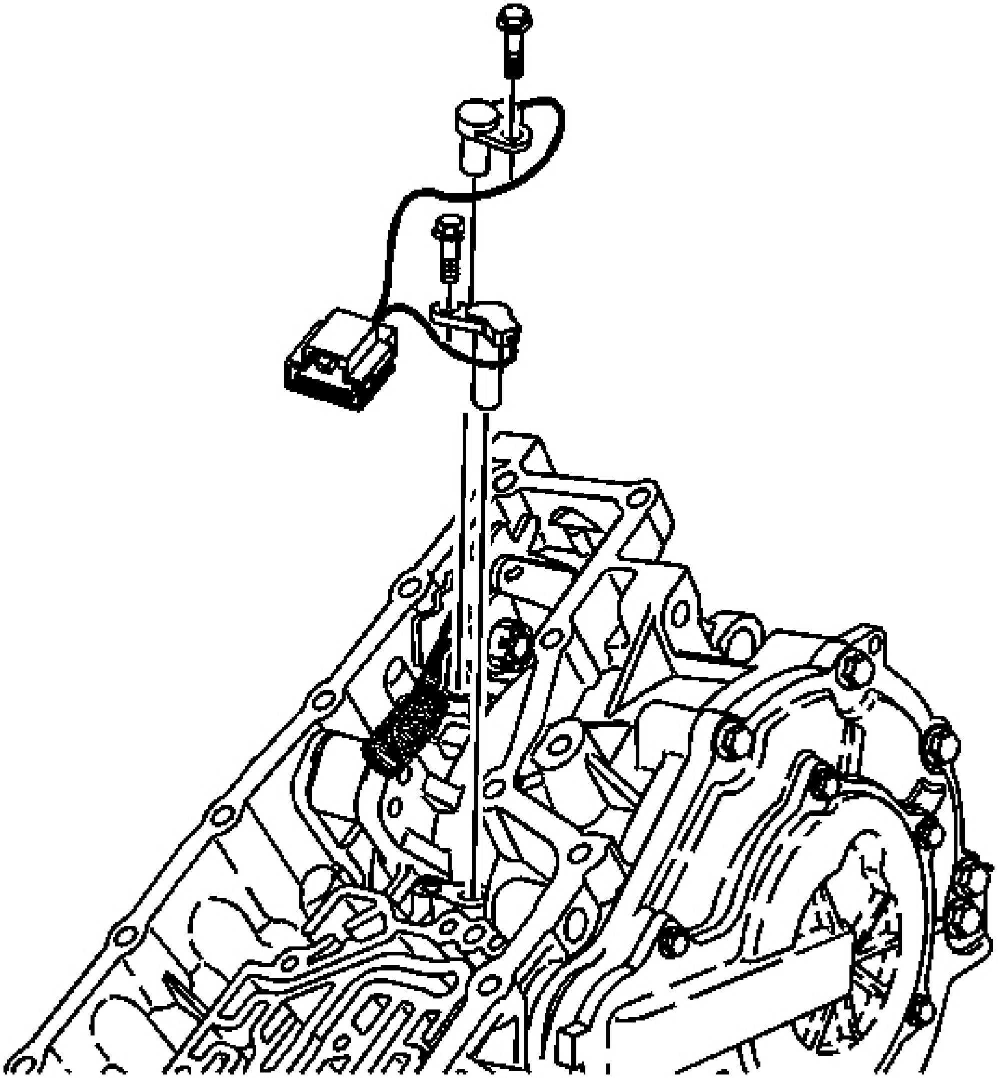


Fig. 87: Transmission Case, Bolts, Input & Output Speed Sensor
Courtesy of GENERAL MOTORS CORP.

2. Remove the 2 bolts and the input and output speed sensor assembly from the transmission case assembly.

Installation Procedure

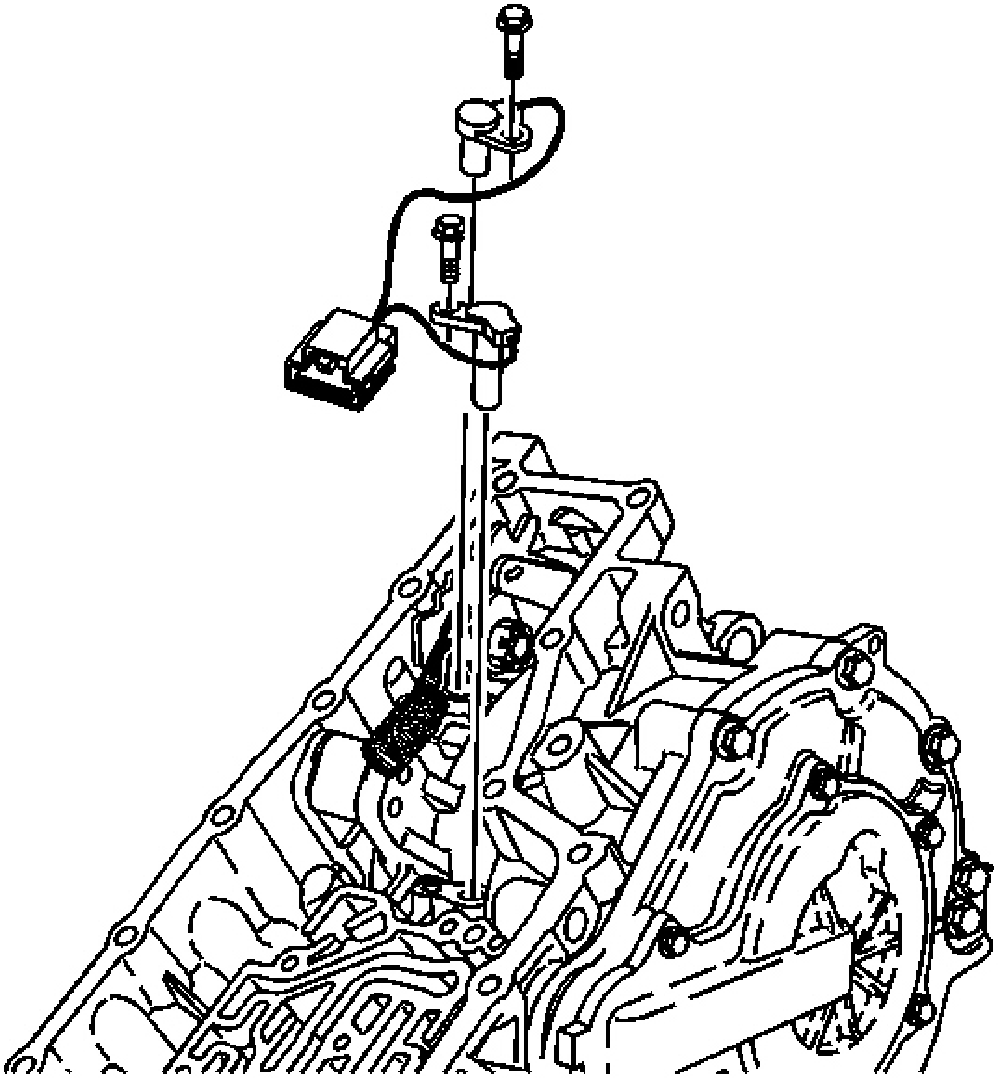


Fig. 88: Transmission Case, Bolts, Input & Output Speed Sensor
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the input and output speed sensor assembly and the 2 bolts on the transmission case assembly.

   Tighten: Tighten the bolts to 11 N.m (8 lb ft).

2. Install the Control Valve body assembly. Refer to **Control Valve Body Replacement** .

CONTROL VALVE BODY COVER REPLACEMENT

Removal Procedure

1. Remove the battery. Refer to **Battery Replacement** in Engine Electrical.
2. Remove the battery tray and bracket. Refer to **Battery Tray Replacement (L61)** or **Battery Tray Replacement (L66)** in Engine Electrical.

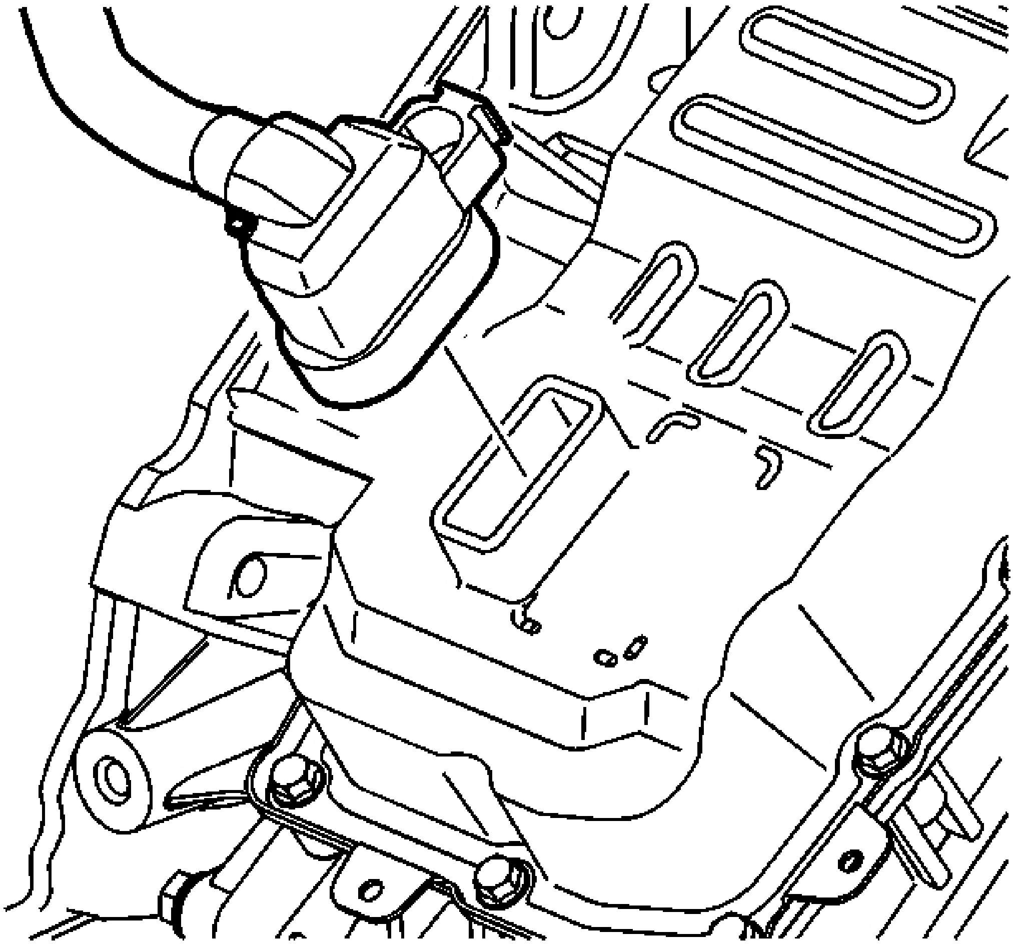


Fig. 89: Transmission Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the transmission electrical connector.

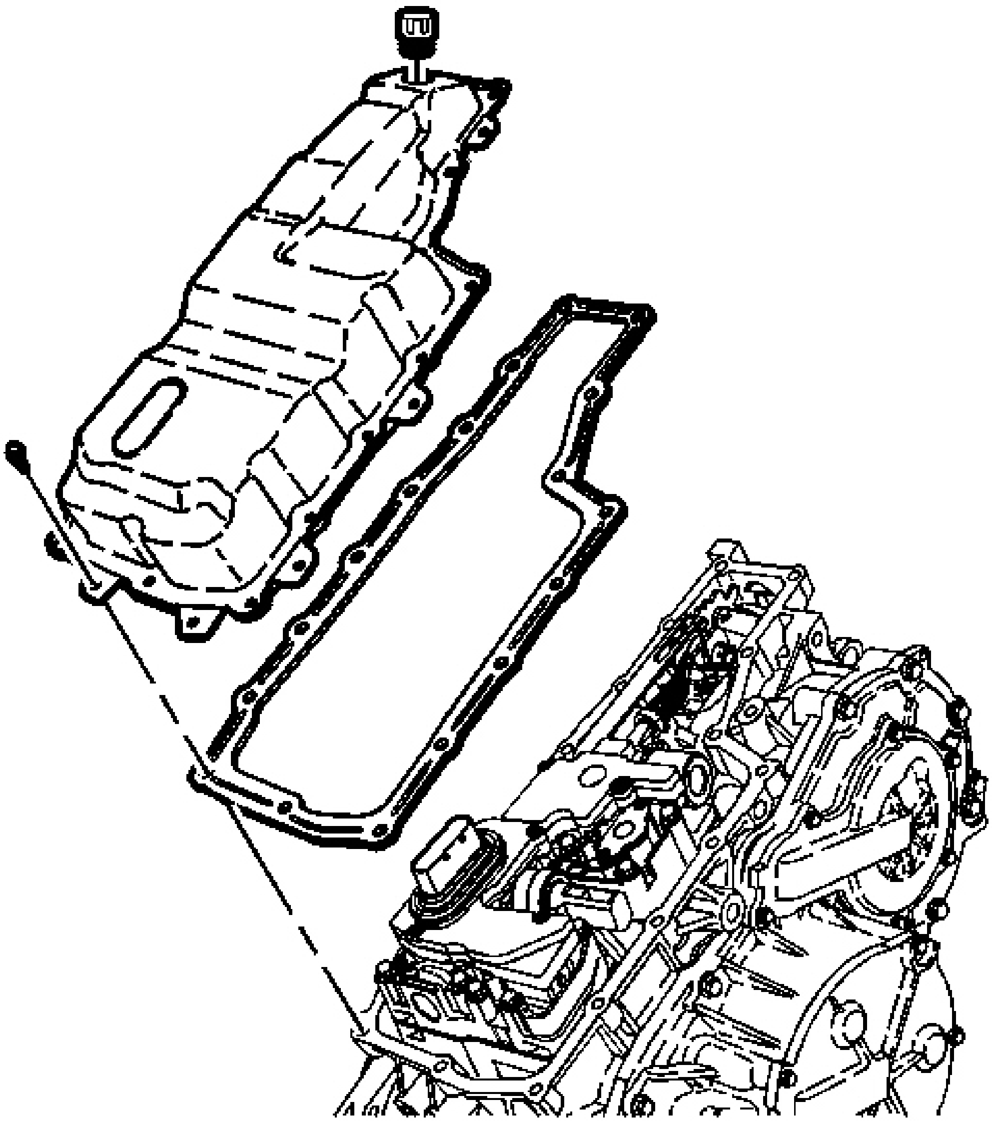


Fig. 90: Control Valve Body Cover, Gasket & Transmission Vent Cap
Courtesy of GENERAL MOTORS CORP.

4. Remove the transmission vent cap.
5. Remove the bolts from the control valve body cover.

6. Remove the control valve body cover.
7. Remove the control valve body cover gasket. Discard the gasket.

Installation Procedure

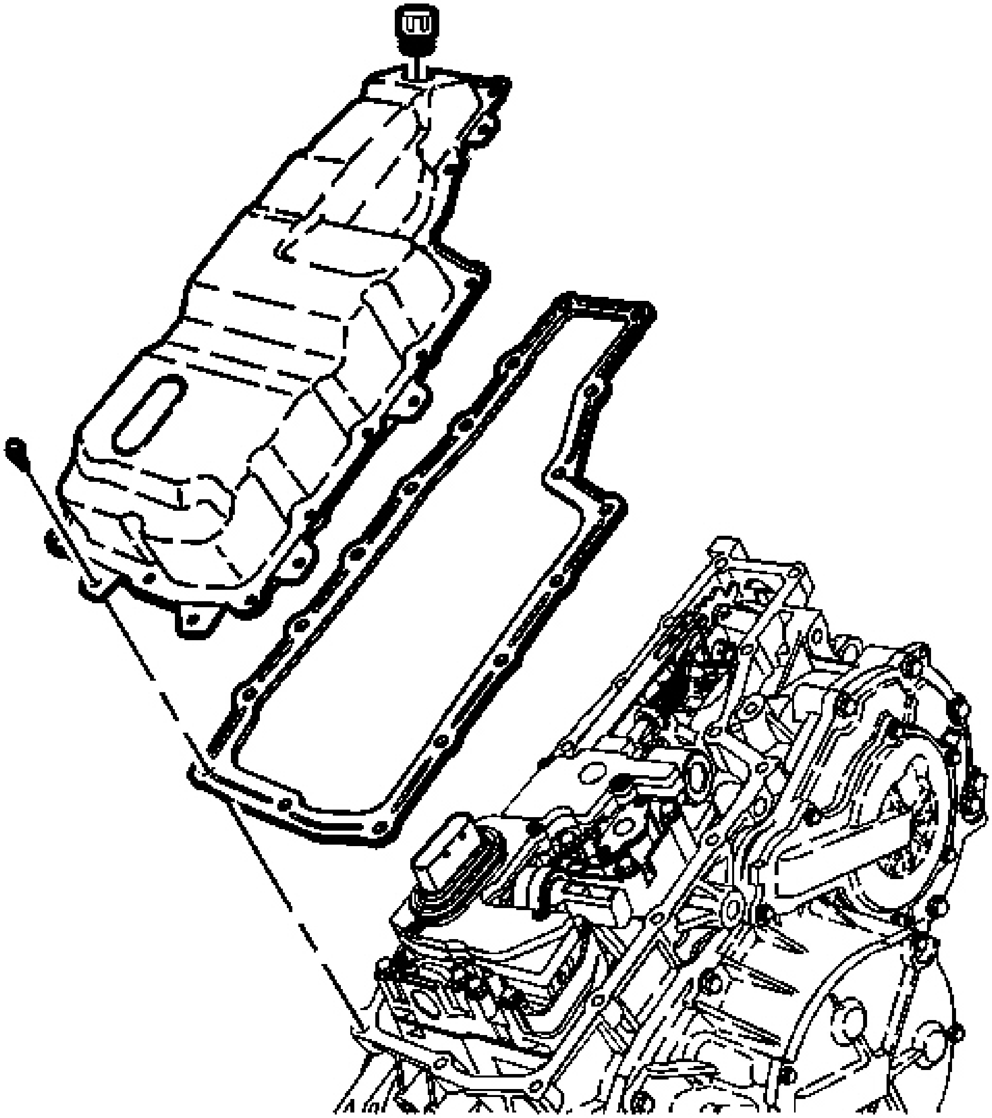


Fig. 91: Control Valve Body Cover, Gasket & Transmission Vent Cap
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW control valve body cover gasket on the transmission case assembly.
2. Inspect the control valve body cover for damage.
3. Install the transmission vent cap.
4. Install the control valve body cover and bolts on the transmission case assembly.

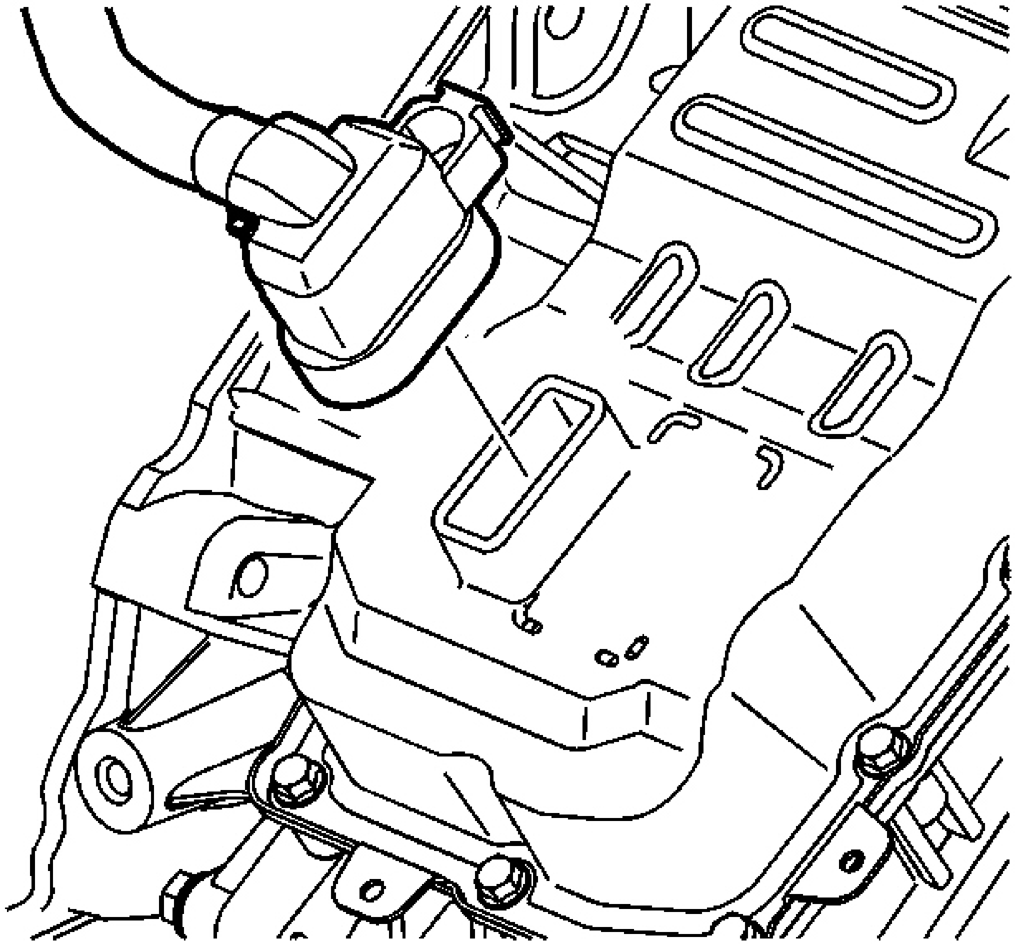


Fig. 92: Transmission Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the transmission electrical connector.

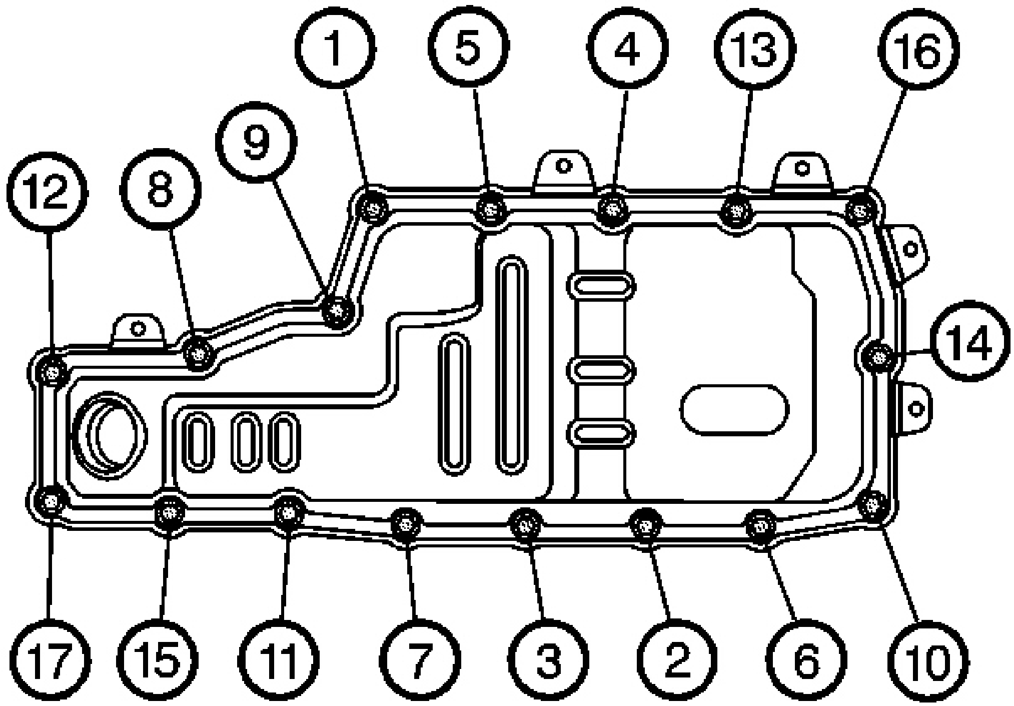


Fig. 93: Tightening Bolts In Sequence On Valve Body Cover
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the valve body cover and bolts.

   Tighten: Tighten the bolts in sequence to 11 N.m (97 lb in).

7. Install the battery tray bracket. Refer to **Battery Tray Replacement (L61)** or **Battery Tray Replacement (L66)** in Engine Electrical.
8. Install the battery. Refer to **Battery Replacement** in Engine Electrical.

CONTROL VALVE BODY REPLACEMENT

Removal Procedure

1. Remove the control valve body cover. Refer to **Control Valve Body Cover Replacement** .

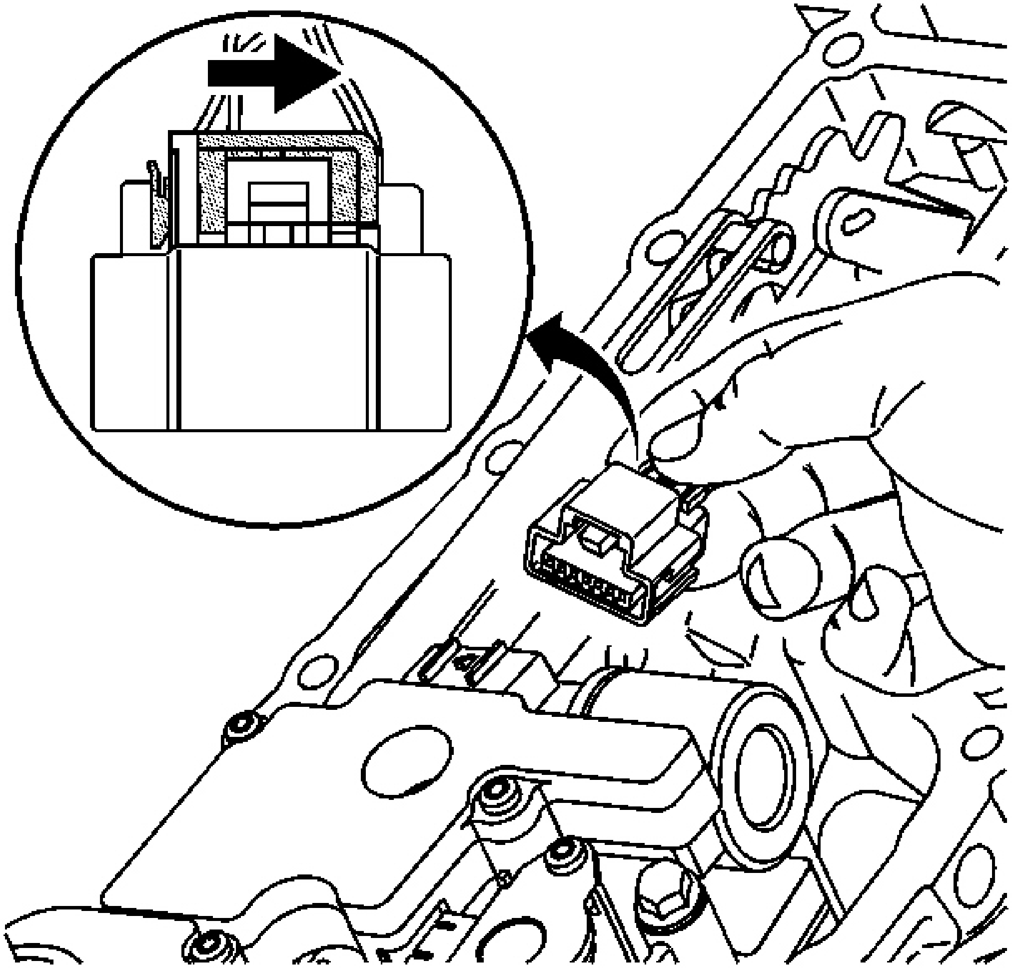


Fig. 94: Unlocking The Connector For Input & Output Speed Sensor
Courtesy of GENERAL MOTORS CORP.

2. Slide the grey locking clip in order to unlock the connector for the input and output speed sensor assembly.
3. Press the connector tab and remove the connector for the input and output speed sensor assembly from the control valve body assembly.

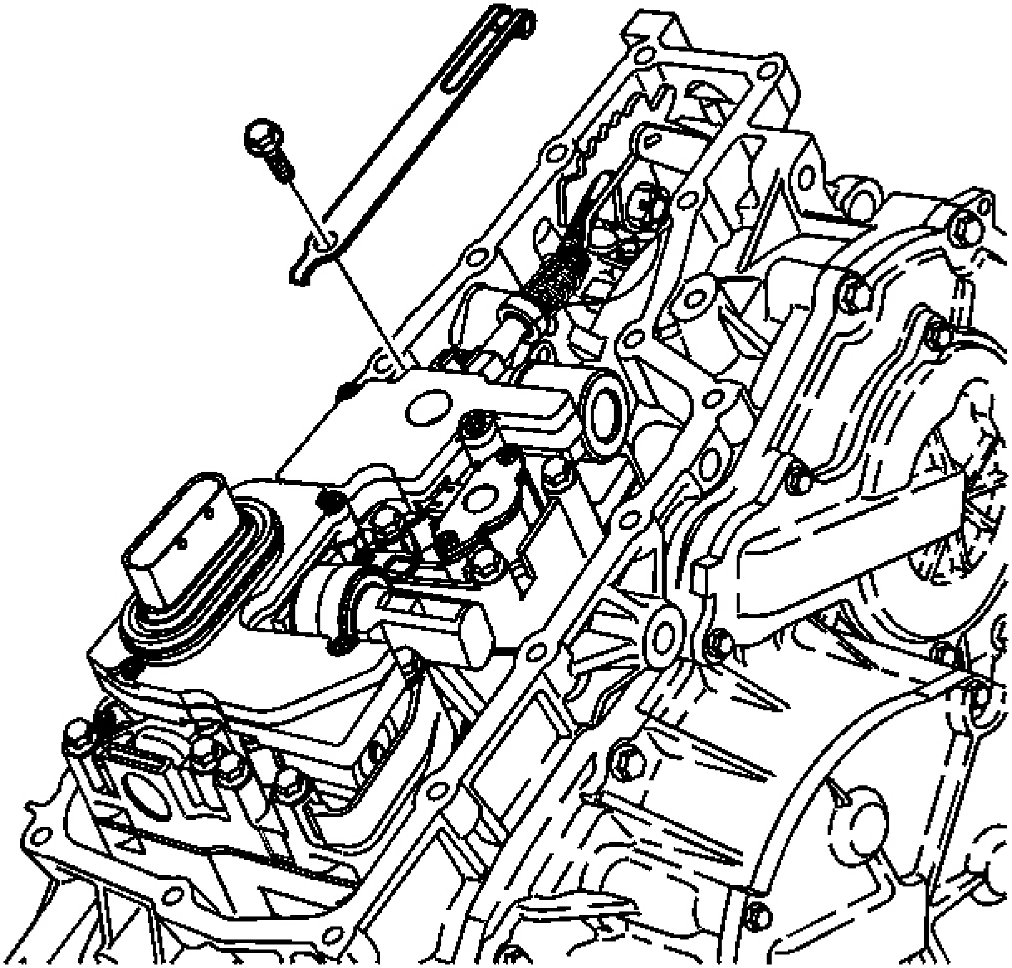


Fig. 95: Manual Shaft Detent & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the bolt and manual shaft detent assembly from the control valve body assembly.

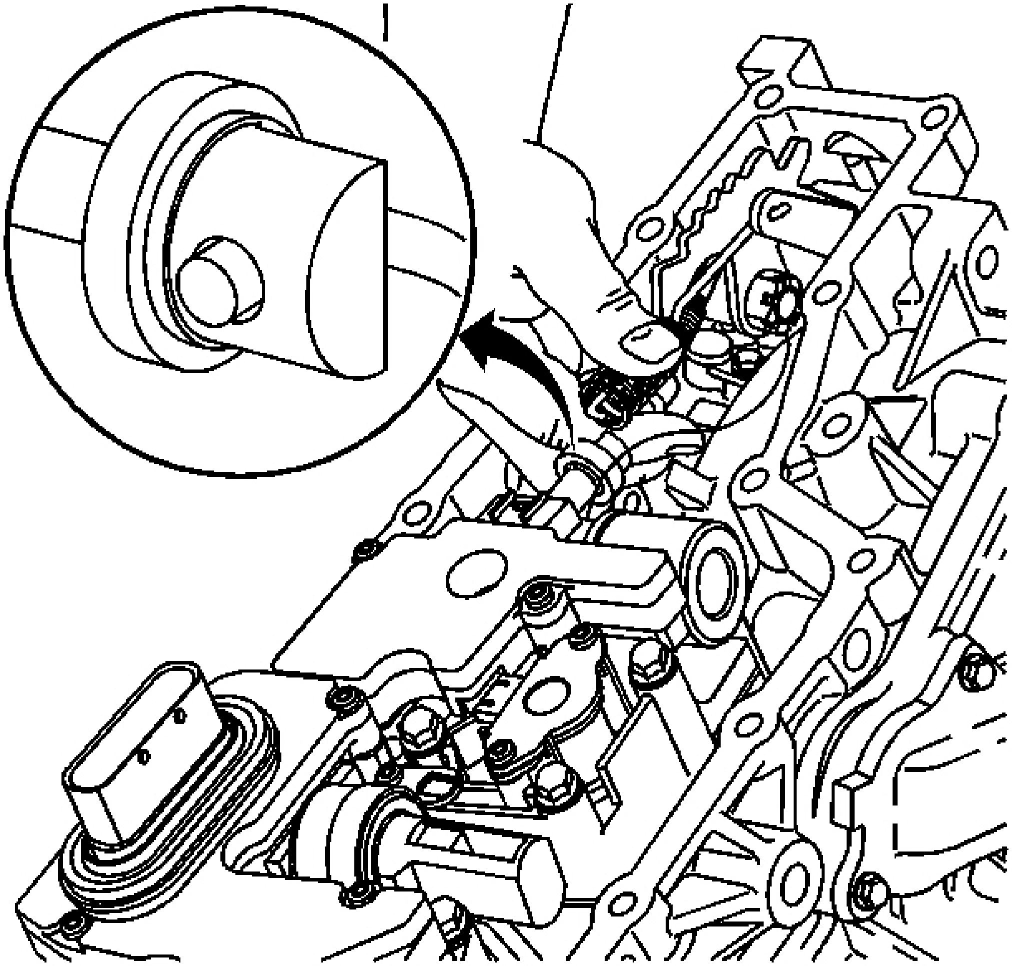


Fig. 96: Manual Valve Link
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the manual valve link assembly from the manual valve.

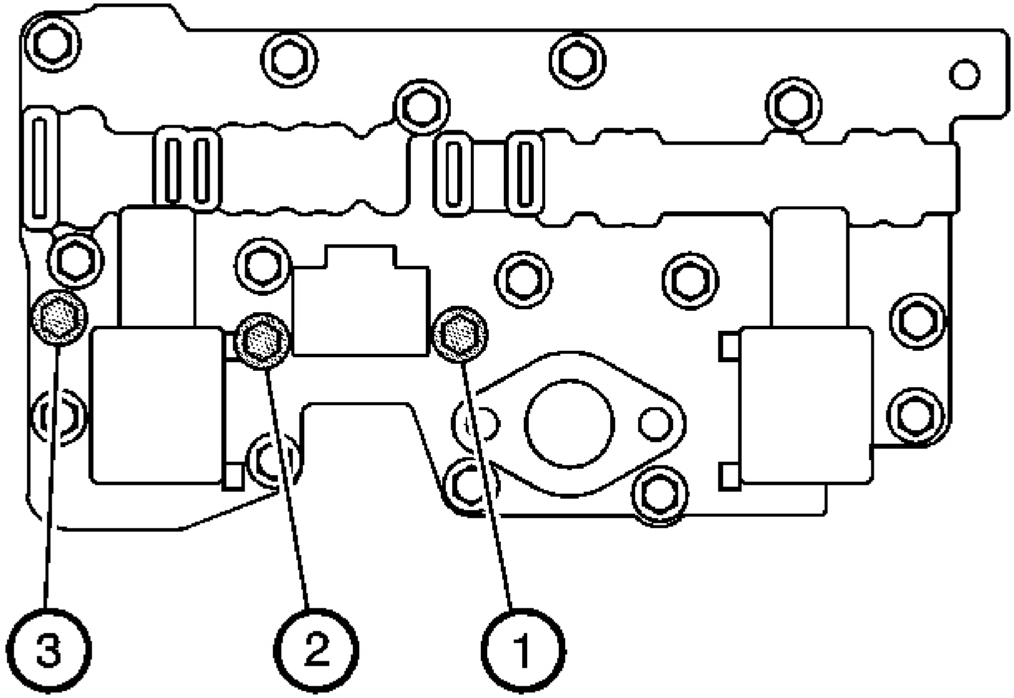


Fig. 97: Transmission Case Assembly Tightening Silver Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

6. Remove the 3 silver bolts from the control valve body assembly.

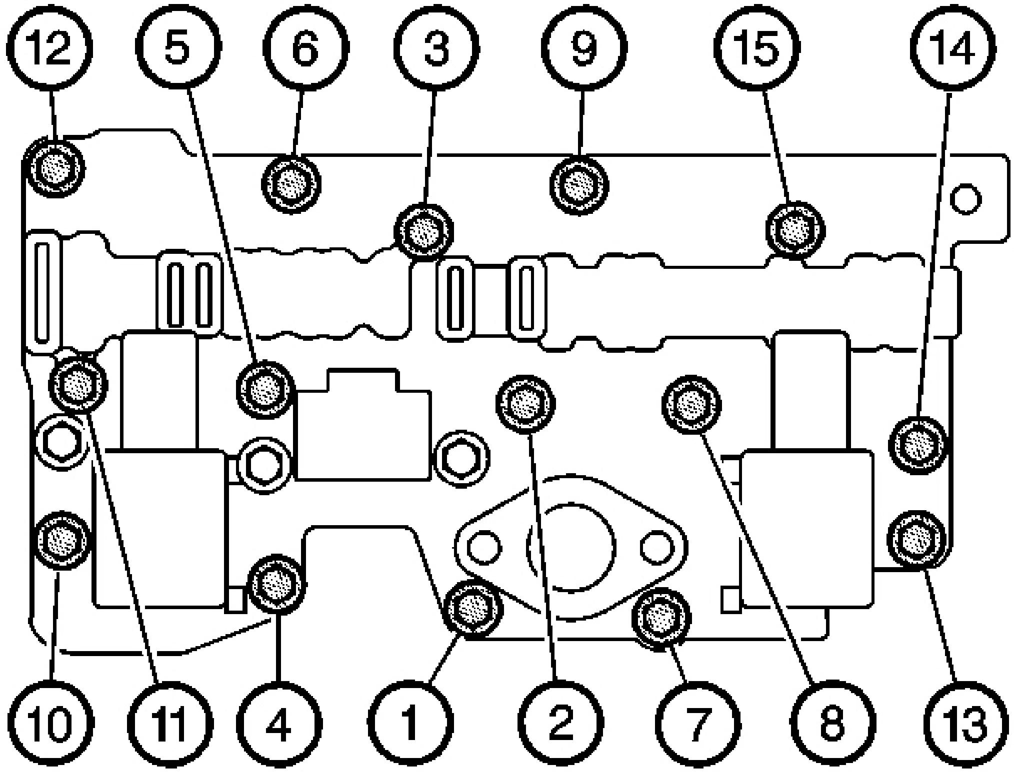


Fig. 98: 15 Black Bolts & Control Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use care when removing the control valve body assembly. The control solenoid valve assembly and the control valve body assembly may separate.

7. Remove the 15 black bolts from the control valve body assembly.

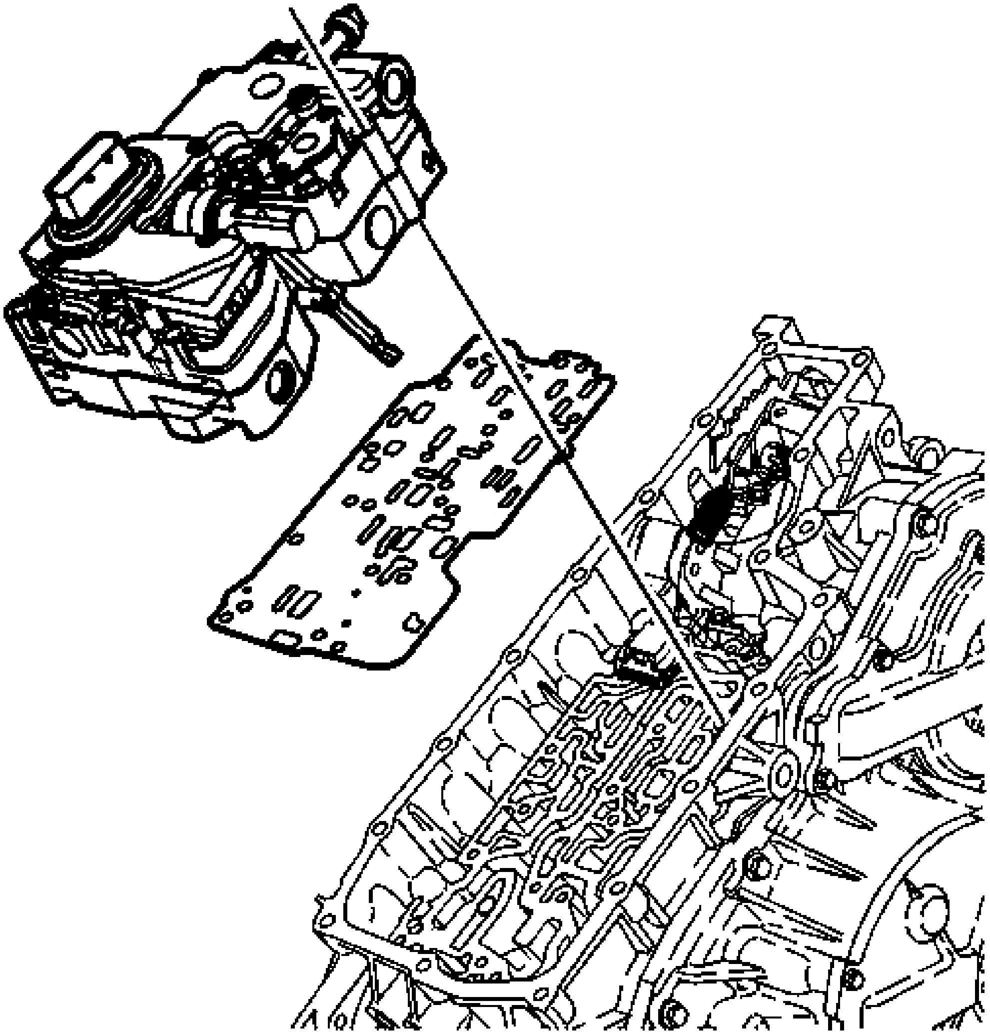
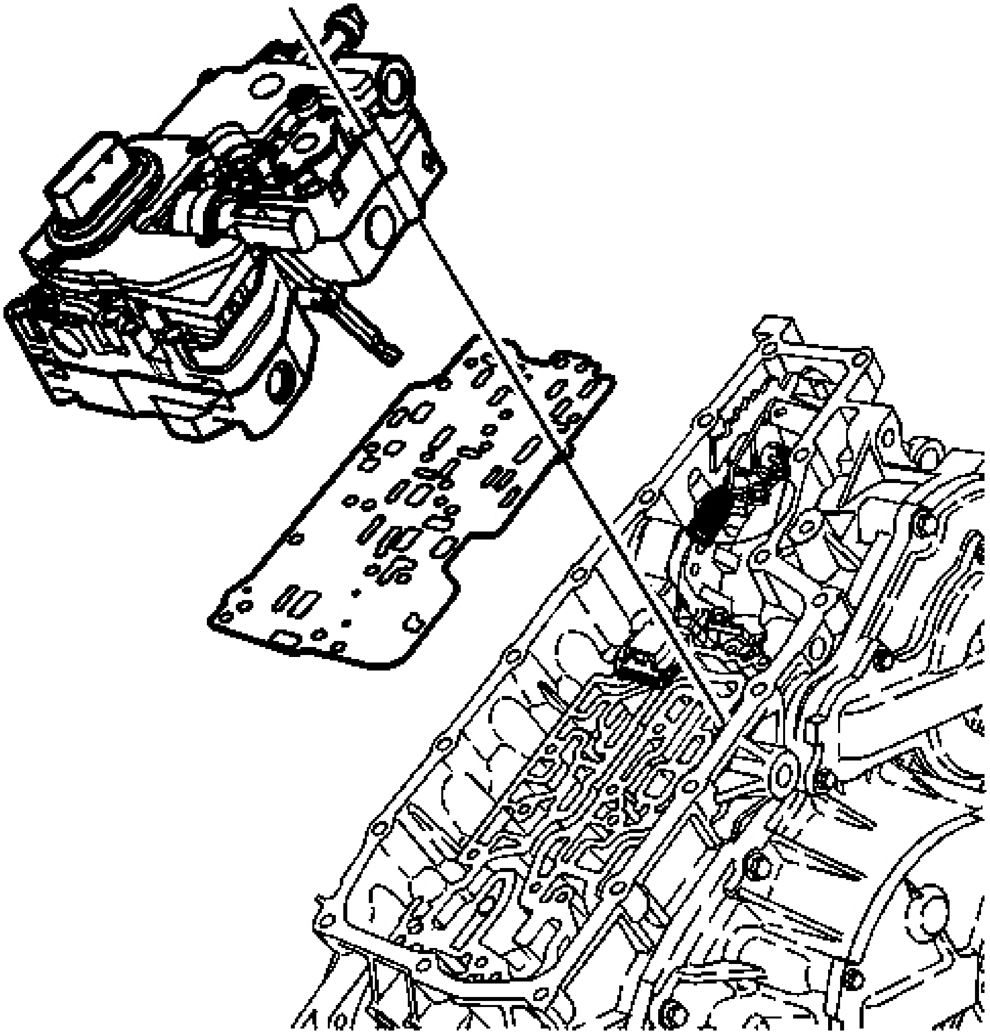


Fig. 99: Control Valve Body, Transmission Case & Spacer Plate
Courtesy of GENERAL MOTORS CORP.

8. Remove the control valve body assembly from the transmission case assembly.
9. Remove the spacer plate assembly. Discard the spacer plate assembly.

Installation Procedure



<u>Fig. 100: Control Valve Body, Transmission Case & Spacer Plate</u>
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW spacer plate assembly on the transmission case assembly.
2. Install the control valve body assembly on the transmission case assembly.

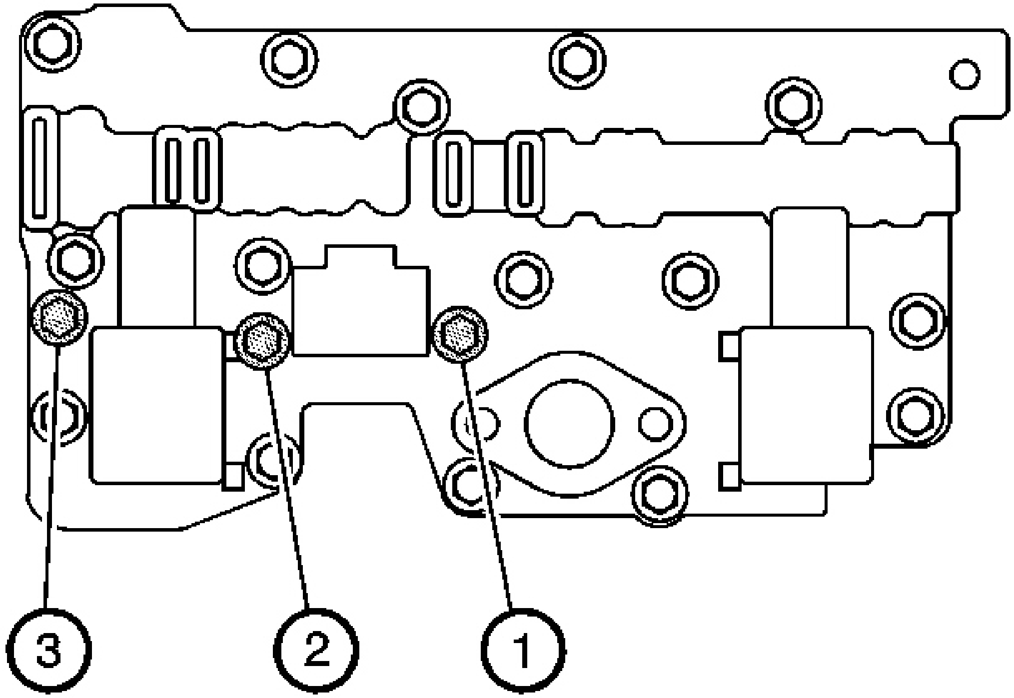


Fig. 101: Transmission Case Assembly Tightening Silver Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Secure the control valve body assembly to the transmission case assembly with the 3 silver bolts.

   Tighten: Tighten the 3 silver bolts to 8 N.m (6 lb ft) in the sequence shown.

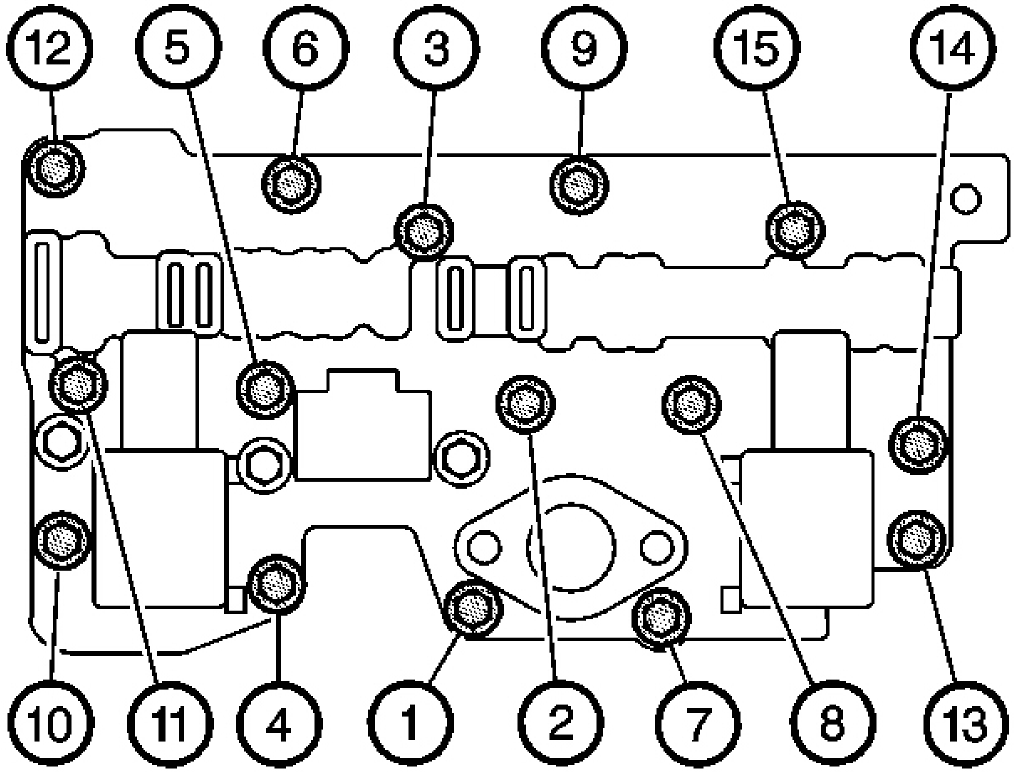


Fig. 102: Transmission Case Assembly Black Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

4. Secure the control valve body assembly to the transmission case assembly with the 15 black bolts.

   Tighten: Tighten the 15 black bolts in three separate steps in the sequence shown.

   1. Tighten to 5 N.m (4 lb ft)
   2. Tighten to 10 N.m (7 lb ft)
   3. Tighten to 15 N.m (11 lb ft)

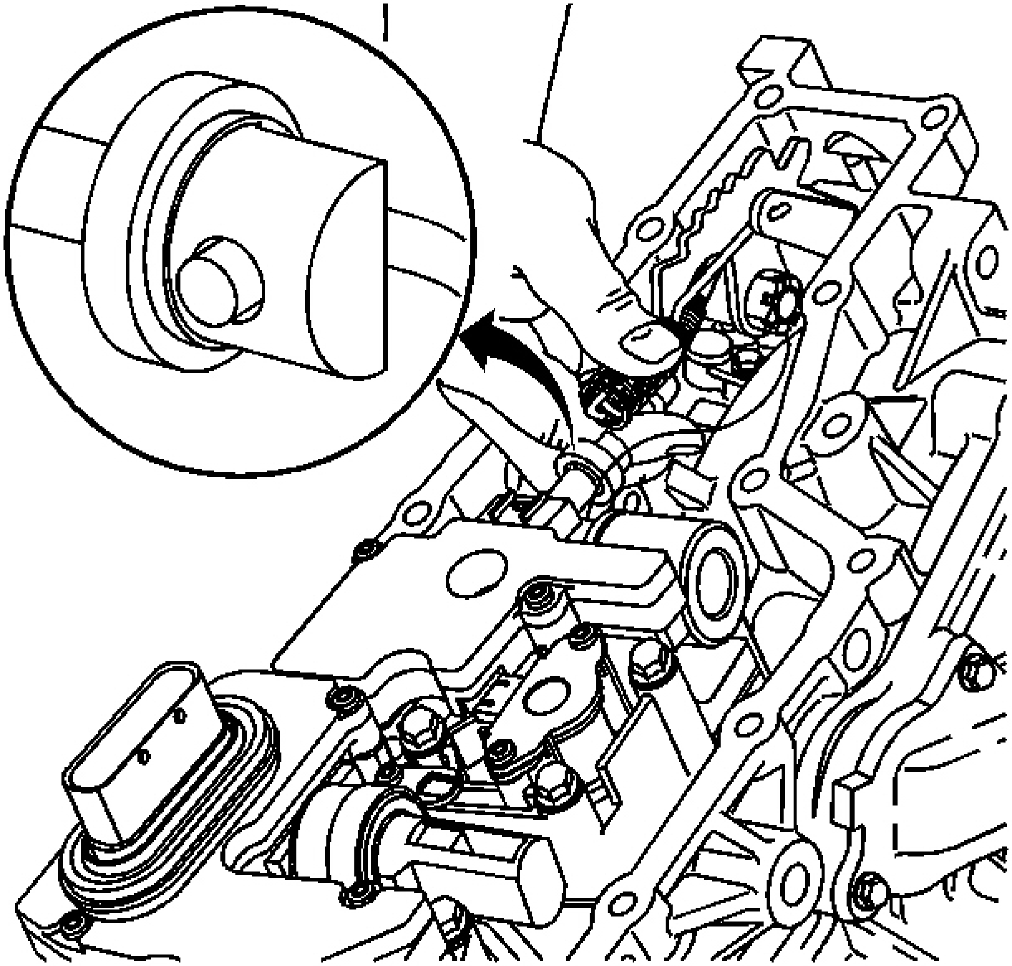


Fig. 103: Manual Valve Link
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Note the orientation of the manual valve before connecting the manual valve link assembly.

5. Connect the manual valve link assembly to the manual valve.

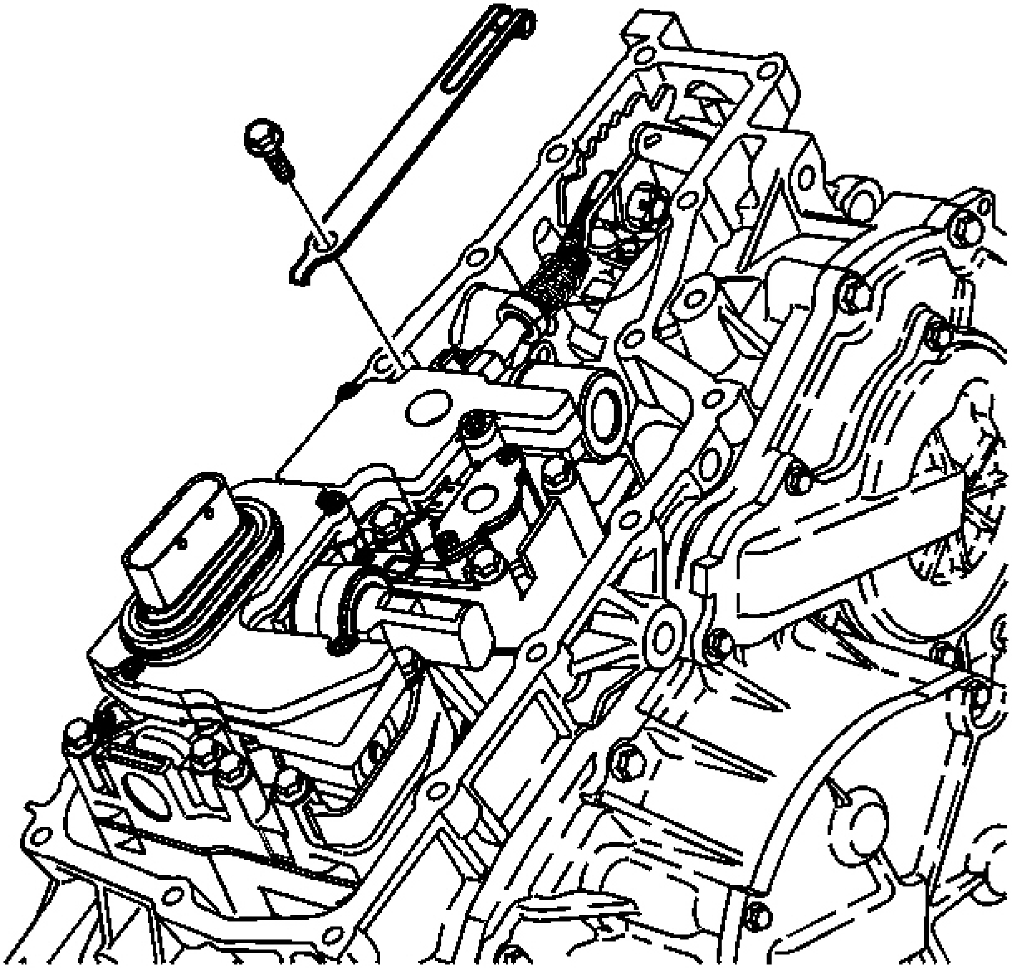


Fig. 104: Manual Shaft Detent & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the manual shaft detent assembly and bolt on the control valve body assembly.

   Tighten: Tighten the bolt to 11 N.m (8 lb ft).

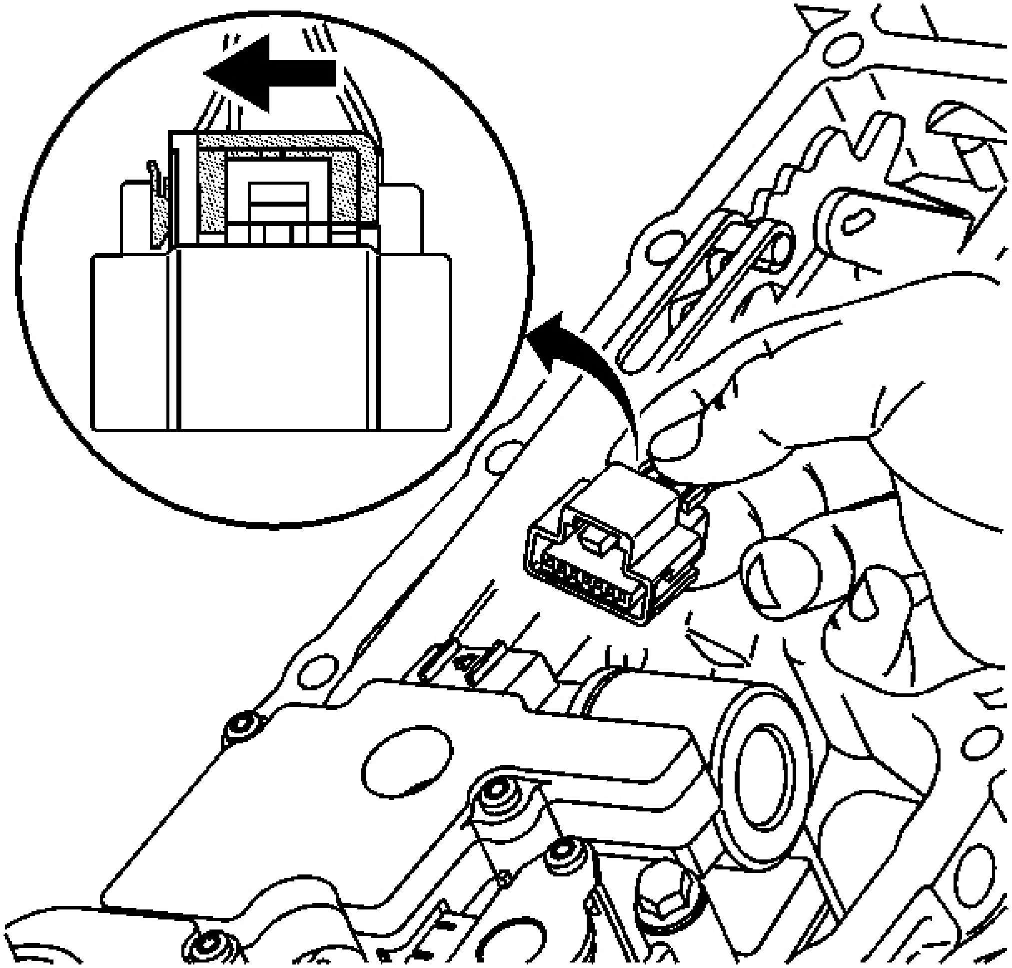


Fig. 105: Connecting The Connector For Input & Output Speed Sensor
Courtesy of GENERAL MOTORS CORP.

7. Connect the connector for the input and output speed sensor assembly to the control valve body assembly.
8. Slide the grey locking clip in order to lock the connector in place.
9. Install the control valve body cover. Refer to **Control Valve Body Cover Replacement** .

OIL PRESSURE TEST PLUG REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

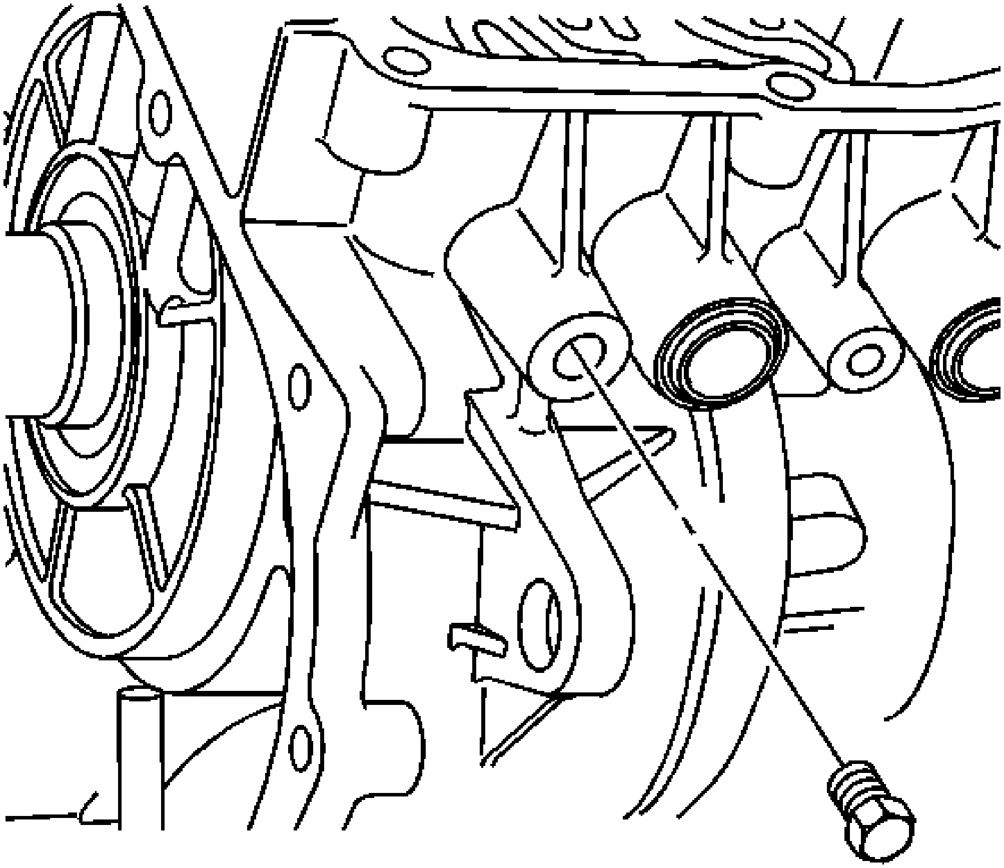


Fig. 106: Transmission Oil Pressure Test Plug
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Transmission fluid may leak from the test hole when the plug is removed.

2. Remove the transmission oil pressure test plug.
3. Clean and inspect the test hole for dirt or debris.

Installation Procedure

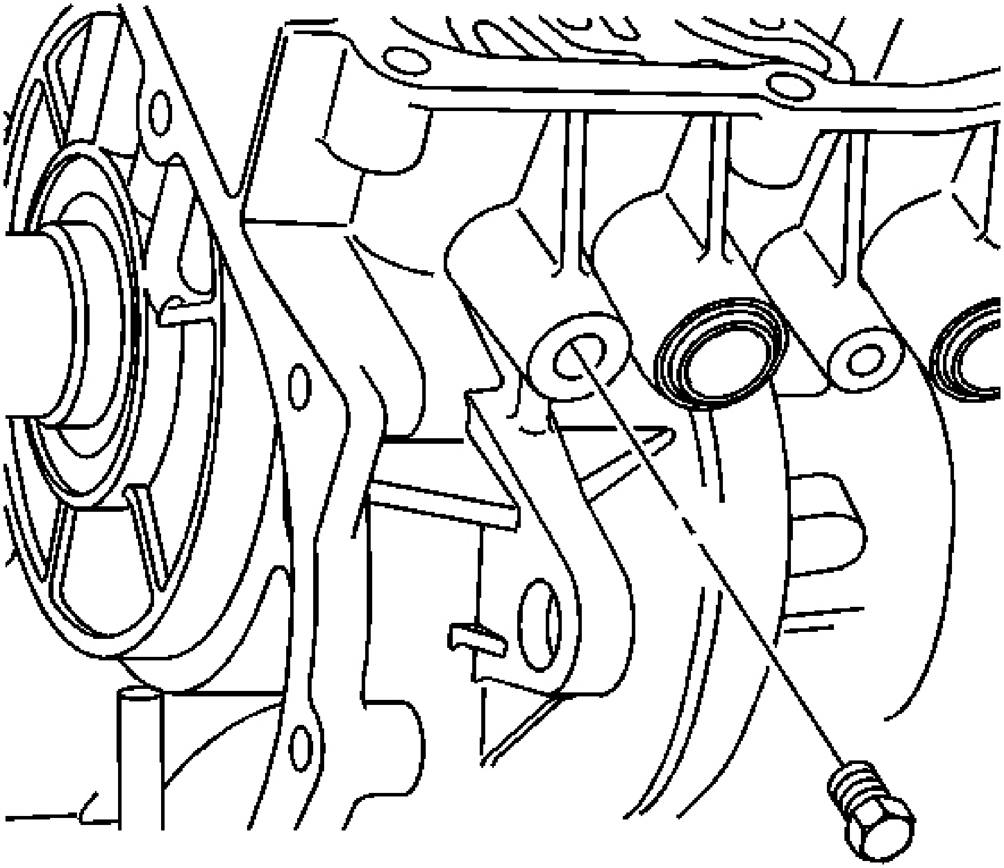


Fig. 107: Transmission Oil Pressure Test Plug
Courtesy of GENERAL MOTORS CORP.

1. Inspect the transmission oil pressure test plug for damage. Replace if necessary.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the transmission oil pressure test plug.

Tighten: Tighten the plug to 9 N.m (80 lb in).

IMPORTANT: A new lower tube assembly drain plug will be required when checking the transmission fluid level.

3. Verify the transmission fluid level. Refer to **Transmission Fluid Replacement** .

AUTOMATIC TRANSMISSION FLUID COOLER REPLACEMENT

Removal Procedure

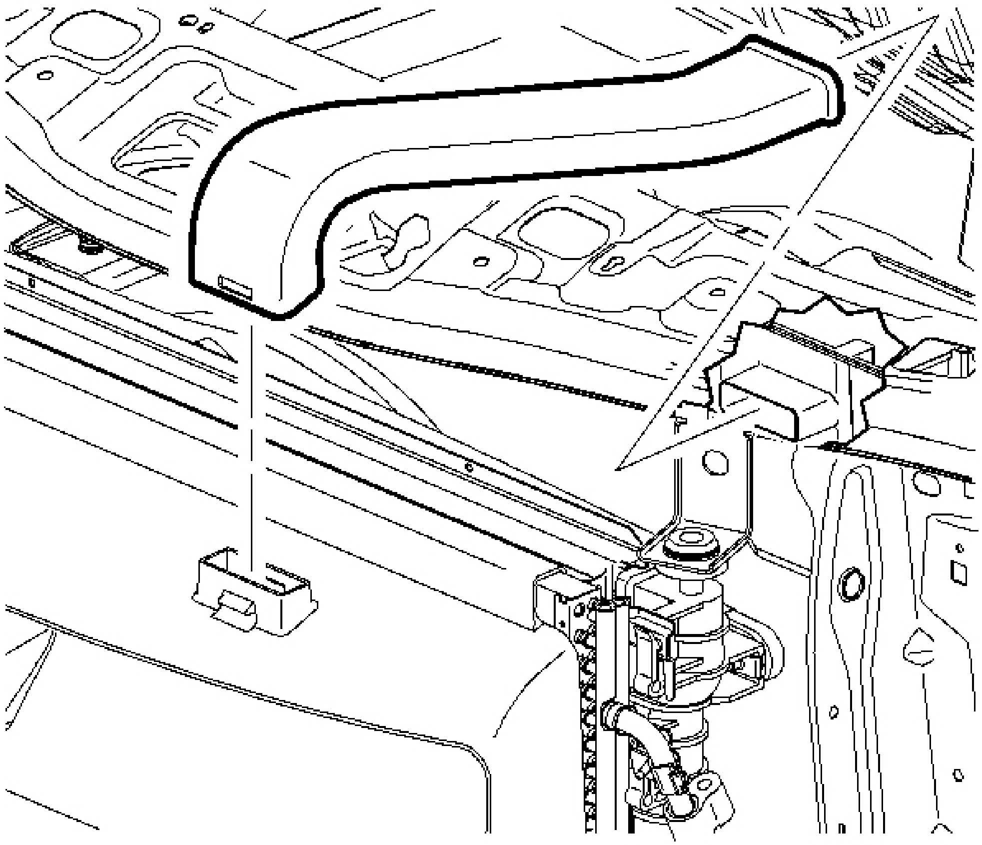


Fig. 108: Battery Box Inlet Air Duct
Courtesy of GENERAL MOTORS CORP.

1. Place a drain pan or suitable container under the vehicle.
2. Remove the front fascia. Refer to **Fascia Replacement - Front Bumper** in Bumpers.
3. Remove the battery box inlet air duct.

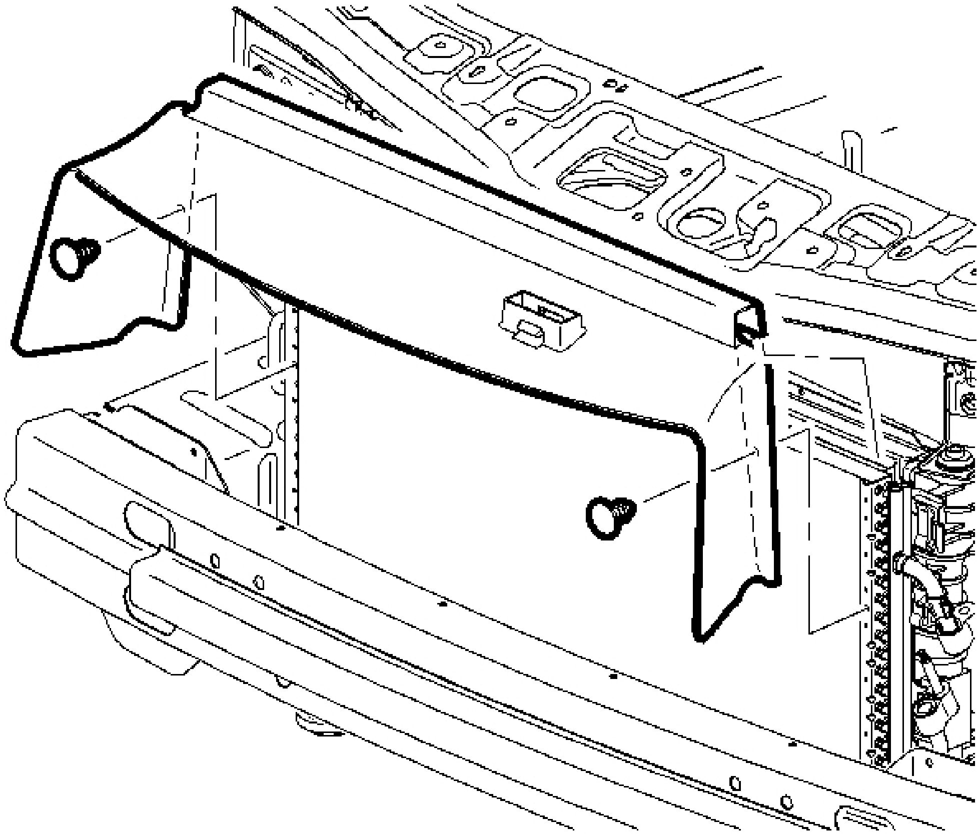


Fig. 109: CRFM Closeout Panel
Courtesy of GENERAL MOTORS CORP.

4. Remove the condenser radiator fan module (CRFM) closeout panel retainers from the condenser.
5. Remove the CRFM closeout panel from the condenser.

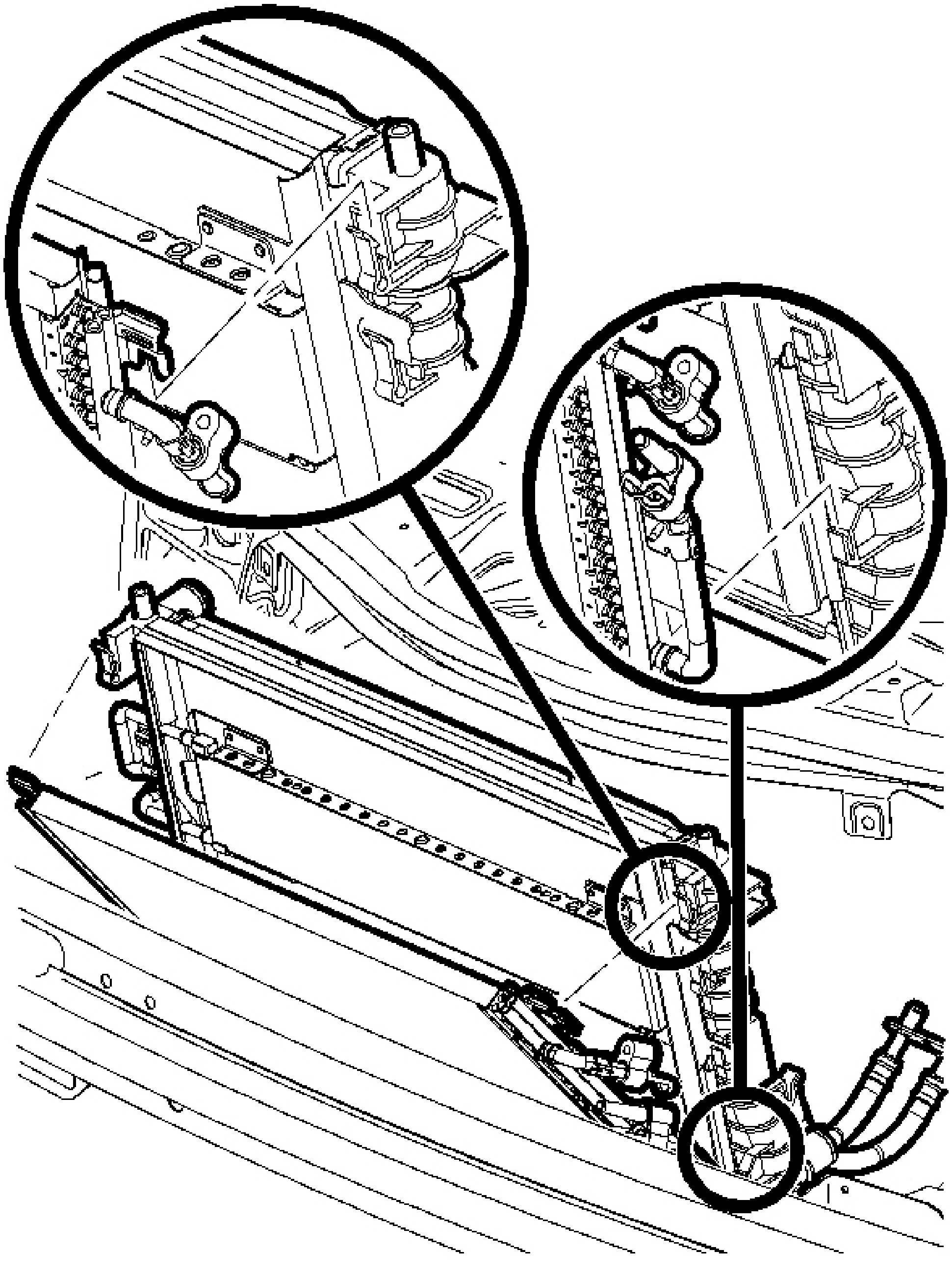


Fig. 110: Condenser & Radiator
Courtesy of GENERAL MOTORS CORP.

6. Lift the condenser while holding the upper retention tabs forward.
7. Position the condenser away from the radiator.

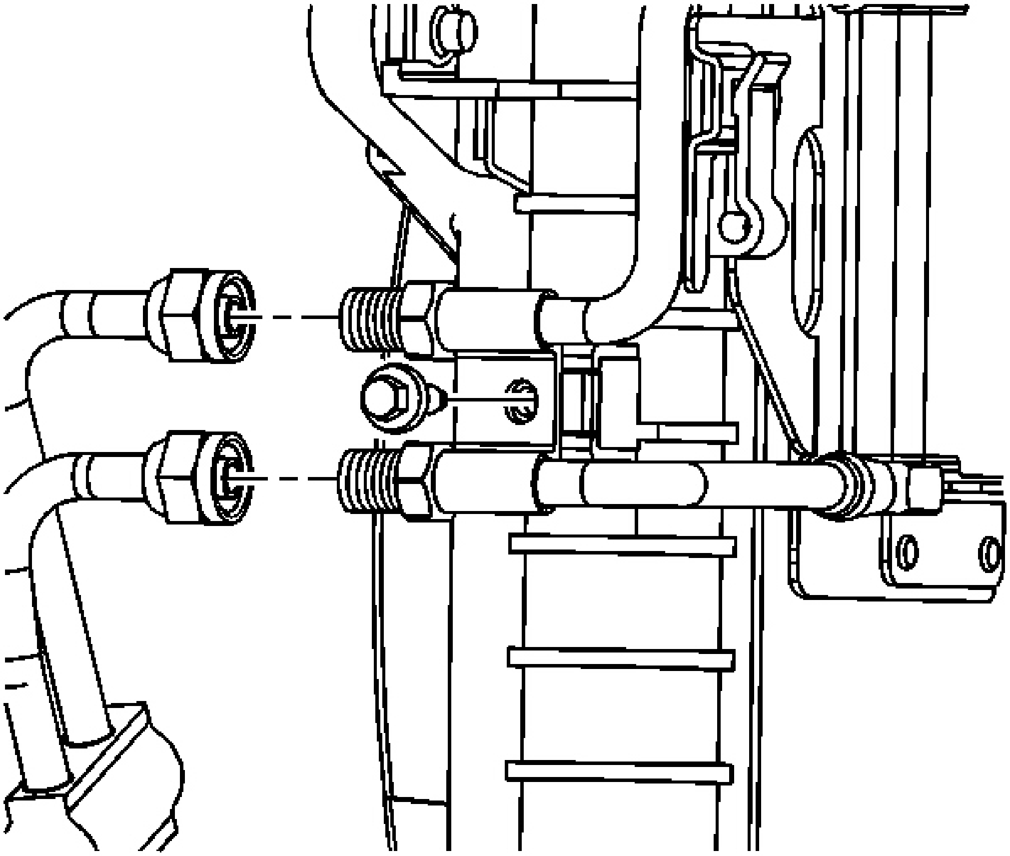


Fig. 111: Transmission Cooler Liners & Transmission Cooler
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the transmission cooler liners from the transmission cooler.
9. Remove the transmission cooler bolt from the radiator.

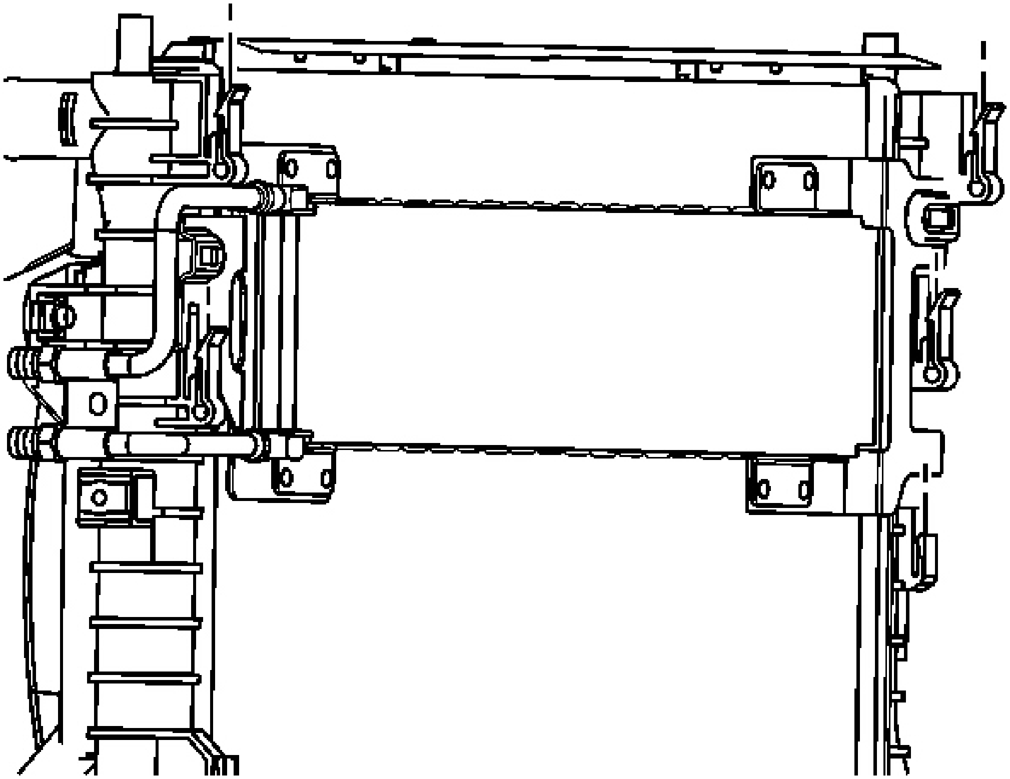


Fig. 112: Transmission Cooler & Upper Retention Tabs
Courtesy of GENERAL MOTORS CORP.

10. Lift the transmission cooler while holding the upper retention tabs forward.
11. Remove the transmission cooler from the vehicle.

Installation Procedure

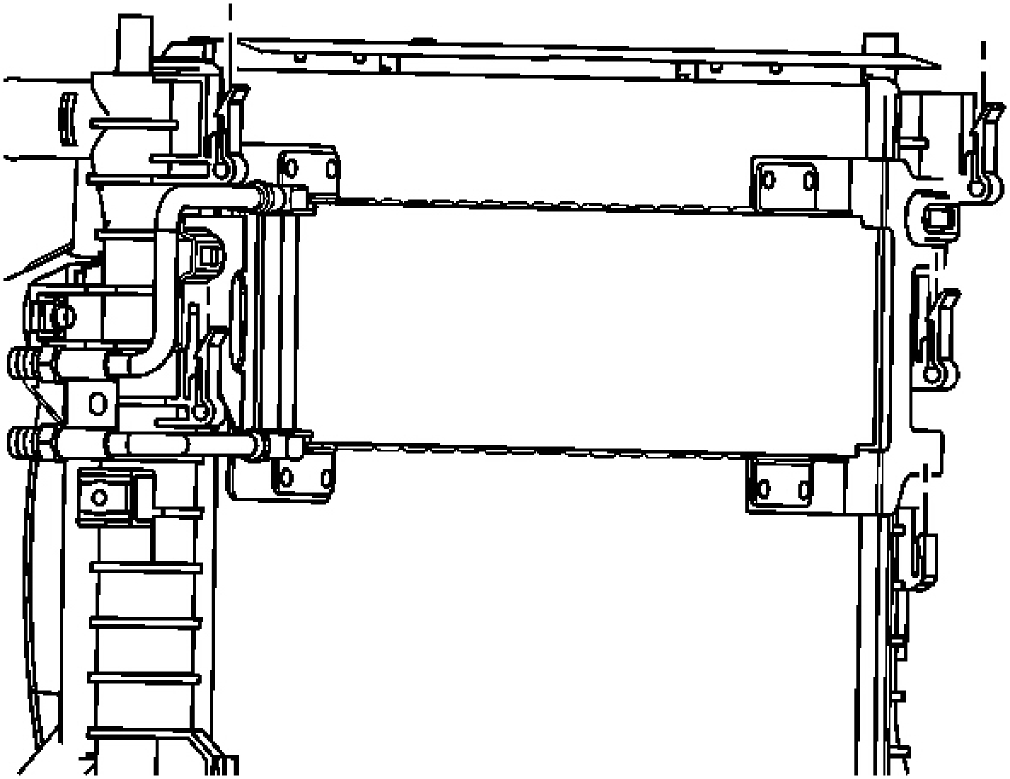


Fig. 113: Transmission Cooler & Upper Retention Tabs
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission cooler to the vehicle. Press down to engage the upper retention tabs.

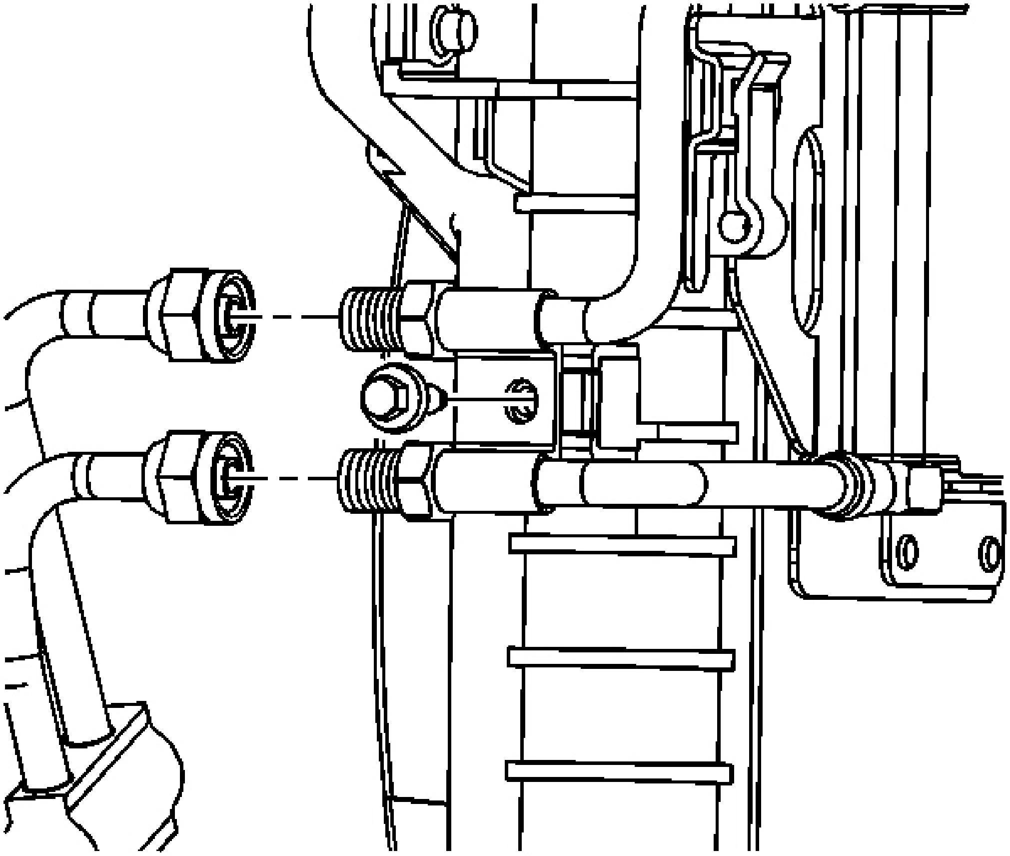


Fig. 114: Transmission Cooler Liners & Transmission Cooler
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the transmission cooler bolt to the radiator.

   Tighten: Tighten the bolt to 8 N.m (71 lb in).

3. Connect the transmission cooler liners to the transmission cooler.

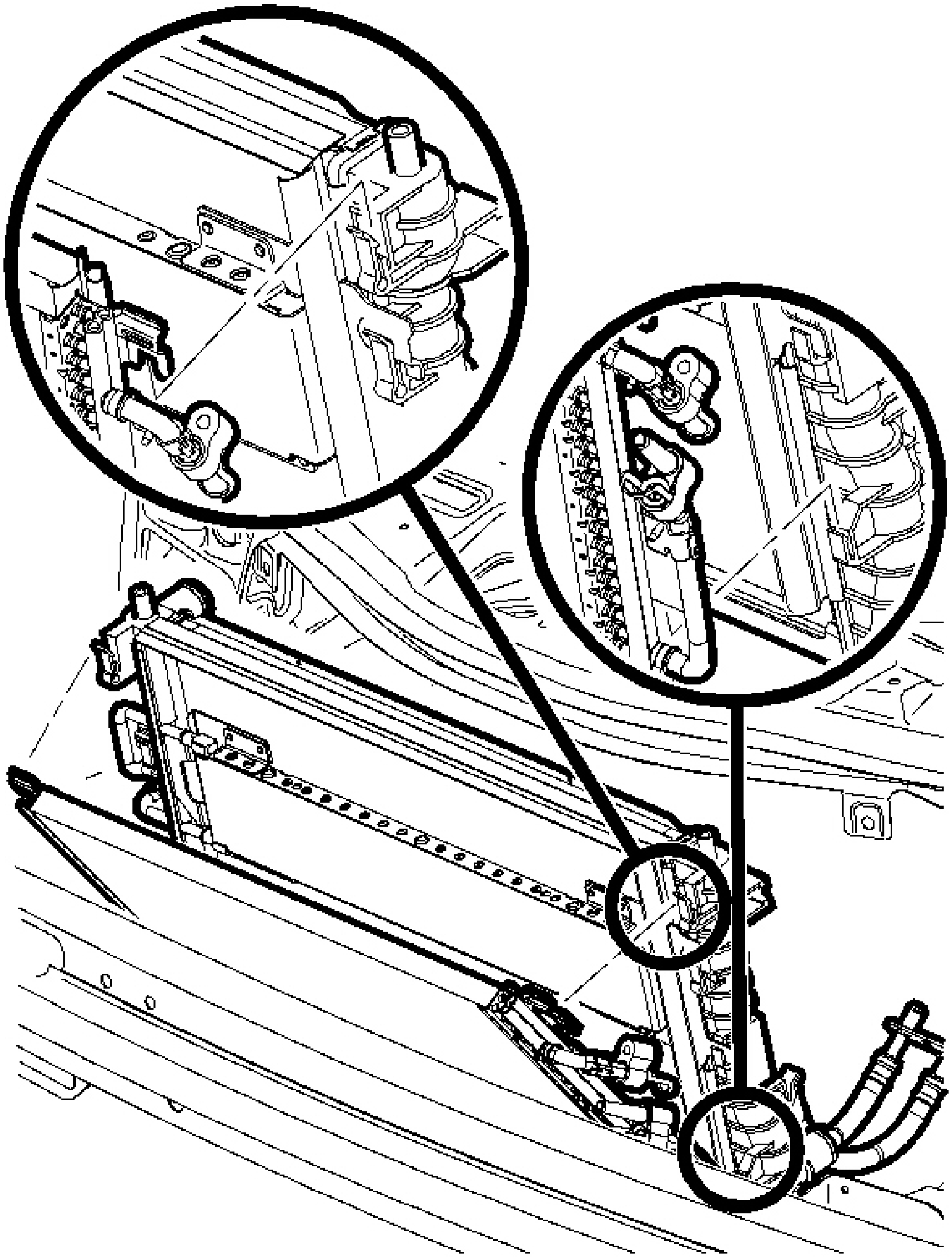


Fig. 115: Condenser & Radiator
Courtesy of GENERAL MOTORS CORP.

4. Install the condenser to the radiator. Press down to engage the upper retention tabs.

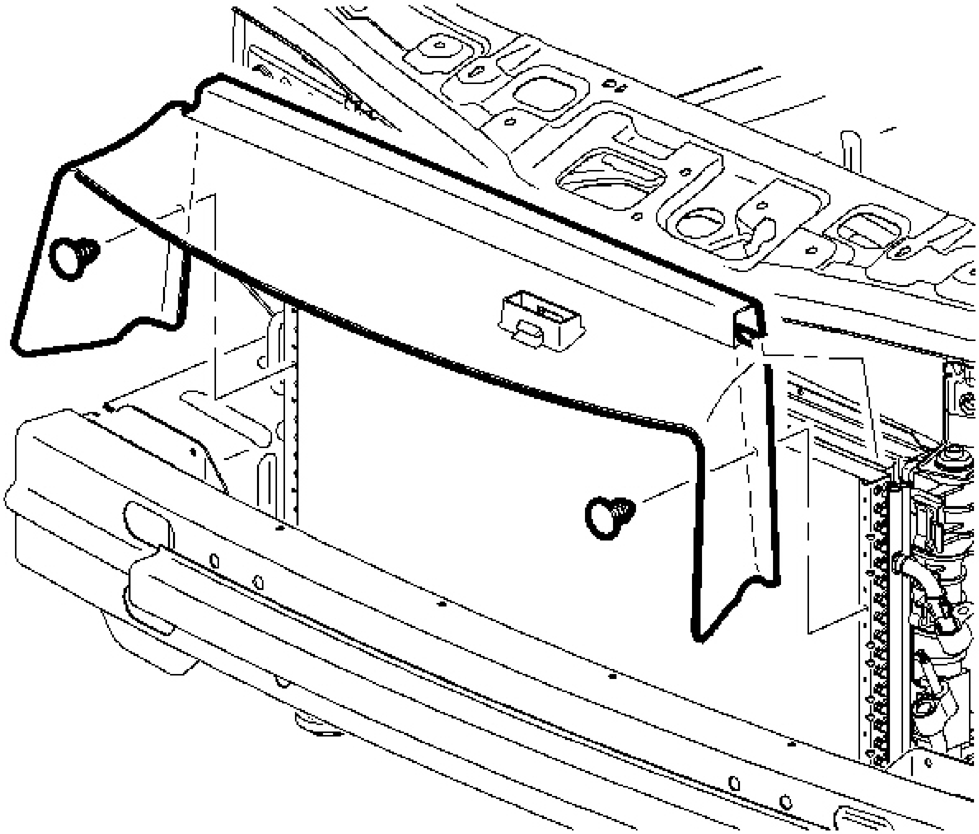


Fig. 116: CRFM Closeout Panel
Courtesy of GENERAL MOTORS CORP.

5. Install the CRFM closeout panel to the condenser.
6. Install the CRFM closeout panel retainers to the condenser.

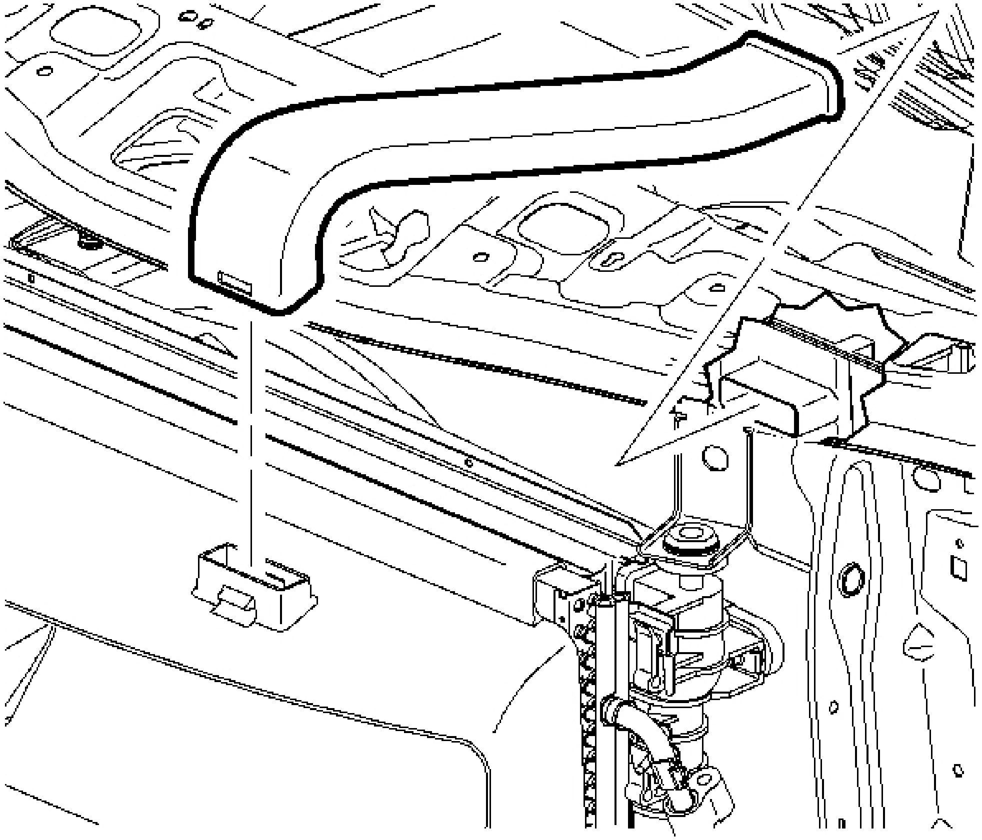


Fig. 117: Battery Box Inlet Air Duct
Courtesy of GENERAL MOTORS CORP.

7. Install the battery box inlet air duct.
8. Install the front fascia. Refer to **Fascia Replacement - Front Bumper** in Bumpers.

IMPORTANT: Do not use ATF P/N 21005966 or P/N 21019223. These fluids are not compatible with this transmission. Use Saturn DEX-CVT(R) fluid P/N 22688912.

9. Add fluid to the transmission as necessary. Refer to **Transmission Fluid Replacement** .
10. Start the engine and inspect for leaks.

OIL COOLER LINE REPLACEMENT

Removal Procedure

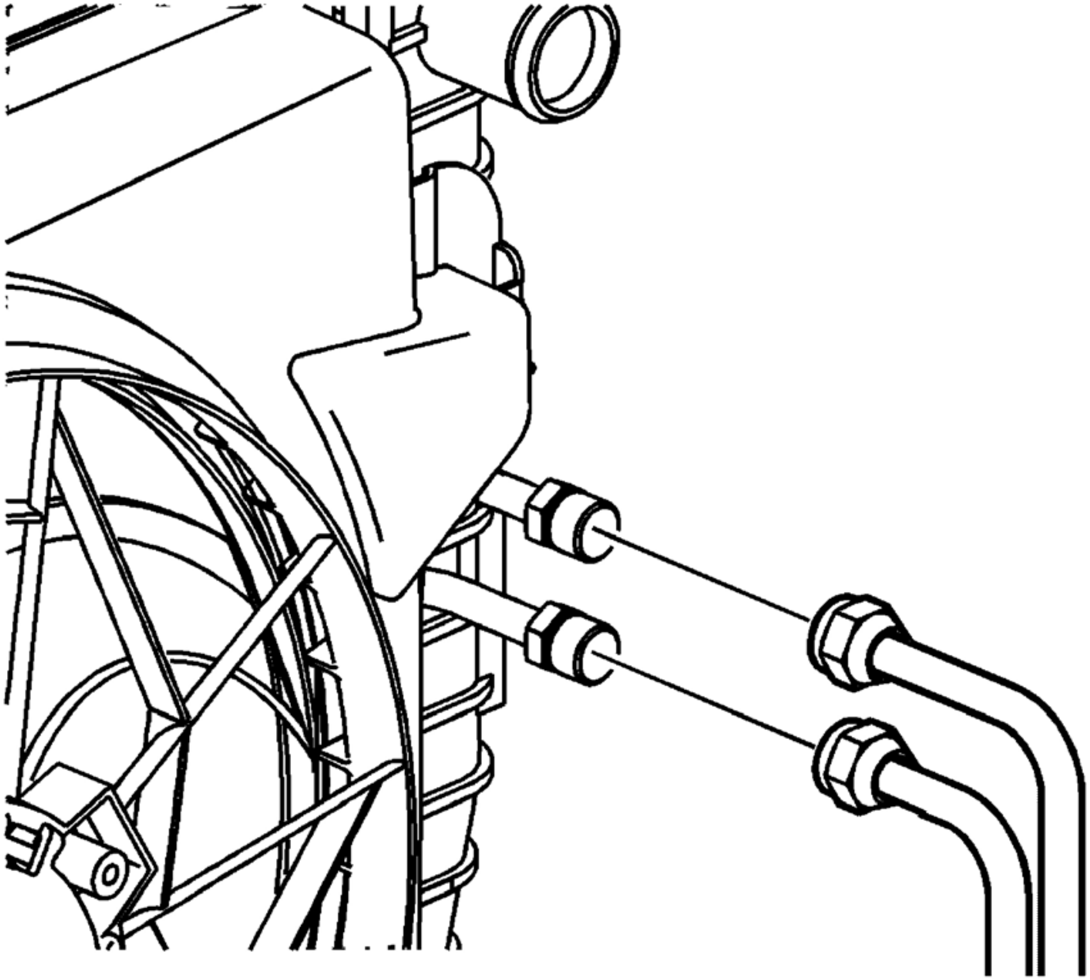


Fig. 118: Transmission Oil Cooler Lines & Radiator
Courtesy of GENERAL MOTORS CORP.

1. Place a drain pan or suitable container under the vehicle.
2. Clean the cooler line connection points at the radiator and transmission.
3. Disconnect the transmission oil cooler lines from the radiator.
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

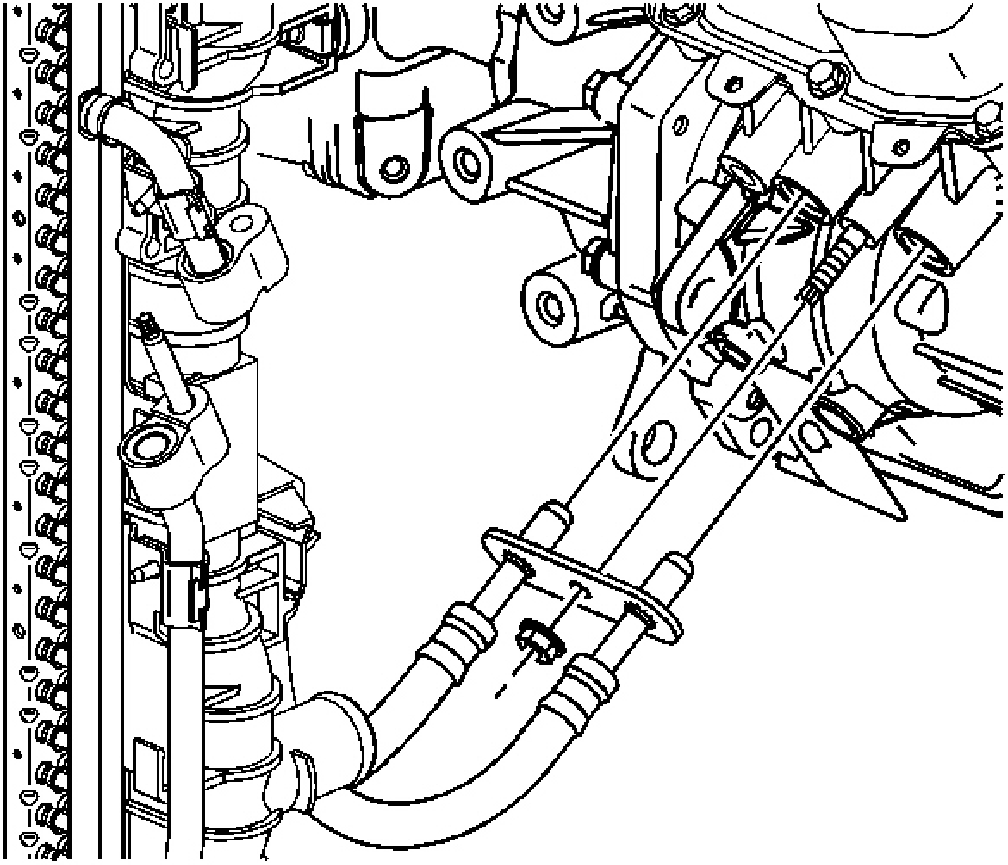


Fig. 119: Transmission Oil Cooler Line Assembly Nut & Transmission
Courtesy of GENERAL MOTORS CORP.

5. Remove the transmission oil cooler line assembly nut from the transmission.
6. Remove the transmission oil cooler lines from the vehicle.

Installation Procedure

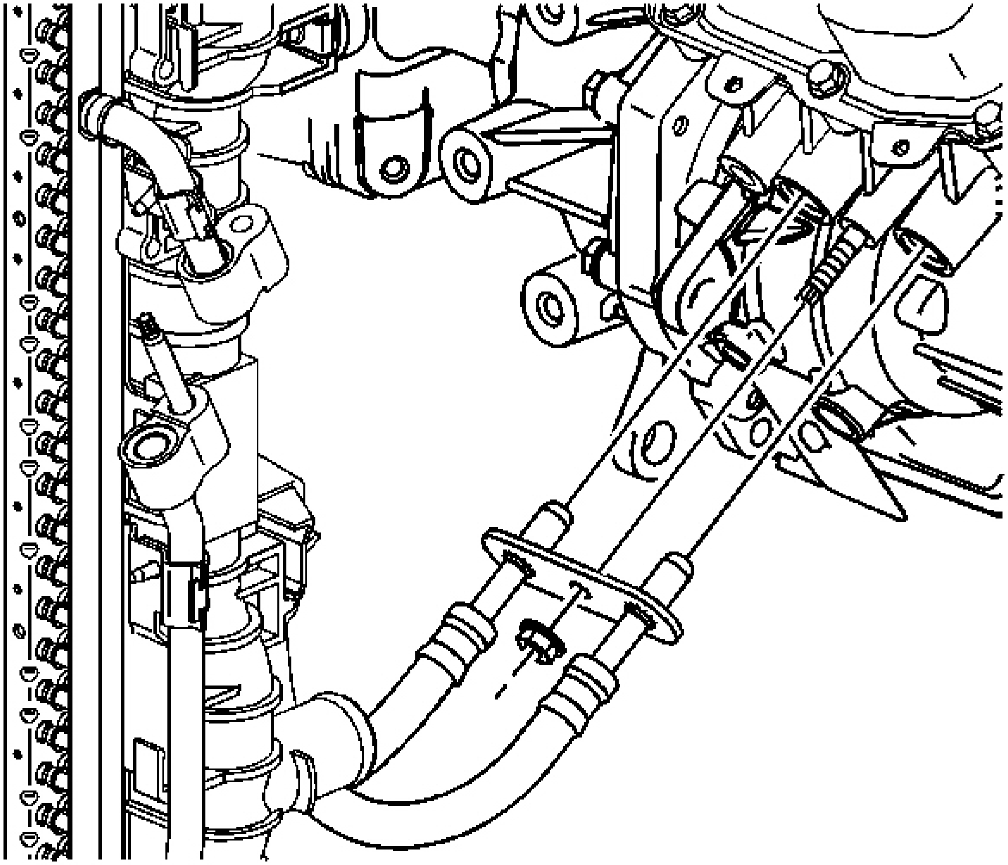


Fig. 120: Transmission Oil Cooler Line Assembly Nut & Transmission
Courtesy of GENERAL MOTORS CORP.

1. Install the oil cooler line assembly to the transmission.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the oil cooler line assembly nut.

   Tighten: Tighten the lines to 7 N.m (62 lb in).

3. Lower the vehicle.

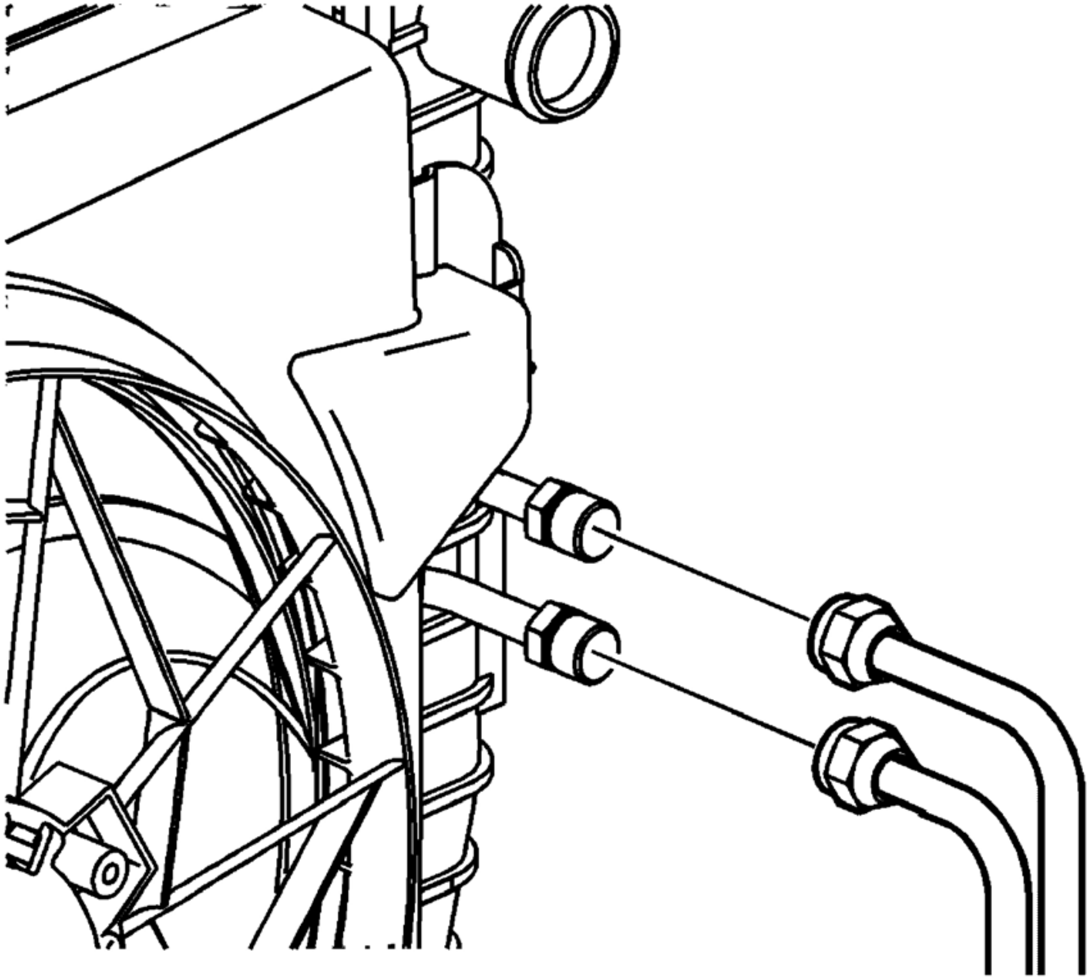


Fig. 121: Transmission Oil Cooler Lines & Radiator
Courtesy of GENERAL MOTORS CORP.

4. Install the transmission oil cooler lines to the radiator.

   Tighten: Tighten the cooler line fittings to 16 N.m (12 lb ft).

   IMPORTANT: Do not use ATF P/N 21005966 or P/N 21019223. These fluids are not compatible with this transmission. Use Saturn DEX-CVT(R) fluid P/N 22688912.

5. Add fluid to the transmission as necessary. Refer to **Transmission Fluid Replacement** .
6. Start the engine and inspect for leaks.

OIL COOLER PIPE SEALS REPLACEMENT

Tools Required

- **J 41239-1** Cooler Line Seal Installer. See **Special Tools and Equipment** .
- **J 45201** Cooler Line Seal Remover. See **Special Tools and Equipment** .

Removal Procedure

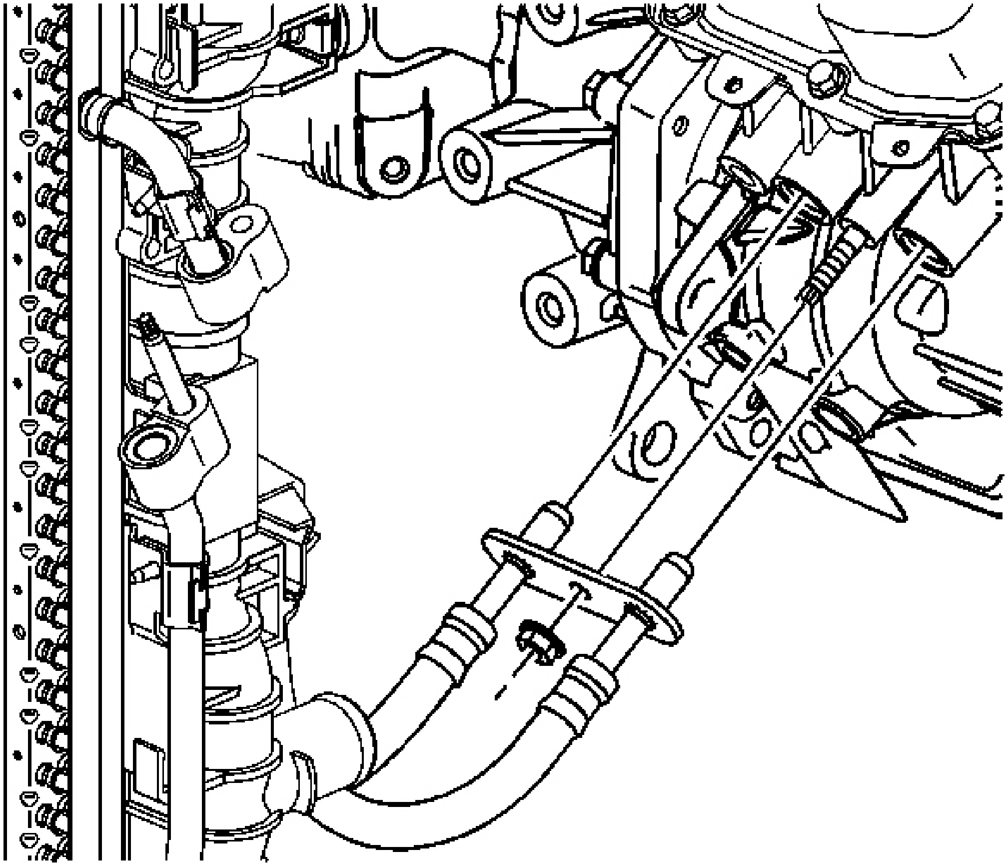


Fig. 122: Transmission Oil Cooler Line Assembly Nut & Transmission
Courtesy of GENERAL MOTORS CORP.

1. Place a drain pan or suitable container under the vehicle.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Clean the cooler line connection points at the transmission.
4. Remove the transmission cooler line assembly nut from the transmission.

5. Disconnect the cooler lines from the transmission.

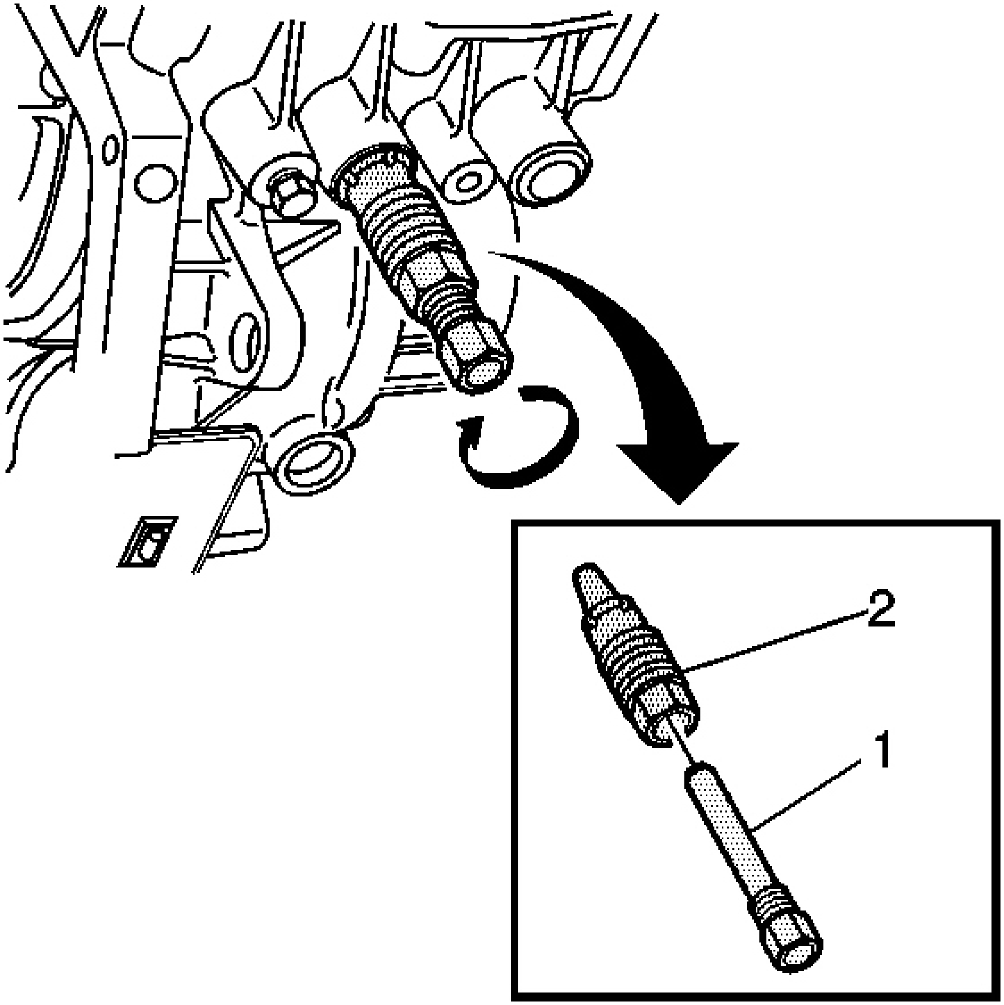


Fig. 123: J 45201, Collet, Forcing Screw & Cooler Line Seal
Courtesy of GENERAL MOTORS CORP.

6. Insert the **J 45201** collet (2) into the cooler line seal. See **Special Tools and Equipment** .
7. Insert the **J 45201** forcing screw (1) into the collet (2). See **Special Tools and Equipment** .
8. Tighten the forcing screw (1) until snug.

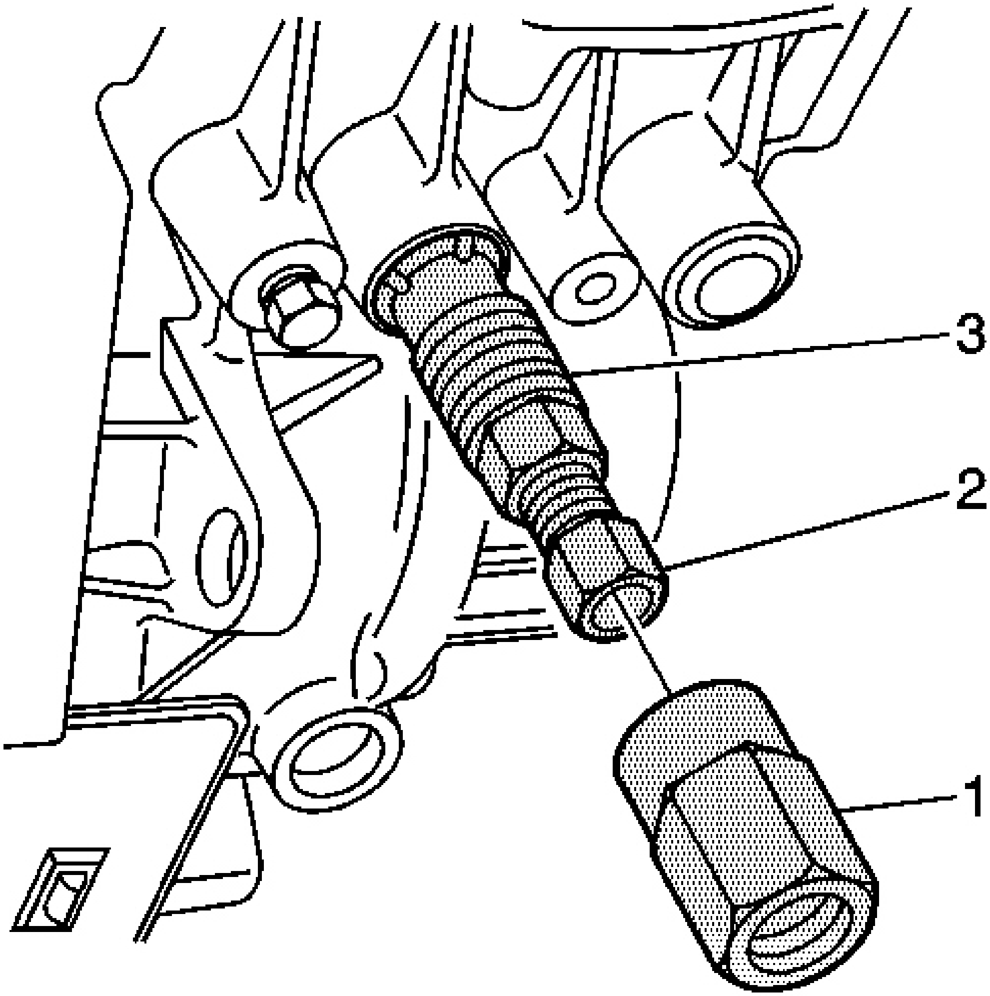


Fig. 124: J 45201, Collar & Collet
Courtesy of GENERAL MOTORS CORP.

9. Thread the **J 45201** collar (1) onto the collet (3). See **Special Tools and Equipment** .

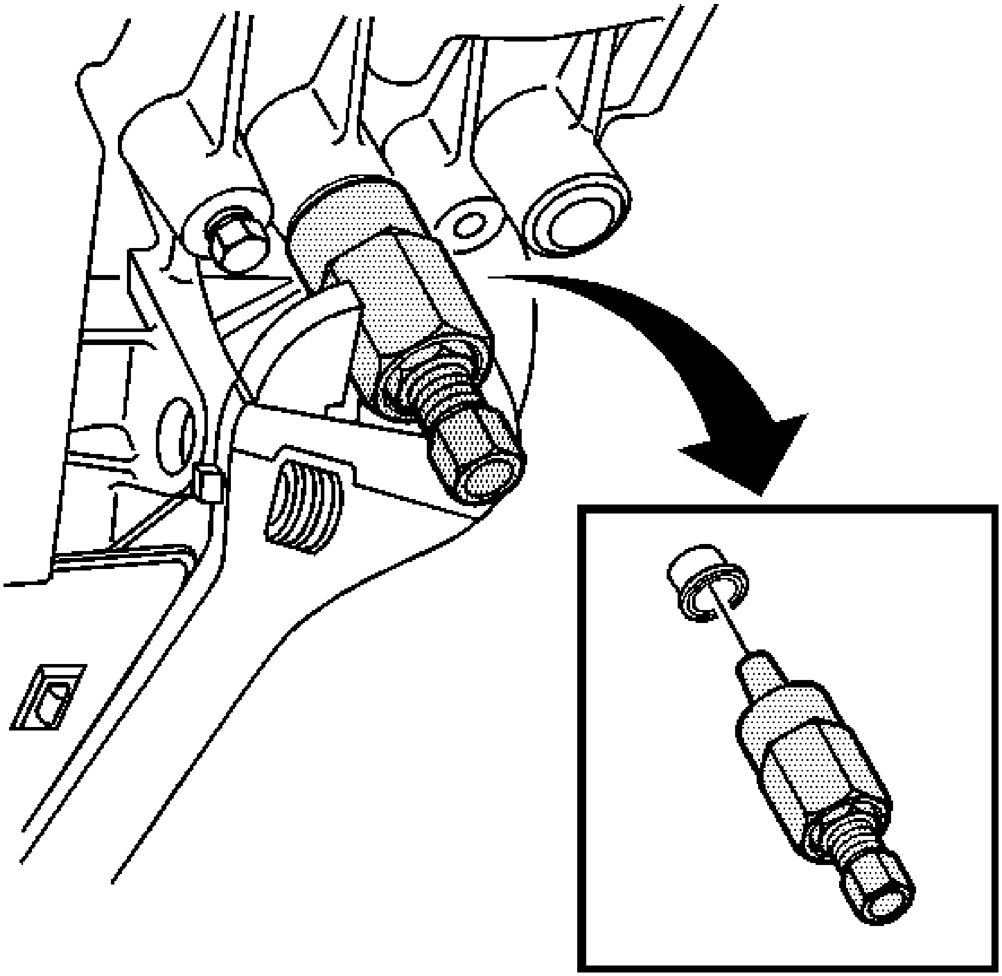


Fig. 125: Collar & Case Bores
Courtesy of GENERAL MOTORS CORP.

10. Turn the collar clockwise in order to remove the seal from the case bores.
11. Discard the seal.
12. Clean the cooler line seal case bores.

Installation Procedure

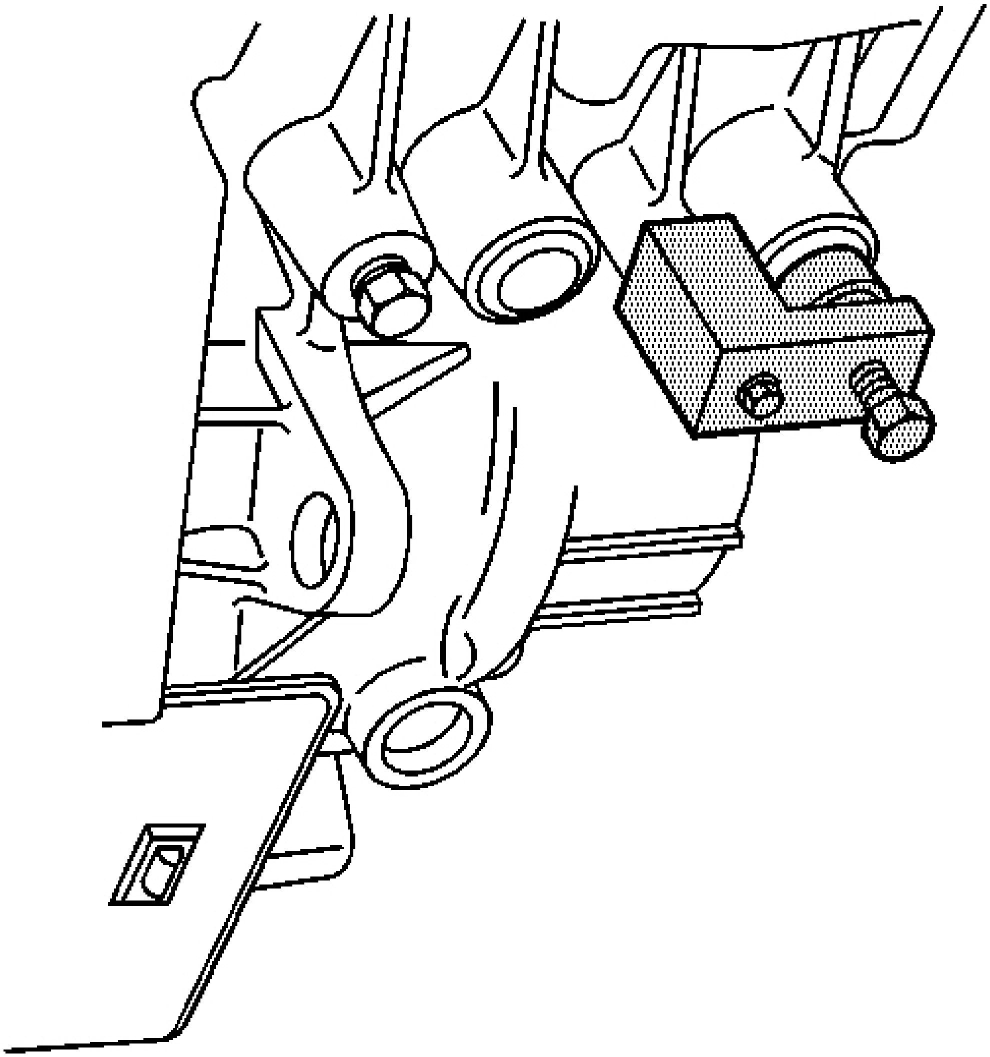


Fig. 126: J 41239-1 & Cooler Line Seal
Courtesy of GENERAL MOTORS CORP.

1. Coat the new cooler line seal with transmission fluid.
2. Using the **J 41239-1** , install the new cooler line seal. See **Special Tools and Equipment** .

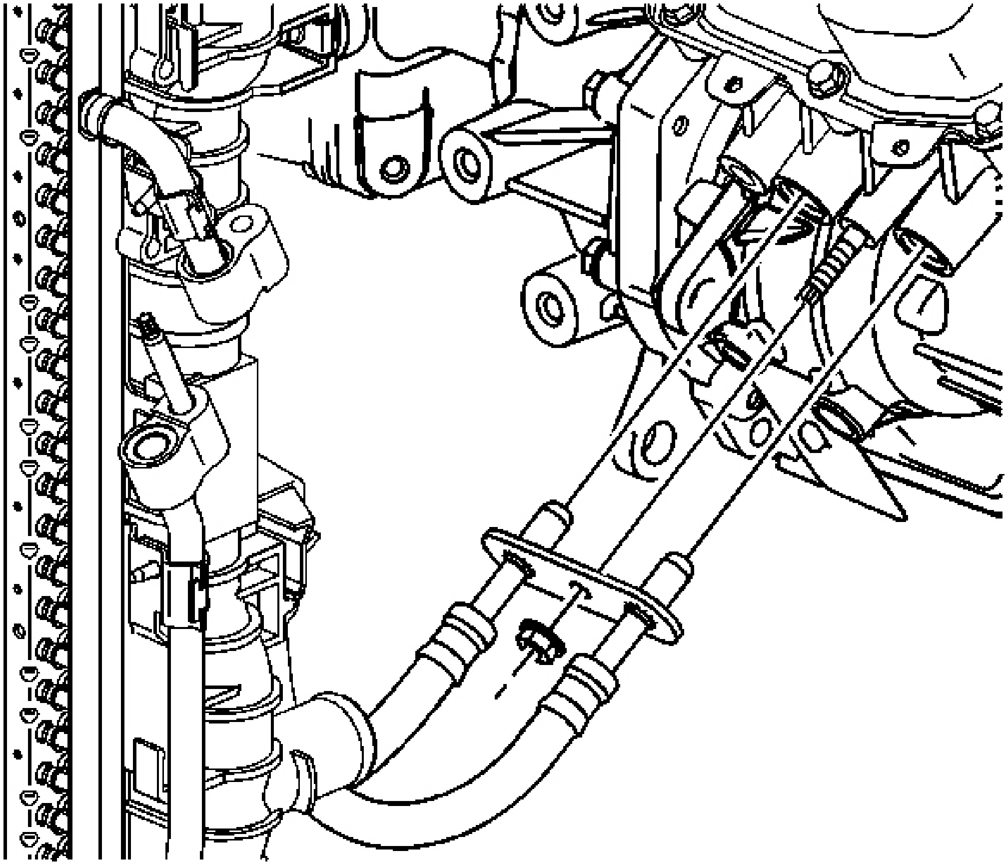


Fig. 127: Transmission Oil Cooler Line Assembly Nut & Transmission
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Connect the transmission cooler line assembly onto the transmission.

   Tighten: Tighten the transmission cooler line retaining nut to 7 N.m (62 lb in).

4. Lower the vehicle.

IMPORTANT: Do not use ATF P/N 21005966 or P/N 21019223. These fluids are not compatible with this transmission. Use Saturn DEX-CVT(R) P/N 22688912.

5. Add fluid to the transmission as necessary. Refer to **Transmission Fluid Replacement** .

6. Start the engine and inspect for leaks.

AUTOMATIC TRANSMISSION OIL COOLER FLUSHING

Tools Required

- **J 35944-440** Cooler Flush Adapter. See **Special Tools and Equipment** .
- **SA9165T** Oil Line Cooler Flusher

The **SA9165T** should be used when flushing of the transmission oil cooler in the radiator assembly is required. Follow the instructions provided with the tool when performing the flushing procedure.

The**J 35944-440** is used in combination with the**SA9165T** and allows you to attach the cooler flusher and cooler lines together at the same time.

The transaxle oil cooler and lines should be flushed in any of the following situations:

- Transaxle Replacement
- Transaxle Oil Cooler Replacement
- Any internal transmission failure that caused debris to enter the transmission oil cooler and oil cooler lines, such as clutch plate material or metal shavings.

Debris may still be trapped within the bypass valve of the cooler lines after performing the cooler flushing procedure. Therefore, cooler line replacement is recommended during transaxle replacement.

DRIVE AXLE SHAFT SEAL REPLACEMENT (FWD RIGHT)

Tools Required

- **J 43068** Axle Seal Installer
- **J 44015** Steering Linkage Installer
- **J 44017** Stub Shaft Assembly Remover
- **J 45000** Seal Remover
- **SA9133T** Axle Seal Puller
- **SA91100C** Tie Rod Separator
- **SA91112T** Axle Seal Protector

Removal Procedure

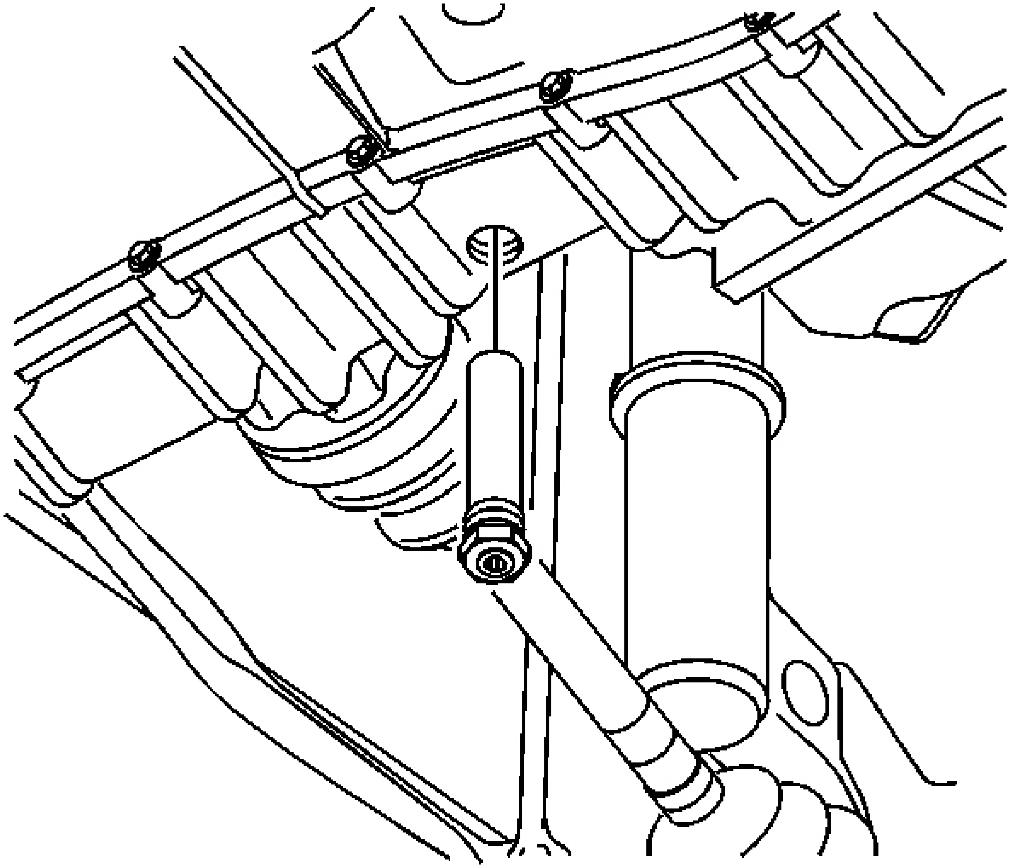


Fig. 128: Lower Tube Assembly & Transmission
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the lower tube assembly and drain the fluid. Allow at least 5 minutes for the fluid to drain completely.
3. Remove the drive axle assembly. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.

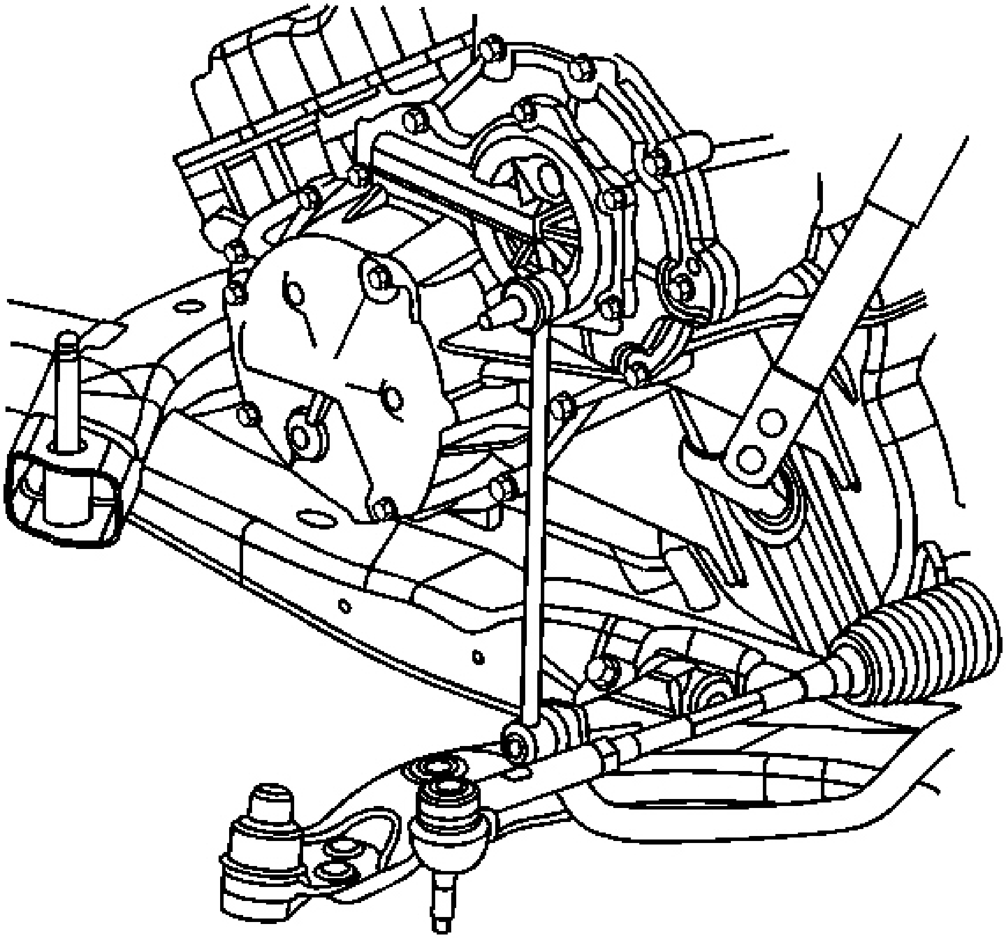


Fig. 129: Axle Seal, Torque Converter & Differential Housing
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 45000** , remove the axle seal from the torque converter and differential housing assembly. Discard the seal.
5. Clean the housing seal bore.

Installation Procedure

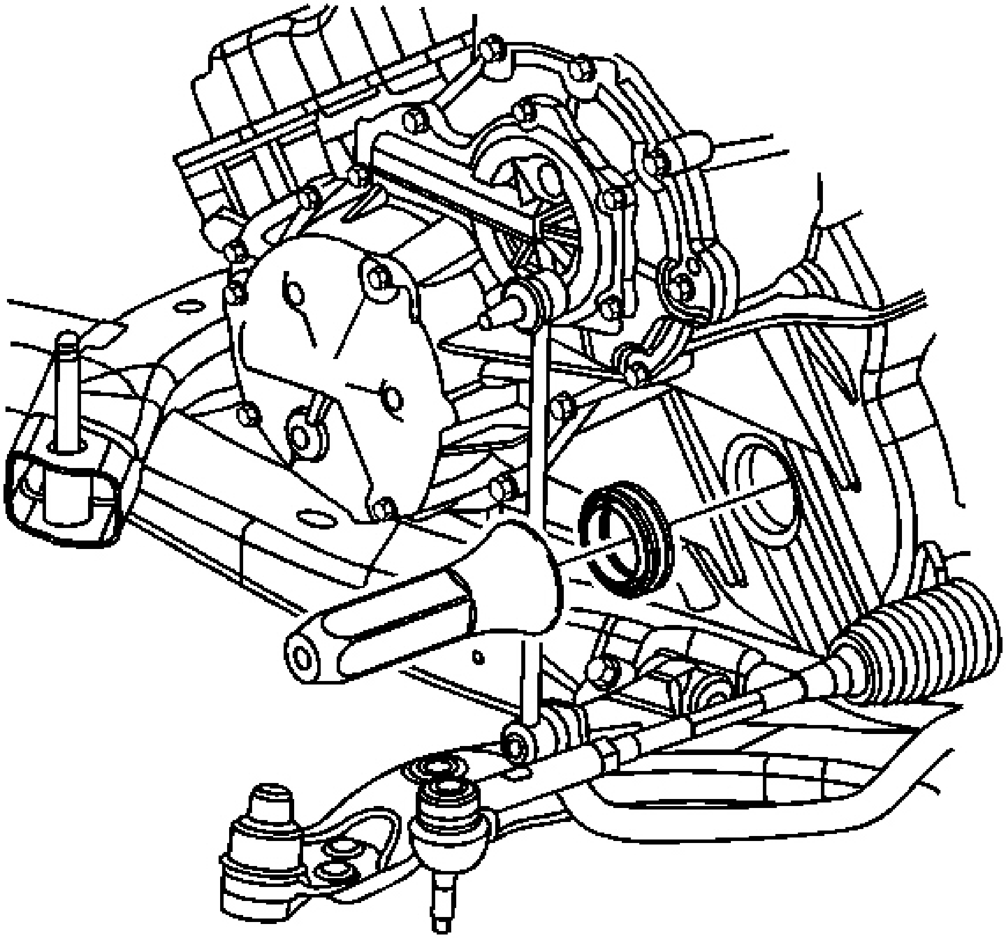


Fig. 130: J 43068, Axle Seal & Drive Axle Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Prior to installing the seal, inspect the J 43068 for nicks and burrs that may damage the seal lip.

1. Using the **J 43068** , install the axle seal. Ensure to keep the seal lined up with the bore during installation.
2. Install the drive axle assembly. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.
3. Lower the vehicle.
4. Using Saturn DEX-CVT(R) fluid P/N 22688912, fill the transmission to the proper level. Refer to **Transmission Fluid Replacement** .

DRIVE AXLE SHAFT SEAL REPLACEMENT (AWD RIGHT)

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

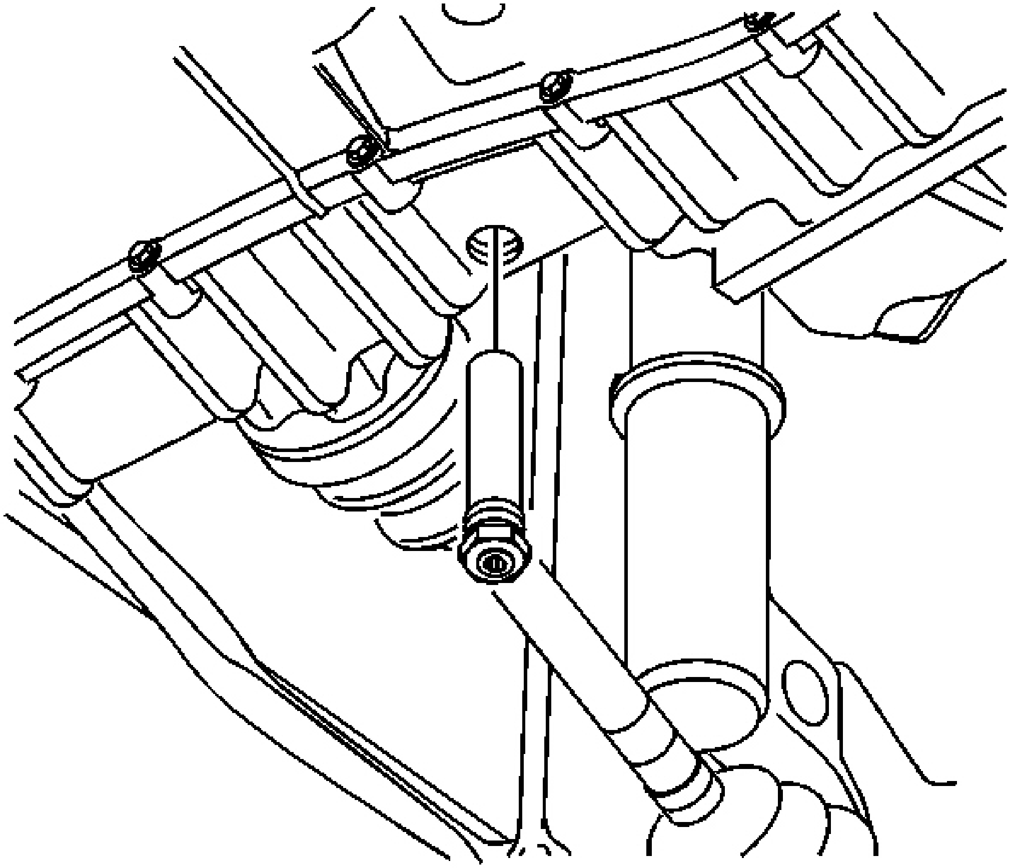


Fig. 131: Lower Tube Assembly & Transmission
Courtesy of GENERAL MOTORS CORP.

2. Remove the lower tube assembly and drain the fluid. Allow at least 5 minutes for the fluid to drain completely.
3. Remove the drive axle assembly. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.

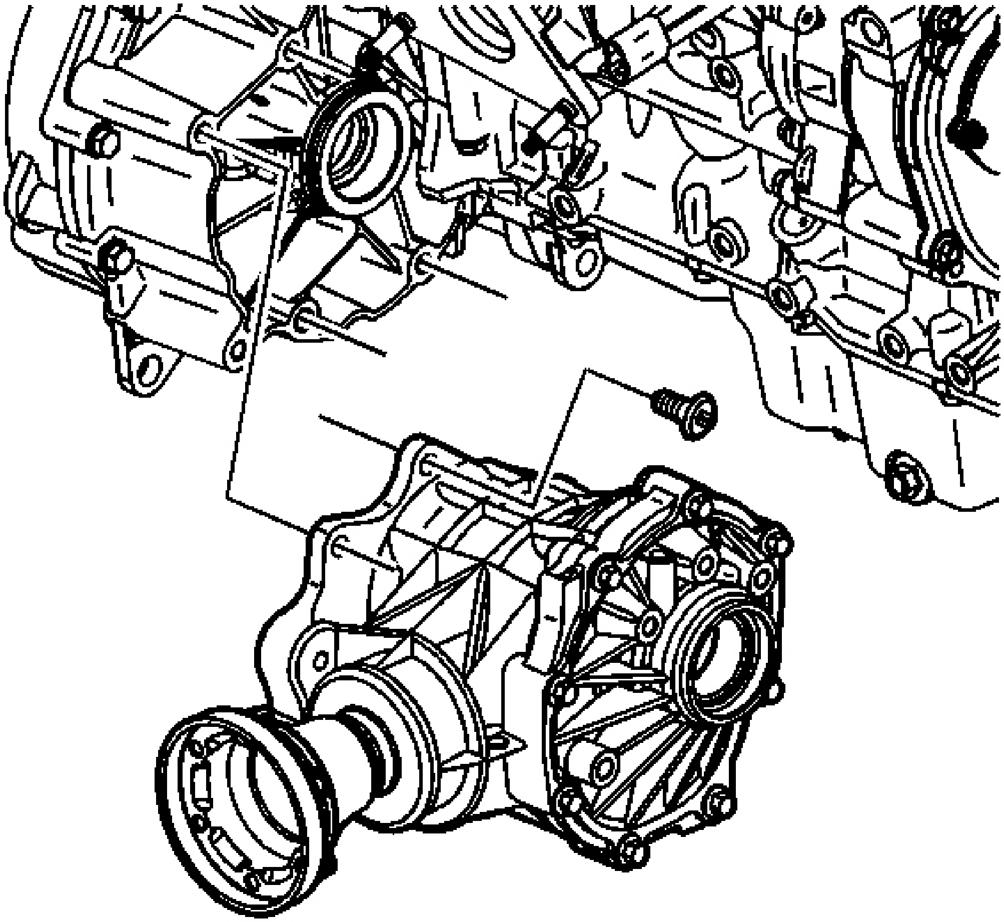


Fig. 132: AWD Right Transfer Case (PTU)
Courtesy of GENERAL MOTORS CORP.

4. Remove the transfer case (PTU). Refer to **Transfer Case Replacement** in Transfer Case - NVG 900.

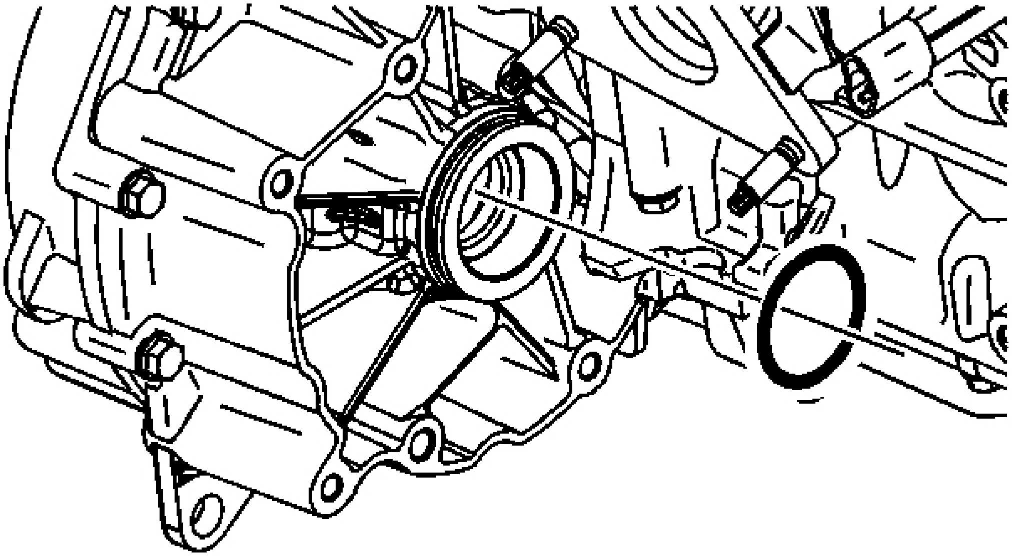


Fig. 133: O-Ring Seal, Torque Converter & Differential Housing (AWD Right)
Courtesy of GENERAL MOTORS CORP.

5. Remove the O-ring seal from the torque converter and differential housing assembly. Discard the seal.

Installation Procedure

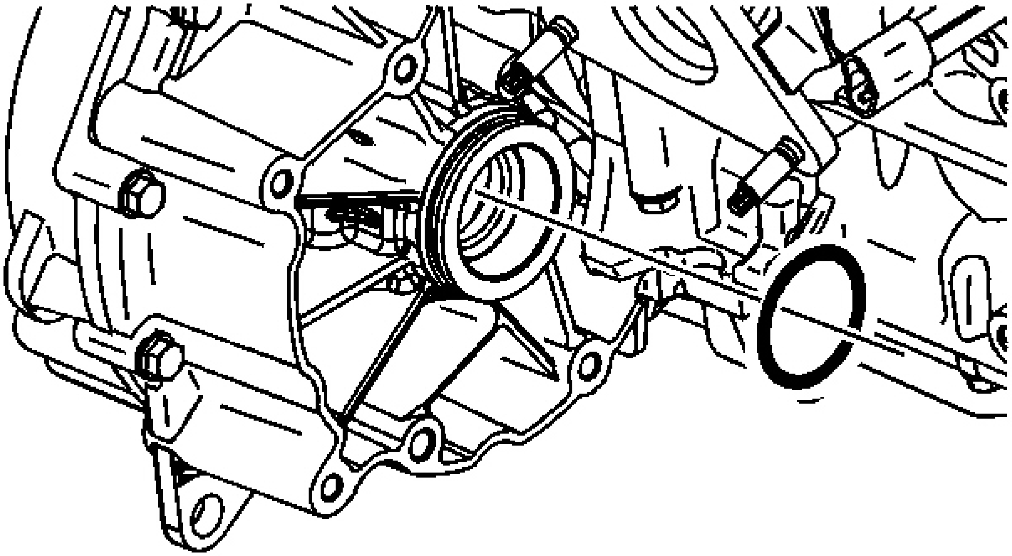


Fig. 134: O-Ring Seal, Torque Converter & Differential Housing (AWD Right)
Courtesy of GENERAL MOTORS CORP.

1. Install a new O-ring seal on the torque converter and differential housing assembly.

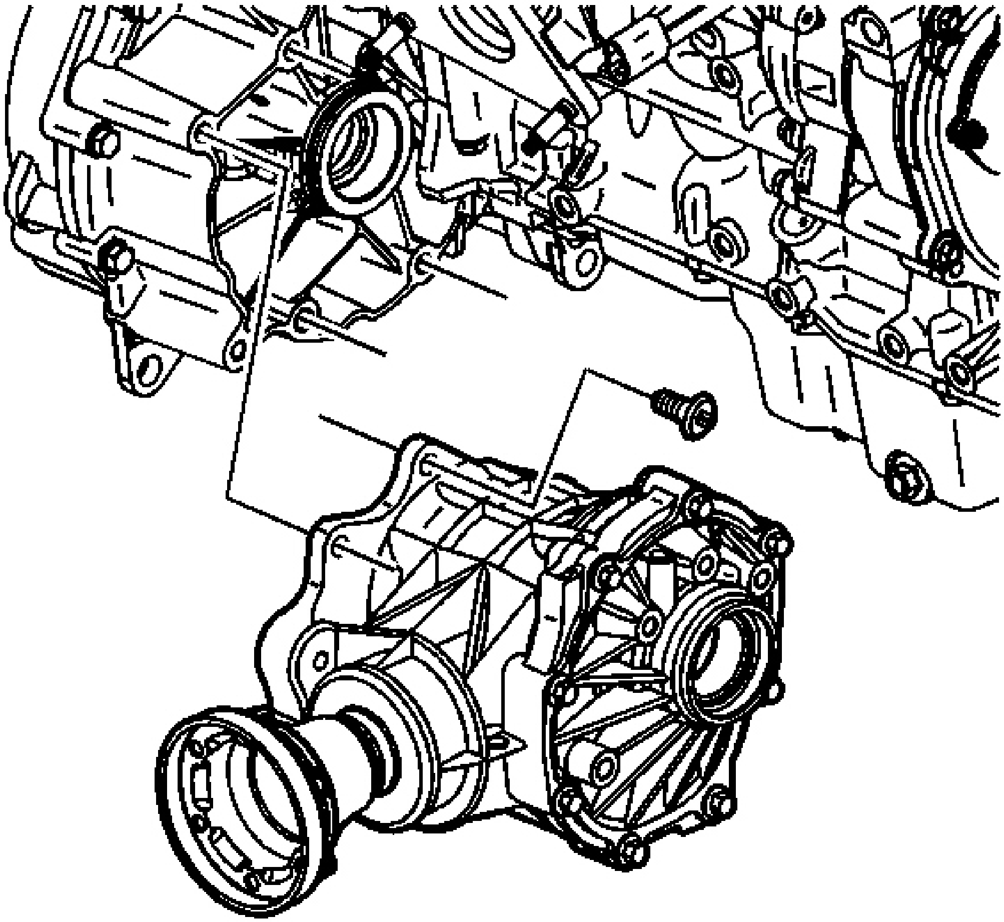


Fig. 135: AWD Right Transfer Case (PTU)
Courtesy of GENERAL MOTORS CORP.

2. Install the transfer case (PTU). Refer to **Transfer Case Replacement** in Transfer Case - NVG 900.
3. Install the drive axle assembly. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.
4. Lower the vehicle.
5. Inspect the alignment and align as necessary. Refer to Alignment, Wheels and Tires in Wheels and Tires.
6. Using Saturn DEX-CVT(R) fluid P/N 22688912, fill the transmission to the proper level. Refer to **Transmission Fluid Replacement** .

TRANSMISSION MOUNT INSPECTION

Inspection Procedure

NOTE: In order to avoid oil pan damage and possible engine failure, insert a block of wood that spans the width of the oil pan bottom between the oil pan and the jack support.

IMPORTANT: Before replacing any transmission mount due to a suspected fluid loss, verify that the source of the fluid is the mount.

1. Raise the transmission/transaxle in order to relieve tension in the mount.
2. Observe the mount while raising the transmission/transaxle. Raising the transmission/transaxle removes the weight from the mount.
3. Replace the mount if it exhibits any of the following conditions:
   - The hard rubber surface is covered with heat check cracks.
   - The rubber is separated from the outer metal sleeve of the mount.
   - The rubber is split through the center of the transmission mount.
   - The mount is leaking fluid.
4. When replacing the transmission mounts or brackets, refer to the following procedures:
   - **Transmission Mount Replacement - Front**
   - **Transmission Mount Replacement - Rear**
   - **Transmission Mount Bracket Replacement - Rear**
   - **Transmission Mount Replacement - Side**

TRANSMISSION MOUNT REPLACEMENT - FRONT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

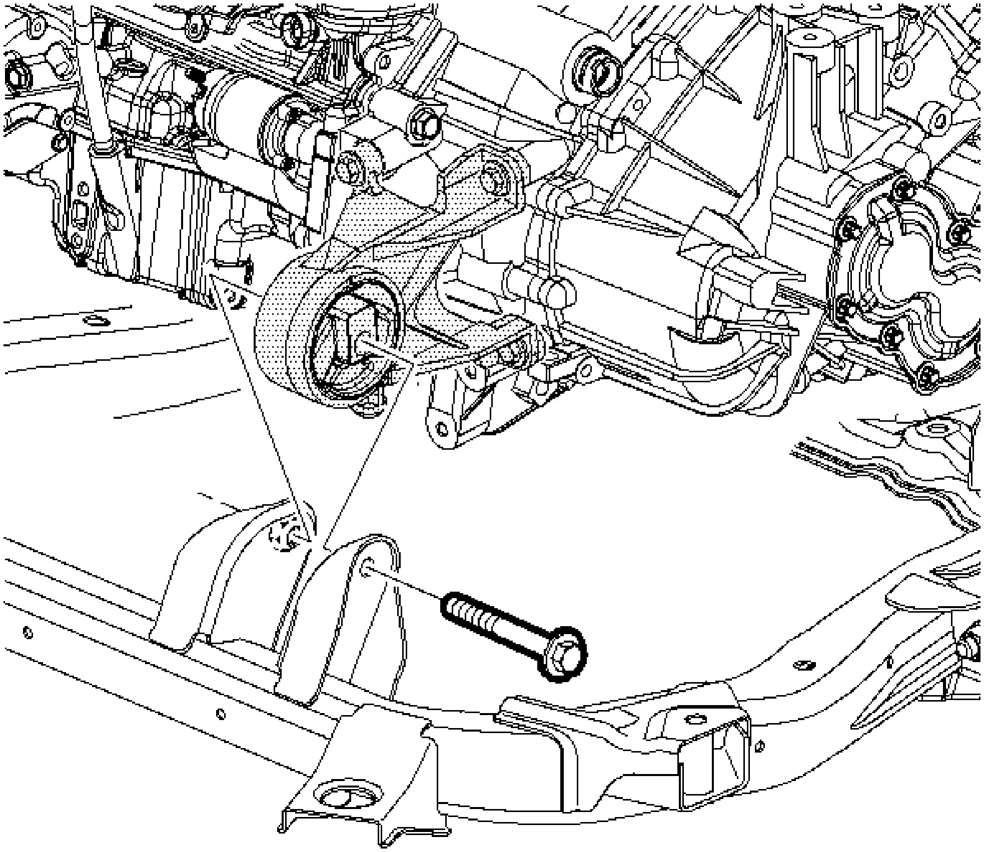


Fig. 136: Front Transmission Mount & Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the transmission mount through bolt.

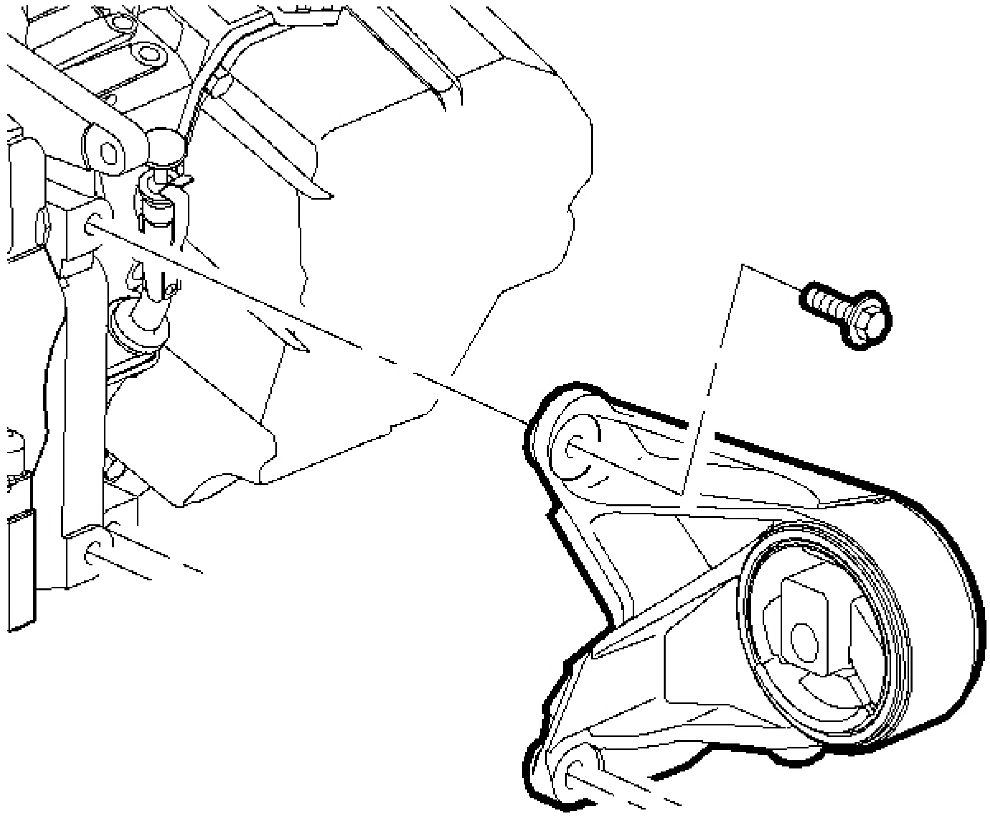


Fig. 137: Transmission Mount & Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the transmission mount to transmission bolts.
4. Remove the transmission mount.

Installation Procedure

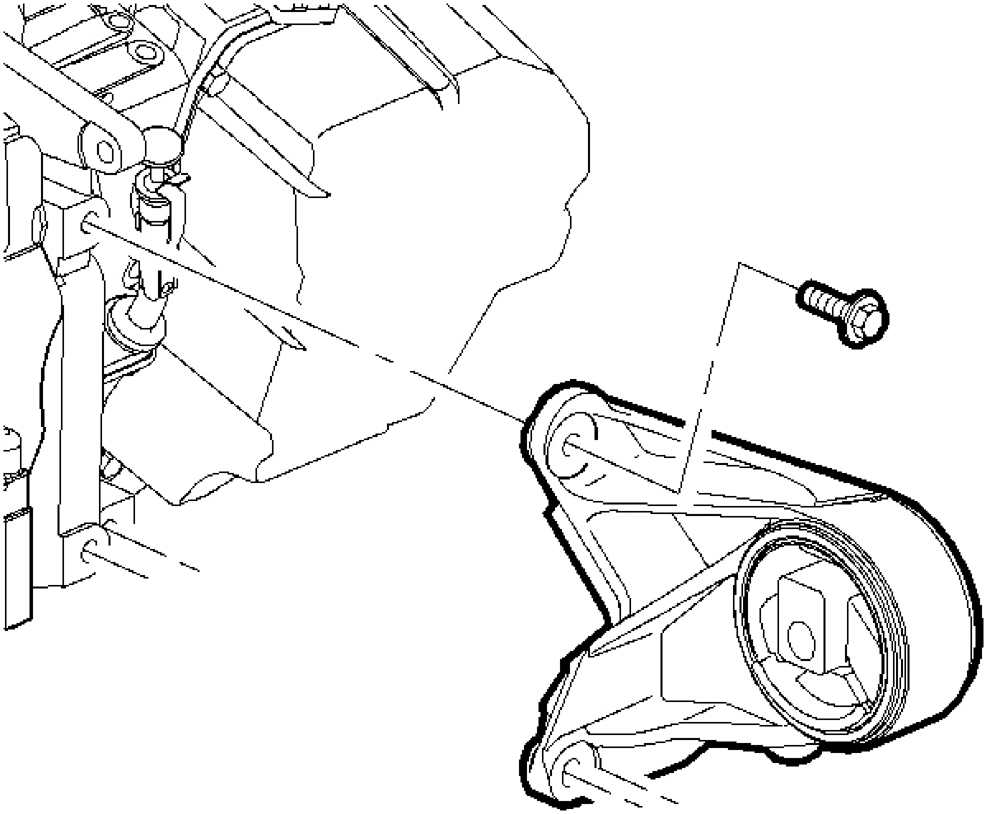


Fig. 138: Transmission Mount & Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the mount to the transmission.

   Tighten: Tighten the transmission mount to transmission bolts to 50 N.m (37 lb ft).

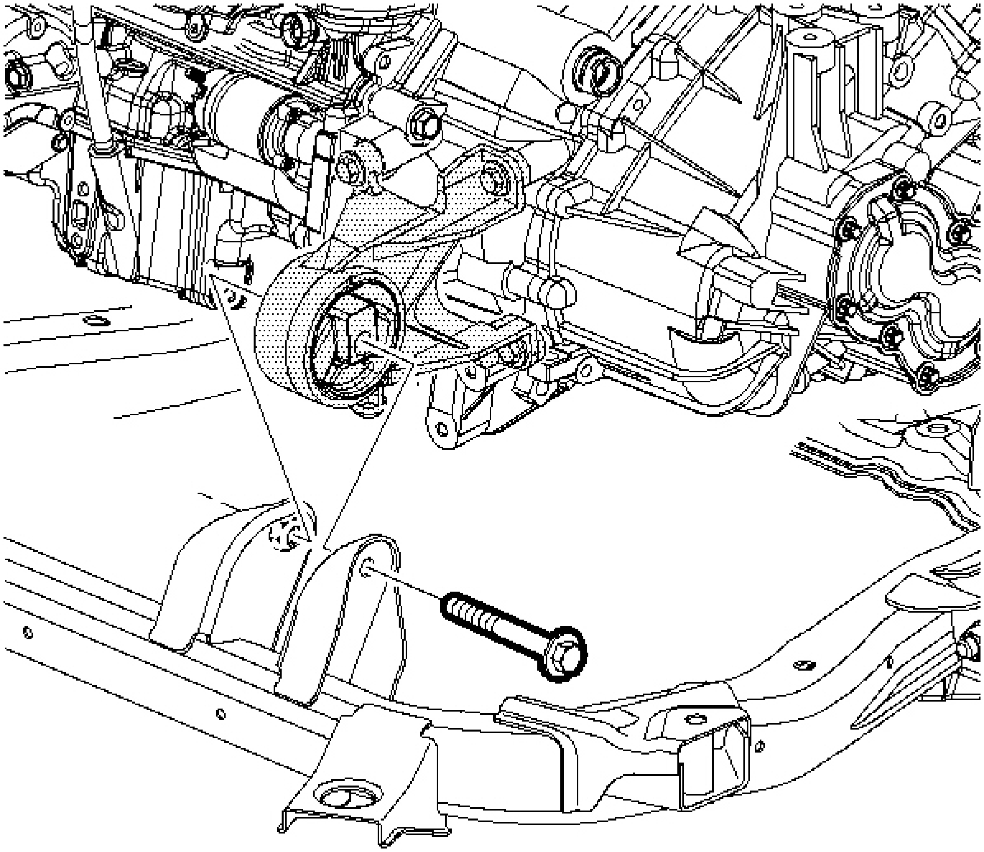


Fig. 139: Front Transmission Mount & Bolt
Courtesy of GENERAL MOTORS CORP.

2. Install the transmission mount through bolt.

   Tighten: Tighten the bolt to 110 N.m (81 lb ft).

3. Lower the vehicle.
4. Perform the powertrain mount balance procedure. Refer to **Powertrain Mount Balance Procedure - Lower Mount** in Engine Mechanical 2.2L (L61).

TRANSMISSION MOUNT REPLACEMENT - REAR

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

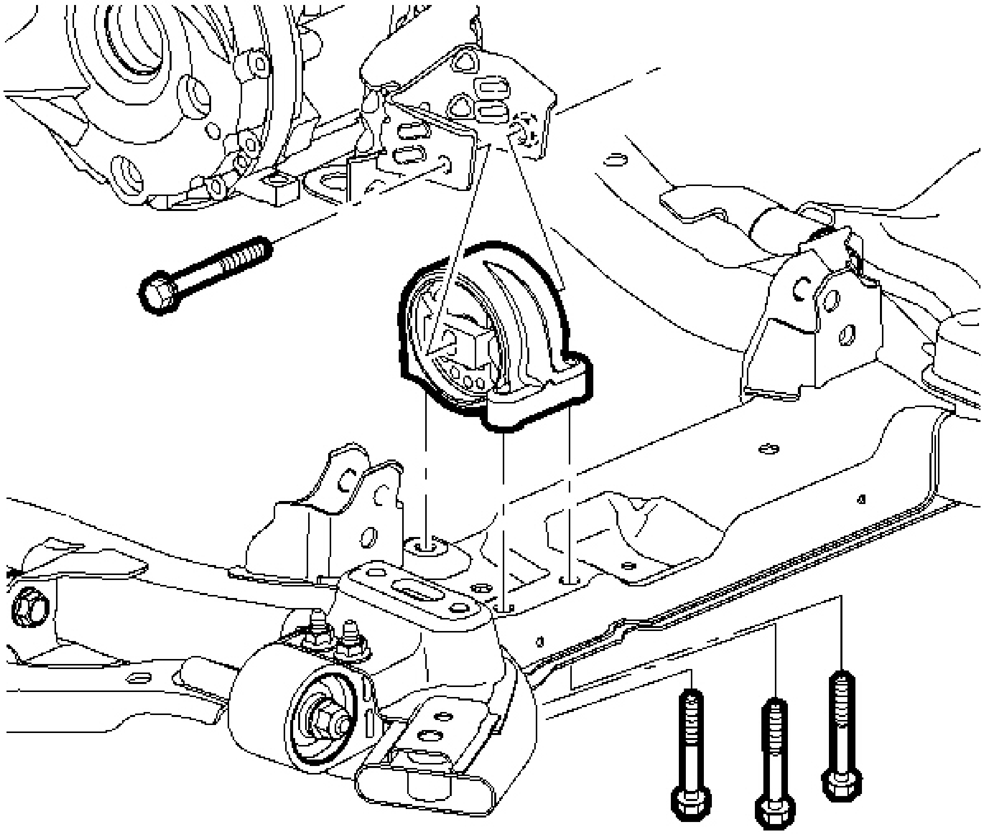


Fig. 140: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

2. Remove the transmission mount through bolt.
3. Remove the frame to transmission mount bolts.
4. Remove the transmission mount.

Installation Procedure

NOTE: Refer to Fastener Notice in Cautions and Notices.

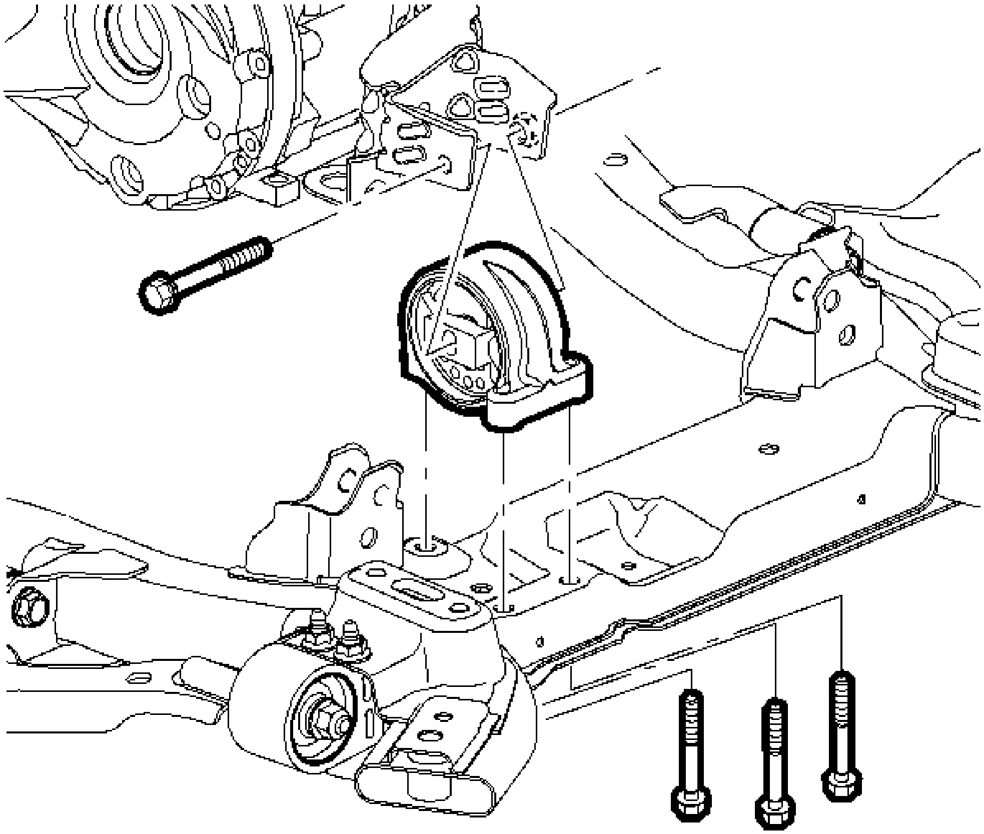


Fig. 141: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

1. Install the mount to the frame.

   Tighten: Tighten the frame to transmission mount bolts to 50 N.m (37 lb ft).

2. Install the transmission mount through bolt.

   Tighten: Tighten the bolt to 110 N.m (81 lb ft).

3. Lower the vehicle.
4. Perform the powertrain mount balance procedure. Refer to **Powertrain Mount Balance Procedure - Lower Mount** in Engine Mechanical 2.2L (L61).

TRANSMISSION MOUNT BRACKET REPLACEMENT - REAR

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

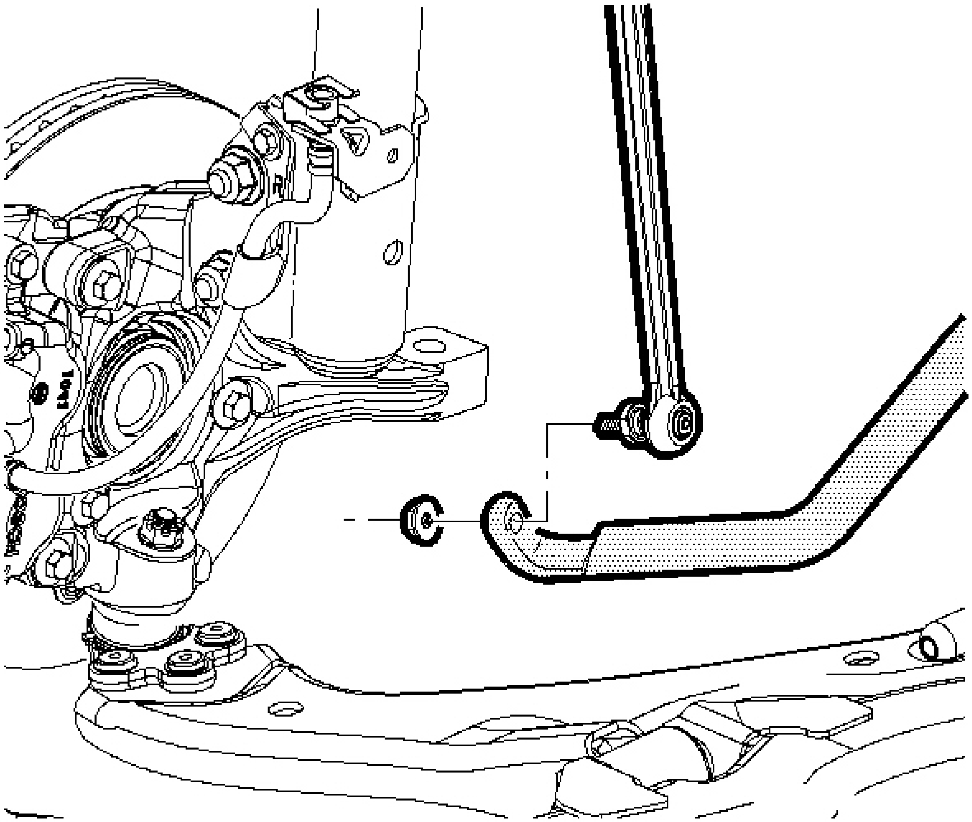


Fig. 142: Locating Rod & Bar
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the stabilizer link from the stabilizer shaft.

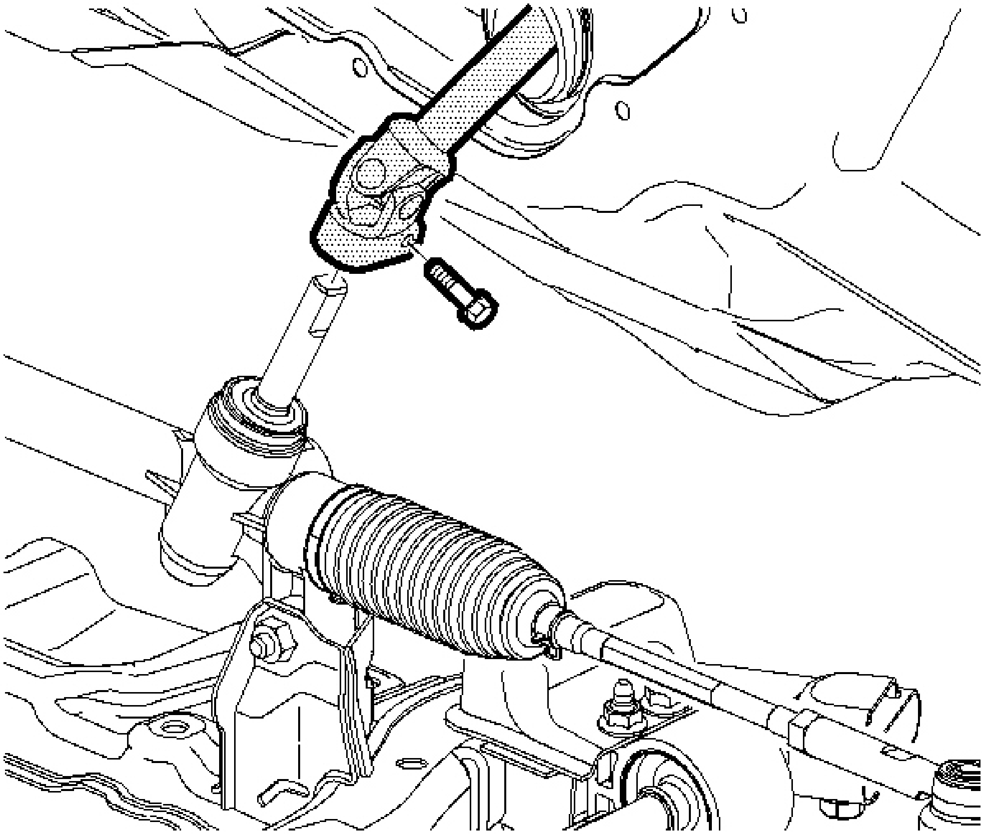


Fig. 143: Rear Intermediate Steering Shaft & Steering Gear
Courtesy of GENERAL MOTORS CORP.

3. Remove the lower intermediate steering shaft pinch bolt. Discard the bolt.
4. Disconnect the intermediate steering shaft from the steering gear.

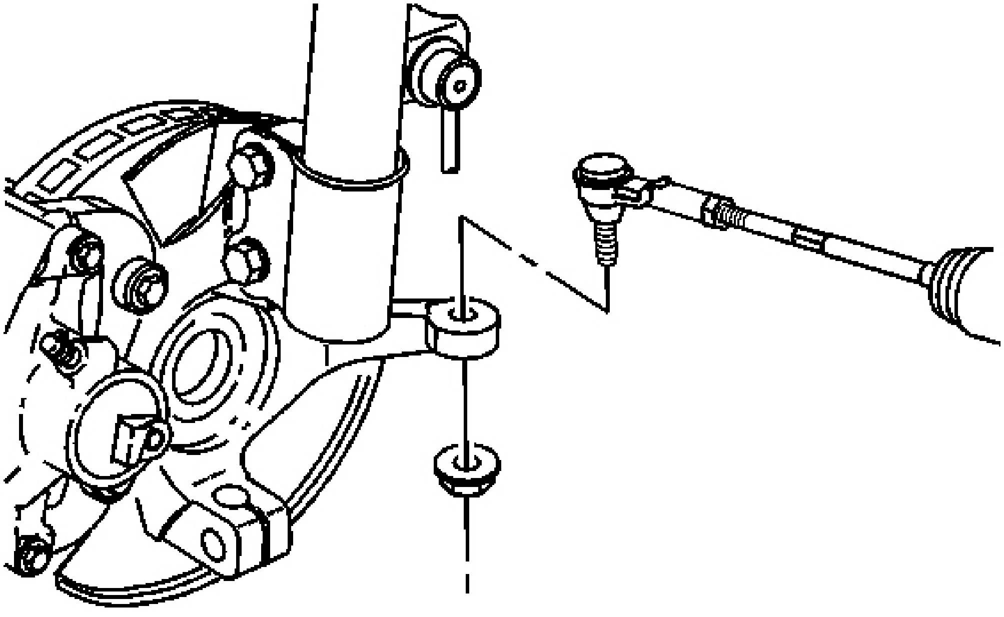


Fig. 144: Tie Rod To Knuckle View
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the left outer tie rod from the steering knuckle. Refer to **Rack and Pinion Outer Tie Rod End Replacement** in Power Steering System.

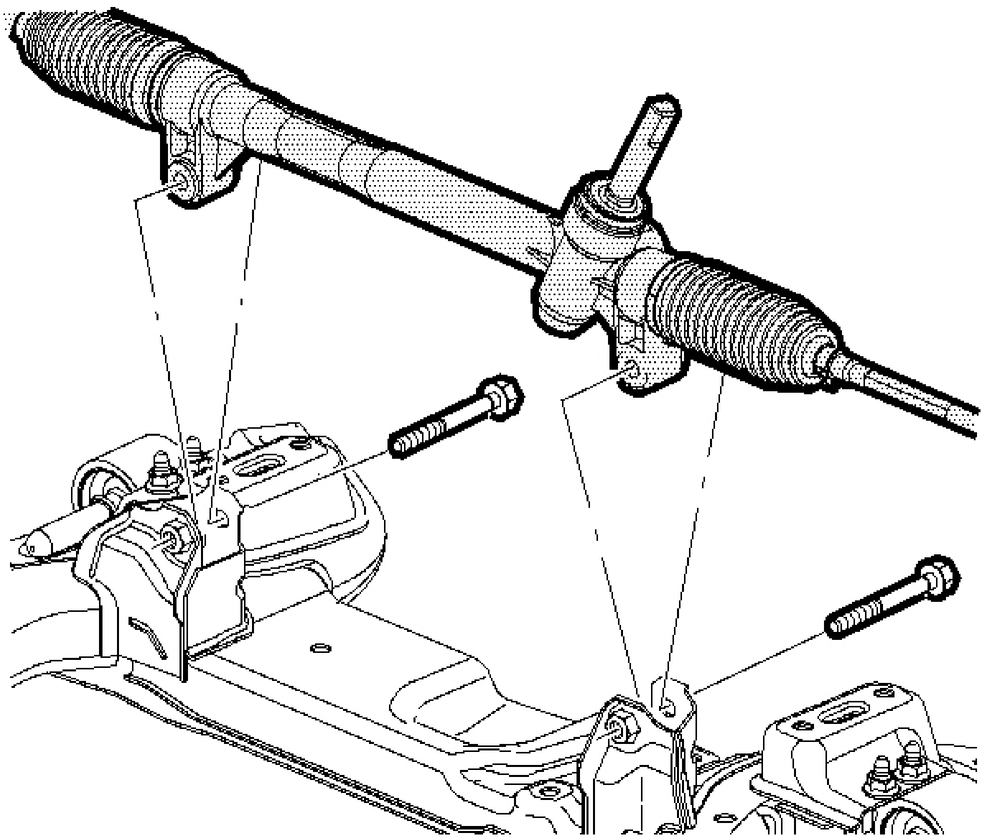


Fig. 145: Rear Steering Gear & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the Steering Gear mounting bolts.
7. Secure the steering gear upward for clearance.

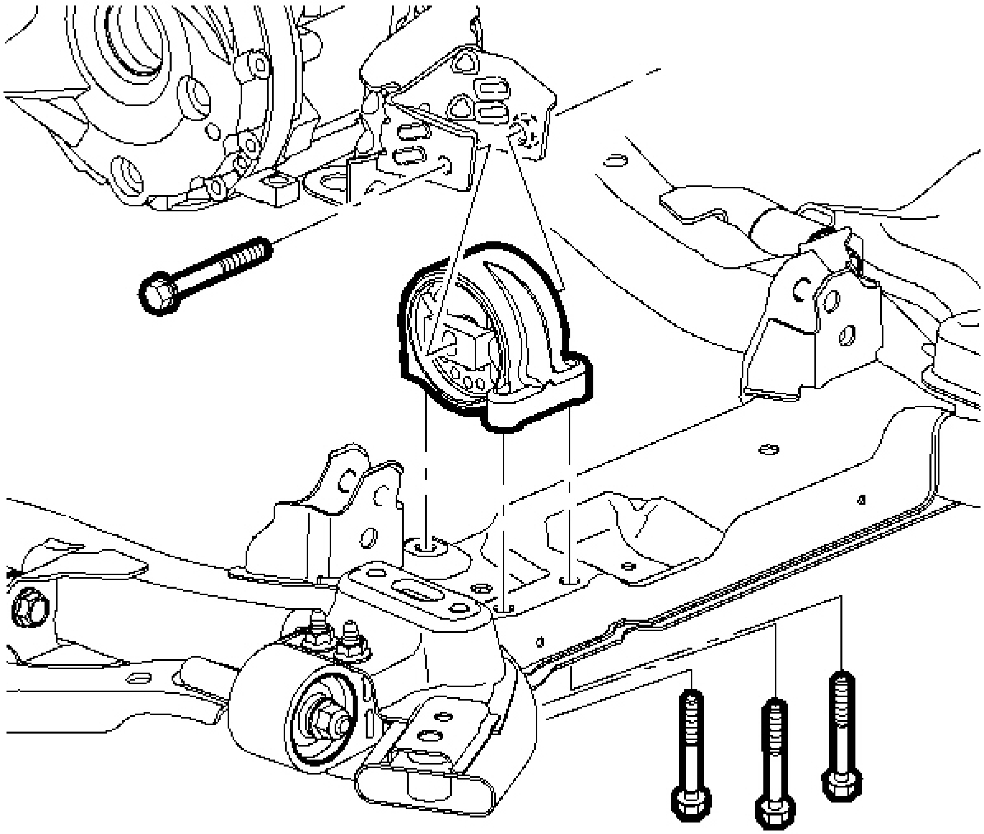


Fig. 146: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

8. Remove the rear transmission mount. Refer to **Transmission Mount Replacement - Rear** .

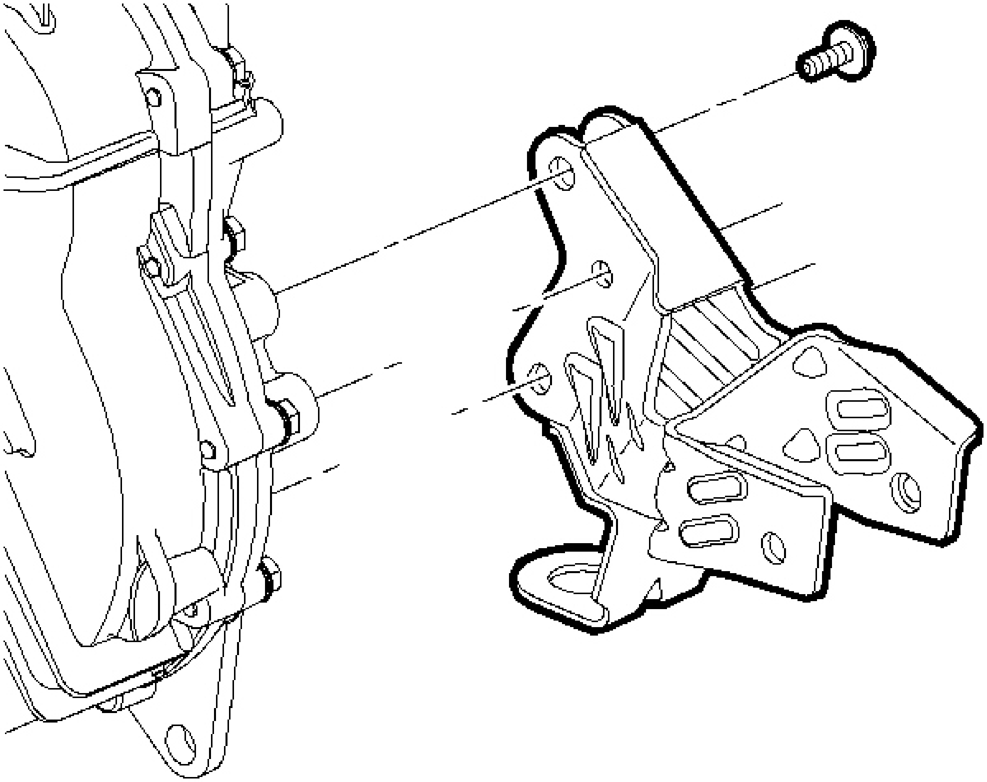


Fig. 147: Rear Transmission Mount Bracket & Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

9. If equipped with FWD, remove the rear transmission mount bracket to transmission bolts.

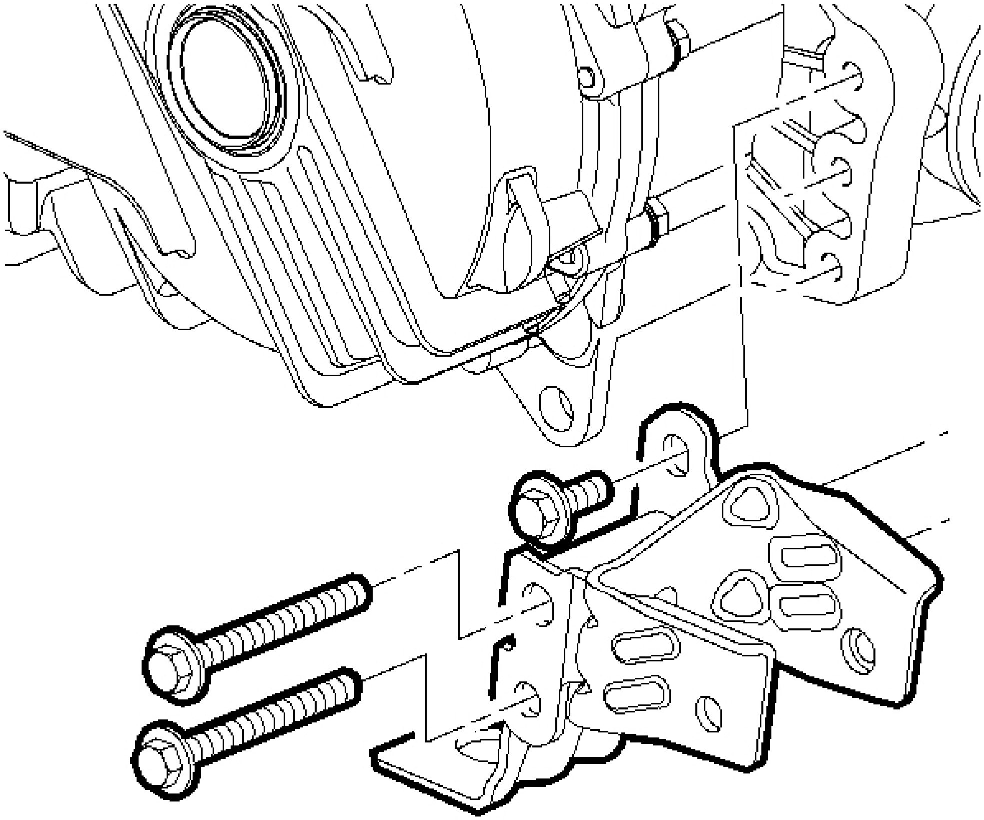


Fig. 148: Rear Transmission Mount Bracket, Power Takeoff & Bolts
Courtesy of GENERAL MOTORS CORP.

10. If equipped with AWD, remove the rear transmission bracket to power takeoff. bolts.
11. Remove the rear transmission mount bracket.

Installation Procedure

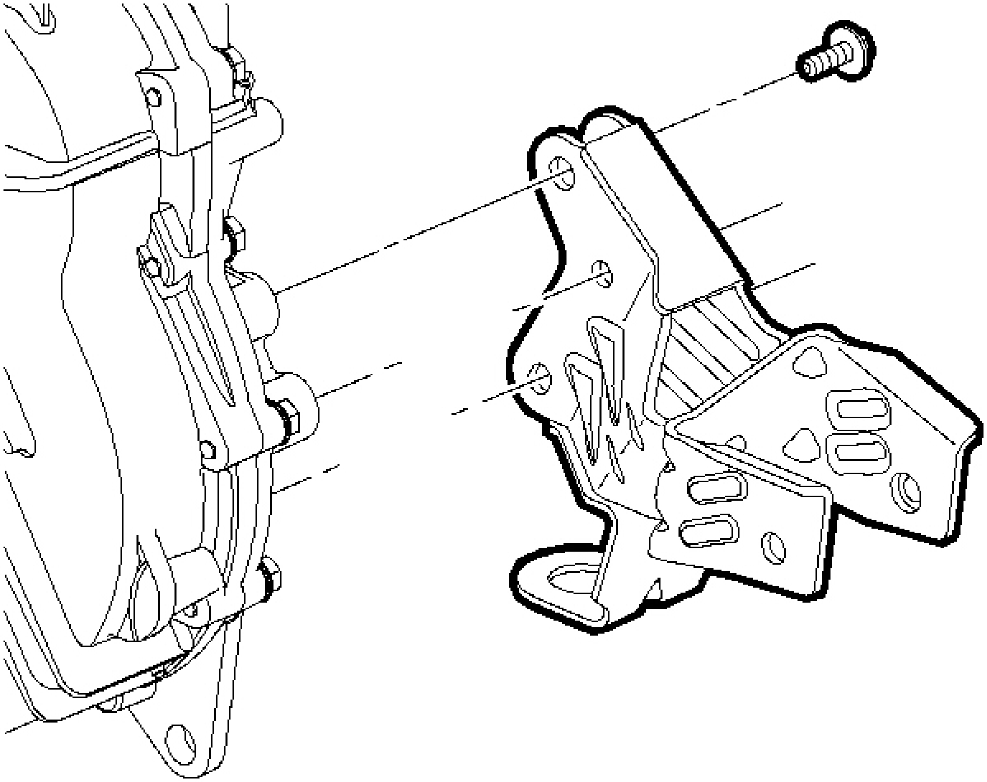


Fig. 149: Rear Transmission Mount Bracket & Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. If equipped with FWD, install the transmission mount bracket to the transmission.

   Tighten: Tighten the bracket to transmission bolts to 55 N.m (41 lb ft).

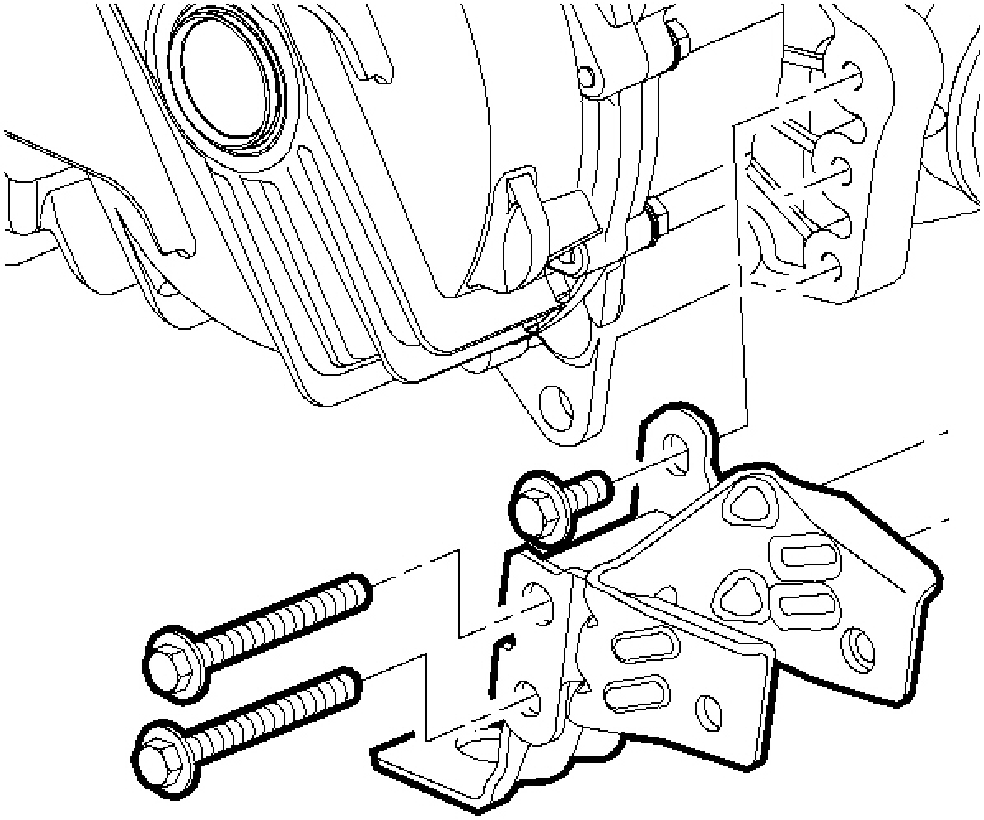


Fig. 150: Rear Transmission Mount Bracket, Power Takeoff & Bolts
Courtesy of GENERAL MOTORS CORP.

2. If equipped with AWD, install the transmission mount bracket to the power takeoff.

   Tighten: Tighten the bracket to power takeoff bolts to 110 N.m (81 lb ft).

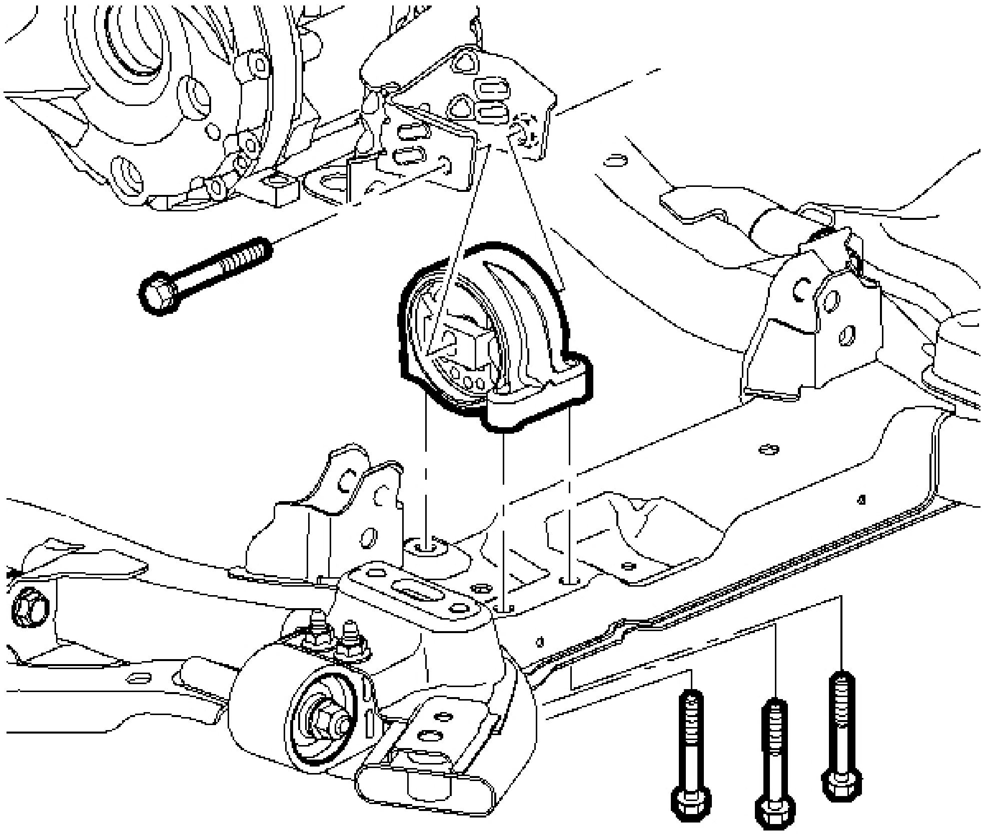


Fig. 151: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

3. Install the rear transmission mount. Refer to **Transmission Mount Replacement - Rear** .

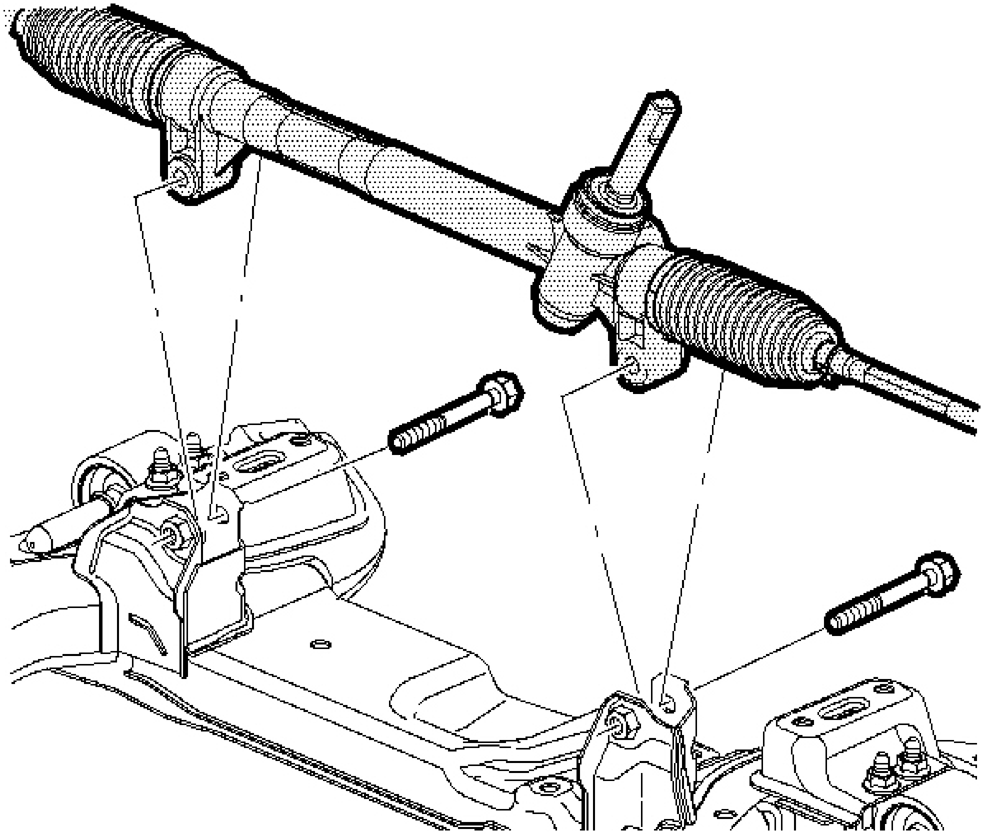


Fig. 152: Rear Steering Gear & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

4. Lower the steering gear in to the steering gear mounts.
5. Hand start both steering gear to frame bolts.
6. Tighten the steering gear to frame bolts.

