SPECIFICATIONS

TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR SPECIFICATIONS

Transmission Fluid Temperature (TFT) Sensor Specifications

Temperature	Temperature	Minimum Resistance	Nominal Resistance	Maximum Resistance	Signal
°F	°C	ohm	ohm	ohm	Volts
-40	-40	90636	100707	110778	5.00
-22	-30	47416	52684	57952	4.78
-4	-20	25809	28677	31545	4.34
14	-10	14558	16176	17794	3.89
32	0	8481	9423	10365	3.45
50	10	5104	5671	6238	3.01
68	20	3164	3515	3867	2.56
86	30	2013	2237	2461	1.80
104	40	1313	1459	1605	1.10
122	50	876	973	1070	3.25
140	60	600	667	734	2.88
158	70	420	467	514	2.56
176	80	299	332	365	2.24
194	90	217	241	265	1.70
212	100	159	177	195	1.42
230	110	119	132	145	1.15
248	120	89.9	99.9	109.9	0.87
266	130	69.1	76.8	84.5	0.60
284	140	53.8	59.8	65.8	0.32
302	150	42.5	47.2	51.9	0.00

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accumulator Cover to Case Bolt	8.0-14.0 N.m	6-10 lb ft
Case Extension to Case Bolt	42.0-48.0 N.m	31-35 lb ft
Case Extension to Case Bolt (4WD Shipping)	11.2-22.6 N.m	8.3-16.7 lb ft

cardiagn.com

Converter Cover Bolt	10 N.m	89 lb in
Converter Housing to Case Screw	65.0-75.0 N.m	48-55 lb ft
Cooler Pipe Connector	35.0-41.0 N.m	26-30 lb ft
Detent Spring to Valve Body Bolt	20.0-27.0 N.m	15-20 lb ft
Differential to Transmission Bolts and Nuts	50 N.m	37 lb ft
Driveline Support Assembly to Engine Flywheel Housing Bolts	50 N.m	37 lb ft
Driveline Support Assembly Front Plug Bolts	50 N.m	37 lb ft
Floorshift Control Bolt	10 N.m	89 lb in
Flywheel to Torque Converter Bolt	63 N.m	46 lb ft
Forward Accumulator Cover to Valve Body Bolt	8.0-14.0 N.m	6-10 lb ft
Heat Shield to Transmission Bolt	17 N.m	13 lb ft
Line Pressure Plug	8.0-14.0 N.m	6-10 lb ft
Manual Shaft to Inside Detent Lever Nut	27.0-34.0 N.m	20-25 lb ft
Negative Battery Cable Bolt	15 N.m	11 lb ft
Oil Level Indicator Bolt	47 N.m	35 lb ft
Oil Pan to Transmission Case Bolt	11 N.m	97 lb in
Oil Passage Cover to Case Bolt	8-14.0 N.m	6-10 lb ft
Park Brake Bracket to Case Bolt	27.0-34.0 N.m	20-25 lb ft
Park/Neutral Position Switch Mounting Bolts	27 N.m	20 lb ft
Park/Neutral Position Switch Screw	3 N.m	27 lb in
Plate to Case Bolt (Shipping)	27.0-34.0 N.m	20-25 lb ft
Plate to Converter Bolt (Shipping)	27.0-34.0 N.m	20-25 lb ft
Plug Assembly, Automatic Transmission Oil Pan (C/K-truck)	30-40 N.m	22.1-29.5 lb ft
Plug Assembly, Automatic Transmission Oil Pan (Y-car)	28-32 N.m	20.7-23.6 lb ft
Pressure Control Solenoid Bracket to Valve Body Bolt	8.0-14.0 N.m	6-10 lb ft
Propeller Input Shaft Front Bearing Positioning Bolts	35 N.m	26 lb ft
Propeller Shaft Hub Clamp Bolt	130 N.m	96 lb ft
Pump Assembly to Case Bolt	26.0-32.0 N.m	19-24 lb ft
Pump Cover to Pump Body Bolt	20.0-27.0 N.m	15-20 lb ft
Rear Shock Absorber Lower Mounting Bolt	220 N.m	162 lb ft
Shift Cable Grommet Screw	1.7 N.m	15 lb in

cardiagn.com

Shift Control Cable Attachment	20 N.m	15 lb ft
Spacer Plate Support Retaining Bolts	11 N.m	97 lb in
Speed Sensor Retainer Bolt	10.5-13.5 N.m	7.7-10 lb ft
Stud, Automatic Transmission Case Extension (Y-car)	18.0-22.0 N.m	13-16 lb ft
TCC Solenoid Assembly to Case Bolt	8.0-14.0 N.m	6-10 lb ft
Transaxle Mount Bracket to Differential Bolts	50 N.m	37 lb ft
Transmission to Driveline Support Assembly Bolts/Studs	50 N.m	37 lb ft
Transmission to Engine Bolt	47 N.m	35 lb ft
Transmission Fluid Check/Fill Plug	30 N.m	22 lb ft
Transmission Fluid Pressure Manual Valve Position Switch to Valve Body Bolt	8.0-14.0 N.m	6-10 lb ft
Transmission Mount to Transmission Bolt	50 N.m	37 lb ft
Transmission Mount Retaining Nut	40 N.m	30 lb ft
Transmission Oil Cooler Pipe Fitting	35.0-41.0 N.m	26-30 lb ft
Transmission Oil Cooler Rear Pipes to Junction Fittings at Engine Flywheel Housing	27 N.m	20 lb ft
Transmission Oil Pan to Case Bolt	9.5-13.8 N.m	7-10 lb ft
Transmission Range Selector Lever Nut	20 N.m	15 lb ft
Transmission Shift Cable Bracket Retaining Nuts	20 N.m	15 lb ft
Transmission Wiring Harness to LH Side of Transmission Case Retaining Bolt	2.5 N.m	22 lb in
Valve Body to Case Bolt	8.0-14.0 N.m	6-10 lb ft

TRANSMISSION GENERAL SPECIFICATIONS

Transmission General Specifications (4L60-E)

Name	Hydra-matic 4L60-E
RPO Codes	M30
Production Location	Toledo, Ohio
Vehicle Platform (Engine/Transmission) Usage	Y
Transmission Drive	Longitudinally-Mounted Rear Wheel Drive
1st Gear Ratio	3.059:1
2nd Gear Ratio	1.625:1
3rd Gear Ratio	1.000:1
4th Gear Ratio	0.696:1
Reverse	2.294:1
Torque Converter Size (Diameter of Torque Converter Turbine)	298 mm

cardiagn.com

Pressure Taps	Line Pressure
Transmission Fluid Type	DEXRON(R) III
Transmission Fluid Capacity (Approximate)	298 mm Converter Dry: 11.25 l (11.9 qt)
Transmission Type: 4	Four Forward Gears
Transmission Type: L	Longitudinal Mount
Transmission Type: 60	Product Series
Transmission Type: E	Electronic Controls
Position Quadrant	P, R, N, Overdrive (Circle D), D, 2, 1 P, R, N, Overdrive (Circle D), 3, 2, 1
Case Material	Die Cast Aluminum
Transmission Weight Dry (Approximate)	298 mm Converter 70.5 kg (155.70 lb)
Transmission Weight Wet (Approximate)	298 mm Converter 80.5 kg (176.16 lb)

FLUID CAPACITY SPECIFICATIONS

Fluid Capacity Specifications

Application	Liters	Quarts
Oil Pan Removal	4.7	5
Overhaul	10.2	10.8

TORQUE CONVERTER END PLAY SPECIFICATIONS

Torque Converter End Play Check

Torque Converter Size	Specification
245 mm (9.65 in)	0.0-0.38 mm (0.0-0.015 in)
258 mm (10.16 in)	0.1-0.50 mm (0.004-0.020 in)
298 mm (11.73 in)	0.1-0.48 mm (0.004-0.019 in)
300 mm (11.81 in)	0.1-0.5 mm (0.004-0.020 in)

RANGE REFERENCE

Range Reference Table

Range	Park	Reverse	Neutral	OD				D			2	
Gear	-	-	-	1st	2nd	3rd	4th	1st	2nd	3rd	1st**	2nd
1-2 Shift Solenoid	ON*	ON*	ON*	ON	OFF	OFF	ON	ON	OFF	OFF	ON	OFF
2-3 Shift Solenoid	ON*	ON*	ON*	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON
2-4 Band	-	-	-	-	A	-	A	-	A	-	-	A

cardiagn.com

Reverse Input Clutch	-	A	-	-	-	-	-	-	-	-	-	-
Overrun Clutch	-	-	-	-	-	-	-	-	-	A	A	A
Forward Clutch	-	-	-	A	A	A	A	A	A	A	A	A
Forward Sprag Clutch Assembly	-	-	-	H	H	H	-	H	H	H	H	H
3-4 Clutch	-	-	-	-	-	A	A	-	-	A	-	-
Lo/Roller Clutch	-	-	-	H	-	-	-	H	-	-	H	-
Lo/Rev Clutch	A	A	-	-	-	-	-	-	-	-	-	-

- A = Applied
- H = Holding
- ON = The solenoid is energized.
- OFF = The solenoid is de-energized.
- *Shift Solenoid state is a function of vehicle speed and may change if the vehicle speed increases sufficie Reverse or Neutral. However, this does not affect the operation of the transmission.
- **Manual Second-First gear is electronically prevented under normal operating conditions.
- ***Manual First-Second gear is only available above approximately 48-56 km/h (30-35 mph).

SHIFT SOLENOID VALVE STATE AND GEAR RATIO

Shift Solenoid Valve State and Gear Ratio 4L60-E

Gear	1-2 Shift Solenoid	2-3 Shift Solenoid	Gear Ratio
1	ON	ON	3.059:1
2	OFF	ON	1.625:1
3	OFF	OFF	1.000:1
4	ON	OFF	0.696:1

SHIFT SPEED

Shift Speed

	1-2 Upshift @ +/-	2-3 Upshift @ +/-		1-2 Upshift @ Wide Open Throttle	(

cardiagn.com

-			250 RPM Output Shaft Speed			250 RPM Output Shaft Speed			3-4 Upshift @ +/- 250 RPM Output Shaft Speed			+/- 250 RPM, Output Shaft Speed
% of TPS			12	25	50	12	25	50	12	25	50	100
Trans Cal	Body	Axle	-			-			-			-
A	Y	2.73	459	636	1130	812	1165	2083	1165	1765	N/A	1960
B	Y	3.15	490	612	1142	857	1102	2081	1183	1673	4406	1962

TRANSMISSION FLUID PRESSURE (TFP) MANUAL VALVE POSITION SWITCH LOGIC

TFP Manual Valve Position Switch Logic

Gear Selector Position	Signal A	Signal B	Signal C
Park/Neutral	HI	LOW	HI
Reverse	LOW	LOW	HI
Drive 4	HI	LOW	LOW
Drive 3	HI	HI	LOW
Drive 2	HI	HI	HI
Drive 1	LOW	HI	HI
Invalid	LOW	HI	LOW
	LOW	LOW	LOW

- HI = Ignition voltage
- LOW = 0 voltage

TRANSMISSION RANGE SWITCH LOGIC

Transmission Range Switch Logic

Gear Selector Position	Signal A	Signal B	Signal C	Signal P
Park (P)	LOW	HI	HI	LOW
Reverse (R)	LOW	LOW	HI	HI
Neutral (N)	HI	LOW	HI	LOW
Drive 4 (OD)	HI	LOW	LOW	HI
Drive 3 (3)	LOW	LOW	LOW	LOW
Drive 2 (2)	LOW	HI	LOW	HI
Drive 1 (1)	HI	HI	LOW	LOW

HI = Ignition voltage
LOW = 0 volts

LINE PRESSURE

cardiagn.com

Line Pressure

Pressure Control Solenoid Current (Amp)	Approximate Line Pressure (PSI)
0.00	198-227
0.10	197-226
0.20	189-221
0.30	181-216
0.40	168-205
0.50	154-193
0.60	137-175
0.70	114-156
0.80	90-132
0.90	64-105
1.00	53-85
1.10	53-68

COMPONENT RESISTANCE

Component Resistance

Component	Pass/Thru Pins	Resistance at 20° C (68°F)	Resistance at 100° C (212°F)	Resistance to Ground (Case)
1-2 Shift Solenoid Valve	A, E	19-24 ohm	24-31 ohm	Greater than 250 K ohm
2-3 Shift Solenoid Valve	B, E	19-24 ohm	24-31 ohm	Greater than 250 K ohm
TCC Solenoid Valve	T, E	21-26 ohm	26-33 ohm	Greater than 250 K ohm
TCC PWM Solenoid Valve	U, E	10-11 ohm	13-15 ohm	Greater than 250 K ohm
3-2 Shift Solenoid Valve Assembly	S, E	20-24 ohm	29-32 ohm	Greater than 250 K ohm
Pressure Control Solenoid Valve	C, D	3-5 ohm	4-7 ohm	Greater than 250 K ohm
*Transmission Fluid Temperature (TFT) Sensor	M, L	3088-3942 ohm	159.3-198.0 ohm	Greater than 10 M ohm
Vehicle Speed Sensor	A, B VSS CONN	1420 ohm @ 25° C	2140 ohm @ 150° C	Greater than 10 M ohm

IMPORTANT:

The resistance of this device is necessarily temperature dependent and will therefore vary far more than any other device. Refer to Transmission Fluid Temperature (TFT) Sensor Specifications .

SCHEMATIC AND ROUTING DIAGRAMS

AUTOMATIC TRANSMISSION CONTROLS SCHEMATICS

cardiagn.com

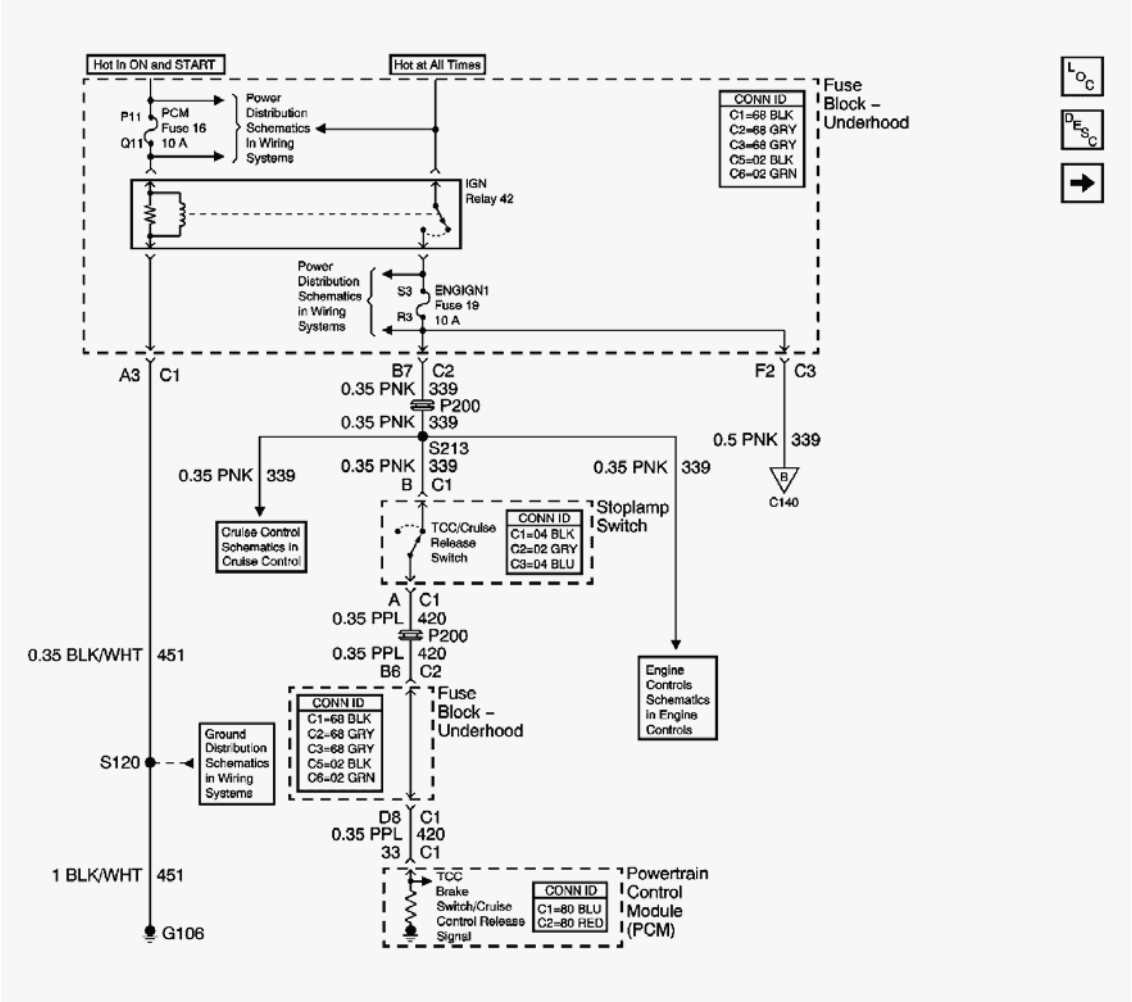


Fig. 1: Torque Convertor Clutch (TCC) Control Switch Schematics
Courtesy of GENERAL MOTORS CORP.

cardiagn.com

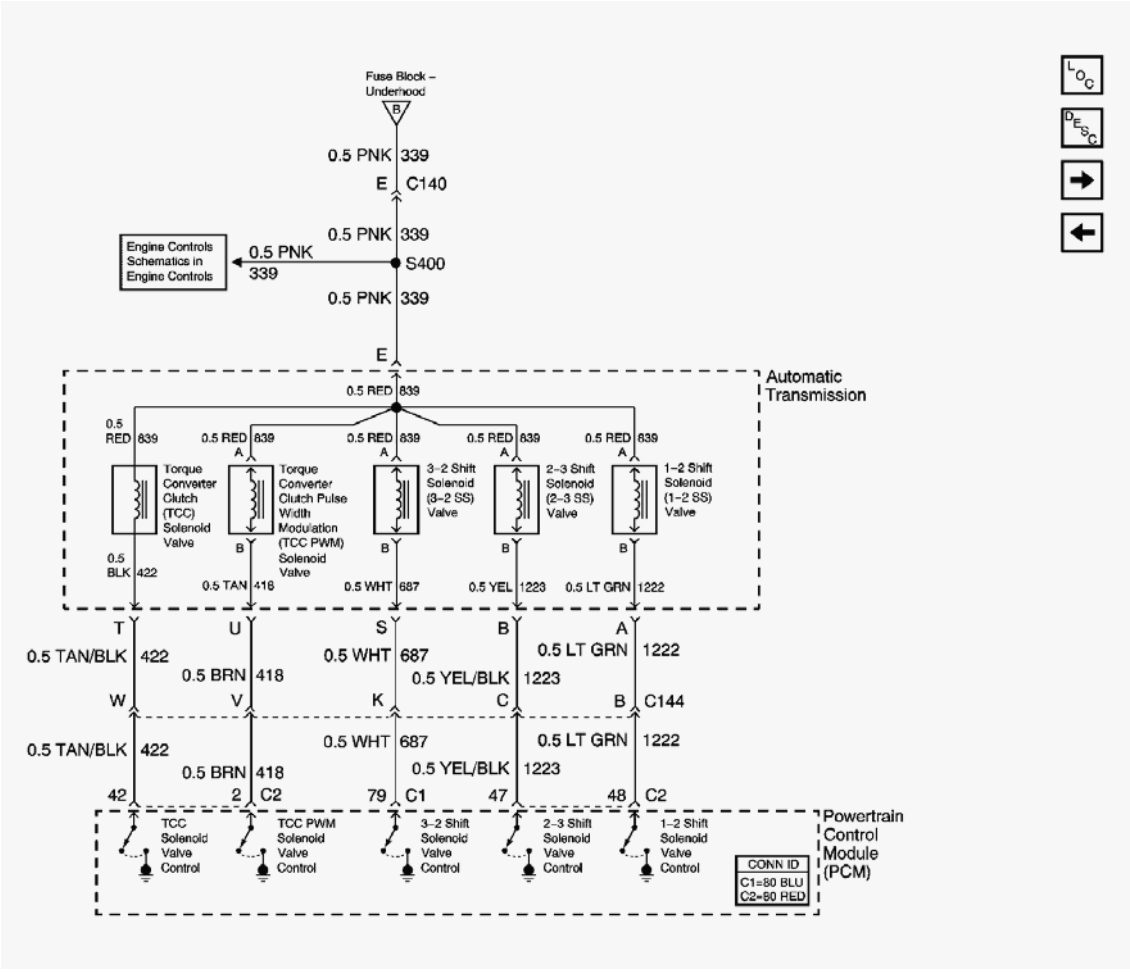


Fig. 2: Transmission Valve Controls Schematics
Courtesy of GENERAL MOTORS CORP.

cardiagn.com

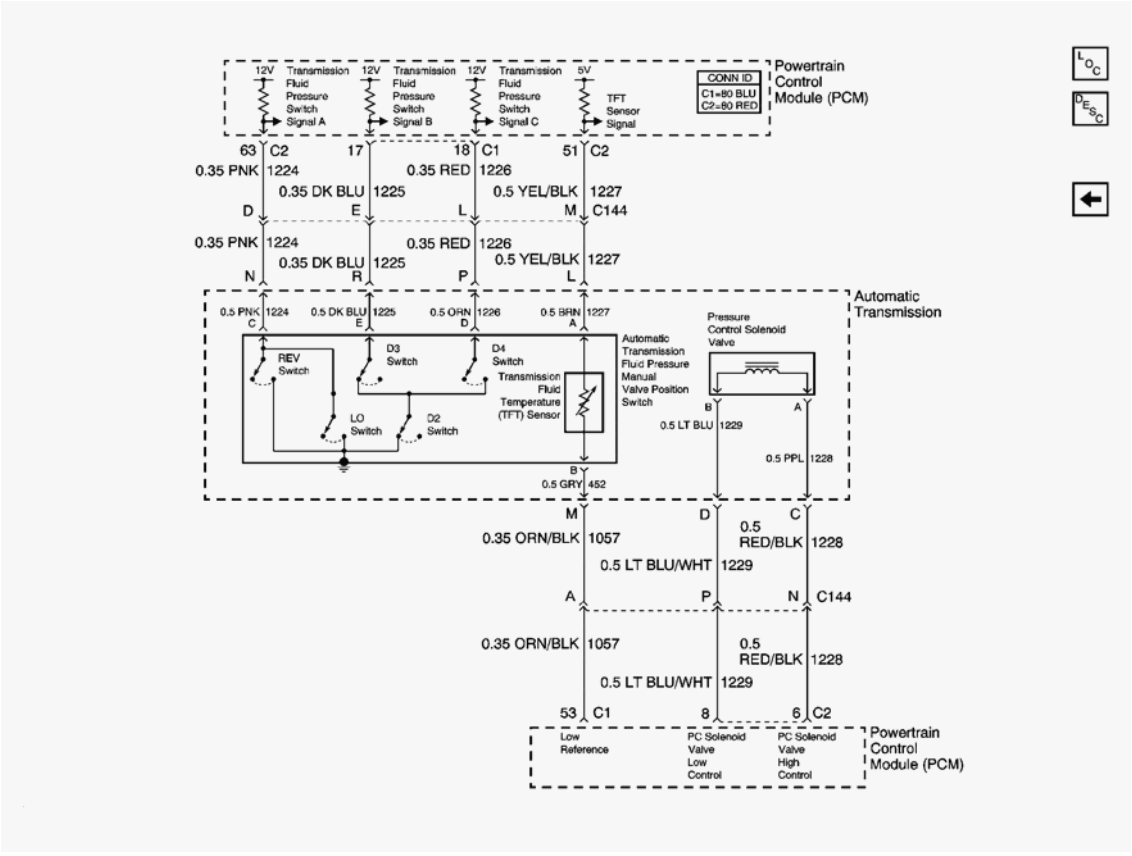


Fig. 3: Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch And Pressure Control Solenoid (PC SOL) Valve Schematics
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

AUTOMATIC TRANSMISSION ELECTRONIC COMPONENT VIEWS

cardiagn.com

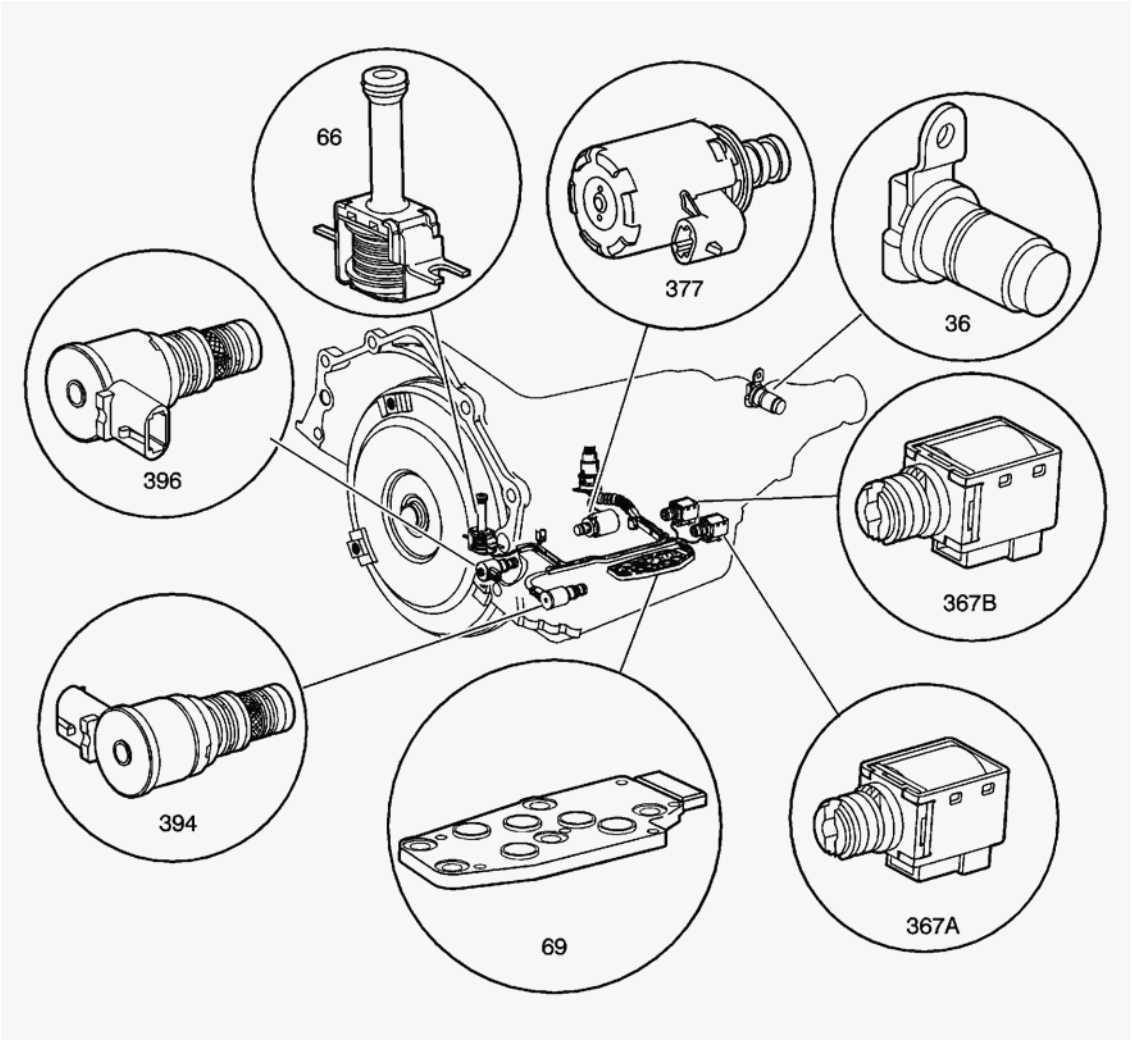


Fig. 4: Electronic Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
36	Vehicle Speed Sensor (VSS)
66	Torque Converter Clutch (TCC) Solenoid Valve
69	Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch
367a	1-2 Shift Solenoid (SS) Valve
367b	2-3 Shift Solenoid (SS) Valve
377	Pressure Control (PC) Solenoid Valve
394	3-2 Shift Solenoid (SS) Valve Assembly
396	Torque Converter Clutch Pulse Width Modulation (TCC PWM) Solenoid Valve

cardiagn.com

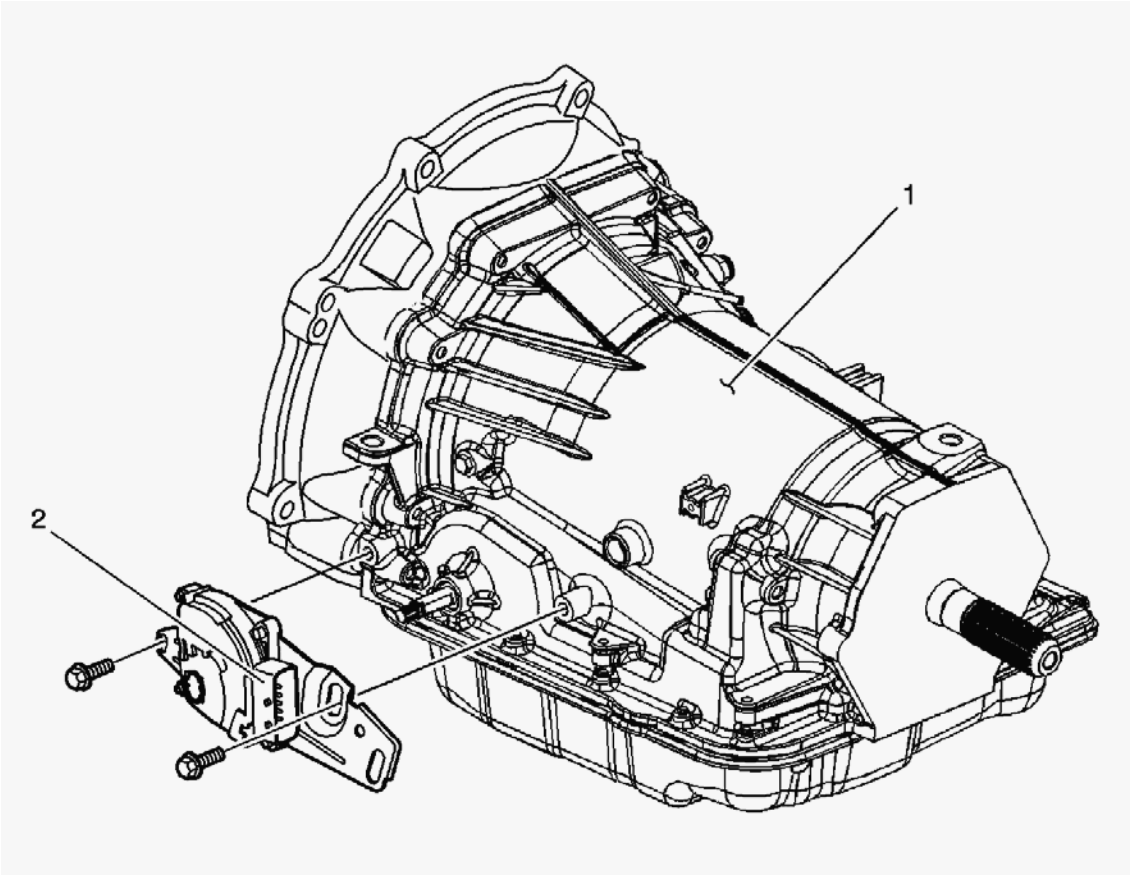


Fig. 5: Park Neutral Position (PNP) Switch
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Automatic Transmission 4L60-E
2	PNP Switch

cardiagn.com

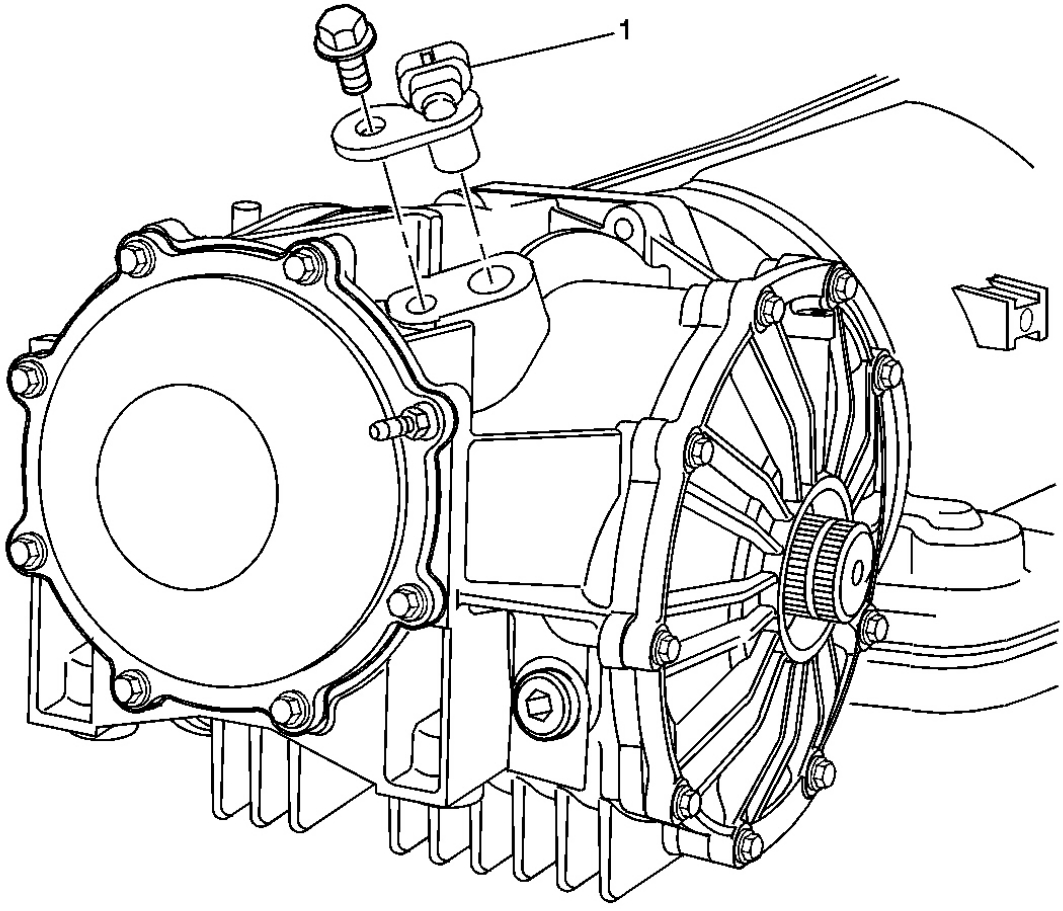


Fig. 6: Vehicle Speed Sensor (VSS)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
1	VSS Sensor

DISASSEMBLED VIEWS

cardiagn.com

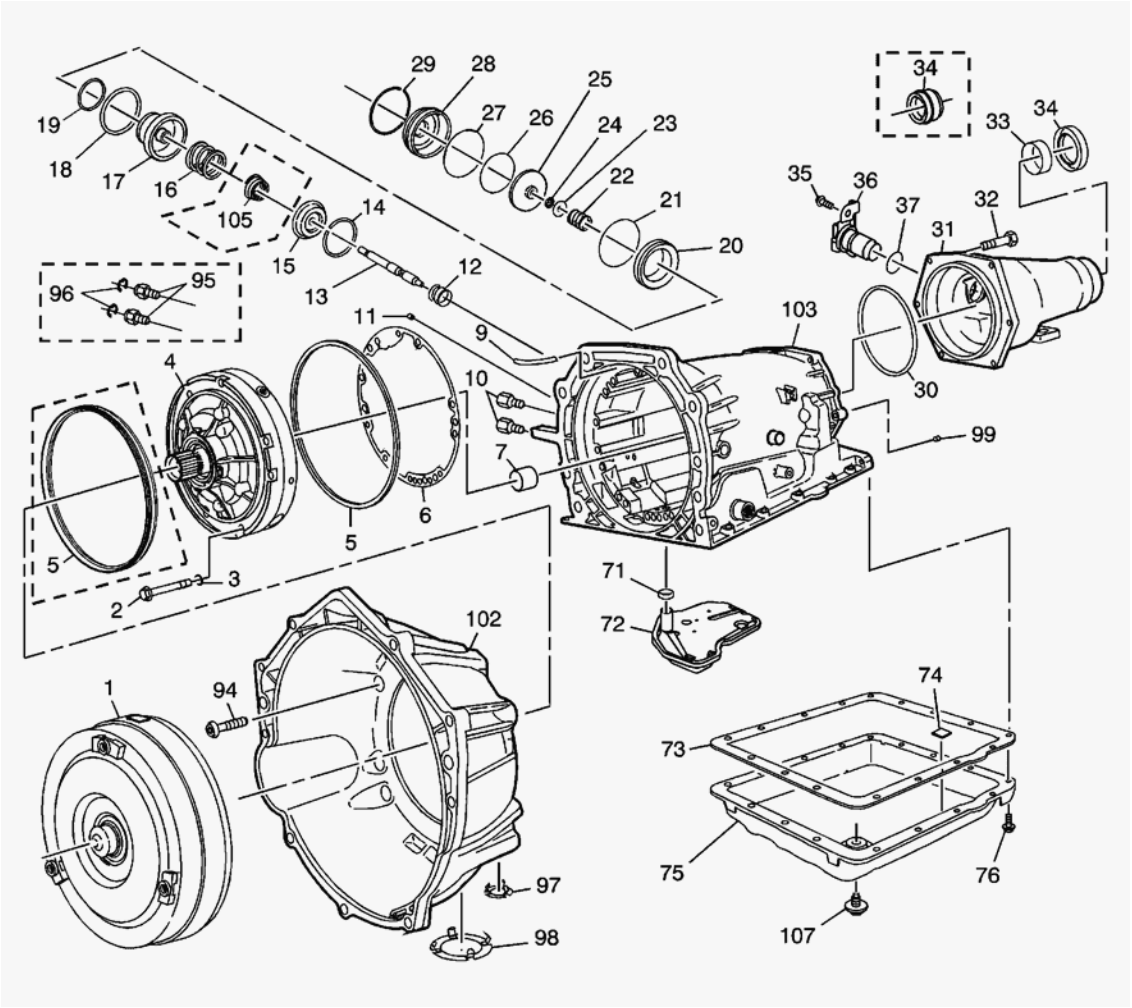


Fig. 7: Case And Associated Parts (1 Of 2)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 7

Callout	Component Name
1	Torque Converter Assembly - Model Dependent On Size
2	Pump to Case Bolt
3	Pump to Case Bolt O-Ring
4	Oil Pump Assembly
5	A/T Fluid Pump Seal - Pump to Case - Model Dependent
5	A/T Fluid Pump Seal - Pump to Case - Model Dependent
6	Pump Cover to Case Gasket
7	Case Bushing
9	Transmission Vent Assembly
10	Oil Cooler Pipe Connector - Model Dependent
11	Case Servo Plug
12	Servo Return Spring

cardiagn.com

13	2nd Apply Piston Pin
14	Retainer Ring - 2nd Apply Piston
15	Servo Cushion Spring Retainer
16	Servo Cushion Spring - Outer
17	2nd Apply Piston
18	Oil Seal Ring - 2nd Apply Piston - Outer
19	Oil Seal Ring - 2nd Apply Piston - Inner
20	Servo Piston Housing - Inner
21	O-Ring Seal
22	Servo Apply Pin Spring
23	Servo Apply Pin Washer
24	Retainer Ring - Apply Pin
25	4th Apply Piston
26	Oil Seal Ring - 4th Apply Piston - Outer
27	O-Ring Seal - 2-4 Servo Cover
28	2-4 Servo Cover
29	Servo Cover Retaining Ring
30	Case Extension to Case Seal
31	Case Extension - Model Dependent
32	Case Extension to Case Bolt
33	Case Extension Bushing
34	Case Extension Oil Seal Assembly - Model Dependent
34	Case Extension Oil Seal Assembly - Model Dependent
35	Speed Sensor Retaining Bolt
36	Internal Transmission Speed Sensor
37	O-Ring Seal - ITSS to Case Extension
71	Filter Seal
72	Transmission Oil Filter Assembly - Model Dependent
73	Transmission Oil Pan Gasket
74	Chip Collector Magnet
75	Transmission Oil Pan - Model Dependent
76	Transmission Oil Pan Screw
94	Converter Housing to Case Bolt
95	Oil Cooler Quick Connector - Model Dependent
96	Oil Cooler Quick Connect Clip - Model Dependent
97	Converter Housing Access Hole Plug - Model Dependent
98	Converter Bolt Inspection Plate - Model Dependent
99	Cup D4 Orifice Plug
102	Converter Housing - Model Dependent
103	Main Section Case - Model Dependent
105	Servo Cushion Spring - Inner - Model Dependent

cardiagn.com

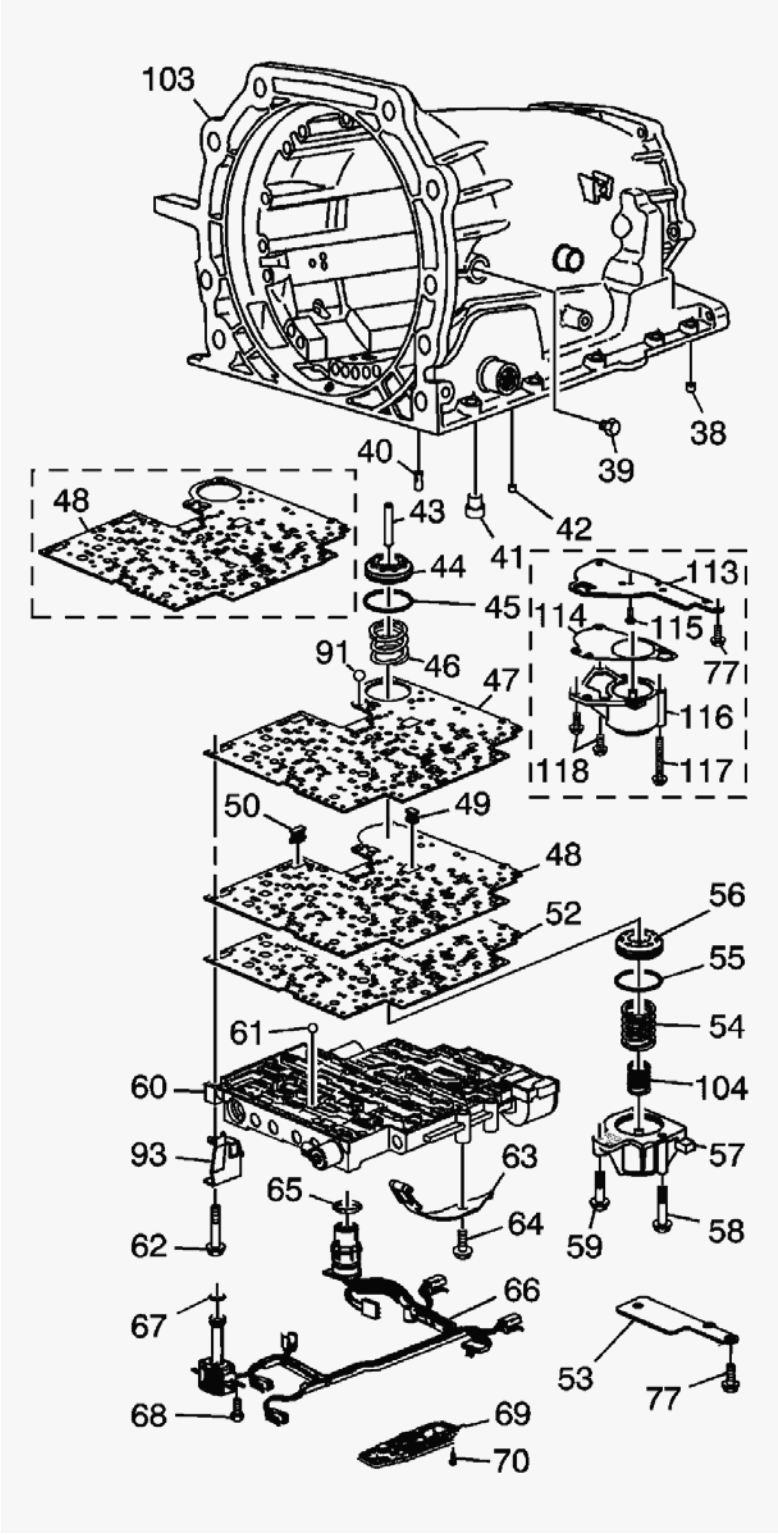


Fig. 8: Case And Associated Parts (2 Of 2) - M30/M32
Courtesy of GENERAL MOTORS CORP.

cardiagn.com

Callouts For Fig. 8

Callout	Component Name
38	Transmission Case Plug - Accumulator Bleed
39	Pressure Plug
40	Third Accumulator (#7) Retainer and Ball Assembly
41	Band Anchor Pin
42	Retainer and Ball Assembly - Double Orifice (#10)
43	Accumulator Piston Pin
44	3-4 Accumulator Piston
45	Oil Seal Ring - 3-4 Accumulator Piston
46	3-4 Accumulator Spring - Model Dependent
47	Spacer Plate to Case Gasket
48	Valve Body Spacer Plate
48	Valve Body Spacer Plate
49	Shift Solenoids Screen
50	Pressure Control Solenoid Screen
52	Spacer Plate to Valve Body Gasket
53	Spacer Plate Support Plate
54	1-2 Accumulator Spring - Outer
55	Oil Seal Ring - 1-2 Accumulator
56	1-2 Accumulator Piston
57	1-2 Accumulator Cover and Pin Assembly - Model Dependent
58	Accumulator Cover Bolt
59	Accumulator Cover Bolt
60	Control Body Valve Assembly - Model Dependent
61	Checkball (#2, 3, 4, 5, 6, 8, 12)
62	Valve Body Bolt
63	Manual Detent Spring Assembly
64	Manual Detent Spring Bolt
65	Wiring Harness Pass-Through Connector O-Ring Seal
66	Wiring Harness Solenoid Assembly - Model Dependent
67	O-Ring Seal - Solenoid
68	Hex Washer Head Bolt - Solenoid
69	Transmission Fluid Pressure Manual Valve Position Switch Assembly
70	Pressure Switch Assembly Bolt
77	Spacer Plate Support Bolt
77	Spacer Plate Support Bolt
91	Number 1 Checkball
93	Dipstick Stop Bracket - Model Dependent
103	Main Section Case - Model Dependent
104	1-2 Accumulator Spring - Inner

cardiagn.com

113	Spacer Plate Support Plate - Colorado/Canyon
114	Accumulator Gasket - Colorado/Canyon
115	Accumulator Bolt - Colorado/Canyon
116	Accumulator Cover - Colorado/Canyon
117	Accumulator Bolt - Colorado/Canyon
118	Accumulator Bolt - Colorado/Canyon

cardiagn.com

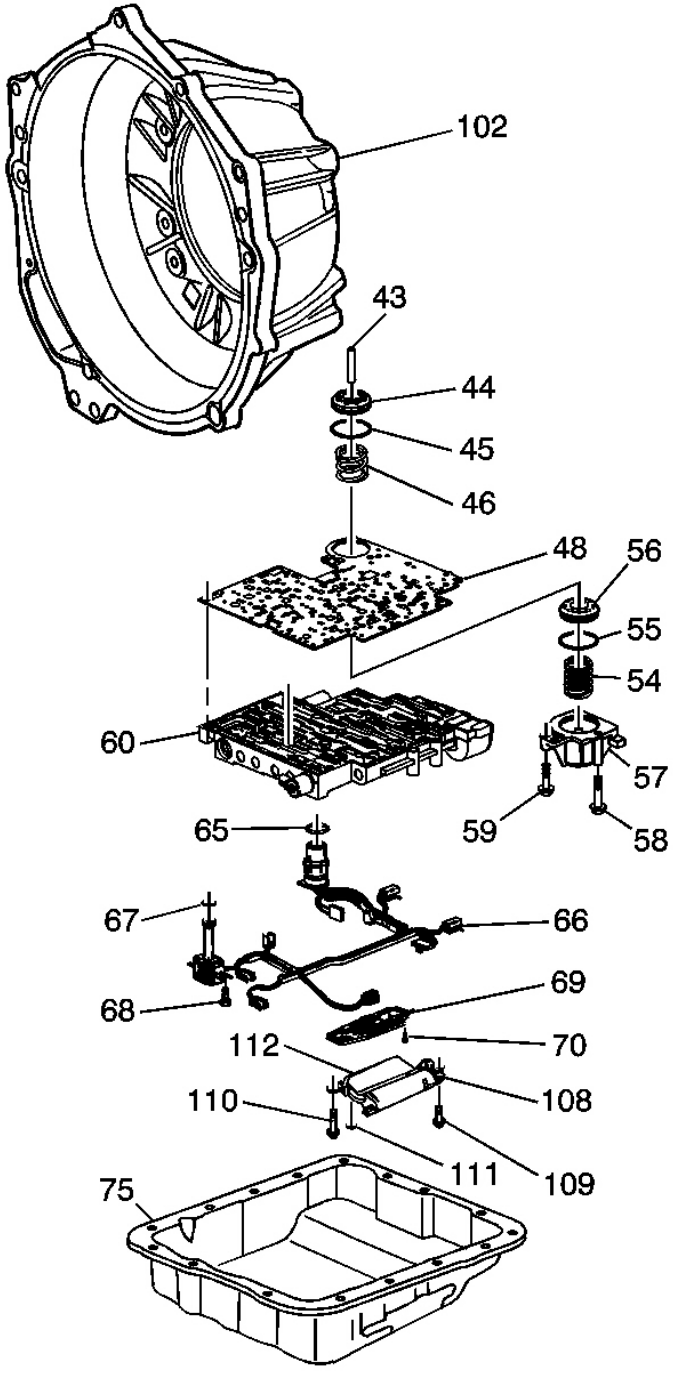


Fig. 9: Case And Associated Parts (2 Of 2) - M33 Only
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 9

cardiagn.com

Callout	Component Name
43	Accumulator Piston Pin
44	3-4 Accumulator Piston
45	Oil Seal Ring - 3-4 Accumulator Piston
46	3-4 Accumulator Spring - Model Dependent
48	Valve Body Spacer Plate with Bonded Gasket
54	1-2 Accumulator Spring - Outer
55	Oil Seal Ring - 1-2 Accumulator
56	1-2 Accumulator Piston
57	1-2 Accumulator Cover and Pin Assembly
58	Accumulator Cover Bolt
59	Accumulator Cover Bolt
60	Control Body Valve Assembly - Model Dependent
65	Wiring Harness Pass-through Connector O-Ring Seal
66	Wiring Harness Solenoid Assembly - Model Dependent
67	O-Ring Seal - Solenoid
68	Hex Washer Head Bolt - Solenoid
69	Transmission Fluid Pressure Manual Valve Position Switch Assembly
70	Pressure Switch Assembly Bolt
75	Transmission Oil Pan
102	Converter Housing
108	Secondary Fluid Pump Assembly
109	Secondary Fluid Pump Bolts
110	Secondary Fluid Pump Bolt
111	Filter Retainer
112	Secondary Fluid Pump Filter

cardiagn.com

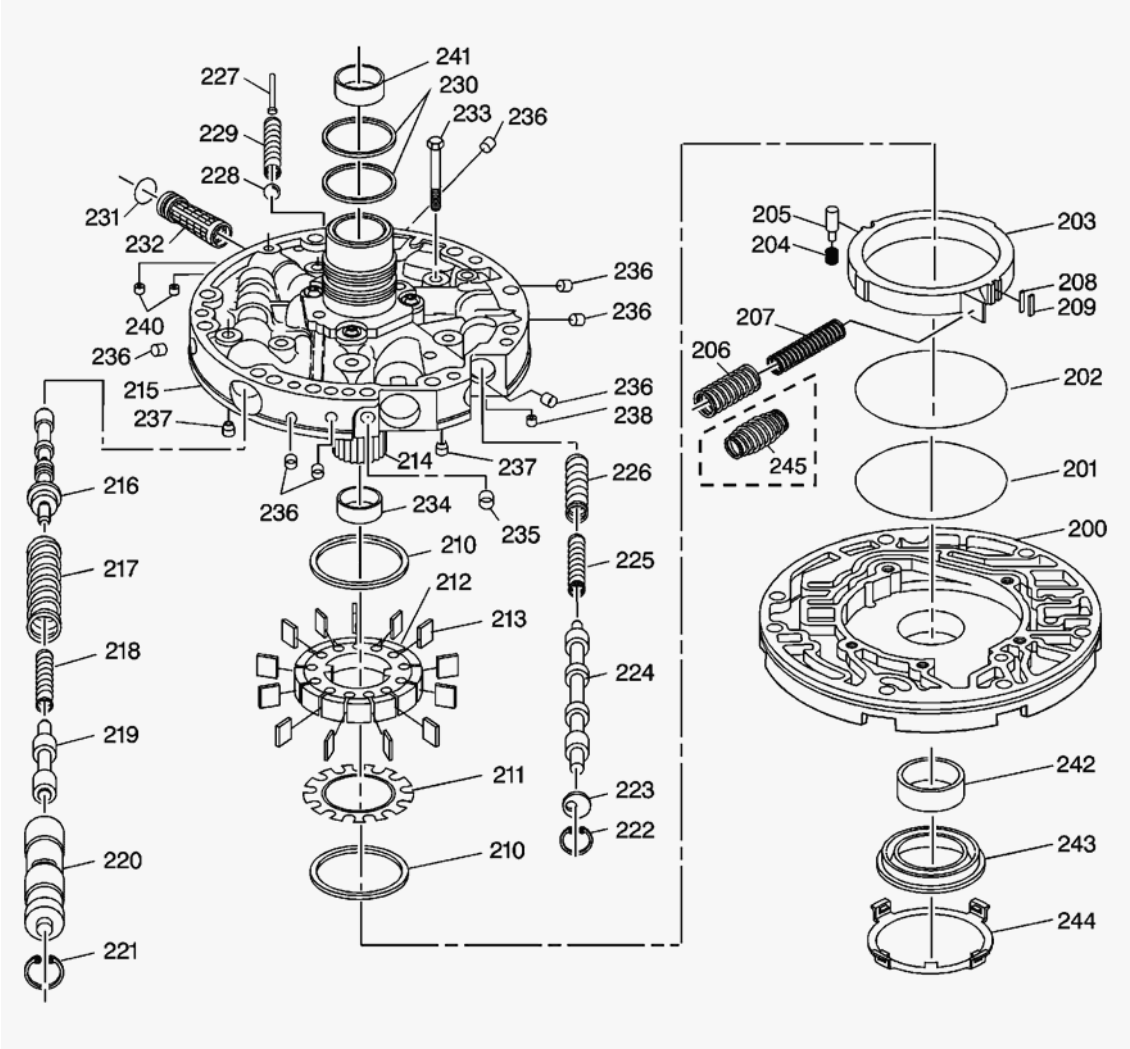


Fig. 10: Exploded View Of Oil Pump Assembly
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 10

Callout	Component Name
200	Pump Body
201	Oil Seal Ring - Slide to Wear Plate
202	O-Ring Seal - Slide Seal Back-Up
203	Pump Slide
204	Pivot Pin Spring
205	Pivot Slide Pin
206	Pump Slide Spring - Outer
207	Pump Slide Spring - Inner
208	Pump Slide Seal Support
209	Pump Slide Seal
210	Pump Vane Ring

cardiagn.com

210	Pump Vane Ring
211	Rotor Guide
212	Oil Pump Rotor
213	Pump Vane
214	Stator Shaft
215	Pump Cover
216	Pressure Regulator Valve
217	Pressure Regulator Valve Spring
218	Pressure Regulator Isolator Spring
219	Reverse Boost Valve
220	Reverse Boost Valve Sleeve
221	Oil Pump Reverse Boost Valve Retaining Ring
222	Oil Pump Converter Clutch Valve Retaining Ring
223	Stop Valve
224	Converter Clutch Valve
225	Converter Clutch Valve Spring - Inner
226	Converter Clutch Valve Spring - Outer
227	Pressure Relief Bolt Rivet
228	Pressure Relief Ball
229	Pressure Relief Spring
230	Oil Seal Ring - Stator Shaft
231	Oil Pump Cover Screen Seal
232	Oil Pump Cover Screen
233	Bolt M8 X 1.25 X 40 - Cover to Body
234	Stator Shaft Bushing - Front
235	Oil Pump Cover Plug - FWD Clutch Feed
236	Oil Pump Cover Plug
236	Oil Pump Cover Plug
236	Oil Pump Cover Plug
236	Oil Pump Cover Plug
236	Oil Pump Cover Plug
236	Oil Pump Cover Plug
237	Check Valve Retainer and Ball Assembly
237	Check Valve Retainer and Ball Assembly
238	Converter Clutch Signal Orifice - Cup Plug
240	Cup Orifice Plug
241	Stator Shaft Bushing - Rear
242	Pump Body Bushing
243	Oil Seal Assembly
244	Front Helix Retainer
245	A/T Fluid Pump Slide Outer Spring

cardiagn.com

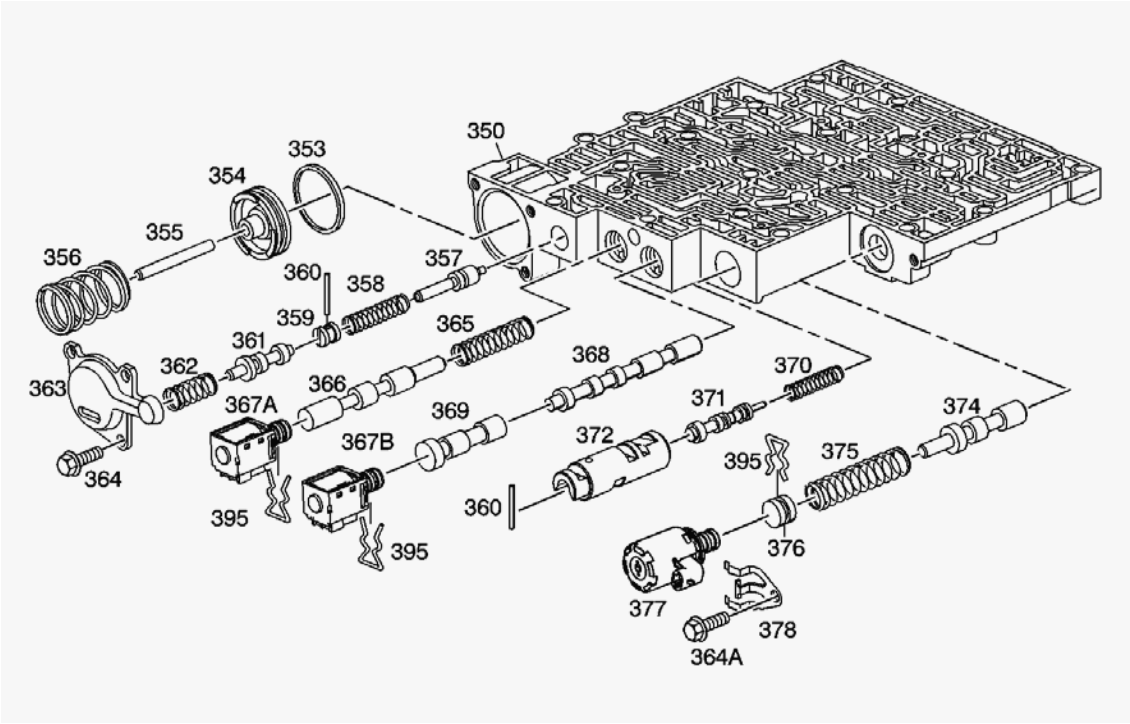


Fig. 11: Control Valve Body Assembly (1 of 2)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 11

Callout	Component Name
350	Control Valve Body Assembly
353	Forward Accumulator Oil Seal
354	Forward Accumulator Piston
355	Forward Accumulator Pin
356	Forward Accumulator Spring
357	Forward Abuse Valve
358	Forward Abuse Valve Spring
359	Bore Plug
360	Coiled Spring Pin
360	Coiled Spring Pin
361	Low Overrun Valve
362	Low Overrun Valve Spring
363	Forward Accumulator Cover
364	Forward Accumulator Cover Bolt
364a	Pressure Control Solenoid Retainer Bolt
365	1-2 Shift Valve Spring - Model Dependent
366	1-2 Shift Valve - Model Dependent
367a	1-2 Shift Solenoid Valve

cardiagn.com

367b	2-3 Shift Solenoid Valve
368	2-3 Shift Valve
369	2-3 Shuttle Valve
370	1-2 Accumulator Valve Spring
371	1-2 Accumulator Valve
372	1-2 Accumulator Valve Sleeve
374	Actuator Feed Limit Valve
375	Actuator Feed Limit Valve Spring
376	Bore Plug
377	Pressure Control Solenoid Valve
378	Pressure Control Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer

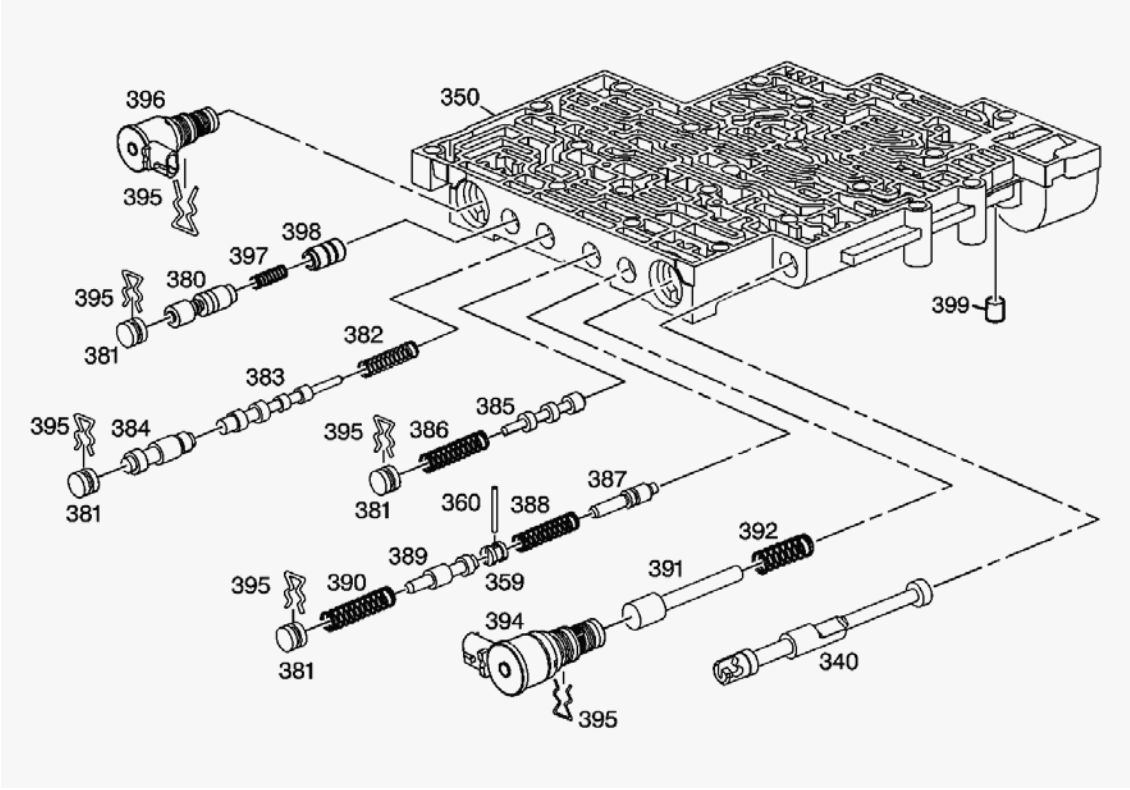


Fig. 12: Control Valve Body Assembly (2 of 2)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 12

Callout	Component Name
340	Manual Valve
350	Control Valve Body Assembly

cardiagn.com

359	Bore Plug
360	Coiled Spring Pin
380	Regulator Apply Valve
381	Bore Plug
381	Bore Plug
381	Bore Plug
381	Bore Plug
382	4-3 Sequence Valve Spring
383	4-3 Sequence Valve
384	3-4 Relay Valve
385	3-4 Shift Valve
386	3-4 Shift Valve Spring
387	Reverse Abuse Valve
388	Reverse Abuse Valve Spring
389	3-2 Downshift Valve
390	3-2 Downshift Valve Spring
391	3-2 Control Valve
392	3-2 Control Valve Spring
394	3-2 Control Solenoid Valve
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
396	TCC PWM Solenoid Valve
397	Regulator Apply Spring
398	Isolator Valve
399	Pump Ball Check Valve - M33 Only

cardiagn.com

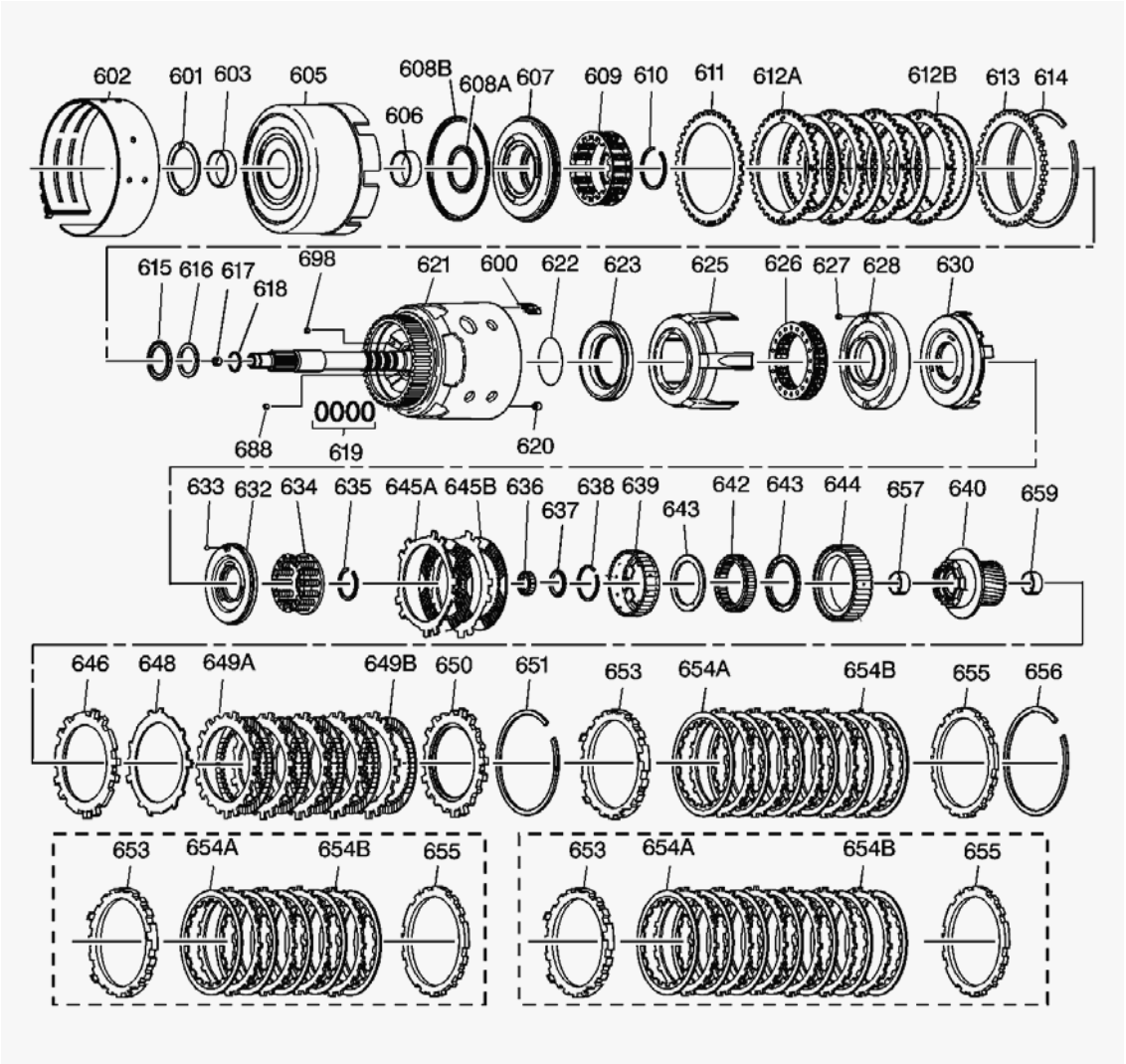


Fig. 13: Internal Parts (1 of 2)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 13

Callout	Component Name
600	3-4 Clutch Boost (5) Spring Assembly
601	Thrust Washer - Pump to Drum
602	2-4 Band Assembly
603	Reverse Input Clutch Bushing - Front
605	Reverse Input Clutch Housing and Drum Assembly
606	Reverse Input Clutch Bushing - Rear
607	Reverse Input Clutch Piston Assembly
608a	Reverse Input Clutch Seal - Inner
608b	Reverse Input Clutch Seal - Outer
609	Reverse Input Clutch Spring Assembly

cardiagn.com

610	Reverse Input Clutch Spring Retainer Ring
611	Reverse Input Clutch Plate - Belleville
612a	Reverse Input Clutch Turbulator Plate - Steel
612b	Reverse Input Clutch Plate Assembly - Fiber
613	Reverse Input Clutch Backing Plate - Selective
614	Reverse Input Clutch Retaining Ring
615	Stator Shaft/Selective Washer Bearing Assembly
616	Thrust Washer - Selective
617	Check Valve Retainer and Ball Assembly
618	O-Ring Seal - Location Model Dependent
619	Oil Seal Ring - Solid
620	Retainer and Checkball Assembly
621	Input Housing and Shaft Assembly - Model Dependent
622	O-Ring Input to Forward Clutch Housing Seal
623	3rd and 4th Clutch Piston
625	3rd and 4th Clutch Ring - Apply
626	3rd and 4th Clutch Spring Assembly
627	Forward Clutch Housing Retainer and Ball Assembly
628	Forward Clutch Housing
630	Forward Clutch Piston
632	Overrun Clutch Piston
633	Overrun Clutch Ball
634	Overrun Clutch Spring Assembly
635	Overrun Clutch Spring Retainer Snap Ring
636	Input Housing to Output Shaft Seal
637	Input Sun Gear Bearing Assembly
638	Overrun Clutch Hub Retaining Snap Ring
639	Overrun Clutch Hub
640	Forward Sprag Clutch Inner Race and Input Sun Gear Assembly
642	Forward Sprag Assembly
643	Sprag Assembly Retainer Ring
643	Sprag Assembly Retainer Ring
644	Forward Clutch Race - Outer
645a	Overrun Clutch Plate - Steel
645b	Overrun Clutch Plate Assembly - Fiber
646	Forward Clutch Plate - Apply
648	Forward Clutch Plate - Waved
649a	Forward Clutch Plate - Steel
649b	Forward Clutch Plate Assembly - Fiber
650	Forward Clutch Backing Plate - Selective
651	Forward Clutch Backing Plate Retainer Ring

cardiagn.com

653	3rd and 4th Clutch Apply Plate - Stepped
653	3rd and 4th Clutch Apply Plate - Stepped
653	3rd and 4th Clutch Apply Plate - Stepped
654a	3rd and 4th Clutch Plate Assembly - Fiber - Quantity Model Dependent 5, 6 or 7 Plates
654a	3rd and 4th Clutch Plate Assembly - Fiber - Quantity Model Dependent 5, 6 or 7 plates
654a	3rd and 4th Clutch Plate Assembly - Fiber - Quantity Model Dependent 5, 6 or 7 plates
654b	3rd and 4th Clutch Plate - Steel - Quantity Model Dependent
654b	3rd and 4th Clutch Plate - Steel - Quantity Model Dependent
654b	3rd and 4th Clutch Plate - Steel - Quantity Model Dependent
655	3rd and 4th Clutch Backing Plate - Selective - Model Dependent
655	3rd and 4th Clutch Backing Plate - Selective - Model Dependent
655	3rd and 4th Clutch Backing Plate - Selective - Model Dependent
656	3rd and 4th Clutch Backing Plate Retainer Ring
657	Input Sun Gear Front Bushing
659	Input Sun Gear Rear Bushing
688	Cup Plug
698	Orificed Cup Plug

cardiagn.com

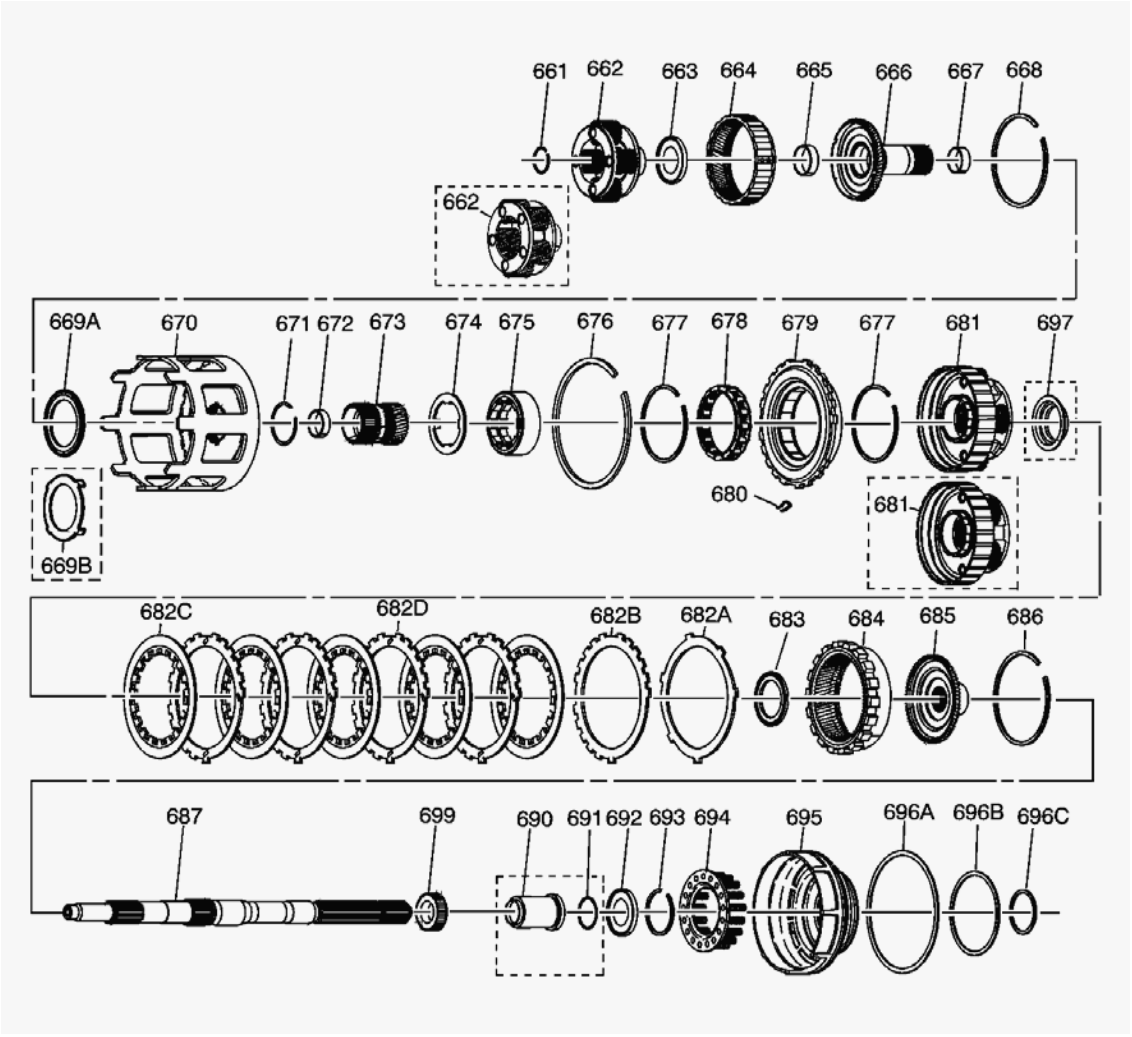


Fig. 14: Internal Parts (2 of 2)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 14

Callout	Component Name
661	Output Shaft to Input Carrier Retainer
662	Input Carrier Assembly - 4 or 5 Pinion-Model Dependent
662	Input Carrier Assembly
663	Thrust Bearing Assembly - Input Carrier to Reaction Shaft
664	Input Internal Gear
665	Reaction Carrier Shaft Front Bushing
666	Reaction Carrier Shaft
667	Reaction Carrier Shaft Rear Bushing
668	Reaction Shaft/Internal Gear Retainer Ring
669a	Thrust Bearing Assembly - Reaction Shaft Shell
669b	Thrust Bearing Assembly - Reaction Shaft Shell - Some Models

cardiagn.com

670	Reaction Sun Shell
671	Reaction Sun Gear Retainer Ring
672	Reaction Sun Bushing
673	Reaction Sun Gear
674	Thrust Washer - Race/Reaction Shell
675	Low and Reverse Roller Clutch Race
676	Low and Reverse Support to Case Retainer Ring
677	Low and Reverse Roller Assembly Retainer Ring - Cam
677	Low and Reverse Roller Assembly Retainer Ring - Cam
678	Low and Reverse Roller Clutch Assembly
679	Low and Reverse Clutch Support Assembly
680	Low and Reverse Clutch Support Retainer Spring
681	Reaction Carrier Assembly - 4 or 5 Pinion-Model Dependent
681	Reaction Carrier Assembly - 4 or 5 Pinion-Model Dependent
682a	Low and Reverse Clutch Plat - Waved
682b	Spacer Low and Reverse Clutch Plate - Selective
682c	Low and Reverse Clutch Plate Assembly - Fiber
682d	Low and Reverse Clutch Turbulator Plate - Steel
683	Thrust Bearing Assembly - Reaction Carrier/Support
684	Internal Reaction Gear
685	Internal Reaction Gear Support
686	Reaction Gear/Support Retainer Ring
687	Output Shaft
690	Output Shaft Sleeve - Model Dependent 2WD only
691	Output Shaft Seal - Model Dependent 2WD only
692	Reaction Gear Support to Case Bearing
693	Low and Reverse Clutch Retainer Ring
694	Low and Reverse Clutch Spring Assembly
695	Low and Reverse Clutch Piston
696a	Low and Reverse Clutch Seal - Outer
696b	Low and Reverse Clutch Seal - Center
696c	Low and Reverse Clutch Seal - Inner
697	Oil Deflector - High Output Models Only
699	Internal Transmission Speed Sensor Rotor

cardiagn.com

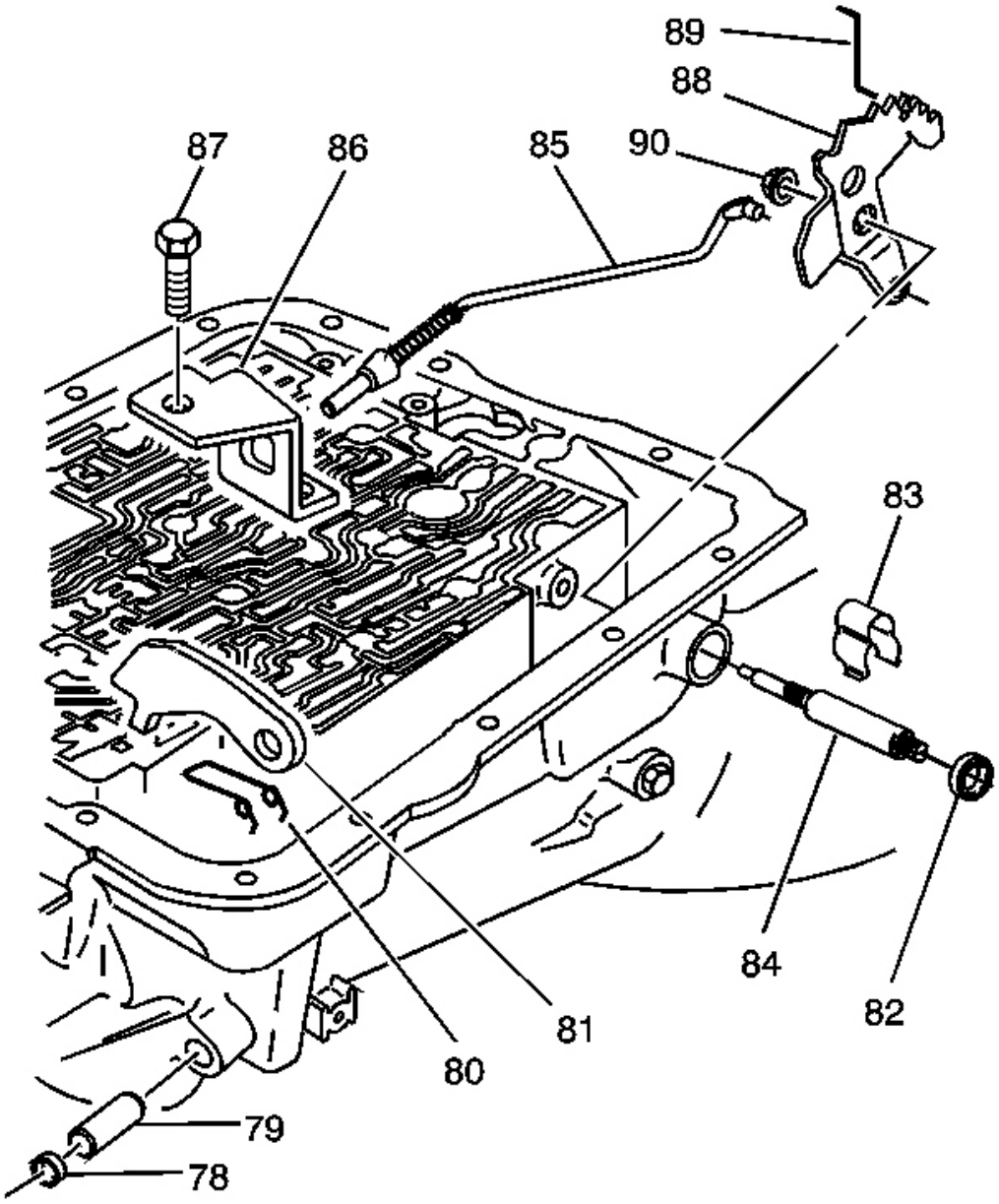


Fig. 15: Parking Lock And Manual Shift Shaft Assembly
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 15

Callout	Component Name
78	Steel Cup Plug

cardiagn.com

79	Parking Brake Pawl Shaft
80	Parking Pawl Return Spring
81	Parking Brake Pawl
82	Manual Shaft Seal
83	Manual Shaft Retainer
84	Manual Shaft - Model Dependent
85	Parking Lock Actuator Assembly
86	Parking Lock Bracket
87	Parking Lock Bracket Bolt
88	Inside Detent Lever
89	Manual Valve Link
90	Hex Head Nut

COMPONENT LOCATION

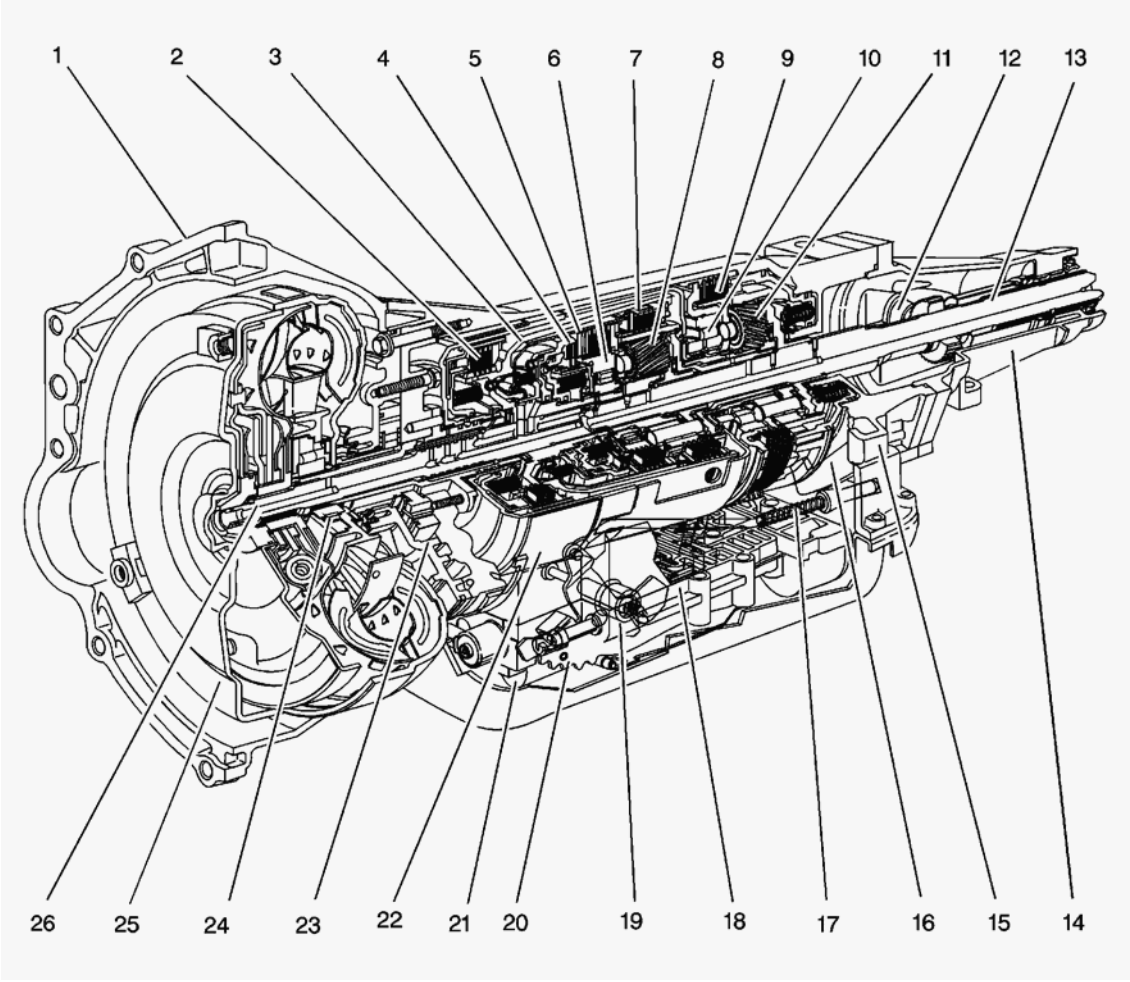


Fig. 16: Components View
Courtesy of GENERAL MOTORS CORP.

cardiagn.com

Callouts For Fig. 16

Callout	Component Name
1	Converter Housing
2	Reverse Input Clutch
3	Input Clutch Housing
4	Overrun Clutch
5	Forward Clutch
6	Forward Sprag Clutch Assembly
7	3-4 Clutch
8	Input Planetary Gear Set
9	Lo and Reverse Clutch
10	Lo Roller Clutch Assembly
11	Reaction Planetary Gear Set
12	Speed Sensor
13	Output Shaft
14	Case Extension
15	Main Section Case
16	Parking Pawl
17	Parking Lock Actuator Assembly
18	Control Valve Assembly
19	Manual Shaft
20	Inside Detent Lever
21	Secondary Fluid Pump Assembly - M33 Models Only
22	2-4 Band Assembly
23	Pump Assembly
24	Stator Roller Clutch
25	Torque Converter Assembly
26	Turbine Shaft

cardiagn.com

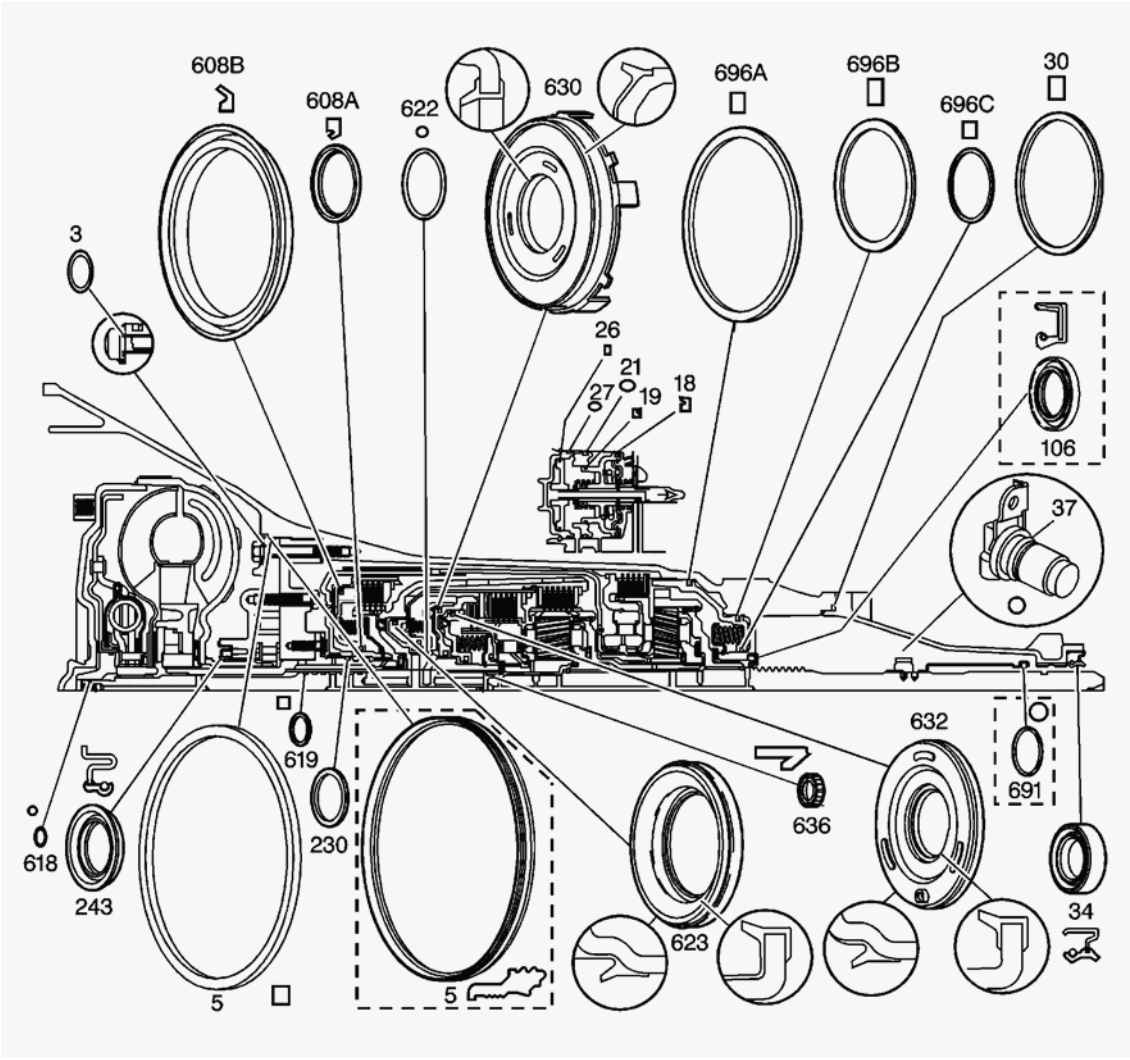


Fig. 17: Exploded View Of Seals
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 17

Callout	Component Name
3	Pump to Case Bolt O-Ring
5	Oil Seal - Pump to Case - Model Dependent
5	Oil Seal - Pump to Case - Model Dependent
18	Oil Seal Ring - 2nd Apply Piston-Outer
19	Oil Seal Ring - 2nd Apply Piston-Inner
21	O-Ring Seal
26	Oil Seal Ring - 4th Apply Piston-Outer
27	O-Ring Seal - 2-4 Servo Cover
30	Case Extension to Case Seal
34	Case Extension Oil Seal Assembly

cardiagn.com

37	O-Ring Seal - Speed Sensor to Case Extension
106	Case Oil Seal Assembly - Y-Car Only
230	Oil Seal Ring - Stator Shaft
243	Oil Seal Assembly
608a	Reverse Input Clutch Seal - Inner
608b	Reverse Input Clutch Seal - Outer
618	O-Ring Seal - Turbine Shaft/Selective Washer
619	Oil Seal Ring - Solid
622	O-Ring Input to Forward Housing Seal
623	3rd and 4th Clutch Piston
630	Forward Clutch Piston
632	Overrun Clutch Piston
636	Input Housing to Output Shaft Seal
691	Output Shaft - Model Dependent Seal
696a	Low and Reverse Clutch - Outer Seal
696b	Low and Reverse Clutch - Center Seal
696c	Low and Reverse Clutch - Inner Seal

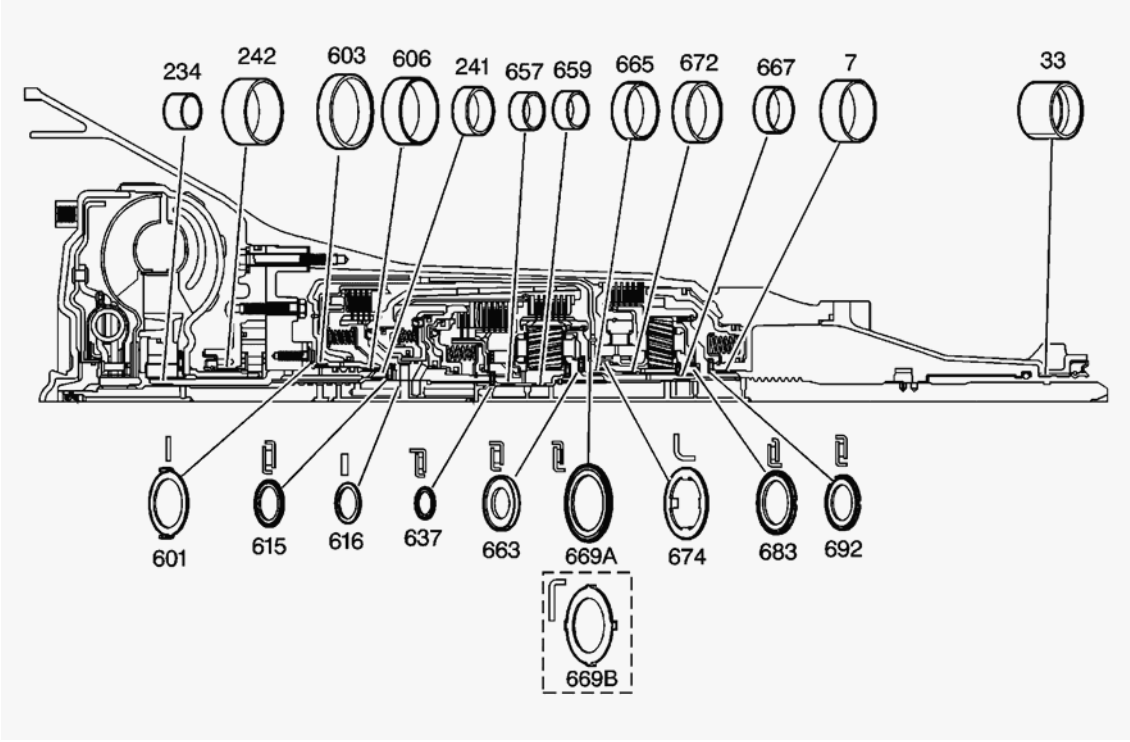


Fig. 18: Exploded View Of Bearings And Bushings
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 18

Callout	Component Name

cardiagn.com

7	Case Bushing
33	Case Extension Bushing
234	Stator Shaft Bushing - Front
241	Stator Shaft Bushing - Rear
242	Oil Pump Body Bushing
601	Thrust Washer - Pump to Drum
603	Reverse Input Cl. Bushing - Front
606	Reverse Input Clutch Bushing - Rear
615	Stator Shaft/Selective Washer Bearing Assembly
616	Thrust Washer - Selective
637	Input Sun Gear Bearing Assembly
657	Input Sun Gear Bushing - Front
659	Input Sun Gear Bushing - Rear
663	Thrust Bearing Assembly - Input Carrier to Reaction Shaft
665	Reaction Carrier Shaft Bushing - Front
667	Reaction Carrier Shaft Bushing - Rear
669a	Thrust Washer - Reaction Shaft/Shell
669b	Thrust Washer - Reaction Shaft/Shell - Some Models
672	Reaction Gear Bushing
674	Thrust Washer - Race/Reaction Shell
683	Thrust Bearing Assembly - Reaction Carrier/Support
692	Reaction Gear Support to Case Bearing

cardiagn.com

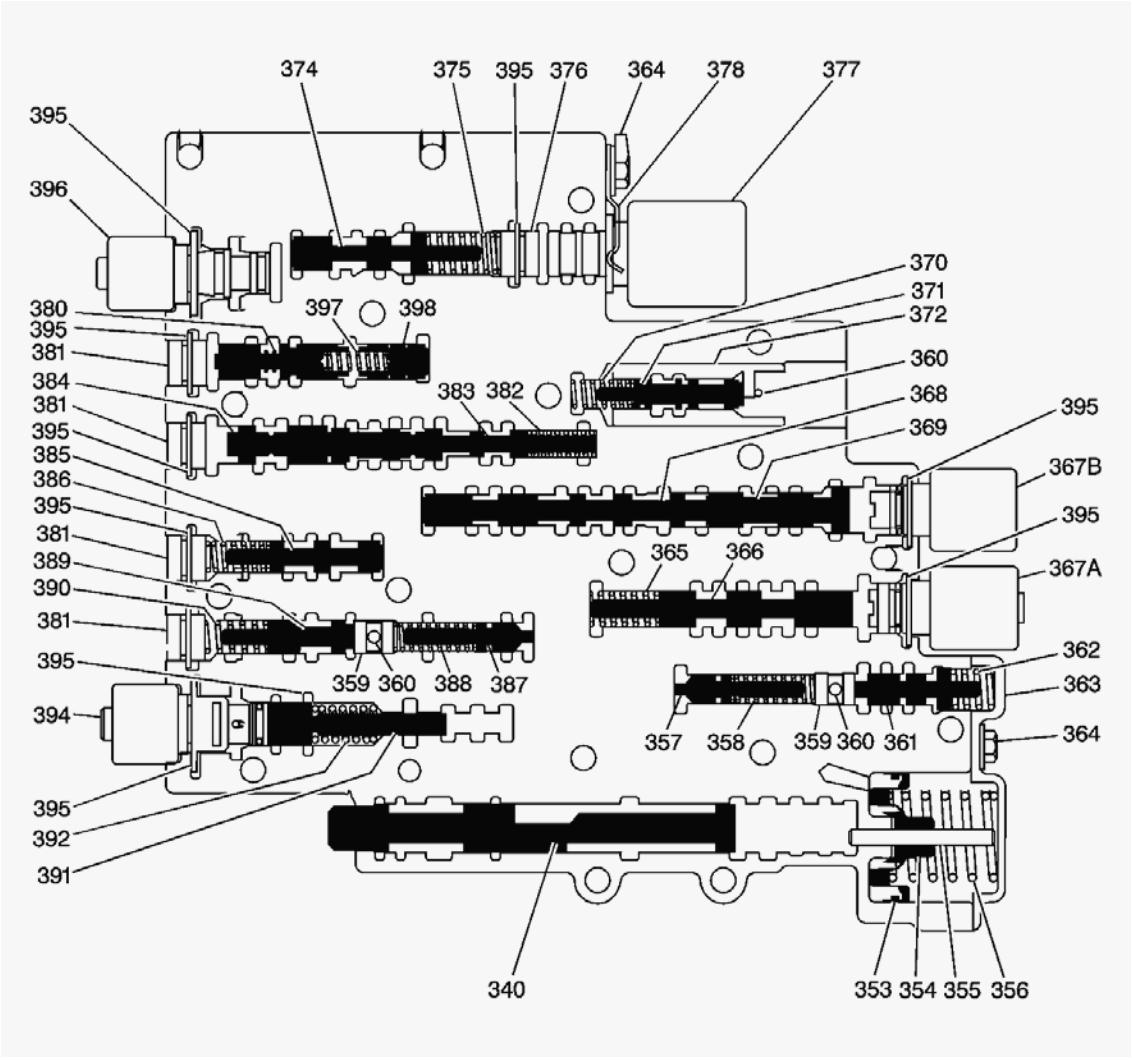


Fig. 19: Exploded View Of Valve Trains
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 19

Callout	Component Name
340	Manual Valve
353	Forward Accumulator Oil Seal
354	Forward Accumulator Piston
355	Forward Accumulator Pin
356	Forward Accumulator Spring
357	Forward Abuse Valve
358	Forward Abuse Valve Spring
359	Bore Plug
359	Bore Plug
360	Coiled Spring Pin

cardiagn.com

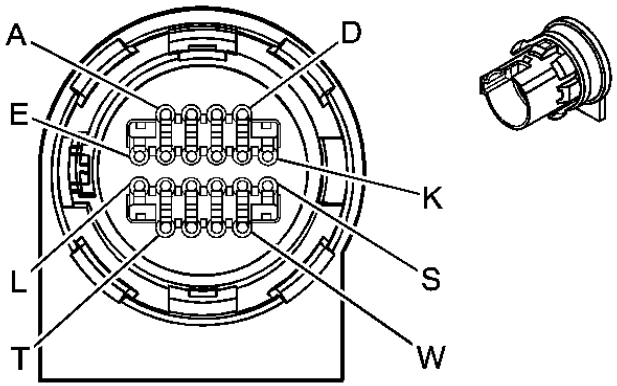
360	Coiled Spring Pin
360	Coiled Spring Pin
361	Low Overrun Valve
362	Low Overrun Valve Spring
363	Forward Accumulator Cover
364	Forward Accumulator Cover Bolt
364	Forward Accumulator Cover Bolt
365	1-2 Shift Valve Spring - Model Dependent
366	1-2 Shift Valve - Model Dependent
367a	1-2 Shift Solenoid Valve
367b	2-3 Shift Solenoid Valve
368	2-3 Shift Valve
369	2-3 Shuttle Valve
370	1-2 Accumulator Valve Spring
371	1-2 Accumulator Valve
372	1-2 Accumulator Valve Sleeve
374	Actuator Feed Limit Valve
375	Actuator Feed Limit Valve Spring
376	Bore Plug
377	Pressure Control Solenoid Valve
378	Pressure Control Solenoid Retainer
380	Regulator Apply Valve - Model Dependent
381	Bore Plug
381	Bore Plug
381	Bore Plug
381	Bore Plug
382	4-3 Sequence Valve Spring
383	4-3 Sequence Valve
384	3-4 Relay Valve
385	3-4 Shift Valve
386	3-4 Shift Valve Spring
387	Reverse Abuse Valve
388	Reverse Abuse Valve Spring
389	3-2 Downshift Valve
390	3-2 Downshift Valve Spring
391	3-2 Control Valve
392	3-2 Control Valve Spring
394	3-2 Control Solenoid Valve
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer

cardiagn.com

395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
395	Bore Plug and Solenoid Retainer
396	TCC PWM Solenoid Valve
397	Regulator Apply Spring
398	Isolator Valve

AUTOMATIC TRANSMISSION INLINE 20-WAY CONNECTOR END VIEW

AT Inline 20-way Connector, Transmission Side Terminal Identification

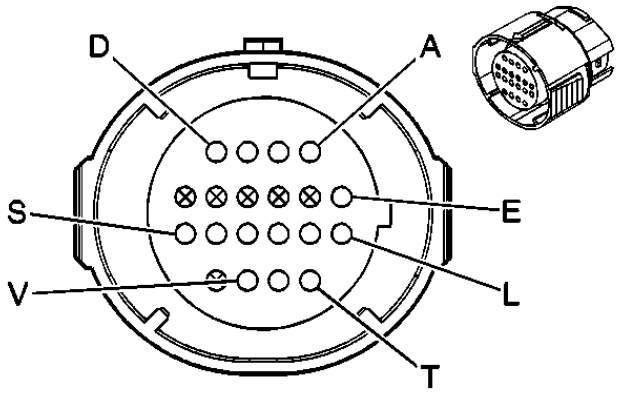


Connector Part Information		• **12160782** • **20-way F Micro-Pack 100W Series (GRY)**	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN	1222	1-2 Shift Solenoid Valve Control
B	YEL	1223	2-3 Shift Solenoid Valve Control
C	PPL	1228	Pressure Control (PC) Solenoid Valve High Control
D	LT BLU	1229	PC Solenoid Valve Low Control
E	RED	839	Ignition 1 Voltage
F-K	-	-	Not Used
L	BRN	1227	Transmission Fluid Temperature (TFT) Sensor Signal
M	GRY	452	Low Reference
N	PNK	1224	TFP Switch Signal A
P	ORN	1226	TFP Switch Signal C
R	DK BLU	1225	TFP Switch Signal B

cardiagn.com

S	WHT	687	3-2 Shift Solenoid Valve Assembly Control
T	BLK	422	Torque Converter Clutch Solenoid Valve Control
U	TAN	418	Torque Converter Clutch Pulse Width Modulation Solenoid Valve Control
V-W	-	-	Not Used

AT Inline 20-way Connector, Engine Side Terminal Identification

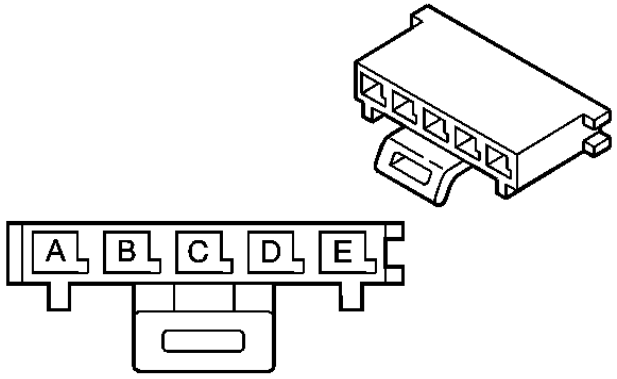


Connector Part Information		• **12160493** • **20-way F Micro-Pack 100W Series (GRY)**	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN	1222	1-2 Shift Solenoid Valve Control
B	YEL/BLK	1223	2-3 Shift Solenoid Valve Control
C	RED/BLK	1228	Pressure Control (PC) Solenoid Valve High Control
D	LT BLU/WHT	1229	PC Solenoid Valve Low Control
E	PNK	339	Ignition 1 Voltage
F-K	-	-	Not Used
L	YEL/BLK	1227	Transmission Fluid Temperature (TFT) Sensor Signal
M	ORN/BLK	1057	Low Reference
N	PNK	1224	TFP Switch Signal A
P	RED	1226	TFP Switch Signal C
R	DK BLU	1225	TFP Switch Signal B
S	WHT	687	3-2 Shift Solenoid Valve Assembly Control
T	TAN/BLK	422	Torque Converter Clutch Solenoid Valve Control
U	BRN	418	Torque Converter Clutch Pulse Width Modulation Solenoid Valve Control
V-W	-	-	Not Used

cardiagn.com

AUTOMATIC TRANSMISSION INTERNAL CONNECTOR END VIEWS

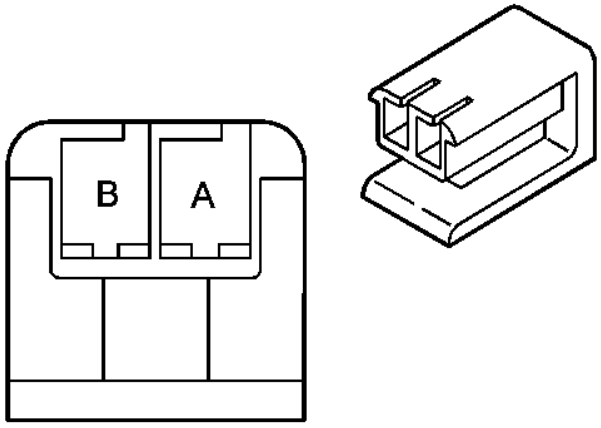
Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Connector, Wiring Harness Side Terminal Identification



Connector Part Information		• 12162213 • Conn 5F M/P 150.2 P2S (NAT)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BRN	1227	Transmission Fluid Temperature (TFT) Sensor Signal
B	GRY	452	Low Reference
C	PNK	1224	TFP Switch Signal A
D	ORN	1226	TFP Switch Signal C
E	DK BLU	1225	TFP Switch Signal B

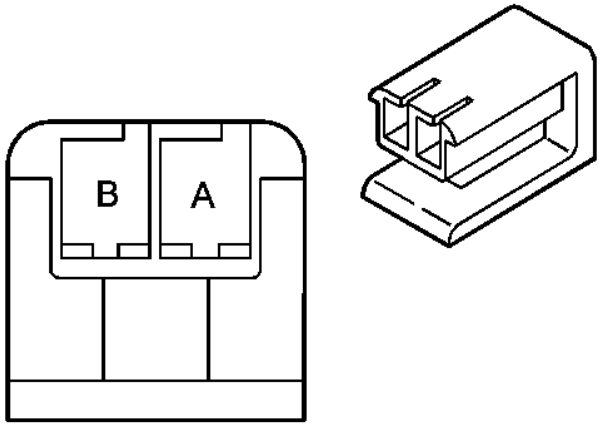
1-2 Shift Solenoid (SS) Valve Connector, Wiring Harness Side Terminal Identification

cardiagn.com



Connector Part Information		• 12162201 • Conn 2F M/P 150.2 P2S (NAT)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED	839B	Ignition 1 Voltage
B	LT GRN	1222	1-2 Shift Solenoid Valve Control

2-3 Shift Solenoid (SS) Valve Connector, Wiring Harness Side Terminal Identification

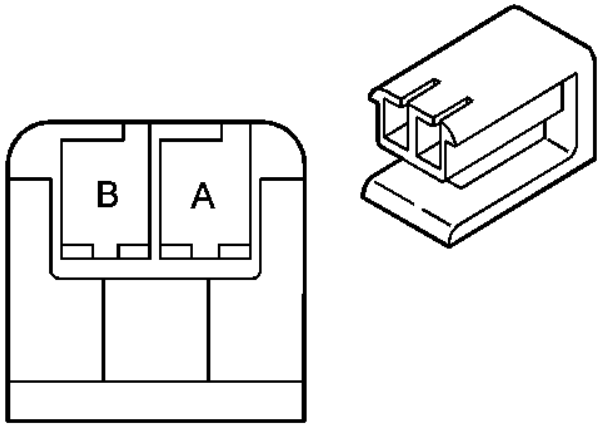


Connector Part Information		• 12162201 • Conn 2F M/P 150.2 P2S (NAT)	
Pin	**Wire Color**	**Circuit No.**	**Function**

cardiagn.com

A	RED	839A	Ignition 1 Voltage
B	YEL	1223	2-3 Shift Solenoid Valve Control

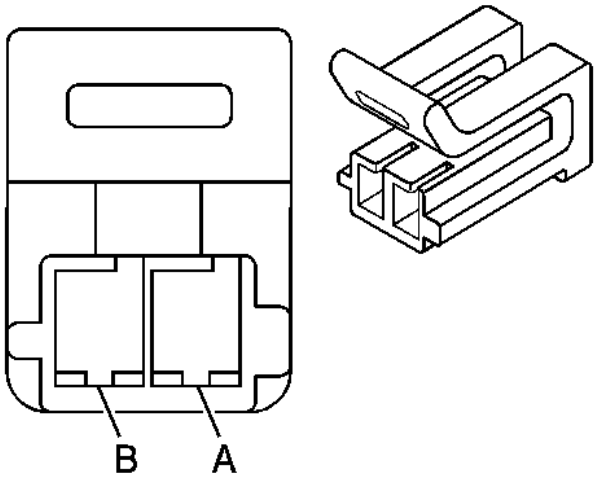
Torque Converter Clutch Pulse Width Modulated (TCC PWM) Solenoid Valve Connector, Wiring Harness Side Terminal Identification



Connector Part Information		• 12162202 • Conn 2F M/P 150.2 P2S (BLU)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED	839E	Ignition 1 Voltage
B	TAN	418	Torque Converter Clutch Pulse Width Modulated Solenoid Valve Control

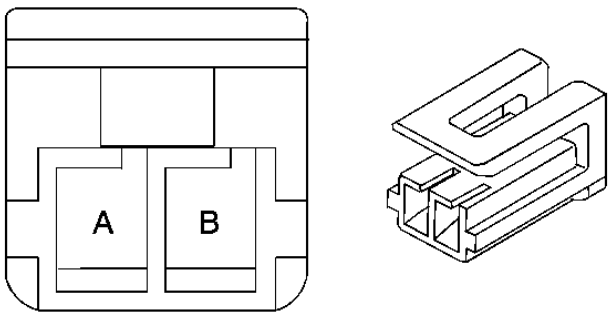
3-2 Shift Solenoid (SS) Valve Assembly Connector, Wiring Harness Side Terminal Identification

cardiagn.com



Connector Part Information		• 12146094 • Conn 2F M/P 150.2 P2S (MD GRY)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED	839C	Ignition 1 Voltage
B	WHT	687	3-2 Shift Solenoid Valve Control

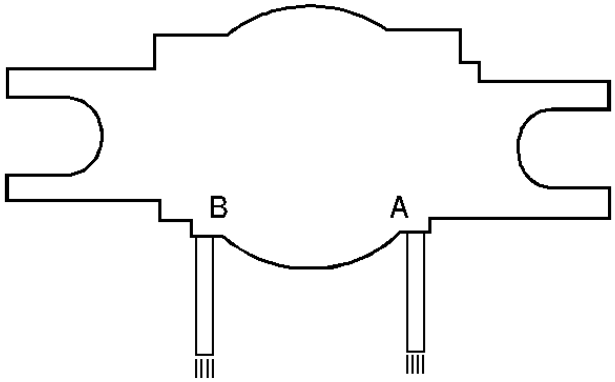
Pressure Control (PC) Solenoid Valve Connector, Wiring Harness Side Terminal Identification



Connector Part Information		• 12146800 • Conn 2F M/P 150.2 (LT GRY) Delphi	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PPL	1228	Pressure Control (PC) Solenoid Valve High Control
B	LT BLU	1229	PC Solenoid Valve Low Control

cardiagn.com

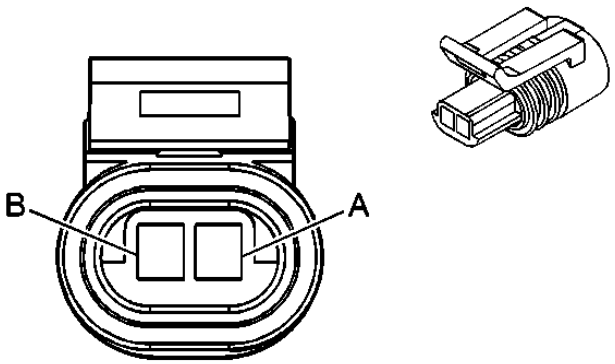
Torque Converter Clutch (TCC) Solenoid Valve Connector, Wiring Harness Side Terminal Identification



Connector Part Information		• **10478128** • **CBL Solenoid Valve**	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED	839D	Ignition 1 Voltage
B	BLK	422	Torque Converter Clutch Solenoid Valve Control

AUTOMATIC TRANSMISSION RELATED CONNECTOR END VIEWS

Vehicle Speed Sensor Assembly Connector, Wiring Harness Side Terminal Identification

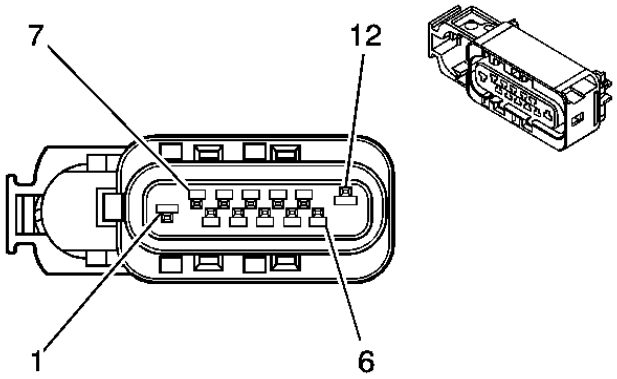


Connector Part Information		• **12162195** • **Asm Conn 2F M/P 150.2 P2S (BLK)**	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PPL	401	VSS Low Signal

cardiagn.com

B	YEL	400	VSS High Signal

Transmission Range Switch Connector, Wiring Harness Side Terminal Identification



Connector Part Information		• **15416722** • **ASM Conn 12 F GT (MD GRY)**	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	YEL	269	Starter Relay Coil Supply Voltage
3	Plug GRN	15305171	Not Used
4	YEL	772	Transmission Range Switch Signal B
5	BLK/WHT	771	Transmission Range Switch Signal A
6	GRY	773	Transmission Range Switch Signal C
7	BLK/WHT	851	Ground
8	WHT	776	Transmission Range Switch Signal P
9	ORG/BLK	434	P/N Position Switch Signal
10	GRY	1524	Back-up Lamp Supply Voltage
11	BRN	341	IGN 1 Voltage
12	PPL	1606	Crank Voltage

REPAIR INSTRUCTIONS

FLOOR SHIFT CONTROL BOOT REPLACEMENT

Removal Procedure

cardiagn.com

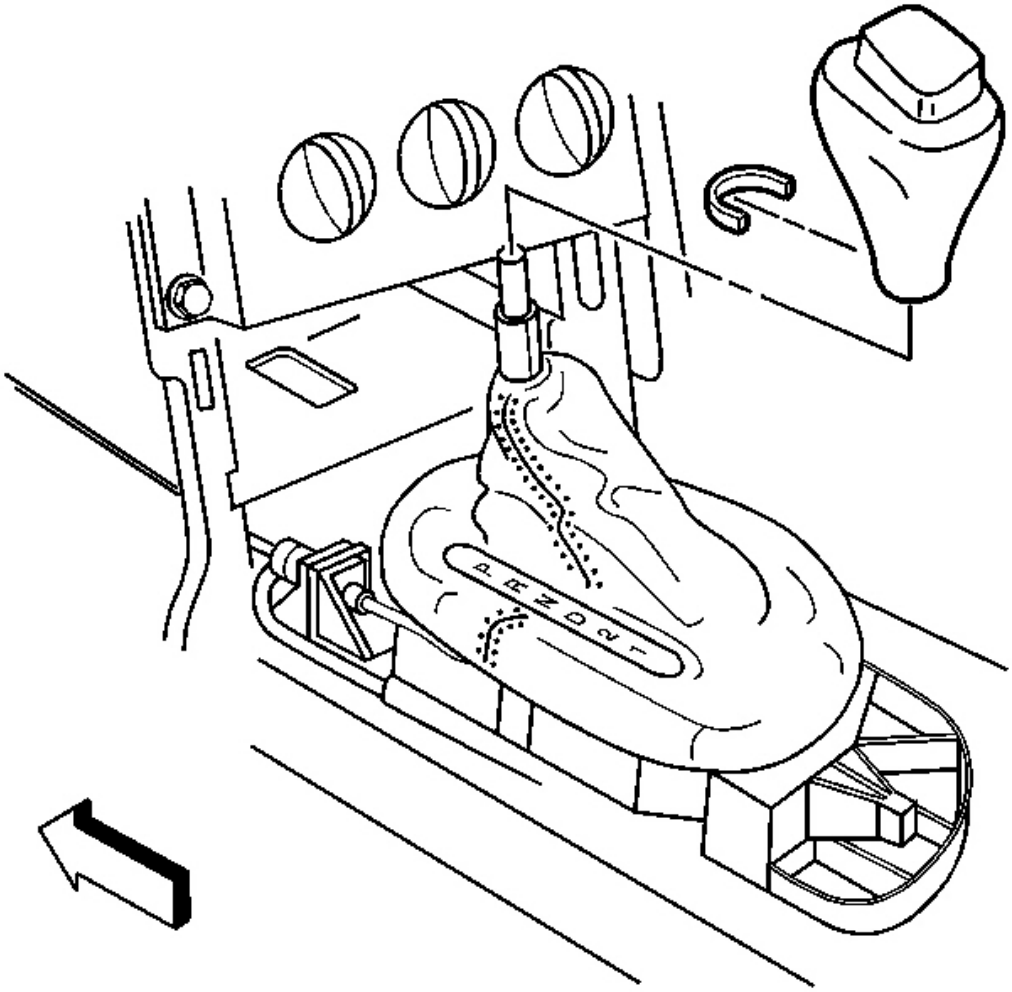


Fig. 20: Floor Shift Control Knob & I/P Accessory Trim Plate
Courtesy of GENERAL MOTORS CORP.

