

2004 TRANSMISSION

Manual Transmission - Getrag 5 Speed - Vue

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Drain Plugs	38 N.m	28 lb ft
Front Transmission Mount Bolts	50 N.m	37 lb ft
Front Transmission Mount Through Bolt	100 N.m	74 lb ft
Heat Shield to Engine Block Bolt	30 N.m	22 lb ft
Heat Shield to Transmission Mount Bolt	10 N.m	89 lb in
Intermediate Shaft Bolt	100 N.m	74 lb ft
Rear Cover Bolts	25 N.m	18 lb ft
Rear Transmission Mount Bracket to Transmission Bolts	60 N.m	44 lb ft
Rear Transmission Mount Through Bolt	100 N.m	74 lb ft
Rear Transmission Mount to Frame Bolts	60 N.m	44 lb ft
Reverse Lockout Bolt	6 N.m	53 lb in
Reverse Switch	18 N.m	13 lb ft
Ring Gear	90 N.m	66 lb ft
Side Transmission Mount Bolts	45 N.m	33 lb ft
Side Transmission Mount to Mid-Rail Bolts	34 N.m	25 lb ft
Shaft Bolts	100 N.m	74 lb ft
Shift Cable Attachment Nut	10 N.m	89 lb in
Shift Control Nuts	25 N.m	18 lb ft
Shifter Guide Bolt	25 N.m	18 lb ft
Shifter Retaining Bolts	25 N.m	18 lb ft
Speed Sensor	12 N.m	106 lb in
Transmission Housing Bolts	27 N.m	20 lb ft
UBEC Bracket Bolts	25 N.m	18 lb ft
UBEC Bracket Nuts	10 N.m	89 lb in
UBEC Positive Post	10 N.m	89 lb in

SEALERS, ADHESIVES, AND LUBRICANTS

Sealers, Adhesives, and Lubricants

Application	Type of Material	Part Number
Case Halves	Sealant	12378516

Differential Ring Gear Bolt	Threadlocker	21005994
Drain Plugs	Sealant	21485278
Input Shaft Bolt	Threadlocker	21005994
Intermediate Shaft Bolt	Threadlocker	21005994
Output Shaft Bolt	Threadlocker	21005994
Rear Cover	Sealant	21019581
Reverse Lockout Lever Bolt	Threadlocker	21485277
Backup Lamp Switch	Sealant	21019581
Shifter Cover	Sealant	12378516
Shifter Guide Bolt	Sealant	21485278
Transmission Fluid	DEXRON(R) III	21019223
Vehicle Speed Sensor Bolt	Threadlocker	21485277

LUBRICATION SPECIFICATIONS

Lubrication Specifications

Application	Specification	
	Metric	English
DEXRON(R)III	1.7 liters	1.8 quarts

COMPONENT RESISTANCE

Component Resistance

Component	Pass Through Pins	Resistance 20°C (68°F)	Resistance 100°C (212°F)	Resistance to Ground (Case)
Vehicle Speed Sensor	1, 2	infinity ohm	infinity ohm	Greater than 10 M ohm

SHIM SIZE SPECIFICATIONS

Shim Size Specifications

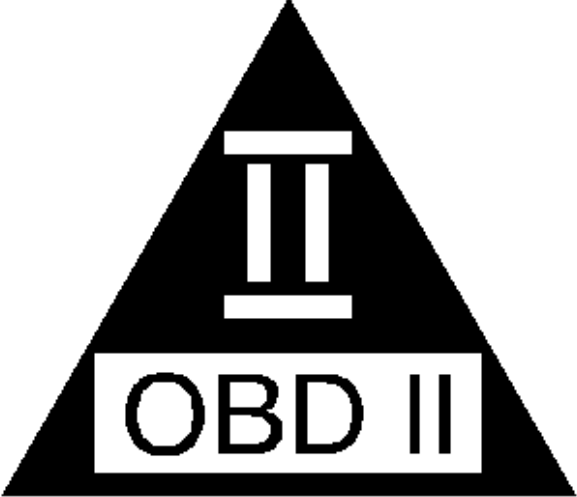
Shim Thickness	
Metric	English
0.5 mm	0.0197 in
0.55 mm	0.0217 in
0.6 mm	0.0236 in
0.65 mm	0.0256 in
0.7 mm	0.0276 in
0.75 mm	0.0295 in
0.8 mm	0.0315 in
0.85 mm	0.0335 in
0.9 mm	0.0354 in

0.95 mm	0.0374 in
1.00 mm	0.0394 in
1.05 mm	0.0413 in
1.1 mm	0.0433 in
1.15 mm	0.0453 in
1.2 mm	0.0473 in
1.25 mm	0.0493 in
1.3 mm	0.0512 in
1.35 mm	0.0531 in

SCHEMATIC AND ROUTING DIAGRAMS

MANUAL TRANSMISSION SCHEMATIC ICONS

Manual Transmission Schematic Icons

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

MANUAL TRANSMISSION SCHEMATICS

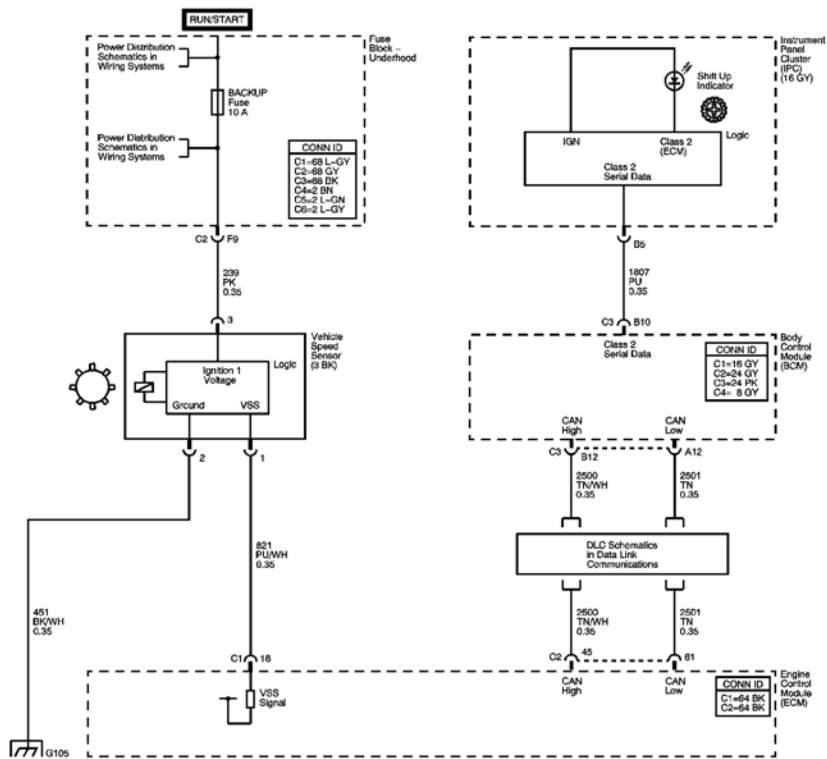


Fig. 1: Manual Transmission Schematics
 Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

MANUAL TRANSMISSION COMPONENT VIEWS

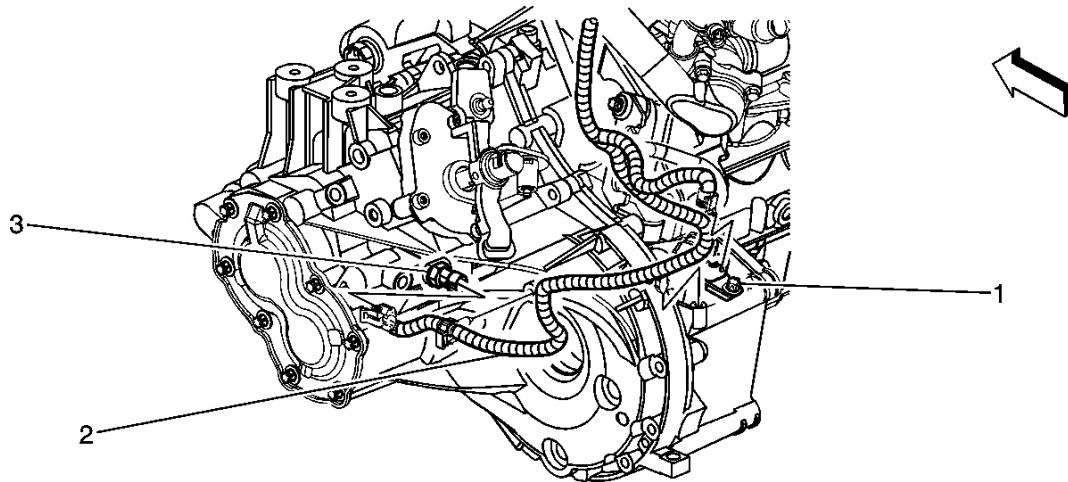


Fig. 2: Manual Transmission Component Location View
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 2

Callout	Component Name
1	Vehicle Speed Sensor (VSS) (3 BK)
2	Engine Wiring Harness
3	Backup Switch (2 BK)

DISASSEMBLED VIEWS

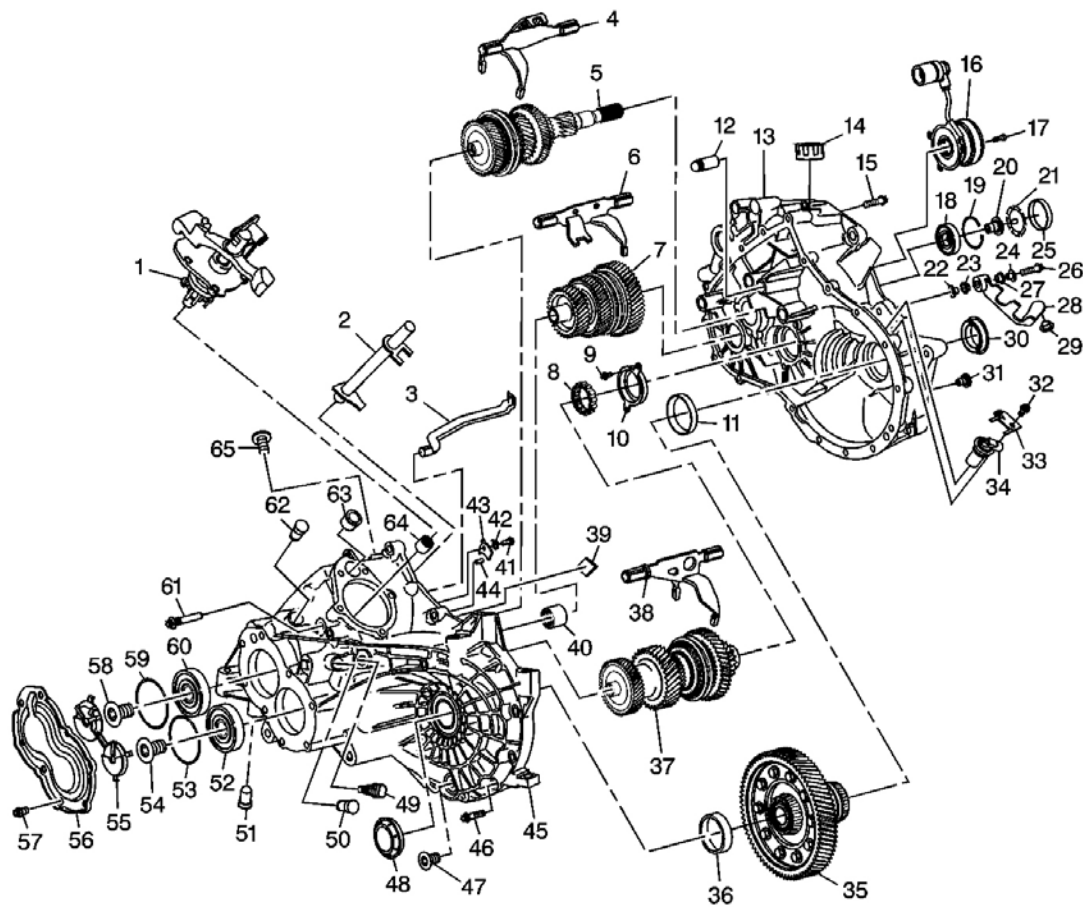


Fig. 3: Exploded View Of Case Components
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 3

Callout	Component Name
1	Shifter
2	Shift Rod
3	Oil Tube
4	3rd/4th Gear Shift Fork
5	Input Shaft Assembly
6	1st/2nd Gear Shift Fork
7	Intermediate Shaft Assembly
8	Output Shaft Roller Bearing
9	Output Shaft Bearing Race Bolt
10	Output Shaft Bearing Race
11	Clutch Housing Differential Bearing Race
12	Shifter Detent

13	Clutch Housing
14	Fill Cap
15	Clutch Housing to Transaxle Case Bolt
16	Actuator
17	Actuator Bolt
18	Intermediate Shaft Roller Bearing
19	Intermediate Shaft Bearing Snap Ring
20	Intermediate Shaft Bolt
21	Oil Guide
22	Shift Cable Bracket Spacer
23	Shift Cable Bracket Isolators
24	Shift Cable Bracket Spacer
25	Intermediate Shaft Seal
26	Shift Cable Bracket Bolt
27	Shift Cable Bracket Isolators
28	Shift Cable Bracket
29	Shift Cable Bracket Isolators
30	Clutch Housing Differential Output Shaft Seal
31	Lubricant Check Plug
32	Vehicle Speed Sensor Bolt
33	Vehicle Speed Sensor Retaining Bracket
34	Vehicle Speed Sensor
35	Differential Assembly
36	Transaxle Case Differential Bearing Race
37	Output Shaft Assembly
38	5th/Reverse Gear Shift Fork
39	Magnet
40	Intermediate Shaft Needle Bearing
41	Bolt, if equipped
42	Spring, if equipped
43	Lever, if equipped
44	Alignment Pin
45	Transaxle Case
46	Transaxle Case to Clutch Housing Bolt
47	Lubricant Drain Plug
48	Transaxle Case Differential Output Shaft Seal
49	Reverse Lamp Switch
50	Shift Shaft Detents
51	Shift Shaft Detents
52	Bearing
53	Output Shaft Bearing Snap Ring

54	Output Shaft Bolt
55	Oil Guide
56	Rear Cover
57	Rear Cover Bolts
58	Input Shaft Bolt
59	Input Shaft Bearing Snap Ring
60	Bearing
61	Shifter Guide Bolt
62	Shift Shaft Detents
63	Shift Rod Bushing
64	Shifter Bearing
65	Fill Plug

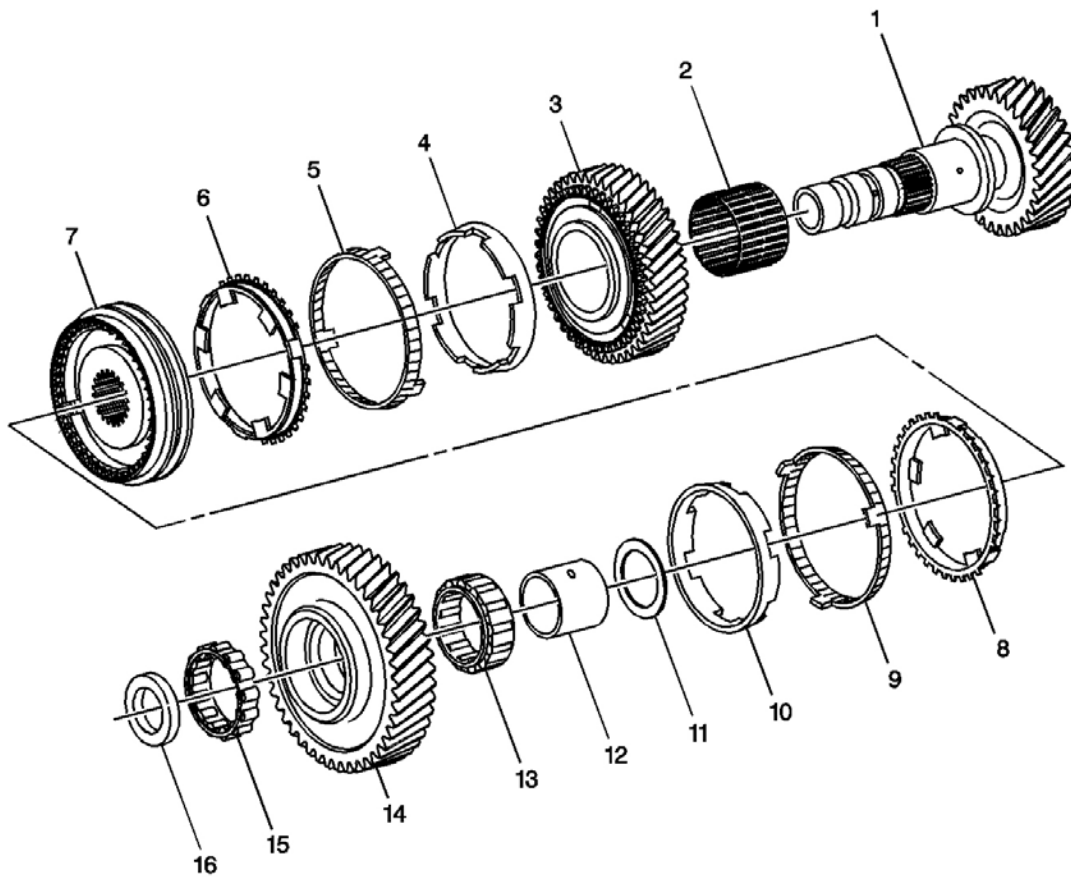


Fig. 4: Intermediate Shaft Components View
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

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Callout	Component Name
1	Intermediate Shaft
2	Caged Needle Bearings
3	2nd Gear
4	2nd Gear Inner Cone
5	2nd Gear Blocking Ring
6	2nd Gear Outer Cone
7	1st/2nd Synchronizer Assembly
8	1st Gear Outer Cone
9	1st Gear Blocking Ring
10	1st Gear Inner Cone
11	Thrust Washer
12	Bearing Collar
13	Roller Bearing
14	1st Gear
15	Roller Bearing
16	Thrust Washer

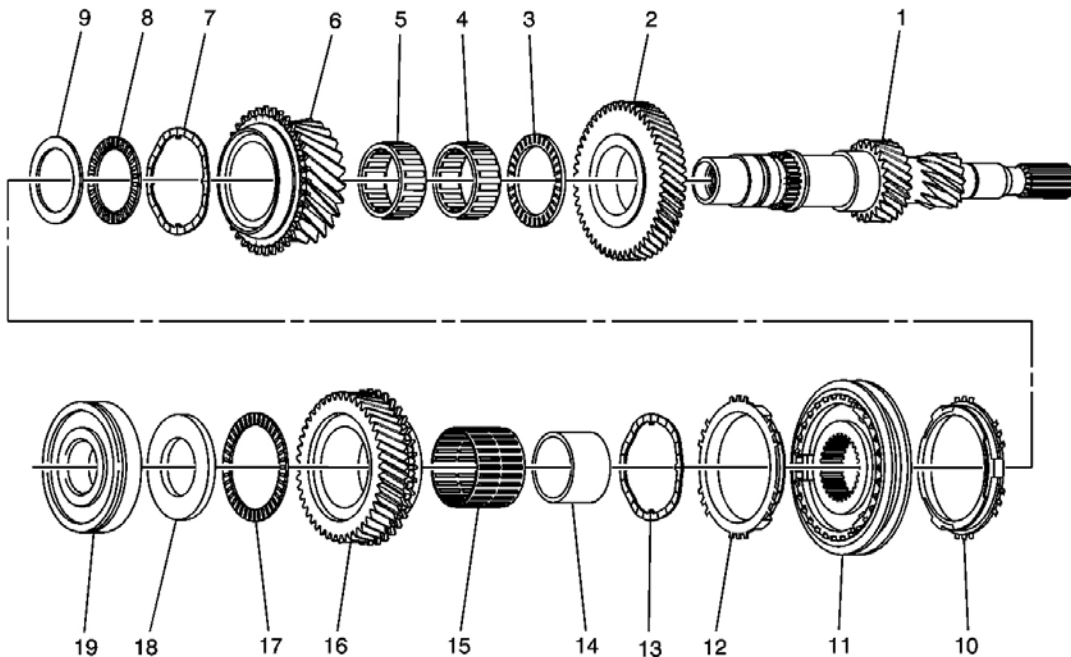


Fig. 5: Input Shaft Components View
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

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Callout	Component Name
1	Input Shaft
2	5th Drive Gear
3	Thrust Bearing
4	Caged Needle Bearing
5	Caged Needle Bearing
6	3rd Drive Gear
7	Wavy Washer
8	Thrust Bearing
9	Thrust Washer
10	3rd Gear Blocking Ring
11	3rd/4th Synchronizer Assembly
12	4th Gear Blocking Ring
13	Wavy Washer
14	Bearing Collar
15	Caged Needle Bearing
16	4th Drive Gear
17	Thrust Bearing
18	Thrust Washer
19	Input Shaft Bearing

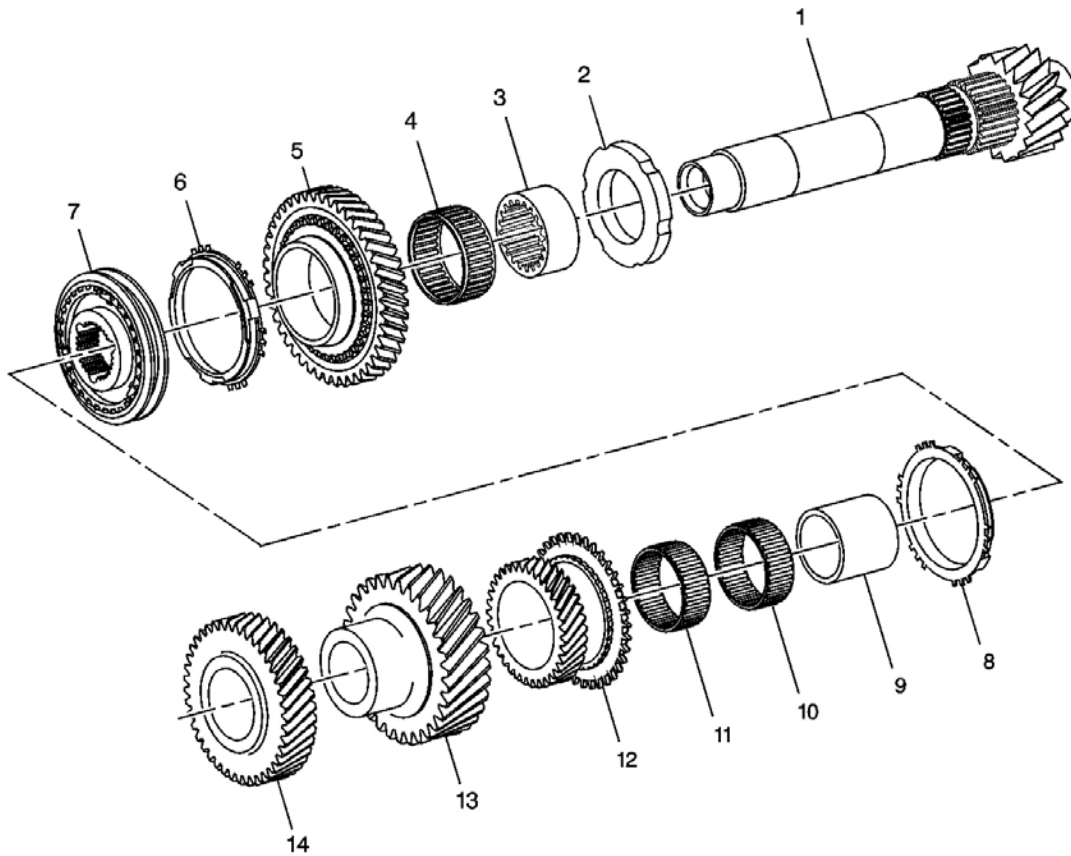


Fig. 6: Output Shaft Components View
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
1	Output Shaft
2	Thrust Washer
3	Bearing Collar
4	Caged Needle Bearing
5	Reverse Gear
6	Reverse Blocking Ring
7	5th/Reverse Synchronizer Assembly
8	5th Gear Blocking Ring
9	Bearing Collar
10	Caged Needle Bearing
11	Caged Needle Bearing
12	5th Driven Gear
13	3rd Driven Gear

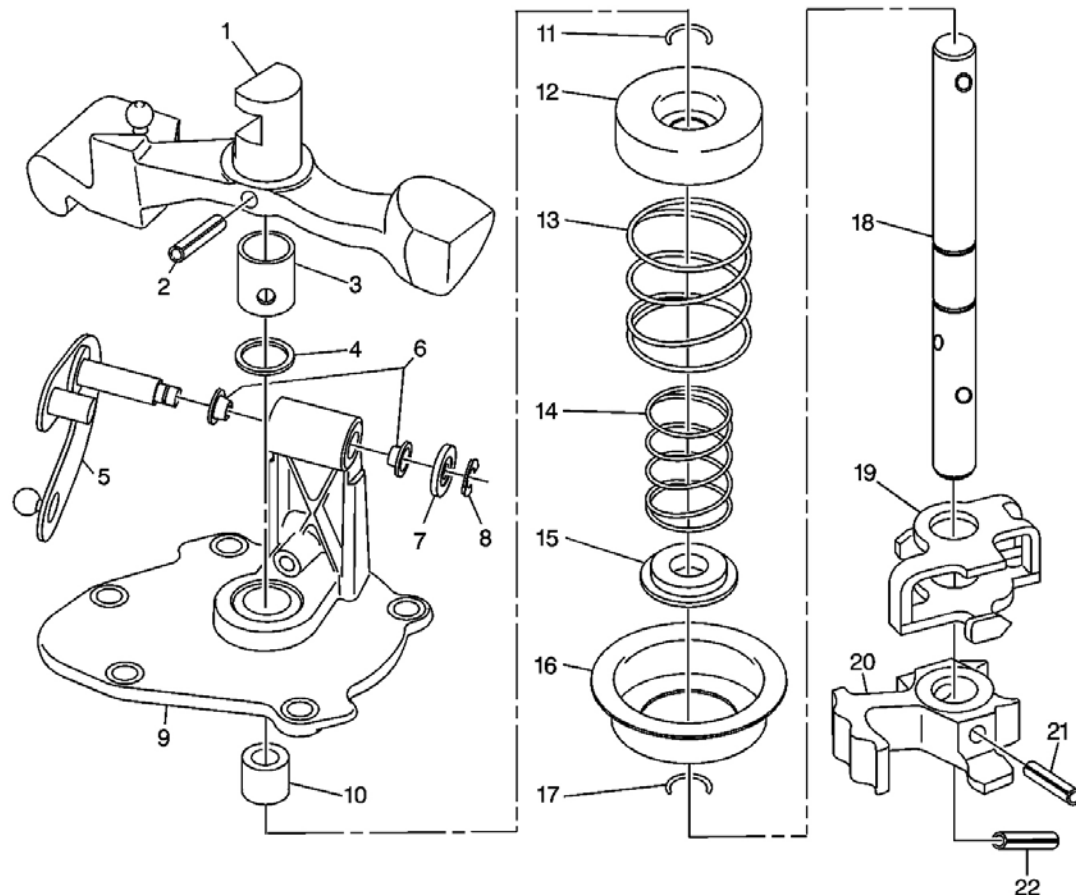


Fig. 7: Shifter Components View
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 7

Callout	Component Name
1	Shift Lever
2	Roll Pin
3	Cover Bushing
4	Seal
5	Select Lever
6	Bushing
7	Washer
8	Retainer
9	Shift Cover
10	Bushing

11	Retainer
12	Outer Spring Seat
13	Outer Spring
14	Inner Spring
15	Inner Spring Seat
16	End Cap
17	Retainer
18	Shift Shaft </td
19	Outer Control Lever
20	Inner Control Lever
21	Roll Pin
22	Reverse Inhibit Roll Pin

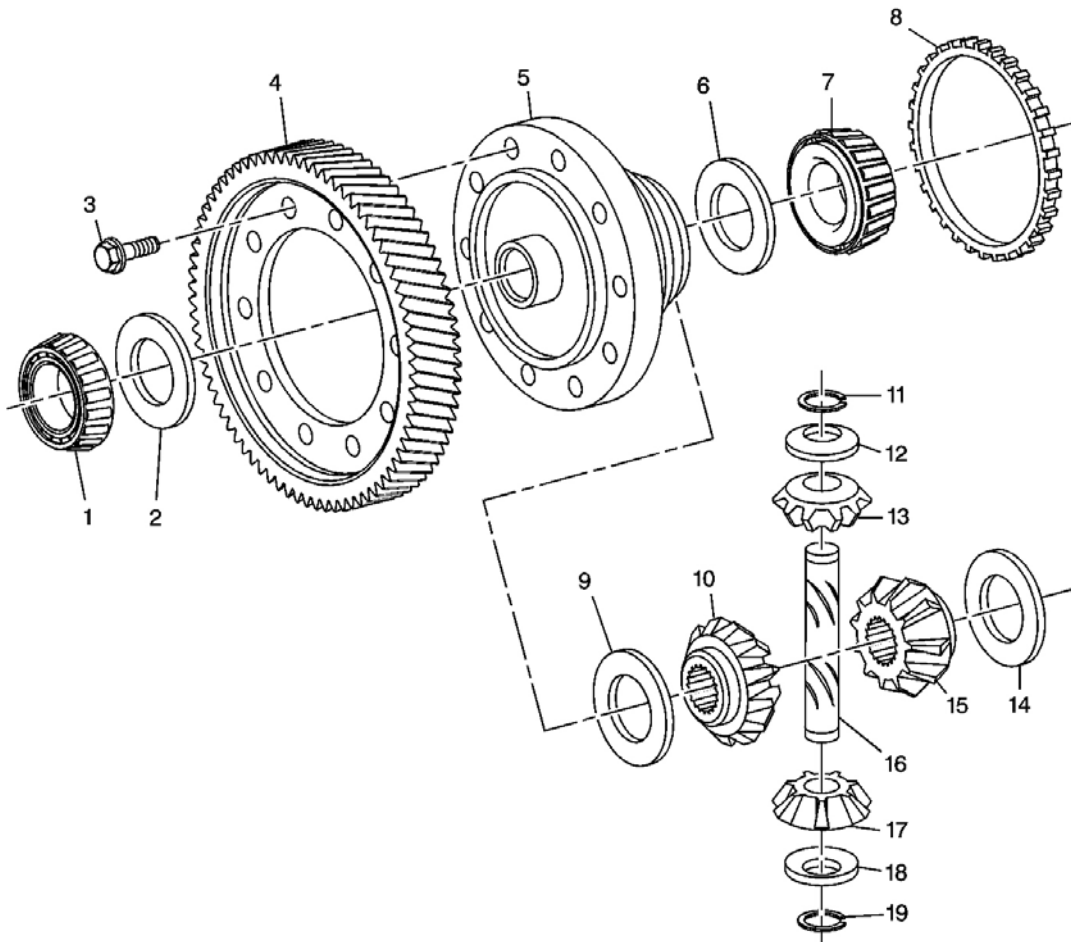


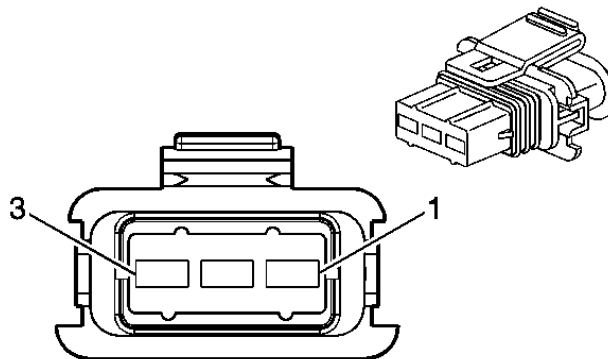
Fig. 8: Differential Components View
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 8

Callout	Component Name
1	Left Differential Side Bearing
2	Left Differential Shim
3	Differential Ring Gear Bolts
4	Differential Ring Gear
5	Differential Case
6	Right Differential Shim
7	Right Differential Side Bearing
8	Vehicle Speed Sensor (VSS) Ring
9	Side Gear Thrust Washer
10	Side Gear
11	Pinion Shaft Snap Ring
12	Pinion Gear Thrust Washer
13	Pinion Gear
14	Side Gear Thrust Washer
15	Side Gear
16	Pinion Shaft
17	Pinion Gear
18	Pinion Gear Thrust Washer
19	Pinion Shaft Snap Ring

MANUAL TRANSMISSION CONNECTOR END VIEWS

Vehicle Speed Sensor (VSS) Terminal Identification



Connector Part Information		<ul style="list-style-type: none"> • 15326597 • 3-Way F (BK) 	
Pin	Wire Color	Circuit Number	Function

1	PU/WH	821	VSS Signal
2	BK/WH	451	Ground
3	PK	239	Ignition 1 Voltage

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - MANUAL TRANSMISSION

Begin the system diagnosis with the **Diagnostic System Check - Manual Transmission** . The Diagnostic System Check - Manual Transmission will provide the following information:

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

The use of the Diagnostic System Check - Manual Transmission will identify the correct procedure for diagnosing the system and where the procedure is located.

DIAGNOSTIC SYSTEM CHECK - MANUAL TRANSMISSION

Circuit Description

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

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

Diagnostic Aids

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

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

Test Description

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

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

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

3: This step determines if the PCM is transmitting class 2 serial data to the DLC and that the class 2 data circuit is not open or shorted.

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

Diagnostic System Check - Manual Transmission

Step	Action	Yes	No
1	<p>1. Install a scan tool.</p> <p>IMPORTANT:</p> <ul style="list-style-type: none"> • Check for applicable service bulletins before proceeding with this test. Perform this test only if there is a driveability complaint or if you have been directed to this table from another section in the service information. • Do not turn the ignition OFF when performing this diagnostic procedure. Do not clear the DTCs unless instructed by this diagnostic procedure. <p>2. Turn ON the ignition, with the engine OFF.</p> <p>Does the scan tool turn ON?</p>	Go to Step 2	Go to Diagnostic Starting Point - Data Link Communications in Data Link Communications
2	<p>Is the MIL ON?</p>	Go to Step 3	Go to Malfunction Indicator Lamp (MIL) Inoperative in Engine Controls - 2.2L (L61)
3	<p>Attempt to establish communication with the PCM.</p> <p>Does the scan tool communicate with the PCM?</p>	Go to Step 4	Go to Diagnostic Starting Point - Data Link Communications in Data Link Communications
4	<p>Use the scan tool Capture Info function in order to save or capture, Store Info, any DTC Information.</p> <p>Are there any DTCs present?</p>	Go to Diagnostic Trouble Code (DTC) List/Type	Go to Symptoms - Manual Transmission

SCAN TOOL DATA LIST

Use the scan tool data values under the following conditions:

- The Powertrain On-Board Diagnostic (OBD) System Check is complete.
- The On-Board Diagnostics are functioning properly.

The values below represent a typical display recorded from a properly functioning system.

IMPORTANT: Do not use a scan tool that displays faulty data. Report the condition to the scan tool manufacturer. The use of a faulty scan tool can result in misdiagnosis and the unnecessary replacement of parts.

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by General Motors for use in diagnosis.

Scan tool values below were recorded under the following conditions:

- Engine at idle
- Upper radiator hose hot
- Closed throttle
- Transmission in Neutral
- Closed Loop operation
- Accessories OFF
- Brake pedal not applied

Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Vehicle Speed	ALL	km/h (mph)	0
*Data List Legend			
<ul style="list-style-type: none">• F0: General Info - Inputs• F1: General Info - Outputs• F2: Fuel and Emissions• F3: Ignition• F4: Misfire• F5: Auxiliary Emissions• F6: Idle/Speed Control• F7: Engineering			

SCAN TOOL DATA DEFINITIONS

Scan Tool Data Definitions

The Transmission Scan Tool Data Definitions contain a brief description of all manual transmission related parameters available on the scan tool. The list is in alphabetical order.

Vehicle Speed

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

DIAGNOSTIC TROUBLE CODE (DTC) TYPE DEFINITIONS

Diagnostic trouble codes (DTCs) are categorized into emissions and non-emissions related types. If a DTC is set, the malfunction indicator lamp (MIL) and failure data are utilized by the control module diagnostic executive according to the DTC type. Each DTC is set based upon the individual DTCs running and setting criteria. Read the Action Taken When the DTC Sets and Conditions for Clearing the MIL/DTC in the supporting text for taking appropriate action to each DTC.

Emissions Related DTCs

Type A

The following actions occur at the time of the first failure:

- The MIL is turned ON.
- A DTC is stored in memory.
- The Freeze Frame/Failure Record data is stored.
- The Failure Records are updated after the first failure of each ignition cycle.

Some Type A DTCs will not perform the above actions when the DTC first detects a failure. Two consecutive failures are required. This allows systems, such as evaporative emission (EVAP), to accurately identify what failure exists before setting a DTC and requesting MIL illumination.

Type B

The following actions occur at one of the following times:

- First failure:
 - The MIL is not turned ON.
 - A DTC is stored in memory as a Failed Last Test.
 - The Failure Record data is stored.
- Second consecutive drive cycle with a failure:
 - The MIL is turned ON.
 - A DTC is stored in memory as a history DTC.
 - The Freeze Frame data is stored.

- The Failure Record data is stored.
- Second non-consecutive drive cycle with a failure:
 - The MIL is not turned ON.
 - A DTC is stored in memory as a Failed Last Test.
 - The Failure Record data is stored.

Non-Emissions Related DTCs

Type C

The following actions occur at the time of a failure:

- The MIL does not turn ON.
- A DTC is stored in memory as a history DTC.
- The Failure Record data is stored.
- The Failure Records are updated after the first failure of each ignition cycle.
- Some Type C DTCs may also cause an auxiliary service lamp to be illuminated, and/or display a message to the vehicle operator.

Type X

Actions did not occur. These DTCs are coded into the control module software, but will not run for one of the following reasons:

- The associated hardware is not installed with the vehicle emission package.
- The diagnostic is not required for the vehicle emission package.

DIAGNOSTIC TROUBLE CODE (DTC) LIST/TYPE

Diagnostic Trouble Code (DTC) List/Type

Diagnostic Trouble Code (DTC)	DTC Type
DTC P0502	B

DTC P0502

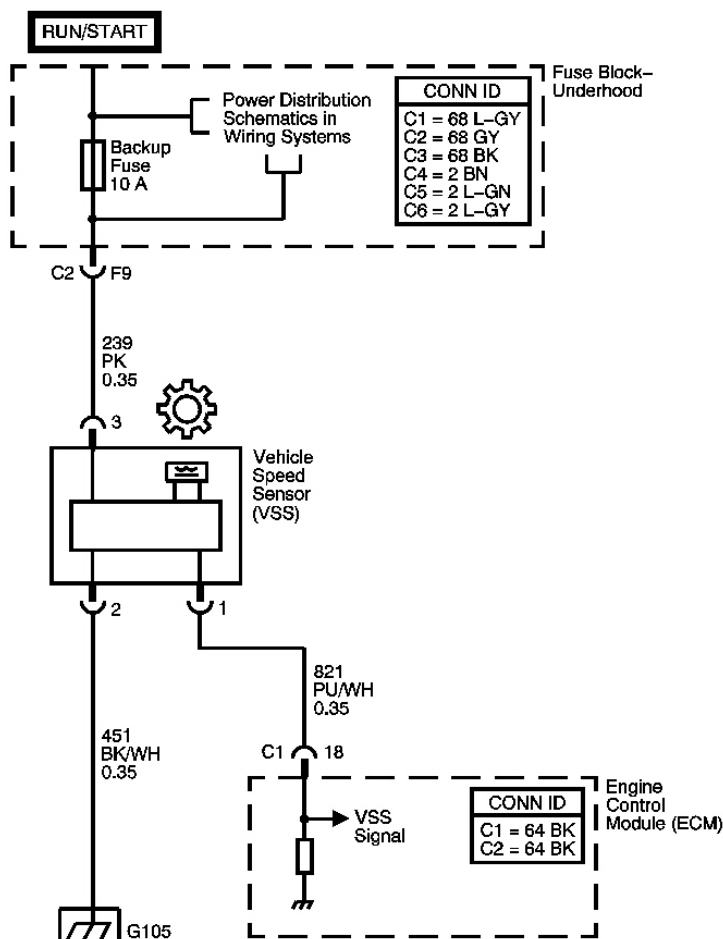


Fig. 9:
 Courtesy of GENERAL MOTORS CORP.

Circuit Description

Vehicle speed information is provided to the engine control module (ECM) by the vehicle speed sensor (VSS). The Hall-Effect sensor contains a permanent magnet and a semiconductor plate to which ignition voltage is applied. As the output shaft spins, the rotor directs the field of the permanent magnet either toward or away from the plate. When the ignition is ON and the magnetic field is directed away from the plate, electrons are evenly distributed across the plate. When the rotor directs the field toward the plate, the electrons are redistributed unevenly across the front and back of the plate. The uneven distribution causes a voltage to be produced across the plate. The VSS produces a frequency signal that is proportional to vehicle speed. The ECM converts the VSS signal to vehicle speed, displayed on the scan tool in miles per hour and kilometers per hour. The ECM also uses the VSS signal to generate the 4,000 pulses per mile vehicle speed signal used by the instrument cluster.

When the ECM detects a very low vehicle speed, while the vehicle is in motion, DTC P0502 sets. DTC P0502 is a type B DTC.

Conditions for Running the DTC

- Engine speed is 1,700-3,600 RPM.
- The TP angle is between 2-23 percent.
- MAP sensor is 60-80 kPa (9-12 psi).

Conditions for Setting the DTC

The vehicle speed sensor indicates a speed of less than 3 km/h (2 mph) for a total of 6 seconds.

Action Taken When the DTC Sets

- The ECM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The ECM disables Cruise Control.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The ECM stores DTC P0502 in ECM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

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

DTC P0502

Step	Action	Value (s)	Yes	No
1	Did you perform the Diagnostic System Check?	-	Go to Step 2	Go to Diagnostic System Check - Engine Controls in Engine Controls - 2.2L
	<ol style="list-style-type: none"> 1. Install a scan tool. 2. Turn ON the ignition with the engine OFF. 			

2	<p>IMPORTANT: Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.</p> <p>3. Record the DTC Freeze Frame and Failure Records.</p> <p>4. Clear the DTCs.</p> <p>NOTE: Support the lower control arms in the normal horizontal position in order to avoid damage to the drive axles. Do not operate the vehicle in gear with the wheels hanging down at full travel.</p> <p>5. Raise the drive wheels.</p> <p>6. Start and idle the engine.</p> <p>7. Place the transmission in 1st gear.</p> <p>8. Monitor Vehicle Speed on the scan tool.</p> <p>9. With the drive wheels rotating, increase and decrease the throttle position.</p> <p>Does the scan tool indicate Vehicle Speed increasing when wheel speed increases?</p>	-	Refer to <u>Intermittent Conditions</u> in Engine Controls - 2.2L	Go to Step 3
3	<p>1. Turn OFF the ignition.</p> <p>2. Disconnect the Vehicle Speed Sensor (VSS).</p> <p>3. Turn ON the ignition with the engine OFF.</p> <p>4. Using the DMM, measure the voltage of ignition 1 voltage circuit of the VSS to ground.</p> <p>Does the voltage measure near the specified value?</p>	B+	Go to Step 4	Go to Step 9
4	<p>Measure the voltage from the ignition 1 voltage circuit of the VSS to the VSS ground circuit.</p> <p>Does the voltage measure near the specified value?</p>	B+	Go to Step 5	Go to Step 12
	<p>1. Using the J-35616 connector test adapter kit, connect a jumper between the</p>			

5	<p>ignition 1 circuit and the VSS.</p> <ol style="list-style-type: none"> 2. Connect another jumper between the VSS ground circuit and the VSS. 3. Connect the DMM between terminal 1 of the VSS and ground. 4. Turn ON the ignition, with the engine OFF. 5. Select AC volts on the DMM. 6. Place transmission in neutral. 7. Rotate the rear wheels by hand while observing the DMM AC volts. <p>Does the DMM display AC volts above the specified value?</p>	.15 V	Go to Step 6	Go to Step 16
6	<ol style="list-style-type: none"> 1. Turn OFF the ignition. 2. Disconnect the ECM. 3. Using the DMM, measure the resistance of the VSS signal circuit between the VSS signal of the ECM and terminal 1 of the VSS. <p>Does the resistance measure less than the specified value?</p>	5 ohm	Go to Step 7	Go to Step 13
7	<p>Using the DMM, measure the resistance between the VSS signal circuit and ground. Is the resistance less than the specified value?</p>	50 kohm	Go to Step 14	Go to Step 8
8	<p>Using a test lamp connected to the ground, probe the VSS signal circuit. Does the test lamp illuminate?</p>	-	Go to Step 15	Go to Step 18
9	<ol style="list-style-type: none"> 1. Inspect the BACKUP fuse for an open. Refer to Circuit Protection - Fuses in Wiring Systems. 2. Replace the fuse if necessary. <p>Was the fuse open?</p>	-	Go to Step 10	Go to Step 11
10	<p>IMPORTANT: The condition that affects this circuit may exist in other connecting branches of the circuit. Refer to <u>Power Distribution Schematics</u> in Wiring Systems for complete circuit distribution.</p> <p>Test the ignition 1 voltage circuit of the VSS</p>	-		

	for a short to ground. Refer to Testing for Short to Ground in Wiring Systems. Did you find and correct the condition?		Go to Step 19	-
11	Test for an open or high resistance in the ignition 1 voltage circuit of the VSS. Refer to Testing for Continuity in Wiring Systems. Did you find and correct the condition?	-	Go to Step 19	-
12	Repair the open in the VSS ground circuit. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	-	Go to Step 19	-
13	Repair the open in the VSS signal circuit. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	-	Go to Step 19	-
14	Repair the short to ground in the VSS signal circuit. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	-	Go to Step 19	-
15	Repair the short to voltage on the VSS signal circuit. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	-	Go to Step 19	-
16	<ol style="list-style-type: none"> 1. Remove the VSS sensor. <p>Refer to Vehicle Speed Sensor (VSS) Replacement .</p> <ol style="list-style-type: none"> 2. Inspect the VSS and the transmission for the following: <ul style="list-style-type: none"> • Incorrect VSS • VSS damage • Excessive VSS to rotor gap • Incorrect VSS rotor alignment • VSS rotor damage • Loose VSS 3. Repair any of the above conditions. <p>Did you find and correct the condition?</p>	-	Go to Step 19	Go to Step 17
17	Replace the VSS. Refer to Vehicle Speed Sensor (VSS) Replacement . Did you complete the repair?	-	Go to Step 19	-
18	Replace the ECM. Refer to Engine Control Module (ECM) Replacement in Engine Controls - 2.2L.	-		

	Did you complete the repair?		Go to Step 19	-
19	In order to verify your repair, perform the following procedure: <ol style="list-style-type: none"> 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle. 4. Ensure the vehicle speed is greater than 3 km/h (2 mph) for at least 3 seconds. 5. Select specific DTC. 6. Enter DTC P0502. 	-		
	Has the test run and passed?		Go to Step 20	Go to Step 2
20	With a scan tool observe the stored information, capture info and DTC Info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to Diagnostic Trouble Code (DTC) List in Engine Controls - 2.2L	System OK

SYMPTOMS - MANUAL TRANSMISSION

Strategy Based Diagnostics

Review the system operations in order to familiarize yourself with the system functions. Refer to **Transmission System Description and Operation** .

Visual/Physical Inspection

- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the manual transaxle for the correct fluid level.
- Inspect the manual transaxle for fluid leaks.
- Inspect the manual transaxle for broken or loose transaxle mounts.

Intermittent

Test the vehicle under the same conditions that the customer reported in order to verify the system is operating properly.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **Transmission Shifts Hard**
- **Transmission Gear Clash When Shifting Gears**
- **Transmission Noisy**
- **Transmission Does Not Shift into One Gear**
- **Transmission Jumps Out of Gear**
- **Transmission Locked in One Gear**
- **Transmission Clunk on Acceleration or Deceleration**

TRANSMISSION SHIFTS HARD

Diagnostic Aids

An intermittent hard shift may be caused by an intermittent clutch condition.

Test Description

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

3: A static shift test is performed by shifting into all of the gear positions with the engine not operating. While performing the test one should note how the shift lever movement is felt. Also while shifting from one gear to the other feel for binding in the shift rails. You should be able to feel the detent plungers operating when coming out of a gear and going into a gear.

6: A dynamic shift test is performed by shifting into the gear positions with the engine operating. Test for the correct mesh of the synchronizers and for the clutch releasing correctly. When shifting into and out of a gear, feel for the shift detent plungers and for the synchronizers sleeve for moving freely.

8: The transaxle uses a DEXRON(R) III transaxle fluid that allows proper synchronizer operation. The incorrect fluid may cause hard shifting by varnish build-up, or not enough lubrication for proper synchronizer operation.

Transmission Shifts Hard

Step	Action	Yes	No
DEFINITION: The transaxle does not shift smoothly, or without difficulty, from one gear to the other.			
1	Did you review the <u>Symptoms - Manual Transmission</u> and perform the necessary inspections?	Go to Step 2	Go to <u>Symptoms - Manual Transmission</u>
2	Inspect the clutch system for proper operation. Refer to <u>Clutch System Description and Operation</u> in Clutch. Did you find or repair the condition?	Go to Step 12	Go to Step 3
3	<ol style="list-style-type: none"> 1. Perform a static shift test on the transaxle. 2. Test for the following: <ul style="list-style-type: none"> • Blockage preventing full shift lever movement • Excessive movement in the shift lever • Binding in the shift lever 		

	<ul style="list-style-type: none"> • Detent plungers or shift rails binding • Shift cable binding • Shift cable proper adjustment 		
	Are you able to shift into all gears?	Go to Step 6	Go to Step 4
4	<p>Remove the floor console. Refer to <u>Console Replacement - Front Floor</u> in Instrument Panel, Gages, and Console. Inspect for the following:</p> <ul style="list-style-type: none"> • Loose mounting • Foreign debris 	Go to Step 12	Go to Step 5
5	<p>Inspect for proper shift cable adjustment. Refer to <u>Shift Cable Adjustment</u> . Did you find and repair the condition?</p>	Go to Step 12	Go to Step 6
6	<ol style="list-style-type: none"> 1. Perform a dynamic shift test on the transaxle. 2. Test for the following: <ul style="list-style-type: none"> • Detent plungers or shift rails binding • Synchronizer sleeve binding • Gear clash into only one gear • Gear clash into all gears 	Go to Step 7	Go to Step 11
7	<p>Inspect the transaxle for the correct fluid level and type of the transaxle fluid. Refer to <u>Transmission Fluid Replacement</u> . Is the transaxle at the correct level and the proper fluid being used?</p>	Go to Step 9	Go to Step 8
8	<p>Drain and refill the transaxle with the correct type fluid. Refer to <u>Transmission Fluid Replacement</u> . Did you find and repair the condition?</p>	Go to Step 12	Go to Step 9
9	<ol style="list-style-type: none"> 1. Remove the transaxle. Refer to <u>Transmission Replacement</u> . 2. Inspect the clutch pressure plate and/or clutch driven plate. <p>Is the clutch pressure plate and/or clutch driven plate worn or faulty?</p>	Go to Step 10	Go to Step 11
10	<p>Replace the clutch assembly. Refer to <u>Clutch Drive Plate and Clutch Driven Plate</u> in Clutch. Did you find and repair the condition?</p>	Go to Step 12	Go to Step 11

11	<ol style="list-style-type: none"> 1. Disassemble the transaxle. Refer to <u>Transaxle Case Disassemble</u> . 2. Inspect the following components for being faulty, in the gear that is hard to shift or clashing: <ul style="list-style-type: none"> • Excessive synchronizers blocking ring to gear clearance • Synchronizer hub external splines worn or damaged • Excessive axial clearance in the speed gear • Mainshaft to speed gear bearing or journal worn • Shift rail and the internal shift control lever components for wear or damage 3. Replace worn or damaged components as necessary. <p>Did you find and repair the condition?</p>	Go to Step 12	Go to Diagnostic Aids
12	<p>Operate the system in order to verify the repair.</p> <p>Did you correct the condition?</p>	System OK	Go to Step 1

TRANSMISSION GEAR CLASH WHEN SHIFTING GEARS

Diagnostic Aids

Gear clashing may be caused by shifting at too high of an engine RPM or by rushing the shift. If gear clashing is occurring in more than one gear, the clutch may not be releasing properly for proper synchronizer operation.

Test Description

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

2: This step tests for the proper releasing of the clutch. If the clutch reserve is not proper, the mainshaft gears may still be turning causing the gear clashing.

5: This step inspects for the proper transaxle fluid. A special fluid is required for the correct lubrication of the synchronizers.

7: A static shift test is performed by shifting into all of the gear positions with the engine not operating. While performing the test, you should note how the shift lever movement is felt. Also, while shifting from one gear to another, feel for binding in the shift rails. You should be able to feel the detent plungers operating when coming out of a gear and going into a gear. Excessive play in the gear shift lever may prevent the shift forks from fully engaging the synchronizer.

10: A dynamic shift test is performed by shifting into all of the gear positions with the engine operating. Test for the correct mesh of the synchronizers, and for the clutch releasing correctly. Move the shift lever and feel for the synchronizer sleeve to just release from the gear, then let up on the clutch pedal. Depress the clutch pedal and move the shift lever to engage that gear again. If it shifts back into the gear without clashing, the clutch is releasing correctly and the synchronizer is working. If clashing occurs, test on another gear. If all gears clash, the clutch is not releasing correctly.

Transmission Gear Clash When Shifting Gears

Step	Action	Yes	No
<p>DEFINITION: Noise from the transaxle when shifting gears. A grinding or grating sound, when the synchronizer sleeve is engaging with the selector teeth on the speed gear. A suspected internal transaxle condition, if the noise only occurs in one gear.</p>			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	With the engine operating, does the transaxle shift from neutral to any gear, without the vehicle lurching or gear clashing?	Go to Step 5	Go to Step 3
3	Inspect for proper clutch operation. Refer to Clutch System Description and Operation in Clutch. Does the clutch operate properly?	Go to Step 5	Go to Step 4
4	Repair the clutch system. Refer to Symptoms - Clutch in Clutch. Did you find and repair the condition?	Go to Step 11	Go to Step 5
5	Inspect for the correct transaxle fluid level and the proper fluid. Refer to Transmission Fluid Replacement . Is the transaxle fluid level correct and at the proper level?	Go to Step 7	Go to Step 6
6	Fill the transaxle to the correct level, or change the transaxle fluid if it is not the correct type. Does the transaxle still have gear clash?	Go to Step 7	Go to Step 11
7	<ol style="list-style-type: none"> 1. Perform a static shift test on the transaxle. 2. Test for the following: <ul style="list-style-type: none"> • Blockage preventing full shift lever movement • Excessive movement in the shift lever • Binding in the shift lever • Detent plungers or shift rails binding • Shift cable binding • Shift cable proper adjustment <p>Did the transaxle shift smoothly into the gear that is clashing?</p>	Go to Step 10	Go to Step 8
8	Remove the floor console. Refer to Console Replacement - Front Floor in Instrument Panel, Gages, and Console. Inspect for the following: <ul style="list-style-type: none"> • Loose mounting 		

	<ul style="list-style-type: none"> Foreign debris 		
	Did you find and repair the condition?	Go to Step 12	Go to Step 10
9	Inspect for proper shift cable adjustment. Refer to <u>Shift Cable Adjustment</u> . Did you find and repair the condition?	Go to Step 12	Go to Step 10
10	<ol style="list-style-type: none"> Perform a dynamic shift test on the transaxle. Test for the following: <ul style="list-style-type: none"> Detent plungers or shift rails binding Synchronizer sleeve binding Gear clashing in more than the suspected gear 		
	Is the transaxle hard to shift into all gears?	Go to <u>Transmission Shifts Hard</u>	Go to Step 11
11	<ol style="list-style-type: none"> Disassemble the transaxle. Refer to <u>Transaxle Case Disassemble</u> . Inspect the following transaxle components for the gear that is clashing: <ul style="list-style-type: none"> Excessive synchronizer blocking ring to gear clearance Synchronizer sleeve to hub clearance excessive Excessive axial clearance in the speed gear Mainshaft to speed gear bearing or journal worn Shift fork worn or damaged Internal shift control worn or damaged Mainshaft bearing worn or damaged Input gear bearing or pilot bearing worn 		
	Did you find and repair the condition?	Go to Step 12	Go to Diagnostic Aids
12	Operate the system and verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION NOISY

Test Description

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

2: This step inspects for vibration causing a noise. If the vehicle is carrying a certain load, the driveline axle may not be correct, and could cause a vibration. The vibration maybe resonating into the transaxle, causing a noise.

6: This step inspects for the correct transaxle fluid level. If the transaxle fluid level is excessively low, damage may have occurred to the transaxle components.

8: This step inspects for the correct type of transaxle fluid. The transaxle uses a special fluid. If the incorrect fluid was used, there may have been an overheating problem. Overheating may cause damage to the transaxle components.

10: This step inspects for noise coming into the driver compartment. Improper sealing of the shift tower may be allowing normal transaxle noise to be heard by the driver.

14: This step tests to determine if clutch components are making the noise. Depress the clutch pedal slowly and listen for the change in noise. If the noise changes while pressing the pedal, it may be a faulty clutch component. If the noise does not change until the clutch is completely disengaged, the transaxle component is faulty.

Transmission Noisy

Step	Action	Yes	No
DEFINITION: The transaxle is making a noise. The different noises may be a whine or a growl from faulty bearings or gears. The noise may also be caused from a faulty component causing a vibration noise or rattle.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Is the noise present at a certain road speed, or with a certain load?	Go to Step 3	Go to Step 4
3	Inspect for the correct driveline angle. Refer to Diagnostic Starting Point - Vibration Diagnosis and Correction in Vibration Diagnosis and Correction. Did you find and repair the condition?	Go to Step 17	Go to Step 4
4	Is the noise present in all gears?	Go to Step 6	Go to Step 5
5	Is the noise present in just one gear?	Go to Step 16	Go to Step 6
6	Inspect the transaxle fluid level. Is the fluid level correct?	Go to Step 8	Go to Step 7
7	Add transaxle fluid. Refer to Transmission Fluid Replacement . Did you find and repair the condition?	Go to Step 17	Go to Step 8
8	Inspect the transaxle for the correct fluid type. Refer to Lubrication Specifications . Is the transaxle fluid the correct type?	Go to Step 10	Go to Step 9
9	Drain and refill the transaxle with the correct type fluid. Refer to Transmission Fluid Replacement . Did you find and repair the condition?	Go to Step 17	Go to Step 10
	Inspect the shift tower boot.	Go to	

10	Is the closeout boot loose or damaged?	Step 11	Go to Step 12
11	Position and tighten the shift tower boot to specifications. Refer to <u>Shift Control Replacement</u> . Did you find and repair the condition?	Go to Step 17	Go to Step 12
12	1. Inspect for engine to transaxle alignment. 2. Inspect for loose transaxle mounting bolts. Are there any loose transaxle mounting bolts?	Go to Step 13	Go to Step 14
13	Replace and tighten the transaxle mounting bolts. Refer to <u>Transmission Replacement</u> . Is the noise still present?	Go to Step 14	Go to Step 17
14	With the engine operating, depress the clutch pedal. Is the noise still present?	Go to Step 15	Go to Step 16
15	1. Remove the clutch. Refer to <u>Clutch Drive Plate and Clutch Driven Plate</u> in Clutch. 2. Inspect the following components for being the cause of the noise. <ul style="list-style-type: none"> • The release bearing • The pilot bearing • The pressure plate • The clutch disc • The input shaft bearing • The engine crankshaft end play Did you find and repair the condition?	Go to Step 17	Go to Step 16
16	1. Remove the transaxle. Refer to <u>Transmission Replacement</u> . 2. Disassemble the transaxle. Refer to <u>Transaxle Case Disassemble</u> . Use the information in the Cleaning and Inspection section to determine if any of the transaxle components are faulty. Did you find and repair the condition?	Go to Step 17	-
17	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION DOES NOT SHIFT INTO ONE GEAR

Diagnostic Aids

If the transaxle shifts into gear and then jumps out of gear, refer to **Transmission Jumps Out of Gear** . If it is an intermittent condition, other driveline components may be faulty.

Test Description

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

2: This step is to confirm that the clutch is not slipping. During certain conditions, the clutch may slip, and feel as though the transaxle is not in gear.

3: A static shift test is performed by shifting into all gears with the engine not operating. While performing the test, you should note how the shift lever movement feels. Also, feel for the shift rails moving freely, the detent plungers operating when coming out of a gear and going in the next gear, and the synchronizer sleeve movement.

6: A dynamic shift test is performed by shifting into all gears with the engine operating. Test for the correct mesh of the synchronizers sleeve and the speed gear selector teeth. Move the shift lever and feel for the synchronizer sleeve to just release from the gear, then let up on the clutch pedal. Depress the clutch pedal and move the shift lever to engage that gear again, to ensure full travel of the shift components.

Transmission Does Not Shift into One Gear

Step	Action	Yes	No
DEFINITION: The shift lever will not move into a particular gear position, or when it is in a gear position, power is not delivered through the transaxle.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Inspect the clutch system for slipping. Refer to Clutch Slipping in Clutch. Is the clutch working properly?	Go to Step 3	Go to Clutch Drive Plate and Clutch Driven Plate in Clutch
3	1. Perform a static shift test on the transaxle. 2. Test for the following: <ul style="list-style-type: none">• Blockage preventing full shift lever movement• Excessive movement in the shift lever• Binding in the shift lever• Detent plungers or shift rails binding• Synchronizer sleeve moving on the hub and pressure pieces• Shift cable binding• Shift cable proper adjustment Were you able to shift into the gear position that has the concern?	Go to Step 6	Go to Step 4
	Remove the floor console. Refer to Console Replacement - Front Floor in Instrument Panel, Gages, and Console. Inspect for the following:		

4	<ul style="list-style-type: none"> • Loose mounting • Foreign debris <p>Did you find and repair the condition?</p>	Go to Step 9	Go to Step 6
5	<p>Inspect for proper shift cable adjustment. Refer to <u>Shift Cable Adjustment</u> .</p> <p>Did you find and repair the condition?</p>	Go to Step 9	Go to Step 6
6	<ol style="list-style-type: none"> 1. Perform a dynamic shift test on the transaxle. 2. Test for the following: <ul style="list-style-type: none"> • Detent plungers or shift rails binding • Synchronizer sleeve binding • Synchronizer sleeve engaging on the speed gear selector teeth <p>Were you able to shift into the gear position that has the concern?</p>	Go to Step 8	Go to Step 7
7	<ol style="list-style-type: none"> 1. Remove the transaxle. Refer to <u>Transmission Replacement</u> . 2. Disassemble the transaxle. Refer to <u>Transaxle Case Disassemble</u> . 3. Inspect the following transaxle internal components for wear or damage: <ul style="list-style-type: none"> • The shift forks • The internal shift control lever <p>Did you find and repair the condition?</p>	Go to Step 9	Go to Step 8
8	<ol style="list-style-type: none"> 1. Remove the transaxle. Refer to <u>Transmission Replacement</u> . 2. Disassemble the transaxle. Refer to <u>Transaxle Case Disassemble</u> . 3. Inspect the following transaxle internal components for wear or damage: <ul style="list-style-type: none"> • The synchronizer sleeve selector teeth • The speed gear selector teeth • The speed gear axial clearance for being excessive • The speed gear to mainshaft bearings and journals • The countershaft for being broken • The mainshaft for being broken 		

	<ul style="list-style-type: none"> • The countershaft gear for being stripped • The mainshaft gear for being stripped 		
	Did you find and repair the condition?	Go to Step 9	Go to Diagnostic Aids
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION JUMPS OUT OF GEAR

Diagnostic Aids

If the transaxle jumps out of gear during deceleration, inspect the components that may allow for the gears or shafts to tip. If the gears or shafts tip, the synchronizer sleeve can disengage from the selector teeth on the speed gear. If the transaxle jumps out of gear during acceleration, inspect the components that may not allow full engagement of the synchronizer sleeve to the selector teeth on the speed gear. Insufficient engagement of the selector teeth under torque may cause the transaxle to jump out of gear.

Test Description

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

2: A static shift test is performed by shifting into all gear positions with the engine not operating. While performing the test, slowly move the shift lever. Feel for proper movement of the shift lever and transaxle internal shift components.

5: A dynamic shift test is performed by shifting into all gear positions with the engine operating. Test for the correct mesh of the synchronizers sleeve and the speed gear selector teeth. Move the shift lever, and feel for the synchronizer sleeve to release from the gear, and then let up on the clutch pedal. Depress the clutch pedal and move the shift lever to engage the gear again, to ensure full travel of the shift components.

6: This step inspects for worn or damaged transaxle or engine mounts. Loose mounts may cause a shock on the transaxle allowing for gear disengagement.

7: This step inspects for the misalignment of the clutch to transaxle. Misalignment may put a bind on the input shaft, allowing for the input shaft or the mainshaft to tip.

9: This step inspects the pilot bearing and the pilot bearing journal on the input shaft. A worn pilot bearing or input shaft may allow the input shaft to tip, causing gear disengagement.

Transmission Jumps Out of Gear

Step	Action	Yes	No
DEFINITION: Gear disengagement occurs during acceleration or deceleration.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
	<ol style="list-style-type: none"> 1. Perform a static shift test. 2. Test for the following: 		

2	<ul style="list-style-type: none"> • Blockage preventing full shift lever movement • Excessive movement in the shift lever • Detent plungers engaging in the shift rails • Synchronizer pressure pieces on the synchronizer sleeves • Shift cable binding • Shift cable proper adjustment <p>Did the transaxle shift completely into all gears?</p>	Go to Step 5	Go to Step 3
3	<p>Remove the floor console. Refer to <u>Console Replacement - Front Floor</u> in Instrument Panel, Gages, and Console. Inspect for the following:</p> <ul style="list-style-type: none"> • Loose mounting • Foreign debris <p>Did you find and repair the condition?</p>	Go to Step 11	Go to Step 4
4	<p>Inspect for proper shift cable adjustment. Refer to <u>Shift Cable Adjustment</u> .</p> <p>Did you find and repair the condition?</p>	Go to Step 11	Go to Step 5
5	<ol style="list-style-type: none"> 1. Perform a dynamic shift test on the transaxle. 2. Test for the following: <ul style="list-style-type: none"> • Synchronizer sleeve engagement to the speed gear selector teeth • Detent plungers engaging in the shift rails <p>Did the transaxle shift completely into all gears?</p>	Go to Step 6	Go to Step 9
6	<p>Inspect the engine and/or transaxle mounts. Refer to <u>Engine Mount Inspection</u> in Engine Mechanical - 2.2L and <u>Transmission Mount Inspection</u> .</p> <p>Did you find and repair the condition?</p>	Go to Step 11	Go to Step 7
7	<p>Inspect the clutch housing for loose bolts or misalignment. Are there any loose bolts or misalignment?</p>	Go to Step 8	Go to Step 9
8	<ol style="list-style-type: none"> 1. Align the housing, if required. 2. Tighten any loose housing bolts. Refer to <u>Fastener Tightening Specifications</u> . <p>Did you find and repair the condition?</p>	Go to Step 11	Go to Step 9
	<ol style="list-style-type: none"> 1. Remove the transaxle. Refer to <u>Transmission Replacement</u> . 2. Remove the clutch assembly. Refer to <u>Clutch Drive Plate</u> 		

9	<p>and Clutch Driven Plate in Clutch.</p> <p>3. Inspect the pilot bearing for being faulty.</p> <p>4. Inspect the input shaft for excessive wear at the pilot bearing.</p> <p>Did you find and repair the condition?</p>	Go to Step 11	Go to Step 10
10	<p>1. Disassemble the transaxle. Refer to Transaxle Case Disassemble .</p> <p>2. Inspect the following components for wear or damage:</p> <ul style="list-style-type: none"> • The shift rails • The detent plungers and springs • The shift forks • The synchronizer sleeve and speed gear selector teeth • The mainshaft to input shaft bearing and journals • The speed gear bearings and journals • The speed gear axial clearance • The mainshaft center and rear bearings <p>Did you find and repair the condition?</p>	Go to Step 11	Go to Diagnostic Aids
11	<p>Operate the system in order to verify the repair.</p> <p>Did you correct the condition?</p>	System OK	Go to Step 1

TRANSMISSION LOCKED IN ONE GEAR

Test Description

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

2: This step is to ensure the use of the proper transaxle fluid. A special fluid is used to ensure proper synchronizer operation, and for sufficient lubrication. Improper fluid may cause the synchronizers to stick or the transaxle components to overheat.

4: A static shift test is performed by shifting into all gears with the engine not operating. By confirming that the transaxle can be shifted into all positions, ensures that the shift lever is not excessively worn or damaged.

6: A dynamic shift test is performed by shifting into all of the gear positions with the engine operating. Test to ensure that the internal shift components are functioning properly.

Transmission Locked in One Gear

Step	Action	Yes	No
DEFINITION: The transaxle cannot be shifted out of a gear, or the vehicle will not move because the transaxle is locked.			

1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Inspect for the correct type of transaxle fluid. Is the correct type transaxle fluid being used?	Go to Step 4	Go to Step 3
3	Drain the transaxle, and refill with the correct type of fluid. Refer to Transmission Fluid Replacement . Did you find and repair the condition?	Go to Step 9	Go to Step 4
4	1. Perform a static shift test on the transaxle. 2. Test for the shift lever moving to all positions. Were you able to shift into all positions?	Go to Step 6	Go to Step 5
5	1. Remove the shift lever. 2. Inspect for worn or faulty components. Refer to Shift Control Replacement . Did you find and repair the conditions?	Go to Step 9	Go to Step 6
6	1. Perform a dynamic shift test on the transaxle. 2. Test for being able to shift in and out of the gear with the concern. Were you able to shift the transaxle correctly?	Go to Step 7	Go to Step 8
7	1. Remove the transaxle. Refer to Transmission Replacement . 2. Inspect the clutch system for the clutch not releasing properly. Refer to Clutch System Description and Operation in Clutch. Did you find and repair the condition?	Go to Step 9	Go to Step 8
8	1. Disassemble the transaxle. Refer to Transaxle Case Disassemble . 2. Inspect the following transaxle internal components for wear or damage: <ul style="list-style-type: none"> • The shift rail • The internal shift control lever • The synchronizer components for being broken or faulty • The speed gears for being seized to the mainshaft Did you find and repair the conditions?	Go to Step 9	-
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION CLUNK ON ACCELERATION OR DECELERATION

Diagnostic Aids

All manual transaxles have gear play that might cause a clunk. If the transaxle is suspected of causing the clunk, compare it with a similar vehicle. An internal clunk in the transaxle is usually caused by wear between two components, or from improper assembly, which would also cause other symptoms.

Test Description

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

5: This step inspects the driveline components that may be the cause of the clunk noise. The noise may resonate to the transaxle.

Transmission Clunk on Acceleration or Deceleration

Step	Action	Yes	No
DEFINITION: A clunk is heard and/or felt on acceleration or deceleration.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Inspect the engine mounts for being loose or damaged. Refer to Engine Mount Inspection in Engine Mechanical - 2.2L. Did you find and repair the condition?	Go to Step 7	Go to Step 3
3	Inspect the transaxle mounts for being loose or damaged. Refer to Transmission Mount Inspection . Did you find and repair the condition?	Go to Step 7	Go to Step 4
4	Inspect the transaxle to engine fasteners for being loose or missing. Refer to Fastener Tightening Specifications . Did you find and repair the condition?	Go to Step 7	Go to Step 5
5	Inspect the driveline for causing the clunk. Refer to Diagnostic Starting Point - Wheel Drive Shafts in Wheel Drive Shafts. Did you find and repair the condition?	Go to Step 7	Go to Step 6
6	<ol style="list-style-type: none">1. Remove the transaxle. Refer to Transmission Replacement .2. Disassemble the transaxle. Refer to Transaxle Case Disassemble .3. Inspect the following transaxle components that may be causing the clunk:<ul style="list-style-type: none">• Faulty mainshaft bearings• Faulty countershaft bearings• Worn speed gear teeth• Worn countershaft gear teeth• Worn synchronizer sleeve to hub		

	<ul style="list-style-type: none"> Worn thrust washers and thrust surfaces on the speed gears or mainshaft 	Go to Step 7	Go to Diagnostic Aids
7	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION FLUID LEAK DIAGNOSIS

Diagnostic Aids

Using the incorrect type of transaxle fluid may affect the sealing ability of the seals. Ensure the use of the correct type of transaxle fluid. The incorrect type of sealer may not be compatible with the transaxle fluid or may not have the correct characteristics for sealing the affected components. Ensure the use of the correct type of sealers. Refer to **Sealers, Adhesives, and Lubricants** .

Test Description

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

5: Use an approved method to clean the transaxle to ensure the leak location is correctly identified. If using a powder method or dye method, ensure the products are compatible with the transaxle fluid.

Transmission Fluid Leak Diagnosis

Step	Action	Yes	No
DEFINITION: Visible sign of the transaxle fluid leaking from the transaxle.			
1	Did you review the <u>Symptoms - Manual Transmission</u> and perform the necessary inspections?	Go to Step 2	Go to <u>Symptoms - Manual Transmission</u>
2	<ol style="list-style-type: none"> Inspect for the transaxle fluid level higher than the recommended level. Refer to <u>Transmission Fluid Replacement</u> . Adjust the transaxle level if incorrect. Was the transaxle fluid level too high?	Go to Step 24	Go to Step 3
3	Inspect the transaxle vent for a blockage. Is the transaxle vent blocked?	Go to Step 4	Go to Step 5
4	Repair or replace the transaxle vent. Did you find and repair the condition?	Go to Step 24	Go to Step 5
5	Verify the location of the leak. <ol style="list-style-type: none"> Clean the transaxle assembly. Operate the vehicle for 24 km (15 mi), or until normal operating temperatures are reached. 		

	<p>3. Visual inspect or use the powder method or dye and black light method to locate the leak.</p> <p>Is the leak occurring at the drain or fill plug?</p>	Go to Step 6	Go to Step 7
6	<p>Replace the drain or fill plug. Refer to <u>Transmission Fluid Replacement</u> .</p> <p>Did you find and repair the condition?</p>	Go to Step 24	Go to Diagnostic Aids
7	<p>Is the leak at the transaxle output shaft seal?</p>	Go to Step 8	Go to Step 9
8	<p>Remove the output shaft seal and inspect for the following. Refer to <u>Axle Shaft Oil Seal Replacement (Left)</u> or <u>Axle Shaft Oil Seal Replacement (Right)</u> .</p> <ul style="list-style-type: none"> • Damaged or worn seal • Damaged seal bore • Improper installation • Cracks in the component • Loose or worn bearing causing excessive seal wear <p>Did you find and repair the condition?</p>	Go to Step 24	Go to Diagnostic Aids
9	<p>Is the leak at the shift lever area?</p>	Go to Step 10	Go to Step 11
10	<ol style="list-style-type: none"> 1. Inspect the shift control lever lower boot for damage. 2. Inspect for loose shift control lever mounting bolts. 3. Remove the shift control lever. Refer to <u>Shift Control Replacement</u> . 4. Replace the shift control lever lower boot if damaged. 5. Inspect the shift control lever sealing surfaces for scratched, nicked or damaged. <p>Did you find and repair the condition?</p>	Go to Step 24	Go to Diagnostic Aids
11	<p>Is the leak at the front of the transaxle?</p>	Go to Step 12	Go to Step 15
12	<ol style="list-style-type: none"> 1. Remove the transaxle. Refer to <u>Transmission Replacement</u> . 2. Inspect the input shaft retainer for leaking. 3. Remove the input shaft bearing retainer. Refer to <u>Axle Shaft Oil Seal Replacement (Left)</u> or <u>Axle Shaft Oil Seal Replacement (Right)</u> . Replace the seal. 	Go to	

	Did you find and repair the condition?	Step 24	Go to Step 13
13	<ol style="list-style-type: none"> 1. Inspect for the leak at the input shaft seal. 2. Inspect for the following if the input shaft seal is leaking: <ul style="list-style-type: none"> • Damaged or worn seal • Damaged seal bore • Improper installation • Cracks in the component • Input shaft sealing surface is scratched, nicked, damaged or worn • Loose or worn bearing causing excessive seal wear 3. Replace the input shaft seal if leaking. Refer to <u>Axle Shaft Oil Seal Replacement (Left)</u> or <u>Axle Shaft Oil Seal Replacement (Right)</u> . <p>Did you find and repair the condition?</p>	Go to Step 24	Go to Step 14
14	<ol style="list-style-type: none"> 1. Inspect the case for cracks or porosity. 2. Replace the transaxle case or clutch housing if it is faulty. Refer to <u>Transaxle Case Disassemble</u> . <p>Did you find and repair the condition?</p>	Go to Step 24	Go to Diagnostic Aids
15	Is the leak at the vehicle speed sensor (VSS)?	Go to Step 16	Go to Step 17
16	<ol style="list-style-type: none"> 1. Remove the VSS. Refer to <u>Vehicle Speed Sensor (VSS) Replacement</u> . 2. Inspect for the following: <ul style="list-style-type: none"> • Cut or damaged O-ring seal • VSS over-tightened causing deformation in the VSS • VSS bore scratched or damaged <p>Did you find and repair the condition?</p>	Go to Step 24	Go to Step 1
17	Is the leak at the backup lamp switch?	Go to Step 18	Go to Step 20
18	<ol style="list-style-type: none"> 1. Remove the backup lamp switch. Refer to <u>Backup Lamp Switch Replacement</u> . 2. Inspect for the following: <ul style="list-style-type: none"> • Cross threaded or damaged threads • Insufficient sealant • Leaking switch • Improper installation <p>Go to</p>	Go to	

	Did you find and repair the condition?	Step 24	Go to Step 1
19	<ol style="list-style-type: none"> 1. Remove the shift shaft detent sleeve. Refer to <u>Transaxle Case Disassemble</u> and <u>Transaxle Case Assembly</u> . 2. Inspect for the following: <ul style="list-style-type: none"> • Cross threaded or damaged threads • Insufficient sealant • Cracked sleeve or case • Improper installation 	Go to Step 24	Go to Step 1
20	Did you find and repair the condition? Is the leak at the sealing flanges of the transaxle case?	Go to Step 21	Go to Step 22
21	<ol style="list-style-type: none"> 1. Remove the transaxle. Refer to <u>Transmission Replacement</u> . 2. Disassemble the transaxle. Refer to <u>Transaxle Case Disassemble</u> . 3. Inspect the sealing surfaces. Refer to <u>Clutch and Differential Housing Cleaning and Inspection</u> . 	Go to Step 24	Go to Step 22
22	Did you find and repair the condition? Is the leak coming from a crack or porosity in the transaxle case ?	Go to Step 23	Go to Diagnostic Aids
23	<ol style="list-style-type: none"> 1. Remove the transaxle. Refer to <u>Transmission Replacement</u> . 2. Disassemble the transaxle. Refer to <u>Transaxle Case Disassemble</u> . 3. Replace the faulty transaxle case or clutch housing. Refer to <u>Transaxle Case Assembly</u> . 	Go to Step 24	Go to Diagnostic Aids
24	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

REPAIR INSTRUCTIONS

TRANSMISSION MOUNT INSPECTION

Inspection Procedure

NOTE: In order to avoid oil pan damage and possible engine failure, insert a block of wood that spans the width of the oil pan bottom between the oil pan and the jack support.

IMPORTANT: Before replacing any transmission mount due to a suspected fluid loss, verify that the source of the fluid is the mount.

1. Raise the transmission/transaxle in order to relieve tension in the mount.
2. Observe the mount while raising the transmission/transaxle. Raising the transmission/transaxle removes the weight from the mount.
3. Replace the mount if it exhibits any of the following conditions:
 - The hard rubber surface is covered with heat check cracks.
 - The rubber is separated from the outer metal sleeve of the mount.
 - The rubber is split through the center of the transmission mount.
 - The mount is leaking fluid.
4. When replacing the transmission mounts or brackets, refer to the following procedures:
 - **Transmission Mount Replacement - Front**
 - **Transmission Mount Replacement - Rear**
 - **Transmission Mount Bracket Replacement - Rear**
 - **Transmission Mount Replacement - Side**

TRANSMISSION MOUNT REPLACEMENT - FRONT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

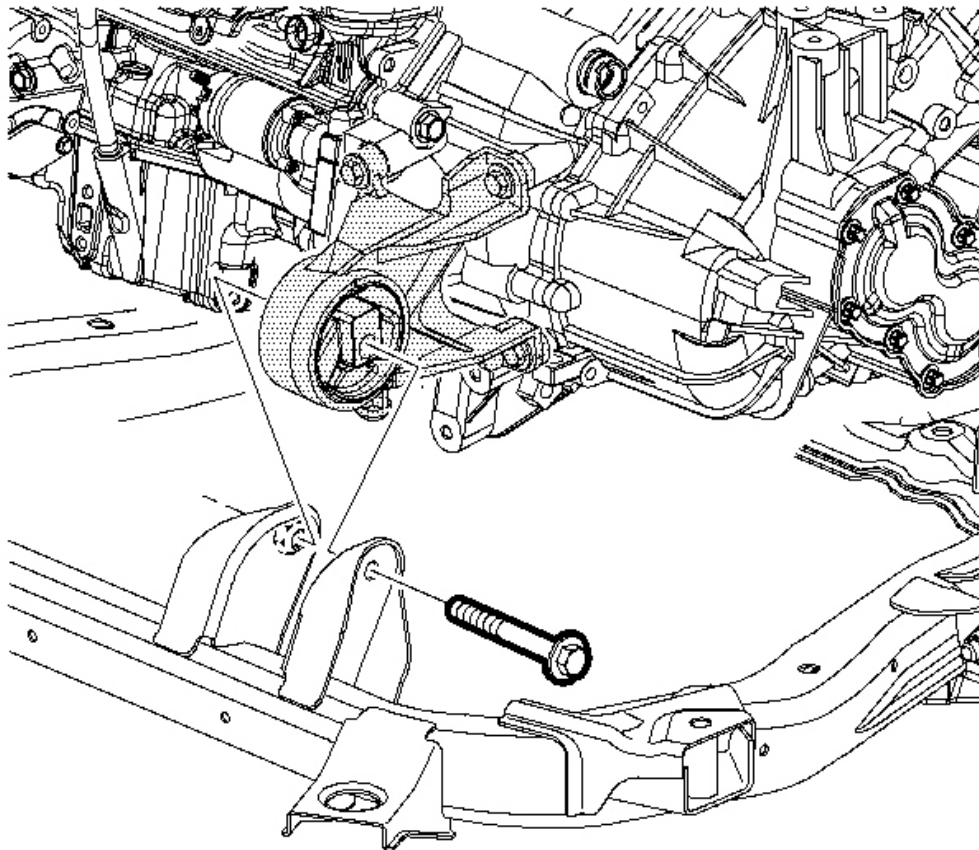


Fig. 10: Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the transmission mount through bolt.

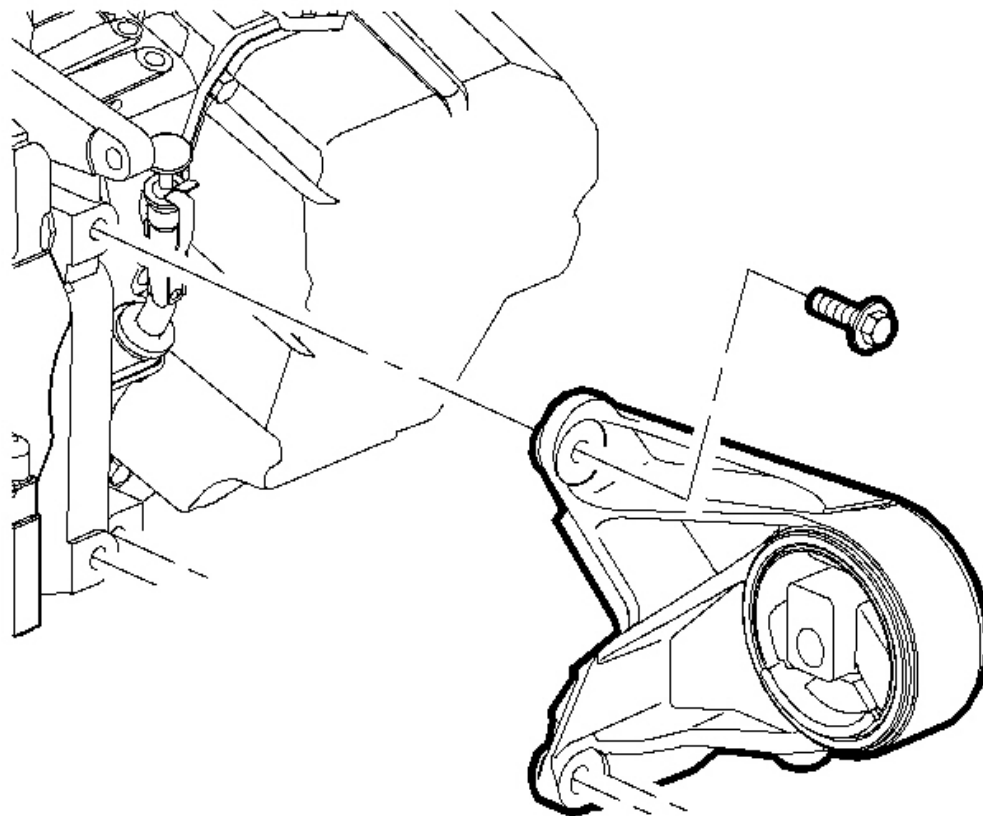


Fig. 11: Transmission Mount & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the transmission mount to transmission bolts.
4. Remove the transmission mount.

Installation Procedure

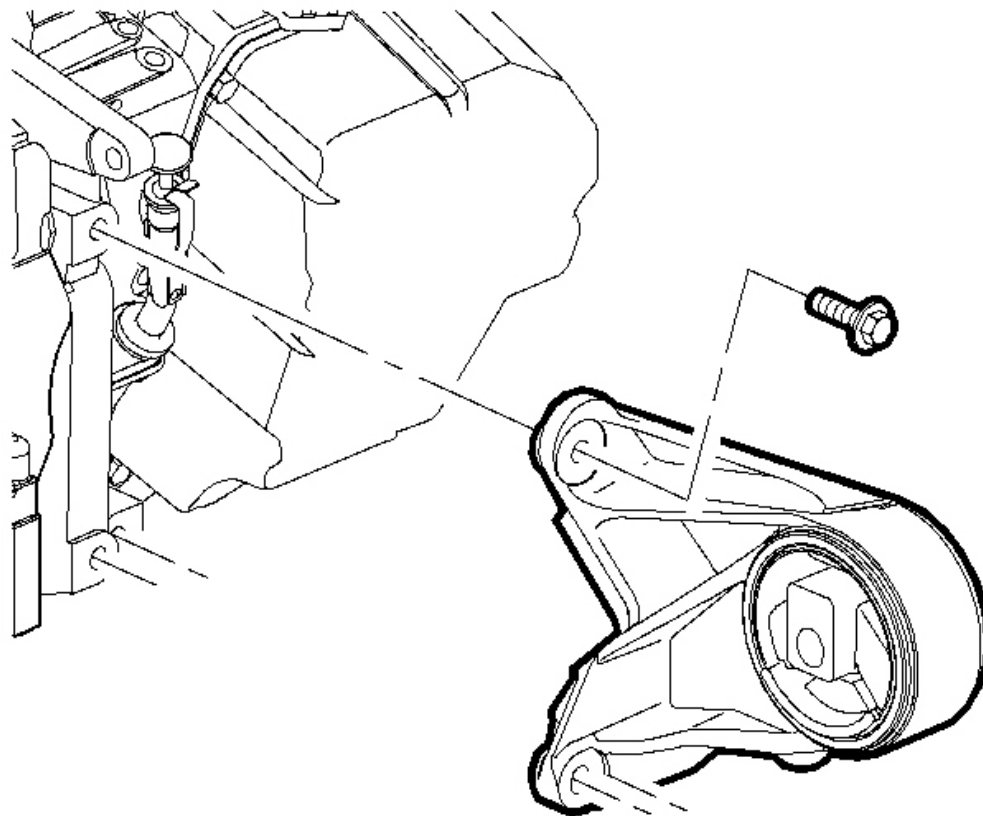


Fig. 12: Transmission Mount & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the mount to the transmission.

Tighten: Tighten the transmission mount to transmission bolts to 50 N.m (37 lb ft).

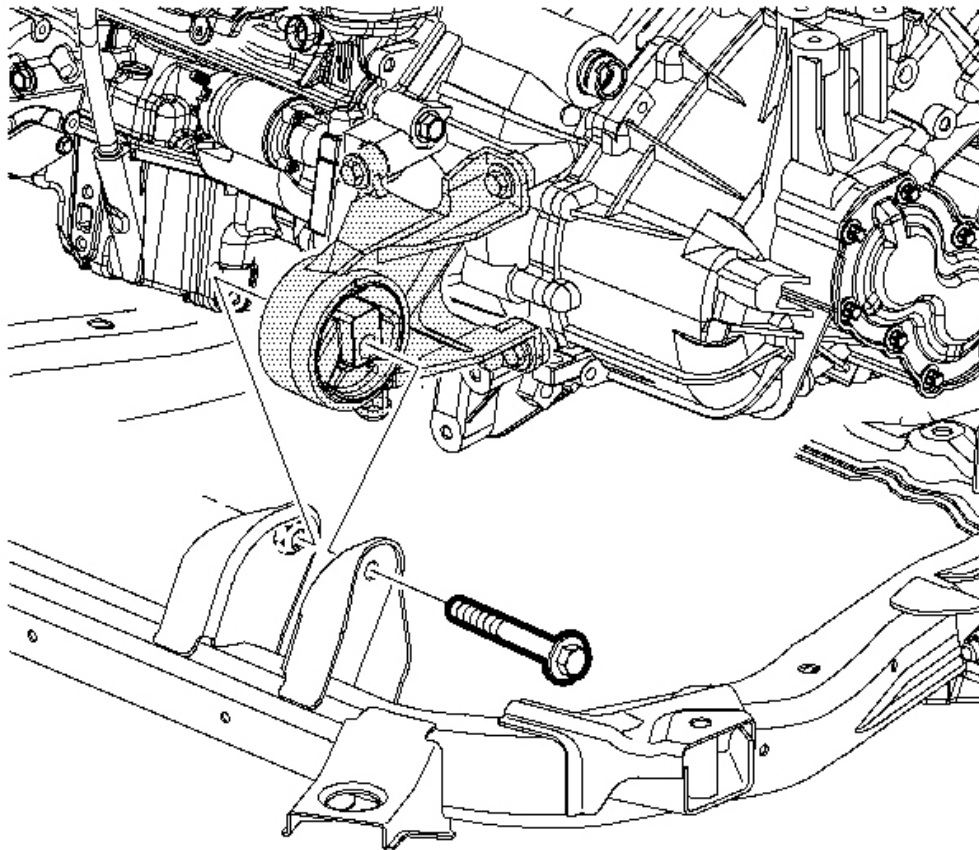


Fig. 13: Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

2. Install the transmission mount through bolt.

Tighten: Tighten the bolt to 110 N.m (81 lb ft).

3. Lower the vehicle.
4. Perform the powertrain mount balance procedure. Refer to **Powertrain Mount Balance Procedure - Lower Mount** in Engine Mechanical 2.2L (L61).

TRANSMISSION MOUNT REPLACEMENT - REAR

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

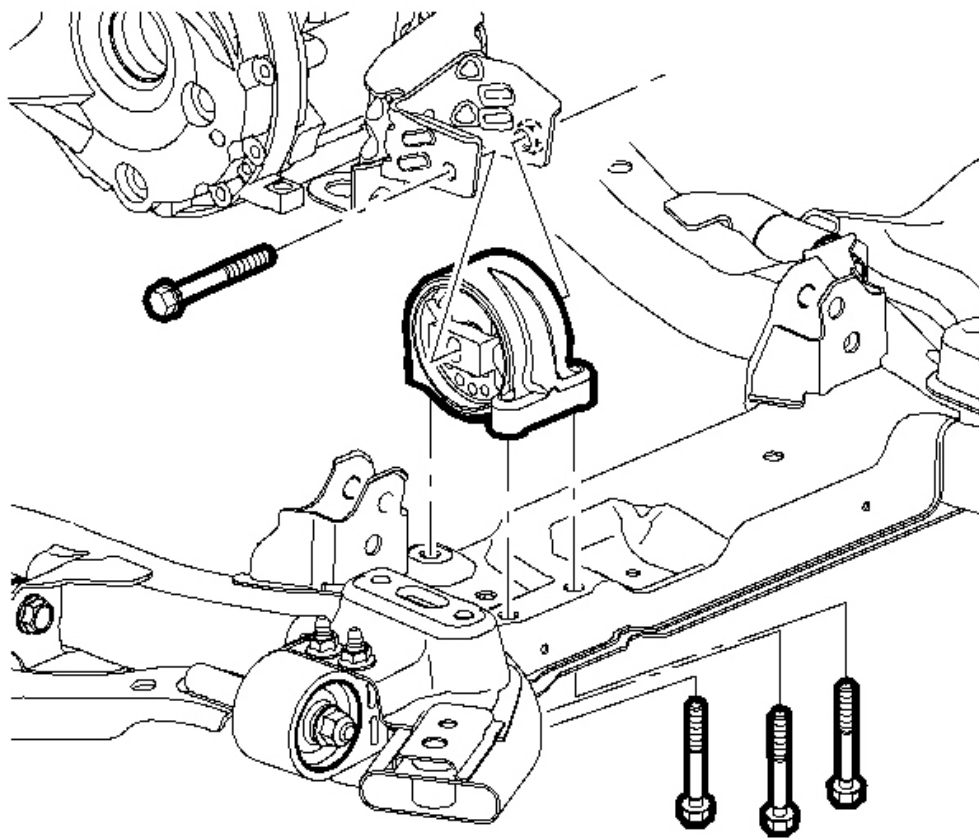


Fig. 14: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

2. Remove the transmission mount through bolt.
3. Remove the frame to transmission mount bolts.
4. Remove the transmission mount.

Installation Procedure

NOTE: Refer to Fastener Notice in Cautions and Notices.

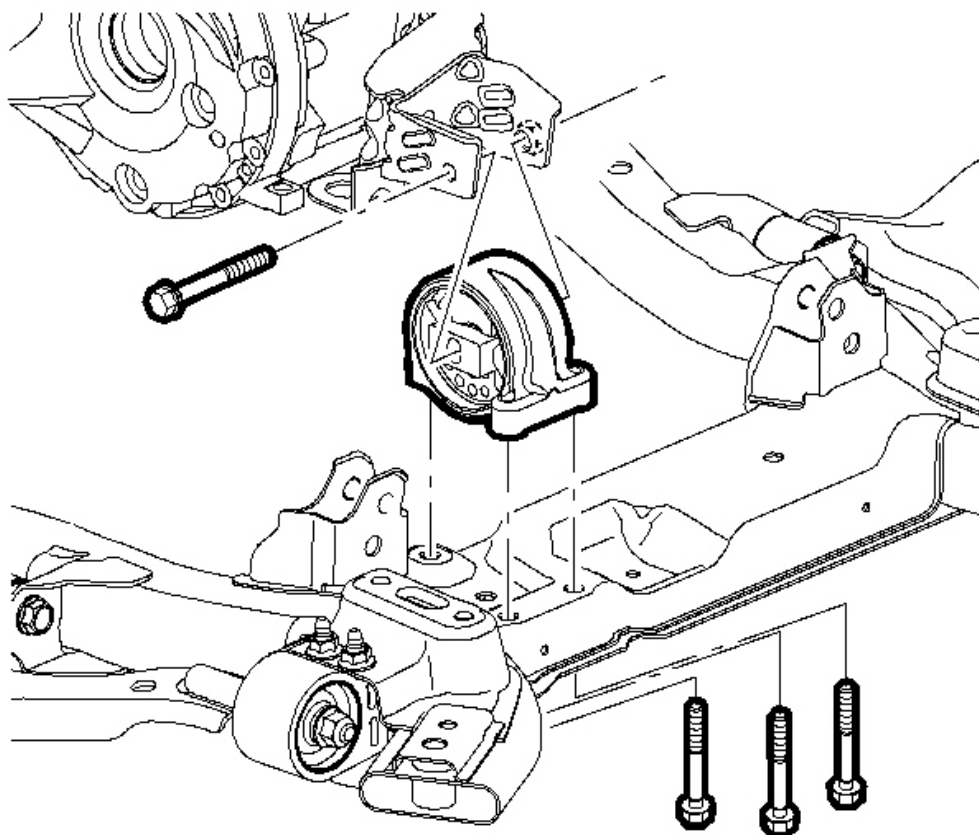


Fig. 15: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

1. Install the mount to the frame.

Tighten: Tighten the frame to transmission mount bolts to 50 N.m (37 lb ft).

2. Install the transmission mount through bolt.

Tighten: Tighten the bolt to 110 N.m (81 lb ft).

3. Lower the vehicle.
4. Perform the powertrain mount balance procedure. Refer to **Powertrain Mount Balance Procedure - Lower Mount** in Engine Mechanical 2.2L (L61).

TRANSMISSION MOUNT BRACKET REPLACEMENT - REAR

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

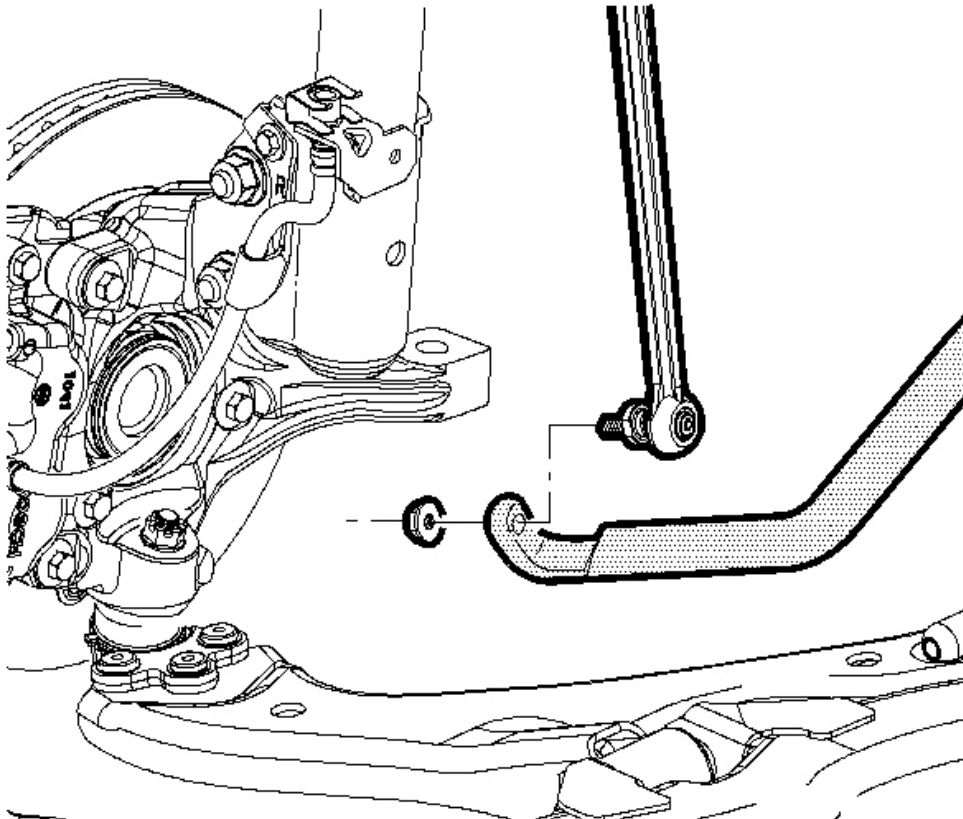


Fig. 16: Locating Rod & Bar
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the stabilizer link from the stabilizer shaft.

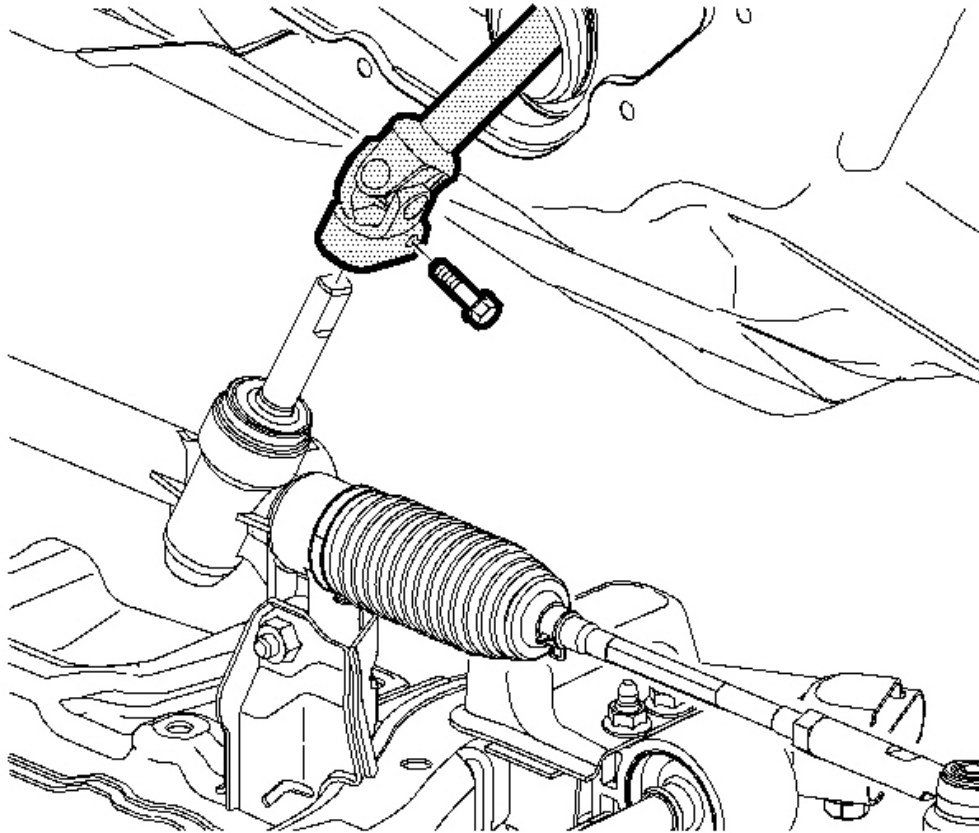


Fig. 17: Lower Intermediate Steering Shaft & Pinch Bolt
Courtesy of GENERAL MOTORS CORP.

3. Remove the lower intermediate steering shaft pinch bolt. Discard the bolt.
4. Disconnect the intermediate steering shaft from the steering gear.

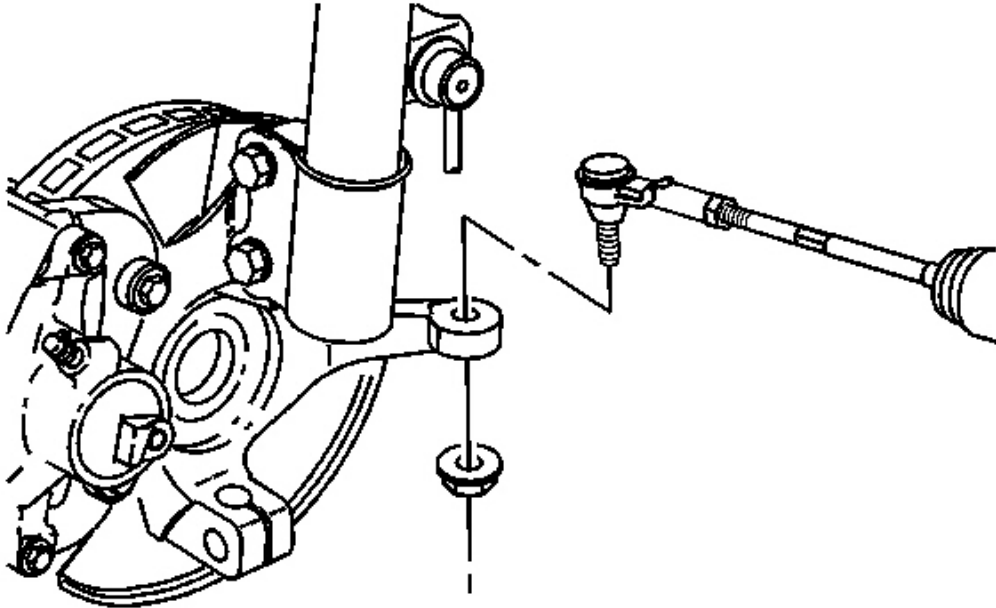


Fig. 18: Tie Rod To Knuckle View
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the left outer tie rod from the steering knuckle. Refer to **Rack and Pinion Outer Tie Rod End Replacement** in Power Steering System.

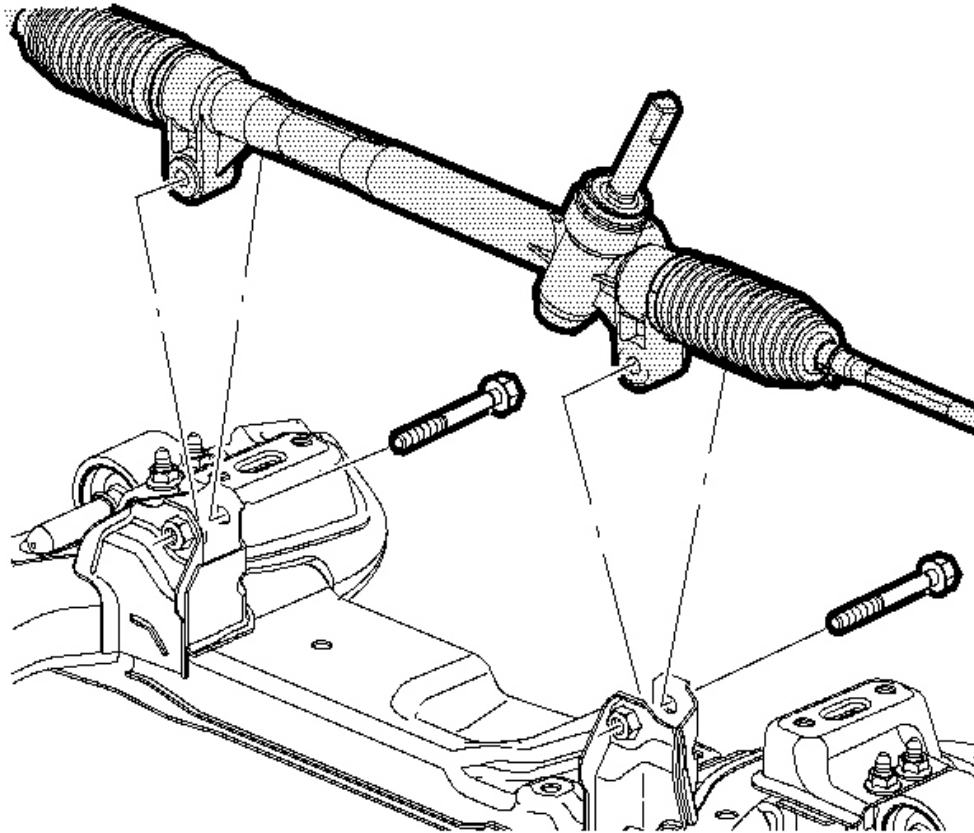


Fig. 19: Steering Gear & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the Steering Gear mounting bolts.
7. Secure the steering gear upward for clearance.

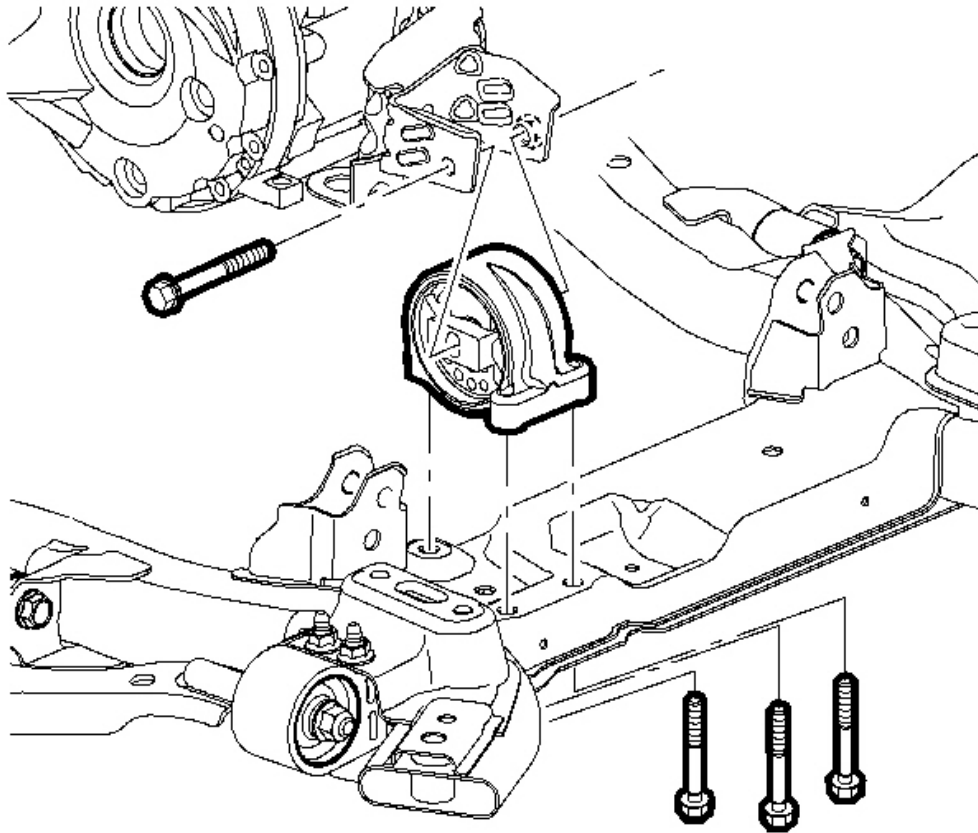


Fig. 20: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

8. Remove the rear transmission mount. Refer to **Transmission Mount Replacement - Rear** .

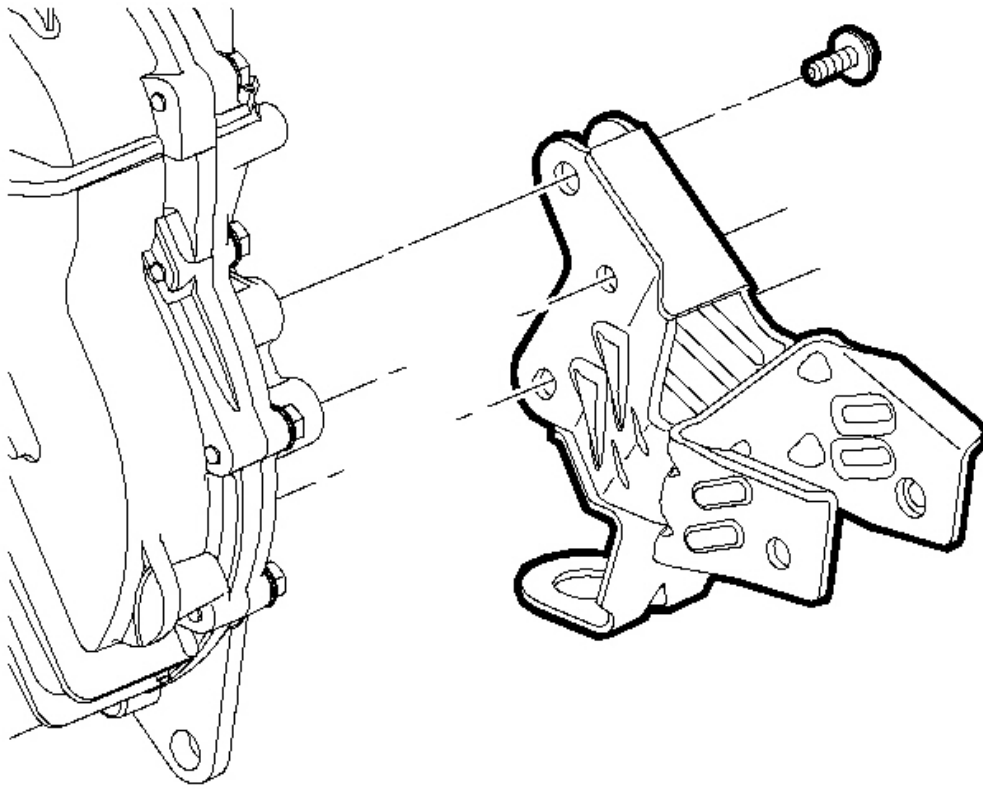


Fig. 21: Rear Transmission Mount Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

9. If equipped with FWD, remove the rear transmission mount bracket to transmission bolts.

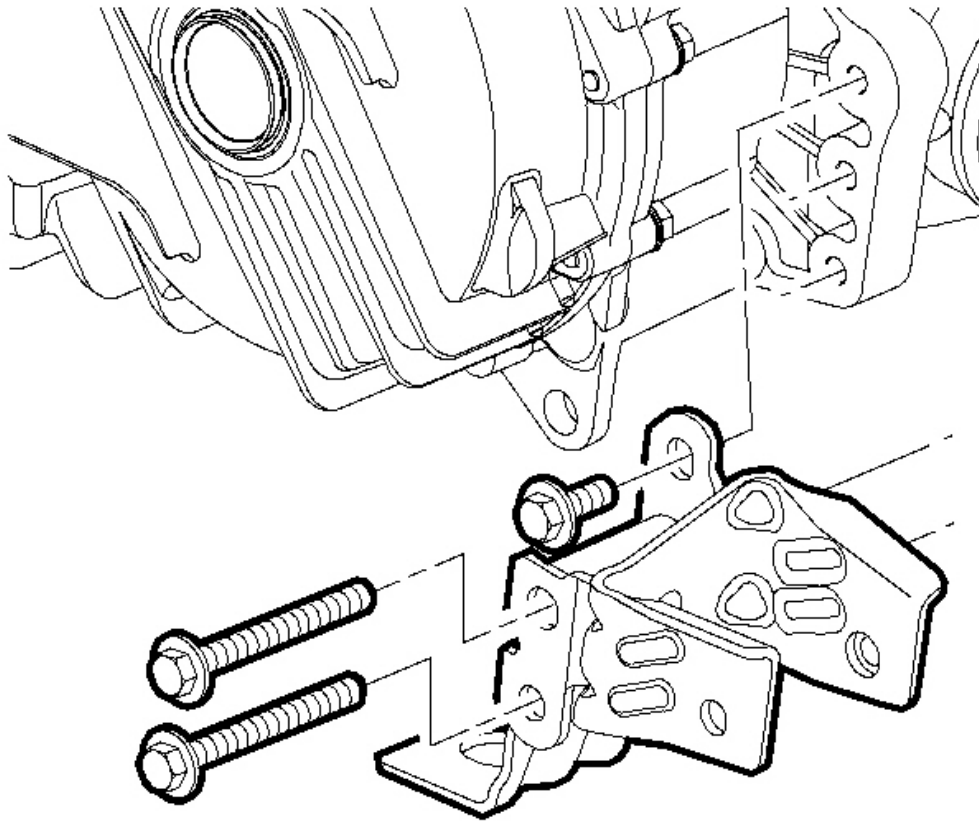


Fig. 22: Rear Transmission Bracket, Power Takeoff & Bolts
Courtesy of GENERAL MOTORS CORP.