Tighten: Tighten the bolts to 110 N.m (81 lb ft).

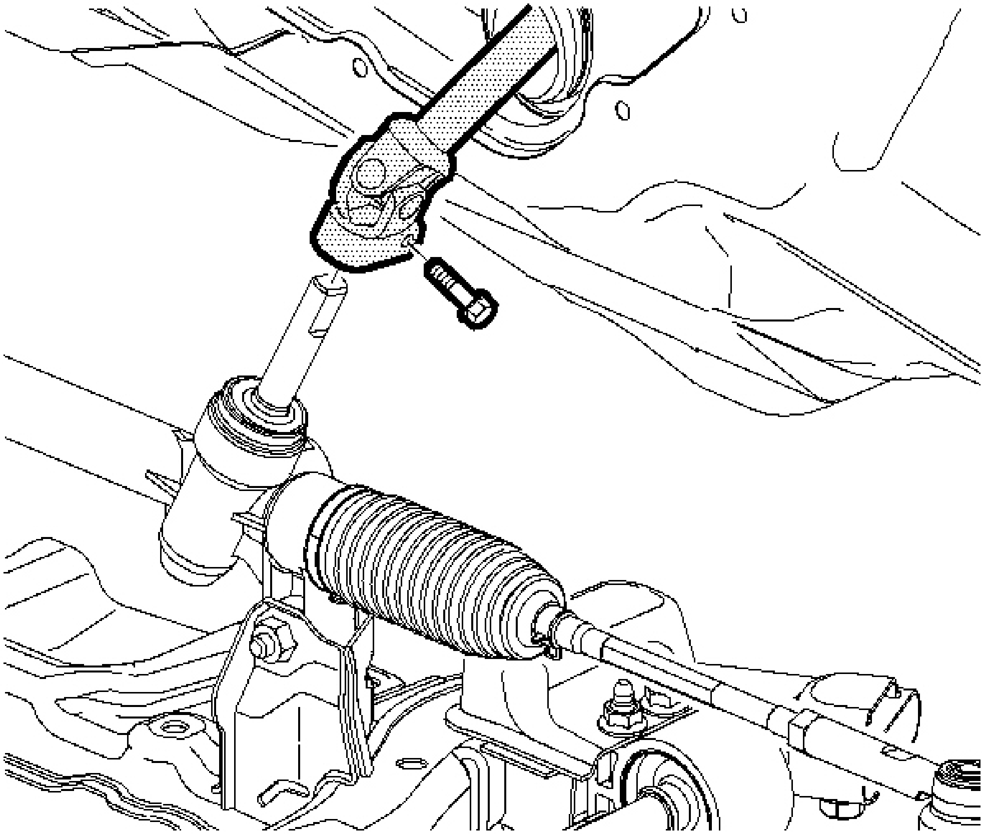


Fig. 153: Rear Intermediate Steering Shaft & Steering Gear
Courtesy of GENERAL MOTORS CORP.

7. Install the intermediate steering shaft to the steering gear.
8. Install a new intermediate steering shaft pinch bolt.

   Tighten: Tighten the bolt to 34 N.m (25 lb ft).

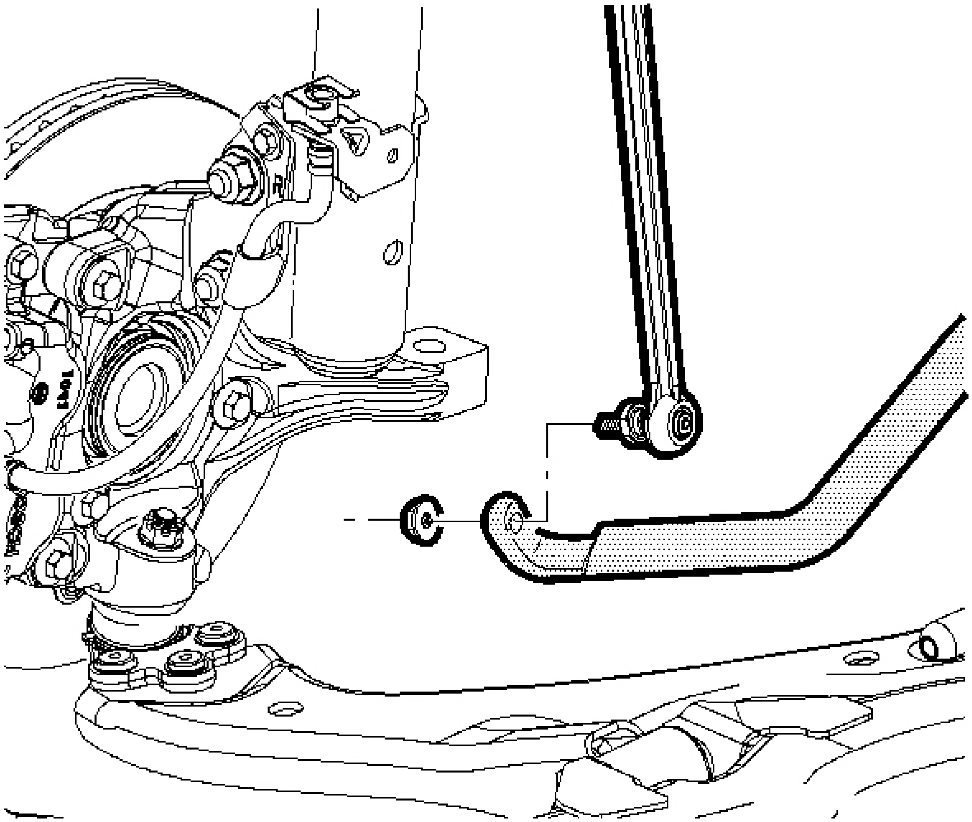


Fig. 154: Locating Rod & Bar
Courtesy of GENERAL MOTORS CORP.

9. Connect the stabilizer link to the Stabilizer shaft.

   Tighten: Tighten the nut to 65 N.m (48 lb ft).

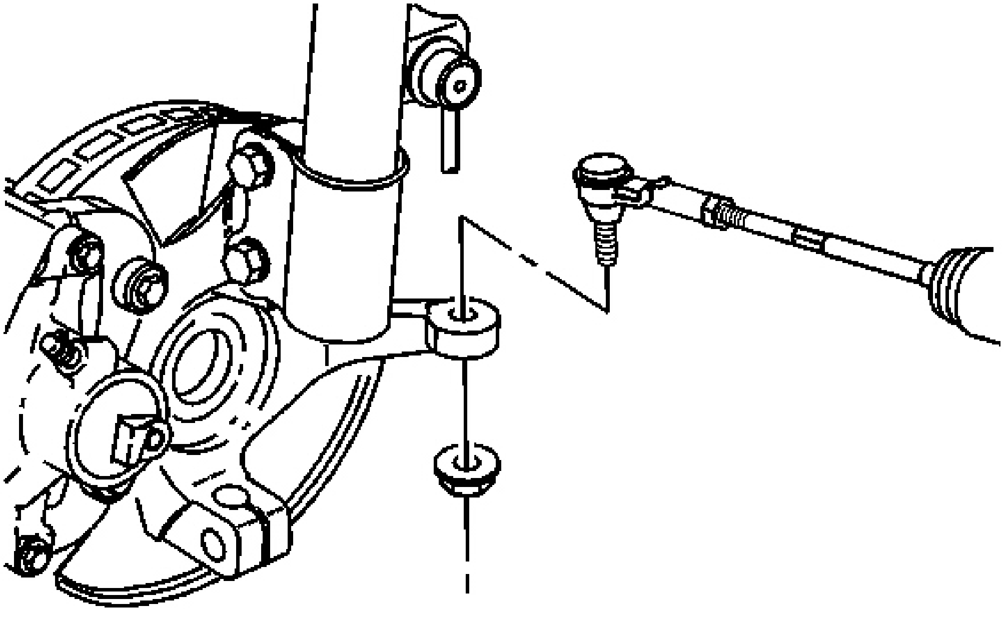


Fig. 155: Tie Rod To Knuckle View
Courtesy of GENERAL MOTORS CORP.

10. Install the left outer tie rod to the steering knuckle. Refer to **Rack and Pinion Outer Tie Rod End Replacement** in Power Steering System.
11. Lower the vehicle.

TRANSMISSION MOUNT REPLACEMENT - SIDE

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

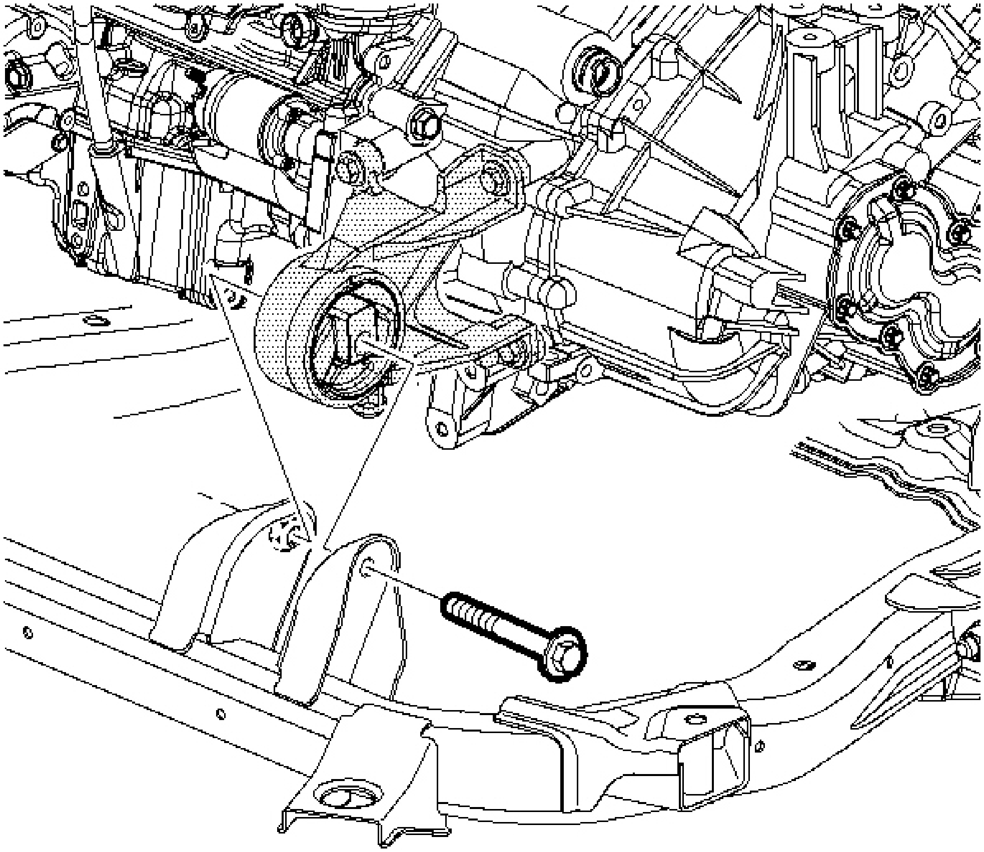


Fig. 156: Front Transmission Mount & Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the front transmission mount through bolt.

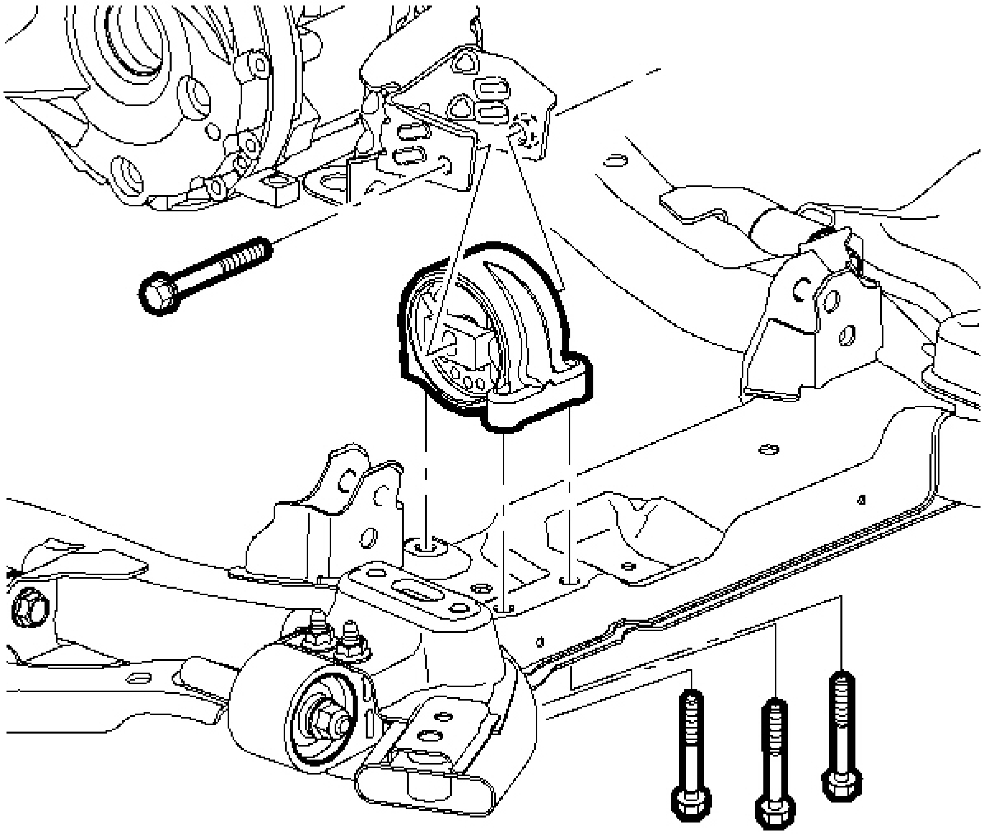


Fig. 157: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

3. Remove the rear transmission mount through bolt.
4. Lower the vehicle.
5. Remove the battery tray. Refer to **Exhaust Manifold Pipe Replacement (L66)** or **Exhaust Manifold Pipe Replacement (L61)** in Engine Electrical.
6. Support the powertrain assembly using a floor jack with a 2x6 in. block of wood.

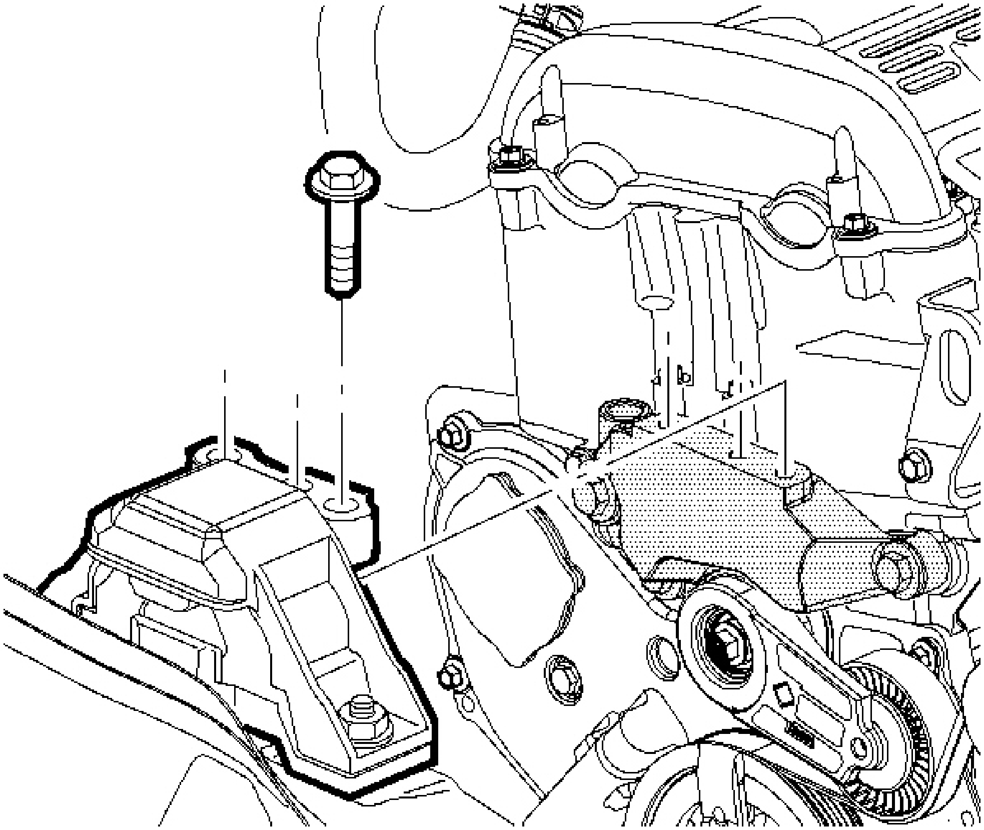


Fig. 158: Engine Mount & Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the right engine mount to mount bracket bolts.

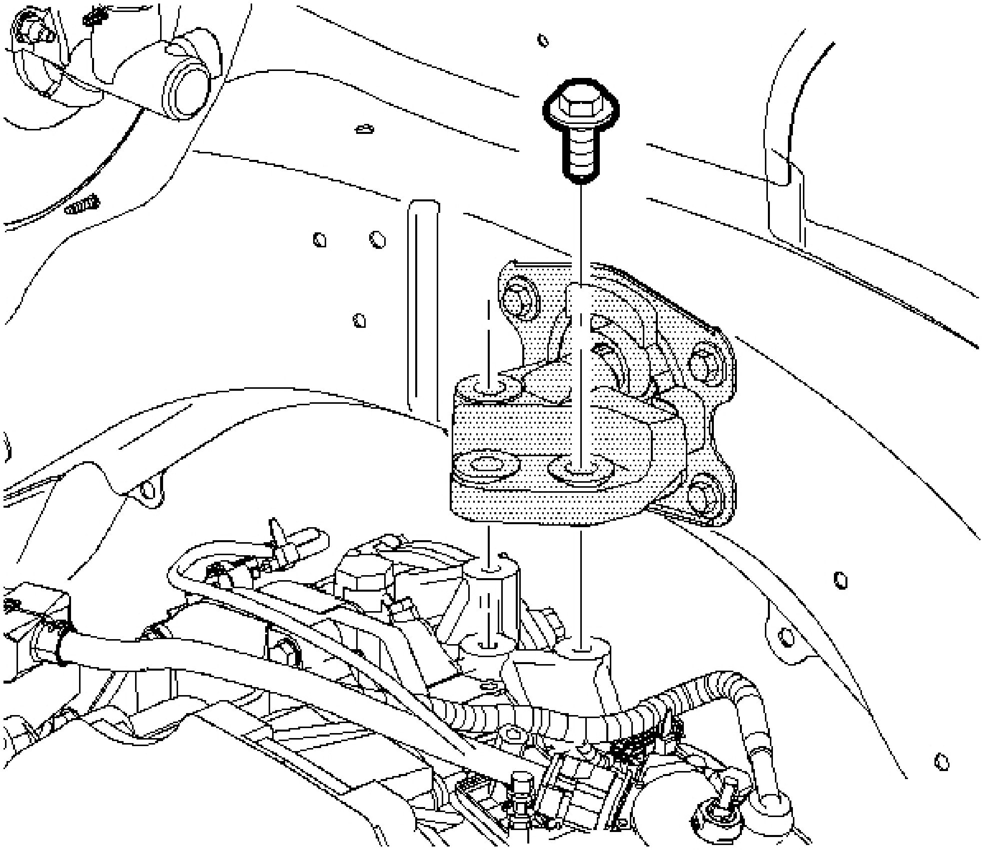


Fig. 159: Transmission Mount & Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the left transmission mount to transmission bolts.
9. Lower the engine in order to gain clearance to for mount removal.

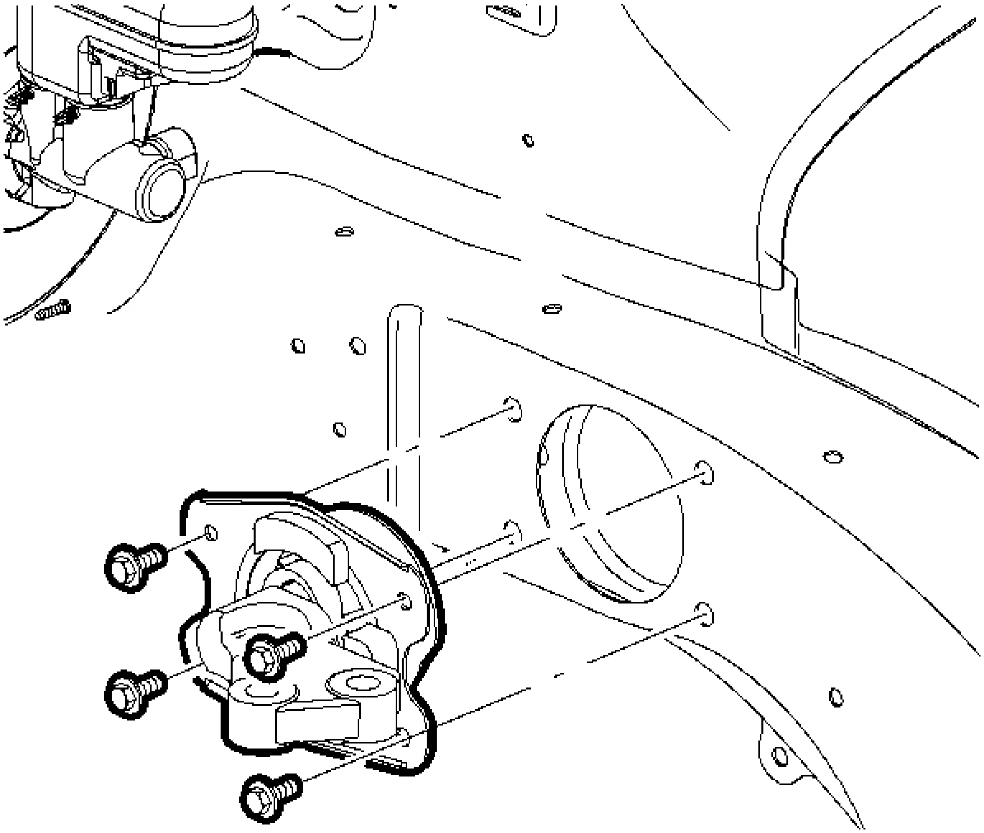


Fig. 160: Transmission Mount & Side Rail Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the left transmission mount to side rail bolts.
11. Remove the transmission mount from the side rail.

Installation Procedure

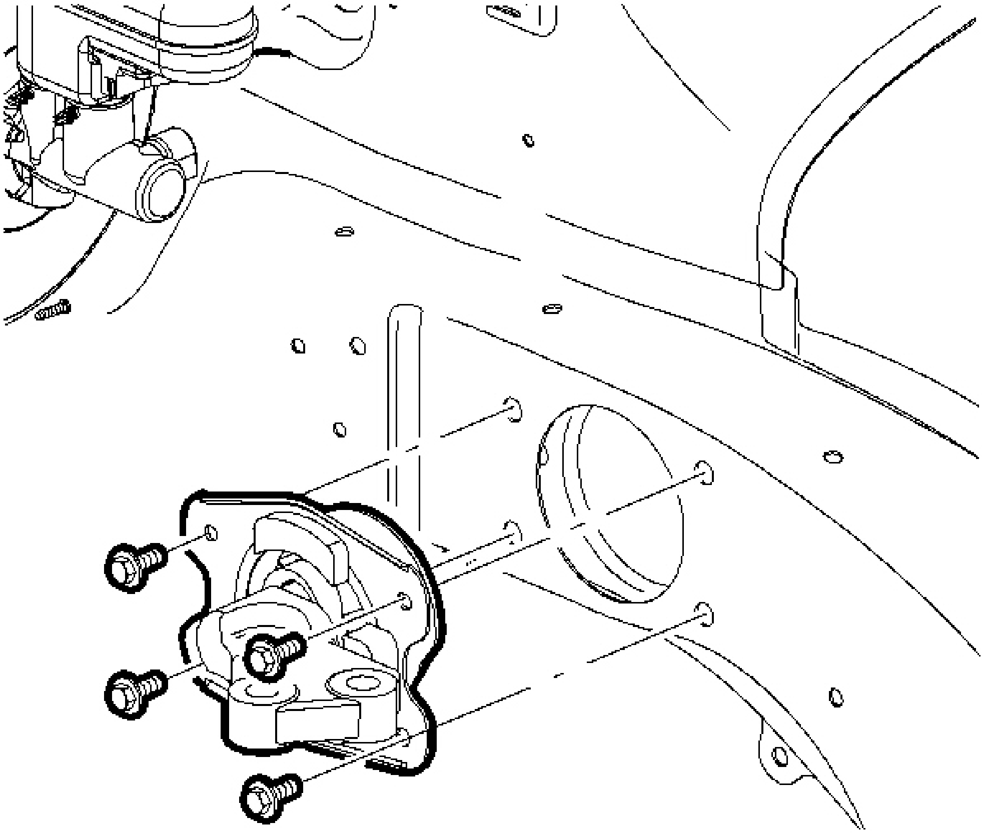


Fig. 161: Transmission Mount & Side Rail Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

IMPORTANT: **Hand start all bolts before tightening.**

1. Install the transmission mount in the side rail.

   Tighten: Tighten the transmission mount to side rail bolts to 37 N.m (27 lb ft).

2. Use the floor jack to raise the powertrain into position.

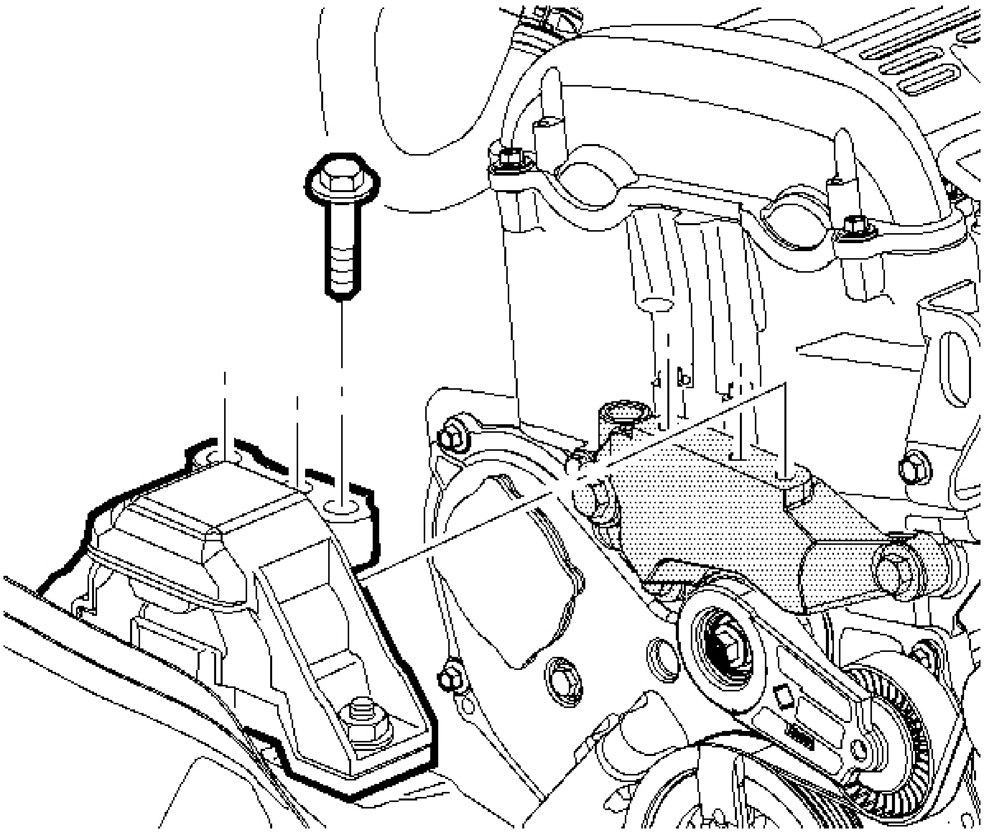


Fig. 162: Engine Mount & Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

3. Align both side mounts with the surfaces flush with the mount brackets.
4. Align all the bolt holes in both side mounts and hand tighten both upper mount bolts. Three per side.

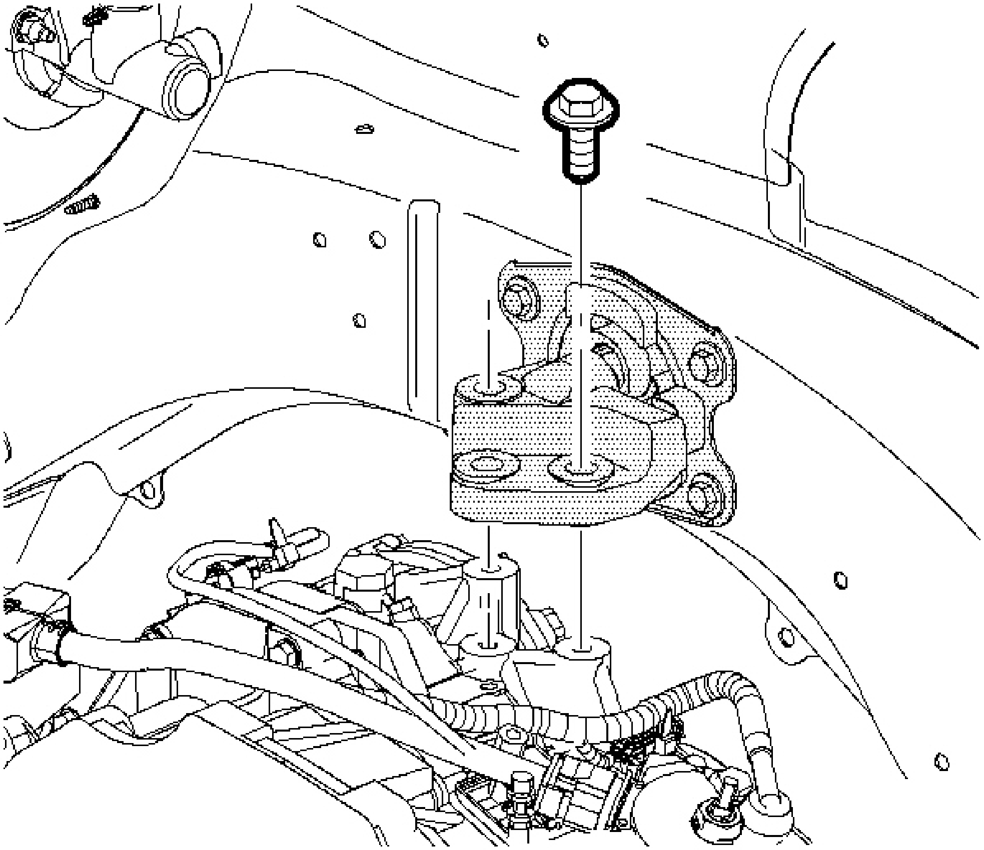


Fig. 163: Transmission Mount & Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

5. Tighten the mount bolts starting with the center ones.

   Tighten: Tighten both upper mount bolts to 50 N.m (37 lb ft).

6. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

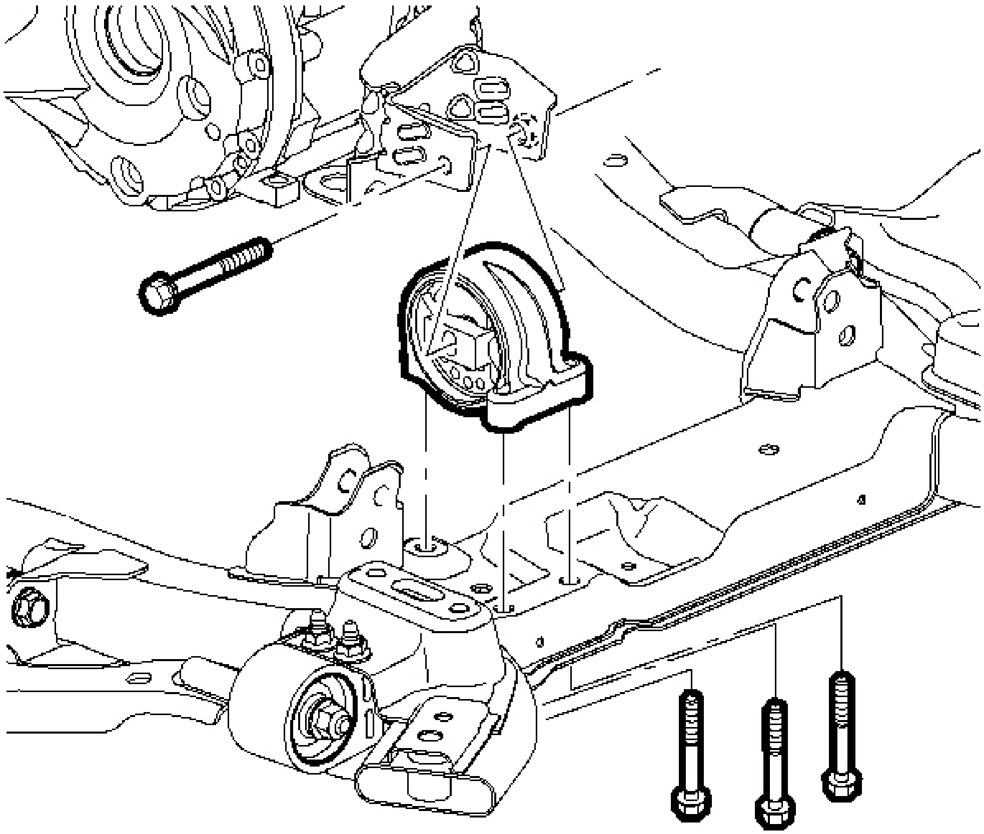


Fig. 164: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

7. Install the rear mount through bolt. Hand tighten only.

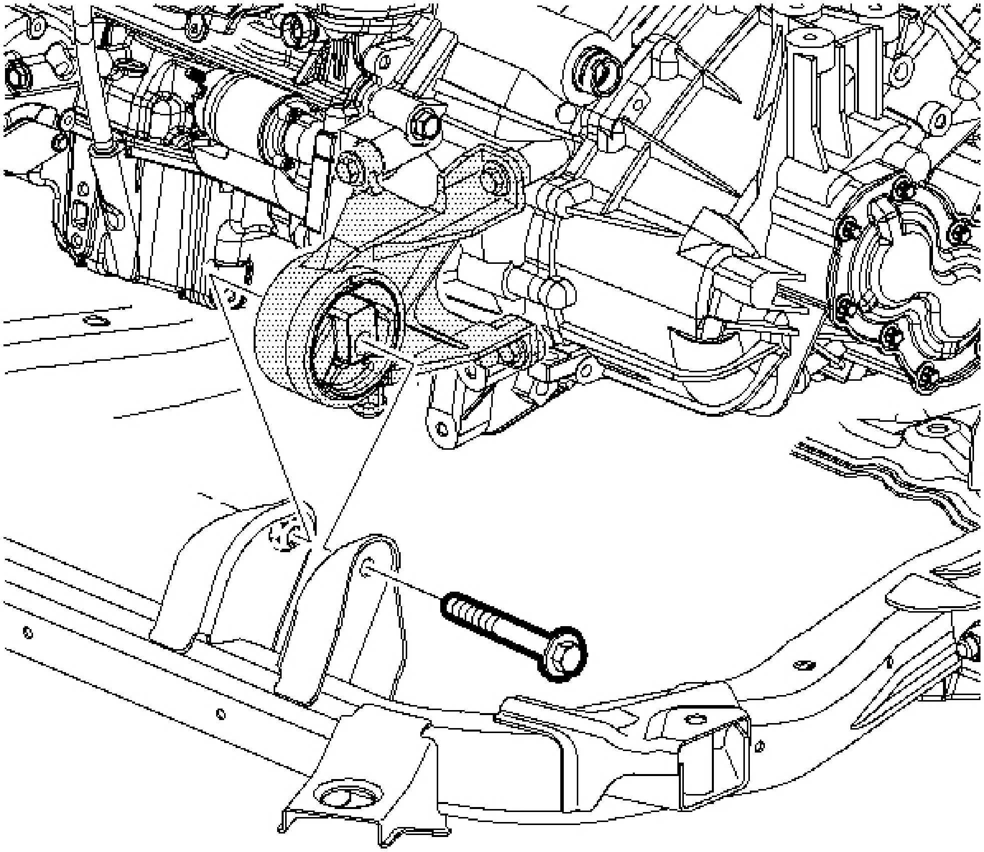


Fig. 165: Front Transmission Mount & Bolt
Courtesy of GENERAL MOTORS CORP.

8. Install the front mount through bolt. Hand tighten only.
9. Perform the powertrain mount balance procedure. Refer to **Powertrain Mount Balance Procedure - Total Mount** in Engine Mechanical - 2.2L (L61).
10. Remove the floor jack and block of wood.
11. Install the battery tray. Refer to **Exhaust Manifold Pipe Replacement (L66)** or **Exhaust Manifold Pipe Replacement (L61)** in Engine Electrical.

TRANSMISSION REPLACEMENT

Tools Required

- **J 44015** Steering Linkage Installer
- **SA91112T** Axle Seal Protector

Removal Procedure

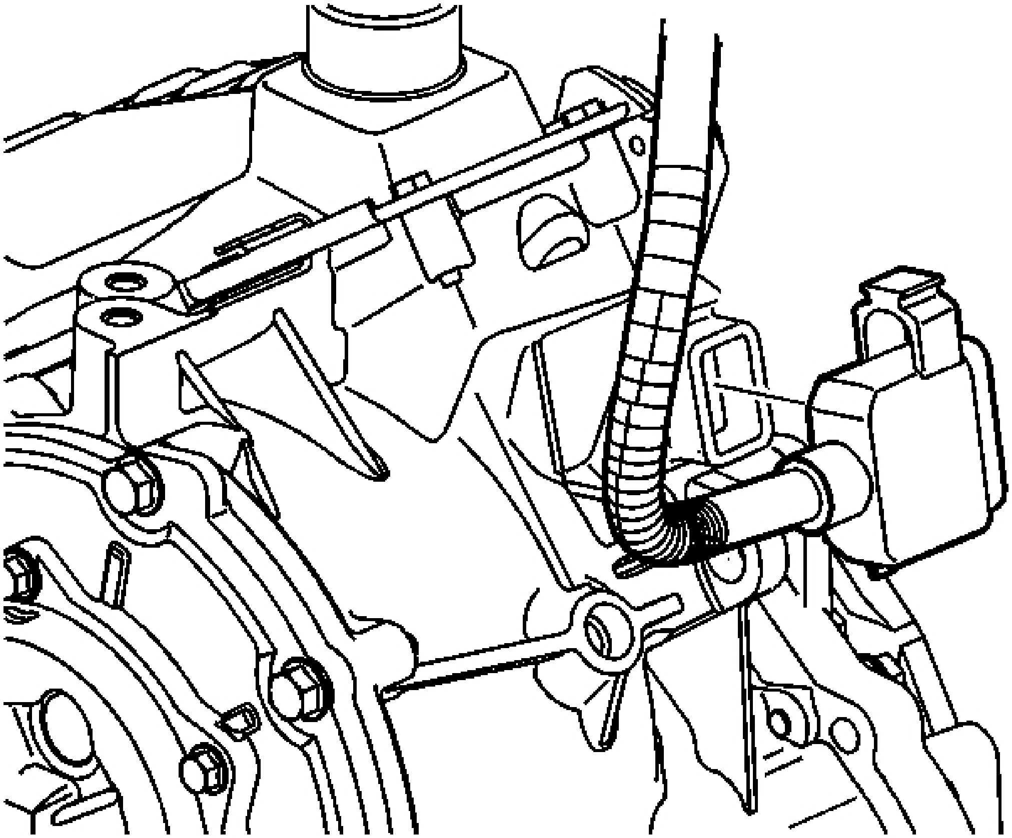


Fig. 166: Transmission Range Switch Harness & Shifter Cable
Courtesy of GENERAL MOTORS CORP.

1. Remove the battery. Refer to **Battery Replacement** in Engine Electrical.
2. Remove the battery cooling box. Refer to **Battery Box Replacement** in Engine Electrical.
3. Remove the battery tray and bracket. Refer to **Battery Tray Replacement (L61)** or **Battery Tray Replacement (L66)** in Engine Electrical.
4. Disconnect the shifter cable. Refer to **Shift Cable Replacement** .

5. Remove the air induction resonator and bracket. Refer to **Air Cleaner Outlet Resonator Replacement** in Engine Controls.
6. Disconnect the transmission range switch harness from the transmission range switch.

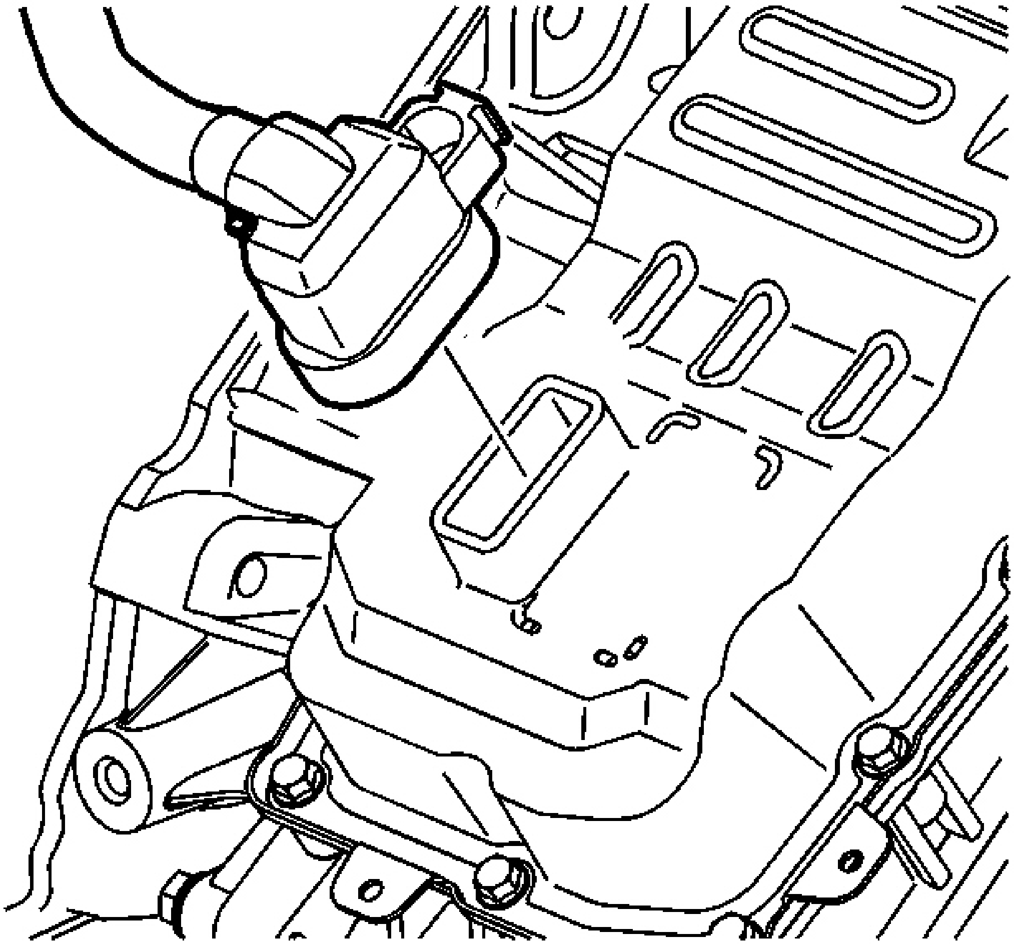


Fig. 167: Transmission Electrical Connector
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the transmission harness connector from the valve body.
8. Remove the headlamp fasteners.
9. Wire the radiator to the radiator core support in order to hold the radiator in place as the cradle is removed.

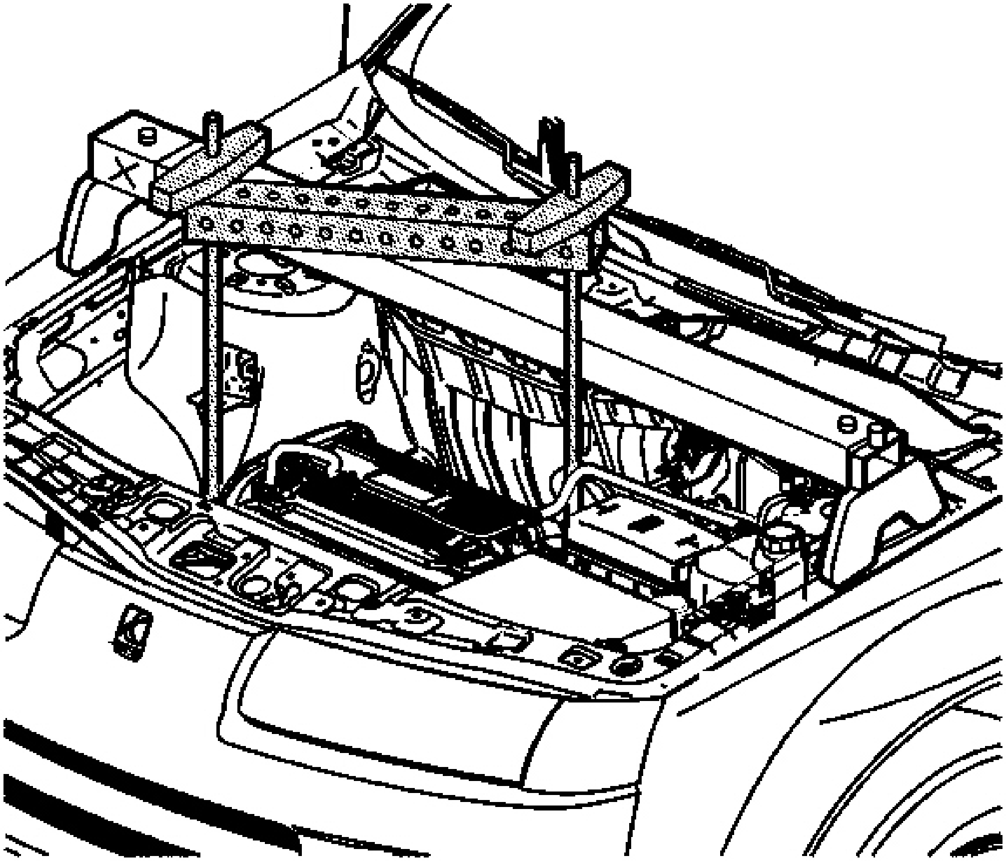


Fig. 168: SA9105E
Courtesy of GENERAL MOTORS CORP.

10. Install the **SA9105E** .

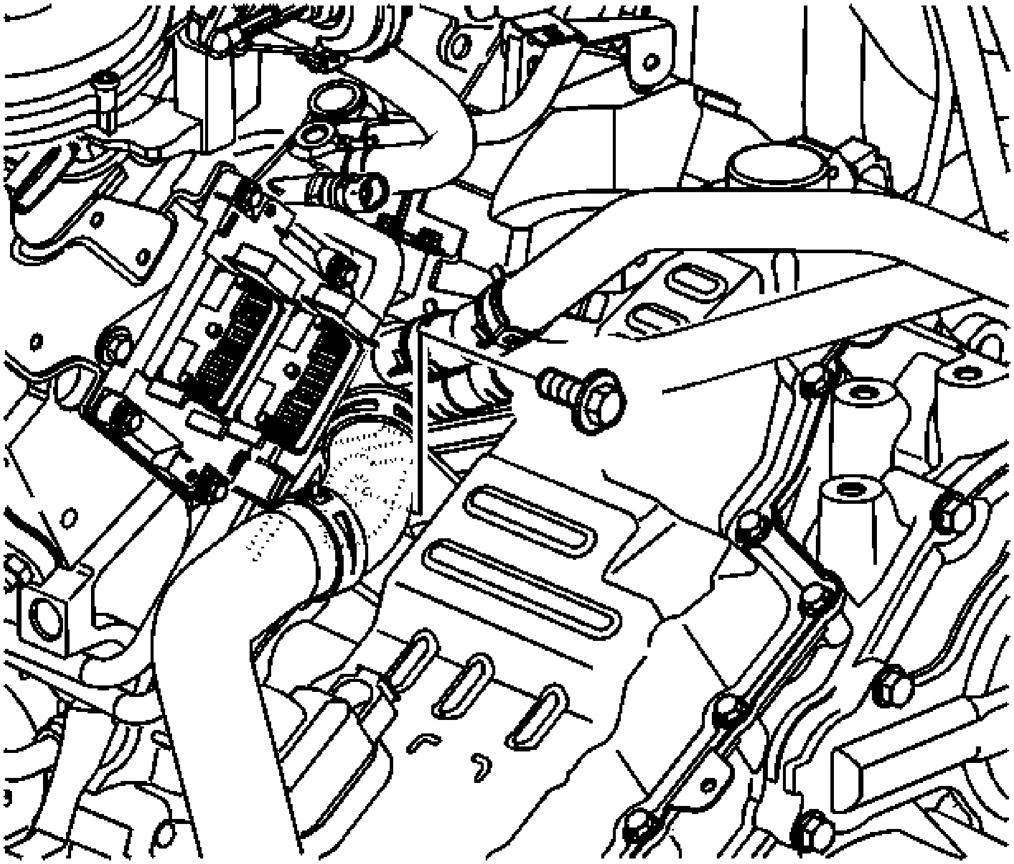


Fig. 169: 1 Upper Transmission-To-Engine Bolt
Courtesy of GENERAL MOTORS CORP.

11. Remove 1 upper transmission-to-engine bolt.

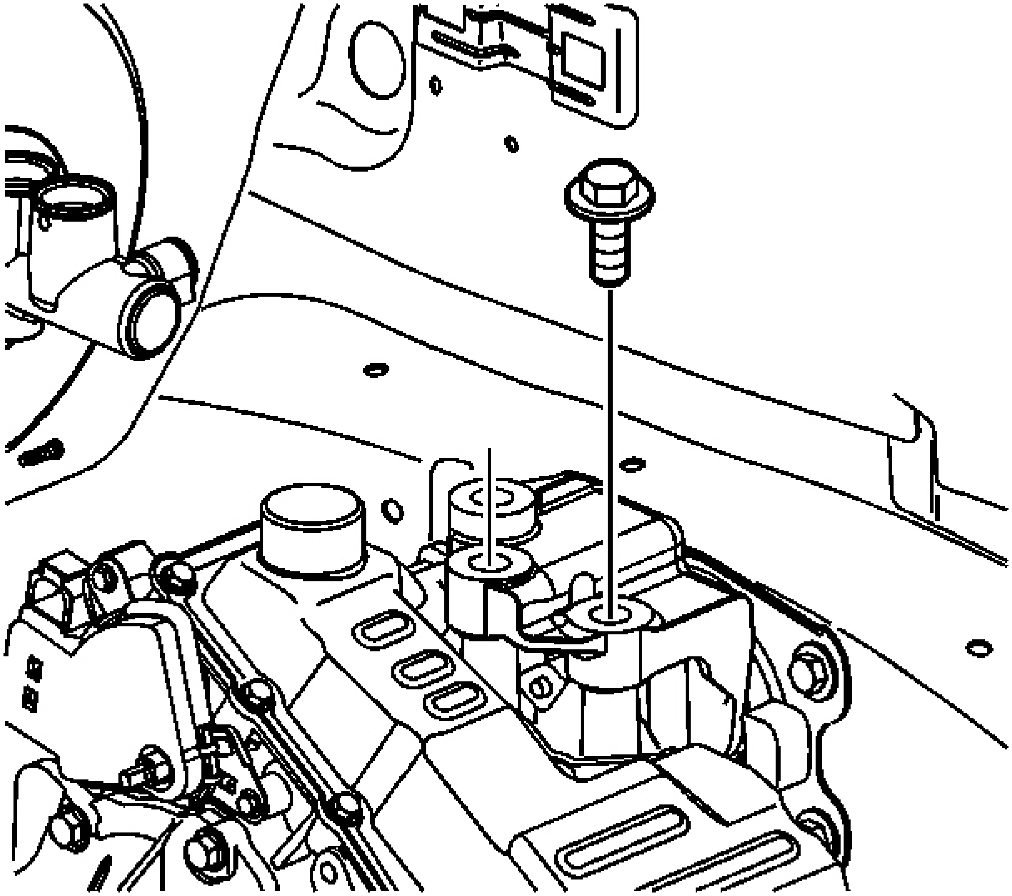


Fig. 170: Upper Left Transmission Mount Bolts
Courtesy of GENERAL MOTORS CORP.

12. Remove the upper left transmission mount bolts.
13. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
14. Remove the right wheel and tire assembly.
15. Remove the left inner splash shield. Refer to **Splash Shield Replacement - Engine** in Body Front End.
16. Remove the front bumper air deflector. Refer to **Air Deflector Replacement - Front Bumper Fascia** in Bumpers.

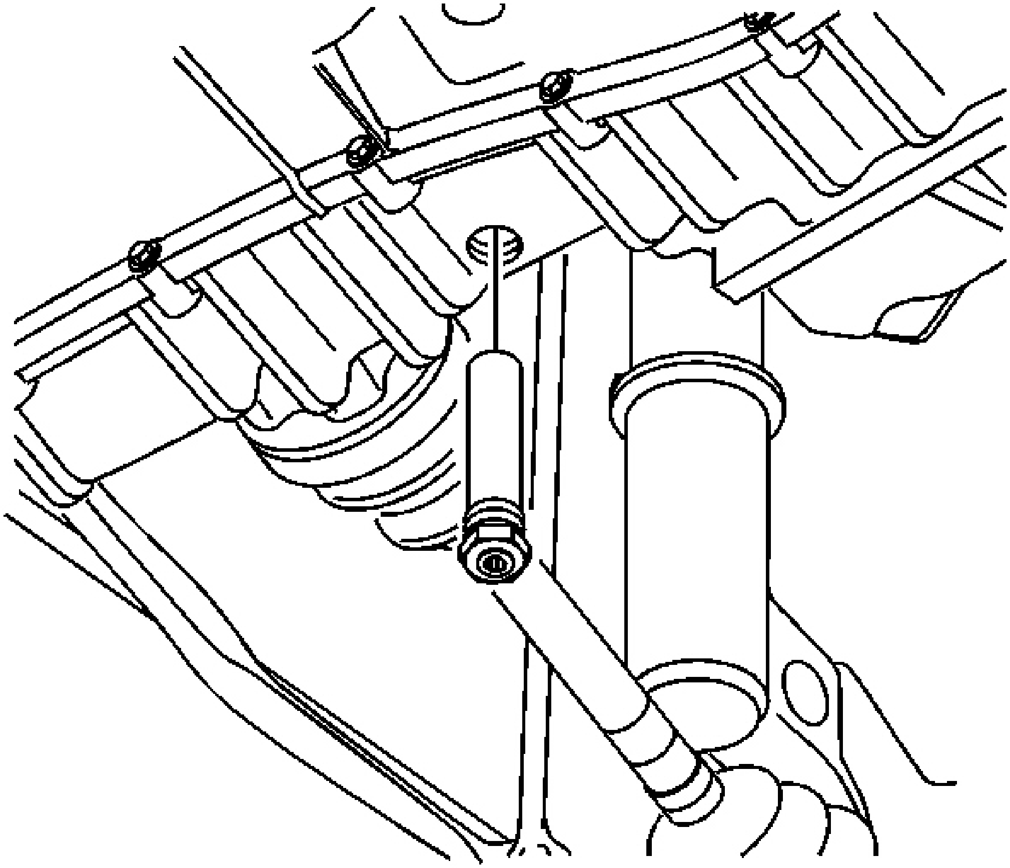


Fig. 171: Lower Tube Assembly & Transmission
Courtesy of GENERAL MOTORS CORP.

17. Remove the lower tube assembly and drain the fluid.

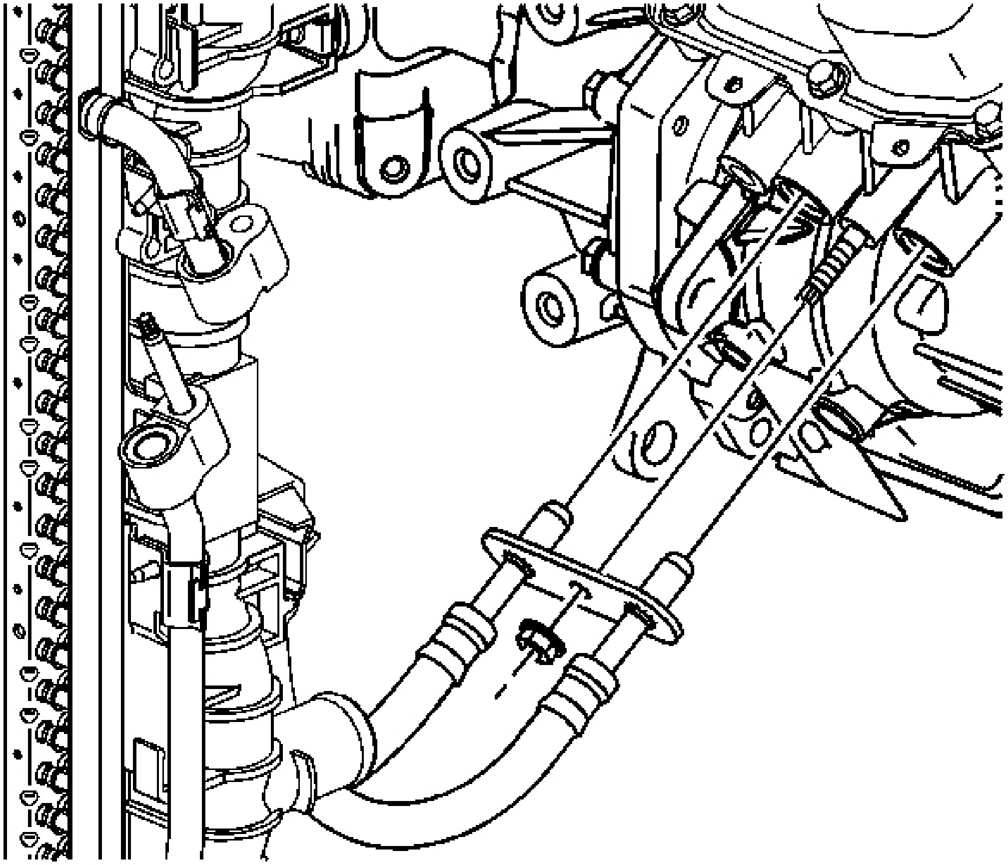


Fig. 172: Transmission Oil Cooler Line Assembly Nut & Transmission
Courtesy of GENERAL MOTORS CORP.

18. Disconnect the transmission cooler lines. Refer to **Oil Cooler Line Replacement** .

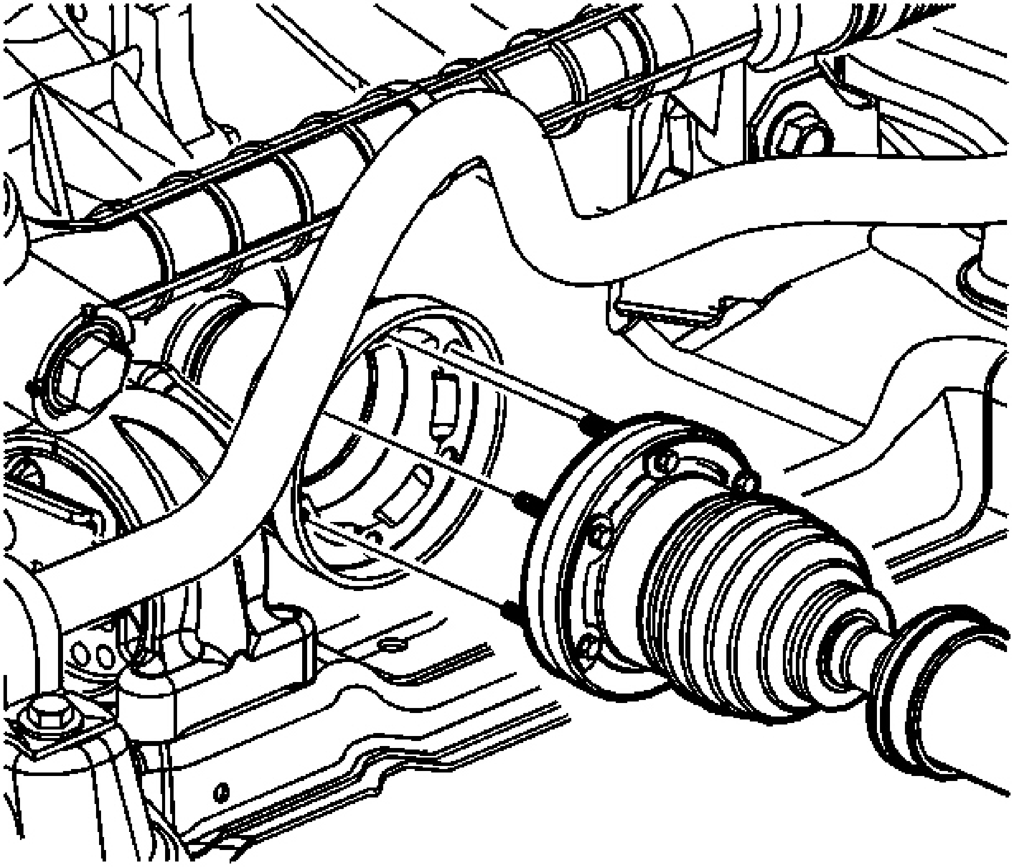


Fig. 173: Drive Shaft & Transfer Case (PTU)
Courtesy of GENERAL MOTORS CORP.

19. For all-wheel drive (AWD) vehicles, disconnect the drive shaft from the transfer case (PTU). Refer to **Transfer Case Replacement** in Transfer Case - NVG-900.

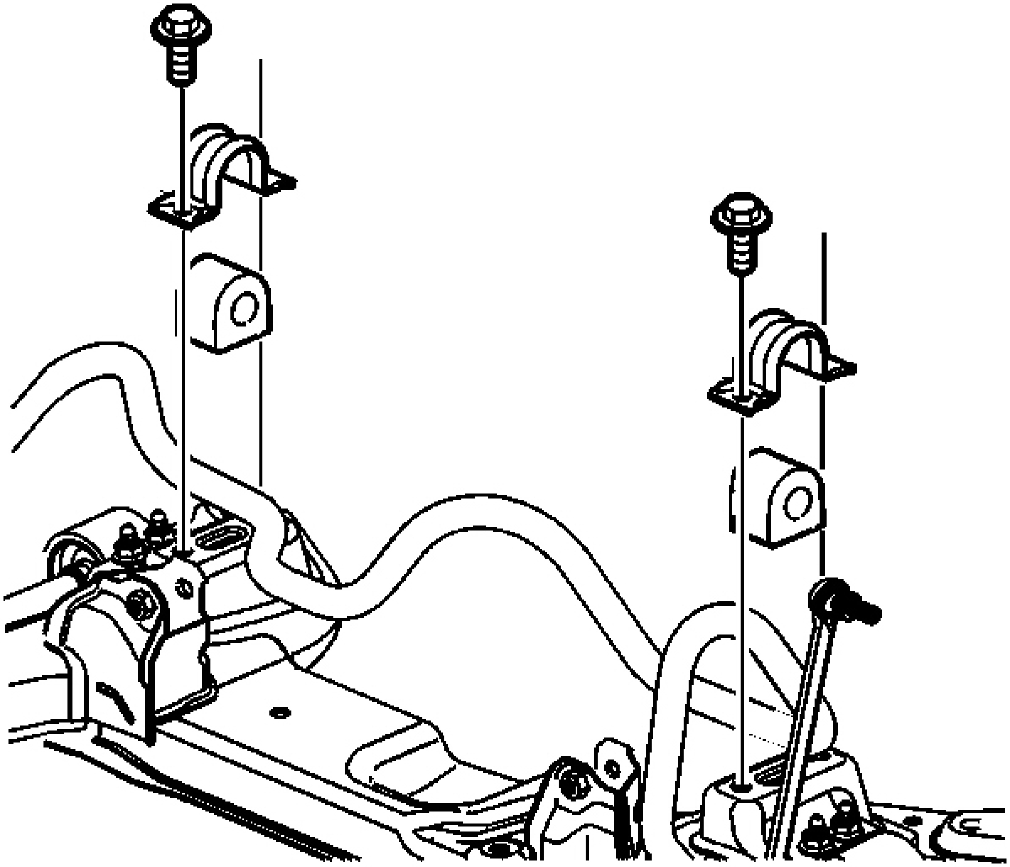


Fig. 174: Lower Stabilizer Nut, Cradle, Rack & Pinion Bolts
Courtesy of GENERAL MOTORS CORP.

20. Disconnect the lower stabilizer nut from the cradle on both sides of vehicle.
21. Remove the rack and pinion bolts from the cradle.

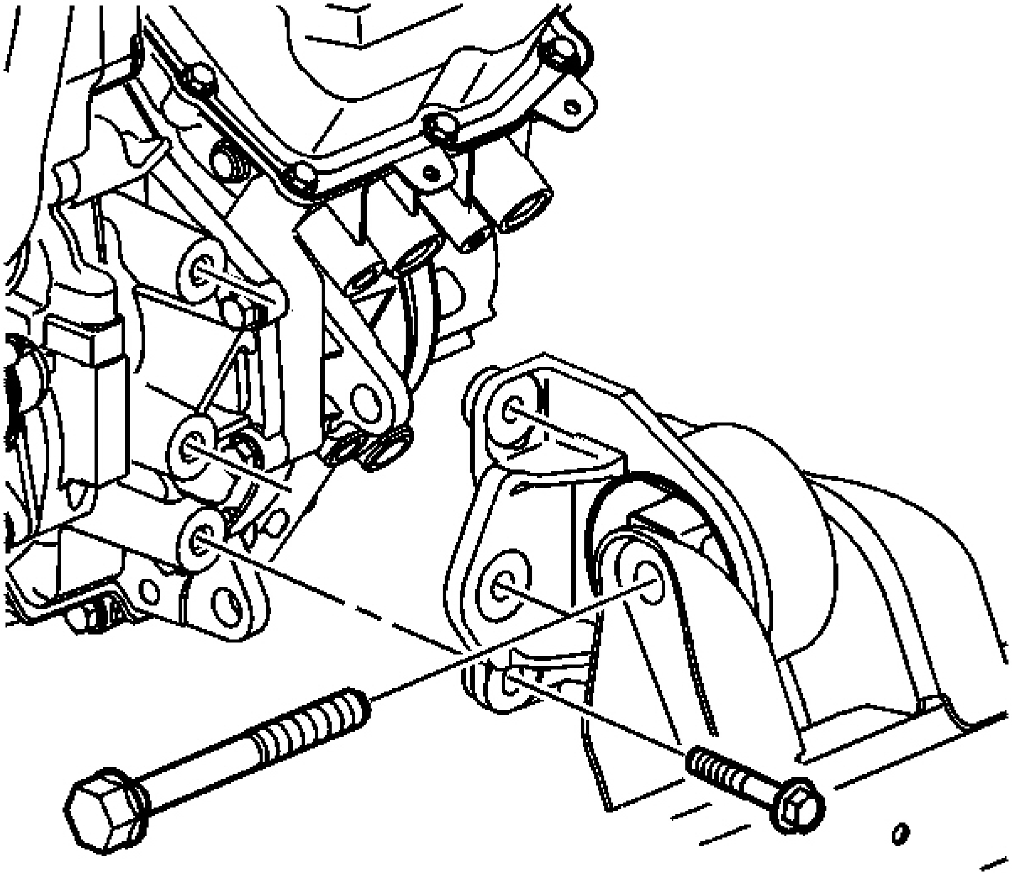


Fig. 175: Front Pitch Restrictor & Bolts
Courtesy of GENERAL MOTORS CORP.

22. Disconnect the tie rod. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.
23. Remove the front pitch restrictor bolts and front pitch restrictor.

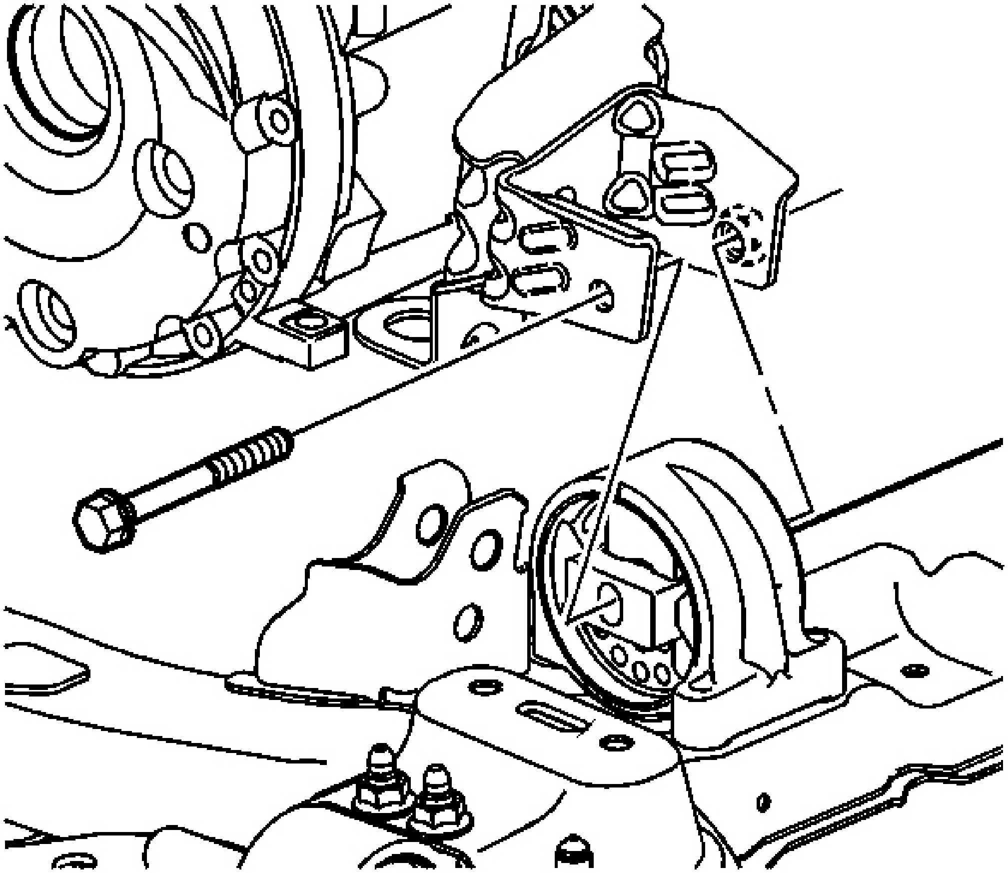


Fig. 176: Rear Pitch Restrictor Through Bolt
Courtesy of GENERAL MOTORS CORP.

24. Remove the rear pitch restrictor through-bolt.
25. Support the cradle with cradle support.

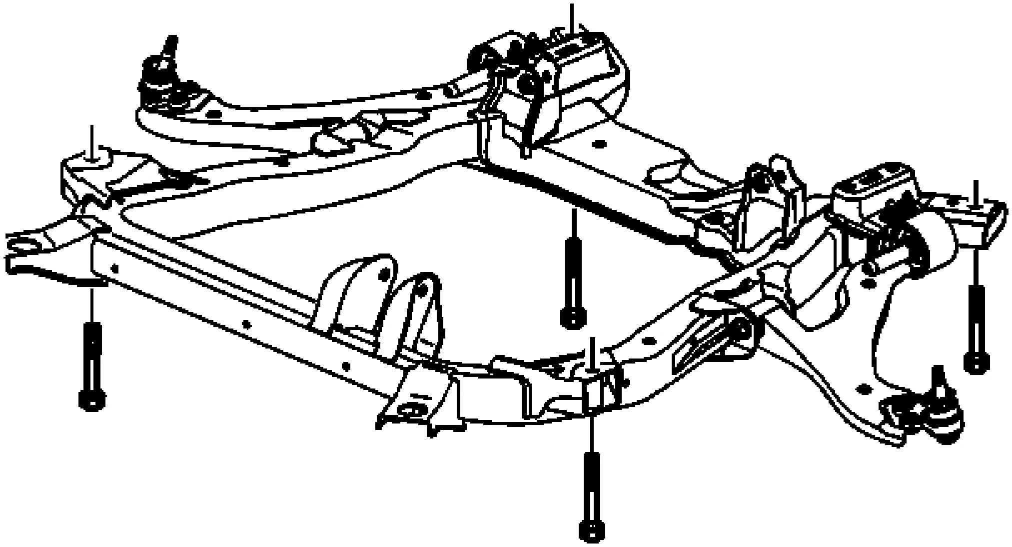
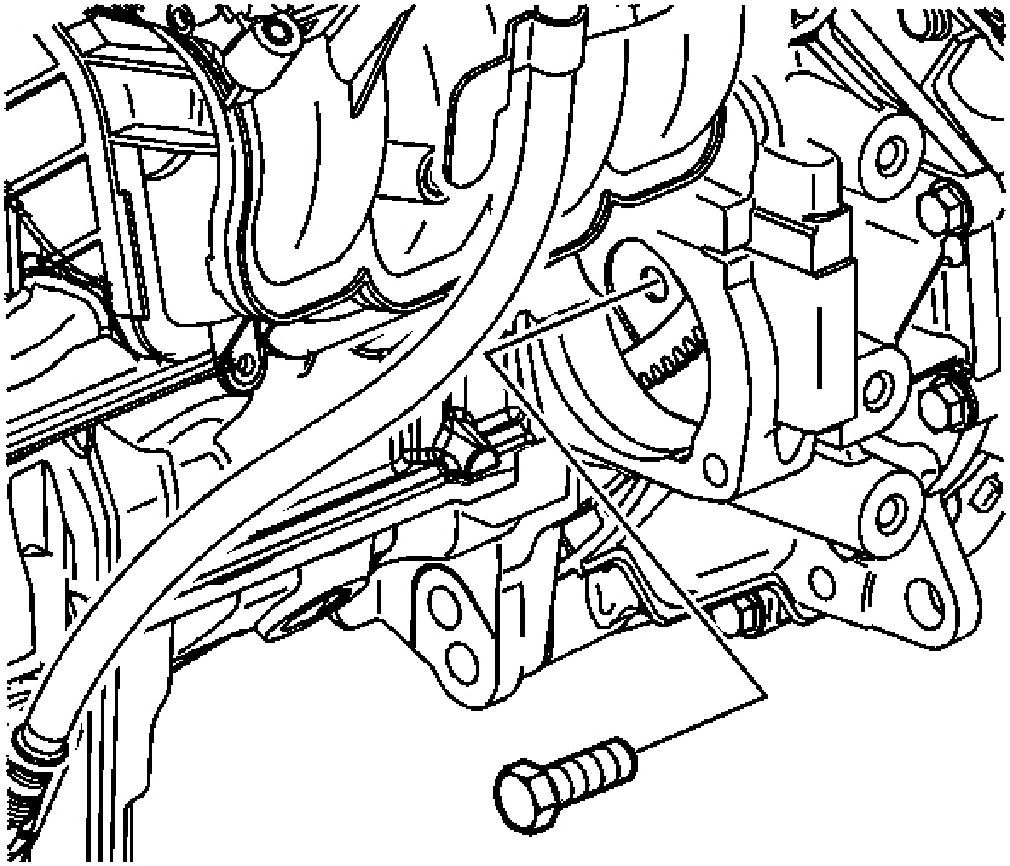


Fig. 177: Cradle, Bolts & Cradle Support
Courtesy of GENERAL MOTORS CORP.

26. Remove the cradle fasteners and lower the cradle onto a support table.
27. Separate the left axle shaft from the transmission. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.
28. For front wheel drive (FWD) vehicles, separate the right intermediate drive shafts. Refer to **Intermediate Shaft Replacement (L61)** or **Intermediate Shaft Replacement (L66)** in Wheel Drive Shafts.
29. For AWD vehicles, separate the right axle shaft from the transfer case (PTU). Refer to **Wheel Drive Shaft Replacement - Front** in Transfer case - NVG-900.
30. Remove the starter. Refer to **Starter Motor Replacement (L61)** or **Starter Motor Replacement (L66)** in Engine Electrical.



<u>Fig. 178: Torque Converter-To-Flexplate Bolts</u>
Courtesy of GENERAL MOTORS CORP.

31. Remove the starter bolts and starter.
32. Turn the crank clockwise to gain access to the torque converter-to-flexplate bolts.
33. Remove the torque converter-to-flexplate bolts through the starter hole.

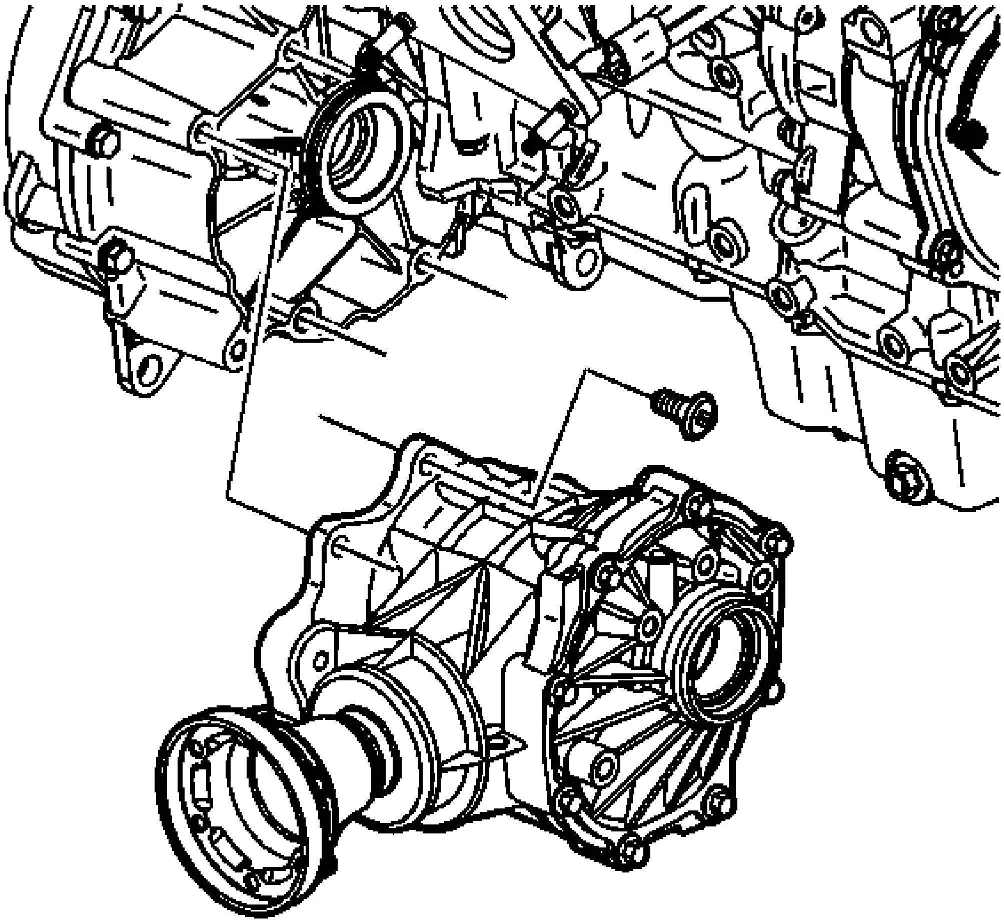


Fig. 179: AWD Right Transfer Case (PTU)
Courtesy of GENERAL MOTORS CORP.

34. For AWD vehicles, remove the transfer case (PTU). Refer to **Transfer Case Replacement** in Transfer Case NVG-900.

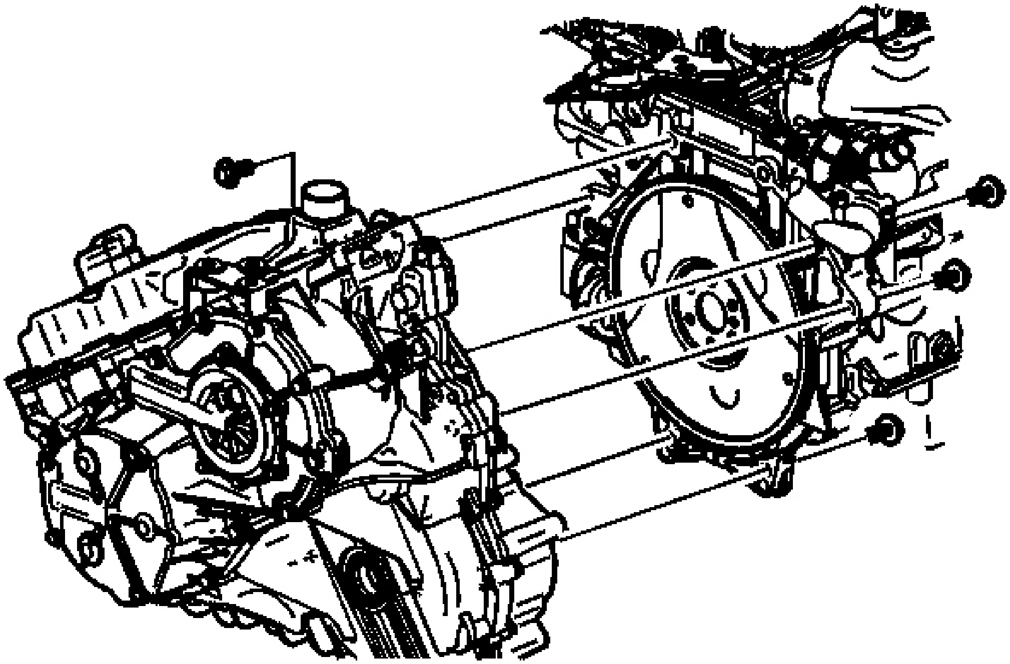


Fig. 180: Lower Transmission-To-Engine Bolts
Courtesy of GENERAL MOTORS CORP.

35. Secure the transmission to a transmission jack.
36. Remove the lower transmission-to-engine bolts.

IMPORTANT:

- **The torque converter has a long pilot shaft. Do not put excessive load on the shaft. Do not lower the transmission until the shaft is clear of the engine crankshaft.**
- **Do not damage the mating surfaces of the engine or transmission.**

37. Separate the transmission from the engine.
38. Lower the transmission carefully.
39. Remove the torque converter and differential housing O-ring seal. Refer to **Torque Converter and Differential Housing Seal Replacement** .

Installation Procedure

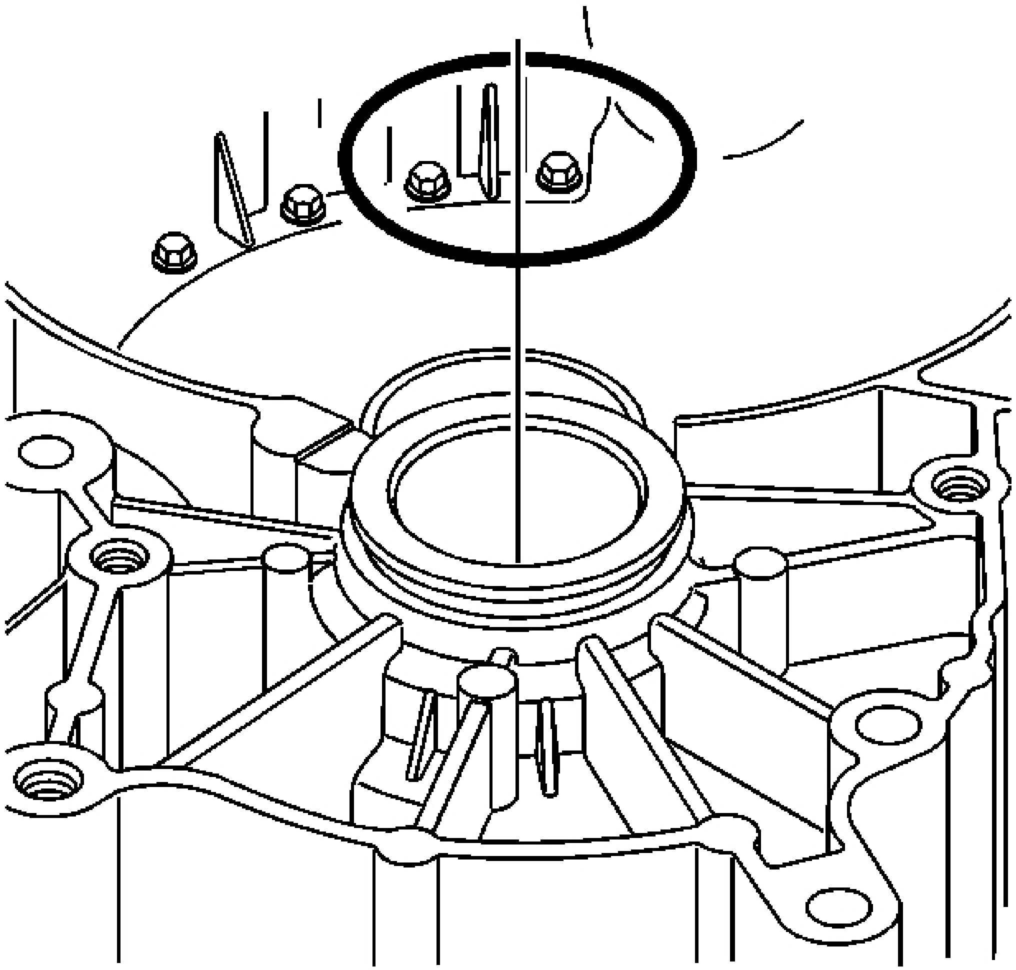


Fig. 181: Torque Converter, Differential Housing & O-Ring Seal (AWD)
Courtesy of GENERAL MOTORS CORP.

1. For all wheel drive (AWD) vehicles, install a new torque converter and differential housing O-ring seal. Refer to **Torque Converter and Differential Housing Seal Replacement** .
2. With the transmission supported, carefully raise the transmission. It may be helpful to lower the vehicle down around the transmission. Ensure that there is not interference with the coolant lines during installation.

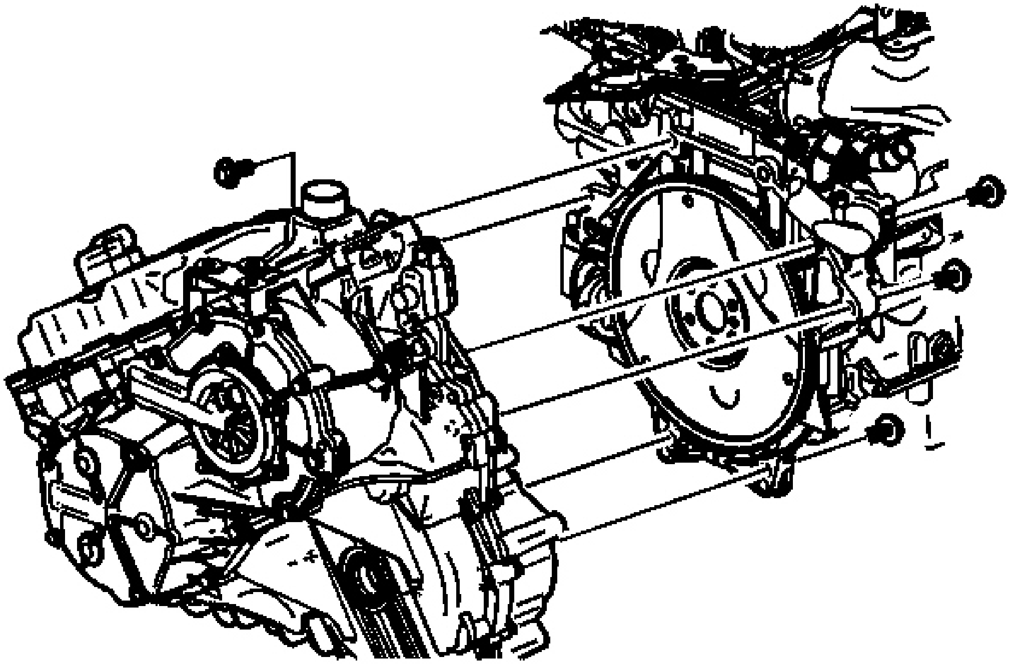


Fig. 182: Lower Transmission-To-Engine Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the engine to the transmission.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the lower transmission-to-engine bolts.

   Tighten: Tighten the bolts to 75 N.m (55 lb ft).

5. For AWD vehicles, install the stub shaft into the transmission. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.

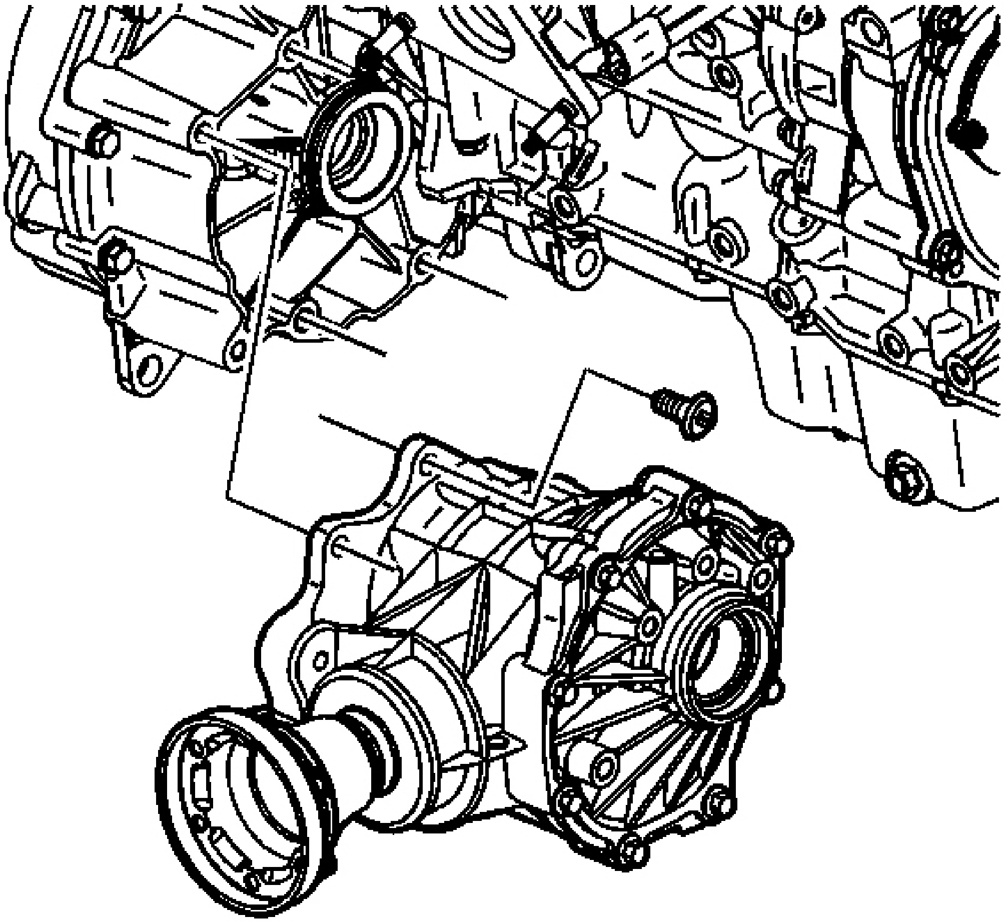
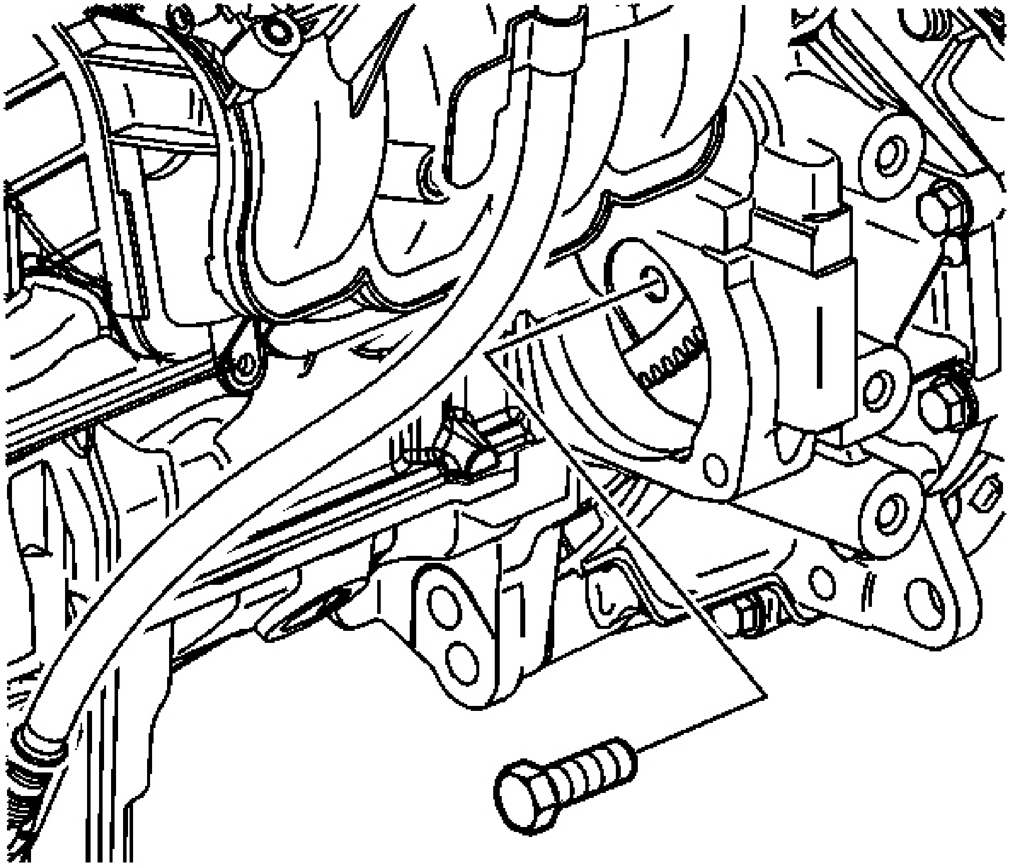


Fig. 183: AWD Right Transfer Case (PTU)
Courtesy of GENERAL MOTORS CORP.

6. For AWD vehicles, install the transfer case (PTU). Refer to **Transfer Case Replacement** in Transfer Case - NVG-900.



<u>Fig. 184: Torque Converter-To-Flexplate Bolts</u>
Courtesy of GENERAL MOTORS CORP.

7. Rotate the crank and align the net hole of the flexplate through the starter opening.
8. Install the torque converter-to-flexplate bolts through the starter opening.

   Tighten: Tighten the bolts to 60 N.m (44 lb ft).

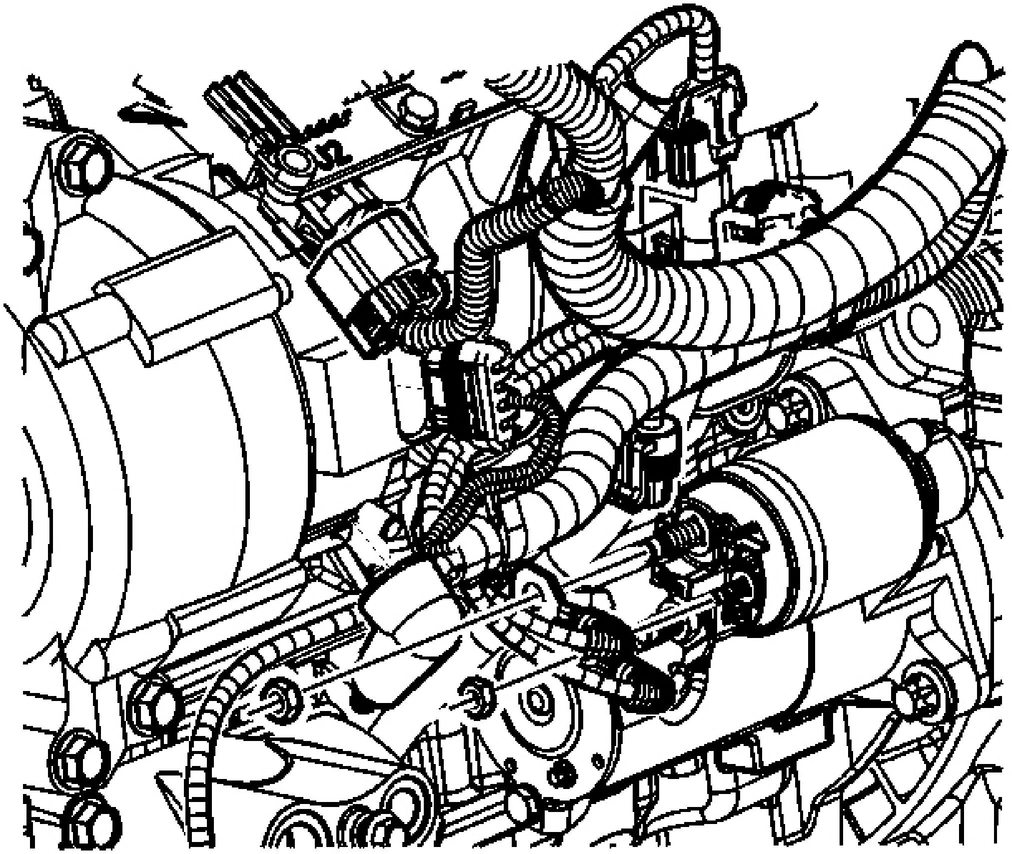


Fig. 185: Right Axle Shaft & PTU (AWD)
Courtesy of GENERAL MOTORS CORP.

9. Install the starter. Refer to **Starter Motor Replacement (L61)** or **Starter Motor Replacement (L66)** in Engine Electrical.
10. Install the right intermediate drive shafts. Refer to **Intermediate Shaft Replacement (L61)** or **Intermediate Shaft Replacement (L66)** in Wheel Drive Shafts.
11. For AWD vehicles, install the right axle shaft to the PTU. Refer to **Wheel Drive Shaft Replacement - Front** in Transfer Case - NVG-900.

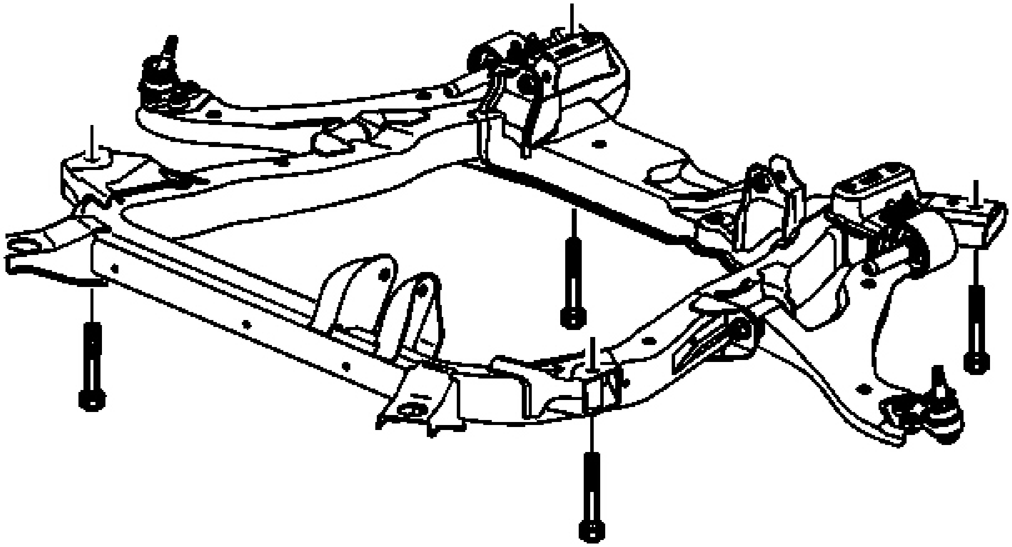


Fig. 186: Cradle, Bolts & Cradle Support
Courtesy of GENERAL MOTORS CORP.

12. Support the cradle with a cradle support.
13. Install the cradle and the bolts.

    Tighten: Tighten the bolts to 155 N.m (114 lb ft).

14. Remove the support table.

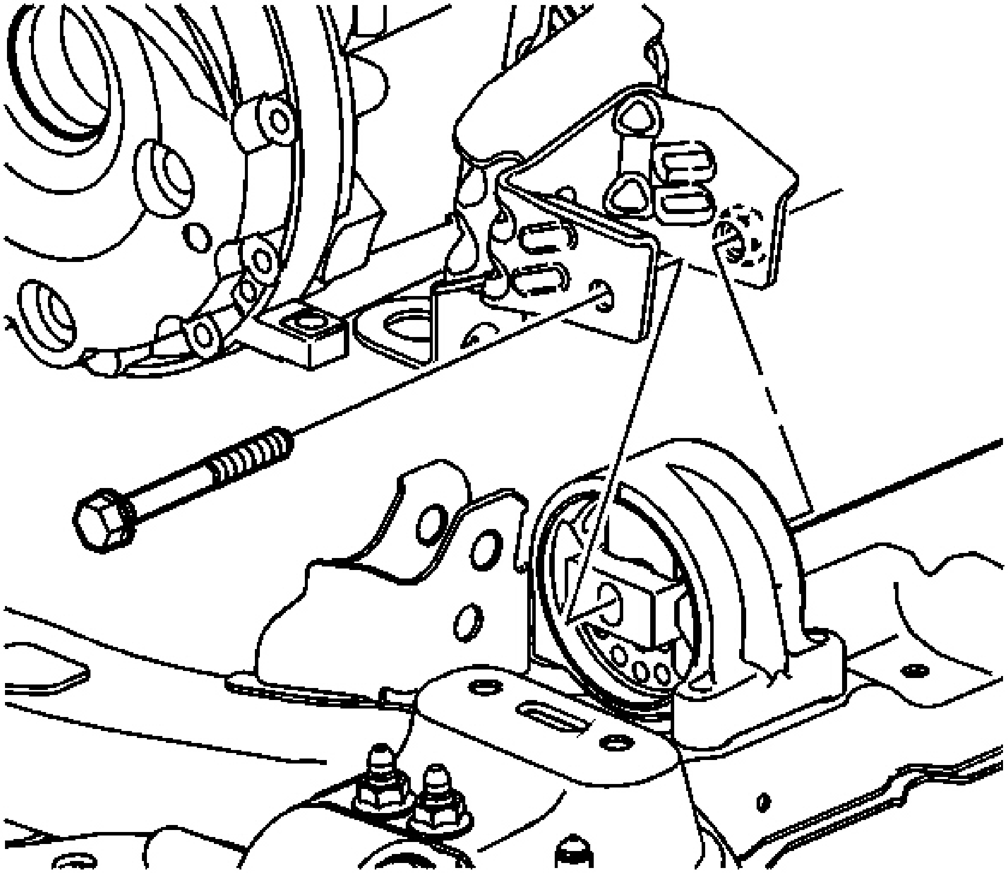


Fig. 187: Rear Pitch Restrictor Through Bolt
Courtesy of GENERAL MOTORS CORP.

15. Install the rear pitch restrictor through bolt.

    Tighten: Tighten the bolt to 110 N.m (81 lb ft).

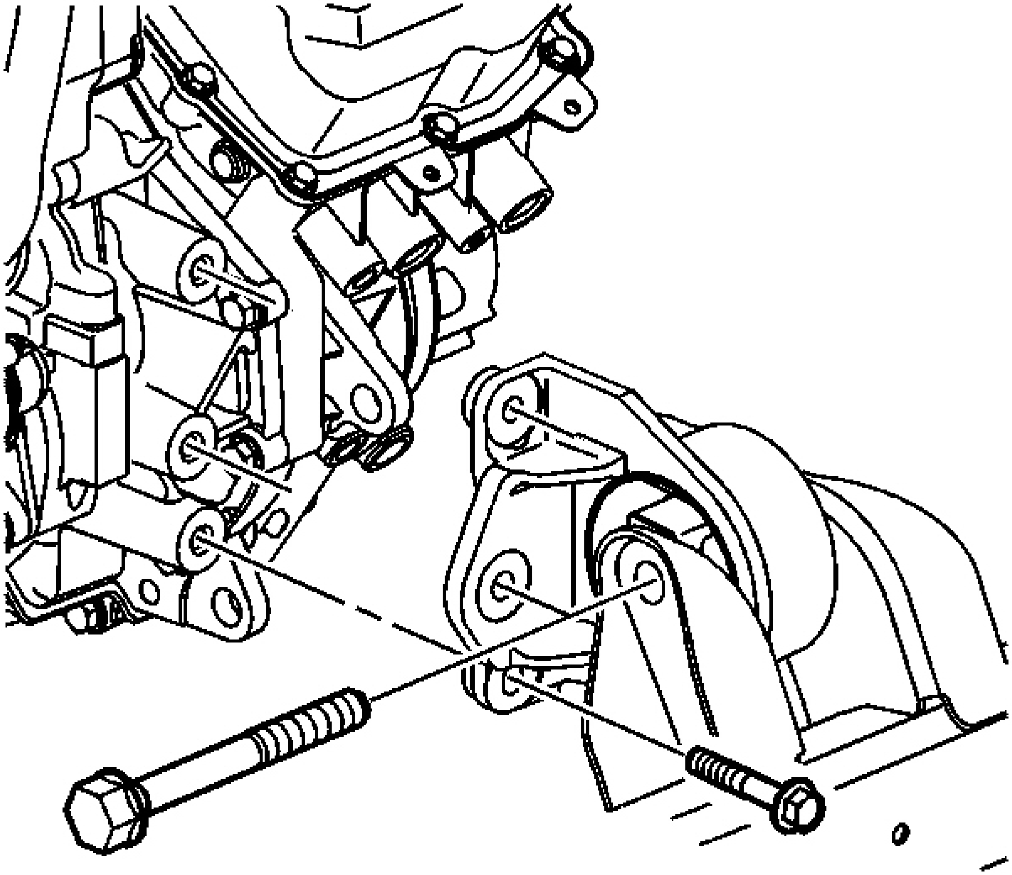


Fig. 188: Front Pitch Restrictor & Bolts
Courtesy of GENERAL MOTORS CORP.

16. Install the front pitch restrictor bolts and front pitch restrictor.

    Tighten: Tighten the bolts to 50 N.m (37 lb ft).

17. Install the tie rod. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.

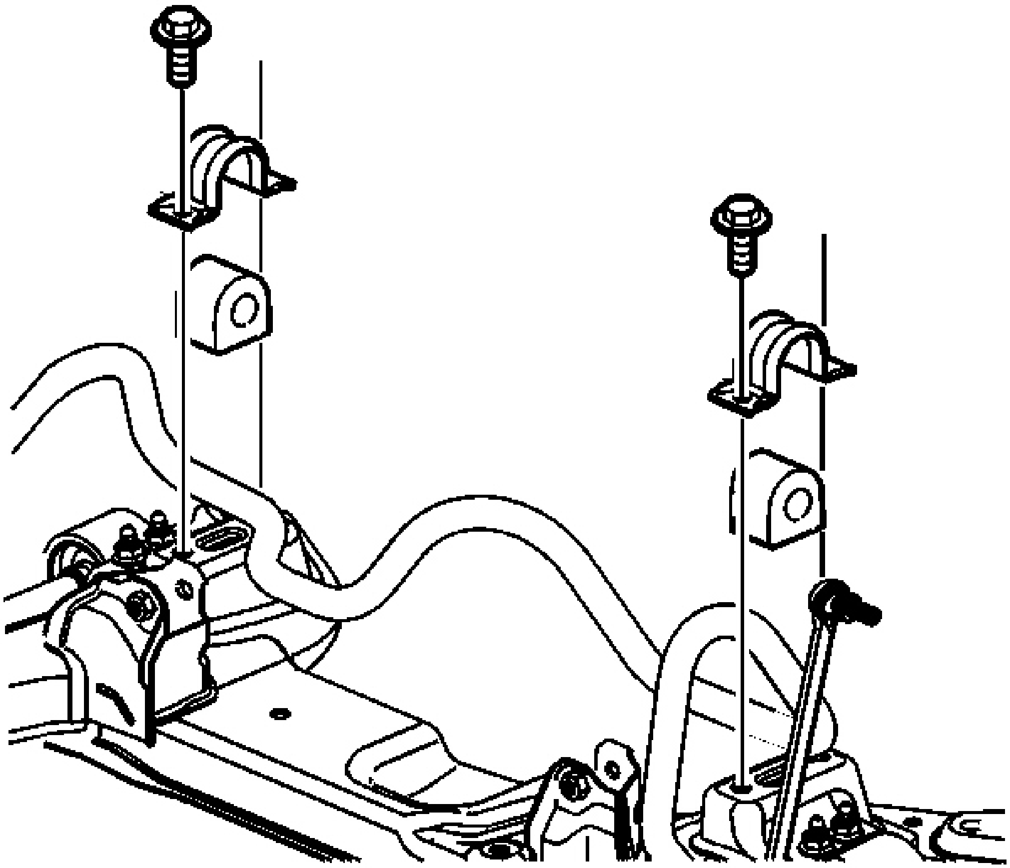


Fig. 189: Lower Stabilizer Nut, Cradle, Rack & Pinion Bolts
Courtesy of GENERAL MOTORS CORP.

18. Install the rack and pinion bolts to the cradle.

    Tighten: Tighten the bolts to 110 N.m (81 lb ft).

19. Install the lower stabilizer nuts to the cradle on both sides of the vehicle.

    Tighten: Tighten the nuts to 65 N.m (48 lb ft).

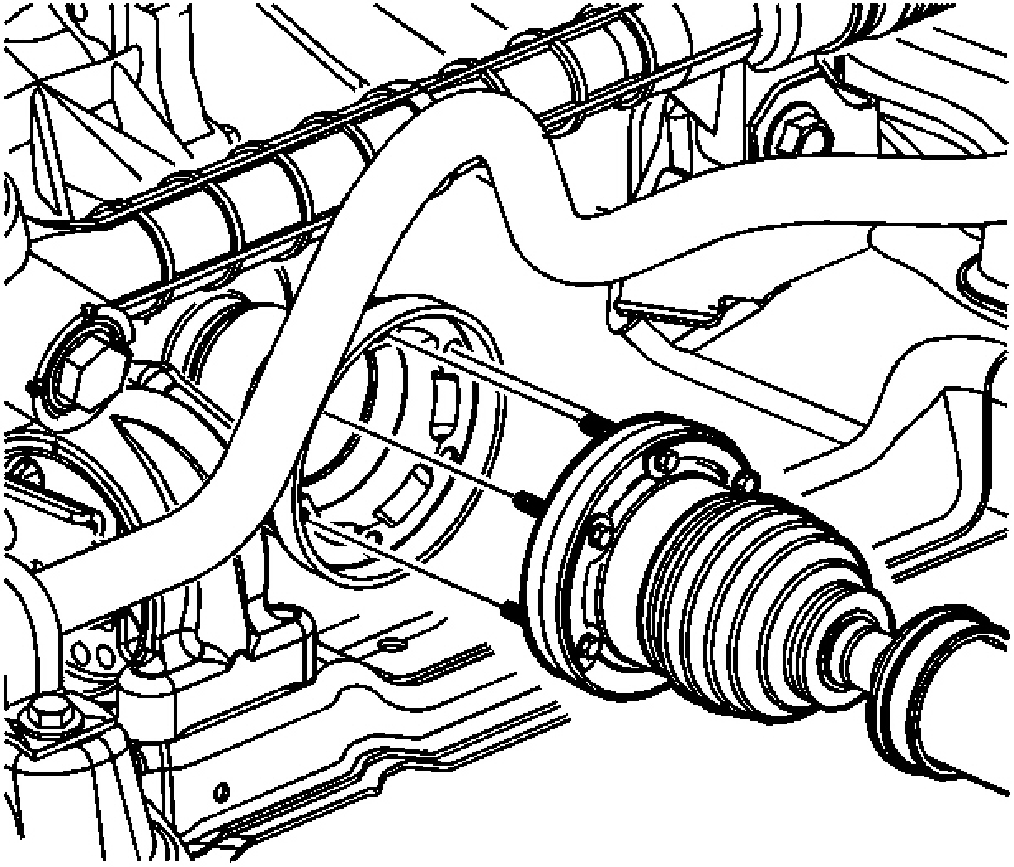


Fig. 190: Drive Shaft & Transfer Case (PTU)
Courtesy of GENERAL MOTORS CORP.

20. For AWD vehicles, install the drive shaft to the PTU. Refer to **Transfer Case Replacement** in Transfer Case - NVG-900.
21. If the transmission being installed is not new, the transmission oil cooler line seals must be removed and replaced. Refer to **Oil Cooler Pipe Seals Replacement** .

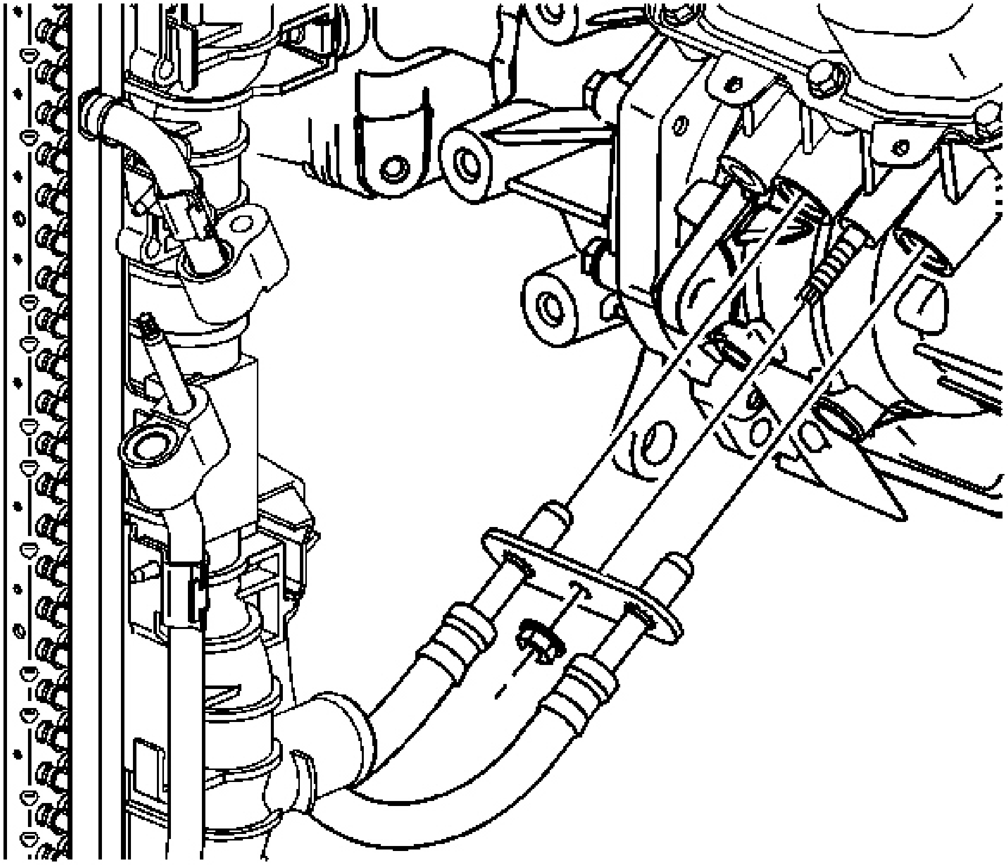


Fig. 191: Transmission Oil Cooler Line Assembly Nut & Transmission
Courtesy of GENERAL MOTORS CORP.

22. Install the transmission oil cooler lines. Refer to **Oil Cooler Line Replacement** .
23. Install the front bumper air deflector. Refer to **Air Deflector Replacement - Front Bumper Fascia** in Bumpers.
24. Install the left and right inner splash shield. Refer to **Splash Shield Replacement - Engine** in Body Front End.

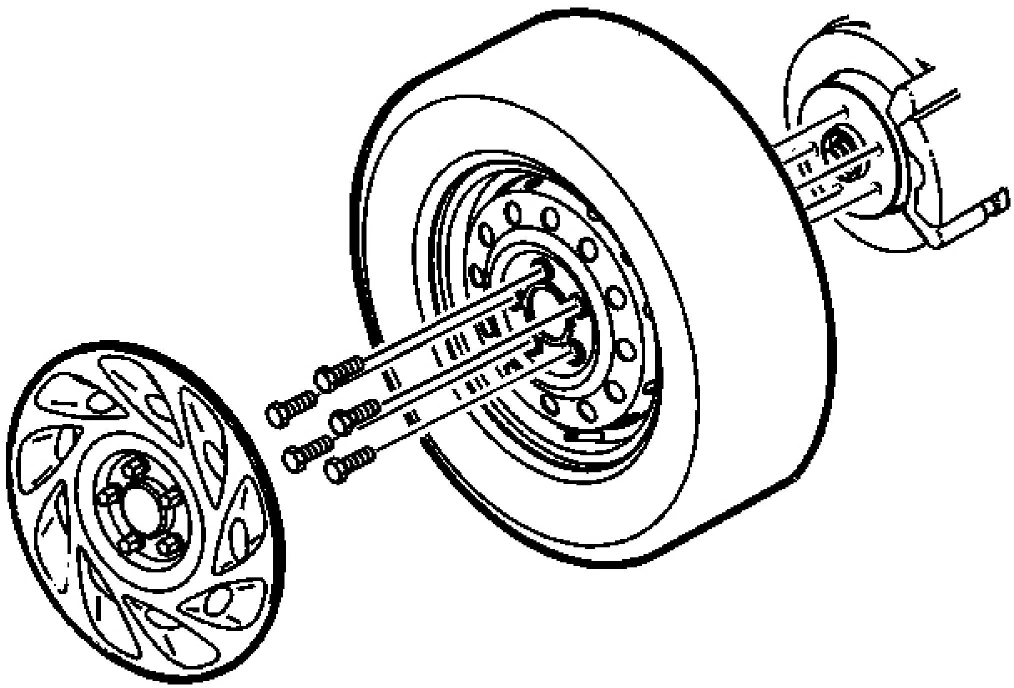


Fig. 192: Wheel & Tire Assemblies
Courtesy of GENERAL MOTORS CORP.

25. Install the left and right wheel and tire assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
26. Lower the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

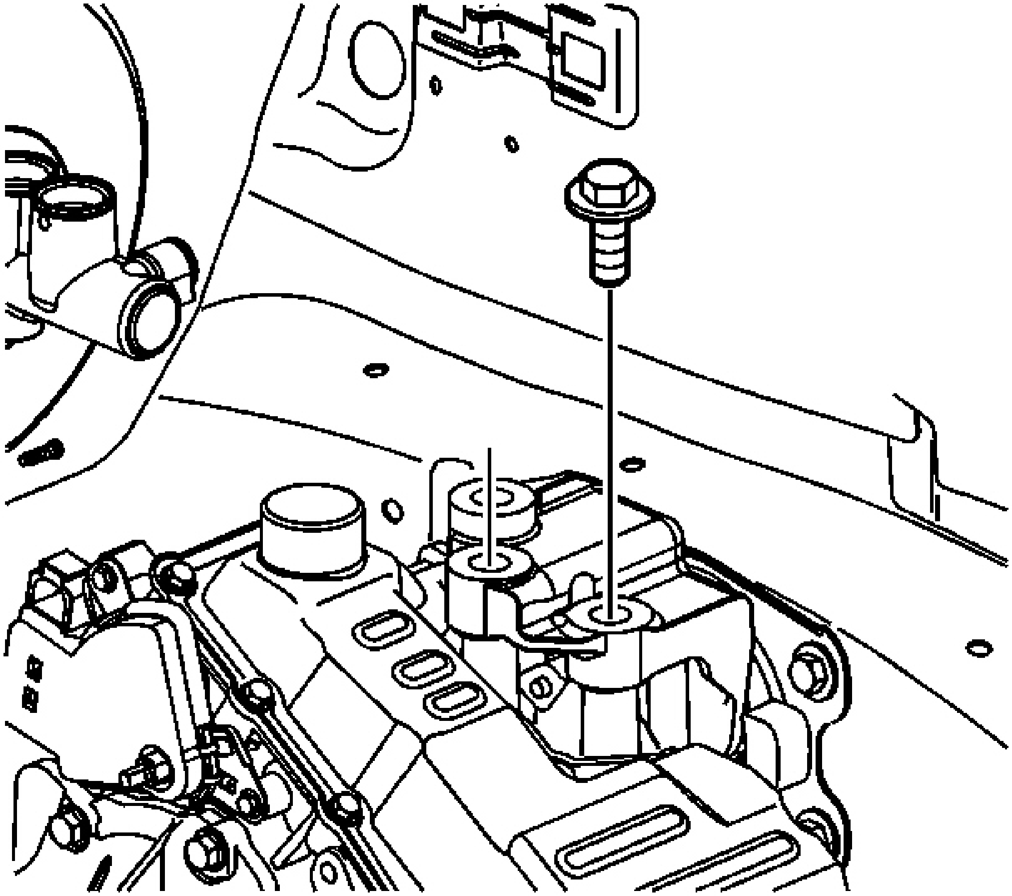


Fig. 193: Upper Left Transmission Mount Bolts
Courtesy of GENERAL MOTORS CORP.

27. Install the upper left transmission mount bolts.

    Tighten: Tighten the bolts to 50 N.m (37 lb ft).

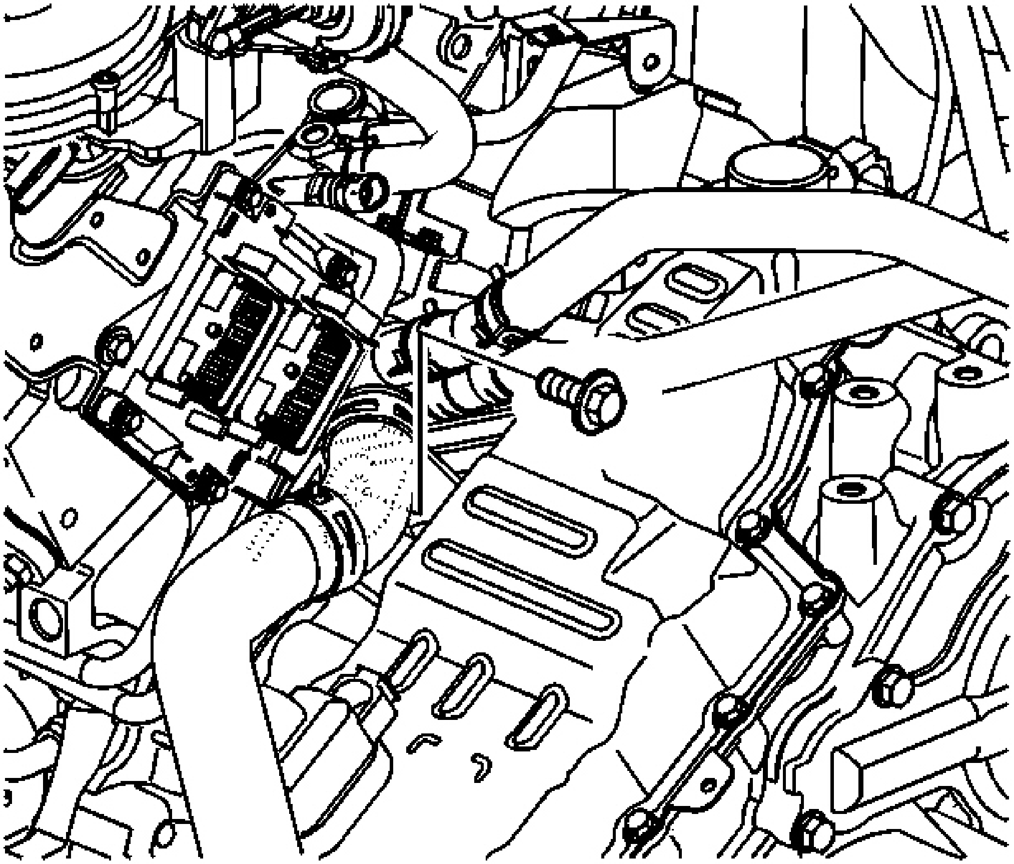


Fig. 194: 1 Upper Transmission-To-Engine Bolt
Courtesy of GENERAL MOTORS CORP.

28. Install 1 upper transmission-to-engine bolt.

    Tighten: Tighten the bolt to 75 N.m (55 lb ft).

29. Remove the **SA9105E** .
30. Remove the tie straps from the radiator.

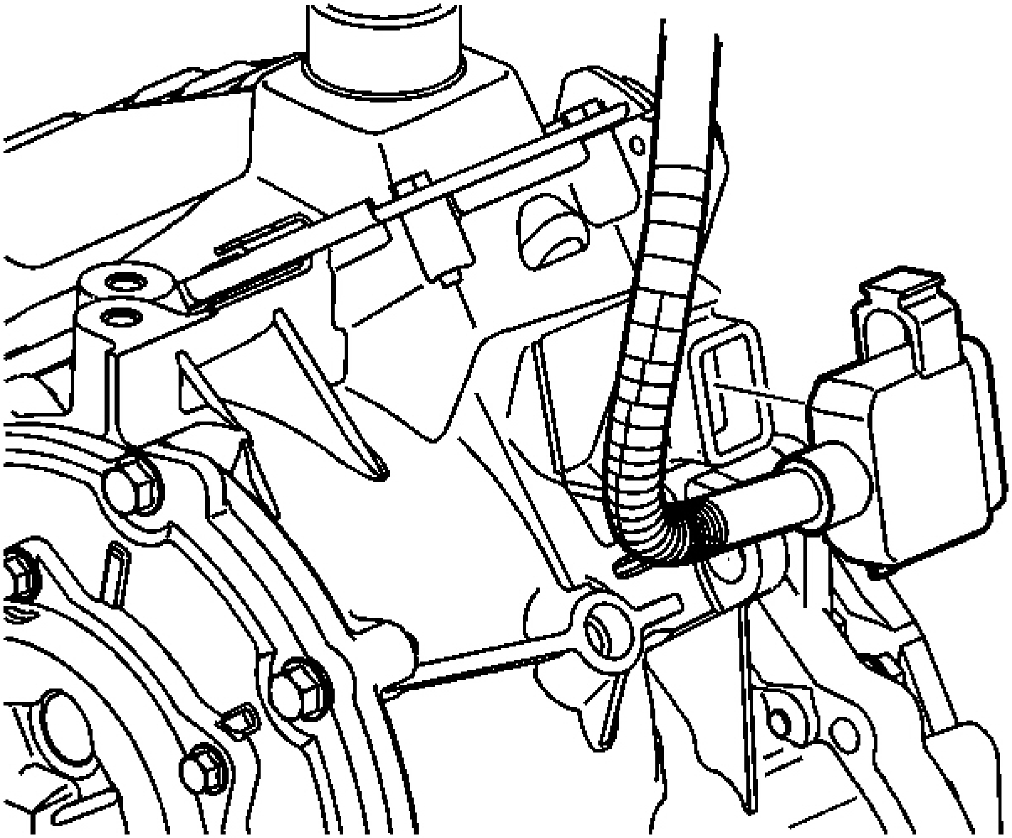


Fig. 195: Transmission Range Switch Harness & Shifter Cable
Courtesy of GENERAL MOTORS CORP.

31. Install the transmission range switch harness to the transmission range switch.

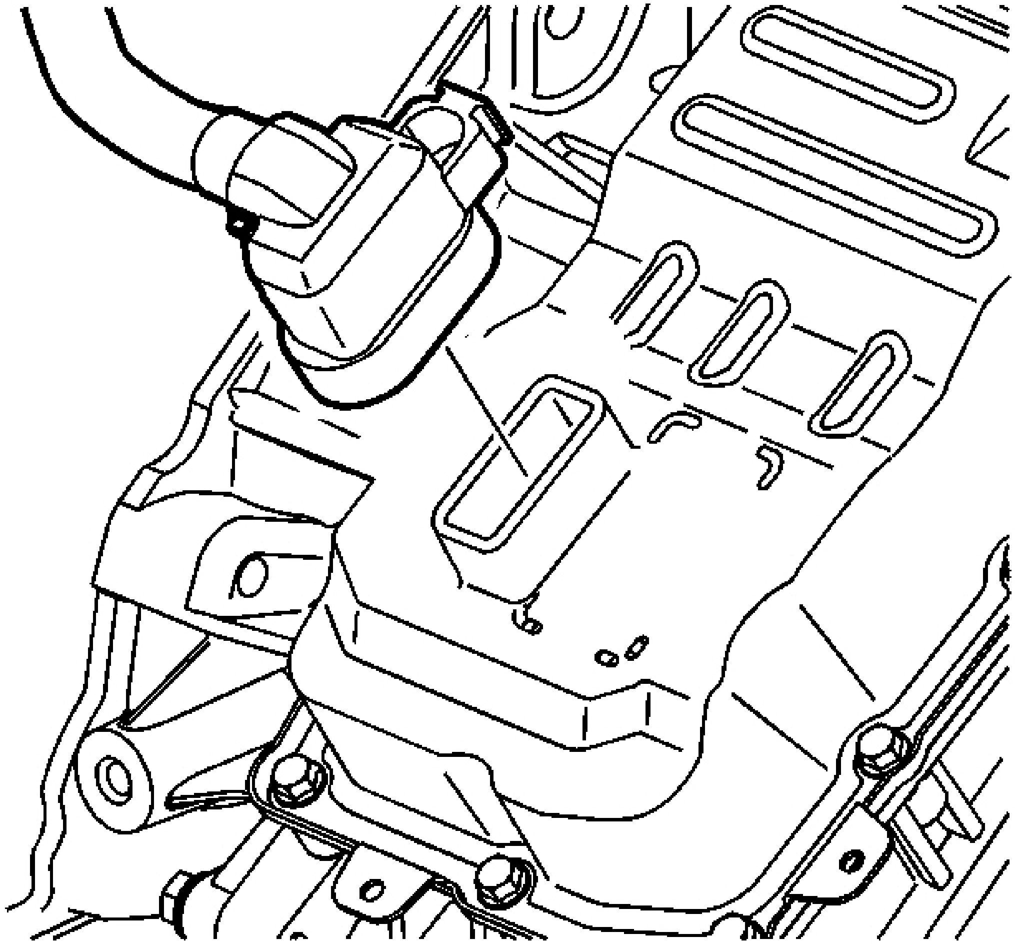


Fig. 196: Transmission Electrical Connector
Courtesy of GENERAL MOTORS CORP.

32. Install the transmission harness connector to the valve body.
33. Install the shifter cable. Refer to **Shift Cable Replacement** .
34. Install the air induction resonator and bracket. Refer to **Air Cleaner Outlet Resonator Replacement** in Engine Controls.
35. Install the battery tray bracket. Refer to **Battery Tray Replacement (L61)** or **Battery Tray Replacement (L66)** in Engine Electrical.
36. Install the battery. Refer to **Battery Replacement** in Engine Electrical.

NOTE: Refer to Fastener Notice in Cautions and Notices.

37. Install the battery cooling box cover and screws. Refer to **Battery Box Replacement** in Engine Electrical.

    Tighten: Tighten the screws to 2 N.m (18 lb in).

38. Using Saturn DEX-CVT(R) fluid P/N 22688912, fill the transmission to the proper level. Refer to **Transmission Fluid Replacement** .
39. Align the wheels. Refer to **Wheel Alignment Specifications** in Wheel Alignment.

TORQUE CONVERTER ASSEMBLY REMOVAL

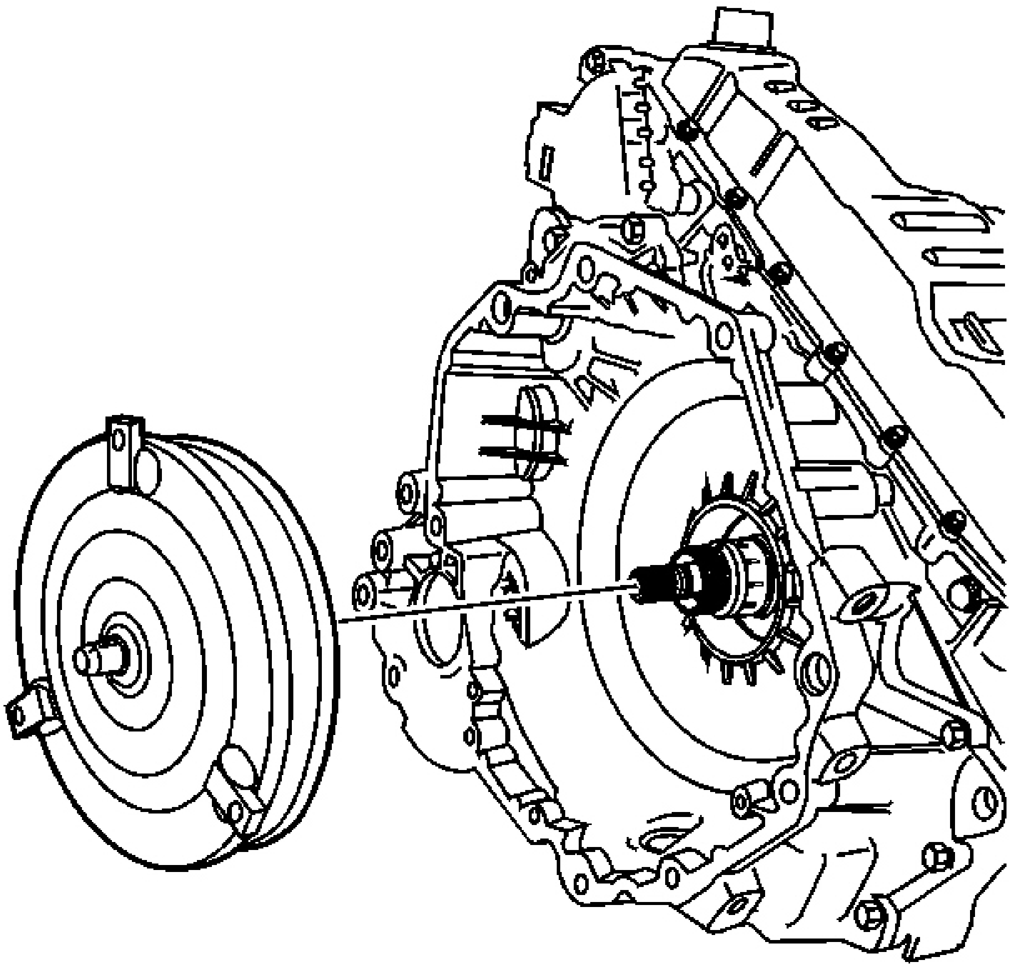


Fig. 197: Torque Converter Assembly
Courtesy of GENERAL MOTORS CORP.

Remove the torque converter assembly.

TORQUE CONVERTER AND DIFFERENTIAL HOUSING SEAL REPLACEMENT

Tools Required

- **J 36850** Assembly Lubricant. See **Special Tools and Equipment** .
- **J 43069** Converter Seal Installer. See **Special Tools and Equipment** .
- **J 45000** Lip Seal Remover

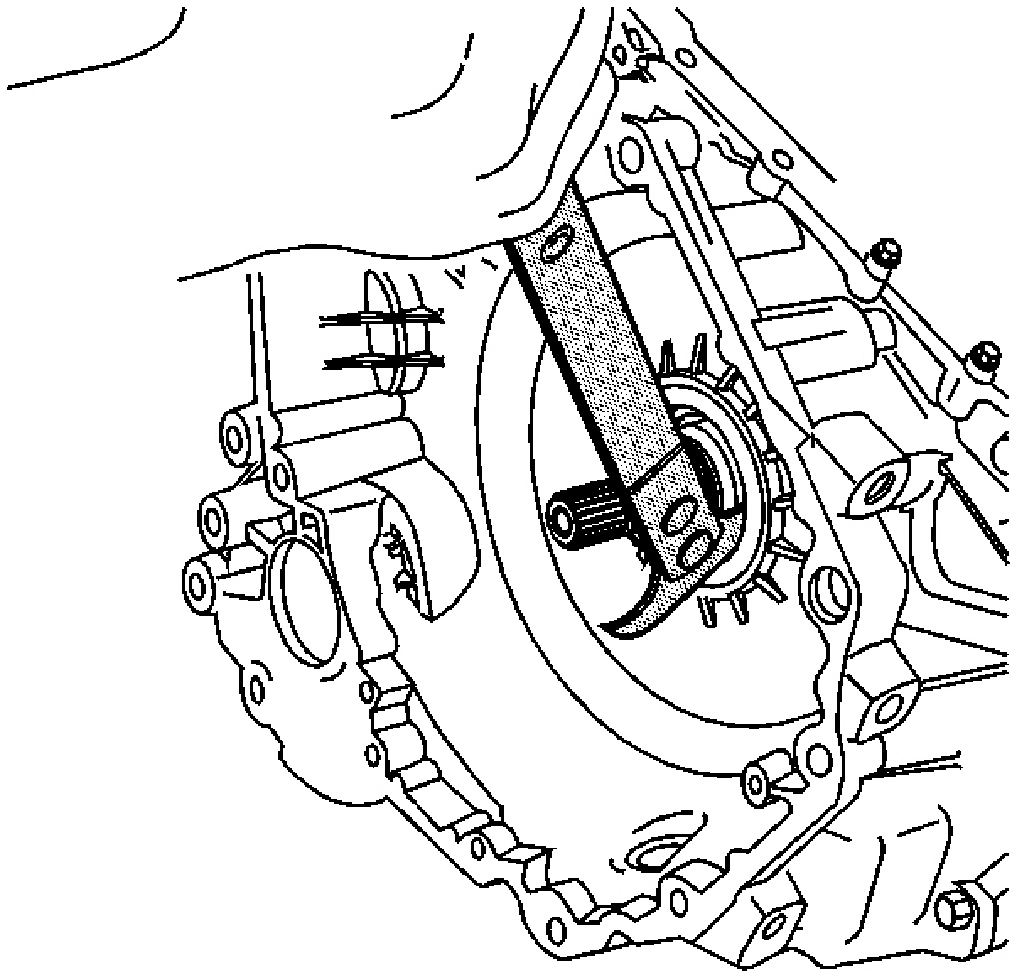


Fig. 198: Removing Converter Seal Assembly Using J 45000
Courtesy of GENERAL MOTORS CORP.

NOTE: **Use care when removing the seal in order to prevent damage to the torque converter and differential housing assembly.**

IMPORTANT: **Discard the seal after removal. Do not reuse the seal.**

1. Using the **J 45000** , remove the converter seal assembly from the torque converter and differential housing assembly.

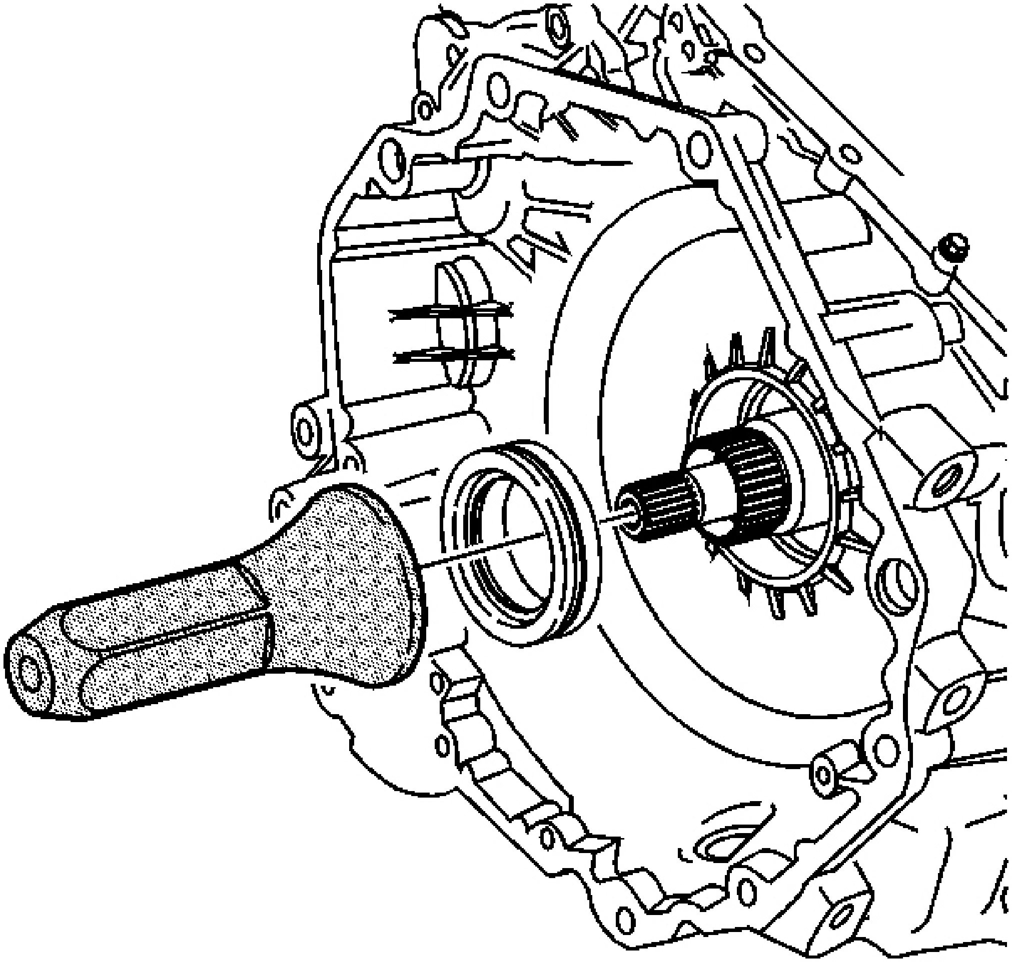


Fig. 199: Installing Converter Seal Assembly Using 43069
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: **Using the J 36850 , lubricate the converter seal for ease of installation.**

See Special Tools and Equipment .

2. Using the **J 43069** , install a new converter seal assembly on the torque converter and differential housing assembly. See **Special Tools and Equipment** .

PARK/NEUTRAL POSITION SWITCH REMOVAL

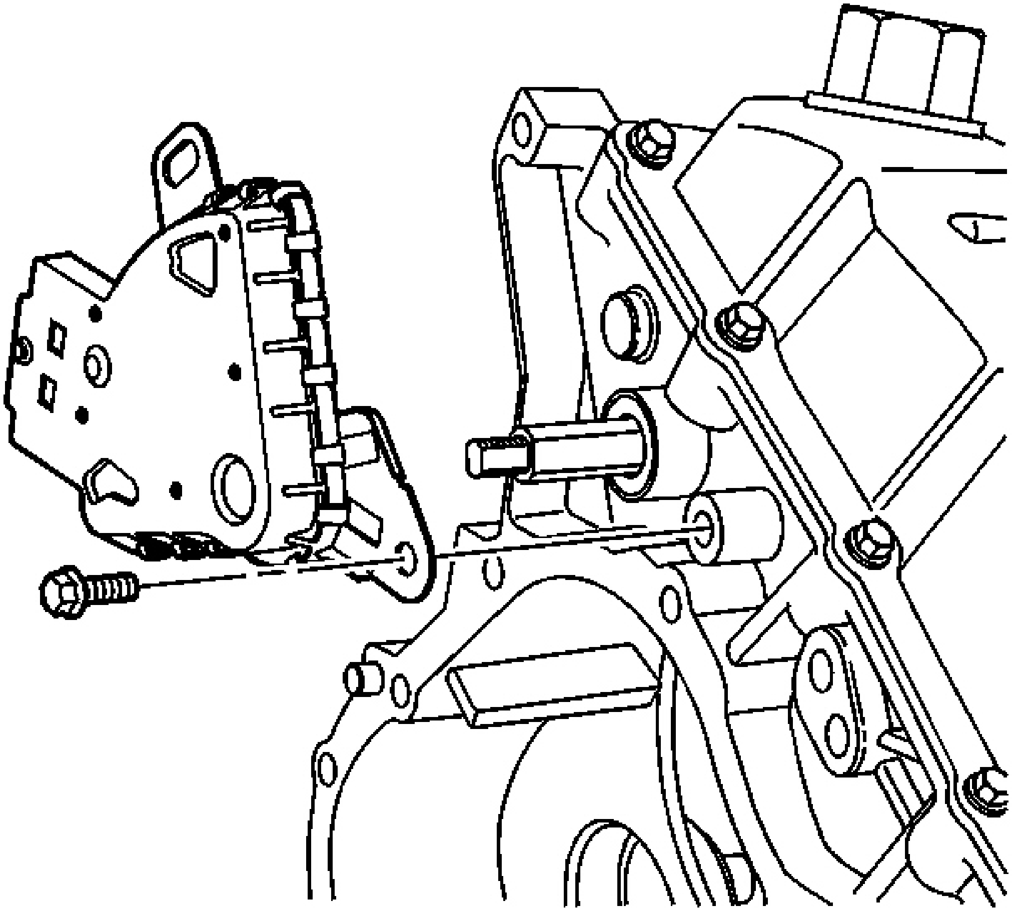
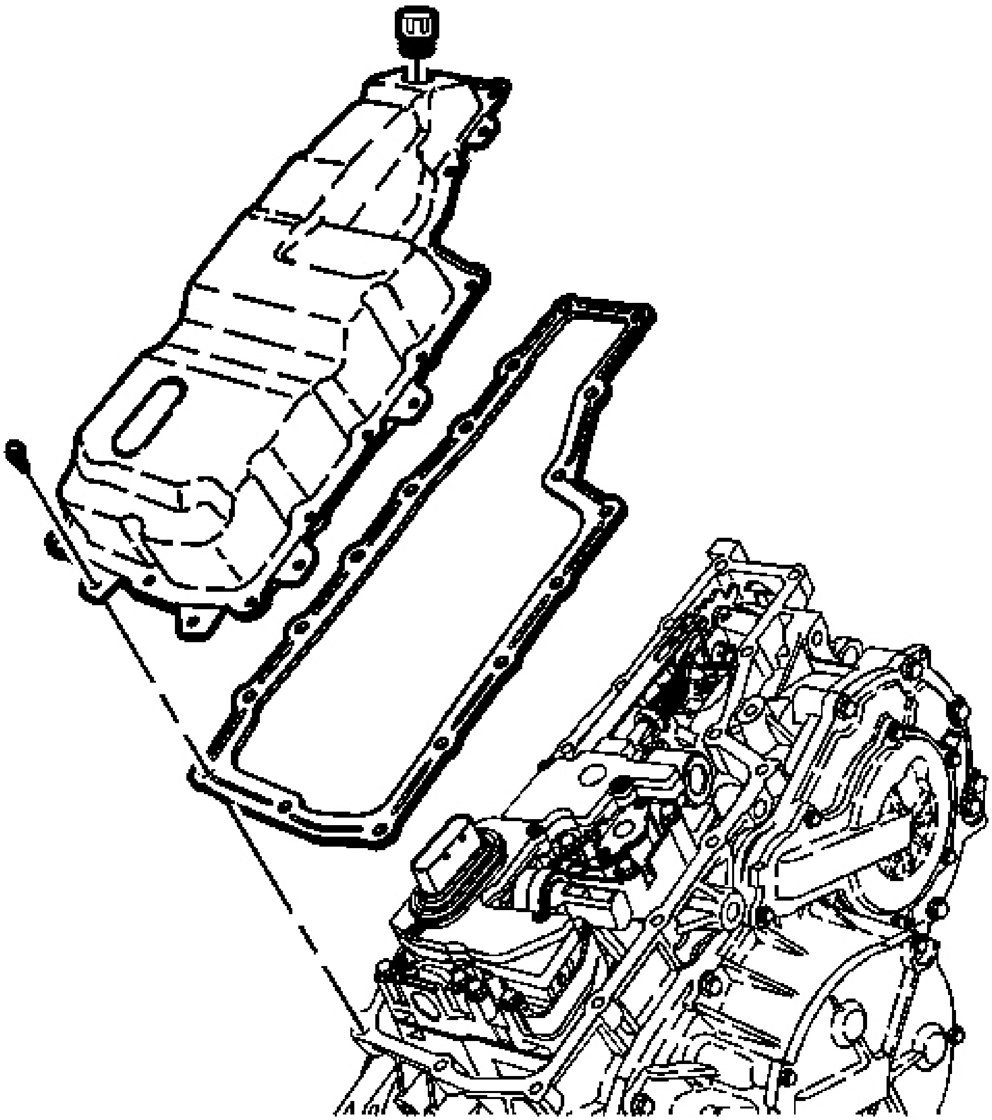


Fig. 200: Park/Neutral Position Switch Assembly & Bolts
Courtesy of GENERAL MOTORS CORP.

Remove the 2 bolts and the park/neutral position switch assembly from the transmission case assembly.

CONTROL VALVE BODY COVER REMOVAL



<u>**Fig. 201: Control Valve Body Cover, Gasket & Transmission Vent Cap**</u>
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission vent cap.
2. Remove the 17 bolts from the control valve body cover.
3. Remove the control valve body cover.
4. Remove the control valve body cover gasket. Discard the gasket.

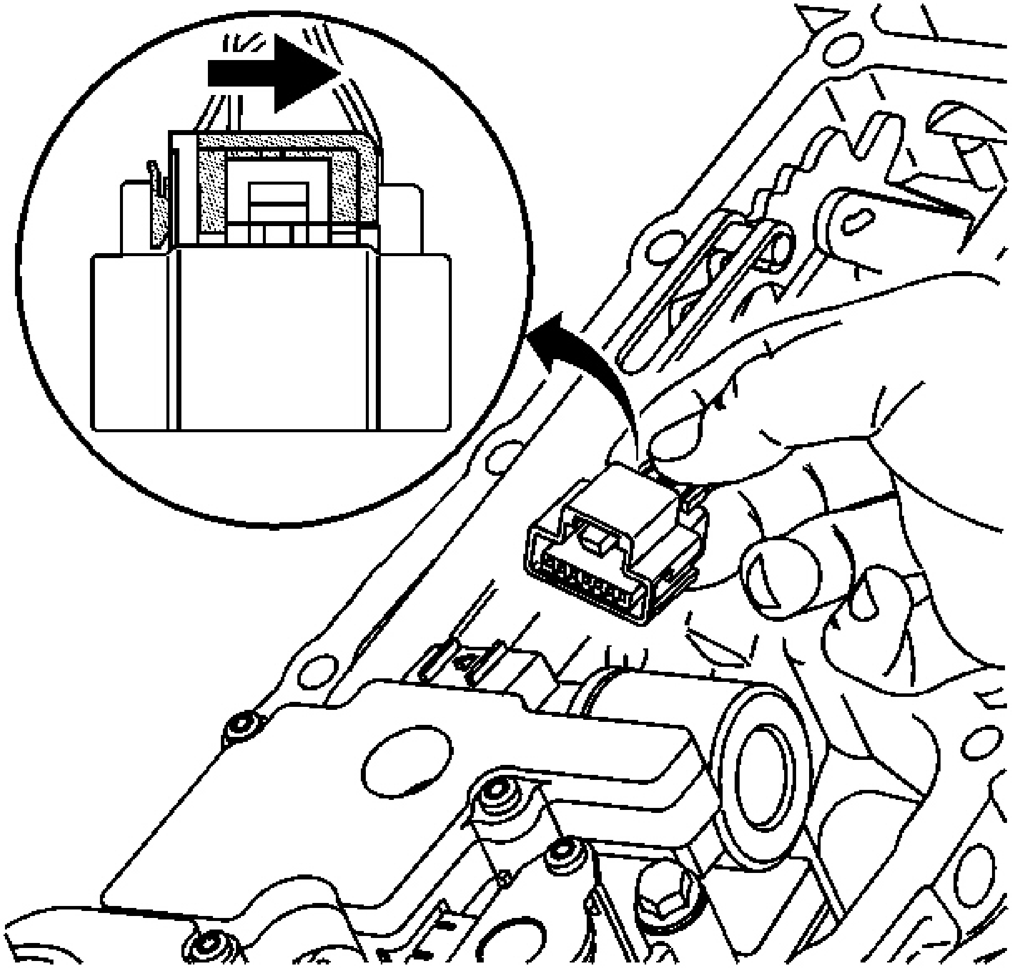


Fig. 202: Unlocking The Connector For Input & Output Speed Sensor
Courtesy of GENERAL MOTORS CORP.

1. Slide the grey locking clip in order to unlock the connector for the input and output speed sensor assembly.
2. Press the connector tab and remove the connector for the input and output speed sensor assembly from the control valve body assembly.

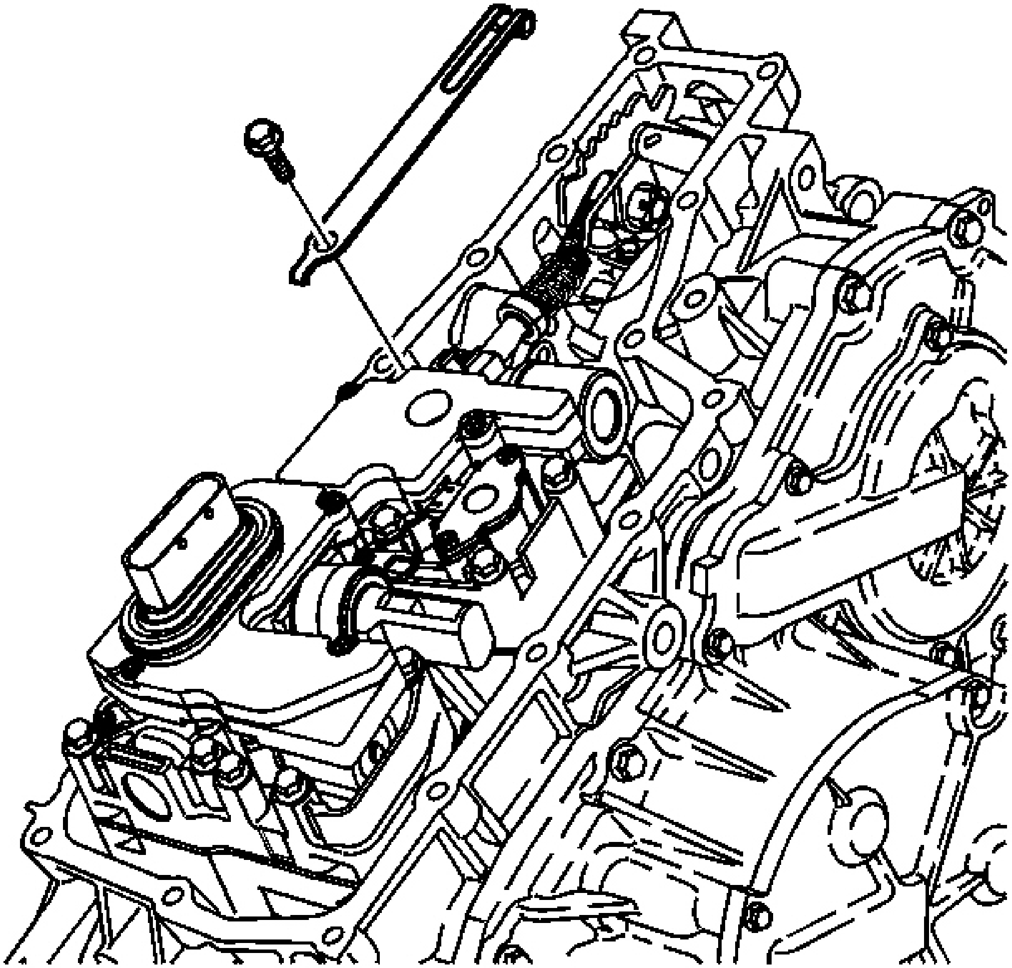


Fig. 203: Manual Shaft Detent & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the bolt and manual shaft detent assembly from the control valve body assembly.

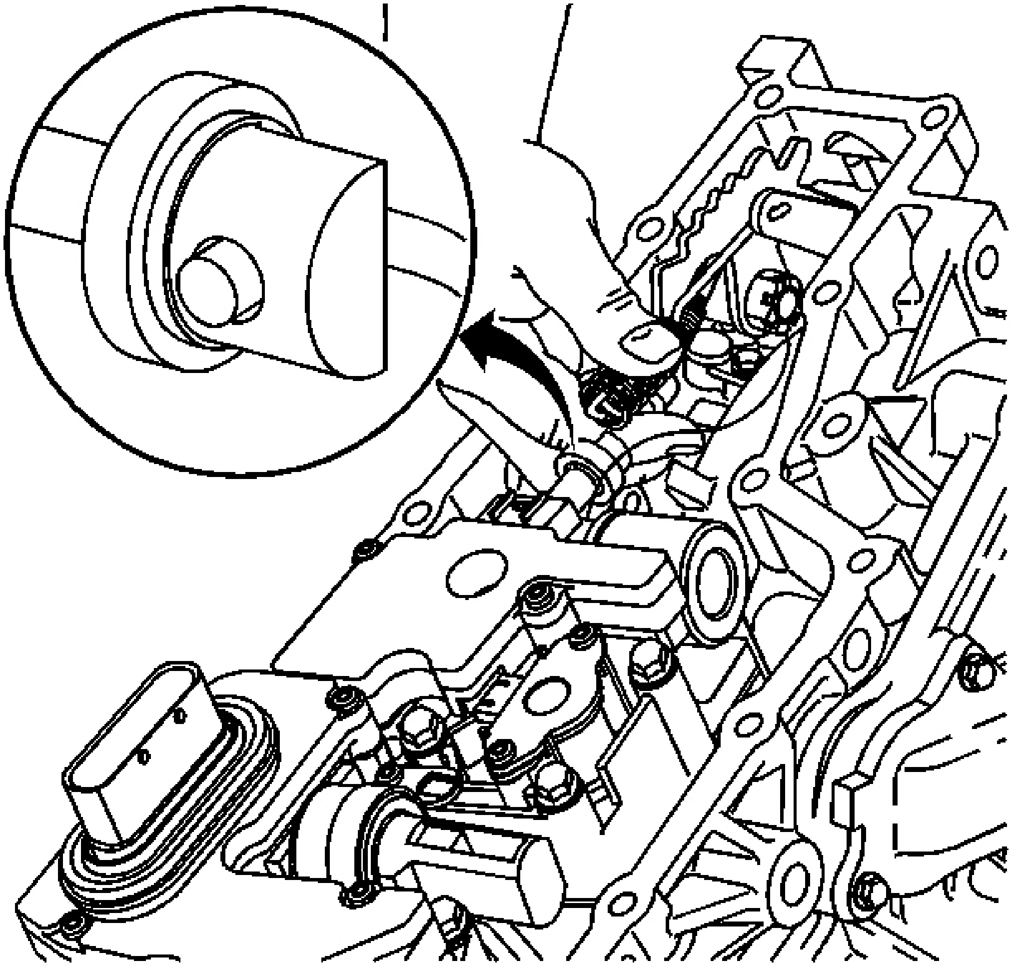


Fig. 204: Manual Valve Link
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the manual valve link assembly from the manual valve.

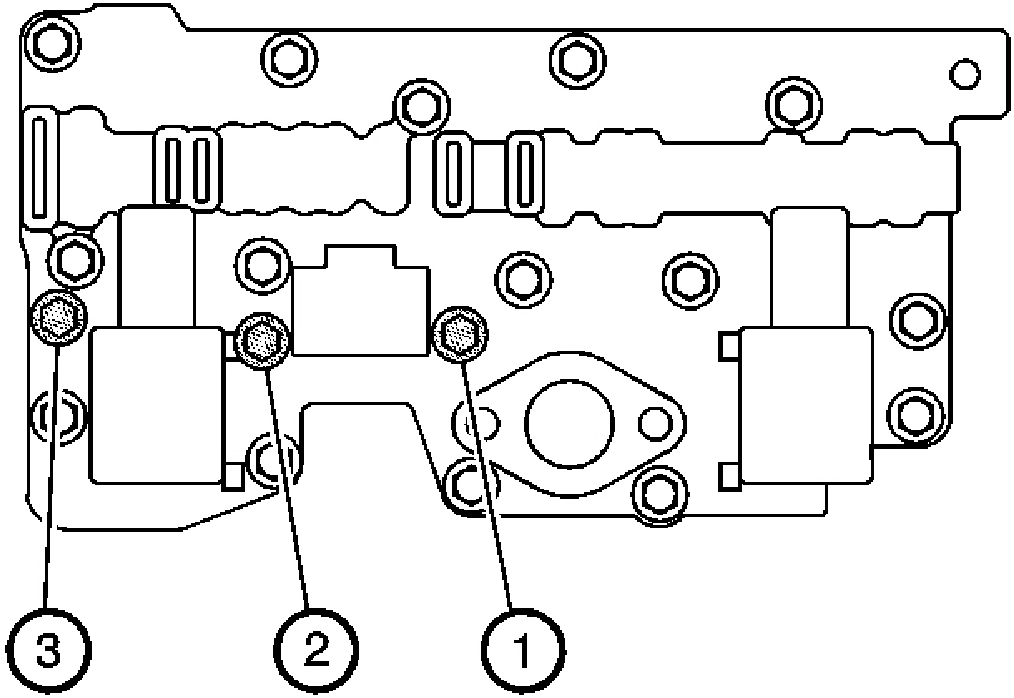


Fig. 205: Transmission Case Assembly Tightening Silver Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

5. Remove the 3 silver bolts from the control valve body assembly.

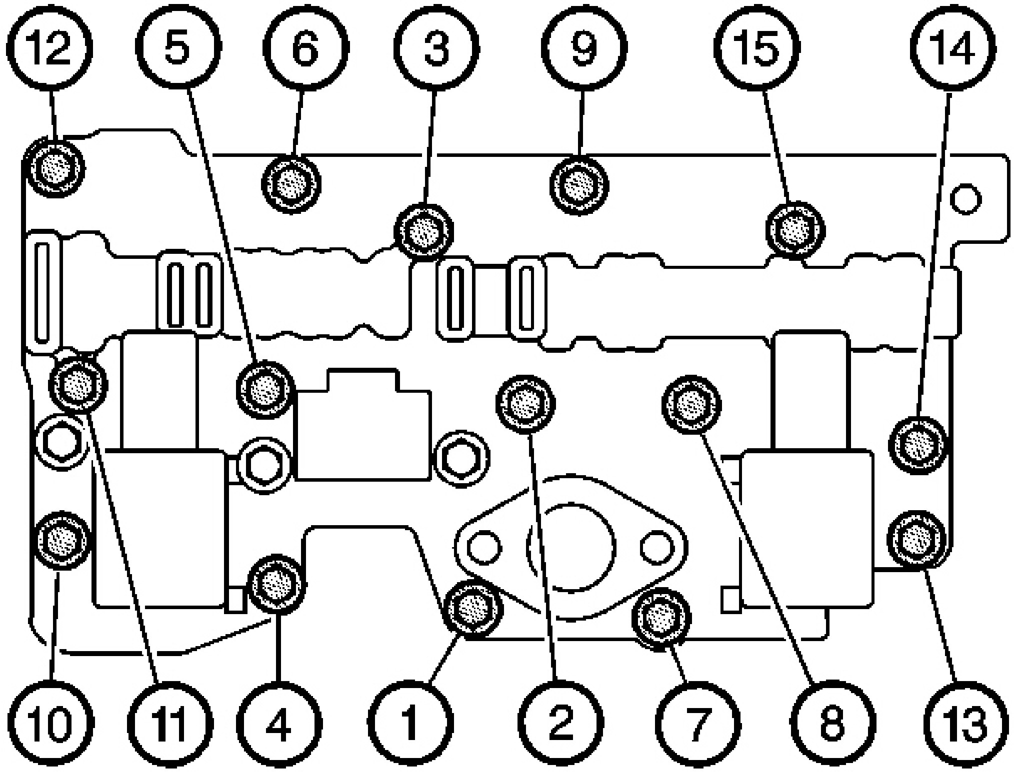


Fig. 206: Transmission Case Assembly Black Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use care when removing the control valve body assembly. The control solenoid valve assembly and the control valve body assembly may separate.

6. Remove the 15 black bolts from the control valve body assembly.

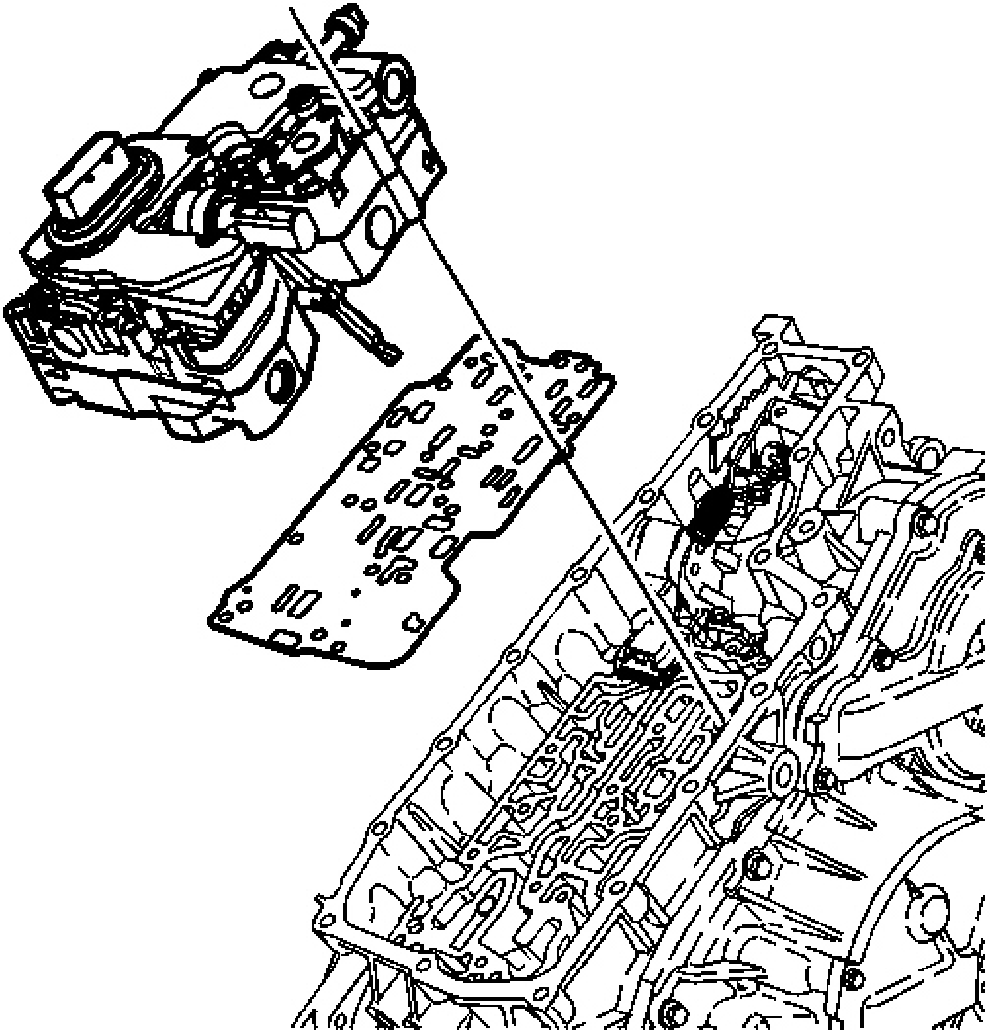


Fig. 207: Control Valve Body, Transmission Case & Spacer Plate
Courtesy of GENERAL MOTORS CORP.

7. Remove the control valve body assembly from the transmission case assembly.
8. Remove the spacer plate assembly. Discard the spacer plate assembly.

INPUT AND OUTPUT SPEED SENSOR ASSEMBLY REMOVAL

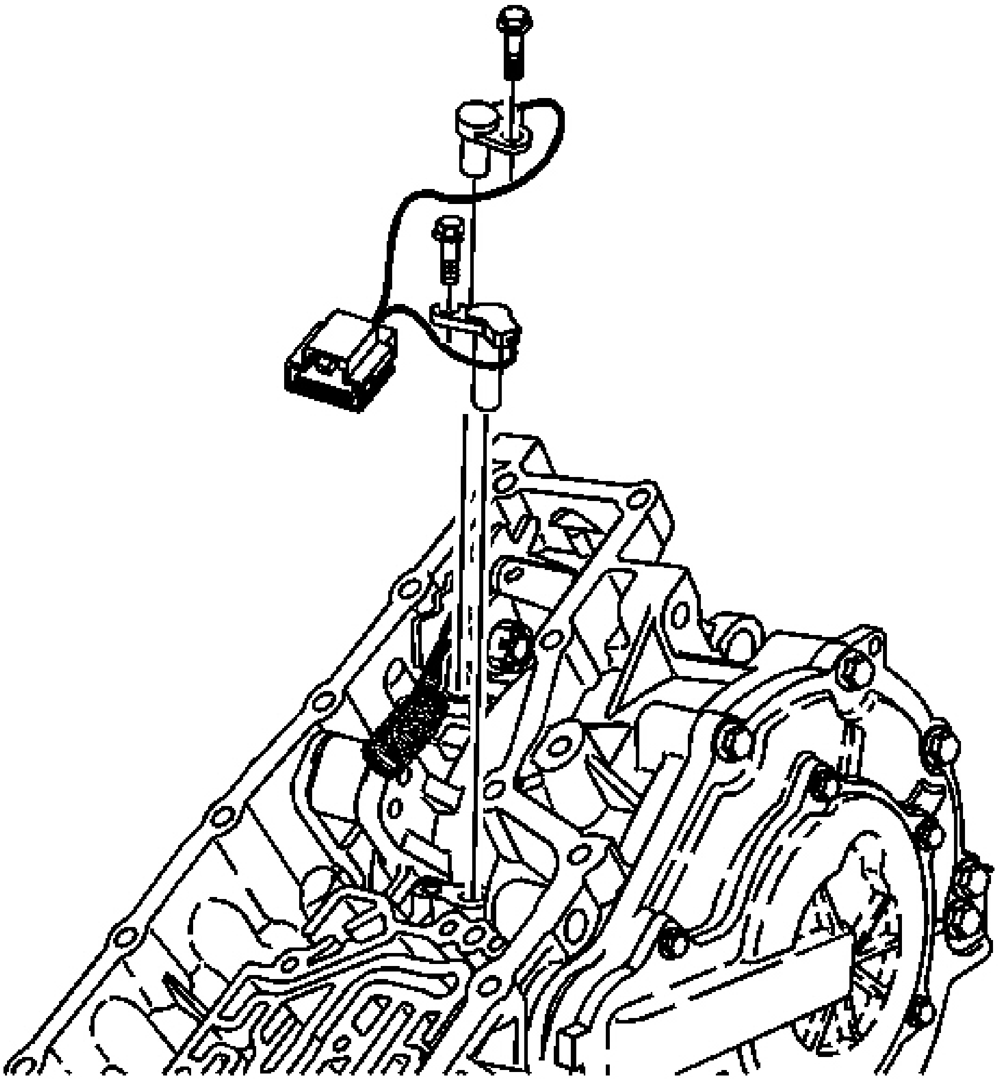


Fig. 208: Transmission Case, Bolts, Input & Output Speed Sensor
Courtesy of GENERAL MOTORS CORP.

Remove the 2 bolts and the input and output speed sensor assembly from the transmission case assembly.

CASE COVER ASSEMBLY REMOVAL

Tools Required

- **J 43969** Case Cover Lifting Bracket. See **Special Tools and Equipment** .
- **J 44337** Build Plate Assembly. See **Special Tools and Equipment** .

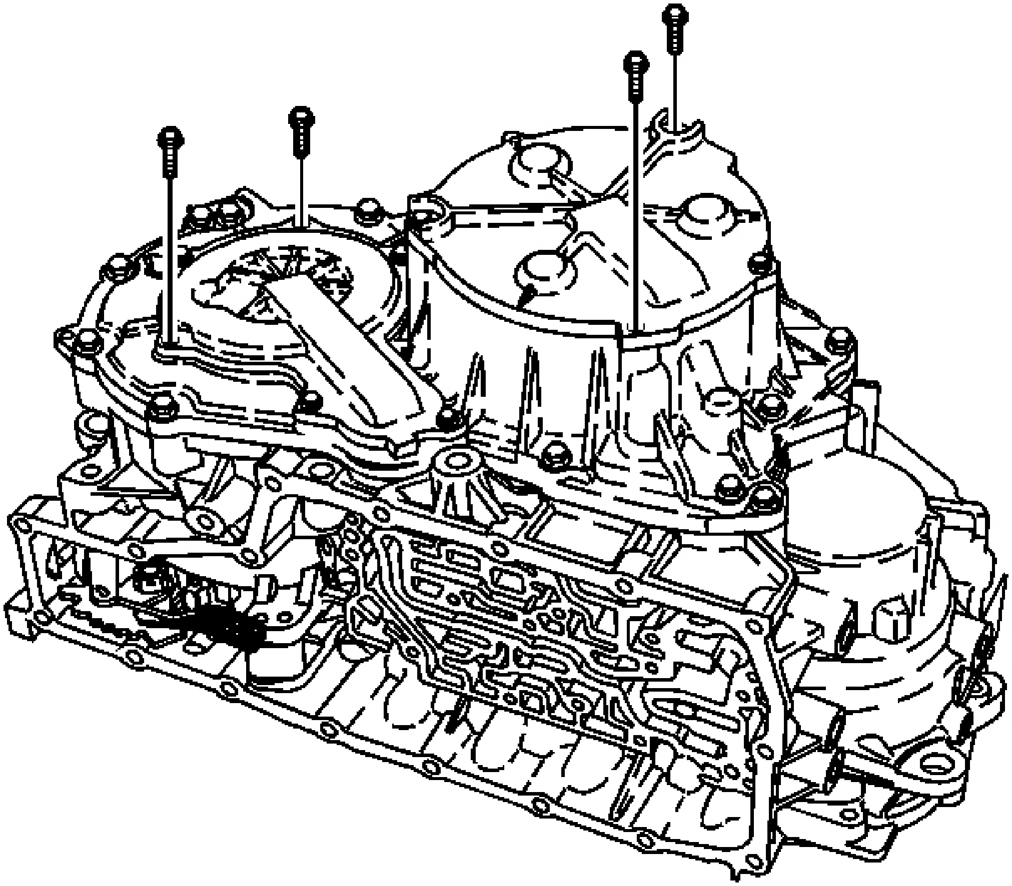


Fig. 209: 2 Bolts & Driven Pulley Cover
Courtesy of GENERAL MOTORS CORP.

NOTE:	**The control valve body assembly must be removed before removing the case cover assembly. Failure to follow this instruction may result in damage to the variable ratio control lever.**

1. Remove the 2 bolts from the driven pulley cover.
2. Remove the 2 bolts from the drive pulley cover.

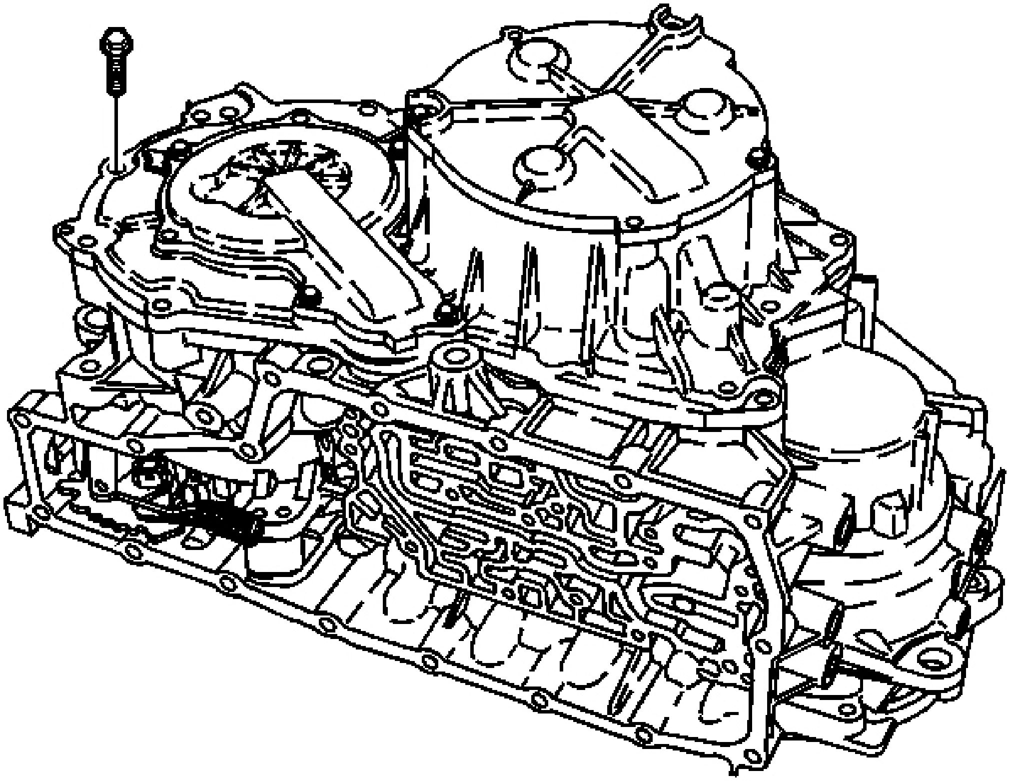


Fig. 210: Case Cover Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the 14 case cover bolts.

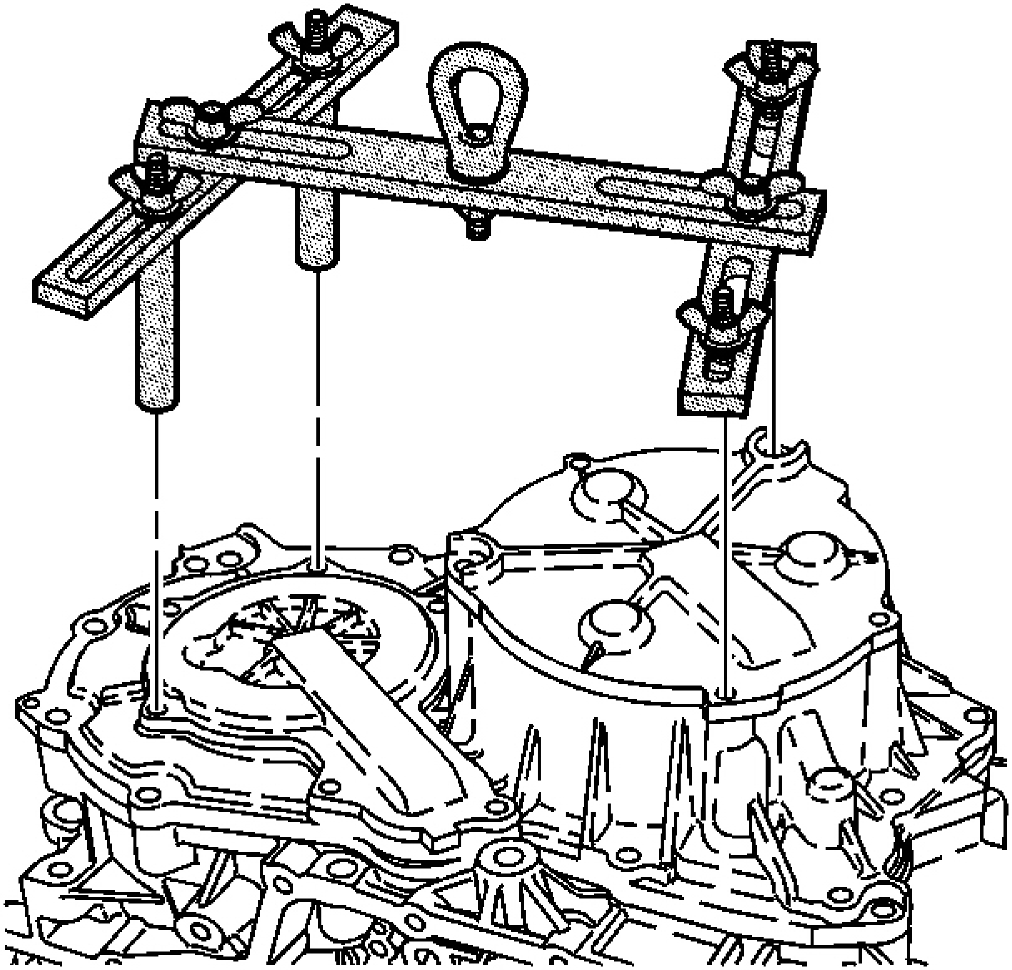


Fig. 211: J 43969, Two Open Bolt Holes & Drive Pulley Cover
Courtesy of GENERAL MOTORS CORP.

4. Attach the shorter legs of the **J 43969** to the two open bolt holes on the drive pulley cover. See **Special Tools and Equipment** .
5. Attach the longer legs of the **J 43969** to the two open bolt holes on the driven pulley cover. See **Special Tools and Equipment** .

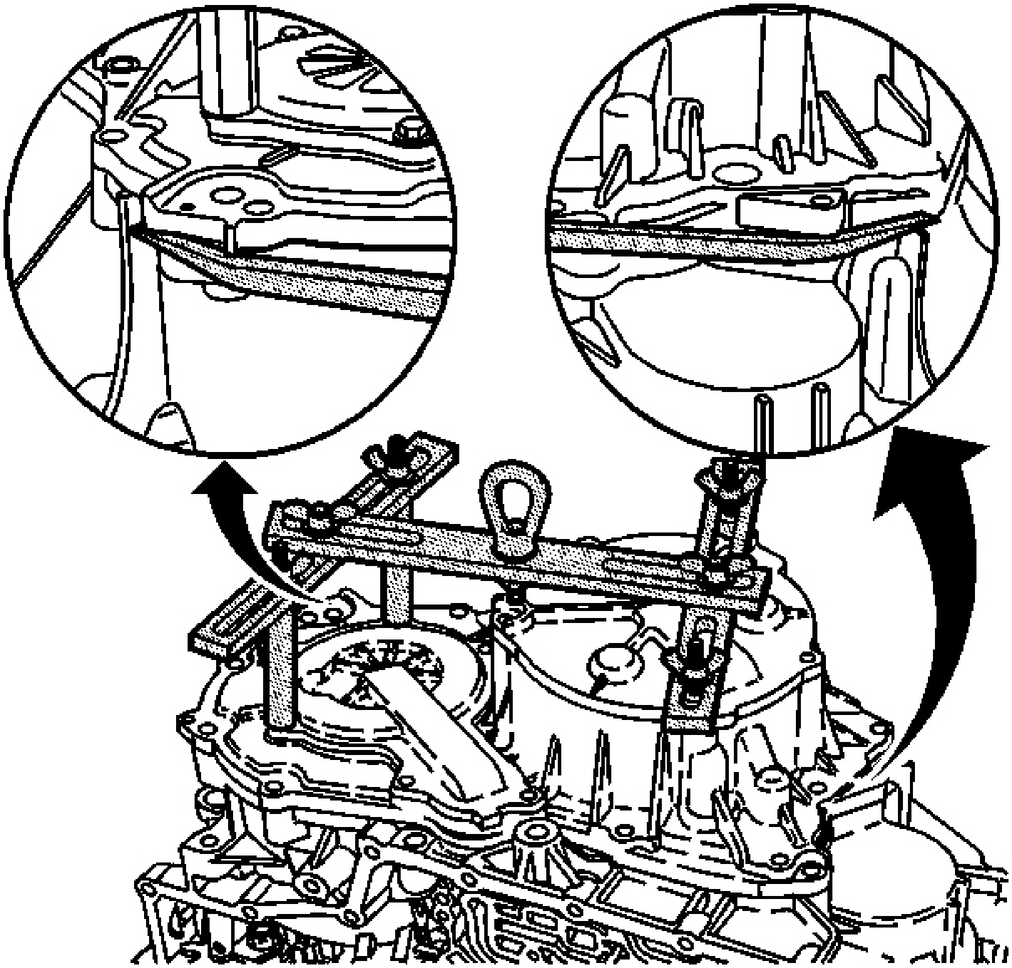


Fig. 212: Using A Pry Bar To Separate The Case Cover From Transmission Case
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: There are two pry points on the case cover assembly.

IMPORTANT: The seal between the case cover assembly and the transmission case assembly is tight.

6. Use a pry bar in order to separate the case cover assembly from the transmission case assembly.

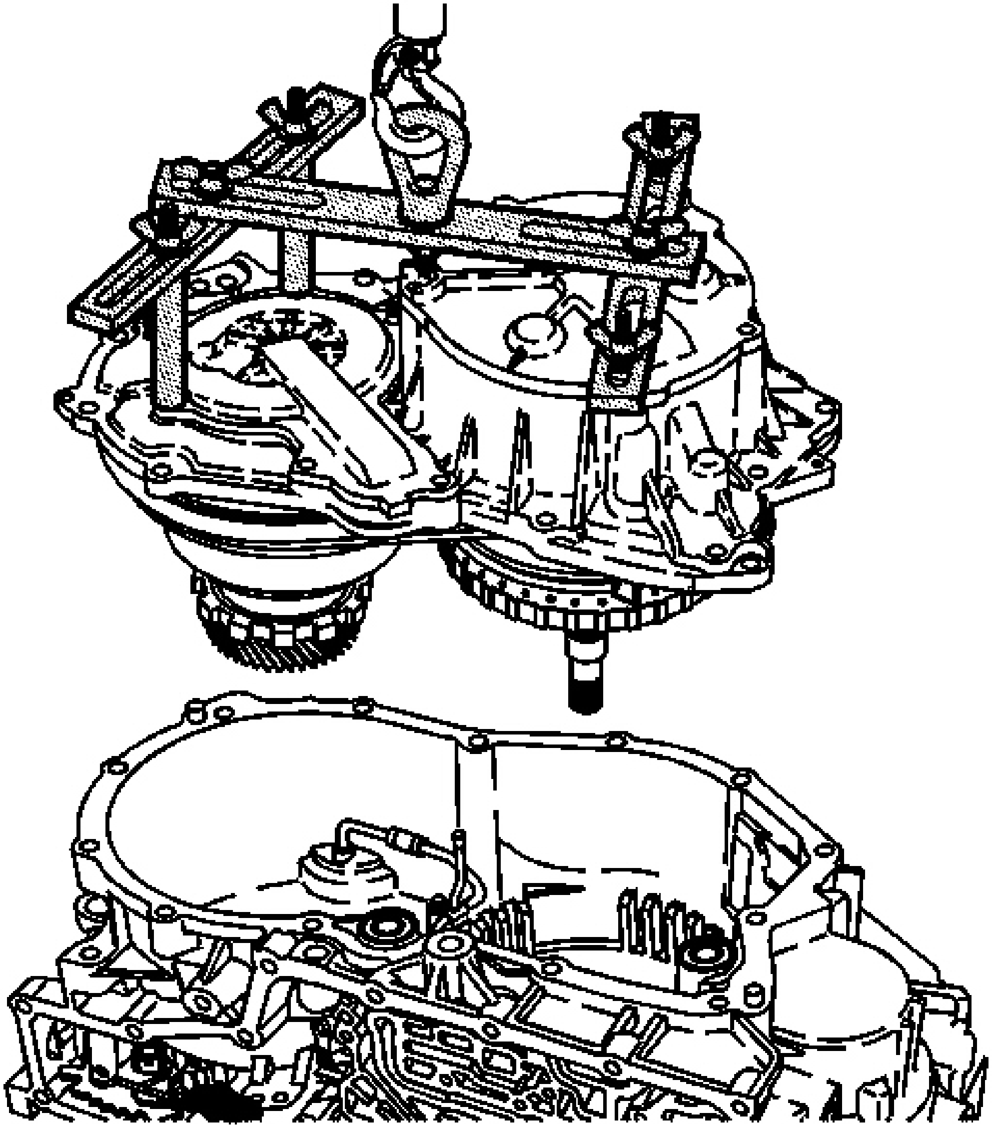


Fig. 213: Carefully Lift The Case Cover Assembly Using A Lifting Device
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The J 43969 may require adjustment when lifting the case cover assembly. See Special Tools and Equipment .

7. Using a suitable lifting device, carefully remove the case cover assembly.

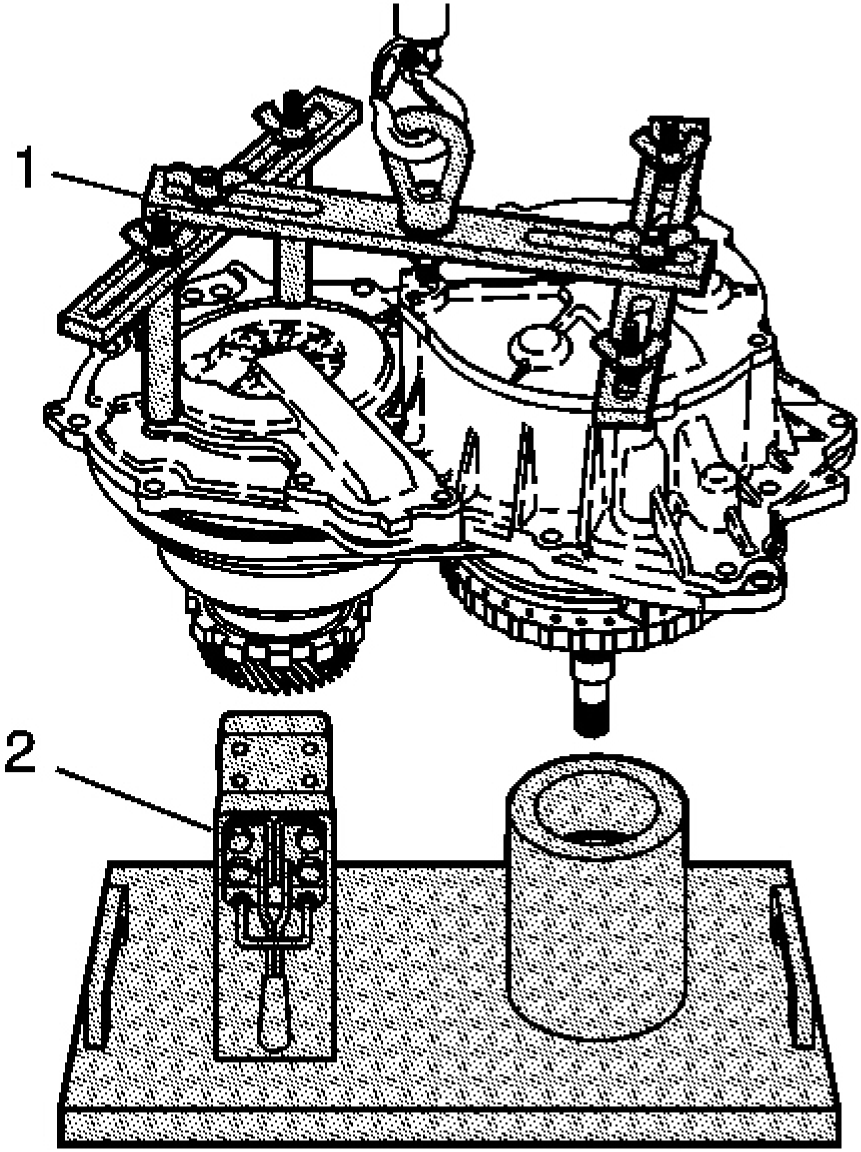


Fig. 214: Lower The Case Cover Assembly Into
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The reverse clutch hub assembly and thrust washer may be stuck to the case cover assembly. Remove these components before installing the case cover assembly into the J 44337 (2). See Special Tools and

Equipment .

8. Lower the case cover assembly, with forward clutch and input shaft, into the**J 44337** (2). See **Special Tools and Equipment** .
9. Remove the **J 43969** (1). See **Special Tools and Equipment** .

CASE COVER ASSEMBLY DISASSEMBLE

Tools Required

J 44337 Build Plate Assembly. See **Special Tools and Equipment** .

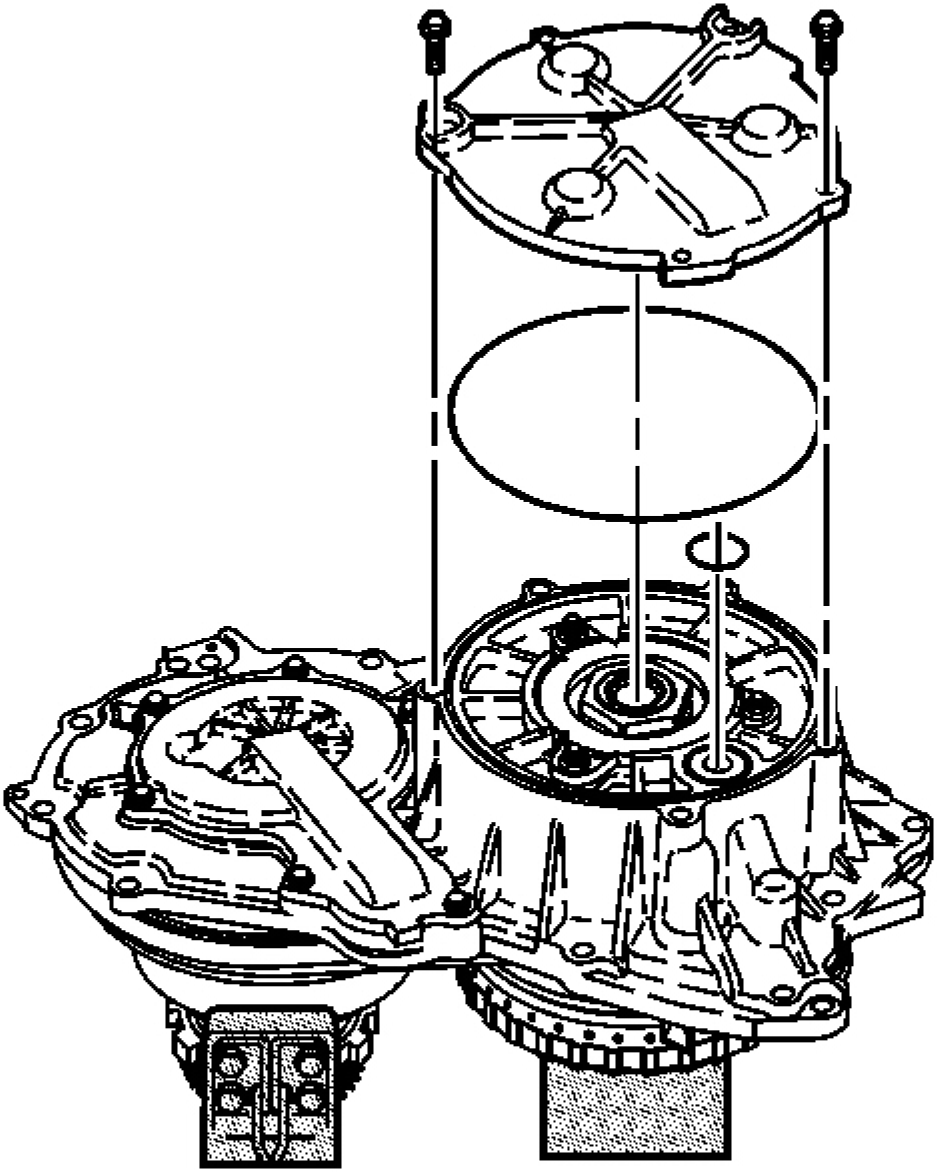


Fig. 215: Drive Pulley Cover, Bolts & Case Cover Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the 2 remaining bolts and the drive pulley cover from the case cover assembly.
2. Remove the 2 drive pulley cover seals. Discard the seals.

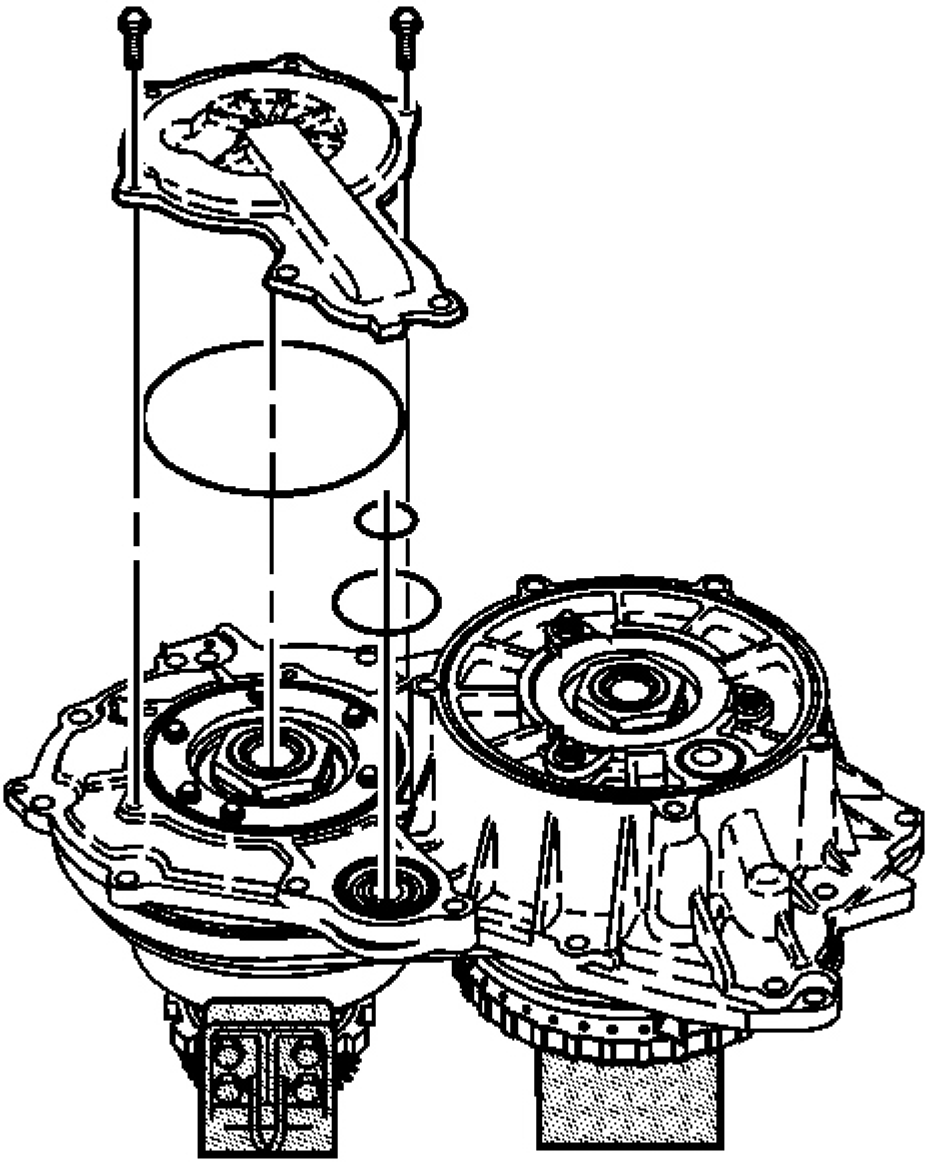


Fig. 216: 2 Driven Pulley Cover Seals, Case Cover O-Ring Seal & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the 2 remaining bolts and the driven pulley cover from the case cover assembly.
4. Remove the 2 driven pulley cover seals and the case cover O-Ring seal. Discard the seals.

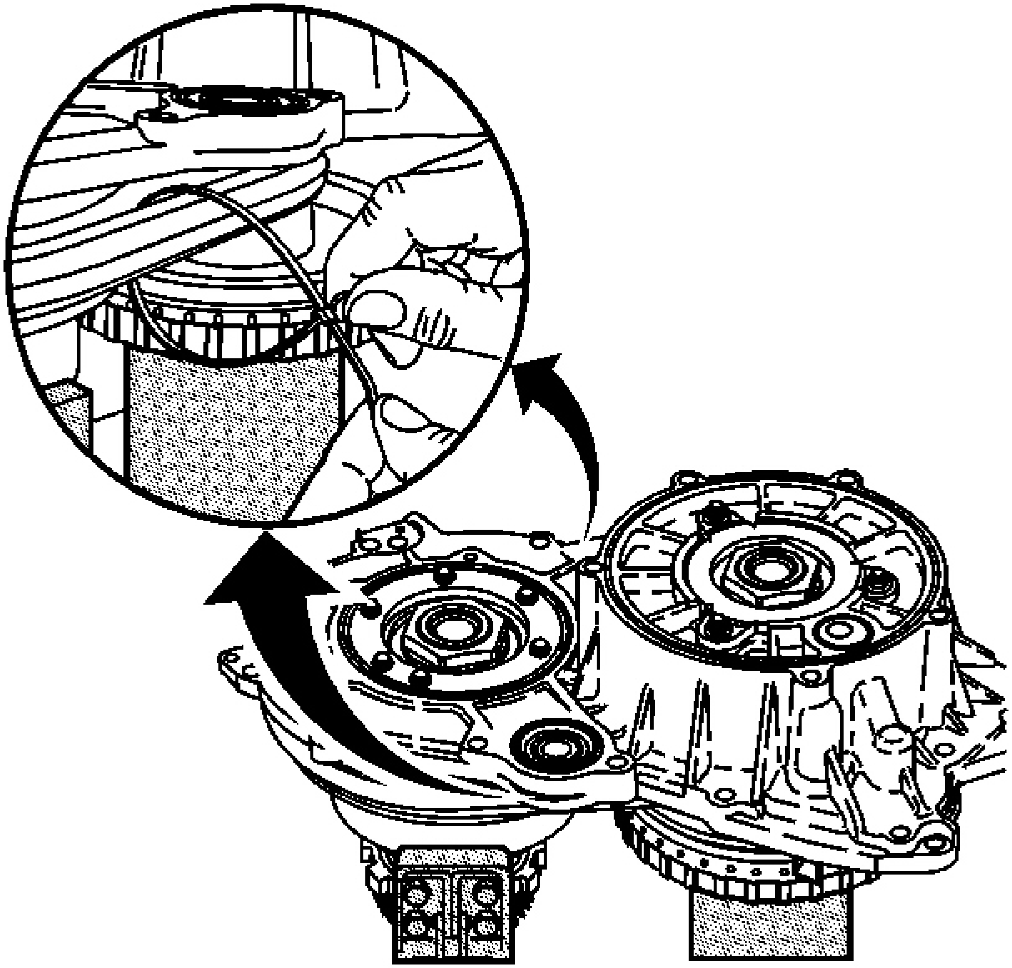


Fig. 217: Installing A Tie Strap On Each Side Of Belt Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure the belt assembly is properly secured with two tie straps. If the belt assembly is not properly secured, the belt elements and ringset may separate.

5. Install a tie strap on each side of the belt assembly.

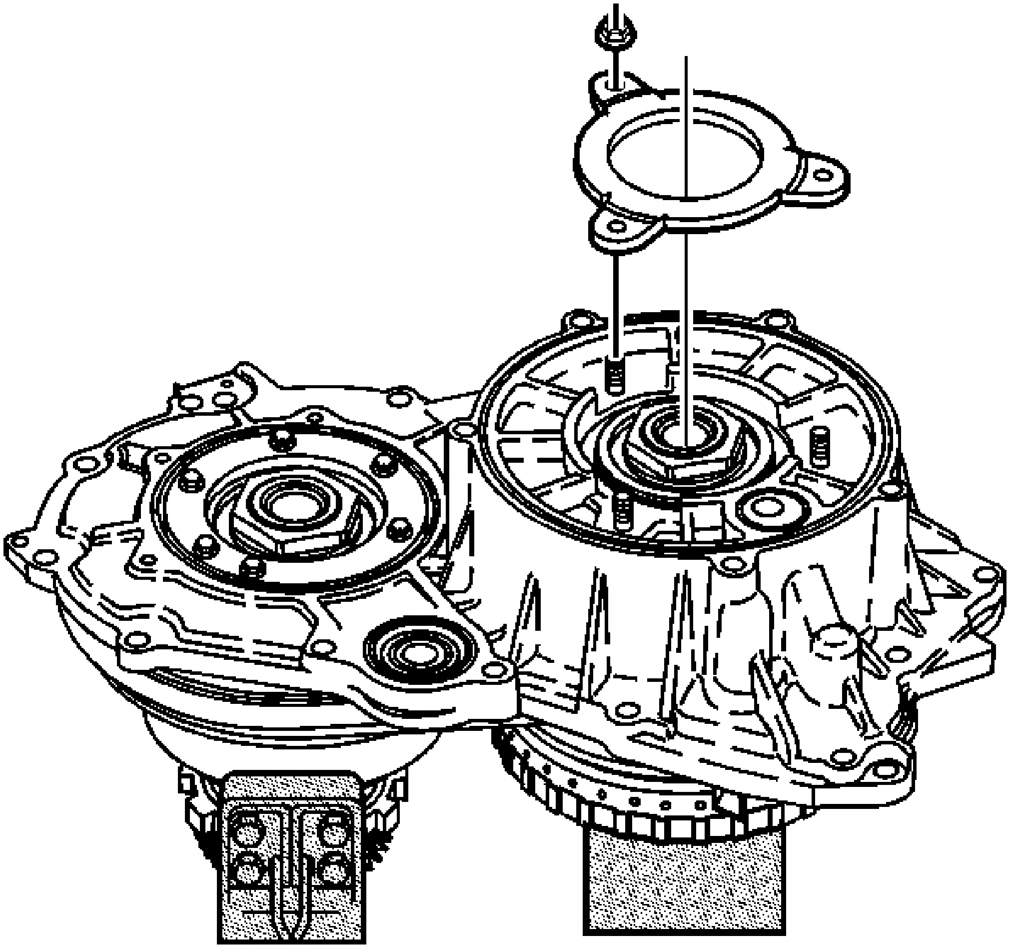


Fig. 218: Drive Pulley Bearing Retainer & Nut
Courtesy of GENERAL MOTORS CORP.