1. Remove the console. Refer to **Console Replacement** in Instrument Panel, Gages and Console.
2. Remove the I/P accessory trim plate. Refer to **Trim Plate Replacement - Instrument Panel (I/P) Accessory** in Instrument Panel, Gages and Console.
3. Remove the floor shift control knob.
    1. Using a flat-bladed screwdriver, carefully pry the staple clip from the knob.
    2. Remove the knob from the floor shift control.
4. Remove the floor shift control from the vehicle; to allow for boot replacement without possible damage to the boot retaining tabs. Refer to **Floor Shift Control Replacement** .

cardiagn.com

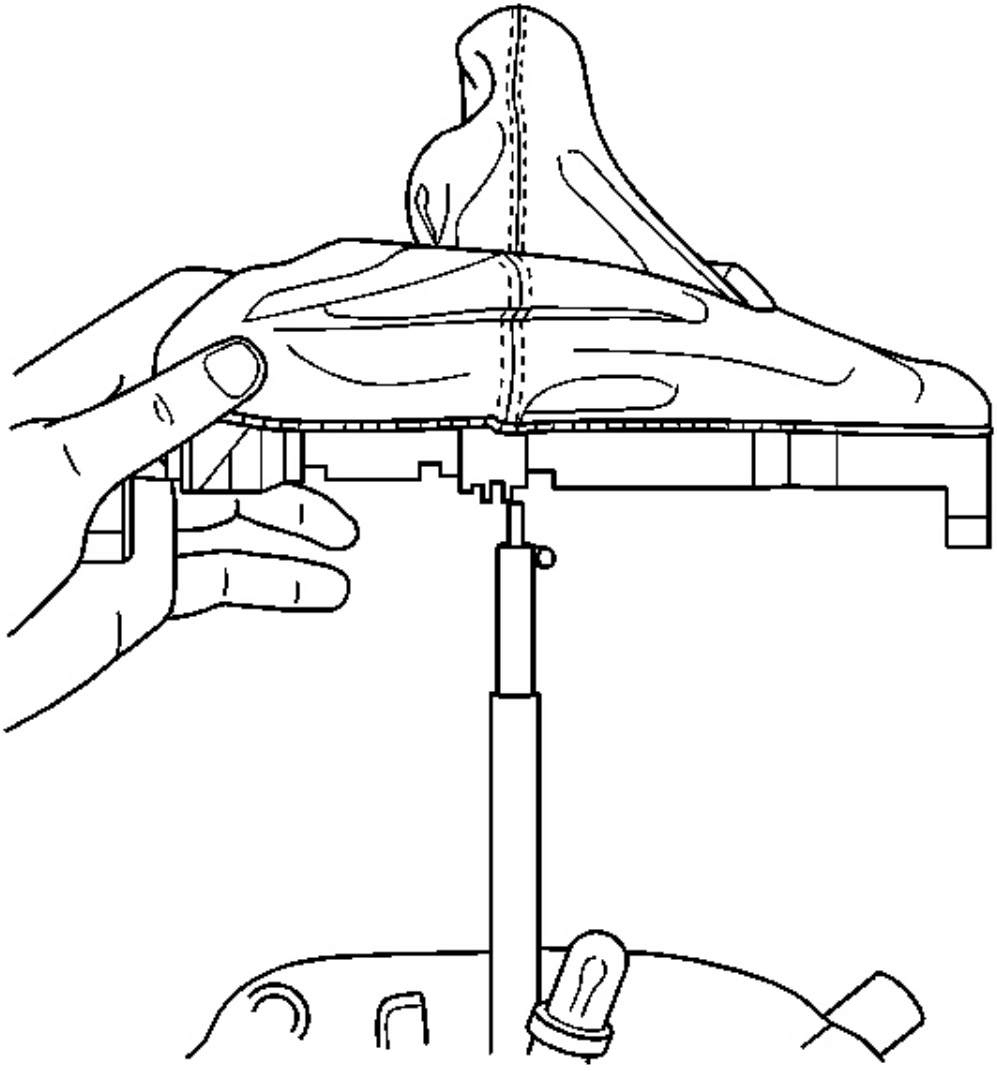


Fig. 21: Floor Shift Control Boot & Floor Shift Control
Courtesy of GENERAL MOTORS CORP.

5. Remove the floor shift control boot from the floor shift control.
    1. Carefully squeeze the front and side tabs or the rear and side tabs at the same time in order to release them.
    2. Carefully squeeze the remaining tab in order to release it.
    3. Release the snap lock retainer on the LH side of the boot.

cardiagn.com

4. Move the boot to the left and release the shift indicator guide pin from the shift control lever.
5. Disconnect the indicator lamp socket from the boot.
6. Remove the boot from the shift control.

Installation Procedure

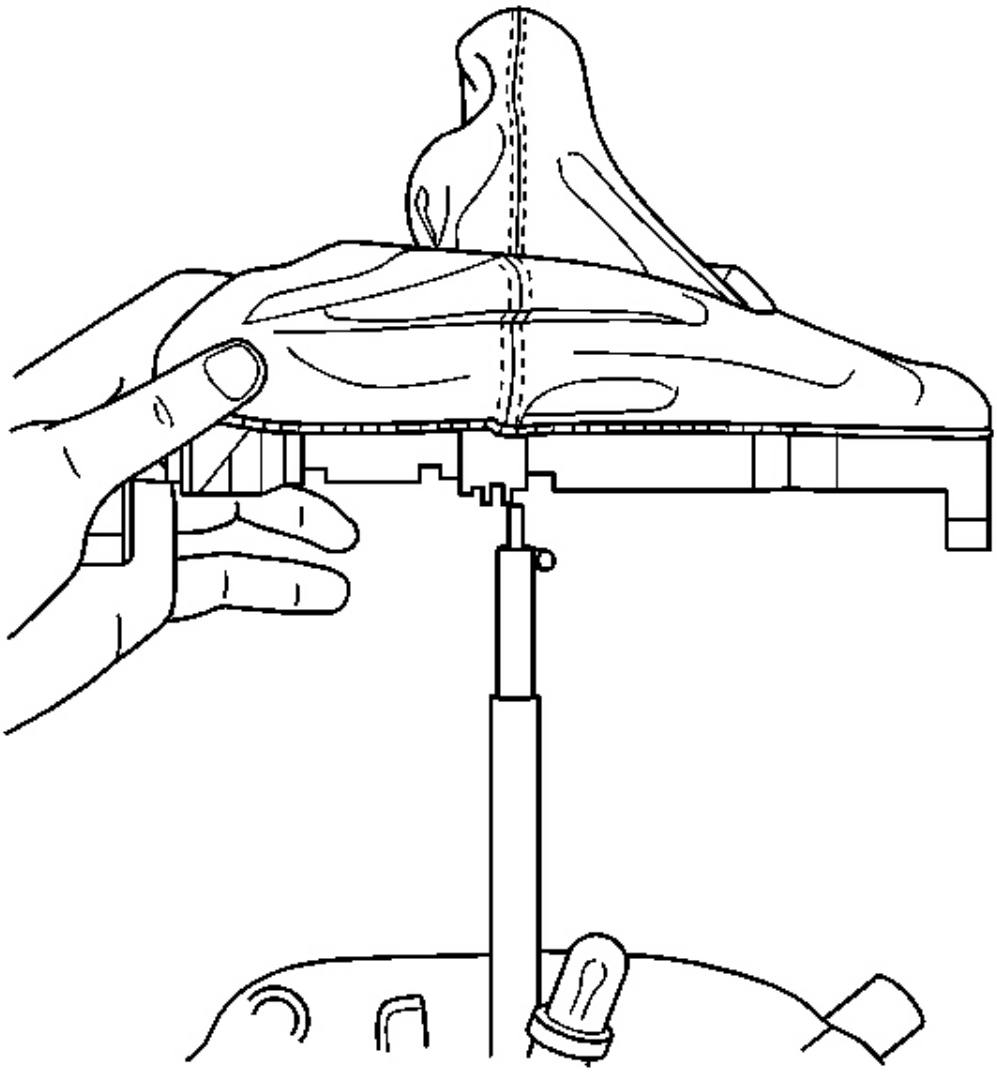


Fig. 22: Floor Shift Control Boot & Floor Shift Control
Courtesy of GENERAL MOTORS CORP.

cardiagn.com

1. Install the floor shift control boot to the floor shift control.
    1. Position the boot onto the shifter.
    2. Align the shift indicator guide pin to the slot in the boot, then move the boot to the right to insert the guide pin into the slot.
    3. Connect the shift indicator lamp socket to the boot.
    4. Evenly insert the tabs until the boot locks into position.

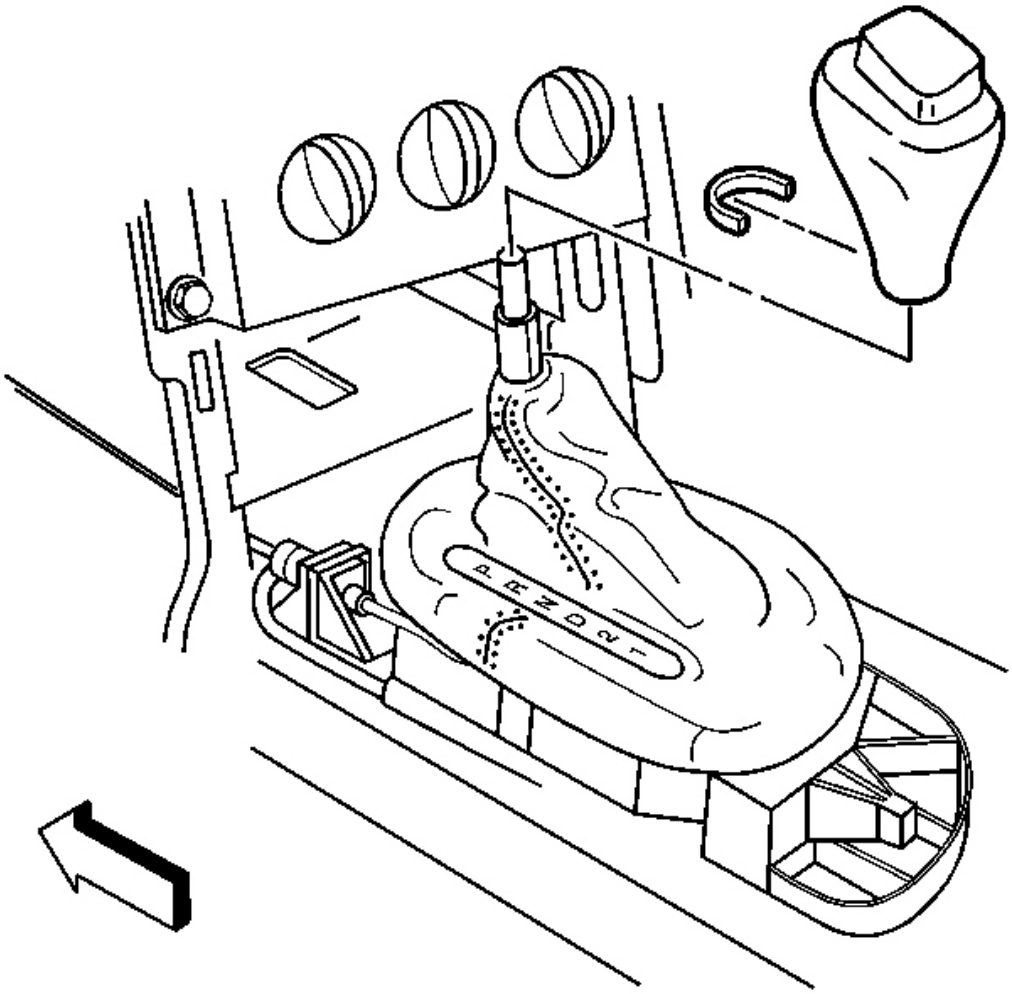


Fig. 23: Floor Shift Control Knob & I/P Accessory Trim Plate
Courtesy of GENERAL MOTORS CORP.

2. Install the floor shift control to the vehicle. Refer to **Floor Shift Control Replacement** .

cardiagn.com

3. Install the shift control knob.
    1. Install the knob onto the shift control.
    2. Install the staple clip.
4. Install the I/P accessory trim plate. Refer to **Trim Plate Replacement - Instrument Panel (I/P) Accessory** in Instrument Panel, Gages and Console.
5. Install the console. Refer to **Console Replacement** in Instrument Panel, Gages and Console.

PARK LOCK CABLE REPLACEMENT

Removal Procedure

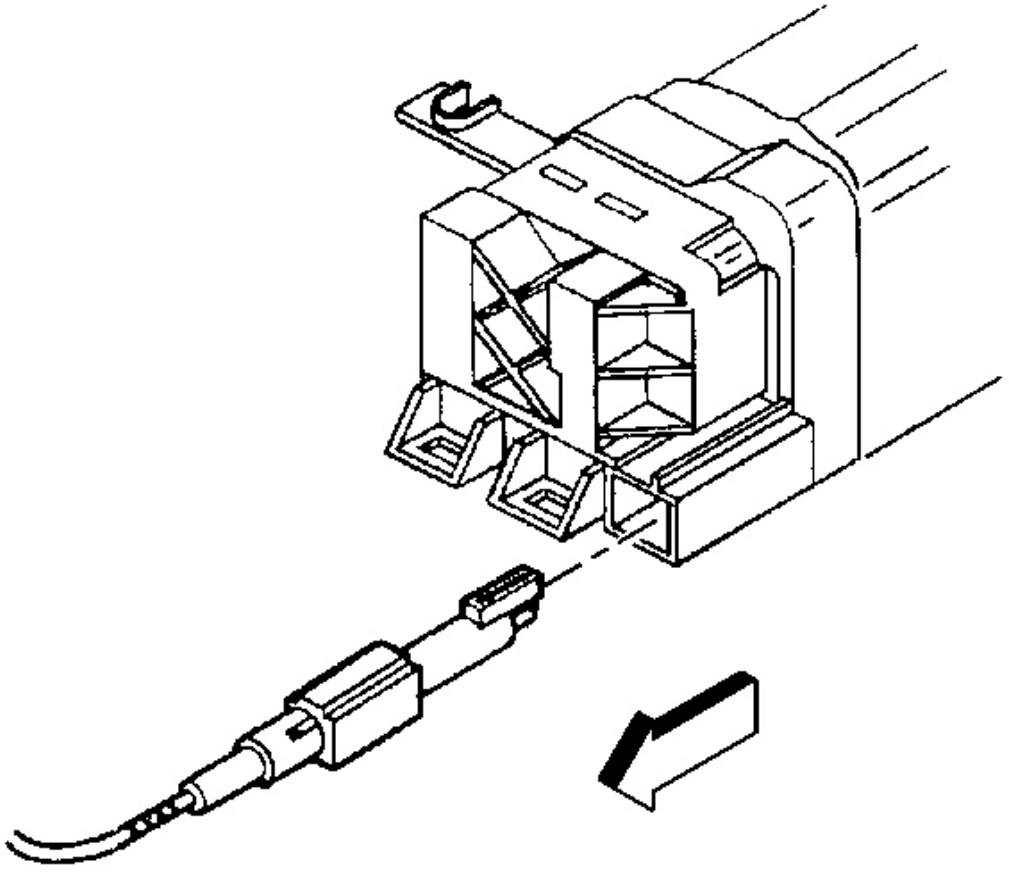


Fig. 24: Park/Lock Cable & Ignition Switch
Courtesy of GENERAL MOTORS CORP.

cardiagn.com

1. Place the vehicle on a level surface.
2. Block the wheels to keep the vehicle from moving.
3. Apply the parking brake.

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

4. Disconnect the negative battery cable.
5. Remove the console. Refer to **Console Replacement** in Instrument Panel, Gages and Console.
6. Remove the I/P accessory trim plate. Refer to **Trim Plate Replacement - Instrument Panel (I/P) Accessory** in Instrument Panel, Gages and Console.
7. Remove the driver knee bolster trim panel. Refer to **Trim Panel Replacement - Knee Bolster** in Instrument Panel, Gages and Console.
8. Install the ignition key and turn the ignition to ON.
9. Using a flat bladed screwdriver or other suitable tool, depress the park/lock control cable retaining tab, located on the underside of the ignition switch near the base of the cable.
10. While still depressing the park/lock cable retaining tab, pull to release the cable from the ignition switch.

cardiagn.com

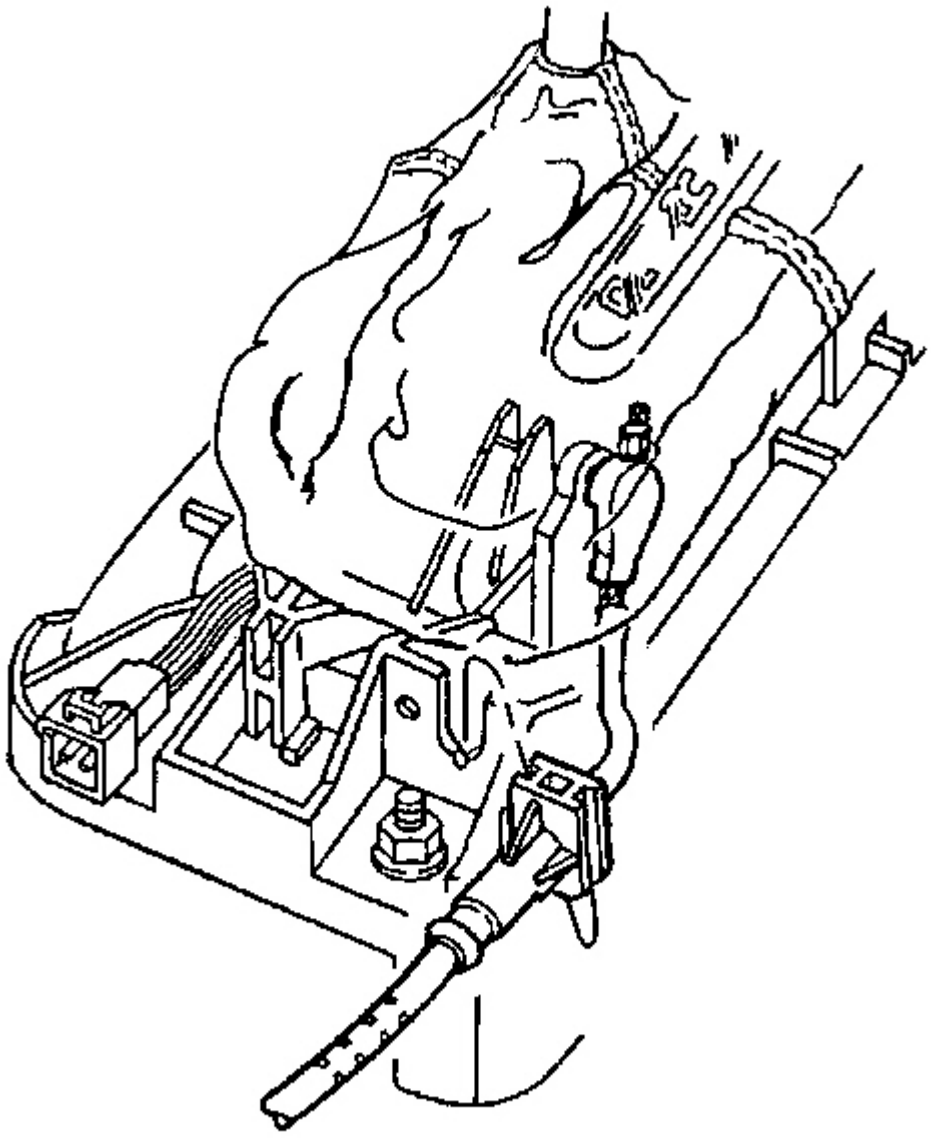


Fig. 25: Park/Lock Cable & Shift Control Slot
Courtesy of GENERAL MOTORS CORP.

11. Using a flat bladed screwdriver or other suitable tool, release the tab retaining the park/lock cable to the slot on the shift control.
12. Lift the park/lock cable out of the shift control slot and reposition the cable.

cardiagn.com

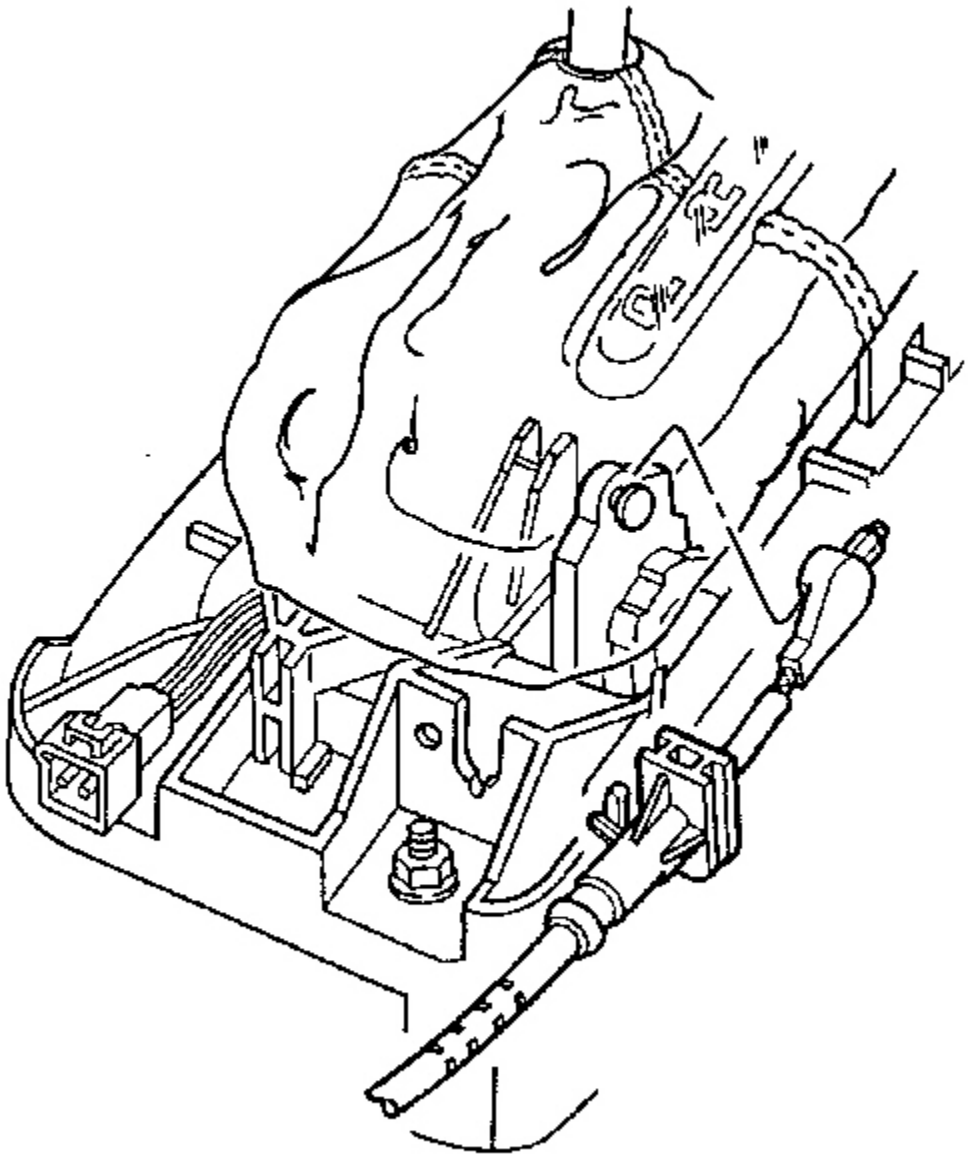


Fig. 26: Park/Lock Cable & Shift Control Pivot Arm Stud
Courtesy of GENERAL MOTORS CORP.

13. Grasp the cable end and pull rearward in order to unlock the cable from the shifter pivot arm stud.

IMPORTANT: Take note of the park/lock cable routing through the I/P center support

cardiagn.com

bracket to aid in reinstallation.

14. Remove the park/lock control cable.

Installation Procedure

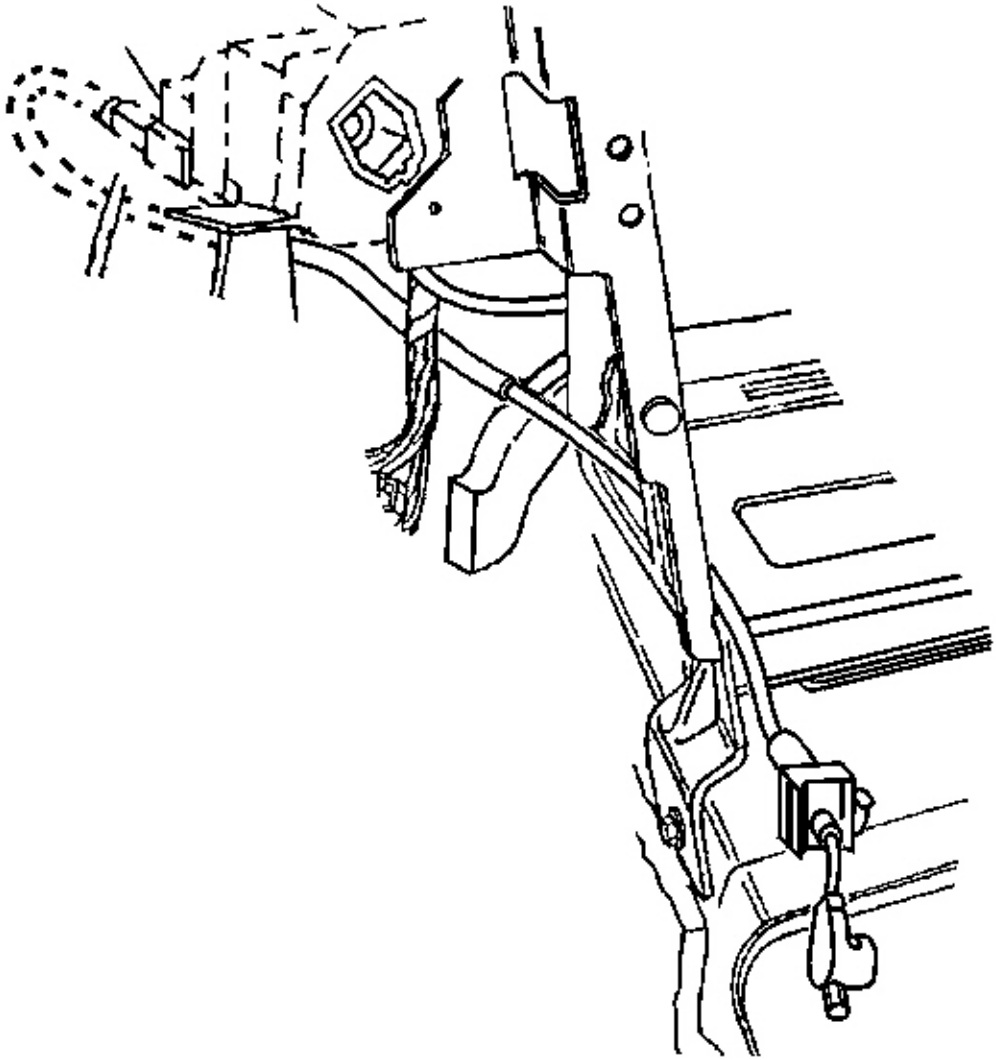


Fig. 27: Park/Lock Cable & I/P Center Support Bracket
Courtesy of GENERAL MOTORS CORP.

cardiagn.com

1. Route and position the park/lock cable through the I/P center support bracket as noted during removal.

   Be sure to route the cable under the wiring harness and above the floor rear outlet duct as shown.

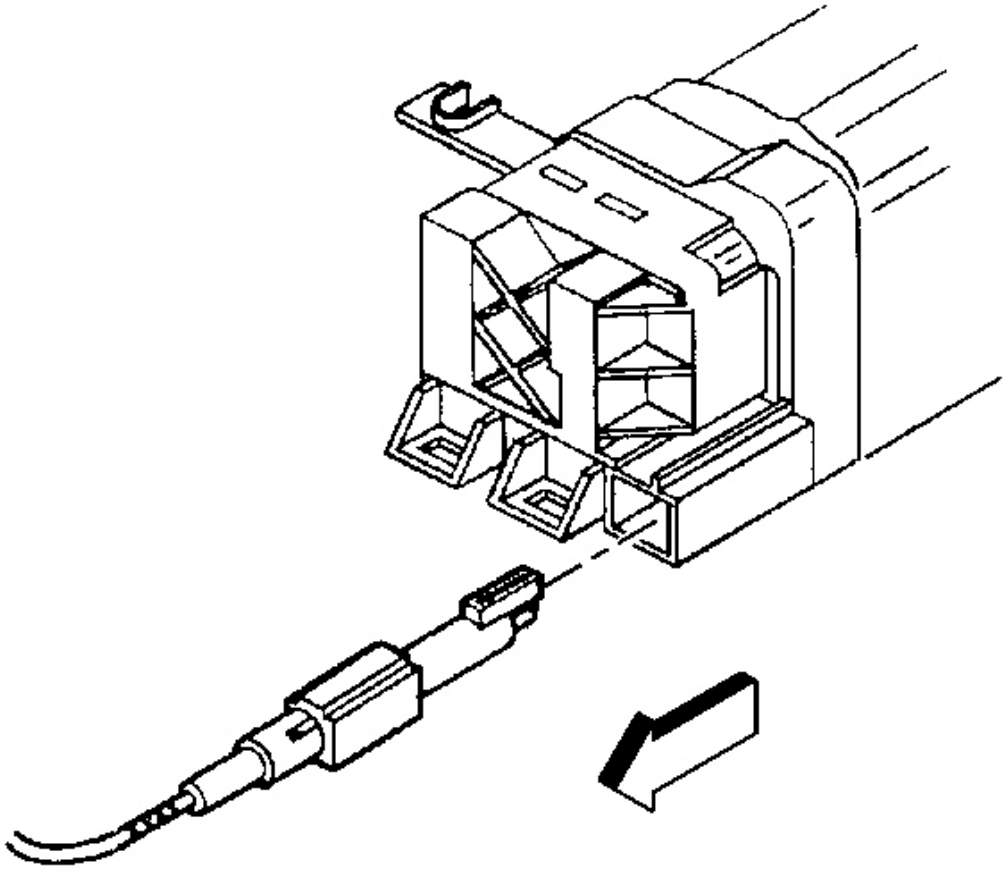


Fig. 28: Park/Lock Cable & Ignition Switch
Courtesy of GENERAL MOTORS CORP.

2. Install the park/lock cable to the ignition switch.

   Insert the cable into the ignition switch slot, then push in to lock the retaining tab.

3. Turn the ignition to OFF.

cardiagn.com

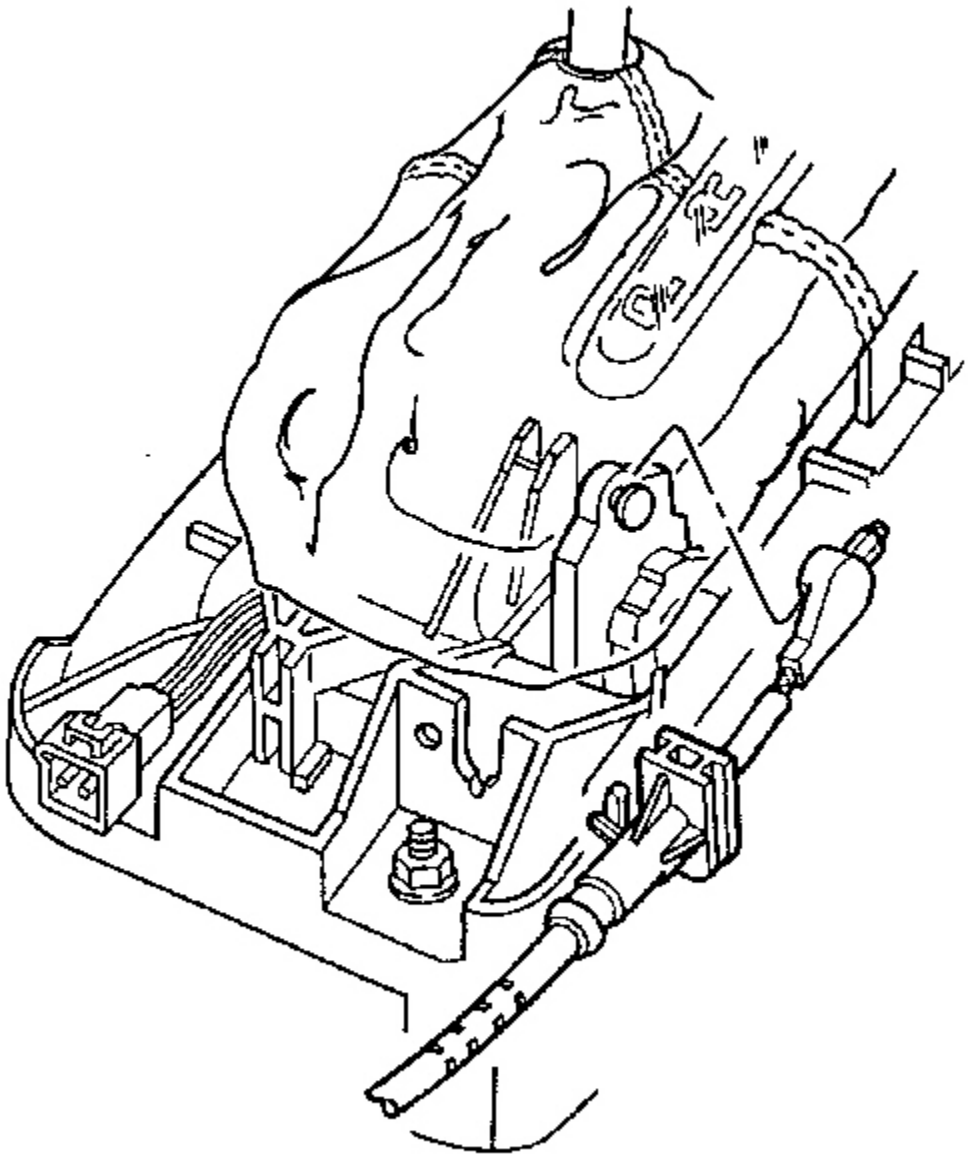


Fig. 29: Park/Lock Cable & Shift Control Pivot Arm Stud
Courtesy of GENERAL MOTORS CORP.

4. Install the park/lock cable to the shift control pivot arm stud.

   Align the cable onto the arm stud then pull forward to lock.

cardiagn.com

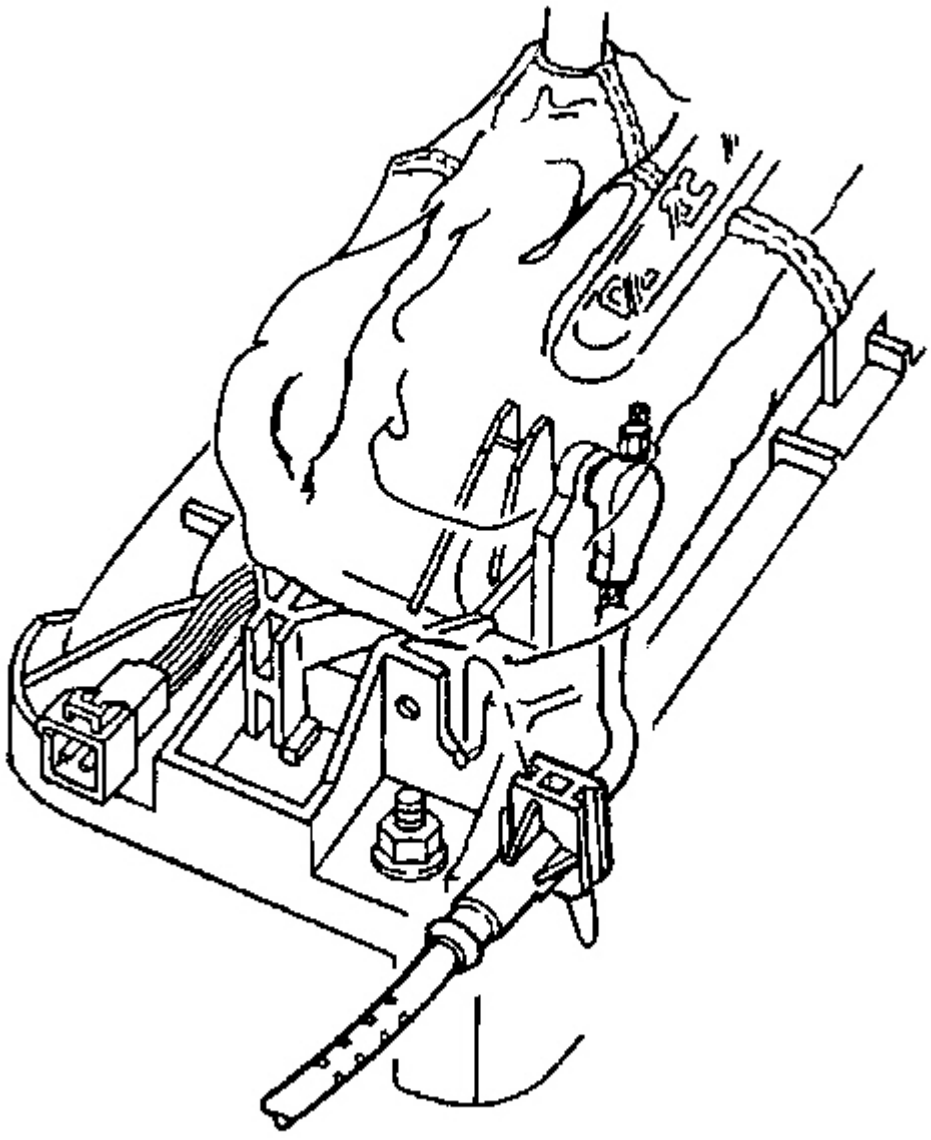


Fig. 30: Park/Lock Cable & Shift Control Slot
Courtesy of GENERAL MOTORS CORP.

5. Insert the cable into the slot on the shift control.

   Be sure the cable retaining tab locks in place.

cardiagn.com

6. Inspect the functional operation of the park/lock system:
    1. Install the ignition key and turn the ignition to ON.
    2. Place the shift lever in each position (other than PARK) and attempt to turn the ignition all the way to OFF and remove the ignition key.

       If the ignition cannot be turned all the way to the OFF position and if the ignition key cannot be removed (except in PARK), the park/lock system is functioning properly.
7. Place the shift lever in PARK.
8. Turn the ignition to OFF and remove the ignition key.
9. Install the driver knee bolster trim panel. Refer to **Trim Panel Replacement - Knee Bolster** in Instrument Panel, Gages and Console.
10. Install the I/P accessory trim plate. Refer to **Trim Plate Replacement - Instrument Panel (I/P) Accessory** in Instrument Panel, Gages and Console.
11. Install the console. Refer to **Console Replacement** in Instrument Panel, Gages and Console.

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT: Prior to restoring battery power, check to be certain that the ignition key is removed from the ignition switch.

12. Connect the negative battery cable.

    Tighten: Tighten the cable bolt to 15 N.m (11 lb ft).
13. Program the transmitters.
14. Unblock the wheels.
15. Release the parking brake.

AUTOMATIC TRANSMISSION RANGE SELECTOR CABLE REPLACEMENT

Removal Procedure

cardiagn.com

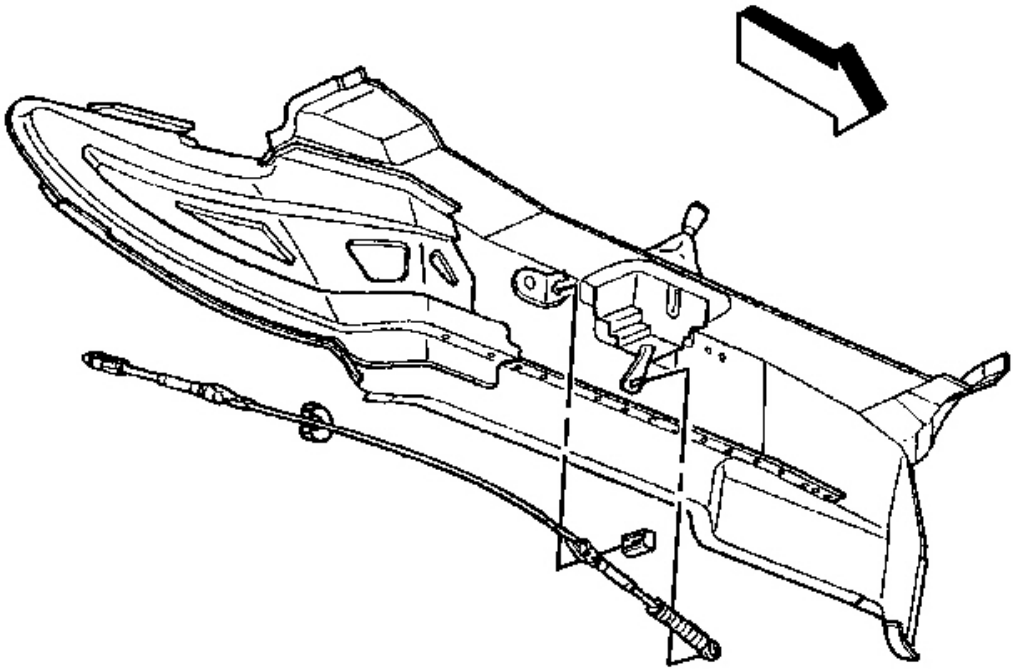


Fig. 31: Shift Control Cable & Driveline Tunnel Bracket
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Shift the floor shift control to NEUTRAL.

   If replacing a damaged cable, be sure that BOTH the floor shift control and the transmission are in NEUTRAL.

3. Remove the catalytic converter assembly. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
4. Remove the driveline tunnel closeout panel.

IMPORTANT: Use care to not suddenly jerk the shift control cable during disassembly, the shift control cable rod end guide tubes are EXTREMELY INFLEXIBLE and capable of only a SLIGHT bend.

5. Using a large flat bladed screwdriver, CAREFULLY release the shift control cable end clip from the floor shift control arm stud.
6. Remove the shift control cable from the driveline tunnel bracket.

cardiagn.com

1. Using a flat bladed screwdriver, pry the cable retaining staple clip from the cable.
2. Depress the cable retaining tabs.
3. While depressing the tabs, push the tabs through the hole in the driveline tunnel bracket.
4. Slide the cable out of the bracket slot.

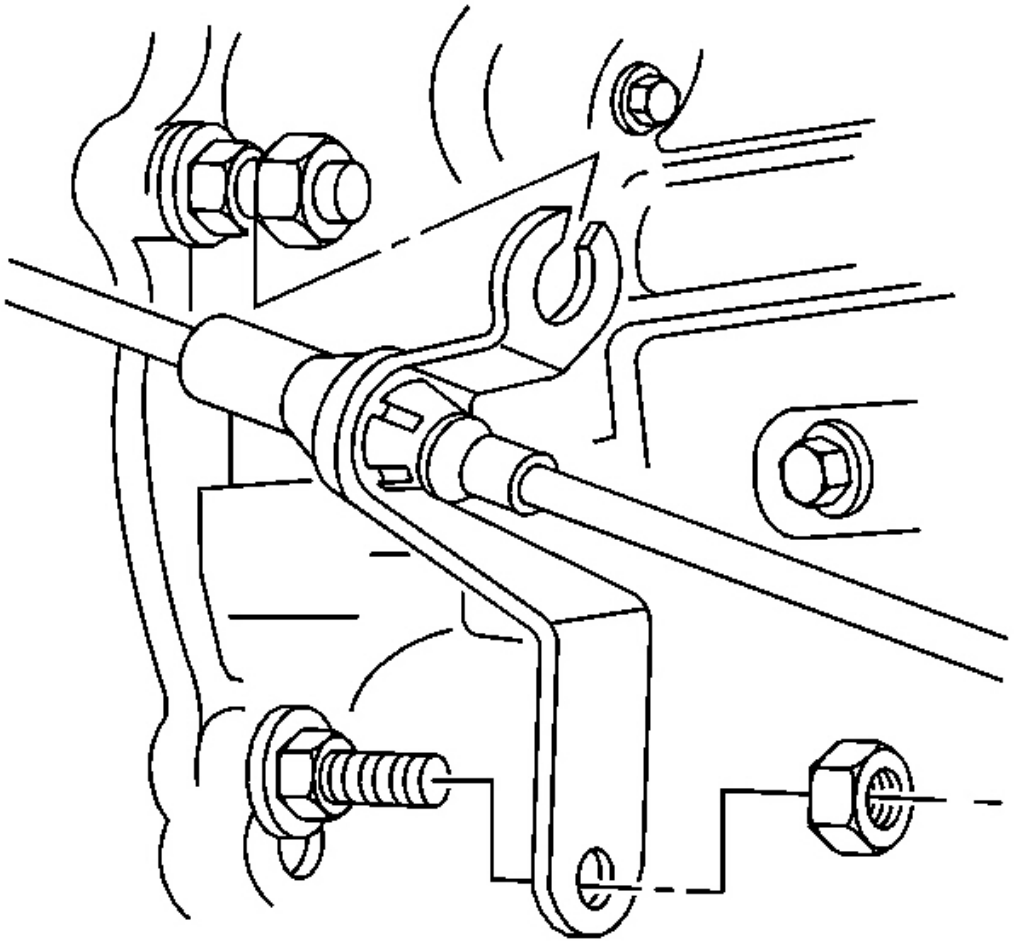


Fig. 32: Shift Control Cable Bracket & Nuts
Courtesy of GENERAL MOTORS CORP.

7. Remove the nuts retaining the shift control cable bracket to the transmission.
8. Reposition the cable and cable bracket away from the studs.

cardiagn.com

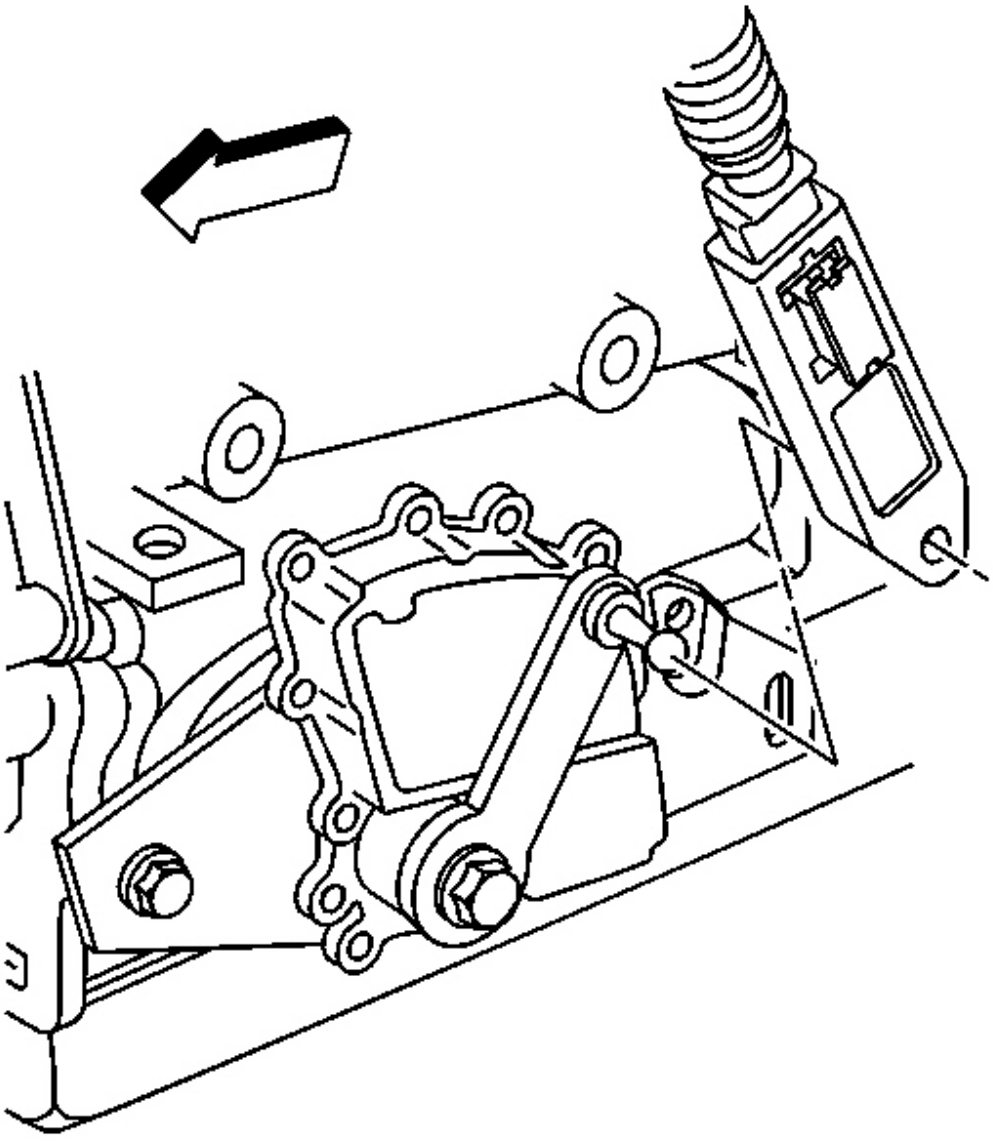


Fig. 33: Transmission Shift Control Cable & Bracket
Courtesy of GENERAL MOTORS CORP.

9. CAREFULLY release the shift control cable end clip from the transmission shift lever stud.
10. Remove the shift control cable and bracket.

cardiagn.com

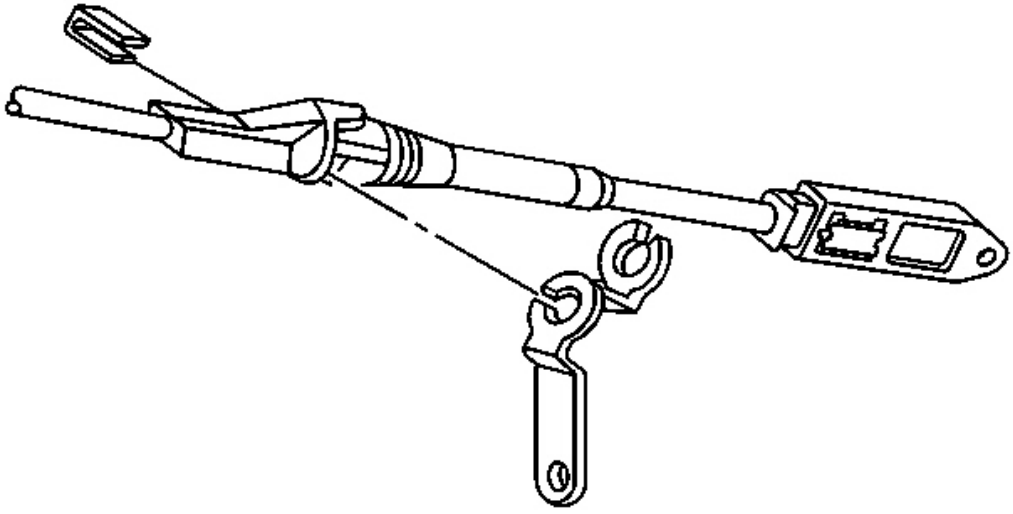


Fig. 34: Shift Control Cable Bracket & Shift Control Cable
Courtesy of GENERAL MOTORS CORP.

11. Remove the shift control cable bracket from the shift control cable, if necessary.
    1. Using a flat bladed screwdriver, pry the shift cable retaining staple clip from the cable.
    2. Depress the shift cable retaining tabs.
    3. While depressing the tabs, push the tabs through the hole in the shift cable bracket.
    4. Slide the cable out of the bracket slot.

Installation Procedure

cardiagn.com

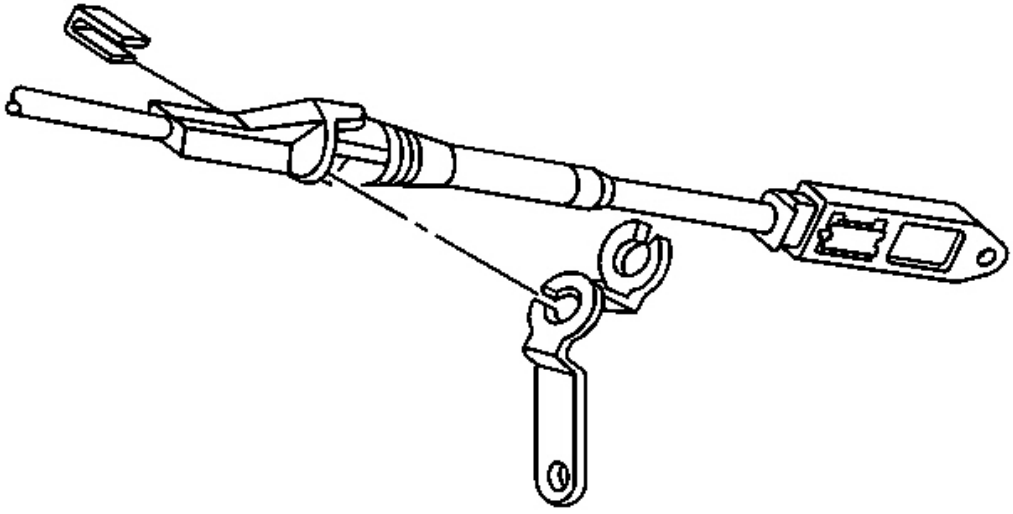


Fig. 35: Shift Control Cable Bracket & Shift Control Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the shift control cable bracket to the shift control cable, if removed.
    1. Slide the smaller diameter portion of the cable into the slot in the shift cable bracket.
    2. Push the tabs through the hole in the bracket to lock the cable in place.
    3. Insert the shift cable retaining staple clip between the shift cable retaining tabs.

       Press the staple clip firmly to secure.

cardiagn.com

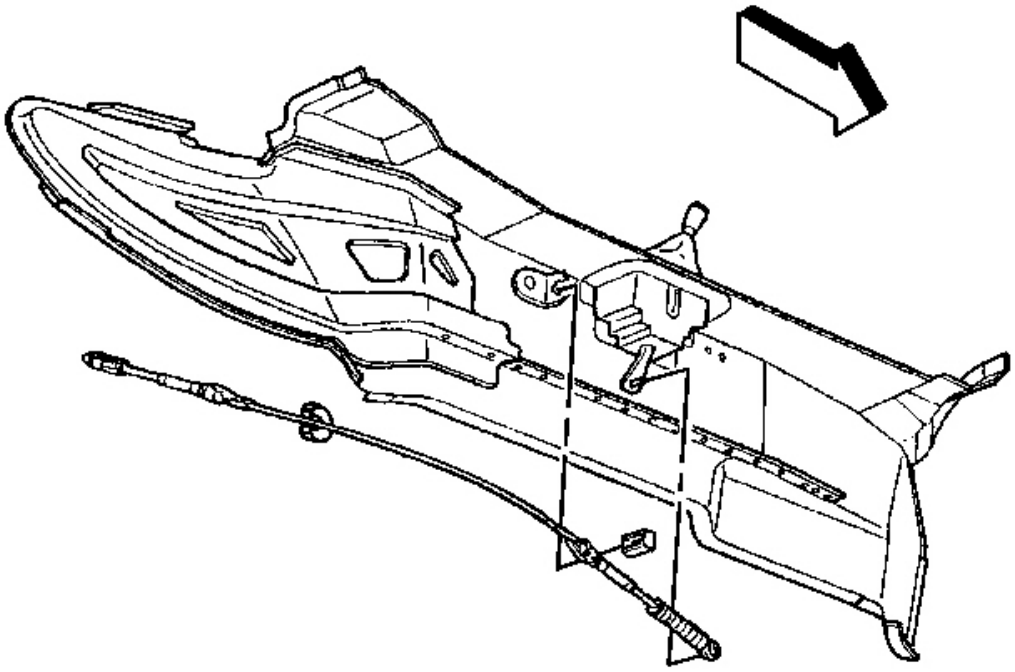


Fig. 36: Shift Control Cable & Driveline Tunnel Bracket
Courtesy of GENERAL MOTORS CORP.

2. Position and install the shift control cable to the driveline tunnel bracket.
    1. Slide the smaller diameter portion of the shift cable into the slot in the driveline tunnel bracket.
    2. Push the shift cable retaining tabs through the hole in the bracket to lock the cable in place.
    3. Insert the shift cable retaining staple clip between the shift cable retaining tabs.

    Press the staple clip firmly to secure.

3. Align the shift control cable end to the floor shift control arm stud.
4. CAREFULLY secure the shift control cable end clip to the floor shift control arm stud.

cardiagn.com

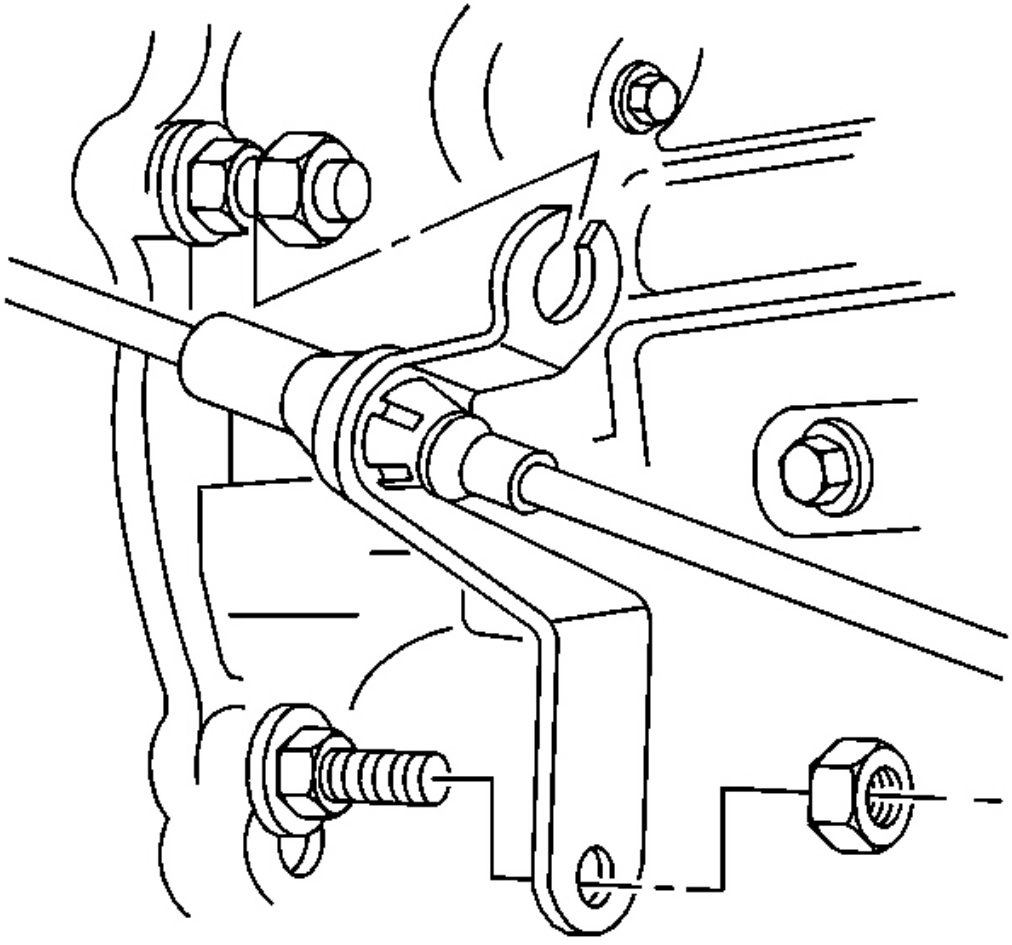


Fig. 37: Shift Control Cable Bracket & Nuts
Courtesy of GENERAL MOTORS CORP.

5. Install the shift control cable bracket to the transmission studs.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the nuts retaining the shift control cable bracket to the transmission.

Tighten: Tighten the transmission shift control cable bracket retaining nuts to 20 N.m (15 lb ft).

cardiagn.com

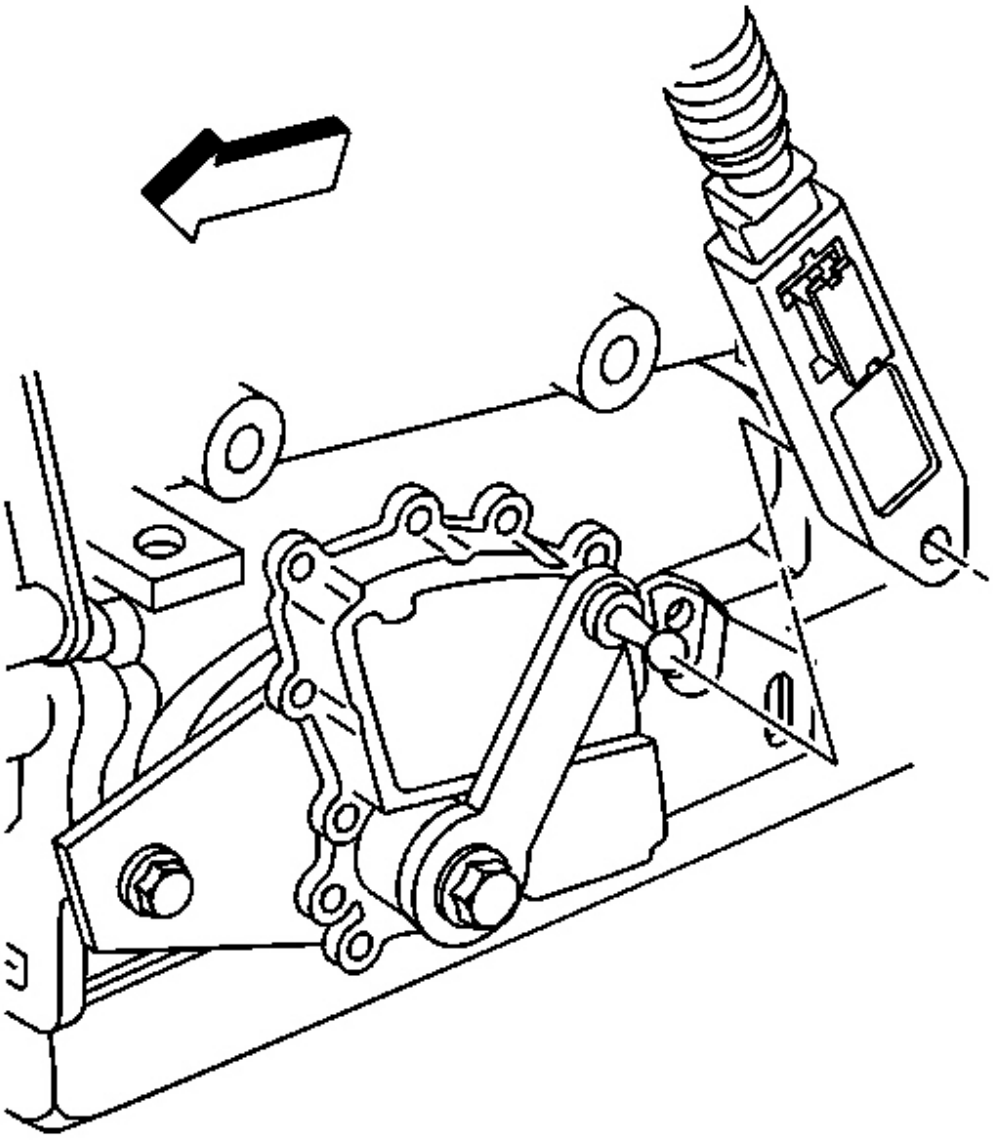


Fig. 38: Transmission Shift Control Cable & Bracket
Courtesy of GENERAL MOTORS CORP.

7. Check to be sure that BOTH the floor shift control and the transmission are in NEUTRAL.
8. Align the shift control cable end to the transmission shift lever stud.
9. CAREFULLY secure the shift control cable end clip to the transmission shift lever stud.

cardiagn.com

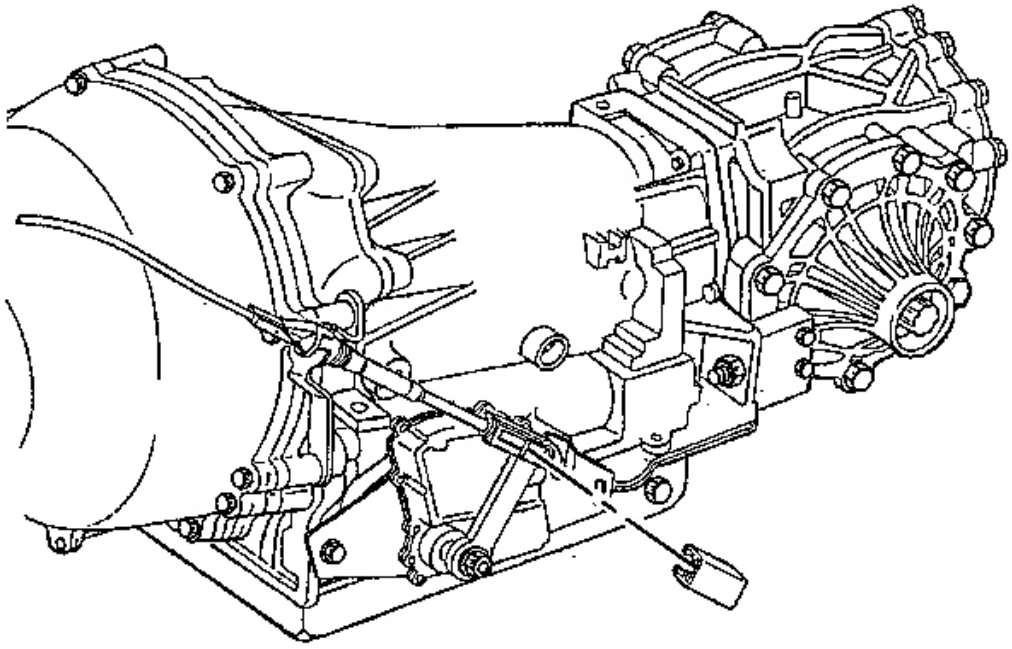


Fig. 39: Transmission Shift Control Cable
Courtesy of GENERAL MOTORS CORP.

10. If installing a NEW transmission shift control cable, remove the shipping guard from the adjuster lock.

cardiagn.com

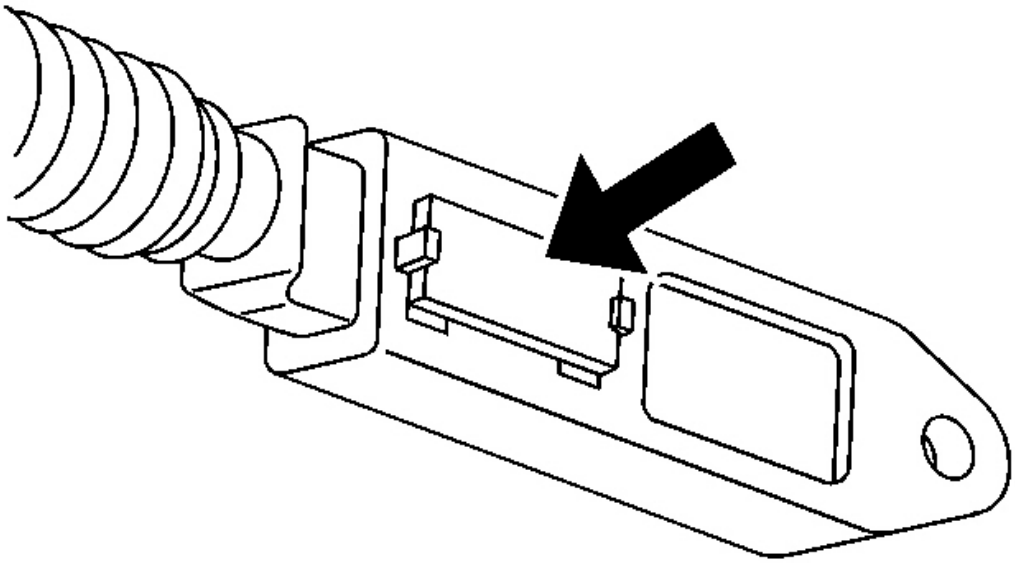


Fig. 40: Depressing The Shift Control Cable Adjuster Lock
Courtesy of GENERAL MOTORS CORP.

11. If installing a NEW transmission shift control cable, depress the shift control cable adjuster lock.
12. Lower the vehicle. Leave the vehicle on the hoist.
13. Verify that the shift control cable is operating smoothly:
    1. Firmly apply the parking brake.
    2. Turn the ignition switch to ON; DO NOT start the engine.
    3. Apply the regular brakes.
    4. Shift from NEUTRAL to FIRST, then shift from FIRST to SECOND, then DRIVE and so on; pause for 1 second in each detent position.

       Take note of an audible sound from the transmission shift lever each time a shift detent is selected.

    5. Shift from PARK directly to FIRST.
    6. Repeat steps 13.4 and 13.5 an additional 2 times.
    7. If any binding is felt during this check, or if no audible sound was produced from the transmission shift lever, inspect the shift control cable for damage (at either end of the cable).
    8. Shift the floor shift control into PARK.
    9. Release the regular brakes.
    10. Turn the ignition switch OFF.

cardiagn.com

11. Release the parking brake.

14. Raise and support the vehicle.
15. Install the driveline tunnel closeout panel.
16. Install the catalytic converter assembly. Refer to **Catalytic Converter Replacement** in Engine Exhaust.

CAUTION: Refer to Road Test Caution in Cautions and Notices.

17. Test drive the vehicle in an area with little traffic; ensure that the transmission will shift smoothly into, and maintain each detent position.

AUTOMATIC TRANSMISSION RANGE SELECTOR CABLE ADJUSTMENT

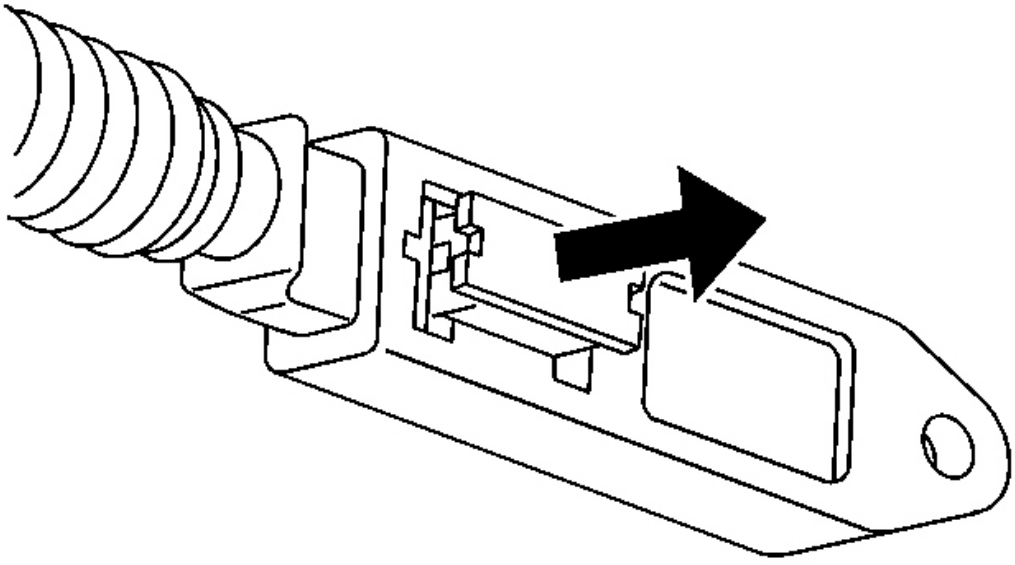


Fig. 41: Releasing The Shift Control Cable Adjuster Lock
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Shift the transmission into NEUTRAL.
3. Using a flat bladed screwdriver, carefully pry to release the transmission shift control cable adjustment lock.
4. Check to be sure that the transmission floor shift control is in the NEUTRAL detent position.
5. Check to be sure that the transmission is in the NEUTRAL detent position.

cardiagn.com

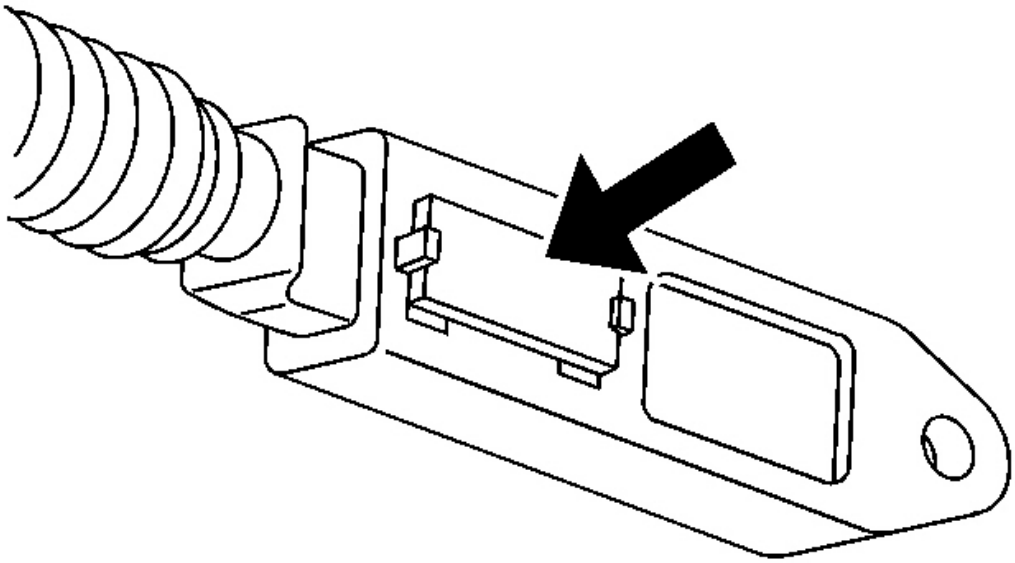


Fig. 42: Depressing The Shift Control Cable Adjuster Lock
Courtesy of GENERAL MOTORS CORP.

6. Press to secure the transmission shift control cable adjustment lock.
7. Lower the vehicle.

FLOOR SHIFT CONTROL REPLACEMENT

Removal Procedure

cardiagn.com

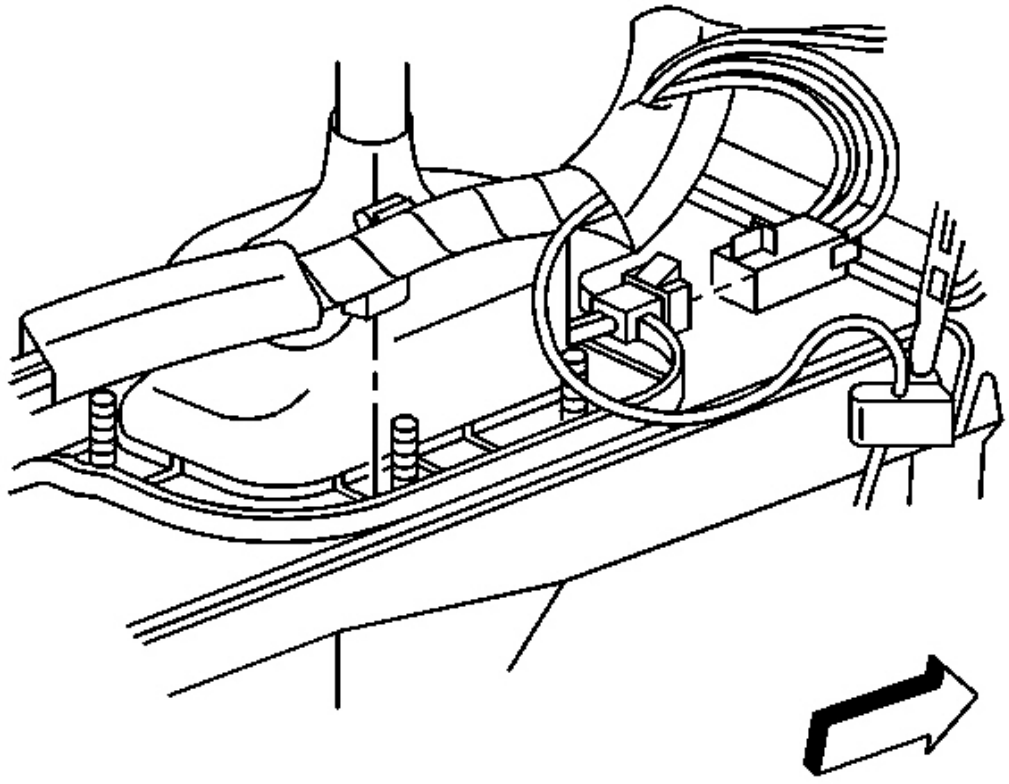


Fig. 43: Floor Shift Control Electrical Connector & I/P Wiring Harness Retaining Clip
Courtesy of GENERAL MOTORS CORP.

1. Place the vehicle on a level surface.
2. Block the wheels to keep the vehicle from moving.
3. Apply the parking brake.
4. Shift the floor shift control into PARK.
5. Turn the ignition to OFF and remove the ignition key.

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

6. Disconnect the negative battery cable.
7. Remove the console. Refer to **Console Replacement** in Instrument Panel, Gages and Console.
8. Remove the I/P accessory trim plate. Refer to **Trim Plate Replacement - Instrument Panel (I/P)**

cardiagn.com

Accessory in Instrument Panel, Gages and Console.

9. Disconnect the floor shift control electrical connector.
10. Disconnect the I/P wiring harness retaining clip from the shift control and reposition the harness.

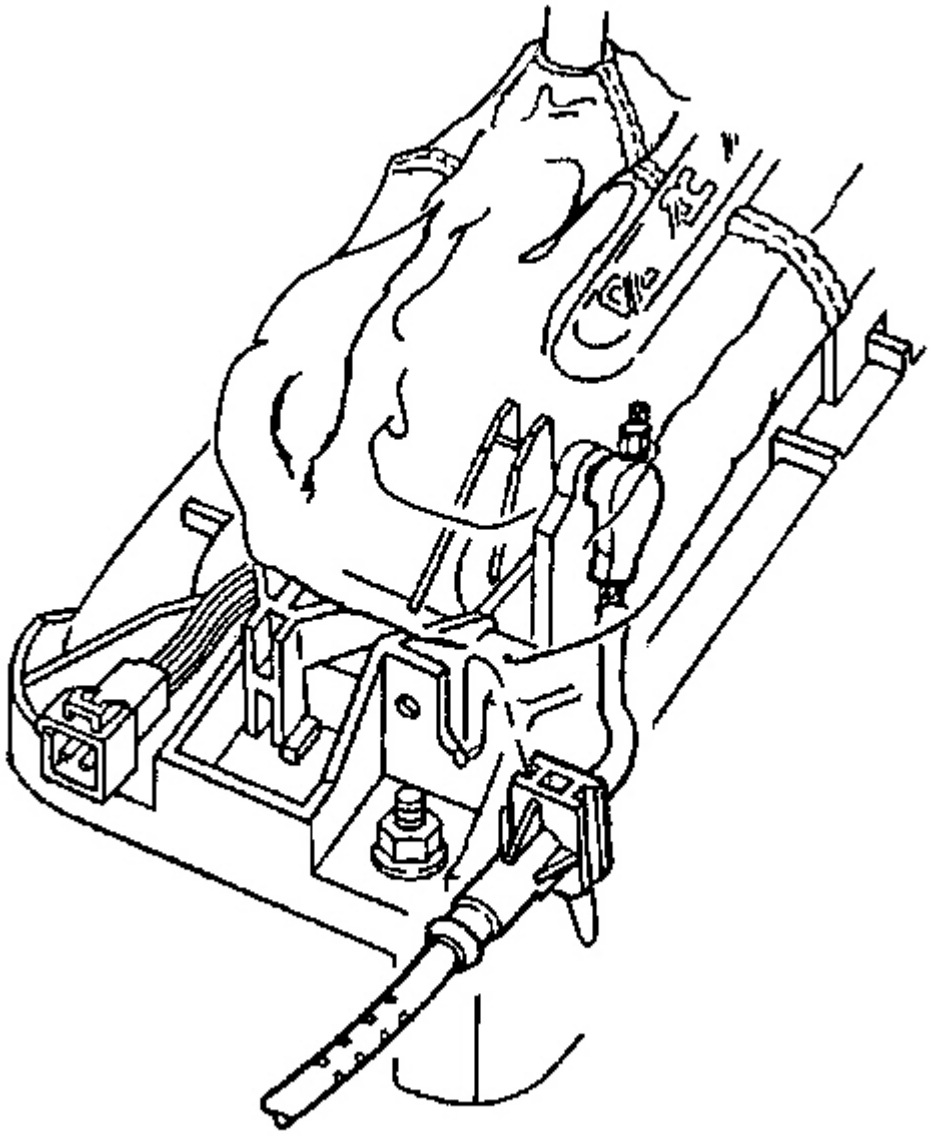


Fig. 44: Park/Lock Cable & Shift Control Slot
Courtesy of GENERAL MOTORS CORP.

cardiagn.com

11. Using a small flat bladed screwdriver or other suitable tool, release the tab retaining the park/lock cable to the slot on the shift control.
12. Lift the park/lock cable out of the shift control slot and reposition the cable.

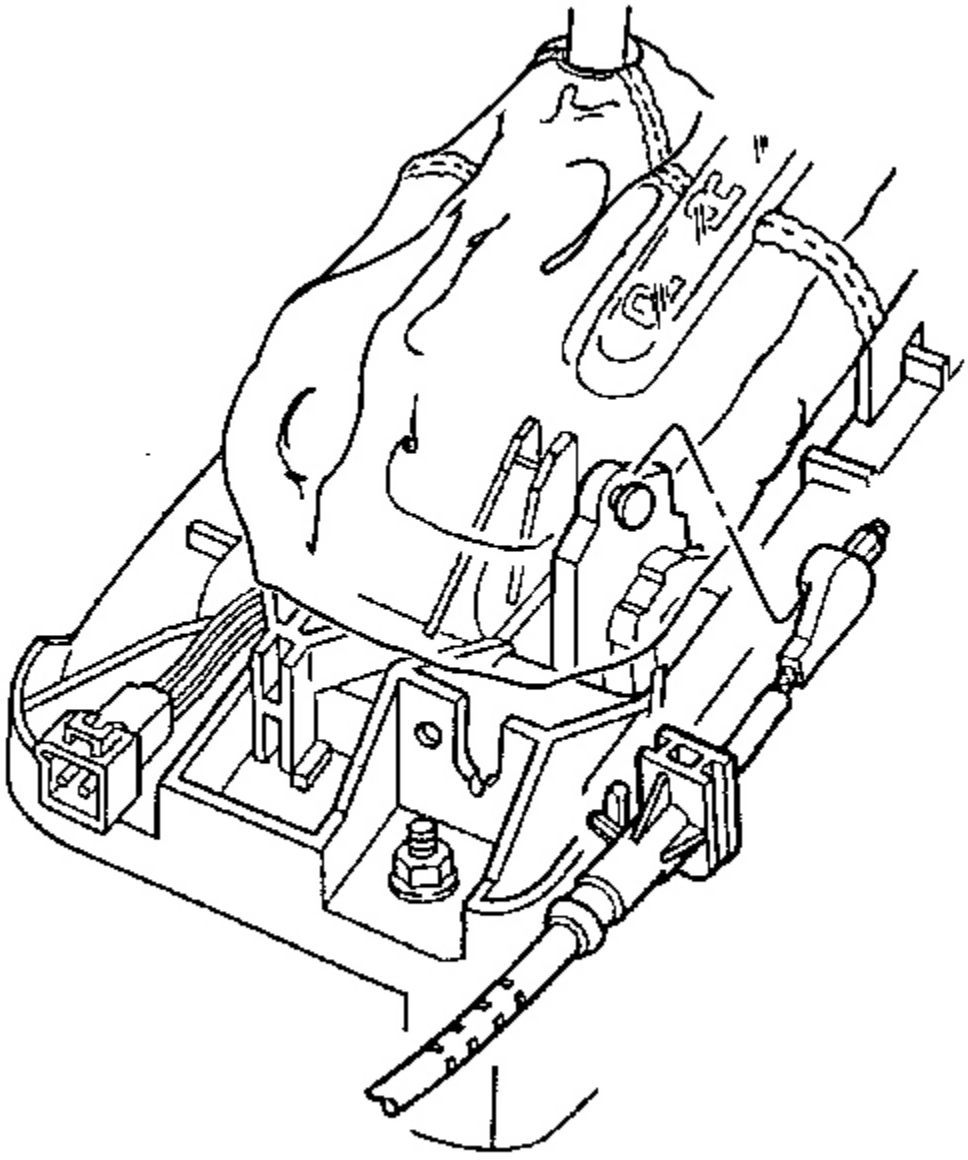


Fig. 45: Park/Lock Cable & Shift Control Pivot Arm Stud
Courtesy of GENERAL MOTORS CORP.

cardiagn.com

13. Grasp the cable end and pull rearward in order to unlock the cable from the shifter pivot arm stud, then reposition the cable.

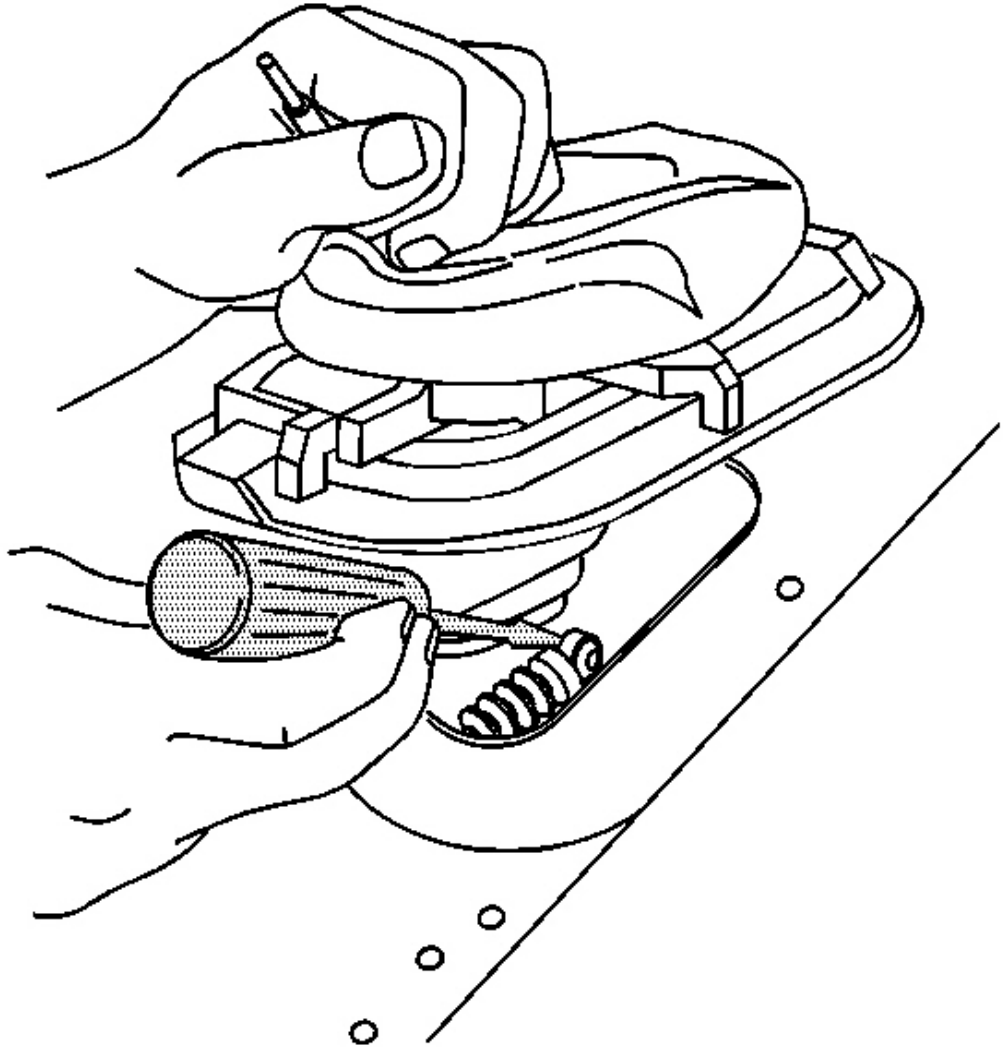


Fig. 46: Removing Nuts Retaining Shift Control & Driveline Tunnel
Courtesy of GENERAL MOTORS CORP.

14. Remove the nuts retaining the shift control to the driveline tunnel.
15. Shift the floor shift control into FIRST.

This will lengthen the shift control cable and provide slightly more movement.

cardiagn.com

IMPORTANT: DO NOT lift the floor shift control any more than shown, the shift control cable rod end guide tubes are EXTREMELY INFLEXIBLE and capable of only a SLIGHT bend.

16. Slowly lift the floor shift control JUST ENOUGH to access the shift control cable end.

    BE SURE the floor shift control remains in FIRST.

IMPORTANT: Use care to not suddenly jerk either the shift control cable or the floor shift control during disassembly, the shift control cable rod end guide tubes are EXTREMELY INFLEXIBLE and capable of only a SLIGHT bend.

17. Using a large flat bladed screwdriver, CAREFULLY release the shift control cable end clip from the floor shift control arm stud.

cardiagn.com

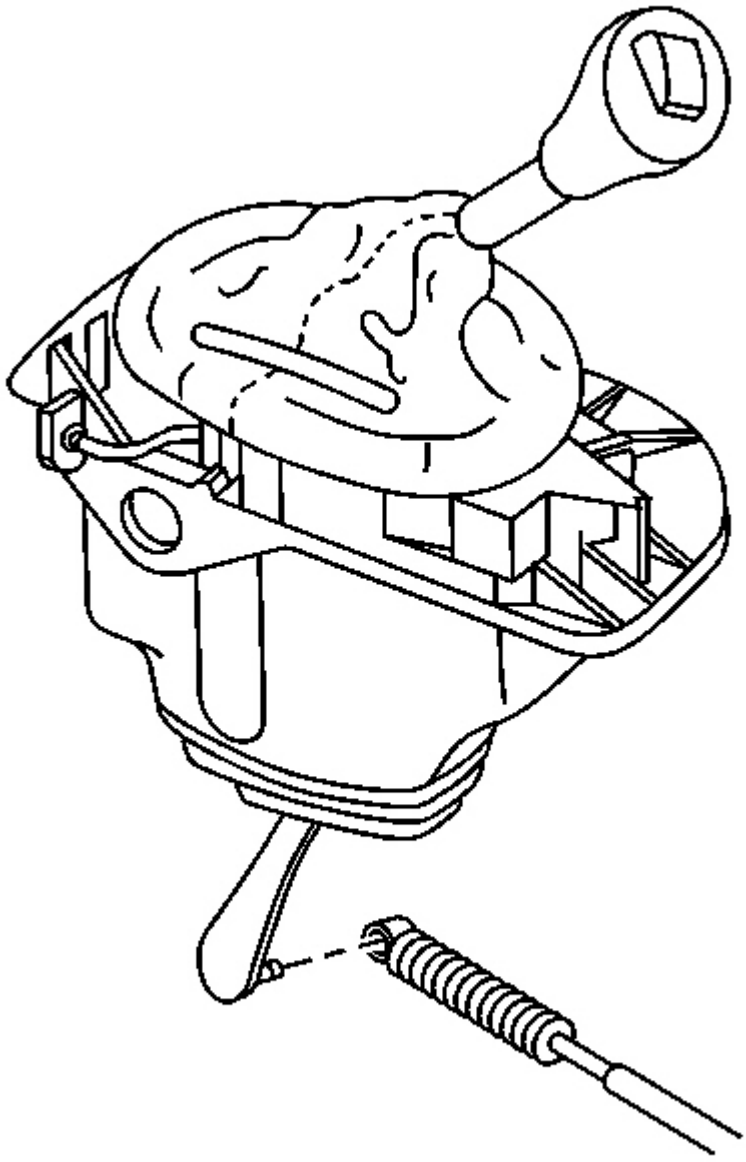


Fig. 47: Shift Control Cable & Floor Shift Control Arm Stud
Courtesy of GENERAL MOTORS CORP.

18. Ensure that the shift control cable is completely disconnected from the floor shift control arm stud.

cardiagn.com

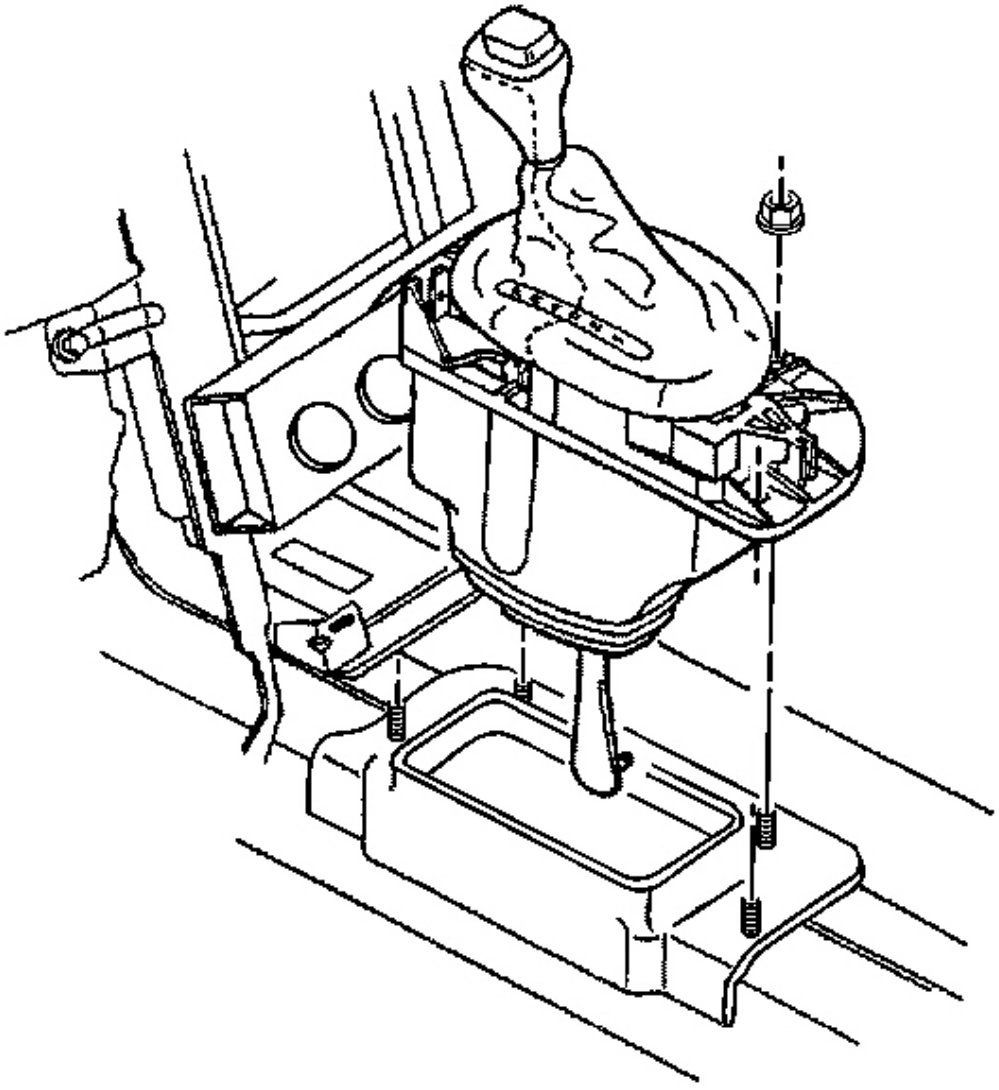


Fig. 48: Floor Shift Control
Courtesy of GENERAL MOTORS CORP.

19. Remove the floor shift control.

Installation Procedure

cardiagn.com

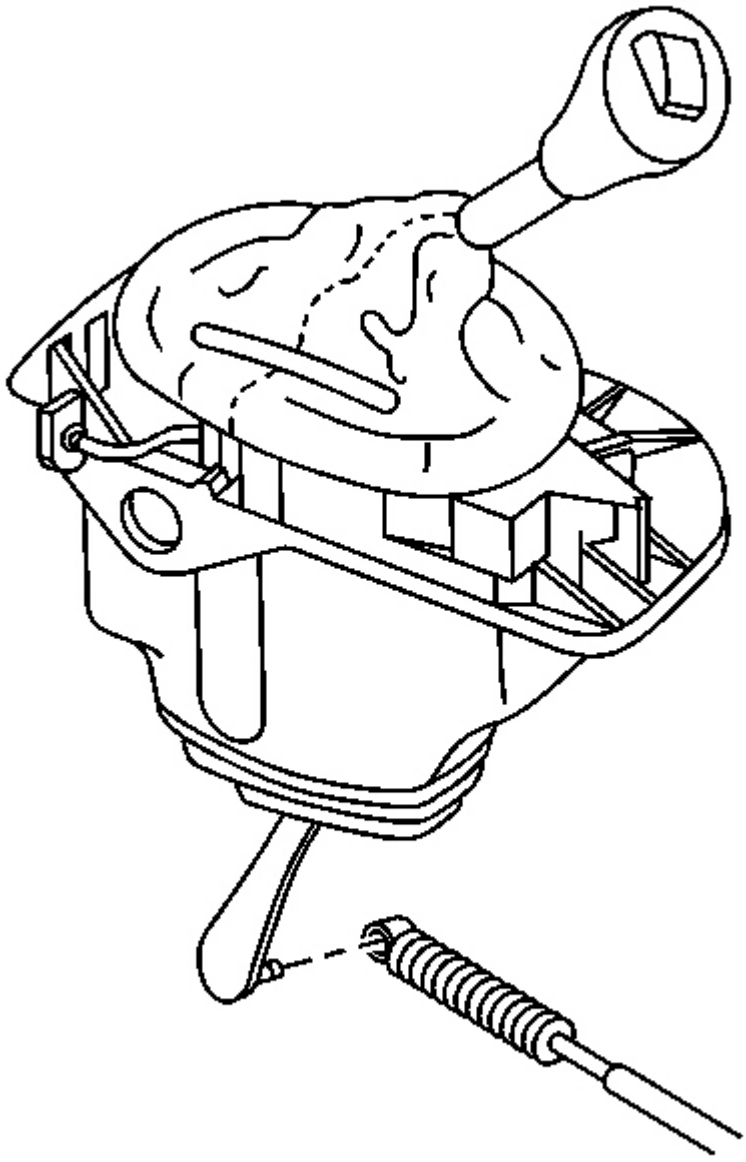


Fig. 49: Shift Control Cable & Floor Shift Control Arm Stud
Courtesy of GENERAL MOTORS CORP.

1. Shift the floor shift control into FIRST.

IMPORTANT: Be sure to position the floor shift control as LOW as possible, the shift

cardiagn.com

control cable rod end guide tubes are EXTREMELY INFLEXIBLE and capable of only a SLIGHT bend.

2. Lower the floor shift control into position.

   BE SURE the floor shift control remains in FIRST.

3. Align the shift control cable end to the floor shift control arm stud.

   IMPORTANT: Use care to not suddenly jerk either the shift control cable or the floor shift control during assembly, the shift control cable rod end guide tubes are EXTREMELY INFLEXIBLE and capable of only a SLIGHT bend.

4. Position a large pry bar along the side of the driveline support assembly and use as an aid to secure the shift control cable end clip to the floor shift control arm stud.
5. Seat the floor shift control to the driveline tunnel.

   NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the nuts retaining the floor shift control to the driveline tunnel.

   Tighten: Tighten the floor shift control retaining nuts to 10 N.m (89 lb in).

7. Verify that the floor shift control and the shift control cable are operating smoothly:
   1. Shift from FIRST to SECOND, then DRIVE and so on; pause for 1 second in each detent position.

      Take note of an audible sound from the transmission shift lever each time a shift detent is selected.

   2. Shift from PARK directly to FIRST.
   3. Repeat steps 7.1 and 7.2 an additional 2 times.
   4. If any binding is felt during this check, or if no audible sound was produced from the transmission shift lever, remove the floor shift control and inspect the floor shift control and the shift control cable for damage (at either end of the cable).
8. Shift the floor shift control into PARK.

cardiagn.com

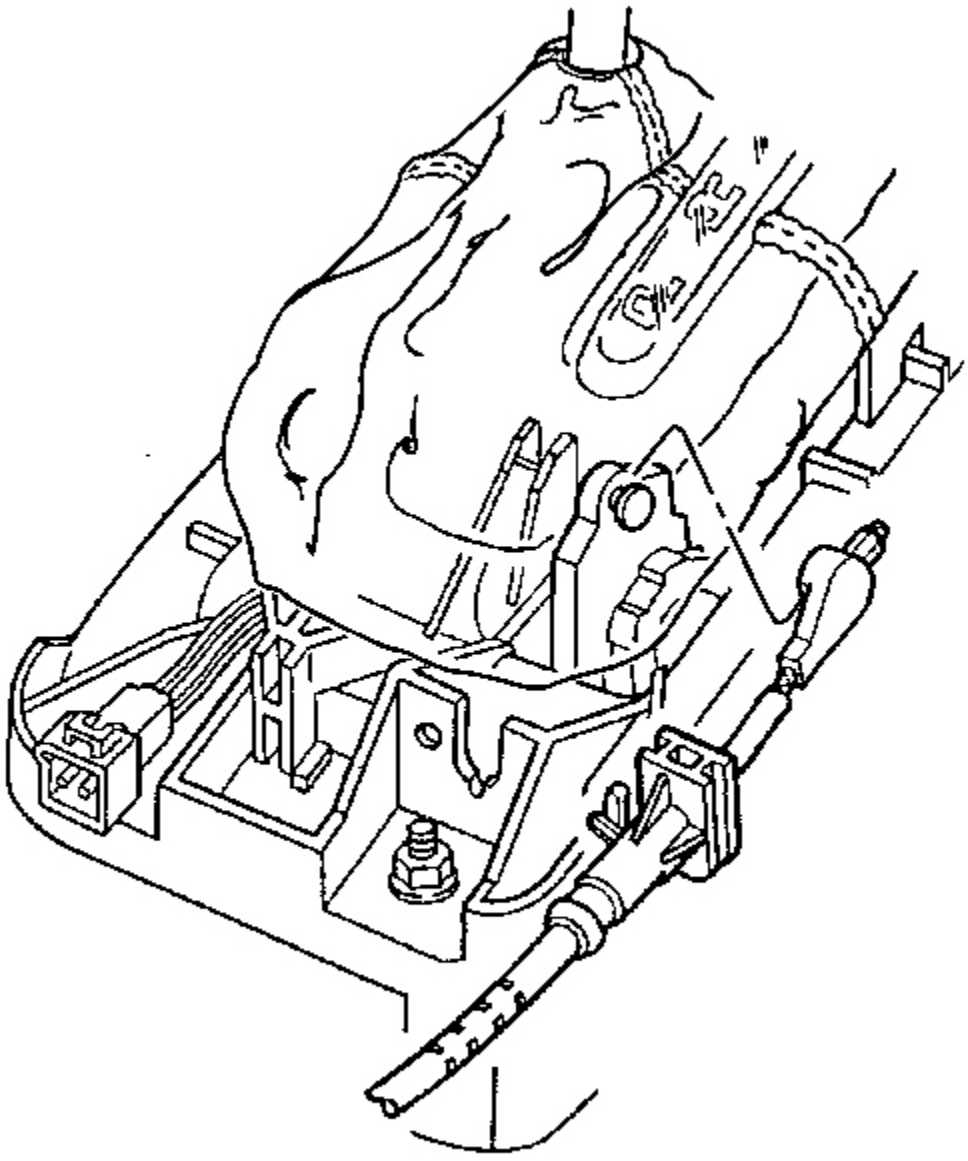


Fig. 50: Park/Lock Cable & Shift Control Pivot Arm Stud
Courtesy of GENERAL MOTORS CORP.

9. Install the park/lock cable to the floor shift control pivot arm stud.

   Align the cable onto the arm stud then pull forward to lock.

cardiagn.com

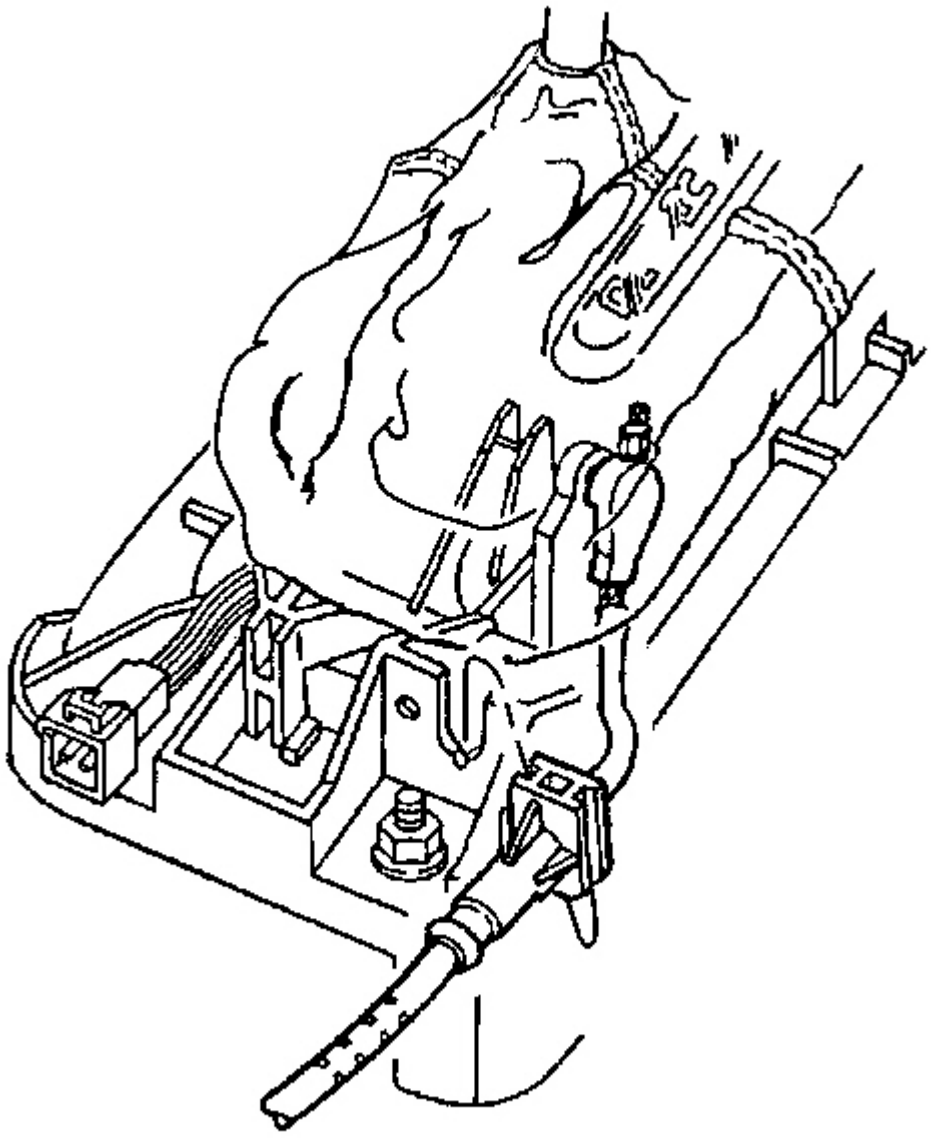


Fig. 51: Park/Lock Cable & Shift Control Slot
Courtesy of GENERAL MOTORS CORP.

10. Insert the park/lock cable into the slot on the floor shift control.

    Be sure the cable retaining tab locks into place.

cardiagn.com

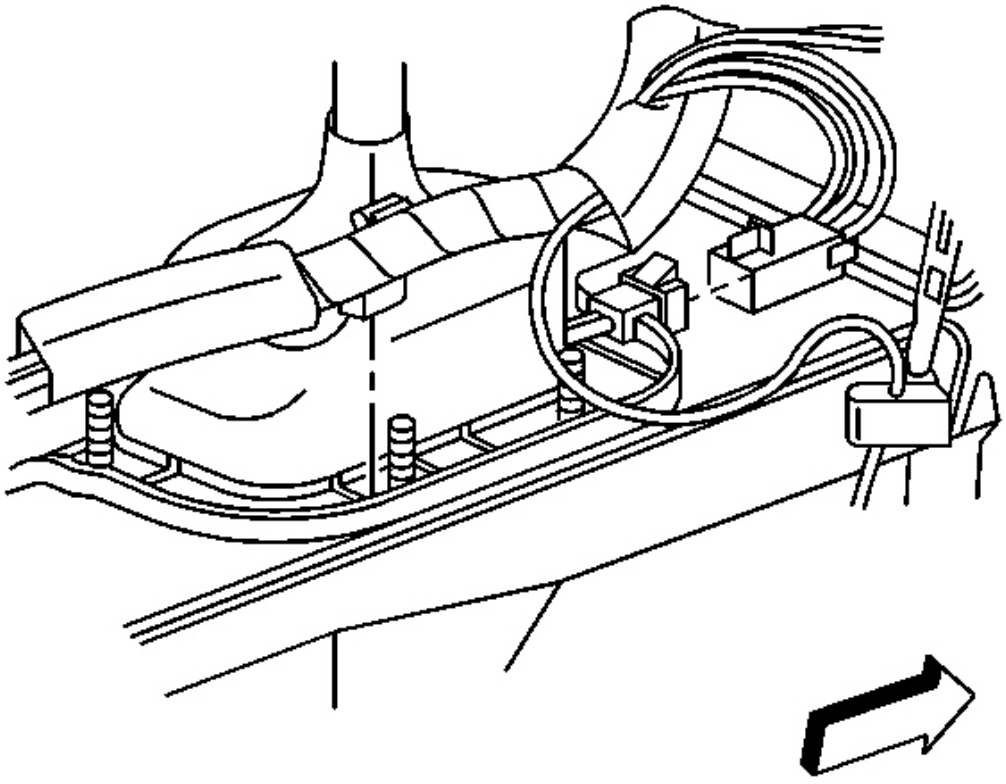


Fig. 52: Floor Shift Control Electrical Connector & I/P Wiring Harness Retaining Clip
Courtesy of GENERAL MOTORS CORP.

11. Connect the I/P wiring harness retaining clip to the shift control.
12. Connect the shift control electrical connector.
13. Install the I/P accessory trim plate. Refer to **Trim Plate Replacement - Instrument Panel (I/P) Accessory** in Instrument Panel, Gages and Console.
14. Install the console. Refer to **Console Replacement** in Instrument Panel, Gages and Console.

IMPORTANT: Prior to restoring battery power, check to be certain that the ignition key is removed from the ignition switch.

15. Connect the negative battery cable.

    Tighten: Tighten the negative battery cable bolt to 15 N.m (11 lb ft).

16. Program the transmitters.

cardiagn.com

17. Unblock the wheels.
18. Release the parking brake.

CAUTION: Refer to Road Test Caution in Cautions and Notices.

19. Test drive the vehicle in an area with little traffic; ensure that the transmission will shift smoothly into, and maintain each detent position.

PARK/NEUTRAL POSITION SWITCH REPLACEMENT

Tools Required

J 41364-A Park/Neutral Position Switch Aligner

Removal Procedure

cardiagn.com

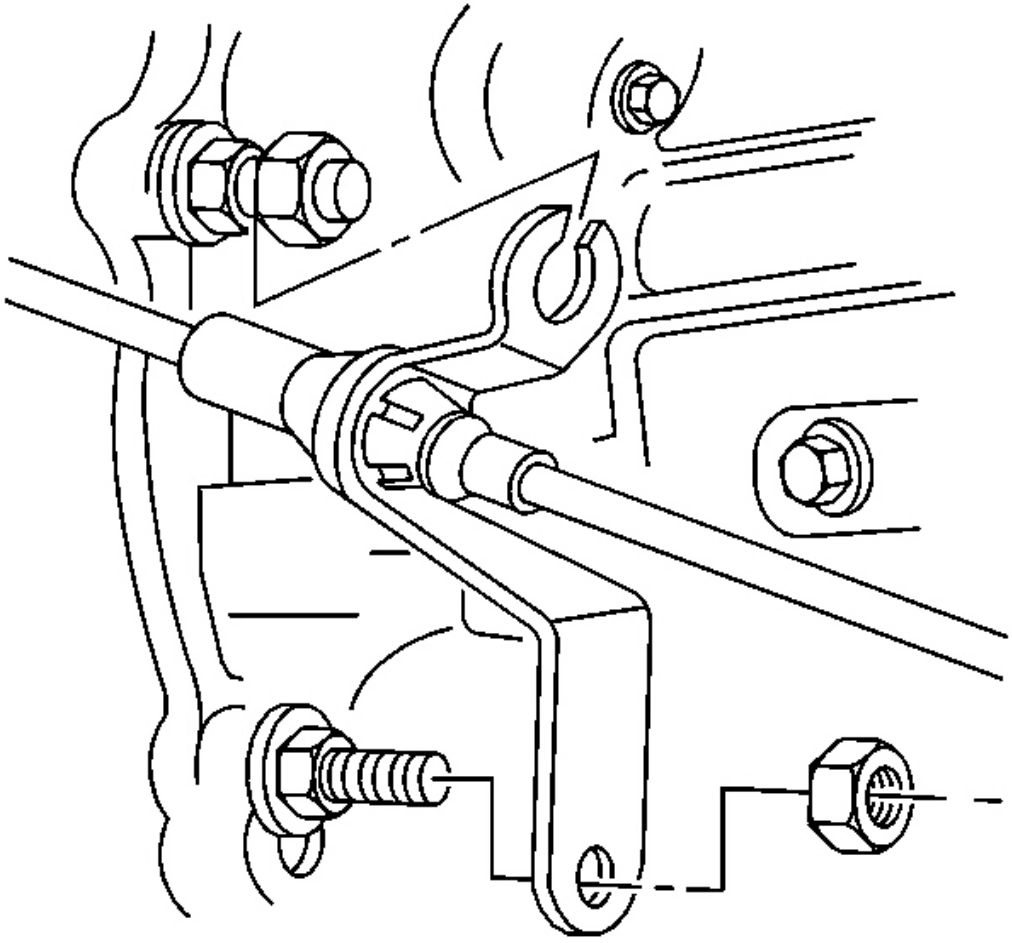


Fig. 53: Shift Control Cable Bracket & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the intermediate exhaust pipe and allow the LH muffler assembly to hang down out of the way. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
3. Shift the transmission into NEUTRAL.
4. Remove the nuts retaining the transmission shift control cable bracket to the transmission.

cardiagn.com

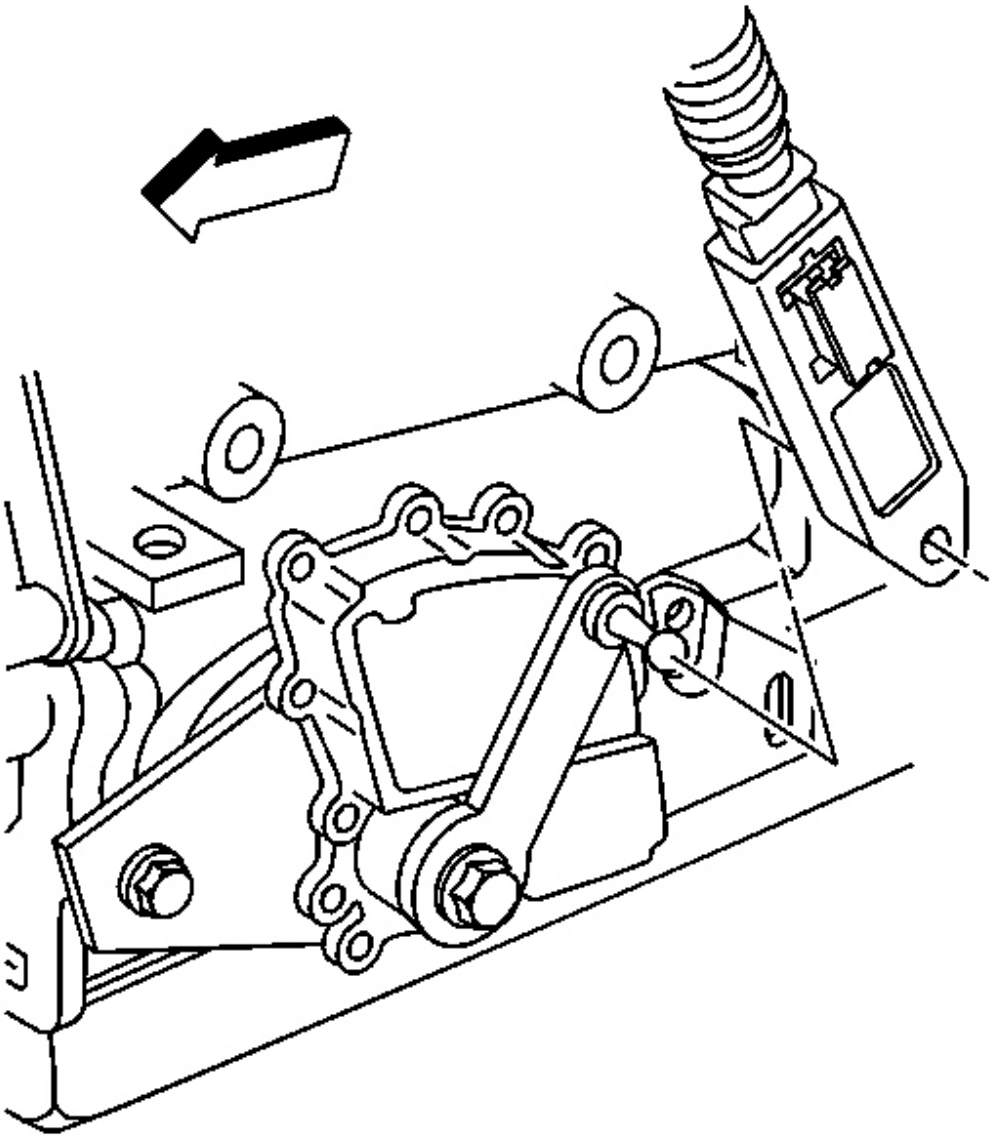


Fig. 54: Transmission Shift Control Cable & Bracket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use care to not suddenly jerk the shift control cable during disassembly, the shift control cable rod end guide tubes are EXTREMELY INFLEXIBLE and capable of only a SLIGHT bend.

cardiagn.com

5. CAREFULLY release the shift control cable end clip from the transmission shift lever stud.
6. Reposition the transmission shift cable and bracket.