10. If equipped with AWD, remove the rear transmission bracket to power takeoff. bolts.
11. Remove the rear transmission mount bracket.

Installation Procedure

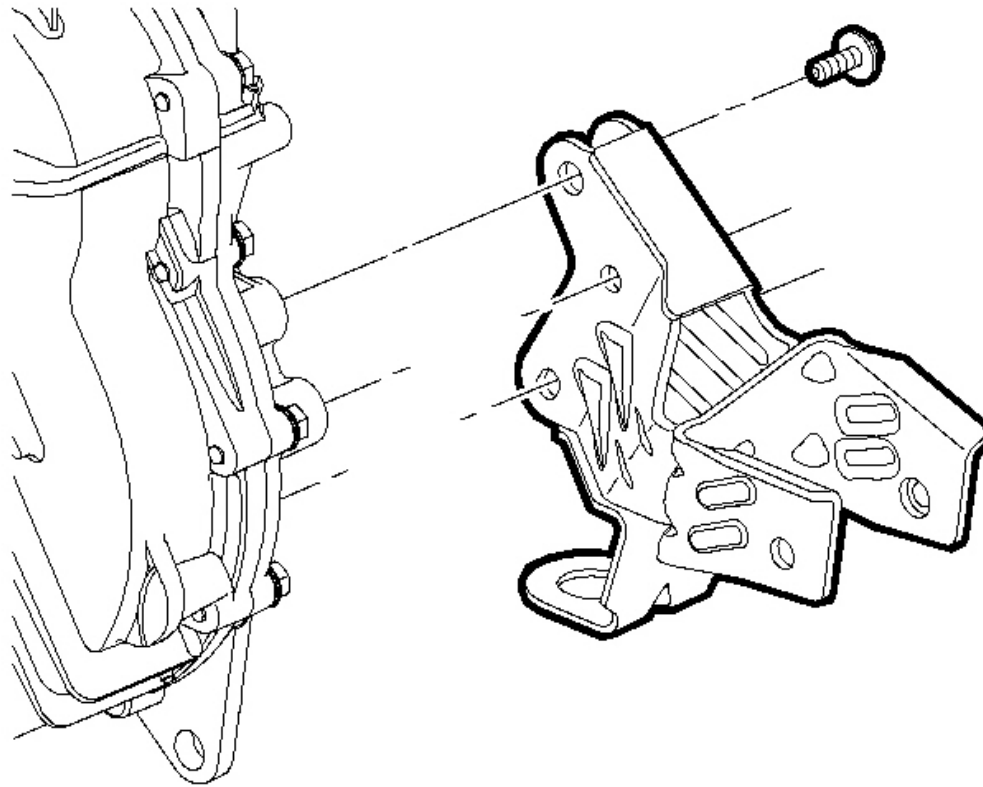


Fig. 23: Rear Transmission Mount Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. If equipped with FWD, install the transmission mount bracket to the transmission.

Tighten: Tighten the bracket to transmission bolts to 55 N.m (41 lb ft).

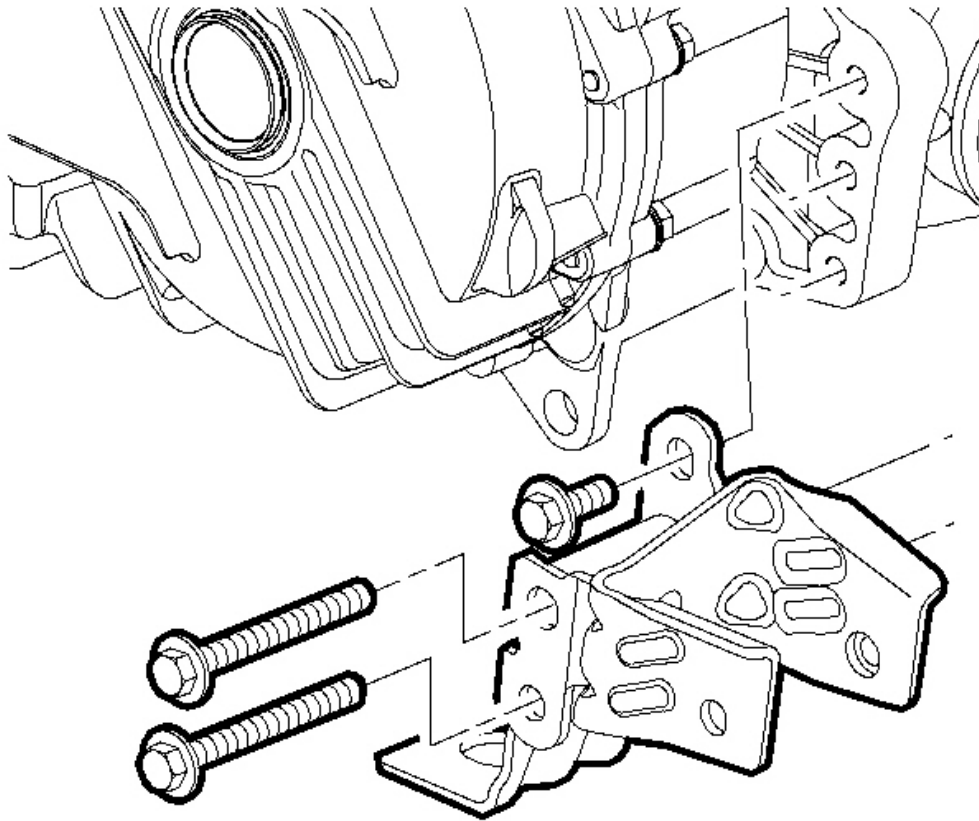


Fig. 24: Rear Transmission Bracket, Power Takeoff & Bolts
Courtesy of GENERAL MOTORS CORP.

2. If equipped with AWD, install the transmission mount bracket to the power takeoff.

Tighten: Tighten the bracket to power takeoff bolts to 110 N.m (81 lb ft).

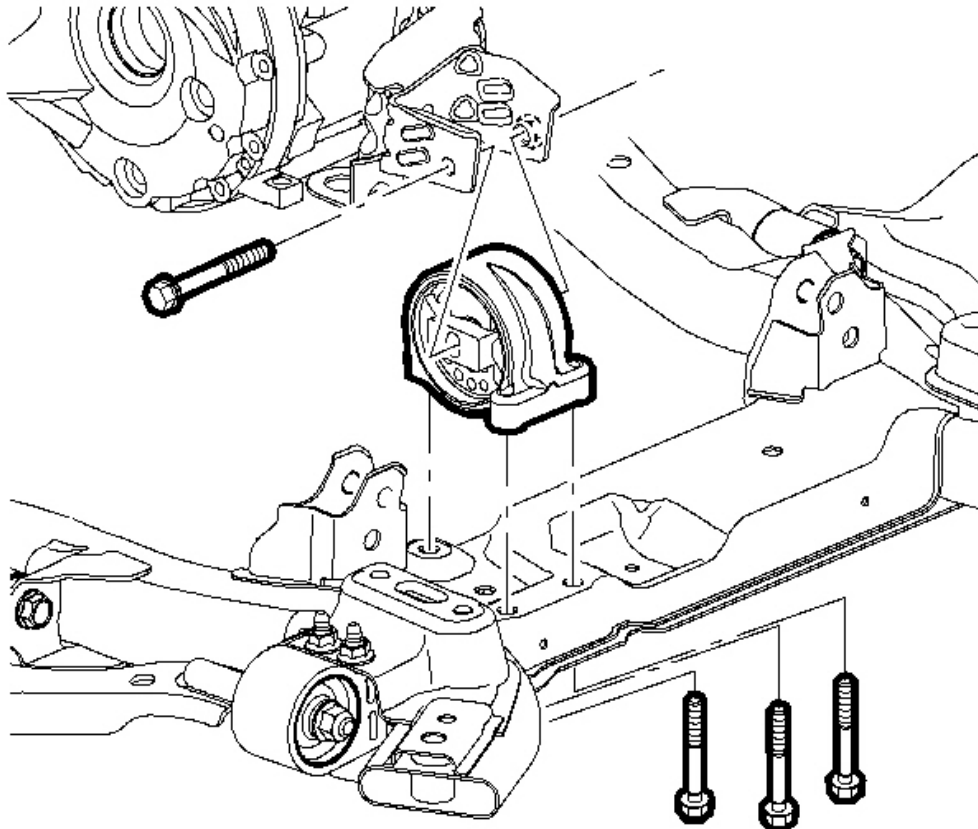


Fig. 25: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

3. Install the rear transmission mount. Refer to **Transmission Mount Replacement - Rear** .

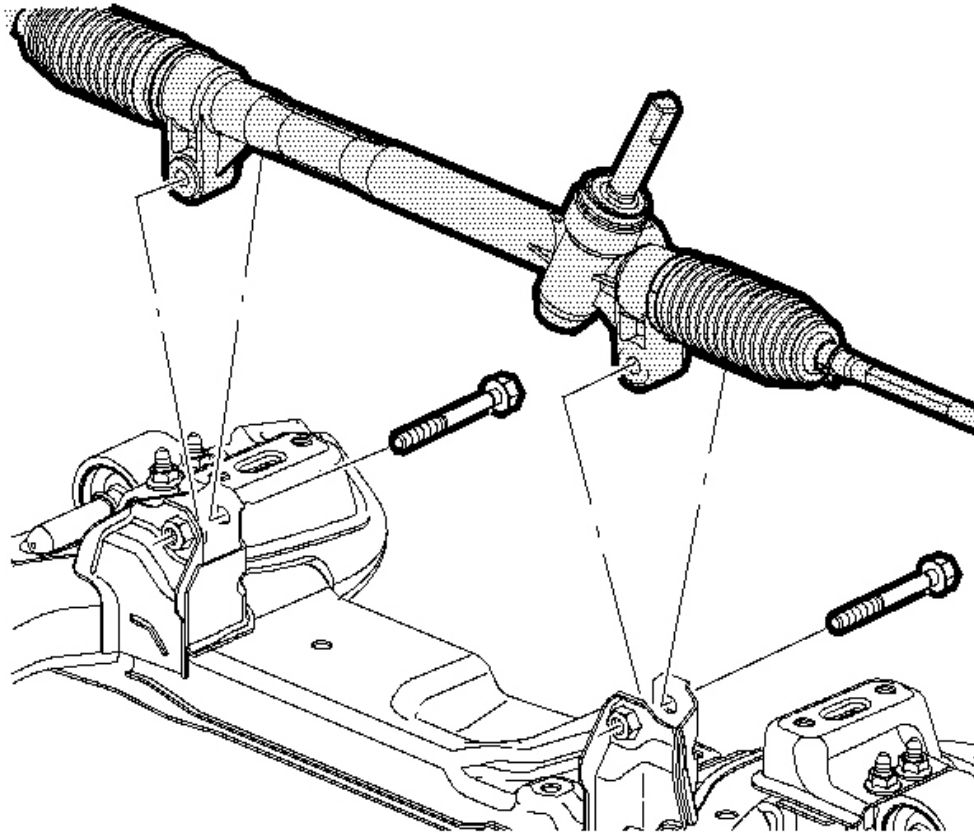


Fig. 26: Steering Gear & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

4. Lower the steering gear in to the steering gear mounts.
5. Hand start both steering gear to frame bolts.
6. Tighten the steering gear to frame bolts.

Tighten: Tighten the bolts to 110 N.m (81 lb ft).

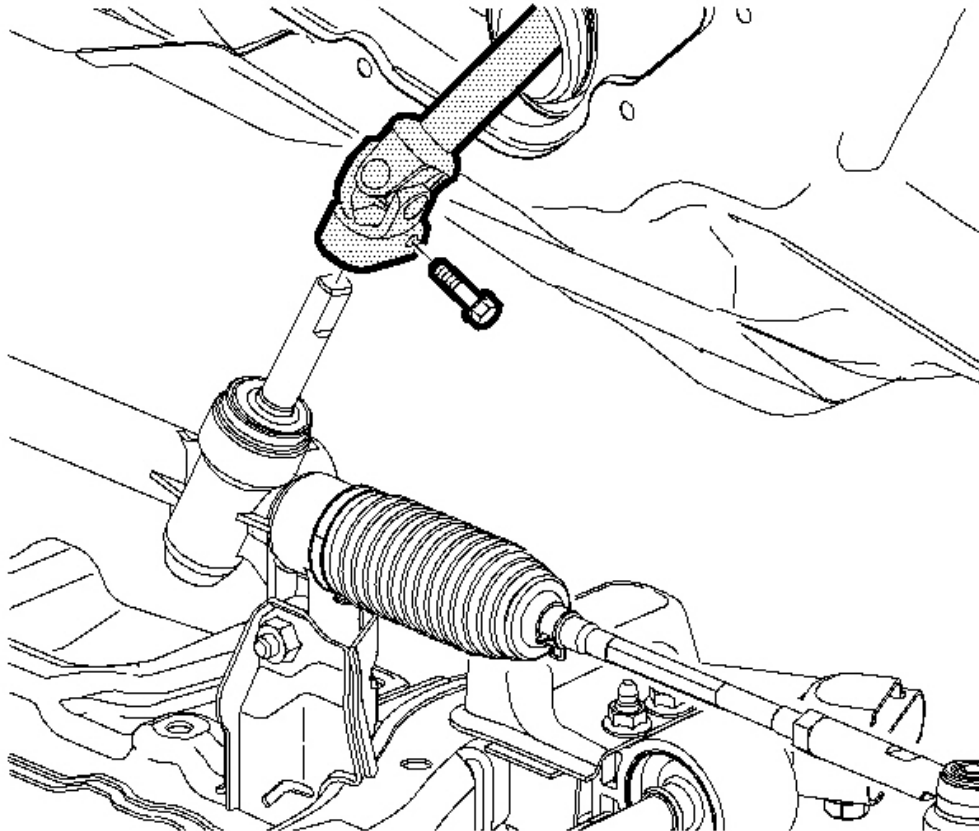


Fig. 27: Lower Intermediate Steering Shaft & Pinch Bolt
Courtesy of GENERAL MOTORS CORP.

7. Install the intermediate steering shaft to the steering gear.
8. Install a new intermediate steering shaft pinch bolt.

Tighten: Tighten the bolt to 34 N.m (25 lb ft).

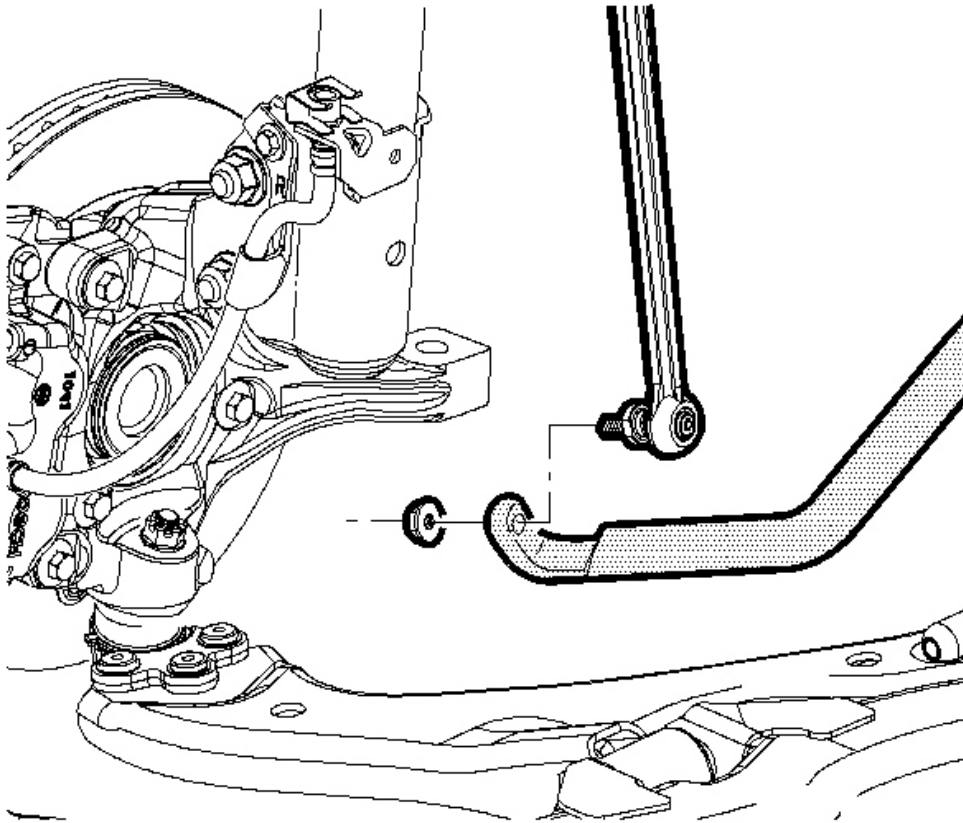


Fig. 28: Locating Rod & Bar
Courtesy of GENERAL MOTORS CORP.

9. Connect the stabilizer link to the Stabilizer shaft.

Tighten: Tighten the nut to 65 N.m (48 lb ft).

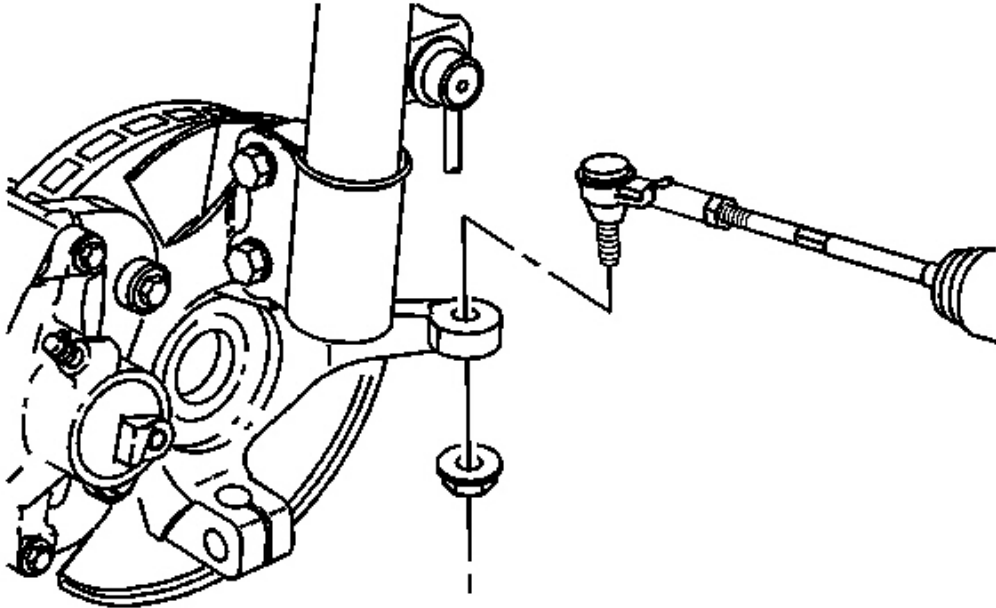


Fig. 29: Tie Rod To Knuckle View
Courtesy of GENERAL MOTORS CORP.

10. Install the left outer tie rod to the steering knuckle. Refer to **Rack and Pinion Outer Tie Rod End Replacement** in Power Steering System.
11. Lower the vehicle.

TRANSMISSION MOUNT REPLACEMENT - SIDE

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

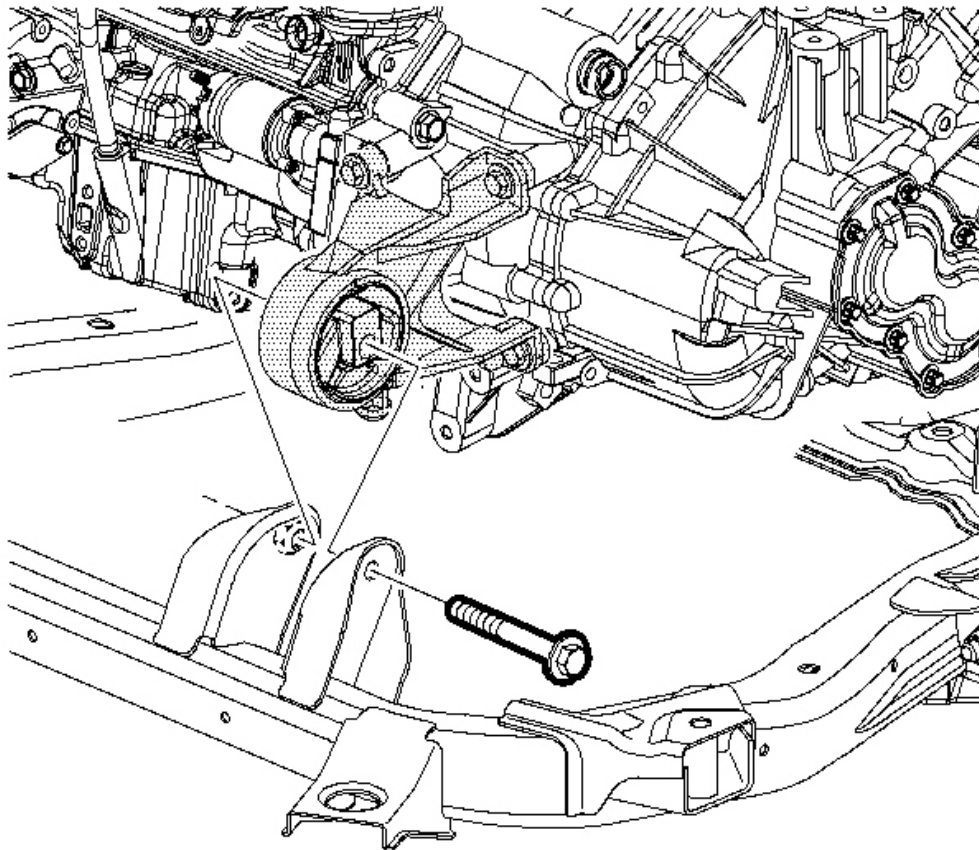


Fig. 30: Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the front transmission mount through bolt.

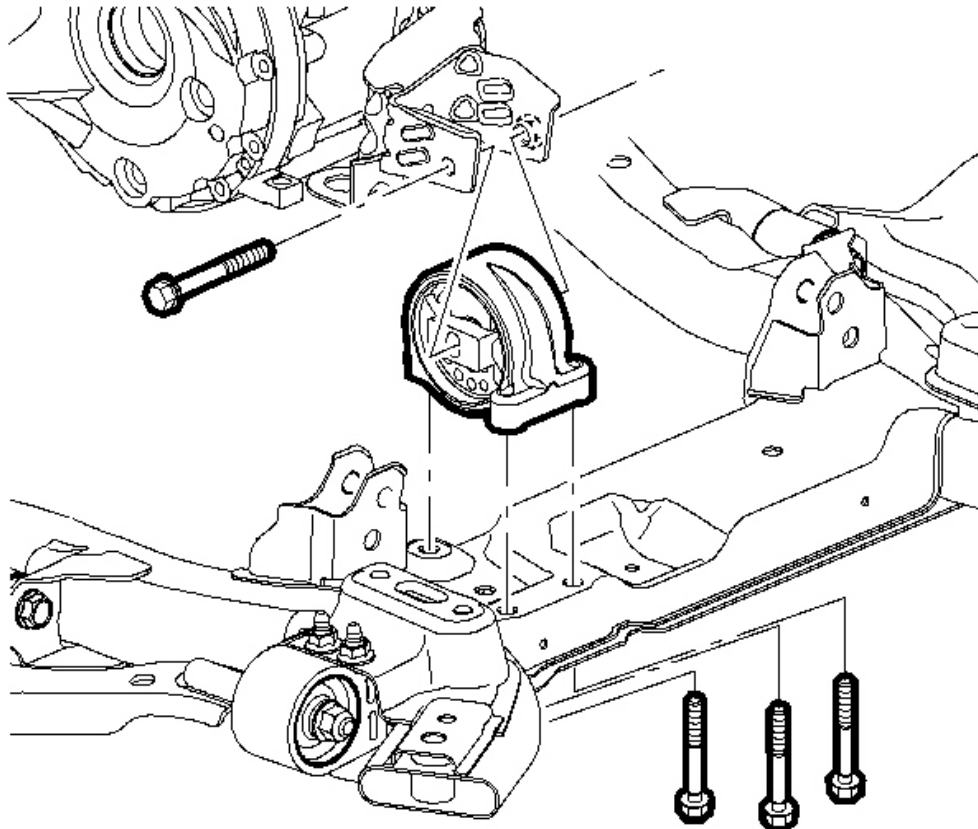


Fig. 31: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

3. Remove the rear transmission mount through bolt.
4. Lower the vehicle.
5. Remove the battery tray. Refer to **Exhaust Manifold Pipe Replacement (L66)** or **Exhaust Manifold Pipe Replacement (L61)** in Engine Electrical.
6. Support the powertrain assembly using a floor jack with a 2x6 inch block of wood.

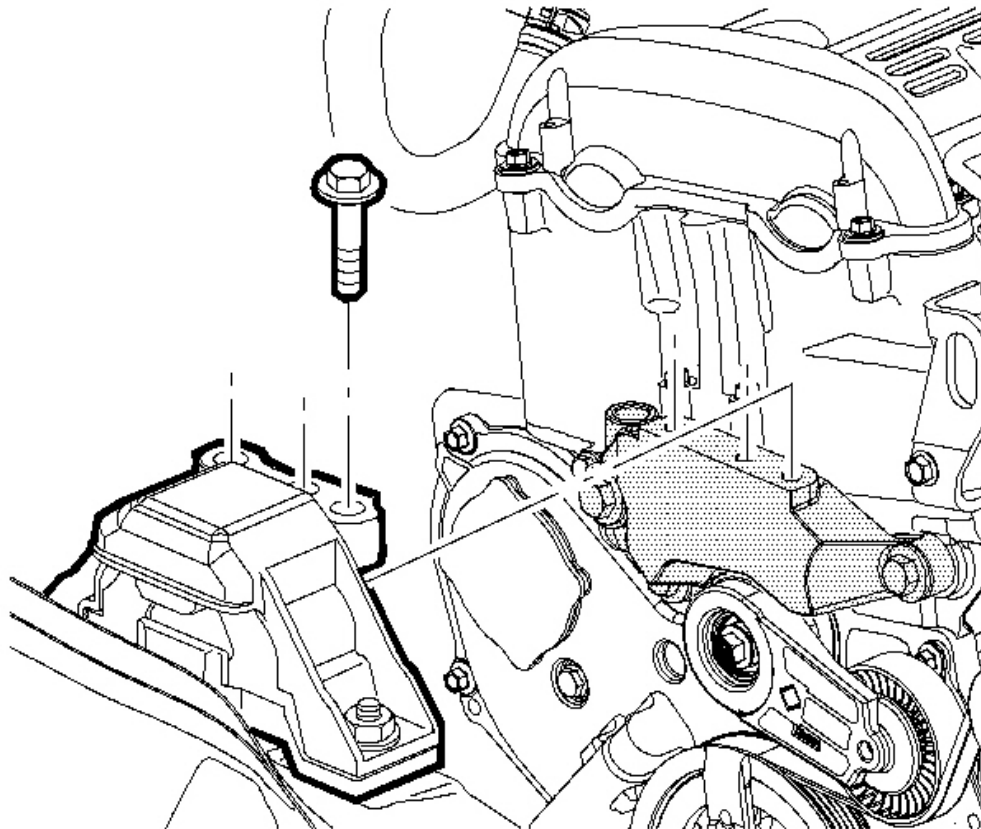


Fig. 32: Right Engine Mount, Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the right engine mount to mount bracket bolts.

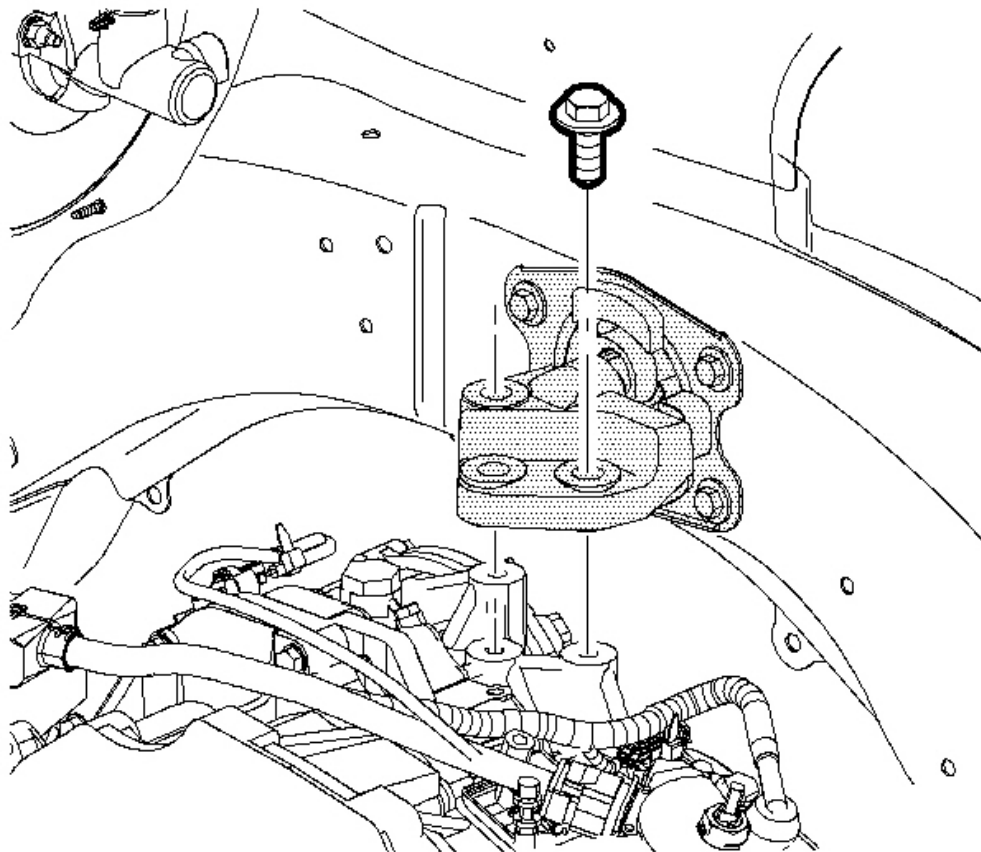


Fig. 33: Left Transmission Mount & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the left transmission mount to transmission bolts.
9. Lower the engine in order to gain clearance to for mount removal.

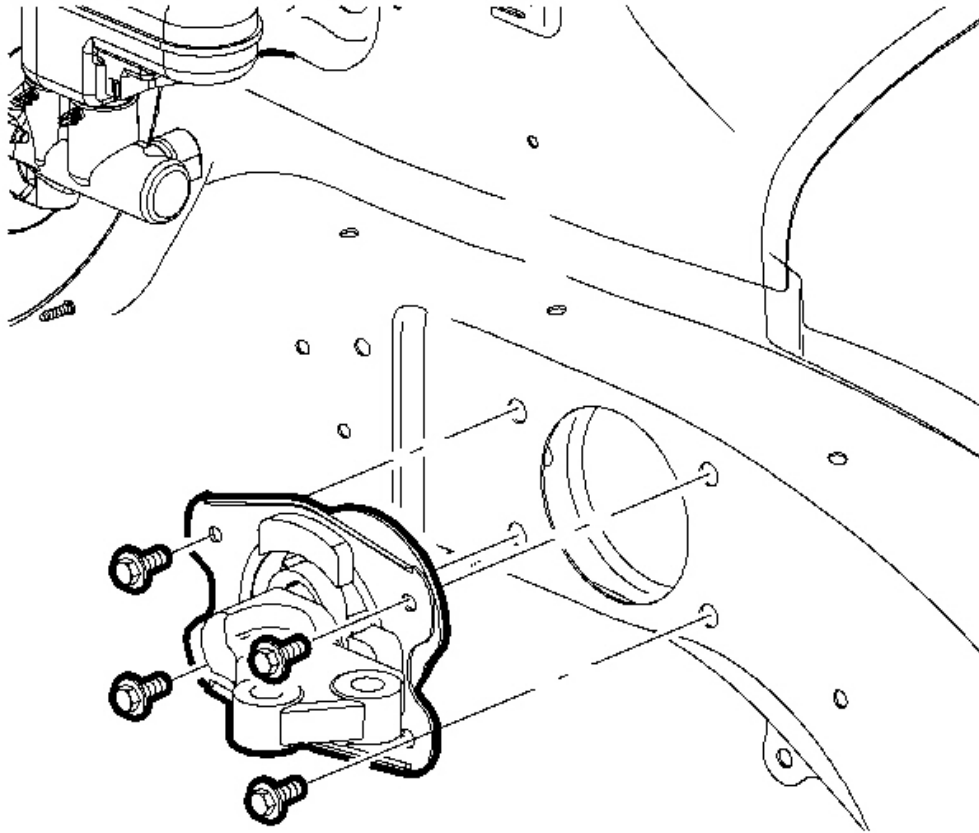


Fig. 34: Left Transmission Mount & Side Rail Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the left transmission mount to side rail bolts.
11. Remove the transmission mount from the side rail.

Installation Procedure

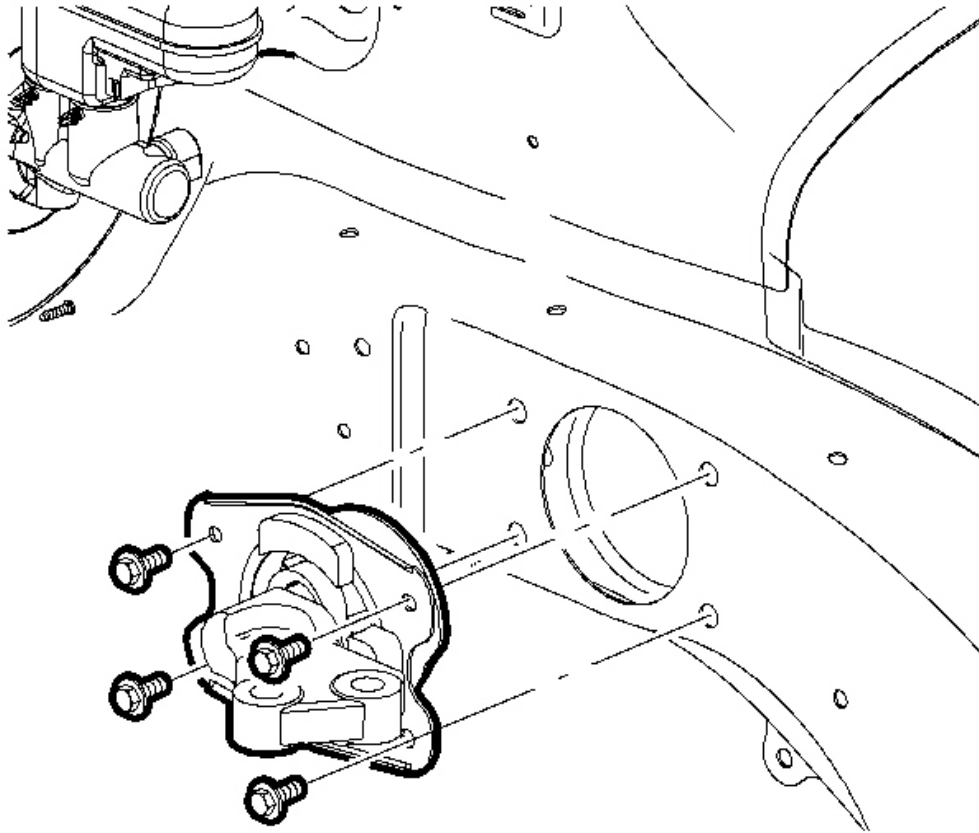


Fig. 35: Left Transmission Mount & Side Rail Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT: Hand start all bolts before tightening.

1. Install the transmission mount in the side rail.

Tighten: Tighten the transmission mount to side rail bolts to 37 N.m (27 lb ft).

2. Use the floor jack to raise the powertrain into position.

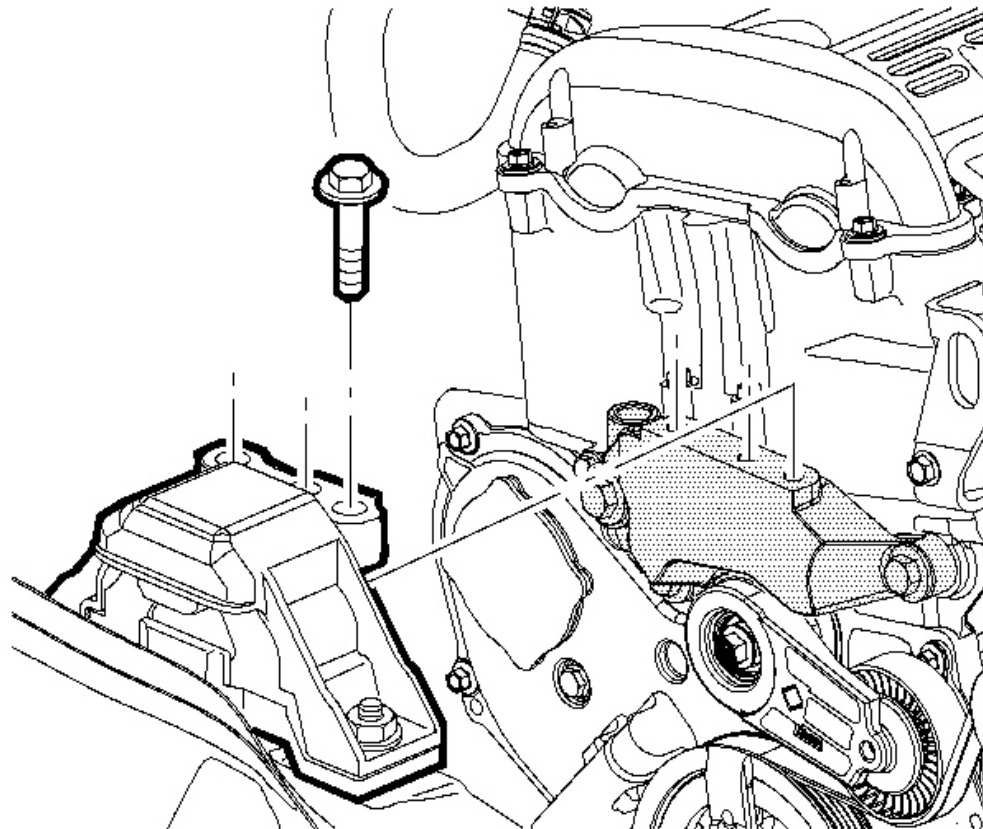


Fig. 36: Right Engine Mount, Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Align both side mounts with the surfaces flush with the mount brackets.
4. Align all the bolt holes in both side mounts and hand tighten both upper mount bolts, three per side.

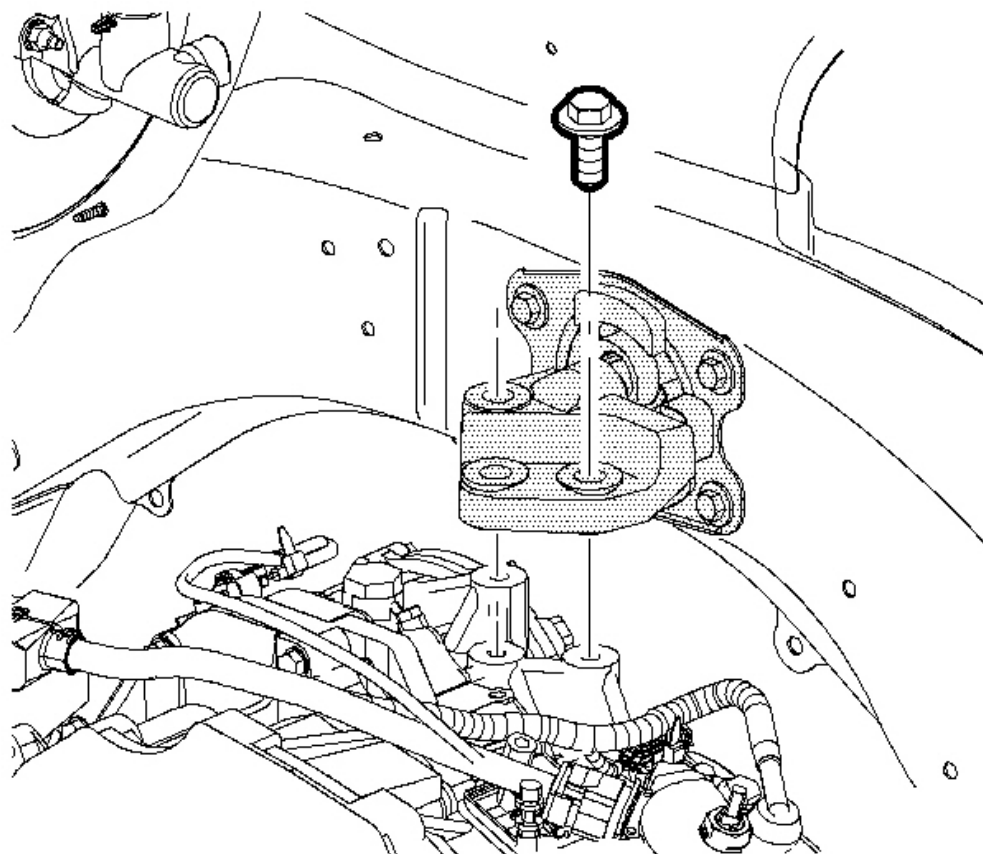


Fig. 37: Left Transmission Mount & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Tighten the mount bolts starting with the center ones.

Tighten: Tighten both upper mount bolts to 50 N.m (37 lb ft).

6. Raise the vehicle.

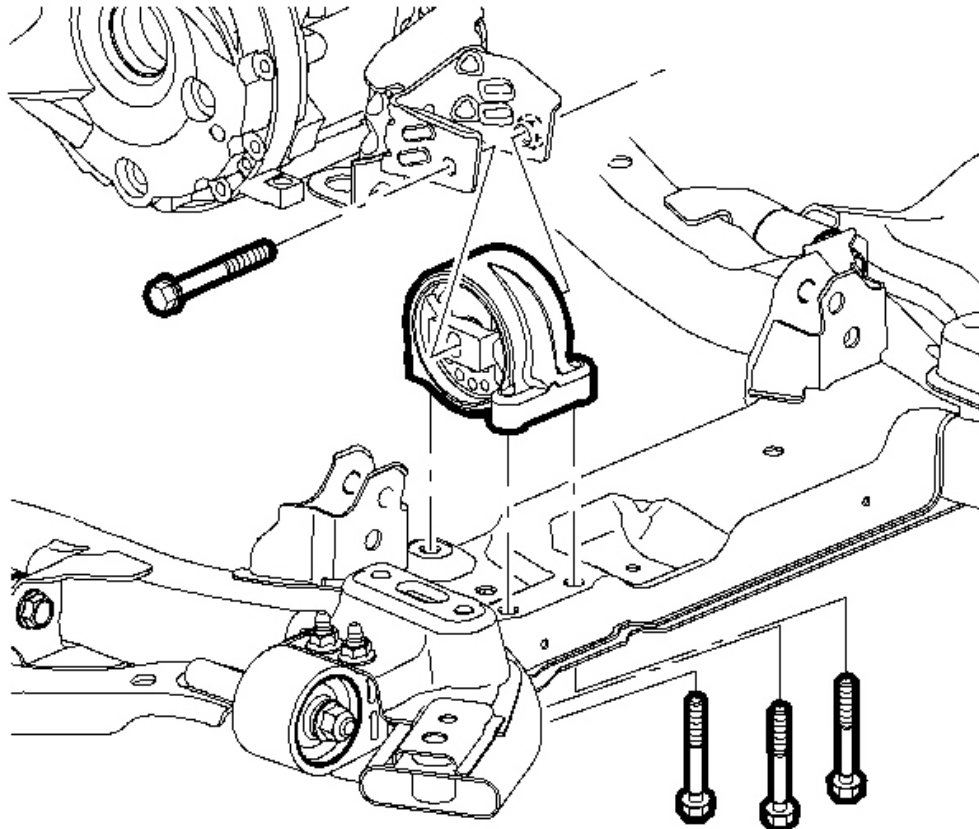


Fig. 38: Locating Engine Mount
Courtesy of GENERAL MOTORS CORP.

7. Install the rear mount through bolt. Hand tighten only.

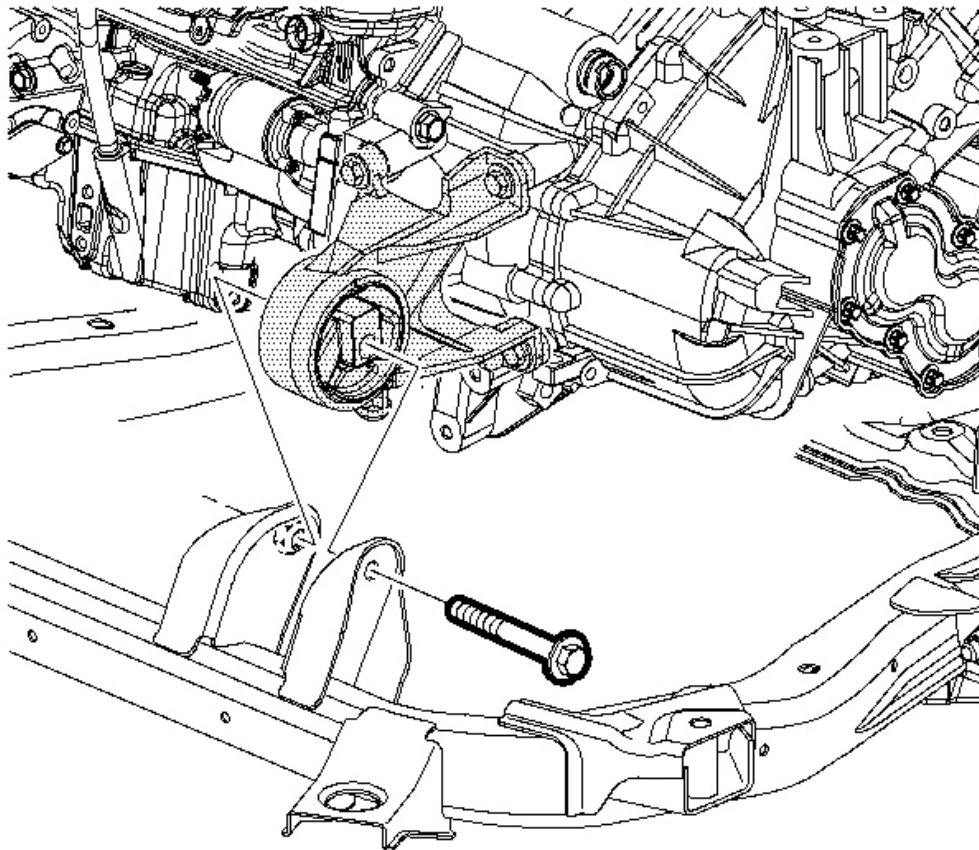


Fig. 39: Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

8. Install the front mount through bolt. Hand tighten only.
9. Perform the powertrain mount balance procedure. Refer to **Powertrain Mount Balance Procedure - Total Mount** in Engine Mechanical - 2.2L (L61).
10. Remove the floor jack and block of wood.
11. Install the battery tray. Refer to **Exhaust Manifold Pipe Replacement (L66)** or **Exhaust Manifold Pipe Replacement (L61)** in Engine Electrical.

TRANSMISSION FLUID CHECKING PROCEDURE

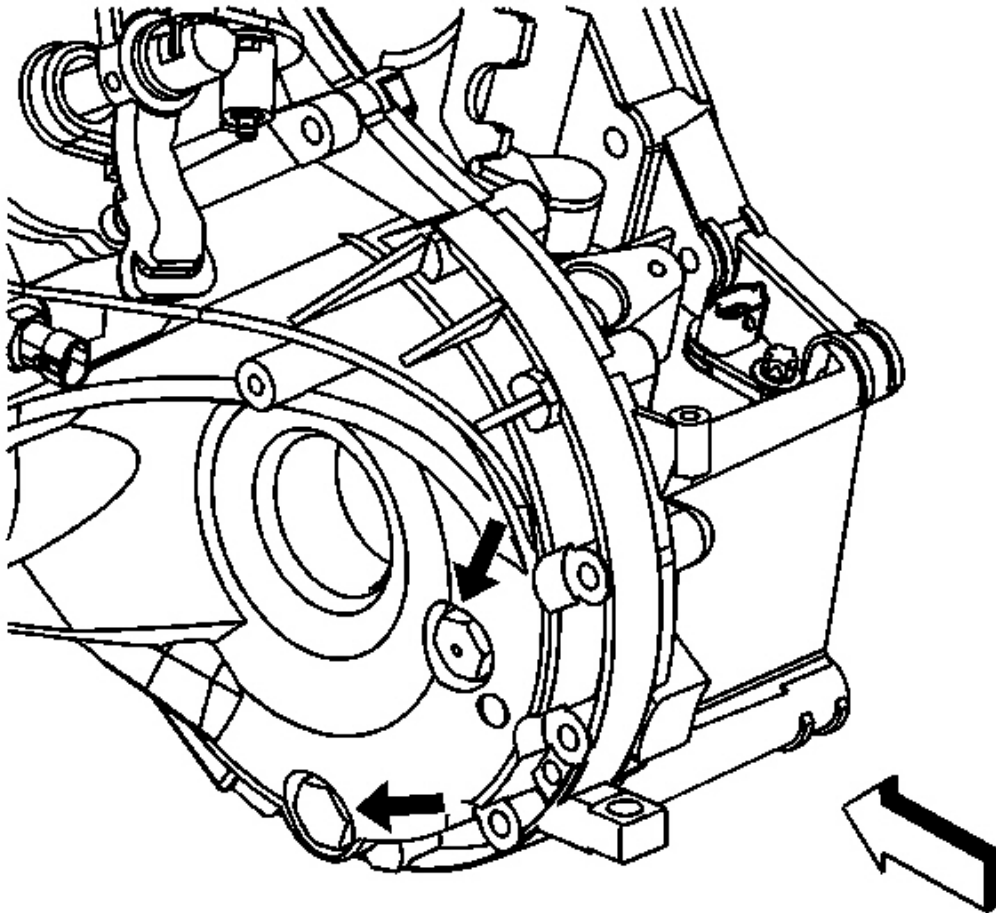


Fig. 40: Transaxle Mount
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- It is not necessary to check the fluid level unless the fluid has been changed or a leak is suspected.
- Inspect the fluid level only when the engine is off. Ensure the vehicle is level. The transaxle must be cold.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the fluid level check plug.
3. Verify that the fluid is level with the opening.
4. If the transaxle is not properly filled, carefully add DEXRON(R)III fluid until it begins to flow out of the

fill/check plug.

NOTE: Refer to Fastener Notice in Cautions and Notices.

5. Install the fluid level check plug.

Tighten: Tighten the fluid level check plug to 38 N.m (28 lb ft).

6. Lower the vehicle.

TRANSMISSION FLUID REPLACEMENT

IMPORTANT: To ensure that all sediment within the transaxle is suspended in the fluid, the fluid should only be drained after it has reached a normal operating temperature of 88-93°C (190-200°F). Normal operating temperature is reached after approximately 25 km (15 miles) of highway driving.

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.

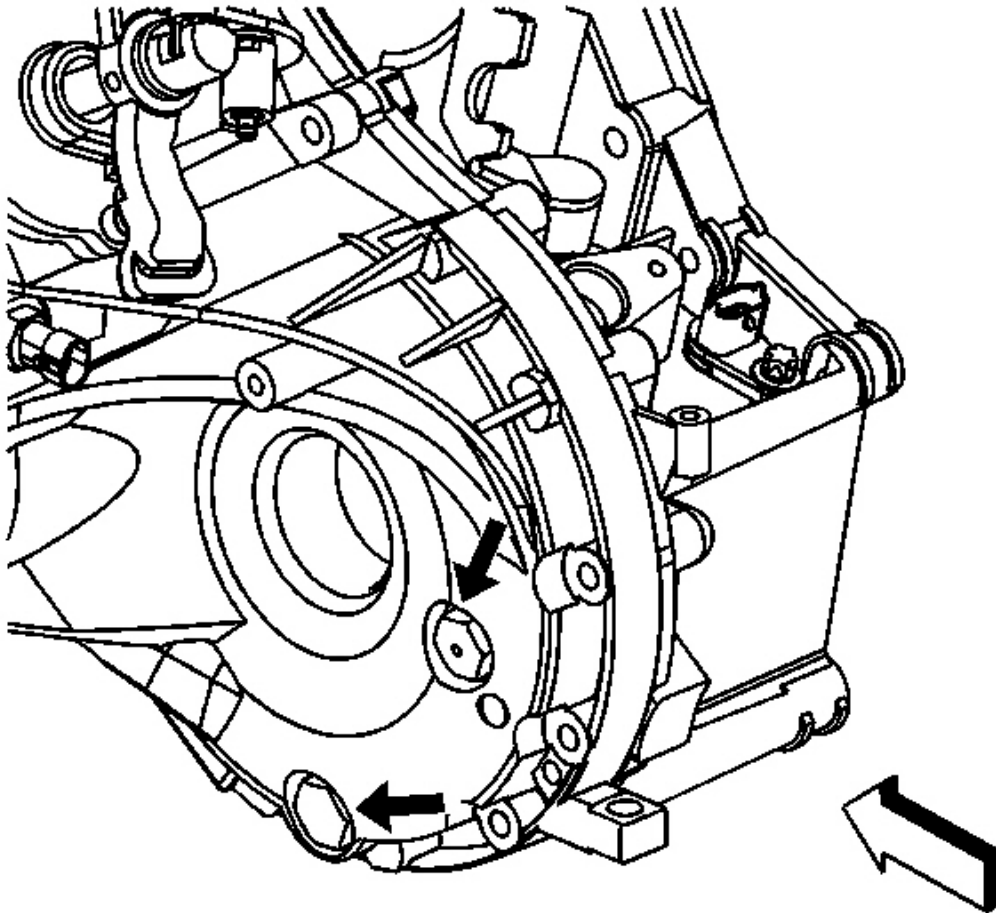


Fig. 41: Transaxle Mount
Courtesy of GENERAL MOTORS CORP.

CAUTION: The transaxle fluid is hot. Caution must be taken to prevent personal injury when the transaxle fluid drains from the transaxle.

2. Remove the transaxle drain plug and allow the transaxle to drain completely.
3. Remove the fluid level check plug.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Clean and install the transaxle drain plug.

Tighten: Tighten the transaxle drain plug to 38 N.m (28 lb ft).

5. Add DEXRON(R)III transaxle fluid P/N 21019223 until it seeps out of the fluid level check plug.
6. Clean and install the fluid level check plug.

Tighten: Tighten the fluid level check plug to 38 N.m (28 lb ft).

7. Lower the vehicle and verify proper operation.

FRONT WHEEL DRIVE SHAFT OIL SEAL REPLACEMENT

Tools Required

- **J 44385** Differential Bearing Race and Seal Installer. See **Special Tools and Equipment** .
- **J 7079-2** Non-threaded Driver Handle. See **Special Tools and Equipment** .
- **SA9133T** Axle Seal Puller

Removal Procedure

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the front wheel and tire assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the wheel driveshaft. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.

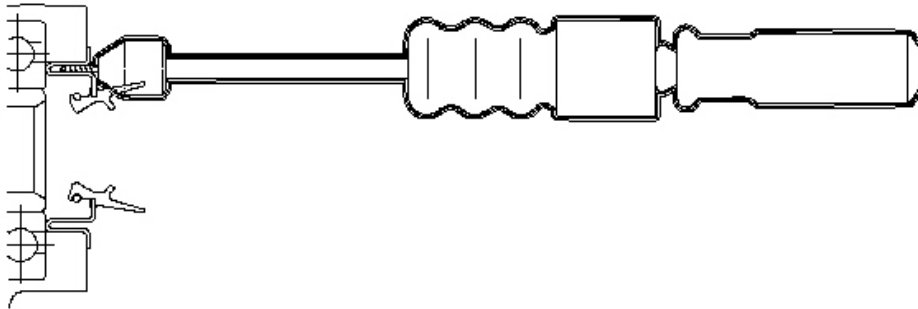


Fig. 42: Inspecting The Seal Bore For Damage
Courtesy of GENERAL MOTORS CORP.

4. Use the SA9133T in order to remove the seal.
5. Inspect the seal bore for nicks or for burrs. Clean the bore with a fine grade sandpaper, if necessary.

Installation Procedure

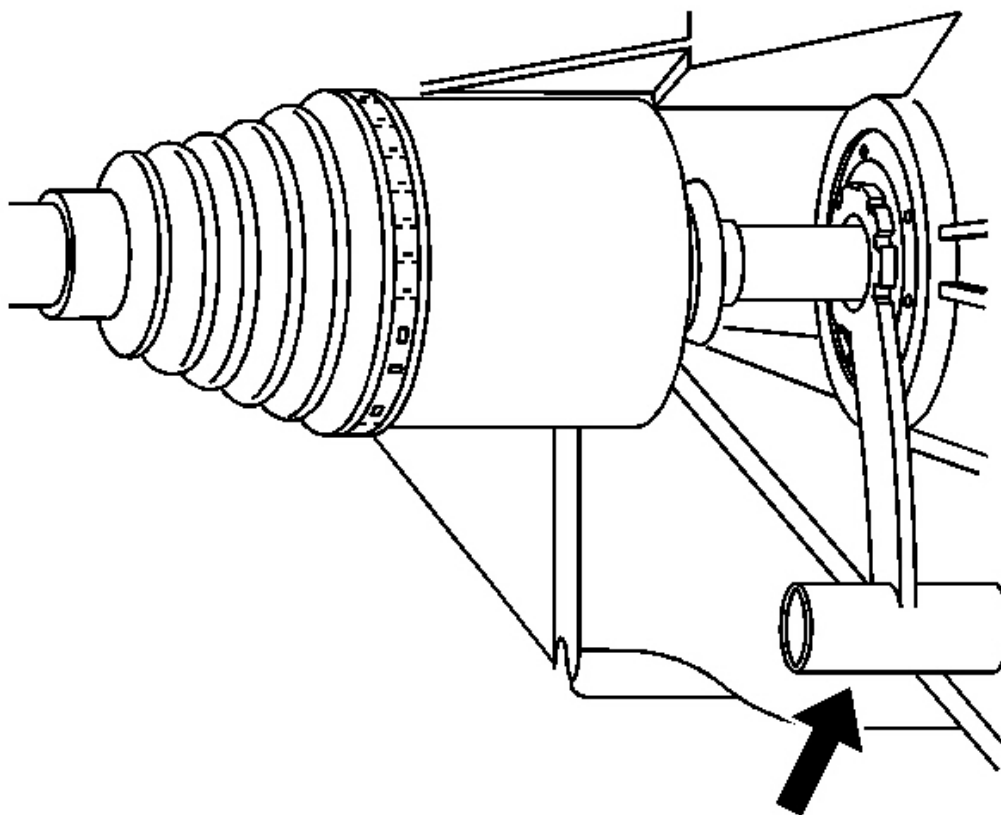


Fig. 43: Drive Axles & Transaxle
Courtesy of GENERAL MOTORS CORP.

1. Use the **J 44385** and the **J 7079-2** in order to install a new seal. See **Special Tools and Equipment** . Ensure that the seal is seated flush to the outer bore area.
2. Lubricate the seal with Dexron(R)-III transmission fluid Saturn P/N 21019223.
3. Install the wheel driveshaft. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.
4. Install the front tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
5. Lower the vehicle.

AXLE SHAFT OIL SEAL REPLACEMENT (LEFT)

Tools Required

- **J 7079-2** Universal Driver Handle - Non-Threaded. See **Special Tools and Equipment** .

- **J 44385** Differential Bearing Race and Seal Installer. See **Special Tools and Equipment** .
- **SA9133T** Axle Seal Puller

Removal Procedure

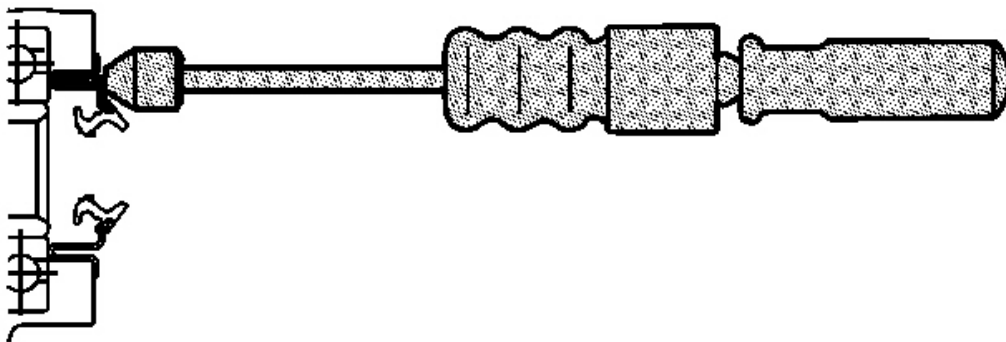


Fig. 44: Axle Seal & SA9133T
 Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the wheel and tire. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the wheel drive shaft. Refer to **Wheel Drive Shaft Replacement - Front** in Wheel Drive Shafts.
4. Using the **SA9133T** , remove the axle seal by threading the **SA9133T** through the steel seal body as close to the outside diameter as possible.

Installation Procedure

1. Clean the seal bore in the housing.
2. Apply a light bead of Permatex 51531(R) P/N 21005993 or equivalent on the diameter of the seal that presses into the case bore.

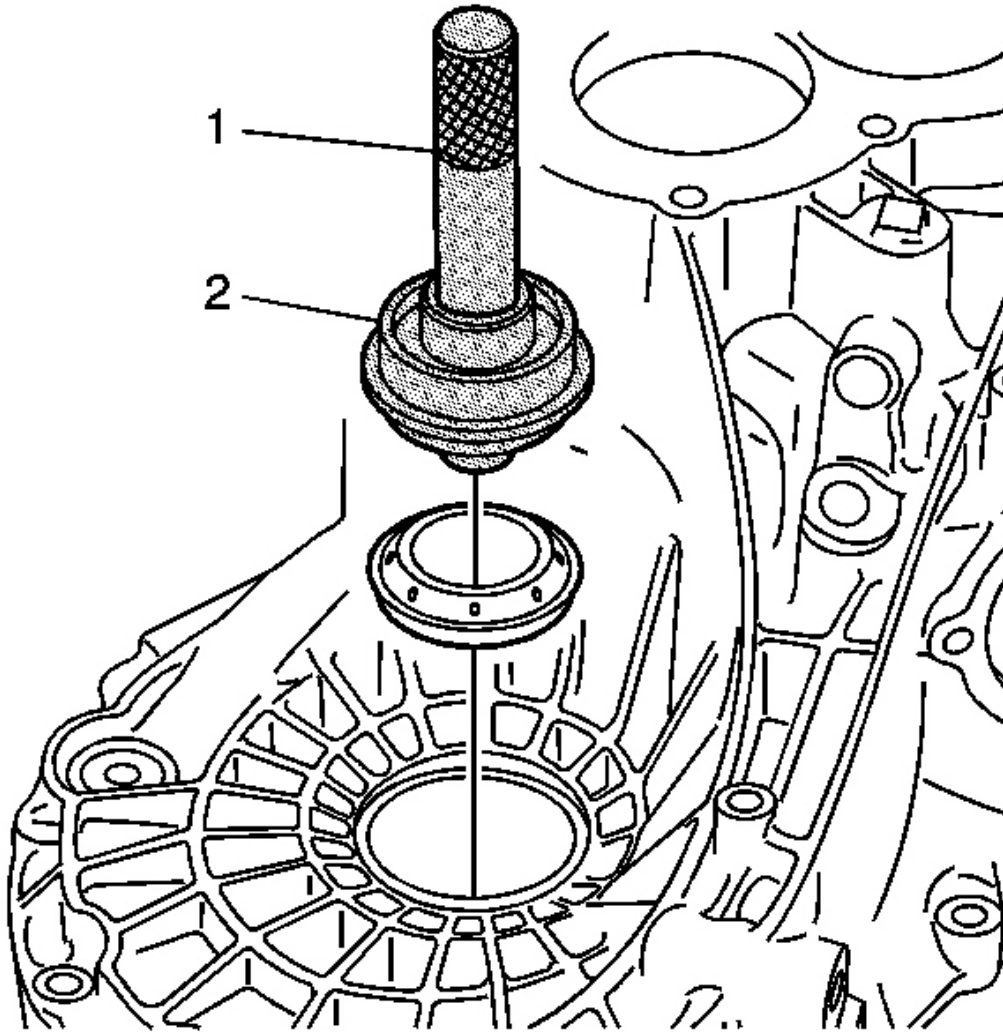


Fig. 45: Axle Seal, J 44385 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Prior to installing the seal, inspect the J 44385 for nicks or burrs that may damage the seal lip. See Special Tools and Equipment .

3. Using the J 44385 (2) and the J 7079-2 (1), install the axle seal. See Special Tools and Equipment . Ensure the seal is lined up with the bore during installation.
4. Install the wheel driveshaft. Refer to Wheel Drive Shaft Replacement - Front in Wheel Drive Shafts.
5. Remove the fluid level check plug and verify the fluid is level with the opening.

6. If the transaxle is not properly filled, add DEXRON(R)III fluid until it begins to flow out of the fill/check plug.

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

7. Install the fluid check plug.

Tighten: Tighten the plug to 38 N.m (28 lb ft).

8. Install the wheel and tire. Refer to **Tire and Wheel Removal and Installation** in **Tires and Wheels**.
9. Lower the vehicle.

AXLE SHAFT OIL SEAL REPLACEMENT (RIGHT)

Tools Required

- SA9113T Axle Seal Installer
- SA9133T Axle Seal Puller

Removal Procedure

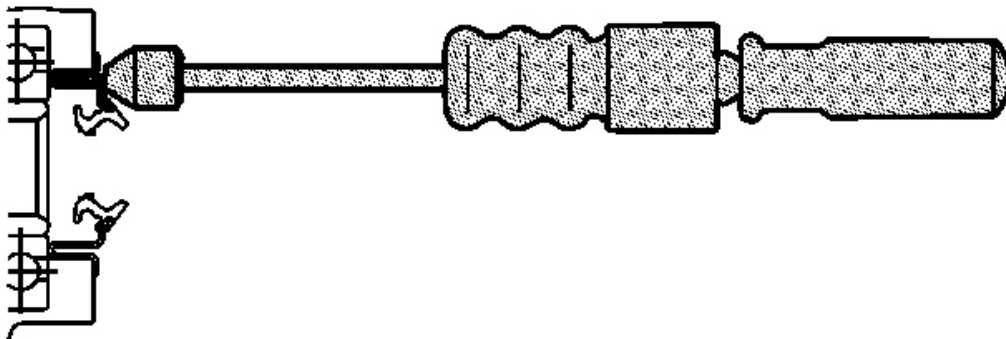


Fig. 46: Axle Seal & SA9133T
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in **General Information**.
2. Remove the right tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in **Tires and Wheels**.
3. Remove the intermediate drive shaft. Refer to **Intermediate Shaft Replacement (L61)** or **Intermediate Shaft Replacement (L66)** in **Wheel Drive Shafts**.

- Using the SA9113T , remove the axle seal.

Installation Procedure

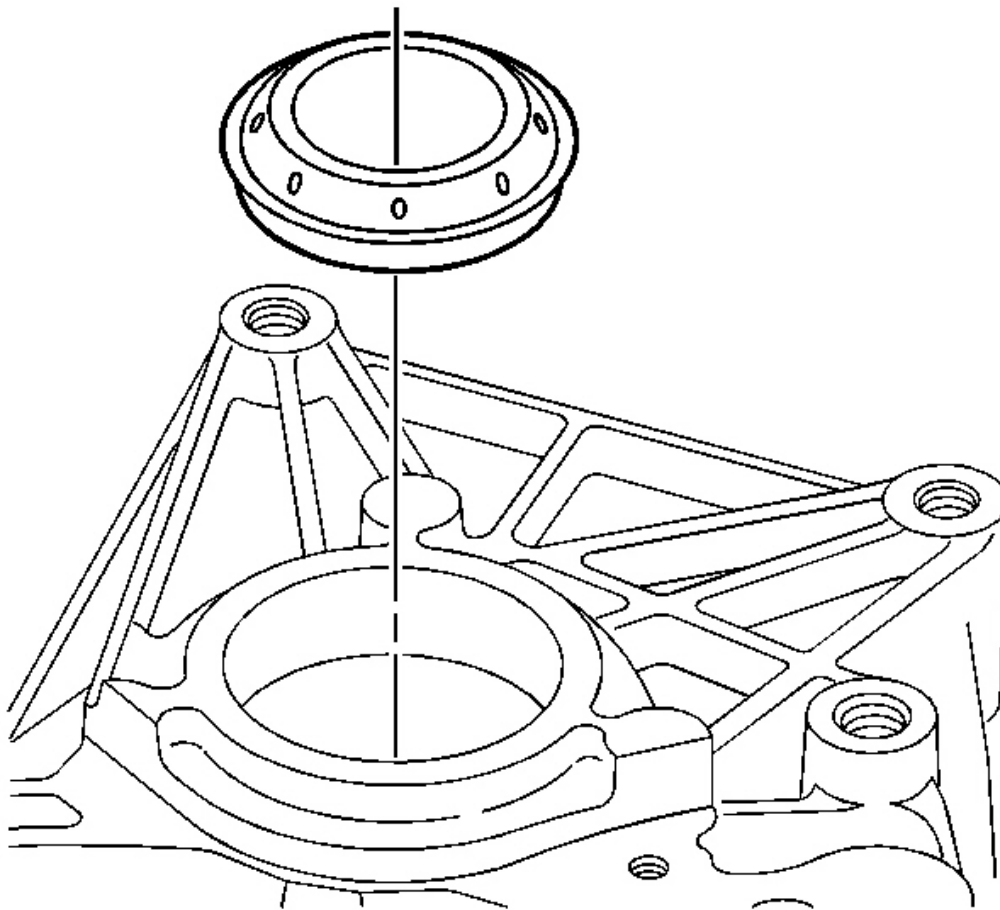


Fig. 47: Axle Seal

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Prior to installing the seal, inspect the SA9113T for nicks or burrs that may damage the seal lip.

- Using the SA9113T , install the axle seal. Ensure the seal is lined up with the bore during installation.
- Install the intermediate drive shaft. Refer to **Intermediate Shaft Replacement (L61)** or **Intermediate Shaft Replacement (L66)** in Wheel Drive Shafts.
- Install the wheel and tire. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

4. Lower the vehicle.

FRONT WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

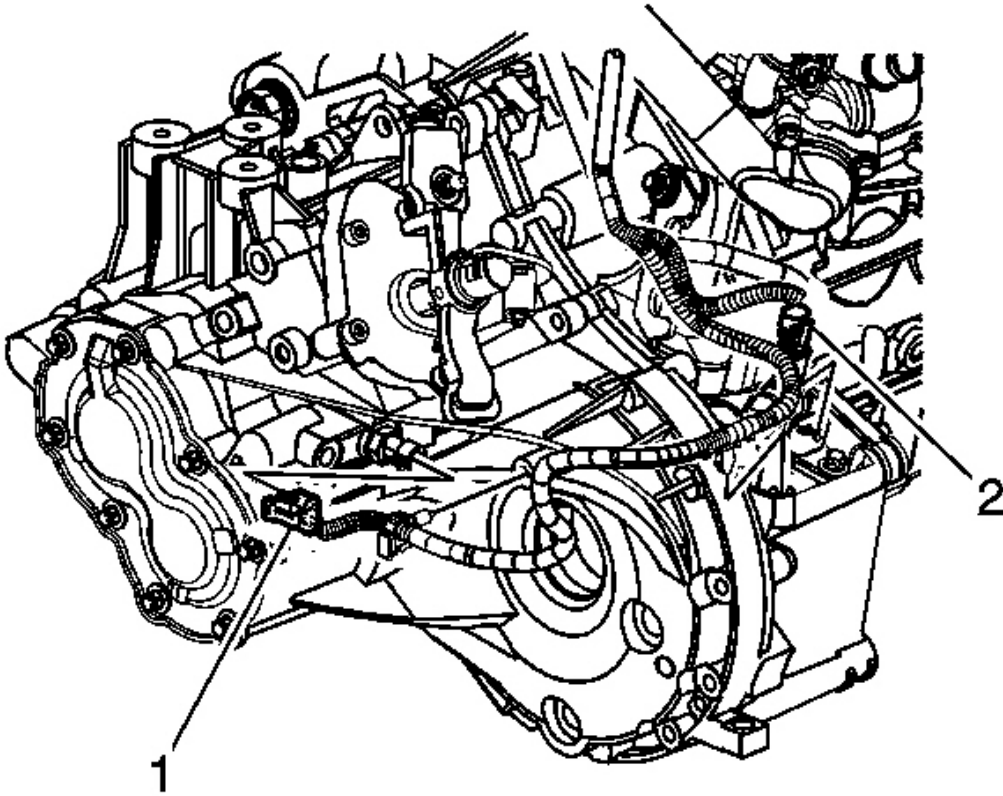


Fig. 48: Front Wheel Speed Sensor VSS Electrical Connector
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Disconnect the vehicle speed sensor (VSS) electrical connector (2).

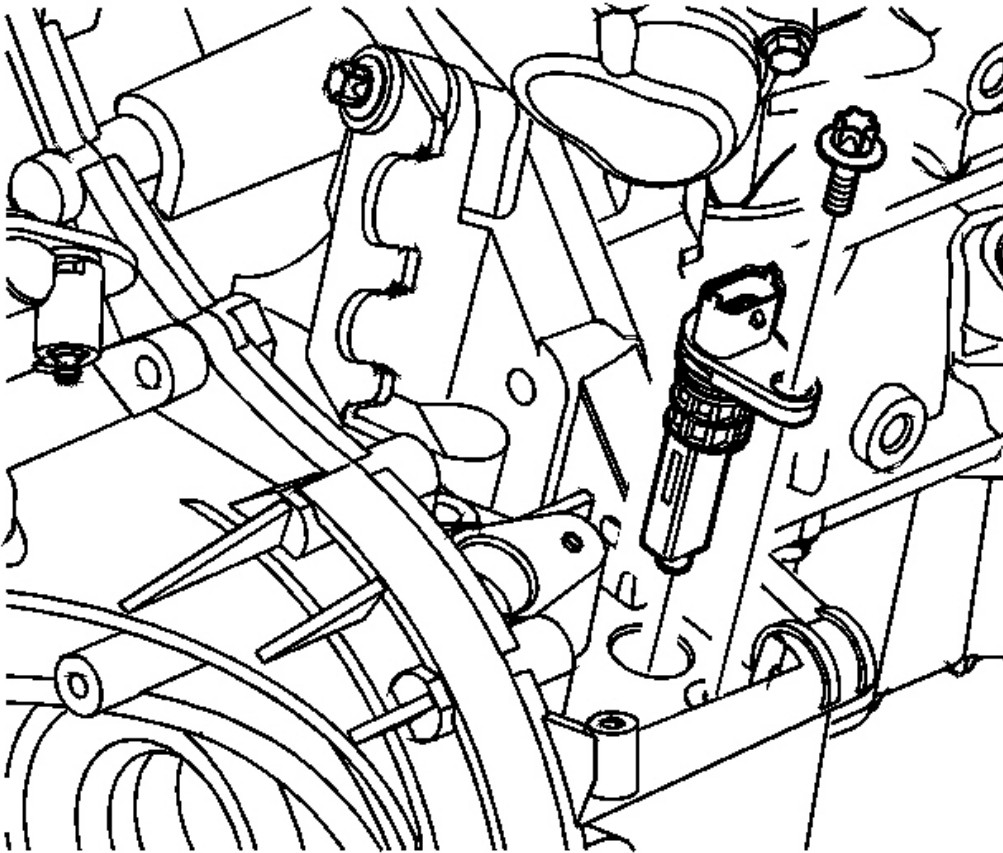


Fig. 49: VSS & Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

3. Remove the VSS retaining bolt.
4. Remove the VSS.

Installation Procedure

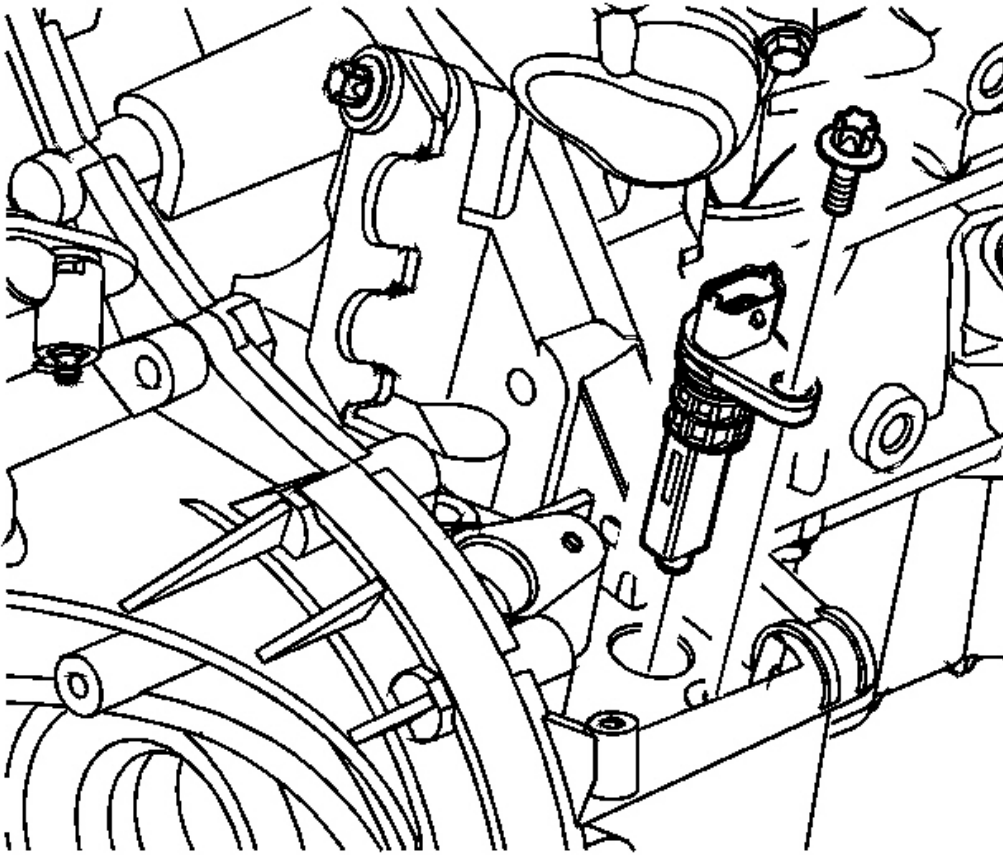


Fig. 50: VSS & Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the VSS.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the VSS retaining bolt.

Tighten: Tighten the bolt to 12 N.m (106 lb in).

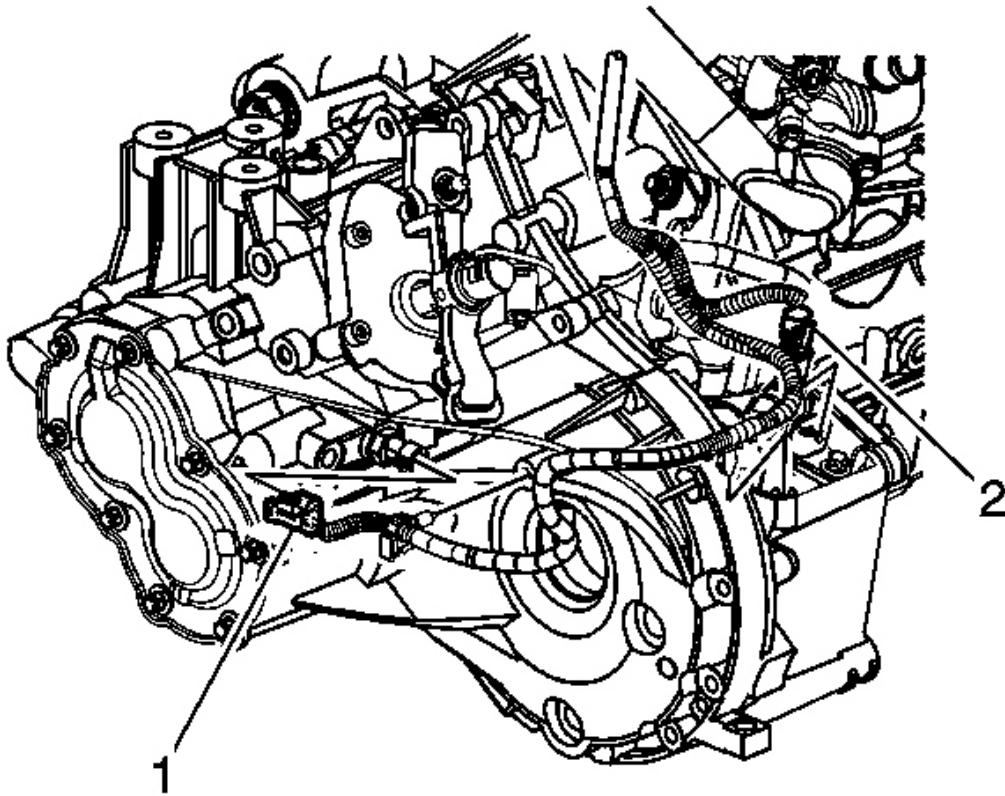


Fig. 51: Front Wheel Speed Sensor VSS Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the VSS electrical connector (2).
4. Lower the vehicle.

VEHICLE SPEED SENSOR (VSS) REPLACEMENT

Removal Procedure

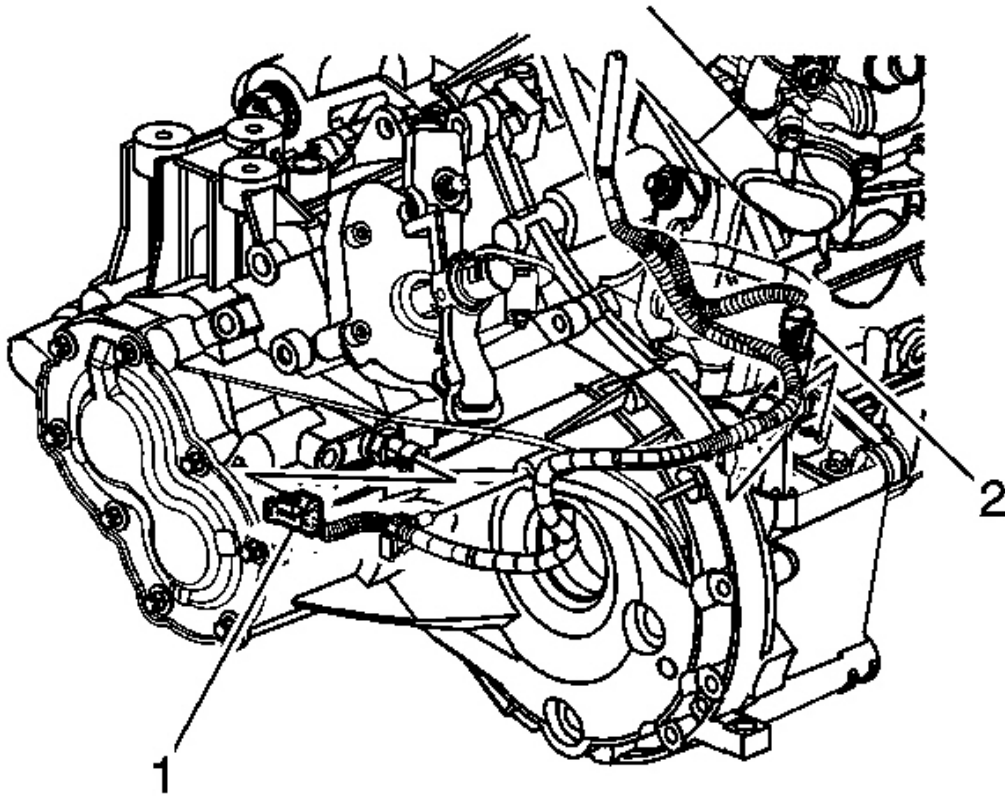


Fig. 52: Front Wheel Speed Sensor VSS Electrical Connector
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Disconnect the vehicle speed sensor (VSS) electrical connector (2).

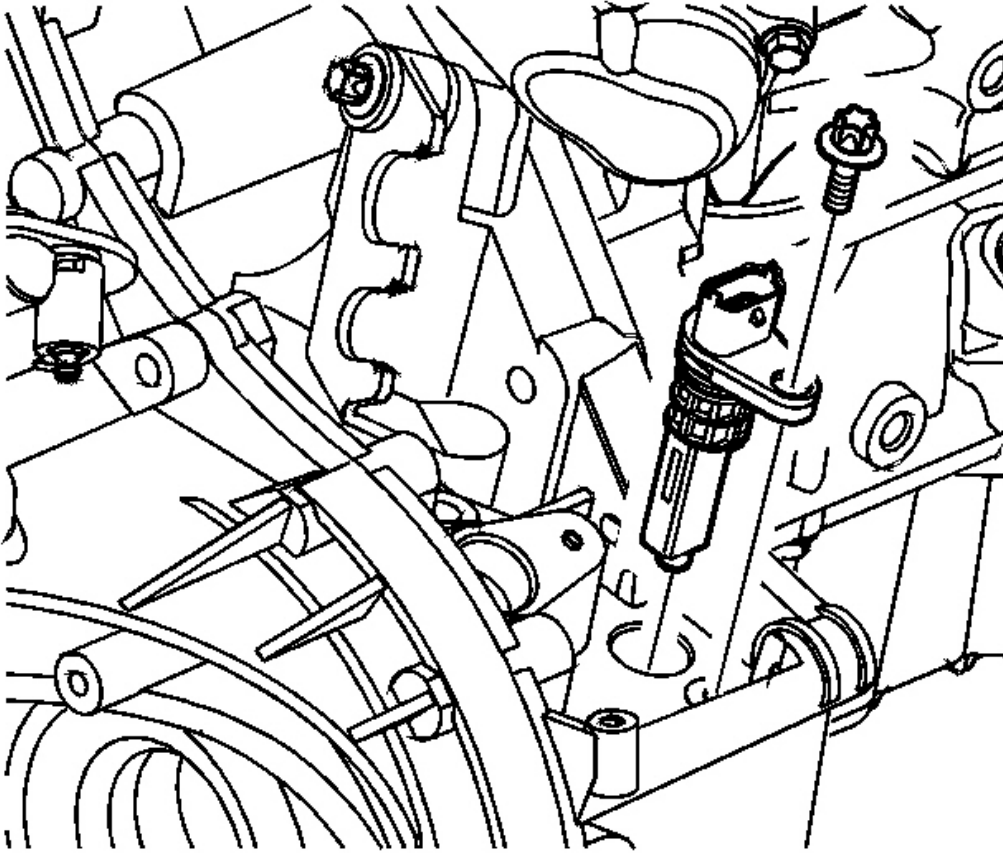


Fig. 53: VSS & Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

3. Remove the VSS retaining bolt.
4. Remove the VSS.

Installation Procedure

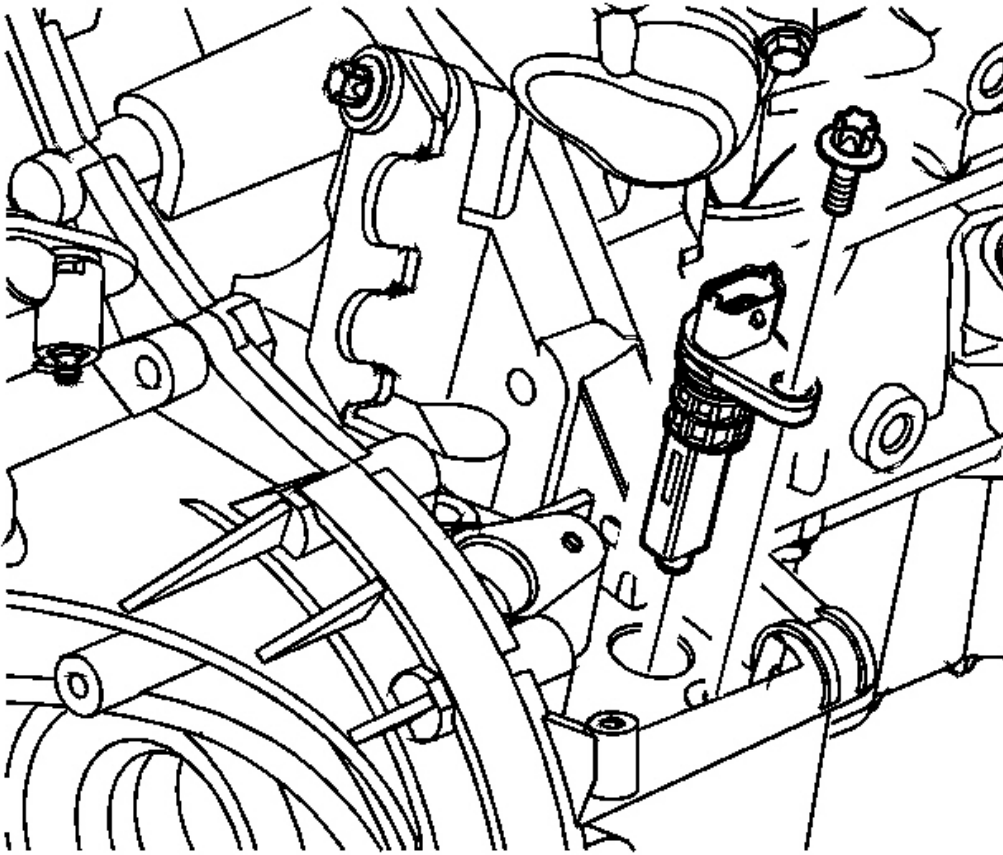


Fig. 54: VSS & Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the VSS.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the VSS retaining bolt.

Tighten: Tighten the bolt to 12 N.m (106 lb in).

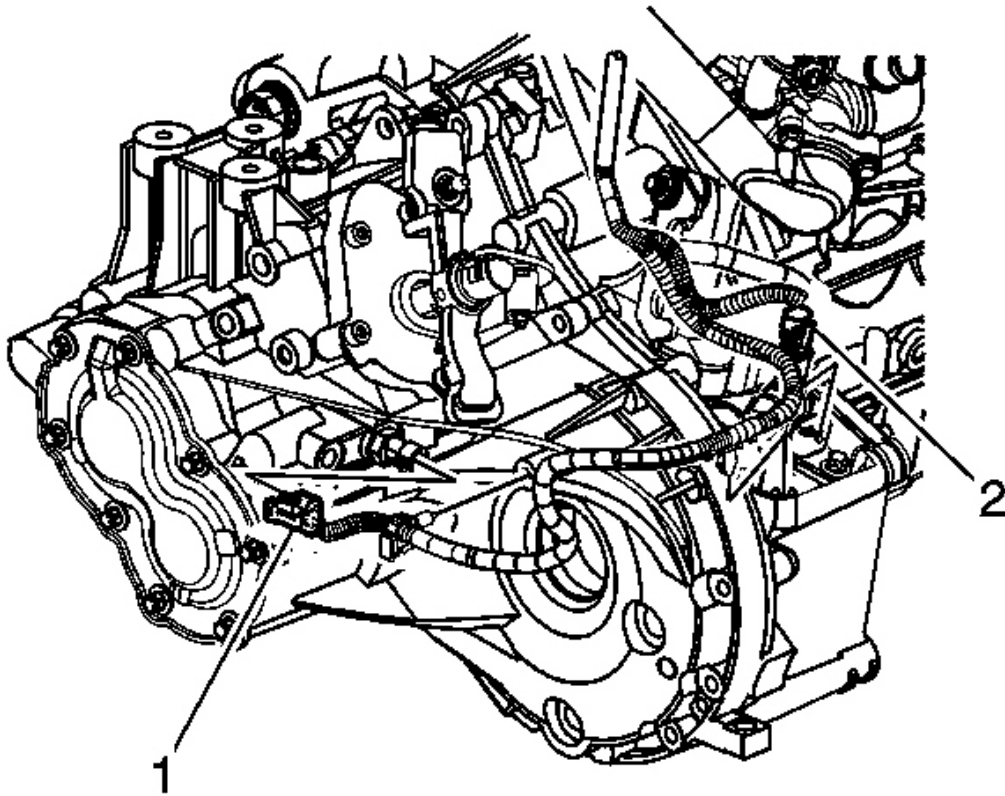


Fig. 55: Front Wheel Speed Sensor VSS Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the VSS electrical connector (2).
4. Lower the vehicle.

SHIFT CABLE REPLACEMENT

Tools Required

J 36346 Fascia Retainer Remover

Removal Procedure

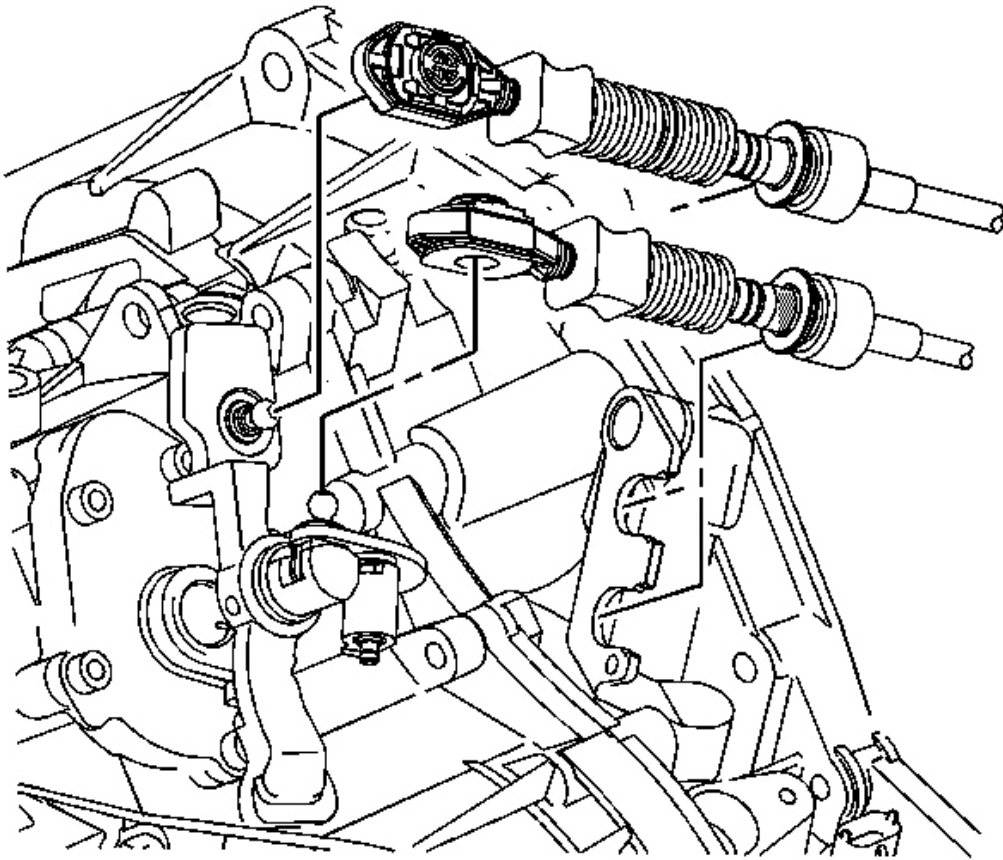


Fig. 56: Shift Cables & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

1. Using the **J 36346** or equivalent, disconnect the shift cable ends from the transaxle by prying on both sides with even pressure.
2. Disconnect the shift cables from the shift cable bracket and discard the shift cable retaining clips.

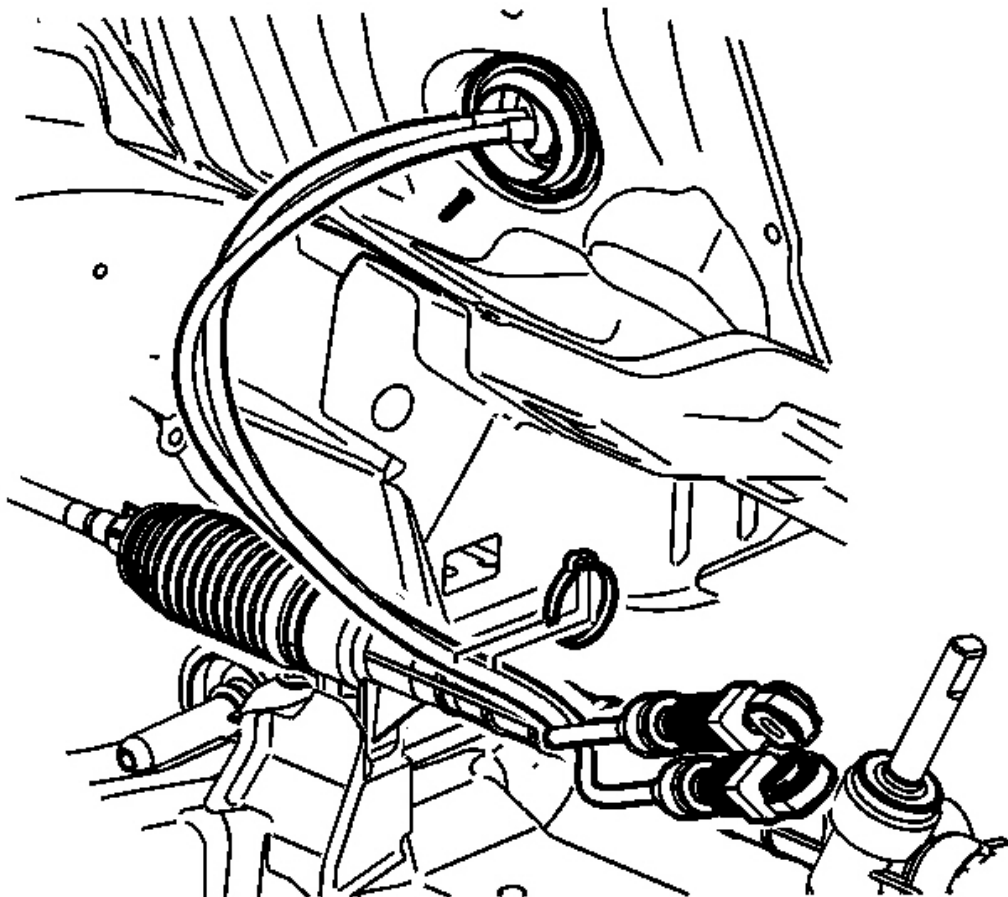


Fig. 57: Cable Retainer & Steering Gear Assembly
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the cable retainer from the steering gear assembly.

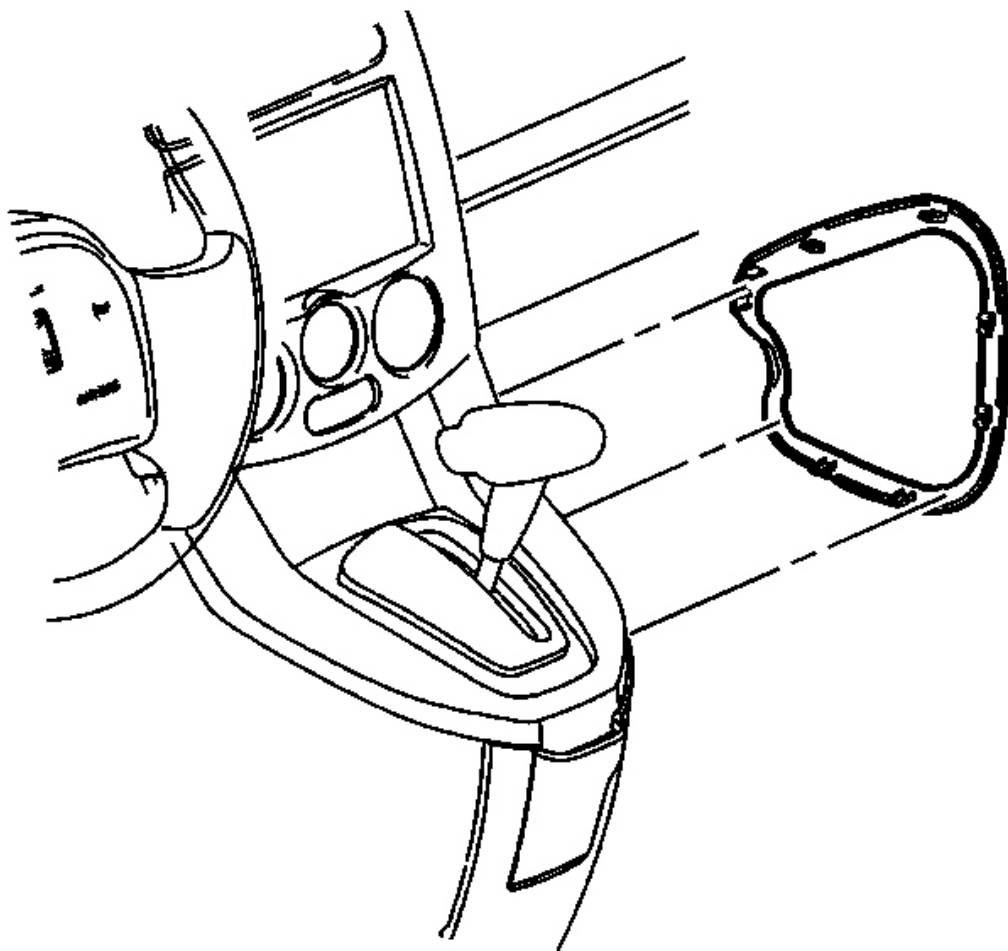


Fig. 58: Control Assembly Boot Trim
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the control assembly boot trim from the trim bezel.
5. Gently pry up the window switch trim bezel.

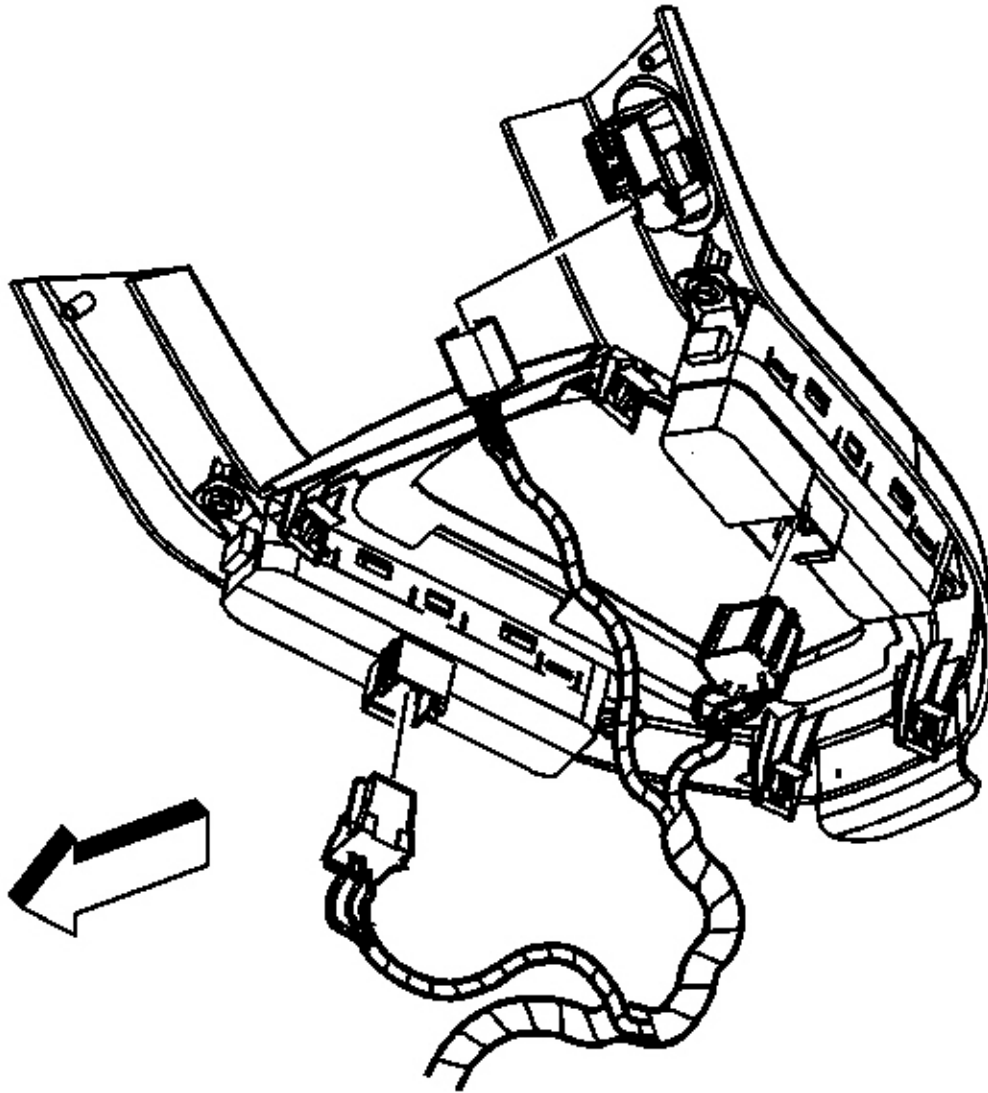


Fig. 59: Electrical Connectors & Window Switch Trim Bezel
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the electrical connectors from the window switch trim bezel and remove the bezel.

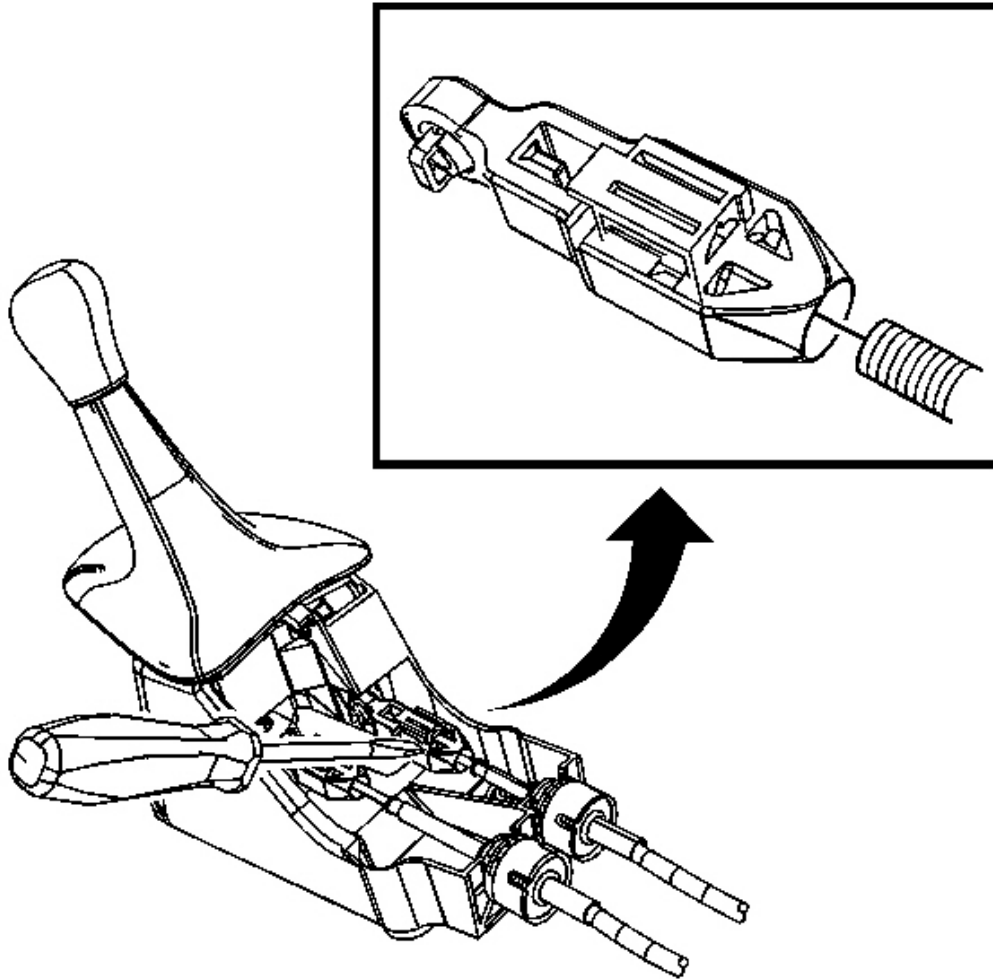


Fig. 60: Shift Cables & Control Lever Assembly Housing
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the shift cables from the shift cable adjusters.
8. Disconnect the shift cables from the control lever assembly housing.
9. Remove the right side console trim panel.
10. Pull back the carpeting from the front of the dash area.