6. Remove the 3 nuts and the drive pulley bearing retainer.

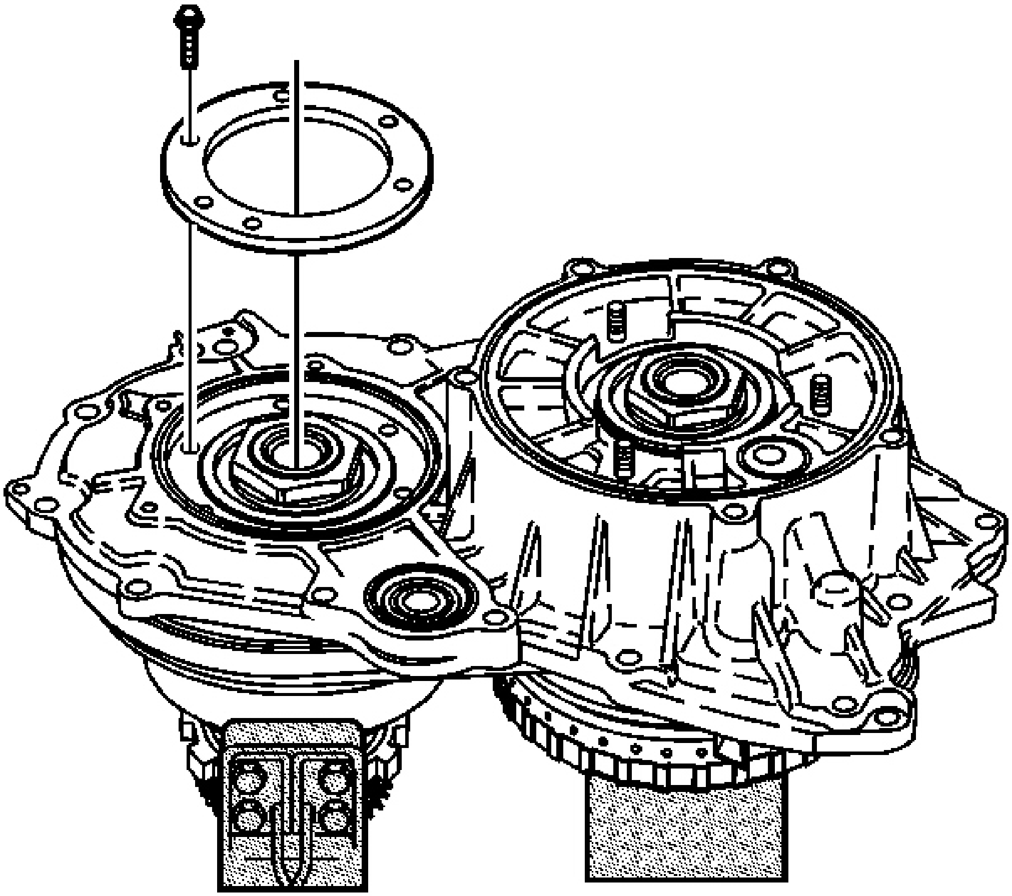


Fig. 219: Driven Pulley Bearing Retainer & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the 6 bolts and the driven pulley bearing retainer.

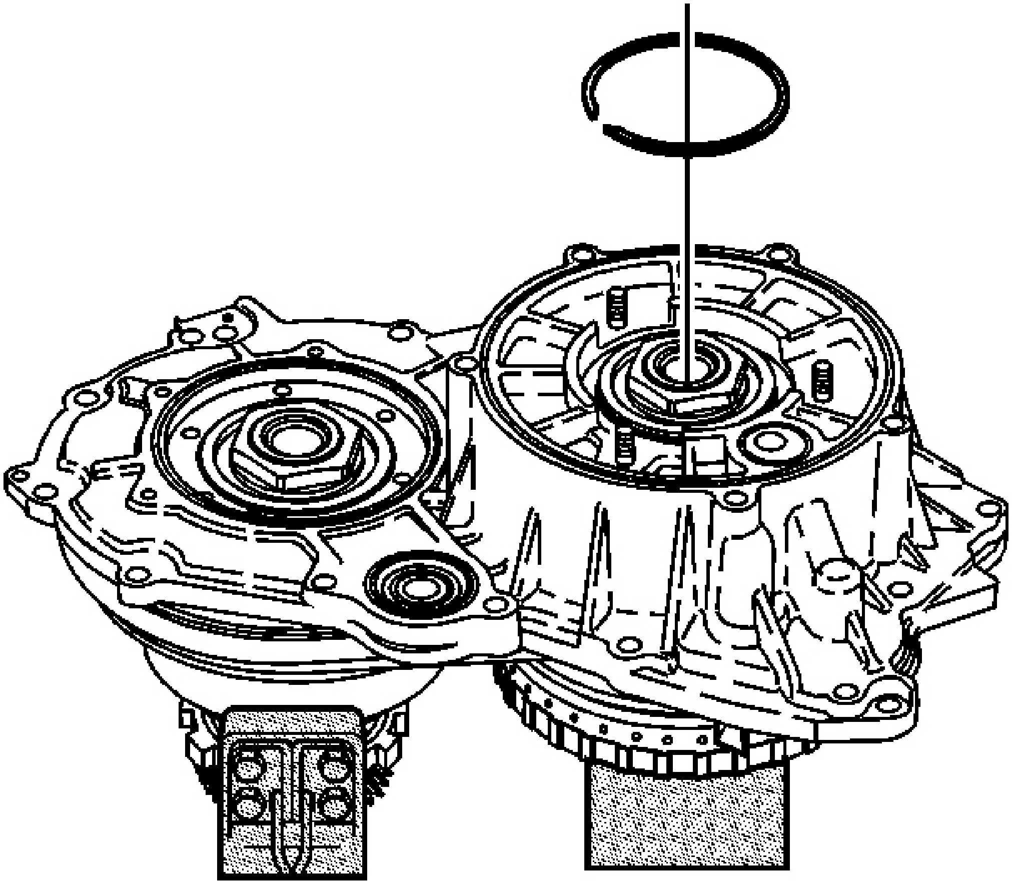


Fig. 220: Drive Pulley Bearing & Retaining Ring
Courtesy of GENERAL MOTORS CORP.

8. Remove the retaining ring for the drive pulley bearing.

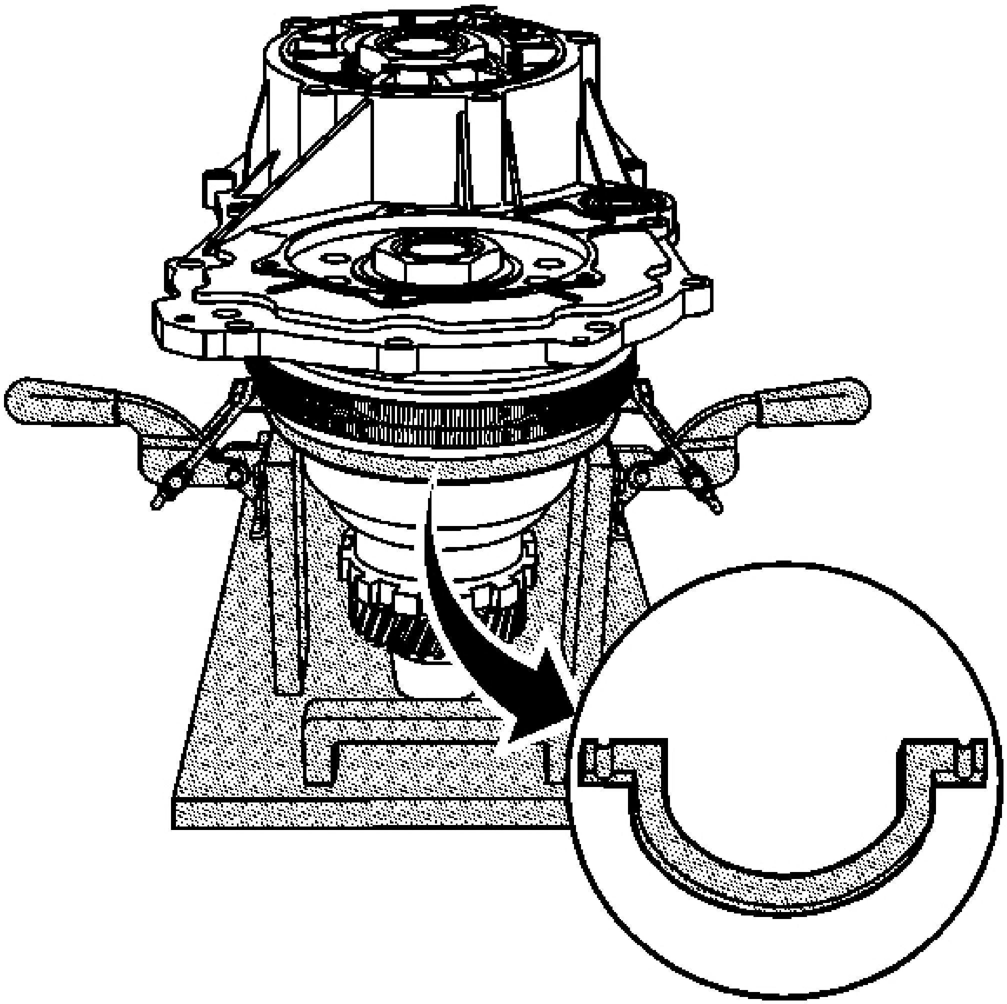


Fig. 221: U-Shaped Ring & J 44337
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: When positioning the U-shaped ring of the J 44337 , ensure that the lip of the U-shaped ring is resting on the top edge of the driven pulley crimp. See Special Tools and Equipment .

9. Position the U-shaped ring of the **J 44337** on the driven pulley assembly. See **Special Tools and Equipment** .
10. Position the clamp U-bolts of the **J 44337** in the slotted grooves of the U-shaped ring. See **Special Tools and Equipment** .

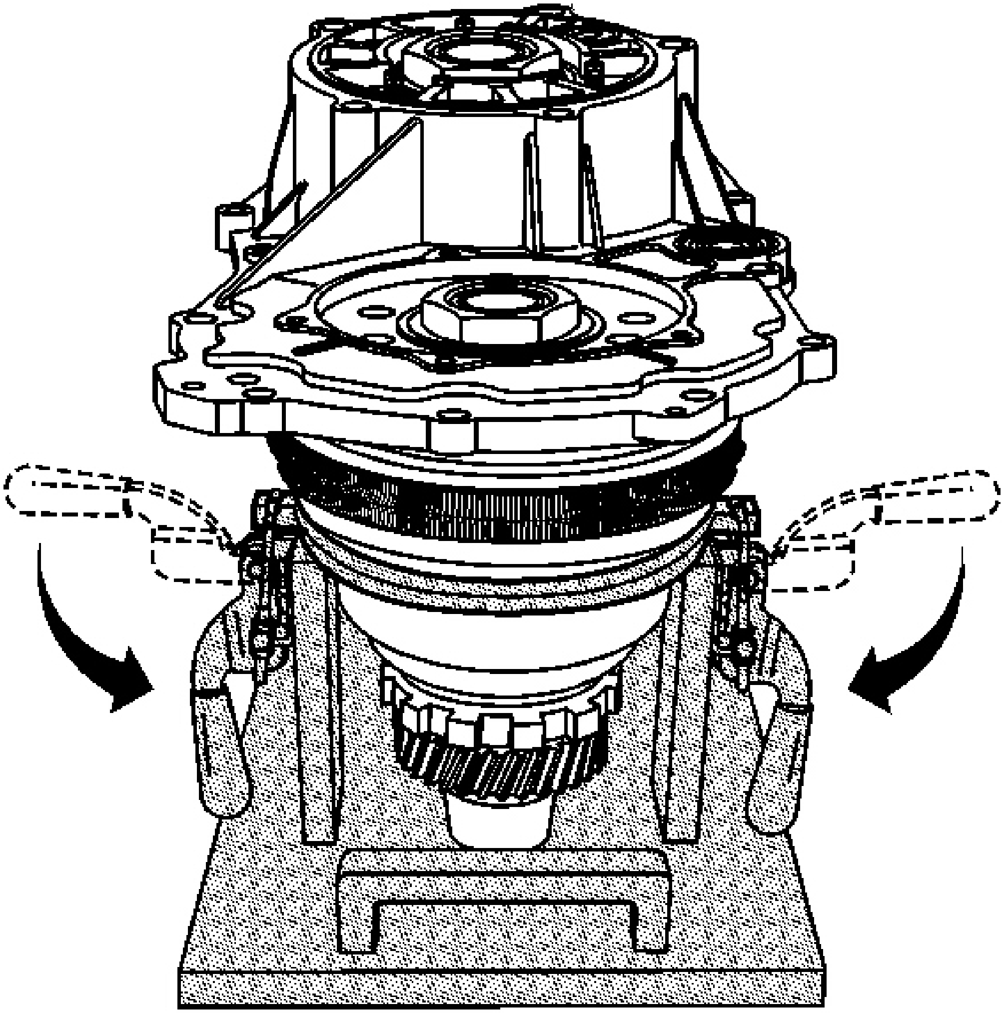


Fig. 222: Push Down On Clamp Handles With Equal Pressure In Order To Compress Driven Pulley Assembly
Courtesy of GENERAL MOTORS CORP.

11. Using both hands, push down on the clamp handles with equal pressure in order to compress the driven pulley assembly.

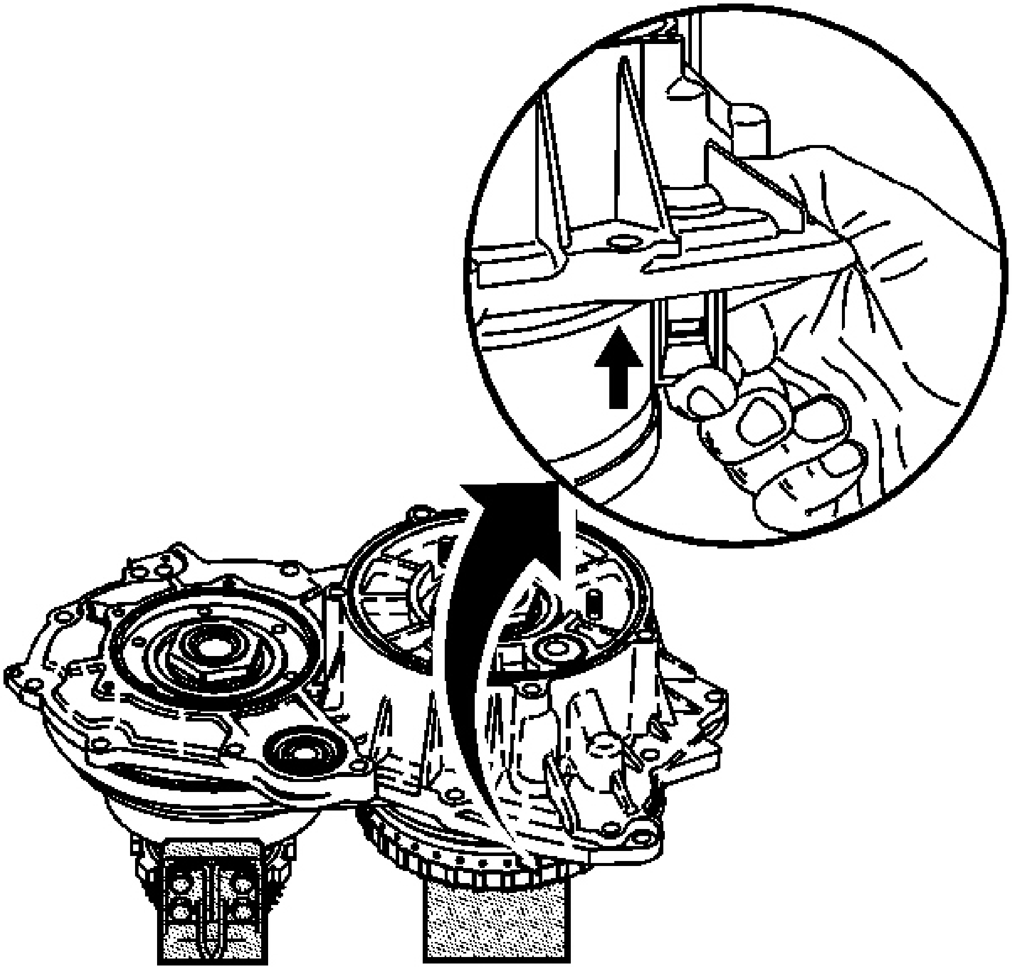


Fig. 223: Depressing The Follower
Courtesy of GENERAL MOTORS CORP.

12. Depress the follower and remove the case cover assembly.

DRIVE BELT REMOVAL

Tools Required

J 44337 Build Plate Assembly. See **Special Tools and Equipment** .

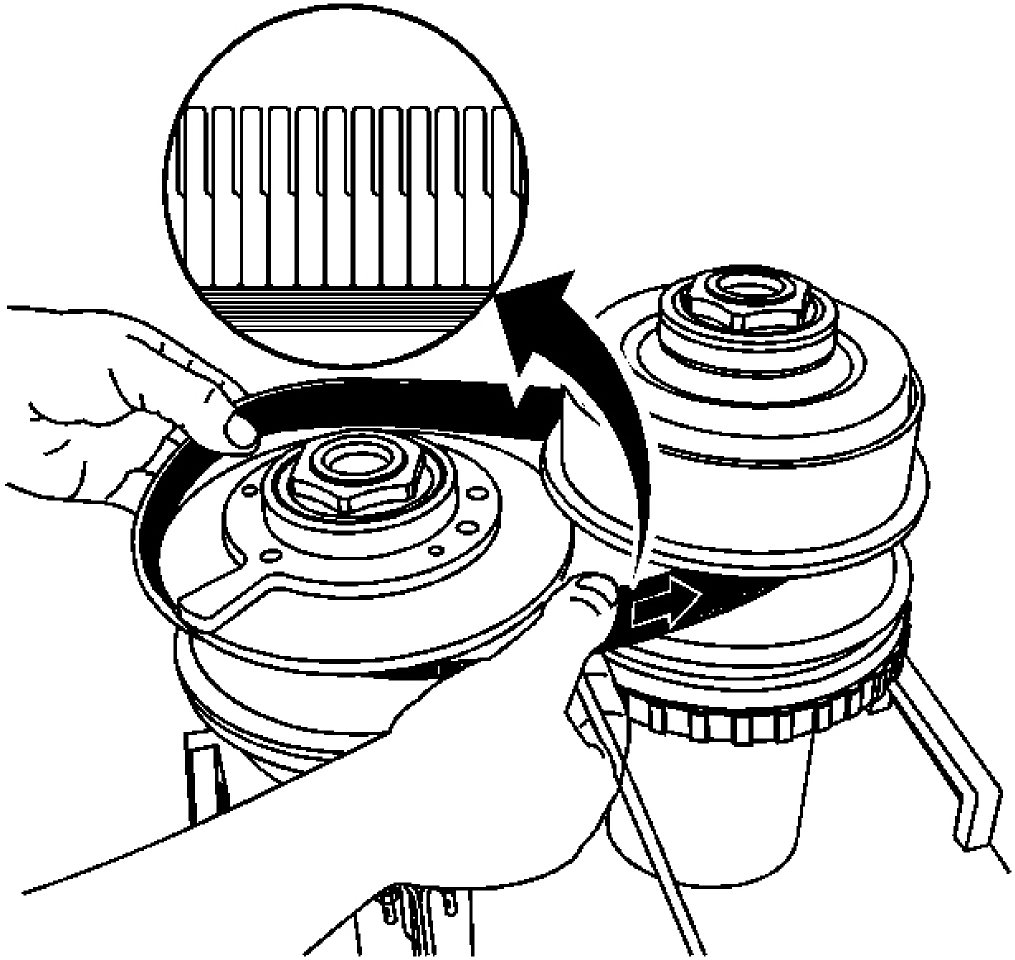


Fig. 224: Removing/Installing The Belt Assembly
Courtesy of GENERAL MOTORS CORP.

NOTE: **Use extreme care when handling the belt assembly. Avoid metal to metal contact with the sides of the belt ringsets. Do not disassemble the belt assembly. Damage to the ringsets may cause the belt to become inoperative.**

1. Carefully remove the belt assembly.

IMPORTANT: **Do not remove the tie straps from the belt assembly.**

2. Place the belt assembly in a clean, sealed plastic bag or box.

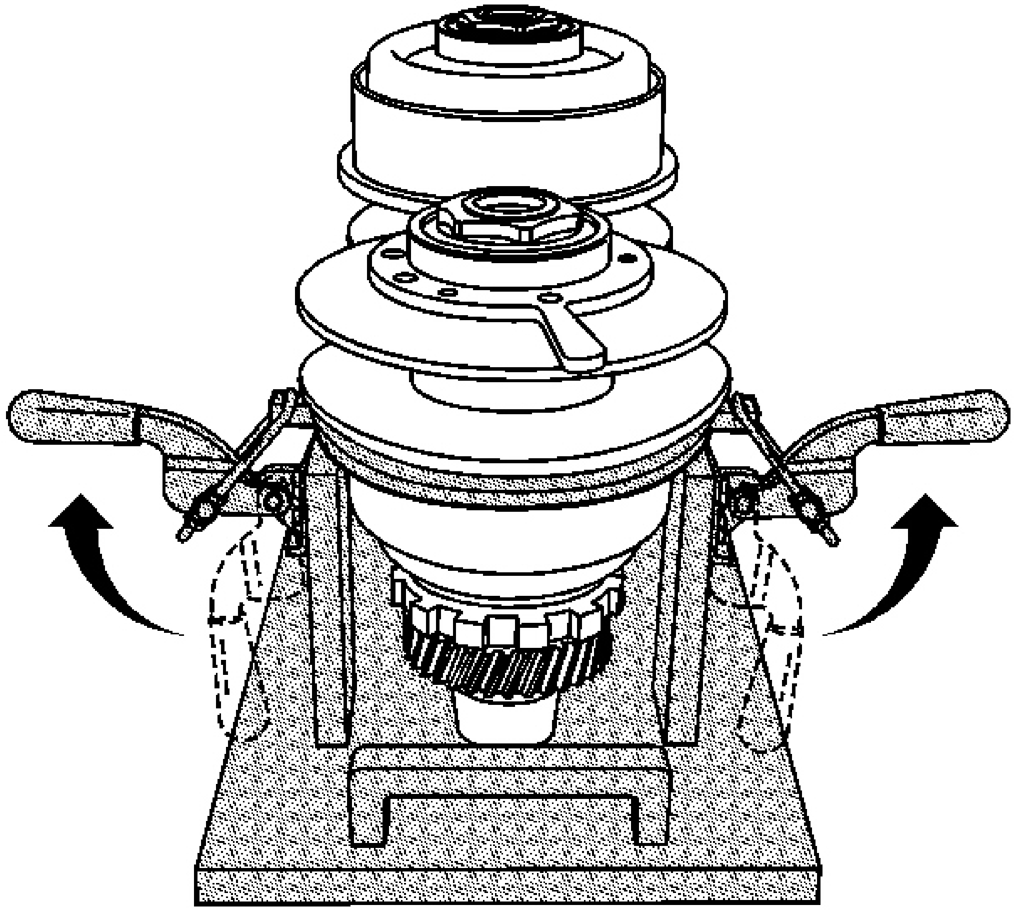


Fig. 225: Slowly Pull Up On Two Clamp Handles In Order To Release Spring Force On Driven Pulley Assembly Using J 4437
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not lean over the driven pulley assembly when releasing the spring force. Transmission fluid may squirt upward. Failure to follow this instruction may result in personal injury.

3. Place a rag over the top of the driven pulley assembly in order to prevent fluid from squirting upward.
4. Using the **J 44337** , slowly pull up on the two clamp handles in order to release the spring force on the driven pulley assembly. See **Special Tools and Equipment** .

REVERSE CLUTCH REMOVAL

Tools Required

- **J 23327** Clutch Spring Compressor
- **J 38734** Reverse Spring Compressor Adapter. See **Special Tools and Equipment** .

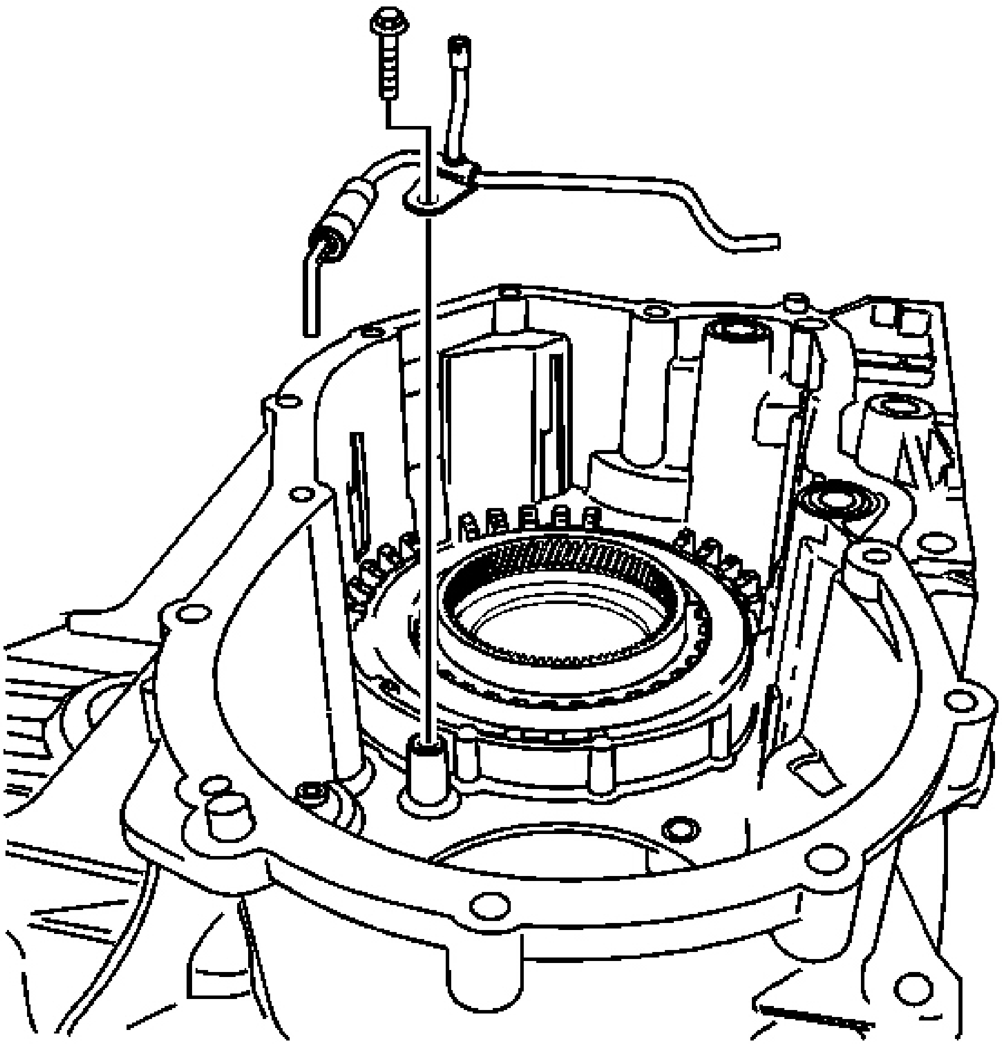


Fig. 226: Lube Oil Pipe & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the bolt and the lube oil pipe from the transmission case assembly.

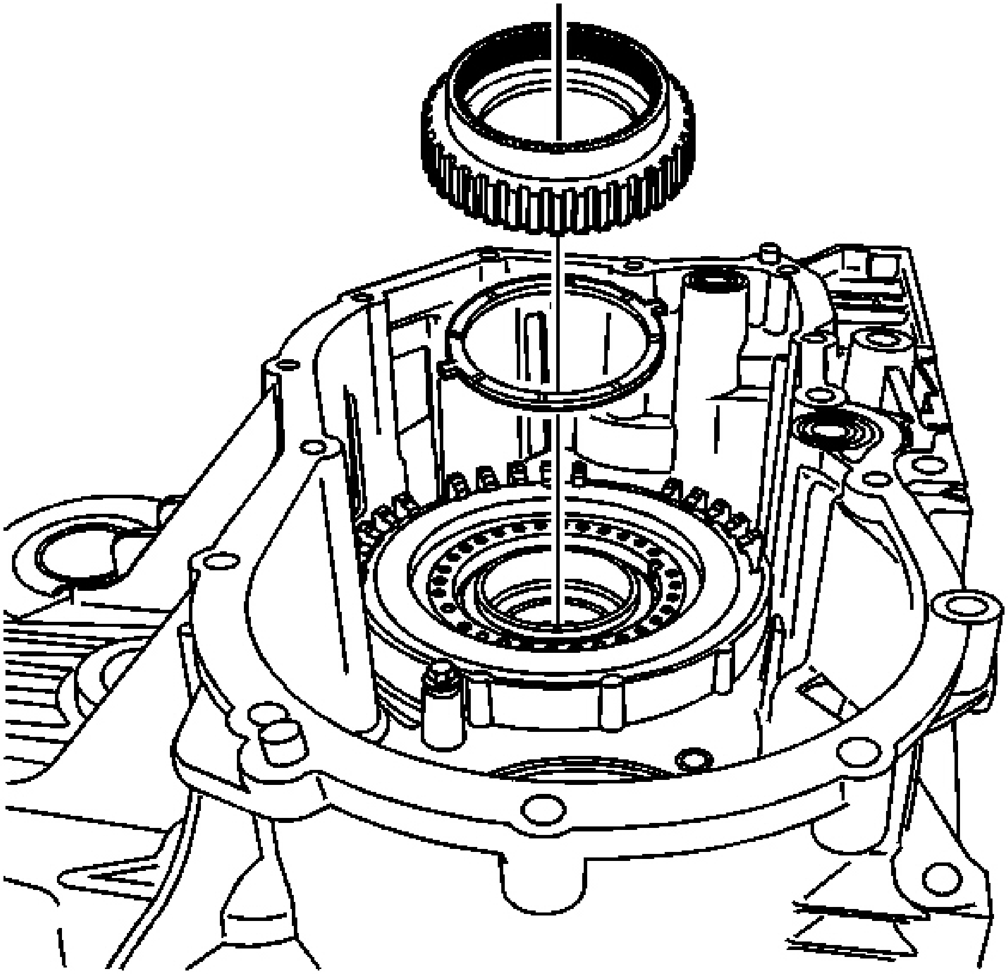


Fig. 227: Reverse Clutch Hub & Thrust Washer
Courtesy of GENERAL MOTORS CORP.

2. Remove the reverse clutch hub assembly.
3. Remove the thrust washer for the reverse clutch hub assembly.

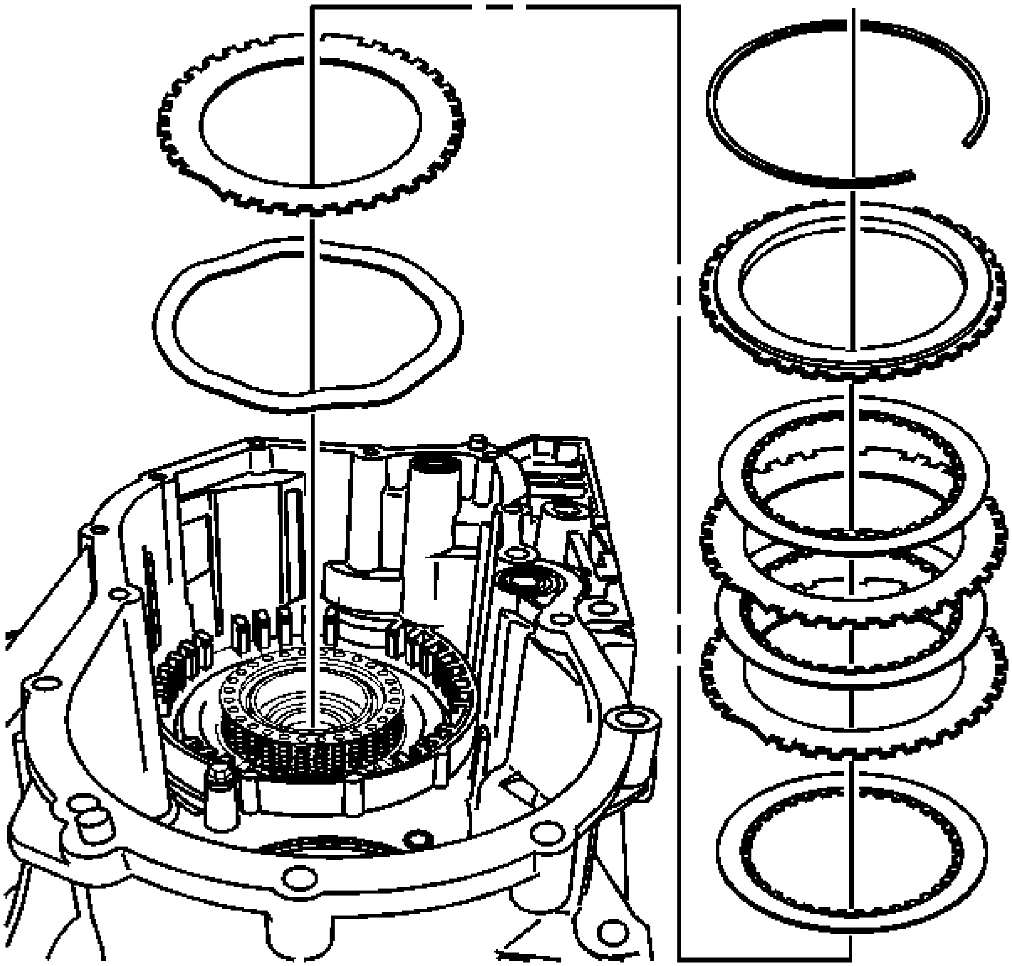


Fig. 228: Retaining Ring & Reverse Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

4. Remove the retaining ring for the reverse clutch backing plate.
5. Remove the reverse clutch backing plate.
6. Remove the reverse clutch plates, three each.
7. Remove the reverse clutch waved plate.

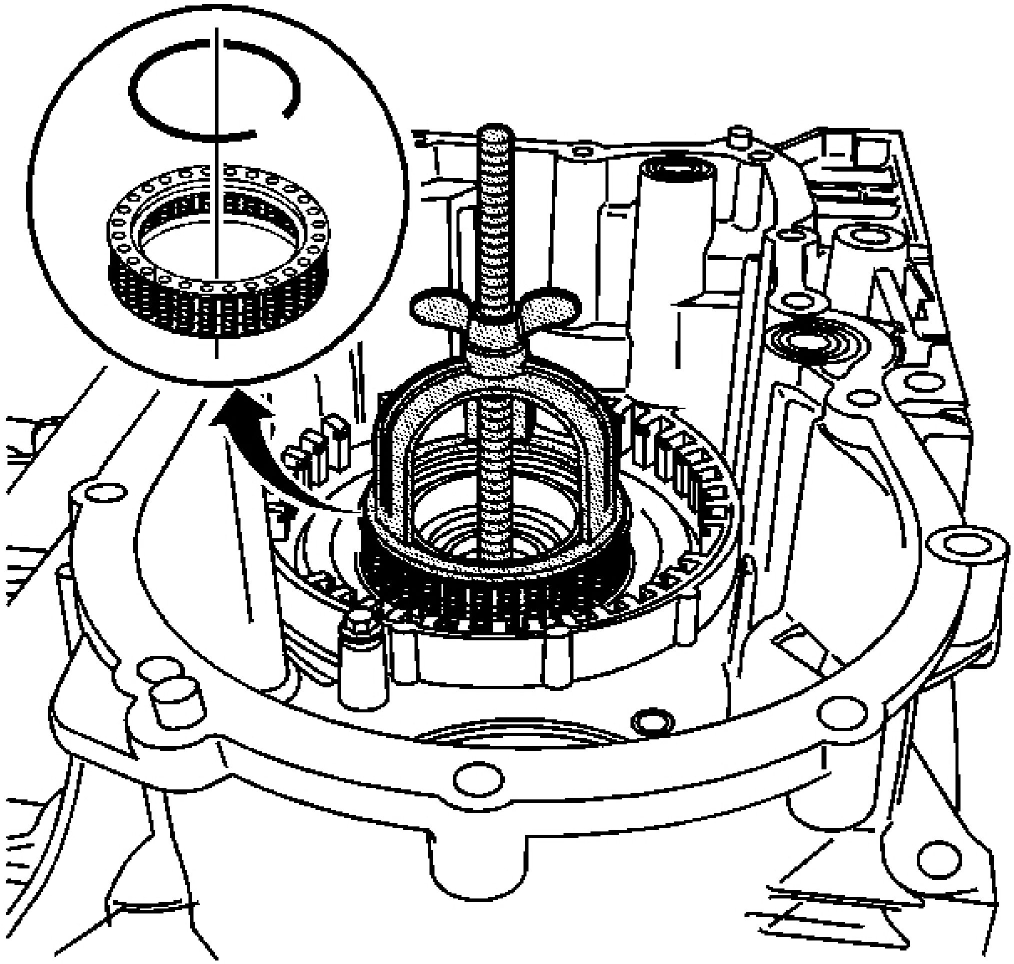


Fig. 229: J 23327, J 38734 & Reverse Clutch Spring
Courtesy of GENERAL MOTORS CORP.

8. Using the **J 23327** and **J 38734** , compress the reverse clutch spring assembly. See **Special Tools and Equipment** .
9. Remove the reverse clutch spring retaining ring.
10. Remove the **J 23327** and **J 38734** . See **Special Tools and Equipment** .
11. Remove the reverse clutch spring assembly.

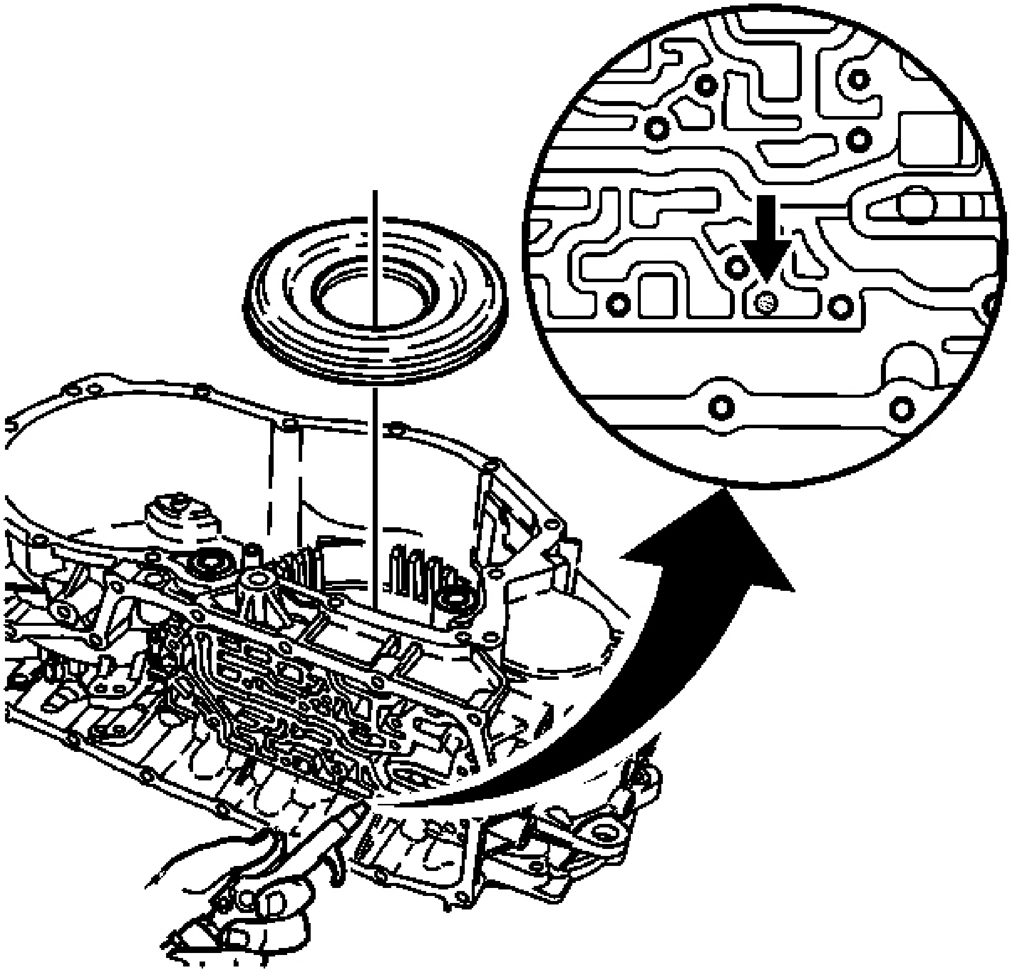


Fig. 230: Reverse Clutch Piston
Courtesy of GENERAL MOTORS CORP.

12. Apply shop air to the reverse clutch fluid port in the transmission case assembly in order to release the reverse clutch piston assembly.
13. Remove the reverse clutch piston assembly.

TORQUE CONVERTER AND DIFFERENTIAL HOUSING REMOVAL

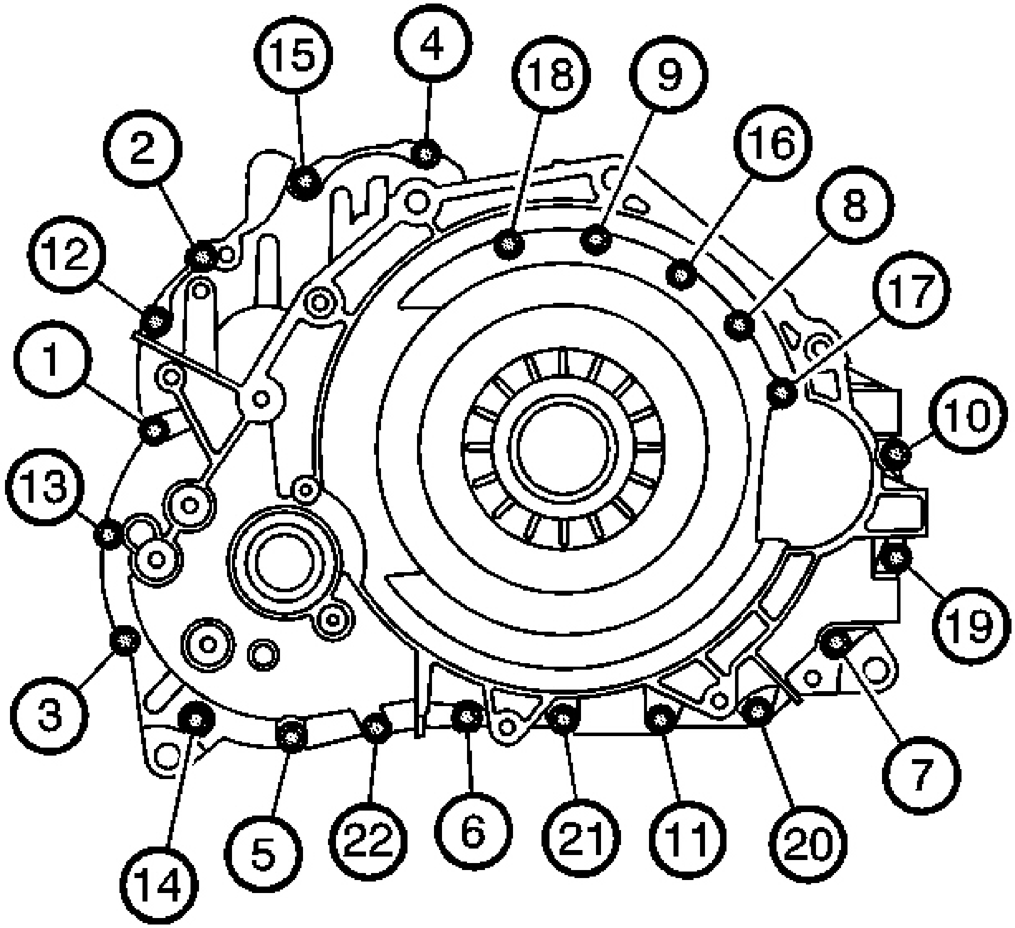


Fig. 231: Torque Converter & Differential Housing Tightening Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

1. Remove the 22 bolts that secure the torque converter and differential housing assembly to the transmission case assembly. Discard the bolts.

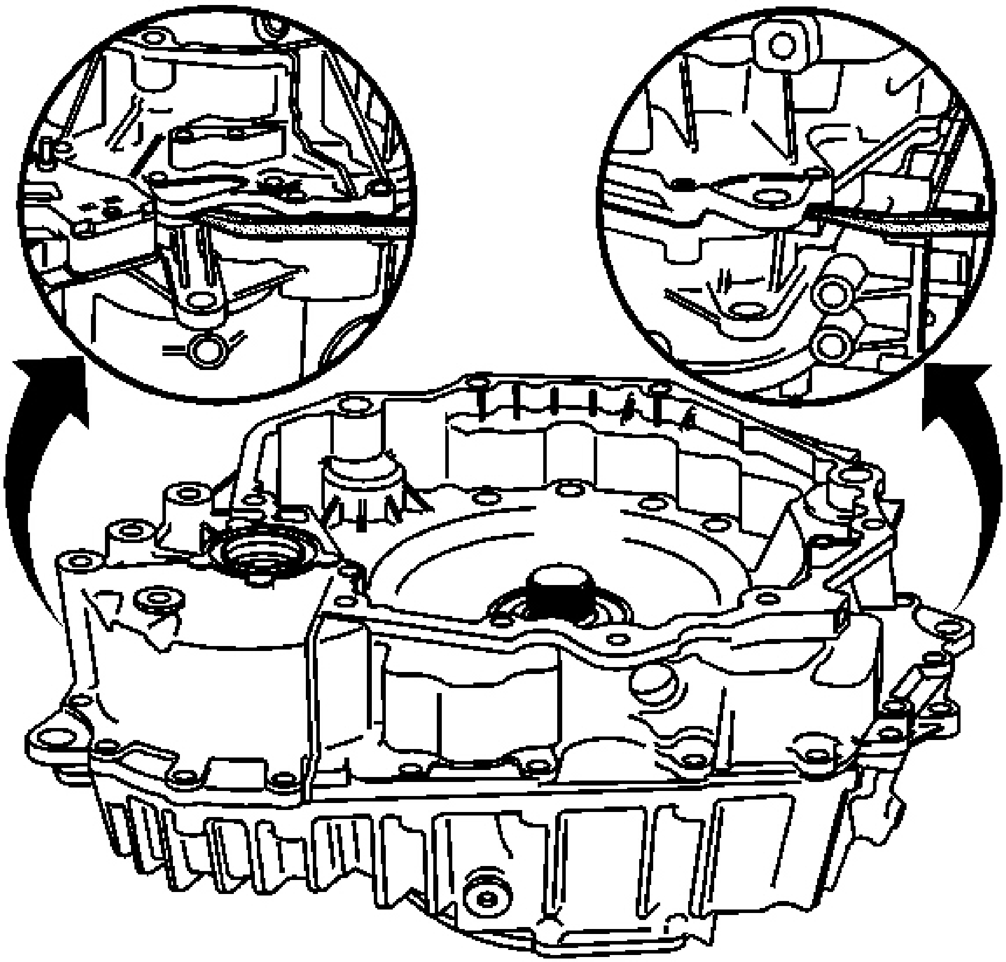


Fig. 232: Using A Pry Bar To Separate The Torque Converter & Differential Housing Assembly From Transmission Case
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: There are two pry points on the torque converter and differential housing assembly.

IMPORTANT: The seal between the torque converter and differential housing assembly and the transmission case assembly is tight.

2. Use a pry bar in order to separate the torque converter and differential housing assembly from the transmission case assembly.

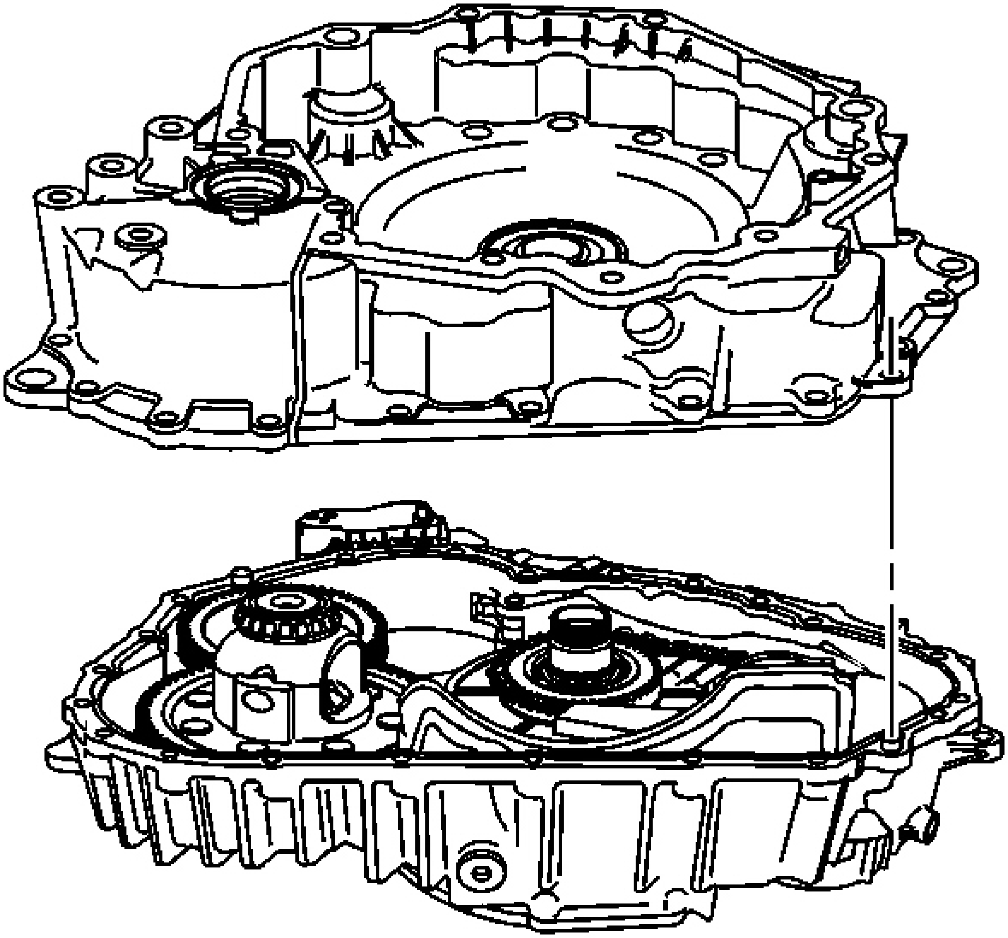


Fig. 233: Torque Converter & Differential Housing
Courtesy of GENERAL MOTORS CORP.

3. Remove the torque converter and differential housing assembly.

FRONT DIFFERENTIAL TRANSFER GEAR REMOVAL

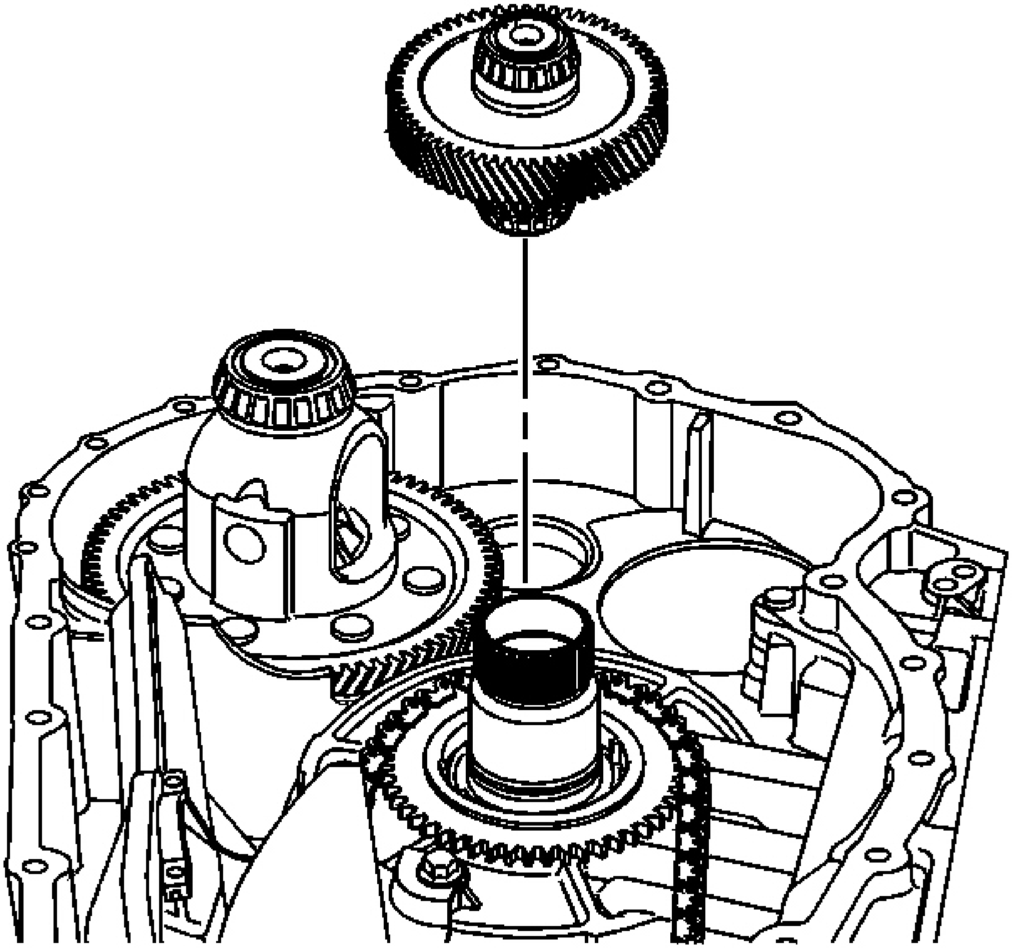


Fig. 234: Front Differential Transfer Gear
Courtesy of GENERAL MOTORS CORP.

Remove the front differential transfer gear from the case assembly.

FRONT DIFFERENTIAL CARRIER REMOVAL

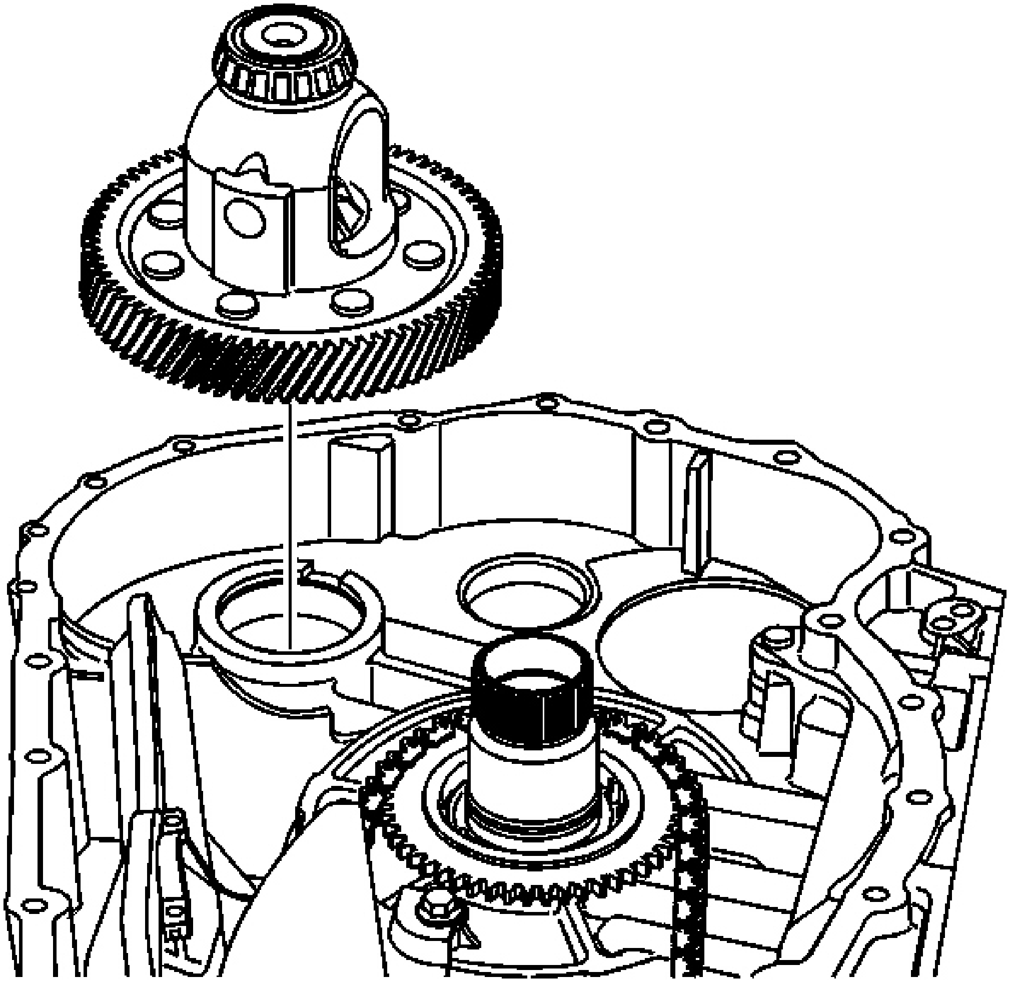


Fig. 235: Front Differential Carrier
Courtesy of GENERAL MOTORS CORP.

Remove the front differential carrier assembly from the case assembly.

DRIVE SPROCKET, DRIVEN SPROCKET, AND DRIVE LINK REMOVAL

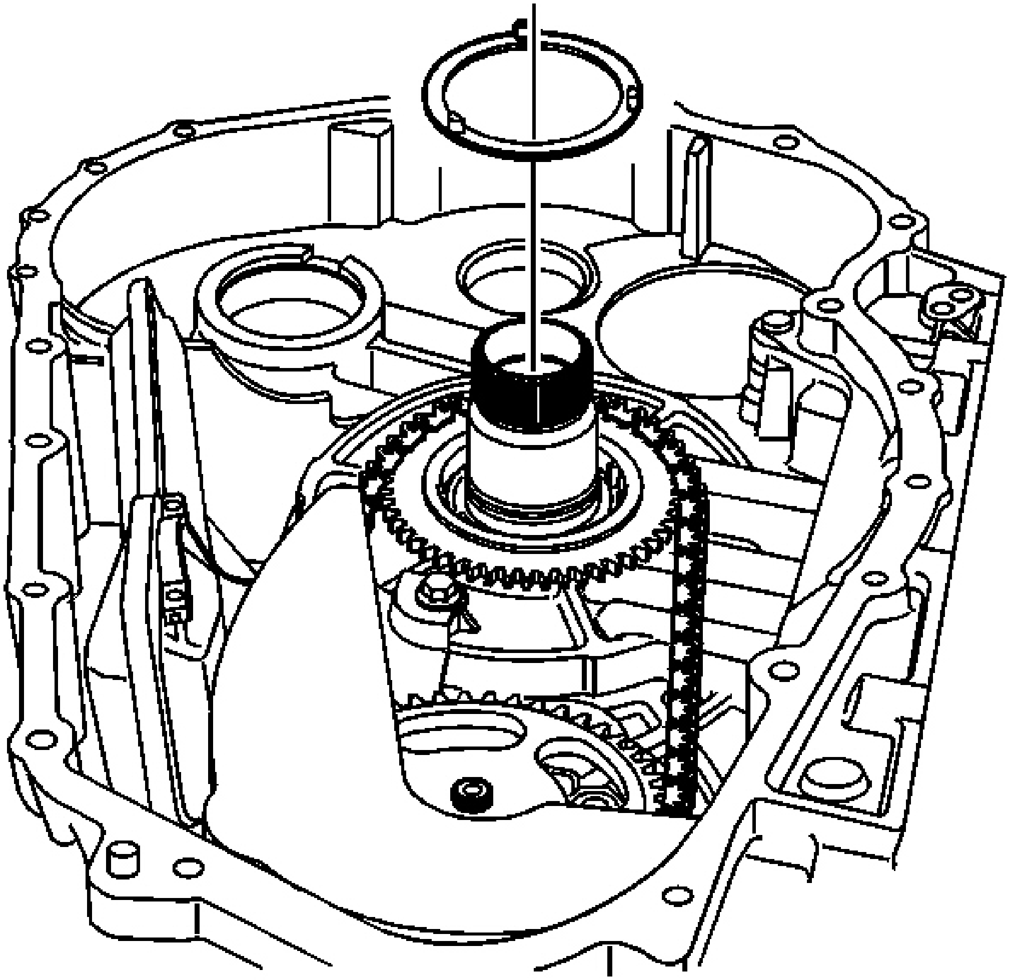


Fig. 236: Upper Drive Sprocket Thrust Washer, Torque Converter & Differential Housing Side
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The drive sprocket thrust washer may be stuck to the torque converter and differential housing assembly.

1. Remove the upper drive sprocket thrust washer - torque converter and differential housing side.

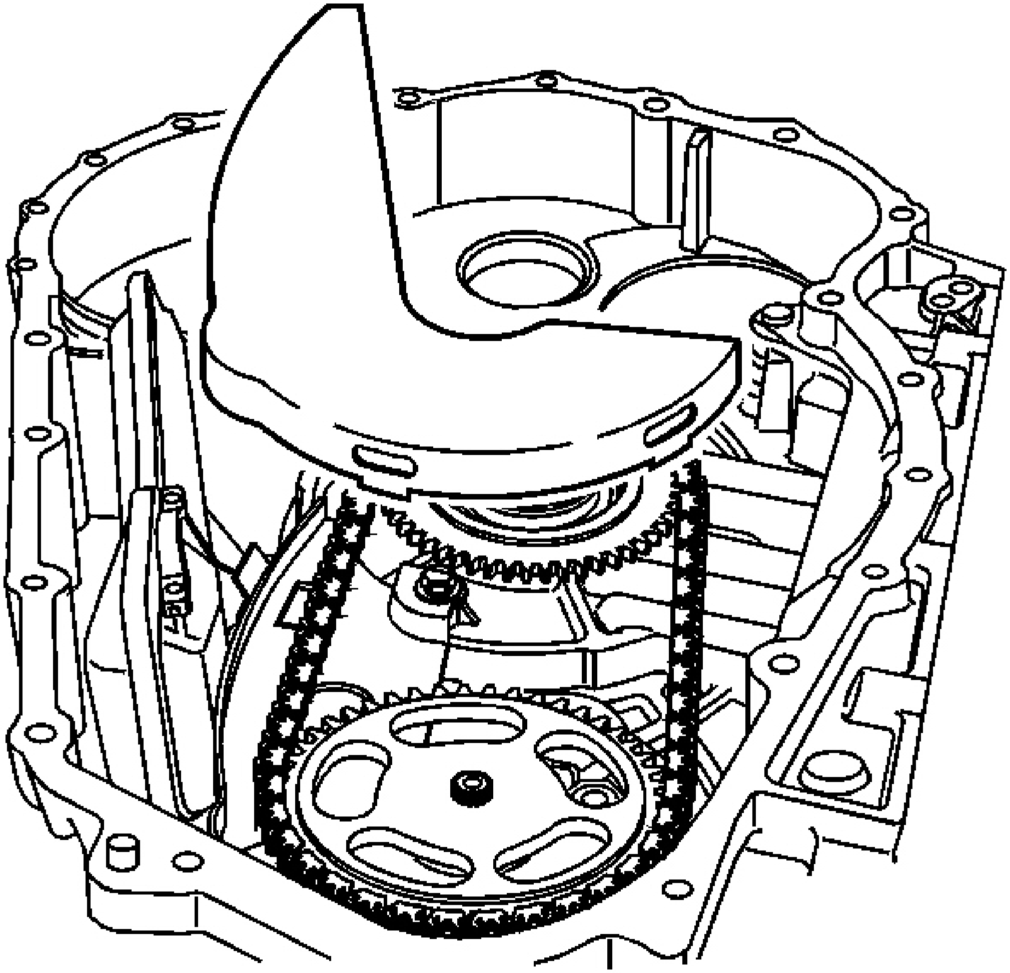


Fig. 237: Top Piece Of Transmission Fluid Baffle
Courtesy of GENERAL MOTORS CORP.

2. Remove the top piece of the transmission fluid baffle.

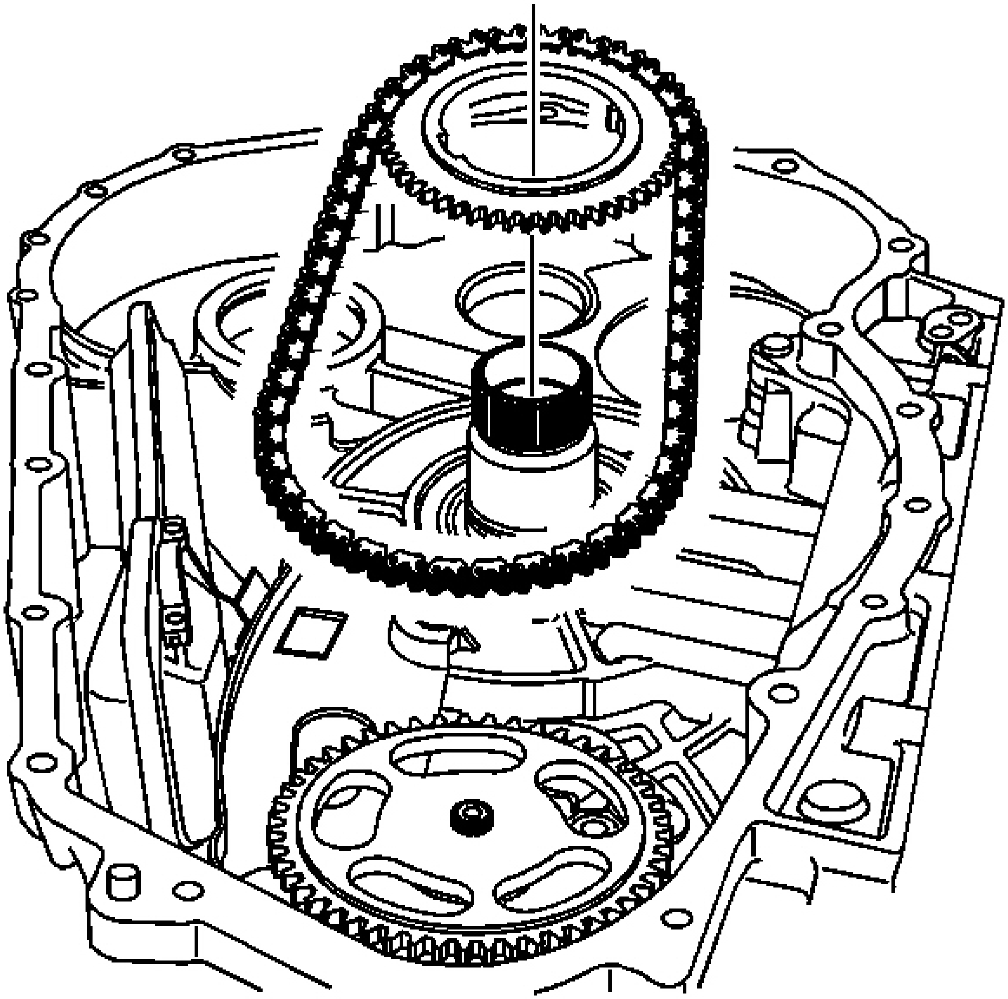


Fig. 238: Drive Sprocket & Drive Link Assembly
Courtesy of GENERAL MOTORS CORP.

3. Remove the drive sprocket and drive link assembly.

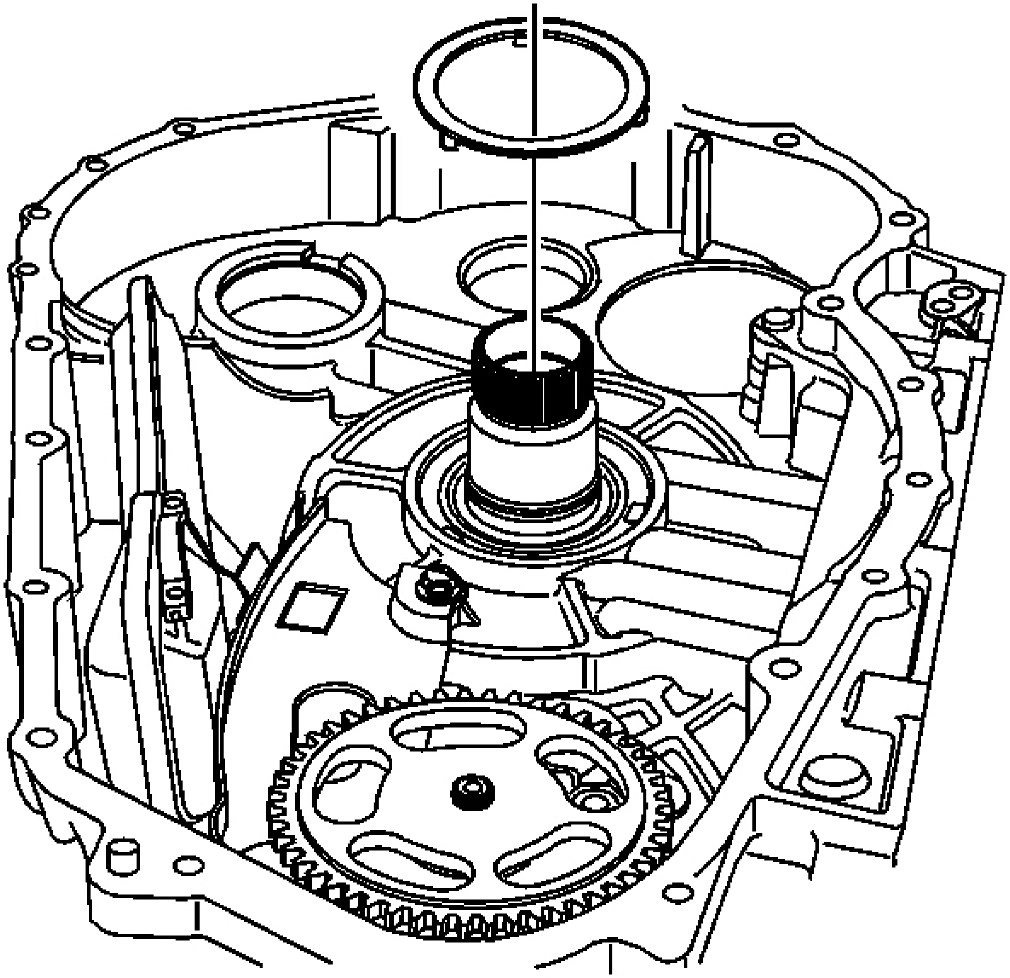


Fig. 239: Lower Drive Sprocket Thrust Washer
Courtesy of GENERAL MOTORS CORP.

4. Remove the lower drive sprocket thrust washer - case side.

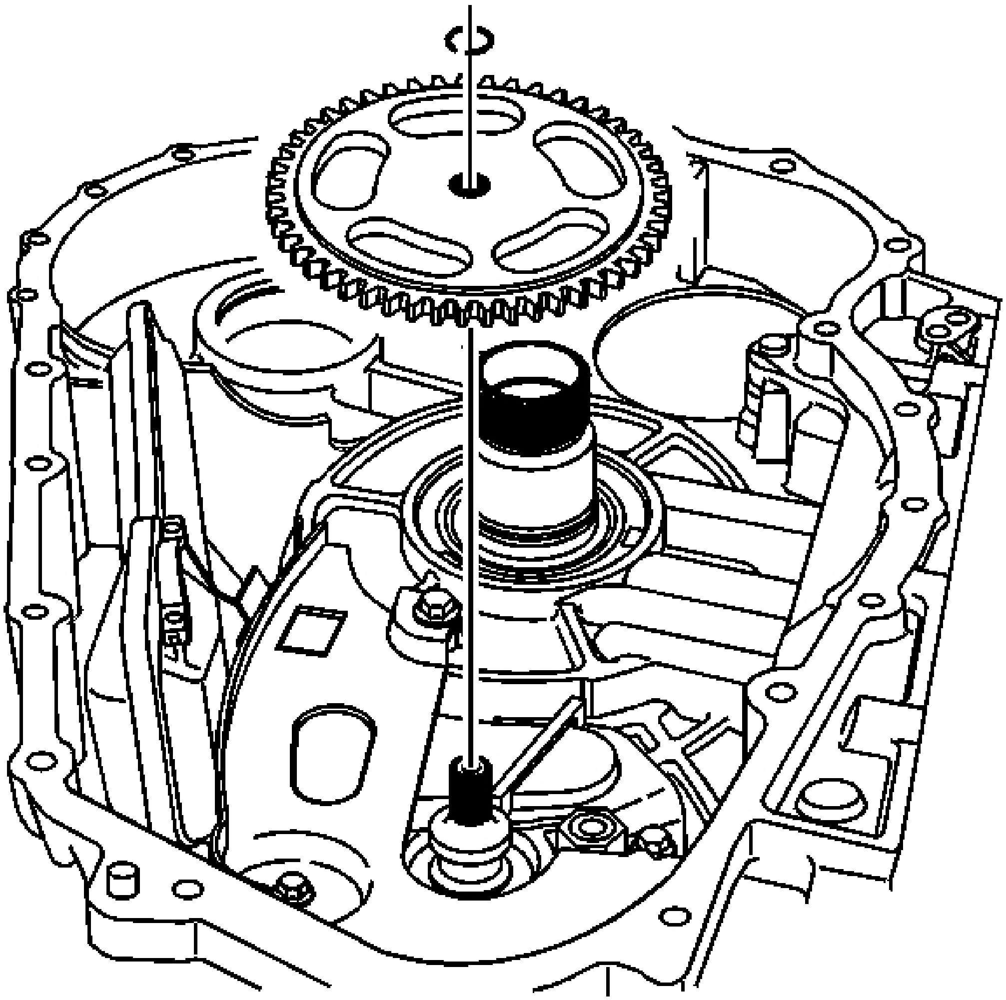


Fig. 240: Driven Sprocket & Retaining Ring
Courtesy of GENERAL MOTORS CORP.

5. Remove the driven sprocket retaining ring. Discard the retaining ring.
6. Remove the driven sprocket.

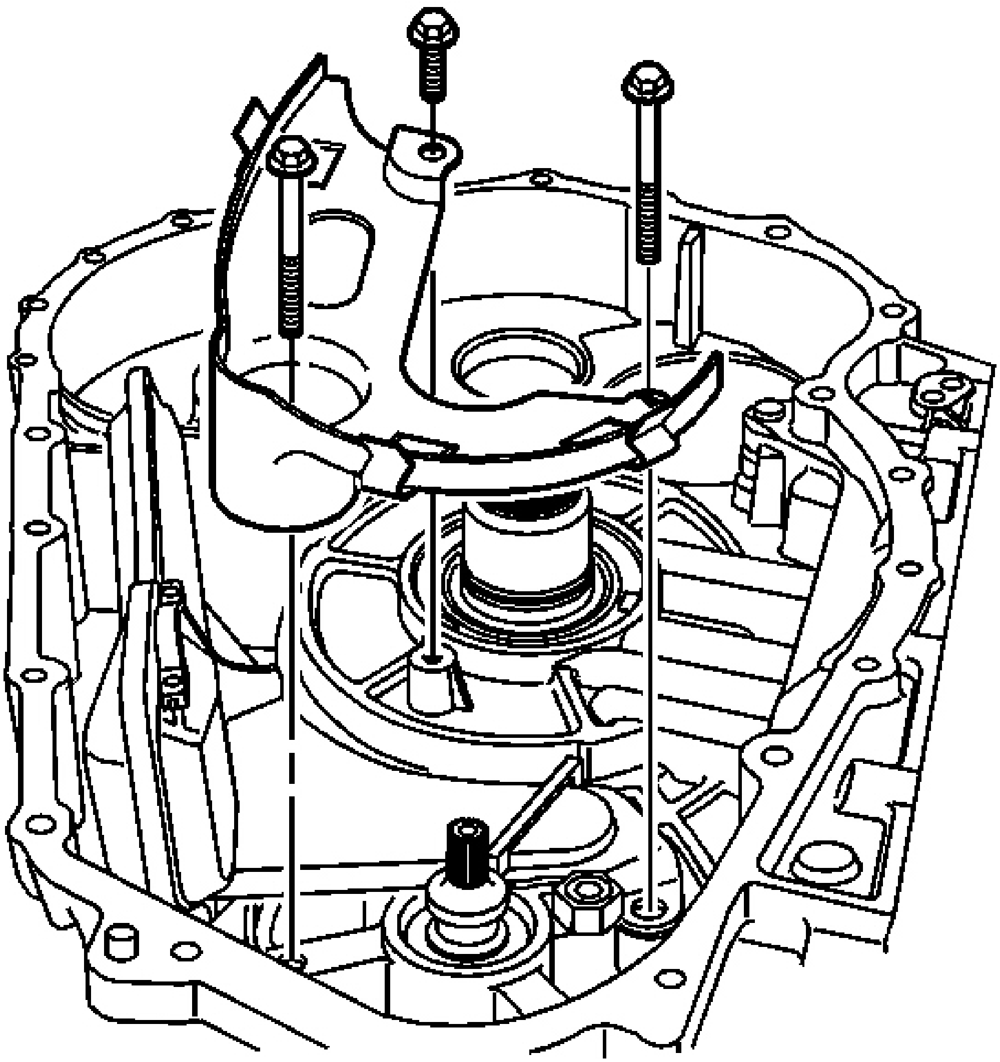


Fig. 241: Bottom Piece Of Transmission Fluid Baffle & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the bolt securing the bottom piece of the transmission fluid baffle to the transmission case assembly.
8. Remove the 2 bolts and the bottom piece of the transmission fluid baffle from the fluid pump assembly and the transmission case assembly.

FLUID FILTER REMOVAL

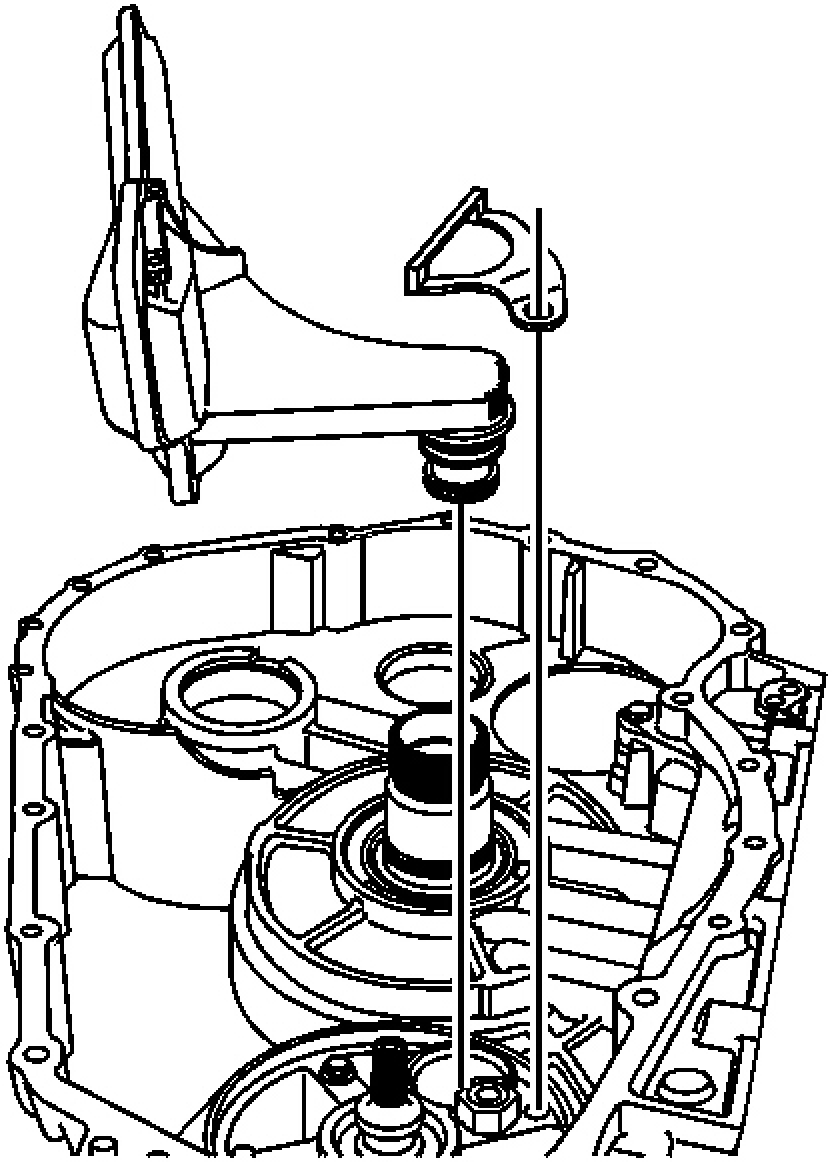


Fig. 242: Fluid Filter Retainer
Courtesy of GENERAL MOTORS CORP.

1. Remove the fluid filter retainer.
2. Remove the fluid filter assembly and discard.

FLUID PUMP REMOVAL

Tools Required

J 43445 Fluid Pump Remover. See **Special Tools and Equipment** .

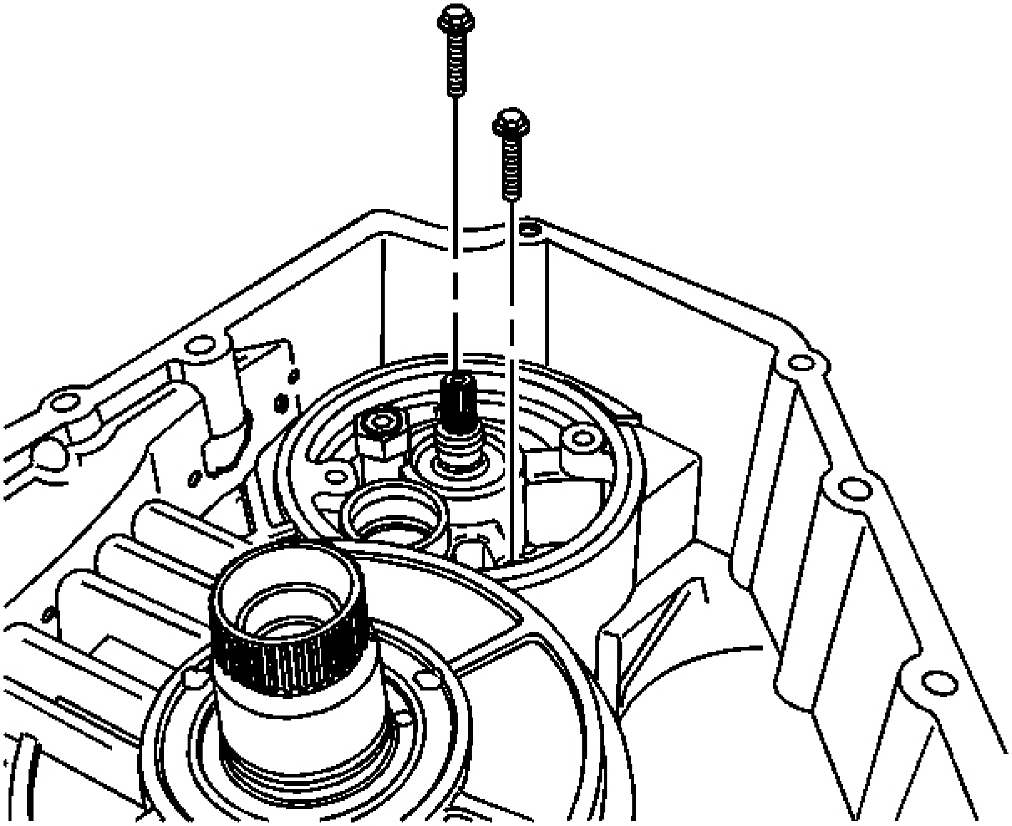


Fig. 243: 2 Bolts & Fluid Pump Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the 2 remaining bolts securing the fluid pump assembly to the transmission case assembly.

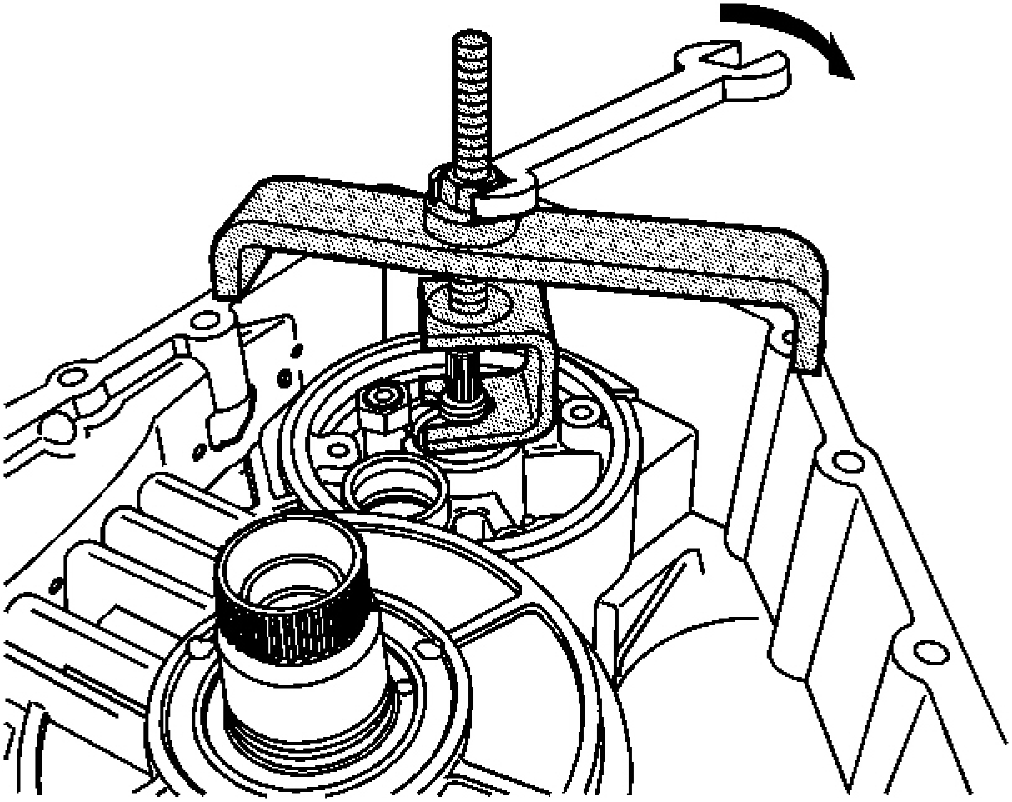


Fig. 244: Turning The Hex Nut Of J 43445 Clockwise
Courtesy of GENERAL MOTORS CORP.

2. Position the forked clamp of the **J 43445** under the splines of the fluid pump shaft. See **Special Tools and Equipment** .
3. Position the support bracket of the **J 43445** on the transmission case assembly. See **Special Tools and Equipment** .
4. Turn the hex nut of the **J 43445** clockwise in order to lift the fluid pump assembly out of the transmission case assembly. See **Special Tools and Equipment** .

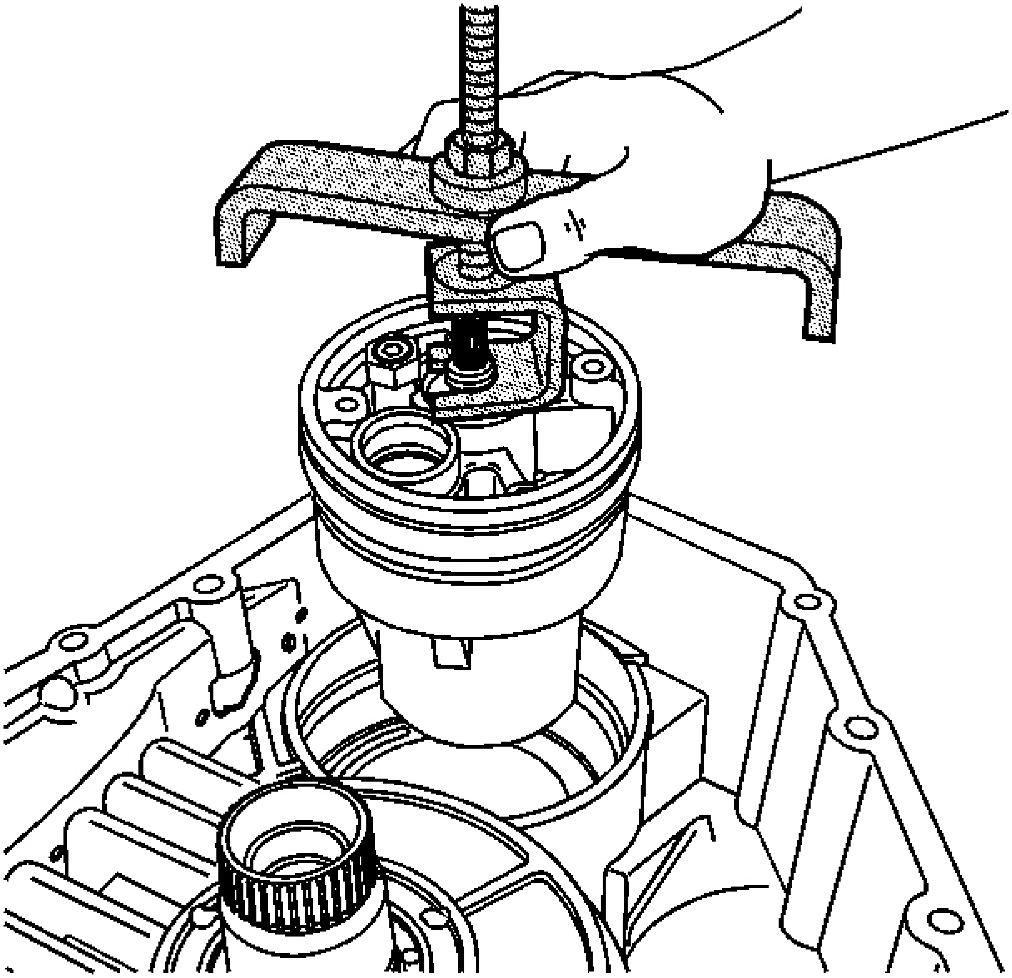


Fig. 245: Fluid Pump Assembly & J 43445
Courtesy of GENERAL MOTORS CORP.

5. Remove the fluid pump assembly.
6. Remove the **J 43445** . See **Special Tools and Equipment** .

MANUAL SHIFT SHAFT AND PARKING SYSTEM COMPONENTS REMOVAL

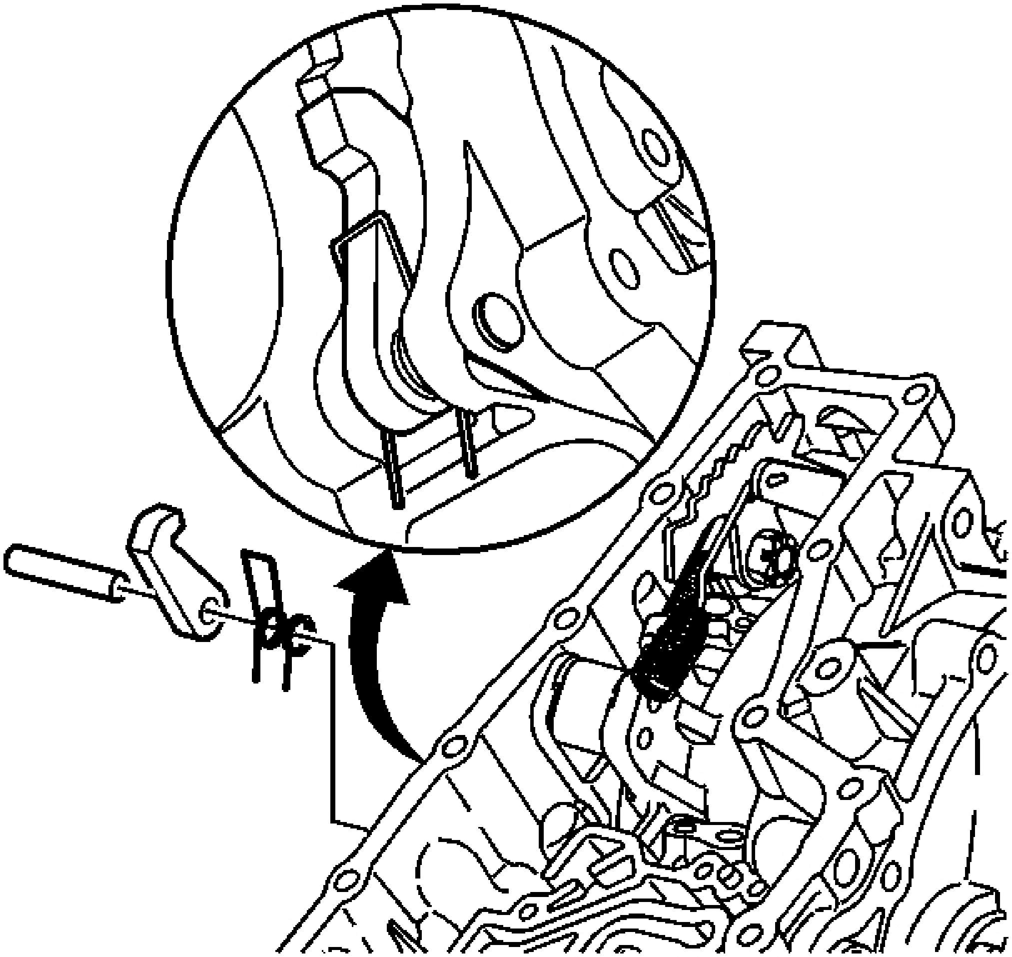


Fig. 246: Park Pawl, Reaction Pin & Spring
Courtesy of GENERAL MOTORS CORP.

1. Remove the park pawl reaction pin, park pawl and spring.

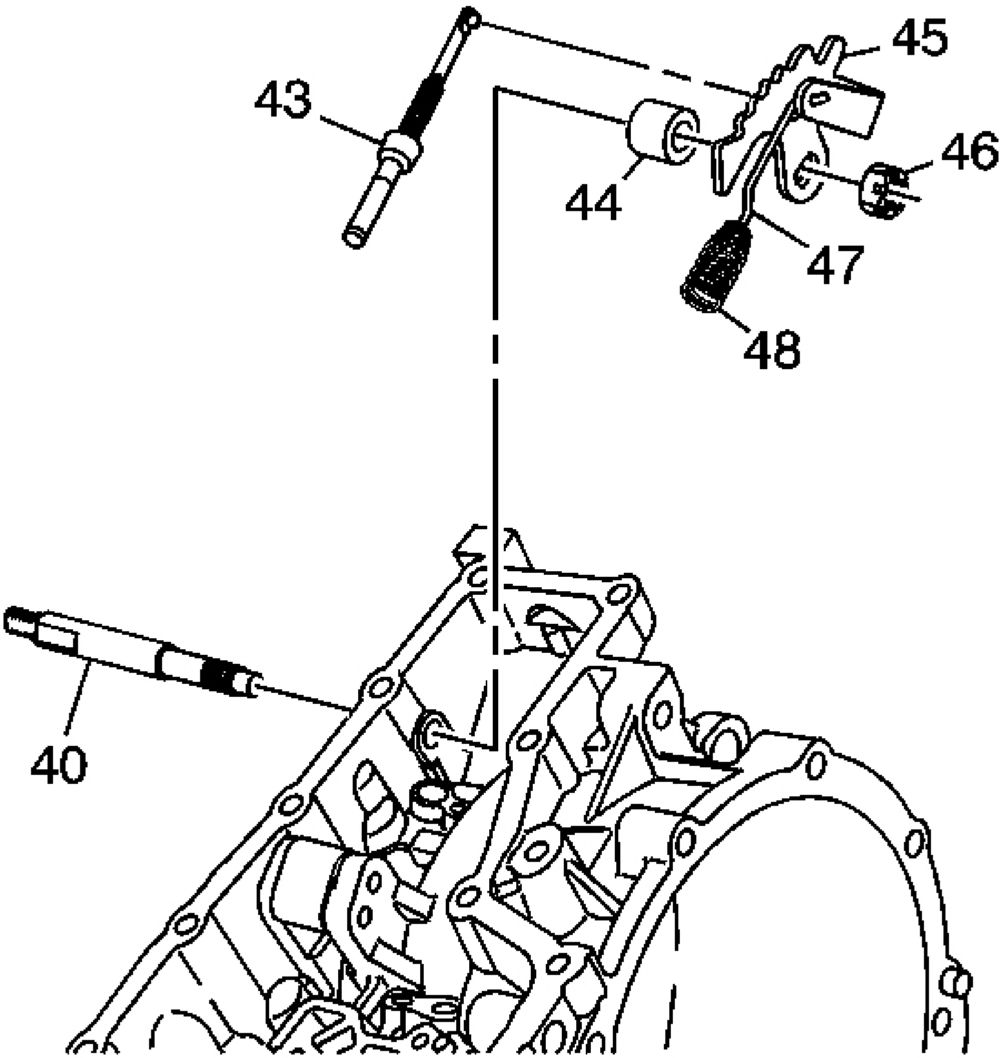


Fig. 247: Manual Shift Shaft & Components
Courtesy of GENERAL MOTORS CORP.

2. Loosen the manual shift shaft nut (46).
3. Remove the manual shift shaft (40), nut (46), detent lever (45), park pawl actuator assembly (43), manual valve link (47), spring (48) and retainer (44).
4. Remove the park pawl actuator assembly (43) from the manual shaft detent lever (45).

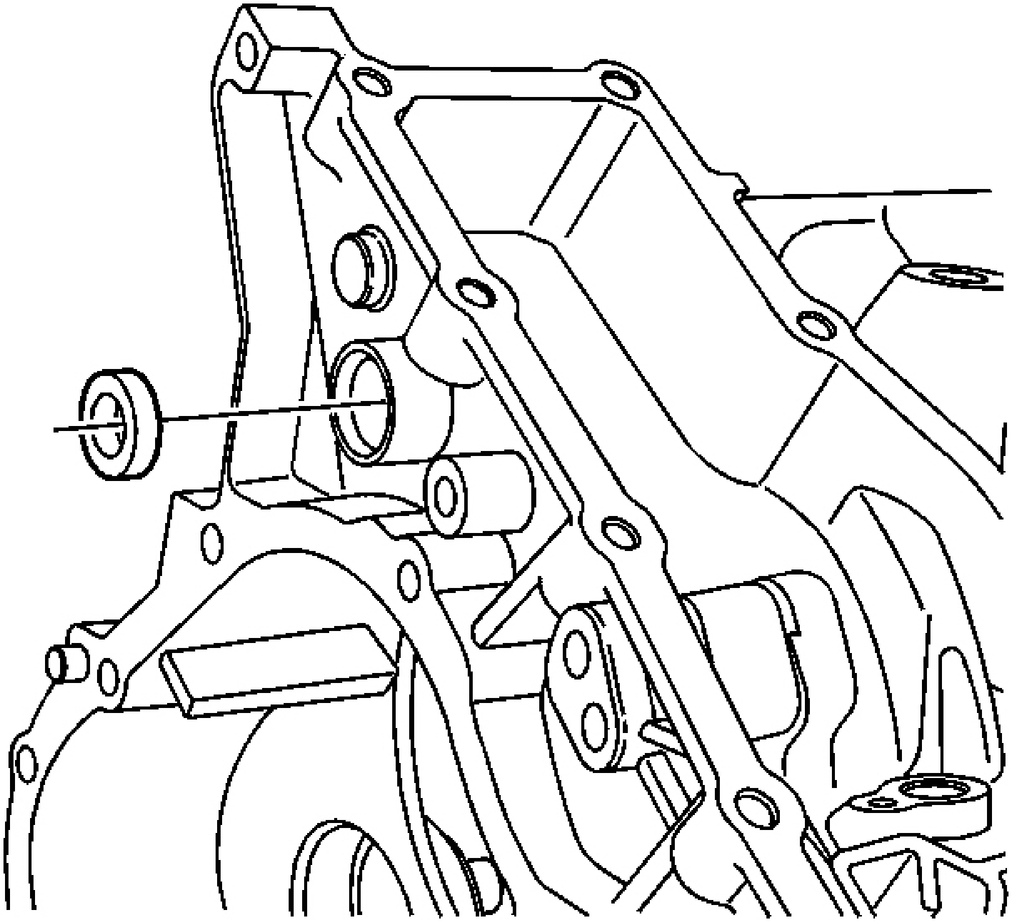


Fig. 248: Manual Shift Shaft Seal Assembly
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not damage the case bore during removal of the manual shaft seal.

5. Using a screwdriver, carefully remove the manual shift shaft seal assembly from the transmission case assembly.

   Discard the seal assembly.

STATOR SHAFT SEAL REMOVAL

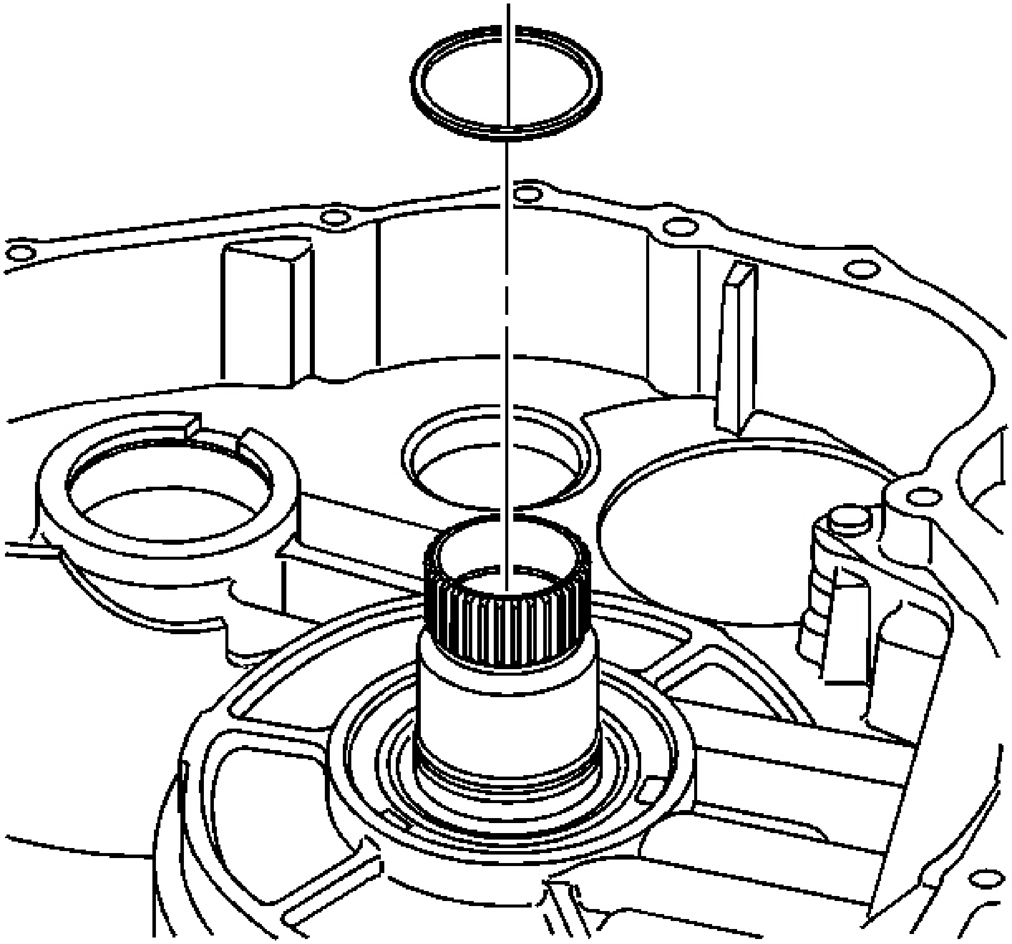


Fig. 249: Seal & Stator Shaft
Courtesy of GENERAL MOTORS CORP.

Remove the seal from the stator shaft. Discard the seal.

TRANSMISSION COOLER LINE SEALS REMOVAL

Tools Required

J 45201 Cooler Line Seal Remover. See **Special Tools and Equipment** .

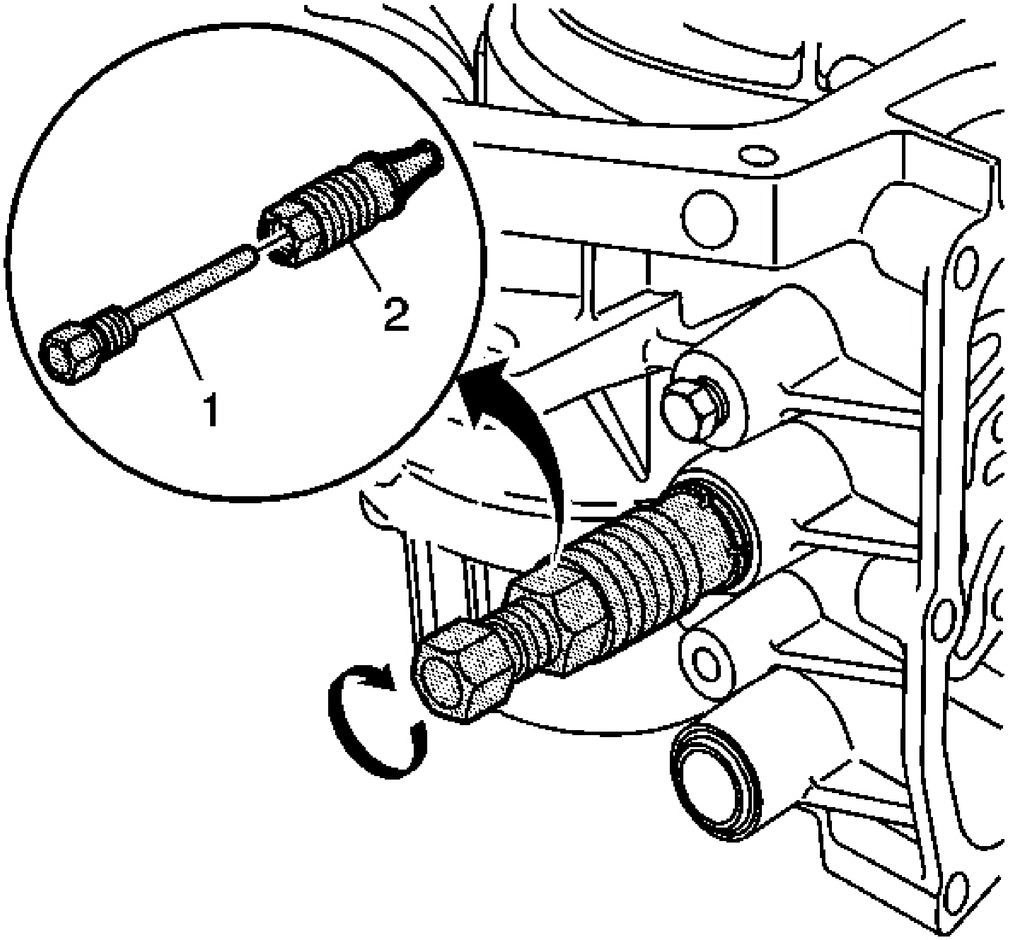


Fig. 250: Collet, Forcing Screw & J 45201
Courtesy of GENERAL MOTORS CORP.

1. Insert the collet (2) of the **J 45201** into the cooler line seal. See **Special Tools and Equipment** .
2. Insert the forcing screw (1) of the **J 45201** into the collet (2). See **Special Tools and Equipment** .
3. Tighten the forcing screw (1) until snug.

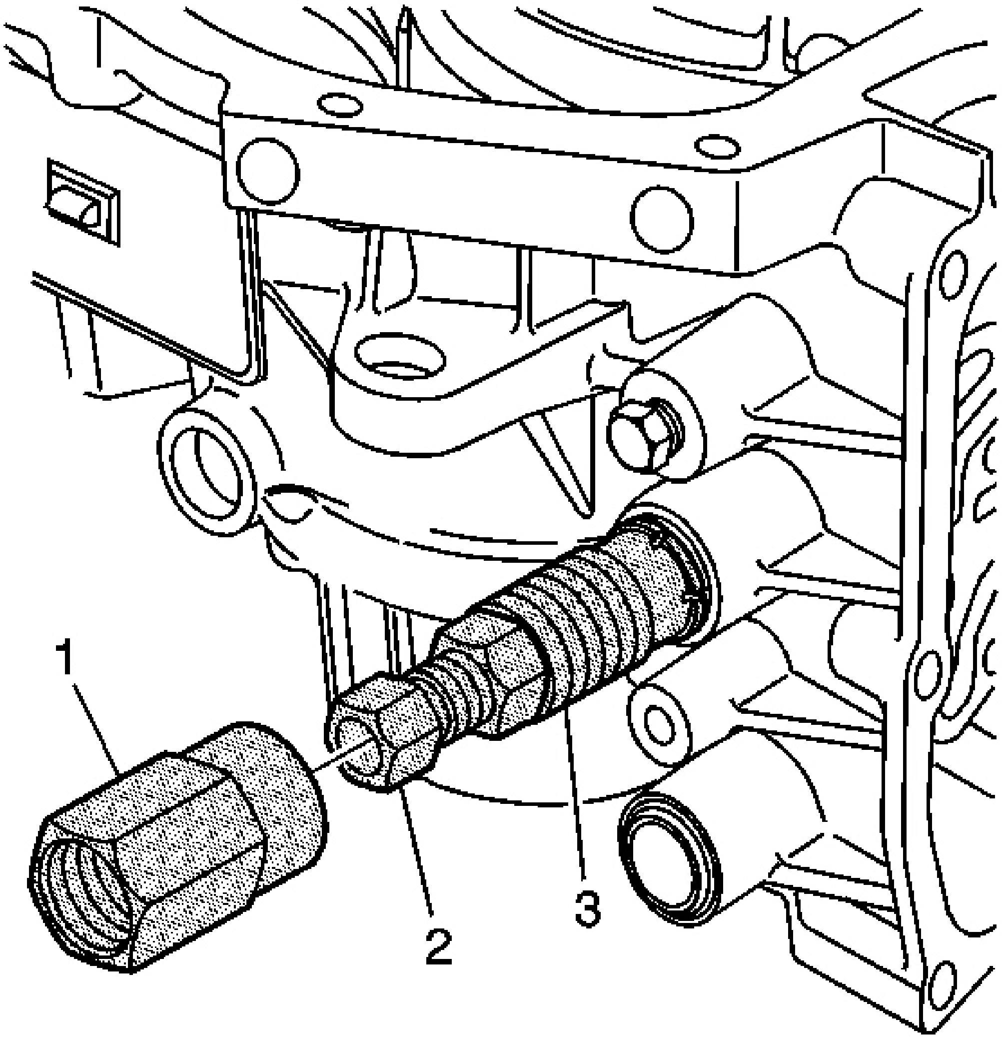


Fig. 251: Collet, Collar & J 45201
Courtesy of GENERAL MOTORS CORP.

4. Thread the collar (1) of the **J 45201** onto the collet (3) until snug. See **Special Tools and Equipment** .

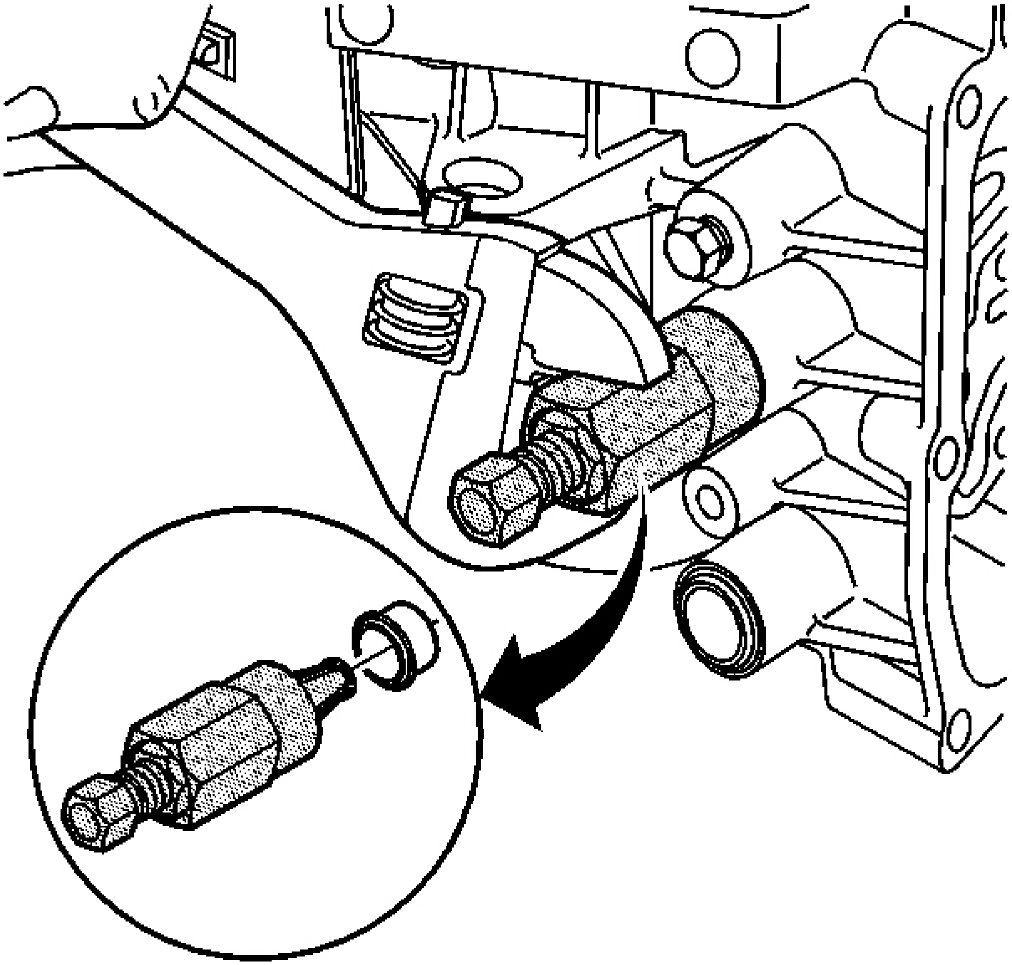


Fig. 252: Turning The Collar Clockwise To Remove The Cooler Line Seal Using A Wrench
Courtesy of GENERAL MOTORS CORP.

5. Using an adjustable wrench, turn the collar clockwise in order to remove the cooler line seal.
6. Discard the seal.
7. Clean the case bores for the cooler line seals.

TRANSMISSION CASE INSPECTION

Tools Required

J 36850 Assembly Lubricant. See **Special Tools and Equipment** .

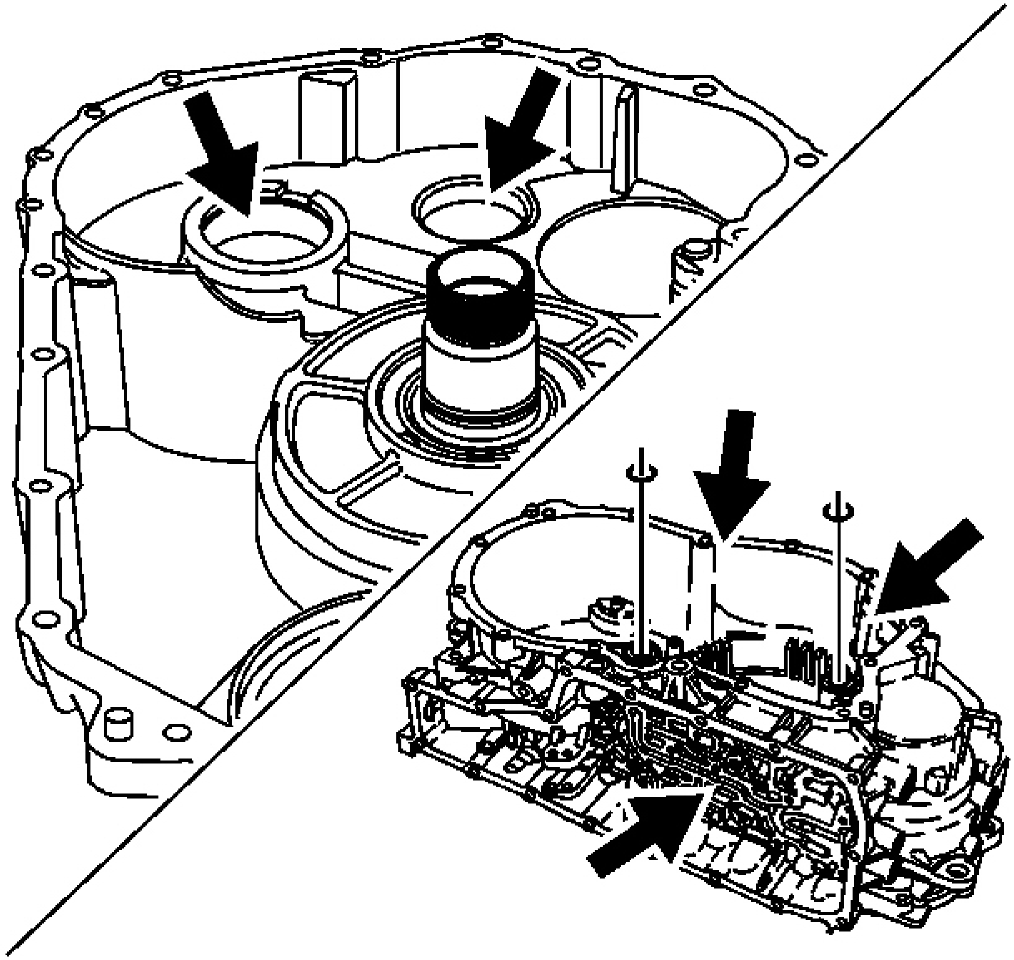


Fig. 253: 2 Case Cover, O-Ring Seals & Transmission Case
Courtesy of GENERAL MOTORS CORP.

NOTE: **Use J 36850 or equivalent during assembly in order to retain checkballs or to lubricate components. Lubricants other than the recommended assembly lube changes the transmission fluid characteristics and causes undesirable shift conditions or filter clogging.**

1. Remove the 2 case cover O-ring seals from the transmission case assembly. Discard the seals.
2. Inspect the transmission case assembly for the following:
   - Cracks
   - Porosity

- Sharp edges
- Connected passages
- Excess gasket material left on any case surfaces
- A loose, missing, or damaged identification label - nameplate

3. Inspect the bearing cup for the front differential drive pinion gear for damage. Replace if necessary. Refer to **Front Differential Transfer Gear Bearing and Cup Replacement** .
4. Inspect the bearing cup for the front differential carrier for damage. Replace if necessary. Refer to **Front Differential Carrier Bearing and Cup Replacement** .

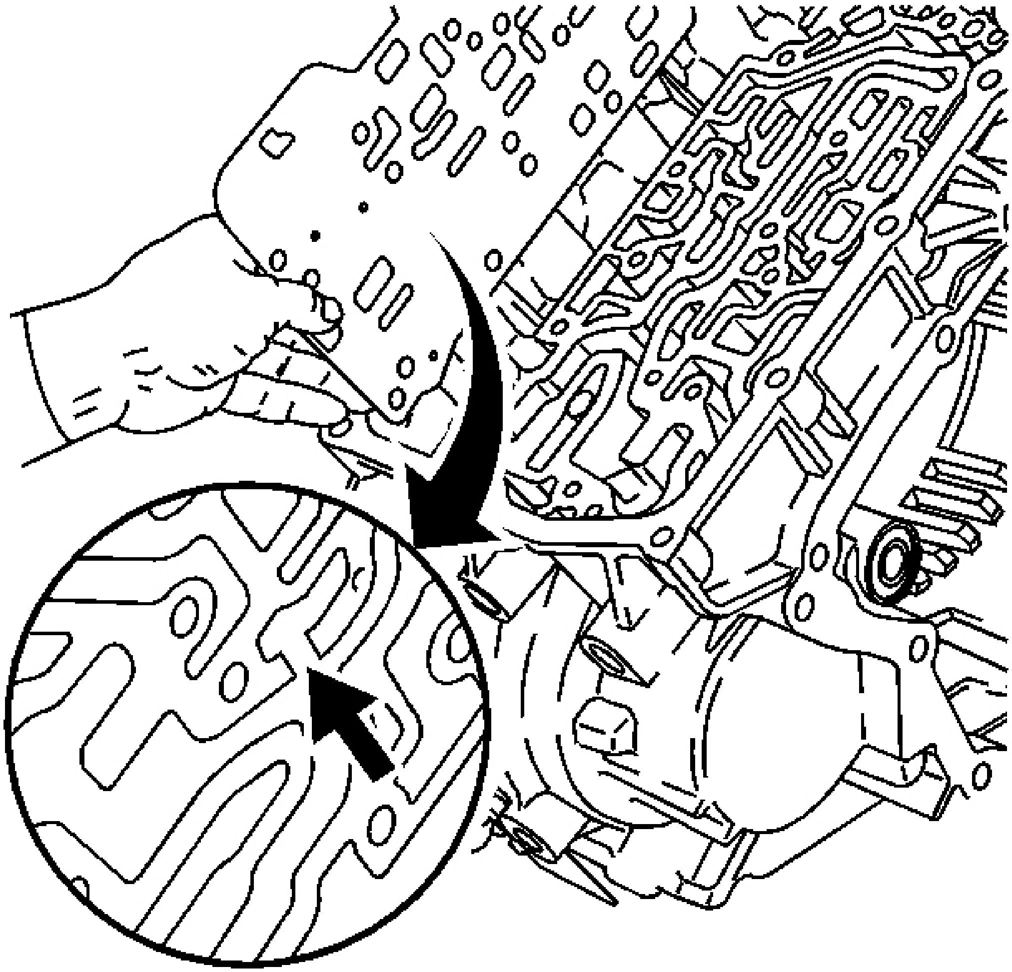


Fig. 254: Inspecting The Spacer Plate For Witness Marks
Courtesy of GENERAL MOTORS CORP.

5. Inspect the spacer plate to case gasket for witness marks. The witness marks should be complete. Incomplete witness marks may indicate an uneven case surface or cross-channel leaks.

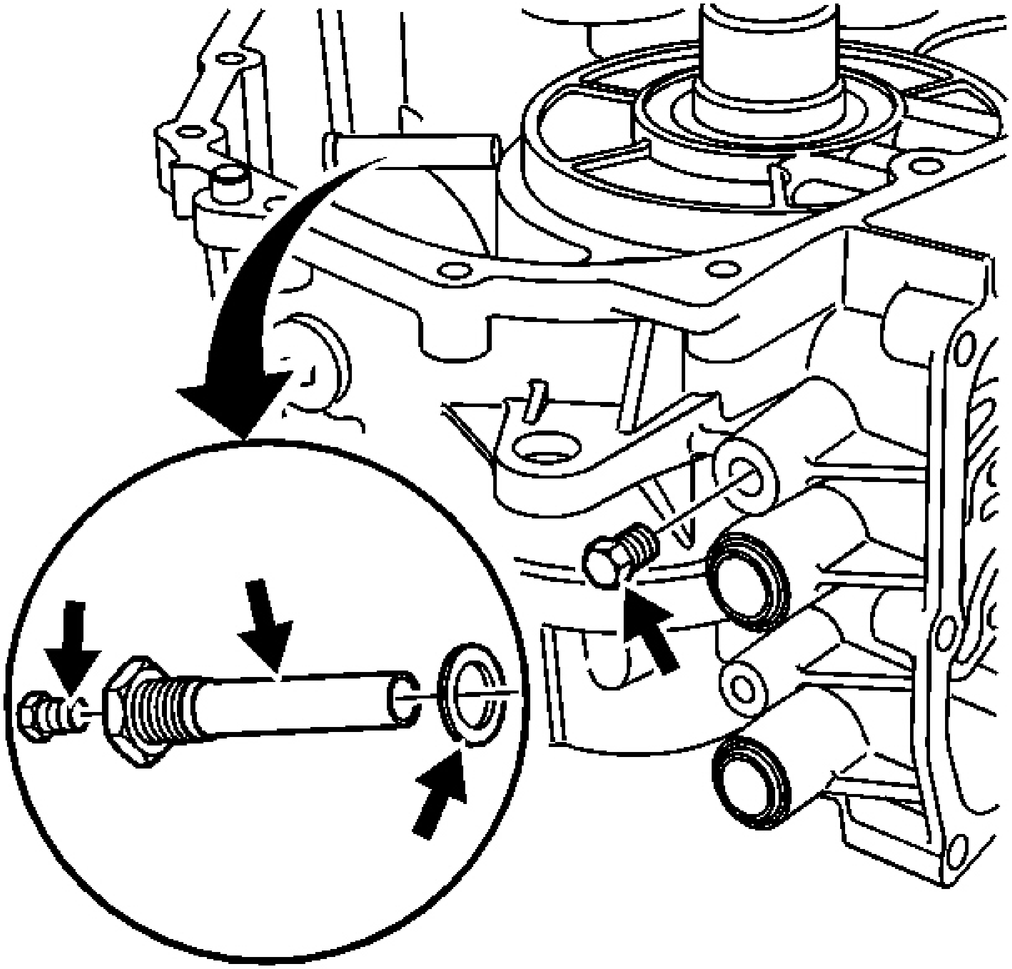


Fig. 255: Inspecting The Fluid Pressure Test Hole Plug For Damage
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Inspect the fluid pressure test hole plug for damage. Replace if necessary.

Tighten: Tighten the fluid pressure test hole plug to 9 N.m (7 lb ft).

7. Inspect the fluid fill lower tube, seal, and plug for damage. Replace if necessary.

   Tighten:

   - Tighten the fluid fill lower tube assembly to 20 N.m (15 lb ft).
   - Tighten the fluid fill lower tube assembly plug to 11 N.m (8 lb ft).

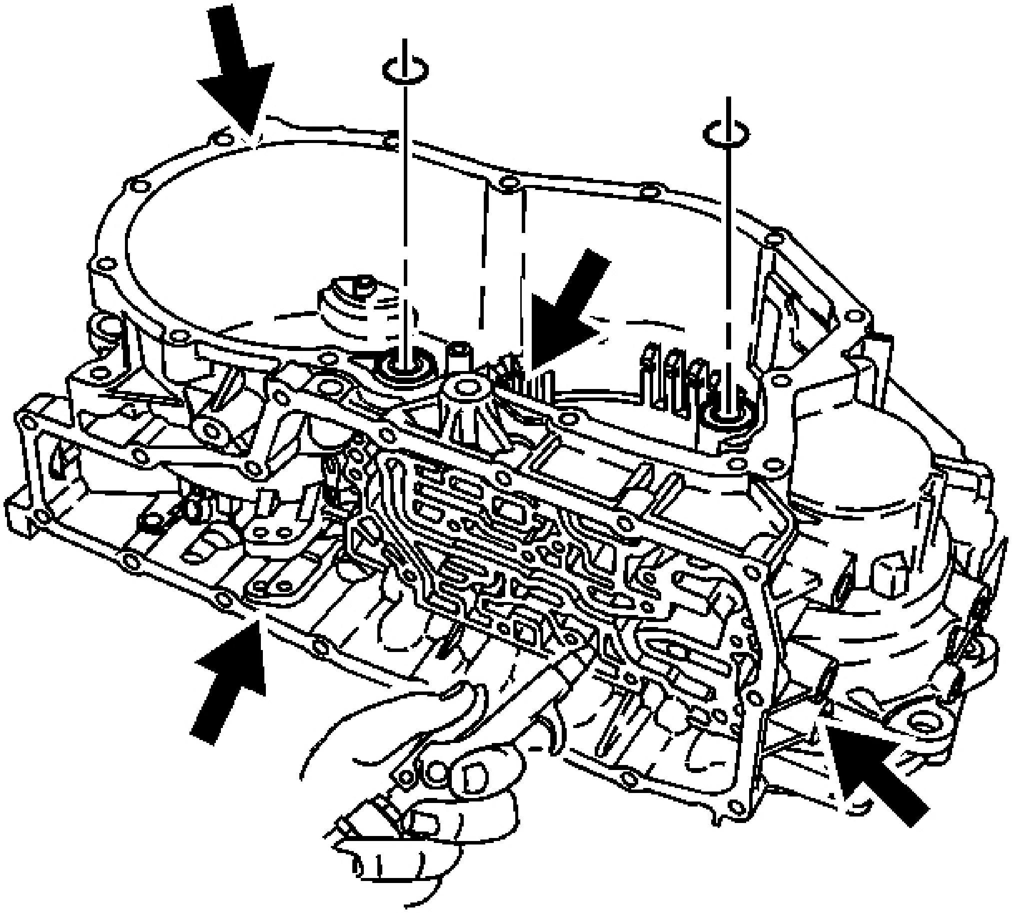


Fig. 256: Inspecting The Retainer Ring Grooves & Bolt Holes For Damage
Courtesy of GENERAL MOTORS CORP.

8. Inspect the bolt holes for thread damage. If necessary, repair any bolt holes.
9. Inspect the retainer ring grooves for damage.
10. Air check all fluid passages. Refer to **Fluid Passages** , Case Fluid Passages Illustration.

NOTE: **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.**

IMPORTANT: **Dirty solvent can deposit sediment that could damage the transmission.**

11. Thoroughly clean the transmission case assembly, including case threads, with clean solvent.
12. Clean gasket sealing surfaces. Remove all residual sealant and/or gasket material.
13. Using the **J 36850** , install 2 new case cover O-ring seals on the transmission case assembly. See **Special Tools and Equipment** .

TORQUE CONVERTER AND DIFFERENTIAL HOUSING INSPECTION

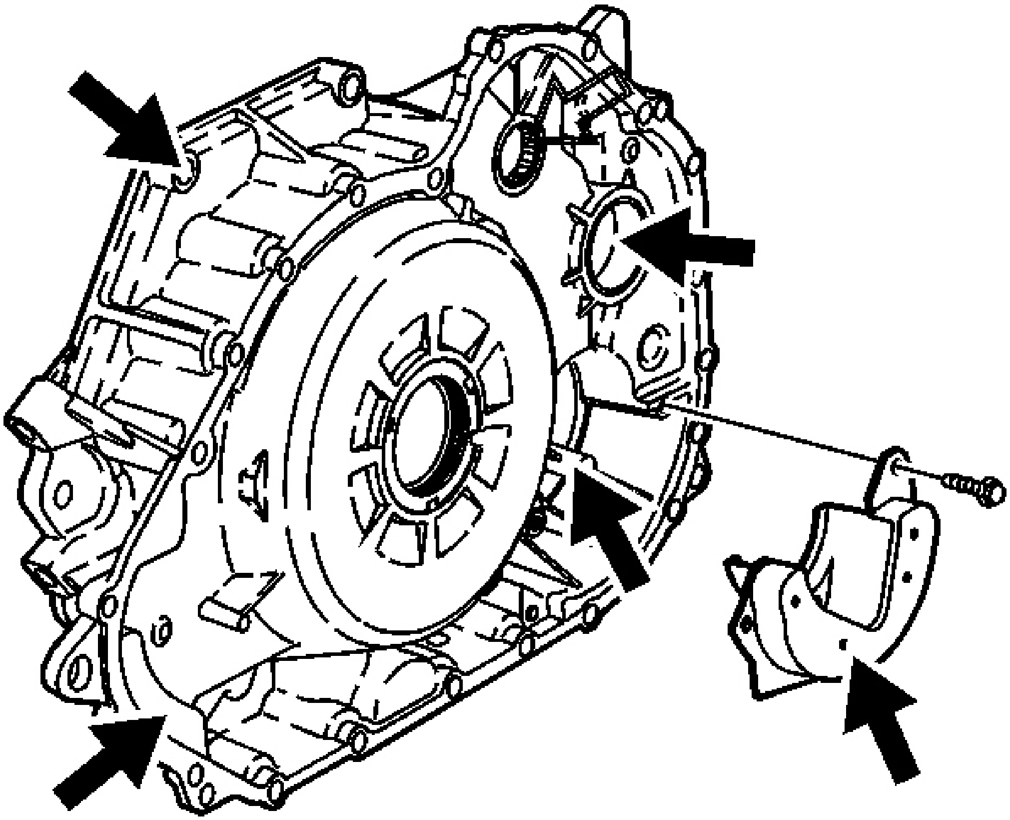


Fig. 257: Fluid Baffle & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Inspect the transmission fluid baffle for damage. Replace if necessary.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the 3 fluid baffle bolts.

   Tighten: Tighten the 3 fluid baffle bolts to 11 N.m (8 lb ft).

3. Inspect the variable driven pulley bearing assembly for damage. Replace if necessary. Refer to **Variable Driven Pulley Bearing Replacement** .
4. Inspect the bearing cup for the front differential drive pinion gear for damage. Replace if necessary. Refer to **Front Differential Transfer Gear Bearing and Cup Replacement** .
5. Inspect the front differential carrier bearing cup for damage. Replace if necessary. Refer to **Front Differential Carrier Bearing and Cup Replacement** .
6. Inspect the torque converter and differential housing assembly for the following:
   - Cracks
   - Porosity
   - Sharp edges
   - Excess gasket material left on any case surfaces
7. Inspect the bolt holes for thread damage. If necessary, repair any bolt holes.

NOTE: Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.

NOTE: 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.

8. Thoroughly clean the housing assembly, including threads, with clean solvent.
9. Clean gasket sealing surfaces. Remove all residual sealant and/or gasket material.

TRANSMISSION COOLER LINE SEALS INSTALLATION

Tools Required

J 41239-1 Cooler Line Seal Installer. See **Special Tools and Equipment** .

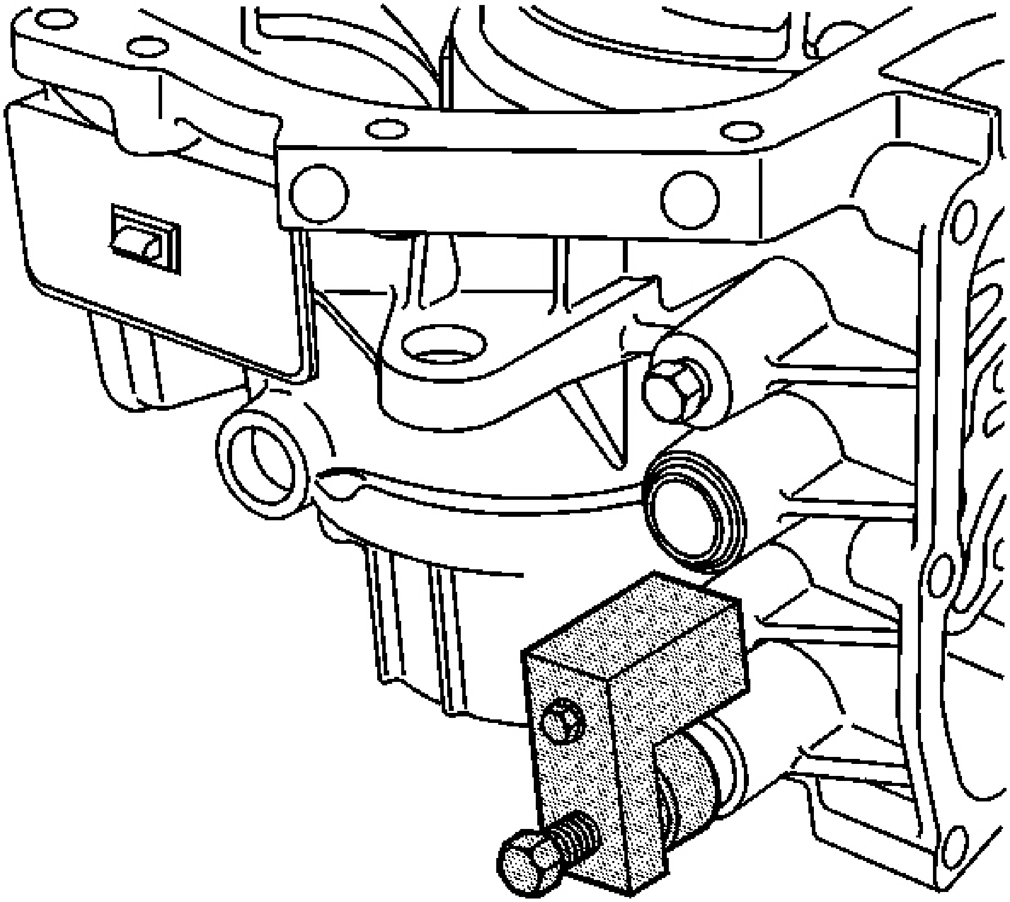


Fig. 258: Cooler Line Seal & J 41239-1
Courtesy of GENERAL MOTORS CORP.

1. Coat the NEW cooler line seal with transmission fluid.
2. Using the **J 41239-1** , install a NEW cooler line seal. See **Special Tools and Equipment** .

STATOR SHAFT SEAL INSTALLATION

Tools Required

- **J 43066-1** Stator Shaft Seal Protector. See **Special Tools and Equipment** .
- **J 43066-2** Stator Shaft Seal Pusher. See **Special Tools and Equipment** .
- **J 43066-3** Stator Shaft Seal Sizer. See **Special Tools and Equipment** .

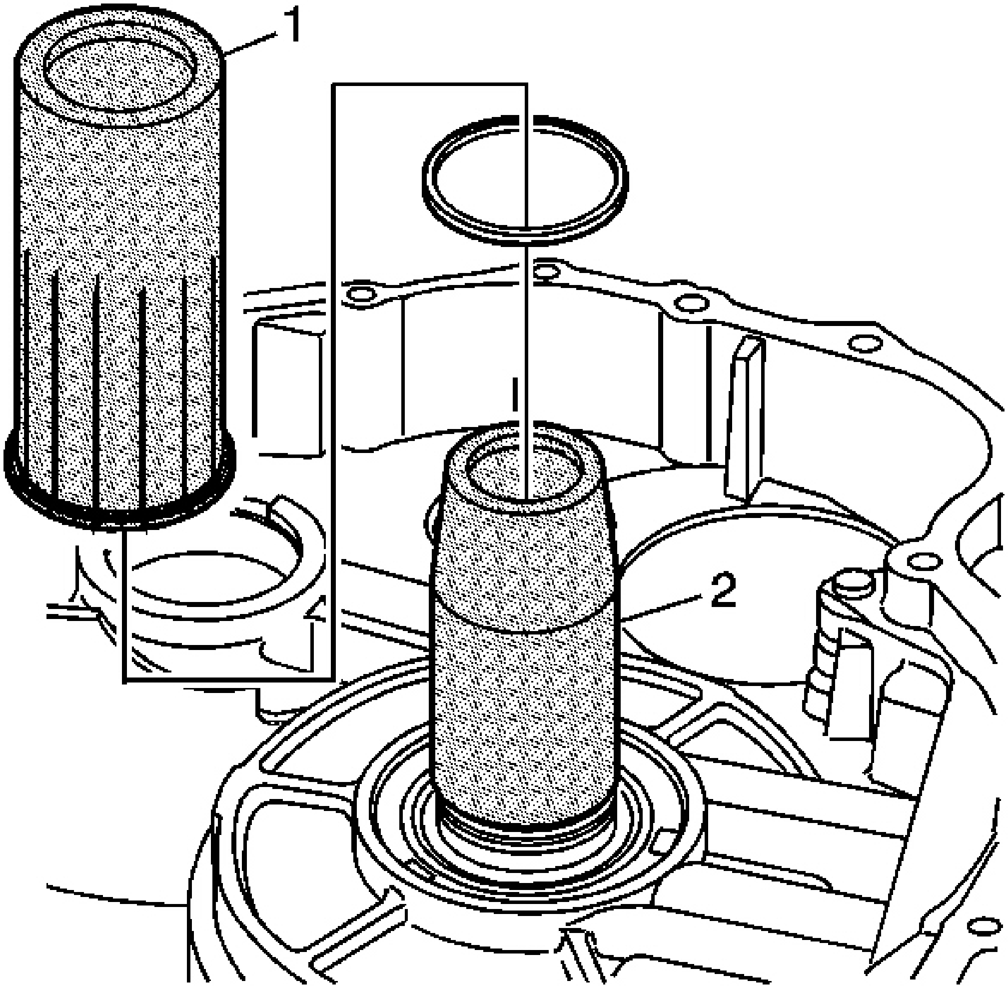


Fig. 259: J 43066-1, J 43066-2 & Seal Groove
Courtesy of GENERAL MOTORS CORP.

1. Slide the **J 43066-1** (2) over the stator shaft and position the**J 43066-1** just above the seal groove. See **Special Tools and Equipment** . Coat the **J 43066-1** with transmission fluid. See **Special Tools and Equipment** .
2. Guide a NEW seal onto the **J 43066-1** and slide the seal into the seal groove using the**J 43066-2** (1). See **Special Tools and Equipment** .
3. Remove the **J 43066-1** and **J 43066-2** . See **Special Tools and Equipment** .

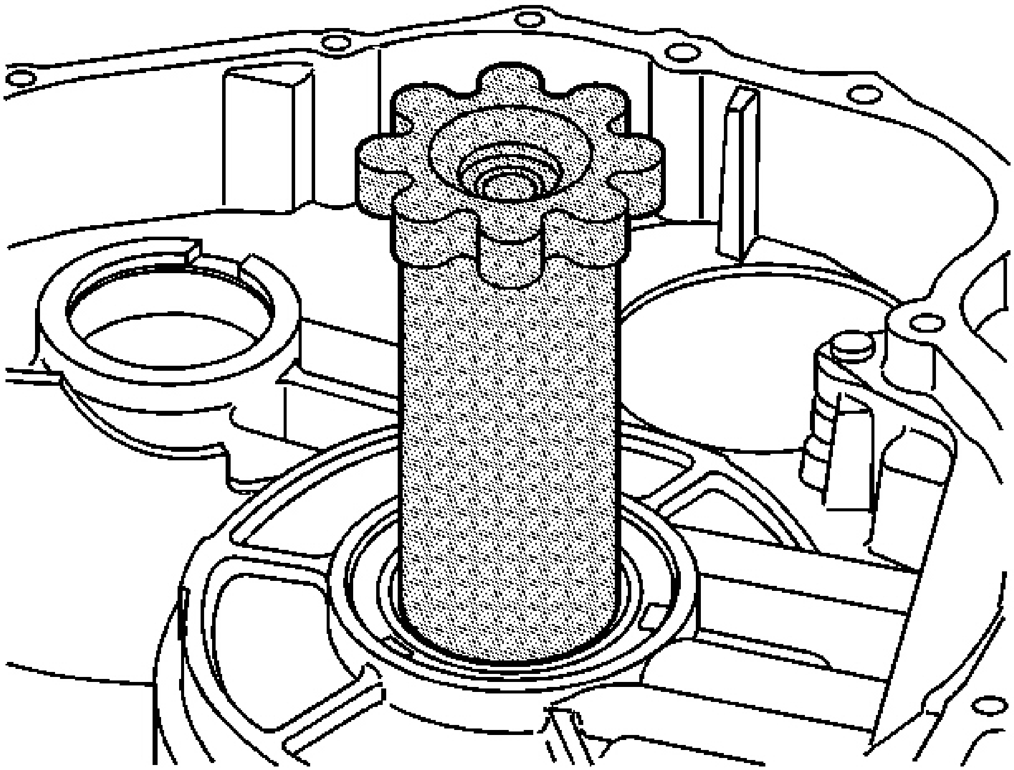


Fig. 260: J 43066-3
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 43066-3** , size the seal. See **Special Tools and Equipment** .
5. Leave the **J 43066-3** in place for at least 5 minutes in order to properly size the seal. See **Special Tools and Equipment** .

MANUAL SHIFT SHAFT AND PARKING SYSTEM COMPONENTS INSTALLATION

Tools Required

- **J 44969** Manual Shift Shaft Seal Installer. See **Special Tools and Equipment** .
- **J 45190** Manual Shift Shaft Socket. See **Special Tools and Equipment** .

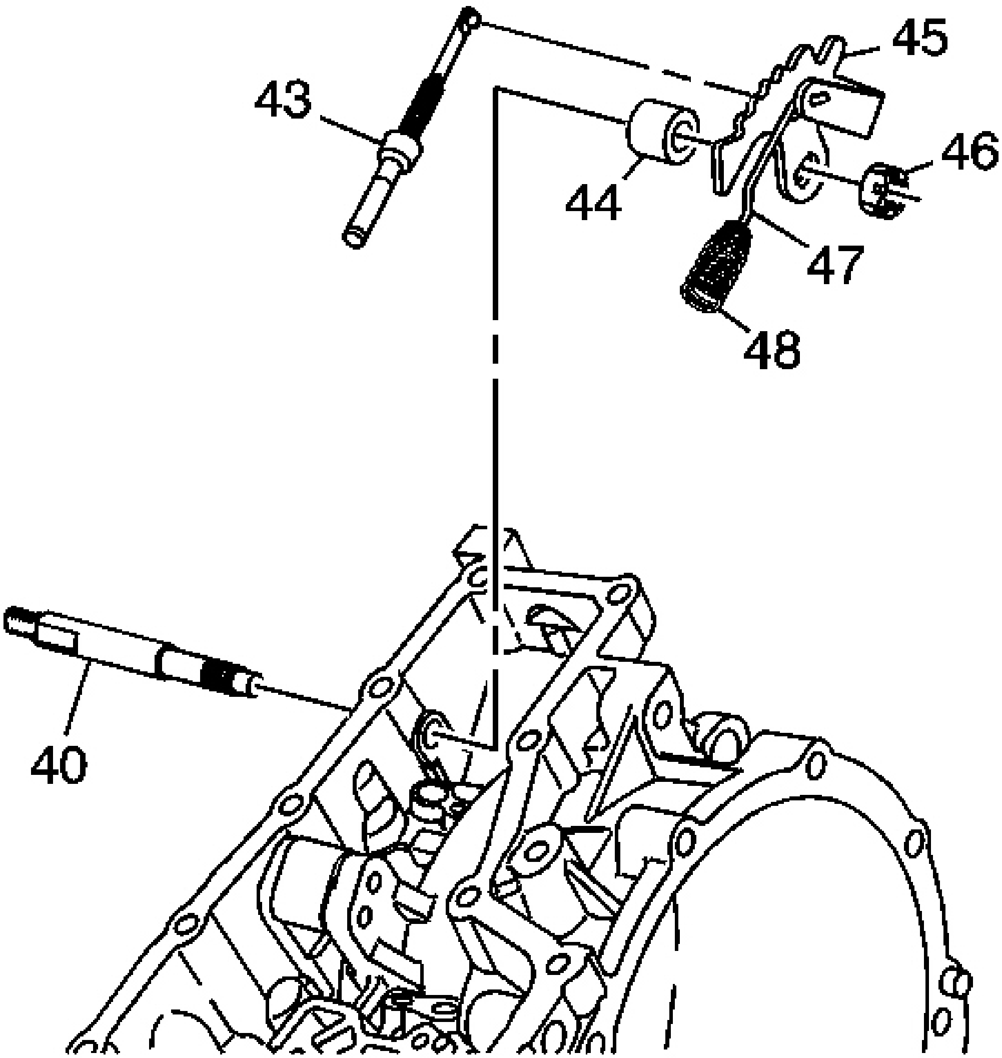


Fig. 261: Manual Shift Shaft & Components
Courtesy of GENERAL MOTORS CORP.

1. Partially insert the manual shift shaft (40) through the case hole.
2. Install the park pawl actuator assembly (43) on the manual shaft detent lever (45).
3. Install the manual shift shaft retainer (44), detent lever (45), manual valve link (47) and spring (48), and nut (46) on the manual shift shaft (40).
4. Fully install the manual shift shaft.

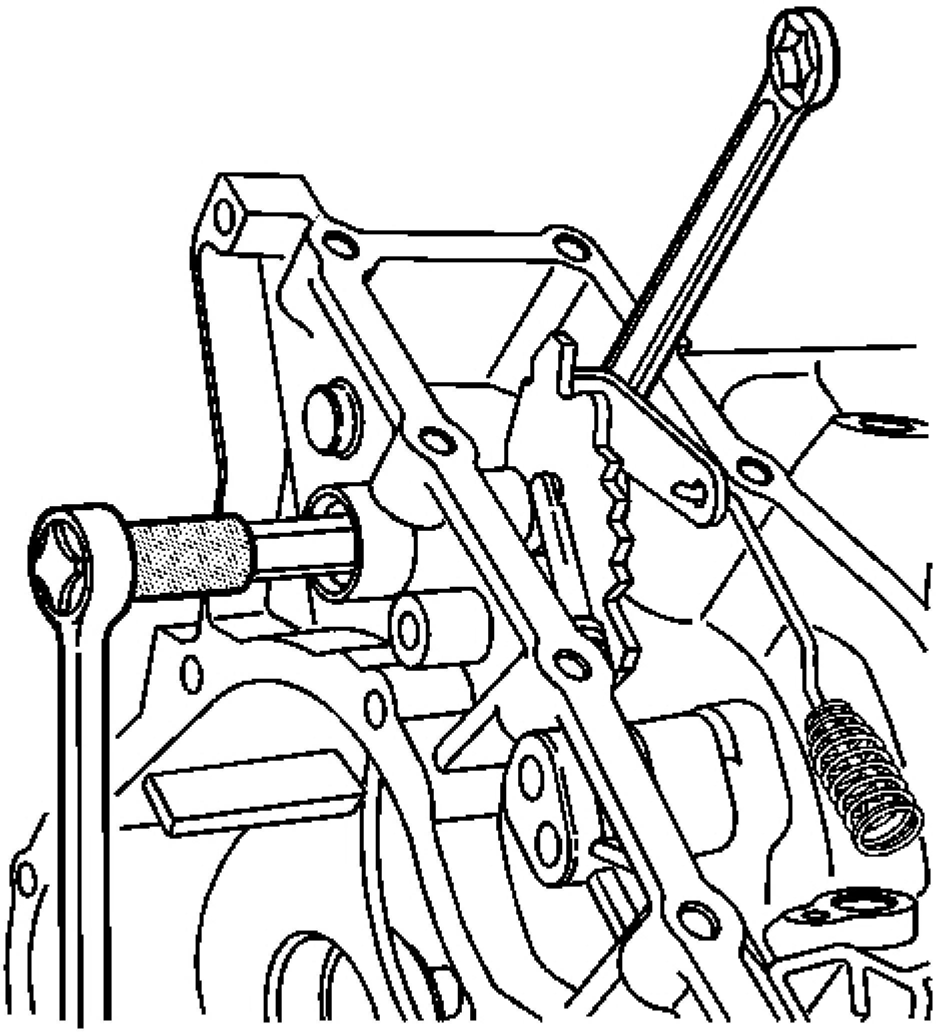


Fig. 262: Tightening The Manual Shift Shaft Nut Using J 45190 And A Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

5. Using the **J 45190** and a wrench, tighten the manual shift shaft nut. See **Special Tools and Equipment** .

Tighten: Tighten the nut to 30 N.m (22 lb ft).

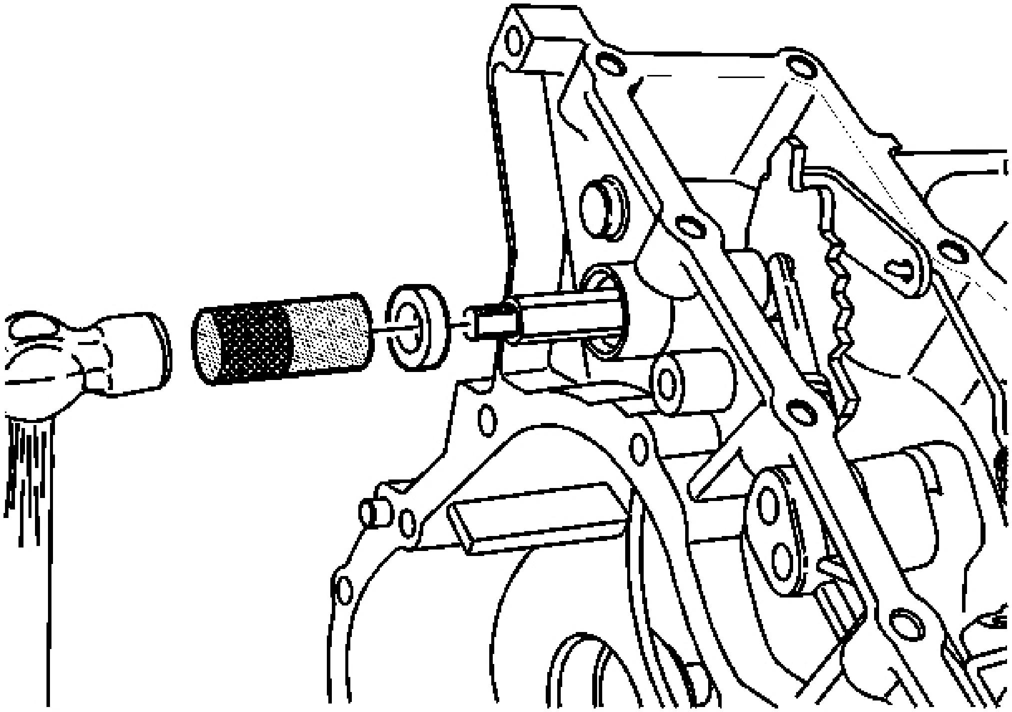
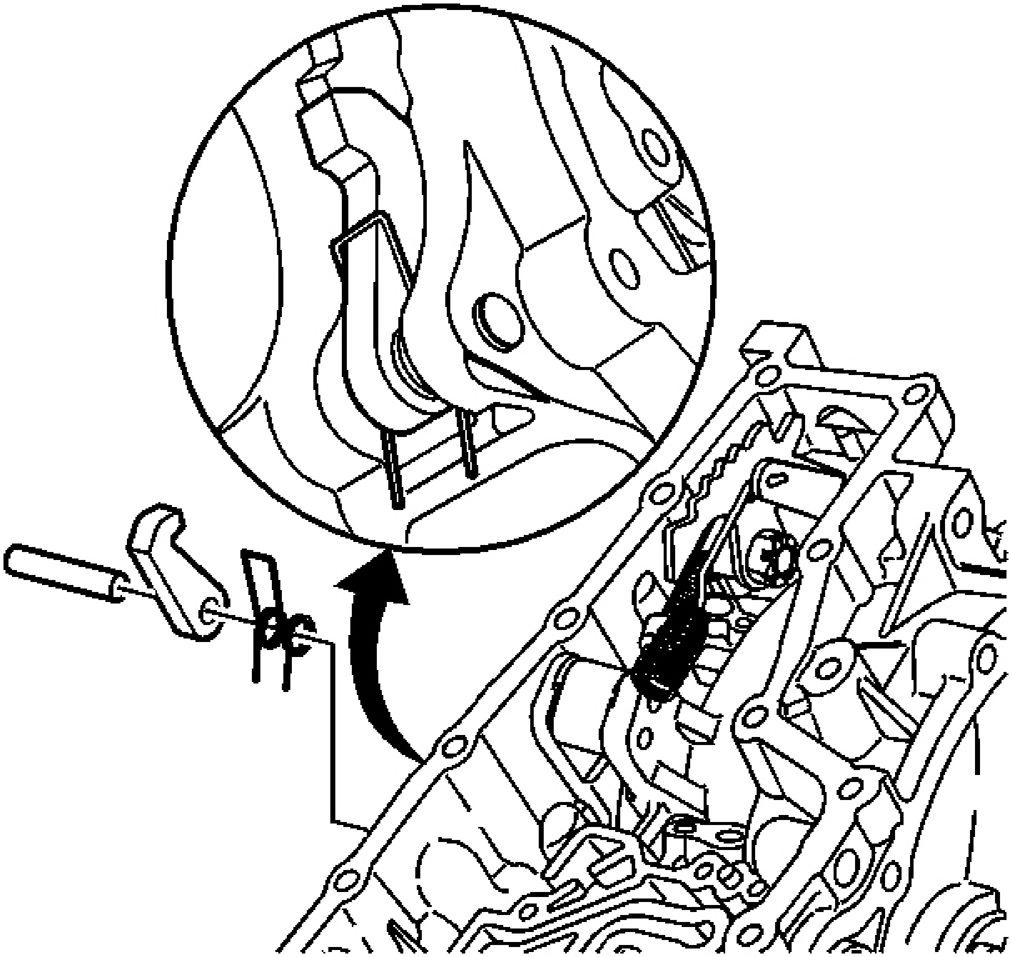


Fig. 263: Manual Shift Shaft Seal, J 44969 & Hammer
Courtesy of GENERAL MOTORS CORP.

6. Using the **J 44969** and a hammer, install a NEW manual shift shaft seal assembly into the transmission case assembly. See **Special Tools and Equipment** .



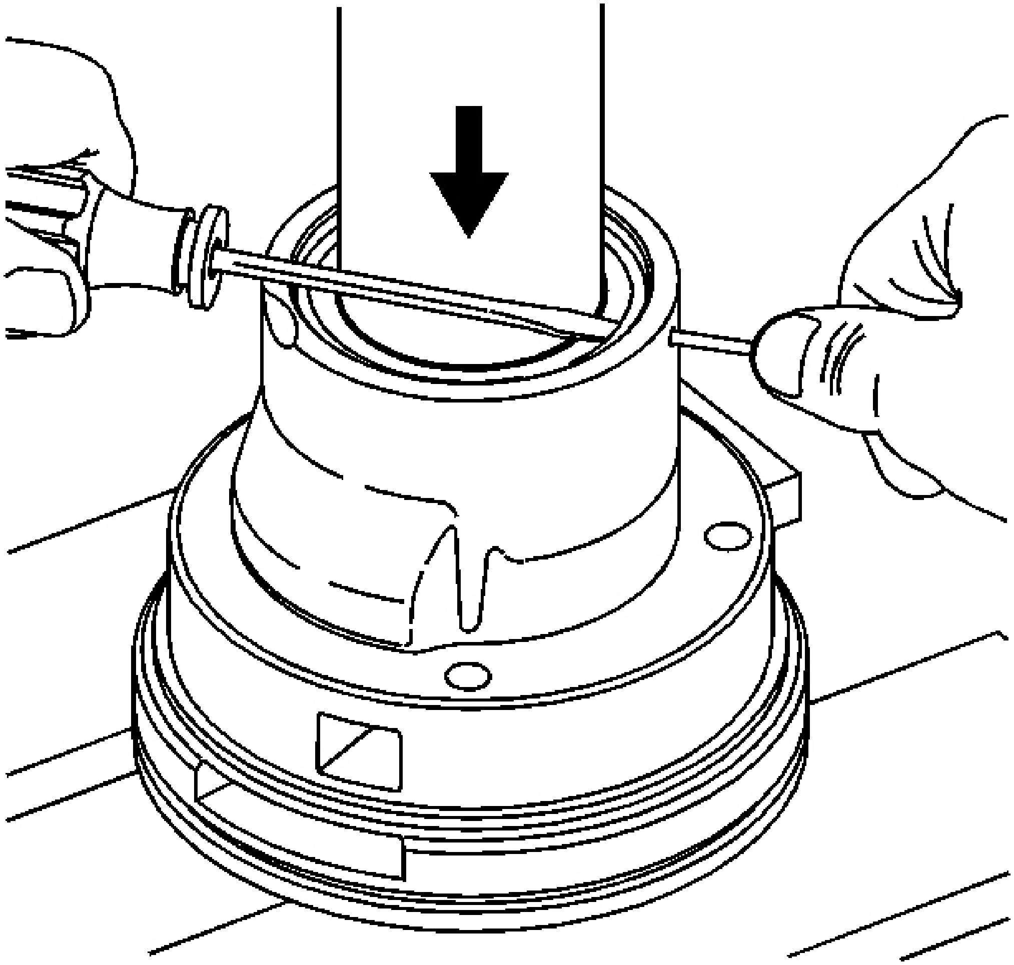
<u>Fig. 264: Park Pawl, Reaction Pin & Spring</u>
Courtesy of GENERAL MOTORS CORP.

7. Install the park pawl reaction pin, park pawl and spring.

FLUID PUMP DISASSEMBLE

Tools Required

J 45000 Seal Remover



<u>**Fig. 265: Removing The Retaining Ring From Pump Assembly Using A Small Screwdriver**</u>
Courtesy of GENERAL MOTORS CORP.

NOTE:	**Do not position the pump assembly on the inlet face. Damage to the inlet face may cause the pump assembly to become inoperative.**

NOTE:	**Do not remove the pressure relief valve assembly from the pump assembly. The threads of the valve are coated with a locking sealant. Reinstalling a valve that has been removed may cause the valve to leak or become loose.**

1. Position the pump assembly on an arbor press so that the pump drive shaft end is face-down and the

pump assembly is resting on its outer diameter rim face.

2. Center the arbor press over the pump end cover.
3. Using the arbor press, apply a light load to the pump end cover in order to relieve the load on the end cover retaining ring.
4. Using a small punch, push the end cover retaining ring inward through the access hole on the pump housing.
5. While the retaining ring is held in, use a small screwdriver to remove the retaining ring from the pump assembly.
6. Remove the punch and release the arbor press load from the pump end cover.

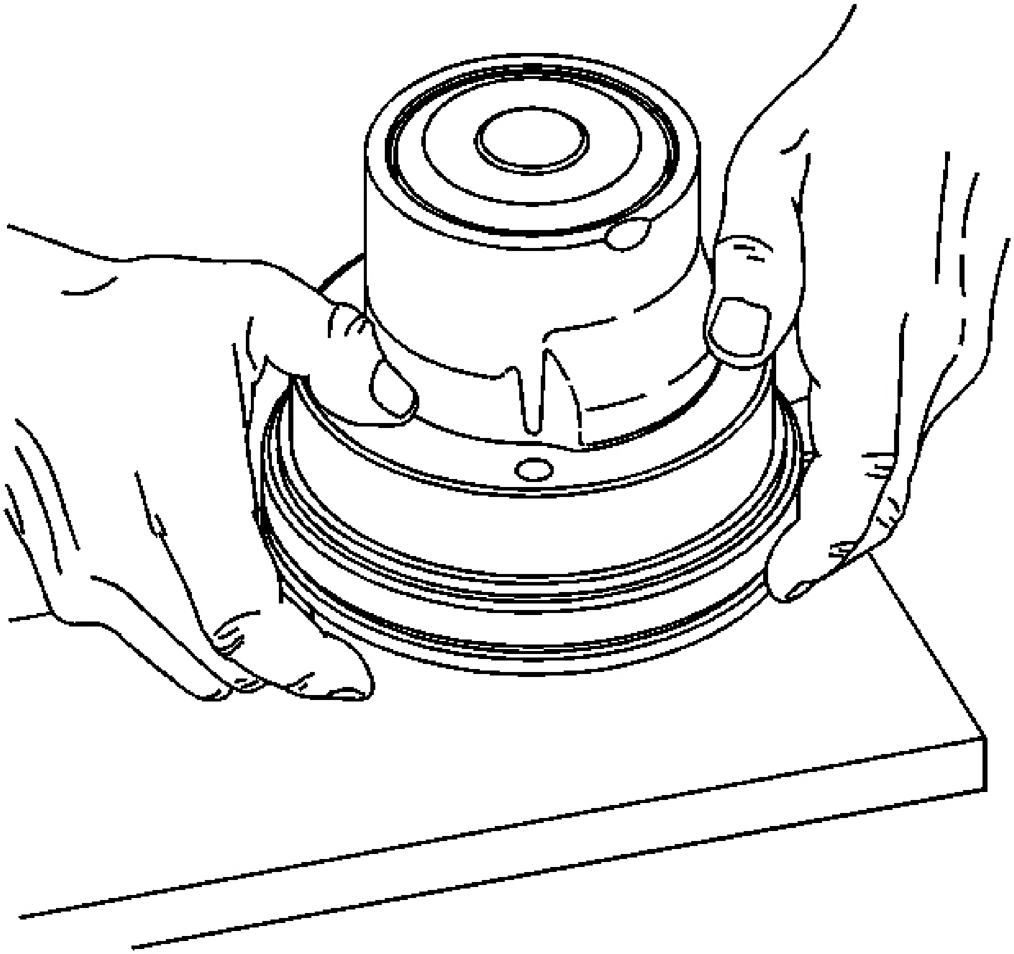


Fig. 266: Grasping The Pump Assembly Using Both Hands
Courtesy of GENERAL MOTORS CORP.

7. Using both hands, grasp the pump assembly and lightly tap the shaft end on a wooden block until the pump end cover comes out of the pump housing.

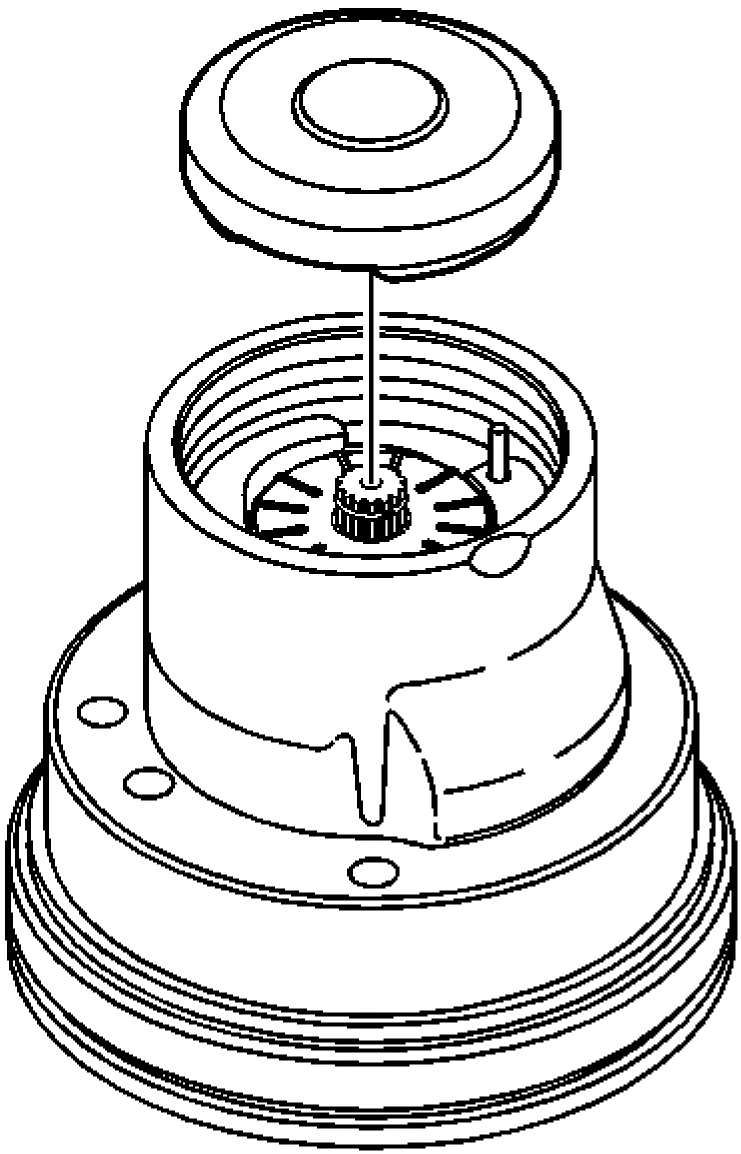


Fig. 267: Pump End Cover, Pressure Plate & Pressure Plate Spring
Courtesy of GENERAL MOTORS CORP.

8. Remove the pump end cover, pressure plate and pressure plate spring as a unit from the pump housing.

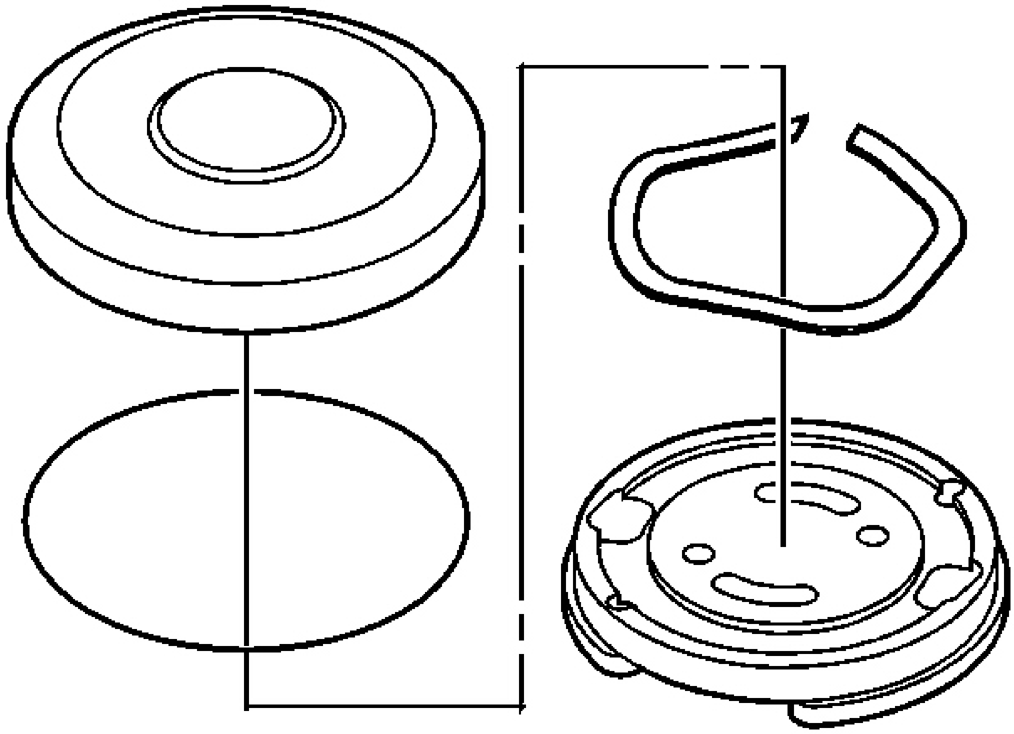


Fig. 268: O-Ring Seal, Pump End Cover, Pressure Plate & Spring
Courtesy of GENERAL MOTORS CORP.

9. Using a small screwdriver, remove the pressure plate and spring from the pump end cover.
10. Remove the O-ring seal from the pump end cover. Discard the O-ring seal.

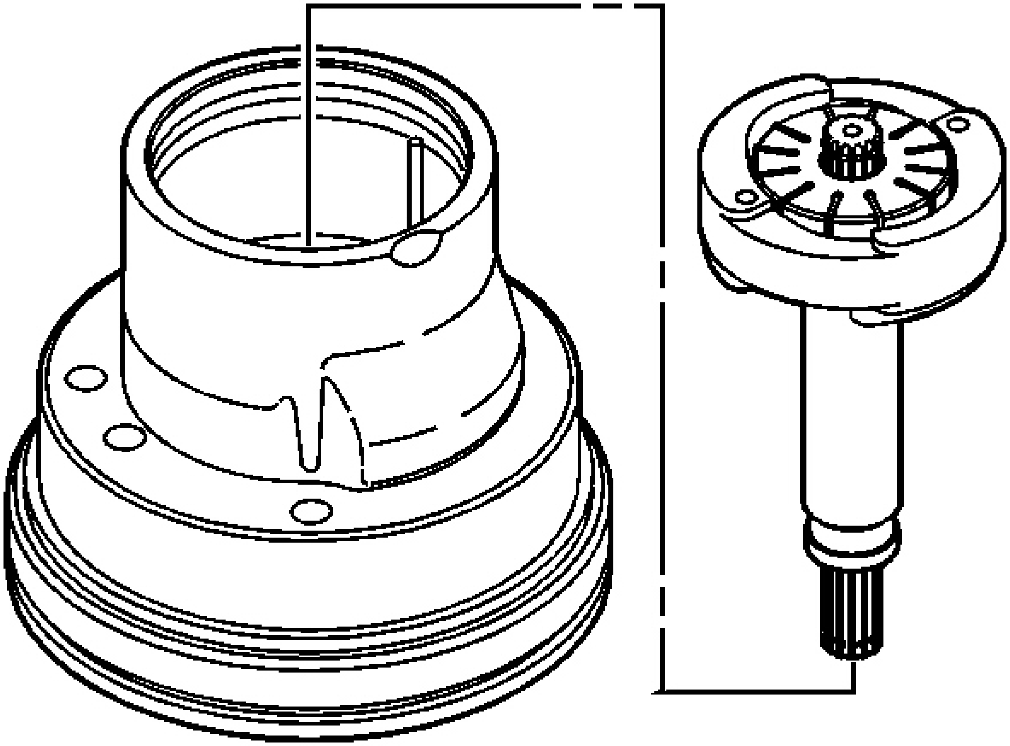


Fig. 269: Drive Shaft, Cam Ring, Thrust Plate & Rotor
Courtesy of GENERAL MOTORS CORP.

11. Remove the drive shaft, cam ring, thrust plate, and rotor as a unit from the pump housing.

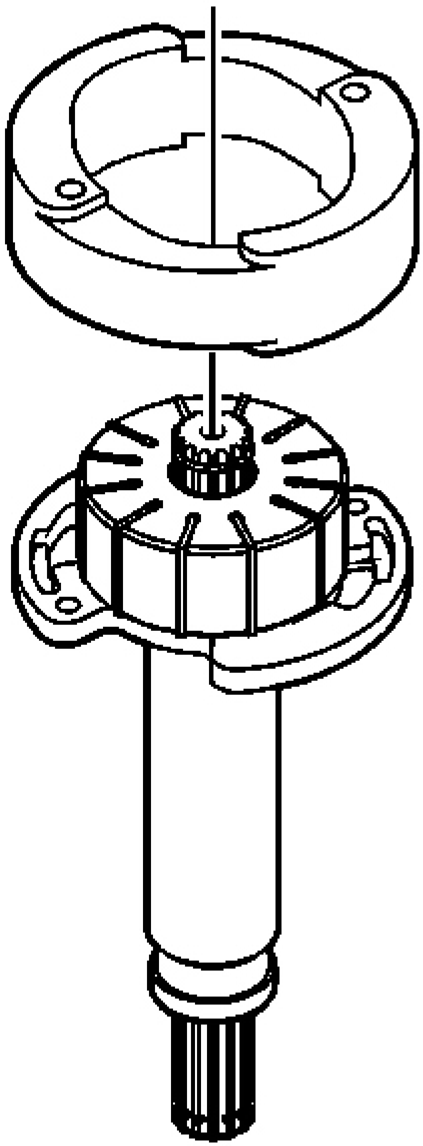
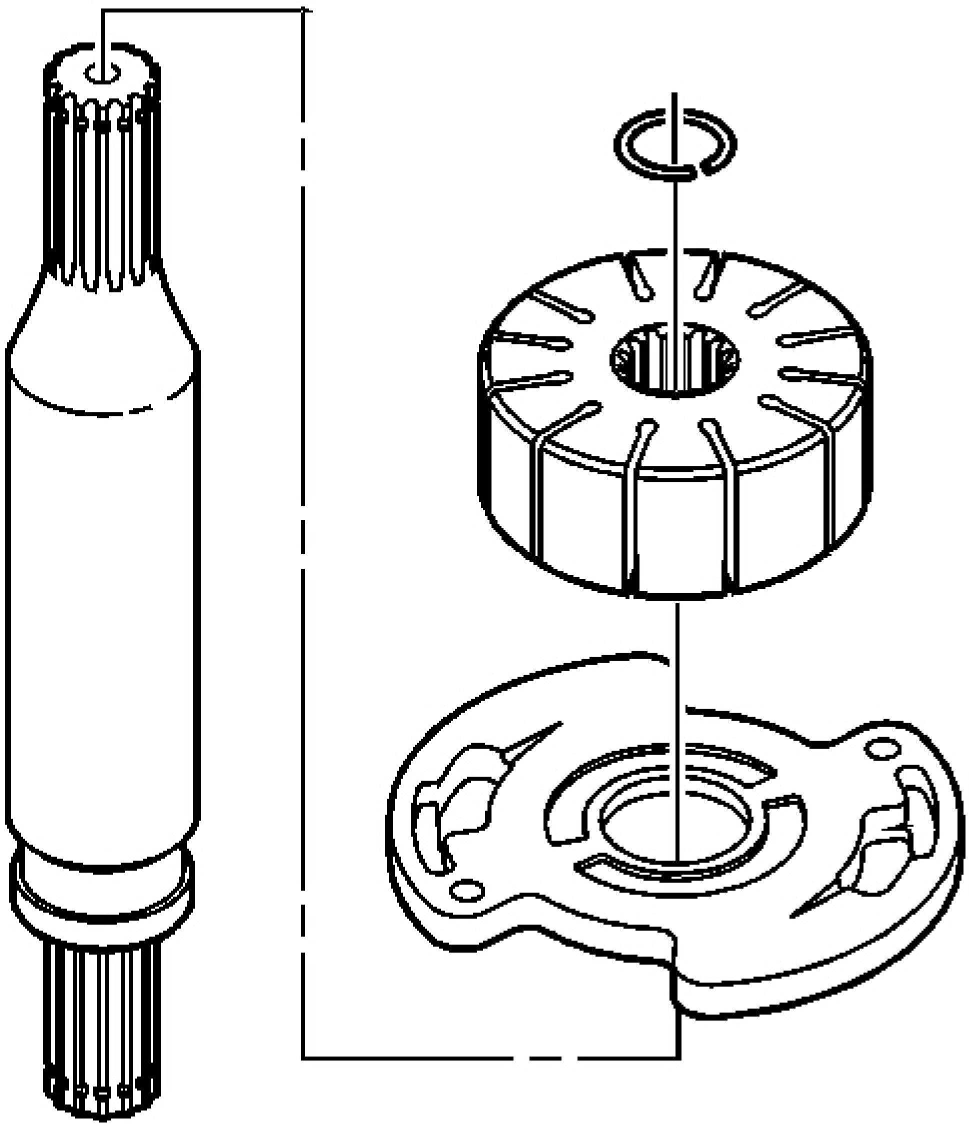


Fig. 270: Cam Ring & Rotor
Courtesy of GENERAL MOTORS CORP.

12. Remove the cam ring from the rotor.



<u>**Fig. 271: Drive Shaft Retaining Ring, Rotor & Thrust Plate**</u>
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not reuse the drive shaft retaining ring after removing it. Reusing the retaining ring may damage the fluid pump.

13. Remove the drive shaft retaining ring. Discard the retaining ring.

14. Remove the rotor and thrust plate from the drive shaft.

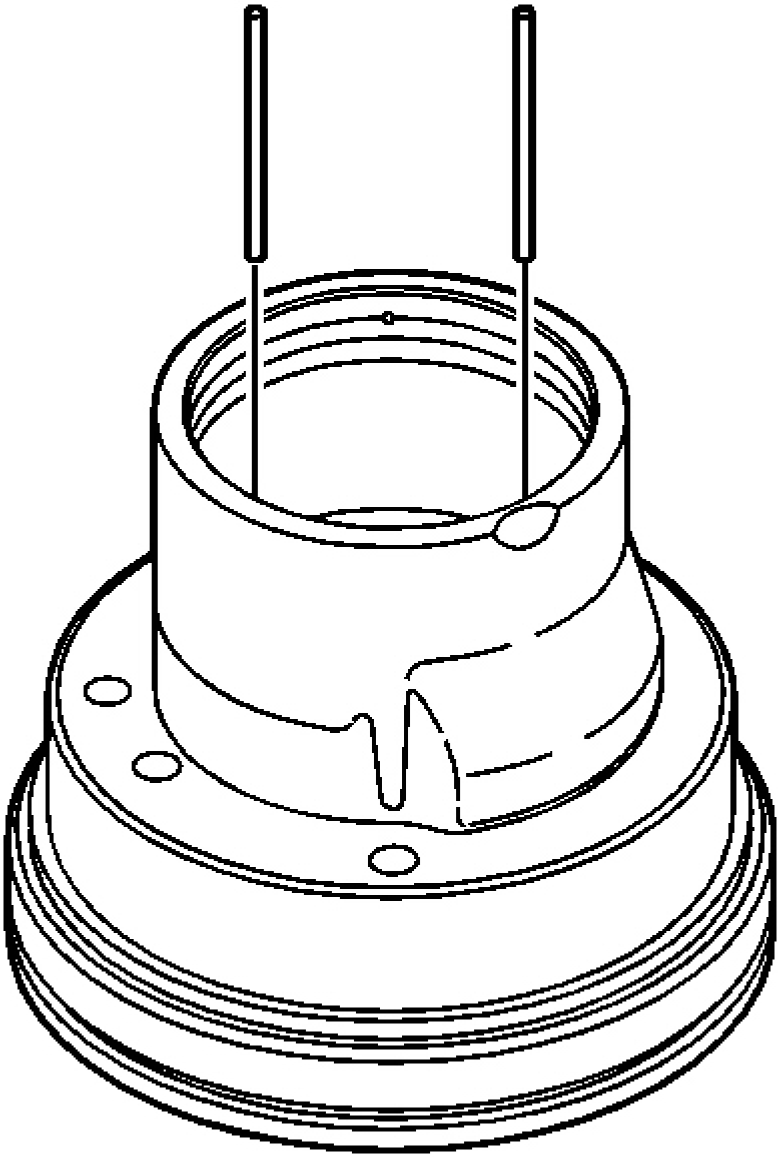


Fig. 272: Cam Ring Dowel Pins & Pump Housing
Courtesy of GENERAL MOTORS CORP.

15. Remove the 2 cam ring dowel pins from the pump housing.

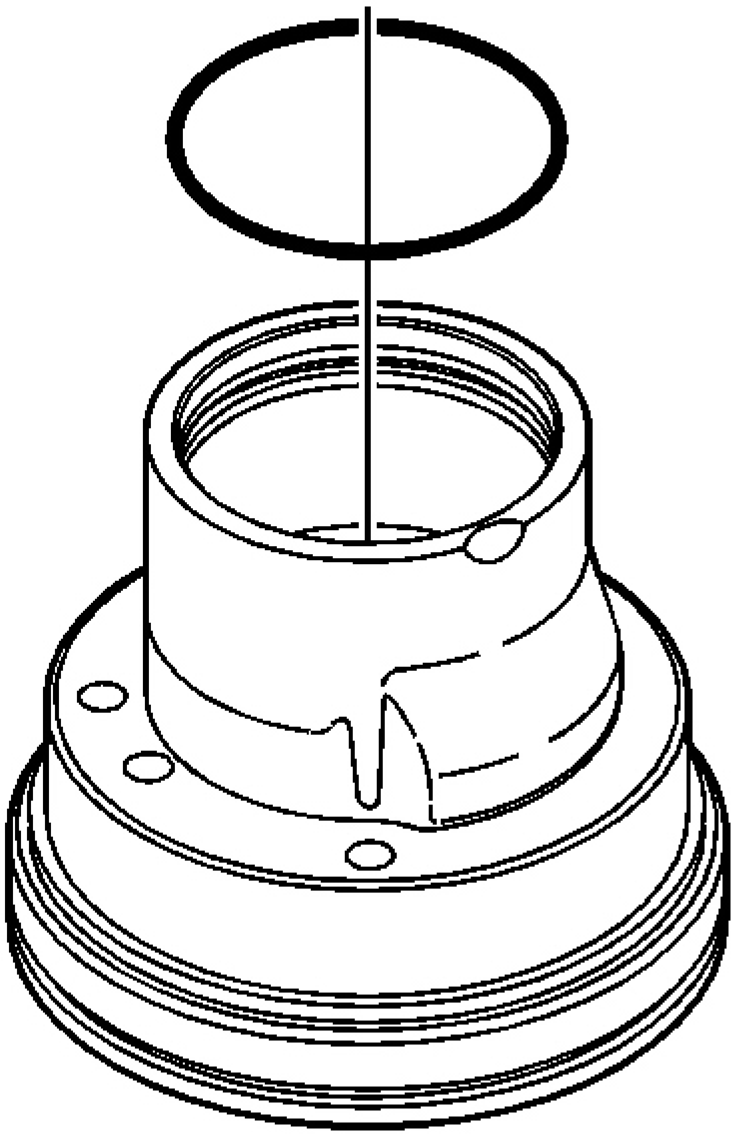


Fig. 273: Inner O-Ring Seal & Pump Housing
Courtesy of GENERAL MOTORS CORP.

16. Remove the inner O-ring seal from the pump housing. Discard the O-ring seal.

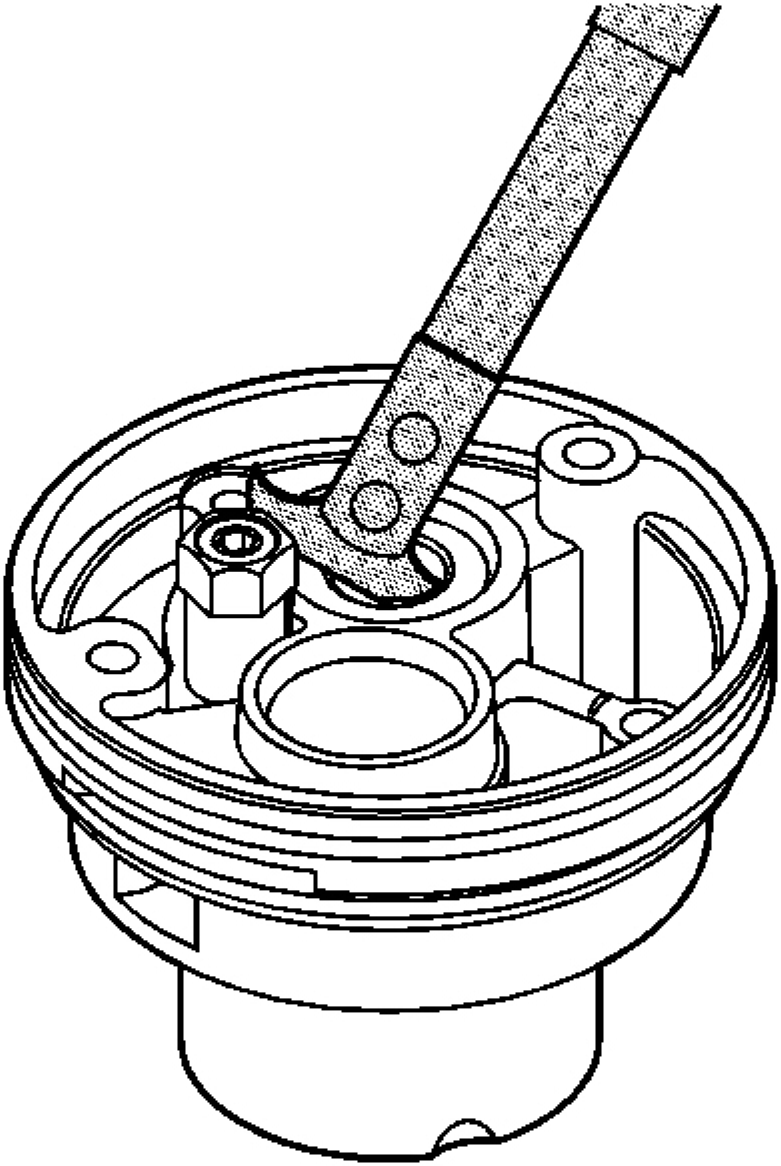


Fig. 274: Pump Drive Shaft Seal & J 45000
Courtesy of GENERAL MOTORS CORP.

NOTE: **Use care when removing the seal in order to prevent damage to the pump housing.**

17. Using the **J 45000** , remove the pump drive shaft seal from the pump housing. Discard the seal.

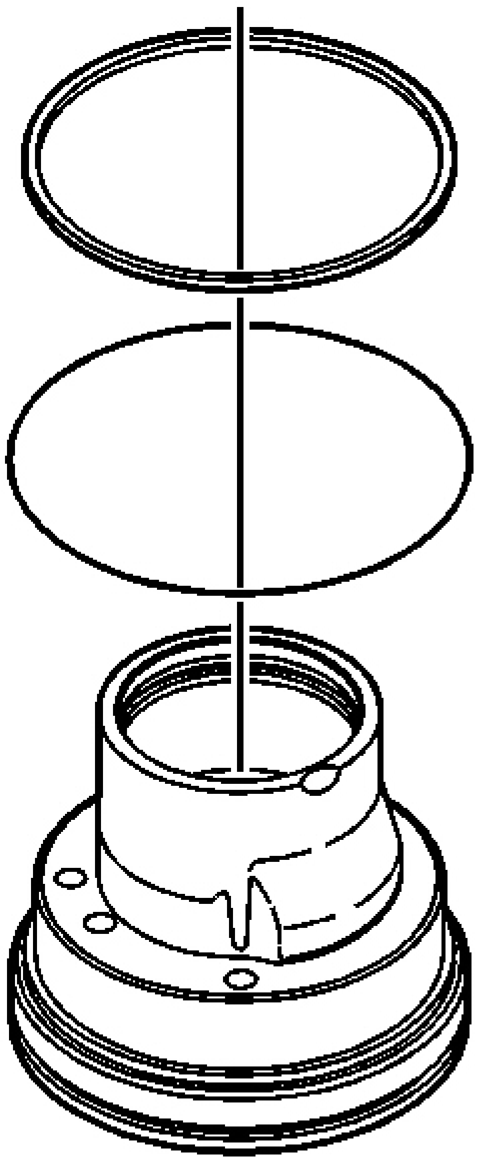


Fig. 275: Outer O-Ring Seal & Outer White Square-Cut Seal
Courtesy of GENERAL MOTORS CORP.

18. Remove the outer O-ring seal and the outer white square-cut seal from the pump housing. Discard the

seals.

FLUID PUMP ASSEMBLE

Tools Required

- **J 36850** Assembly Lubricant. See **Special Tools and Equipment** .
- **J 45112-1** Pump Drive Shaft Retaining Ring Sizing Rod. See **Special Tools and Equipment** .
- **J 45112-2** Pump Drive Shaft Retaining Ring Sizer/Installer. See **Special Tools and Equipment** .
- **J 45198** Pump Drive Shaft Seal Installer. See **Special Tools and Equipment** .

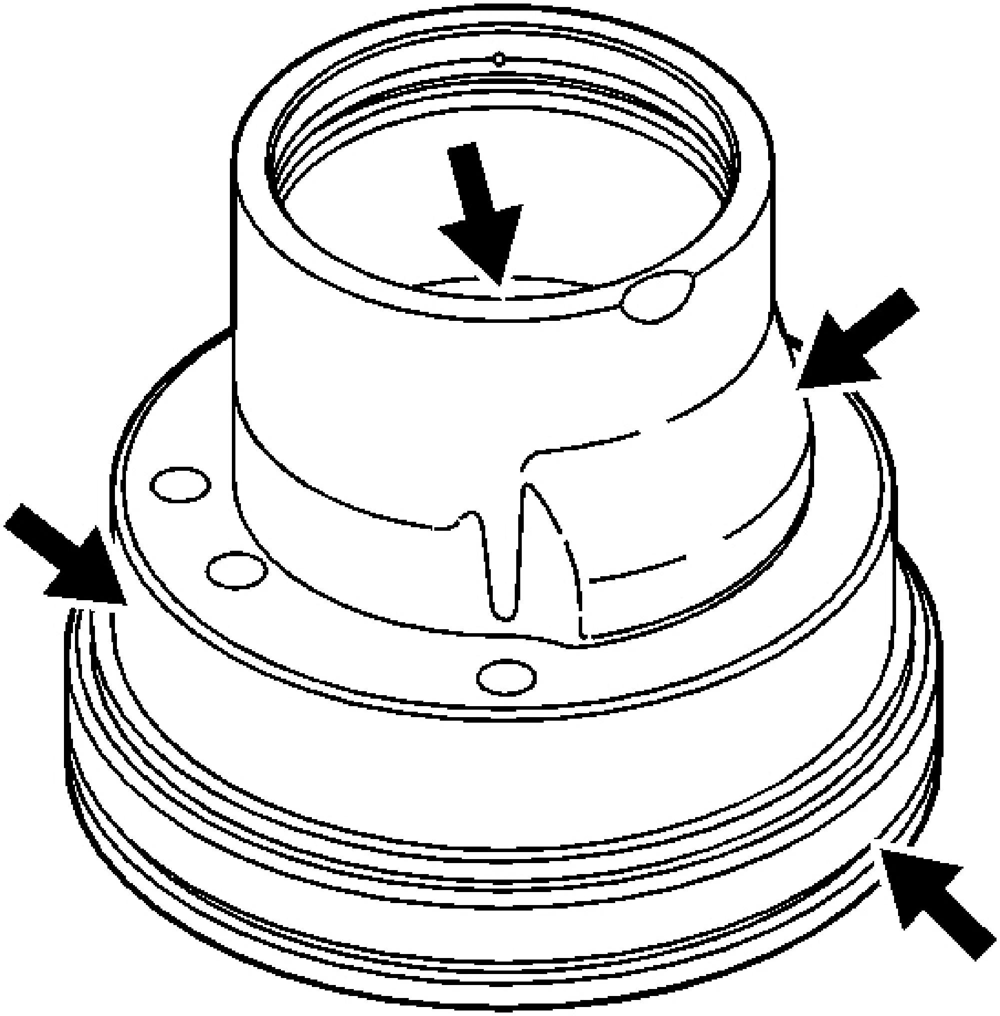
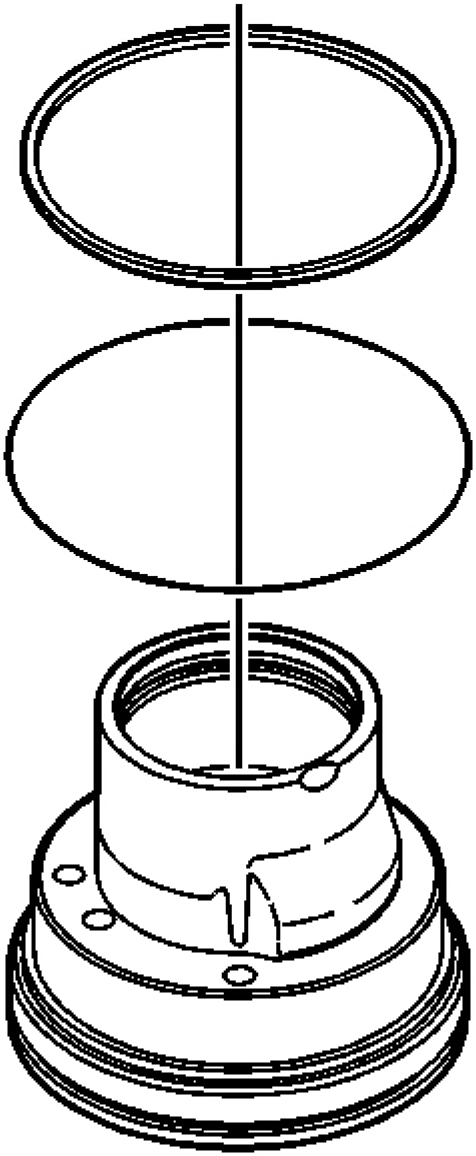


Fig. 276: Inspecting Pump Housing For Damage
Courtesy of GENERAL MOTORS CORP.

1. Inspect the pump housing for damage. Ensure that the inside of the housing is free of any debris.



<u>**Fig. 277: Outer O-Ring Seal & Outer White Square-Cut Seal**</u>
Courtesy of GENERAL MOTORS CORP.

2. Install a NEW outer O-ring seal into the pump housing seal groove.

IMPORTANT: Avoid twisting the square-cut seal during installation. Also ensure that the

seal is positioned so that it does not interfere with the rectangular-shaped discharge port on the side of the pump housing.

3. Install a NEW outer white square-cut seal onto the pump housing. Push the seal flush against the housing shoulder.

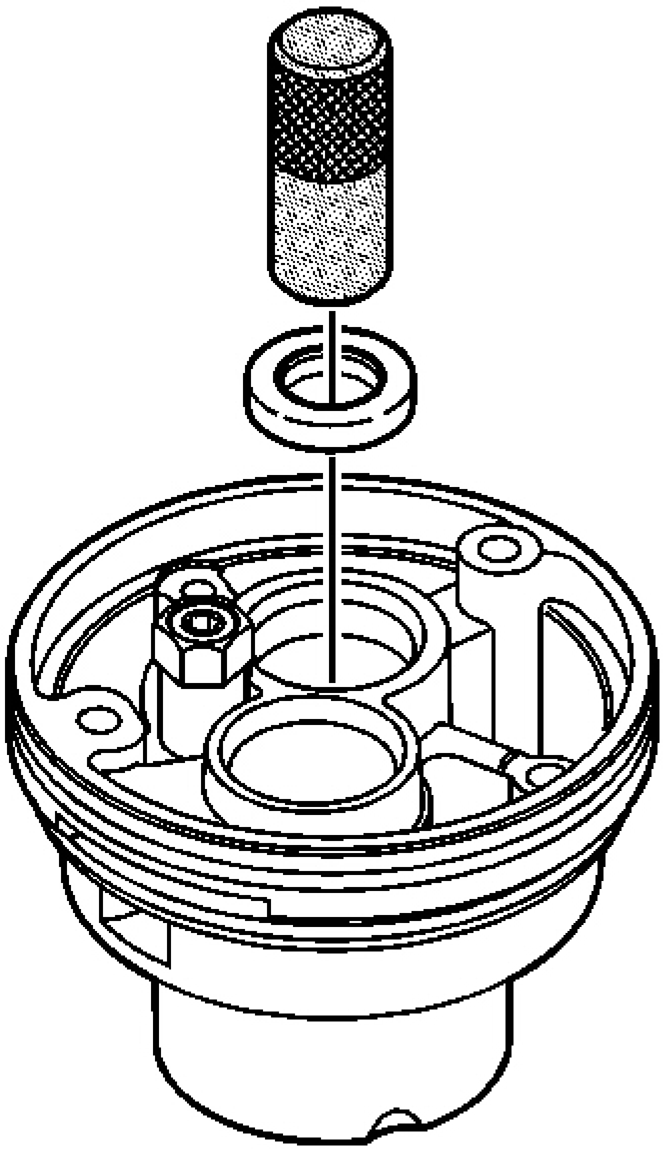


Fig. 278: Pump Drive Shaft Seal & J 45198
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Using the J 36850 , lubricate the pump drive shaft seal for ease of installation. See Special Tools and Equipment .

4. Using the **J 45198** , install a NEW pump drive shaft seal into the pump housing. See **Special Tools and Equipment** .

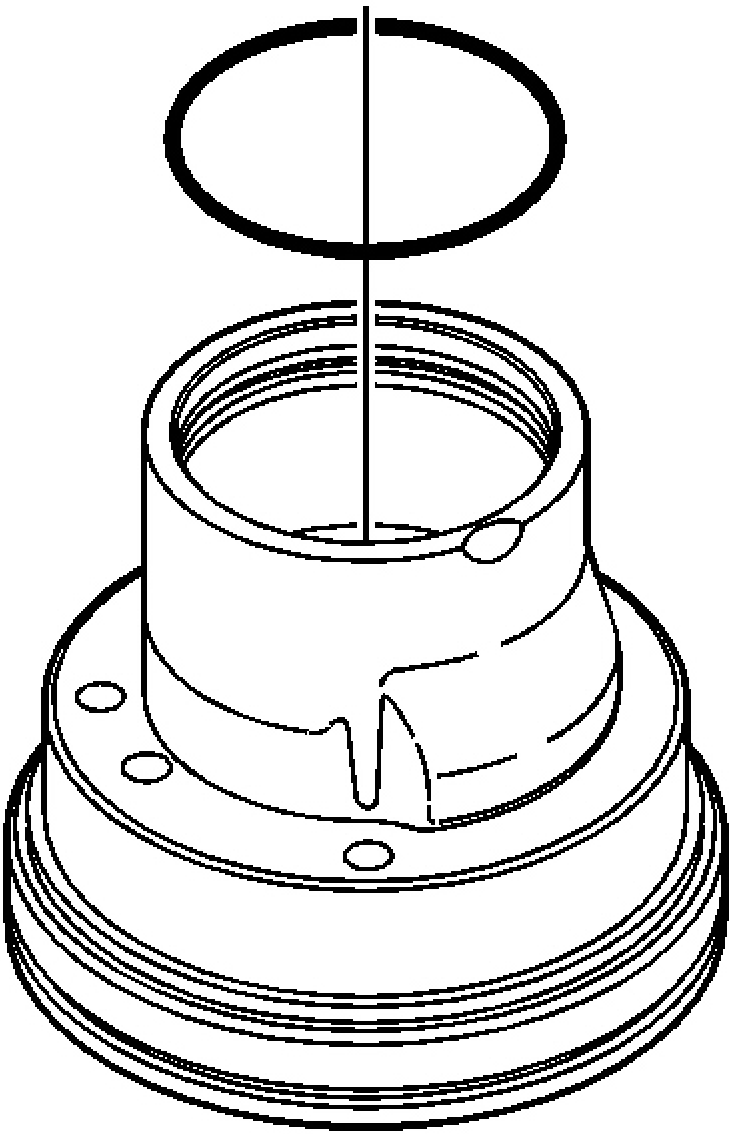


Fig. 279: Inner O-Ring Seal & Pump Housing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: **The inner pump O-ring seal fits into the second ID groove from the pump end. The first ID groove from the pump end is for the end cover retaining ring.**

5. Install a NEW inner O-ring seal into the pump housing seal groove.
6. Apply the **J 36850** to the ID of the O-ring seal. See **Special Tools and Equipment** .

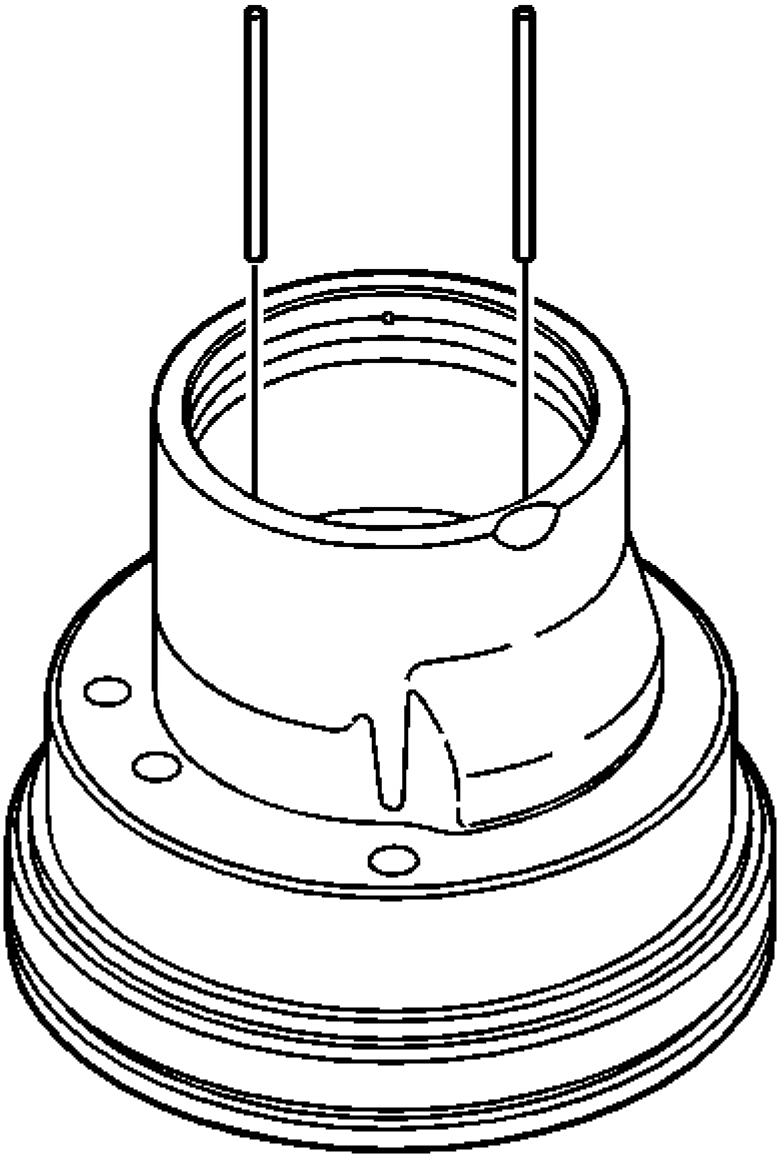


Fig. 280: Cam Ring Dowel Pins & Pump Housing
Courtesy of GENERAL MOTORS CORP.