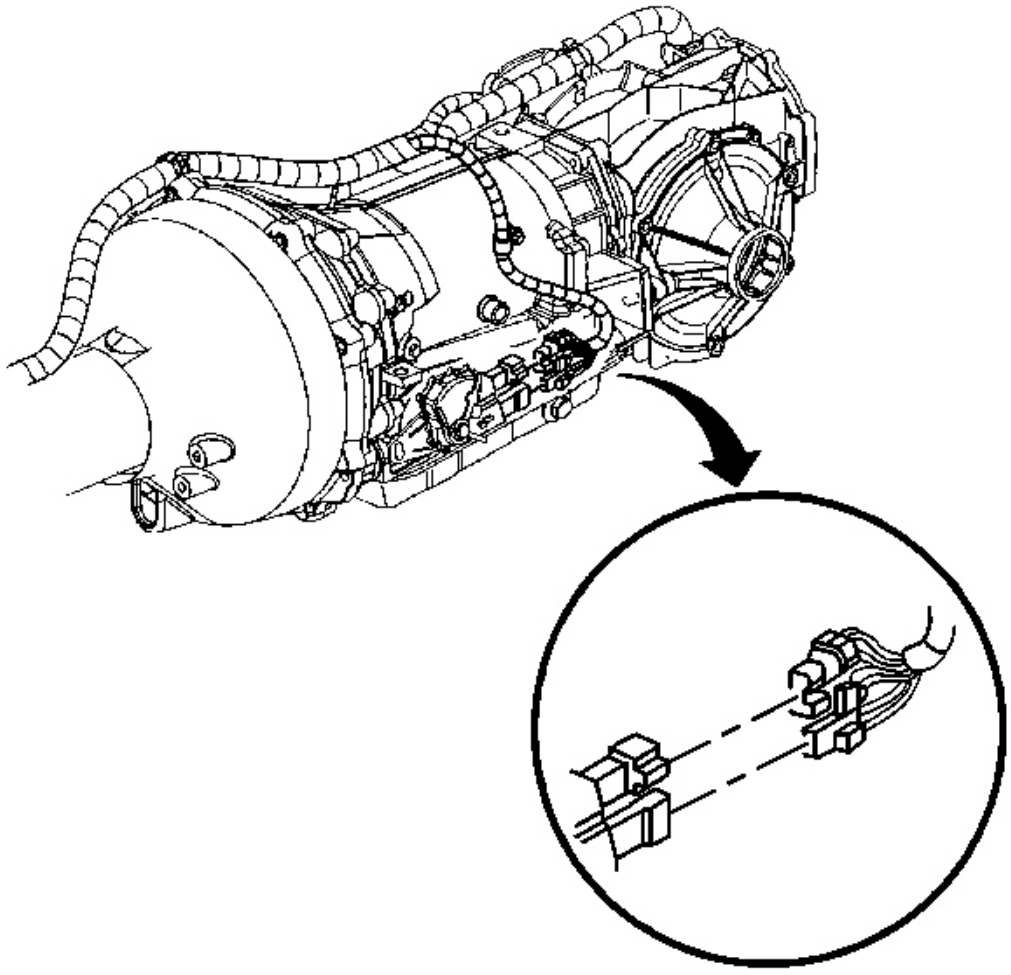


Fig. 55: Park/Neutral Position Switch Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the park/neutral position switch electrical connectors.

cardiagn.com

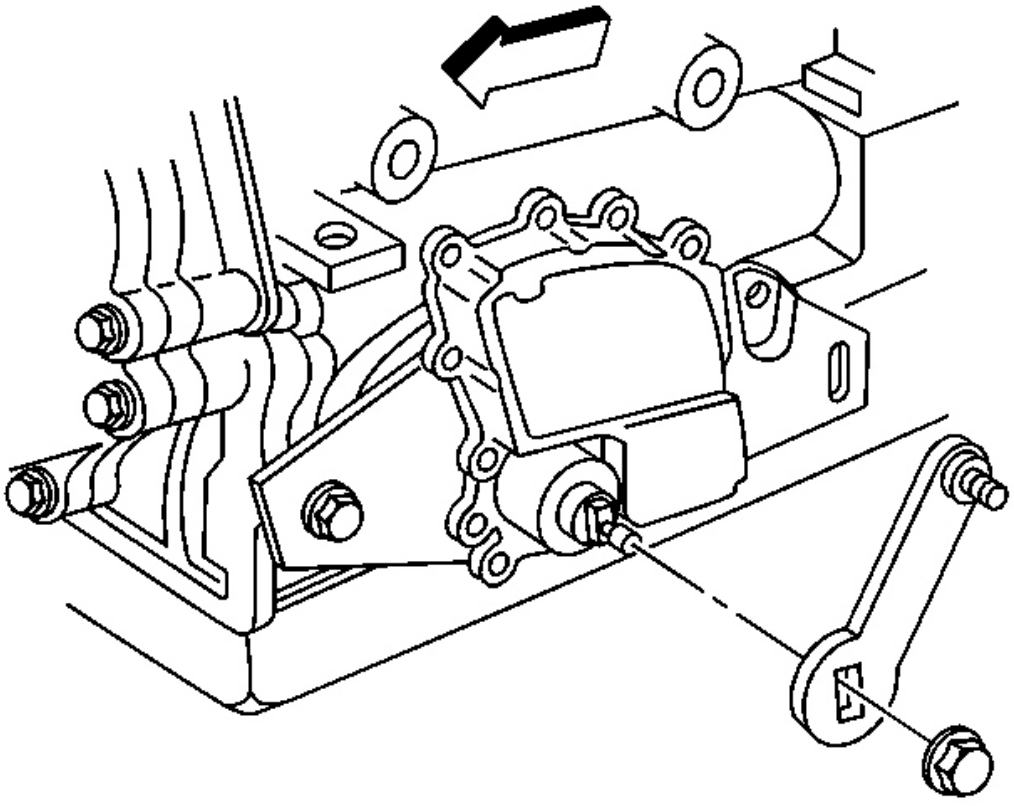


Fig. 56: Range Selector (Shift) Lever & Nuts
Courtesy of GENERAL MOTORS CORP.

8. Using a wrench on the transmission manual shaft wrench flats (in order to keep the shaft from turning), remove the range selector (shift) lever retaining nut.
9. Remove the range selector (shift) lever.
10. Check that the transmission is still in NEUTRAL.

cardiagn.com

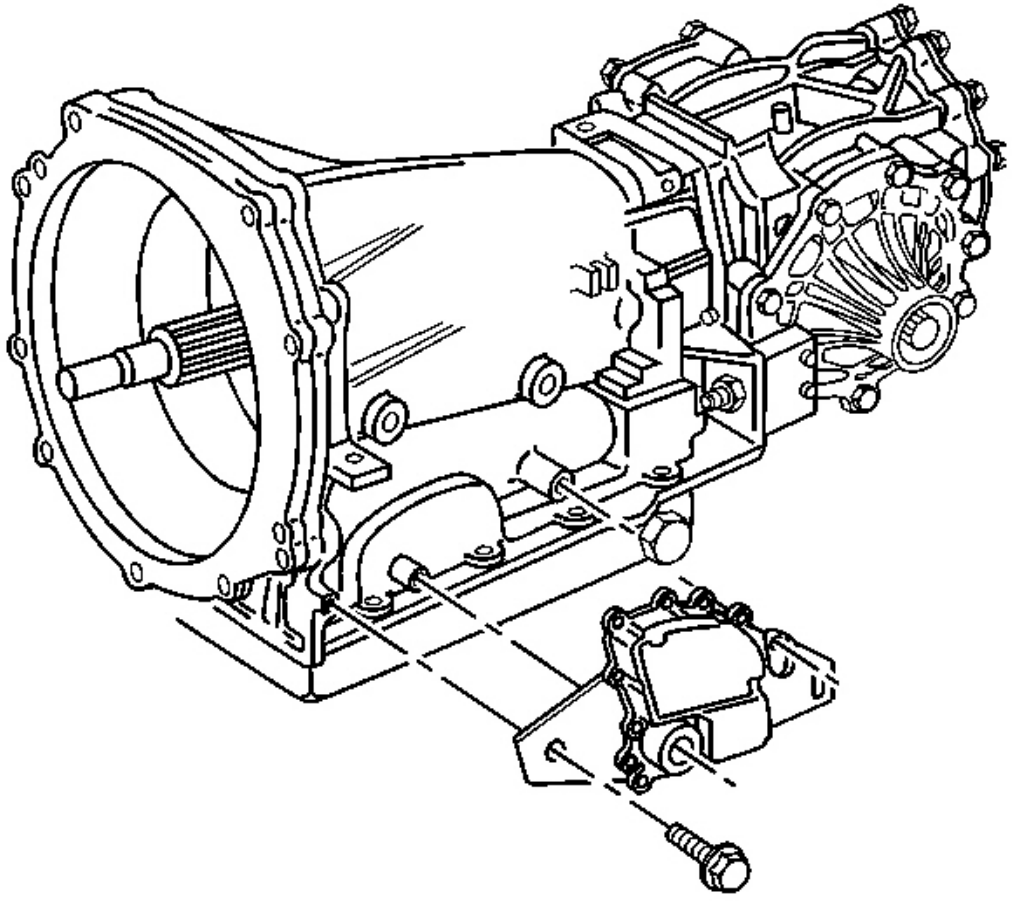


Fig. 57: Park/Neutral Position Switch & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

11. Remove the park/neutral position switch mounting bolts.
12. Slide the switch off of the manual shaft.

Installation Procedure

cardiagn.com

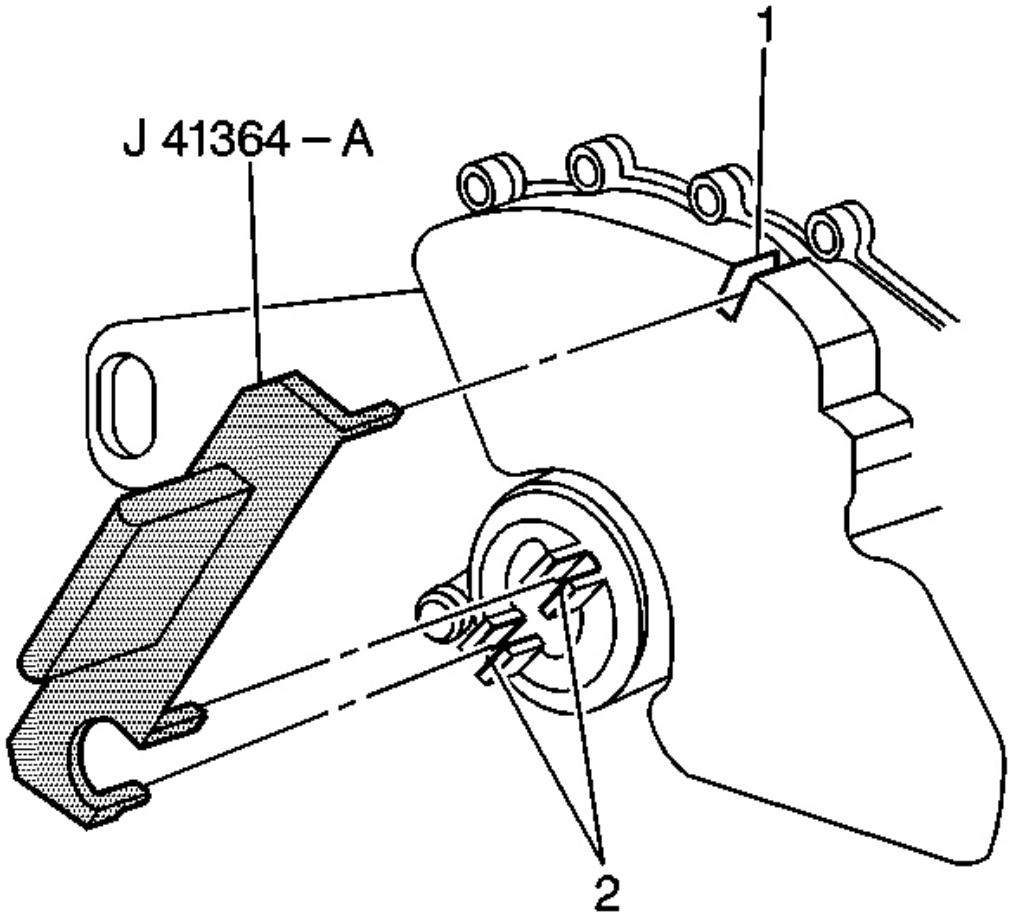


Fig. 58: J 41364-A & Park/Neutral Position Switch
Courtesy of GENERAL MOTORS CORP.

1. Install the J 41364-A to the park/neutral position switch.
    1. Align the two lower slots on the switch (2) with the two lower tabs on the J 41364-A .
    2. Rotate the tool until the upper pin on the tool is lined up with the slot on the top of the switch (1).
2. Check that the transmission is still in NEUTRAL.

cardiagn.com

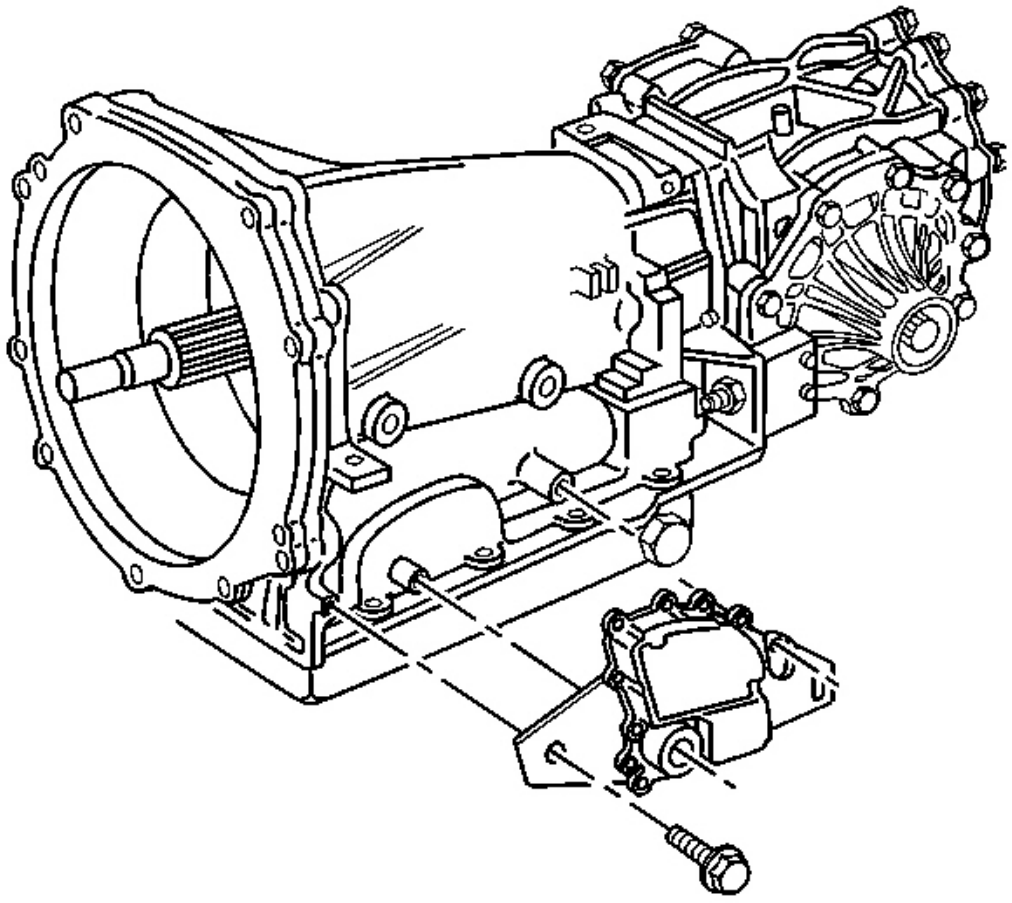


Fig. 59: Park/Neutral Position Switch & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not remove the J 41364-A from the park/neutral position switch until instructed.

3. Install the park/neutral position switch to the transmission manual shaft.
    1. Align the flats in the switch hub with the flats on the manual shaft.
    2. Slide the switch onto the transmission manual shaft until the switch mounting bracket contacts the mounting bosses on the transmission case.

NOTE: Refer to Fastener Notice in Cautions and Notices.

cardiagn.com

4. Install the park/neutral position switch mounting bolts.

   Tighten: Tighten the park/neutral position switch mounting bolts to 27 N.m (20 lb ft).

5. Remove the J 41364-A from the switch.

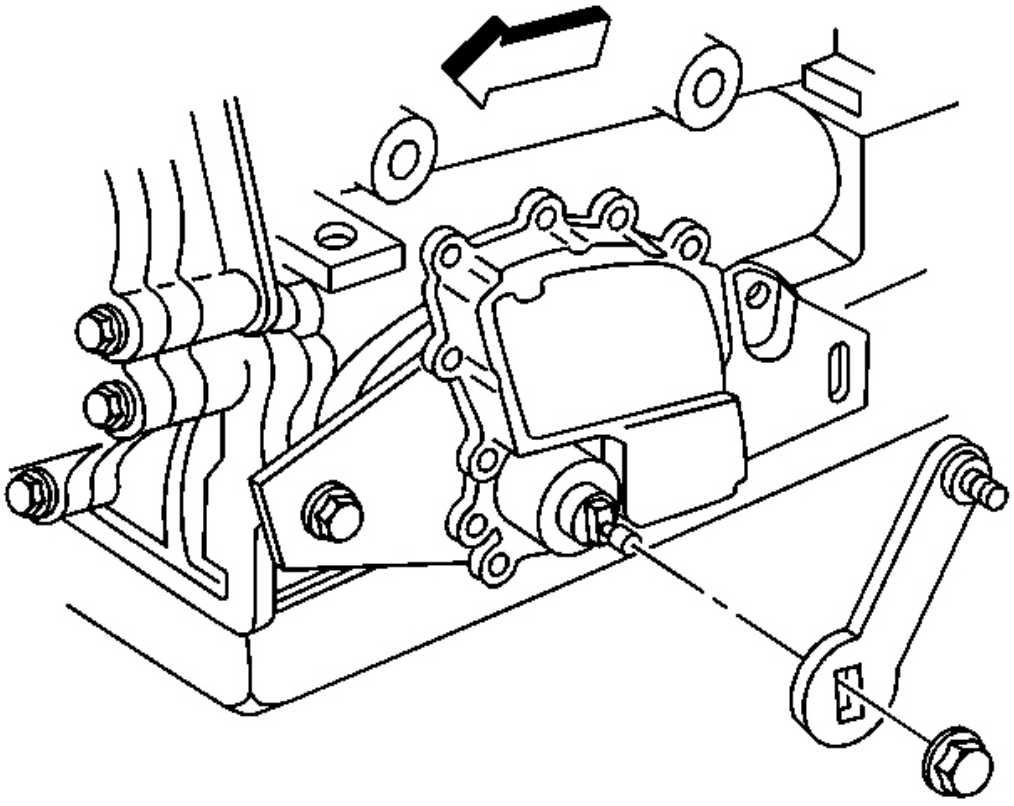


Fig. 60: Range Selector (Shift) Lever & Nuts
Courtesy of GENERAL MOTORS CORP.

6. Install the transmission range selector (shift) lever onto the transmission manual shaft.

   Be sure to install the shift lever in an upright orientation.

7. Using a wrench on the transmission manual shaft wrench flats (in order to keep the shaft from turning), install the range selector (shift) lever retaining nut.

   Tighten: Tighten the transmission range selector lever nut to 20 N.m (15 lb ft).

cardiagn.com

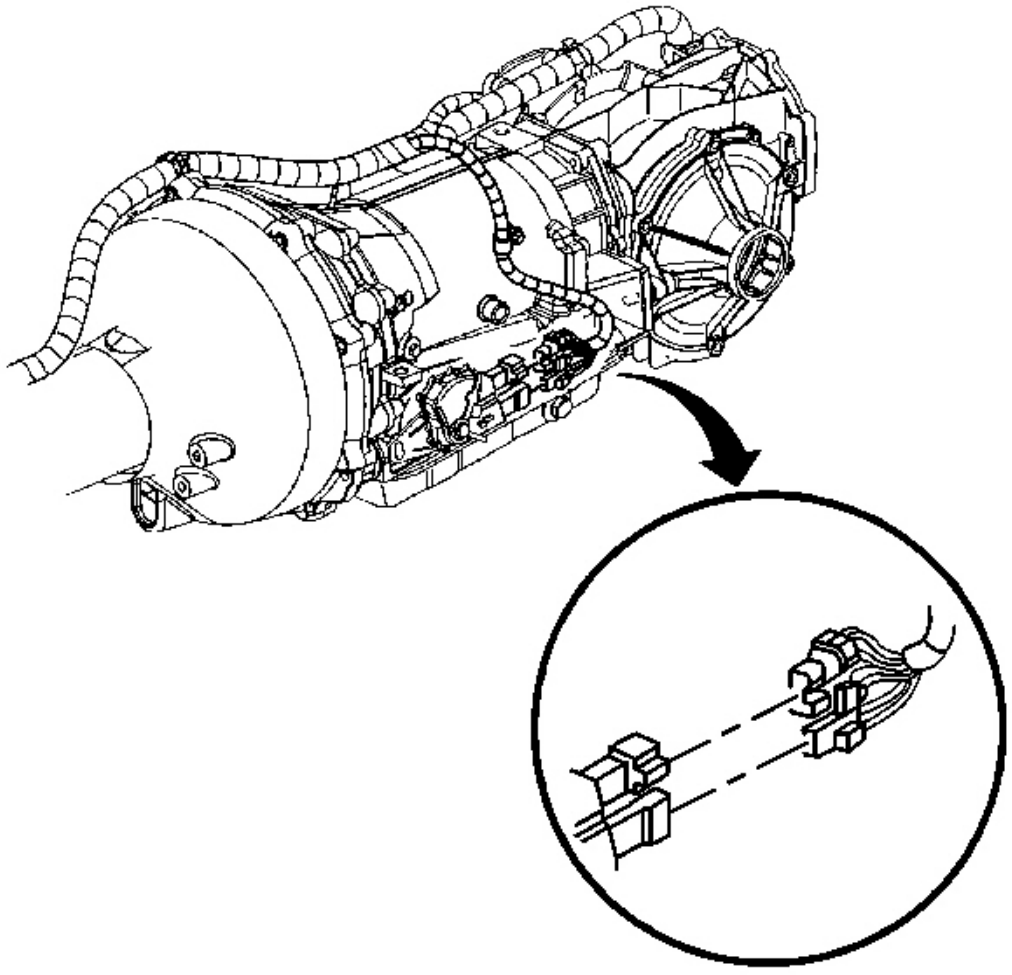


Fig. 61: Park/Neutral Position Switch Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

8. Connect the park/neutral position switch electrical connectors.

cardiagn.com

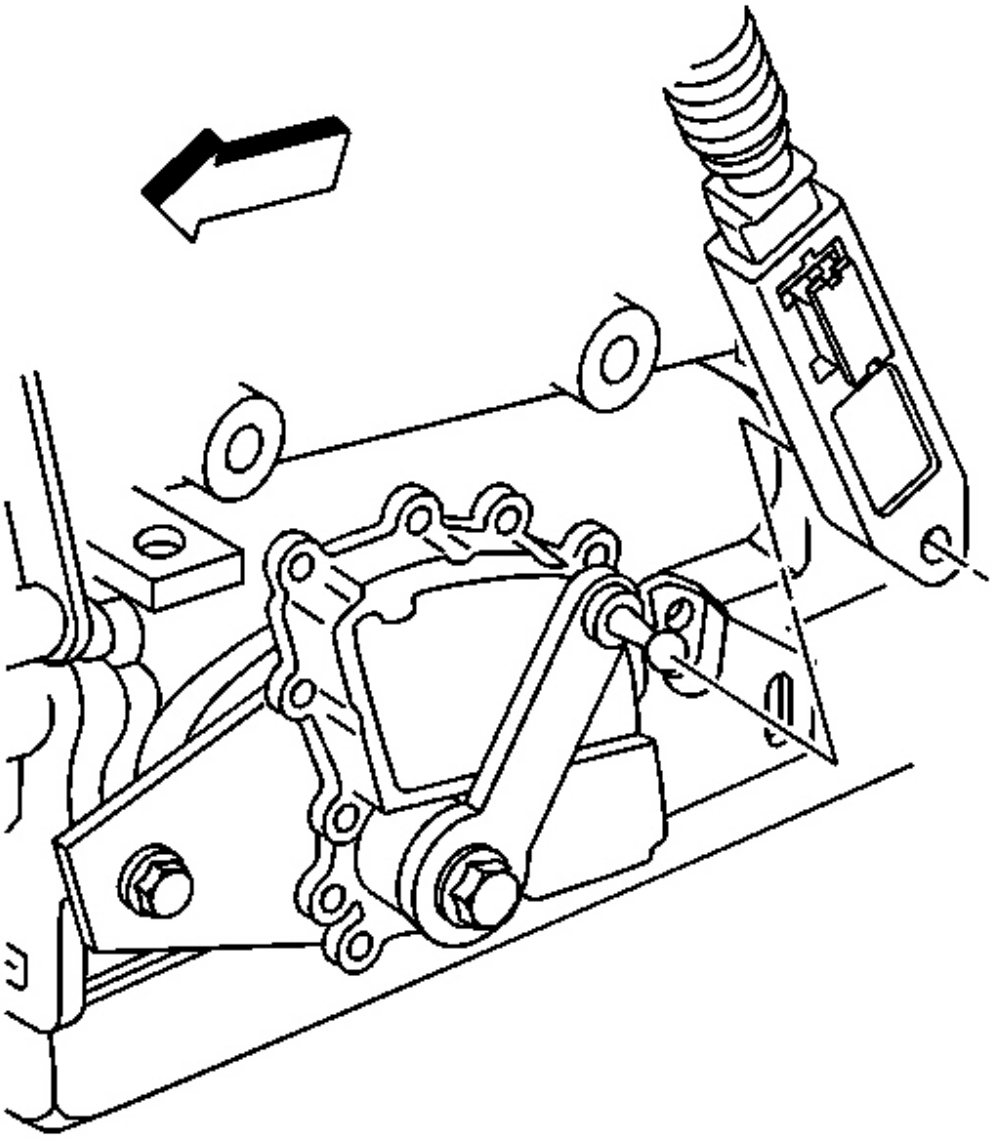


Fig. 62: Transmission Shift Control Cable & Bracket
Courtesy of GENERAL MOTORS CORP.

9. Install the transmission shift control cable and bracket into position.
10. Align the shift control cable end to the transmission shift lever stud.

IMPORTANT: Use care to not suddenly jerk the shift control cable during assembly, the

cardiagn.com

shift control cable rod end guide tubes are EXTREMELY INFLEXIBLE and capable of only a SLIGHT bend.

11. CAREFULLY secure the shift control cable end clip to the transmission shift lever stud.

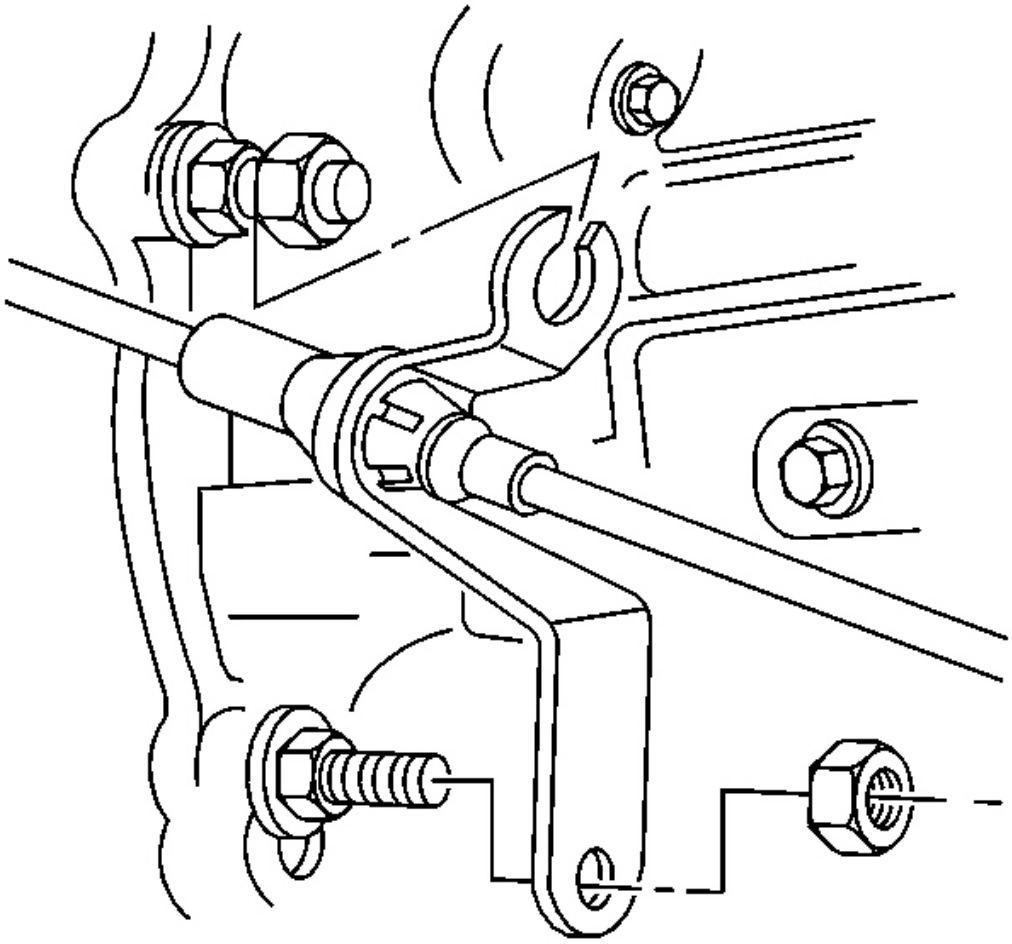


Fig. 63: Shift Control Cable Bracket & Nuts
Courtesy of GENERAL MOTORS CORP.

12. Install the nuts retaining the transmission shift control cable bracket to the transmission.

    Tighten: Tighten the transmission shift control cable bracket retaining nuts to 20 N.m (15 lb ft).

13. Install the intermediate exhaust pipe. Refer to **Catalytic Converter Replacement** in Engine Exhaust.

cardiagn.com

14. Shift the transmission into PARK.
15. Lower the vehicle.

PARK/NEUTRAL POSITION SWITCH ADJUSTMENT

Adjustment Procedure

Tools Required

J 41364-A Park/Neutral Position Switch Aligner

cardiagn.com

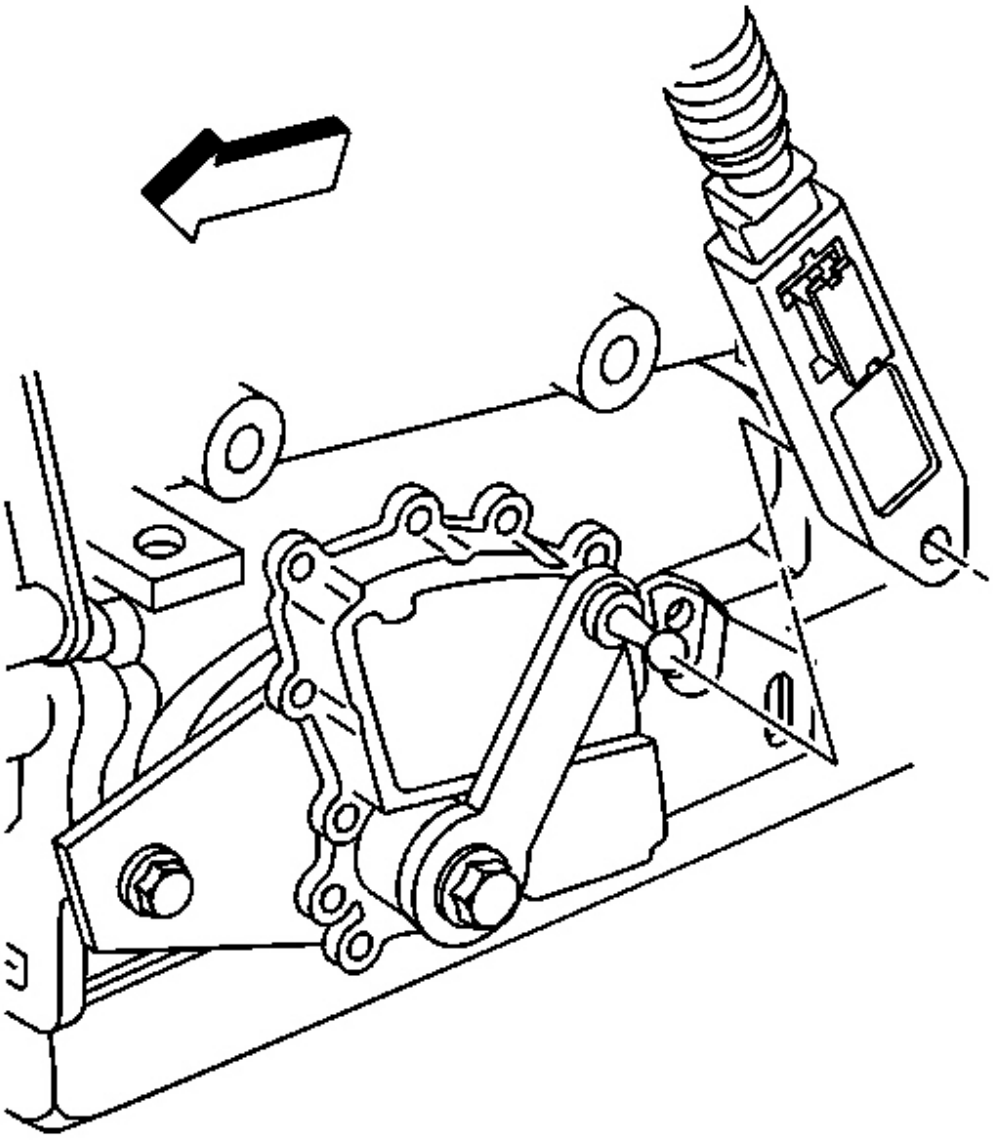


Fig. 64: Transmission Shift Control Cable & Bracket
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Disconnect the shift control cable from the range selector lever.

cardiagn.com

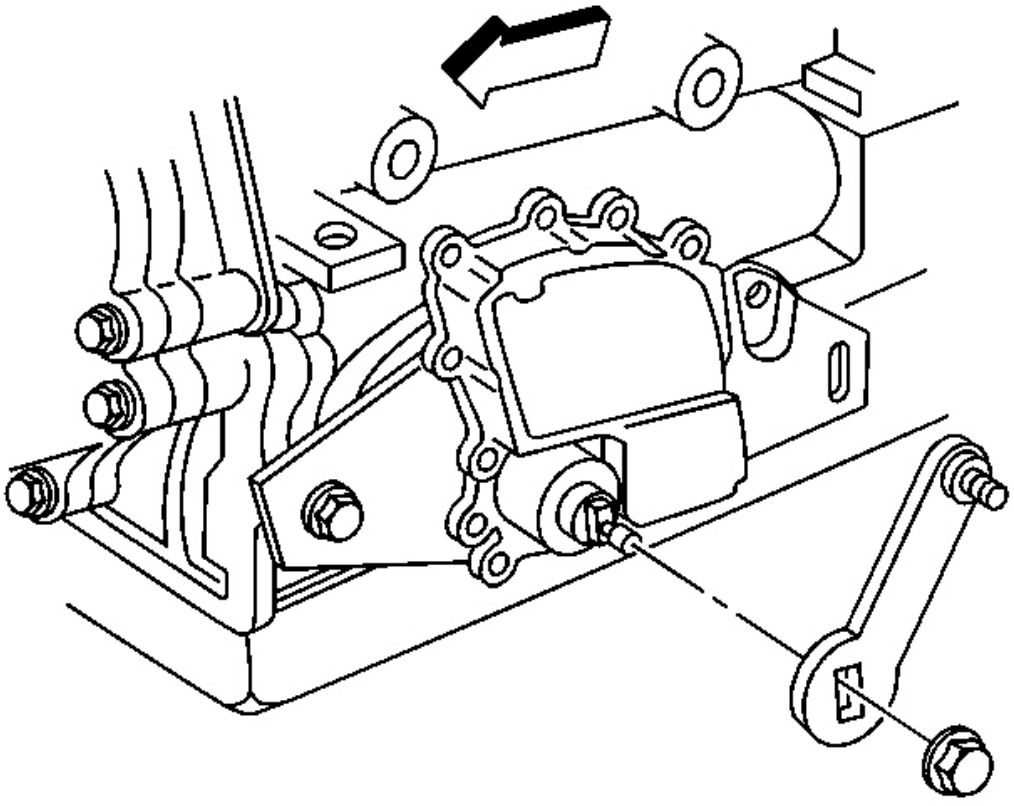


Fig. 65: Range Selector (Shift) Lever & Nuts
Courtesy of GENERAL MOTORS CORP.

3. Using a wrench on the range selector lever (in order to keep the shaft from turning), remove the range selector (shift) lever nut.
4. Remove the range selector (shift) lever.
5. Ensure that the transmission is still in neutral.

cardiagn.com

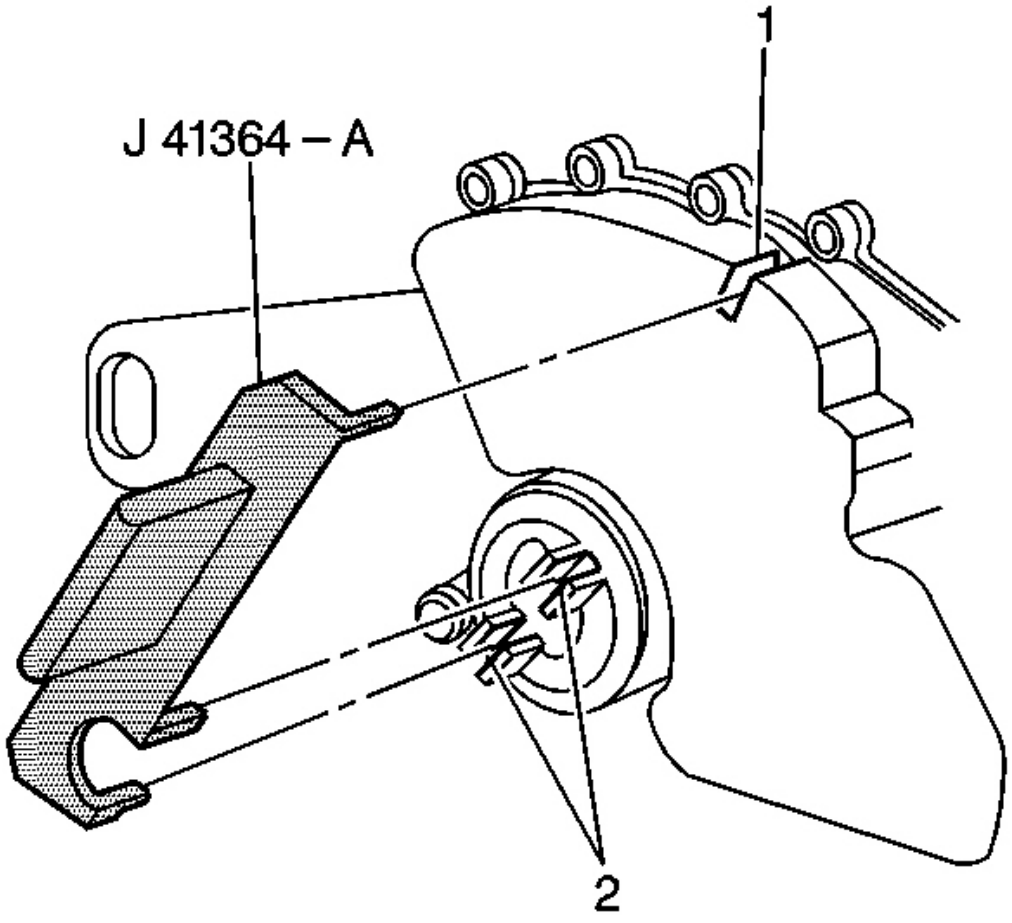


Fig. 66: J 41364-A & Park/Neutral Position Switch
Courtesy of GENERAL MOTORS CORP.

6. Loosen the park/neutral position switch mounting bolts.
7. Install the J 41364-A park/neutral position switch aligner to the park/neutral position switch.
    1. Align the two lower slots on the switch (2) with the two lower tabs on the J 41364-A park/neutral position switch aligner.
    2. Rotate the tool until the upper pin on the tool is lined up with the slot on the top of the switch (1).
8. Check that the transmission is still in NEUTRAL.

cardiagn.com

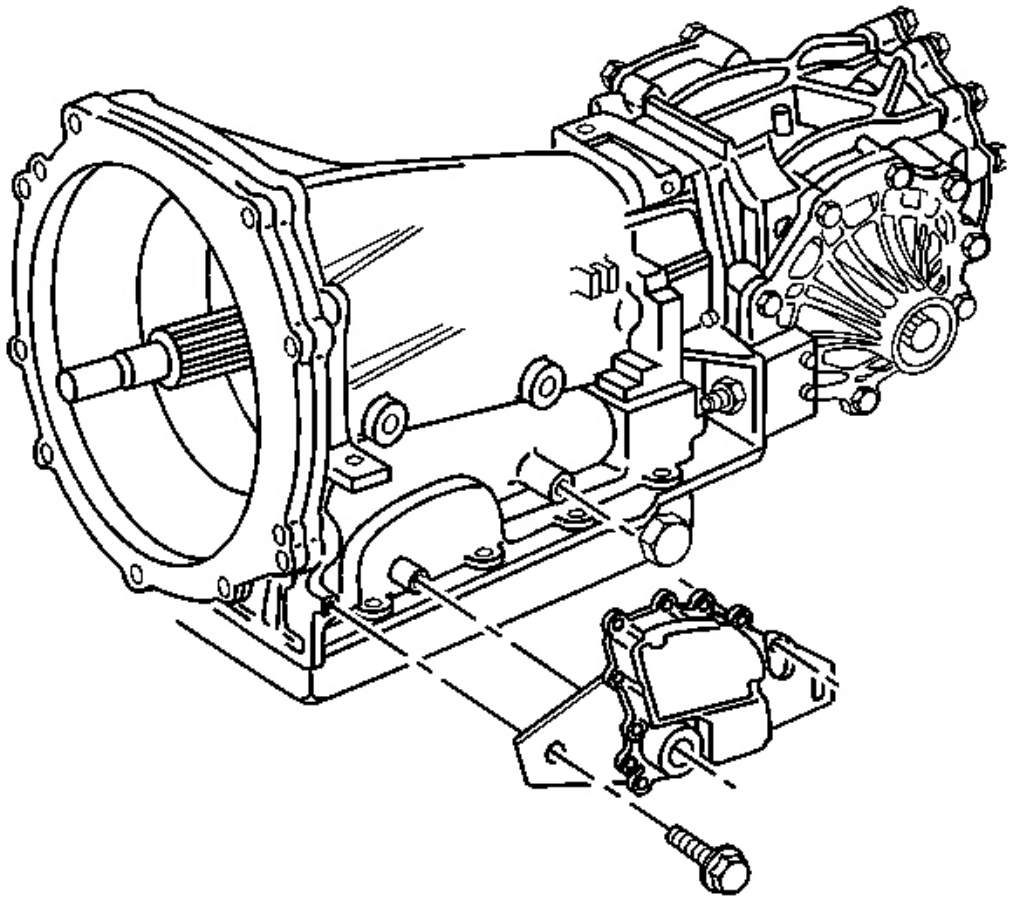


Fig. 67: Park/Neutral Position Switch & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

9. Install the park/neutral position switch mounting bolts.

   Tighten: Tighten the park/neutral position switch mounting bolts to 27 N.m (20 lb ft).

10. Remove the J 41364-A park/neutral position switch aligner from the switch.

cardiagn.com

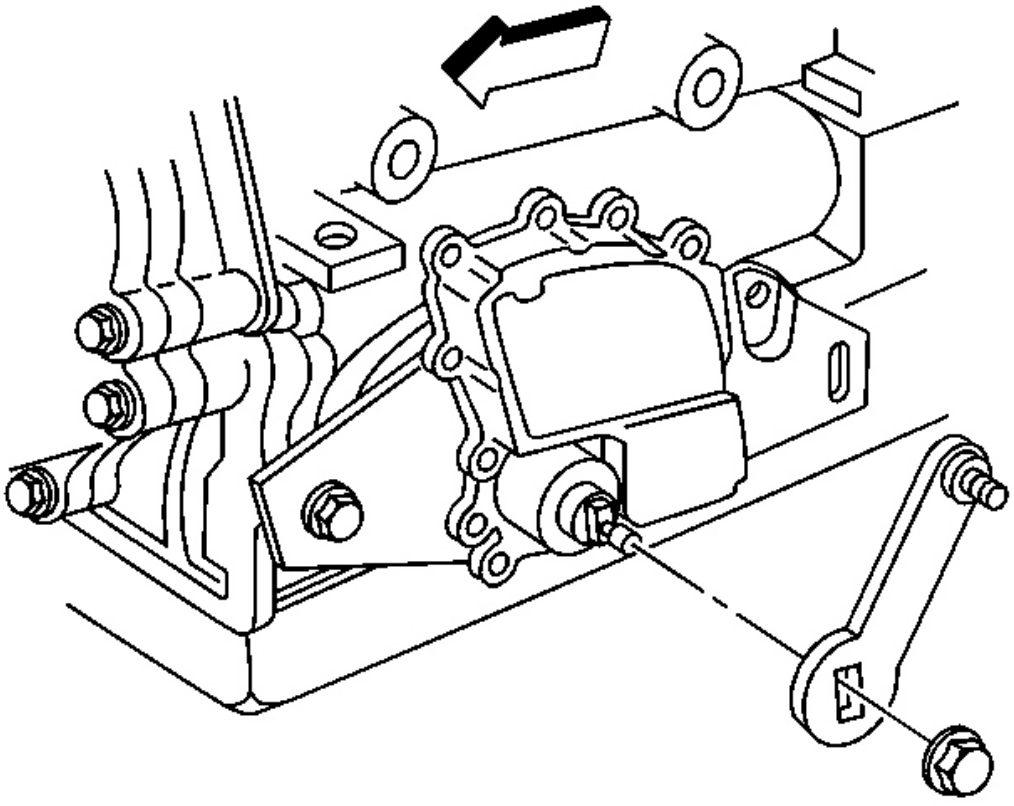


Fig. 68: Range Selector (Shift) Lever & Nuts
Courtesy of GENERAL MOTORS CORP.

11. Install the range selector (shift) lever.
12. Install the range selector (shift) lever nut.

Tighten: Tighten the range selector (shift) lever nut (using a wrench to hold the lever in place), to 20 N.m (15 lb ft).

cardiagn.com

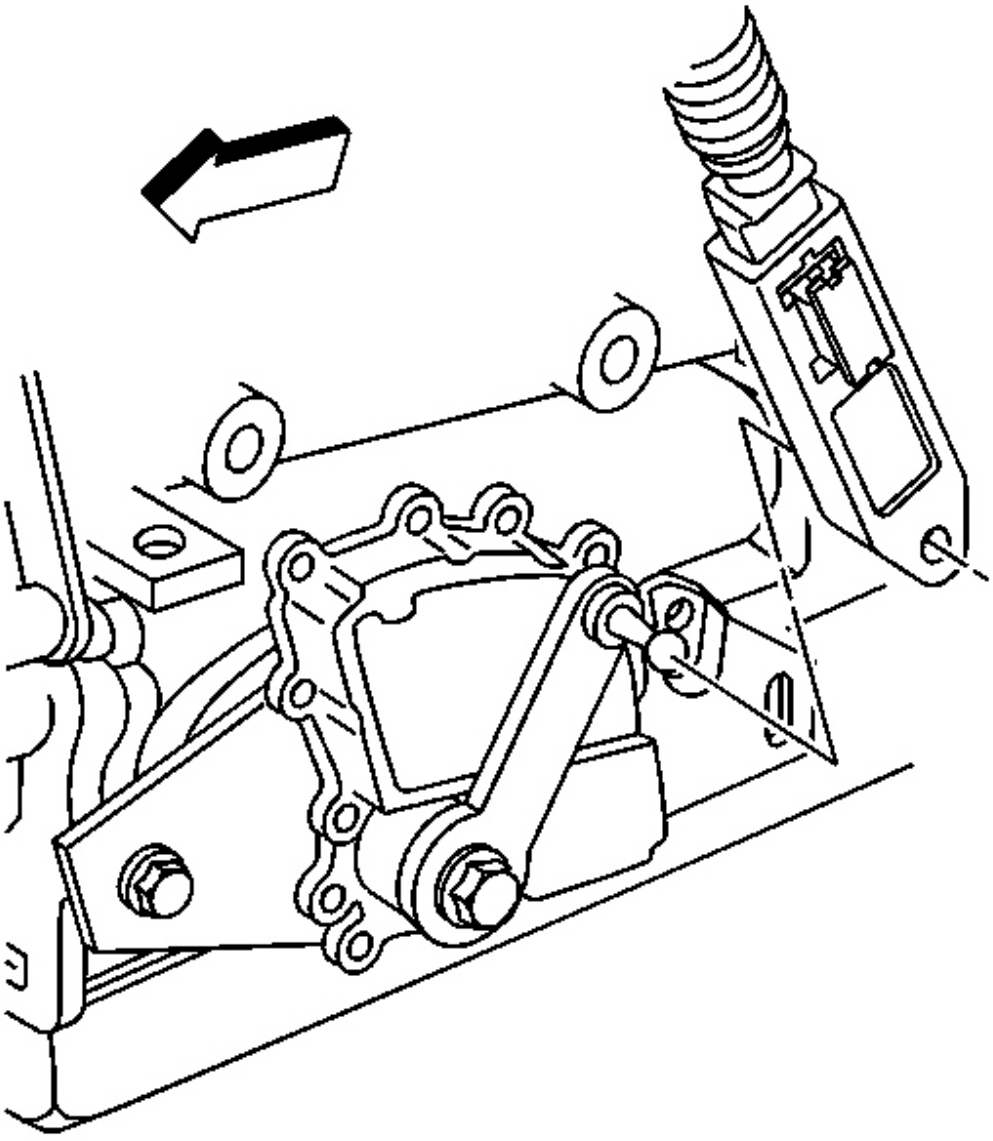


Fig. 69: Transmission Shift Control Cable & Bracket
Courtesy of GENERAL MOTORS CORP.

13. Connect the shift control cable to the range selector lever.
14. Lower the vehicle.

AUTOMATIC TRANSMISSION FLUID/FILTER REPLACEMENT

cardiagn.com

Tools Required

J 36850 Transmission Assembling Lubricant (Transjel(tm)). See **Special Tools and Equipment** .

Removal Procedure

CAUTION: When the transmission is at operating temperatures, take necessary precautions when removing the check/fill plug, to avoid being burned by draining fluid.

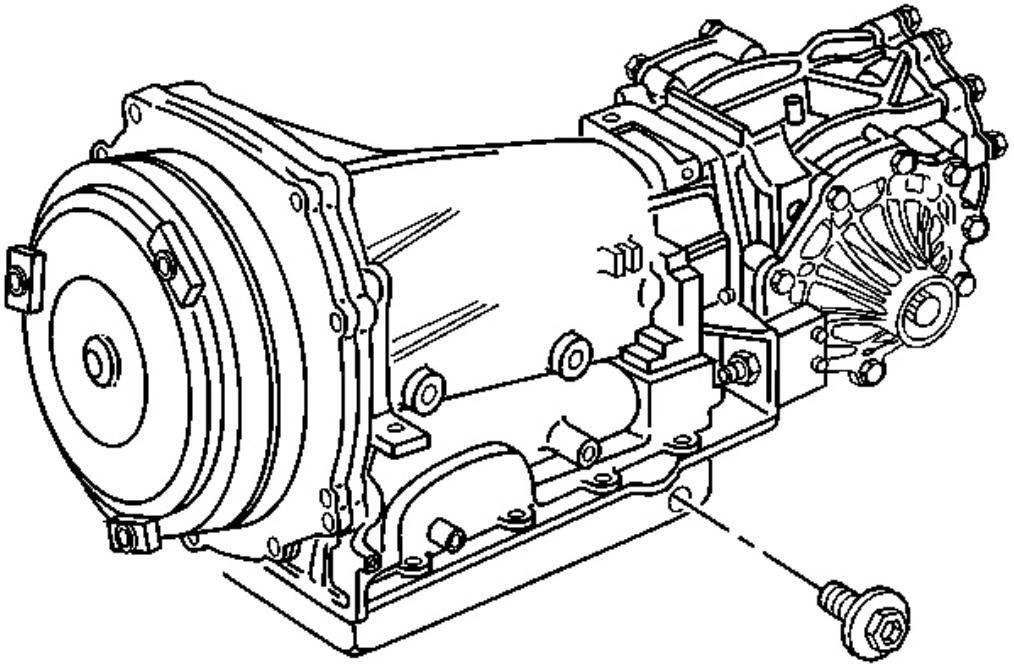


Fig. 70: Transmission Check/Fill Plug
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Place a drain pan under the transmission.
3. Clean any dirt from around the transmission check/fill plug.
4. Remove the transmission fluid check/fill plug and allow the fluid to drain.

cardiagn.com

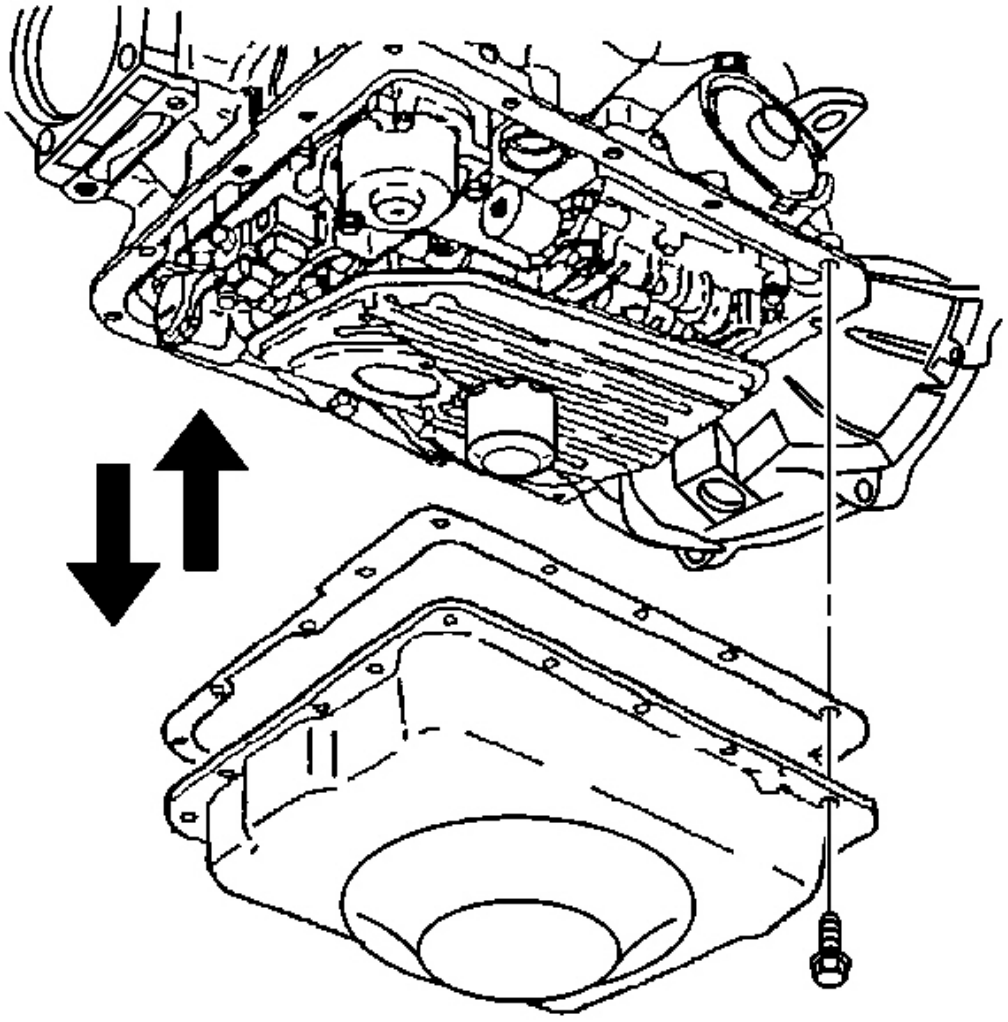


Fig. 71: Transmission Oil Pan Bolts
Courtesy of GENERAL MOTORS CORP.

5. Support the transmission oil pan.
6. Remove the transmission oil pan bolts.
7. Loosely reinstall the fluid check/fill plug.
8. Lightly tap the oil pan with a rubber mallet or pry gently in order to loosen the pan.
9. Remove the transmission oil pan.
10. Drain the remaining fluid from the oil pan.

cardiagn.com

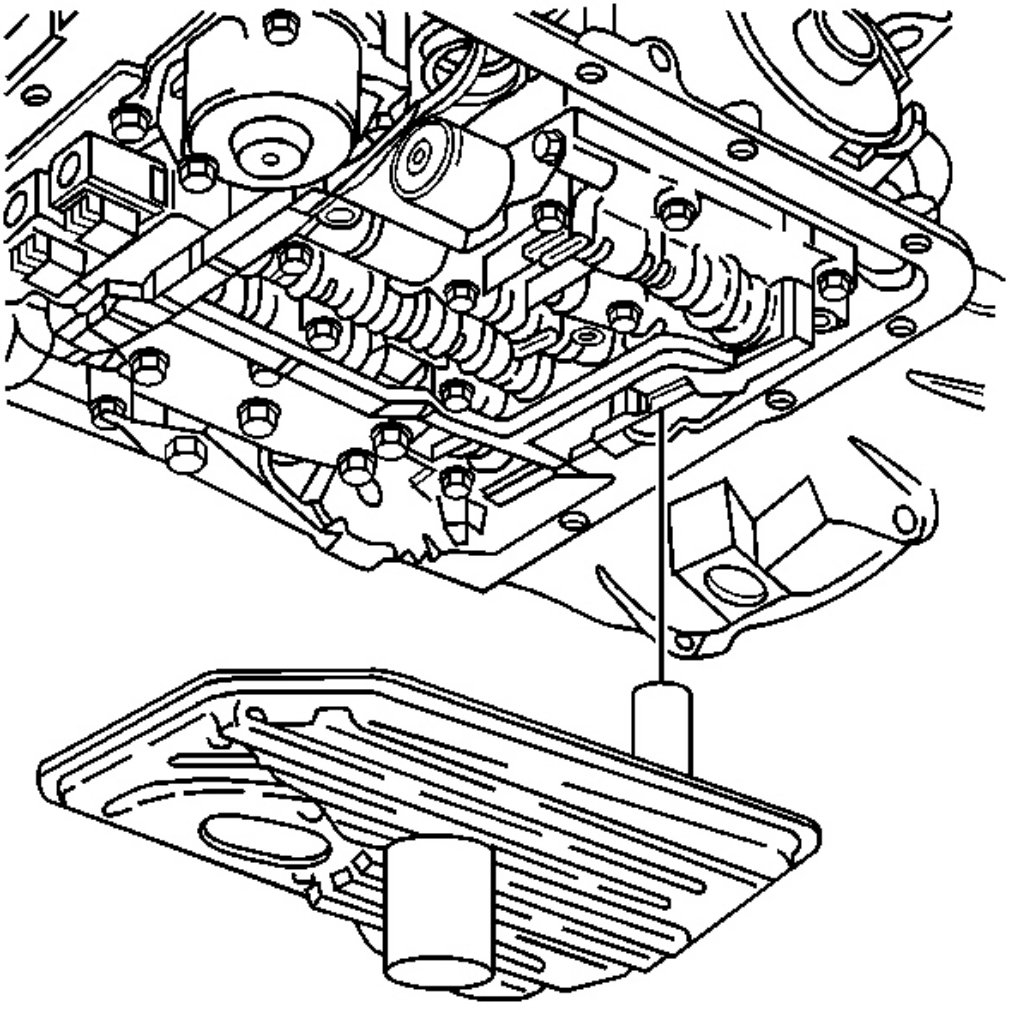


Fig. 72: Oil Filter
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Note the position of the filter before removal to aid in installation.

11. Grasp firmly while pulling down with a twisting motion in order to remove the filter.

cardiagn.com

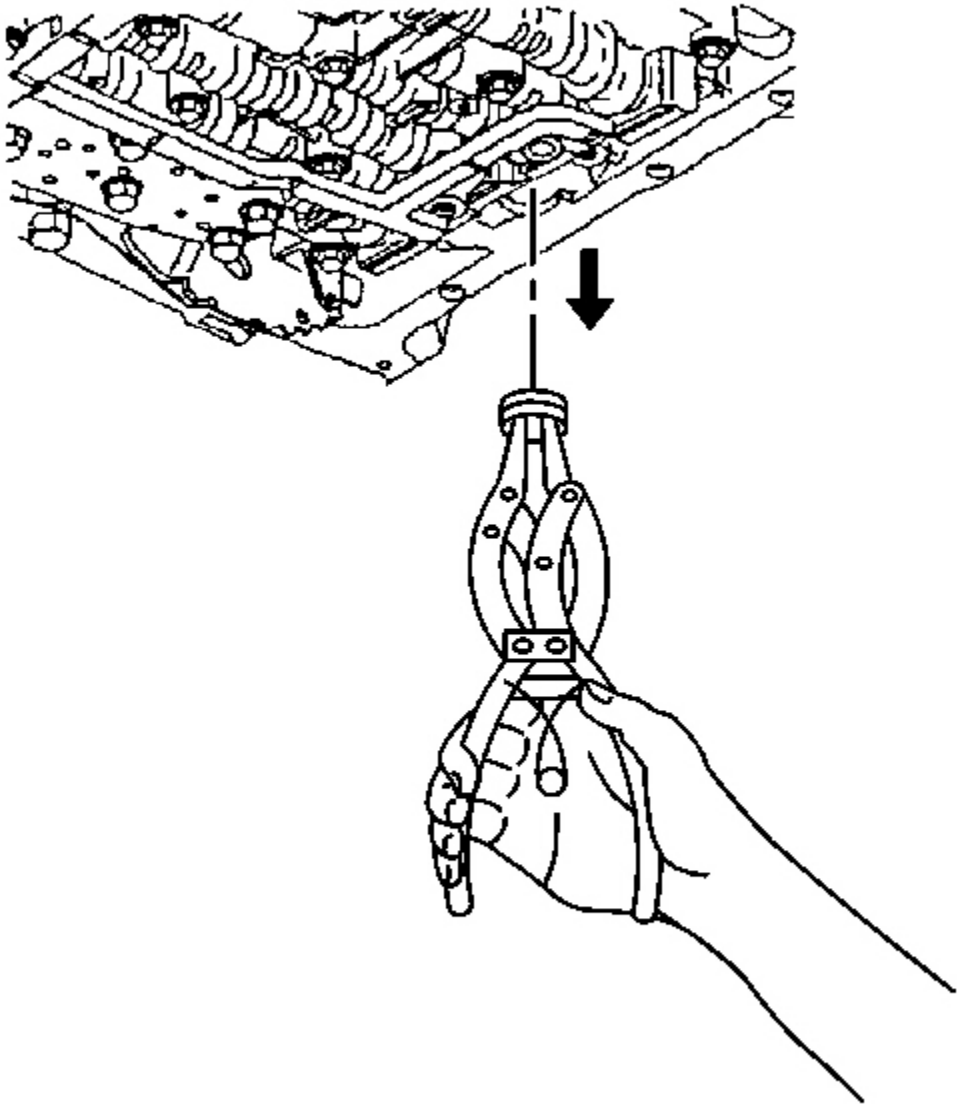


Fig. 73: Removing The Filter Seal
Courtesy of GENERAL MOTORS CORP.

12. Remove the filter seal.

    The filter seal may be stuck in the pump; if necessary, carefully use pliers or another suitable tool to remove the seal.

cardiagn.com

13. Discard the seal.
14. Inspect the transmission fluid. Refer to **Transmission Fluid Checking Procedure** .
15. Inspect the transmission fluid filter.

    Pry the metal crimping away from the top of the filter and pull apart.

    The filter may contain evidence for root cause diagnosis:

    - Clutch material
    - Bronze slivers indicating bushing wear
    - Steel particles

    IMPORTANT: Remove ALL traces of old gasket material from the transmission case and the oil pan gasket surfaces.

16. Clean the oil pan gasket mating surfaces, on both the transmission case and the transmission oil pan, with solvent and air dry.

Installation Procedure

cardiagn.com

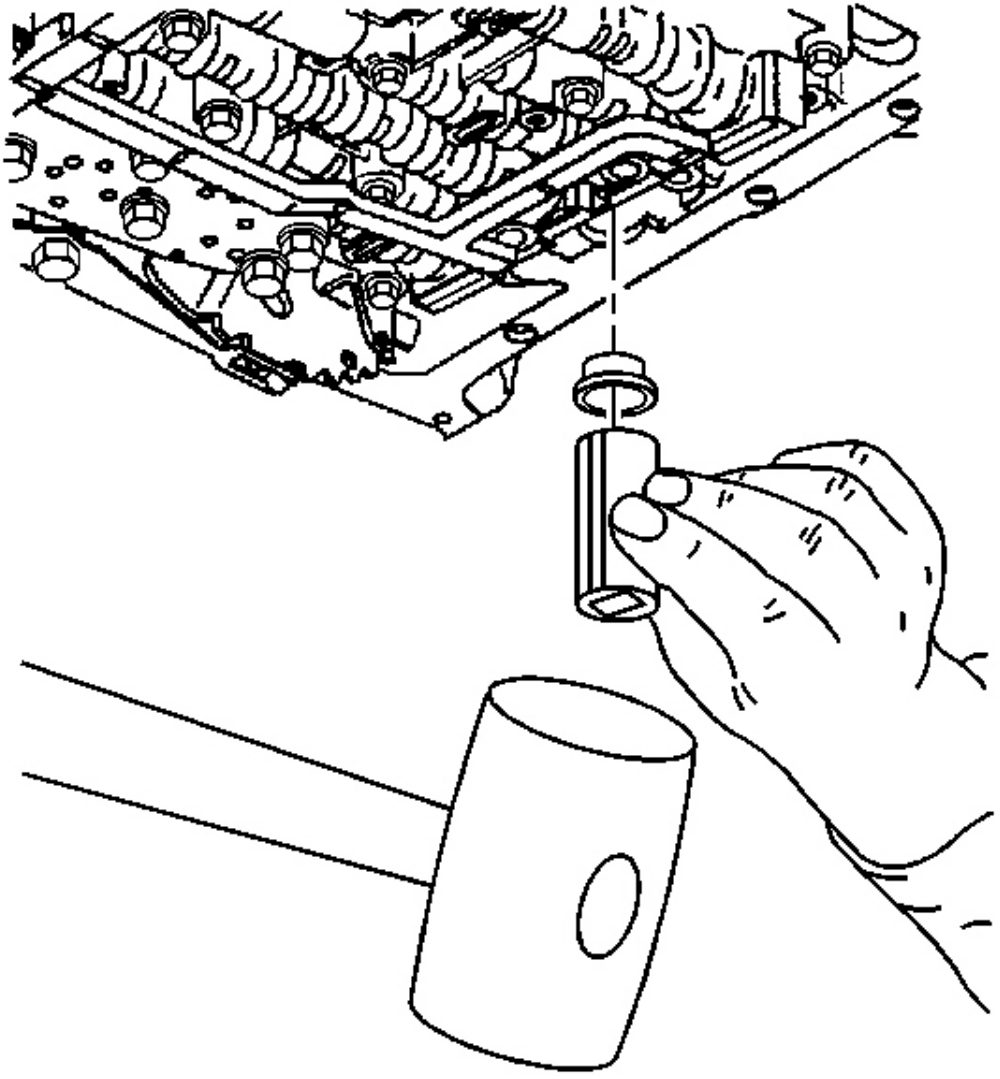


Fig. 74: Installing The New Filter Seal Into The Transmission Case
Courtesy of GENERAL MOTORS CORP.

1. Coat the new filter seal with a small amount of **J 36850** or equivalent. See **Special Tools and Equipment** .
2. Install the new filter seal into the transmission case.

   Gently tap the seal into place using a suitable size socket.

cardiagn.com

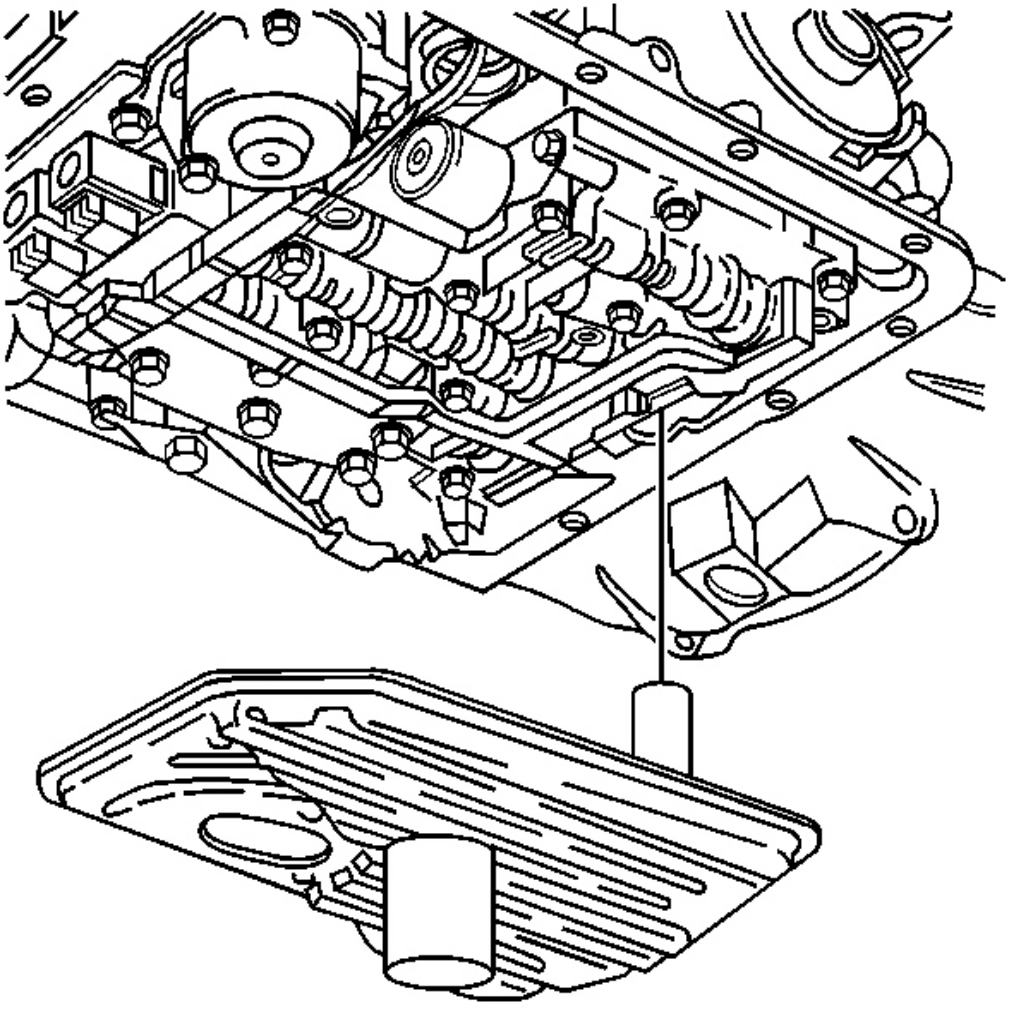


Fig. 75: Oil Filter
Courtesy of GENERAL MOTORS CORP.

3. Install the new oil filter into position as noted during removal.

cardiagn.com

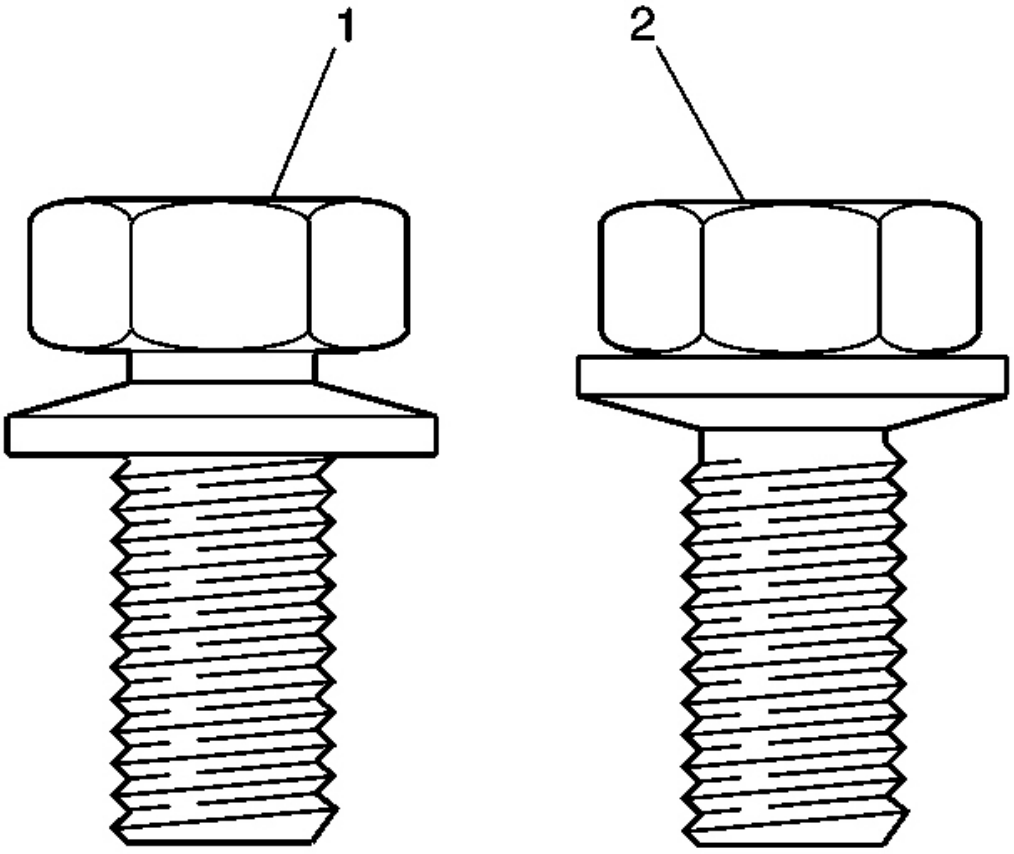


Fig. 76: Oil Pan Bolts & Conical Washers
Courtesy of GENERAL MOTORS CORP.

4. Inspect the oil pan bolts and washers to determine if the conical washers are reversed.
    - Reuse the oil pan bolts and washers if the conical washers are NOT reversed (1).
    - Replace the oil pan bolts and washers if the conical washers are reversed (2).

cardiagn.com

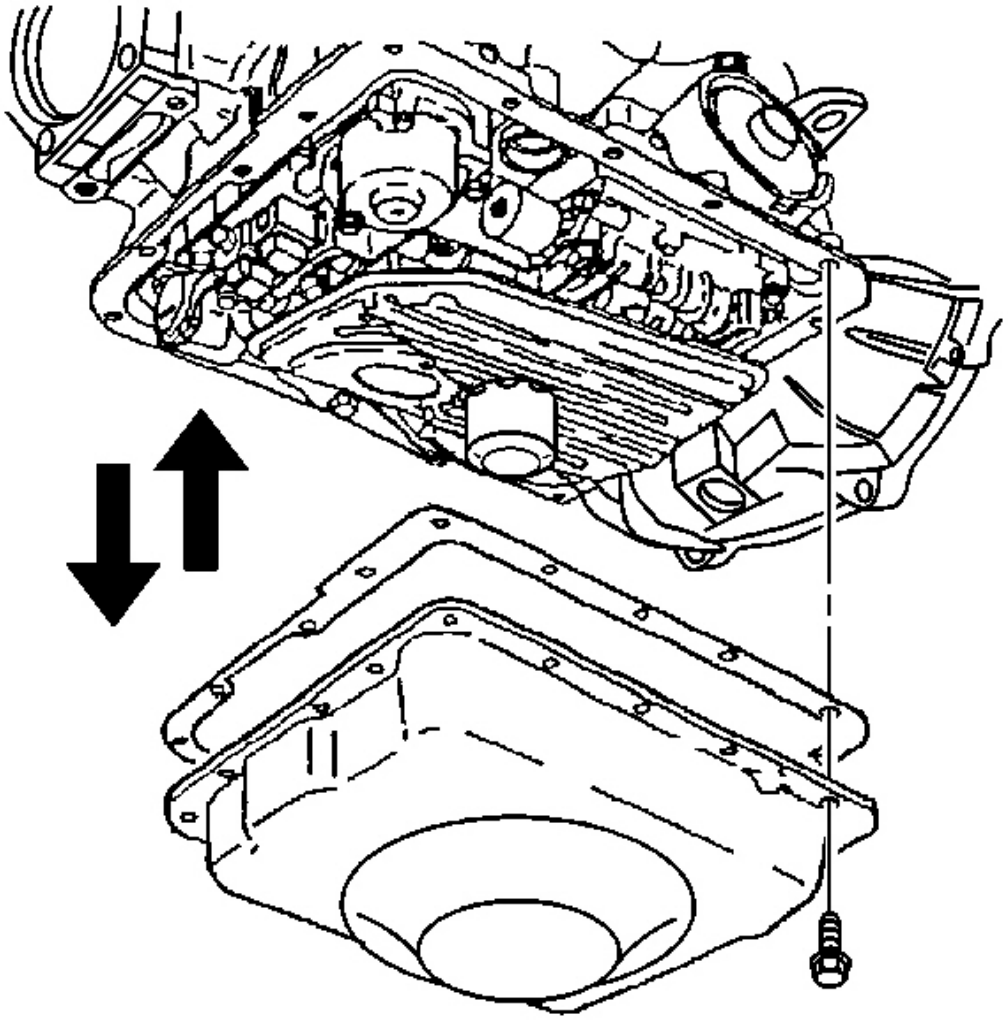


Fig. 77: Transmission Oil Pan Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the new oil pan gasket to the oil pan sealing surface.
6. Position the oil pan to the transmission case and support the oil pan.

NOTE: Refer to Fastener Notice in Cautions and Notices.

7. Install the oil pan bolts.

Tighten: Tighten the transmission oil pan bolts alternately and evenly to 11 N.m (97 lb in).

cardiagn.com

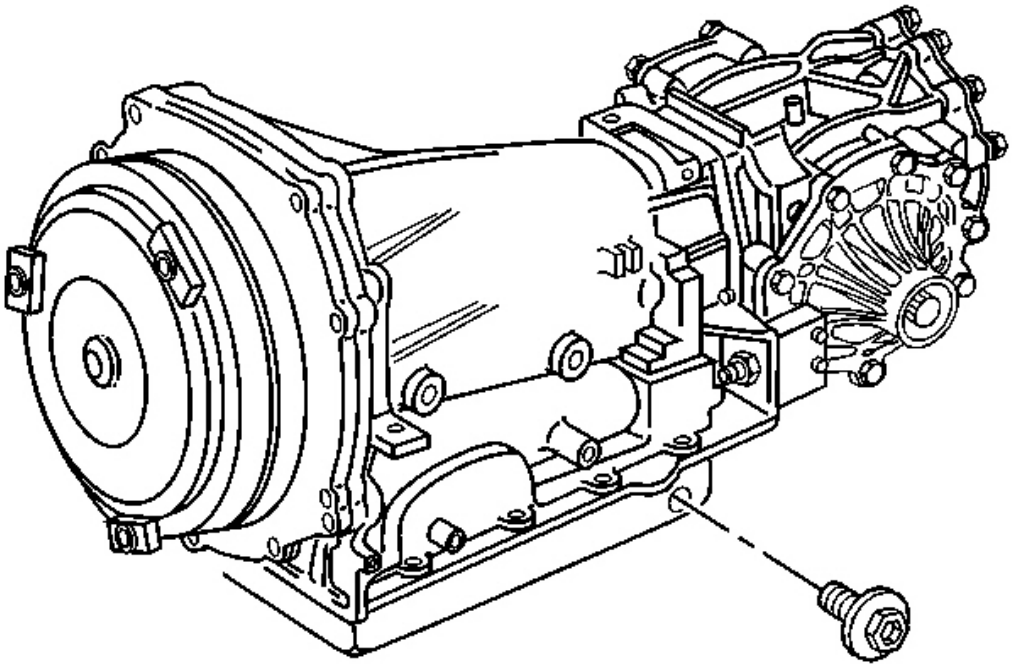


Fig. 78: Transmission Check/Fill Plug
Courtesy of GENERAL MOTORS CORP.

8. Remove the transmission fluid check/fill plug.
9. Fill the transmission with DEXRON(R)-III automatic transmission fluid through the check/fill plug hole until fluid begins to pour out, then install the check/fill plug hand-tight.
10. Complete filling the transmission with fluid to the proper level. Refer to **Transmission Fluid Checking Procedure** .
11. Tighten the transmission fluid check/fill plug.

    Tighten: Tighten the transmission fluid check/fill plug to 30 N.m (22 lb ft)

12. Inspect the oil pan gasket for leaks.

OIL COOLER LINE REPLACEMENT (FRONT)

Tools Required

- **J 28467-B** Universal Engine Support Fixture
- **J 38185** Spring Hose Clamp Pliers

cardiagn.com

- **J 41803** Engine Support Fixture
- **J 44827** Transmission Cooler Quick Disconnect. See **Special Tools and Equipment** .

Removal Procedure

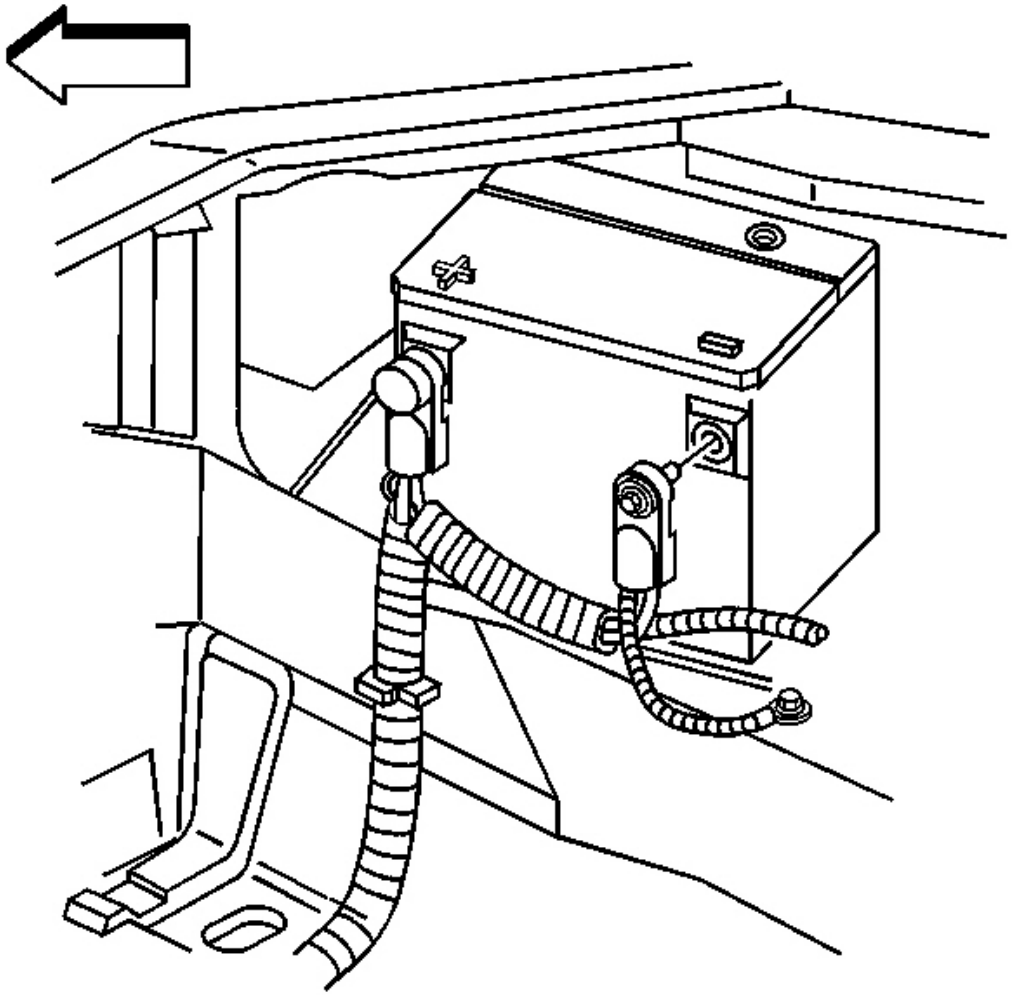


Fig. 79: Identifying Battery Negative Cable
Courtesy of GENERAL MOTORS CORP.

1. Position the front wheels straight ahead, remove the ignition key to lock the steering column.
2. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.

cardiagn.com

3. Drain the cooling system. Refer to **Draining and Filling Cooling System** in Engine Cooling.
4. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
5. Place a drain pan under the vehicle to catch any fluid.

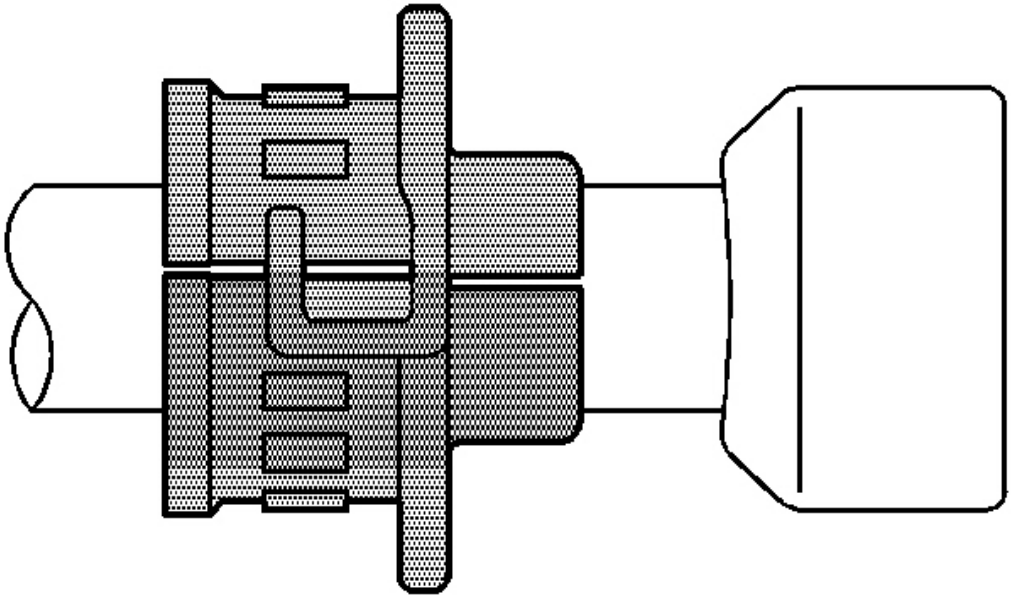


Fig. 80: TOC Connection & J 44827
Courtesy of GENERAL MOTORS CORP.

6. Reposition the plastic retainer, in order to gain access to the lower transmission oil cooler (TOC) connection.
7. Using **J 44827** , disconnect the lower TOC line from the oil cooler. See **Special Tools and Equipment** .
8. Lower the vehicle; leave the vehicle on the hoist.
9. Reposition the plastic retainer, in order to gain access to the upper TOC connection.
10. Using **J 44827** disconnect the upper TOC line from the oil cooler. See **Special Tools and Equipment** .
11. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** in Engine Controls - 5.7L.
12. Remove the upper and lower radiator support. Refer to **Radiator Support Replacement** in Engine Cooling.

cardiagn.com

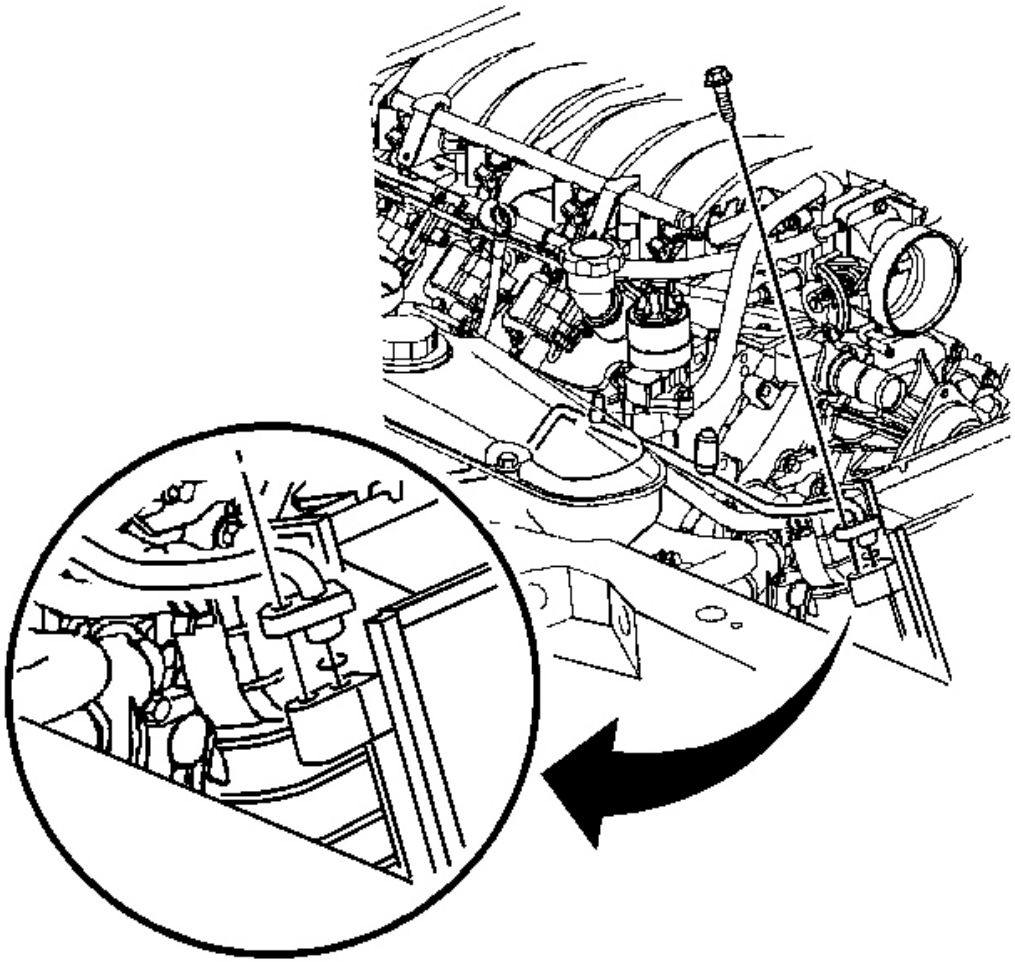


Fig. 81: Front Evaporator Tube & Condenser Bolt
Courtesy of GENERAL MOTORS CORP.

13. Recover the refrigerant from the air conditioning (A/C) system. Refer to **Refrigerant Recovery and Recharging** in Heating, Ventilation, and Air Conditioning.
14. Remove the front evaporator tube to condenser bolt.

IMPORTANT: Cap or tape the opening in the front evaporator tube and condenser immediately to prevent contamination.

15. Disconnect the front evaporator tube from the condenser.

cardiagn.com

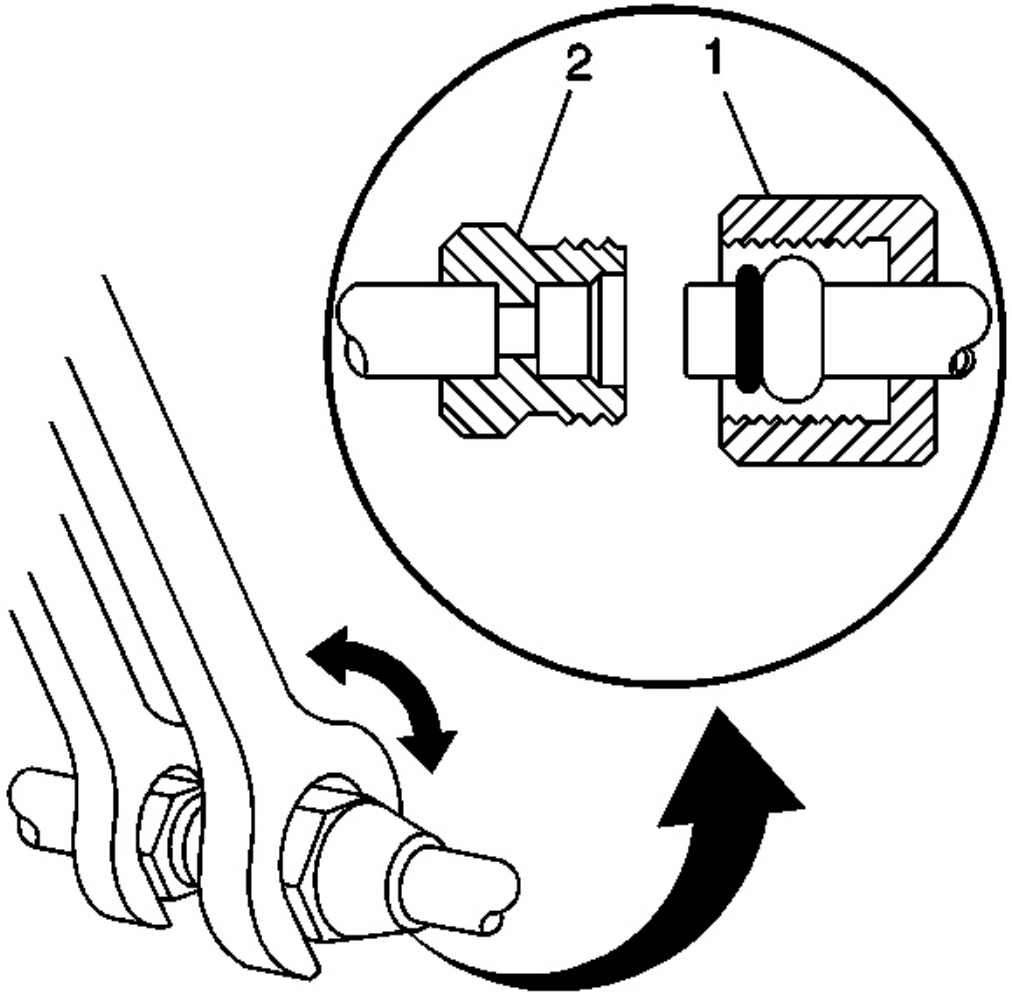


Fig. 82: Identifying A/C Line Fittings
Courtesy of GENERAL MOTORS CORP.

16. Using a back-up wrench on the condenser fitting (2), loosen the compressor hose fitting (1) from the condenser.

cardiagn.com

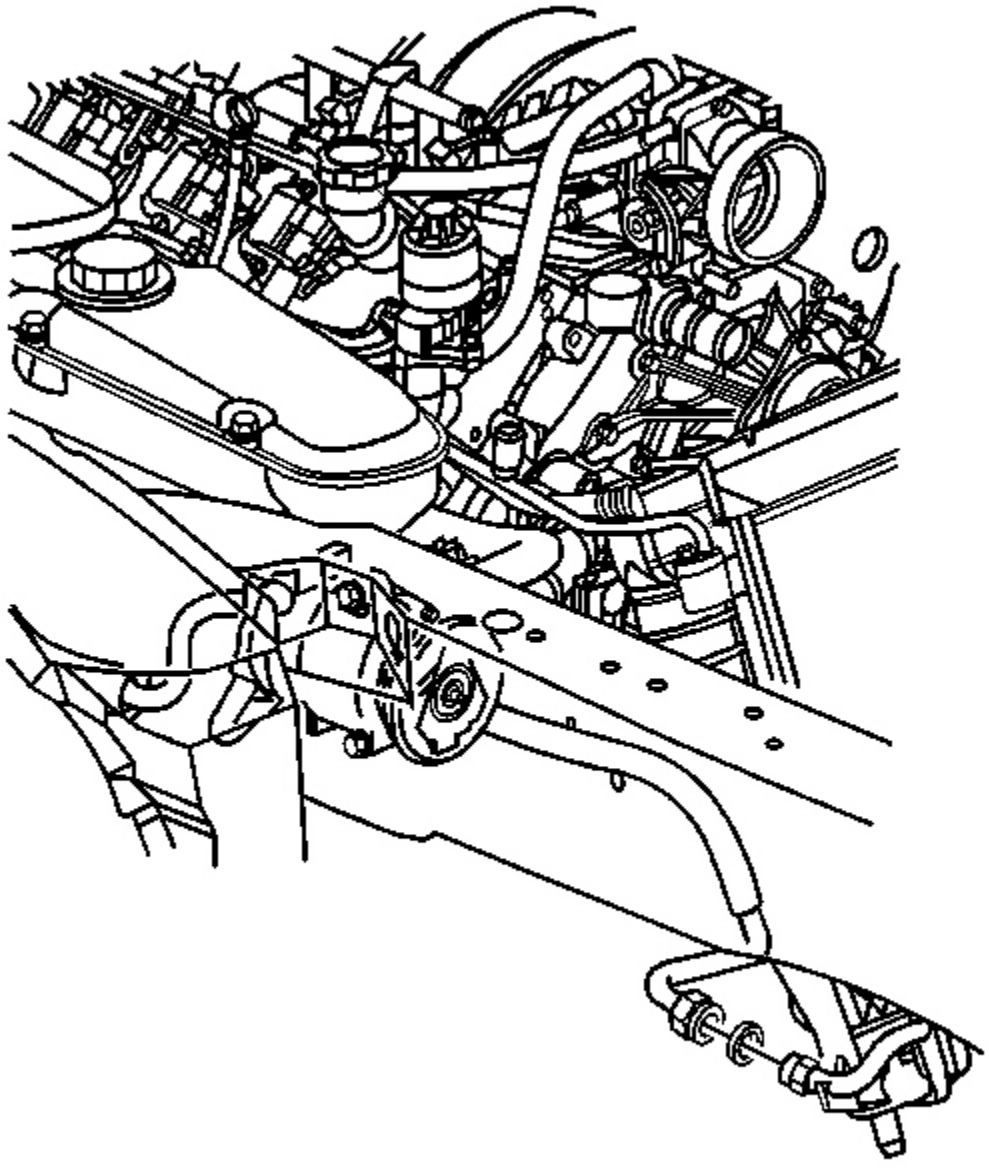


Fig. 83: Compressor Hose & Condenser
Courtesy of GENERAL MOTORS CORP.

17. Disconnect the compressor hose from the condenser.
18. Discard the O-ring seal and cap or tape the compressor hose and condenser openings.

cardiagn.com

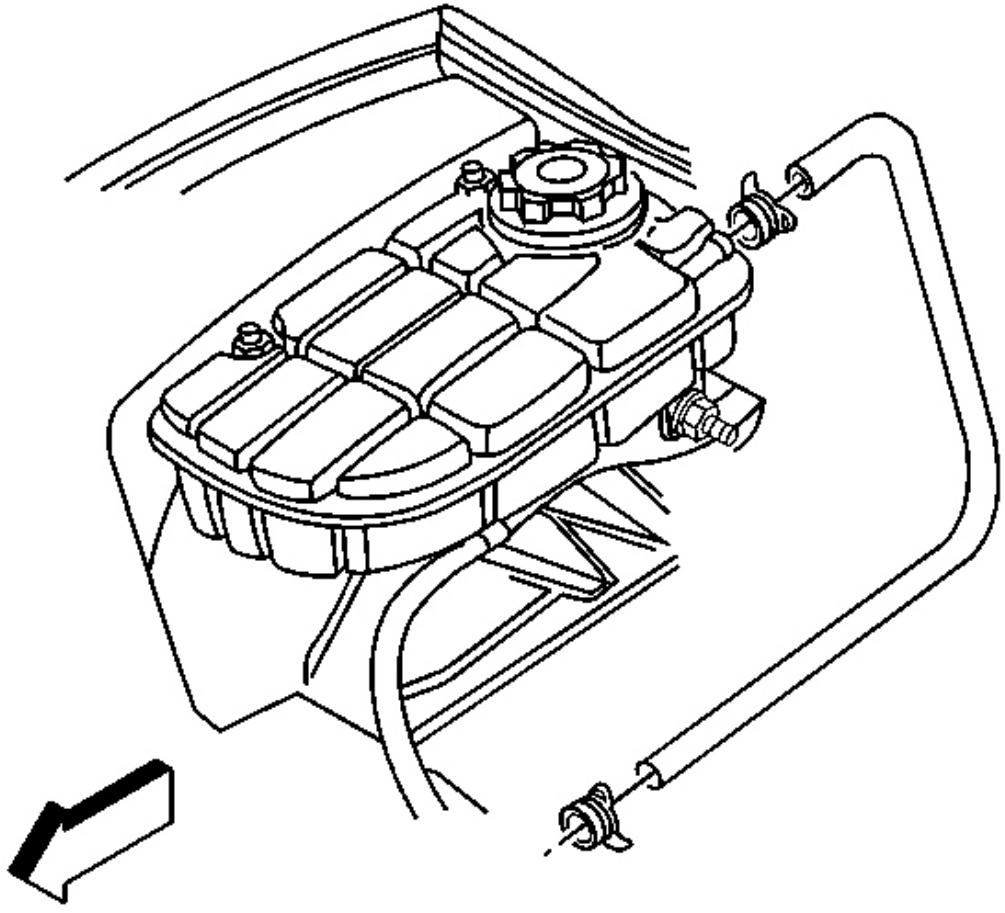


Fig. 84: Surge Tank Upper Hose & Radiator Inlet
Courtesy of GENERAL MOTORS CORP.

19. Using **J 38185** , release and reposition the coolant surge tank upper hose clamp away from the radiator inlet.
20. Separate the surge tank upper hose from the radiator inlet.

cardiagn.com

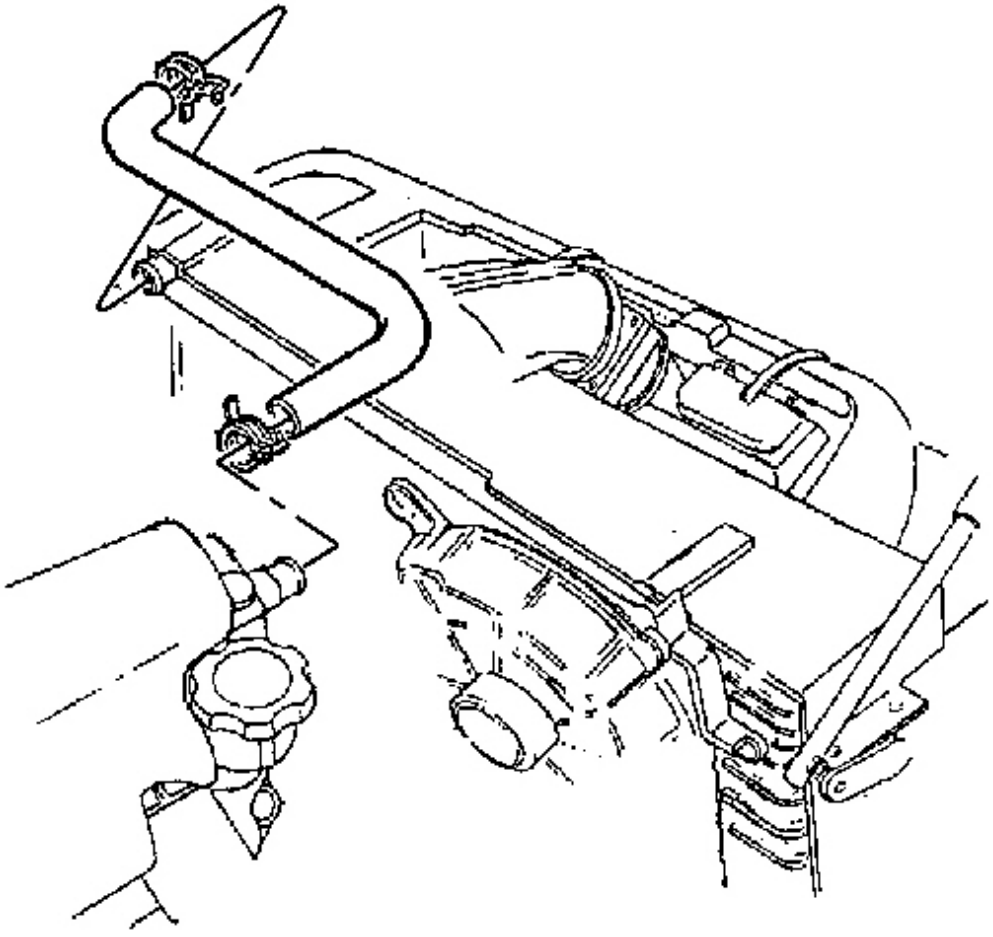


Fig. 85: Radiator Inlet Hose & Radiator Inlet
Courtesy of GENERAL MOTORS CORP.

21. Using **J 38185** , release and reposition the radiator inlet hose clamp away from the radiator inlet.
22. Separate the radiator inlet hose from the radiator inlet.

cardiagn.com

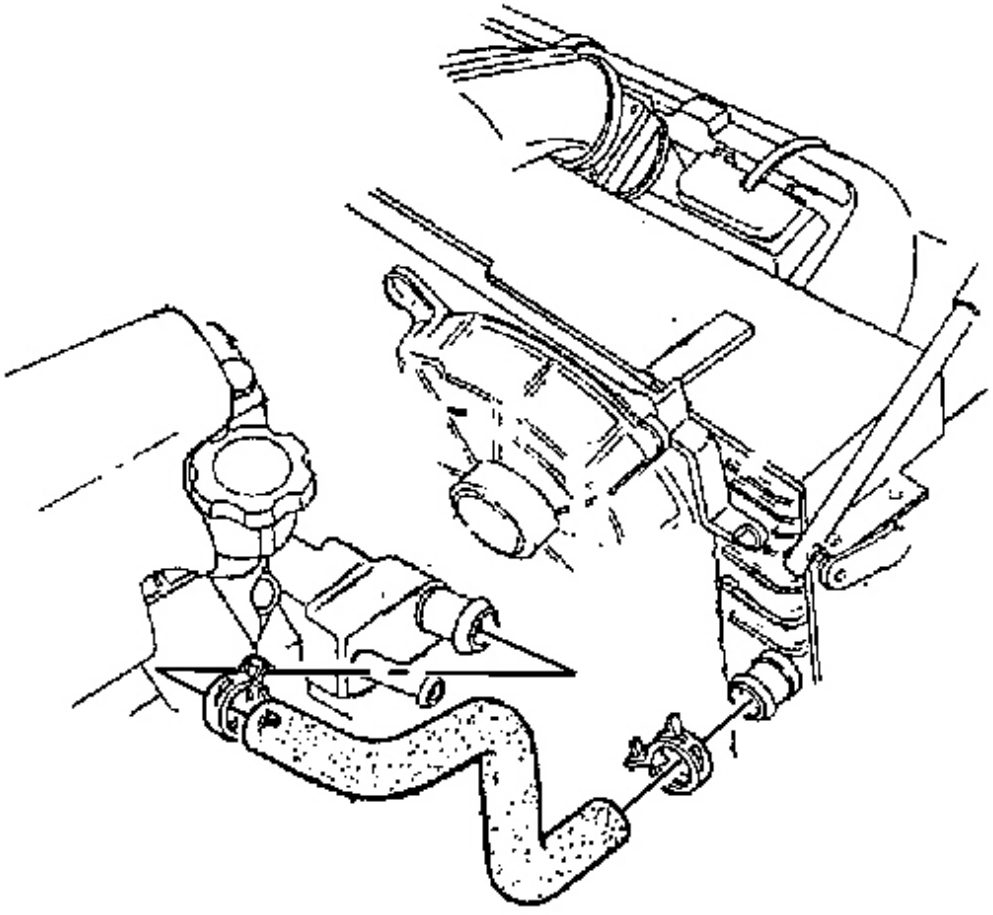


Fig. 86: Radiator Outlet Hose & Radiator Outlet
Courtesy of GENERAL MOTORS CORP.

23. Using **J 38185** , release and reposition the radiator outlet hose clamp away from the radiator outlet.
24. Separate the radiator outlet hose from the radiator outlet.

cardiagn.com

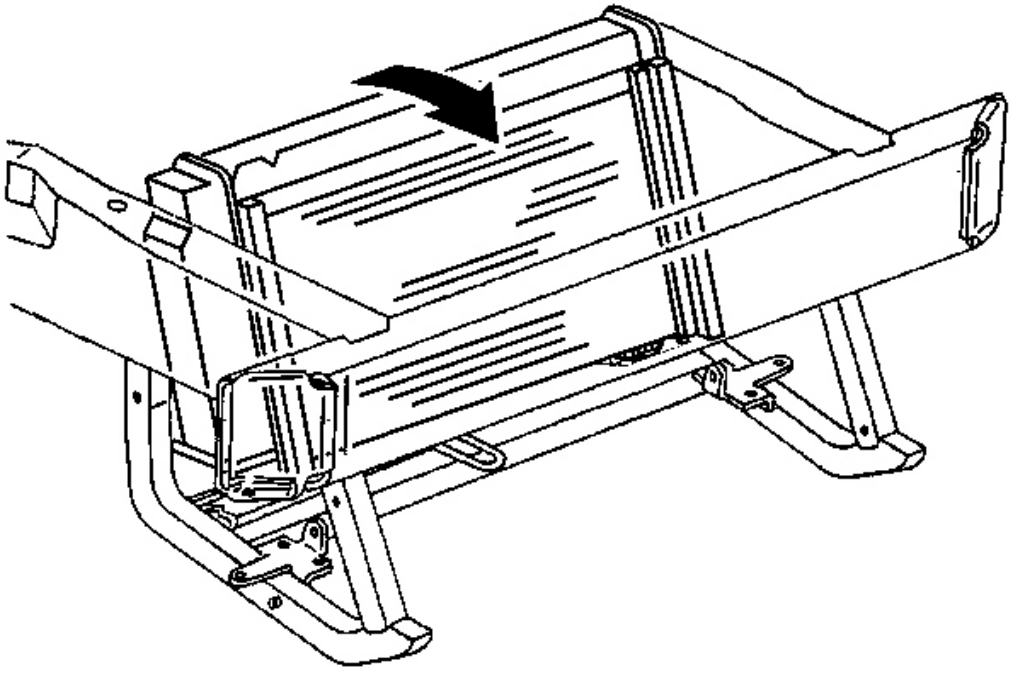


Fig. 87: A/C Condenser With Radiator Forward & Assembly
Courtesy of GENERAL MOTORS CORP.

25. Carefully pivot the A/C condenser with the radiator forward and tie off to support the assembly.

cardiagn.com

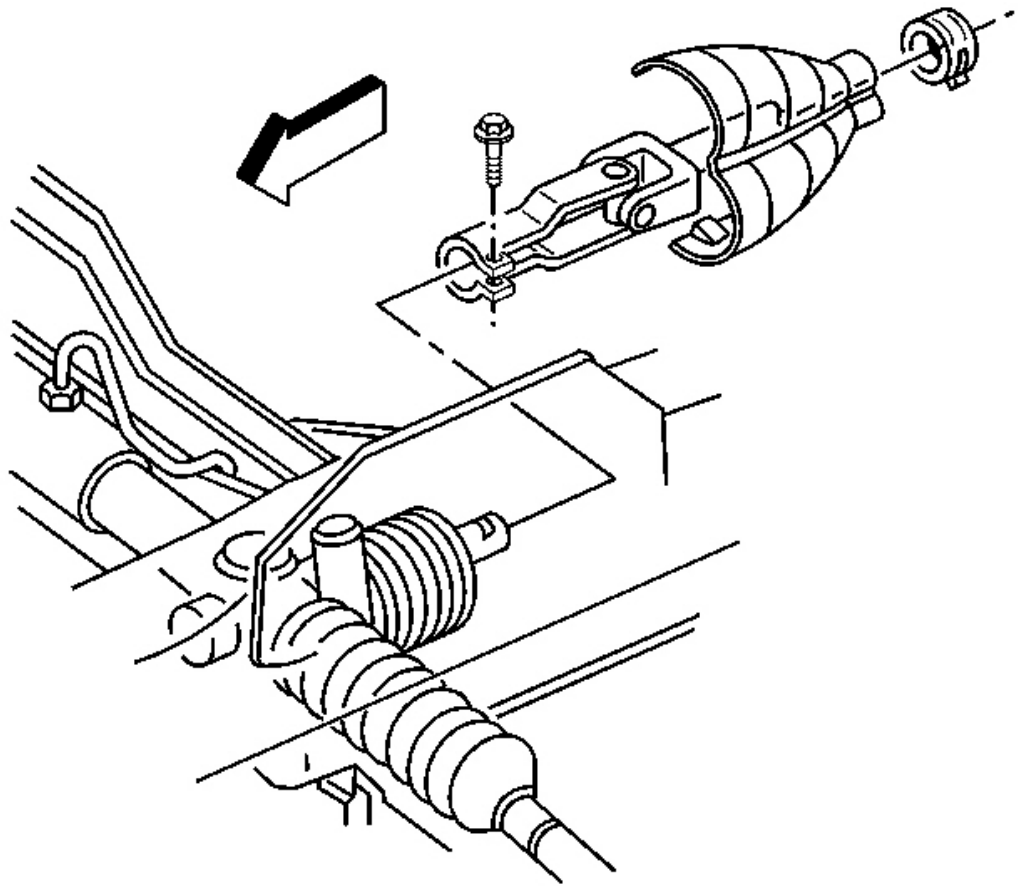


Fig. 88: Intermediate Shaft Lower Coupling & Bolt
Courtesy of GENERAL MOTORS CORP.

26. Remove the steering column intermediate shaft lower coupling shield.
27. Match-mark the intermediate shaft lower coupling to the power steering (PS) gear to ensure correct orientation upon installation.
28. Remove the intermediate shaft lower coupling bolt.
29. Disconnect the intermediate shaft lower coupling from the PS gear.