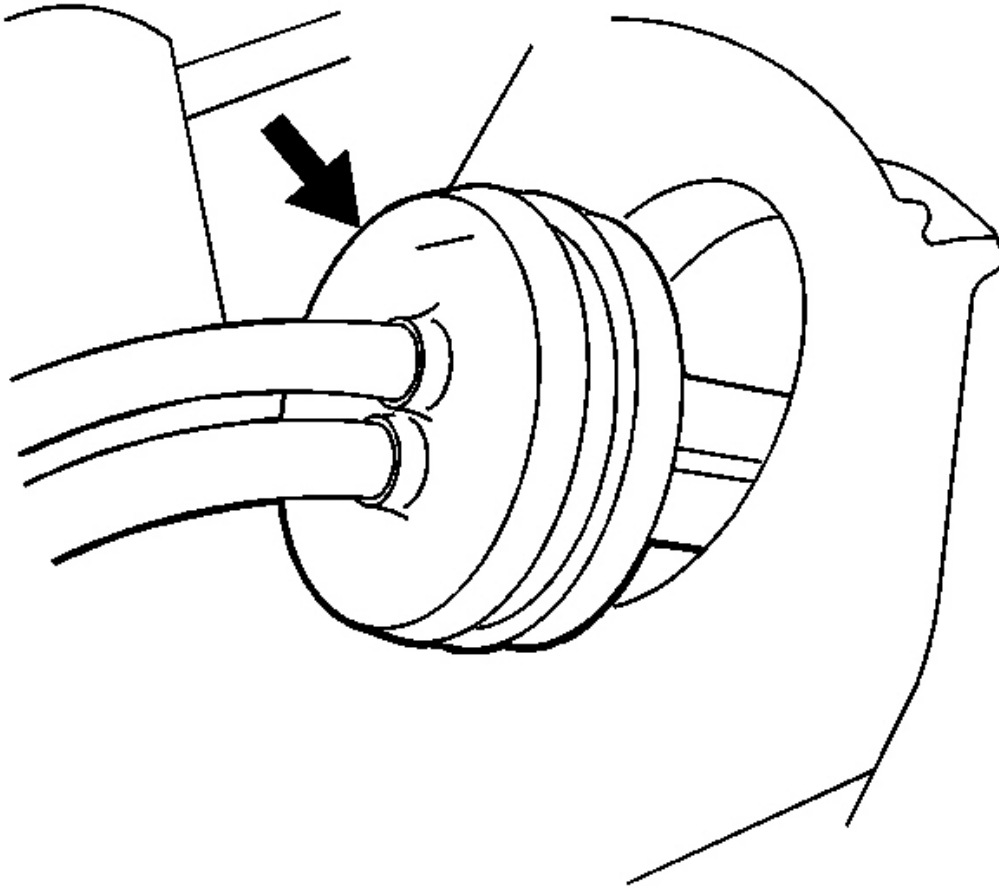


Fig. 61: Shift Cable Pass-Through Grommet
Courtesy of GENERAL MOTORS CORP.

11. Pry the shift cable pass-through grommet away from the opening and remove the shift cable.

Installation Procedure

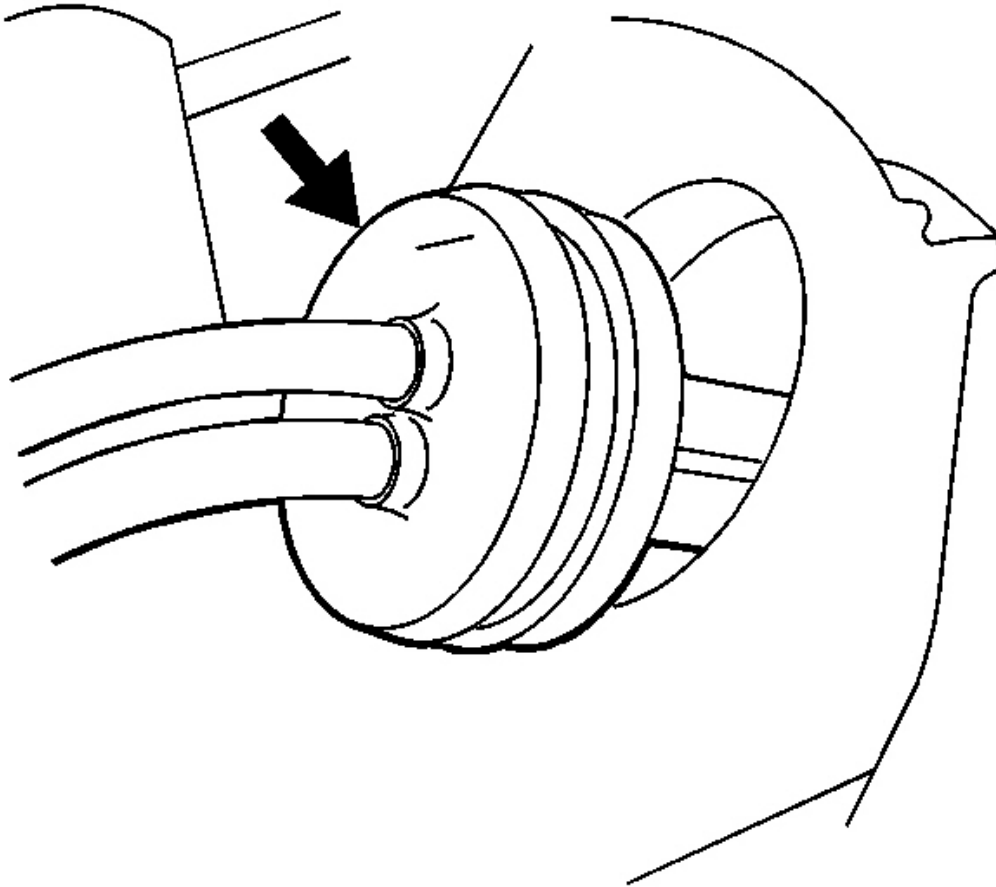


Fig. 62: Shift Cable Pass-Through Grommet
Courtesy of GENERAL MOTORS CORP.

1. Install the shift cables from the interior of the vehicle to the underhood area. Ensure that the shift cable pass-through grommet is properly seated and the grommet arrow is pointing up.
2. Replace the carpeting at the front of the dash.
3. Install the right side console trim panel.

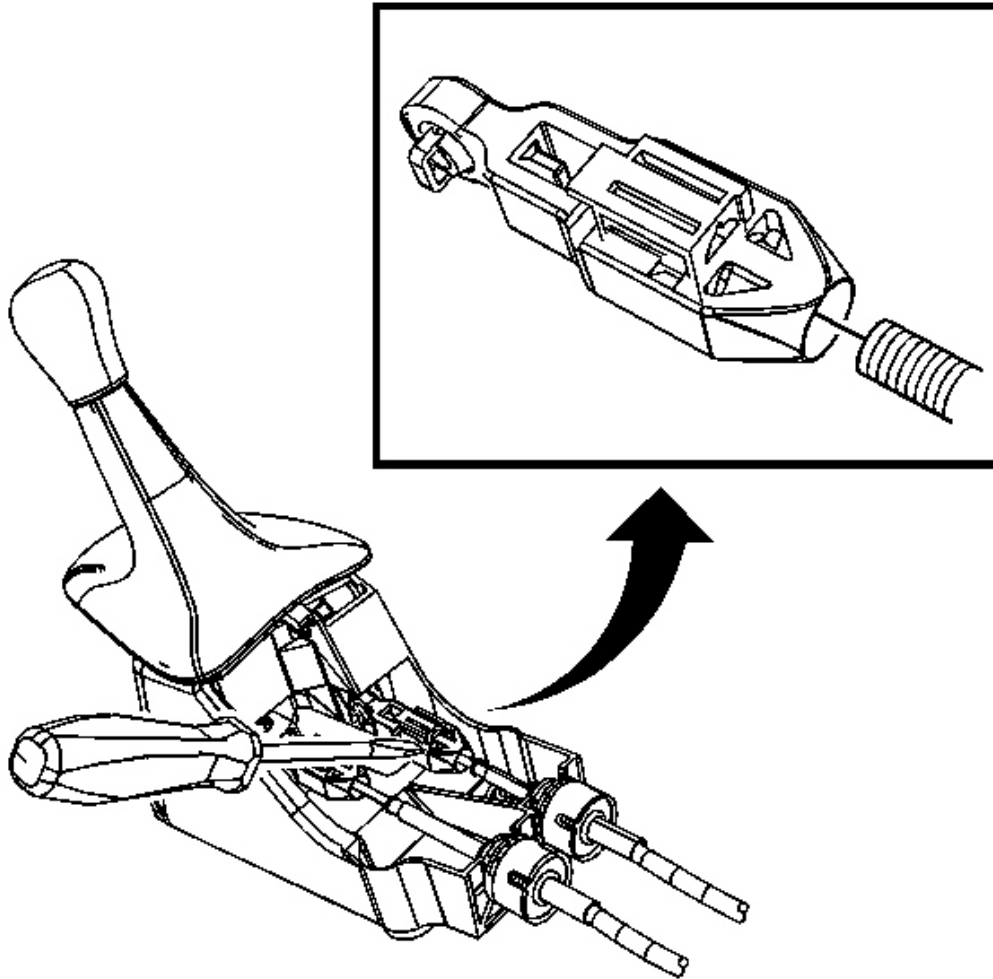


Fig. 63: Shift Cables & Control Lever Assembly Housing
Courtesy of GENERAL MOTORS CORP.

4. Connect the shift cables to the control lever assembly.
5. With the shift cable ends in the adjusters, adjust the cables by pushing the shifter neutral lock clip. Move the shifter slightly to center the lock clip.

IMPORTANT: Ensure the transaxle is in NEUTRAL.

6. Press and lock the shift cable retainers.
7. Pull the shifter neutral lock clip to the original position.

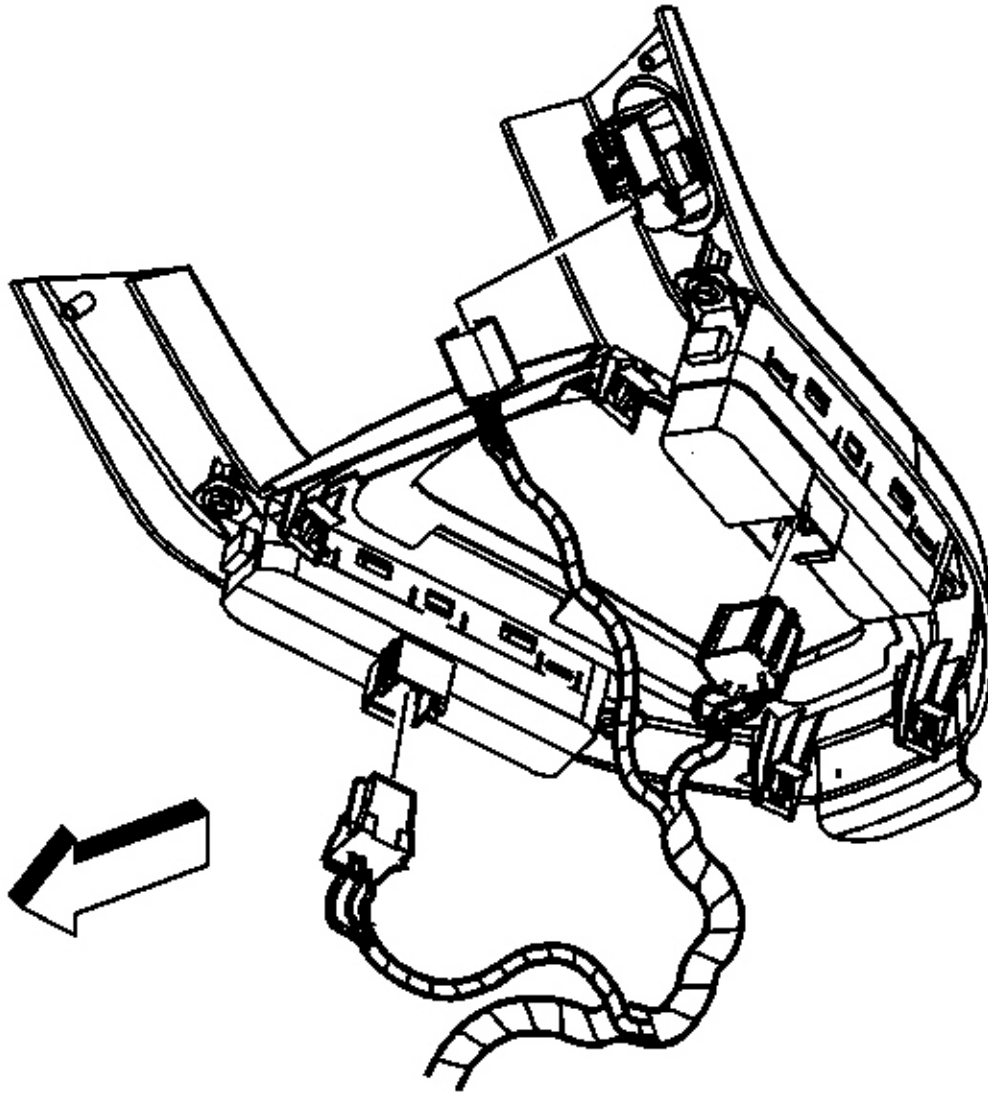


Fig. 64: Electrical Connectors & Window Switch Trim Bezel
Courtesy of GENERAL MOTORS CORP.

8. Connect the electrical connectors.
9. Install the trim bezel.
10. Install the control assembly boot to the trim bezel.

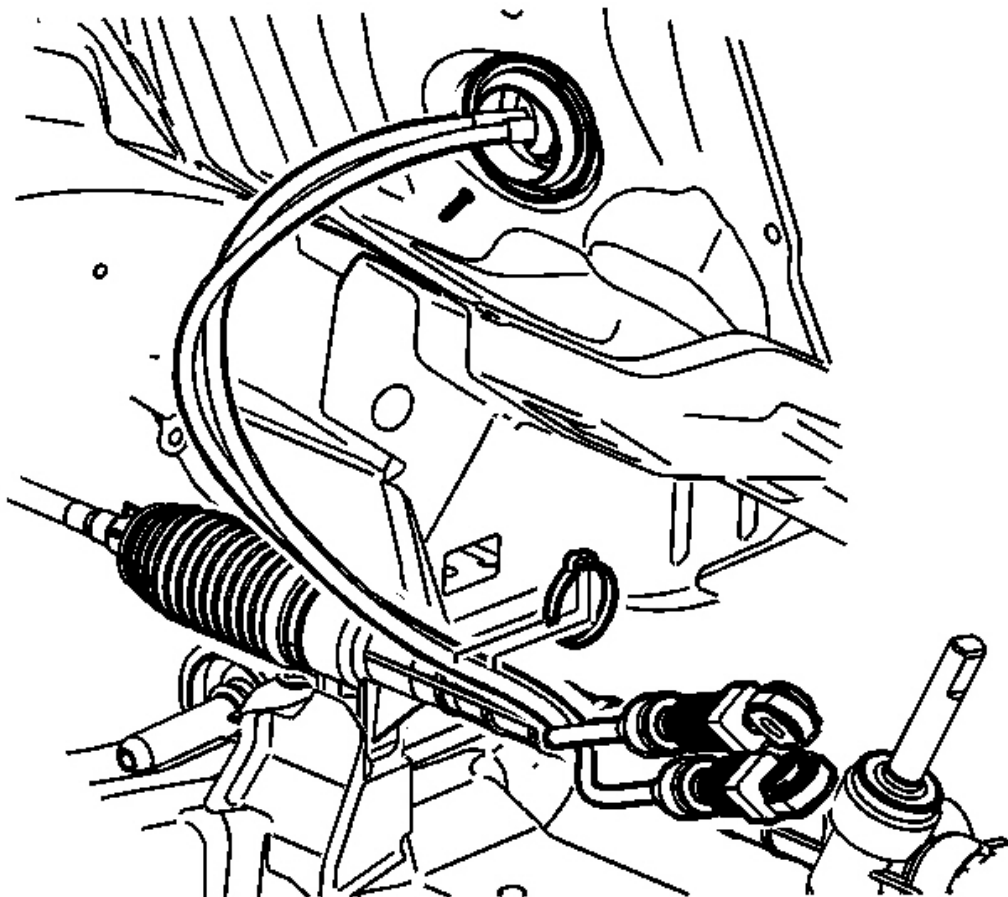


Fig. 65: Cable Retainer & Steering Gear Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: New cable clips must be used to ensure proper retention.

11. Clip the cables to the steering gear assembly.
12. Connect the shift cables to the shift cable bracket.

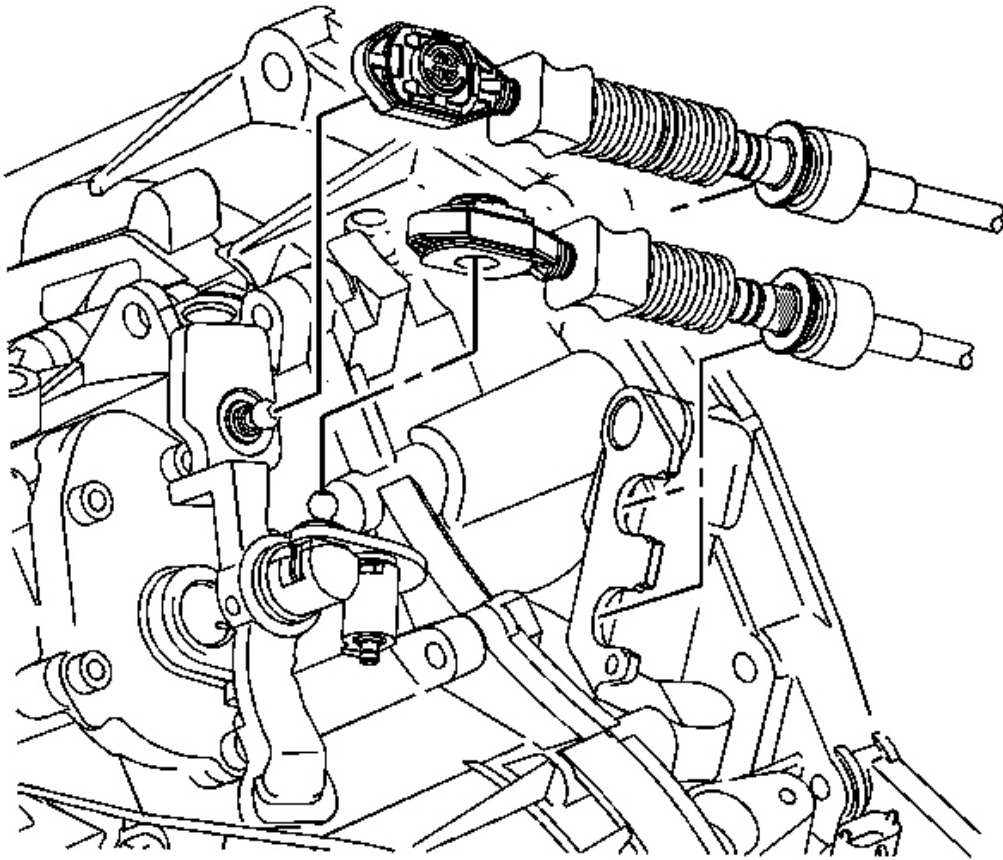


Fig. 66: Shift Cables & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

13. Connect the shift cable ends to the transaxle.

SHIFT CONTROL CABLE REPLACEMENT

Tools Required

J 36346 Fascia Retainer Remover

Removal Procedure

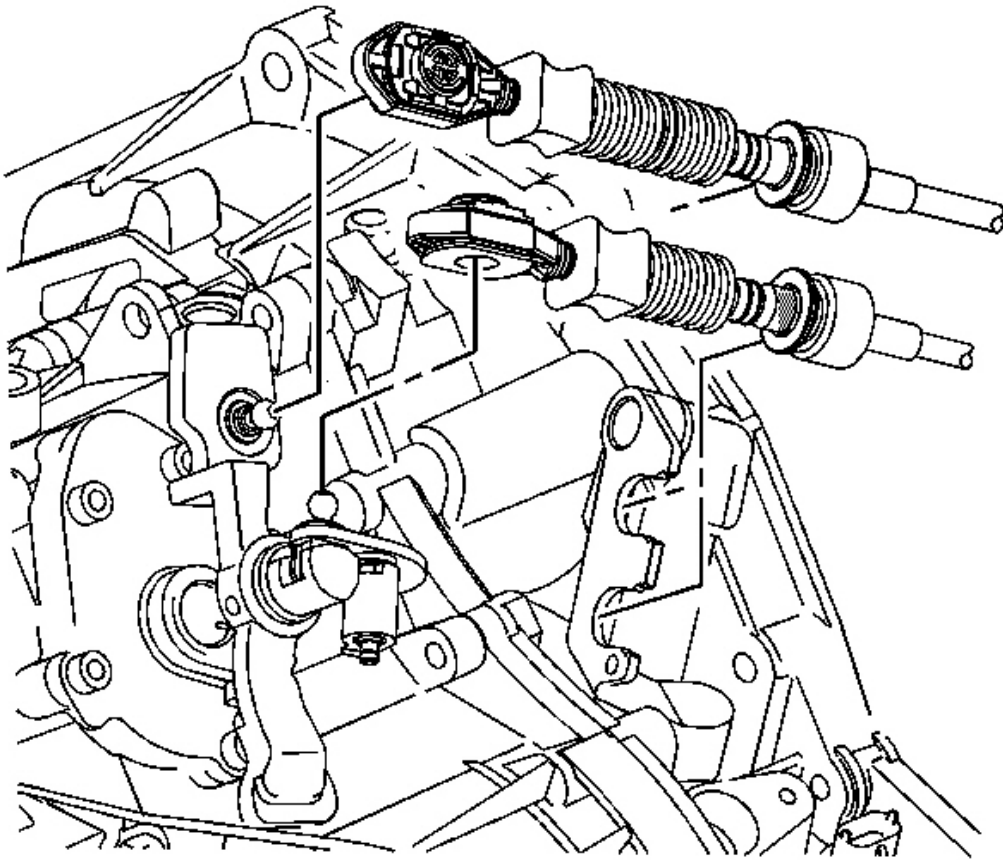


Fig. 67: Shift Cables & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

1. Lift up the shift cable retaining clips and discard.
2. Using the **J 36346** or equivalent, disconnect the shift cable ends from the transaxle by prying on both sides with even pressure.
3. Disconnect the shift cables from the shift cable bracket.

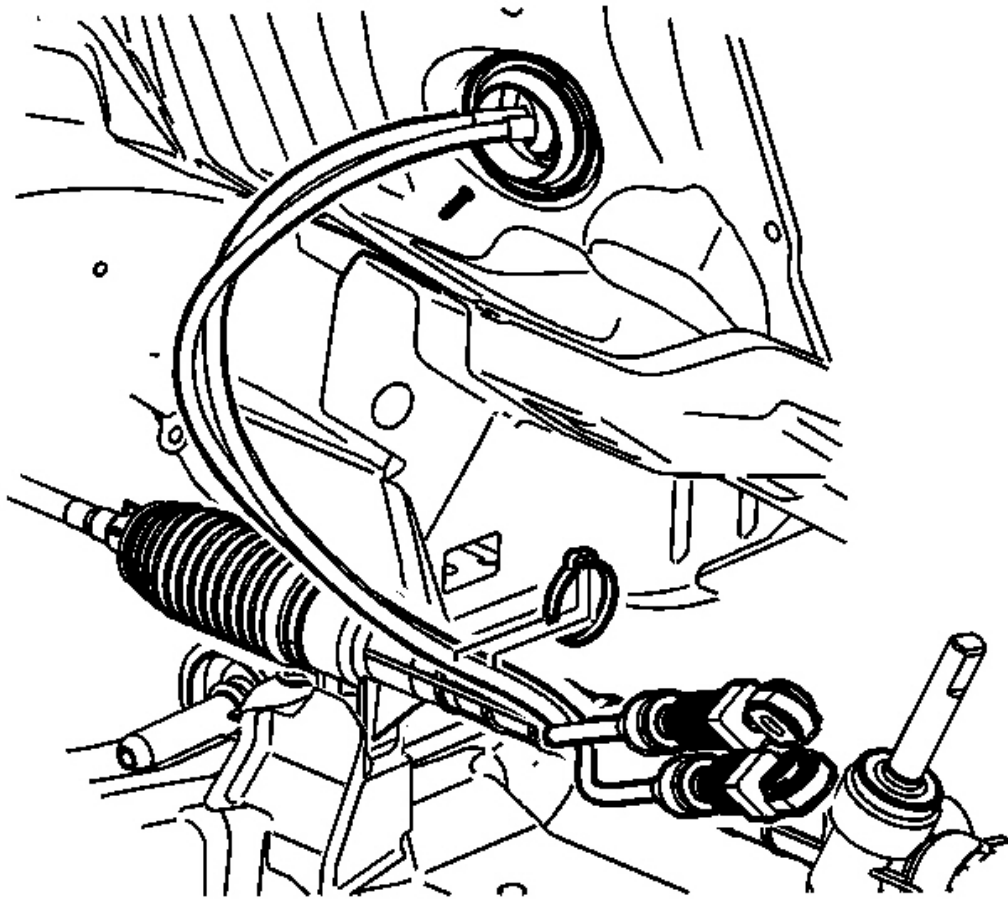


Fig. 68: Cable Retainer & Steering Gear Assembly
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the cable retainer from the steering gear assembly.

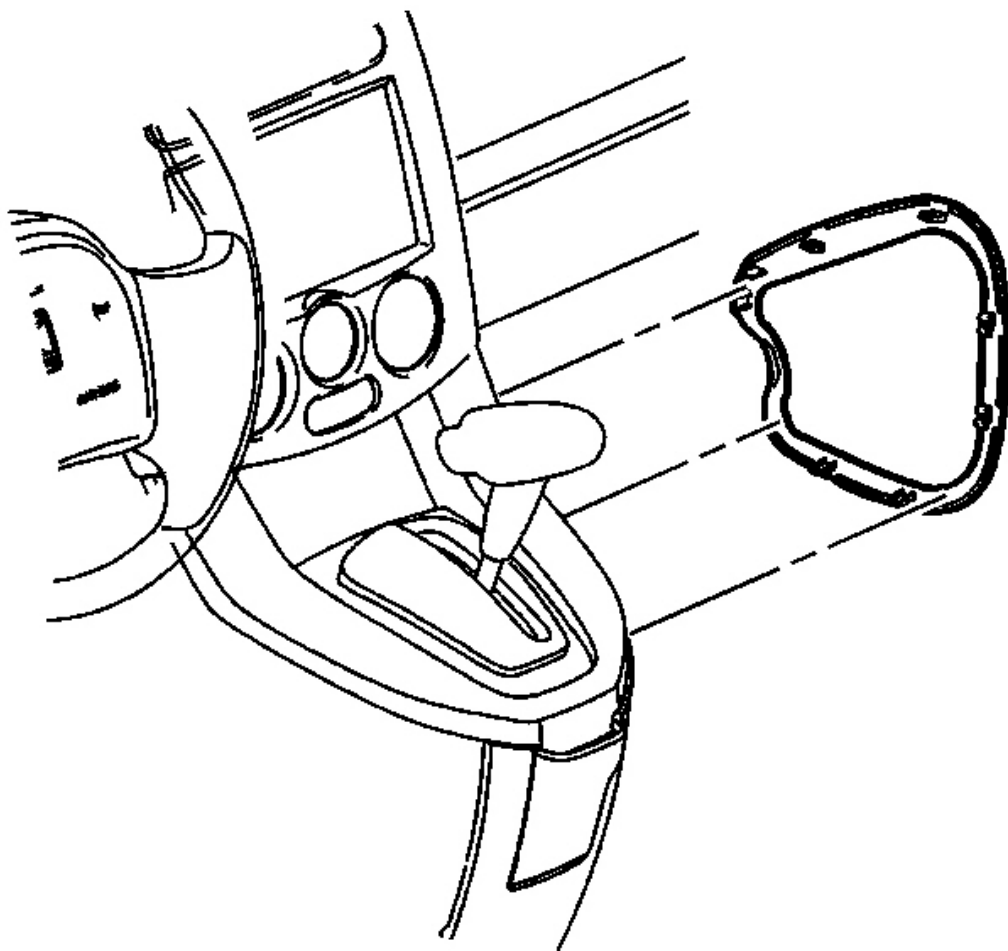


Fig. 69: Control Assembly Boot Trim
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the control assembly boot trim from the trim bezel.
6. Gently pry up the window switch trim bezel.

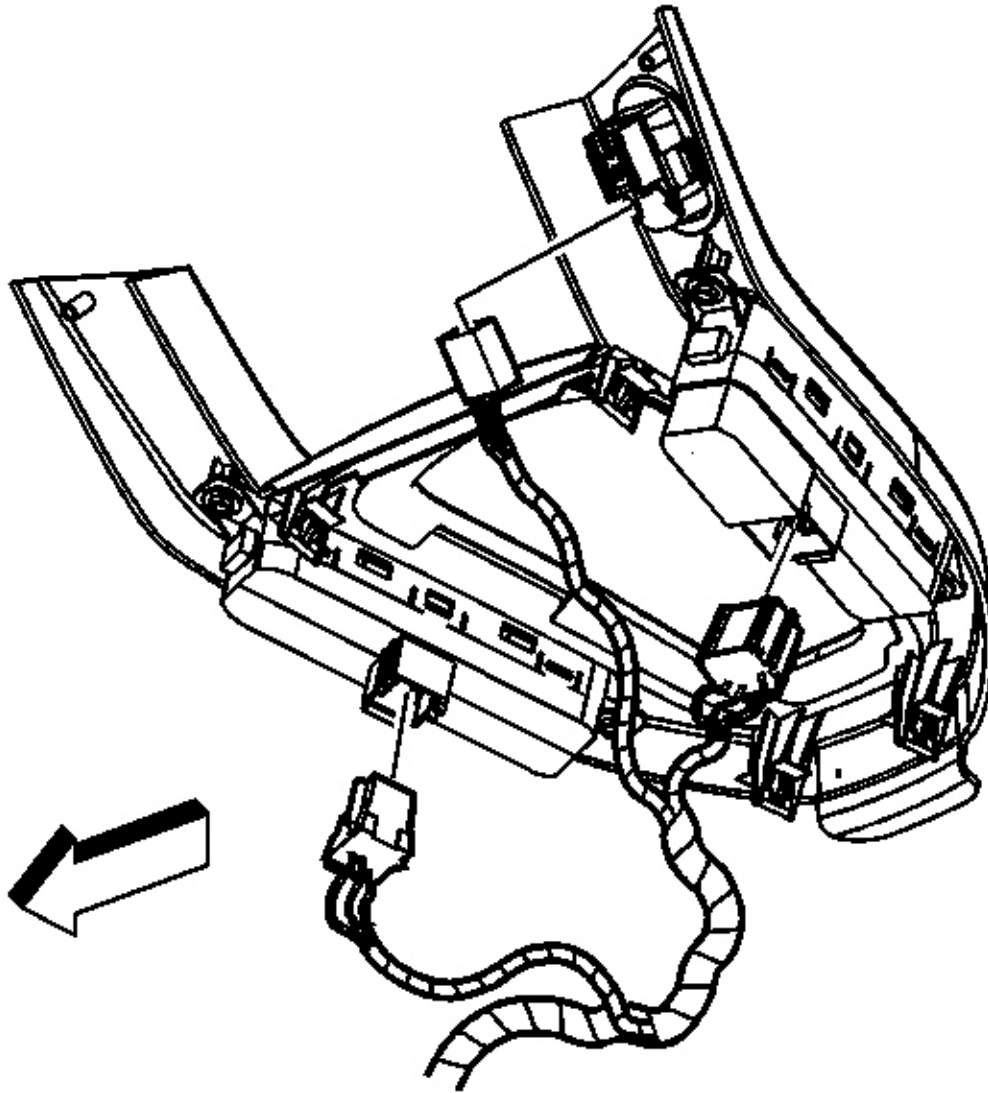


Fig. 70: Electrical Connectors & Window Switch Trim Bezel
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the electrical connectors from the window switch trim bezel and remove the bezel.

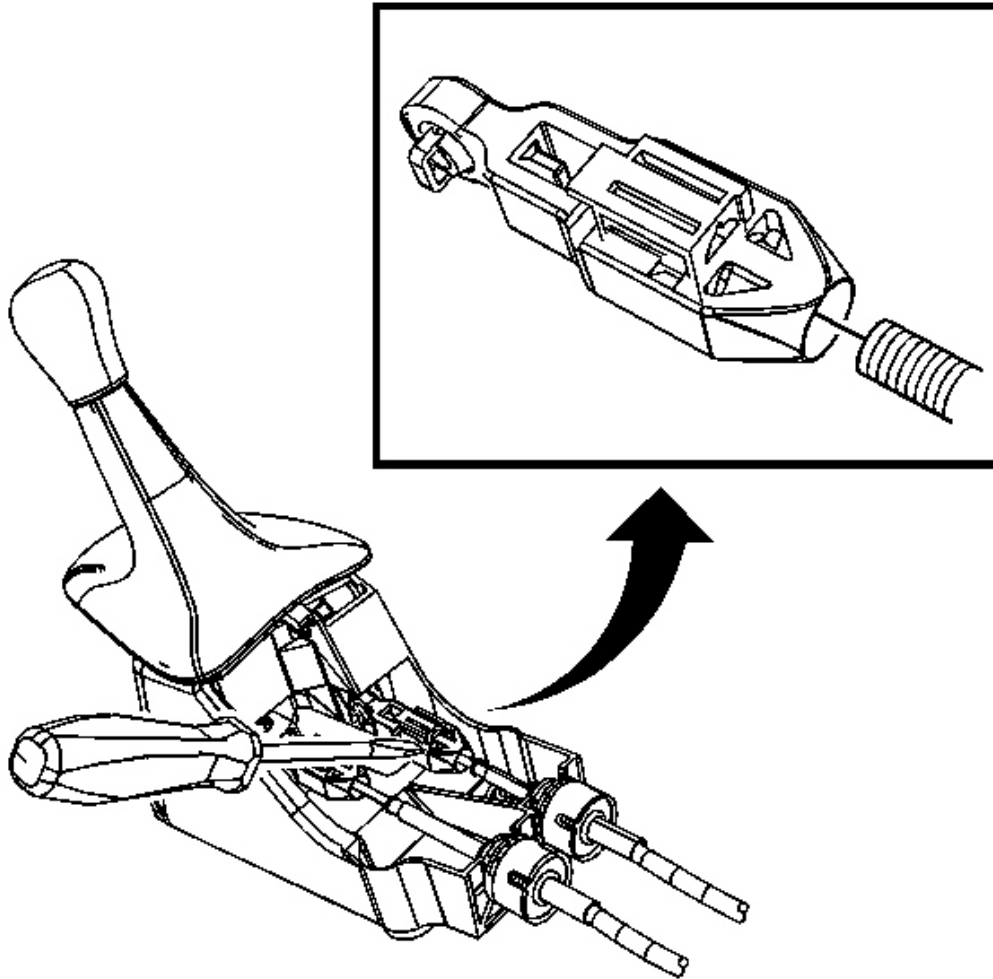


Fig. 71: Shift Cables & Control Lever Assembly Housing
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the shift cables from the shift cable adjusters.
9. Disconnect the shift cables from the control lever assembly housing.
10. Remove the right side console trim panel.
11. Pull back the carpeting from the front of the dash area.

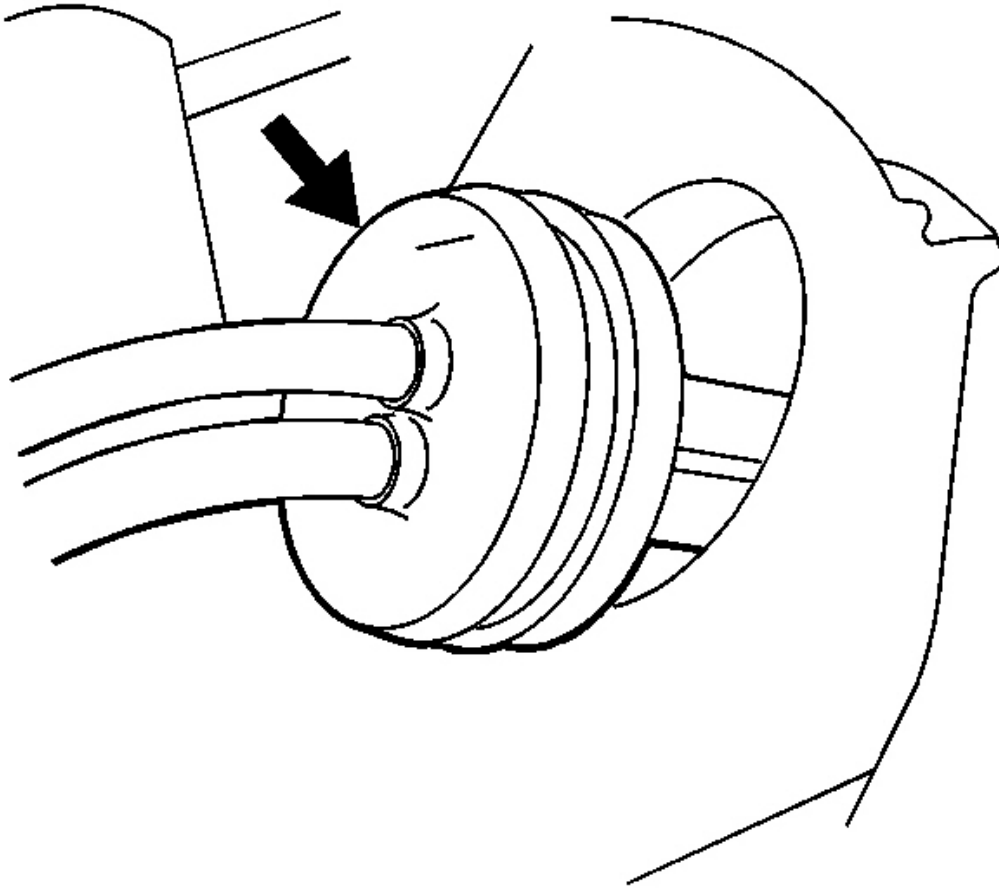


Fig. 72: Shift Cable Pass-Through Grommet
Courtesy of GENERAL MOTORS CORP.

12. Pry the shift cable pass-through grommet away from the opening and remove the shift cable.

Installation Procedure

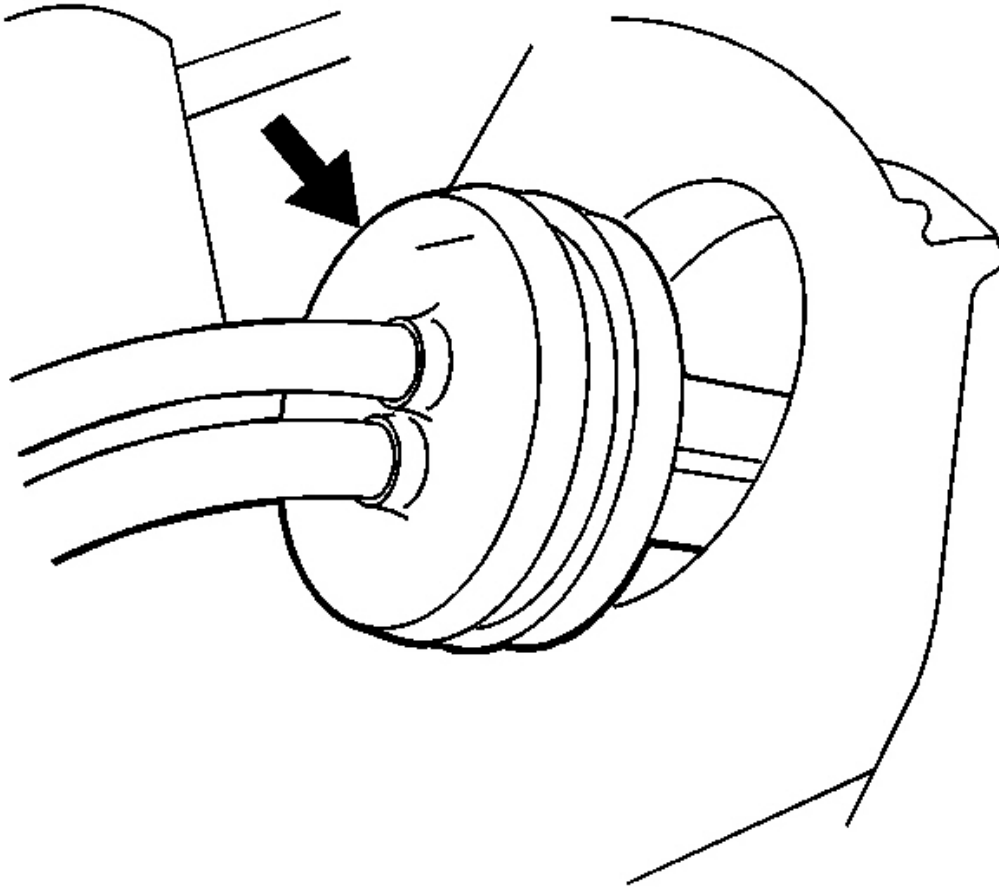


Fig. 73: Shift Cable Pass-Through Grommet
Courtesy of GENERAL MOTORS CORP.

1. Install the shift cables from the interior of the vehicle to the underhood area. Ensure that the shift cable pass-through grommet is properly seated and the grommet arrow is pointing up.
2. Replace the carpeting at the front of the dash.
3. Install the right side console trim panel.

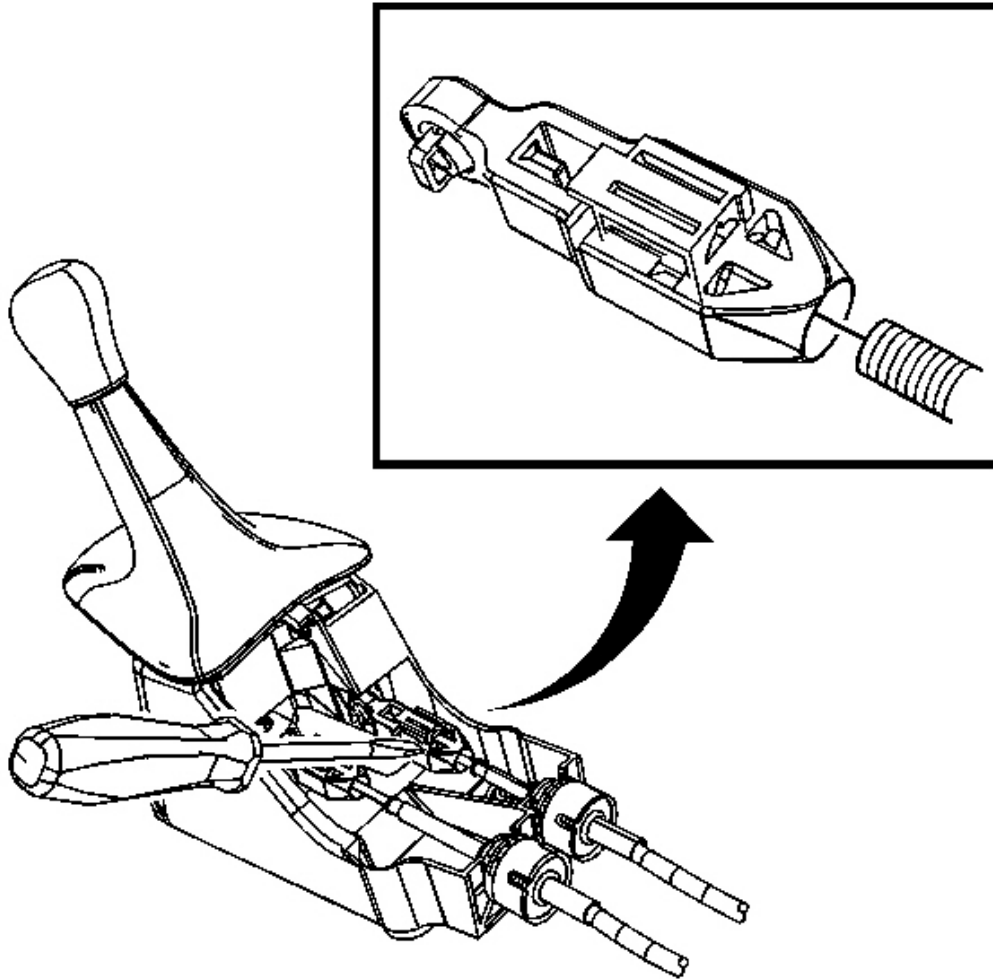


Fig. 74: Shift Cables & Control Lever Assembly Housing
Courtesy of GENERAL MOTORS CORP.

4. Connect the shift cables to the control lever assembly.
5. With the shift cable ends in the adjusters, adjust the cables by pushing the shifter neutral lock clip. Move the shifter slightly to center the lock clip.

IMPORTANT: Ensure the transaxle is in NEUTRAL.

6. Press and lock the shift cable retainers.
7. Pull the shifter neutral lock clip to the original position.

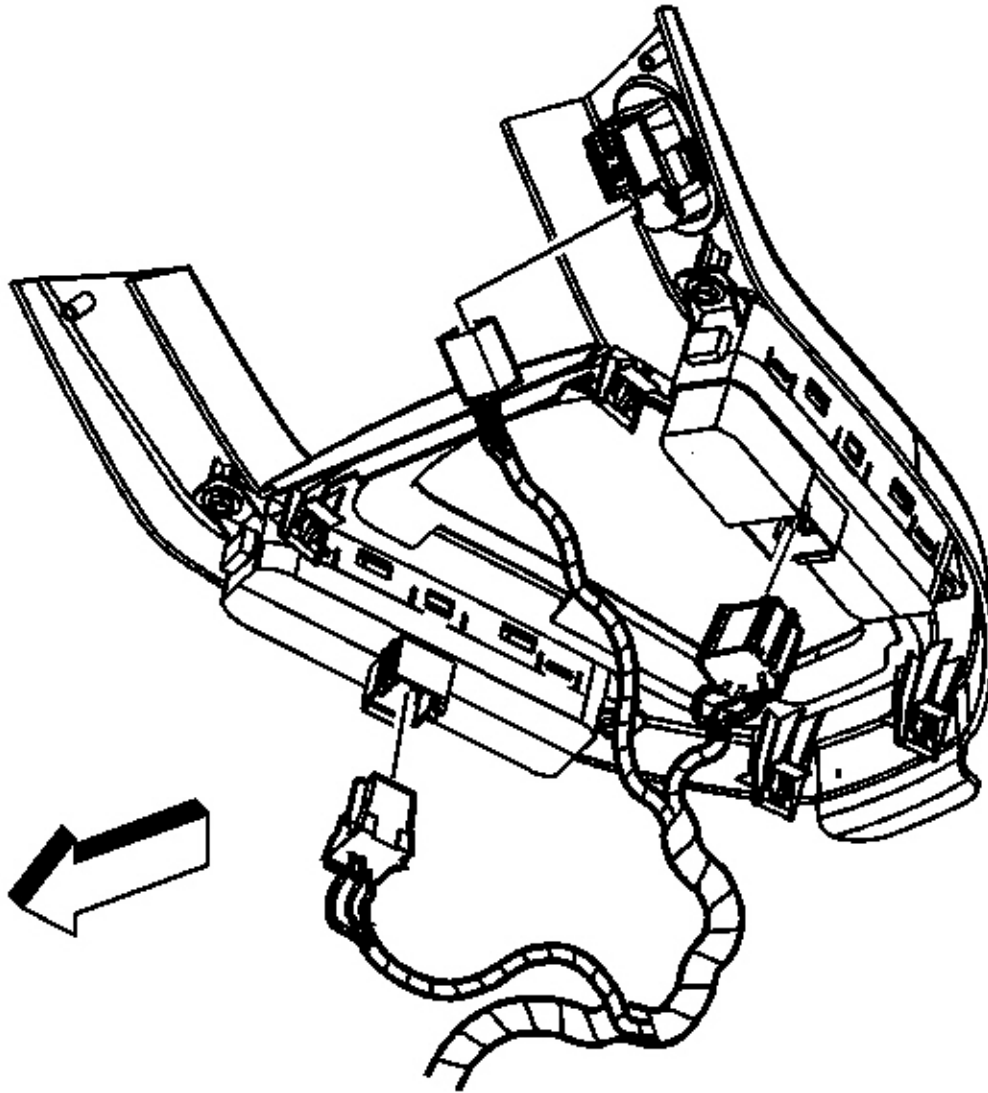


Fig. 75: Electrical Connectors & Window Switch Trim Bezel
Courtesy of GENERAL MOTORS CORP.

8. Connect the electrical connectors.
9. Install the trim bezel.
10. Install the control assembly boot to the trim bezel.

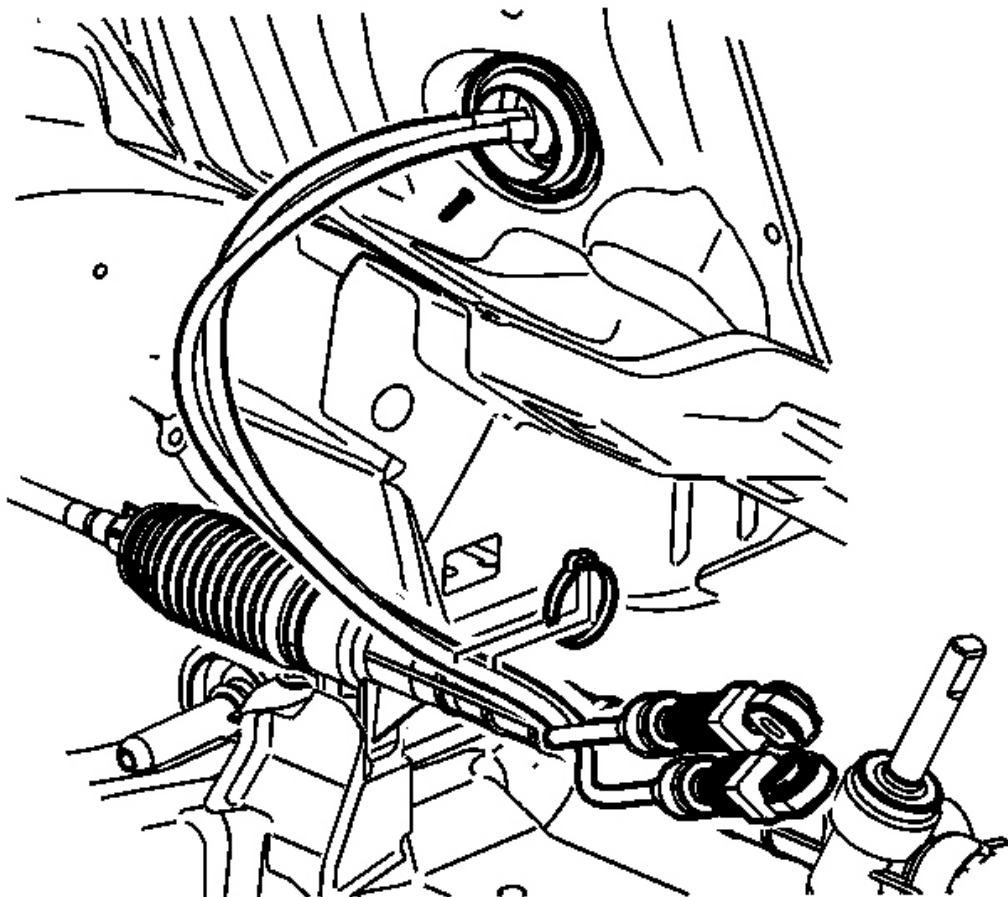


Fig. 76: Cable Retainer & Steering Gear Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: New cable clips must be used to ensure proper retention.

11. Clip the cables to the steering gear assembly.
12. Connect the shift cables to the shift cable bracket.

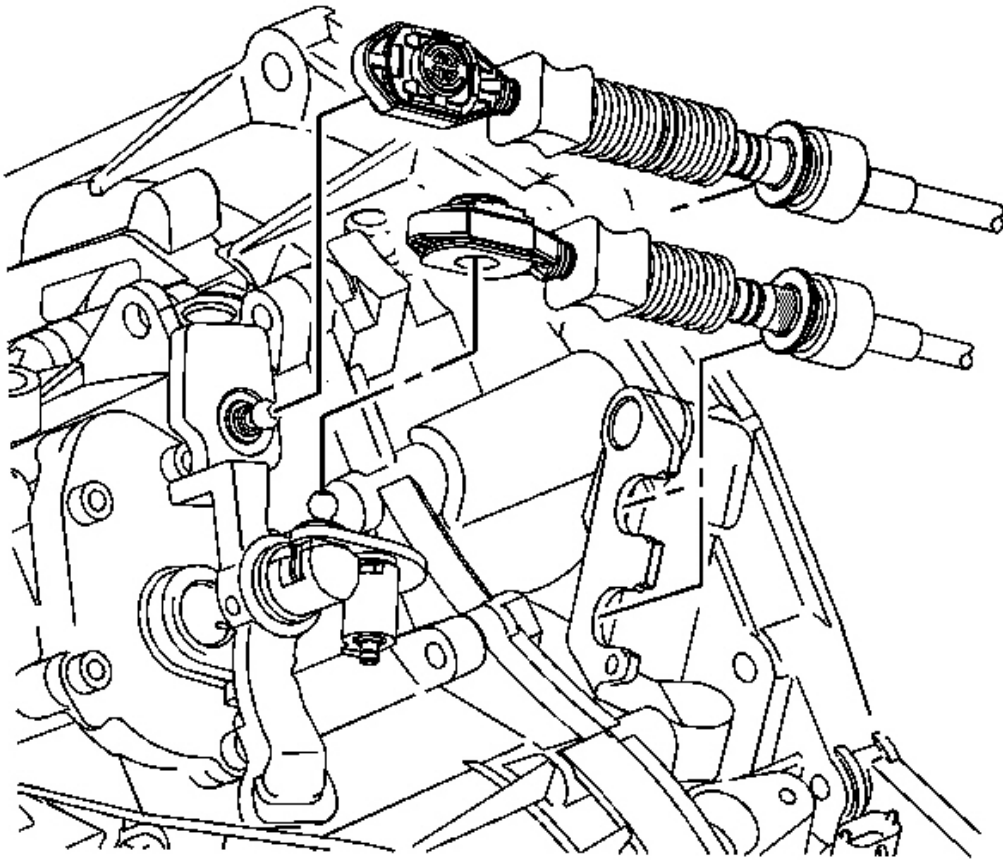


Fig. 77: Shift Cables & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

13. Connect the shift cable ends to the transaxle.

SHIFT CONTROL REPLACEMENT

Removal Procedure

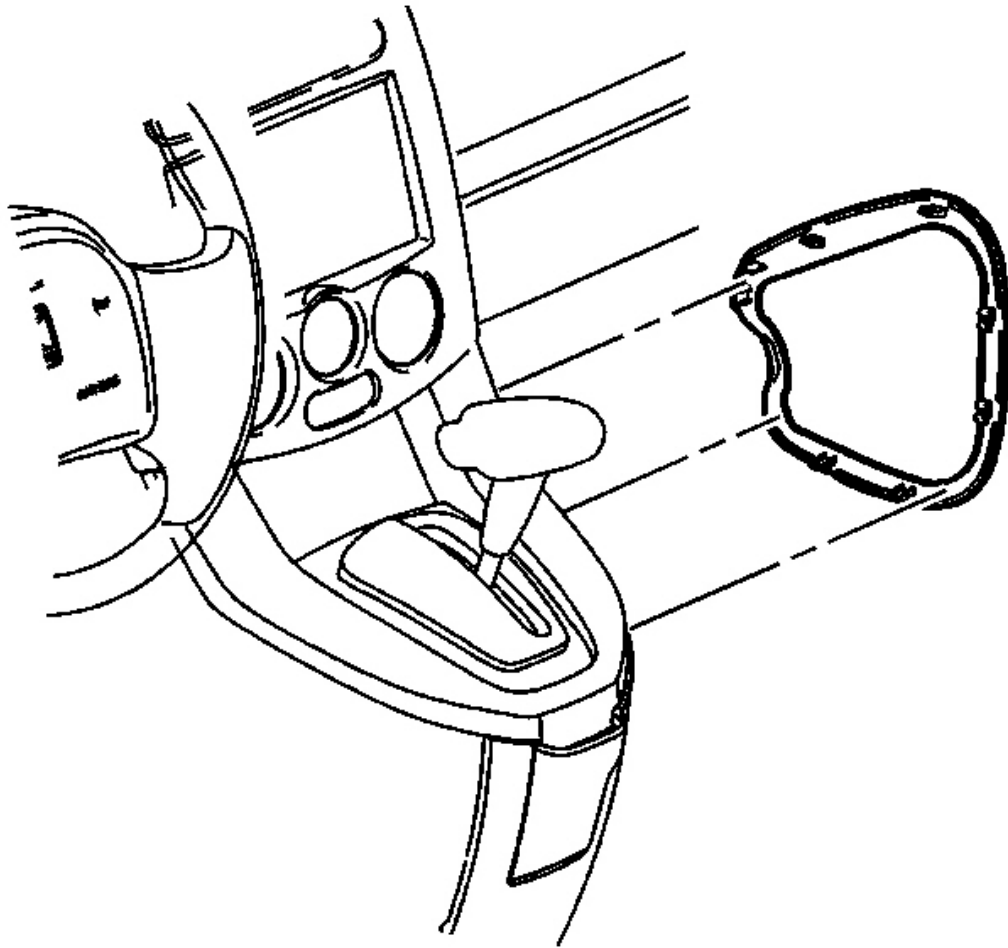


Fig. 78: Control Assembly Boot Trim
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the control assembly boot trim from the trim bezel.
2. Gently pry up the window switch trim bezel.

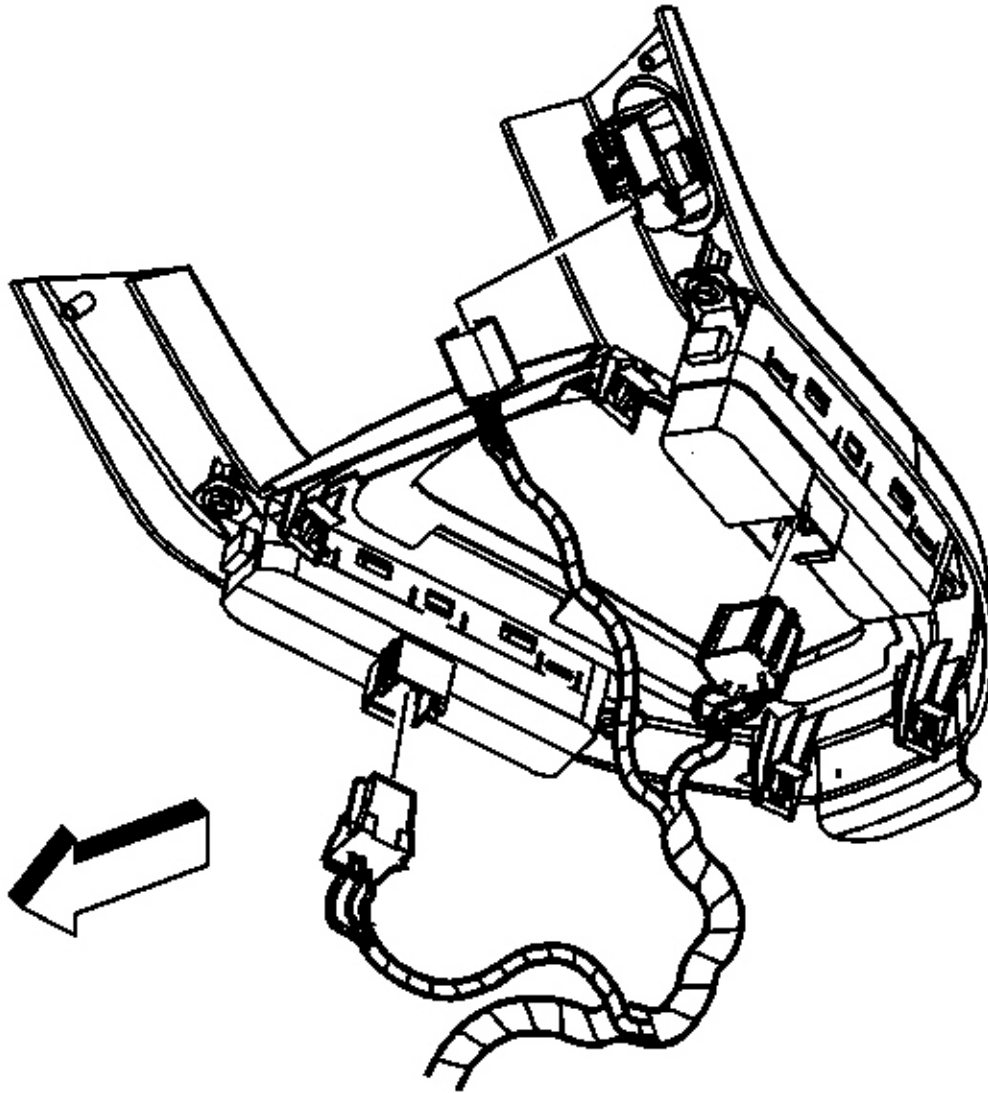


Fig. 79: Electrical Connectors & Window Switch Trim Bezel
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the electrical connectors from the window switch trim bezel and remove the bezel.

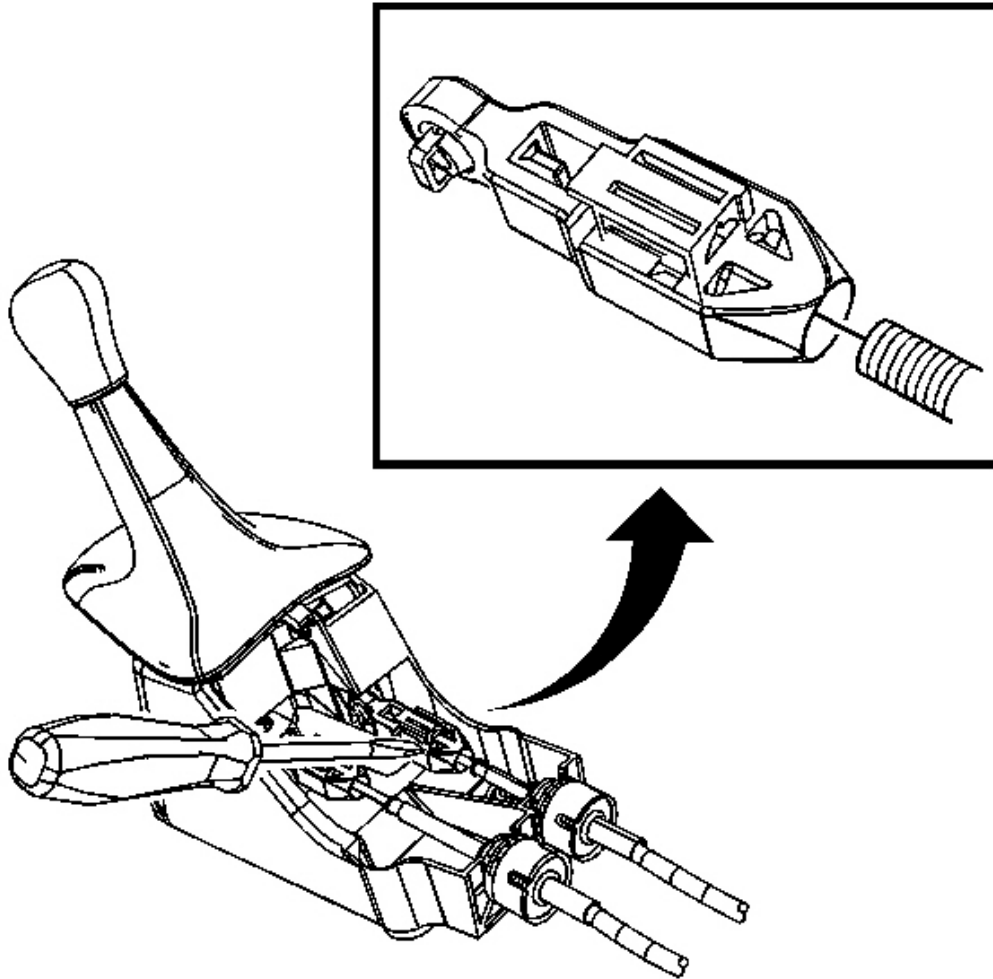


Fig. 80: Shift Cables & Control Lever Assembly Housing
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the shift cables from the shift cable adjusters.
5. Disconnect the shift cables from the control lever assembly housing by pressing the retainers together and lifting upward.

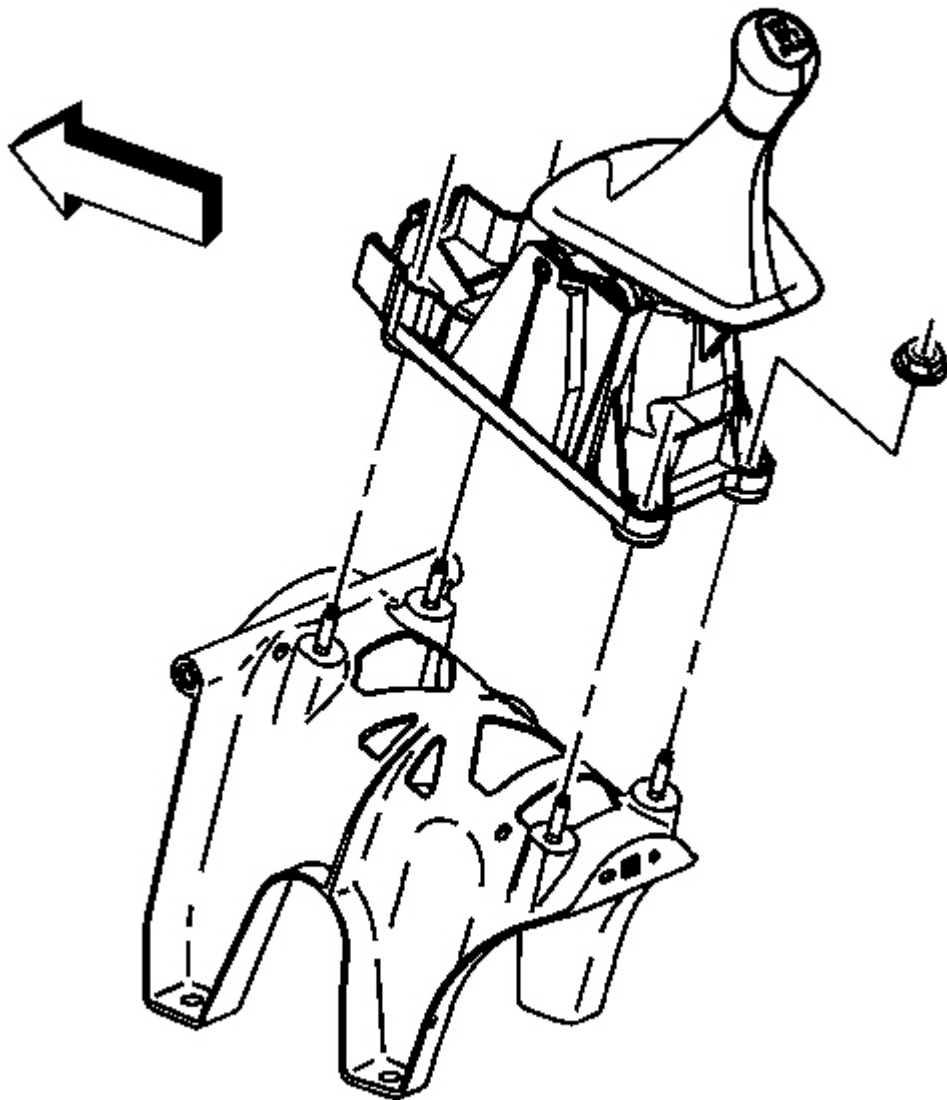


Fig. 81: Control Lever Assembly, Bracket & Nuts
Courtesy of GENERAL MOTORS CORP.

6. Remove the nuts retaining the control lever assembly to the control lever assembly bracket.

Installation Procedure

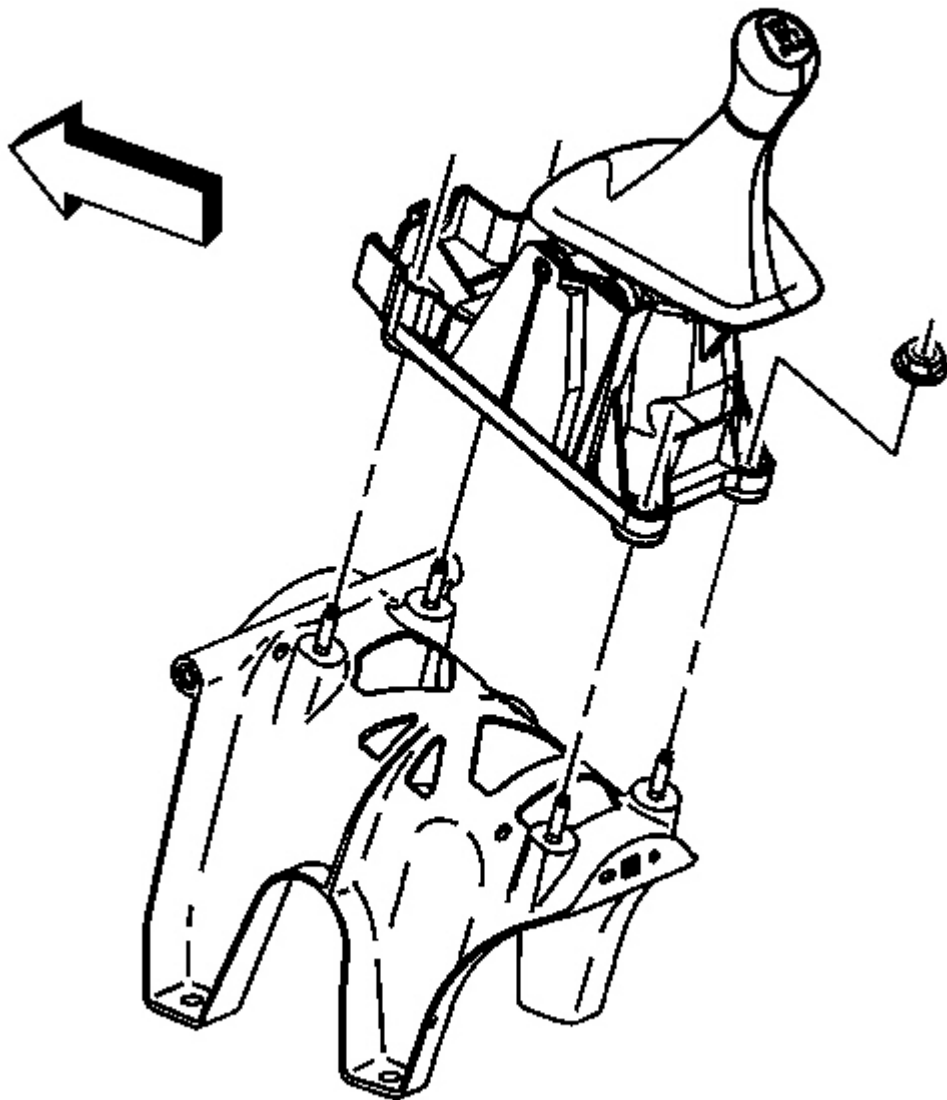


Fig. 82: Control Lever Assembly, Bracket & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the control lever assembly to the control lever assembly bracket.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the control lever nuts.

Tighten: Tighten the nuts to 25 N.m (18 lb ft).

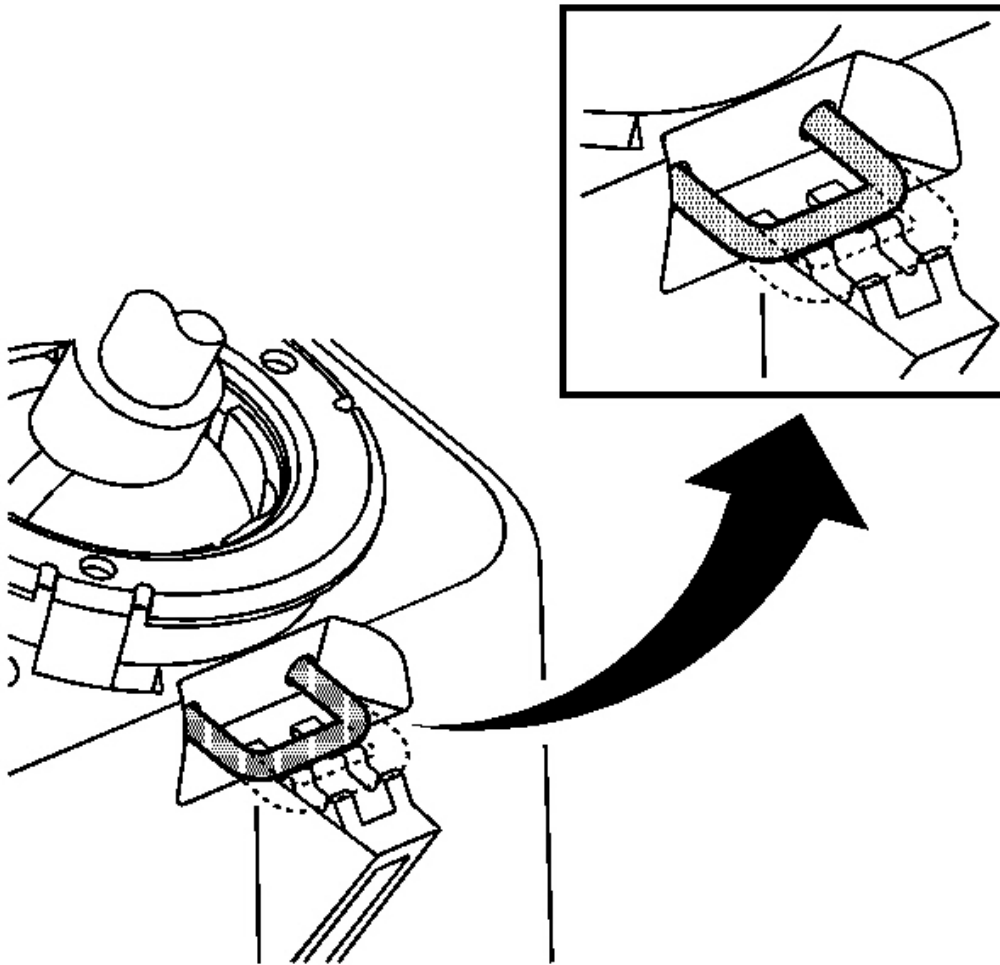


Fig. 83: Pulling The Shifter Neutral Lock Clip To Original Position
Courtesy of GENERAL MOTORS CORP.

3. Connect the shift cables to the control lever assembly.
4. With the shift cable ends in the adjusters, adjust the cables by pushing the shifter neutral lock clip. Move the shifter slightly to center the lock clip.

IMPORTANT: Ensure the transaxle is in NEUTRAL.

5. Press and lock the shift cable retainers.

6. Pull the shifter neutral lock clip to the original position.

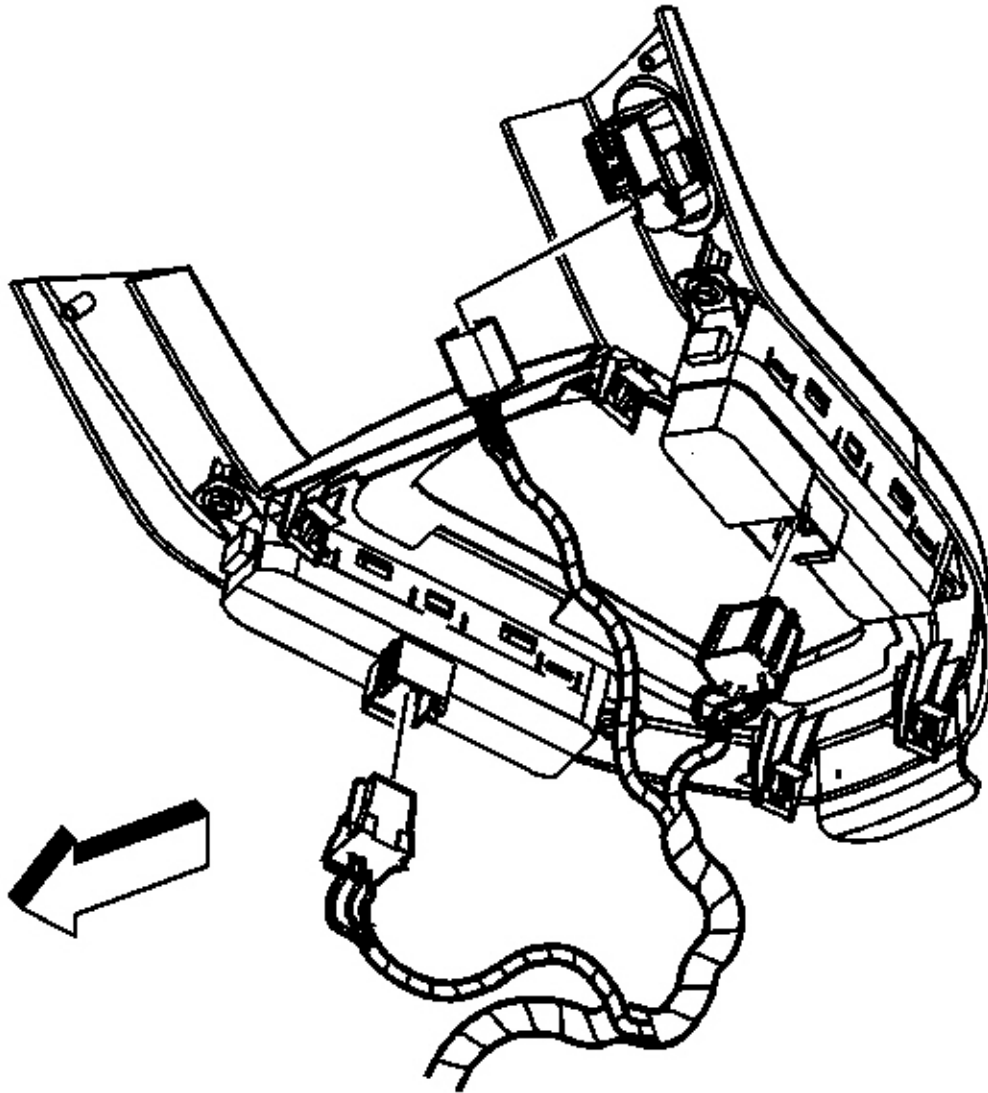


Fig. 84: Electrical Connectors & Window Switch Trim Bezel
Courtesy of GENERAL MOTORS CORP.

7. Connect the electrical connectors.
8. Connect the shift cables to the control lever assembly.
9. Install the trim bezel.

10. Install the control assembly boot to the trim bezel.

BACKUP LAMP SWITCH REPLACEMENT

Removal Procedure

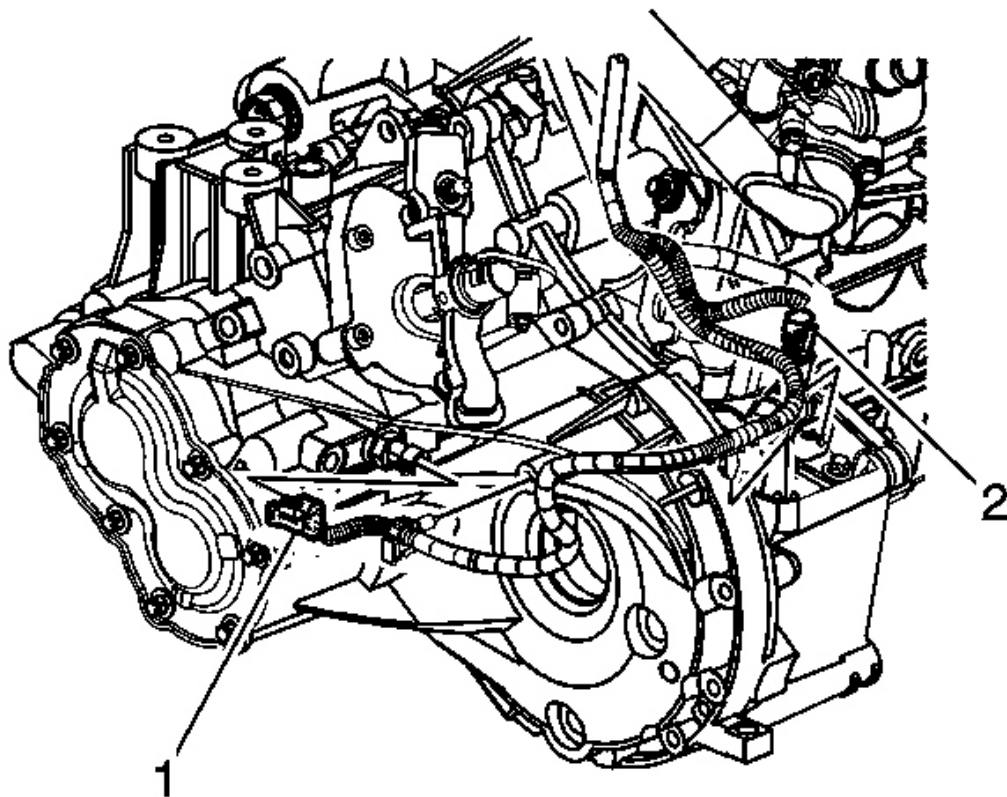


Fig. 85: Front Wheel Speed Sensor VSS Electrical Connector
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Disconnect the backup lamp switch electrical connector (1).

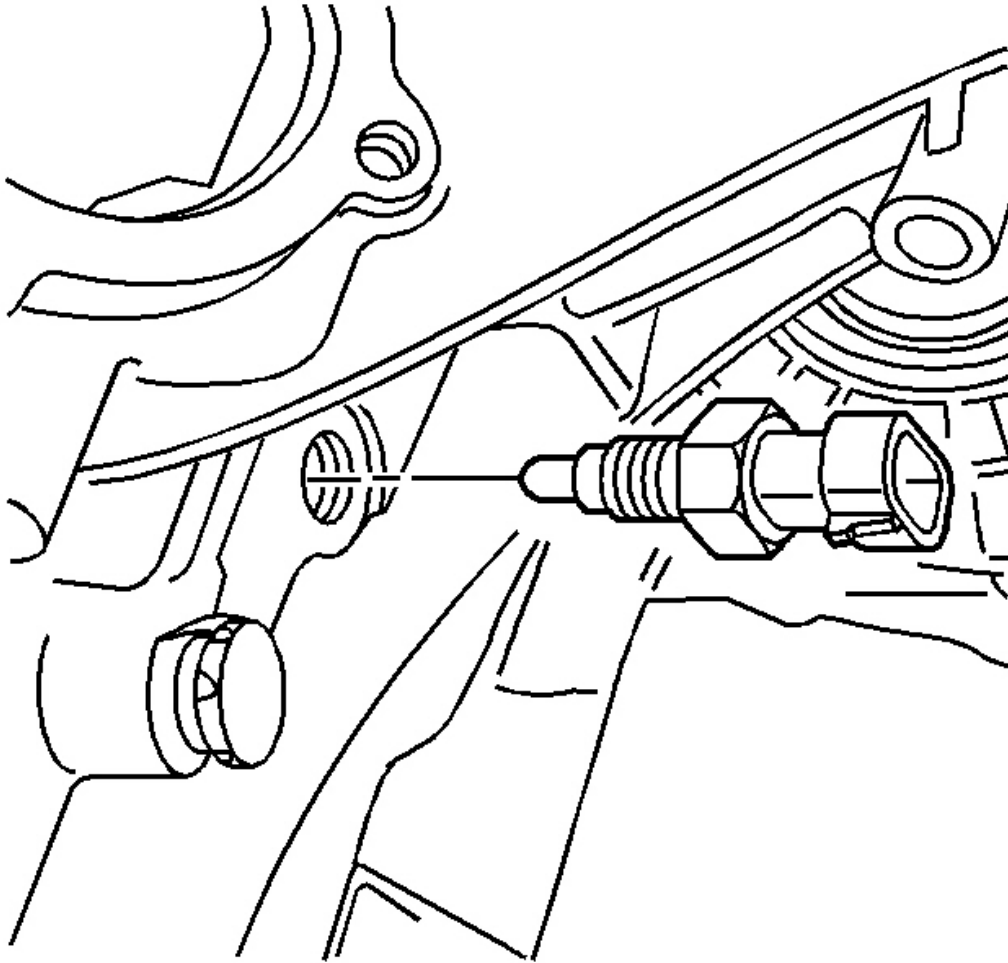


Fig. 86: Backup Lamp Switch
Courtesy of GENERAL MOTORS CORP.

3. Remove the backup lamp switch from the transaxle.

Installation Procedure

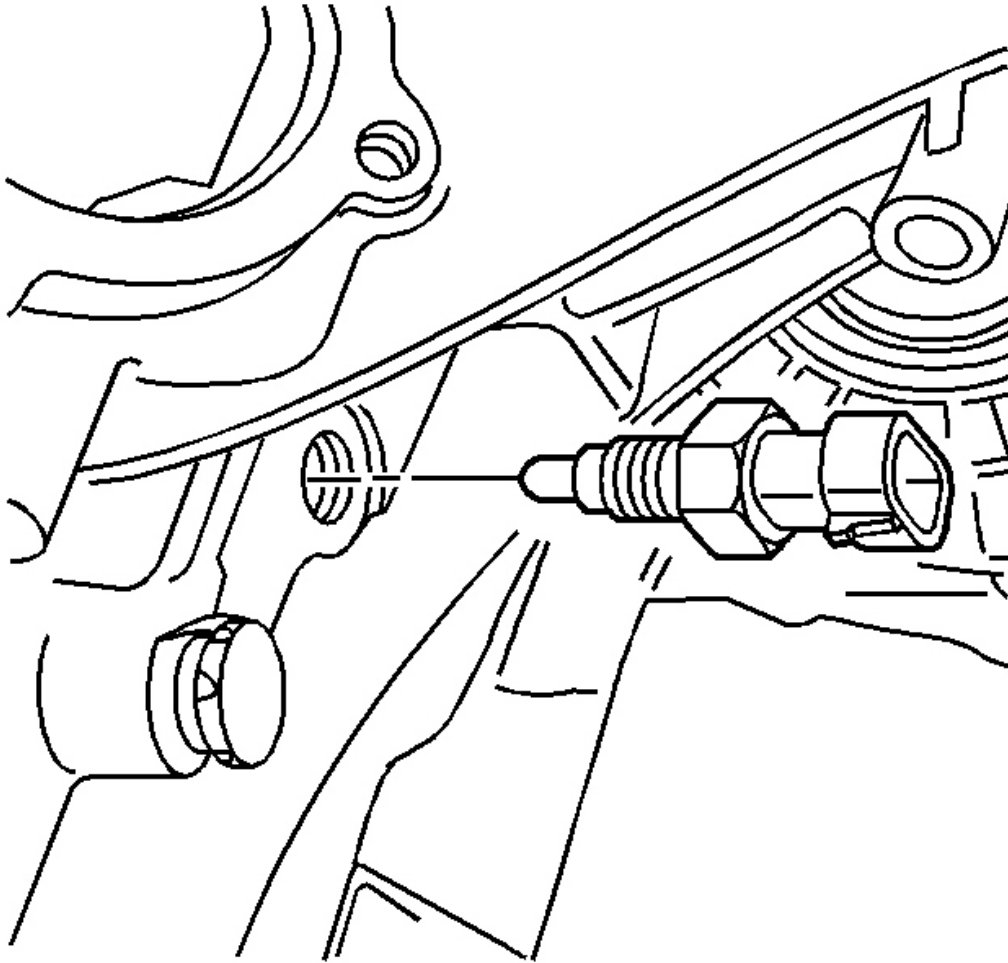


Fig. 87: Backup Lamp Switch
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the backup lamp switch.

Tighten: Tighten the switch to 18 N.m (13 lb ft).

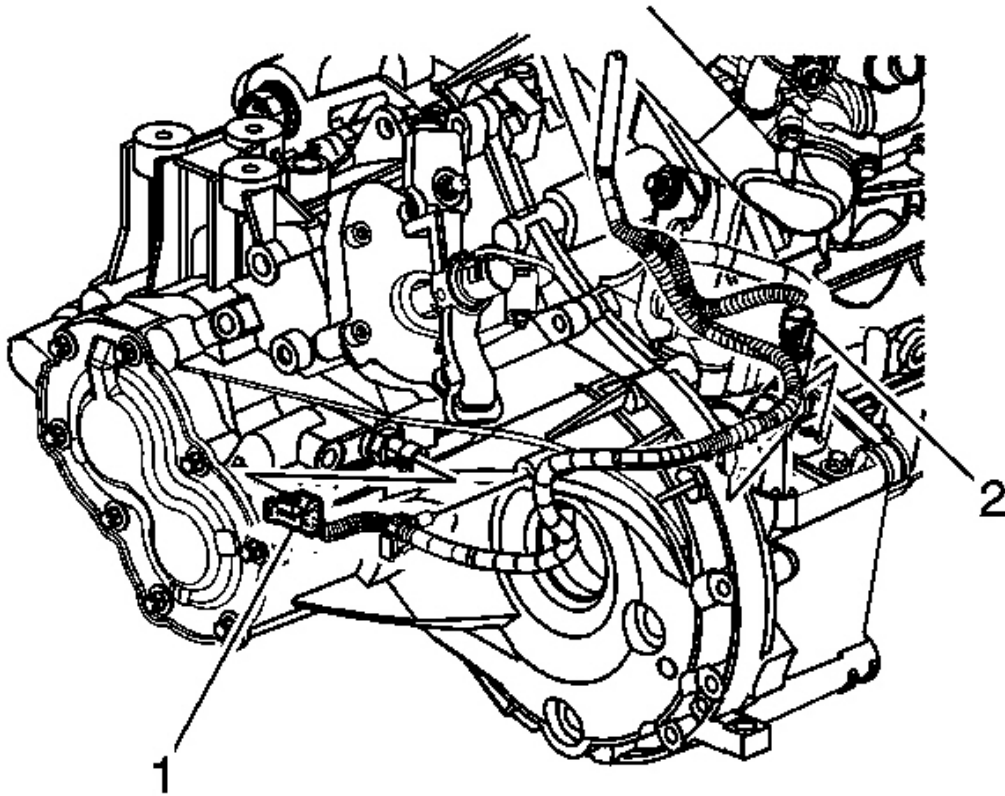


Fig. 88: Front Wheel Speed Sensor VSS Electrical Connector
Courtesy of GENERAL MOTORS CORP.

2. Connect the backup lamp switch electrical connector (1).
3. Lower the vehicle.

REAR COVER REPLACEMENT

Removal Procedure

1. Remove the left front wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels

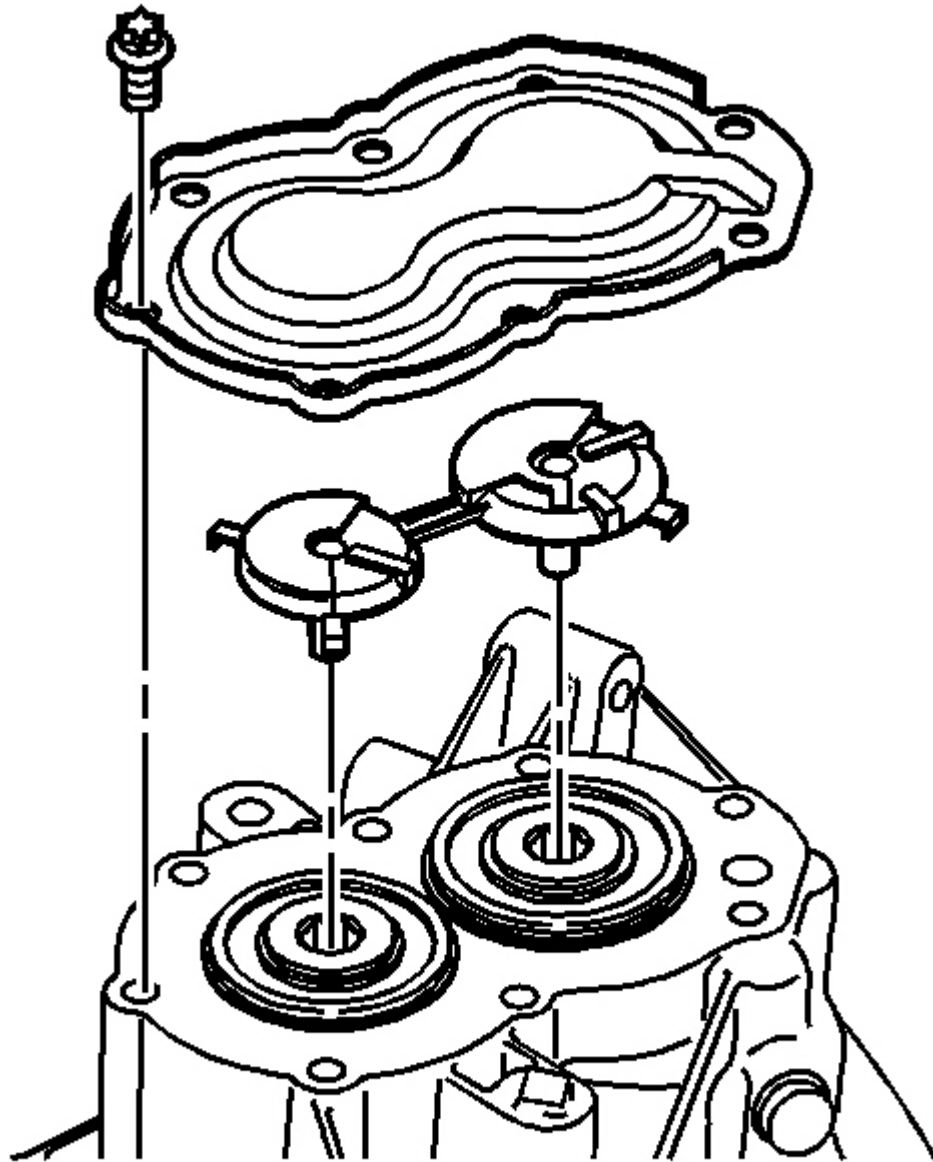


Fig. 89: Rear Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

2. Remove the rear cover bolts.
3. Remove the rear cover.
4. Inspect the oil guide for damage and replace as necessary.

Installation Procedure

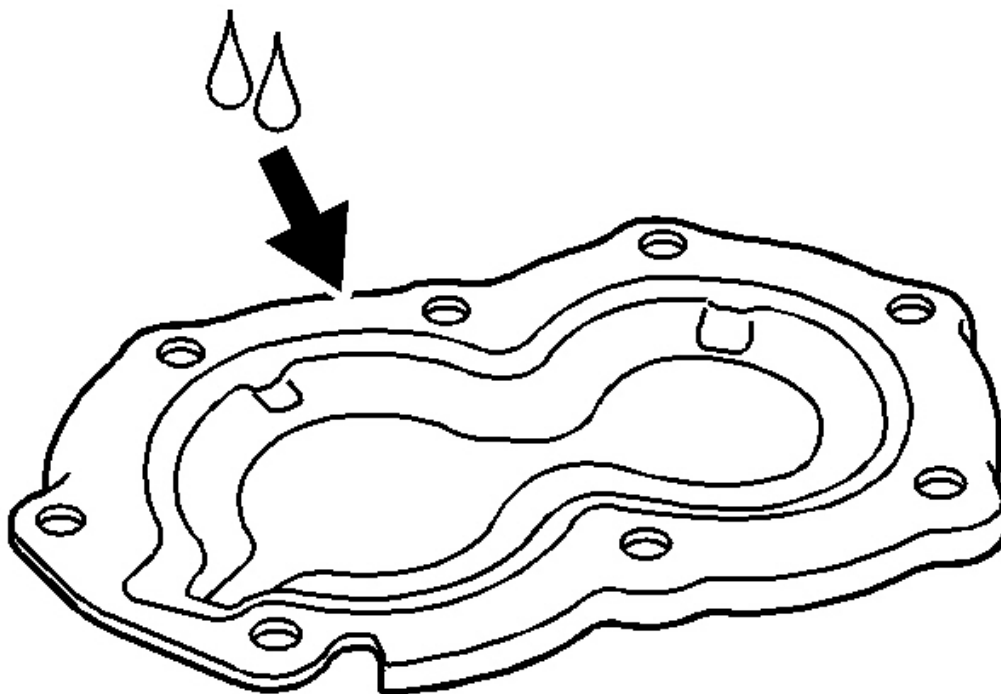


Fig. 90: Installing Sealant To Rear Cover
Courtesy of GENERAL MOTORS CORP.

1. Install sealant Saturn P/N 21019581 to the rear cover.

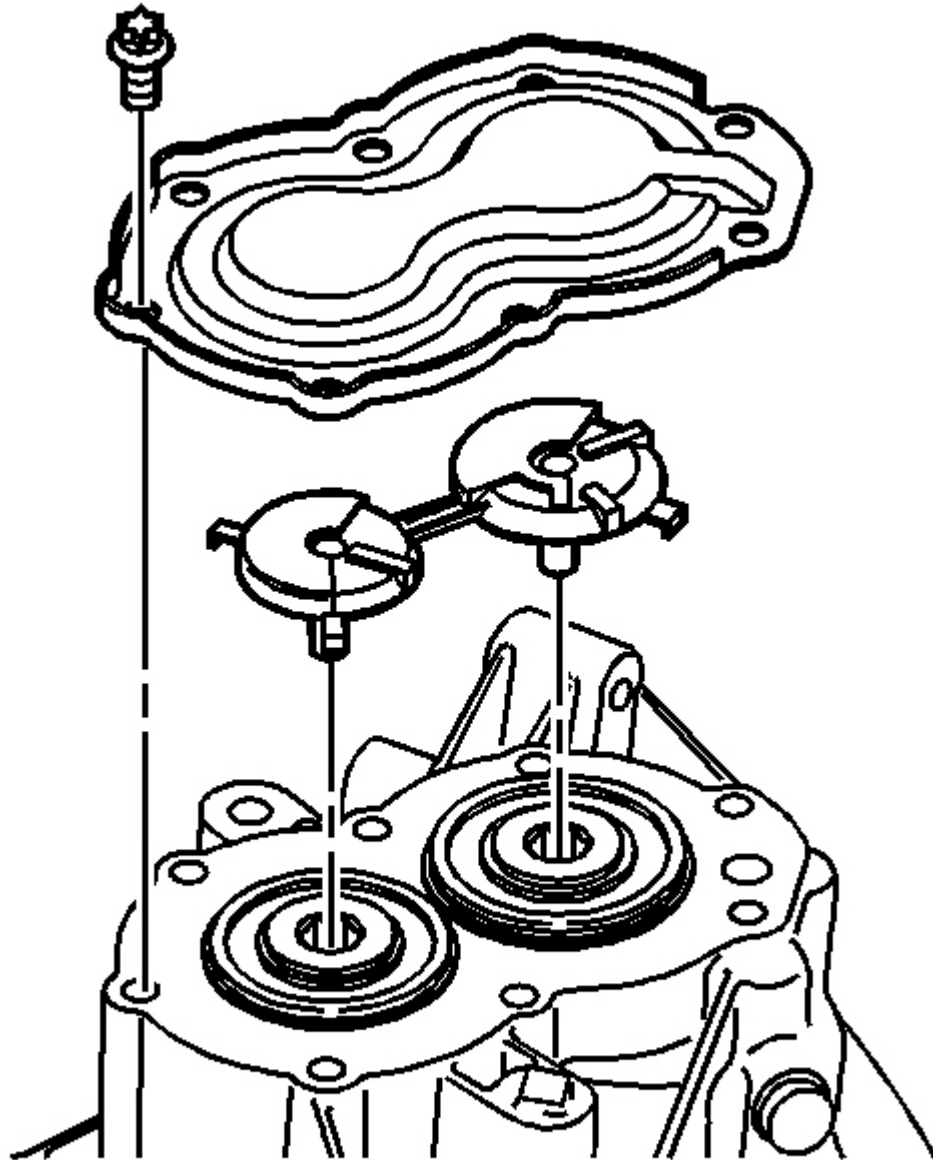


Fig. 91: Rear Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The oil guide only installs in one direction. Ensure the oil guide is completely seated in the gear shafts.

2. Install the oil guide.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the rear cover.

Tighten: Tighten the rear cover bolts to 25 N.m (18 lb ft).

4. Install the left front wheel. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.

SHIFT CONTROL ASSEMBLY REPLACEMENT

Tools Required

J 36346 Fascia Retainer Remover

Removal Procedure

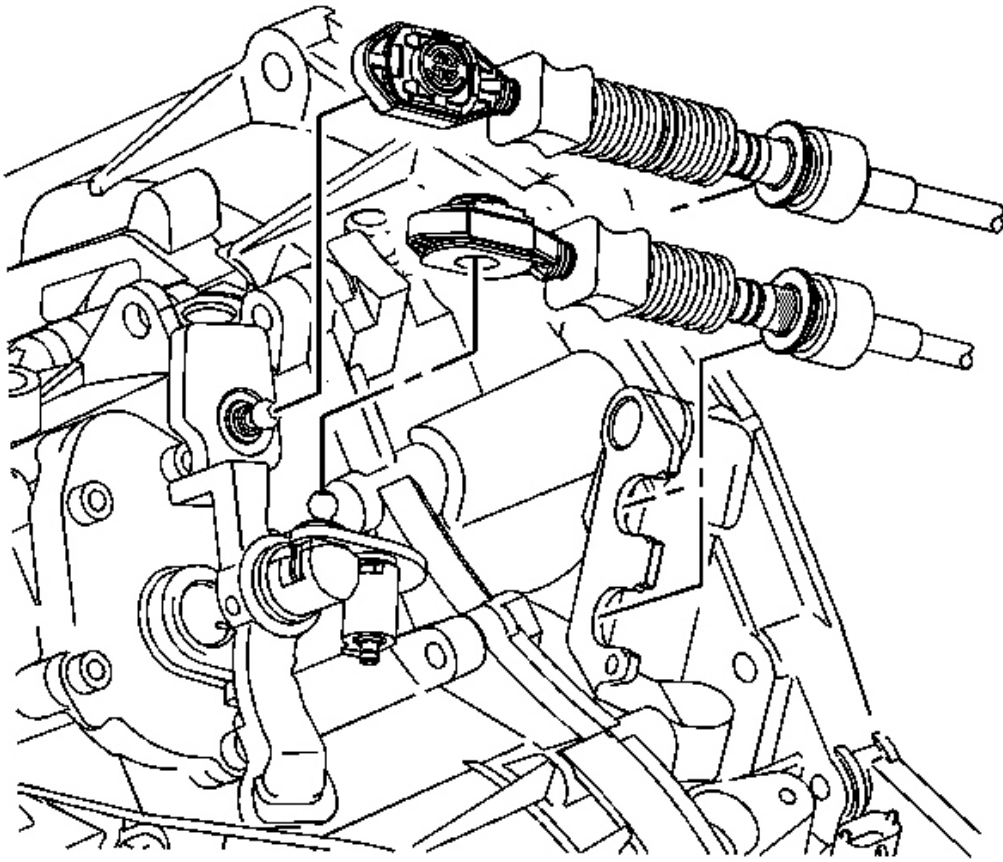


Fig. 92: Shift Cables & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

1. Using the **J 36346** or equivalent, disconnect the shift cable ends from the transaxle by prying on both sides with even pressure.
2. Disconnect the shift cables from the shift cable bracket. Discard the shift cable retaining clips.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
4. Remove the wheel.
5. Remove the left inner splash shield.

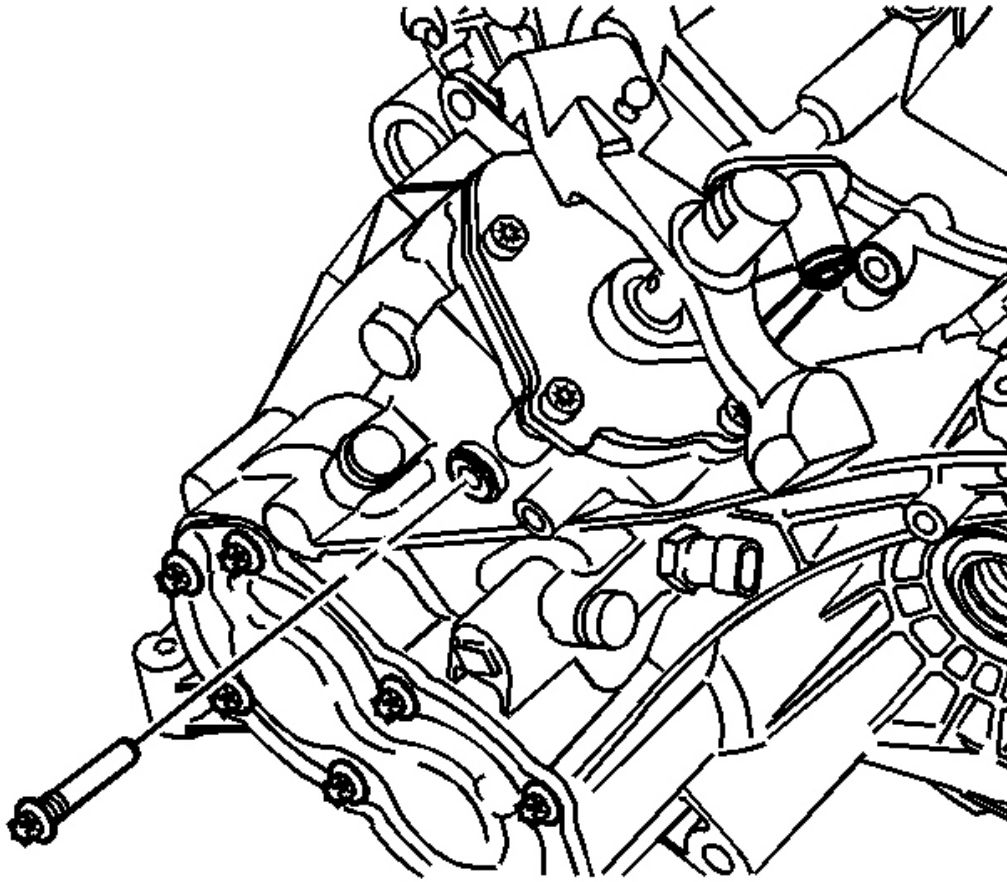


Fig. 93: Shifter Guide Bolt
Courtesy of GENERAL MOTORS CORP.

6. Shift the transmission into NEUTRAL.
7. Remove the shifter guide bolt.

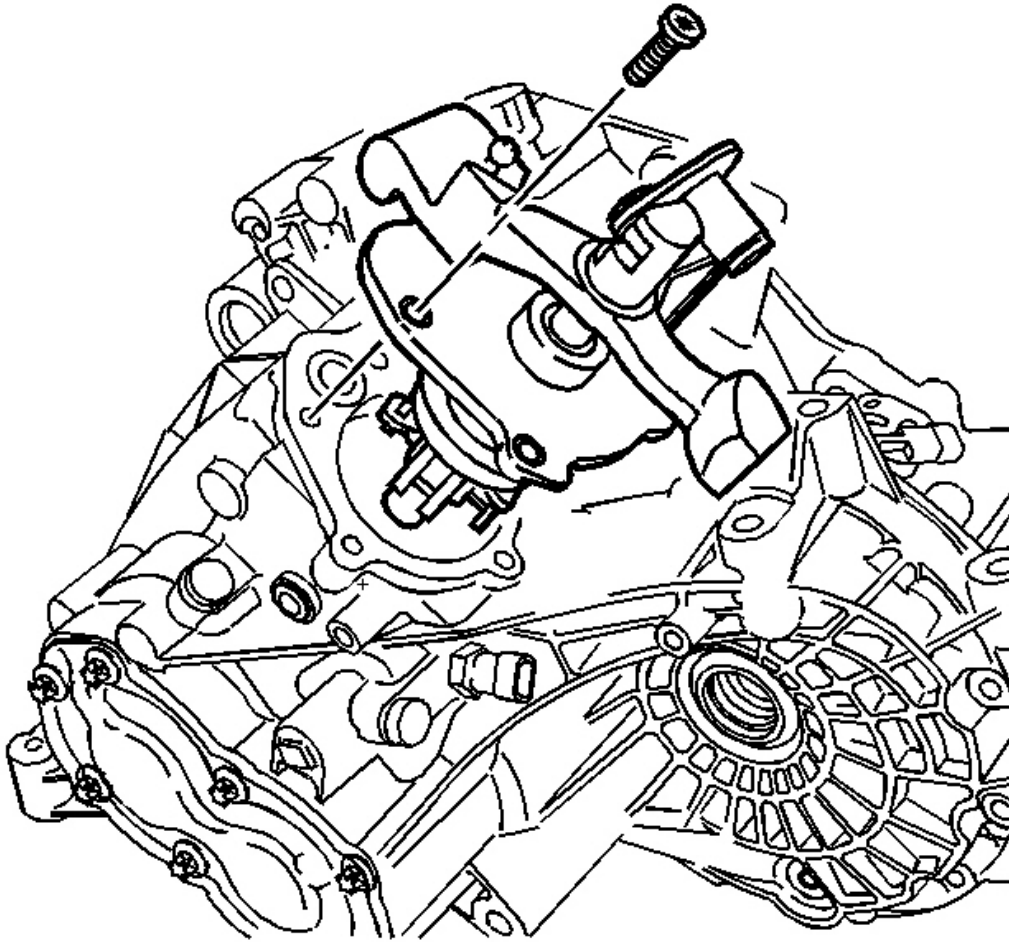


Fig. 94: Shifter Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the shifter retaining bolts.
9. Remove the shifter.