7. Install the 2 cam ring dowel pins into the locating holes in the pump housing.

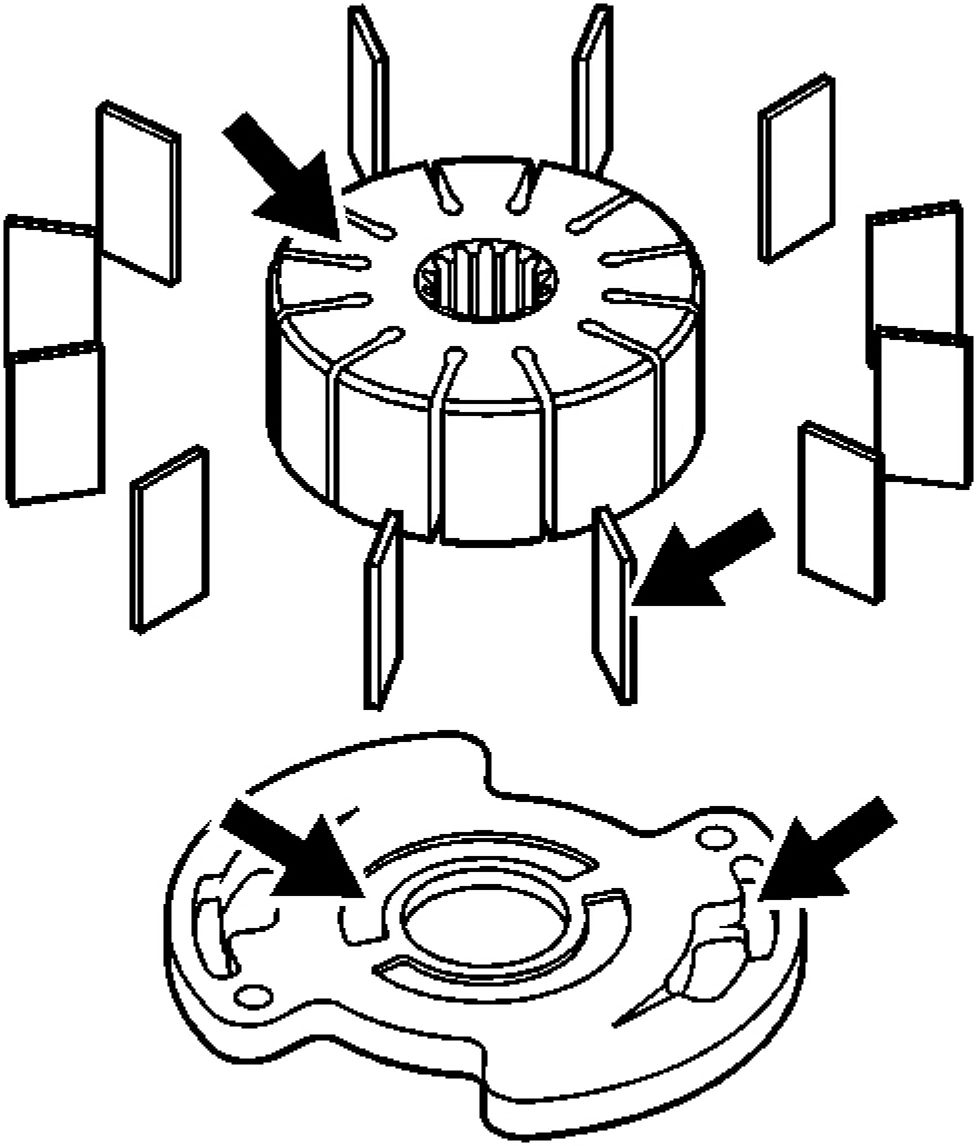


Fig. 281: Inspecting The Thrust Plate, Pump Rotor & Pump Rotor Vanes For Damage
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The pump rotor vanes are symmetrical and may be assembled in any

orientation.

8. Inspect the thrust plate, pump rotor and pump rotor vanes for damage.

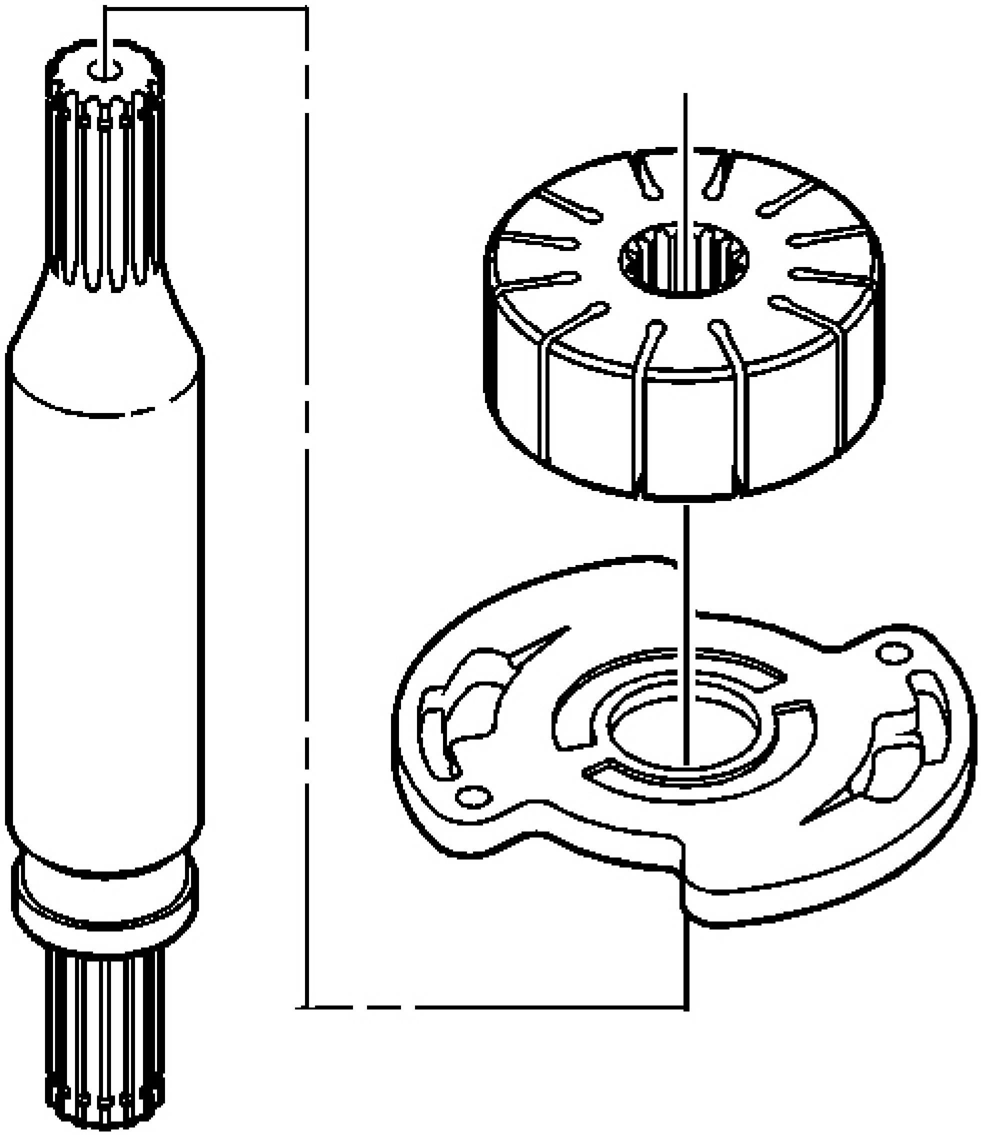


Fig. 282: Thrust Plate, Rotor & Vanes
Courtesy of GENERAL MOTORS CORP.

9. Install the thrust plate and rotor, with vanes, on the drive shaft.

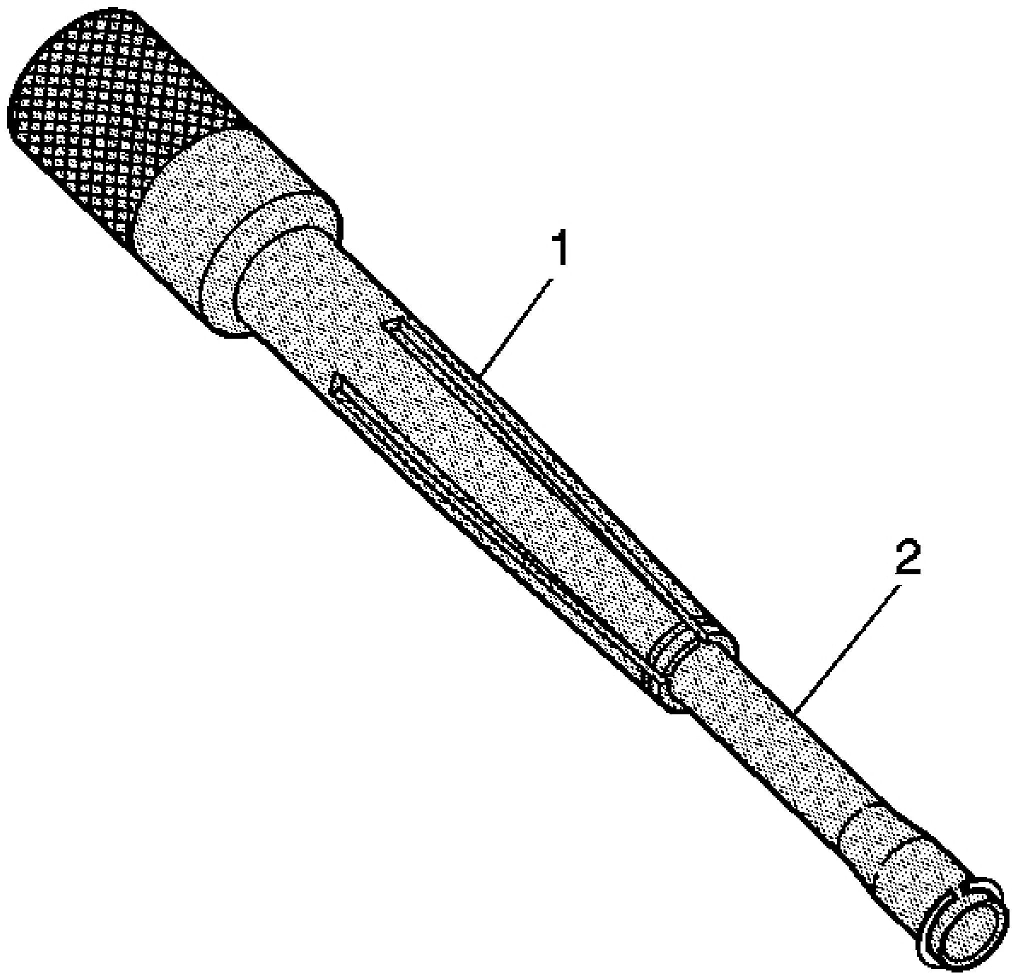


Fig. 283: J 45112-1 & J 45112-2
Courtesy of GENERAL MOTORS CORP.

NOTE: Use care when mounting the drive shaft in the vise. Nicks or score marks on the drive shaft could damage the pump.

10. Mount the drive shaft and rotor in a vise.
11. Using the **J 45112-2** (1), size a NEW drive shaft retaining ring on the**J 45112-1** (2). See **Special Tools and Equipment** .

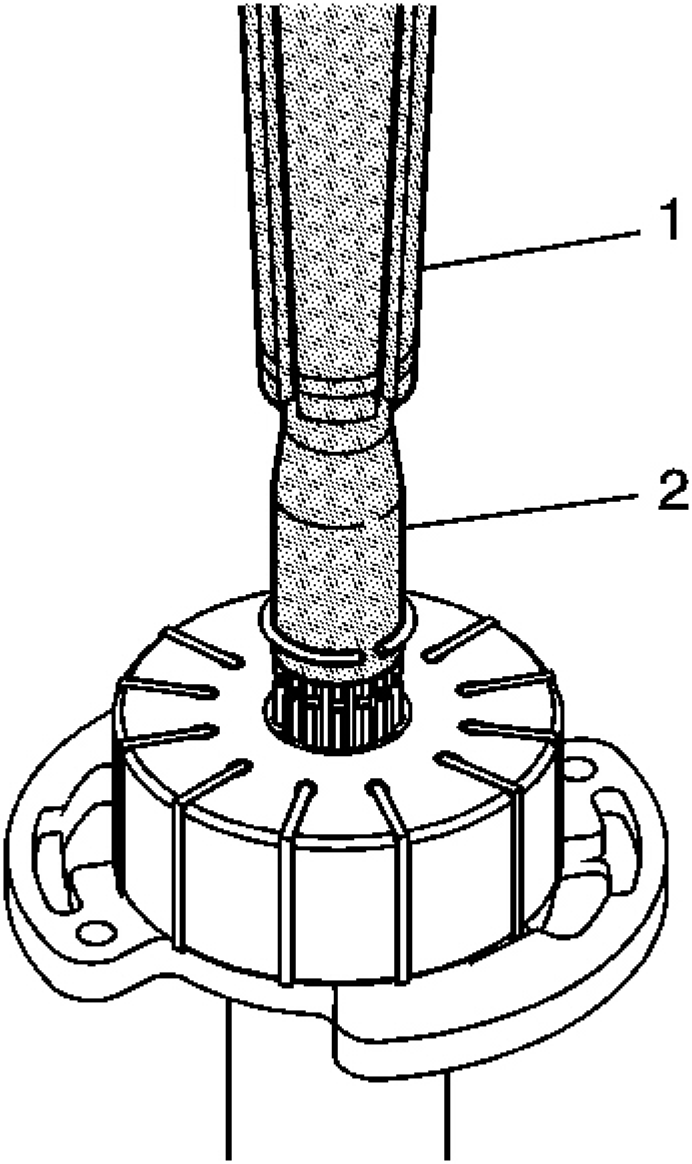


Fig. 284: J 45112-1, J 45112-2 & Drive Shaft
Courtesy of GENERAL MOTORS CORP.

NOTE: **Ensure that the drive shaft retaining ring is uniformly installed on the drive shaft. A crooked or improperly installed retaining ring could damage the pump.**

12. Using the **J 45112-2** (1) and the**J 45112-1** (2), install the drive shaft retaining ring into the groove on the drive shaft. See **Special Tools and Equipment** .

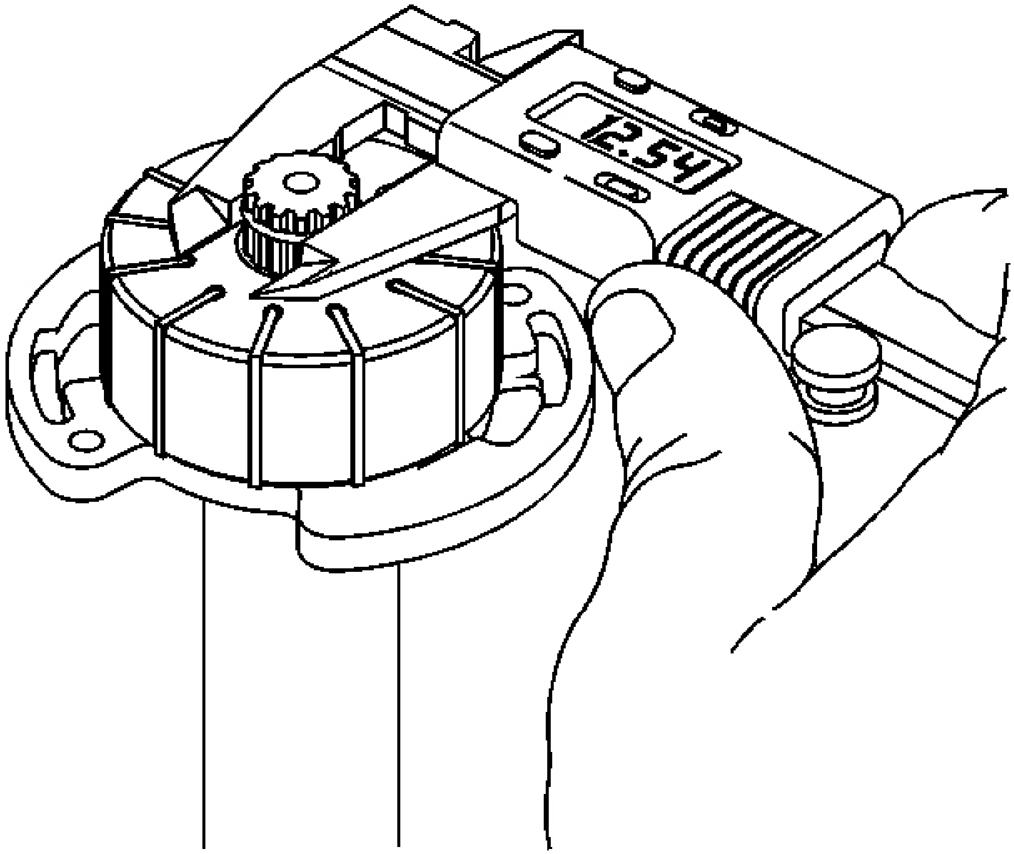


Fig. 285: Measuring The OD Of Installed Retaining Ring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If an acceptable measurement is not obtained, install a NEW retaining ring.

13. Measure the OD of the installed retaining ring. The measurement should be 12.54 mm (0.49 in) or less.

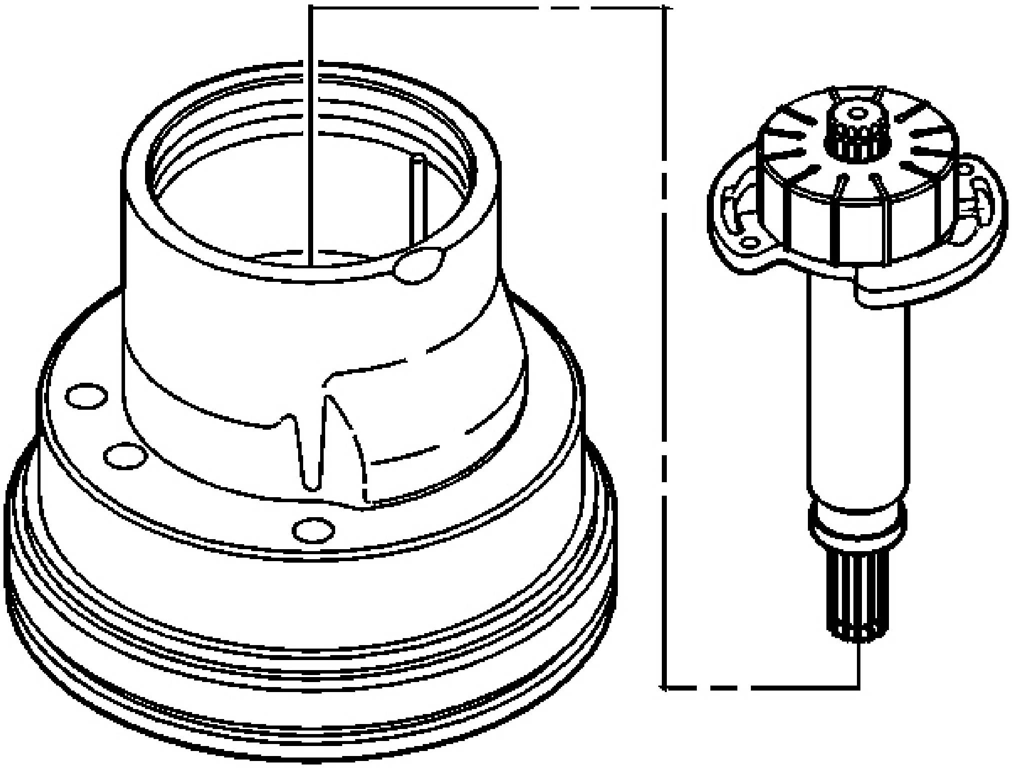


Fig. 286: Inserting Drive Shaft, Thrust Plate & Rotor Into Pump Housing
Courtesy of GENERAL MOTORS CORP.

14. Insert the drive shaft, thrust plate and rotor as a unit into the pump housing. Align the two holes in the thrust plate with the cam dowel pins.

IMPORTANT: It is normal to have to overcome some resistance caused by the lip seal on the sprocket end of the shaft.

15. Push down on the shaft until the thrust plate and rotor are fully positioned in the pump housing.

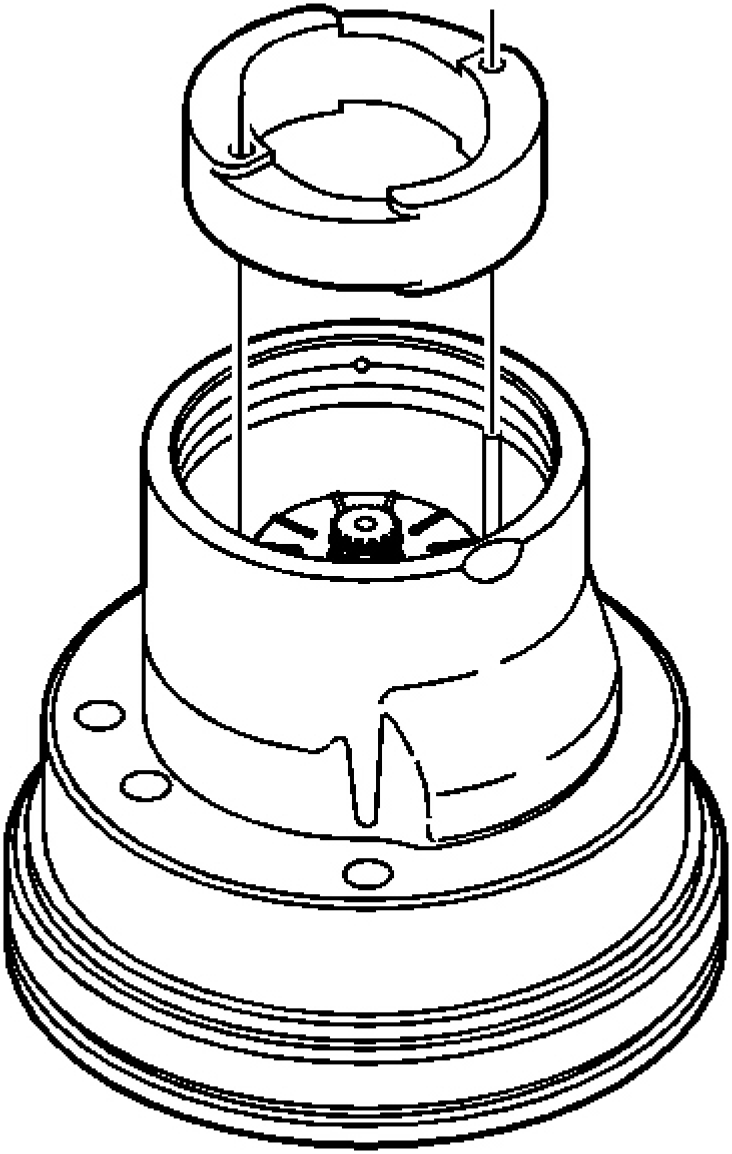


Fig. 287: Installing Cam Ring Into Pump Housing
Courtesy of GENERAL MOTORS CORP.

16. Install the cam ring into the pump housing, aligning the cam ring through-holes on the dowel pins. Ensure that the cam ring inlet notches are aligned with the thrust plate scallops.

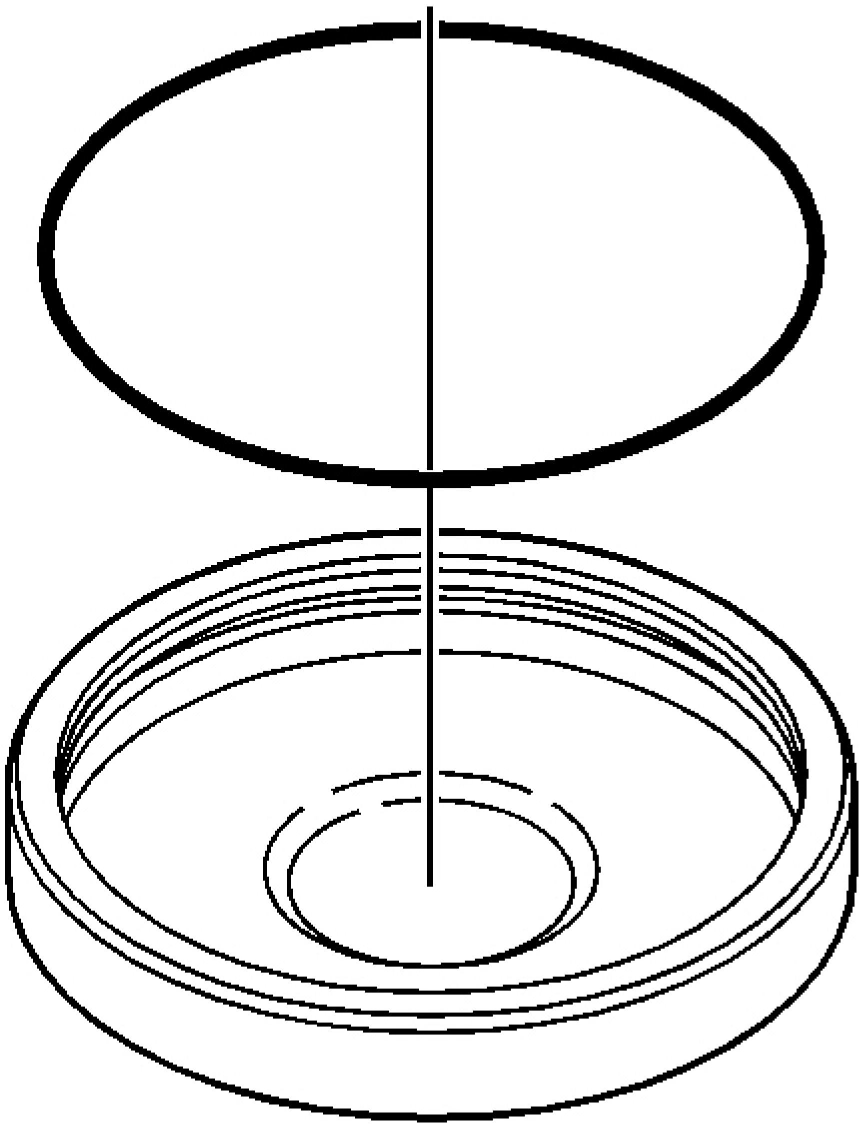


Fig. 288: Installing O-Ring Seal Into Pump End Cover Groove
Courtesy of GENERAL MOTORS CORP.

17. Install a NEW O-ring seal into the pump end cover groove.
18. Apply the **J 36850** to the ID of the O-ring seal. See **Special Tools and Equipment** .

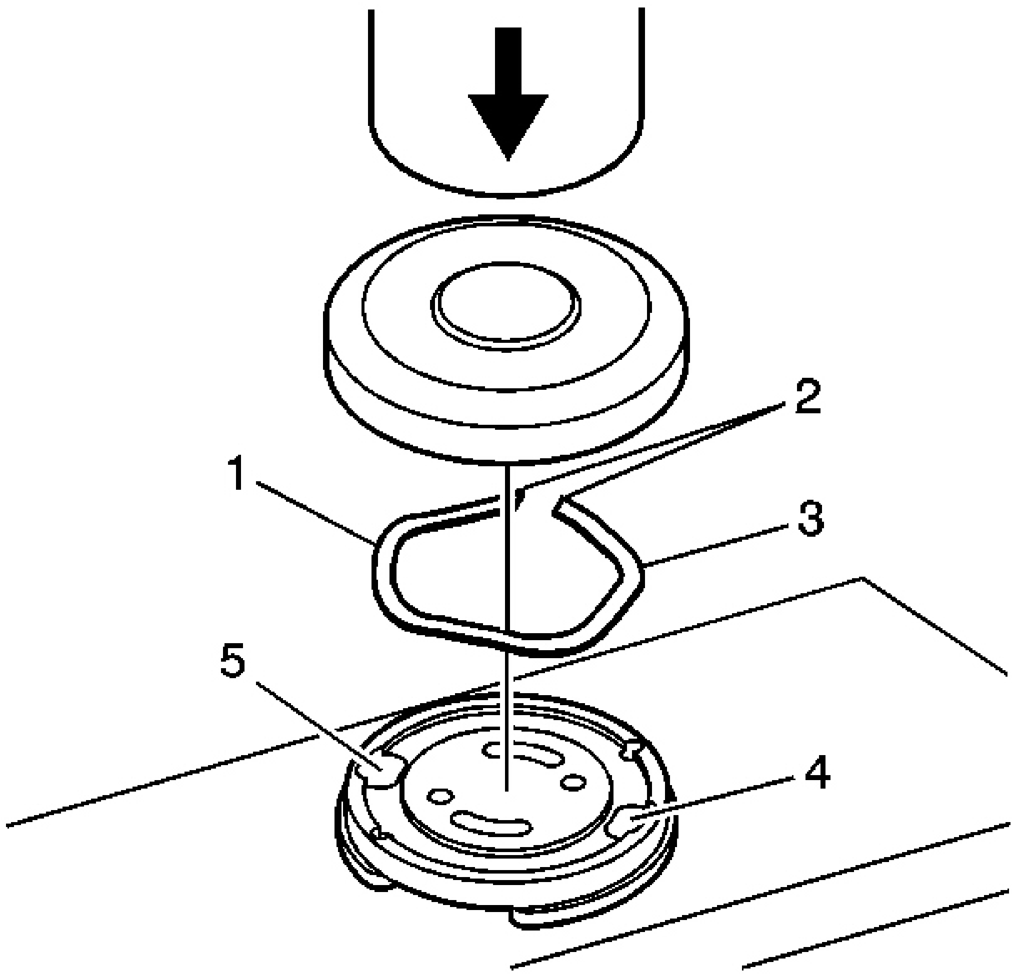


Fig. 289: Centering The Pressure Plate, Flat Side Down, On A Flat Block Under An Arbor Press
Courtesy of GENERAL MOTORS CORP.

19. Center the pressure plate, flat side down, on a flat block under an arbor press.

IMPORTANT: The pressure plate spring must be positioned in the pressure plate so that the free ends (2) are up and the higher areas (1 and 3) of the spring are located above the through-hole ports (4 and 5) in the pressure plate.

20. Position the pressure plate spring into the groove on the top of the pressure plate.

IMPORTANT: The end cover must be pressed square to the pressure plate in order to

avoid cutting the O-ring seal.

21. Using the arbor press, press the end cover on the pressure plate until the O-ring seal is fully engaged onto the pressure plate outside diameter.
22. Inspect for any signs of a cut O-ring seal. If required, repeat the assembly with a NEW O-ring seal.

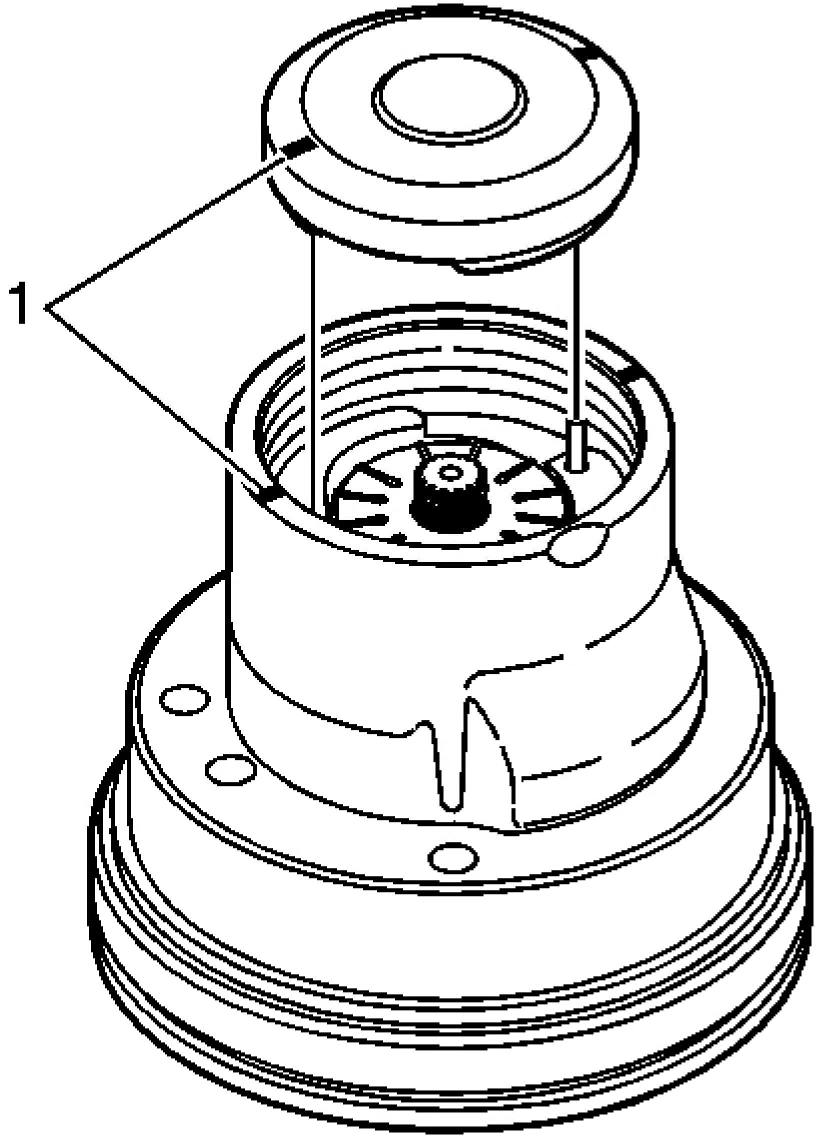


Fig. 290: End Cover, Pump Housing & Marks
Courtesy of GENERAL MOTORS CORP.

23. To aid in the assembly of the end cover, use a permanent marker and mark the pump housing adjacent to the cam ring dowel pins.
24. Mark the end cover adjacent to the dowel pin holes located in the pressure plate.
25. Position the end cover and pressure plate assembly in the pump housing, aligning the through-holes in the pressure plate with the dowel pins.
26. Verify the correct orientation of the end cover into the pump housing by using the marks (1) made in Steps 23 and 24.

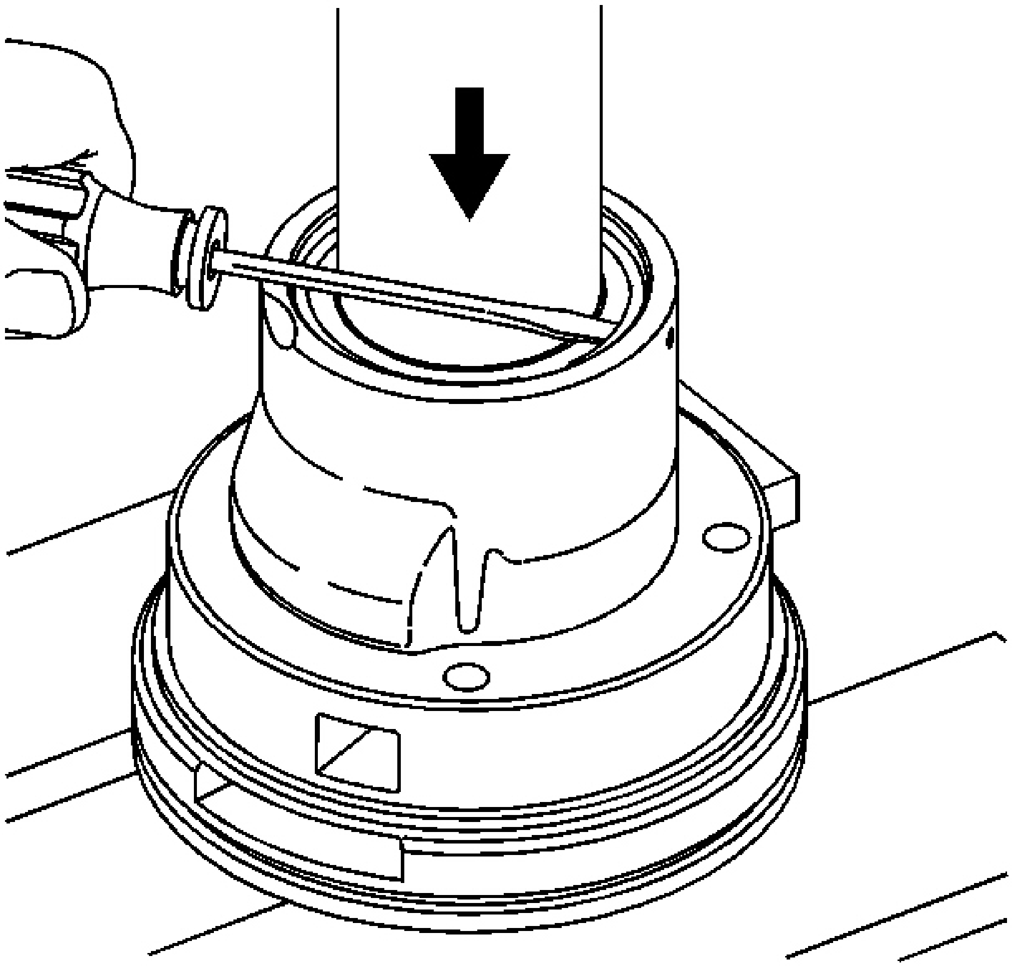


Fig. 291: Installing The End Cover Retaining Ring Into Pump Housing Groove Using A Small

__Screwdriver__
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not position the pump assembly on the inlet face. Damage to the inlet face may cause the pump assembly to become inoperative.

27. Position the pump assembly on an arbor press so that the pump drive shaft end is face-down and the pump assembly is resting on its outer diameter rim face.
28. Position the end cover retaining ring onto the end of the pump.
29. Center the arbor press over the pump end cover.
30. Using the arbor press, apply a light load to the pump end cover in order to install the end cover retaining ring.

NOTE: Use care when installing the end cover retaining ring. Damage to the pump housing groove may cause the pump to become inoperable.

IMPORTANT: When installing the end cover retaining ring, locate the open end of the retaining ring opposite of the retaining ring access hole in the pump housing.

31. Using a small screwdriver, install the end cover retaining ring into the pump housing groove.
32. Release the arbor press load from the pump end cover.
33. Rotate the drive shaft by hand in order to ensure that the pump rotates freely.

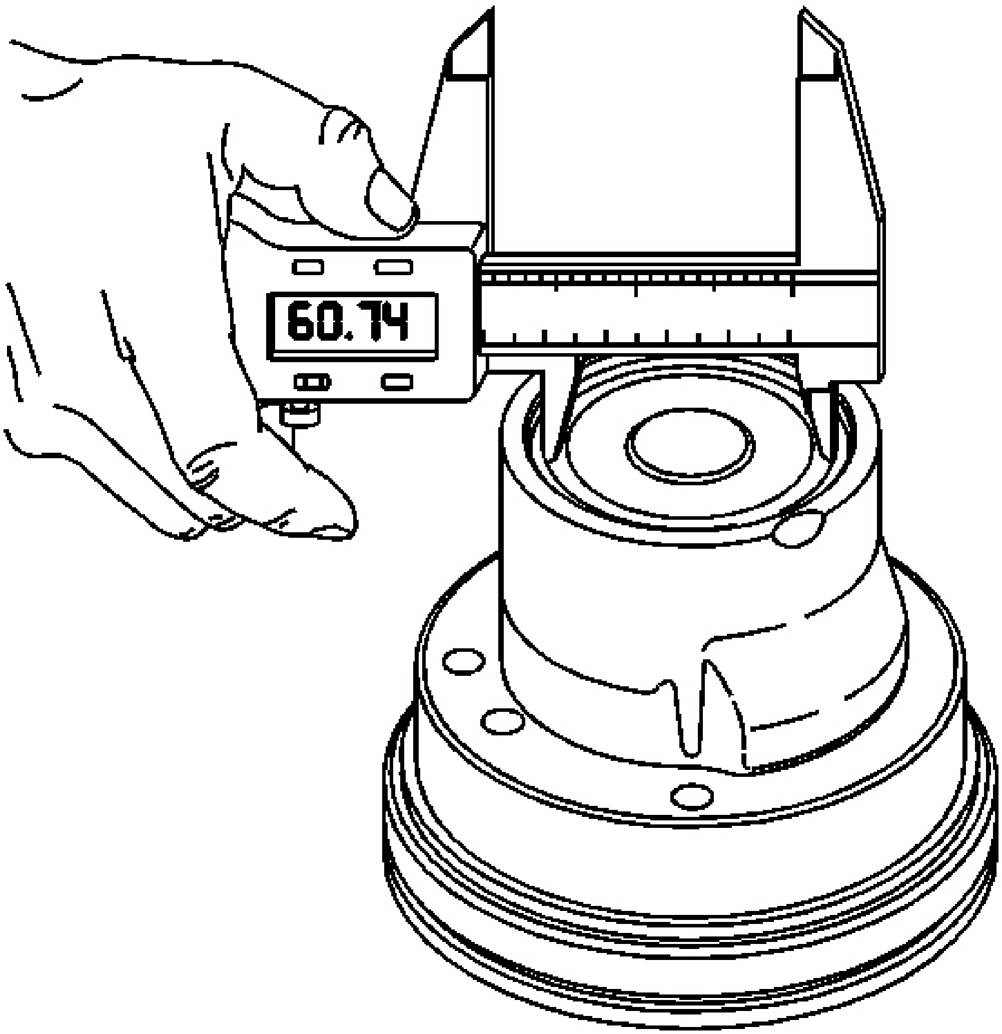


Fig. 292: Measuring The Inside Diameter Of Installed End Cover Retaining Ring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If an acceptable measurement is not obtained, install a NEW retaining ring.

34. Measure the inside diameter of the installed end cover retaining ring in the following 3 places:
    - At approximately 6 mm (0.24 in) from each end of the retaining ring
    - At 90 degrees from the retaining ring end gap.

Cover Retaining Ring Specification: The measurement for each should be 60.74 mm (2.39 in) or more.

FLUID PUMP INSTALLATION

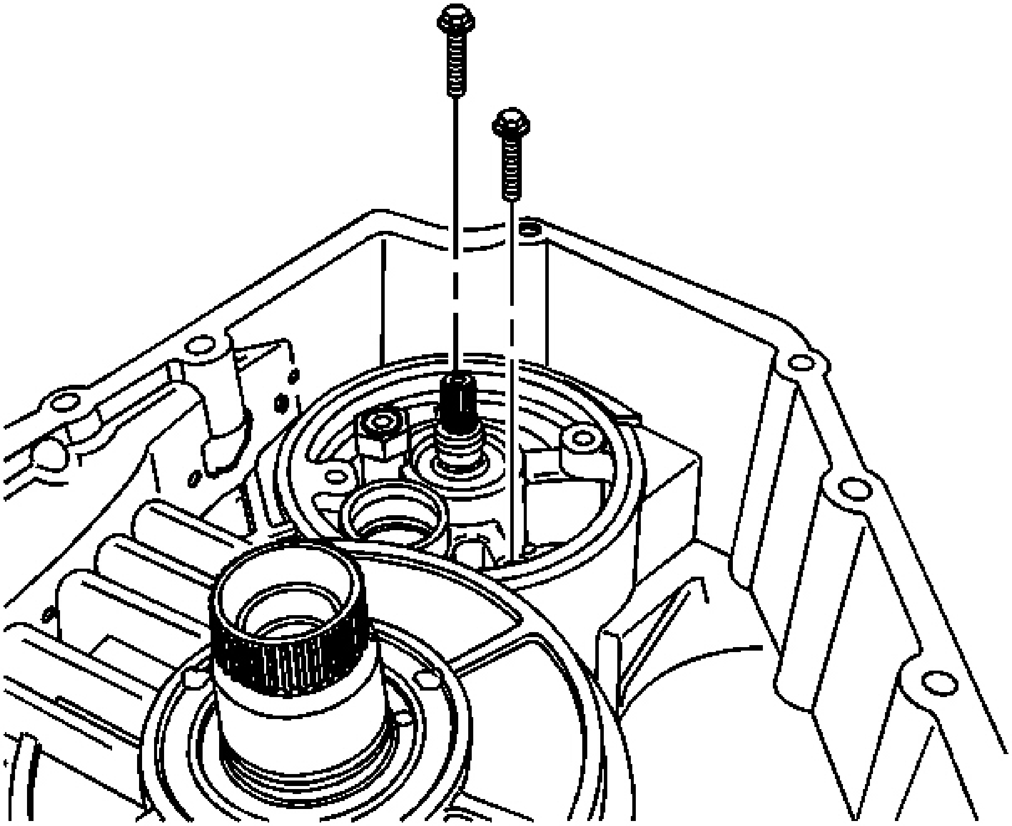


Fig. 293: 2 Bolts & Fluid Pump Assembly
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the fluid pump assembly and the 2 bolts into the transmission case assembly.

   Tighten: Tighten the bolts to 11 N.m (8 lb ft).

2. Pour approximately 120-240 cc (4-8 ounces) of automatic transmission fluid into the pump inlet, and rotate the pump shaft by hand, in order to aid pump priming at start-up.

FLUID FILTER INSTALLATION

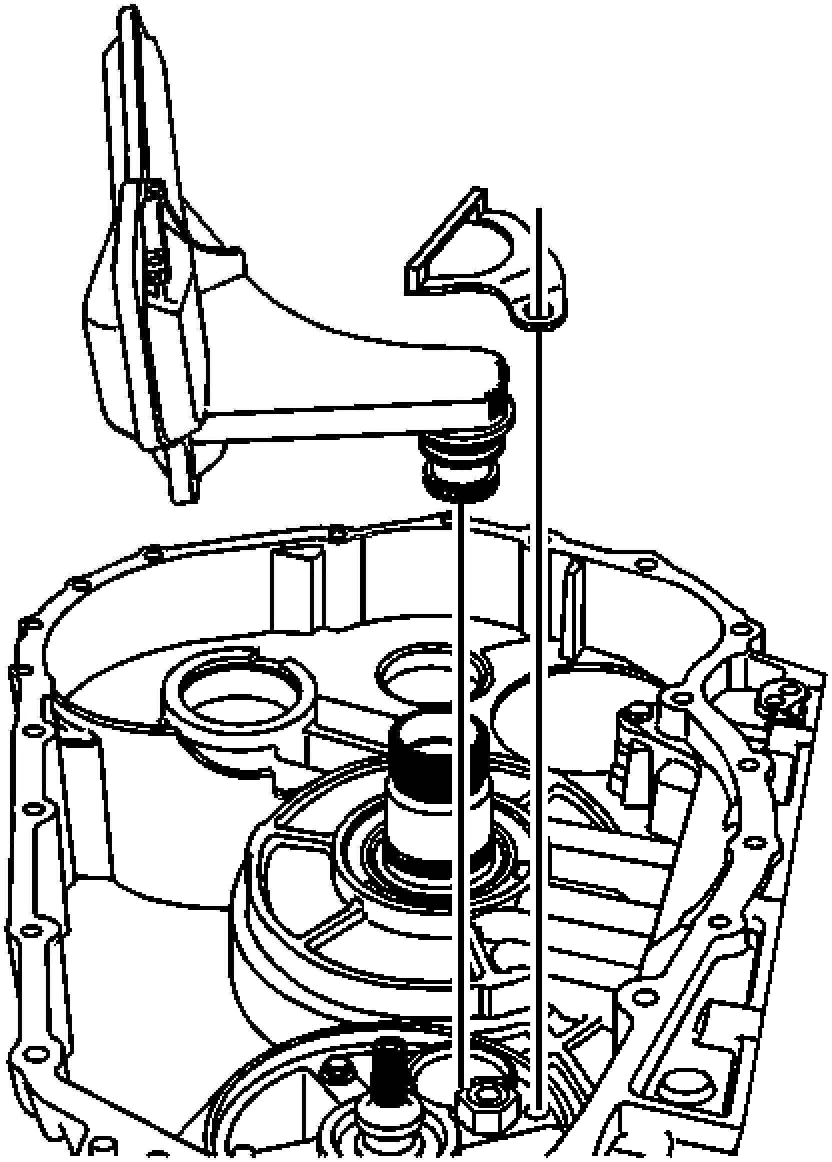


Fig. 294: Fluid Filter Retainer
Courtesy of GENERAL MOTORS CORP.

1. Install the fluid filter assembly.

2. Position the fluid filter retainer on the fluid filter assembly.

DRIVE SPROCKET, DRIVEN SPROCKET, AND DRIVE LINK INSTALLATION

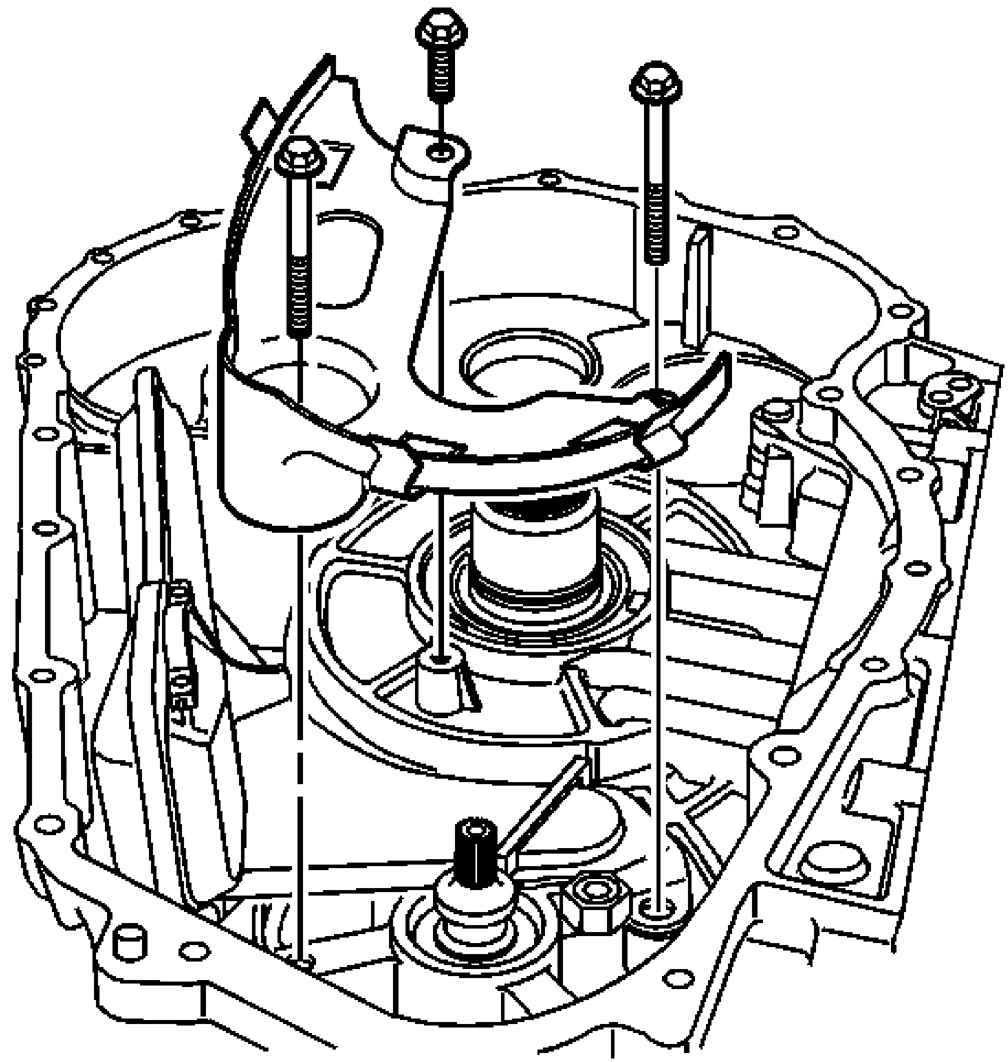


Fig. 295: Bottom Piece Of Transmission Fluid Baffle & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

1. Install the bottom piece of the transmission fluid baffle and the 3 bolts on the fluid pump assembly and the transmission case assembly.

   Tighten: Tighten the bolts to 11 N.m (8 lb ft).

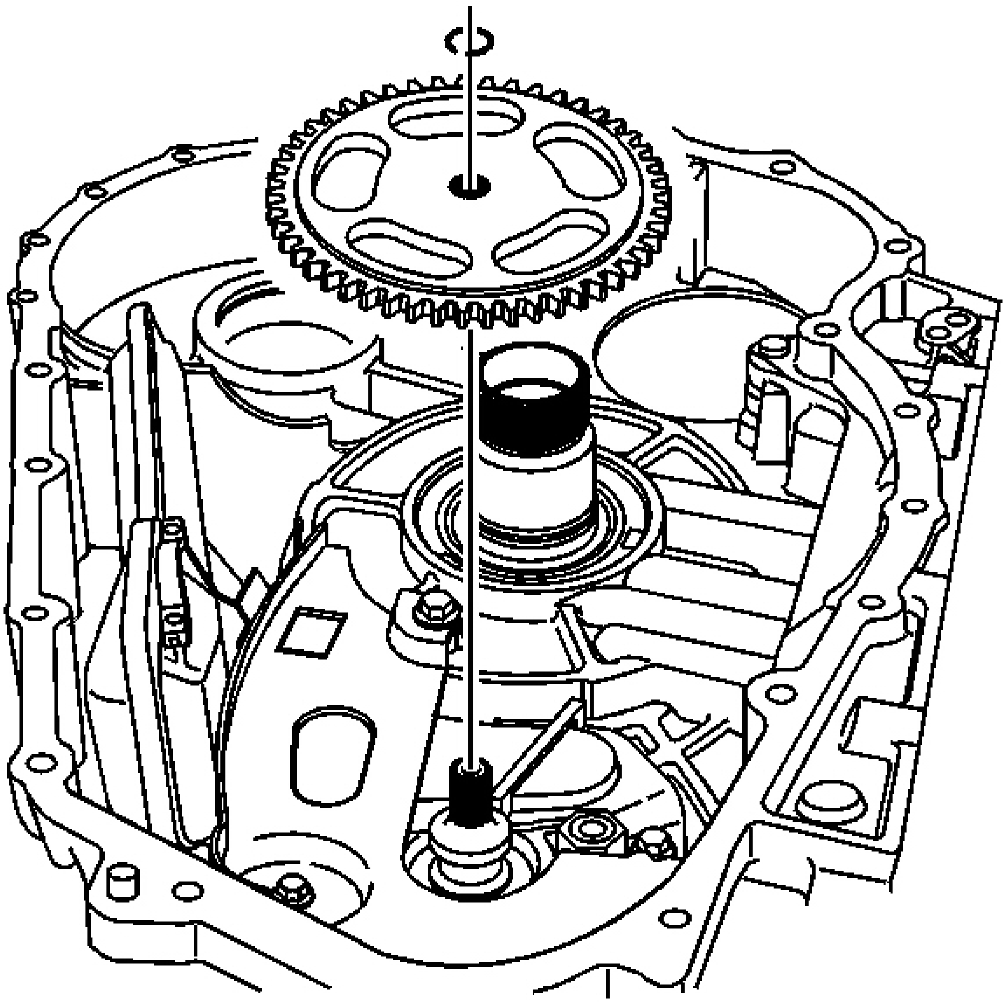


Fig. 296: Driven Sprocket & Retaining Ring
Courtesy of GENERAL MOTORS CORP.

2. Install the driven sprocket on the fluid pump assembly.
3. Install a NEW driven sprocket retaining ring.

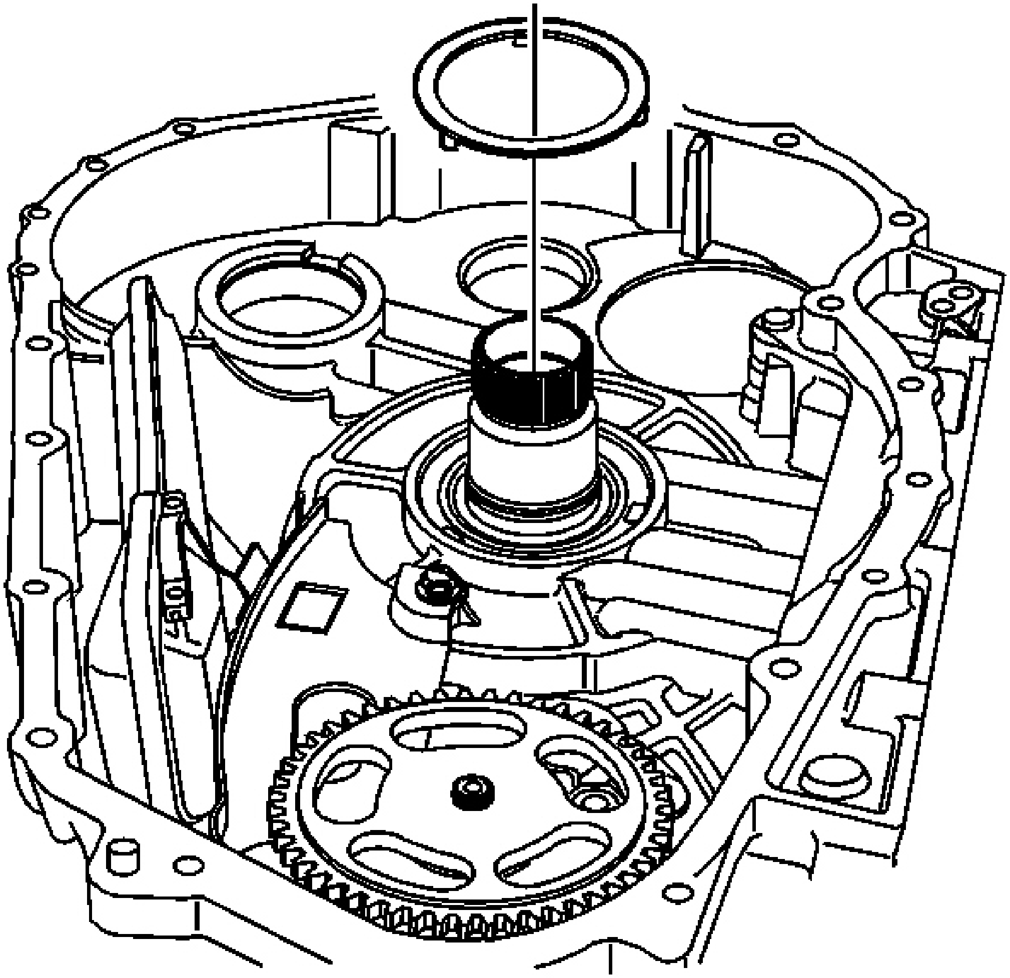


Fig. 297: Lower Drive Sprocket Thrust Washer
Courtesy of GENERAL MOTORS CORP.

4. Install a drive sprocket thrust washer on the transmission case assembly.

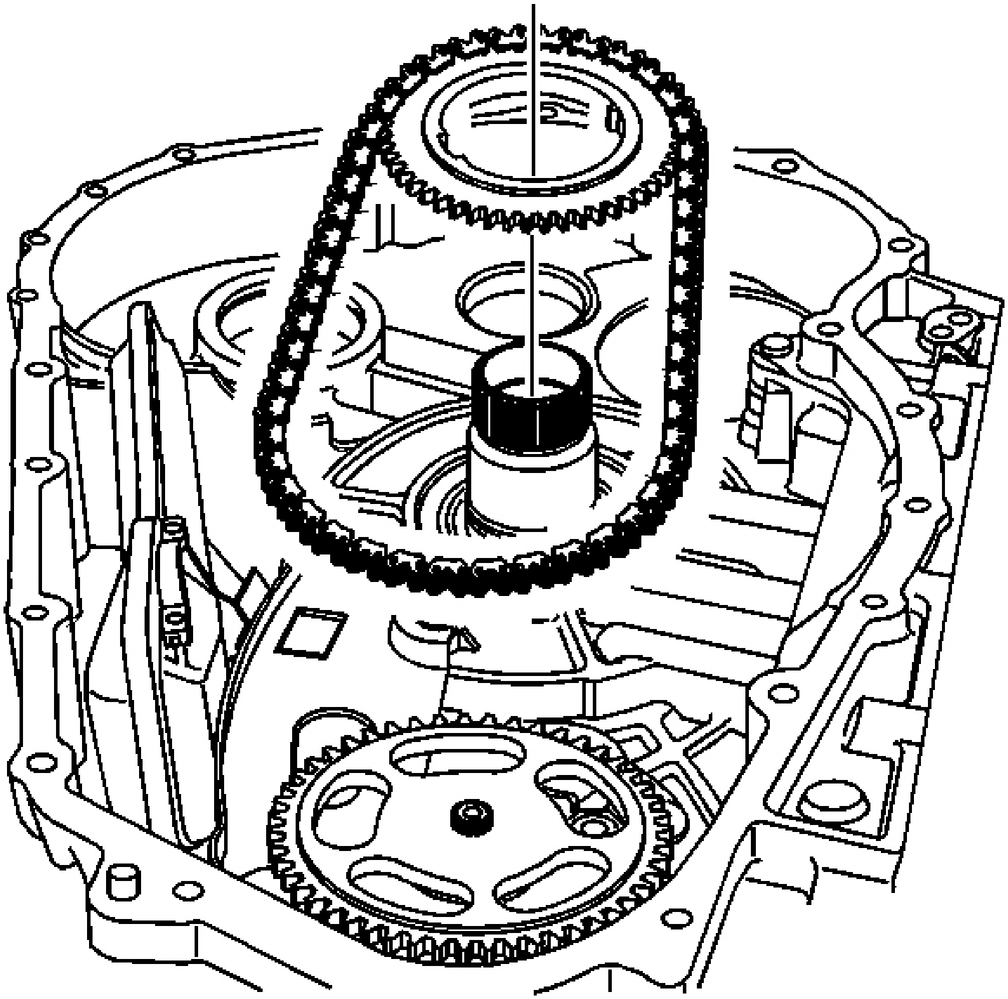


Fig. 298: Drive Sprocket & Drive Link Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The thrust washer locates the drive sprocket until the torque converter is installed.

5. Install the drive sprocket and drive link assembly.

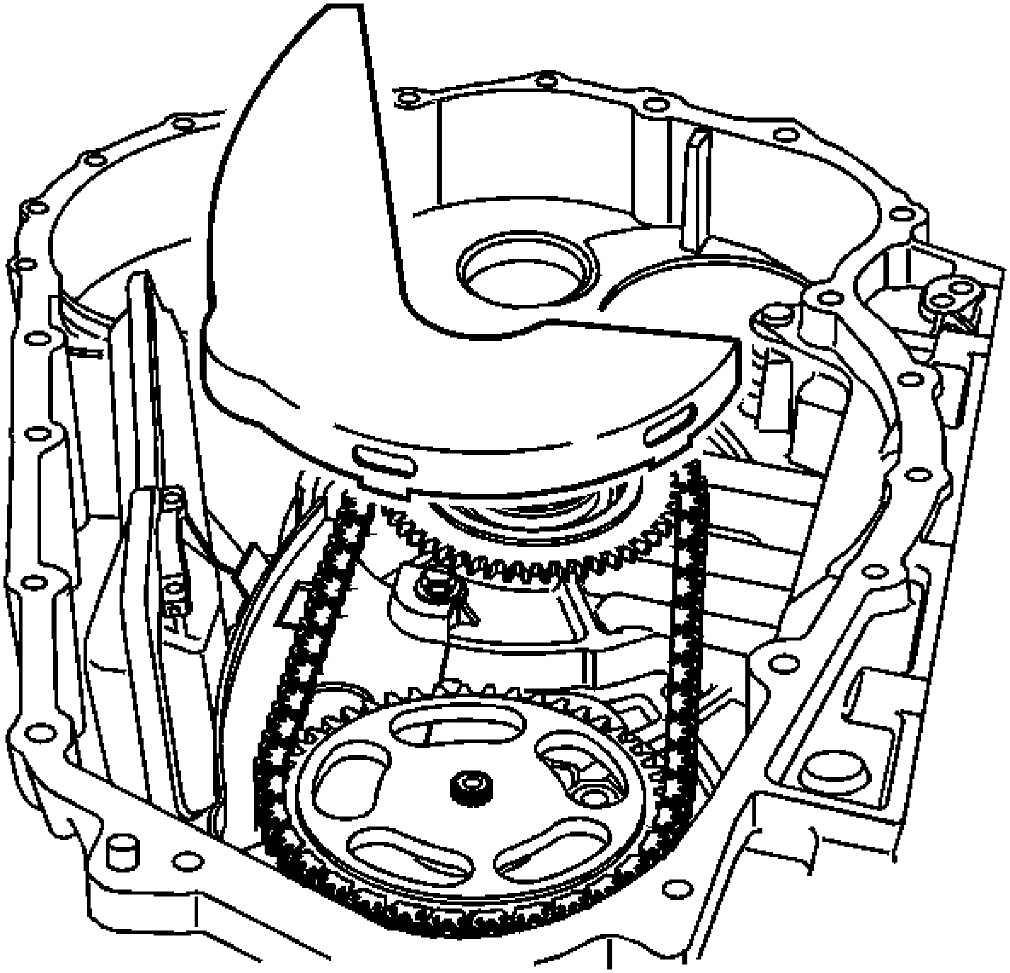


Fig. 299: Top Piece Of Transmission Fluid Baffle
Courtesy of GENERAL MOTORS CORP.

6. Install the top piece of the transmission fluid baffle.

FRONT DIFFERENTIAL CARRIER DISASSEMBLE

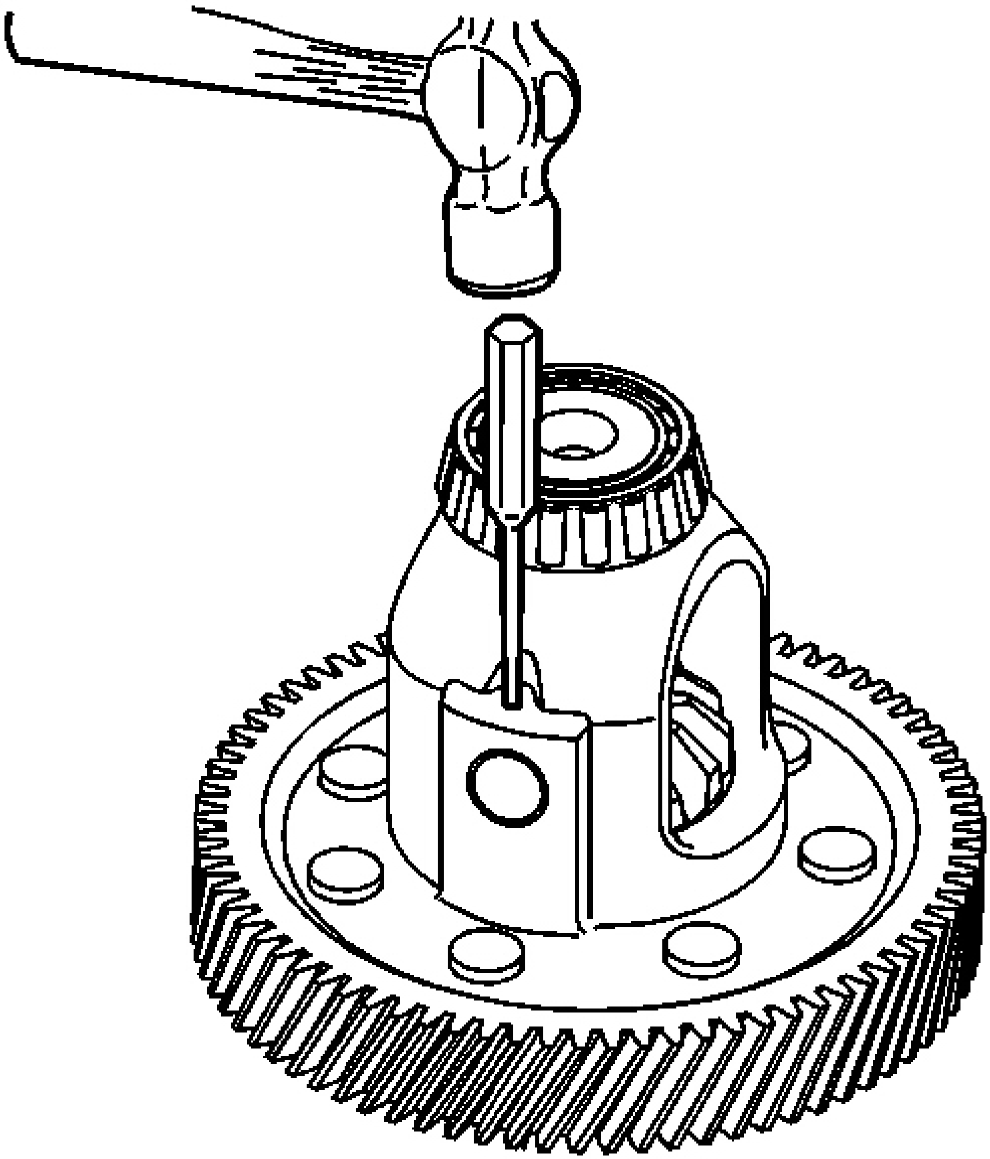


Fig. 300: Removing Pinion Gear Shaft Pin Using A Small Punch & Hammer
Courtesy of GENERAL MOTORS CORP.

1. Using a small punch and a hammer, remove the pinion gear shaft pin from the front differential carrier assembly. Discard the pin.

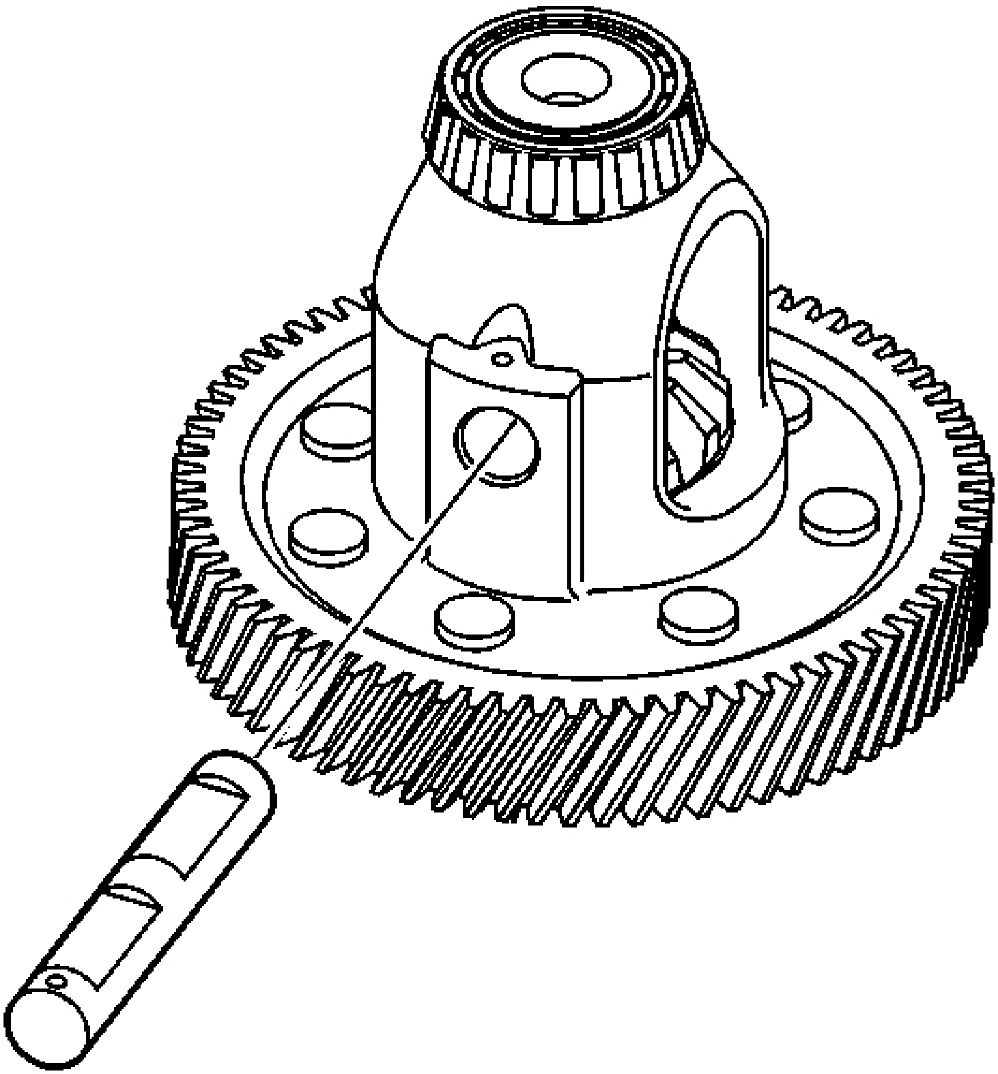
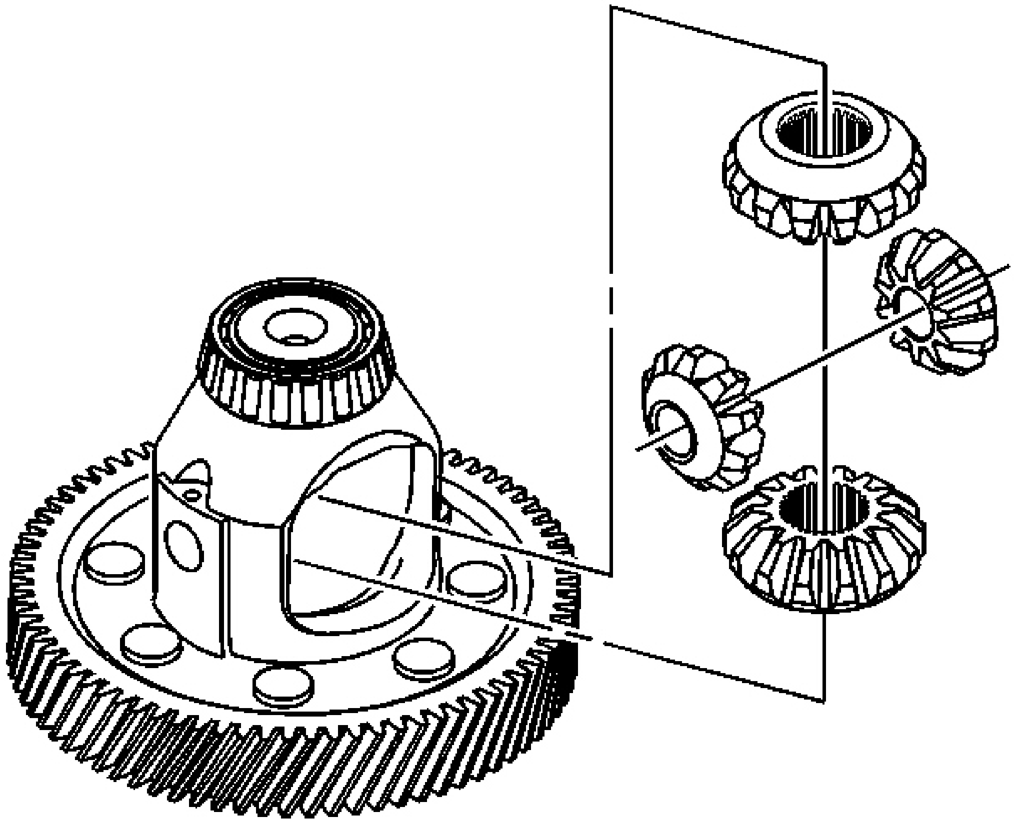


Fig. 301: Front Differential Pinion Shaft
Courtesy of GENERAL MOTORS CORP.

2. Remove the front differential pinion shaft.



<u>**Fig. 302: 2 Side Gears, 2 Pinion Gears & Front Differential Carrier**</u>
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: It is necessary to rotate the gears in order to remove them.

3. Remove the 2 side gears and the 2 pinion gears from the front differential carrier assembly.

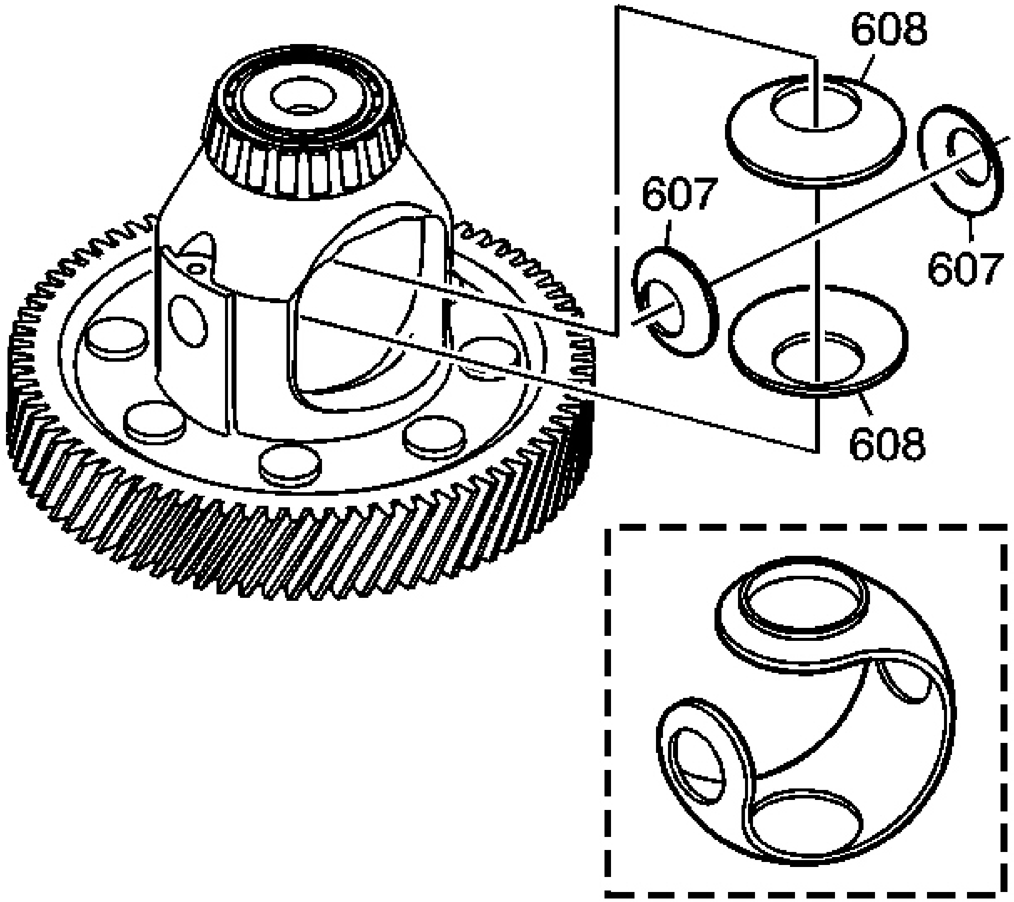


Fig. 303: Plastic Thrust Washers & Front Differential Carrier
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: There are two different thrust washer designs, a 1 piece design and a 4 piece design. Note the orientation of the plastic thrust washers for reassembly into the front differential carrier assembly.

4. Remove the plastic thrust washers from the front differential carrier assembly.

FRONT DIFFERENTIAL CARRIER ASSEMBLE

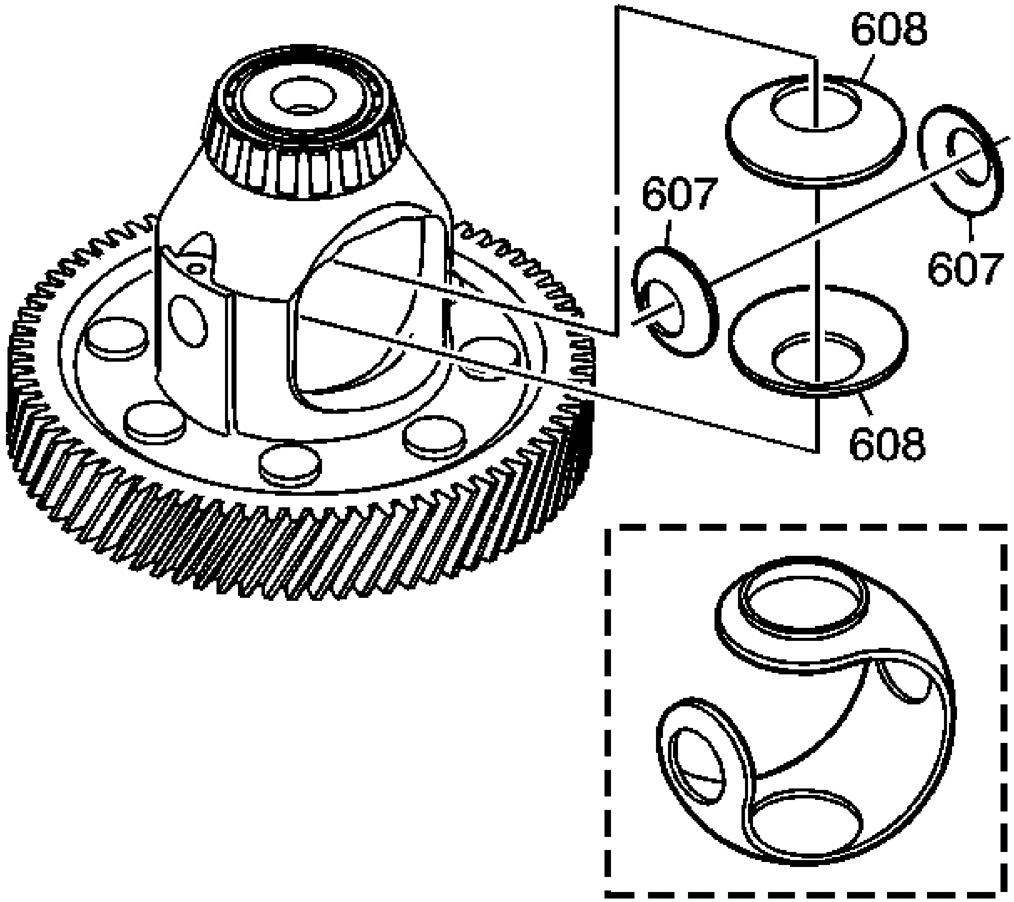


Fig. 304: Plastic Thrust Washers & Front Differential Carrier
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: There are two different thrust washer designs, a 1 piece design and a 4 piece design.

1. Install the plastic thrust washers (607, 608) into the front differential carrier assembly.

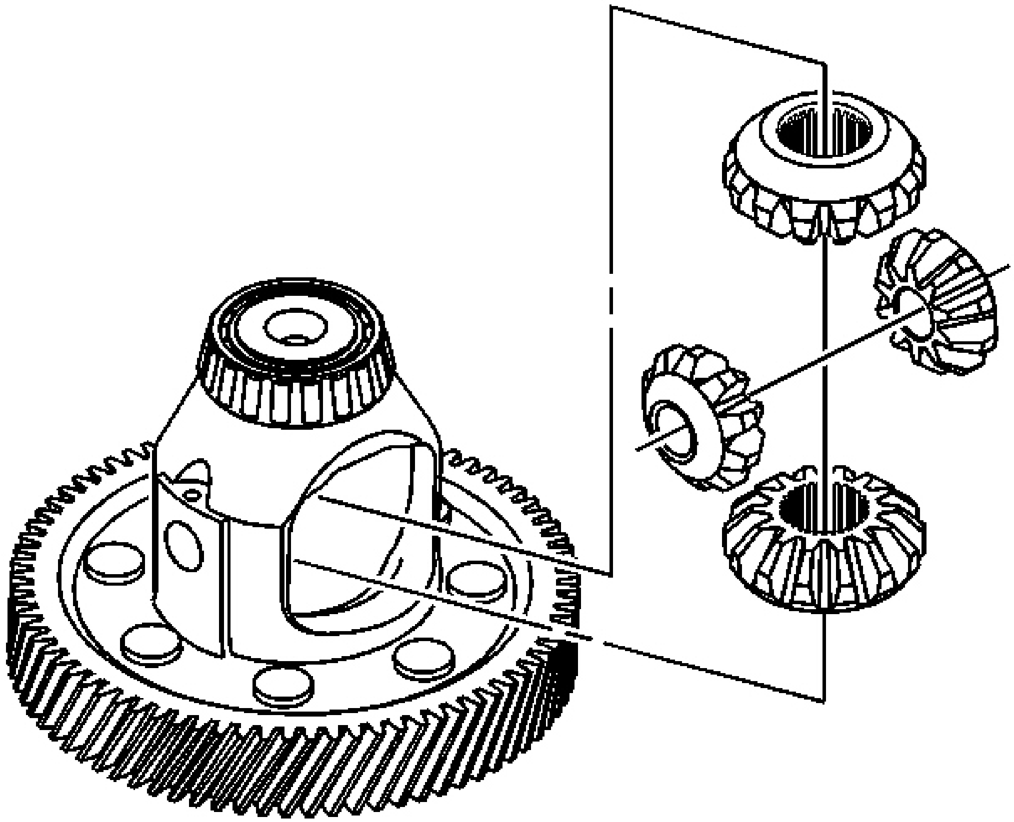


Fig. 305: 2 Side Gears, 2 Pinion Gears & Front Differential Carrier
Courtesy of GENERAL MOTORS CORP.

2. Install the 2 side gears and the 2 pinion gears into the front differential carrier assembly.

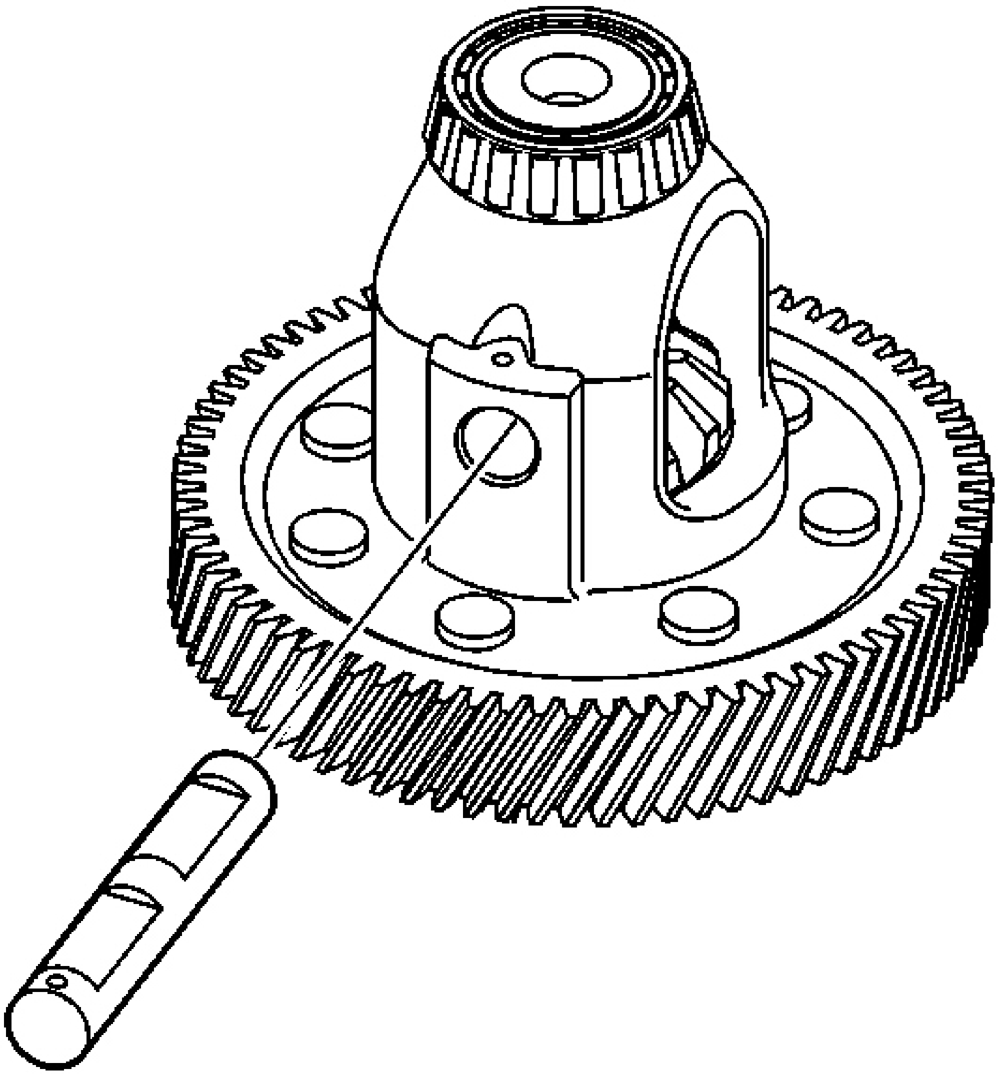


Fig. 306: Front Differential Pinion Shaft
Courtesy of GENERAL MOTORS CORP.

3. Rotate the pinion gears into position in order to install the front differential pinion shaft through the pinion gears.

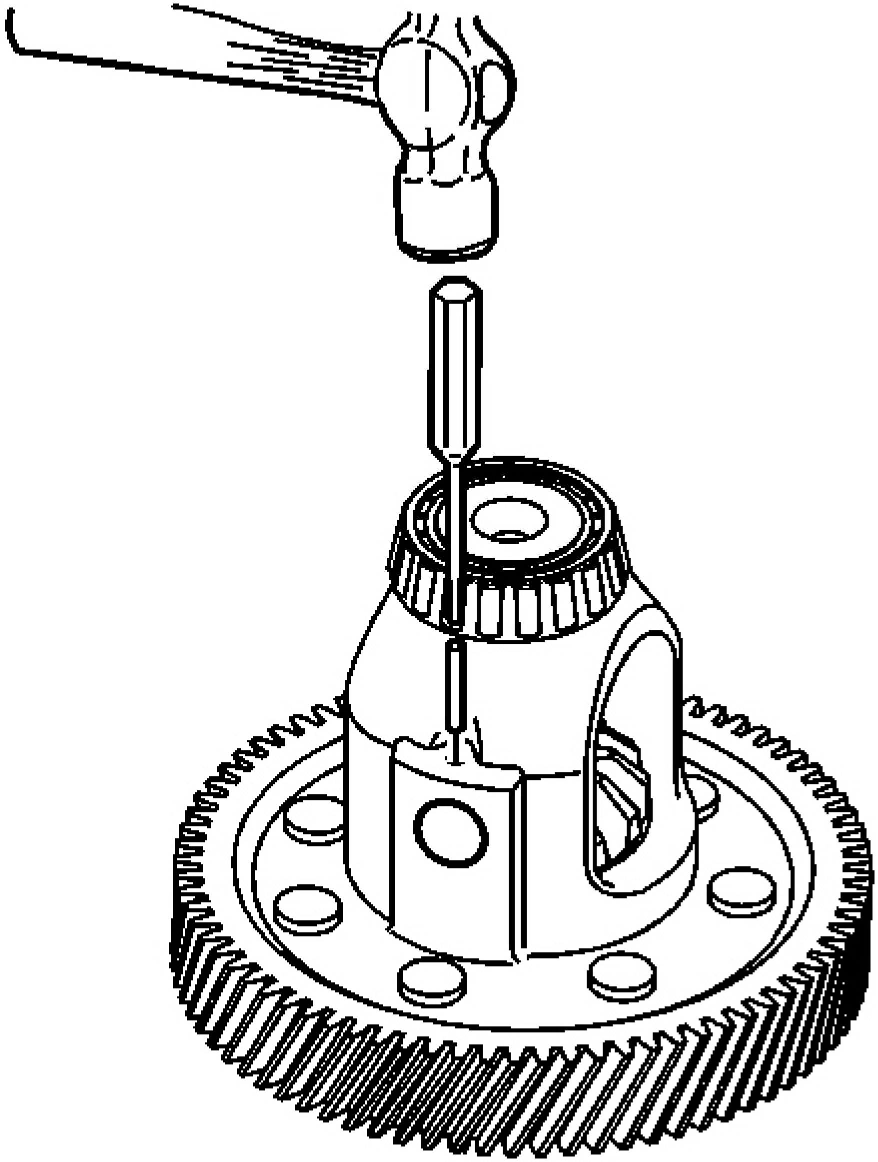


Fig. 307: Installing Pinion Gear Shaft Pin Using A Small Punch & Hammer
Courtesy of GENERAL MOTORS CORP.

4. Position the pinion shaft in order to allow installation of the pinion gear shaft pin.
5. Using a small punch and a hammer, install a NEW pinion gear shaft pin through the front differential carrier assembly and through the pinion shaft in order to retain the pinion shaft.

FRONT DIFFERENTIAL CARRIER BEARING AND CUP REPLACEMENT

Tools Required

- **J 8092** Universal Driver Handle
- **J 22912-01** Split Plate Bearing Puller
- **J 35512** Inner Pinion Bearing Installer. See **Special Tools and Equipment** .
- **J 43076** Carrier Bearing and Cup Installer. See **Special Tools and Equipment** .
- **J 44719** Carrier Bearing Cup Installer - F4WD. See **Special Tools and Equipment** .
- **J 45114** Bearing Cup Remover - F4WD. See **Special Tools and Equipment** .
- **J 45124** Removal Bridge
- **J 45189** Bearing Remover. See **Special Tools and Equipment** .
- **J 45191** Bearing Cup Remover - 2WD. See **Special Tools and Equipment** .

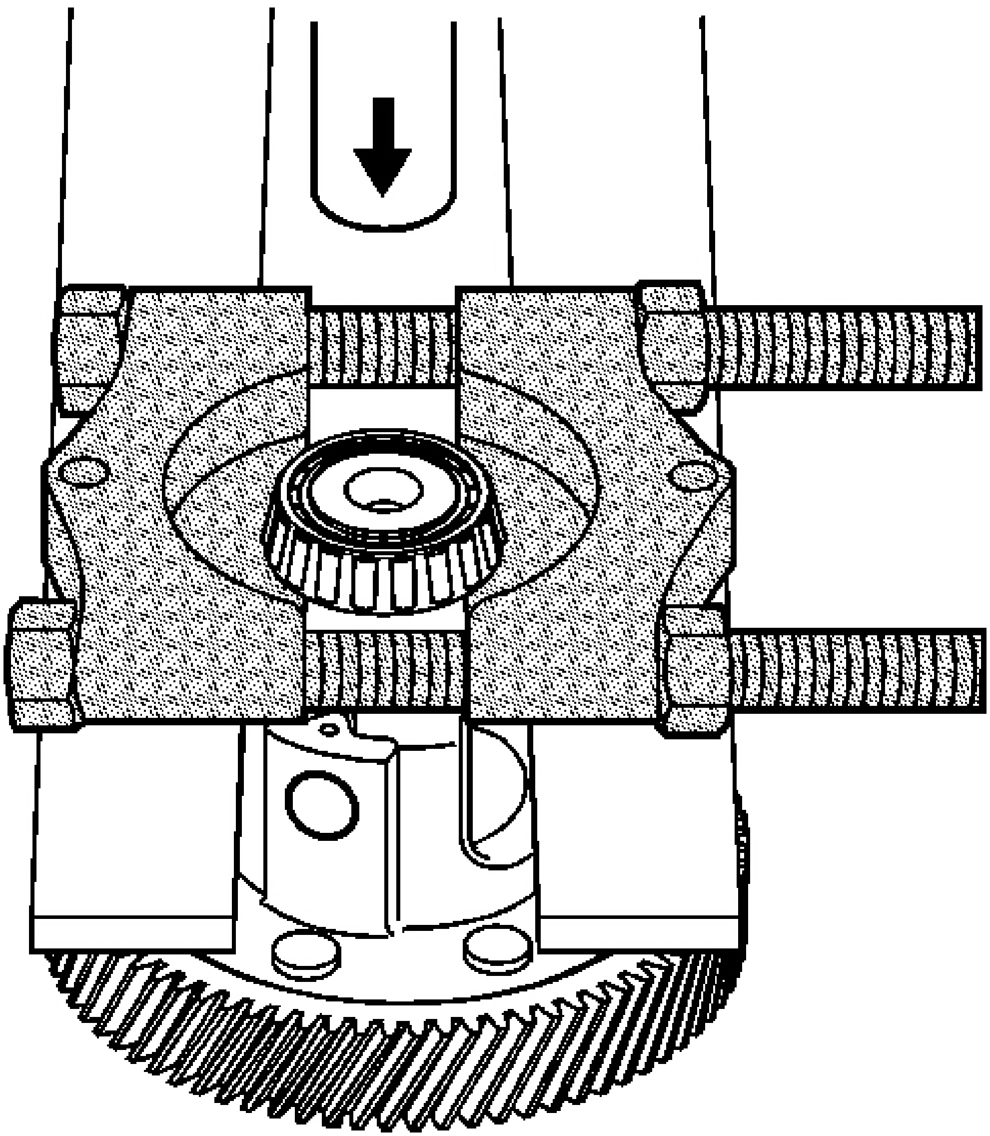


Fig. 308: Removing Bearing Assembly Using J 22912-01 & Arbor Press
Courtesy of GENERAL MOTORS CORP.

NOTE: Bearings and cups must be replaced as a set. Do not replace a bearing without also replacing the corresponding cup, or replace a cup without replacing the corresponding bearing. Failure to replace both components may damage the front differential carrier assembly.

1. Using the **J 22912-01** and an arbor press, remove the bearing assembly from the front differential carrier assembly - torque converter and differential housing side.

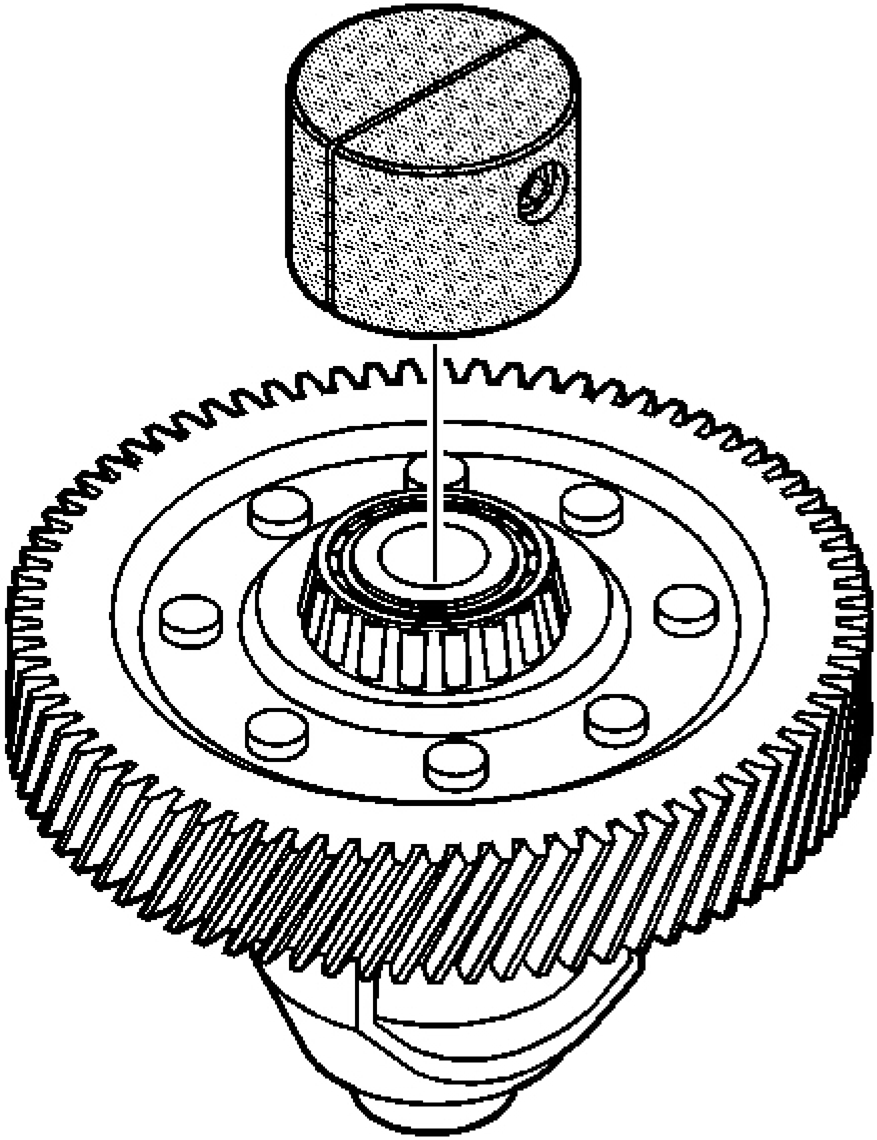


Fig. 309: Attaching J 45189 To Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The front differential carrier assembly must be disassembled in order to use the J 45189 and remove the bearing assembly on the transmission case side. See Special Tools and Equipment .

2. Disassemble the front differential carrier assembly. Refer to **Front Differential Carrier Disassemble** .
3. Attach the **J 45189** to the bearing assembly on the front differential carrier assembly - transmission case side. See **Special Tools and Equipment** .

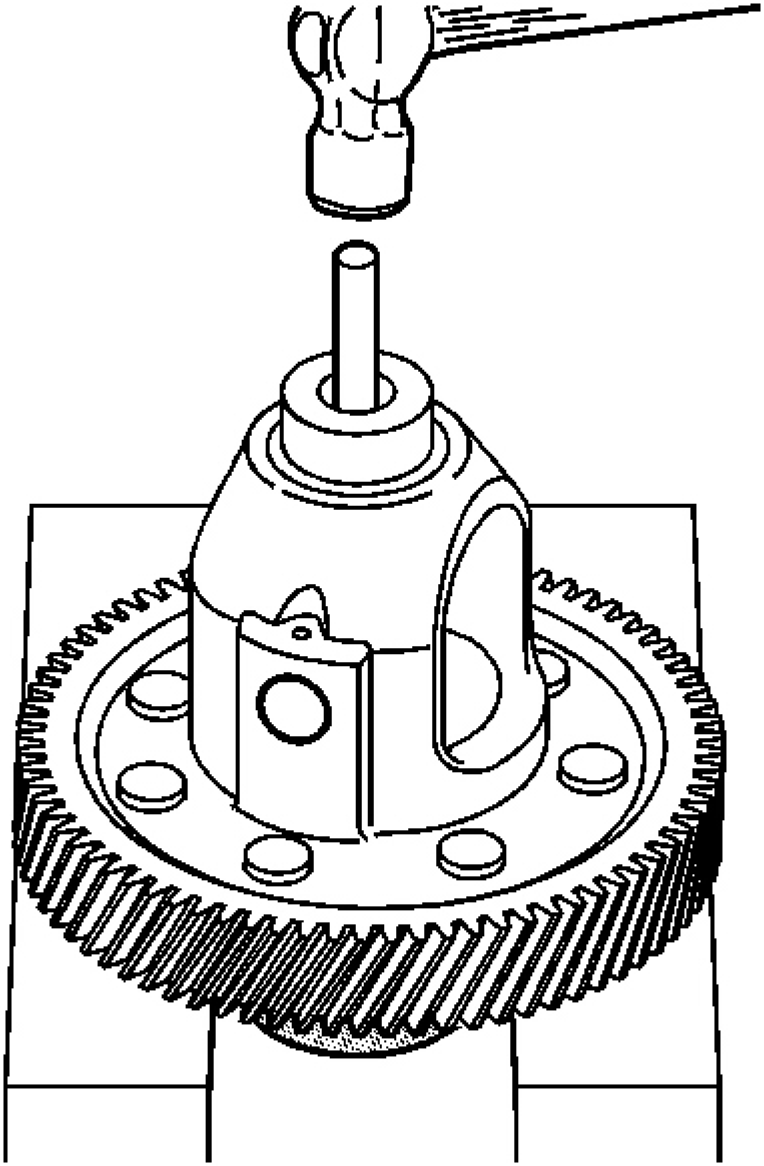


Fig. 310: Removing Bearing Assembly From Front Differential Carrier Using A Brass Drift & Hammer
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 45189** , a brass drift and a hammer, remove the bearing assembly from the front differential carrier assembly - transmission case side. See **Special Tools and Equipment** .

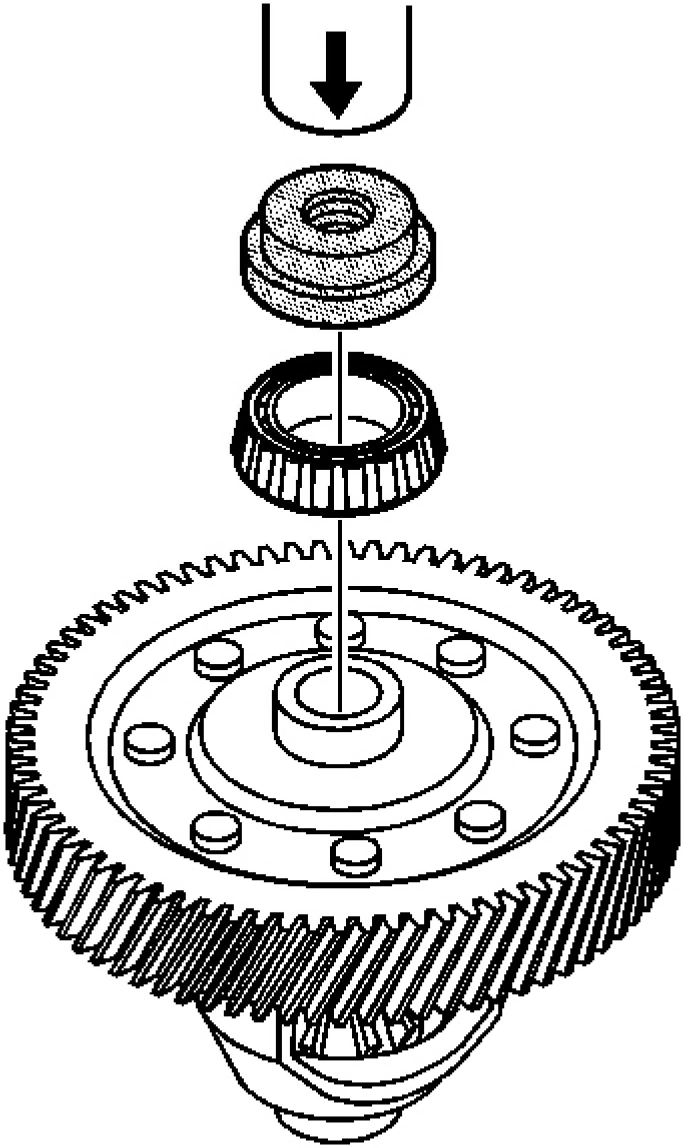


Fig. 311: Installing Bearing Assembly On Front Differential Carrier Transmission Case Side Using J 43076 & Arbor Press
Courtesy of GENERAL MOTORS CORP.

5. Using the **J 43076** and an arbor press, install the bearing assembly on the front differential carrier assembly - transmission case side. See **Special Tools and Equipment** .

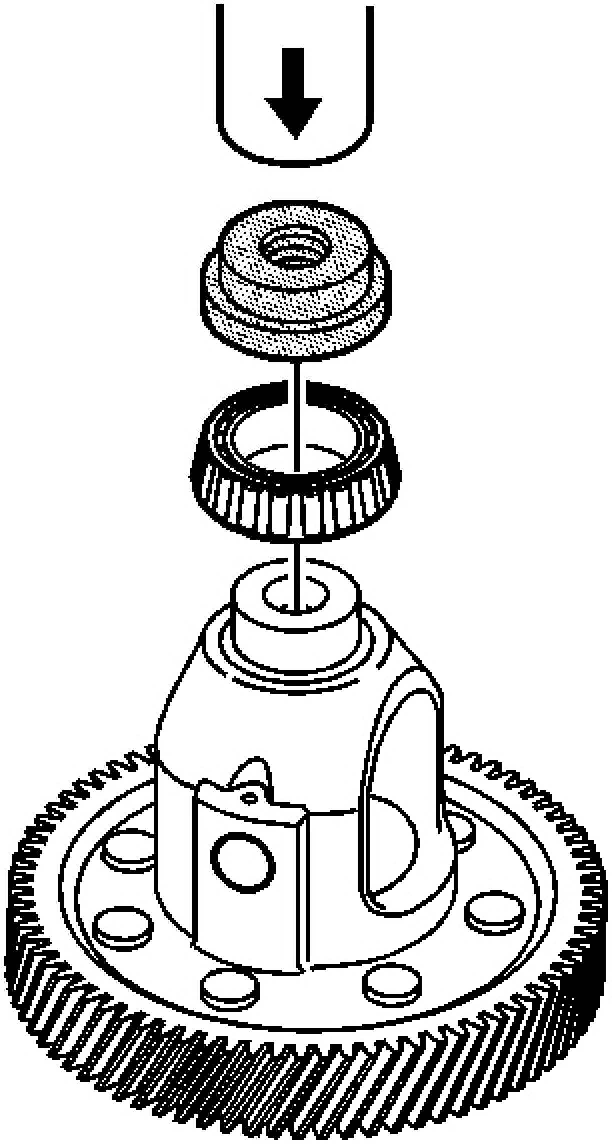


Fig. 312: Installing Bearing Assembly On Front Differential Carrier Torque Converter & Differential Housing Using J 43076 & Arbor Press
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: **Perform Step 6 for 2WD applications. Perform Step 7 for F4WD applications.**

6. Using the **J 43076** and an arbor press, install the bearing assembly on the front differential carrier assembly - torque converter and differential housing side. See **Special Tools and Equipment** .

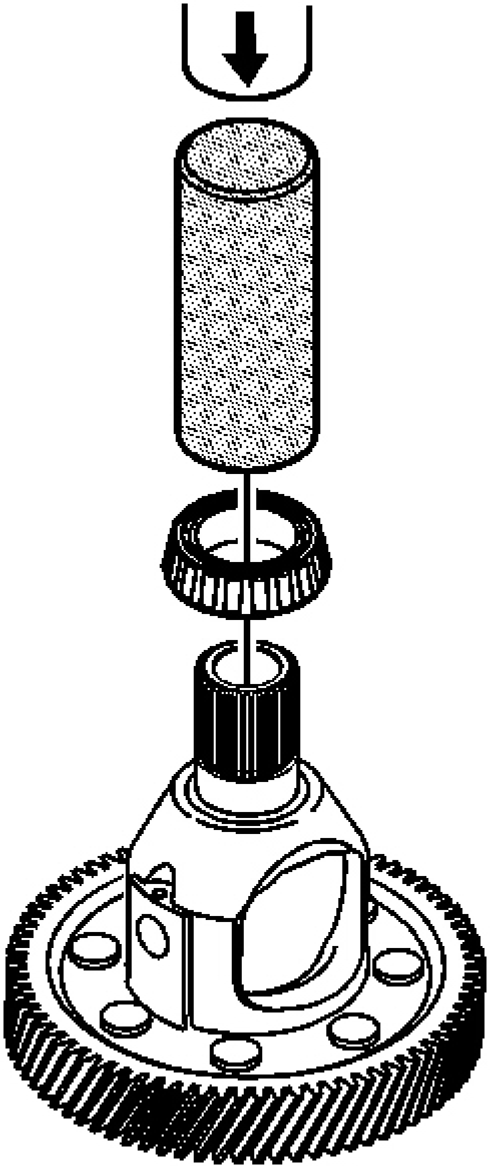


Fig. 313: Installing Bearing Assembly On Front Differential Carrier Using J 35512 & Arbor Press
Courtesy of GENERAL MOTORS CORP.

7. Using the **J 35512** and an arbor press, install the bearing assembly on the front differential carrier assembly - torque converter and differential housing side. See **Special Tools and Equipment** .

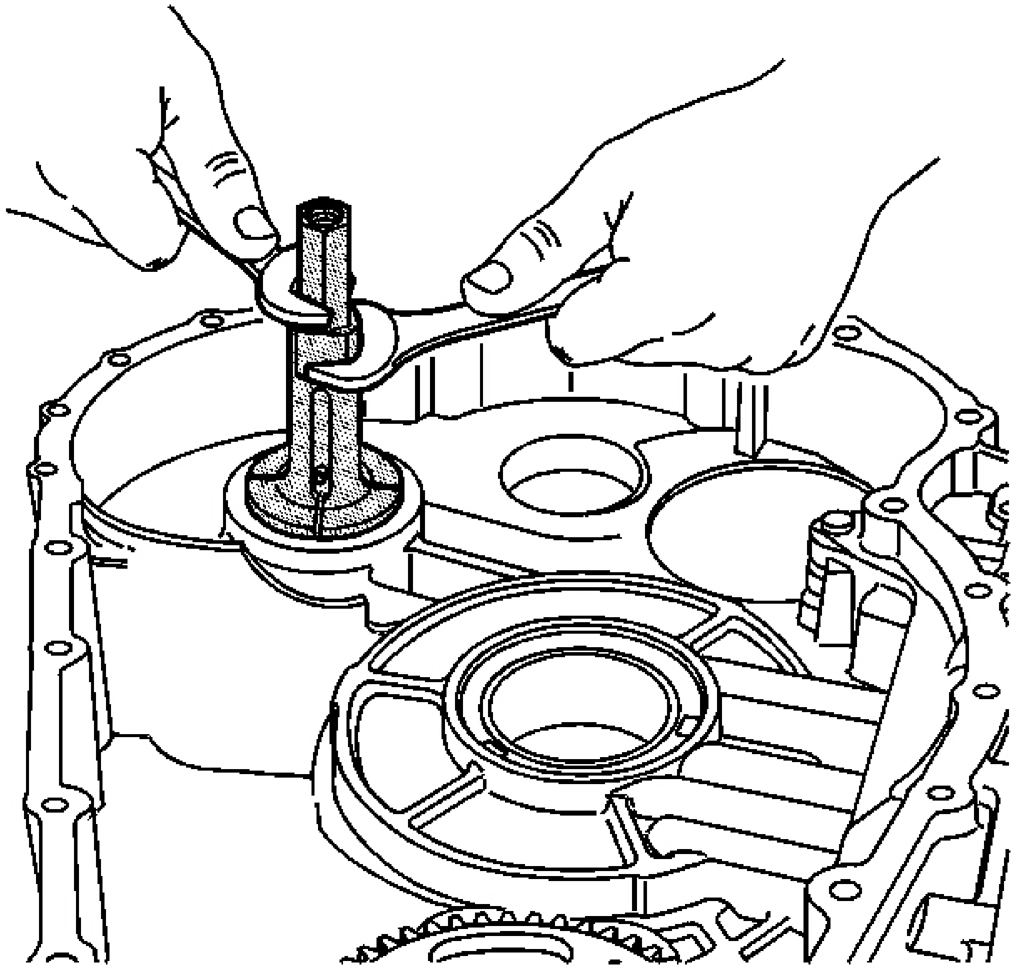


Fig. 314: Installing J 45191 Into Front Differential Carrier Bearing Cup
Courtesy of GENERAL MOTORS CORP.

8. Install the **J 45191** into the front differential carrier bearing cup on the transmission case assembly. See **Special Tools and Equipment** .
9. Using 2 wrenches, tighten the **J 45191** . See **Special Tools and Equipment** .

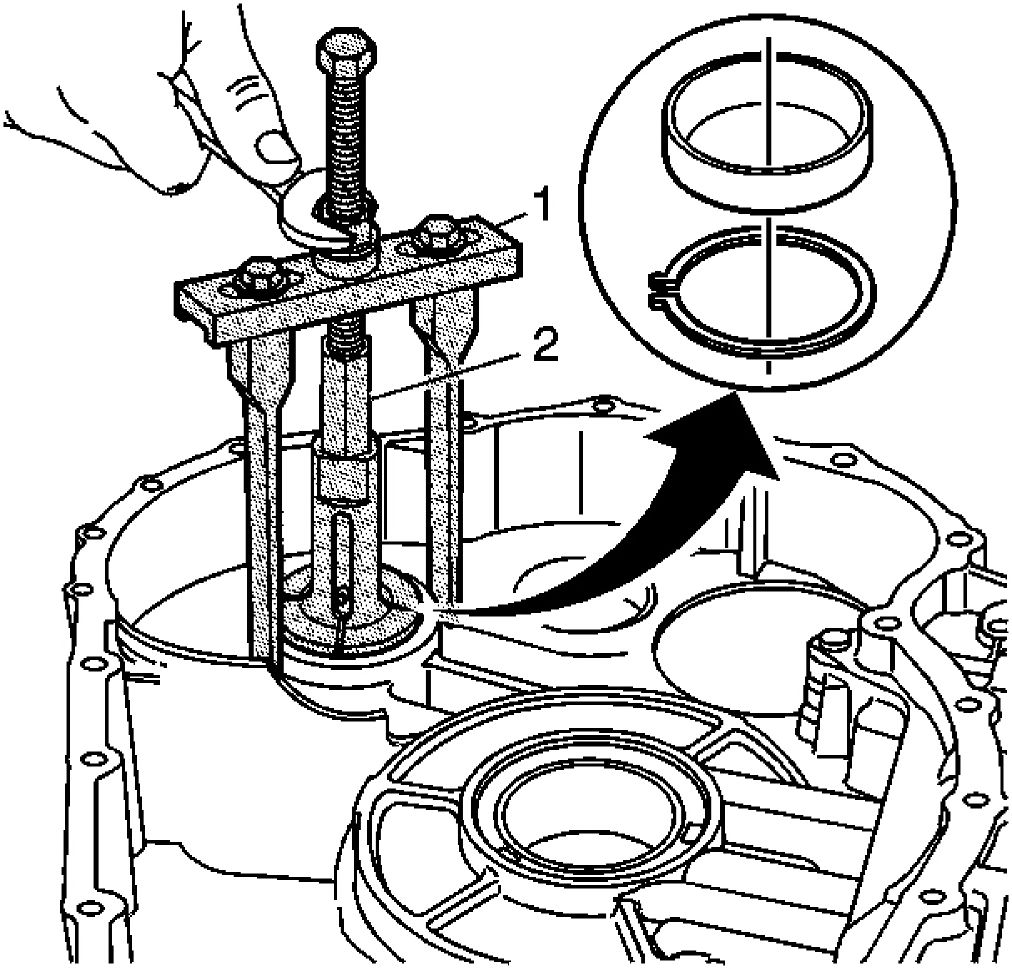


Fig. 315: Removing Front Differential Carrier Bearing Cup From Transmission Case Using A Wrench, J 45191 & J 45124
Courtesy of GENERAL MOTORS CORP.

10. Using a wrench, the **J 45191** (2) and the**J 45124** (1), remove the front differential carrier bearing cup from the transmission case assembly.

IMPORTANT: The bearing shim is reusable.

11. Remove the front differential carrier bearing shim from the transmission case assembly.

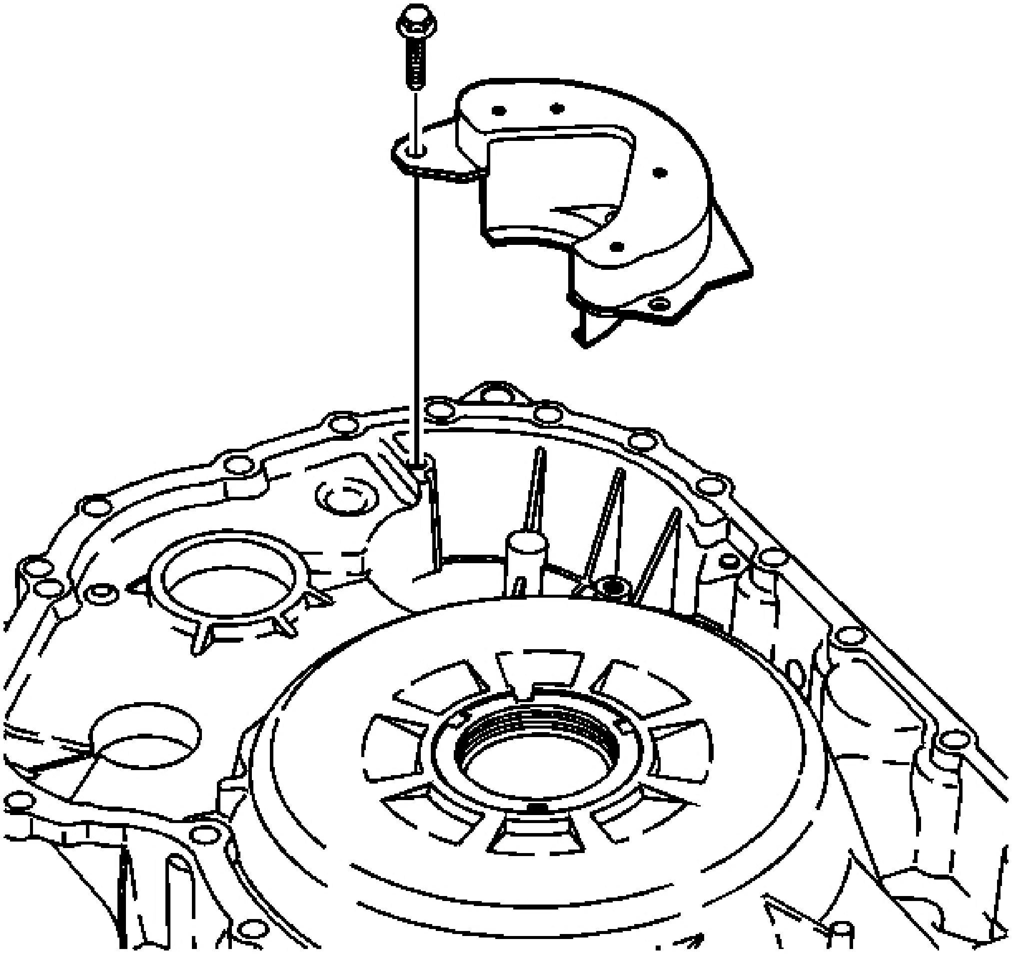


Fig. 316: Transmission Fluid Baffle & Bolts
Courtesy of GENERAL MOTORS CORP.

12. Remove the 3 bolts and the transmission fluid baffle from the torque converter and differential housing assembly.

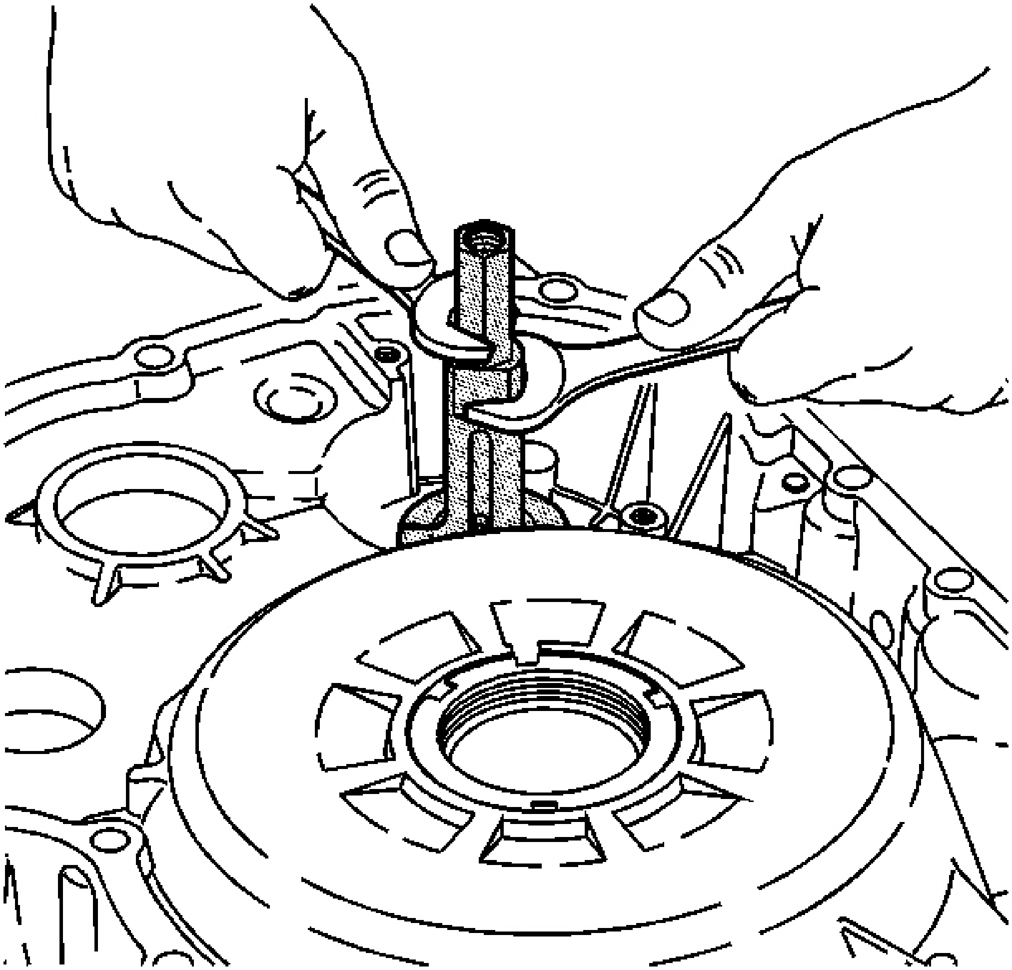


Fig. 317: Installing J45191 & J 45114 Into Front Differential Carrier Bearing Cup
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use the J 45191 for 2WD applications. See Special Tools and Equipment . Use the J 45114 for F4WD applications. See Special Tools and Equipment .

13. Install the **J 45191** or the**J 45114** into the front differential carrier bearing cup on the torque converter and differential housing assembly. See **Special Tools and Equipment** .
14. Using the 2 wrenches, tighten the **J 45191** or the**J 45114** . See **Special Tools and Equipment** .

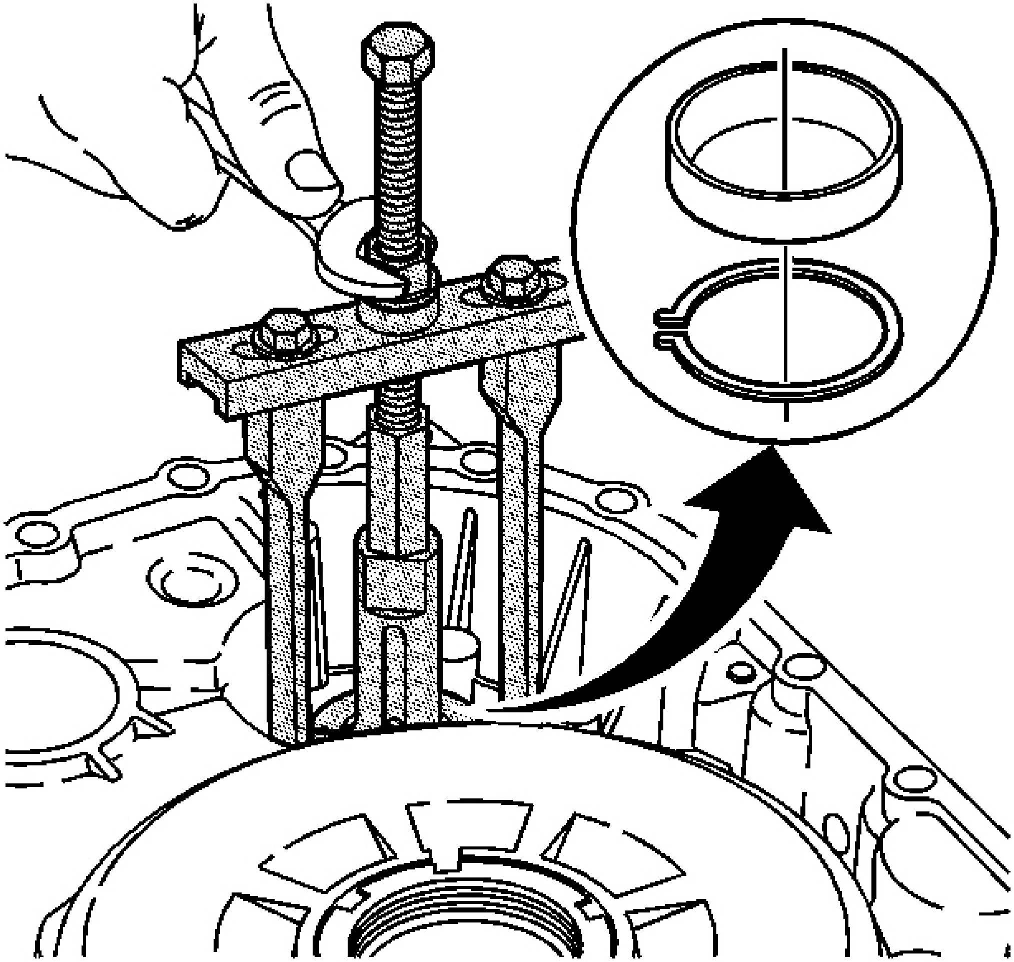


Fig. 318: Removing Front Differential Carrier Bearing Cup From Torque Converter & Differential Housing Using A Wrench, J 45124 & J 45191
Courtesy of GENERAL MOTORS CORP.

15. Using a wrench, the **J 45124** , the **J 45191** or the**J 45114** , remove the front differential carrier bearing cup from the torque converter and differential housing assembly. See **Special Tools and Equipment** .

IMPORTANT: The bearing shim is reusable.

16. Remove the front differential carrier bearing shim from the torque converter and differential housing assembly.

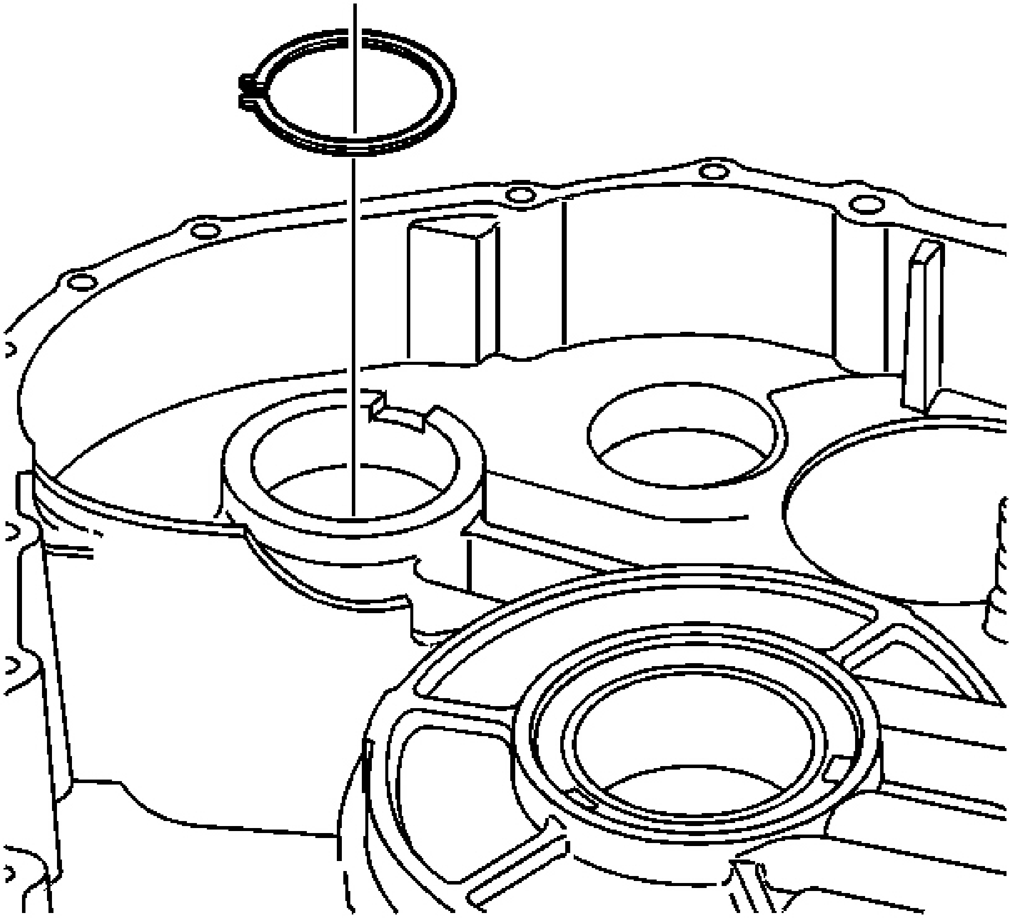


Fig. 319: Front Differential Carrier Bearing Shim To Transmission Case
Courtesy of GENERAL MOTORS CORP.

17. Install the front differential carrier bearing shim into the transmission case assembly.

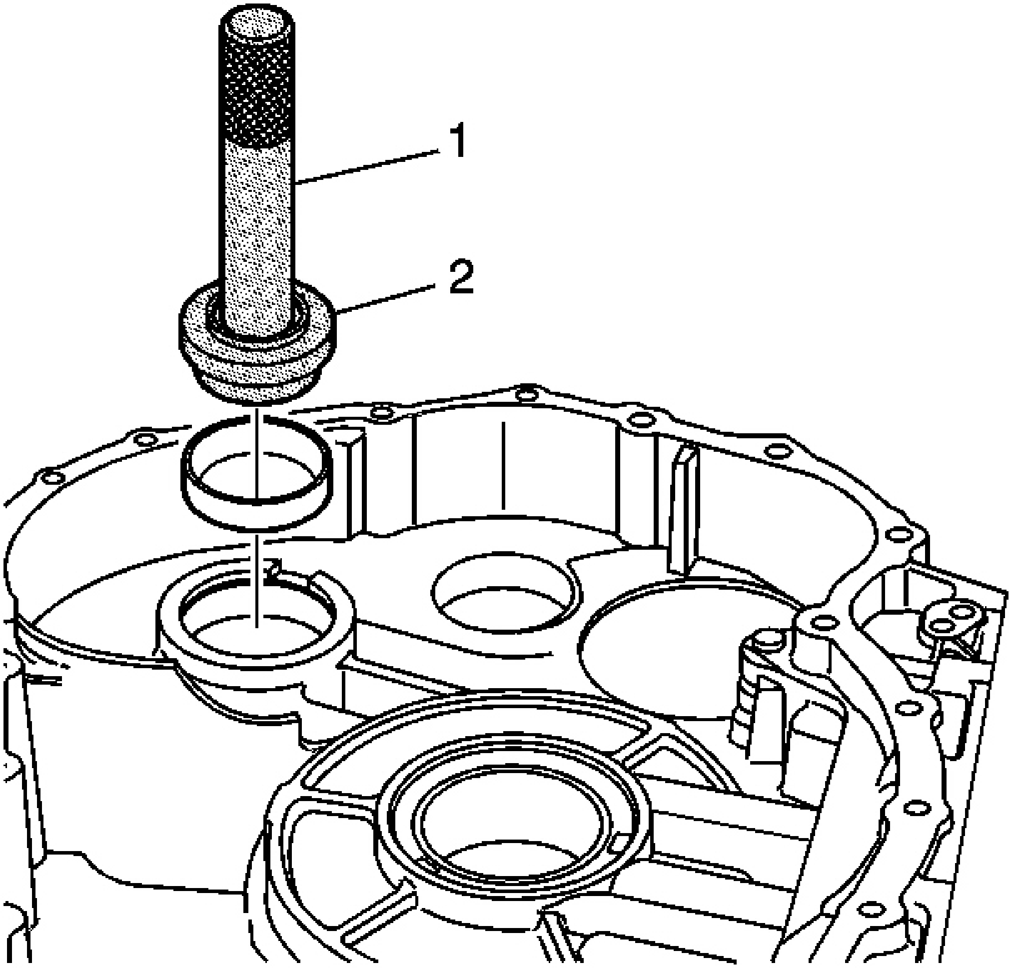


Fig. 320: Installing Front Differential Carrier Bearing Cup Using J 8092, J 43076 & Hammer
Courtesy of GENERAL MOTORS CORP.

18. Using the **J 8092** (1), the **J 43076** (2) and a hammer, install the front differential carrier bearing cup into the transmission case assembly. See **Special Tools and Equipment** .

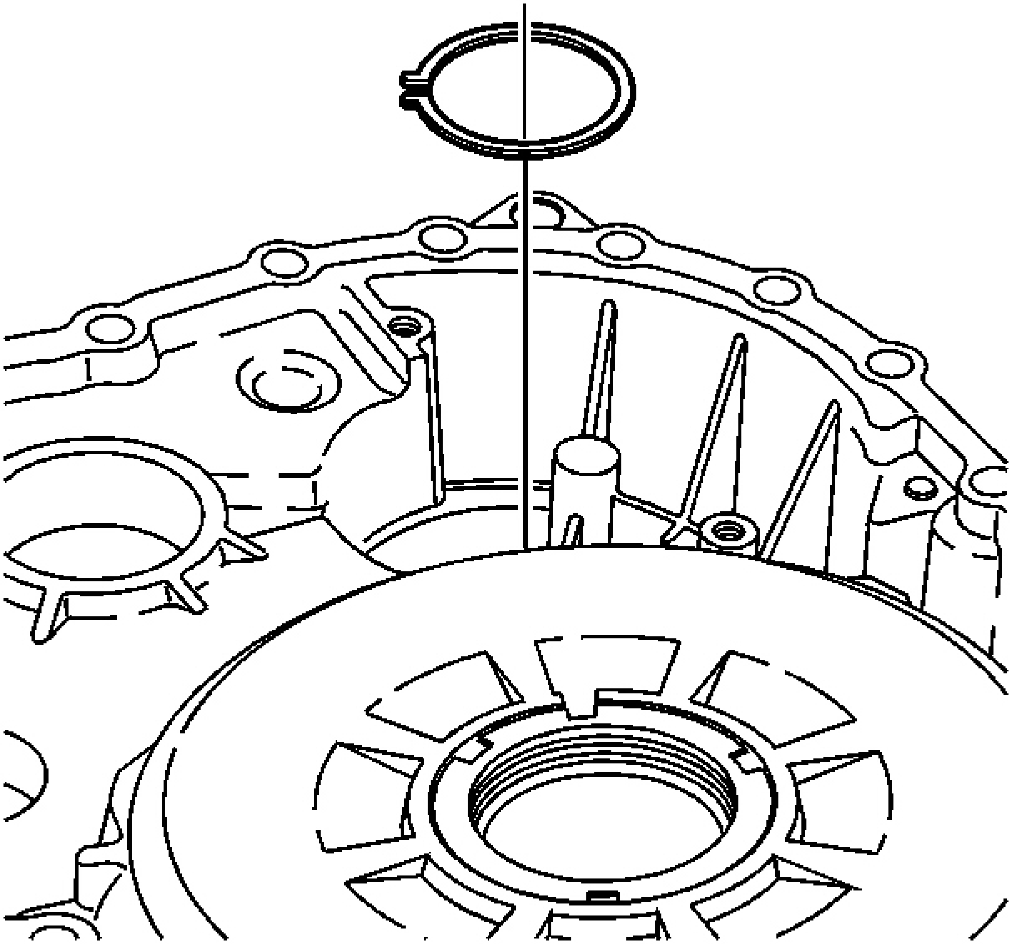


Fig. 321: Front Differential Carrier Bearing Shim To The Torque Converter & Differential Housing
Courtesy of GENERAL MOTORS CORP.

19. Install the front differential carrier bearing shim into the torque converter and differential housing assembly.

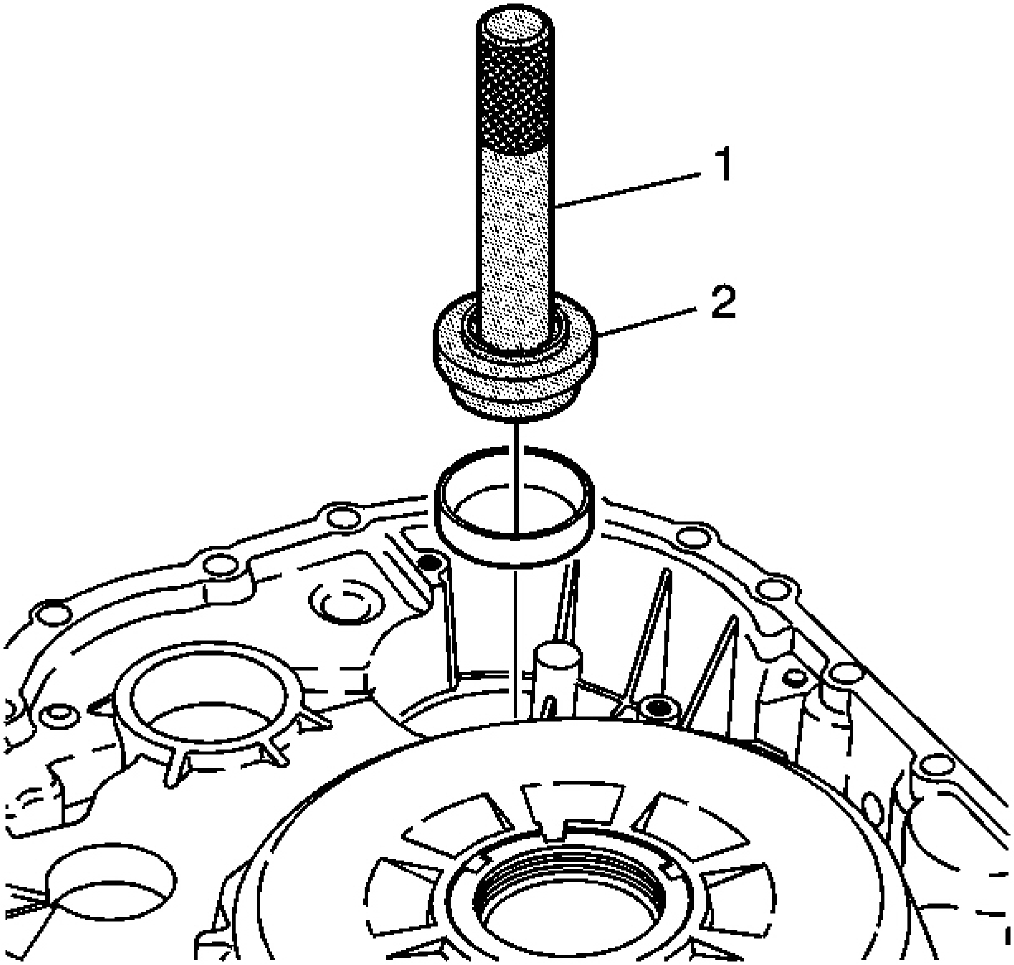


Fig. 322: Installing Front Differential Carrier Bearing Cup Into Torque Converter & Differential Housing Using J 8092 & J 43076
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use the J 43076 for 2WD applications. See Special Tools and Equipment . Use the J 44719 for F4WD applications. See Special Tools and Equipment .

20. Using the **J 8092** (1), the **J 43076** (2) or the**J 44719** (2) and a hammer, install the front differential carrier bearing cup into the torque converter and differential housing assembly. See **Special Tools and Equipment** .

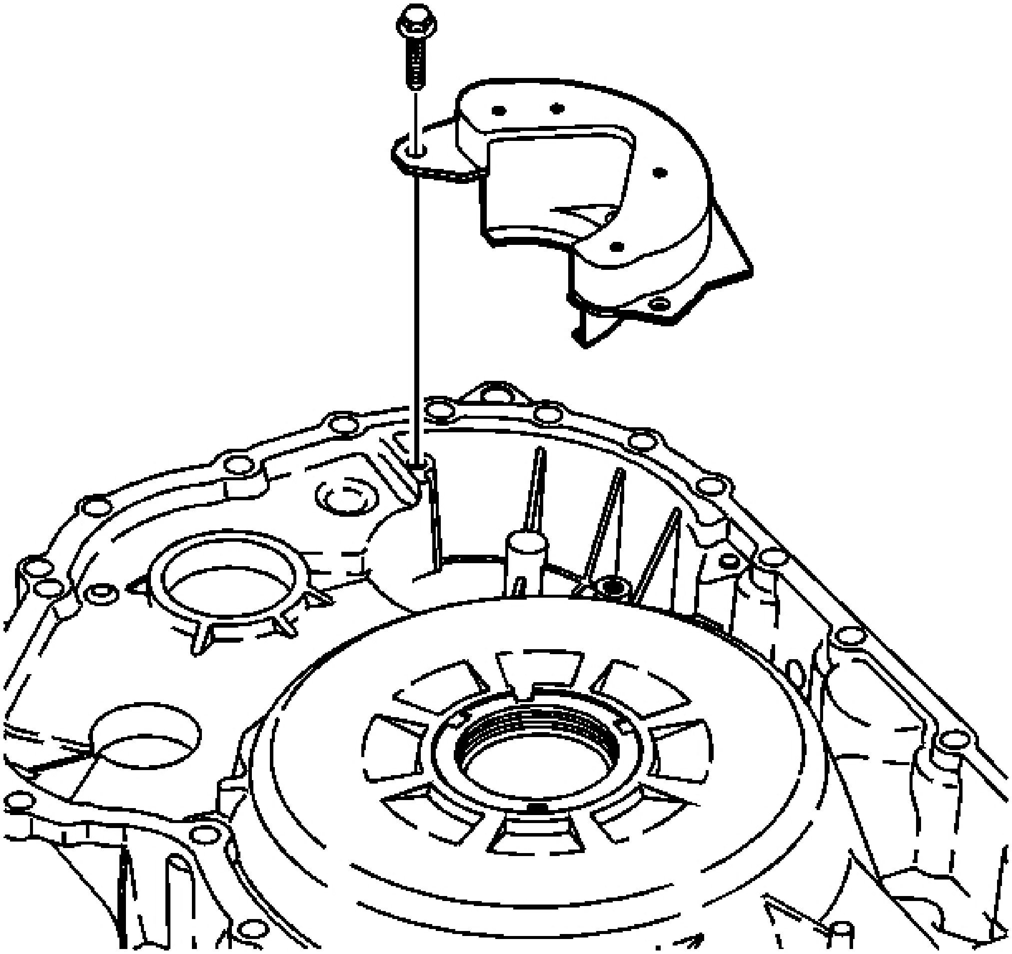


Fig. 323: Transmission Fluid Baffle & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

21. Install the transmission fluid baffle and the 3 bolts on the torque converter and differential housing assembly.

    Tighten: Tighten the fluid baffle bolts to 11 N.m (8 lb ft).

FRONT DIFFERENTIAL CARRIER INSTALLATION

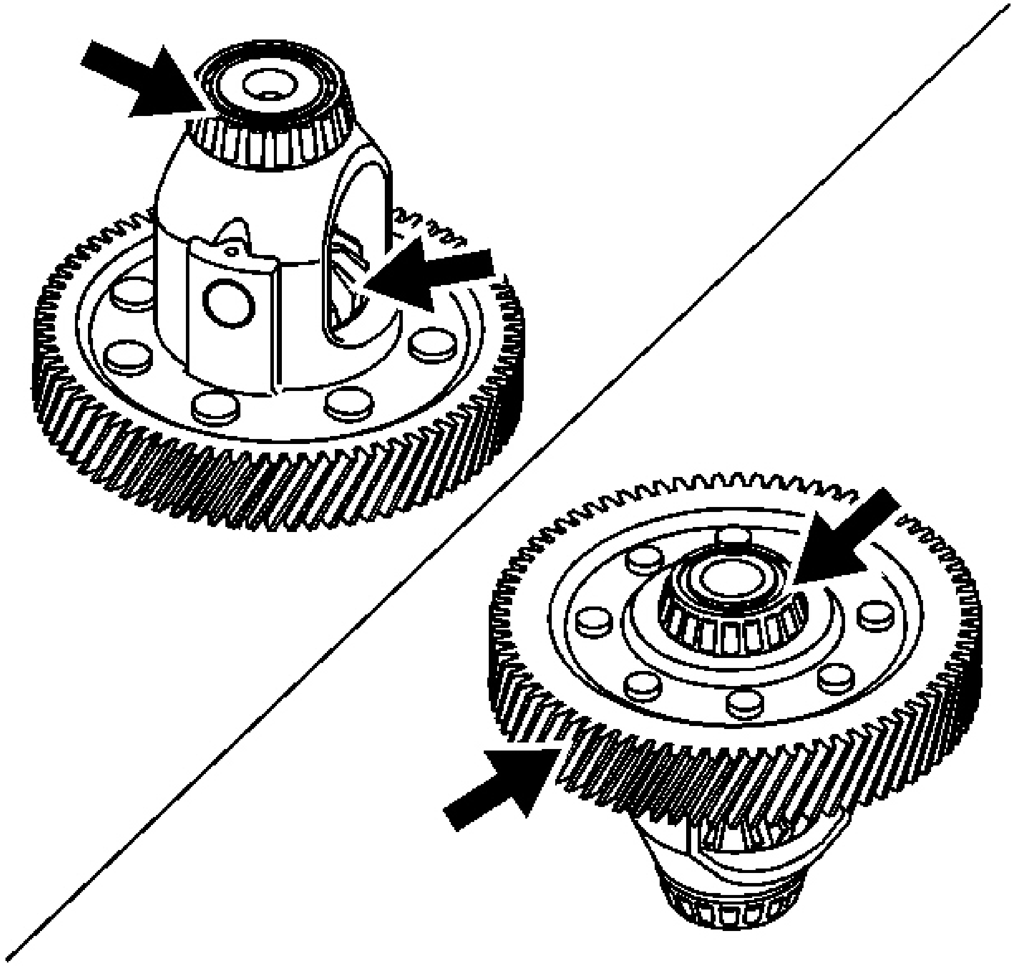


Fig. 324: Inspecting Bearing Assemblies, Front Differential Side Gears & Pinion Gears For Damage
Courtesy of GENERAL MOTORS CORP.

1. Inspect the front differential side gears and pinion gears for excessive wear. If wear is found, refer to the **Front Differential Carrier Disassemble** .
2. Inspect the bearing assemblies on the front differential carrier for damage or wear. If a bearing assembly needs replacement, refer to the **Front Differential Carrier Bearing and Cup Replacement** .
3. Inspect the front differential carrier bearing cup on the transmission case assembly for damage or wear. If the bearing cup needs replacement, refer to the **Front Differential Carrier Bearing and Cup Replacement** .
4. Inspect the front differential carrier bearing cup on the torque converter and differential housing assembly

for damage or wear. If the bearing cup needs replacement, refer to the **Front Differential Carrier Bearing and Cup Replacement** .

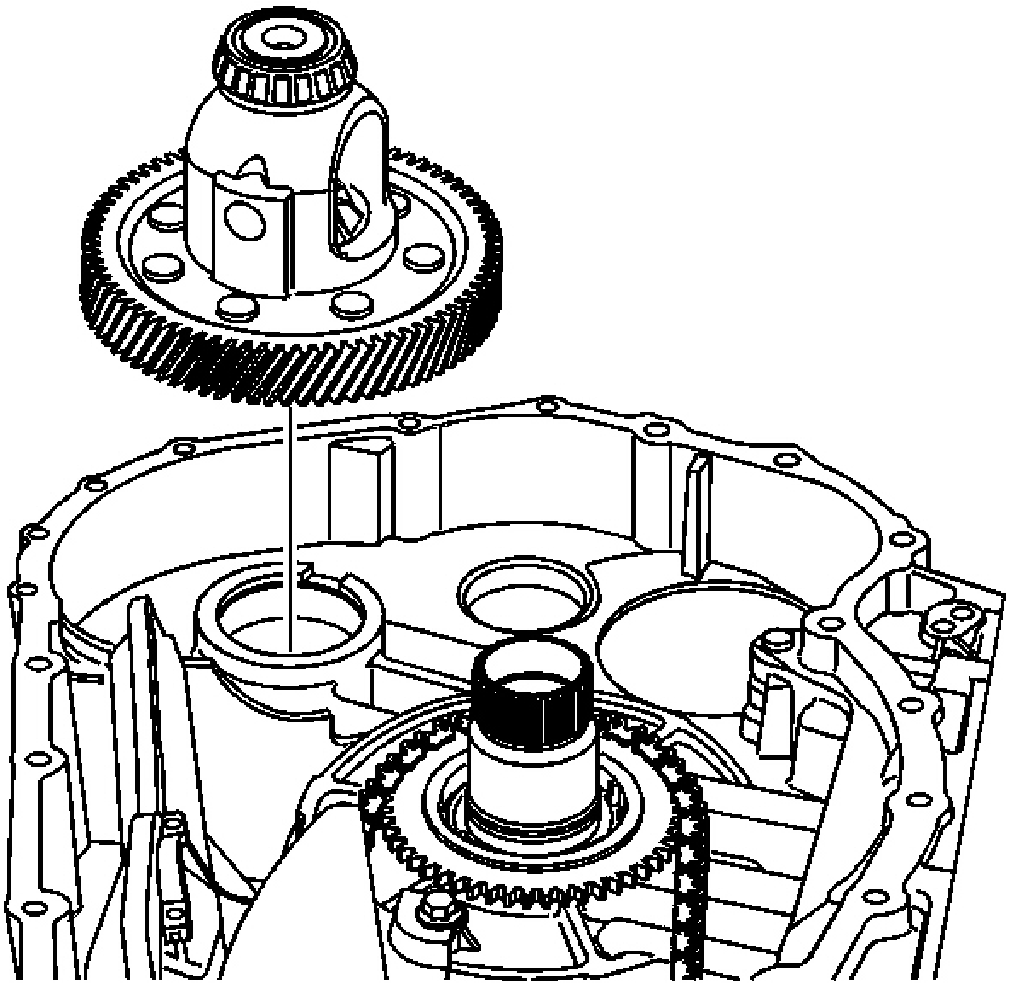


Fig. 325: Front Differential Carrier
Courtesy of GENERAL MOTORS CORP.

5. Install the front differential carrier assembly on the transmission case assembly.

FRONT DIFFERENTIAL TRANSFER GEAR BEARING AND CUP REPLACEMENT

Tools Required

- **J 8092** Universal Driver Handle
- **J 22912-01** Split Plate Bearing Puller
- **J 43075** Drive Pinion Bearing and Cup Installer. See **Special Tools and Equipment** .
- **J 45115** Bearing Cup Remover. See **Special Tools and Equipment** .
- **J 45124** Removal Bridge

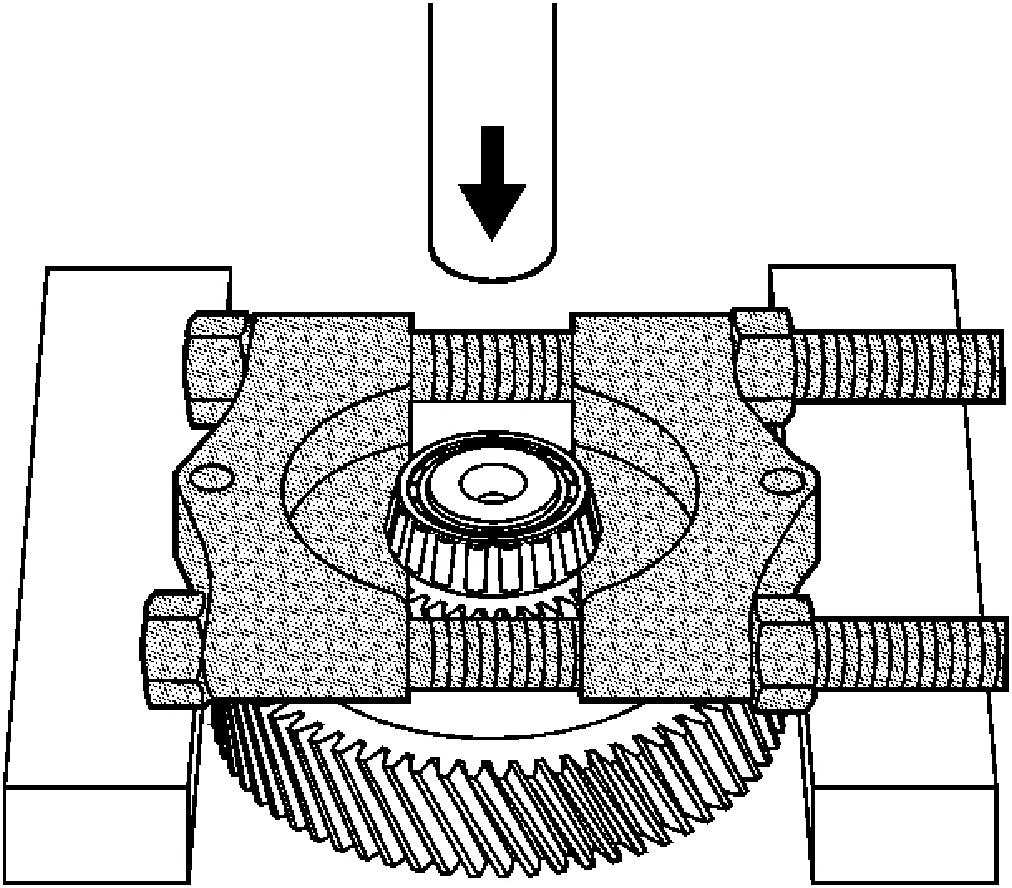


Fig. 326: Removing Bearing Assembly From Front Differential Drive Pinion Gear Transmission Case Side Using J 22912-01
Courtesy of GENERAL MOTORS CORP.

NOTE:	**Bearings and cups must be replaced as a set. Do not replace a bearing without also replacing the corresponding cup, or replace a cup without replacing the corresponding bearing. Failure to replace both components may damage the front differential carrier assembly.**

1. Using the **J 22912-01** and an arbor press, remove the bearing assembly from the front differential drive pinion gear - transmission case side.

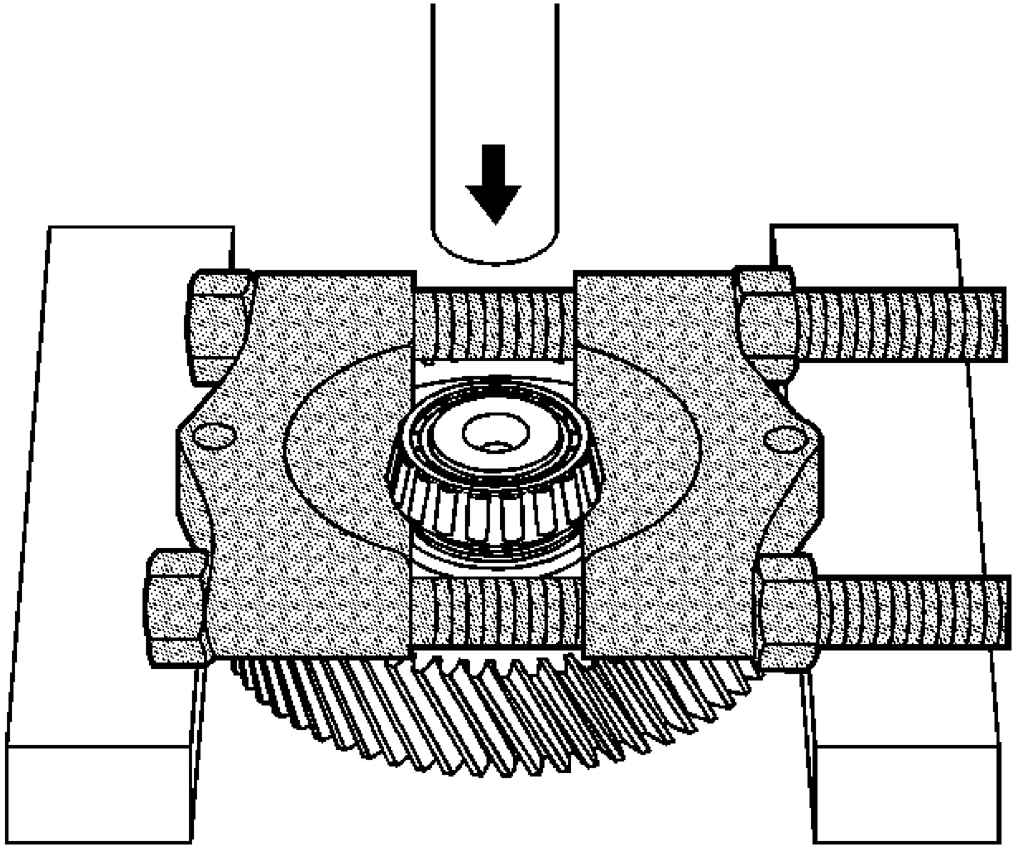


Fig. 327: Removing Bearing Assembly From Front Differential Drive Pinion Gear Torque Converter & Differential Housing Side Using J 22912-01
Courtesy of GENERAL MOTORS CORP.

2. Using the **J 22912-01** and an arbor press, remove the bearing assembly from the front differential drive pinion gear - torque converter and differential housing side.

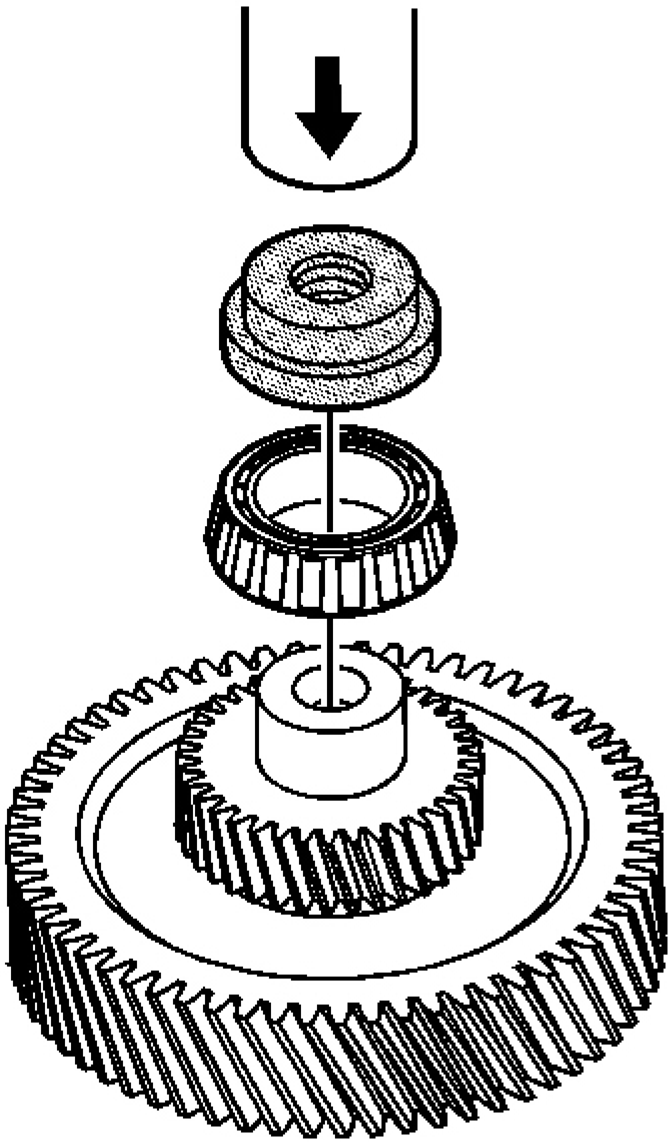


Fig. 328: Installing Bearing Assembly On Front Differential Drive Pinion Gear Transmission Case Side Using J 43075
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 43075** and an arbor press, install the bearing assembly on the front differential drive pinion gear - transmission case side. See **Special Tools and Equipment** .

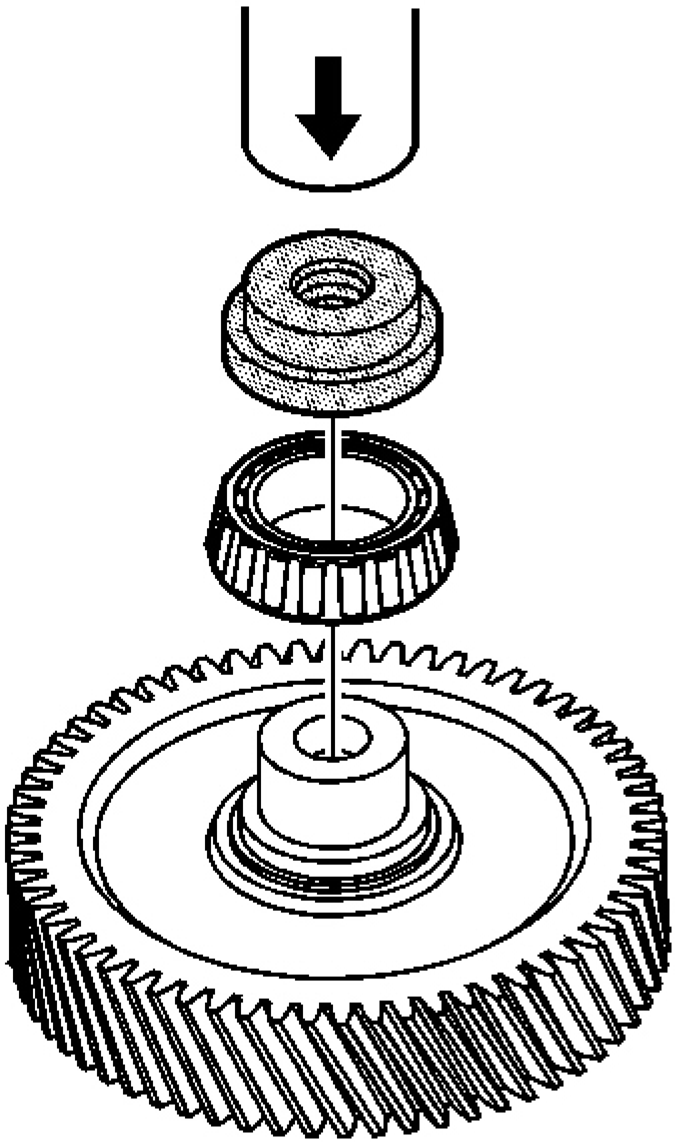


Fig. 329: Installing Bearing Assembly On Front Differential Drive Pinion Gear Torque Converter & Differential Housing Side Using J 43075
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 43075** and an arbor press, install the bearing assembly on the front differential drive pinion gear - torque converter and differential housing side. See **Special Tools and Equipment** .

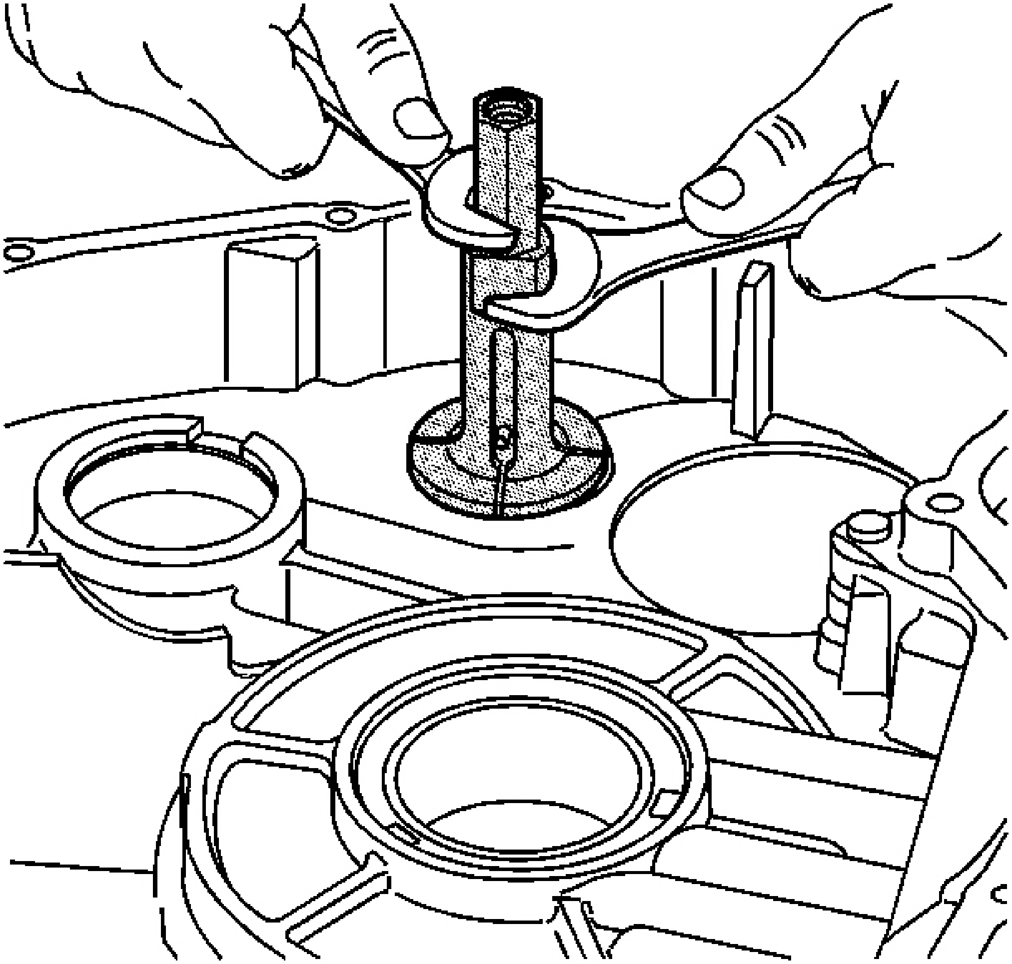


Fig. 330: Installing J 45115 Into Drive Pinion Gear Bearing Cup On Transmission Case Assembly
Courtesy of GENERAL MOTORS CORP.

5. Install the **J 45115** into the drive pinion gear bearing cup on the transmission case assembly. See **Special Tools and Equipment** .
6. Using 2 wrenches, tighten the **J 45115** . See **Special Tools and Equipment** .

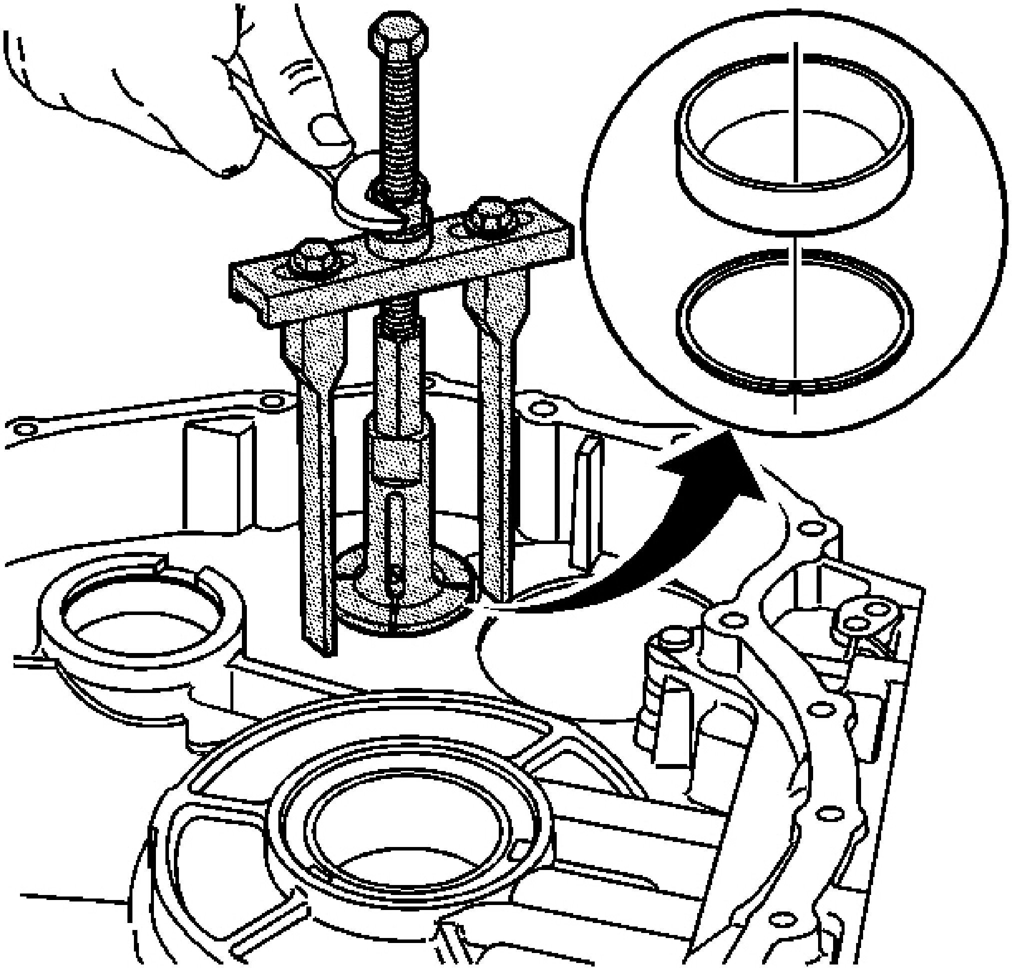


Fig. 331: Removing Drive Pinion Gear Bearing Cup From Transmission Case Assembly Using A Wrench, J 45124 & J 45115
Courtesy of GENERAL MOTORS CORP.

7. Using a wrench, the **J 45124** and the **J 45115** , remove the drive pinion gear bearing cup from the transmission case assembly. See **Special Tools and Equipment** .

IMPORTANT: The bearing shim is reusable.

8. Remove the drive pinion gear bearing shim from the transmission case assembly.

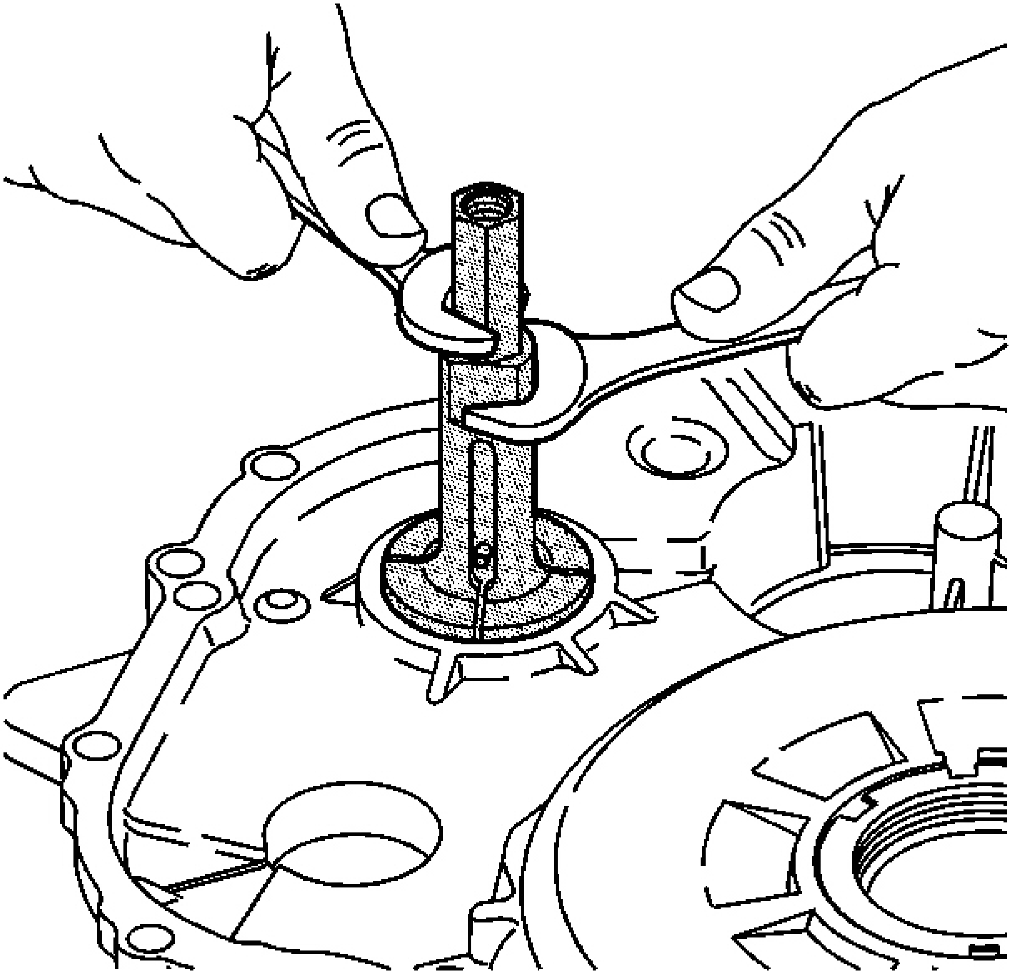


Fig. 332: Installing Into Drive Pinion Gear Bearing Cup On Torque Converter & Differential Housing Assembly Using J 45115
Courtesy of GENERAL MOTORS CORP.

9. Install the **J 45115** into the drive pinion gear bearing cup on the torque converter and differential housing assembly. See **Special Tools and Equipment** .
10. Using 2 wrenches, tighten the **J 45115** . See **Special Tools and Equipment** .

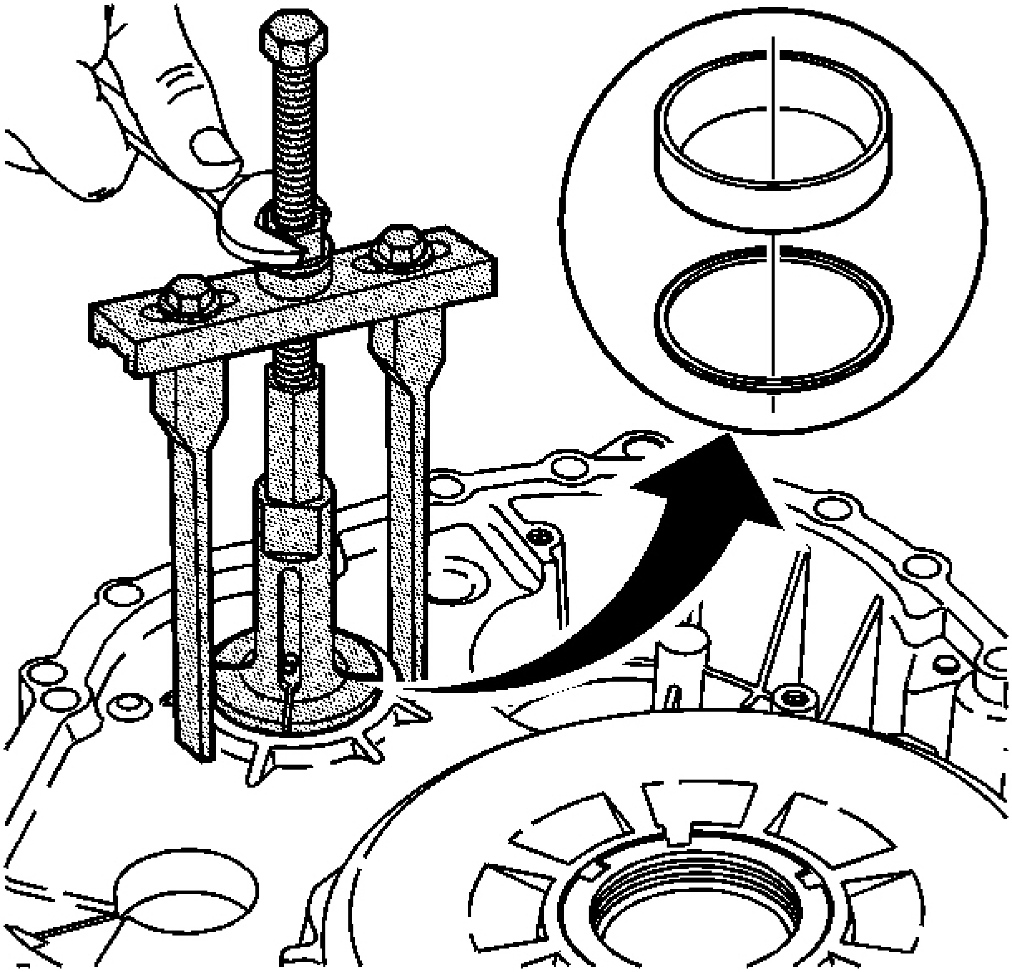


Fig. 333: Removing Drive Pinion Gear Bearing Cup From Torque Converter & Differential Housing Assembly Using A Wrench, J 45124 & J 45115
Courtesy of GENERAL MOTORS CORP.

11. Using a wrench, the **J 45124** and the **J 45115** , remove the drive pinion gear bearing cup from the torque converter and differential housing assembly. See **Special Tools and Equipment** .

IMPORTANT: The bearing shim is reusable.

12. Remove the drive pinion gear bearing shim from the torque converter and differential housing assembly.

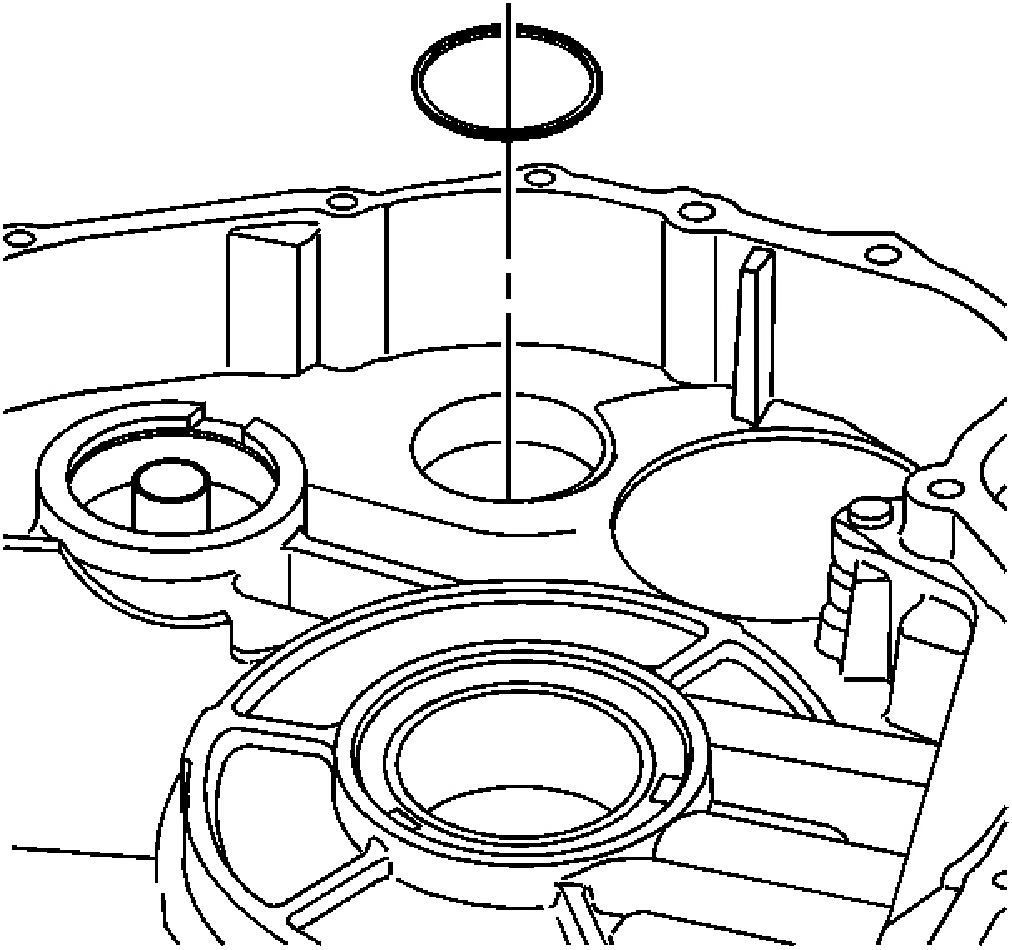


Fig. 334: Installing Drive Pinion Gear Bearing Shim Into Transmission Case Assembly
Courtesy of GENERAL MOTORS CORP.

13. Install the drive pinion gear bearing shim into the transmission case assembly.

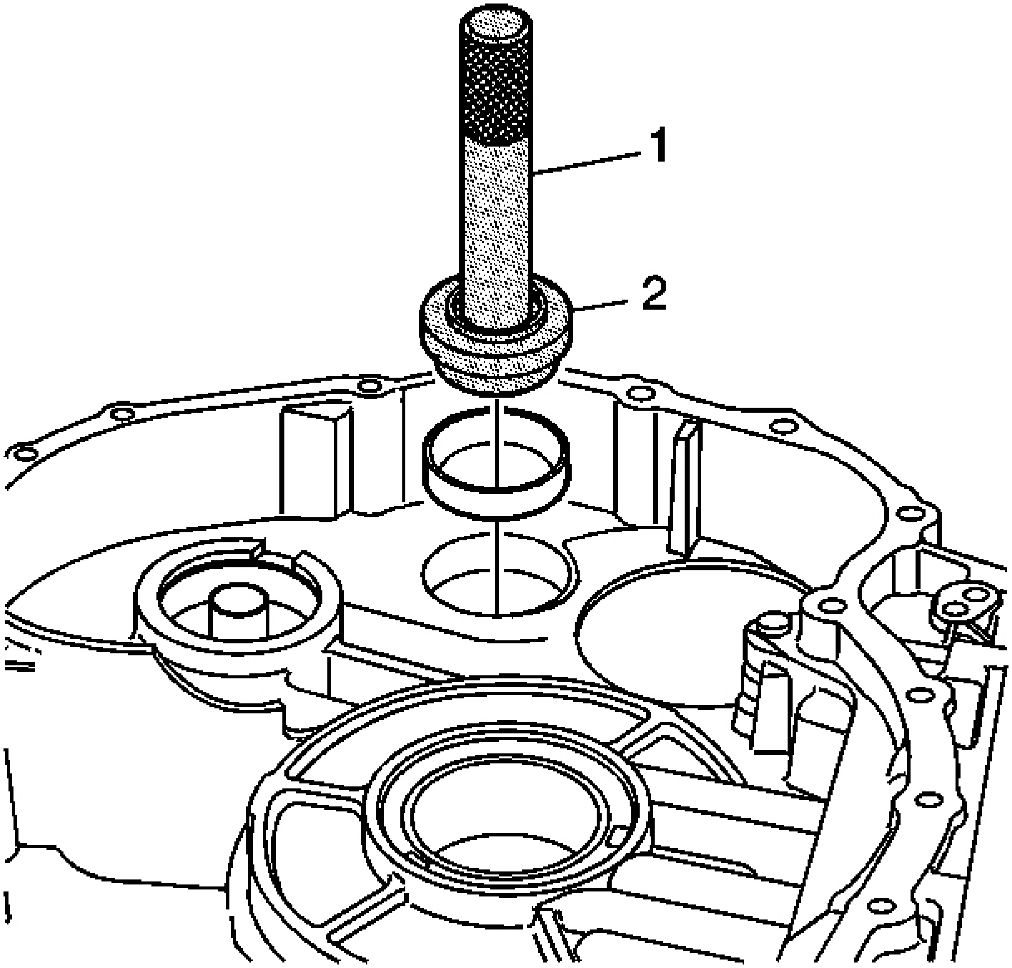


Fig. 335: Installing Drive Pinion Gear Bearing Cup Into Transmission Case Using J 8092 & J 43075
Courtesy of GENERAL MOTORS CORP.

14. Using the **J 8092** (1), the **J 43075** (2) and a hammer, install the drive pinion gear bearing cup into the transmission case assembly. See **Special Tools and Equipment** .

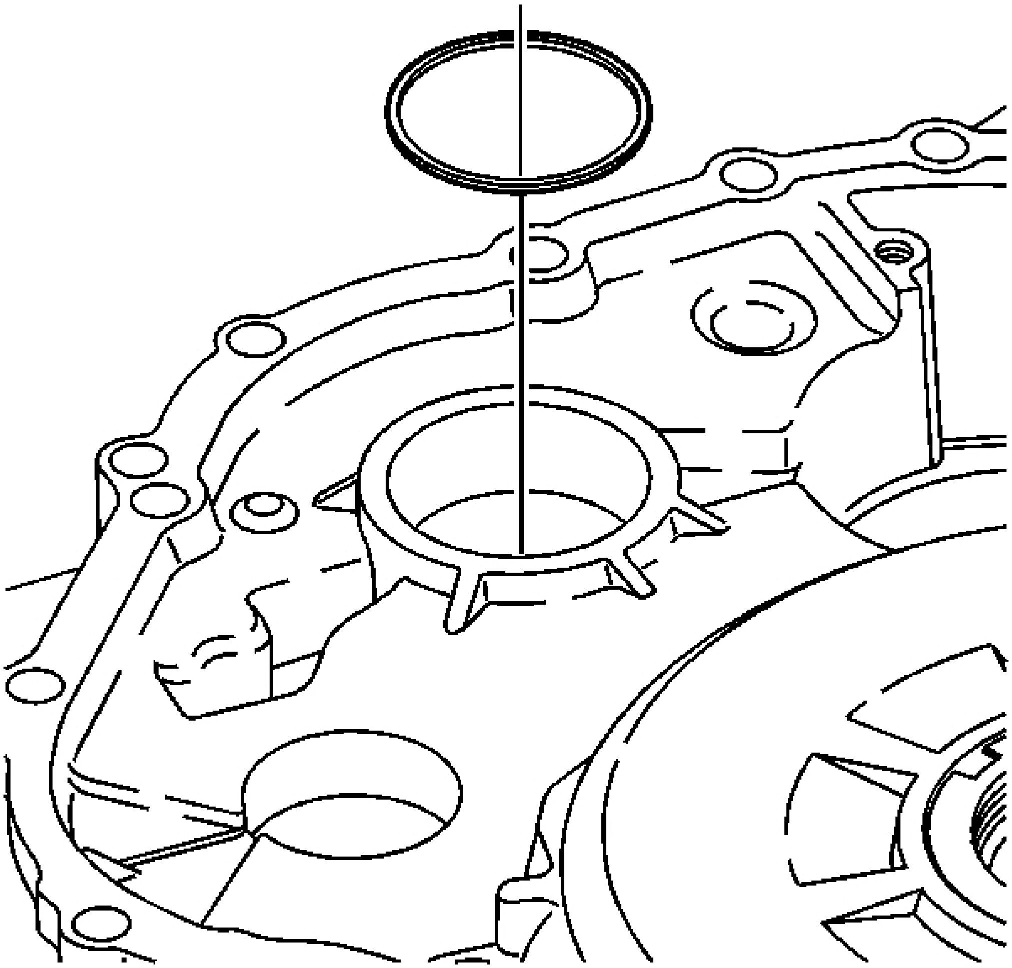


Fig. 336: Installing Drive Pinion Gear Bearing Shim Into Torque Converter & Differential Housing Assembly
Courtesy of GENERAL MOTORS CORP.

15. Install the drive pinion gear bearing shim into the torque converter and differential housing assembly.

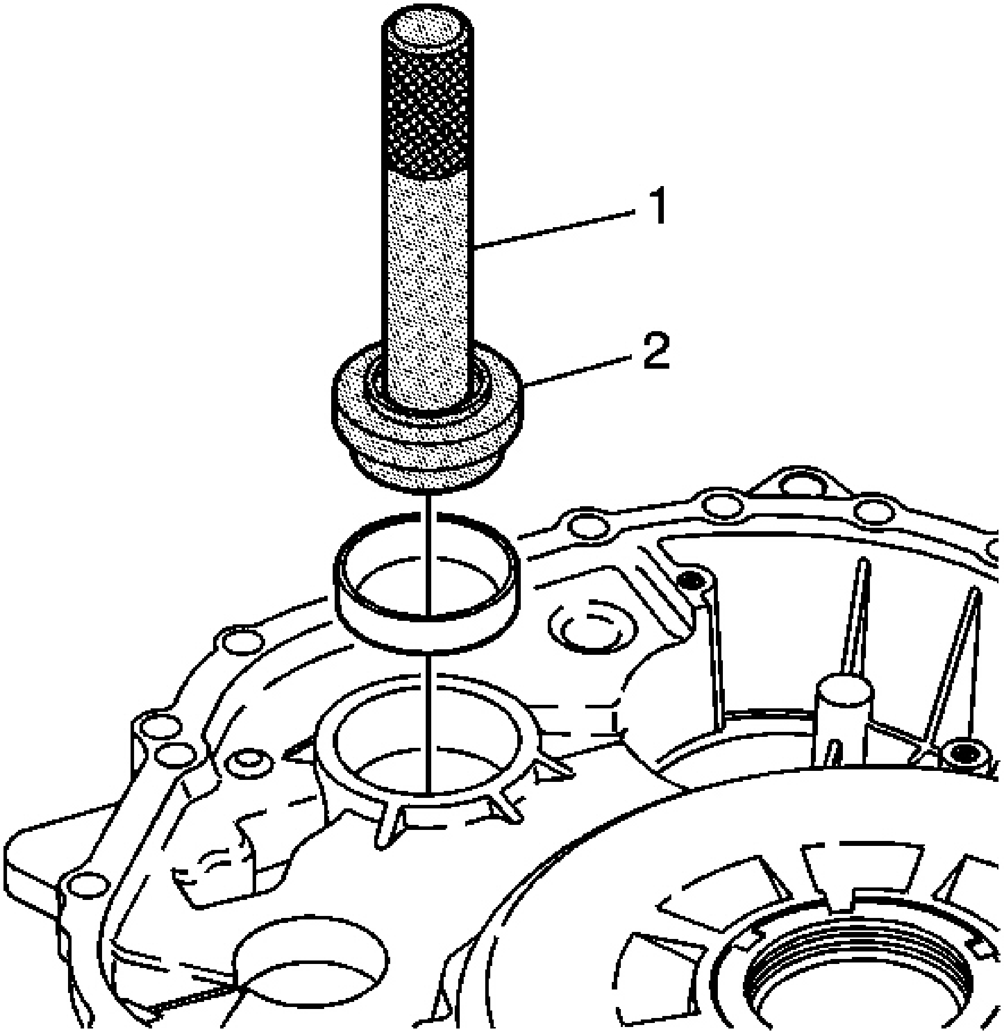


Fig. 337: Installing Drive Pinion Gear Bearing Cup Into Torque Converter & Differential Housing Assembly Using J 8092 & J 43075
Courtesy of GENERAL MOTORS CORP.

16. Using the **J 8092** (1), the **J 43075** (2) and a hammer, install the drive pinion gear bearing cup into the torque converter and differential housing assembly. See **Special Tools and Equipment** .

FRONT DIFFERENTIAL TRANSFER GEAR INSTALLATION

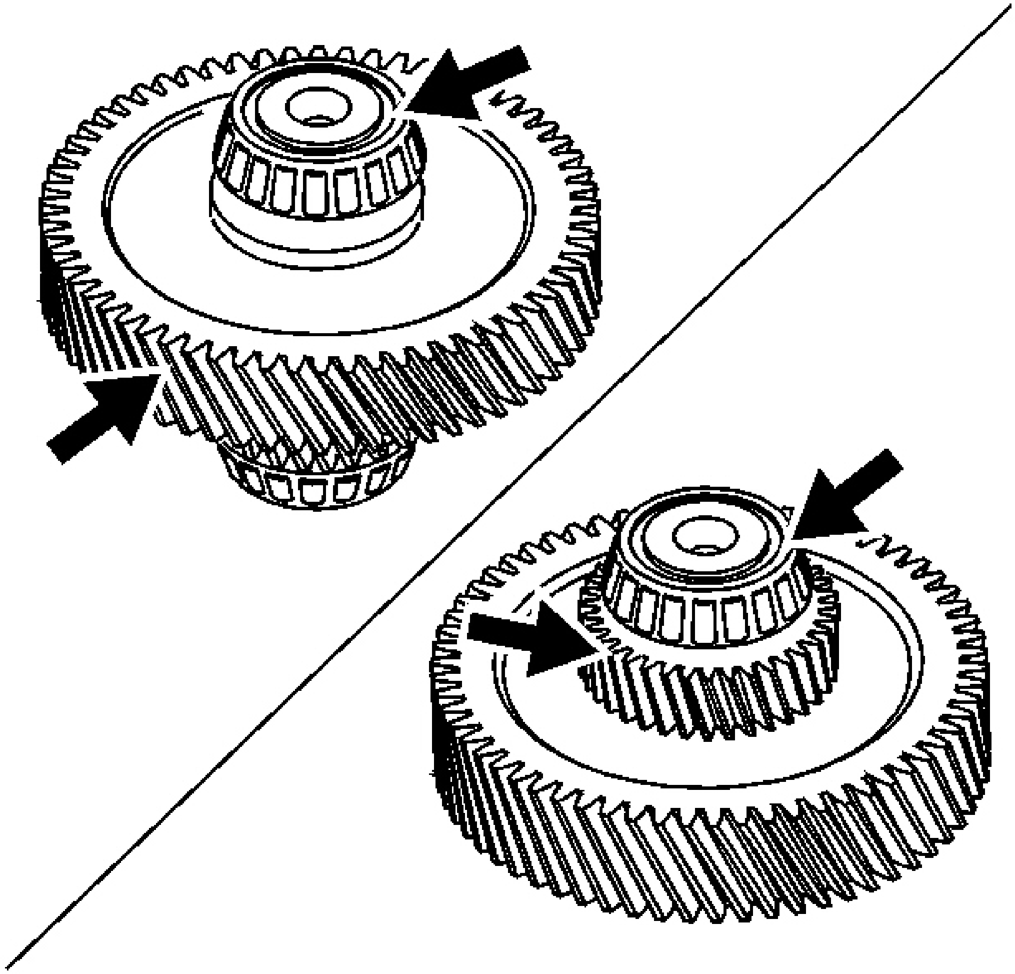


Fig. 338: Inspecting Bearing Assemblies On Front Differential Transfer Gear & Drive Pinion Gear For Damage
Courtesy of GENERAL MOTORS CORP.

1. Inspect the front differential transfer gear and drive pinion gear for excessive wear.
2. Inspect the bearing assemblies on the front differential transfer gear for damage or wear. If a bearing assembly needs replacement, refer to the **Front Differential Transfer Gear Bearing and Cup Replacement** .
3. Inspect the drive pinion bearing cup on the transmission case assembly for damage or wear. If the bearing cup needs replacement, refer to the **Front Differential Transfer Gear Bearing and Cup Replacement** .
4. Inspect the drive pinion gear bearing cup on the torque converter and differential housing assembly for damage or wear. If the bearing cup needs replacement, refer to the**Front Differential Transfer Gear**

Bearing and Cup Replacement .

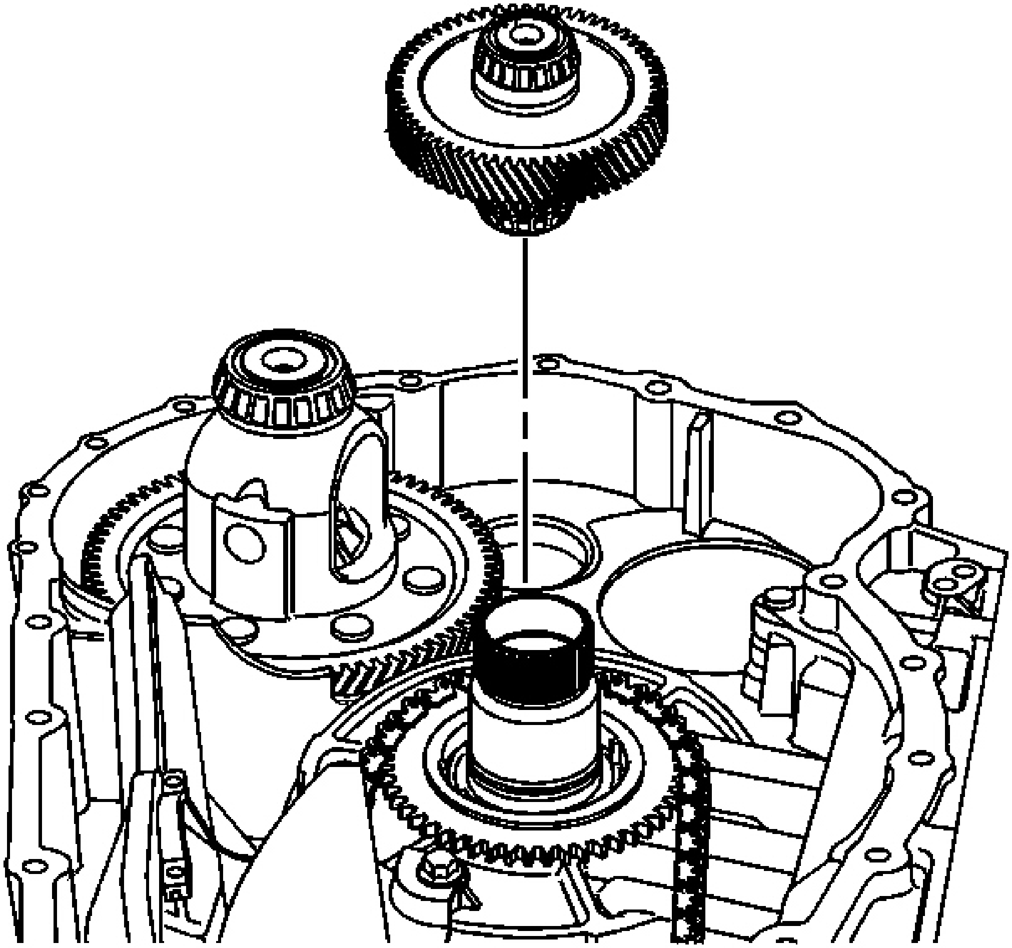


Fig. 339: Front Differential Transfer Gear
Courtesy of GENERAL MOTORS CORP.

5. Install the front differential transfer gear on the transmission case assembly.

FRONT WHEEL DRIVE SHAFT OIL SEAL REMOVAL

Tools Required

J 45000 Seal Remover

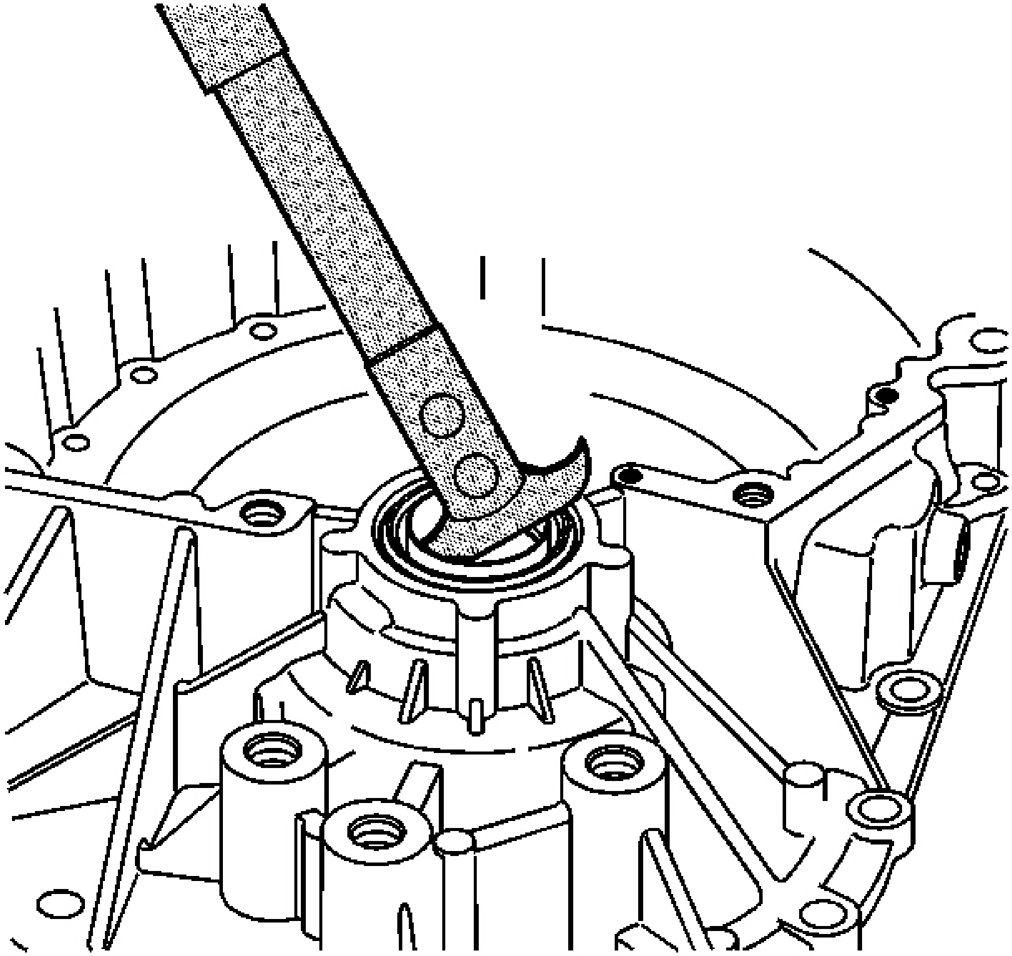


Fig. 340: Removing Oil Seal From Torque Converter & Differential Housing Assembly Using J 45000
Courtesy of GENERAL MOTORS CORP.

NOTE:	**Use care when removing the seal in order to prevent damage to the torque converter and differential housing assembly.**

IMPORTANT:	**There are 2 front wheel drive shaft oil seals. The right seal is located on the torque converter and differential housing assembly. The left seal is located on the transmission case assembly.**

IMPORTANT:	**Discard the seals after removal. Do not reuse the seals.**

IMPORTANT: Perform Step 1 for 2WD transmissions. Perform Step 2 for F4WD transmissions.

1. Using the **J 45000** , remove the oil seal from the torque converter and differential housing assembly.

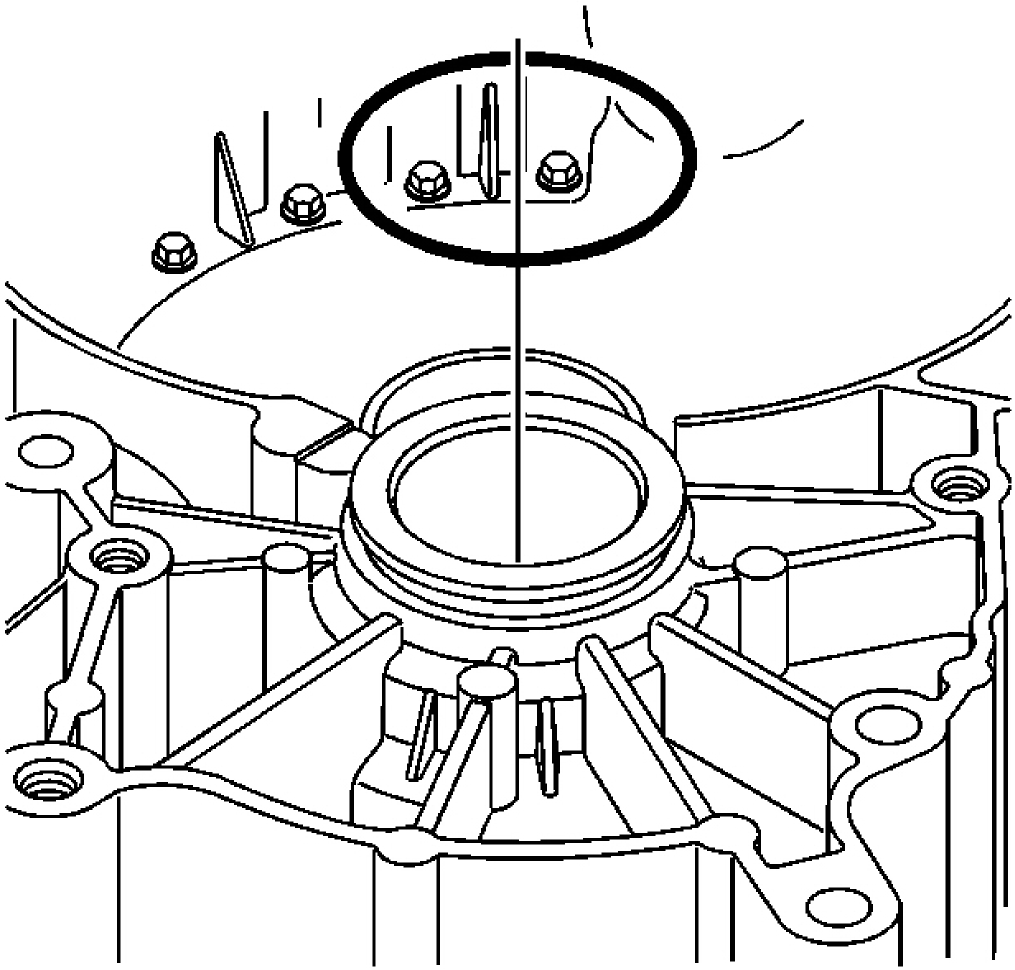


Fig. 341: Torque Converter, Differential Housing & O-Ring Seal (AWD)
Courtesy of GENERAL MOTORS CORP.