Slide the intermediate shaft lower coupling off of the PS gear steering shaft.

cardiagn.com

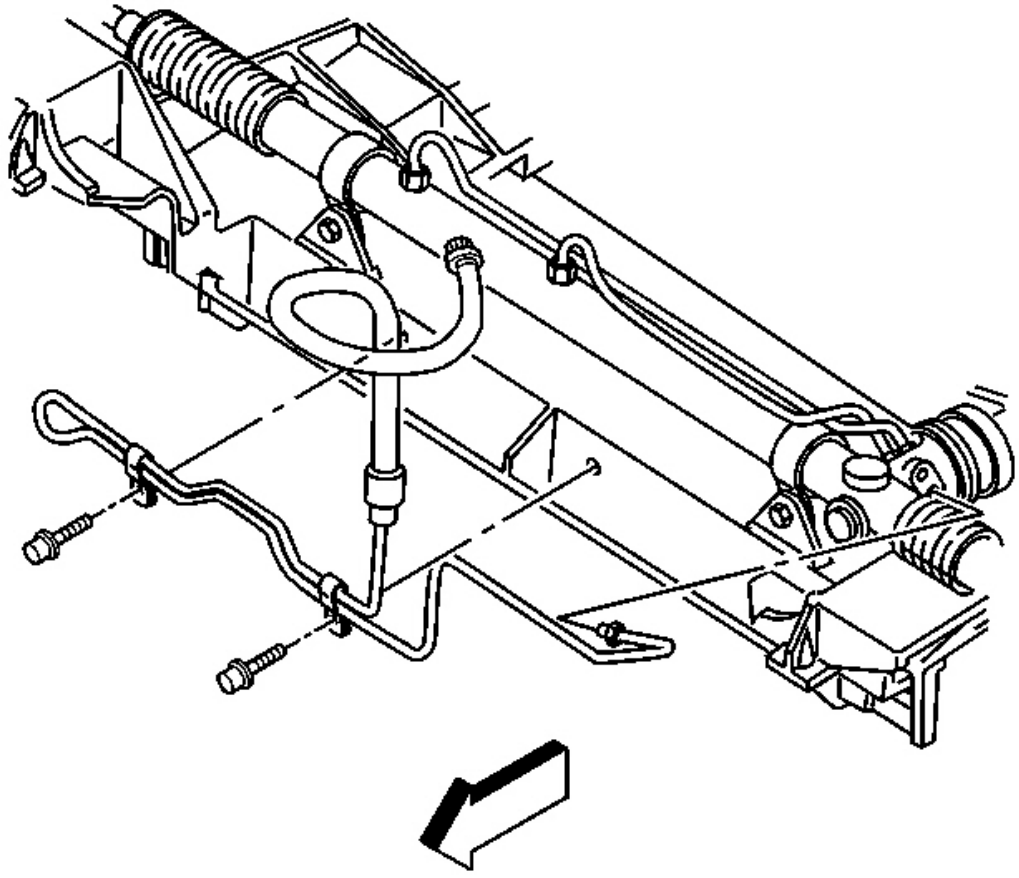


Fig. 89: PS Cooler & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

30. Remove the PS cooler retaining bolts.

cardiagn.com

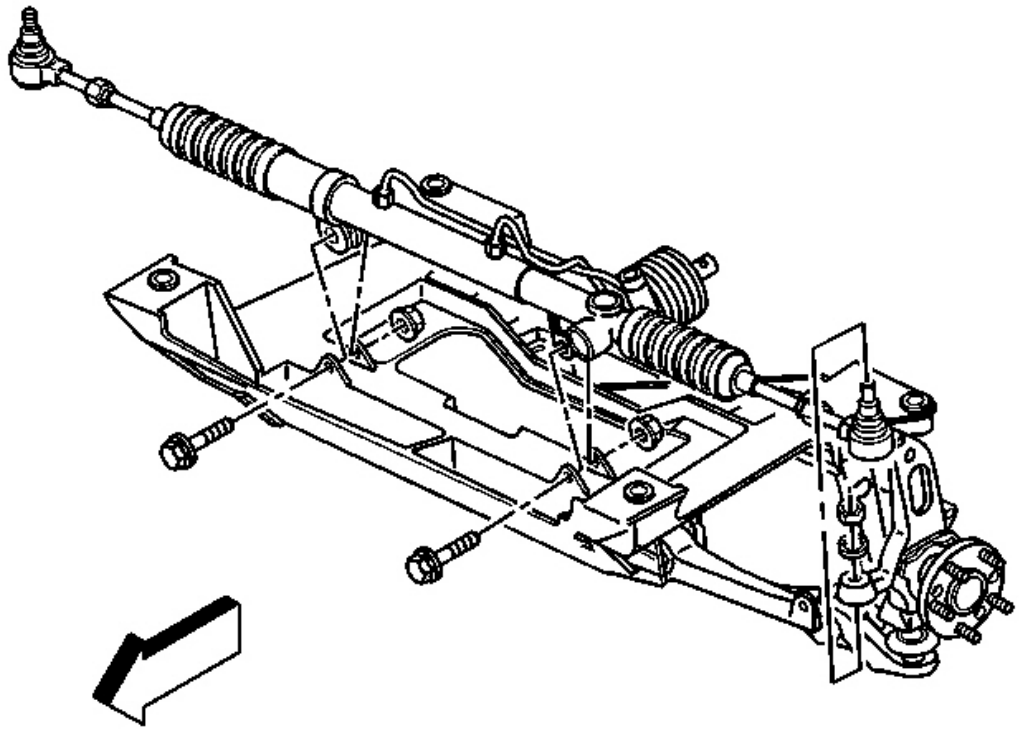


Fig. 90: BPMV Bracket, PS Gear, Mounting Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

31. Remove the brake pressure modulator valve (BPMV) bracket. Refer to **Brake Pressure Modulator Valve (BPMV) Bracket Replacement** in Antilock Brake System.
32. Remove the PS gear mounting bolts and nuts.
33. Release the PS gear and cooler from the front suspension crossmember, then slave the gear and cooler forward.
34. Remove the A/C compressor bracket. Refer to **Compressor Mounting Bracket Replacement** in Heating, Ventilation, and Air Conditioning.
35. Remove the generator. Refer to **Generator Replacement** in Engine Electrical.
36. Install the **J 41803** and the **J 28467-B** in order to support the engine.
37. Remove the right hand engine mount (and bracket). Refer to **Engine Mount Replacement - Right** in Engine Mechanical - 5.7L.

cardiagn.com

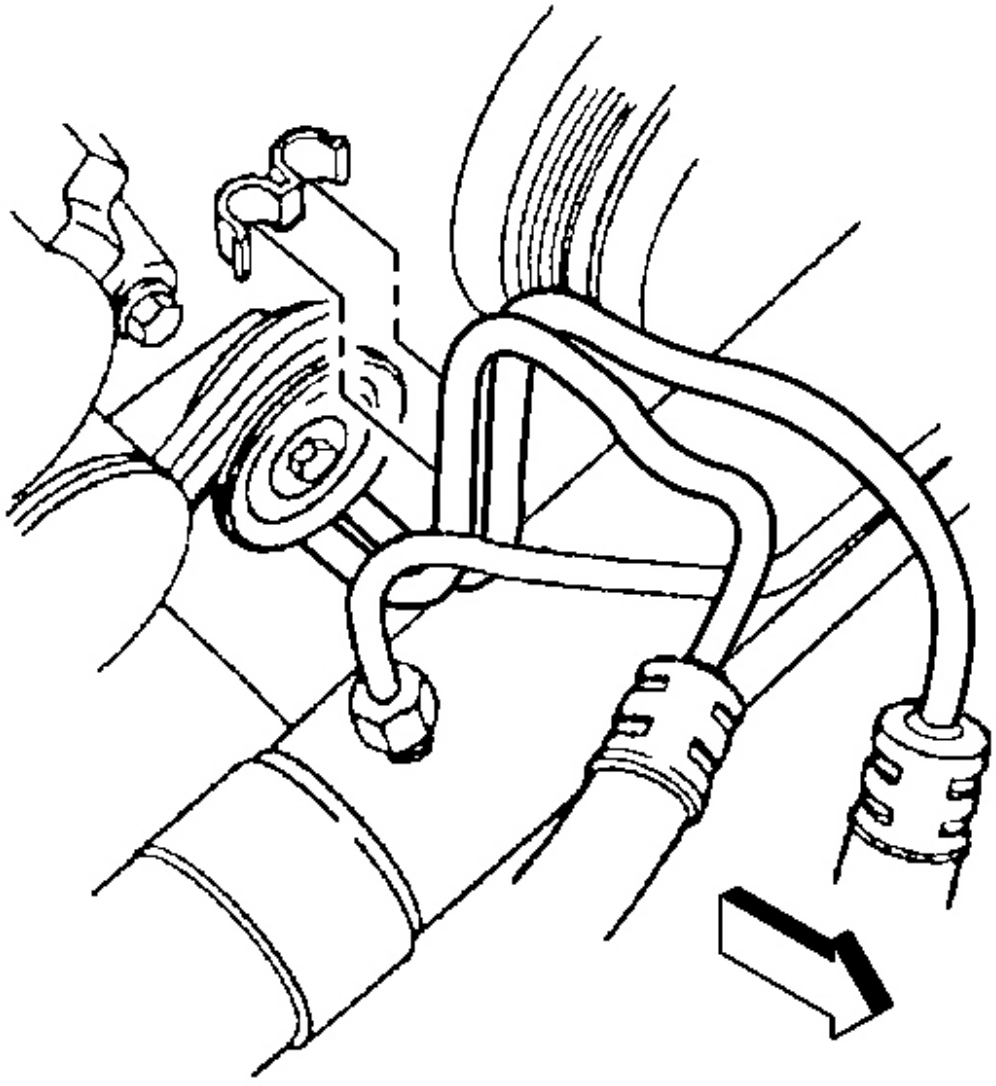


Fig. 91: TOC Front Pipe & Front Clip
Courtesy of GENERAL MOTORS CORP.

38. Remove the TOC front pipe front clip.
39. Raise the vehicle.

cardiagn.com

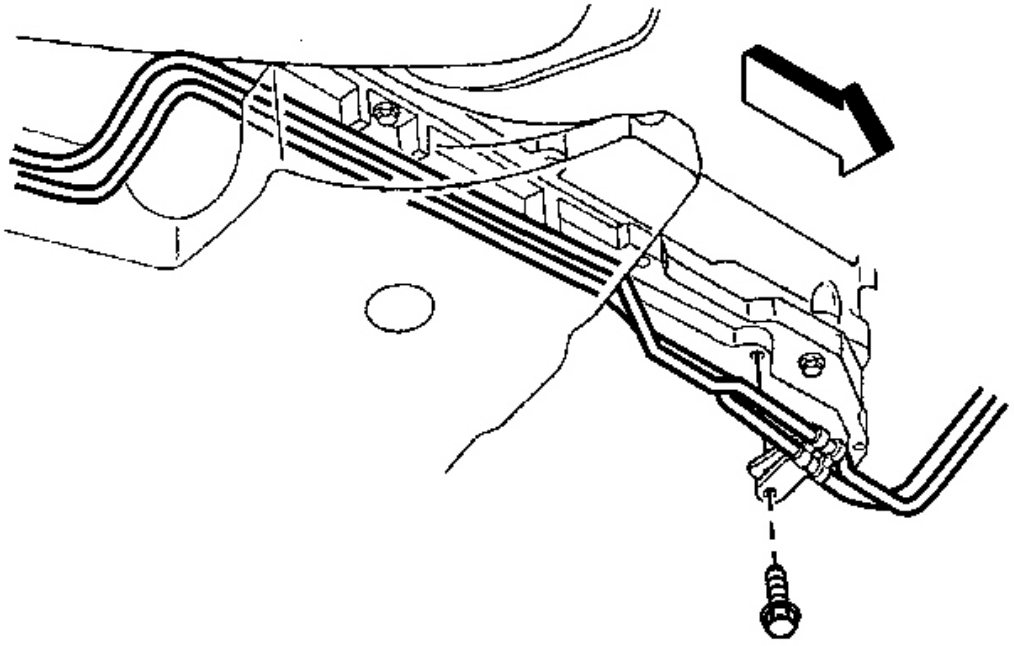


Fig. 92: TOC Front Pipe, Front Retaining Clamp & Bolt
Courtesy of GENERAL MOTORS CORP.

40. Remove the TOC front pipe front retaining clamp bolt and retaining clamp.

cardiagn.com

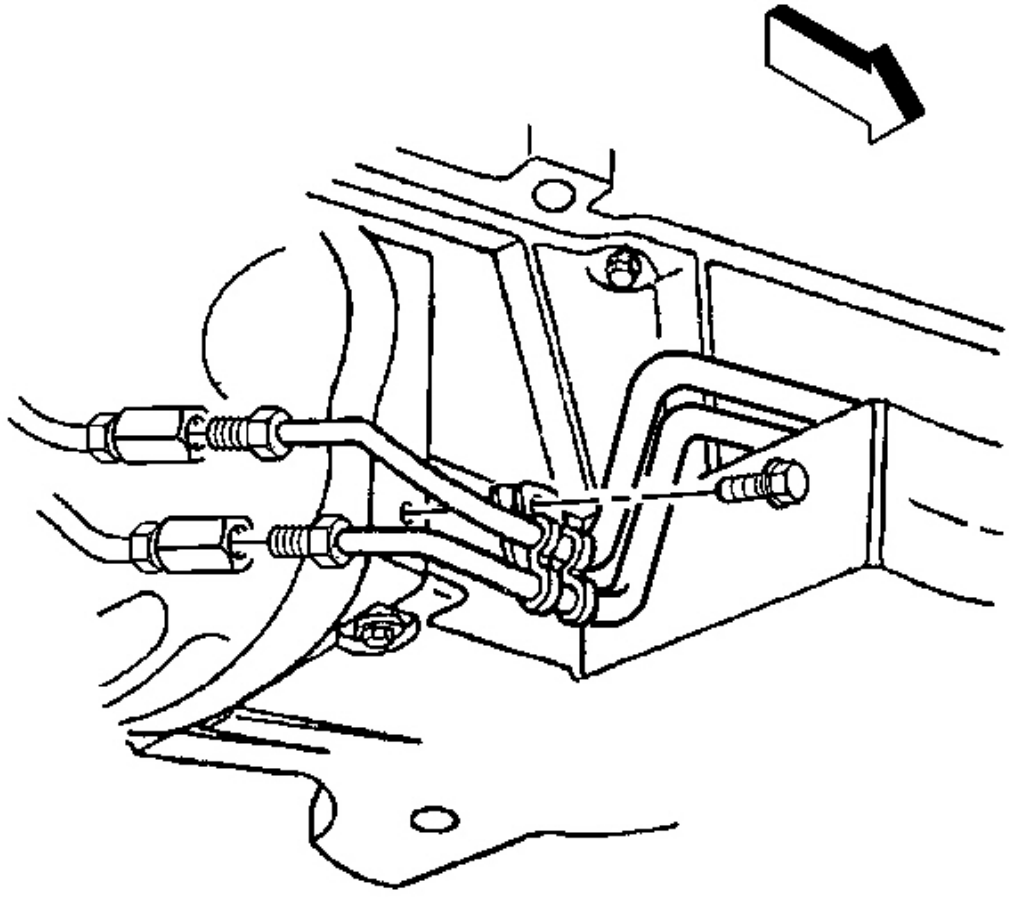


Fig. 93: Locating Cooler Fittings
Courtesy of GENERAL MOTORS CORP.

41. Remove the TOC front pipe rear retaining clamp bolt and retaining clamp.
42. Disconnect the TOC front pipe fittings from the junction fittings at the engine flywheel housing, then cap the pipe fittings and plug the junction fittings to prevent contamination.
43. Lower the vehicle; leave the vehicle slightly above the ground.
44. Finesse the TOC front pipes out of the vehicle (through the top).

Installation Procedure

cardiagn.com

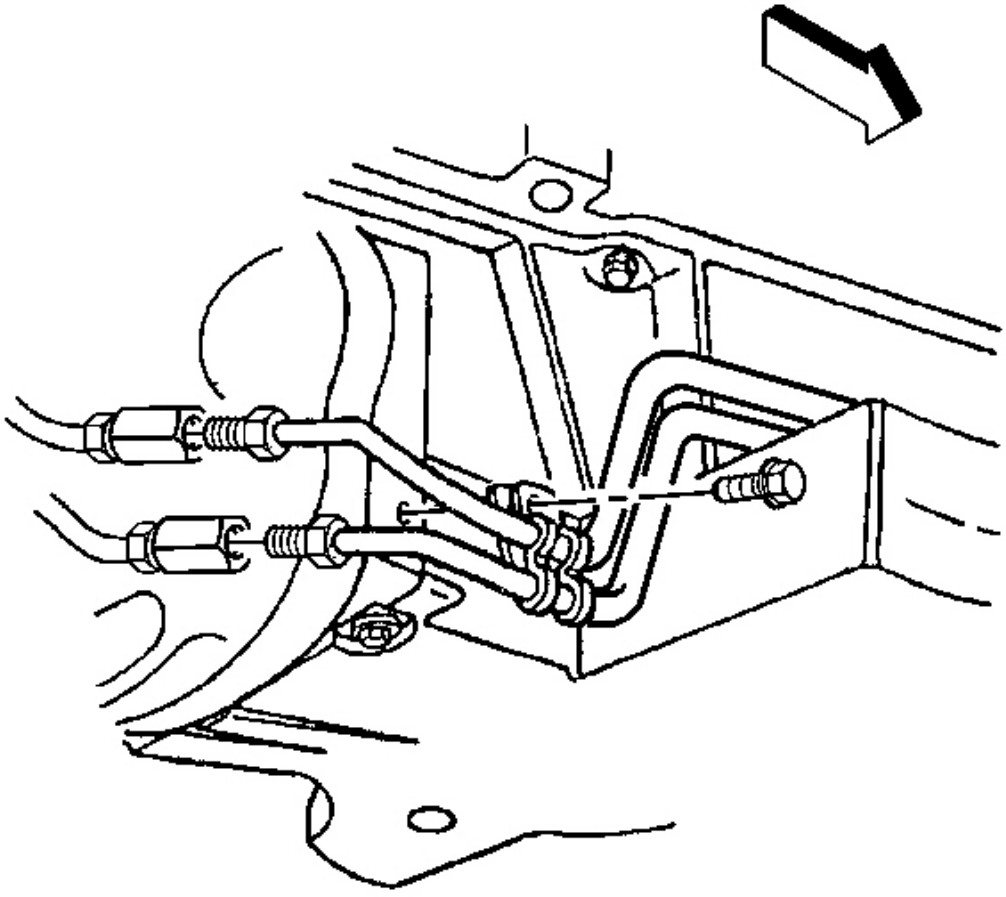


Fig. 94: Locating Cooler Fittings
Courtesy of GENERAL MOTORS CORP.

1. Install the TOC front pipes to the vehicle (through the top of the vehicle).

   Finesse the pipes into position.

2. Raise the vehicle.
3. Remove the caps from the rear of the TOC front pipes and remove the plugs from the junction fittings at the engine flywheel housing.

   NOTE: Refer to Fastener Notice in Cautions and Notices.

4. ALIGN and HAND-START, then tighten ONLY by hand to seat the TOC front upper and lower pipe

cardiagn.com

fittings to the junction fittings at the engine flywheel housing.

Tighten: Tighten the transmission oil cooler front upper and lower pipe fittings to the junction at the engine flywheel housing to 27 N.m (20 lb ft).

5. Install the TOC front pipe rear retaining clamp and bolt.

   Tighten: Tighten the transmission oil cooler front pipe rear retaining clamp bolt to 2.2 N.m (19 lb in).

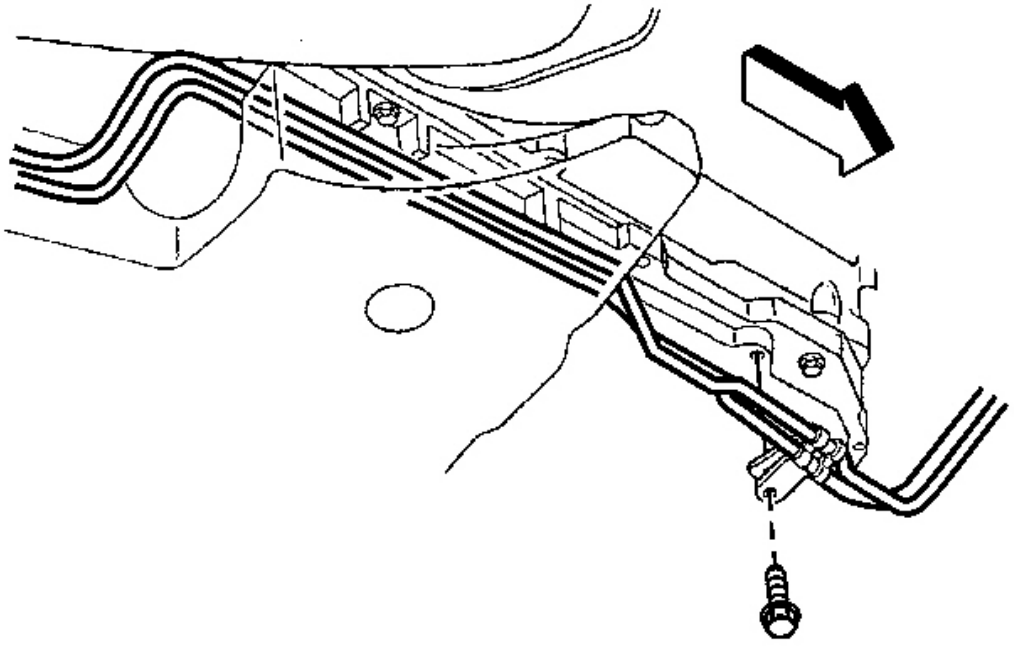


Fig. 95: TOC Front Pipe, Front Retaining Clamp & Bolt
Courtesy of GENERAL MOTORS CORP.

6. Install the TOC front pipe front retaining clamp and bolt.

   Tighten: Tighten the transmission oil cooler front pipe front retaining clamp bolt to 12 N.m (106 lb in).

cardiagn.com

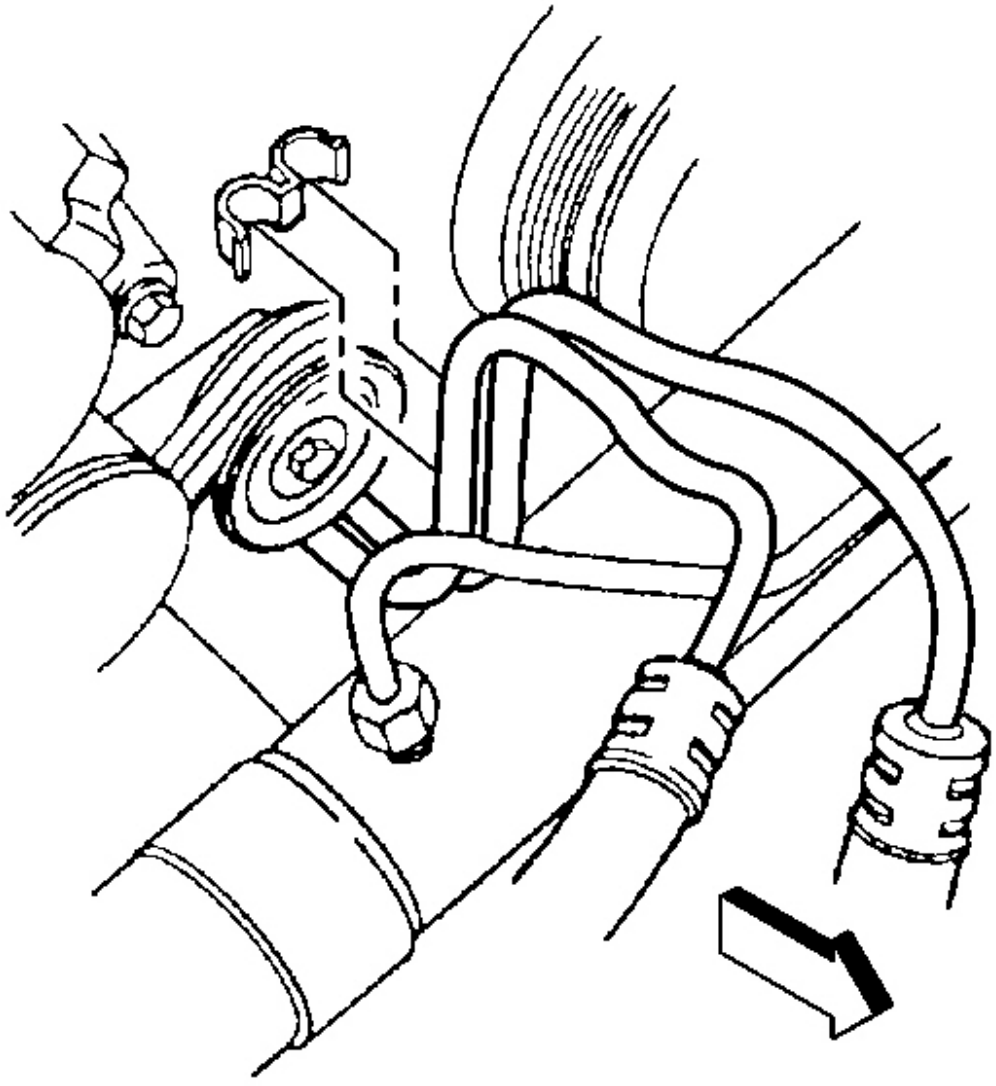


Fig. 96: TOC Front Pipe & Front Clip
Courtesy of GENERAL MOTORS CORP.

7. Install the TOC front pipe front clip.

cardiagn.com

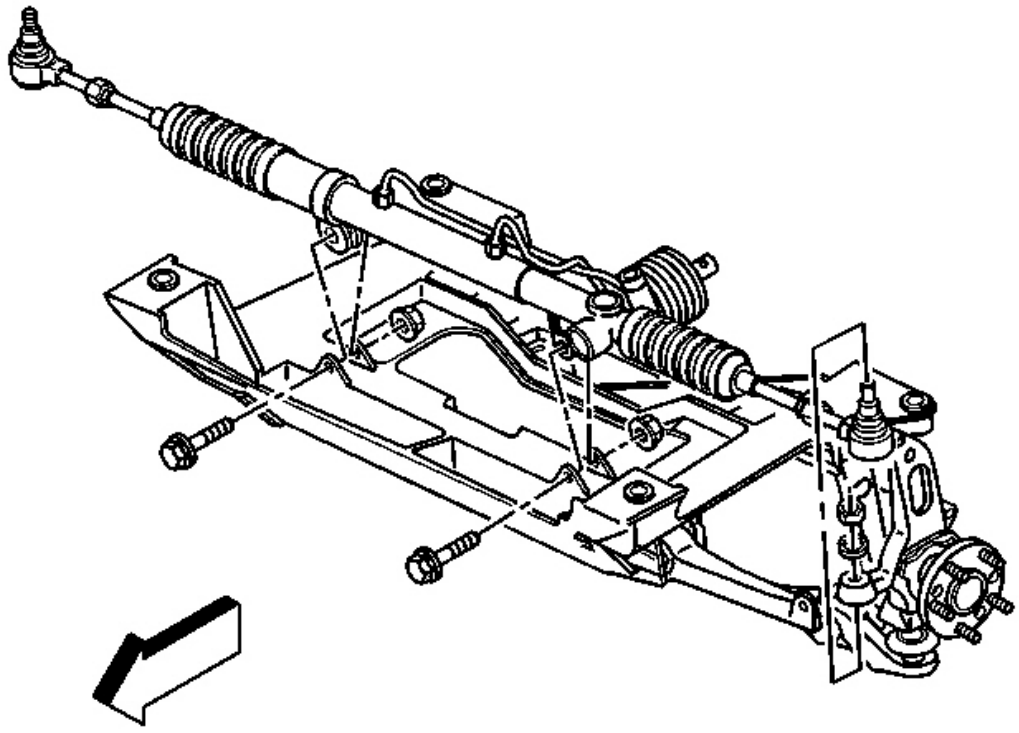


Fig. 97: BPMV Bracket, PS Gear, Mounting Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

8. Install the right hand engine mount (and bracket). Refer to **Engine Mount Replacement - Right** in Engine Mechanical - 5.7L.
9. Lower the vehicle; leave the vehicle on the hoist.
10. Remove the **J 41803** and the **J 28467-B** .
11. Install the generator. Refer to **Generator Replacement** in Engine Electrical.
12. Install the A/C compressor bracket. Refer to **Compressor Mounting Bracket Replacement** in Heating, Ventilation, and Air Conditioning.
13. Position the PS gear and cooler to the front suspension crossmember.
14. Install the BPMV bracket. Refer to **Brake Pressure Modulator Valve (BPMV) Bracket Replacement** in Antilock Brake System.
15. Install the PS gear mounting bolts and nuts.

Tighten: Tighten the power steering gear mounting nuts to 100 N.m (74 lb ft).

cardiagn.com

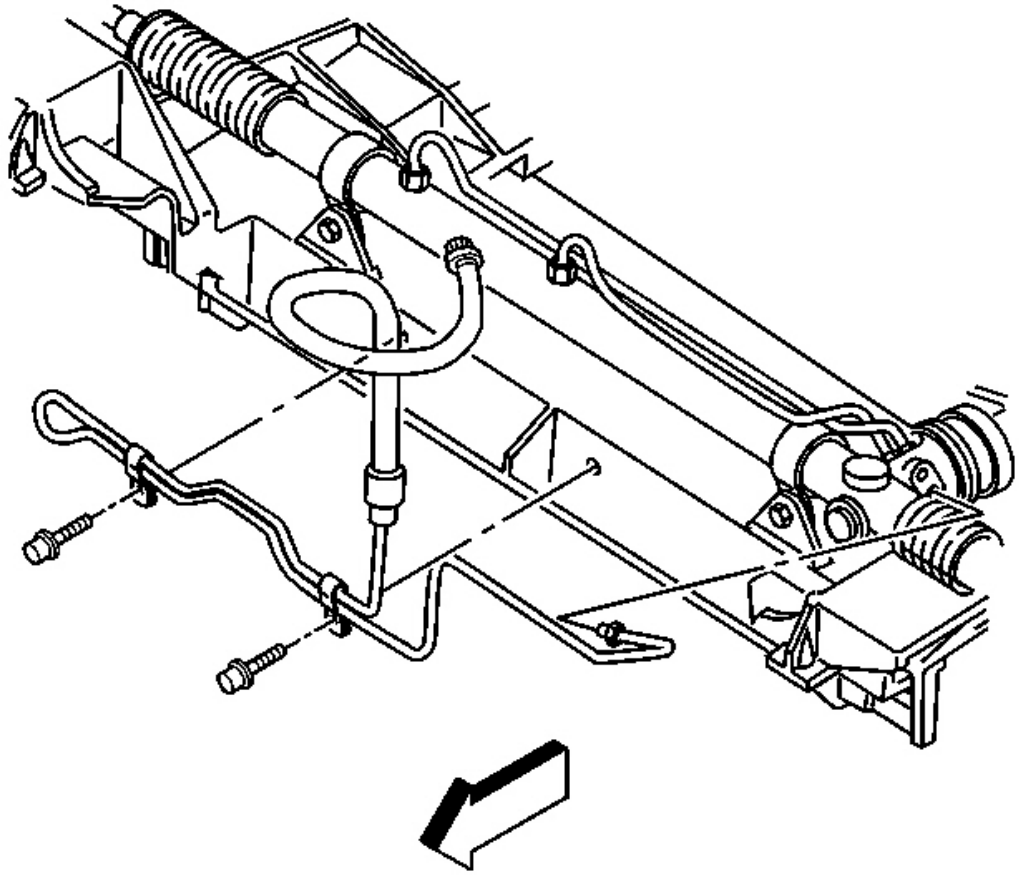


Fig. 98: PS Cooler & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

16. Install the PS cooler retaining bolts.

    Tighten: Tighten the power steering cooler retaining bolts to 11 N.m (97 lb in).

cardiagn.com

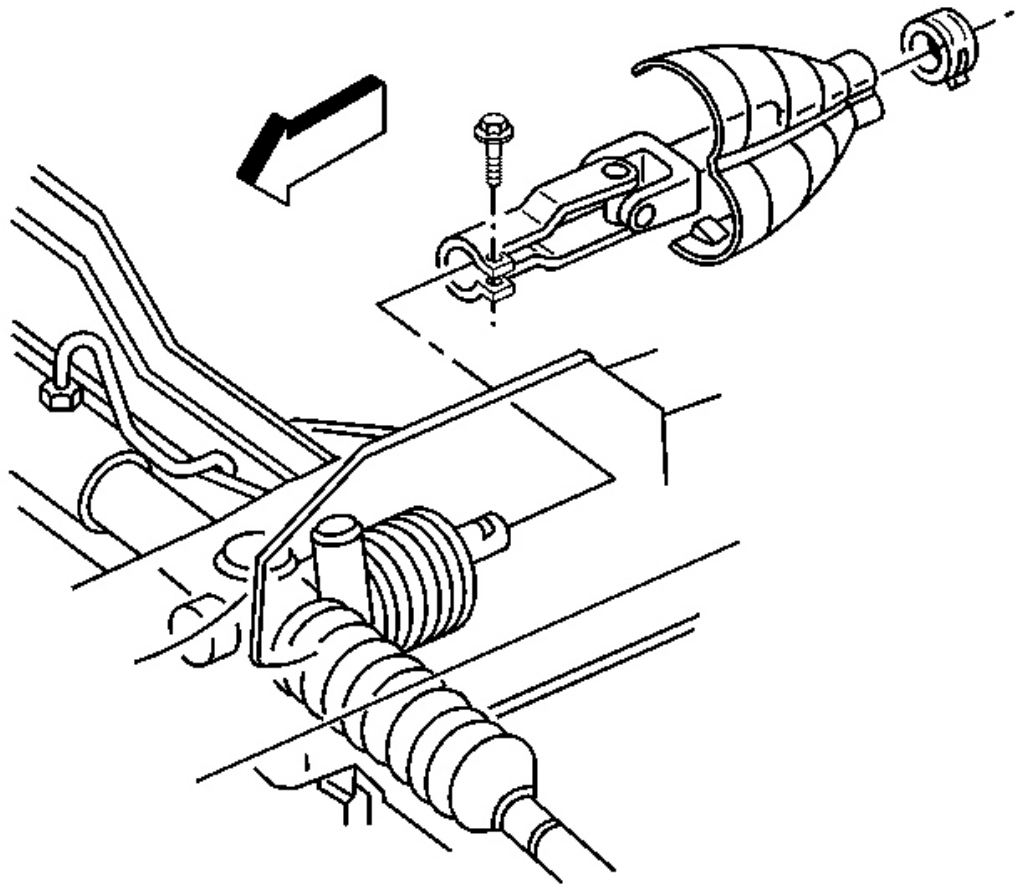


Fig. 99: Intermediate Shaft Lower Coupling & Bolt
Courtesy of GENERAL MOTORS CORP.

17. Connect the intermediate shaft lower coupling to the PS gear; be sure that the intermediate shaft and the PS gear steering shaft are orientated as marked prior to disconnecting them.

    Slide the intermediate shaft lower coupling onto the PS gear steering shaft.

18. Install the intermediate shaft lower coupling bolt.

    Tighten: Tighten the steering column intermediate shaft lower coupling bolt to 34 N.m (25 lb ft).

19. Install the intermediate shaft lower coupling shield.
20. Lower the vehicle.

cardiagn.com

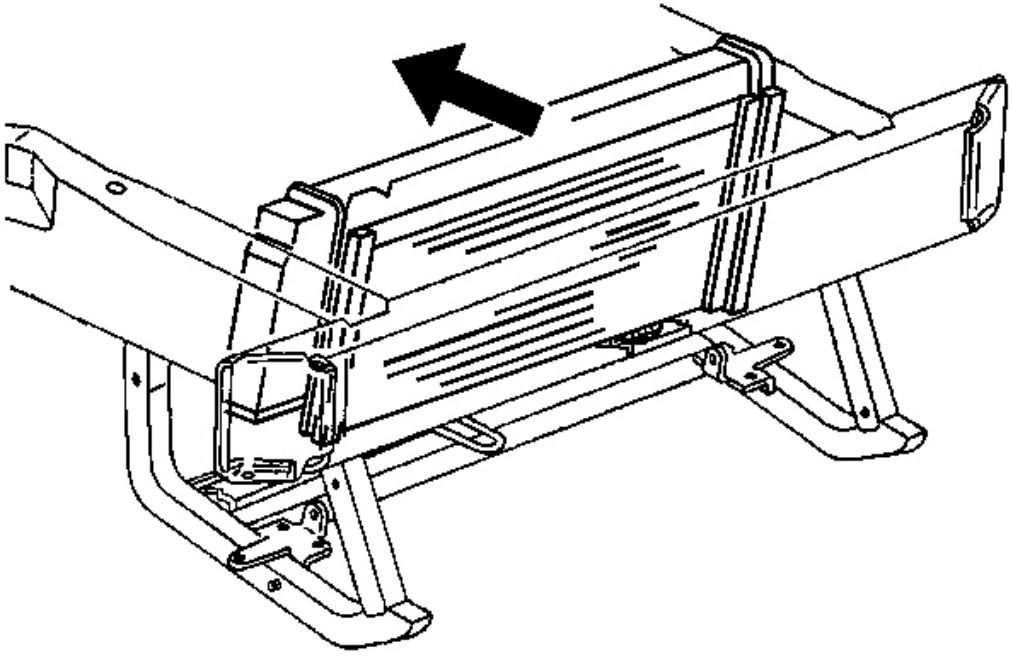


Fig. 100: Tie-Off Retainer, AC Condenser & Radiator
Courtesy of GENERAL MOTORS CORP.

21. Remove the tie-off retainer and carefully pivot the AC condenser and the radiator back into position.

cardiagn.com

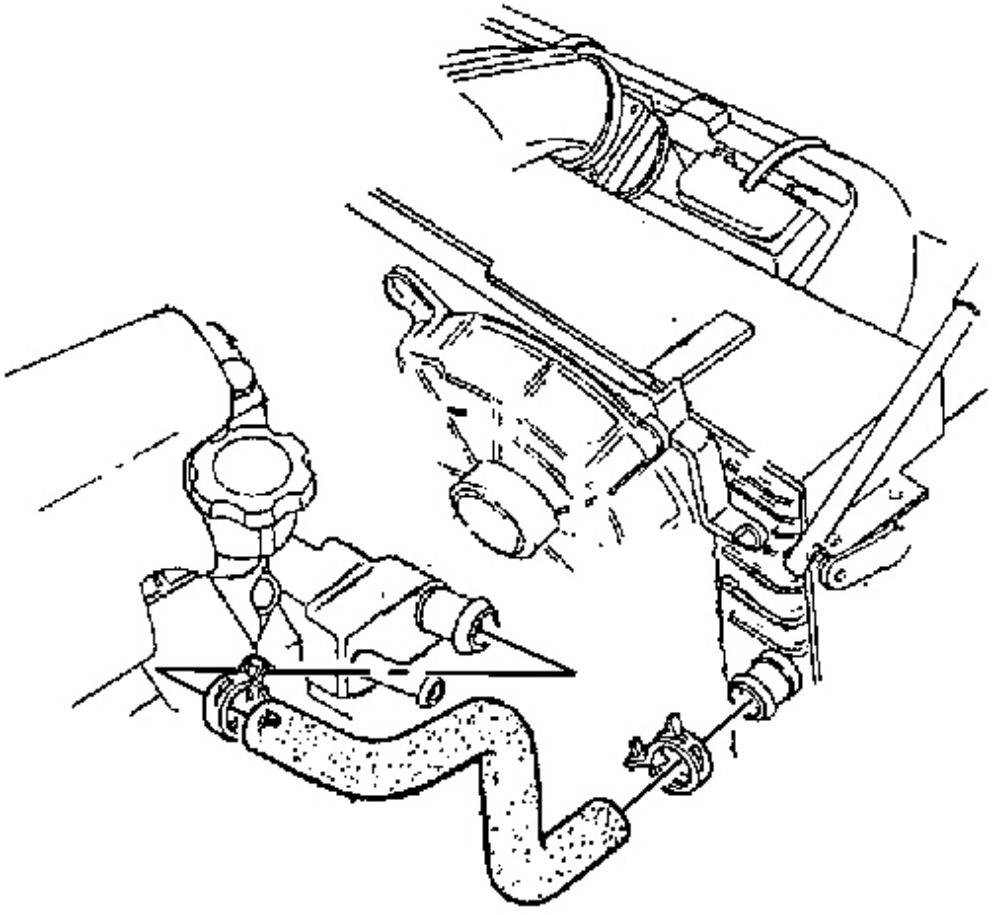


Fig. 101: Radiator Outlet Hose & Radiator Outlet
Courtesy of GENERAL MOTORS CORP.

22. Install the radiator outlet hose to the radiator outlet.
23. Using **J 38185** , position the radiator outlet hose clamp onto the radiator outlet.

cardiagn.com

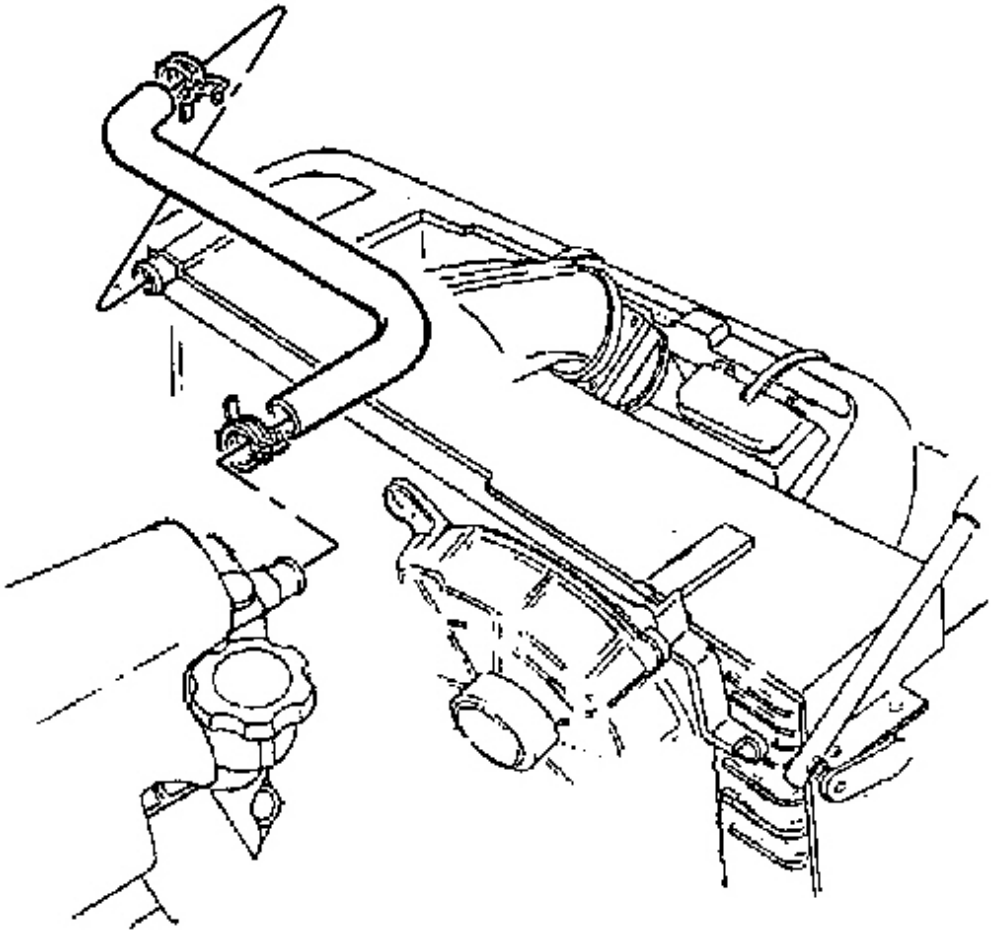


Fig. 102: Radiator Inlet Hose & Radiator Inlet
Courtesy of GENERAL MOTORS CORP.

24. Install the radiator inlet hose to the radiator inlet.
25. Using **J 38185** , position the radiator inlet hose clamp onto the radiator inlet.

cardiagn.com

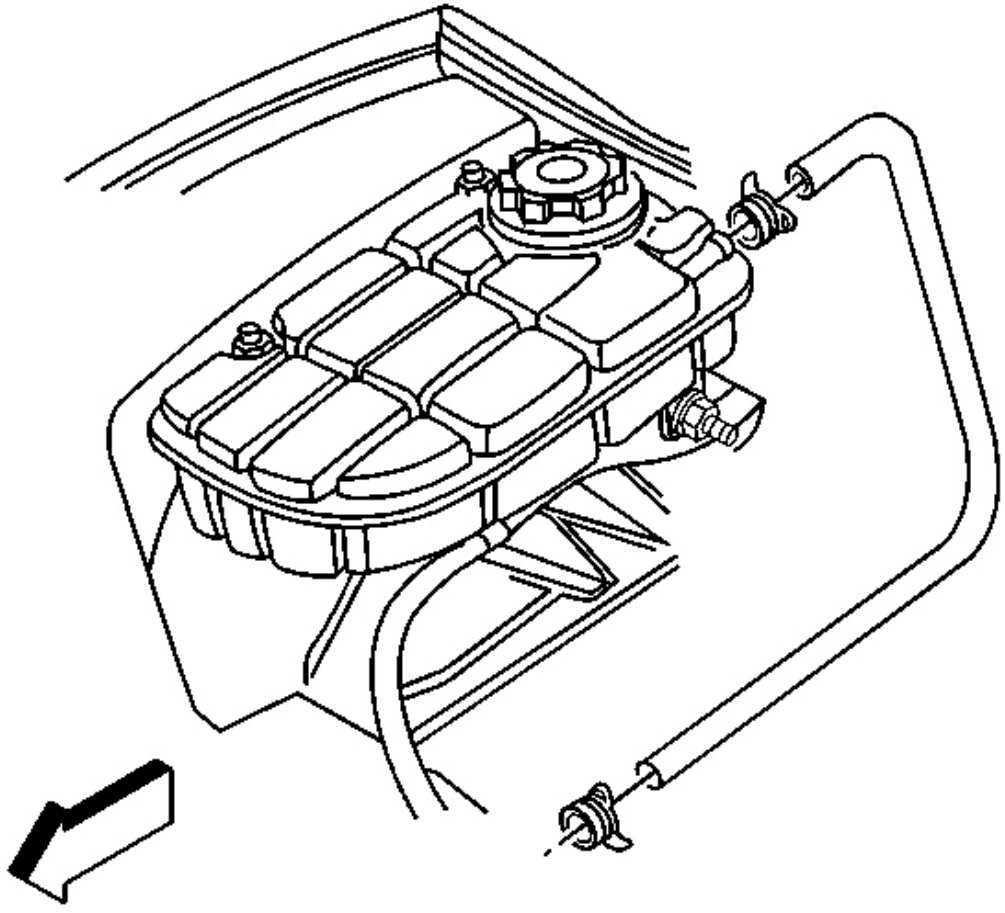


Fig. 103: Surge Tank Upper Hose & Radiator Inlet
Courtesy of GENERAL MOTORS CORP.

26. Install the surge tank upper hose to the radiator inlet.
27. Using **J 38185** , position the coolant surge tank upper hose clamp onto the radiator inlet.

cardiagn.com

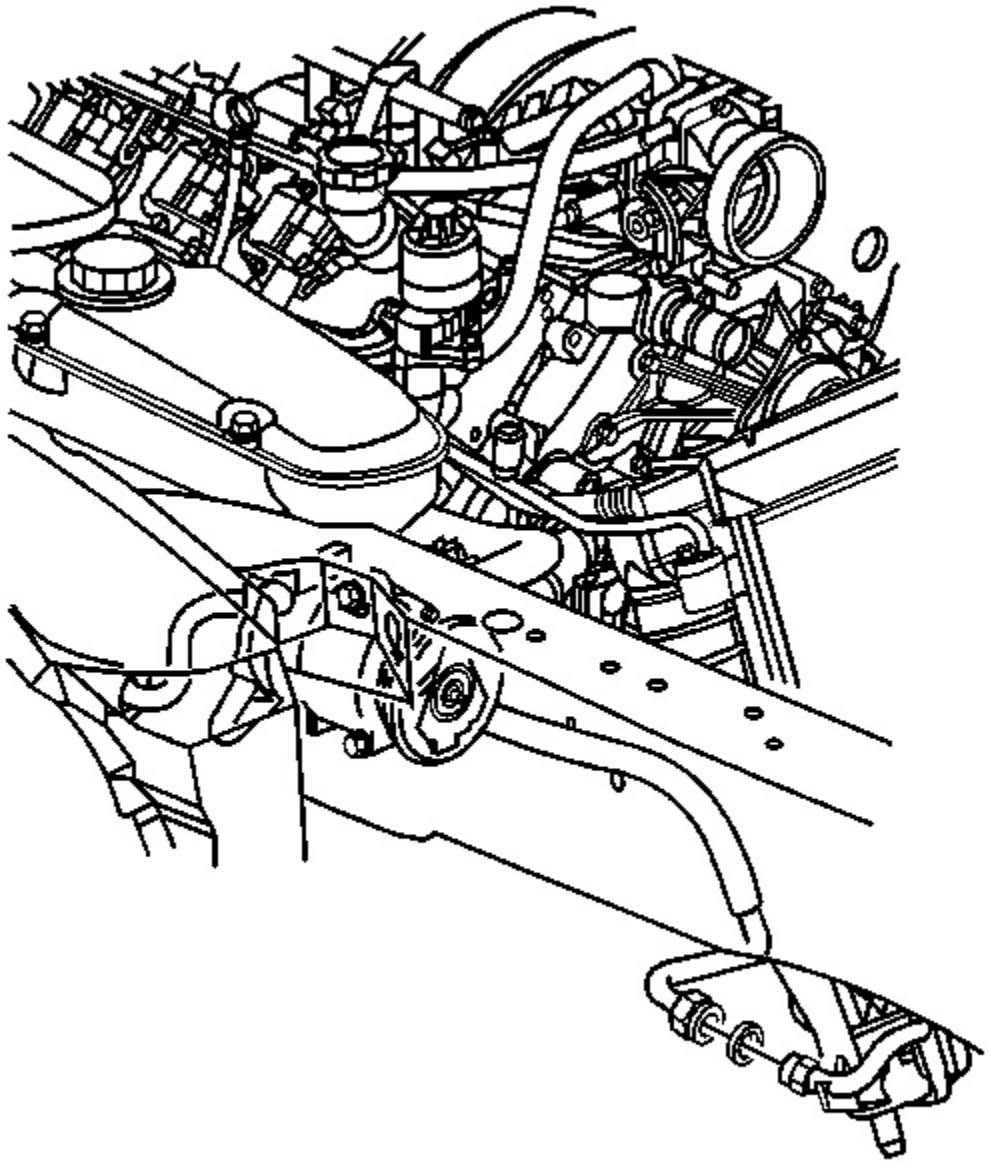


Fig. 104: Compressor Hose & Condenser
Courtesy of GENERAL MOTORS CORP.

28. Install the compressor hose to the condenser.

cardiagn.com

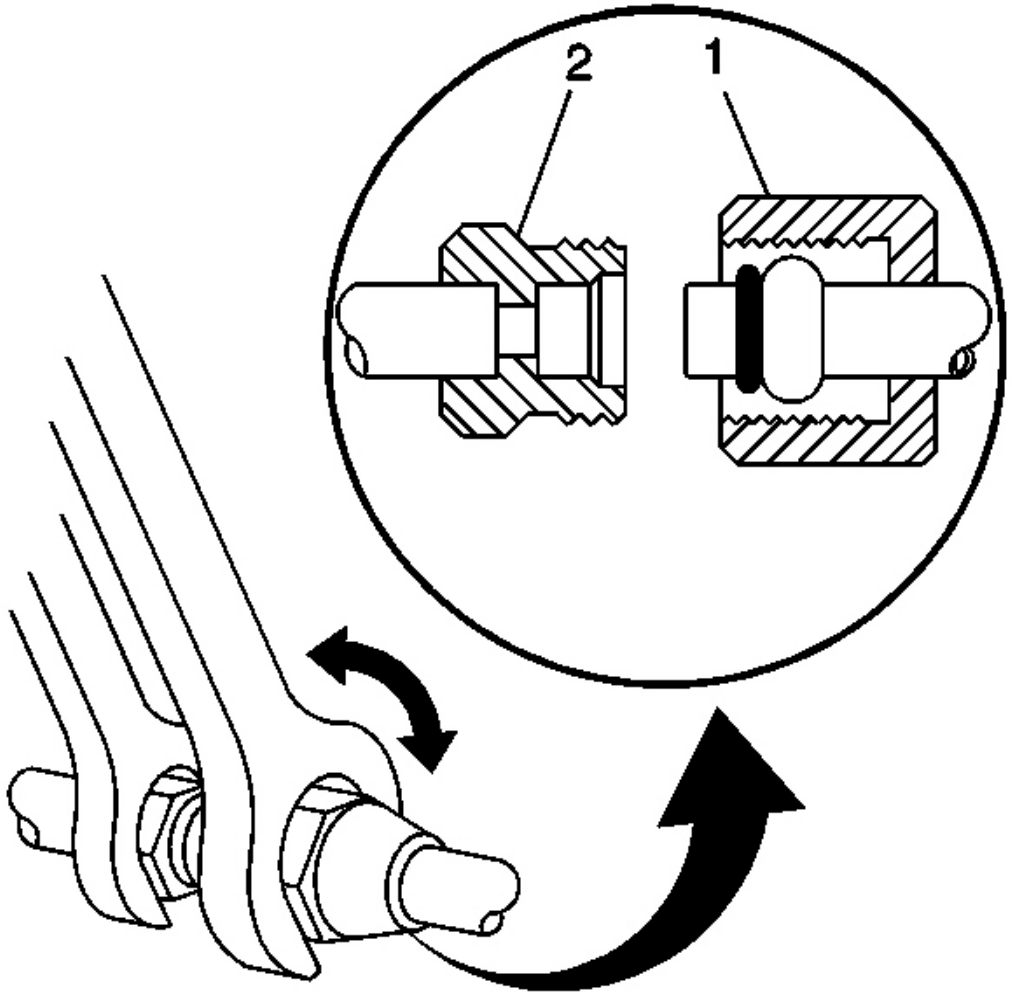


Fig. 105: Identifying A/C Line Fittings
Courtesy of GENERAL MOTORS CORP.

29. Using a back-up wrench on the condenser fitting (2), tighten the compressor hose fitting (1) to the condenser.

    Tighten: Tighten the fitting to 24 N.m (17 lb ft).

cardiagn.com

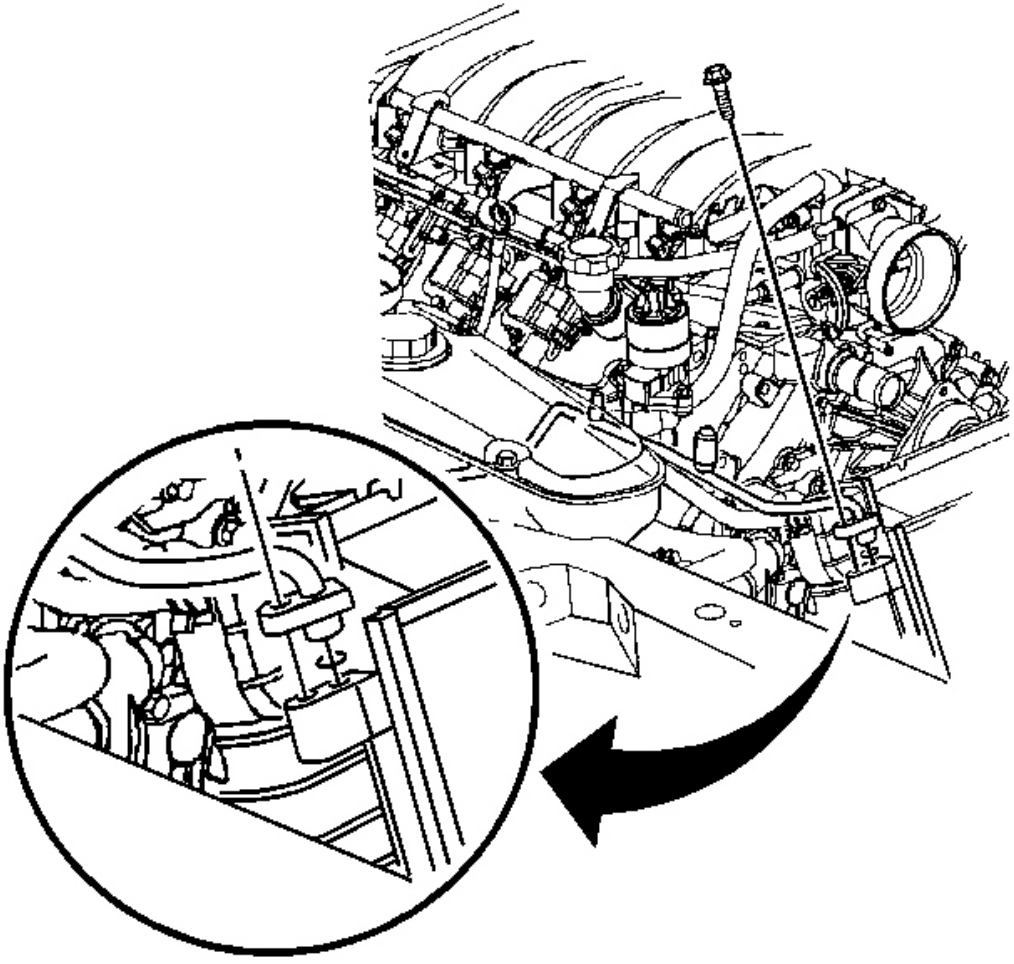


Fig. 106: Front Evaporator Tube & Condenser Bolt
Courtesy of GENERAL MOTORS CORP.

30. Connect the front evaporator tube to the condenser.
31. Install the front evaporator tube to condenser bolt.

    Tighten: Tighten the front evaporator tube bolt to 27 N.m (20 lb ft).

32. Install the upper and lower radiator support. Refer to **Radiator Support Replacement** in Engine Cooling.
33. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement** in Engine Controls.

cardiagn.com

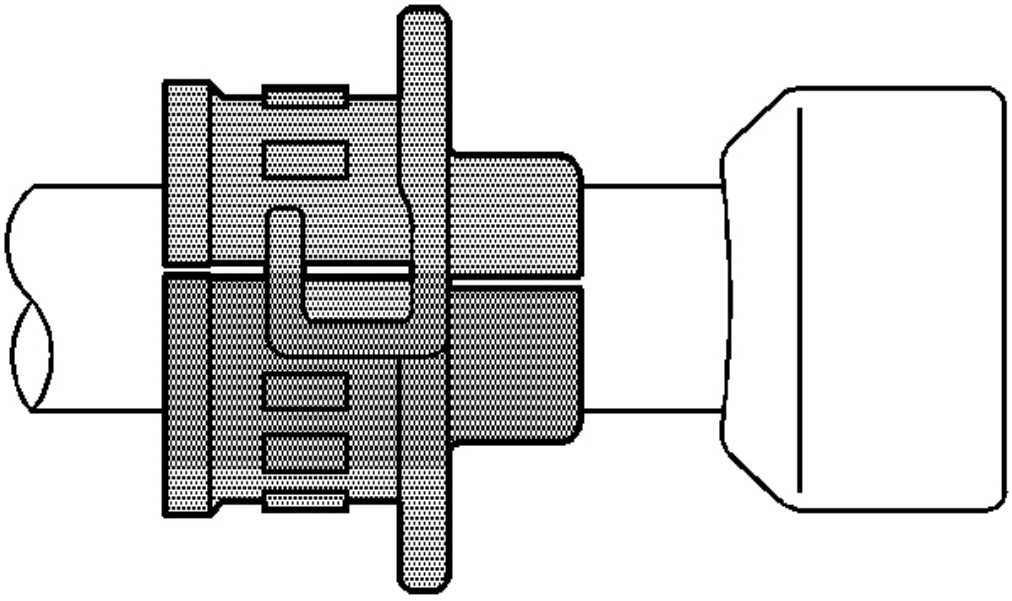


Fig. 107: TOC Connection & J 44827
Courtesy of GENERAL MOTORS CORP.

34. Connect the upper TOC line to the oil cooler using the following steps:
    1. Push the TOC pipe into the quick connect fitting, until a click is heard.
    2. Tug gently in the TOC line to ensure a proper connection.
35. Position the plastic retainer over the connection.
36. Raise the vehicle.
37. Connect the lower TOC line to the oil cooler using the following steps:
    1. Push the TOC pipe into the quick connect fitting, until a click is heard.
    2. Tug gently in the TOC line to ensure a proper connection.
38. Position the plastic retainer over the connection.
39. Lower the vehicle.

cardiagn.com

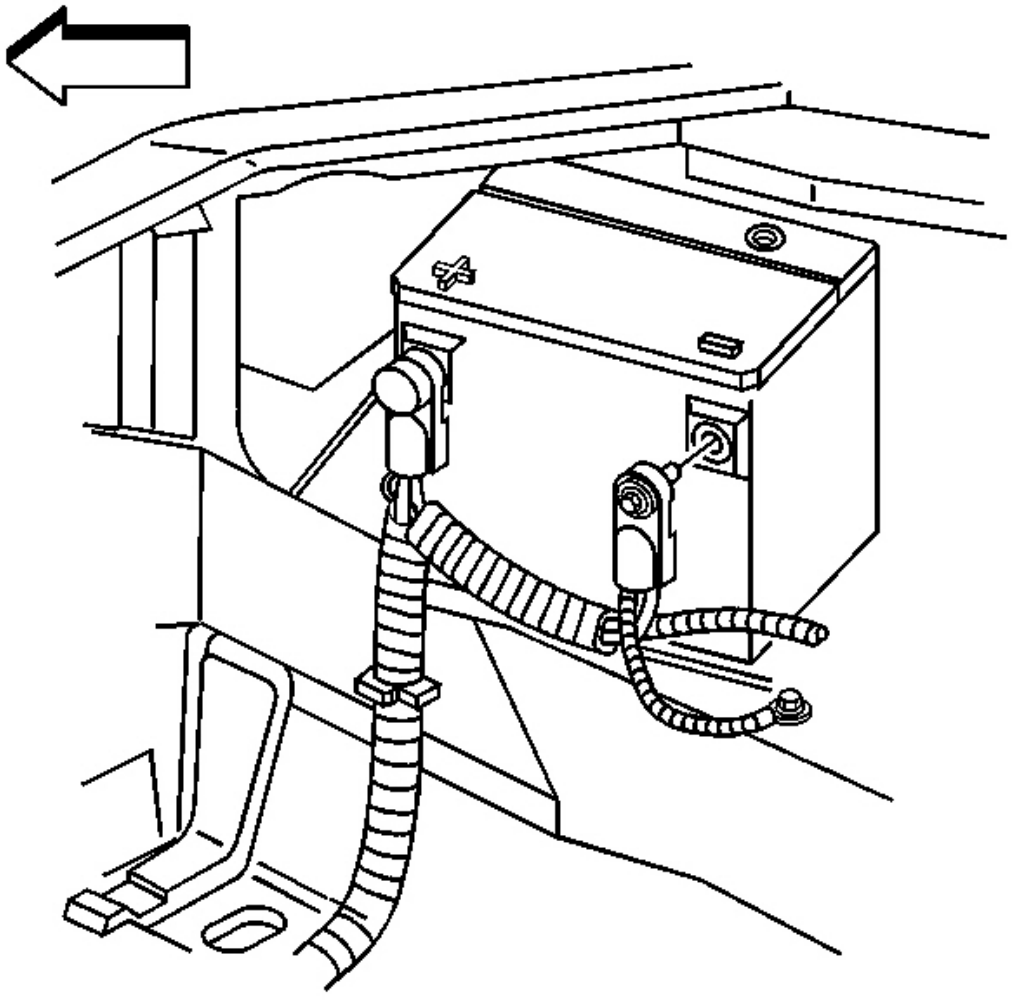


Fig. 108: Identifying Battery Negative Cable
Courtesy of GENERAL MOTORS CORP.

40. Connect the negative battery cable.

    Tighten: Tighten the negative battery cable bolt to 15 N.m (11 lb ft).

41. Fill the cooling system. Refer to **Draining and Filling Cooling System** in Engine Cooling.
42. Recharge the AC system. Refer to **Refrigerant Recovery and Recharging** in Heating, Ventilation, and Air Conditioning.
43. Check the transmission fluid level. Add if necessary.

cardiagn.com

OIL COOLER LINE REPLACEMENT (REAR)

Removal Procedure

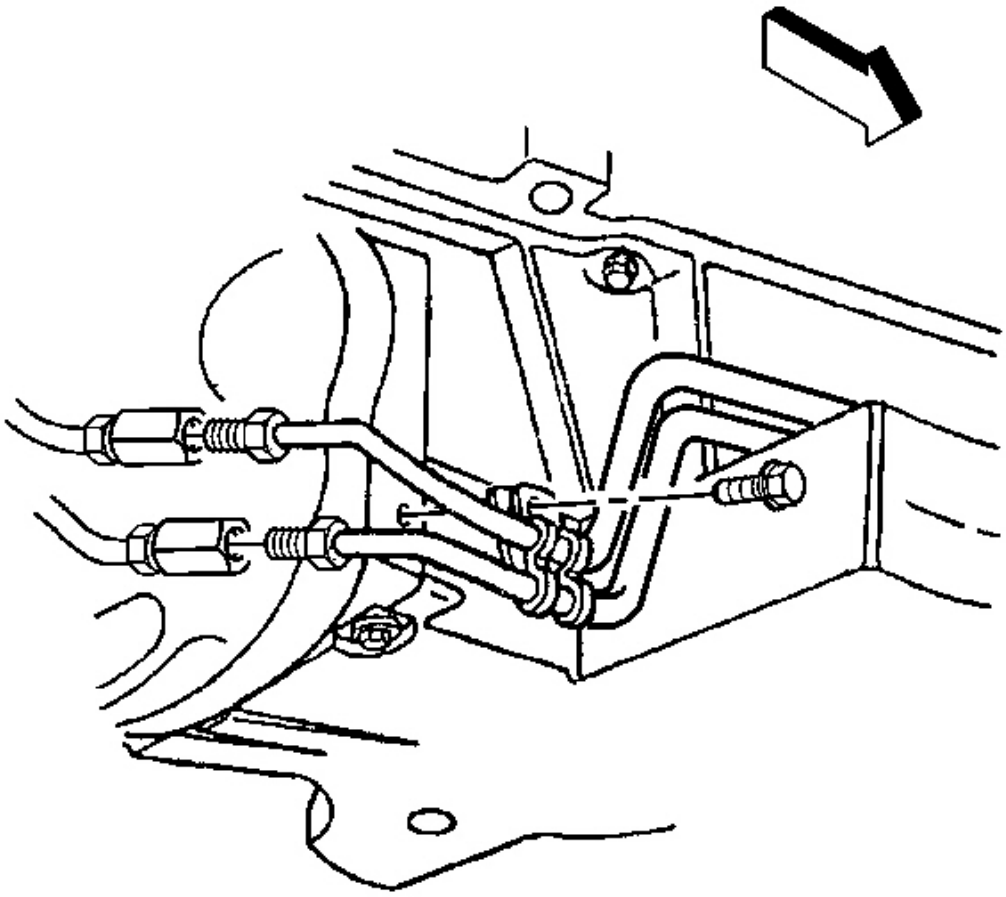


Fig. 109: Locating Cooler Fittings
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the catalytic converter. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
3. Remove the right side muffler. Refer to **Muffler Replacement - Right** in Engine Exhaust.
4. Remove the driveline tunnel closeout panel. Refer to **Driveline Tunnel Closeout Panel Replacement** in Propeller Shaft.
5. Disconnect the transmission oil cooler (TOC) rear upper and lower pipe fittings from the junction fittings at the engine flywheel housing, then cap the pipes and plug the junction fittings to prevent contamination.

cardiagn.com

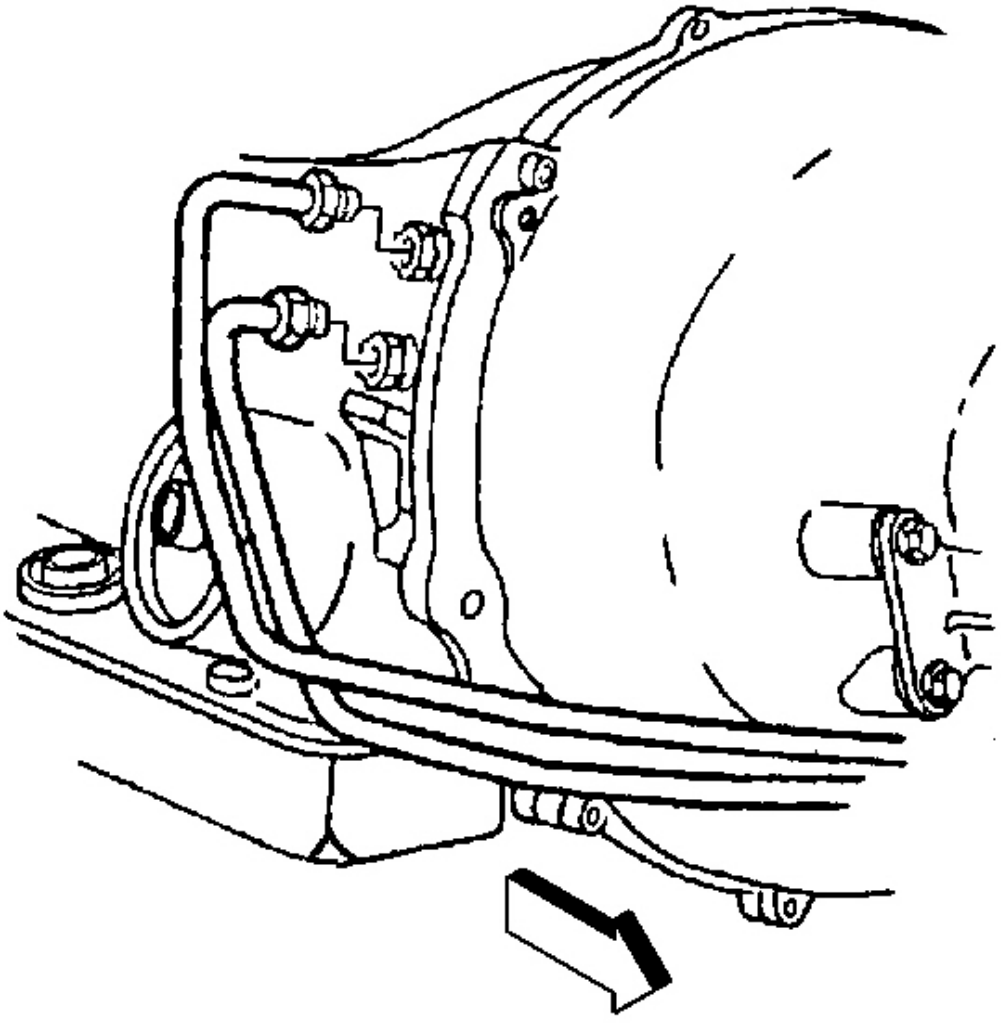


Fig. 110: TOC Rear Upper & Lower Pipe Fittings
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the TOC rear upper and lower pipe fittings from the transmission fittings, then cap the pipes and plug the transmission fittings to prevent contamination.

cardiagn.com

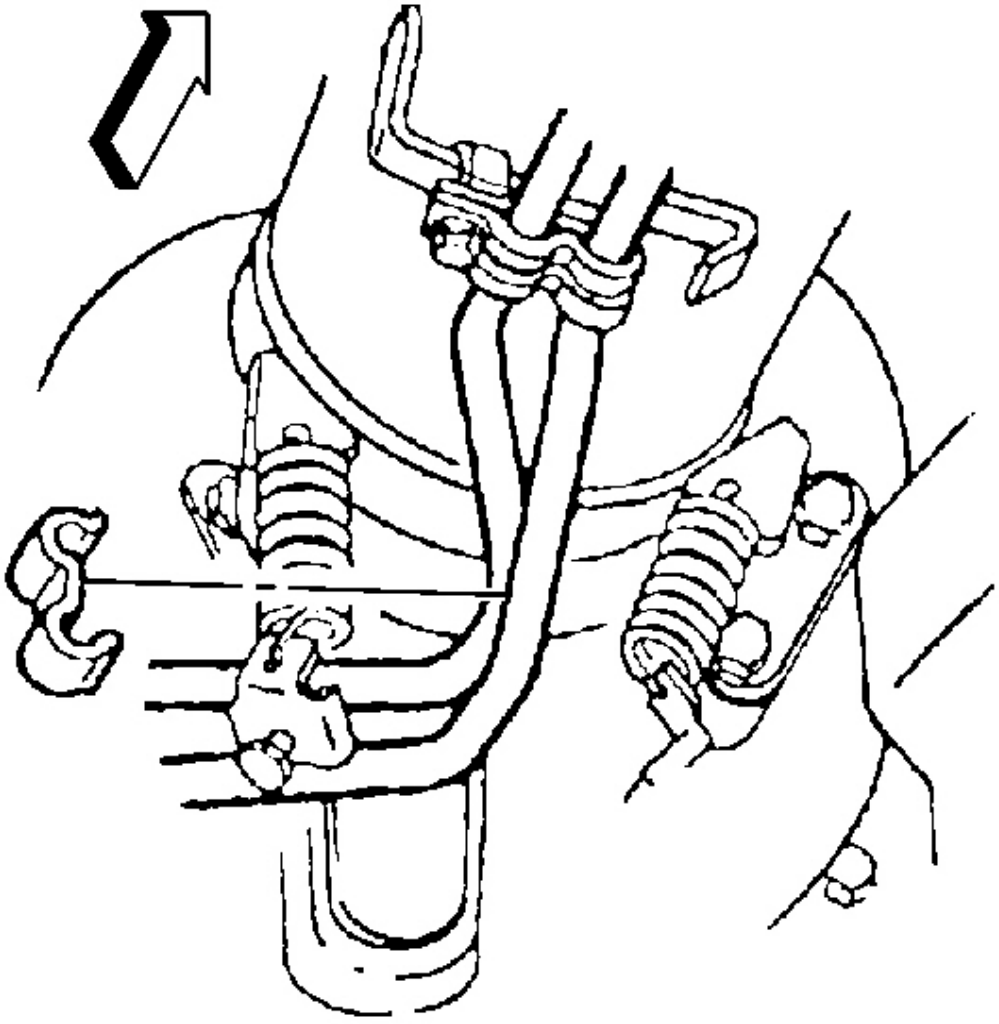


Fig. 111: TOC Rear Pipe & Rear Clip
Courtesy of GENERAL MOTORS CORP.

7. Remove the TOC rear pipe rear clip.

cardiagn.com

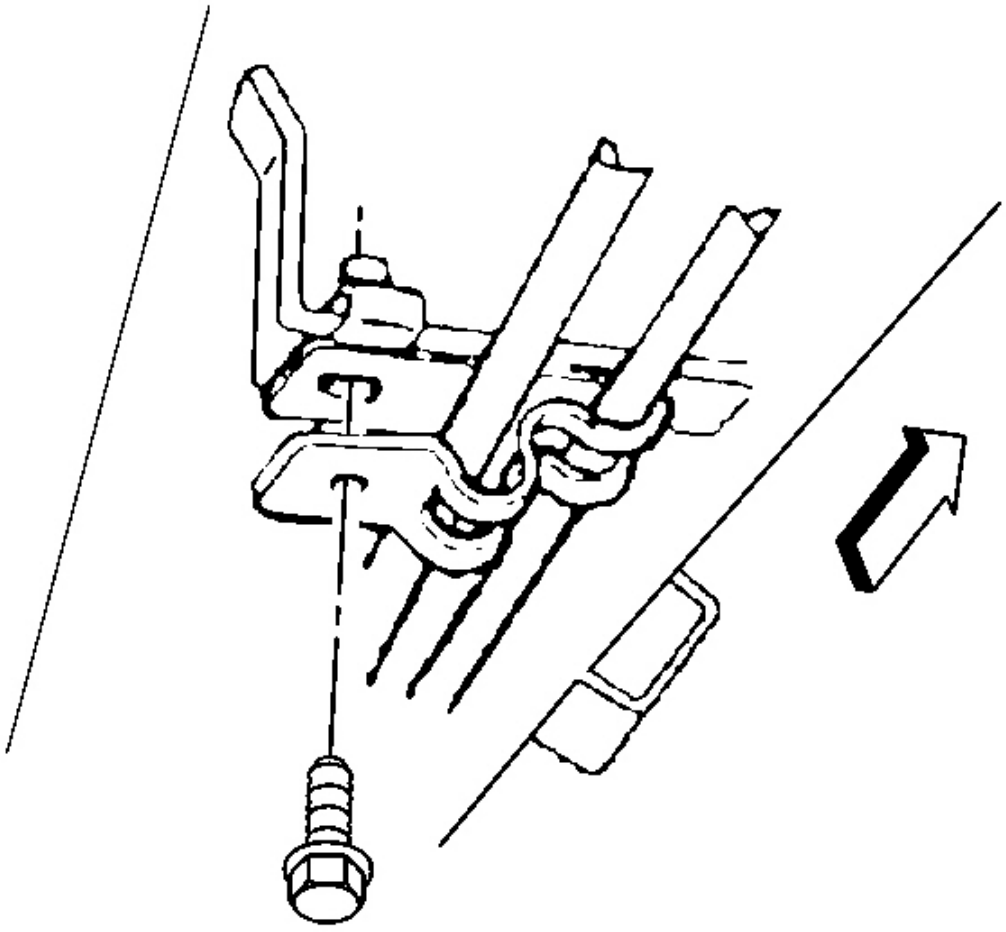


Fig. 112: TOC Rear Pipe Front, Rear Clamp & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the TOC rear pipe middle clip.
9. Remove the TOC rear pipe front and rear clamp bolts and clamps.
10. Remove the TOC rear pipes from the vehicle.

Installation Procedure

cardiagn.com

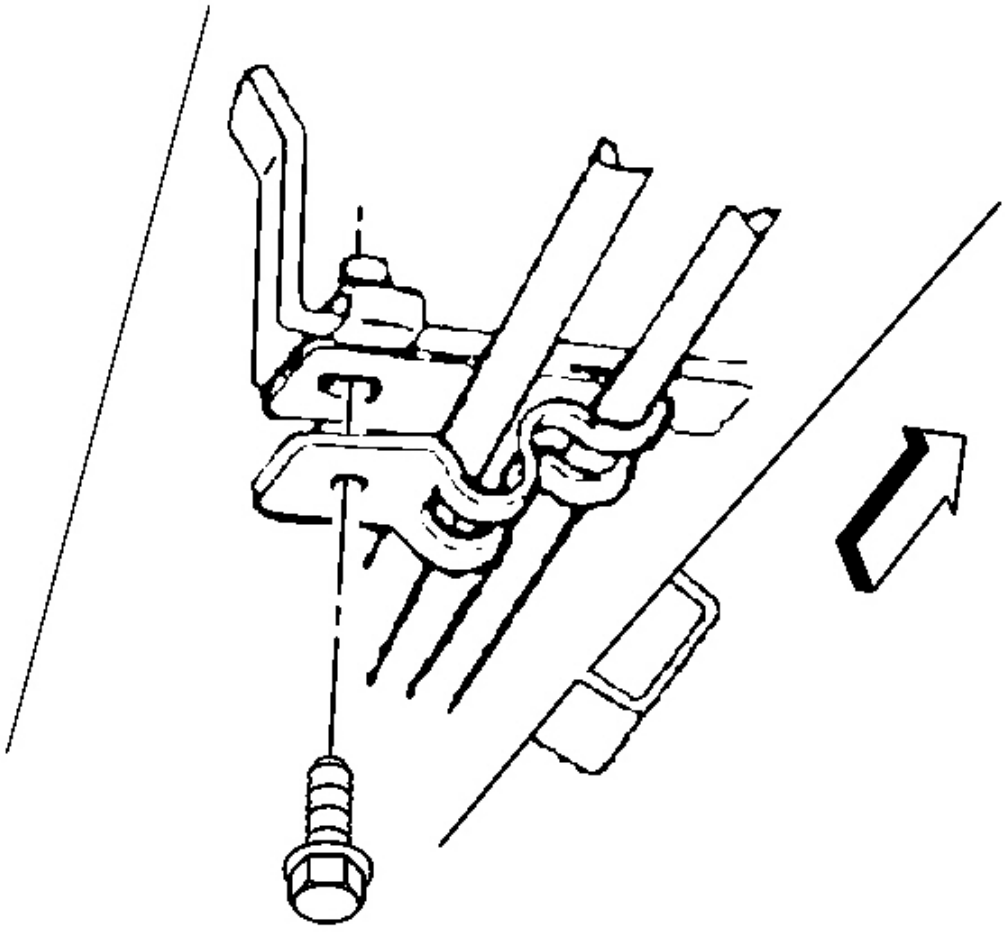


Fig. 113: TOC Rear Pipe Front, Rear Clamp & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission oil cooler (TOC) rear pipes into position.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the TOC rear pipe front and rear retaining clamps and bolts.

Tighten: Tighten the transmission oil cooler rear pipe front and rear retaining clamp bolts to 12 N.m (106 lb in).

3. Install the TOC rear pipe middle clip.

cardiagn.com

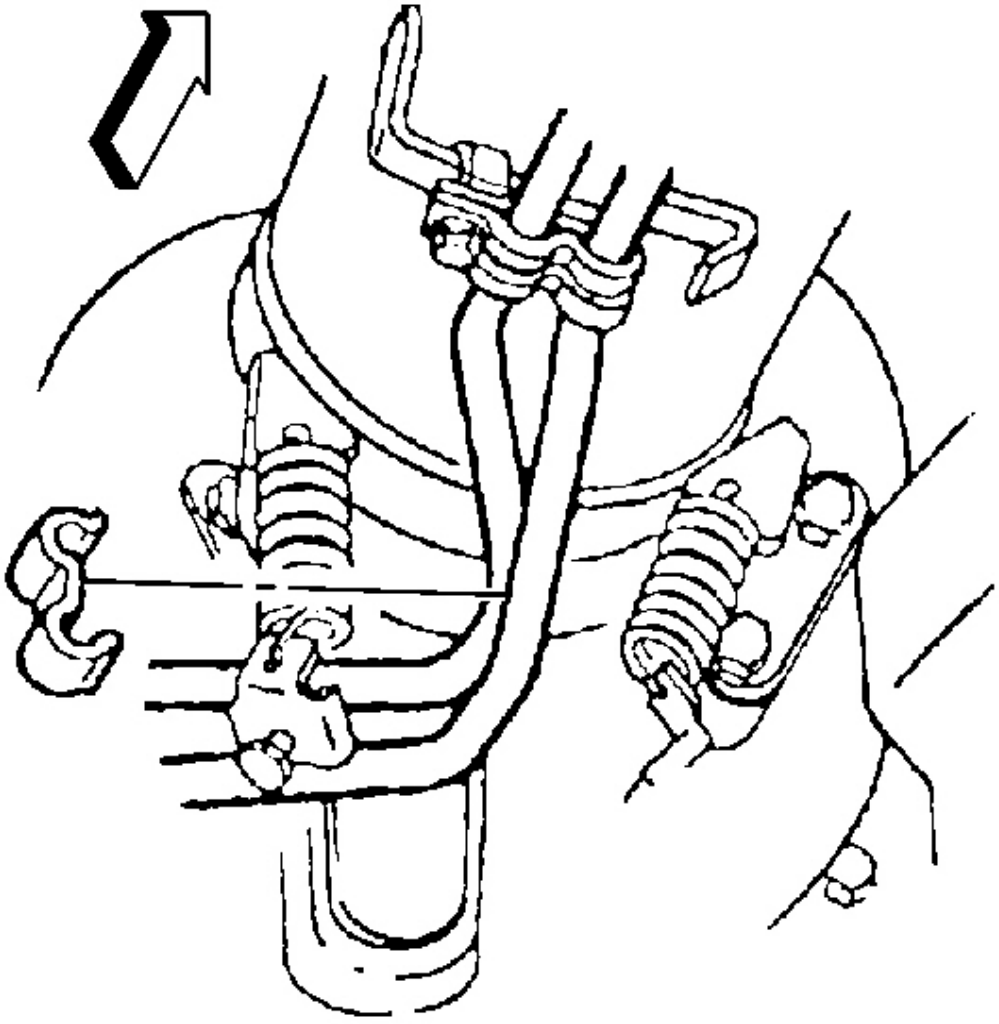


Fig. 114: TOC Rear Pipe & Rear Clip
Courtesy of GENERAL MOTORS CORP.

4. Install the TOC rear pipe rear clip.

cardiagn.com

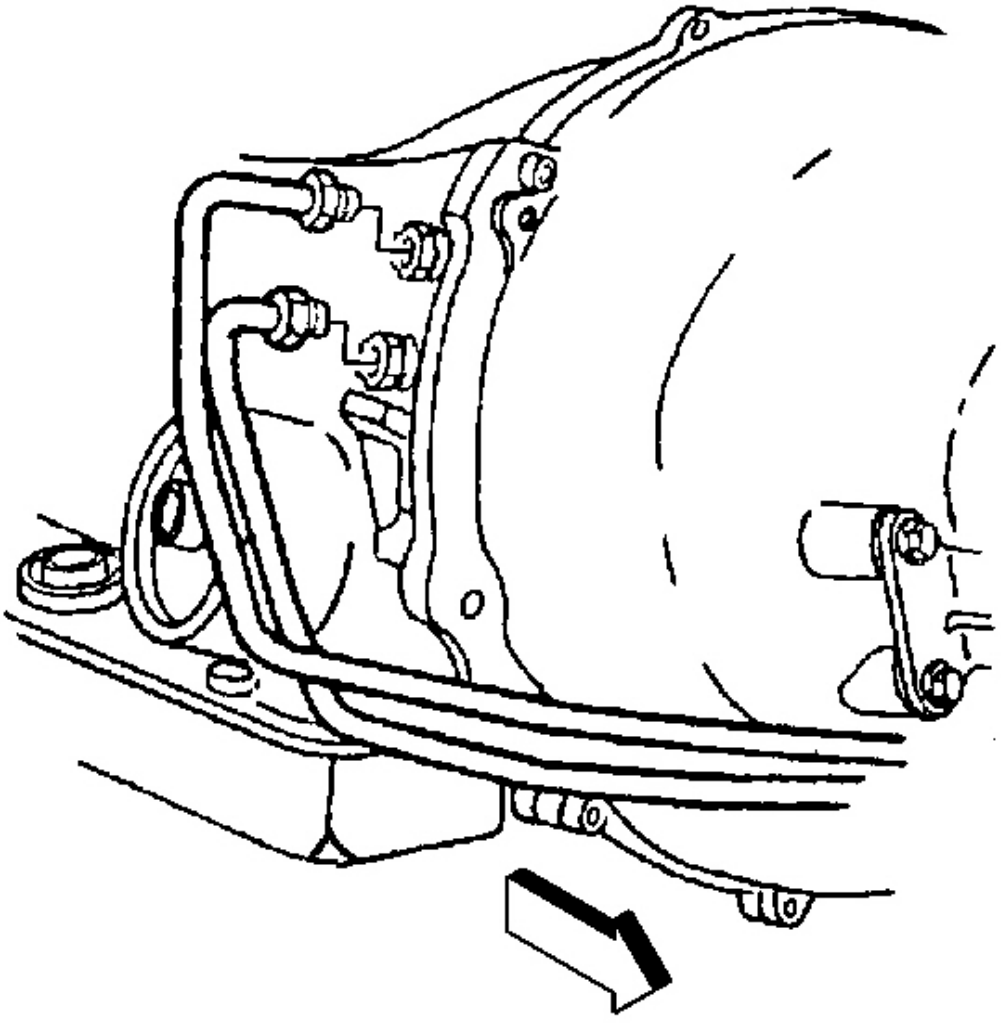


Fig. 115: TOC Rear Upper & Lower Pipe Fittings
Courtesy of GENERAL MOTORS CORP.

5. Remove the caps from the rear of the TOC rear pipes and remove the plugs from the transmission fittings.
6. ALIGN and HAND-START, then tighten ONLY by hand to seat the TOC rear upper and lower pipe fittings to the transmission fittings.

Tighten: Tighten the transmission oil cooler rear upper and lower pipe fittings to the transmission fittings to 35 N.m (26 lb ft).

cardiagn.com

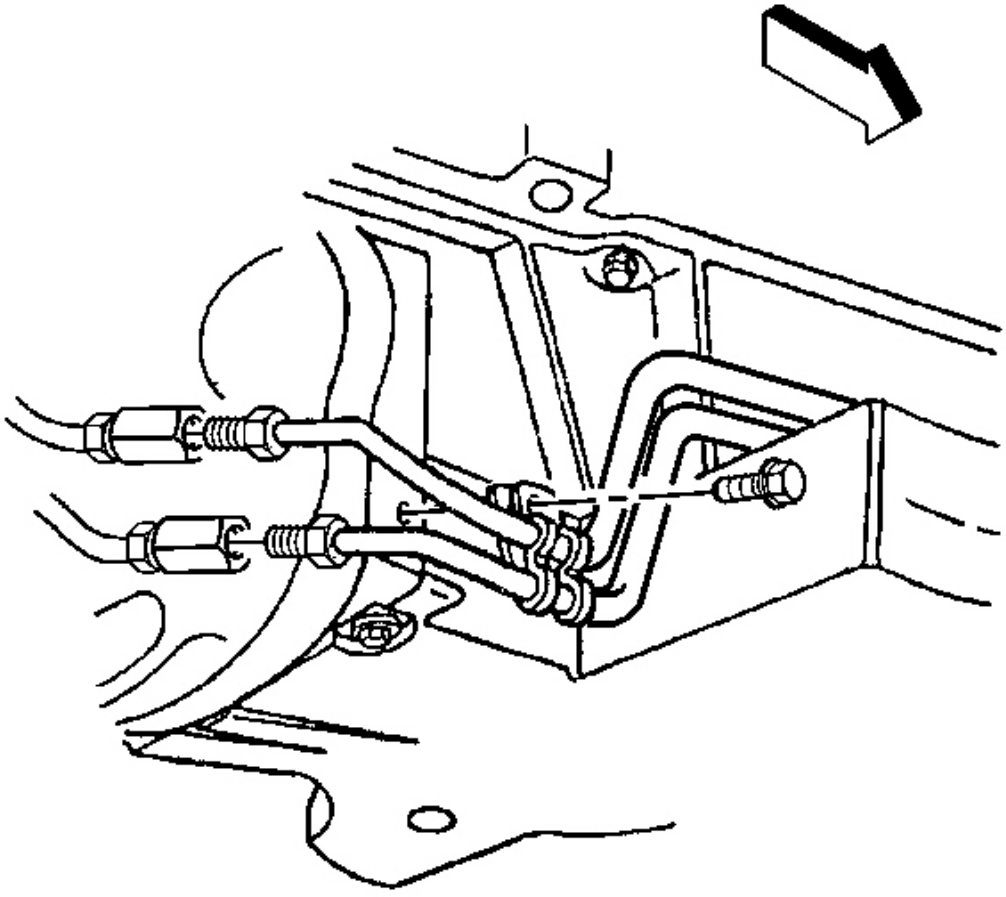


Fig. 116: Locating Cooler Fittings
Courtesy of GENERAL MOTORS CORP.

7. ALIGN and HAND-START, then tighten ONLY by hand to seat the TOC rear upper and lower pipe fittings to the junction fittings at the engine flywheel housing.

   Tighten: Tighten the transmission oil cooler rear upper and lower pipe fittings to the junction fittings at the engine flywheel housing to 27 N.m (20 lb ft).

8. Install the driveline tunnel closeout panel. Refer to **Driveline Tunnel Closeout Panel Replacement** in Propeller Shaft.
9. Install the right side muffler. Refer to **Muffler Replacement - Right** in Engine Exhaust.
10. Install the catalytic converter. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
11. Check the transmission fluid level. Add if necessary.

cardiagn.com

12. Lower the vehicle.

VENT HOSE REPLACEMENT

Removal Procedure

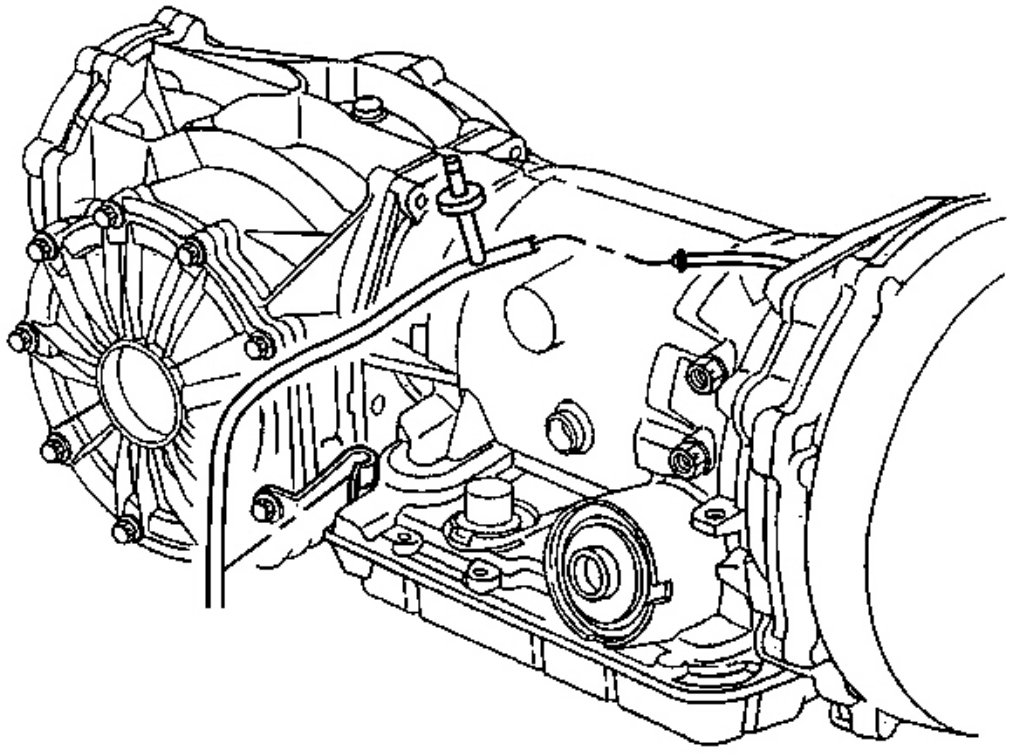


Fig. 117: Transmission Vent Hose & Lower Retaining Clip
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Release the transmission vent hose from the lower retaining clip.

IMPORTANT: Observe the orientation of the transmission vent hose check valve prior to removal of the hose.

3. Remove the transmission vent hose from the transmission vent tube.

Installation Procedure

cardiagn.com

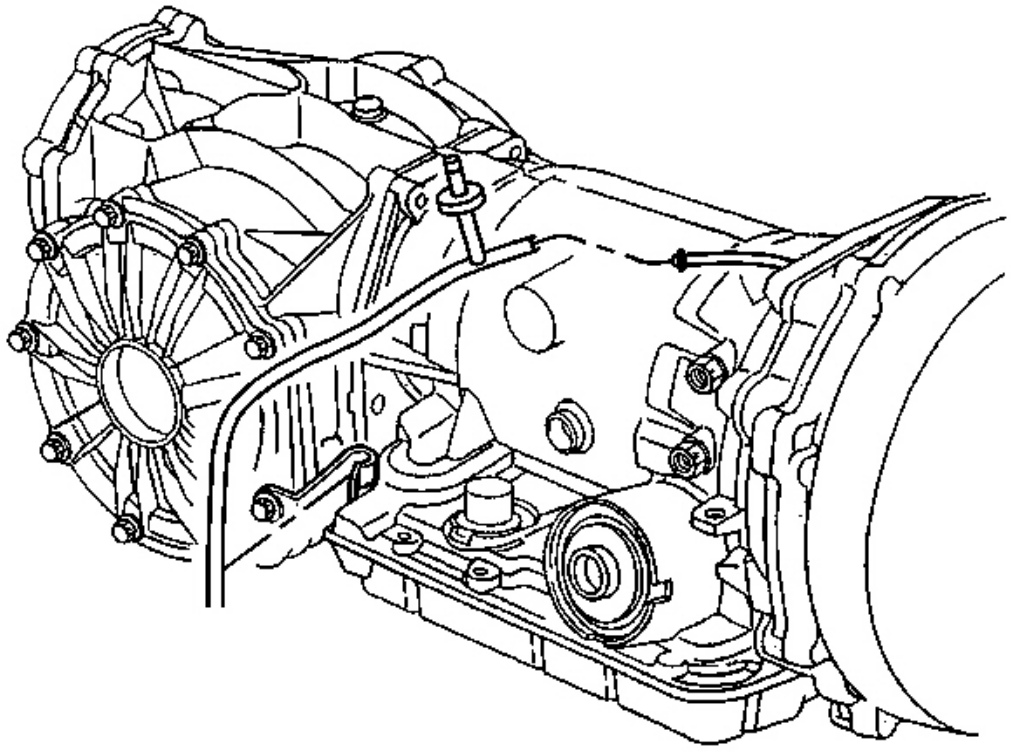


Fig. 118: Transmission Vent Hose & Lower Retaining Clip
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission vent hose to the transmission vent tube.

   Orient the transmission vent hose check valve as noted during prior to removal.

2. Secure the transmission vent hose to the lower retaining clip.
3. Lower the vehicle.

PRESSURE REGULATOR REPLACEMENT

Removal Procedure

cardiagn.com

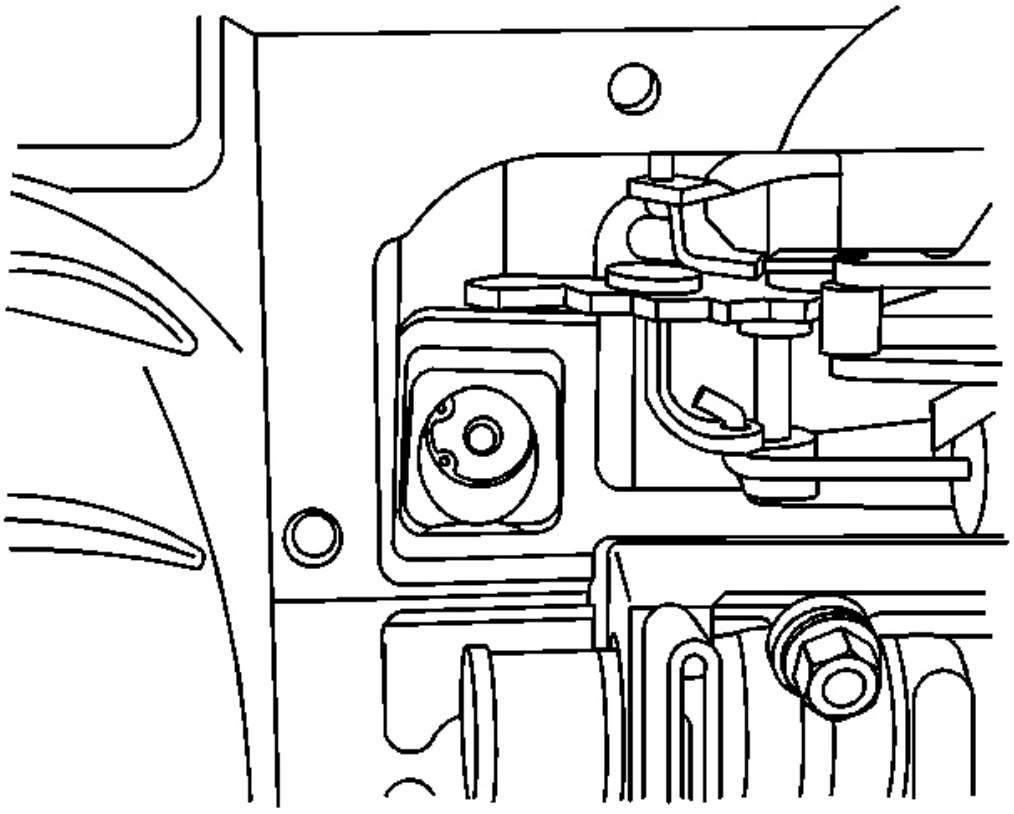


Fig. 119: Locating Reverse Boost Valve
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the transmission oil pan and filter. Refer to **Automatic Transmission Fluid/Filter Replacement** .
3. Compress the reverse boost valve sleeve into the bore of the oil pump to release tension on the reverse boost valve retaining ring.
4. Remove the reverse boost valve retaining ring, then slowly release tension on the reverse boost valve sleeve.

cardiagn.com

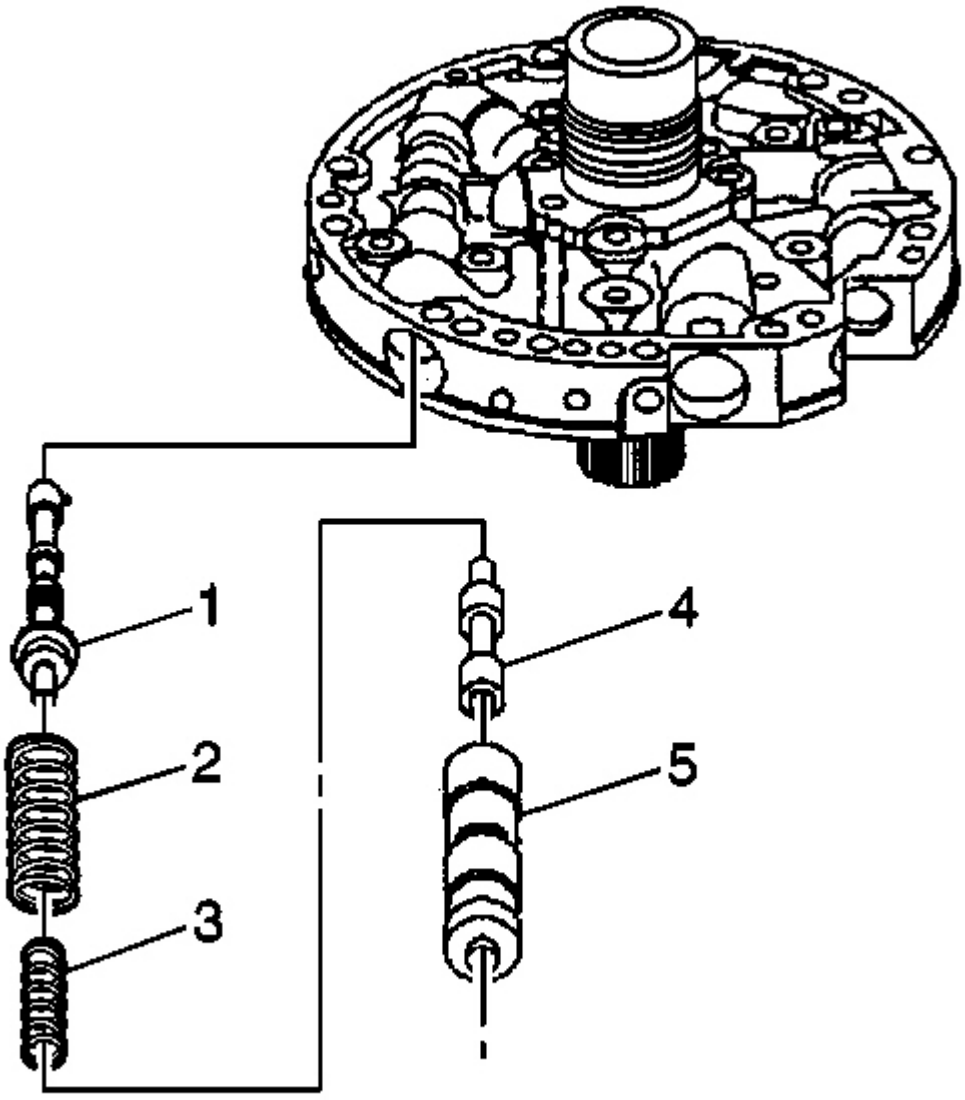


Fig. 120: Identifying Pressure Regulator Valve
Courtesy of GENERAL MOTORS CORP.

5. Remove the reverse boost valve sleeve (5) and the reverse boost valve (4).
6. Remove the pressure regulator isolator spring (3) and the pressure regulator valve spring (2).
7. Remove the pressure regulator valve (1).

Installation Procedure

cardiagn.com

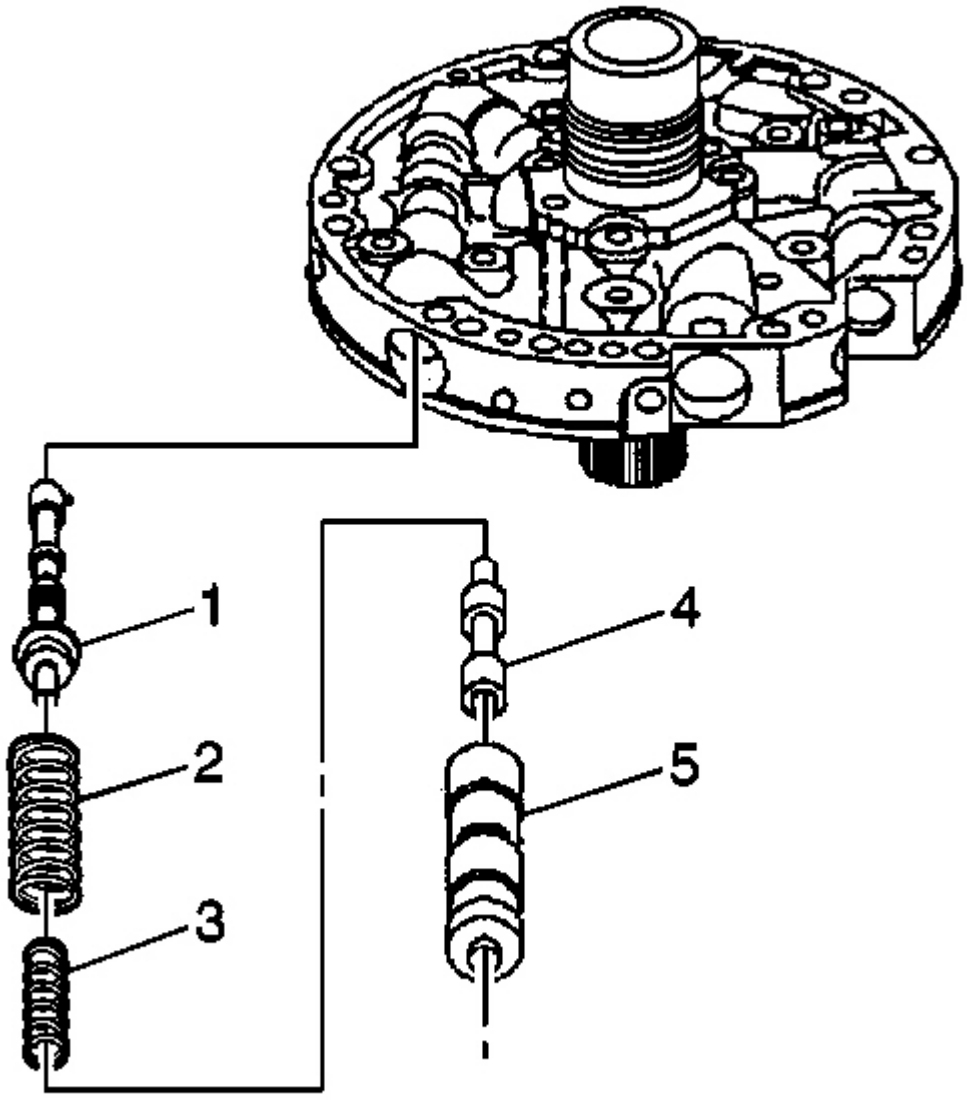


Fig. 121: Identifying Pressure Regulator Valve
Courtesy of GENERAL MOTORS CORP.

1. Install the pressure regulator valve (1).
2. Install the pressure regulator isolator spring (3) and the pressure regulator valve spring (2).
3. Install the reverse boost valve (4) in the reverse boost valve sleeve (5).
4. Install the reverse boost valve (4) and sleeve (5) in the oil pump cover.

cardiagn.com

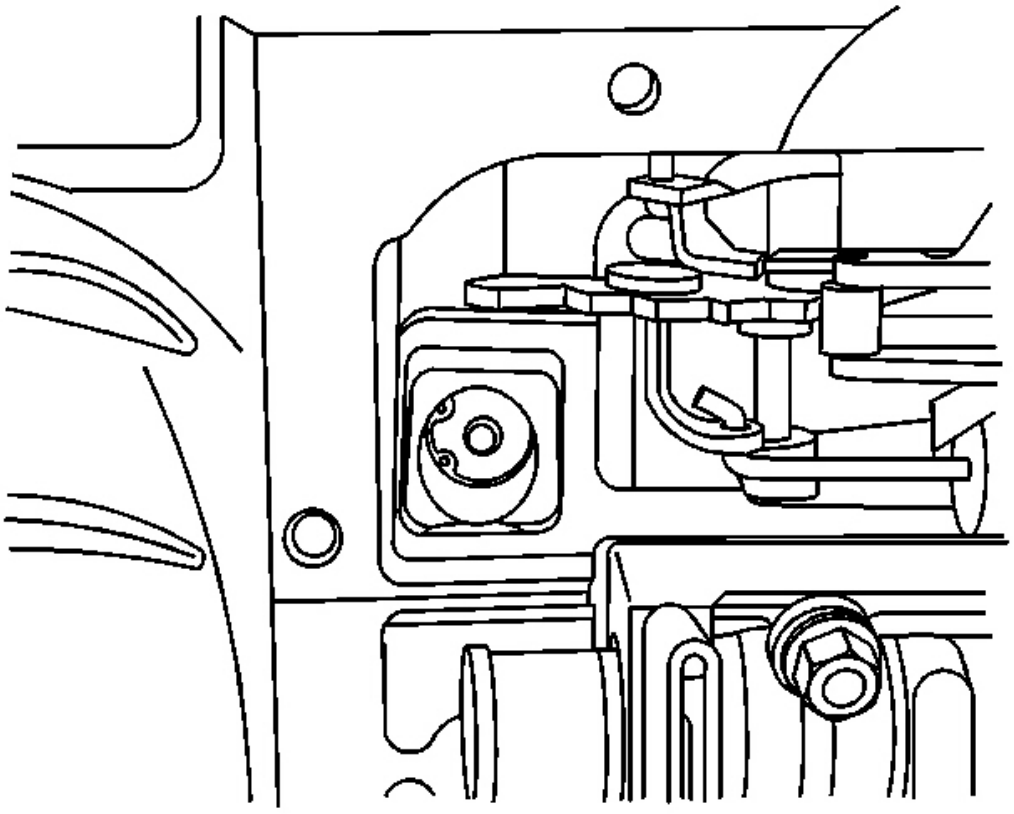


Fig. 122: Locating Reverse Boost Valve
Courtesy of GENERAL MOTORS CORP.

5. Compress the reverse boost valve sleeve into the bore of the oil pump to expose the retaining ring slot.
6. Install the reverse boost valve retaining ring, then slowly release tension on the reverse boost valve sleeve.
7. Install the transmission oil filter and pan. Refer to **Automatic Transmission Fluid/Filter Replacement** .
8. Lower the vehicle.
9. Fill the transmission to the proper level with DEXRON(R) III transmission fluid. Refer to **Transmission Fluid Checking Procedure** .

VALVE BODY AND PRESSURE SWITCH REPLACEMENT

Removal Procedure

cardiagn.com

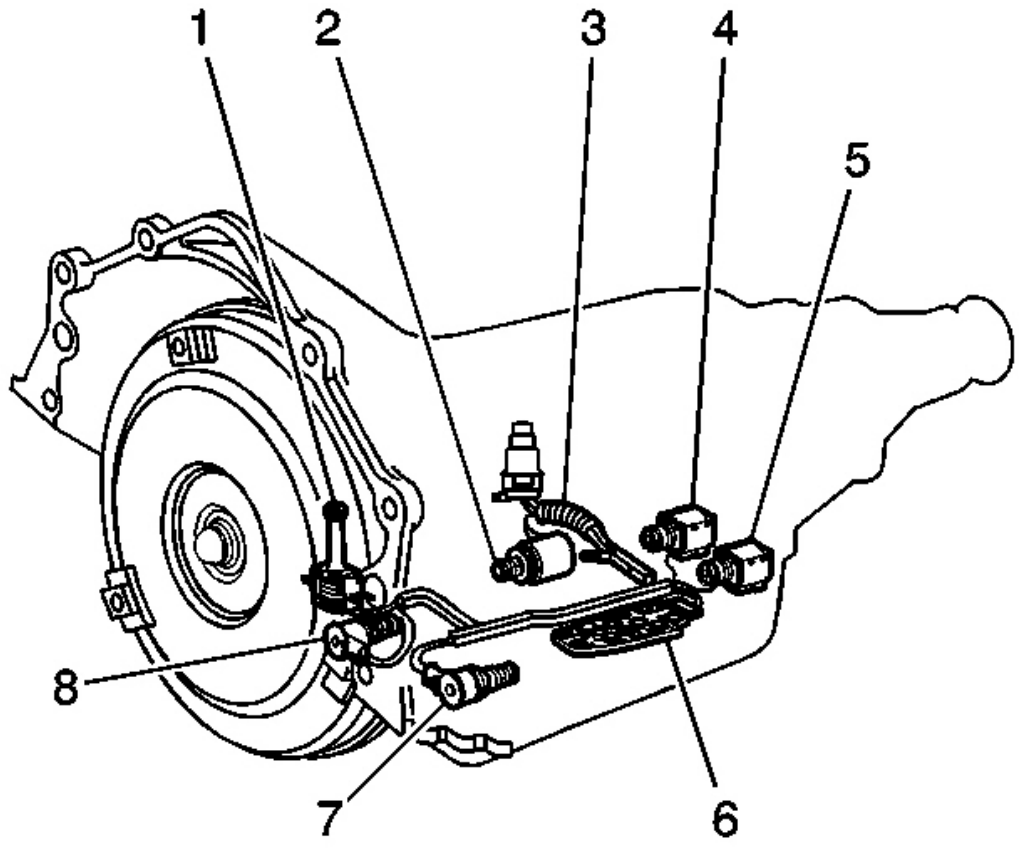


Fig. 123: Locating Valve Body Electrical Components
Courtesy of GENERAL MOTORS CORP.

1. Ensure that removal of the valve body is necessary before proceeding.

IMPORTANT: The following components can be serviced without removing the valve body from the transmission:

- The torque converter clutch solenoid (1)
- The pressure control solenoid (2)
- The internal wiring harness (3)
- The 2-3 shift solenoid (4)
- The 1-2 shift solenoid (5)
- The transmission fluid pressure manual valve position switch (6)
- The 3-2 shift solenoid (7)

cardiagn.com

- The torque converter clutch pulse width modulation (TCC PWM) solenoid (8)

2. Remove the fluid level indicator.
3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
4. Remove the oil pan, gasket, and filter. Refer to **Automatic Transmission Fluid/Filter Replacement** .

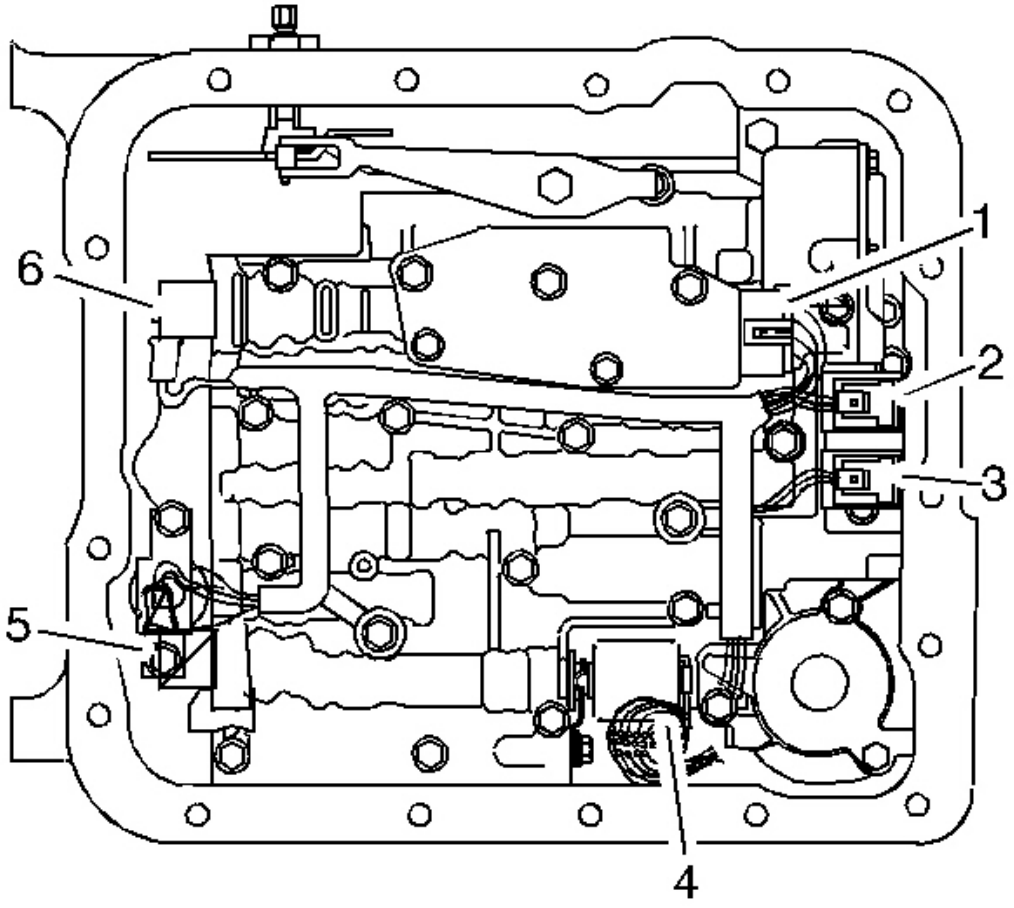


Fig. 124: Identifying Valve Body Electrical Connections
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the internal wiring harness electrical connectors from the following components:
   - The transmission fluid pressure manual valve position switch (1)
   - The 1-2 shift solenoid (2)
   - The 2-3 shift solenoid (3)

cardiagn.com

- The pressure control solenoid (4)
- The TCC PWM solenoid (5)
- The 3-2 shift solenoid (6)

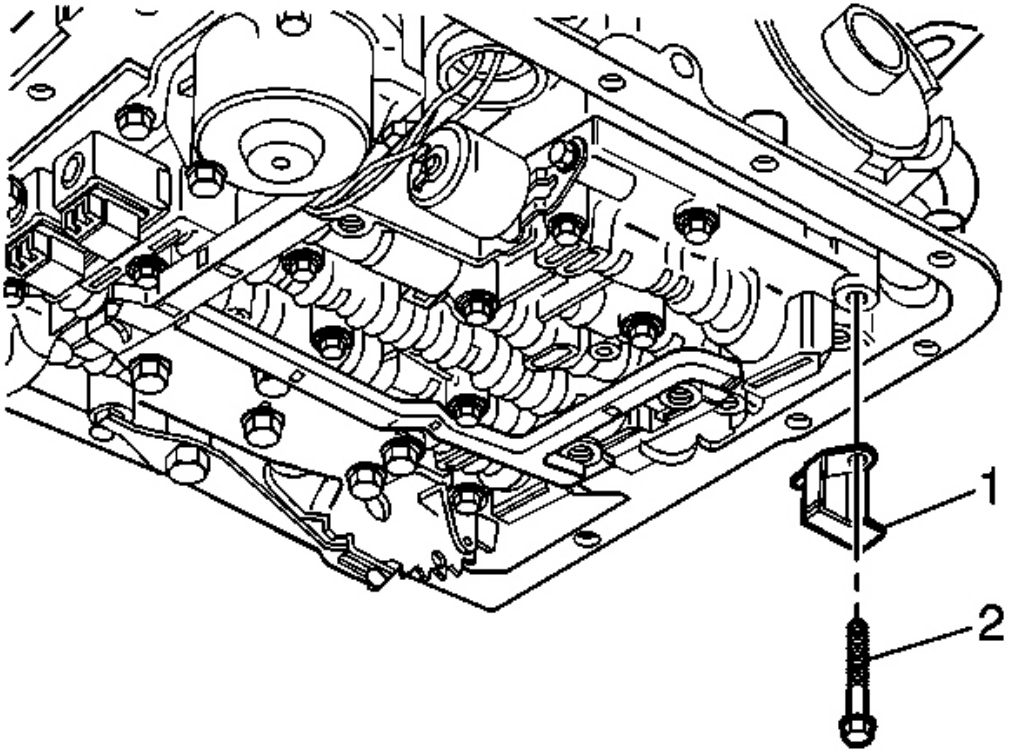


Fig. 125: Installing The Transmission Fluid Indicator Stop Bracket
Courtesy of GENERAL MOTORS CORP.