Installation Procedure

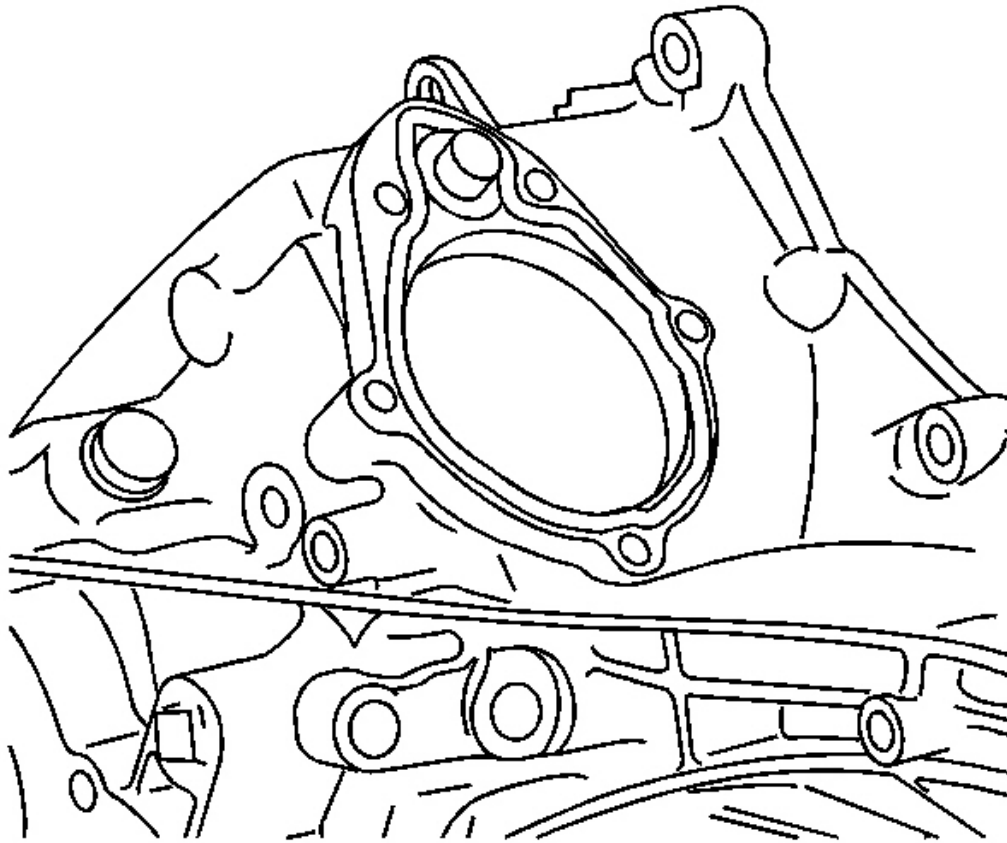


Fig. 95: Transaxle Case & Shifter Cover Mating Surface
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure there is not any excessive sealer around the shift rod bushing.

1. Apply sealer P/N 12378516 to the transaxle case to shifter cover mating surface.

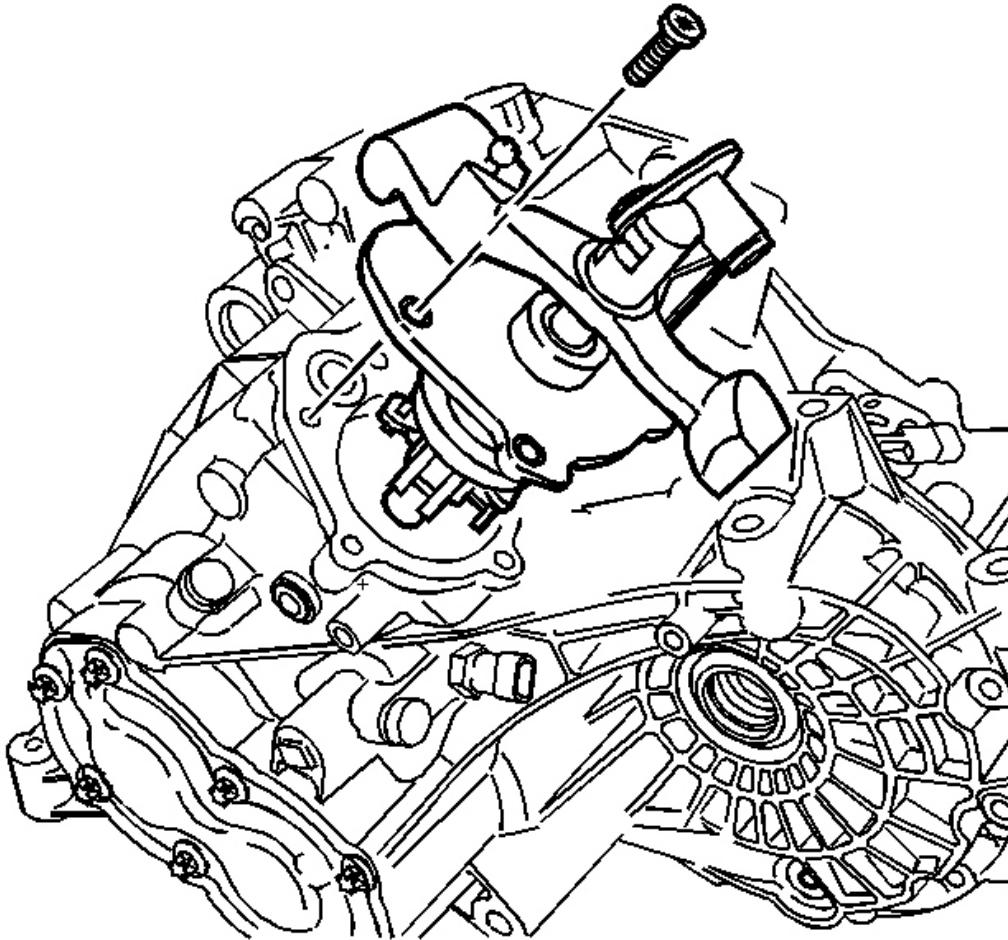


Fig. 96: Shifter Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Install all possible shifter bolts with the shifter in NEUTRAL. Install the last shifter bolt with the shifter in gear, then shift back into NEUTRAL.

2. Install the shifter.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the shifter retaining bolts.

Tighten: Tighten the bolts to 25 N.m (18 lb ft).

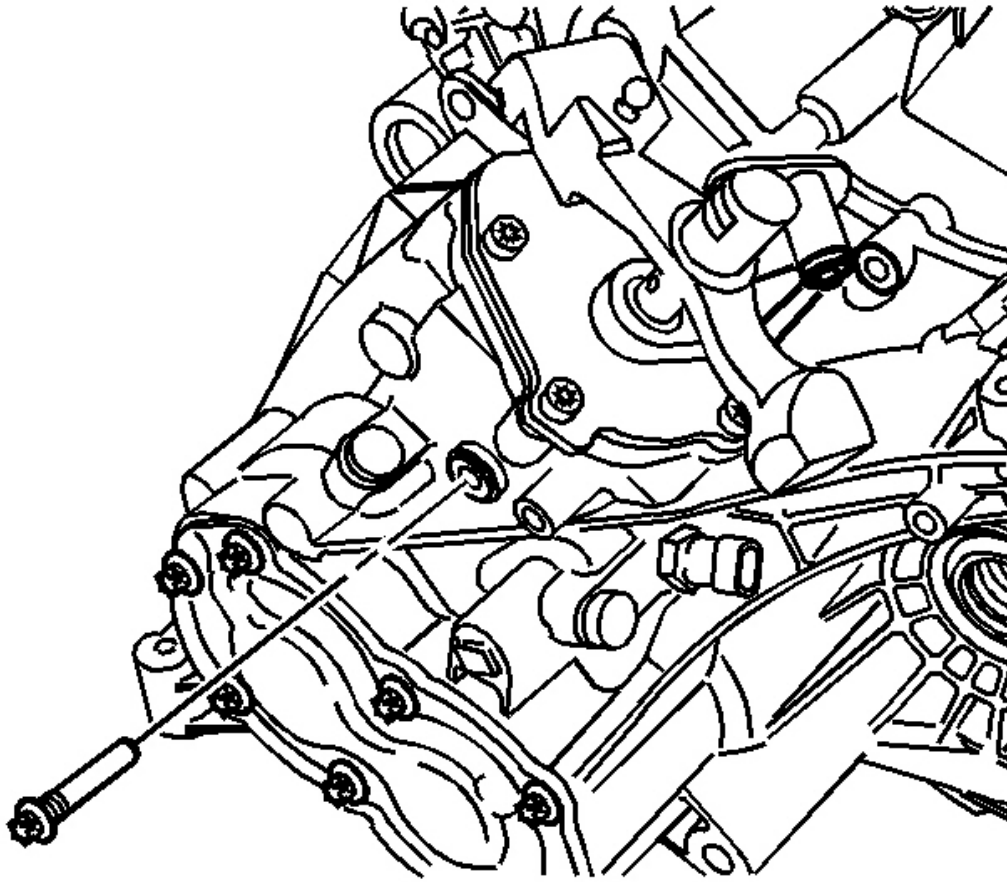


Fig. 97: Shifter Guide Bolt
Courtesy of GENERAL MOTORS CORP.

4. Ensure the transaxle is in NEUTRAL.
5. Apply P/N 21485278 to the shifter guide bolt.

NOTE: Hand start and tighten the shifter guide bolt to avoid damaging the shift lever.

6. Install the shifter guide bolt.

Tighten: Tighten the bolt to 25 N.m (18 lb ft).

7. Install the left inner splash shield.

8. Install the wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

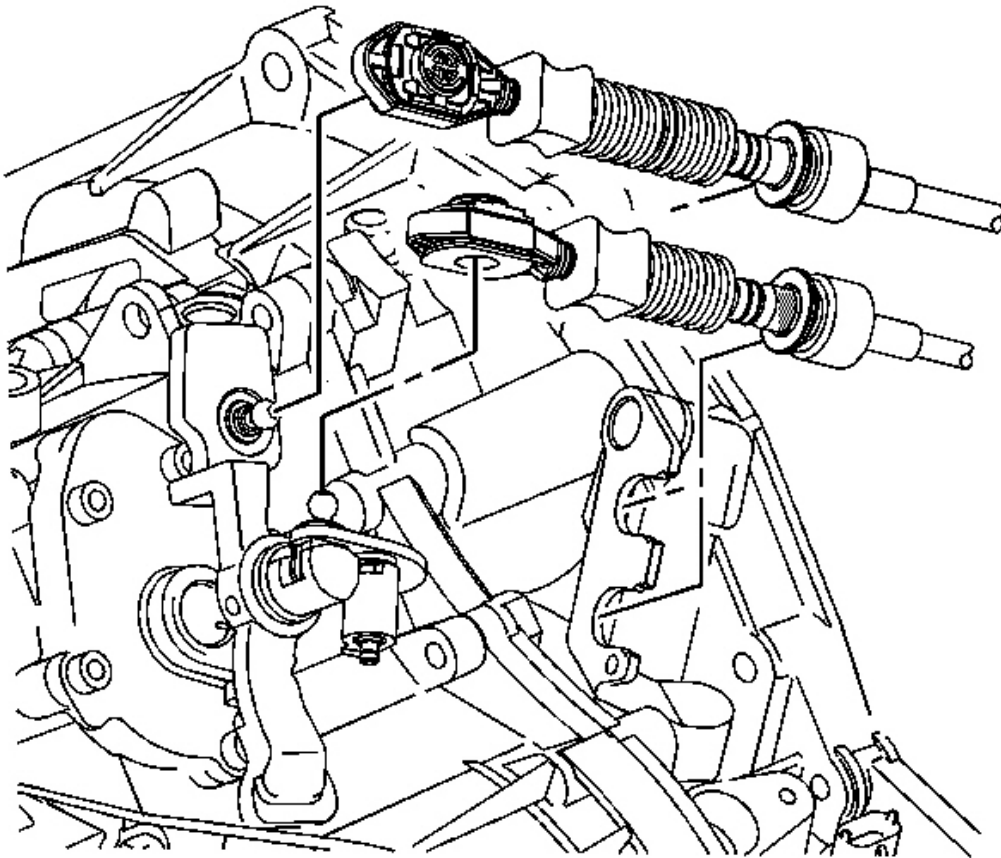


Fig. 98: Shift Cables & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: New cable clips must be used to ensure proper retention.

9. Connect the shift cables to the shift cable bracket.
10. Connect the shift cable ends to the transaxle.
11. Lower the vehicle.

TRANSMISSION REPLACEMENT

Tools Required

- **J 36346** Fascia Retainer Remover
- **J 43405** Engine Support Fixture Adapter
- **J 44015** Steering Linkage Installer
- **J 44017** Stub Shaft Assembly Remover
- **J 45341** Rear Wheel Drive Shaft Removal Tool
- **SA9105E** Engine Support Fixture - 3-Bar
- **SA9133T** Axle Seal Puller
- **SA9173G** Slide Hammer
- **SA91100C** Tie Rod Separator
- **SA91112T** Axle Seal Protector

Removal Procedure

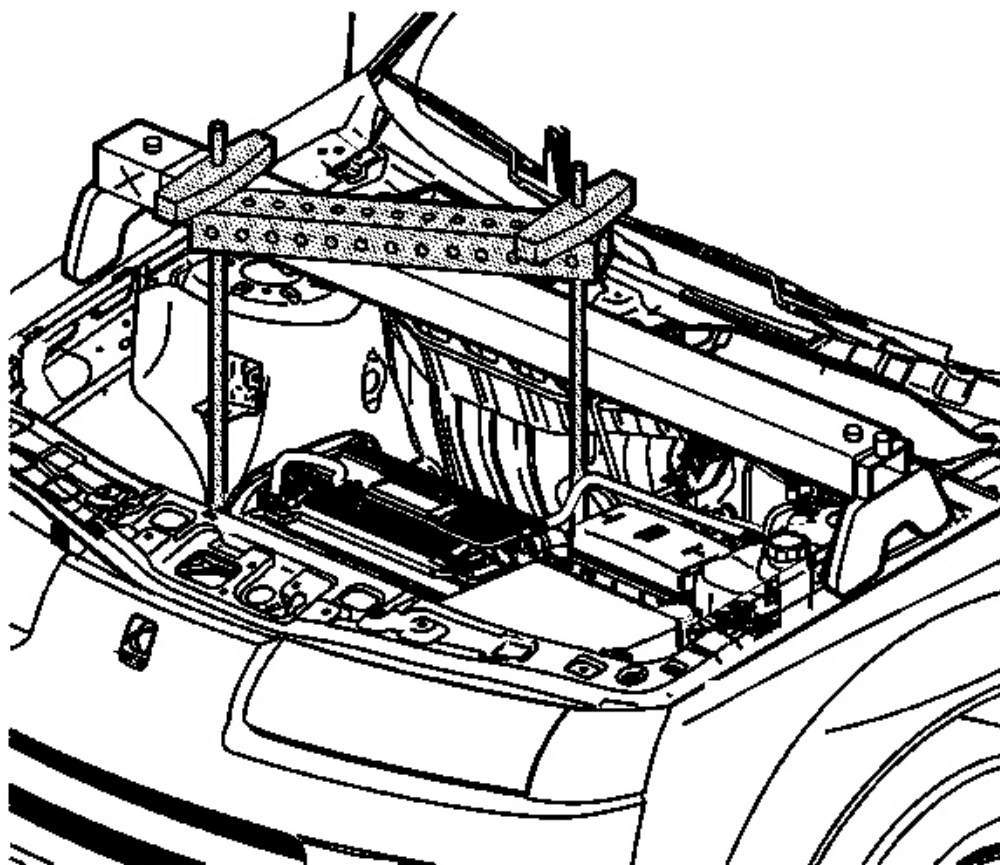


Fig. 99: SA9105E & J 43405

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Record all pre-set radio stations.

1. Turn the ignition off.
2. Remove the battery cover.

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

3. Disconnect the negative battery cable.
4. Install the **SA9105E** and the **J 43405** .

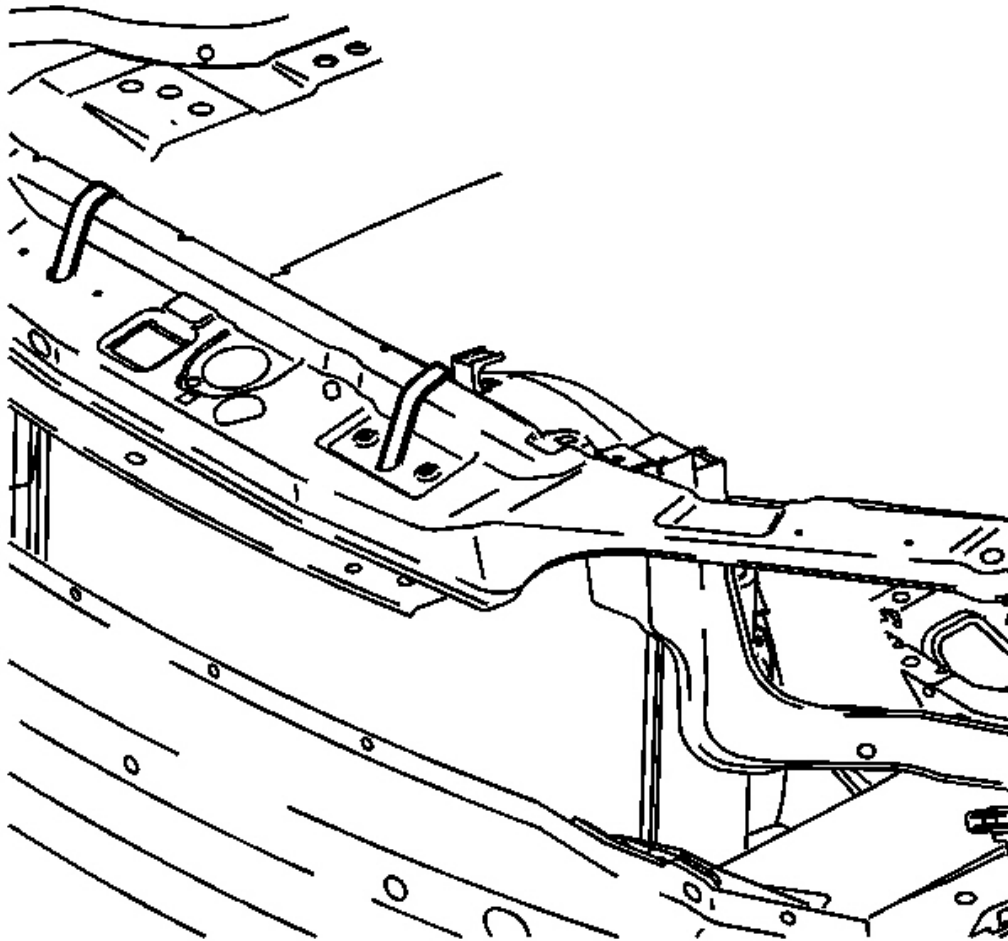


Fig. 100: Radiator & Upper Radiator Support
Courtesy of GENERAL MOTORS CORP.

5. Fasten the radiator to the upper radiator support.
6. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

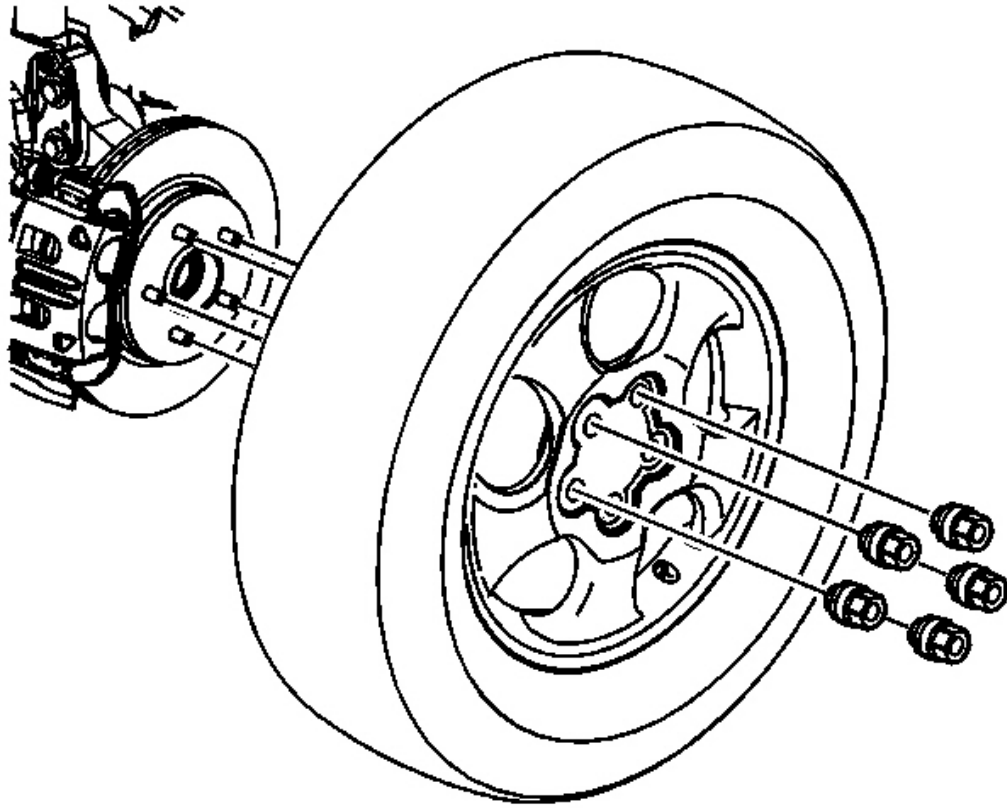


Fig. 101: Left Inner Splash Shield & Ball Joints
Courtesy of GENERAL MOTORS CORP.

7. Remove the wheels.
8. Remove the left inner splash shield.
9. Remove the ball joints.

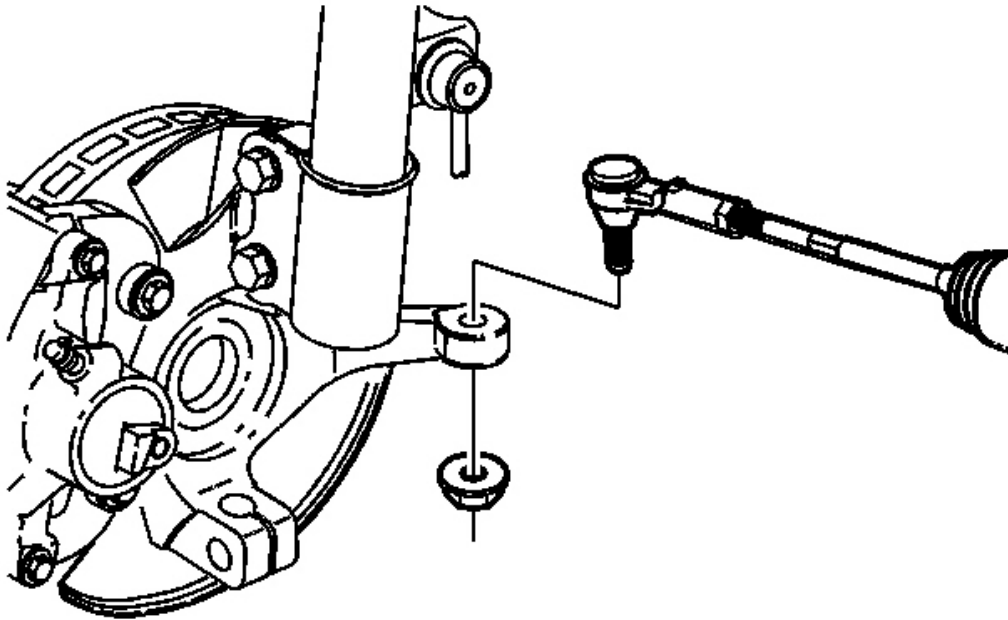


Fig. 102: Tie Rod Outer & Knuckle Nut
Courtesy of GENERAL MOTORS CORP.

10. Remove the tie rod outer to the knuckle nut.

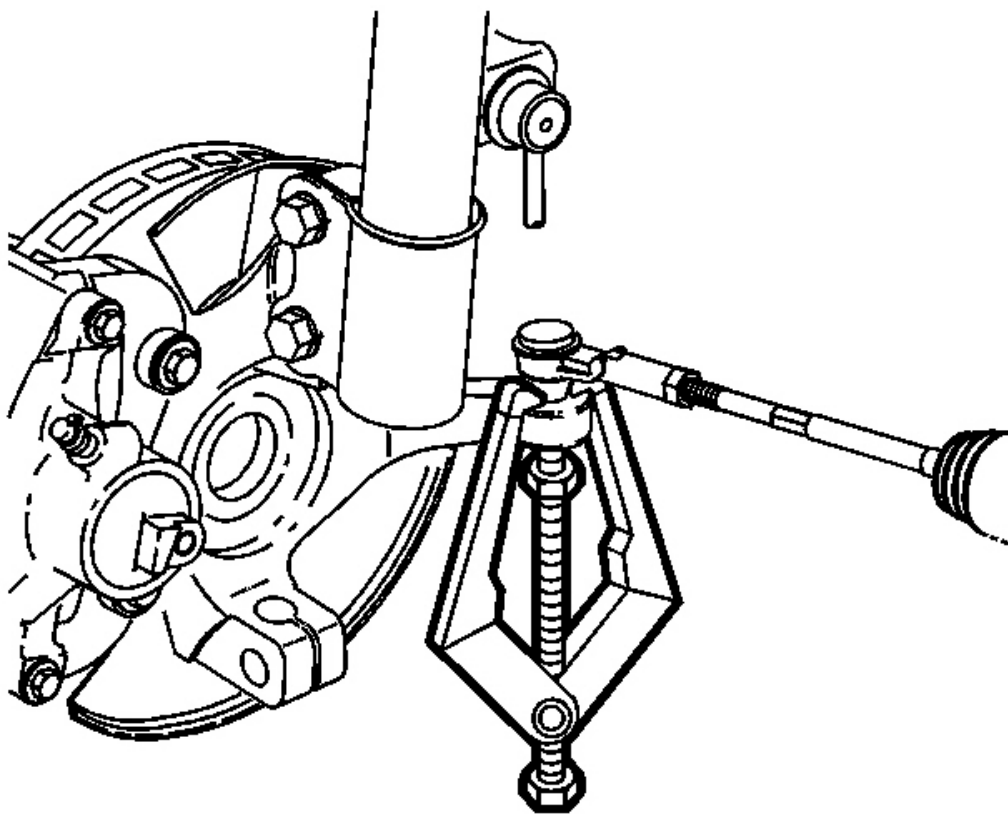


Fig. 103: Separating Tie Rod From Knuckle Using SA91100C
Courtesy of GENERAL MOTORS CORP.

NOTE: Hold the ball stud from turning when removing/installing the nut. The boot can become torn and damaged if the ball stud turns.

NOTE: Do not attempt to separate the joint using a wedge-type tool because seal may be damaged.

11. Using the SA91100C or equivalent, separate the tie rod from the knuckle.

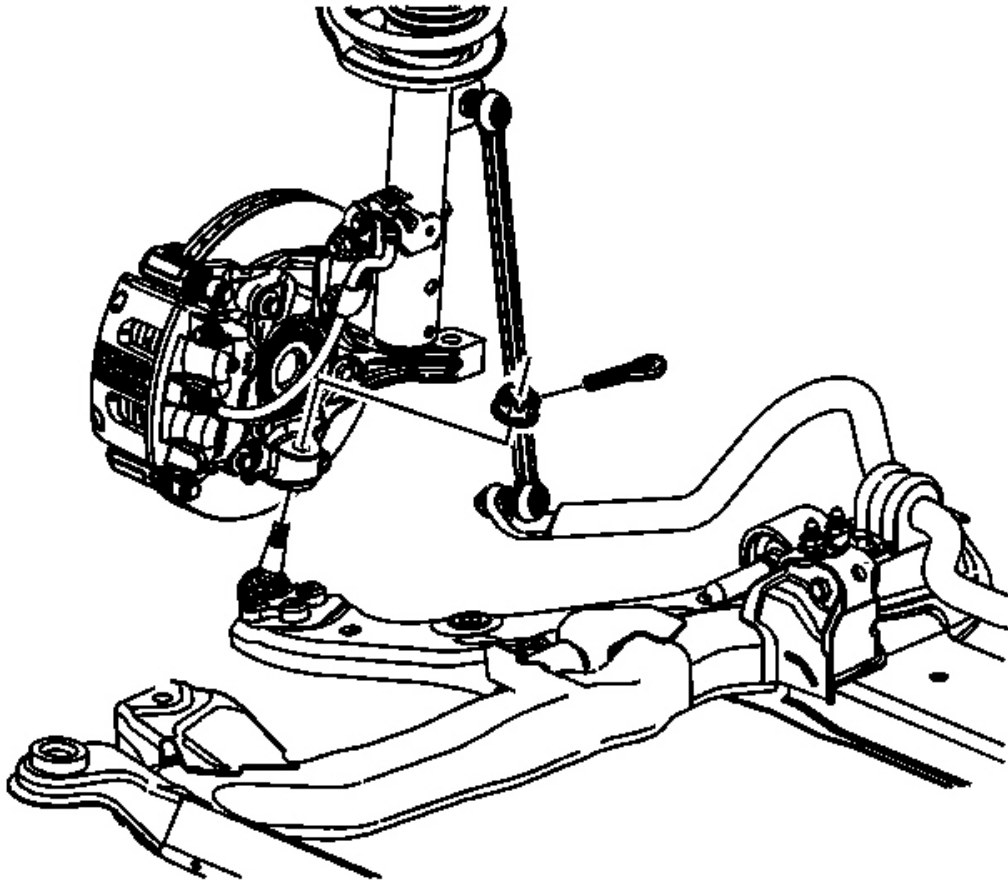


Fig. 104: Lower Control Arm Ball Stud, Cotter Pin & Nut
Courtesy of GENERAL MOTORS CORP.

12. Remove the lower control arm ball stud cotter pin and nut. Discard the pin.

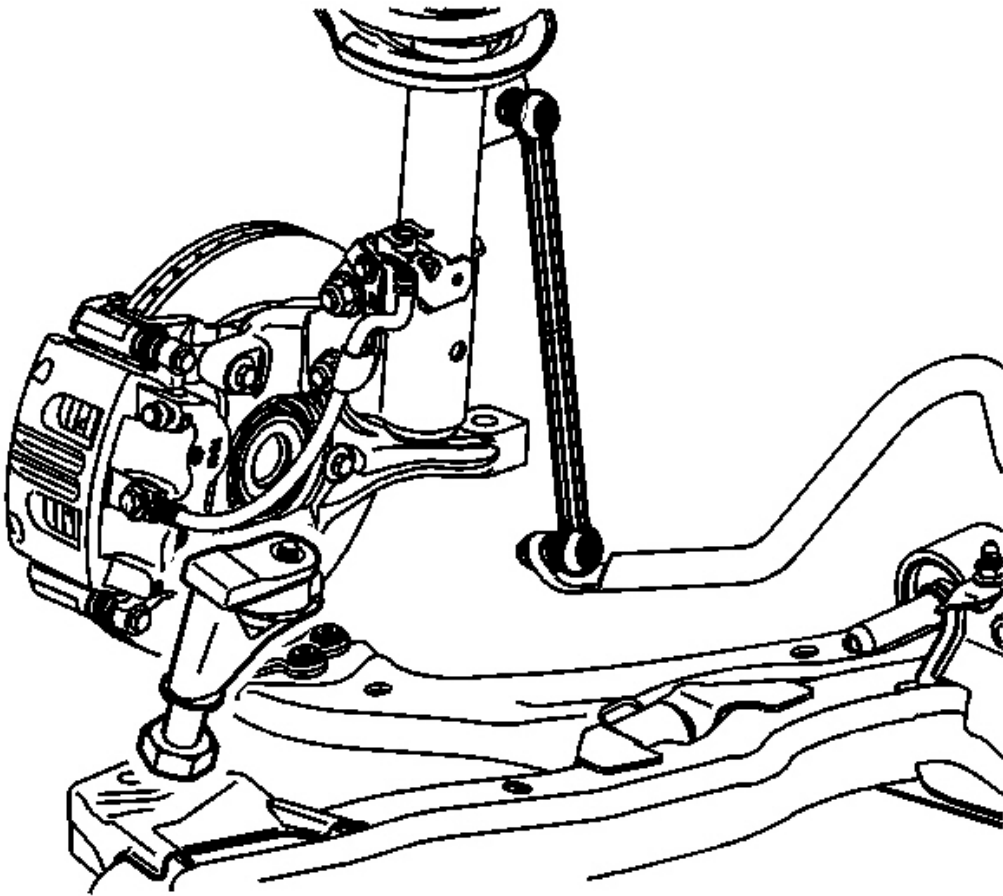


Fig. 105: Ball Stud & Knuckle
Courtesy of GENERAL MOTORS CORP.

13. Disengage the ball stud from the knuckle.

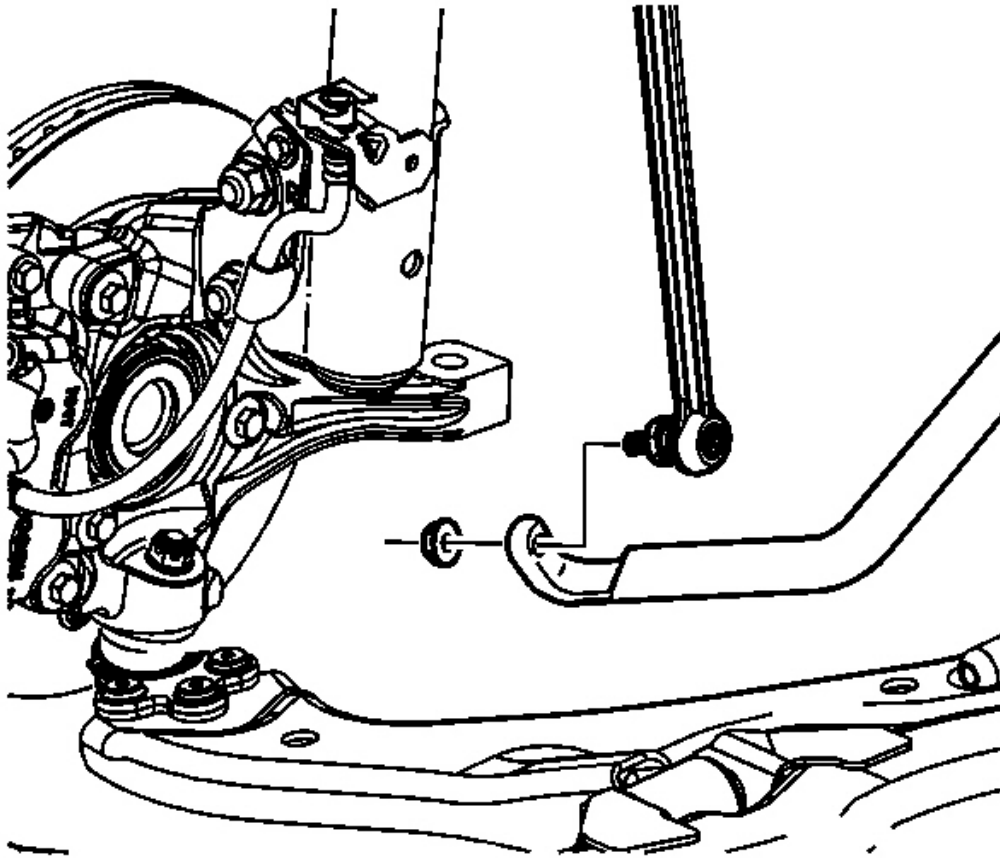


Fig. 106: Lower Stabilizer Bar Links & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not allow the stud to rotate. Secure the link stud with a wrench in order to remove the nut.

14. Remove the lower stabilizer bar links.
15. Remove the steering gear from the steering column assembly.
 1. Remove the rear transaxle mount-to-cradle bolts.
 2. Remove the rear transaxle mount bracket-to-transaxle bolts.
16. Remove the front lower mount through bolt from the cradle.

IMPORTANT: The front air dam deflector stays connected to the cradle.

17. Remove the front air dam deflector from the body.
18. Place a jack under the cradle and remove the cradle bolts.
19. Carefully remove the cradle from the vehicle.

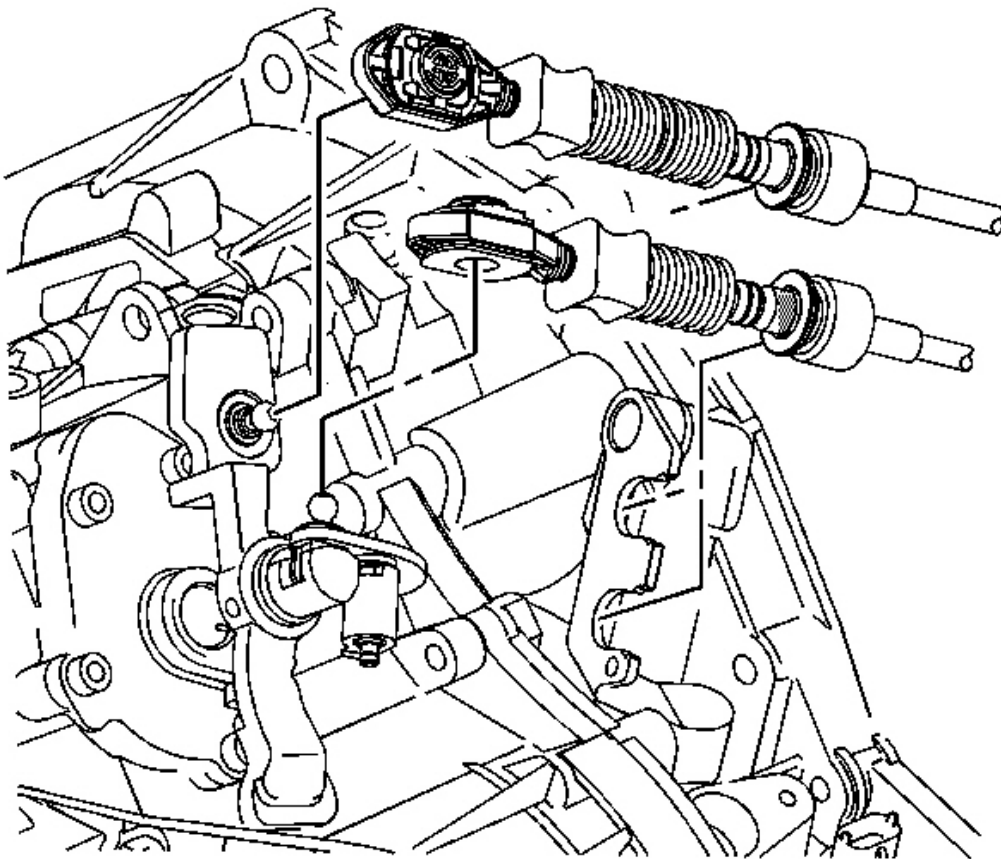


Fig. 107: Shift Cables & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not use too much force when disconnecting the shift cables or damage may result.

20. Using the **J 36346** or equivalent, disconnect the shift lever cables from the shift control housing by prying with even pressure.
21. Disconnect the shift lever cables from the shift lever cable bracket.

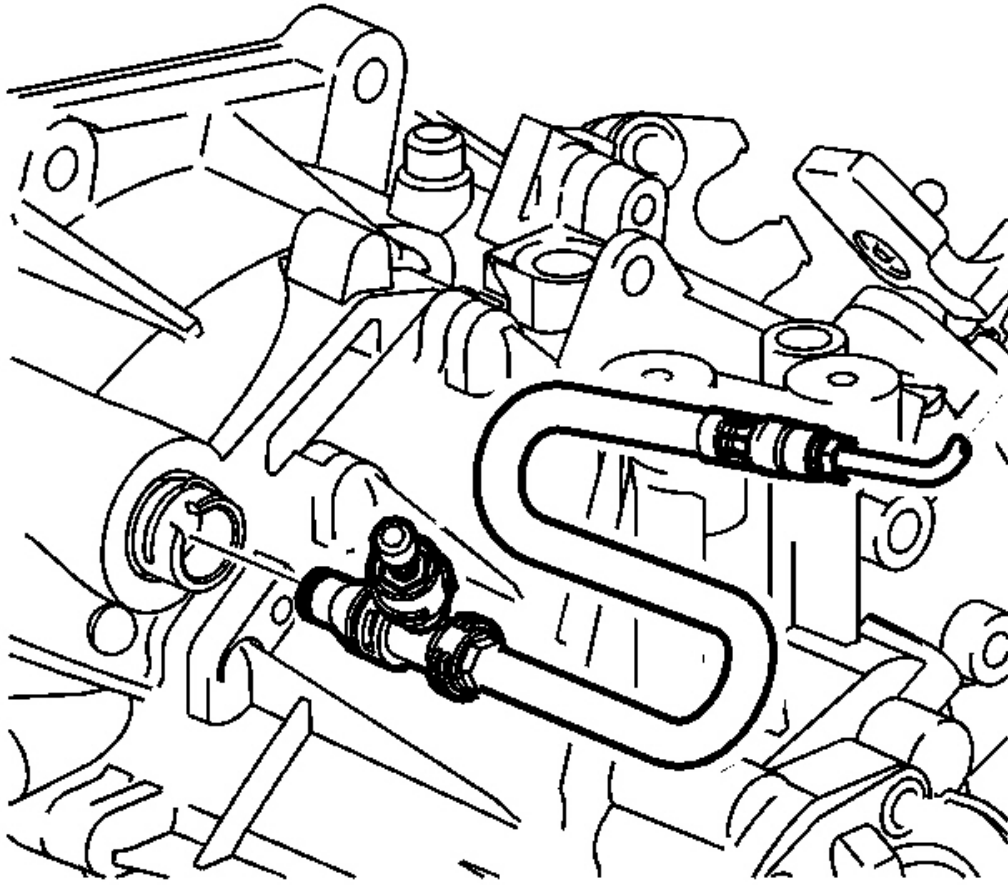


Fig. 108: Pressure Line & Clutch Actuator Cylinder
Courtesy of GENERAL MOTORS CORP.

22. Disconnect the pressure line from the clutch actuator cylinder by removing the C-clip, then pull the line away from the clutch actuator cylinder.

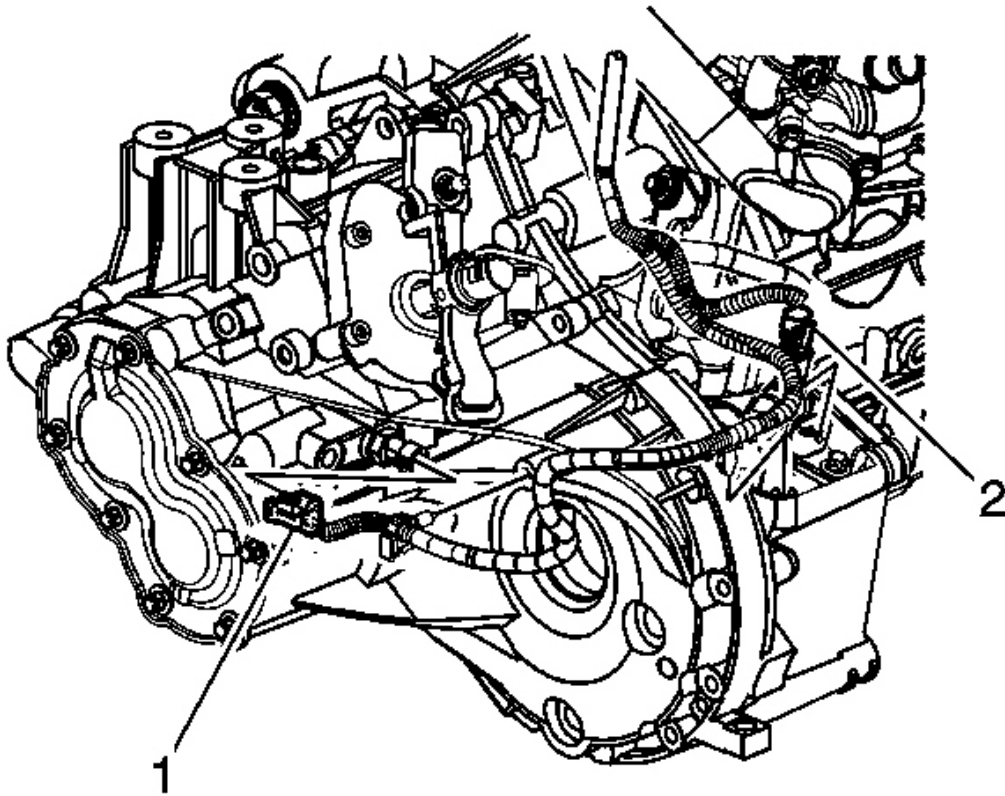


Fig. 109: Front Wheel Speed Sensor VSS Electrical Connector
Courtesy of GENERAL MOTORS CORP.

23. Disconnect the backup lamp switch (1) and front wheel speed sensor (2).

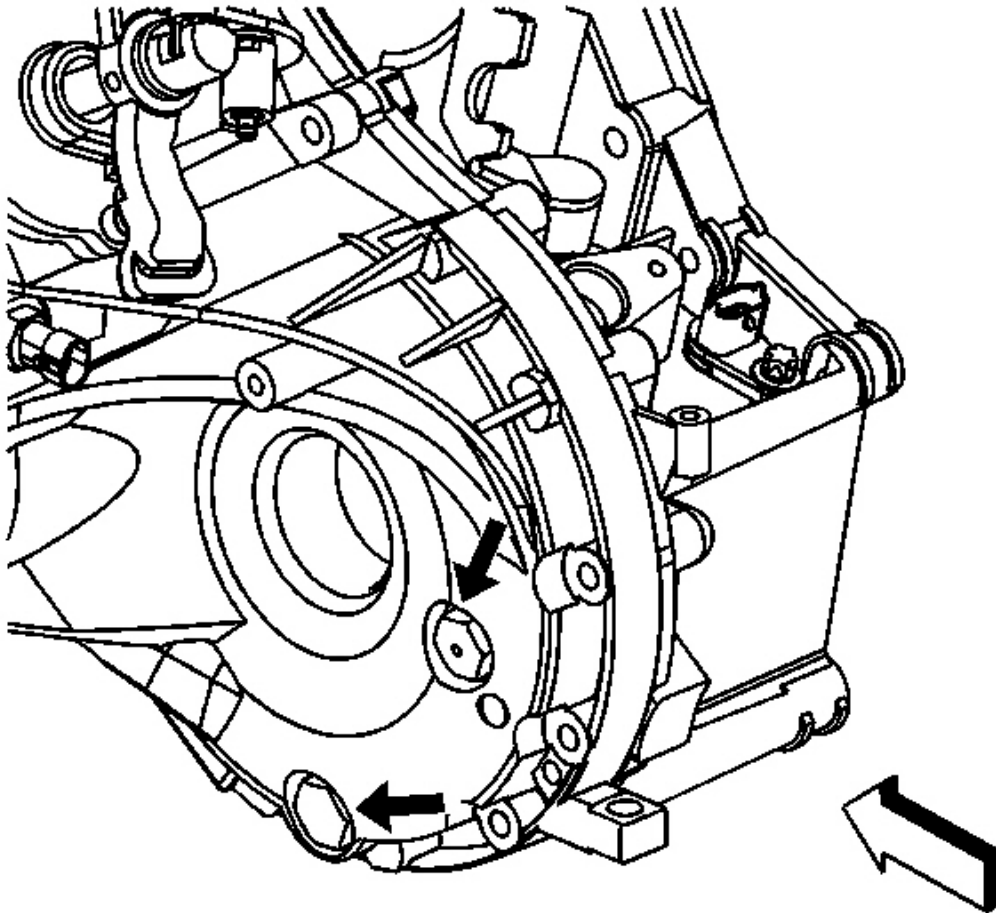


Fig. 110: Transaxle Mount
Courtesy of GENERAL MOTORS CORP.

24. Drain the transaxle fluid.
25. Remove the front transaxle mount from the transaxle.
 1. Using the **J 45341** and the **SA9173G** , disengage the right drive axle from the intermediate drive shaft.
 2. Secure the drive axle away from the intermediate drive shaft.
 3. Remove the intermediate drive shaft bearing retainer-to-support bracket bolts.

**IMPORTANT: Remove the retaining ring from the stub shaft prior to tool installation.
Discard the retaining ring.**

26. Remove the intermediate drive shaft. If the intermediate drive shaft is difficult to remove, use the **J 44017** and the **SA9133T**.

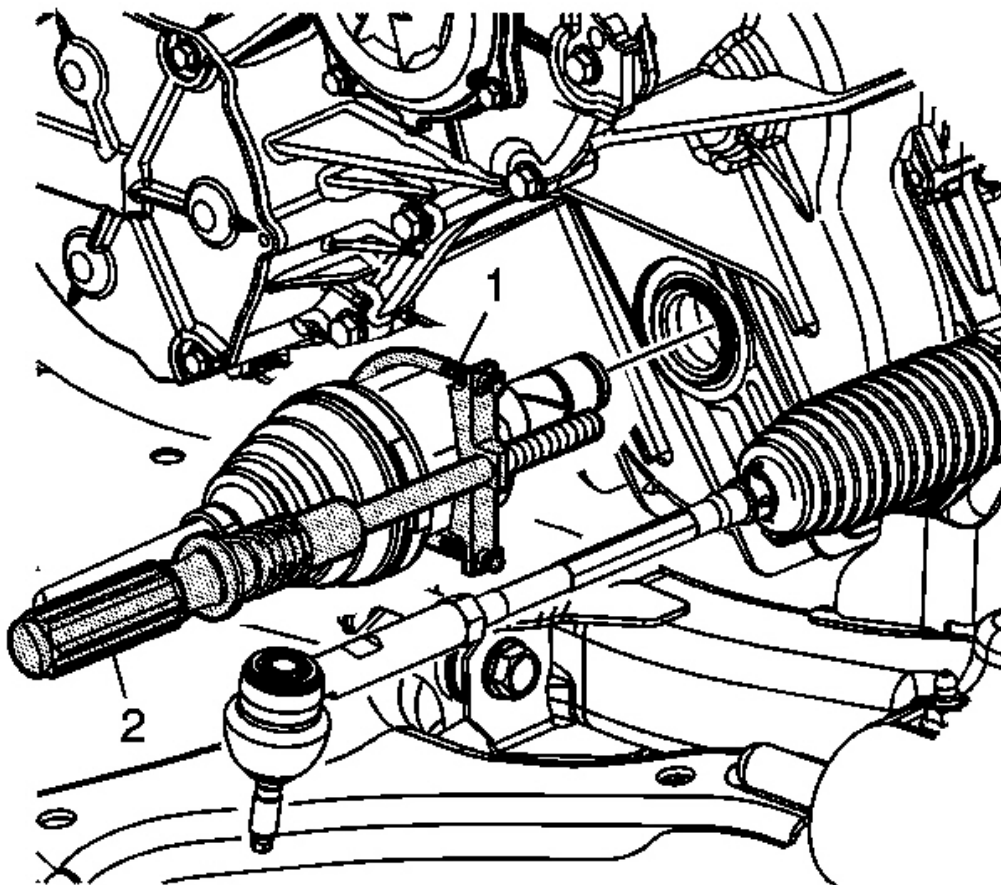


Fig. 111: Left Drive Axle, J 45341 & SA9173G
Courtesy of GENERAL MOTORS CORP.

27. Using the **J 45341** (1) and the **SA9173G** (2), remove the left drive axle.
28. Secure the drive axle out of the way.
29. Remove the bolts from the top transaxle mount.
30. Lower the vehicle.
31. Lower the transaxle, with the engine support fixture, enough to remove the transaxle.
32. Raise the vehicle.
33. Secure the transaxle to the transaxle jack.

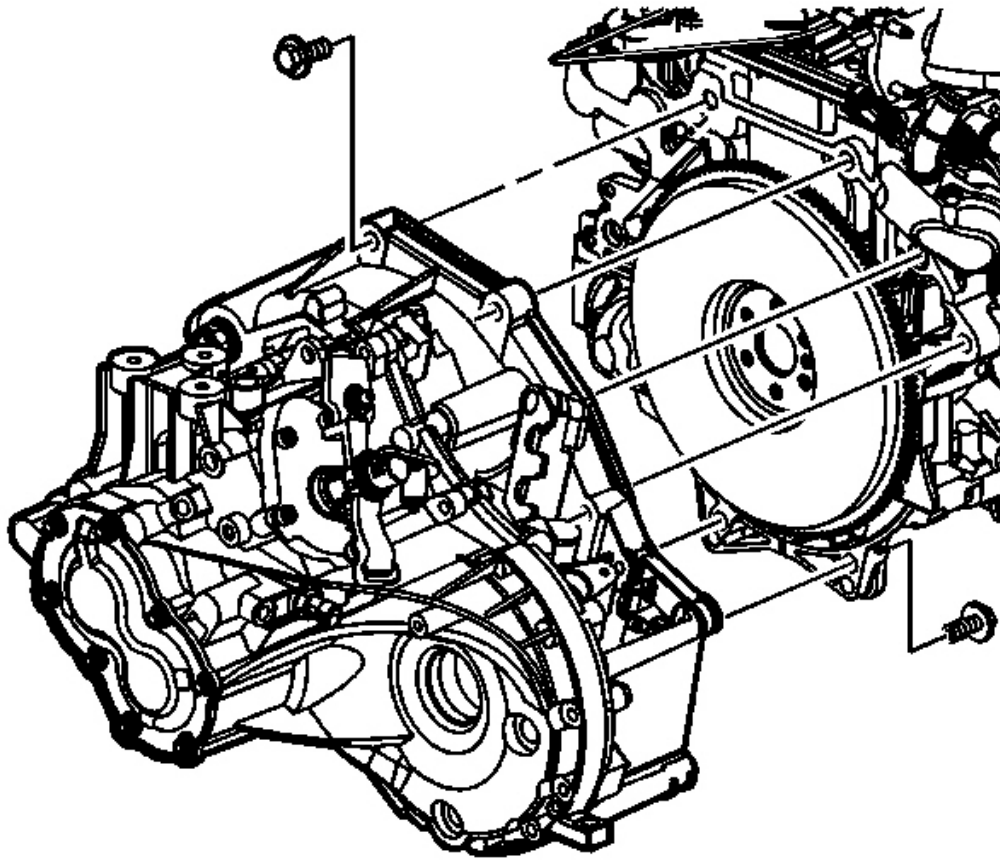


Fig. 112: Transaxle Housing & Bolts
Courtesy of GENERAL MOTORS CORP.

34. Remove the transaxle housing bolts on the engine side.
35. Remove the transaxle housing bolt on the transaxle side.
36. Lower the transaxle support stand.

Installation Procedure

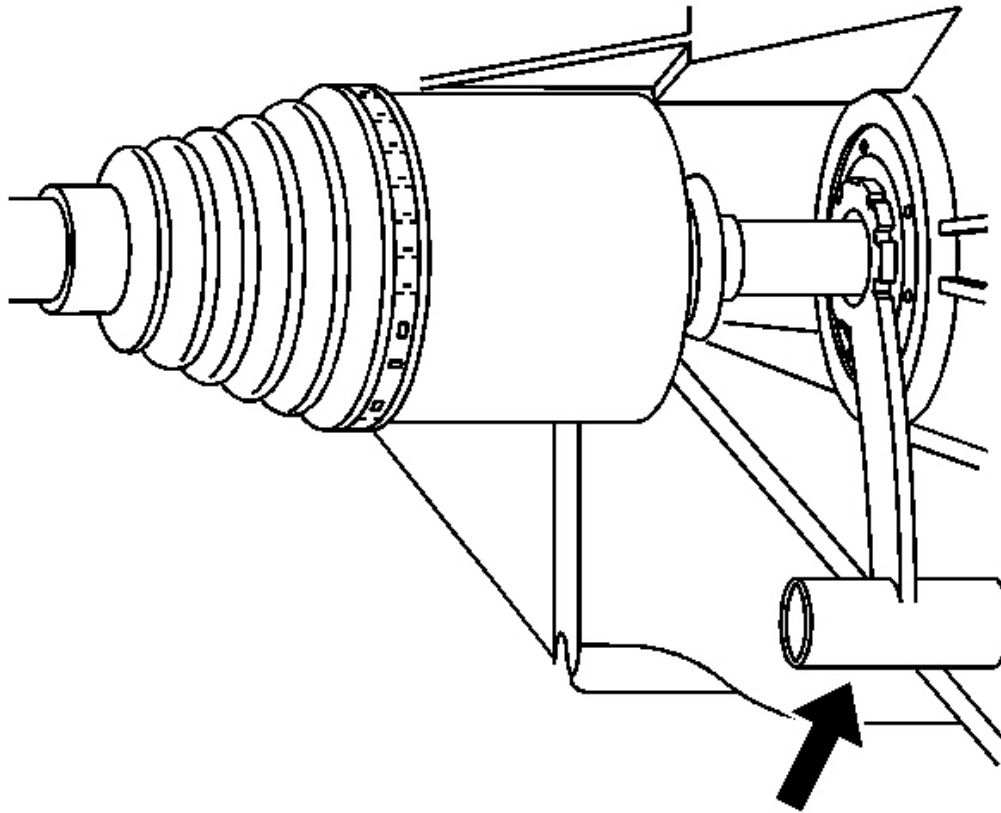


Fig. 113: Drive Axles & Transaxle
Courtesy of GENERAL MOTORS CORP.

1. Place the transaxle securely on a jack and position under the vehicle.
2. Install the **SA91112T** into both axle seals.
3. Place the transaxle into any gear.
4. Raise the transaxle into the vehicle in order to align the input shaft to the center of the clutch. Guide the transaxle into position and rotate back and forth to align the input shaft splines to the clutch disc.

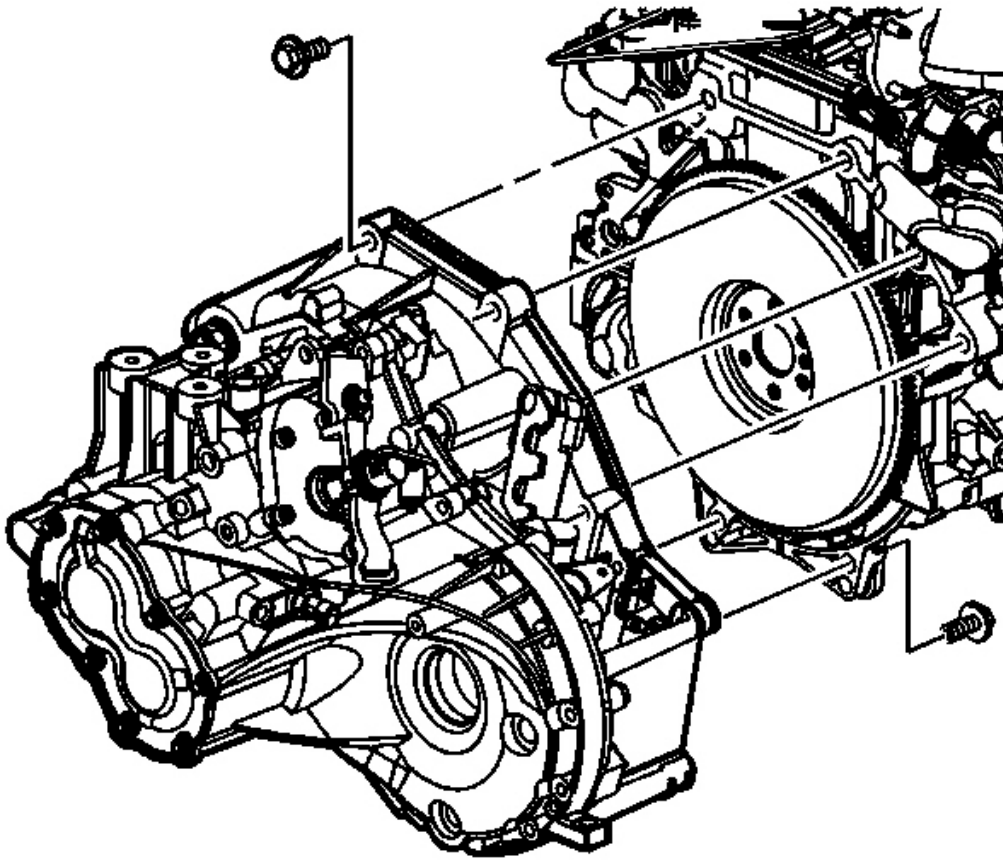


Fig. 114: Transaxle Housing & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT:

- Ensure the input shaft splines line up with the clutch disc splines before tightening the clutch housing bolts. Do not use the bolts to pull the transaxle up to the engine.
- Ensure that proper fastening locations are used.

5. Install the transaxle to engine bolt from the transaxle side.

Tighten: Tighten the bolts to 75 N.m (55 lb ft).

6. Install the engine to transaxle bolts from the engine side.

Tighten: Tighten the bolts to 75 N.m (55 lb ft).

7. Raise the transaxle jack until the transaxle lines up with the top of the transaxle mount.
8. Hand start the top transaxle mount bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

9. Remove the transaxle jack.

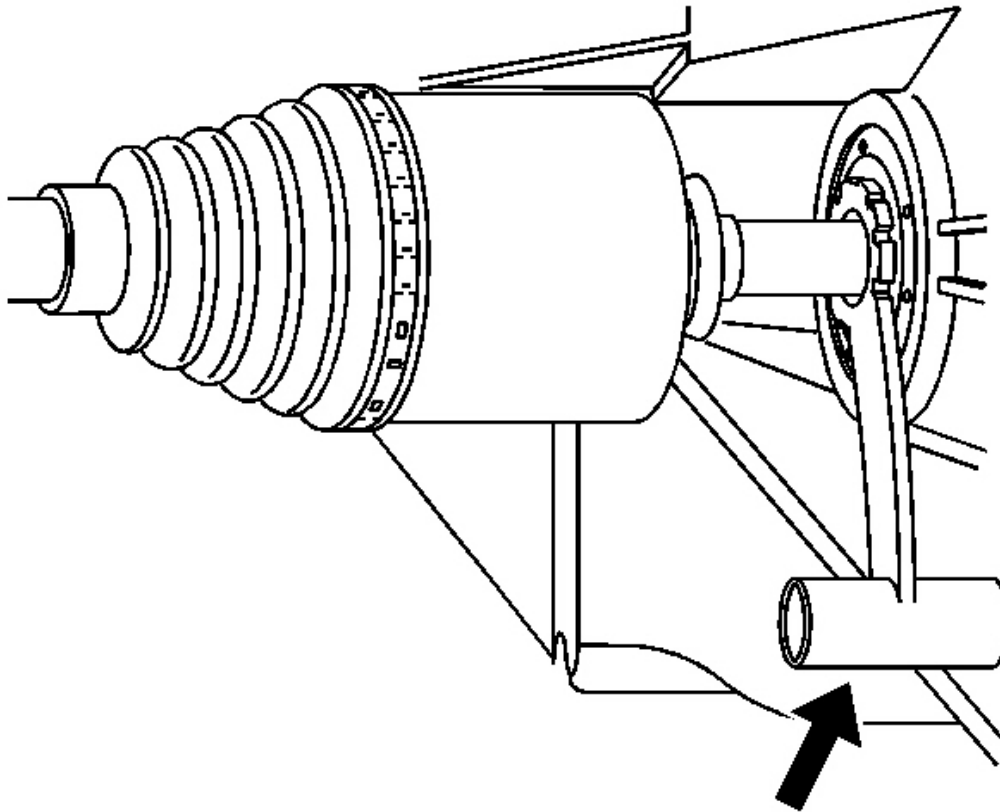


Fig. 115: Drive Axles & Transaxle
Courtesy of GENERAL MOTORS CORP.

10. Install the drive axles into the transaxle. Refer to **Wheel Drive Shaft Replacement - Front** in Driveline/Axle.

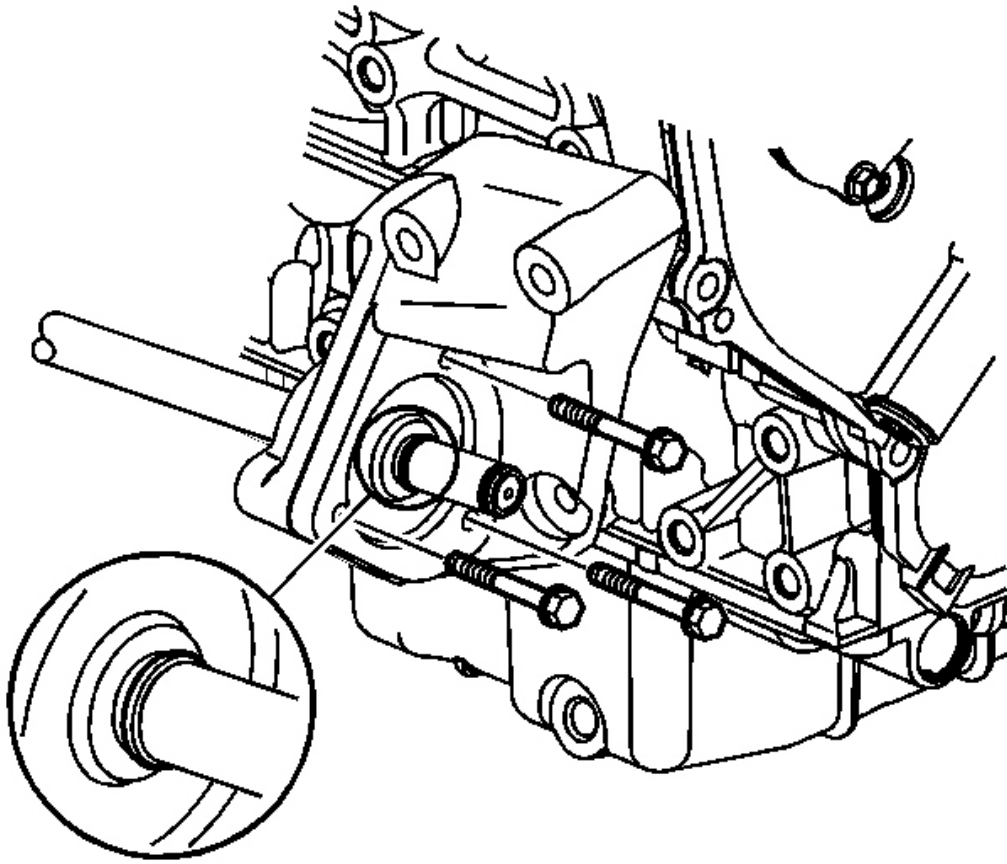


Fig. 116: Front Transaxle Mount & Bolts
Courtesy of GENERAL MOTORS CORP.

11. Install the front transaxle mount to the transaxle.
12. Install the front transaxle mount bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

13. Install the rear transaxle mount and bracket to the transaxle.
14. Install the rear transaxle mount-to-transaxle bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

15. Raise the cradle and place the lower ball joints into the knuckles while installing.

IMPORTANT: Ensure the following components are correctly positioned when raising the frame into the vehicle.

- **The lower control arm studs to the knuckle**
- **The cooling module support bushings**
- **The front pitch restrictor**

16. Tighten the cradle-to-body bolts.

Tighten: Tighten the bolts to 155 N.m (114 lb ft).

17. Install the front air dam to body push pins.

18. Install the front transaxle mount through bolt.

Tighten: Tighten the bolt to 110 N.m (81 lb ft).

19. Install the rear transaxle mount through bolt.

Tighten: Tighten the bolt to 110 N.m (81 lb ft).

20. Connect the steering gear to the steering column assembly.

21. Install the steering gear-to-steering column bolt.

Tighten: Tighten the bolts to 34 N.m (25 lb ft).

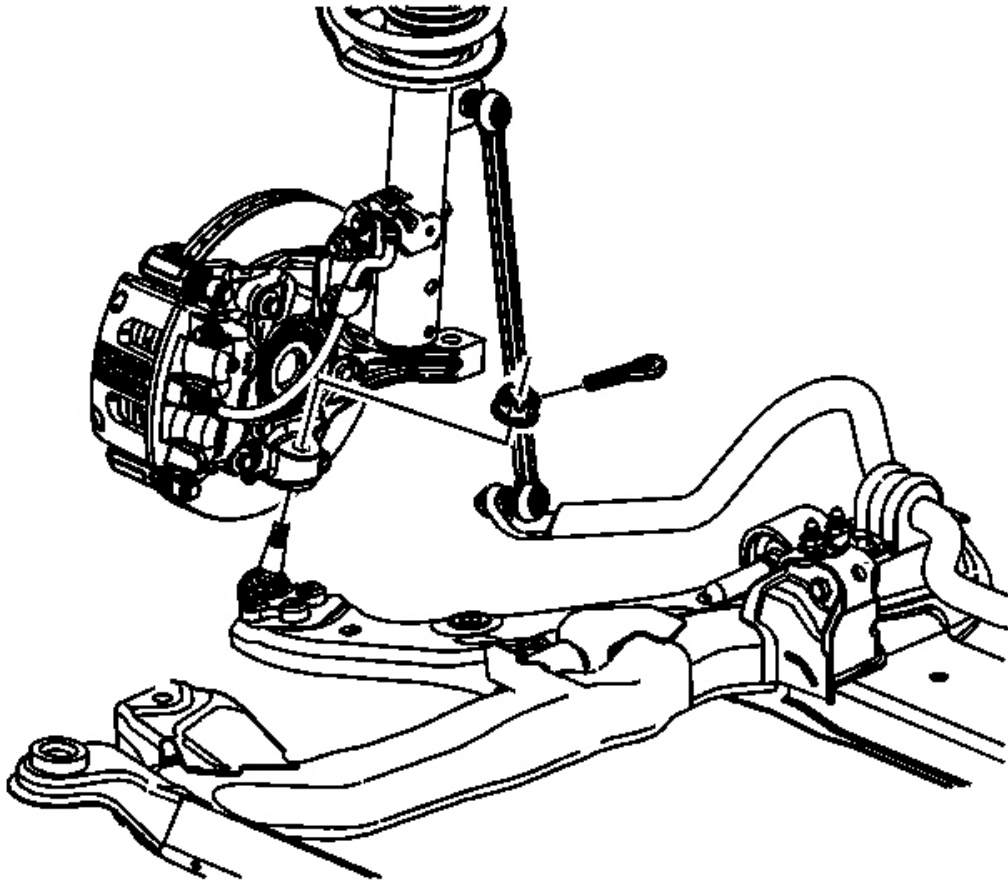


Fig. 117: Lower Control Arm Ball Stud, Cotter Pin & Nut
Courtesy of GENERAL MOTORS CORP.

22. Install the lower control arm ball stud to the knuckle.
23. Install the lower control arm nut and a new cotter pin.

Tighten: Tighten the nut to 10 N.m +150° (89 lb in +150°).

IMPORTANT: Do not allow the stud to rotate.

24. Tighten the nut one additional flat in order to align the cotter pin hole, if necessary. Secure the cotter pin.

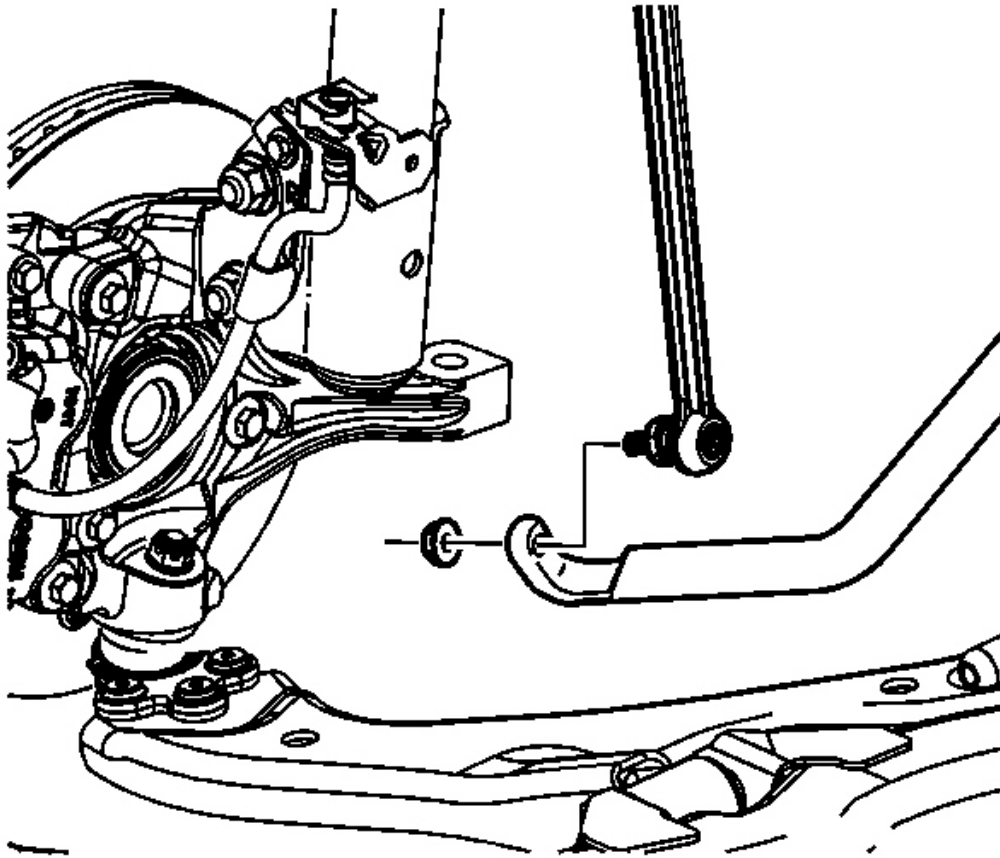


Fig. 118: Lower Stabilizer Bar Links & Bolts
Courtesy of GENERAL MOTORS CORP.

25. Install new stabilizer bar link nuts to the lower stabilizer bar links.

Tighten: Tighten the nuts to 65 N.m (48 lb ft).

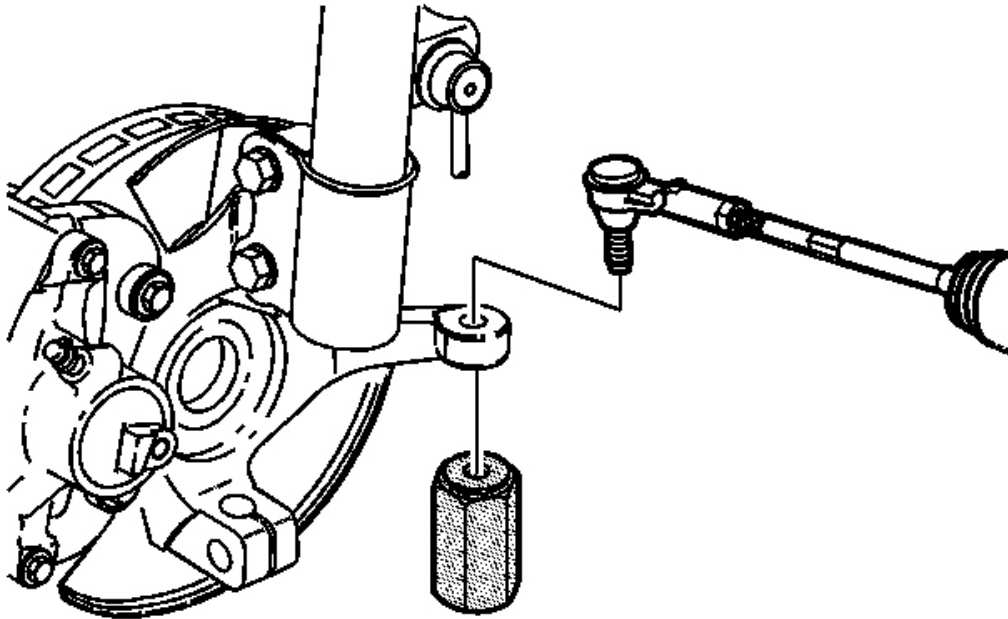


Fig. 119: Tie Rod-To-Knuckle & J 44015
Courtesy of GENERAL MOTORS CORP.

26. Insert the tie rod-to-knuckle.
27. Install the **J 44015** and tighten.

Tighten: Tighten the tie rod end installation to 40 N.m (30 lb ft).

28. Install the outer tie rod ends and tighten.

Tighten: Tighten the tie rod-to-steering knuckle nut to 50 N.m (37 lb ft).

29. Install the backup lamp switch.
30. Install the front wheel speed sensor.

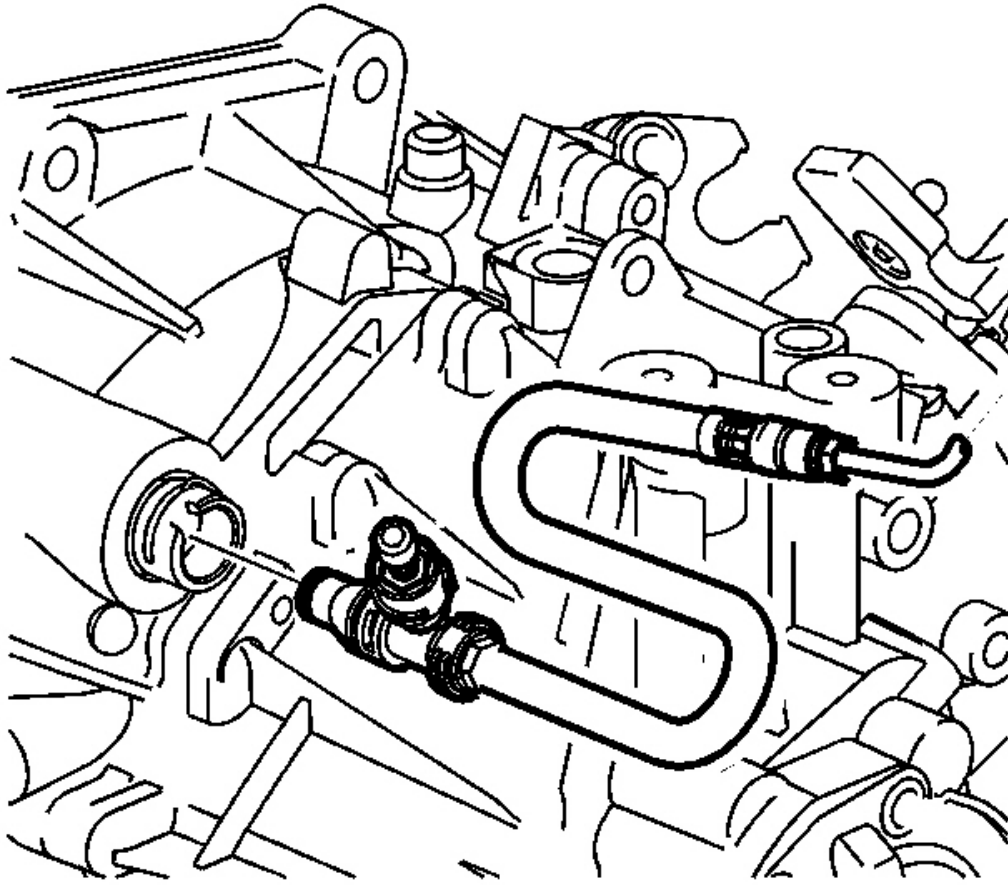


Fig. 120: Pressure Line & Clutch Actuator Cylinder
Courtesy of GENERAL MOTORS CORP.

31. Connect the clutch hydraulic line to the actuator cylinder by inserting and pushing in the C-clip until it stops.
32. Connect the shift cables into the shift cable bracket.
33. Connect the shift cable ends to the transaxle.
34. Install the left inner splash shield.

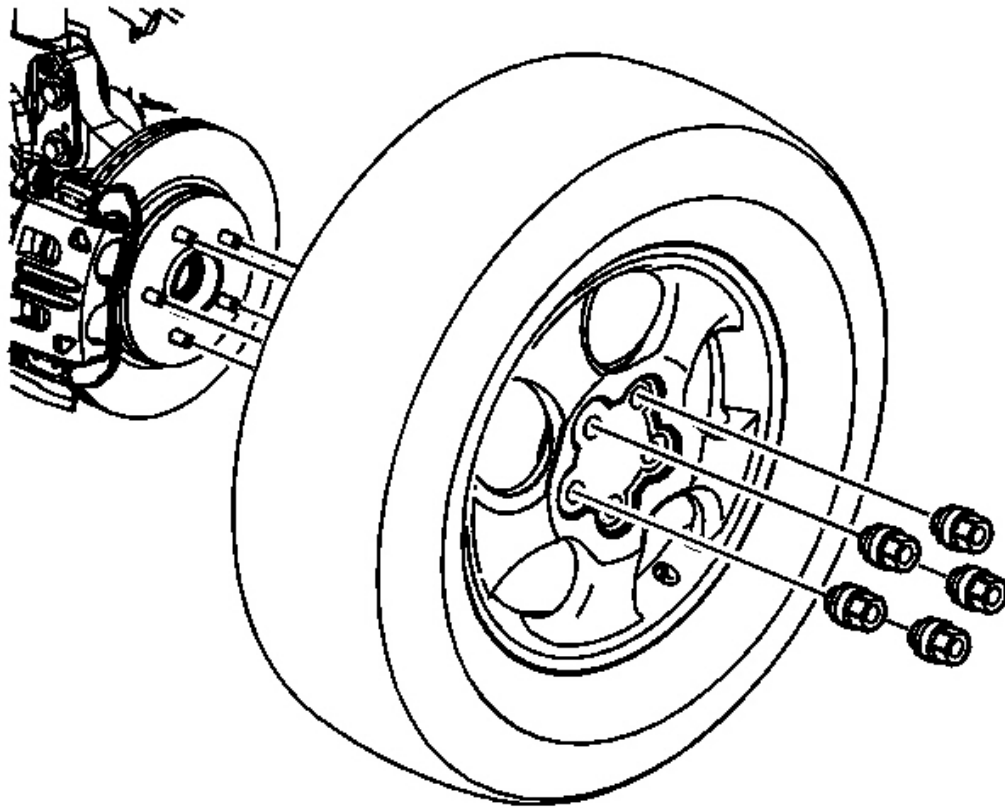


Fig. 121: Left Inner Splash Shield & Ball Joints
Courtesy of GENERAL MOTORS CORP.

35. Install the wheels.
36. Install the wheel nuts.

Tighten: Tighten the nuts in a crisscross pattern to 125 N.m (92 lb ft).

37. Bleed the clutch system. Refer to **Hydraulic Clutch Bleeding** in Clutch.
38. Connect the negative battery cable to the battery. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.

Tighten: Tighten the battery terminal bolts to 17 N.m (13 lb ft).

39. Install the battery cover and screws.

Tighten: Tighten the battery cover screws to 2 N.m (18 lb in).

40. Program the radio stations.

SHIFT CABLE ADJUSTMENT

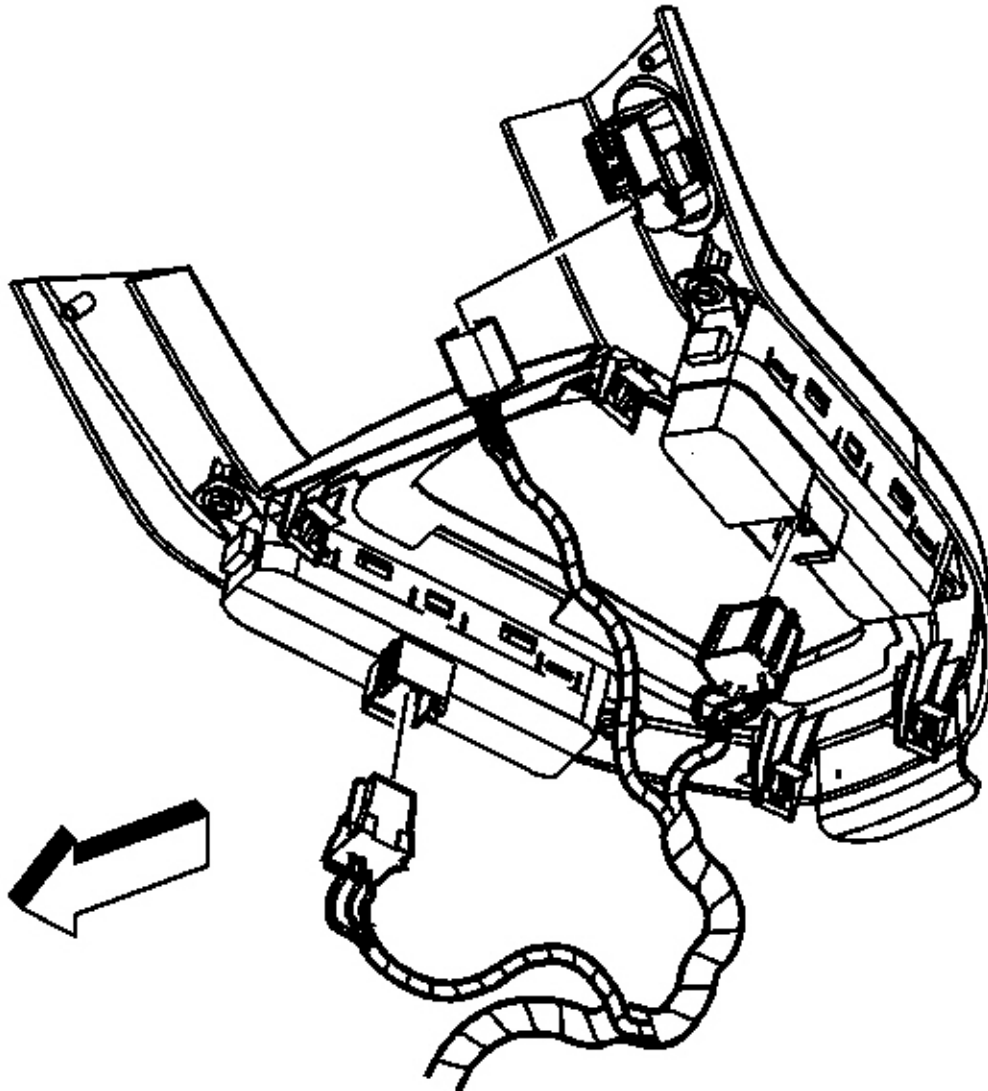


Fig. 122: Electrical Connectors & Window Switch Trim Bezel
Courtesy of GENERAL MOTORS CORP.

1. Set the parking brake and shift the transaxle to NEUTRAL.

2. Disconnect the control assembly boot trim from the trim bezel.
3. Gently pry up the window switch trim bezel.
4. Disconnect the electrical connectors from the window switch trim bezel and remove the bezel.

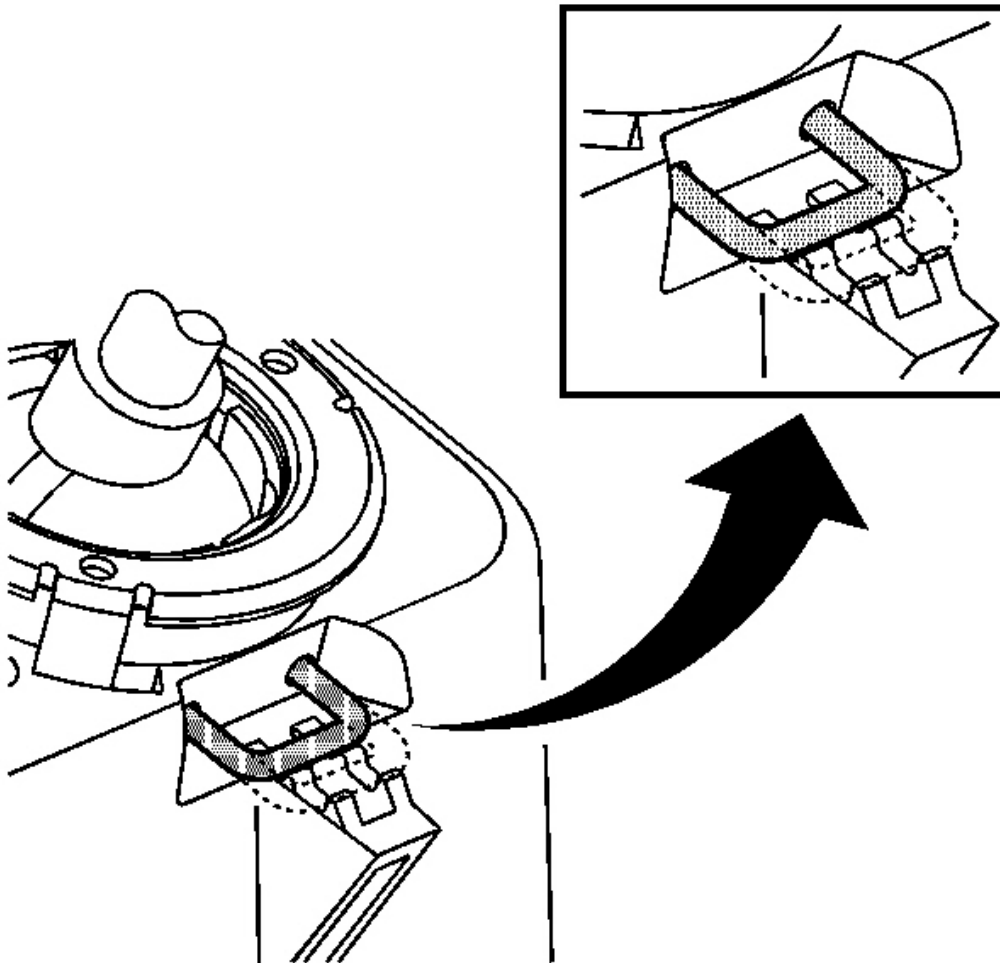


Fig. 123: Pulling The Shifter Neutral Lock Clip To Original Position
Courtesy of GENERAL MOTORS CORP.

5. Lift the shift cable adjuster retainers.
6. Adjust the cable by pushing the shifter neutral lock clip. Move the shifter slightly in order to center the lock clip.

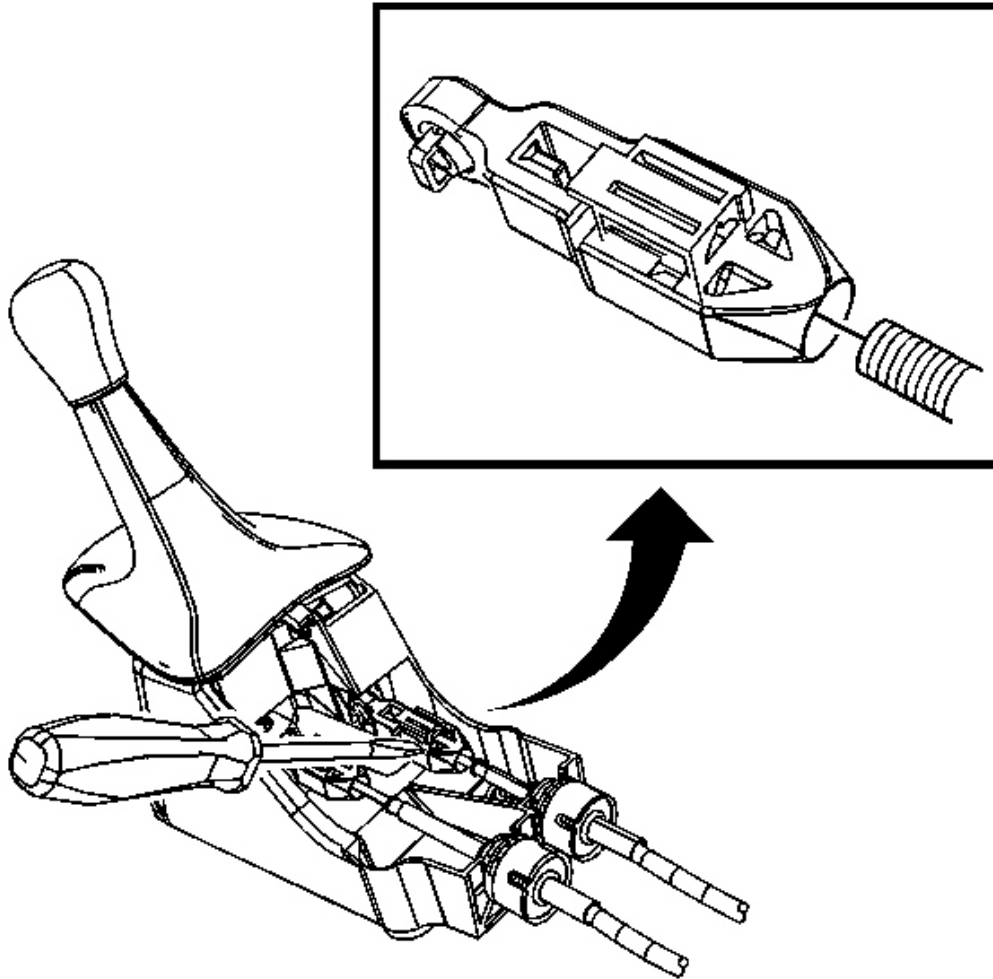


Fig. 124: Shift Cables & Control Lever Assembly Housing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure the transaxle is in NEUTRAL.

7. Press and lock the shift cable retainers.
8. Pull the shifter neutral lock clip to the original position.

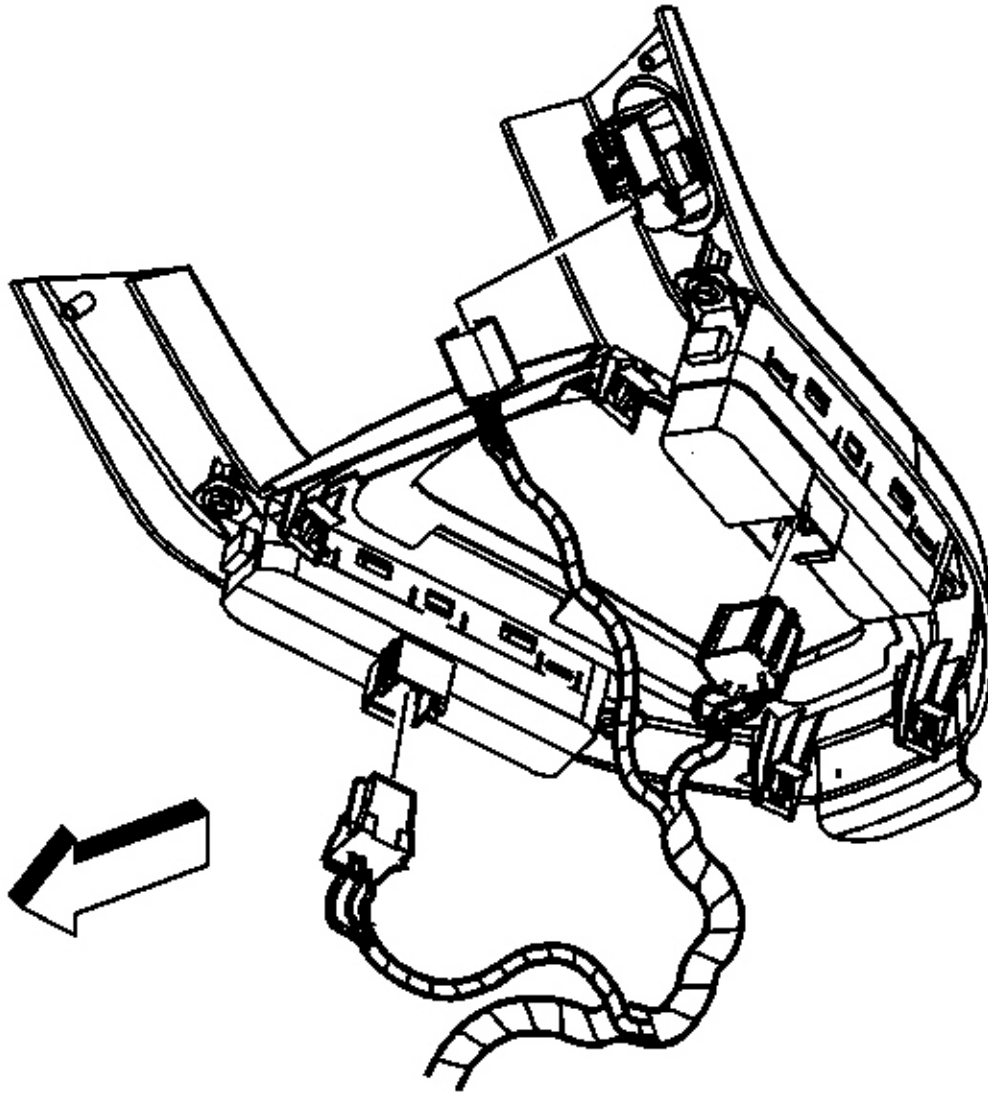


Fig. 125: Electrical Connectors & Window Switch Trim Bezel
Courtesy of GENERAL MOTORS CORP.

9. Connect the electrical connectors.
10. Install the bezel.
11. Connect the control assembly boot trim to the bezel.

Tools Required

- **J 7079-2** Universal Driver Handle - Non-Threaded. See **Special Tools and Equipment** .
- **J 8092** Universal Driver Handle - 3/4 in - 10. See **Special Tools and Equipment** .
- **J 23907** Slide Hammer with Bearing Adapter/(SA9133T)/(SA9133T-1)/(SA9133T-2). See **Special Tools and Equipment** .
- **J 44375** Assembly Pallet. See **Special Tools and Equipment** .
- **J 44376** Bearing Pusher/Puller. See **Special Tools and Equipment** .
- **J 44377** Input Shaft Anti-Rotation Tool. See **Special Tools and Equipment** .
- **J 44380** Differential Bearing Race Puller. See **Special Tools and Equipment** .
- **J 44381** Shifter Bearing/Input and Output Bearing Remover. See **Special Tools and Equipment** .
- **J 44382** Countershaft Needle Bearing Puller. See **Special Tools and Equipment** .
- **J 44385** Differential Bearing Race and Seal Installer. See **Special Tools and Equipment** .

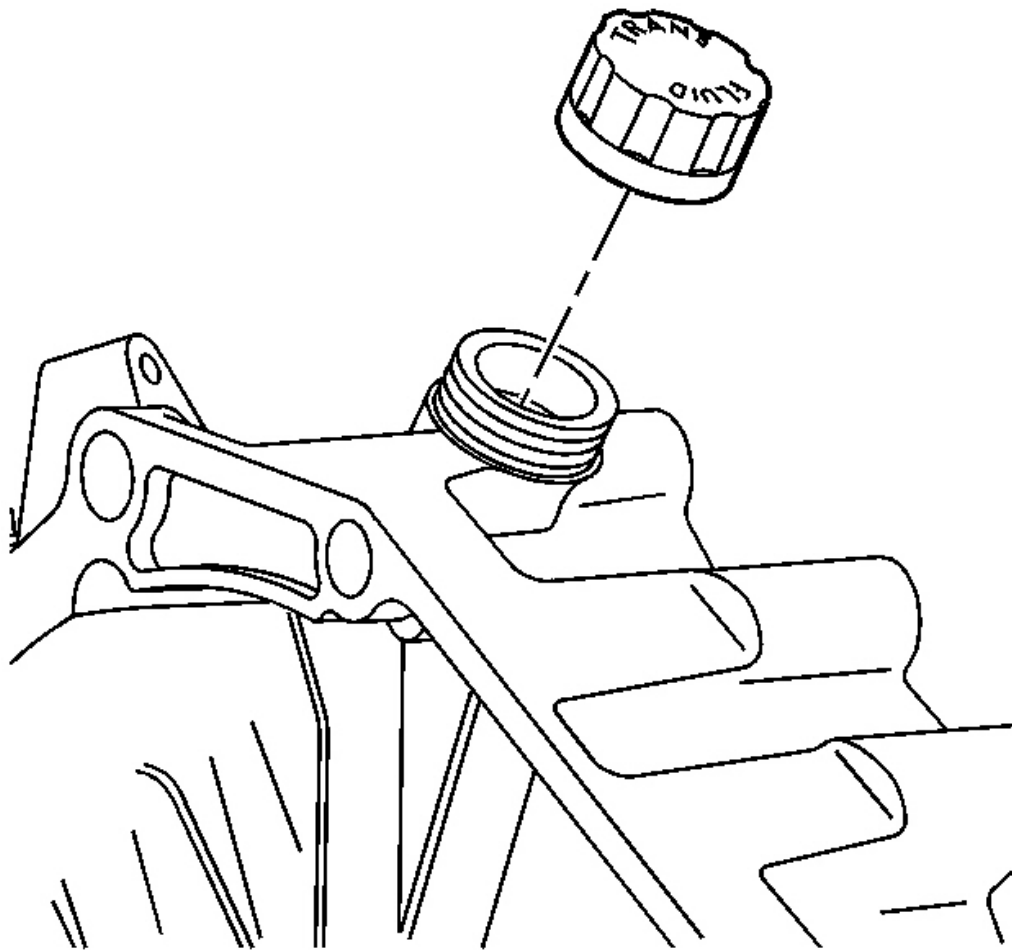


Fig. 126: Transmission Filler Cap
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission filler cap.

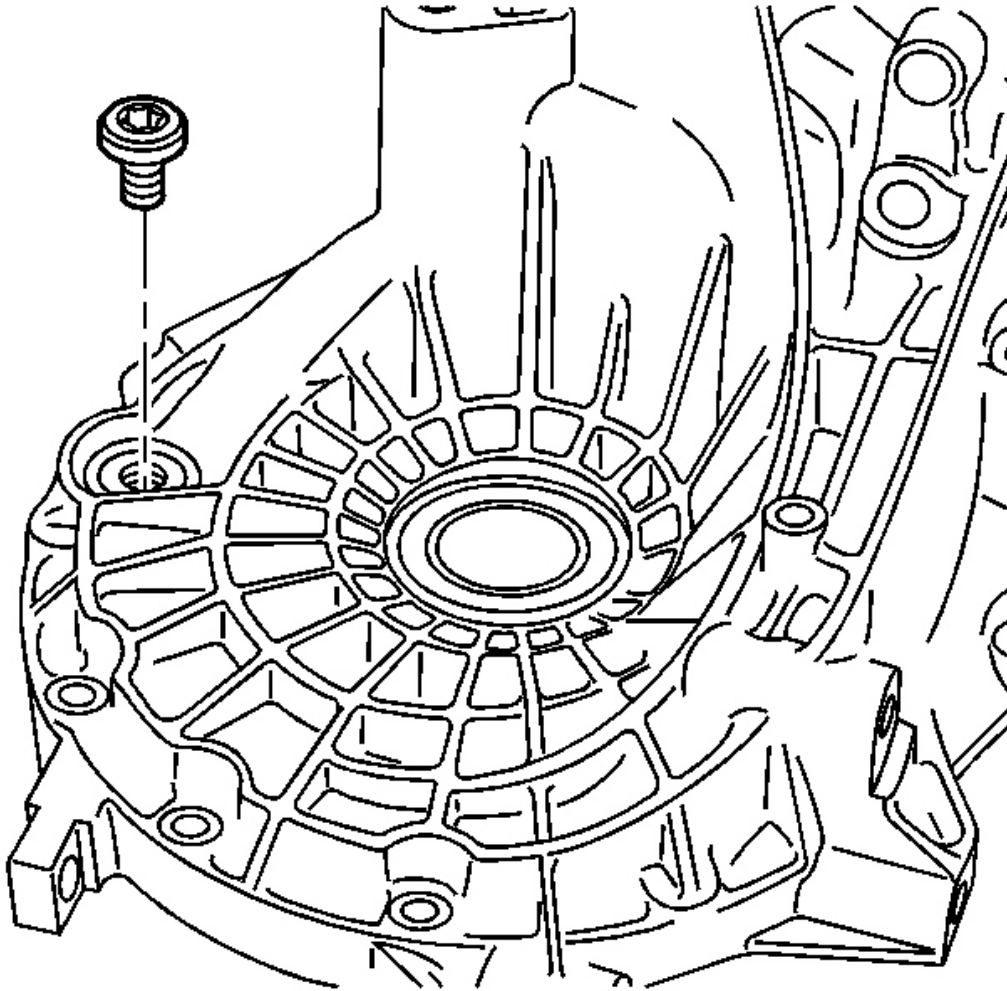


Fig. 127: Transmission Drain Plug
Courtesy of GENERAL MOTORS CORP.

2. Remove the transmission drain plug and drain the fluid.

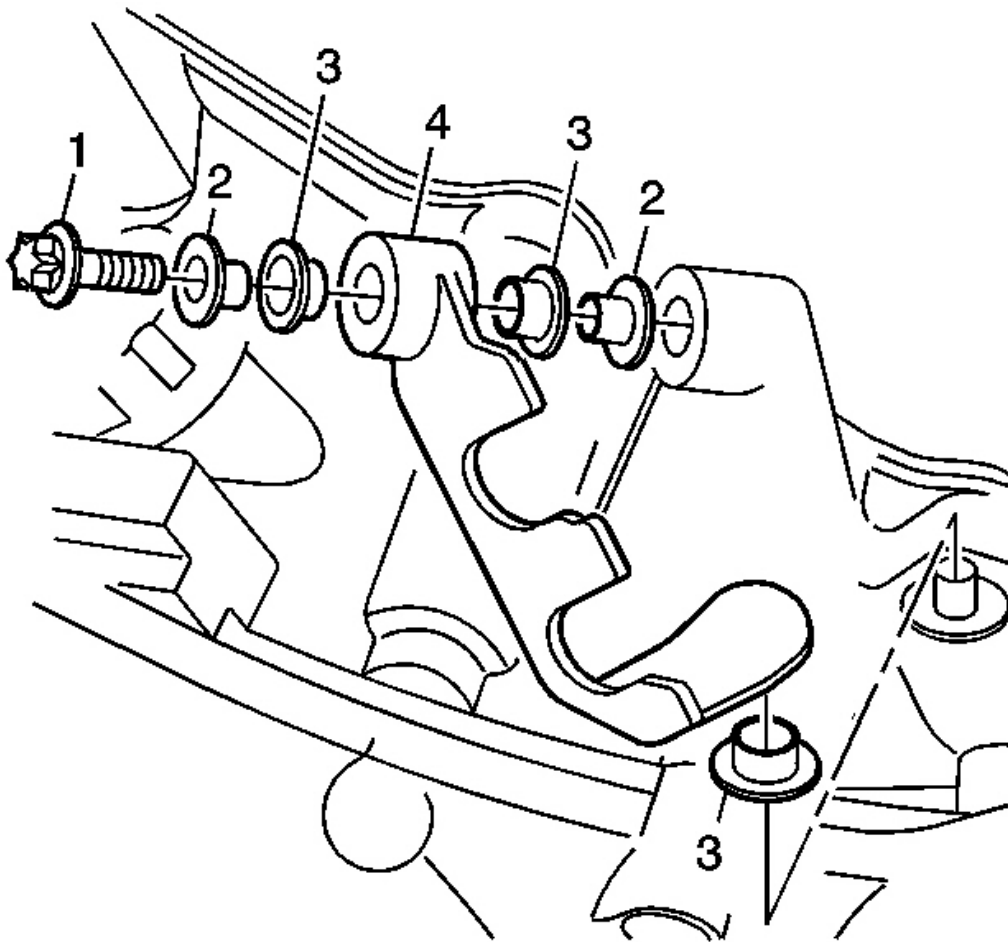


Fig. 128: Shift Cable Bracket, Spacers, Isolators & Bolt
Courtesy of GENERAL MOTORS CORP.

3. Remove the shift cable bracket (4), the spacers (2), the isolators (3) and the bolt (1).

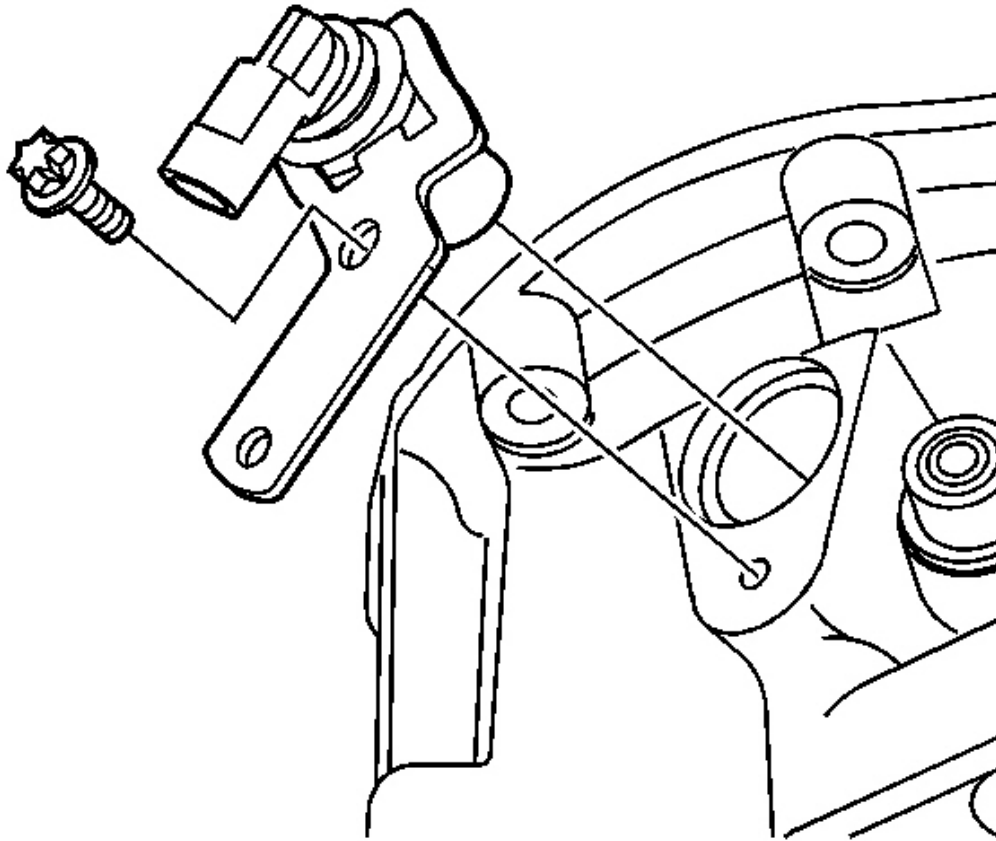


Fig. 129: Vehicle Speed Sensor & Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the vehicle speed sensor and bolt.

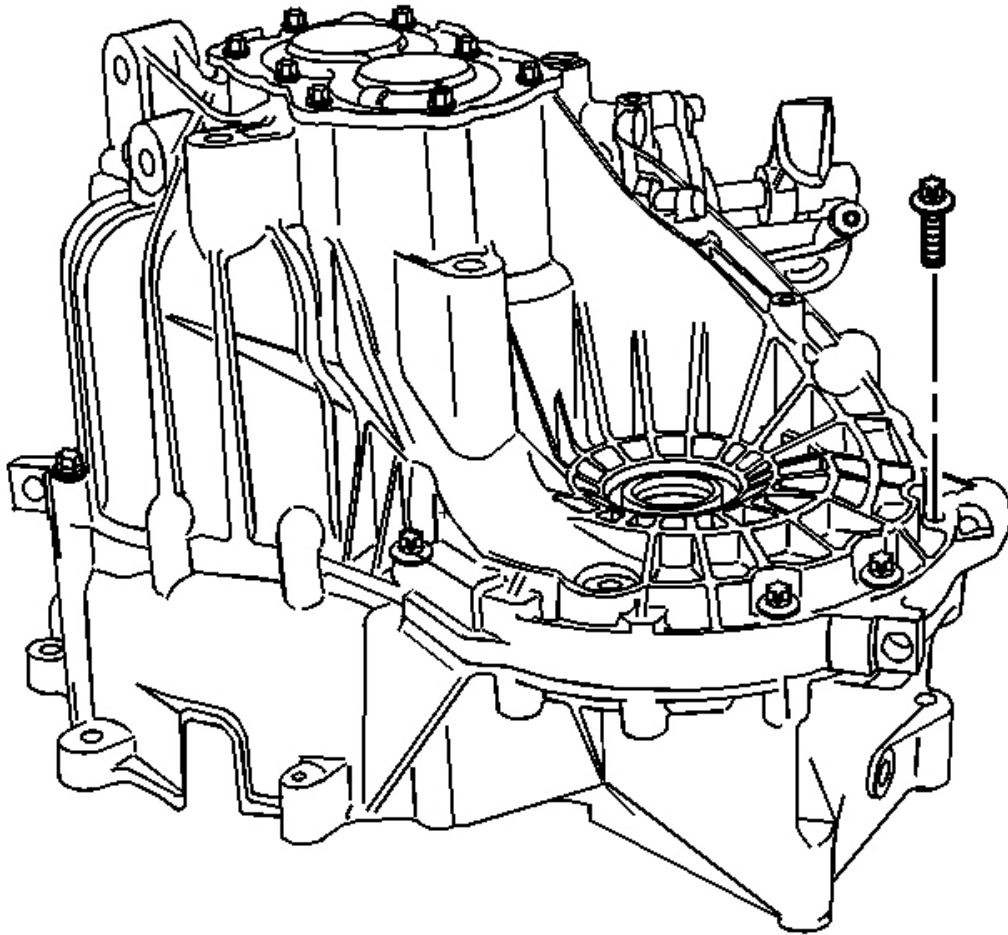


Fig. 130: Transaxle Case Side & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Position the transmission, with the transaxle case side facing up, on a bench.
6. Remove the 7 bolts from the transaxle case side of the housing.