2. Remove the O-ring seal from the torque converter and differential housing assembly.

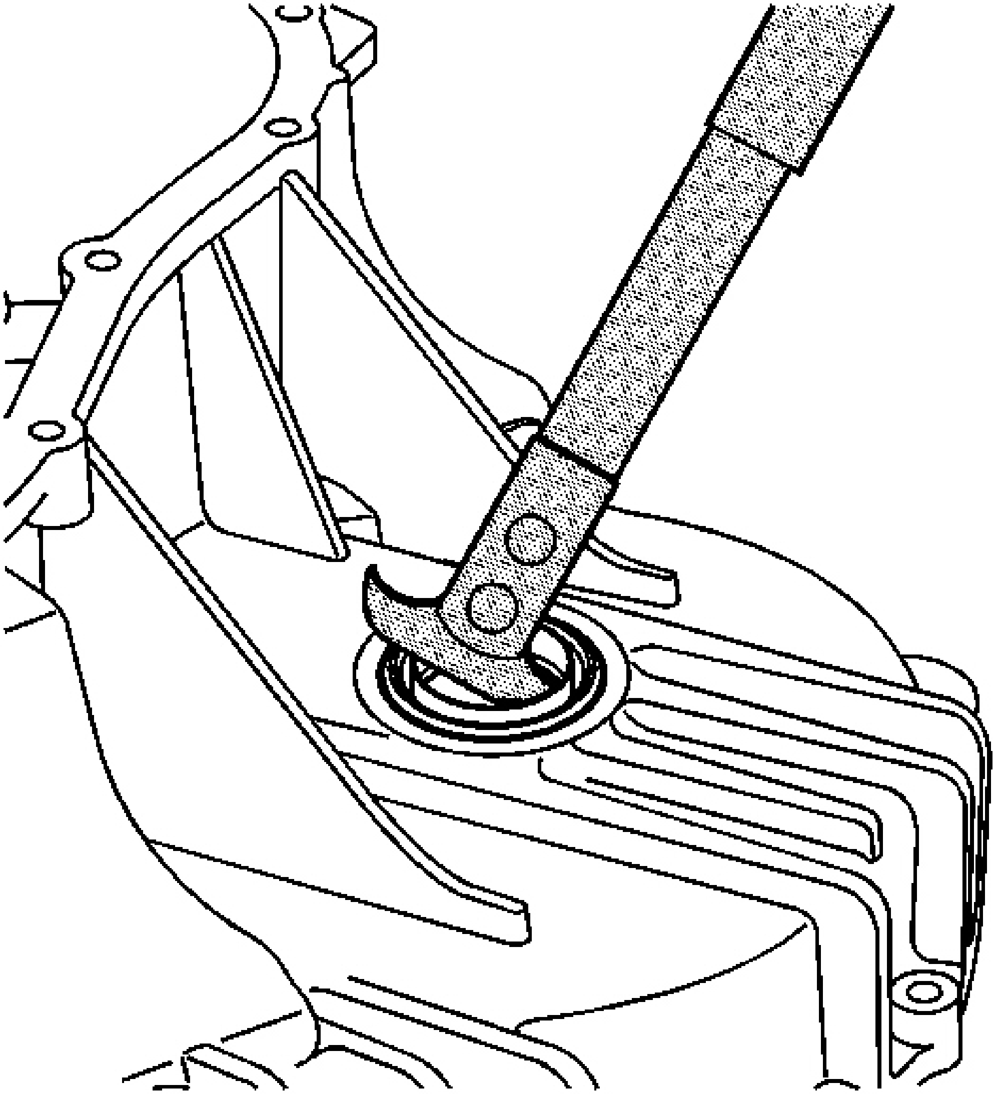


Fig. 342: Removing Oil Seal From Transmission Case Assembly Using J 45000
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 45000** , remove the oil seal from the transmission case assembly.

VARIABLE DRIVEN PULLEY BEARING REPLACEMENT

Tools Required

- **J 8092** Universal Driver Handle
- **J 43077** Variable Driven Pulley Bearing Installer. See **Special Tools and Equipment** .
- **J 45113** Variable Driven Pulley Bearing Remover. See **Special Tools and Equipment** .
- **J 45124** Removal Bridge

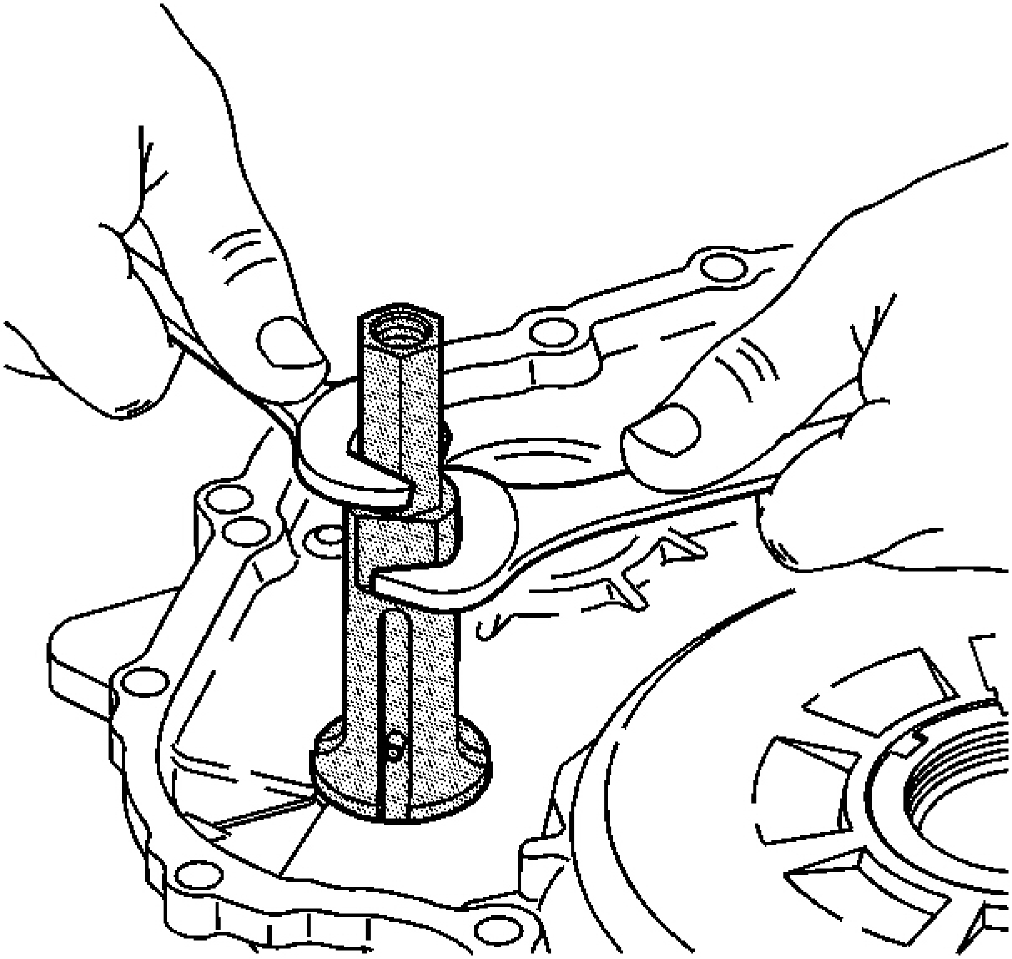


Fig. 343: Installing J 45113 Into Variable Driven Pulley Bearing On Torque Converter & Differential Housing Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the **J 45113** into the variable driven pulley bearing on the torque converter and differential housing assembly. See **Special Tools and Equipment** .
2. Using 2 wrenches, tighten the **J 45113** . See **Special Tools and Equipment** .

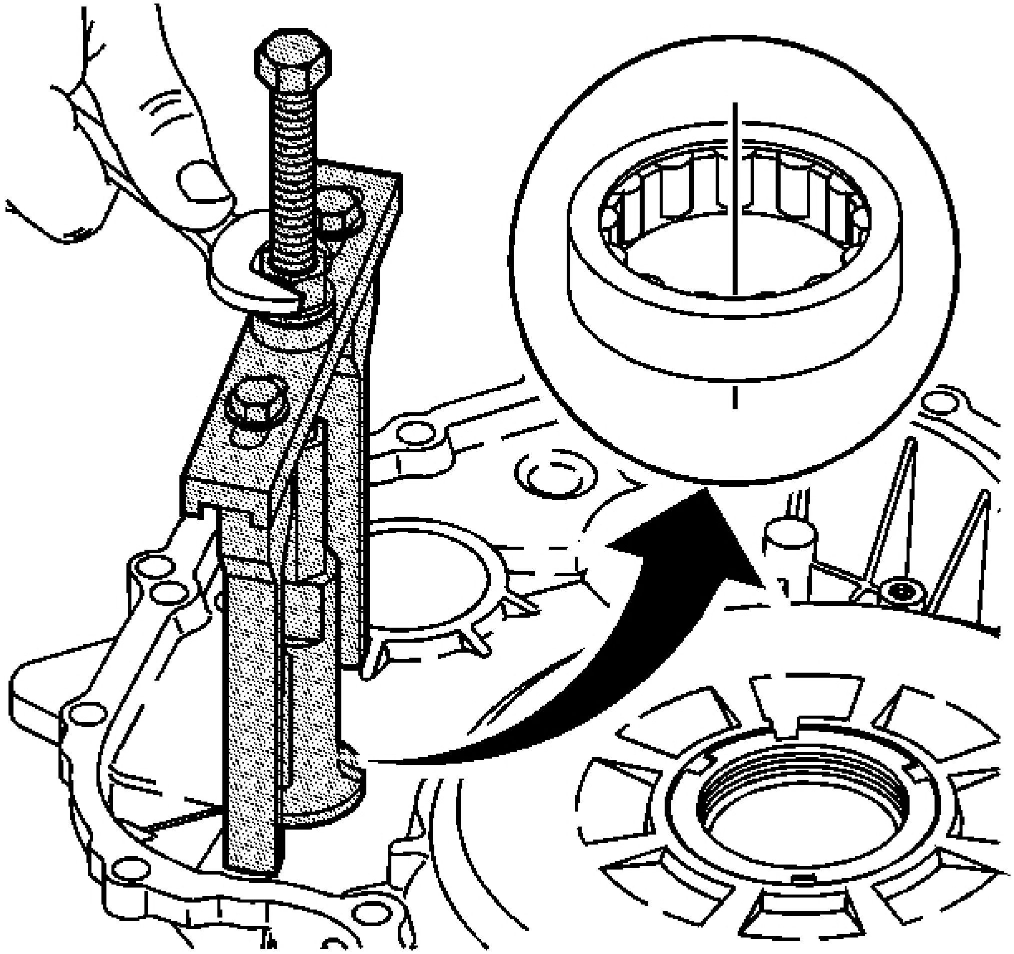


Fig. 344: Removing Variable Driven Pulley Bearing Assembly From Torque Converter & Differential Housing Assembly Using A Wrench, J 45124 & J 45113
Courtesy of GENERAL MOTORS CORP.

3. Using a wrench, the **J 45124** and the **J 45113** , remove the variable driven pulley bearing assembly from the torque converter and differential housing assembly. See **Special Tools and Equipment** .

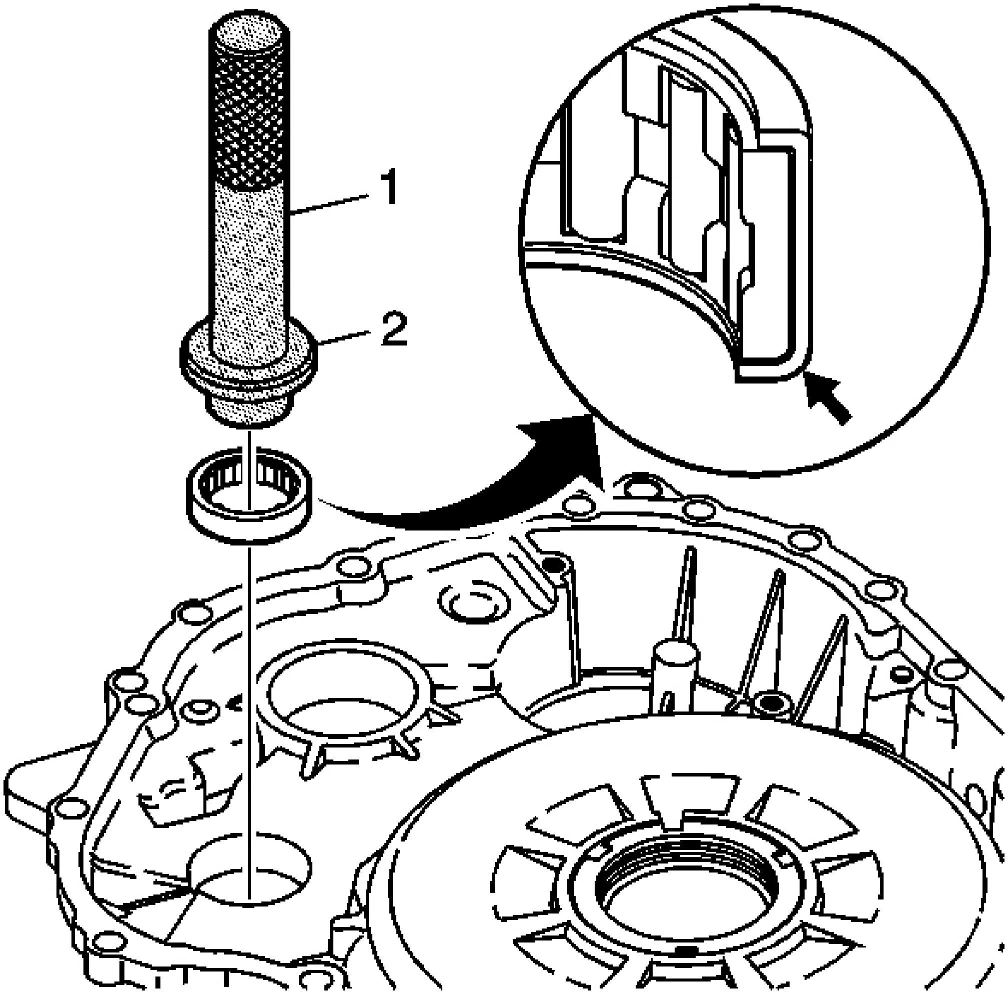


Fig. 345: Installing Variable Driven Pulley Bearing Assembly Into Torque Converter & Differential Housing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Install the variable driven pulley bearing assembly with the rounded edge down.

4. Using the **J 8092** (1), the **J 43077** (2) and a hammer, install the variable driven pulley bearing assembly into the torque converter and differential housing assembly. See **Special Tools and Equipment** .

FRONT WHEEL DRIVE SHAFT OIL SEAL INSTALLATION

Tools Required

J 43068 Axle Seal Installer

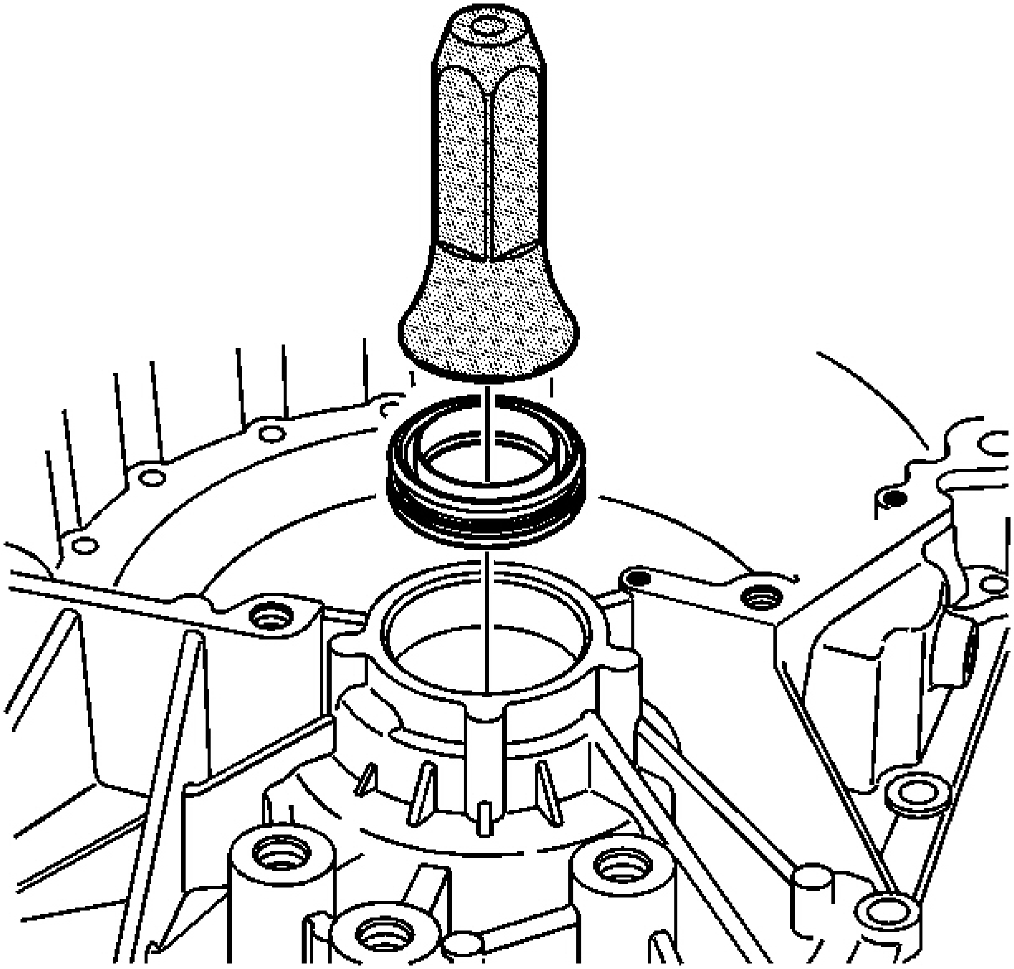


Fig. 346: Installing Oil Seal On Torque Converter & Differential Housing Assembly Using J 43068
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: There are 2 front wheel drive shaft oil seals. The right seal is located on the torque converter and differential housing assembly. The left seal is located on the transmission case assembly.

IMPORTANT: Perform Step 1 for 2WD transmissions. Perform Step 2 for F4WD

transmissions.

1. Using the **J 43068** , install a NEW oil seal on the torque converter and differential housing assembly.

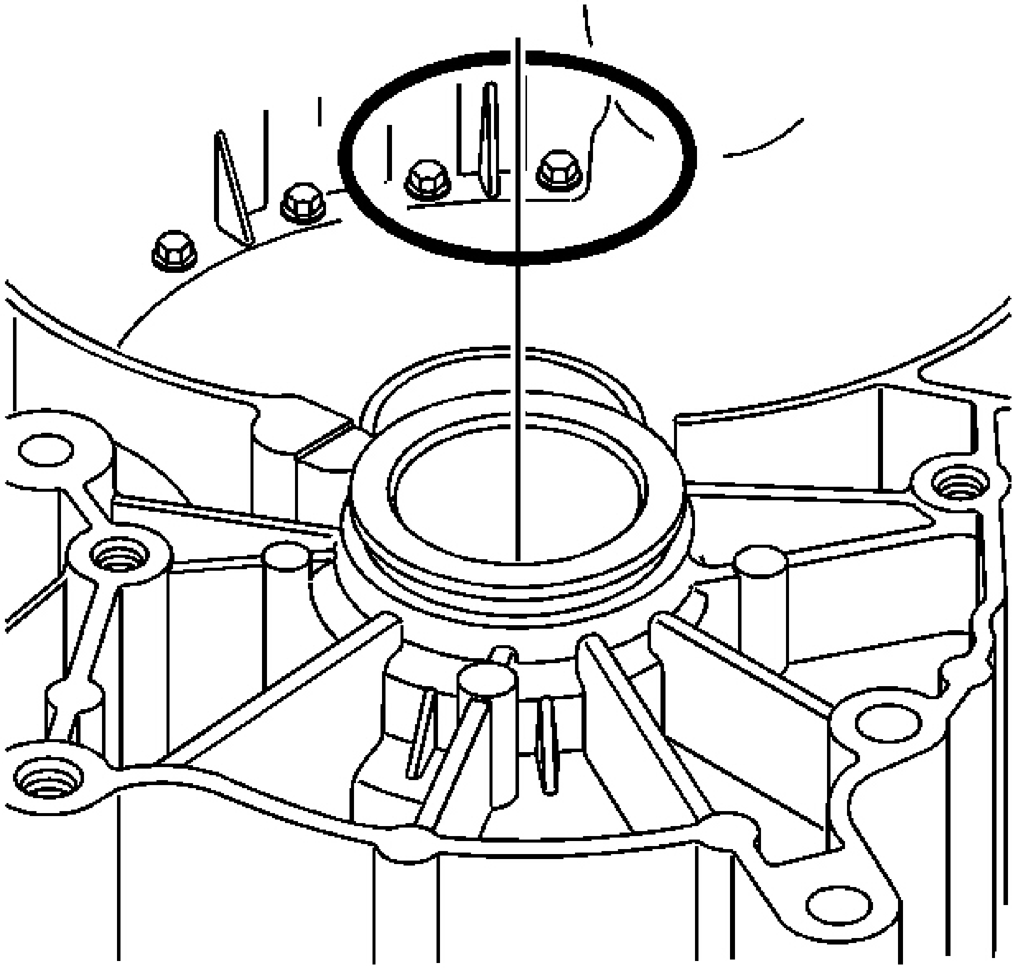


Fig. 347: Torque Converter, Differential Housing & O-Ring Seal (AWD)
Courtesy of GENERAL MOTORS CORP.

2. Install a NEW O-ring seal on the torque converter and differential housing assembly.

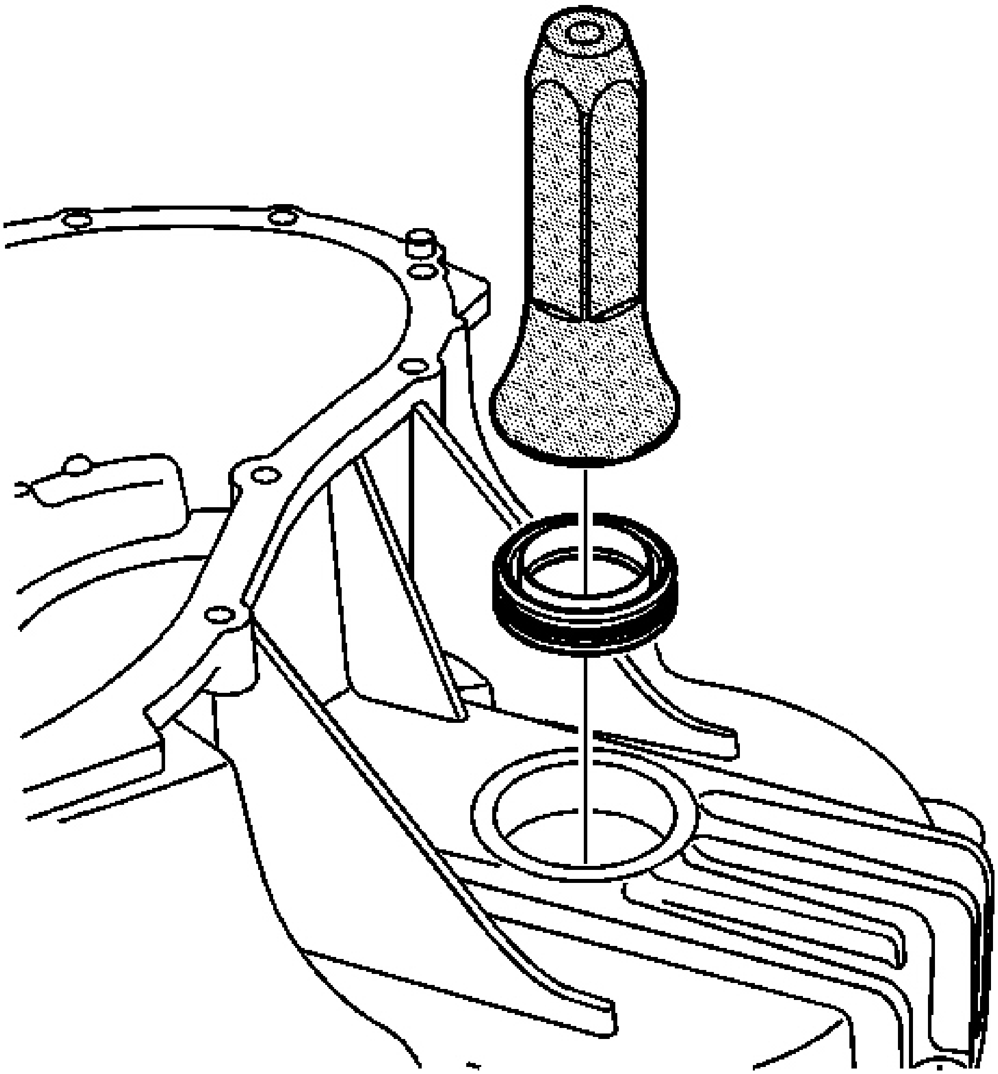


Fig. 348: Installing Oil Seal On Transmission Case Using J 43068
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 43068** , install a NEW oil seal on the transmission case assembly.

TORQUE CONVERTER AND DIFFERENTIAL HOUSING INSTALLATION

Tools Required

J 36850 Assembly Lubricant. See **Special Tools and Equipment** .

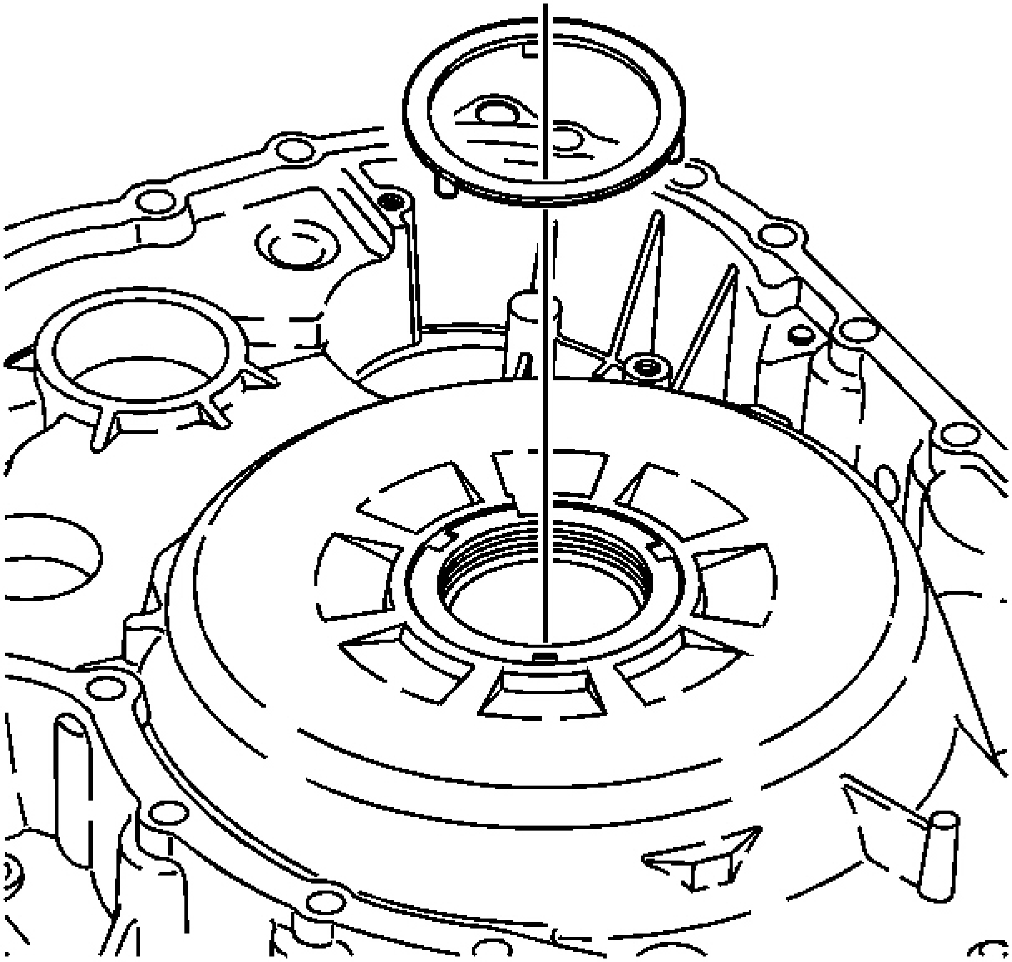


Fig. 349: Thrust Washer, Torque Converter & Differential Housing
Courtesy of GENERAL MOTORS CORP.

1. Apply **J 36850** to the prong-side mating surface of a drive sprocket thrust washer. See **Special Tools and Equipment** .
2. Install the thrust washer onto the torque converter and differential housing assembly.

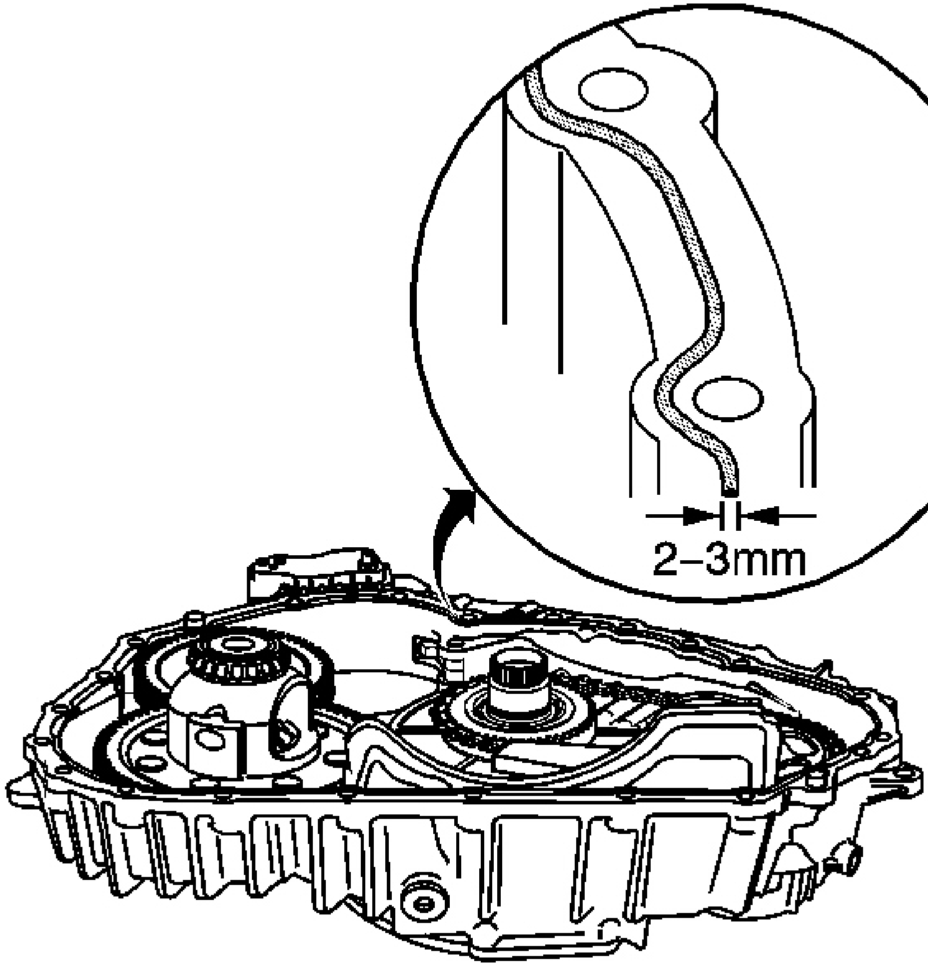


Fig. 350: Applying 2-3 Mm Bead Of Sealant GM P/N 24233365 To Mating Surface Of Transmission Case
Courtesy of GENERAL MOTORS CORP.

NOTE:	**Use extreme care when applying sealant. Ensure the bead of sealant does not exceed 2-3 mm (0.079-0.118 in). Excess sealant inside the transmission may cause restrictions resulting in various performance and noise complaints.**
IMPORTANT:	**Liquid PA Sealant GM P/N 24233365 is the only authorized sealant that should be applied to the mating surfaces.**

IMPORTANT: Ensure the bead of sealant is centered on the mating surface between the bolt holes, and on the inside mating surface around the bolt holes.

3. Apply a 2-3 mm (0.079-0.118 in) bead of sealant GM P/N 24233365 to the mating surface of the transmission case assembly.

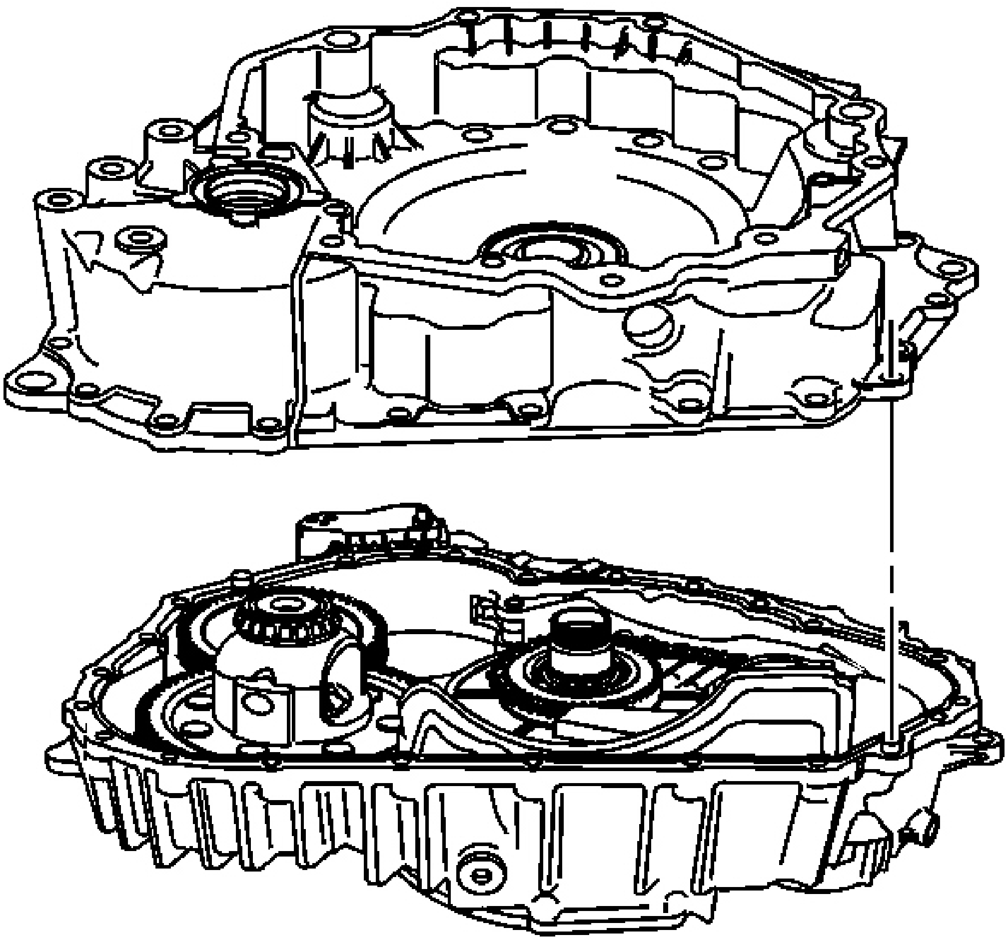


Fig. 351: Torque Converter & Differential Housing
Courtesy of GENERAL MOTORS CORP.

4. Carefully install the torque converter and differential housing assembly on the transmission case assembly.

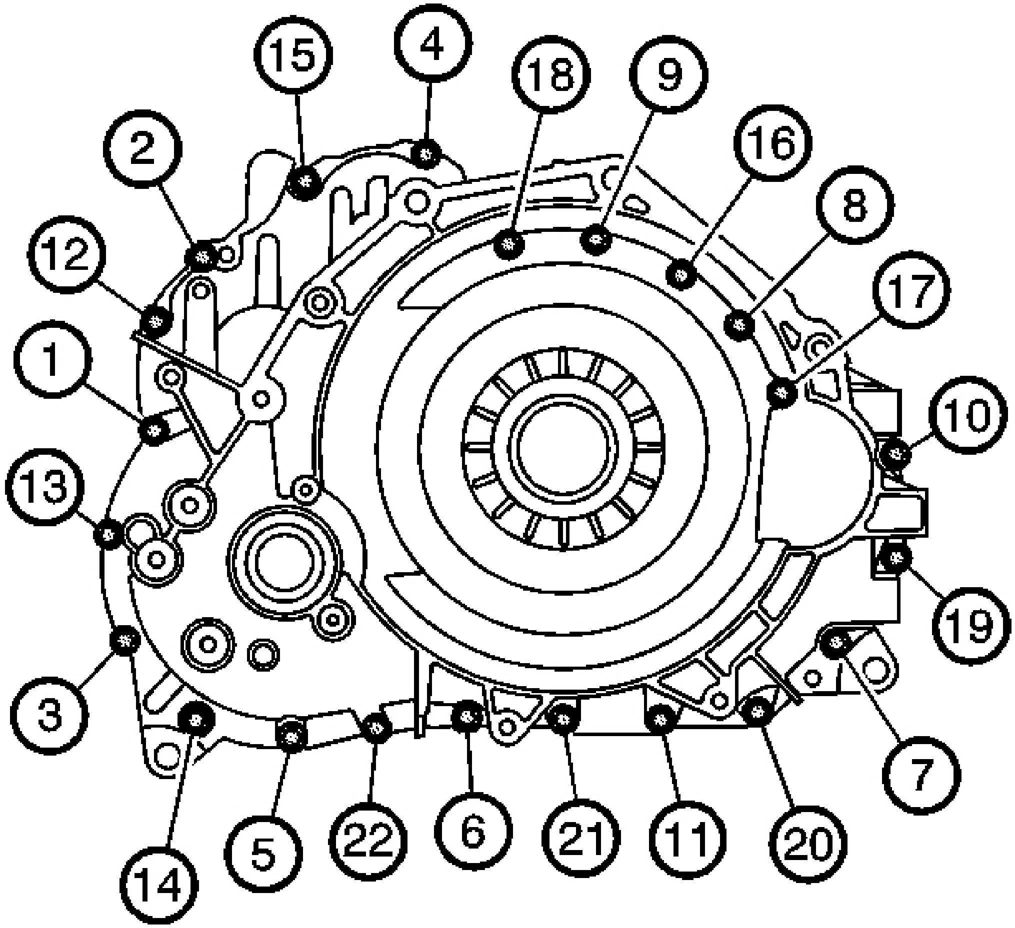


Fig. 352: Torque Converter & Differential Housing Tightening Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

5. Secure the torque converter and differential housing assembly to the transmission case assembly with 22 NEW bolts.

   Tighten: Tighten the bolts to 28 N.m (21 lb ft) in the sequence shown.

REVERSE CLUTCH INSTALLATION

Tools Required

- **J 23456** Booster and Clutch Pack Compressor. See **Special Tools and Equipment** .
- **J 36850** Assembly Lubricant. See **Special Tools and Equipment** .
- **J 38734** Reverse Spring Compressor Adapter. See **Special Tools and Equipment** .
- **J 43065-1** Reverse Clutch Piston Pusher. See **Special Tools and Equipment** .
- **J 43065-2** Reverse Clutch Piston OD Protector. See **Special Tools and Equipment** .
- **J 43065-3** Reverse Clutch Piston ID Protector. See **Special Tools and Equipment** .
- **J 45995** Clutch Compressor. See **Special Tools and Equipment** .
- **J 46251** Weight. See **Special Tools and Equipment** .

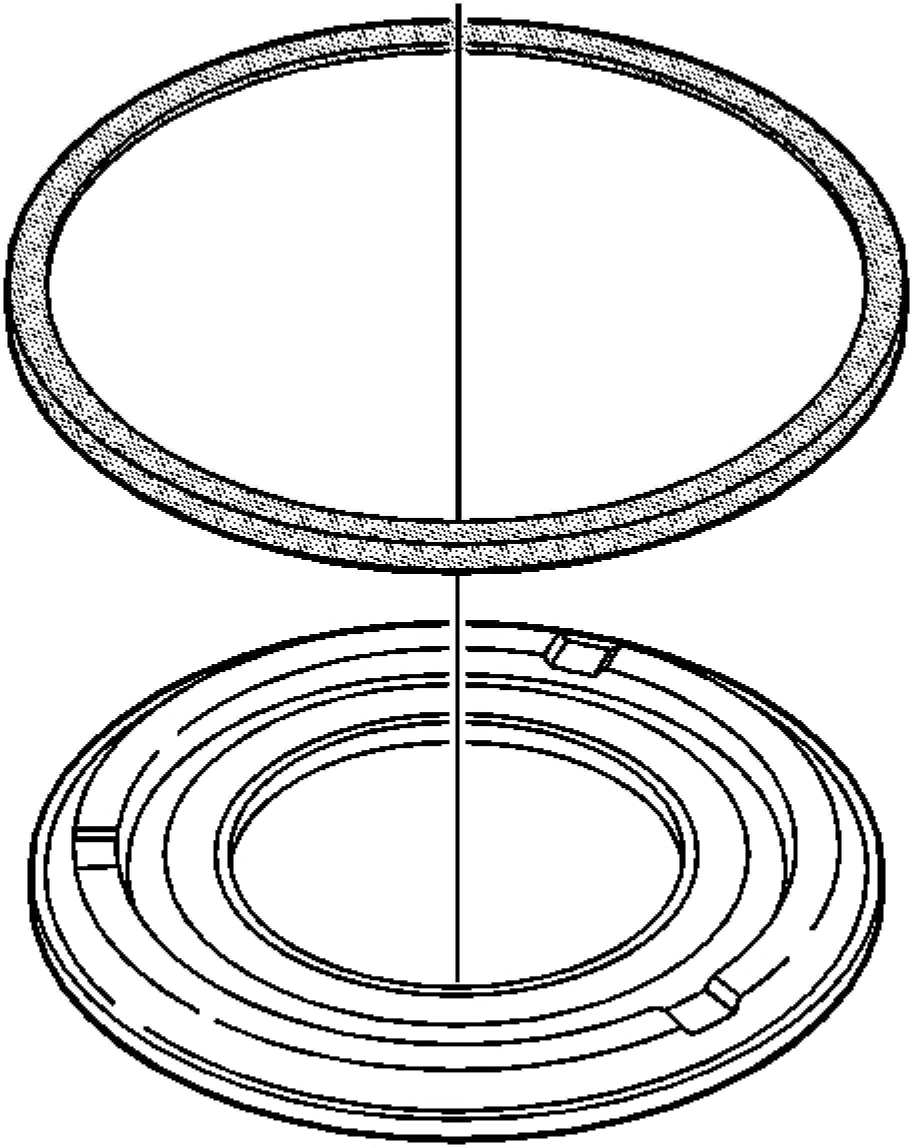


Fig. 353: Applying J 36850 To Outer Seal Edge Of Reverse Clutch Piston
Courtesy of GENERAL MOTORS CORP.

1. Apply **J 36850** to the outer seal edge of the reverse clutch piston assembly. See **Special Tools and Equipment** .

CAUTION: Use care when installing the J 43065-2 onto the reverse clutch piston assembly. The metal OD protector has a sharp edge. Failure to use care may result in personal injury.

2. Install the **J 43065-2** onto the reverse clutch piston assembly. See **Special Tools and Equipment** .

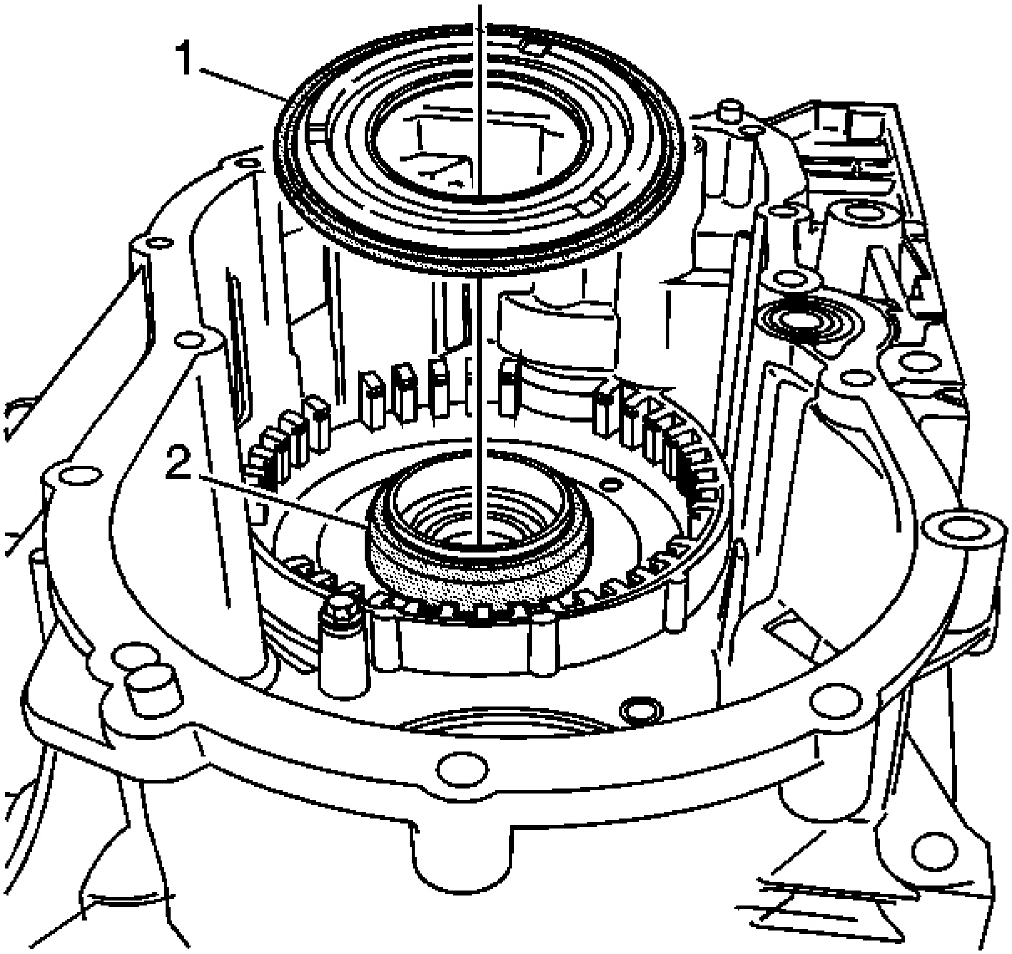


Fig. 354: J 43065-3 & J 43065-2
Courtesy of GENERAL MOTORS CORP.

3. Position the **J 43065-3** (2) on the transmission case assembly. See **Special Tools and Equipment** .
4. Apply **J 36850** to the inner seal edge of the reverse clutch piston assembly. See **Special Tools and Equipment** .
5. Position the **J 43065-2** (1) and the reverse clutch piston assembly over the**J 43065-3** . See **Special Tools**

and Equipment .

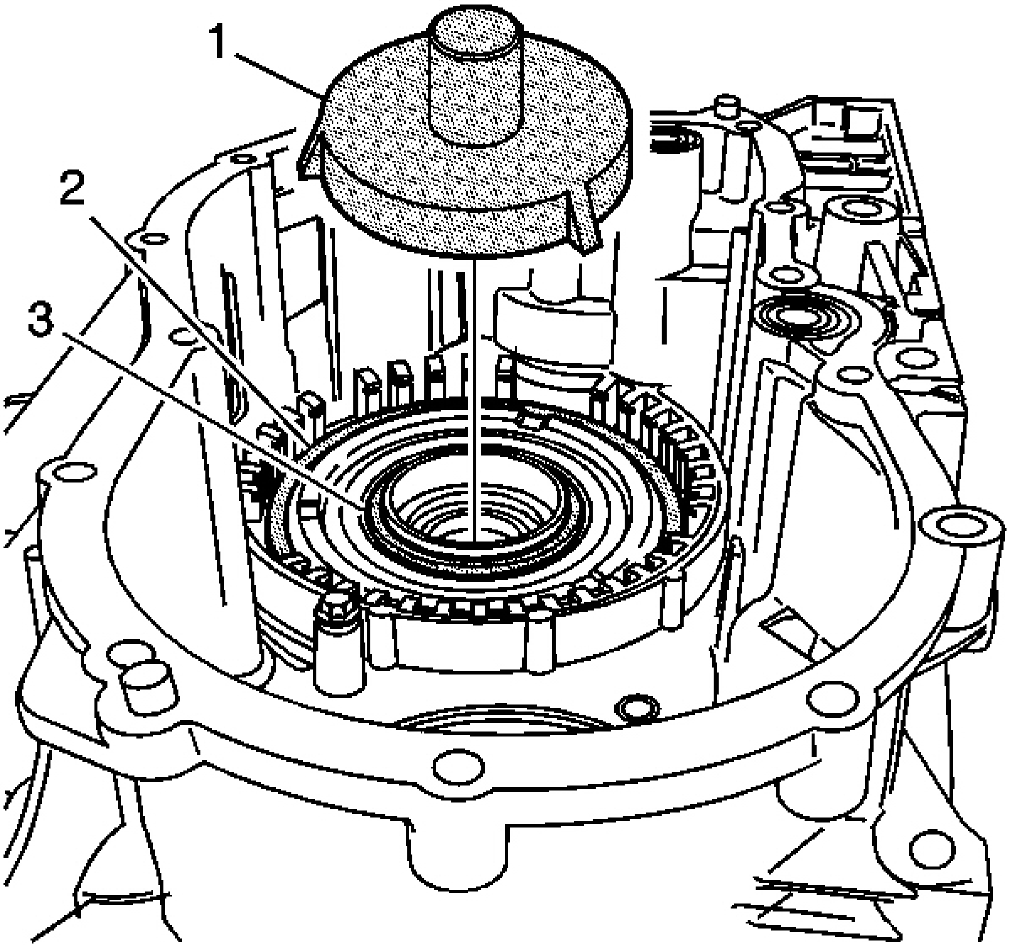


Fig. 355: J 43065-1, J 43065-2 & J 43065-3
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: When using the J 43065-1 (1), keep the piston assembly level and apply equal downward pressure in order to ensure proper piston seating in the transmission case assembly. See Special Tools and Equipment .

6. Using the **J 43065-1** , install the reverse clutch piston assembly into the transmission case assembly. See **Special Tools and Equipment** .
7. Remove the **J 43065-1** (1),**J 43065-2** (2) and**J 43065-3** (3). See **Special Tools and Equipment** .

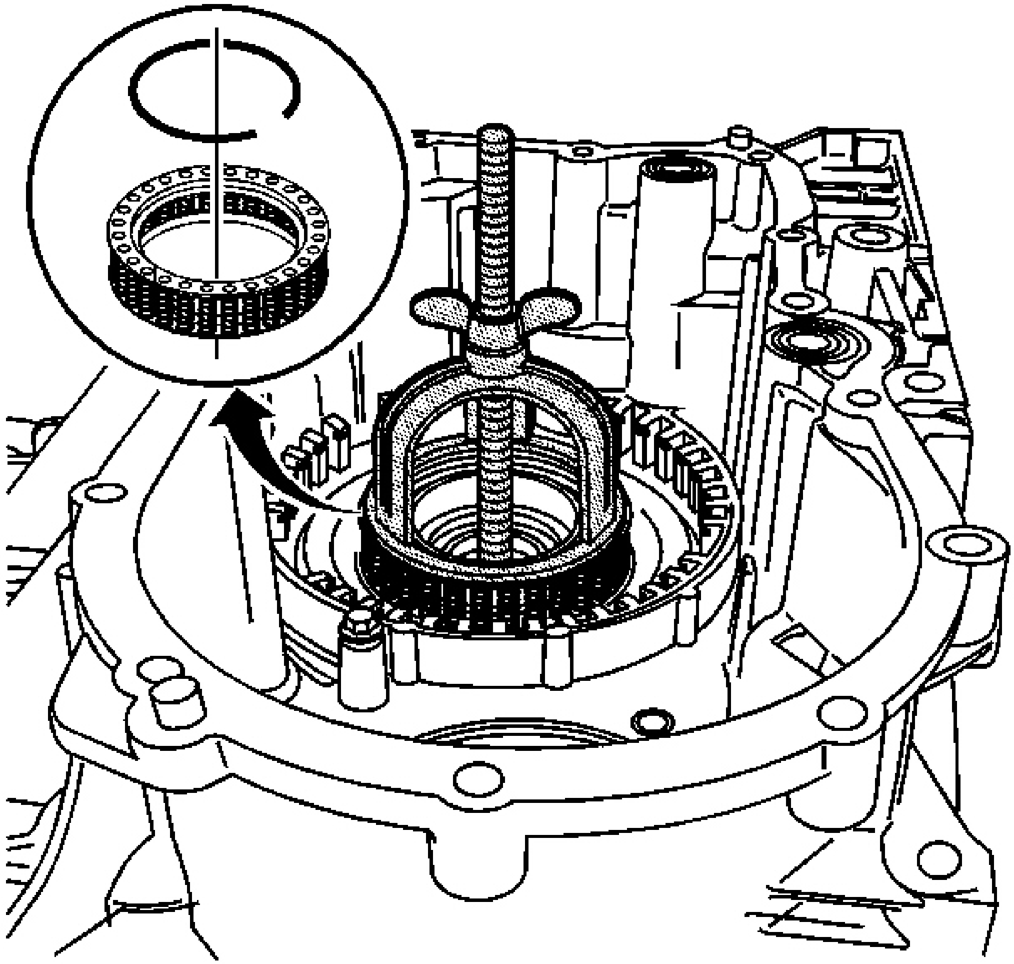


Fig. 356: J 23327, J 38734 & Reverse Clutch Spring
Courtesy of GENERAL MOTORS CORP.

8. Using the **J 23456** and**J 38734** , compress the reverse clutch spring assembly. See **Special Tools and Equipment** .
9. Install the reverse clutch spring retaining ring.
10. Remove the **J 23456** and **J 38734** . See **Special Tools and Equipment** .

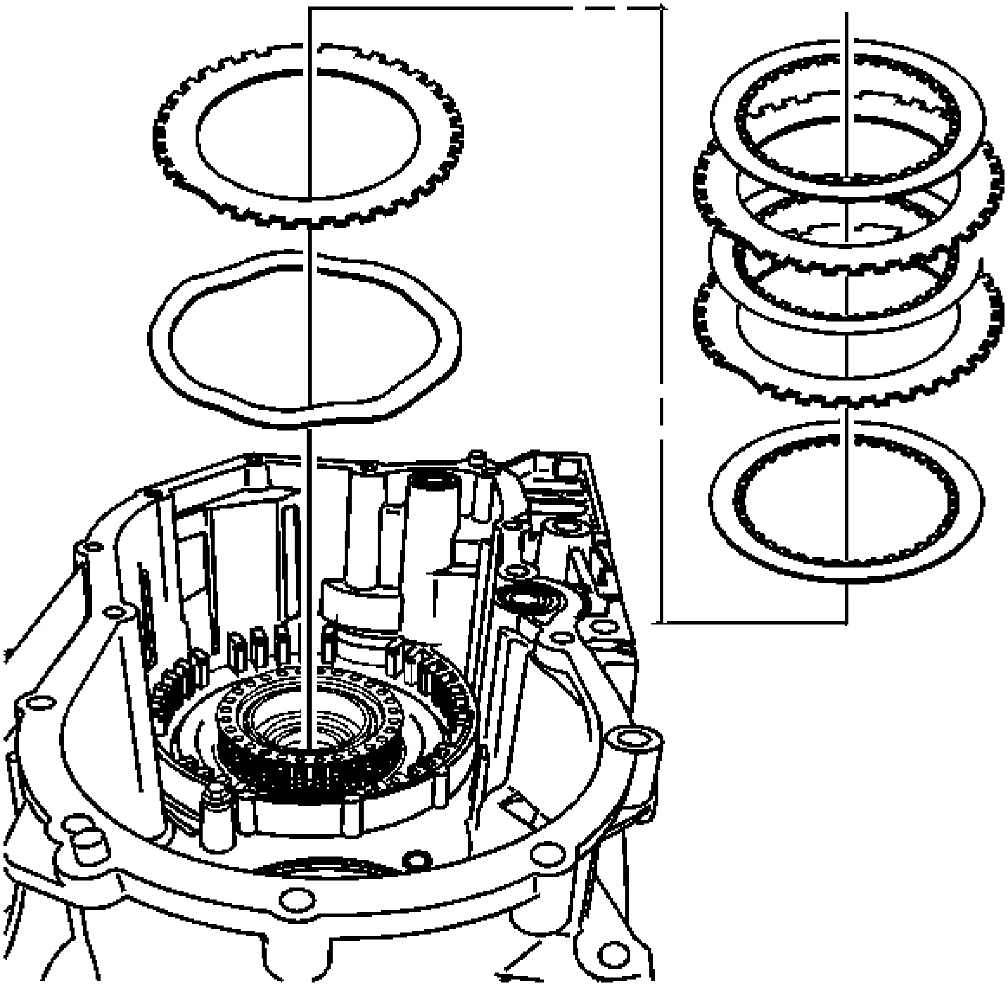


Fig. 357: Reverse Clutch Waved Plates
Courtesy of GENERAL MOTORS CORP.

11. Install the reverse clutch waved plate.

IMPORTANT: The reverse clutch plates are designed to fit only one way into the transmission case assembly.

IMPORTANT: Install the reverse clutch plates with the friction material facing up, toward the backing plate.

12. Install the reverse clutch plates, 3 each, starting with a plate with the splines on the outer, external,

diameter.

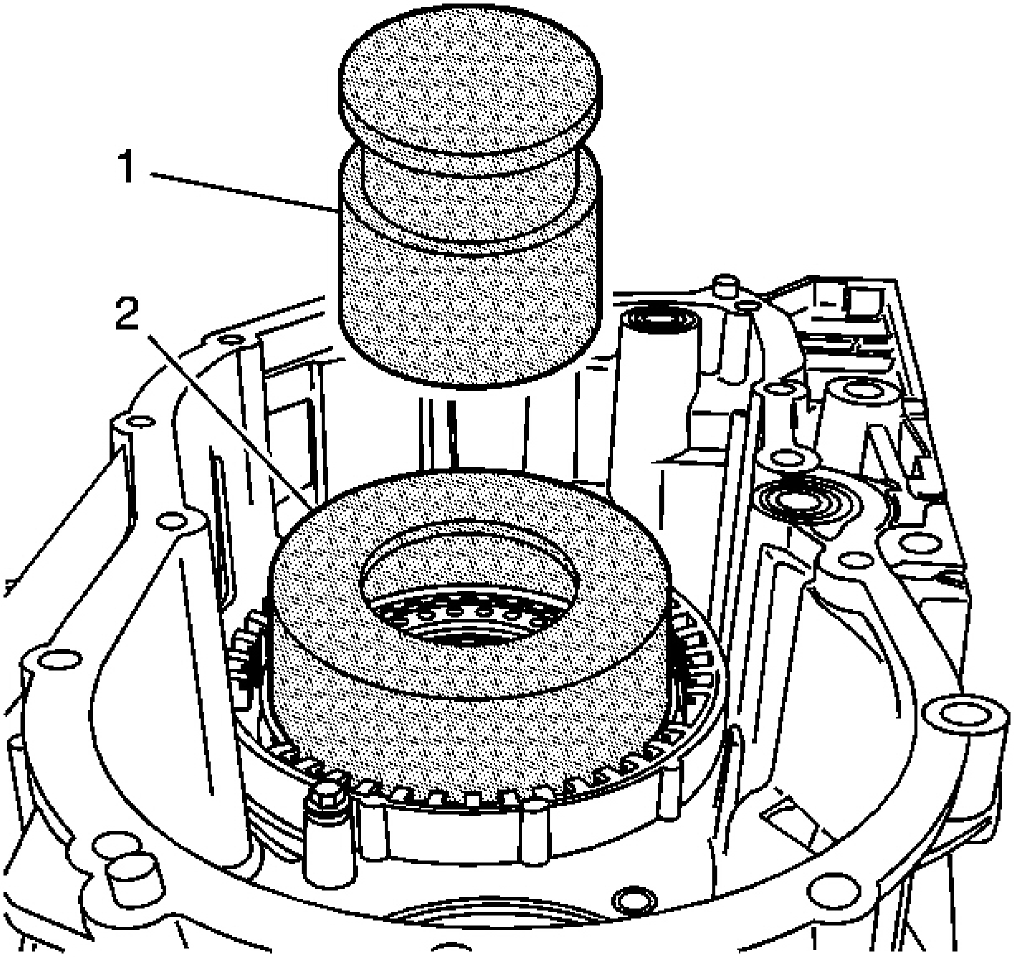


Fig. 358: Compressing The Clutch Plates Using J 45995 & J 46251
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Perform this step for transmissions equipped with I.D.-splined waved clutch plates.

13. Using the **J 45995** (2) and **J 46251** (1), compress the clutch plates. See **Special Tools and Equipment** .

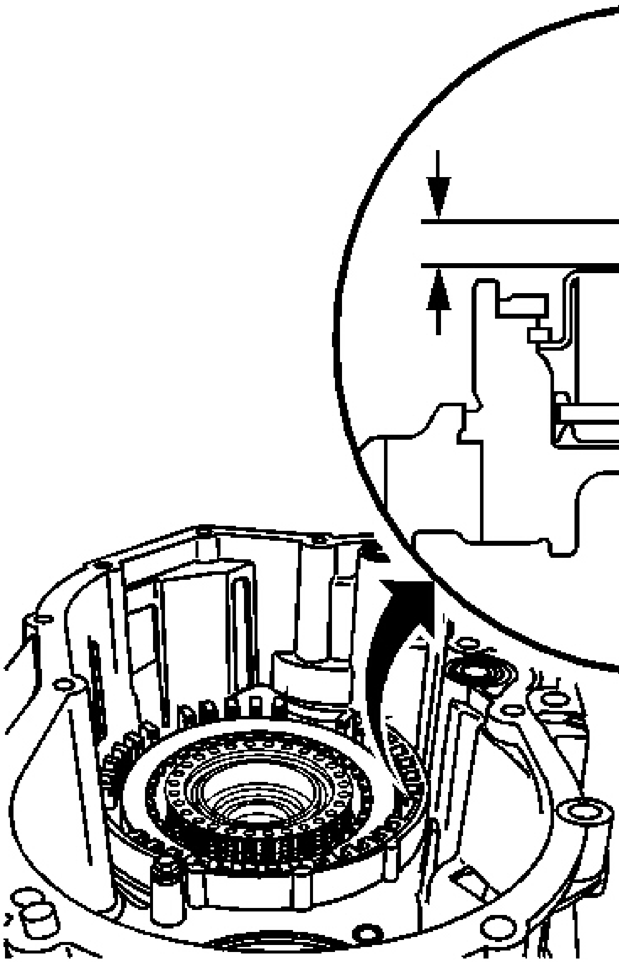


Fig. 359: Measuring The Distance Between Top, Outer, Edge Of Retaining Ring Groove & Top Friction Plate
Courtesy of GENERAL MOTORS CORP.

14. Measure the distance between the top, outer, edge of the retaining ring groove and the top friction plate. Record the measurement.

IMPORTANT: The backing plate identification letter is stamped on the backing plate.

15. Refer to the **Reverse Clutch Backing Plate Specifications (Flat Clutch Plate Design-I.D. Spline)** or **Reverse Clutch Backing Plate Specifications (Wave Clutch Plate Design-I.D. Spline)** table in Specifications in order to select the proper backing plate.

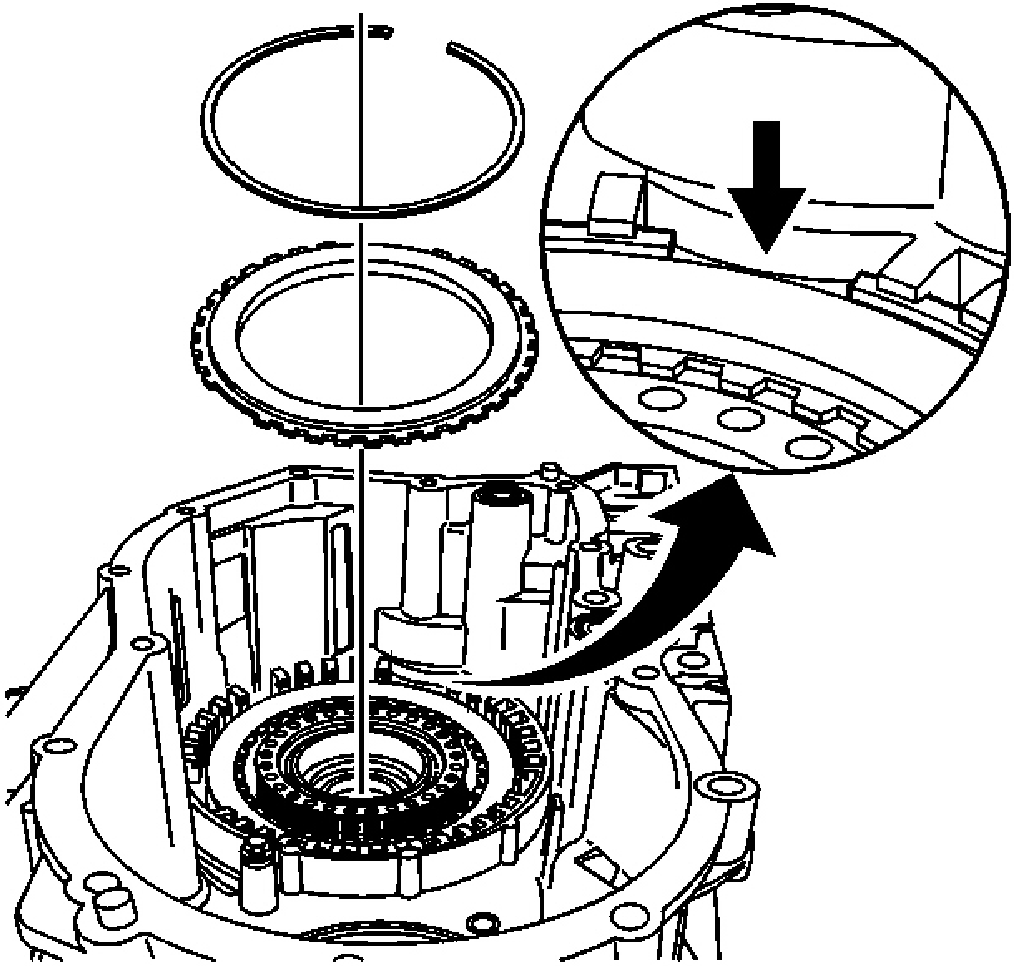


Fig. 360: Retaining Ring & Reverse Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

16. Install the reverse clutch backing plate.

IMPORTANT: Align the retaining ring gap with the fluid pump housing area of the transmission case assembly.

17. Install the retaining ring for the reverse clutch backing plate.

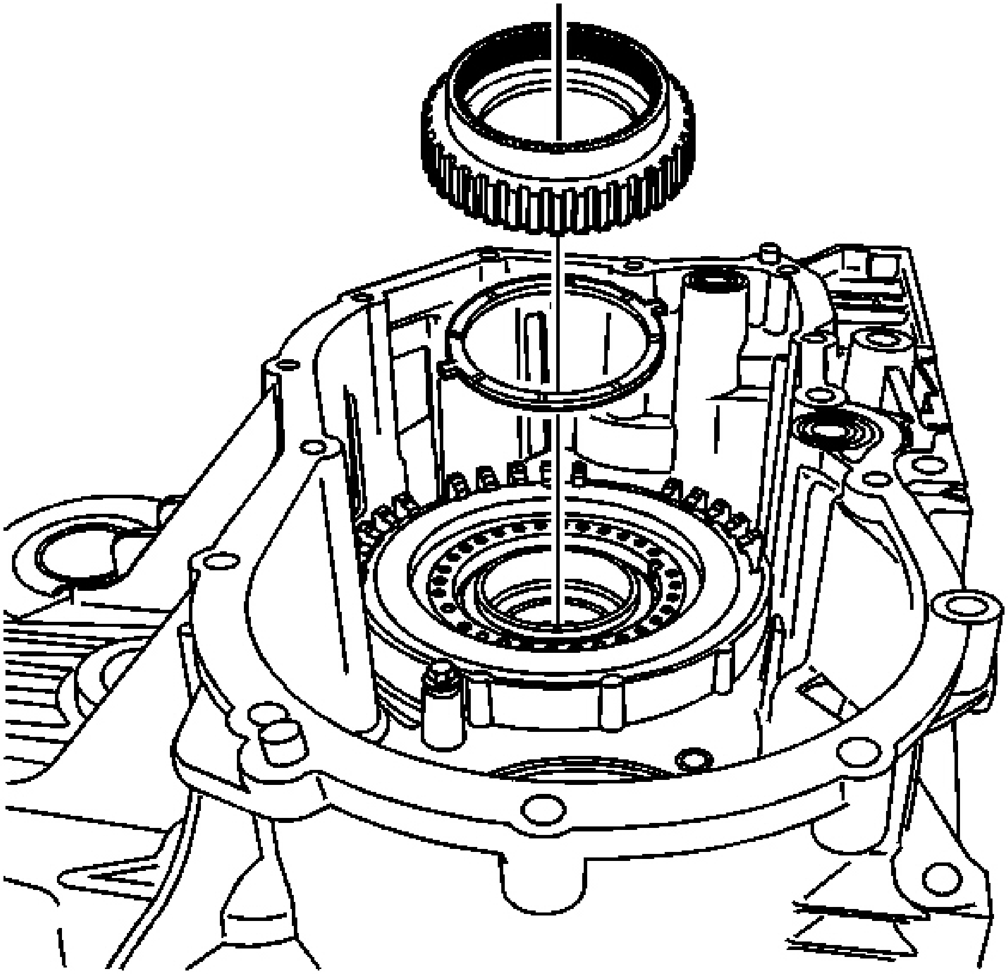


Fig. 361: Reverse Clutch Hub & Thrust Washer
Courtesy of GENERAL MOTORS CORP.

18. Install the thrust washer for the reverse clutch hub assembly.
19. Install the reverse clutch hub assembly.

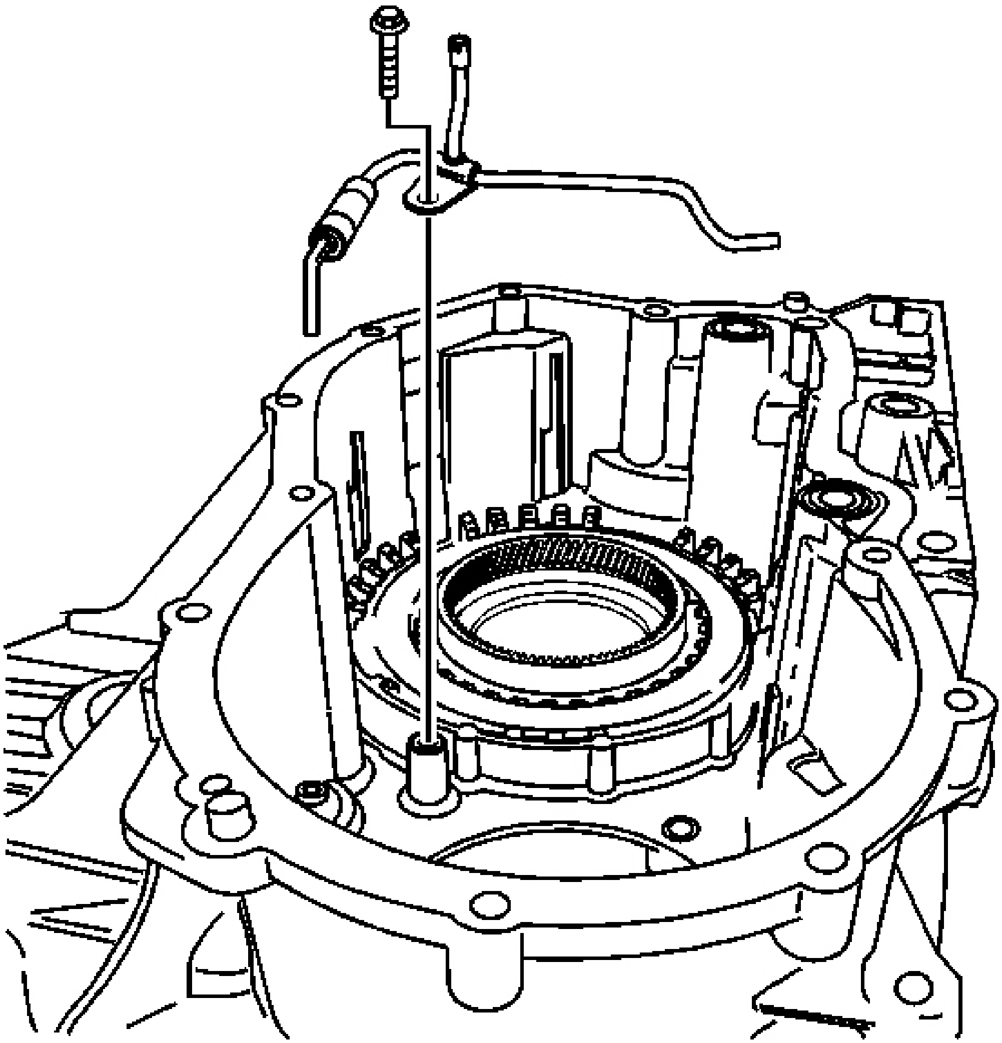


Fig. 362: Lube Oil Pipe & Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

20. Install the lube oil pipe and bolt into the transmission case assembly.

    Tighten: Tighten the bolt to 11 N.m (8 lb ft).

FORWARD CLUTCH ASSEMBLY DISASSEMBLE

Tools Required

- **J 2619-01** Slide Hammer. See **Special Tools and Equipment** .
- **J 23456** Booster and Clutch Pack Compressor. See **Special Tools and Equipment** .
- **J 43074** Forward Clutch Piston Spring Compressor. See **Special Tools and Equipment** .
- **J 43083** Input Shaft Holding Base. See **Special Tools and Equipment** .
- **J 45209** Fluid Passage Sleeve Remover. See **Special Tools and Equipment** .

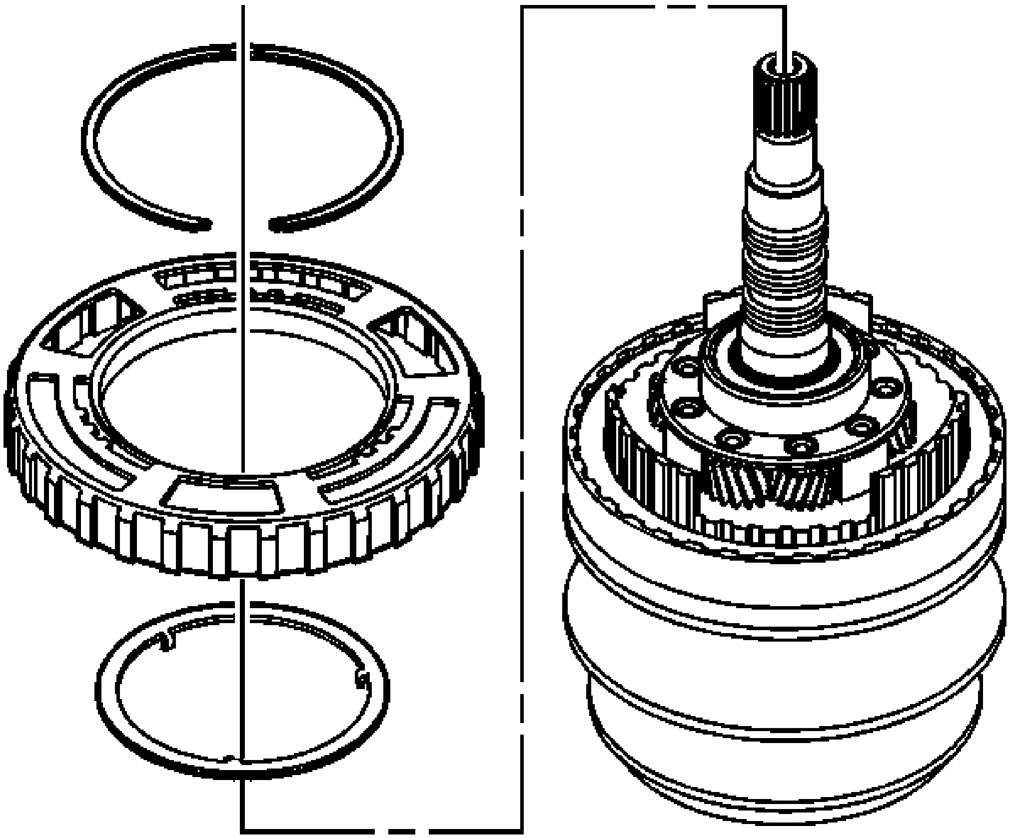


Fig. 363: Retaining Ring, Internal Gear Thrust Washer & Speed Sensor Reluctor Ring
Courtesy of GENERAL MOTORS CORP.

1. Remove the retaining ring for the speed sensor reluctor ring.
2. Remove the speed sensor reluctor ring.
3. Remove the internal gear thrust washer.

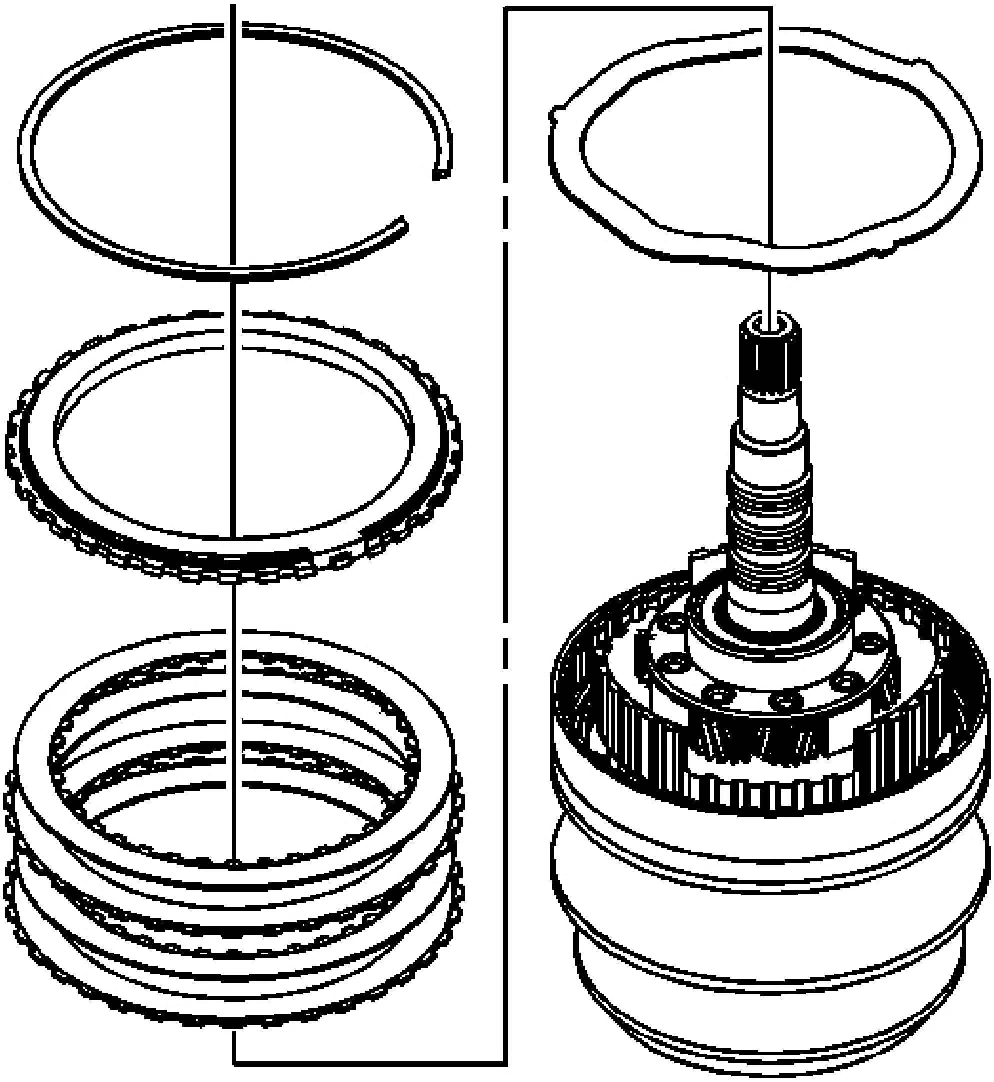


Fig. 364: Retaining Ring, Forward Clutch Backing Plate & Waved Plate
Courtesy of GENERAL MOTORS CORP.

4. Remove the retaining ring for the forward clutch backing plate.
5. Remove the forward clutch backing plate.
6. Remove the forward clutch backing plates, 2 each.
7. Remove the forward clutch waved plate.

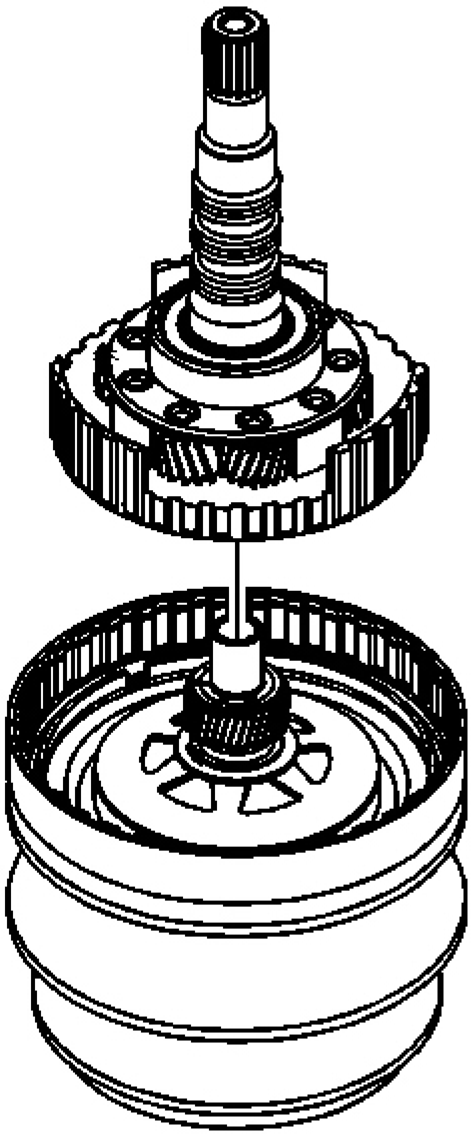


Fig. 365: Input Shaft Assembly
Courtesy of GENERAL MOTORS CORP.

8. Remove the input shaft assembly.

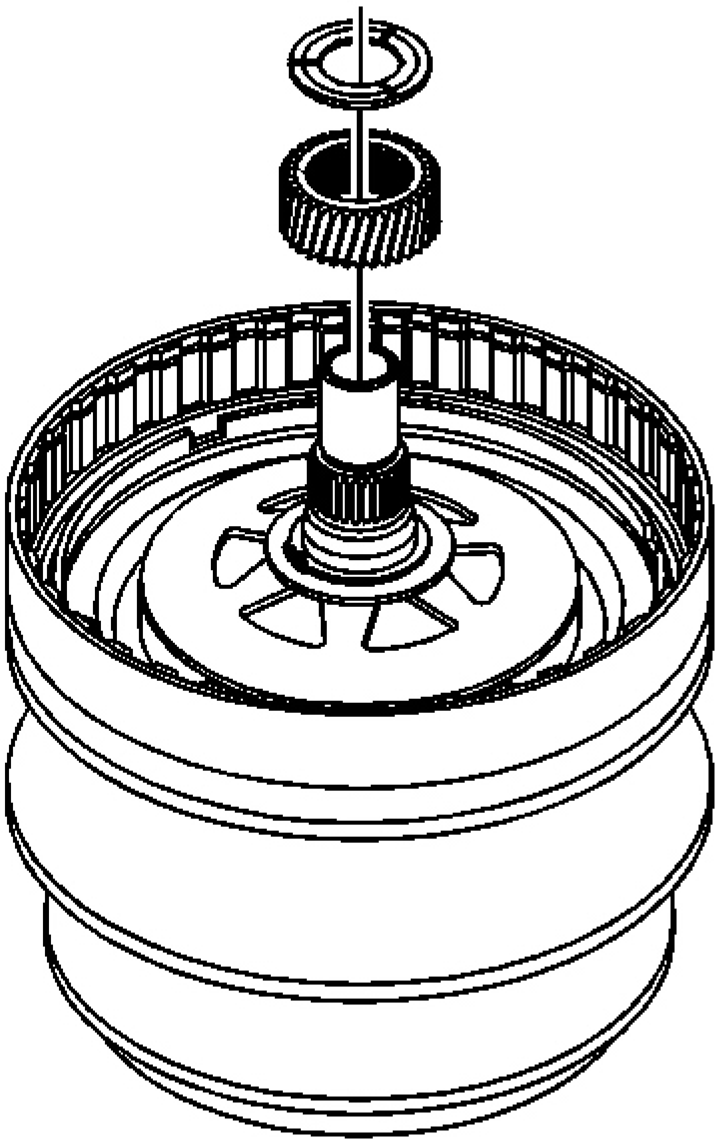


Fig. 366: Thrust Washer & Sun Gear
Courtesy of GENERAL MOTORS CORP.

9. Remove the thrust washer and sun gear.

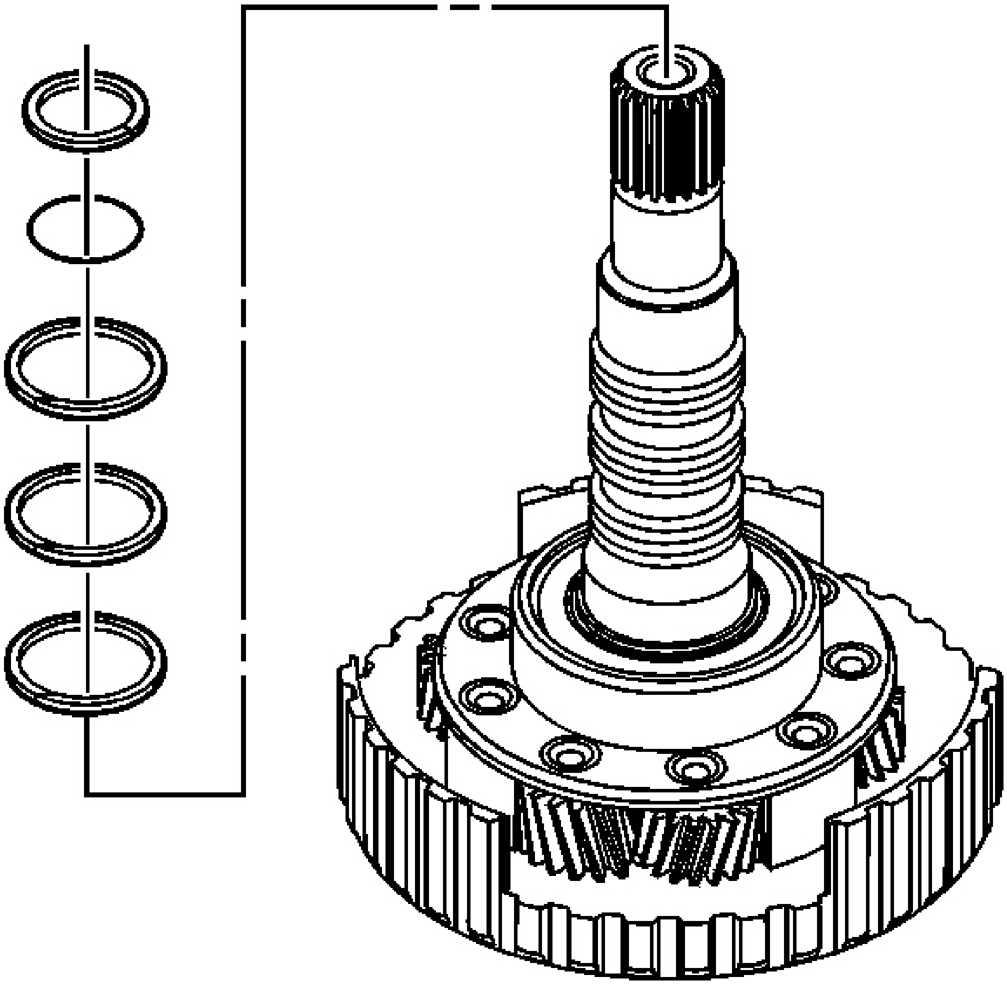


Fig. 367: Removing Split Spiral Fluid Seal Ring & Input Shaft
Courtesy of GENERAL MOTORS CORP.

10. Remove the split spiral fluid seal ring from the input shaft.
11. Discard the split spiral fluid seal.
12. Remove the input shaft O-ring seal.
13. Discard the input shaft O-ring seal.
14. Remove the 3 fluid seal rings from the input shaft assembly.
15. Discard the fluid seal rings.

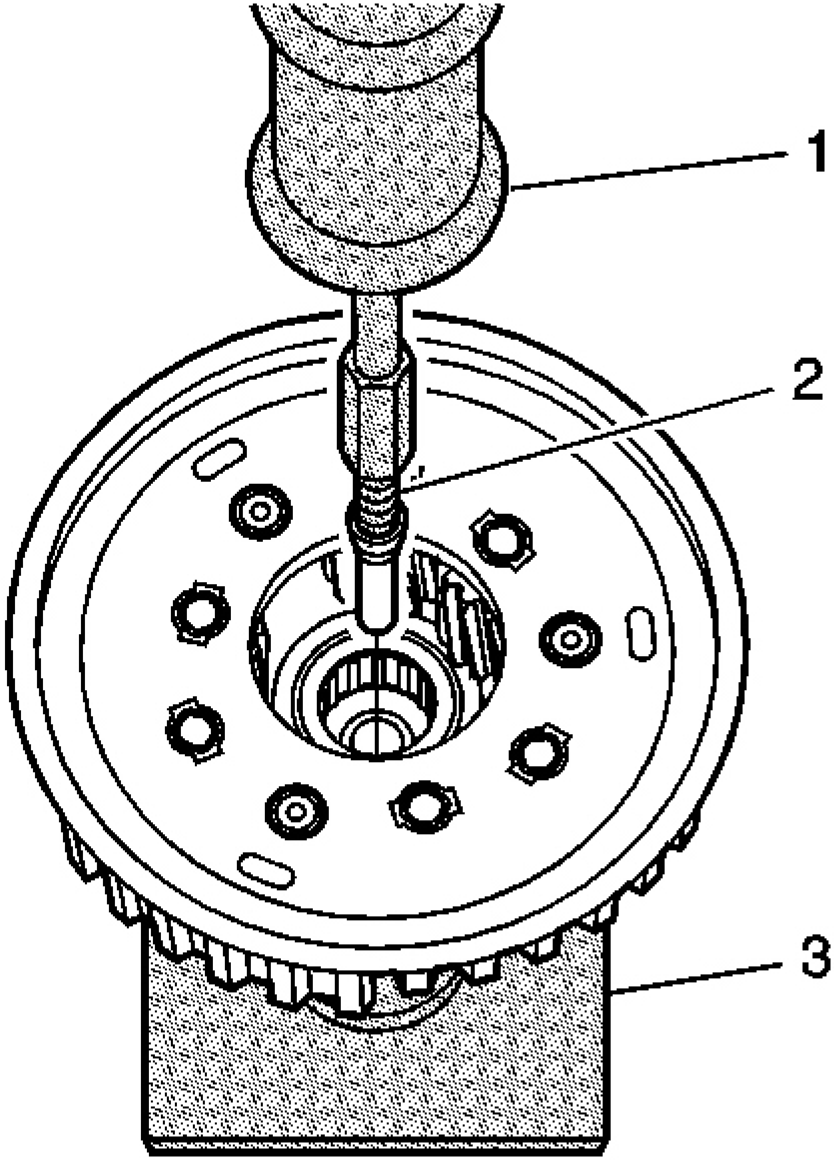


Fig. 368: J 43083, J 45209 & J 2619-01
Courtesy of GENERAL MOTORS CORP.

16. Place the input shaft assembly into the**J 43083** (3). See **Special Tools and Equipment** .
17. Install the **J 45209** (2) into the fluid passage sleeve. See **Special Tools and Equipment** .
18. Using the **J 2619-01** (1) and the**J 45209** (2), remove the fluid passage sleeve from the input shaft

assembly. See **Special Tools and Equipment** .

19. Discard the fluid passage sleeve.

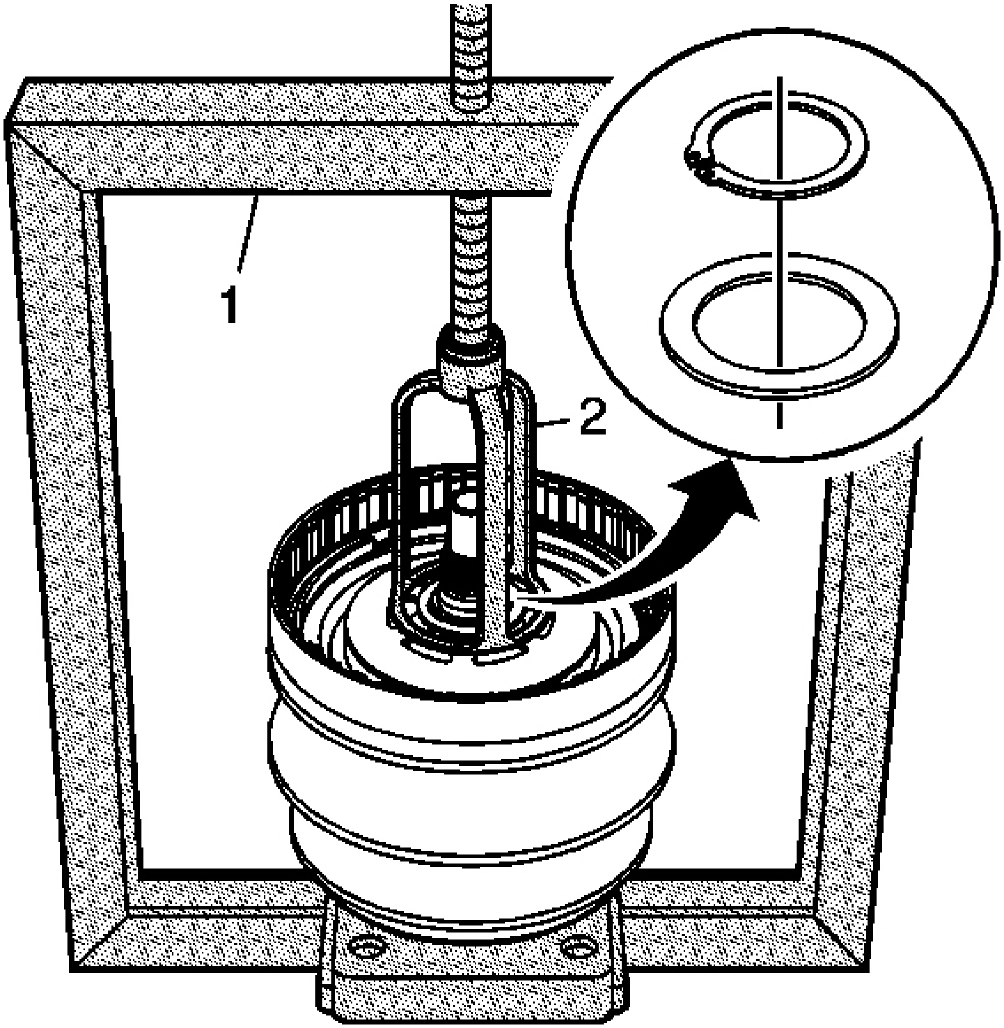


Fig. 369: Compressing The Forward Clutch Piston Spring Using J 23456 & J 43074
Courtesy of GENERAL MOTORS CORP.

20. Using the **J 23456** (1) and the**J 43074** (2), compress the forward clutch piston spring. See **Special Tools and Equipment** .

CAUTION: Use care when removing the retaining ring and spring washer. These

components could become lodged in the snap ring groove of the variable drive pulley assembly. This condition may cause the retaining ring and/or spring washer to expel upward during removal. Failure to follow this instruction may result in personal injury.

21. Remove the retaining ring for the forward clutch piston spring.
22. Remove the forward clutch spring washer.

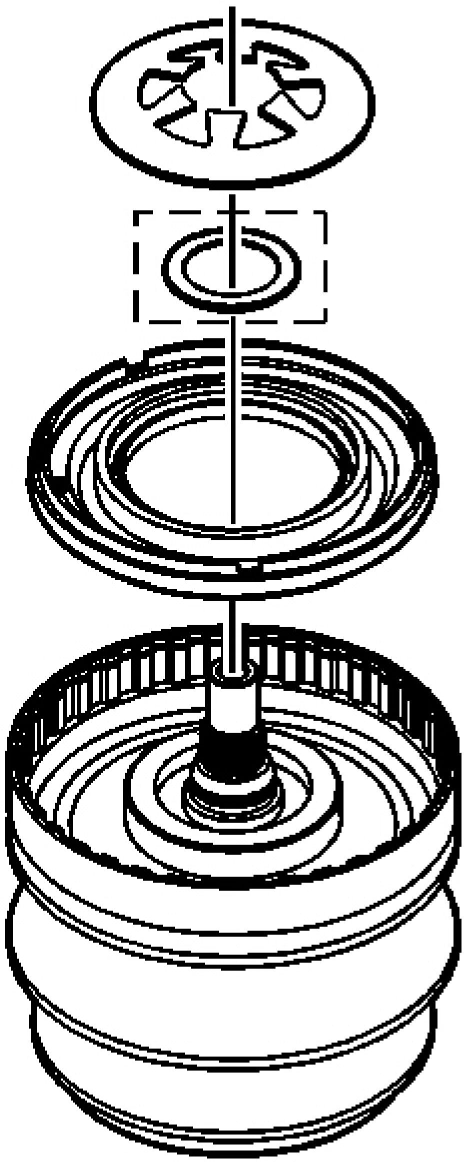


Fig. 370: Forward Clutch Spring Washer & Piston Spring
Courtesy of GENERAL MOTORS CORP.

23. Remove the **J 23456** and the**J 43074** . See **Special Tools and Equipment** .
24. Remove the forward clutch piston spring.
25. Remove the forward clutch spring washer - some models.

26. Remove the forward clutch piston assembly.

INPUT SHAFT CARRIER PINION END PLAY MEASUREMENT

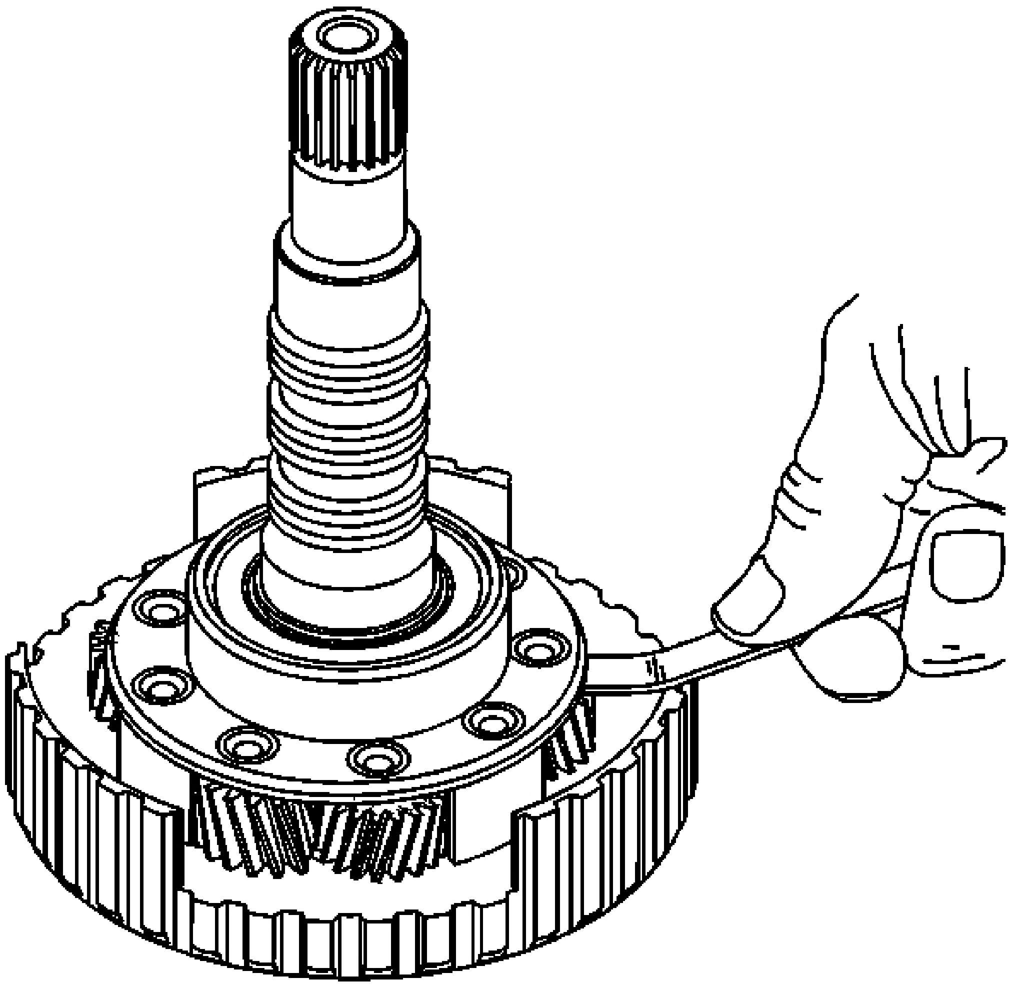


Fig. 371: Measuring The Input Shaft Carrier Pinion End Play For Proper Clearance Using A Feeler Gage
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: **Replace the input shaft carrier assembly if the pinion gear clearance is out of specification. The pinion gears are permanently assembled to the carrier and are not serviced separately.**

Using a feeler gage, measure the input shaft carrier pinion end play for proper clearance.

End Play Specification: The correct end play is 0.14-0.65 mm (0.01-0.026 in).

FORWARD CLUTCH ASSEMBLY ASSEMBLE

Tools Required

- **J 6133-A** Bearing Race Installer. See **Special Tools and Equipment** .
- **J 22912-01** Split Plate Bearing Puller
- **J 23456** Booster and Clutch Pack Compressor. See **Special Tools and Equipment** .
- **J 36850** Assembly Lubricant. See **Special Tools and Equipment** .
- J 43060 Input Shaft (Inner) Bearing Installer
- **J 43063-1** Input Shaft Seal Protector. See **Special Tools and Equipment** .
- **J 43063-2** Input Shaft Seal Pusher. See **Special Tools and Equipment** .
- **J 43063-3** Input Shaft Seal Sizer. See **Special Tools and Equipment** .
- **J 43074** Forward Clutch Piston Spring Compressor. See **Special Tools and Equipment** .
- **J 43083** Input Shaft Holding Base. See **Special Tools and Equipment** .
- **J 43084** Spiral Ring Installer. See **Special Tools and Equipment** .
- **J 44939** Fluid Passage Sleeve Installer. See **Special Tools and Equipment** .
- **J 44998** Input Shaft - Inner - Bearing Remover. See **Special Tools and Equipment** .

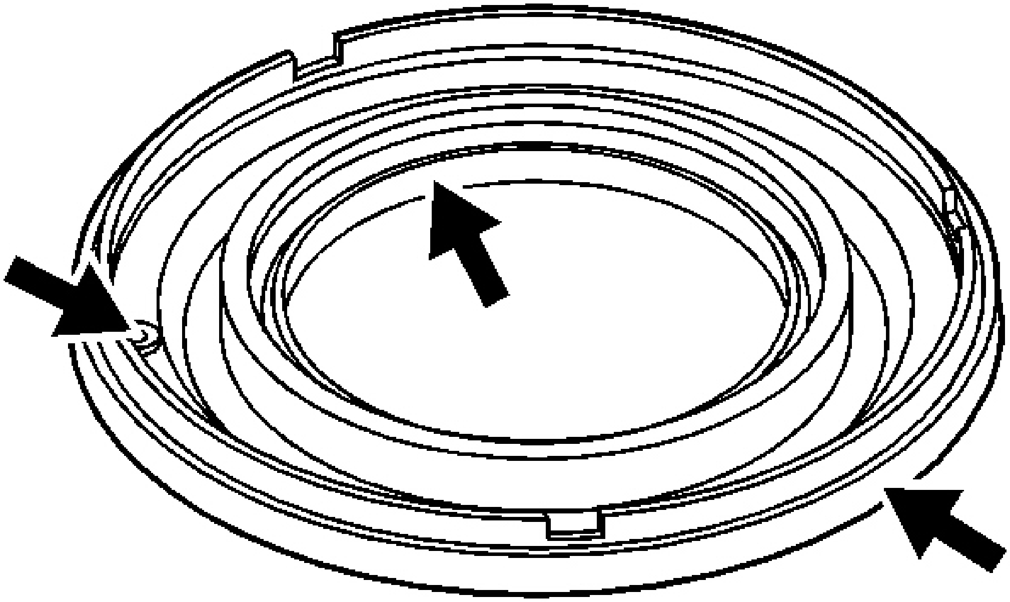


Fig. 372: Inspecting Forward Clutch Piston Assembly For Damage
Courtesy of GENERAL MOTORS CORP.

1. Inspect the forward clutch piston assembly for cuts, nicks or damage.

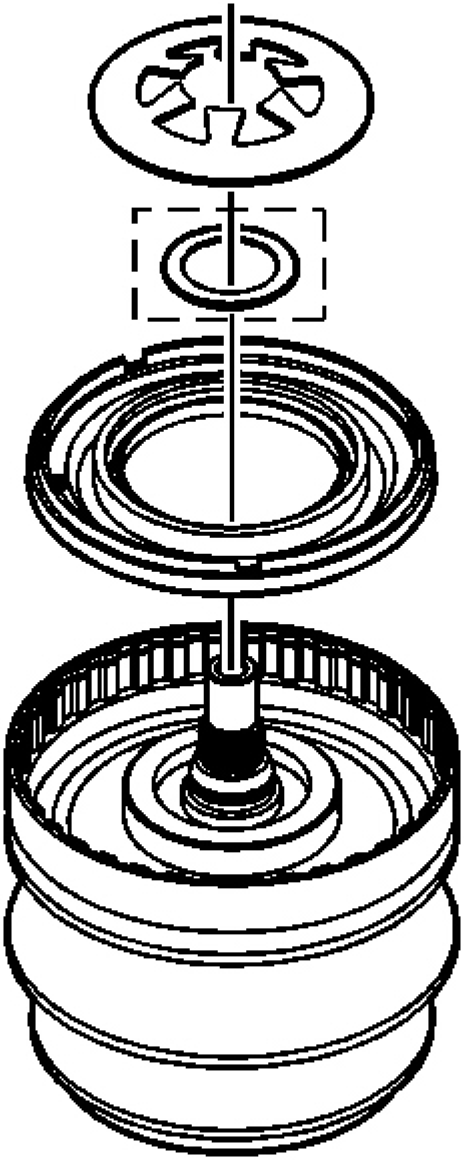


Fig. 373: Forward Clutch Spring Washer & Piston Spring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The forward clutch piston assembly may be carefully pressed into the drive pulley assembly by hand.

2. Install the forward clutch piston assembly into the drive pulley assembly.
3. Install the forward clutch spring washer - some models.
4. Install the forward clutch piston spring.

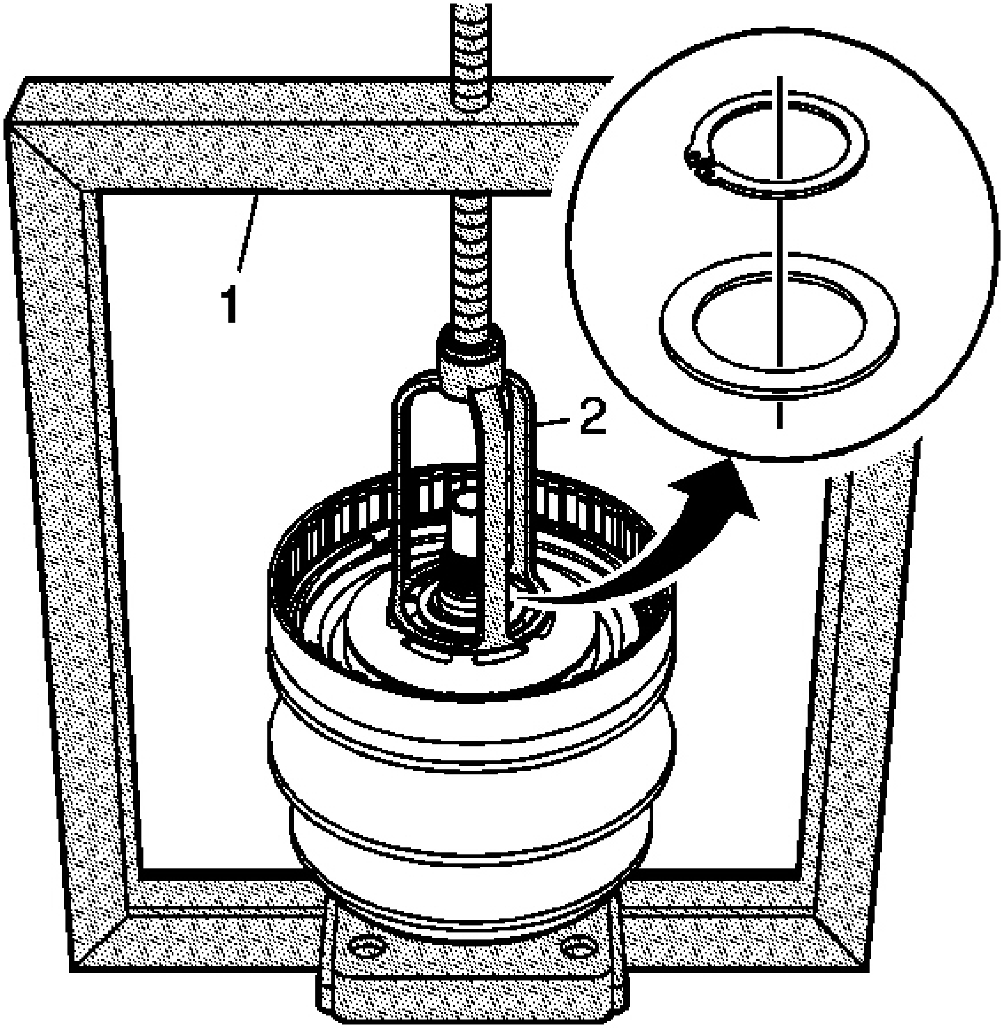


Fig. 374: Compressing The Forward Clutch Piston Spring Using J 23456 & J 43074
Courtesy of GENERAL MOTORS CORP.

5. Using the **J 23456** (1) and the**J 43074** (2), compress the forward clutch piston spring. See **Special Tools and Equipment** .
6. Install the forward clutch spring washer.

IMPORTANT: Ensure that the retaining ring is properly seated in the snap ring groove of the variable drive pulley assembly.

7. Install the retaining ring for the forward clutch piston spring.
8. Remove the **J 23456** and the**J 43074** . See **Special Tools and Equipment** .

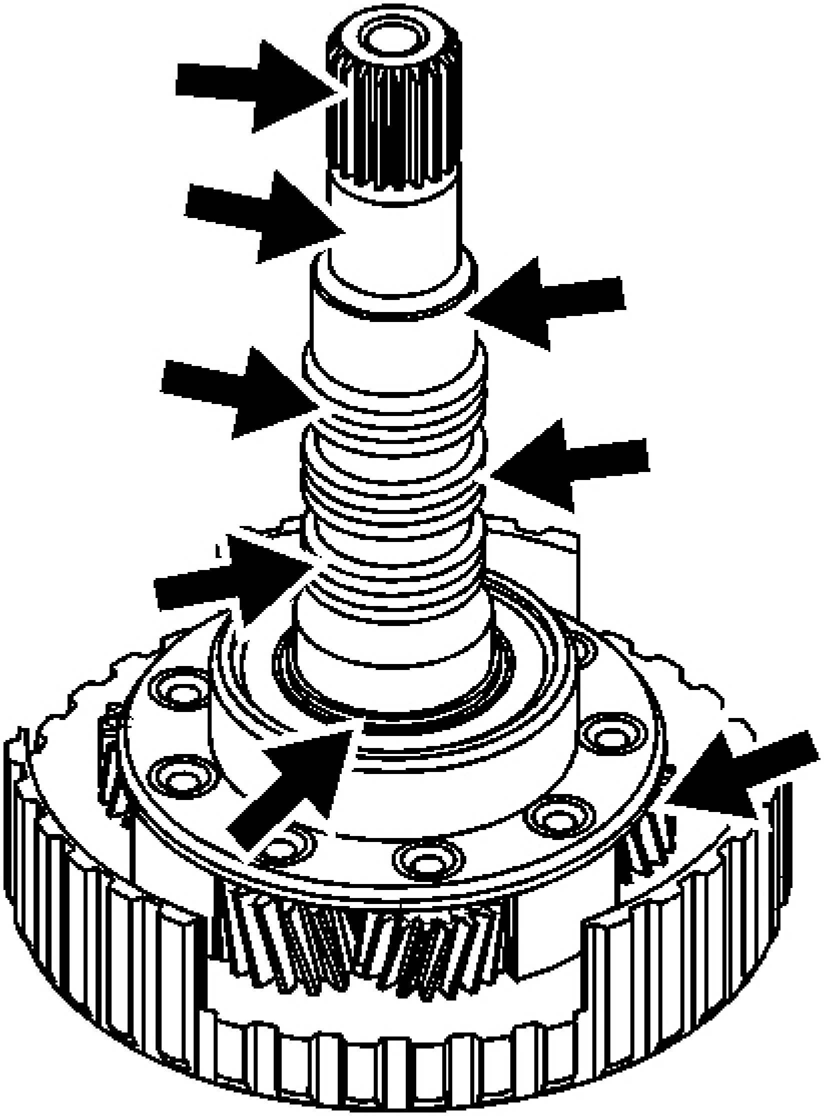


Fig. 375: Inspecting Input Shaft Carrier Assembly For Damage

Courtesy of GENERAL MOTORS CORP.

9. Inspect the input shaft carrier assembly for the following conditions:
   - Damaged or worn journals on the input shaft
   - Damaged or worn splines on the input shaft
   - Damaged or worn pinion gear teeth
   - Damaged or worn thrust washers
   - Proper pinion end play, refer to **Input Shaft Carrier Pinion End Play Measurement**

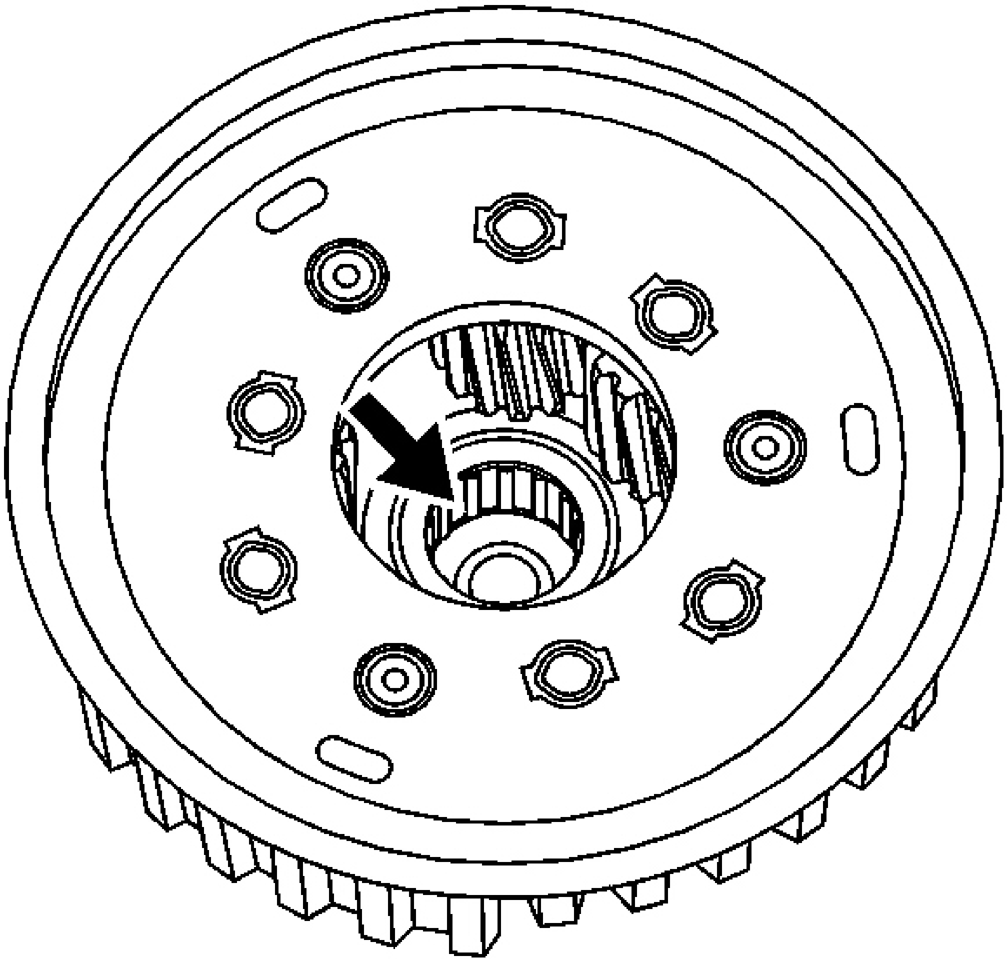


Fig. 376: Inspecting Input Shaft - Inner - Bearing Assembly For Damage
Courtesy of GENERAL MOTORS CORP.

10. Inspect the input shaft - inner - bearing assembly for damage or wear.

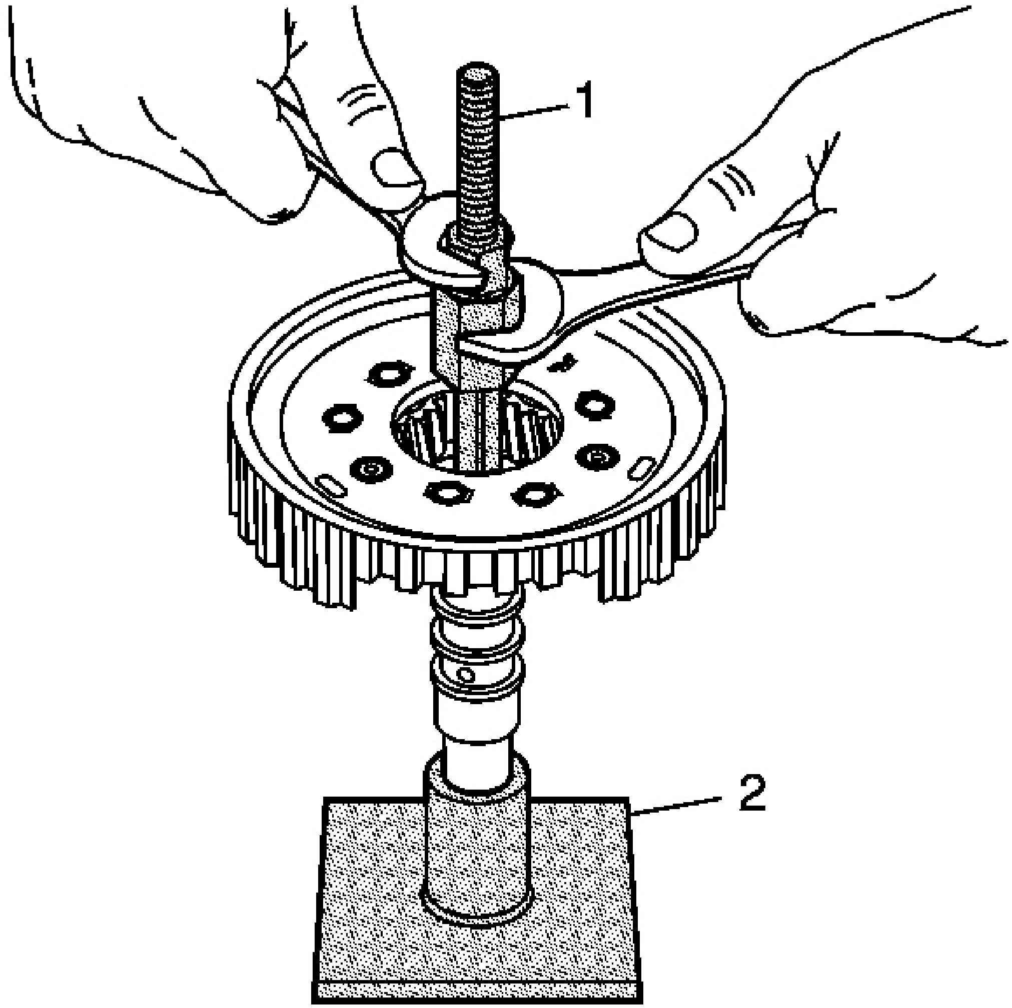


Fig. 377: Tightening J 44998 Into Input Shaft - Inner - Bearing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Perform steps 10 through 12 only if replacing the input shaft - inner - bearing assembly.

11. With the input shaft installed into the **J 43083** (2), tighten the**J 44998** (1), into the input shaft - inner - bearing assembly. See **Special Tools and Equipment** .

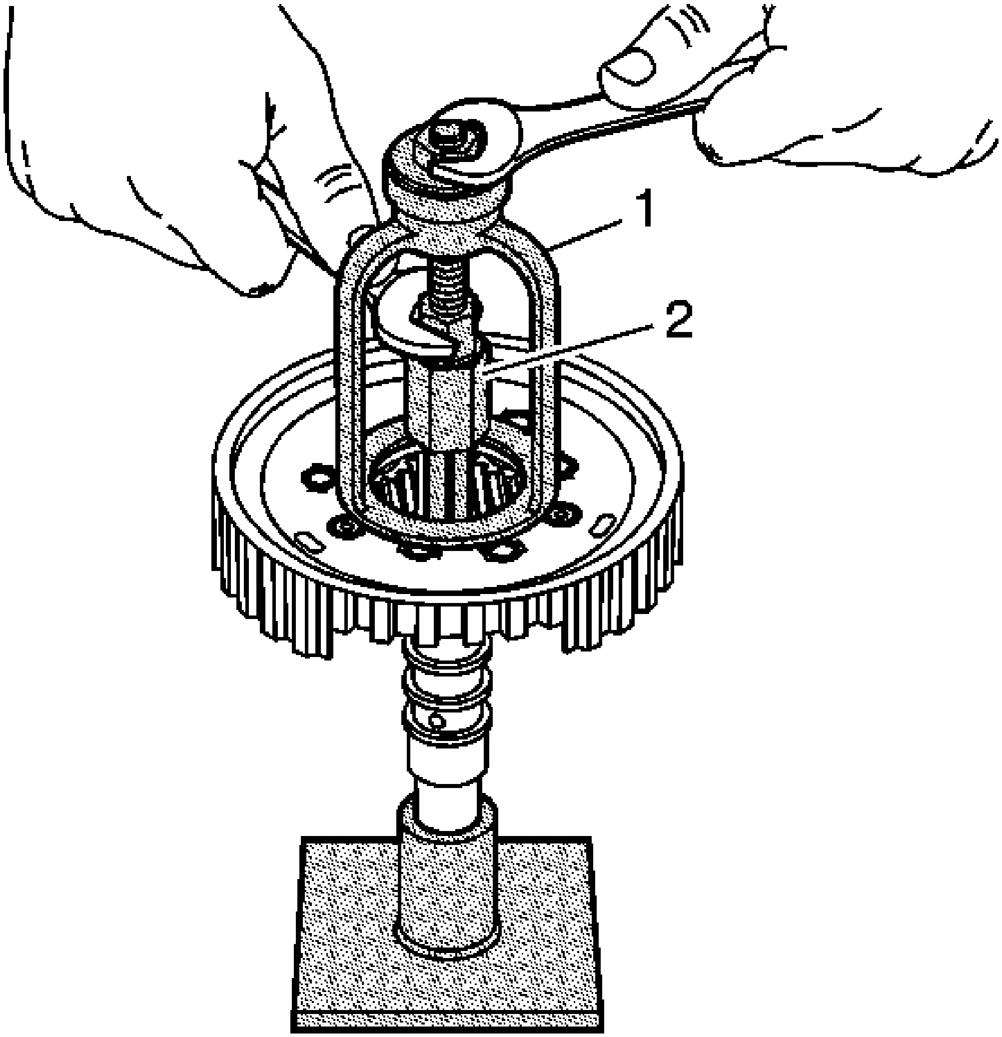


Fig. 378: Removing Input Shaft - Inner - Bearing Using J 43074 & J 44998
Courtesy of GENERAL MOTORS CORP.

12. Using the **J 43074** (1) and the**J 44998** (2), remove the input shaft - inner - bearing assembly. See **Special Tools and Equipment** .

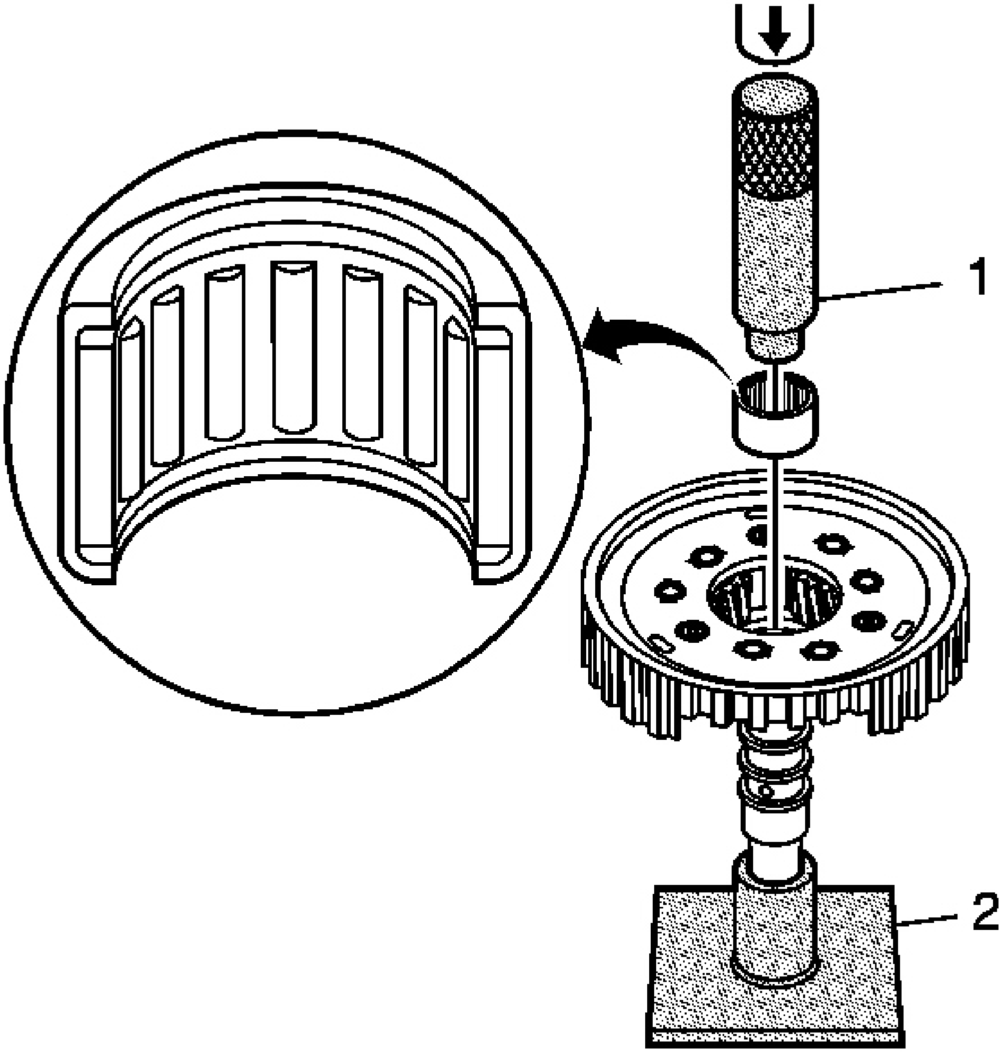


Fig. 379: Installing Input Shaft - Inner - Bearing Using J 43083 & J 43060
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: When installing the NEW input shaft - inner - bearing assembly, press the flat end of the bearing shell. The flat end of the bearing shell is slightly thicker than the other end.

13. Using the **J 43083** (2),. See **Special Tools and Equipment** . J 43060 (1) and an arbor press, install a NEW input shaft - inner - bearing assembly.

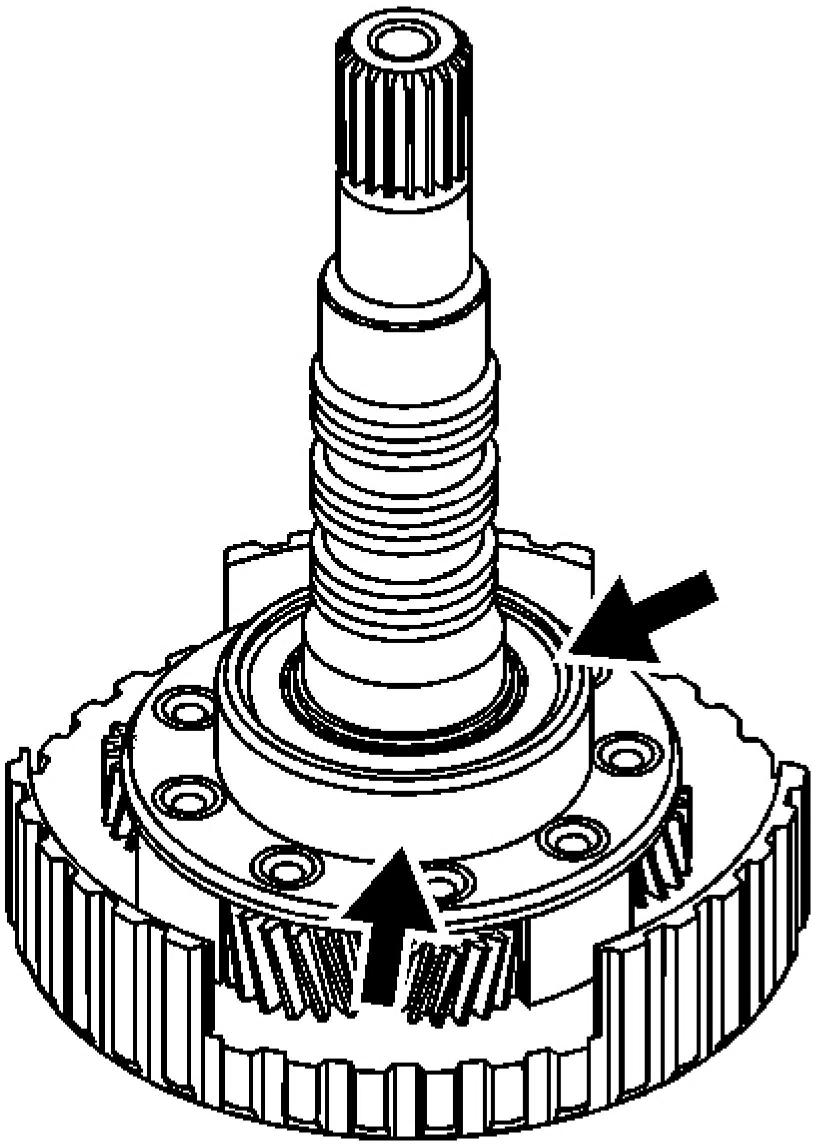


Fig. 380: Inspecting Input Shaft - Outer - Bearing Assembly For Damage
Courtesy of GENERAL MOTORS CORP.

14. Inspect the input shaft - outer - bearing assembly for damage or wear.

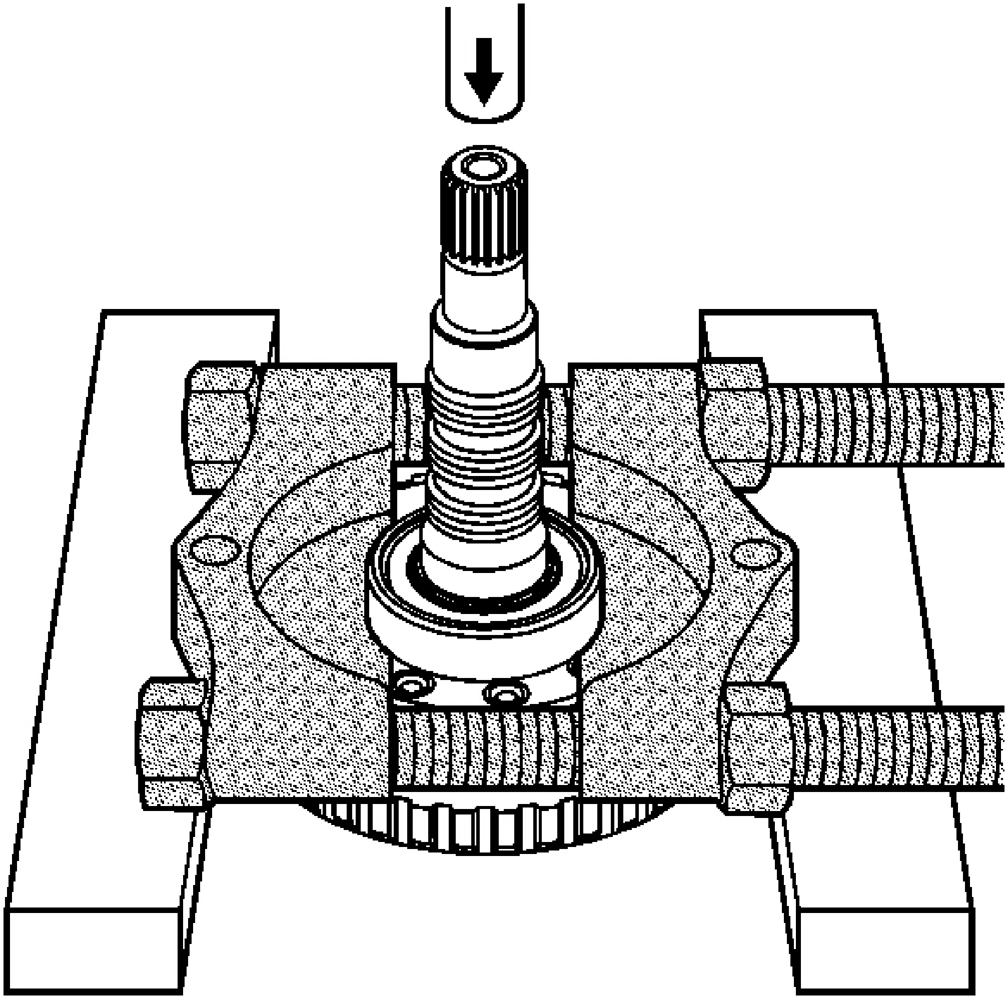


Fig. 381: Removing Input Shaft - Outer - Bearing Using J 22912-01
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Perform steps 14 and 15 only if replacing the input shaft - outer - bearing assembly.

15. Using the **J 22912-01** and an arbor press, remove the input shaft - outer - bearing assembly.

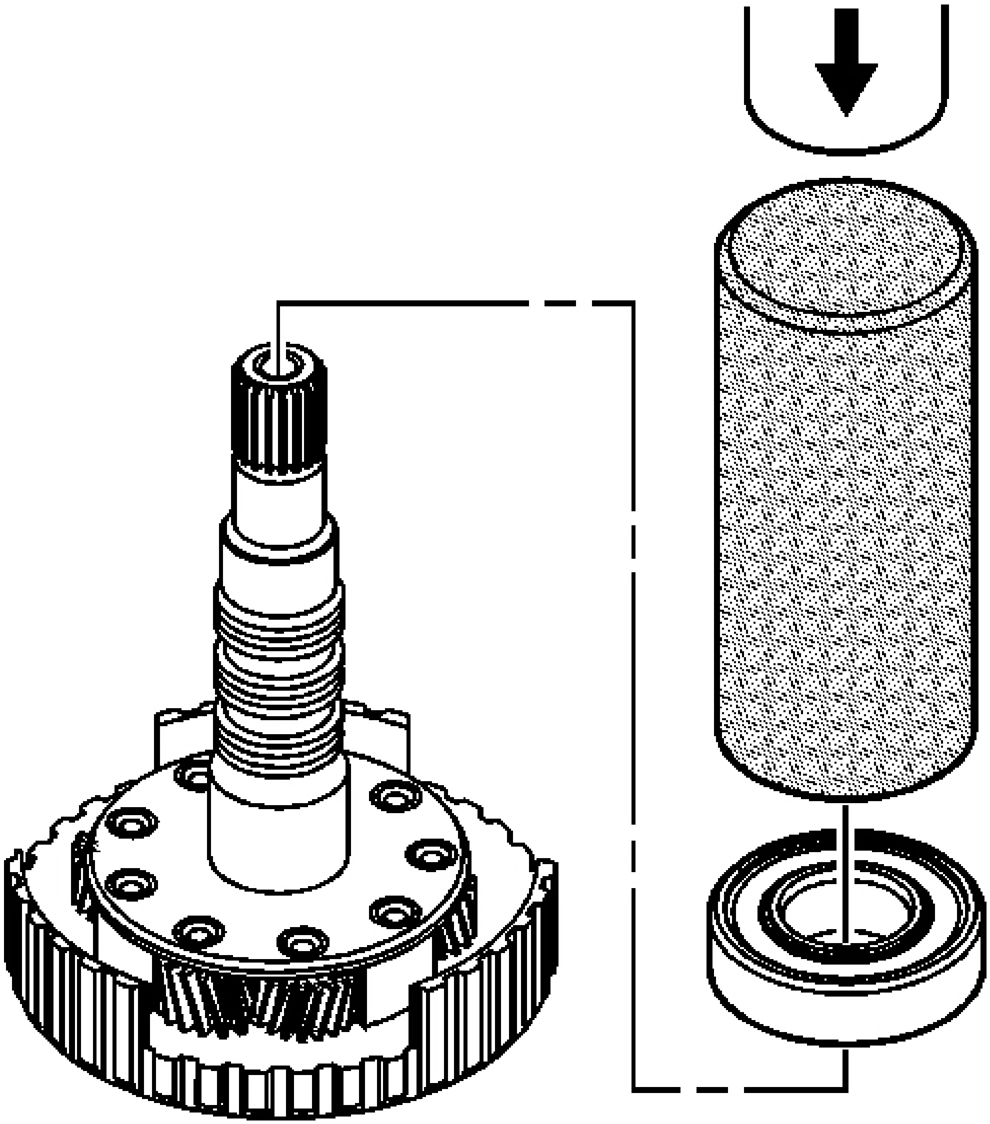


Fig. 382: Installing Input Shaft - Outer - Bearing Using J 6133-A
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The input shaft - outer - bearing must rotate freely after installation.

16. Using the **J 6133-A** and an arbor press, install a NEW input shaft - outer - bearing assembly. See **Special Tools and Equipment** .

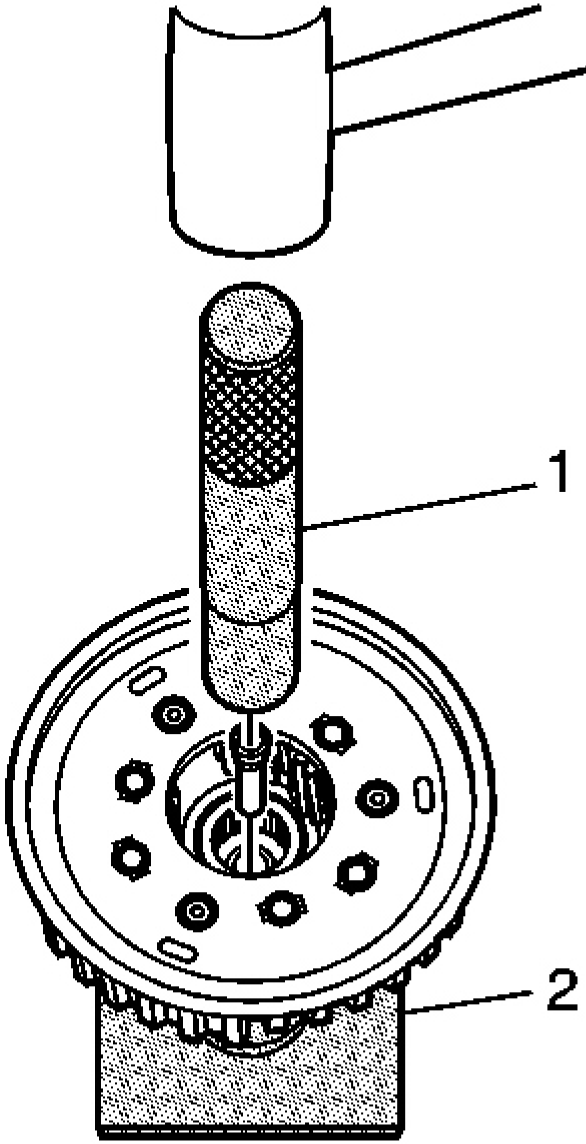


Fig. 383: Installing Fluid Passage Sleeve Using J 43083, J 44939 & Hammer
Courtesy of GENERAL MOTORS CORP.

17. Using the **J 43083** (2),**J 44939** (1) and a hammer, install a NEW fluid passage sleeve. See **Special Tools and Equipment** .

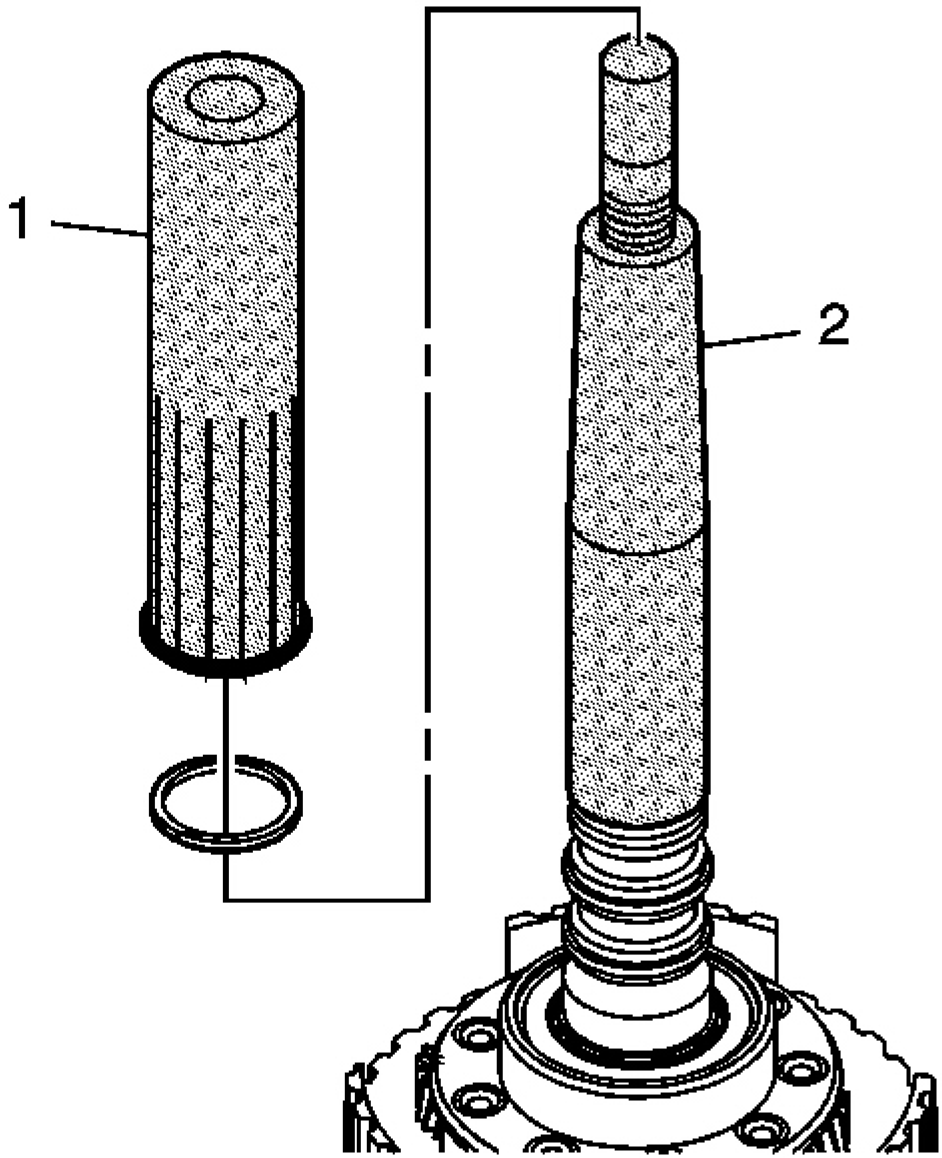


Fig. 384: Sliding The Seal Into Seal Groove Using J 43063-2 & J 43063-1
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: **When installing the 3 teflon fluid seal rings onto the input shaft, begin with the seal closest to the input carrier assembly.**

18. Slide the **J 43063-1** (2) over the input shaft and position the**J 43063-1** at the appropriate seal groove. See **Special Tools and Equipment** . Coat the **J 43063-1** with transmission fluid. See **Special Tools and Equipment** .
19. Guide a NEW seal onto the **J 43063-1** . See **Special Tools and Equipment** .
20. Using the **J 43063-2** (1), slide the seal into the seal groove. See **Special Tools and Equipment** .

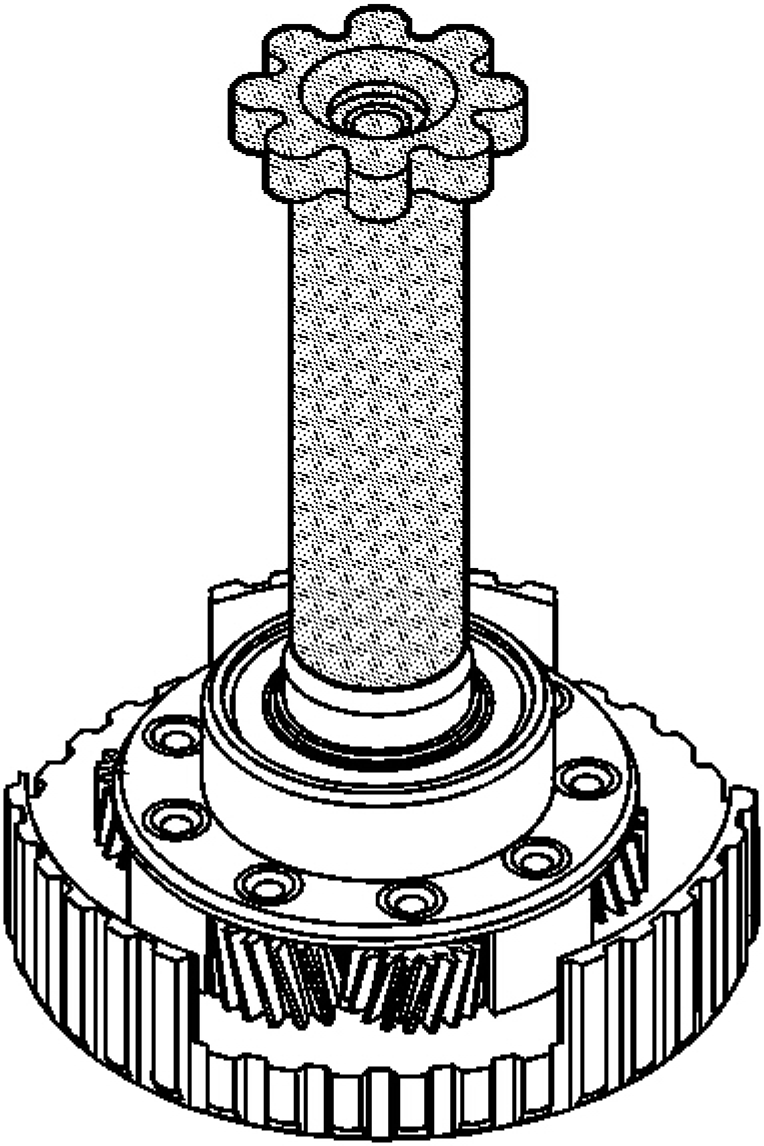


Fig. 385: Sizing Fluid Seal Ring Using J 43063-3
Courtesy of GENERAL MOTORS CORP.

NOTE: Size only 1 seal at a time. Sizing more than 1 seal at the same time will result in damage to the seals.

IMPORTANT: Allow each seal to shrink momentarily before using the J 43063-3 . See Special Tools and Equipment . It may be necessary to manipulate the seal with your fingers in order to decrease the outside diameter of the seal.

IMPORTANT: Ensure the J 43063-3 bottoms out on the input shaft. See Special Tools and Equipment .

21. Using the **J 43063-3** , size the fluid seal ring. See **Special Tools and Equipment** .
22. Leave the **J 43063-3** in place for at least 5 minutes in order to properly size the fluid seal ring. See **Special Tools and Equipment** .
23. Repeat steps 17 through 21 for each seal.

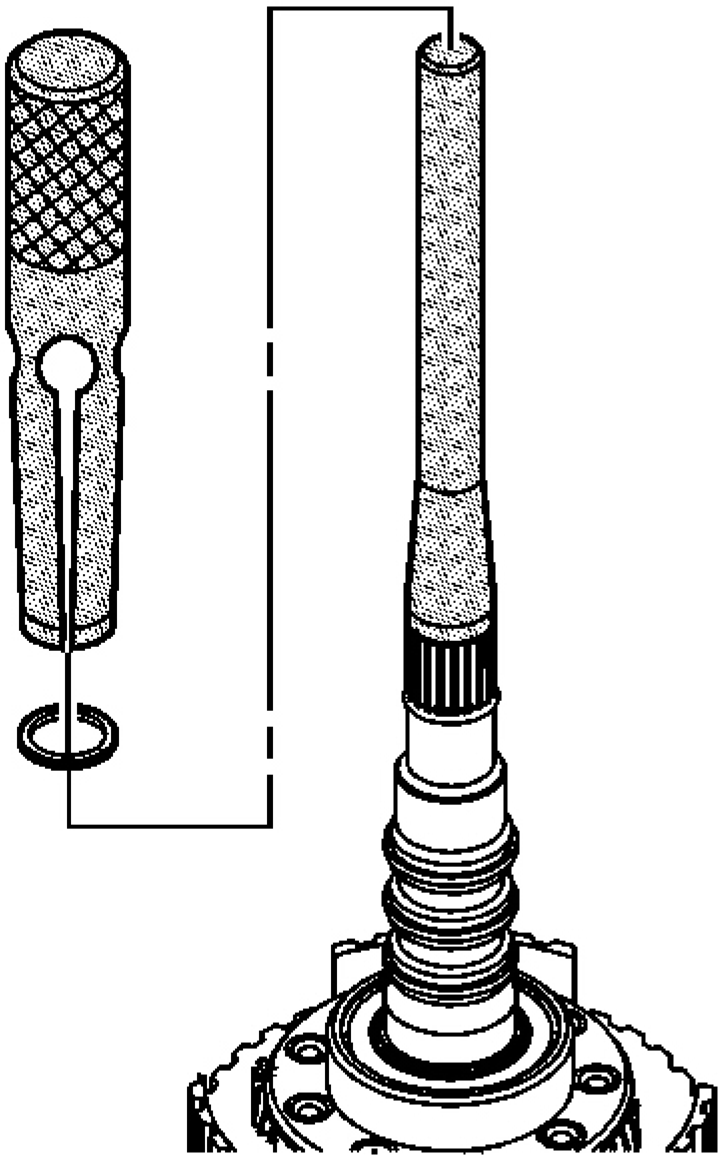


Fig. 386: Installing Split Spiral Fluid Seal Ring On Input Shaft Using J 43084
Courtesy of GENERAL MOTORS CORP.

24. Using the **J 43084** , install a NEW split spiral fluid seal ring on the input shaft. See **Special Tools and Equipment** .

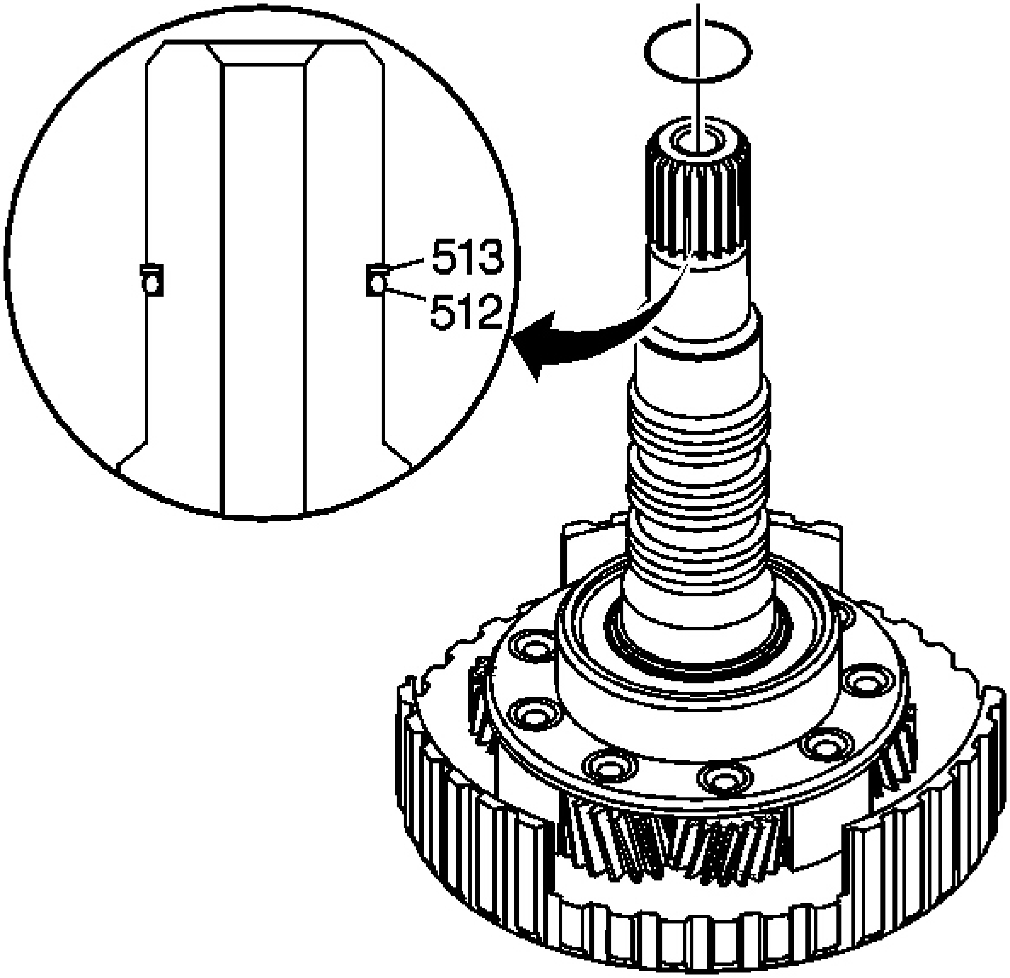


Fig. 387: Input Shaft O-Ring Seal & Fluid Seal Ring - Split Spiral Ring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the input shaft O-ring seal (512) is positioned below the fluid seal ring - split spiral ring (513).

25. Install a NEW input shaft O-ring seal. Apply **J 36850** to the seal. See **Special Tools and Equipment** .

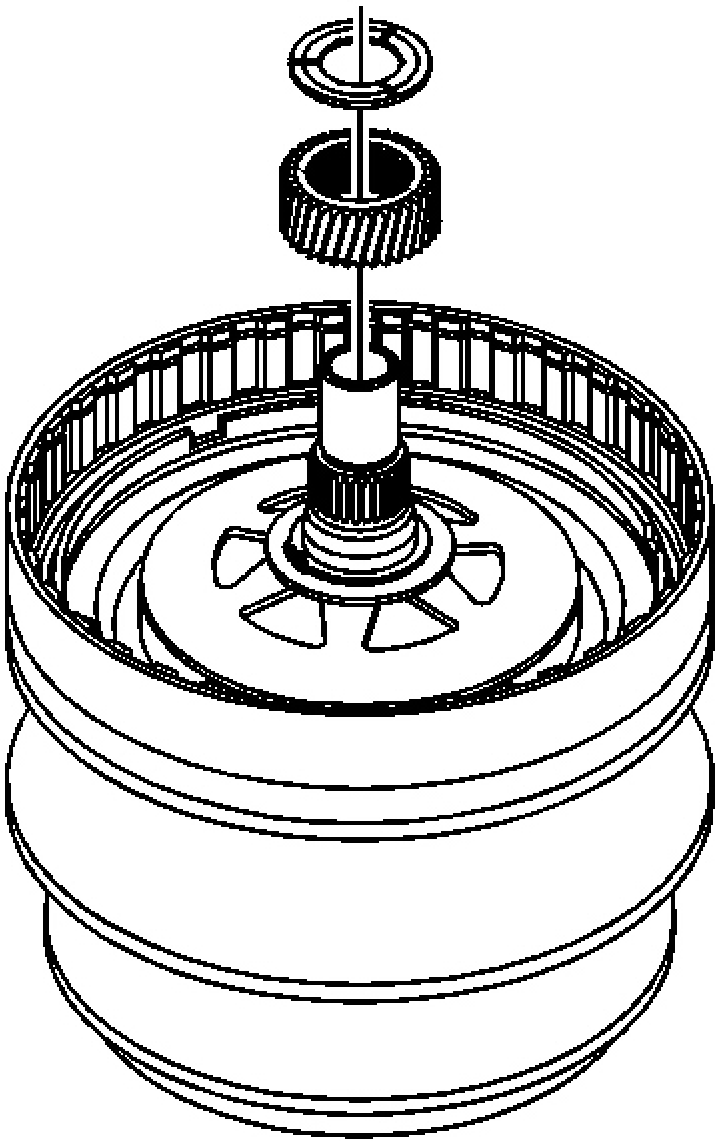


Fig. 388: Thrust Washer & Sun Gear
Courtesy of GENERAL MOTORS CORP.

26. Install the sun gear thrust washer on the drive pulley assembly.

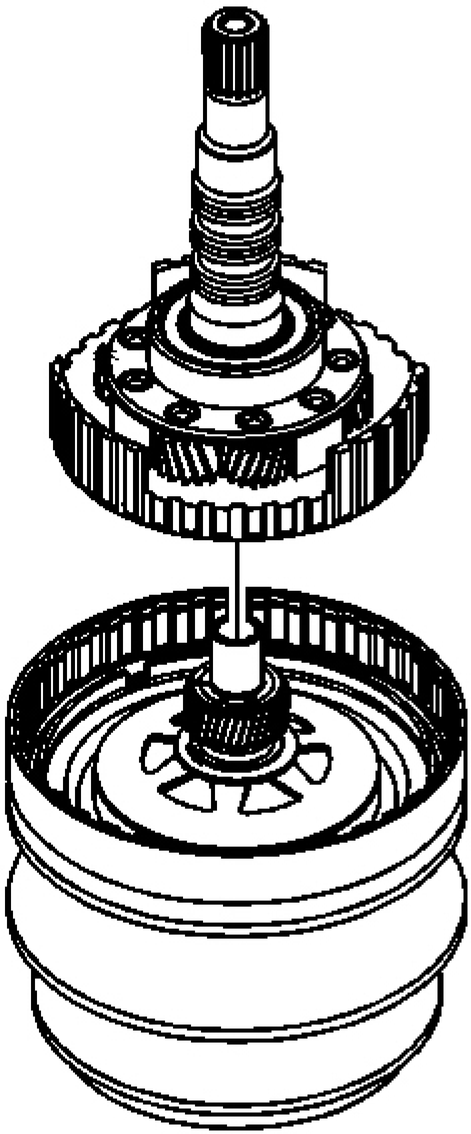
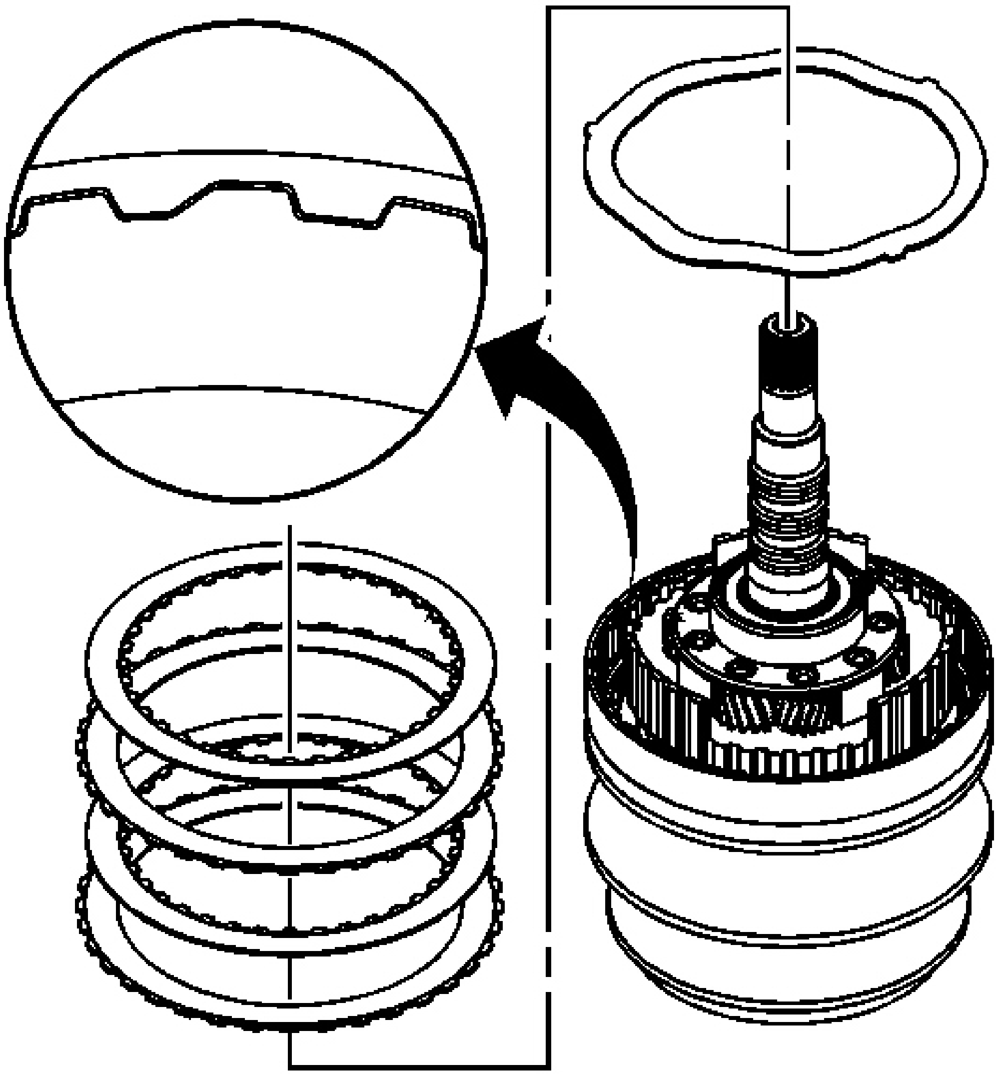


Fig. 389: Input Shaft Assembly
Courtesy of GENERAL MOTORS CORP.

27. Carefully install the input shaft assembly on the drive pulley assembly. Align the input carrier pinion gears over the sun gear.



<u>Fig. 390: Installing Forward Clutch Waved Plates</u>
Courtesy of GENERAL MOTORS CORP.

28. Install the forward clutch waved plate.

IMPORTANT: The forward clutch plates are designed to fit only one way in the forward clutch assembly. Match the alignment notches on the clutch plates with the corresponding notches on the forward clutch assembly and the input shaft assembly.

IMPORTANT: Install the forward clutch plates with the friction material facing up, towards the backing plate.

29. Install the forward clutch plates, two each, starting with a plate with the splines on the outer, external, diameter.

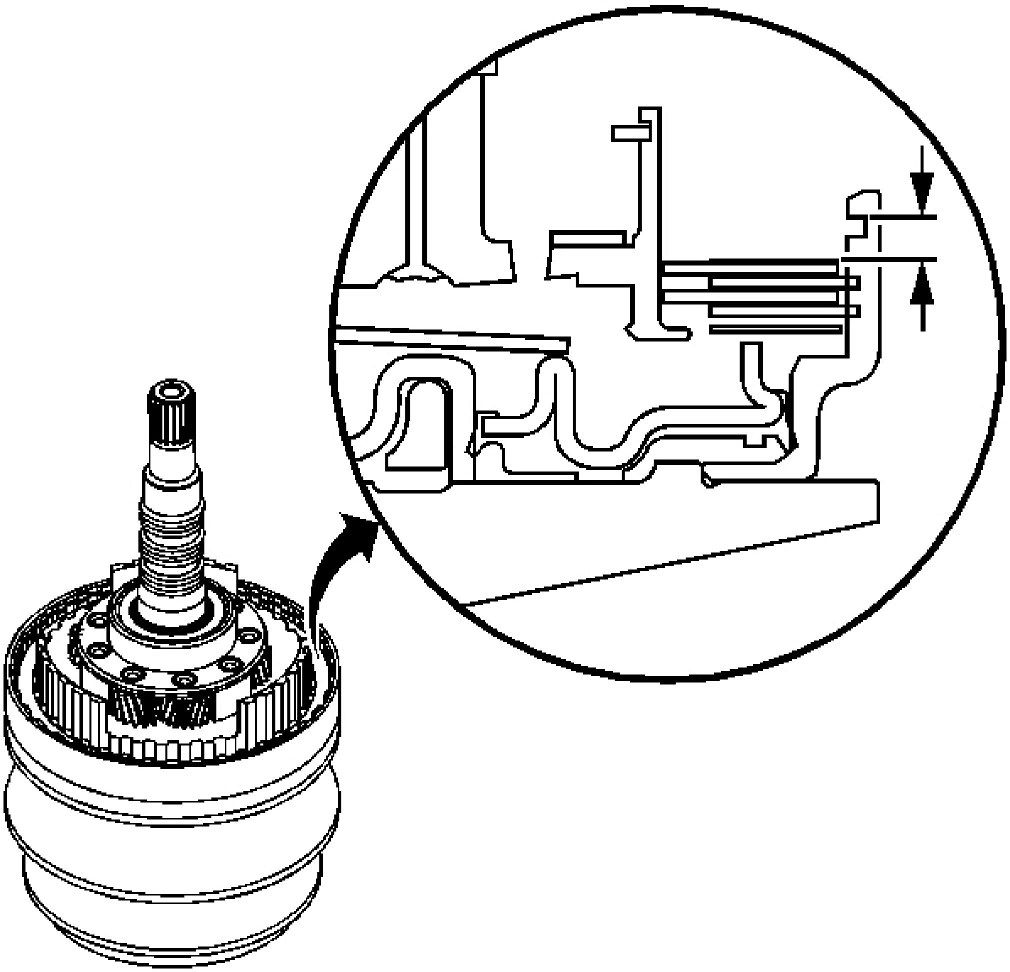


Fig. 391: Measuring The Distance Between Top Outer Edge Of Retaining Ring Groove & Top Friction Plate
Courtesy of GENERAL MOTORS CORP.

30. Measure the distance between the top outer edge of the retaining ring groove and the top friction plate.

    Record the measurement.

IMPORTANT: The backing plate identification letter is stamped on the backing plate.

31. Refer to the **Forward Clutch Backing Plate Specifications** table in Specifications in order to select the proper packing plate.

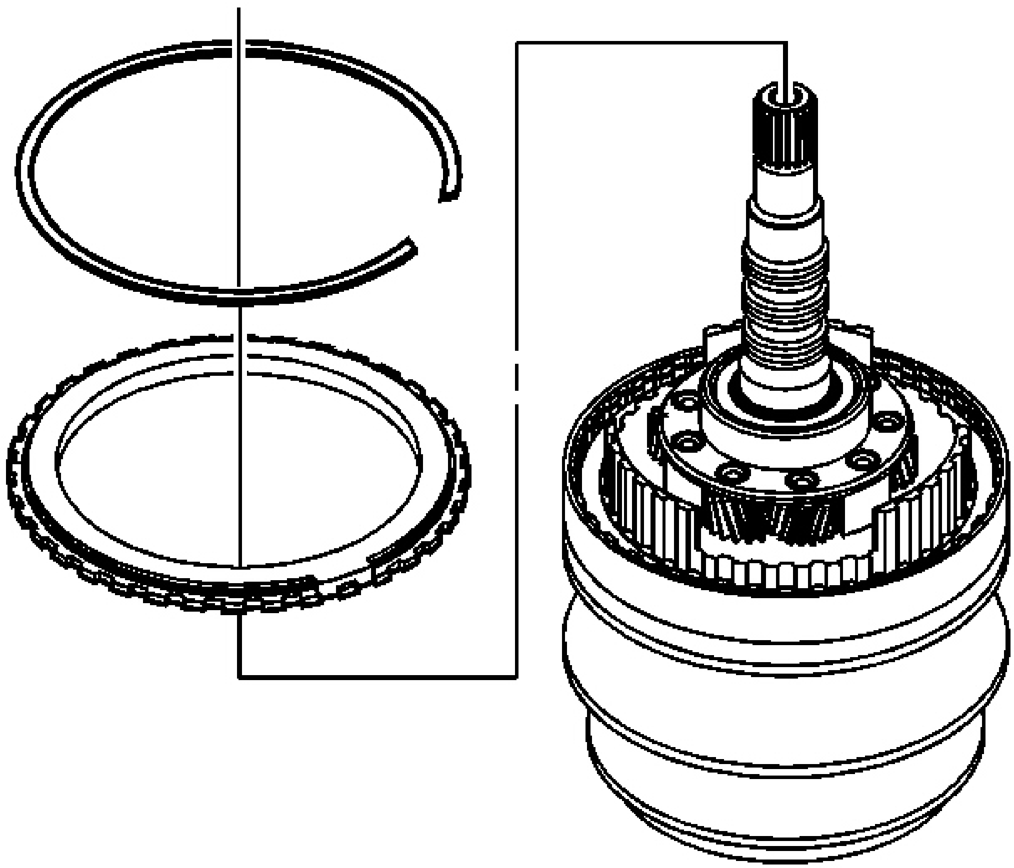


Fig. 392: Installing Retaining Ring & Forward Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

32. Install the forward clutch backing plate.
33. Install the retaining ring for the forward clutch backing plate.

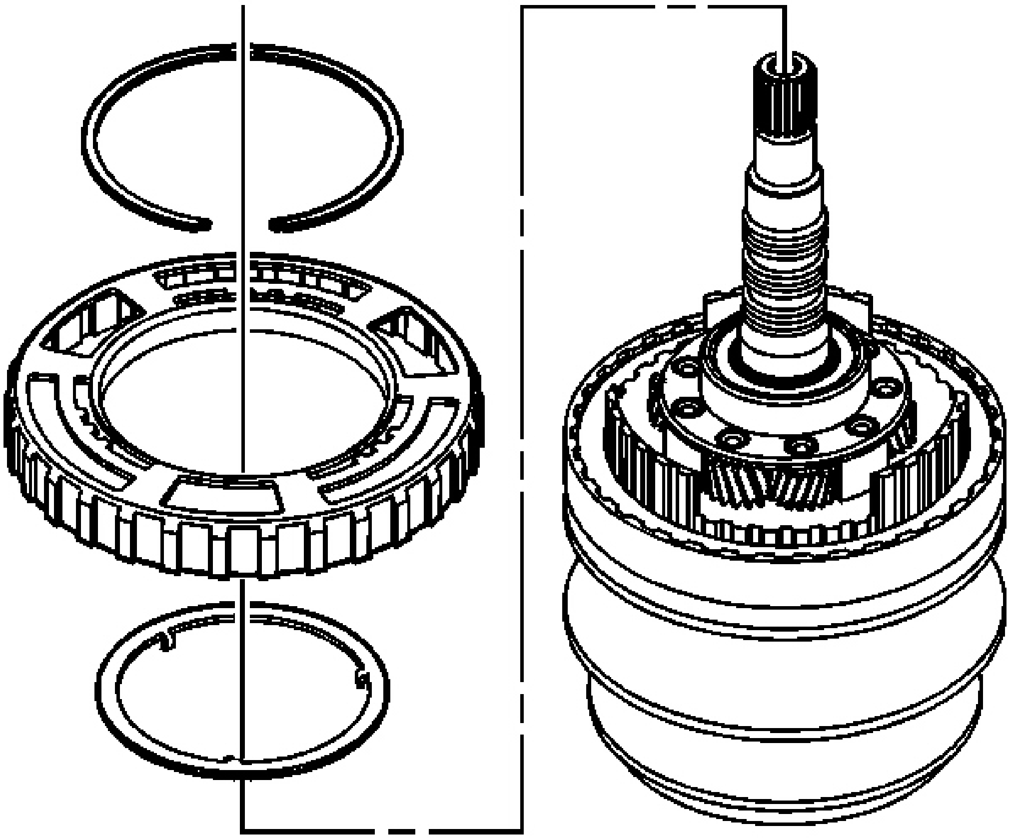


Fig. 393: Retaining Ring, Internal Gear Thrust Washer & Speed Sensor Reluctor Ring
Courtesy of GENERAL MOTORS CORP.

34. Install the internal gear thrust washer, tabs down.
35. Install the speed sensor reluctor ring.
36. Install the retaining ring for the speed sensor reluctor ring.

DRIVE BELT INSTALLATION

Tools Required

J 44337 Build Plate Assembly. See **Special Tools and Equipment** .

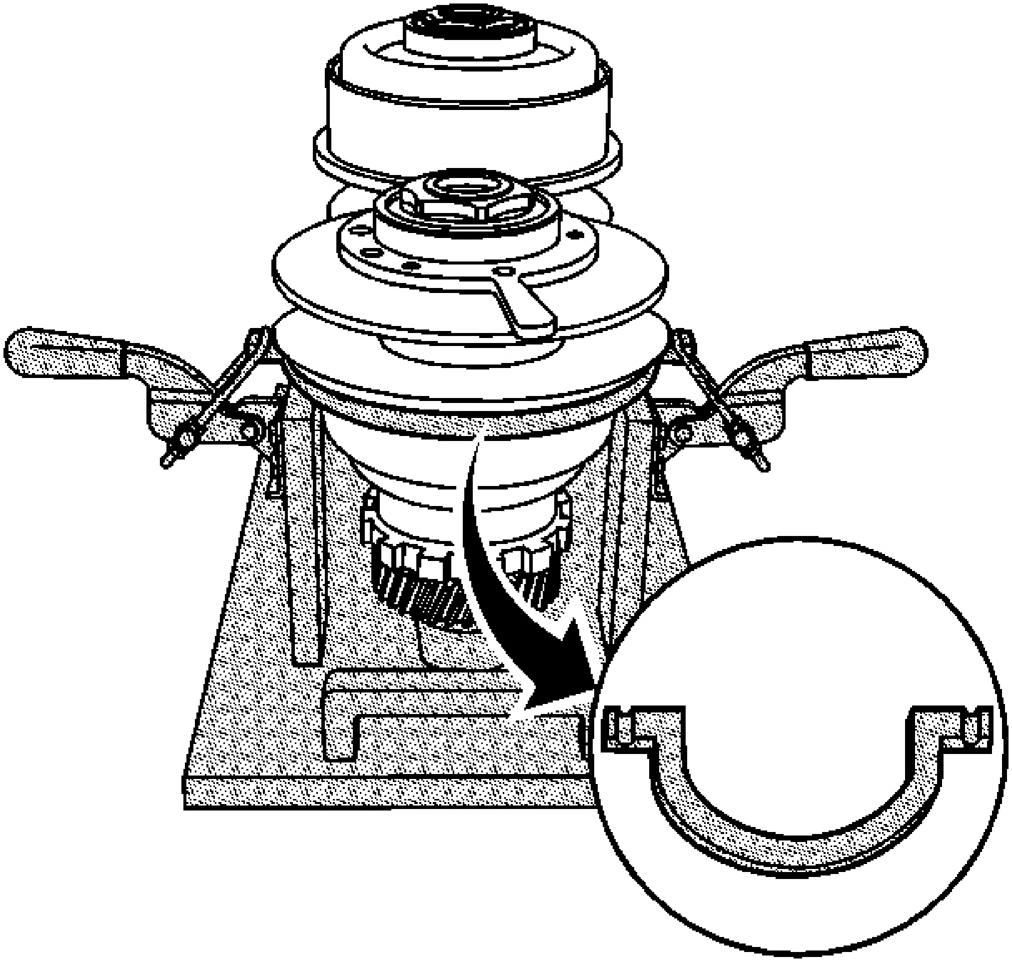


Fig. 394: Driven Pulley Assembly, U-Shaped Ring & J 44337
Courtesy of GENERAL MOTORS CORP.

1. Position the drive and driven pulley assemblies on the **J 44337** . See **Special Tools and Equipment** .
2. Inspect the belt contact areas on the drive and driven pulley assemblies. The surfaces should be smooth and free from any scoring.

IMPORTANT: When positioning the U-shaped ring of the J 44337 , ensure that the lip of the U-shaped ring is resting on the top edge of the driven pulley crimp. See Special Tools and Equipment .

3. Position the U-shaped ring of the **J 44337** on the driven pulley assembly. See **Special Tools and Equipment** .

4. Position the clamp U-bolts of the **J 44337** in the slotted grooves of the U-shaped ring. See **Special Tools and Equipment** .

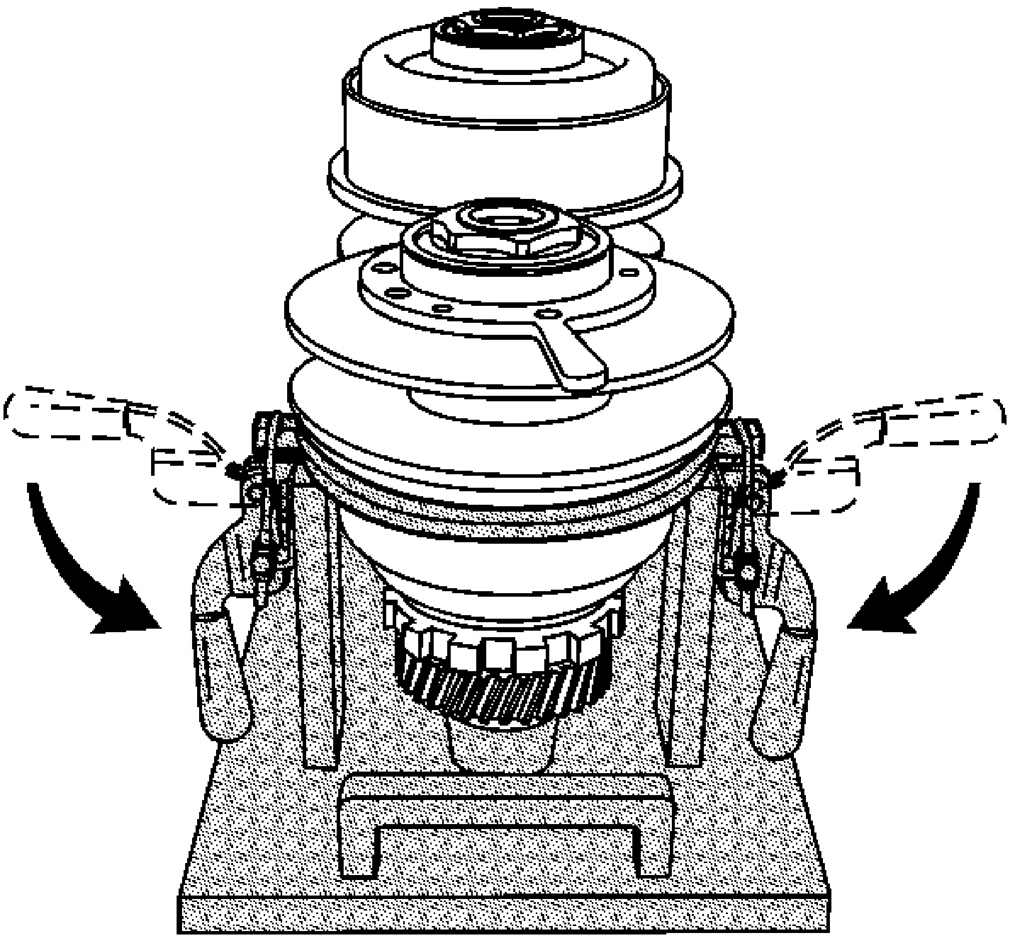


Fig. 395: Pushing Down On Clamp Handles With Equal Pressure To Compress The Driven Pulley With Both Hands
Courtesy of GENERAL MOTORS CORP.

5. Using both hands, push down on the clamp handles with equal pressure in order to compress the driven pulley assembly.

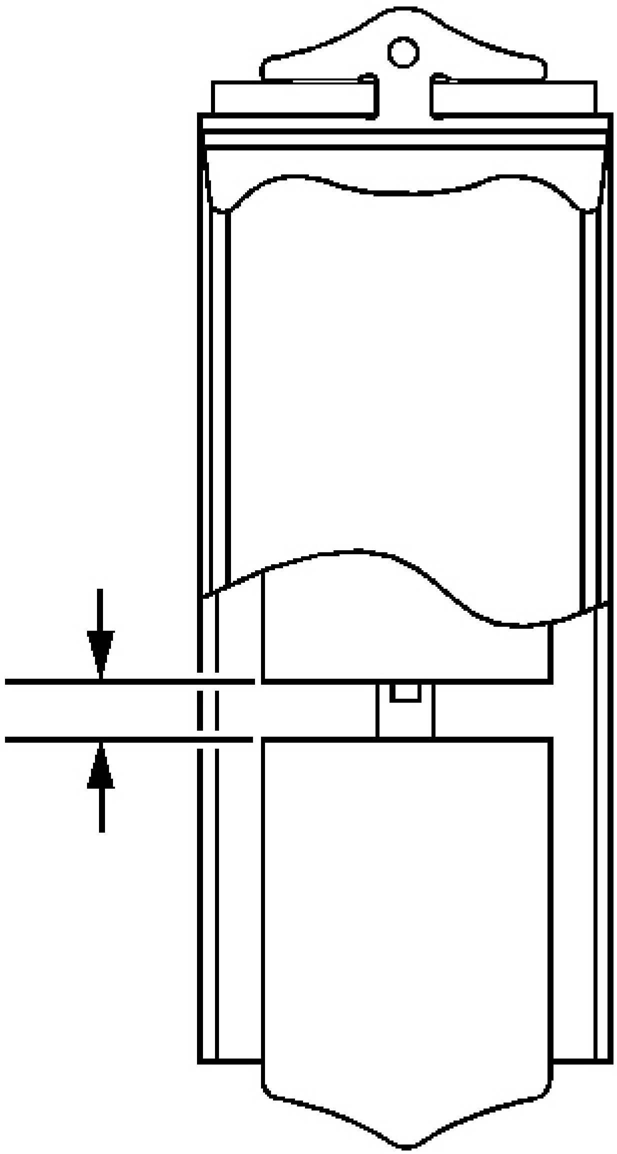


Fig. 396: Measuring The Belt End Play Over The Full Width Of Belt Assembly Element Using A Feeler Gage
Courtesy of GENERAL MOTORS CORP.

NOTE: **Use extreme care when handling the belt assembly. Avoid metal to metal contact with the sides of the belt ringsets. Do not disassemble the belt**

assembly. Damage to the ringsets may cause the belt to become inoperative.

IMPORTANT: Do not remove the tie straps from the belt assembly.

IMPORTANT: When inspecting the belt assembly, wipe the oil from the inspection area with a soft cloth. Wear patterns are easier to distinguish when the oil is removed.

6. Inspect the belt assembly for sharp dents on the sides of the ringsets.
7. Inspect the belt ringsets for burrs.
8. Using a feeler gage, measure the belt end play over the full width of the belt assembly element.

   End Play Specification: The correct end play is 2.0 mm (0.079 in) or less.

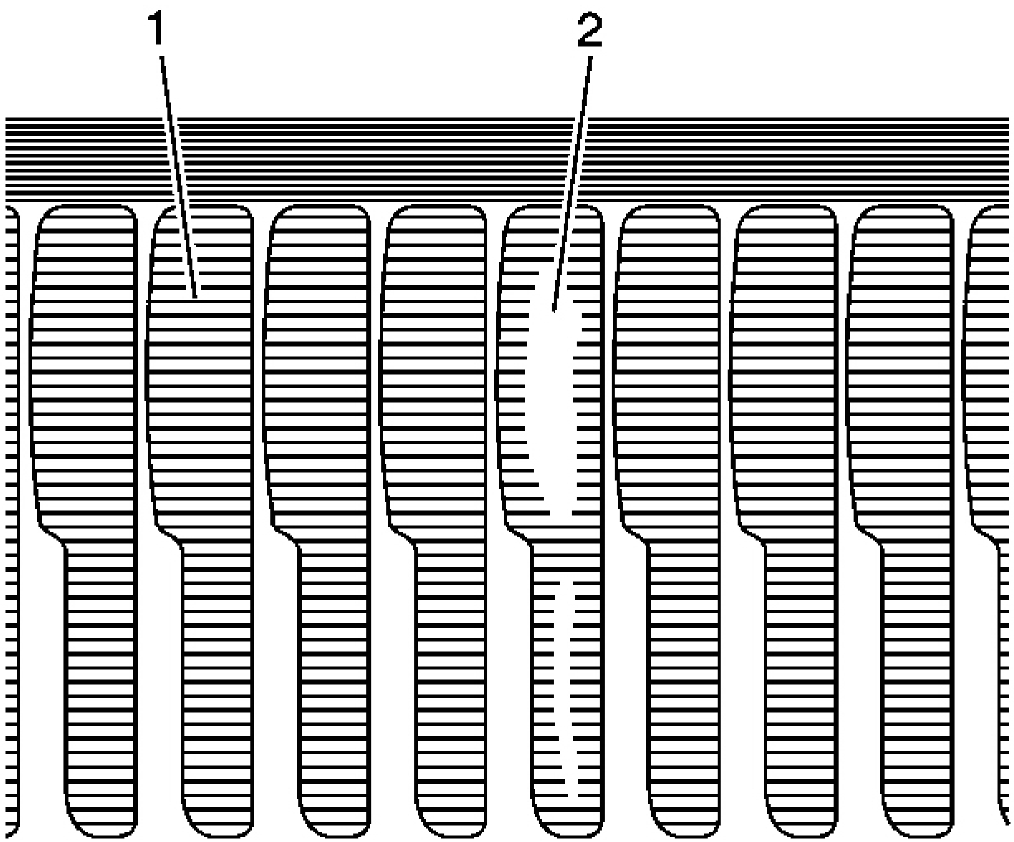


Fig. 397: Inspecting The Pulley Contact Area On Belt Assembly Elements For Damage
Courtesy of GENERAL MOTORS CORP.

9. Inspect the pulley contact area on the belt assembly elements for wear. The contact area on the elements should display visible horizontal grooves (1). These grooves can also be distinguished by feel. Worn grooves (2) indicate a slipping belt.

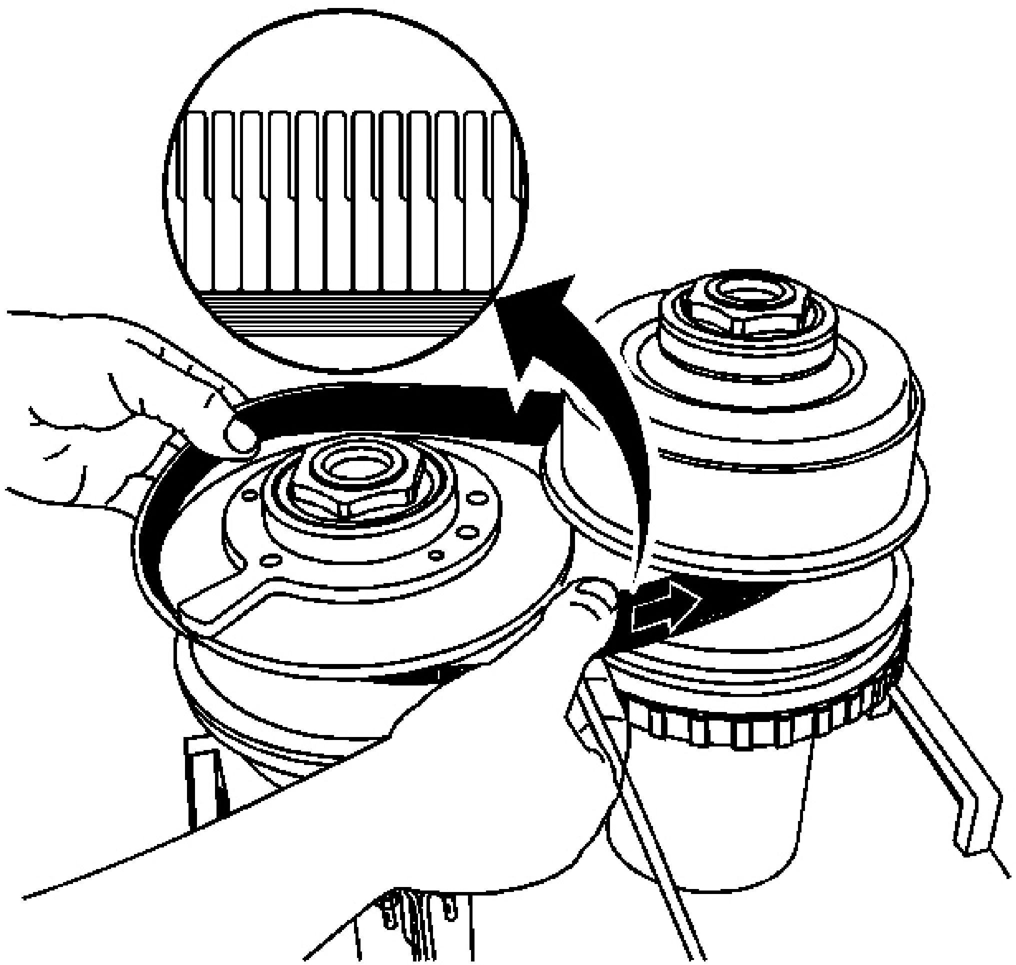


Fig. 398: Removing/Installing The Belt Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: When installing the belt assembly, ensure that the printed arrow on the belt assembly points to the right. If the printed arrow is not visible, install the belt assembly so that the step in the ringset element points to the

right.

10. Carefully install the belt assembly.

CASE COVER ASSEMBLY ASSEMBLE

Tools Required

J 44337 Build Plate Assembly. See **Special Tools and Equipment** .

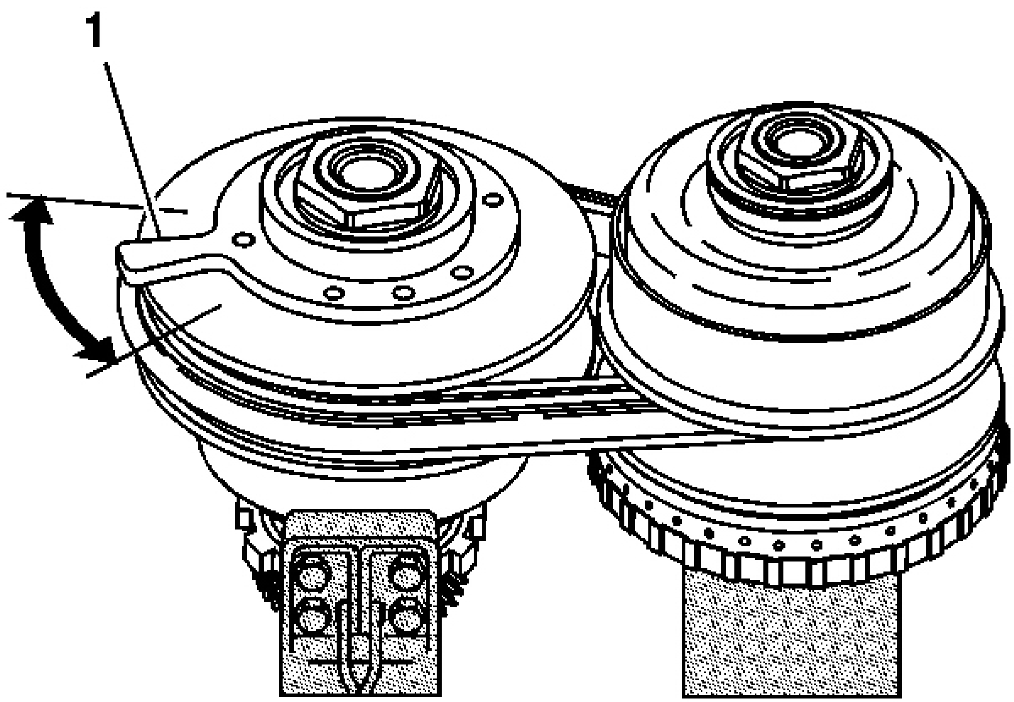


Fig. 399: Driven Pulley Retainer Extension
Courtesy of GENERAL MOTORS CORP.

1. Ensure that the driven pulley retainer extension (1) is properly aligned to the case cover assembly.

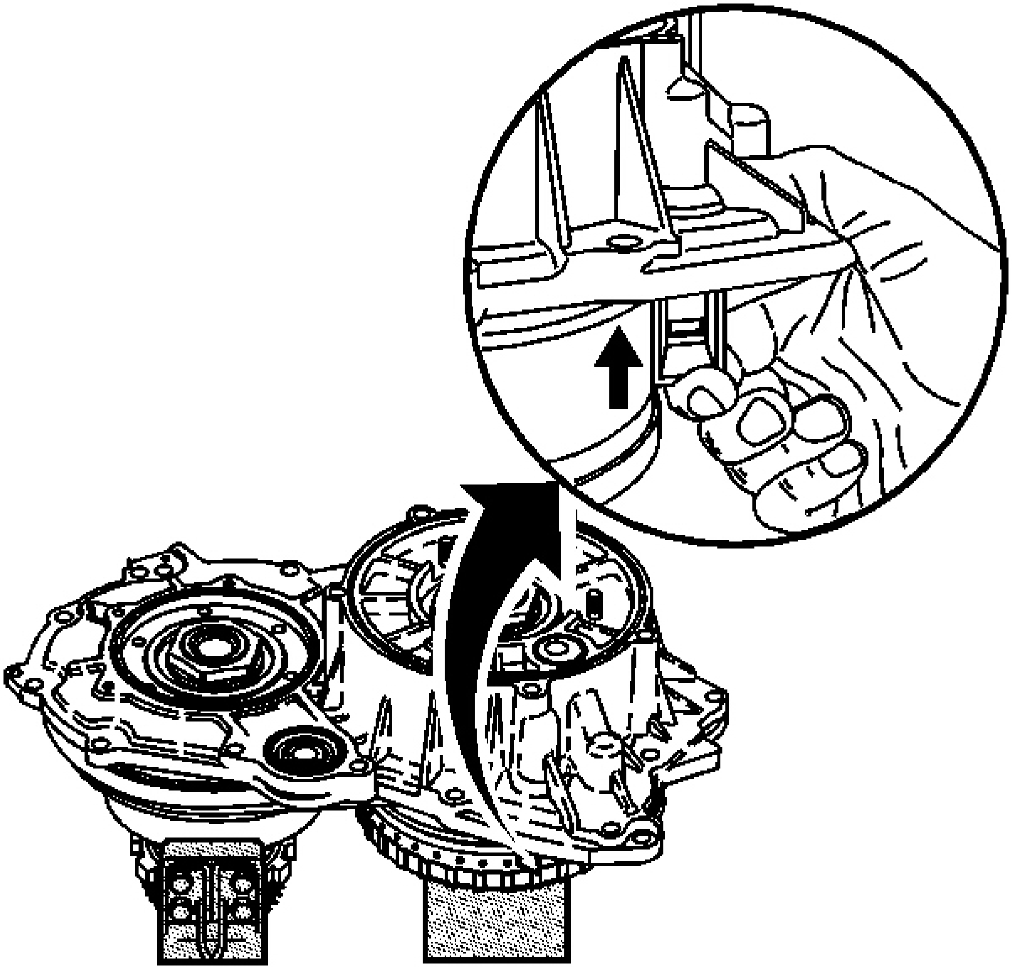


Fig. 400: Depressing The Follower
Courtesy of GENERAL MOTORS CORP.

2. Ensure that the drive belt assembly is installed and that the driven pulley assembly is still in the compressed position. Refer to **Drive Belt Installation** .

IMPORTANT: When installing the case cover assembly onto the drive and driven pulley assemblies, ensure that the follower is positioned properly on the drive pulley.

3. Position the case cover assembly onto the drive and driven pulley assemblies.

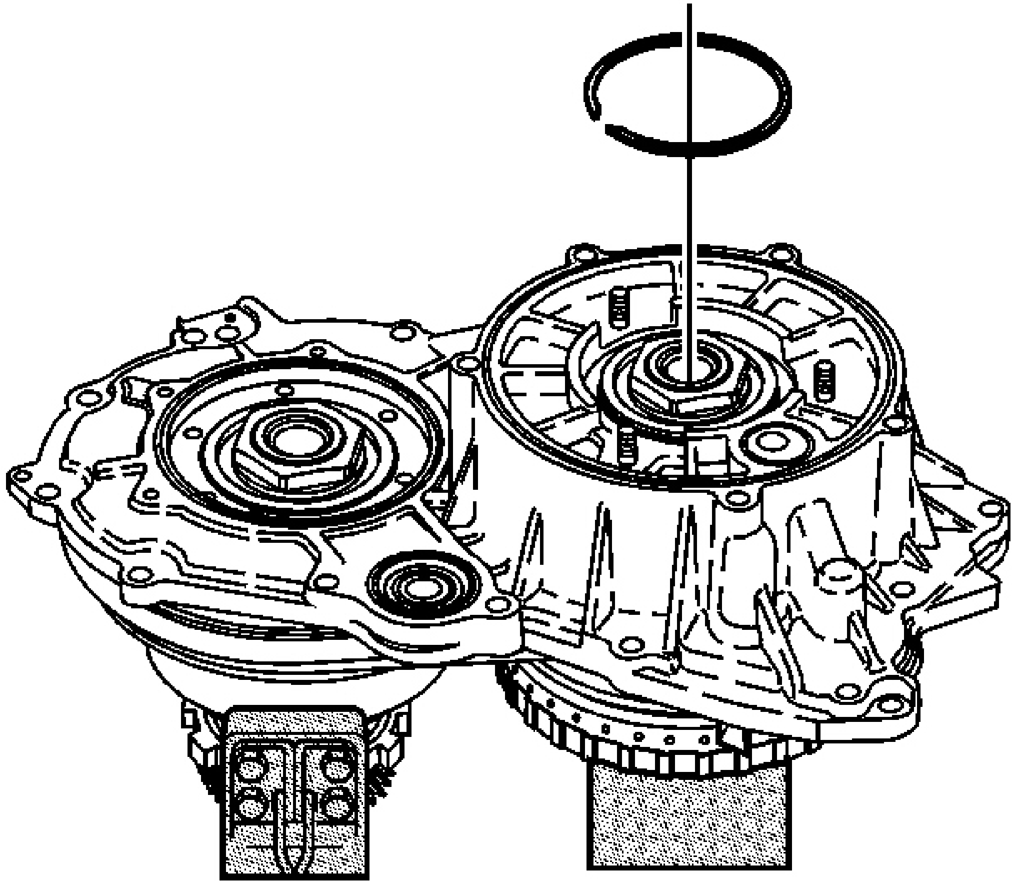


Fig. 401: Drive Pulley Bearing & Retaining Ring
Courtesy of GENERAL MOTORS CORP.

4. Install the retaining ring for the drive pulley bearing.

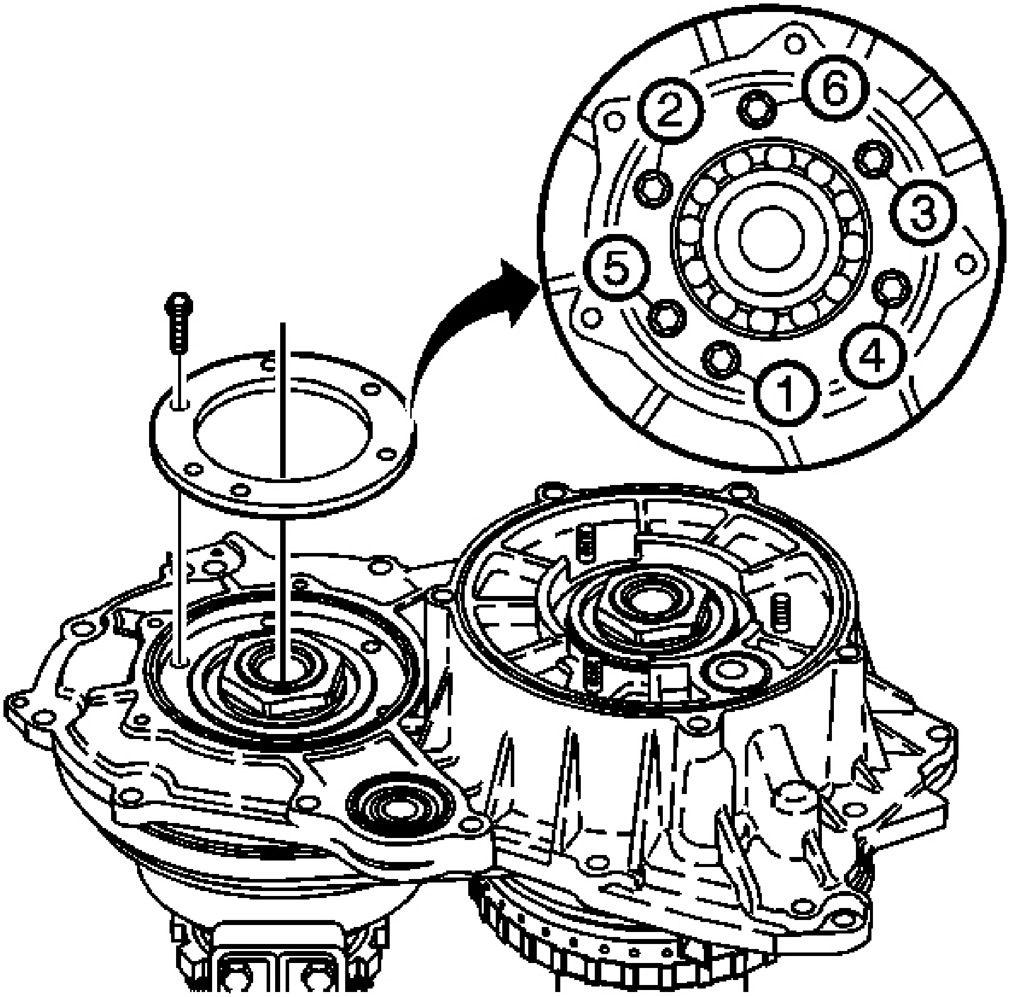


Fig. 402: Driven Pulley Bearing Retainer Tightening Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE:	**Refer to Fastener Notice in Cautions and Notices.**

IMPORTANT:	**Ensure that the bolt holes in the driven pulley retainer extension are properly aligned with the bolt holes in the driven pulley bearing retainer.**

5. Install the driven pulley bearing retainer and 6 bolts.

Tighten:

- Tighten the bearing retainer bolts - 8 mm hex head to 5 N.m (44 lb in) in the sequence shown.
- Tighten the bearing retainer bolts - 10 mm hex head to 9 N.m (80 lb in) in the sequence shown.