6. Remove the fluid indicator stop bracket bolt (2).
7. Remove the fluid indicator bracket (1).

cardiagn.com

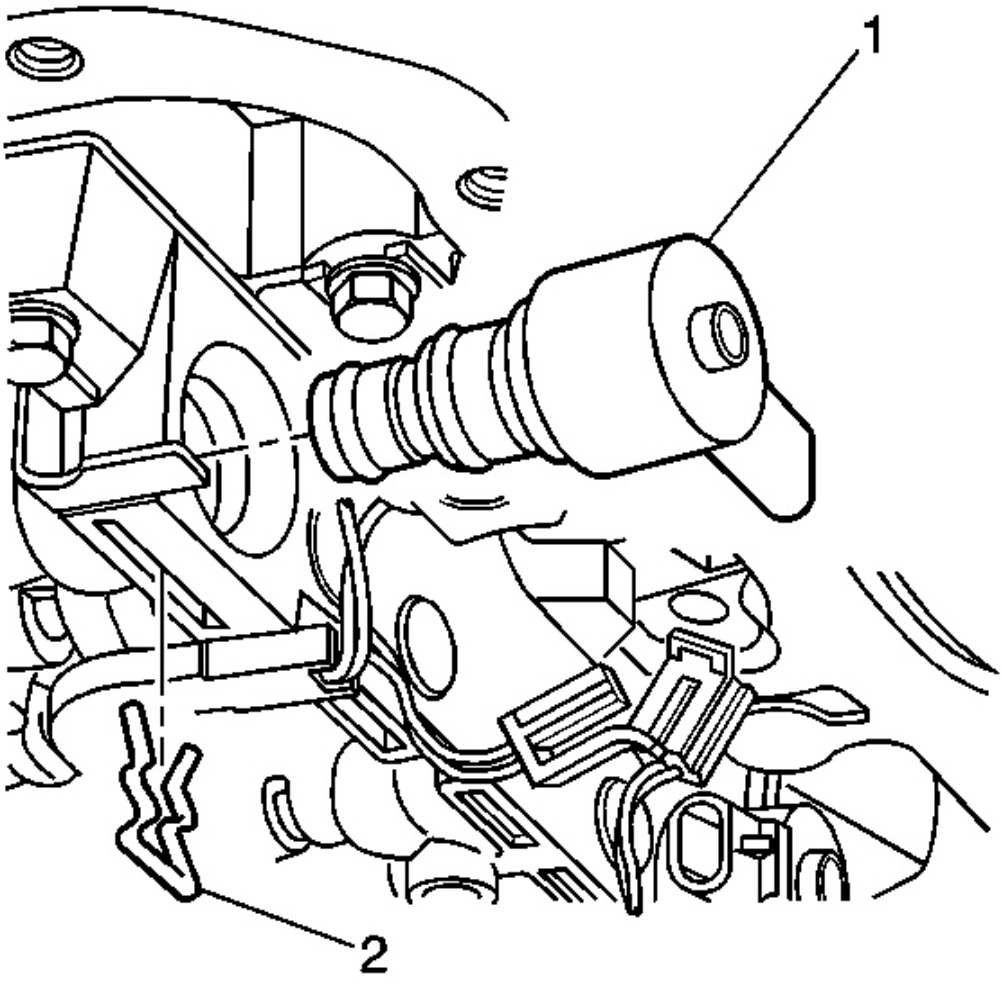


Fig. 126: Installing The TCC PWM Solenoid
Courtesy of GENERAL MOTORS CORP.

8. Remove the TCC PWM solenoid retainer (2) with a small screwdriver. Rotate the solenoid (1) in the bore, if necessary, until the flat part of the retainer (2) is visible.
9. Remove the TCC PWM solenoid (1) in order to access the TCC solenoid retaining bolts.

cardiagn.com

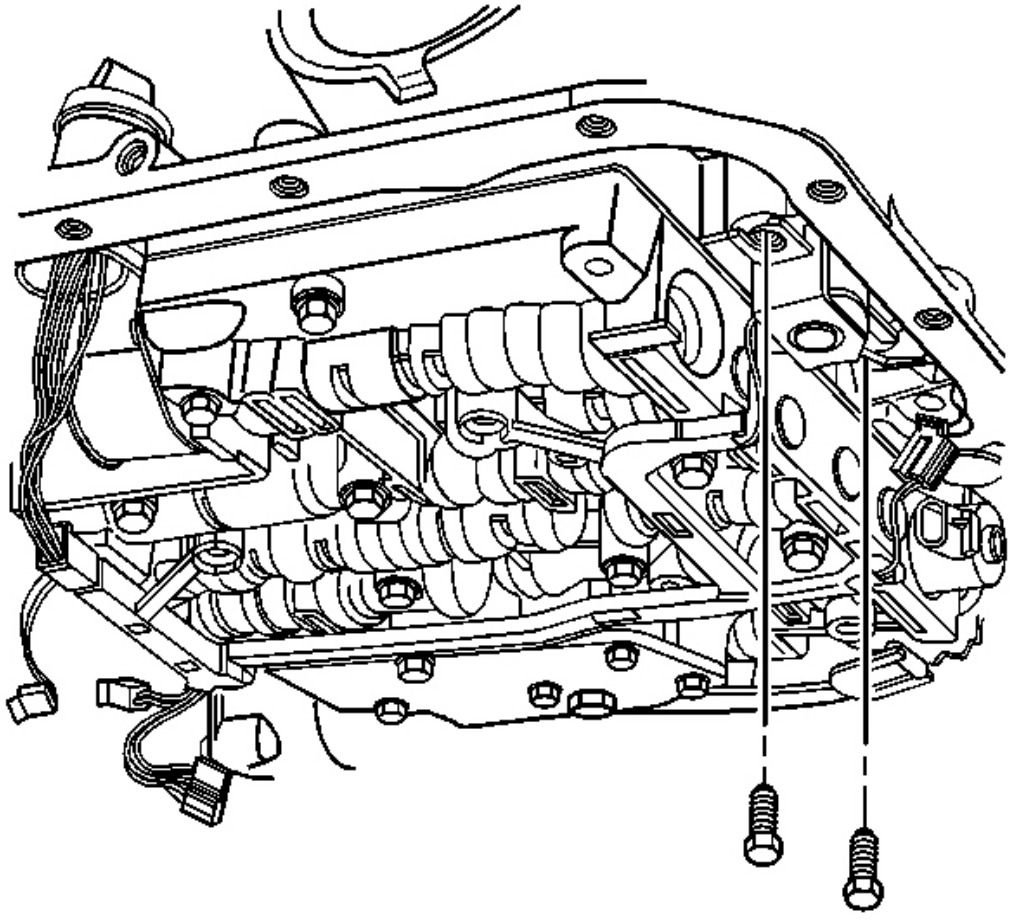


Fig. 127: Identifying TCC Solenoid & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the TCC solenoid retaining bolts.

cardiagn.com

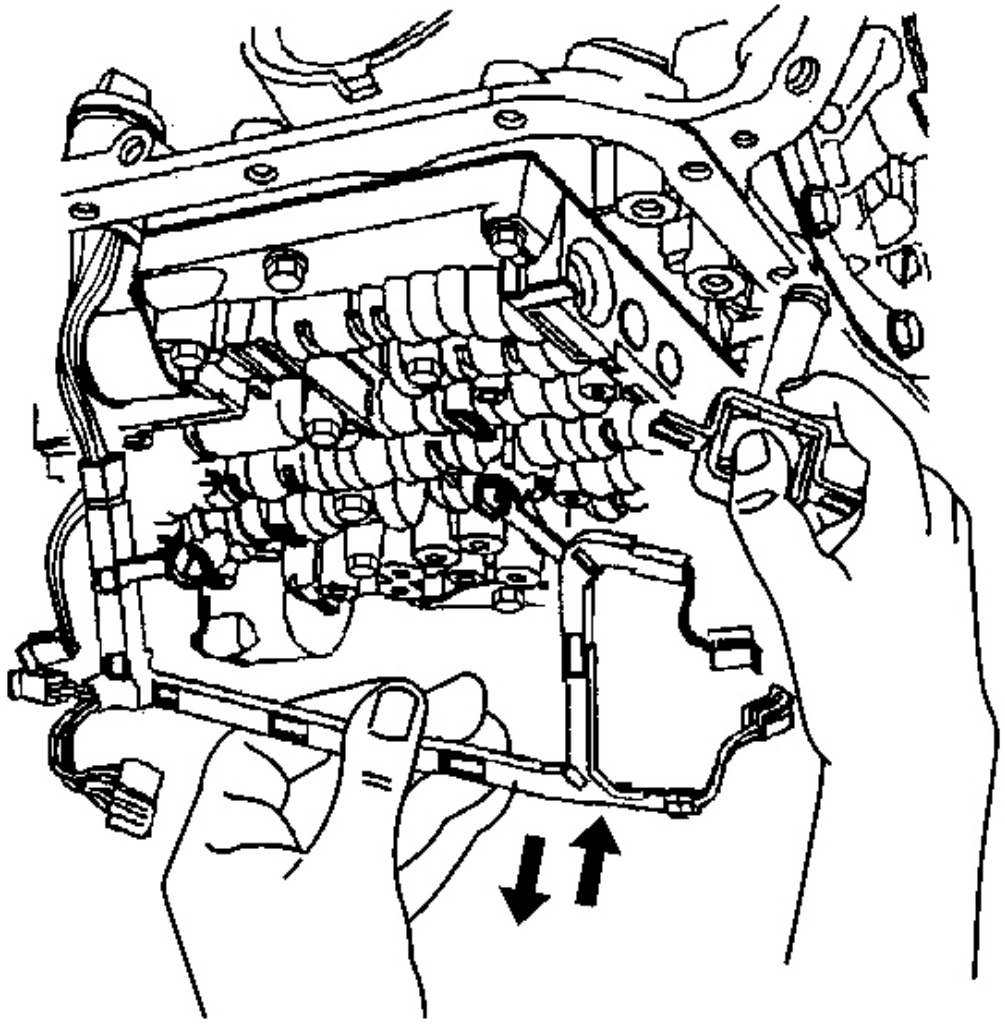


Fig. 128: Identifying TCC Solenoid (With O-Ring Seal) And Wiring Harness
Courtesy of GENERAL MOTORS CORP.

11. Remove the TCC solenoid (with O-ring seal) and wiring harness from the control valve body.
12. Reposition the harness to the side of the transmission case.

cardiagn.com

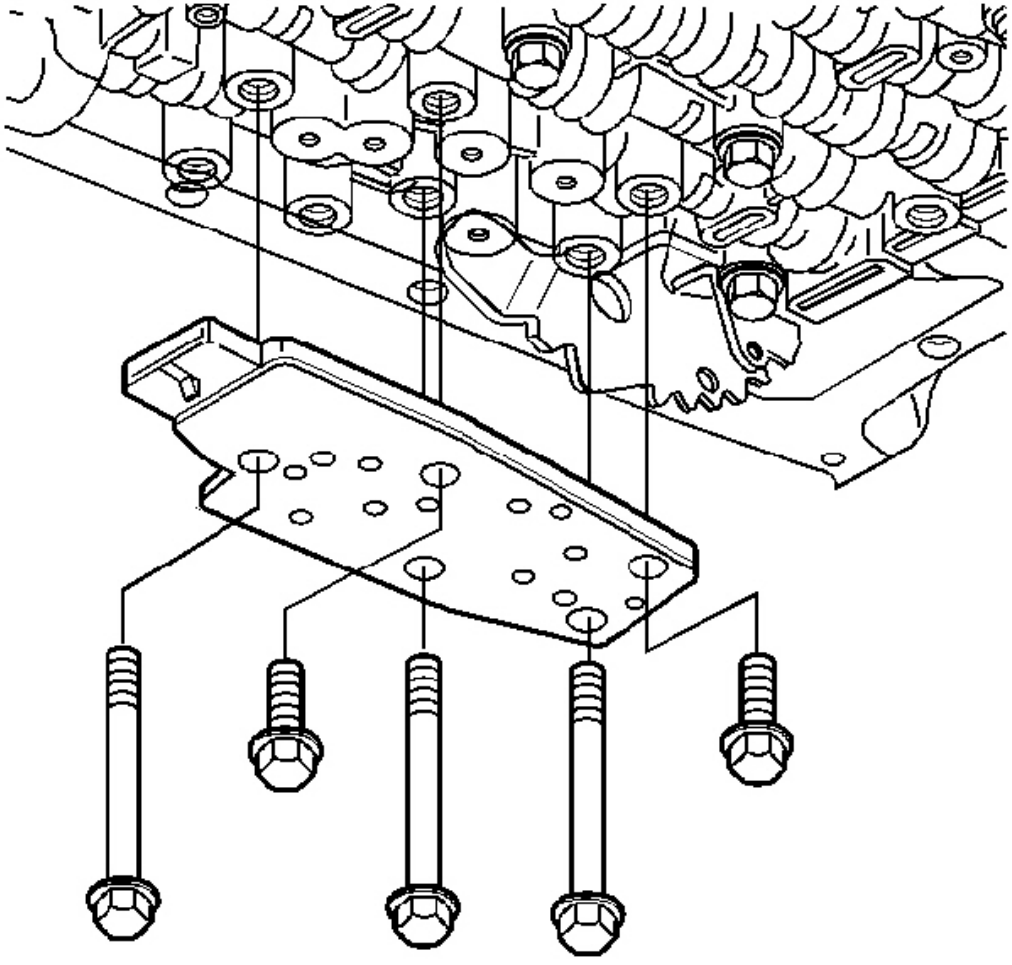


Fig. 129: Identifying Transmission Fluid Pressure Switch
Courtesy of GENERAL MOTORS CORP.

13. Remove the control valve body bolts which retain the transmission fluid pressure switch to the control valve body.
14. Remove the transmission fluid pressure switch.

cardiagn.com

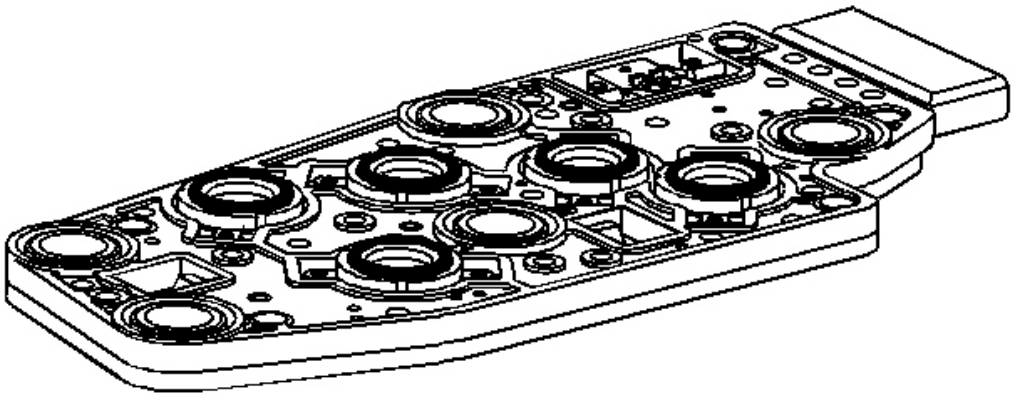


Fig. 130: Inspecting The Transmission Fluid Pressure Switch
Courtesy of GENERAL MOTORS CORP.

15. Inspect the transmission fluid pressure switch for damage or debris.

cardiagn.com

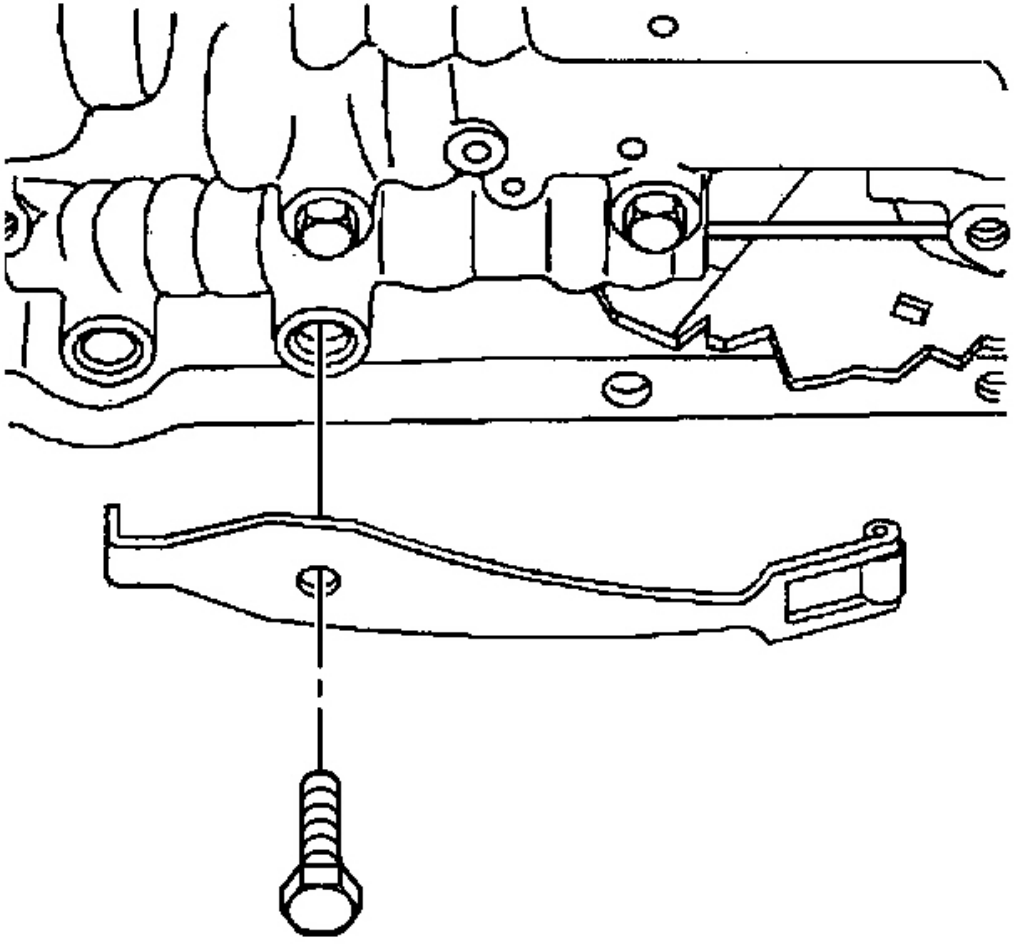


Fig. 131: Identifying The Manual Detent Spring
Courtesy of GENERAL MOTORS CORP.

16. Remove the manual detent spring retaining bolt.
17. Remove the manual detent spring.
18. Inspect the manual detent spring for cracks or damage.

IMPORTANT: Keep the control valve body level when lowering it from the vehicle. This will prevent the loss of checkballs located in the control valve body passages.

19. Remove the remaining control valve body bolts.

cardiagn.com

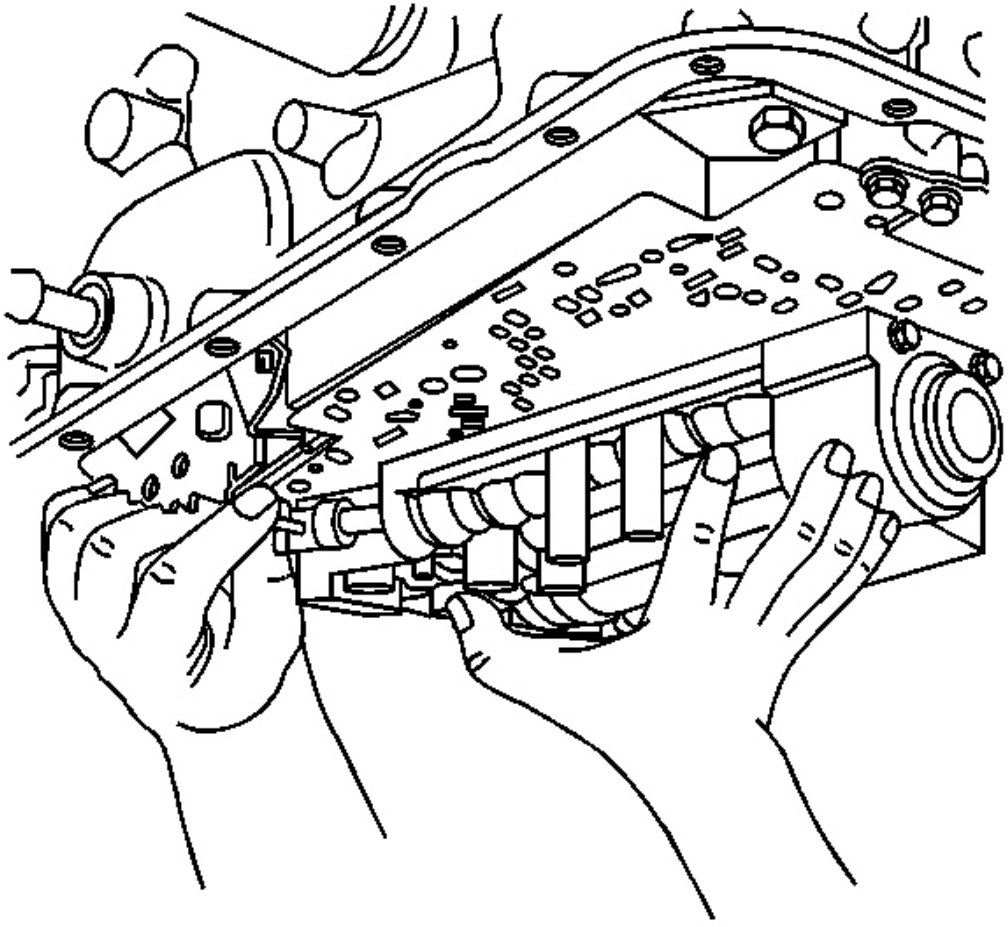


Fig. 132: View Of Valve Body To The Transmission Case
Courtesy of GENERAL MOTORS CORP.

20. Carefully begin to lower the control valve body down from the transmission case while simultaneously disconnecting the manual valve link.

Installation Procedure

cardiagn.com

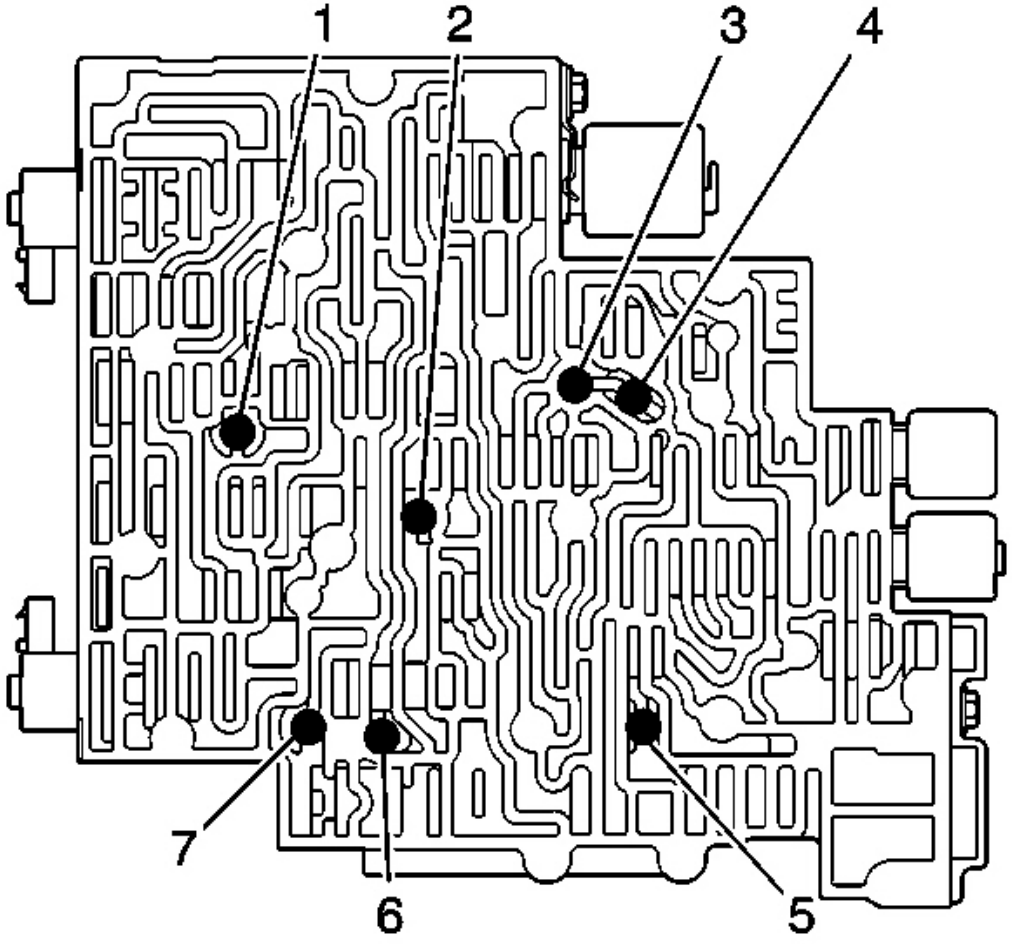


Fig. 133: Locating Seven Valve Body Check Balls
Courtesy of GENERAL MOTORS CORP.

1. Install the checkballs (1-7) in the valve body.

cardiagn.com

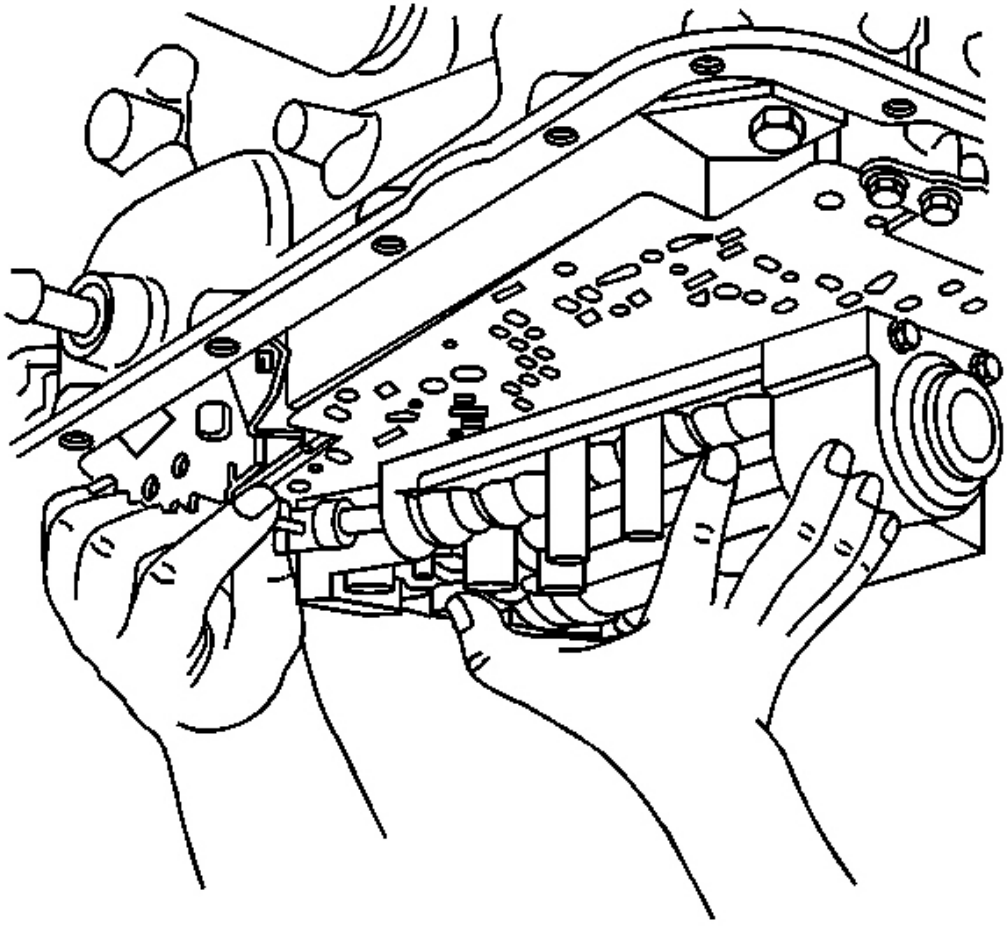


Fig. 134: View Of Valve Body To The Transmission Case
Courtesy of GENERAL MOTORS CORP.

2. Install the control valve body to the transmission case while simultaneously connecting the manual valve link to the manual valve.

cardiagn.com

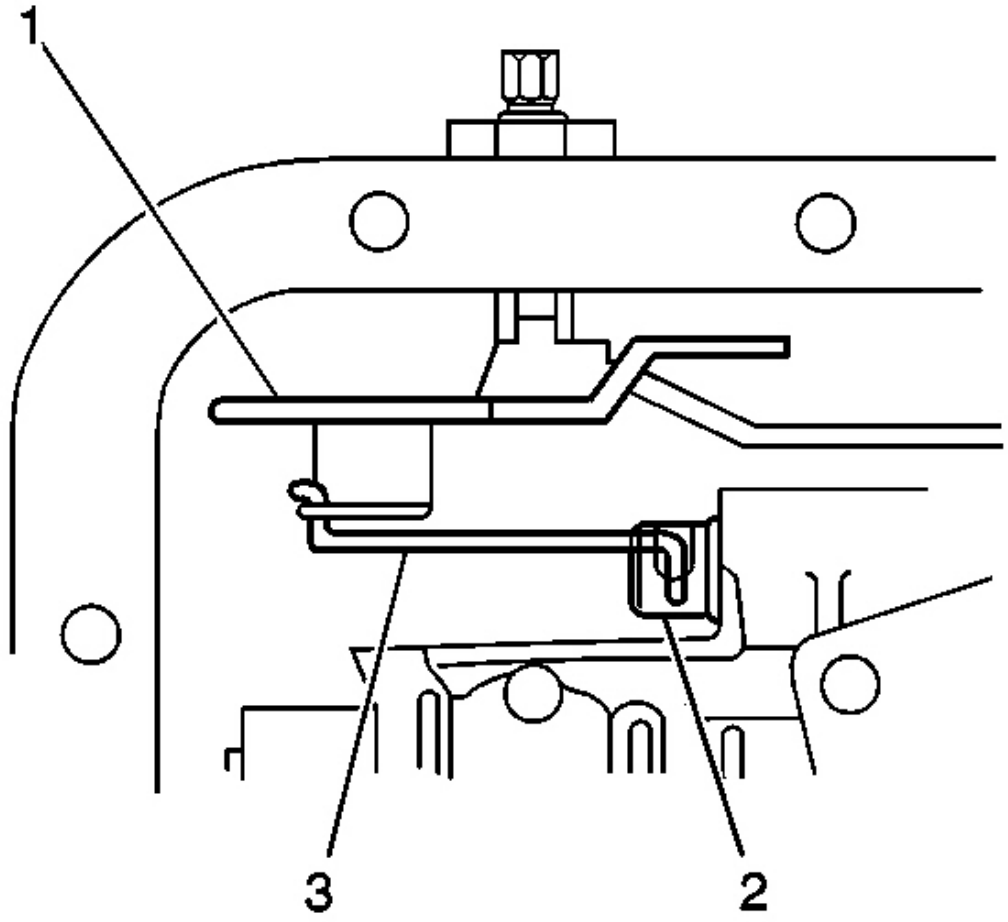


Fig. 135: Verifying Manual Valve Link Is Installed Properly To The Inside Detent Lever And The Manual Valve
Courtesy of GENERAL MOTORS CORP.

3. Verify that the manual valve link (3) is installed properly to the inside detent lever (1) and the manual valve (2).

cardiagn.com

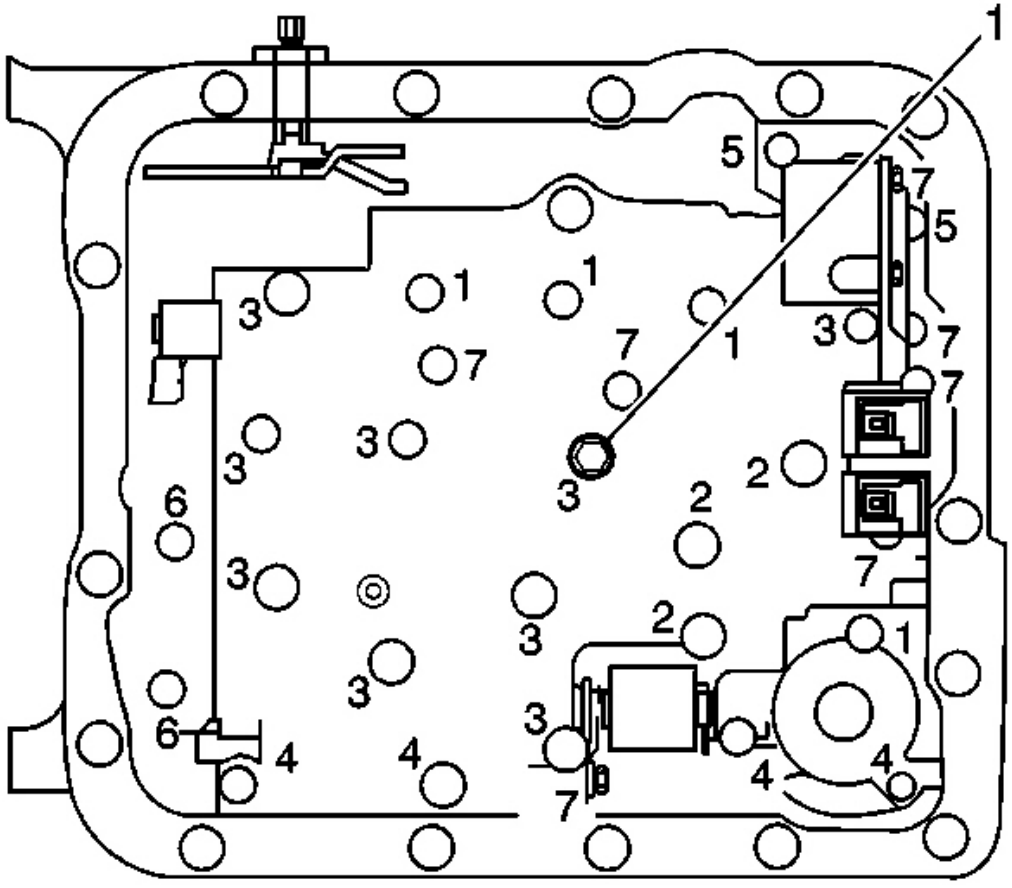


Fig. 136: Installing One Bolt Hand Tight In The Center Of The Valve Body
Courtesy of GENERAL MOTORS CORP.

4. Install one bolt (M6 X 1.0 X 47.5) hand tight in the center (1) of the valve body to hold it in place.

cardiagn.com

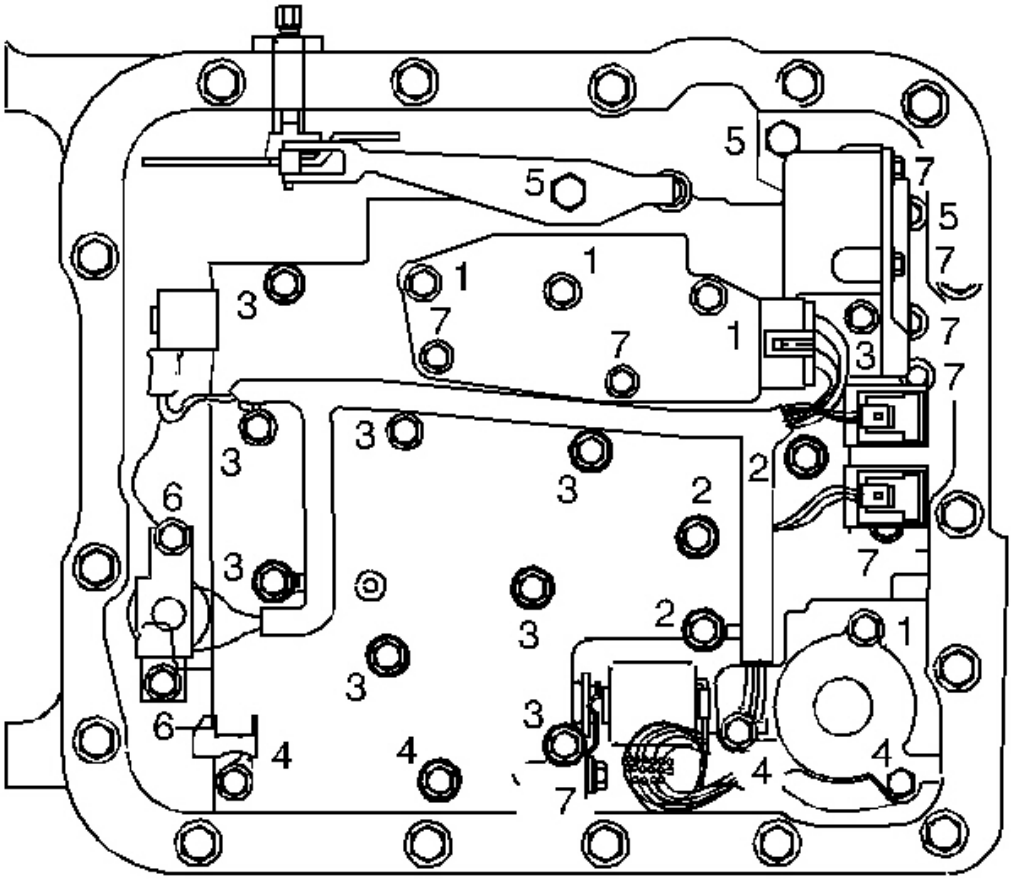


Fig. 137: Installing Valve Body Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: When installing bolts throughout this procedure, be sure to use the correct bolt size and length in the correct location as specified.

5. Do not install the transmission fluid indicator stop bracket and bolt at this time.

   Install but do not tighten the control valve body bolts which retain only the valve body directly.

   Each numbered bolt location corresponds to a specific bolt size and length, as indicated by the following:

   - M6 X 1.0 X 65.0 (1)
   - M6 X 1.0 X 54.4 (2)

cardiagn.com

- M6 X 1.0 X 47.5 (3)
- M6 X 1.0 X 35.0 (4)
- M8 X 1.0 X 20.0 (5)
- M6 X 1.0 X 12.0 (6)
- M6 X 1.0 X 18.0 (7)

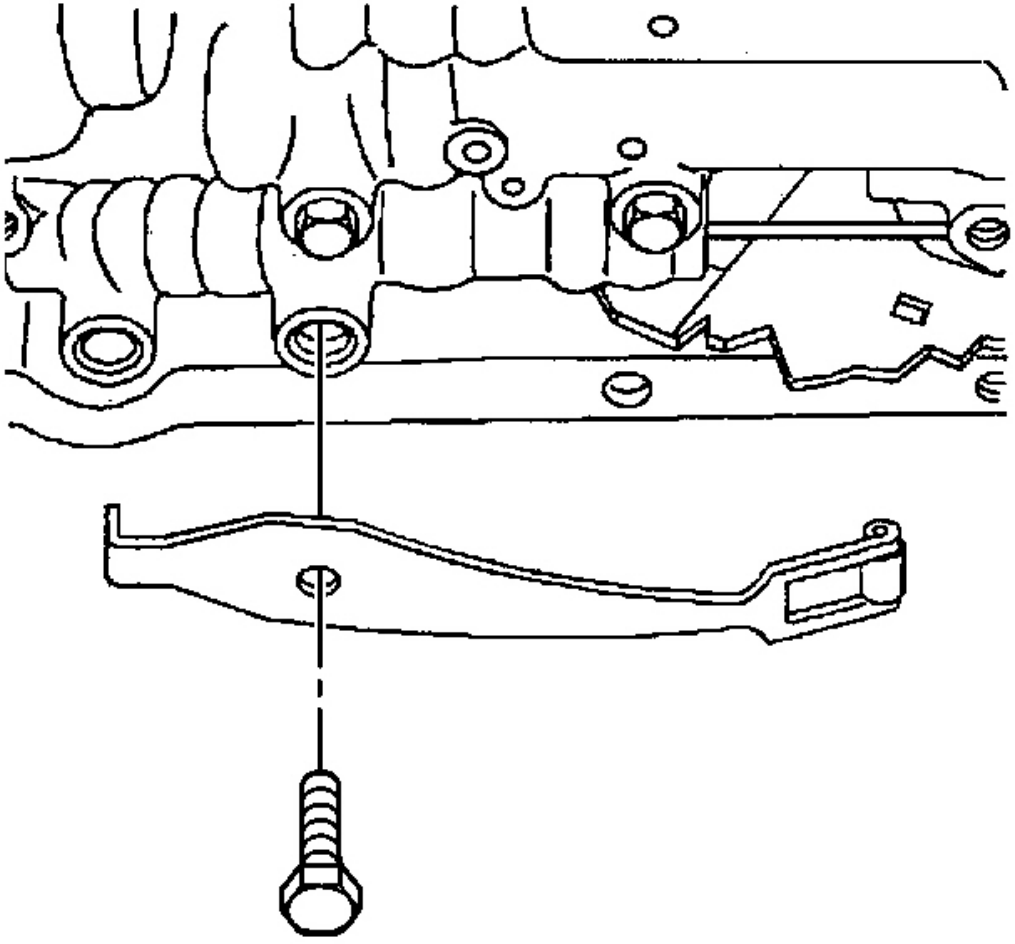


Fig. 138: Identifying The Manual Detent Spring
Courtesy of GENERAL MOTORS CORP.

6. Install the manual detent spring.
7. Install but do not tighten the manual detent spring retaining bolt.

cardiagn.com

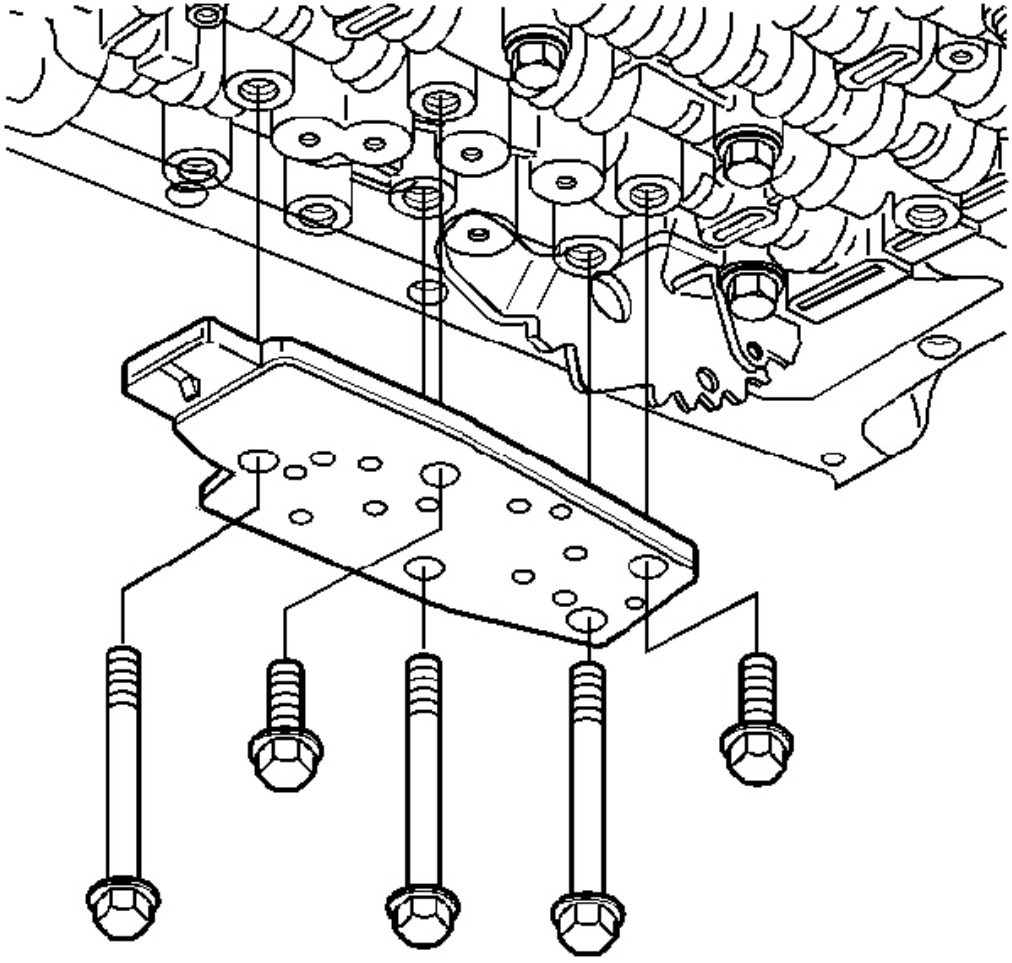


Fig. 139: Identifying Transmission Fluid Pressure Switch
Courtesy of GENERAL MOTORS CORP.

8. Install the transmission fluid pressure switch.
9. Install but do not tighten the control valve body bolts which retain the transmission fluid pressure switch to the control valve body.

NOTE: Refer to Fastener Notice in Cautions and Notices.

NOTE: Torque valve body bolts in a spiral pattern starting from the center. If the bolts are torqued at random, valve bores may be distorted and inhibit valve operation.

cardiagn.com

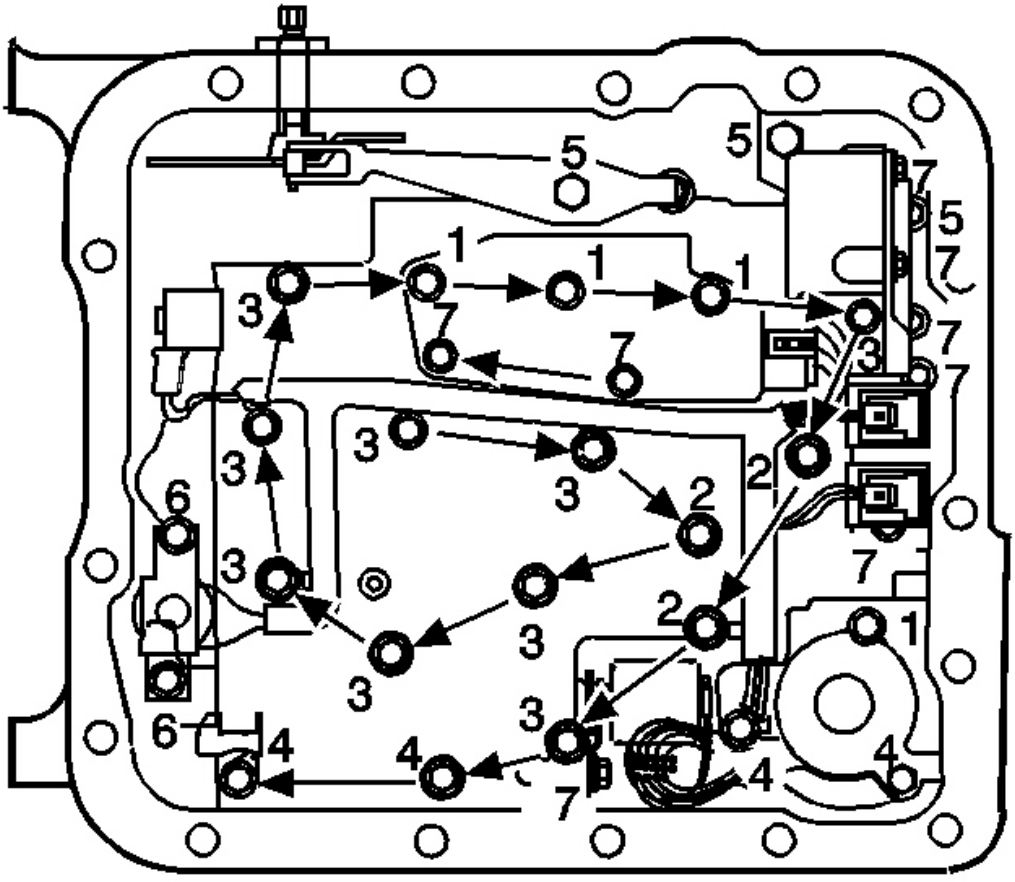


Fig. 140: Valve Body Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

10. Tighten the control valve body bolts in a spiral pattern starting from the center, as indicated by the arrows.

Tighten: Tighten the control valve body bolts (in sequence) to 11 N.m (97 lb in).

cardiagn.com

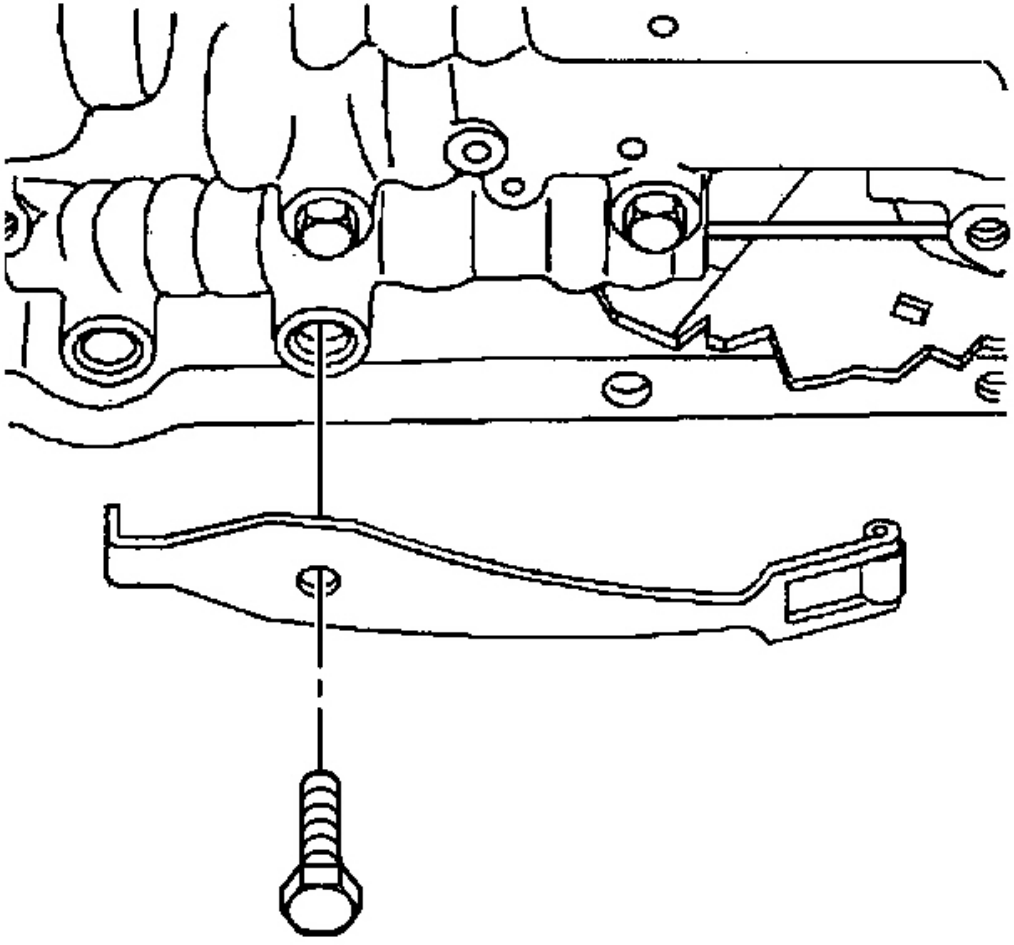


Fig. 141: Identifying The Manual Detent Spring
Courtesy of GENERAL MOTORS CORP.

11. Ensure that the manual detent spring is aligned properly with the detent lever.

    Tighten: Tighten the manual detent spring bolt to 11 N.m (97 lb in).

cardiagn.com

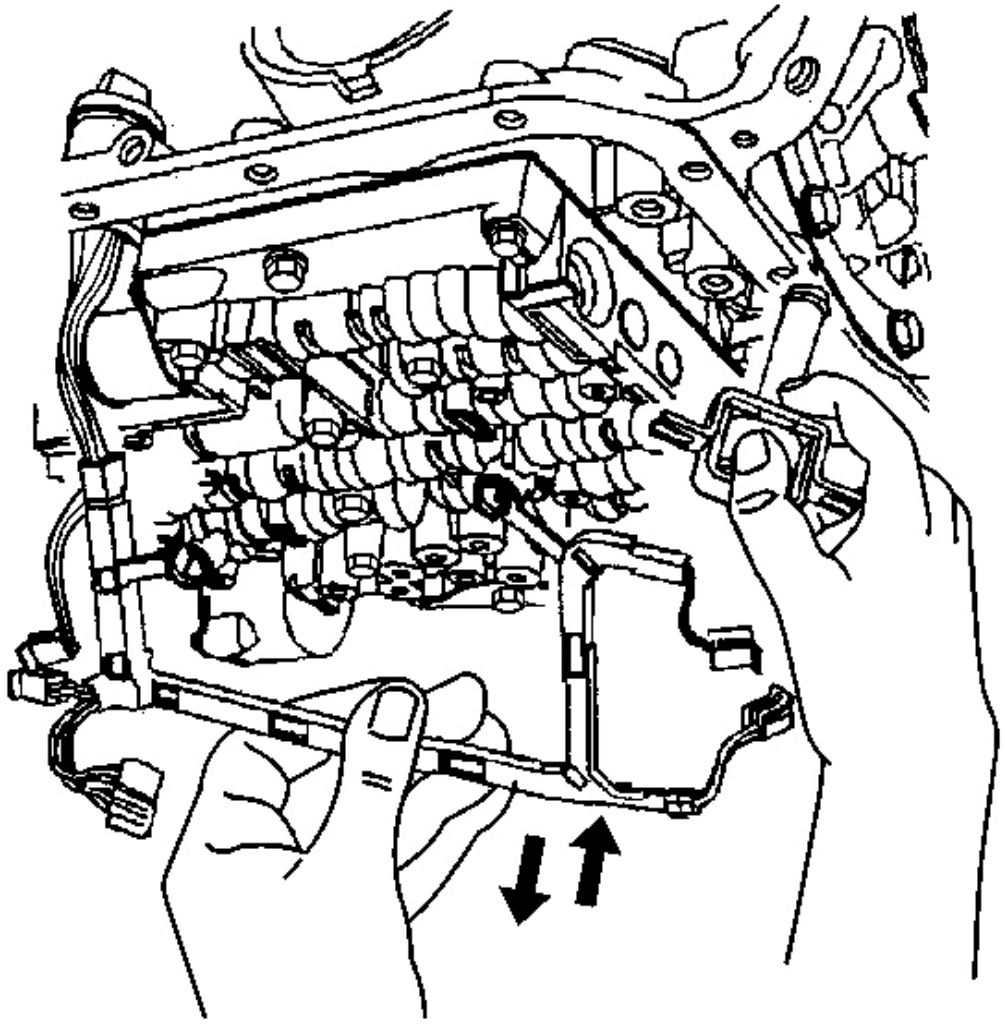


Fig. 142: Identifying TCC Solenoid (With O-Ring Seal) And Wiring Harness
Courtesy of GENERAL MOTORS CORP.

12. Install the TCC solenoid with a new O-ring seal to the valve body.

cardiagn.com

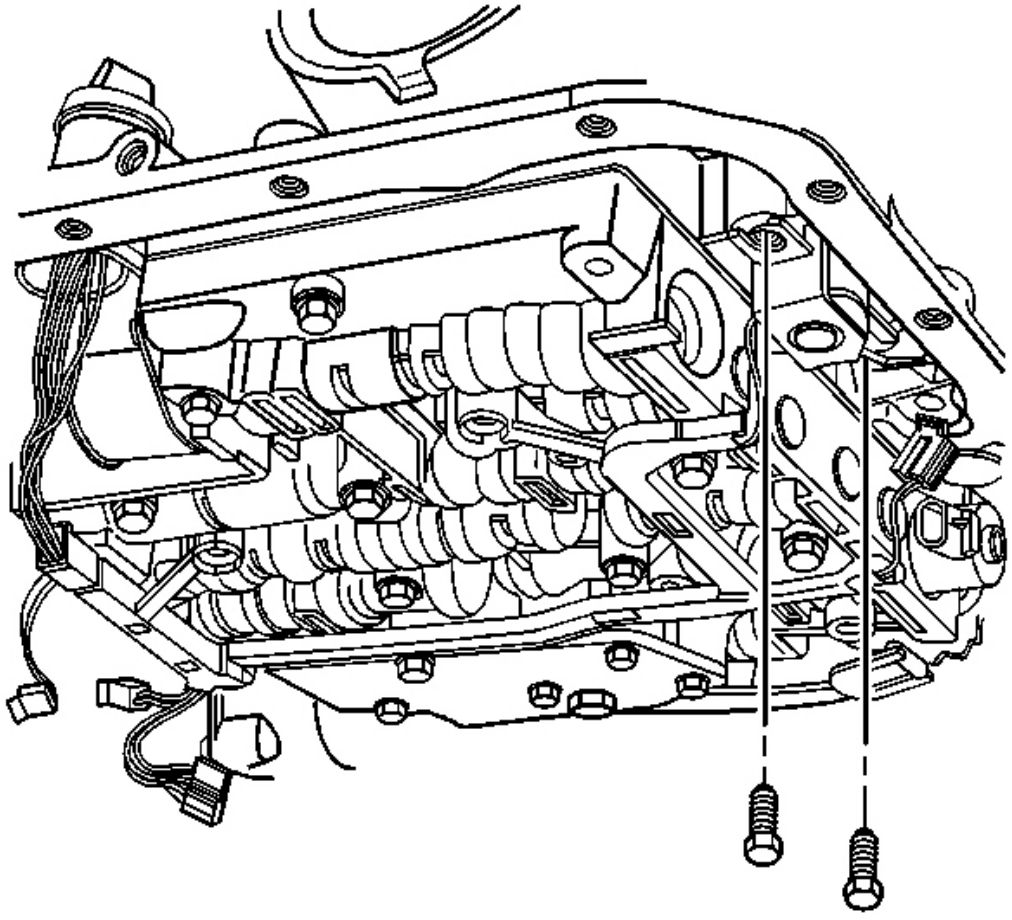


Fig. 143: Identifying TCC Solenoid & Bolts
Courtesy of GENERAL MOTORS CORP.

13. Install the TCC solenoid bolts.

    Tighten: Tighten the TCC solenoid retaining bolts to 11 N.m (97 lb in).

cardiagn.com

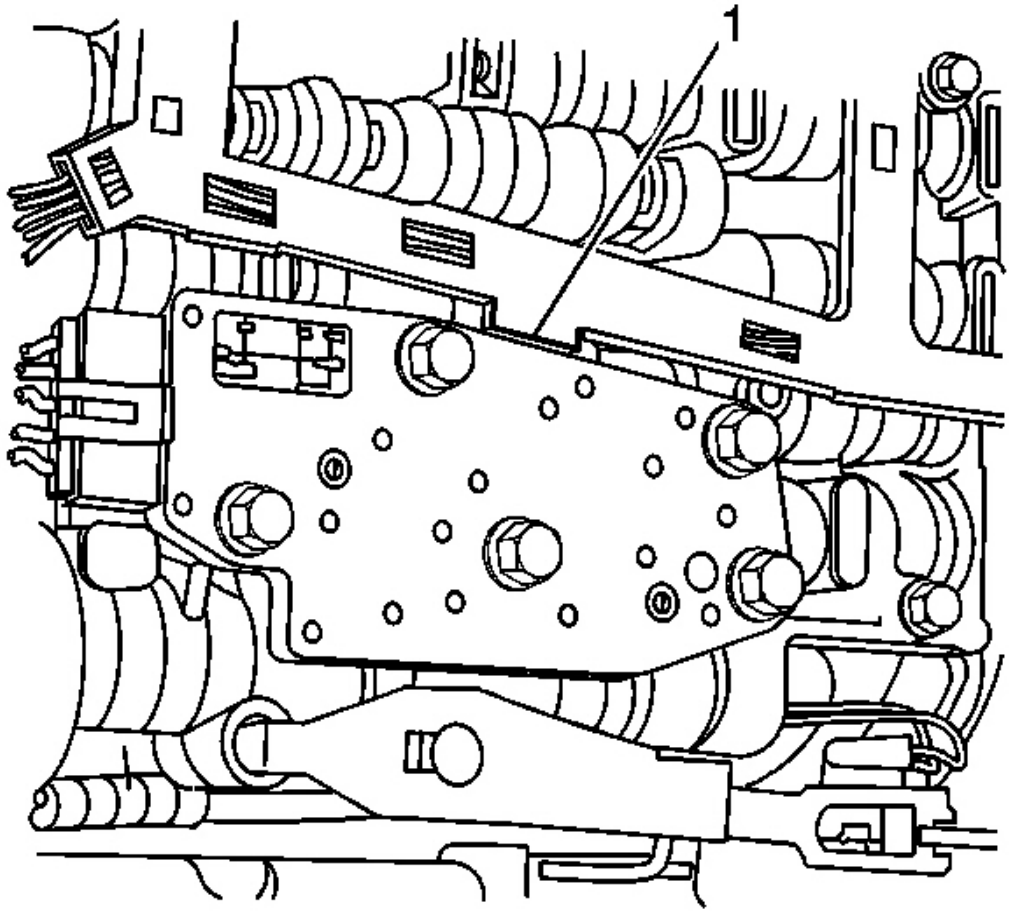


Fig. 144: View Of Internal Wiring Harness To The Valve Body
Courtesy of GENERAL MOTORS CORP.

14. Install the internal wiring harness to the valve body. The internal wiring harness has a tab (1) on the edge of the conduit.

cardiagn.com

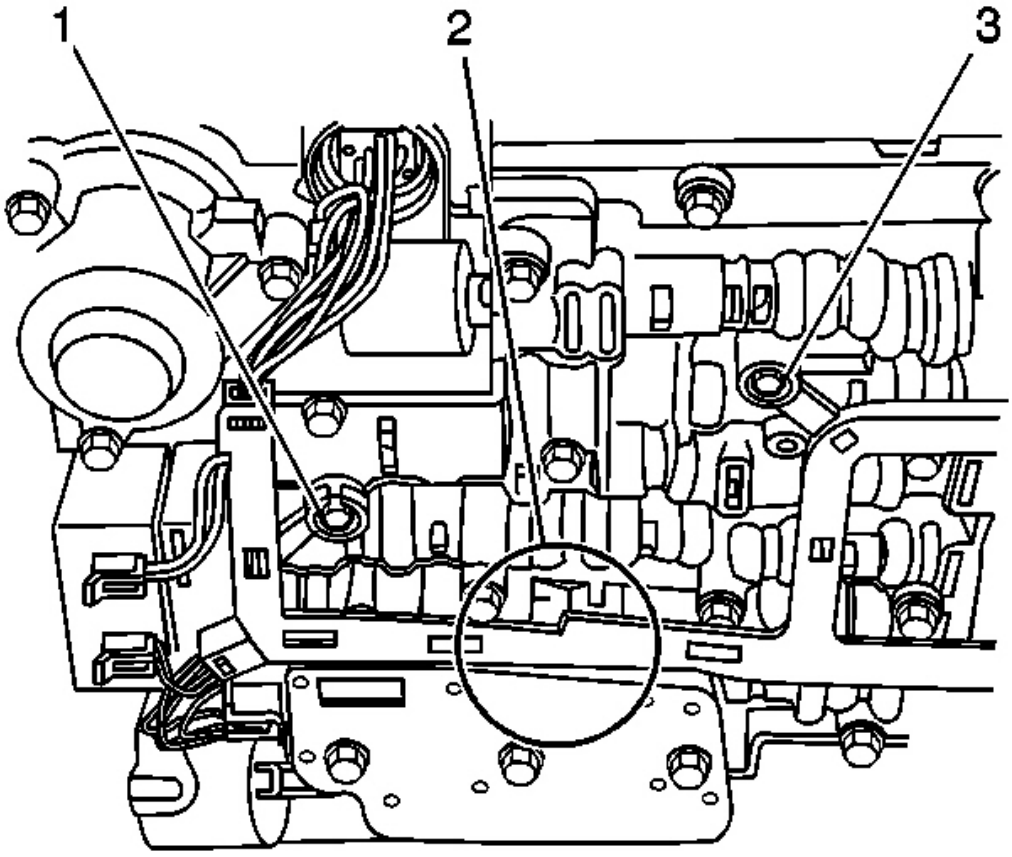


Fig. 145: Placing Tab Between The Valve Body And The Pressure Switch
Courtesy of GENERAL MOTORS CORP.

15. Place the tab between the valve body and the pressure switch in the location shown (2). Press the harness into position on the valve body bolt bosses (1, 3).

cardiagn.com

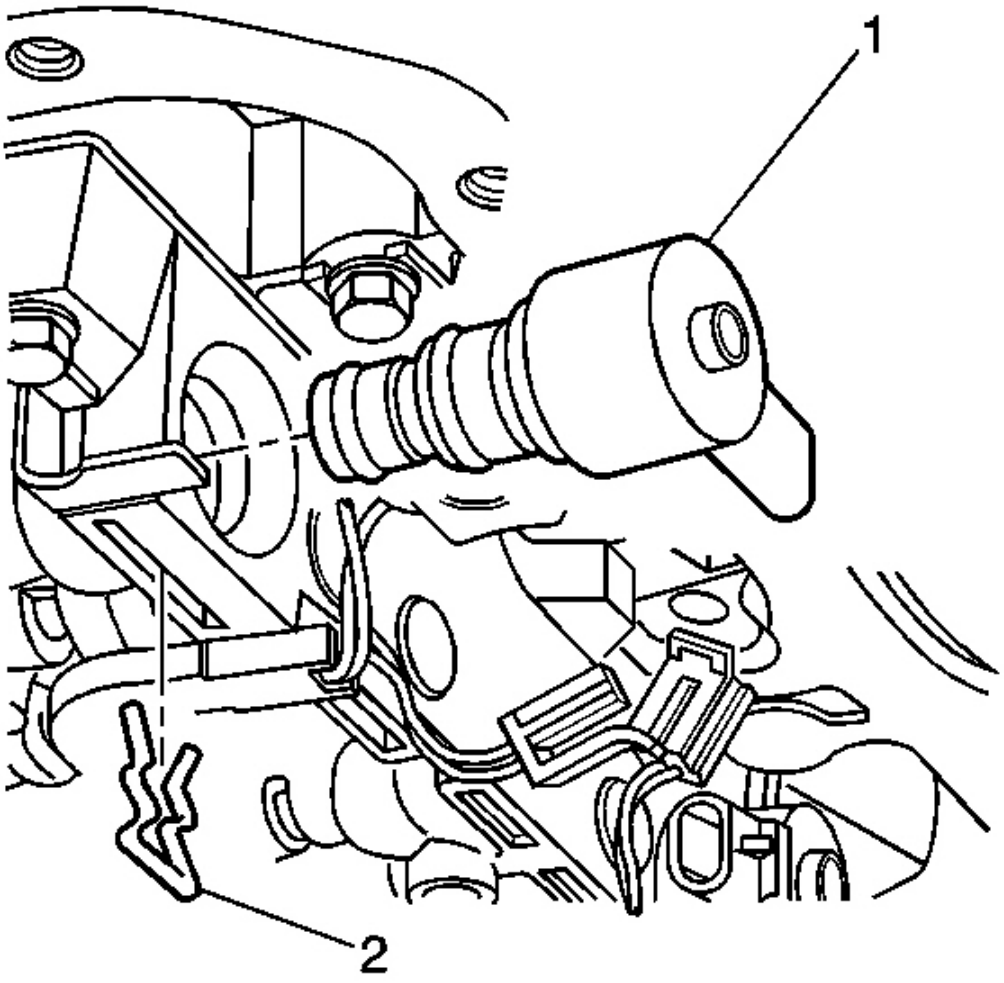


Fig. 146: Installing The TCC PWM Solenoid
Courtesy of GENERAL MOTORS CORP.

16. Install the TCC PWM solenoid (1) to the control valve body.
17. Install the TCC PWM solenoid retainer (2).

cardiagn.com

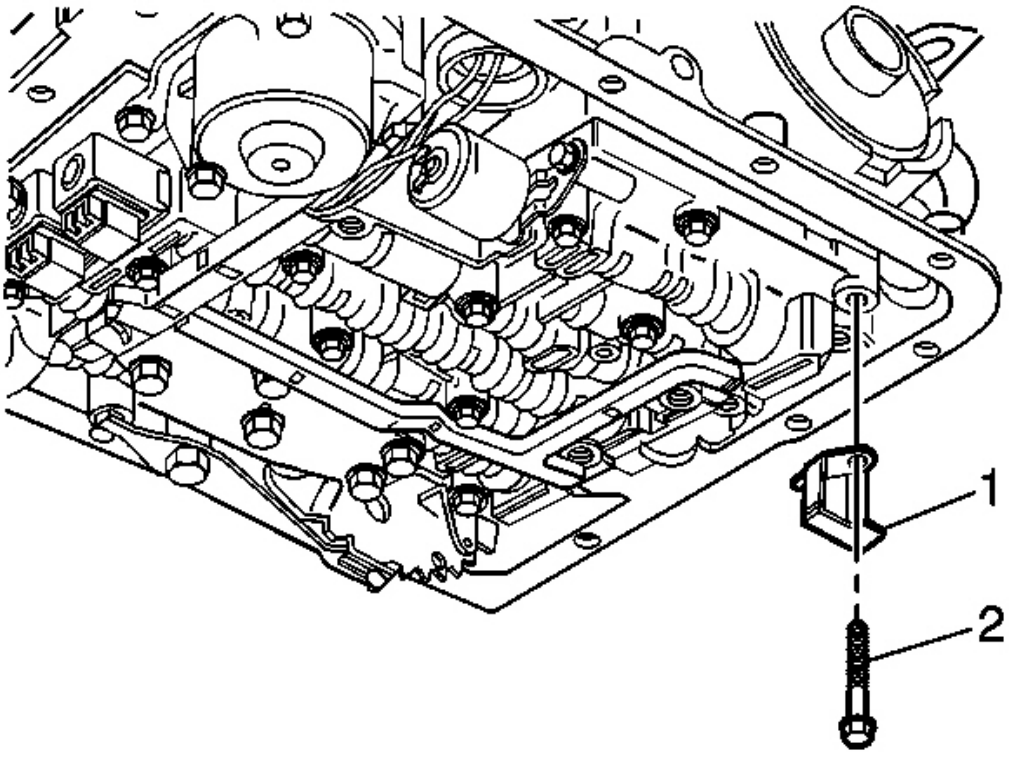


Fig. 147: Installing The Transmission Fluid Indicator Stop Bracket
Courtesy of GENERAL MOTORS CORP.

18. Install the transmission fluid indicator stop bracket (1) and bolt (2).

    Tighten: Tighten the transmission fluid indicator stop bracket bolt to 11 N.m (97 lb in).

cardiagn.com

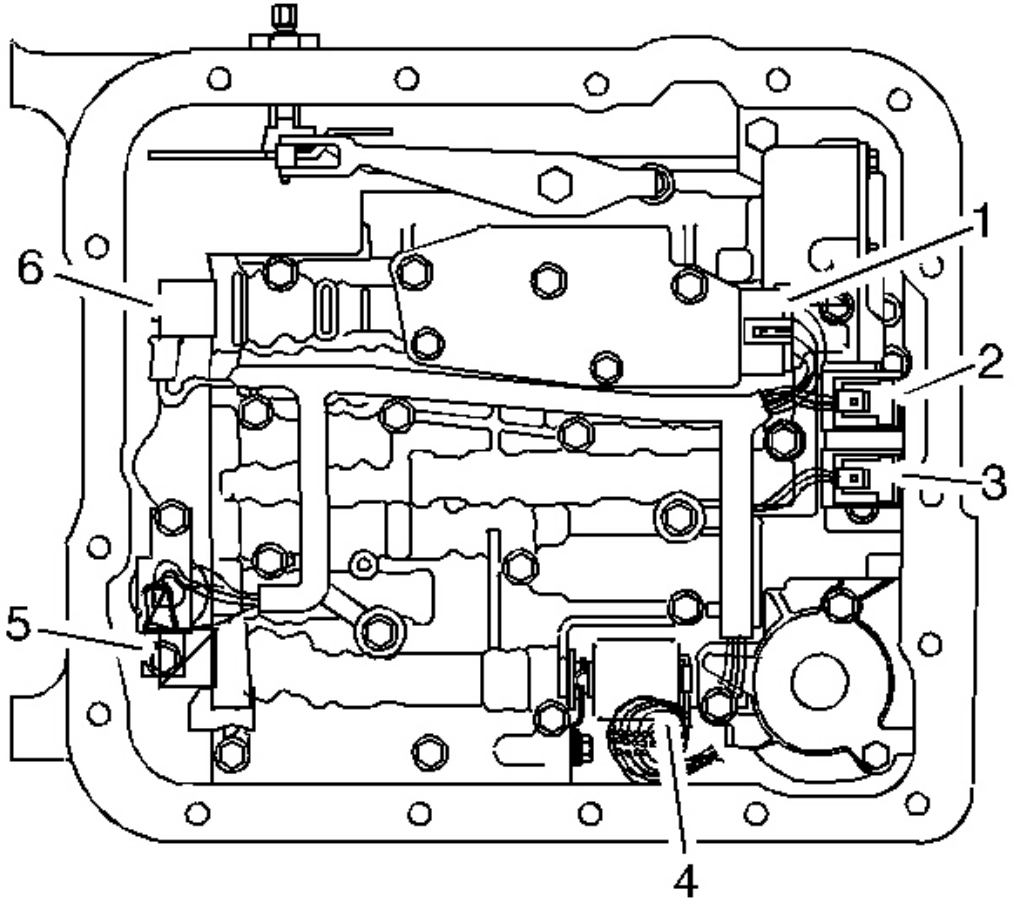


Fig. 148: Identifying Valve Body Electrical Connections
Courtesy of GENERAL MOTORS CORP.

19. Connect the internal wiring harness electrical connectors to the following components:
    - The transmission fluid pressure manual valve position switch (1)
    - The 1-2 shift solenoid (2)
    - The 2-3 shift solenoid (3)
    - The pressure control solenoid (4)
    - The TCC PWM solenoid (5)
    - The 3-2 shift solenoid (6)
20. Install the transmission oil pan and filter. Refer to **Automatic Transmission Fluid/Filter Replacement** .
21. Lower the vehicle.

cardiagn.com

22. Fill the transmission to the proper level with DEXRON(R) III transmission fluid. Refer to **Transmission Fluid Checking Procedure** .

CONTROL AND SHIFT SOLENOIDS REPLACEMENT

Removal Procedure

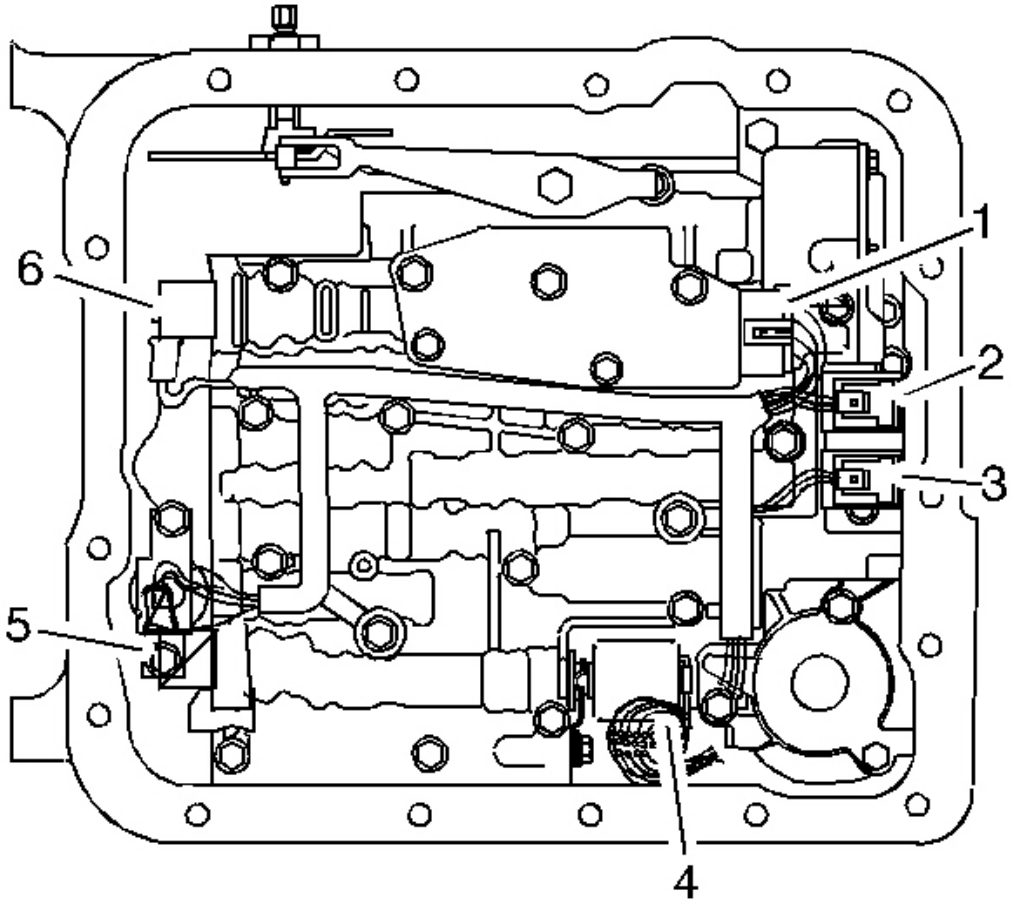


Fig. 149: Identifying Valve Body Electrical Connections
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission oil pan and filter. Refer to **Automatic Transmission Fluid/Filter Replacement** .

IMPORTANT: Do not remove the valve body for the following procedures. Removal of

cardiagn.com

the 1-2 accumulator is necessary only if servicing the pressure control solenoid.

2. Remove the 1-2 accumulator if necessary. Refer to **Accumulator Assembly, Spacer Plate, and Gaskets** .
3. Disconnect the internal wiring harness electrical connectors from the following components:
   - Transmission fluid pressure switch (1)
   - 1-2 shift control solenoid (2)
   - 2-3 shift control solenoid (3)
   - Pressure control solenoid (4)
   - TCC PWM solenoid (5)
   - 3-2 control solenoid (6)

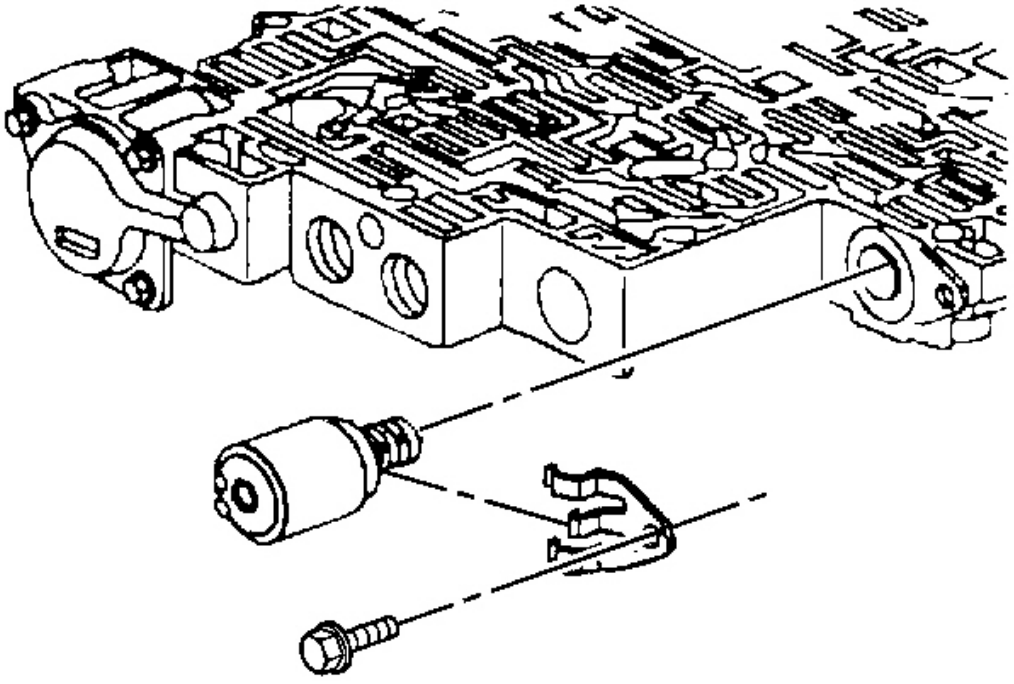


Fig. 150: Locating Pressure Control Solenoid
Courtesy of GENERAL MOTORS CORP.

4. Remove the pressure control solenoid retainer.
5. Remove the pressure control solenoid.

cardiagn.com

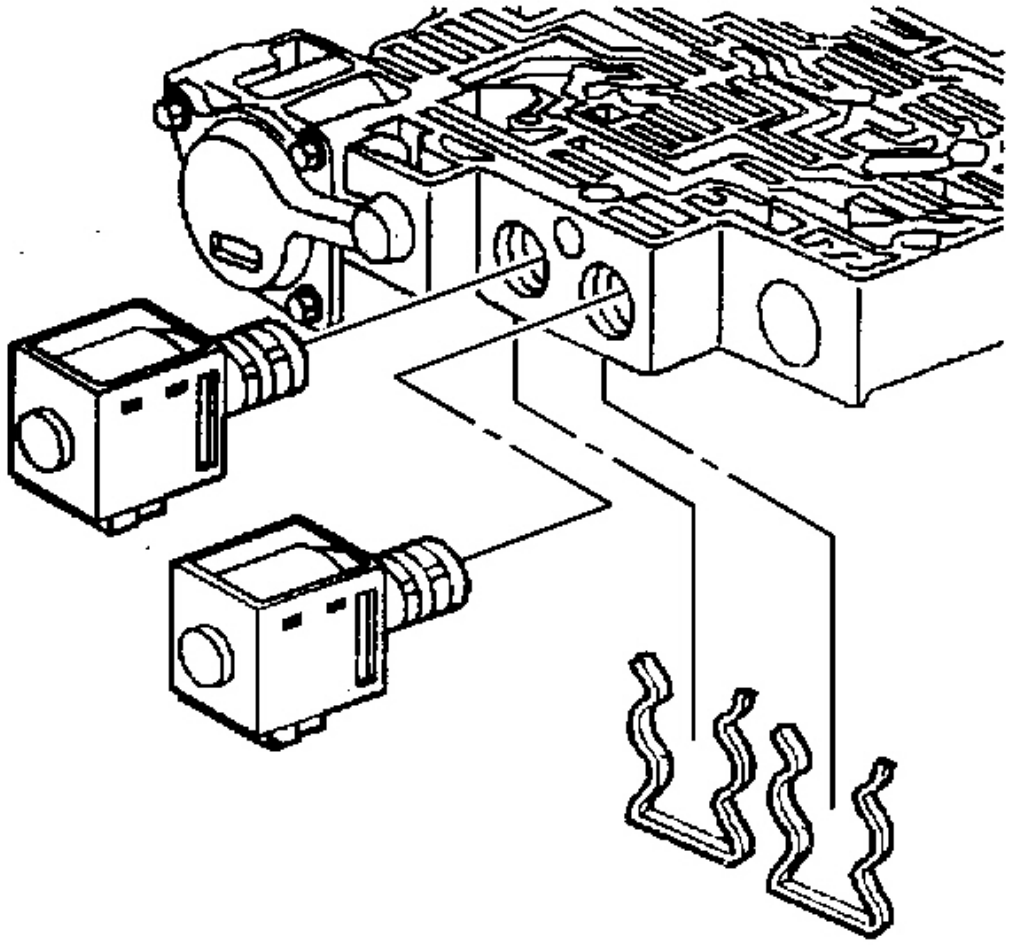


Fig. 151: 1-2 & 2-3 Shift Solenoids
Courtesy of GENERAL MOTORS CORP.

6. Remove the 1-2 and 2-3 shift solenoid retainers.
7. Remove the 1-2 and 2-3 shift solenoids.

cardiagn.com

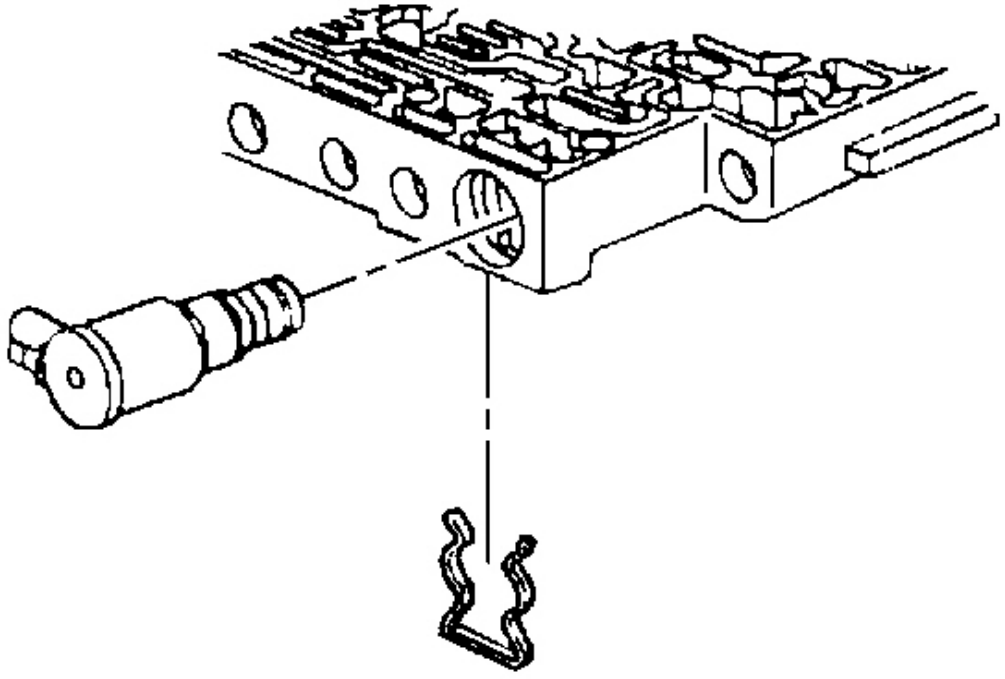


Fig. 152: 3-2 Control Solenoid
Courtesy of GENERAL MOTORS CORP.

8. Remove the 3-2 control solenoid retainer.
9. Remove the 3-2 control solenoid.

Installation Procedure

cardiagn.com

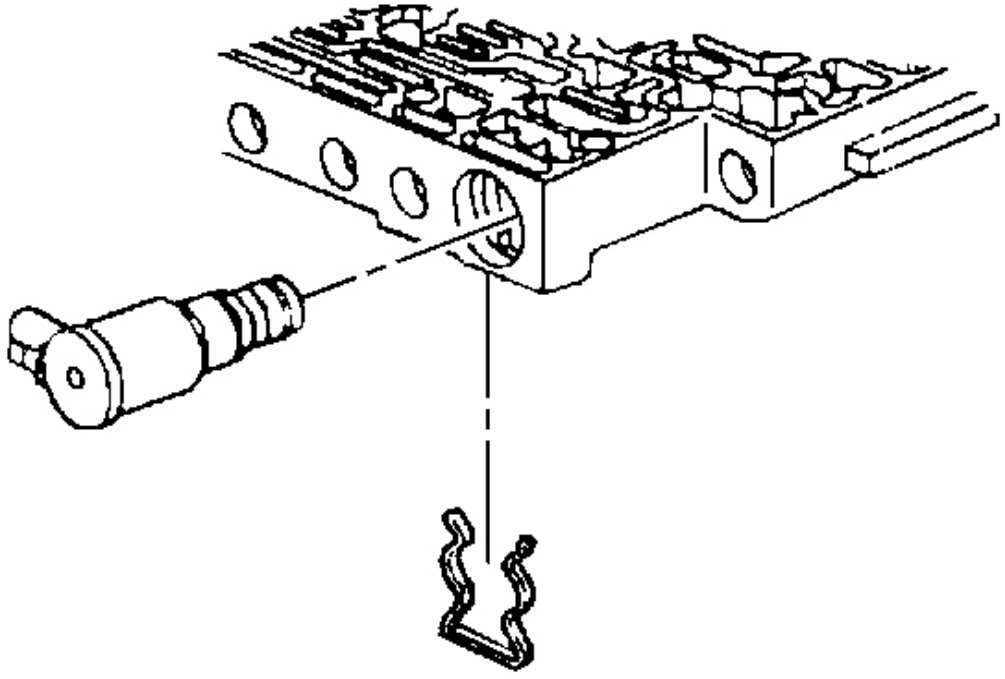


Fig. 153: 3-2 Control Solenoid
Courtesy of GENERAL MOTORS CORP.

1. Install the 3-2 control solenoid.
2. Install the 3-2 control solenoid retainer.

cardiagn.com

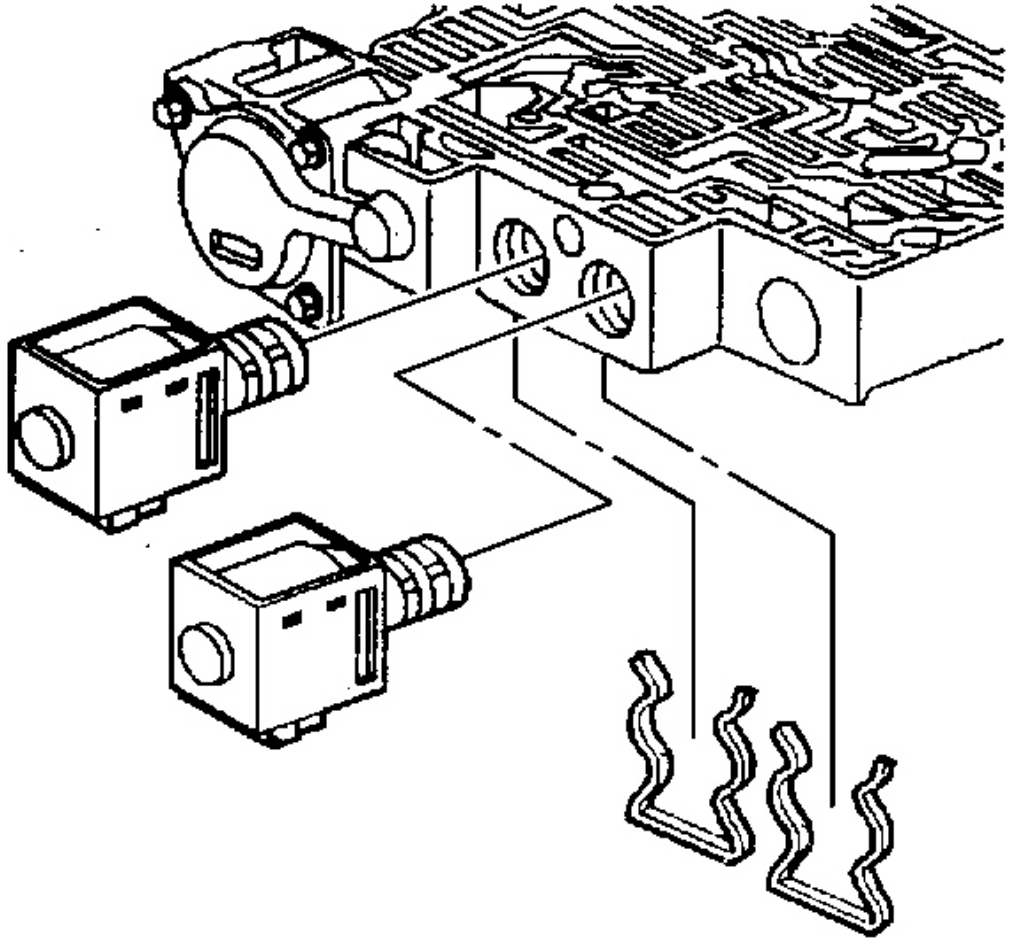


Fig. 154: 1-2 & 2-3 Shift Solenoids
Courtesy of GENERAL MOTORS CORP.

3. Install the 1-2 and 2-3 shift solenoids.
4. Install the 1-2 and 2-3 shift solenoid retainers.

cardiagn.com

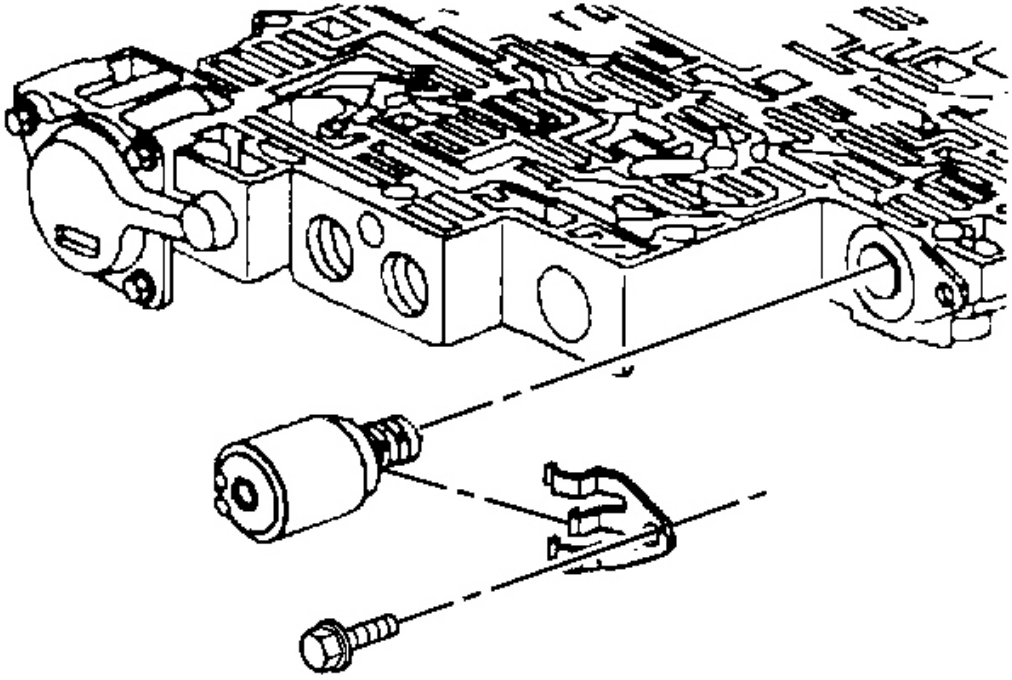


Fig. 155: Locating Pressure Control Solenoid
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

5. Install the pressure control solenoid.

   Ensure that the electrical tabs are facing outboard.

6. Install the pressure control solenoid retainer and retaining bolt.

   Tighten: Tighten the pressure control solenoid retaining bolt to 11 N.m (97 lb in).

cardiagn.com

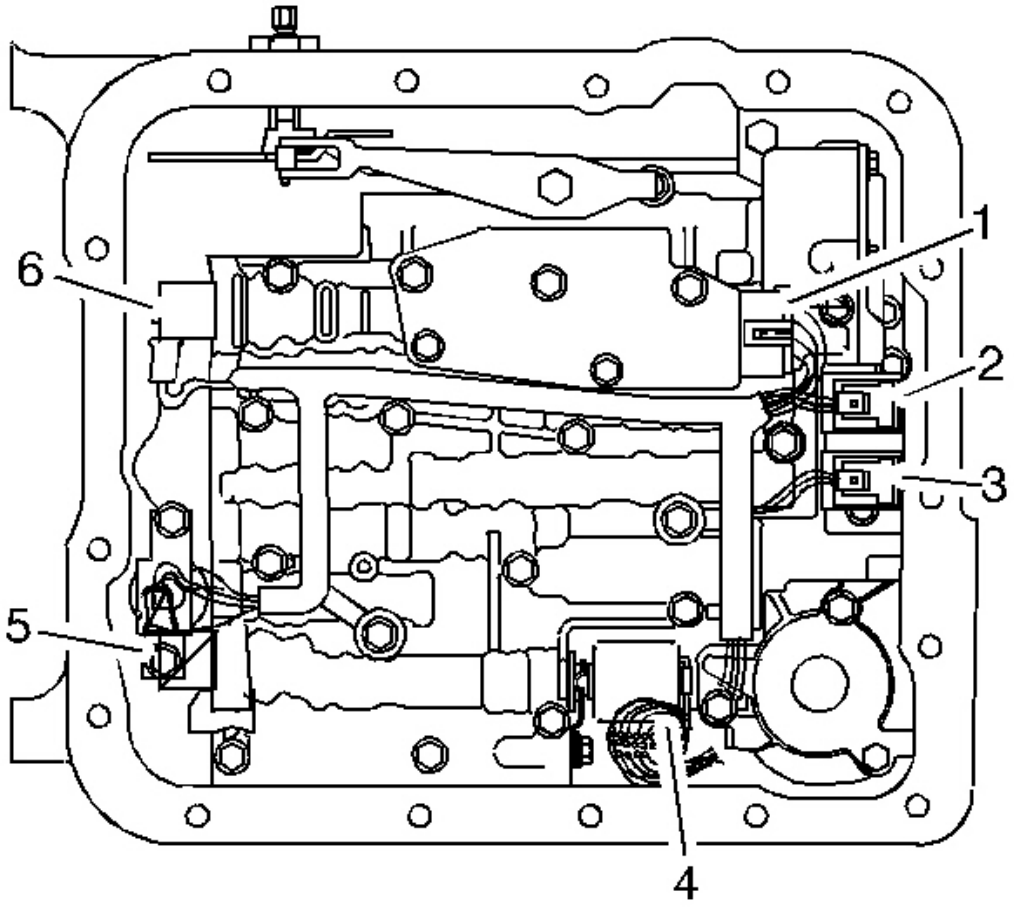


Fig. 156: Identifying Valve Body Electrical Connections
Courtesy of GENERAL MOTORS CORP.

7. Connect the internal wiring harness electrical connectors to the following components:
   - Transmission fluid pressure switch (1)
   - 1-2 shift control solenoid (2)
   - 2-3 shift control solenoid (3)
   - Pressure control solenoid (4)
   - TCC PWM solenoid (5)
   - 3-2 control solenoid (6)
8. Install the 1-2 accumulator. Refer to **Accumulator Assembly, Spacer Plate, and Gaskets** .
9. Install the transmission oil pan and filter. Refer to **Automatic Transmission Fluid/Filter Replacement** .

cardiagn.com

10. Fill the transmission to the proper level with DEXRON(R) III transmission fluid. Refer to **Transmission Fluid Checking Procedure** .

TORQUE CONVERTER CLUTCH PULSE WIDTH MODULATION (TCC PWM) SOLENOID, TCC SOLENOID, AND WIRING HARNESS

Tools Required

J 28458 Seal Protector Retainer Installer. See **Special Tools and Equipment** .

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the transmission oil pan and the filter. Refer to **Automatic Transmission Fluid/Filter Replacement** .

cardiagn.com

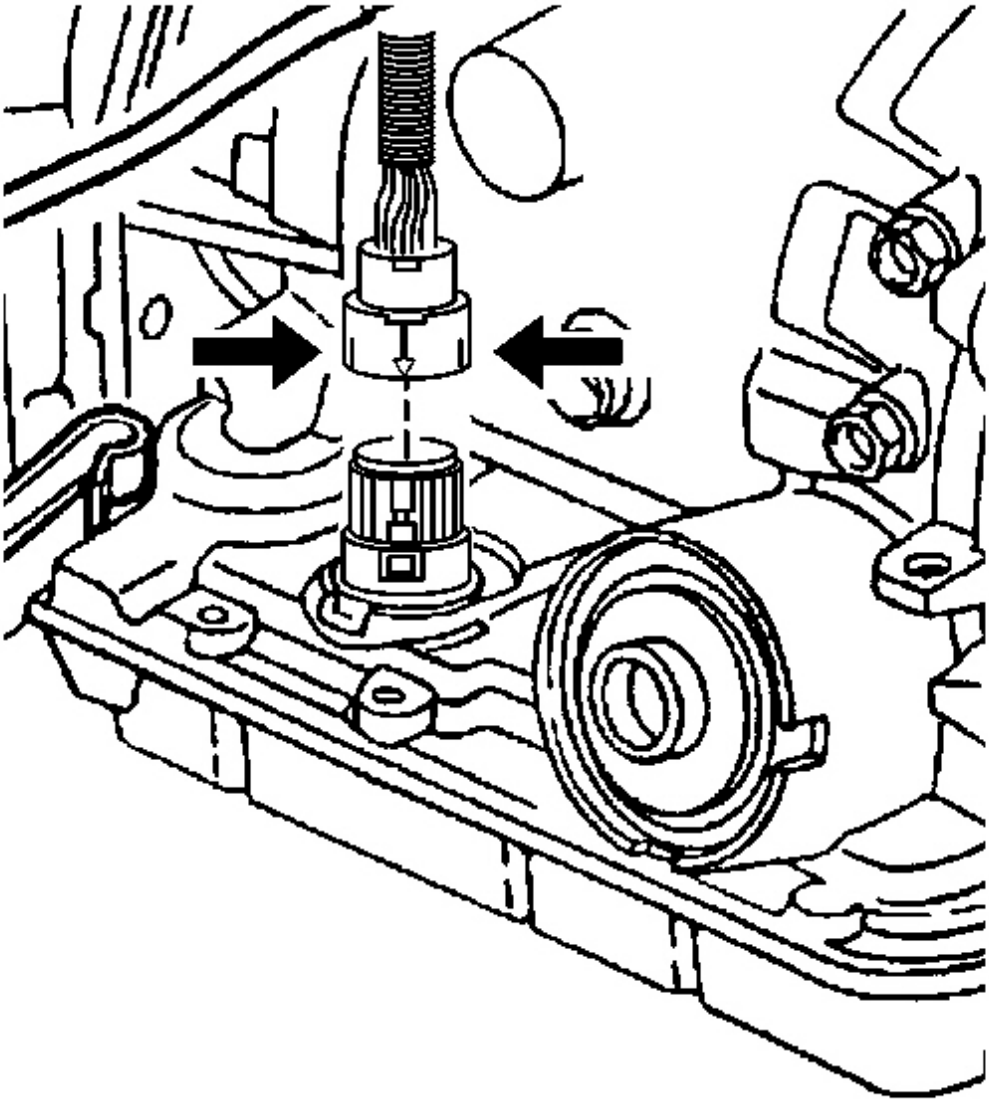


Fig. 157: Disconnecting The Transmission Harness 20-Way Connector
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the transmission harness 20-way connector from the transmission internal harness pass-through connector.

   Depress both tabs on the connector and pull straight up; do not pry the connector.

cardiagn.com

IMPORTANT: Removal of the valve body is not necessary for the following procedure.

4. Remove the 1-2 accumulator assembly. Do not remove the spacer plate. Refer to **Accumulator Assembly, Spacer Plate, and Gaskets** .

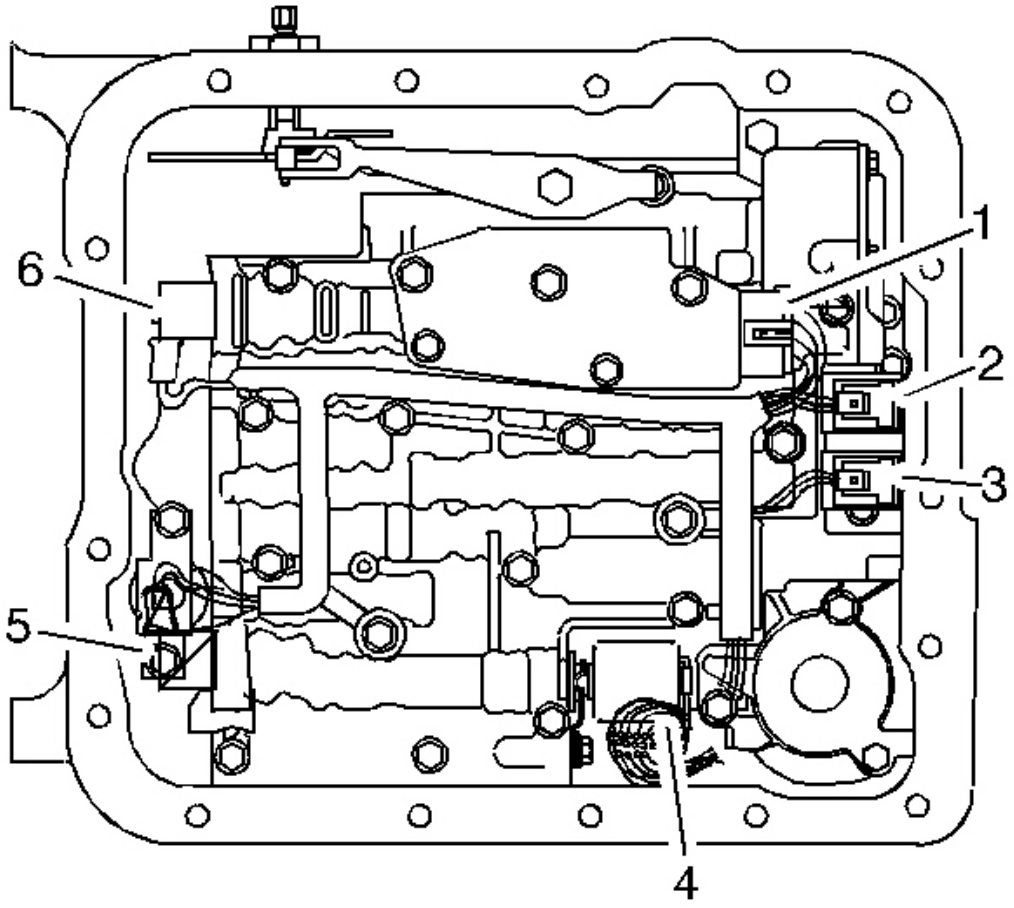


Fig. 158: Identifying Valve Body Electrical Connections
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the internal wiring harness electrical connectors from the following components:
   - Transmission fluid pressure switch (1)
   - 1-2 shift control solenoid (2)
   - 2-3 shift control solenoid (3)
   - Pressure control solenoid (4)

cardiagn.com

- TCC PWM solenoid (5)
- 3-2 control solenoid (6)

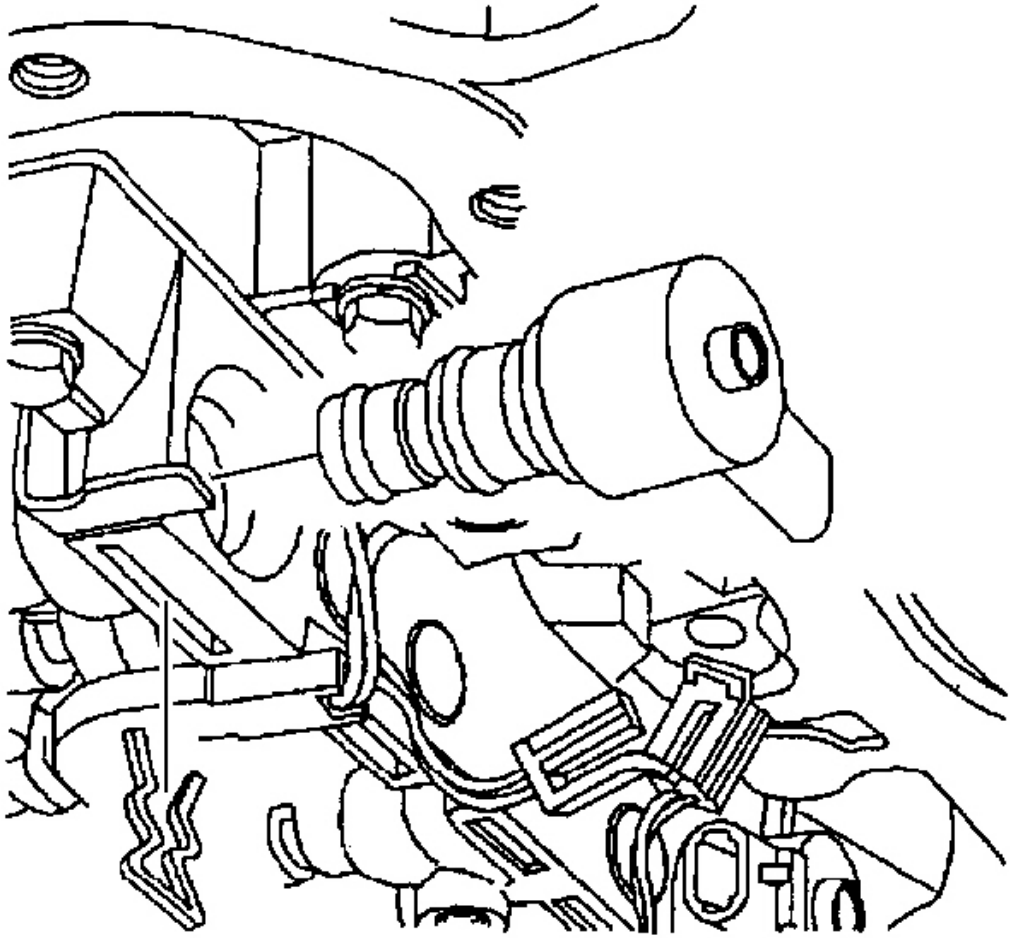


Fig. 159: Installing The TCC PWM Solenoid To The Control Valve Body
Courtesy of GENERAL MOTORS CORP.

6. Remove the TCC PWM solenoid retainer.
7. Remove the TCC PWM solenoid in order to access one of the TCC solenoid retaining bolts.

cardiagn.com

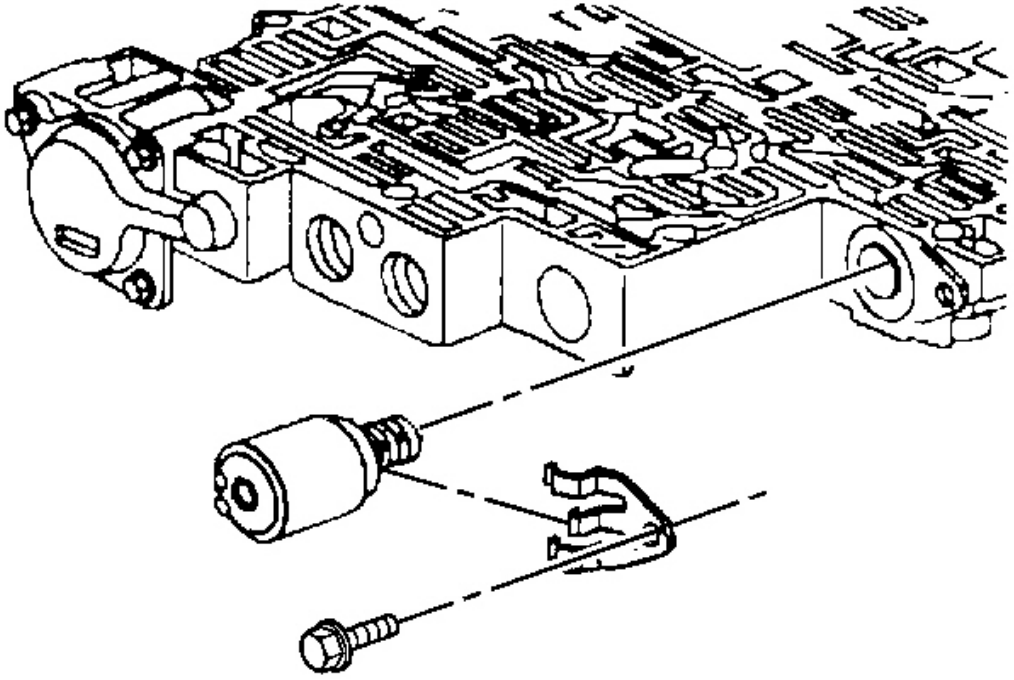


Fig. 160: Locating Pressure Control Solenoid
Courtesy of GENERAL MOTORS CORP.

8. Remove the pressure control solenoid retainer.
9. Remove the pressure control solenoid.

cardiagn.com

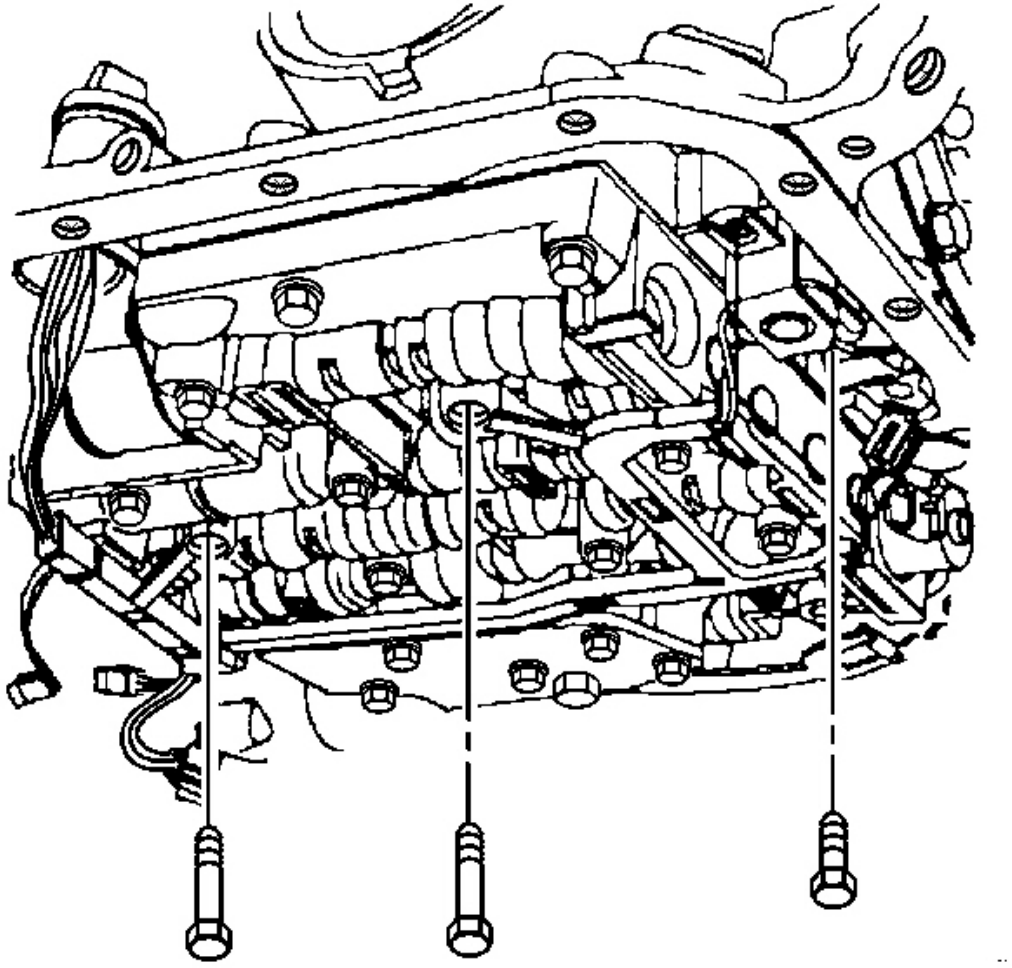


Fig. 161: Removing The TCC Solenoid Bolts And The Valve Body Bolts Which Retain The Internal Wiring Harness
Courtesy of GENERAL MOTORS CORP.

10. Remove the TCC solenoid retaining bolts and the valve body bolts which retain the internal wiring harness.

cardiagn.com

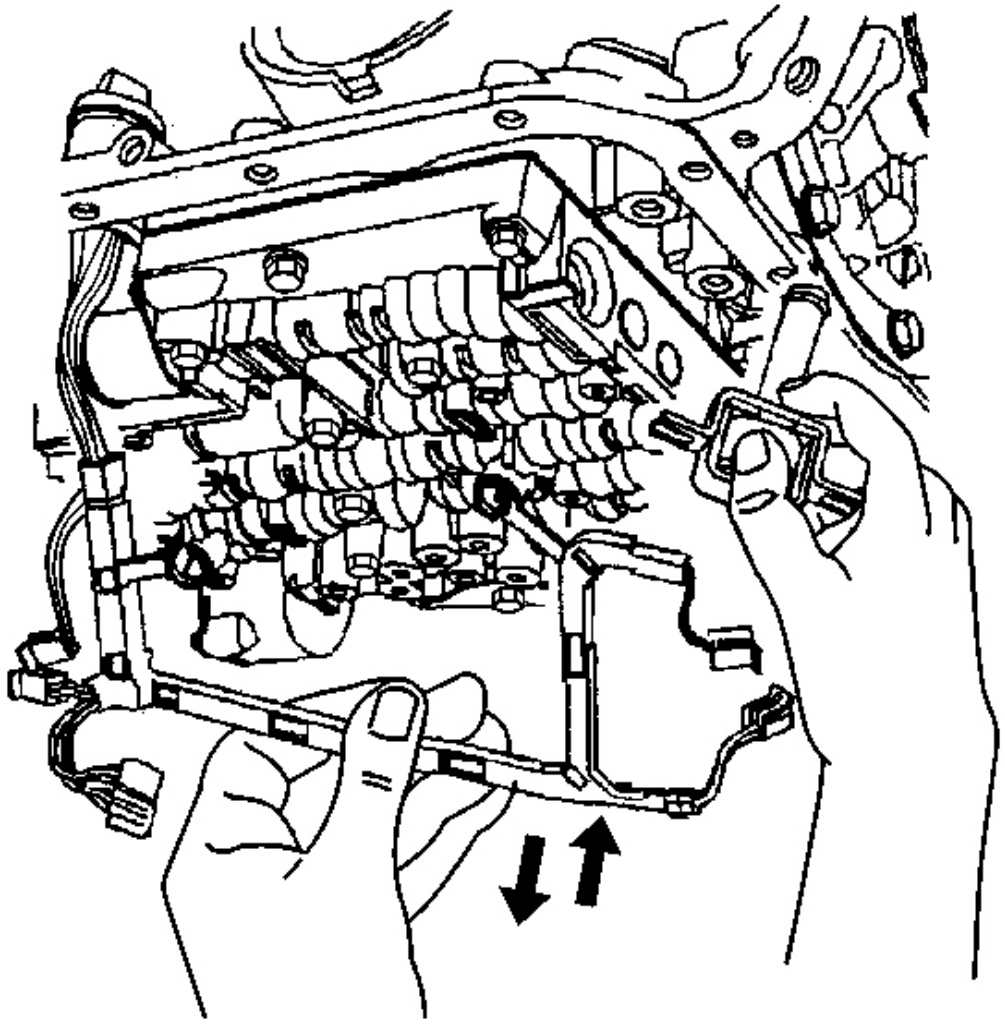


Fig. 162: Identifying TCC Solenoid (With O-Ring Seal) And Wiring Harness
Courtesy of GENERAL MOTORS CORP.

11. Using **J 28458** , release the pass-through electrical connector from the transmission case. See **Special Tools and Equipment** .
    1. Use the small end of the **J 28458** over the top of the connector. See **Special Tools and Equipment** .
    2. Twist in order to release the four tabs retaining the connector.
    3. Pull the harness connector down through the transmission case.
12. Remove the TCC solenoid (with O-ring seal) and wiring harness assembly from the transmission case.

cardiagn.com

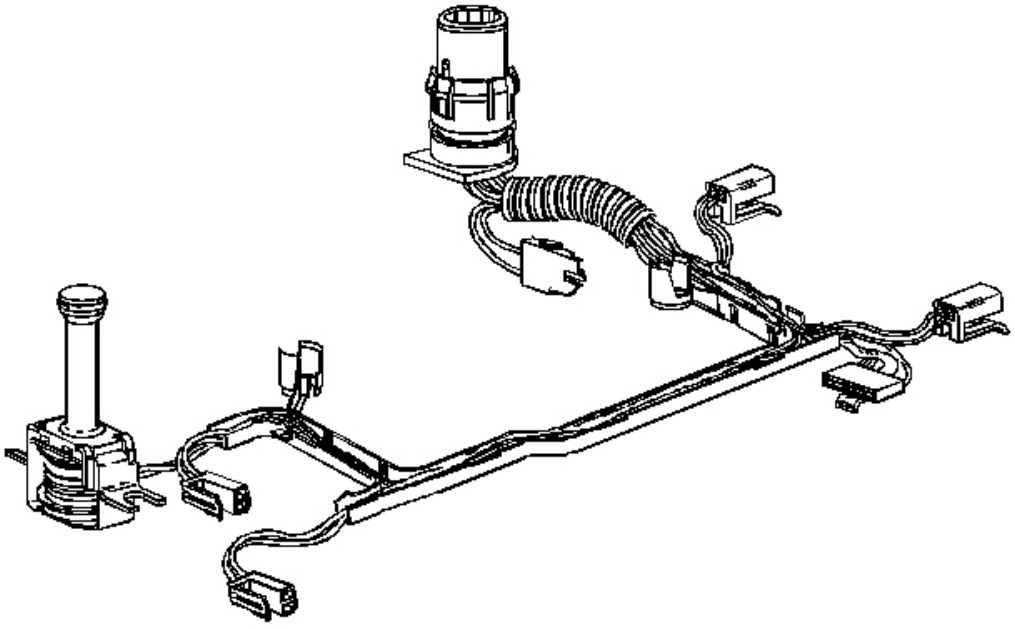


Fig. 163: TCC Wiring Harness
Courtesy of GENERAL MOTORS CORP.