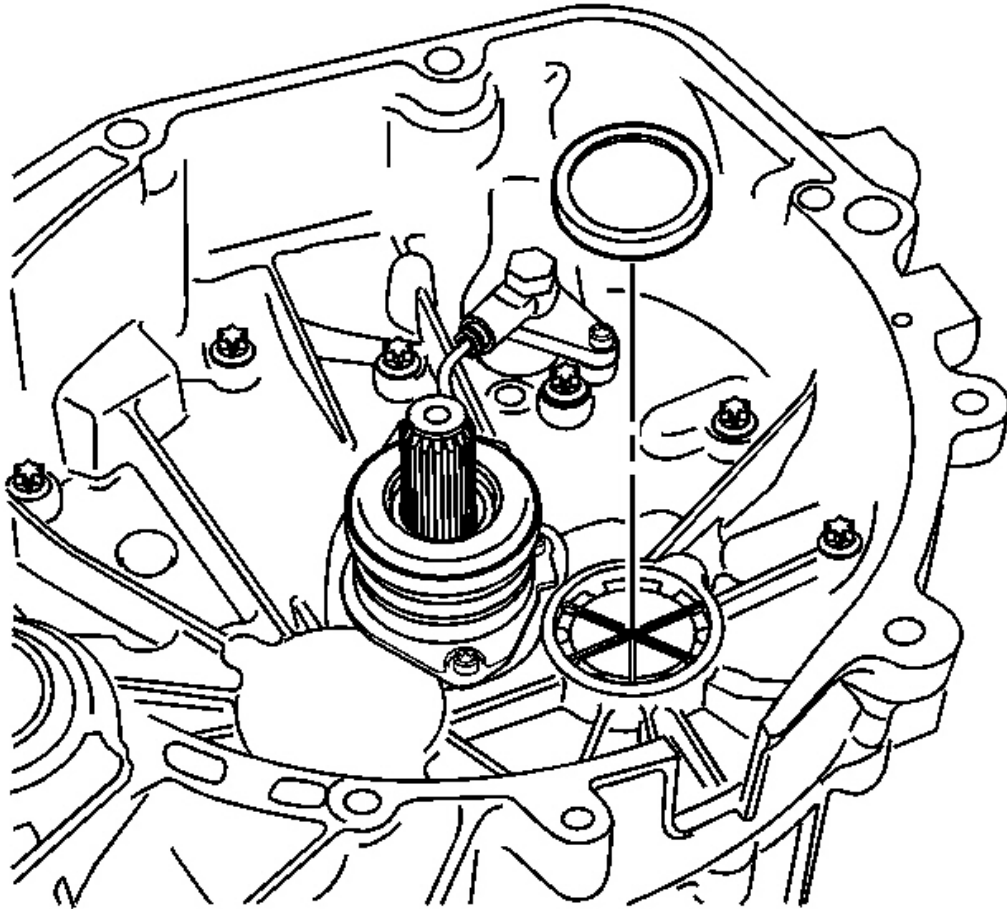


Fig. 131: Intermediate Shaft Seal
Courtesy of GENERAL MOTORS CORP.

7. Turn the transmission over.

NOTE: Puncture the seal in the center to prevent damage to the transmission.

8. Remove the intermediate shaft seal using a suitable tool. Discard the seal.

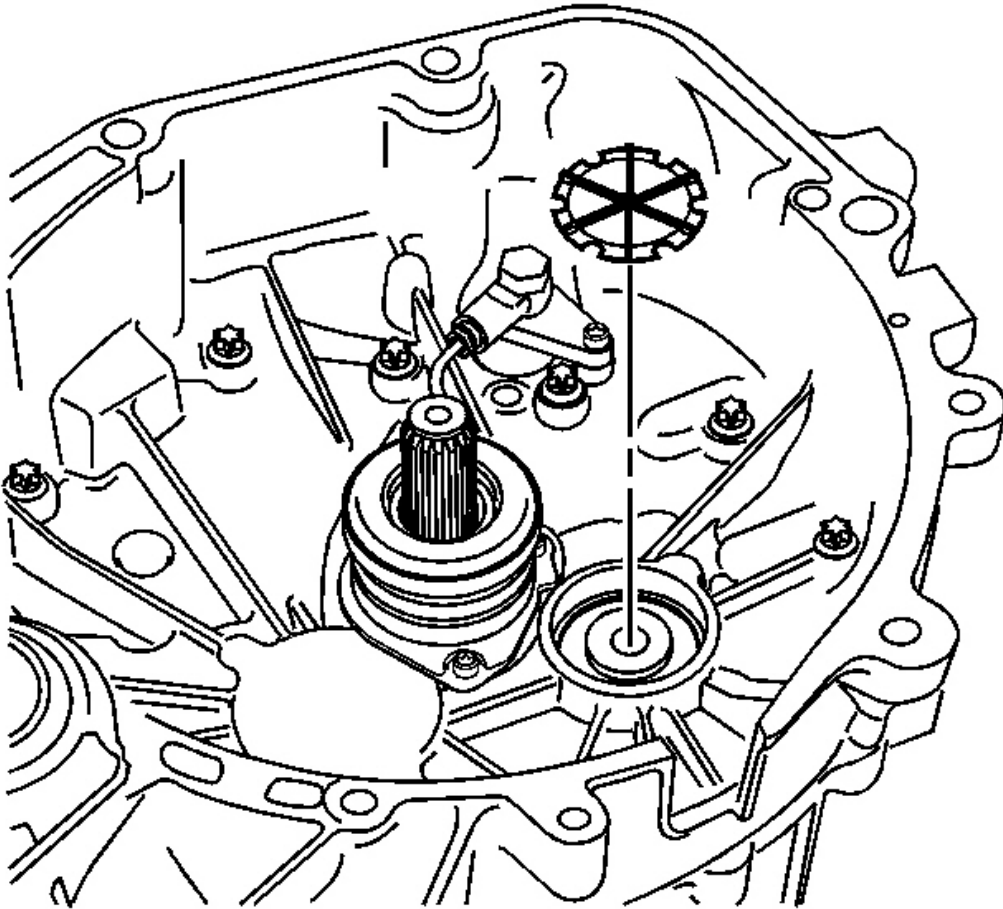


Fig. 132: Plastic Oil Guide & Intermediate Shaft
Courtesy of GENERAL MOTORS CORP.

9. Remove the plastic oil guide from the intermediate shaft using a suitable tool. Discard the oil guide.

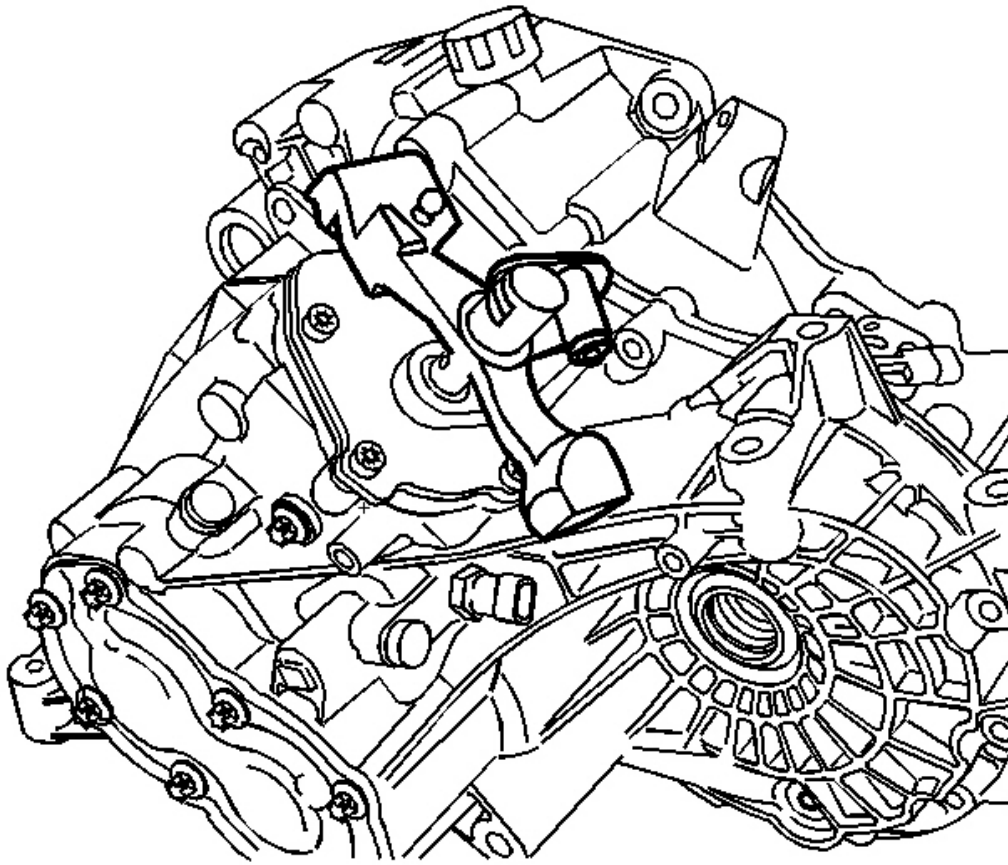


Fig. 133: Transmission
Courtesy of GENERAL MOTORS CORP.

10. Turn the transmission so the shifter is on top.
11. Shift the transmission into any gear.

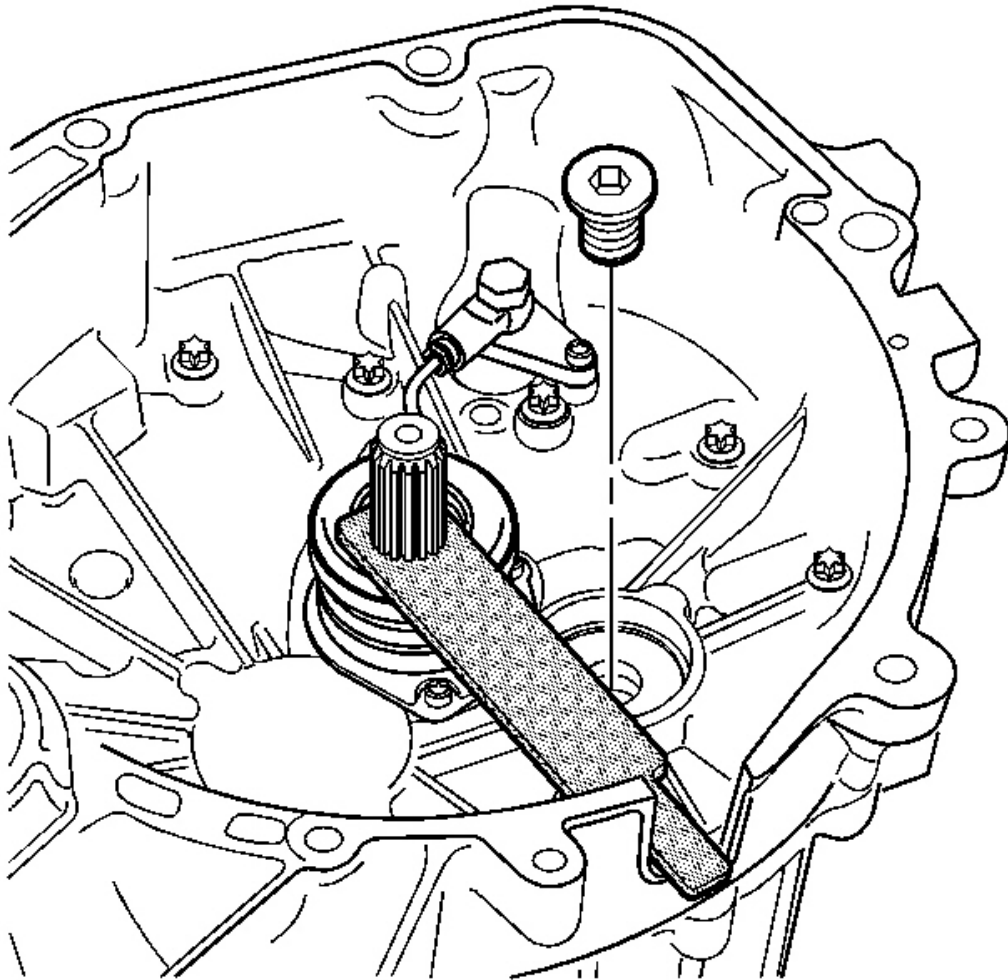


Fig. 134: Intermediate Shaft, Input Shaft, J 44377 & Bolt
Courtesy of GENERAL MOTORS CORP.

12. Hold the input shaft with **J 44377** . See **Special Tools and Equipment** .
13. Remove the bolt from the intermediate shaft.

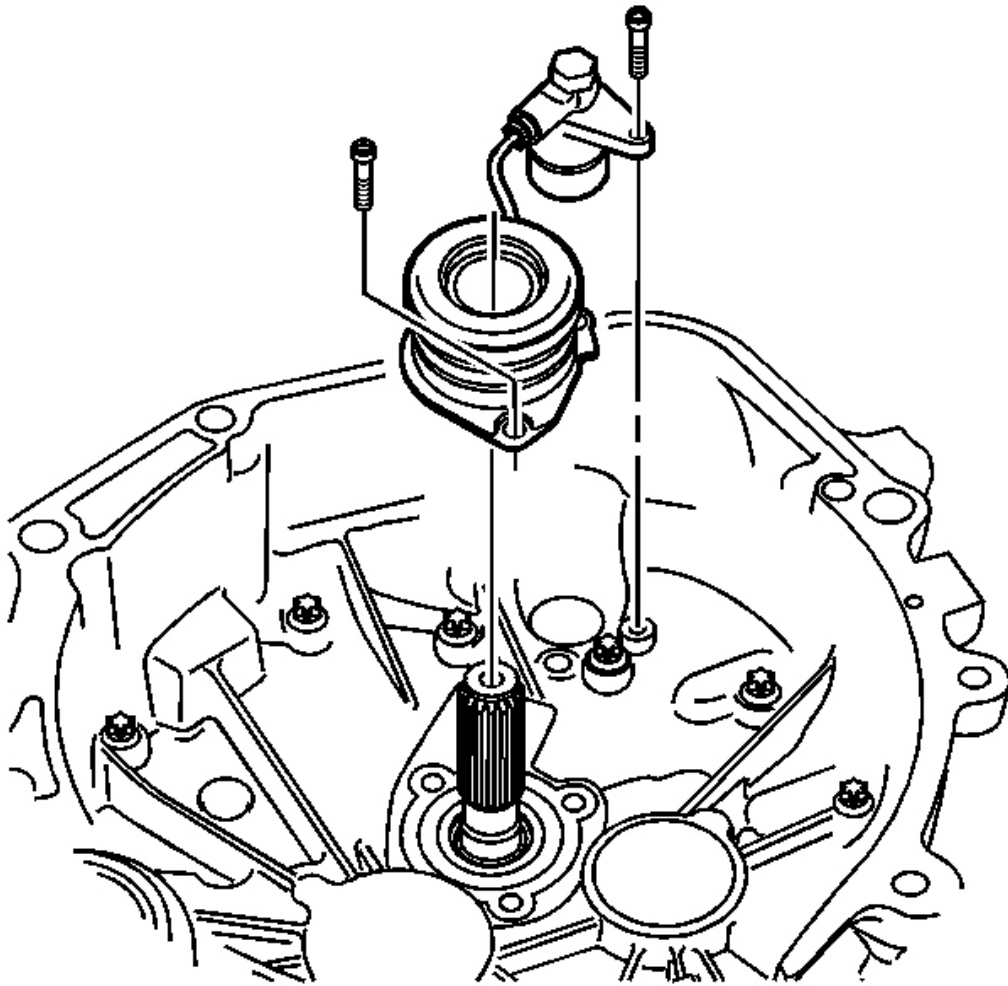


Fig. 135: Actuator & Tube Bolts
Courtesy of GENERAL MOTORS CORP.

14. Remove the actuator and tube bolts.
15. Remove the actuator and tube.
16. Inspect the input shaft seal for cuts, nicks, and damage. If damaged, replace the actuator.

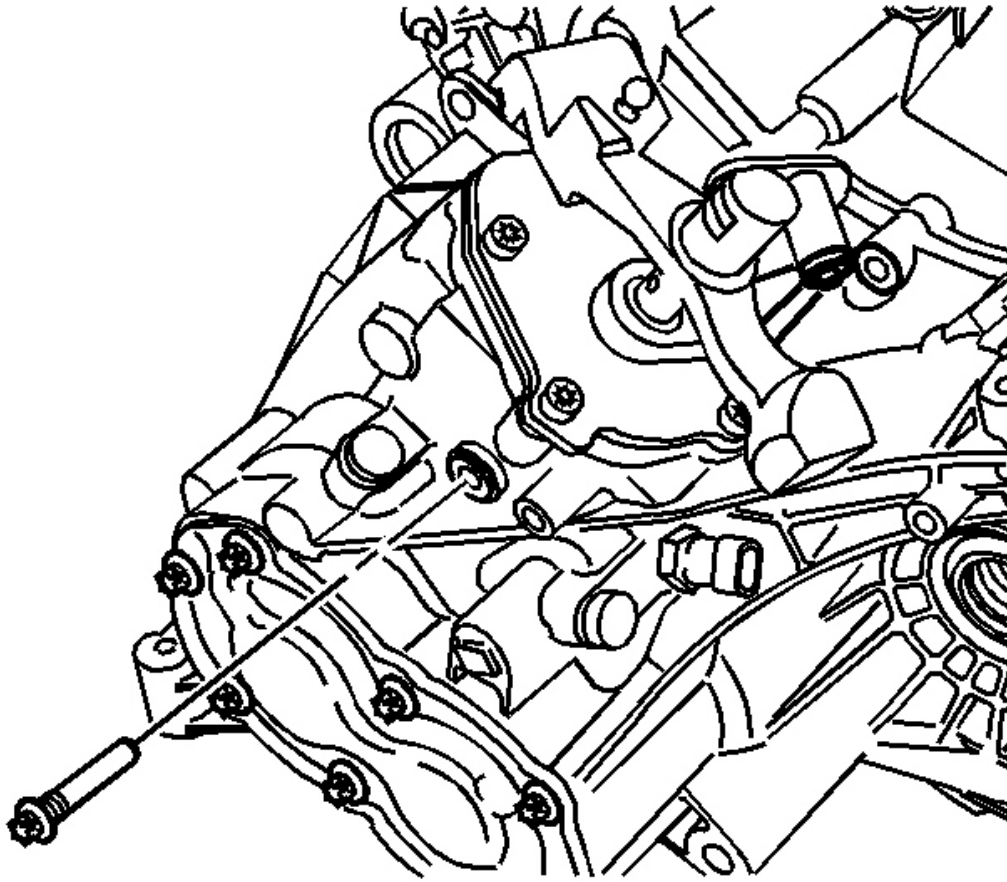


Fig. 136: Shifter Guide Bolt
Courtesy of GENERAL MOTORS CORP.

17. Shift the transmission into neutral.
18. Remove the shifter guide bolt.

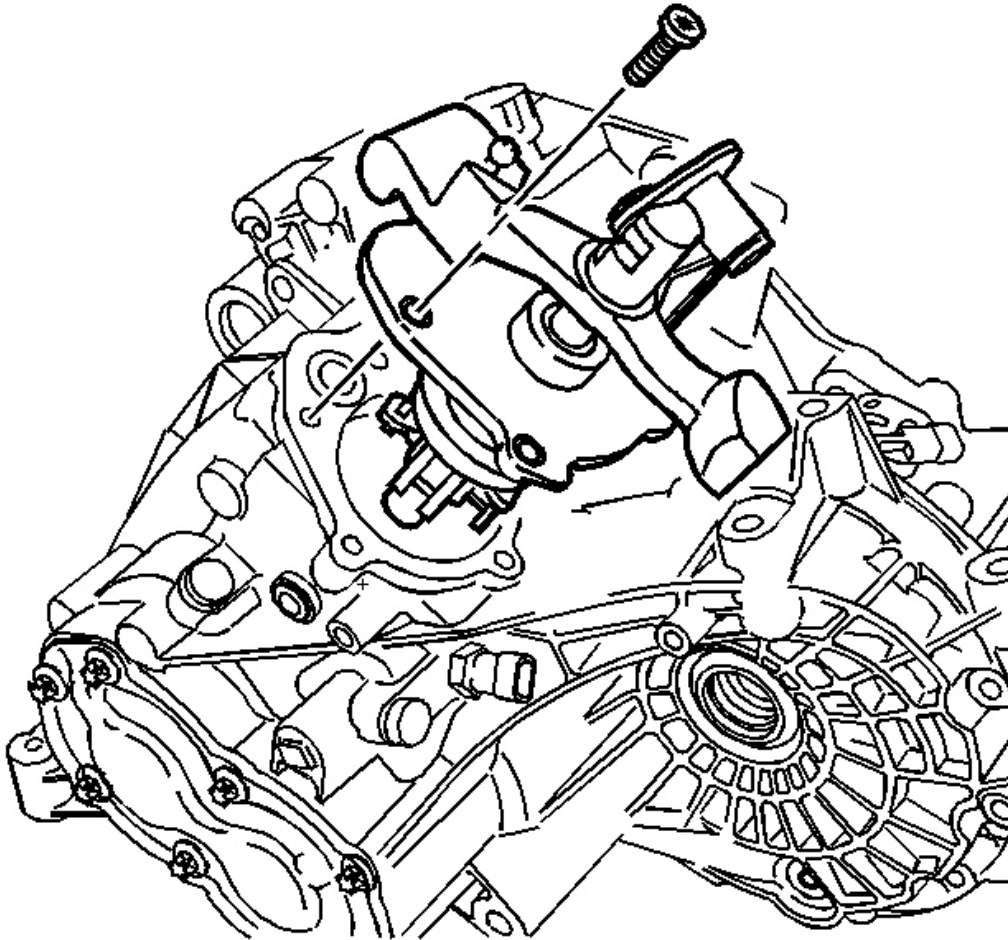


Fig. 137: Shifter Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

19. Remove the 5 shifter retaining bolts.
20. Remove the shifter.

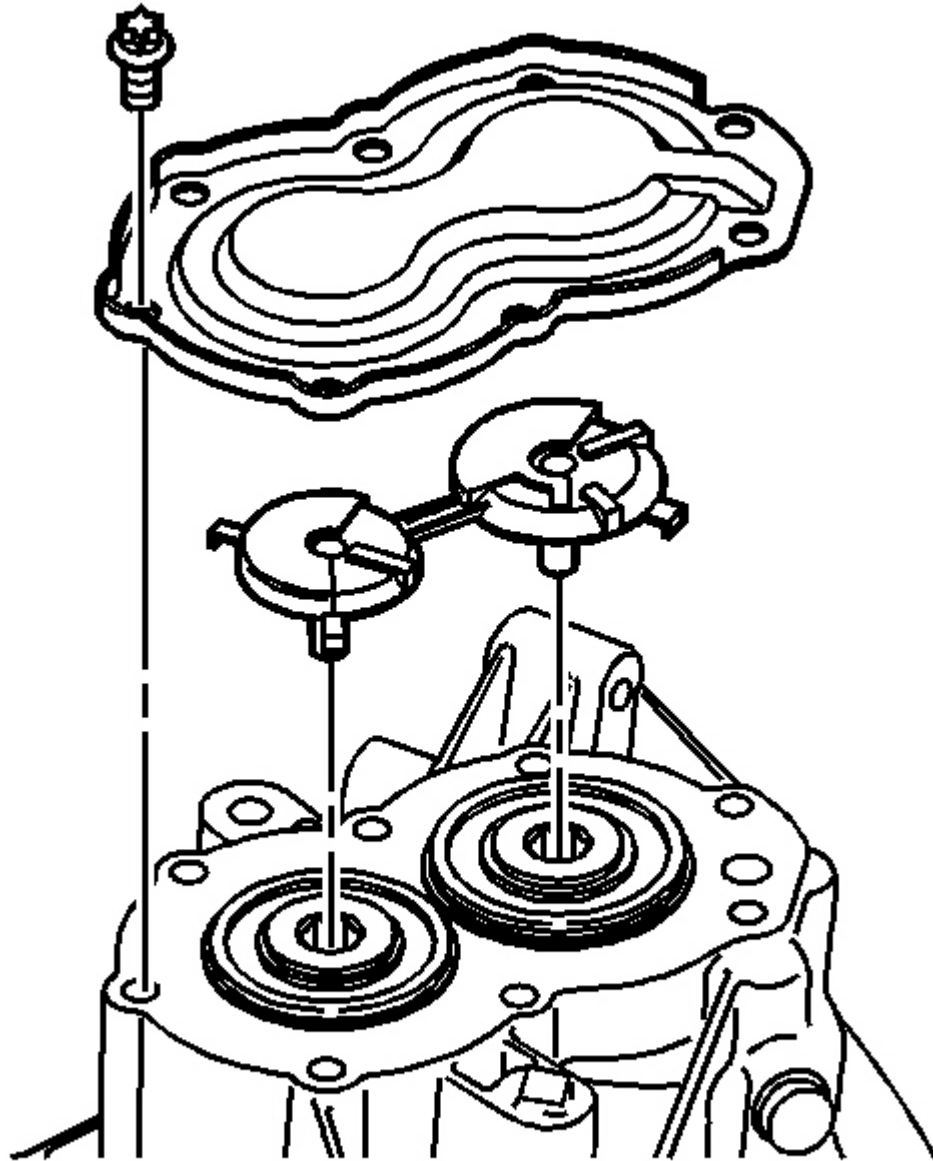


Fig. 138: Rear Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

21. Remove the rear cover bolts.
22. Remove the rear cover.
23. Remove the oil guide.

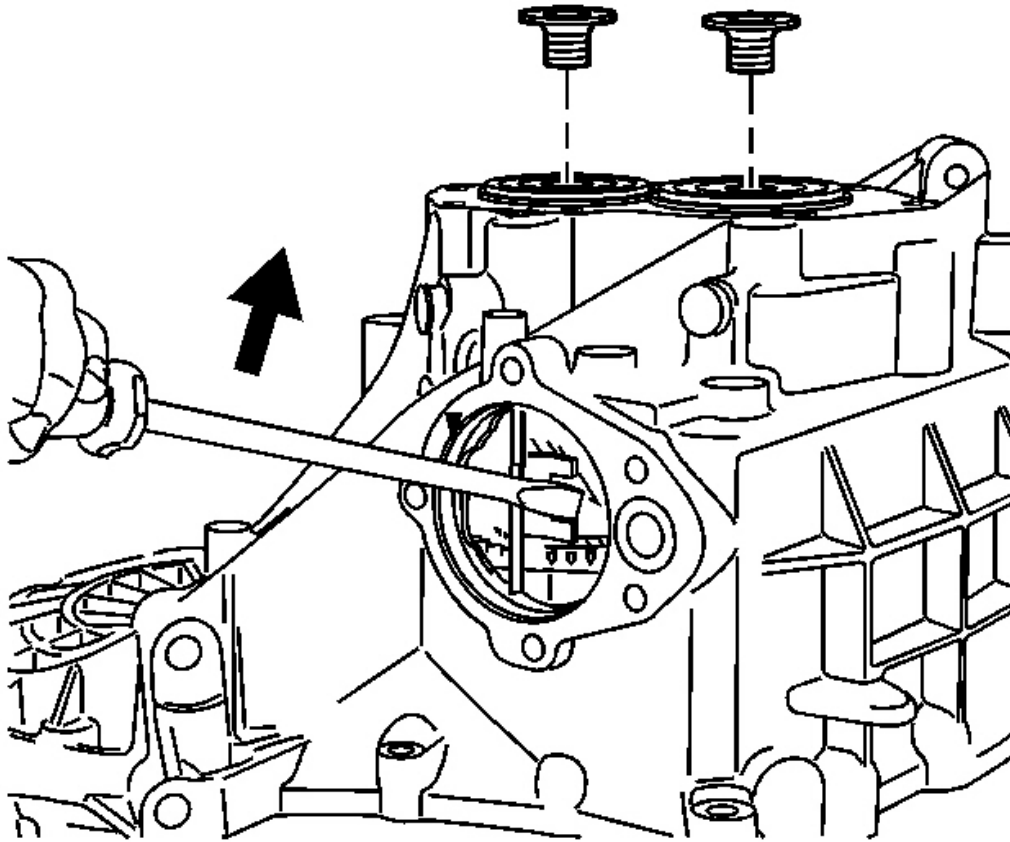


Fig. 139: Shaft Bolts & Transmission
Courtesy of GENERAL MOTORS CORP.

24. Shift the transmission into 4th and 5th gear using a screwdriver in an upward direction.
25. Remove the 2 shaft bolts while holding the transmission into 4th and 5th gear with a screwdriver in an upward direction.

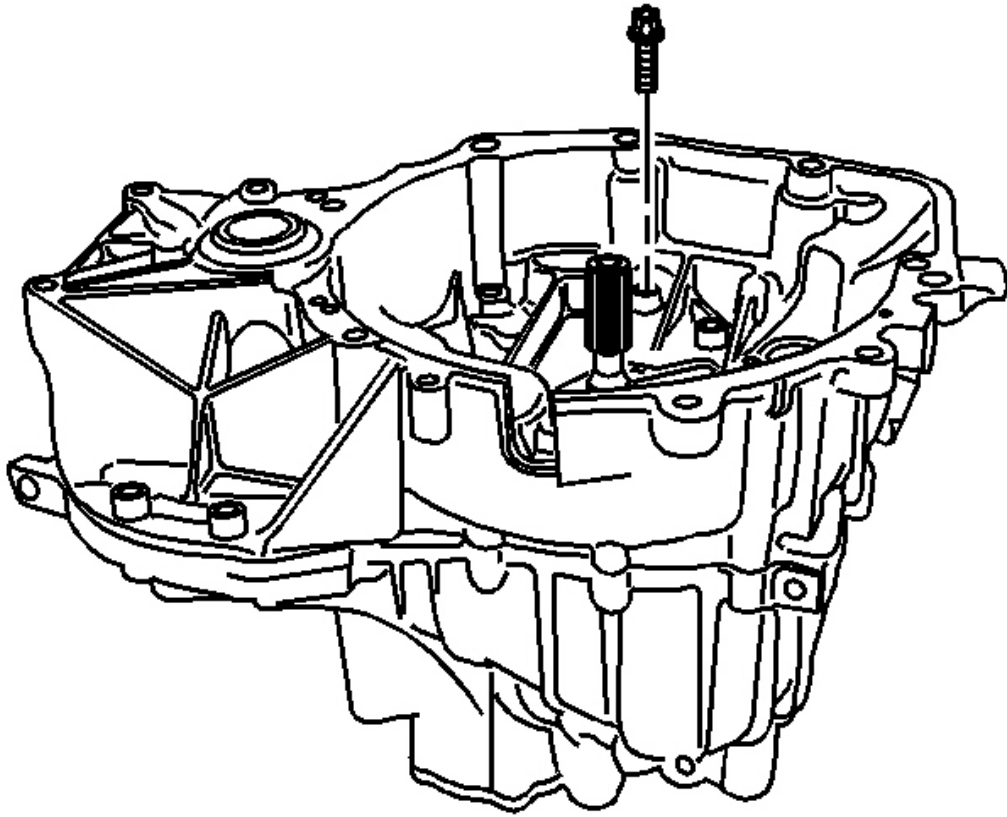


Fig. 140: Transmission Housing Bolts
Courtesy of GENERAL MOTORS CORP.

26. Turn the transmission over and remove the remainder of the transmission housing bolts from the clutch housing side.

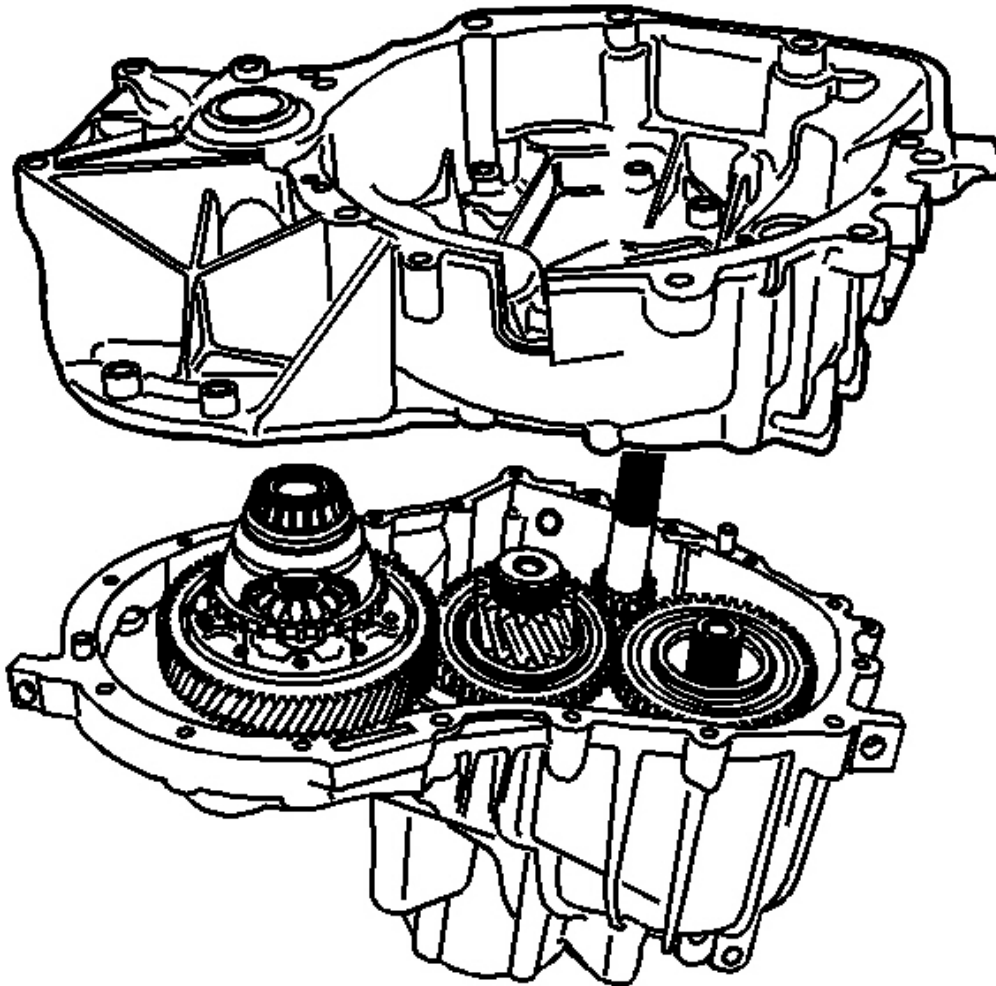


Fig. 141: Clutch Housing & Transaxle Case
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: In line with the intermediate shaft, use two suitable tools to assist in the case separation.

27. Remove the clutch housing from the transaxle case.

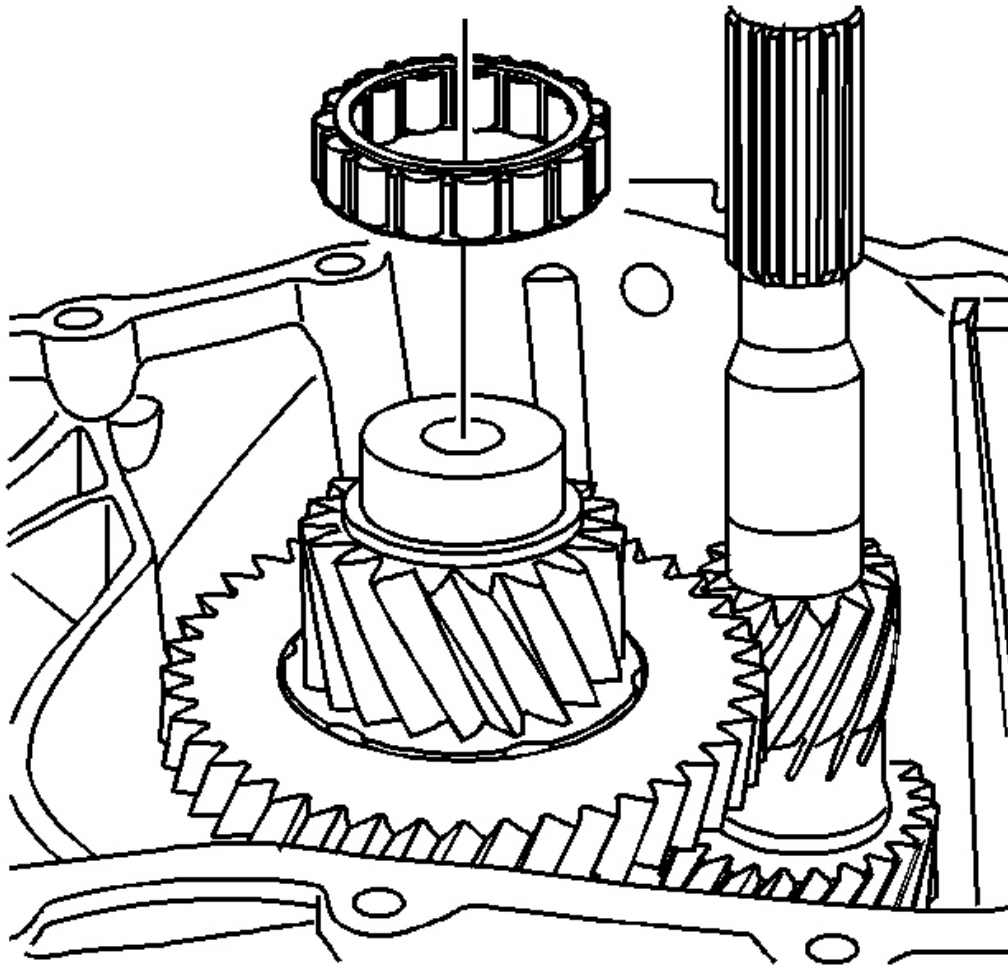


Fig. 142: Roller Bearing & Output Shaft
Courtesy of GENERAL MOTORS CORP.

28. Remove the roller bearing from the output shaft.

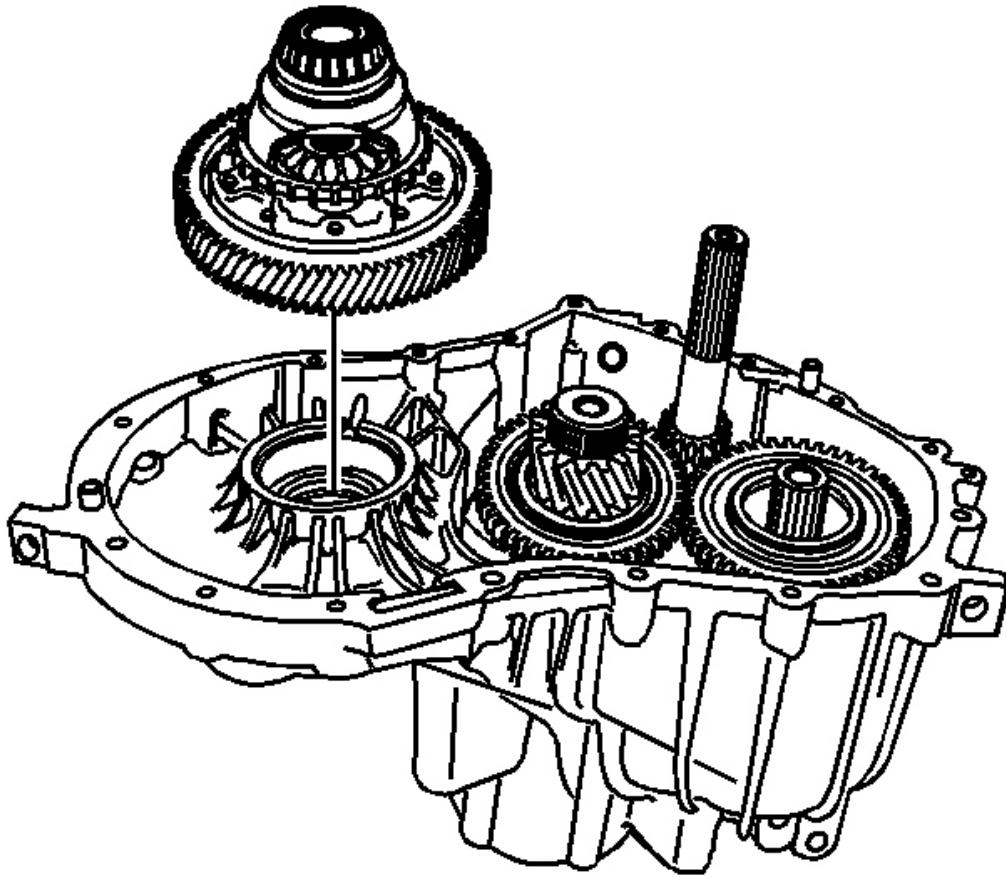


Fig. 143: Differential & Transaxle Case
Courtesy of GENERAL MOTORS CORP.

29. Remove the differential from the transaxle case.

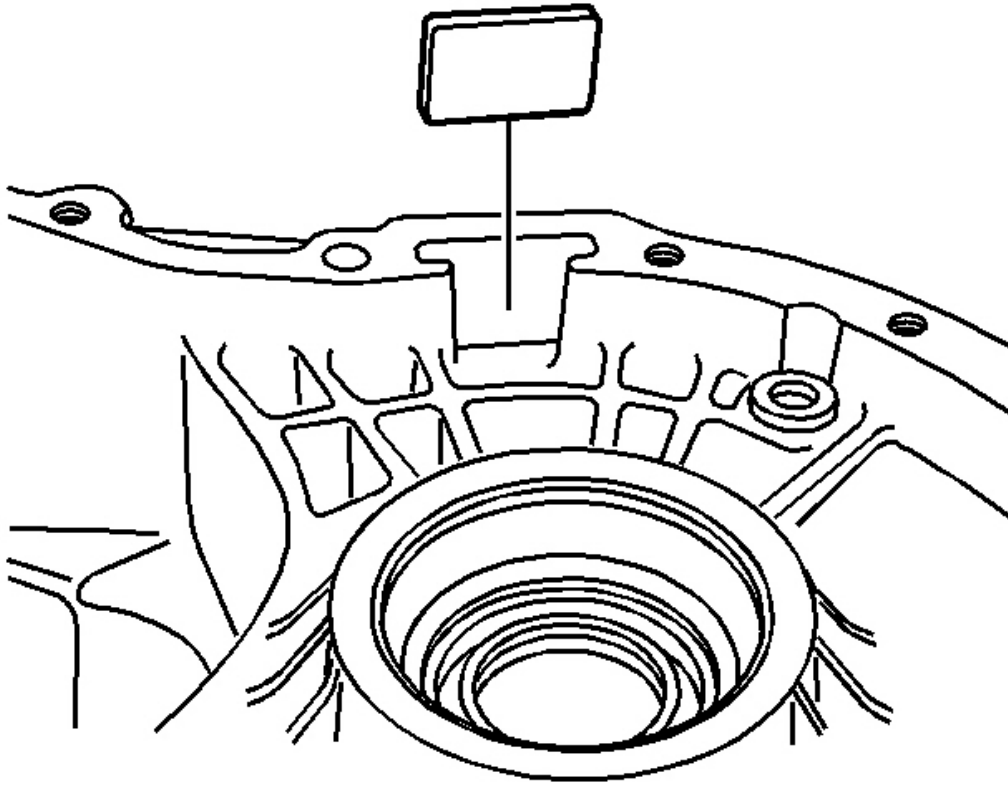


Fig. 144: Magnet & Transaxle Case
Courtesy of GENERAL MOTORS CORP.

30. Remove the magnet from the transaxle case.

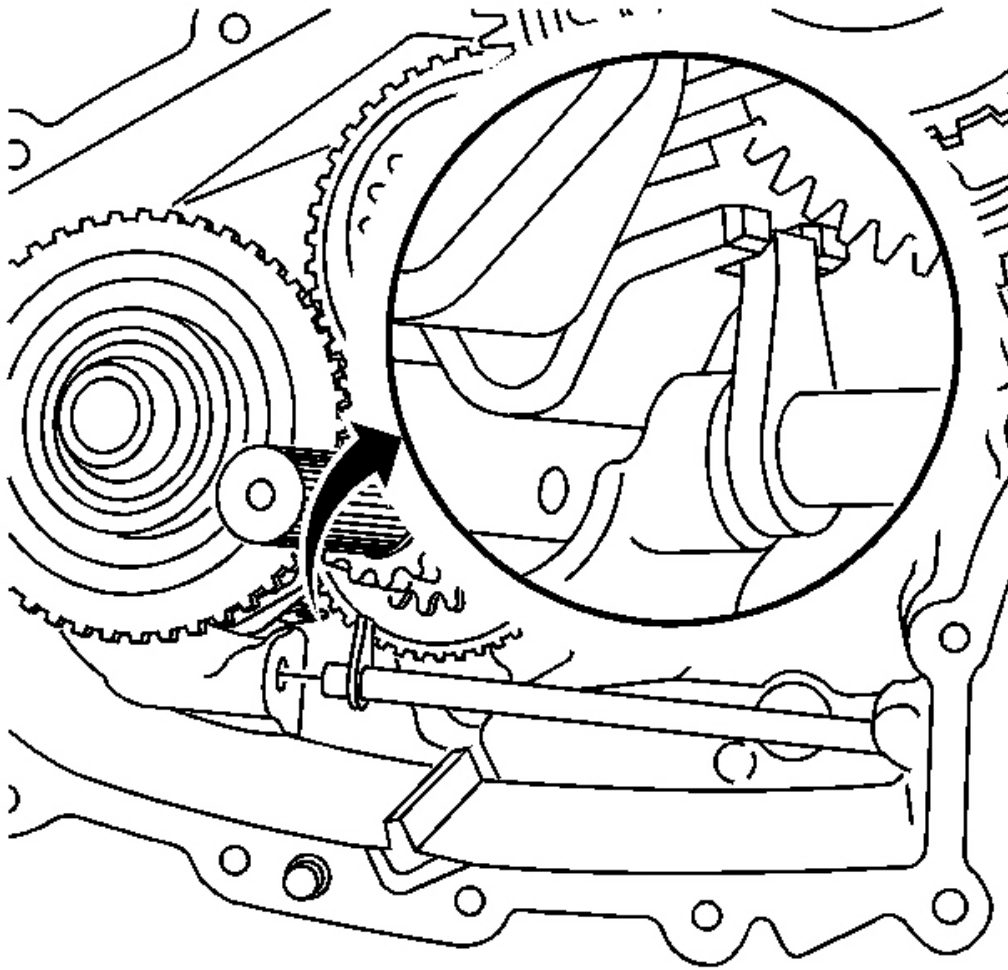


Fig. 145: Shift Rod & Shift Fork
Courtesy of GENERAL MOTORS CORP.

31. Slide outward and unhook the shift rod from the shift fork.

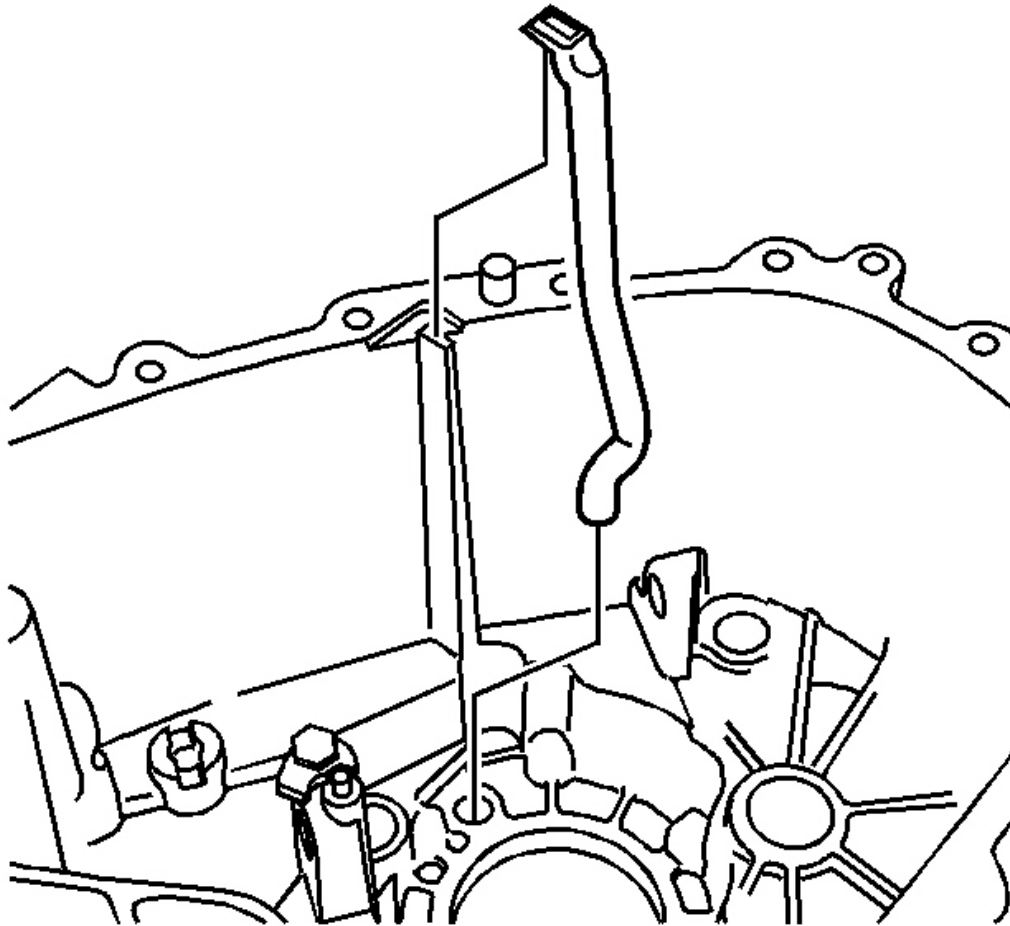


Fig. 146: Oil Tube & Transaxle Case
Courtesy of GENERAL MOTORS CORP.

32. Remove the oil tube from the transaxle case.

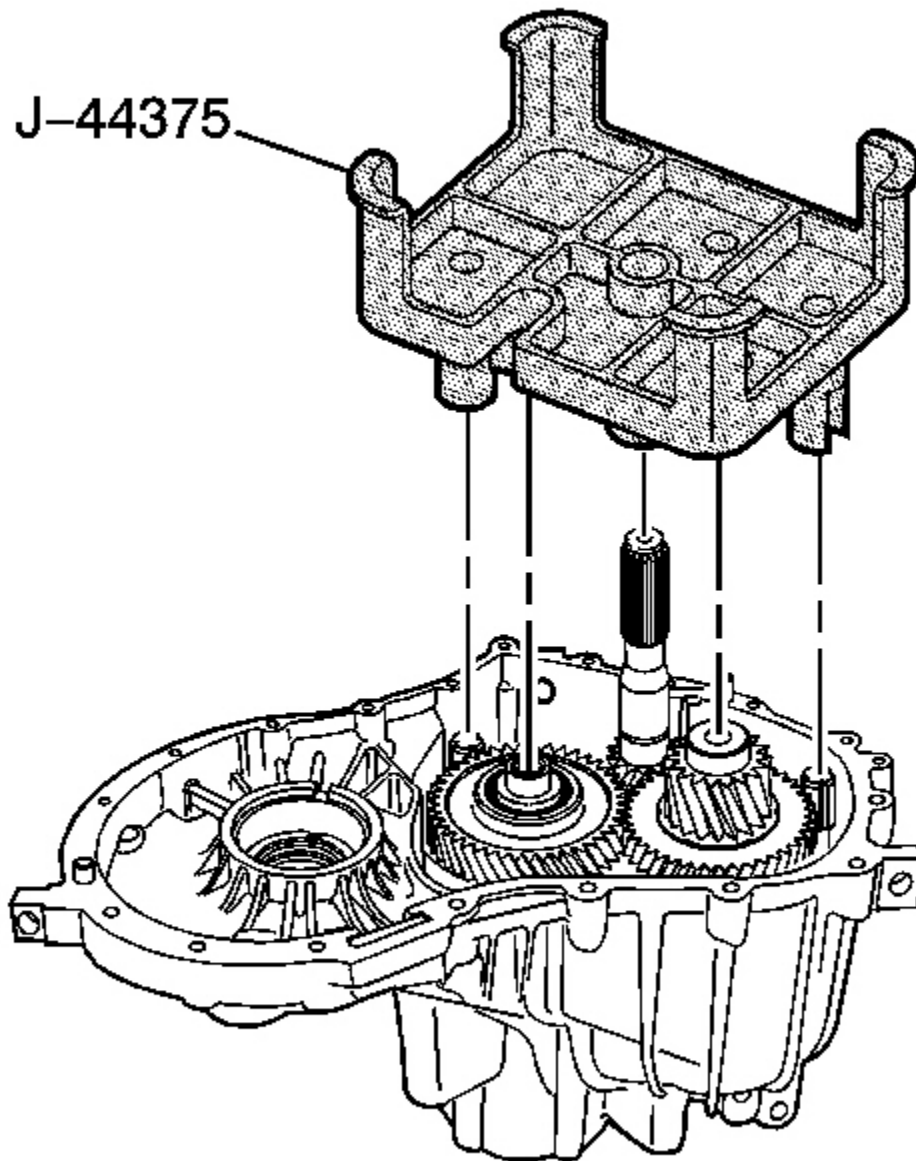


Fig. 147: Gear Shafts, Shift Forks & J 44375
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure all of the shafts are in the proper slots on the holding fixture.

33. Install the J 44375 onto the gear shafts and the shift forks. See **Special Tools and Equipment** .

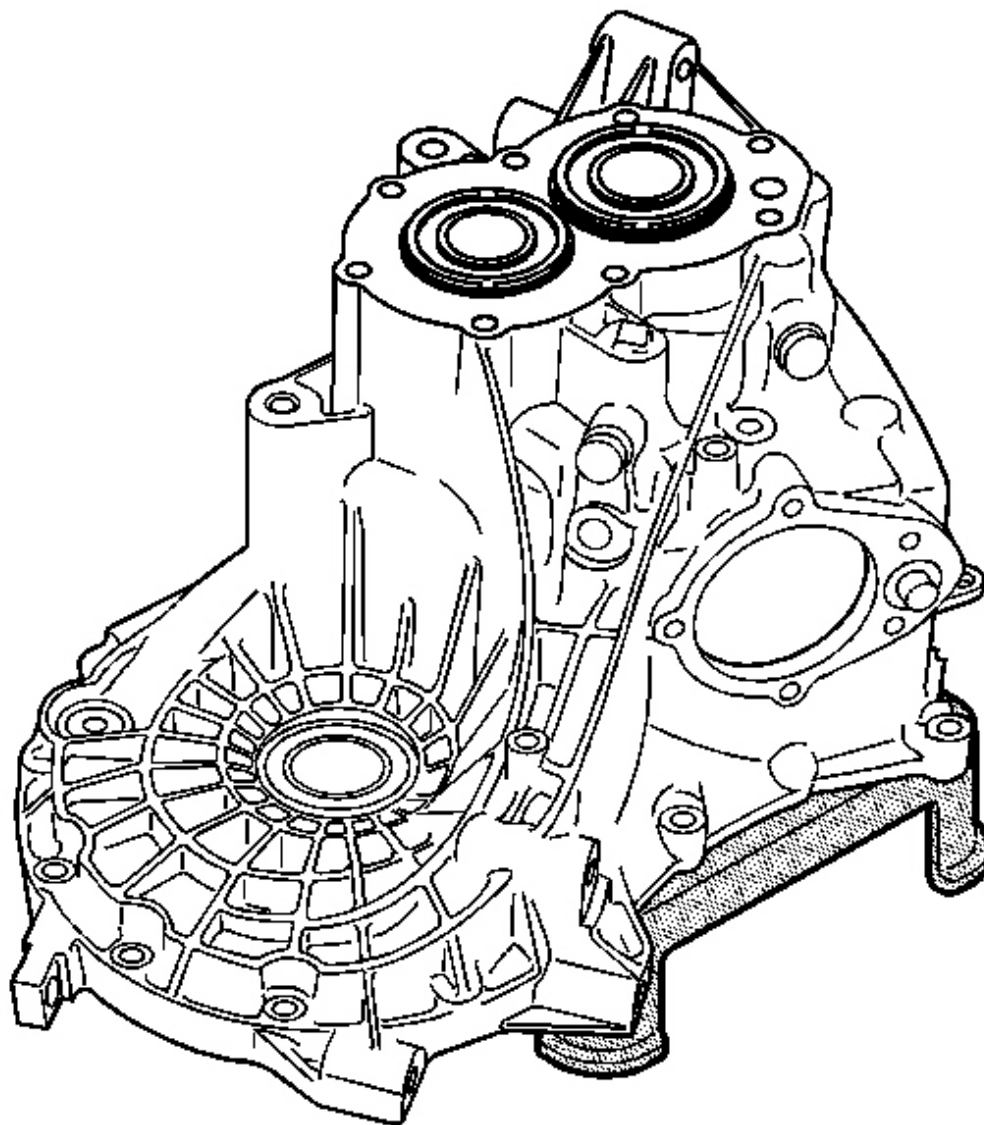


Fig. 148: Transaxle Case (Bottom) & J 44375
Courtesy of GENERAL MOTORS CORP.

34. Turn the transaxle case over on the J 44375 . See Special Tools and Equipment .

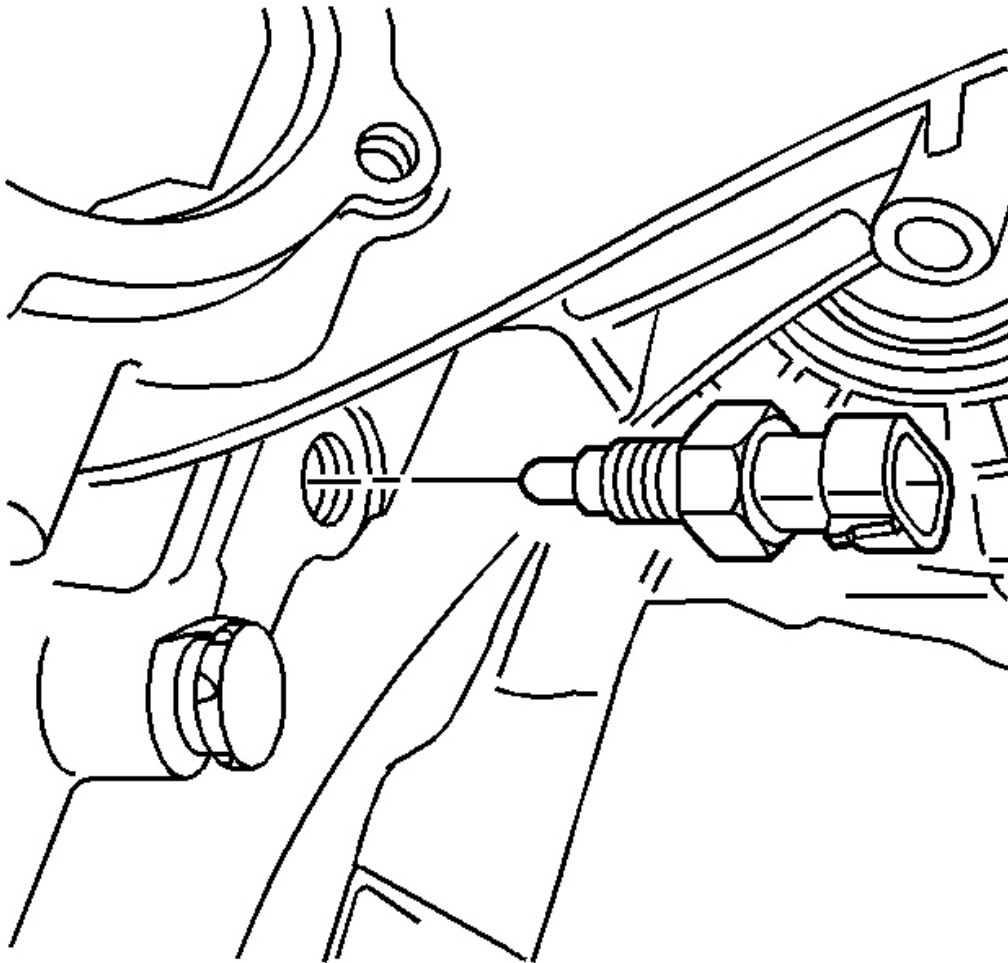


Fig. 149: Backup Lamp Switch
Courtesy of GENERAL MOTORS CORP.

35. Remove the reverse lamp switch.

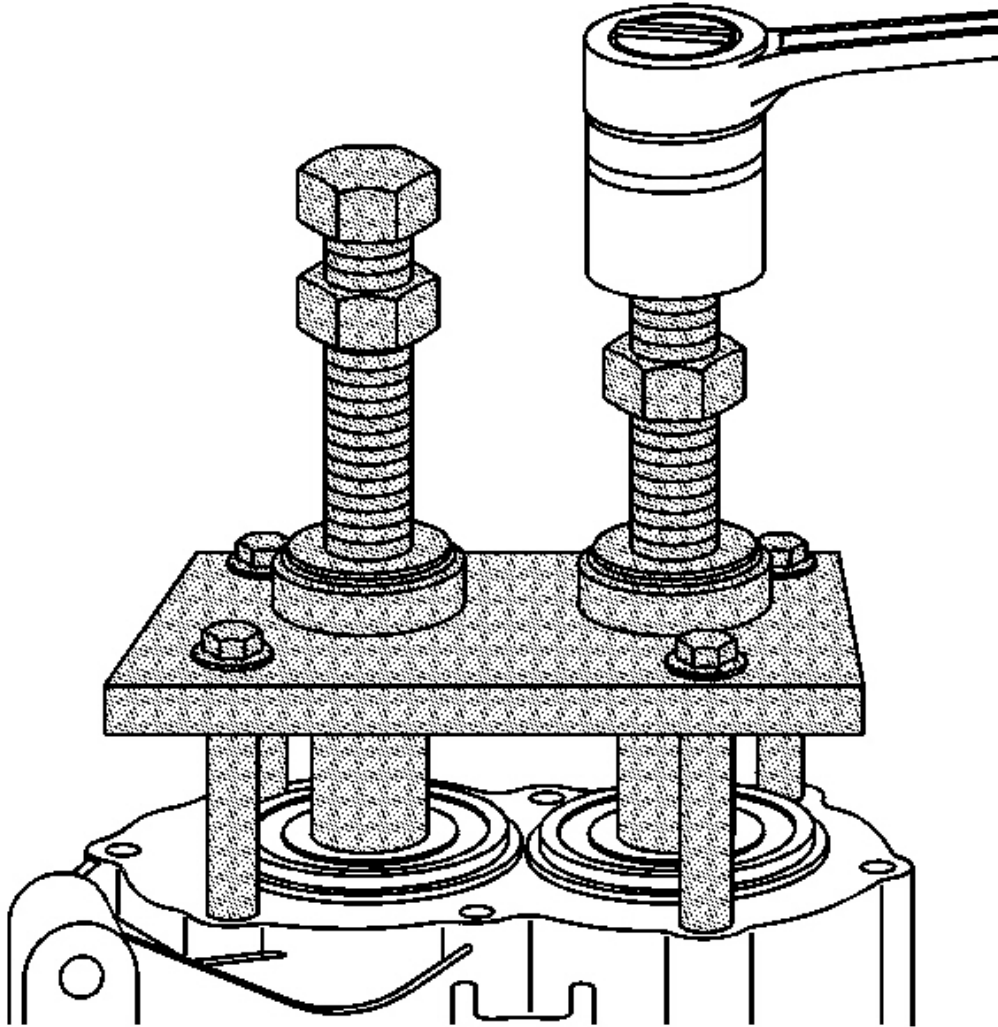


Fig. 150: Transaxle Case, Shafts & J 44376
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Alternate the tightening of the jack screws on the J 44376 to ensure proper removal of the transaxle case. See Special Tools and Equipment .

36. Remove the transaxle case from the shafts using the J 44376-1, J 44376-2, and J 44376-3.

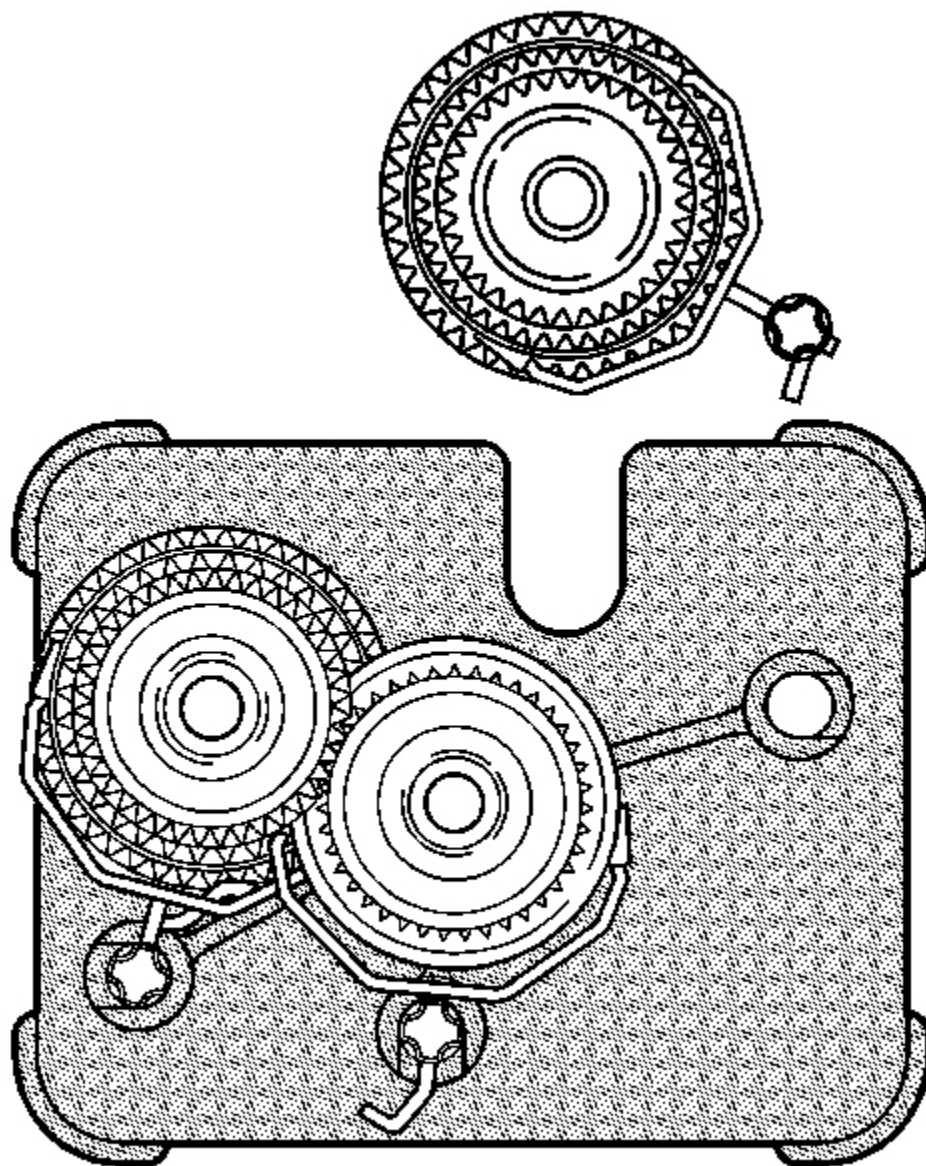


Fig. 151: Intermediate Shaft, Shift Fork & J 44375
Courtesy of GENERAL MOTORS CORP.

37. Remove the intermediate shaft and shift fork from the input shaft, the output shaft, and the **J 44375** . See **Special Tools and Equipment** .

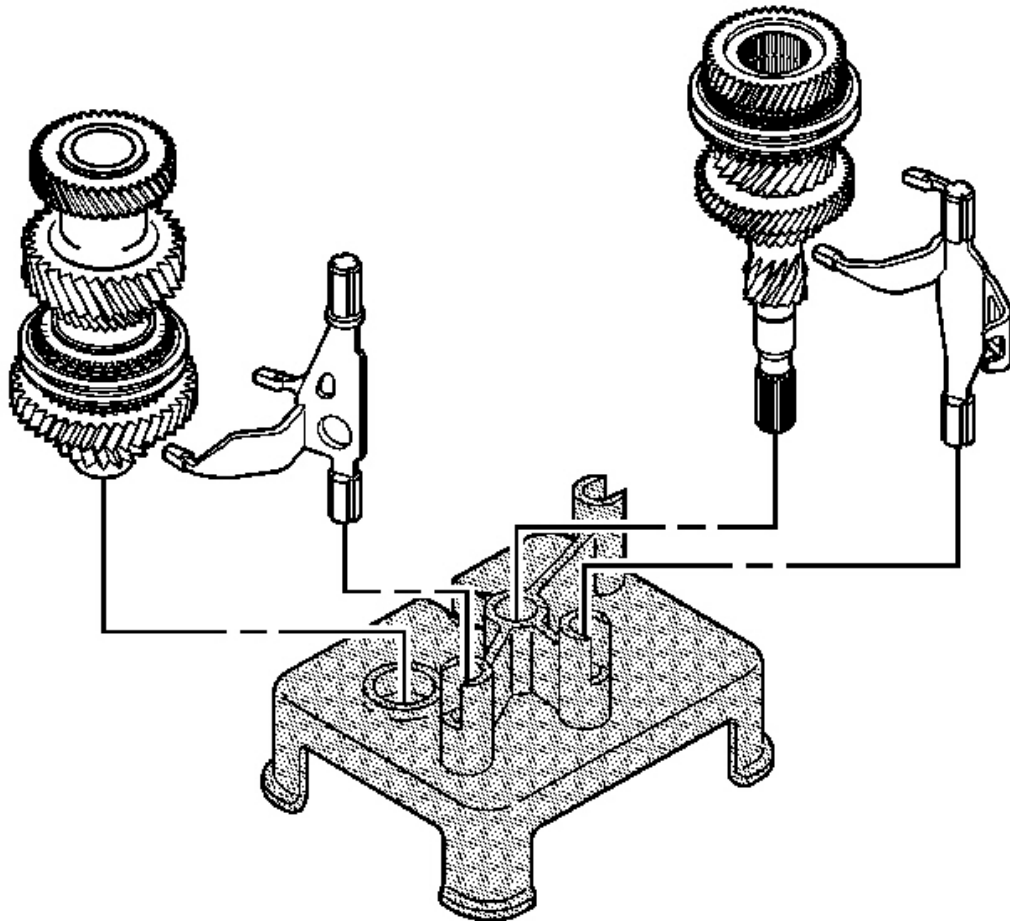


Fig. 152: Shift Forks & Gear Assemblies
Courtesy of GENERAL MOTORS CORP.

38. Remove the remaining gear assemblies from the holding fixtures.
39. Remove the shift forks from the gear assemblies.

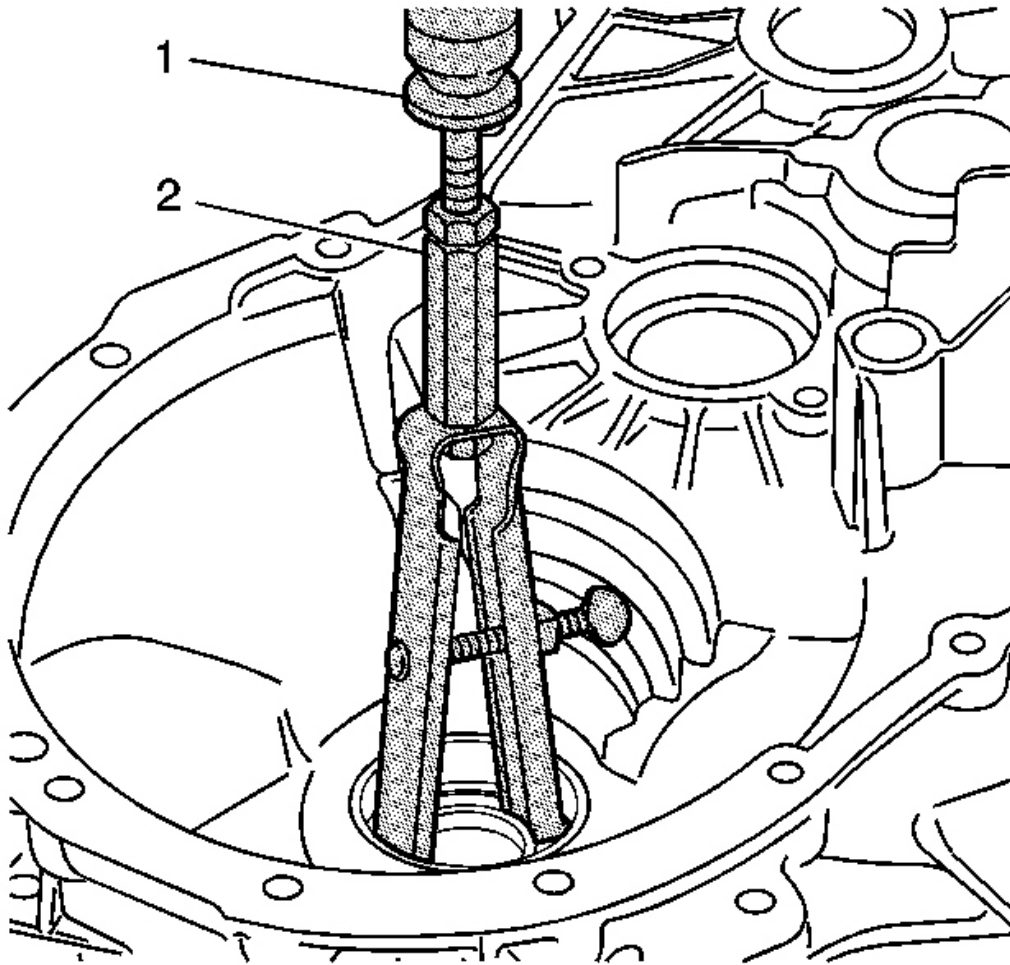


Fig. 153: Differential Bearing Outer Race, J 44380 & J 23907
Courtesy of GENERAL MOTORS CORP.

40. Using the **J 44380** (2) and the **J 23907** (SA9133T)/(SA9133T-1) (1), remove the differential bearing outer race from the clutch housing. See **Special Tools and Equipment** . Discard the race.

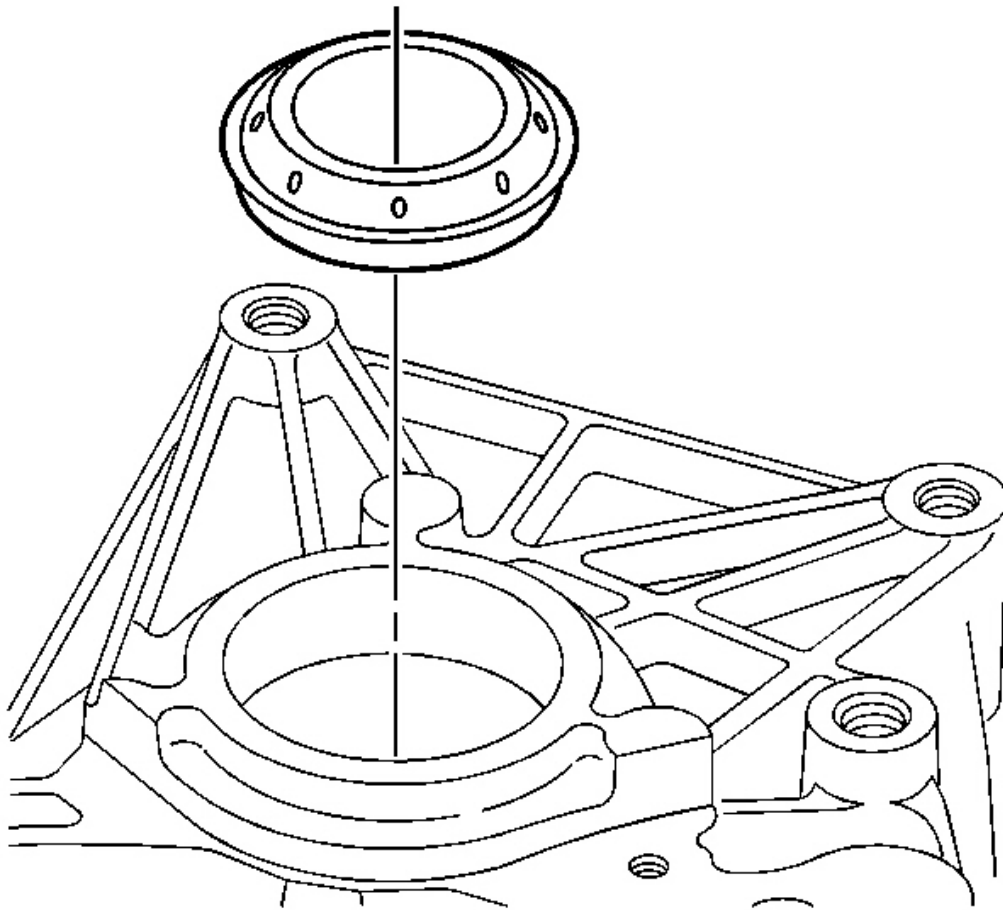


Fig. 154: Axle Seal
Courtesy of GENERAL MOTORS CORP.

41. Remove the differential output shaft seal from the clutch housing. Discard the seal.

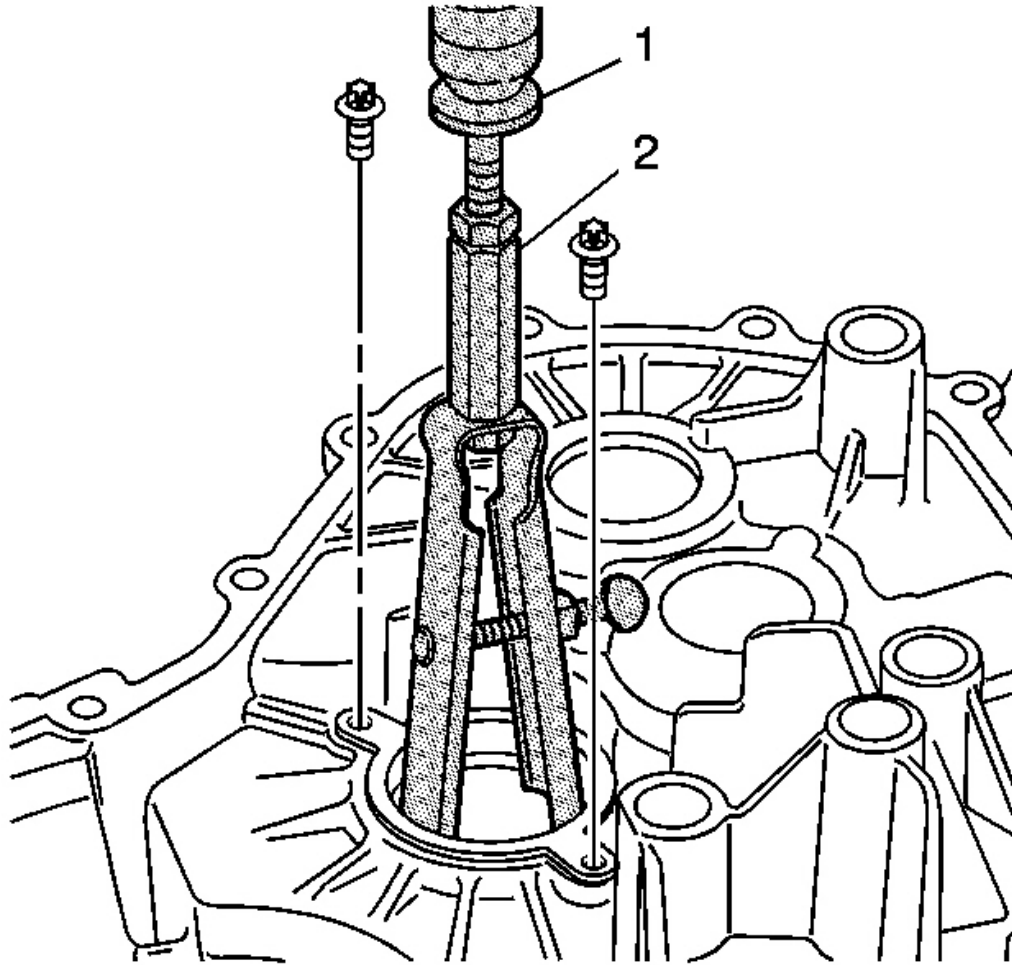


Fig. 155: Output Shaft Bearing Race, Bolts, J 23907 & J 44380
Courtesy of GENERAL MOTORS CORP.

42. Remove the output shaft bearing race and bolts from the clutch housing using the **J 23907** /(SA9133T)/ (SA9133T-1) (1) and the **J 44380** (2). See **Special Tools and Equipment** .

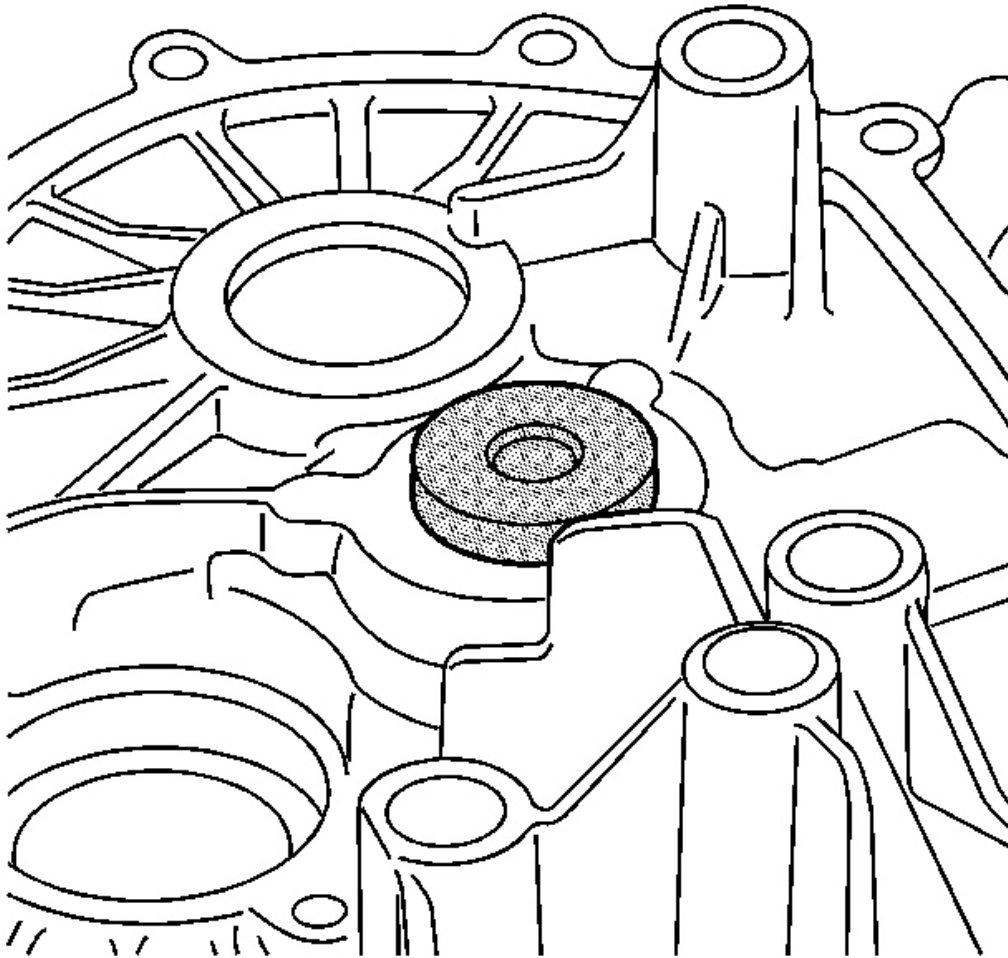


Fig. 156: Input Shaft Bearing, J 44381 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

43. Remove the input shaft bearing from the clutch housing using the **J 44381** and **J 7079-2** . See **Special Tools and Equipment** .

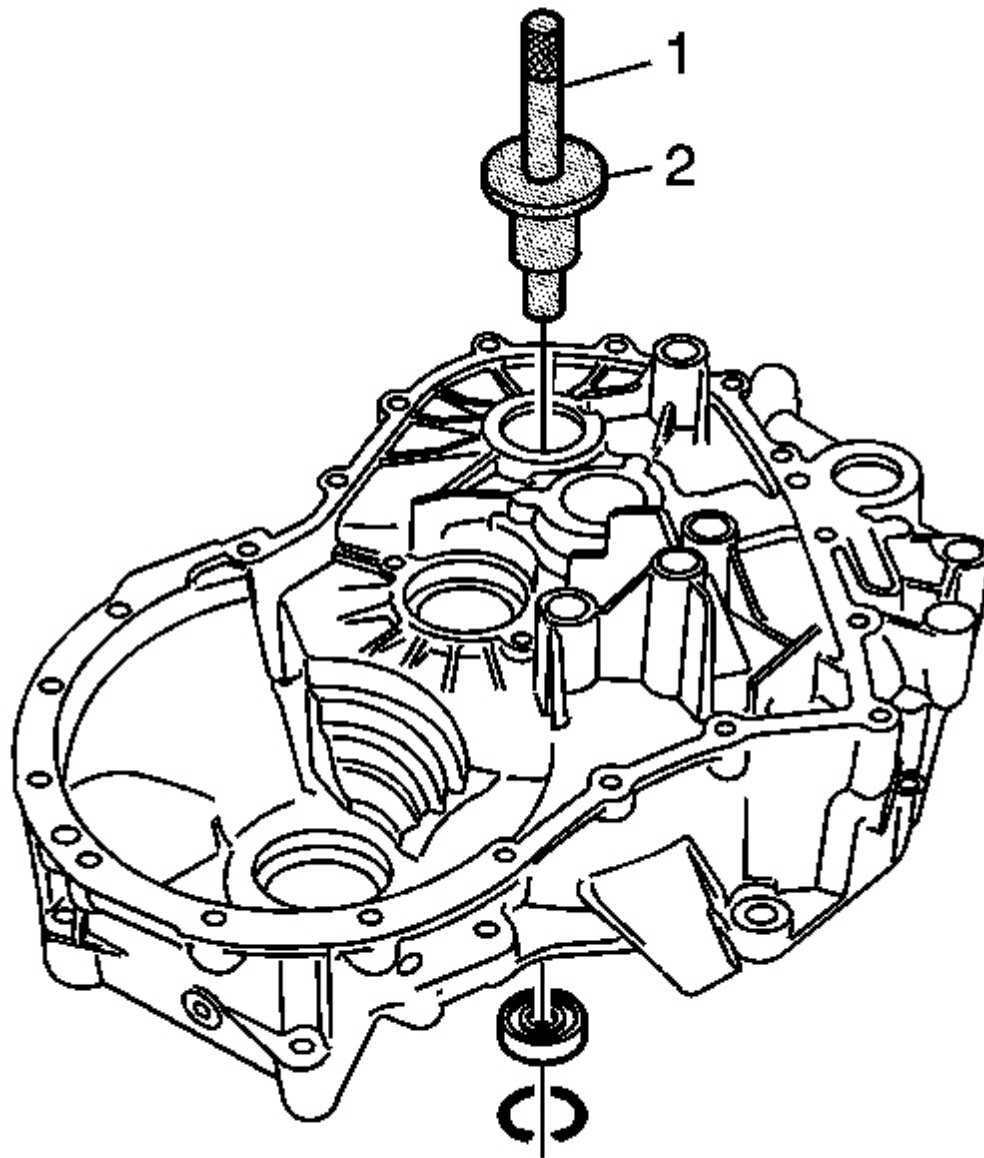


Fig. 157: Counter Shaft Bearing, J 44381 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

44. Remove the snap ring from the counter shaft bearing.
45. Remove the counter shaft bearing from the clutch housing using the **J 44381 (2)** and the **J 7079-2 (1)**. See **Special Tools and Equipment** .

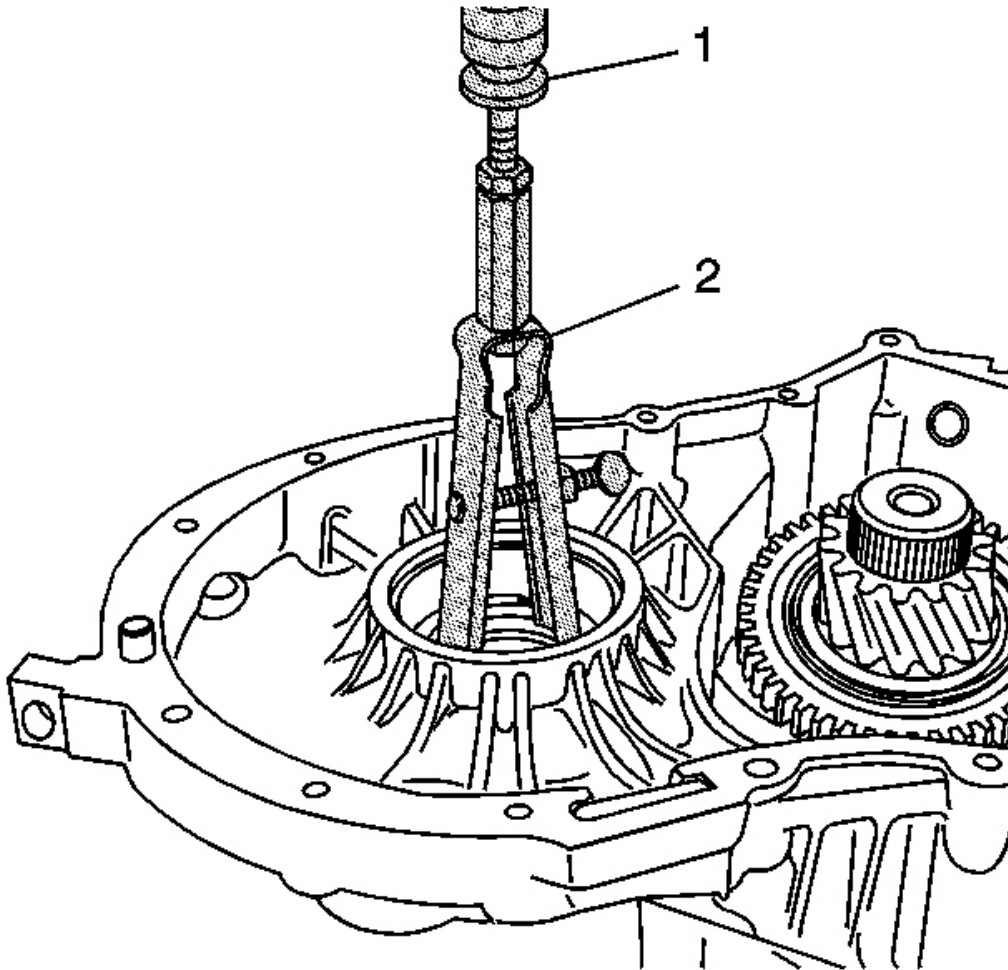


Fig. 158: Differential Bearing Outer Race, J 44380 & J 23907
Courtesy of GENERAL MOTORS CORP.

46. Remove the differential bearing outer race from the transmission housing using the **J 44380** (2) and the **J 23907** /(SA9133T)/(SA9133T-1) (1). See **Special Tools and Equipment** . Discard the race.

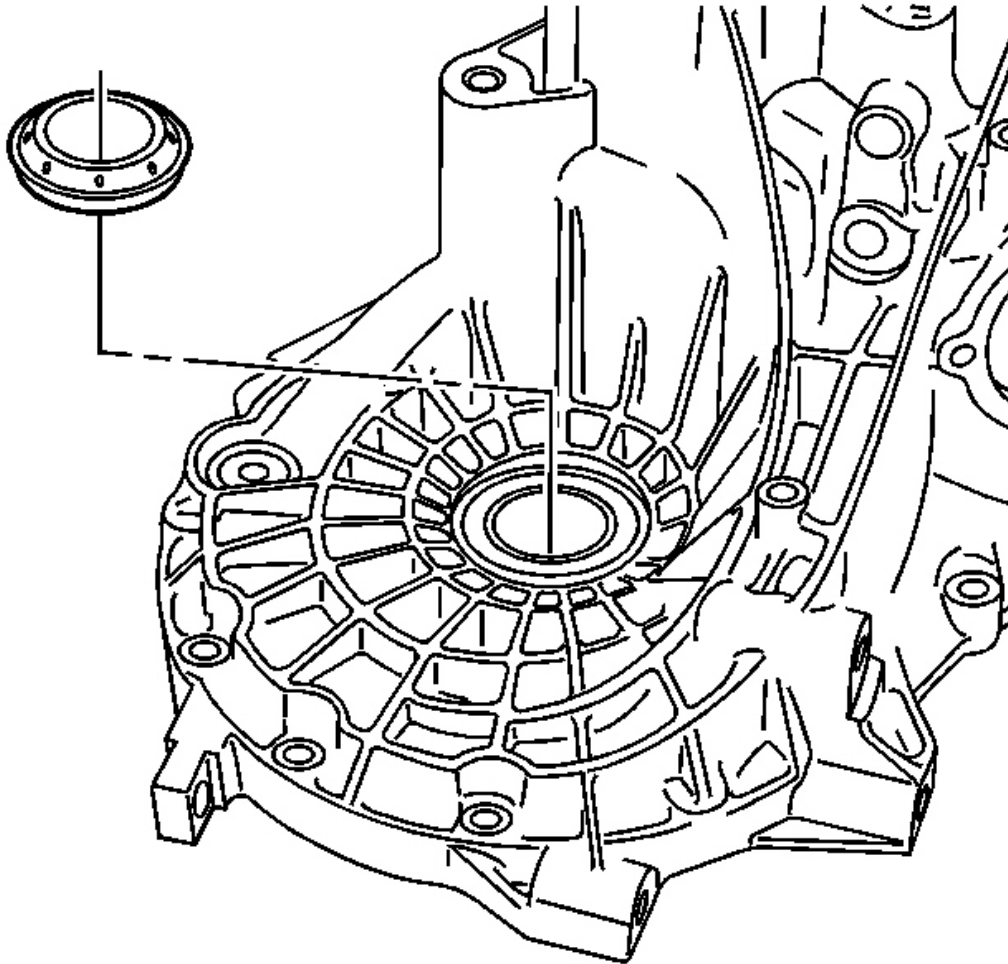


Fig. 159: Differential Output Shaft Seal
Courtesy of GENERAL MOTORS CORP.

47. Remove the differential output shaft seal from the transmission housing. Discard the seal.

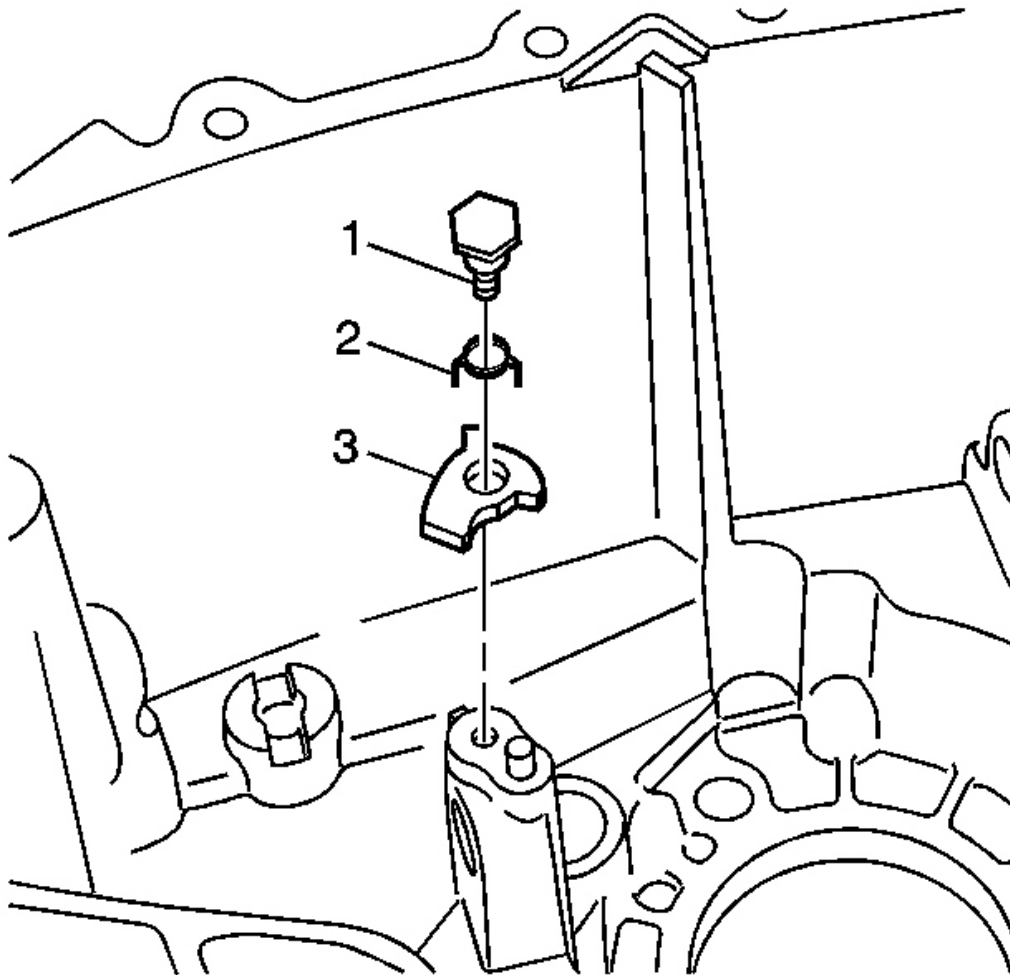


Fig. 160: Bolt, Lever, Spring & Transmission Housing
Courtesy of GENERAL MOTORS CORP.

48. Remove the bolt (1), lever (3) and spring (2) from the transmission housing, if equipped.

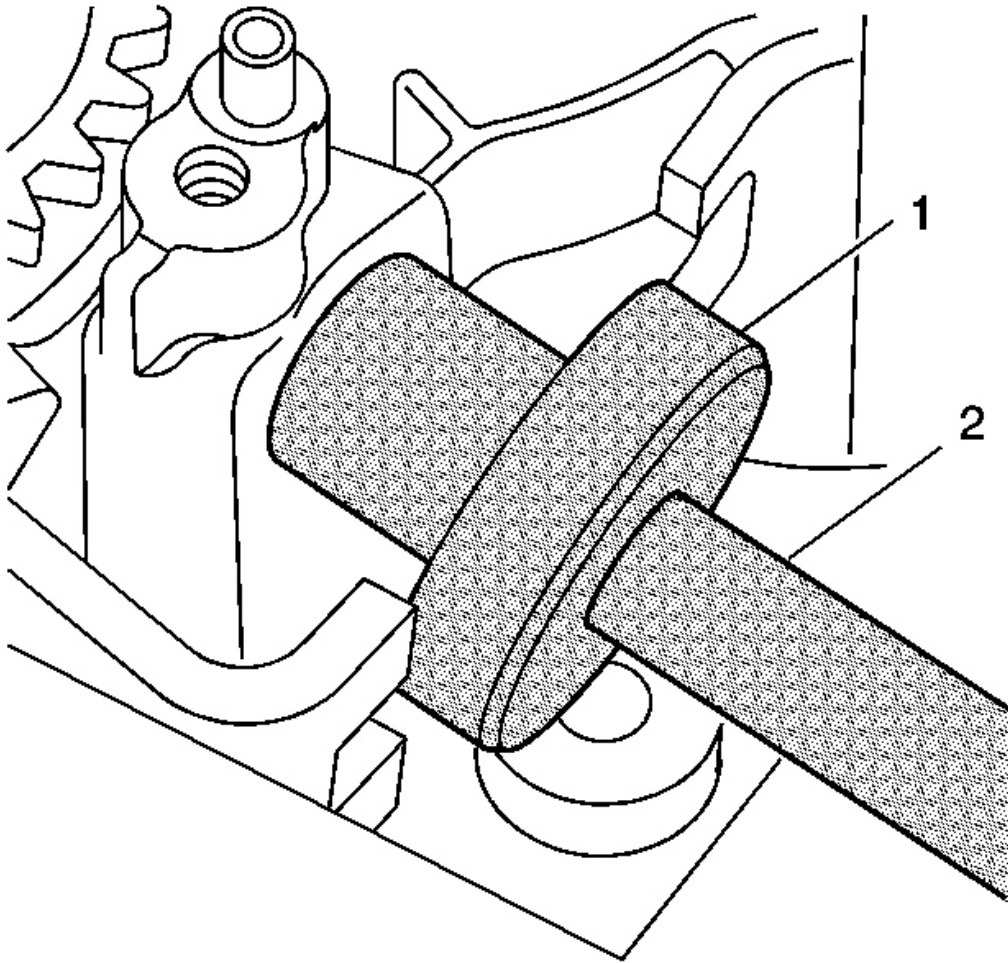


Fig. 161: Shifter Bearing, J 44381 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

49. Remove the shifter bearing from the transmission housing using the **J 44381** (1) and the **J 7079-2** (2). See **Special Tools and Equipment** .

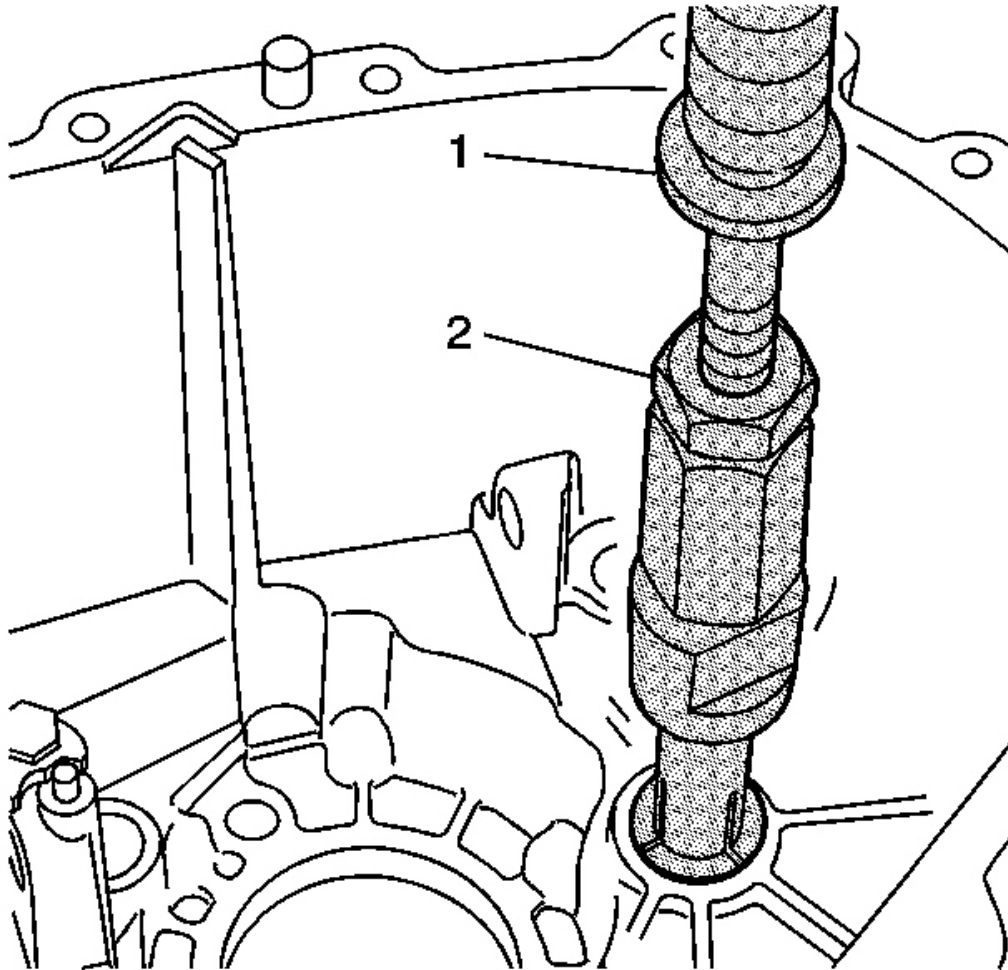


Fig. 162: Intermediate Shaft Needle Bearing, J 44380 & J 23907
Courtesy of GENERAL MOTORS CORP.

50. Remove the intermediate shaft needle bearing from the transmission housing using the **J 44382 (2)** and the **J 23907** /(SA9133T)/(SA9133T-2) (1). See **Special Tools and Equipment** .

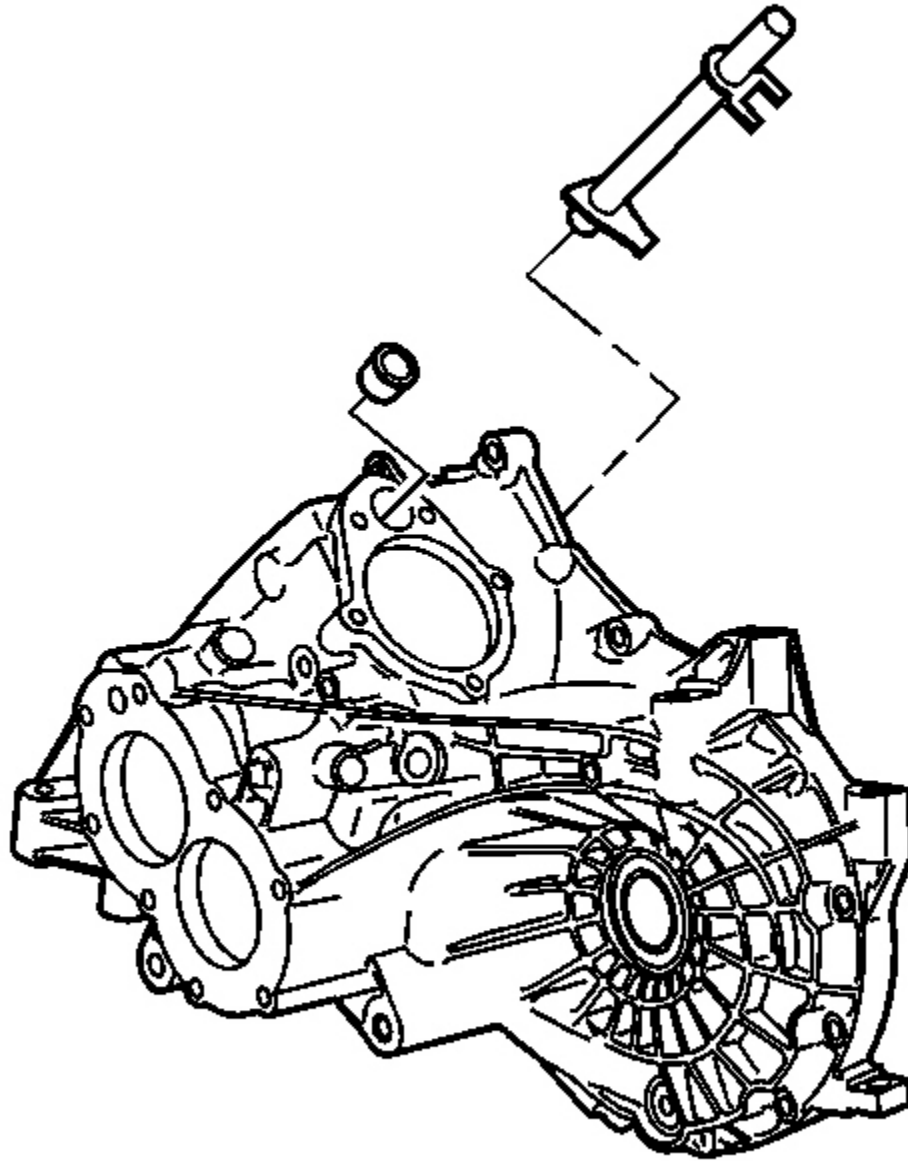


Fig. 163: Shift Rod, Bushing & Transmission Housing
Courtesy of GENERAL MOTORS CORP.

51. Remove the shift rod bushing and the shift rod from the transmission housing.

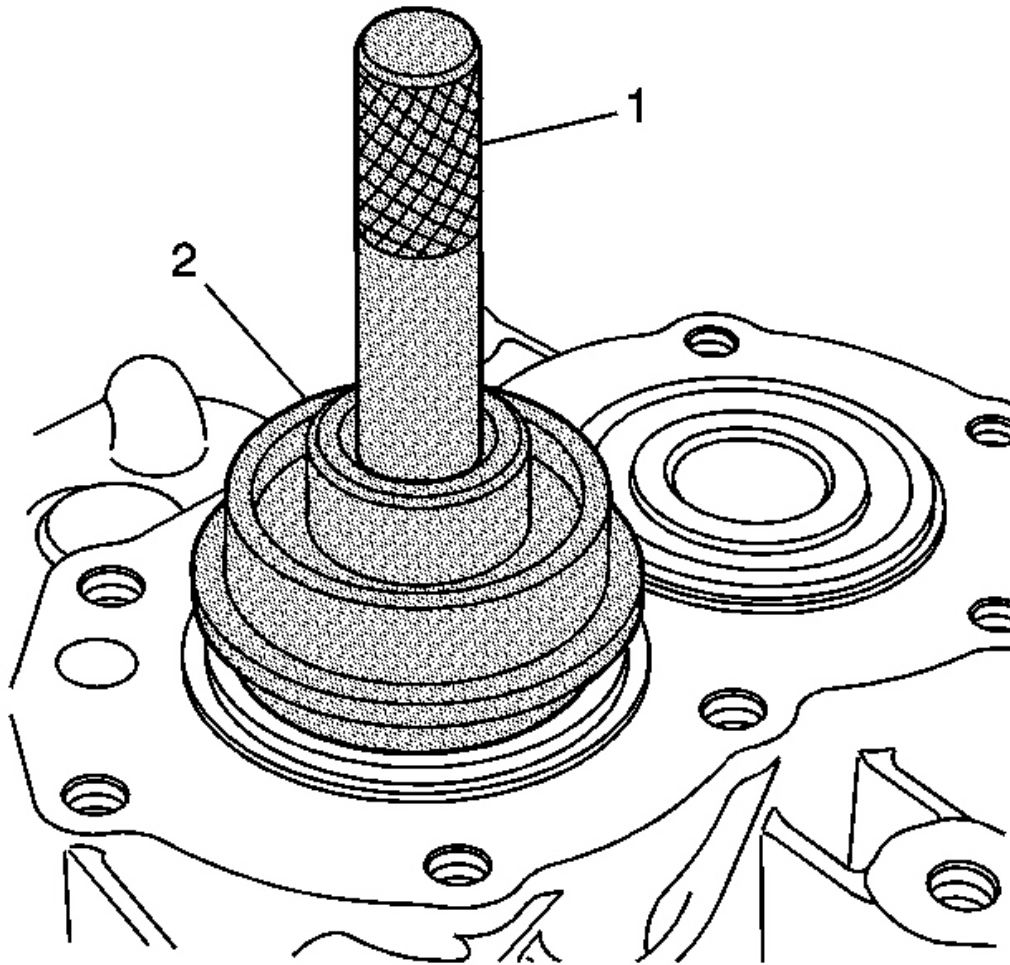


Fig. 164: Snap Ring, Input Shaft Bearing, J 44385 & J 8092
Courtesy of GENERAL MOTORS CORP.