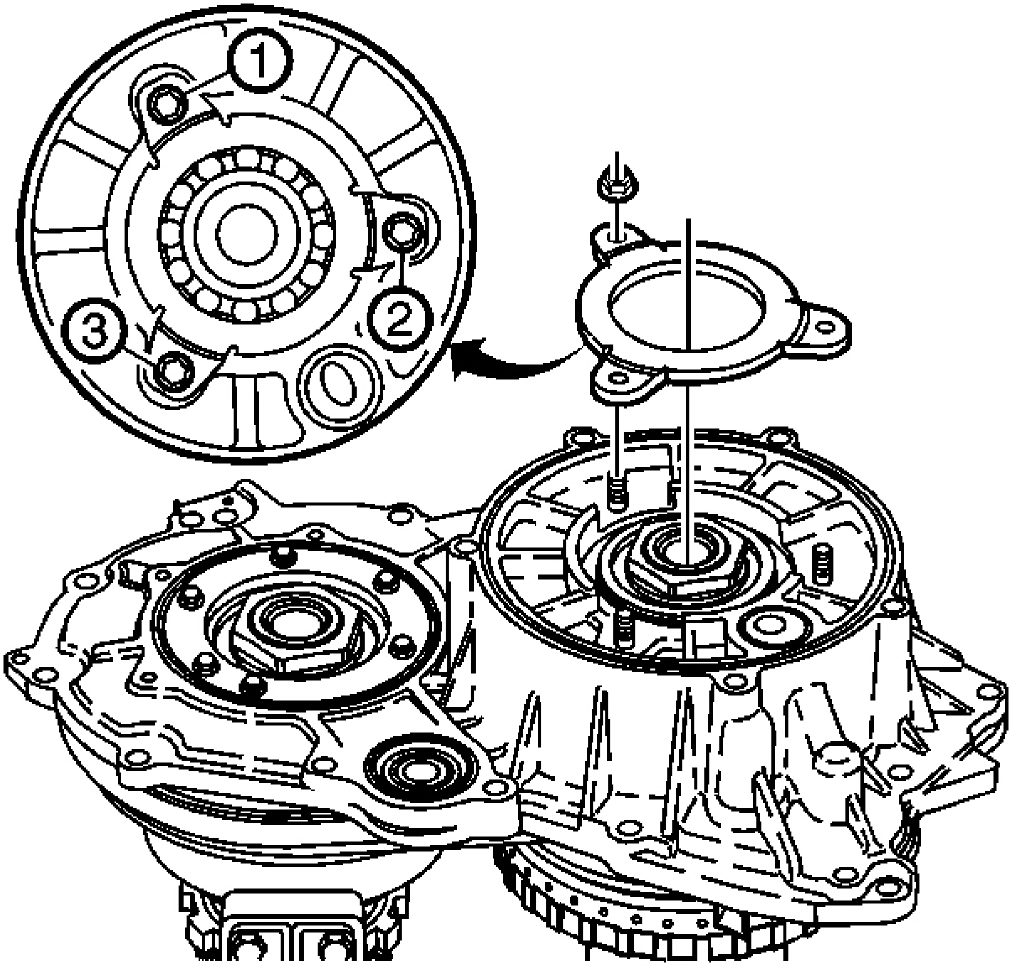


Fig. 403: Drive Pulley Bearing Retainer Tightening Nuts Sequence
Courtesy of GENERAL MOTORS CORP.

6. Install the drive pulley bearing retainer and 3 nuts.

   Tighten: Tighten the bearing retainer nuts to 11 N.m (8 lb ft) in the sequence shown.

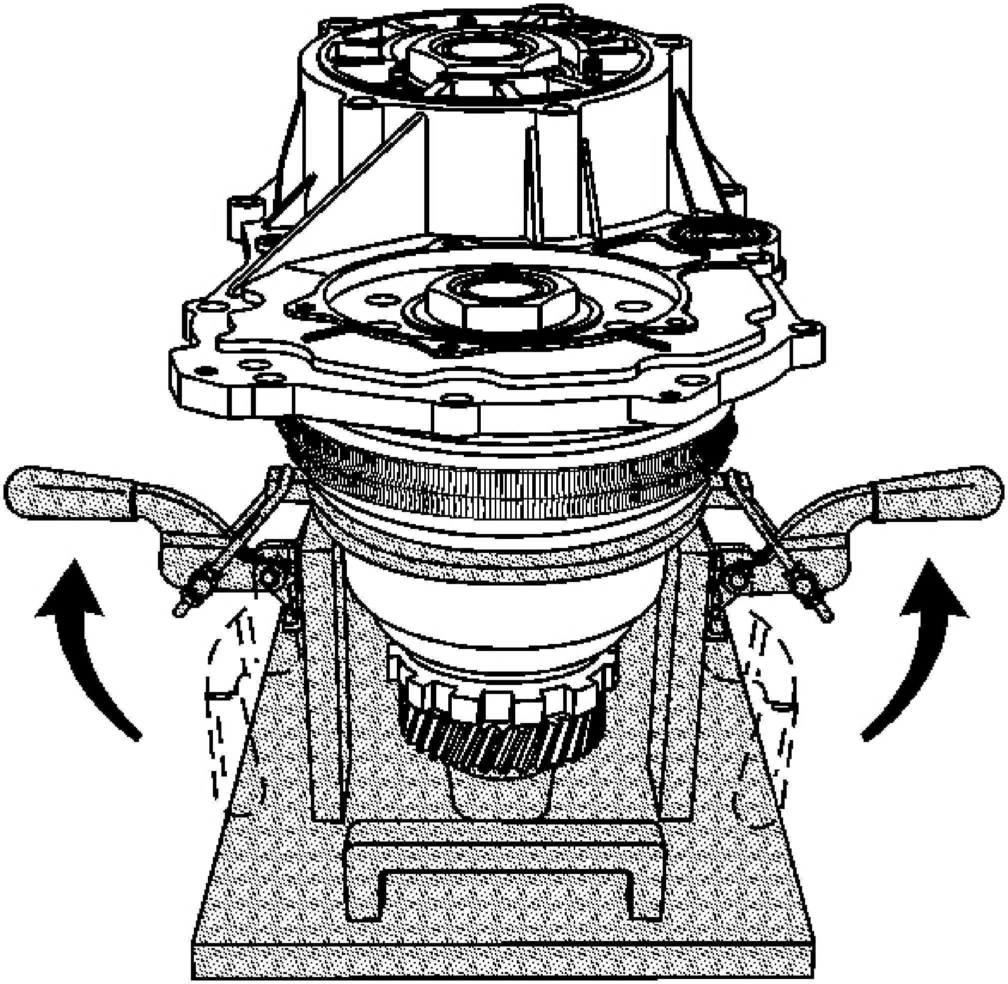


Fig. 404: Slowly Pull Up On Two Clamp Handles To Release Spring Force On Driven Pulley Using J 44337
Courtesy of GENERAL MOTORS CORP.

NOTE:	**When releasing the spring force on the driven pulley assembly, slowly pull up on the two clamp handles. A rapid release of the spring force may cause damage to the belt assembly.**

7. Using the **J 44337** , slowly pull up on the two clamp handles in order to release the spring force on the driven pulley assembly. See **Special Tools and Equipment** .
8. Remove the U-shaped ring from the driven pulley.

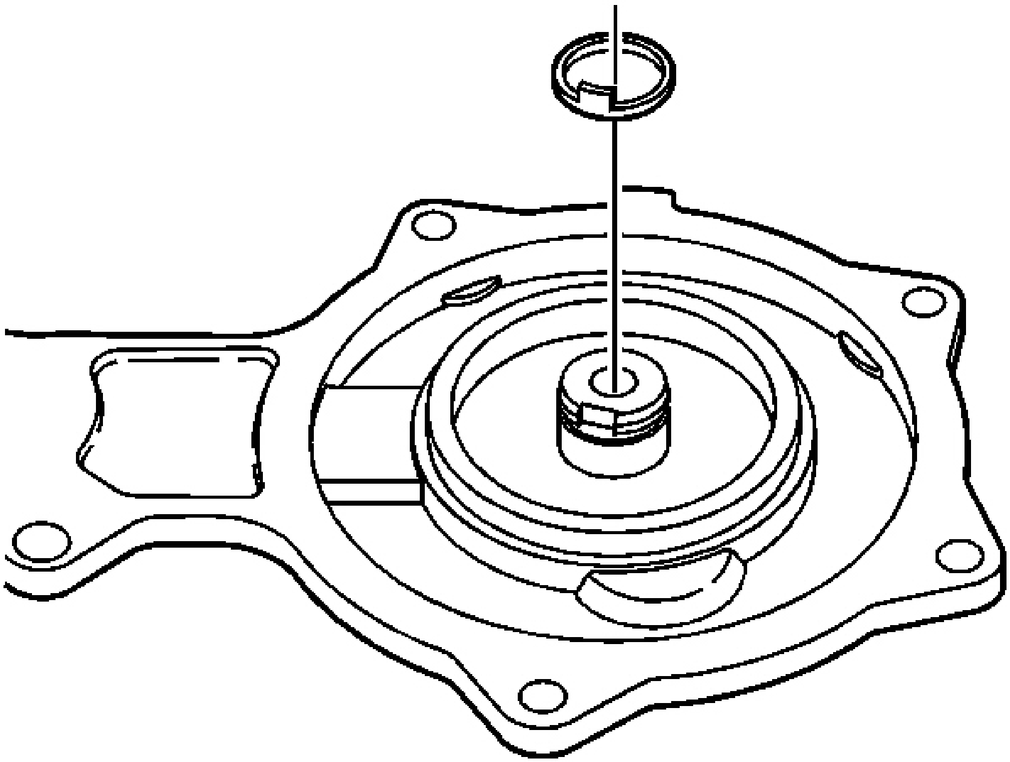
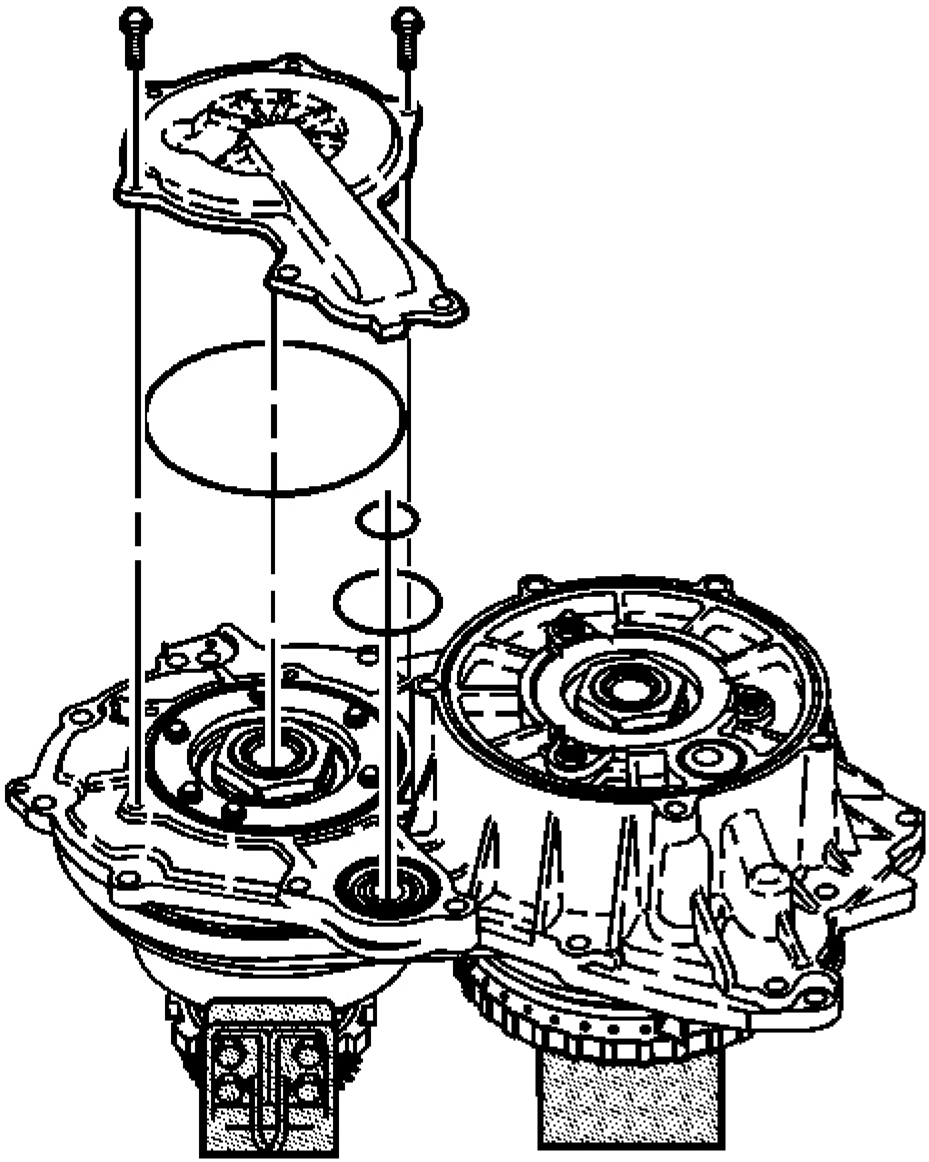


Fig. 405: Variable Driven Cover & Cover Seal
Courtesy of GENERAL MOTORS CORP.

9. Inspect the case cover seal on the driven pulley cover for damage. Replace if necessary.



<u>Fig. 406: 2 Driven Pulley Cover Seals, Case Cover O-Ring Seal & Bolts</u>
Courtesy of GENERAL MOTORS CORP.

10. Install the 2 NEW driven pulley cover seals and the NEW case cover O-ring seal on the case cover assembly.

IMPORTANT: Do not install all 4 of the bolts used to secure the driven pulley cover to the case cover assembly. Two of the bolt holes are used for attaching the case cover lifting bracket.

11. Install the driven pulley cover and the 2 bolts on the case cover assembly.

    Tighten: Tighten the bolts to 11 N.m (8 lb ft).

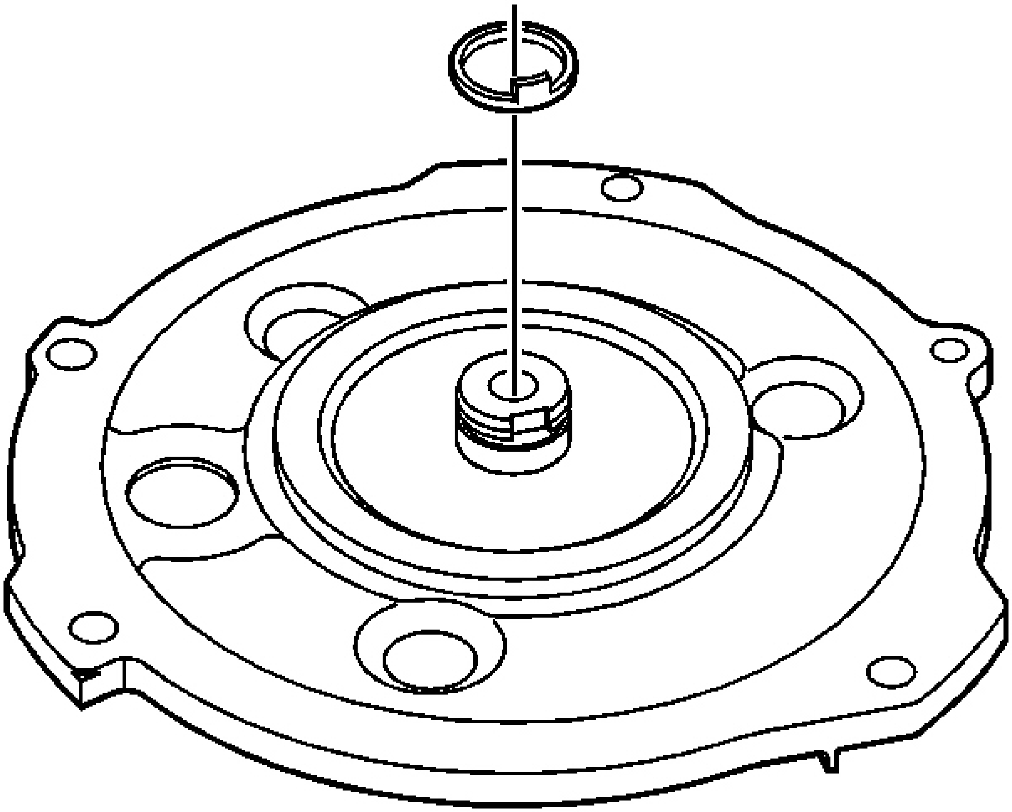


Fig. 407: Inspecting Case Cover Seal On Drive Pulley Cover For Damage
Courtesy of GENERAL MOTORS CORP.

12. Inspect the case cover seal on the drive pulley cover for damage. Replace if necessary.

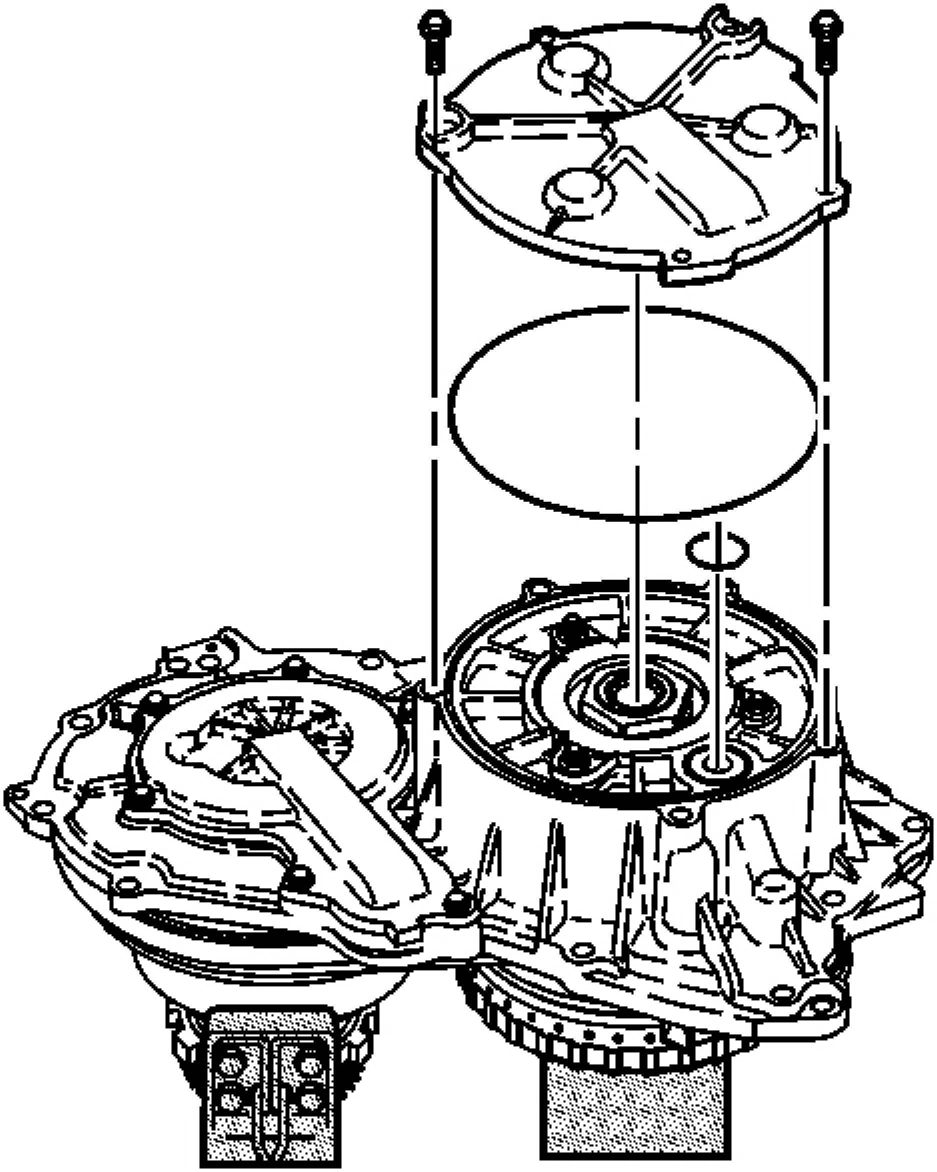


Fig. 408: Drive Pulley Cover, Bolts & Case Cover Assembly
Courtesy of GENERAL MOTORS CORP.

13. Install the 2 NEW drive pulley cover seals on the case cover assembly.

IMPORTANT: Do not install all 4 of the bolts used to secure the drive pulley cover to the

case cover assembly. Two of the bolt holes are used for attaching the case cover lifting bracket.

14. Install the drive pulley cover and the 2 bolts on the case cover assembly.

    Tighten: Tighten the bolts to 11 N.m (8 lb ft).

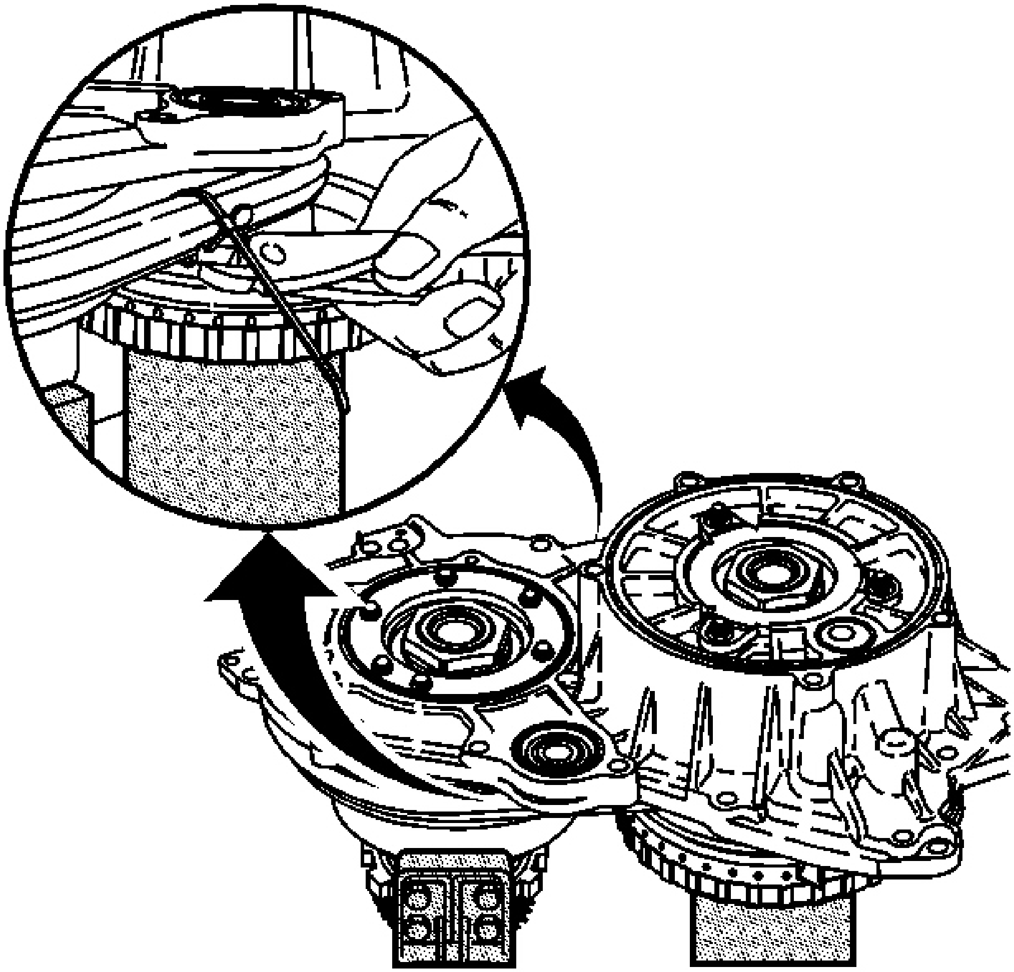


Fig. 409: Removing 2 Tie Straps From Belt Assembly
Courtesy of GENERAL MOTORS CORP.

NOTE:	**Avoid damage to the belt ringsets. Damage to the ringsets may cause the belt to become inoperative.**

15. Remove the 2 tie straps from the belt assembly.

CASE COVER ASSEMBLY INSTALLATION

Tools Required

- **J 43969** Case Cover Lifting Bracket. See **Special Tools and Equipment** .
- **J 44337** Build Plate Assembly. See **Special Tools and Equipment** .
- **J 44996** Input Carrier Alignment Tool. See **Special Tools and Equipment** .

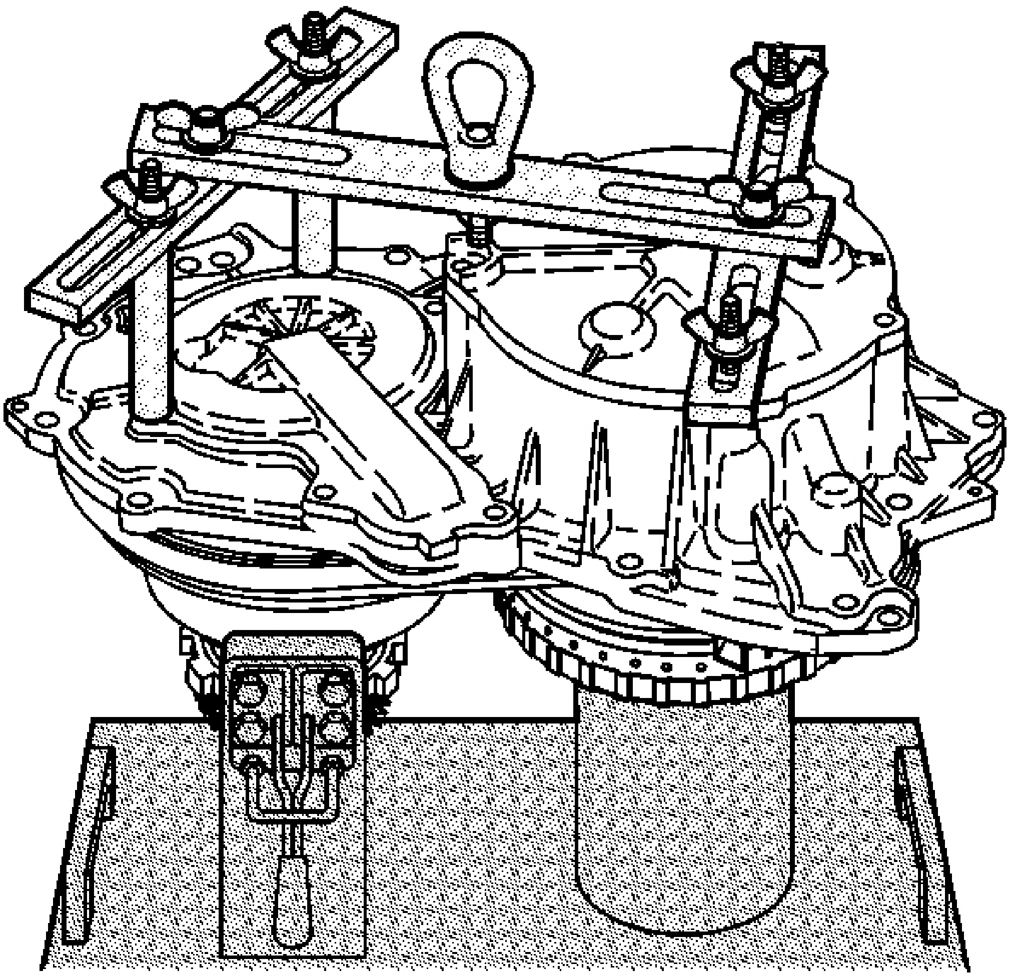


Fig. 410: Drive Pulley Cover, J 43969 & J 43969
Courtesy of GENERAL MOTORS CORP.

NOTE: **The control valve body assembly must be removed before installing the case cover assembly. Failure to follow this instruction may result in damage to the variable ratio control lever.**

1. Attach the shorter legs of the **J 43969** to the two open bolt holes on the drive pulley cover. See **Special Tools and Equipment** .
2. Attach the longer legs of the **J 43969** to the two open bolt holes on the driven pulley cover. See **Special Tools and Equipment** .

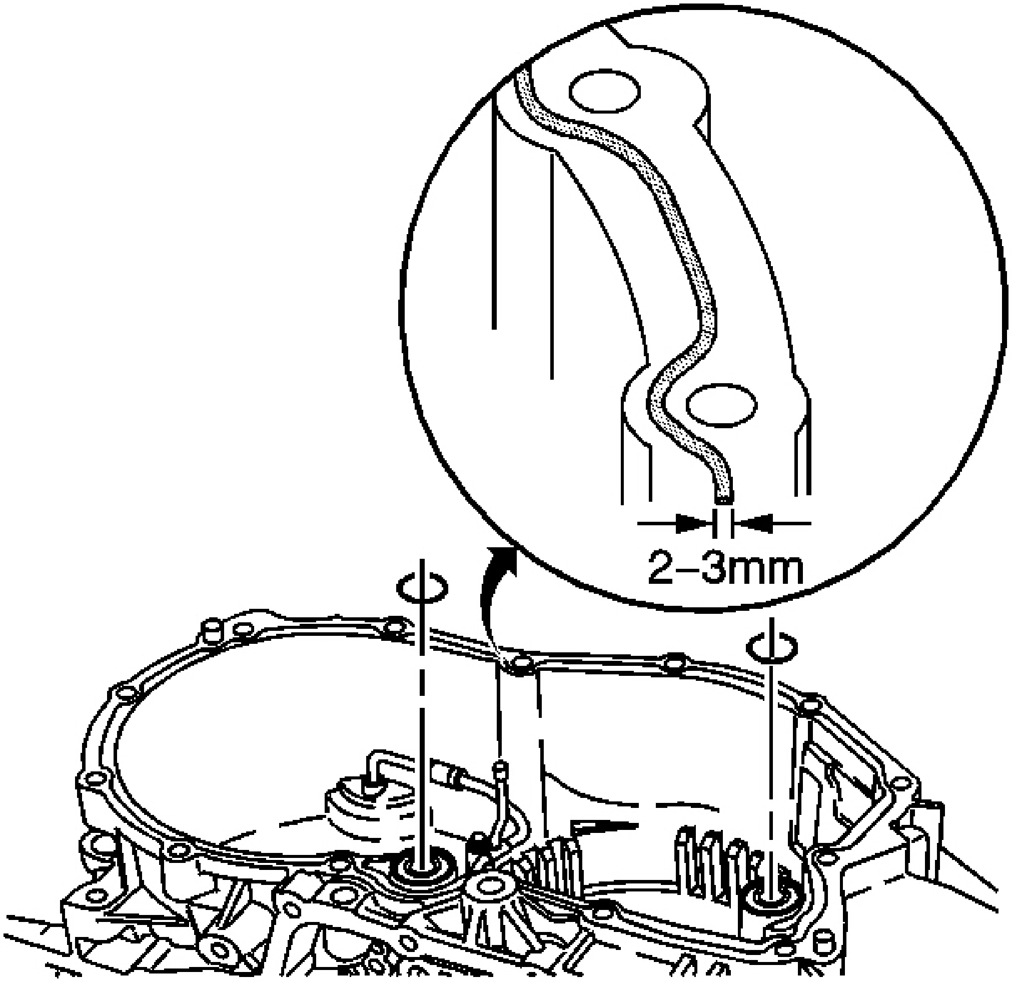


Fig. 411: Installing Two Case Cover O-Ring Seals On Transmission Case
Courtesy of GENERAL MOTORS CORP.

3. Install two NEW case cover O-ring seals on the transmission case assembly.

NOTE: Use extreme care when applying sealant. Ensure the bead of sealant does not exceed 2-3 mm (0.079-0.118 in). Excess sealant inside the transmission may cause restrictions resulting in various performance and noise complaints.

IMPORTANT: Liquid PA Sealant GM P/N 24233365 is the only authorized sealant that should be applied to the mating surfaces.

IMPORTANT: Ensure the bead of sealant is centered on the mating surface between the bolt holes, and on the inside mating surface around the bolt holes.

4. Apply a 2-3 mm (0.079-0.118 in) bead of sealant GM P/N 24233365 to the mating surfaces of the transmission case assembly.

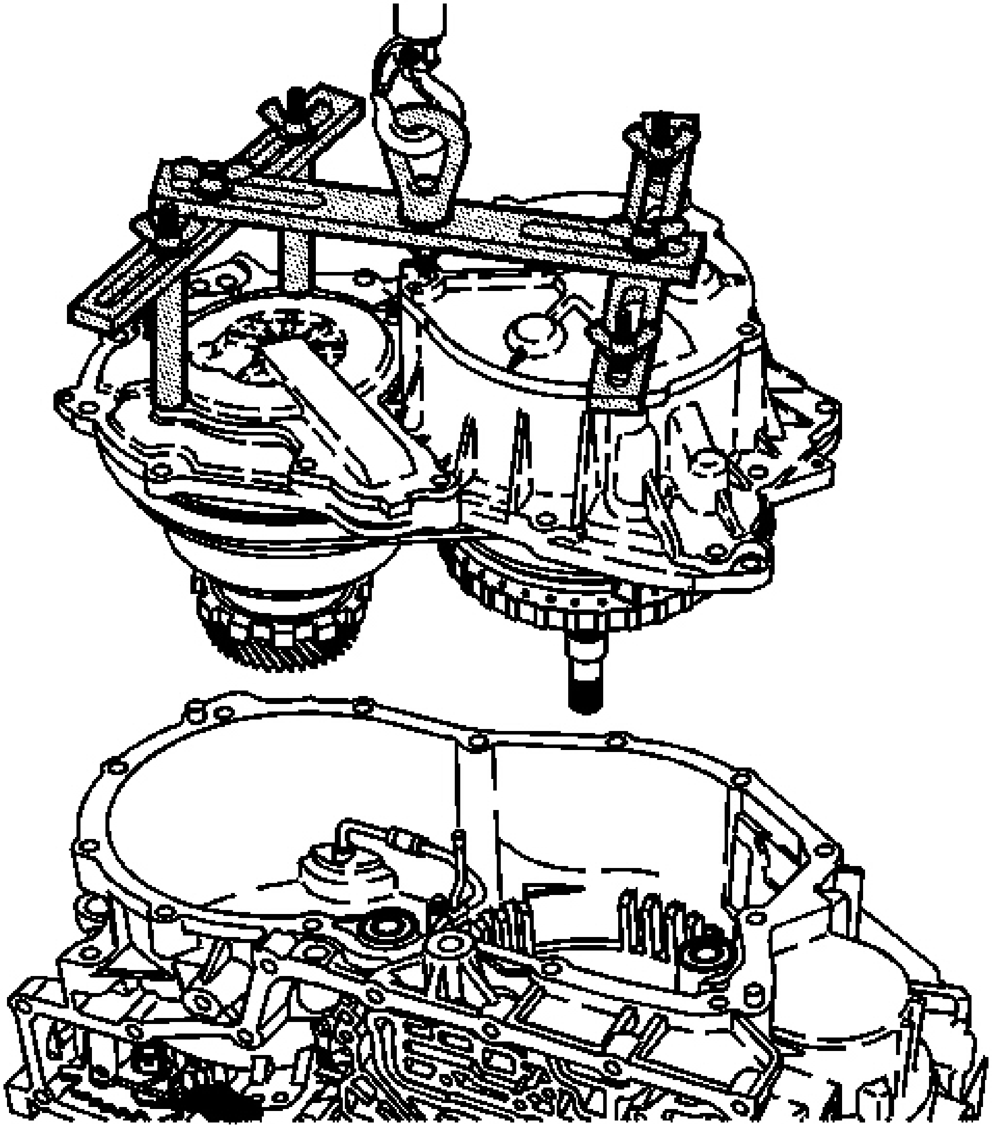


Fig. 412: Carefully Lift The Case Cover Assembly Using A Lifting Device
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: **Ensure that the reverse clutch hub assembly and thrust washer are installed into the transaxle case assembly before installing the case cover assembly.**

5. Using a suitable lifting device, carefully lift the case cover assembly - with forward clutch and input shaft - out of the **J 44337** and lower into the transmission case assembly. See **Special Tools and Equipment** .

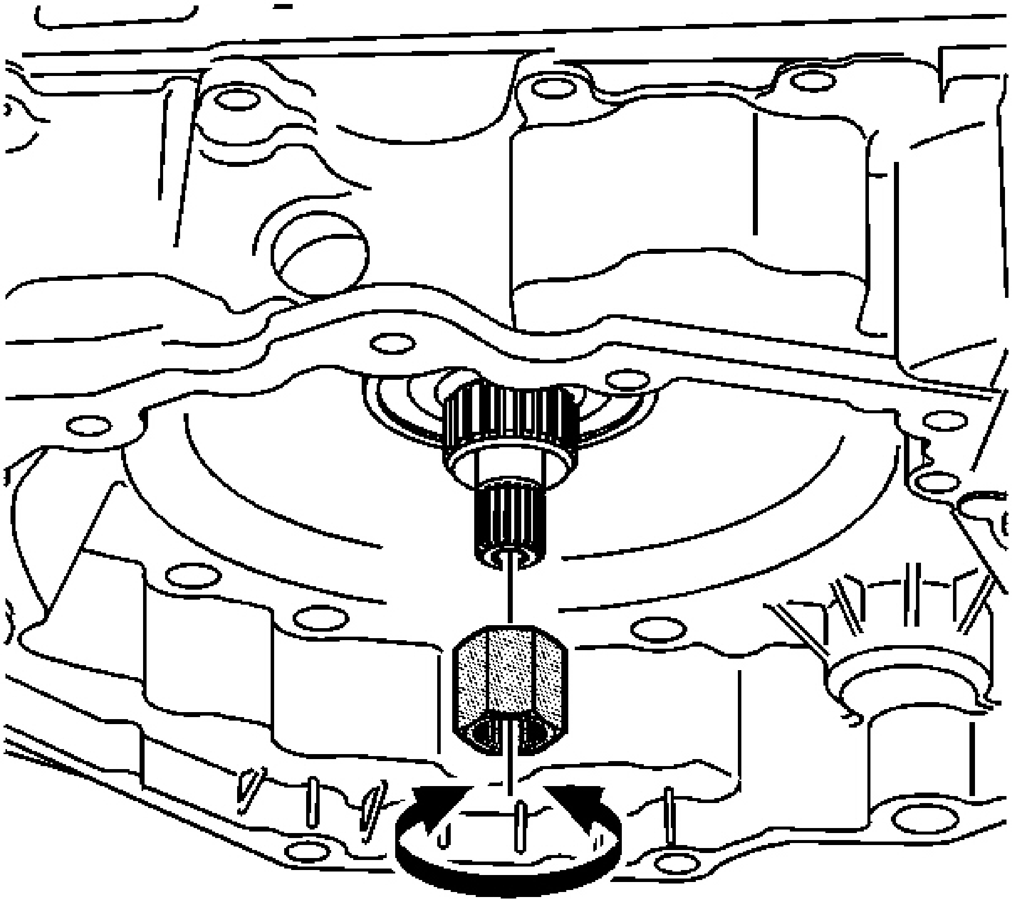


Fig. 413: Removing J 43969
Courtesy of GENERAL MOTORS CORP.

6. Using the **J 44996** on the end of the input shaft, align the reverse carrier into the reverse clutch hub assembly. See **Special Tools and Equipment** .
7. Remove the **J 43969** . See **Special Tools and Equipment** .

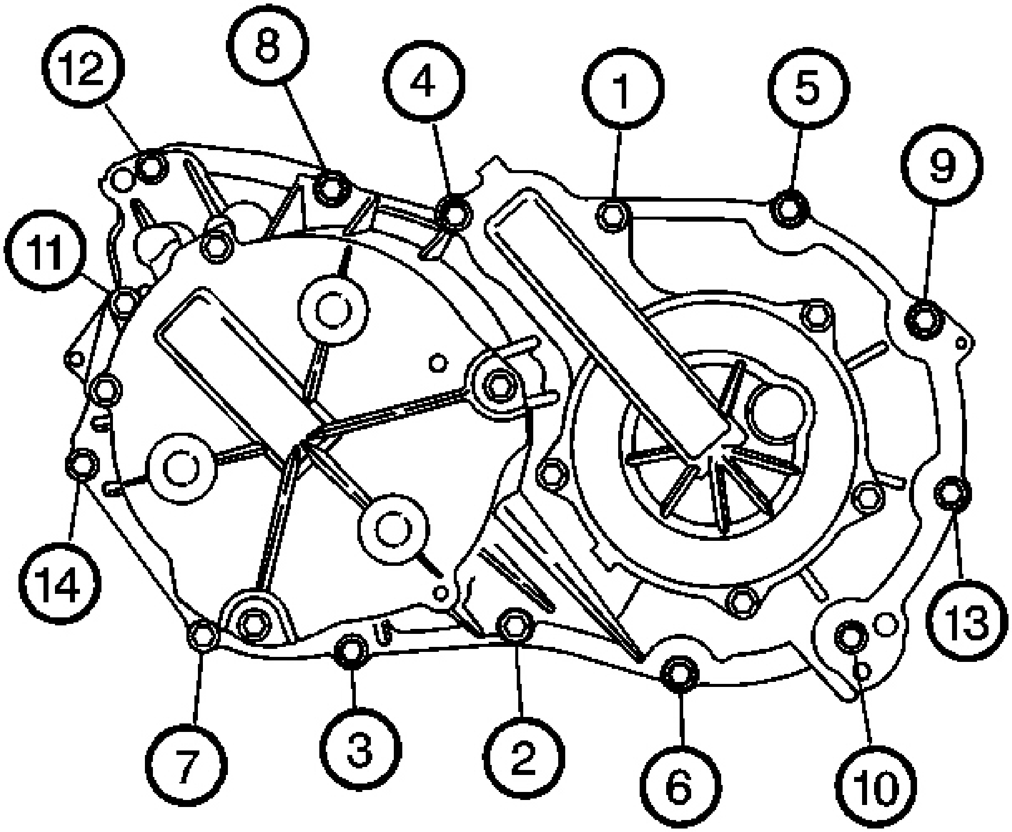


Fig. 414: Case Cover Assembly Tightening Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

IMPORTANT: **Two of the 14 case cover bolts are longer than the other bolts. These two bolts are used for the driven pulley cover.**

8. Secure the case cover assembly to the transmission case assembly with the 14 case cover bolts.

Tighten: Tighten the bolts to 28 N.m (21 lb ft) in the sequence shown.

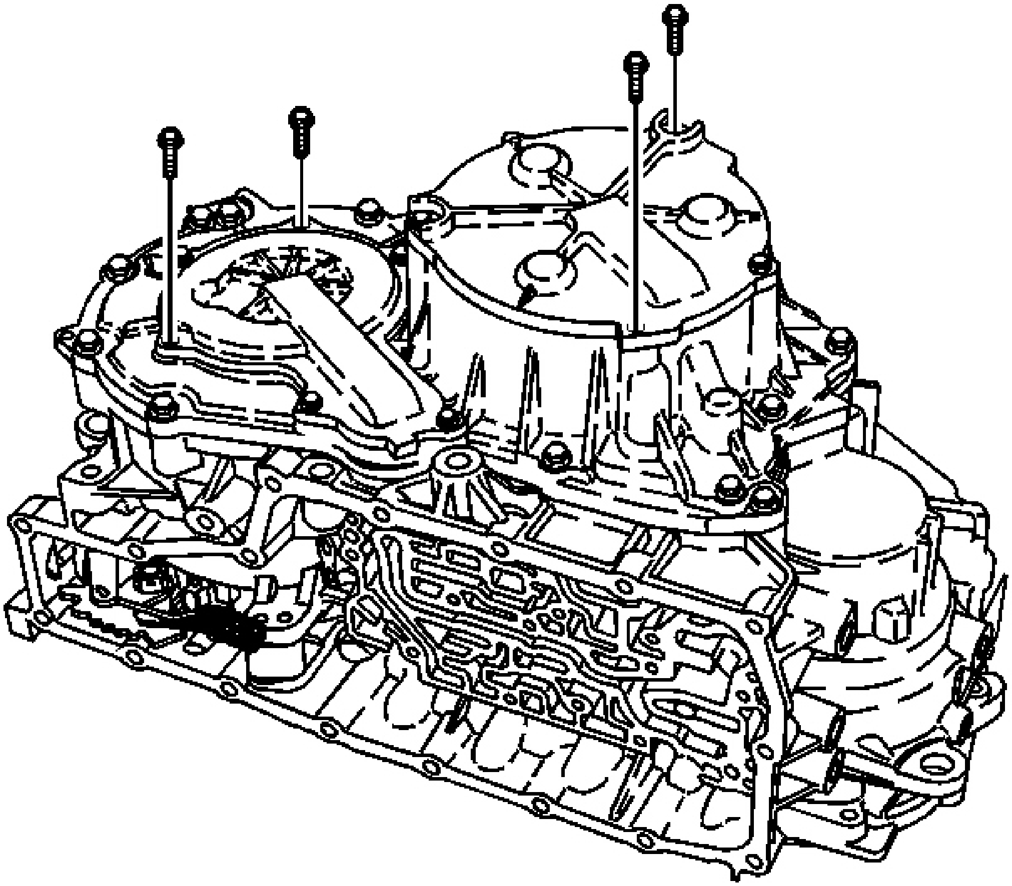


Fig. 415: 2 Bolts & Driven Pulley Cover
Courtesy of GENERAL MOTORS CORP.

9. Install the remaining 2 bolts on the drive pulley cover.

   Tighten: Tighten the bolts to 11 N.m (8 lb ft).

10. Install the remaining 2 bolts on the driven pulley cover.

    Tighten: Tighten the bolts to 11 N.m (8 lb ft).

CONTROL VALVE BODY ASSEMBLY DISASSEMBLE

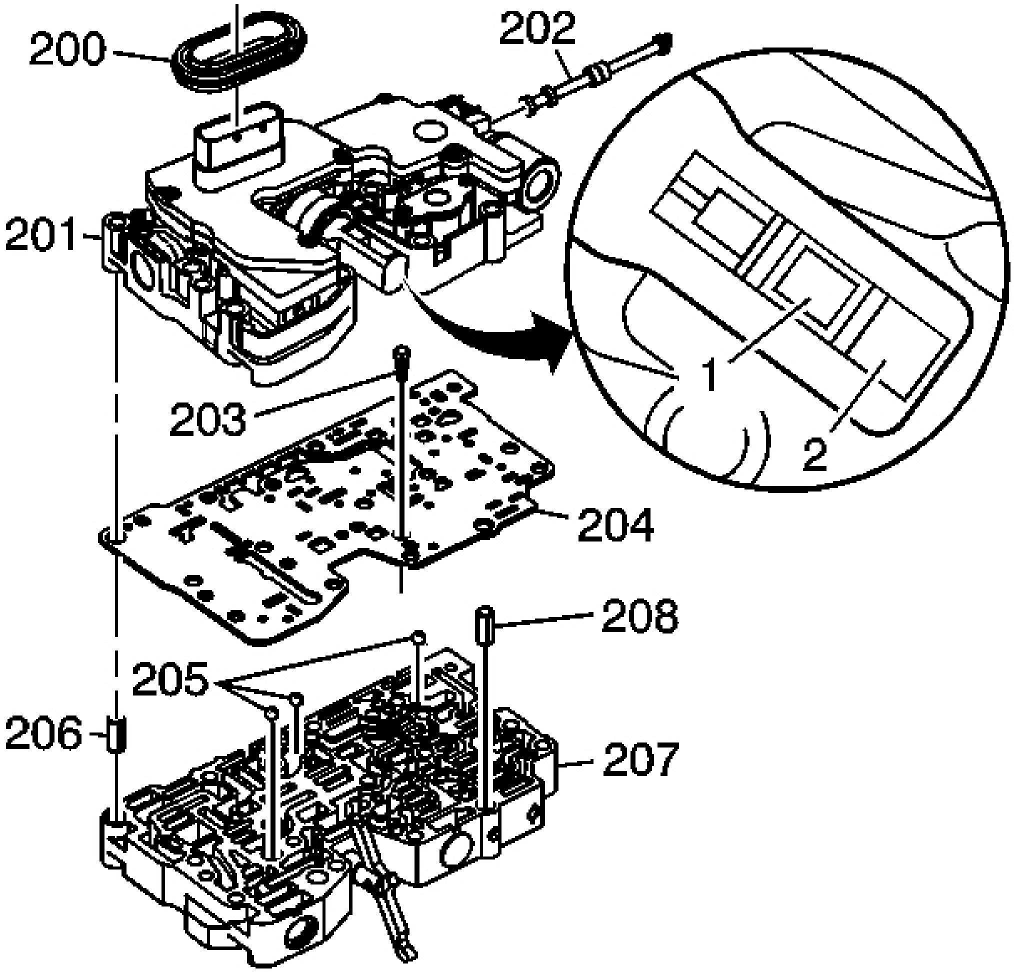


Fig. 416: Control Solenoid Valve Body Cover & Components
Courtesy of GENERAL MOTORS CORP.

1. Remove the manual valve (202) from the control solenoid valve assembly.
2. Remove the wiring connector hole seal (200) for the control valve body cover.
3. Carefully separate the control solenoid valve assembly (201) from the valve body assembly (207).
4. Remove the spacer plate assembly (204). Discard the spacer plate assembly.
5. Remove the fluid pump pressure screen assembly (203) from the spacer plate assembly.
6. Remove the 3 ball check valves (205) from the valve body assembly (207).

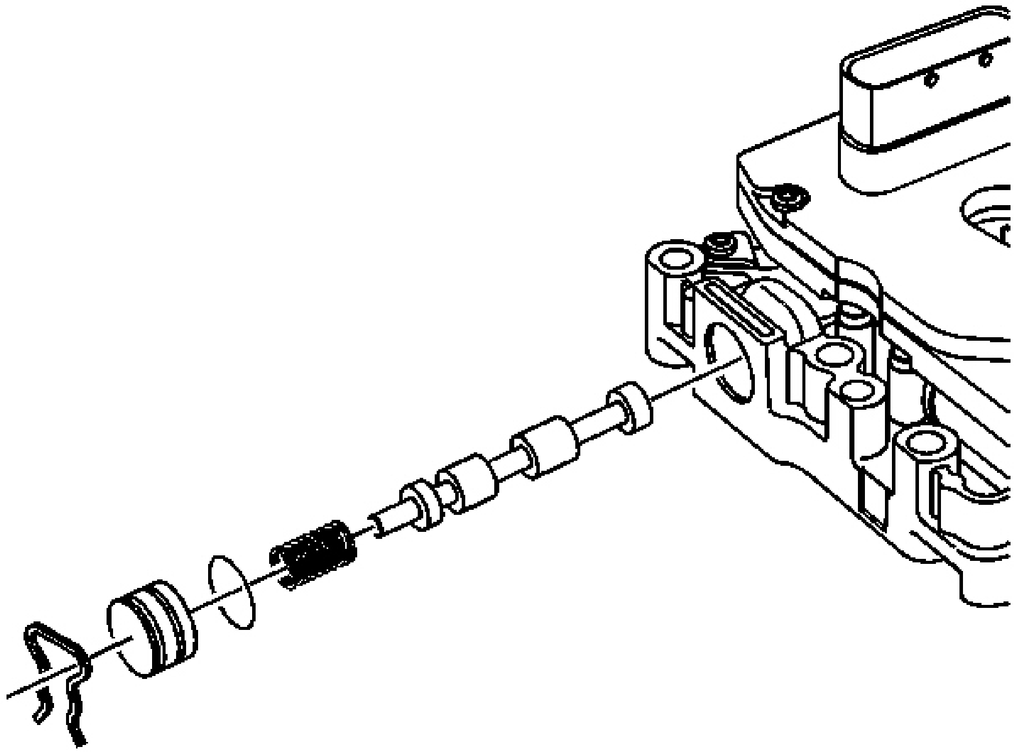


Fig. 417: Bore Plug, O-Ring Seal & 2 Pressure Regulator Valve
Courtesy of GENERAL MOTORS CORP.

CAUTION: Some valves are under pressure. Cover the bores while removing the retainers and plugs or personal injury could result.

7. Remove the bore plug retainer for the line 2 pressure regulator valve.
8. Remove the bore plug for the line 2 pressure regulator valve.
9. Remove the bore plug - O-ring - seal for the line 2 pressure regulator valve. Discard the seal.
10. Remove the line 2 pressure regulator valve spring.
11. Remove the line 2 pressure regulator valve.

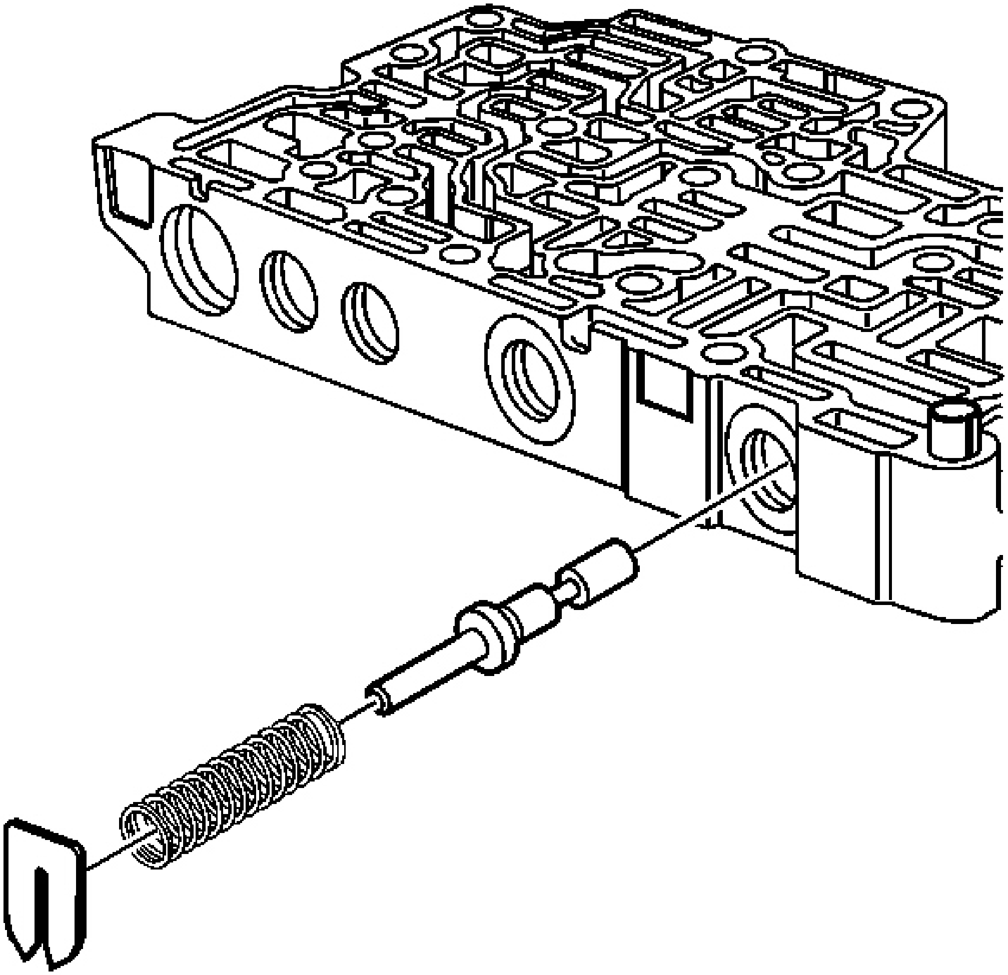


Fig. 418: Spring Seat & Primary Limit Valve
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Position the control valve body assembly on a clean surface during disassembly.

12. Remove the spring seat for the primary limit valve.
13. Remove the primary limit valve spring.
14. Remove the primary limit valve.

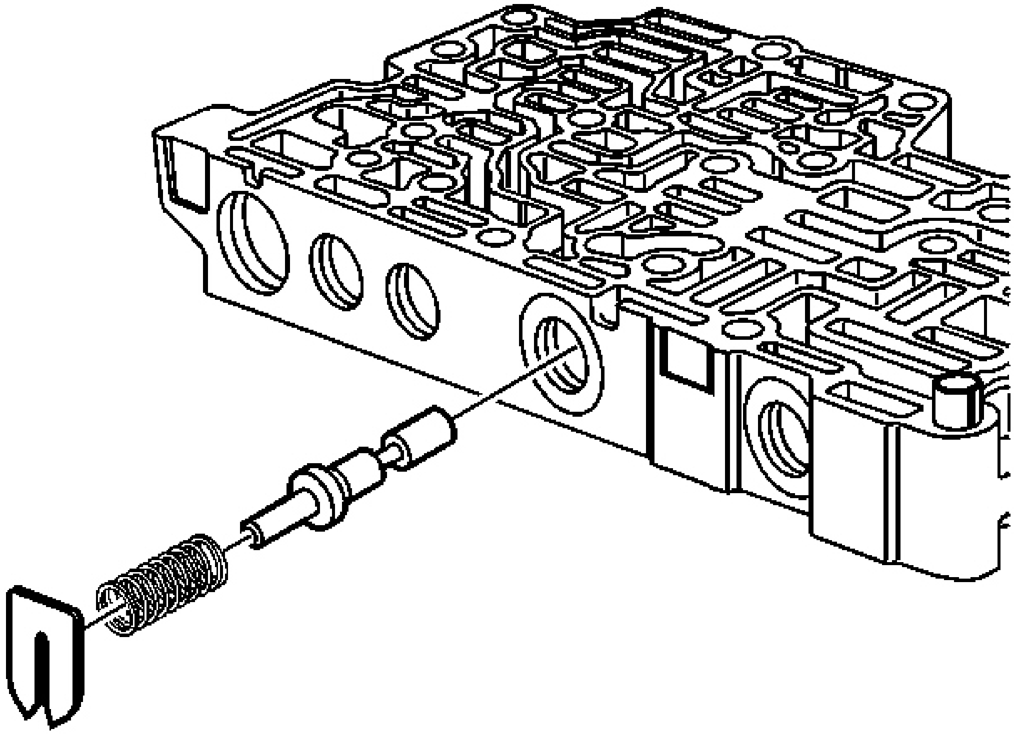


Fig. 419: Spring Seat & Actuator Feed Limit Valve
Courtesy of GENERAL MOTORS CORP.

15. Remove the spring seat for the actuator feed limit valve.
16. Remove the spring for the actuator feed limit valve.
17. Remove the actuator feed limit valve.

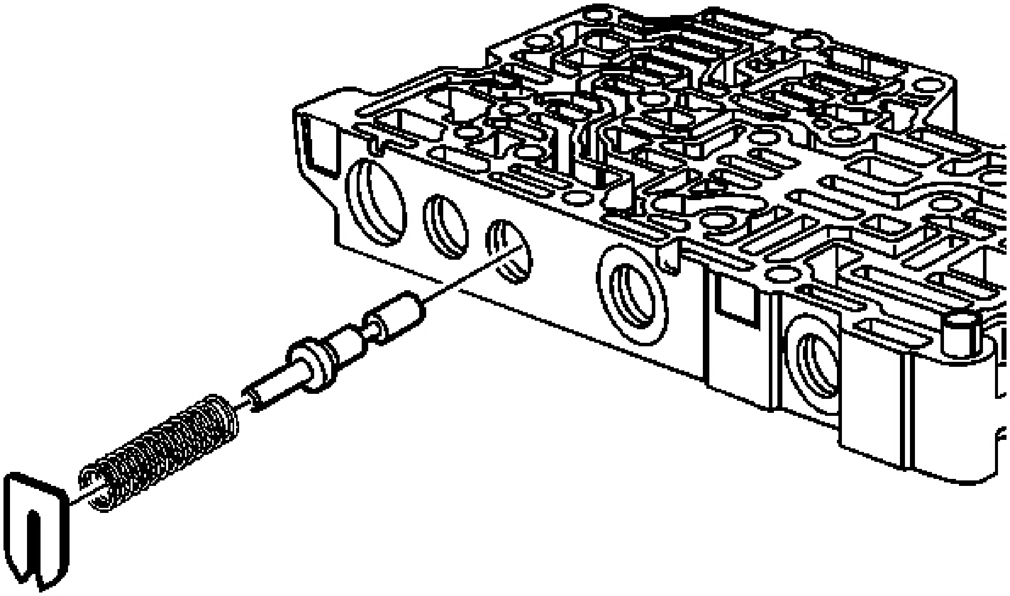


Fig. 420: Spring Seat & Line Limit Valve
Courtesy of GENERAL MOTORS CORP.

18. Remove the spring seat for the line limit valve.
19. Remove the line limit valve spring.
20. Remove the line limit valve.

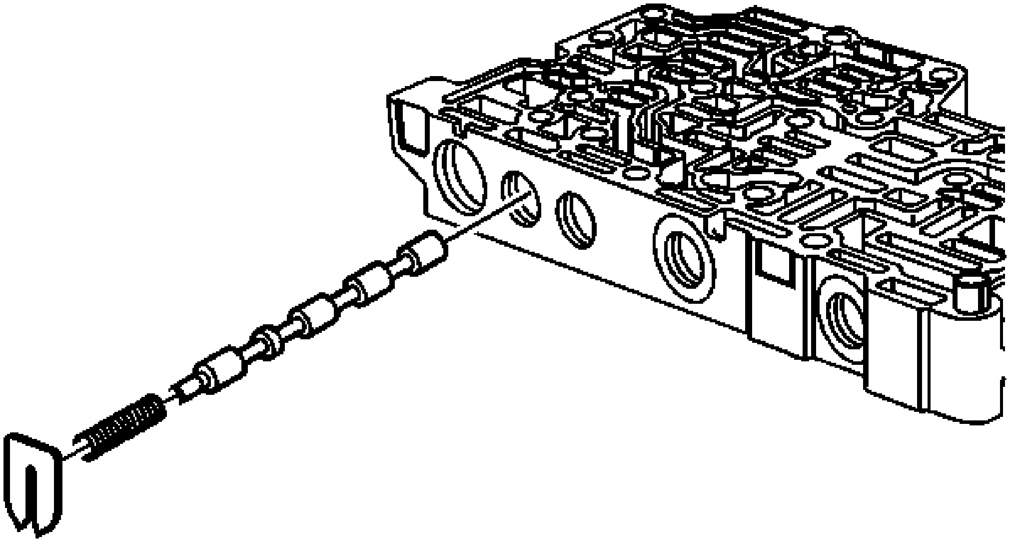


Fig. 421: Spring Seat & TCC Control Valve
Courtesy of GENERAL MOTORS CORP.

21. Remove the spring seat for the TCC control valve.
22. Remove the TCC control valve spring.
23. Remove the TCC control valve.

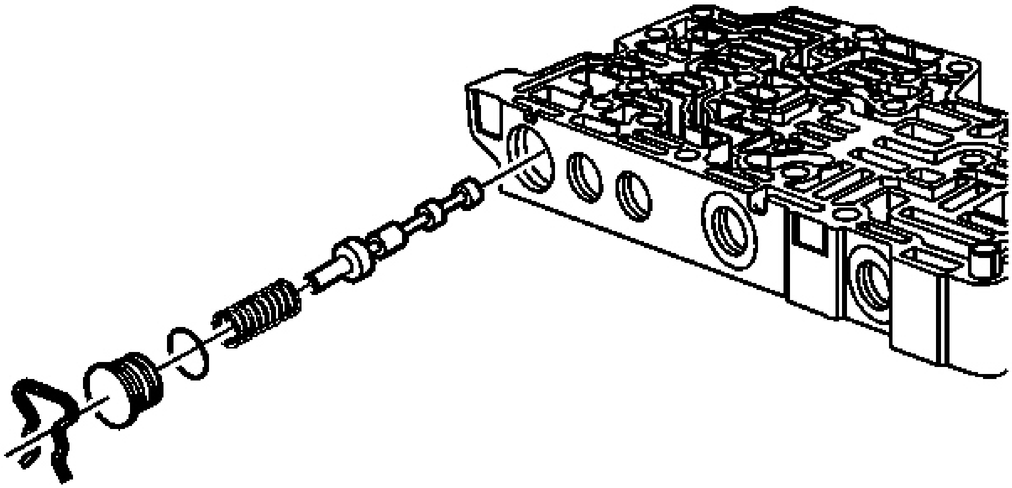


Fig. 422: Bore Plug, O-Ring Seal, Forward & Reverse Clutch Valve
Courtesy of GENERAL MOTORS CORP.

24. Remove the bore plug retainer for the forward and reverse clutch valve.
25. Remove the bore plug for the forward and reverse clutch valve.
26. Remove the bore plug - O-ring - seal for the forward and reverse clutch valve. Discard the seal.
27. Remove the spring for the forward and reverse clutch valve.
28. Remove the forward and reverse clutch valve.

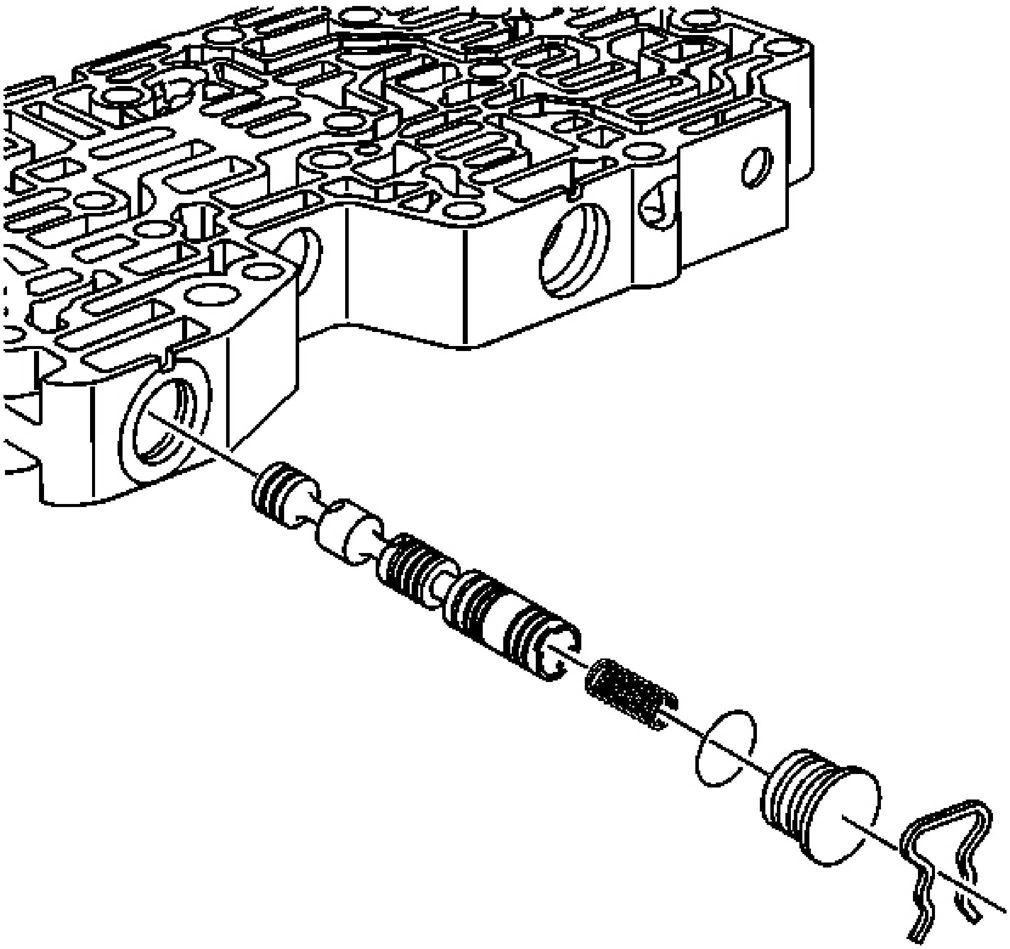


Fig. 423: Bore Plug, O-Ring Seal & Line 1 Pressure Regulator Valve
Courtesy of GENERAL MOTORS CORP.

29. Remove the bore plug retainer for the line 1 pressure regulator valve.
30. Remove the bore plug for the line 1 pressure regulator valve.
31. Remove the bore plug - O-ring - seal for the line 1 pressure regulator valve. Discard the seal.
32. Remove the line 1 pressure regulator valve spring.
33. Remove the line 1 pressure regulator valve.

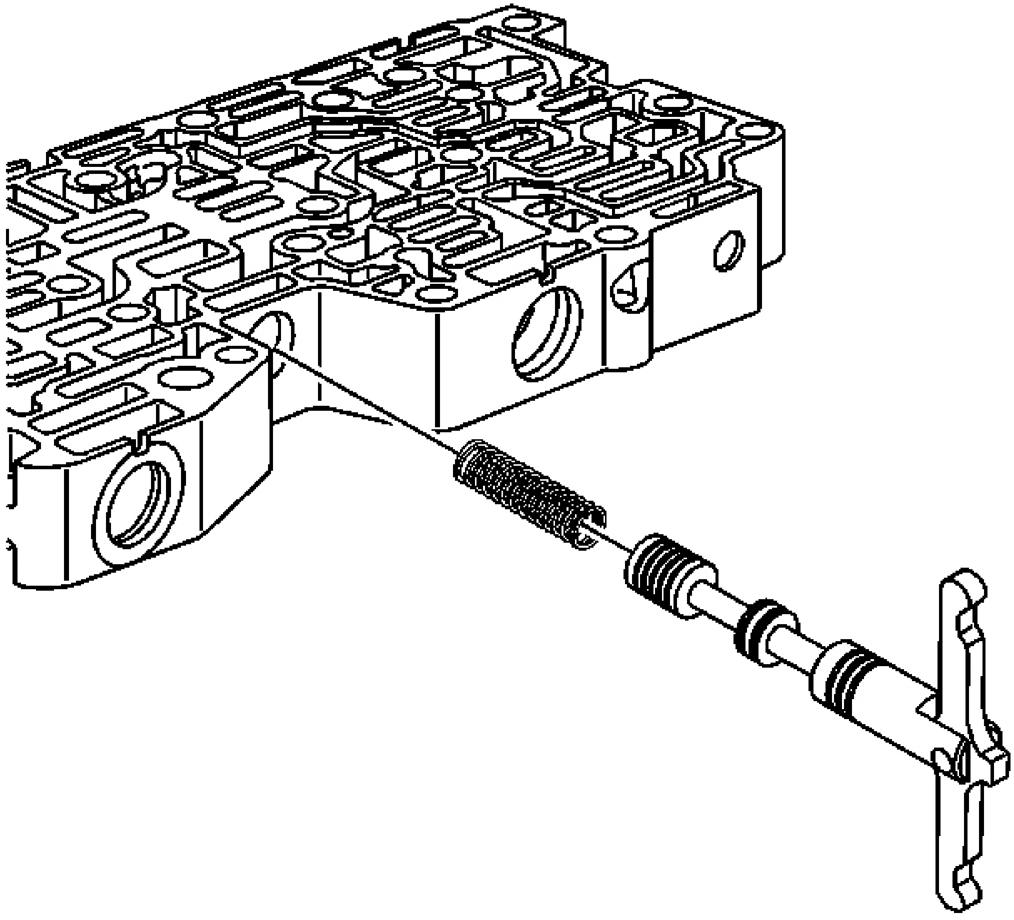


Fig. 424: Variable Ratio Control Valve Lever Assembly
Courtesy of GENERAL MOTORS CORP.

34. Remove the variable ratio control valve lever assembly.
35. Remove the spring for the variable ratio control valve.

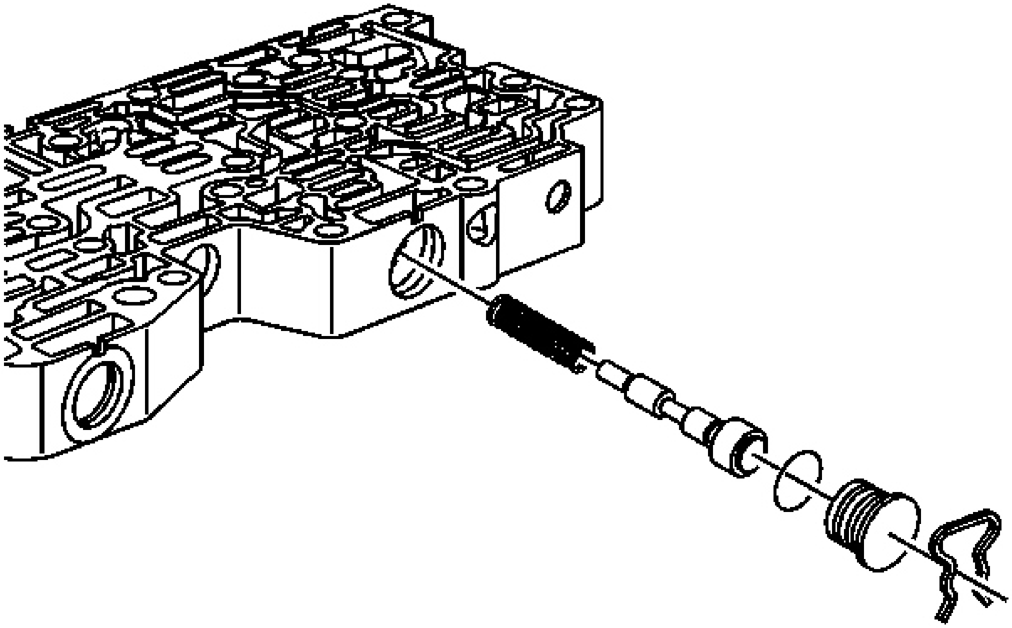


Fig. 425: Bore Plug, O-Ring Seal & TCC Regulator Valve
Courtesy of GENERAL MOTORS CORP.

36. Remove the bore plug retainer for the TCC regulator valve.
37. Remove the bore plug for the TCC regulator valve.
38. Remove the bore plug - O-ring - seal for the TCC regulator valve. Discard the seal.
39. Remove the TCC regulator valve.
40. Remove the spring for the TCC regulator apply valve.

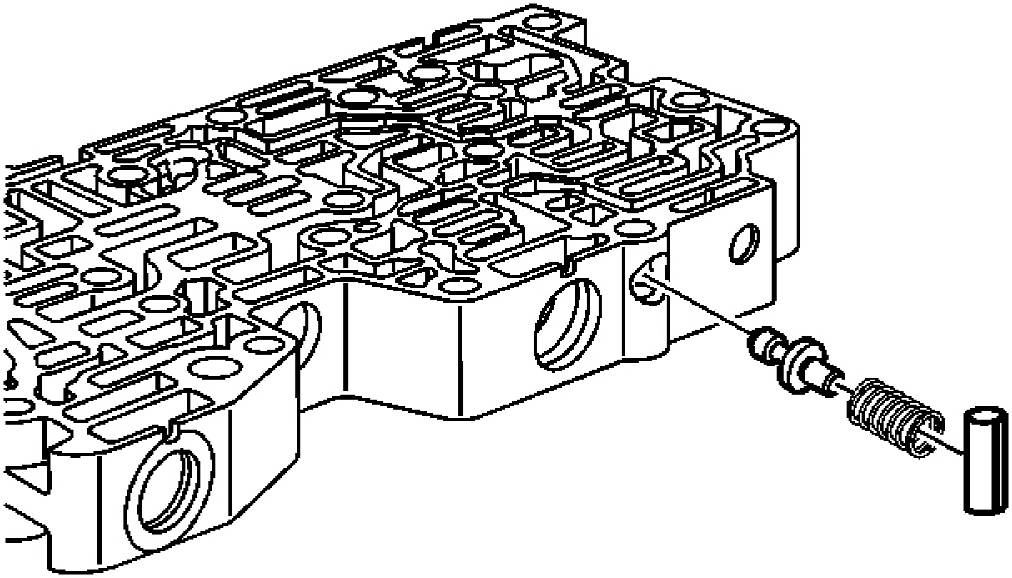


Fig. 426: Control Solenoid Valve Locator Pin & Clutch Boost Valve Spring
Courtesy of GENERAL MOTORS CORP.

41. Remove the control solenoid valve locator pin.
42. Remove the clutch boost valve spring.
43. Remove the clutch boost valve.

CONTROL VALVE BODY ASSEMBLY ASSEMBLE

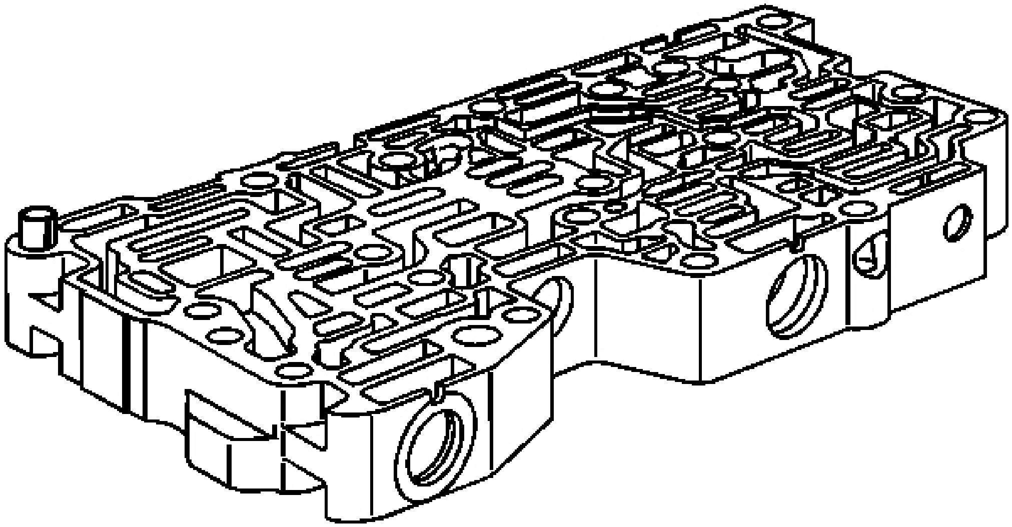


Fig. 427: Control Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Dirty solvent can deposit sediment that could damage the transmission.

1. Using clean solvent, thoroughly clean the control valve body assembly, valves, springs, and all other components.
2. Using compressed air, dry all components.
3. Inspect the valve body casting for the following conditions:
    - Porosity
    - Cracks
    - Damaged machined surfaces
    - Chips or debris
    - Interconnected passages
    - Damaged sealing surfaces
4. During assembly, inspect the control valve body components for the following:
    - Worn or damaged valves
    - Broken, missing or damaged springs
    - Damaged bore plugs, spring seats or retainers

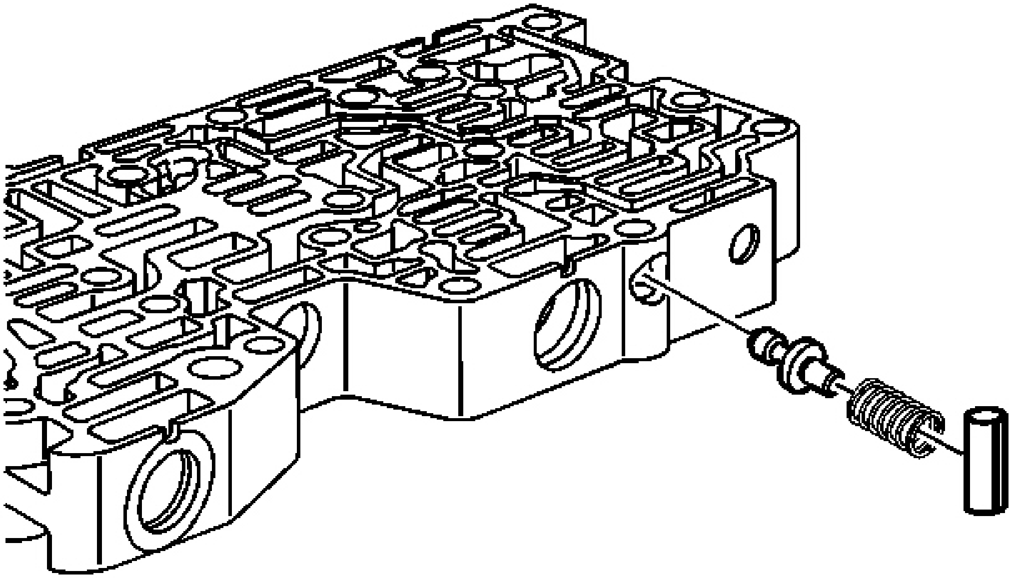


Fig. 428: Control Solenoid Valve Locator Pin & Clutch Boost Valve Spring
Courtesy of GENERAL MOTORS CORP.

5. Inspect the control solenoid valve locator pin in the control valve body assembly for damage. Replace the pin if necessary.
6. Install the clutch boost valve into the control valve body assembly.
7. Install the clutch boost valve spring.
8. Install the control solenoid valve locator pin.

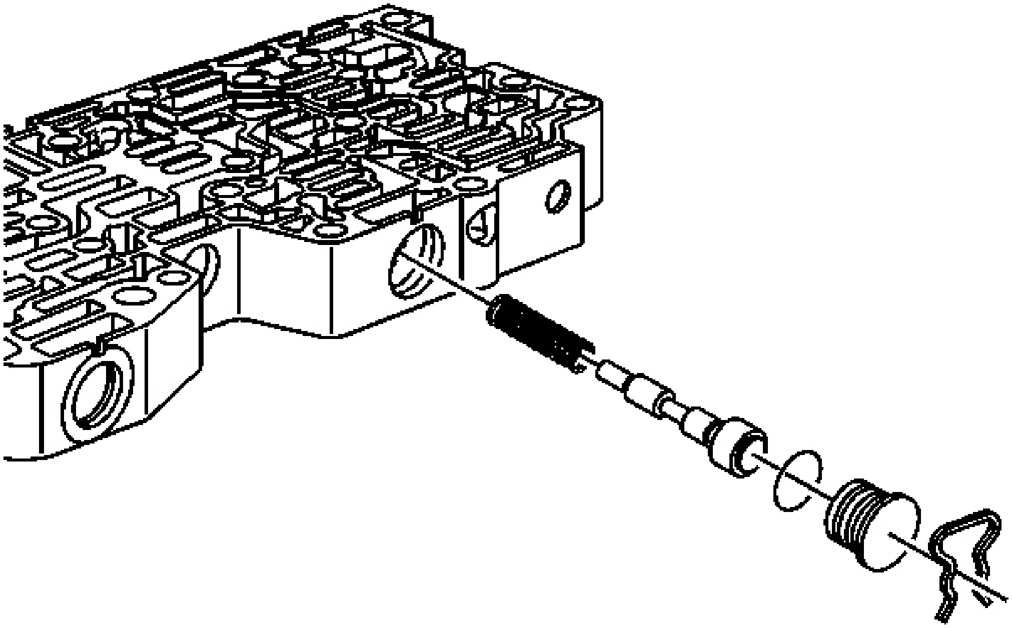


Fig. 429: Bore Plug, O-Ring Seal & TCC Regulator Valve
Courtesy of GENERAL MOTORS CORP.

9. Install the spring for the TCC regulator apply valve.
10. Install the TCC regulator valve.
11. Install a NEW bore plug - O-ring - seal on the bore plug for the TCC regulator valve.
12. Install the bore plug for the TCC regulator valve.
13. Install the bore plug retainer for the TCC regulator valve.

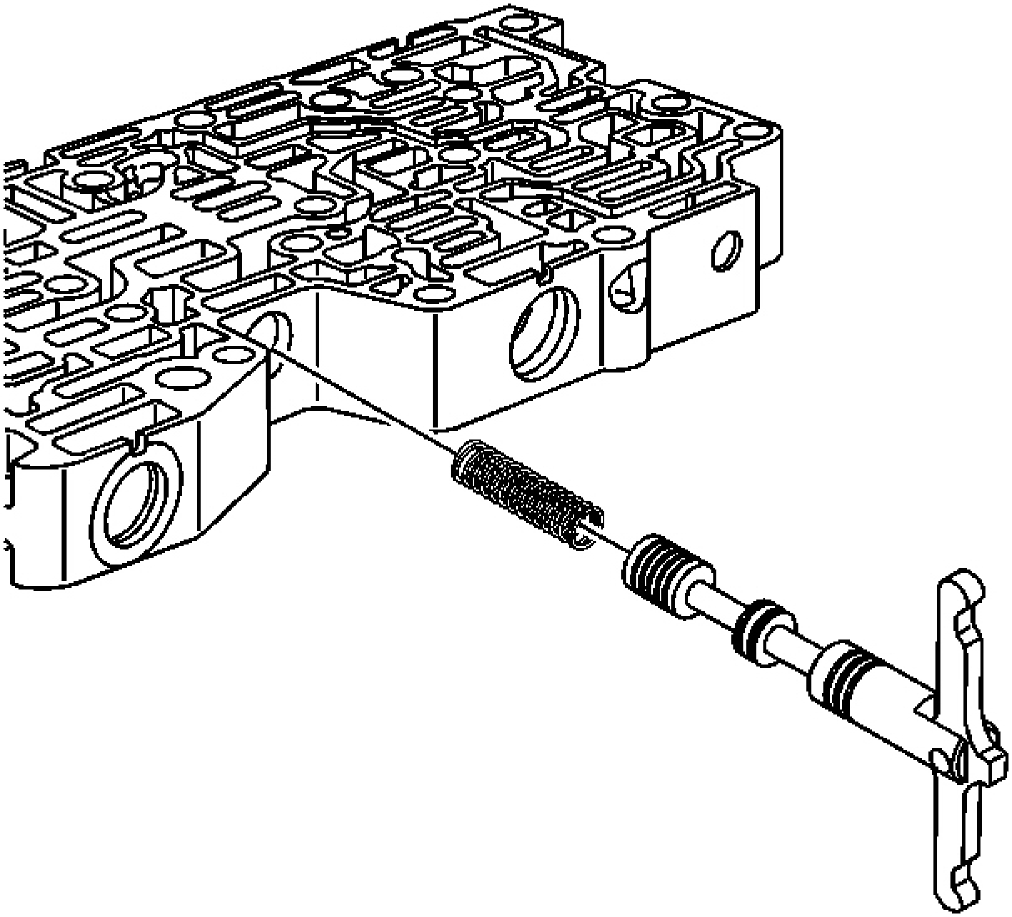


Fig. 430: Variable Ratio Control Valve Lever Assembly
Courtesy of GENERAL MOTORS CORP.

14. Install the spring for the variable ratio control valve.
15. Install the variable ratio control valve lever assembly.

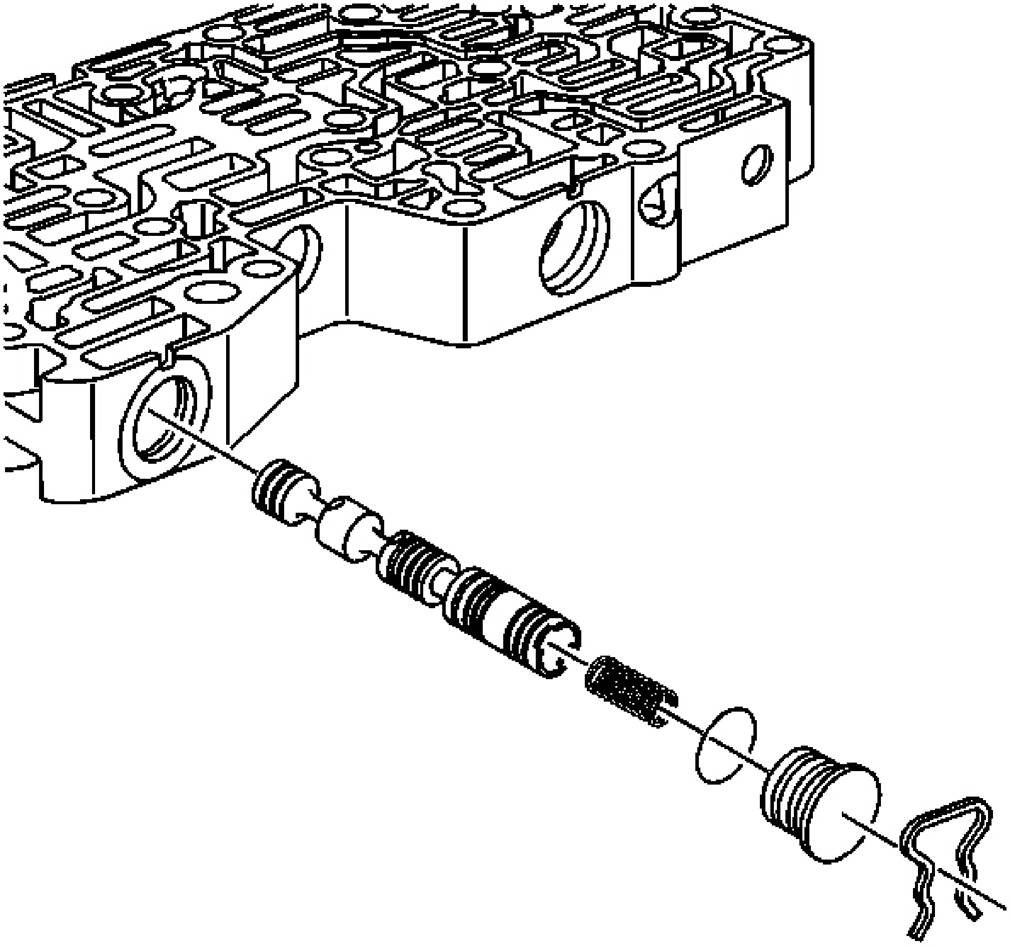


Fig. 431: Bore Plug, O-Ring Seal & Line 1 Pressure Regulator Valve
Courtesy of GENERAL MOTORS CORP.

16. Install the line 1 pressure regulator valve.
17. Install the line 1 pressure regulator valve spring.
18. Install a NEW bore plug - O-ring - seal on the bore plug for the line 1 pressure regulator valve.
19. Install the bore plug for the line 1 pressure regulator valve.
20. Install the bore plug retainer for the line 1 pressure regulator valve.

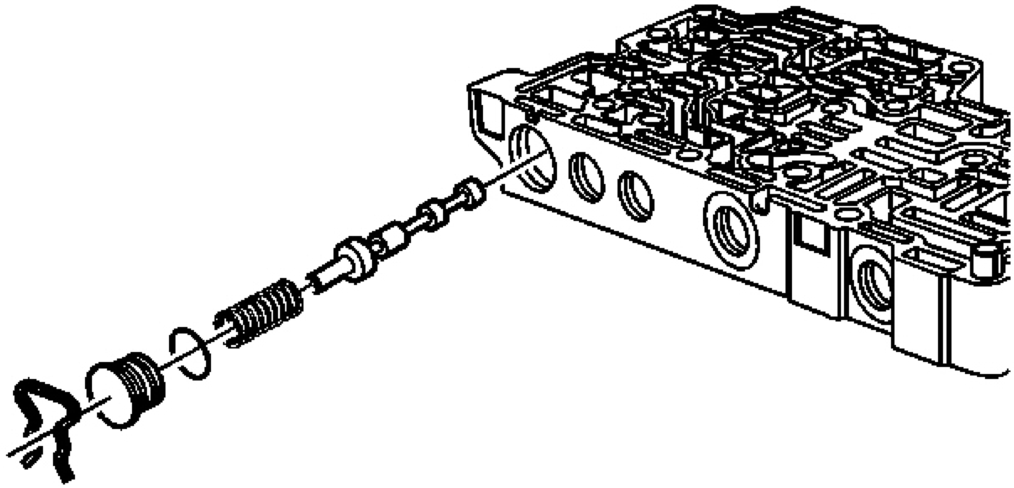


Fig. 432: Bore Plug, O-Ring Seal, Forward & Reverse Clutch Valve
Courtesy of GENERAL MOTORS CORP.

21. Install the forward and reverse clutch valve.
22. Install the spring for the forward and reverse clutch valve.
23. Install a NEW bore plug - O-ring - seal on the bore plug for the forward and reverse clutch valve.
24. Install the bore plug for the forward and reverse clutch valve.
25. Install the bore plug retainer for the forward and reverse clutch valve.

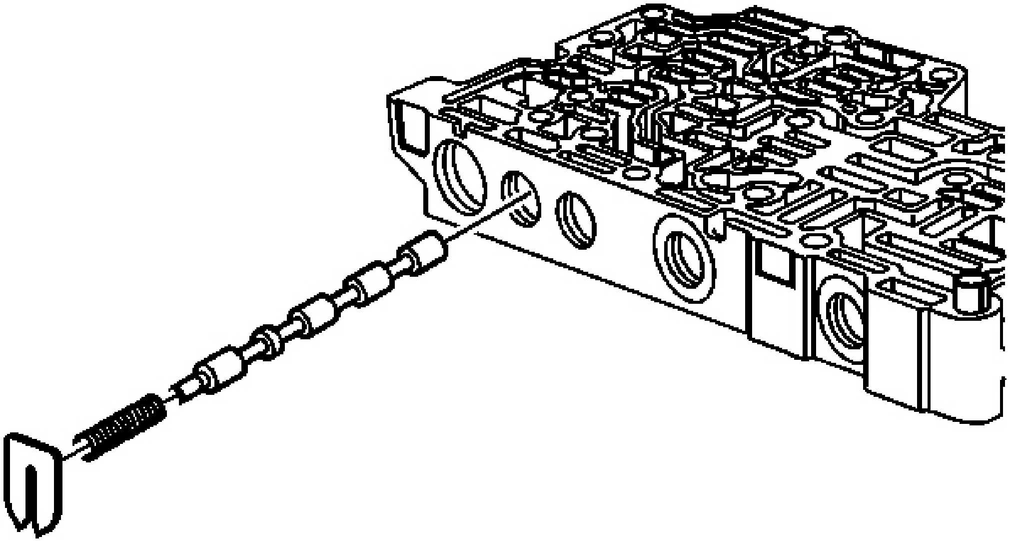


Fig. 433: Spring Seat & TCC Control Valve
Courtesy of GENERAL MOTORS CORP.

26. Install the TCC control valve.
27. Install the TCC control valve spring.
28. Install the spring seat for the TCC control valve.

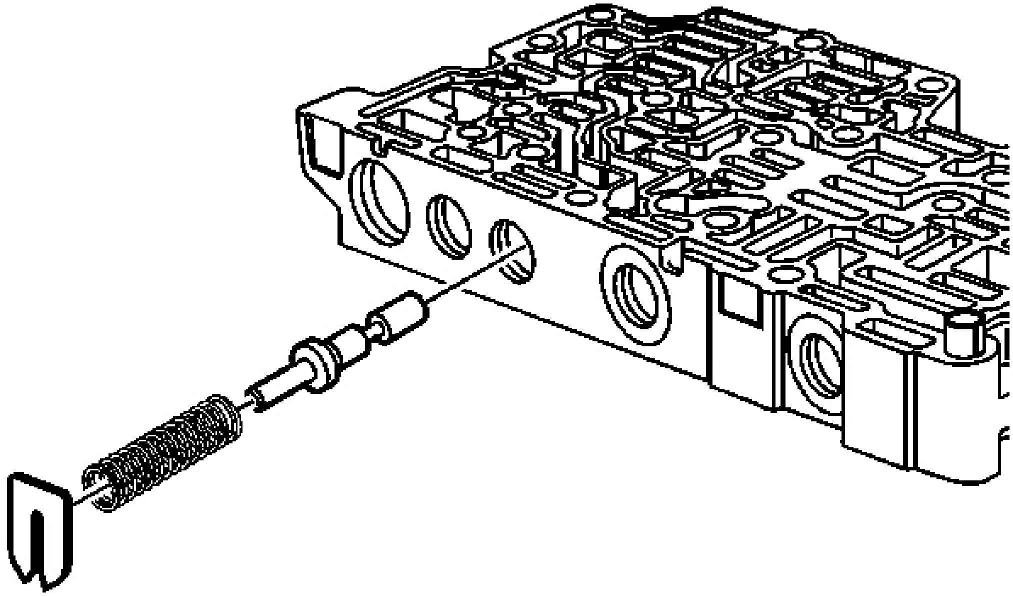


Fig. 434: Spring Seat & Line Limit Valve
Courtesy of GENERAL MOTORS CORP.

29. Install the line limit valve.
30. Install the line limit valve spring.
31. Install the spring seat for the line limit valve.

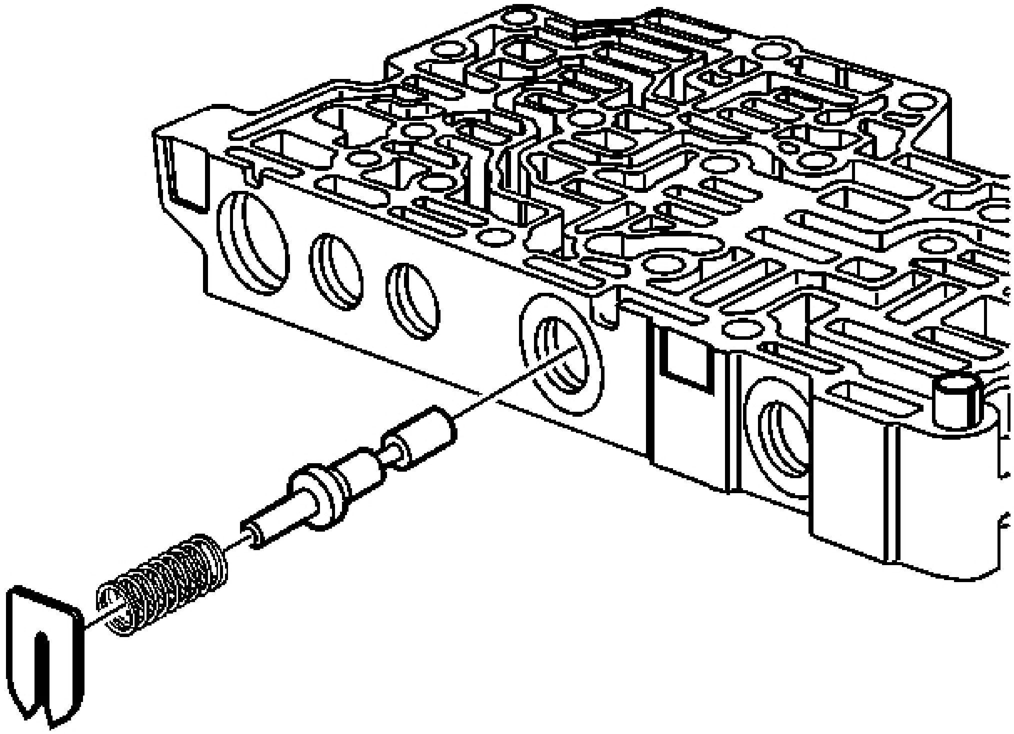


Fig. 435: Spring Seat & Actuator Feed Limit Valve
Courtesy of GENERAL MOTORS CORP.

32. Install the actuator feed limit valve.
33. Install the spring for the actuator feed limit valve.
34. Install the spring seat for the actuator feed limit valve.

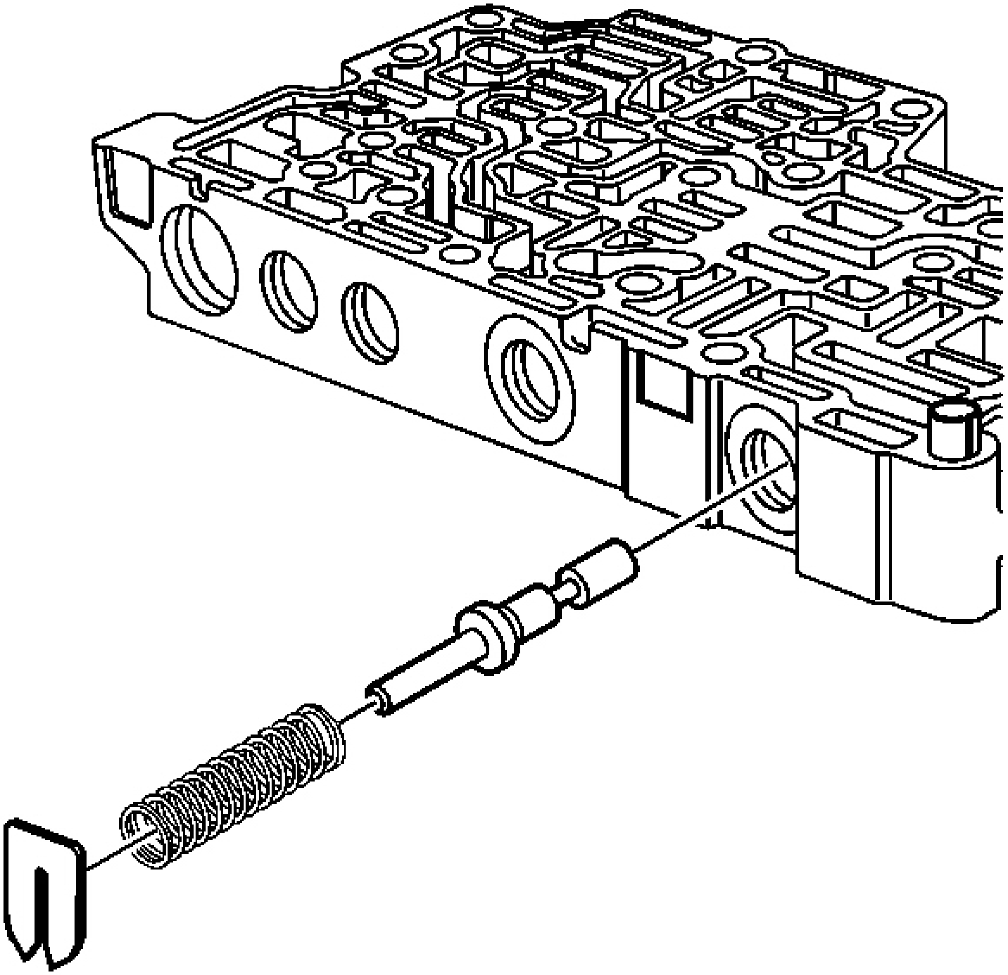


Fig. 436: Spring Seat & Primary Limit Valve
Courtesy of GENERAL MOTORS CORP.

35. Install the primary limit valve.
36. Install the primary limit valve spring.
37. Install the spring seat for the primary limit valve.

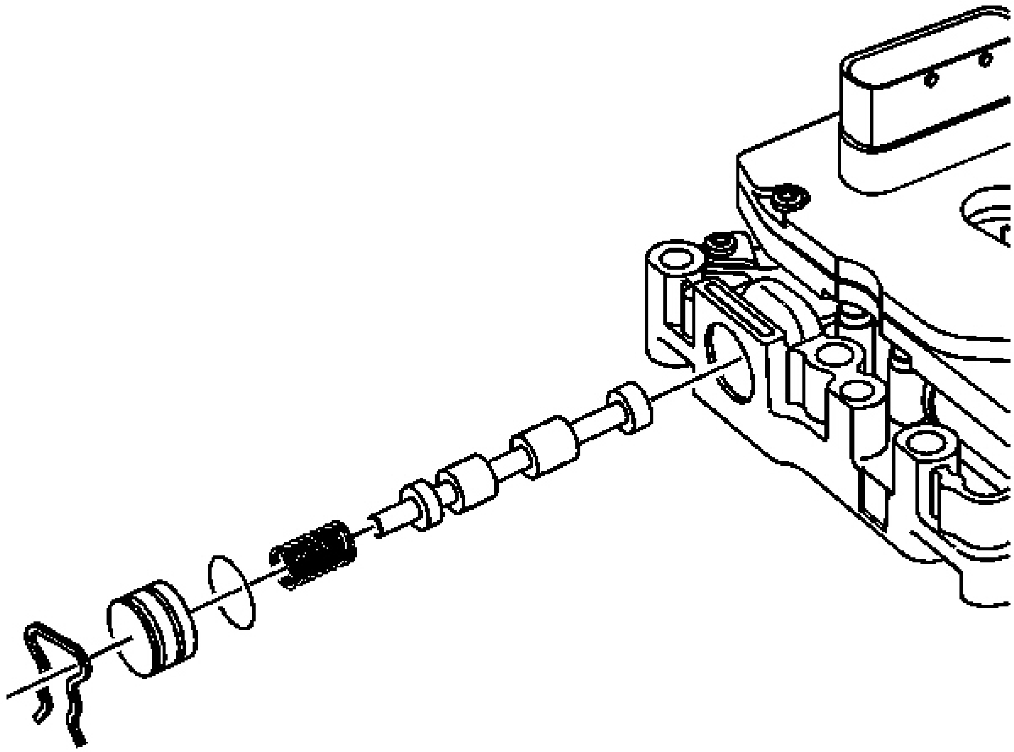


Fig. 437: Bore Plug, O-Ring Seal & 2 Pressure Regulator Valve
Courtesy of GENERAL MOTORS CORP.

38. Install the line 2 pressure regulator valve.
39. Install the line 2 pressure regulator valve spring.
40. Install a NEW bore plug - O-ring - seal on the bore plug for the line 2 pressure regulator valve.
41. Install the bore plug for the line 2 pressure regulator valve.
42. Install the bore plug retainer for the line 2 pressure regulator valve.

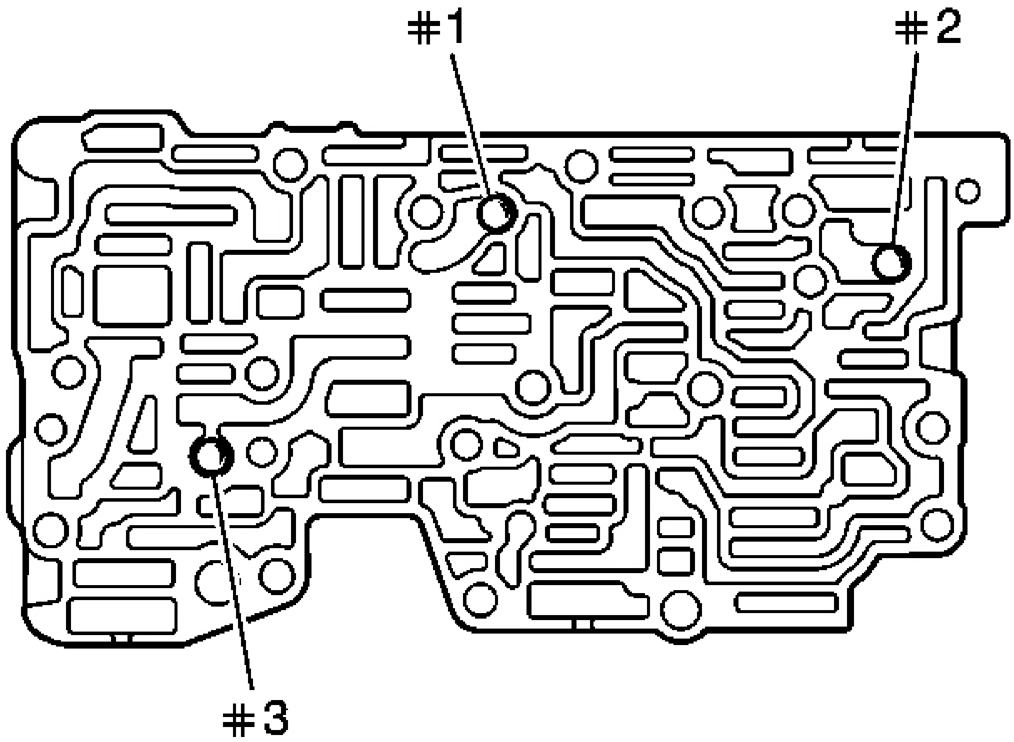


Fig. 438: Installing Ball Check Valves Into Valve Body
Courtesy of GENERAL MOTORS CORP.

43. Install the 3 ball check valves into the valve body assembly.

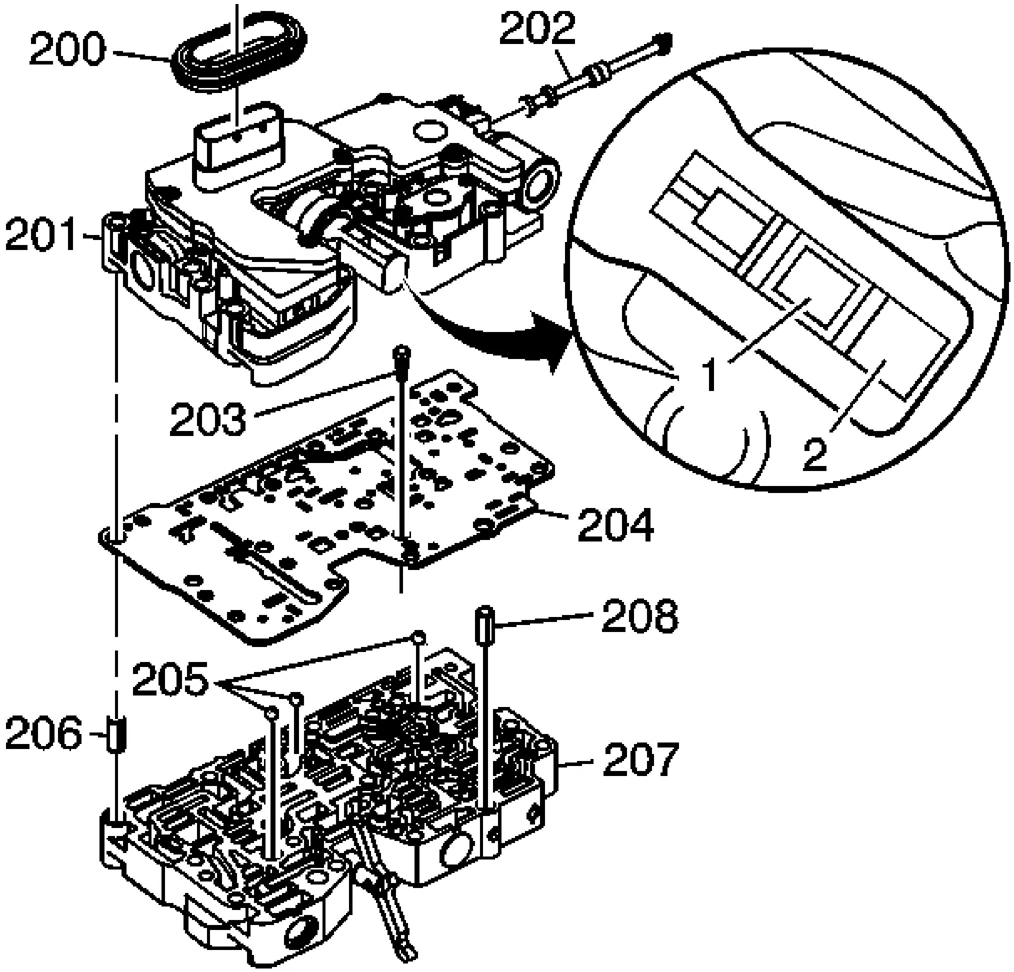


Fig. 439: Control Solenoid Valve Body Cover & Components
Courtesy of GENERAL MOTORS CORP.

44. Install a NEW fluid pump pressure screen assembly (203) on the spacer plate assembly.
45. Install a NEW spacer plate assembly (204).

IMPORTANT: Note the orientation of the variable ratio control valve lever assembly into the ratio control motor.

- **1 - correct location**
- **2 - incorrect location**

46. Install the control solenoid valve assembly (201) on the valve body assembly (207).
47. Install the wiring connector hole seal (200) for the control valve body cover.
48. Install the manual valve (202) in the control solenoid valve assembly.

INPUT AND OUTPUT SPEED SENSOR ASSEMBLY INSTALLATION

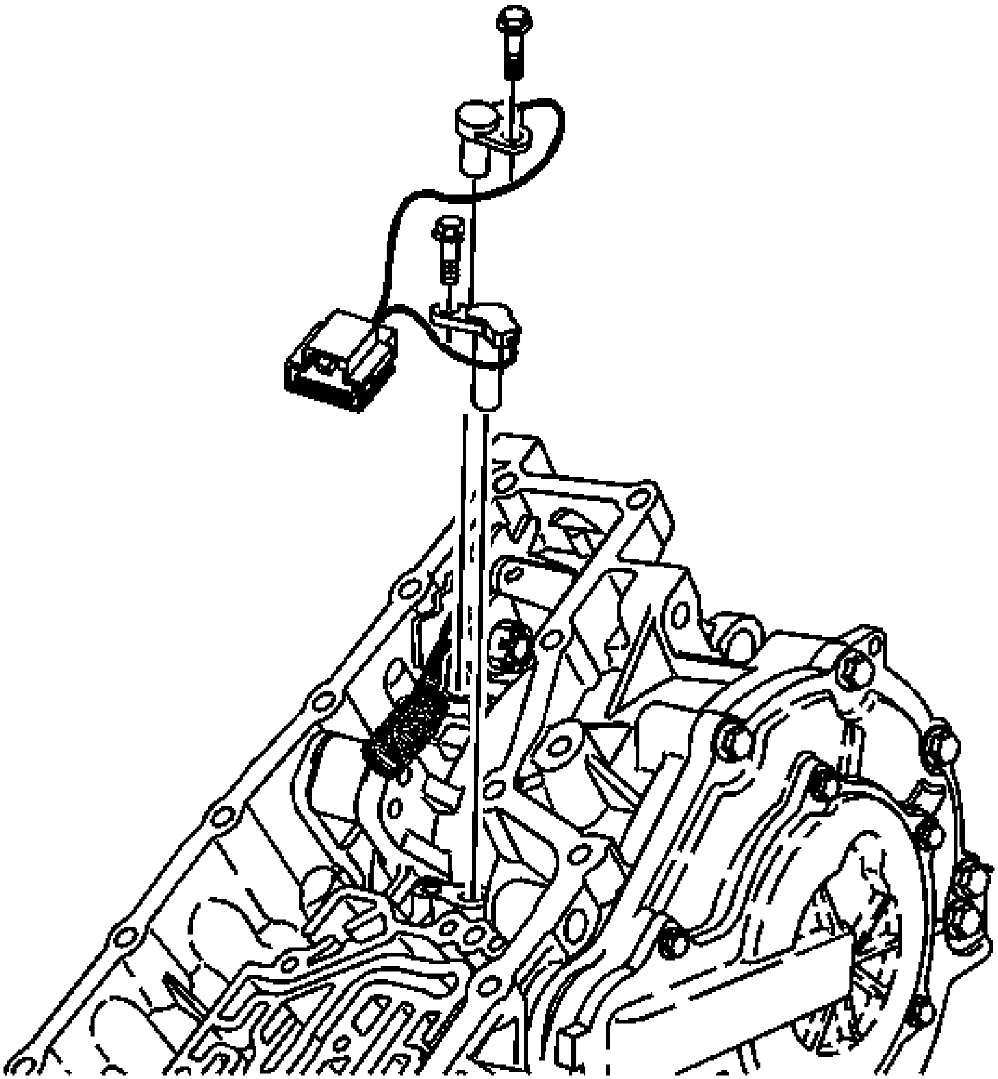


Fig. 440: Transmission Case, Bolts, Input & Output Speed Sensor
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

Install the input and output speed sensor assembly and the 2 bolts on the transmission case assembly.

Tighten: Tighten the bolts to 11 N.m (8 lb ft).

CONTROL VALVE BODY ASSEMBLY INSTALLATION

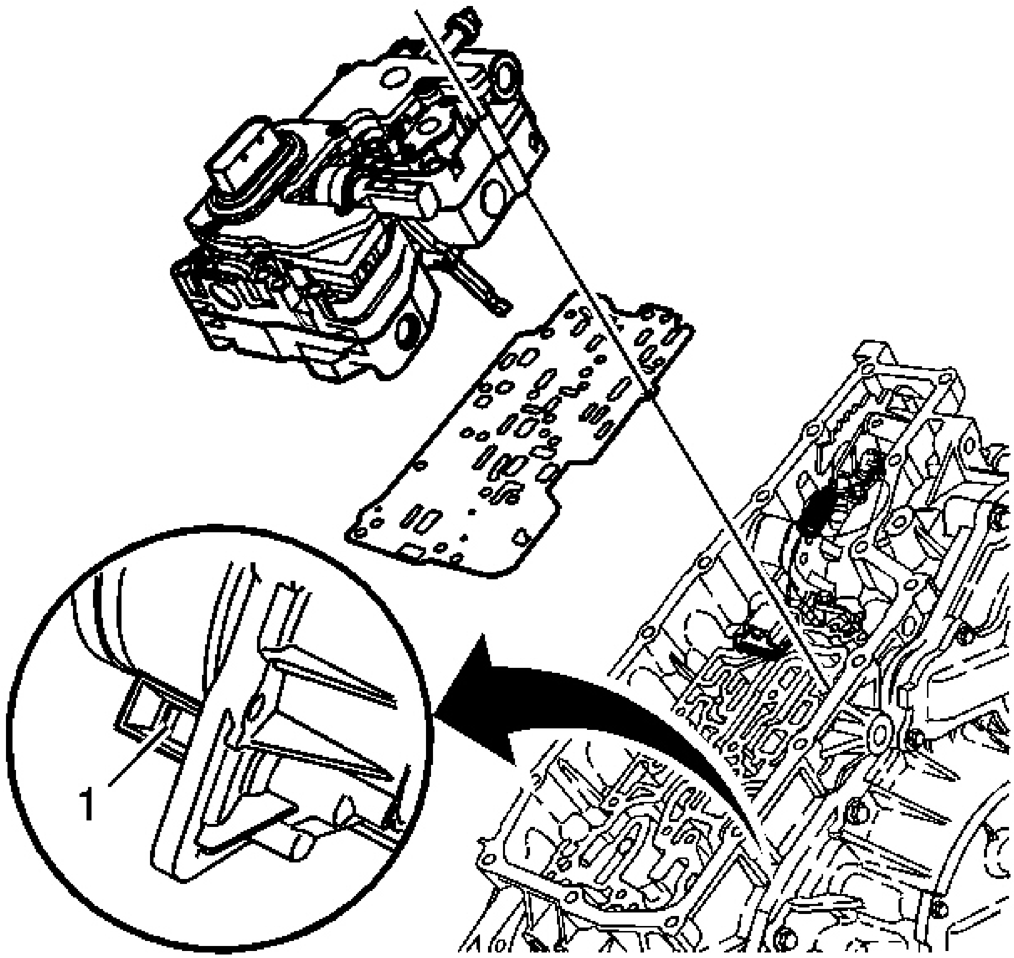


Fig. 441: Spacer Plate, Control Valve Body & Case Cover
Courtesy of GENERAL MOTORS CORP.

NOTE: **The case cover assembly must be installed before installing the control valve body assembly. Failure to follow this instruction may result in**

damage to the variable ratio control lever.

1. Install a NEW spacer plate assembly on the transmission case assembly.
2. Install the control valve body assembly on the transmission case assembly. Ensure that the free end of the variable ratio control lever is properly positioned in the variable drive pulley follower - location 1, which is located on the case cover assembly.

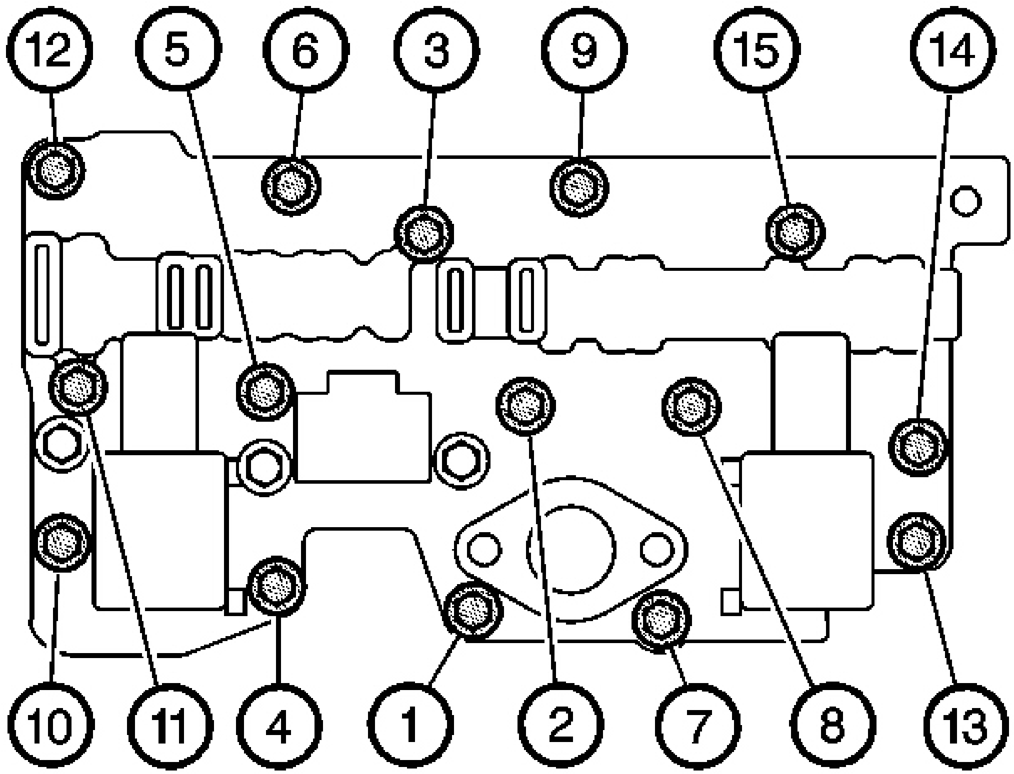


Fig. 442: Transmission Case Assembly Black Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

3. Secure the control valve body assembly to the transmission case assembly with the 15 black bolts.

   Tighten: Tighten the 15 black bolts in three separate steps in the sequence shown.

   1. Tighten to 5 N.m (4 lb ft)
   2. Tighten to 10 N.m (7 lb ft)
   3. Tighten to 15 N.m (11 lb ft)

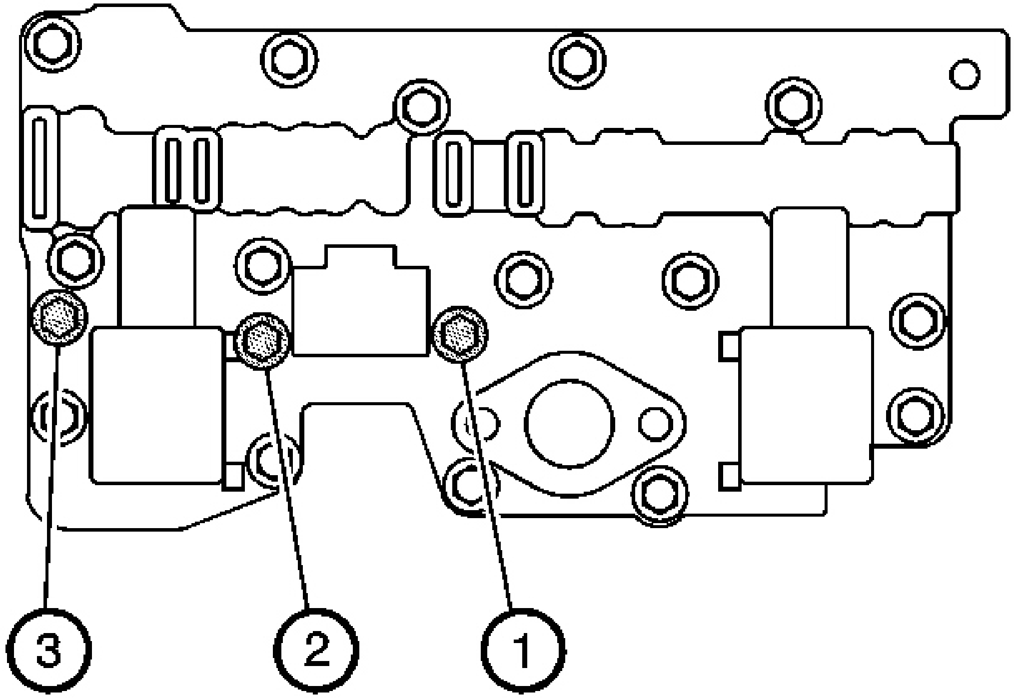


Fig. 443: Transmission Case Assembly Tightening Silver Bolts Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Secure the control valve body assembly to the transmission case assembly with the 3 silver bolts.

   Tighten: Tighten the 3 silver bolts to 8 N.m (6 lb ft) in the sequence shown.

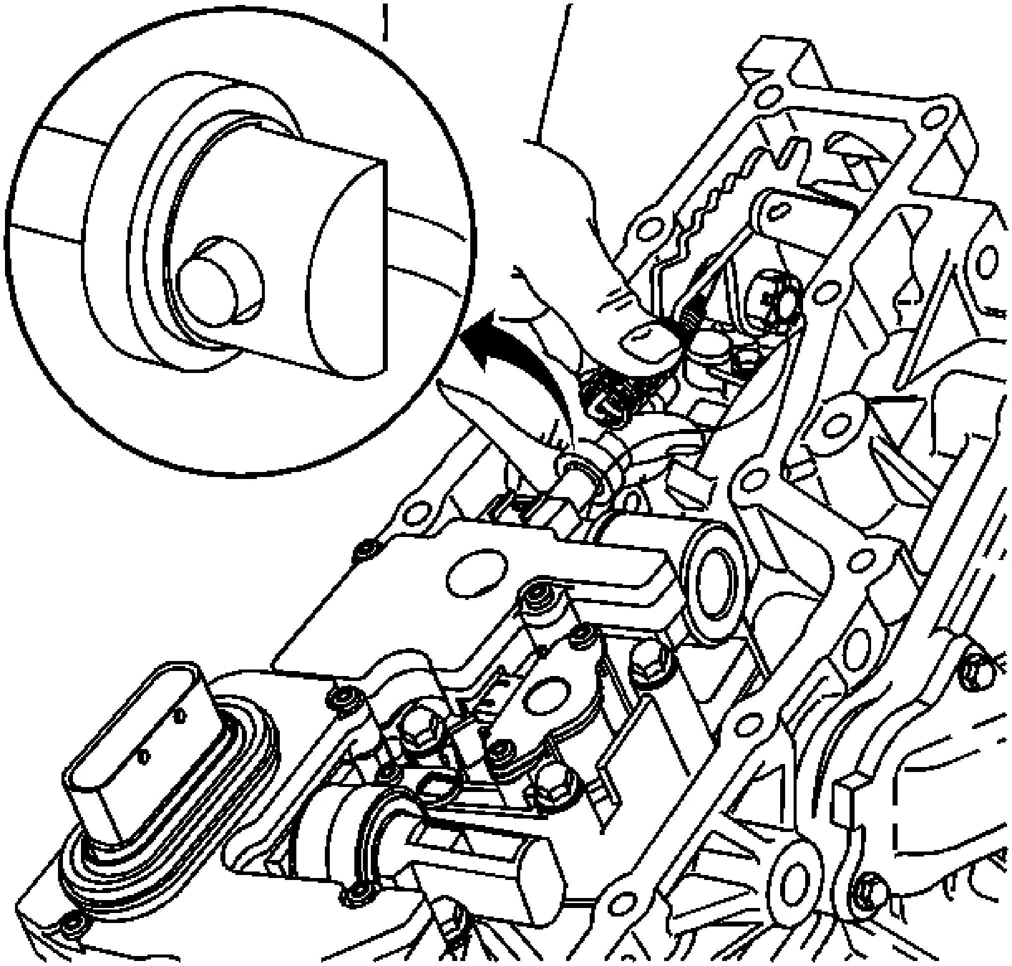


Fig. 444: Manual Valve Link
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Note the orientation of the manual valve before connecting the manual valve link assembly.

5. Connect the manual valve link assembly to the manual valve.

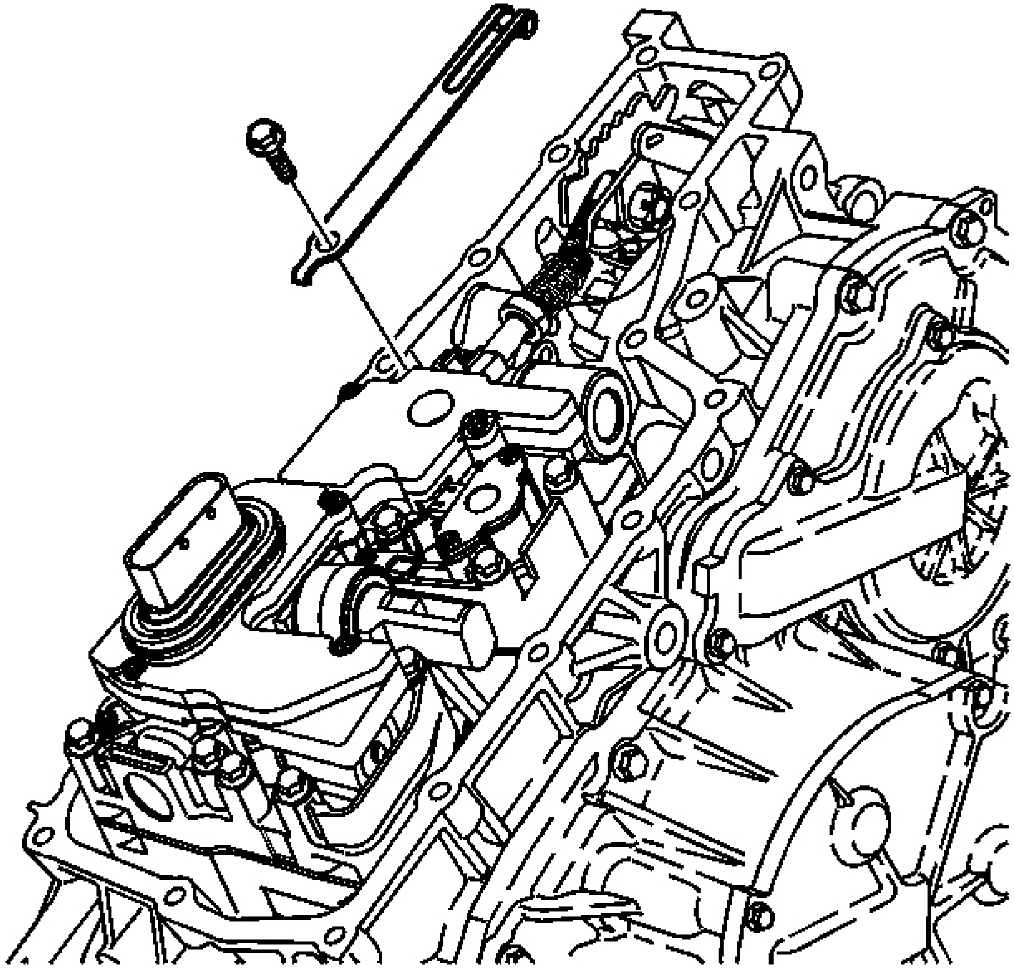


Fig. 445: Manual Shaft Detent & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the manual shaft detent assembly and bolt on the control valve body assembly.

   Tighten: Tighten the bolt to 11 N.m (8 lb ft).

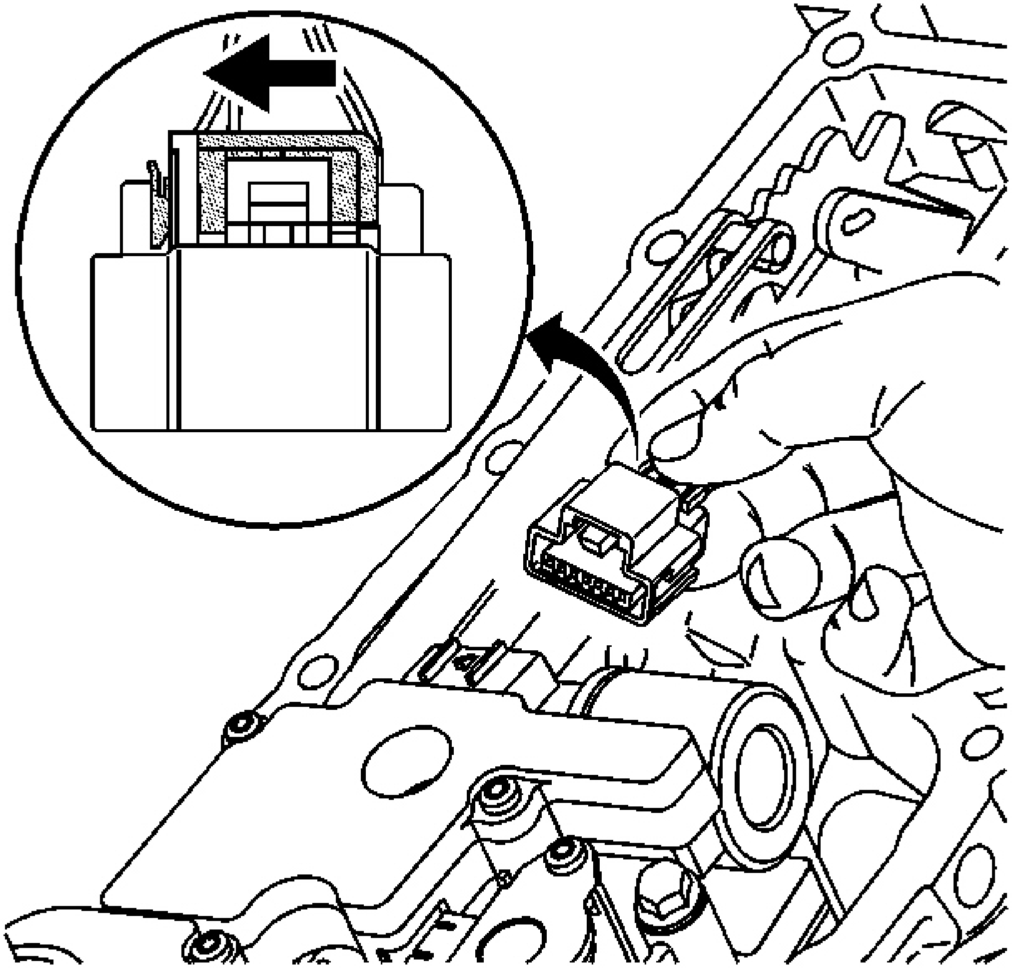


Fig. 446: Connecting The Connector For Input & Output Speed Sensor
Courtesy of GENERAL MOTORS CORP.

7. Connect the connector for the input and output speed sensor assembly to the control valve body assembly.
8. Slide the grey locking clip in order to lock the connector in place.

CONTROL VALVE BODY COVER INSTALLATION

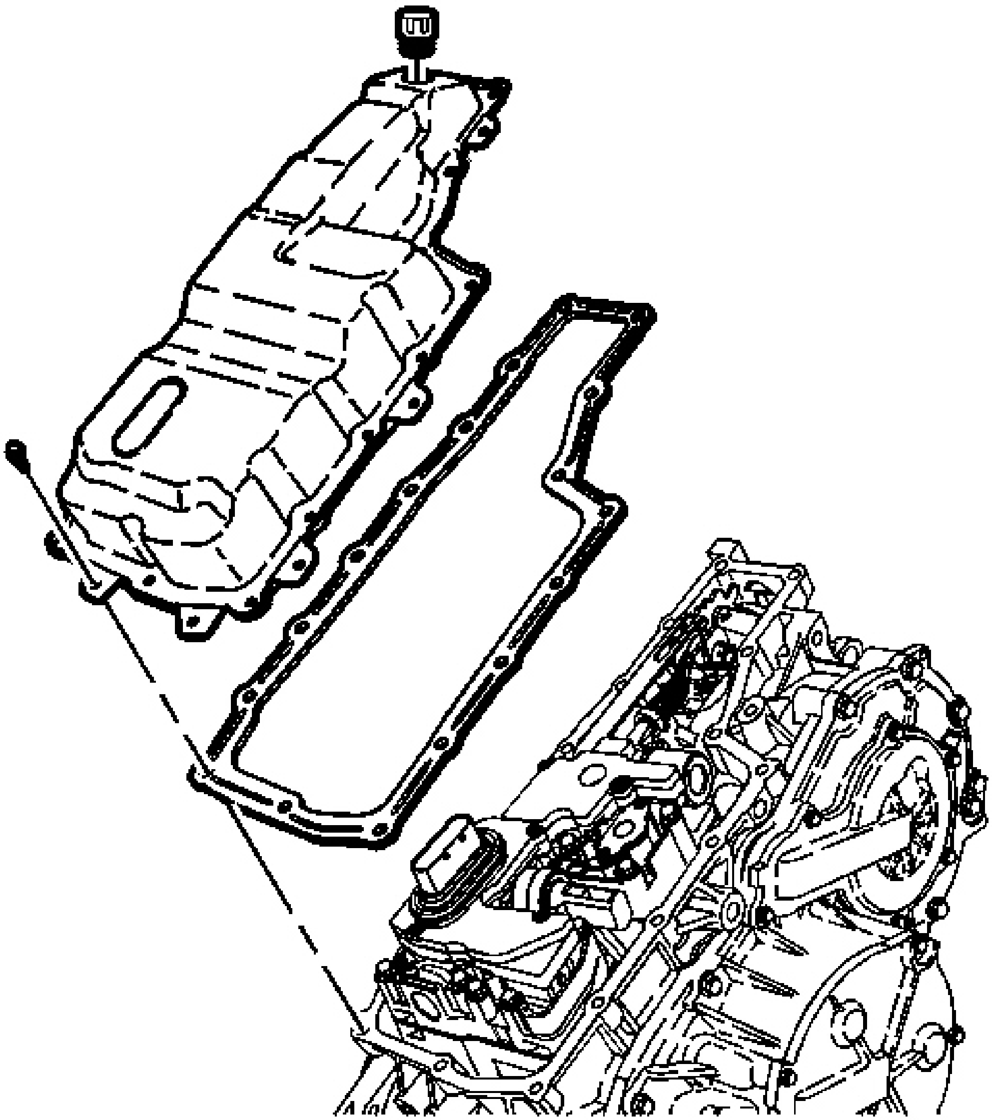


Fig. 447: Control Valve Body Cover, Gasket & Transmission Vent Cap
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW control valve body cover gasket on the transmission case assembly.
2. Inspect the control valve body cover for damage.
3. Install the transmission vent cap.

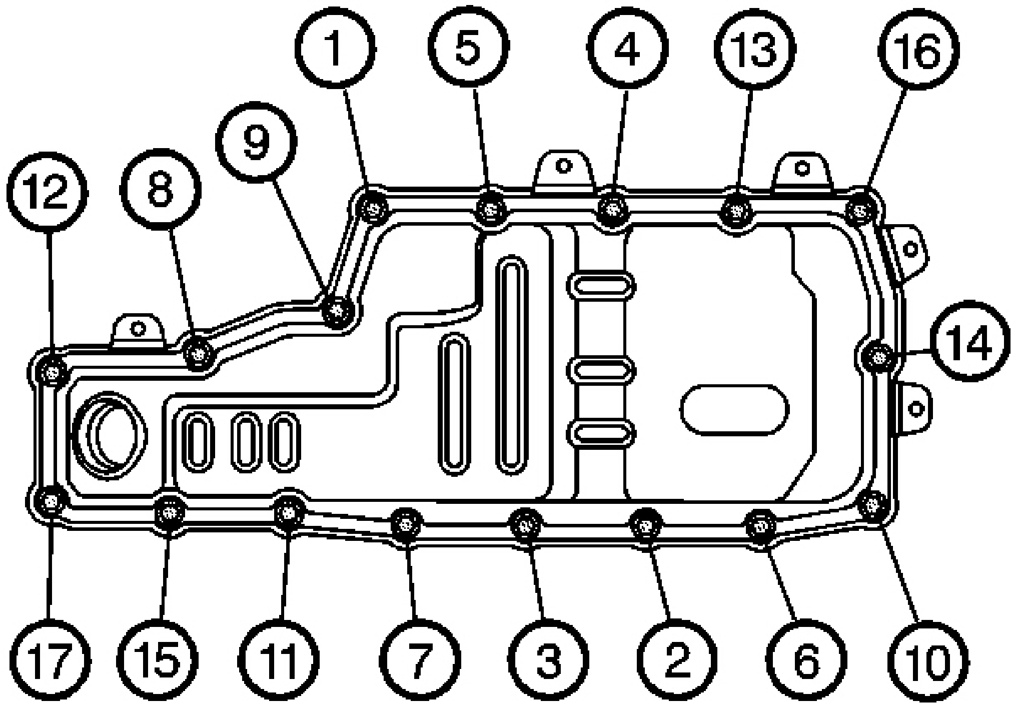


Fig. 448: Tightening Bolts In Sequence On Valve Body Cover
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the control valve body cover and 17 bolts on the transmission case assembly.

   Tighten: Tighten the bolts to 11 N.m (8 lb ft) in the sequence shown.

PARK/NEUTRAL POSITION SWITCH INSTALLATION

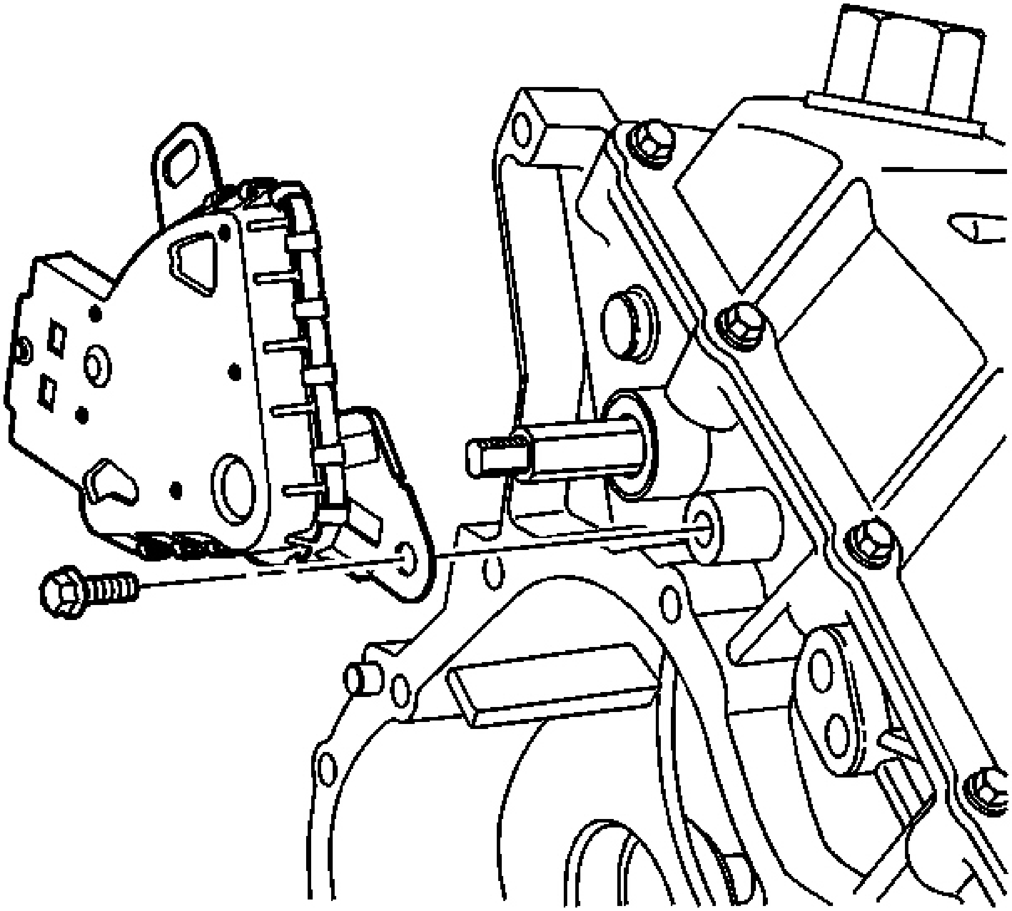


Fig. 449: Park/Neutral Position Switch Assembly & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

Install the park/neutral position switch assembly and the 2 bolts on the transmission case assembly.

Tighten: Tighten the bolts to 11 N.m (8 lb ft).

TORQUE CONVERTER END PLAY INSPECTION

Tools Required

- **SA9179NE** Dial Indicator

- **J 8001** Dial Indicator Set
- **J 45051** Torque Converter End Play Checking Tool. See **Special Tools and Equipment** .

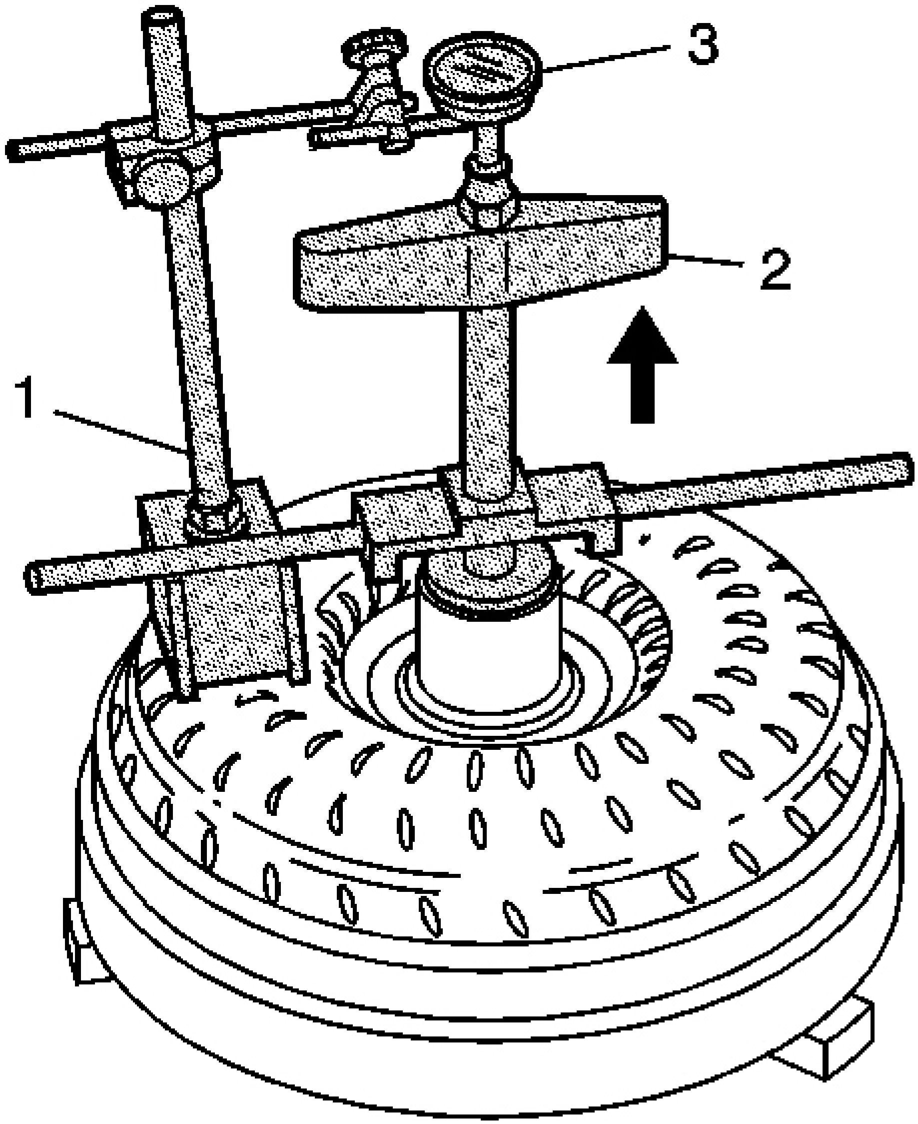


Fig. 450: Sa91979Ne, J 45051, J 8001 & Torque Converter
Courtesy of GENERAL MOTORS CORP.

1. Position the torque converter with the flywheel lugs facing down.

2. Install the **SA9179NE** (1) and **J 45051** (2) and **J 8001** (3) onto the torque converter.
3. Set the dial indicator to zero.
4. Pull up on the **J 45051** (2) handle. See **Special Tools and Equipment** .
5. Inspect the reading on the **SA9179NE** (1).

   End Play Specification: The correct end play is 0.5 mm (0.02 in) or less.

6. Repeat this procedure several times in order to get an accurate measurement.
7. Replace the torque converter if the end play is too high.
8. Inspect the torque converter assembly for the following:
   - External damage
   - Metal particles found after flushing the oil cooler and the cooler lines
   - External leaks in the hub weld area
   - The torque converter pilot is damaged or fits poorly into the crankshaft,
   - Internal failure of the stator roller clutch
   - A damaged or worn torque converter bushing
   - Contamination from the engine coolant
   - Stripped bolt threads

TORQUE CONVERTER ASSEMBLY INSTALLATION

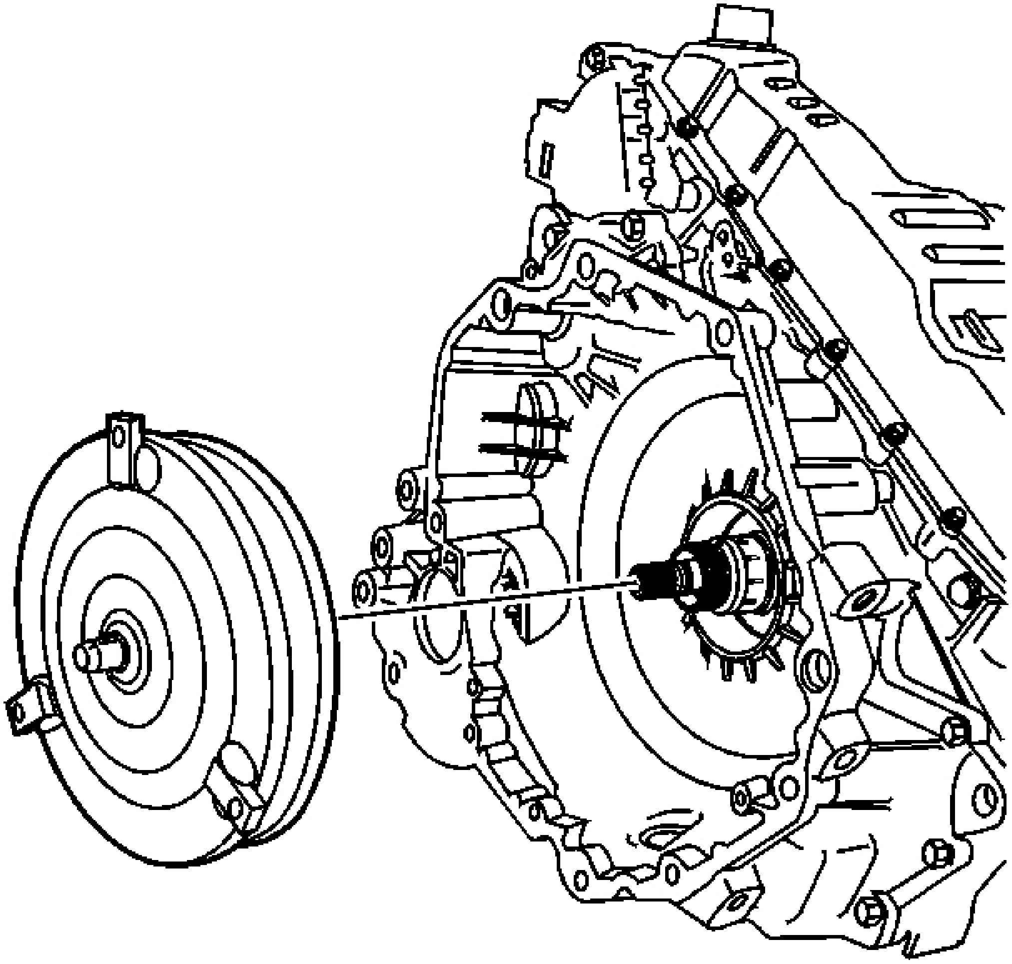


Fig. 451: Torque Converter Assembly
Courtesy of GENERAL MOTORS CORP.

Install the torque converter assembly.

DESCRIPTION AND OPERATION

PARK - ENGINE RUNNING

When the range selector lever is in the Park (P) position and the engine is running, fluid is drawn into the fluid pump and line 1 pressure is directed to the line 1 pressure regulator valve, the actuator feed limit valve, and the variable ratio control valve. Line 1 pressure also supplies fluid to the variable driven pulley assembly.

Pressure Regulation

Manual Valve

Mechanically controlled by the range selector lever, the manual valve is in the Park (P) position and prevents clutch feed pressure from the TCC control valve from entering the drive and reverse fluid circuits.

Line Pressure Control Solenoid Valve

Actuator feed limit fluid from the actuator feed limit valve is routed to the line pressure control solenoid valve where it passes into the VBS signal (line control) fluid circuit. VBS signal fluid pressure is regulated by the line pressure control solenoid valve duty cycle and helps to regulate line 1 fluid pressure at the line 1 pressure regulator valve, and line 2 fluid pressure at the line 2 pressure regulator valve.

Line 1 Pressure Regulator Valve

VBS signal - line control fluid is routed to the line 1 pressure regulator valve and, together with spring force, opposes orificed line 1 fluid pressure to regulate line 1 fluid pressure into the tier 2 feed fluid circuit.

Line 2 Pressure Regulator Valve

VBS signal - line control fluid is also routed to the line 2 pressure regulator valve and, together with spring force, opposes orificed line 2 fluid pressure to regulate tier 2 feed fluid pressure through orifice #23 into the line 2 fluid circuit.

Actuator Feed Limit Valve

Line 1 pressure is routed through the valve and into the actuator feed limit fluid circuit. The valve limits actuator feed limit fluid pressure to a maximum pressure. Actuator feed limit fluid is routed to the line pressure control solenoid valve, the neutral idle/TCC clutch control valve, and the neutral idle/TCC On-Off solenoid valve.

Line Limit Valve

Line 2 fluid is routed to the line limit valve where it is regulated against spring force into the line 2 limit fluid circuit.

Pressure Sensor

The pressure sensor monitors tier 2 fluid pressure. The TCM uses this information to adjust the line pressure control solenoid duty cycle in order to regulate line 1 and line 2 fluid pressures.

Ratio Control

Variable Ratio Control Valve

Line 1 pressure passes through orifice #25 and is routed to the variable ratio control valve. The valve regulates line 1 pressure into the primary feed circuit in response to TCM signals to the ratio control motor.

Primary Limit Valve

The primary limit valve regulates primary feed fluid pressure into the primary feed limit circuit and limits primary feed limit fluid to a maximum pressure. Primary feed limit fluid is routed to the variable drive pulley assembly.

Torque Converter

Line 2 Pressure Regulator Valve

Line 2 limit pressure is routed through the line 2 pressure regulator valve and into the limited converter feed fluid circuit. Limited converter feed fluid is routed to the TCC control valve.

TCC Control Valve

Clutch control fluid passes through the valve into the clutch feed fluid circuit and is routed to the manual valve where it stops in preparation for a shift to drive or reverse.

TCC Regulator Valve

Spring force holds the valve in the released position, thereby blocking line 2 limit pressure from entering the regulated apply fluid circuit.

Neutral Idle/TCC On-Off Solenoid Valve

Controlled by the TCM, the neutral idle/TCC On-Off solenoid valve regulates filtered actuator feed limit fluid pressure into the TCC/NI enable signal fluid circuit. TCC/NI enable signal fluid is used to control the apply and release of the torque converter clutch.

Neutral Idle/TCC Clutch Control Solenoid Valve

Actuator feed limit fluid from the actuator feed limit valve is routed to the neutral idle/TCC clutch control solenoid valve where it passes into the VBS signal - TCC/NI control fluid circuit. VBS signal fluid pressure is regulated by the neutral idle/TCC clutch control solenoid valve duty cycle and is routed to the forward and reverse clutch valve and the TCC regulator valve.

Forward and Reverse Clutch Valve

VBS signal - TCC/NI control, fluid opposes forward and reverse clutch valve spring force and regulates line 2 limit fluid into the clutch control fluid circuit.

Torque Converter

TCC release fluid pressure is routed to the torque converter to keep the TCC released. Fluid leaves the converter in the TCC apply fluid circuit and returns to the cooler through the TCC control valve.

Variable Driven Pulley Assembly

Line 1 fluid is also routed to the variable driven pulley assembly in preparation for a shift to drive or reverse.

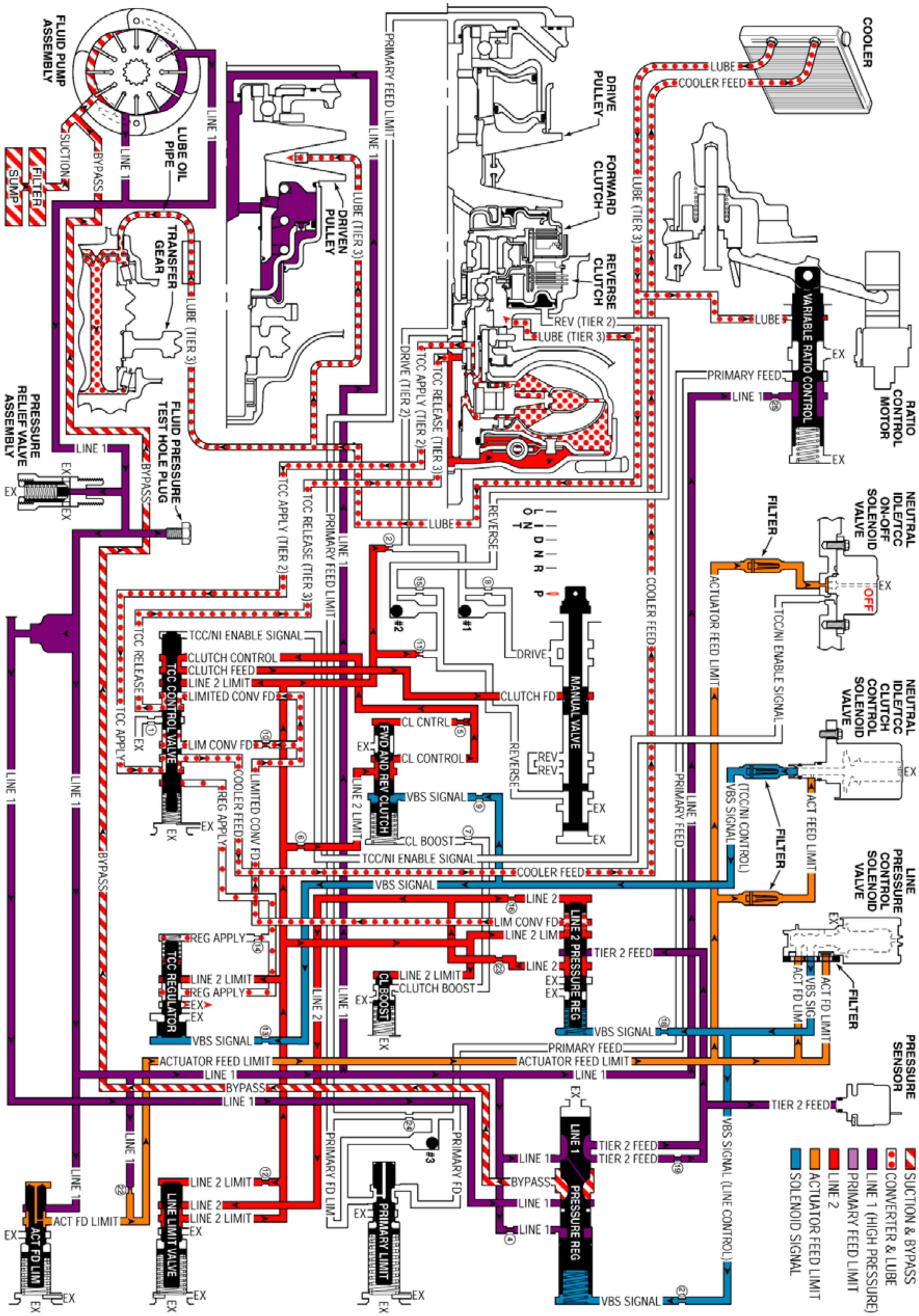


Fig. 452: Park - Engine Running
Courtesy of GENERAL MOTORS CORP.

REVERSE

When the range selector lever is moved to the Reverse (R) position - from the Park position, the following changes occur in the transmission's hydraulic and electrical systems.

Reverse Clutch Applies

Manual Valve

With the manual valve in the reverse position, clutch feed pressure is directed into the reverse fluid circuit.

#2 Ball Check Valve

Located in the control valve body assembly, the #2 ball check valve remains unseated and routes reverse fluid to the reverse clutch.

Reverse Clutch Assembly

Reverse clutch fluid is routed to the reverse clutch piston to apply the reverse clutch plates.

Pressure Regulation

Line Pressure Control Solenoid Valve

The line pressure control solenoid valve duty cycle is ramped up, increasing VBS signal - line control, fluid pressure.

Line 2 Pressure Regulator Valve

Increased VBS signal fluid pressure, together with spring force, moves the line 2 pressure regulator valve against orificed line 2 fluid pressure to increase the amount of tier 2 feed fluid pressure that is regulated into the line 2 circuit.

Line Limit Valve

Increased line 2 fluid pressure is routed to the line limit valve where it is regulated against spring force into the line 2 limit fluid circuit, increasing line 2 limit fluid pressure.

Clutch Boost Valve

Increased line 2 limit fluid is routed to the clutch boost valve and moves the valve against spring force and enters the clutch boost fluid circuit.

Forward and Reverse Clutch Valve

Clutch boost fluid is routed to the forward and reverse clutch valve where it assists spring force and moves the valve against VBS signal and orificed clutch control fluid pressures. This allows increased line 2 limit fluid pressure to increase the amount of fluid pressure in the clutch control circuit.

TCC Control Valve

Increased clutch control fluid pressure passes through the TCC control valve and increases the pressure in the clutch feed circuit. This allows extra fluid pressure to enter the reverse circuit, at the manual valve, in order to provide additional force to apply the reverse clutch plates.

Ratio Control

IMPORTANT: Remember that the function of an orifice is to control the flow rate of fluid and the rate of apply or release of a clutch or pulley

Ratio Control Motor and Variable Ratio Control Valve

The ratio control motor is activated by the TCM, in response to throttle position, and moves the variable ratio control valve against spring force. This allows line 1 fluid to be regulated into the primary feed circuit.

Primary Limit Valve

Primary feed fluid is routed to the primary limit valve where it is regulated against spring force into the primary feed limit circuit.

#3 Ball Check Valve

Located in the control valve body assembly, primary feed fluid seats the #3 ball check valve and passes through orifice #24 into the primary feed limit circuit. This orifice helps to control variable drive pulley assembly apply.

Variable Drive Pulley Assembly Applied

Primary feed limit fluid enters the variable drive pulley assembly and acts on the variable drive pulley piston to control the variable drive ratio.

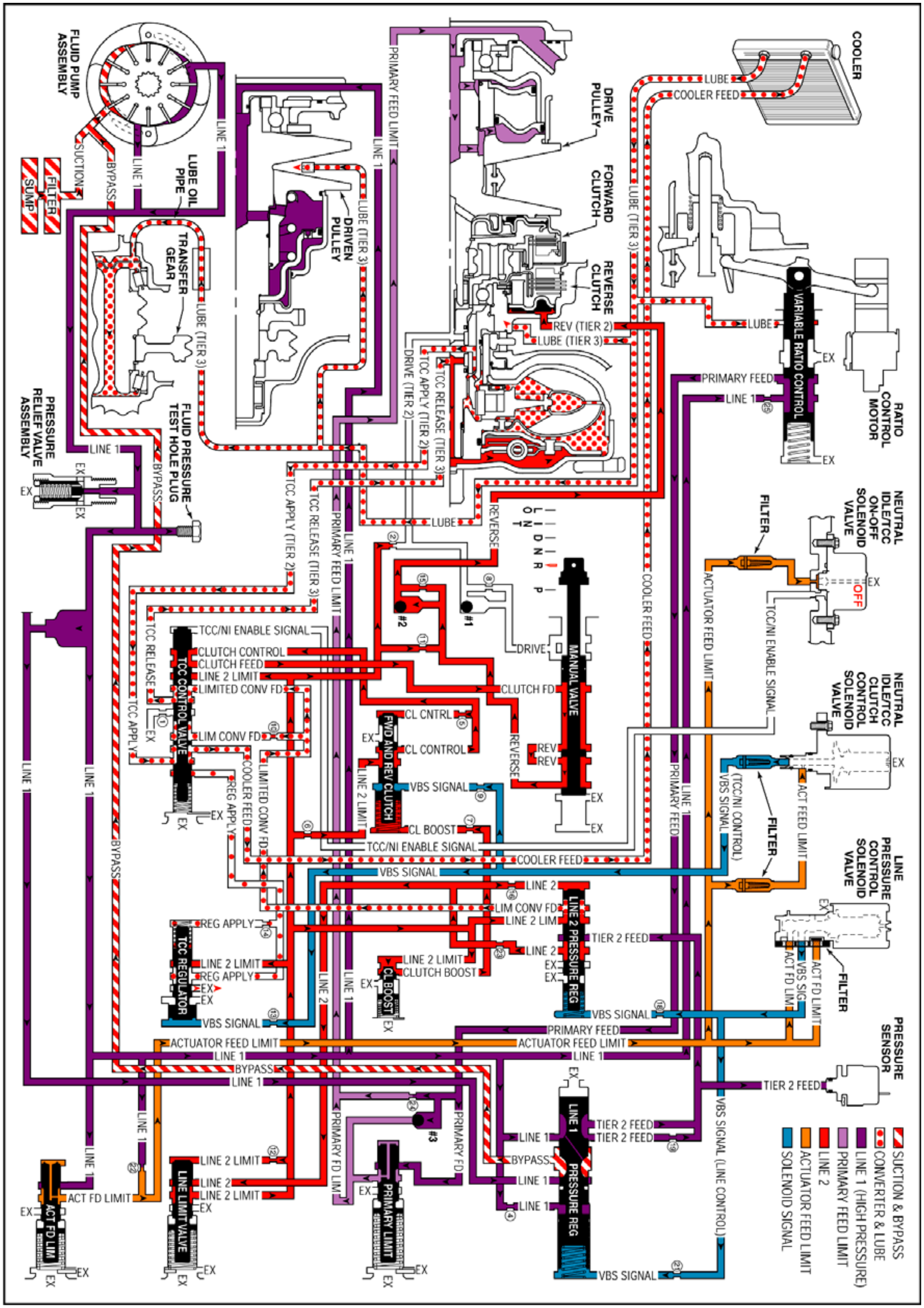


Fig. 453: Reverse
Courtesy of GENERAL MOTORS CORP.

NEUTRAL - ENGINE RUNNING

When the range selector lever 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 following changes would occur in the hydraulic system:

Reverse Clutch Releases

IMPORTANT: Remember that the function of an orifice is to control the flow rate of fluid and the rate of apply or release of a clutch.

Manual Valve

The manual valve is moved to the Neutral position and blocks clutch feed pressure from entering the reverse fluid circuit. The reverse fluid circuit is opened to an exhaust at the manual valve.

Reverse Clutch

Reverse clutch fluid exhausts from the reverse clutch to the #2 ball check valve allowing the reverse clutch to release.

#2 Ball Check Valve

Exhausting reverse clutch fluid seats the #2 ball check valve and is forced to pass through orifice #15. Reverse fluid then flows to the manual valve where it exhausts.

Pressure Regulation

Line Pressure Control Solenoid Valve

The line pressure control solenoid valve duty cycle is ramped down, decreasing VBS signal (line control) fluid pressure.

Line 2 Pressure Regulator Valve

When VBS signal fluid pressure decreases, orificed line 2 fluid pressure is able to move the line 2 pressure regulator valve against spring force, thus decreasing the amount of tier 2 feed fluid pressure that is regulated into the line 2 circuit.

Line Limit Valve

Because line 2 fluid pressure is decreased, the amount of fluid regulated through the line limit valve into the line 2 limit fluid circuit is also decreased.

Clutch Boost Valve

When line 2 limit fluid pressure is decreased, the clutch boost valve spring is able to shift the clutch boost valve to the released position, allowing clutch boost fluid to exhaust.

Forward and Reverse Clutch Valve

When clutch boost fluid exhausts, VBS signal and orificed clutch control fluid pressures are able to move the forward and reverse clutch valve against spring force. This decreases the amount of 2 limit fluid pressure regulated into the clutch control circuit.

TCC Control Valve

Decreased clutch control fluid pressure passes through the TCC control valve, thus decreasing the pressure in the clutch feed circuit. Extra fluid pressure is not required at the manual valve in Neutral because no clutches are applied.

Ratio Control

IMPORTANT: Allowing fluid to bypass an orifice when exhausting ensures a quick release of the clutch or pulley. This prevents the friction material from dragging and creating excess fluid temperatures or damaging the clutch.

Ratio Control Motor and Variable Ratio Control Valve

The ratio control motor is commanded by the TCM to the low ratio position and moves the variable ratio control valve against spring force. This blocks line 1 fluid and allows primary feed fluid pressure to exhaust.

Variable Drive Pulley Assembly Released

Primary feed limit fluid exhausts from the variable drive pulley assembly releasing the variable drive pulley piston.

#3 Ball Check Valve

Exhausting primary feed fluid unseats the #3 ball check valve, allowing a quick exhaust of fluid into the primary feed limit circuit. Primary feed limit fluid then exhausts at the variable ratio control valve.

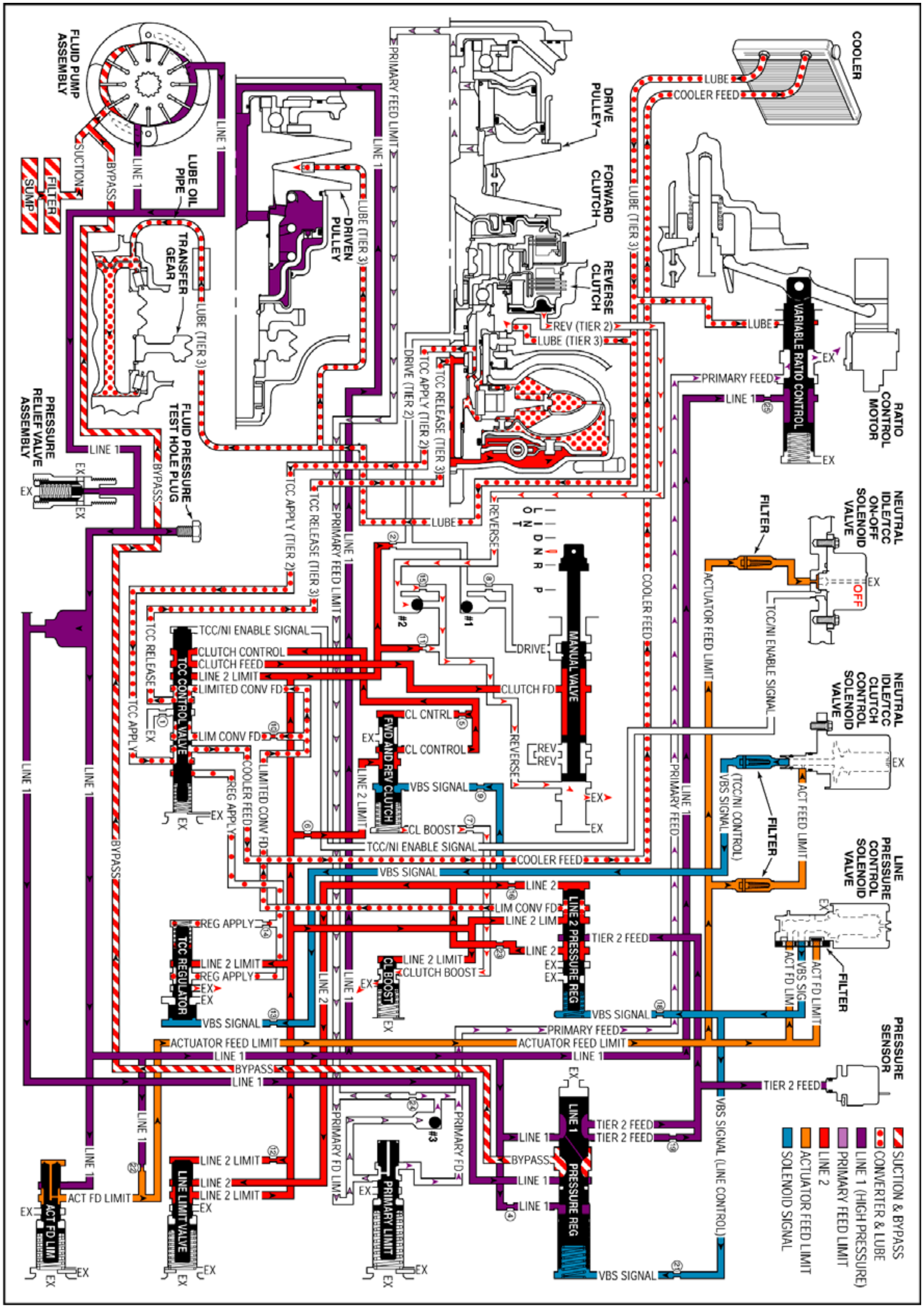


Fig. 454: Neutral - Engine Running

Courtesy of GENERAL MOTORS CORP.

DRIVE, INTERMEDIATE AND LOW RANGE - TCC RELEASED

When the range selector lever is moved to the Drive Range - D position from the Neutral - N position, the following hydraulic and electrical system changes occur to shift the transmission into Drive Range.

Manual Valve

In the Drive Range position, the manual valve routes clutch feed pressure into the drive fluid circuit.

Forward Clutch Applies

#1 Ball Check Valve

Located in the control valve body assembly, the #1 ball check valve remains unseated and routes drive fluid to the forward clutch.

Forward Clutch Assembly

Drive fluid is routed to the forward clutch piston to apply the forward clutch plates.

Pressure Regulation

Line Pressure Control Solenoid Valve

The line pressure control solenoid valve duty cycle is ramped up, increasing VBS signal - line control fluid pressure.

Line 2 Pressure Regulator Valve

Increased VBS signal fluid pressure, together with spring force, moves the line 2 pressure regulator valve against orificed line 2 fluid pressure to increase the amount of tier 2 feed fluid pressure that is regulated into the line 2 circuit.

Line Limit Valve

Increased line 2 fluid pressure is routed to the line limit valve where it is regulated against spring force into the line 2 limit fluid circuit, increasing line 2 limit fluid pressure.

Clutch Boost Valve

Increased line 2 limit fluid is routed to the clutch boost valve and moves the valve against spring force and enters the clutch boost fluid circuit.

Forward and Reverse Clutch Valve

Clutch boost fluid is routed to the forward and reverse clutch valve where it assists spring force and moves the valve against VBS signal and orificed clutch control fluid pressures. This allows increased line

2 limit fluid pressure to increase the amount of fluid pressure in the clutch control circuit.

TCC Control Valve

Increased clutch control fluid pressure passes through the TCC control valve and increases the pressure in the clutch feed circuit. This allows extra fluid pressure to enter the drive circuit, at the manual valve, in order to provide additional force to apply the forward clutch plates.

Ratio Control

IMPORTANT: Remember that the function of an orifice is to control the flow rate of fluid and the rate of apply or release of a clutch or pulley

Ratio Control Motor and Variable Ratio Control Valve

The ratio control motor is activated by the TCM, in response to throttle position, and moves the variable ratio control valve against spring force. This allows line 1 fluid to be regulated into the primary feed circuit.

Primary Limit Valve

Primary feed fluid is routed to the primary limit valve where it is regulated against spring force into the primary feed limit circuit.

#3 Ball Check Valve

Located in the control valve body assembly, primary feed fluid seats the #3 ball check valve and passes through orifice #24 into the primary feed limit circuit. This orifice helps to control variable drive pulley assembly apply.

Variable Drive Pulley Assembly Applied

Primary feed limit fluid enters the variable drive pulley assembly and acts on the variable drive pulley piston to control the variable drive ratio.

Intermediate and Low Ranges

Intermediate Range may be selected at any time while the vehicle is being operated in a forward range. However, TCM control prevents the transmission from operating in a high ratio. When the range selector lever is moved to Intermediate Range - INT from Drive Range - D, the manual valve also moves. There are no changes to the hydraulic system but, the Park/Neutral position switch assembly signals the TCM that the transmission is in Intermediate Range.

Low Range may also be selected at any time while the vehicle is being operated in a forward range. However, TCM control limits the transmission to lower ratios only. When the range selector lever is moved to Low Range - LO from Drive Range - D or Intermediate Range - INT, the manual valve also moves. There are no changes to the hydraulic system but, the Park/Neutral position switch assembly signals the TCM that the transmission is in Low Range.

IMPORTANT: Power flow for Drive, Intermediate and Low is exactly the same except the ratio is changed - controlled differently in each range. Drive range allows the full range of ratios from high to low. Intermediate does not allow the high ratios, and low is limited to only the lower ratios.

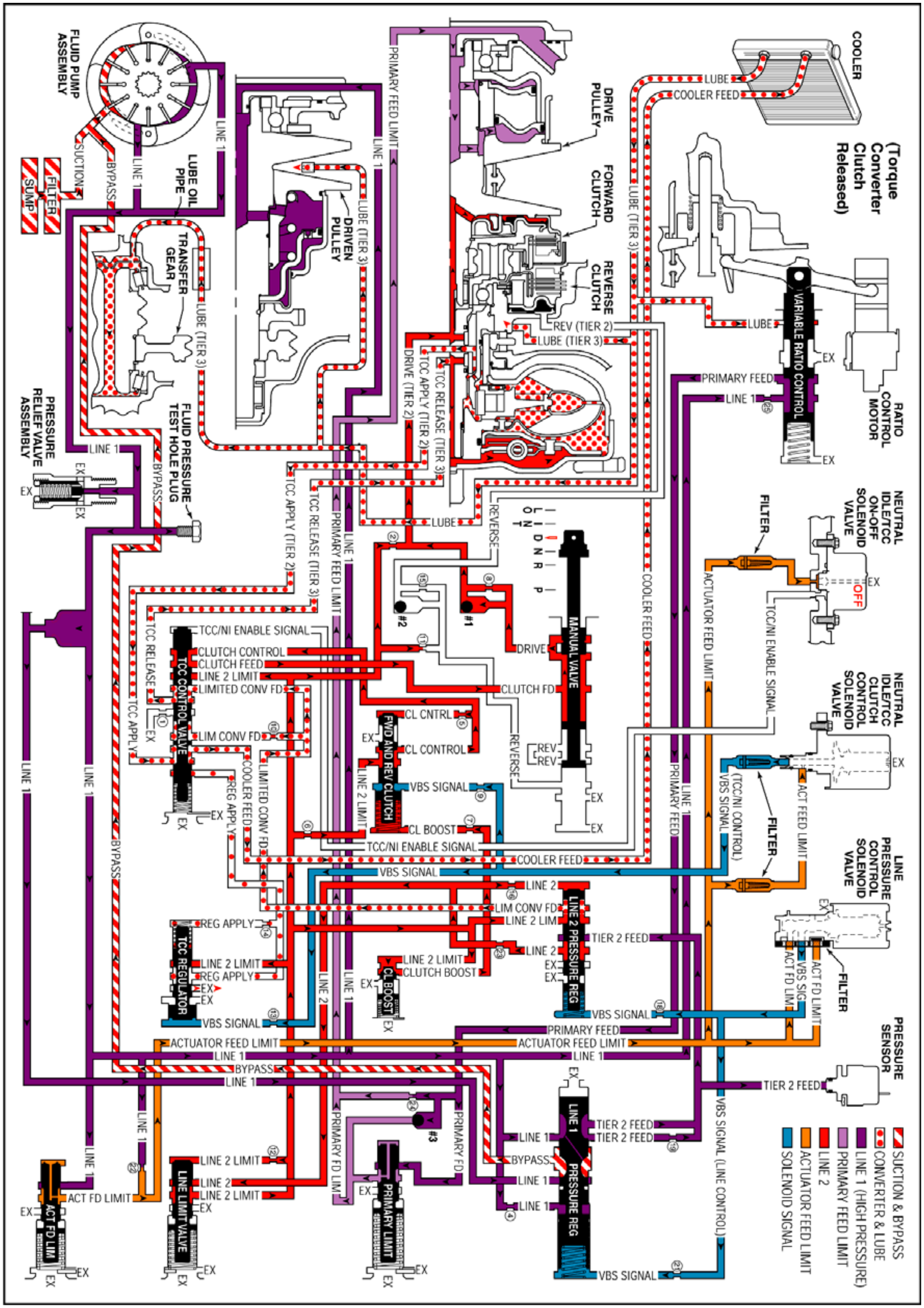


Fig. 455: Drive, Intermediate and Low Range - TCC Released
Courtesy of GENERAL MOTORS CORP.

DRIVE, INTERMEDIATE AND LOW RANGE - TCC APPLIED

When the transmission control module (TCM) determines that the engine and transmission are operating properly to engage the torque converter clutch (TCC), the TCM energizes the Neutral Idle/TCC On-Off solenoid valve and regulates the duty cycle of the Neutral Idle/TCC Clutch Control solenoid valve.

At this time the Torque Converter Clutch is considered to be disengaged - OFF, and the Neutral Idle/TCC On-Off solenoid valve is OFF, the Neutral Idle/TCC Clutch Control solenoid valve maintains a 90% duty cycle.

IMPORTANT: The Neutral Idle/TCC Clutch Control solenoid valve operates independently from the Neutral Idle/TCC On-Off solenoid valve. The Neutral Idle/TCC On-Off solenoid valve only controls when the TCC is applied. When the Neutral Idle/TCC On-Off solenoid valve is ON, the Neutral Idle/TCC Clutch Control solenoid valve only controls the fluid pressure used to apply the TCC.

IMPORTANT: Under normal operating conditions the torque converter clutch is in the released position while the transmission is operating in the Intermediate or Low Ranges. However, when the transmission fluid temperatures exceed approximately 121°C (250°F), the TCM will apply the torque converter clutch in Intermediate or Low Range to help reduce fluid temperatures.

The following events occur in order to apply the torque converter clutch:

Stage 1

The TCM immediately decreases the Neutral Idle/TCC Clutch Control solenoid valve duty cycle to 0% - from point S to point A, then pulses the Neutral Idle/TCC Clutch Control solenoid valve to approximately 25% duty cycle from point B to point C. Actuator feed limit fluid at the Neutral Idle/TCC Clutch Control solenoid is "pulsed" into the VBS signal - TCC/NI control, fluid circuit. The VBS signal - TCC/NI control, fluid pressure at point C regulates a line pressure branch which creates regulated apply fluid. The TCM also energizes the Neutral Idle/TCC On-Off solenoid valve, allowing actuator feed limit fluid to pass through the solenoid and enter the TCC/NI enable signal circuit. TCC/NI enable signal fluid is routed to the TCC control valve, and overcomes spring force, in order to shift the valve to the apply position. With the TCC control valve in the apply position, release fluid can exhaust through the valve. This stage is designed to move the TCC control valve from the released to the applied position; there is not yet enough pressure to apply the TCC.

Stage 2

The Neutral Idle/TCC Clutch Control solenoid valve duty cycle is ramped up from point C to point D to approximately 50%. Regulated apply fluid pressure is now strong enough to cause the converter apply to occur. Line 2 limit pressure enters the regulated apply circuit at the TCC regulator valve. Regulated apply fluid is routed through the TCC control valve into the TCC apply fluid circuit. The pressure value in the regulated apply circuit should now be high enough to fully apply the TCC pressure plate. Slip speed should be at the correct value - near "0".
In vehicles equipped with the Electronically Controlled Clutch Capacity (ECCC) system, the pressure

plate does not fully lock to the torque converter cover. It is instead precisely controlled to maintain a small amount of slippage between the engine and the turbine, reducing driveline torsional disturbances.

Stage 3

If it is determined by the TCM that it is desirable to fully lock the TCC, regulated apply fluid pressure is increased. This is caused by the Neutral Idle/TCC Clutch Control solenoid valve duty cycle being increased from point E to point F, to approximately 98%. This extra pressure ensures that the apply force on the TCC pressure plate is not at the slip threshold, but a little above it. TCC plate material is therefore protected from excessive heat.

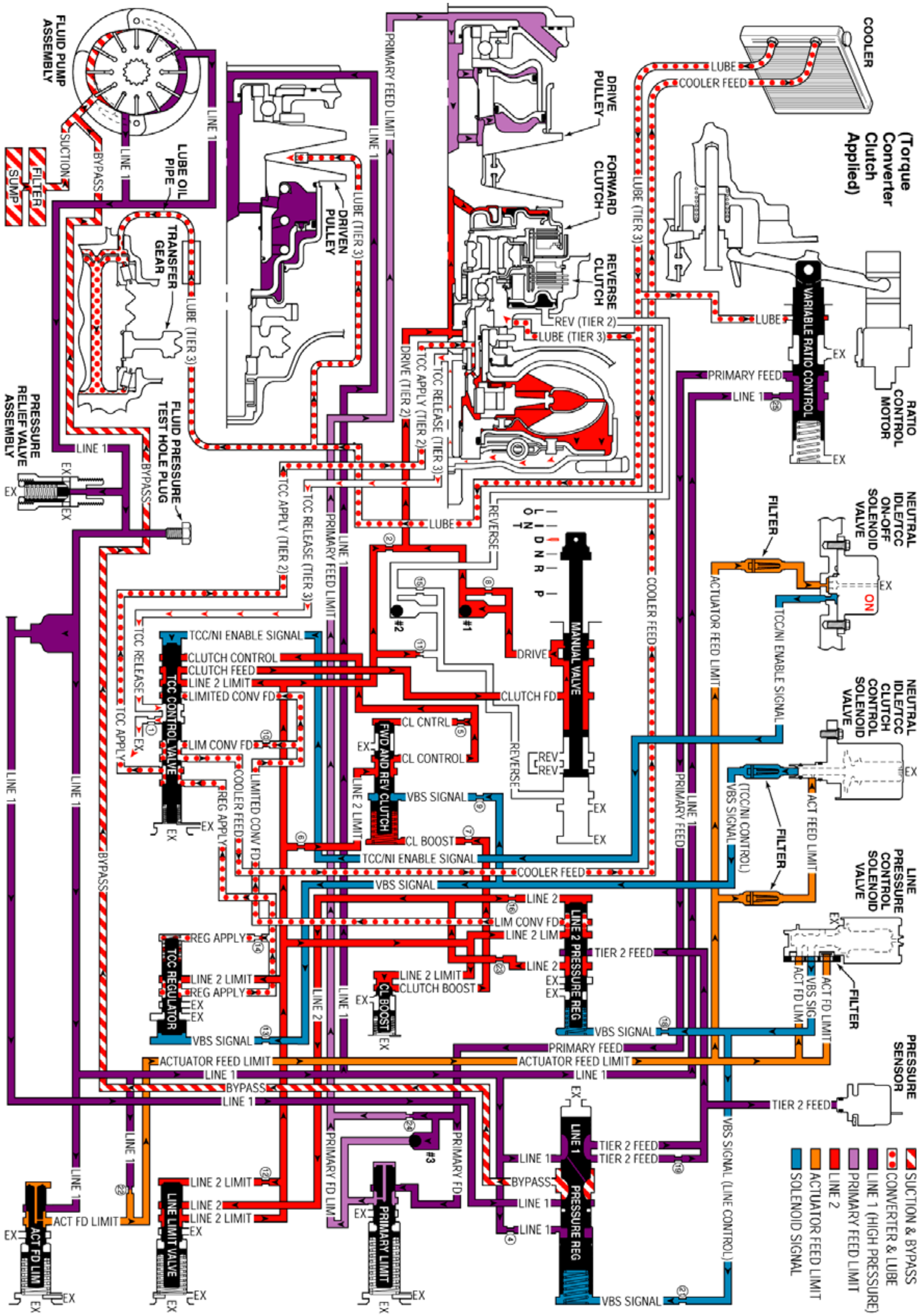


Fig. 456: Drive, Intermediate and Low Range - TCC Applied
Courtesy of GENERAL MOTORS CORP.