13. Inspect the TCC solenoid and wiring harness assembly for the following defects:
    - Damage
    - Cracked connectors
    - Exposed wires
    - Loose pins

Installation Procedure

cardiagn.com

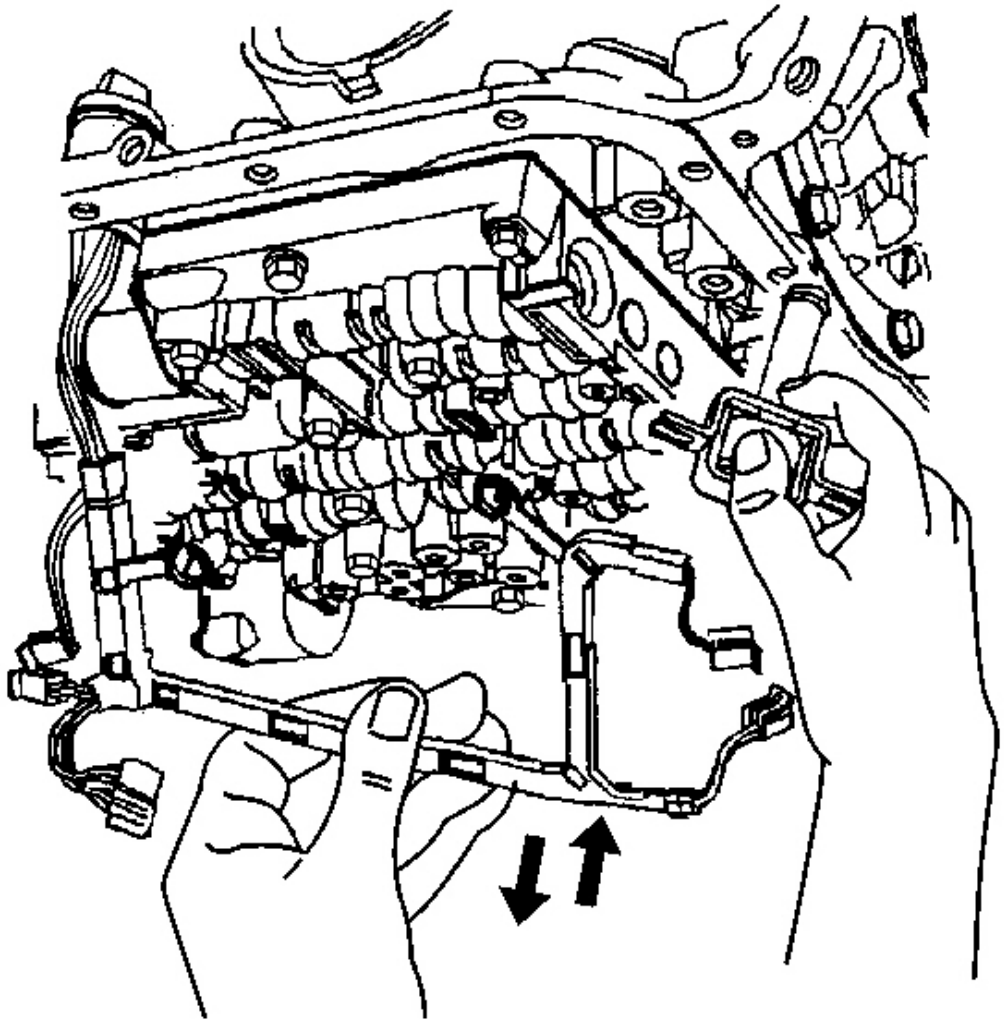


Fig. 164: Identifying TCC Solenoid (With O-Ring Seal) And Wiring Harness
Courtesy of GENERAL MOTORS CORP.

1. Install the wiring harness and TCC solenoid assembly with a new O-ring seal to the transmission.
2. Install the pass-through electrical connector to the transmission case.

cardiagn.com

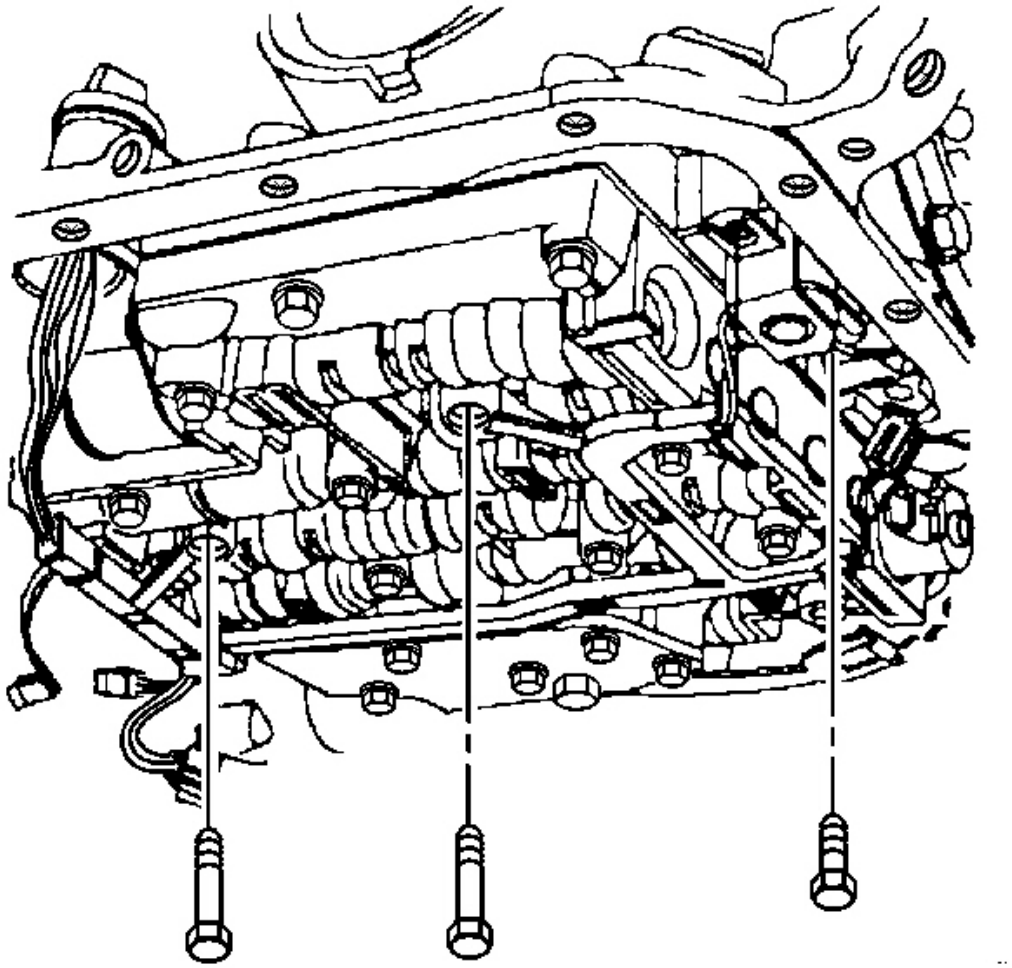


Fig. 165: Removing The TCC Solenoid Bolts And The Valve Body Bolts Which Retain The Internal Wiring Harness
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the valve body bolts which retain the internal wiring harness and install the TCC solenoid retaining bolts.

Tighten:

- Tighten the control valve body retaining bolts to 11 N.m (97 lb in).
- Tighten the TCC solenoid retaining bolts to 11 N.m (97 lb in).

cardiagn.com

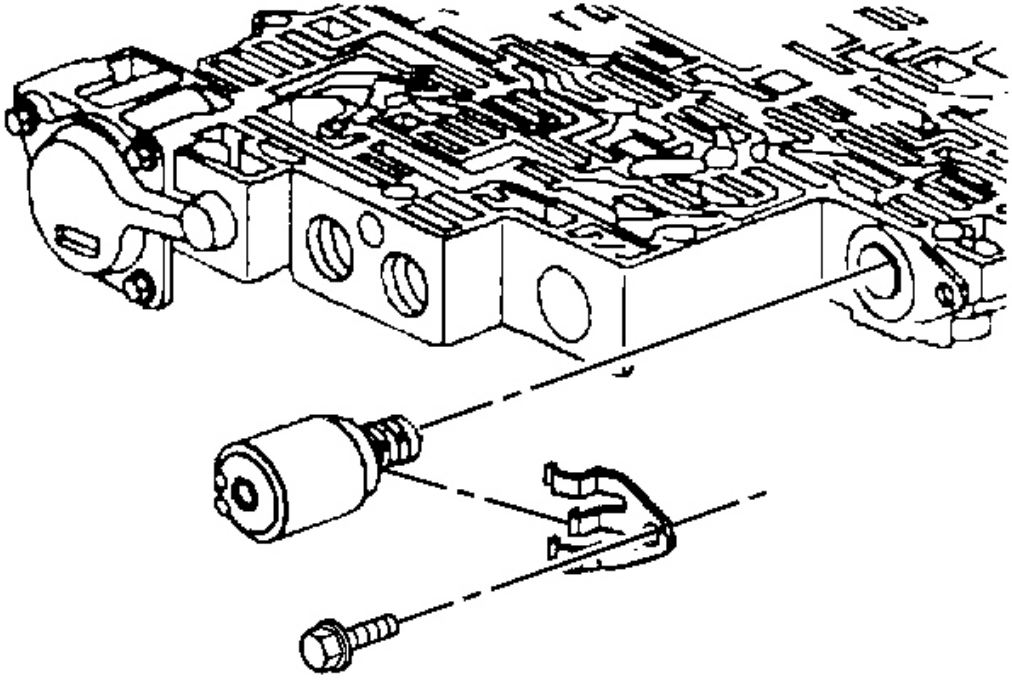


Fig. 166: Locating Pressure Control Solenoid
Courtesy of GENERAL MOTORS CORP.

4. Install the pressure control solenoid.

   Ensure that the electrical tabs are facing outboard.

5. Install the pressure control solenoid retainer and retaining bolt.

   Tighten: Tighten the pressure control solenoid retaining bolt to 11 N.m (97 lb in).

cardiagn.com

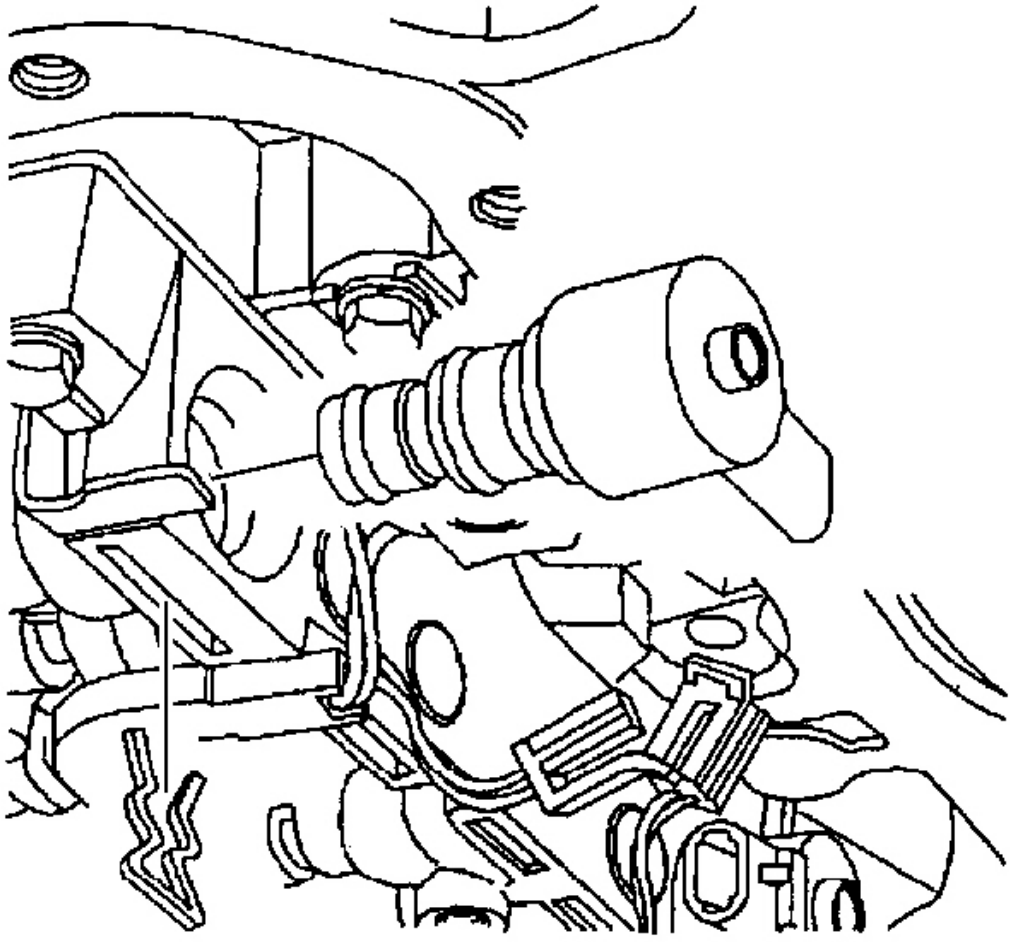


Fig. 167: Installing The TCC PWM Solenoid To The Control Valve Body
Courtesy of GENERAL MOTORS CORP.

6. Install the TCC PWM solenoid to the control valve body.
7. Install the TCC PWM solenoid retainer.

cardiagn.com

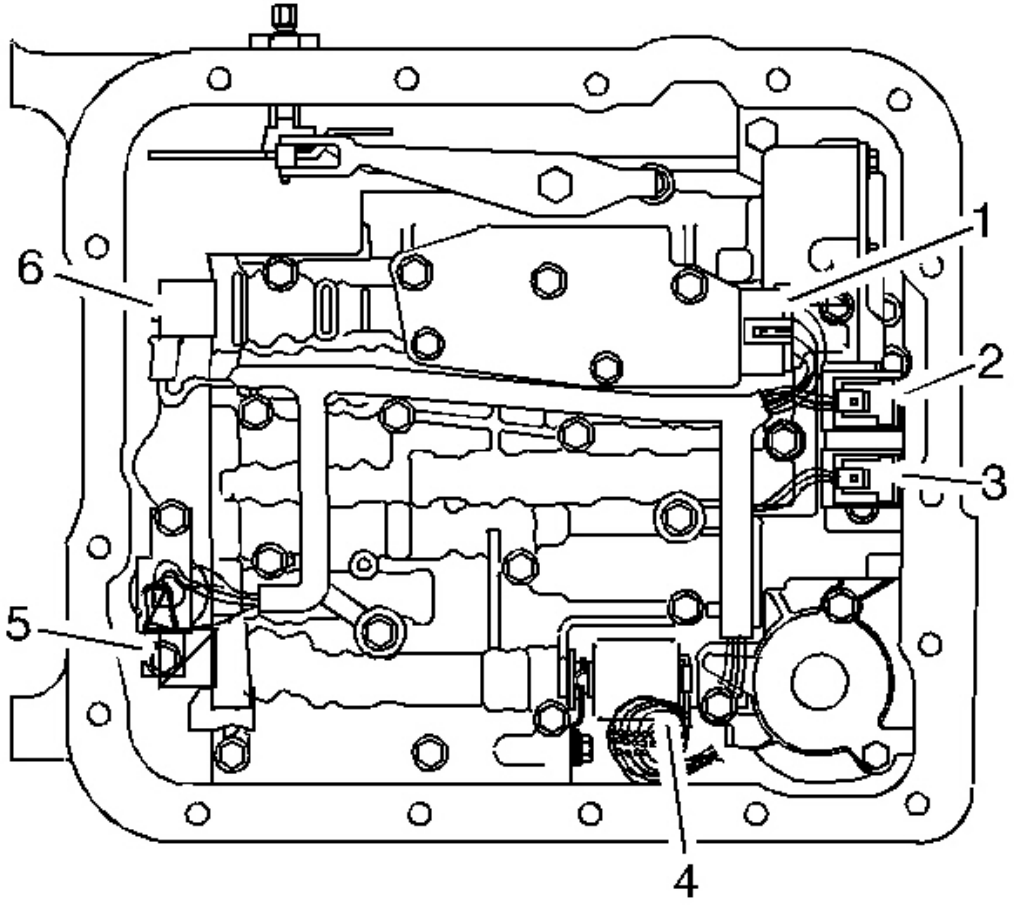


Fig. 168: Identifying Valve Body Electrical Connections
Courtesy of GENERAL MOTORS CORP.

8. Connect the internal wiring harness electrical connectors to the following components:
    - Transmission fluid pressure switch (1)
    - 1-2 shift control solenoid (2)
    - 2-3 shift control solenoid (3)
    - Pressure control solenoid (4)
    - TCC PWM solenoid (5)
    - 3-2 control solenoid (6)
9. Install the 1-2 accumulator. Refer to **Accumulator Assembly, Spacer Plate, and Gaskets** .

cardiagn.com

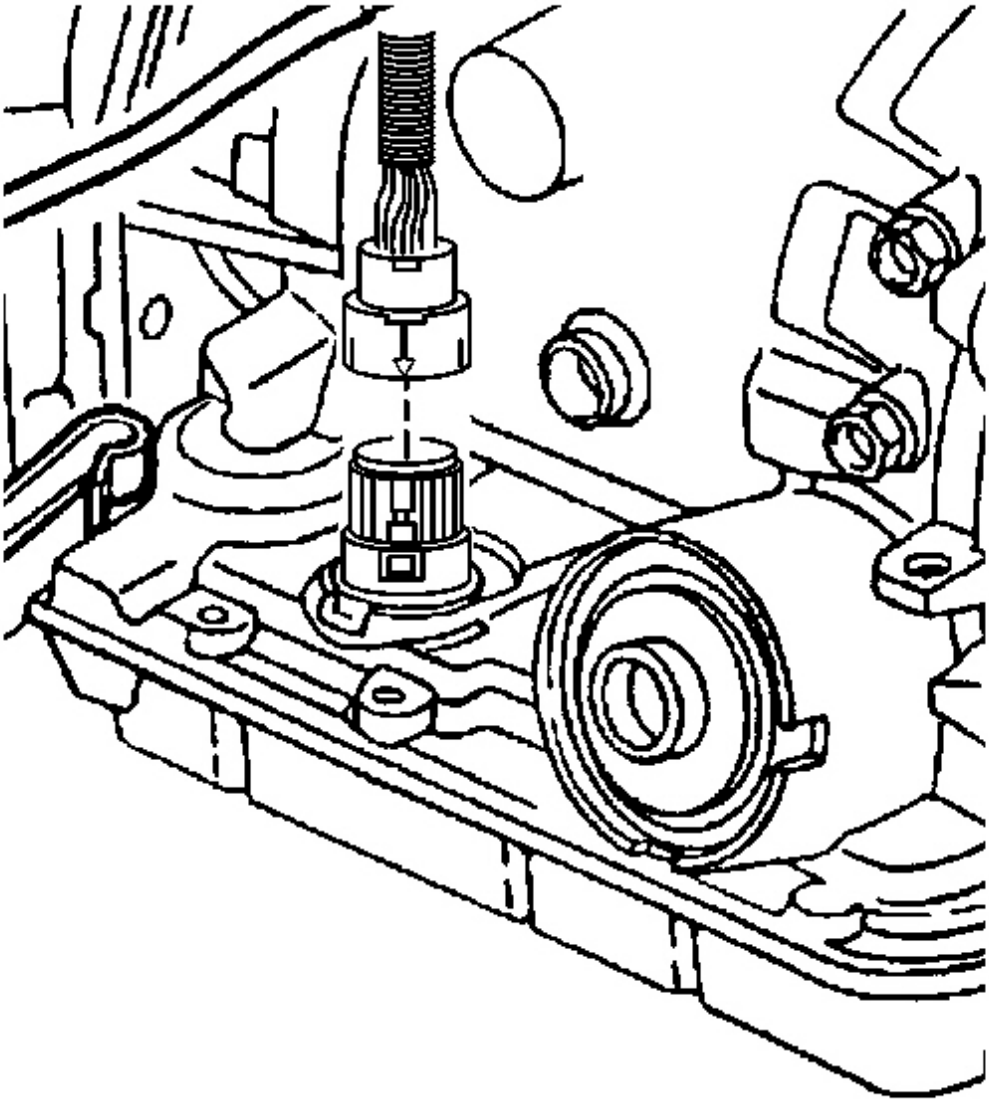


Fig. 169: Connecting The Transmission Harness 20-Way Connector
Courtesy of GENERAL MOTORS CORP.

10. Connect the transmission harness 20-way connector to the transmission pass-through connector.

    Align the arrows on each half of the connector and insert straight down.

11. Install the transmission oil pan and filter. Refer to **Automatic Transmission Fluid/Filter Replacement** .

cardiagn.com

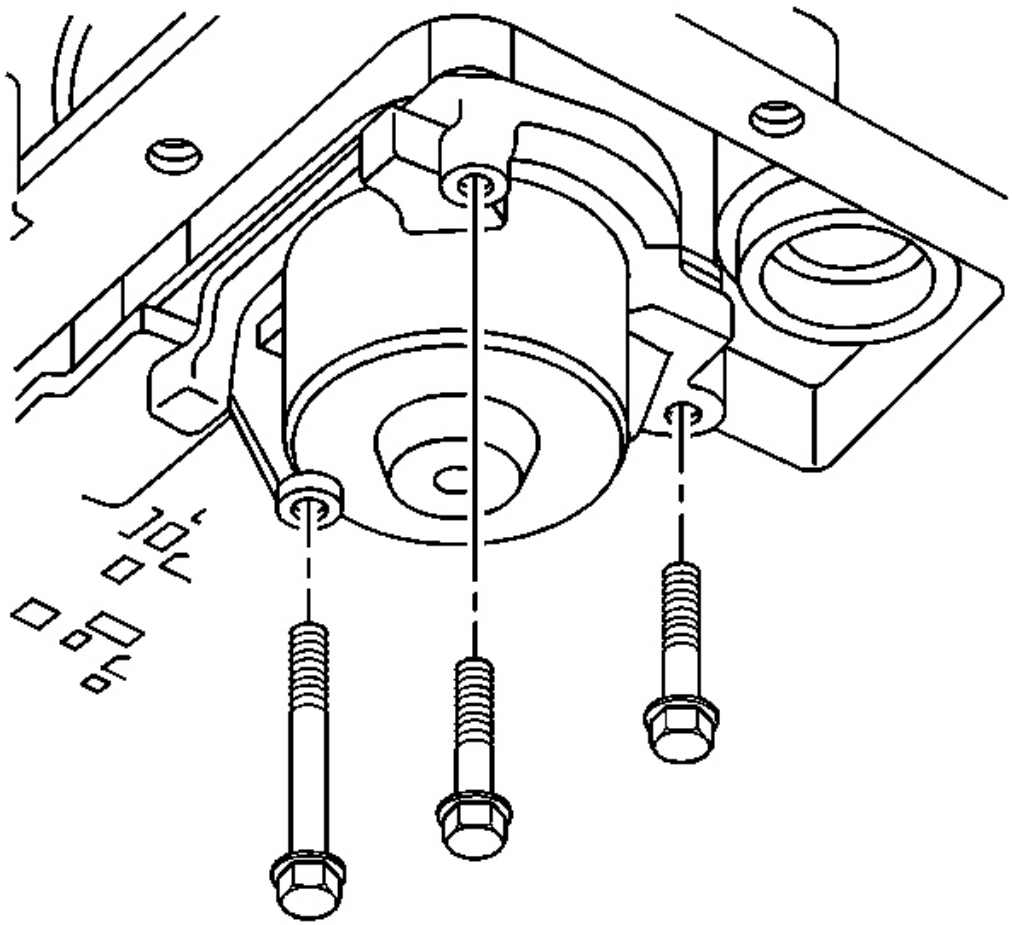
12. Lower the vehicle.
13. Fill the transmission to the proper level with DEXRON(R) III transmission fluid. Refer to **Transmission Fluid Checking Procedure** .

ACCUMULATOR ASSEMBLY, SPACER PLATE, AND GASKETS

Tools Required

- **J 25025-B** Pump and Valve Body Alignment Pin Set. See **Special Tools and Equipment** .
- **J 36850** Transjel Lubricant. See **Special Tools and Equipment** .

Removal Procedure



cardiagn.com

Fig. 170: Removing The 1-2 Accumulator Cover
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the transmission oil pan and filter. Refer to **Automatic Transmission Fluid/Filter Replacement** .

IMPORTANT: The 1-2 accumulator can be removed without removing the control valve assembly.

3. Remove the control valve body. Refer to **Valve Body and Pressure Switch Replacement** .
4. Remove the accumulator cover retaining bolts.
5. Remove the 1-2 accumulator cover assembly.

cardiagn.com

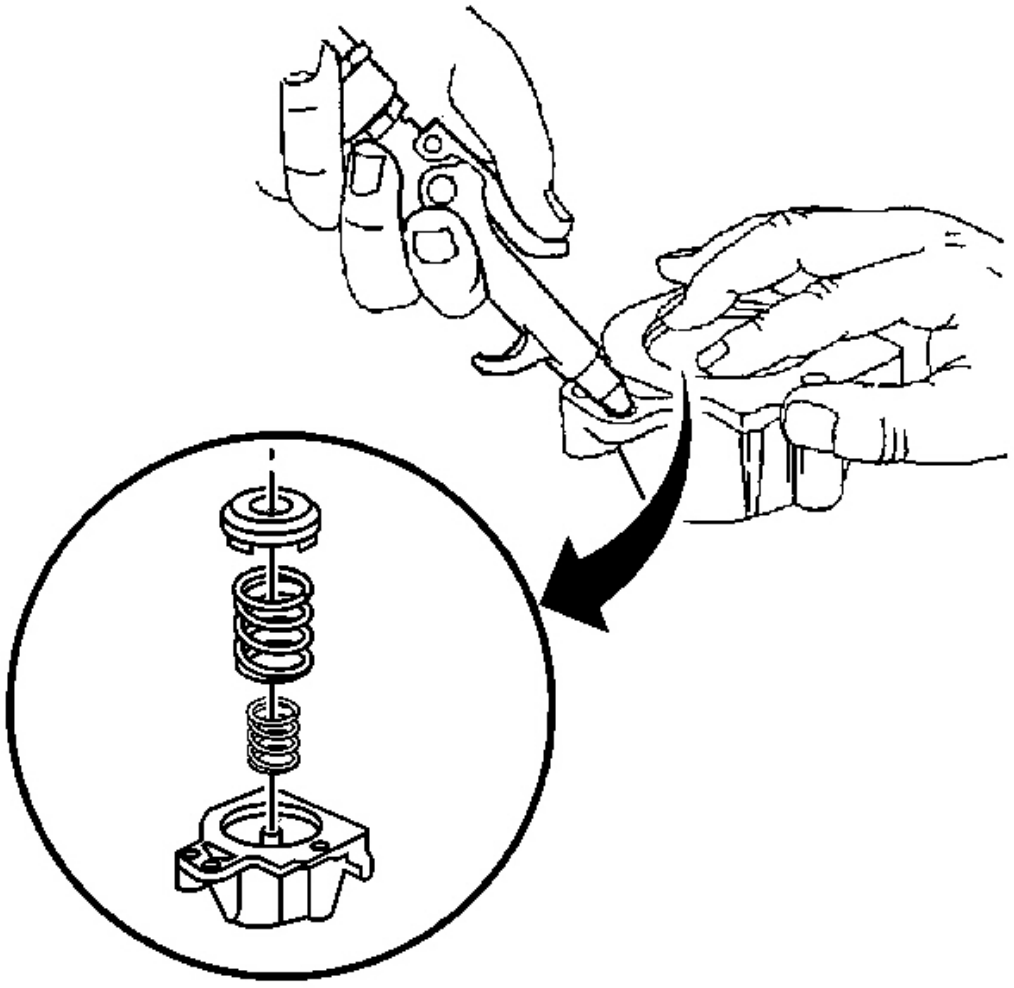


Fig. 171: Inspecting The 1-2 Accumulator Inner & Outer Springs For Cracks
Courtesy of GENERAL MOTORS CORP.

6. Disassemble the 1-2 accumulator.
    1. Blow compressed air into the 1-2 accumulator cover, as shown, to remove the 1-2 accumulator piston.
    2. Remove the 1-2 accumulator inner and outer springs.
7. Inspect the 1-2 accumulator inner and outer springs for cracks.

cardiagn.com

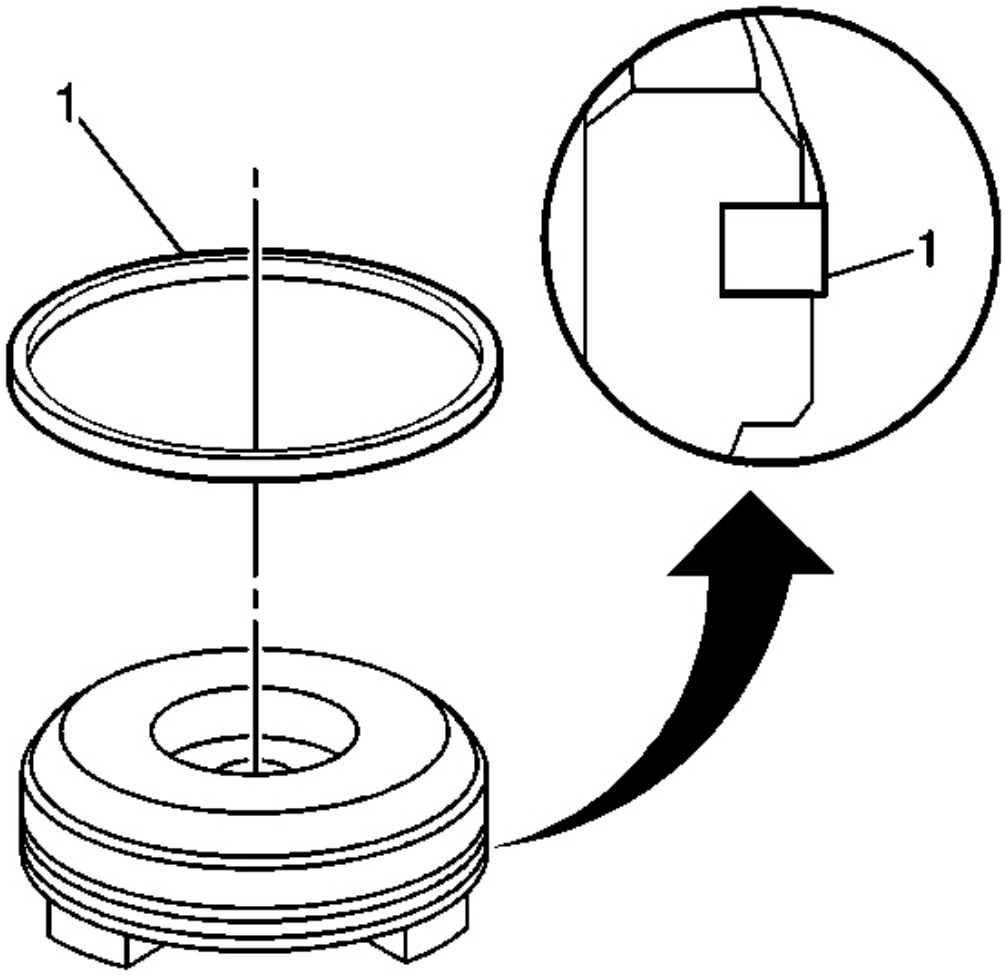


Fig. 172: Identifying Accumulator Piston Seal
Courtesy of GENERAL MOTORS CORP.

8. Remove the 1-2 accumulator piston seal (1) from the 1-2 accumulator piston.
9. Inspect the 1-2 accumulator piston for the following defects:
    - Porosity
    - Cracks
    - Scoring
    - Nicks and scratches

cardiagn.com

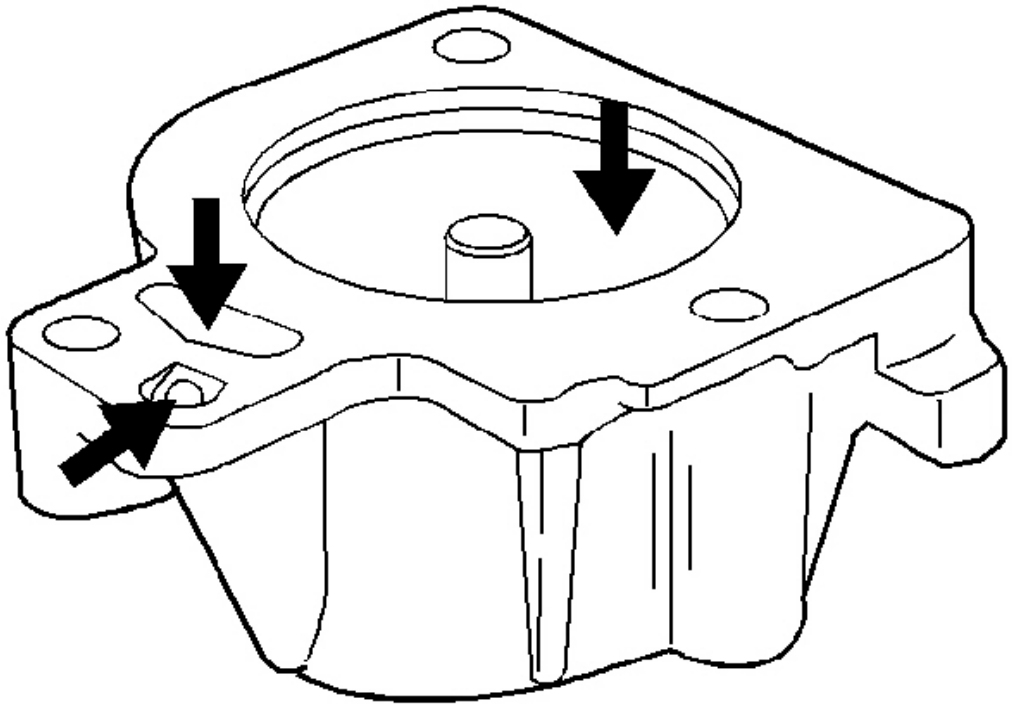


Fig. 173: Inspecting The 1-2 Accumulator Cover
Courtesy of GENERAL MOTORS CORP.

10. Inspect the 1-2 accumulator cover for the following defects:
    - Porosity
    - Cracks
    - Scoring
    - Nicks and scratches

cardiagn.com

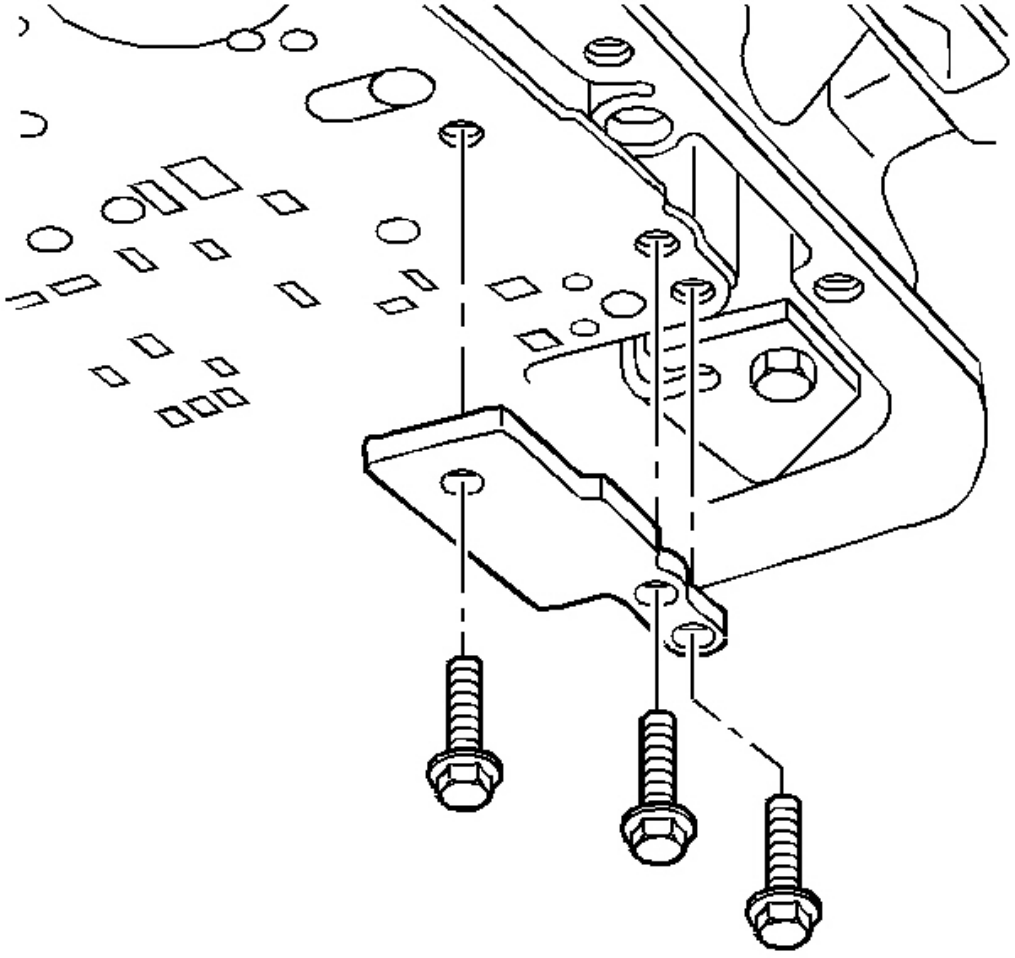


Fig. 174: Identifying Spacer Plate Support Bolts
Courtesy of GENERAL MOTORS CORP.

11. Remove the spacer plate support retaining bolts.

IMPORTANT: Use care not to drop the following items that will be removed along with the spacer plate:

- **The number 1 checkball**
- **The 3-4 accumulator spring**
- **The 3-4 accumulator pin**

cardiagn.com

12. Remove the spacer plate support.

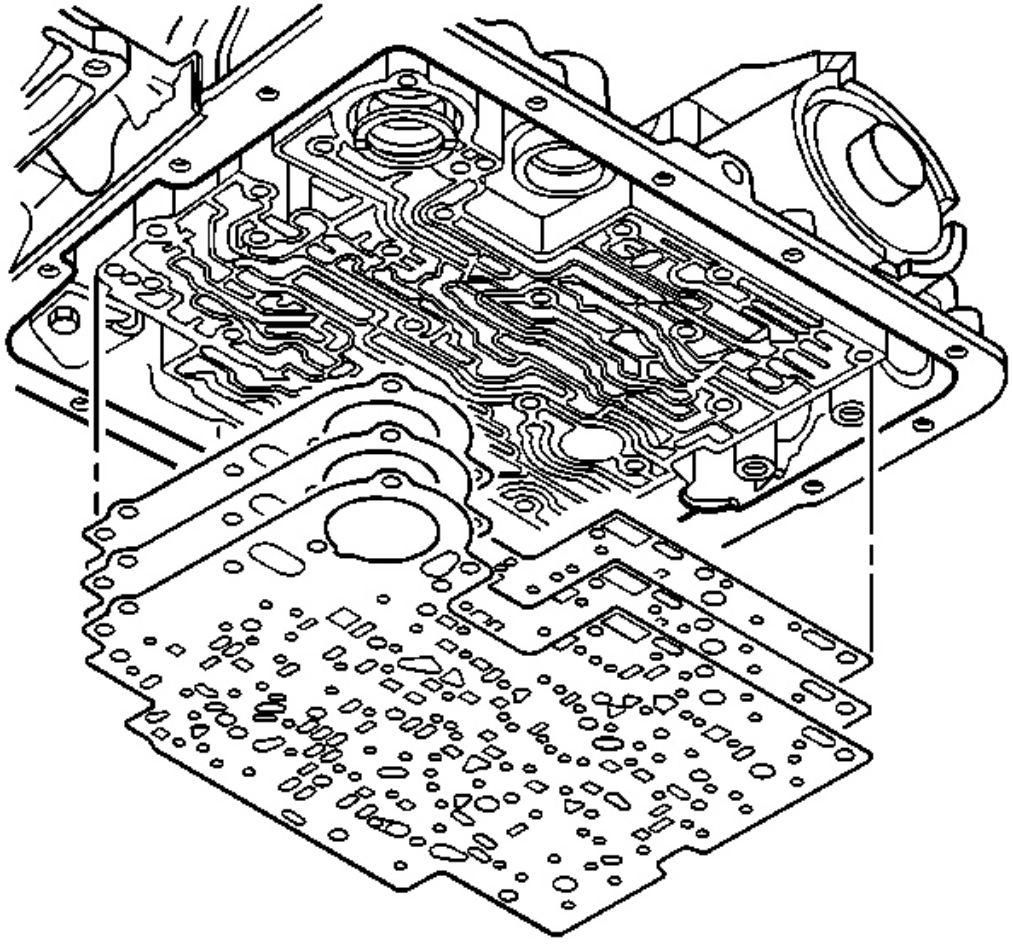


Fig. 175: Spacer Plate To Valve Body Gasket & Spacer Plate And The Spacer Plate To Transmission Case Gasket
Courtesy of GENERAL MOTORS CORP.

13. Remove the spacer plate to valve body gasket, the spacer plate and the spacer plate to transmission case gasket.

cardiagn.com

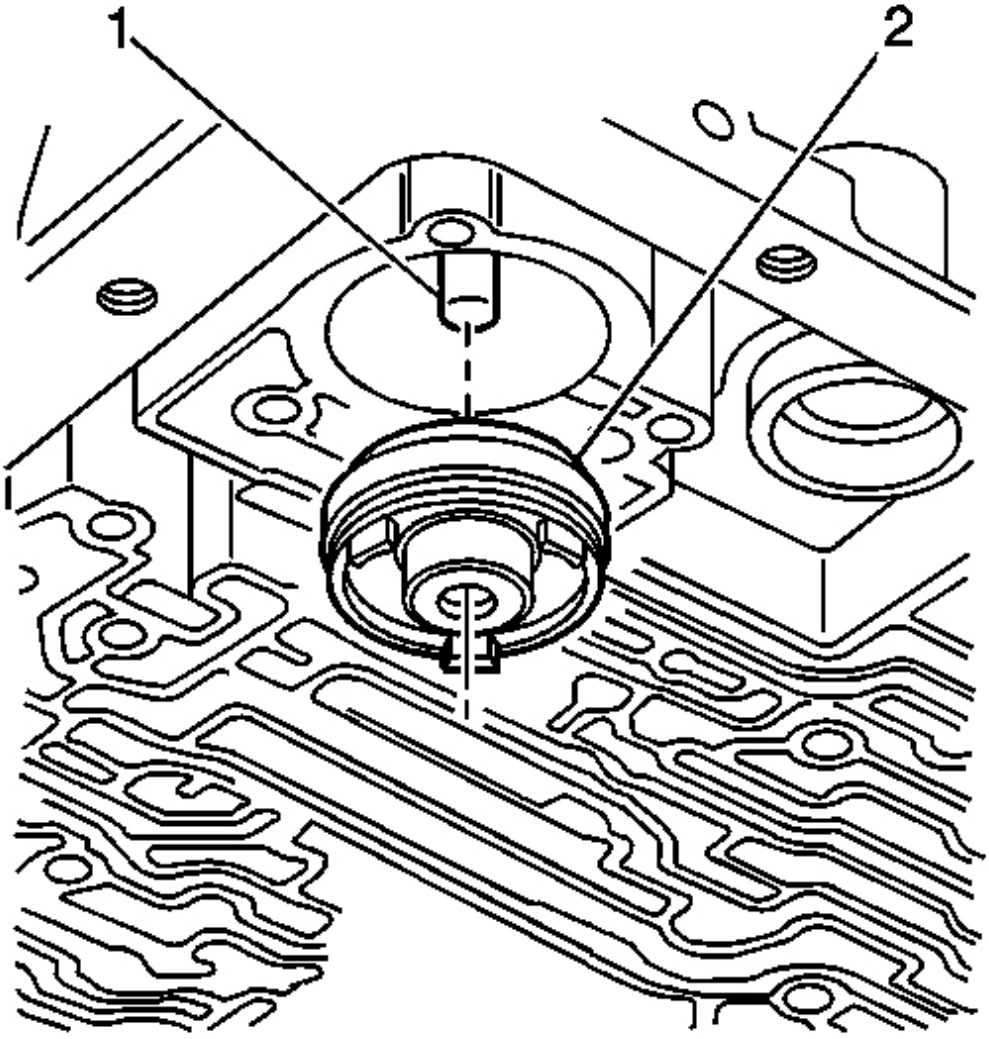


Fig. 176: Identifying 3-4 Accumulator Piston
Courtesy of GENERAL MOTORS CORP.

14. Remove the 3-4 accumulator piston (2).
15. Inspect the 3-4 accumulator spring for cracks.

cardiagn.com

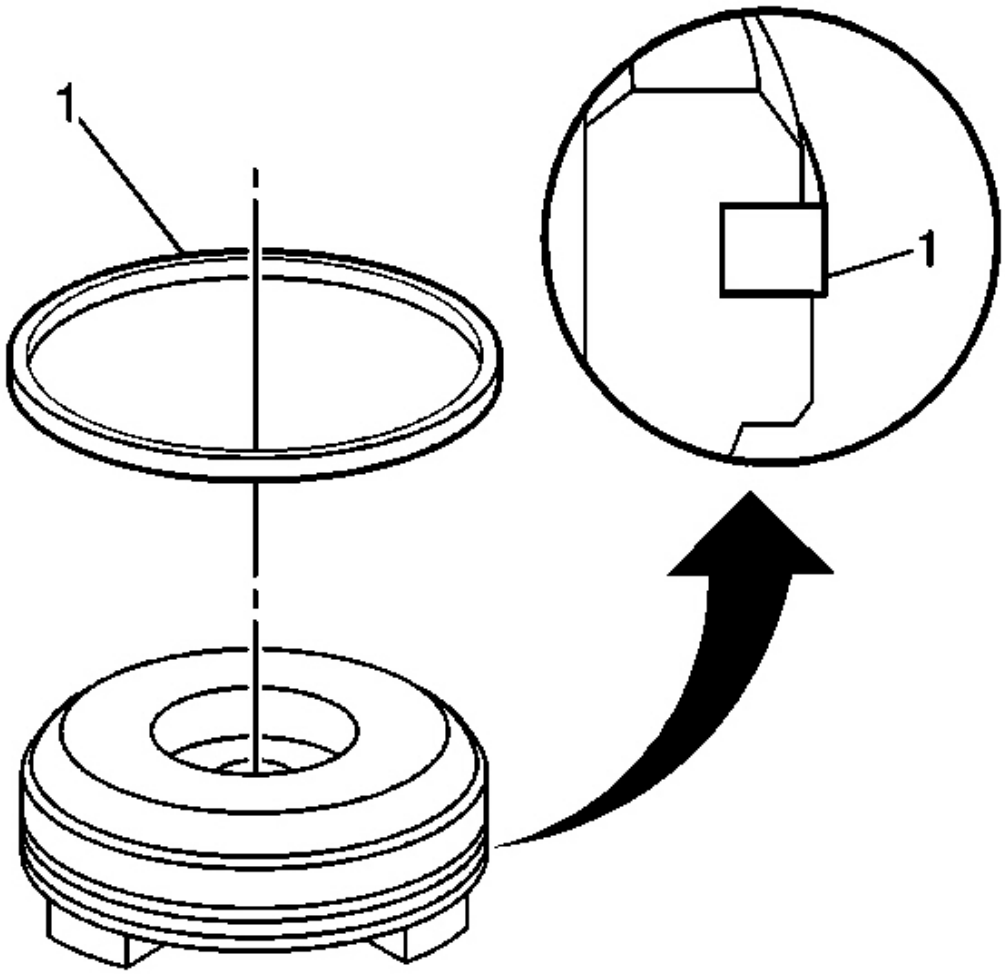


Fig. 177: Identifying Accumulator Piston Seal
Courtesy of GENERAL MOTORS CORP.

16. Remove the 3-4 accumulator piston seal (1) from the 3-4 accumulator piston.
17. Inspect the 3-4 accumulator piston for the following defects:
    - Porosity
    - Cracks
    - Scoring
    - Nicks and scratches

Installation Procedure

cardiagn.com

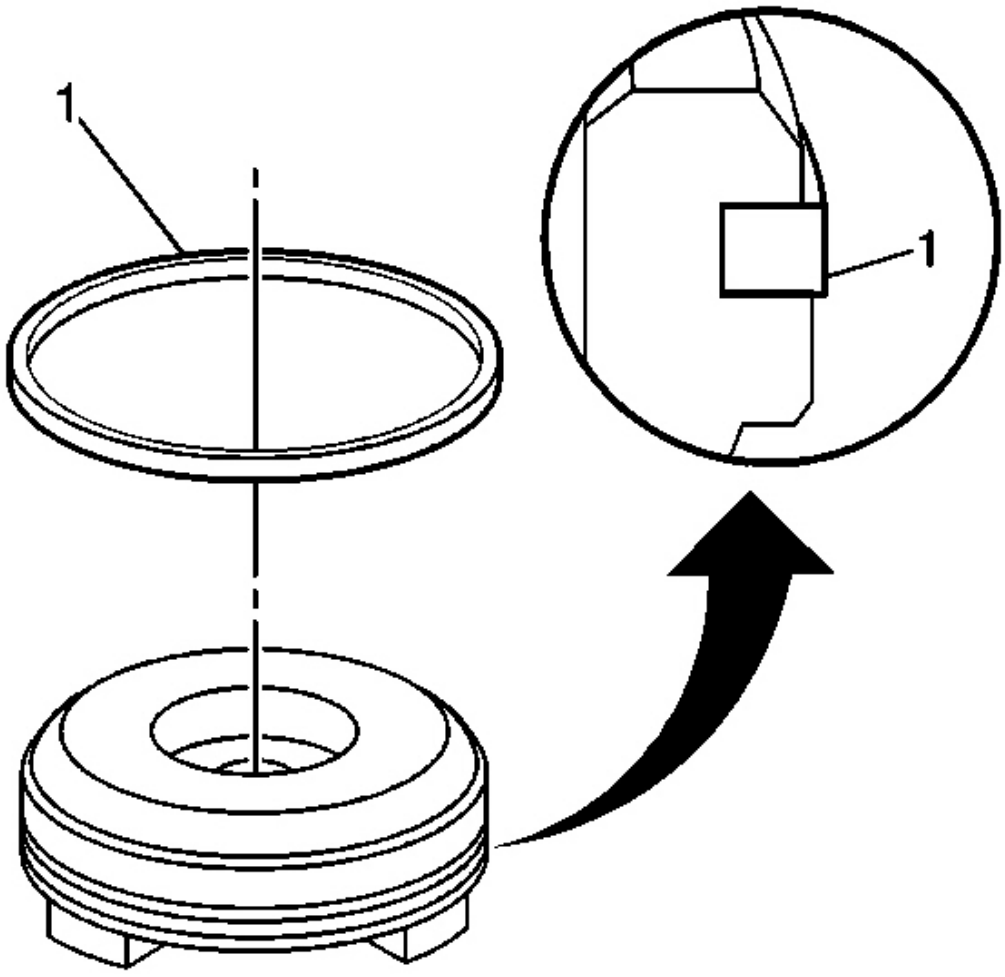


Fig. 178: Identifying Accumulator Piston Seal
Courtesy of GENERAL MOTORS CORP.

1. Install a new 3-4 accumulator piston seal (1) to the 3-4 accumulator piston.

cardiagn.com

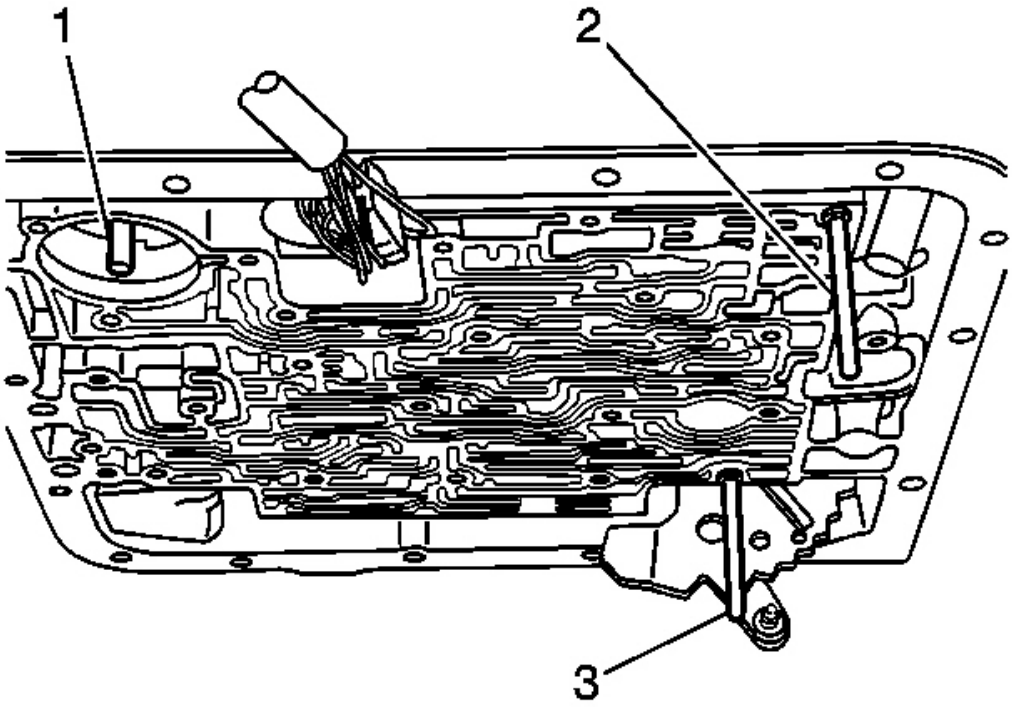


Fig. 179: Installing The 3-4 Accumulator Pin Into The Transmission Case
Courtesy of GENERAL MOTORS CORP.

2. Install the 3-4 accumulator pin (1) into the transmission case and retain the pin with **J 36850** . See **Special Tools and Equipment** .

cardiagn.com

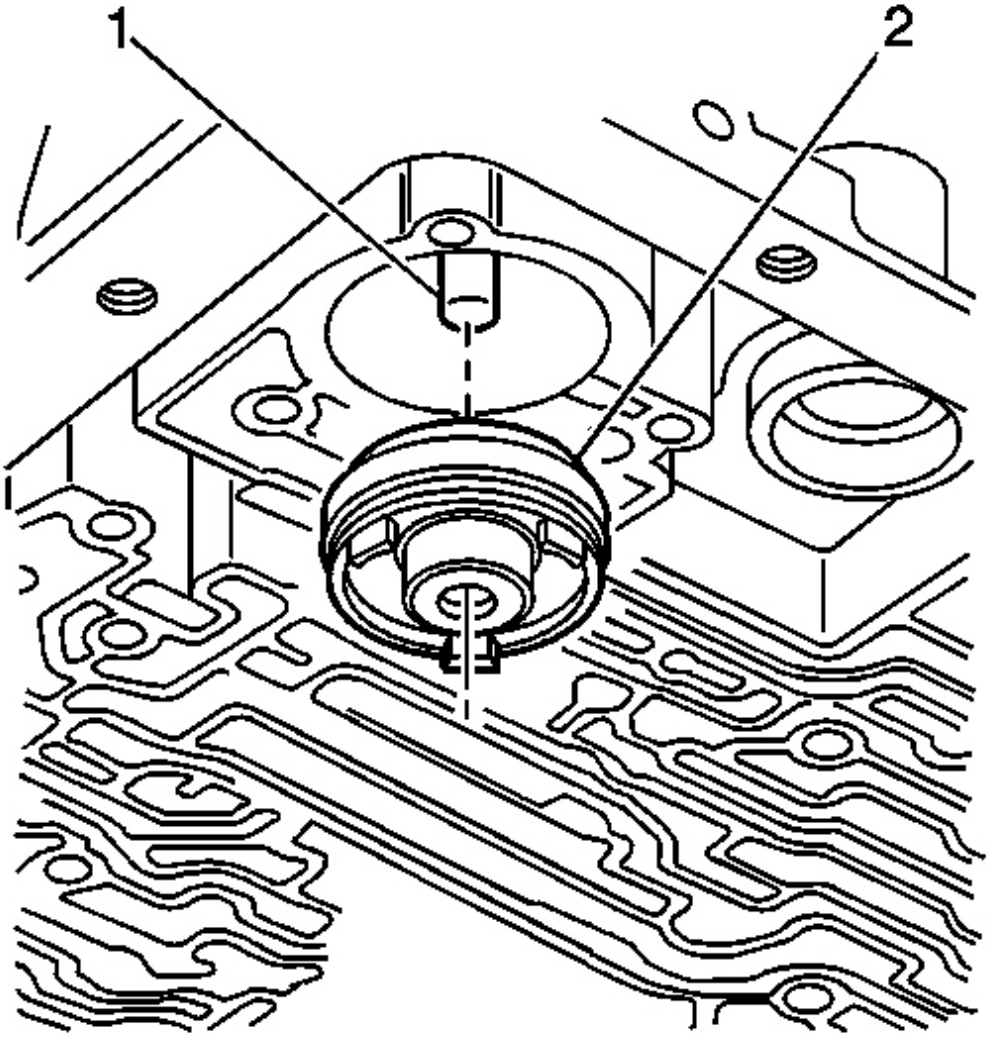


Fig. 180: Identifying 3-4 Accumulator Piston
Courtesy of GENERAL MOTORS CORP.

3. Install the 3-4 accumulator piston (2) onto the pin (1) in the transmission case.

   Ensure that the 3-4 accumulator piston legs face away from the transmission case.

cardiagn.com

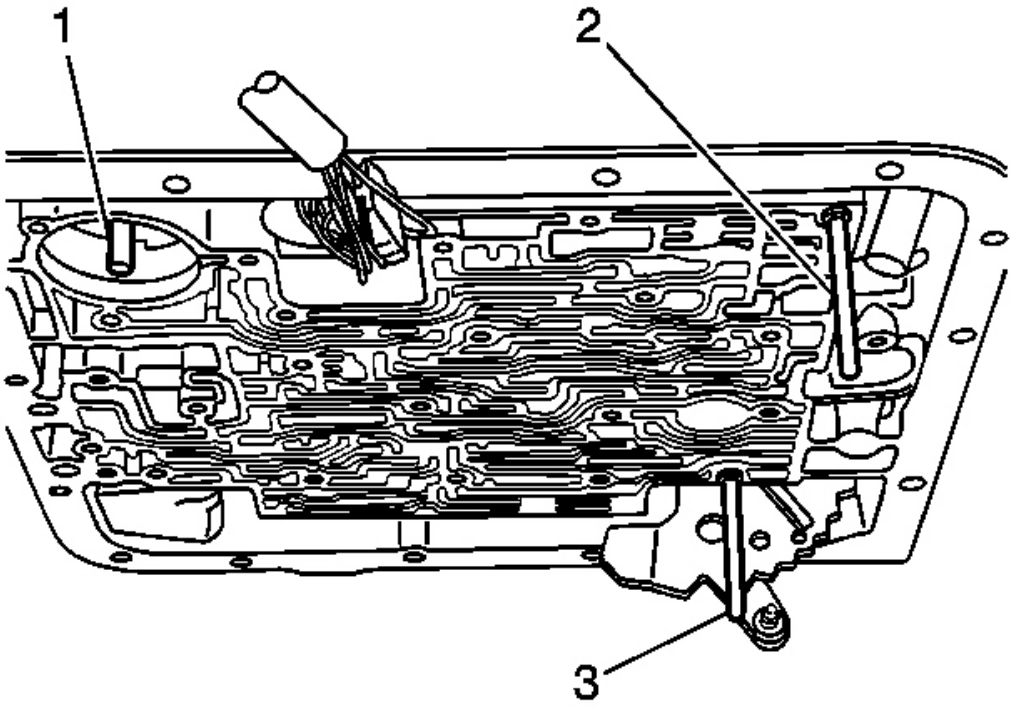


Fig. 181: Installing The 3-4 Accumulator Pin Into The Transmission Case
Courtesy of GENERAL MOTORS CORP.

4. Install the **J 25025-B** (2, 3) to the transmission case. See **Special Tools and Equipment** .

cardiagn.com

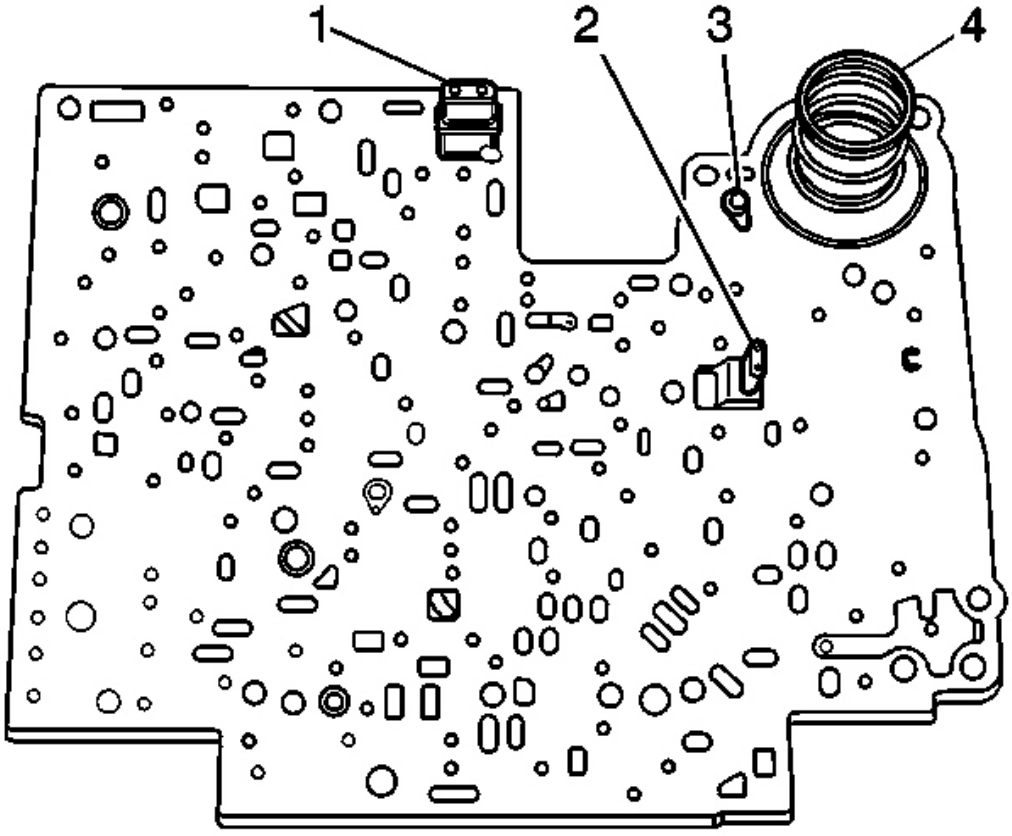


Fig. 182: Installing Spacer Plate Components
Courtesy of GENERAL MOTORS CORP.

5. Install the spacer plate to transmission case gasket and the spacer plate to valve body gasket to the spacer plate; use **J 36850** in order to retain the gaskets to the spacer plate. See **Special Tools and Equipment** .
   - The case gasket is identified by a C.

     Be sure to place the case gasket on the transmission case side of the spacer plate.

   - The valve body gasket is identified by a V.

     Be sure to place the valve body gasket on the valve body side of the spacer plate.

6. Ensure that the solenoid screens (1, 2) are in place on the spacer plate.
7. Place the checkball (3) on the spacer plate in the location shown.
8. Place the 3-4 accumulator spring (4) on the spacer plate.

cardiagn.com

9. Install the spacer plate and related components to the transmission.

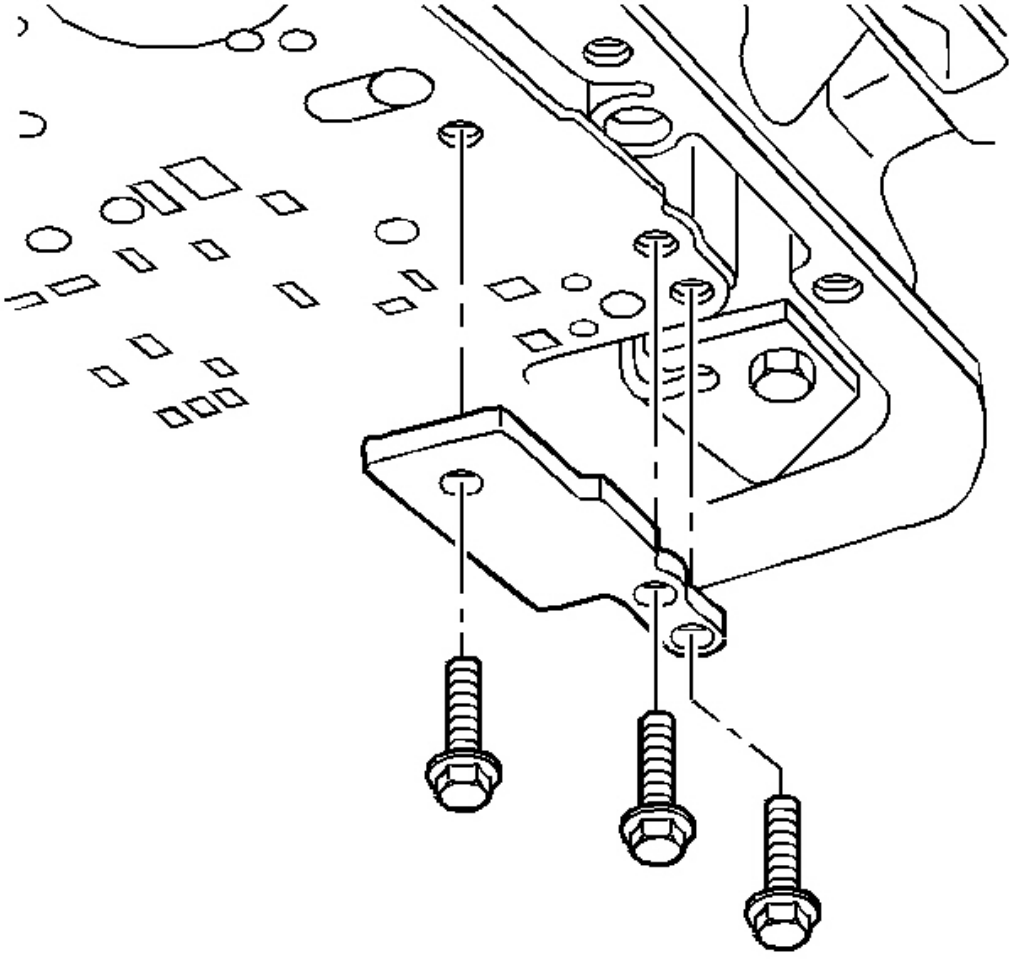


Fig. 183: Identifying Spacer Plate Support Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

10. Install the spacer plate support and the spacer plate support retaining bolts.

    Tighten: Tighten the spacer plate support retaining bolts to 11 N.m (97 lb in).

cardiagn.com

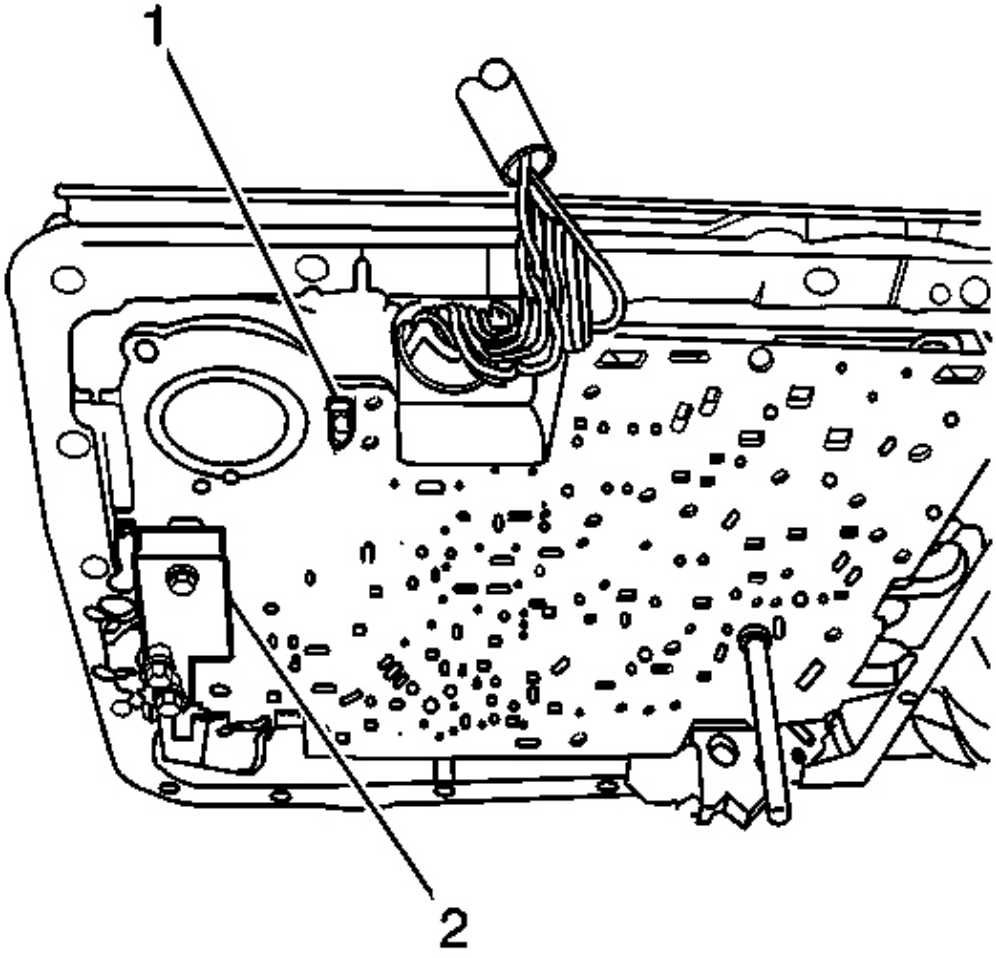


Fig. 184: Ensuring Checkball Has Remained In The Proper Location
Courtesy of GENERAL MOTORS CORP.

11. After installing the spacer plate support (2), look through the hole in the spacer plate to ensure that the checkball (1) has remained in the proper location.

cardiagn.com

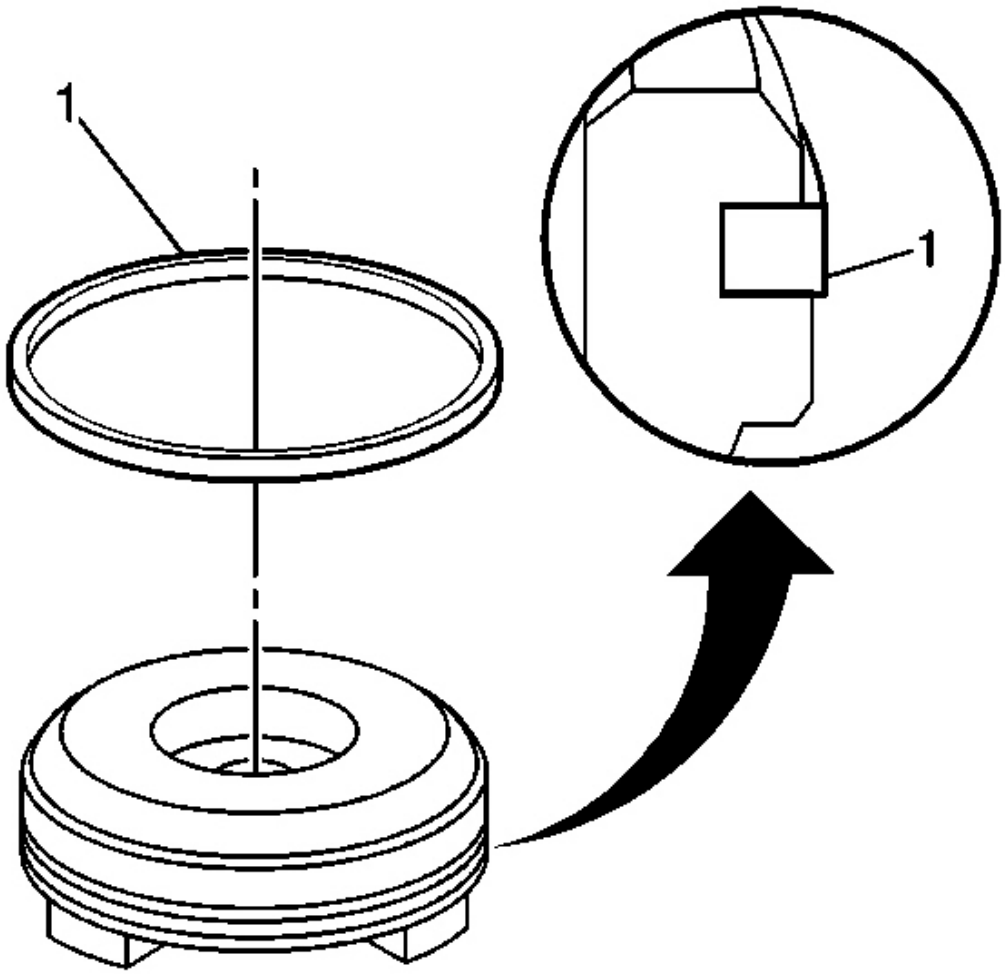


Fig. 185: Identifying Accumulator Piston Seal
Courtesy of GENERAL MOTORS CORP.

12. Install a new 1-2 accumulator piston seal (1) to the 1-2 accumulator piston.

cardiagn.com

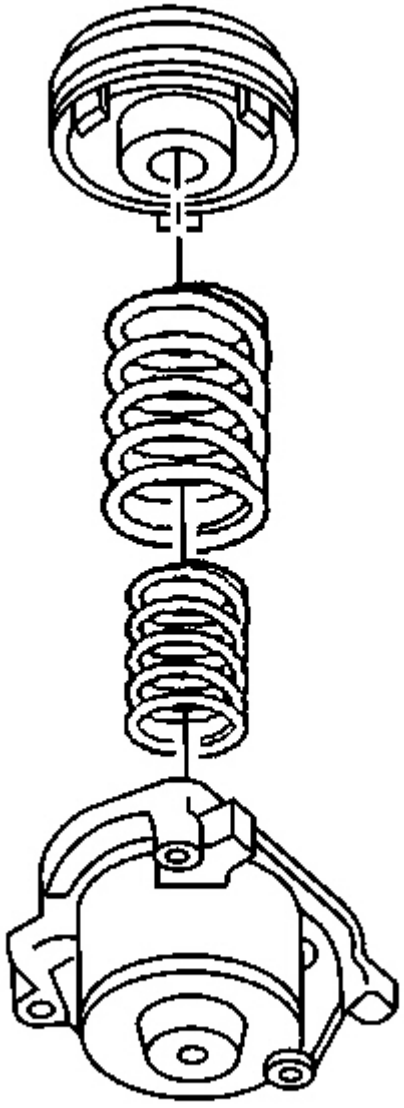


Fig. 186: 1-2 Accumulator Inner & Outer Springs
Courtesy of GENERAL MOTORS CORP.

13. Install the 1-2 accumulator inner and outer springs to the 1-2 accumulator cover.
14. Install the 1-2 accumulator piston onto the pin in the 1-2 accumulator cover.

    Ensure that the piston legs face the accumulator cover.

cardiagn.com

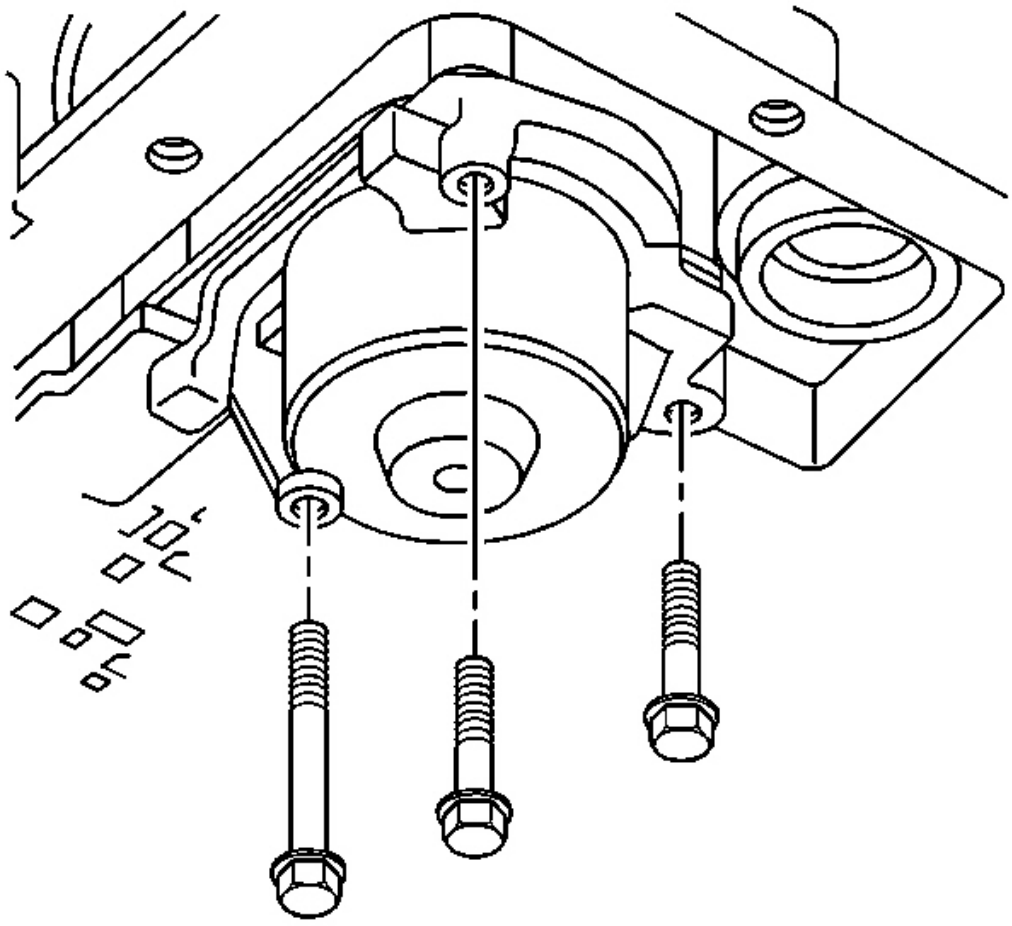


Fig. 187: Removing The 1-2 Accumulator Cover
Courtesy of GENERAL MOTORS CORP.

15. Install the 1-2 accumulator cover and the accumulator cover retaining bolts.

    Tighten: Tighten the accumulator cover retaining bolts to 11 N.m (97 lb in).

16. Remove the **J 25025-B** from the transmission case. See **Special Tools and Equipment** .
17. Install the control valve body. Refer to **Valve Body and Pressure Switch Replacement** .
18. Install the transmission oil pan and filter. Refer to **Automatic Transmission Fluid/Filter Replacement** .
19. Lower the vehicle.
20. Fill the transmission to the proper level with DEXRON(R) III transmission fluid. Refer to **Transmission Fluid Checking Procedure** .

cardiagn.com

FLEXPLATE TO TORQUE CONVERTER BOLTS

Tools Required

J 42386-A Flywheel Holding Tool

Removal Procedure

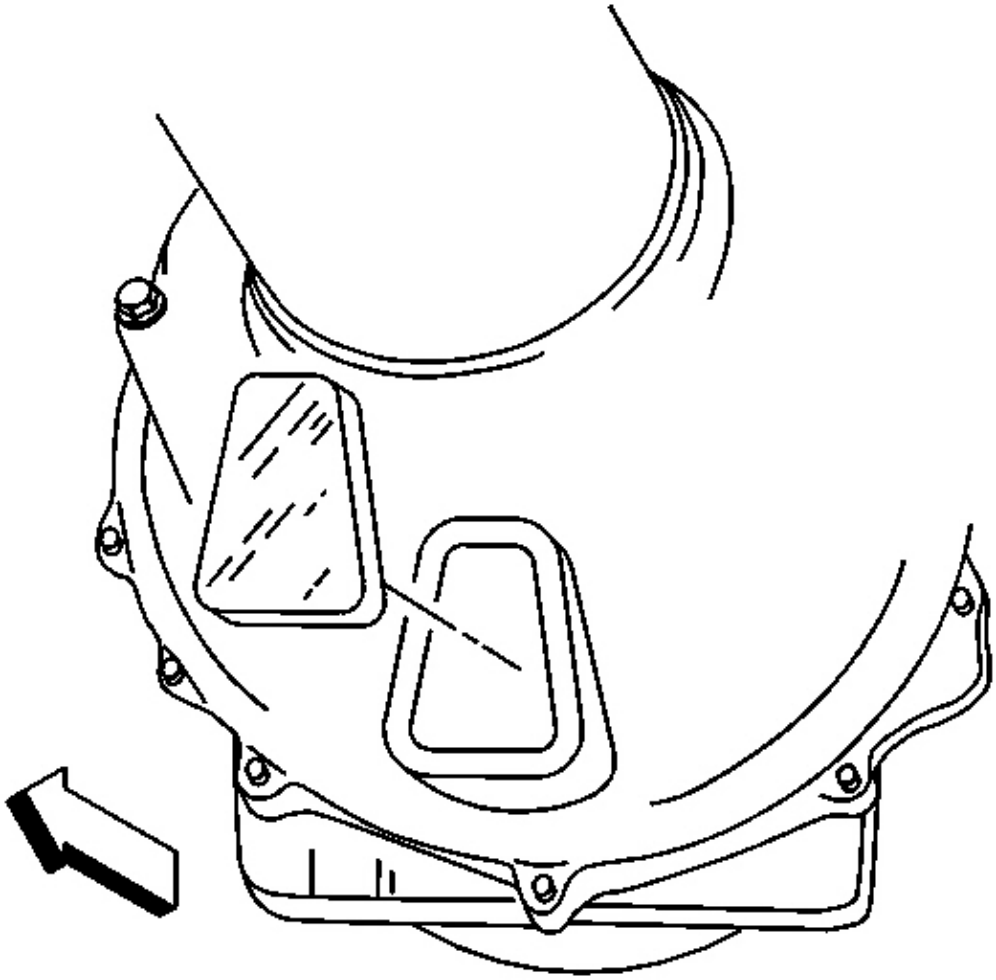


Fig. 188: Driveline Support Assembly Access Plug
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

cardiagn.com

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Remove the catalytic converter assembly. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
4. Remove the starter motor. Refer to **Starter Motor Replacement** in Engine Electrical.
5. Using a flat bladed screwdriver, remove the access plug from the driveline support assembly.

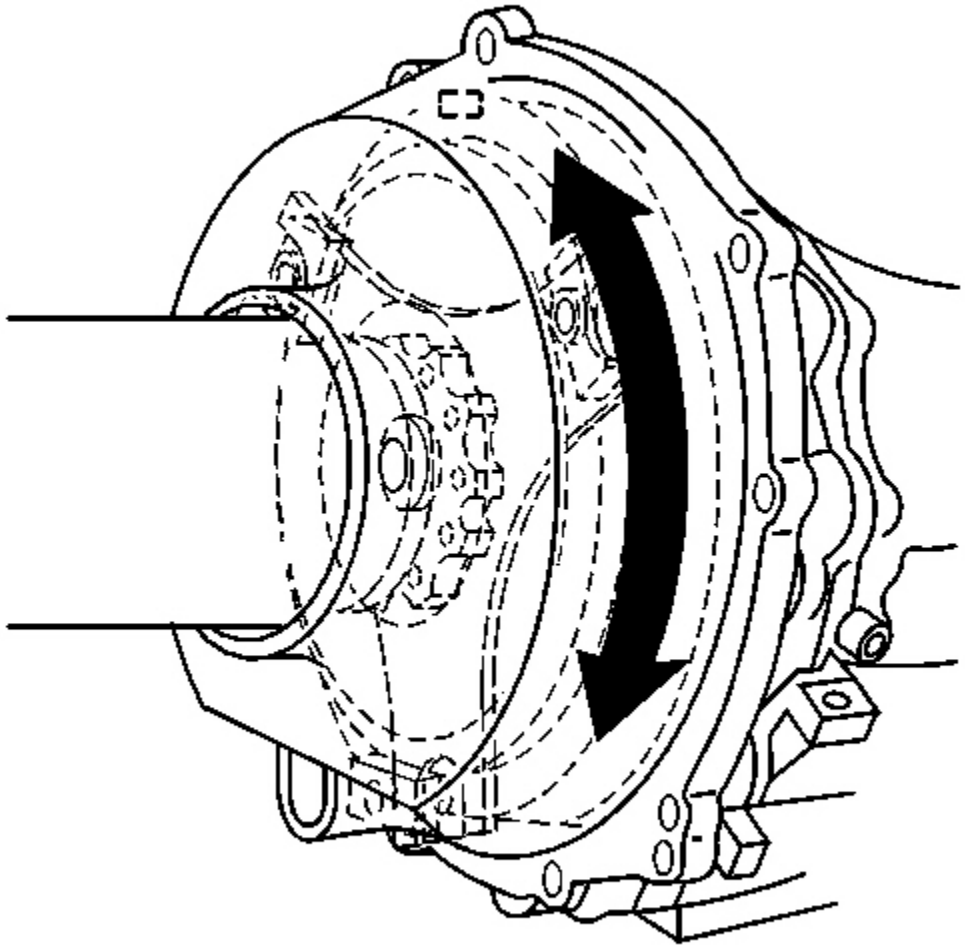


Fig. 189: Engine Flywheel & Flexplate
Courtesy of GENERAL MOTORS CORP.

cardiagn.com

6. Matchmark the transmission flexplate to the transmission torque converter through the access hole.

   It may be helpful to have an assistant for the remaining steps.

7. Turn the engine flywheel through the starter motor opening until one of the flexplate to torque converter bolts lines up with the access hole.

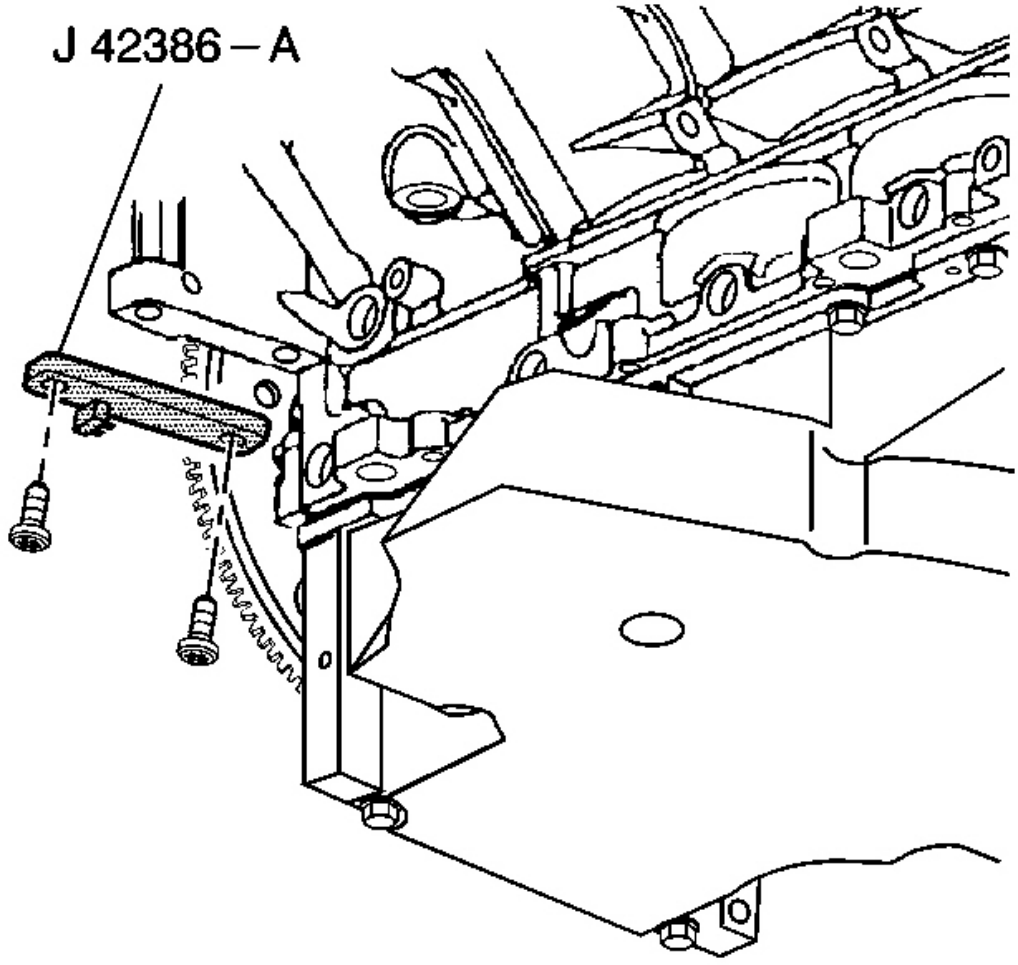


Fig. 190: J 42386-A & Engine Flywheel
Courtesy of GENERAL MOTORS CORP.

8. Install the **J 42386-A** to the engine flywheel, in order to keep the flywheel from turning.

cardiagn.com

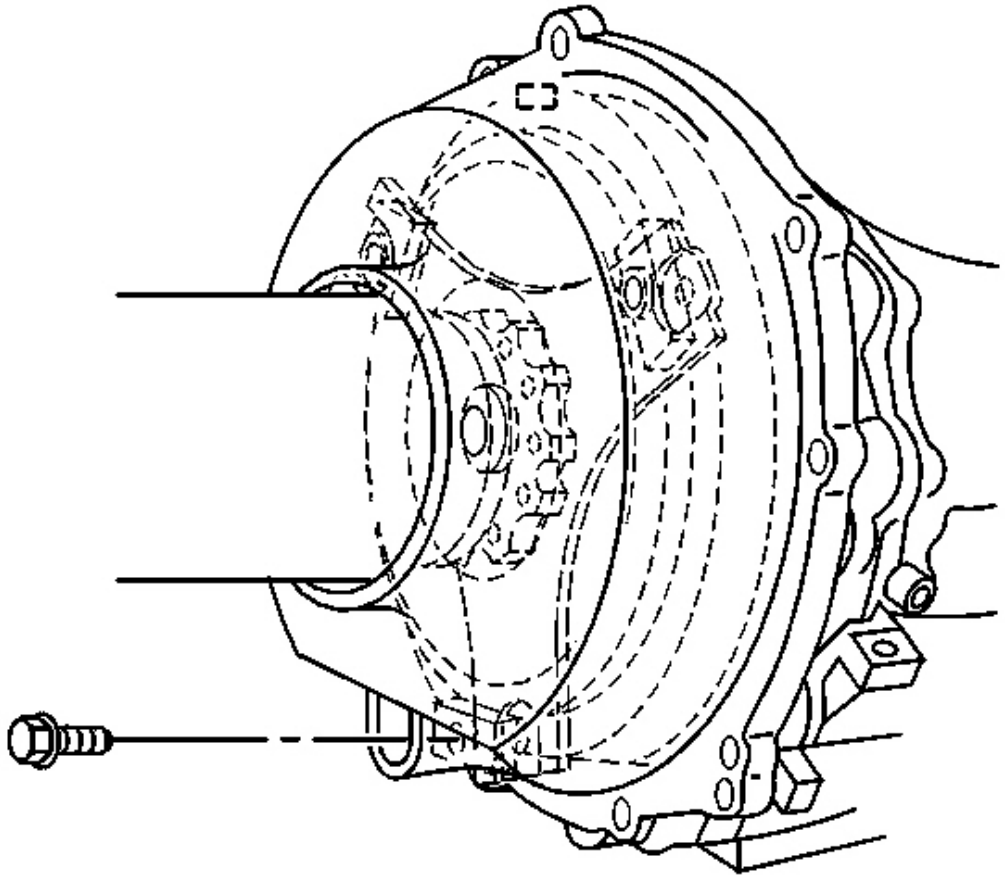


Fig. 191: Flexplate & Torque Converter Bolt
Courtesy of GENERAL MOTORS CORP.

9. Remove the flexplate to torque converter bolt.
10. Remove the **J 42386-A** .
11. Repeat steps 7 through 10 to remove the 2 remaining bolts.

Installation Procedure

cardiagn.com

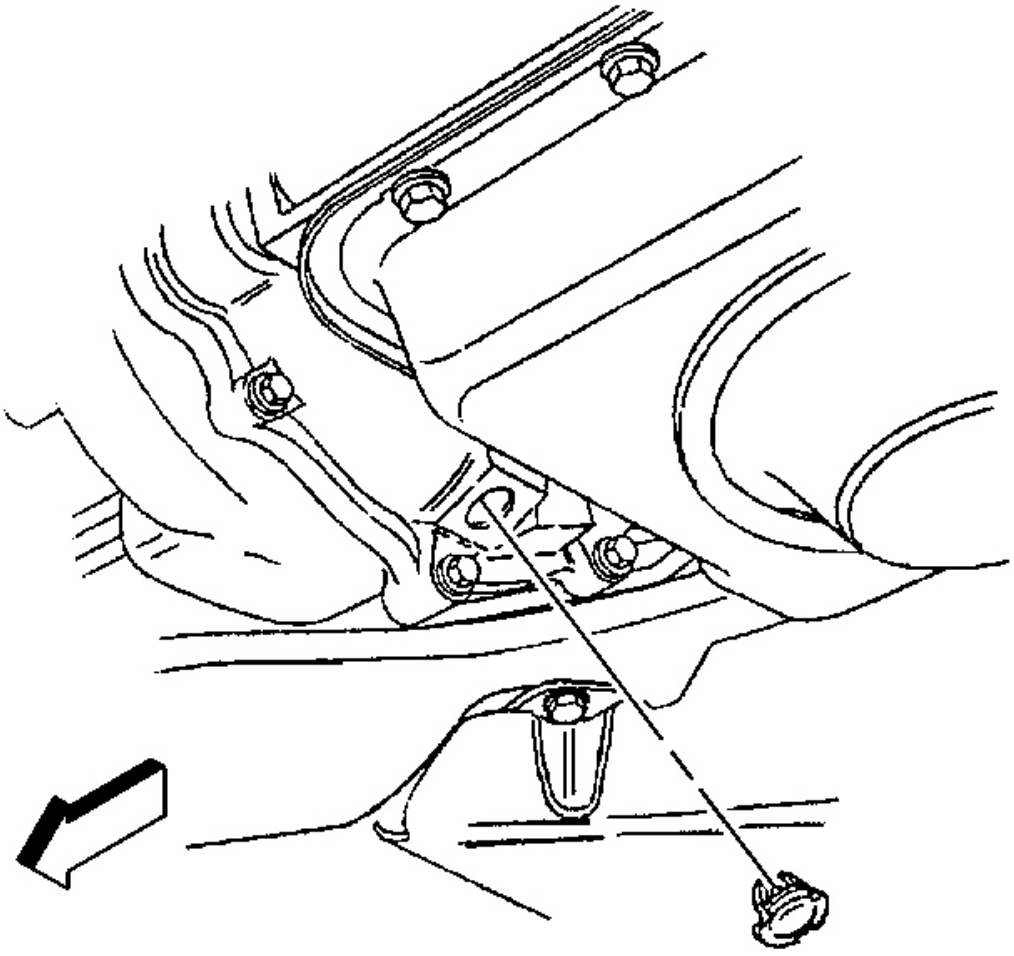


Fig. 192: Transmission Torque Converter Access Plug
Courtesy of GENERAL MOTORS CORP.

1. Using a flat bladed screwdriver, remove the transmission torque converter access plug.

cardiagn.com

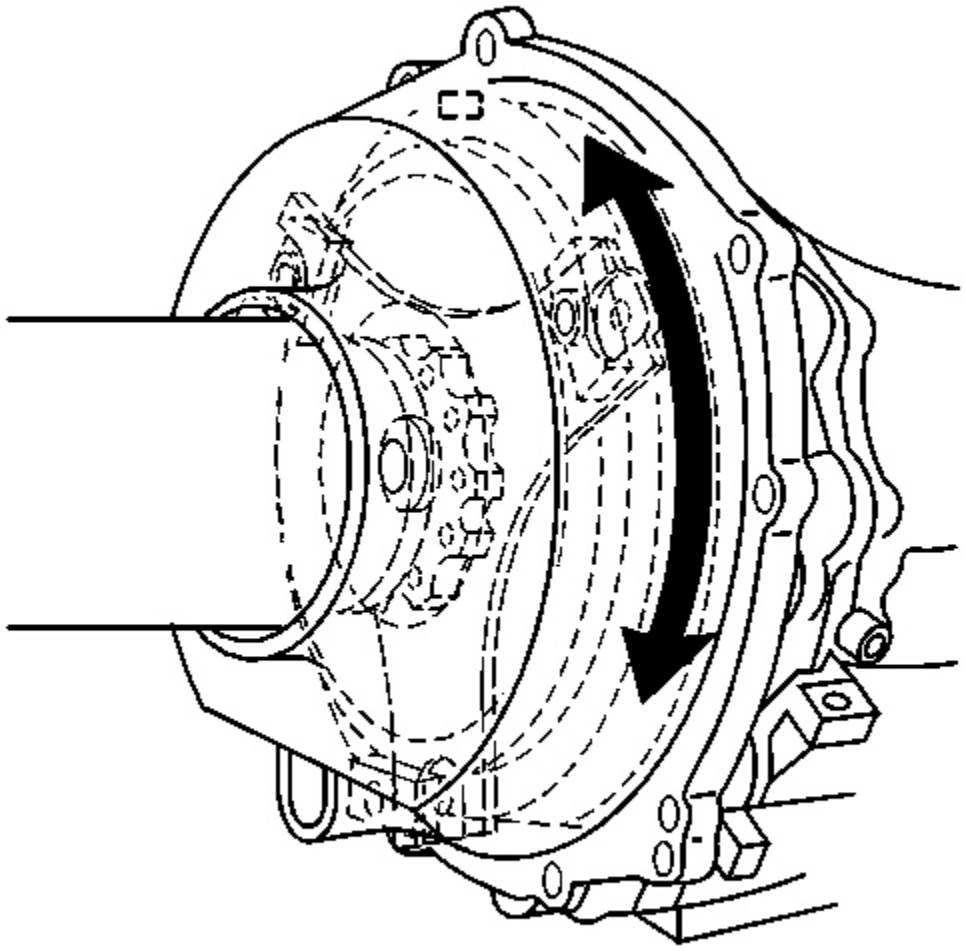


Fig. 193: Torque Converter Bolt Holes & Driveline Support Assembly Access Hole
Courtesy of GENERAL MOTORS CORP.

2. Align one of the torque converter bolt holes with the driveline support assembly access hole, if necessary.

   Carefully rotate the torque converter, working through the access holes in the rear bellhousing and the transmission housing.

cardiagn.com

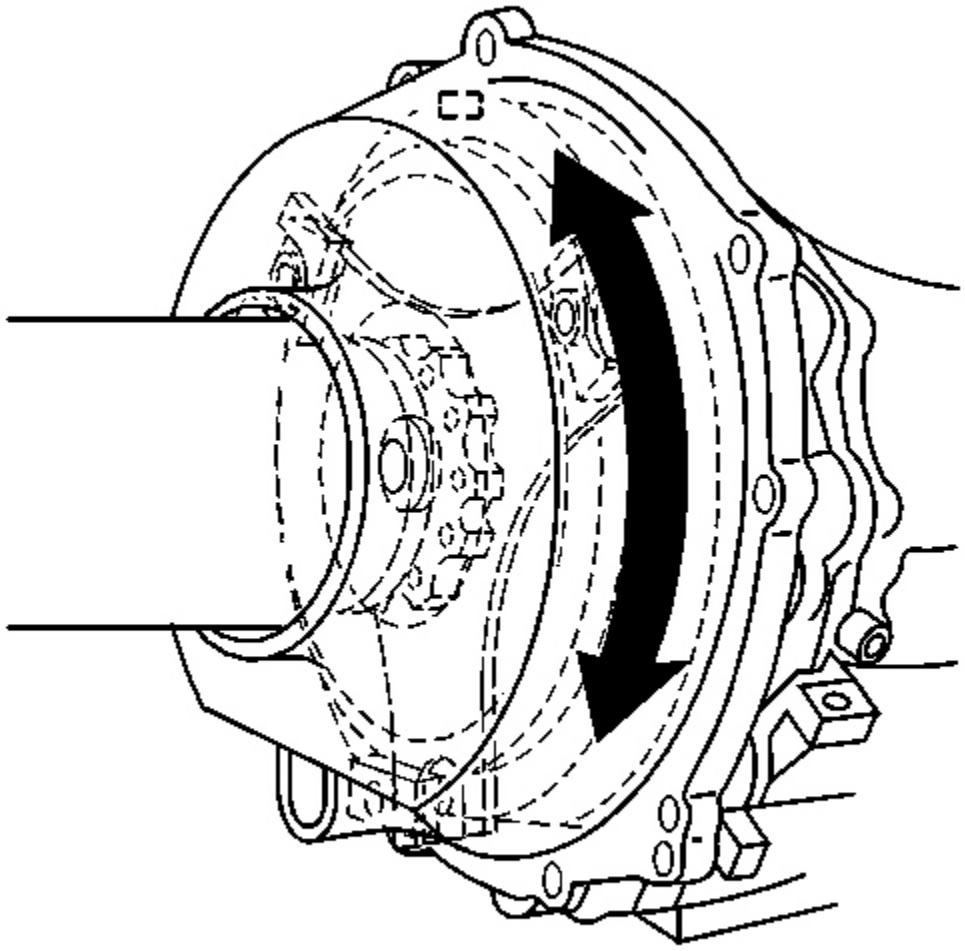


Fig. 194: Engine Flywheel & Flexplate
Courtesy of GENERAL MOTORS CORP.

3. Align one of the flexplate bolt holes with the driveline support assembly access hole, if necessary.
    1. Remove the **J 42386-A** from the engine flywheel.
    2. Slowly turn the engine flywheel through the starter motor opening until the desired flexplate bolt hole lines up with the torque converter bolt hole.
    3. Install the **J 42386-A** to the engine flywheel, in order to keep the flywheel from turning.

cardiagn.com

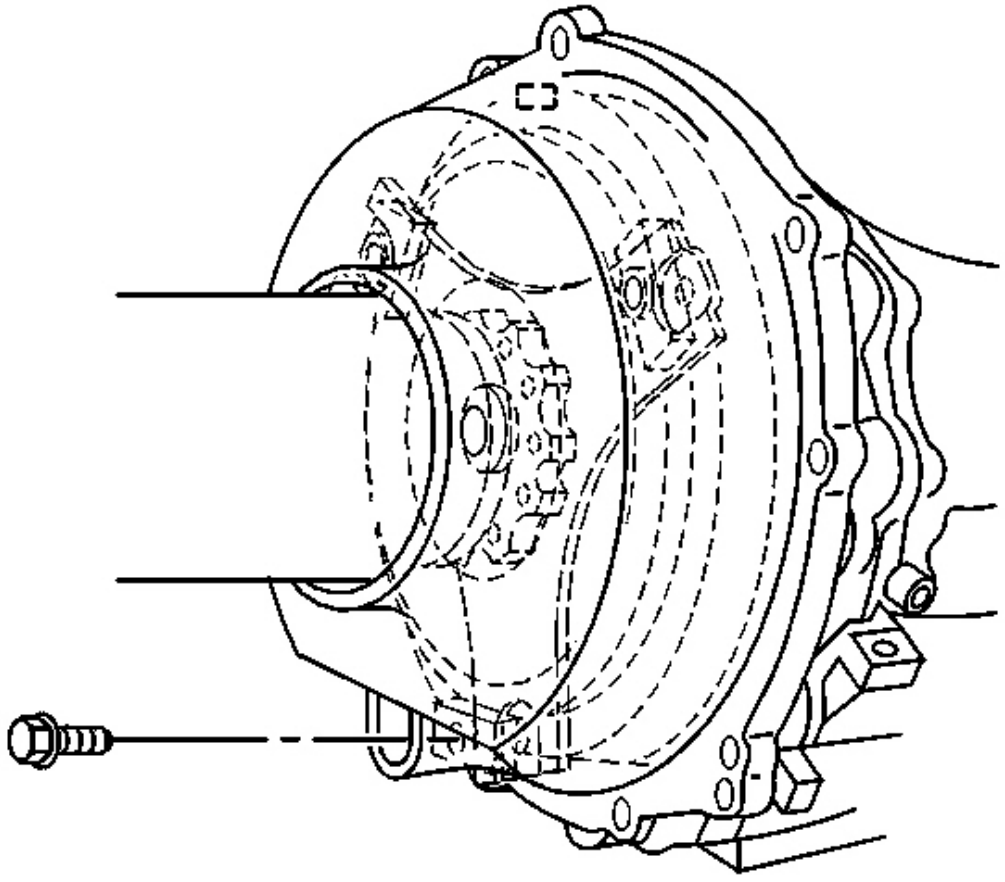


Fig. 195: Flexplate & Torque Converter Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT: HAND-START the flexplate to torque converter bolts before torquing to ensure proper alignment and to avoid cross threading.

IMPORTANT: Carefully WALK the transmission torque converter to the transmission flywheel through the torque converter access plug opening, if necessary. DO NOT use the bolts to draw the torque converter to the flexplate.

4. Install the flexplate to torque converter bolt through the driveline support assembly access hole.

cardiagn.com

HAND-TIGHTEN until FINGER-TIGHT, then torque to specification.

Tighten: Tighten the flexplate to torque converter bolt to 63 N.m (47 lb ft).

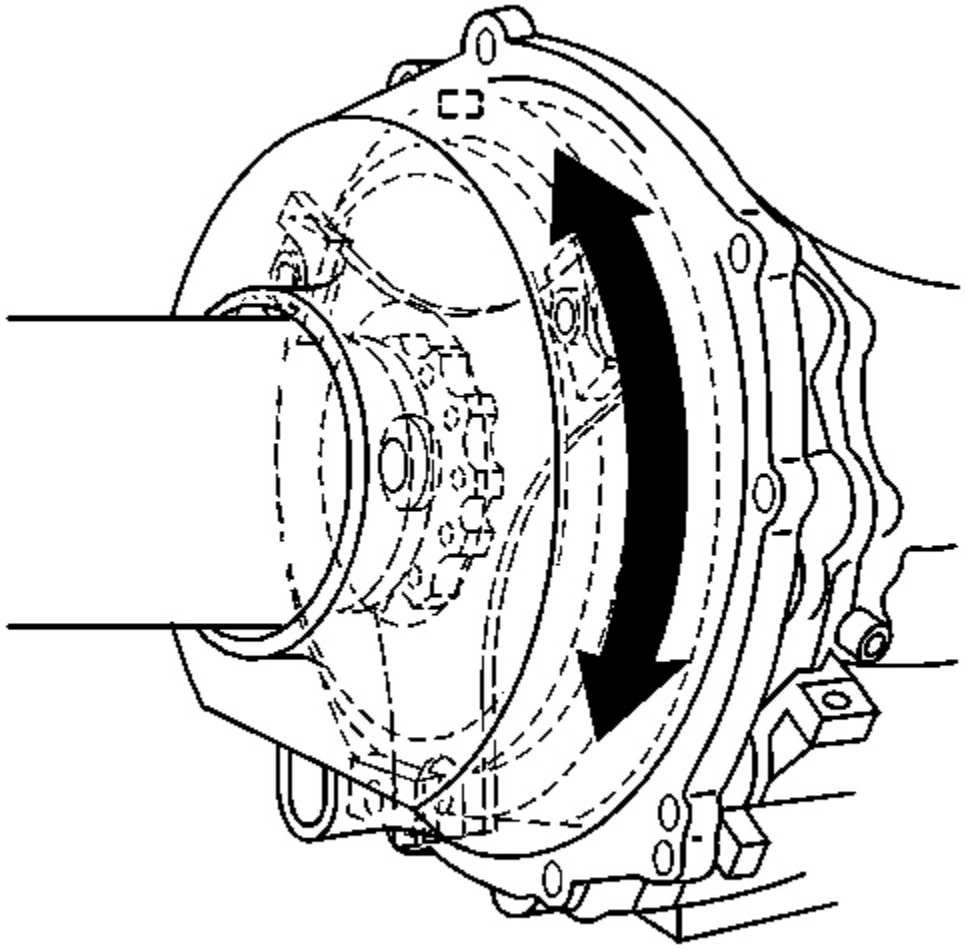


Fig. 196: Engine Flywheel & Flexplate
Courtesy of GENERAL MOTORS CORP.

5. Remove the **J 42386-A** from the engine flywheel.
6. Turn the engine flywheel slowly until the next bolt holes line up with the rear bellhousing access hole.
7. Install the **J 42386-A** to the engine flywheel, in order to keep the flywheel from turning.
8. Repeat steps 4 through 7 to install the 2 remaining bolts.

cardiagn.com

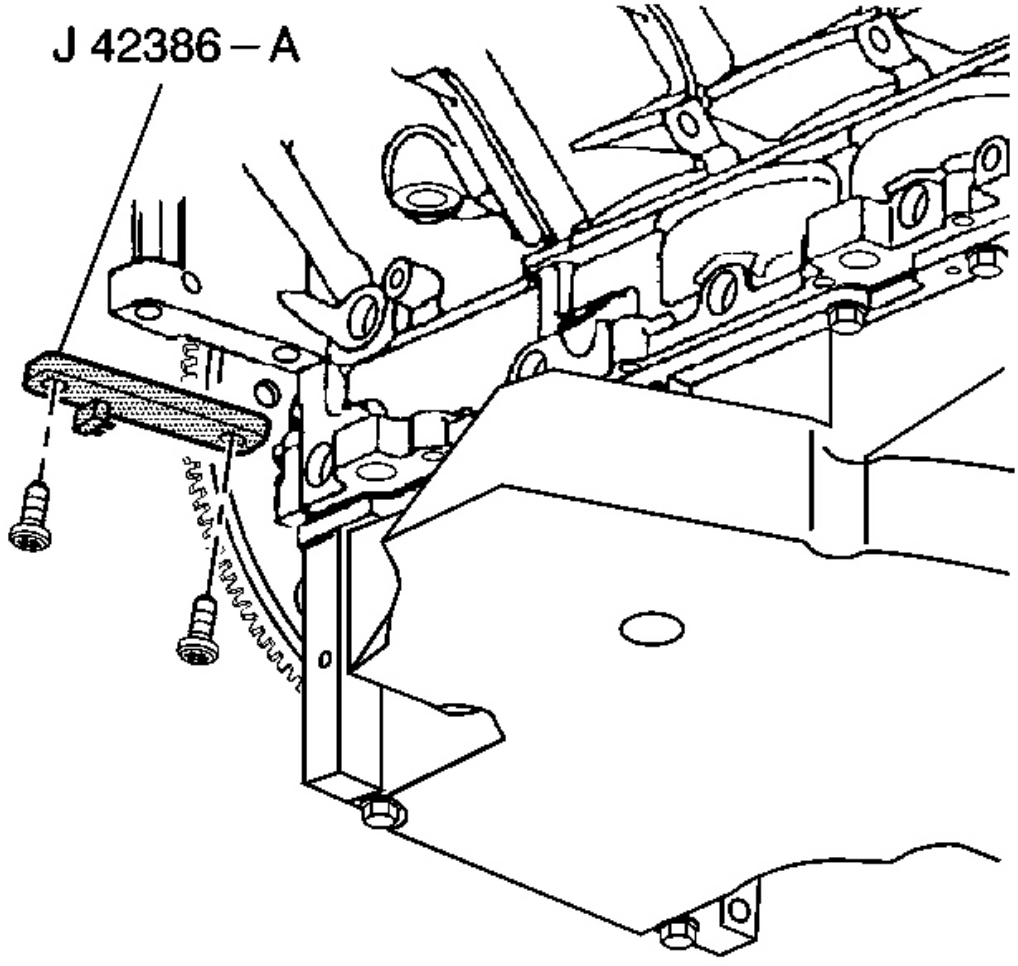


Fig. 197: J 42386-A & Engine Flywheel
Courtesy of GENERAL MOTORS CORP.

9. Remove the **J 42386-A** from the engine flywheel.

cardiagn.com

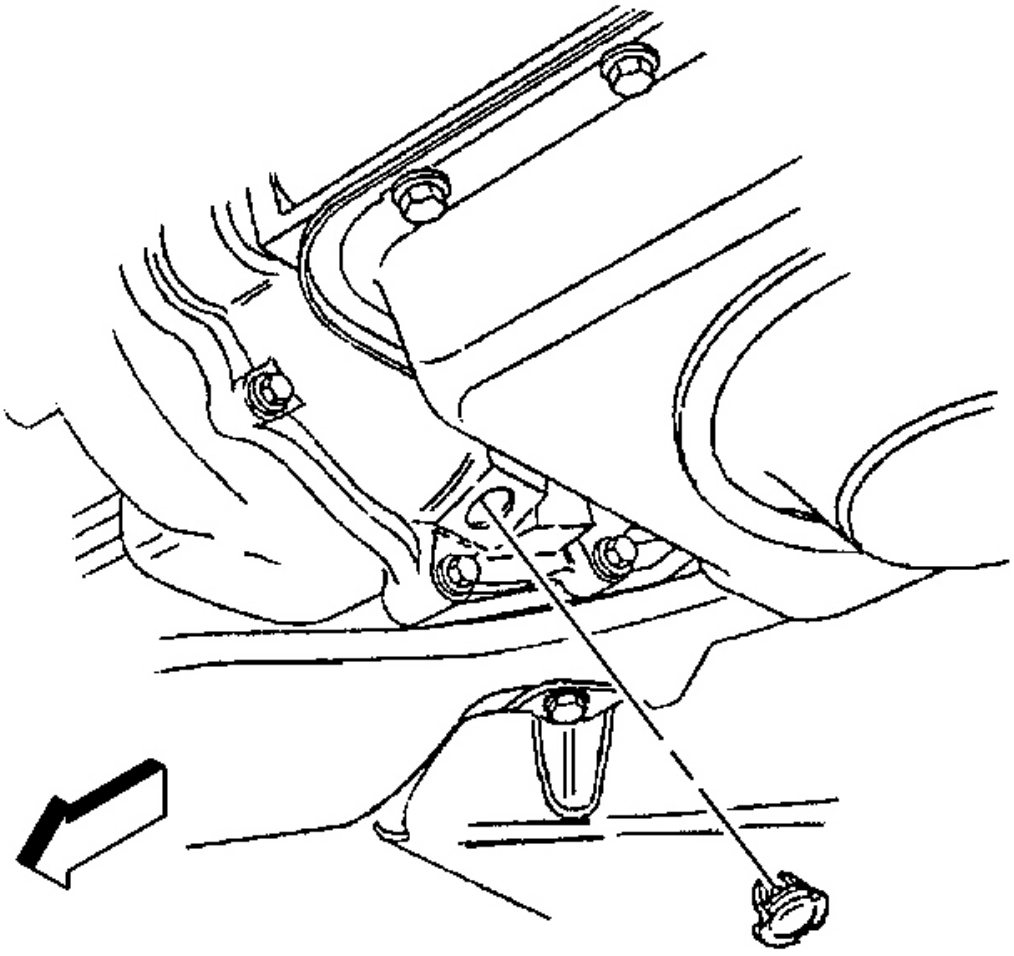


Fig. 198: Transmission Torque Converter Access Plug
Courtesy of GENERAL MOTORS CORP.

10. Install the torque converter access plug.

cardiagn.com

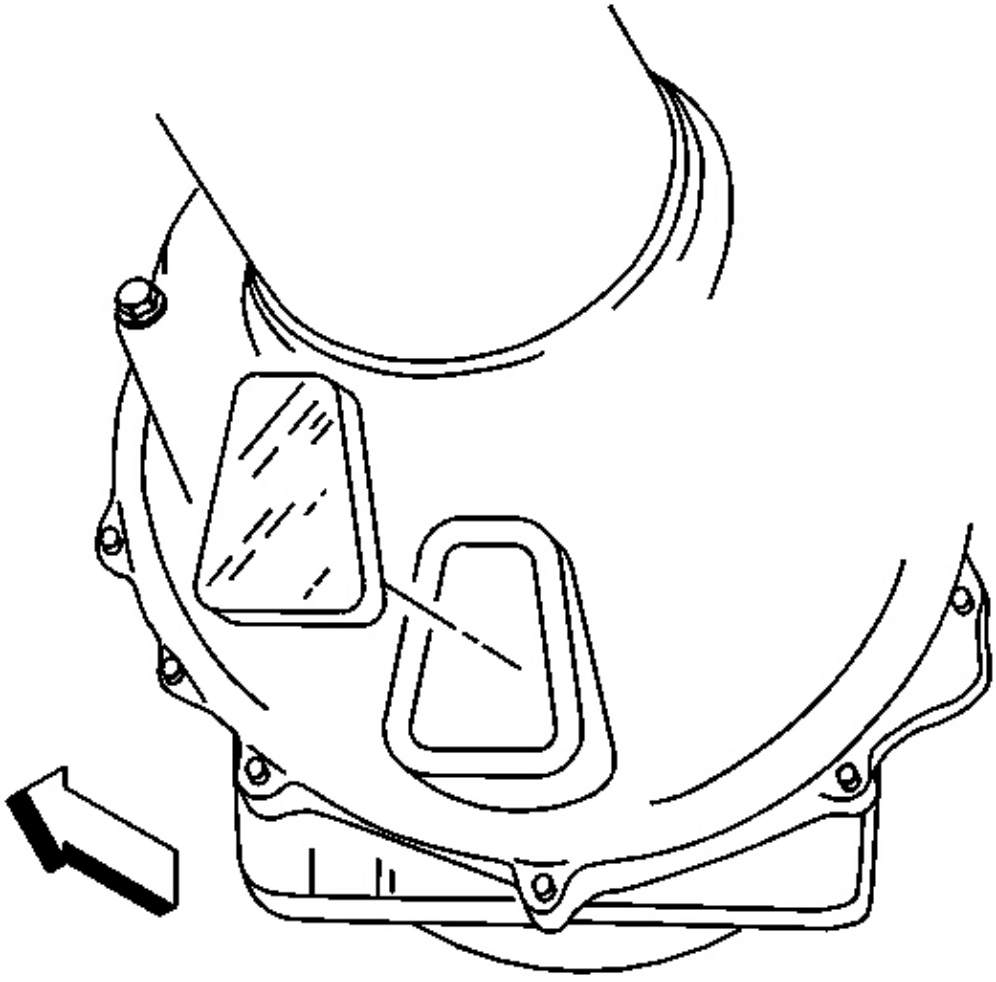


Fig. 199: Driveline Support Assembly Access Plug
Courtesy of GENERAL MOTORS CORP.