52. Remove the snap ring and the input shaft bearing from the transmission housing using the **J 44385 (2)** and the **J 8092 (1)**. See **Special Tools and Equipment** . Discard the snap ring.
53. Remove the snap ring and the output shaft bearing from the transmission housing using the **J 44385 (2)** and the **J 8092 (1)**. See **Special Tools and Equipment** . Discard the snap ring.

INTERMEDIATE SHAFT DISASSEMBLE

Tools Required

- **J 36513** Gear and Bearing Separator Plate. See **Special Tools and Equipment** .

- **J 44383** Countershaft Bearing Installer. See **Special Tools and Equipment** .

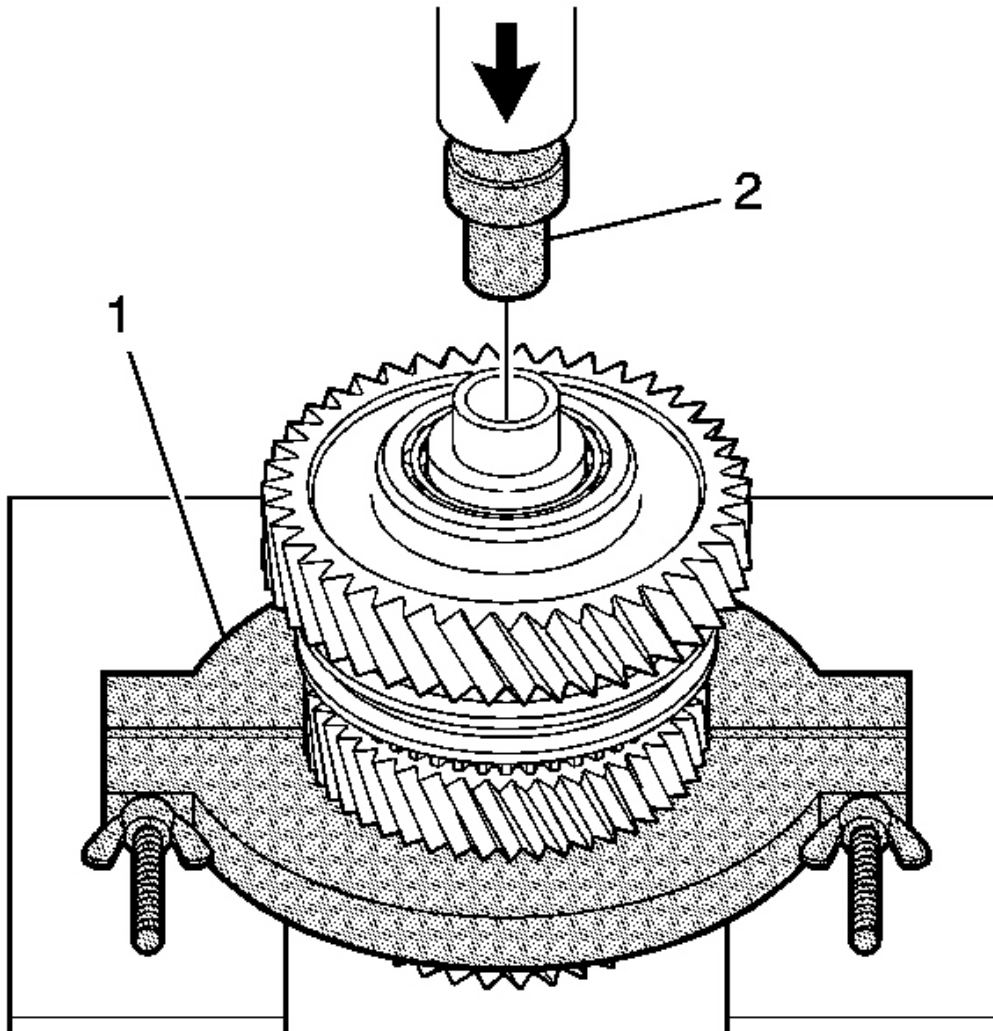


Fig. 165: Intermediate Shaft, J 36513 & J 44383
Courtesy of GENERAL MOTORS CORP.

1. Press off the 1st gear assembly and the 2nd gear assembly as a unit, from the intermediate shaft using the **J 36513** (1), the **J 44383** (2) and a hydraulic press. See **Special Tools and Equipment** .

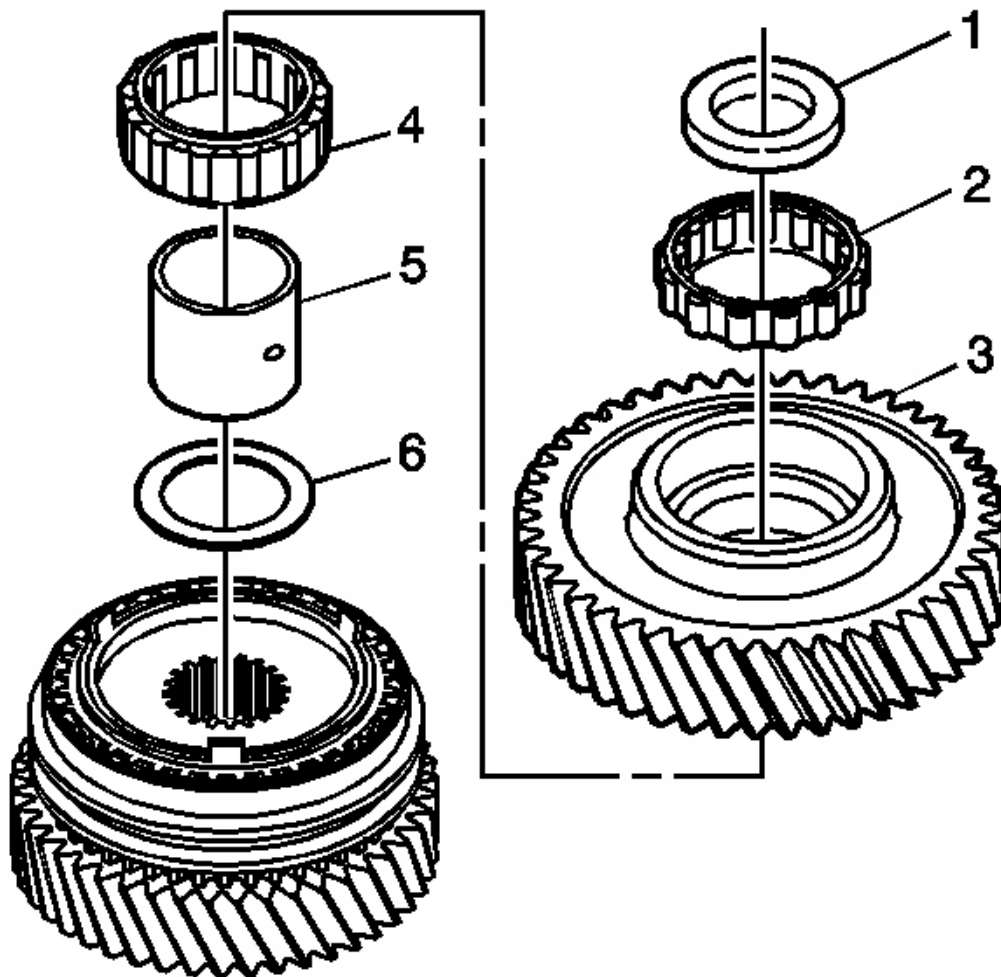


Fig. 166: 1st/2nd Gear Assembly & Components
Courtesy of GENERAL MOTORS CORP.

2. Put the 1st gear assembly and the 2nd gear assembly, as a unit, on the bench.
3. Remove the thrust washer (1).
4. Remove the roller bearing (2).
5. Remove the 1st gear (3).
6. Remove the roller bearing (4).
7. Remove the bearing collar (5).
8. Remove the thrust washer (6).

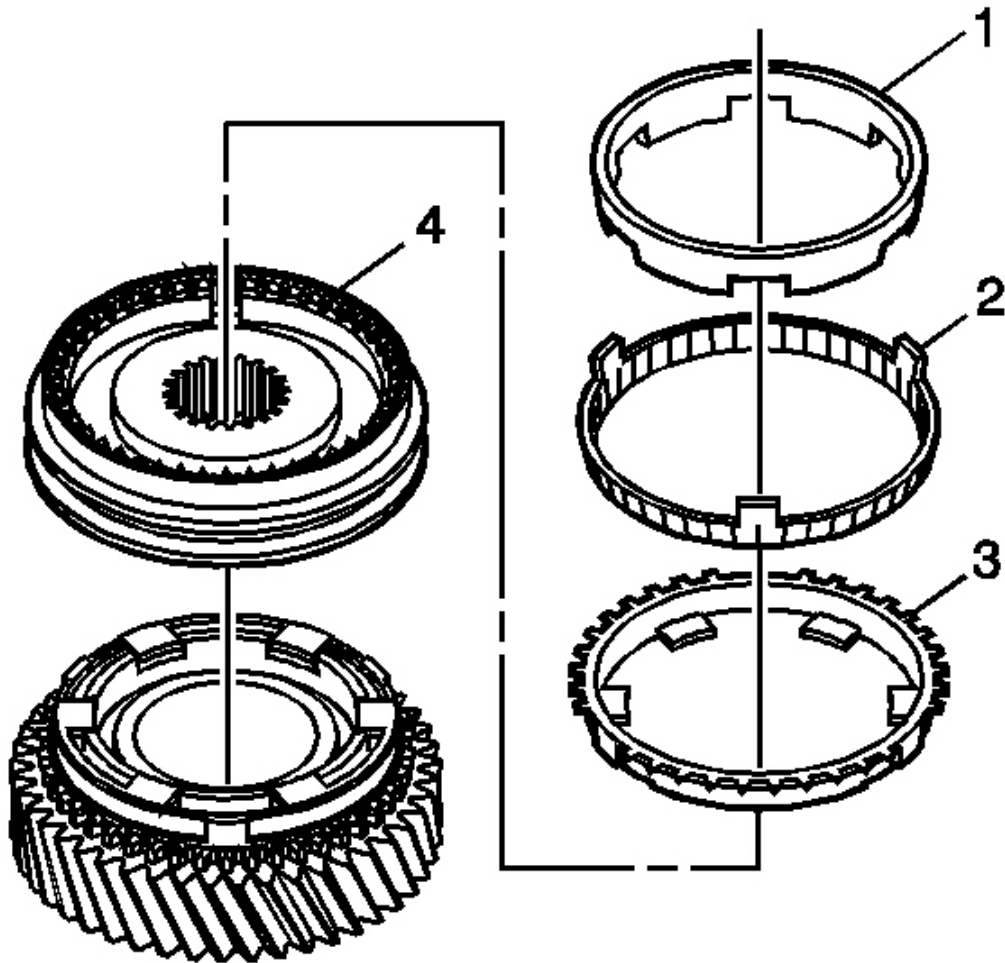


Fig. 167: 1st Gear Inner/Outer Cone, Blocking Ring & Synchronizer Assembly
Courtesy of GENERAL MOTORS CORP.

9. Remove the 1st gear inner cone (1).
10. Remove the 1st gear blocking ring (2).
11. Remove the 1st gear outer cone (3).
12. Remove the 1st/2nd synchronizer assembly (4).

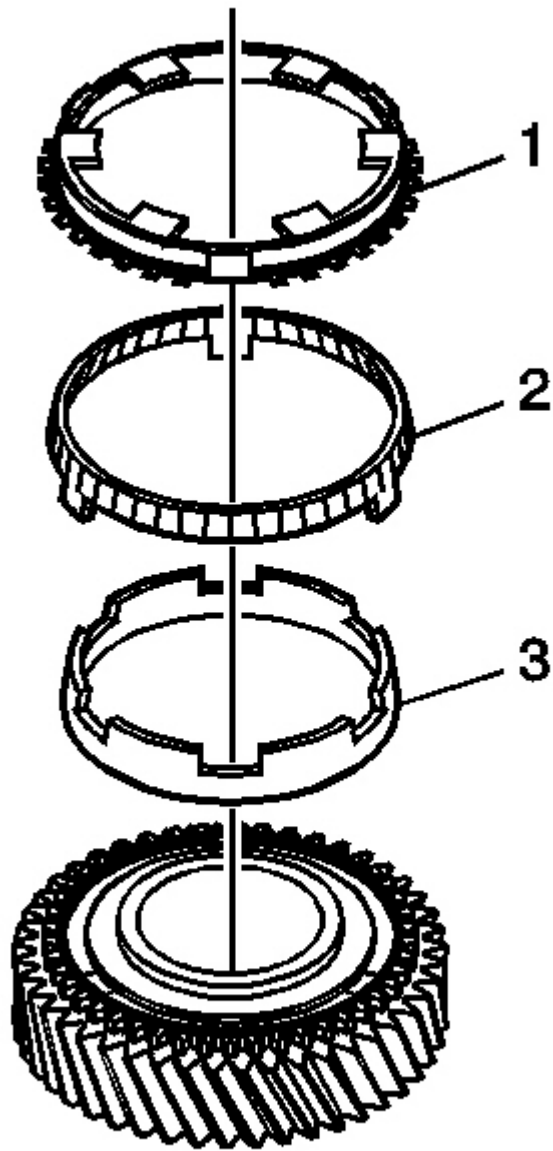


Fig. 168: 2nd Gear Inner/Outer Cone & Blocking Ring
Courtesy of GENERAL MOTORS CORP.

13. Remove the 2nd gear outer cone (1).
14. Remove the 2nd gear blocking ring (2).
15. Remove the 2nd gear inner cone (3).

16. Remove the 2nd gear.

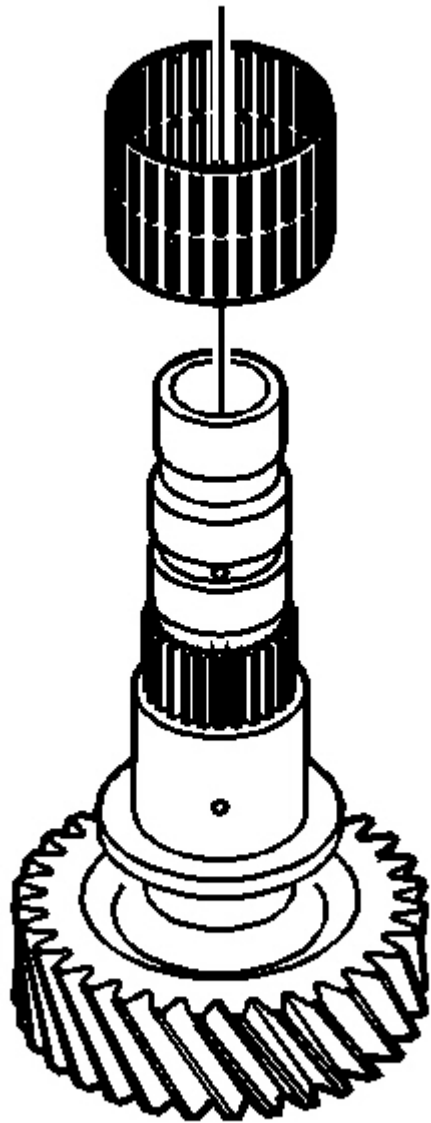


Fig. 169: Caged Needle Bearings & Intermediate Shaft
Courtesy of GENERAL MOTORS CORP.

17. Remove the caged needle bearings from the intermediate shaft.

INPUT SHAFT DISASSEMBLE

Tools Required

- **J 36513** Gear and Bearing Separator Plate. See Special Tools and Equipment .
- **J 44378** Press Adapter (all shafts). See Special Tools and Equipment .

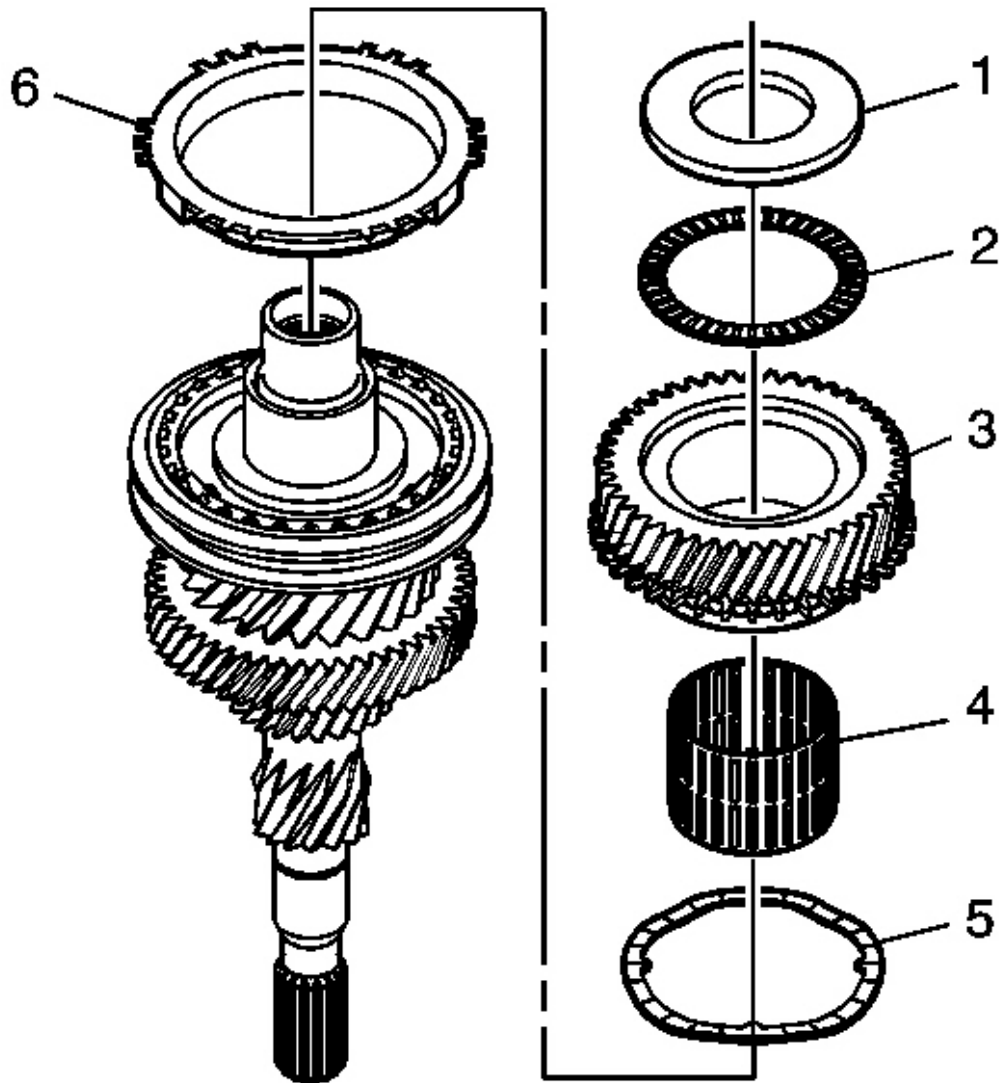


Fig. 170: Input Shaft Disassemble & Components

Courtesy of GENERAL MOTORS CORP.

1. Remove the thrust washer (1).
2. Remove the thrust bearing (2).
3. Remove the 4th gear (3).
4. Remove the caged needle bearing (4).
5. Remove the wavy washer (5).
6. Remove the 4th gear blocking ring (6).

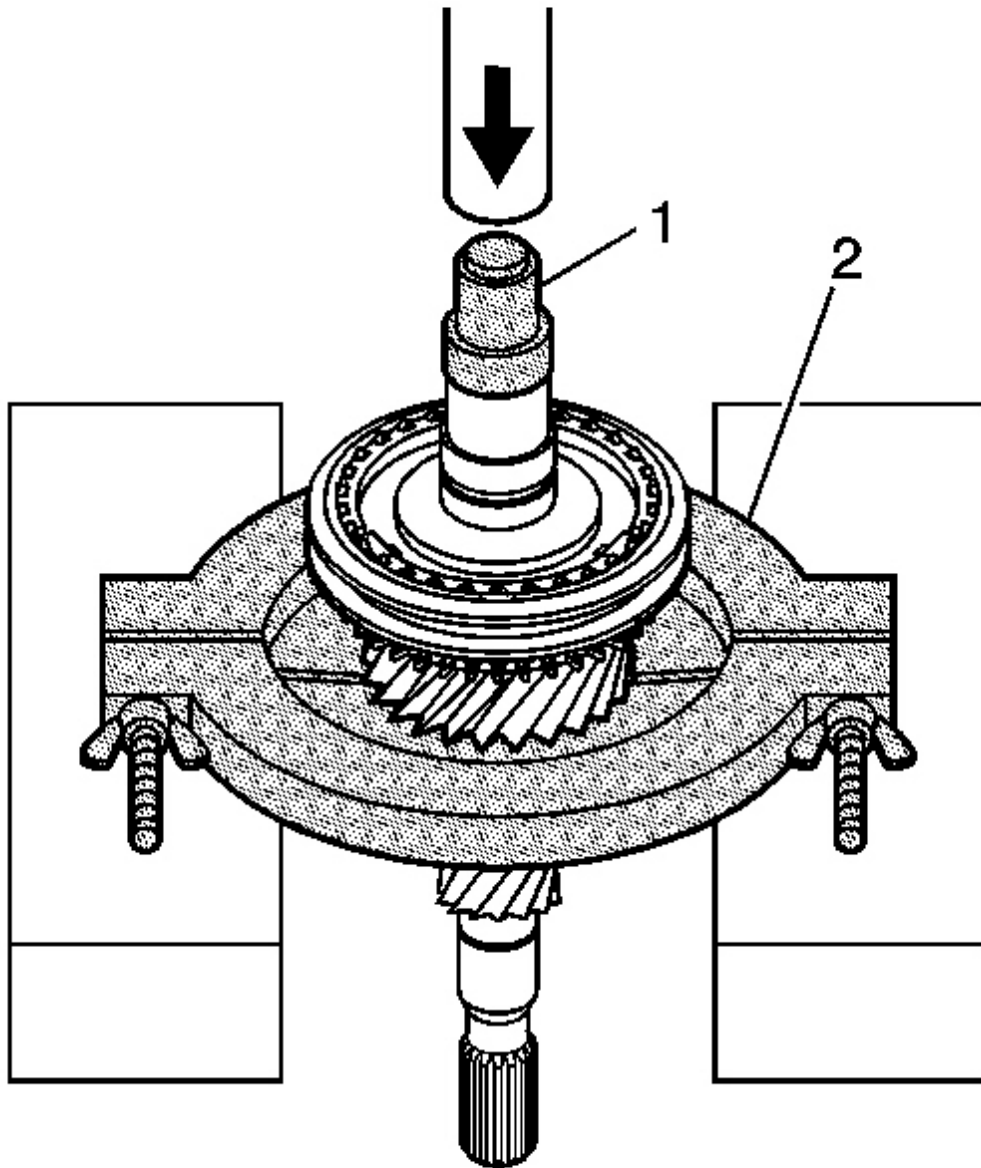


Fig. 171: Bearing Collar, 3rd/4th Synchronizer, J 36513 & J 44378
Courtesy of GENERAL MOTORS CORP.

7. Remove the bearing collar and the 3rd/4th synchronizer from the input shaft using the **J 36513** (2) under the 3rd speed gear, the **J 44378** (1), and a hydraulic press. See **Special Tools and Equipment** .

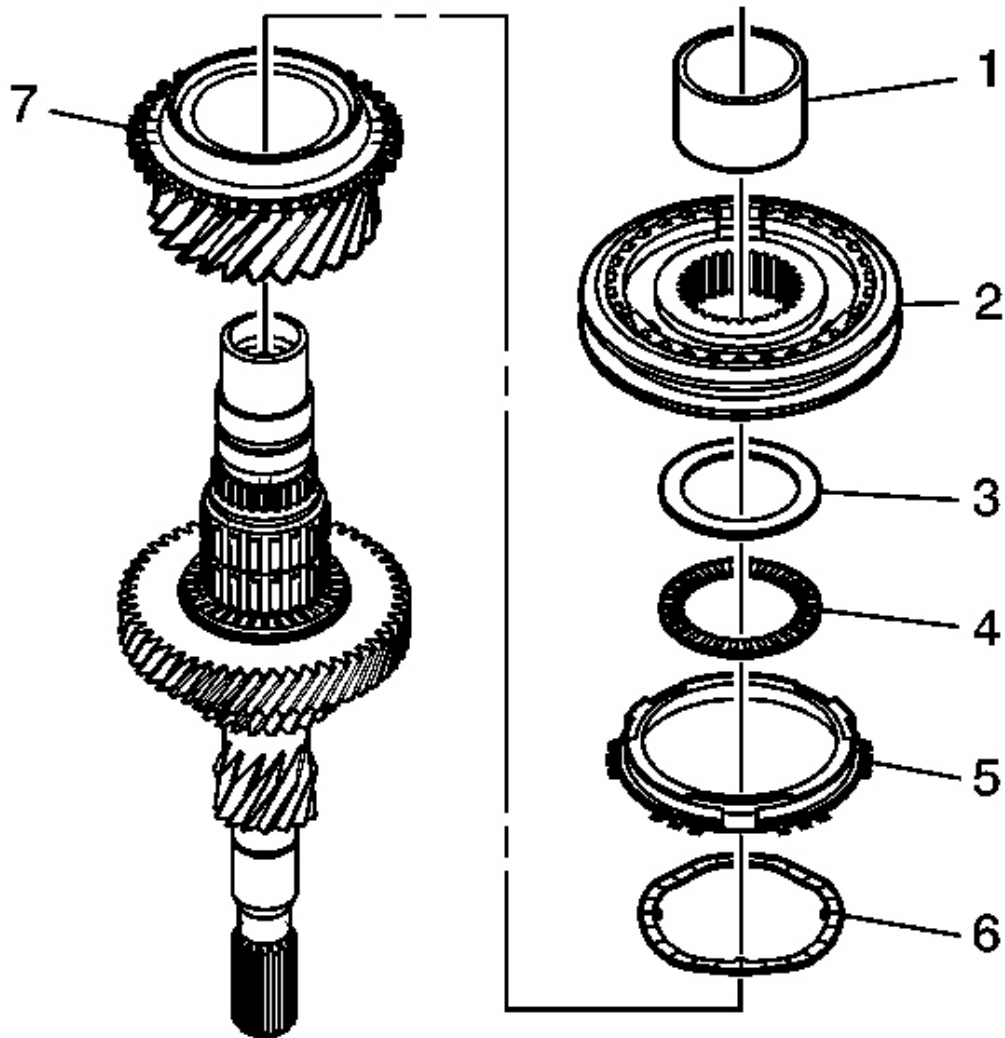


Fig. 172: 3rd/4th Synchronizer, Bearing Collar, Washer & Blocking Ring
 Courtesy of GENERAL MOTORS CORP.

8. Remove the following components as an assembly:

1. The bearing collar (1)
2. The 3rd/4th synchronizer assembly (2)
3. The thrust washer (3)
4. The thrust bearing (4)
5. The 3rd gear blocking ring (5)

6. The wavy washer (6)
7. The 3rd gear (7)

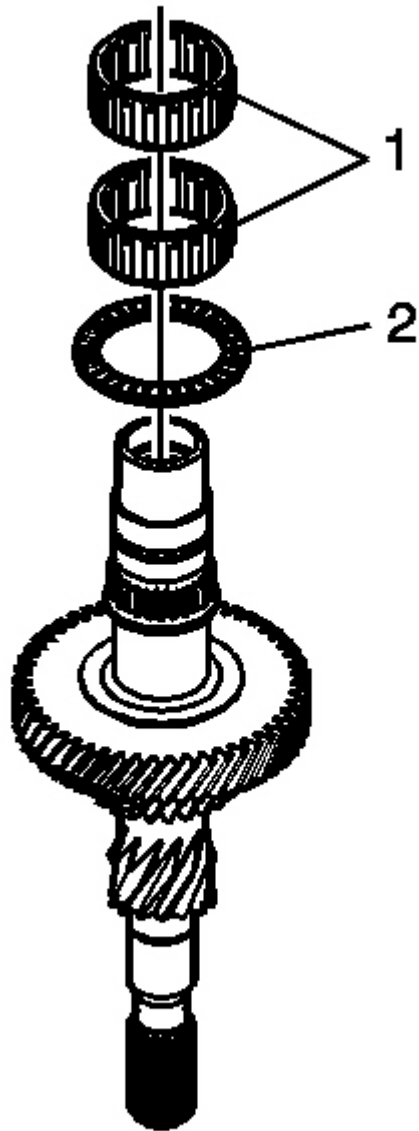


Fig. 173: Caged Needle Bearing & Thrust Bearing
Courtesy of GENERAL MOTORS CORP.

9. Remove the caged needle bearing (1).

10. Remove the caged needle bearing (1).
11. Remove the thrust bearing (2).

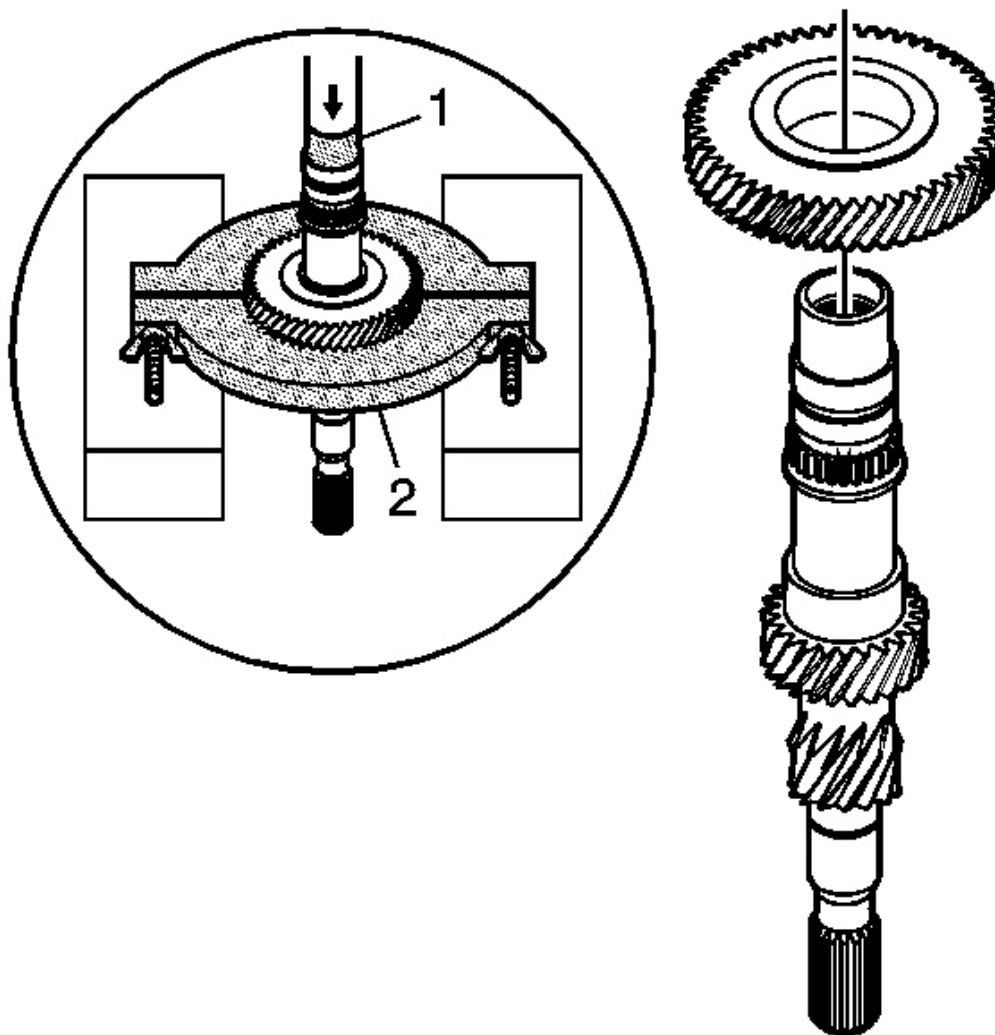


Fig. 174: 5th Gear, J 44378 & J 36513
Courtesy of GENERAL MOTORS CORP.

12. Press off 5th gear using the **J 44378** (1), the **J 36513** (2) and a hydraulic press. See **Special Tools and Equipment** .

OUTPUT SHAFT DISASSEMBLE

Tools Required

- **J 36513** Gear and Bearing Separator Plate. See Special Tools and Equipment .
- **J 44378** Press Adapter (all shafts). See Special Tools and Equipment .

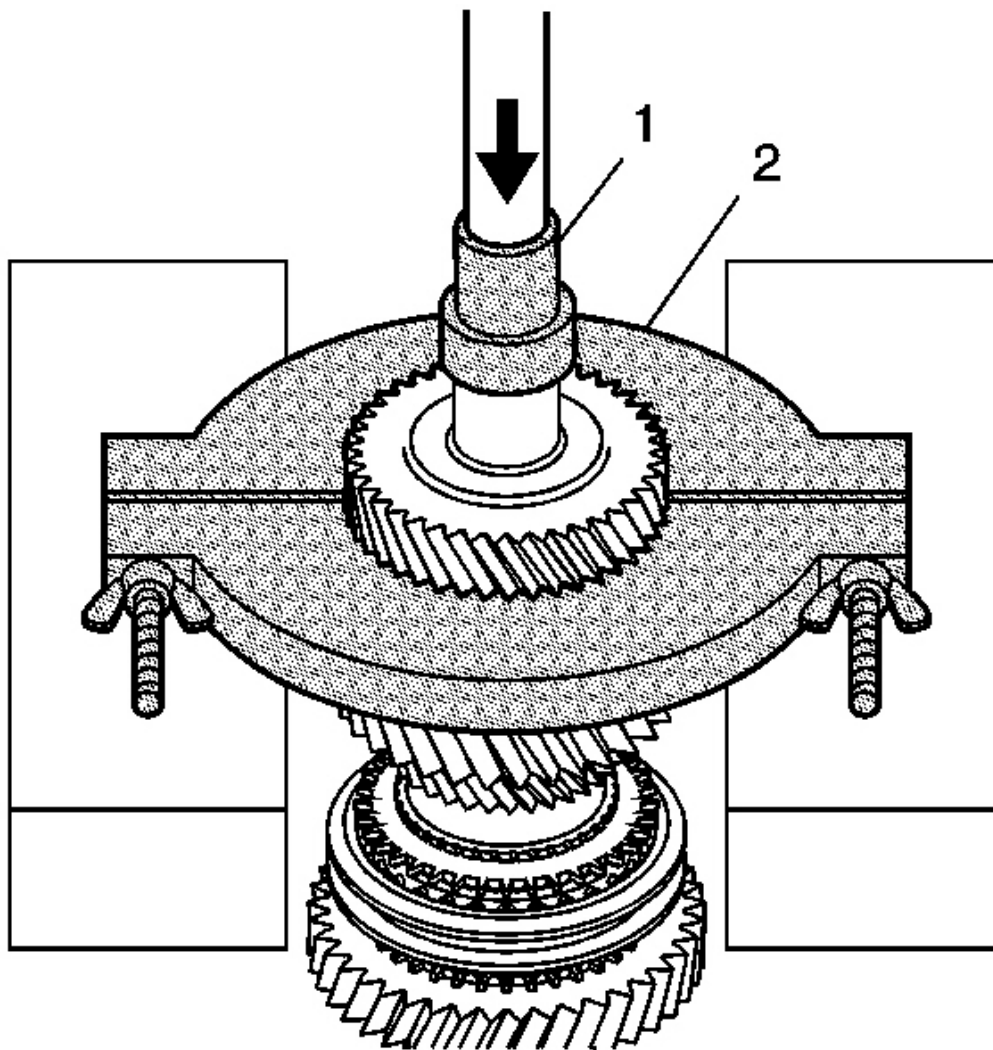


Fig. 175: 4th Driven Gear, J 36513 & J 44378
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The 4th driven gear is a very tight press.

1. Press off the 4th driven gear using the **J 36513** (2) and the **J 44378** (1). See **Special Tools and Equipment** .

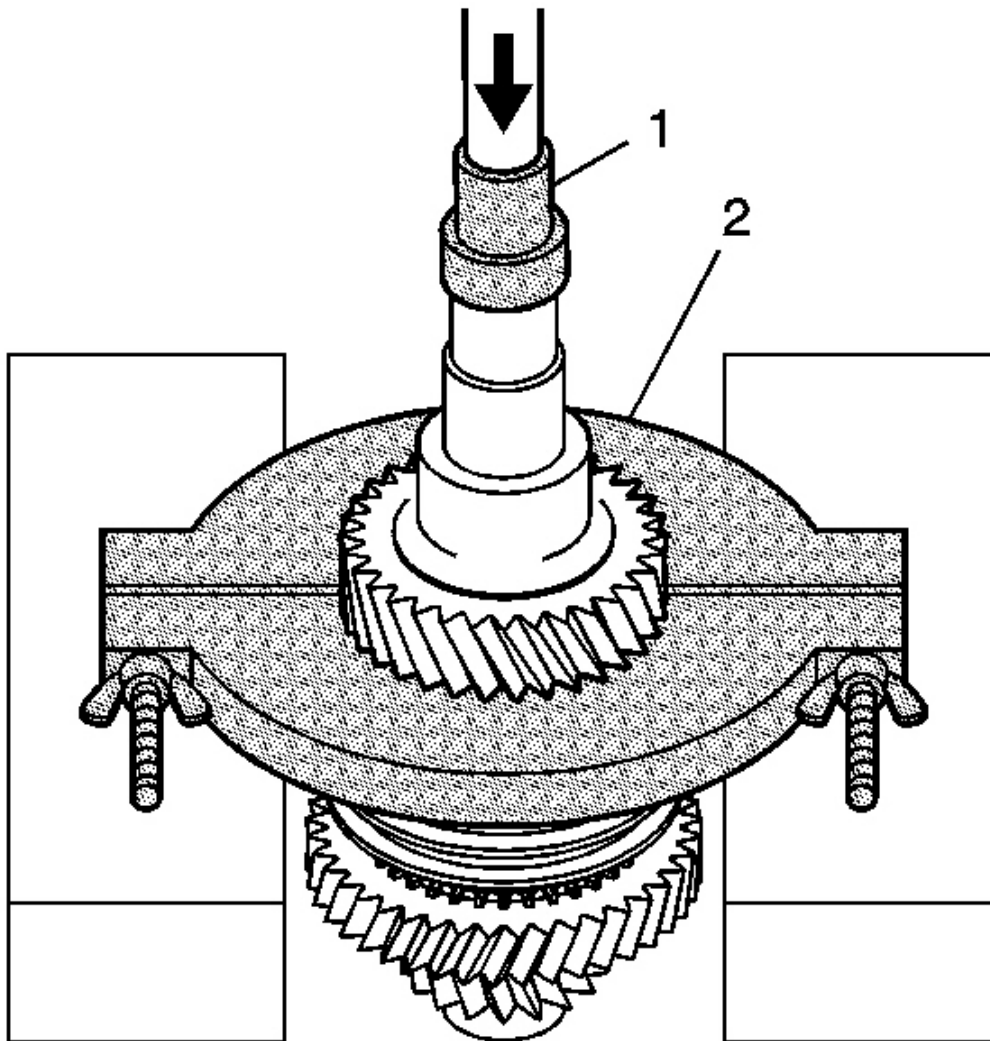


Fig. 176: 3rd Driven Gear, J 36513 & J 44378
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The 3rd driven gear is a very tight press.

2. Remove the 3rd driven gear using the **J 36513** (2) and the **J 44378** (1). See **Special Tools and Equipment** .

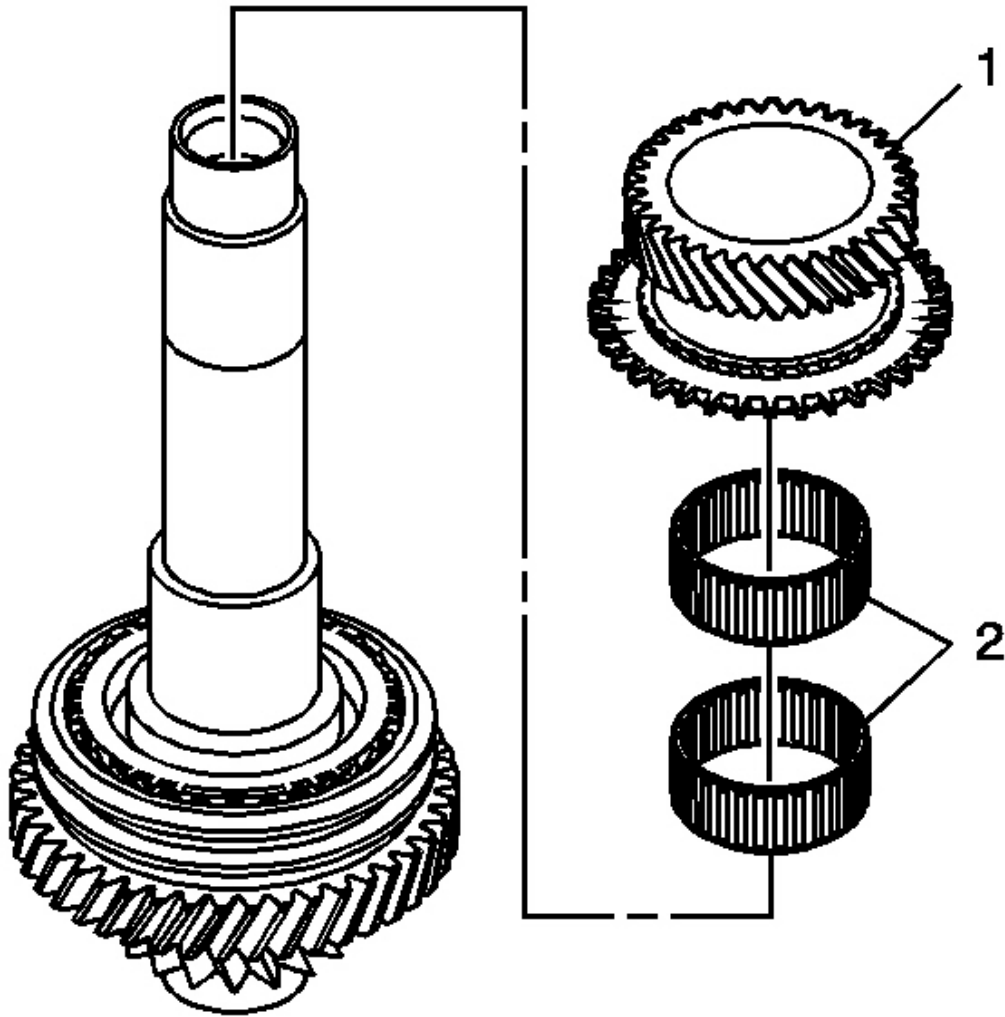


Fig. 177: 5th Gear & Two Caged Needle Bearings
Courtesy of GENERAL MOTORS CORP.

3. Remove the 5th gear (1) and the two caged needle bearings (2).

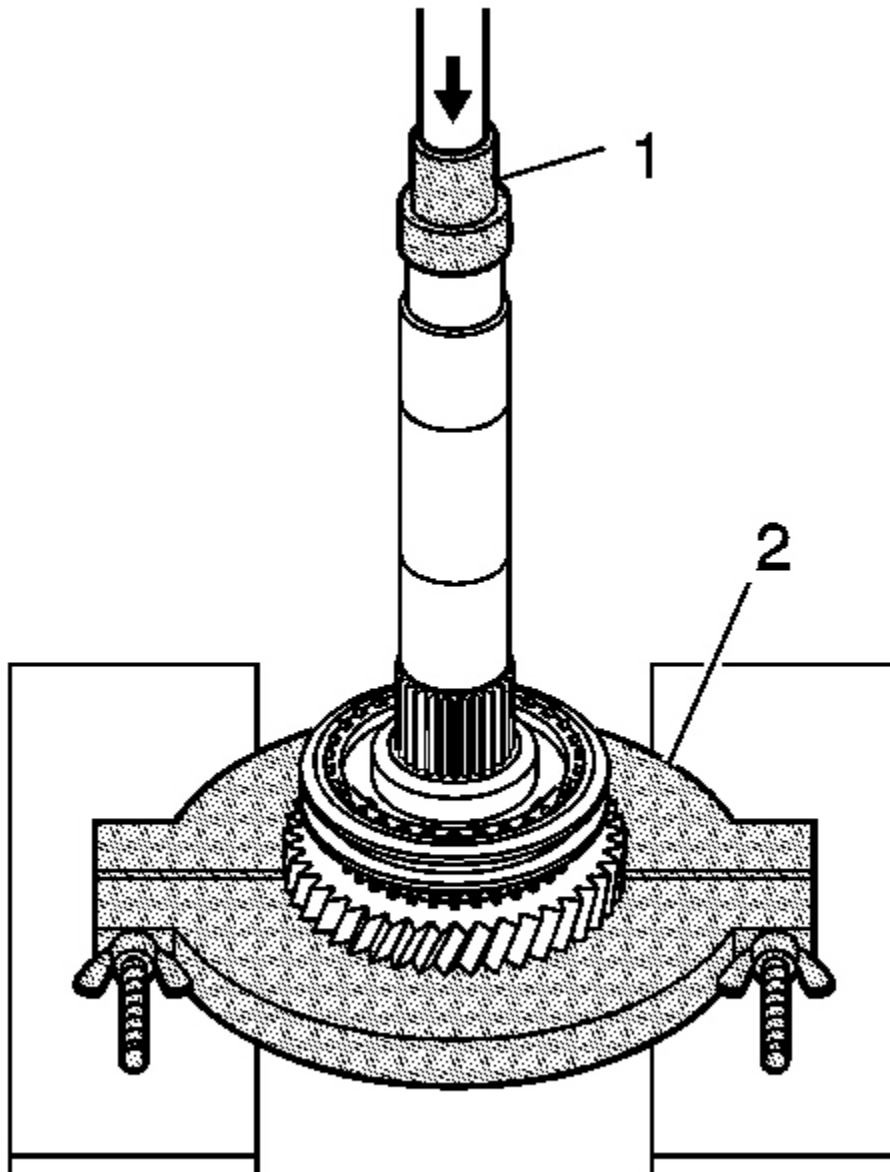


Fig. 178: Bearing Collar, J 36513 & J 44378
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not contact the thrust washer under the reverse gear.

4. Remove the bearing collar using the **J 36513** (2), under the reverse gear, the **J 44378** (1), and a hydraulic

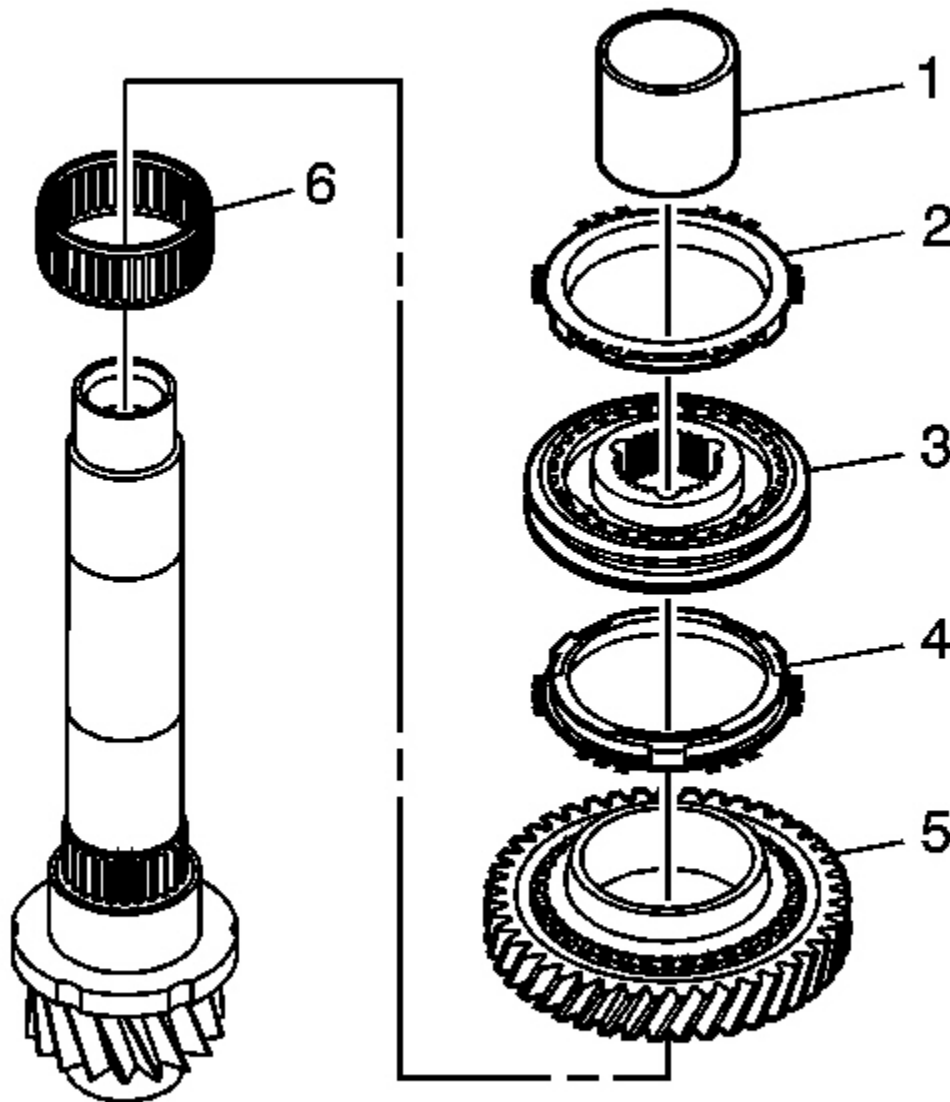


Fig. 179: 5th Gear Blocking Ring, Bearing Collar, Reverse Gear & Caged Needle Bearing
Courtesy of GENERAL MOTORS CORP.

5. Remove the following components as an assembly:
 1. The bearing collar (1)

2. The 5th gear blocking ring (2)
3. The 5th/Reverse synchronizer assembly (3)
4. The reverse blocking ring (4)
5. The reverse gear (5)
6. The caged needle bearing (6)

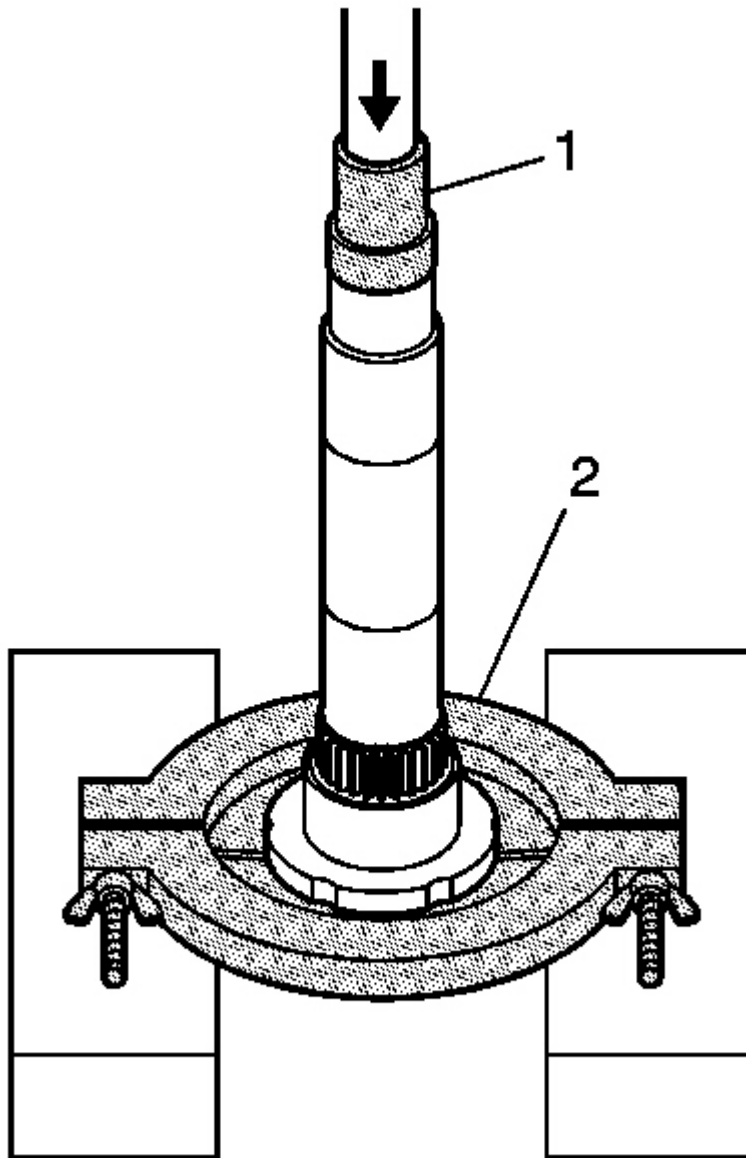


Fig. 180: Collar, Thrust Washer, J 36513 & J 44378
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the J 36513 is not making contact with the pinion gear before pressing off the collar and thrust washer. See Special Tools and Equipment .

6. Remove the collar and the thrust washer using the **J 44378** (1), the **J 36513** (2), and a hydraulic press. See **Special Tools and Equipment** .

DIFFERENTIAL CASE DISASSEMBLE

Tools Required

- **J 44379** Differential Bearing Puller Plate. See **Special Tools and Equipment** .
- **J 44381** Shifter Bearing/Input and Output Bearing Remover. See **Special Tools and Equipment** .

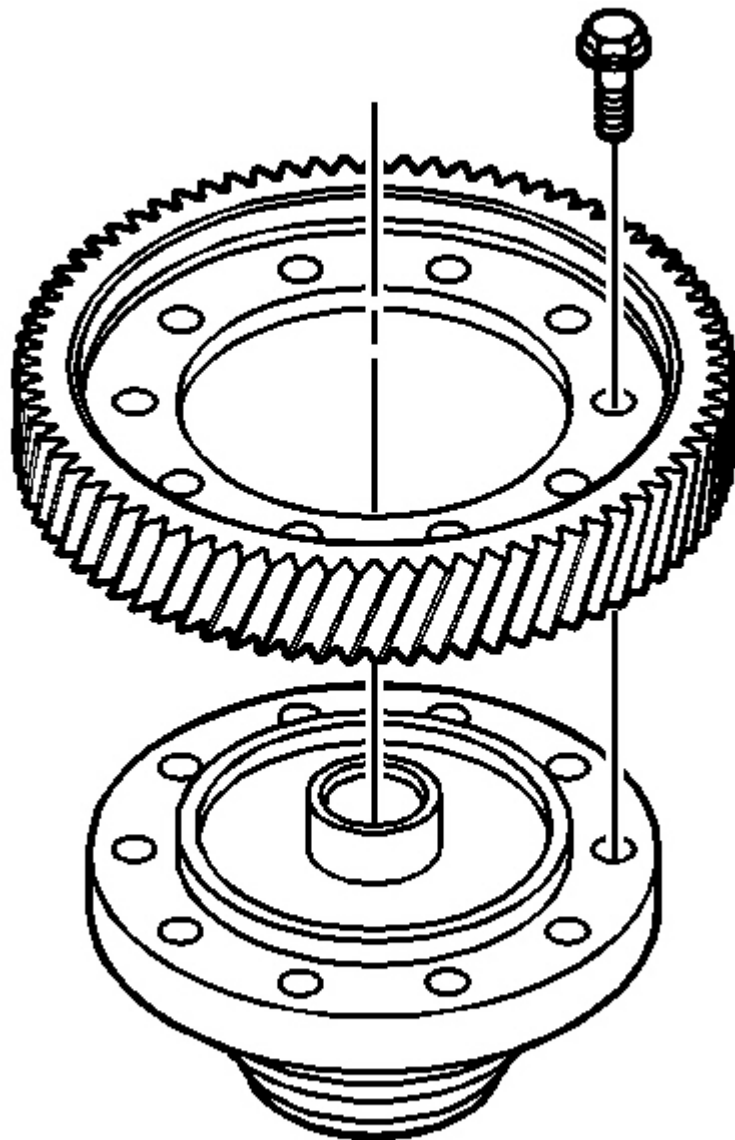


Fig. 181: Differential Ring Gear & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the ten differential ring gear bolts from the differential case. Discard the bolts.
2. Remove the differential ring gear from the differential case.

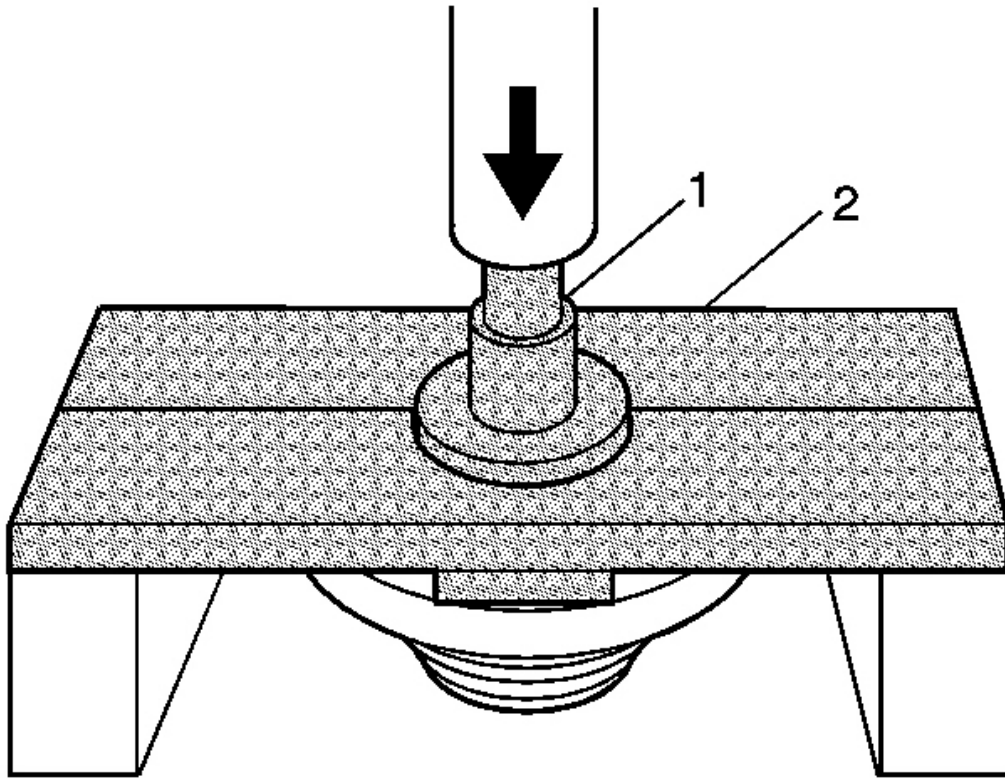


Fig. 182: Left Differential Side, J 44379 & J 44381
Courtesy of GENERAL MOTORS CORP.

3. Remove the left differential side bearing using the **J 44379** (2), the **J 44381** (1), and a hydraulic press. See **Special Tools and Equipment** . Discard the bearing.

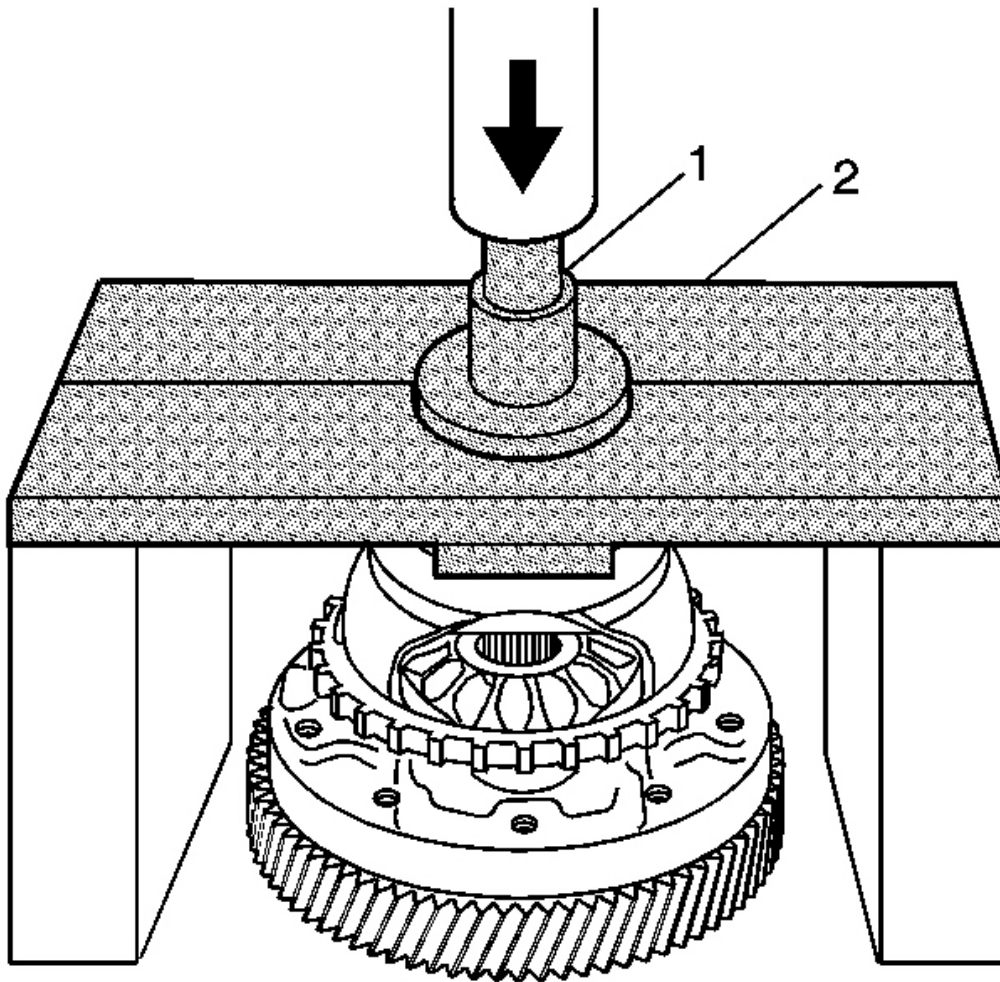


Fig. 183: Right Differential Side, J 44379 & J 44381
Courtesy of GENERAL MOTORS CORP.

4. Remove the right differential side bearing from the differential case using the **J 44379** (2), the **J 44381** (1), and a hydraulic press. See **Special Tools and Equipment** . Discard the bearing.

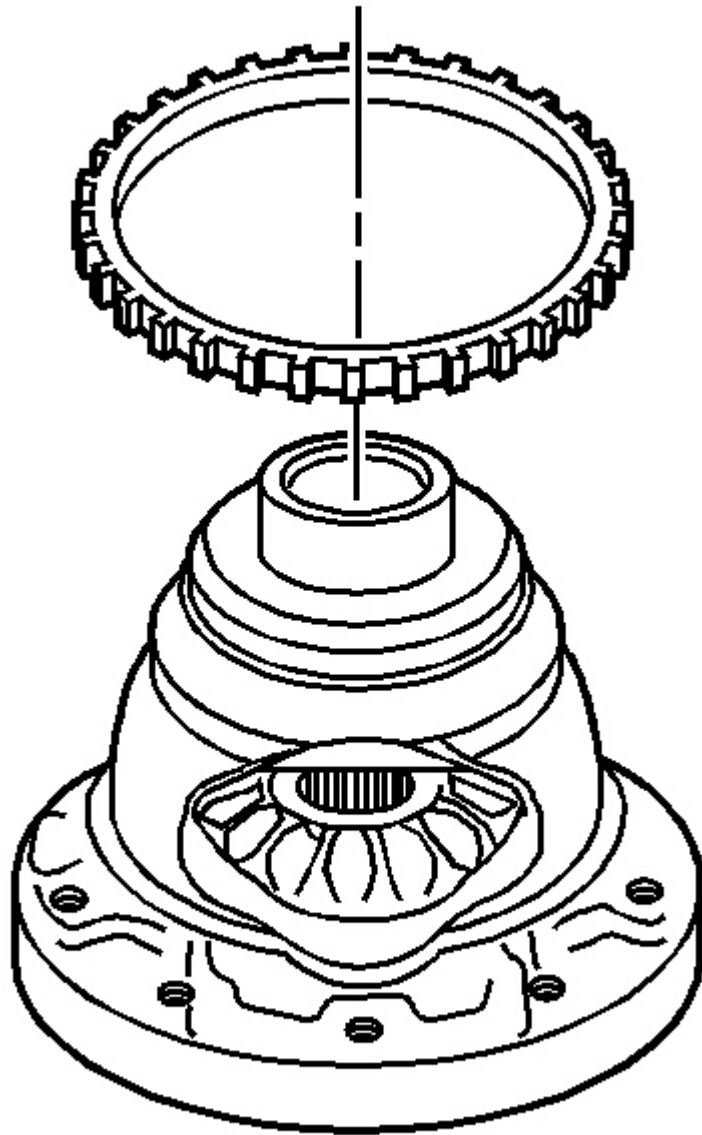


Fig. 184: VSS Ring
Courtesy of GENERAL MOTORS CORP.

5. Remove the vehicle speed sensor (VSS) ring.

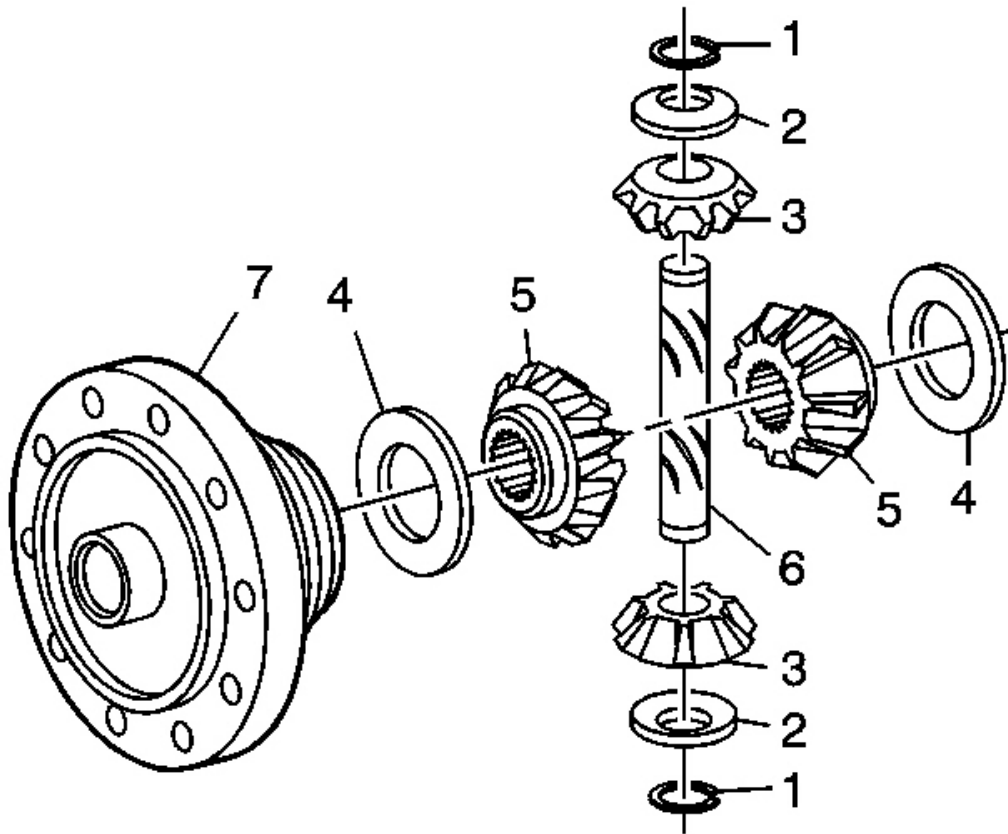


Fig. 185: Differential Case & Components
 Courtesy of GENERAL MOTORS CORP.

6. Remove the following parts from the differential case (7):

- The snap rings (1)

Discard the snap rings.

- The pinion shaft (6)
- The pinion gears (3)
- The pinion gear thrust washers (2)
- The side gears (5)
- The side gear thrust washers (4)

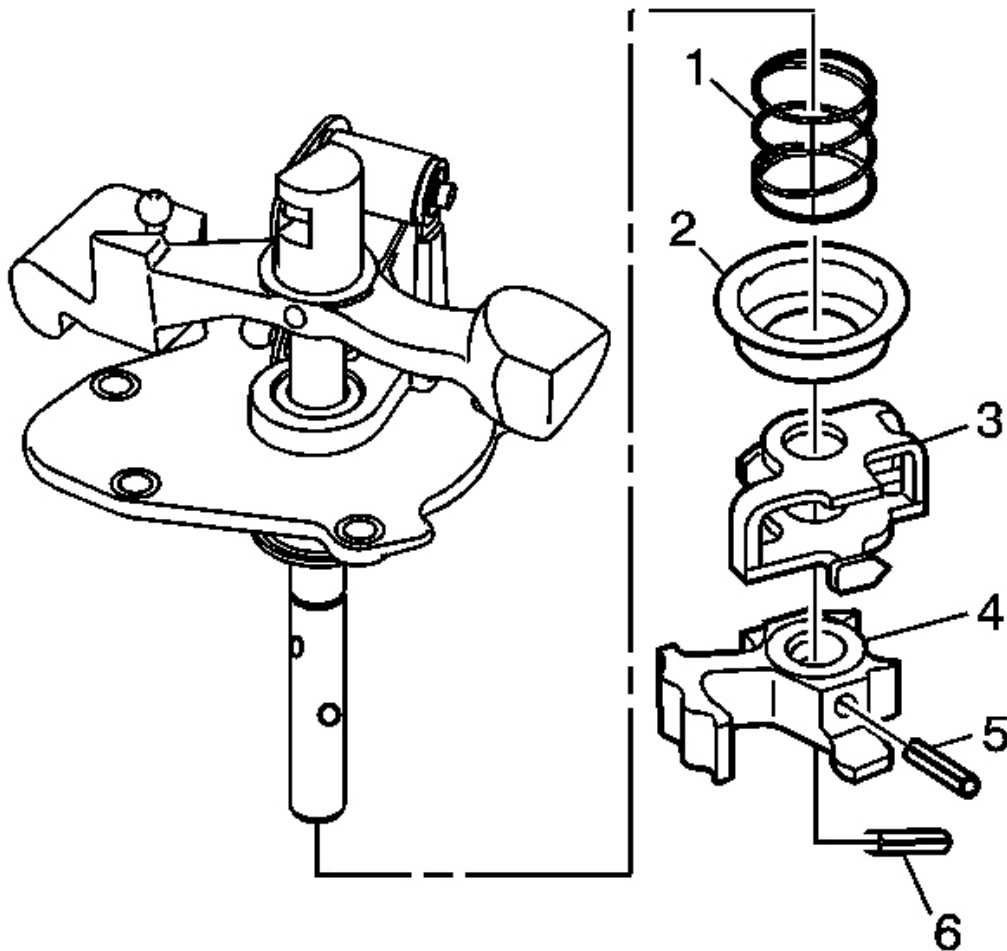


Fig. 186: Reverse Inhibit, Roll Pin, Outer/Inner Control Lever, End Cap & Outer Spring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Observe the orientation of the roll pin (4) before removal.

1. Remove the reverse inhibit roll pin (6). Discard the inhibit roll pin.
2. Remove the roll pin (5). Discard the roll pin.
3. Remove the outer control lever (3).
4. Remove the inner control lever (4).
5. Remove the end cap (2).
6. Remove the outer spring (1).

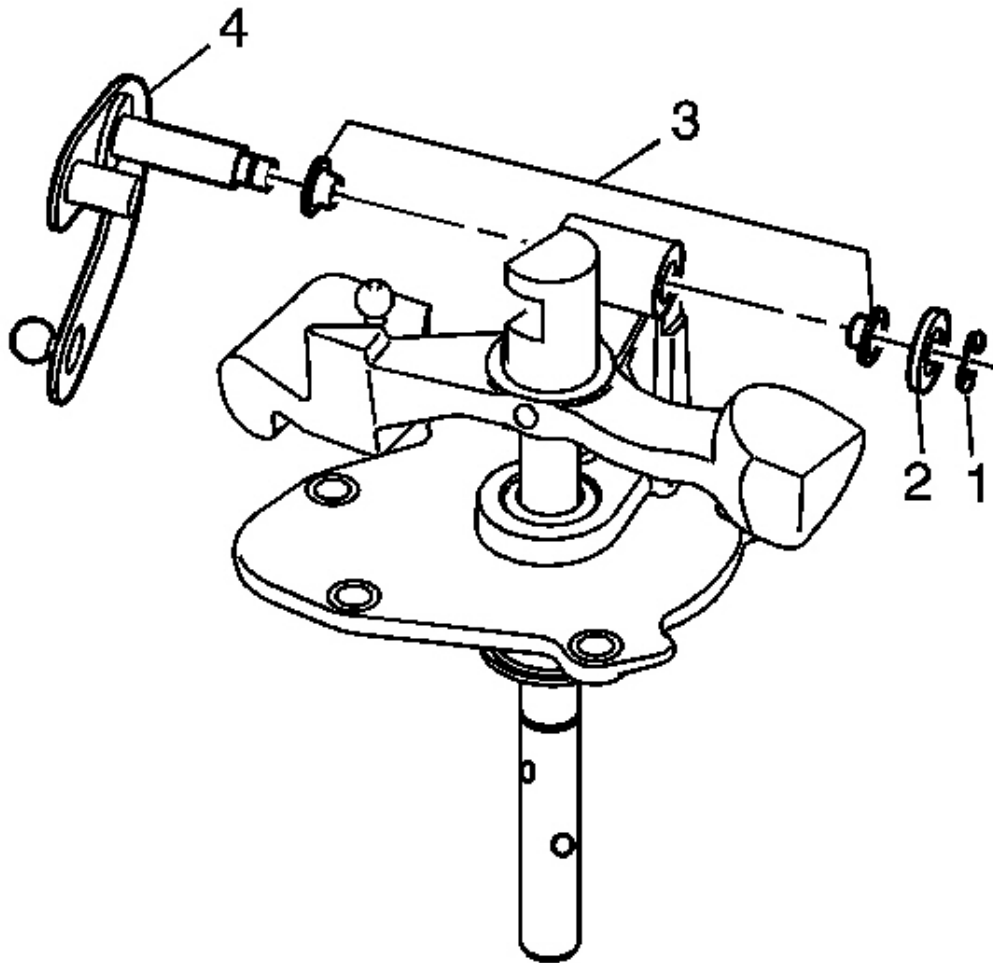


Fig. 187: Retainer, Washer, Select Lever & Bushings
Courtesy of GENERAL MOTORS CORP.

7. Remove the retainer (1).
8. Remove the washer (2).
9. Remove the select lever (4).
10. Inspect the bushings (3). Do not remove.

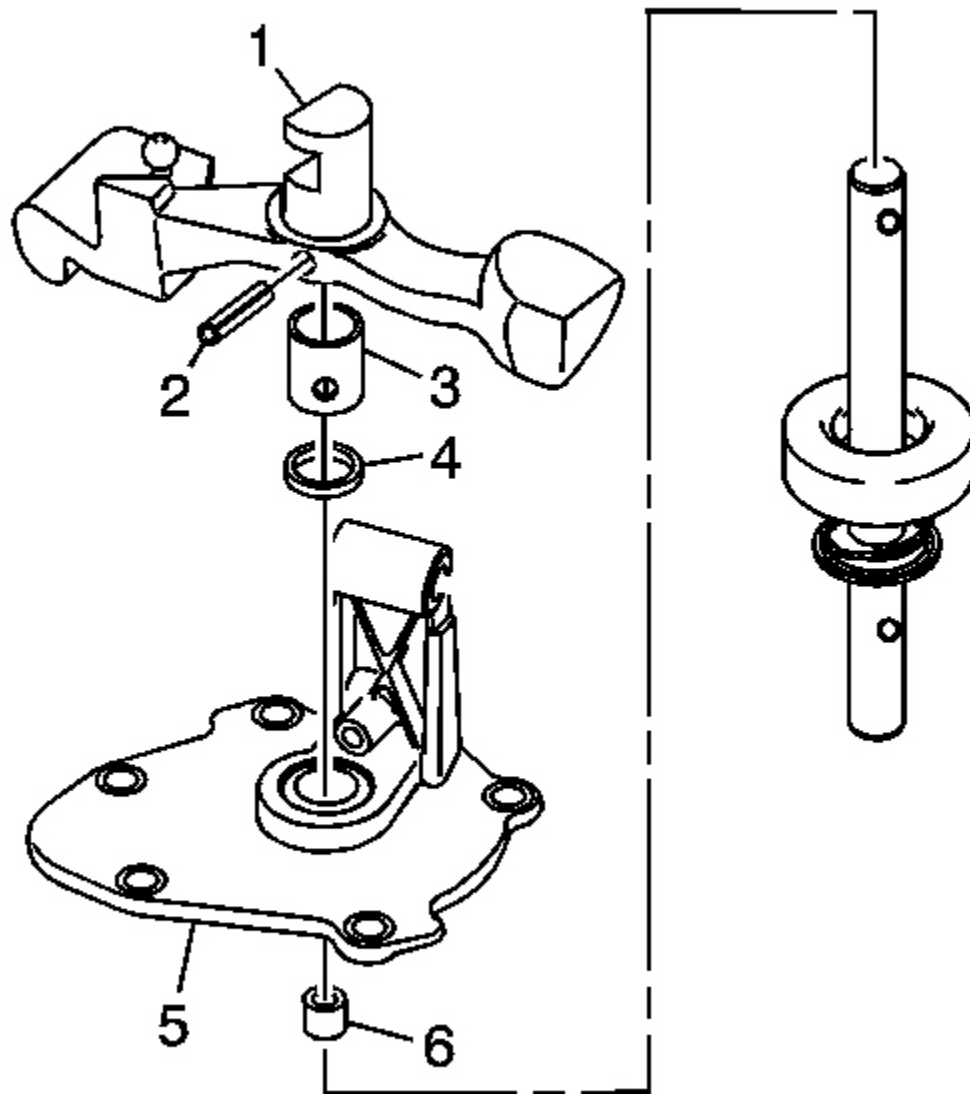


Fig. 188: Shift Lever, Cover, Bushing, Roll Pin, Seals & Bearing
Courtesy of GENERAL MOTORS CORP.

11. Remove the roll pin (2). Discard the roll pin.
12. Remove the shift lever (1).
13. Remove the shift cover (5).
14. Inspect the shift cover bushing (3). Do not remove.

15. Inspect the seals (4). Do not remove.
16. Inspect the bearing (6). Do not remove.

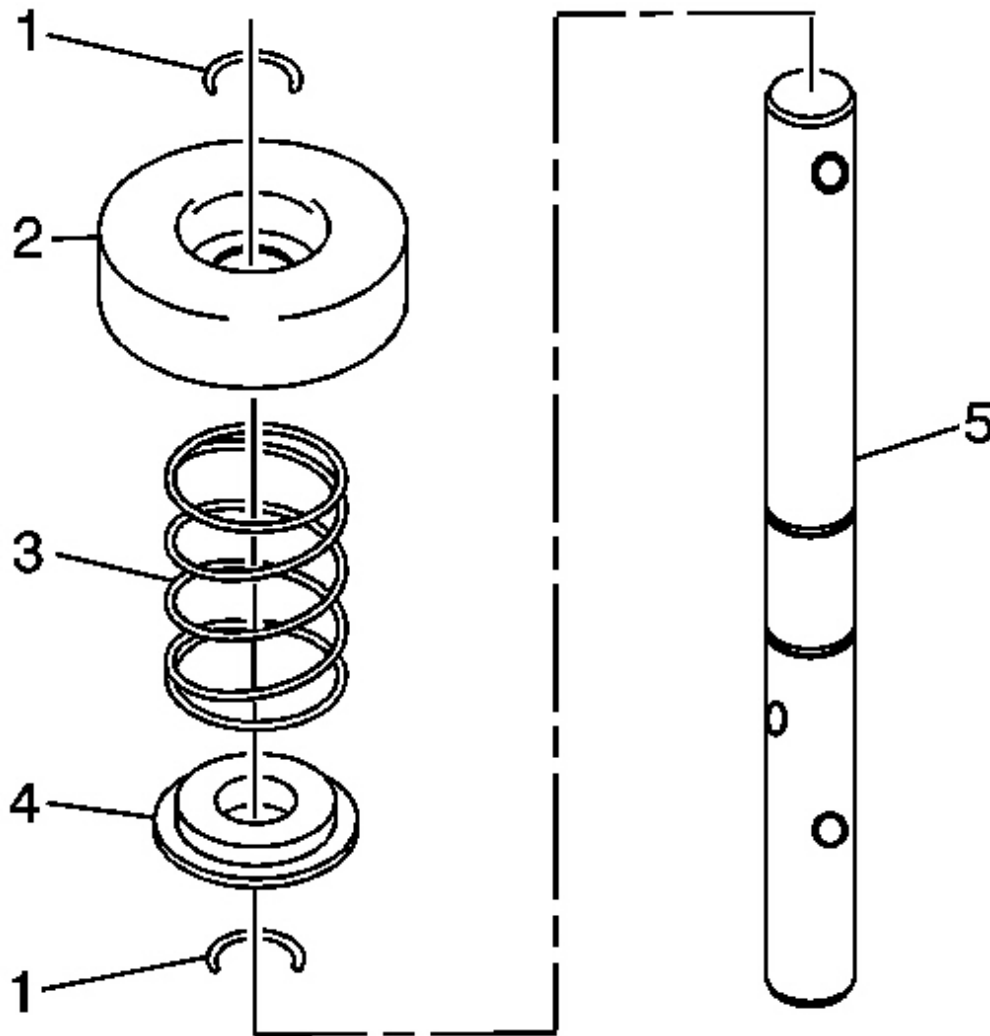


Fig. 189: Inner/Outer Spring Seat, Retainers & Shift Rod
Courtesy of GENERAL MOTORS CORP.

17. Remove the retainers (1). Discard the retainers.
18. Remove the outer spring seat (2).
19. Remove the inner spring (3).

20. Remove the inner spring seat (4) from the shift rod (5).

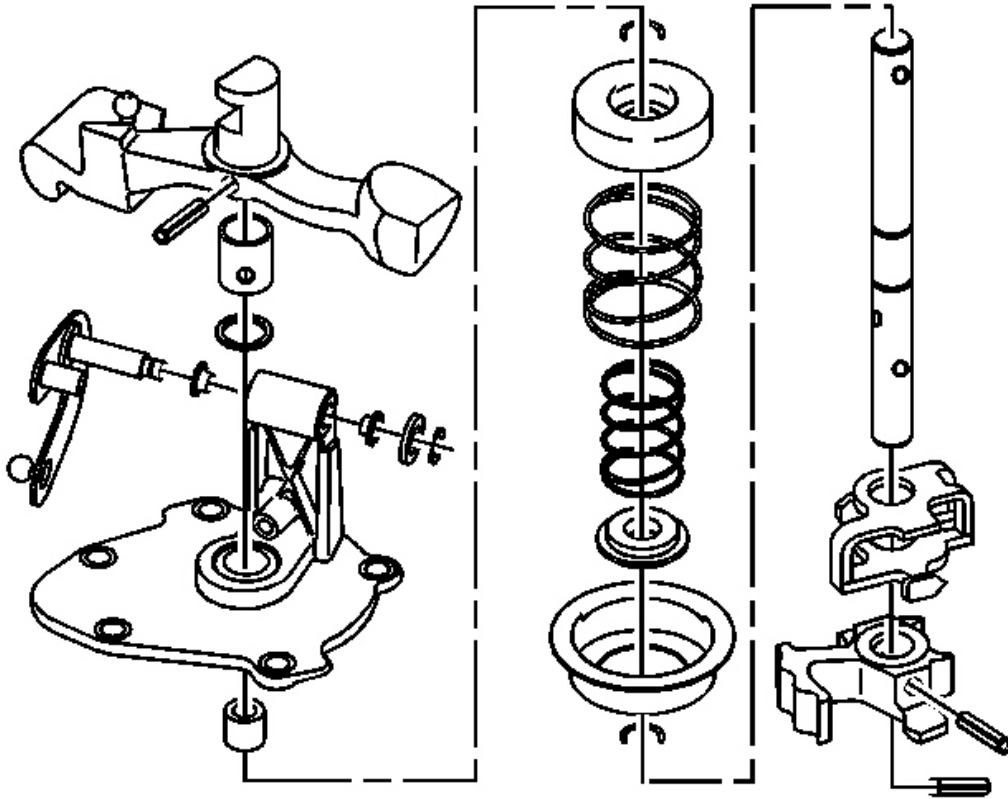


Fig. 190: Shifter Disassemble & Components
Courtesy of GENERAL MOTORS CORP.

21. Clean all components in a suitable solution.
22. Inspect all components for wear or damage.
23. If any components have wear or damage, replace the shifter.

CLUTCH AND DIFFERENTIAL HOUSING CLEANING AND INSPECTION

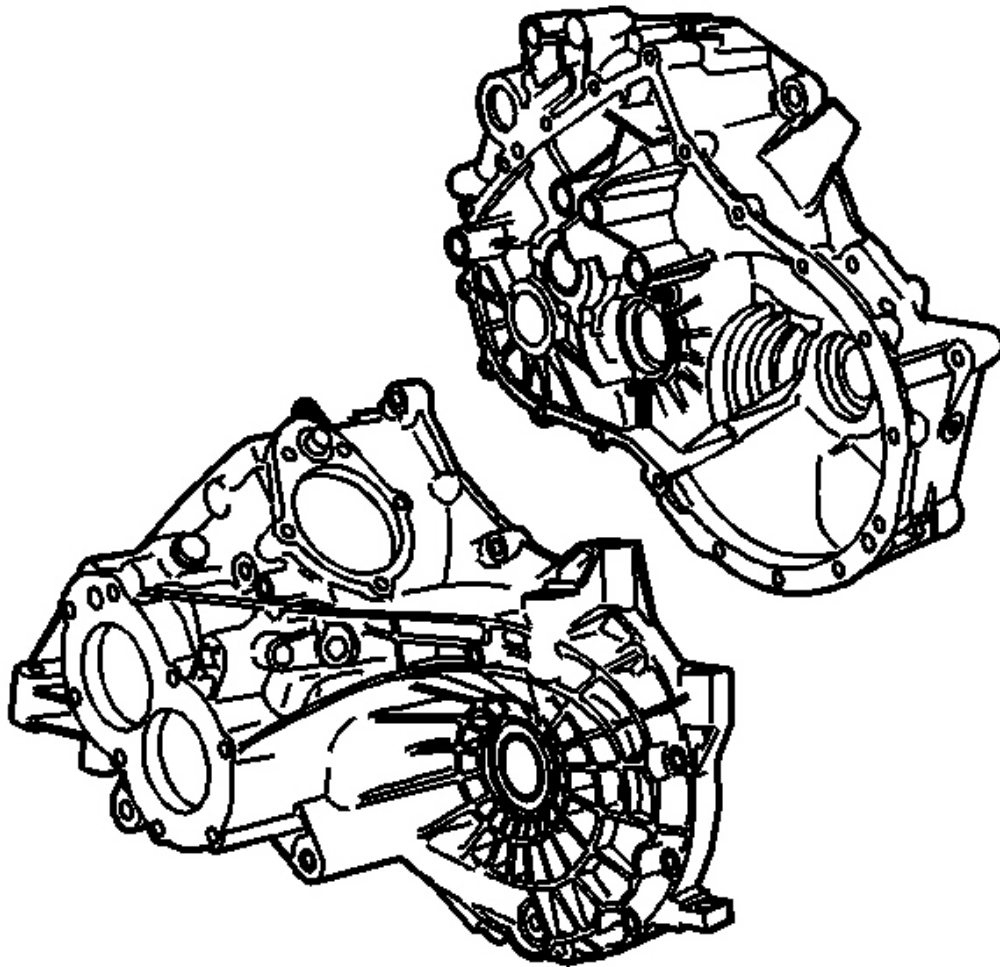


Fig. 191: Clutch Housing & Differential Housing
Courtesy of GENERAL MOTORS CORP.

Inspect the clutch housing and the differential housing for the following:

- Cracks
- Porosity
- Damaged mating surface
- Stripped bolt threads
- Distortion

Replace any part that exhibits any of these conditions.

GEARS CLEANING AND INSPECTION

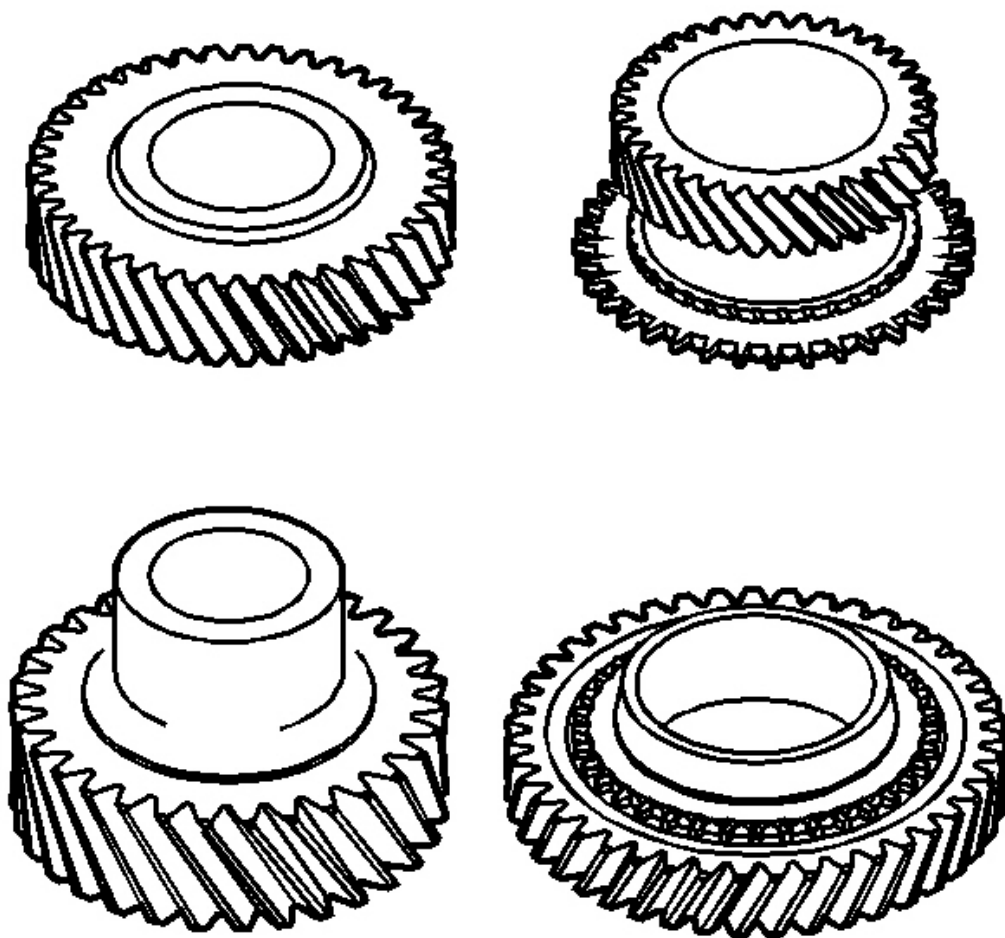


Fig. 192: Inspecting Gear Teeth & Gear Splines For Damage
Courtesy of GENERAL MOTORS CORP.

Inspect the gear teeth and the gear splines for excessive wear or damage. Remove minor nicks or scratches with an oil stone. Replace worn or damaged gears.

THRUST WASHER AND BEARING CLEANING AND INSPECT

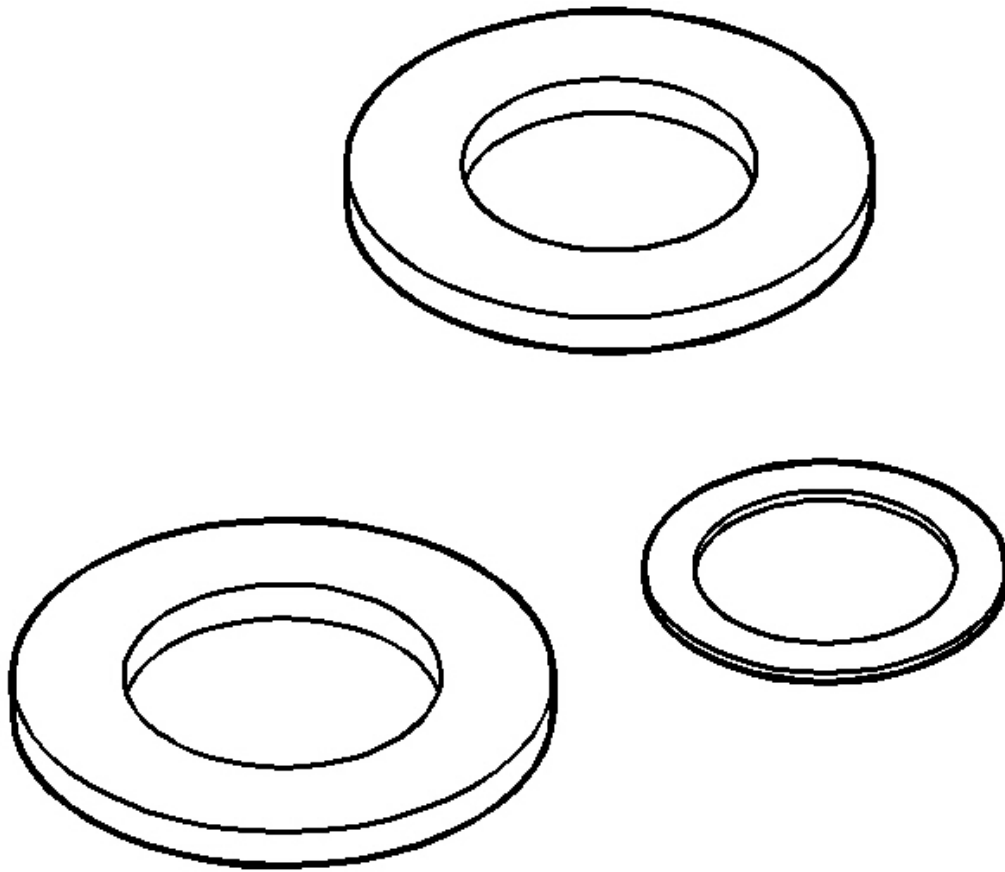


Fig. 193: Inspecting Thrust Washer For Damage
Courtesy of GENERAL MOTORS CORP.

1. Inspect the thrust washer for wear or damage.

Replace worn or damaged thrust washers.

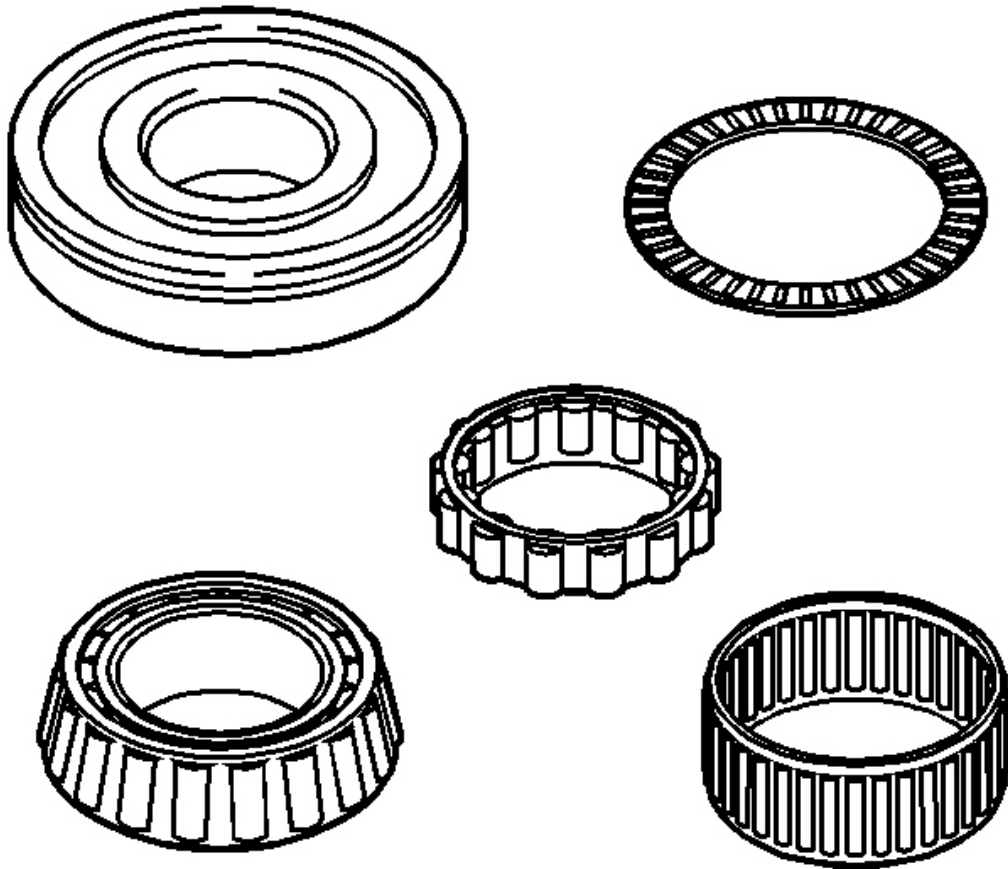


Fig. 194: Inspecting The Condition Of Thrust Bearings, Input Shaft Bearing & Output Shaft Bearing

Courtesy of GENERAL MOTORS CORP.

NOTE: Do not allow the bearings to spin. Turn the bearings slowly by hand. Spinning bearings may cause damage to the rollers.

2. Inspect the condition of all thrust bearings, input shaft bearing, and output shaft bearing.

Wash the bearings thoroughly in a cleaning solvent. Apply compressed air to the bearings. Lubricate the bearings with light oil. Check the bearings for roughness by slowly turning the race by hand.

SYNCHRONIZERS CLEANING AND INSPECTION

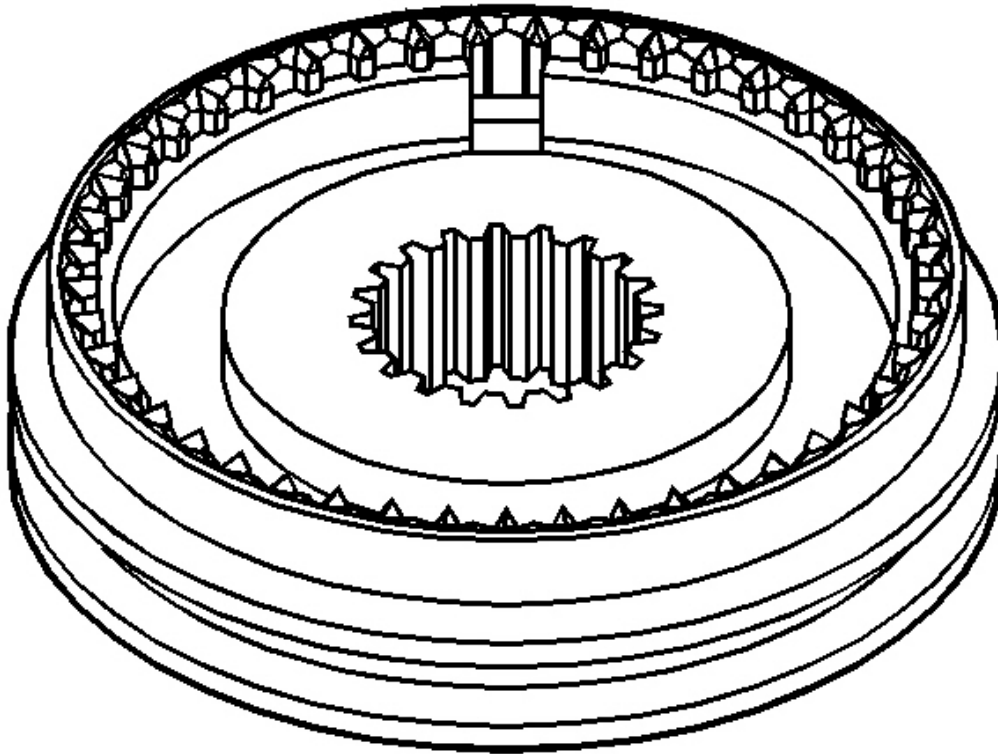


Fig. 195: Inspecting Synchronizer Teeth For Damage
Courtesy of GENERAL MOTORS CORP.

1. Clean the synchronizer with clean solvent.
2. Air dry the components.
3. Inspect the synchronizer teeth for the following conditions:
 - Wear
 - Scuffing
 - Nicks
 - Burrs
 - Breaking
4. Inspect the keys or the springs for the following:
 - Wear
 - Cracks
 - Distortion

If any of the following conditions exist, replace synchronizer.

SHIFT FORK CLEANING AND INSPECTION

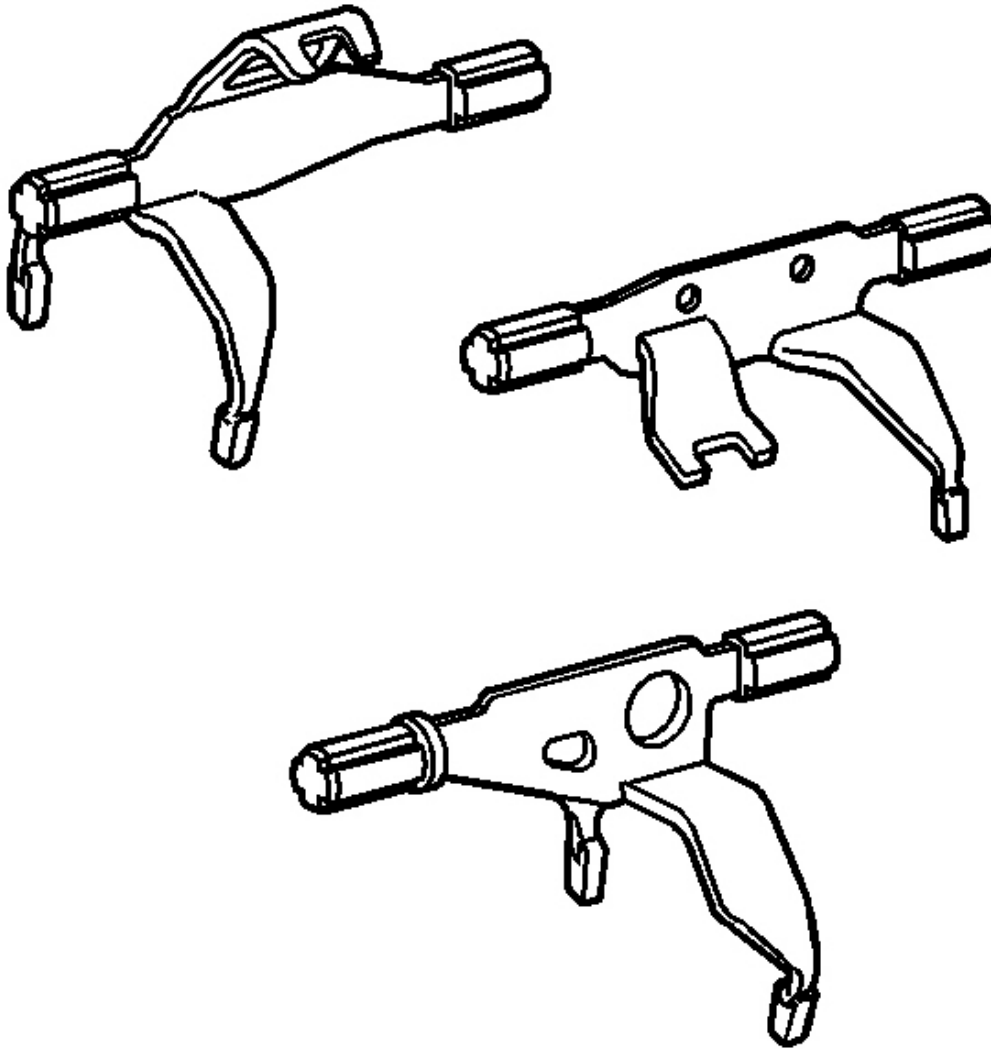


Fig. 196: Inspecting Shift Forks, Shafts & Rubber End For Wear Or Damage
Courtesy of GENERAL MOTORS CORP.

Inspect the shift forks, shafts and the rubber end for wear or damage.

Replace any part that is worn or damaged.

SHIFTER ASSEMBLE

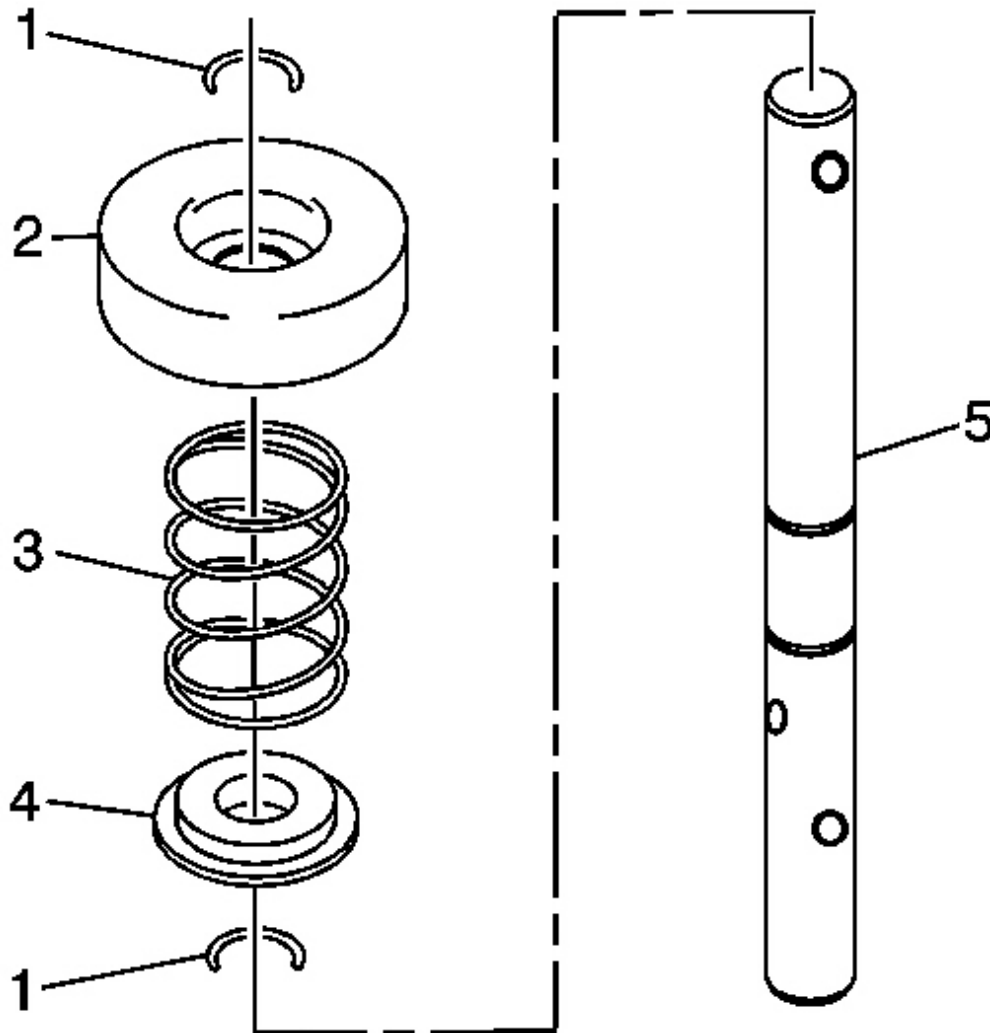


Fig. 197: Inner/Outer Spring Seat, Retainers & Shift Rod
Courtesy of GENERAL MOTORS CORP.

1. Install the inner spring seat (4) onto the shift rod (5).
2. Install the inner spring (3).
3. Install the outer spring seat (2).
4. Install NEW retainers (1).

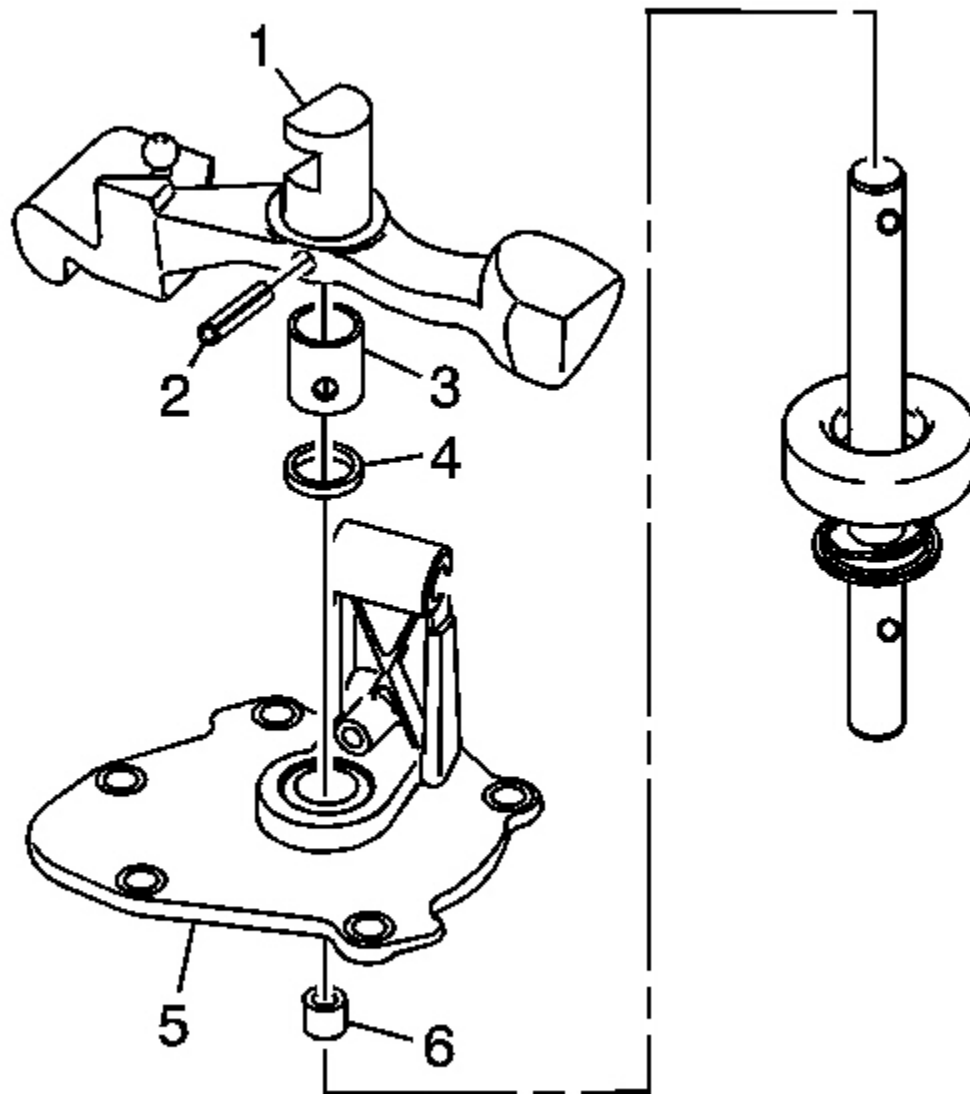


Fig. 198: Shift Lever, Cover, Bushing, Roll Pin, Seals & Bearing
Courtesy of GENERAL MOTORS CORP.

5. Install the shift cover (5).
6. Install the shift cover bushing (3), if removed.
7. Install the shift lever (1).
8. Install a new roll pin (2).