FLUID PASSAGES

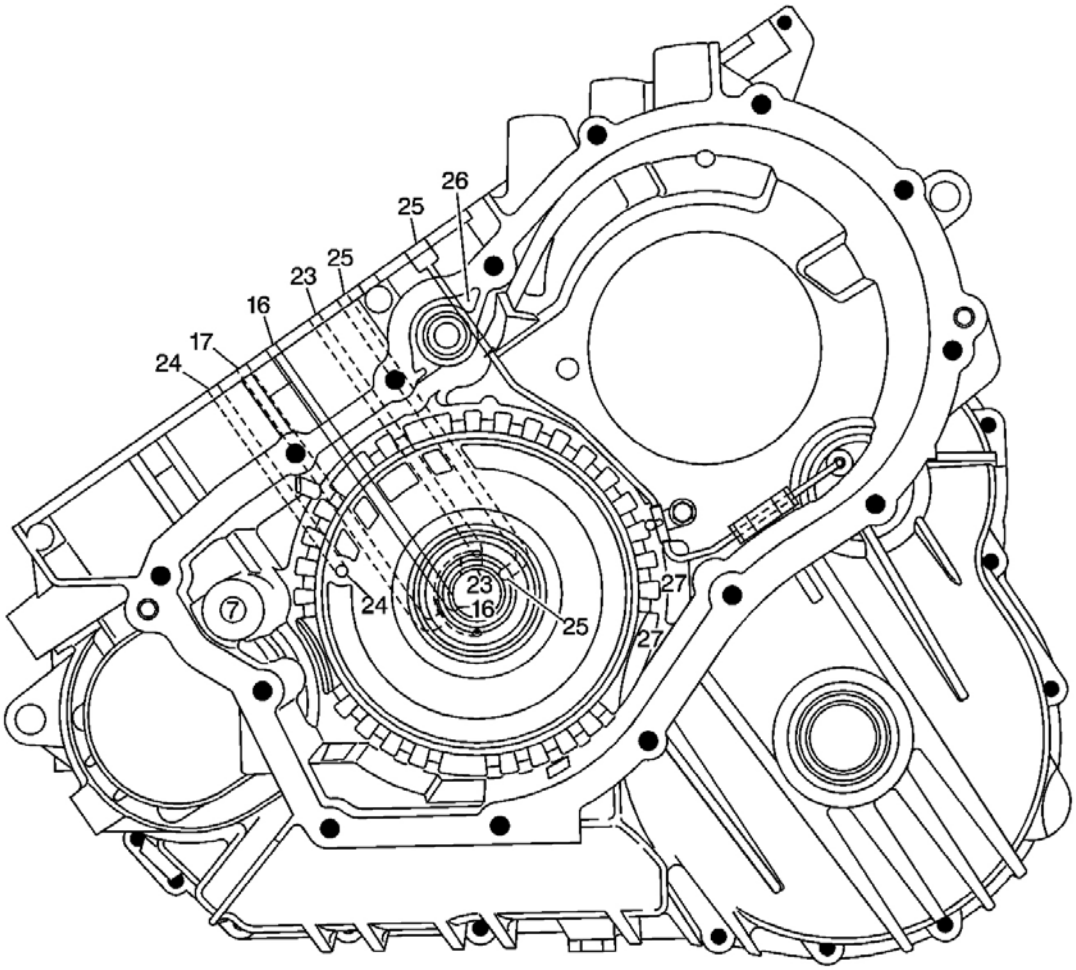


Fig. 457: Transmission Case Assembly (50) - Case Cover Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 495

Callout	Component Name
16	TCC Release - Tier 3
16	TCC Release - Tier 3
17	TCC Apply - Tier 2
23	Drive - Tier 2
23	Drive - Tier 2
24	Reverse - Tier 2
24	Reverse - Tier 2
25	Lube - Tier 3

25	Lube - Tier 3
25	Lube - Tier 3
26	Exhaust
27	Void
27	Void

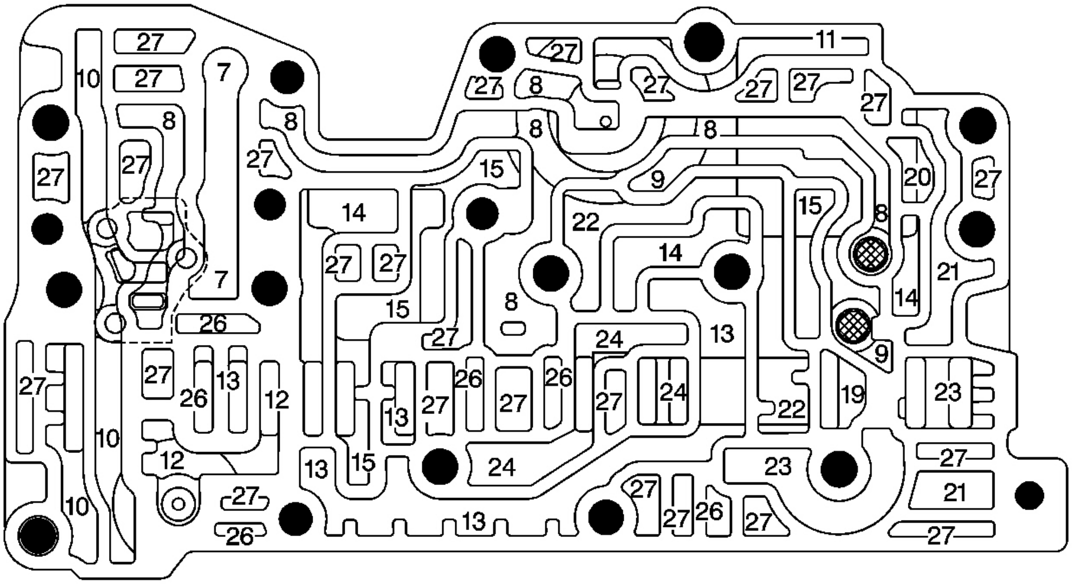


Fig. 458: Control Solenoid Valve Assembly (201) - Control Valve Body Assembly Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 496

Callout	Component Name
7	Primary Feed Limit
7	Primary Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
9	VBS Signal - TCC/NI Control
9	VBS Signal - TCC/NI Control
10	VBS Signal - Line Control
10	VBS Signal - Line Control

10	VBS Signal - Line Control
11	TCC/NI Enable Signal
12	Tier 2 Feed
12	Tier 2 Feed
13	Line 2
13	Line 2
13	Line 2
13	Line 2
13	Line 2
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
15	Limited Converter Feed
15	Limited Converter Feed
15	Limited Converter Feed
15	Limited Converter Feed
19	Clutch Feed
20	Clutch Control
21	Clutch Boost
21	Clutch Boost
22	Regulated Apply
22	Regulated Apply
23	Drive - Tier 2
23	Drive - Tier 2
24	Reverse - Tier 2
24	Reverse - Tier 2
24	Reverse - Tier 2
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
27	Void
27	Void
27	Void
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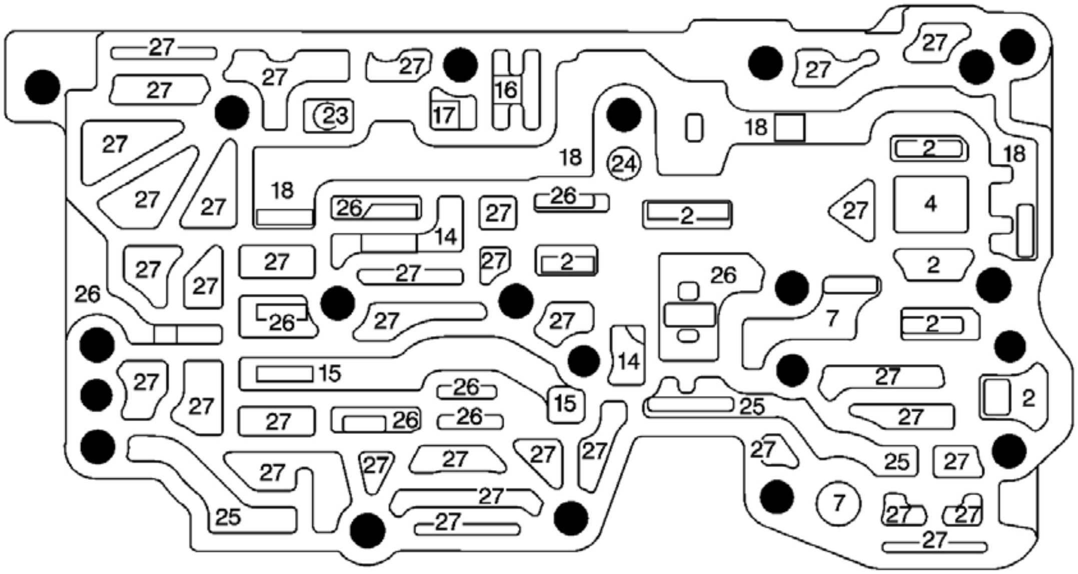

Fig. 459: Control Valve Body Assembly (207) - Transmission Case Assembly Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 497

Callout	Component Name

2	Line 1
2	Line 1
2	Line 1
2	Line 1
2	Line 1
2	Line 1
4	Bypass
7	Primary Feed Limit
7	Primary Feed Limit
14	Line 2 Limit
14	Line 2 Limit
15	Limited Converter Feed
15	Limited Converter Feed
16	TCC Release - Tier 3
17	TCC Apply - Tier 2
18	Cooler Feed
18	Cooler Feed
18	Cooler Feed
18	Cooler Feed
23	Drive - Tier 2
24	Reverse - Tier 2
25	Lube - Tier 3
25	Lube - Tier 3
25	Lube - Tier 3
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
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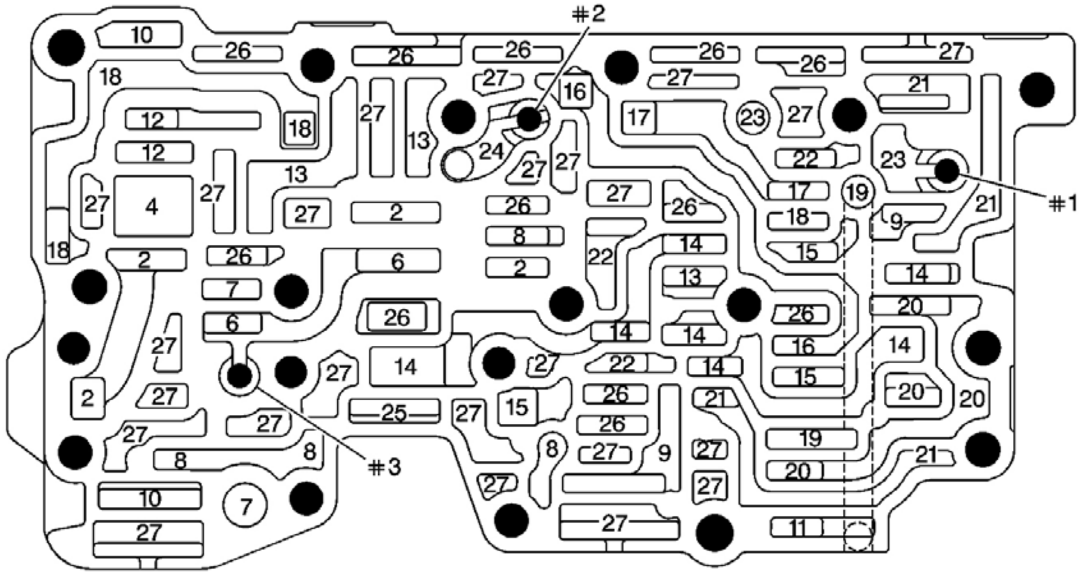

Fig. 460: Control Valve Body Assembly (207) - Control Solenoid Valve Assembly Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 498

Callout	Component Name
2	Line 1
2	Line 1
2	Line 1
2	Line 1
4	Bypass
6	Primary Feed
6	Primary Feed
7	Primary Feed Limit
7	Primary Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
9	VBS Signal - TCC/NI Control
9	VBS Signal - TCC/NI Control
10	VBS Signal - Line Conrol
10	VBS Signal - Line Conrol
11	TCC/NI Enable Signal
12	Tier 2 Feed

12	Tier 2 Feed
13	Line 2
13	Line 2
13	Line 2
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
15	Limited Converter Feed
15	Limited Converter Feed
15	Limited Converter Feed
16	TCC Release - Tier 3
16	TCC Release - Tier 3
17	TCC Apply - Tier 2
17	TCC Apply - Tier 2
18	Cooler Feed
18	Cooler Feed
18	Cooler Feed
18	Cooler Feed
19	Clutch Feed
19	Clutch Feed
20	Clutch Control
20	Clutch Control
20	Clutch Control
20	Clutch Control
21	Clutch Boost
21	Clutch Boost
21	Clutch Boost
21	Clutch Boost
22	Regulated Apply
22	Regulated Apply
22	Regulated Apply
23	Drive - Tier 2
23	Drive - Tier 2
24	Reverse - Tier 2
25	Lube - Tier 3
26	Exhaust
26	Exhaust

26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
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27	Void
27	Void

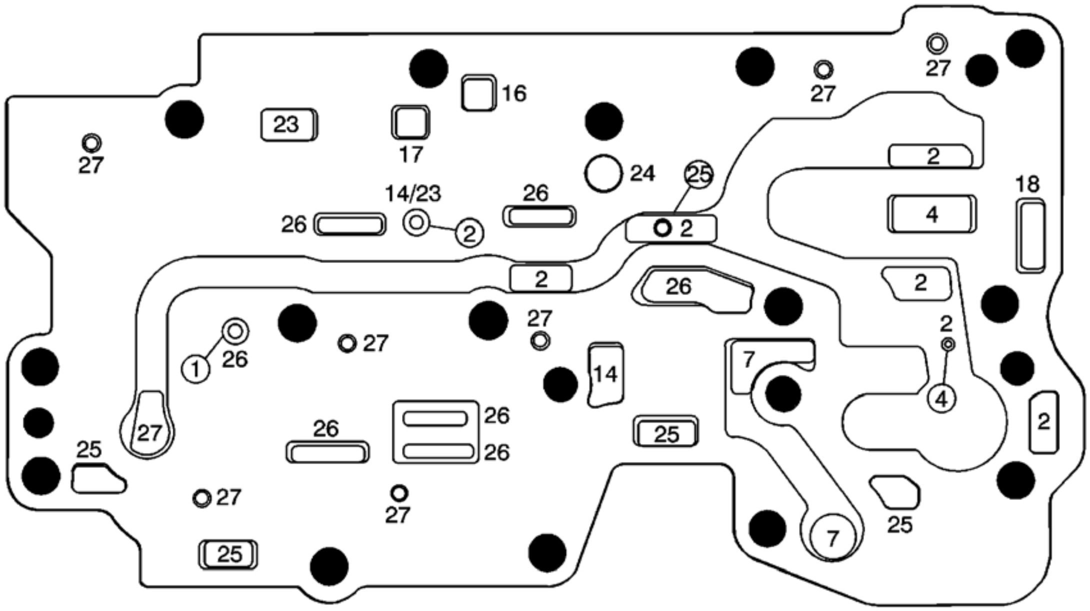

Fig. 461: Control Valve Body Spacer Plate - With Gasket (73) - Transmission Case Assembly Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 499

Callout	Component Name
2	Line 1
2	Line 1
2	Line 1
2	Line 1
2	Line 1
2	Line 1
4	Bypass
7	Primary Feed Limit
7	Primary Feed Limit
14	Line 2 Limit
14	Line 2 Limit
16	TCC Release - Tier 3
17	TCC Apply - Tier 2
18	Cooler Feed
23	Drive - Tier 2
23	Drive - Tier 2
24	Reverse - Tier 2
25	Lube - Tier 3

25	Lube - Tier 3
25	Lube - Tier 3
25	Lube - Tier 3
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void

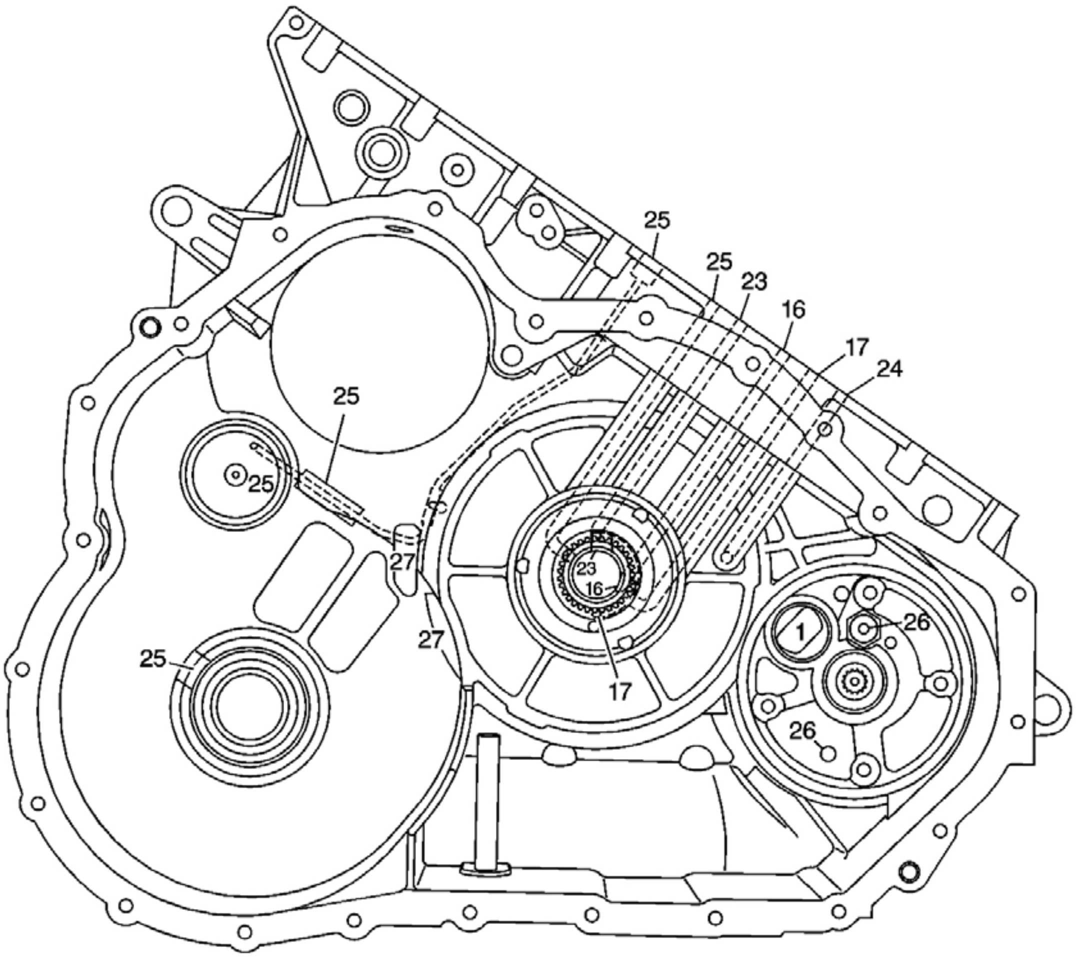

Fig. 462: Transmission Case Assembly (50) - Torque Converter And Differential Housing Assembly Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 500

Callout	Component Name
1	Suction
16	TCC Release - Tier 3
16	TCC Release - Tier 3
17	TCC Apply - Tier 2
17	TCC Apply - Tier 2
23	Drive - Tier 2
23	Drive - Tier 2
24	Reverse - Tier 2
25	Lube - Tier 3

25	Lube - Tier 3
25	Lube - Tier 3
25	Lube - Tier 3
25	Lube - Tier 3
26	Exhaust
26	Exhaust
27	Void
27	Void

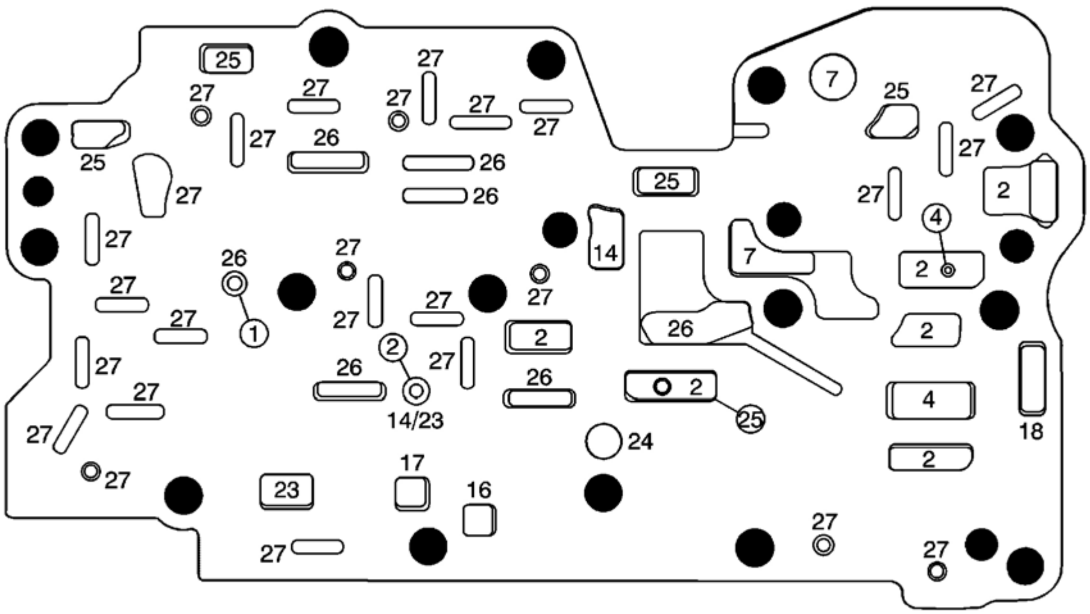

Fig. 463: Control Valve Body Spacer Plate - With Gasket (73) - Control Valve Body Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 501

Callout	Component Name
2	Line 1
2	Line 1
2	Line 1
2	Line 1
2	Line 1
2	Line 1
4	Bypass
7	Primary Feed Limit
7	Primary Feed Limit
14	Line 2 Limit

14	Line 2 Limit
16	TCC Release - Tier 3
17	TCC Apply - Tier 2
18	Cooler Feed
23	Drive - Tier 2
23	Drive - Tier 2
24	Reverse - Tier 2
25	Lube - Tier 3
25	Lube - Tier 3
25	Lube - Tier 3
25	Lube - Tier 3
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
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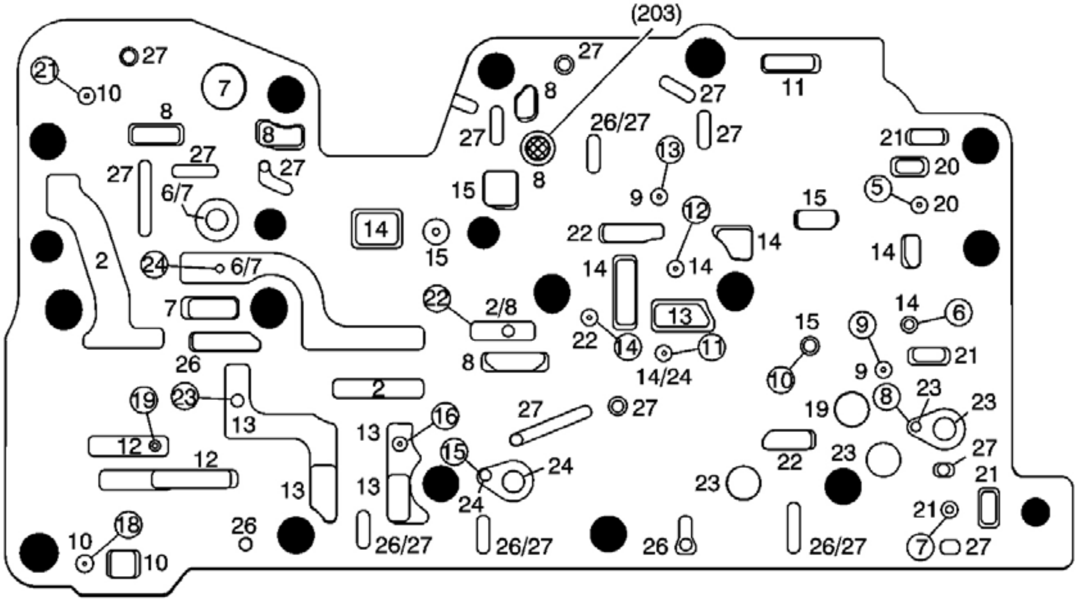

Fig. 464: Control Valve Body Spacer Plate - With Gasket (204) - Control Valve Body Assembly Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 502

Callout	Component Name
2	Line 1
2	Line 1
2	Line 1
6	Primary Feed
6	Primary Feed
7	Primary Feed Limit
7	Primary Feed Limit
7	Primary Feed Limit
7	Primary Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit

8	Actuator Feed Limit
9	VBS Signal - TCC/NI Control
9	VBS Signal - TCC/NI Control
10	VBS Signal - Line Control
10	VBS Signal - Line Control
10	VBS Signal - Line Control
11	TCC/NI Enable Signal
12	Tier 2 Feed
12	Tier 2 Feed
13	Line 2
13	Line 2
13	Line 2
13	Line 2
13	Line 2
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
15	Limited Converter Feed
15	Limited Converter Feed
15	Limited Converter Feed
15	Limited Converter Feed
19	Clutch Feed
20	Clutch Control
20	Clutch Control
21	Clutch Boost
21	Clutch Boost
21	Clutch Boost
21	Clutch Boost
22	Regulated Apply
22	Regulated Apply
22	Regulated Apply
23	Drive - Tier 2
23	Drive - Tier 2
23	Drive - Tier 2
23	Drive - Tier 2
24	Reverse - Tier 2
24	Reverse - Tier 2

24	Reverse - Tier 2
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
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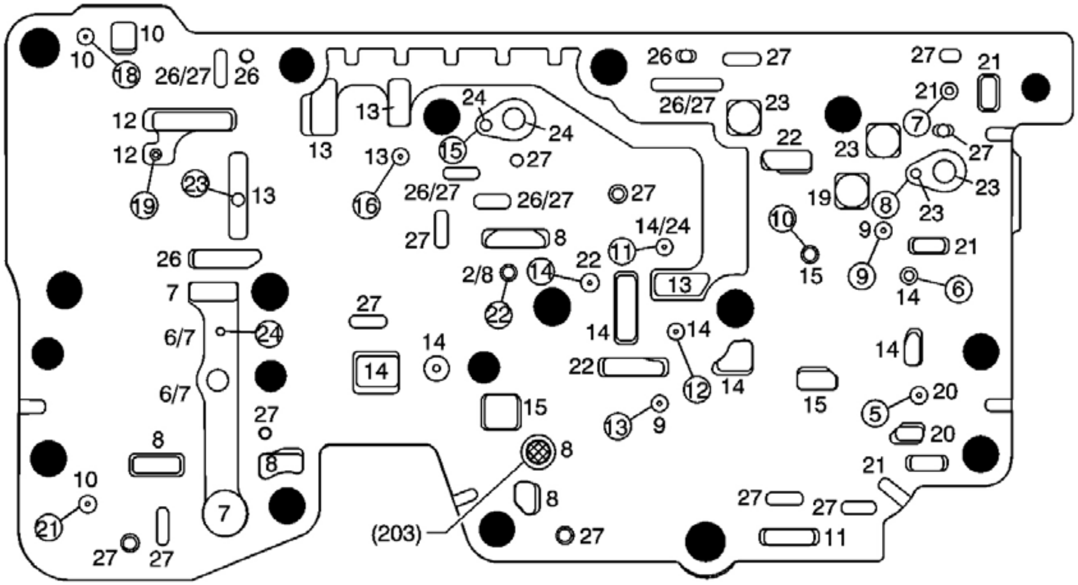
27	Void
27	Void



<u>**Fig. 465: Control Valve Body Spacer Plate - With Gasket (204) - Control Solenoid Valve Assembly Side Passages**</u>
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 503

Callout	Component Name
2	Line 1
6	Primary Feed
6	Primary Feed
7	Primary Feed Limit
7	Primary Feed Limit
7	Primary Feed Limit
7	Primary Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
8	Actuator Feed Limit
9	VBS Signal - TCC/NI Control
9	VBS Signal - TCC/NI Control
10	VBS Signal - Line Control
10	VBS Signal - Line Control
10	VBS Signal - Line Control

11	TCC/NI Enable Signal
12	Tier 2 Feed
12	Tier 2 Feed
13	Line 2
13	Line 2
13	Line 2
13	Line 2
13	Line 2
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
14	Line 2 Limit
15	Limited Converter Feed
15	Limited Converter Feed
15	Limited Converter Feed
19	Clutch Feed
20	Clutch Control
20	Clutch Control
21	Clutch Boost
21	Clutch Boost
21	Clutch Boost
21	Clutch Boost
22	Regulated Apply
22	Regulated Apply
22	Regulated Apply
23	Drive - Tier 2
23	Drive - Tier 2
23	Drive - Tier 2
23	Drive - Tier 2
24	Reverse - Tier 2
24	Reverse - Tier 2
24	Reverse - Tier 2
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust

26	Exhaust
26	Exhaust
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
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27	Void
27	Void

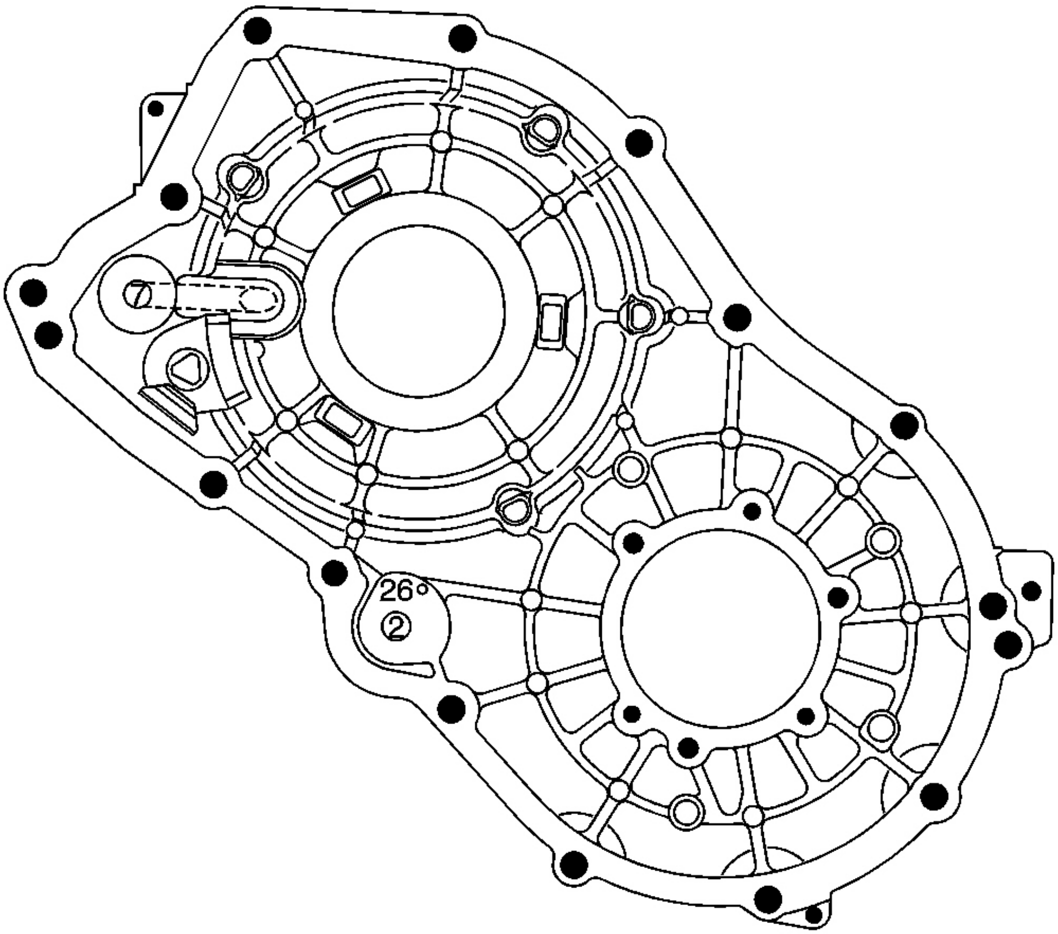


Fig. 466: Transmission Case Cover (97) - Transmission Case Assembly Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 504

Callout	Component Name
2	Line 1
7	Primary Feed Limit
26	Exhaust

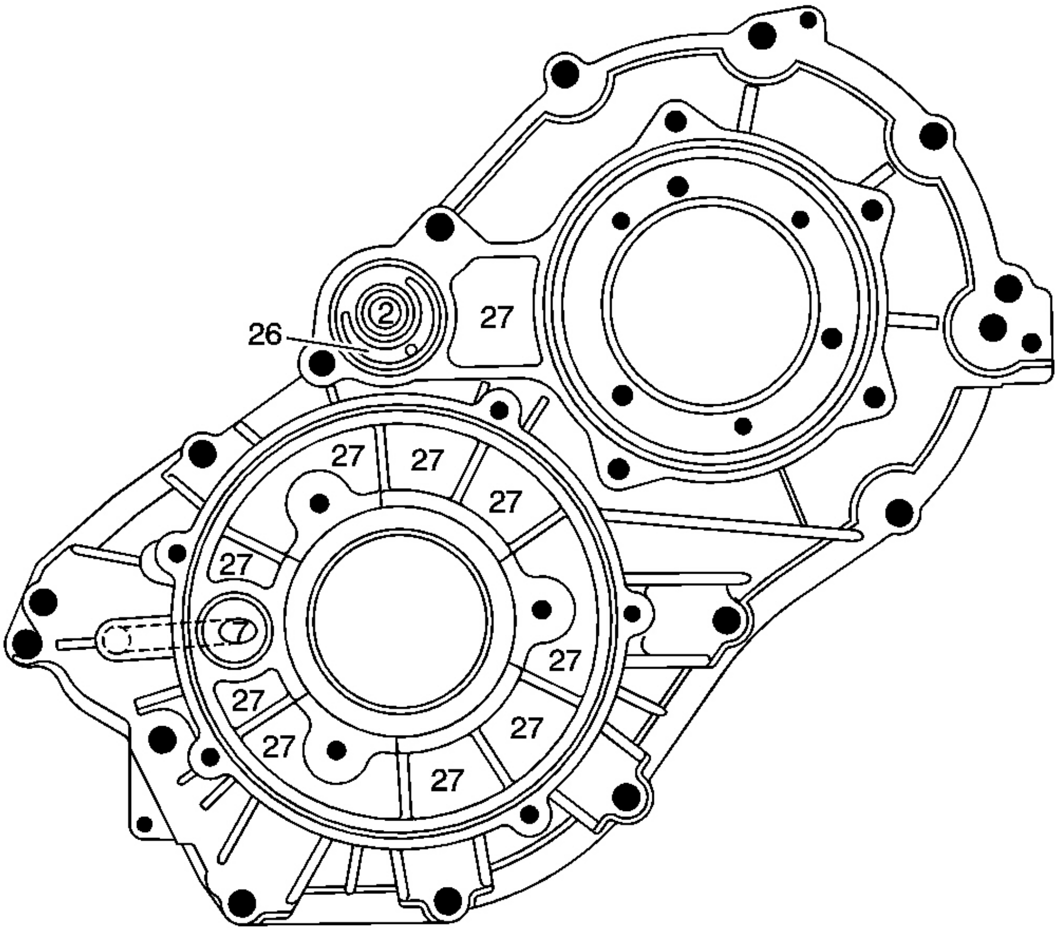


Fig. 467: Transmission Case Cover (97) - Pulley Opening Cover Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 505

Callout	Component Name
2	Line 1
7	Primary Feed Limit
26	Exhaust
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void

27	Void
27	Void
27	Void

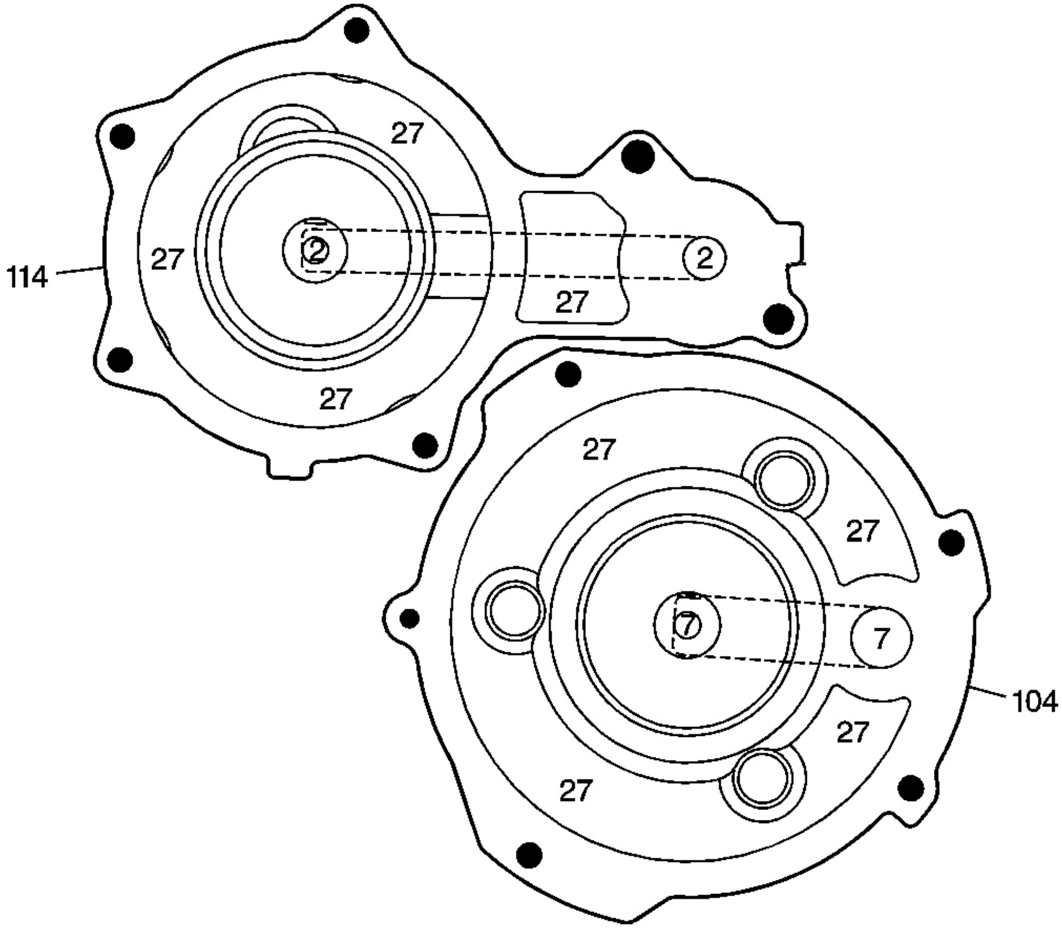


Fig. 468: Pulley Opening Covers (114 and 104) - Transmission Case Cover Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 506

Callout	Component Name
2	Line 1
2	Line 1
7	Primary Feed Limit
7	Primary Feed Limit
27	Void
27	Void

27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
104	Variable Drive Pulley Opening Cover
114	Variable Driven Pulley Opening Cover

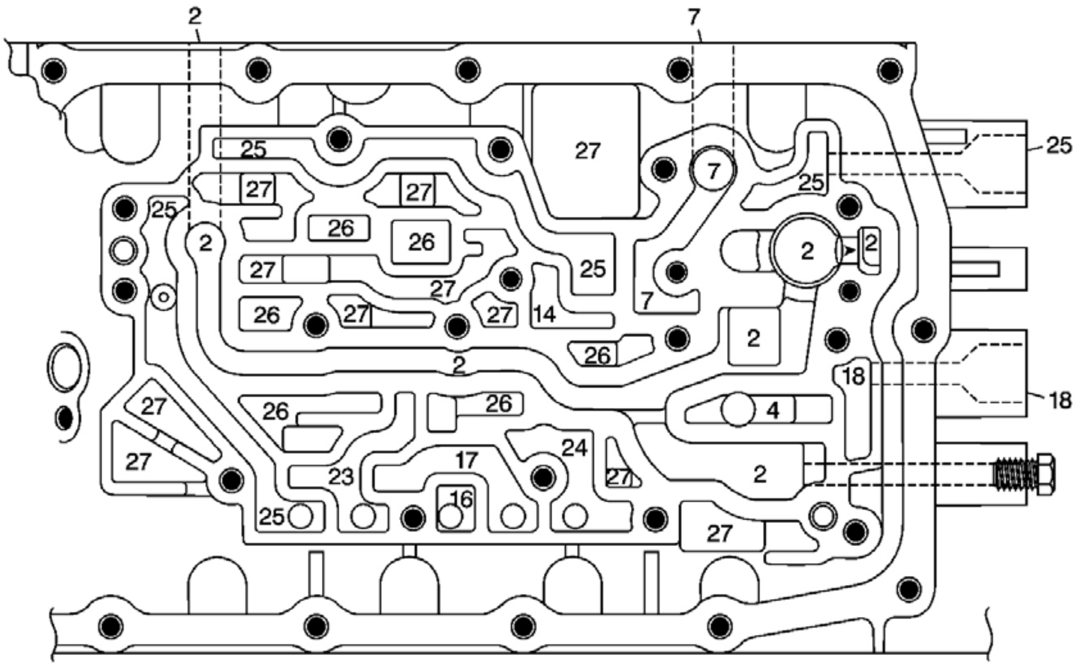


Fig. 469: Transmission Case Assembly (50) - Control Valve Body Side Passages
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 507

Callout	Component Name
2	Line 1
2	Line 1
2	Line 1
2	Line 1
2	Line 1
2	Line 1
2	Line 1
4	Bypass

7	Primary Feed Limit
7	Primary Feed Limit
7	Primary Feed Limit
14	Line 2 Limit
16	TCC Release - Tier 3
17	TCC Apply - Tier 2
18	Cooler Feed
18	Cooler Feed
23	Drive - Tier 2
24	Reverse - Tier 2
25	Lube - Tier 3
25	Lube - Tier 3
25	Lube - Tier 3
25	Lube - Tier 3
25	Lube - Tier 3
25	Lube - Tier 3
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
26	Exhaust
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void
27	Void

TRANSMISSION GENERAL INFORMATION

How to Use This Section

This section provides the following information:

- General diagnosis information on transmissions

- Procedures for diagnosing the VT20-E/VT25-E transmission

When you diagnose any condition of the VT20-E/VT25-E transmission, begin with Diagnostic Starting Point. This procedure indicates the proper path of diagnosing the transmission by describing the basic checks. This procedure will then refer you to the locations of specific checks. After you have determined the cause of a condition, refer to Repair Instructions for repair procedures.

Basic Knowledge

NOTE: **Do not, under any circumstances, attempt to diagnose a powertrain condition without basic knowledge of this powertrain. If you perform diagnostic procedures without this basic knowledge, you may incorrectly diagnose the condition or damage the powertrain components.**

You must be familiar with some basic electronics in order to use this section of the service manual. You should also be able to use the following special tools:

- A digital multimeter (DMM)
- A circuit tester
- Jumper wires or leads
- A line pressure gage set

Diagnosis

NOTE: **If you probe a wire with a sharp instrument and do not properly seal the wire afterward, the wire corrodes and an open circuit results.**

Diagnostic test probes are now available that allow you to probe individual wires without leaving the wire open to the environment. These probe devices are inexpensive and easy to install, and they permanently seal the wire from corrosion.

DEFINITIONS AND ABBREVIATIONS

Throttle Positions

Engine Braking

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

Full Throttle Detent Downshift

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

Heavy Throttle

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

Light Throttle

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

Medium Throttle

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

Minimum Throttle

The least amount of throttle opening required for an upshift.

Wide Open Throttle (WOT)

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

Zero Throttle Coastdown

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

Shift Condition Definitions

Bump

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

Chuggle

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

Delayed

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

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.

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

Diagnostic Link Connector

DMM

Digital Multimeter

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

PWM

Pulse Width Modulation

RPM

Revolutions Per Minute

SS

Shift Solenoid

STL

Service Transmission Lamp

TAP

Transmission Adaptive Pressure

TCC

Torque Converter Clutch

TCM

Transmission Control Module

TFP

Transmission Fluid Pressure

TFT

Transmission Fluid Temperature

TP

Throttle Position

TV

Throttle Valve

VCM

Vehicle Control Module

VSS

Vehicle Speed Sensor

WOT

Wide Open Throttle

TRANSMISSION IDENTIFICATION INFORMATION

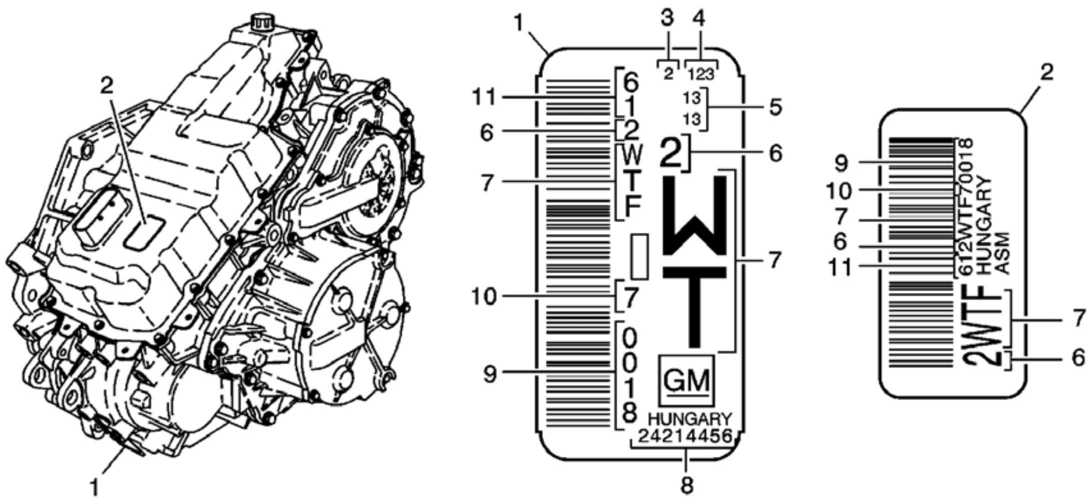


Fig. 470: Transmission Identification
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 508

Callout	Component Name
1	Transmission ID Location-Metal Tag
1	Transmission ID Location-Metal Tag
2	Transmission ID Location-Sticker
2	Transmission ID Location-Sticker
3	Calendar Year
4	Julian Date
5	Shift and Line Number
6	Model Year

6	Model Year
6	Model Year
6	Model Year
7	Model
7	Model
7	Model
7	Model
8	Transmission Part Number
9	Serial Number
9	Serial Number
10	Hungary Plant
10	Hungary Plant
11	Transmission
11	Transmission

TRANSMISSION GENERAL DESCRIPTION

The VT20-E/VT25-E is a fully-automatic, continuously-variable, front-wheel drive transmission. It consists primarily of a four-element torque converter, one planetary gear set, an electronic hydraulic pressurization and control system, two variable drive pulleys, two friction clutches and, a differential assembly.

The four-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 set provides REVERSE. Changing drive ratios is fully automatic and is accomplished through the use of a transmission control module (TCM). The TCM receives and monitors various electronic sensor inputs and uses this information to control the transmission ratios at the most optimum time.

The ratio control motor is used to change drive ratios, and feedback from the speed sensors supplies information to the TCM. The TCM then uses this information to determine when to apply and release the torque converter clutch. This allows the engine to deliver the maximum fuel efficiency without sacrificing vehicle performance.

The hydraulic system primarily consists of a vane type pump, a control valve body, a control solenoid valve assembly, a case and a case cover. 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 forward or reverse ranges of the transmission.

The hydraulic system supplies pressurized fluid to the variable drive and driven pulley assemblies to provide accurate variable ratio-controlled output torque to the differential.

The transmission can be operated in any one of the six different positions shown on the shift quadrant.

P

PARK position enables the engine to be started while preventing the vehicle from rolling either forward or backward. For safety reasons, the vehicle parking brake should be used in addition to the transmission "PARK" position. Since the front differential carrier assembly is mechanically locked to the case through the park pawl, variable driven pulley assembly and front differential drive pinion gear assembly, PARK position should not be selected until the vehicle has come to a complete stop.

R

REVERSE enables the vehicle to be operated in a rearward direction.

N

NEUTRAL position enables the engine to start and operate without driving the vehicle.

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 the full range of variable ratios. DRIVE allows low to high ratios without any limitations, and torque converter clutch apply.The transmission should not be operated in DRIVE when towing a trailer or driving on hilly terrain. Under such conditions that put an extra load on the engine, the transmission should be driven in a lower range selection for maximum efficiency.

I

Intermediate can be used for conditions where it may be desirable to use only low and intermediate ratios. These conditions include towing a trailer and driving on hilly terrain as described above. The variable ratios are the same as in DRIVE range except that the variable drive pulleys will not be allowed to achieve the higher ratios.

Low

Low can be selected at any vehicle speed. If the transmission is in DRIVE or Intermediate range, it will immediately change the ratio to low when vehicle speed is below approximately 56 km/h (35 mph). This is particularly beneficial for maintaining maximum engine braking when descending steep grades. With Low range selected, the variable drive pulleys will not be allowed to achieve the high or intermediate ratios.

TRANSMISSION COMPONENT AND SYSTEM DESCRIPTION

The primary mechanical components of this unit are as follows:

- A torque converter with an electronically controlled capacity clutch (ECCC)

  This transmission is equipped with an electronically controlled capacity clutch (ECCC). The pressure plate does not fully lock to the torque converter cover. Instead, the pressure plate maintains a small amount of slippage, about 20 RPM, in SECOND, THIRD and FOURTH gears, depending on the vehicle application. ECCC was developed to reduce the possibility of noise, vibration or chuggle caused by TCC apply. Typical apply speeds are 49-52 km/h (30-32 mph) in THIRD gear and 65-73 km/h (40-45 mph) in FOURTH gear. Full lockup is available at highway speeds on some applications.

- A variable drive pulley assembly
- A variable driven pulley assembly
- A variable drive belt assembly
- Forward clutch piston and clutch assemblies
- Reverse clutch piston and clutch assemblies
- A front differential carrier assembly
- A front differential drive pinion gear assembly
- A vane-type fluid pump
- A drive link assembly
- A control valve body assembly
- One planetary gear set

The electrical components of this unit are as follows:

- A module leadframe, including a transmission fluid temperature (TFT) sensor
- A ratio control motor
- A TCC pressure control solenoid valve
- A TCC enable solenoid valve
- A line pressure control solenoid valve
- A transmission fluid pressure sensor
- An input and output speed sensor assembly
- A park/neutral position switch

For more information refer to **Electronic Component Description** .

TRANSMISSION ADAPTIVE FUNCTIONS

The Hydra-Matic VT25-E uses a line pressure control system which has the ability to adapt the system line pressure in order to compensate for normal wear of clutch fiber plates, seals, springs, etc. The adapt feature is similar in function to fuel control (integrator/block learn).

The Hydra-Matic VT25-E transmission uses the adapt function for garage shifts, ratio control, and TCC application. The TCM monitors the input shaft speed in order to determine if the ratio control is occurring too fast or too slow and adjusts the pressure control solenoid in order to maintain the proper ratio control and garage shift feel.

ELECTRONIC COMPONENT DESCRIPTION

Transmission Control Module (TCM)

The transmission control module (TCM) is mounted in the engine compartment and connects directly to the wiring harness. Two 64-way connectors are used to make connections between the vehicle wiring, the transmission, and the TCM. The TCM is an electronic control module that receives input and provides output to control the operation of the VT25-E automatic transmission.

The TCM receives the following inputs from the engine control module (ECM):

- Engine speed and torque values
- Engine intake air temperature (IAT), and throttle position (TP) information
- Engine coolant temperature (ECT)
- Air-conditioning (A/C) status
- Cruise control status

The engine control module (ECM) provides this data to the TCM through the GMLAN high-speed controller area network (HSCAN). A two-wire circuit is used to communicate data between the ECM and TCM, CAN H and CAN L. Other TCM inputs are the following:

- Battery and ignition voltage
- Brake switch status
- Transmission fluid temperature (TFT)
- Transmission input speed sensor (ISS)
- Transmission output speed sensor (OSS)

The TCM provides the following outputs in order to control the automatic transmission:

- Ratio control motor to control the speed ratio of the transmission
- Line pressure control solenoid (PCS) valve regulates the transmission line pressure
- The TCC enable solenoid valve is used to hydraulically select whether the TCC pressure control solenoid valve will control the fluid pressure used to apply the forward and reverse clutches or the fluid pressure used to apply the torque converter clutch
- TCC pressure control solenoid valve is used to control the fluid pressure used to apply and release the forward and reverse clutches, and the torque converter clutch

Other TCM outputs provided to the ECM are the following:

- MIL illumination request
- Vehicle speed
- Transmission input speed
- Transmission fluid temperature

- TCC status
- Torque reduction requests
- Park/Neutral Position Assembly status
- Transmission service status

TCM Programming Procedures

1. The transmission control module (TCM) must be programmed with the proper software/calibrations. Ensure that the following conditions exist in order to prepare for TCM programming:
    - The battery is fully charged.
    - The ignition is in the RUN position.
    - The service stall equipment cable connection at the data link connector (DLC) is secure.
2. Program the TCM using the latest software matching the vehicle. Refer to up-to-date service stall equipment user instructions.
3. If the TCM fails to program, proceed as follows:
    - Ensure that the TCM connection is OK.
    - Inspect the service stall equipment for the latest software version.
    - Attempt to program the TCM. If the TCM still cannot be programmed properly, replace the TCM.

Park/Neutral Position Switch Assembly

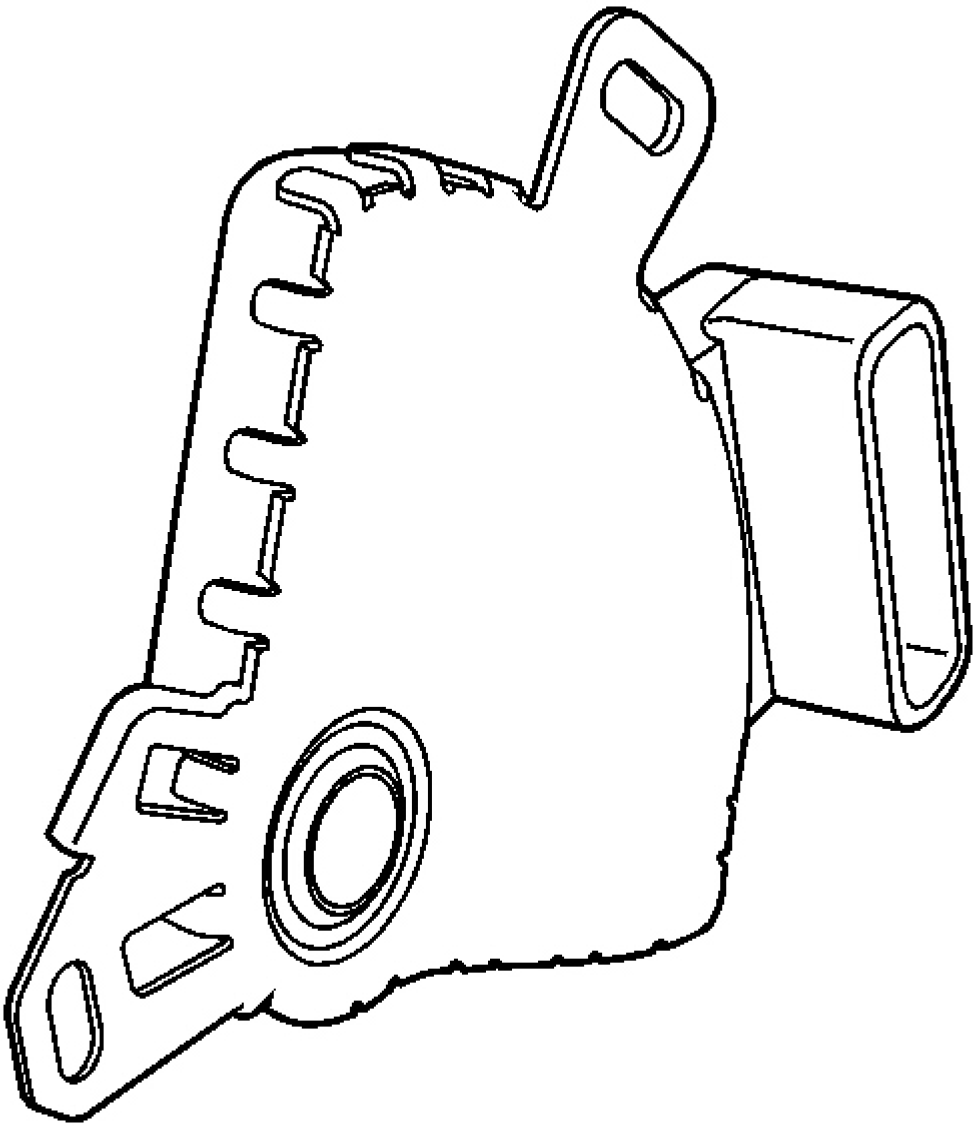


Fig. 471: Park/Neutral Position Switch Assembly
Courtesy of GENERAL MOTORS CORP.

The park/neutral position switch assembly is a sliding contact switch attached to outside of the automatic transmission case assembly and splined to the manual shift shaft. The four inputs to the TCM from the park/neutral position switch assembly indicate which position is selected by the transmission selector lever. This information is used for engine controls as well as determining the transmission ratio control patterns. The state of each input is available for display on the scan tool. The four input parameters represented are Mode A, Mode B, Mode C and Mode P (P/N Start).

Module Leadframe

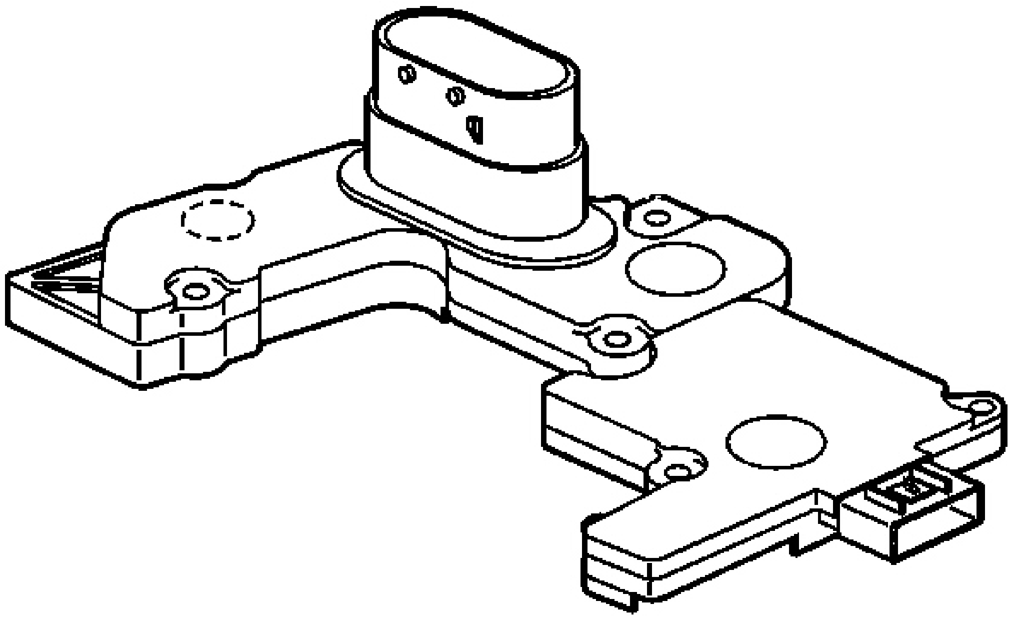


Fig. 472: Module Leadframe
Courtesy of GENERAL MOTORS CORP.

The leadframe is used to replace a conventional wiring harness and connects the various module components to the integral pass through connector. The leadframe also incorporates a 7-way speed sensor connector and a temperature sensor.

Automatic Transmission Input and Output Speed Sensor Assembly

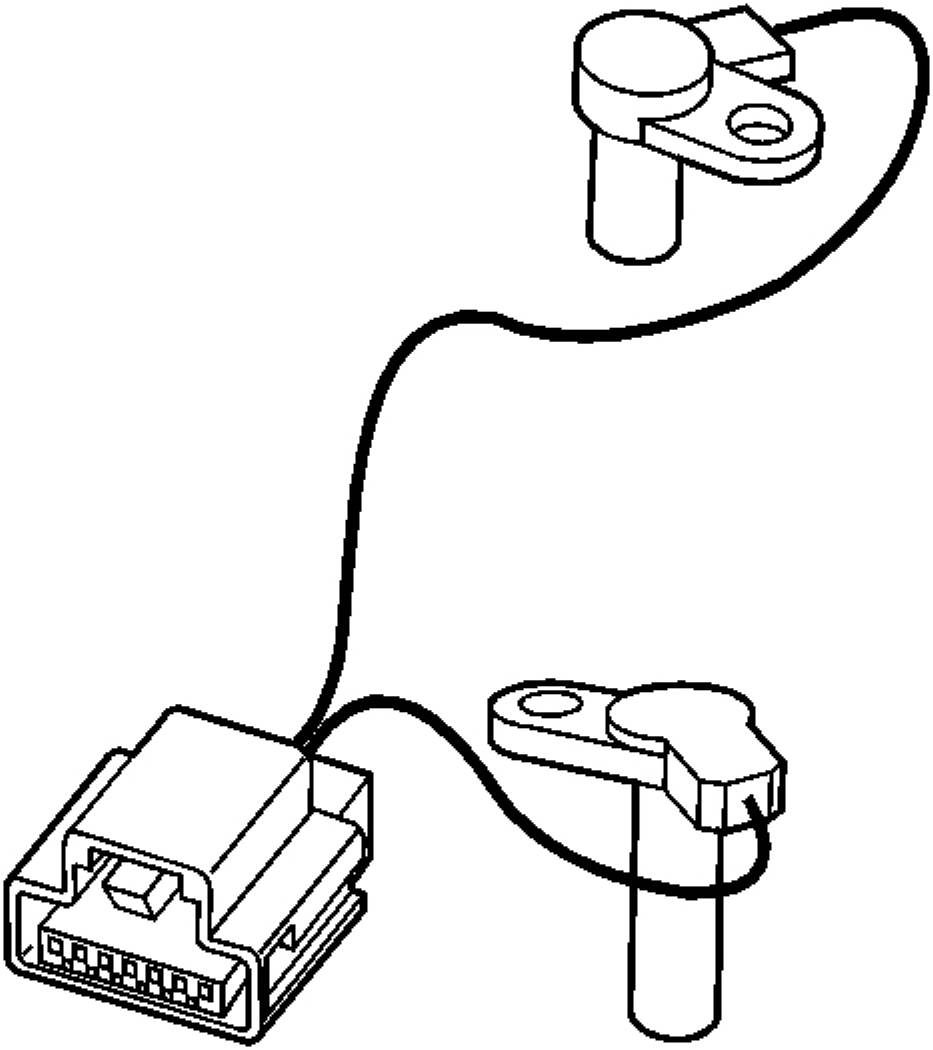


Fig. 473: Automatic Transmission Input & Output Speed Sensor Assembly
Courtesy of GENERAL MOTORS CORP.

The input and output speed sensor assembly is mounted inside the transmission, under the control valve body cover. Both sensors are variable reluctance magnetic pickups and are wired into the same connector, which plugs into the control solenoid valve assembly. The sensors consist of a permanent magnet surrounded by a coil of wire.

Input Speed Sensor (ISS)

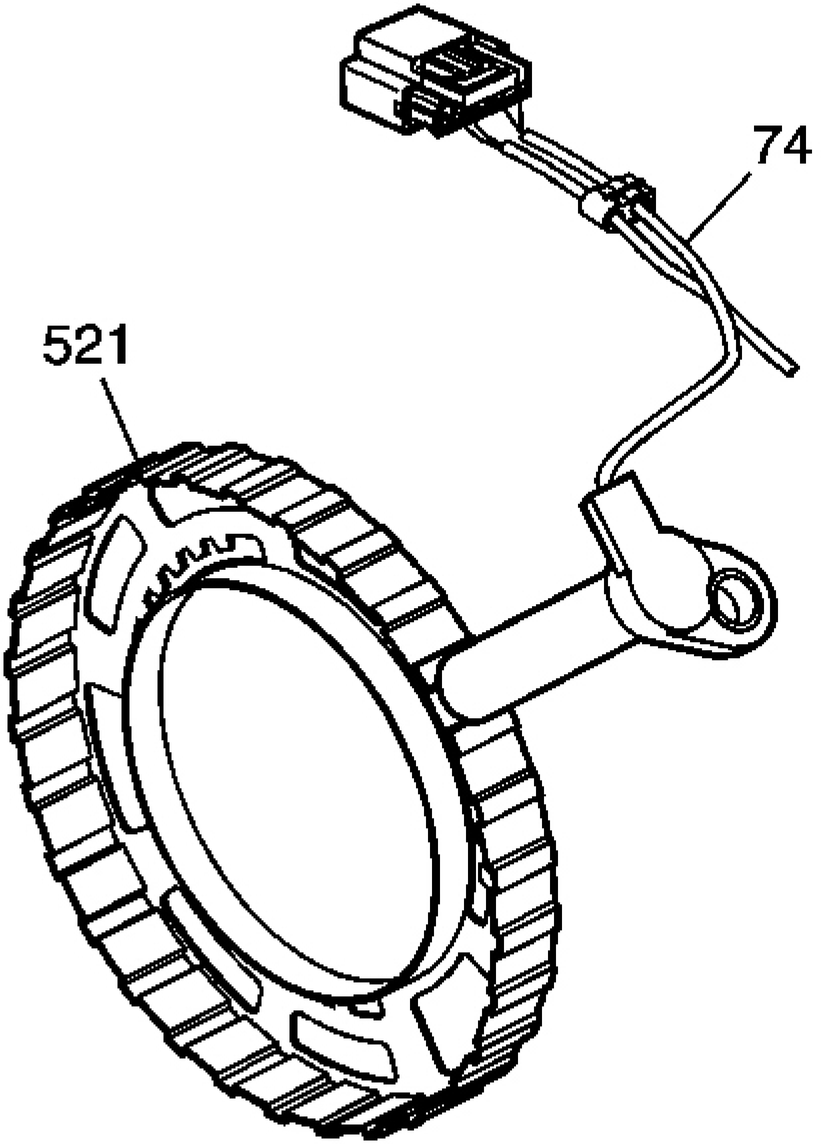


Fig. 474: Input Speed Sensor (ISS)
Courtesy of GENERAL MOTORS CORP.

The ISS is positioned next to the input speed sensor reluctor ring assembly (521) and has an air gap of 1.143-2.77 mm (0.045-0.109 in) between the reluctor ring teeth and the magnetic pickup. As the input speed sensor reluctor ring assembly rotates, an alternating current (AC) is induced in the coil by the "teeth" on the reluctor ring as they pass by the magnetic pickup. Therefore, whenever the turbine shaft, input shaft assembly, is turning, the ISS produces an AC voltage signal proportional to turbine speed. At the TCM, the AC signal is electronically conditioned to a 5-volt square wave form. The square wave form can then be interpreted as transmission input speed by the TCM through the frequency of square waves in a given time frame. The square waves can be thought of as a representation of the reluctor ring teeth. Therefore, the more teeth, or waves, that pass by the magnetic pickup in a given time frame, the faster the turbine shaft is turning. The square wave form is compared to a fixed clock signal within the TCM to determine transmission input speed.

Output Speed Sensor (OSS)

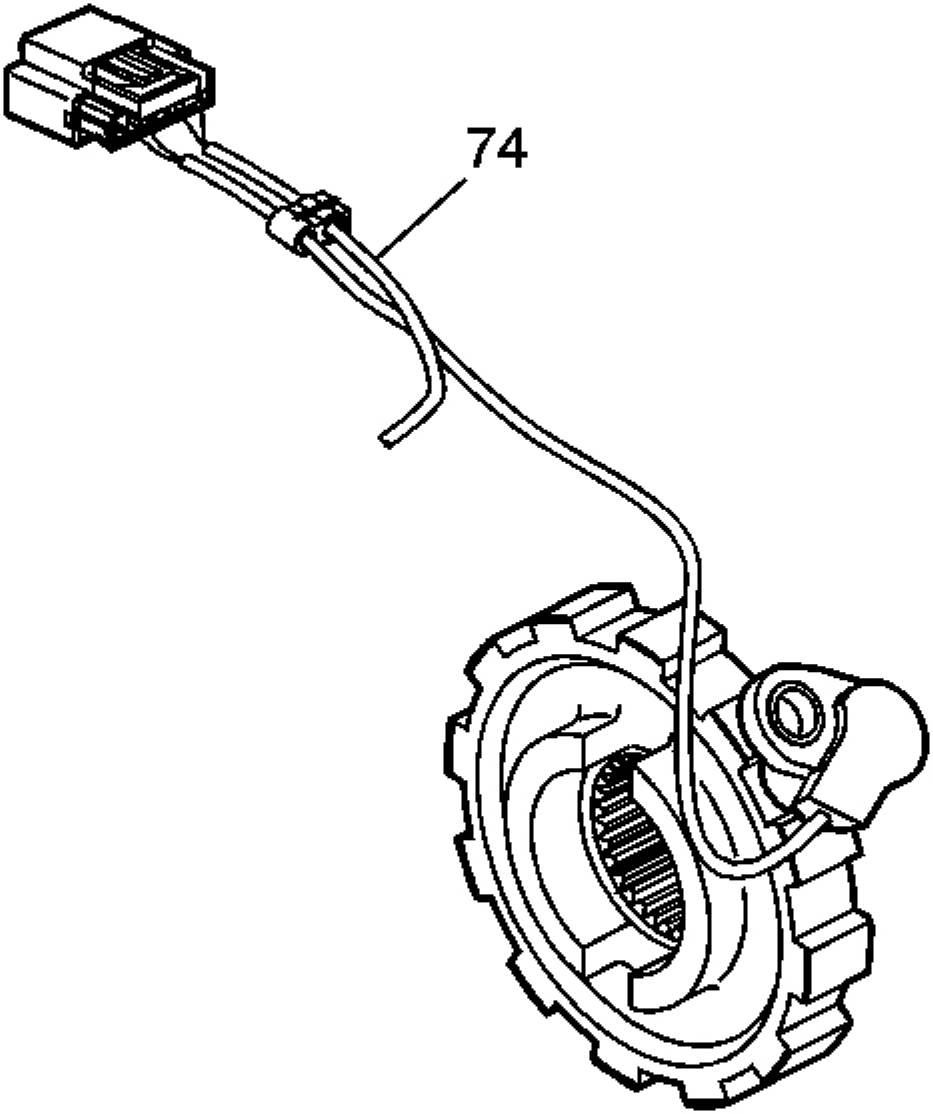


Fig. 475: Output Speed Sensor (OSS)
Courtesy of GENERAL MOTORS CORP.

The output speed sensor (OSS) operates identically to the ISS sensor except that it uses the teeth of the parking lock gear as the rotor, reluctor. The parking lock gear is splined to the variable driven pulley assembly. The OSS has an air gap of 1.143-2.77 mm (0.045-0.109 in) between the teeth and the magnetic pickup. The OSS sensor square wave form is also compared to a fixed clock signal within the TCM to determine actual vehicle speed. The TCM uses transmission input and output speeds to help determine line pressure, transmission ratio control patterns and TCC apply pressure and timing. This speed sensor information is also used to calculate turbine speed, drive ratios, and TCC slippage for diagnostic purposes.

Transmission Fluid Pressure Sensor

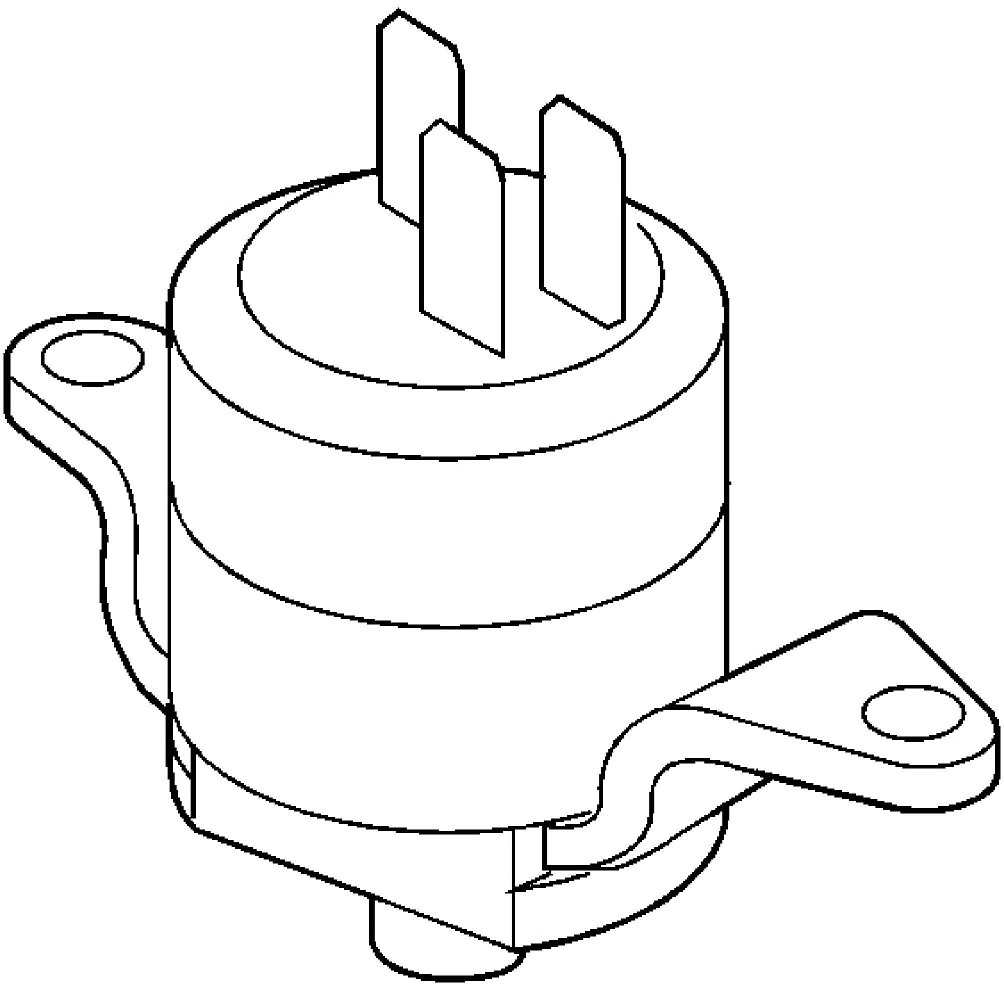


Fig. 476: Transmission Fluid Pressure Sensor
Courtesy of GENERAL MOTORS CORP.

The transmission fluid pressure (TFP) sensor is used to monitor line pressure and feedback to the TCM with an analog signal of 0-5 volts. The TFP sensor is fed with tier 2 feed fluid pressure, which nominally ranges from 483-5861 kPa (70-850 psi).

Transmission Fluid Temperature -TFT - Sensor

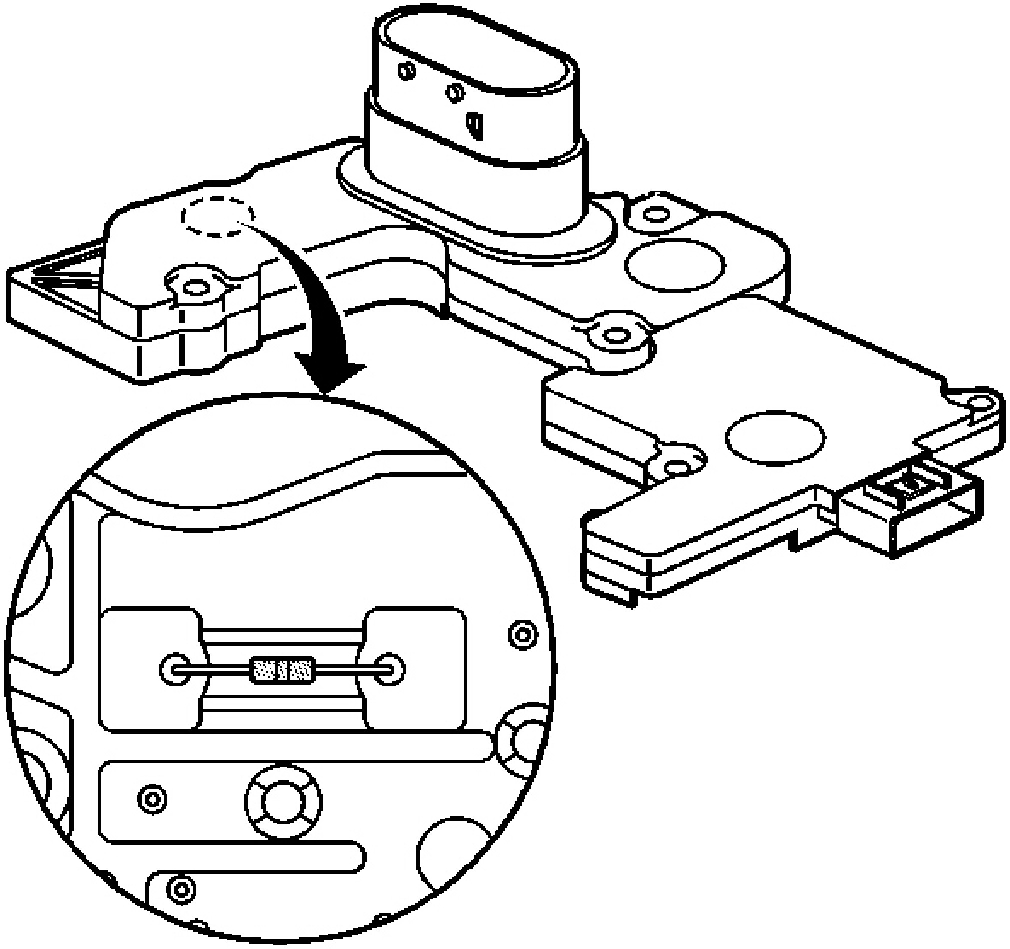


Fig. 477: Transmission Fluid Temperature -TFT - Sensor
Courtesy of GENERAL MOTORS CORP.

The TFT sensor is part of the module leadframe assembly, which is attached to the control solenoid valve assembly. The TFT sensor is a resistor, or thermistor, which changes value based on temperature. Refer to **Transmission Fluid Temperature (TFT) Sensor Specifications** . The sensor has a negative-temperature coefficient. This means that as the temperature increases, the resistance decreases, and as the temperature decreases the resistance increases. The TCM supplies a 5-volt reference signal to the sensor and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the TCM detects high signal voltage, counts. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage, counts, decreases. The TCM uses this information to maintain shift quality and torque converter clutch apply quality over the operating temperature range.

If transmission fluid temperatures become excessively high, (above approximately 140°C (284°F), the TCM will disable ECCC function and command TCC lock up mode. Applying the TCC serves to reduce transmission fluid temperatures created by the fluid coupling in the torque converter with the TCC released.

Above approximately 149°C (300°F) (calibratable in the TCM), the TCM will set a transmission fluid temperature diagnostic trouble code (DTC). This causes the TCM to use a fixed value of 135°C (275°F) (calibratable in the TCM) as the transmission fluid temperature input signal.

Ratio Control Motor (RCM)

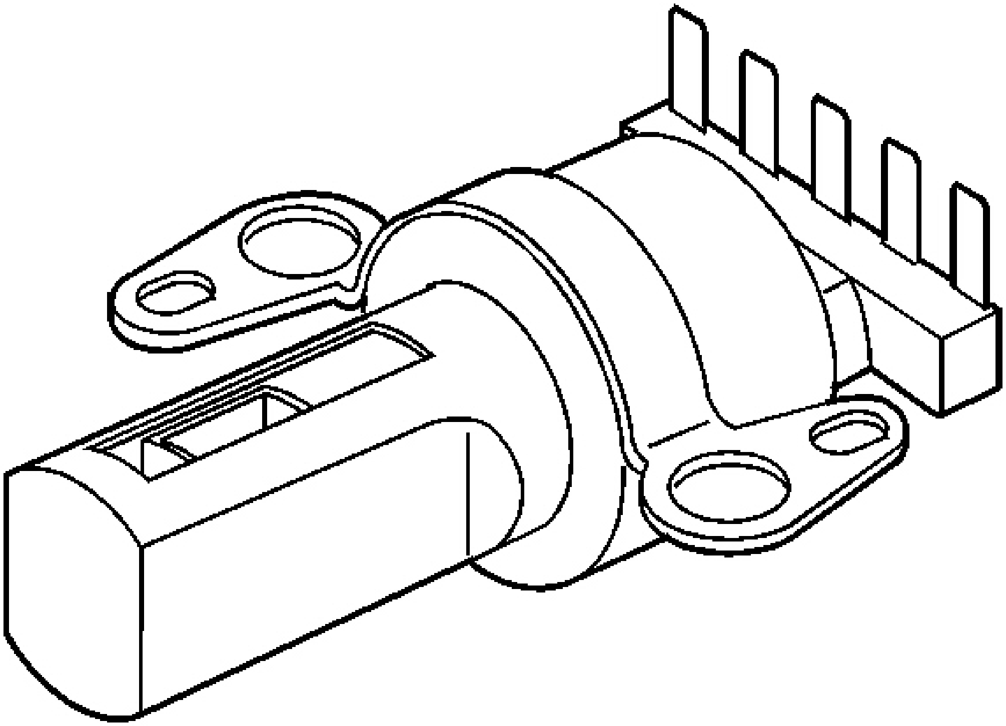


Fig. 478: Ratio Control Motor (RCM)
Courtesy of GENERAL MOTORS CORP.

The ratio control motor - RCM is a linear position device, which changes transmission ratio by accurately controlling the position of the variable ratio control valve in order to regulate primary feed fluid flow. The RCM has a total nominal travel of 22.0 mm (0.87 in).

The transmission control module (TCM) controls the sheave ratio by adjusting the position of the RCM pintle. Movement of the pintle changes the position of the variable ratio control valve, which regulates the primary feed fluid flow and directly changes the sheave ratio. The RCM is a bi-directional motor driven by two coils.

The TCM supplies a ground to apply current to the RCM in steps, counts, to extend or retract the pintle. An increase in counts will result in a larger speed ratio, smaller sheave ratio, and a decrease in counts will result in a smaller speed ratio, larger sheave ratio.

Ratio Control Motor Frequency

The RCM frequency is calculated in a 25 ms loop and used throughout the 25 ms time. The RCM counts are spaced equally for each 25 ms loop. This is accomplished by looking at how many counts are requested for this period. If all of them can be done in less than the maximum frequency, then the slower frequency is used.

Ratio Control Motor Time Delay

When there is a change in direction, the RCM must pause for a minimum time. If there is a change in frequency, then there is the same minimum pause time. The ratio control motor control algorithm incorporates a feature that will delay the count command for a calibratable amount of time when a change in direction of rotation of the ratio control motor shaft is detected. This feature is necessary because a significant amount of "lost" counts can occur due to overshoot of the rotor. The time delay allows the rotor to stabilize before beginning the rotation in the opposite direction.

Closed Loop Control

The ratio control system is a closed loop system utilizing a Proportional - Integral - Derivative (PID) controller (part of the TCM) to compensate for differences between commanded speed ratio and actual speed ratio. The PID controller utilizes the combination of proportional control action, integral control action, and derivative control action to continually adjust ratio control motor step counts in an attempt to maintain zero difference between commanded counts and actual counts. Commanded speed ratio is determined from the difference between desired speed ratio and the last commanded speed ratio. This difference is used to determine the rate at which commanded speed ratio converges to desired speed ratio. The difference between commanded speed ratio (converted to RCM counts) and actual speed ratio (converted to RCM counts) is used as the input to the PID controller which modifies the step counts of the ratio control actuator.

Open Loop Control

The closed loop ratio control algorithm will not function correctly when the transmission is in a Neutral state. This is because the variable drive pulley speed signal is not valid in Neutral and actual speed ratio becomes an invalid signal. Additionally, when a malfunction is detected in either the input or output signal, actual speed ratio will not be a valid signal. When either of these situations occur, open loop control is used to maintain actual ratio and minimize the difference between actual and commanded ratio.

Line Pressure Control Solenoid Valve

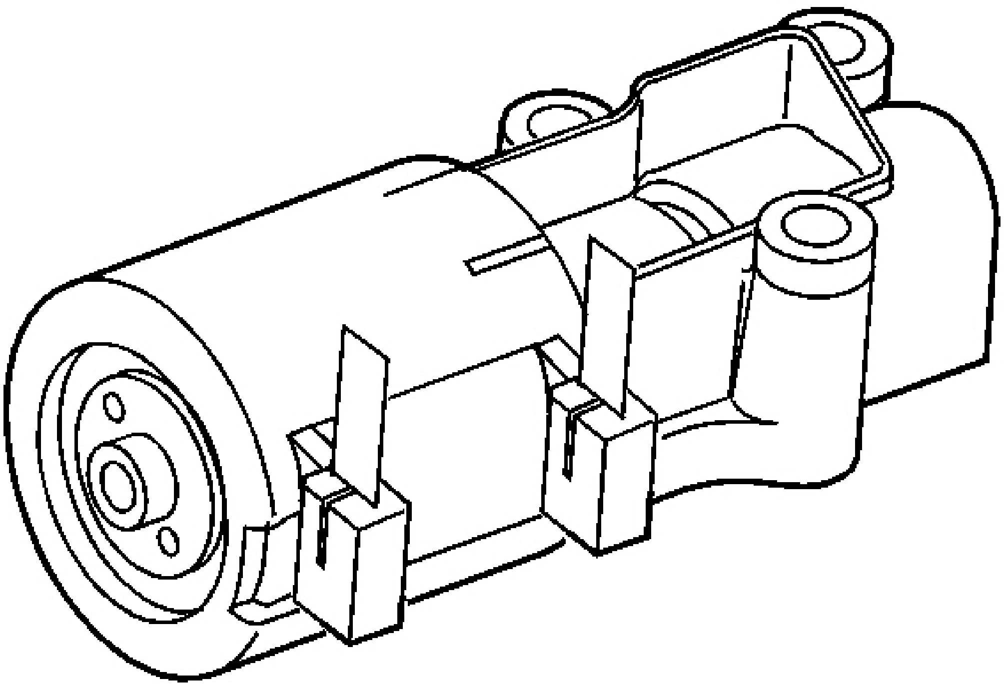


Fig. 479: Line Pressure Control Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

The line pressure control solenoid valve (normally-high, 3-port linear pressure control solenoid) is a precision electronic pressure regulator that controls transmission line pressure based on current flow through its coil windings. As current flow is increased, the magnetic field produced by the coil moves the solenoid's plunger further away from the exhaust port. Opening the exhaust port decreases the output fluid pressure regulated by the line pressure control solenoid valve, which ultimately decreases line pressure. The TCM controls the line pressure control solenoid valve based on various inputs including throttle position, transmission fluid temperature and ratio.

A "duty cycle" may be defined as the percentage of time current is flowing through a solenoid coil during each cycle. The number of cycles that occur within a specified amount of time, usually measured in seconds, is called "frequency". Typically, the operation of an electronically-controlled pulse width modulated solenoid is explained in terms of duty cycle and frequency.

The TCM controls the line pressure control solenoid valve on a positive duty cycle at a fixed frequency of 292.5 Hz, cycles per second. A higher duty cycle provides a greater current flow through the solenoid. The high, positive, side of the line pressure control solenoid valve electrical circuit at the TCM controls the line pressure control solenoid valve operation. The TCM provides a ground path for the circuit, monitors average current and continuously varies the line pressure control solenoid valve duty cycle to maintain the correct average current flowing through the line pressure control solenoid valve.

The duty cycle and current flow to the line pressure control solenoid valve are mainly affected by throttle position (engine torque), and they are inversely proportional to throttle angle (engine torque). In other words, as the throttle angle (engine torque) increases, the duty cycle is decreased by the TCM which decreases current flow to the line pressure control solenoid valve. Current flow to the line pressure control solenoid valve creates a magnetic field that moves the solenoid armature against spring force.

TCC Pressure Control Solenoid Valve

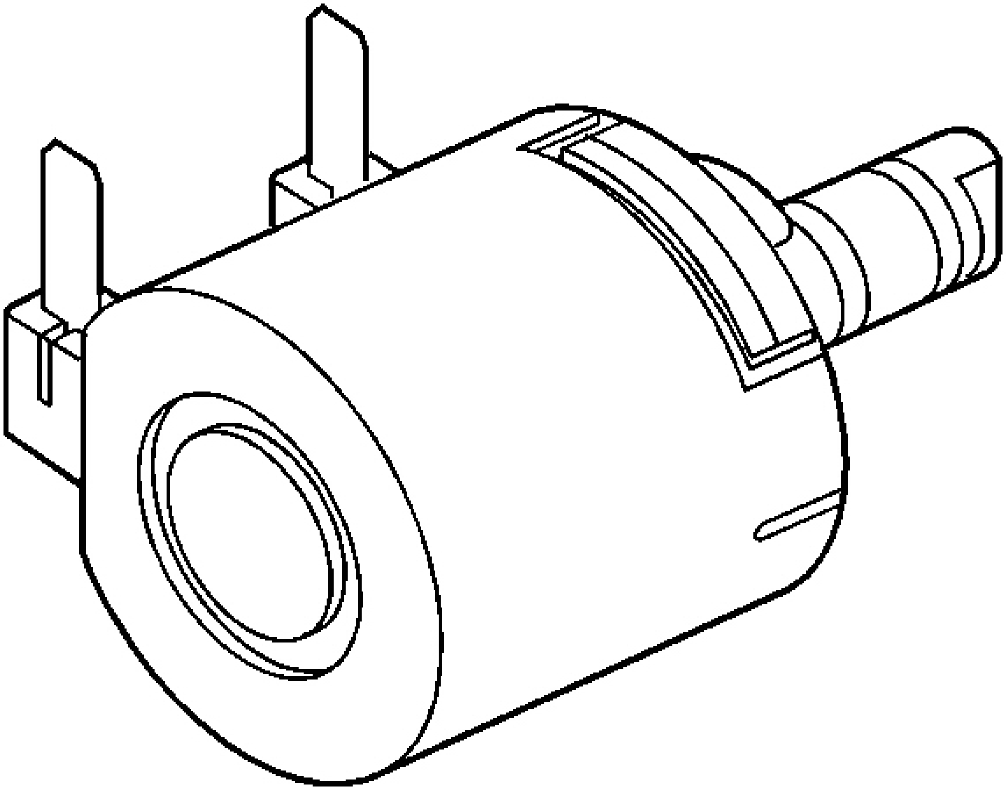


Fig. 480: TCC Pressure Control Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

The TCC pressure control solenoid valve is a normally-low, 3-port linear pressure control solenoid that controls the fluid pressure used to apply and release the forward and reverse clutches, and the torque converter clutch. The TCM operates the solenoid with a negative duty cycle at a fixed frequency of 32 Hz to control the rate of clutch apply/release. The solenoid's ability to "ramp" the clutch apply and release pressures results in a smoother clutch operation.

TCC Pressure Control Solenoid Valve Operation

The TCC pressure control solenoid valve is one electronic control component of the TCC control system. The other electronic component is the TCC enable solenoid valve, which enables the TCC to turn ON and OFF. The other components are all hydraulic control or regulating valves.

Forward and Reverse Clutch Control

When the TCC enable solenoid valve is OFF, the TCC pressure control solenoid valve controls the fluid pressure used to apply the forward and reverse clutches.

Neutral Idle Control

The TCC pressure control solenoid valve is also used to turn OFF clutch control fluid when the TCM commands Neutral Idle. If the TCC is applied, the TCM will first turn OFF the TCC enable solenoid valve to release the torque converter clutch. The TCM then ramps the TCC pressure control solenoid valve duty cycle up to approximately 98 percent to move the forward and reverse clutch valve against spring force, block line 2 limit fluid, and open the clutch control circuit to exhaust. This causes the forward or reverse clutch to release and places the transmission in a Neutral condition.

Torque Converter Clutch Control

When the TCC enable solenoid valve is ON, the TCC pressure control solenoid valve controls the fluid pressure used to apply the torque converter clutch. In drive range, at approximately 13 km/h (8 mph), the TCM operates the TCC pressure control solenoid valve at approximately 90 percent duty cycle. This duty cycle is maintained until a TCC apply is commanded. When vehicle operating conditions are appropriate to apply the TCC, the TCM immediately decreases the duty cycle to 0 percent, then increases it to approximately 25 percent. The TCM then ramps the duty cycle up to approximately 50 percent to achieve regulated apply pressure in vehicles equipped with the Electronically Controlled Clutch Capacity (ECCC) system. With the ECCC system, the pressure plate does not fully lock to the torque converter. Instead, a consistent slip of 20-40 RPM is regulated. The rate at which the TCM increases the duty cycle controls the TCC apply. Similarly, the TCM also ramps down the TCC pressure control solenoid duty cycle to control TCC release. Under some high torque or high vehicle speeds, the converter clutch is fully locked. There are some operating conditions that prevent or enable TCC apply under various conditions. Refer to **Transmission Fluid Temperature (TFT) Sensor Specifications** . Also, if the TCM receives a high voltage signal from the brake switch, signalling that the brake pedal is applied, the TCM immediately releases the TCC.

TCC Enable Solenoid Valve

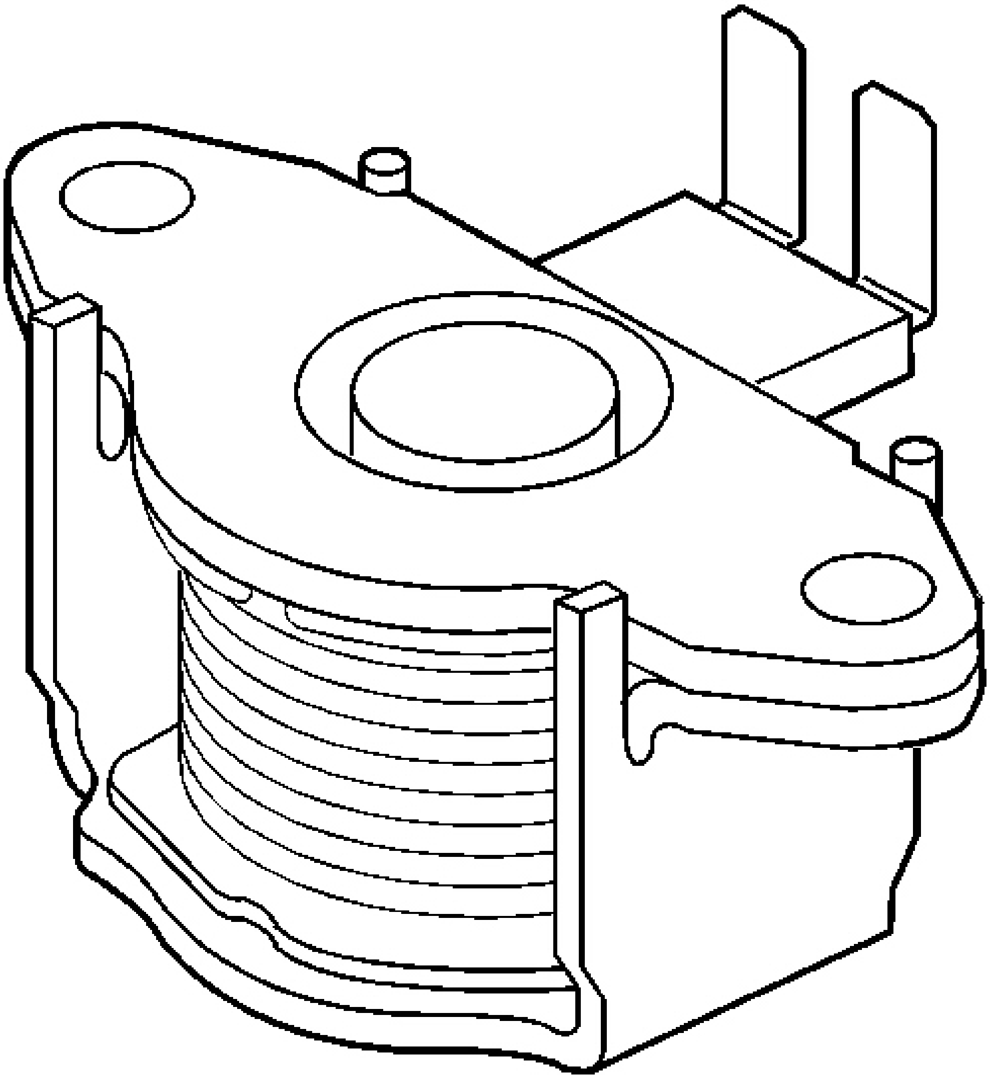


Fig. 481: TCC Enable Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

The TCC enable solenoid valve is a normally-closed, 3-port, ON/OFF solenoid controlled by the TCM. It is used to hydraulically select which fluid pressure, clutch control or regulated apply, will be controlled by the TCC pressure control solenoid valve. When the TCC enable solenoid valve is de-energized, actuator feed limit fluid pressure is blocked from pressurizing the TCC/NI enable signal fluid circuit. Without TCC/NI enable signal fluid pressure at the end of the TCC control valve, spring force holds the valve in the released position.

When vehicle operating conditions are appropriate for TCC apply, the TCM provides a ground for the TCC enable solenoid valve electrical circuit. Electrical current flows through the coil assembly in the solenoid and creates a magnetic field. The magnetic field moves the plunger and valve to allow actuator feed limit fluid to pass through the solenoid into the TCC/NI enable signal circuit. TCC/NI enable signal fluid pressure increases at the TCC control valve and moves the valve against spring force to the apply position.

Under normal operating conditions, the torque converter clutch only applies when the transmission is in an Overdrive ratio, in DRIVE range. However, at high speeds under heavy throttle conditions, the TCM will command TCC apply when in Intermediate range. Also, when transmission fluid temperature is above approximately 135°C (275°F), the TCC is applied all of the time in DRIVE range to help reduce transmission fluid temperatures.

When the TCM commands TCC release, the ground for the TCC enable solenoid valve electrical circuit is opened, causing the solenoid to block actuator feed limit fluid and open the TCC/NI enable signal circuit to an exhaust. TCC/NI enable signal fluid pressure exhausts from the TCC control valve and spring force moves the valve to the released position.

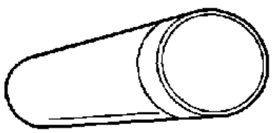
Other conditions that cause the TCM to change the operating state of the TCC enable solenoid valve include:

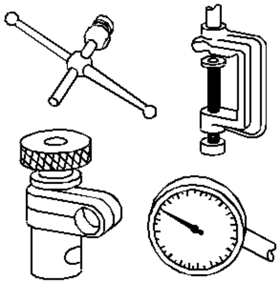
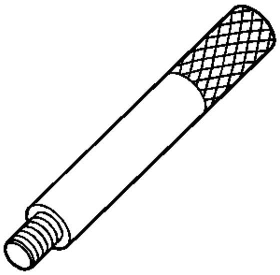
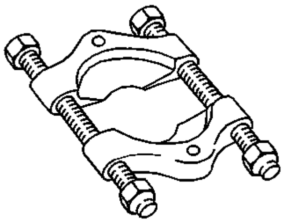
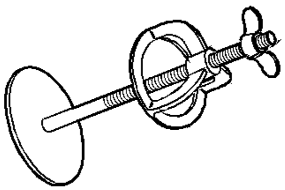
- The TCC is released when the vehicle decelerates and the TCM commands Neutral Idle.
- The TCC is released when the brake pedal is applied.
- The TCC is released under minimum and maximum throttle conditions.
- TCC apply is prevented until engine coolant temperature is above approximately 20°C (68°F).
- TCC apply is prevented until transmission fluid temperature is above approximately 29°C (84°F).

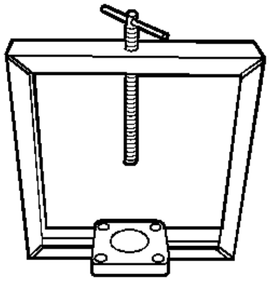
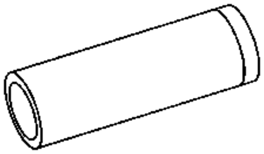
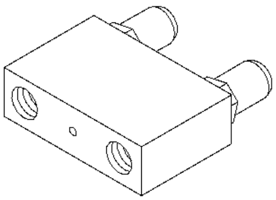
SPECIAL TOOLS AND EQUIPMENT

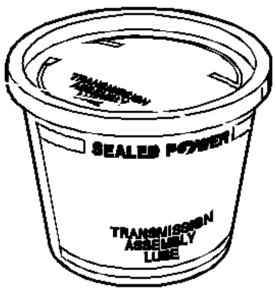
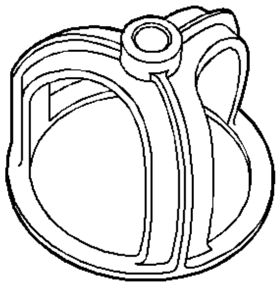
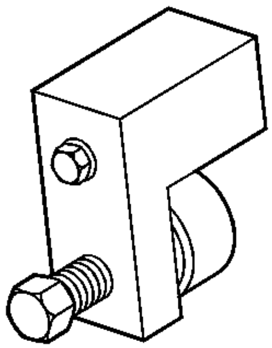
SPECIAL TOOLS

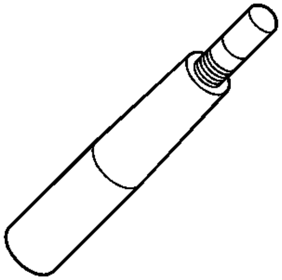
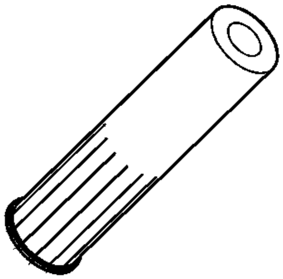
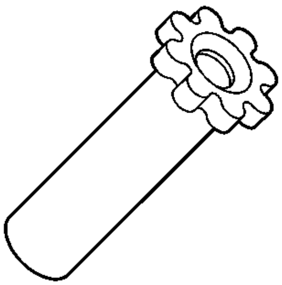
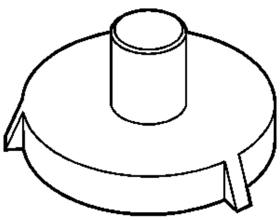
Special Tools

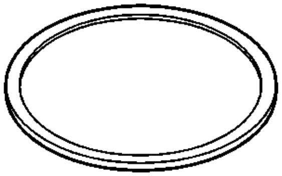
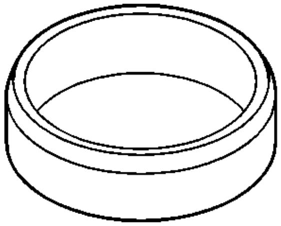
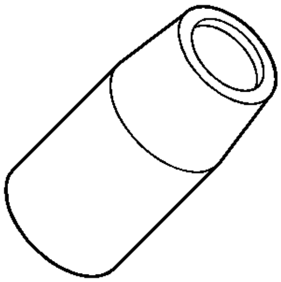
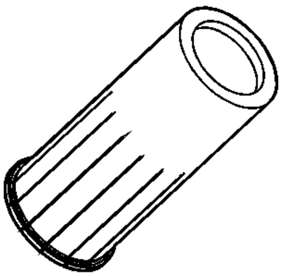
Illustration	Tool Number/Description
	J 2619-01 or SA9173G Slide Hammer
	J 6133-A Bearing Race Installer

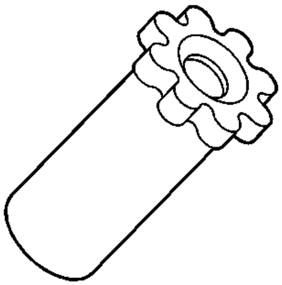
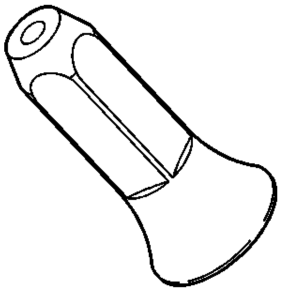
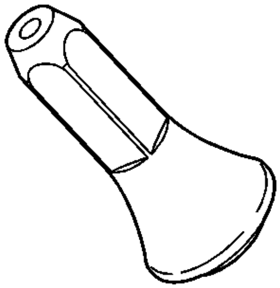
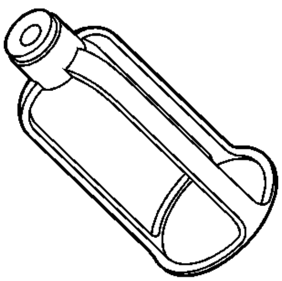
	J 8001 Dial Indiator Set
	J 8092 Universal Driver Handle
	J 22912-01 Split Plate Bearing Puller
	J 23327 Clutch Spring Compressor

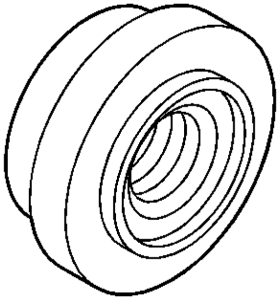
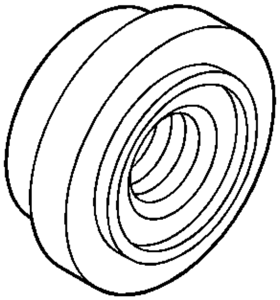
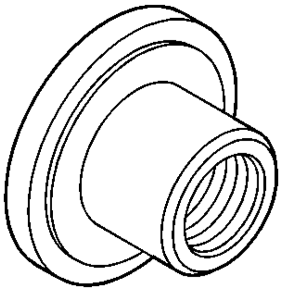
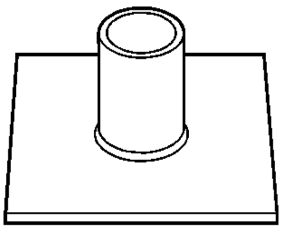
	J 23456 Booster and Clutch Pack Compressor
	J 35512 Inner Pinion Bearing Installer
	J 35944-440 Cooler Flush Adapter
	J 36346 Fascia Retainer Remover
	J 36850 Assembly Lubricant

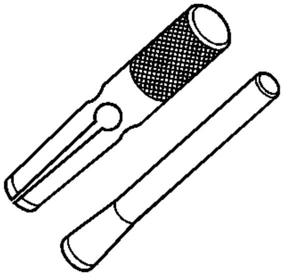
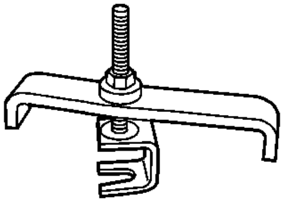
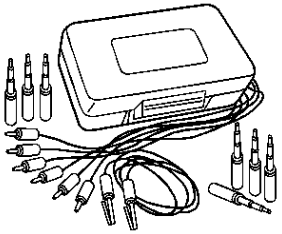
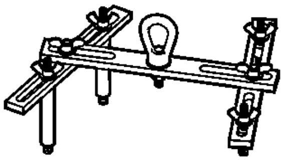
	
	J 38734 Reverse Spring Compressor Adaptor
	J 41239-1 Cooler Line Seal Installer
	J 43063-1 Input Shaft Seal Protector

	
	J 43063-2 Input Shaft Seal Pusher
	J 43063-3 Input Shaft Seal Sizer
	J 43065-1 Reverse Clutch Piston Pusher

	J 43065-2 Reverse Clutch Piston OD Protector
	J 43065-3 Reverse Clutch Piston ID Protector
	J 43066-1 Stator Shaft Seal Protector
	J 43066-2 Stator Shaft Seal Pusher

	J 43066-3 Stator Shaft Seal Sizer
	J 43068 Axle Seal Installer
	J 43069 Converter Seal Installer
	J 43074 Forward Clutch Piston Spring Compressor

	J 43075 Drive Pinion Bearing and Cup Installer
	J 43076 Carrier Bearing and Cup Installer
	J 43077 Variable Driven Pulley Bearing Installer
	J 43083 Input Shaft Holding Base

	J 43084 Spiral Ring Installer
	J 43445 Fluid Pump Remover
	J 43907 Connector Test Adapter Kit
	J 43969 Case Cover Lifting Bracket
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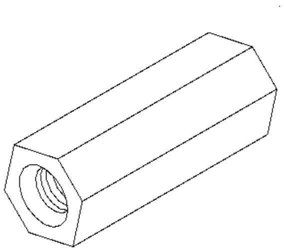
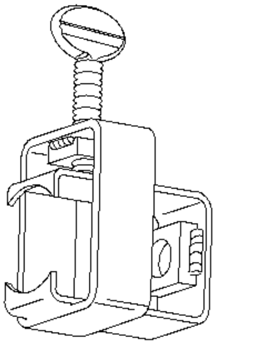
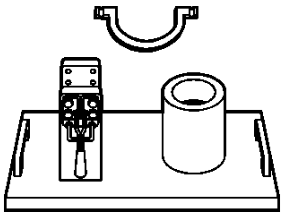
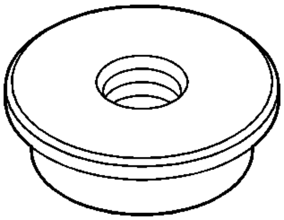
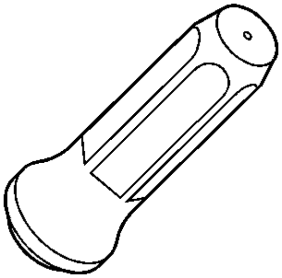
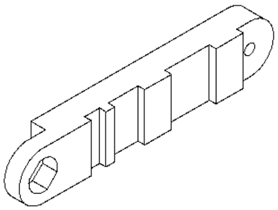
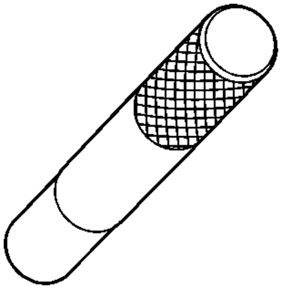
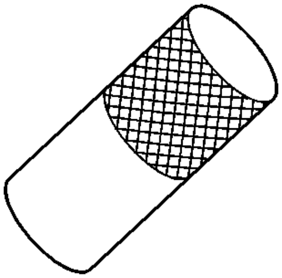
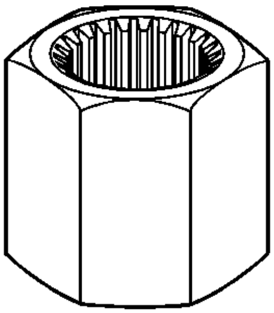
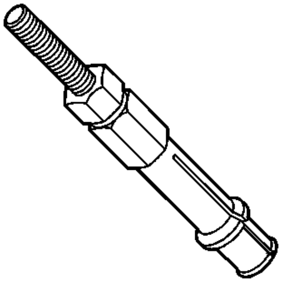
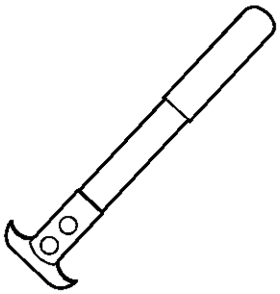
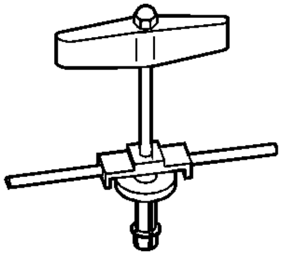
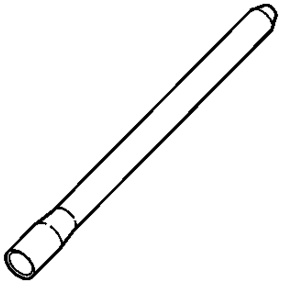
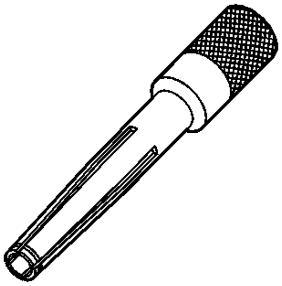
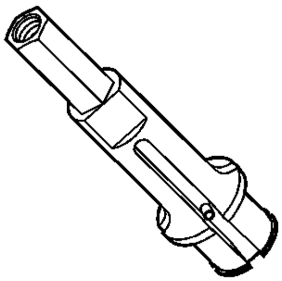
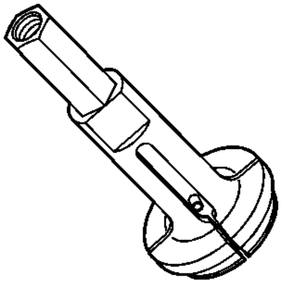
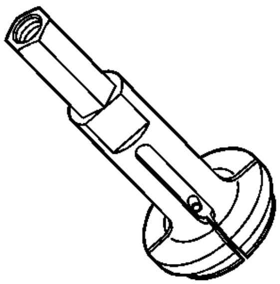
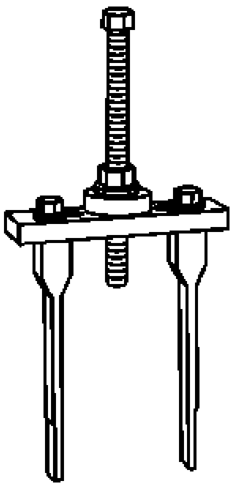
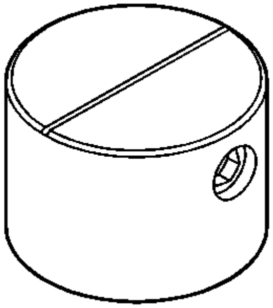
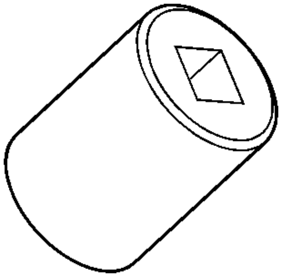
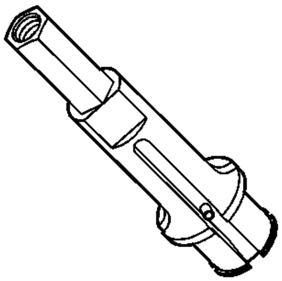
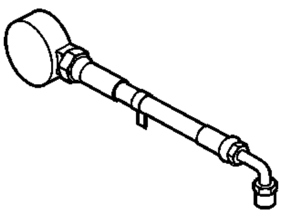
	
	J 44017 Stub Shaft Assembly Remover
	J 44337 Build Plate Assembly
	J 44719 Carrier Bearing Cup Installer F4WD

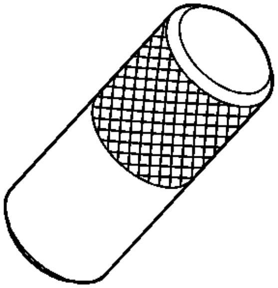
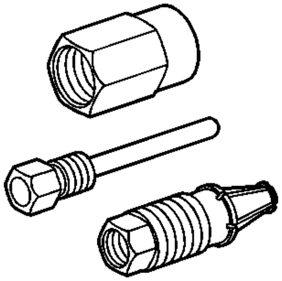
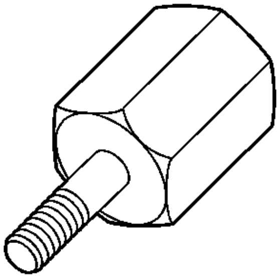
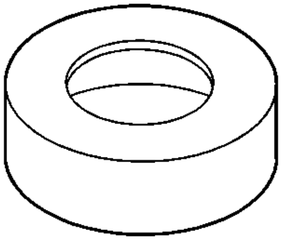
	J 44809 Output Shaft Seal
	J 44810 Transaxle Range Switch Alignment Tool
	J 44939 Fluid Passage Sleeve Installer
	J 44969 Manual Shift Shaft Seal Installer

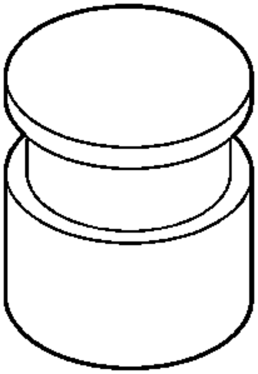
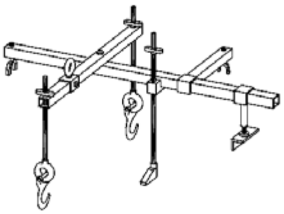
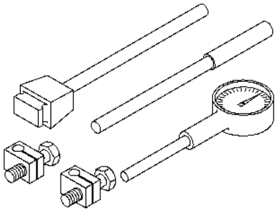
	J 44996 Input Carrier Alignment Tool
	J 44998 Input Shaft (Inner) Bearing Remover
	J 45000 Seal Remover
	J 45051 Torque Converter End Play Checking Tool

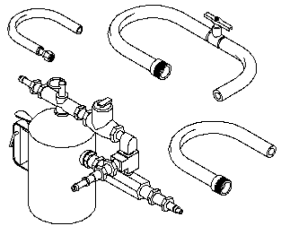
	
	J 45112-1 Pump Drive Shaft Retaining Ring Sizing Rod
	J 45112-2 Pump Drive Shaft Retaining Ring Sizer/Installer
	J 45113 Variable Driven Pulley Bearing Remover

	J 45114 Bearing Cup Remover (F4WD)
	J 45115 Bearing Cup Remover
	J 45124 Removal Bridge

	J 45189 Bearing Remover
	J 45190 Manual Shift Shaft Socket
	J 45191 Bearing Cup Remover (2WD)
	J 45195 Line Pressure Gage

	J 45198 Pump Drive Shaft Seal Installer
	J 45201 Cooler Line Seal Remover
	J 45209 Fluid Passage Sleeve Remover
	J 45995 Clutch Compressor

	J 46251 or SA91111T Weight
	SA9105E Engine Support Fixture - 3-Bar
	SA9179NE Dial Indicator
	SA9165T Oil Cooler Line Flusher



DIAGNOSTIC INFORMATION & PROCEDURES

DIAGNOSTIC STARTING POINT - AUTOMATIC TRANSMISSION

Begin the system diagnosis with **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L. The Diagnostic System Check provides the following information:

- The identification of the control module or modules which commands the system
- The ability of the control module or modules to communicate through the serial data circuit
- The identification and status of stored diagnostic trouble codes (DTCs)

The use of **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L identifies the correct procedure for diagnosing the system and the procedure location.

Symptoms

When it has been determined through **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L that no DTCs are present, begin symptom diagnosis by reviewing the **Transmission Component and System Description** . Reviewing the **Transmission Component and System Description** information enables you to understand the operation of the system. This helps you determine if the condition described by the customer is normal or if a malfunction exists. If it is determined that a malfunction exists, identify the concern by referring to the **Symptoms - Automatic Transmission** table. The **Symptoms - Automatic Transmission** table provides common diagnostic categories which relate directly to diagnostic information or procedures.

DIAGNOSTIC SYSTEM CHECK - AUTOMATIC TRANSMISSION

Description

IMPORTANT: Do not perform the Diagnostic System Check-Automatic Transmission unless one of the concerns noted is present. Failure to follow this procedure could lead to misdiagnosis of the system.

The Diagnostic System Check-Automatic Transmission is an organized approach to identifying a condition created by an electronic transmission control system. The Diagnostic System Check-Automatic Transmission is intended for use in diagnosing a concern in a vehicle with separate engine and transmission control modules, ECM and TCM.

When an emission related diagnostic trouble code (DTC) sets as a result of a transmission fault, the TCM requests the ECM to illuminate the malfunction indicator lamp (MIL). This request will be identified by the ECM as DTC P0700. The ECM may also independently illuminate the MIL. Although either module may cause the MIL to illuminate, the scan tool can display DTCs from only one module at a time. In addition, the Clear DTC Info command clears DTC data from both modules. If the DTC failure records are not recorded from both modules before the DTC data is cleared, important diagnostic information will be erased.

Your training and experience as a technician may cause you to focus on either the TCM or the ECM, instead of both modules at the same time. To ensure that both modules are properly diagnosed, separate system checks are included. The **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L identifies DTC status and communication function for the ECM. If no ECM DTCs are present, the **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L will direct you to the Diagnostic System Check-Automatic Transmission.

The ECM diagnostics do not require transmission data in order to run. Correct use of the tables will reduce diagnostic time and prevent the replacement of good parts.

Diagnostic Aids

Inspect all of the related wiring and connections including the connections at the TCM, as these may cause an intermittent concern. Inspect the terminals for any damage or any corrosion. Inspect the connector for any pushed-out terminals.

Diagnostic System Check - Automatic Transmission

Step	Action	Yes	No
1	Perform the following preliminary inspections: • Ensure that the battery is fully charged. Refer to **Battery Inspection/Test (Side Terminal Battery)** or **Battery Inspection/Test (Top Post Terminal Battery)** in Engine Electrical. • Ensure that the battery cables are clean and tight. • Inspect the easily accessible systems of the visible system components for obvious damage or conditions that could cause the symptom. Refer to **Strategy Based Diagnosis** in General Information. • Ensure that the engine and control module grounds are clean, tight, and in the correct location. • Inspect for aftermarket devices that could affect the operation of the system. Refer to **Checking Aftermarket Accessories** in Wiring Systems. • Ensure the resistance between the TCM housing and the battery negative cable is less than 0.5 ohm.		

	Did you find and correct the condition?	System OK	Go to **Step 2**
2	1. Turn ON the ignition, with the engine OFF. 2. Attempt to establish communication with the listed control modules: • Transmission control module (TCM) • Engine control module (ECM) • Electronic brake control module (EBCM) • Instrument panel cluster (IPC) • HVAC control module • Theft deterrent control module Does the scan tool communicate with all the listed control modules?	Go to **Step 3**	Go to **Scan Tool Does Not Communicate with Class 2 Device** in Data Link Communications
3	**IMPORTANT:** **The engine may start during the following step. Turn OFF the engine as soon as you have observed the Crank power mode.** 1. Access the Class 2 Power Mode in the Diagnostic Circuit Check on the scan tool. 2. Rotate the ignition switch through all positions while observing the ignition switch power mode parameter. Refer to **Body Control System Description and Operation** in Body Control Systems for a list of the power mode states that correspond to each ignition switch position. Does the ignition switch parameter reading match the ignition switch position for all switch positions?	Go to **Step 4**	Go to **Control Module References** in Body Control System
4	Attempt to start the engine. Does the engine crank?	Go to **Step 5**	Go to **Symptoms - Engine Electrical** in Engine Electrical
5	Did the engine start and idle?	Go to **Step 6**	Go to **Engine Cranks but Does Not Run** in Engine Controls - 2.2L
	IMPORTANT: **Do NOT clear the DTCs unless instructed by a diagnostic procedure.**		

6	1. Select the DTC display function for the following control modules and record the DTCs: • Transmission control module (TCM) • Engine control module (ECM) • Electronic brake control module (EBCM) • Instrument panel cluster (IPC) • HVAC control module • Theft deterrent control module 2. IF multiple powertrain DTCs are stored, diagnose the DTCs in the following order: Test for component lever DTCs. For example, sensor DTCs, then solenoid DTCs. Begin with the lowest number DTC unless the diagnostic table directs you otherwise. 3. If there is any powertrain DTCs, Select Capture Info in order to store the Powertrain DTC information with a scan tool. Does the scan tool display any DTCs?	Go to **Step 7**	Go to **Step 10**
7	Does the scan tool display DTCs which begin with a "U"?	Go to **Diagnostic Trouble Code (DTC) List** in Data Link Communications	Go to **Step 8**
8	Does the scan tool display DTC P0601, P0602, P0603, P0604 or P0606?	Go to **DTC P0601** , **DTC P0602** , **DTC P0603** , **DTC P0604** or **DTC P0606**	Go to **Step 9**
9	Does the scan tool display DTC P0562 or P0563?	Go to **DTC P0562** or **DTC P0563**	Go to **Step 10**
10	Are there any other TCM DTCs observed?	Go to **Diagnostic Trouble Code (DTC) List/Type**	Go to **Step 11**
11	Are there any ECM DTCs or driveability symptoms other than DTC P0700 observed?	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls-2.2L	Go to **Step 12**
12	Are there any transmission controls or transmission driveability symptoms observed?	Go to **Symptoms - Automatic Transmission**	System OK

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selection(s)	Description

Line PC Solenoid	Line PC Sol. Functional	• The TCM commands the amperage to the line pressure control solenoid in order to control transmission line pressure. As the amperage increases, the line pressure decreases. As the amperage decreases, the line pressure increases. The amperage range is 0.20-1.10 and may be commanded in one-tenth amp increments.
		• When the engine is running, the following control limits apply:
		  ○ When the transmission range is Park or Neutral, the reference, commanded, amperage may be controlled within calibrated limits. The engine speed must be less than 1,500 RPM. If the engine speed is greater than 1,500 RPM, the message "TR in park/neutral and engine speed over 1,500 RPM" appears on the scan tool display. Both scan tool parameters "Line PC Sol. Ref. Current" and "Line PC Sol. Actual Current" change with the scan tool commands and remain until commanded otherwise.
		  ○ When the transmission range is not Park or Neutral, amperage may be controlled within calibrated limits. If the current requested is too high or too low, the message "Requested current for the PC Solenoid is too high" appears on the scan tool display.
		  ○ When the transmission range is not in Park or Neutral, the reference amperage can only be controlled less than the current determined by the TCM. The TCM does not allow a value to be selected that may cause damage to the transmission. If the requested amperage is more than allowed by the TCM, the message "Requested override current out of range" appears on the scan tool display.
		  ○ Transmission range DTCs must not be active. If a transmission range DTC is active, the message "Engine running with transmission DTC present" appears on the scan tool display.

		• The TCM commands the position of the ratio control motor pintle in order to control the speed of the transmission. As the pintle is extended, the speed ratio of the transmission is increased. The speed ratio range is 0.4-1.8 and can be commanded in 0.2 increments. • When the engine is running, the following control limits apply: ○ The sheave ratio control may not be commanded to increase the speed ratio, if the engine speed is below a calibrated value. If the solenoid is commanded to increase when the engine speed is too low, the message "Engine Speed Too Low" appears on the scan tool display.

Sheave Ratio Control	-	◦ The sheave ratio control may not be commanded to increase the speed ratio, if the vehicle speed is below a calibrated value. If the solenoid is commanded to increase when the vehicle speed is too low, the message "Vehicle Speed Too Low" appears on the scan tool display. ◦ The sheave ratio control may only command changes in speed ratio when the vehicle is moving within a calibrated vehicle speed range in Drive range. When the transmission range is not Drive and sheave ratio control is attempted, the message "Transmission range must be in drive" appears on the scan tool display. ◦ Transmission range DTCs must not be active. If a transmission range DTC is active, the message "Engine running with transmission DTC present" appears on the scan tool display.
TCC Solenoid	TCC Enable Sol. Functional	• The TCM commands the state of the TCC enable solenoid. The state represents whether the solenoid is directing fluid to the TCC/NI enable signal fluid circuit or not. "Enabled" indicates that the TCC Enable solenoid is ON and is directing fluid to the fluid circuit and thereby allowing the TCC PC solenoid to apply the torque converter clutch. "Disabled" indicates that the TCC Enable solenoid is exhausting fluid from the TCC/NI enable signal fluid circuit. The scan tool TCC enable solenoid parameter should match the commanded state. • When the engine is running, the following control limits apply: ◦ The TCC enable solenoid may not be commanded enabled if the vehicle speed is below a calibrated value. If the solenoid is commanded ON when the vehicle speed is too low, the message "The Vehicle Speed is Too Low" appears on the scan tool display. ◦ Transmission range DTCs must not be active. If a transmission range DTC is active, the message "Engine running with transmission DTC present" appears on the scan tool display. ◦ The TCC Enable Sol. Functional control may only command the TCC system ON and OFF when the vehicle is moving within a calibrated vehicle speed range in Drive range. When the transmission range is not Drive and TCC system is commanded ON or OFF, the message "The Vehicle Speed is Too Low" appears on the scan tool display.
		• The TCM commands the duty cycle of the TCC PC solenoid. The duty cycle is represented by a percentage of ON, energized, time. Approximately 90-100 percent duty cycle represents an ON, energized, commanded state. One percent represents an OFF, non-energized, commanded state. The scan tool TCC Duty Cycle parameter should match the commanded state. • When the engine is running, the following control limits apply: ◦ The TCC PC solenoid may not be commanded OFF for more than a calibrated amount of time. If the solenoid is commanded OFF

TCC Solenoid	TCC PC Sol. Functional	for a certain amount of time, the message "TCC OFF time has been exceeded" appears on the scan tool display. ◦ The TCC PC solenoid may not be commanded ON if the vehicle speed is below a calibrated value. If the solenoid is commanded ON when the vehicle speed is too low, the message "The Vehicle Speed is Too Low" appears on the scan tool display. ◦ The TCC PC Sol. Functional control may only command the TCC system ON and OFF when the vehicle is moving within a calibrated vehicle speed range in Drive range. When the transmission range is not Drive and TCC system is commanded ON or OFF, the message "The Vehicle Speed is Too Low" appears on the scan tool display. ◦ Transmission range DTCs must not be active. If a transmission range DTC is active, the message "Engine running with transmission DTC present" appears on the scan tool display.
Trans. Adaptive Reset	-	• The TCM clears, or resets, all TAP cells to zero. • There are no limits to using this control. It may be performed with the engine running or when the ignition is ON, and the engine is OFF.

SCAN TOOL DATA LIST

Use the Scan Tool Data List under the following conditions:

- The **Diagnostic System Check - Automatic Transmission** has been completed.
- The On-Board Diagnostics are functioning properly.
- No DTCs are present.

IMPORTANT: Do not use a scan tool that displays faulty data. Report the condition to the scan tool manufacturer. The use of a faulty scan tool can result in misdiagnosis and the unnecessary replacement of parts.

Only the parameters listed below are used in this service manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by General Motors for use in diagnosis.

Scan tool values below were recorded under the following conditions:

- Engine at idle
- Upper radiator hose is hot
- Closed throttle
- Transmission in Park
- Closed loop operation
- Accessories OFF
- Brake pedal not applied

Scan Tool Data List

Scan Tool Parameter	Data List*	Units Displayed	Typical Data Value
APP Angle	F0, F1, F2, F3	%	0%
Brake Switch	F0, F1	Applied/Released	Released
Desired Speed Ratio	F0, F1, F2	Ratio	0.36-0.40
ECT	F0, F1	°C (°F)	85-115°C (185-239°F)
Engine Run Time	F0	Hours:Minutes:Seconds	Varies
Engine Speed	F0, F1, F2, F3	RPM	550-800 RPM
Engine Torque	F0, F1	N.m (lb ft)	8-25 N.m (7-18 lb ft)
Ignition Voltage	F0	Volts	12.0-14.7 Volts
Line PC Sol. Actual Current	F0, F3	Amps	0.80-0.98
Line PC Sol. Duty Cycle	F0, F3	%	38-56
Line PC Sol. Ref. Current	F0, F3	Amps	0.80-0.98
Line Pressure Actual	F0, F3	kPa (psi)	480-750 kPa (70-109 psi)
Line Pressure Commanded	F0, F3	kPa (psi)	900-1200 kPa (131-174 psi)
Ratio Ctrl. Mtr. Actual	F0, F2	Counts	39-46
Ratio Ctrl. Mtr. CKT A1 Status	F0, F2	OK, Open/Short to GND, Short to Volts	OK
Ratio Ctrl. Mtr. CKT A2 Status	F0, F2	OK, Open/Short to GND, Short to Volts	OK
Ratio Ctrl. Mtr. CKT B1 Status	F0, F2	OK, Open/Short to GND, Short to Volts	OK
Ratio Ctrl. Mtr. CKT B2 Status	F0, F2	OK, Open/Short to GND, Short to Volts	OK
Ratio Ctrl. Mtr. Commanded	F0, F2	Counts	39-58
Ratio Ctrl. Mtr. Dither	F0, F2	Active/Inactive	Active
Sheave Ratio	F0, F1, F2, F3	Ratio	2.50-2.80
Shifter Inhibit	F0	Normal/Low TFT	Normal
Speed Ratio	F0, F1, F2	Ratio	0.00
TCC Enable Solenoid	F0, F1	Disabled/Enabled	Disabled
TCC PC Sol. Actual Current	F0, F1	Amps	0.20-0.30
TCC PC Sol. Duty Cycle	F0, F1	%	10-18%
TCC PC Sol. Ref. Current	F0, F1	Amps	0.20-0.25

TCC Slip Speed	F0, F1	RPM	20-90 RPM
TCC Tap Cell 1-5	F4	kPa (psi)	Varies
TR Sw.	F0	Park, Neutral, Reverse, Drive, Intermediate, Low	Park
TR Sw. A/B/C/P	F0	HI/LOW	HI/LOW/LOW/HI
Trans. Component Slip	F0, F2	RPM	500-650 RPM
Trans. Fluid Temp.	F0, F1, F3	°C (°F)	70-115°C (158-239°F)
Transmission ISS	F0, F1, F2	RPM	500-700 RPM
Transmission OSS	F0, F1, F2	RPM	0 RPM
Vehicle Speed	F0, F1, F2	km/h (mph)	0 km/h (0 mph)

***Data List Legend**

- F0: Transmission Data
- F1: TCC Data
- F2: Sheave Ratio Control Data
- F3: Line PC Solenoid Data
- F4: TCC Adapt Data

SCAN TOOL DATA DEFINITIONS

This list explains each data message displayed on the scan tool. This information will assist you in tracking down emissions or driveability DTCs, because you can view the displays while you are driving the vehicle. Refer to **Diagnostic System Check - Automatic Transmission** for additional information.

APP Angle

The engine control module (ECM) computes the accelerator pedal position (APP) sensor angle from the APP sensor voltage input. The ECM sends the APP angle information to the transmission control module (TCM) via the control area network (CAN) serial data link line. The scan tool displays the APP angle in percentage. The APP angle is automatically set to 0 percent at idle, when the APP voltage is below 0.90 volts, and reads 100 percent at wide open throttle (WOT) when APP voltage is 5 volts. The ECM sends the APP angle information to the transmission control module (TCM) via the high speed GMLAN serial data line.

Brake Switch

This parameter displays the state of the brake switch. The scan tool will display Applied when the brake pedal is depressed and Released when the brake pedal is released.

Desired Speed Ratio

This parameter displays the current speed ratio commanded by the transmission control module (TCM).

ECT

This parameter displays the input signal from the Engine Coolant Temperature (ECT) sensor. The scan tool displays -40°C (-40°F) to 151°C (304°F). When the engine coolant temperature is high at 151°C (304°F), the signal voltage is low, 0 V. When the engine coolant temperature is low at -40°C (-40°F), the signal voltage is high, 5 V. The ECM sends the ECT information to the transmission control module (TCM) via the high speed GMLAN serial data line.

Engine Run Time

This parameter displays a measure in Hr:Min:Sec of how long the engine has been operating. When the ignition is cycled to OFF, the value is reset to zero. The ECM sends the engine run time information to the transmission control module (TCM) via the high speed GMLAN serial data line.

Engine Speed

This parameter displays a measure in Hr:Min:Sec of how long the engine has been operating. When the ignition is cycled to OFF, the value is reset to zero. The ECM sends the engine run time information to the transmission control module (TCM) via the high speed GMLAN serial data line.

Engine Torque

This parameter displays the estimated amount of torque that is delivered from the engine. The scan tool displays engine torque in N.m (lb ft). The ECM sends the engine torque information to the transmission control module (TCM) via the high speed GMLAN serial data line.

Ignition Voltage

This parameter displays the system voltage, which is measured by the transmission control module (TCM) at the TCM ignition voltage input circuit. The scan tool displays the TCM input voltage in volts.

Line PC Sol. Actual Current

This parameter displays the actual current flow of the line pressure control (PC) solenoid valve circuit at the transmission control module (TCM). The scan tool displays current flow in amps. A reading of 0.00 amps, no current is flowing, indicates high line pressure. A reading of 1.10 amps, a high flow of current, indicates low pressure.

Line PC Sol. Duty Cycle

This parameter displays the commanded state of the line pressure control (PC) solenoid valve. The scan tool displays the percentage of the PC solenoid valve energized On time. A reading of 0 percent indicates zero On time, or a non-energized, commanded Off, state. A reading of 100 percent represents a fully energized, commanded On, state.

Line PC Sol. Ref. Current

This parameter displays the commanded reference current flow of the line pressure control (PC) solenoid valve circuit commanded by the transmission control module (TCM). The scan tool displays current flow in amps. A reading of 0.00 amps, no current is flowing, indicates high line pressure. A reading of 1.10 amps, a high flow of current, indicates low pressure.

Line Pressure Actual

This parameter displays the transmission fluid pressure (TFP) sensor signal to the transmission control module (TCM). The TFP sensor sends a signal proportional to the pressure in the tier 2 feed pressure circuit. When the pressure in this circuit is low a low signal voltage signal will be sent, and a high signal voltage is sent when the pressure in the circuit is high.

Line Pressure Commanded

This parameter displays the commanded main line pressure by the transmission control module (TCM).

Ratio Ctrl. Mtr. Actual

This parameter displays the commanded position of the ratio control motor position in counts. The higher the number of counts, the higher the speed ratio. The ratio control motor will compensate for varying driving conditions and driver input.

Ratio Ctrl. Mtr. CKT A1 Status

This parameter displays whether an open/short to ground, or short to voltage exists in the ratio control motor A1 control circuit. The scan tool displays OK, Open/Short to GND, Short to Volts.

Ratio Ctrl. Mtr. CKT A2 Status

This parameter displays whether an open/short to ground, or short to voltage exists in the ratio control motor A2 control circuit. The scan tool displays OK, Open/Short to GND, Short to Volts.

Ratio Ctrl. Mtr. CKT B1 Status

This parameter displays whether an open/short to ground, or short to voltage exists in the ratio control motor B1 control circuit. The scan tool displays OK, Open/Short to GND, Short to Volts.

Ratio Ctrl. Mtr. CKT B2 Status

This parameter displays whether an open/short to ground, or short to voltage exists in the ratio control motor A2 control circuit. The scan tool displays OK, Open/Short to GND, or Short to Volts.

Ratio Ctrl. Mtr. Commanded

This parameter displays the commanded position of the ratio control motor pintle in counts. During steady state operation, 40 counts would indicate the lowest speed ratios being commanded and approximately 2700 counts would correspond to the highest speed ratios being commanded.

Ratio Ctrl. Mtr. Dither

This parameter displays whether the ratio control motor is being commanded to vibrate rapidly. The scan tool displays Active, or Inactive.

Sheave Ratio

This parameter displays the calculated speed ratio of the transmission. The ratio is calculated by dividing the input speed sensor signal by the output speed sensor signal. This ratio is similar to gear ratio in a step-gear transmission.

Shifter Inhibit

This parameter displays whether the shifter is being locked in the Park position because of low transmission fluid temperature. Once the transmission fluid temperature is above a calibrated value the shifter will operate normally. The scan tool displays Normal or Low TFT.

Speed Ratio

This parameter displays the calculated speed ratio of the transmission. The ratio is calculated by dividing the output speed sensor signal by the input speed sensor signal. Gear ratio in a step-gear transmission is calculated in the opposite manner.

TCC Enable Solenoid

This parameter displays the commanded state of the torque converter clutch (TCC) enable solenoid. The scan tool displays Enabled or Disabled.

TCC PC Sol. Actual Current

This parameter displays the actual current flow of the torque converter clutch (TCC) pressure control (PC) solenoid valve circuit at the transmission control module (TCM). The scan tool displays current flow in amps. A reading of 0.00 amps, no current is flowing, indicates a low TCC apply pressure. A reading of 1.10 amps, a high flow of current, indicates a high apply TCC pressure.

TCC PC Sol. Duty Cycle

This parameter displays the commanded On time of the torque converter clutch (TCC) pressure control (PC) solenoid valve. The scan tool displays On time in a percentage. A reading of 100 percent represents a fully energized, commanded On, state.

TCC PC Sol. Ref. Current

This parameter displays the reference current flow of the torque converter clutch (TCC) pressure control (PC) solenoid valve circuit commanded by the transmission control module (TCM). The scan tool displays current flow in amps. A reading of 0.00 amps, no current is flowing, indicates a low TCC apply pressure. A reading of 1.10 amps, a high flow of current, indicates a high apply TCC pressure.

TCC Slip Speed

This parameter displays the amount of torque converter clutch (TCC) slip between the engine and the transmission input shaft. The scan tool displays the TCC slip speed in revolutions per minute (RPM).

TCC Tap Cell 1-5

This parameter displays the offset pressure values stored in the TCC transmission adaptive pressure (TAP) cells for TCC operation. Each TAP cell stores the commanded pressure offset needed for proper TCC system operation within a fixed engine torque range. A low cell number corresponds to a low torque range and each subsequent cell corresponds to the next engine torque range. A positive value within a given cell indicates that the TCC system applied slowly or softer than expected and a pressure increase was commanded. Conversely, a negative value indicates that the TCC system applied faster or harsher than expected and a pressure decrease was commanded.

TR Sw.

This parameter displays the decoded status of the four A/B/C/P inputs from the transmission range switch. The scan tool displays Park, Reverse, Neutral, Drive, Intermediate, Low, and Invalid. Invalid is displayed when the transmission control module (TCM) does not recognize a valid combination of inputs.

TR Sw. A/B/C/P

This parameter displays the status of the four inputs from the transmission range switch to the transmission control module (TCM). The scan tool displays Hi/Low. Hi indicates ignition voltage input to the TCM. Low indicates a zero voltage input to the TCM.

Trans. Fluid Temp.

This parameter displays the transmission fluid temperature (TFT) sensor input to the transmission control module (TCM). The scan tool displays the TCM converted TFT sensor resistance in degrees. Transmission fluid temperature is used in order to determine when to execute hot mode operation.

Trans. Component Slip

This parameter displays the amount of slip calculated in the components between the input shaft and the output shaft. The components that can be responsible for this slip may be the forward or reverse clutch, and the drive belt. The calculations are performed continuously, and during harsh transitions slip may report when all the drive components are performing well. However, when driving at a constant speed over a level surface, slip above 800 RPM may indicate a problem with the transmission components.

Transmission ISS

This parameter displays the rotational speed of the transmission input shaft. The scan tool displays input shaft speed in revolutions per minute (RPM).

Transmission OSS

This parameter displays the rotational speed of the transmission output shaft. The scan tool displays output shaft speed in revolutions per minute (RPM).

Vehicle Speed

This parameter displays the speed at which the vehicle is traveling. The scan tool displays vehicle speed as kilometers per hour (km/h), (miles per hour (MPH)). The transmission control module (TCM) calculates vehicle speed based on the input signal from the automatic output shaft speed sensor.

DIAGNOSTIC TROUBLE CODE (DTC) TYPE DEFINITIONS

Diagnostic Trouble Codes (DTCs) are grouped into several types. Each type has a unique set of characteristics for MIL operation, DTC storage, and DTC clearing. The following list contains a brief summary of the DTC types and the associated properties of each.

Type A

This DTC is emissions related. The MIL illuminates and default actions, if any, are activated immediately after a failure is detected. The DTC is then stored in history and the Freeze Frame data is captured.

Type B

This DTC is emissions related. Default actions, if any, are activated and a Failure Record is stored after the first failure is detected. At the time of the first fail, the DTC will appear in memory as pending. If the next trip reports a pass, the pending DTC is deleted. If the failure recurs on the next consecutive drive cycle, the MIL illuminates, the DTC is stored in history, and the Freeze Frame data is captured at the time of failure.

Type C

This DTC is non-emissions related. The TCM stores the DTC in History and Failure Records during the first trip in which the conditions for setting the DTC are met. The TCM does not store the DTC in Freeze Frame and does not illuminate the MIL. For some type C DTCs, a separate service lamp, other than the MIL, may be illuminated.

DIAGNOSTIC TROUBLE CODE (DTC) LIST/TYPE

Diagnostic Trouble Code (DTC) List/Type

DTC	DTC Type
DTC P0218	C
DTC P0502	B
DTC P0562	C
DTC P0563	C
DTC P0601	A
DTC P0602	A
DTC P0603	A

DTC P0604	A
DTC P0606	A
DTC P0705	B
DTC P0711	C
DTC P0712	C
DTC P0713	C
DTC P0716	A
DTC P0717	A
DTC P0719	C
DTC P0722	A
DTC P0723	A
DTC P0724	C
DTC P0727	B
DTC P0741	B
DTC P0742	B
DTC P0841	B
DTC P0842	A
DTC P0843	A
DTC P0960	B
DTC P0961	B
DTC P0962	B
DTC P0964	B
DTC P0965	B
DTC P0966	B
DTC P1756	B
DTC P1758	B
DTC P1779	B
DTC P1882	A
DTC P1883	A
DTC P1884	A
DTC P1885	A
DTC P1886	A
DTC P1888	A
DTC P1889	A
DTC UXXXX **Scan Tool Does Not Communicate with Class 2 Device** in Data Link Communications	A, C

TROUBLESHOOTING

SYMPTOMS - AUTOMATIC TRANSMISSION

Symptoms - Automatic Transmission

Diagnostic Category	Diagnostic Information
The following table consists of eight diagnostic categories that are located in the left-hand column. Using this column, choose the appropriate category based on the operating conditions of the vehicle or transmission. After selecting a category, use the right-hand column to locate the specific symptom diagnostic information.	
Fluid Diagnosis: This category contains the following topics: • Fluid condition, such as appearance, contaminants, smell, overheating • Line pressure, high or low • Fluid leaks	- • Refer to **Transmission Fluid Checking Procedure** . • Refer to **Transmission Overheats** . • Refer to **Line Pressure Instability** . • Refer to **Low Line Pressure** . • Refer to **High Line Pressure** . • Refer to **Automatic Transmission Fluid Leaks** . • Refer to **Fluid Leak Diagnosis** .
Noise and Vibration Diagnosis: This category contains the following topics: • Noise, drive gear, final drive, whine, growl, rattle, buzz, popping • Vibration	- • Refer to **Final Drive Noise or Hum Noise** . • Refer to **Whine/Growl Noise That Changes with Vehicle Speed** . • Refer to **Noisy in Reverse Only** . • Refer to **Reattaching Noise** . • Refer to **Whine Noise Varying with RPM or Fluid Pressure** . • Refer to **Gravel or Grating Noise** . • Refer to **Moaning Noise** . • Refer to **Transmission Clunk on Acceleration or Deceleration** . • Refer to **Rattle Noise** . • Refer to **Vibration** . • Refer to **Flexplate/Torque Converter Vibration Test** .

	• Refer to **Noise and Vibration Analysis** .
Range Performance Diagnosis: This category contains the following topics: • No Drive/Slips in Drive • No Reverse/Slips in Reverse • No Drive and Reverse • No Park • Stays in Park • Stays in Drive • Stays in Low • Stays in Intermediate • Stays in Reverse • Range Selector Position Inaccurate	- • Refer to **No Drive in Forward Ranges** . • Refer to **Slips in Drive** . • Refer to **No Reverse** . • Refer to **Slips in Reverse** . • Refer to **No Forward and Reverse** . • Refer to **No Park** . • Refer to **Transmission Does Not Shift Out of Park** . • Refer to **Stays in Drive** . • Refer to **Stays in Low** . • Refer to **Stays in Intermediate** . • Refer to **Stays in Reverse** . • Refer to **Range Selector Displays Incorrect Range** . • Refer to **DTC P0705** . • Refer to **DTC P1756** . • Refer to **DTC P1758** .
Shift Quality Feel Diagnosis: This category contains the following topic: Harsh Garage Shift	- Refer to **Harsh Garage Shift** .
Driveability/Ratio Control Diagnosis: This category contains the following topic: Poor driveability	- Refer to **Poor Driveability - Poor or No Ratio Control** .
Torque Converter Diagnosis: This category contains the following topics: • Torque converter diagnosis • TCC does not apply • TCC does not release • TCC apply/release quality • Poor acceleration/No torque multiplication	- • Refer to **Torque Converter Diagnosis Procedure** . • Refer to **Flexplate/Torque Converter Vibration Test** . • Refer to **No Torque Converter Clutch (TCC) Apply/TCC Slipping/Soft TCC Apply** . • Refer to **Torque Converter Clutch (TCC) Stuck On** . • Refer to **Harsh Torque Converter Clutch (TCC) Apply** . • Refer to **Torque Converter Clutch (TCC) Slipping** .
Indicator On or Message Center Displays	-

Message: This category contains the following topics: • Message Center displays "Trans Hot" • Message Center displays "Trans Cold"	• Refer to **Transmission Fluid Checking Procedure** . • Refer to **Transmission Overheats** . • Refer to **DTC P0218** . • Refer to **Transmission Does Not Shift Out of Park** .
Symptom Not Found or No Symptom Detected	• Refer to **Transmission Fluid Checking Procedure** . • Refer to **Road Test Procedure** . • Refer to **Line Pressure Check Procedure** .

CLEARING TRANSMISSION DIAGNOSTIC TROUBLE CODES

IMPORTANT: Disconnecting the battery terminals or the TCM connectors will NOT clear a transmission-related DTC. A transmission-related DTC may only be cleared using a scan tool.

1. Install a scan tool.
2. Turn ON the ignition with the engine OFF.

IMPORTANT: Before clearing the DTC, use the scan tool in order to record the ECM Freeze Frame and the TCM Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the ECM and TCM.

3. Record the DTC Freeze Frame and Failure Records.
4. Clear the DTC.
5. Turn OFF the ignition and wait 10 seconds.
6. Turn ON the ignition and wait 5 seconds. The DTC(s) should be cleared.

TRANSMISSION FLUID CHECKING PROCEDURE

1. Install a scan tool.
2. Start the engine.
3. Park the vehicle on a level surface.
4. Depress the brake pedal and move the shift lever from PARK to REVERSE for 10 seconds.
5. Depress the brake pedal and move the shift lever from REVERSE to DRIVE for 10 seconds.
6. Move the shift lever back to PARK. The engine should remain running.

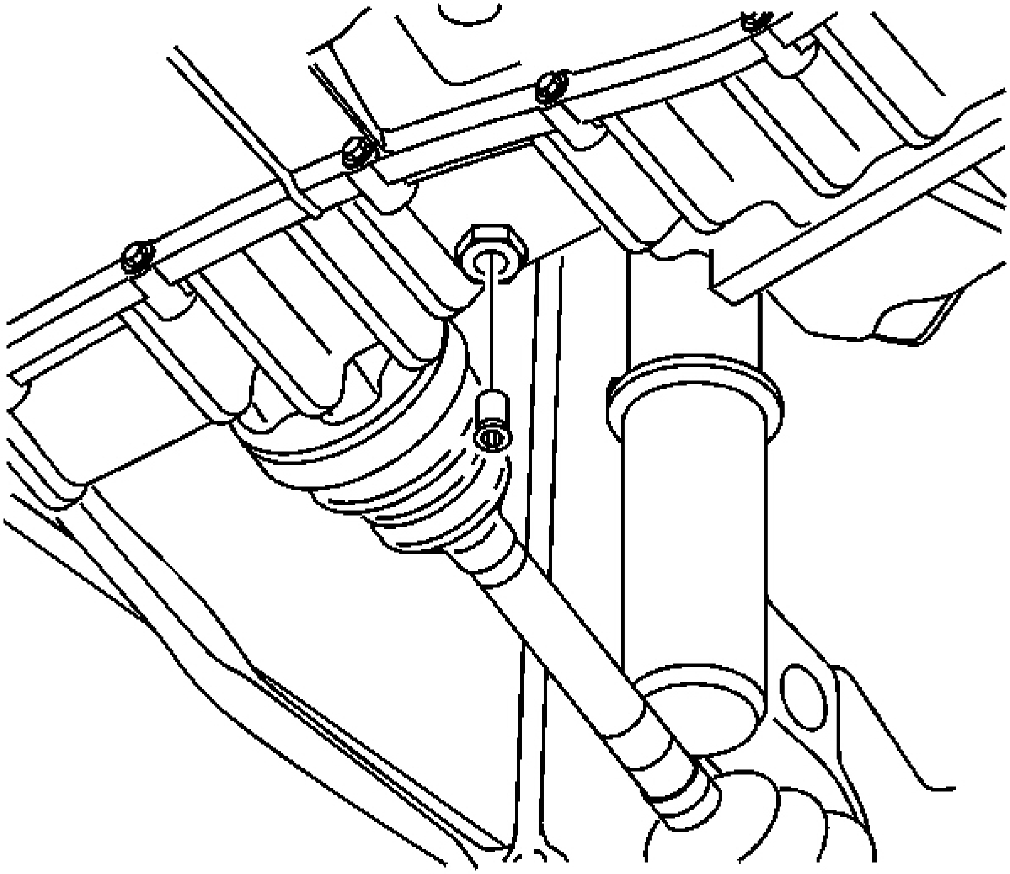


Fig. 1: Center Of Fluid Fill Lower Tube
Courtesy of GENERAL MOTORS CORP.

7. Remove the plug from the center of the fluid fill lower tube. The fluid fill lower tube is located on the bottom of the unit.

IMPORTANT:

- **Do not use ATF P/N 21005966 or P/N 21019223. These fluids are not compatible with this transmission.**
- **Use Saturn DEX-CVT(R) Fluid P/N 22688912.**

8. If fluid drains down as a steady stream from the opening, wait for it to stop. If fluid does not drain from the opening, add more fluid until it starts to drain as a steady stream, then stop adding fluid immediately. Allow fluid to drain until the fluid stream stops.

IMPORTANT: The normal use color for DEX-CVT(R) fluid is green or light brown. Fluid may also turn dark brown from normal use, and does not always indicate contamination. Fluid that is very dark or black and has a burnt odor usually indicates contamination or over-heating.

9. Inspect the fluid color.
10. Inspect the fluid for metal or other debris which may indicate transaxle damage.
11. Inspect the fluid for a cloudy or milky appearance which may indicate engine coolant contamination.

NOTE: Refer to Fastener Notice in Cautions and Notices.

12. Replace the lower fill tube plug.

    Tighten: Tighten the plug to 11 N.m (97 lb in).

13. On the scan tool, observe the Trans. Fluid Temp. and record the temperature.
    - If the Trans. Fluid Temp. is 20°C (68°F), add 0.5 qt (0.47 liter) of fluid to the transmission. Do not remove the plug.
    - If the Trans. Fluid Temp. is 40°C (104°F), add 0.75 qt (0.71 liter) of fluid to the transmission. Do not remove the plug.
    - If the Trans. Fluid Temp. is 60°C (140°F), add 1 qt (0.95 liter) of fluid to the transmission. Do not remove the plug.
    - If the Trans. Fluid Temp. is 80°C (176°F), add 1.25 qt (1.18 liters) of fluid to the transmission. Do not remove the plug.

LINE PRESSURE CHECK PROCEDURE

Tools Required

J 45195 Pressure Gage

CAUTION: Keep the brakes applied at all times in order to prevent unexpected vehicle motion. Personal injury may result if the vehicle moves unexpectedly.

1. Remove the fluid pressure test hole plug from the transaxle.

IMPORTANT: Permatex High Temperature Threadsealant P/N 21485278 (GM P/N 12346004) or equivalent must be applied to the threaded components of the pressure gage to ensure that no leakage occurs during testing.

2. Install the **J 45195** .
3. Ensure that the gear selector is in PARK and the parking brake is set.

4. Install a scan tool.
5. Start the engine and allow the engine to warm up at idle.
6. Access the Line PC Solenoid functional test on the scan tool output controls.

NOTE: The total test running time should not be longer than 2 minutes. Running the test longer than 2 minutes may damage the transaxle.

IMPORTANT: The scan tool can only control the line pressure control solenoid when the transaxle is in PARK and the engine is running. This protects the transaxle clutches from extremely high or low pressure, as occurs when the transaxle is in DRIVE or REVERSE.

7. With the engine speed at idle, use the scan tool to increase the Line PC Solenoid amperage to 1 amp. Read and record the corresponding line pressure on the pressure gage.

IMPORTANT: In order to obtain the required pressure for the high pressure test point, the engine speed must be 1,400-1,500 RPM. A line pressure reading taken at a lower engine speed will be inaccurate and may lead to misdiagnosis.

8. Slowly increase the engine speed to 1,400-1,500 RPM before performing the next test step.
9. Using the scan tool, decrease the Line PC Solenoid amperage to 0.2 amp. Read and record the corresponding line pressure on the pressure gage.
10. Compare the collected readings to the Line Pressure table. Refer to **Line Pressure** .
11. If pressure readings differ greatly from the table, refer to **Low Line Pressure** or **High Line Pressure** .
12. Shut the engine OFF. Remove the **J 45195** .

IMPORTANT: Before installing the fluid pressure test hole plug, apply Permatex Medium Grade Threadlocker Blue P/N 12345382 or equivalent to the threads of the plug.

13. Install the fluid pressure test hole plug.

    Tighten: Tighten the plug to 9 N.m (7 lb ft).

ROAD TEST PROCEDURE

Electrical/Garage Shift Procedure

Perform a preliminary test before the road test in order to ensure that the electronic control inputs are operating properly. If you do not check the inputs before operating the transmission, you could misdiagnose a simple electrical condition as a major transmission condition.

A scan tool provides valuable information and must be used on the VT25-E transaxle for accurate diagnosis.

1. Ensure that the gear selector is in PARK (P) and set the parking brake.
2. Install the scan tool.
3. Start the engine.
4. Using the scan tool, the Transmission Scan Tool Data Definitions and the Transmission Scan Tool Data List, verify that the data parameters listed are present and functioning properly. Refer to **Scan Tool Data Definitions** and **Scan Tool Data List** .

Road Test Procedure

The TCM calculates the speed ratio using two primary inputs: transaxle input speed and output speed. When the TCM demands an increase in the speed ratio, an electrical signal is sent to the ratio control motor to move the ratio control valve. The lever on the variable ratio control valve pulls the valve into a position which allows fluid from line 1 to enter the primary feed circuit. The primary feed fluid is routed to the apply piston cavities and the fluid pressure moves the piston side of the pulley toward the stationary half of the pulley. The drive belt reacts to the drive pulley position change by rising between the two sides of the pulley. Ratio changes begin as soon as the drive belt moves higher between the driver pulley halves.

Perform the road test using the scan tool.

Perform this test when traffic and road conditions permit. Observe all safety regulations.

1. Install the scan tool.
2. Start the engine.
3. Depress the brake pedal. Move the gear selector as follows:
   - PARK to REVERSE
   - REVERSE to NEUTRAL
   - NEUTRAL to DRIVE

   The range engagement should be immediate and not harsh.
4. Set up the scan tool to monitor the Throttle Angle, Transmission Output Speed and Speed Ratio.
5. With the gear selector in DRIVE (D), accelerate to a chosen throttle angle and hold the throttle steady. Compare the output speed and speed ratio to a chosen throttle angle. Refer to **Ratio vs Speed** - Ratio From Stop.
6. Repeat step 5. Refer to **Ratio vs Speed** - Ratio Steady State.
7. Monitor the scan tool TCC Enable Solenoid parameter and accelerate to a chosen throttle angle. The TCC Enable Solenoid should activate at a transmission output speed of 500 RPM or greater.
8. Coasting down, the TCC Enable Solenoid should de-activate at a transmission output speed of 500 RPM or less.
9. Repeat steps 5-8 using different throttle angles.

TORQUE CONVERTER DIAGNOSIS PROCEDURE

The Torque Converter Clutch (TCC) is applied by fluid pressure, which is controlled by the TCC clutch control solenoid valve. This solenoid valve is located inside the automatic transmission assembly. The solenoid valve is controlled by the TCM.

Torque Converter Stator

The torque converter stator roller clutch can have two different malfunctions.

- The stator assembly freewheels in both directions.
- The stator assembly remains locked up at all times.

Poor Acceleration at Low Speed

If the stator is freewheeling at all times, the vehicle tends to have poor acceleration from a standstill. At speeds above 50-55 km/h (30-35 mph), the vehicle may act normal. For poor acceleration, you should first determine that the exhaust system is not blocked, and the transmission ratio is accurate for the throttle angle and the output speed.

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

If the stator is locked up at all times, performance is normal when accelerating from a standstill. Engine RPM and car speed are limited or restricted at high speeds. Visual examination of the converter may reveal a blue color from overheating.

If the converter has been removed, you can check the stator roller clutch by inserting a finger into the splined inner race of the roller clutch and trying to turn the race in both directions. You should be able to freely turn the inner race clockwise, but you should have difficulty in moving the inner race counterclockwise or you may be unable to move the race at all.

Noise

IMPORTANT: Do not confuse this noise with pump whine noise, which is usually noticeable in PARK, NEUTRAL and all other gear ranges. Pump whine will vary with line pressure.

You may notice a torque converter whine 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 both halves of the converter are turning at the same speed.

Perform a stall test to make sure the noise is actually coming from the converter:

1. Place your foot on the brake.

2. Put the gear selector in DRIVE.

NOTE: You may damage the transmission if you depress the accelerator for more than 6 seconds.

3. Depress the accelerator to obtain approximately 1,200 RPM for no more than 6 seconds.

A torque converter noise will increase under this load.

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 which is caused by the transmission should only occur during the apply or the release of the converter clutch. Shudder should never occur after the TCC plate is fully applied.

If the shudder occurs while the TCC is applying, the condition can be within the transmission or the torque converter. Something is causing one of the following conditions to occur:

- Something is not allowing the clutch to become fully engaged.
- Something is not allowing the clutch to release.
- The clutch is releasing and applying at the same time.

One of the following conditions may be causing the shudder to occur:

- Leaking turbine shaft seals
- A restricted release orifice
- A distorted clutch or housing surface due to long converter bolts
- Defective friction material on the TCC plate

If Shudder Occurs After TCC has Applied

If shudder occurs after the TCC has applied, most of the time there is nothing wrong with the transmission!

As mentioned above, the TCC is not likely to slip after the TCC has been applied. Engine conditions may go unnoticed under light throttle and load, but they become noticeable after the TCC apply when going up a hill or accelerating. This is due to the mechanical coupling between the engine and the transmission.

Once TCC is applied, there is no torque converter fluid coupling assistance. Engine or driveline vibrations could be unnoticeable before TCC engagement.

Inspect the following components in order to avoid misdiagnosis of TCC shudder. An inspection will also avoid the unnecessary disassembly of a transmission or the unnecessary replacement of a torque converter.

- Spark plugs

  Inspect for cracks, high resistance or a broken insulator.

- Plug wires

  Look in each end. If there is red dust, ozone, or a black substance - carbon - present, then the wires are bad. Also look for a white discoloration of the wire. This indicates arcing during hard acceleration.

- Coil

  Look for a black discoloration on the bottom of the coil. This indicates arcing while the engine is misfiring.

- Fuel injector

  The filter may be plugged.

- Vacuum leak

  The engine will not get a correct amount of fuel. The mixture may run rich or lean depending on where the leak occurs.

- EGR valve

  The valve may let in too much or too little unburnable exhaust gas and could cause the engine to run rich or lean.

- MAP sensor

  Like a vacuum leak, the engine will not get the correct amount of fuel for proper engine operation.

- Carbon on the intake valves

  Carbon restricts the proper flow of air/fuel mixture into the cylinders.

- Flat cam

  Valves do not open enough to let the proper fuel/air mixture into the cylinders.

- Oxygen sensor

  This sensor may command the engine too rich or too lean for too long.

- Fuel pressure

This may be too low.

- Engine mounts

  Vibration of the mounts can be multiplied by TCC engagement.

- Axle joints

  Check for vibration.

- TP Sensor

  The TCC apply and release depends on the TP Sensor in many engines. If the TP Sensor is out of specification, TCC may remain applied during initial engine loading.

- Cylinder balance

  Bad piston rings or poorly sealing valves can cause low power in a cylinder.

- Fuel contamination

  This causes poor engine performance.

Torque Converter Evaluation and Diagnosis

Replace the torque converter if any of the following conditions exist:

- External leaks appear in the hub weld area.
- The converter hub is scored or damaged.
- The converter pilot is broken, damaged, or fits poorly into the crankshaft.
- You discover steel particles after flushing the cooler and the cooler lines.
- The pump is damaged, or you discover steel particles in the converter.
- The vehicle has TCC shudder and/or no TCC apply. Replace the torque converter only after all hydraulic and electrical diagnoses have been made. The converter clutch material may be glazed.
- The converter has an imbalance which cannot be corrected. Refer to **Flexplate/Torque Converter Vibration Test** .
- The converter is contaminated with engine coolant which contains antifreeze.
- An internal failure occurs in the stator roller clutch.
- You notice excessive end play.
- Overheating produces heavy debris in the clutch.
- You discover steel particles or clutch lining material in the fluid filter or on the magnet, when no internal parts in the unit are worn or damaged. This condition indicates that lining material came from the converter.

DO NOT REPLACE the torque converter if you discover any of the following symptoms:

- The oil has an odor or the oil is discolored, even though metal or clutch facing particles are not present.
- The threads in one or more of the converter bolt holds are damaged. Correct the condition with a new thread inset.
- Transmission failure did not display evidence of damaged or worn internal parts, steel particles or clutch plate lining material in the unit and inside the fluid filter.
- The vehicle has been exposed to high mileage only. An exception may exist where the lining of the torque converter clutch dampener plate has seen excess wear by vehicles operated in heavy and/or constant traffic, such as taxi, delivery, or police use.

FLEXPLATE/TORQUE CONVERTER VIBRATION TEST

Isolating Vibration

NOTE:	**Some engine/transaxle combinations cannot be balanced in this manner due to restricted access or limited clearances between the torque converter bolts and the engine. Ensure that the bolts do not bottom out in the lug nuts or the torque converter cover could be dented and cause internal damage.**

To isolate and correct a flywheel or torque converter vibration, separate the torque converter from the flywheel to determine if vibration is in the engine or transmission.

1. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration.
2. Turn the engine OFF.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
4. Remove the transmission converter cover bolts and the cover. Refer to **Transmission Replacement** .
5. Mark the relationship of the converter to the flywheel.
6. Remove the bolts attaching the converter to the flywheel. Refer to **Transmission Replacement** .
7. Slide the torque converter away from the flywheel.
8. Rotate the flywheel and torque converter to inspect for defects or missing balance weights. Refer to Engine Flywheel Cleaning and Inspection in Engine Mechanical - 2.2L (L61).
9. Lower the vehicle.
10. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration. Refer to Diagnostic Starting Point - Vibration Diagnosis and Correction in Vibration Diagnosis and Correction.
11. Turn the engine OFF.

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 flywheel balance.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

2. Rotate the torque converter one bolt position.

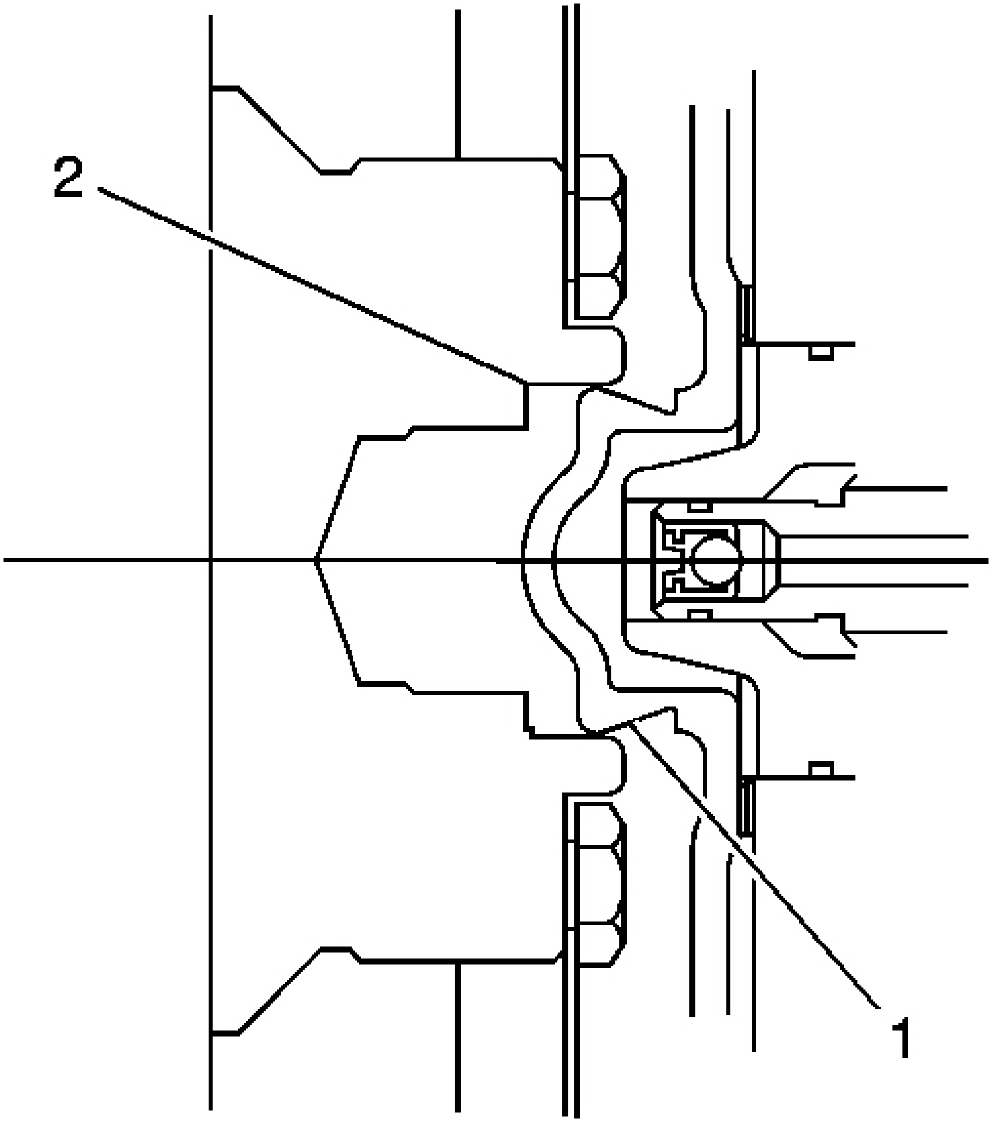


Fig. 2: Aligning Torque Converter Hub
Courtesy of GENERAL MOTORS CORP.

3. Align the torque converter hub (1) in the engine crankshaft (2) and install the torque converter to flywheel bolts. Refer to **Transmission Replacement** .

4. Lower the vehicle.
5. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration. Refer to **Noise and Vibration Analysis** .
6. Repeat this procedure until you obtain the best possible balance.
7. Install the transmission converter cover bolts and the cover. Refer to **Transmission Replacement** .

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 cause may be from poor engine performance.

- Inspect the tire for the following:
  - Uneven wear
  - Imbalance
  - Mixed sizes
  - Mixed radial and bias ply
- Inspect the suspension components for the following:
  - Alignment and wear
  - Loose fasteners
- Inspect the engine and transmission mounts for damage and loose bolts.
- Inspect the transmission case mounting holes for the following:
  - Missing bolts, nuts, and studs
  - Stripped threads
  - Cracks
- Inspect the flywheel for the following:
  - Missing or loose bolts
  - Cracks
  - Imbalance
- Inspect the torque converter for the following:
  - Missing or loose bolts or lugs
  - Missing or loose balance weights
  - Imbalance

CLUTCH PLATE DIAGNOSIS

Composition Side of Clutch Plates

Dry the plates and inspect the plates for the following conditions:

- Pitting
- Flaking
- Wear
- Glazing
- Cracking
- Charring
- Chips or metal particles embedded in the lining

Replace a composition plate which shows any of these conditions.

Steel Side of Clutch 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 is between channels.
  - The valve bushing clips are improperly installed.
  - The checkballs are misplaced.
- The Teflon(R) seal rings are worn or damaged.

ENGINE COOLANT/WATER IN TRANSMISSION

NOTE: 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.

FLUID LEAK DIAGNOSIS

General Method

1. Verify that the leak is transmission fluid.
2. Thoroughly clean the suspected leak area.
3. Operate the vehicle for 24 km (15 mi), or 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

1. Thoroughly clean the suspected leak area with solvent.
2. Apply an aerosol type powder, such as foot powder, to the suspected leak area.
3. Operate the vehicle for 24 km (15 mi), or 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. Detect the leak with the black light.
3. 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 or output shaft surface is scratched, nicked, or damaged
- Loose or worn bearing causing excess seal wear

Possible Points of Fluid Leaks

Transmission Oil Pan

- Incorrectly tightened oil pan bolts
- Improperly installed or damaged oil pan gasket
- Damaged oil pan or mounting face
- Incorrect oil pan gasket

Case Leak

- Damaged or missing fill tube seal
- Mislocated fill tube bracket
- Damaged vehicle speed sensor seal
- Damaged manual shaft seal

- Loose or damaged oil cooler connector fittings
- Worn or damaged propeller shaft oil seal
- Loose line pressure pipe plug
- Porous casting

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 transmission case or the oil pump

Leak at the Vent Pipe or the Fluid Fill Tube

- Overfilled system
- Water or coolant in the fluid

  The fluid will appear milky.

- Transmission case porous
- Incorrect fluid level indicator
- Plugged vent
- Drain-back holes plugged
- Mispositioned oil pump to case gasket, if equipped

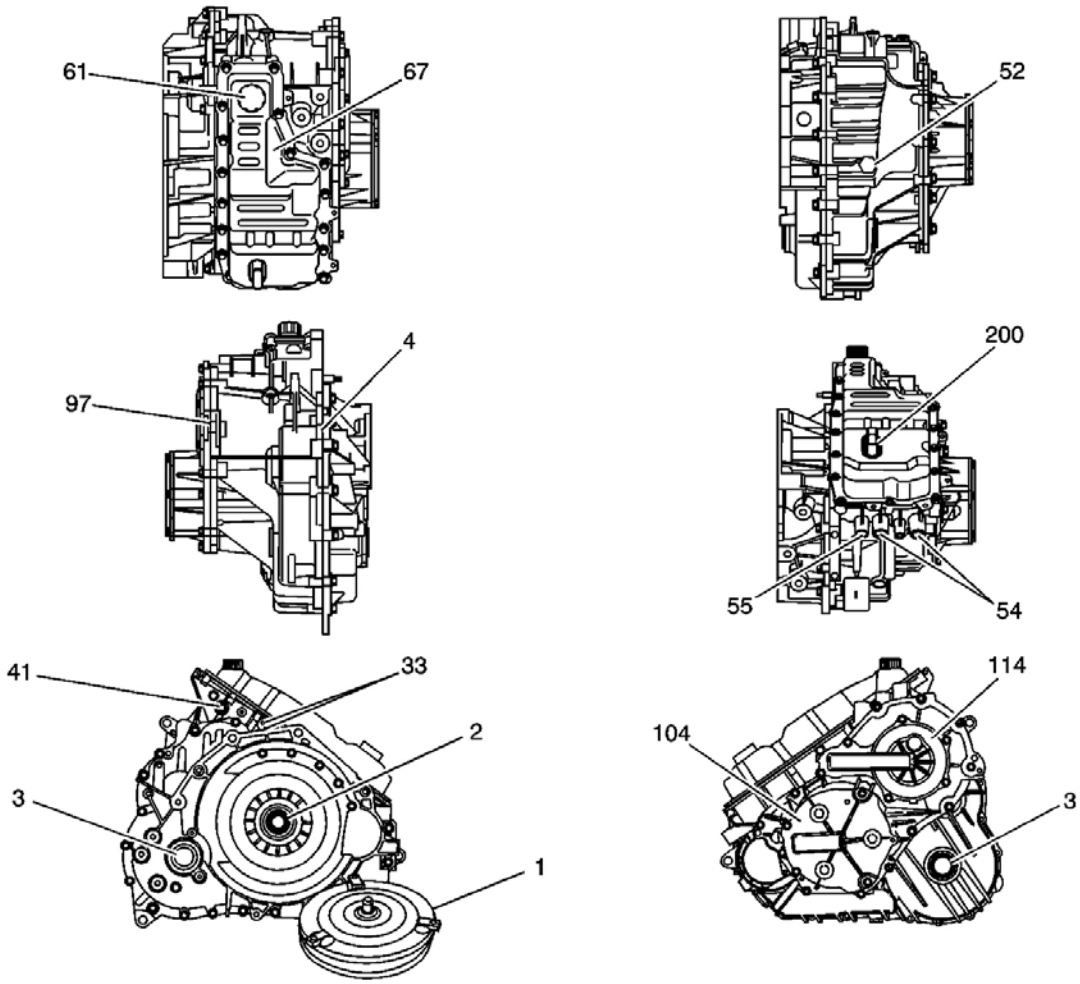


Fig. 3: Leak Point Locations
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 53

Callout	Component Name
1	Torque Converter Assembly
2	Torque Converter and Differential Housing Seal Assembly
3	Front Wheel Drive Shaft Oil Seal Assembly
3	Front Wheel Drive Shaft Oil Seal Assembly
4	Torque Converter and Differential Housing Assembly
33	Park Pawl Shaft Hole Plug
41	Manual Shift Shaft Seal Assembly
52	Transmission Fluid Fill Lower Tube
54	Transmission Fluid Cooler Pipe Fitting Seal

55	Automatic Transmission Fluid Pressure Test Hole Plug
61	Automatic Transmission Vent Cap
67	Control Valve Body Cover
97	Automatic Transmission Case Cover Assembly
104	Variable Drive Pulley Opening Cover
114	Variable Driven Pulley Opening Cover
200	Control Valve Body Cover Wiring Connector Hole Seal

CASE POROSITY REPAIR

Some external leaks are caused by case porosity in non-pressurized areas. You can usually repair these leaks with the transmission in the vehicle.

1. Thoroughly clean the area to be repaired with a cleaning solvent. Air dry the area.

CAUTION: 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. While the transmission case is still hot, apply the epoxy. You can use a clean, dry soldering acid brush 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 starting the engine.
5. Repeat the fluid leak diagnosis procedures.

TRANSMISSION OVERHEATS

Transmission Overheats

Checks	Action
Fluid filter assembly (26)	Inspect filter for clog, loose, or improperly sealing. Replace the fluid filter assembly (26). Refer to **Fluid Filter Removal** .
Fluid pump assembly (23)	Inspect for internal damage - causing low or no pressure at the discharge port and low cooler flow. Replace the transmission fluid pump assembly (23). Refer to **Fluid Pump Removal** .
Fluid pump bolts (19, 20)	Inspect for loose or stripped bolts securing the fluid pump to the case. Tighten or replace the bolts (19, 20). Refer to **Fluid Pump Removal** .

LINE PRESSURE INSTABILITY

Line Pressure Instability

Checks	Action
Pump drive	Inspect for worn or broken teeth - causing the drive link assembly (15) to jump

sprocket (30)	teeth. Replace the pump drive sprocket (30). Refer to **Drive Sprocket, Driven Sprocket, and Drive Link Removal** .
Pump driven sprocket (17)	Inspect for worn or broken teeth - causing the drive link assembly (15) to jump teeth. Replace the pump driven sprocket (17). Refer to **Drive Sprocket, Driven Sprocket, and Drive Link Removal** .
Variable drive pulley assembly (93)	Inspect for leaking. Replace the variable drive pulley assembly (93). Refer to **Case Cover Assembly Disassemble** .
Variable driven pulley assembly (106)	Inspect for leaking. Replace the variable driven pulley assembly (106). Refer to **Case Cover Assembly Disassemble** .

LOW LINE PRESSURE

Low Line Pressure

Checks	Action
Fluid filter assembly (26)	Inspect for clog or damage. Replace the fluid filter assembly (26). Refer to **Fluid Filter Removal** .
Variable drive pulley assembly (93)	Inspect for leaking. Replace the variable drive pulley assembly (93). Refer to **Case Cover Assembly Disassemble** .
Variable driven pulley assembly (106)	Inspect for leaking. Replace the variable driven pulley assembly (106). Refer to **Case Cover Assembly Disassemble** .
Line 1 pressure regulator valve (316)	Inspect for worn, sticking or binding valve. Replace the line 1 pressure regulator valve (316). Refer to **Control Valve Body Assembly Disassemble** .
Line 1 pressure regulator valve spring (315)	Inspect for worn, sticking or damaged spring. Replace the line 1 pressure regulator valve spring (315). Refer to **Control Valve Body Assembly Disassemble** .
Bore plug retainer (300)	Inspect the bore plug retainer (300) for damage or incorrect installation. Replace the bore plug retainer (300). Refer to **Control Valve Body Assembly Disassemble** .
Bore plug seal (302)	Inspect for missing or cut seal. Replace the bore plug seal (302). Refer to **Control Valve Body Assembly Disassemble** .
Bore plug (301)	Inspect for wear or damage. Replace the bore plug (301). Refer to **Control Valve Body Assembly Disassemble** .
Line 2 pressure regulator valve (212)	Inspect for worn, sticking or binding valve. Replace the line 2 pressure regulator valve (212). Refer to **Control Valve Body Assembly Disassemble** .
Line 2 pressure regulator valve spring (211)	Inspect for worn, sticking or damaged spring. Replace the line 2 pressure regulator valve spring (211). Refer to **Control Valve Body Assembly Disassemble**
Bore plug seal (210)	Inspect for missing or cut seal. Replace the bore plug seal (210). Refer to **Control Valve Body Assembly Disassemble** .
Primary limit valve (314)	Inspect for wear, sticking or binding. Replace the primary limit valve (314). Refer to **Control Valve Body Assembly Disassemble** .
Primary limit valve	Inspect for wear, sticking or damage. Replace the primary limit valve spring

spring (313)	(313). Refer to **Control Valve Body Assembly Disassemble** .
Actuator feed limit valve (312)	Inspect for wear, sticking or binding. Replace the actuator feed limit valve (312). Refer to **Control Valve Body Assembly Disassemble** .
Actuator feed limit valve spring (311)	Inspect for wear, sticking or damage. Replace the actuator feed limit valve spring (311). Refer to **Control Valve Body Assembly Disassemble** .

HIGH LINE PRESSURE

High Line Pressure

Checks	Action
Line 1 pressure regulator valve (316)	Inspect for worn, sticking or binding valve. Replace the line 1 pressure regulator valve (316). Refer to **Control Valve Body Assembly Disassemble** .
Line 1 pressure regulator valve spring (315)	Inspect for worn, sticking or damaged spring. Replace the line 1 pressure regulator valve spring (315). Refer to **Control Valve Body Assembly Disassemble** .
Line 2 pressure regulator valve (212)	Inspect for worn, sticking or binding valve. Replace the line 2 pressure regulator valve (212). Refer to **Control Valve Body Assembly Disassemble** .
Line 2 pressure regulator valve spring (211)	Inspect for worn, sticking or damaged spring. Replace the line 2 pressure regulator valve spring (211). Refer to **Control Valve Body Assembly Disassemble** .
Actuator feed limit valve (312)	Inspect for wear, sticking or binding. Replace the actuator feed limit valve (312). Refer to **Control Valve Body Assembly Disassemble** .
Actuator feed limit valve spring (311)	Inspect for wear, sticking or damage. Replace the actuator feed limit valve spring (311). Refer to **Control Valve Body Assembly Disassemble** .

AUTOMATIC TRANSMISSION FLUID LEAKS

Automatic Transmission Fluid Leaks

Checks	Action
Control valve body cover (67)	Inspect for damage. Replace the control valve body cover. Refer to **Control Valve Body Cover Replacement** .
Control valve body cover (67) bolts/screws (60)	Inspect for loose, cross - threaded, or missing bolts. Tighten or replace the bolts/screws (60). Refer to **Control Valve Body Cover Replacement** .
Control valve body cover gasket (68)	Inspect gasket for damage or misalignment. Replace the control valve body cover gasket (68). Refer to **Control Valve Body Cover Replacement** .
Control valve body assembly (72)	Inspect for porosity or damage. Replace the control valve body assembly (72). Refer to **Control Valve Body Replacement** .
Spacer with gasket plate (73)	Inspect for damage or improper sealing. Replace the spacer with gasket plate (73). Refer to **Control Valve Body Replacement** .
Control valve body bolts/screws (71, 79)	Inspect for loose, cross-threaded or missing bolts/screws. Tighten or replace the bolts/screws (71, 79). Refer to **Control Valve Body Replacement** .

Case assembly (50)	Inspect for porosity or damage. Refer to **Transmission Case Inspection** . Replace the case assembly (50).
Anaerobic seal between the case assembly (50) and the torque converter and differential housing (4)	Inspect for inadequate or too narrow seal. Apply a NEW bead of anaerobic sealant. Refer to **Torque Converter and Differential Housing Installation** .
Fluid cooler pipe fitting seal (54)	Inspect for loose, damaged or worn seal. Replace the fluid cooler pipe fitting seal (54). Refer to **Oil Cooler Pipe Seals Replacement** .
Fluid pressure test hole plug (55)	Inspect for loose, cross-threaded, or damaged plug. Replace the fluid pressure test hole plug (55). Refer to **Oil Pressure Test Plug Replacement** .
Torque converter and differential housing assembly (4)	Inspect for porosity or damage. Replace the torque converter and differential housing assembly (4). Refer to **Torque Converter and Differential Housing Installation** .
Torque converter and differential housing seal assembly (2)	Inspect for loose or damaged seal. Replace the torque converter and differential housing seal assembly (2). Refer to **Torque Converter and Differential Housing Seal Replacement** .
Front wheel drive shaft oil seal (3, 3A)	Inspect for loose or damaged seal. Replace the front wheel drive shaft oil seal (3, 3A). Refer to **Drive Axle Shaft Seal Replacement (FWD Right)** or **Drive Axle Shaft Seal Replacement (AWD Right)** .
Case cover assembly (97)	Inspect for porosity or damage. Replace the case cover assembly (97). Refer to **Case Cover Assembly Removal** .
Case cover bolts/screws (108)	Inspect for loose, cross-threaded, or stripped bolts/screws. Tighten or replace the required bolts. Refer to **Case Cover Assembly Removal** .
Anaerobic seal between the case cover assembly (97) and the case assembly (50)	Inspect for inadequate or narrow seal. Apply a NEW bead of anaerobic sealant. Refer to **Case Cover Assembly Installation** .
Drive/driven pulley opening covers (104, 114)	Inspect for porosity or damage. Replace the drive/driven pulley opening covers (104, 114). Refer to **Variable Drive Cover Replacement** .
Drive/driven pulley opening cover seals (98, 102, 109, 113)	Inspect for cut, damaged or leaking seals. Replace the drive/driven pulley opening cover seals (98, 102, 109, 113). Refer to **Variable Drive Cover Replacement** .
Manual shift shaft seal assembly (41)	Inspect for loose, cocked or damaged seal. Replace the manual shift shaft seal assembly (41). Refer to **Manual Shift Shaft and Parking System Components Removal** .
Torque converter (1)	Inspect for damage. Replace the torque converter (1). Refer to **Torque Converter Assembly Removal** .

FINAL DRIVE NOISE OR HUM NOISE

Final Drive Noise or Hum Noise

Checks	Action
Front differential carrier assembly (32)	Inspect for damage or the gears are out of position. Replace the front differential carrier assembly (32). Refer to **Front Differential Carrier Removal** .
Front differential carrier thrust washer (604)	Inspect for worn, melted or extruding washer. Replace the front differential carrier thrust washer (604). Refer to **Front Differential Carrier Disassemble** .
Pinion gear and/or transfer gear teeth on the front differential drive pinion gear assembly (9)	Inspect for broken or damaged teeth. Replace the front differential drive pinion gear assembly (9). Refer to **Front Differential Transfer Gear Installation** .
Sun gear (505)	Inspect for worn or broken teeth. Replace the sun gear (505). Refer to **Forward Clutch Assembly Disassemble** .

WHINE/GROWL NOISE THAT CHANGES WITH VEHICLE SPEED

Whine/Growl Noise That Changes with Vehicle Speed

Checks	Action
Bearing assemblies (600) on the front differential carrier assembly (601)	Inspect for worn or damaged bearings. Replace the bearing assemblies (600). Refer to **Front Differential Carrier Bearing and Cup Replacement** .
Drive sprocket (30)	Inspect for worn or broken teeth - causing loss of hydraulic power from drive link failure. Replace the drive sprocket (30). Refer to **Drive Sprocket, Driven Sprocket, and Drive Link Removal** .
Driven sprocket (17)	Inspect for worn or broken teeth - causing loss of hydraulic power from drive link failure. Replace the driven sprocket (17). Refer to **Drive Sprocket, Driven Sprocket, and Drive Link Removal** .
Drive link assembly (15)	Inspect for stretched, worn or damaged chain links. Replace the drive link assembly (15). Refer to **Drive Sprocket, Driven Sprocket, and Drive Link Removal** .
Bearing assemblies (700) on the front differential drive pinion gear and transfer gear assembly (701)	Inspect for worn or damaged bearings. Replace the bearing assemblies (700). Refer to **Front Differential Transfer Gear Bearing and Cup Replacement** .

NOISY IN REVERSE ONLY

Noisy in Reverse Only

Checks	Action
Splines in the case assembly (50)	Inspect for damage. Replace the case assembly (50). Refer to **Case Cover Assembly Removal** .

REATTACHING NOISE

Reattaching Noise

Checks	Action

Variable drive pulley assembly (500)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for worn splines - causing excessive backlash. Replace the variable drive pulley assembly (500). Refer to **Variable Driven Pulley Bearing Replacement** .

WHINE NOISE VARYING WITH RPM OR FLUID PRESSURE

Whine Noise Varying with RPM or Fluid Pressure

Checks	Action
Transmission fluid pump assembly (23)	Inspect the component for air ingestion or damage - causing low or no pressure at the discharge port. Replace the transmission fluid pump assembly (23). Refer to **Fluid Pump Removal** .

GRAVEL OR GRATING NOISE

Gravel or Grating Noise

Checks	Action
Fluid filter assembly (26)	Inspect for looseness or improper sealing. Replace the fluid filter assembly (26). Refer to **Fluid Filter Removal** .

MOANING NOISE

Moaning Noise

Checks	Action
Stator shaft assembly (81)	Inspect for damaged splines. Replace the transmission case assembly (50). Refer to **Transmission Case Inspection** .

TRANSMISSION CLUNK ON ACCELERATION OR DECELERATION

Transmission Clunk on Acceleration or Deceleration

Checks	Action
Lug bolts for the torque converter (1)	Inspect for loose torque converter (1) lug bolts. Tighten the lug bolts.

RATTLE NOISE

Rattle Noise

Checks	Action
Bolts (19, 20) securing the transmission fluid pump assembly (23) to the case	Inspect for loose or stripped bolts securing the transmission fluid pump assembly to the case. Tighten or replace the bolts (19, 20).

VIBRATION

Vibration

Checks	Action
Lug bolts for the torque converter (1)	Inspect for loose torque converter (1) lug bolts. Tighten the lug bolts.
Bolts (19, 20) securing the transmission fluid pump assembly (23) to the case	Inspect for loose or stripped bolts securing the transmission fluid pump assembly to the case. Tighten or replace the bolts (19, 20). Refer to **Fluid Pump Installation** .
Line 1 pressure regulator valve (316)	Inspect for worn, sticking or binding valve. Replace the line 1 pressure regulator valve (316). Refer to **Control Valve Body Assembly Disassemble** .
Line 1 pressure regulator valve spring (315)	Inspect for worn, sticking or damaged spring. Replace the line 1 pressure regulator valve spring (315). Refer to **Control Valve Body Assembly Disassemble** .
Line 2 pressure regulator valve (212)	Inspect for worn, sticking or binding valve. Replace the line 2 pressure regulator valve (212). Refer to **Control Valve Body Assembly Disassemble** .
Line 2 pressure regulator valve spring (211)	Inspect for worn, sticking or damaged spring. Replace the line 2 pressure regulator valve spring (211). Refer to **Control Valve Body Assembly Disassemble** .
Control valve body (305)	Inspect for porosity, damage or contamination with debris. Replace or flush the control valve body (305). Refer to **Control Valve Body Replacement** .

NO DRIVE IN FORWARD RANGES

No Drive in Forward Ranges

Checks	Action
Input shaft assembly (509)	Inspect for damage, wear or misalignment in the case. Replace the input shaft assembly (509). Refer to **Forward Clutch Assembly Disassemble** .
Input shaft, outer, bearing (510)	Inspect for damaged, seized or worn bearing. Replace the input shaft, outer, bearing (510). Refer to **Forward Clutch Assembly Disassemble** .
Input shaft fluid passage sleeve (508)	Inspect for obstruction or damage. Replace the input shaft fluid passage sleeve (508). Refer to **Forward Clutch Assembly Disassemble** .
Sun gear (505) and sun gear thrust washer (506)	Inspect for wear. Refer to **Forward Clutch Assembly Disassemble** .
Input shaft, inner, bearing (507)	Inspect for damaged, seized or worn bearing. Replace the input shaft, inner, bearing (507). Refer to **Forward Clutch Assembly Disassemble** .
Front differential carrier assembly (32)	Inspect for damage. Replace the front differential carrier assembly (32). Refer to **Front Differential Carrier Removal** .

Front differential side gear (605) and pinion gear (606)	Inspect for a broken tooth. Refer to **Front Differential Carrier Disassemble** .
Front differential pinion shaft (603)	Inspect for damage or fracture. Replace the front differential pinion shaft (603). Refer to **Front Differential Carrier Disassemble** .
Front differential pinion gear shaft pin (602)	Inspect for damage. Replace the front differential pinion gear shaft pin (602). Refer to **Front Differential Carrier Disassemble** .
Fluid pump seals (18, 25)	Inspect for cut or damage - causing leaking past the seal. Replace the fluid pump seals (18, 25). Refer to **Fluid Pump Disassemble** .
Control valve body bolts/screws (71, 79)	Inspect for loose, cross-threaded or stripped bolts. Tighten or replace the bolts/screws (71, 79).
Bearing retainer (100) for the variable drive pulley (93)	Inspect for damage or not holding - causing drive belt failure. Replace the bearing retainer (100). Refer to **Case Cover Assembly Disassemble** .
Bearing retaining ring (99) for the variable drive pulley (93)	Inspect for loose, damaged or ring not holding - causing drive belt failure. Replace the bearing retaining ring (99). Refer to **Case Cover Assembly Disassemble** .
Pump drive sprocket (30)	Inspect for worn or broken teeth - causing loss of hydraulic power from drive link failure. Replace the pump drive sprocket (30). Refer to **Drive Sprocket, Driven Sprocket, and Drive Link Removal** .
Pump driven sprocket (17)	Inspect for worn or broken teeth - causing loss of hydraulic power from drive link failure. Replace the pump driven sprocket (17). Refer to **Drive Sprocket, Driven Sprocket, and Drive Link Removal** .
Splines on the pump driven sprocket (17)	Inspect for wear or damage. Replace the pump driven sprocket (17). Refer to **Drive Sprocket, Driven Sprocket, and Drive Link Removal** .
Drive link assembly (15)	Inspect for stretched, worn or damaged chain links. Replace the drive link assembly (15). Refer to **Drive Sprocket, Driven Sprocket, and Drive Link Removal** .
Drive/driven pulley opening covers (104, 114)	Inspect for internal leaking and/or damage. Replace the drive/driven pulley opening covers (104, 114). Refer to **Variable Drive Cover Replacement** .
Drive/driven pulley opening covers seals (98, 102, 109, 113)	Inspect for leaking, cut or damage. Replace the drive/driven pulley opening covers seals (98, 102, 109, 113). Refer to **Variable Drive Cover Replacement** .
Variable drive belt assembly (107)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for damage or broken belt. Replace the variable drive belt assembly (107). Refer to **Drive Belt Removal** .
Retainer on the variable driven pulley assembly (106)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually**

	replaced as a set if one or more of these components are damaged. Inspect each component as necessary. Inspect retainer for damage or not holding - causing drive belt failure. Replace the variable driven pulley assembly (106). Refer to **Case Cover Assembly Assemble** .
Selective bearing retainer (111) for the variable driven pulley (106)	Inspect retainer for damage or not holding - causing drive belt failure. Replace the selective bearing retainer (111). Refer to **Case Cover Assembly Assemble** .
Pinion gear and/or transfer gear teeth on the front differential drive pinion gear assembly (9)	Inspect for broken or damaged teeth. Replace the front differential drive pinion gear assembly (9). Refer to **Front Differential Transfer Gear Removal** .
Forward clutch backing plate (517)	Inspect for wear, broken splines or damage. Replace the forward clutch backing plate (517). Refer to **Forward Clutch Assembly Disassemble** .
Retaining ring (519) for the forward clutch backing plate (517)	Inspect for damage, looseness, or not holding. Replace the retaining ring (519). Refer to **Forward Clutch Assembly Disassemble** .
Forward clutch plate assemblies (515, 516)	Inspect for worn splines or friction material. Replace the forward clutch plate assemblies (515, 516). Refer to **Forward Clutch Assembly Disassemble** .
Forward clutch piston assembly (501)	Inspect for cut or rolled seals. Replace the forward clutch piston assembly (501). Refer to **Forward Clutch Assembly Disassemble** .
Variable drive pulley assembly (500)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for damage. Replace the variable drive pulley assembly (500). Refer to **Forward Clutch Assembly Disassemble** .
Forward clutch piston, Belleville, spring (502)	Inspect for damage. Replace the forward clutch piston, Belleville, spring (502). Refer to **Forward Clutch Assembly Disassemble** .
Transmission fluid pump assembly (23)	Inspect for internal damage - causing low or no pressure at the discharge port. Replace the transmission fluid pump assembly (23). Refer to **Fluid Pump Disassemble** .
Fluid filter assembly (26)	Inspect for clog, loose or improper sealing. Replace the fluid filter assembly (26). Refer to **Fluid Filter Removal** .
Stator shaft assembly (81)	Inspect for damage. Replace the transmission case assembly (50). Refer to **Transmission Case Inspection** .
Torque converter (1)	Inspect for: • Damaged lugs or sheared lug bolts • Worn or damaged internal hub splines

	Refer to **Torque Converter Assembly Removal** .
Shaft splines on the variable drive pulley assembly (500)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for wear or damage. Replace the variable drive pulley assembly (500). Refer to **Forward Clutch Assembly Disassemble** .
Fixed bearing on the variable driven pulley assembly (106)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for wear or damage. Replace the variable driven pulley assembly (106). Refer to **Variable Driven Pulley Bearing Replacement** .
Bolts (19, 20) securing the transmission fluid pump assembly (23) to the case	Inspect for loose or stripped bolts. Tighten or replace the bolts (19, 20). Refer to **Fluid Pump Removal** .
Pump driven sprocket retaining ring (16)	Inspect for loose, damaged or ring not holding. Replace the retaining ring (16). Refer to **Drive Sprocket, Driven Sprocket, and Drive Link Removal** .
Line 1 pressure regulator valve train	Inspect for: • Worn, sticking or binding valve (316) • Worn, sticking or damaged spring (315) • Damaged or incorrectly installed bore plug retainer (300) • Worn or damaged bore plug (301) Refer to **Control Valve Body Assembly Disassemble** .
Line limit valve (310)	Inspect if the component is stuck in the exhaust position. Replace the line limit valve (310) and flush the control valve body (305). Refer to **Control Valve Body Assembly Disassemble** .
Line 2 pressure regulator valve train	Inspect for: • Worn, sticking or binding valve (212) • Worn, sticking or damaged spring (211) • Missing or cut bore plug seal (210)

	Refer to **Control Valve Body Assembly Disassemble** .
Manual valve (202)	Inspect for wear, sticking or binding. Replace the manual valve (202). Refer to **Control Valve Body Assembly Disassemble** .
Control valve body (305)	Inspect for porosity, damage, or contamination with debris. Replace or flush the control valve body (305). Refer to **Control Valve Body Replacement** .
Forward and reverse clutch valve (304)	Inspect for wear, sticking or binding. Replace the forward and reverse clutch valve (304). Refer to **Control Valve Body Assembly Disassemble** .

SLIPS IN DRIVE

Slips in Drive

Checks	Action
Forward clutch plates (515, 516)	Inspect for wear - causing slow clutch apply. Replace the forward clutch plates (515, 516). Refer to **Forward Clutch Assembly Disassemble** .
Forward clutch piston assembly (501)	Inspect for cut or rolled seals. Replace the forward clutch piston assembly (501). Refer to **Forward Clutch Assembly Disassemble** .
Transmission fluid pump assembly (23)	Inspect for internal damage - causing low or no pressure at the discharge port. Replace the fluid pump assembly (23). Refer to **Fluid Pump Disassemble** .
Fluid filter assembly (26)	Inspect filter for clog, looseness or improper sealing. Replace the fluid filter assembly (26). Refer to **Fluid Filter Removal** .
Shaft splines on the variable drive pulley assembly (500)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for wear or damage. Replace the variable drive pulley assembly (500). Refer to **Forward Clutch Assembly Disassemble** .
Elements on the variable drive belt assembly (107)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for wear. Replace the variable drive belt assembly (107). Refer to **Drive Belt Removal** .
Bolts (19, 20) securing the transmission fluid pump assembly (23) to the case	Inspect for loose or stripped bolts. Tighten or replace the bolts (19, 20). Refer to **Fluid Pump Removal** .
Line 1 pressure regulator valve train	Inspect for: • Worn, sticking or binding valve (316)

	• Worn, sticking or damaged spring (315) • Missing or cut bore plug seal (302) Refer to **Control Valve Body Assembly Disassemble** .
Line 2 pressure regulator valve train	Inspect for: • Worn, sticking or binding valve (212) • Worn, sticking or damaged spring (211) • Missing or cut bore plug seal (210) Refer to **Control Valve Body Assembly Disassemble** .
Control valve body (305)	Inspect for porosity, damage, or contamination with debris. Replace or flush the control valve body (305). Refer to **Control Valve Body Replacement** .

NO REVERSE

No Reverse

Checks	Action
Input shaft assembly (509) pinion pins	Inspect for damage or walking. Replace the input shaft assembly (509). Refer to **Forward Clutch Assembly Disassemble** .
Input shaft assembly (509) pinion gear thrust washers	Inspect for damage or wear - causing excessive end play and interference with other components. Replace the input shaft assembly (509). Refer to **Forward Clutch Assembly Disassemble** .
Input shaft assembly (509)	Inspect for a broken tooth. Replace the input shaft assembly (509). Refer to **Forward Clutch Assembly Disassemble** .
Reverse clutch assembly	Inspect for: • Damaged reverse clutch hub assembly (86) • Damaged or worn reverse clutch hub thrust washer (85) • Damaged or worn splines of the reverse clutch backing plate (91) • Broken or damaged retaining ring (92) • Worn splines or friction material in the reverse clutch plate assemblies (88, 89) • Damaged, loose or not holding retaining ring (84) • Damaged or worn reverse clutch spring assembly (83) Refer to **Reverse Clutch Removal** .
Shaft splines on the	**IMPORTANT:**

variable drive pulley assembly (500)	**The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for wear or damage. Replace the variable drive pulley assembly (500). Refer to **Forward Clutch Assembly Disassemble** .
Variable drive belt assembly (107)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for wear or scoring. Replace the variable drive belt assembly (107). Refer to **Drive Belt Installation** .
Manual valve (202)	Inspect for wear, sticking or binding. Replace the manual valve (202). Refer to **Control Valve Body Assembly Disassemble** .
Forward and reverse clutch valve (304)	Inspect for wear, sticking or binding. Replace the forward and reverse clutch valve (304). Refer to **Control Valve Body Assembly Disassemble** .

SLIPS IN REVERSE

Slips in Reverse

Checks	Action
Reverse clutch spring assembly (83)	Inspect for damage or wear. Replace the reverse clutch spring assembly (83). Refer to **Reverse Clutch Removal** .
Elements on the variable drive belt assembly (107)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for wear. Replace the variable drive belt assembly (107). Refer to **Drive Belt Installation** .

NO FORWARD AND REVERSE

No Forward and Reverse

Checks	Action
Variable drive belt assembly (107)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.**

	Inspect for wear or scoring. Replace the variable drive belt assembly (107). Refer to **Drive Belt Installation** .
Forward clutch piston, Belleville, spring (502)	Inspect for damage or distortion. Replace the forward clutch piston, Belleville, spring (502). Refer to **Forward Clutch Assembly Disassemble** .
Input shaft assembly (509)	Inspect for damage or a broken tooth. Replace the input shaft assembly (509). Refer to **Forward Clutch Assembly Disassemble** .
Input shaft assembly (509) pinion gear thrust washers	Inspect for damage or wear - causing excessive end play and interference with other components. Replace the input shaft assembly (509). Refer to **Forward Clutch Assembly Disassemble** .
Sun gear (505)	Inspect for worn or broken teeth. Replace the sun gear (505). Refer to **Forward Clutch Assembly Disassemble** .
Forward and reverse clutch valve train	Inspect for: • Worn or stuck valve (304) • Worn, sticking or damaged spring (303) • Damaged or incorrectly installed bore plug retainer (300) • Worn or damaged bore plug (301) • Missing or cut bore plug seal (302) Refer to **Control Valve Body Assembly Disassemble** .
Manual valve (202)	Inspect for wear, sticking or binding. Replace the manual valve (202). Refer to **Control Valve Body Assembly Disassemble** .
Line 1 pressure regulator valve (316)	Inspect for wear, sticking or binding. Replace the line 1 pressure regulator valve (316). Refer to **Control Valve Body Assembly Disassemble** .
Line 2 pressure regulator valve train	Inspect for: • Worn, sticking or binding valve (212) • Worn, sticking or damaged spring (211) • Missing or cut bore plug seal (210) Refer to **Control Valve Body Assembly Disassemble** .
Line limit valve (310) and spring (309)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Actuator feed limit valve (312) and spring (311)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Variable ratio control valve lever assembly (317) and spring (318)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Control valve body spacer plate (204)	Inspect for worn or plugged fluid passages. Replace or flush the spacer plate (204). Refer to **Control Valve Body Assembly Disassemble** .
Control valve body (305)	Inspect for clogs with debris or sediment. Replace or flush the control valve

	body (305). Refer to **Control Valve Body Replacement** .
Control solenoid valve assembly (201)	Inspect for clogs with debris or sediment. Replace the control solenoid valve assembly (201). Refer to **Control Valve Body Replacement** .

NO LOW OR REVERSE

No Low or Reverse

Checks	Action
Splines in the case assembly (50)	Inspect for damage. Replace the case assembly (50). Refer to **Transmission Case Inspection** .
Variable drive belt assembly (107)	**IMPORTANT:** **The variable drive pulley assembly (500), variable driven pulley assembly (106) and variable drive belt assembly (107) are usually replaced as a set if one or more of these components are damaged. Inspect each component as necessary.** Inspect for wear or scoring. Replace the variable drive belt assembly (107). Refer to **Drive Belt Installation** .

NO PARK

No Park

Checks	Action
Front differential carrier assembly (32)	Inspect for: • Damage to the assembly (32) • Broken teeth on the front differential side gear (605) and pinion gear (606) • Fractured front differential pinion shaft (603) Refer to **Front Differential Carrier Disassemble** .
Park pawl shaft hole plug (33) and actuator guide pin (34)	Inspect for missing plug, - causing the actuator guide (42) to become inoperative. Install a NEW park pawl shaft hole plug (33) and actuator guide pin (34). Refer to **Manual Shift Shaft and Parking System Components Removal** .
Pinion gear and/or transfer gear teeth on the front differential drive pinion gear assembly (9)	Inspect for broken or damaged teeth. Replace the front differential drive pinion gear assembly (9). Refer to **Front Differential Transfer Gear Removal** .
Manual shift shaft and parking system components	Inspect for: • Damage, worn or rounded teeth on the manual shaft detent lever (45) • Binding, bent or damaged park pawl actuator assembly (43)

	• Broken or distorted spring on the park pawl actuator assembly (43) • Damaged manual shift shaft (40) • Damaged park pawl reaction pin (35) or spring (37) • Damaged or stuck park pawl (36) • Loose or stripped manual shift shaft nut (46) Refer to **Manual Shift Shaft and Parking System Components Removal** .
Manual valve (202)	Inspect for wear, sticking or binding. Replace the manual valve (202). Refer to **Control Valve Body Assembly Disassemble** .

TRANSMISSION DOES NOT SHIFT OUT OF PARK

Transmission Does Not Shift Out of Park

Checks	Action
Park pawl actuator assembly (43), manual shift shaft (40) and park pawl (36)	Inspect for damage or sticking. Refer to **Manual Shift Shaft and Parking System Components Removal** .
Transmission fluid temperature	Inspect if temperature is -40°C to -25°C (-40°F to -13°F). Allow the transmission fluid temperature to warm up.

STAYS IN DRIVE

Stays in Drive

Checks	Action
Variable drive pulley follower (95)	Inspect for wear, binding or damage. Replace the case cover assembly (97). Refer to **Case Cover Assembly Assemble** .
Manual valve (202)	Inspect for wear, sticking or binding. Replace the manual valve (202). Refer to **Control Valve Body Assembly Disassemble** .
Control solenoid valve assembly (201)	Inspect for contamination with debris. Replace or flush the control solenoid valve assembly (201). Refer to **Control Valve Body Assembly Disassemble** .

STAYS IN LOW

Stays in Low

Checks	Action
Manual valve (202)	Inspect for wear, sticking or binding. Replace the manual valve (202). Refer to **Control Valve Body Assembly Disassemble** .
Control solenoid valve assembly (201)	Inspect for contamination with debris. Replace or flush the control solenoid valve assembly (201). Refer to **Control Valve Body Assembly Disassemble** .
Primary limit valve train	Inspect for:

	• Worn, sticking, binding or damaged valve (314) or spring (313) • Damaged valve spring seat (306) Refer to **Control Valve Body Assembly Disassemble** .
Variable ratio control valve lever assembly (317)	Inspect for wear, sticking or binding. Replace the variable ratio control valve lever assembly (317). Refer to **Control Valve Body Assembly Disassemble** .
Variable drive pulley follower (95)	Inspect for wear, binding or damage. Replace the case cover assembly (97). Refer to **Case Cover Assembly Assemble** .
Variable drive pulley follower spring (96)	Inspect for wear, sticking or damage. Replace the variable drive pulley follower spring (96). Refer to **Case Cover Assembly Assemble** .

STAYS IN INTERMEDIATE

Stays in Intermediate

Checks	Action
Manual valve (202)	Inspect for wear, sticking or binding. Replace the manual valve (202). Refer to **Control Valve Body Assembly Disassemble** .
Control solenoid valve assembly (201)	Inspect for contamination with debris. Replace or flush the control solenoid valve assembly (201). Refer to **Control Valve Body Assembly Disassemble** .

STAYS IN REVERSE

Stays in Reverse

Checks	Action
Manual valve (202)	Inspect for wear, sticking or binding. Replace the manual valve (202). Refer to **Control Valve Body Assembly Disassemble** .
Control solenoid valve assembly (201)	Inspect for contamination with debris. Replace or flush the control solenoid valve assembly (201). Refer to **Control Valve Body Assembly Disassemble** .

RANGE SELECTOR DISPLAYS INCORRECT RANGE

Range Selector Displays Incorrect Range

Checks	Action
Manual shift shaft nut (46)	Tighten or replace the manual shift shaft nut (46) if loose or stripped. Refer to **Manual Shift Shaft and Parking System Components Removal** .

HARSH GARAGE SHIFT

Harsh Garage Shift

Checks	Action
Valve spring seat (306) for the	Inspect for damage. Replace the valve spring seat (306) for the line limit

line limit valve spring (309)	valve spring (309). Refer to **Control Valve Body Assembly Disassemble** .
Forward and reverse clutch valve spring (303)	Inspect for sticking. Replace the forward and reverse clutch valve spring (303). Refer to **Control Valve Body Assembly Disassemble** .
Manual valve (202)	Inspect for wear, sticking or binding. Replace the manual valve (202). Refer to **Control Valve Body Assembly Disassemble** .
Clutch boost valve (322)	Inspect for wear, sticking or binding. Replace the clutch boost valve (322). Refer to **Control Valve Body Assembly Disassemble** .

POOR DRIVEABILITY - POOR OR NO RATIO CONTROL

Poor Driveability - Poor or No Ratio Control

Checks	Action
Primary limit valve (314) and spring (313)	Inspect for wear, sticking or binding. Refer to **Control Valve Body Assembly Disassemble** .
Variable ratio control valve lever assembly (317), spring (318) and Pivot link/retaining pin	Inspect for wear, sticking, binding or damage. Replace the variable ratio control valve lever assembly (317). Refer to **Control Valve Body Assembly Disassemble** .
Variable drive pulley follower (95)	Inspect for wear, binding or damage. Replace the case cover assembly (97). Refer to **Case Cover Assembly Assemble** .
Variable drive pulley follower spring (96)	Inspect for wear, sticking or damage. Replace the variable drive pulley follower spring (96). Refer to **Case Cover Assembly Assemble** .
Line limit valve (310) and spring (309)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Actuator feed limit valve (312) and spring (311)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .

NO TORQUE CONVERTER CLUTCH (TCC) APPLY/TCC SLIPPING/SOFT TCC APPLY

No Torque Converter Clutch (TCC) Apply/TCC Slipping/Soft TCC Apply

Checks	Action
Stator shaft assembly (81)	Inspect if the component contains debris or is damaged - causing restricted fluid flow and increased fluid temperature. Replace the transmission case assembly (50). Refer to **Case Cover Assembly Removal** .
Torque converter and housing seal assembly (2)	Inspect for looseness or damage. Replace the torque converter and housing seal assembly (2). Refer to **Drive Axle Shaft Seal Replacement (FWD Right)** or **Drive Axle Shaft Seal Replacement (AWD Right)** .
Line limit valve (310) and spring (309)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Control valve body (305)	Inspect for porosity, damage, or contamination with debris. Replace or flush the control valve body (305). Refer to **Control Valve Body Replacement** .
TCC control valve (308) and spring (307)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .

TCC regulator valve (319) and apply valve spring (320)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .

TORQUE CONVERTER CLUTCH (TCC) STUCK ON

Torque Converter Clutch (TCC) Stuck On

Checks	Action
Line limit valve (310) and spring (309)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Control valve body (305)	Inspect for porosity, damage, or contamination with debris. Replace or flush the control valve body (305). Refer to **Control Valve Body Replacement** .
TCC control valve (308) and spring (307)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
TCC regulator valve (319) and apply valve spring (320)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .

HARSH TORQUE CONVERTER CLUTCH (TCC) APPLY

Harsh Torque Converter Clutch (TCC) Apply

Checks	Action
TCC control valve (308) and spring (307)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
TCC regulator valve (319) and apply valve spring (320)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Line limit valve (310) and spring (309)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Actuator feed limit valve (312) and spring (311)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Primary limit valve (314) and spring (313)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .

TORQUE CONVERTER CLUTCH (TCC) SLIPPING

Torque Converter Clutch (TCC) Slipping

Checks	Action
Line limit valve (310) and spring (309)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Actuator feed limit valve (312) and spring (311)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
Primary limit valve (314) and spring (313)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .
TCC control valve (308) and spring	Inspect for wear, sticking, binding or damage. Refer to **Control**

(307)	**Valve Body Assembly Disassemble** .
TCC regulator valve (319) and apply valve spring (320)	Inspect for wear, sticking, binding or damage. Refer to **Control Valve Body Assembly Disassemble** .

DIAGNOSIS

DTC P0218

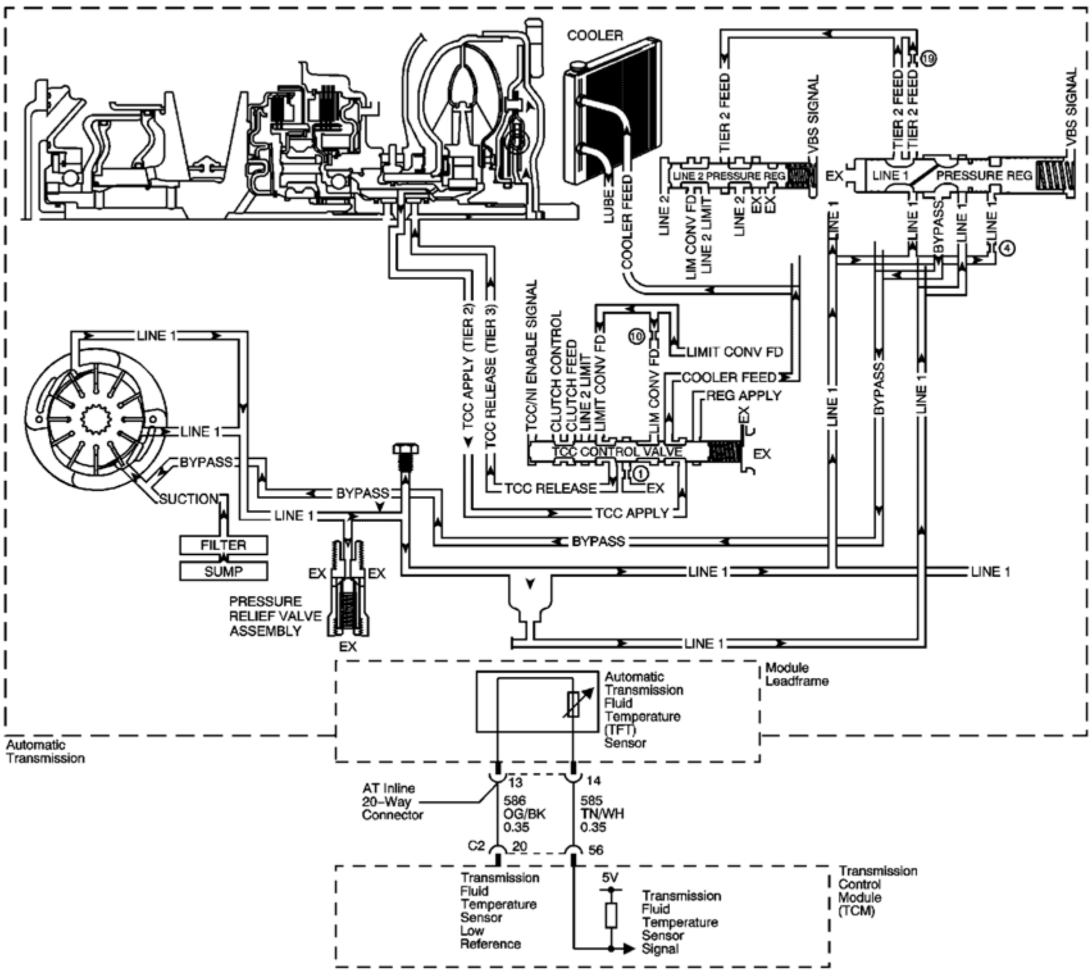


Fig. 1: DTC P0218 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The primary source of heat in the transmission is the torque converter. Hot oil exits the torque converter through the torque converter clutch (TCC) control valve and flows to the transmission cooler supply line. The supply line connects to the cooler, which is located in front of the radiator. From the cooler, the oil returns through the oil cooler return line and enters the lubrication circuits. After lubricating the internal components, the oil then returns to the oil pan. The oil pump draws oil through the filter. It pressurizes the oil and directs it to the line 1 pressure regulator valve and driven sheave. The line 1 pressure regulator valve is the starting point for the main supply of oil to the torque converter and the transmission hydraulic control systems.

If the TCM detects a high transmission fluid temperature for a long period of time, DTC P0218 sets. DTC P0218 is a type C DTC.

Conditions for Running the DTC

No TFT DTCs P0711, P0712 or P0713.

Conditions for Setting the DTC

The transmission fluid temperature is greater than 140°C (284°F) for 3 minutes.

Action Taken When the DTC Sets

- The TCM does not request the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM will request the ECM to illuminate the service vehicle soon (SVS) lamp.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0218 in TCM history.

Conditions for Clearing the SVS Lamp/DTC

- The TCM clears the SVS lamp request when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring

Diagnostic Aids

Ask the customer about overloading the vehicle, or exceeding the trailer towing limit.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step tests for low fluid level, which can cause high transmission fluid temperatures.

3: This step inspects for transmission cooling restrictions.

DTC P0218

Step	Action	Values	Yes	No
	Did you perform the Diagnostic System Check - Engine Controls?			Go to **Diagnostic System Check -**

1		-	Go to **Step 2**	**Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. Did you perform the Transmission Fluid Checking Procedure?	-	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Inspect the transmission cooling system for the following conditions: • Air flow restrictions • Air flow blockage • Debris • Damaged cooler lines 2. Repair any of the above conditions as necessary. Did you find and correct a condition?	-	Go to **Step 7**	Go to **Step 4**
4	1. Inspect the oil cooler pipe system for the following conditions: • Restrictions, bends in oil cooler lines • Leaking seals • Restricted oil cooler 2. Repair any of the above conditions as necessary. Did you find and correct a condition?	-	Go to **Step 7**	Go to **Step 5**

5	Did you perform the Line Pressure Check Procedure?	-	Go to **Step 6**	Refer to **Line Pressure Check Procedure**
6	Inspect the torque converter for stator damage. Refer to **Torque Converter Diagnosis Procedure** . Did you find and correct the condition?	-	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the conditions for running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P0218. Has the test run and passed?	-	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0502

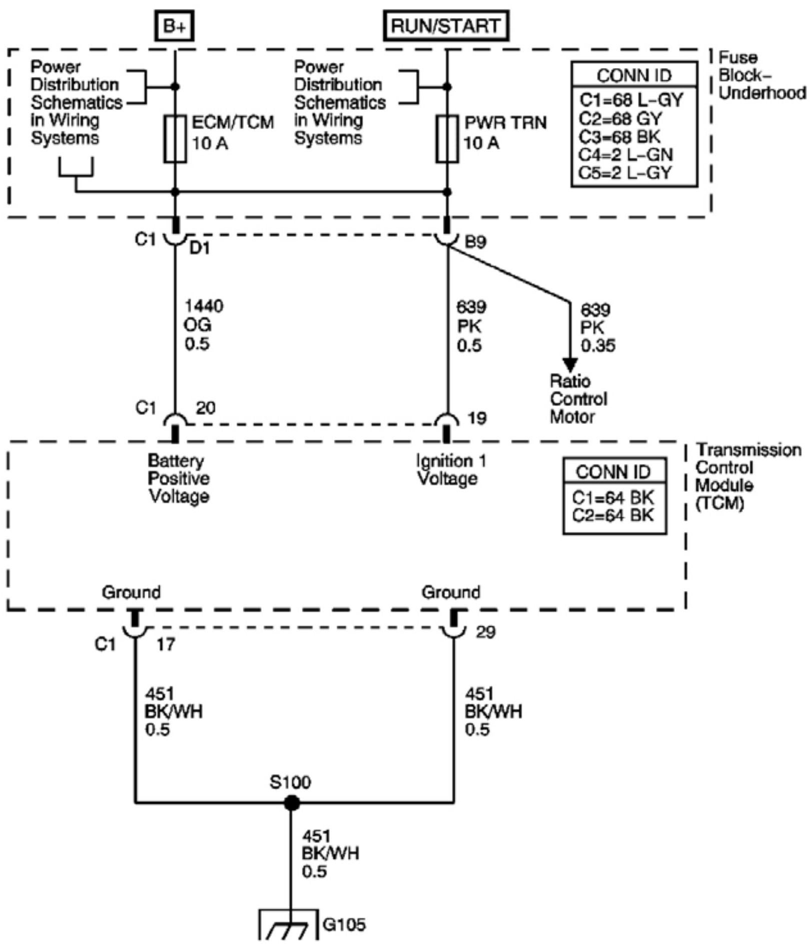


__**Fig. 2: DTC P0502 Schematics**__
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The engine control module (ECM) receives vehicle speed through high-speed communications on the controller area network (CAN) from the transmission control module (TCM) based on the output speed sensor (OSS). The OSS is mounted inside the transmission, under the control valve body cover. The sensor produces an AC current generated as the output shaft rotates. The ECM continuously monitors the vehicle speed signal supplied by the TCM.

If the ECM does not detect a sufficient amount of vehicle speed from the TCM over the CAN link when engine speed is above a certain range while the vehicle is in fourth of fifth gear, DTC P0502 sets. DTC P0502 is a type B DTC.

Conditions for Running The DTC

- No CAN DTCs U2100, U2104 or U2106.
- The engine speed is 1,800-3,000 RPM.
- The engine coolant temperature is greater than 64°C (147°F).

Conditions for Setting The DTC

The vehicle speed is less than 5 km/h (3 mph) for a total of 3 seconds.

Action Taken When the DTC Sets

- The ECM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The ECM stores DTC P0502 in ECM history.