11. Install the driveline support assembly access plug.
12. Install the starter motor. Refer to **Starter Motor Replacement** in Engine Electrical.
13. Remove the catalytic converter assembly. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
14. Lower the vehicle.
15. Connect the negative battery cable.

Tighten: Tighten the negative battery cable bolt to 15 N.m (11 lb ft).

cardiagn.com

16. Program the transmitters.
17. Run the engine and inspect for the presence of vibration, repair if necessary. Refer to **Flexplate/Torque Converter Vibration Test** .

TRANSMISSION REPLACEMENT

Tools Required

J 42055 Transmission Support Fixture

Removal Procedure

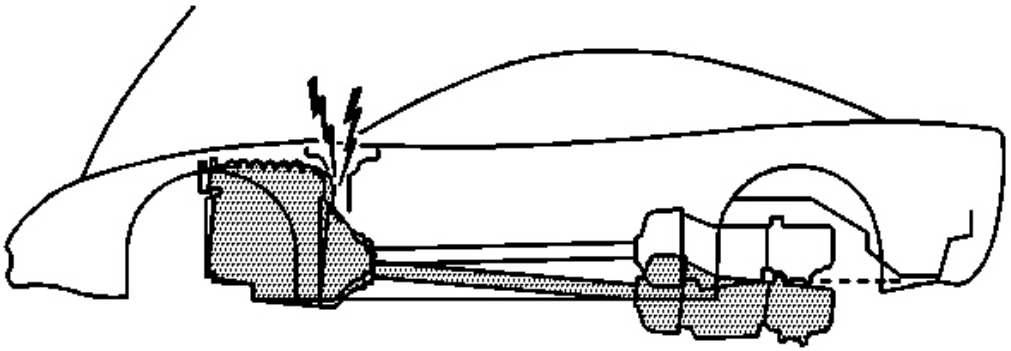


Fig. 200: Rear Of Driveline, Rear Of Transaxle Assembly & Rear Of Engine
Courtesy of GENERAL MOTORS CORP.

NOTE: Failure to follow the proper removal and installation procedures may result in damage to the engine crankshaft thrust bearing.

NOTE: When tilting down the rear of the driveline, observe the clearance between the rear of the engine and the composite dash panel. Do not allow the engine to rest unsupported against the composite dash panel, or vehicle damage may result.

NOTE: When lowering and removing the rear of the driveline, observe the clearance between the rear of the transaxle assembly and the underbody to prevent damage.

cardiagn.com

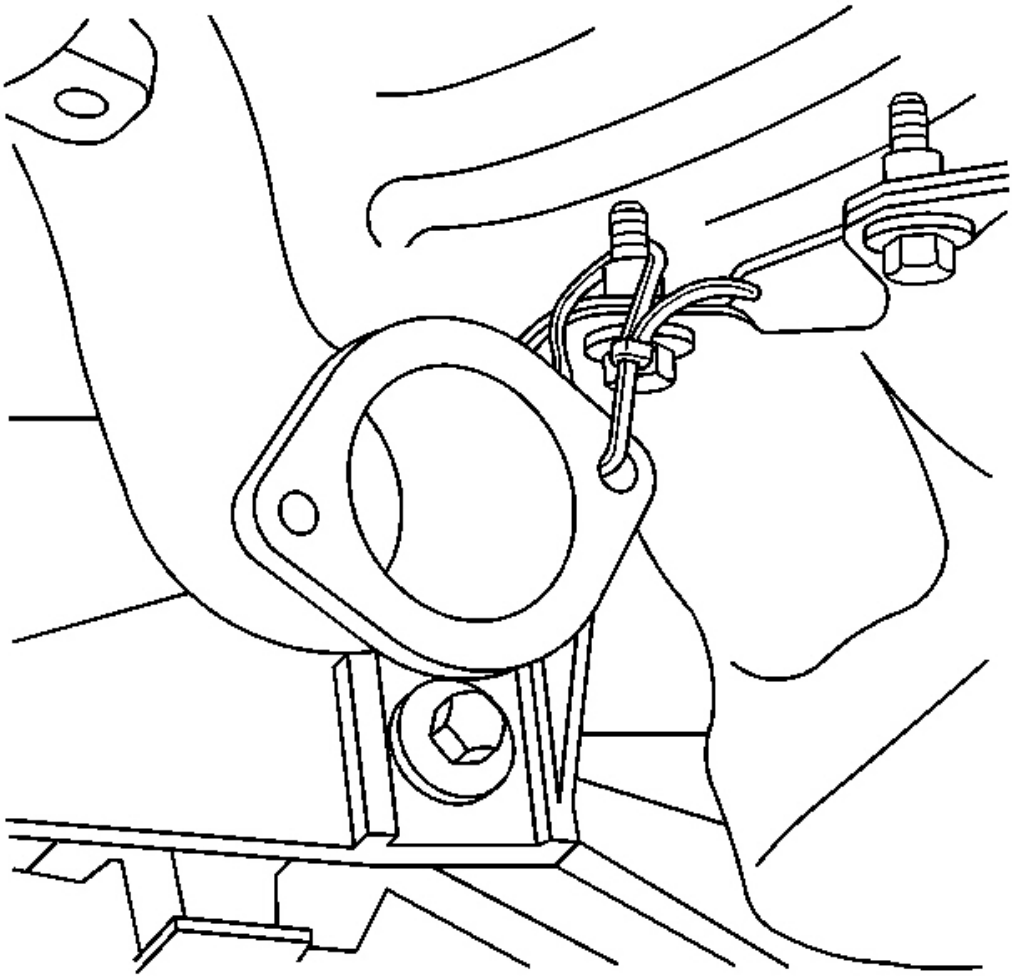


Fig. 201: Catalytic Converter Pipe Assembly
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Remove the rear tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

cardiagn.com

4. Remove the catalytic converter pipe assembly. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
5. Tie off the LH muffler assembly to the underbody to support the muffler out of the way.
6. Remove the RH muffler assembly. Refer to **Muffler Replacement - Right** in Engine Exhaust.
7. Remove the driveline tunnel closeout panel. Refer to **Driveline Tunnel Closeout Panel Replacement** in Propeller Shaft.

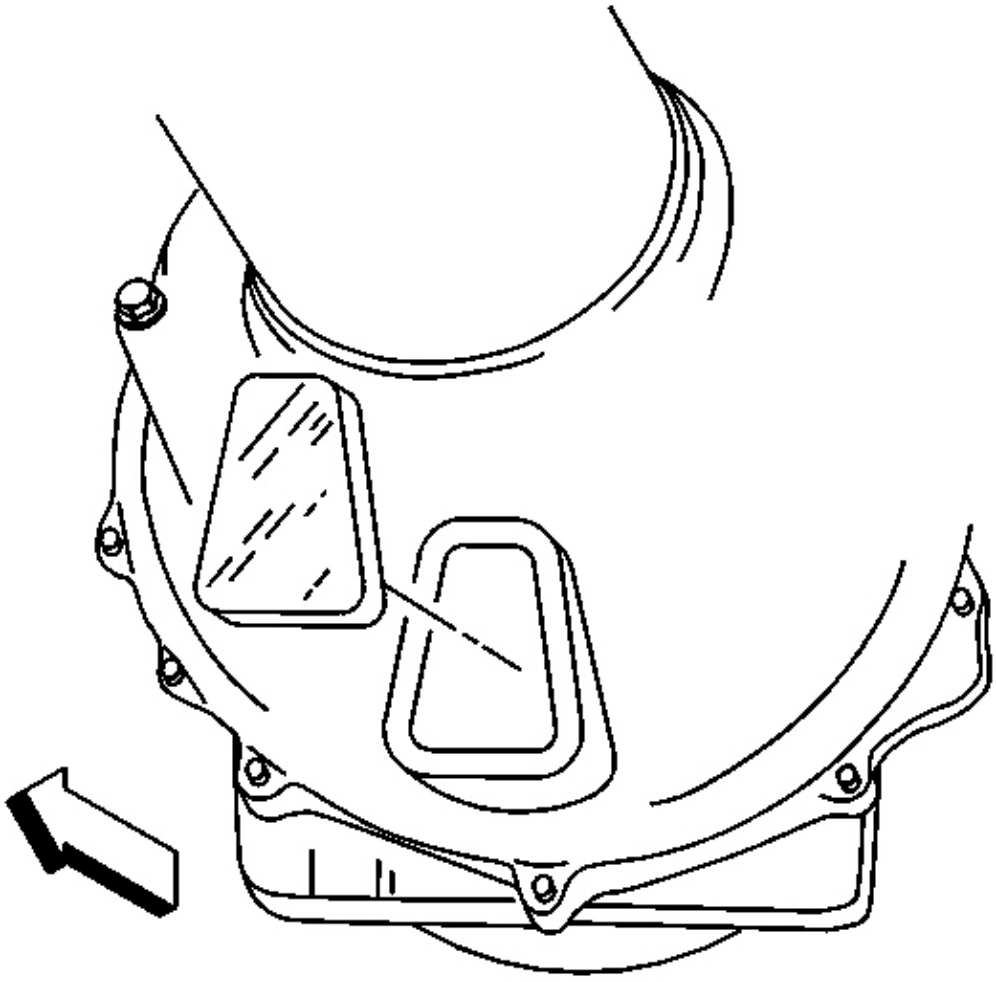


Fig. 202: Driveline Support Assembly Access Plug
Courtesy of GENERAL MOTORS CORP.

8. Using a flat-bladed screwdriver, remove the rear bellhousing access plug.

cardiagn.com

IMPORTANT: The following step must be performed to assure proper torque converter balance during installation.

9. Matchmark the transmission flexplate to the transmission torque converter through the access hole in the rear bellhousing.
10. Remove the transmission flexplate to transmission torque converter bolts. Refer to **Flexplate to Torque Converter Bolts** .

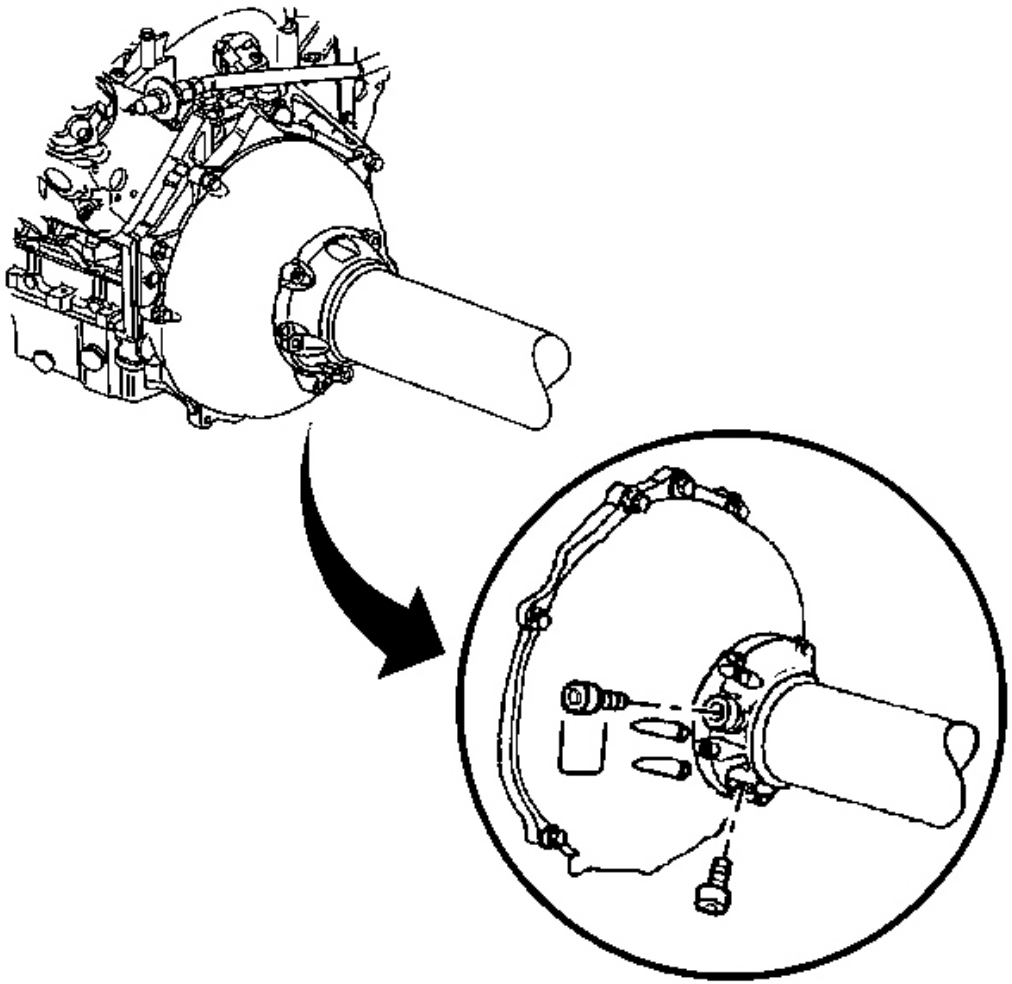


Fig. 203: Two Plug Bolts & Front Of Driveline Support Assembly
Courtesy of GENERAL MOTORS CORP.

11. Remove the two plug bolts from the front of driveline support assembly.

cardiagn.com

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

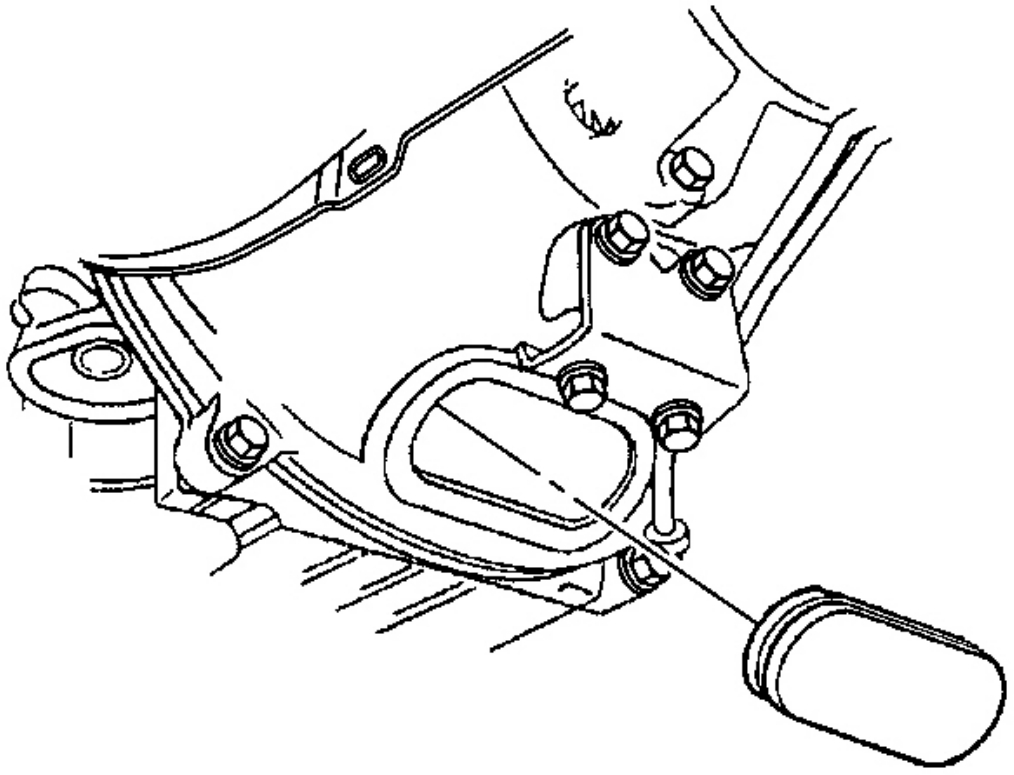
IMPORTANT: The propeller input shaft front bearing positioning bolts are intended to remain torqued to specification and in place UNTIL INSTRUCTED in the installation procedure.

IMPORTANT: Failure to use the minimum length fastener specified will prevent proper retention of the propeller input shaft front bearing during disassembly or installation.

12. Install two bolts, M10 - 1.5 X 55 mm, or longer, in place of the plug bolts.

(The long bolts are located to maintain the propeller input shaft front bearing in original position during removal and installation.)

Tighten: Tighten the propeller input shaft front bearing positioning bolts to 35 N.m (26 lb ft).



cardiagn.com

Fig. 204: Engine Flywheel Housing Access Plug
Courtesy of GENERAL MOTORS CORP.

13. Using a flat- bladed screwdriver, remove the engine flywheel housing access plug.

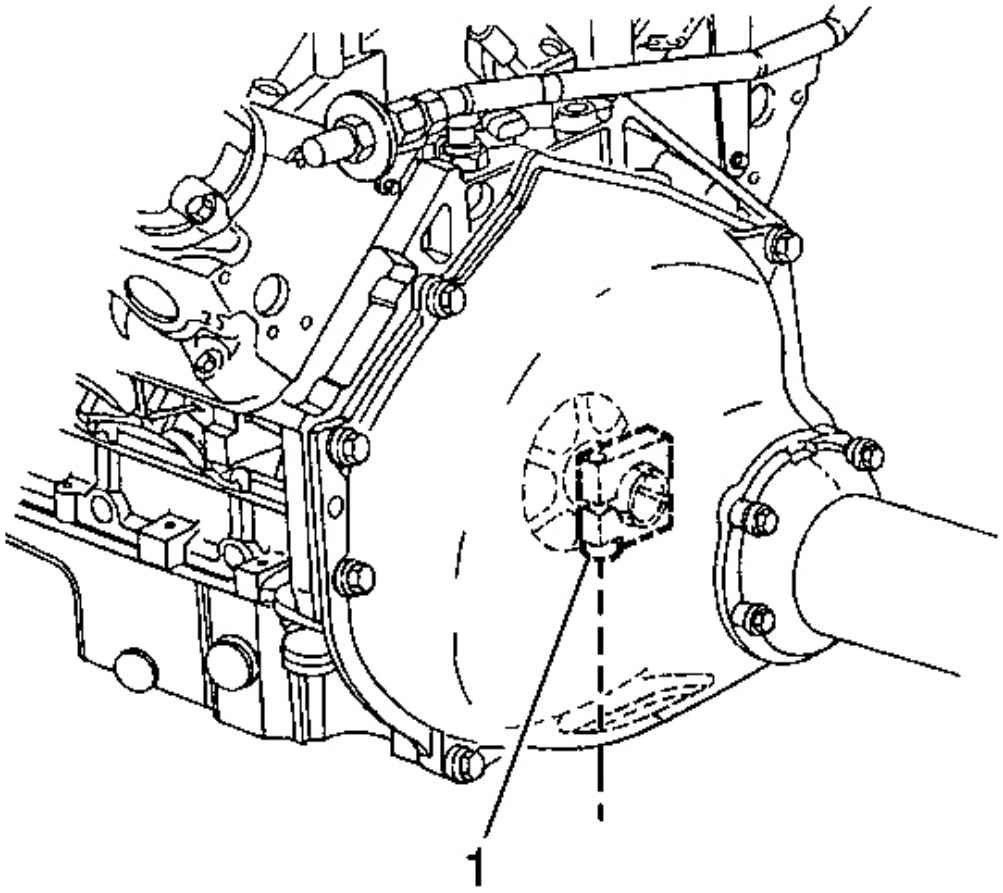


Fig. 205: Propeller Shaft Hub Clamp & Bolt
Courtesy of GENERAL MOTORS CORP.

14. Loosen the propeller shaft hub clamp bolt (1).

    Rotate the engine at the flywheel, if necessary for alignment.

cardiagn.com

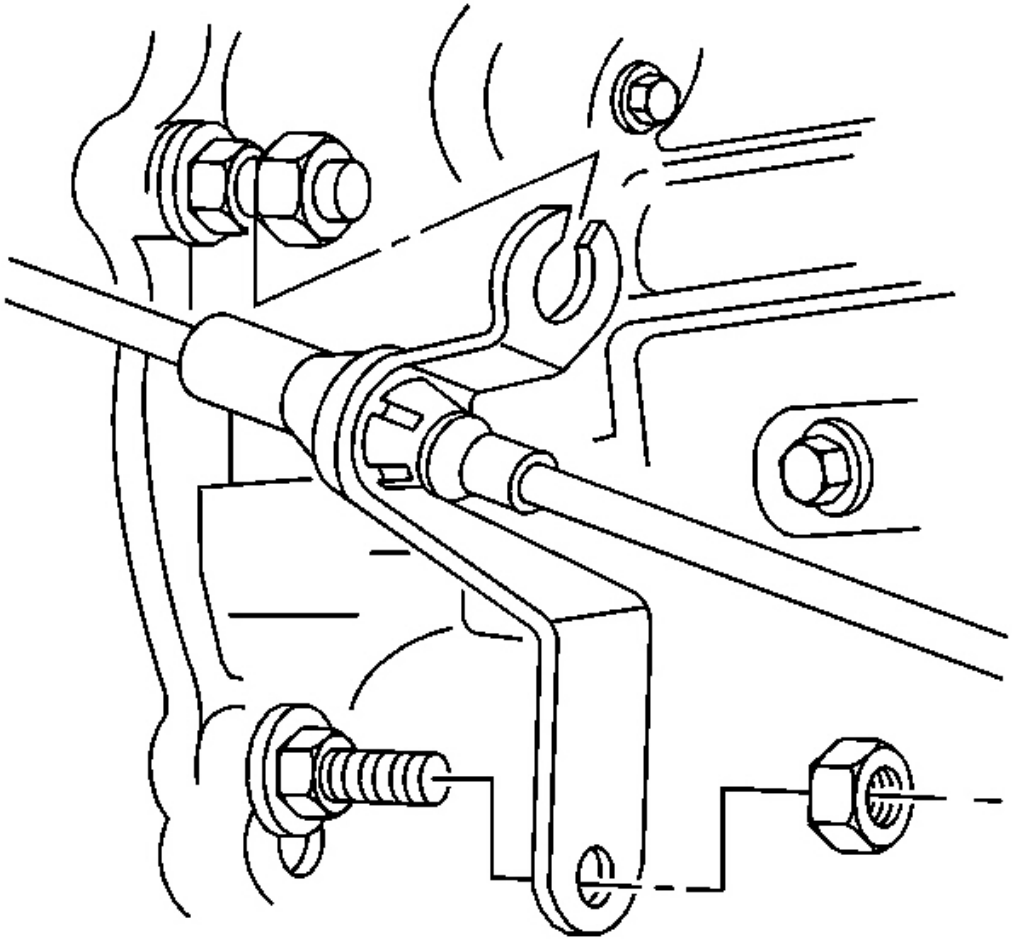


Fig. 206: Shift Control Cable Bracket & Nuts
Courtesy of GENERAL MOTORS CORP.

15. Remove the nuts retaining the transmission shift cable bracket to the transmission.

cardiagn.com

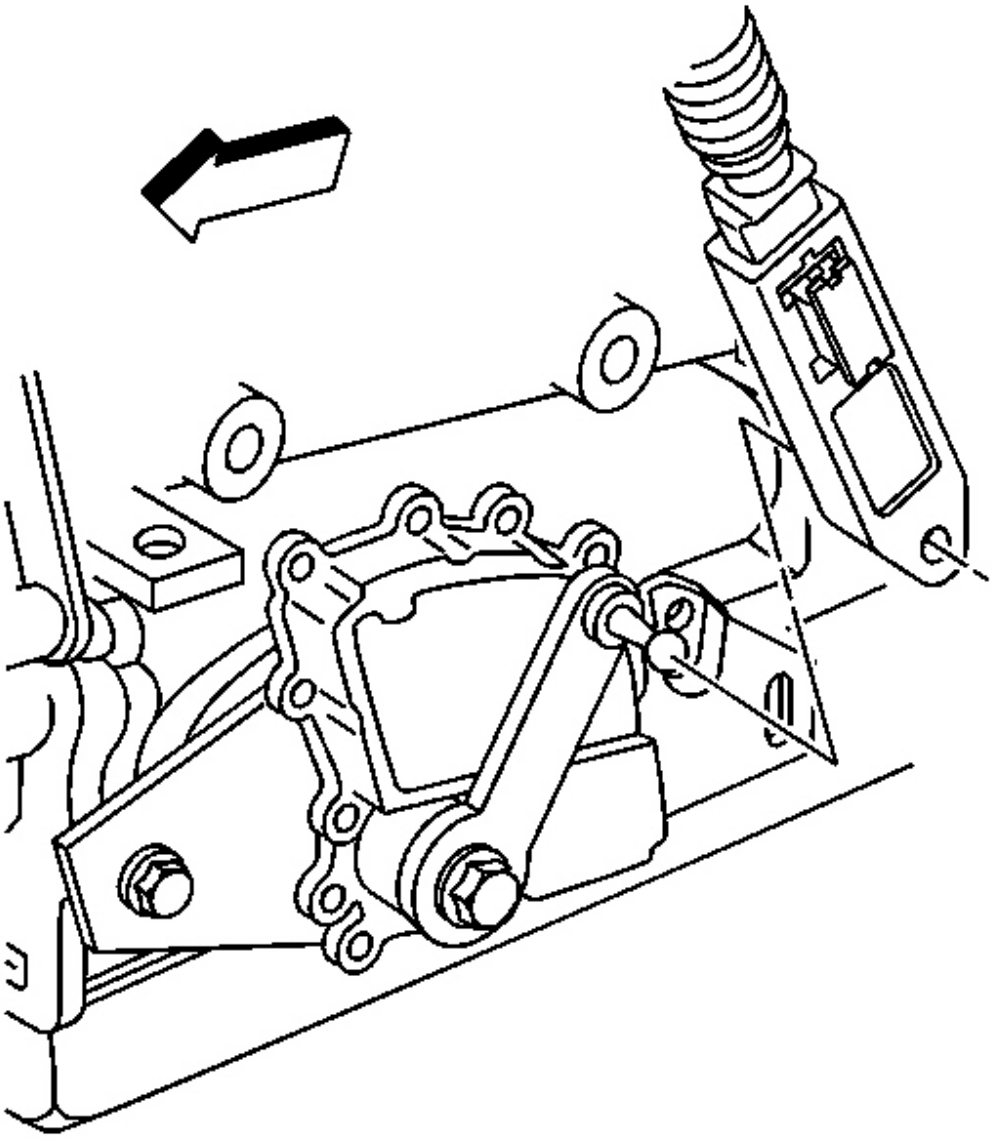


Fig. 207: Transmission Shift Control Cable & Bracket
Courtesy of GENERAL MOTORS CORP.

16. Disconnect the transmission shift control cable from the transmission shift lever.

    Unsnap to release the cable.

cardiagn.com

17. Position the transmission shift cable and bracket aside.

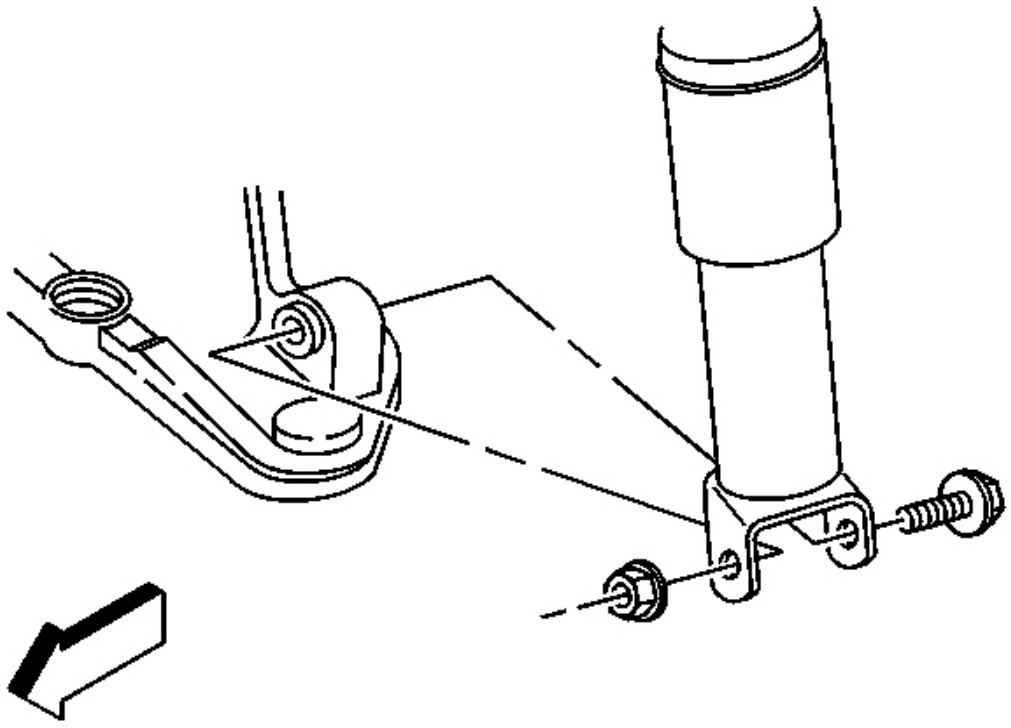


Fig. 208: Mounting Shock Absorber To Control Arm
Courtesy of GENERAL MOTORS CORP.

18. Remove the rear transverse spring. Refer to **Rear Transverse Spring Replacement** in Rear Suspension.
19. Support the lower control arm with a straight jack.
20. Disconnect the outer tie rod end from the suspension knuckle. Refer to **Tie Rod Replacement (Outer End)** or **Tie Rod Replacement (Suspension Link)** in Rear Suspension.
21. Remove the shock absorber lower mounting bolt.
22. Disconnect the lower ball joint from the suspension knuckle. Refer to **Knuckle Replacement** in Rear Suspension.
23. Remove the straight jack from the control arm.
24. Repeat steps 21 through 25 for the other side of the vehicle.

cardiagn.com

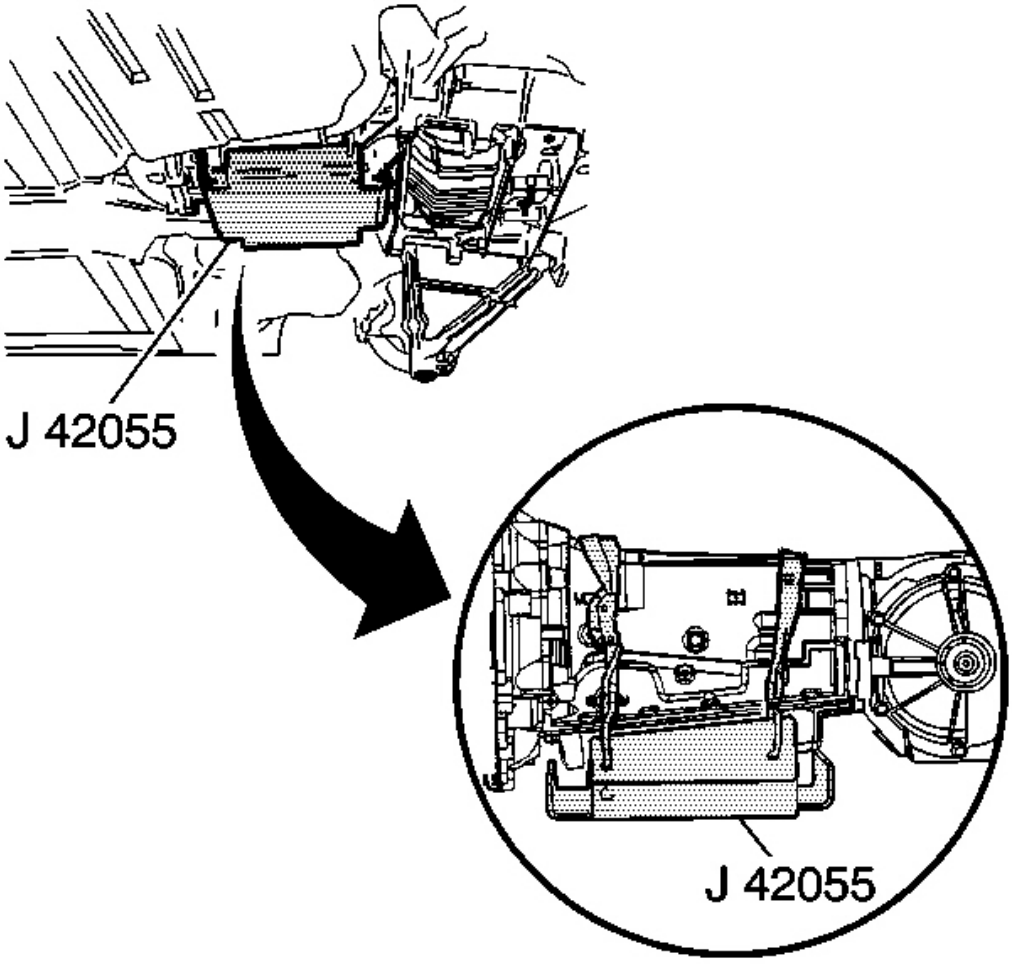


Fig. 209: J 42055 & Transmission Jack
Courtesy of GENERAL MOTORS CORP.

25. Assemble the **J 42055** .
26. Install the **J 42055** to a transmission jack.
27. Position and firmly secure the **J 42055** with the transmission jack to the transmission.

cardiagn.com

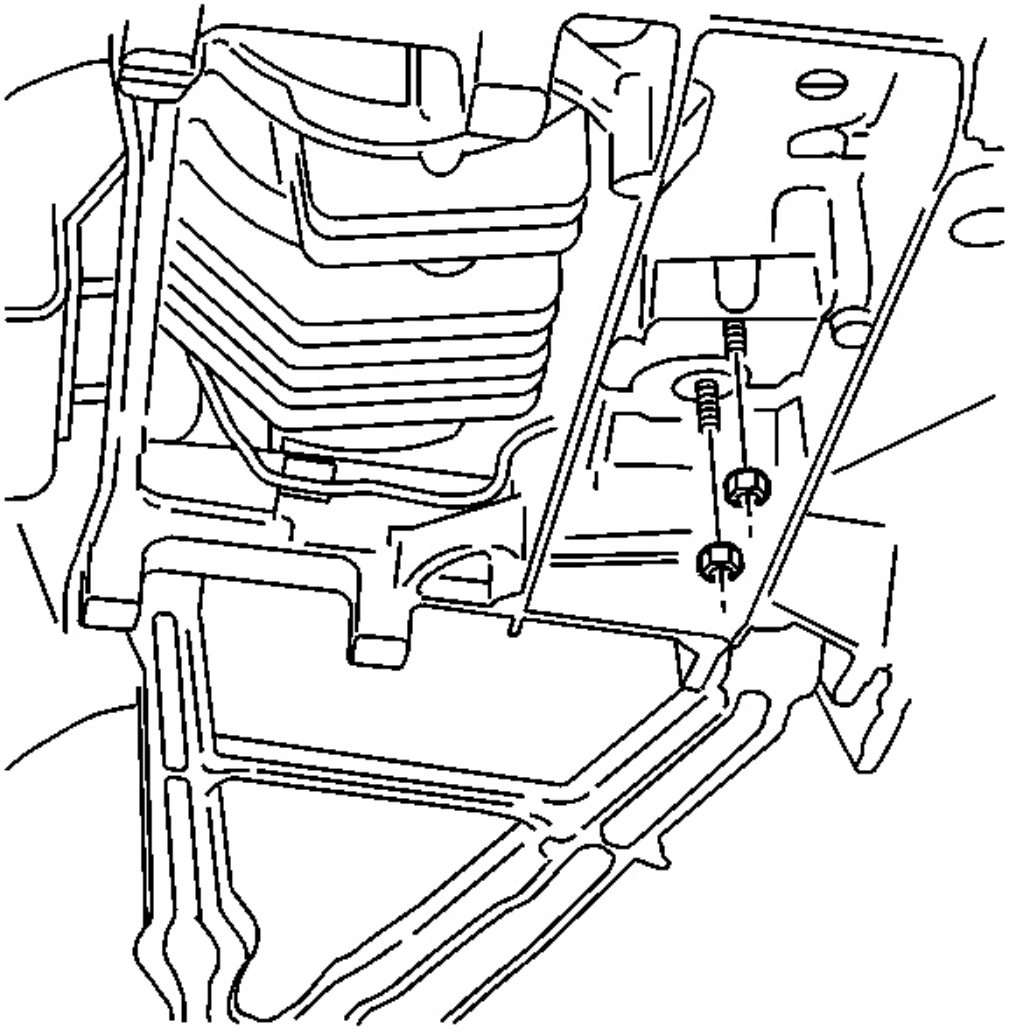


Fig. 210: Transaxle Mount To Rear Crossmember Nuts
Courtesy of GENERAL MOTORS CORP.

28. Disconnect the wiring harness and brake pipe clip retainers from the rear suspension crossmember.
29. Remove the differential to transmission lower nut.
30. Remove the transaxle mount to rear crossmember nuts.

cardiagn.com

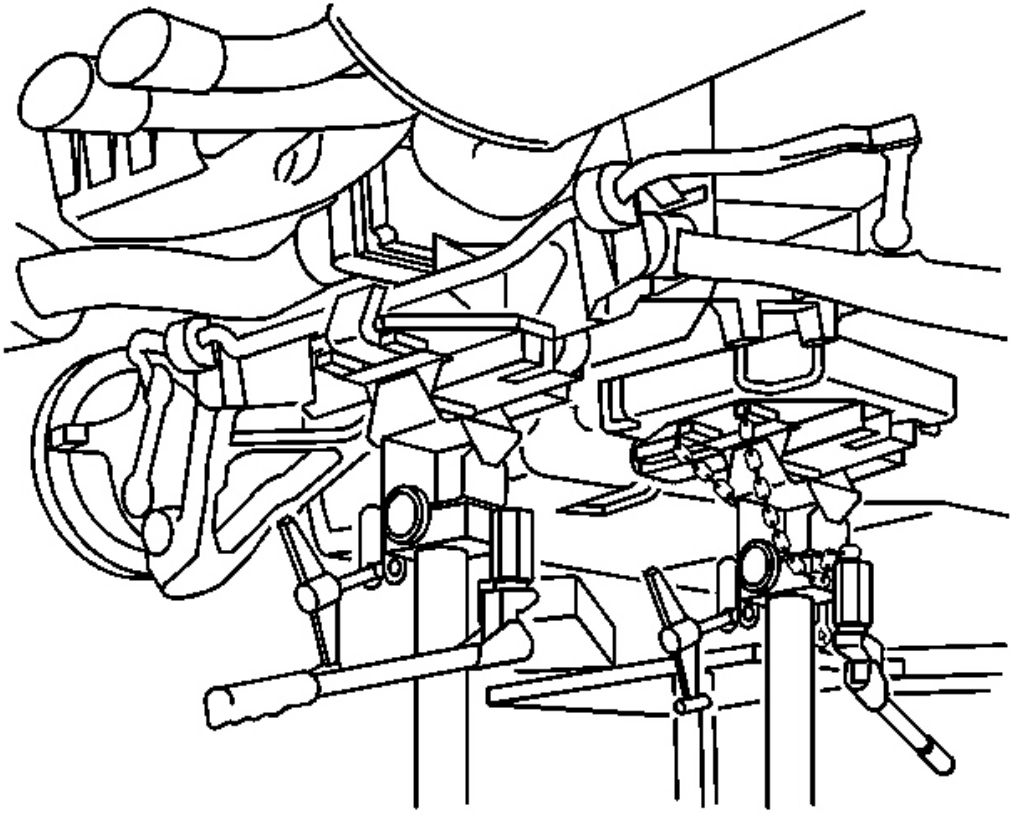


Fig. 211: View Of Jack Under Front End
Courtesy of GENERAL MOTORS CORP.

31. Position a transmission jack under the rear suspension crossmember and firmly secure the crossmember to the jack.
32. Using ONLY HAND TOOLS, remove the rear suspension crossmember retaining nuts.

cardiagn.com

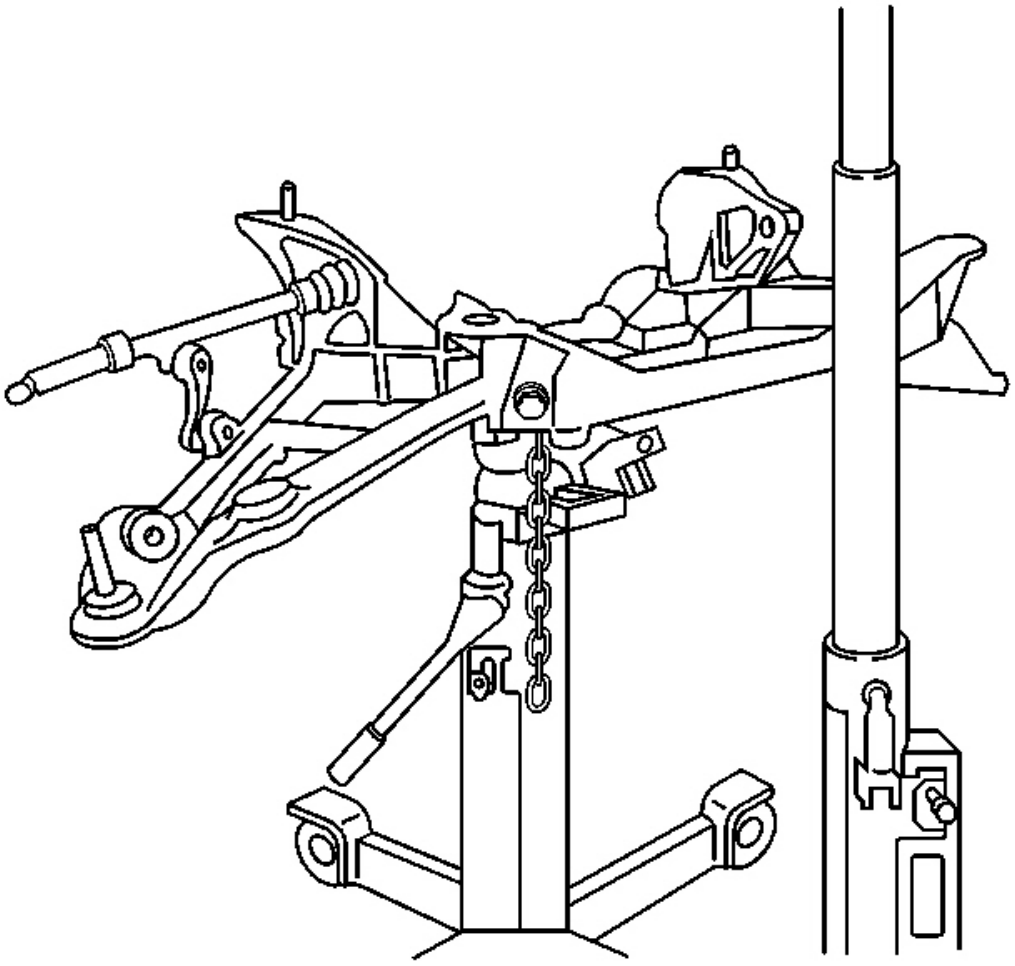


Fig. 212: Supporting Crossmember On Jack
Courtesy of GENERAL MOTORS CORP.

33. With the aid of an assistant, slowly lower the rear suspension crossmember away from the vehicle frame rails and remove the crossmember.

cardiagn.com

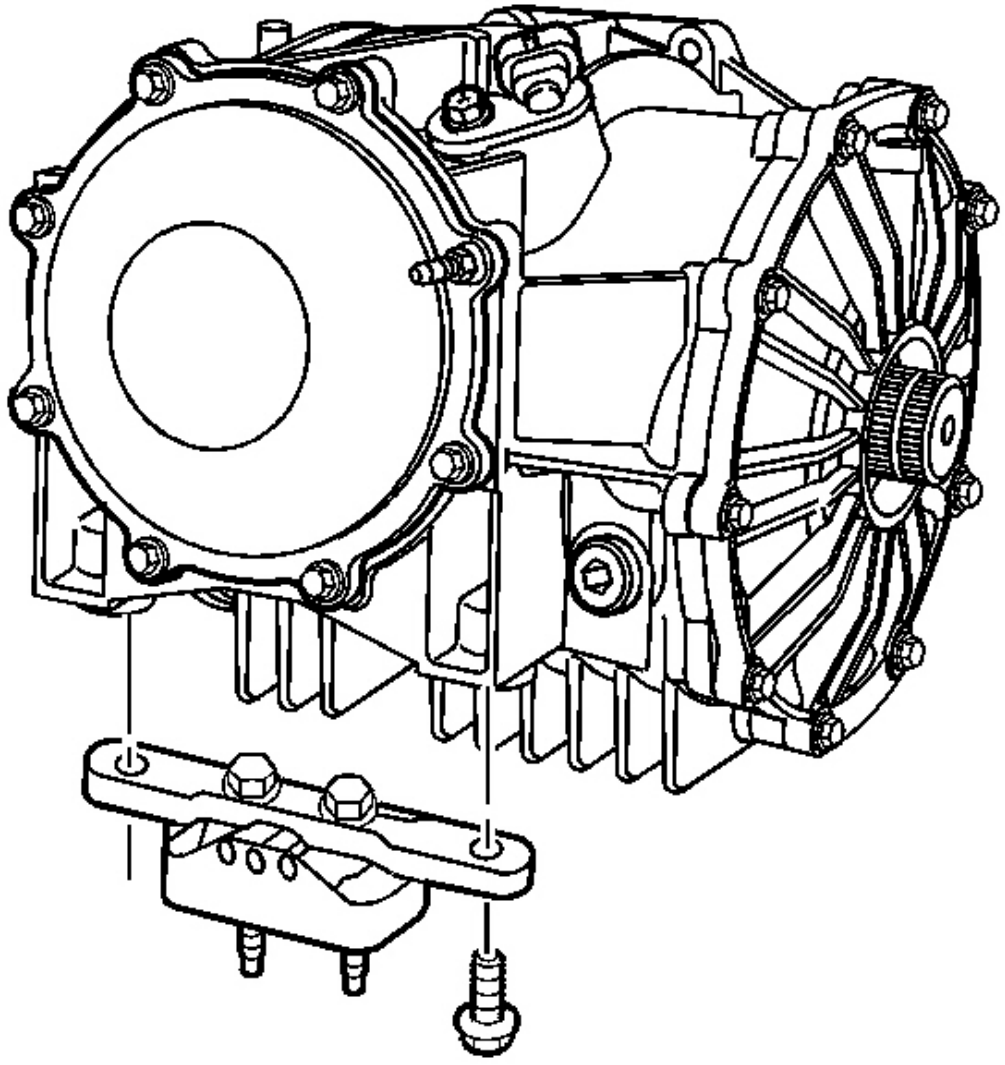


Fig. 213: Mount Location
Courtesy of GENERAL MOTORS CORP.

34. Remove the transaxle mount bracket to differential bolts.
35. Remove the transaxle mount with bracket.

(Removing the transaxle mount will allow for greater stability on a workbench after the driveline is removed.)

cardiagn.com

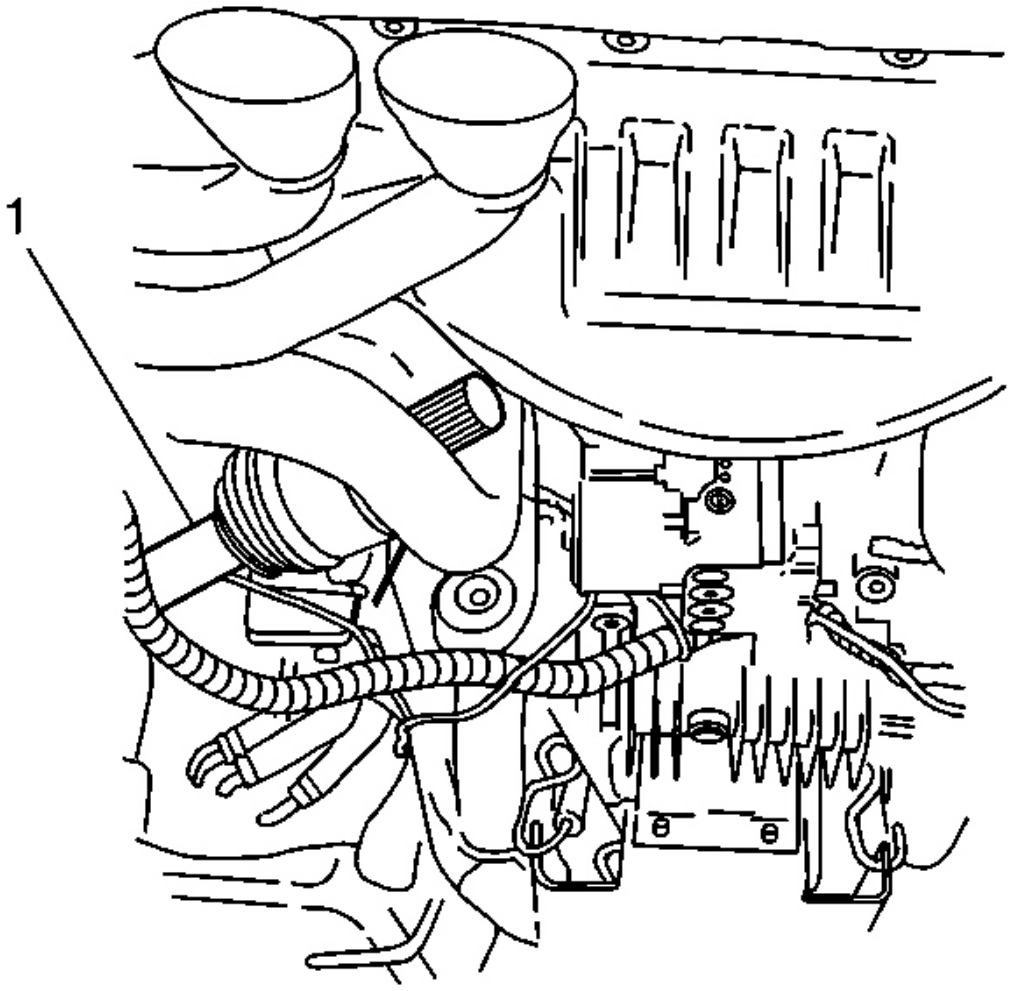


Fig. 214: LH Axle Shaft
Courtesy of GENERAL MOTORS CORP.

36. Using a pry bar, CAREFULLY release the axle shafts from the differential.
37. Tie off the axle shafts to the underbody to support the shafts out of the way.

The LH muffler assembly pipe toward the rear offers a good location to help support the LH axle shaft (1).

cardiagn.com

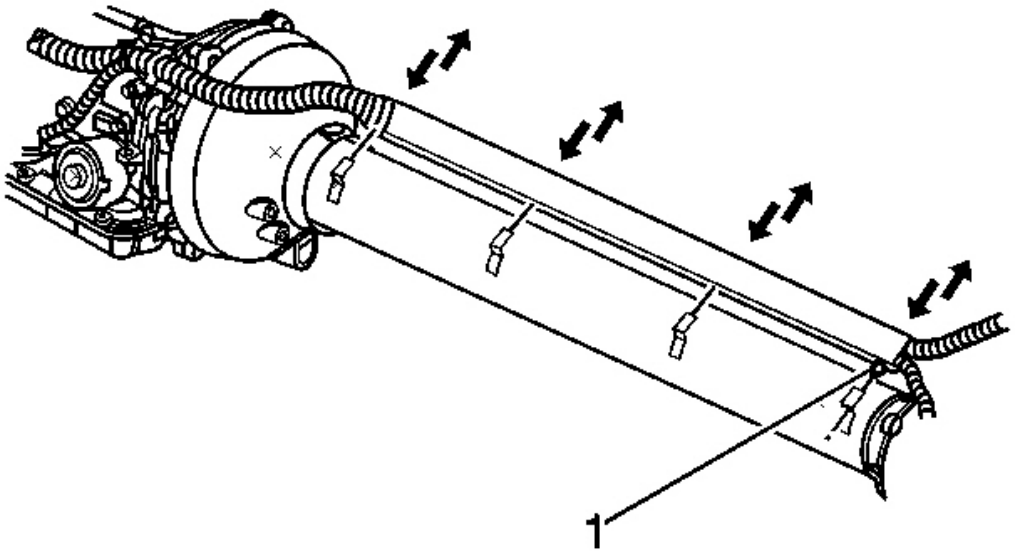


Fig. 215: Releasing The Retainer Securing The Wiring Harness
Courtesy of GENERAL MOTORS CORP.

38. Release the retainer (1) securing (and positioning) the wiring harness to the L-shaped brackets along the driveline support assembly, then slide the harness up out of the brackets and position out of the way.

cardiagn.com

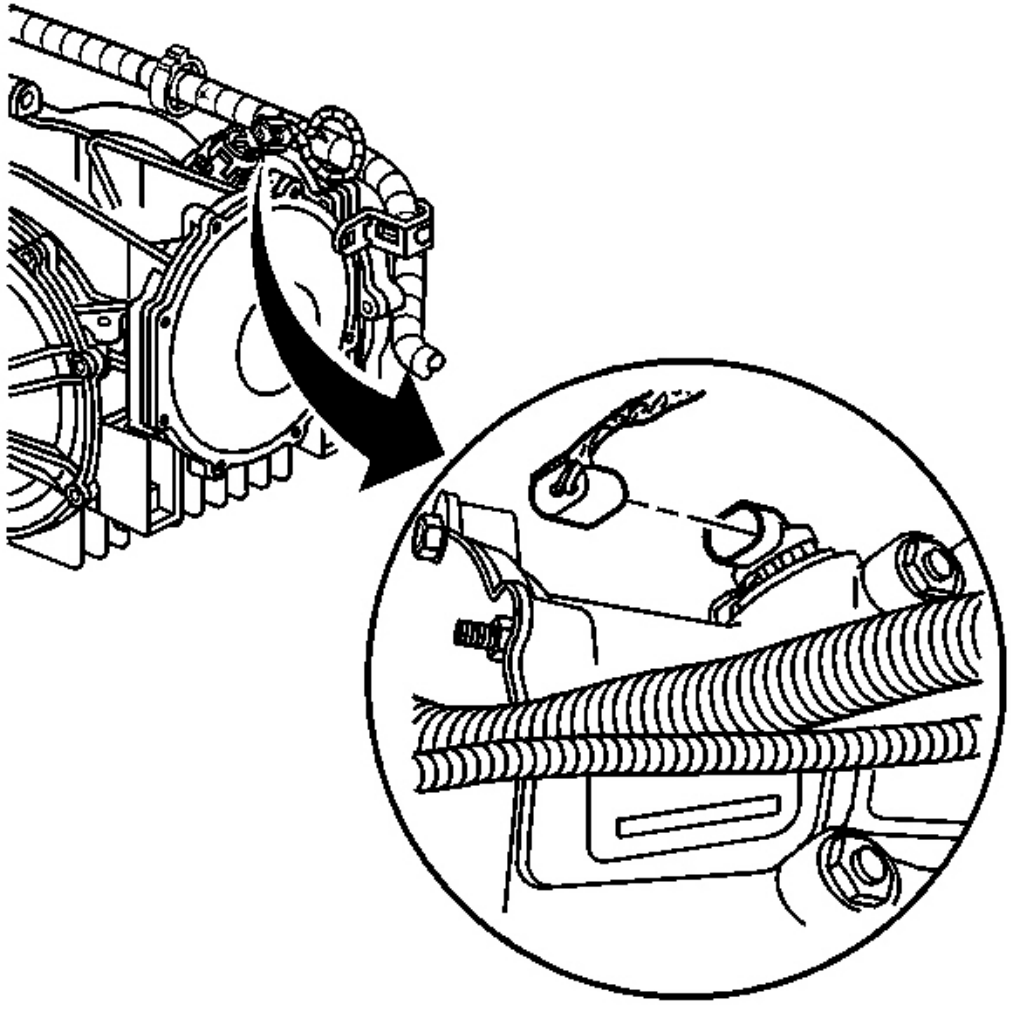


Fig. 216: VSS Electrical Connector
Courtesy of GENERAL MOTORS CORP.

39. SLOWLY lower the driveline approximately 5 cm (2 in), while simultaneously adjusting the angle of tilt, in order to access the electrical connectors.
40. Disconnect the vehicle speed sensor (VSS) electrical connector.

cardiagn.com

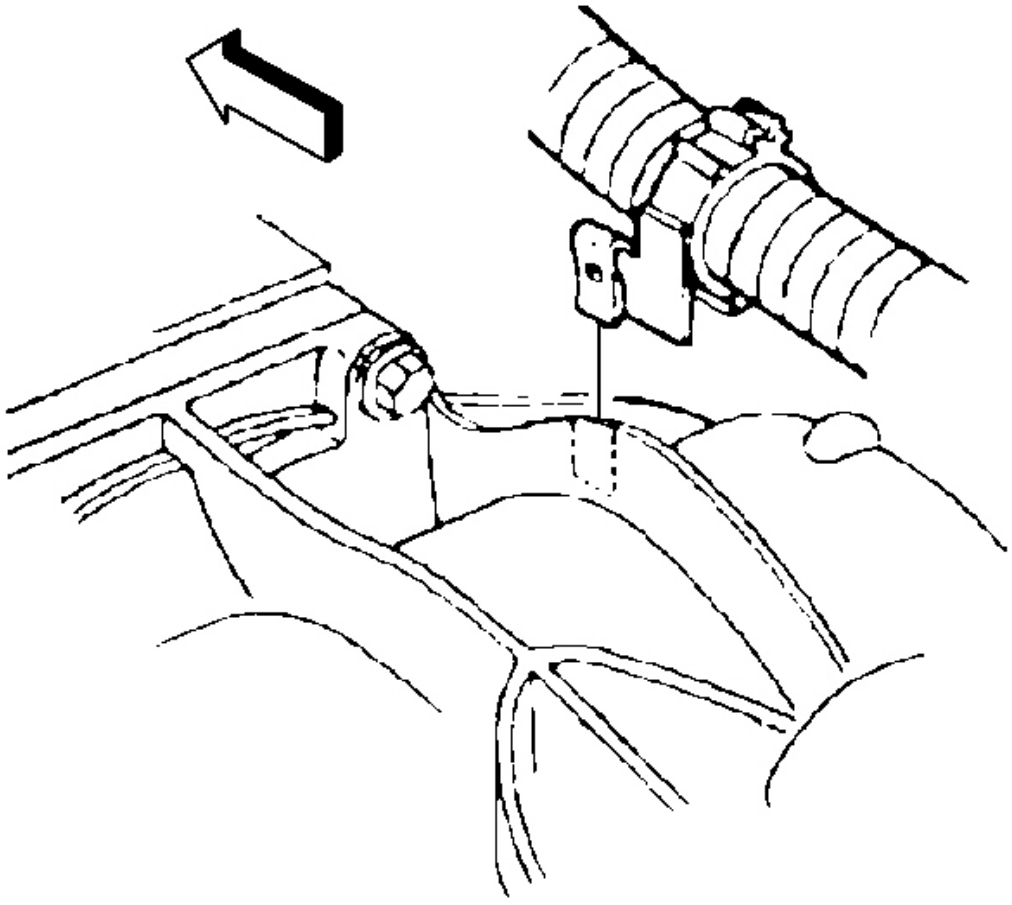


Fig. 217: Wiring Harness Retainer & Clip
Courtesy of GENERAL MOTORS CORP.

41. Disconnect the wiring harness retainer from the stud at the differential rear cover.
42. Disconnect the wiring harness retainer clip from the top of the differential.

cardiagn.com

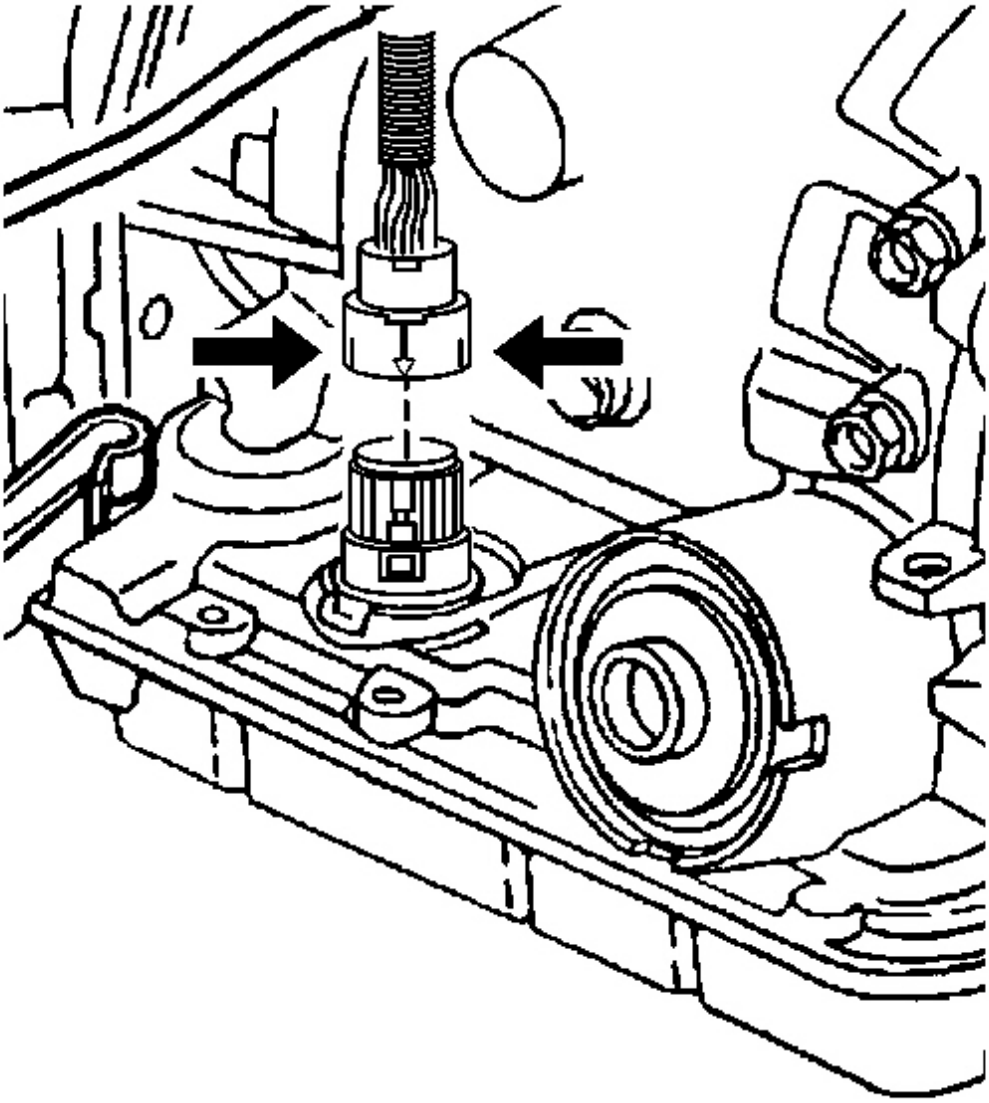


Fig. 218: Disconnecting The Transmission Harness 20-Way Connector
Courtesy of GENERAL MOTORS CORP.

43. Disconnect the transmission harness 20-way connector.

    Depress both tabs on the connector and pull straight up; do not pry the connector.

cardiagn.com

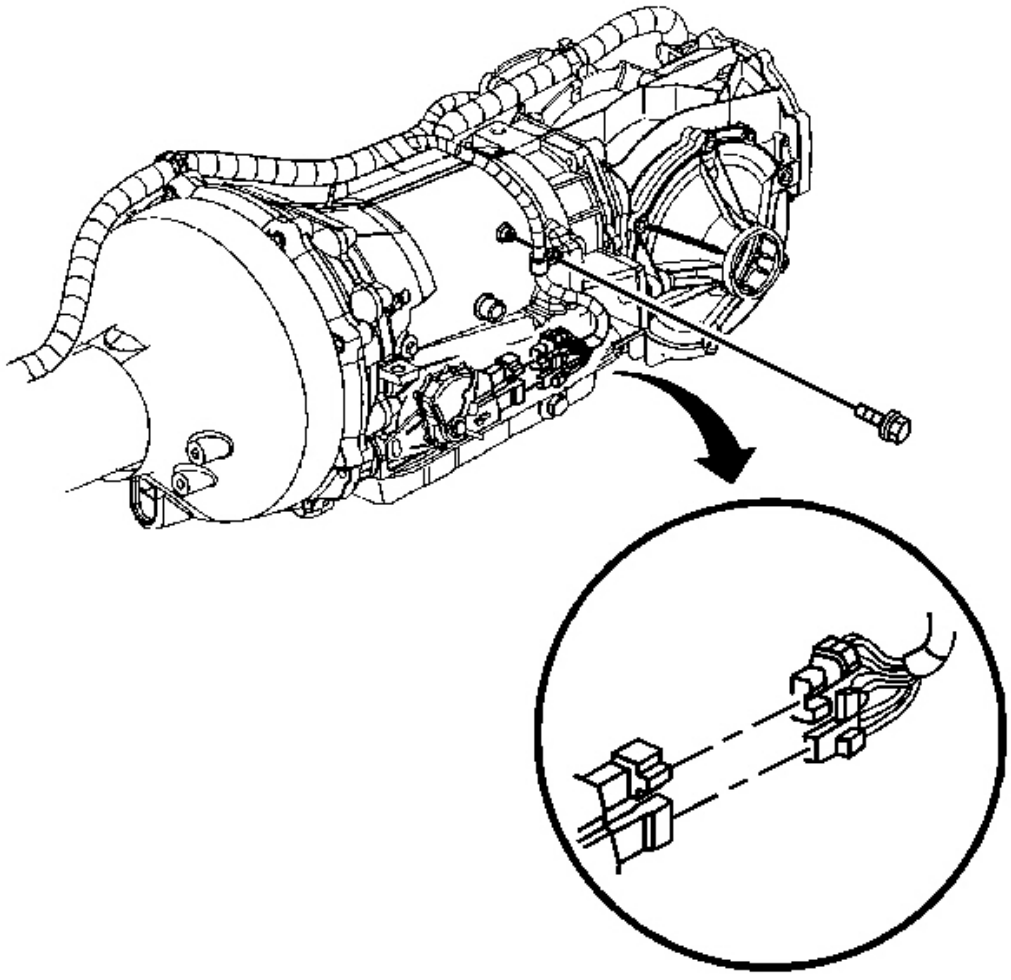


Fig. 219: Park/Neutral Position Switch Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

44. Disconnect the park/neutral position switch electrical connectors.
45. Remove the bolt retaining the transmission wiring harness to the LH side of the transmission case.

cardiagn.com

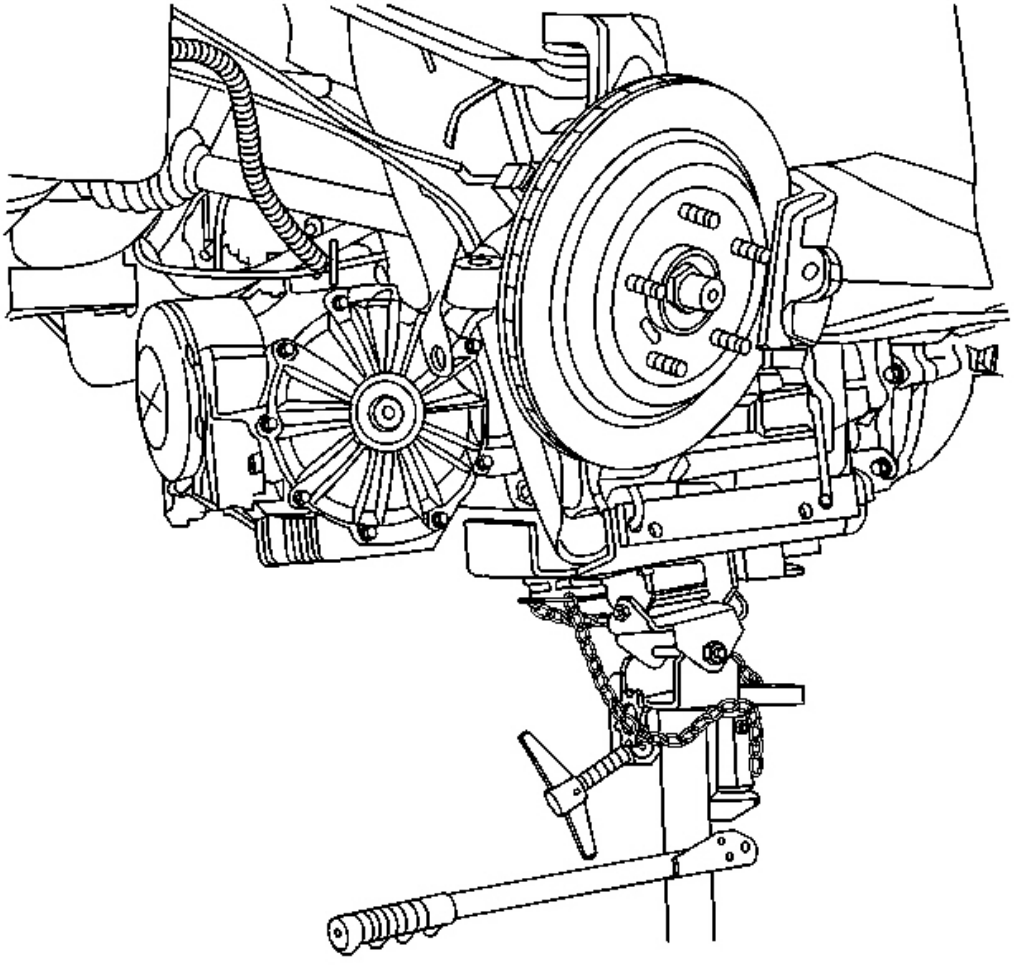


Fig. 220: Transmission Jack Supporting The Differential
Courtesy of GENERAL MOTORS CORP.

46. SLOWLY lower the driveline, while simultaneously adjusting the angle of tilt, and observe the relationship between the top rear of the differential and the lowest part of the rear compartment panel floor (the center storage compartment between the frame rails). The differential should not be lowered more than approximately EVEN with the specified body point of reference.

    (The engine positive crankcase ventilation (PCV) pipes which route along the rear of the engine intake manifold will likely contact the dash panel.)

47. Release the wiring harness from the harness retainer along the top of the transmission.
48. Check to be sure that the wiring harness is free from the driveline being removed.

cardiagn.com

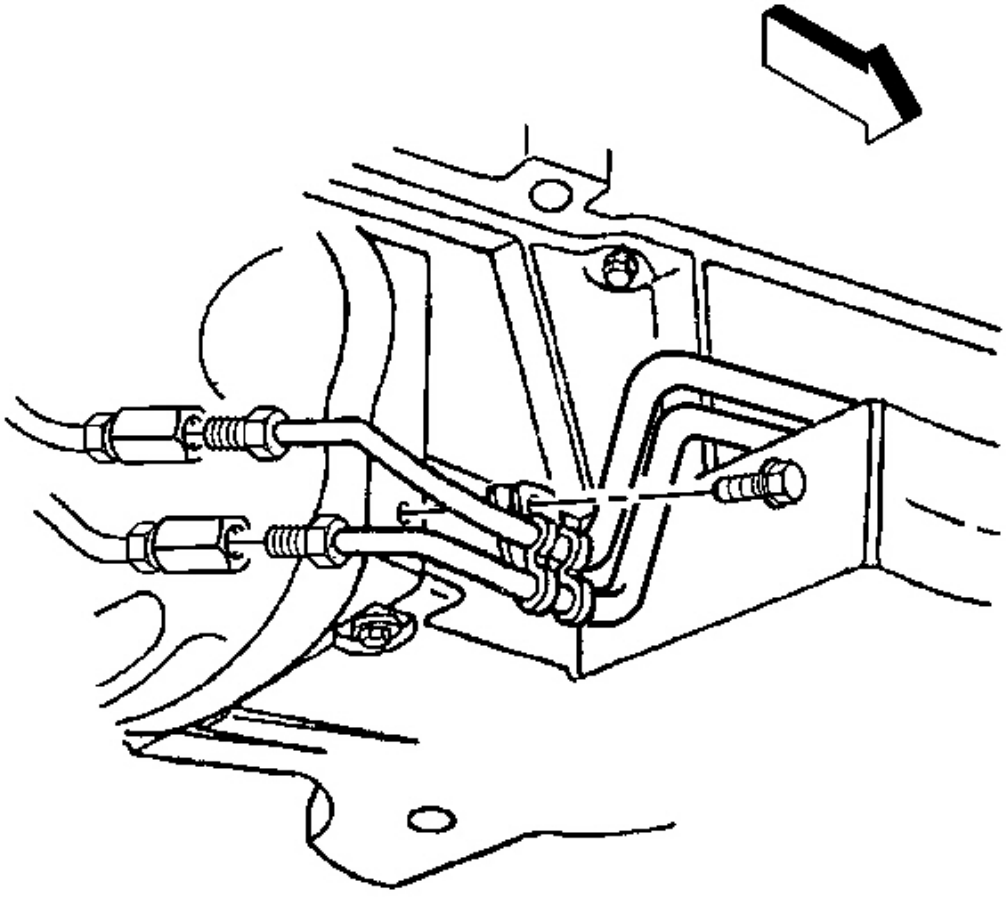


Fig. 221: Locating Cooler Fittings
Courtesy of GENERAL MOTORS CORP.

49. Disconnect the transmission oil cooler rear pipes from the junction fittings at the engine flywheel housing, then cap the pipes and plug the junction fittings to prevent contamination.

cardiagn.com

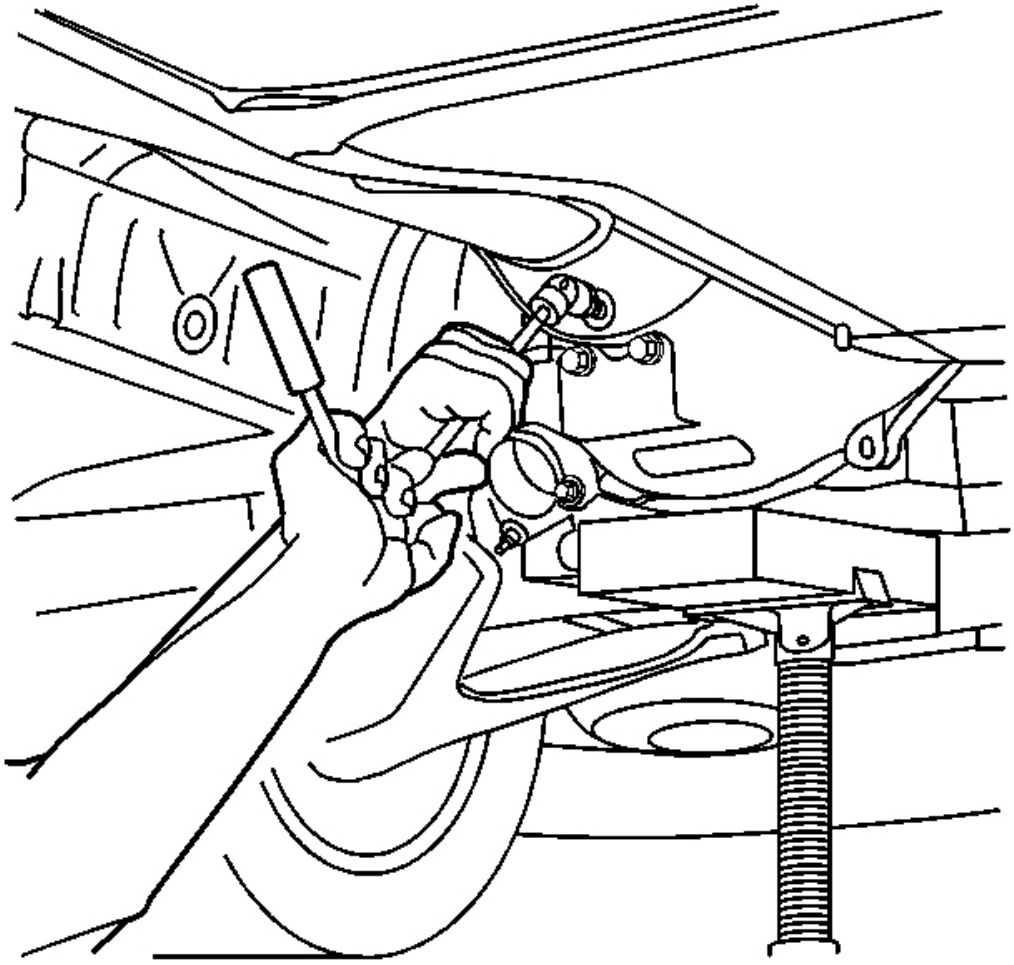


Fig. 222: Removing/Installing The Five Driveline Support Assembly To Engine Flywheel Housing Bolts
Courtesy of GENERAL MOTORS CORP.

50. Using a block of wood to protect the engine oil pan, place a straight jack under the rear of the engine oil pan to support the engine from stressing the composite dash panel.
51. Remove the five driveline support assembly to engine flywheel housing bolts.

cardiagn.com

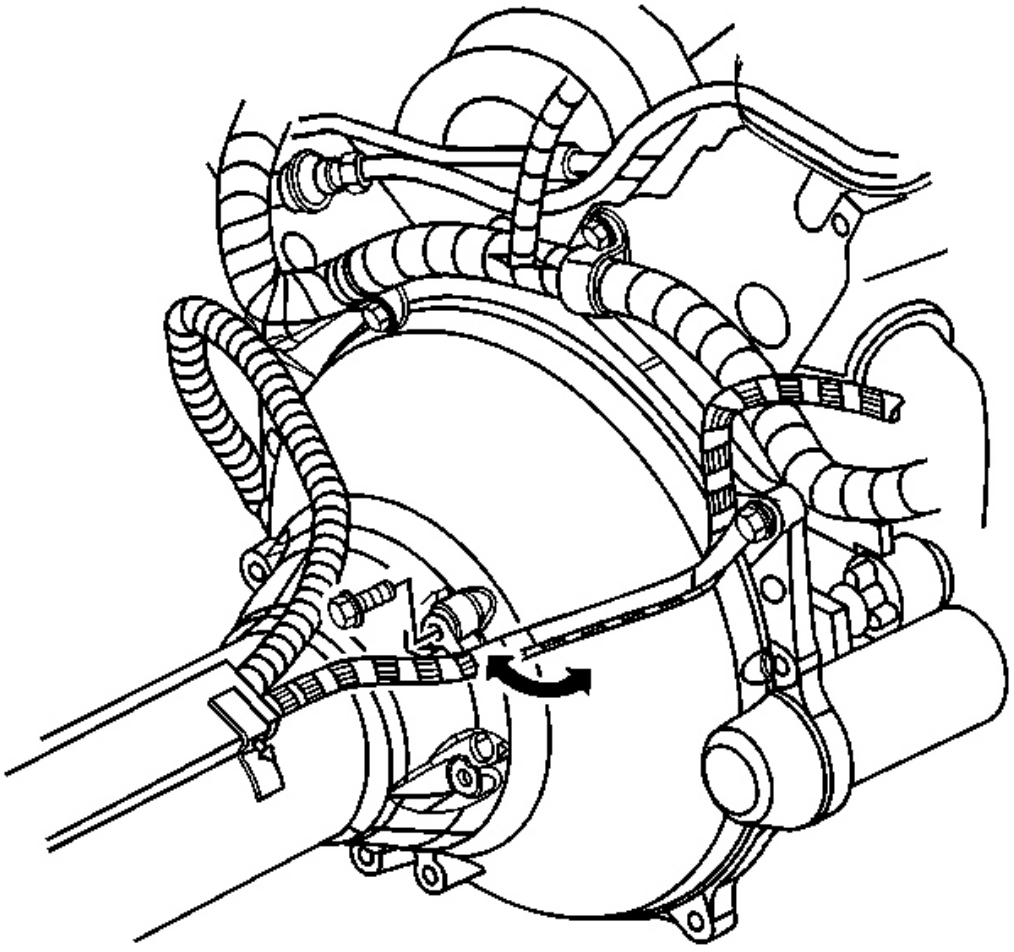


Fig. 223: Wiring Harness Bracket
Courtesy of GENERAL MOTORS CORP.

52. Carefully bend the wiring harness bracket away from the driveline, toward the driveline tunnel wall in order to make a clear removal path for the driveline.

cardiagn.com

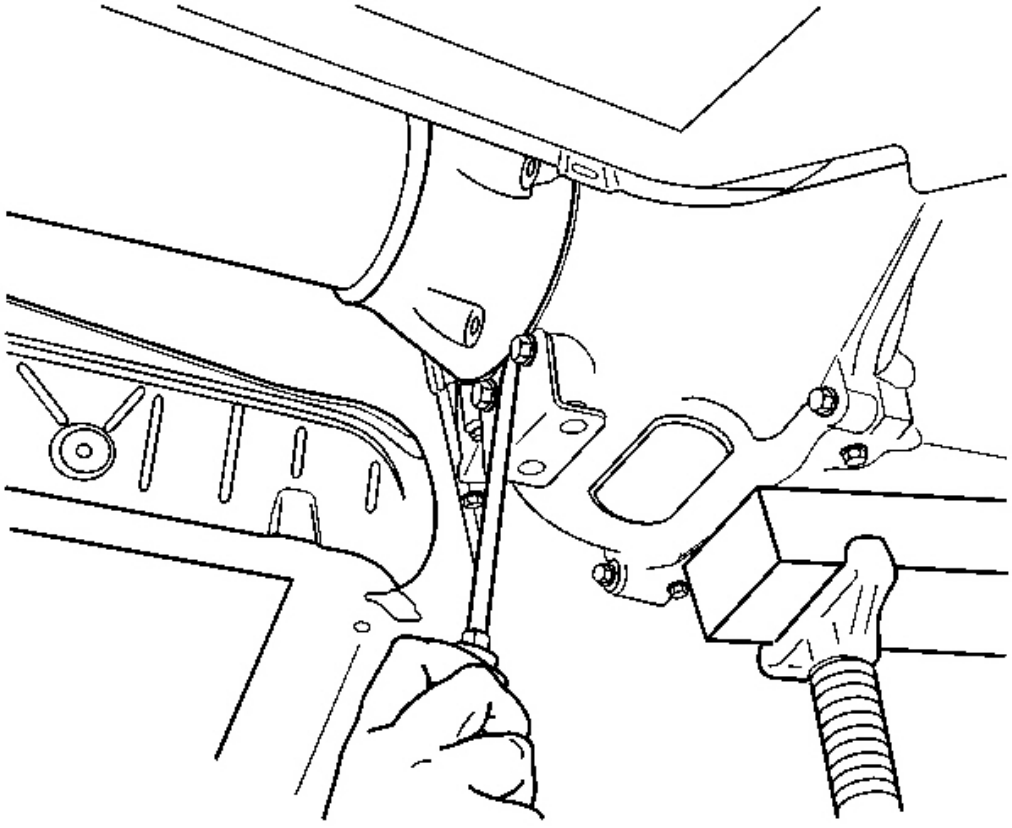


Fig. 224: Inserting A Flat Bladed Tool Between The Edge Of Driveline Support Assembly & Engine Flywheel Housing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The aid of an assistant will be necessary for the remaining steps.

53. Have an assistant insert a flat bladed screwdriver, or similar tool, between the edge of the driveline support assembly and the engine flywheel housing, then begin to pry the driveline loose from the engine.

cardiagn.com

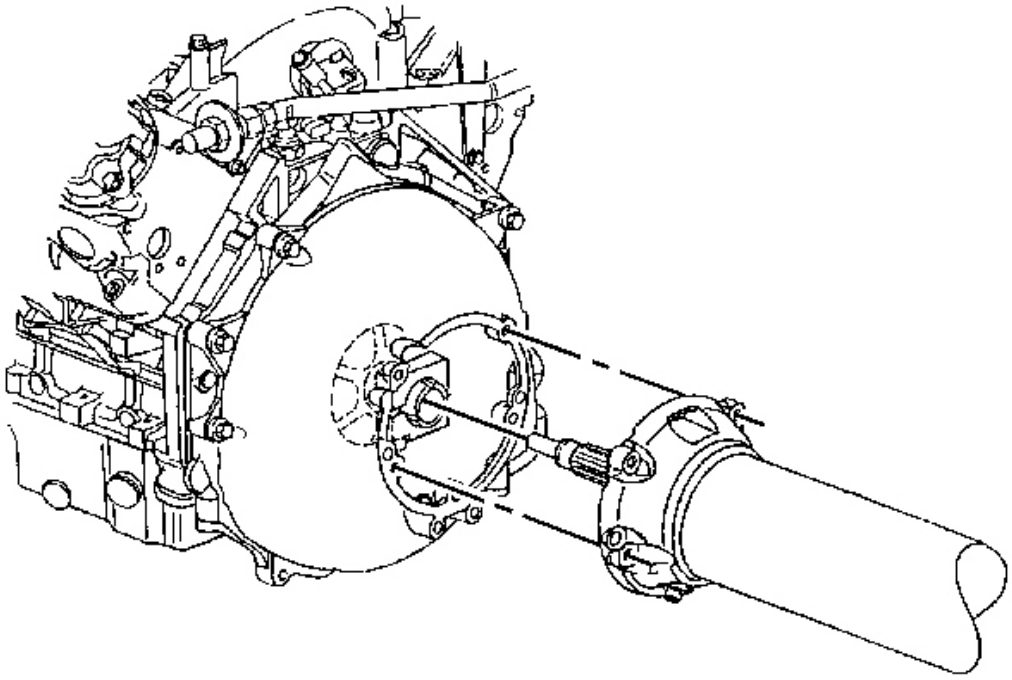


Fig. 225: Propeller Input Shaft & Rear Of Engine Flywheel Housing
Courtesy of GENERAL MOTORS CORP.

54. Have an assistant guide the front of the driveline during the removal of the driveline from the vehicle.
55. SLOWLY lower the driveline, while simultaneously adjusting the angle of tilt and pulling the driveline away from the engine UNTIL the propeller input shaft at the front of the driveline support assembly just clears the engine flywheel housing.
56. SLOWLY lower the driveline completely out of the vehicle.

cardiagn.com

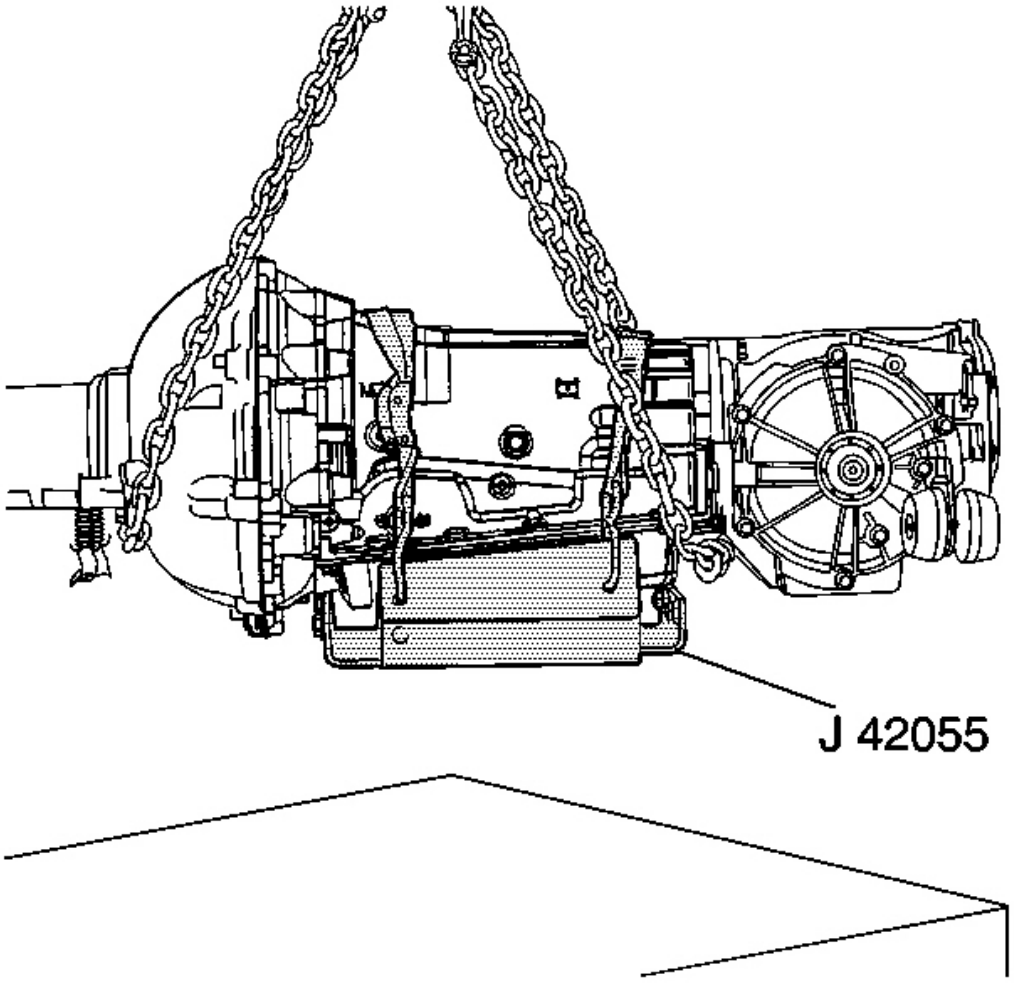


Fig. 226: J 42055 & Transmission Jack
Courtesy of GENERAL MOTORS CORP.

57. Position the chainfall, or equivalent, of a lift device in a way which will protect the transmission oil cooler rear pipes and the rear exhaust hangers located on the driveline support assembly.
58. Using the lift device, raise the driveline to relieve the weight from the transmission jack.
59. Disconnect the **J 42055** from the transmission jack ONLY, the **J 42055** will provide stability to the driveline components while working on a bench.
60. Position the driveline on a workbench with the lift device still attached.
61. Support the driveline support assembly and the differential for additional balance.
62. Remove the lift device from the driveline.

cardiagn.com

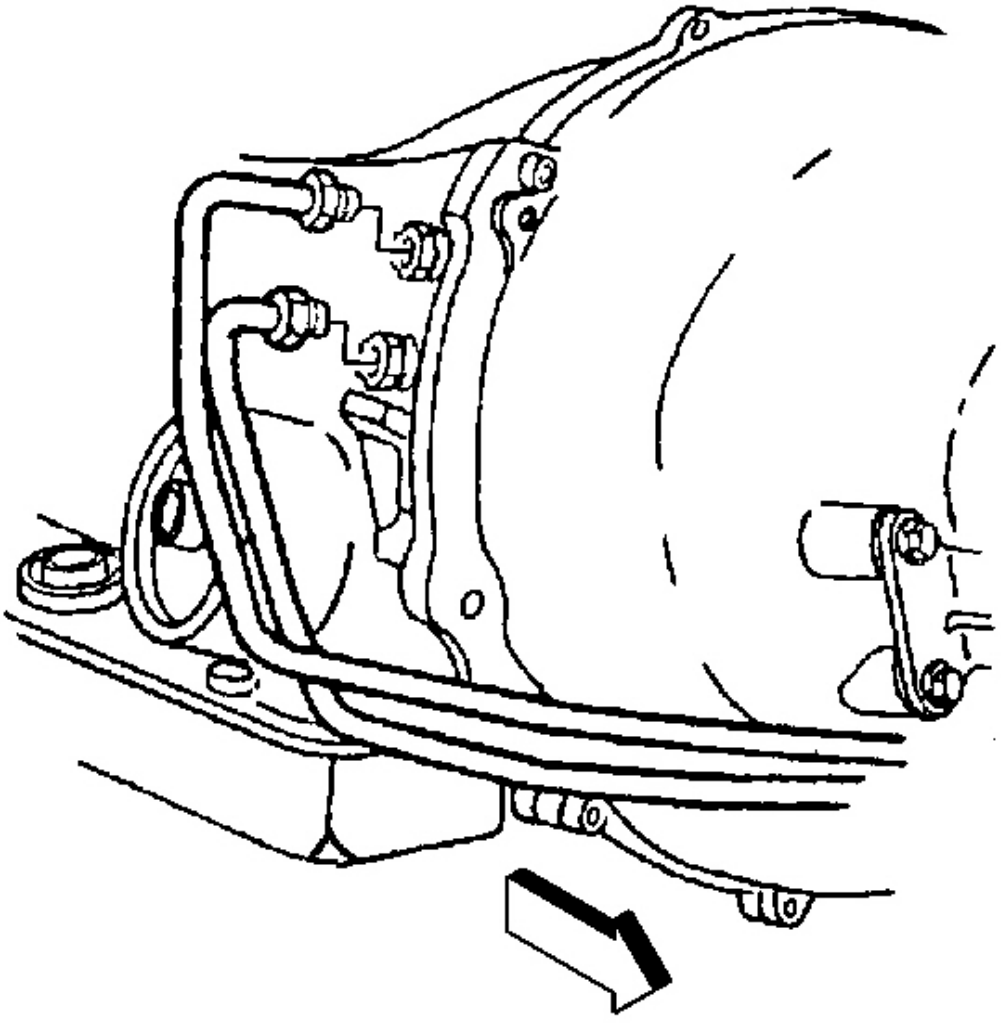


Fig. 227: TOC Rear Upper & Lower Pipe Fittings
Courtesy of GENERAL MOTORS CORP.

63. Disconnect the transmission oil cooler rear pipes from the fittings on the transmission, then cap the pipes and plug the transmission fittings to prevent contamination.

cardiagn.com

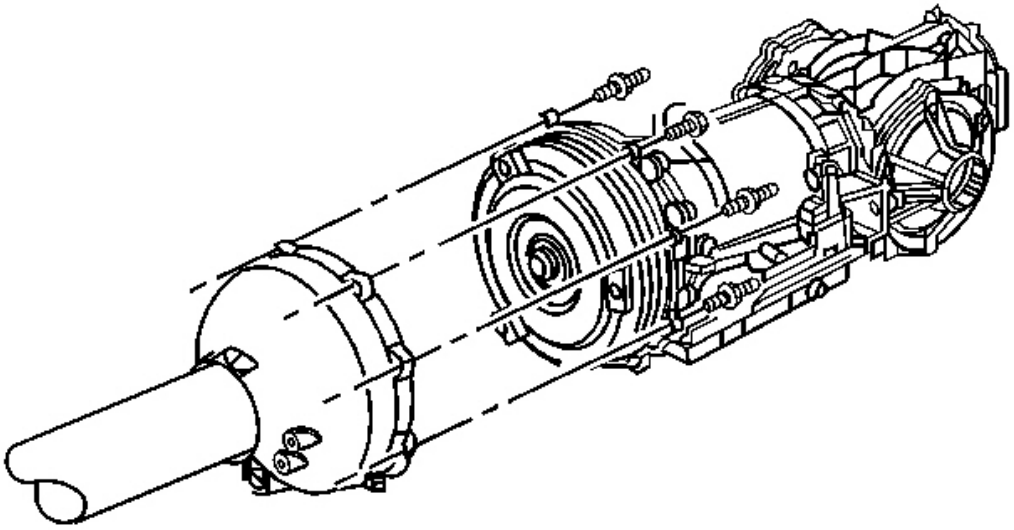


Fig. 228: Driveline Support Assembly, Bolts & Studs
Courtesy of GENERAL MOTORS CORP.

64. Remove the transmission to driveline support assembly bolts/studs.
65. Insert a flat bladed screwdriver, or similar tool, between the edge of the driveline support assembly and the transmission, then begin to pry the driveline support assembly loose from the transmission.
66. Slowly slide the driveline support assembly away from the transmission while supporting the transmission torque converter.
67. Using a strap positioned from side to side, secure the transmission torque converter to the transmission.

cardiagn.com

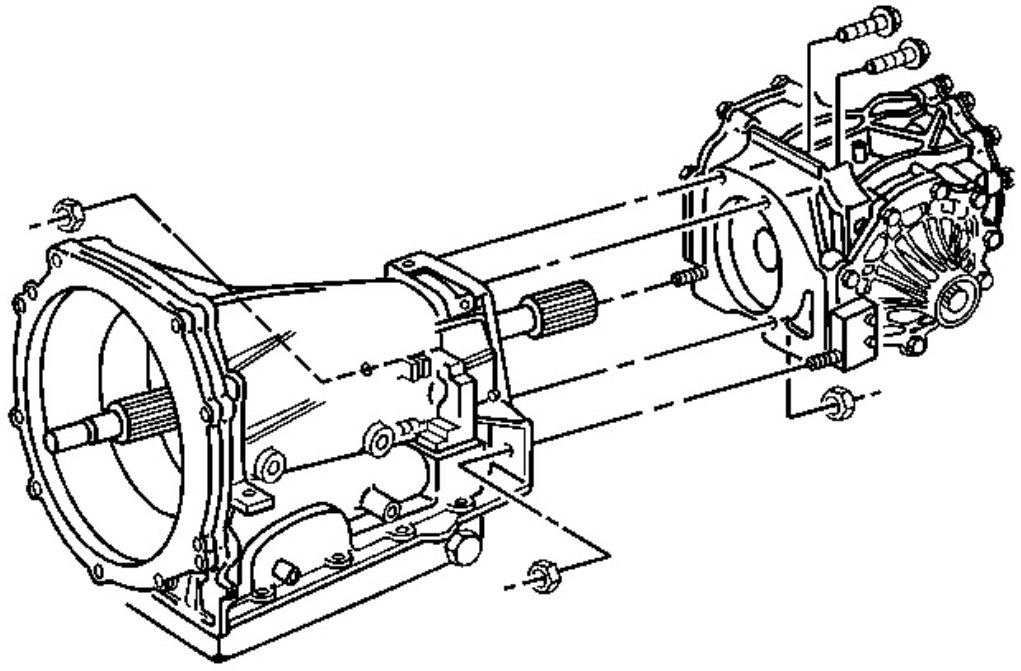


Fig. 229: Differential, Transmission Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

68. Remove the differential to transmission bolts and nuts.

IMPORTANT: Use care when separating the differential from the transmission to not damage the transmission output shaft seal in the differential plate.

69. SLOWLY slide the differential from the transmission.

cardiagn.com

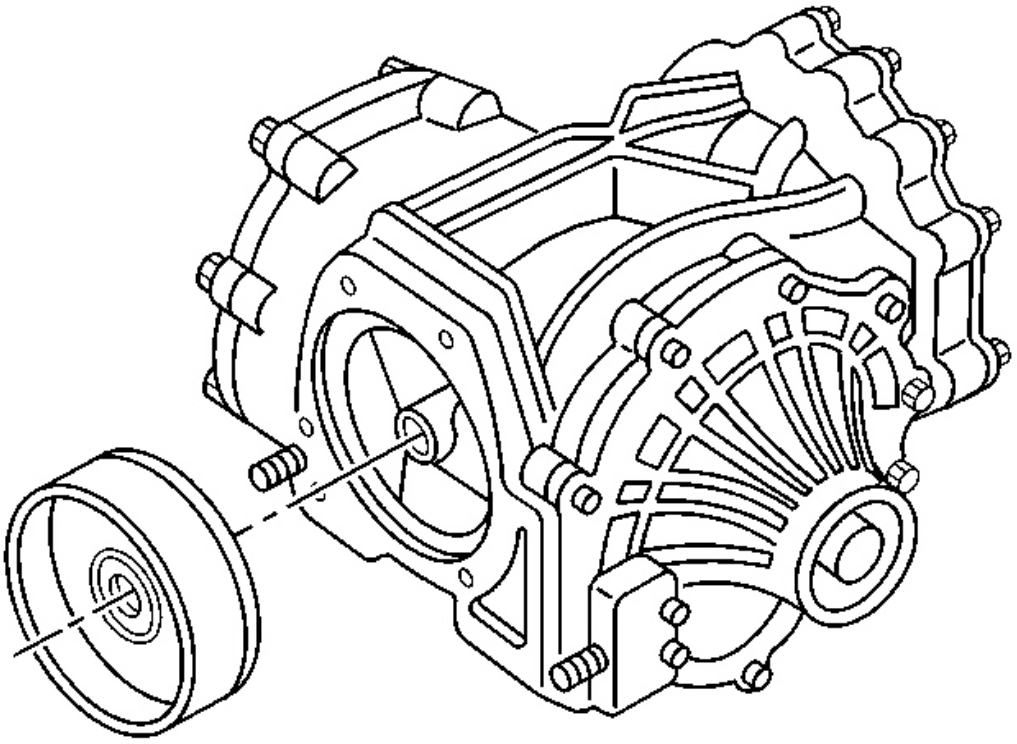


Fig. 230: Differential Plate & Differential
Courtesy of GENERAL MOTORS CORP.

70. Remove the differential plate from the differential.
71. Remove the transmission from the **J 42055** , if necessary.

Installation Procedure

NOTE: Failure to follow the proper removal and installation procedures may result in damage to the engine crankshaft thrust bearing.

Tools Required

J 42055 Transmission Support Fixture

cardiagn.com

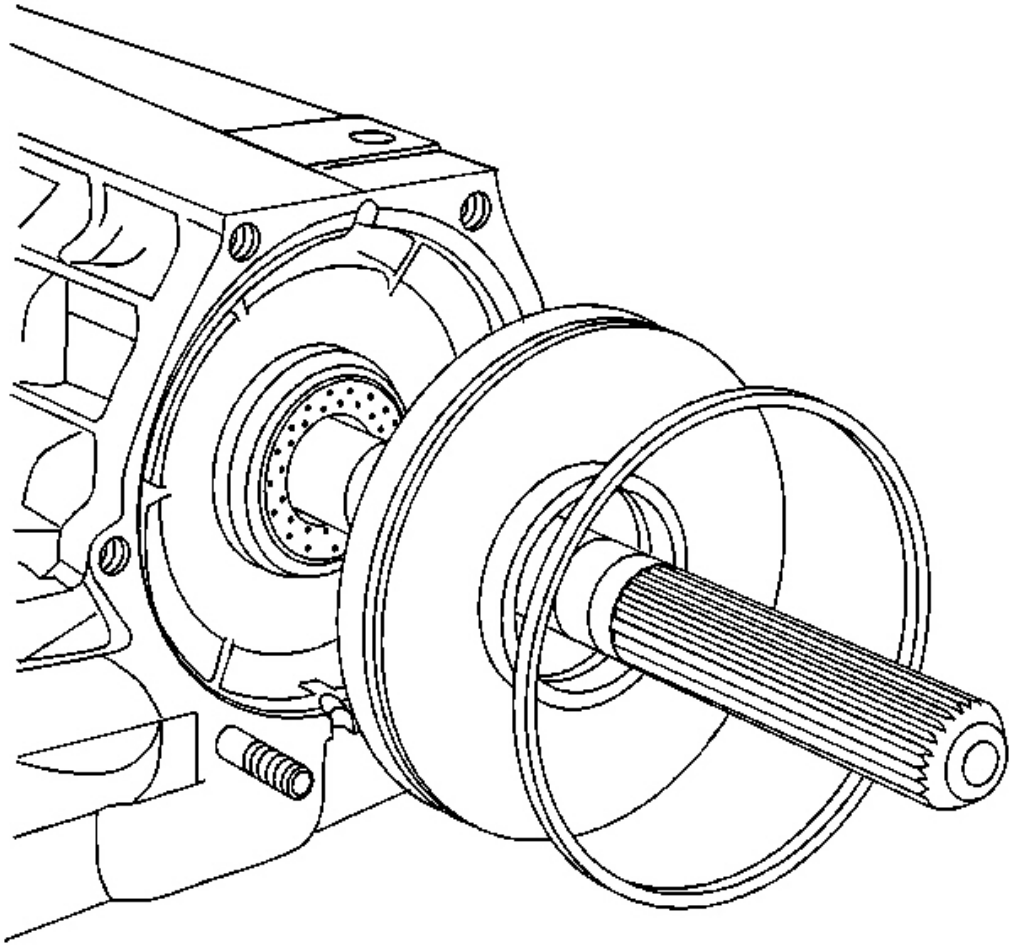


Fig. 231: Differential Plate Seal Flush & Differential Plate
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission to the **J 42055** , if removed.
2. Install the differential plate to the transmission, use care not to damage the transmission output seal in the rear of the plate.
3. Position the differential plate seal flush with the transmission case.

cardiagn.com

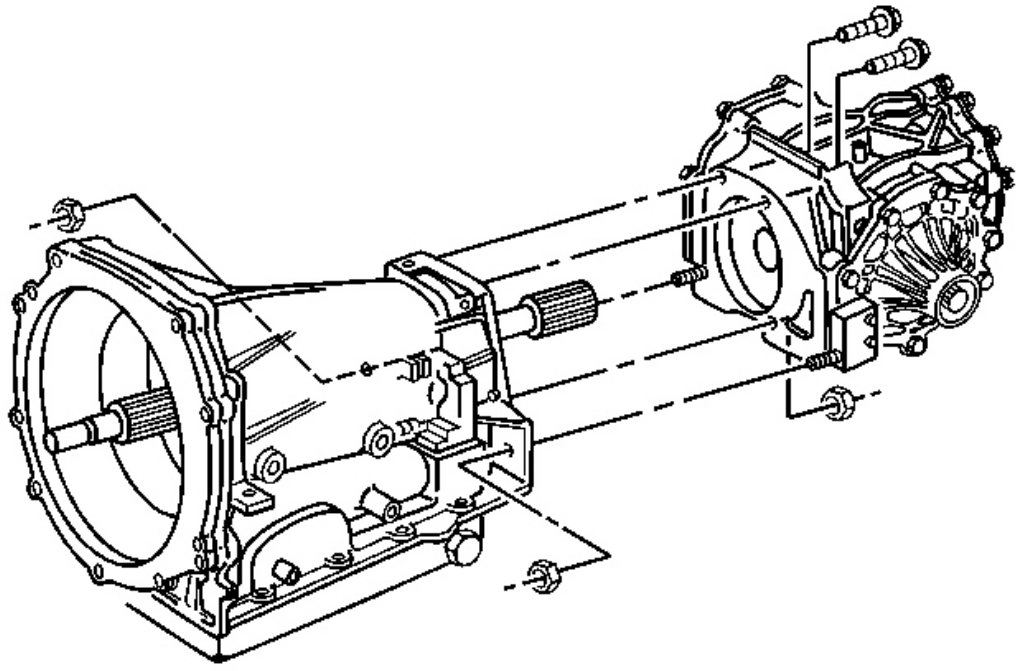


Fig. 232: Differential, Transmission Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

4. SLOWLY slide the differential to the transmission.

NOTE: Refer to Fastener Notice in Cautions and Notices.

5. Install the differential to transmission bolts and nuts.

Tighten: Tighten the differential to transmission bolts and nuts to 50 N.m (37 lb ft).

cardiagn.com

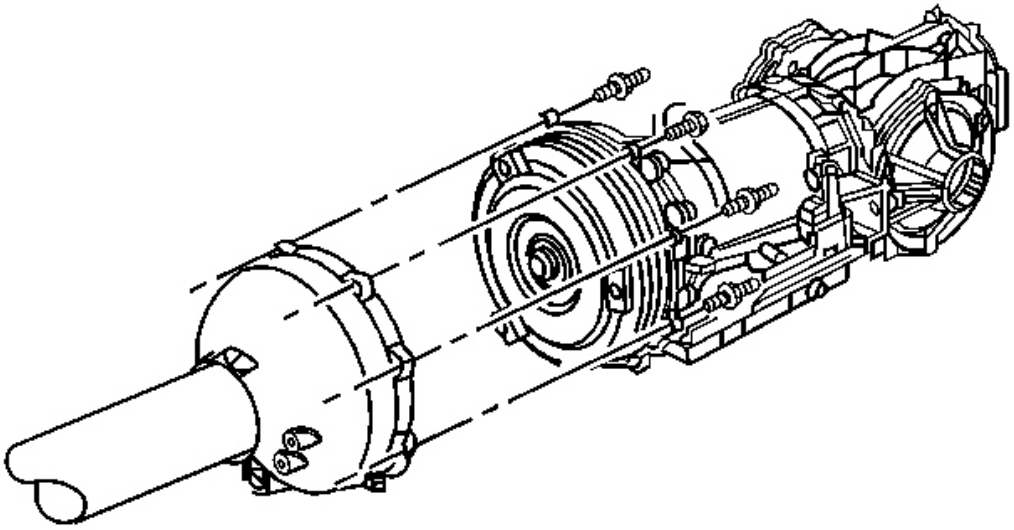


Fig. 233: Driveline Support Assembly, Bolts & Studs
Courtesy of GENERAL MOTORS CORP.

6. Remove the strap retaining the transmission torque converter.
7. Slowly slide the driveline support assembly to the transmission, while supporting the transmission torque converter.
8. Install the transmission to driveline support assembly bolts/studs.

Tighten: Tighten the transmission to driveline support assembly bolts/studs to 50 N.m (37 lb ft).

cardiagn.com

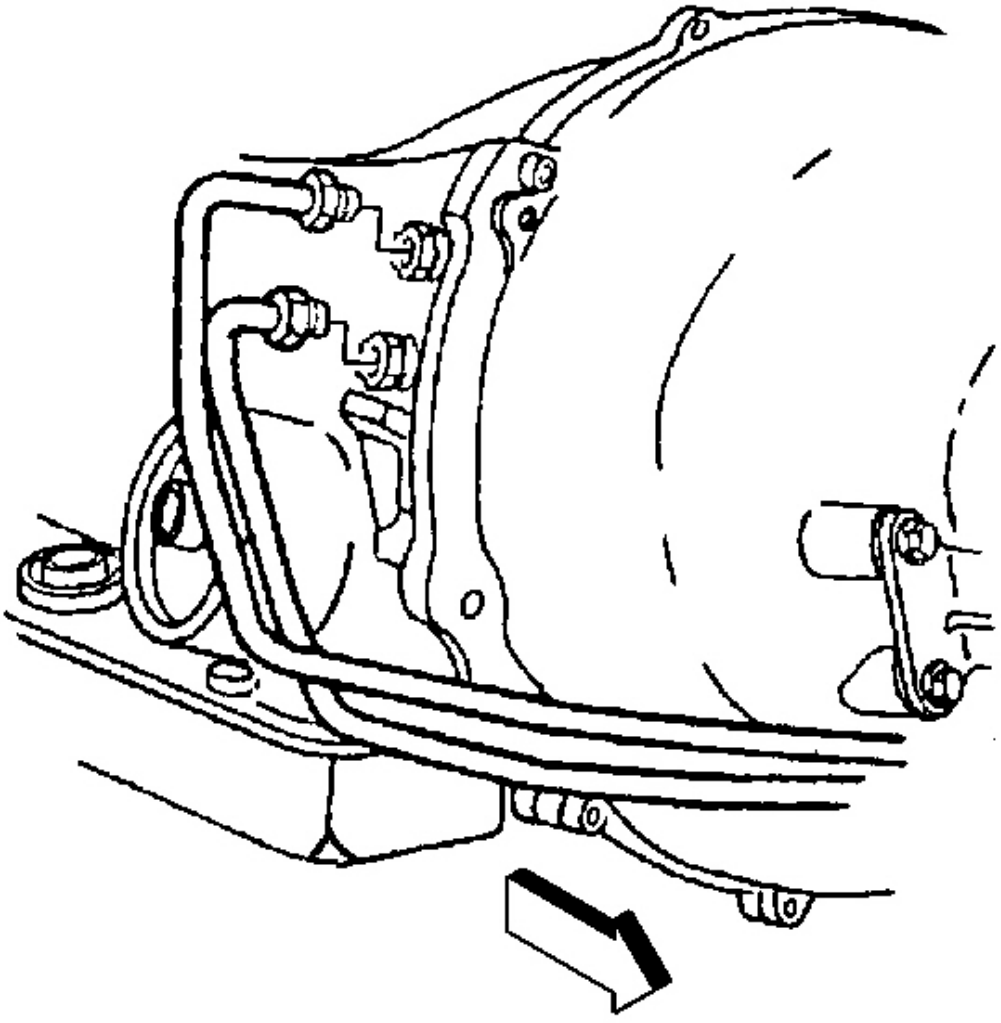


Fig. 234: TOC Rear Upper & Lower Pipe Fittings
Courtesy of GENERAL MOTORS CORP.

9. Remove the caps from the rear of the transmission oil cooler rear pipes and remove the plugs from the fittings on the transmission.
10. ALIGN and HAND-START, then tighten ONLY by hand to seat the transmission oil cooler rear pipes to the fittings on the transmission.

Tighten: Tighten the transmission oil cooler rear pipes to transmission fittings to 40 N.m (30 lb ft).

cardiagn.com

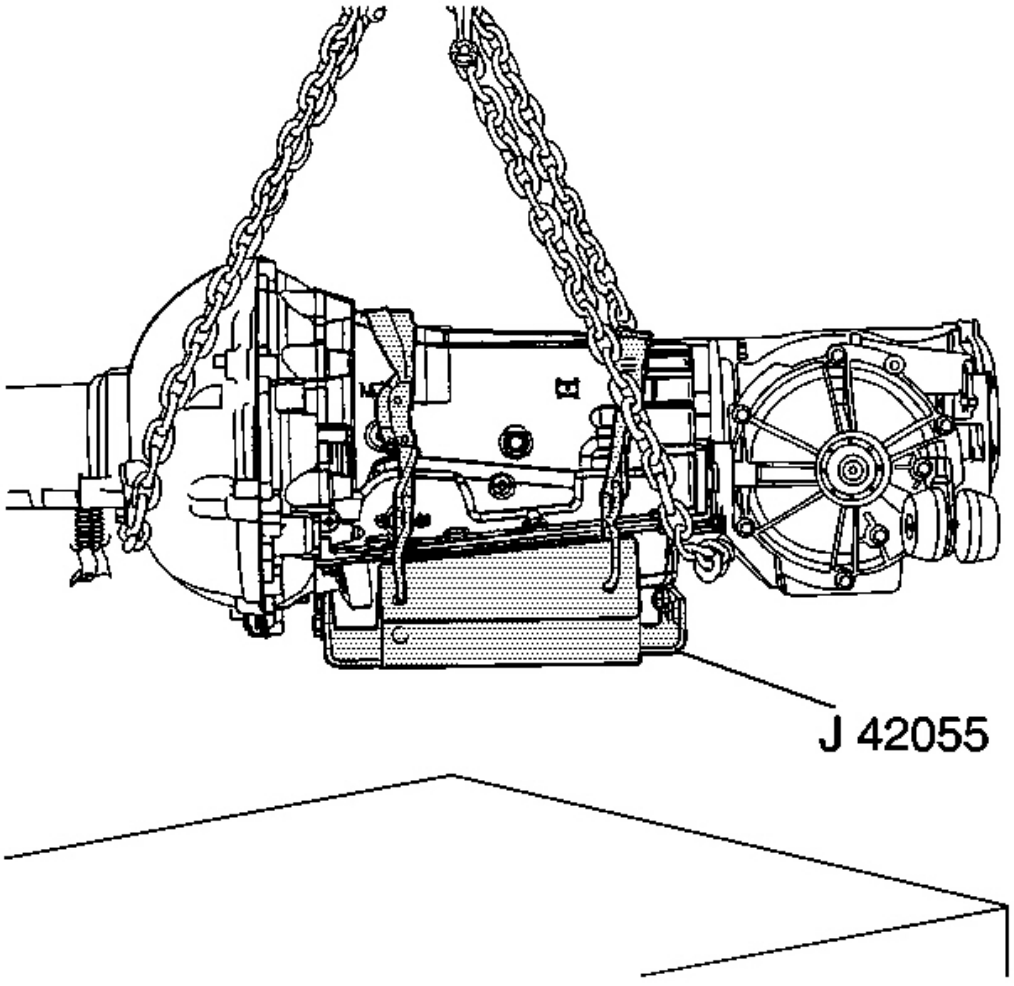


Fig. 235: J 42055 & Transmission Jack
Courtesy of GENERAL MOTORS CORP.

11. Position the chainfall, or equivalent, of a lift device in a way which will protect the transmission oil cooler rear pipes and the rear exhaust hangers located on the driveline support assembly.

IMPORTANT: The aid of an assistant will be necessary for the following steps until the driveline is installed into the vehicle.

12. Using the lift device, raise the driveline off the workbench and position the driveline with the **J 42055** onto a transmission jack.
13. Connect the **J 42055** to the transmission jack.

cardiagn.com

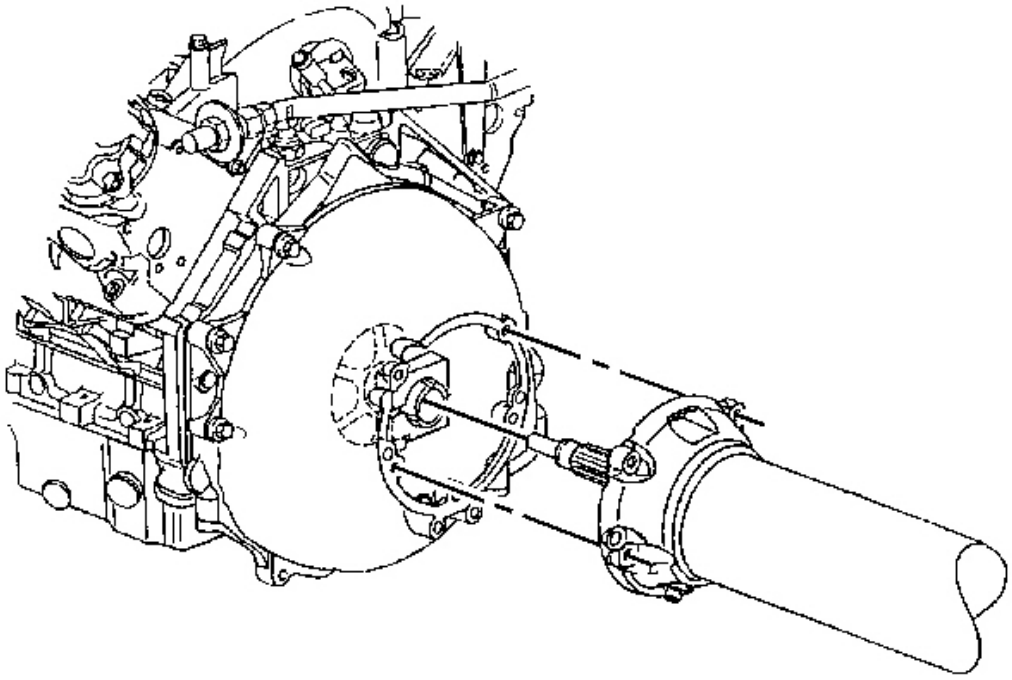


Fig. 236: Propeller Input Shaft & Rear Of Engine Flywheel Housing
Courtesy of GENERAL MOTORS CORP.

14. Remove the lift device from the driveline.
15. Position the driveline under the vehicle.
16. Begin to raise the driveline at the approximate angle used during removal.
17. Position the wiring harness along the driveline support assembly and LOOSELY install the harness into the harness retaining slots.
18. Have an assistant guide the front of the driveline so the propeller input shaft is just to the rear of the engine flywheel housing, then raise the driveline to the PROPER HEIGHT and the PROPER ANGLE to install to the engine.