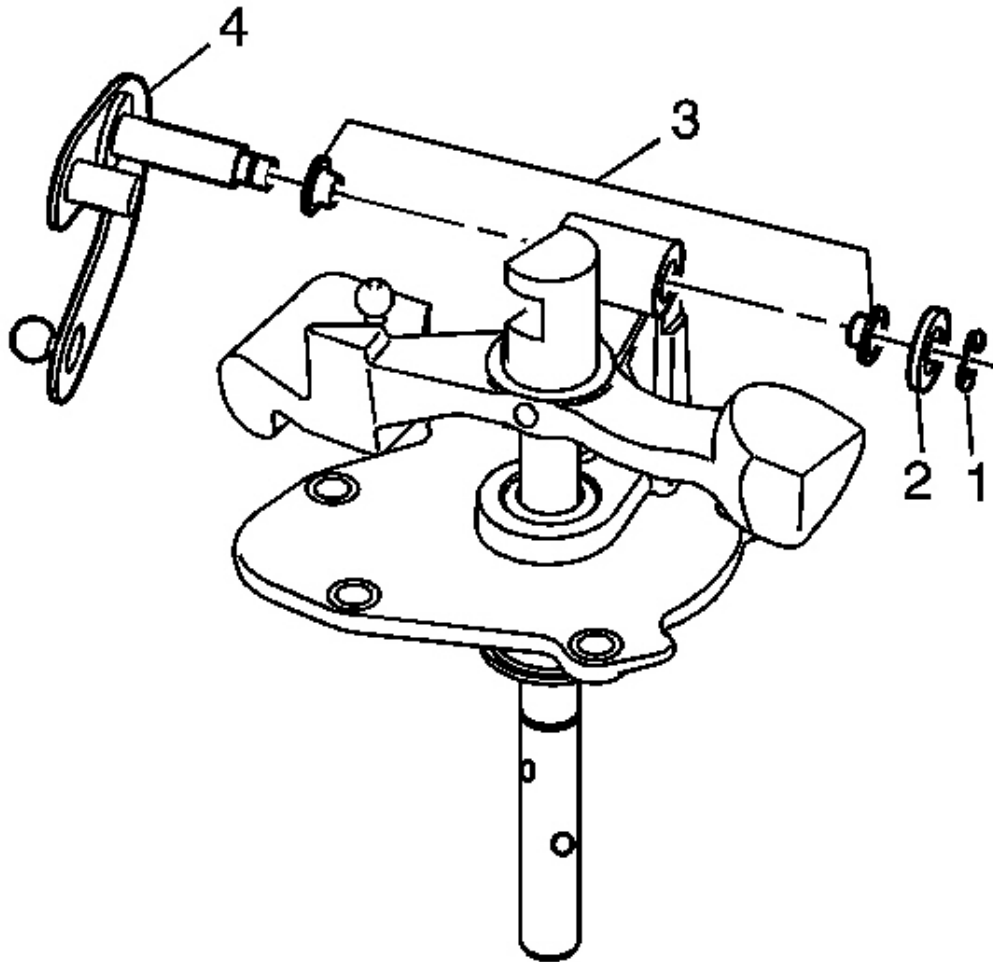


Fig. 199: Retainer, Washer, Select Lever & Bushings
Courtesy of GENERAL MOTORS CORP.

9. Install the select lever (4).
10. Install the washer (2).
11. Install the retainer (1).

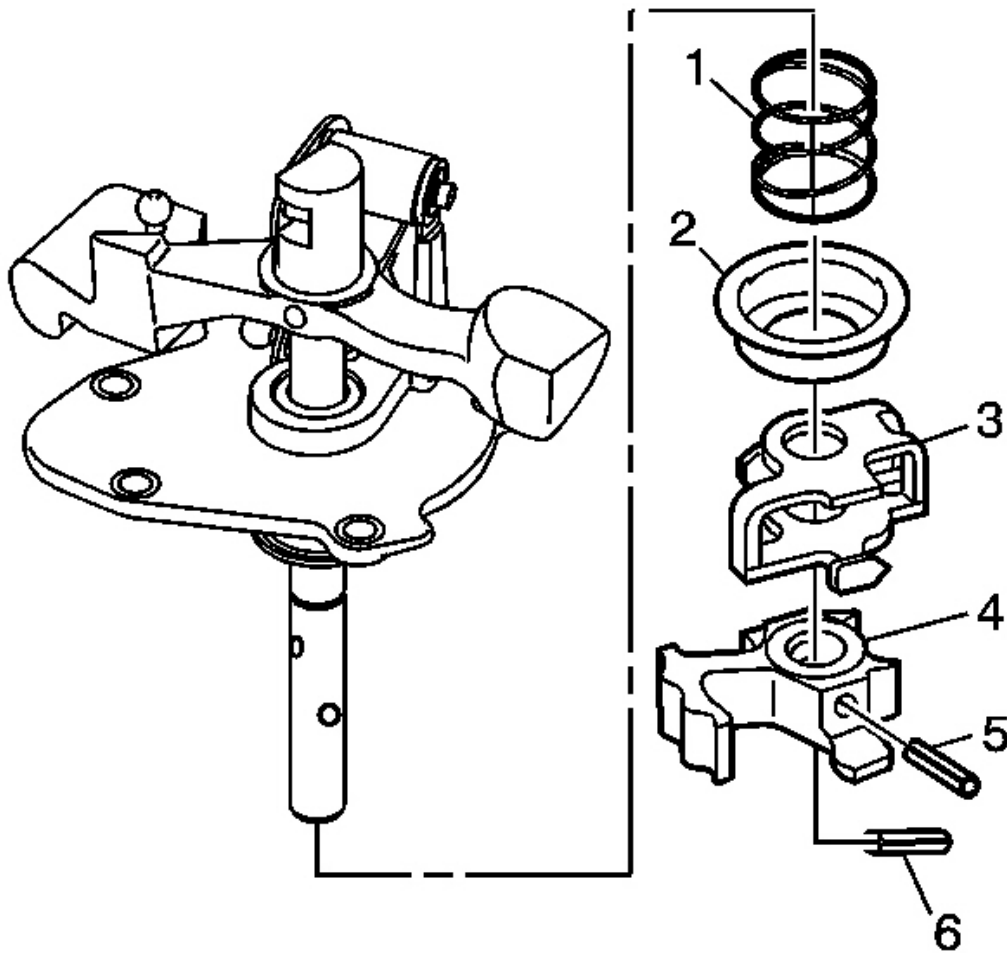


Fig. 200: Reverse Inhibit, Roll Pin, Outer/Inner Control Lever, End Cap & Outer Spring
Courtesy of GENERAL MOTORS CORP.

12. Install the outer spring (1).
13. Install the end cap (2).
14. Install the inner control lever (4) into the outer control lever (3).
15. Install the control levers onto the shaft.

IMPORTANT: Properly support the inner control lever (4) when installing the roll pin. Do not support the inner control lever (4) with the outer control lever (3).

16. Install a new roll pin (5).

IMPORTANT: Install the reverse lockout inhibit roll pin 1/3 to 1/4 way into the shaft. The pin must activate the reverse inhibit lever.

17. Install a new reverse lockout inhibit roll pin (6).

INTERMEDIATE SHAFT ASSEMBLY

Tools Required

J 24433 Press Tube. See Special Tools and Equipment .

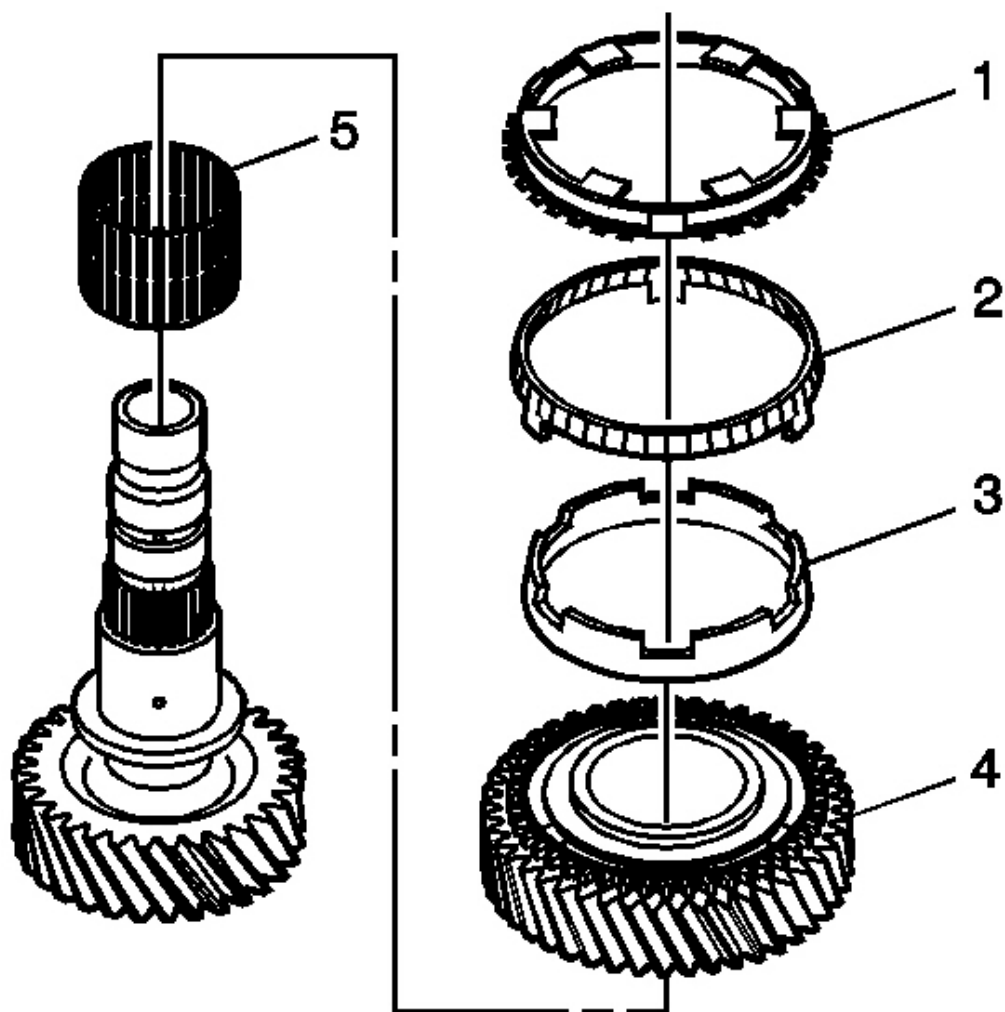


Fig. 201: Intermediate Shaft Assemble & Components Removed
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Lubricate all components with transmission fluid before installation.

1. Install the caged needle bearing (5).
2. Install the 2nd gear (4).
3. Install the 2nd gear inner cone (3).
4. Install the 2nd gear blocking ring (2).
5. Install the 2nd gear outer cone (1).

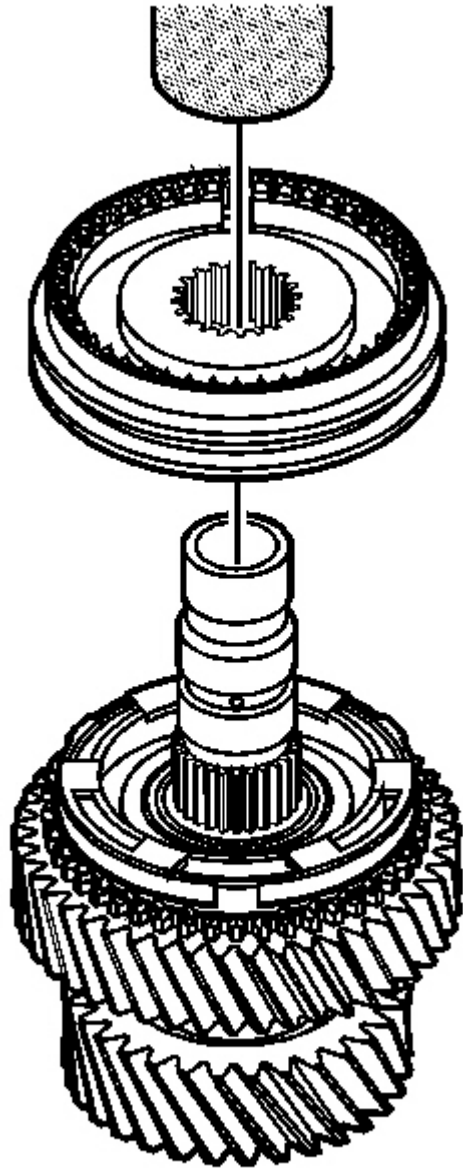


Fig. 202: 1st/2nd Synchronizer & J 24433
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- Make sure to properly align the synchronizer to the gear and notches in the blocking ring.

- Observe the orientation of the synchronizer. The shoulder of the synchronizer faces 1st gear.

6. Install the 1st/2nd synchronizer using J 24433 and a hydraulic press. See Special Tools and Equipment .

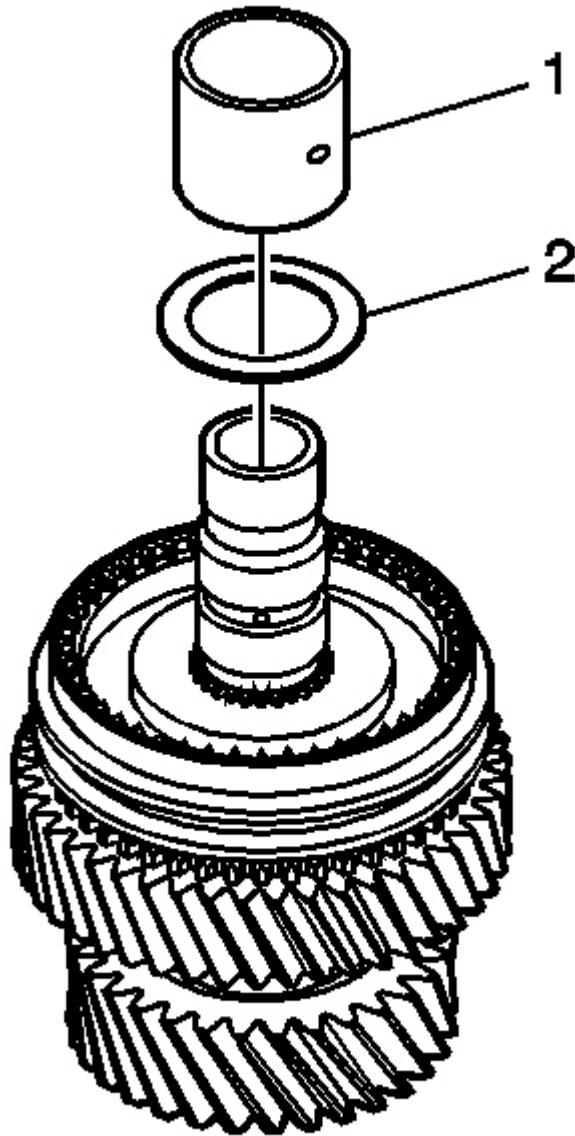


Fig. 203: Thrust Washer & Bearing Collar

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Install the bearing collar oil hole 180 degrees from shaft oil hole.

7. Install the thrust washer (2) and the bearing collar (1) using an appropriate tool and a hydraulic press.

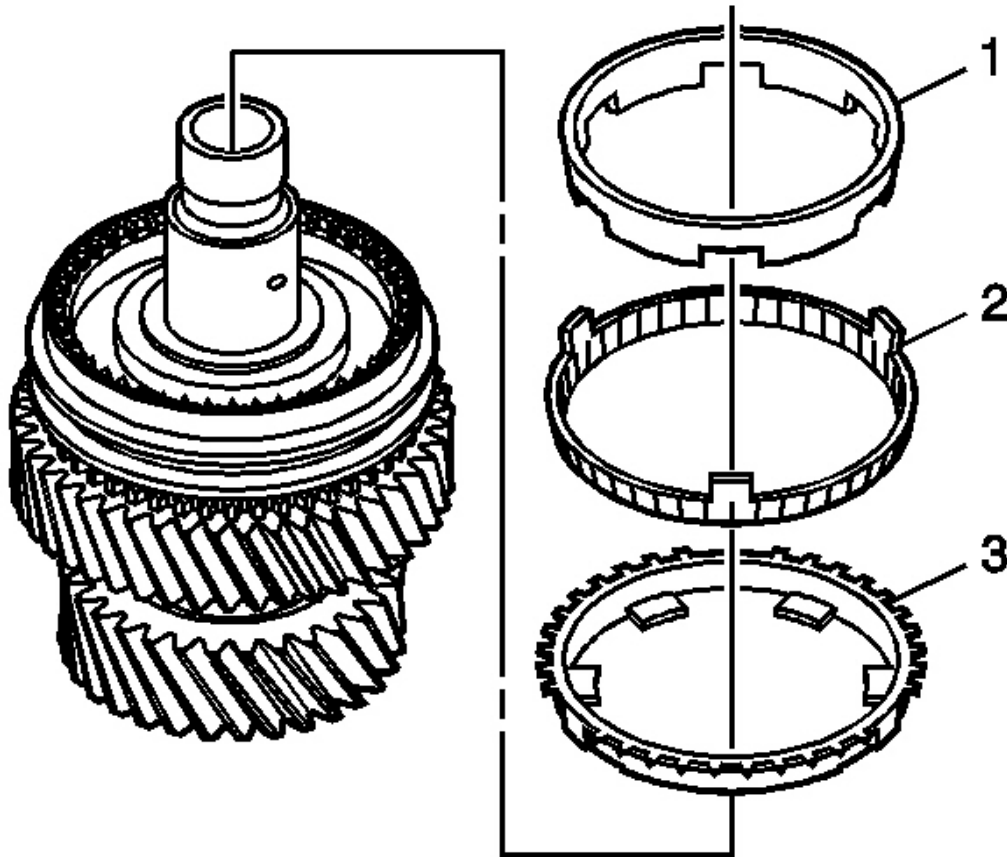


Fig. 204: 1st Gear Outer/Inner Cone & Blocking Ring
Courtesy of GENERAL MOTORS CORP.

8. Install the 1st gear outer cone (3).
9. Install the 1st gear blocking ring (2).
10. Install the 1st gear inner cone (1).

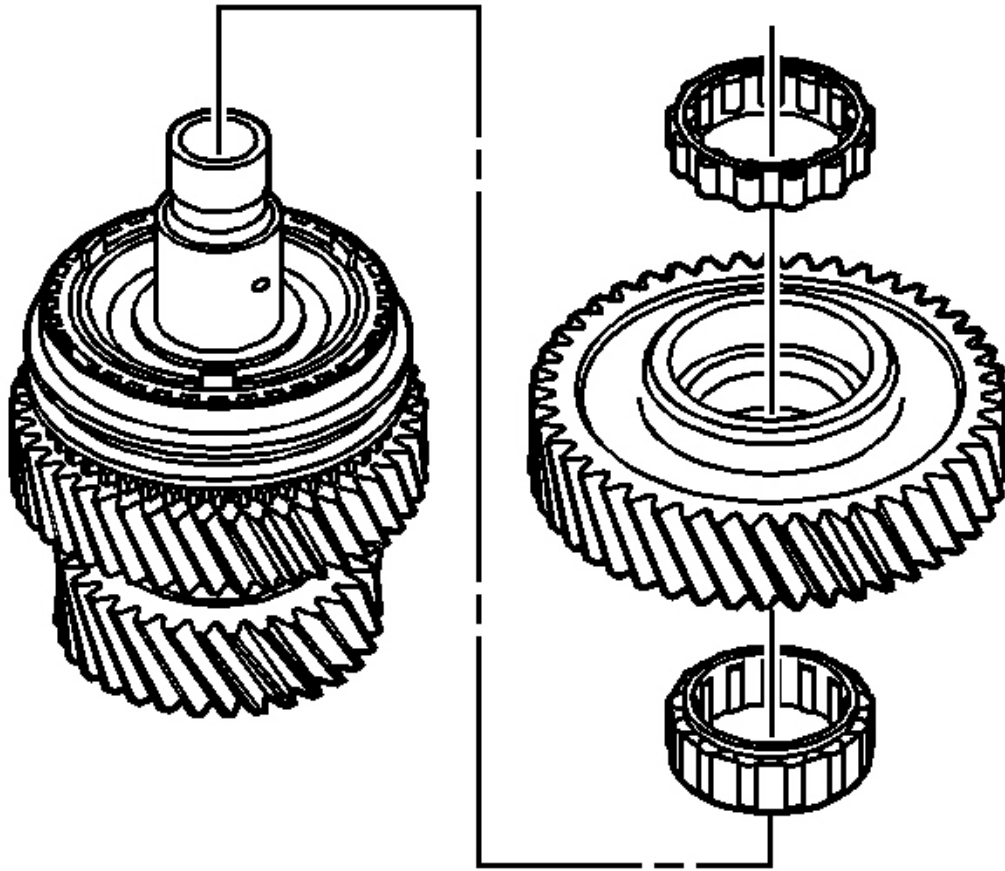


Fig. 205: 1st Gear & Roller Bearing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The steps in both roller bearings must fall into the 1st gear.

11. Install the roller bearing.
12. Install the 1st gear.
13. Install the roller bearing.

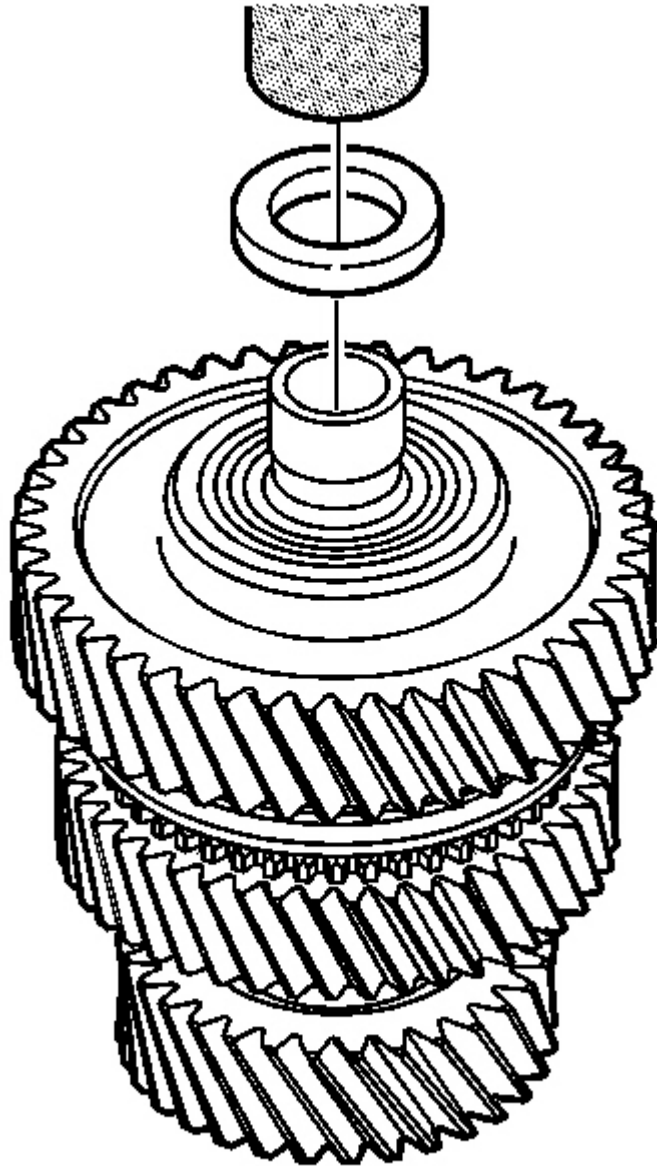


Fig. 206: Thrust Washer & J 24433
Courtesy of GENERAL MOTORS CORP.

14. Install the thrust washer using J 24433 and a hydraulic press. See **Special Tools and Equipment** .

Tools Required

J 24433 Press Tube. See Special Tools and Equipment .

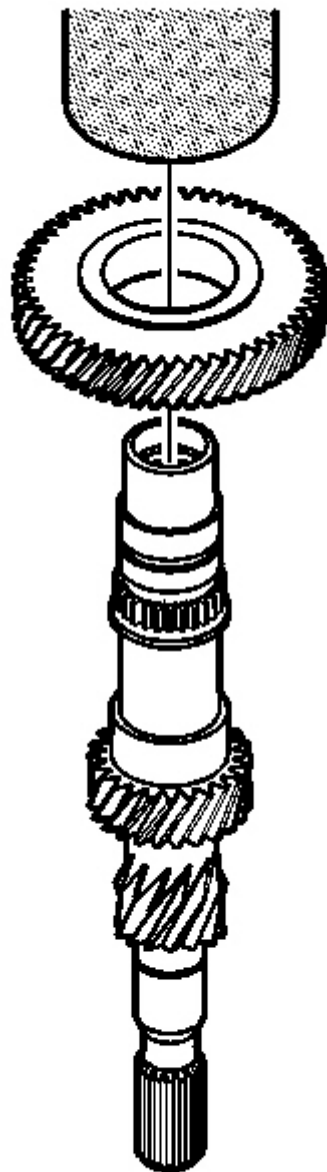


Fig. 207: Input Shaft Assemble & Components
Courtesy of GENERAL MOTORS CORP.

- IMPORTANT:**
- Lubricate all components with transmission fluid before installation.
 - The machined surface faces the needle thrust bearing.

1. Install the 5th gear using **J 24433** and a hydraulic press. See **Special Tools and Equipment** .

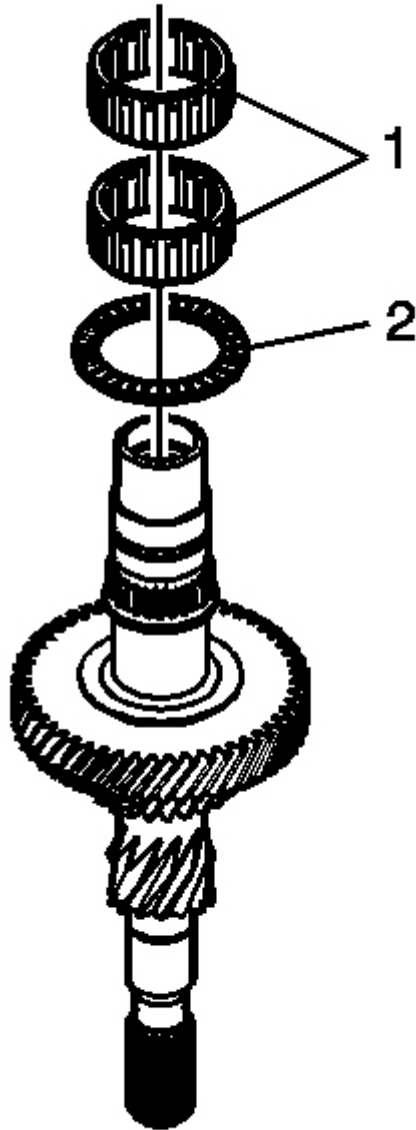


Fig. 208: Caged Needle Bearing & Thrust Bearing

Courtesy of GENERAL MOTORS CORP.

2. Install the thrust bearing (2).
3. Install the two caged needle bearings (1).

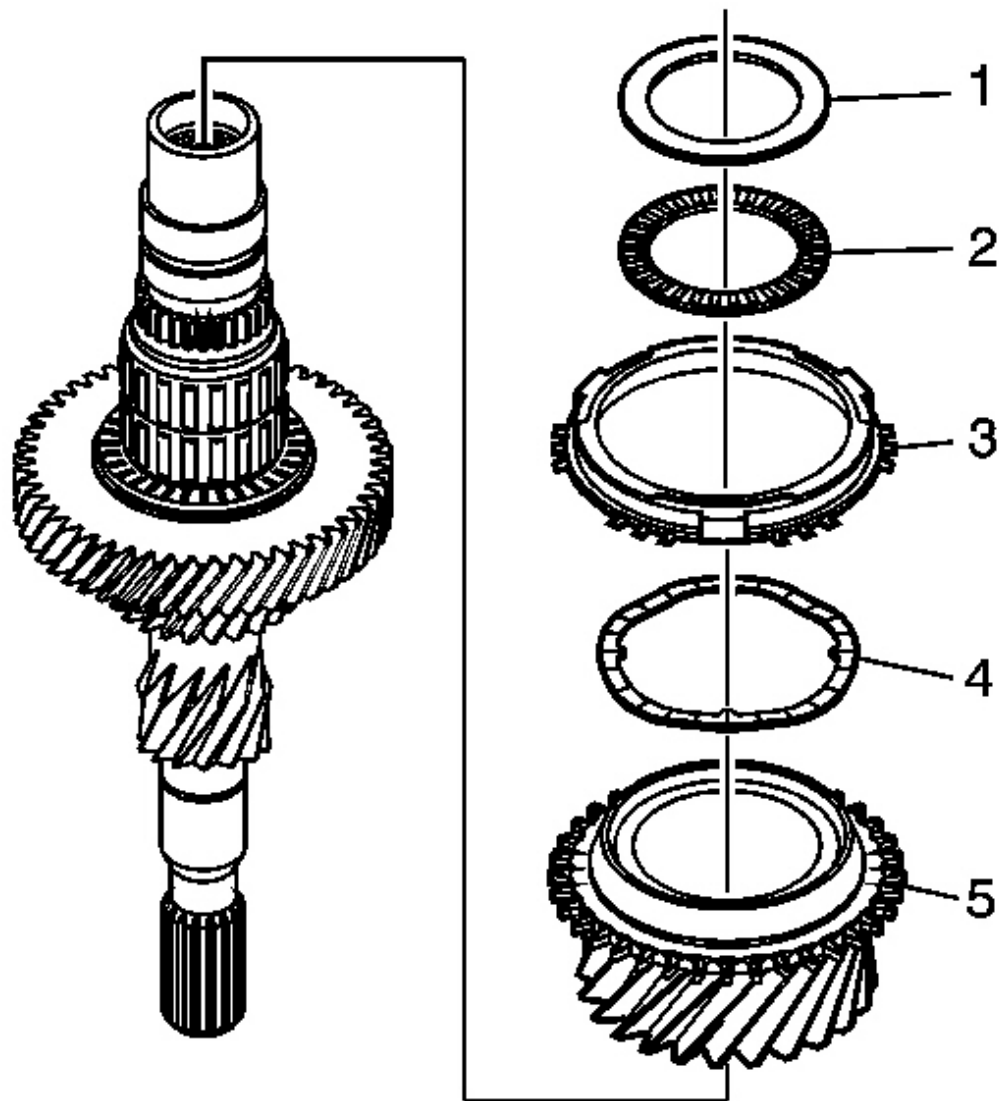


Fig. 209: 3rd Gear, Blocking Ring, Thrust Bearing & Wavy Washer
Courtesy of GENERAL MOTORS CORP.

4. Install the 3rd gear (5).
5. Install the wavy washer (4).
6. Install the 3rd gear blocking ring (3).
7. Install the thrust bearing (2).

IMPORTANT: Use a NEW thrust washer.

8. Install a new thrust washer (1).

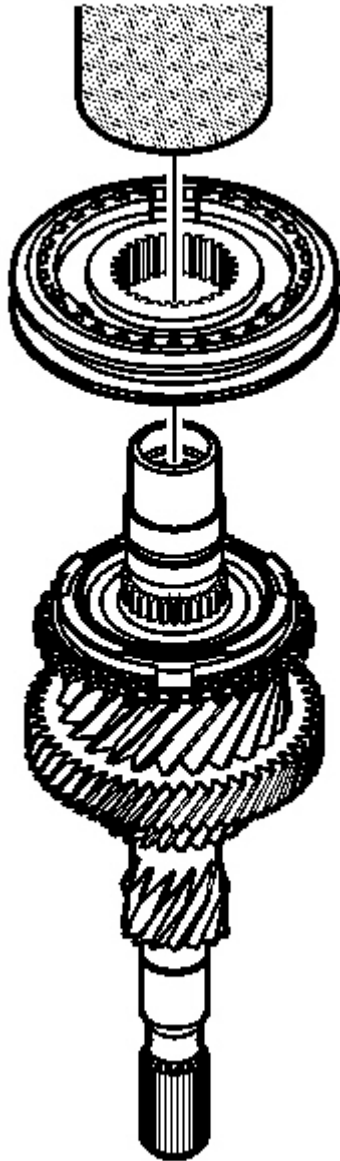


Fig. 210: 3rd/4th Synchronizer & J 24433
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- The machined surface of the synchronizer faces the thrust washer.
- Make sure to align the slots in the synchronizer with the gear

blocking ring tabs.

9. Install the 3rd/4th synchronizer using the **J 24433** and a hydraulic press. See **Special Tools and Equipment** .

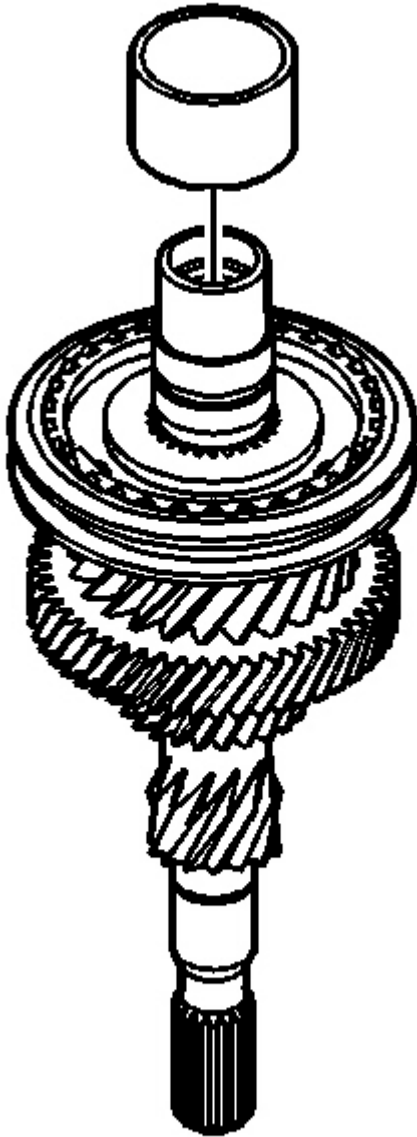


Fig. 211: Bearing Collar
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Make sure the oil hole on the bearing collar is 90 degrees from the oil hole in the shaft.

10. Install the bearing collar using an appropriate tool and a hydraulic press.

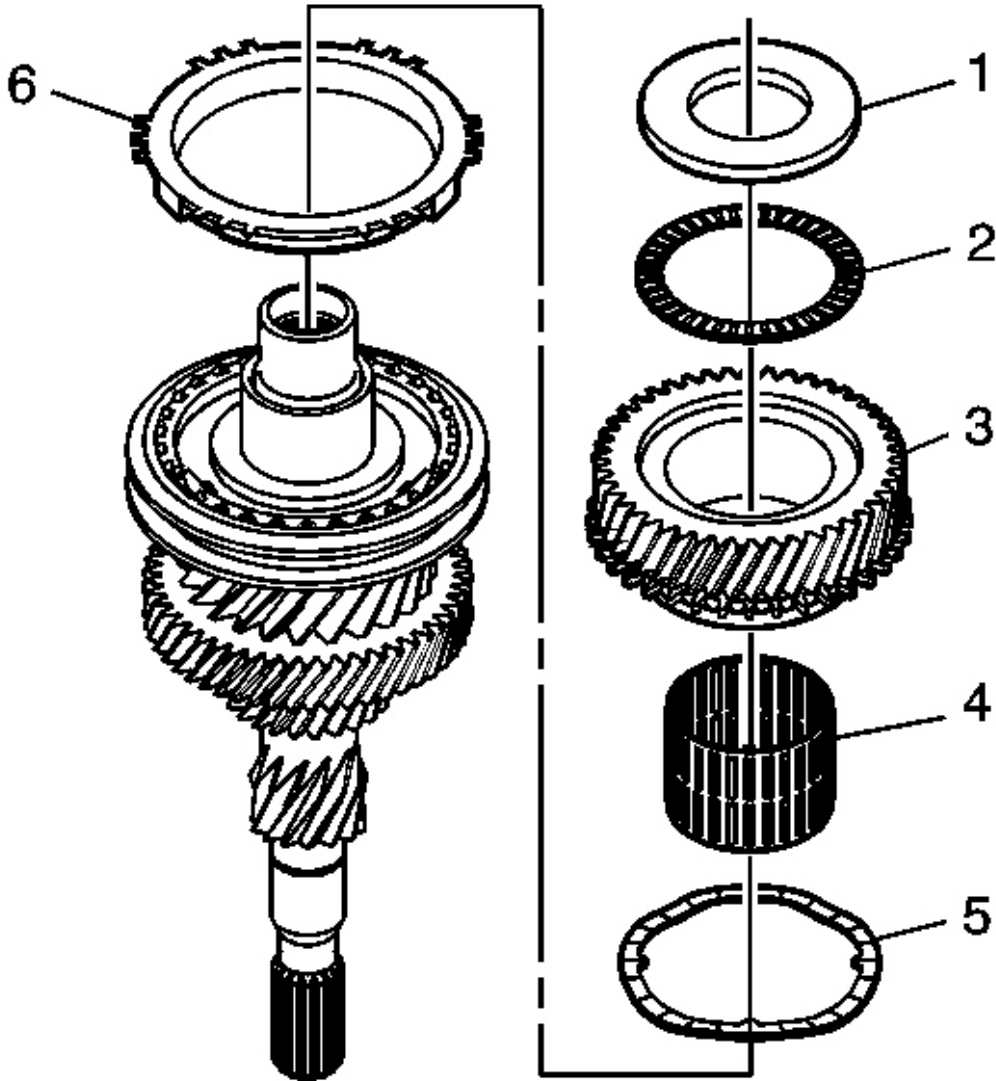


Fig. 212: Input Shaft Disassemble & Components
Courtesy of GENERAL MOTORS CORP.

11. Install the 4th gear blocking ring (6).
12. Install the wavy washer (5).
13. Install the caged needle bearing (4).
14. Install the 4th gear (3).

IMPORTANT: The pocketed side of the thrust bearing (2) faces the thrust washer.

15. Install the thrust bearing (2).
16. Install the thrust washer (1).

OUTPUT SHAFT ASSEMBLE

Tools Required

J 24433 Press Tube. See **Special Tools and Equipment** .

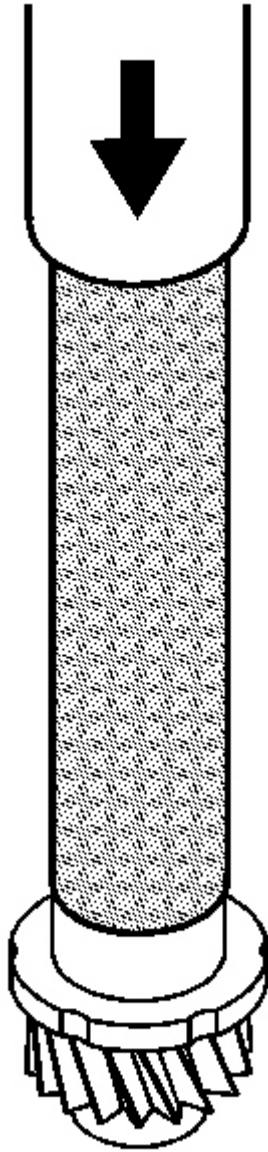


Fig. 213: Installing Thrust Washer & Collar Using J 24433
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- Lubricate all components in transmission fluid before installation.
- Make sure the oil hole in the collar is 90 degrees from the oil hole in the output shaft.

1. Install the thrust washer using the **J 24433** and a hydraulic press. See **Special Tools and Equipment** .
2. Install the collar using the **J 24433** and a hydraulic press. See **Special Tools and Equipment** .

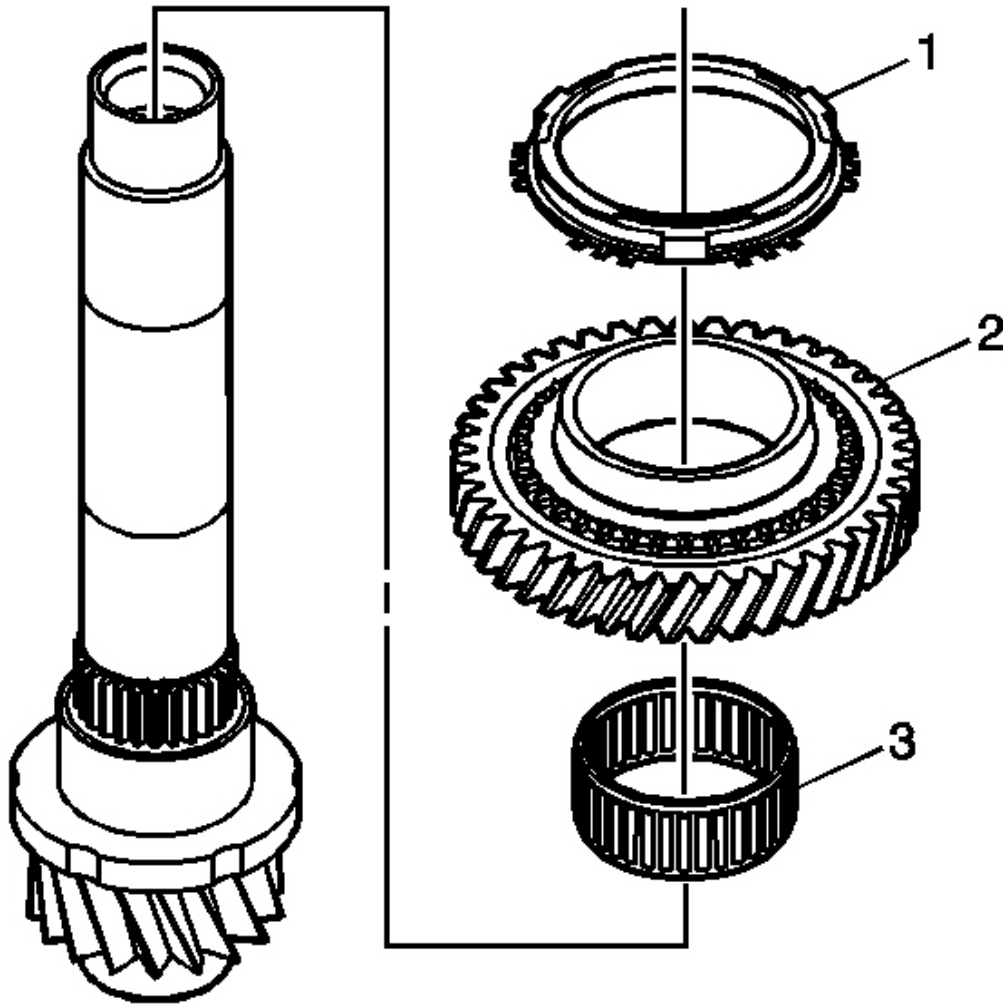


Fig. 214: Caged Needle Bearings, Reverse Gear & Blocking Ring
Courtesy of GENERAL MOTORS CORP.

3. Install the caged needle bearings (3).
4. Install the reverse gear (2).
5. Install the reverse gear blocking ring (1).

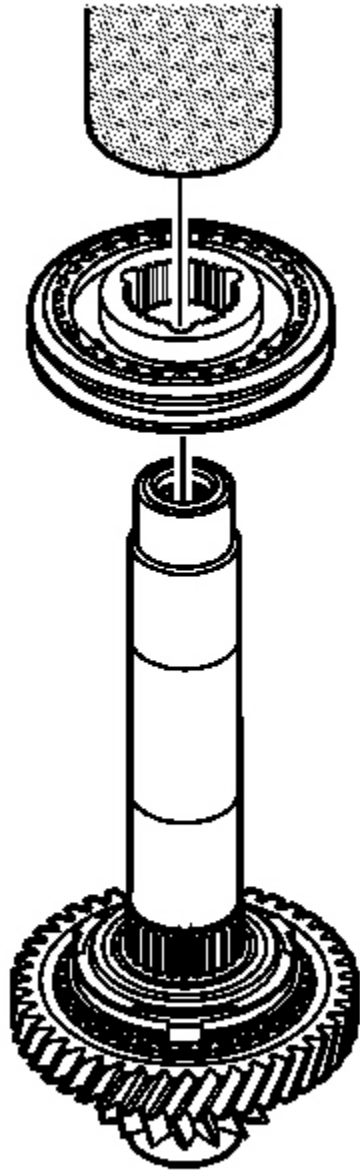


Fig. 215: 5th/Reverse Synchronizer & J 24433
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- The raised center hub of the 5th/Reverse synchronizer assembly faces the 5th gear.

- Line up the blocking ring tabs and the hub keyways while pressing.

6. Install the 5th/Reverse synchronizer using the **J 24433** and a hydraulic press. See **Special Tools and Equipment** .

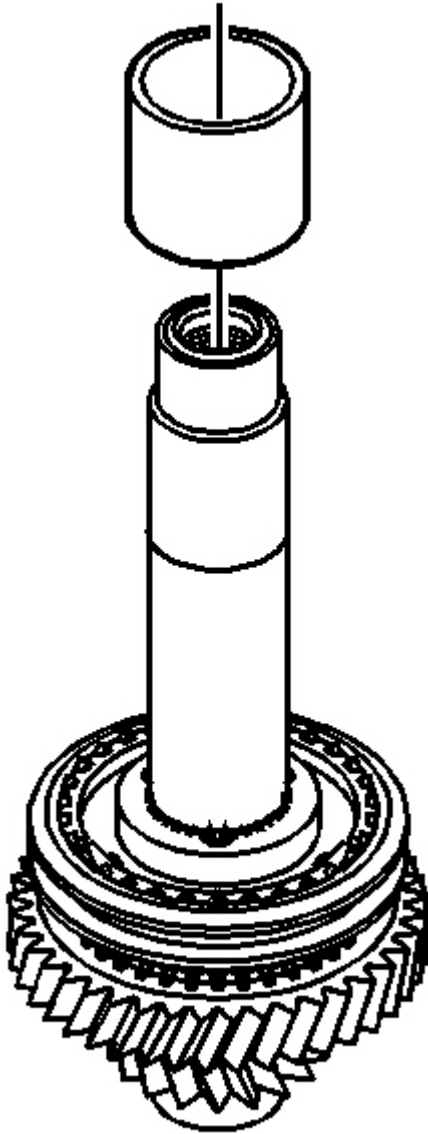


Fig. 216: Output Shaft Assemble & Bearing Collar

Courtesy of GENERAL MOTORS CORP.

7. Install the bearing collar using an appropriate tool and a hydraulic press.

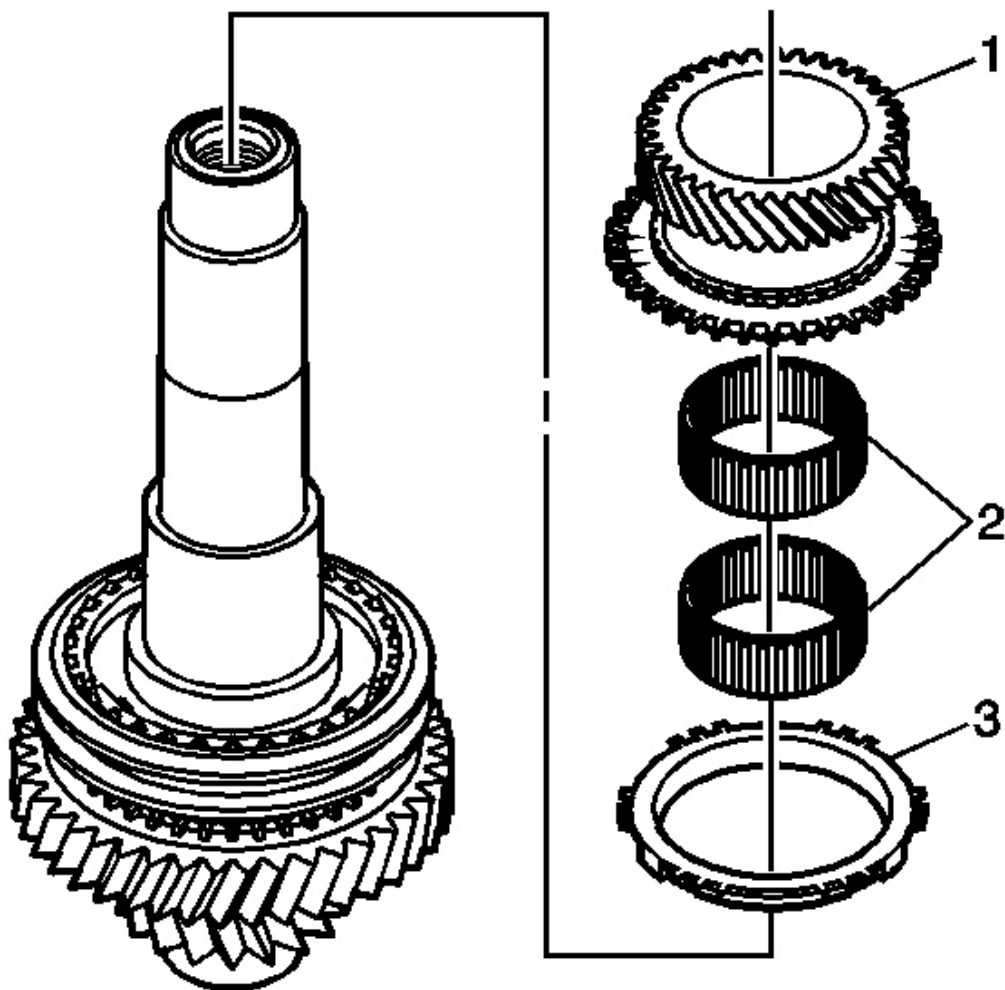


Fig. 217: 5th Gear, Blocking Ring & Two Caged Needle Bearings
Courtesy of GENERAL MOTORS CORP.

8. Install the 5th gear blocking ring (3).
9. Install the two caged needle bearings (2).
10. Install the 5th gear (1).

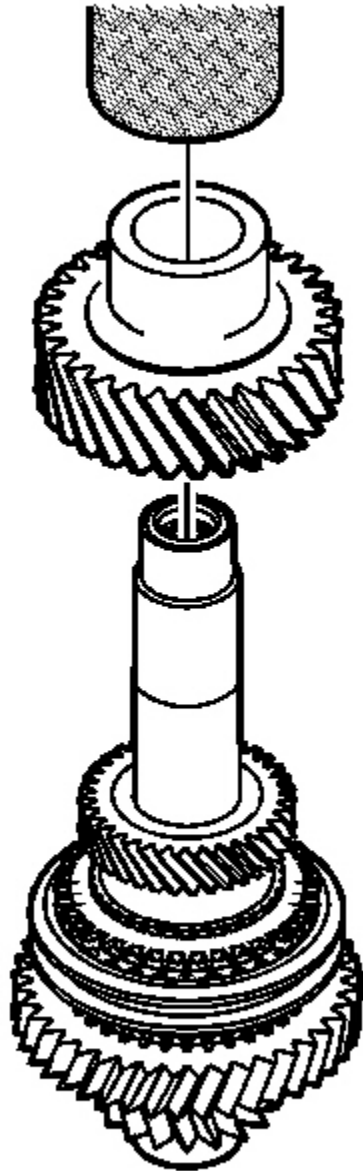


Fig. 218: 3rd Gear & J 24433
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The 3rd gear will install very tight. Ensure that the mating surfaces are clean.

11. Install the 3rd gear using the **J 24433** and a hydraulic press. See **Special Tools and Equipment** .

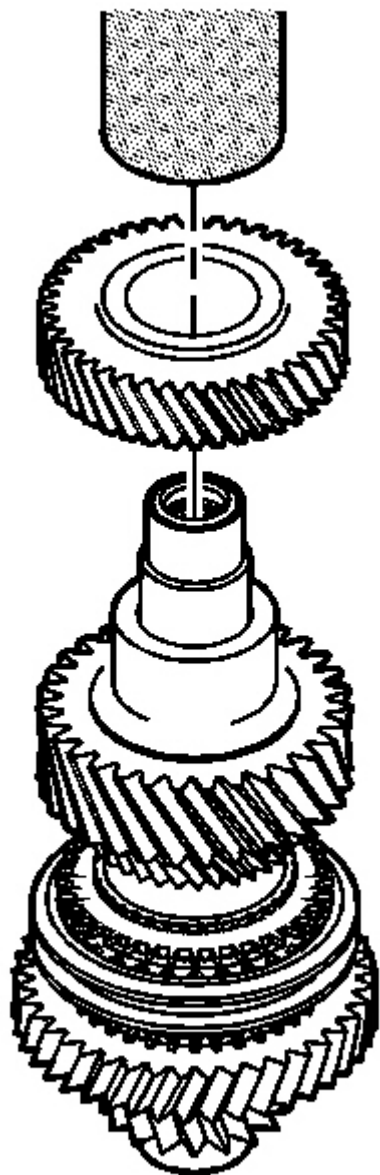


Fig. 219: 4th Gear & J 24433
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The 4th gear will install very tight. Ensure that the mating surfaces are clean.

12. Install the 4th gear using the **J 24433** and a hydraulic press. See **Special Tools and Equipment** .

DIFFERENTIAL CASE ASSEMBLE

Tools Required

- **J 7079-2** Universal Driver Handle - Non-Threaded. See **Special Tools and Equipment** .
- **J 44386** Input/Output Bearing Installer. See **Special Tools and Equipment** .

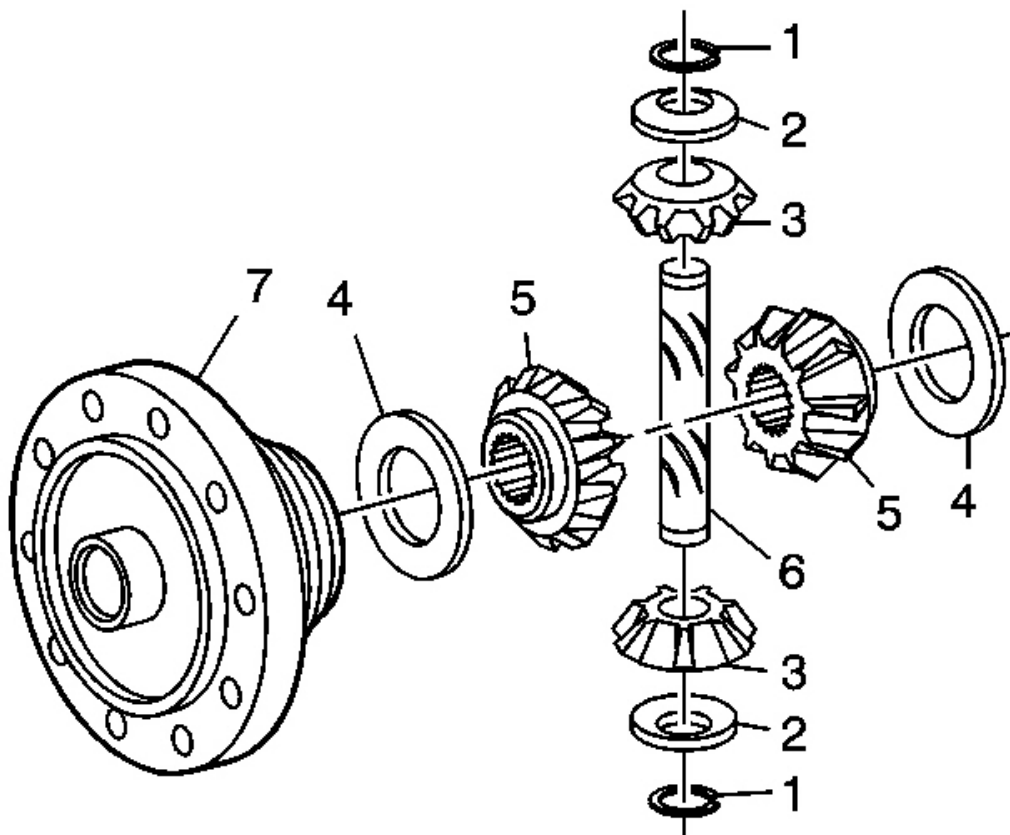


Fig. 220: Differential Case & Components
Courtesy of **GENERAL MOTORS CORP.**

1. Clean all parts in a suitable solution before assembling.

IMPORTANT:

- Refer to Shimming Procedures before assembling the differential case.
- Lubricate the bearing inner and outer race surface before assembly.

2. Install the following parts into the differential case (7):

- The pinion gears (3)
- The pinion gear thrust washers (2)
- The side gears (5)
- The side gear thrust washers (4)
- The pinion shaft (6)
- NEW snap rings (1)

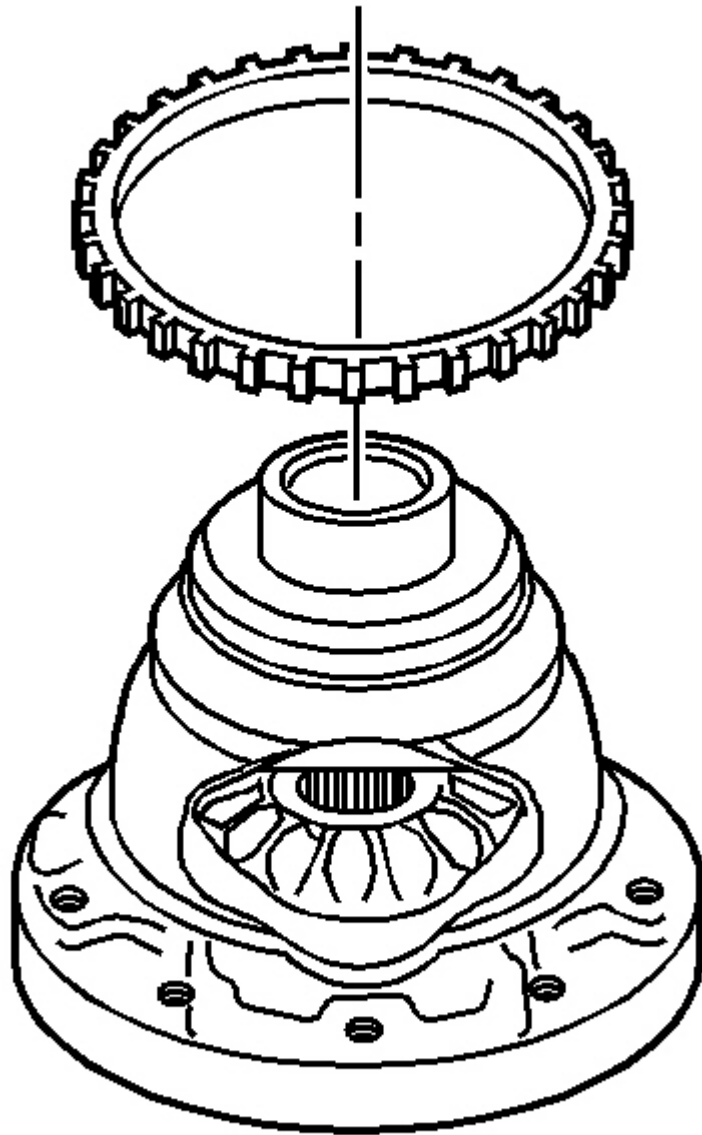


Fig. 221: VSS Ring

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Apply even pressure to the vehicle speed sensor (VSS) ring during installation.

3. Install the vehicle speed sensor (VSS) ring onto the differential case.

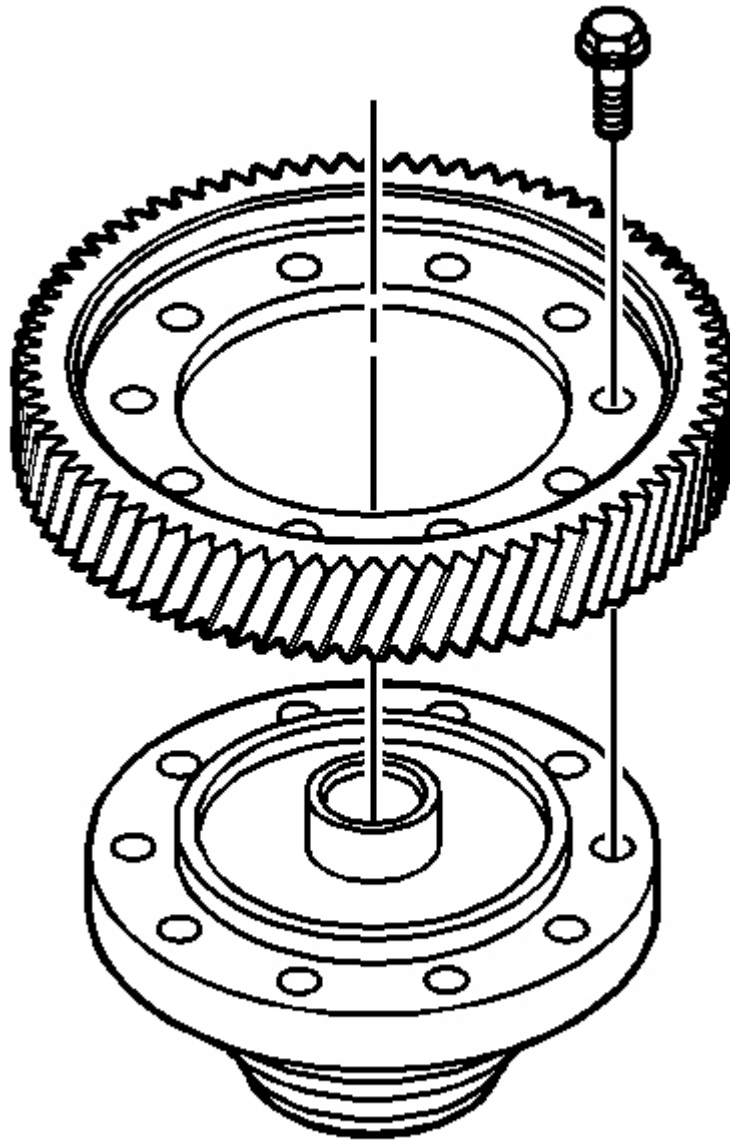


Fig. 222: Differential Ring Gear & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Apply P/N 21005994 or equivalent to the differential ring gear bolts.

IMPORTANT: The machined surface on the differential ring gear faces the differential case.

5. Install the differential ring gear onto the differential case.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the ten NEW differential ring gear bolts.

Tighten: Tighten the differential ring gear bolts to 95 N.m (68 lb ft).

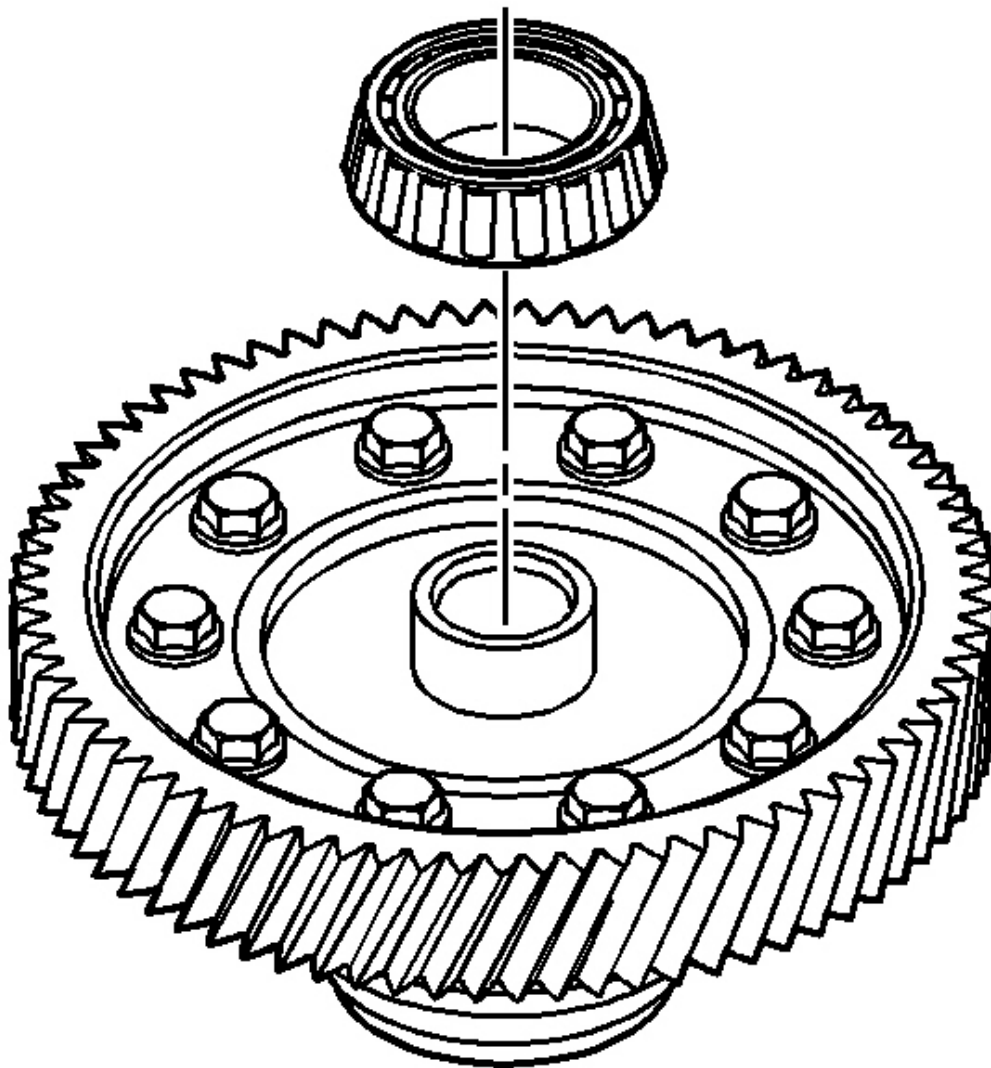


Fig. 223: Left Differential Side Bearing & Shim

Courtesy of **GENERAL MOTORS CORP.**

IMPORTANT: Refer to Shimming Procedures before installing the left differential side bearing.

7. Install a NEW left differential side bearing and shim onto the differential case using the **J 44386** and the **J 7079-2** . See Special Tools and Equipment .

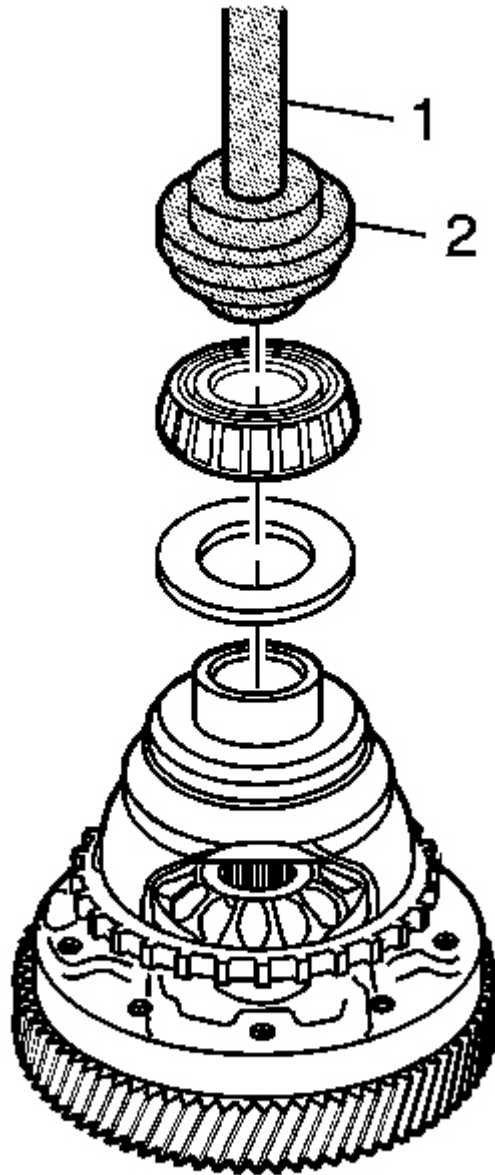


Fig. 224: Right Differential Side Bearing & Shim
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Refer to Shimming Procedures before installing the right differential side bearing.

8. Install a NEW right differential side bearing and shim onto the differential case using the **J 44386** (2) and the **J 7079-2** (1). See **Special Tools and Equipment** .

TRANSAXLE CASE ASSEMBLY

Tools Required

- **J 7079-2** Universal Driver Handle - Non-Threaded. See **Special Tools and Equipment** .
- **J 8092** Universal Driver Handle - 3/4 in - 10. See **Special Tools and Equipment** .
- **J 44375** Assembly Pallet. See **Special Tools and Equipment** .
- **J 44376** Bearing Pusher/Puller. See **Special Tools and Equipment** .
- **J 44377** Input Shaft Anti-Rotation Tool. See **Special Tools and Equipment** .
- **J 44381** Shifter Bearing/Input and Output Bearing Remover. See **Special Tools and Equipment** .
- **J 44383** Countershaft Bearing Installer (to case). See **Special Tools and Equipment** .
- **J 44385** Differential Bearing Race and Seal Installer. See **Special Tools and Equipment** .
- **J 44387** Output Shaft Bearing Sleeve Installer and Pin. See **Special Tools and Equipment** .
- **J 44389** Countershaft Bearing Installer. See **Special Tools and Equipment** .

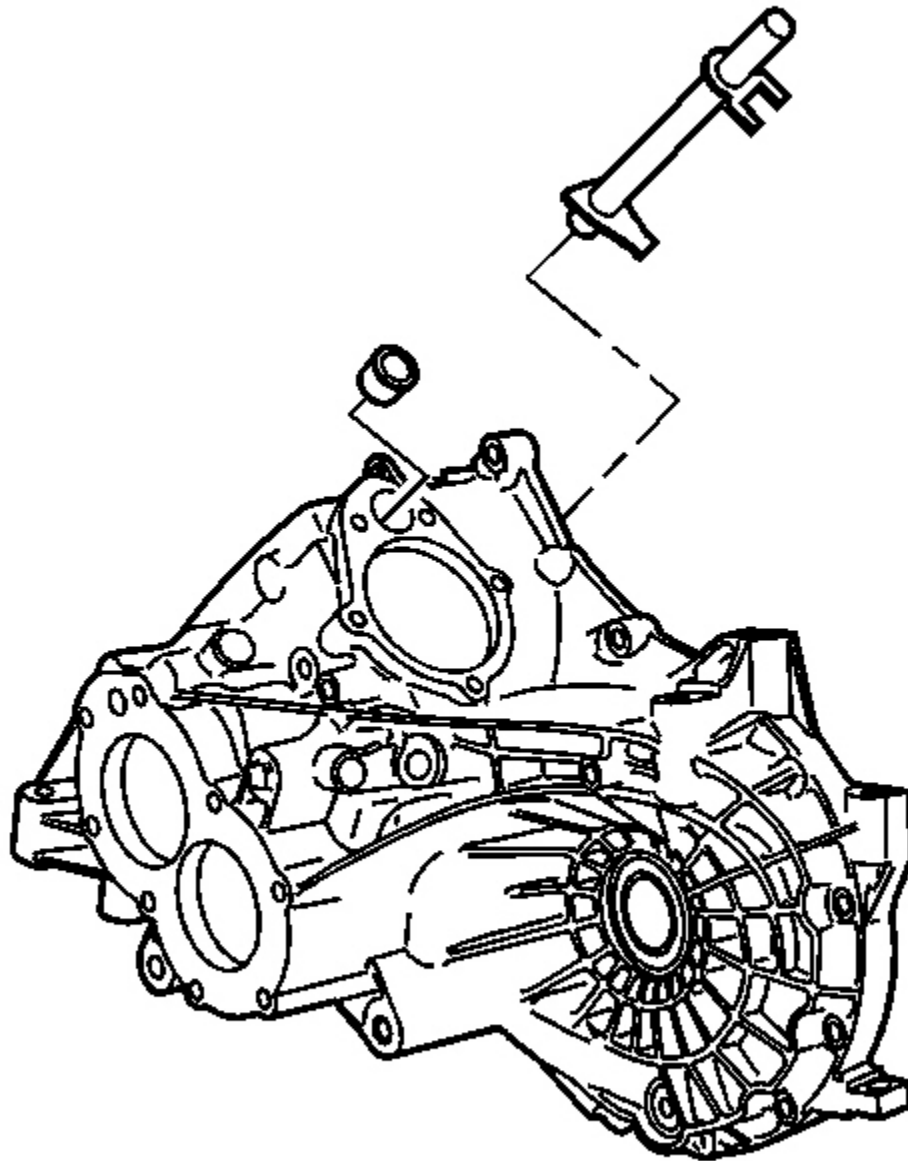


Fig. 225: Shift Rod, Bushing & Transmission Housing
Courtesy of GENERAL MOTORS CORP.

1. Install the shift rod and bushing.

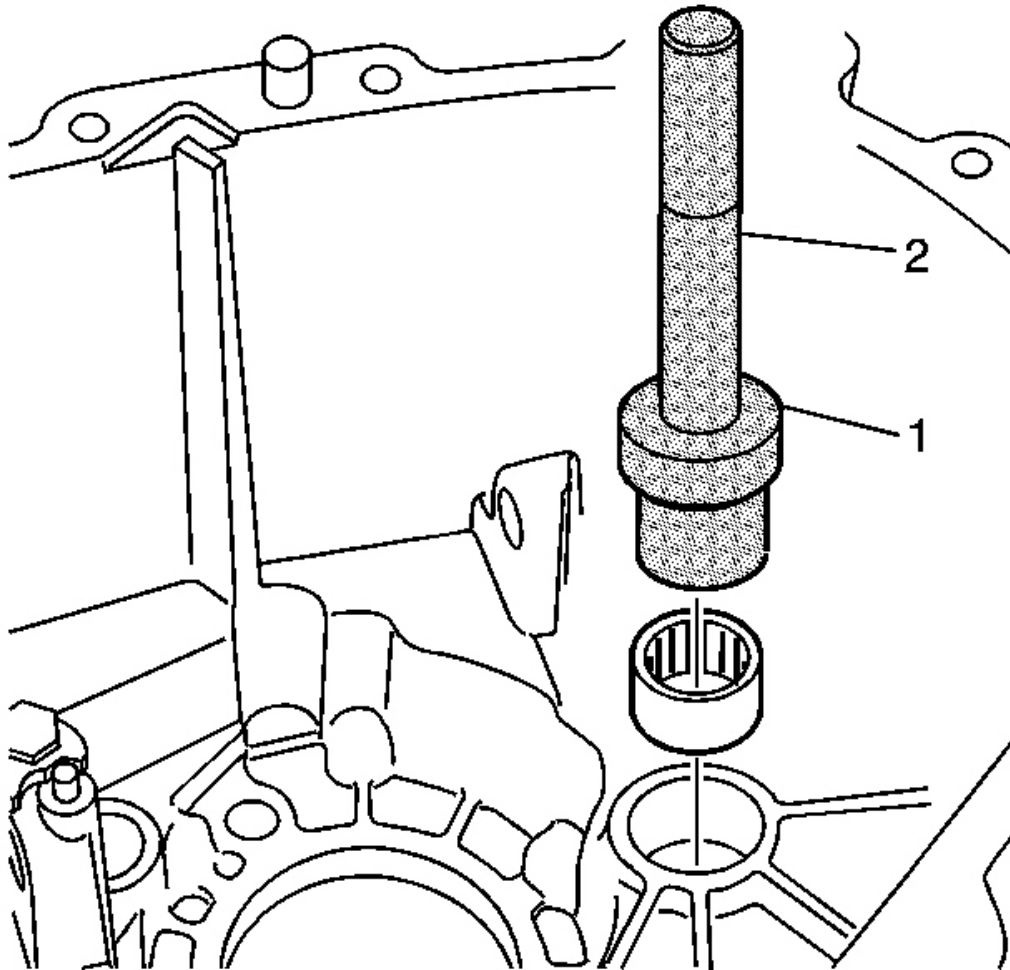


Fig. 226: Intermediate Shaft Needle Bearing, J 44383 & J 8092
Courtesy of GENERAL MOTORS CORP.

2. Install the intermediate shaft needle bearing to the transmission housing using the **J 44383** (1) and the **J 8092** (2). See **Special Tools and Equipment** .

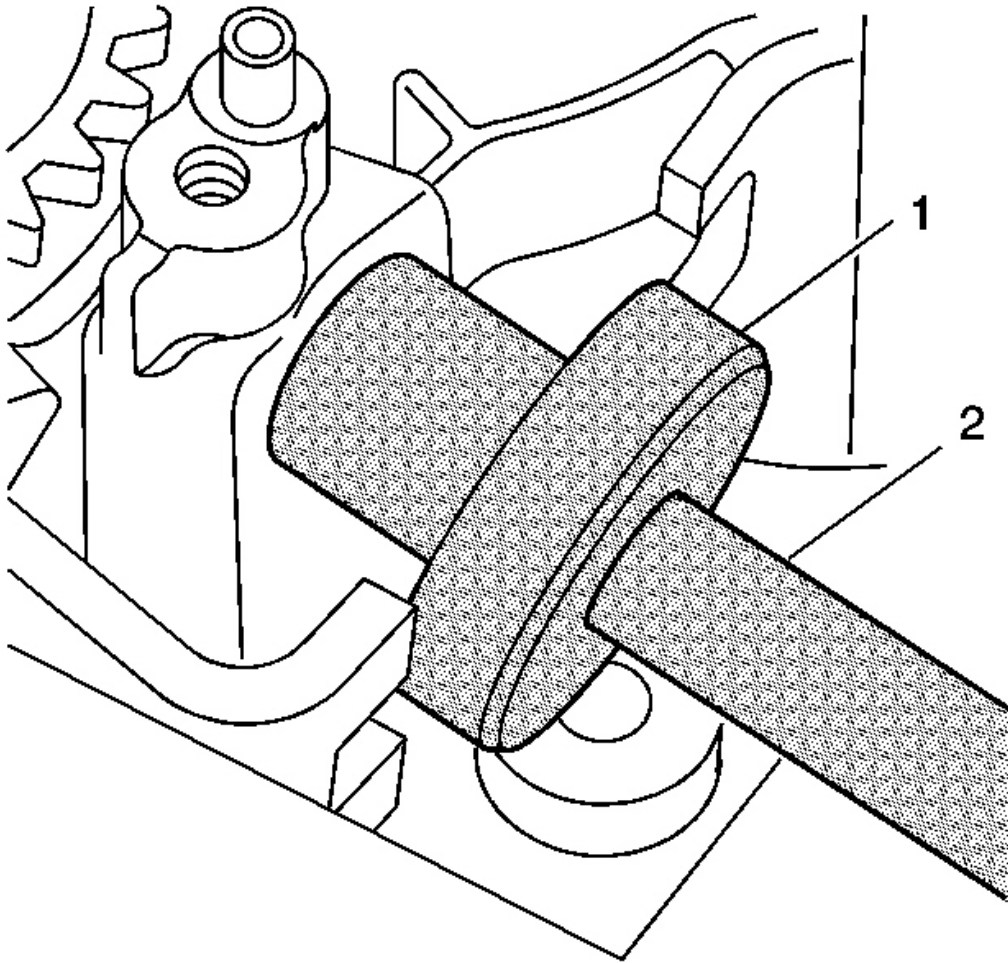


Fig. 227: Shifter Bearing, J 44381 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

3. Install a new shifter shaft bearing flush with the casting in the transmission housing, using the **J 44381** (1) and the **J 8092** (2). See **Special Tools and Equipment** .

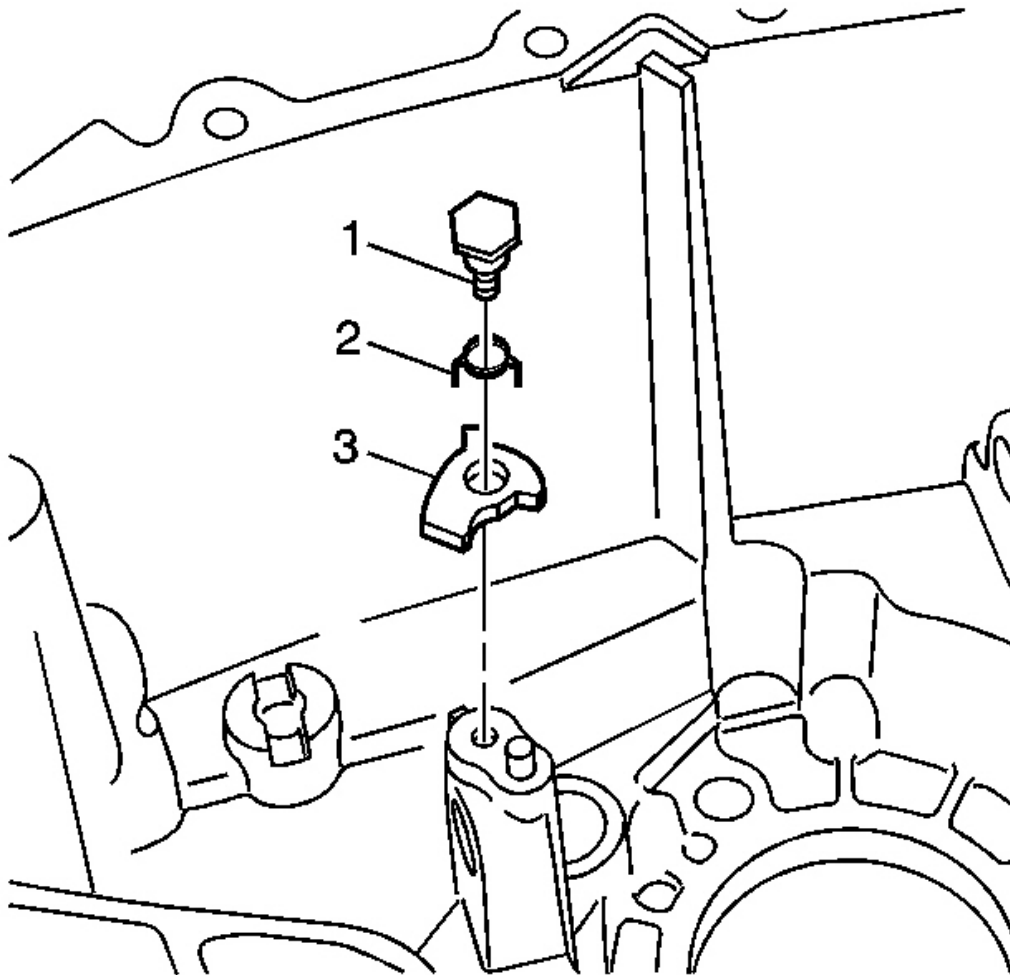


Fig. 228: Bolt, Lever, Spring & Transmission Housing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not over apply the threadlocker to the bolt threads.

4. Apply P/N 21485277 to the reverse lockout lever bolt threads.

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT: The spring (2) fingers must be positioned on either side of the lever (3).

5. Install the reverse lockout lever (3), spring (2), and the bolt (1) to the transmission housing, if equipped.

Tighten: Tighten the bolt to 6 N.m (53 lb in).

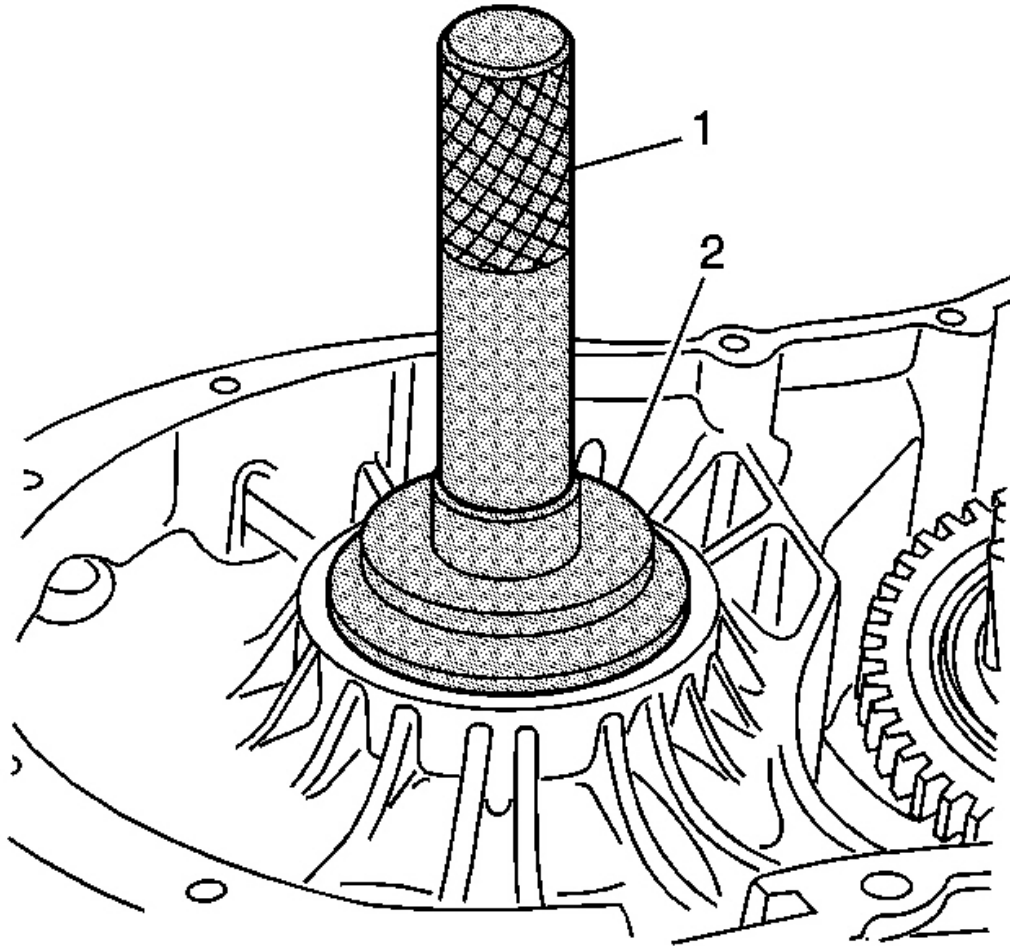


Fig. 229: Differential Bearing Race, Transmission Housing, J 44381 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

6. Install a new differential bearing race to the transmission housing using the **J 44385 (2)** and the **J 7079-2 (1)**. See **Special Tools and Equipment** .

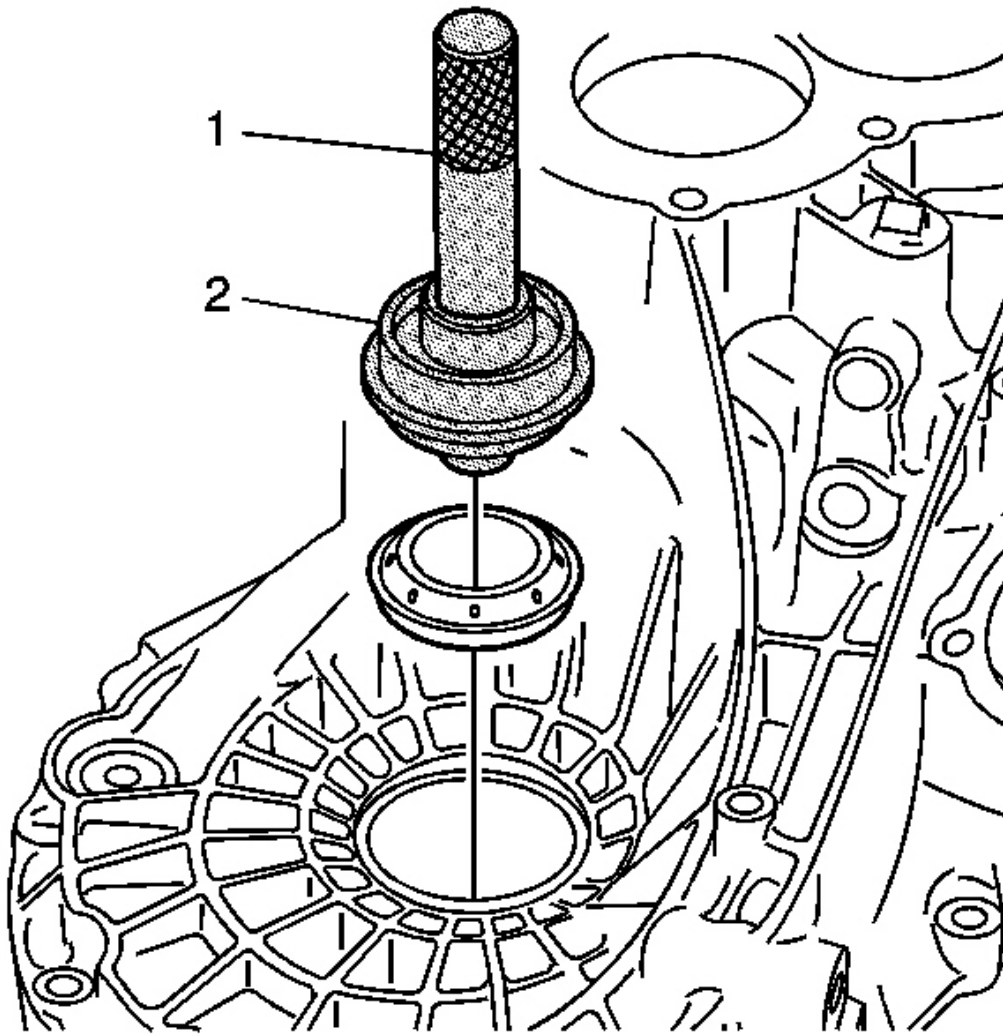


Fig. 230: Axle Seal, J 44385 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

7. Install a new differential side bearing race seal to the transmission housing using the **J 44385** (2) and the **J 7079-2** (1). See **Special Tools and Equipment** .

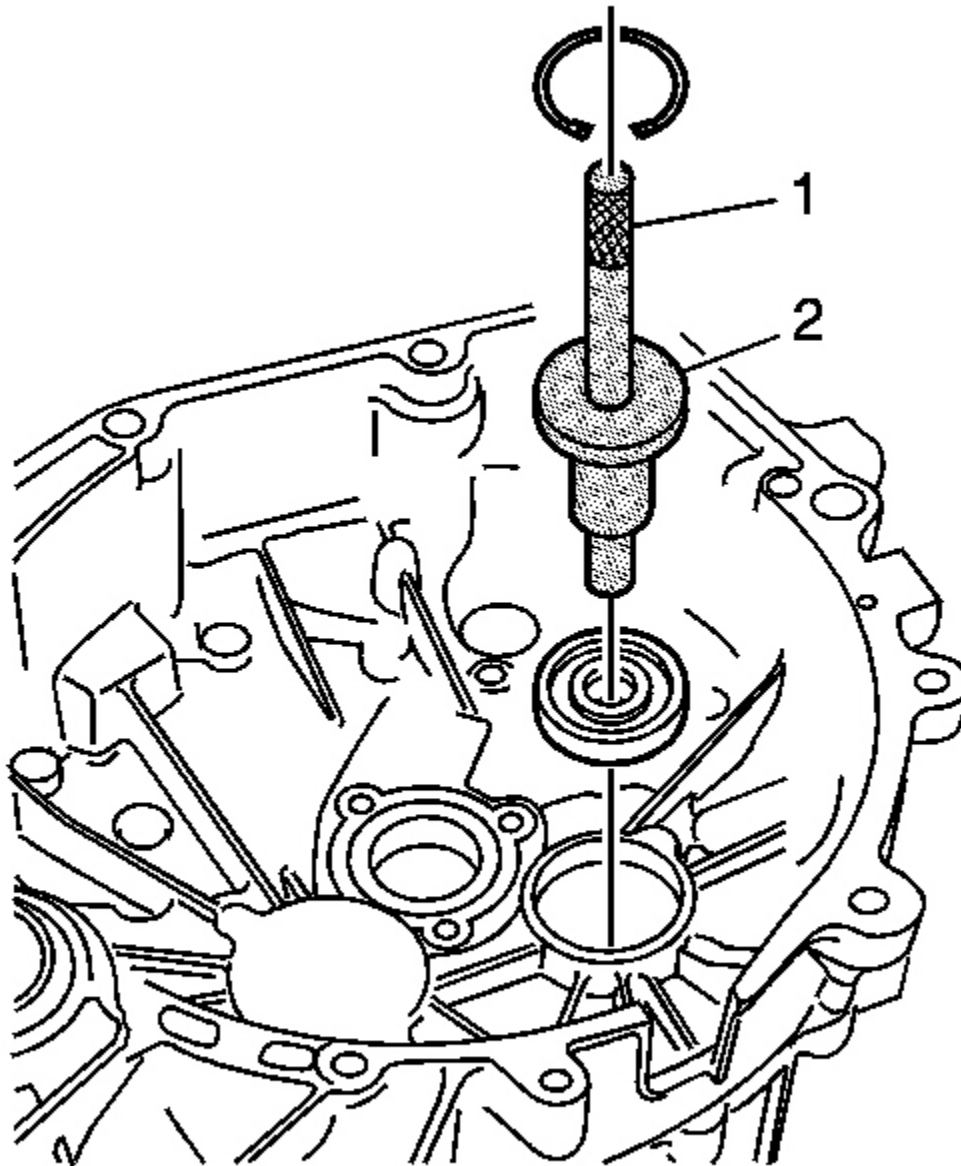


Fig. 231: Countershaft Bearing, J 44381 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

8. Install the countershaft bearing to the clutch housing using the **J 44381** (1) and the **J 7079-2** (2). See **Special Tools and Equipment** .
9. Install a new snap ring.

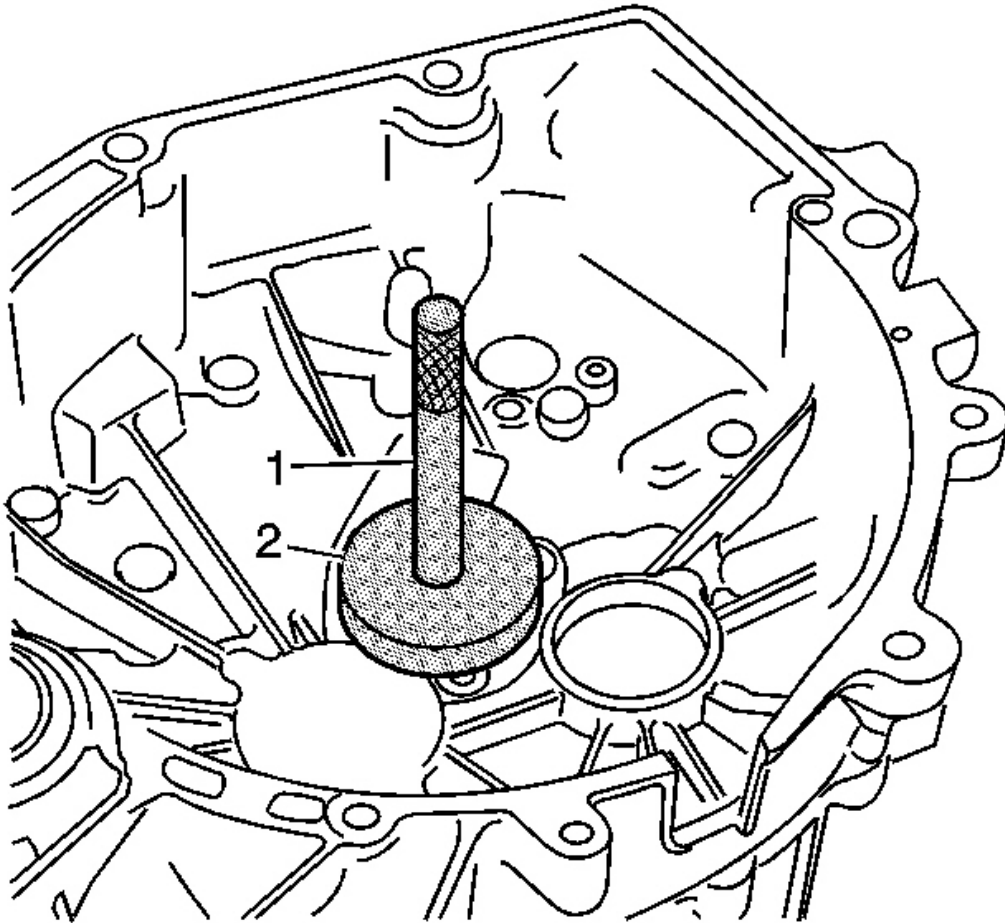


Fig. 232: Input Shaft Bearing, J 44381 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

10. Install the input shaft bearing to the clutch housing using the **J 44381** (2) and the **J 7079-2** (1). See **Special Tools and Equipment** .

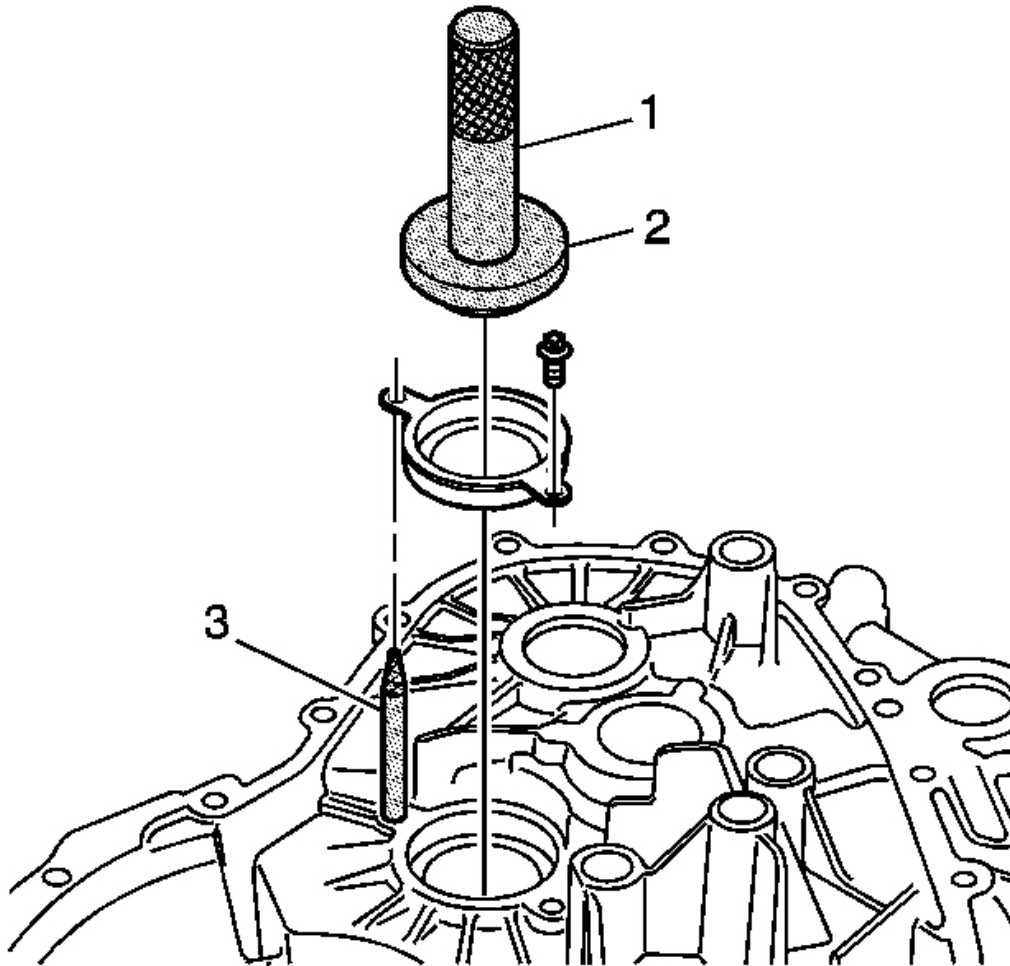


Fig. 233: Output Shaft Bearing Race, Bolts, J 44381 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

11. Install the output shaft bearing race and bolts using the J 44387-1 (2), J 44387-2 (3), and the **J 7079-2** (1). See **Special Tools and Equipment** .

Tighten: Tighten the output shaft bearing bolts to 10 N.m (89 lb in).

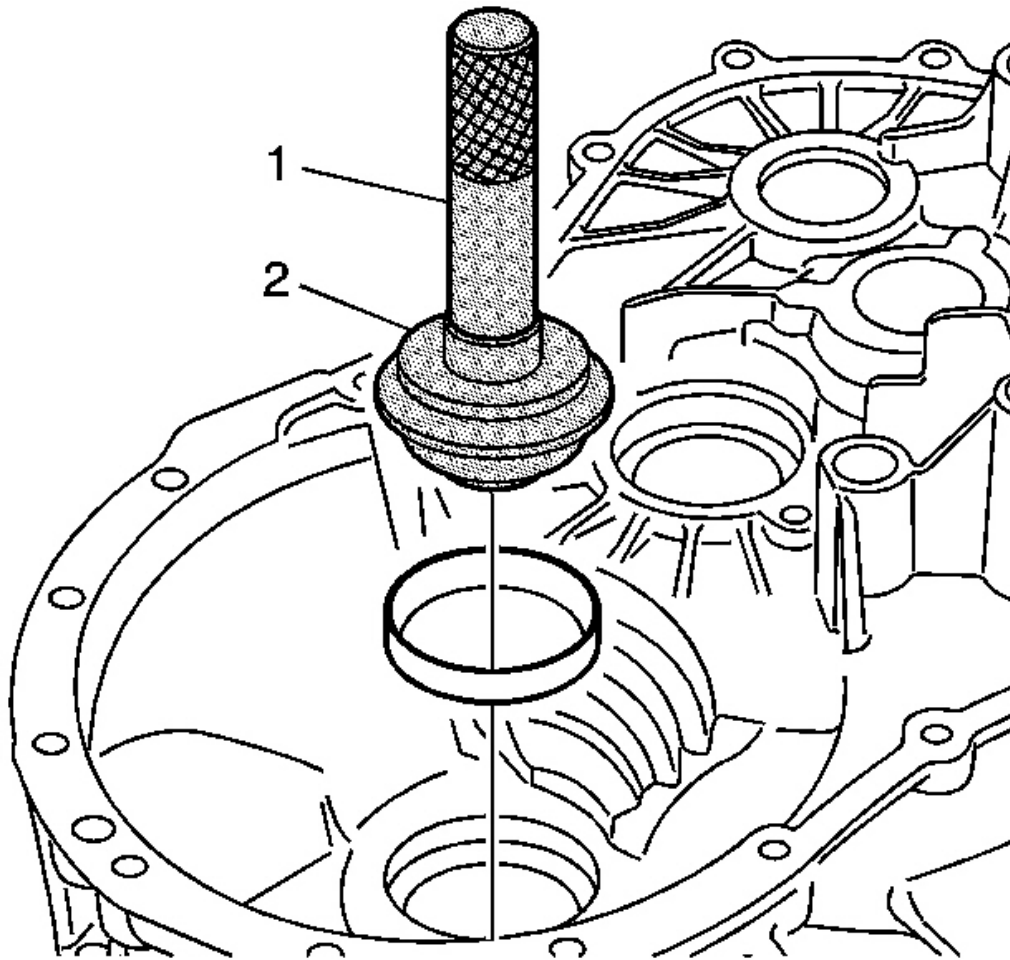


Fig. 234: Differential Bearing Race, Clutch Housing, J 44381 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

12. Install a new differential bearing race to the clutch housing using the **J 44385** (2) and the **J 7079-2** (1). See **Special Tools and Equipment** .

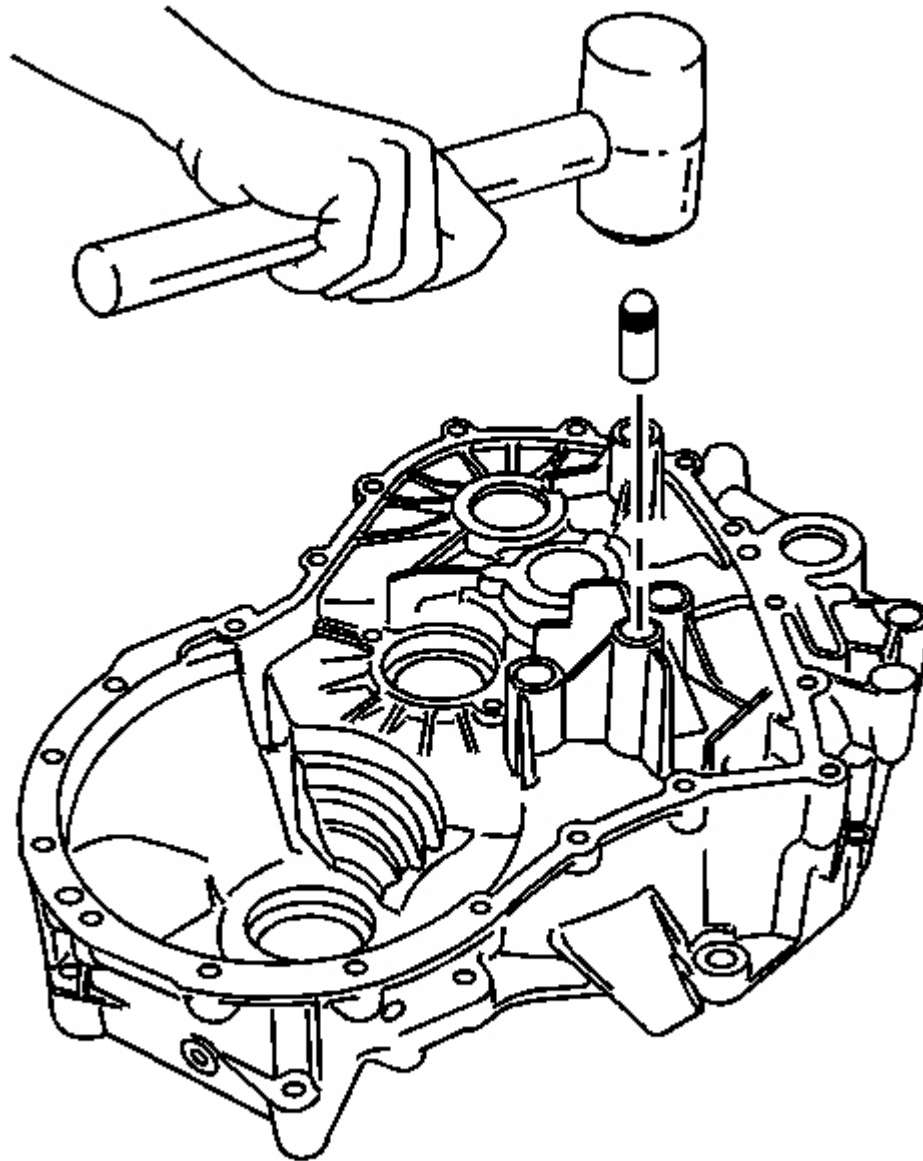


Fig. 235: Shifter Detent
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If either the case or shifter detent is damaged, it may be necessary to install a new shifter detent and/or case.

13. Install the shifter detent into the case if necessary.

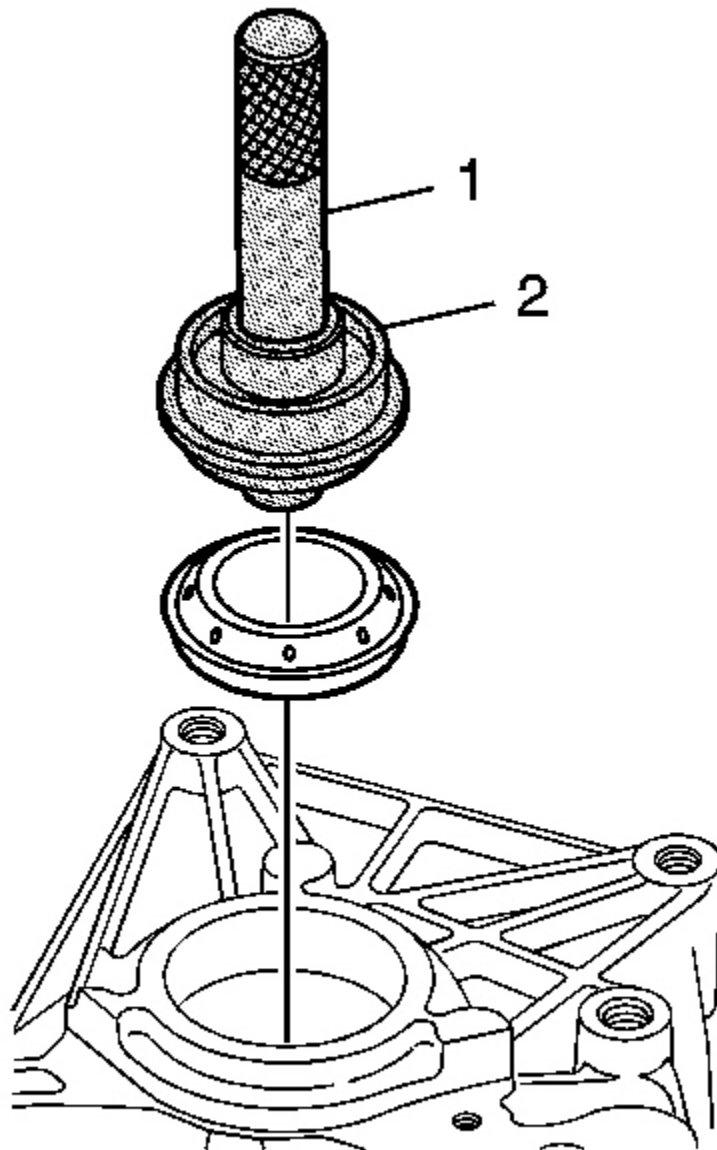


Fig. 236: Differential Output Shaft Seal, Clutch Housing, J 44385 & J 8092
Courtesy of GENERAL MOTORS CORP.

14. Install a new differential output shaft seal to the clutch housing using the **J 44385 (2)** and the **J 8092 (1)**.

See Special Tools and Equipment .

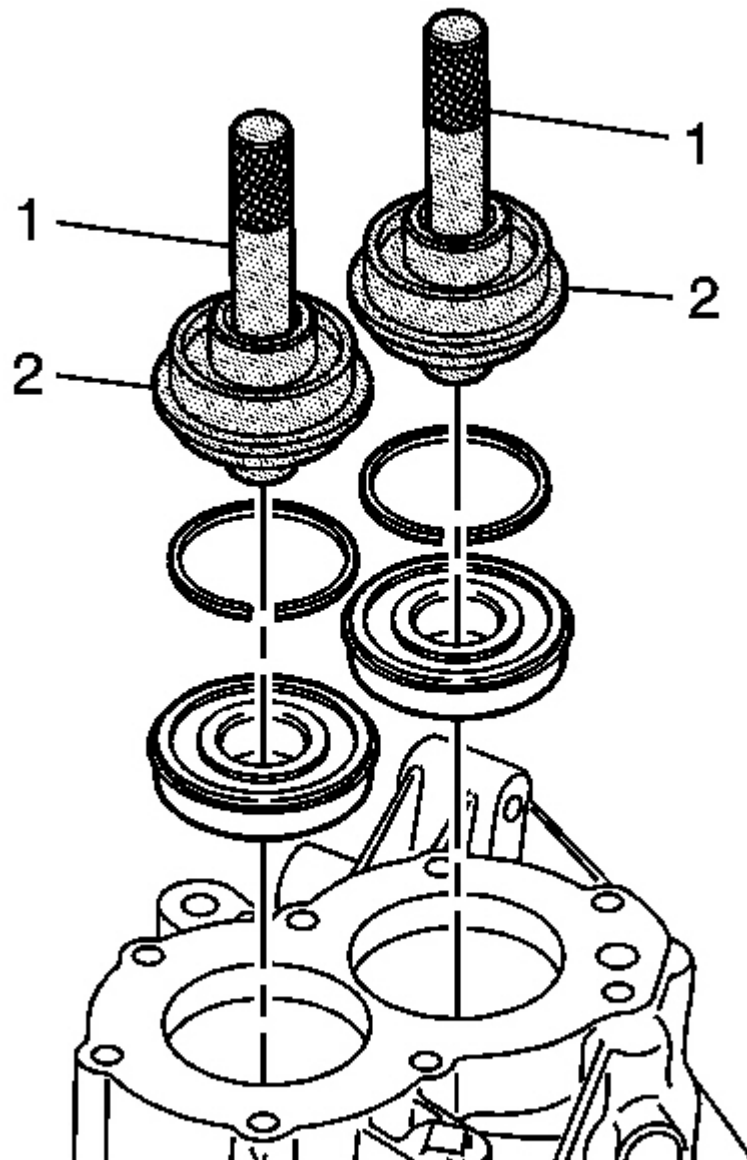


Fig. 237: Input/Output Shaft Bearings, Transmission Housing, J 44385 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

15. Install the snap rings to the input shaft and output shaft bearings.

16. Install the input shaft and output shaft bearings into the transmission housing using the **J 44385** (2) and the **J 7079-2** (1). See **Special Tools and Equipment** .