Conditions for Clearing the DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the DTC.
- The ECM clears the DTC from ECM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

Diagnostic Aids

- If TCM DTCs P0722 or P0723 are set, diagnose these DTCs first.
- If an output speed sensor signal circuit fault is occurring, a vehicle speed of 0 km/h (0 mph) will be sent to the ECM and the ECM will set DTC P0502.
- To locate an intermittent problem, use the scan tool to monitor vehicle speed in the ECM data list with the vehicle raised and the drive wheels moving greater than 5 km/h (3 mph). If an intermittent output speed sensor signal is occurring, vehicle speed on the scan tool will go to 0 km/h (0 mph).

Test Description

The number below refers to the step number on the diagnostic table.

3: Because the TCM supplies the ECM with vehicle speed, the TCM will also have set a DTC.

DTC P0502

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-		Go to **Diagnostic System Check - Engine Controls** in

			Go to **Step 2**	Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** **Before clearing the DTC, use the scan tool in order to record the ECM Freeze Frame and the TCM Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the ECM and the TCM.** 3. Record the Freeze Frame and Failure Records. Did you record Freeze Frame or Failure Records for any of the following communication codes: U2100, U2104 or U2106?	-	Go to **DTC U2100** and/or **DTC U2105-U2199** in Data Link Communications	Go to **Step 3**
3	Did you record Freeze Frame or Failure Records for DTCs P0722 or P0723?	-	Go to **DTC P0722** and **DTC P0723**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)

DTC P0562

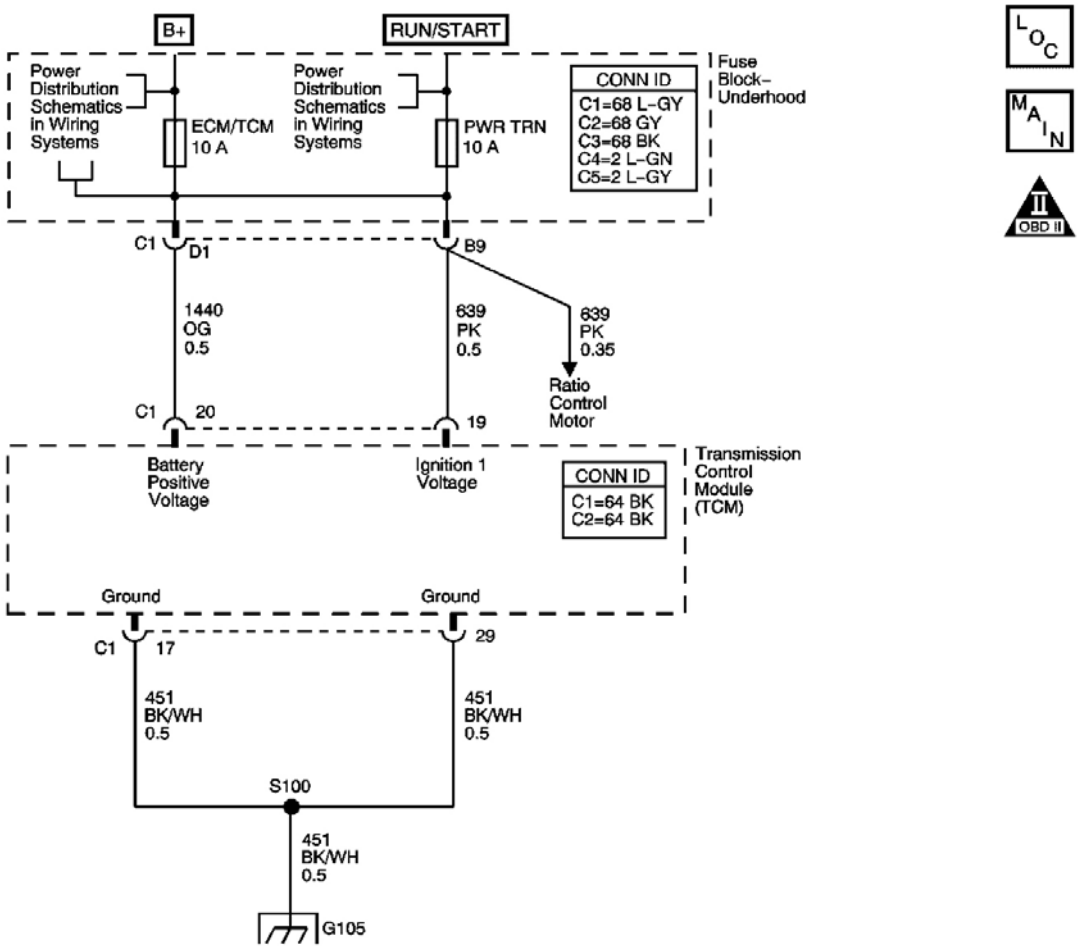


Fig. 3: DTC P0562 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) samples the system voltage on the Ignition 1 circuit every 0.1 seconds. Lower than normal voltage may be inadequate to operate the transmission control solenoids properly. Improper solenoid operation may cause erratic ratio control operation, which may result in internal damage.

If the TCM detects low voltage for a number of samples, DTC P0562 sets. DTC P0562 is a type C DTC.

Conditions for Running The DTC

The engine speed is 1,500 RPM or greater.

Conditions for Setting The DTC

The TCM detects system voltage is 11 volts or less for 42 out of 50 samples.

Action Taken When the DTC Sets

- The TCM does not request the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM will request the ECM to illuminate the service vehicle soon (SVS) lamp.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM inhibits TCC engagement.
- The TCM commands maximum line pressure.
- The TCM no longer inhibits shifting to between reverse and drive when moving.
- The TCM turns power off to the TCC enable solenoid valve.
- The TCM discontinues torque management.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM records this information as Failure Records.
- The TCM stores DTC P0562 in TCM history.

Conditions for Clearing the SVS Lamp/DTC

- The TCM clears the SVS lamp request when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

Inspect for the following conditions:

- Loose or damaged terminals at the generator
- Loose or worn generator drive belt
- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: This step tests the charging system voltage with a normal load.

5: This step obtains the ignition voltage measurement reported by the TCM.

6: This step tests the voltage drop from the battery and ignition voltage input at the TCM.

10: This step tests the voltage drop from the ground terminals of the TCM to the ground terminal of the battery.

DTC P0562

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the Failure Records. 4. Clear the DTC. 5. Using the DMM, measure and record the battery voltage across the battery terminals. Is the voltage higher than the specified value?	11 V	Go to **Step 3**	Go to **Battery Inspection/Test (Side Terminal Battery)** or **Battery Inspection/Test (Top Post Terminal Battery)** in Engine Electrical
3	1. Start the engine. 2. Allow the engine to warm up to normal operating temperature. Is the charge indicator ON?	-	Go to **Diagnostic System Check - Engine Electrical** in Engine Electrical	Go to **Step 4**
	1. Turn ON the high beam headlamps.			

4	2. Turn the HVAC blower control to the highest speed setting. 3. Turn ON the rear window defroster. 4. Increase the engine speed to 1,500 RPM. 5. Observe the DMM battery voltage and record your voltage reading for reference. Is the voltage within the specified range?	12.5-14.5 V	Go to **Step 5**	Go to **Charging System Test** in Engine Electrical
5	1. Increase the engine speed to 1,500 RPM. 2. Observe the Ignition Voltage with the scan tool. Is the scan tool Ignition Voltage within the specified range?	12.5-14.5 V	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)	Go to **Step 6**
6	1. Turn OFF the ignition. 2. Disconnect the TCM connector. 3. Probe the ignition 1 and the battery positive voltage circuits of the TCM connector with the ground probe of the DMM. Refer to **Circuit Testing** in Wiring Systems. 4. Connect the positive lead of the DMM to the battery positive terminal. 5. Turn ON the ignition, with the engine OFF. Are the voltage drop measurements less than the specified value?	0.5 V	Go to **Step 10**	Go to **Step 7**
7	Inspect the 10 amp ECM/TCM battery fuse and the 10 amp PWR TRAIN fuse for an open. Refer to **Circuit Protection - Fuses** in Wiring Systems. Did you find an open fuse?	-	Go to **Step 8**	Go to **Step 9**
8	**IMPORTANT:** **The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Engine Controls Schematics in Engine Controls - 2.2L (L61) for complete circuit distribution**	-		-

	Repair the short to ground in the battery voltage circuit or the ignition voltage circuit. Refer to **Wiring Repairs** in Wiring Systems.Is the repair complete?		Go to **Step 13**	
9	Test the battery voltage circuit or the ignition voltage circuit for an open or high resistance condition. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 10**
10	1. Turn ON the ignition, with the engine OFF. 2. Using the positive probe of the DMM, probe each of the TCM ground circuits of the TCM connector. Connect the negative lead of the DMM to the battery ground terminal. Observe and record the voltage measurement. Are all of the voltage drop measurements less than the specified value?	0.2 V	Go to **Step 12**	Go to **Step 11**
11	Repair the open or high resistance condition in the TCM ground circuits. Refer to **Wiring Repairs** in Wiring Systems. Is the repair complete?	-	Go to **Step 13**	-
12	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** Is the replacement complete?	-	Go to **Step 13**	-
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Start the engine. • Allow the engine to warm up to normal operating temperature. • Raise the engine speed to at least 1,500 RPM. • TCM voltage must be greater	-		

	than 11 volts for 5 seconds. 4. Select Specific DTC. 5. Enter DTC P0562. Has the test run and passed?		Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls 2.2L (L61)	System OK

DTC P0563

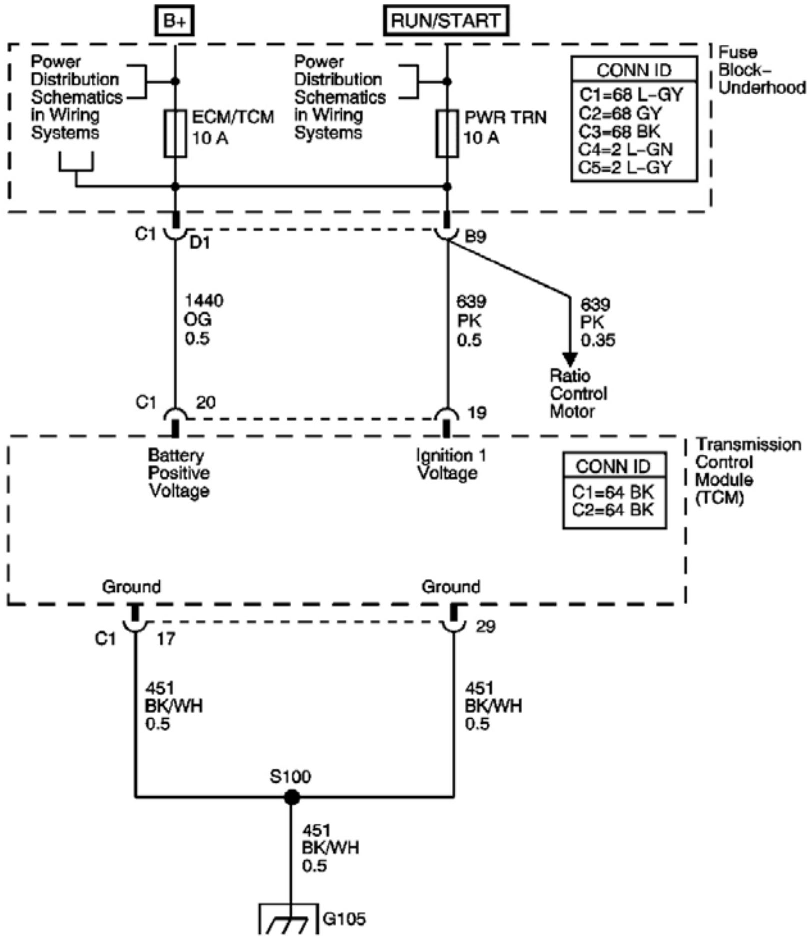


Fig. 4: DTC P0563 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) samples the system voltage on the Ignition 1 circuit every 0.1 seconds. Higher than normal voltage may cause the transmission control solenoids to operate improperly or damage the solid-state components inside the TCM.

If the TCM detects high voltage for a number of samples, DTC P0563 sets. DTC P0563 is a type C DTC.

Conditions for Running The DTC

The engine is running.

Conditions for Setting The DTC

The TCM detects system voltage is 18 volts or greater for 43 out of 50 samples.

Action Taken When the DTC Sets

- The TCM does not request the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM will request the ECM to illuminate the service vehicle soon (SVS) lamp.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM inhibits TCC engagement.
- The TCM commands maximum line pressure.
- The TCM turns power off to the TCC enable solenoid valve.
- The TCM discontinues torque management.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0563 in TCM history.

Conditions for Clearing the SVS Lamp/DTC

- The TCM clears the SVS lamp request when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Use the scan tool in order to inspect all other modules for voltage related DTCs.
- Running the engine with a battery charger attached may cause DTC P0563 to set.
    - Inspect the charging circuit for high resistance.
    - Inspect the vehicle battery for open or sulfated cells.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests the charging system voltage with a minimal load.

4: This step obtains the ignition voltage measurement reported by the TCM.

DTC P0563

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the Failure Records. 4. Clear the DTC. 5. Start the engine and allow the engine to warm up to normal operating temperature. Is the battery charge indicator lamp ON?	-	Go to **Diagnostic System Check - Engine Electrical** in Engine Electrical	Go to **Step 3**
	1. Turn OFF all electrical accessories. 2. Increase the engine speed to 2,000			

3	RPM. 3. Using the DMM, measure the voltage between the battery terminals. Record the measurement for reference. Is the voltage within the specified range?	12.5-14.5 V	Go to **Step 4**	Go to **Charging System Test** in Engine Electrical
4	1. Leave the engine running. 2. Observe the Ignition Voltage on the scan tool. 3. Increase the engine speed to 2,000 RPM. Is the difference between the voltage displayed on the scan tool and the voltage measurement in Step 3 greater than the specified value?	1.0 V	Go to **Step 6**	Go to **Step 5**
5	Did DTC P0563 reset?	-	Go to **Step 6**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
6	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Start the engine. • Allow the engine to warm up to normal operating temperature. • Observe the Ignition Voltage on the scan tool. • TCM voltage must remain below 18 volts for 5 seconds. 4. Select Specific DTC. 5. Enter DTC P0563. Has the test run and passed?	-	Go to **Step 8**	Go to **Step 2**
	With the scan tool, observe the stored information, capture info and DTC info.		Go to **Diagnostic Trouble Code**	

8	Does the scan tool display any DTCs that you have not diagnosed?	-	**(DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0601

Circuit Description

A normal function of the transmission control module (TCM) is to perform an internal test that verifies the integrity of the ROM memory allocation. This diagnostic detects faults in the allocation of flash memory that contains the program and calibration by comparing a calculated checksum with a stored checksum. When the TCM detects that the calculated checksum is different from the stored checksum, DTC P0601 sets. DTC P0601 is a type A DTC.

Conditions for Running The DTC

The engine is running.

Conditions for Setting The DTC

The TCM EEPROM checksums do not match.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM freezes all ratio control functions, including the ratio control motor and desired speed ratio.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM inhibits TCC engagement.
- The TCM commands maximum line pressure.
- The TCM no longer inhibits shifting to between reverse and drive when moving.
- The TCM turns power off to the TCC enable solenoid valve.
- The TCM discontinues torque management.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0601 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the default actions when the ignition switch is OFF long enough in order to power down the TCM.

DTC P0601

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM Freeze Frame and the TCM Failure Records. Using the Clear DTC Info function erases the Failure Records from the ECM and TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for at least 30 seconds. 6. Turn ON the ignition. Did DTC P0601 reset?	-	Go to **Step 3**	-
3	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Is the replacement complete?	-	Go to **Step 4**	-
	Perform the following procedure in order to verify the repair:			

4	1. Select DTC. 2. Select Clear Info. 3. Turn OFF the ignition for at least 30 seconds. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 5. Select Specific DTC. 6. Enter DTC P0601. Has the test run and passed?	-	Go to **Step 5**	Go to **Step 2**
5	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0602

Circuit Description

A normal function of the transmission control module (TCM) is to perform an internal test that verifies the security of the diagnostic and control calibration programming. The programming must contain security codes that enable a software lock to engage. The software lock is designed to prevent unauthorized changes to the diagnostics or control calibrations. The software lock utility is processed independently from the diagnostic and control calibration software and contains application specific data. The software lock data is entered into the TCM during the final assembly of the vehicle.

When the security codes from the diagnostic and shift calibration software fail to engage the software lock, the TCM sets DTC P0602. DTC P0602 is a type A DTC.

Conditions for Running The DTC

- No TCM DTC P0601.
- The engine is running.

Conditions for Setting The DTC

The TCM detects an unlocked calibration memory range.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM inhibits TCC engagement.

- The TCM commands a line pressure increase for all operating conditions.
- The TCM freezes main line pressure transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0602 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

DTC P0602 may set as a result of TCM reprogramming.

Test Description

The number below refers to the step number on the diagnostic table.

3: This step eliminates the TCM software as a possible cause of the DTC. If the DTC continues to set after reprogramming, the fault is in the TCM hardware.

DTC P0602

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the**			

2	**scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the ECM and the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for at least 30 seconds. 6. Turn ON the ignition. Did DTC P0602 reset?	-	Go to **Step 3**	Go to Diagnostic Aids
3	Perform the Transmission Control Module Reprogramming Procedure. Refer to **Service Programming System (SPS)** in Programming. Did the DTC P0602 reset?	-	Go to **Step 4**	Go to **Step 5**
4	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Is the replacement complete?	-	Go to **Step 5**	-
5	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Turn OFF the ignition for at least 30 seconds. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 5. Select Specific DTC. 6. Enter DTC P0602. Has the test run and passed?	-	Go to **Step 6**	Go to **Step 2**
6	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0603

Circuit Description

A normal function of the transmission control module (TCM) is to perform an internal test that verifies the integrity of the non-volatile random access memory (NVRAM) allocation. This diagnostic detects faults in the allocation of NVRAM that contain the transmission adaptive memory cells by comparing a calculated checksum with a stored checksum. When the TCM detects that the calculated checksum is different from the stored checksum, DTC P0603 sets. DTC P0603 is a type A DTC.

Conditions for Running The DTC

- No TCM DTC P0604.
- The engine is running.

Conditions for Setting The DTC

The TCM NVRAM checksums do not match.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM freezes all ratio control functions, including the ratio control motor and desired speed ratio.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM inhibits TCC engagement.
- The TCM commands maximum line pressure.
- The TCM no longer inhibits shifting to between reverse and drive when moving.
- The TCM turns power off to the TCC enable solenoid valve.
- The TCM discontinues torque management.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0603 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.

- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the default actions when the ignition switch is OFF long enough in order to power down the TCM.

DTC P0603

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the ECM and the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for at least 30 seconds. 6. Turn ON the ignition. Did DTC P0603 reset?	-	Go to **Step 3**	Go to Diagnostic Aids
3	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Is the replacement complete?	-	Go to **Step 4**	-
	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Turn OFF the ignition for at least 30			

4	seconds. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 5. Select Specific DTC. 6. Enter DTC P0603. Has the test run and passed?	-	Go to **Step 5**	Go to **Step 2**
5	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0604

Circuit Description

A normal function of the transmission control module (TCM) is to perform an internal test that verifies the read and write capability of the random access memory (RAM). This diagnostic detects faults in the RAM by writing test data to the RAM, reading the same data, and then comparing the two data sets. When the TCM detects that the data that was read from the RAM is different from the test data that was written to the RAM, DTC P0604 sets. DTC P0604 is a type A DTC.

Conditions for Running The DTC

The engine is running.

Conditions for Setting The DTC

The data read from RAM does not match the test data written to the RAM.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM freezes all ratio control functions, including the ratio control motor and desired speed ratio.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM inhibits TCC engagement.
- The TCM commands maximum line pressure.
- The TCM no longer inhibits shifting to between reverse and drive when moving.
- The TCM turns power off to the TCC enable solenoid valve.

- The TCM discontinues torque management.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0604 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

DTC P0604

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records.	-		

	4. Clear the DTC. 5. Turn OFF the ignition for at least 30 seconds. 6. Turn ON the ignition. Did DTC P0604 reset?		Go to **Step 3**	Go to Diagnostic Aids
3	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Is the action complete?	-	Go to **Step 4**	-
4	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Turn OFF the ignition for at least 30 seconds. 4. Start the engine. 5. Select Specific DTC. 6. Enter DTC P0604. Has the test run and passed?	-	Go to **Step 5**	Go to **Step 2**
5	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0606

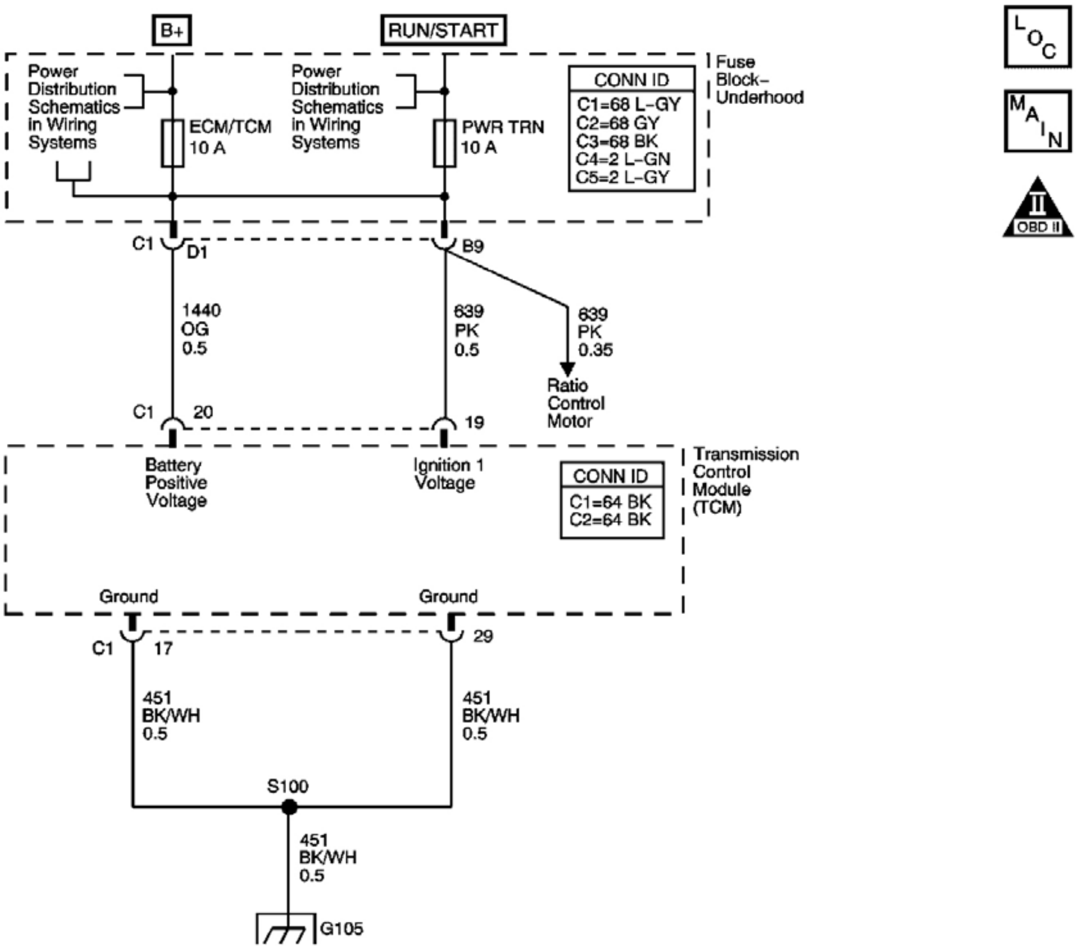


Fig. 5: DTC P0606 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

A normal function of the transmission control module (TCM) is monitoring the microprocessor status. When there is a microprocessor reset, the controller software will perform a power-up cycle. If a power-up cycle is performed without a power-down occurring, the controller will interpret this as a running reset. When the TCM detects that a calibrated number of power-up cycles have been interpreted as running resets, DTC P0606 sets. DTC P0606 is a type A DTC.

Conditions for Running The DTC

- No TCM DTCs P0601, or P0604.
- The ignition is ON.

Conditions for Setting The DTC

The TCM has performed 10 power-up cycles and 7 were interpreted as running resets.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM freezes all ratio control functions, including the ratio control motor and desired speed ratio.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM inhibits TCC engagement.
- The TCM commands maximum line pressure.
- The TCM no longer inhibits shifting to between reverse and drive when moving.
- The TCM turns power off to the TCC enable solenoid valve.
- The TCM discontinues torque management.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0606 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not sent a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P0606

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the ECM and the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Turn ON the ignition. Did DTC P0606 reset?	-	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Test the ignition voltage circuit for an intermittent open or short condition between the TCM C1 and fuse block - underhood 68-way connector. 2. Test the battery voltage circuit for an intermittent open or short condition between the TCM C1 and fuse block - underhood 68-way connector. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 5**	Go to **Step 4**
4	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Is the replacement complete?	-	Go to **Step 5**	-
	Perform the following procedure in order to			

5	verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select Specific DTC. 5. Enter DTC P0606. Has the test run and passed?	-	Go to **Step 6**	Go to **Step 2**
6	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0705

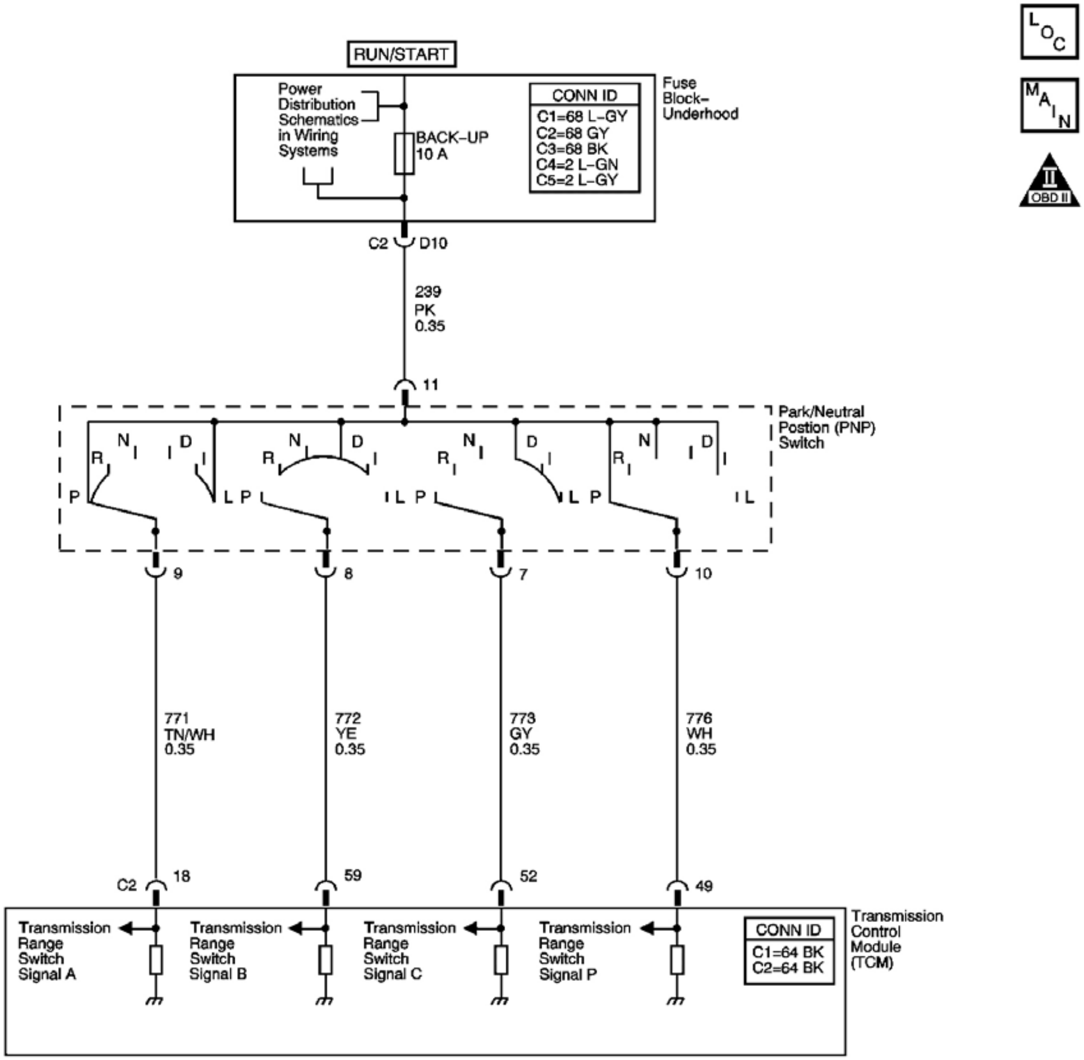


Fig. 6: DTC P0705 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission range (TR) switch is part of the park/neutral position and back-up lamp switch assembly and is mounted on the transmission manual shaft. The TR switch is a multi-signal switch. The fuse block - underhood supplies ignition voltage to the TR switch on four signal circuits, A, B, C, and P. Each gear selector lever position powers two or more of the signal circuits in a unique pattern. In order to determine the gear range selected by the driver, the TCM compares the voltage combination on the signal circuits to a TR switch combination table stored in memory. Refer to **Transmission Range Switch Logic** .

When the TCM detects an invalid combination of TR switch signals, DTC P0705 sets. DTC P0705 is a type B DTC.

Conditions for Running the DTC

The ignition voltage is 8-18 volts.

Conditions for Setting the DTC

The combination of TR switch signals is invalid for 5 seconds. Refer to the**Transmission Range Switch Logic** table.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM turns power off to the torque converter clutch pressure control solenoid valve.
- The TCM discontinues abuse torque management.
- The TCM defaults the selected gear range to DRIVE.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0705 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not sent a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the park/neutral position switch, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: By disconnecting the TR switch, the voltage supply for all TR switch circuits would be removed and the TCM should recognize all circuits as open. The scan tool should display LOW for all range signals.

6: This step tests the TR switch wiring for an open or lack of a ground path from the TCM.

7: This step tests the TR switch wiring and the TCM by providing a voltage supply through a fused jumper wire. When voltage is applied, the scan tool range signal A should change to HI.

8: This step tests the TR switch wiring and the TCM by providing a voltage supply through a fused jumper wire. When voltage is supplied, the scan tool range signal B should change to HI.

9: This step tests the TR switch wiring and the TCM by providing a voltage supply through a fused jumper wire. When voltage is applied, the scan tool range signal C should change to HI.

DTC P0705

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Select TR Sw. on the scan tool. 4. With the scan tool, observe the TR Sw. display while selecting each transmission range: P, R, N, D, I, and L. Does each selected transmission range match the scan tool TR Sw. display?	-	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)	Go to **Step 3**
3	1. Inspect the PNP switch assembly for the following: • Damage • Loose or missing mounting hardware • Proper adjustment Refer to **Park/Neutral Position Switch Replacement** . 2. Inspect the shift cable for the following: • Damaged or stretched cable • Proper adjustment Refer to **Shift Cable**	-		

	Replacement . Did you find and correct a condition?		Go to **Step 18**	Go to **Step 4**
4	With the scan tool, observe the TR Sw. A/B/C/P display. Does the scan tool TR Sw. A/B/C/P parameter indicate LOW for all range signal states?	-	Go to **Step 13**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Disconnect the park/neutral position switch 12-way connector. 3. Turn ON the ignition, with the engine OFF. Does the scan tool TR Sw. A/B/C/P parameter indicate LOW for all range signal states?	-	Go to **Step 6**	Go to **Step 10**
6	1. Using the DMM and the **J-35616** Connector Test Adapter Kit, measure the voltage from the TR signal A circuit of the park/neutral position switch 12-way connector to battery positive. 2. Measure the voltage from the TR signal B circuit of the park/neutral position switch 12-way connector to battery positive. 3. Measure the voltage from the TR signal C circuit of the park/neutral position switch 12-way connector to battery positive. 4. Measure the voltage from the TR signal P circuit of the park/neutral position switch 12-way connector to battery positive. Does the voltage measure within the specified value at all four terminals?	10-14 V	Go to **Step 7**	Go to **Step 11**
7	Connect a fused jumper wire from the TR signal A circuit of the park/neutral position switch 12-way connector to battery positive while monitoring the scan tool TR Sw. A/B/C/P parameter. When the TR signal A circuit is shorted to voltage, do any other signal circuits indicate HI?	-	Go to **Step 12**	Go to **Step 8**
8	Connect a fused jumper wire from the TR signal B circuit of the park/neutral position switch 12-way connector circuit, to battery positive while monitoring the scan tool TR Sw. A/B/C/P parameter.	-		

	When the TR signal B circuit is shorted to voltage, do any other signal circuits indicate HI?		Go to **Step 12**	Go to **Step 9**
9	Connect a fused jumper wire from the TR signal C circuit of the park/neutral position switch 12-way connector circuit, to battery positive while monitoring the scan tool TR Sw. A/B/C/P parameter. When the TR signal C circuit is shorted to voltage, do any other signal circuits indicate HI?	-	Go to **Step 12**	Go to **Step 16**
10	Test the signal circuit or circuits of the TR switch that did not indicate LOW for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 17**
11	Test the signal circuit or circuits of the TR switch that did not indicate proper voltage for an open. Refer to **Testing for Continuity** and**Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 17**
12	Test the affected signal circuits of the TR switch for a shorted together condition. Refer to **Testing for Continuity** and**Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 17**
13	1. Remove the BACKUP fuse. 2. Test the fuse for an open. Refer to **Circuit Protection - Fuses** and **Wiring Repairs** in Wiring Systems.Is the fuse open?	-	Go to **Step 14**	Go to **Step 15**
14	1. Test the Ignition 1 Voltage circuit for a short to ground. 2. Test the Transmission Range Signal A circuit for a short to ground. 3. Test the Transmission Range Signal B circuit for a short to ground. 4. Test the Transmission Range Signal C circuit for a short to ground. 5. Test the Transmission Range Signal P circuit for a short to ground. Refer to **Testing for Short to Ground** and	-		-

	Wiring Repairs in Wiring Systems.Did you complete the repair?		Go to **Step 18**	
15	Test the Ignition 1 voltage circuit of the TR switch for an open. Refer to **Testing for Continuity** and**Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 16**
16	Replace the TR switch. The TR switch is part of the park/neutral position switch. Refer to **Park/Neutral Position Switch Replacement** . Did you complete the replacement?	-	Go to **Step 18**	-
17	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 18**	-
18	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the conditions for running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P0705. Has the test run and passed?	-	Go to **Step 19**	Go to **Step 2**
19	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0711

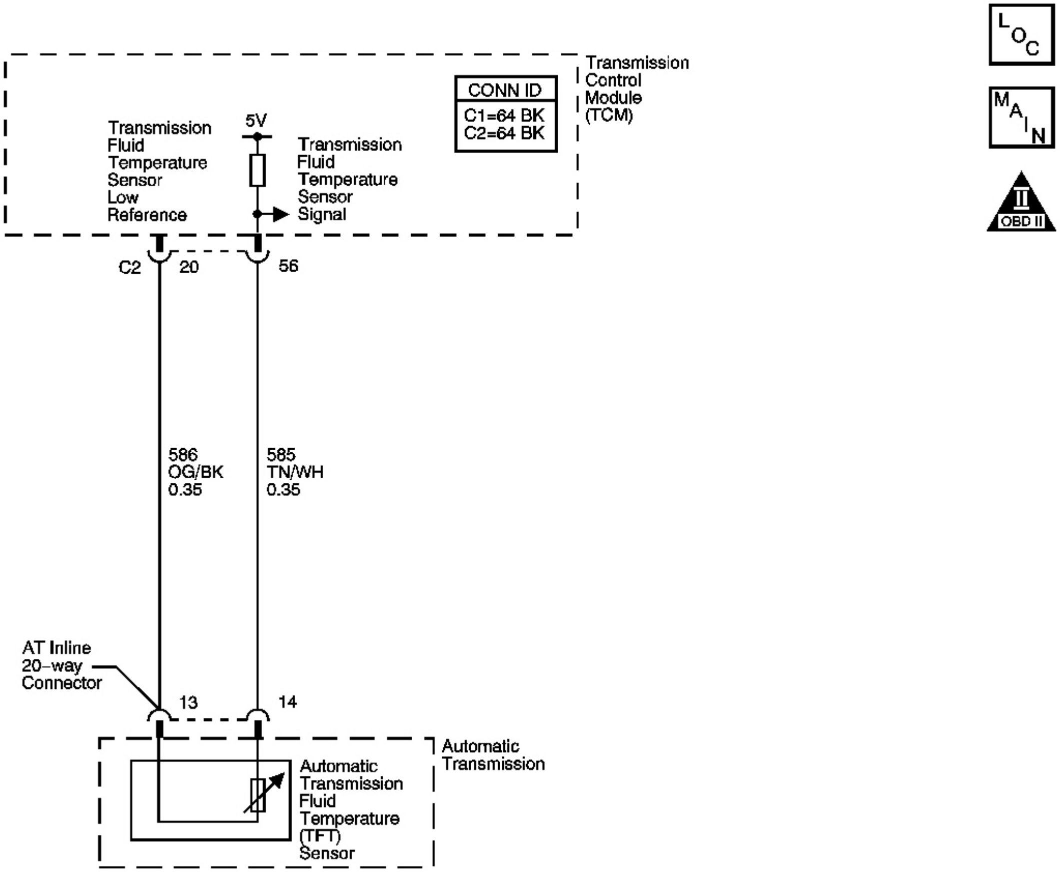


Fig. 7: DTC P0711 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission fluid temperature (TFT) sensor is a negative coefficient thermistor. When the transmission fluid is cold, the sensor resistance is high. As the transmission fluid warms up, the sensor resistance decreases. This diagnostic monitors the TFT circuit. The circuit may be functional, but not in the normal operating range. This diagnostic indicates stuck, erratic, intermittent, skewed, or inaccurate values, indicating poor system performance. The TFT range is -40 to +151°C (-40 to +305°F).

If the TCM detects no voltage changes or rapid voltage changes in the TFT sensor circuit, then DTC P0711 sets. DTC P0711 is a type C DTC.

Conditions for Running the DTC

- For condition 1 and 2 below, no ECT DTC P1792.
- For condition 1 below, no OSS DTCs P0722, or P0723.

- For condition 1 below, no ISS DTCs P0716, or P0717.
- For condition 1 and 2 below, P0711 has not passed in the current ignition cycle.
- The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting the DTC

One of the following conditions occurs:

Condition 1

- The transmission fluid temperature at startup is -40 to -20°C (-40 to -4°F).
- The engine coolant temperature is 0°C (32°F) or greater and has changed more than 20°C (36°F).
- The transmission fluid temperature has not changed by more than 2°C (4°F) since startup for 180 seconds.

Condition 2

- The transmission fluid temperature at startup is -20°C and 140°C (-4°F and 284°F).
- The engine coolant temperature is 70°C (158°F) or greater and has changed more than 50°C (90°F).
- The transmission fluid temperature has not changed by more than 2°C (4°F) since startup for 180 seconds.
- The transmission output shaft speed is 400 RPM or greater for 5 minutes.
- The TCC slip speed is 50 RPM or greater for 5 minutes.

Condition 3

The transmission fluid temperature has changed by 15°C (27°F) or greater 10 times within 2 seconds.

Action Taken When the DTC Sets

- The TCM does not request the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM will request the ECM to illuminate the service vehicle soon (SVS) lamp.
- The TCM calculates a default transmission fluid temperature based on engine coolant temperature, intake air temperature and engine run time.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0711 in TCM history.

Conditions for Clearing the SVS Lamp/DTC

- The TCM clears the SVS lamp request when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.

- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the DTC passes.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: This step tests for an intermittent short or open condition in the engine wiring harness. The test light is used as a resistor in the circuit.

6: This step determines if the TCM or the TFT, sensor is causing a steady, unchanging TFT, reading.

DTC P0711

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	Perform the Transmission Fluid Checking Procedure. Refer to **Transmission Fluid Checking Procedure** . Did you perform the Transmission Fluid Checking Procedure?	-	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM and TCM Failure Records. Using the Clear DTC Info function erases the Failure Records from the ECM and TCM.** • **Using the Clear DTC Info**			

3	**function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Select Trans. Fluid Temp. on the scan tool. 6. Drive the vehicle and observe the scan tool for either of the following conditions: • The TFT does not change greater than 2°C (4°F) in 3 minutes since startup. • The TFT changes by 15°C (27°F) or greater 10 times within 2 seconds, unrealistic change. Did either of the conditions occur?	-	Go to **Step 4**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
4	Did the scan tool display a condition in which the Trans. Fluid Temp. does not change by greater than the specified value in 3 minutes since startup?	2°C (4°F)	Go to **Step 6**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Using the connectorl test adapter kit, connect a test light between the TFT sensor signal and the low reference circuits of the AT inline 20-way connector. 4. Turn ON the ignition, with the engine OFF. 5. While observing the scan tool display, move or wiggle the engine wiring harness from the TCM connector to the AT inline 20-way connector. Does the Trans. Fluid Temp. change by greater than the specified value?	15°C (27°F)	Go to **Step 7**	Go to **Step 8**
	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. 3. Turn ON the ignition, with the engine	2°C (4°		

	OFF.	F)		
6	Did the scan tool display a condition in which the Trans. Fluid Temp. does not change by greater than the specified value in 3 minutes?		Go to **Step 9**	Go to **Step 8**
7	1. Test the TFT sensor signal circuit for an intermittent open or short condition between the TCM connector and the AT inline 20-way connector. 2. Test the TFT sensor low reference circuit for an intermittent open or short condition between the TCM connector and the AT inline 20-way connector. Refer to **Circuit Testing** and **Testing for Short to Ground** in Wiring Systems.Did you find and correct a condition?	-	Go to **Step 10**	Go to **Step 8**
8	Replace the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** Did you complete the replacement?	-	Go to **Step 10**	-
9	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 10**	-
10	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text and ensure the following conditions are met: • The TFT is -39°C to +149°C (-38°F to +300°F). • The TFT changes by greater than 2°C (4°F) since startup. • The TFT does not change by 15°C (27°F) or greater within 0.250 second. 4. Select Specific DTC. 5. Enter DTC P0711.	-		

	Has the test run and passed?		Go to **Step 11**	Go to **Step 2**
11	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0712

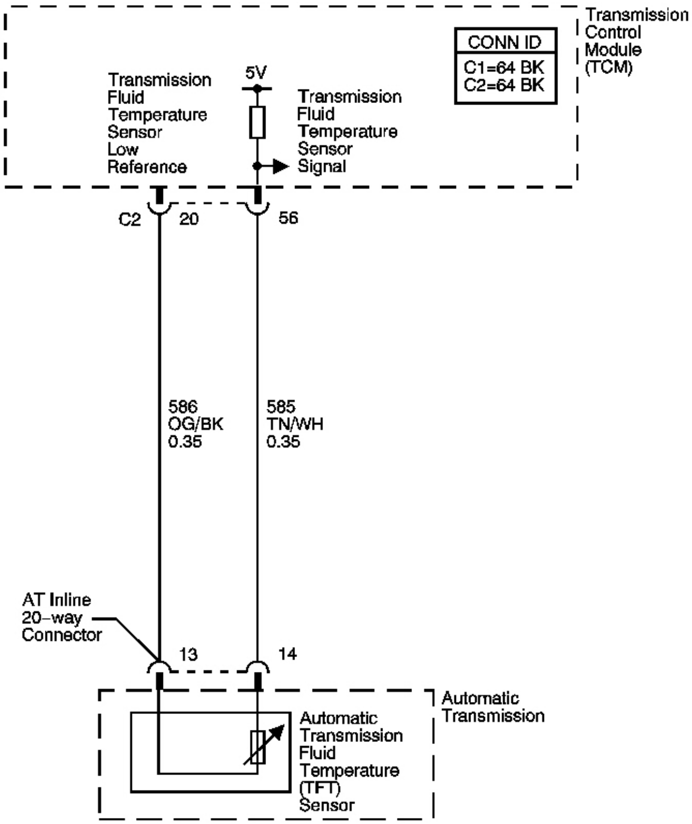


Fig. 8: DTC P0712 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission fluid temperature (TFT) sensor is part of the control solenoid valve assembly. The TFT sensor is a thermistor, or a resistor that changes resistance when the temperature changes. The sensor has a negative-temperature coefficient. This means that as the temperature increases, the resistance decreases, and as the temperature decreases, the resistance increases. The transmission control module (TCM) supplies a 5 volt reference signal to the sensor and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the TCM detects high signal voltage. As the fluid temperature increases, the resistance of the sensor decreases, which lowers the signal voltage.

If the TCM detects a short to ground in the TFT sensor or signal circuit, then DTC P0712 sets. DTC P0712 is a type C DTC.

Conditions for Running The DTC

The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting The DTC

The TCM detects a transmission fluid temperature of 151° C (304° F) or greater for 2 seconds.

Action Taken When the DTC Sets

- The TCM does not request the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM will request the ECM to illuminate the service vehicle soon (SVS) lamp.
- The TCM calculates a default transmission fluid temperature based on engine coolant temperature, intake air temperature and engine run time.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0712 in TCM history.

Conditions for Clearing the SVS Lamp/DTC

- The TCM clears the SVS lamp request when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without a non emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the DTC passes.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests the ability of the TCM to detect an open circuit. If the TCM recognizes the open, this eliminates the TCM and the wiring up to the transmission connector. The fault must be internal to the transmission.

5: Because the TFT is an integral part of the control solenoid valve assembly, the control solenoid valve assembly must be replaced.

DTC P0712

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM and the TCM Failure Records. Using the Clear DTC Info function erases the Failure Records from the ECM and TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the Failure Records. 4. Clear the DTCs. 5. Select Trans. Fluid Temp. on the scan tool. Does the scan tool display transmission fluid temperature equal to or greater than the specified value?	151°C (304°F)	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Turn ON the ignition, with the engine OFF.	-40°C (-40°F)		

	Does the scan tool display transmission fluid temperature equal to the specified value?		Go to **Step 5**	Go to **Step 4**
4	Test the TFT sensor signal circuit from the AT inline 20-way connector to the TCM for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 7**	Go to **Step 6**
5	Replace the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Is the action complete?	-	Go to **Step 7**	-
6	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Is the action complete?	-	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Turn ON the ignition, with the engine OFF. • The Trans. Fluid Temp. must be less than 151°C (304°F) for 2 seconds. 4. Select Specific DTC. 5. Enter DTC P0712. Has the test run and passed?	-	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0713

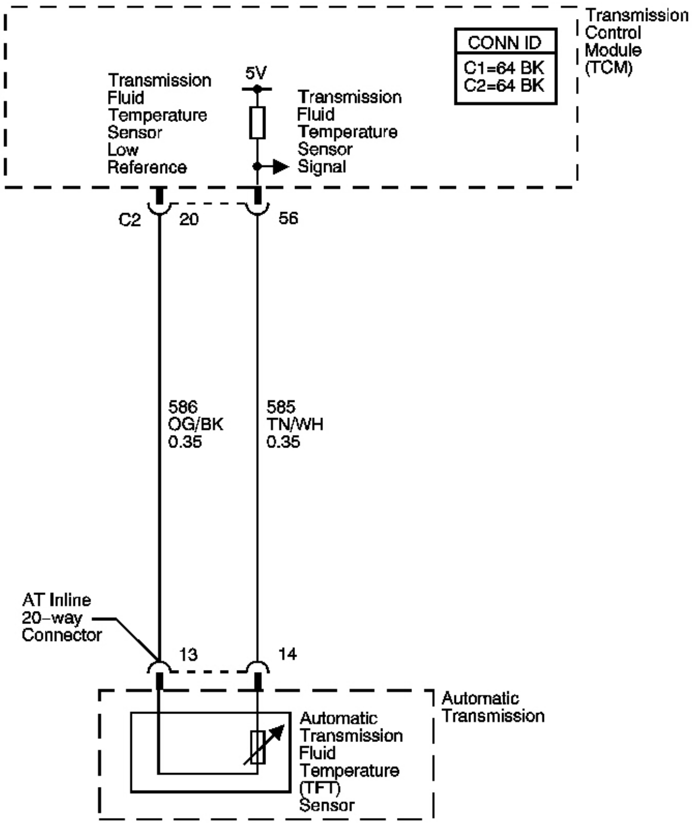


Fig. 9: DTC P0713 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The automatic transmission fluid temperature (TFT) sensor is part of the control solenoid valve assembly. The TFT sensor is a thermistor, or a resistor that changes resistance when the temperature changes. The sensor has a negative-temperature coefficient. This means that as the temperature increases, the resistance decreases, and as the temperature decreases, the resistance increases. The transmission control module (TCM) supplies a 5 volt reference signal to the sensor and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the TCM detects high signal voltage. As the fluid temperature increases, the resistance of the sensor decreases, which lowers the signal voltage.

If the TCM detects an open or high voltage in the TFT signal circuit, DTC P0713 sets. DTC P0713 is a type C DTC.

Conditions for Running The DTC

- No ISS DTCs P0716 or P0717.

- No OSS DTCs P0722 or P0723
- The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting The DTC

The TCM detects a transmission fluid temperature of -40°C (-40°F) or less for 80 seconds.

Action Taken When the DTC Sets

- The TCM does not request the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM will request the ECM to illuminate the service vehicle soon (SVS) lamp.
- The TCM calculates a default transmission fluid temperature based on engine coolant temperature, intake air temperature and engine run time.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0713 in TCM history.

Conditions for Clearing the SVS Lamp/DTC

- The TCM clears the SVS lamp request when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the DTC passes.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P0713

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
	1. Install a scan tool. 2. Turn ON the ignition, with the engine			

2	OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM and the TCM Failure Records. Using the Clear DTC Info function erases the Failure Records from the ECM and TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Select Trans. Fluid Temp. on the scan tool. Does the scan tool display a Trans. Fluid Temp. less than the specified value?	-39°C (-38°F)	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Using the DMM and the J 35616 GM Terminal Test Kit, measure the resistance between the TFT sensor signal and the low reference circuits of the transmission. Is the resistance less than the specified value?	100 K ohm	Go to **Step 5**	Go to **Step 4**
4	1. Test the TFT sensor signal circuit for a short to voltage between the TCM C2 connector and the TFT sensor. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. 2. Repair the wiring as necessary. 3. Replace the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Is the repair complete?	-	Go to **Step 8**	-
	1. Test the TFT sensor signal circuit for an open between the TCM connector and the AT inline 20-way connector.			

5	2. Test the TFT sensor low reference circuit for an open between the TCM connector and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems.Did you find and correct an open condition?	-	Go to **Step 8**	Go to **Step 6**
6	Test for continuity between the TFT sensor signal circuit and the other circuits between the TCM C2 connector and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 8**	Go to **Step 7**
7	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 8**	-
8	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Turn ON the ignition, with the engine OFF. • The Trans. Fluid Temp. must be greater than -40°C (-40°F) for 2 seconds. 4. Select Specific DTC. 5. Enter DTC P0713. Has the test run and passed?	-	Go to **Step 9**	Go to **Step 2**
9	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0716

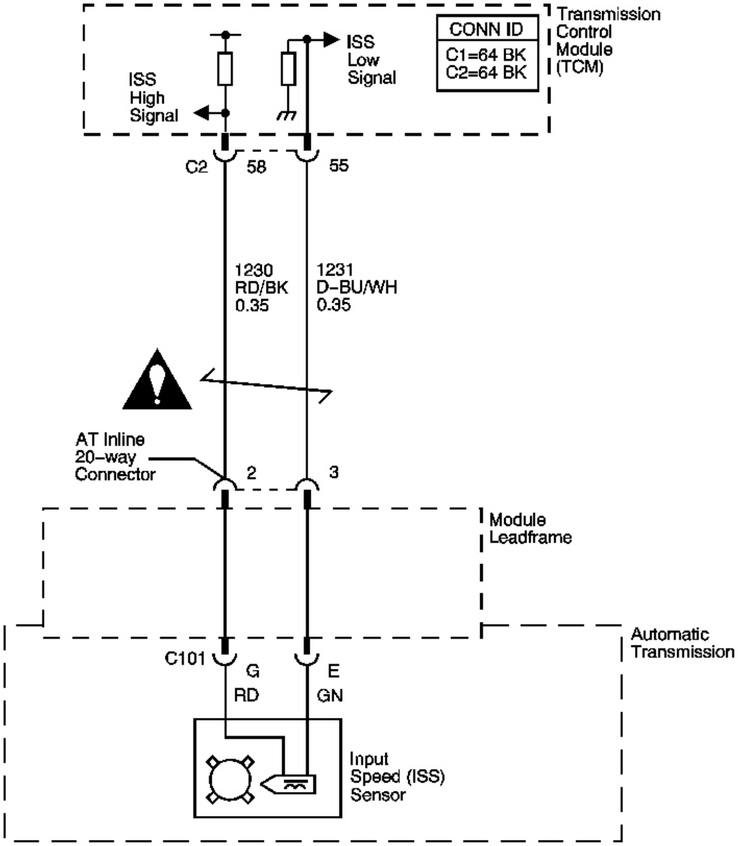


Fig. 10: DTC P0716 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The input shaft speed sensor (ISS) is a permanent magnet generator. The ISS sensor is mounted inside the transmission, under the control valve body cover. The sensor faces the input shaft speed sensor reluctor ring assembly. As the reluctor ring assembly rotates, an AC voltage is induced and transmitted to the transmission control module (TCM). The AC voltage level and the number of pulses increase as the speed of the reluctor ring assembly increases. The TCM converts the AC voltage into a digital signal. The TCM uses the input speed signal to help determine line pressure, transmission ratio control patterns and TCC apply pressure and timing.

If the TCM detects an unrealistic drop in the input shaft speed, DTC P0716 sets. DTC P0716 is a type A DTC.

Conditions for Running the DTC

- No ISS DTC P0717.
- No OSS DTCs P0722 or P0723.

- No transmission range switch DTCs P0705, P1756, or P1758.
- The engine speed is greater than 500 RPM for 5 seconds.
- The selected range is DRIVE.
- The APP angle is 15 percent or greater.
- The transmission input shaft speed is greater than 1,000 RPM for 5 seconds.
- The transmission output shaft speed is 1,350 RPM or greater.
- The transmission input shaft speed has increased 200 RPM or less for 3 seconds.

Conditions for Setting the DTC

The transmission input shaft speed drops 1000 RPM or greater and then remains for at least 0.8 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM moves the speed ratio towards a target ratio and then freezes ratio changes.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM commands maximum pressure to the input clutch.
- The TCM calculates input shaft speed from the output shaft speed sensor and the commanded speed ratio.
- The TCM commands a line pressure increase for all operating conditions.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0716 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Ensure the ISS is properly installed in the transmission.
- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: The resistance measurement will not change if either the ISS high signal circuit or the ISS low signal circuit, but not both, is shorted to ground. The vehicle speed detector in the TCM and the ISS are matched in such a way that an open or a short to ground in the ISS low signal circuit will not usually cause a loss of speed signal or a DTC P0716 to set.

6: This step isolates the short between the ISS and the wiring.

12: Refer to the latest procedures for TCM reprogramming.

DTC P0716

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM Freeze Frame and the TCM Failure Records. Using the Clear DTC Info function erases the Freeze Frame and Failure Records from the ECM and the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC.	-		

	5. Start the engine. 6. Operate the vehicle as described in Conditions for Running the DTC. 7. Select specific DTC. 8. Enter P0716. Has the test run and passed?		Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the TCM C2 connector. 3. Using the DMM and the J 35616 GM Terminal Test Kit, measure the resistance between the ISS high signal and the ISS low signal circuits at the TCM connector. Is the resistance within the specified range?	1,000-2,000 ohm	Go to **Step 5**	Go to **Step 4**
4	Test the ISS high signal circuit and ISS low signal circuit for the following conditions: • An open circuit or high resistance condition • ISS high signal circuit and ISS low signal circuit shorted together Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 9**
5	Measure the resistance between the ISS high signal circuit at the TCM connector. Is the resistance greater than the specified value?	50K ohm	Go to **Step 8**	Go to **Step 6**
6	1. Leave the DMM connected. 2. Disconnect the AT inline 20-way connector. 3. Measure the resistance between the ISS high signal circuit at the TCM connector and ground. Is the resistance greater than the specified value?	50K ohm	Go to **Step 9**	Go to **Step 7**
7	Repair the short to ground in the ISS high signal circuit. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems.	-		-

	Did you complete the repair?		Go to **Step 13**	
8	1. Connect the DMM between the ISS high signal and the ISS low signal circuits. 2. Place the transmission in PARK. 3. Start the engine. Is the AC voltage equal to or greater than the specified value?	0.5 V	Go to **Step 9**	Go to **Step 10**
9	Test for continuity between the ISS high signal circuit of the TCM C2 64-way connector and all other terminals except the ISS low signal circuit. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 12**
10	1. Remove the ISS. Refer to **Input and Output Speed Sensor Replacement** 2. Inspect the ISS and the ISS reluctor assembly for the following conditions: • Poor conditions at leadframe • ISS damage • ISS reluctor assembly damage • Excessive air gap between the input shaft speed sensor reluctor ring assembly (521) and the ISS • Incorrect alignment between the ISS and the input shaft speed sensor reluctor ring assembly (521) 3. Repair or replace any of the above items as necessary. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 11**
11	Replace the ISS. Refer to **Input and Output Speed Sensor Replacement** . Did you complete the repair?	-	Go to **Step 13**	-
12	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Is the action complete?	-	Go to **Step 13**	-
	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info.			

13	3. Start and idle the engine. 4. Observe Transmission ISS on the scan tool. Input speed must be 700 RPM or greater for 5 seconds. 5. Select Specific DTC. 6. Enter DTC P0716. Has the test run and passed?	-	Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0717

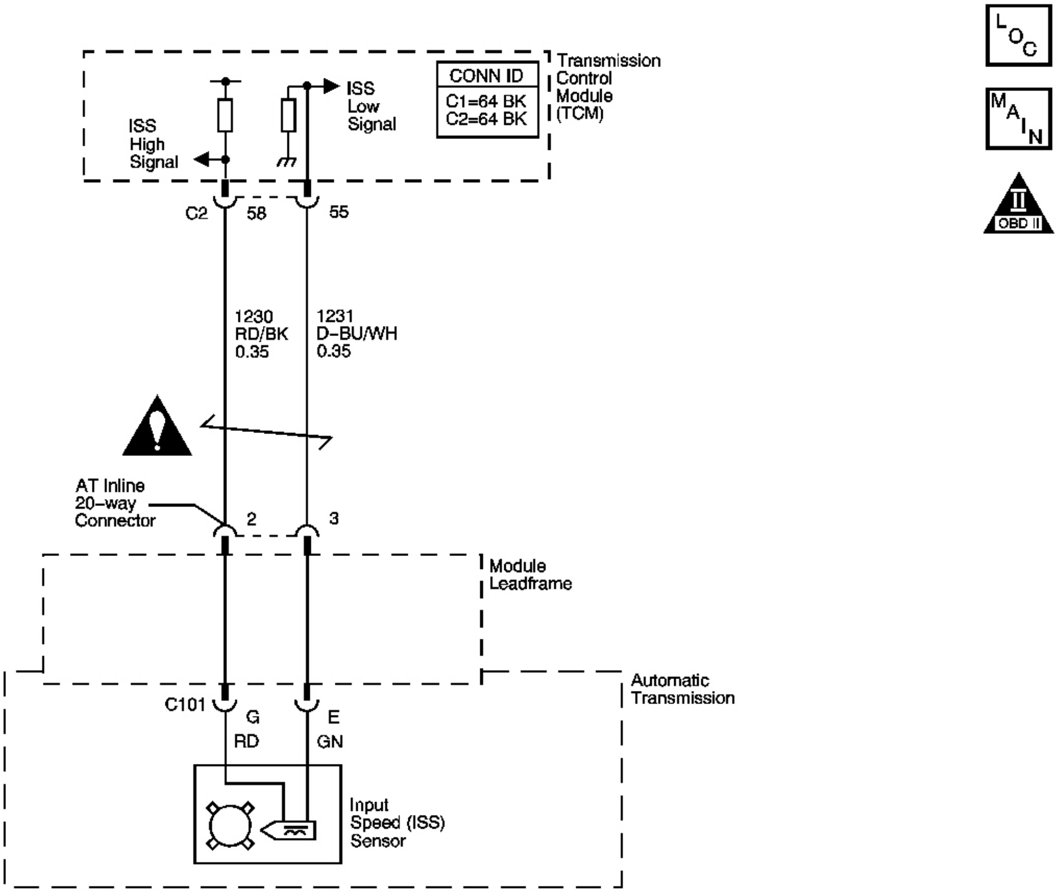


Fig. 11: DTC P0717 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The input speed sensor (ISS) is a permanent magnet generator. The ISS sensor is mounted inside the transmission, under the control valve body cover. The sensor faces the input shaft speed sensor reluctor ring assembly. As the reluctor ring assembly rotates, an AC voltage is induced and transmitted to the transmission control module (TCM). The AC voltage level and the number of pulses increase as the speed of the reluctor ring assembly increases. The TCM converts the AC voltage into a digital signal. The TCM uses the input speed signal to help determine line pressure, transmission ratio control patterns and TCC apply pressure and timing.

If the TCM detects no input shaft speed when there is vehicle speed in a drive gear range, DTC P0717 sets. DTC P0717 is a type A DTC.

Conditions for Running the DTC

- No OSS DTCs P0722 or P0723.

- No transmission range switch DTCs P0705, P1756, or P1758.
- No engine torque DTC P1779.
- The engine speed is greater than 500 RPM for 5 seconds.
- The selected range is not PARK or NEUTRAL.
- The engine torque is between 30-300N.m (22-221 lb ft).
- The transmission output shaft speed is 400 RPM or greater.

Conditions for Setting the DTC

The transmission input shaft speed is 100 RPM or less for 5 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM moves the speed ratio towards a target ratio and then freezes ratio changes.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM commands maximum pressure to the input clutch.
- The TCM calculates input shaft speed from the output shaft speed sensor and the commanded speed ratio.
- The TCM commands a line pressure increase for all operating conditions.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0717 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Ensure the ISS is properly installed in the transmission.

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: The resistance measurement will not change if either the ISS high signal circuit or the ISS low signal circuit, but not both, is shorted to ground. The vehicle speed detector in the TCM and the ISS are matched in such a way that an open or a short to ground in the ISS low signal circuit will not usually cause a loss of speed signal or a DTC P0717 to set.

6: This step isolates the short between the ISS and the wiring.

12: Refer to the latest procedures for TCM reprogramming.

DTC P0717

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM Freeze Frame and the TCM Failure Records. Using the Clear DTC Info function erases the Freeze Frame and Failure Records from the ECM and the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Start the engine.	-		

	6. Operate the vehicle as described in Conditions for Running the DTC. 7. Select specific DTC. 8. Enter P0717. Has the test run and passed?		Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the TCM C2 connector. 3. Using the DMM and the **J-35616** Connector Adapter Test Kit, measure the resistance between the ISS high signal and the ISS low signal circuits at the TCM connector. Is the resistance within the specified range?	1,000-2,000 ohm	Go to **Step 5**	Go to **Step 4**
4	Test the ISS high signal circuit and ISS low signal circuit for the following conditions: • An open circuit or high resistance condition • ISS high signal and ISS low signal circuits shorted together Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 9**
5	Measure the resistance between the ISS high signal circuit at the TCM connector and ground. Is the resistance greater than the specified value?	50K ohm	Go to **Step 8**	Go to **Step 6**
6	1. Leave the DMM connected. 2. Disconnect the AT inline 20-way connector. 3. Measure the resistance between the ISS high signal circuit at the TCM connector and ground. Is the resistance greater than the specified value?	50K ohm	Go to **Step 9**	Go to **Step 7**
7	Repair the short to ground in the ISS high signal circuit. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 13**	-
	1. Connect the DMM between the ISS high			

8	signal and the ISS low signal circuits. 2. Place the transmission in PARK. 3. Start the engine. Is the AC voltage equal to or greater than the specified value?	0.5 V	Go to **Step 9**	Go to **Step 10**
9	Test for continuity between the ISS high signal circuit of the TCM C2 64-way connector and all other terminals except the ISS low signal circuit. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 12**
10	1. Remove the ISS. Refer to **Input and Output Speed Sensor Replacement** . 2. Inspect the ISS and the ISS reluctor assembly for the following conditions: • Poor connections at leadframe • ISS damage • ISS reluctor assembly damage • Excessive air gap between the input shaft speed sensor reluctor ring assembly (521) and the ISS • Incorrect alignment between the ISS and the input shaft speed sensor reluctor ring assembly (521) 3. Repair or replace any of the above items as necessary. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 11**
11	Replace the ISS. Refer to **Input and Output Speed Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
12	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Is the action complete?	-	Go to **Step 13**	-
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Start and idle the engine. 4. Observe Transmission ISS on the scan tool. Input speed must be 100 RPM or	-		

	greater for 5 seconds. 5. Select Specific DTC. 6. Enter DTC P0717. Has the test run and passed?		Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0719

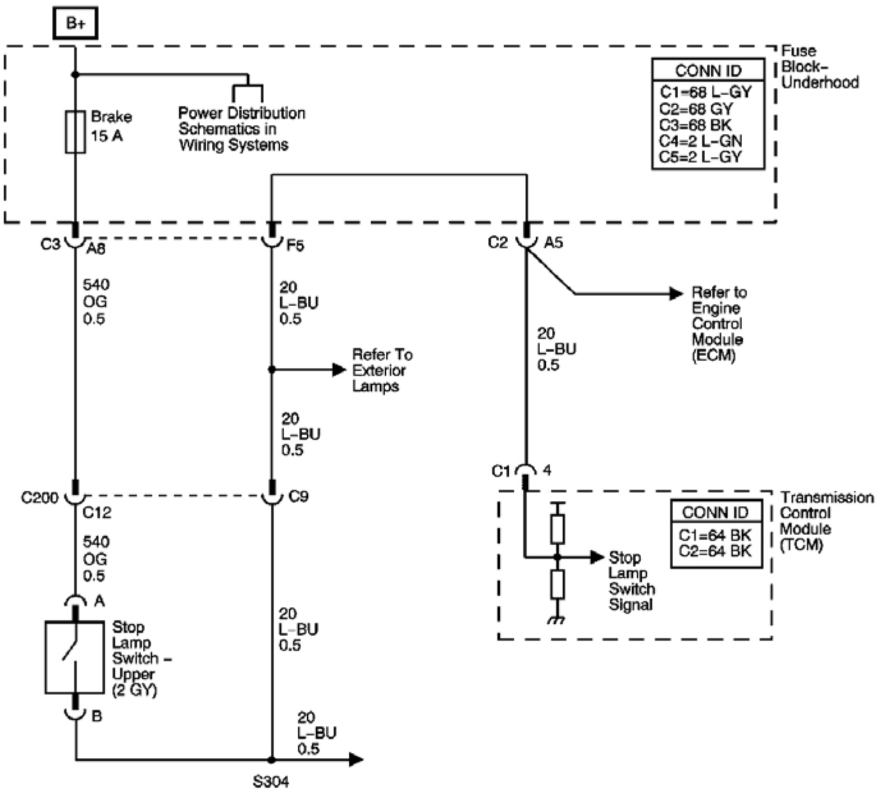


Fig. 12: DTC P0719 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The stop lamp switch is used to indicate the status of the brake switch, applied or released, to the transmission control module (TCM). The normally-closed stop lamp switch supplies an ignition voltage input to the TCM. Applying the brake pedal allows the switch to close, thereby applying a voltage to the TCM. Releasing the pedal pushes the brake plunger in and opens the switch, thus interrupting the voltage to the TCM. When the TCM senses ignition voltage at the stop lamp switch input, the TCM de-energizes the TCC pressure control solenoid valve.

If the TCM detects an open stop lamp switch, stuck OFF, during decelerations, the DTC P0719 sets. DTC P0719 is a type C DTC.

Conditions for Running the DTC

No OSS DTCs P0722 or P0723.

Conditions for Setting the DTC

The stop lamp switch input detects low voltage and the following conditions occur 8 times without a status change on the stop lamp switch input:

- The output shaft speed is greater than 1,400 RPM for 6 seconds, then;
- The output shaft speed is between 1,400 RPM and 400 RPM for 3 seconds, then;
- The output shaft speed is less than 400 RPM.

Action Taken When the DTC Sets

- The TCM does not request the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM will request the ECM to illuminate the service vehicle soon (SVS) lamp.
- The TCM defaults to the Controller Area Network brake switch or a calculated brake switch based on the output speed sensor, and the throttle position sensor.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0719 in TCM history.

Conditions for Clearing the SVS Lamp/DTC

- The TCM clears the SVS lamp request when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the DTC passes.

Diagnostic Aids

- Inspect the connectors at the TCM, the stop lamp switch, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.

- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

> **2:** Disconnecting the brake switch connector, jumping the circuit, and observing a status change, isolates the brake switch as the source of the DTC.
>
> **3:** If the battery positive voltage circuit shorts to ground, the brake fuse opens.
>
> **7:** Replace the TCM only after you have completed the preceding diagnostic steps.

DTC P0719

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM and the TCM Failure Records. Using the Clear DTC Info function erases the Failure Records from the ECM and TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Select Brake Switch on the scan tool. 6. Disconnect the brake switch connector. 7. Using the **J-35616** Connector Adapter Test Kit, install a fused jumper wire between the battery positive voltage circuit and the stop lamp switch signal circuit of the stop lamp connector.	-		

	Did the brake switch status change from released to applied?		Go to **Step 6**	Go to **Step 3**
3	1. Remove the brake fuse. 2. Test the fuse for an open. Refer to **Circuit Protection - Fuses** and **Wiring Repairs** in Wiring Systems.Is the fuse open?	-	Go to **Step 4**	Go to **Step 5**
4	**IMPORTANT:** **The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to Engine Controls Schematics in Engine Controls - 2.2L (L61) for complete circuit distribution.** 1. Test the battery positive voltage circuit for a short to ground. 2. Test the stop lamp switch signal circuit for a short to ground. Refer to **Circuit Testing** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 8**	-
5	1. Test the battery positive voltage circuit for an open. 2. Test the stop lamp switch signal for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct a condition?	-	Go to **Step 8**	Go to **Step 7**
6	Replace the brake switch. Refer to **Stop Lamp Switch Replacement** in Lighting Systems. Did you complete the replacement?	-	Go to **Step 8**	-
7	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 8**	-
	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info.			

8	3. Operate the vehicle under the following conditions: • Turn ON the ignition, with the engine OFF. • Apply and release the brake pedal. • The TCM must receive 12 volts, brake switch applied, on the signal circuit. 4. Select Specific DTC. 5. Enter DTC P0719. Has the test run and passed?	-	Go to **Step 9**	Go to **Step 2**
9	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0722

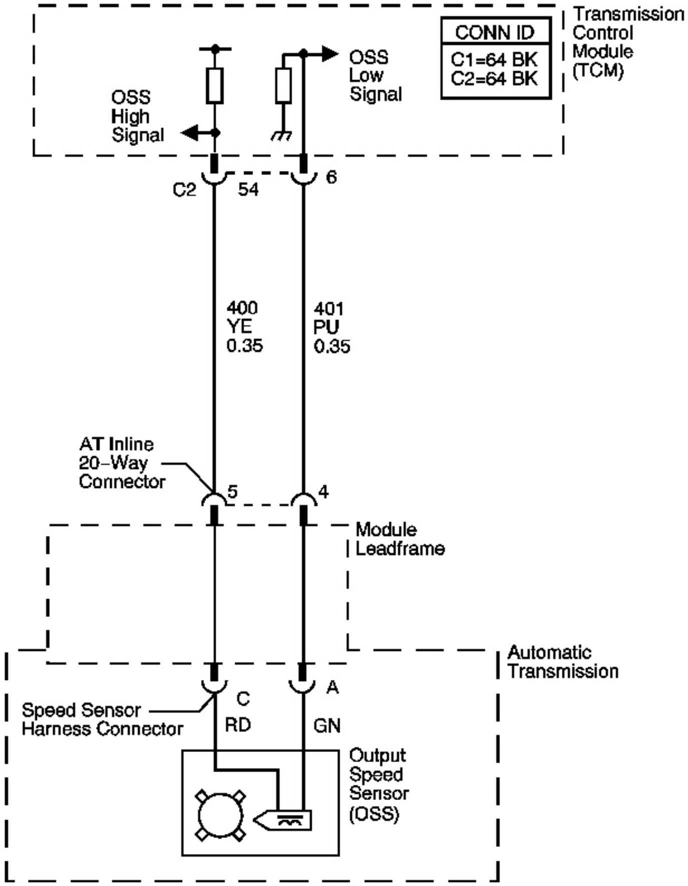


Fig. 13: DTC P0722 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The output speed sensor (OSS) provides vehicle speed information to the transmission control module (TCM). The OSS is a permanent magnet generator. The OSS sensor is mounted inside the transmission, under the control valve body cover. The sensor faces the output shaft speed sensor reluctor ring. As the reluctor ring rotates, an AC voltage is induced and transmitted to the transmission control module (TCM). The AC voltage level and the number of pulses increase as the speed of the vehicle increases. The TCM converts the AC voltage to vehicle speed. The TCM uses the output speed signal to help determine line pressure, transmission ratio control patterns and TCC apply pressure and timing.

If the TCM detects no output shaft speed when there is input shaft speed in a drive gear range, DTC P0722 sets. DTC P0722 is a type A DTC.

Conditions for Running the DTC

- No transmission range switch DTCs P0705, P1756, or P1758.
- No ISS DTCs P0716 or P0717.
- No OSS DTC P0723.
- No engine speed sensor DTC P0727
- No engine torque DTC P1779.
- The engine speed is greater than 500 RPM for 5 seconds.
- The transmission is not in PARK or NEUTRAL.
- The APP angle is greater than 15 percent.
- The engine torque is 30-300 N.m (22-221 lb ft).
- Engine torque default values are not being used.
- The transmission input shaft speed is greater than 750 RPM.

Conditions for Setting the DTC

The transmission output shaft speed is 200 RPM or less for 5 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM moves the speed ratio towards a target ratio and then freezes ratio changes.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM calculates output shaft speed from the input shaft speed sensor and the commanded speed ratio.
- The TCM commands a line pressure increase for all operating conditions.
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0722 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to

power down the TCM.

Diagnostic Aids

- Ensure the OSS sensor is properly installed in the transmission.
- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: The resistance measurement will not change if either the OSS high signal circuit or the OSS low signal circuit, but not both, is shorted to ground.

6: This step isolates the short between the OSS and the wiring.

12: Refer to the latest procedures for TCM reprogramming.

DTC P0722

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
	NOTE: **In order to avoid damage to the drive axles, support the lower control arms in the normal horizontal position. Do not run the vehicle in gear with the wheels hanging down at full travel.** 1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTCs, use the scan tool in order to record the ECM Freeze Frame and the TCM Failure Records. Using the Clear DTC Info function erases the Freeze Frame and Failure Records from the ECM and TCM.**			

<table>
<tr><td rowspan="1">2</td><td>Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.
<ol start="3">
Record the DTC Freeze Frame and Failure Records.
Clear the DTC.
Raise the drive wheels.
Support the lower control arms so that the drive axles are in a horizontal, straight, position.
Start the engine.
Shift the transmission into D.
Select Transmission OSS on the scan tool.
Does the scan tool display transmission output speed above the specified value?</td><td>RPM</td><td>Go to Intermittent Conditions in Engine Controls - 2.2L (L61)</td><td>Go to Step 3</td></tr>
<tr><td>3</td><td>Turn OFF the ignition.
Disconnect the TCM C2 connector.
Measure the resistance between the OSS high signal and the OSS low signal circuits at the TCM connector.
Is the resistance within the specified range?</td><td>1,000-2,000 ohm</td><td>Go to Step 5</td><td>Go to Step 4</td></tr>
<tr><td>4</td><td>Test the OSS high signal circuit and the OSS low signal circuit for the following conditions:
An open circuit or high resistance condition
OSS high signal and OSS low signal circuits shorted together
Refer to Circuit Testing and Wiring Repairs in Wiring Systems.
Did you find and correct a condition?</td><td>-</td><td>Go to Step 13</td><td>Go to Step 9</td></tr>
<tr><td>5</td><td>Measure the resistance between the OSS high signal circuit at the TCM connector and ground.
Is the resistance greater than the specified value?</td><td>50K ohm</td><td>Go to Step 8</td><td>Go to Step 6</td></tr>
<tr><td></td><td>Leave the DMM connected.
Disconnect the AT inline 20-way connector.</td><td>50K</td><td></td><td></td></tr>
</table>

6	3. Measure the resistance between the OSS high signal circuit at the TCM connector and ground. Is the resistance greater than the specified value?	ohm	Go to **Step 9**	Go to **Step 7**
7	Repair the short to ground in the OSS high signal circuit. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 13**	-
8	1. Connect the DMM between the OSS high signal and the OSS low signal circuits of the TCM 64-way connector. 2. Measure the AC voltage with the DMM while rotating the drive wheels by hand. Is the AC voltage equal to or greater than the specified value?	0.5 V	Go to **Step 9**	Go to **Step 10**
9	Test for continuity between the OSS high signal circuit of the TCM C2 64-way connector and all other terminals except the OSS low signal circuit. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 12**
10	1. Remove the OSS. Refer to **Input and Output Speed Sensor Replacement** . 2. Inspect the OSS and the OSS reluctor for the following conditions: • Poor connections at leadframe • OSS damage • OSS reluctor damage • Excessive air gap between the OSS reluctor and the OSS • Incorrect alignment between the OSS and the OSS reluctor 3. Repair or replace any of the above items as necessary. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 11**
11	Replace the OSS. Refer to **Input and Output Speed Sensor Replacement** .	-		-

	Did you complete the repair?		Go to **Step 13**	
12	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle in D and observe the Transmission OSS on the scan tool. 4. Ensure the Transmission OSS is greater than 200 RPM for at least 3 seconds. 5. Select Specific DTC. 6. Enter DTC P0722. Has the test run and passed?	-	Go to **Step 14**	Go to **Step 2**
14	With a scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0723

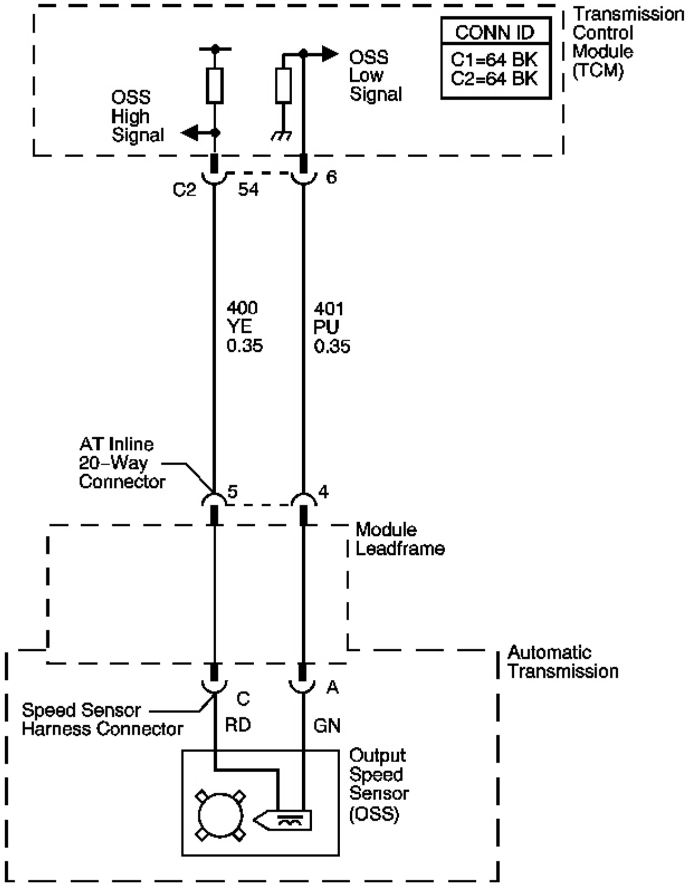


Fig. 14: DTC P0723 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The output speed sensor (OSS) provides vehicle speed information to the transmission control module (TCM). The OSS is a permanent magnet generator. The OSS sensor is mounted inside the transmission, under the control valve body cover. The sensor faces the output shaft speed sensor reluctor ring. As the reluctor ring rotates, an AC voltage is induced and transmitted to the transmission control module (TCM). The AC voltage level and the number of pulses increase as the speed of the vehicle increases. The TCM converts the AC voltage to vehicle speed. The TCM uses the output speed signal to help determine line pressure, transmission ratio control patterns and TCC apply pressure and timing.

If the TCM detects an unrealistic drop in output shaft speed, DTC P0723 sets. DTC P0723 is a type A DTC.

Conditions for Running the DTC

- No transmission range switch DTCs P0705, P1756, or P1758.
- No ISS DTCs P0716 or P0717.
- The engine speed is greater than 500 RPM for 5 seconds.
- The selected range is not PARK or NEUTRAL.
- The time since the gear select lever change is greater than 6 seconds.
- The transmission input shaft speed is greater than 200 RPM.
- The transmission output shaft speed is 600 RPM or greater for 5 seconds.
- The transmission output shaft speed changes 200 RPM or less every 0.25 seconds for 3 seconds.
- The transmission input shaft speed changes 100 RPM or less every 0.25 seconds for 3 seconds.

Conditions for Setting the DTC

The transmission output shaft speed drops 500 RPM or greater and then remains for at least 0.8 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM moves the speed ratio towards a target ratio and then freezes ratio changes.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM calculates output shaft speed from the input shaft speed sensor and the commanded speed ratio.
- The TCM commands a line pressure increase for all operating conditions.
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM records this information as Failure Records.
- The TCM stores DTC P0723 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Ensure the OSS sensor is properly installed in the transmission.
- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: The resistance measurement will not change if either the OSS high signal circuit or the OSS low signal circuit, but not both, is shorted to ground.

6: This step isolates the short between the OSS and the wiring.

12: Refer to the latest procedures for TCM reprogramming.

DTC P0723

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	**NOTE:** **In order to avoid damage to the drive axles, support the lower control arms in the normal horizontal position. Do not run the vehicle in gear with the wheels hanging down at full travel.** 1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM Freeze Frame and the TCM Failure Records. Using the Clear DTC Info function erases the Freeze Frame and Failure Records from the ECM and the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.**	200 RPM		

	3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Raise the drive wheels. 6. Support the lower control arms so that the drive axles are in a horizontal, straight, position. 7. Start the engine. 8. Shift the transmission into D. 9. Select Transmission OSS on the scan tool. Does the scan tool display transmission output speed above the specified value?		Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the TCM. 3. Measure the resistance between the OSS high signal and the OSS low signal circuits. Is the resistance within the specified range?	1,000-2,000 ohm	Go to **Step 5**	Go to **Step 4**
4	Test the OSS high signal circuit and the OSS low signal circuit for the following conditions: • An open circuit or high resistance condition • OSS high signal and OSS low signal circuits shorted together Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 9**
5	Measure the resistance between the OSS high signal circuit at the TCM connector and ground. Is the resistance greater than the specified value?	50K ohm	Go to **Step 8**	Go to **Step 6**
6	1. Leave the DMM connected. 2. Disconnect the AT inline 20-way connector. 3. Measure the resistance between the OSS high signal circuit at the TCM connector and ground.	50K ohm		

	Is the resistance greater than the specified value?		Go to **Step 9**	Go to **Step 7**
7	Repair the short to ground in the OSS high signal circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 13**	-
8	1. Connect the DMM between the OSS high signal and the OSS low signal circuits of the TCM 64-way connector. 2. Measure the AC voltage with the DMM while rotating the drive wheels by hand. Is the AC voltage equal to or greater than the specified value?	0.5 V	Go to **Step 9**	Go to **Step 10**
9	Test for continuity between the OSS high signal circuit of the TCM C2 64-way connector and all other terminals except the OSS low signal circuit. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 12**
10	1. Remove the OSS. Refer to **Input and Output Speed Sensor Replacement** . 2. Inspect the OSS and the OSS rotor for the following conditions: • Poor connections at leadframe • OSS damage • OSS reluctor damage • Excessive air gap between the OSS reluctor and the OSS • Incorrect alignment between the OSS and the OSS reluctor 3. Repair or replace any of the above items as necessary. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 11**
11	Replace the OSS. Refer to **Input and Output Speed Sensor Replacement** . Did you complete the repair?	-	Go to **Step 13**	-
12	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
	Perform the following procedure in order to verify the repair:			

13	1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text and observe Transmission OSS on the scan tool. 4. Ensure the Transmission OSS is greater than 350 RPM and does not drop greater than 300 RPM for 5 seconds. 5. Select Specific DTC. 6. Enter DTC P0723. Has the test run and passed?	-	Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0724

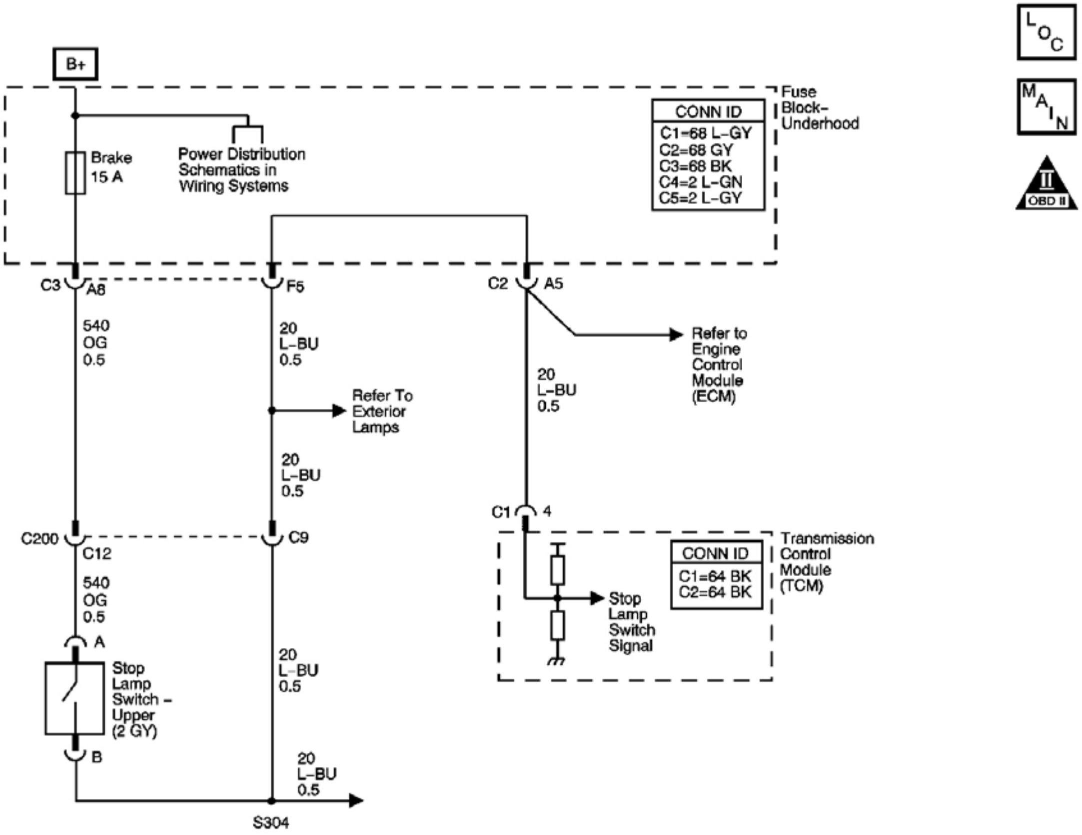


Fig. 15: DTC P0724 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The stop lamp switch is used to indicate the status of the brake switch, applied or released, to the transmission control module (TCM). The normally-closed stop lamp switch supplies an ignition voltage input to the TCM. Applying the brake pedal allows the switch to close, thereby applying a voltage to the TCM. Releasing the pedal pushes the brake plunger in and opens the switch, thus interrupting the voltage to the TCM. When the TCM senses ignition voltage at the stop lamp switch input, the TCM de-energizes the TCC pressure control solenoid valve.

If the TCM detects a closed stop lamp switch, stuck ON, during accelerations, the DTC P0724 sets. DTC P0724 is a type C DTC.

Conditions for Running the DTC

No OSS DTCs P0722 or P0723.

Conditions for Setting the DTC

The stop lamp switch input detects ignition voltage for 15 minutes and the following conditions occur 8 times without a status change on the stop lamp switch input:

- The output shaft speed is less than 400 RPM, then;
- The output shaft speed is between 400 RPM and 1,400 RPM for 3 seconds, then;
- The output shaft speed is greater than 1,400 RPM for 6 seconds.

Action Taken When the DTC Sets

- The TCM does not request the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM will request the ECM to illuminate the service vehicle soon (SVS) lamp.
- The TCM defaults to the Controller Area Network brake switch or a calculated brake switch based on the output speed sensor, and the throttle position sensor.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0724 in TCM history.

Conditions for Clearing the SVS Lamp/DTC

- The TCM clears the SVS lamp request when the condition no longer exists.
- A scan tool can clear the SVS lamp/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without a non-emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the DTC passes.

Diagnostic Aids

- Inspect the connectors at the TCM, the stop lamp switch, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: Disconnecting the brake switch connector, and observing a status change, isolates the brake switch as the source of the DTC.

3: This step tests the signal circuit for a short to voltage, if the brake switch status on the scan tool did not change in Step 2.

4: If the brake switch is properly adjusted, then the brake switch must be replaced.

5: Replace the TCM only after you have completed the preceding diagnostic steps.

DTC P0724

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM and the TCM Failure Records. Using the Clear DTC Info function erases the Failure Records from the ECM and TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Select Brake Switch on the scan tool. 6. Disconnect the brake switch connector. Does the brake switch status change from applied to released?	-	Go to **Step 4**	Go to **Step 3**
3	Test the stop lamp switch signal of the brake switch for a short to voltage. Refer to **Testing for a Short to Voltage** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 6**	Go to **Step 5**
4	Replace the brake switch. Refer to **Stop Lamp Switch Replacement** in Lighting Systems. Did you complete the replacement?	-	Go to **Step 6**	-
5	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 6**	-
	Perform the following procedure in order to verify the repair: 1. Select DTC.			

6	2. Select Clear Info. 3. Operate the vehicle under the following conditions: • Start and idle the engine for 5 seconds. • Apply the brake pedal, then release it. 4. Select Specific DTC. 5. Enter DTC P0724. Has the test run and passed?	-	Go to **Step 7**	Go to **Step 2**
7	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0727

Circuit Description

Engine speed information is sent to the transmission control module (TCM) by the engine control module (ECM) through the controller area network (CAN). A two-wire circuit is used to communicate data between the ECM and TCM, CAN H and CAN L. A fault in the CAN will not cause DTC P0727 to set by itself. If a communication fault occurs, other DTCs will set before P0727.

When the ECM sends the TCM an invalid engine speed, DTC P0727 sets. DTC P0727 is a type B DTC.

Conditions for Running the DTC

No CAN DTCs U2103, or U2105

Conditions for Setting the DTC

The engine speed is invalid for 2.0 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM moves the speed ratio towards a target ratio and then freezes ratio changes.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.

- The TCM commands maximum pressure to the input clutch.
- The TCM commands maximum line pressure.
- The TCM calculates a default engine speed based on transmission input shaft speed.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0727 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

DTC P0727

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM Freeze Frame and the TCM Failure Records. Using the Clear DTC Info function erases the Freeze Frame and Failure Records from the ECM and the TCM.** • **Using the Clear DTC Info function erases stored DTCs**	-		

	in both the ECM and TCM. 3. Record the DTC Failure Records. Did you record any ECM Failure Records?		Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	Go to **Step 3**
3	Did you record a TCM Failure Record for DTC U2105?	-	Go to **DTC U2105-U2199** in Data Link Communications	Go to **Step 4**
4	1. Clear the DTC. 2. Turn the ignition OFF for at least 30 seconds. 3. Start and idle the engine. 4. Observe the Engine Speed on the scan tool. Is the Engine Speed within the specified range?	500-1,000 RPM	Go to **Step 5**	Go to **Step 6**
5	Road test the vehicle using various engine speeds. Did DTC P0727 reset?	-	Go to **Step 7**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
6	1. Select Engine Data on the scan tool. 2. Observe the scan tool Engine Speed parameter. Is the Engine Speed value within the specified range?	500-1,000 RPM	Go to **Step 7**	Go to **Step 8**
7	Did any other DTCs set?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	Go to **Step 8**
8	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Is the action complete?	-	Go to **Step 9**	-
9	Perform the following procedure to verify the repair: 1. Select DTC on the scan tool. 2. Select Clear Info. 3. Start the engine. 4. Operate the engine at varying speeds. 5. Select Specific DTC.	-		

	6. Enter DTC P0727. Has the test run and passed?		Go to **Step 10**	Go to **Step 2**
10	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0741

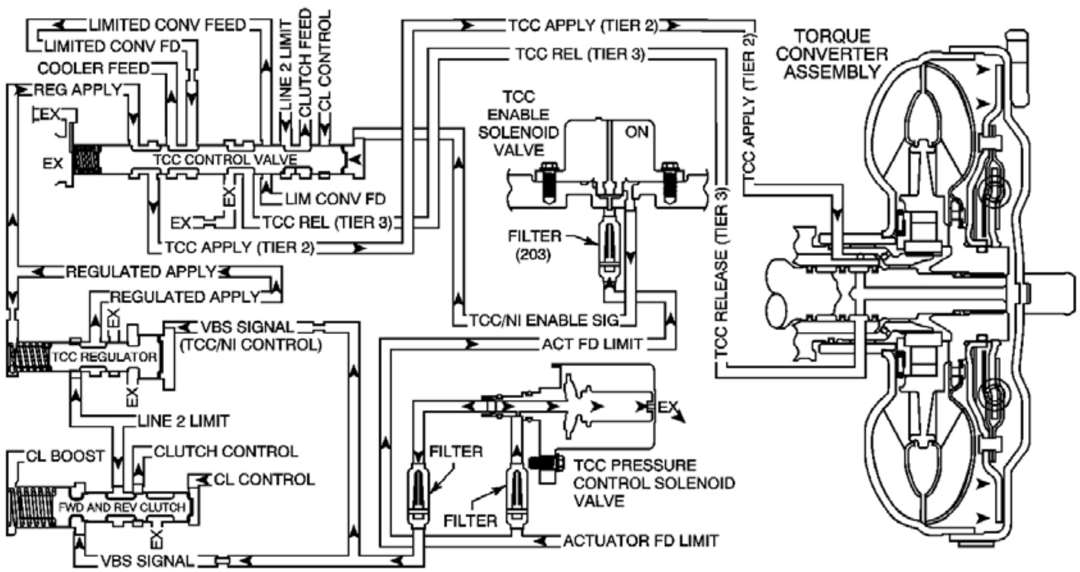


Fig. 16: DTC P0741 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) controls the TCC pressure control solenoid valve pulse width modulation. When the solenoid is commanded on, it exhausts release oil and allows regulated apply oil to flow to the apply circuit of the TCC system. The pressure in this system applies the pressure plate to the converter housing, and couples the transmission and engine directly through the TCC. The TCC slip speed should be near zero when fully applied.

When the TCM detects high torque converter slip when the TCC is commanded on, DTC P0741 sets. DTC P0741 is a type B DTC.

Conditions for Running the DTC

- No transmission range switch DTCs P0705, P1756, or P1758.
- No ISS DTCs P0716 or P0717.
- No OSS DTCs P0722 or P0723.
- No TCC system stuck ON DTC P0742.
- No engine torque DTC P1779.
- No TCC enable solenoid valve DTCs P1888 or P1889.
- The engine speed is greater than 500 RPM for 5 seconds.
- The engine torque and throttle angle signals are valid.
- The selected range is DRIVE, INTERMEDIATE, or LOW.
- The time since the gear select lever change is greater than 6 seconds.
- The transmission fluid temperature is 21-130°C (70-266°F).
- The engine torque is 30-300 N.m (22-221 lb ft).
- The APP angle is greater than 5 percent.
- The speed ratio is greater than 0.38.
- The commanded TCC pressure is greater than 100 kPa (15 psi) for 5 seconds.
- The TCC is commanded ON.

Conditions for Setting the DTC

The TCM commands the TCC ON, and the TCC slip speed is greater than 220 RPM for 3 seconds 3 times within the same ignition cycle.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive drive trip in which the Conditions for Setting the DTC are met.
- The TCM inhibits TCC engagement.
- The TCM limits the commanded speed ratio to 1.6 or less.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0741 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.

- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the transmission fluid lines to the radiator. The lines may be pinched, plugged or twisted.
- A worn or cut input shaft O-ring seal can cause DTC P0741 to set.
- Inspect for sediment contamination caused by debonding of the TCC friction plate.

Test Description

The number below refers to the step number on the diagnostic table.

2: This step inspects the transmission fluid to ensure that it is at the proper level.

DTC P0741

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	Perform the Transmission Fluid Checking Procedure. Refer to **Transmission Fluid Checking Procedure** . Did you perform the Transmission Fluid Checking Procedure?	-	Go to **Step 3**	Go to **Transmission Fluid Checking Procedure**
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records.	-50 to +50 RPM		

	4. Clear the DTC. 5. Drive the vehicle at a constant speed above 72 km/h (45 mph) on a level road. 6. Monitor the TCC Slip Speed on the scan tool. Is the slip speed within the specified range?		Go to Diagnostic Aids	Go to **Step 4**
4	Inspect for the following conditions: • Stuck TCC pressure control solenoid valve, or damaged O-ring • Stuck TCC enable solenoid valve, or damaged O-ring • Line limit valve and spring for damage, sticking or binding • TCC control valve and spring for damage, sticking or binding • TCC regulator valve for damage, sticking or binding • Control valve body for damage, porosity, or contamination Refer to **Control Valve Body Assembly Disassemble** . Did you find and correct any of the above conditions?	-	Go to **Step 7**	Go to **Step 5**
5	Inspect the torque converter and torque converter housing seal for damage or engagement. Refer to **Torque Converter Assembly Removal** . Did you find and correct a condition?	-	Go to **Step 7**	Go to **Step 6**
6	Inspect the stator shaft assembly for debris or damage restricting the fluid flow. Refer to **Reverse Clutch Removal** . Did you find and correct a condition?	-	Go to **Step 7**	-
	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the			

7	Conditions for Running the DTC as specified in the supporting text at a constant speed above 72 km/h (45 mph) on a level road. 4. Select Specific DTC. 5. Enter DTC P0741. Has the test run and passed?	-	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0742

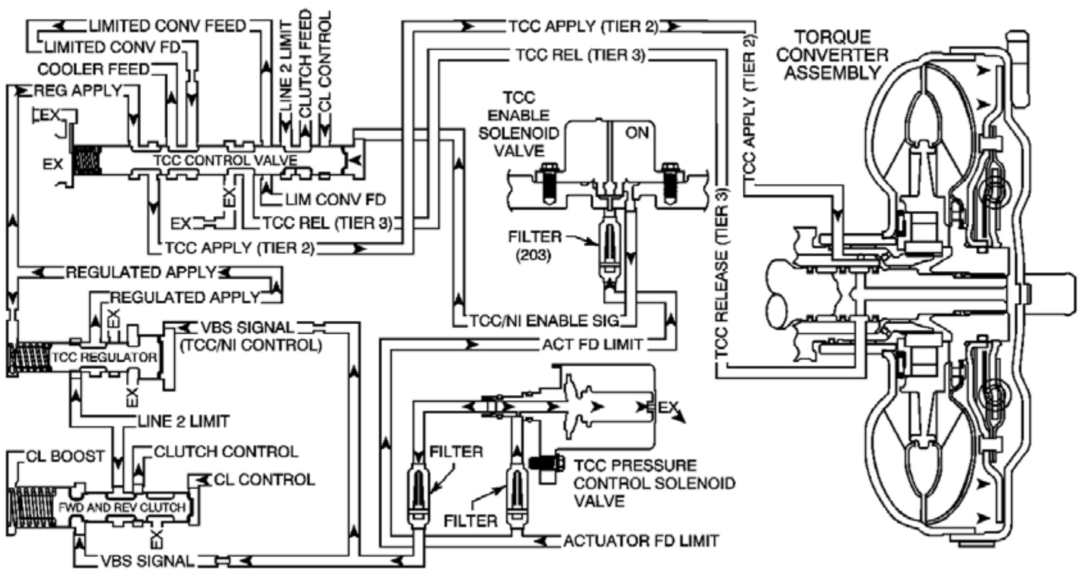


Fig. 17: DTC P0742 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) controls the TCC pressure control solenoid valve pulse width modulation. When the solenoid is commanded on, it exhausts release oil and allows regulated apply oil to flow to the apply circuit of the TCC system. The pressure in this system applies the pressure plate to the converter housing, and couples the transmission and engine directly through the TCC. The TCC slip speed should be near zero when fully applied.

At start-up with the vehicle in park, the TCC slip speed is sampled. If the slip speed is less than a calibrated value, a fail counter is incremented.

When the TCM detects that a certain percentage of the TCC slip speed samples have failed when the TCC is commanded OFF in park, DTC P0742 sets. DTC P0742 is a type B DTC.

Conditions for Running the DTC

- No transmission range switch DTCs P0705, P1756, or P1758.
- No ISS DTCs P0716 or P0717.
- No OSS DTCs P0722 or P0723.
- No TCC system stuck OFF DTC P0741.
- No engine torque DTC P1779.
- No TCC enable solenoid valve DTCs P1888 or P1889.
- The engine speed is 500-2000 RPM.
- The selected range is PARK.
- The transmission fluid temperature is greater than 20°C (68°F).
- The APP angle is less than 3 percent.
- The change in throttle position angle is 2 percent or less since start-up.

Conditions for Setting the DTC

Eighty percent of the TCC slip speed samples are less than 3 RPM.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM commands full TCC engagement when output shaft speed is above 500 RPM.
- The TCM commands maximum pressure to the input clutch.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0742 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an

emission related diagnostic fault occurring.

- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- The customer may notice an engine stalling condition.
- An intermittent stuck TCC control valve and/or TCC regulator valve can cause DTC P0742 to set.

Test Description

The number below refers to the step number on the diagnostic table.

3: This step inspects and repairs the components that caused the DTC to set.

DTC P0742

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2 (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Start the engine and leave the gear selector in PARK. 6. Monitor the TCC Slip Speed on the scan tool. Is the TCC Slip Speed within the specified	-3 to +3 RPM		Go to **Intermittent Conditions** in Engine

	range?		Go to **Step 3**	Controls - 2.2L (L61)
3	Inspect for the following conditions: • Stuck TCC enable solenoid valve or damaged O-ring • Stuck TCC pressure control solenoid valve or damaged O-ring • Line limit valve and spring for damage, sticking or binding • TCC control valve and spring for damage, sticking or binding • TCC regulator valve for damage, sticking or binding • TCC regulator apply valve spring for damage, sticking or binding • Control valve body for damage, porosity, or contamination Refer to **Control Valve Body Assembly Disassemble** . Did you find and correct any of the above conditions?	-	Go to **Step 4**	-
4	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Start the engine and allow the engine to idle in PARK until transmission fluid temperature is greater than 20°C (68°F). 4. Select Specific DTC. 5. Enter DTC P0742. Has the test run and passed?	-	Go to **Step 5**	Go to **Step 2**
5	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0841

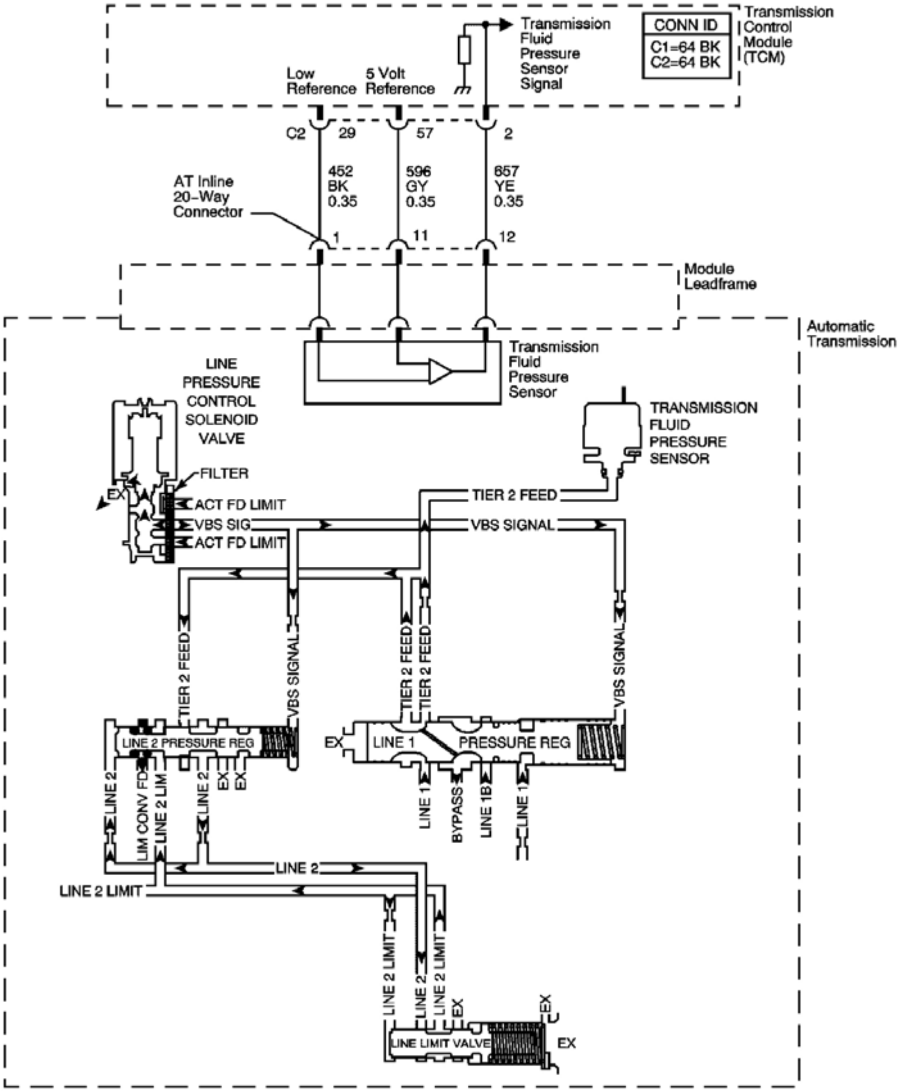


Fig. 18: DTC P0841 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission fluid pressure (TFP) sensor is used to monitor the line pressure and feedback to the transmission control module (TCM) with an analog signal of 0-5 volts. The pressure sensor is fed with tier 2 feed fluid pressure and nominally ranges from 483-5861 kPa (70-850 psi). This diagnostic monitors the TFP circuit. The circuit may be functional, but not in the normal operating range. This diagnostic indicates poor sensor performance such as stuck, erratic, intermittent, or skewed values.

When the TCM detects an intermittent voltage or no voltage change in the TFP sensor circuit, then DTC P0841 sets. DTC P0841 is a type B code.

Conditions for Running the DTC

- No HSCAN DTC U2105.
- No engine speed DTC P0727.
- No TFP sensor DTCs P0842, or P0843.
- No line PC solenoid DTCs P0960, P0961, or P0962.
- For condition 1 below, No OSS DTCs P0722, or P0723.
- For condition 2 below, P0841 has not passed in the current ignition cycle.
- The engine speed is greater than 500 RPM for 5 seconds
- For condition 1 below, engine speed is 1,500 RPM or greater.
- The transmission fluid temperature is 21°C (70°F) or greater.
- For condition 1 below, output sensor speed is 300 RPM or greater.
- For condition 2 below, commanded line pressure has changed more than 200 kPa (29 psi) since start-up.

Conditions for Setting the DTC

One of the following conditions occurs:

Condition 1

- The magnitude of the commanded change in the line pressure is less 600 kPa (87 psi) or less.
- The magnitude of the measured change in the line pressure is 1000 kPa (145 psi) or greater 10 times within 2 seconds.

Condition 2

The transmission fluid temperature has not changed by more than 100 kPa (15 psi) since startup for 2 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM commands a line pressure increase for all operating conditions.
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0841 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission-related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- If P0842, or P0843 is also set, diagnose the other DTC first.
- Unsteady engine torque or engine misfires may cause fluctuation in transmission pressure and may set this code. Check the engine control module for fuel injector codes P0201 - P0204 and misfire codes P0300 - P0304. If any of these DTCs are present, repair the condition which set the DTC first. Then clear DTCs and operate the vehicle within the conditions for running DTC P0841 as specified in this text.
- To locate an intermittent problem, use the scan tool to monitor Line Pressure Actual with the engine running. Wiggle the wiring harness from the TCM to the transmission while watching for a change in the parameter. This may help locate the area where the fault in the wiring may lie. Also, check for poor terminal connections.
- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- A damaged filter, damaged or missing thrust washer or a leaking secondary pulley can cause DTC P0841 to set.

DTC P0841

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	Did you perform the Line Pressure Check Procedure?	-	Go to **Step 3**	Go to **Line Pressure Check Procedure**
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record**			

3	**the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Select Line Pressure Actual and Line Pressure Commanded on the scan tool. 6. Drive the vehicle and observe the scan tool for either of the following fail conditions: • Line Pressure Actual does not change 100 kPa (15 psi) or greater in 2 seconds since startup. • Line Pressure Actual changes 1000 kPa (145 psi) or greater 10 times within 2 seconds when Line Pressure Commanded does not change more than 600 kPa (87 psi). Did either of the fail conditions occur?	-	Go to **Step 4**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
4	Did the scan tool display a condition in which the Line Pressure Actual does not change 100 kPa (15 psi) or greater in 2 seconds since startup?	-	Go to **Step 7**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Using the **J-35616** Connector Adapter Test Kit, connect a test light between the 5 volt reference and the low reference circuits of the AT inline connector. Refer to **Automatic Transmission Inline Harness Connector End View** . 4. Turn ON the ignition, with the engine	-		

	OFF. 5. While observing the test lamp, move or wiggle the engine wiring harness from the TCM 64-way C2 connector to the AT inline 20-way connector. Was the test lamp constantly ON?		Go to **Step 6**	Go to **Step 8**
6	1. Turn OFF the ignition. 2. Using the **J-35616** Connector Adapter Test Kit, connect a test light between the 5 volt reference and the TFP sensor signal circuits of the AT inline 20-way connector. Refer to **Automatic Transmission Inline Harness Connector End View** . 3. Turn ON the ignition, with the engine OFF. 4. While observing the scan display, move or wiggle the engine wiring harness between the TCM 64-way C2 connector to the AT inline 20-way connector. Does the Line Pressure Actual change by greater than the specified value?	1000 kPa (145 psi)	Go to **Step 9**	Go to **Step 10**
7	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. 3. Turn ON the ignition, with the engine OFF. Did the scan tool display a condition in which the Line Pressure Actual does not change by greater than the specified value in 2 seconds since startup?	100 kPa (15 psi)	Go to **Step 11**	Go to **Step 12**
	1. Test the low reference circuit for an intermittent open or short condition between the TCM connector C2 and the AT inline 20-way connector. 2. Test the 5-volt reference circuit for an intermittent open or short condition			

	between the TCM 64-way C2 connector and the AT inline 20-way connector.			
8	Refer to **Circuit Testing** , **Testing for Intermittent Conditions and Poor Connections** , and **Wiring Repairs** in Wiring Systems.Did you find and correct a condition?	-	Go to **Step 14**	Go to **Step 11**
9	Test the TFP sensor signal circuit for an intermittent open or short condition between the TCM 64-way C2 connector and the AT inline 20-way connector. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 12**	Go to **Step 11**
10	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 11**
11	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 13**
12	Replace the TFP sensor. The TFP is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 14**	-
13	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 14**	-
14	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P0841.	-		

	Has the test run and passed?		Go to **Step 15**	Go to **Step 2**
15	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0842

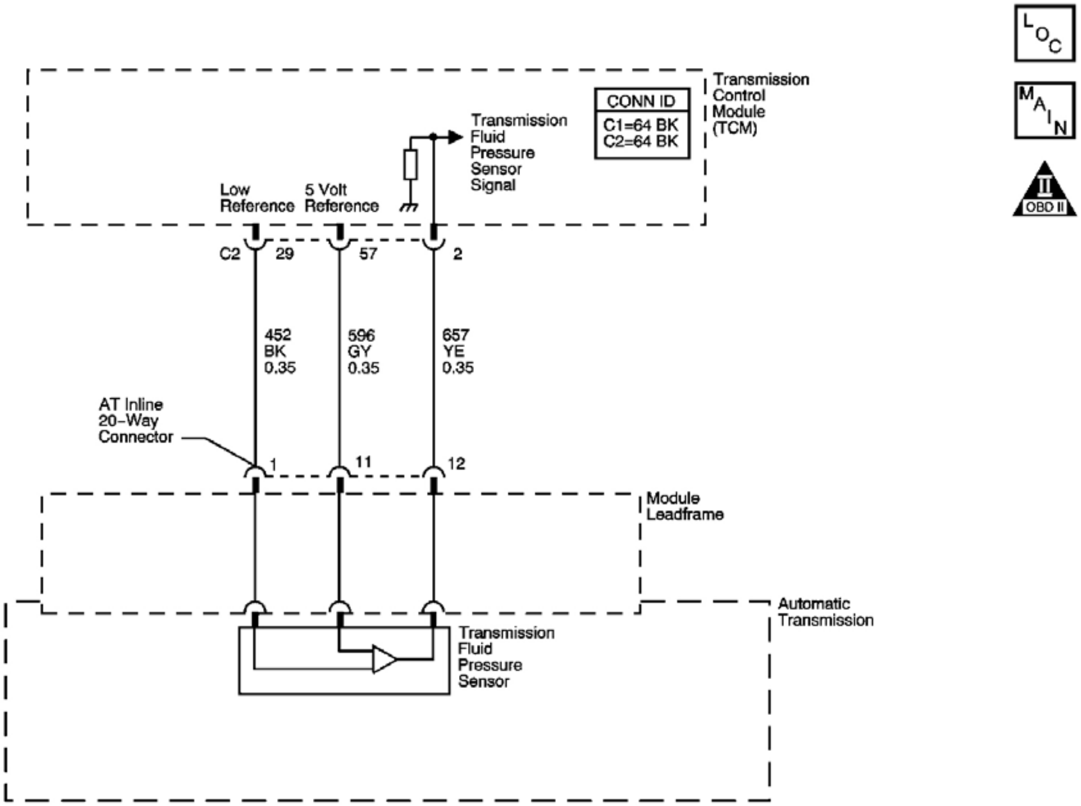


Fig. 19: DTC P0842 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission fluid pressure (TFP) sensor is used to monitor the line pressure and feedback to the transmission control module (TCM) with an analog signal of 0-5 volts. The pressure sensor is fed with tier 2 feed fluid pressure and nominally ranges from 483-5861 kPa (70-850 psi). This diagnostic monitors the TFP circuit.

When the TCM detects a voltage signal that is excessively low, DTC P0842 sets. DTC P0842 is a type A code.

Conditions for Running the DTC

- No Line PC Solenoid DTCs P0960, P0961, or P0962.
- The engine speed is greater than 500 RPM for 5 seconds.
- The commanded line pressure is 2200 kPa (319 psi) or greater.

Conditions for Setting the DTC

The TCM detects a measured line pressure value of 50 kPa (7 psi) or less for 20 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM commands a line pressure increase for all operating conditions
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0842 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- To locate an intermittent problem, use the scan tool to monitor Line Pressure Actual with the engine running. Wiggle the wiring harness from the TCM to the transmission while watching for a change in the parameter. This may help locate the area where the fault in the wiring may lie. Also, check for poor terminal connections.
- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.
- A damaged module leadframe, damaged or missing differential thrust washer or excessive customer abuse can cause DTC P0842 to set.

DTC P0842

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn the ignition ON with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failures Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Select Line Pressure Actual on the scan tool. Does the scan tool display a Line Pressure Actual reading less than the specified value?	50 kPa (7 psi)	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Turn ON the ignition, with the engine OFF. 4. Using the DMM and the **J-35616** Connector Adapter Test Kit, measure the voltage between the 5 volt reference circuit and a good ground. Does the voltage measure near the specified value?	5 V	Go to **Step 4**	Go to **Step 5**

4	Connect a test light between the 5-volt reference circuit and the signal circuit of the TFP sensor. Does the scan tool display a Line Pressure Actual reading equal to or greater than the specified value?	4500 kPa (653 psi)	Go to **Step 7**	Go to **Step 6**
5	Test the 5-volt reference circuit of the TFP sensor for a short to ground, a short to the low reference circuit, or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 11**	Go to **Step 8**
6	Test the signal circuit of the TFP sensor for a short to ground, a short to the low reference circuit, or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 11**	Go to **Step 8**
7	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 11**	Go to **Step 9**
8	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 11**	Go to **Step 10**
9	Replace the TFP. The TFP is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 11**	-
10	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 11**	-
11	Perform the following procedure in order to verify the repair. 1. Select the DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select Specific DTC. 5. Enter DTC P0842.	-		

	Has the test run and passed?		Go to **Step 12**	Go to **Step 2**
12	With a scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0843

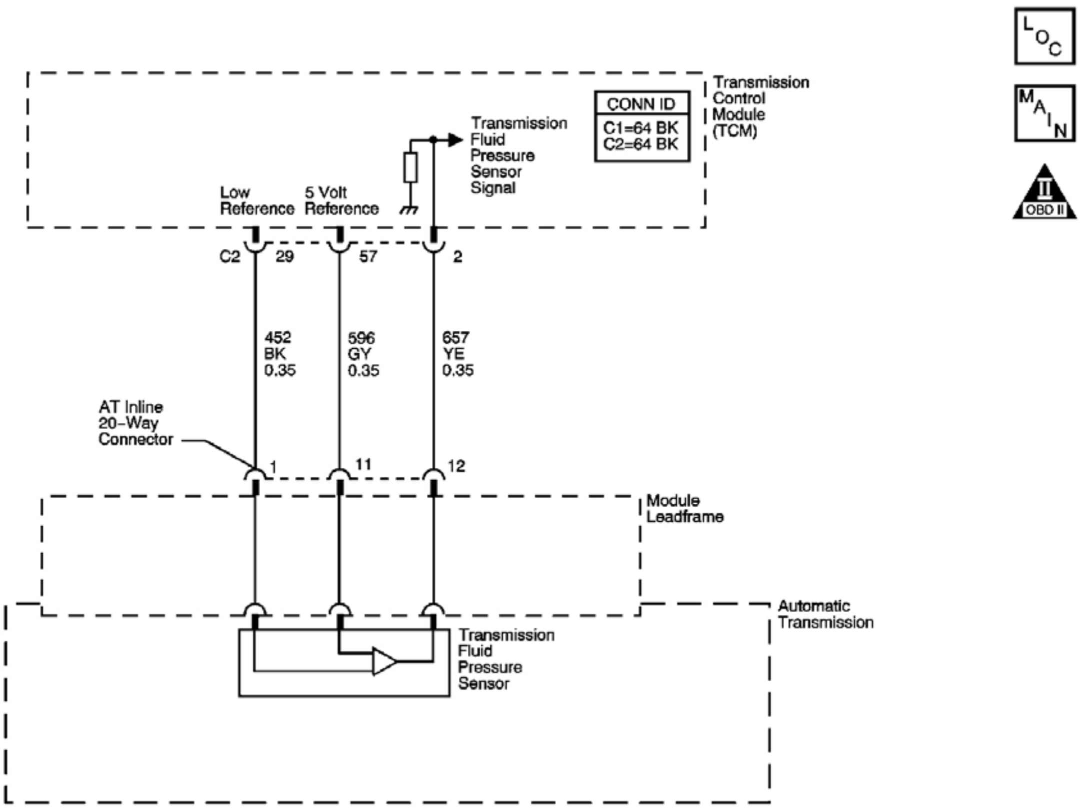


Fig. 20: DTC P0843 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission fluid pressure (TFP) sensor is used to monitor the line pressure and feedback to the transmission control module (TCM) with an analog signal of 0-5 volts. The pressure sensor is fed with tier 2 feed fluid pressure and nominally ranges from 483-5861 kPa (70-850 psi). This diagnostic monitors the TFP circuit.

When the TCM detects a voltage signal that is excessively high, DTC P0843 sets. DTC P0843 is a type A code.

Conditions for Running the DTC

- No line PC solenoid DTCs P0960, P0961, P0962.
- The engine speed is greater than 500 RPM for 5 seconds.
- The commanded line pressure is 4000 kPa (580 psi) or less.

Conditions for Setting the DTC

The TCM detects a measured line pressure value of 4500 kPa (653 psi) or greater for 20 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM commands a line pressure increase for all operating conditions.
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0843 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- To locate an intermittent problem, use the scan tool to monitor Line Pressure Actual with the engine running. Wiggle the wiring harness from the TCM to the transmission while watching for a change in the parameter. This may help locate the area where the fault in the wiring may lie. Also, check for poor terminal connections.
- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P0843

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failures Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Select Line Pressure Actual on the scan tool. Does the scan tool display a Line Pressure Actual reading more than the specified value?	4500 kPa (653 psi)	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Turn ON the ignition, with the engine OFF. Does the scan tool display a Line Pressure Actual reading less than the specified value?	50 kPa (7 psi)	Go to **Step 4**	Go to **Step 6**
4	Using the DMM and the **J-35616** Connector Adapter Test Kit, measure the voltage between the 5-volt reference circuit and the low reference circuit of the TFP sensor. Does the voltage measure within the specific	4.7-5.2 V		

	range?		Go to **Step 9**	Go to **Step 5**
5	Does the voltage measure more than the specified value?	5.2 V	Go to **Step 8**	Go to **Step 7**
6	Test the signal circuit of the TFP sensor for a short to the 5 volt reference circuit, or a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 10**
7	Test the low reference circuit of the TFP sensor for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 10**
8	Test the 5-volt reference circuit of the TFP sensor for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 10**
9	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 11**
10	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
11	Replace the TFP. The TFP is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 13**	-
12	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
13	Perform the following procedure in order to verify the repair. 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select Specific DTC. 5. Enter DTC P0843.	-		

	Has the test run and passed?		Go to **Step 14**	Go to **Step 2**
14	With a scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DIAGNOSIS

DTC P0960

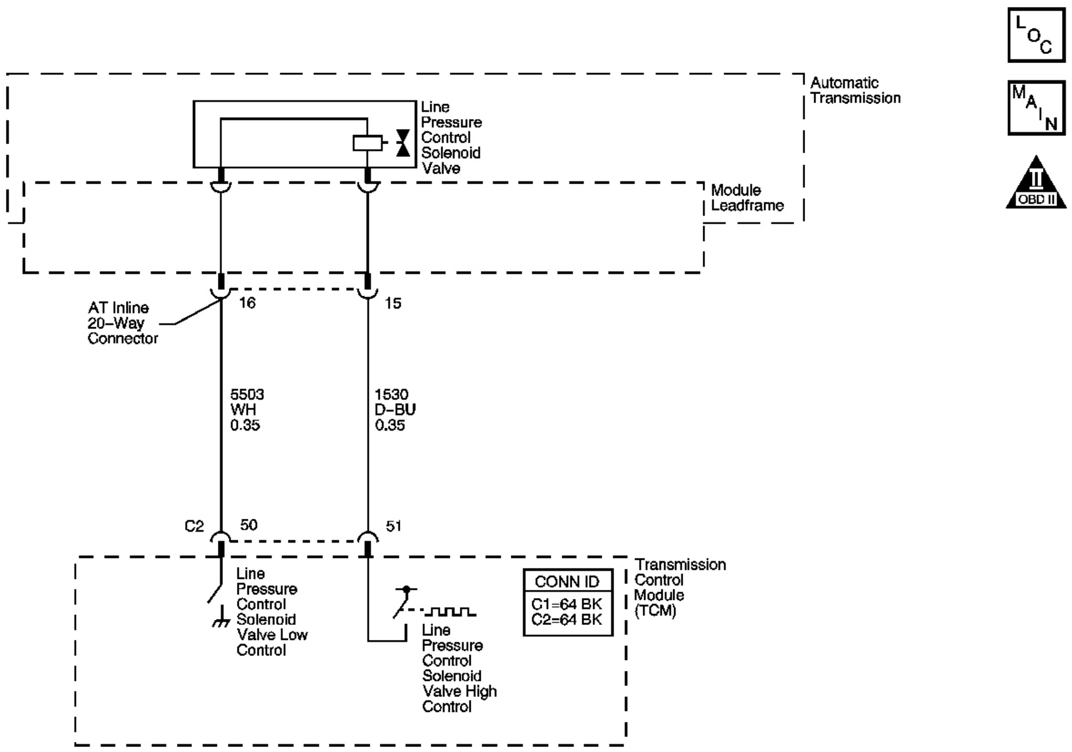


Fig. 1: DTC P0960 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The TCM uses the line pressure control (PC) solenoid valve in order to regulate the transmission line pressure. The line PC solenoid valve is attached to the control solenoid valve assembly. The TCM compares TP angle signal, transmission fluid temperature, speed ratio, and other inputs in order to determine the line pressure appropriate for a given load. The TCM regulates the pressure by applying a varying amperage to the line PC solenoid valve. The applied amperage varies from 0.1 amps for maximum line pressure to 1.1 amps for minimum line pressure. The TCM then monitors the amperage at the return line.

When the TCM detects a continuous open or short to voltage in the line PC solenoid valve circuit, DTC P0960 sets. DTC P0960 is a type B DTC.

Conditions for Running the DTC

- No line PC solenoid DTCs P0961, or P0962.
- The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting the DTC

The TCM detects a continuous open or short to voltage for 3.5 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM turns the power off to the line PC solenoid valve which results in maximum line pressure.
- The TCM no longer inhibits shifting to between reverse and drive when moving.
- The TCM commands maximum pressure to the input clutch.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0960 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** .
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** .

DTC P0960

Step	Action	Values	Yes	No

1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failures Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the engine for 30 seconds. 6. Start the engine and idle for 1 minute. 7. Select Specific DTC. 8. Enter DTC P0960. Does the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between battery positive and low control circuit of the line PC solenoid valve. Does the test lamp illuminate?	-	Go to **Step 4**	Go to **Step 5**
4	Using the DMM and the **J-35616** Connector Adapter Test Kit, measure the voltage between the high control circuit of the line PC solenoid valve and a good ground. Does the voltage measure within the	2-6 V		

	specified range?		Go to **Step 11**	Go to **Step 8**
5	Connect a test lamp between the low control circuit of the line PC solenoid valve and a good ground. Does the lamp illuminate?	-	Go to **Step 6**	Go to **Step 7**
6	Test the low control circuit of the line PC solenoid valve for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
7	Test the low control circuit of the line PC solenoid valve for an open. Refer to **Testing for Continuity** and**Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
8	Using the DMM and the **J-35616** Connector Adapter Test Kit, measure the voltage between the high control circuit of the line PC solenoid valve and a good ground. Does the voltage measure below the specified value?	2 V	Go to **Step 9**	Go to **Step 10**
9	Test the high control circuit of the line PC solenoid valve for an open or short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
10	Test the high control circuit of the line PC solenoid valve for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
11	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
12	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
13	Replace the line PC solenoid valve. The line PC solenoid valve is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** .	-		-

	Did you complete the replacement?		Go to **Step 15**	
14	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
15	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P0960. Has the test run and passed?	-	Go to **Step 16**	Go to **Step 2**
16	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0961

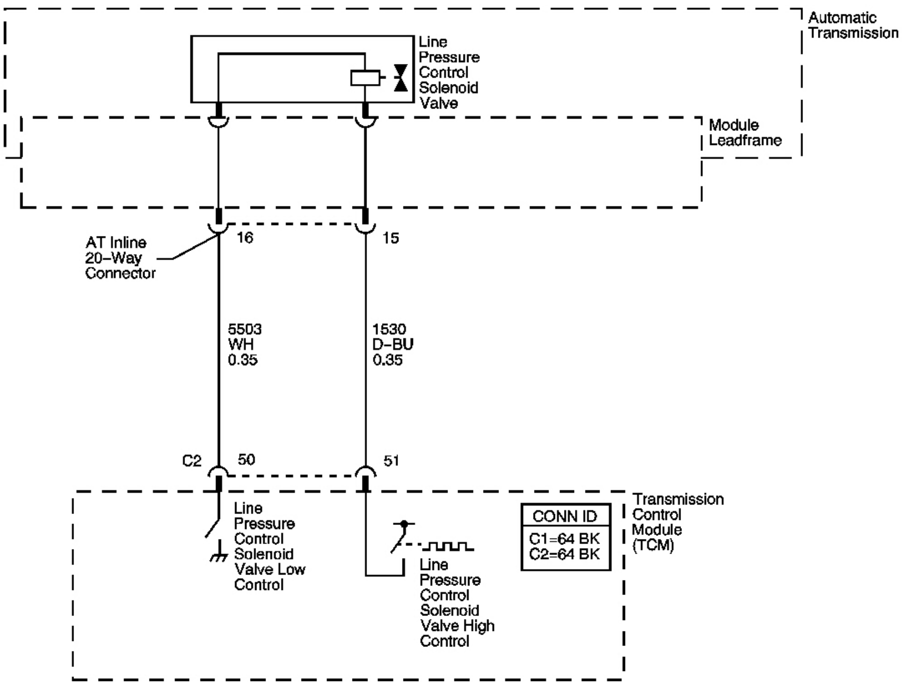


Fig. 2: DTC P0961 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The TCM uses the line pressure control (PC) solenoid valve in order to regulate the transmission line pressure. The line PC solenoid valve is attached to the control solenoid valve assembly. The TCM compares TP angle signal, transmission fluid temperature, speed ratio, and other inputs in order to determine the line pressure appropriate for a given load. The TCM regulates the pressure by applying a varying amperage to the line PC solenoid valve. The applied amperage varies from 0.1 amps for maximum line pressure to 1.1 amps for minimum line pressure. The TCM then monitors the amperage at the return line.

When the TCM detects a significant difference between commanded and actual current in the PC solenoid valve circuit, DTC P0961 sets. DTC P0961 is a type B DTC.

Conditions for Running the DTC

- No Line PC Solenoid DTCs P0960, or P0962.
- The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting the DTC

The TCM detects that the actual current flowing through the circuit is outside of a calibrated current threshold for the current commanded duty cycle for 2 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM no longer inhibits shifting to between reverse and drive when moving.
- The TCM commands maximum pressure to the input clutch.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0961 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** .
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** .

DTC P0961

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
	1. Install a scan tool. 2. Turn ON the ignition, with the engine			

2	OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine and idle for 1 minute. 7. Select Specific DTC. 8. Enter DTC P0961. Does the DTC fail this condition?	-	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	Using the scan tool, monitor Ignition Voltage. Is Ignition Voltage below the specified value?	11 V	Refer to **DTC P0562**	Go to **Step 4**
4	Test the low control circuit of the line PC solenoid valve for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Connect the AT inline 20-way connector. 3. Disconnect the TCM C2 64-way connector. 4. Using the DMM and the **J-35616** Connector Adapter Test Kit, measure the resistance between the line PC solenoid valve high control and the line PC solenoid valve low control circuits. Is the resistance value within the specified range?	2.8-6.8ohm	Go to **Step 10**	Go to **Step 6**
	Using the DMM and the **J-35616** Connector			

6	Adapter Test Kit, measure the resistance between the line PC solenoid valve high control and the line PC solenoid valve low control circuits. Is the resistance less than the specified value?	2.8ohm	Go to **Step 7**	Go to **Step 8**
7	Test the high control circuit for a short to the low control circuit of the line PC solenoid valve. Refer to **Testing for Continuity** and**Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 11**
8	1. Test the high control circuit of the line PC solenoid valve for high resistance. 2. Test the low control circuit of the line PC solenoid valve for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 9**
9	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 11**
10	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
11	Replace the line PC solenoid valve. The line PC solenoid valve is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 13**	-
12	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC.	-		

	5. Enter DTC P0961. Has the test run and passed?		Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0962

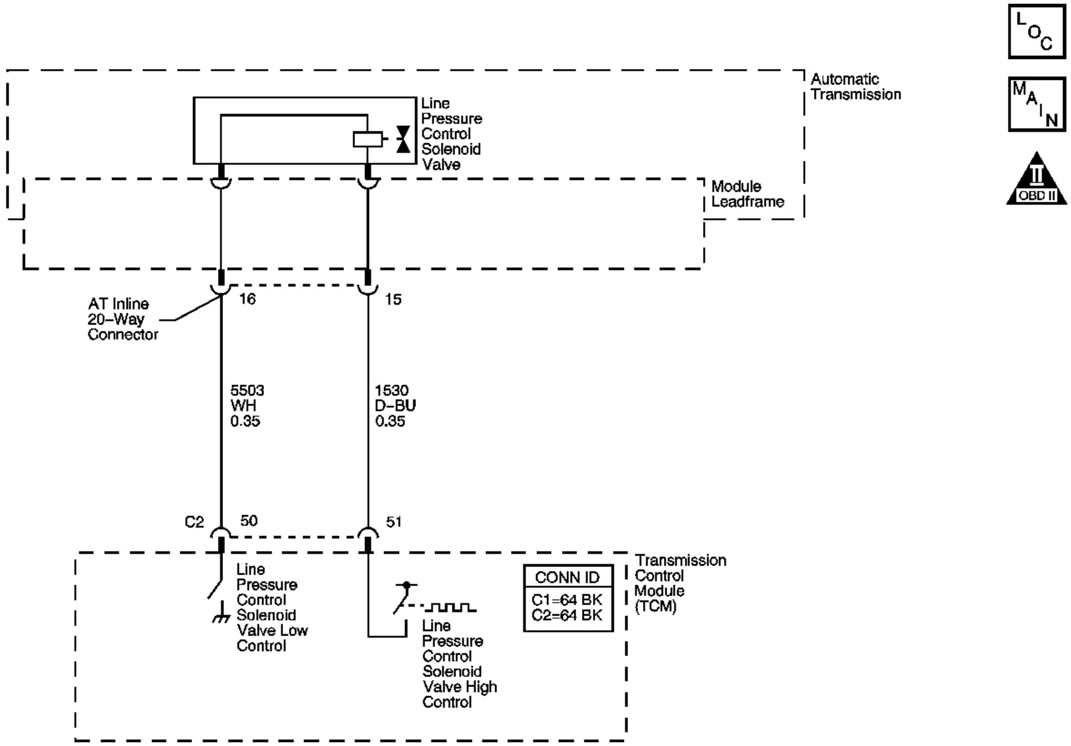


Fig. 3: DTC P0962 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The TCM uses the line pressure control (PC) solenoid valve in order to regulate the transmission line pressure. The line PC solenoid valve is attached to the control solenoid valve assembly. The TCM compares TP angle signal, transmission fluid temperature, speed ratio, and other inputs in order to determine the line pressure appropriate for a given load. The TCM regulates the pressure by applying an amperage to the line PC solenoid valve. The applied amperage varies from 0.1 amps for maximum line pressure to 1.1 amps for minimum line pressure. The TCM then monitors the amperage at the return line.

When the TCM detects a continuous short to ground in the line PC solenoid valve circuit, DTC P0962 sets. DTC P0962 is a type B DTC.

Conditions for Running the DTC

- No line PC solenoid DTCs P0960, or P0961.
- The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting the DTC

The TCM detects a continuous short to ground for 1.3 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM turns the power off to the line PC solenoid valve which results in maximum line pressure.
- The TCM no longer inhibits shifting to between reverse and drive when moving.
- The TCM commands maximum pressure to the input clutch.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes main line pressure transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0962 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** .

- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** .

DTC P0962

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine and idle for 1 minute. 7. Select Specific DTC. 8. Enter DTC P0962. Does the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between battery positive and high control circuit of the line PC solenoid valve. Does the test lamp illuminate?	-	Go to **Step 4**	Go to **Step 5**
	Test the high control circuit of the line PC			

4	solenoid valve for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Repairs. Did you find and correct a condition?	-	Go to **Step 10**	Go to **Step 9**
5	Connect a test lamp between the low control circuit of the line PC solenoid valve and a good ground. Does the test lamp illuminate?	-	Go to **Step 6**	Go to **Step 7**
6	Test the low control circuit of the Line PC Solenoid Valve for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 9**
7	Test the high control circuit for a short to the low control circuit of the line PC solenoid valve. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 8**
8	Replace the Line PC Solenoid Valve. The Line PC Solenoid Valve is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 10**	-
9	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 10**	-
10	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the conditions for running the DTC as specified in the supporting text. 4. Select Specific DTC. 5. Enter DTC P0962. Has the test run and passed?	-	Go to **Step 11**	Go to **Step 2**
11	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0964

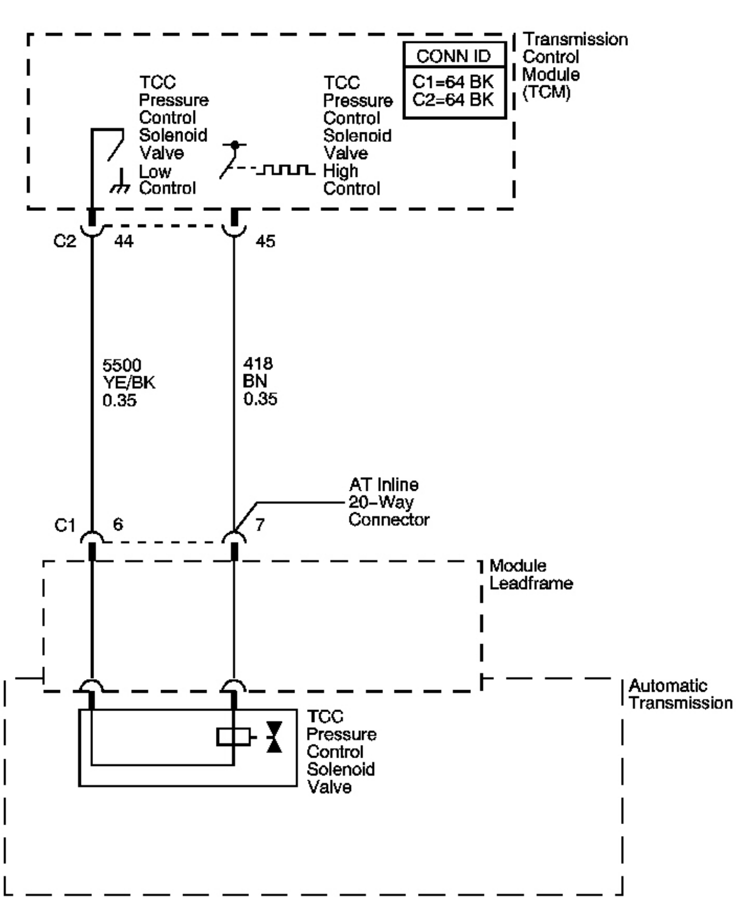


Fig. 4: DTC P0964 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The TCM uses the TCC pressure control solenoid valve to apply and release the TCC system. The TCC pressure control solenoid valve is attached to the control solenoid valve assembly. The TCM compares engine and transmission inputs to determine if TCC should be applied. The TCM then regulates the pressure by applying a varying amperage to the TCC pressure control solenoid valve. The TCM then monitors the amperage at the return line.

When the TCM detects a continuous open or short to voltage in the TCC pressure control solenoid valve circuit, DTC P0964 sets. DTC P0964 is a type B DTC.

Conditions for Running the DTC

- No TCC pressure control solenoid DTCs P0965, or P0966.
- The engine speed is 500 RPM or greater for 5 seconds.

Conditions for Setting the DTC

The TCM detects a continuous open or short to voltage for 1.3 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM inhibits TCC engagement.
- The TCM turns the power off to the TCC enable solenoid valve and the TCC pressure control solenoid valve. This results in harsher garage shifts and no TCC engagement.
- The TCM no longer inhibits shifting to between reverse and drive when moving.
- The TCM commands maximum pressure to the input clutch.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0964 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P0964

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine. 7. Select Specific DTC. 8. Enter DTC P0964. Does the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between battery positive and low control circuit of the TCC pressure control solenoid valve. Does the test lamp illuminate?	-	Go to **Step 4**	Go to **Step 5**
4	Using the DMM and the **J-35616** , measure the voltage between the high control circuit of the TCC pressure control solenoid valve and a	2-6 V		

	good ground. Does the voltage measure within the specified range?		Go to **Step 11**	Go to **Step 8**
5	Connect a test lamp between the low control circuit of the TCC pressure control solenoid valve and a good ground. Does the test lamp illuminate?	-	Go to **Step 6**	Go to **Step 7**
6	Test the low control circuit of the TCC pressure control solenoid valve for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
7	Test the low control circuit of the TCC pressure control solenoid valve for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
8	Using the DMM and the **J-35616** , measure the voltage between the high control circuit and a good ground. Does the voltage measure below the specified value?	2 V	Go to **Step 9**	Go to **Step 10**
9	Test the high control circuit of the TCC pressure control solenoid valve for an open or short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
10	Test the high control circuit of the TCC pressure control solenoid valve for a short to voltage Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
11	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
12	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
13	Replace the TCC pressure control solenoid valve. The TCC pressure control solenoid valve is part of the control solenoid valve assembly. Refer to **Control Valve Body**	-		-

	Assembly Disassemble . Did you complete the replacement?		Go to **Step 15**	
14	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
15	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P0964. Has the test run and passed?	-	Go to **Step 16**	Go to **Step 2**
16	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0965

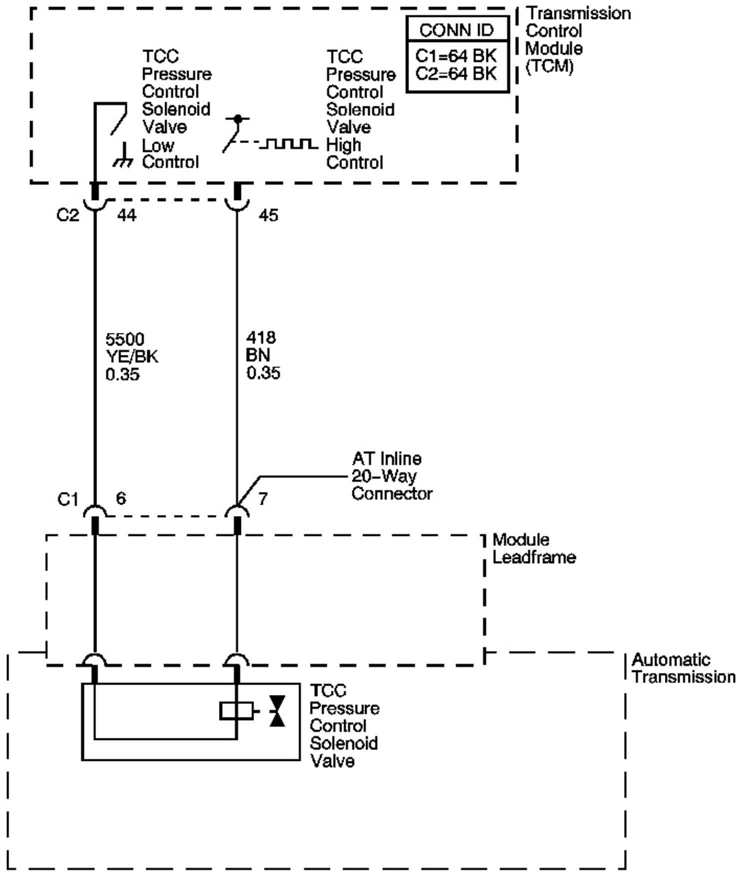


Fig. 5: DTC P0965 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) uses the TCC pressure control solenoid valve to apply and release the TCC system. The TCC pressure control solenoid valve is attached to the control solenoid valve assembly. The TCM compares engine and transmission inputs to determine if TCC should be applied. The TCM then regulates the pressure by applying a varying amperage to the TCC pressure control solenoid valve. The TCM then monitors the amperage at the return line.

When the TCM detects a significant difference between commanded and actual current in the TCC pressure control solenoid valve circuit, DTC P0965 sets. DTC P0965 is a type B DTC.

Conditions for Running the DTC

- No TCC pressure control solenoid DTC P0964 or P0966.

- The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting the DTC

The TCM detects that the actual current flowing through the circuit is outside of a calibrated current threshold for the current commanded duty cycle for 2 seconds.

Action Taken When the DTC Sets

- The TCM requests the engine control module (ECM) to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM inhibits TCC engagement.
- The TCM turns the power off to the TCC enable solenoid valve and the TCC pressure control solenoid valve. This results in harsher garage shifts and no TCC engagement.
- The TCM no longer inhibits shifting between reverse and drive when moving.
- The TCM commands maximum pressure to the input clutch.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0965 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P0965

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine. 7. Select Specific DTC. 8. Enter DTC P0965. Does the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	Using the scan tool, monitor Ignition Voltage. Is Ignition Voltage below the specified value?	11 V	Go to **DTC P0562**	Go to **Step 4**
4	Test the low control circuit of the TCC pressure control solenoid valve for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 13**	Go to **Step 5**
	1. Turn OFF the ignition. 2. Connect the AT inline 20-way connector. 3. Disconnect the TCM C2 64-way connector. 4. Using the DMM and the **J-35616**	2.8-6.8		

5	Connector Adapter Test Kit, measure the resistance between the TCC PC solenoid valve high control and the TCC PC solenoid valve low control circuits. Is the resistance value within the specified range?	ohm	Go to **Step 10**	Go to **Step 6**
6	Using the DMM and the **J-35616** , measure the resistance between the TCC PC solenoid valve high control and the TCC PC solenoid valve low control circuits. Is the resistance less the specified value?	2.8 ohm	Go to **Step 7**	Go to **Step 8**
7	Test the high control circuit for a short to the low control circuit of the TCC pressure control solenoid valve. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 11**
8	1. Test the high control circuit of the TCC pressure control solenoid valve for high resistance. 2. Test the low control circuit of the TCC pressure control solenoid valve for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 9**
9	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 11**
10	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
11	Replace the TCC pressure control solenoid valve. The TCC pressure control solenoid valve is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 13**	-
12	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** .	-		-

	Did you complete the replacement?		Go to **Step 13**	
13	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the conditions for running the DTC as specified in the supporting text. 4. Select Specific DTC. 5. Enter DTC P0965. Has the test run and passed?	-	Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P0966

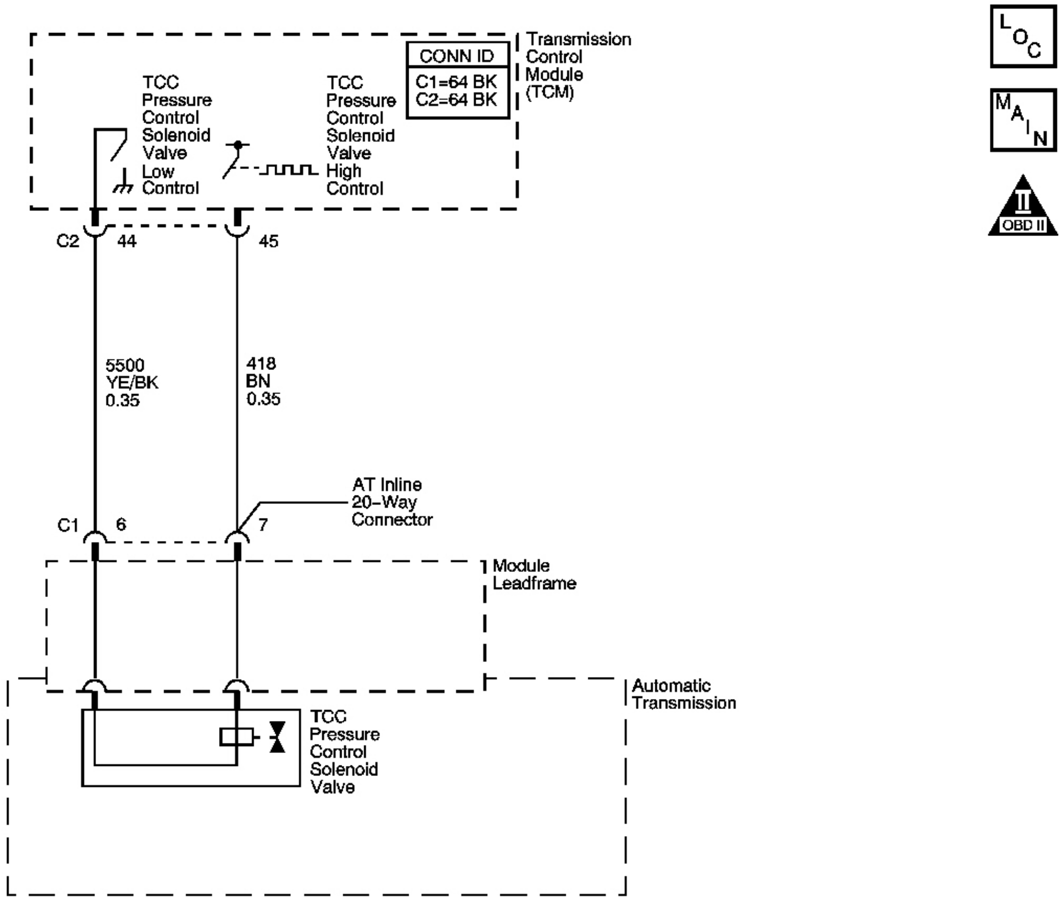


Fig. 6: DTC P0966 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) uses the TCC pressure control solenoid valve to apply and release the TCC system. The TCC pressure control solenoid valve is attached to the control solenoid valve assembly. The TCM compares engine and transmission inputs to determine if TCC should be applied. The TCM then regulates the pressure by applying a varying amperage to the TCC pressure control solenoid valve. The TCM then monitors the amperage at the return line.

When the TCM detects a continuous short to ground in the TCC pressure control solenoid valve circuit, DTC P0966 sets. DTC P0966 is a type B DTC.

Conditions for Running the DTC

- No TCC pressure control solenoid DTC P0964, or P0965.

- The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting the DTC

The TCM detects a continuous short to ground for 1.3 seconds.

Action Taken When the DTC Sets

- The TCM requests the engine control module (ECM) to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM inhibits TCC engagement.
- The TCM turns the power off to the TCC enable solenoid valve and the TCC pressure control solenoid valve. This results in harsher garage shifts and no TCC engagement.
- The TCM no longer inhibits shifting between reverse and drive when moving.
- The TCM commands maximum pressure to the input clutch.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P0966 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P0966

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine. 7. Select Specific DTC. 8. Enter DTC P0966. Does the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between battery positive and high control circuit of the TCC pressure control solenoid valve. Does the test lamp illuminate?	-	Go to **Step 4**	Go to **Step 5**
	1. Test the high control circuit of the TCC pressure control solenoid valve for a short to ground. 2. Test the high control circuit for a short			

4	to the low control circuit of the TCC pressure control solenoid valve. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct a condition?	-	Go to **Step 10**	Go to **Step 9**
5	Connect a test lamp between the low control circuit of the TCC pressure control solenoid valve and a good ground. Does the test lamp illuminate?	-	Go to **Step 6**	Go to **Step 7**
6	Test the low control circuit of the TCC pressure control solenoid valve for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 9**
7	Test the high control circuit for a short to the low control circuit of the TCC pressure control solenoid valve. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 8**
8	Replace the TCC pressure control solenoid valve. The TCC pressure control solenoid valve is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 10**	-
9	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 10**	-
10	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the conditions for running the DTC as specified in the supporting text. 4. Select Specific DTC. 5. Enter DTC P0966. Has the test run and passed?	-	Go to **Step 11**	Go to **Step 2**
	With the scan tool, observe the stored		Go to **Diagnostic**	

11	information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	**Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P1756

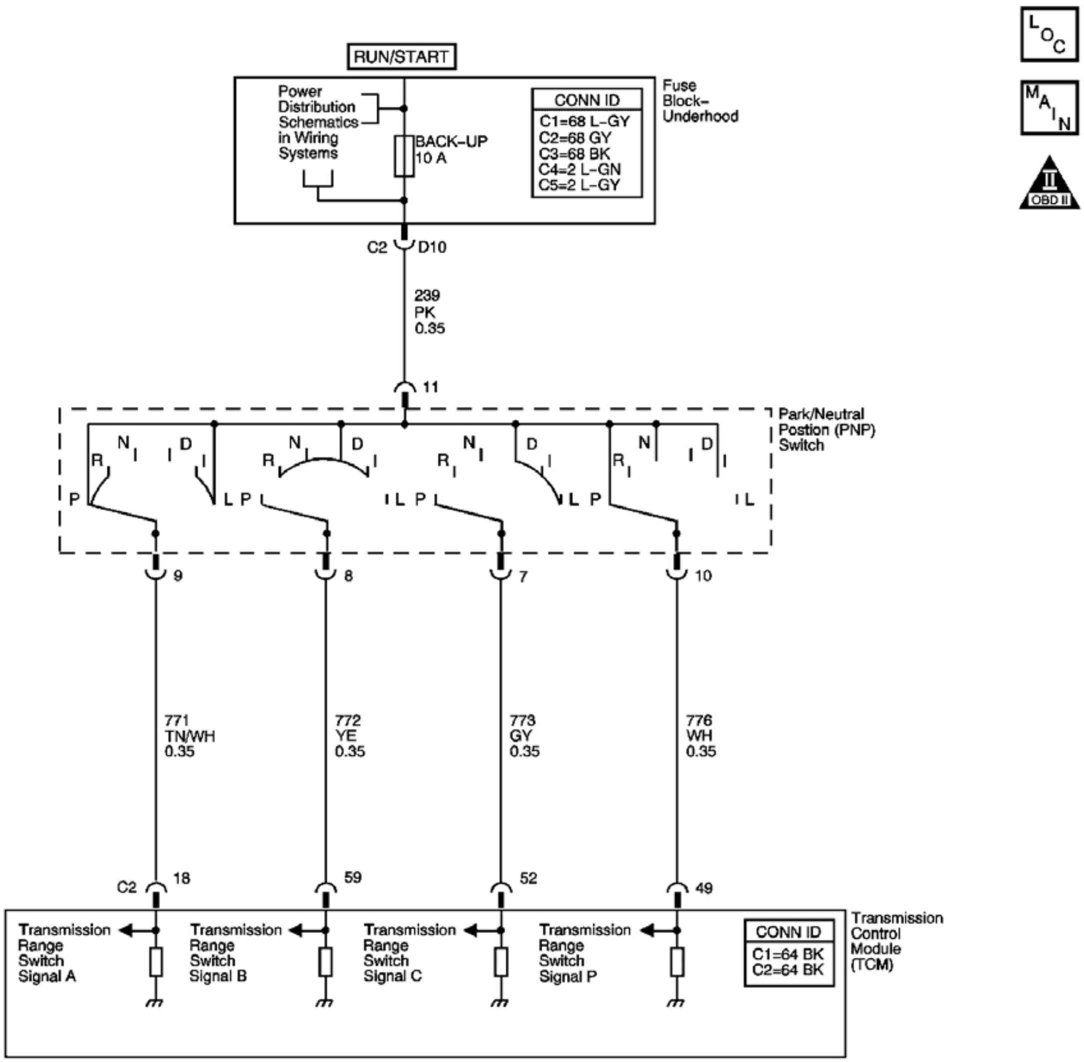


Fig. 7: DTC P1756 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission range (TR) switch is part of the park/neutral position and back-up lamp switch assembly and is mounted on the transmission manual shaft. The TR switch is a multi-signal switch. The fuse block -

underhood supplies ignition voltage to the TR switch on four signal circuits, A, B, C, and P. Each gear selector lever position powers two or more of the signal circuits in a unique pattern. In order to determine the gear range selected by the driver, the TCM compares the voltage combination on the signal circuits to a TR switch combination table stored in memory. Refer to **Transmission Range Switch Logic** .

When the TCM detects the combination of TR switch signals for PARK or NEUTRAL and the vehicle is moving, DTC P1756 sets. DTC P1756 is a type B DTC.

Conditions for Running the DTC

- No transmission range switch DTCs P0705, or P1758.
- No ISS DTCs P0716, or P0717.
- No OSS DTCs P0722, or P0723.
- No TCC system stuck ON DTC P0742.
- No engine torque CAN DTC P1779.
- No TCC enable solenoid valve DTCs P1888, or P1889.
- The engine speed is greater than 500 RPM for 5 seconds.
- The APP angle is 5 percent or greater.
- The engine torque is greater than 2 N.m (2 lb ft).
- The transmission input shaft speed is 550 RPM or greater for 20 seconds.
- The transmission output shaft speed is 400 RPM or greater.
- The speed ratio is greater than 0.38.

Conditions for Setting the DTC

The combination of TR switch signals indicate a forward range while the vehicle is not moving. Refer to **Transmission Range Switch Logic** .

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM turns off power off to the torque converter clutch pressure control solenoid valve.
- The TCM discontinues abuse torque management.
- The TCM defaults the selected gear range to Drive.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P1756 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from PCM history if the vehicle completes 40 warm-up cycles without an emission-related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

DTC P1756

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Apply the parking brake. 6. Depress the brake pedal. 7. Start the engine, shift to PARK and bring up engine speed. 8. Idle the engine, shift to NEUTRAL and bring up engine speed. 9. Turn the ignition OFF. Did the vehicle attempt to move in either gear selections?	-	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	Did you check the control cable for proper	-		Go to **Shift Cable**

	adjustment?		Go to **Step 4**	**Adjustment**
4	1. Turn the ignition ON, with engine OFF. 2. Using the scan tool, monitor the TR Sw. parameter. 3. Shift from PARK to LOW, and check that each shifter position corresponds to the scan tool display. Did the scan tool display the correct gear selections?	-	Go to **Step 5**	Go to **DTC P0705**
5	1. Inspect for damaged manual shift shaft and parking system components. Refer to **Manual Shift Shaft and Parking System Components Removal** . 2. Repair as necessary. Did you complete the repair?	-	Go to **Step 6**	-
6	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select Specific DTC. 5. Enter DTC P1756. Has the test run and passed?	-	Go to **Step 7**	Go to **Step 2**
7	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P1758

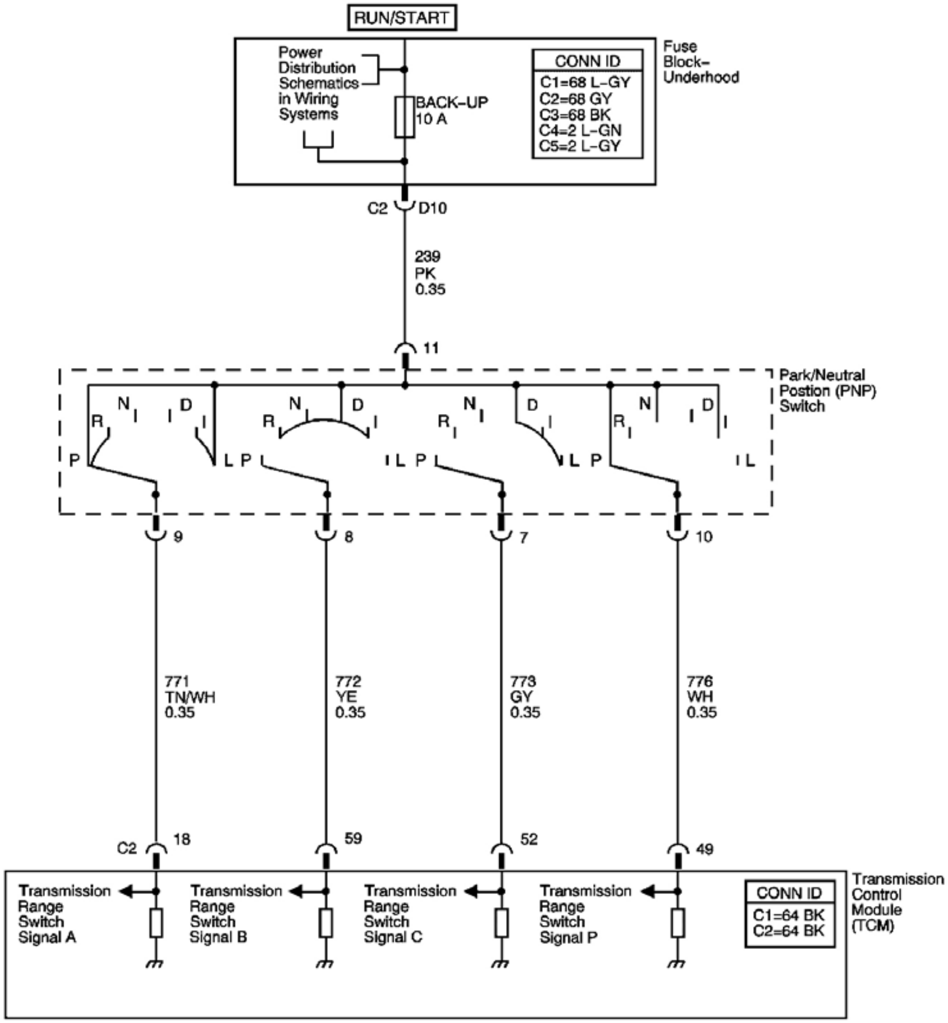


Fig. 8: DTC P1758 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission range (TR) switch is part of the park/neutral position and back-up lamp switch assembly and is mounted on the transmission manual shaft. The TR switch is a multi-signal switch. The fuse block - underhood supplies ignition voltage to the TR switch on four signal circuits, A, B, C, and P. Each gear selector lever position powers two or more of the signal circuits in a unique pattern. In order to determine the gear range selected by the driver, the TCM compares the voltage combination on the signal circuits to a TR switch combination table stored in memory. Refer to **Transmission Range Switch Logic** . When the TCM detects the combination of TR switch signals for a forward range and the vehicle is not moving moving, DTC P1758 sets. DTC P1758 is a type B DTC.

Conditions for Running the DTC

- No transmission range switch DTCs P0705, or P1756.
- No ISS DTCs P0716, or P0717
- No OSS DTCs P0722, or P0723.
- No TCC system stuck ON DTC P0742.
- No engine torque CAN DTC P1779.
- No TCC enable solenoid valve DTCs P1888, or P1889.
- The engine speed is greater than 500 RPM for 5 seconds.
- The APP angle is less than 1 percent.
- The transmission input shaft speed is 550 RPM or greater for 20 seconds.
- The transmission output shaft speed is 150 RPM or less.
- The speed ratio is 0.38-0.6.

Conditions for Setting the DTC

The combination of TR switch signals indicate a forward range while the vehicle is not moving. Refer to **Transmission Range Switch Logic** .

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM turns off power off to the torque converter clutch pressure control solenoid valve.
- The TCM discontinues abuse torque management.
- The TCM defaults the selected gear range to Drive.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P1758 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission-related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Test Description

The number below refers to the step number on the diagnostic table.

2: Proper fluid level is important to the normal operation of the transmission.

DTC P1758

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Visually inspect the transmission cooling system for fluid leaks. 2. Repair any leaks as necessary. Refer to **Fluid Leak Diagnosis** . Did you find and correct a condition?	-	Go to **Step 8**	Go to **Step 3**
3	Did you perform the Line Pressure Check Procedure?	-	Go to **Step 4**	Go to **Line Pressure Check Procedure**
4	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Apply the parking brake. 6. Depress the brake pedal. 7. Start the engine, shift to DRIVE and bring up engine speed. 8. Idle the engine, shift to INTERMEDIATE and bring up engine speed. 9. Idle the engine, shift to LOW and	-		

	bring up engine speed. 10. Turn the ignition OFF. Did the vehicle attempt to move in all gear selections?		Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)	Go to **Step 5**
5	Did you check the control cable for proper adjustment?	-	Go to **Step 6**	Go to **Shift Cable Adjustment**
6	1. Turn the ignition ON, with engine OFF. 2. Using the scan tool, monitor the TR Sw. parameter. 3. Shift from PARK to LOW, and check that each shifter position corresponds to the scan tool display. Did the scan tool display the correct gear selections?	-	Go to **Step 7**	Go to **DTC P0705**
7	1. Inspect for damaged manual shift shaft and parking system components. Refer to **Manual Shift Shaft and Parking System Components Removal** . 2. Repair as necessary. Did you complete the repair?	-	Go to **Step 8**	-
8	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P1758. Has the test run and passed?	-	Go to **Step 9**	Go to **Step 2**
9	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P1779

Circuit Description

Engine torque information is sent to the transmission control module (TCM) by the engine control module (ECM) through the controller area network (CAN). A two-wire circuit is used to communicate data between the ECM and TCM, CAN H and CAN L. A fault in the CAN will not cause DTC P1779 to set by itself. If a communication fault occurs, other DTCs will set before P1779.

When the ECM sends the TCM an invalid engine torque, DTC P1779 sets. DTC P1779 is a type B DTC.

Conditions for Running the DTC

- No CAN DTCs U2103, or U2105
- The engine speed is greater than 300 RPM for 5 seconds.

Conditions for Setting the DTC

The engine torque is invalid for 2.0 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The TCM moves the speed ratio towards a target ratio and then freezes the ratio changes.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM commands maximum pressure to the input clutch.
- The TCM defaults to a fixed engine torque value.
- The TCM no longer inhibits shifting to between reverse and drive when moving.
- The TCM freezes garage shift transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P1779 in TCM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

DTC P1779

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the ECM Freeze Frame and the TCM Failure Records. Using the Clear DTC Info function erases the Freeze Frame and Failure Records from the ECM and the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. Did you record any ECM Failure Records?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	Go to **Step 3**
3	1. Clear the DTC. 2. Turn the ignition OFF for at least 30 seconds. 3. Start, and allow the engine to idle. Did DTC P1779 reset?	-	Go to **Step 4**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
4	Did any other DTCs set?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	Go to **Step 5**
5	Replace the ECM. Refer to **Engine Control Module (ECM) Replacement** in Engine Controls - 2.2L (L61). Is the action complete?	-	Go to **Step 6**	-
	Perform the following operation to verify the			

6	repair: 1. Select DTC on the scan tool. 2. Select Clear Info. 3. Start, and idle the engine. 4. Select Specific DTC. 5. Enter DTC P1779. Has the test run and passed?	-	Go to **Step 7**	Go to **Step 2**
7	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P1882

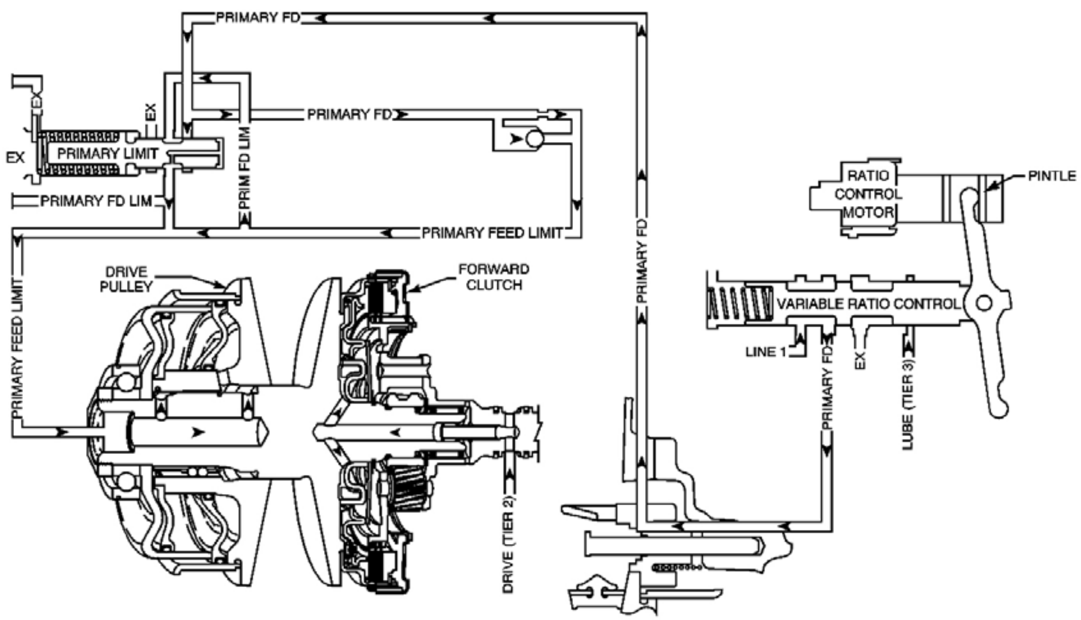


Fig. 9: DTC P1882 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) uses the input and output shaft speed sensor input signals to calculate the speed ratio. The speed ratio is then compared to the desired speed ratio, and the difference between the two values is the speed ratio error. If the ratio control response is slow or jerky, a fail counter is incremented a number of counts depending upon the magnitude of the speed ratio error above a calibrated threshold. Conversely, if the ratio control response is smooth and the speed ratio is close to the desired speed ratio the fail counter will be decremented.

When the fail counter has accumulated a calibrated number of fail counts, DTC 1882 sets. DTC P1882 is a type A DTC.

Conditions for Running the DTC

- No transmission range switch DTCs P0705, or P1756.
- No ISS DTCs P0716, or P0717.
- No OSS DTCs P0722, or P0723.
- No engine torque HSCAN DTC P1779.
- No ratio control motor DTCs P1883, P1884, P1885, or P1886.
- No TCC enable solenoid valve DTCs P1888, or P1889.
- No HSCAN DTCs U2103, U2104, or U2105.
- The engine speed is greater than 500 RPM for 5 seconds.
- The selected range is DRIVE.
- The time since the gear select lever change is greater than 6 seconds.
- The transmission fluid temperature is greater than 21°C (70°F).
- The APP angle is greater than 5 percent.
- The transmission input shaft speed is greater than 700 RPM.
- The transmission output shaft speed is greater than 400 RPM.
- The speed ratio is between 0.35-1.1.
- The absolute value of the difference between the speed ratio and the desired speed ratio is greater than 0.42.

Conditions for Setting the DTC

When the fail counter has accumulated 10,000 fail counts.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM moves the speed ratio towards a target ratio and then freezes ratio changes.
- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The TCM inhibits TCC engagement.
- The TCM commands maximum pressure to the input clutch.
- The TCM freezes garage shift transmission adaptive functions.

- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P1882 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect for intermittent automatic transmission input speed sensor (ISS) circuit conditions.
- Inspect for an incorrect calibration.
- A misaligned variable ratio control valve lever will cause DTC P1882 to set. One end of the lever must be properly positioned in the ratio control motor pintle, and the opposite end of the lever must be properly positioned in the variable drive pulley follower, which is located on the case cover. If the transmission case cover assembly has been previously removed for service, and was installed after the valve body was installed, misalignment of the lever is possible.
- A missing or damaged primary pulley snap ring, damaged ratio control motor or a leaking secondary pulley can cause DTC P1882 to set.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: Proper fluid level is important to the normal operation of the transmission.

6: This determines if the transmission is working properly until the TCC system is going to be engaged. If the TCC enable solenoid is not enabled at this point, the forward clutch may slip.

9: With the ignition ON and the engine OFF, the ratio control motor will normally make a "whine" noise like an electric hand drill. If the ratio control motor is damaged, the noise will become less constant and start to sound like a "tick" noise like a clock or watch. Finally, when the ratio control motor is frozen, it will produce no noise.

DTC P1882

Step	Action	Values	Yes	No
	Did you perform the Diagnostic System Check - Engine Controls?			Go to **Diagnostic System Check -**

<table>
<tr><td>1</td><td></td><td>-</td><td>Go to Step 2</td><td><u>Engine Controls</u> in Engine Controls - 2.2L (L61)</td></tr>
<tr><td>2</td><td>1. Visually inspect the transmission cooling system for fluid leaks.
2. Repair any leaks as necessary.

Refer to <u>Fluid Leak Diagnosis</u> .Did you find and correct a condition?</td><td>-</td><td>Go to Step 14</td><td>Go to Step 3</td></tr>
<tr><td>3</td><td>Did you perform the Line Check Procedure?</td><td>-</td><td>Go to Step 4</td><td>Go to <u>Line Pressure Check Procedure</u></td></tr>
<tr><td>4</td><td>IMPORTANT:
Depending upon the fault, the vehicle may or may not be able to travel at the required speed and the TCC PC Sol. Duty Cycle may not exceed 68 percent.

1. Install a scan tool.
2. Turn ON the ignition, with the engine OFF.

IMPORTANT:
• Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.
• Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.

3. Record the DTC Failure Records.
4. Clear the DTC.
5. Use the scan tool snapshot mode in order to record the following parameters:
• Desired Speed Ratio
• Speed Ratio
• Transmission ISS
• TCC PC Sol. Duty Cycle
• Trans. Component Slip
• Vehicle Speed
6. Drive the vehicle in transmission range D</td><td>-</td><td></td><td></td></tr>
</table>

	with the TP angle greater than 5 percent, and the Vehicle Speed greater than 32 km/h (20 mph) until the TCC PC Sol. Duty Cycle increases above 68 percent. Is desired speed ratio and speed ratio approximately the same during the drive?		Go to **Intermittent Conditions** in Engine Controls-2.2L (L61)	Go to **Step 5**
5	Did the scan tool display Transmission ISS above the specified value?	10 RPM	Go to **Step 6**	Go to **DTC P0717**
6	Did the scan tool display that the Speed Ratio was approximately the same as Desired Speed Ratio until the vehicle was above the specified value?	32 km/h (20 mph)	Go to **Step 7**	Go to **Step 8**
7	1. Disconnect the AT inline 20-way connector. 2. Disconnect the TCM C2 64-way connector. 3. Test the TCC enable solenoid low control circuit and the TCC enable solenoid high control circuit for continuity between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 12**
8	Did the speed ratio change slowly or not at all?	-	Go to **Step 9**	Go to **Step 11**
9	1. Turn the ignition ON, and the engine OFF. 2. Use a stethoscope or equivalent device to listen to the top of the transmission just above the AT inline 20-way connector. Did you hear a muffled "ticking" noise or none at all?	-	Go to **Step 13**	Go to **Step 10**
10	1. Inspect for damaged components. Refer to **Poor Driveability - Poor or No Ratio Control** . 2. Repair as necessary. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the repair?	-	Go to **Step 14**	-
11	1. Inspect for damaged components. Refer to **No Drive in Forward Ranges** . 2. Perform root cause and repair as necessary. Did you complete the repair?	-	Go to **Step 14**	-

12	Replace the TCC enable solenoid valve. The TCC enable solenoid valve is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 14**	-
13	Replace the ratio control motor. The ratio control motor is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 14**	-
14	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P1882. Has the test run and passed?	-	Go to **Step 15**	Go to **Step 2**
15	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P1883

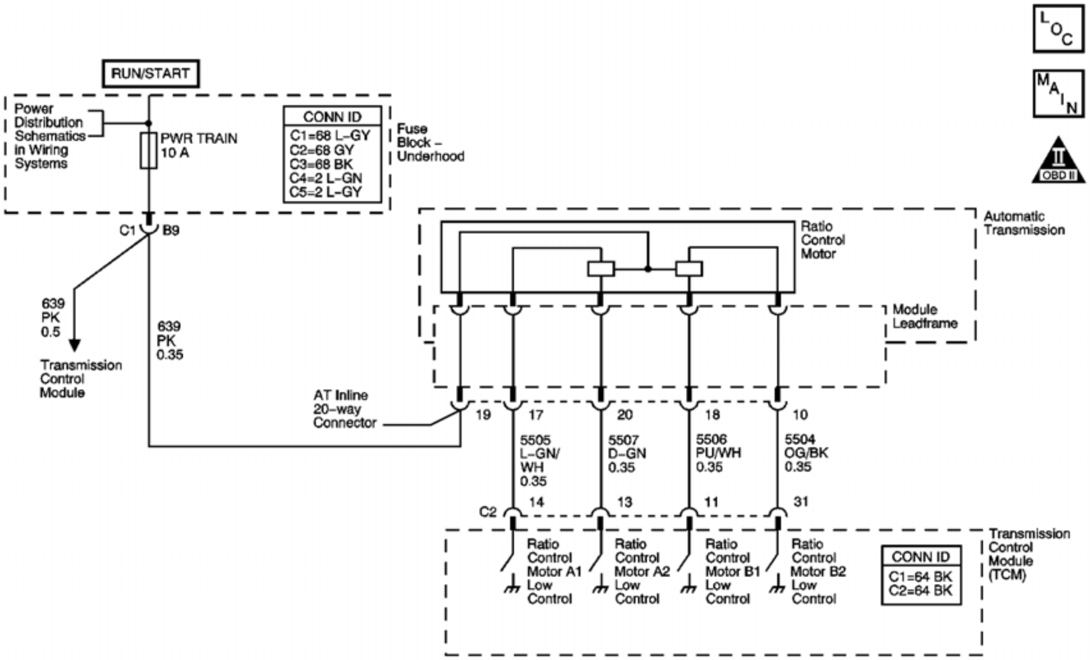


Fig. 10: DTC P1883 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) uses the ratio control motor to control the speed ratio. The ratio control motor is a linear position device, which changes the speed ratio by accurately controlling the position of the variable ratio control valve. Movement of the variable ratio control valve allows fluid to be applied and exhausted from the primary feed limit circuit. The TCM controls the ratio control motor by grounding four control circuits with power being supplied directly from the fuse block - underhood. The TCM monitors the status of the four low control circuits and can detect a short to power or a short to ground/open.

When either of these failures is detected, DTC P1883 sets. DTC P1883 is a type A DTC.

Conditions for Running the DTC

The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting the DTC

The TCM detects an open, a short to ground, or a short to voltage on the ratio control motor A1 control circuit.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM moves the speed ratio towards a target ratio and then freezes ratio changes.

- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P1883 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P1883

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure**			

2	**Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine and idle for 1 minute. Is DTC P1884, P1885, or P1886 also set?	-	Go to **Step 3**	Go to **Step 4**
3	Test the Ignition 1 voltage circuit for a open between the fuse block - underhood and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 16**
4	Using the scan tool, select Ratio Ctrl. Mtr. A1 Status. Does the scan tool display OPEN/SHORT TO GND?	-	Go to **Step 6**	Go to **Step 5**
5	Does the scan tool display SHORT TO VOLTS?	-	Go to **Step 7**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
6	1. Disconnect the AT inline 20-way connector. 2. Turn ON the ignition, with the engine OFF. 3. Connect a test lamp between the Ignition 1 Voltage circuit and the ratio control motor A1 low control circuit. Is the test lamp blinking?	-	Go to **Step 14**	Go to **Step 8**
7	1. Disconnect the AT inline 20-way connector. 2. Turn ON the ignition, with the engine OFF. 3. Connect a test lamp between the Ignition 1 voltage circuit and the ratio control motor A1 low control circuit. Is the test lamp OFF?	-	Go to **Step 10**	Go to **Step 17**
8	Is the test lamp always ON?	-	Go to **Step 9**	Go to **Step 11**

9	Test the ratio control motor A1 low control circuit for a short to ground between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
10	Test the ratio control motor A1 low control circuit for a short to voltage between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
11	Connect a test lamp between the Ignition 1 voltage circuit and a good ground. Is the test lamp always ON?	-	Go to **Step 13**	Go to **Step 12**
12	Test the Ignition 1 voltage circuit for an open between the fuse block - underhood and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	-
13	Test the ratio control motor A1 low control circuit for an open between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 15**
14	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 17**
15	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
16	Replace the leadframe. The leadframe is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 19**	-
	Replace the ratio control motor. The ratio control motor is part of the control solenoid			

17	valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 19**	-
18	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 19**	-
19	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select Specific DTC. 5. Enter DTC P1883. Has the test run and passed?	-	Go to **Step 20**	Go to **Step 2**
20	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P1884

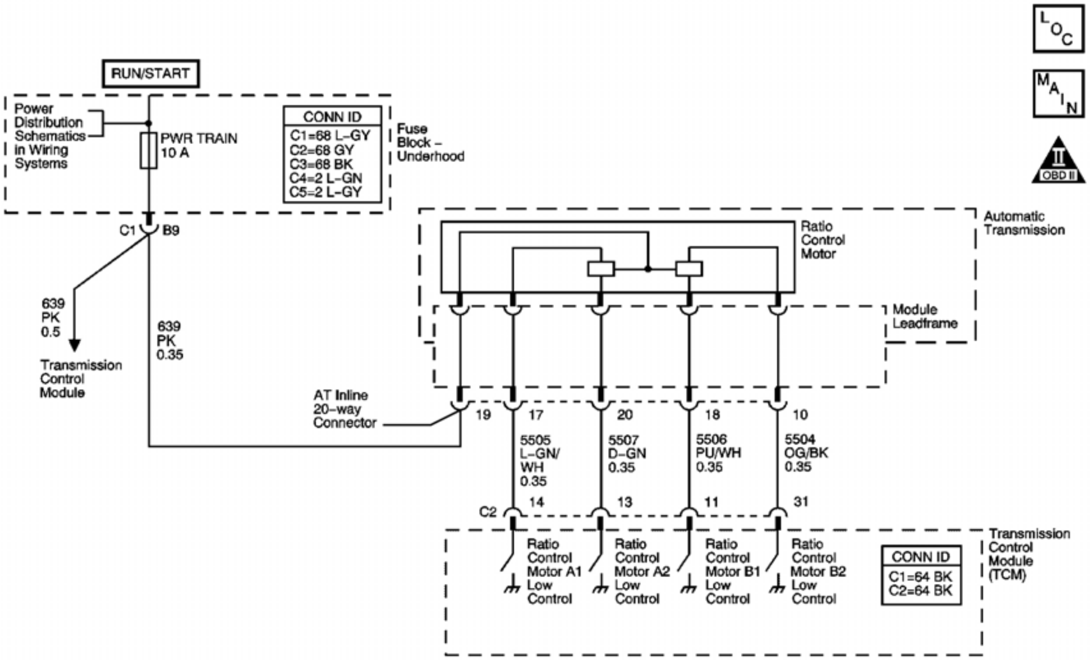


Fig. 11: DTC P1884 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) uses the ratio control motor to control the speed ratio. The ratio control motor is a linear position device, which changes the speed ratio by accurately controlling the position of the variable ratio control valve. Movement of the variable ratio control valve allows fluid to be applied and exhausted from the primary feed limit circuit. The TCM controls the ratio control motor by grounding four control circuits with power being supplied directly from the fuse block - underhood. The TCM monitors the status of the four low control circuits and can detect a short to power or a short to ground/open.

When either of these failures is detected, DTC P1884 sets. DTC P1884 is a type A DTC.

Conditions for Running the DTC

The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting the DTC

The TCM detects an open, a short to ground, or a short to voltage on the ratio control motor A2 control circuit.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM moves the speed ratio towards a target ratio and then freezes ratio changes.

- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P1884 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission-related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P1884

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure**			

2	**Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine and idle for 1 minute. Is DTC P1883, P1885, or P1886 also set?	-	Go to **Step 3**	Go to **Step 4**
3	Test the Ignition 1 voltage circuit for an open between the fuse block - underhood and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 16**
4	Using the scan tool, select Ratio Ctrl. Mtr. A2 Status. Does the scan tool display OPEN/SHORT TO GND?	-	Go to **Step 6**	Go to **Step 5**
5	Does the scan tool display SHORT TO VOLTS?	-	Go to **Step 7**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
6	1. Disconnect the AT inline 20-way connector. 2. Turn ON the ignition, with the engine OFF. 3. Connect a test lamp between the Ignition 1 voltage circuit and the ratio control motor A2 low control circuit. Is the test lamp blinking?	-	Go to **Step 14**	Go to **Step 8**
7	1. Disconnect the AT inline 20-way connector. 2. Turn ON the ignition, with the engine OFF. 3. Connect a test lamp between the Ignition 1 voltage circuit and the ratio control motor A2 low control circuit. Is the test lamp OFF?	-	Go to **Step 10**	Go to **Step 17**
8	Is the test lamp always ON?	-	Go to **Step 9**	Go to **Step 11**

9	Test the ratio control motor A2 low control circuit for a short to ground between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
10	Test the ratio control motor A2 low control circuit for a short to voltage between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
11	Connect a test lamp between the Ignition 1 voltage circuit and a good ground. Is the test lamp always ON?	-	Go to **Step 13**	Go to **Step 12**
12	Test the Ignition 1 voltage circuit for an open between the fuse block - underhood and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	-
13	Test the ratio control motor A2 low control circuit for an open between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 15**
14	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 17**
15	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
16	Replace the leadframe. The leadframe is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 19**	-
	Replace the ratio control motor. The ratio control motor is part of the control solenoid			

17	valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 19**	-
18	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 19**	-
19	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P1884. Has the test run and passed?	-	Go to **Step 20**	Go to **Step 2**
20	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P1885

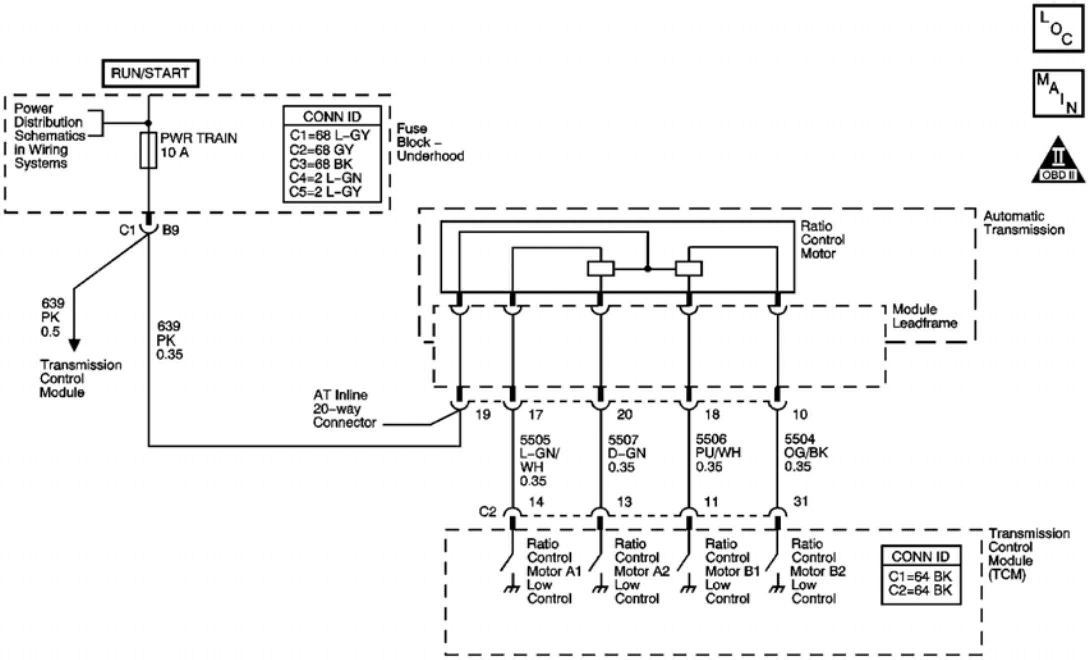


Fig. 12: DTC P1885 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) uses the ratio control motor to control the speed ratio. The ratio control motor is a linear position device, which changes the speed ratio by accurately controlling the position of the variable ratio control valve. Movement of the variable ratio control valve allows fluid to be applied and exhausted from the primary feed limit circuit. The TCM controls the ratio control motor by grounding four control circuits with power being supplied directly from the fuse block - underhood. The TCM monitors the status of the four low control circuits and can detect a short to power or a short to ground/open.

When either of these failures is detected, DTC P1885 sets. DTC P1885 is a type A DTC.

Conditions for Running the DTC

The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting the DTC

The TCM detects an open, a short to ground, or a short to voltage on the ratio control motor B1 control circuit.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM moves the speed ratio towards a target ratio and then freezes ratio changes.

- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P1885 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P1885

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure**			

2	**Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine and idle for 1 minute. Is DTC P1883, P1884, or P1886 also set?	-	Go to **Step 3**	Go to **Step 4**
3	Test the ignition 1 voltage circuit for an open between the fuse block - underhood and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find the condition?	-	Go to **Step 19**	Go to **Step 16**
4	Using the scan tool, select Ratio Ctrl. Mtr. B1 Status. Does the scan tool display OPEN/SHORT TO GND?	-	Go to **Step 6**	Go to **Step 5**
5	Does the scan tool display SHORT TO VOLTS?	-	Go to **Step 7**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
6	1. Disconnect the AT inline 20-way connector. 2. Turn ON the ignition, with the engine OFF. 3. Connect a test lamp between the Ignition 1 voltage circuit and the ratio control motor B1 low control circuit. Is the test lamp blinking?	-	Go to **Step 14**	Go to **Step 8**
7	1. Disconnect the AT inline 20-way connector. 2. Turn ON the ignition, with the engine OFF. 3. Connect a test lamp between the Ignition 1 voltage circuit and the ratio control motor B1 low control circuit. Is the test lamp OFF?	-	Go to **Step 10**	Go to **Step 17**
8	Is the test lamp always ON?	-	Go to **Step 9**	Go to **Step 11**

9	Test the ratio control motor B1 low control circuit for a short to ground between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
10	Test the ratio control motor B1 low control circuit for a short to voltage between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
11	Connect a test lamp between the Ignition 1 voltage circuit and a good ground. Is the test lamp always ON?	-	Go to **Step 13**	Go to **Step 12**
12	Test the Ignition 1 voltage circuit for an open between the fuse block - underhood and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	-
13	Test the ratio control motor B1 low control circuit for an open between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 15**
14	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 17**
15	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
16	Replace the leadframe. The leadframe is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 19**	-
	Replace the ratio control motor. The ratio control motor is part of the control solenoid			

17	valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 19**	-
18	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 19**	-
19	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P1885. Has the test run and passed?	-	Go to **Step 20**	Go to **Step 2**
20	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P1886

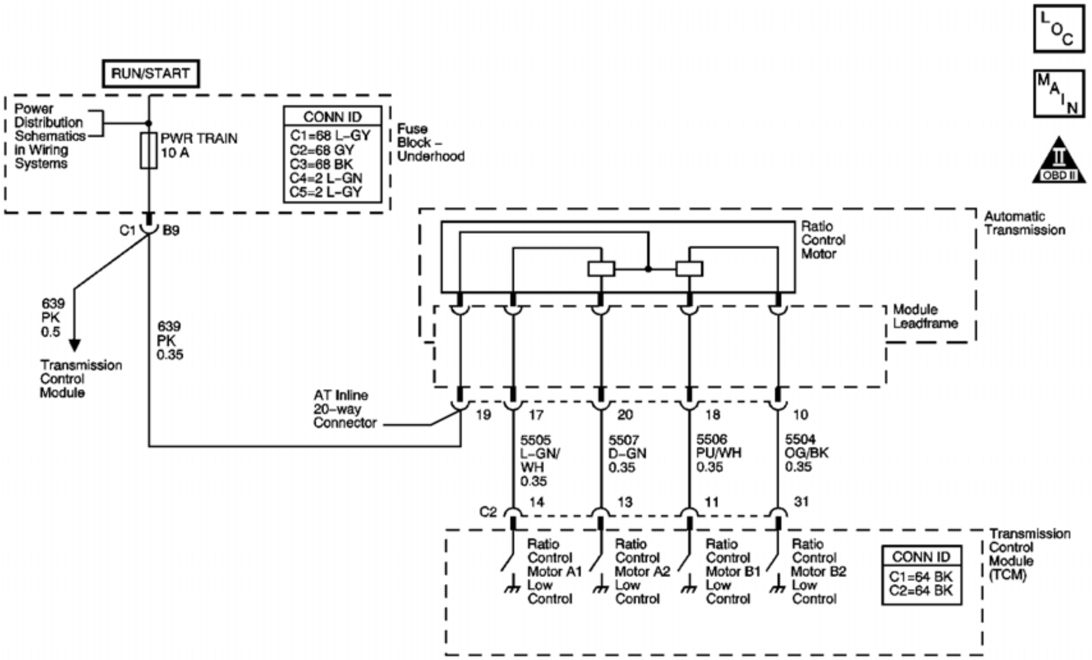


Fig. 13: DTC P1886 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) uses the ratio control motor to control the speed ratio. The ratio control motor is a linear position device, which changes the speed ratio by accurately controlling the position of the variable ratio control valve. Movement of the variable ratio control valve allows fluid to be applied and exhausted from the primary feed limit circuit. The TCM controls the ratio control motor by grounding four control circuits with power being supplied directly from the fuse block - underhood. The TCM monitors the status of the four low control circuits and can detect a short to power or a short to ground/open.

When either of these failures is detected, DTC P1886 sets. DTC P1886 is a type A DTC.

Conditions for Running the DTC

The engine speed is greater than 500 RPM for 5 seconds.

Conditions for Setting the DTC

The TCM detects an open, a short to ground, or a short to voltage on the ratio control motor B2 control circuit.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM moves the speed ratio towards a target ratio and then freezes ratio changes.

- The TCM discontinues use of the closed loop ratio control algorithm. This causes the speed ratio to be defaulted and possibly not accurate. The resulting open loop control may or may not provide optimum ratio performance.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P1886 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P1886

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure**			

2	**Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine and idle for 1 minute. Is DTC P1883, P1884, or P1885 also set?	-	Go to **Step 3**	Go to **Step 4**
3	Test the Ignition 1 voltage circuit for an open between the fuse block - underhood and the inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 16**
4	Using the scan tool, select Ratio Ctrl. Mtr. B2 Status. Does the scan tool display OPEN/SHORT TO GND?	-	Go to **Step 6**	Go to **Step 5**
5	Does the scan tool display SHORT TO VOLTS?	-	Go to **Step 7**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
6	1. Disconnect the AT inline 20-way connector. 2. Turn ON the ignition, with the engine OFF. 3. Connect a test lamp between the Ignition 1 voltage circuit and the ratio control motor B2 low control circuit. Is the test lamp blinking?	-	Go to **Step 14**	Go to **Step 8**
7	1. Disconnect the AT inline 20-way connector. 2. Turn ON the ignition, with the engine OFF. 3. Connect a test lamp between the Ignition 1 voltage circuit and the ratio control motor B2 low control circuit. Is the test lamp OFF?	-	Go to **Step 10**	Go to **Step 17**
8	Is the test lamp always ON?	-	Go to **Step 9**	Go to **Step 11**

9	Test the ratio control motor B2 low control circuit for a short to ground between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
10	Test the ratio control motor B2 low control circuit for a short to voltage between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
11	Connect a test lamp between the Ignition 1 voltage circuit and a good ground. Is the test lamp always ON?	-	Go to **Step 13**	Go to **Step 12**
12	Test the Ignition 1 voltage circuit for an open between the fuse block - underhood and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	-
13	Test the ratio control motor B2 low control circuit for an open between the TCM C2 64-way connector and the AT inline 20-way connector. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 15**
14	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 17**
15	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
16	Replace the leadframe. The leadframe is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 19**	-
	Replace the ratio control motor. The ratio control motor is part of the control solenoid			

17	valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 19**	-
18	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 19**	-
19	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P1886. Has the test run and passed?	-	Go to **Step 20**	Go to **Step 2**
20	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P1888

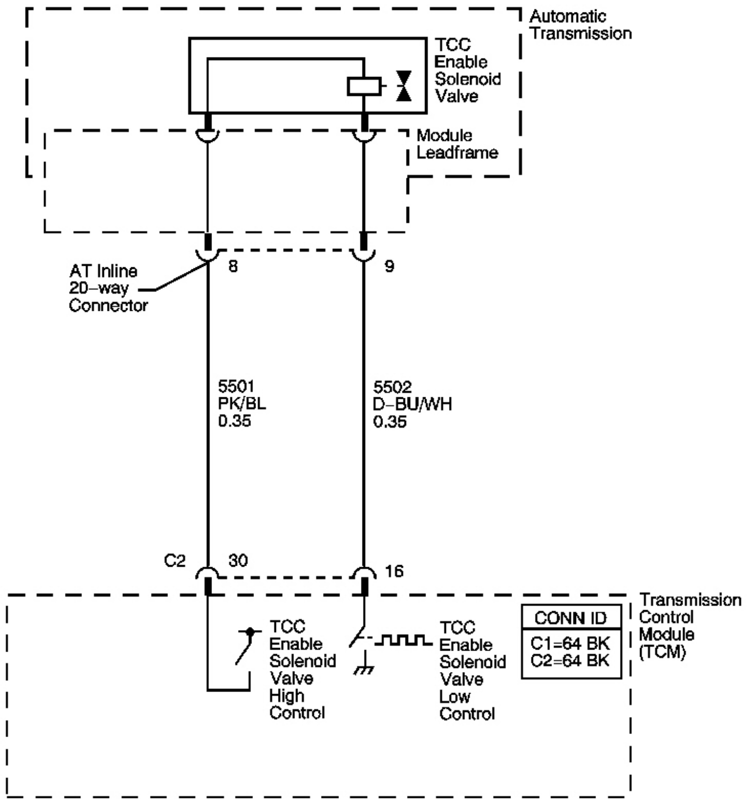


Fig. 14: DTC P1888 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) uses the torque converter clutch (TCC) enable solenoid valve to hydraulically select whether the TCC pressure control solenoid valve will control the fluid pressure to apply the forward and reverse clutches or the fluid pressure to apply the torque converter clutch. The TCC enable solenoid valve is attached to the control valve assembly. The TCM compares engine and transmission inputs to determine if the solenoid should be enabled. The TCM then enables the solenoid by providing a ground. The TCM monitors the status of the low control circuit and can detect a short to power or a short to ground/open.

When the TCM detects an open or short to ground, DTC 1888 sets. DTC P1888 is a type A DTC.

Conditions for Running the DTC

- The engine speed is greater than 500 RPM for 5 seconds.
- The TCC enable solenoid valve high side driver is enabled.
- The TCC enable solenoid valve is disabled.

Conditions for Setting the DTC

The TCM detects an open, or a short to ground for 0.36 seconds

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM limits the commanded speed ratio to 1.6 or less.
- The TCM inhibits TCC engagement.
- The TCM turns the power off to the TCC enable solenoid valve. This results in no TCC engagement.
- The TCM no longer inhibits shifting between REVERSE and DRIVE when moving.
- The TCM commands maximum pressure to the input clutch.
- The TCM freezes garage shift transmission adaptive functions.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P1888 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission-related diagnostic fault occurring.
- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P1888

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-		Go to **Diagnostic System Check - Engine Controls** in

			Go to **Step 2**	Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine and idle for 1 minute. 7. Select Specific DTC. 8. Enter DTC P1888. Does the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
3	1. Turn OFF the ignition. 2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between high control circuit of the TCC enable solenoid valve and a good ground. Does the test lamp illuminate?	-	Go to **Step 4**	Go to **Step 8**
4	Connect a test lamp between battery positive and the low control circuit of the TCC enable solenoid valve. Does the test lamp illuminate?	-	Go to **Step 5**	Go to **Step 6**
5	Test the low control circuit of the TCC enable solenoid valve for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**

6	1. Turn OFF the ignition. 2. Install the AT inline 20-way connector. 3. Disconnect the TCM C2 64-way Connector. 4. Using a digital multimeter (DMM) and the **J-35616** Connector Adapter Test Kit, measure the resistance between the low control circuit and the high control circuit of the TCC enable solenoid valve. Is the resistance measured less than the specified value?	25ohm	Go to **Step 10**	Go to **Step 7**
7	Test the low control circuit of the TCC enable solenoid valve for an open. Refer to **Testing for Continuity** and**Wiring Repairs** in Wiring Systems. Did you find the condition?	-	Go to **Step 13**	Go to **Step 9**
8	Test the high control circuit of the TCC enable solenoid valve for an open or short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
9	Inspect for faulty connections at the transmission. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 11**
10	Inspect for faulty connections at the TCM. Refer to **Circuit Testing** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
11	Replace the TCC enable solenoid valve. The TCC enable solenoid valve is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 13**	-
12	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
	Perform the following procedure in order to verify the repair: 1. Select DTC.			

13	2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P1888. Has the test run and passed?	-	Go to **Step 14**	Go to **Step 2**
14	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK

DTC P1889

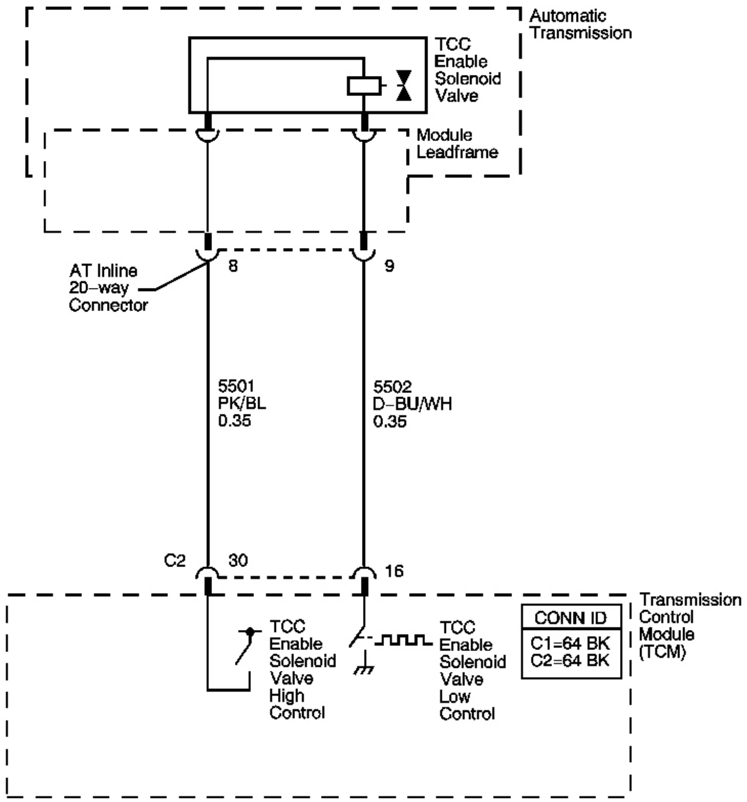


Fig. 15: DTC P1889 Schematics
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The transmission control module (TCM) uses the torque converter clutch (TCC) enable solenoid valve to hydraulically select whether the TCC pressure control solenoid valve will control the fluid pressure to apply the forward and reverse clutches or the fluid pressure to apply the torque converter clutch. The TCC enable solenoid valve is attached to the control valve assembly. The TCM compares engine and transmission inputs to determine if the solenoid should be enabled. The TCM then enables the solenoid by providing a ground. The TCM monitors the status of the low control circuit and can detect a short to power or a short to ground/open.

When the TCM detects a short to voltage, DTC P1889 sets. DTC P1889 is a type A DTC.

Conditions for Running the DTC

- The engine speed is greater than 500 RPM for 5 seconds.
- The TCC enable solenoid valve high side driver is enabled.
- The TCC enable solenoid valve is enabled

Conditions for Setting the DTC

The TCM detects a short to voltage for 0.1 seconds.

Action Taken When the DTC Sets

- The TCM requests the ECM to illuminate the malfunction indicator lamp (MIL).
- The TCM limits the commanded speed ratio to 1.6 or less.
- The TCM inhibits TCC engagement.
- The TCM turns the power off to the TCC enable solenoid valve. This results in no TCC engagement.
- The TCM freezes torque converter clutch (TCC) transmission adaptive functions.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The TCM records the operating conditions when the Conditions for Setting the DTC are met. The TCM stores this information as Failure Records.
- The TCM stores DTC P1889 in TCM history.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL after the third consecutive drive trip in which the TCM does not send a MIL illumination request.
- A scan tool can clear the MIL/DTC.
- The TCM clears the DTC from TCM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.

- The TCM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the TCM.

Diagnostic Aids

- Inspect the connectors at the TCM, the transmission, and all other circuit connecting points for an intermittent condition. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.
- Inspect the circuit wiring for an intermittent condition. Refer to **Testing for Electrical Intermittents** in Wiring Systems.

DTC P1889

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls** in Engine Controls - 2.2L (L61)
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. **IMPORTANT:** • **Before clearing the DTC, use the scan tool in order to record the Failure Records. Using the Clear DTC Info function erases the Failure Records from the TCM.** • **Using the Clear DTC Info function erases stored DTCs in both the ECM and TCM.** 3. Record the DTC Failure Records. 4. Clear the DTC. 5. Turn OFF the ignition for 30 seconds. 6. Start the engine and drive the vehicle for about 30 m (98 ft). 7. Select Specific DTC. 8. Enter DTC P1889. Does the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions** in Engine Controls - 2.2L (L61)
	1. Turn OFF the ignition.			

3	2. Disconnect the AT inline 20-way connector. Additional DTCs may set. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between low control circuit of the TCC enable solenoid valve and a good ground. Does the test lamp illuminate?	-	Go to **Step 4**	Go to **Step 5**
4	Test the low control circuit of the TCC enable solenoid valve for a short to voltage. Refer to **Testing for a Short to Voltage** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 7**	Go to **Step 6**
5	Replace the TCC enable solenoid valve. The TCC enable solenoid valve is part of the control solenoid valve assembly. Refer to **Control Valve Body Assembly Disassemble** . Did you complete the replacement?	-	Go to **Step 7**	-
6	Replace the TCM. Refer to **Transmission Control Module (TCM) Replacement** . Did you complete the replacement?	-	Go to **Step 7**	-
7	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Select specific DTC. 5. Enter DTC P1889. Has the test run and passed?	-	Go to **Step 8**	Go to **Step 2**
8	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTC's that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List** in Engine Controls - 2.2L (L61)	System OK