IMPORTANT: Use care not to use too much force to install the propeller input shaft into the propeller shaft hub. The propeller input shaft front bearing positioning system is designed to withstand an insertion force not greater than 582 N (130 lb).

19. Have an assistant begin to insert the propeller input shaft into the propeller shaft hub while maintaining the proper angle of the driveline, if necessary use a screwdriver to rotate the shaft slightly to bring the splines into alignment.

cardiagn.com

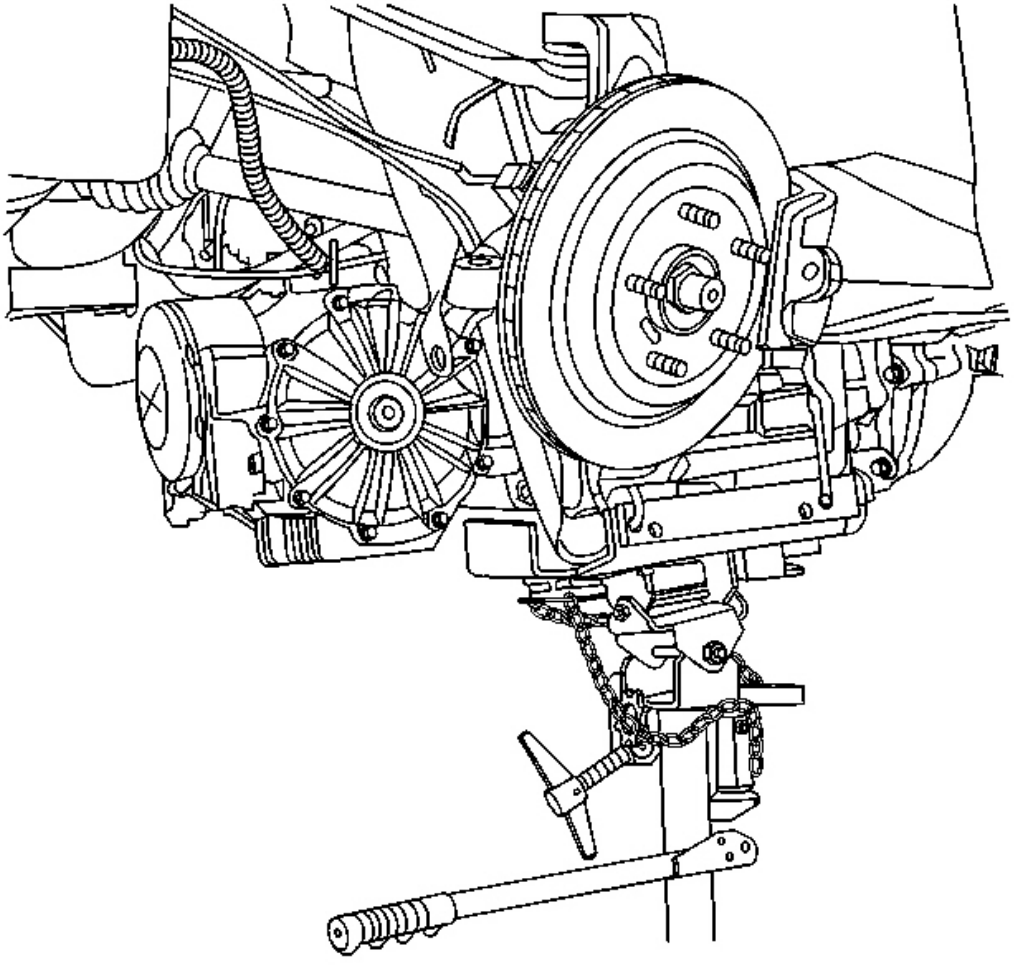


Fig. 237: Transmission Jack Supporting The Differential
Courtesy of GENERAL MOTORS CORP.

20. SLOWLY seat the driveline to the engine flywheel housing while maintaining the proper angle of the driveline.

cardiagn.com

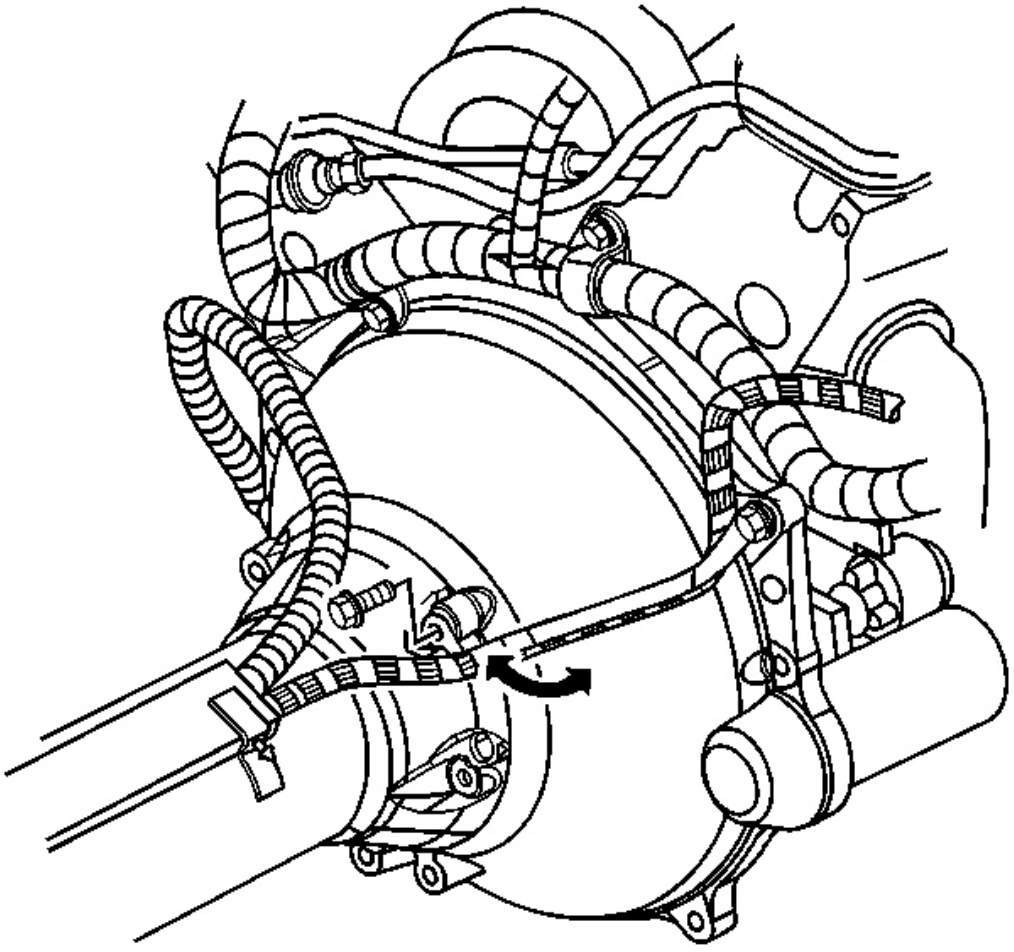


Fig. 238: Wiring Harness Bracket
Courtesy of GENERAL MOTORS CORP.

21. Reposition the wiring harness bracket from near the driveline tunnel wall to align with the appropriate driveline support assembly bolt hole.

cardiagn.com

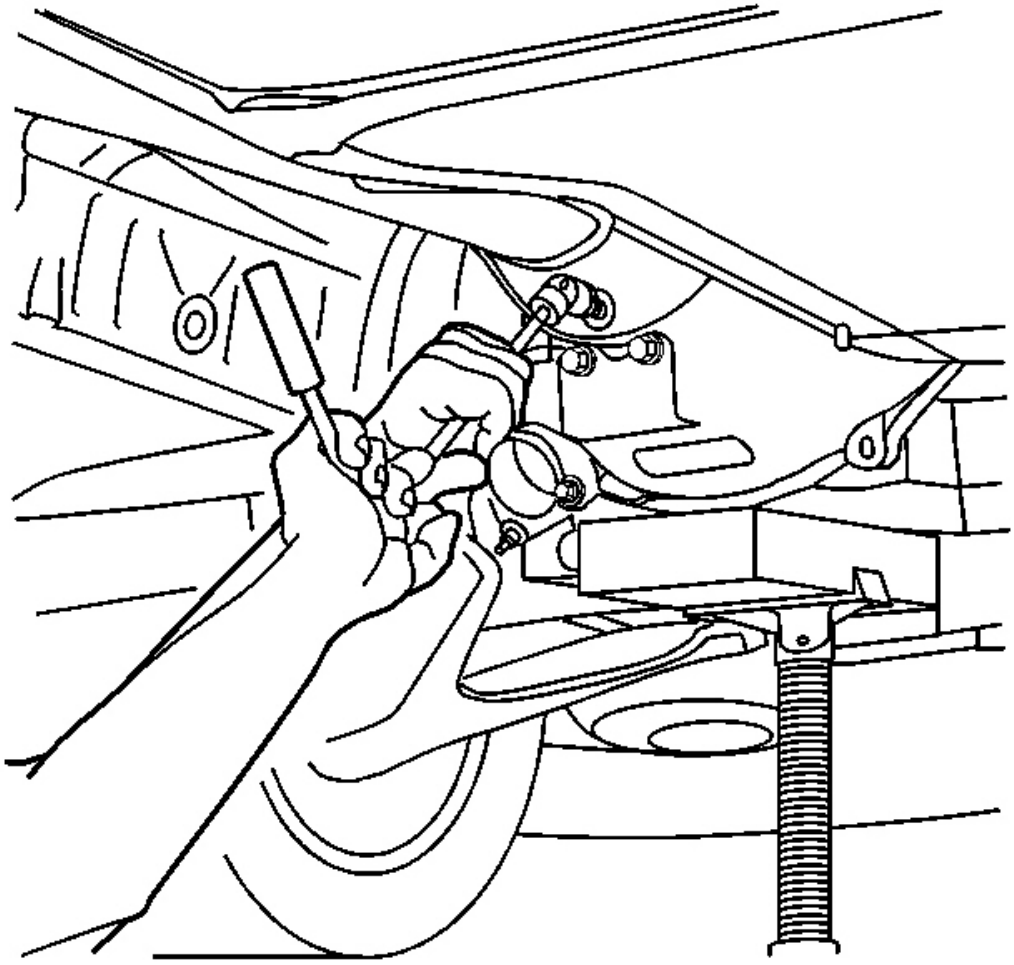


Fig. 239: Removing/Installing The Five Driveline Support Assembly To Engine Flywheel Housing Bolts
Courtesy of GENERAL MOTORS CORP.

22. Install the five driveline support assembly to engine flywheel housing bolts.

    Tighten: Tighten the driveline support assembly to engine flywheel housing bolts to 50 N.m (37 lb ft).

23. Install the wiring harness to the wiring harness retainer along the top of the transmission.
24. SLOWLY raise the driveline to approximately 5 cm (2 in) BELOW the final installed height.

cardiagn.com

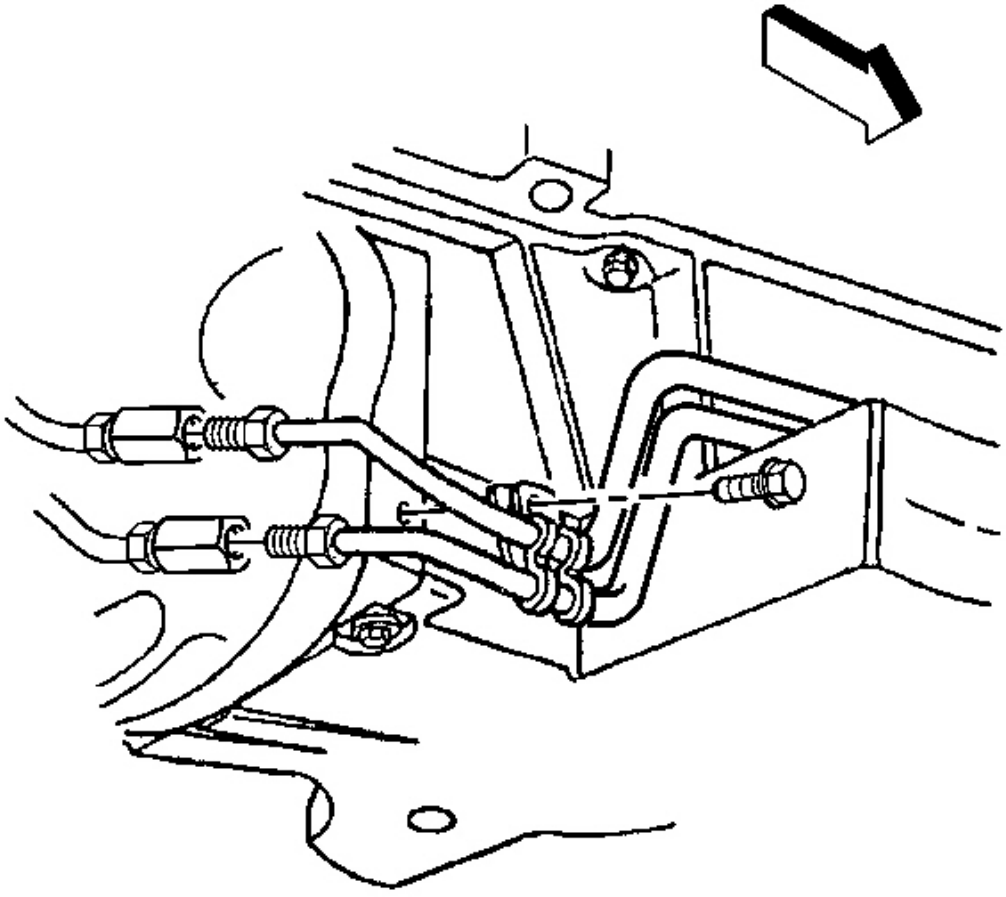


Fig. 240: Locating Cooler Fittings
Courtesy of GENERAL MOTORS CORP.

25. Remove the caps from the front of the transmission oil cooler rear pipes and remove the plugs from the junction fittings at the engine flywheel housing.
26. ALIGN and HAND-START, then tighten ONLY by hand to seat the transmission oil cooler rear pipes to the junction fittings at the engine flywheel housing.

    Tighten: Tighten the transmission oil cooler rear pipes to junction fittings at engine flywheel housing to 27 N.m (20 lb ft).

cardiagn.com

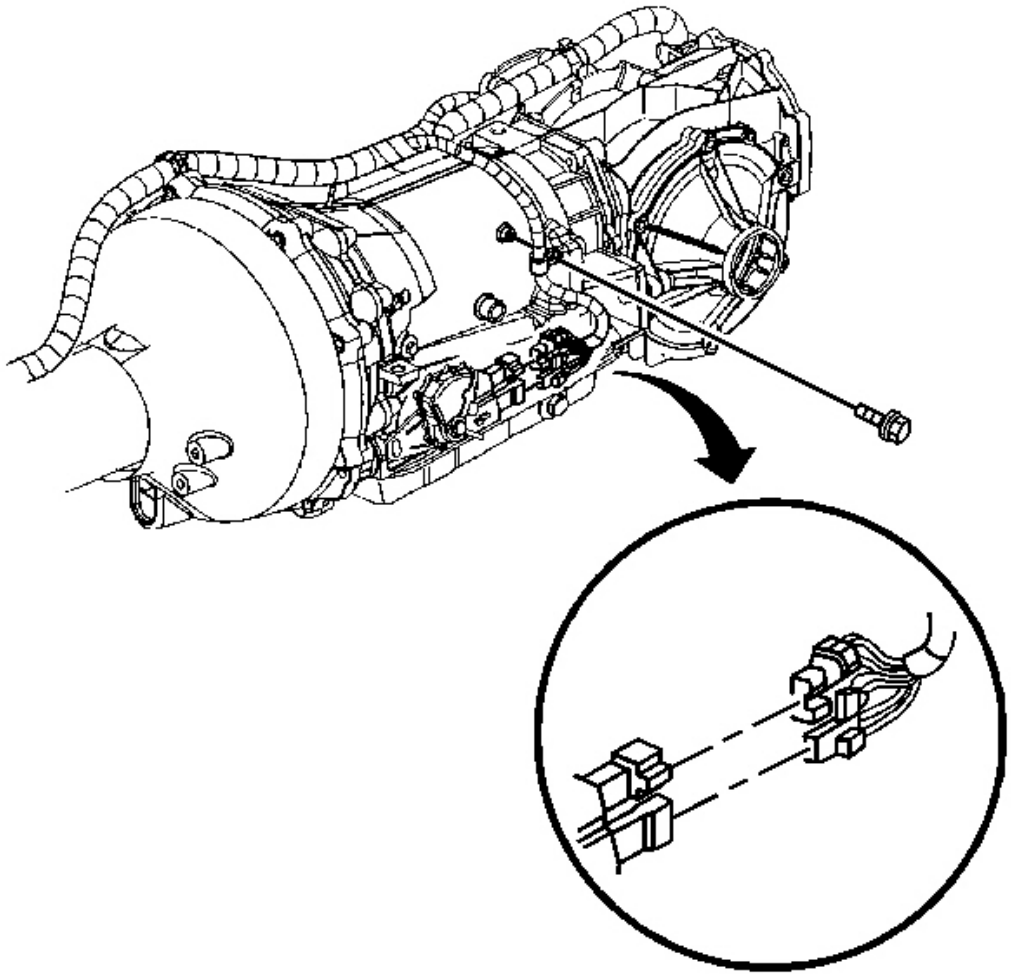


Fig. 241: Park/Neutral Position Switch Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

27. Install the transmission wiring harness to LH side of transmission case retaining bolt.

    Tighten: Tighten the transmission wiring harness to LH side of transmission case retaining bolt to 2.5 N.m (22 lb in).

28. Connect the park/neutral position switch electrical connectors.

cardiagn.com

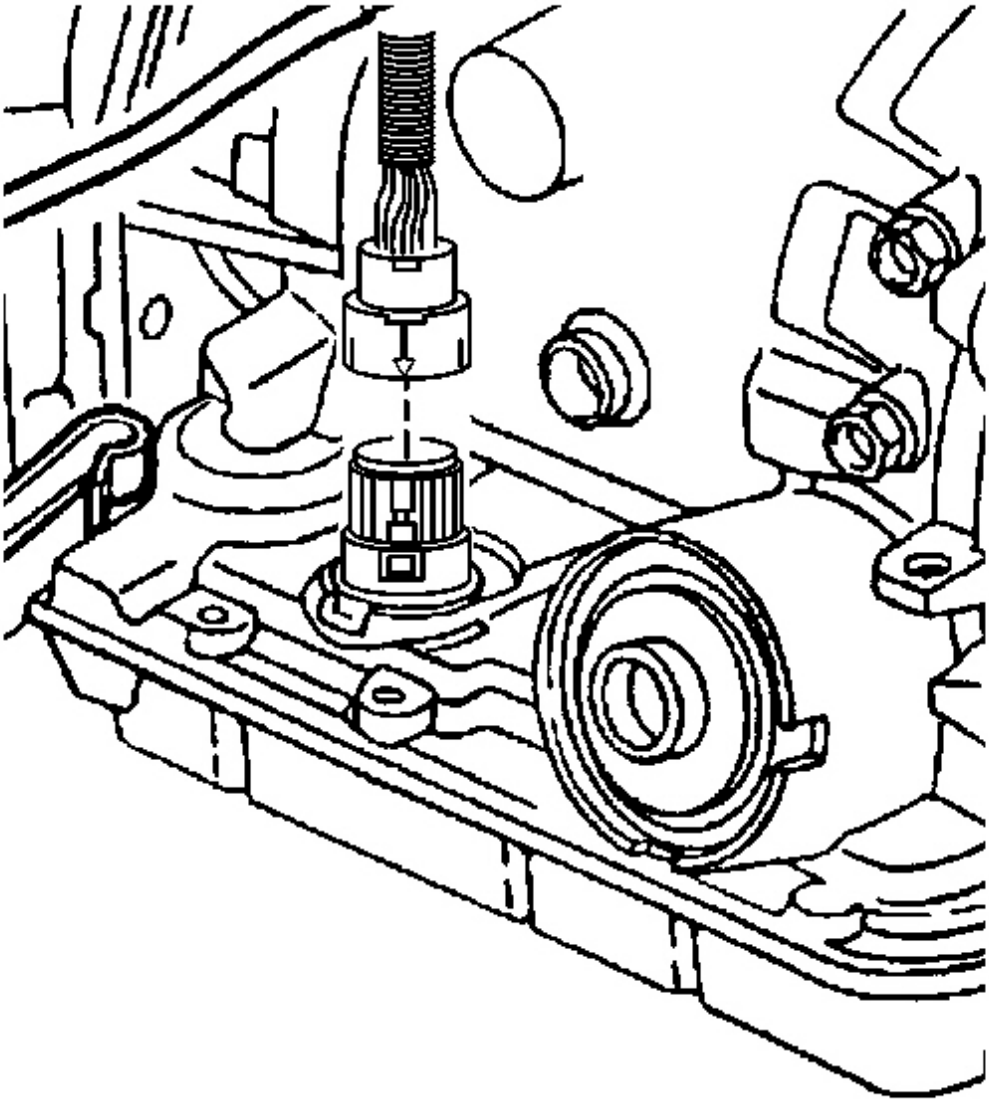


Fig. 242: Connecting The Transmission Harness 20-Way Connector
Courtesy of GENERAL MOTORS CORP.

29. Connect the transmission harness 20-way connector.

    Align the arrows on each half of the connector and insert straight down.

cardiagn.com

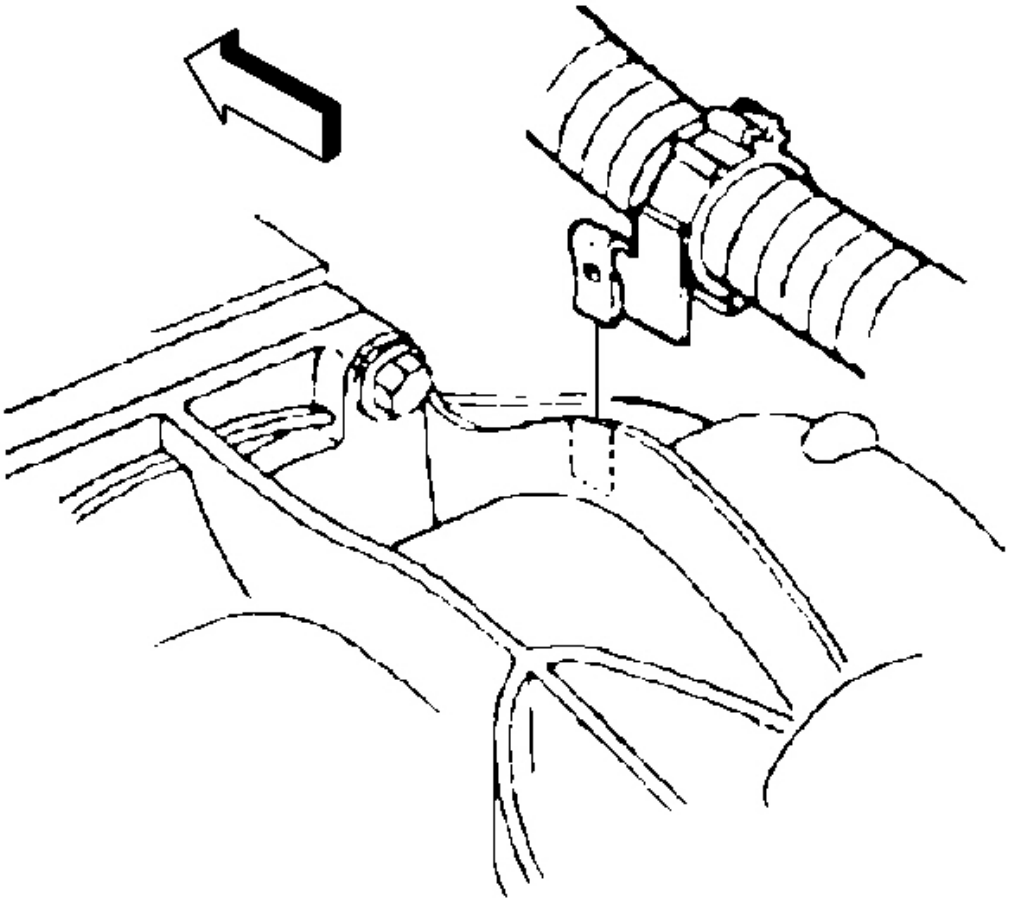


Fig. 243: Wiring Harness Retainer & Clip
Courtesy of GENERAL MOTORS CORP.

30. Connect the wiring harness clip to the top of the differential.
31. Connect the wiring harness retainer to the stud at the differential rear cover.

cardiagn.com

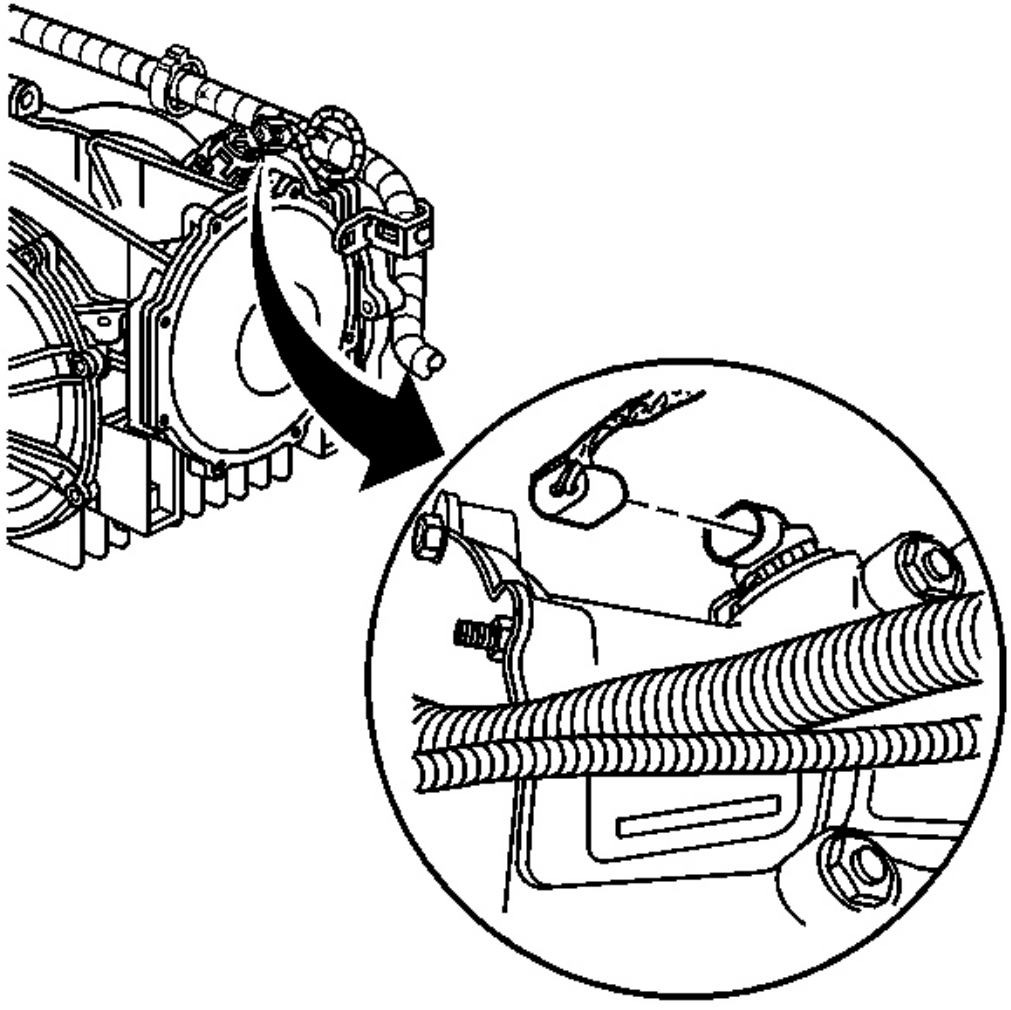


Fig. 244: VSS Electrical Connector
Courtesy of GENERAL MOTORS CORP.

32. Connect the vehicle speed sensor (VSS) electrical connector.

cardiagn.com

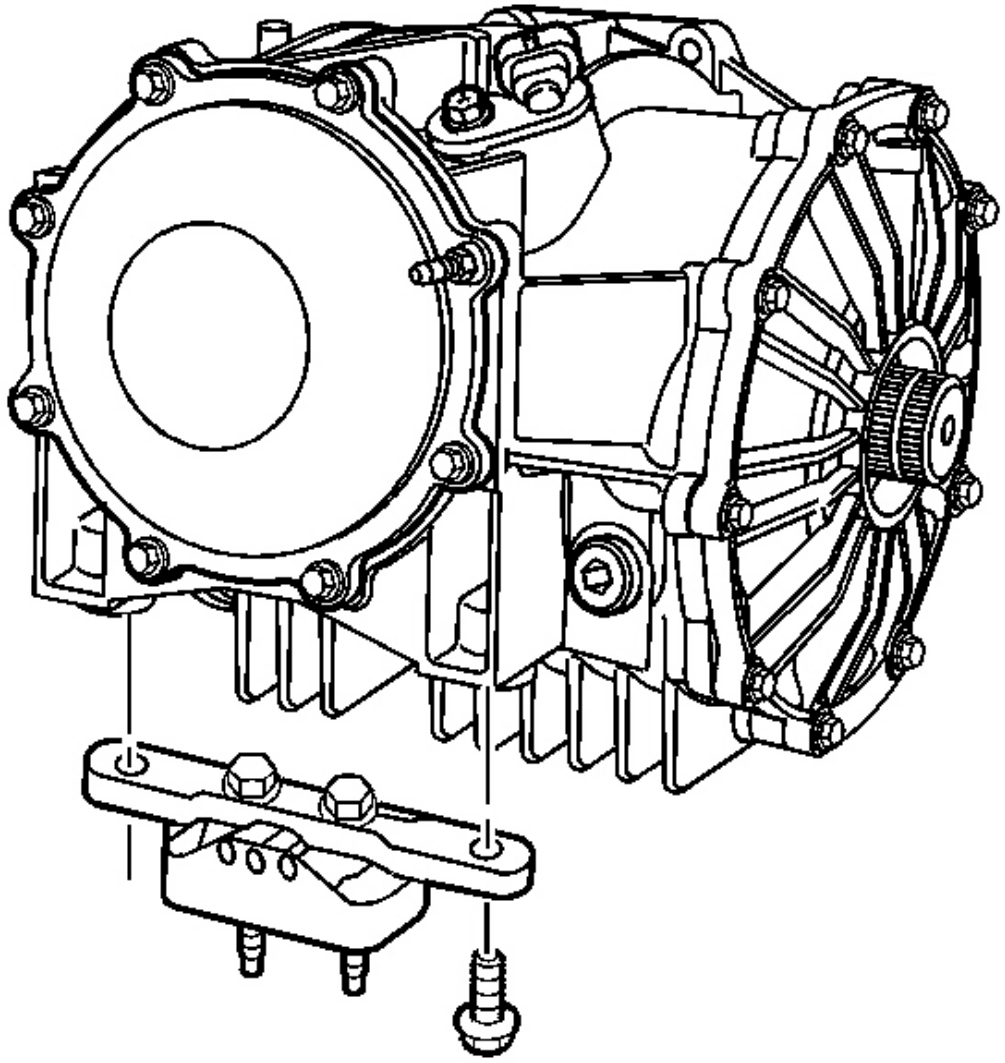


Fig. 245: Mount Location
Courtesy of GENERAL MOTORS CORP.

33. Slowly raise the driveline to final installation height.
34. Remove the jack which supported the engine.
35. Remove the tie-off retainers from the axle shafts.
36. CAREFULLY align and seat the axle shafts to the differential.
37. Install the transaxle mount and bracket to the differential.

cardiagn.com

38. Install the transaxle mount bracket to differential bolts.

    Tighten: Tighten the transaxle mount bracket to differential bolts to 50 N.m (37 lb ft).

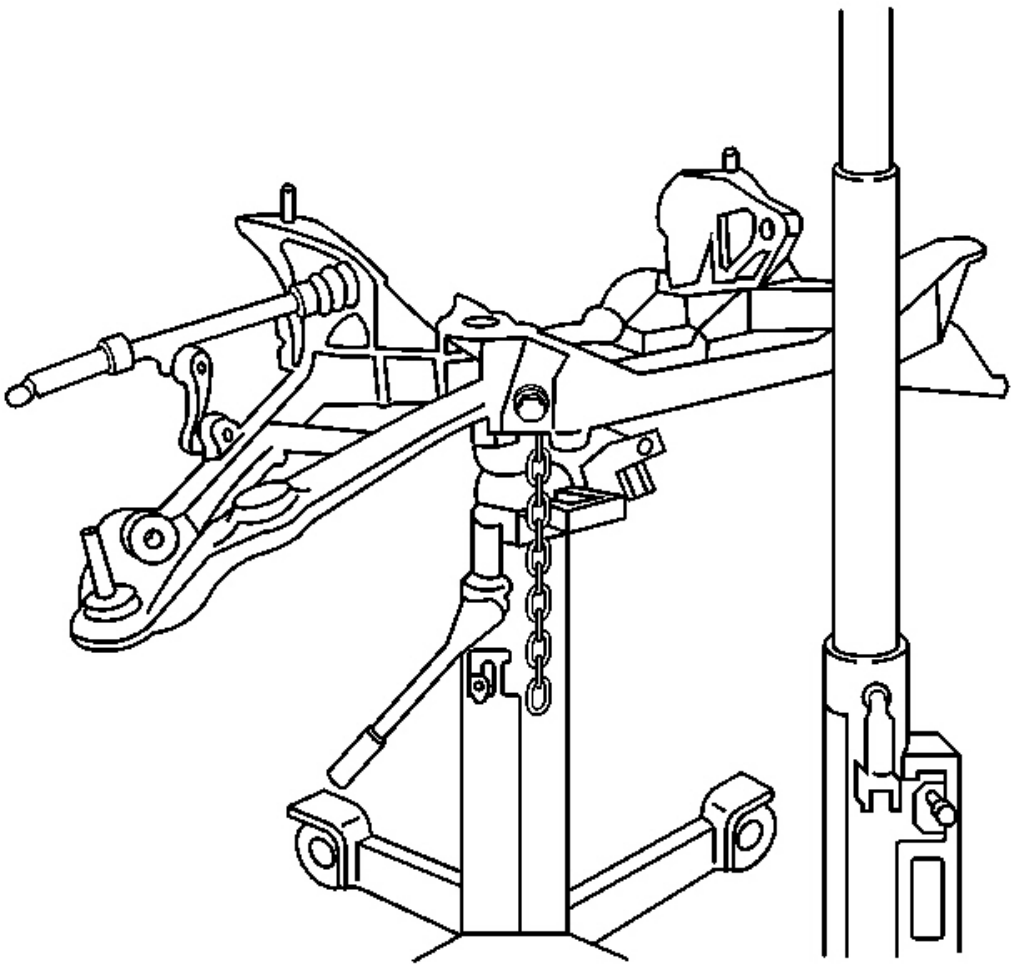


Fig. 246: Supporting Crossmember On Jack
Courtesy of GENERAL MOTORS CORP.

39. With the aid of an assistant, begin to raise the rear suspension crossmember (still firmly attached to a transmission jack), to the vehicle frame rails.
40. Guide the rear suspension crossmember alignment pins into the alignment holes in the vehicle frame rails, and guide the transaxle mount studs into the mounting holes in the crossmember, then raise the crossmember to seat to the frame rails.

cardiagn.com

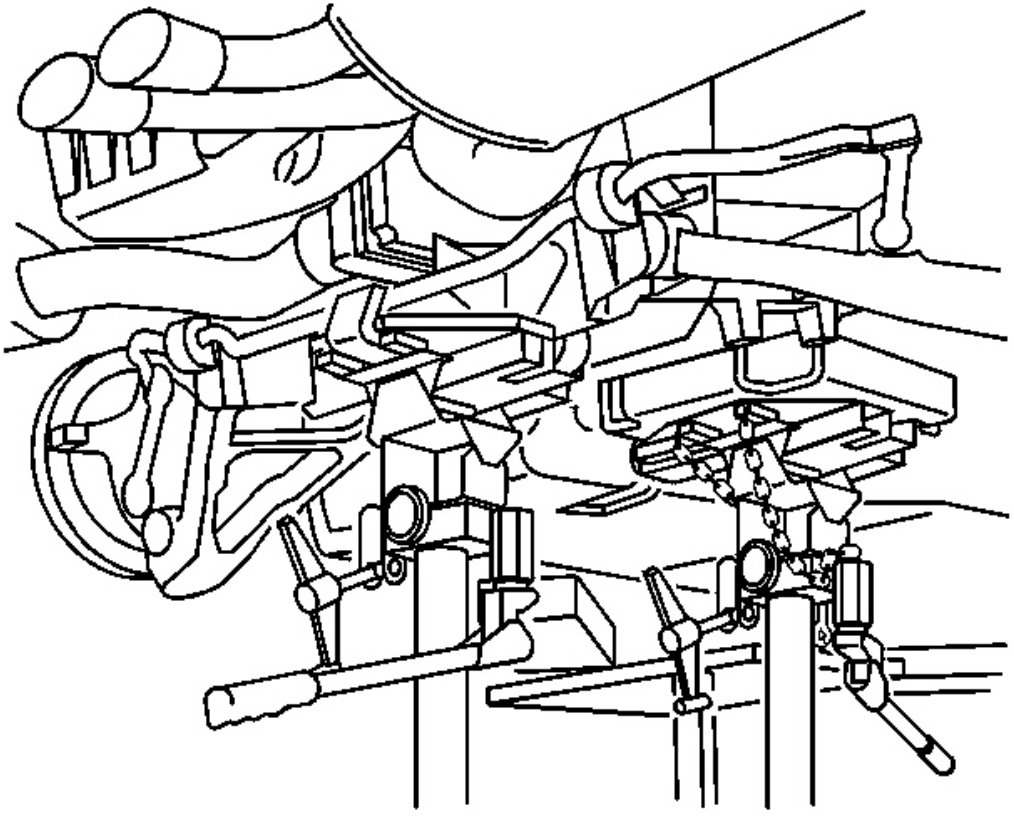


Fig. 247: View Of Jack Under Front End
Courtesy of GENERAL MOTORS CORP.

41. Using ONLY HAND TOOLS, install NEW rear suspension crossmember mounting nuts.

    Tighten: Tighten the rear suspension crossmember mounting nuts to 110 N.m (81 lb ft).

cardiagn.com

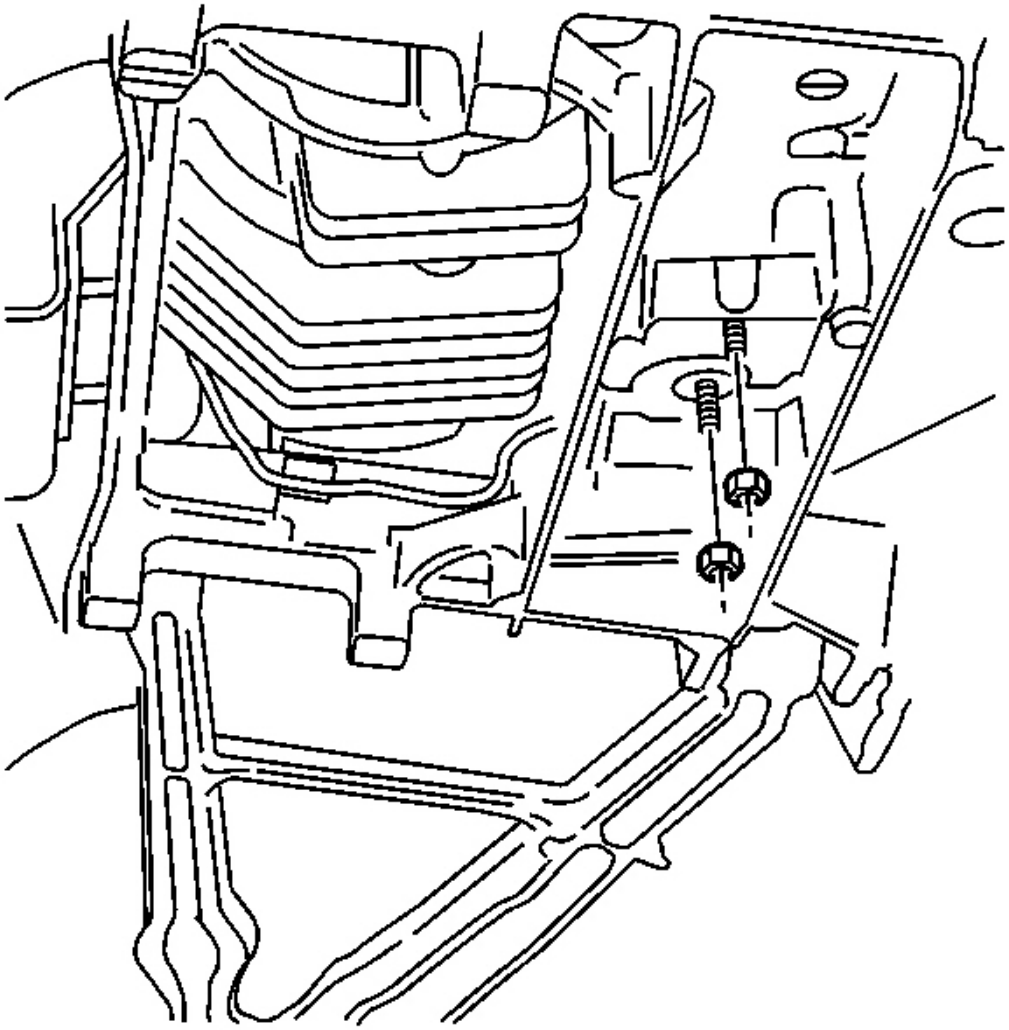


Fig. 248: Transaxle Mount To Rear Crossmember Nuts
Courtesy of GENERAL MOTORS CORP.

42. Remove the transmission jack from the rear suspension crossmember.
43. Release the **J 42055** from the transmission, then remove the **J 42055** and transmission jack.
44. Install the transaxle mount to rear suspension crossmember nuts.

    Tighten: Tighten the transaxle mount to rear suspension crossmember nuts to 50 N.m (37 lb ft).

45. Install the differential to transmission lower nut.

cardiagn.com

Tighten: Tighten the differential to transmission lower nut to 50 N.m (37 lb ft).

46. Connect the wiring harness and brake pipe clip retainers to the rear suspension crossmember.

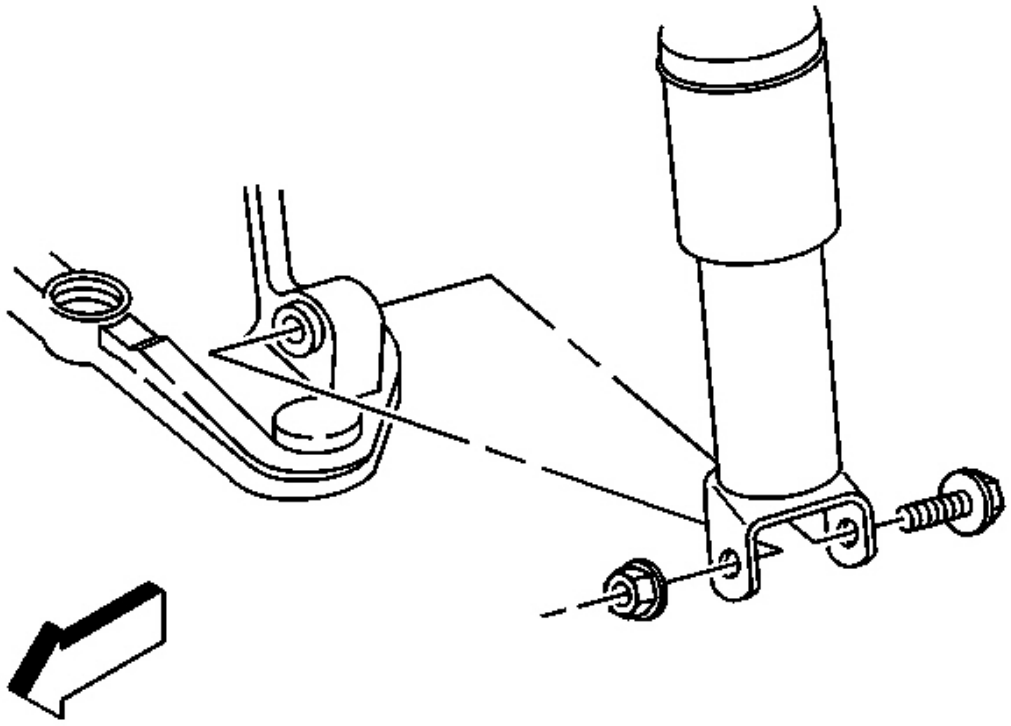


Fig. 249: Mounting Shock Absorber To Control Arm
Courtesy of GENERAL MOTORS CORP.

47. Support the lower control arm with a straight jack.
48. Connect the lower ball joint to the suspension knuckle. Refer to **Knuckle Replacement** in Rear Suspension.
49. Install the shock absorber lower mounting bolt.

Tighten: Tighten the rear shock absorber lower mounting bolt to 220 N.m (162 lb ft).

50. Connect the outer tie rod end to the suspension knuckle. Refer to **Tie Rod Replacement (Outer End)** or **Tie Rod Replacement (Suspension Link)** in Rear Suspension.
51. Remove the straight jack from the suspension control arm.
52. Repeat steps 45 through 49 for the other side of the vehicle.

cardiagn.com

53. Install the rear transverse spring. Refer to **Rear Transverse Spring Replacement** in Rear Suspension.

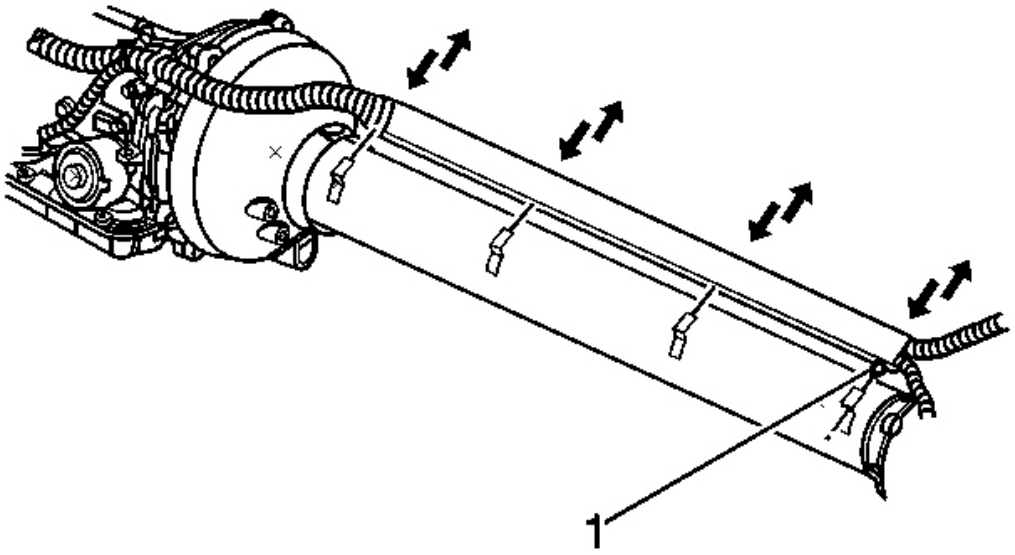


Fig. 250: Releasing The Retainer Securing The Wiring Harness
Courtesy of GENERAL MOTORS CORP.

54. Carefully pull the wiring harness down into the L-shaped brackets along the driveline support assembly, align the harness retainer (locator) (1) to the hole in the forward bracket, then secure in place.

cardiagn.com

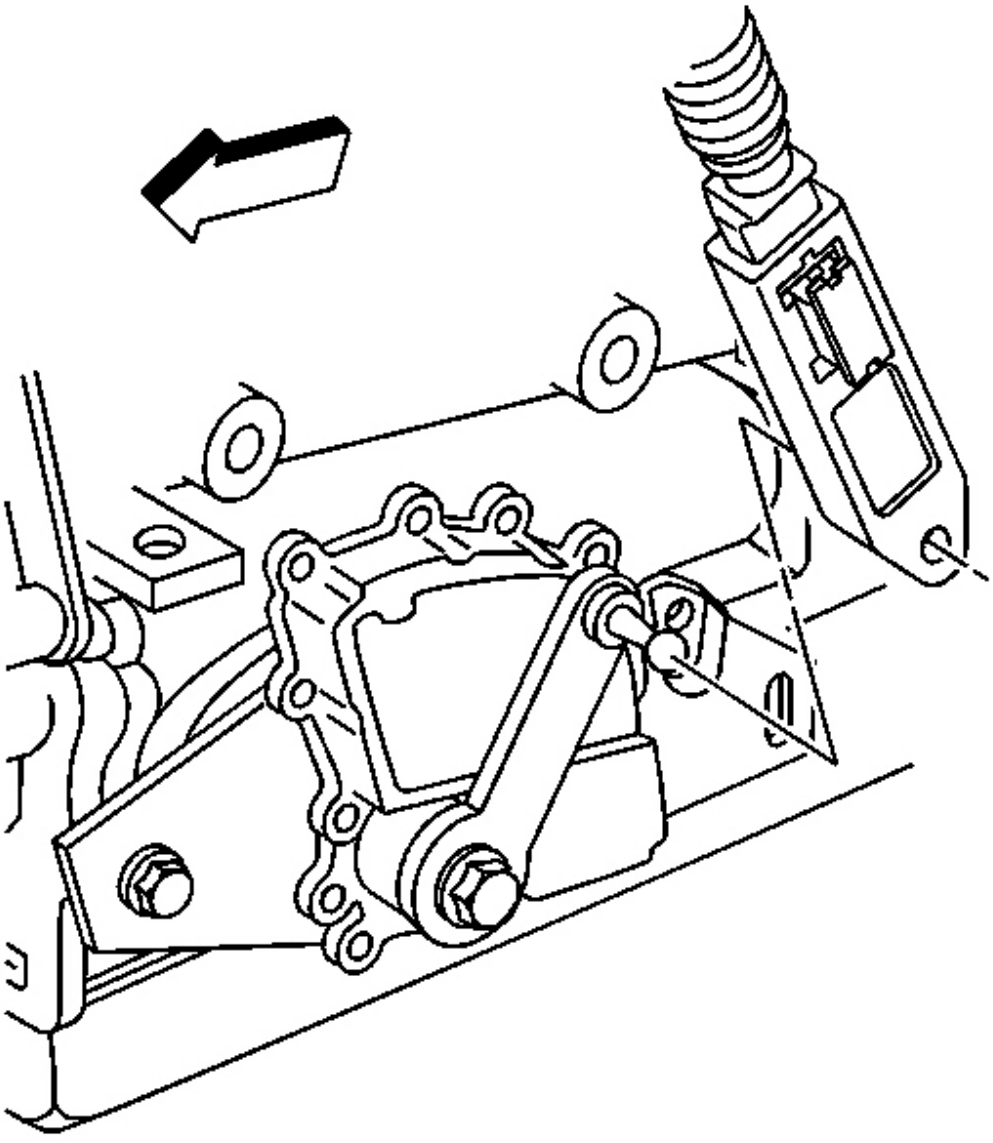


Fig. 251: Transmission Shift Control Cable & Bracket
Courtesy of GENERAL MOTORS CORP.

55. Install the transmission shift cable and bracket into position.
56. Connect the transmission shift cable to the transmission shift lever.

    Press to secure the cable.

cardiagn.com

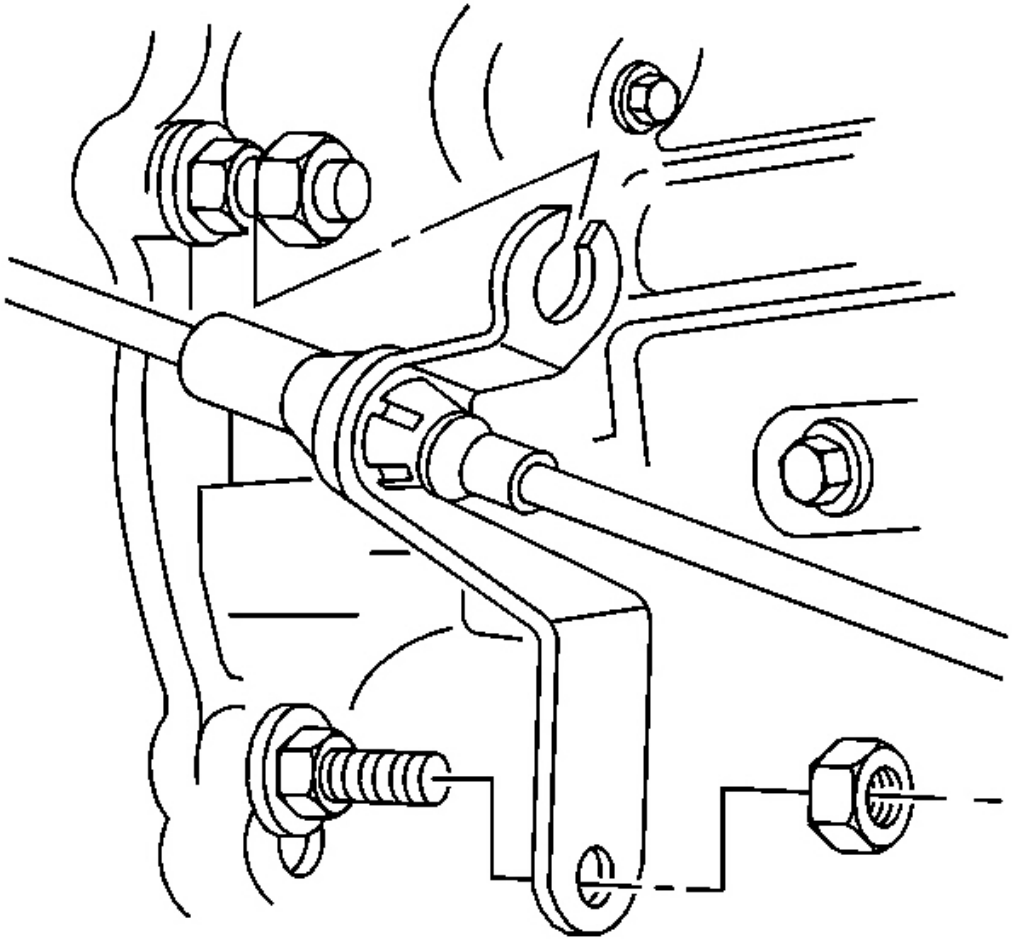


Fig. 252: Shift Control Cable Bracket & Nuts
Courtesy of GENERAL MOTORS CORP.

57. Install the nuts retaining the transmission shift cable bracket to the transmission.

    Tighten: Tighten the transmission shift cable bracket retaining nuts to 20 N.m (15 lb ft).

cardiagn.com

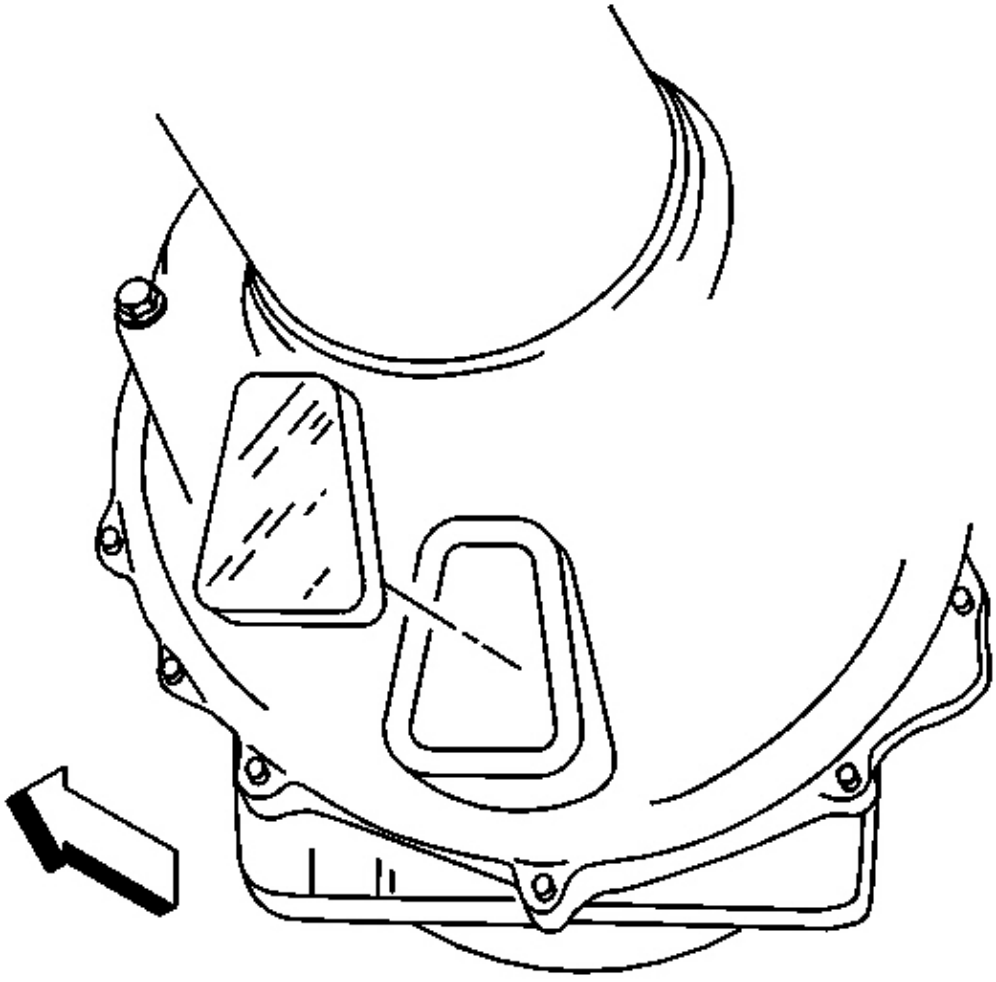


Fig. 253: Driveline Support Assembly Access Plug
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The following step must be performed to assure proper torque converter balance during installation.

58. Align the transmission flexplate to the transmission torque converter using the matchmark made prior to removal.
59. Install the transmission flexplate to transmission torque converter bolts. Refer to **Flexplate to Torque Converter Bolts** .
60. Install the rear bellhousing access plug.

cardiagn.com

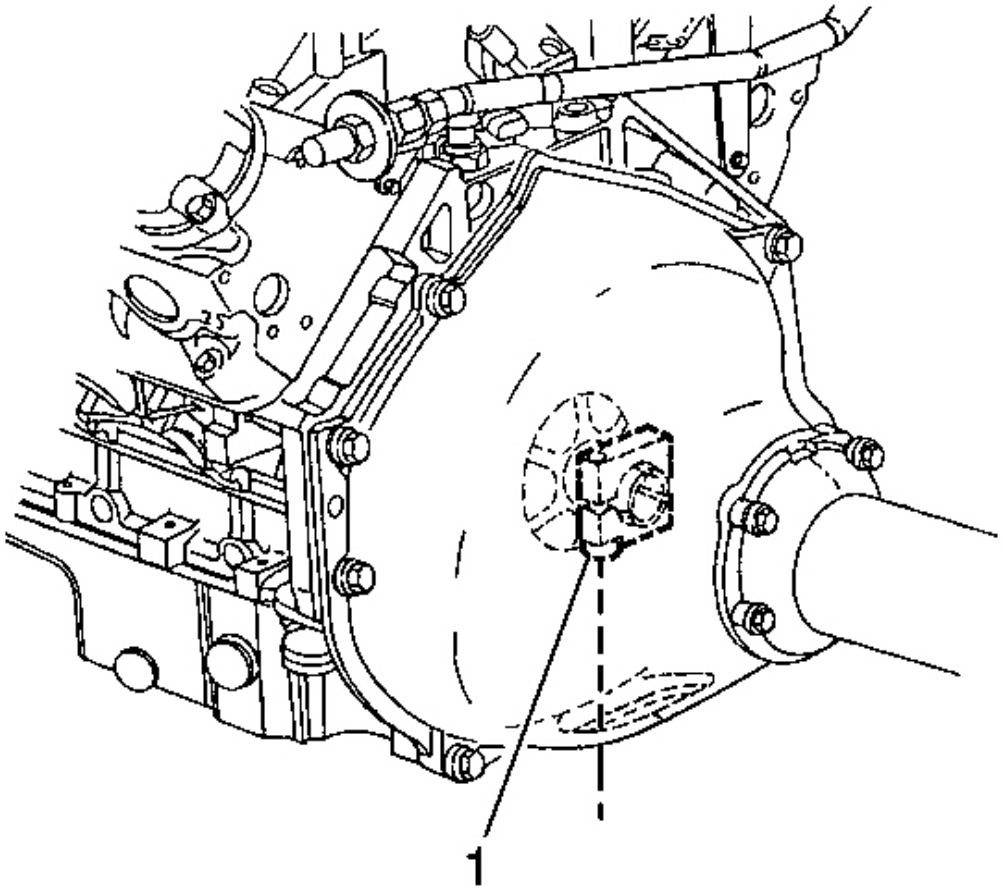


Fig. 254: Propeller Shaft Hub Clamp & Bolt
Courtesy of GENERAL MOTORS CORP.

61. HAND-TIGHTEN the propeller shaft hub clamp bolt (1) until FINGER-TIGHT.

cardiagn.com

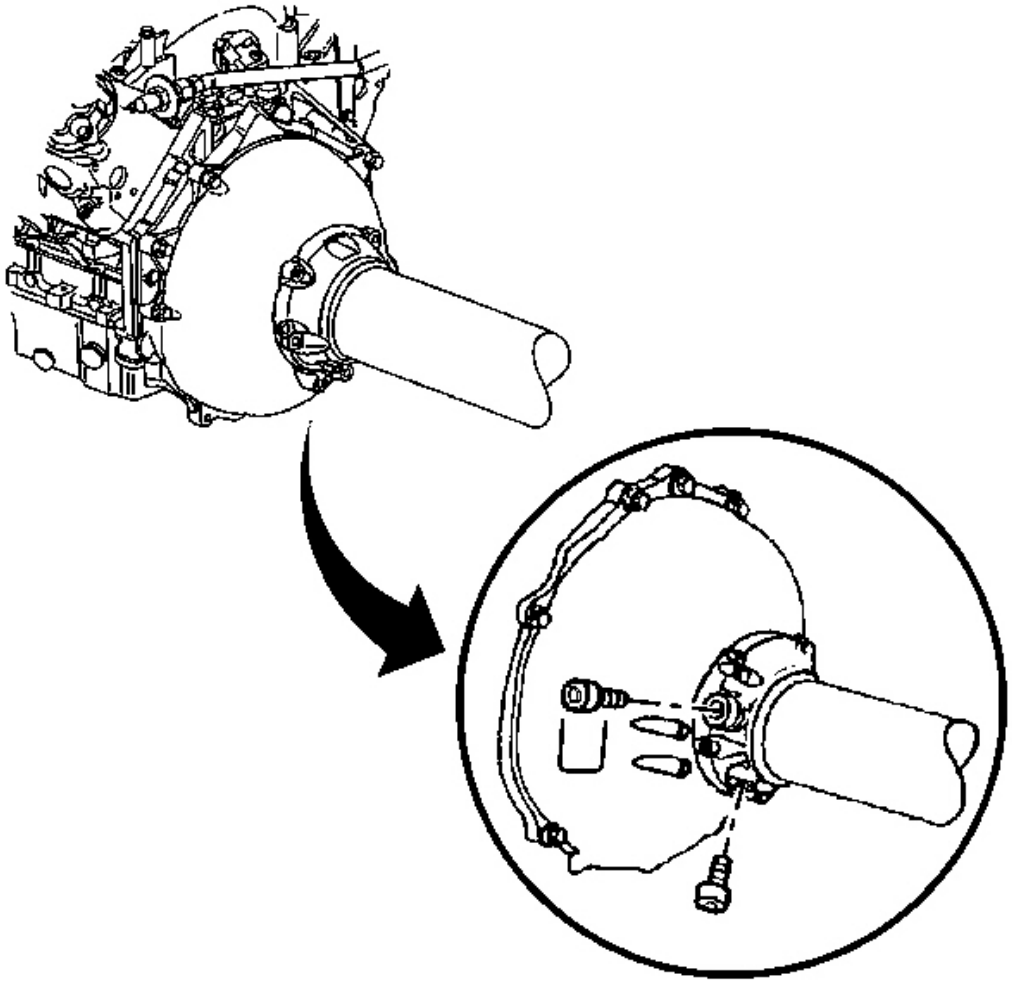


Fig. 255: Two Plug Bolts & Front Of Driveline Support Assembly
Courtesy of GENERAL MOTORS CORP.

62. Remove the propeller input shaft front bearing positioning bolts (M10 - 1.5 X 55 mm) from the driveline support assembly.
63. Install the two plug bolts to the front of the driveline support assembly.

Tighten: Tighten the driveline support assembly front plug bolts to 50 N.m (37 lb ft).

cardiagn.com

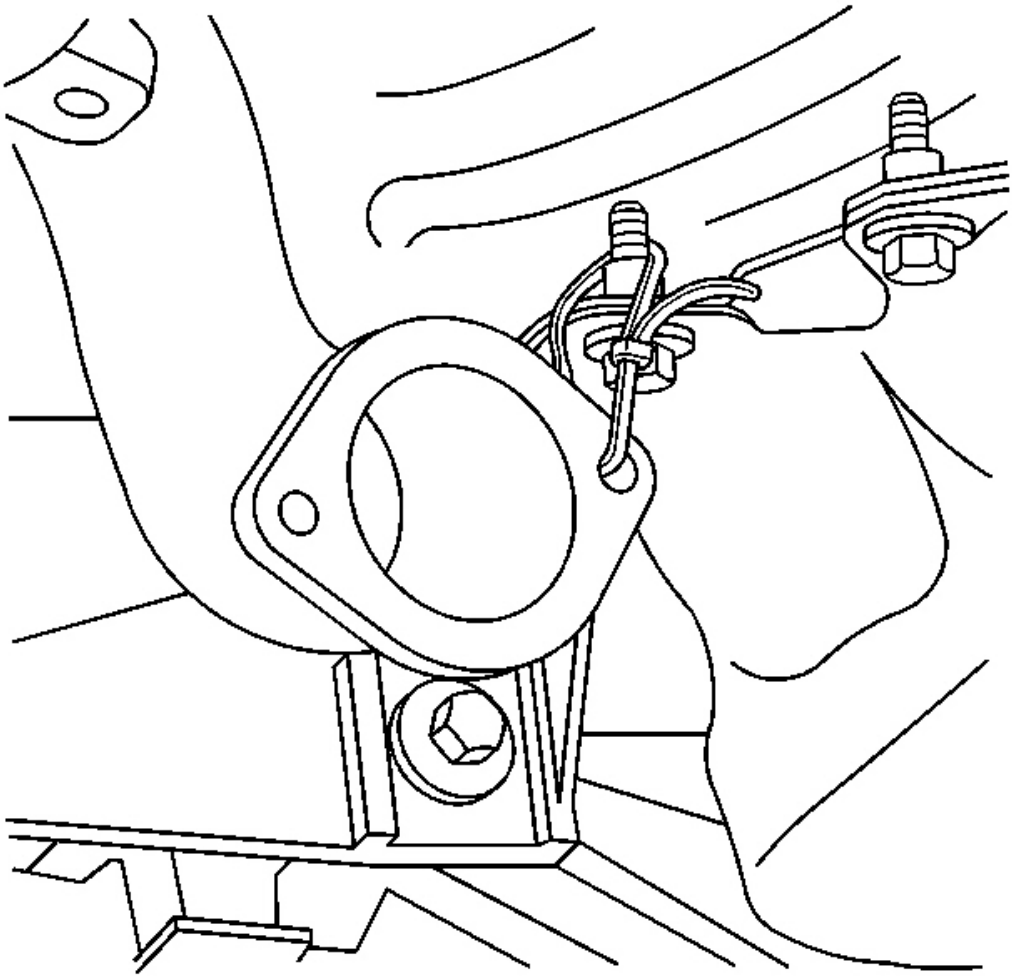


Fig. 256: Catalytic Converter Pipe Assembly
Courtesy of GENERAL MOTORS CORP.

64. Install the driveline tunnel closeout panel. Refer to **Driveline Tunnel Closeout Panel Replacement** in Propeller Shaft.
65. Remove the tie-off retainer from the LH muffler assembly.
66. Install the RH muffler assembly. Refer to **Muffler Replacement - Right** in Engine Exhaust.
67. Install the catalytic converter pipe assembly. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
68. Install the rear tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
69. Lower the vehicle.

cardiagn.com

70. Connect the negative battery cable.

    Tighten: Tighten the negative battery cable bolt to 15 N.m (11 lb ft).

71. Program the transmitters. Refer to **Transmitter Programming** in Keyless Entry.

IMPORTANT: The following steps MUST be performed in order to provide proper alignment of the propeller shaft hub, the propeller input shaft and the propeller input shaft front bearing.

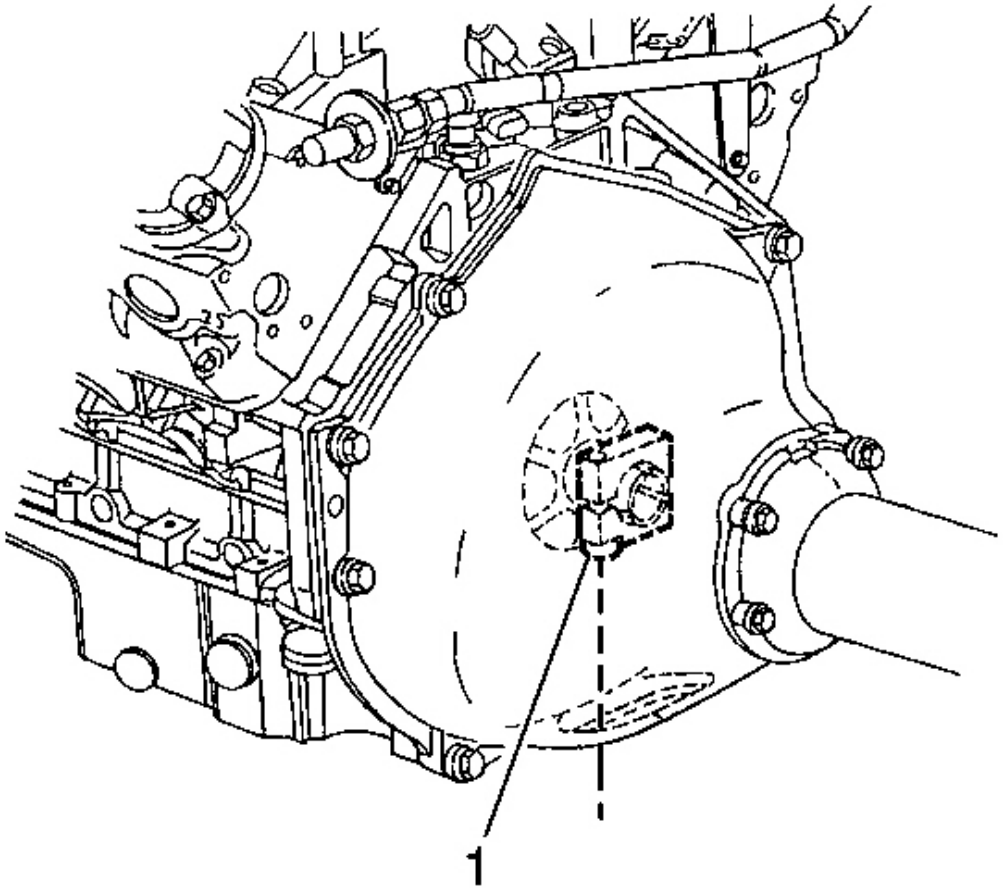


Fig. 257: Propeller Shaft Hub Clamp & Bolt
Courtesy of GENERAL MOTORS CORP.

72. Start and run the engine at idle until normal operating temperatures are reached.

cardiagn.com

(Idle or drive for at least 10 minutes.)

73. Turn off the engine and allow the powertrain to cool to ROOM temperature.
74. Raise the vehicle.
75. Tighten the propeller shaft hub clamp bolt (1).

Tighten: Tighten the propeller shaft hub clamp bolt to 130 N.m (96 lb ft).

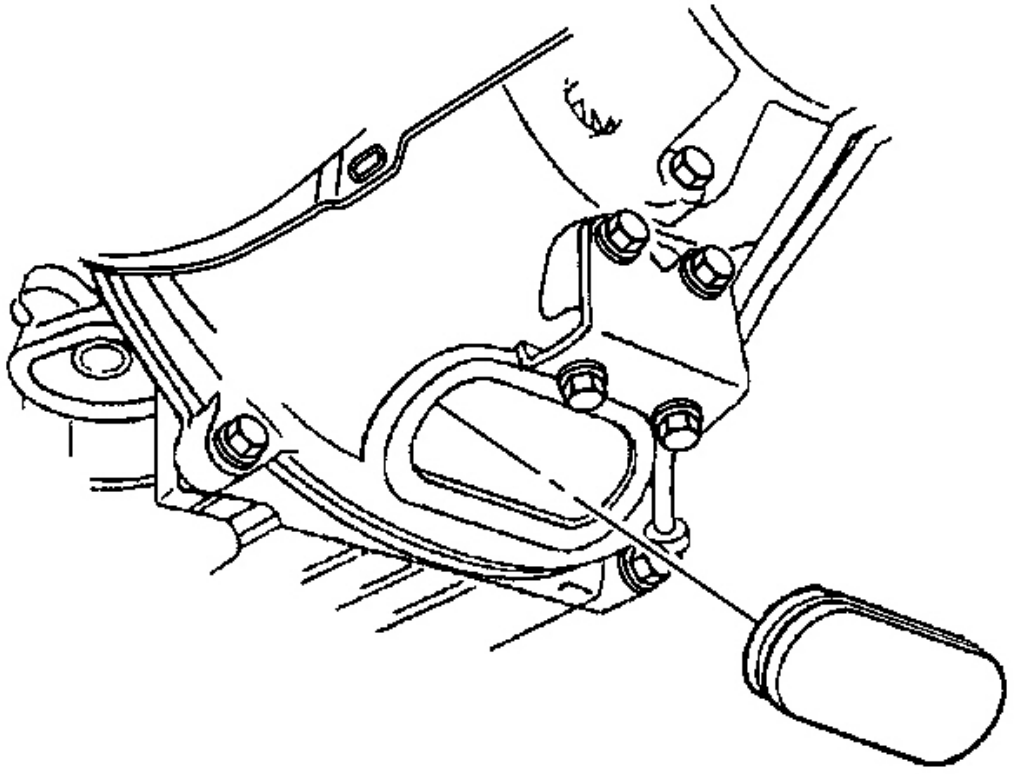


Fig. 258: Engine Flywheel Housing Access Plug
Courtesy of GENERAL MOTORS CORP.

76. Install the engine flywheel housing access plug.
77. Flush the transmission oil cooler. Refer to **Automatic Transmission Oil Cooler Flushing and Flow Test (J 45096)** or **Automatic Transmission Oil Cooler Flushing and Flow Test (J 35944-A)** .
78. Lower the vehicle.

DESCRIPTION AND OPERATION

cardiagn.com

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 transmission

When you diagnose any condition of the Hydra-matic transmission, begin with A 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 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

cardiagn.com

A condition where the engine friction 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

cardiagn.com

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

cardiagn.com

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

cardiagn.com

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

ECT

Engine Coolant Temperature

EMI

cardiagn.com

Electromagnetic Interference

IAT

Intake Air Temperature

IGN

Ignition

MAP

Manifold Absolute Pressure

MIL

Malfunction Indicator Lamp

NC

Normally Closed

NO

Normally Open

OBD

On Board Diagnostic

OSS

Output (Shaft) Speed Sensor

PC

Pressure Control

PCM

Powertrain Control Module

PWM

Pulse Width Modulation

cardiagn.com

RPM

Revolutions Per Minute

SS

Shift Solenoid

TAP

Transmission Adaptive Pressure

TCC

Torque Converter Clutch

TFP

Transmission Fluid Pressure

TFT

Transmission Fluid Temperature

TP

Throttle Position

TV

Throttle Valve

VSS

Vehicle Speed Sensor

WOT

Wide Open Throttle

4WD

Four-Wheel Drive

TRANSMISSION IDENTIFICATION INFORMATION

cardiagn.com

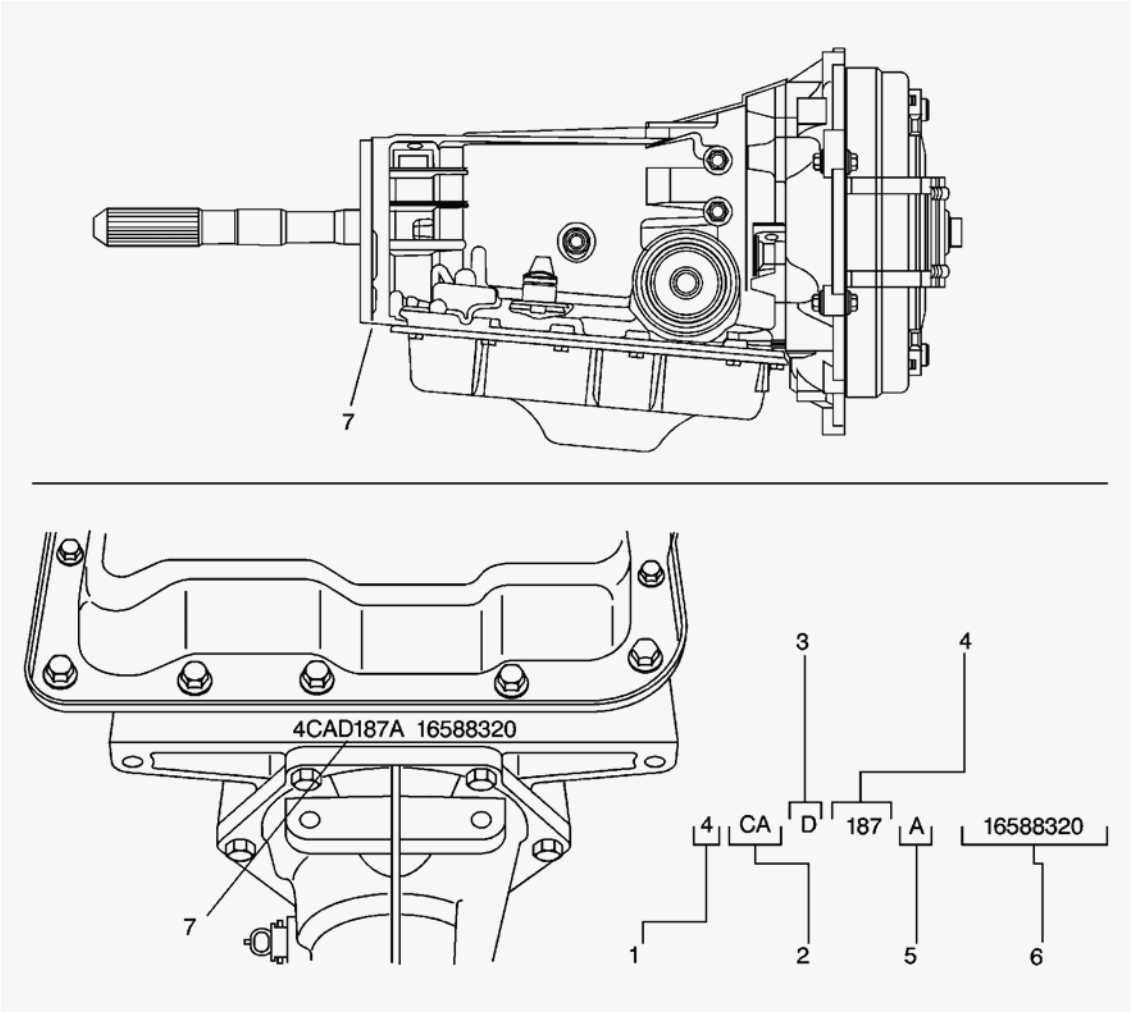


Fig. 259: Transmission Identification
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 308

Callout	Component Name
1	4 = 2004
2	Model
3	Hydra-Matic 4L60-E
4	Julian Date or Day of the Year
5	Shift Built, A, B, J = First Shift; C, H, W = Second Shift
6	Serial No.
7	Transmission ID Location
7	Transmission ID Location

TRANSMISSION COMPONENT AND SYSTEM DESCRIPTION

The mechanical components of the 4L60-E are as follows:

cardiagn.com

- A torque converter with an electronically controlled capacity clutch (ECCC)

  This transmission is equipped with an 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.

- Torque converter assembly
- Servo assembly and 2-4 band assembly
- Reverse input clutch and housing
- Overrun clutch
- Forward clutch
- 3-4 clutch
- Forward sprag clutch assembly
- Lo and reverse roller clutch assembly
- Lo and reverse clutch assembly
- Two planetary gear sets: Input and Reaction
- Oil pump assembly
- Control valve body assembly

The electrical components of the 4L60-E are as follows:

- 1-2 and 2-3 shift solenoid valves
- 3-2 shift solenoid valve assembly
- Transmission pressure control (PC) solenoid
- Torque converter clutch (TCC) solenoid valve
- TCC pulse width modulation (PWM) solenoid valve
- Automatic transmission fluid pressure (TFP) manual valve position switch
- Automatic transmission fluid temperature (TFT) sensor
- Vehicle speed sensor assembly

For more information, refer to **Electronic Component Description** .

TRANSMISSION ADAPTIVE FUNCTIONS

The 4L60-E transmission utilizes a line pressure control system during upshifts to compensate for the normal wear of transmission components. By adjusting the line pressure, the PCM can maintain acceptable transmission shift times. This process is known as "adaptive learning" or "shift adapts" and is similar to the closed loop fuel control system used for the engine.

cardiagn.com

In order for the PCM to perform a "shift adapt," it must first identify if an upshift is acceptable to analyze. For example, upshifts that occur during cycling of the A/C compressor or under extreme throttle changes could cause the PCM to incorrectly adjust line pressure. When an upshift is initiated, a number of contingencies, such as throttle position, transmission temperature, and vehicle speed, are checked in order to determine if the actual shift time is valid to compare to a calibrated desired shift time. If all the contingencies are met during the entire shift, then the shift is considered valid and the adapt function may be utilized if necessary.

Once an adaptable shift is identified, the PCM compares the actual shift time to the desired shift time and calculates the difference between them. This difference is known as the shift error. The actual shift time is determined from the time that the PCM commands the shift to the start of the engine RPM drop initiated by the shift. If the actual shift time is longer than the calibrated desired shift time, a soft feel or slow engagement, then the PCM decreases current to the pressure control (PC) solenoid in order to increase line pressure for the next, same, upshift under identical conditions. If the actual shift time is shorter than the calibrated desired shift time, a firm engagement, then the PCM increases current to the PC solenoid in order to decrease line pressure for the next, same, upshift under identical conditions.

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

Clearing Transmission Adaptive Pressure (TAP)

Transmission adaptive pressure (TAP) information is displayed and may be reset using a scan tool.

The adapt function is a feature of the PCM that either adds or subtracts line pressure from a calibrated base line pressure in order to compensate for normal transmission wear. The TAP information is divided into 13 units, called cells. The cells are numbered 4 through 16. Each cell represents a given torque range. TAP cell 4 is the lowest adaptable torque range and TAP cell 16 is the highest adaptable torque range. It is normal for TAP cell values to display zero or negative numbers. This indicates that the PCM has adjusted line pressure at or below the calibrated base line pressure.

Updating TAP information is a learning function of the PCM designed to maintain acceptable shift times. It is not recommended that TAP information be reset unless one of the following repairs has been made:

- Transmission overhaul or replacement
- Repair or replacement of an apply or release component, clutch, band, piston, servo
- Repair or replacement of a component or assembly which directly affects line pressure

Resetting the TAP values using a scan tool will erase all learned values in all cells. As a result, the PCM will need to relearn TAP values. Transmission performance may be affected as new TAPs are learned. Learning can only take place when the PCM has determined that an acceptable shift has occurred. The PCM must also relearn TAP values if it is replaced.

TRANSMISSION INDICATORS AND MESSAGES

The following transmission-related indicators and messages may be displayed on the Instrument Panel Cluster (IPC). For a complete listing and description of all vehicle indicators and messages, refer to

cardiagn.com

Indicator/Warning Message Description and Operation in Instrument Panel, Gages, and Console.

"High Trans Temp"

This message is displayed when the PCM detects a transmission fluid temperature (TFT) equal to or greater than 130°C (266°F) for 5 seconds.

ELECTRONIC COMPONENT DESCRIPTION

1-2 and 2-3 Shift Solenoid Valves

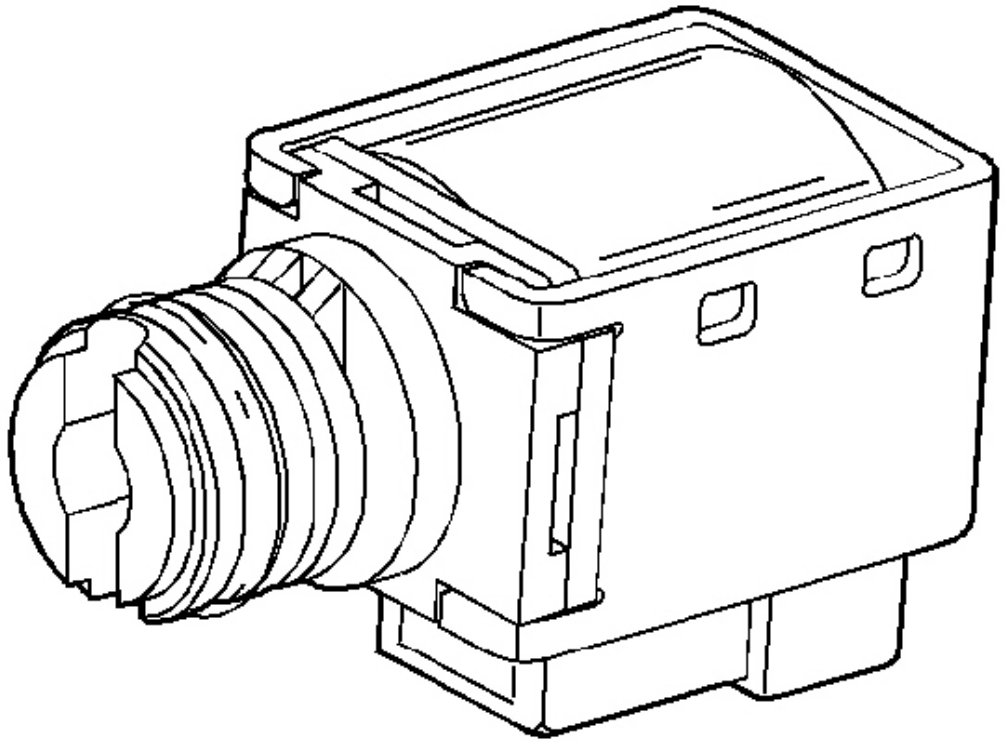


Fig. 260: 1-2 and 2-3 Shift Solenoid Valves
Courtesy of GENERAL MOTORS CORP.

The 1-2 and 2-3 shift solenoid valves (also called A and B solenoids) are identical devices that control the movement of the 1-2 and 2-3 shift valves. The 3-4 shift valve is not directly controlled by a shift solenoid. The solenoids are normally-open exhaust valves that work in 4 combinations to shift the transmission into different gears.

cardiagn.com

The powertrain control module (PCM) energizes each solenoid by grounding the solenoid through an internal quad driver. This sends current through the coil winding in the solenoid and moves the internal plunger out of the exhaust position. When ON, the solenoid redirects fluid to move a shift valve.

IMPORTANT: The manual valve hydraulically can override the shift solenoids. Only in D4 do the shift solenoid states totally determine what gear the transmission is in. In the other manual valve positions, the transmission shifts hydraulically and the shift solenoid states CATCH UP when the throttle position and the vehicle speed fall into the correct ranges.

The PCM-controlled shift solenoids eliminate the need for TV and governor pressures to control shift valve operation.

3-2 Shift Solenoid Valve Assembly

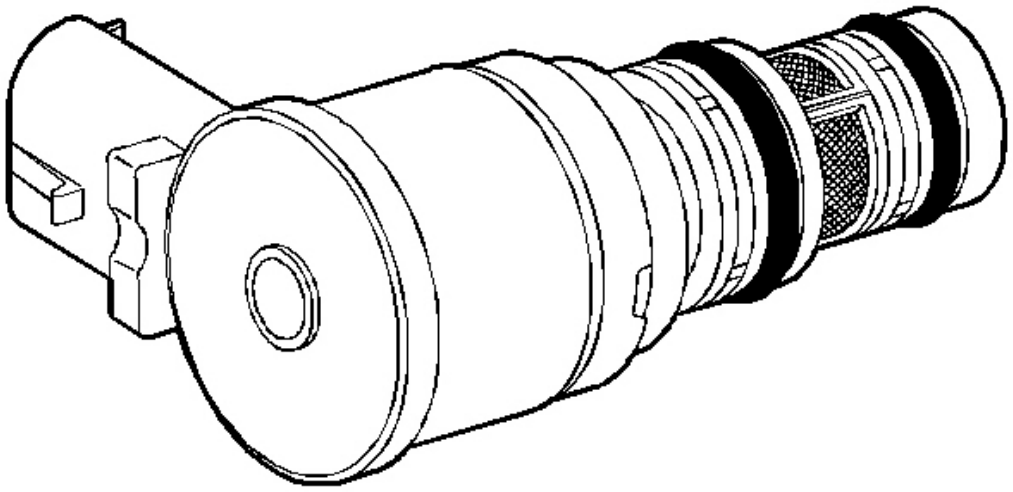


Fig. 261: 3-2 Shift Solenoid Valve Assembly
Courtesy of GENERAL MOTORS CORP.

The 3-2 shift solenoid valve assembly is a normally-closed, 3-port, ON/OFF device that is used in order to improve the 3-2 downshift. The solenoid regulates the release of the 3-4 clutch and the 2-4 band apply.

Transmission Pressure Control Solenoid

cardiagn.com

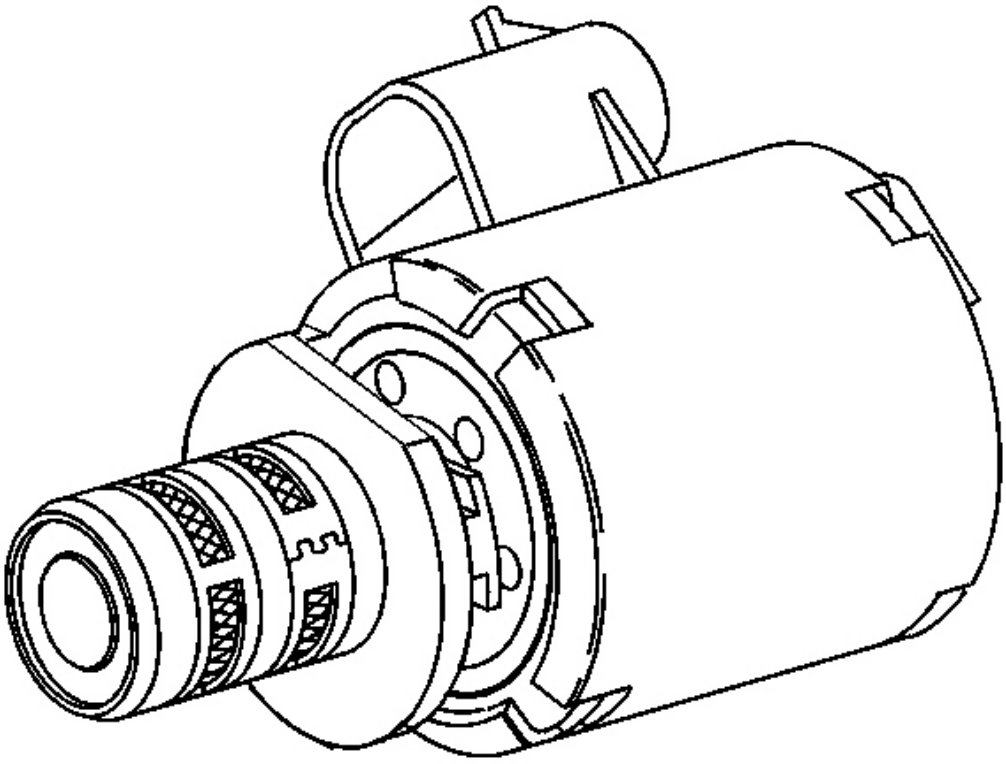


Fig. 262: Transmission Pressure Control Solenoid
Courtesy of GENERAL MOTORS CORP.

The transmission pressure control solenoid is an electronic pressure regulator that controls pressure based on the current flow through its coil winding. The magnetic field produced by the coil moves the solenoid's internal valve which varies pressure to the pressure regulator valve.

The PCM controls the pressure control solenoid by commanding current between 0.1-1.1 amps. This changes the duty cycle of the solenoid, which can range between 5-95 percent, typically less than 60 percent. High amperage (1.1 amps) corresponds to minimum line pressure, and low amperage (0.1 amp) corresponds to maximum line pressure, if the solenoid loses power, the transmission defaults to maximum line pressure.

The PCM commands the line pressure values, using inputs such as engine speed and throttle position sensor voltage.

The pressure control solenoid takes the place of the throttle valve or the vacuum modulator that was used on past model transmissions.

Torque Converter Clutch Solenoid Valve

cardiagn.com

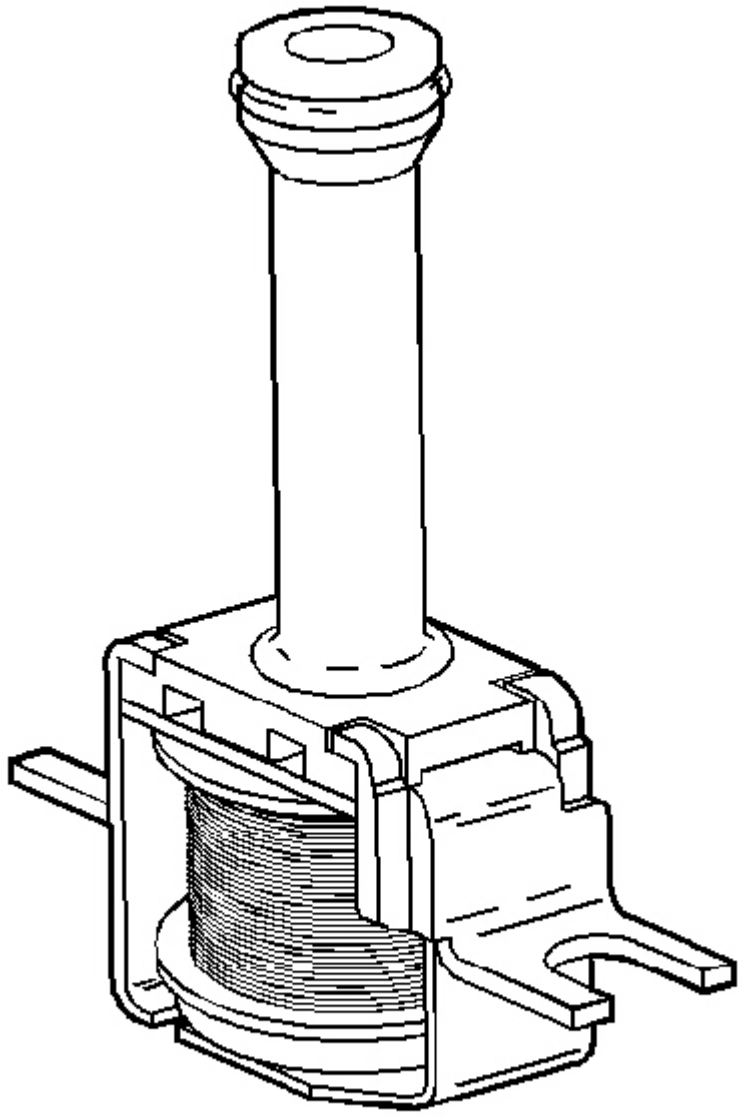


Fig. 263: Torque Converter Clutch Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

The torque converter clutch (TCC) solenoid valve is a normally-open exhaust valve that is used to control torque converter clutch apply and release. When grounded (energized) by the powertrain control module (PCM), the TCC solenoid valve stops converter signal oil from exhausting. This causes converter signal oil pressure to increase and move the TCC solenoid valve into the apply position.

cardiagn.com

Torque Converter Clutch Pulse Width Modulation Solenoid Valve

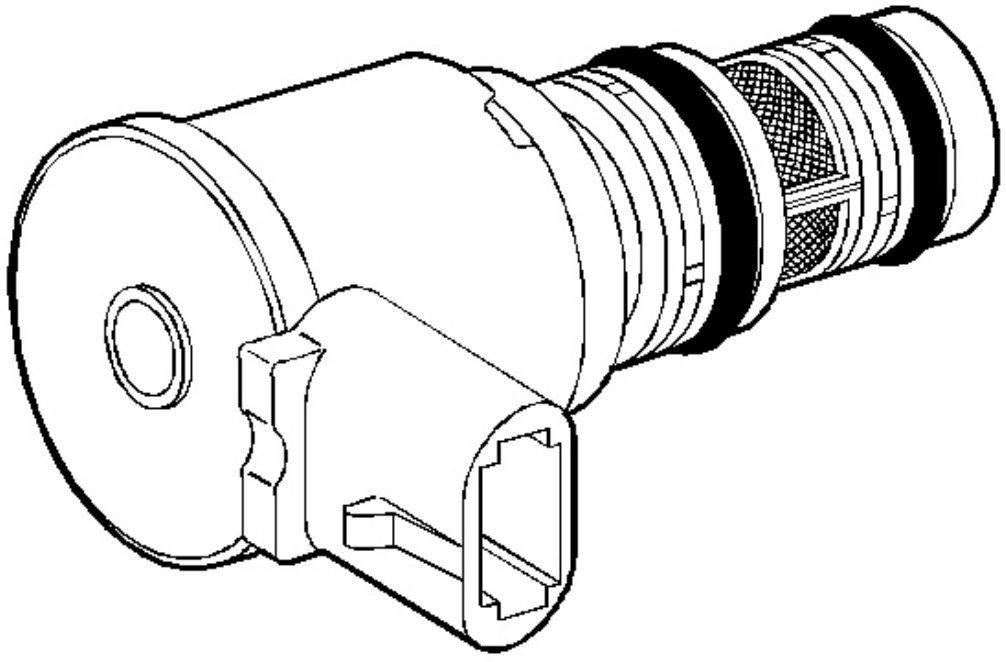


Fig. 264: Torque Converter Clutch Pulse Width Modulation Solenoid Valve (M30/M32)
Courtesy of GENERAL MOTORS CORP.

The torque converter clutch pulse width modulation solenoid valve controls the fluid acting on the converter clutch valve. The converter clutch valve controls the torque converter clutch (TCC) apply and release. This solenoid is attached to the control valve body assembly within the transmission. The TCC PWM solenoid valve provides a smooth engagement of the torque converter clutch by operating during a duty cycle percent of ON time.

Transmission Fluid Pressure (TFP) Manual Valve Position Switch

cardiagn.com

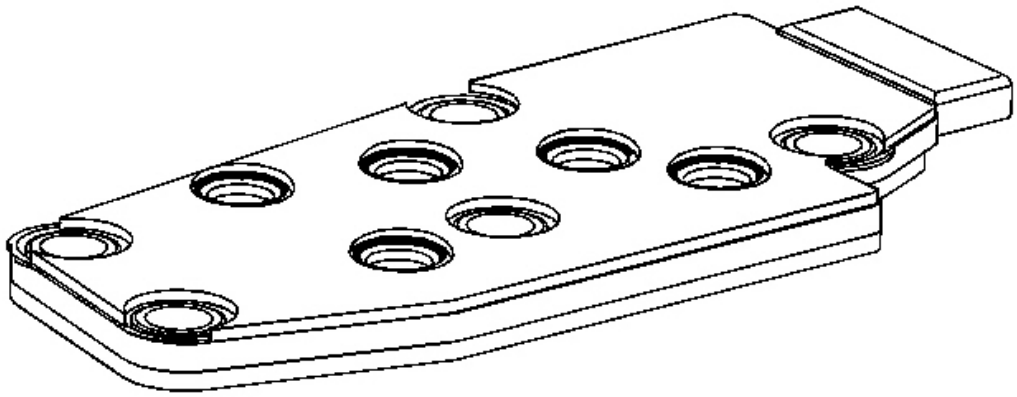


Fig. 265: Transmission Fluid Pressure (TFP) Manual Valve Position Switch (M33 Only)
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Seven valid combinations and two invalid combinations are available from the TFP manual valve position switch. Refer to the Transmission Fluid Pressure (TFP) Manual Valve Position Switch Logic table for valid/invalid combinations for range signal circuits A, B and C.

The transmission fluid pressure (TFP) manual valve position switch consists of five pressure switches (two normally-closed and three normally-open) on the control valve body that sense whether fluid pressure is present in five different valve body passages. The combination of switches that are open and closed is used by the PCM in order to determine the actual manual valve position. The TFP manual valve position switch, however, cannot distinguish between PARK and NEUTRAL because the monitored valve body pressures are identical in both cases.

The switches are wired to provide three signal lines that are monitored by the PCM. These signals are used to help control line pressure, torque converter clutch apply and shift solenoid valve operation. Voltage at each of the signal lines is either zero or twelve volts.

In order to monitor the TFP manual valve position switch operation, the PCM compares the actual voltage combination of the switches to a TFP combination table stored in its memory.

The TFP manual valve position switch signal voltage can be measured from each pin-to-ground and compared to the combination table. On the automatic transmission (AT) wiring harness assembly, pin N is signal A, pin R is signal B, and pin P is signal C. With the AT wiring harness assembly connected and the engine running, a voltage measurement of these three lines will indicate a high reading (near 12 volts) when a circuit is open, and a low reading (zero volts) when the circuit is switched to ground.

The transmission fluid temperature (TFT) sensor is part of the TFP manual valve position switch assembly.

cardiagn.com

Vehicle Speed Sensor Assembly

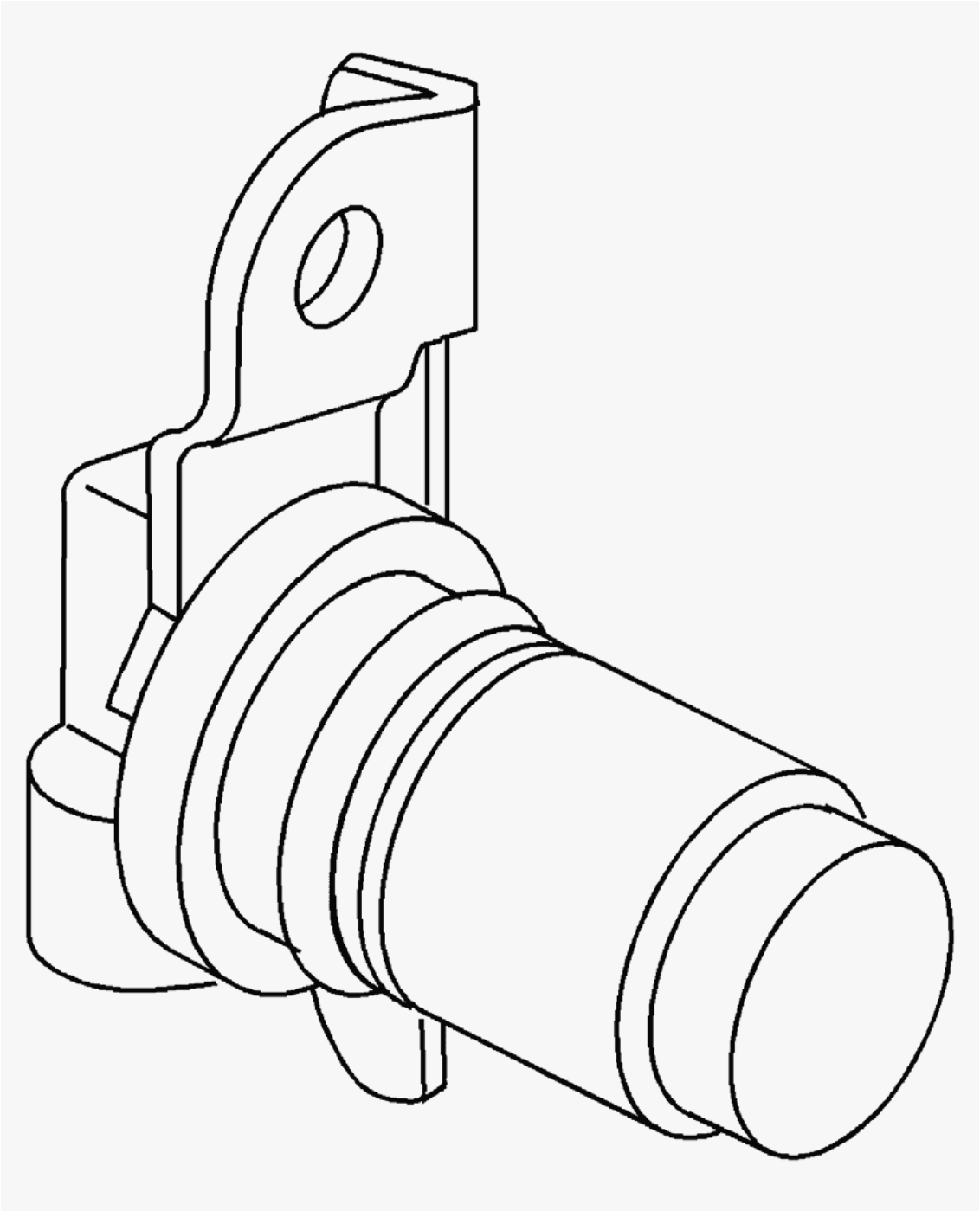


Fig. 266: Vehicle Speed Sensor
Courtesy of GENERAL MOTORS CORP.

The vehicle speed sensor (VSS) assembly provides vehicle speed information to the PCM. The VSS assembly is a permanent magnet (PM) generator. The PM generator produces a pulsing AC voltage as rotor teeth on the transmission output shaft pass through the sensor's magnetic field. The AC voltage level and the number of

cardiagn.com

pulses increase as the speed of the vehicle increases. Output voltage varies with speed from a minimum of 0.5 volts at 100 RPM to more than 100 volts at 8000 RPM. The PCM converts the pulsing voltage to vehicle speed. The PCM uses the vehicle speed signal to determine shift timing and TCC scheduling.

Automatic Transmission Fluid Temperature Sensor

The automatic transmission fluid temperature (TFT) sensor is part of the automatic transmission fluid pressure (TFP) manual valve position switch. The TFT sensor is a resistor, or thermistor, which changes value based on temperature. 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 PCM supplies a 5-volt reference signal to the TFT sensor and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the PCM detects high signal voltage. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage decreases. Refer to TFT Sensor Specifications for a complete comparison of sensor resistance, temperature and signal voltage.

The PCM uses the TFT sensor information to control shift quality and TCC application.

Transmission Range Switch

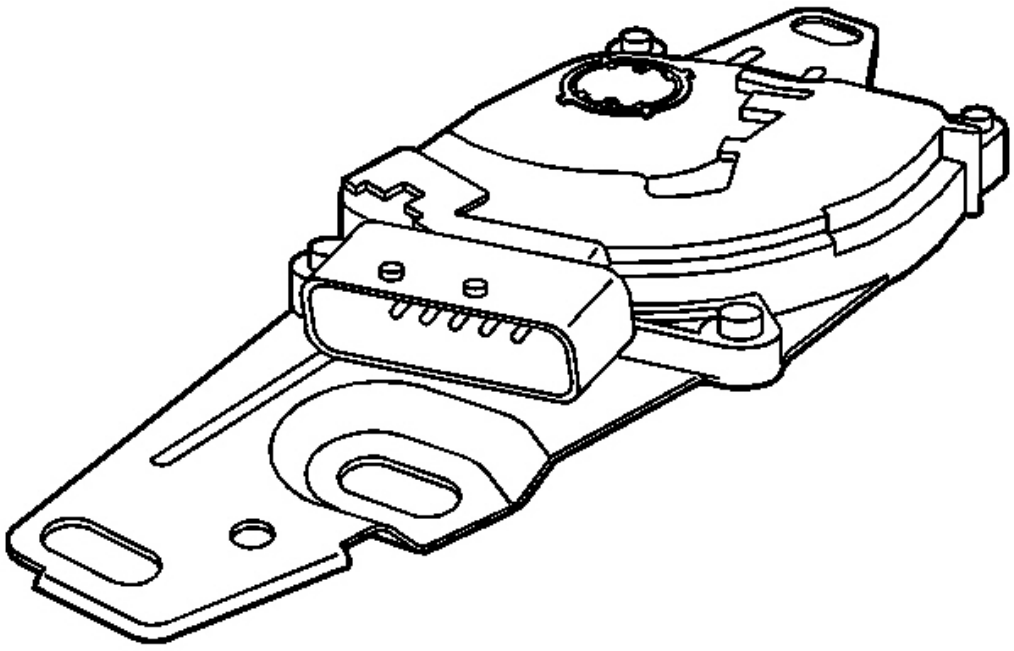


Fig. 267: Transmission Range Switch (M30/M32)

cardiagn.com

Courtesy of GENERAL MOTORS CORP.

The transmission range (TR) switch is part of the park/neutral position (PNP) and backup lamp switch assembly, which is externally mounted on the transmission manual shaft. The TR switch contains four internal switches that indicate the transmission gear range selector lever position. The powertrain control module (PCM) supplies ignition voltage to each switch circuit. As the gear range selector lever is moved, the state of each switch may change, causing the circuit to open or close. An open circuit or switch indicates a high voltage signal. A closed circuit or switch indicates a low voltage signal. The PCM detects the selected gear range by deciphering the combination of the voltage signals. The PCM compares the actual voltage combination of the switch signals to a TR switch combination chart stored in memory.

AUTOMATIC TRANSMISSION INLINE 20-WAY CONNECTOR DESCRIPTION

cardiagn.com

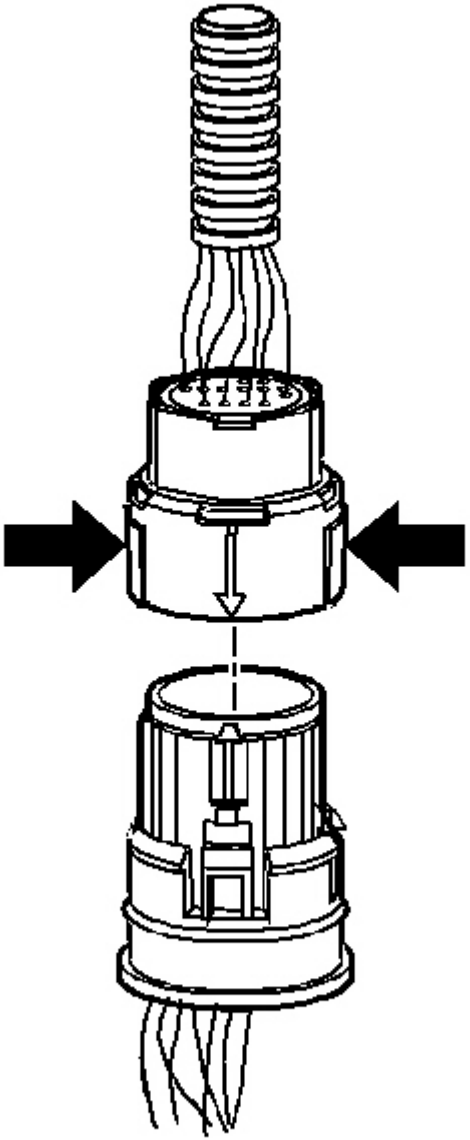


Fig. 268: Automatic Transmission Inline 20-Way Connector
Courtesy of GENERAL MOTORS CORP.

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

cardiagn.com

The following items can affect the electrical connection:

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

Remember the following points:

- In order to remove the connector, squeeze the two tabs toward each other and pull straight up without pulling by the wires.
- Limit twisting or wiggling the connector during removal. Bent pins can occur.
- Do not pry the connector off with a screwdriver or other tool.
- Visually inspect the seals to ensure that they are not damaged during handling.
- In order to reinstall the external wiring connector, first orient the pins by lining up the arrows on each half of the connector. Push the connector straight down into the transmission without twisting or angling the mating parts.
- The connector should click into place with a positive feel and/or noise.
- Whenever the transmission external wiring connector is disconnected from the internal harness and the engine is operating, DTCs will set. Clear these DTCs after reconnecting the external connector.

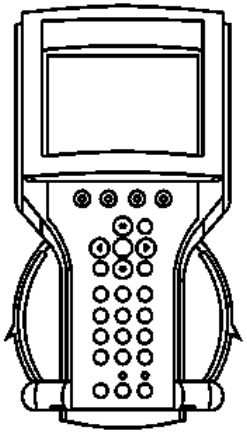
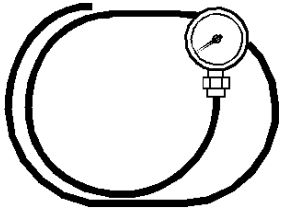
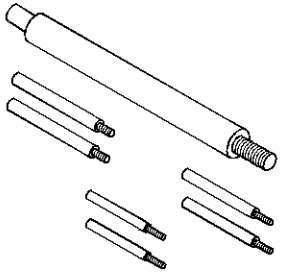
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

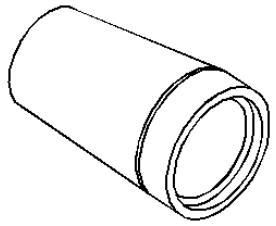
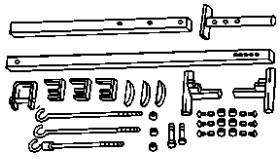
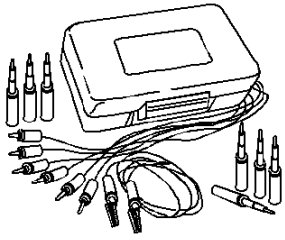
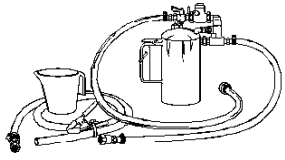
Special Tools

Illustration	Tool Number/Description

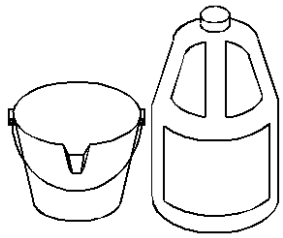
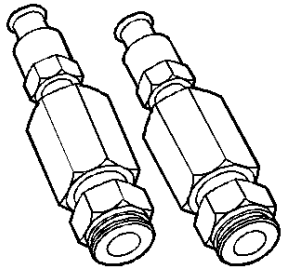
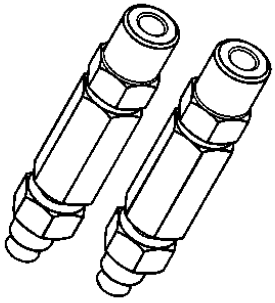
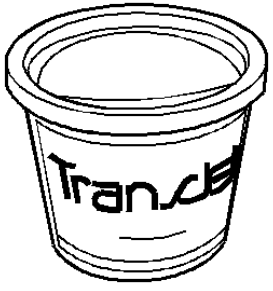
cardiagn.com

	Scan Tool
	J 21867 Pressure Gage
	J 25025-B Pump and Valve Body Alignment
	J 28458 Power Piston Seal Protector

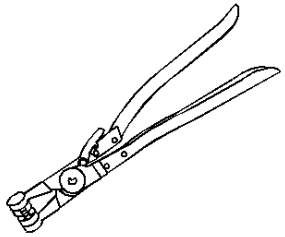
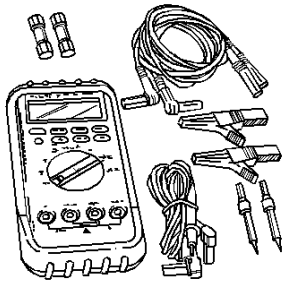
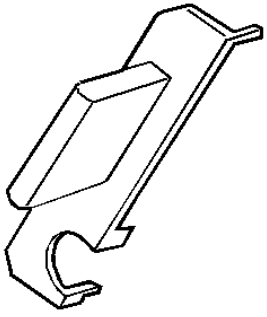
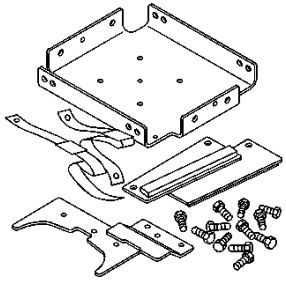
cardiagn.com

	
	J 28467-B Universal Engine Support Fixture
	J 35616-B GM Terminal Test Kit
	J 35944-A Transmission Oil Cooler Flusher
	J 35944-22 Transmission Oil Cooler Flushing Fluid

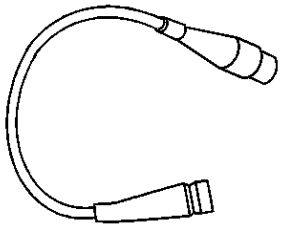
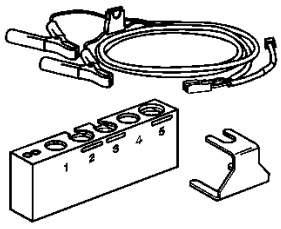
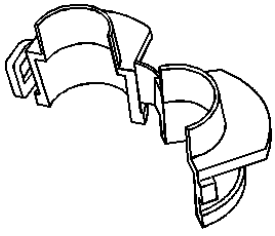
cardiagn.com

	
	J 35944-200 Cooler Flushing Adapter
	J 35944-600 Transmission Cooler Flush Adapter
	J 36850 Transmission Assembly Lubricant

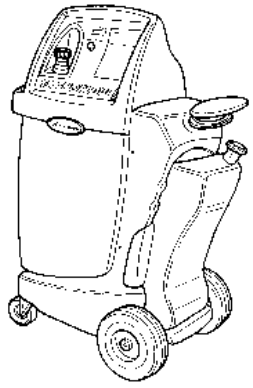
cardiagn.com

	J 38185 Hose Clamp Pliers
	J 39200 Digital Multimeter (DMM)
	J 41364-A Neutral Position Adjustment Tool
	J 42055 Transmission Support Fixture

cardiagn.com

	J 42386-A Flywheel Holding Tool
	J 44152 Jumper Harness (20 pins)
	J 44246 Solenoid Testing Kit
	J 44827 Transmission Cooler Quick Disconnect

cardiagn.com



J 45096
Transmission Oil Cooling System Flush and Flow Test Tool

cardiagn.com