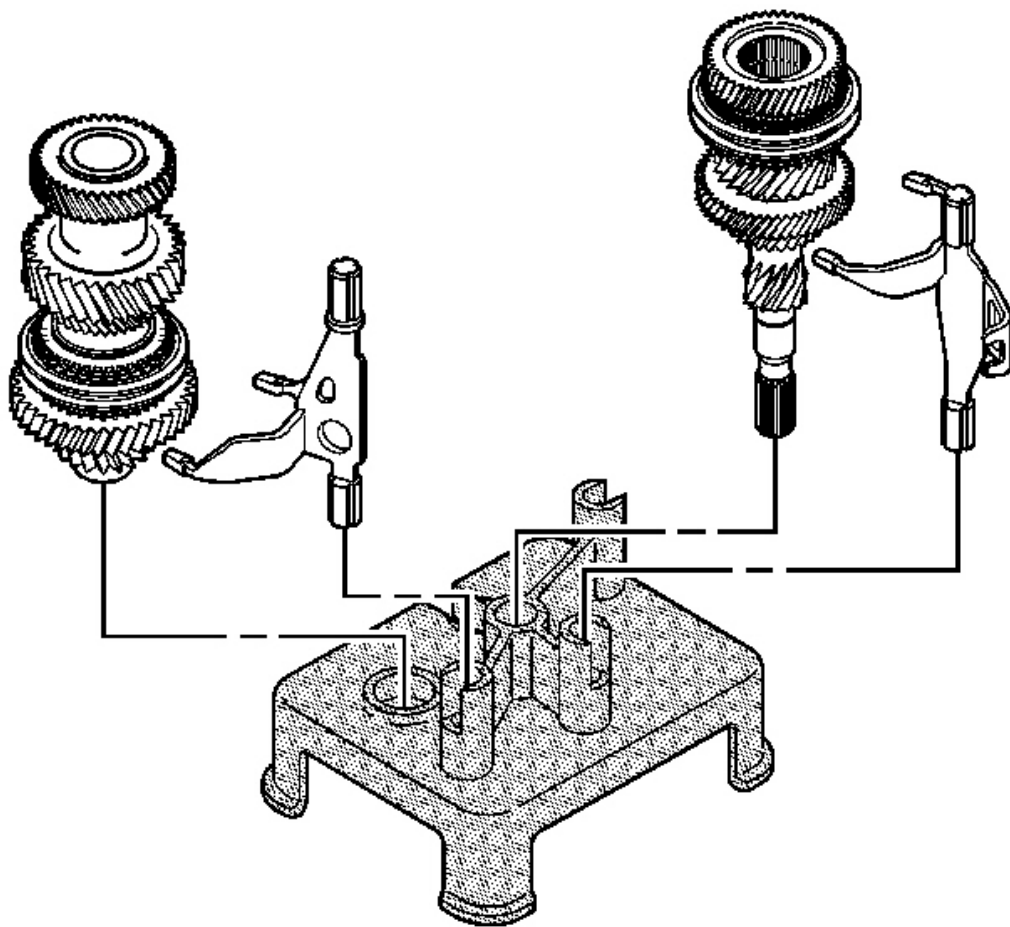


Fig. 238: Shift Forks & Gear Assemblies
Courtesy of GENERAL MOTORS CORP.

17. Install the shift forks and the input shaft and output shaft onto the **J 44375** . See **Special Tools and Equipment** .

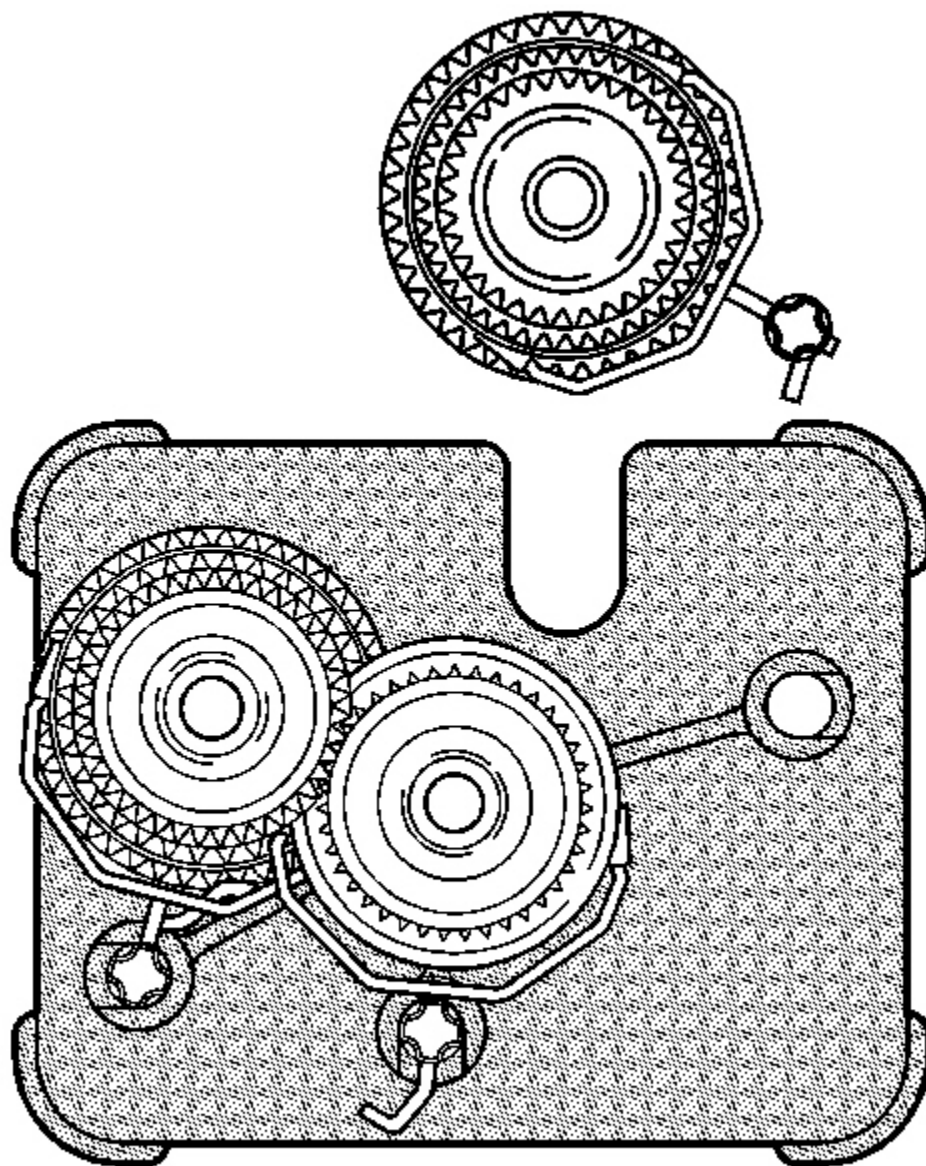


Fig. 239: Intermediate Shaft, Shift Fork & J 44375
Courtesy of GENERAL MOTORS CORP.

18. Install the countershaft and the shift fork onto the **J 44375** . See **Special Tools and Equipment** .
19. Rotate the shaft to verify all gears are properly meshing.

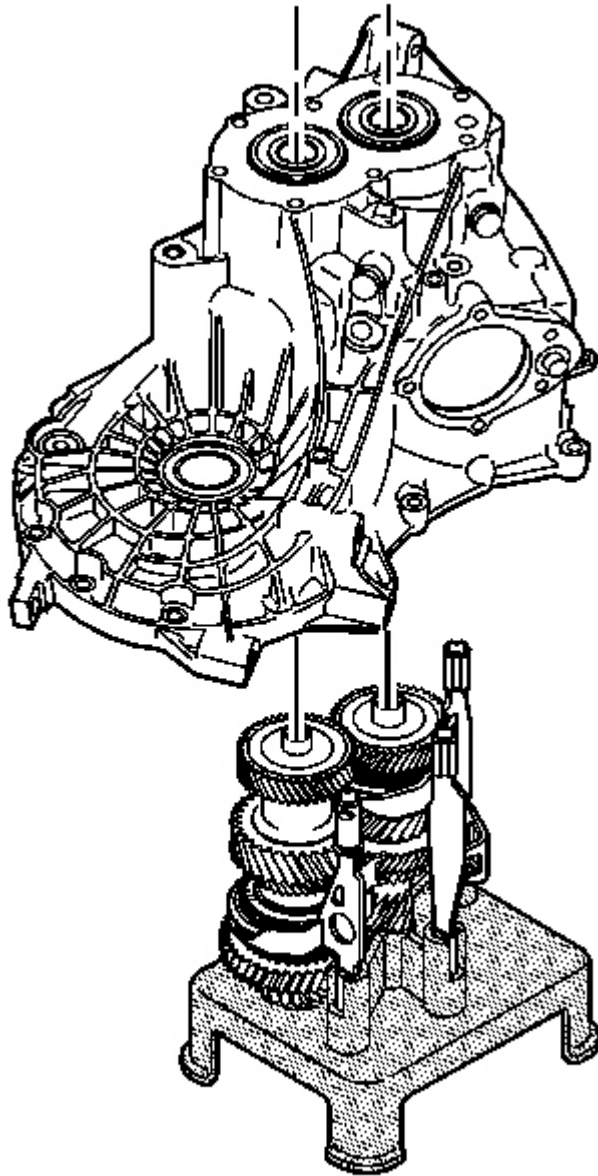


Fig. 240: Housing, Shift Forks, Shafts & J 44375
Courtesy of GENERAL MOTORS CORP.

20. Install the housing onto the shift forks and the shafts on to the **J 44375** . See **Special Tools and Equipment** . Line up the shift forks and the shafts with the housing.

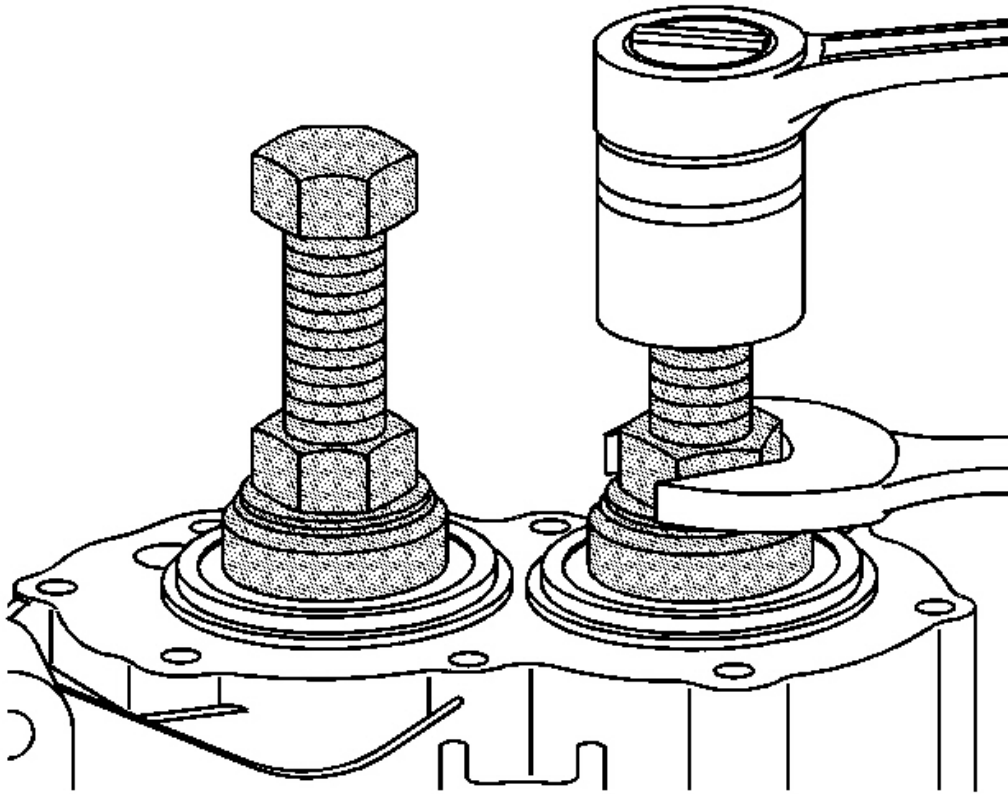


Fig. 241: Transaxle Case, Shafts & J 44376
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Install the transaxle case to the shafts evenly using the J 44376 . See Special Tools and Equipment .

21. Install the transaxle case to the shafts using the J 44376 . See Special Tools and Equipment .

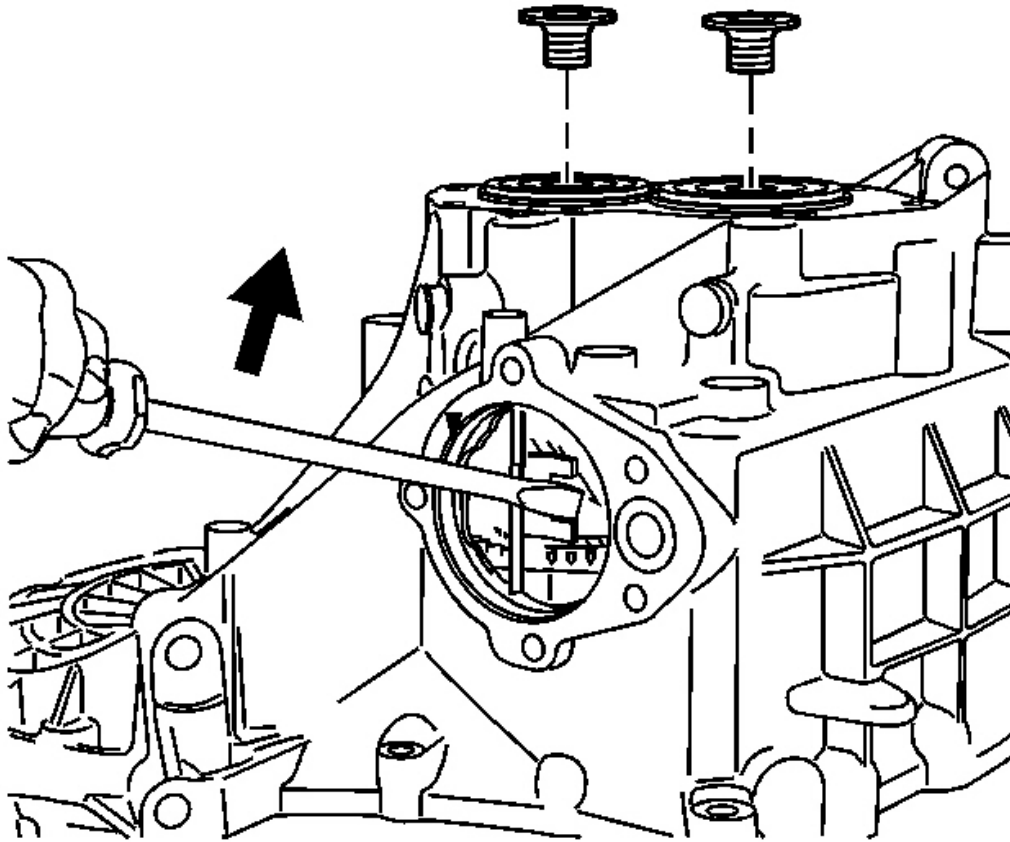


Fig. 242: Shaft Bolts & Transmission
Courtesy of GENERAL MOTORS CORP.

22. Shift the transmission into 4th and 5th gear using a screwdriver in an upward direction.
23. Apply P/N 21005994 to the input and output shaft bolts.
24. Install NEW input and output shaft bolts while holding the transmission into 4th and 5th gear in an upward direction.

Tighten: Tighten the shaft bolts to 95 N.m (68 lb ft).

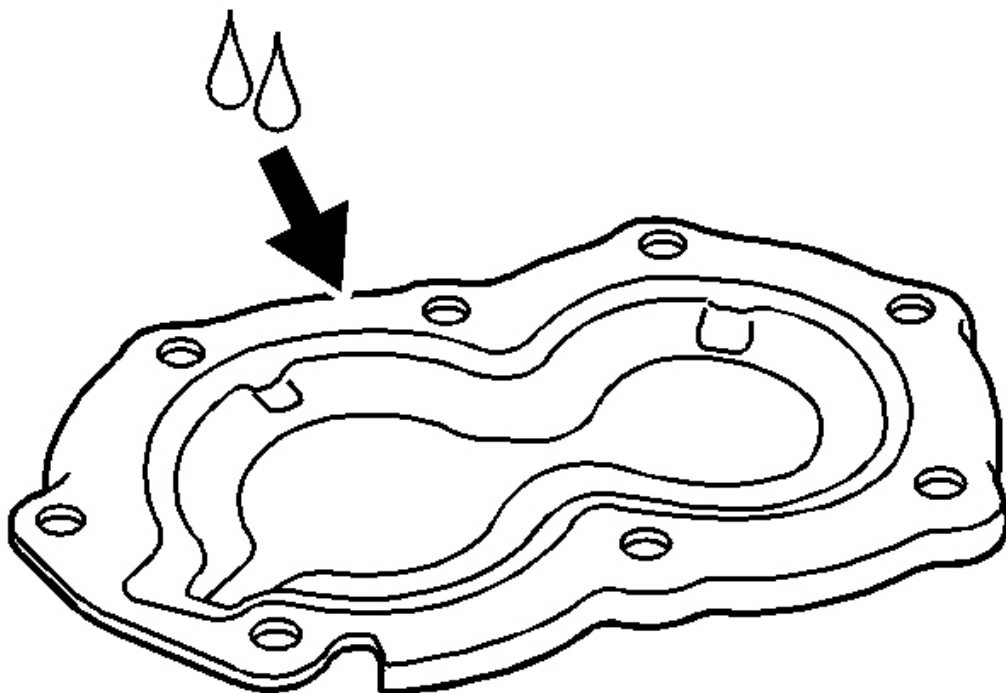


Fig. 243: Installing Sealant To Rear Cover
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If shimming is required, refer to Shimming Procedures before installing the cover.

25. Install sealant P/N 21019581 to the rear cover.

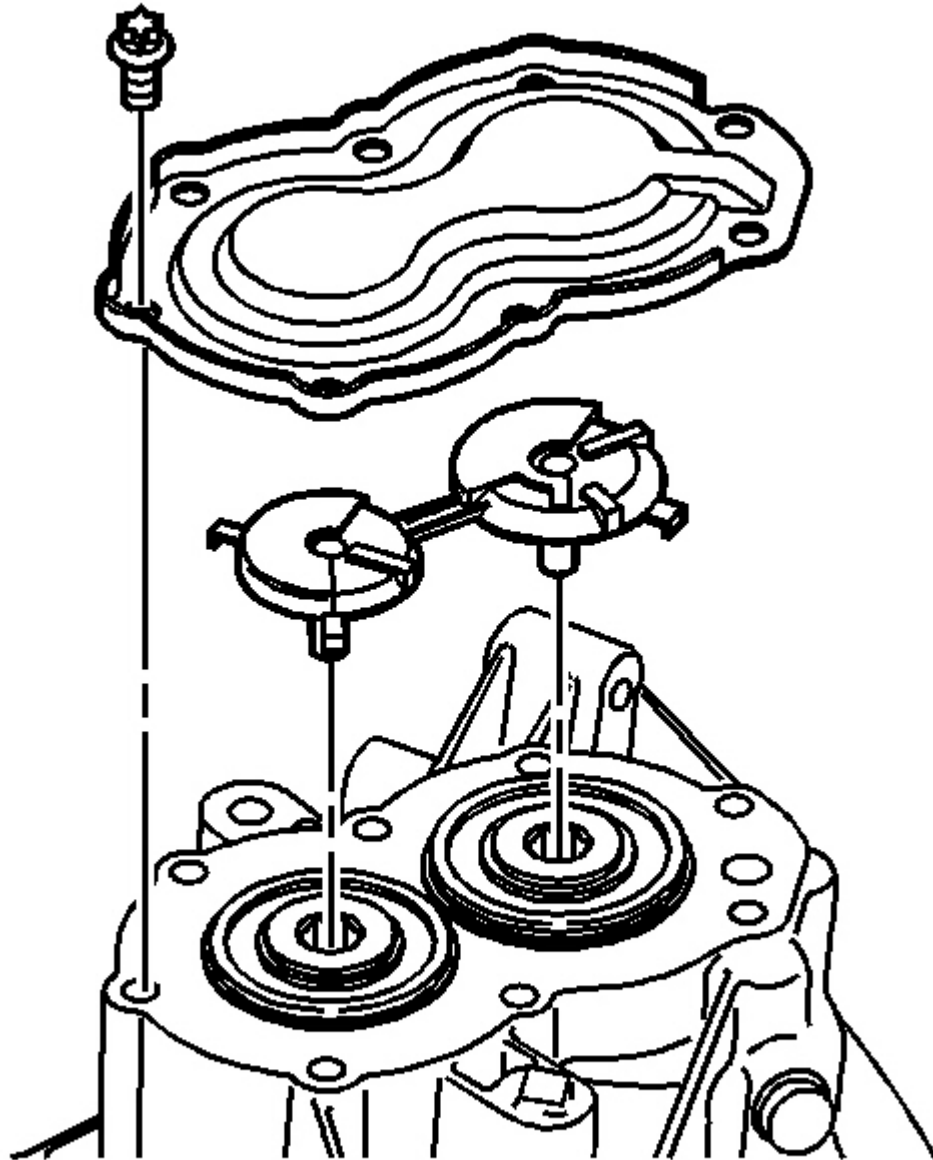


Fig. 244: Rear Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The oil guide only installs in one direction. Ensure the oil guide is completely seated in the gear shafts.

26. Install the oil guide.
27. Install the rear cover.
28. Install the rear cover bolt.

Tighten: Tighten the rear cover bolt to 23 N.m (17 lb ft).

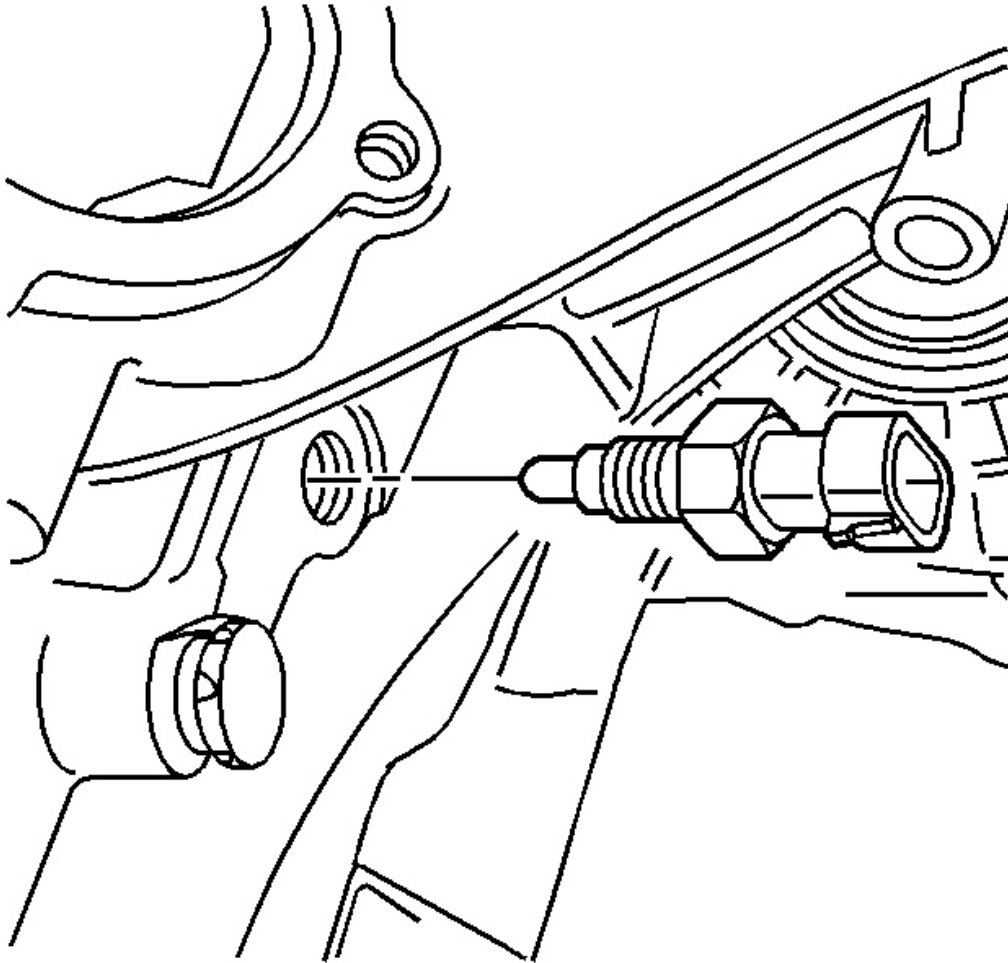


Fig. 245: Backup Lamp Switch
Courtesy of GENERAL MOTORS CORP.

29. Apply sealant P/N 21019581 to the backup lamp switch.
30. Install the backup lamp switch into the transaxle case.

Tighten: Tighten the backup lamp switch to 18 N.m (13 lb ft).

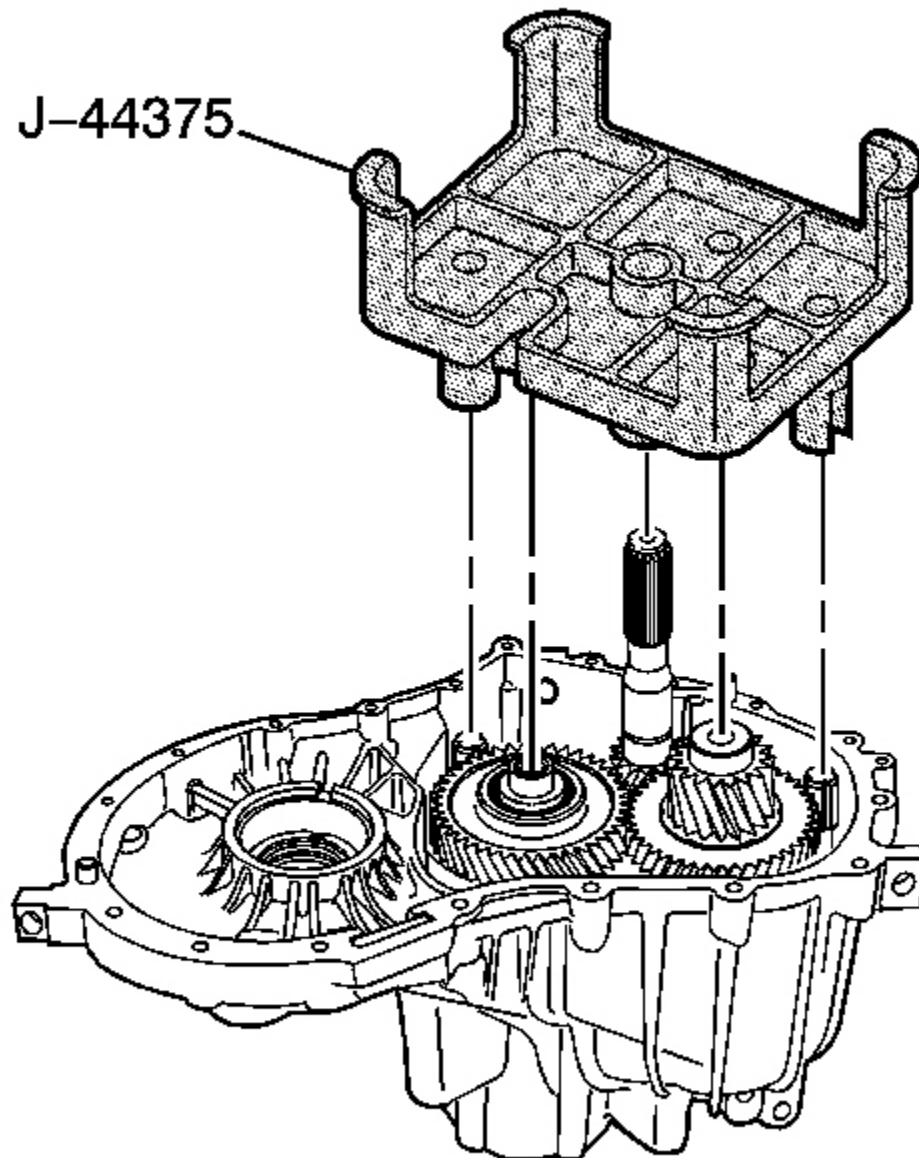


Fig. 246: Gear Shafts, Shift Forks & J 44375
Courtesy of GENERAL MOTORS CORP.

31. Turn the transaxle case and the **J 44375** over on the table. See **Special Tools and Equipment** .

32. Remove the **J 44375** from the gear shafts and the shift forks. See **Special Tools and Equipment** .

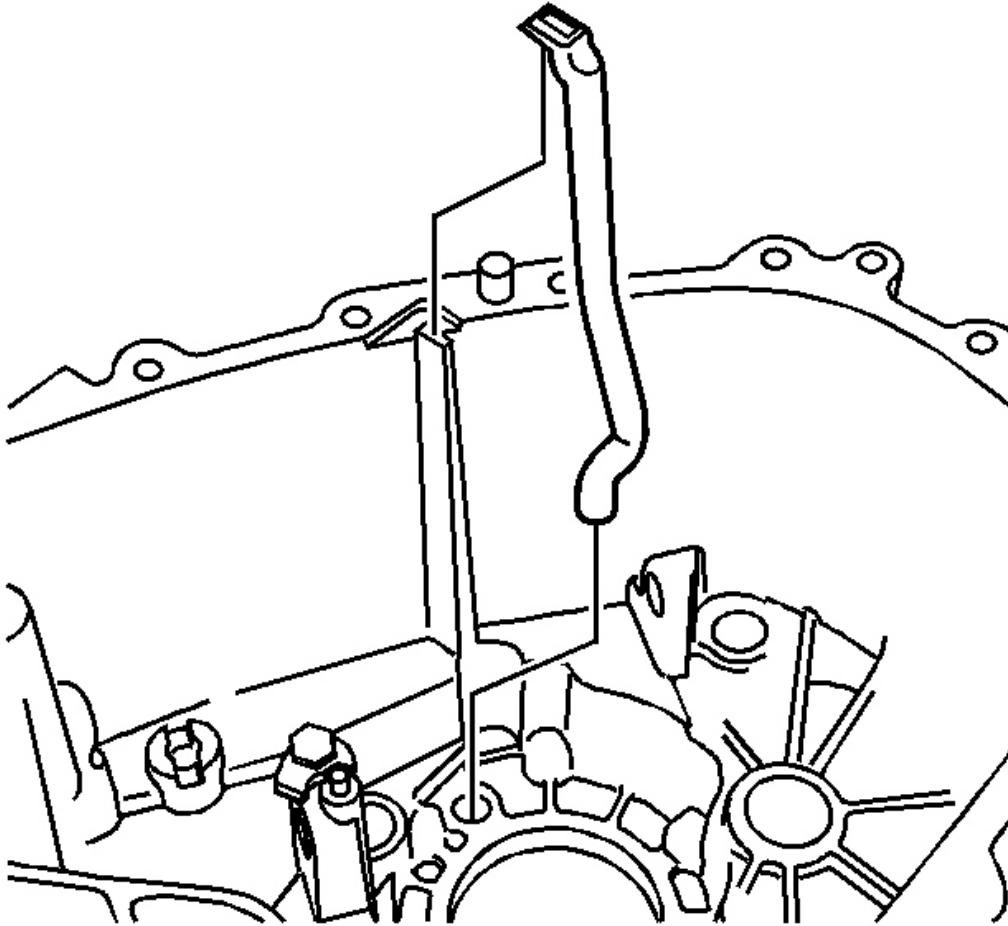


Fig. 247: Oil Tube & Transaxle Case
Courtesy of GENERAL MOTORS CORP.

33. Install the oil tube into the transaxle case.

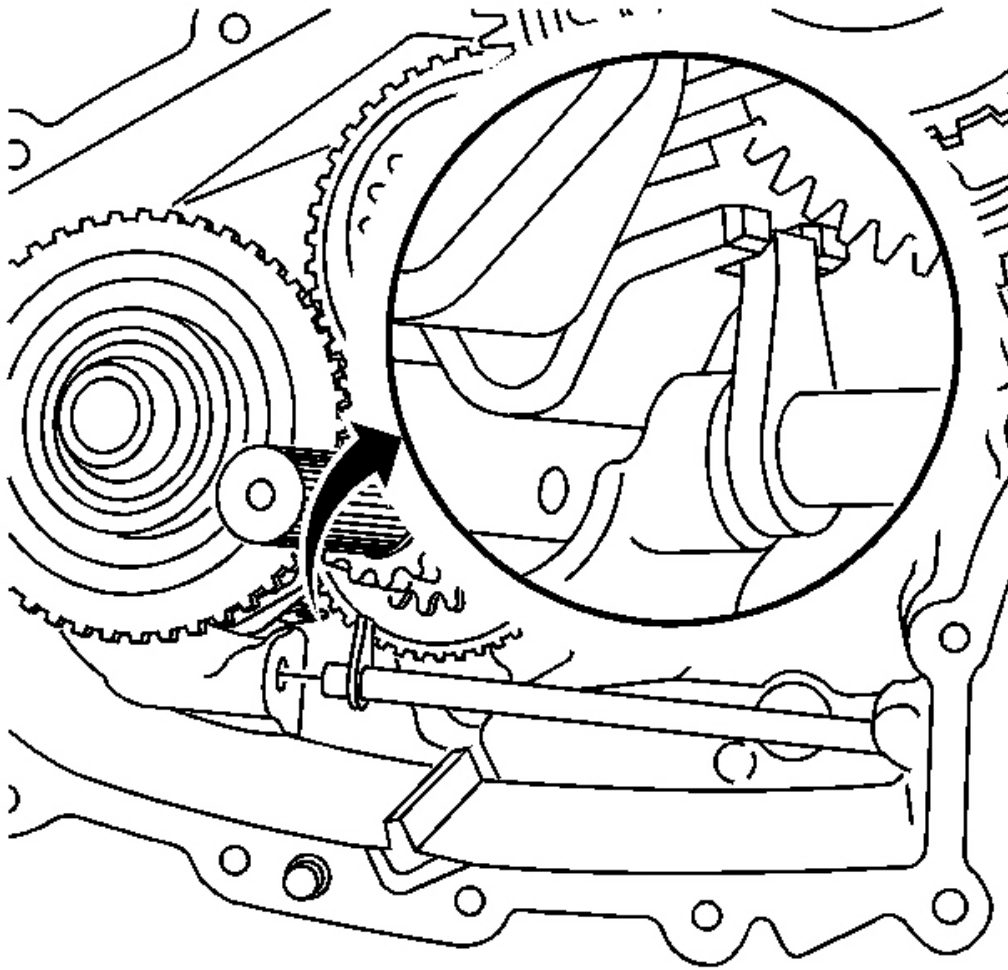


Fig. 248: Shift Rod & Shift Fork
Courtesy of GENERAL MOTORS CORP.

34. Install the shift rod to the shift fork.

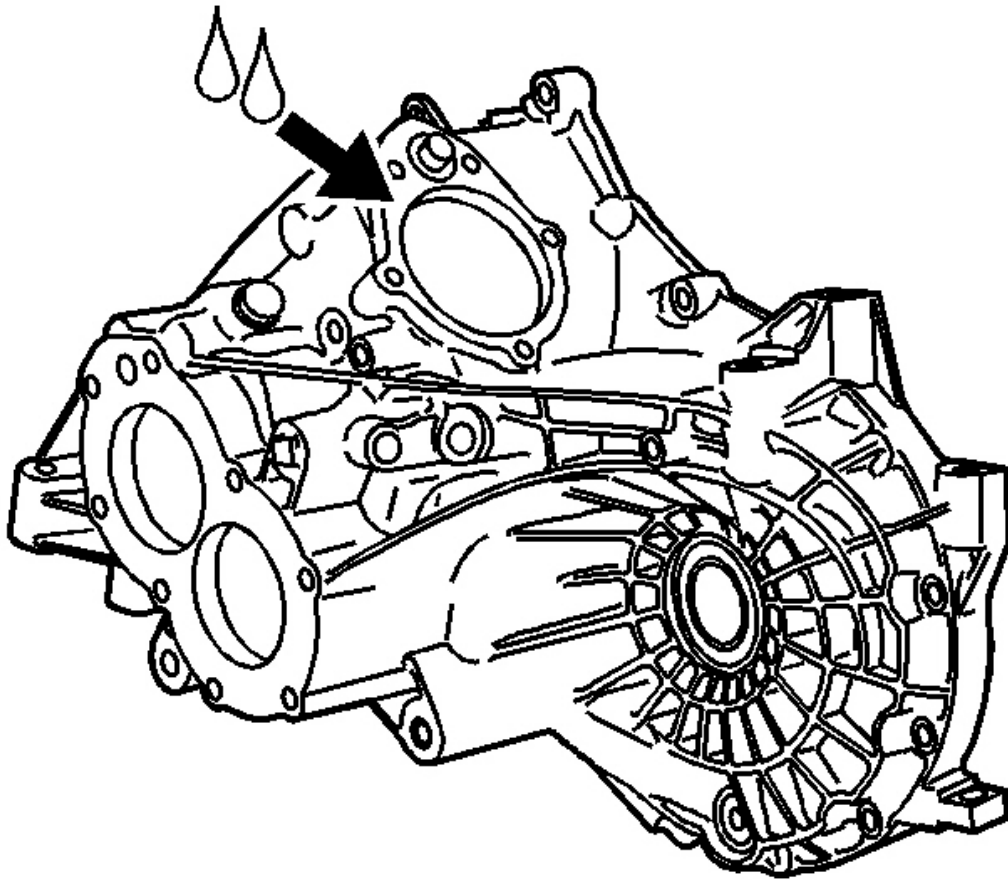


Fig. 249: Transaxle Case & Shifter Cover Mating Surface
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use only the approved sealer for the transaxle case to shifter cover mating surface.

35. Apply sealer P/N 12378516 to the transaxle case to shifter cover mating surface.

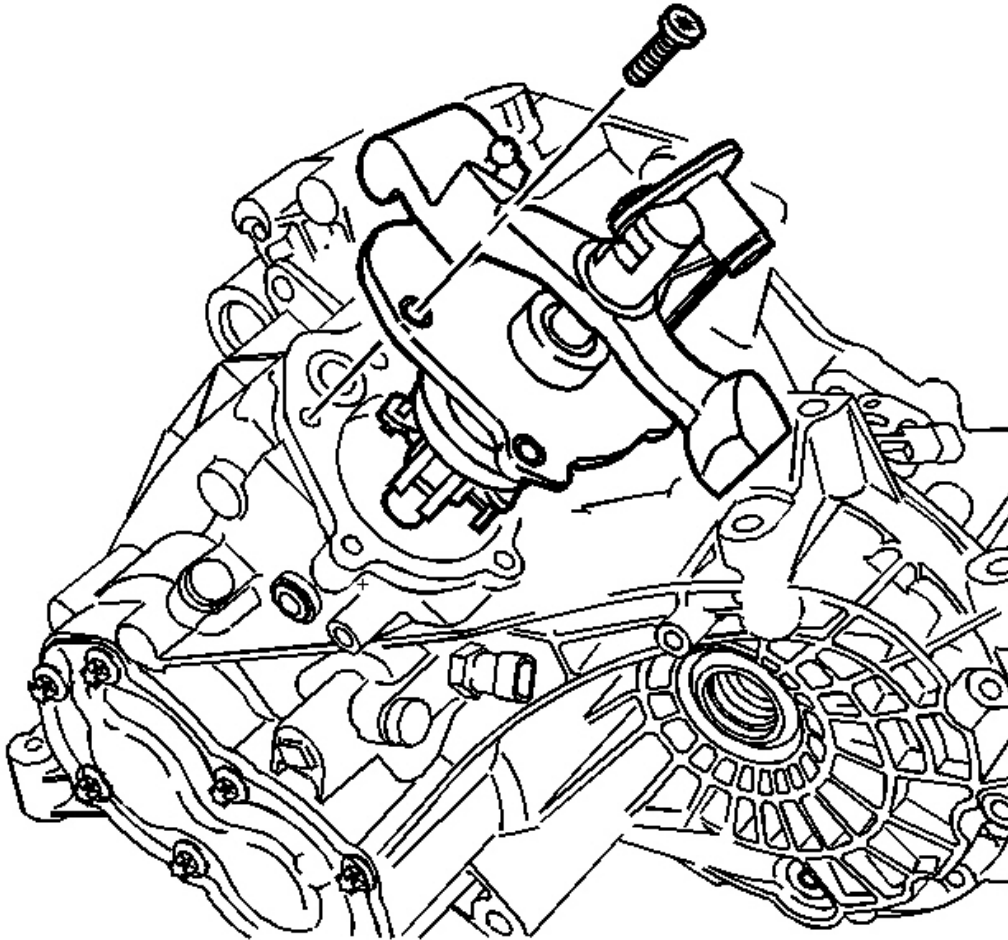


Fig. 250: Shifter Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

36. Install the shifter and the shifter retaining bolts.

Tighten: Tighten the shifter retaining bolts to 25 N.m (18 lb ft).

Install all possible shifter bolts with the shifter in the neutral position. Install the last shifter bolt in gear and then shift the transmission back into neutral.

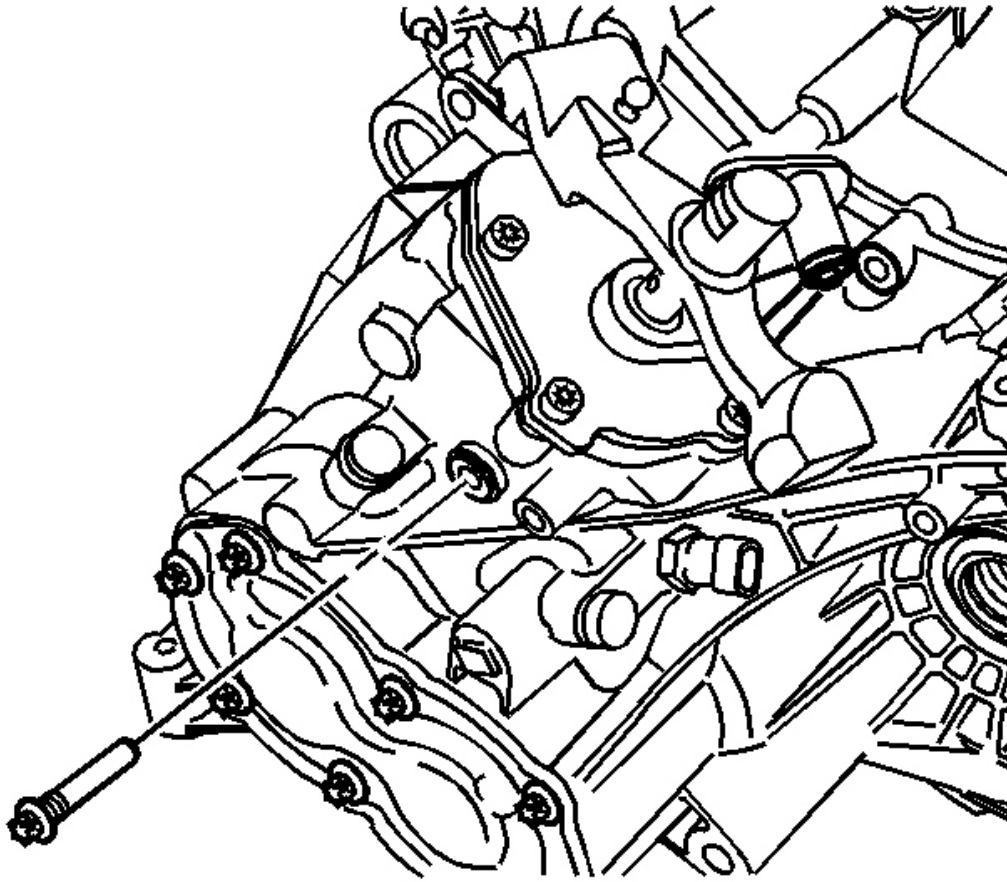


Fig. 251: Shifter Guide Bolt
Courtesy of GENERAL MOTORS CORP.

37. Shift the transmission into neutral.
38. Apply P/N 21485278 to the shifter guide bolt.

NOTE: Hand start and tighten the shifter guide bolt to avoid damaging the shift lever.

39. Install the shifter guide bolt.

Tighten: Tighten the shifter guide bolt to 25 N.m (18 lb ft).

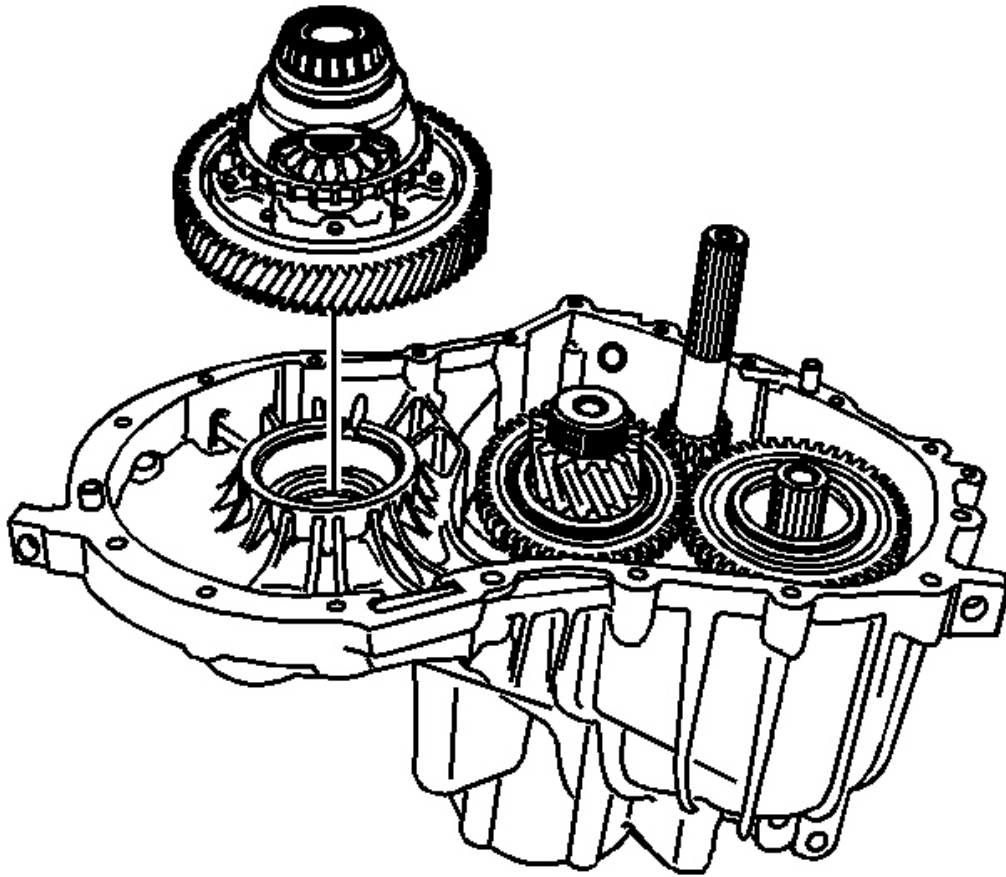


Fig. 252: Differential & Transaxle Case
Courtesy of GENERAL MOTORS CORP.

40. Install the differential into the transaxle case.

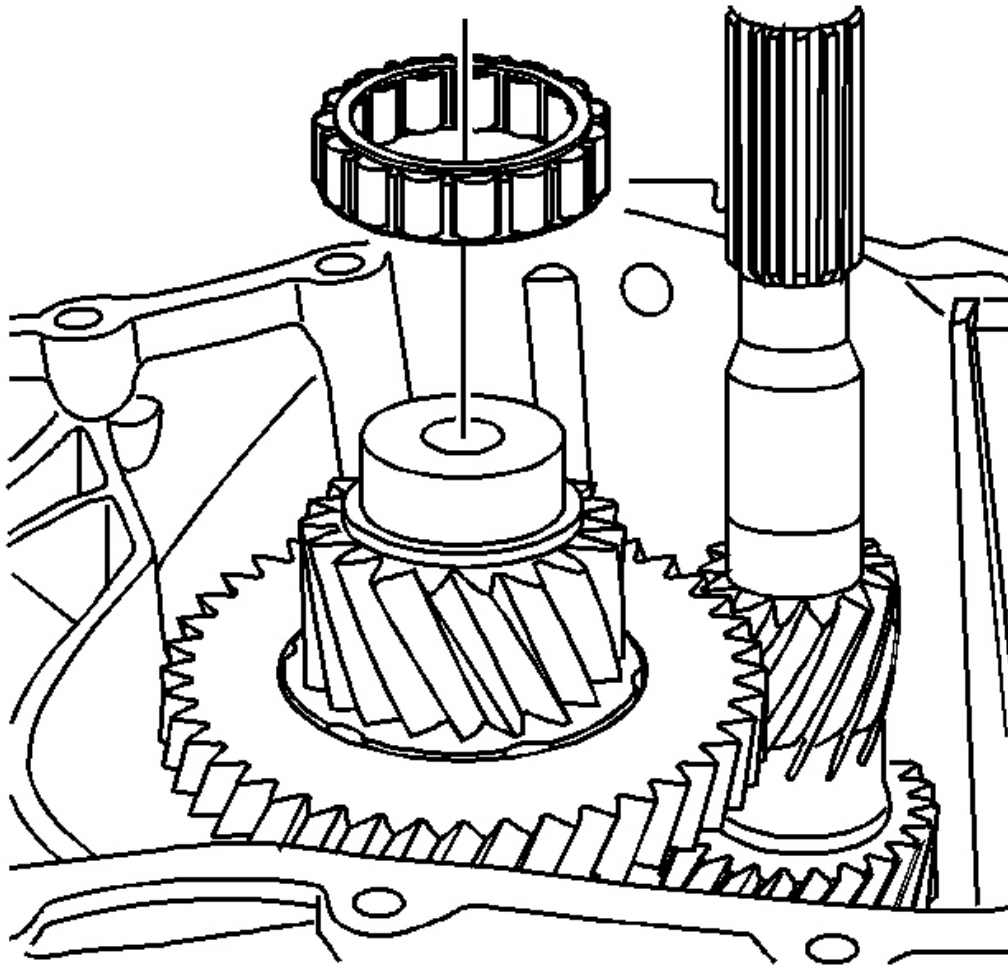


Fig. 253: Roller Bearing & Output Shaft
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The step in the roller bearing faces opposite of the pinion gear.

41. Install the roller bearing onto the output shaft.

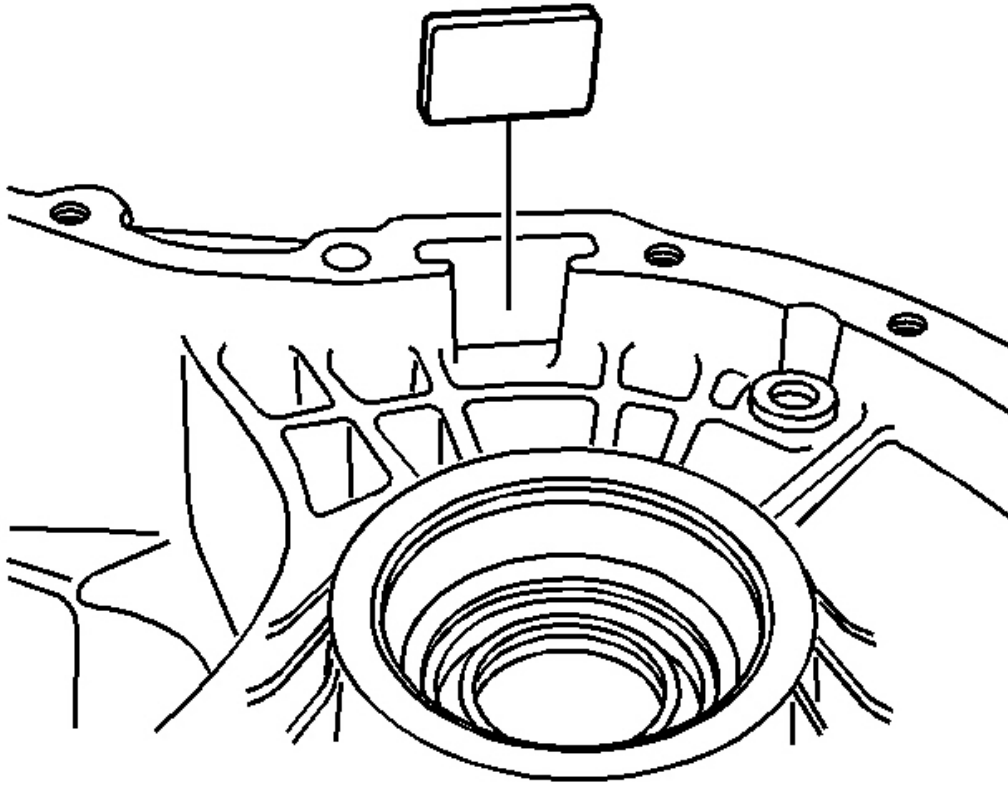


Fig. 254: Magnet & Transaxle Case
Courtesy of GENERAL MOTORS CORP.

42. Install the magnet into the transaxle case.

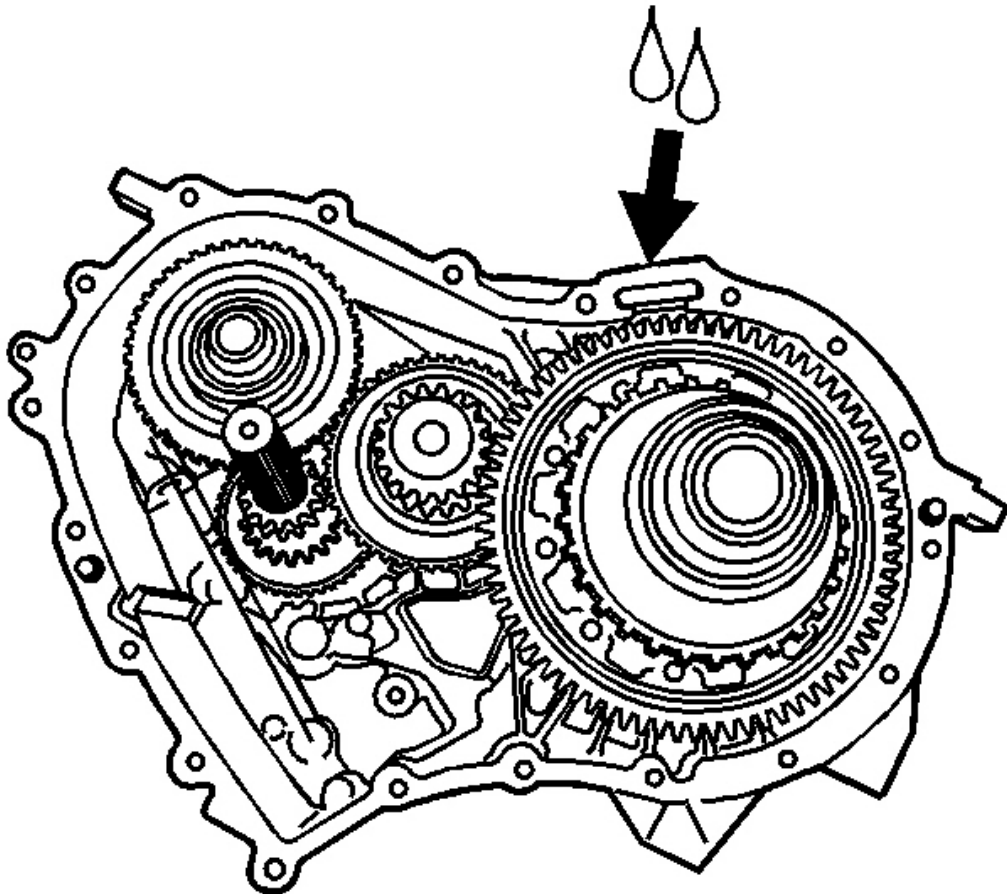


Fig. 255: Applying Sealant To Transaxle Case & Clutch Housing Mating Surface
Courtesy of GENERAL MOTORS CORP.

43. Apply sealant P/N 12378516 to the transaxle case to clutch housing mating surface.

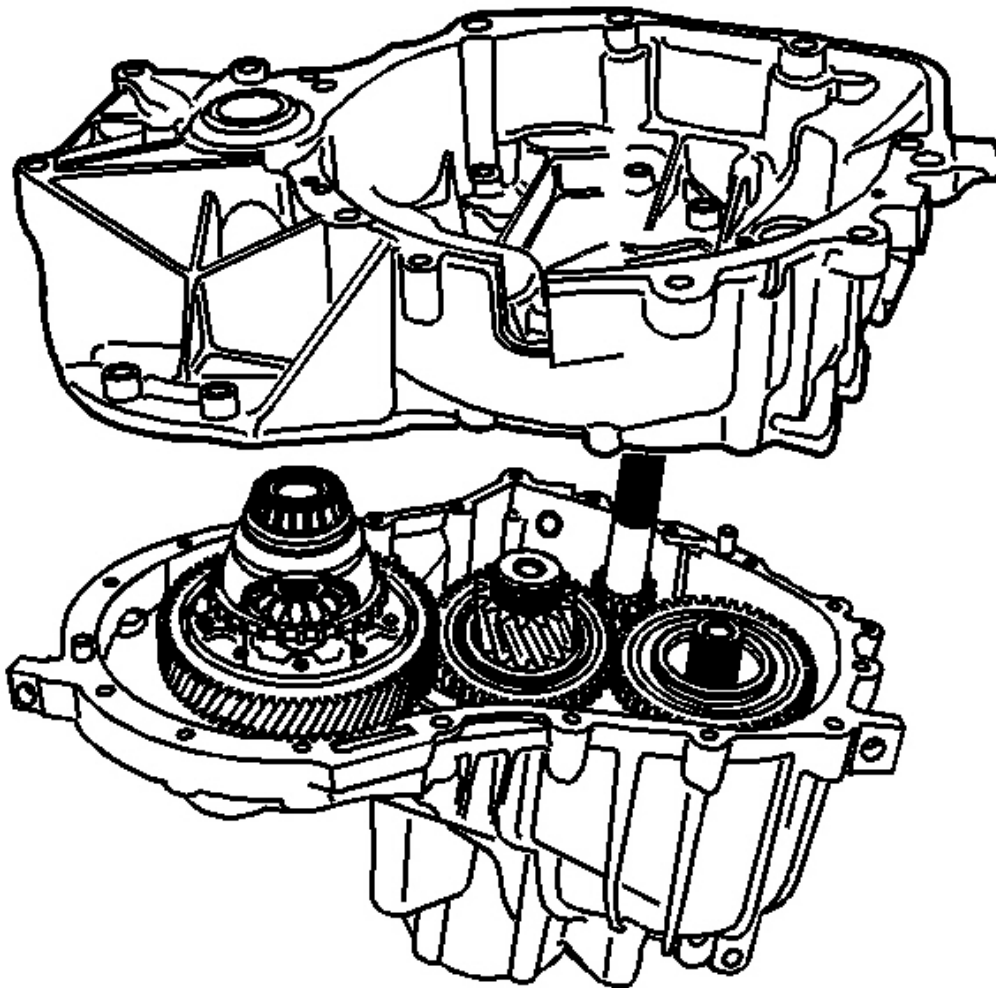


Fig. 256: Clutch Housing & Transaxle Case
Courtesy of GENERAL MOTORS CORP.

44. Install the clutch housing to the transaxle case.

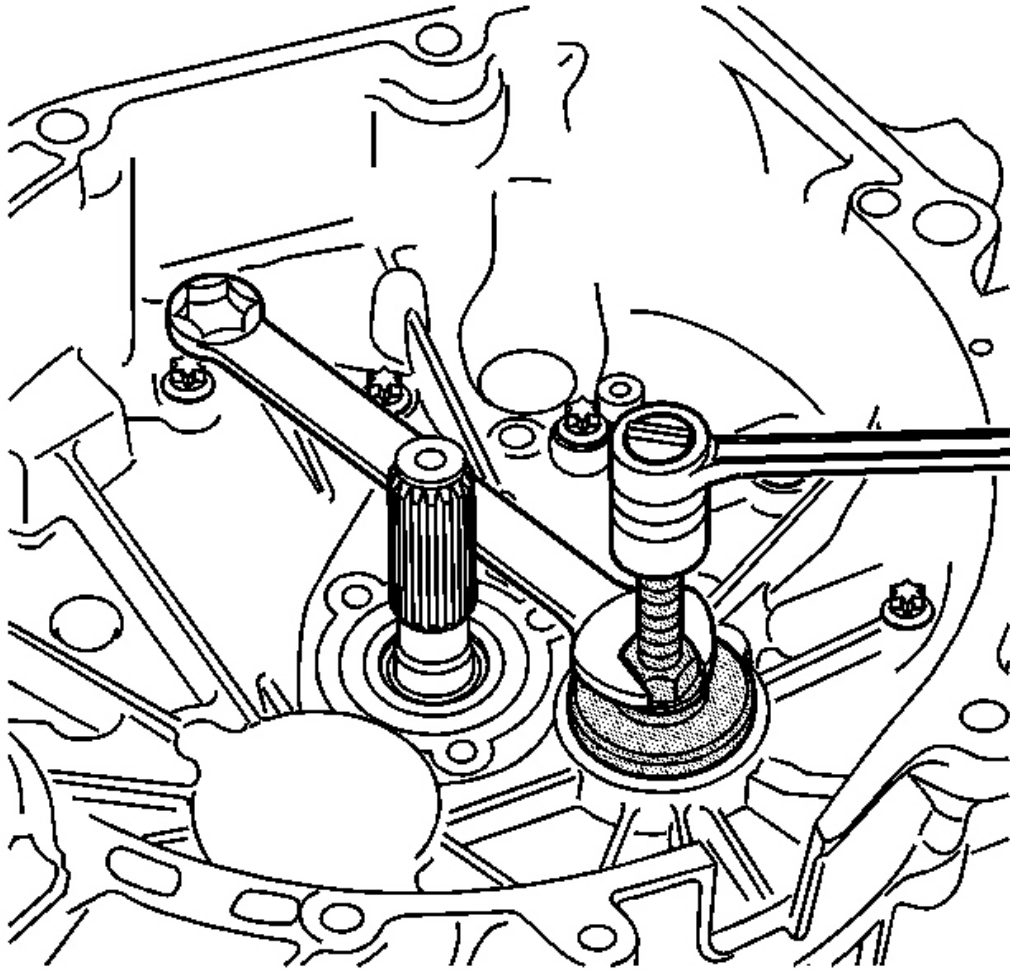


Fig. 257: Countershaft, Clutch Housing Bearing & J 44389
Courtesy of GENERAL MOTORS CORP.

45. Install the countershaft into the clutch housing bearing using the **J 44389** . See **Special Tools and Equipment** .

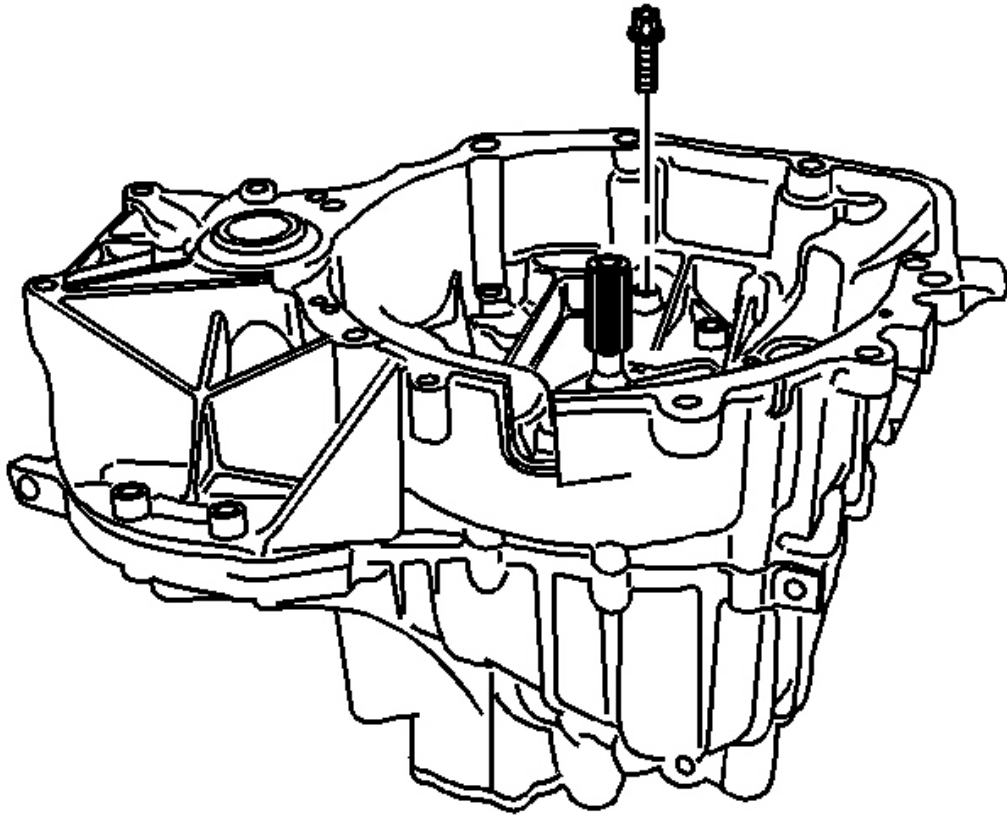


Fig. 258: Transmission Housing Bolts
Courtesy of GENERAL MOTORS CORP.

46. Install the clutch housing to transaxle case bolts.

Tighten: Tighten the housing bolts to 27 N.m (20 lb ft).

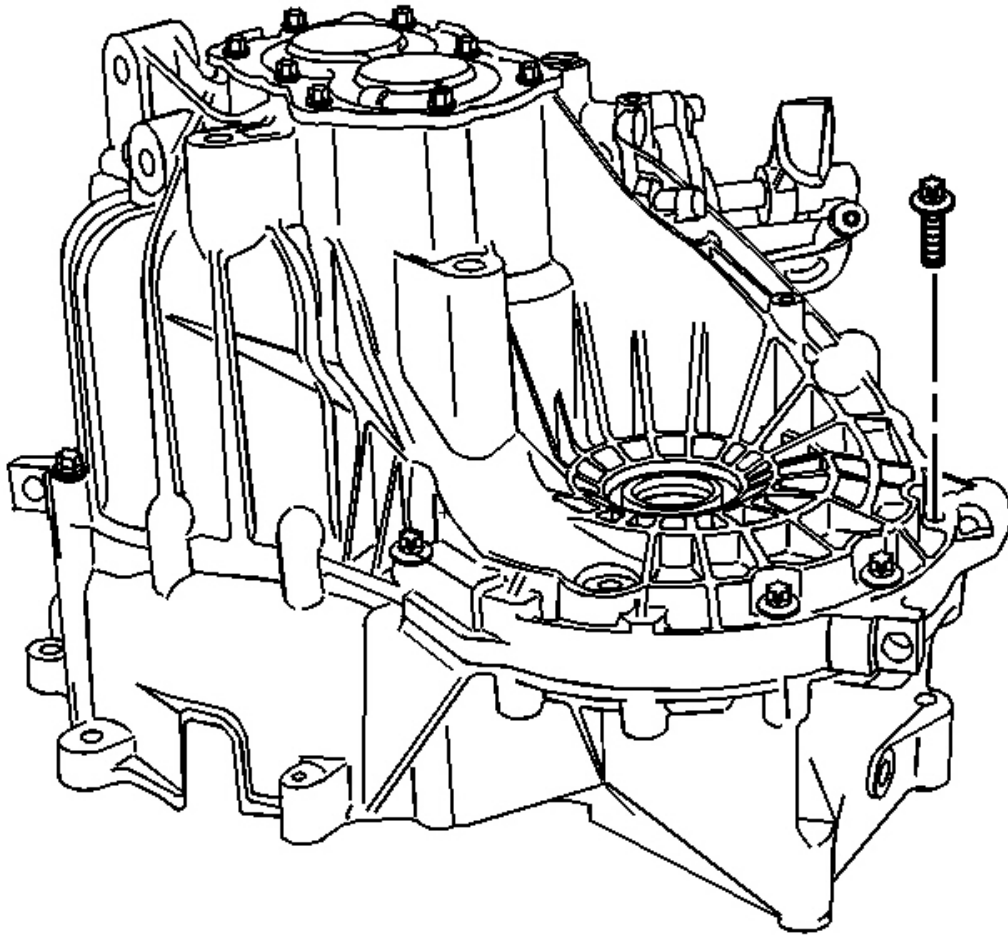


Fig. 259: Transaxle Case Side & Bolts
Courtesy of GENERAL MOTORS CORP.

47. Turn the transmission over.
48. Install the transaxle case to clutch housing bolts.

Tighten: Tighten the housing bolts to 27 N.m (20 lb ft).

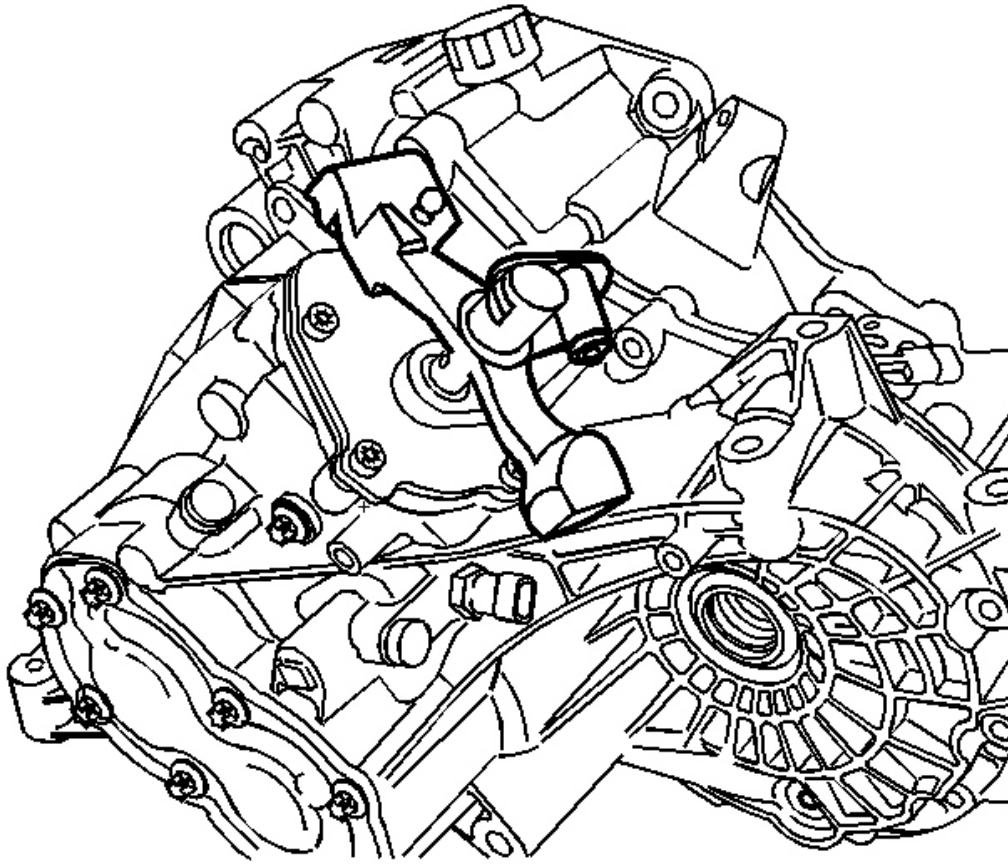


Fig. 260: Transmission
Courtesy of GENERAL MOTORS CORP.

49. Turn the transmission so the shifter is on top.
50. Shift the transmission into any gear.

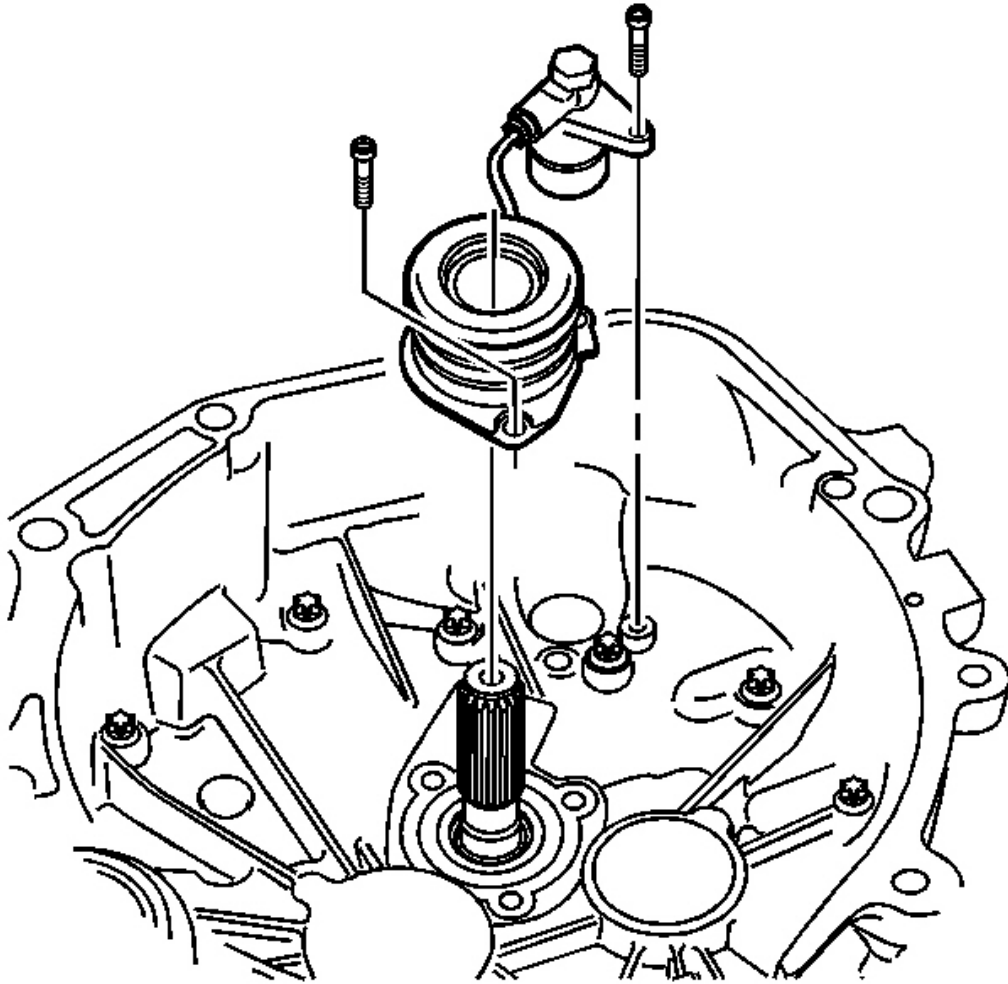


Fig. 261: Actuator & Tube Bolts
Courtesy of GENERAL MOTORS CORP.

51. Install the actuator and tube.
52. Install the actuator and tube bolts.

Tighten: Tighten the tube bolts to 10 N.m (89 lb in).

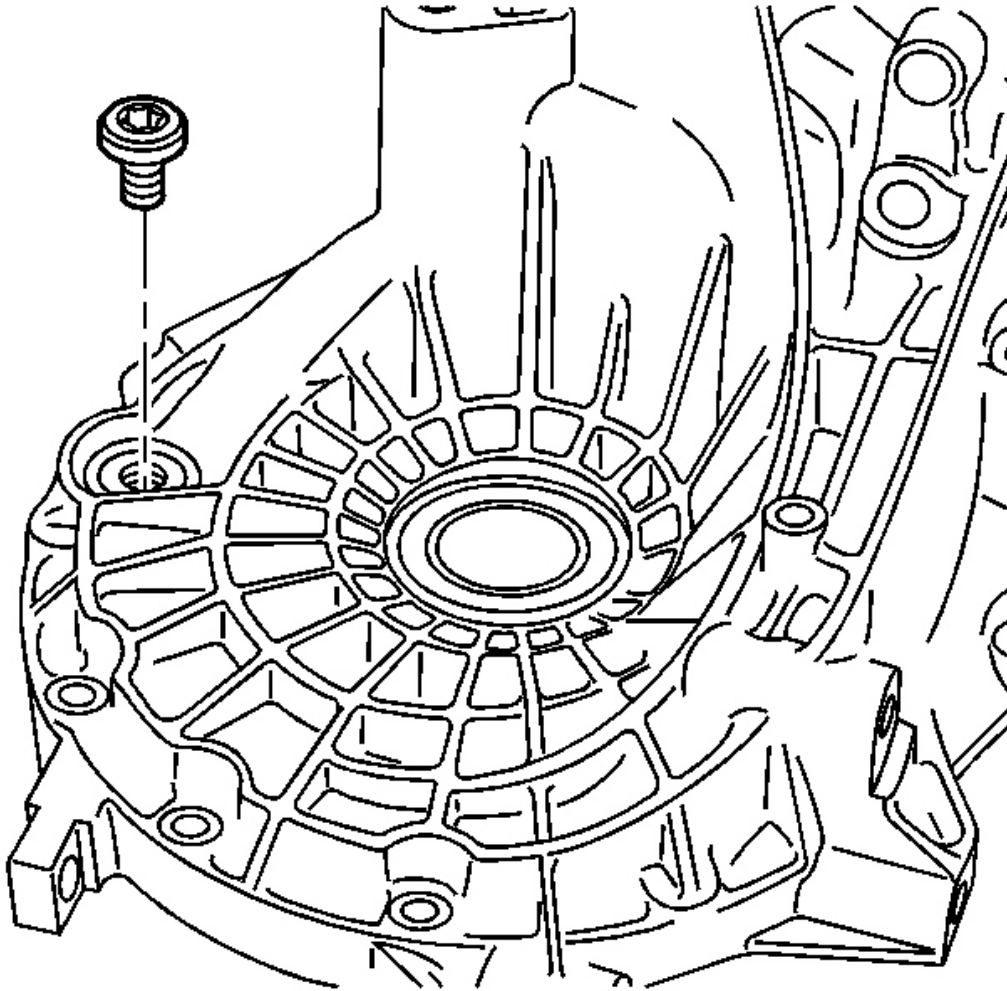


Fig. 262: Transmission Drain Plug
Courtesy of GENERAL MOTORS CORP.

53. Apply P/N 21485278 to the transmission drain plug.
54. Install the transmission drain plug.

Tighten: Tighten the transmission drain plug to 38 N.m (28 lb ft).

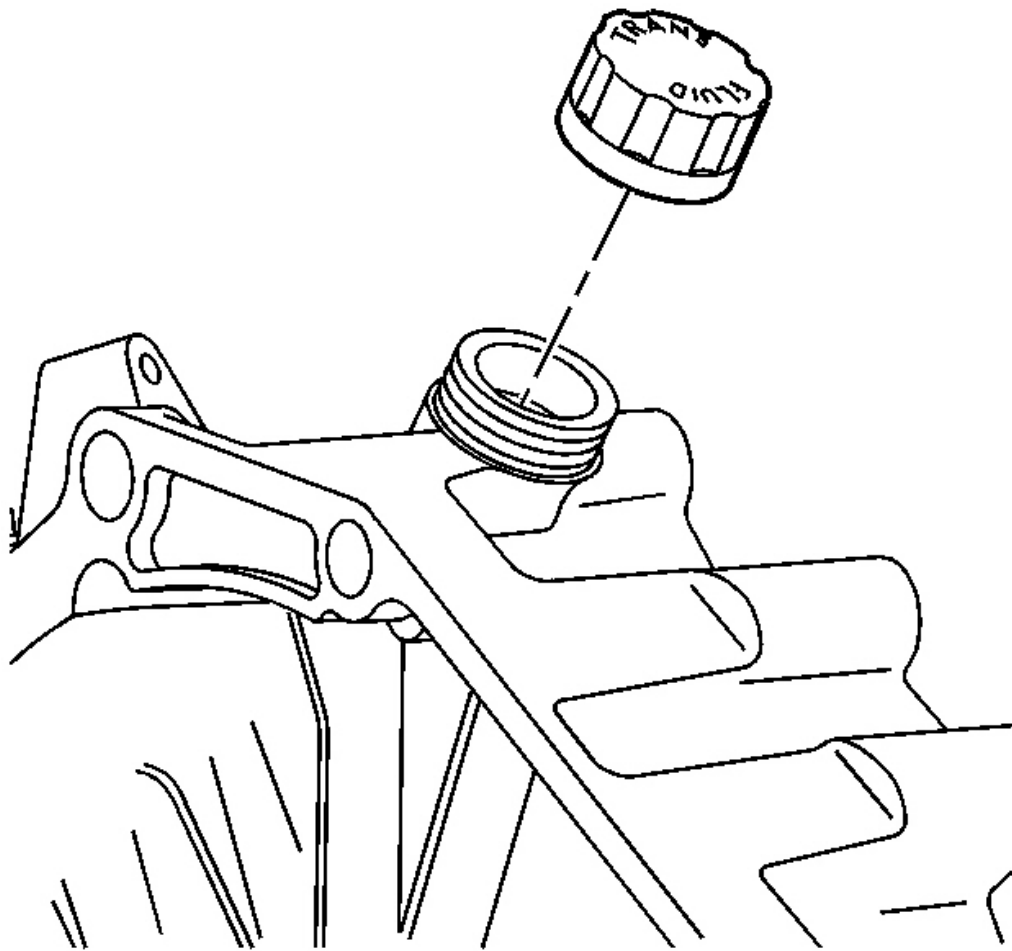


Fig. 263: Transmission Filler Cap
Courtesy of GENERAL MOTORS CORP.

55. Install the transmission fill cap.

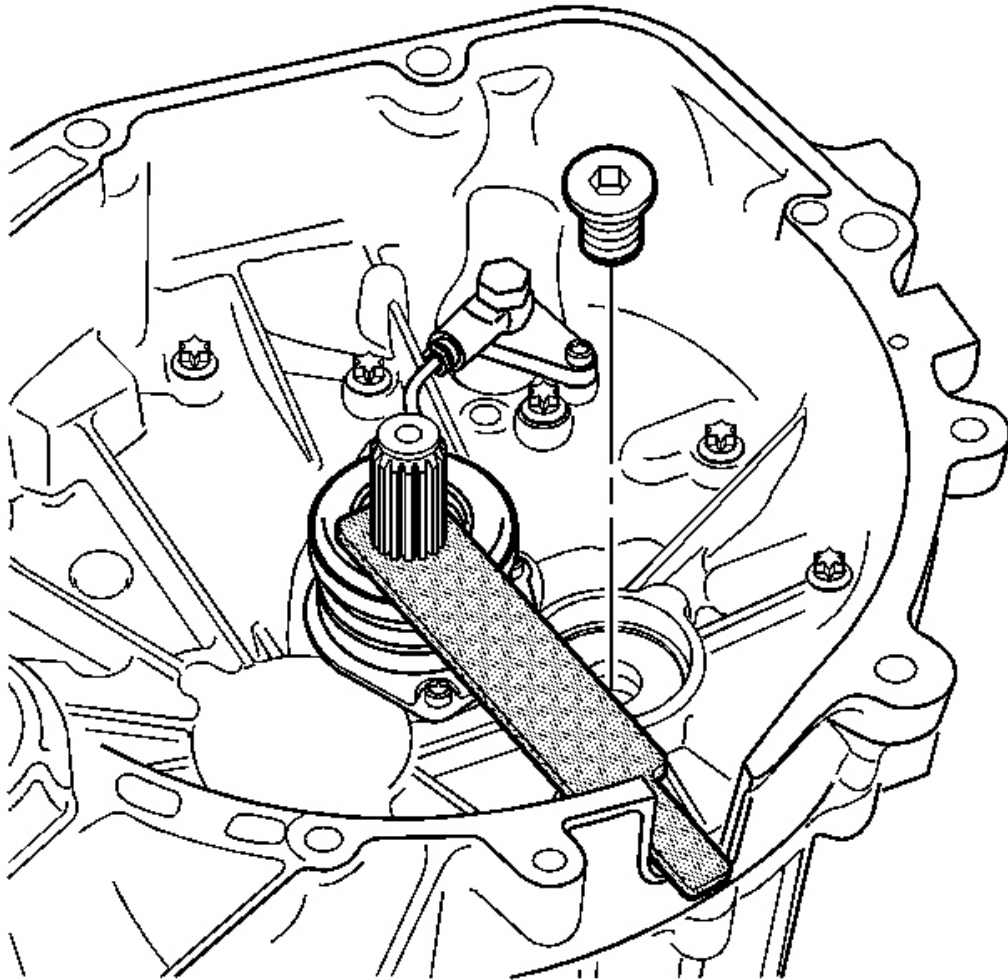


Fig. 264: Intermediate Shaft, Input Shaft, J 44377 & Bolt
Courtesy of GENERAL MOTORS CORP.

56. Hold the input shaft with the **J 44377** . See **Special Tools and Equipment** .
57. Apply P/N 21005994 to the intermediate shaft bolt.
58. Install the bolt in the intermediate shaft.

Tighten: Tighten the intermediate shaft bolts to 95 N.m (70 lb ft).

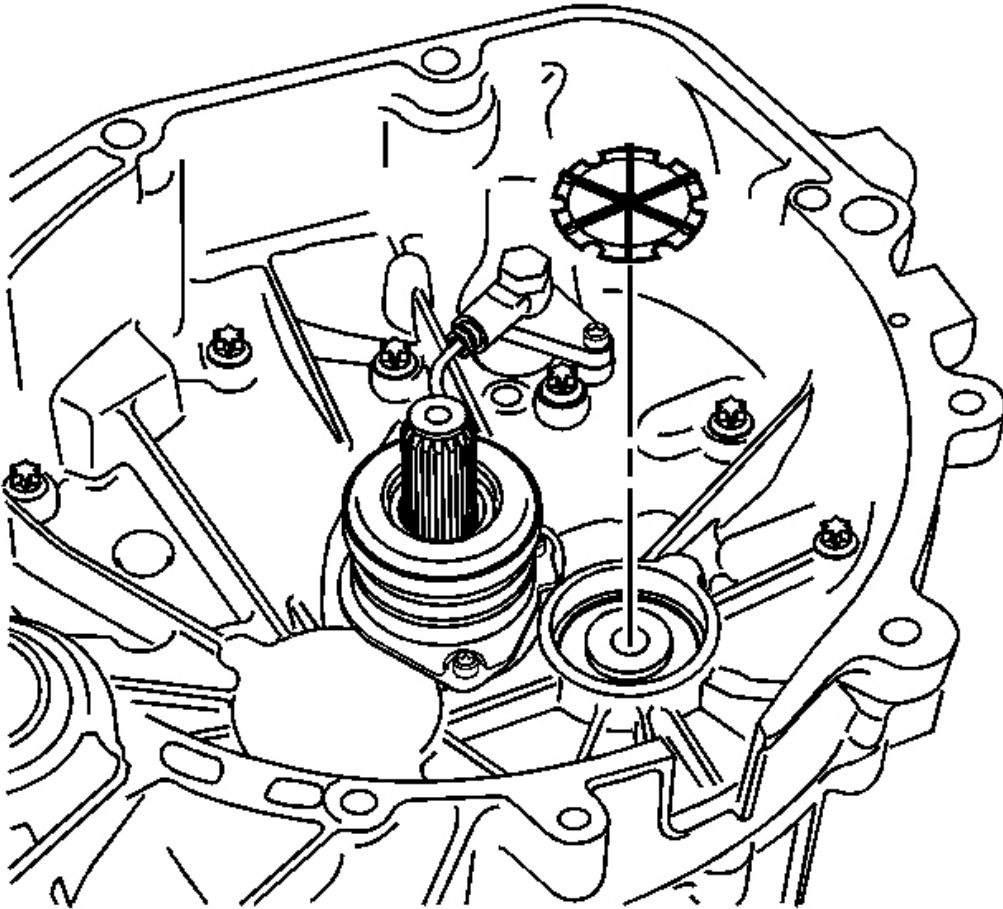


Fig. 265: Plastic Oil Guide & Intermediate Shaft
Courtesy of GENERAL MOTORS CORP.

59. Install a new plastic oil guide into the intermediate shaft.

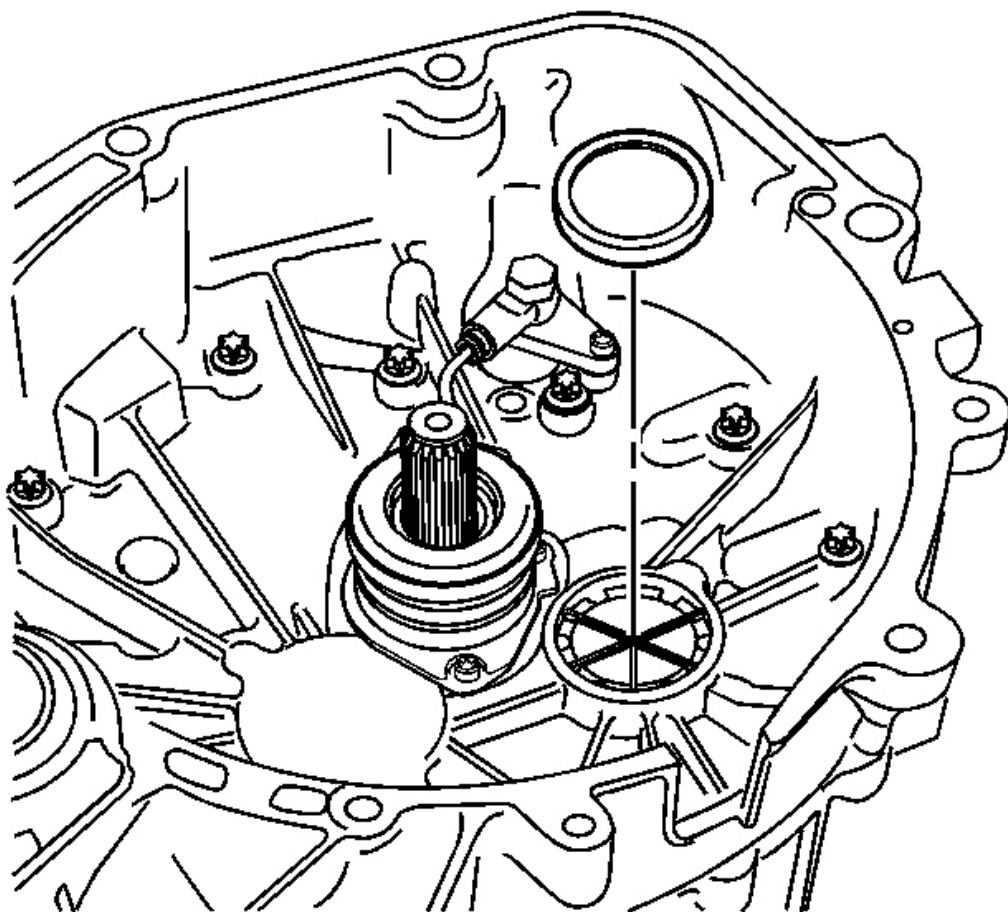


Fig. 266: Intermediate Shaft Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure not to press the sealing cap past the bottom of the chamfer.

60. Install a new intermediate shaft sealing cap.

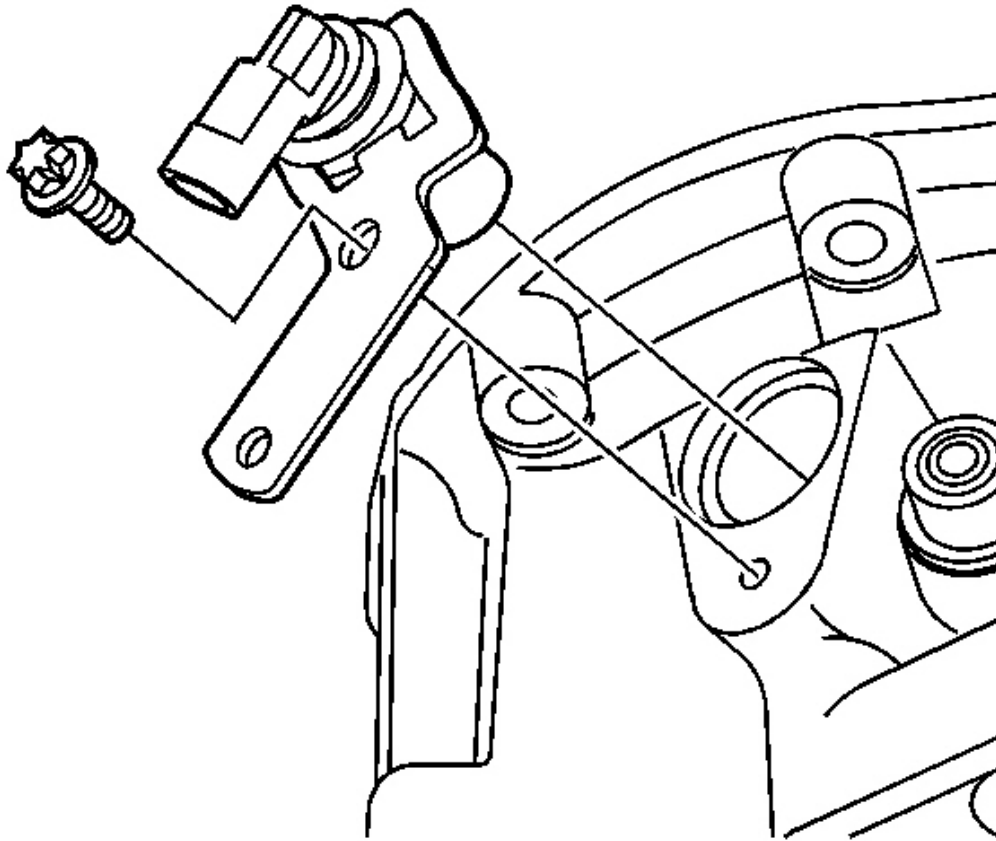


Fig. 267: Vehicle Speed Sensor & Bolt
Courtesy of GENERAL MOTORS CORP.

61. Apply P/N 21485277 to the vehicle speed sensor bolt.
62. Install the vehicle speed sensor, seal, and bolt.

Tighten: Tighten the bolt to 12 N.m (106 lb in).

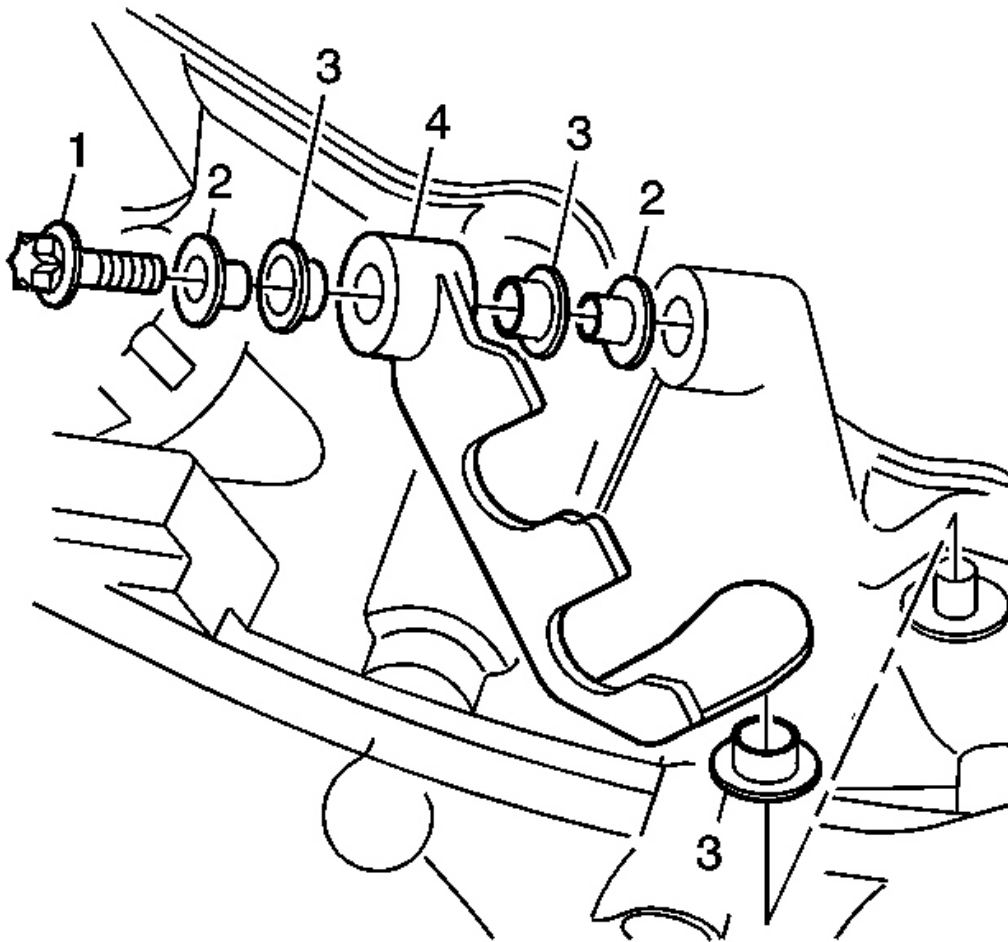


Fig. 268: Shift Cable Bracket, Spacers, Isolators & Bolt
Courtesy of GENERAL MOTORS CORP.

63. Install the shift cable bracket (4), the isolators (3), the spacers (2) and the bolt (1).

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

SHIMMING PROCEDURES

Tools Required

- **J 7079-2** Universal Driver Handle - Non-Threaded. See **Special Tools and Equipment** .
- **J 44385** Differential Bearing Race and Seal Installer. See **Special Tools and Equipment** .

- **J 44388** Final End Checking Fixture. See **Special Tools and Equipment** .

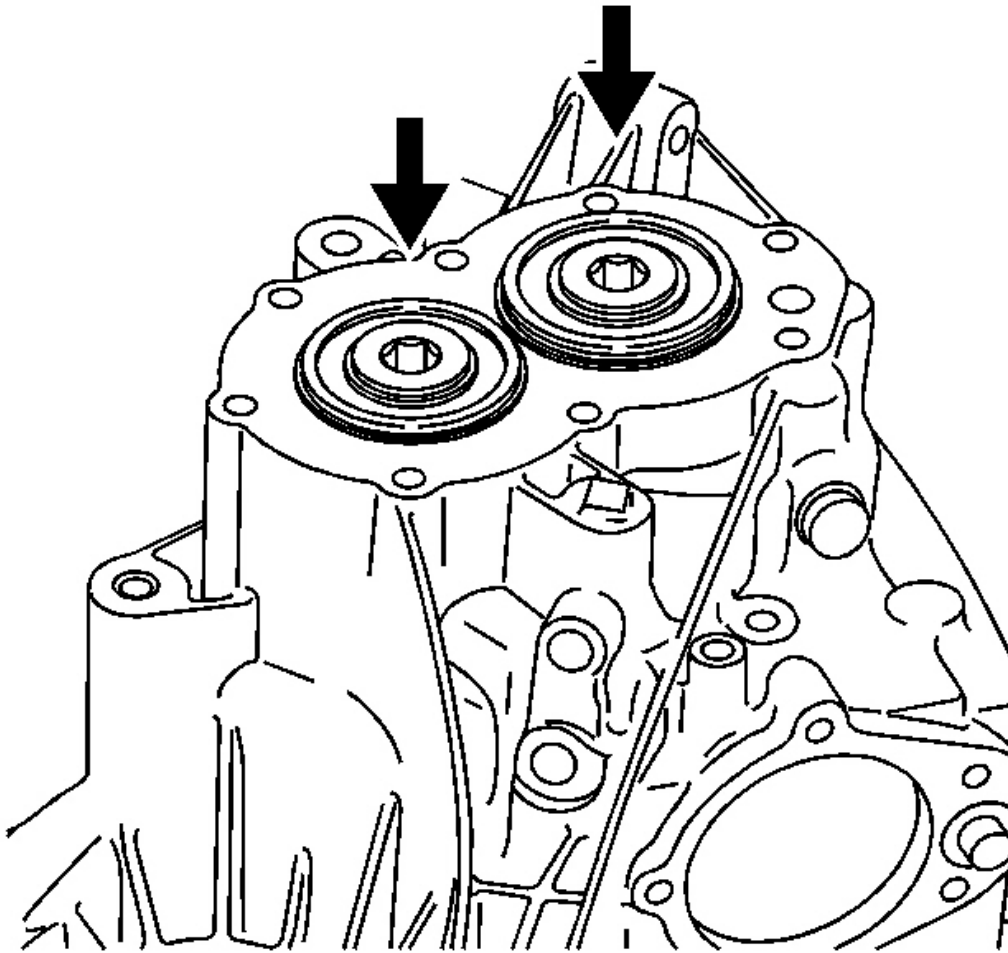


Fig. 269: Making Sure Bearings Are Fully Seated In Case
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Remove all of the old shims before performing the Shimming Procedures.

1. Make sure the bearings are fully seated in the case.

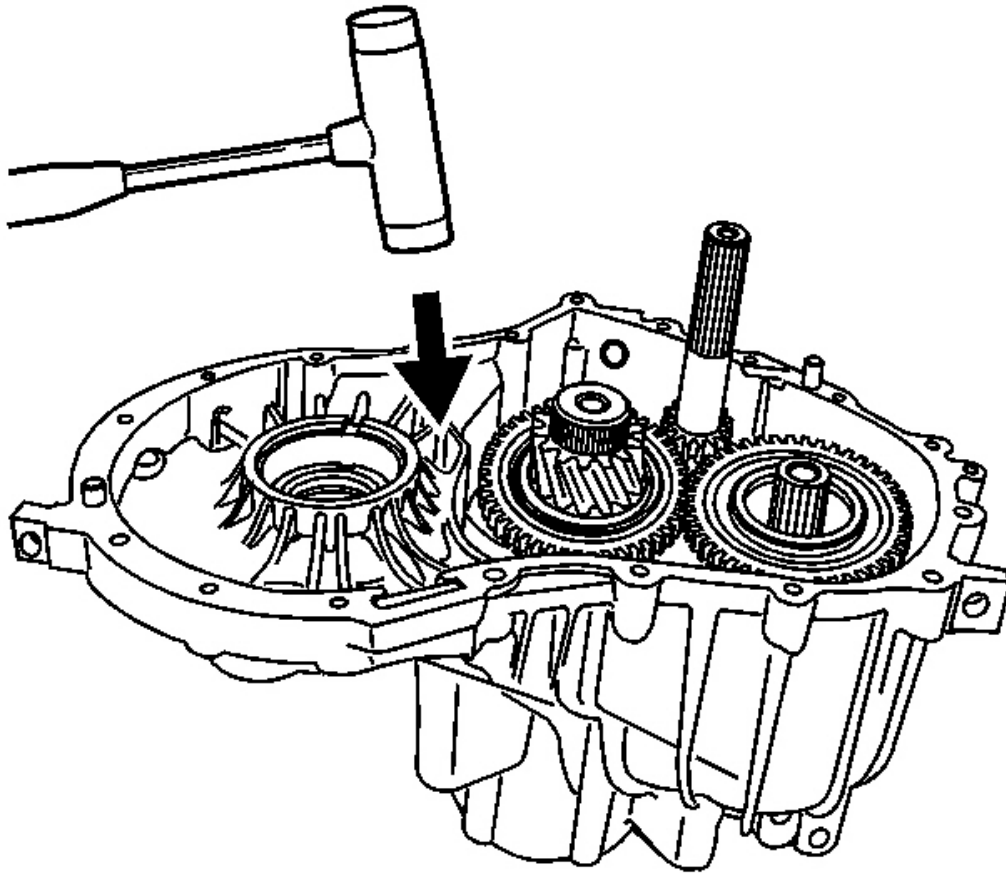


Fig. 270: Taping Lightly On Case Mating Surface Using A Rubber Mallet
Courtesy of GENERAL MOTORS CORP.

2. Position the transaxle on a bench so that the bearings are resting on a flat surface.
3. Using a rubber mallet, tap lightly on the case mating surface to ensure the bearings are fully seated.

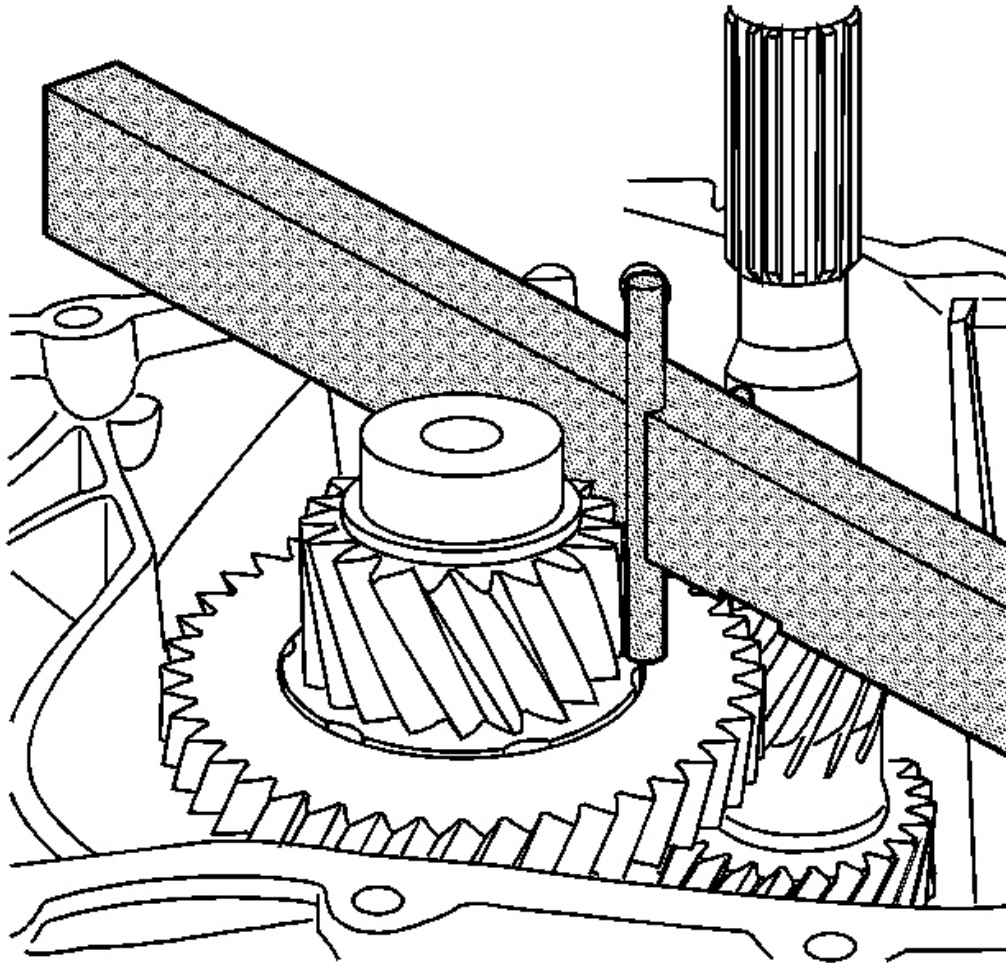


Fig. 271: Case Parting Surface & J 44388-1
Courtesy of GENERAL MOTORS CORP.

4. Measure the distance of the transaxle case parting surface to the output shaft gear thrust washer surface using the J 44388-1.
5. Place the J 44388-1 on the case parting surface.
6. Extend the gage rod on the J 44388-1 until it is bottomed on the output shaft gear thrust washer.
7. Tighten the thumbscrew on the J 44388-1 to retain the gage rod.

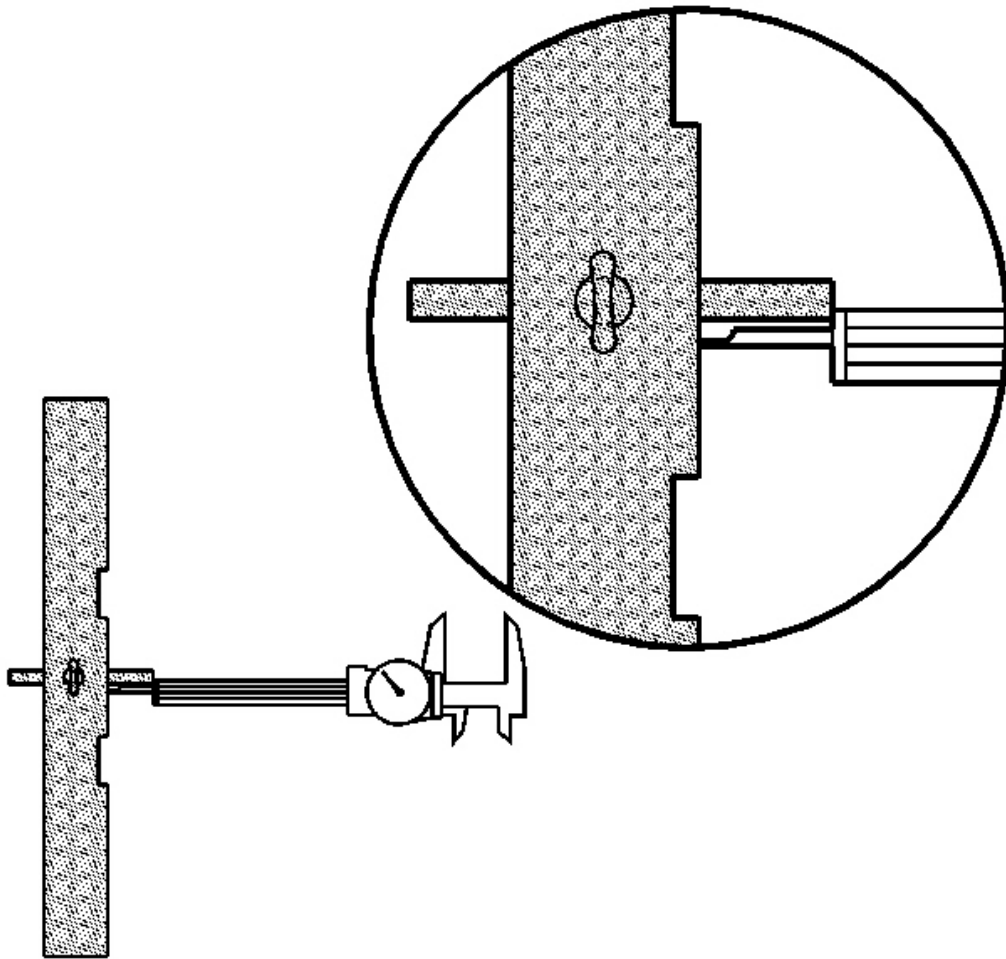


Fig. 272: Measuring The Length Of Gage Rod Protruding & Gage Bar
Courtesy of GENERAL MOTORS CORP.

8. Measure and record the length of the gage rod protruding from the gage bar (measurement A).

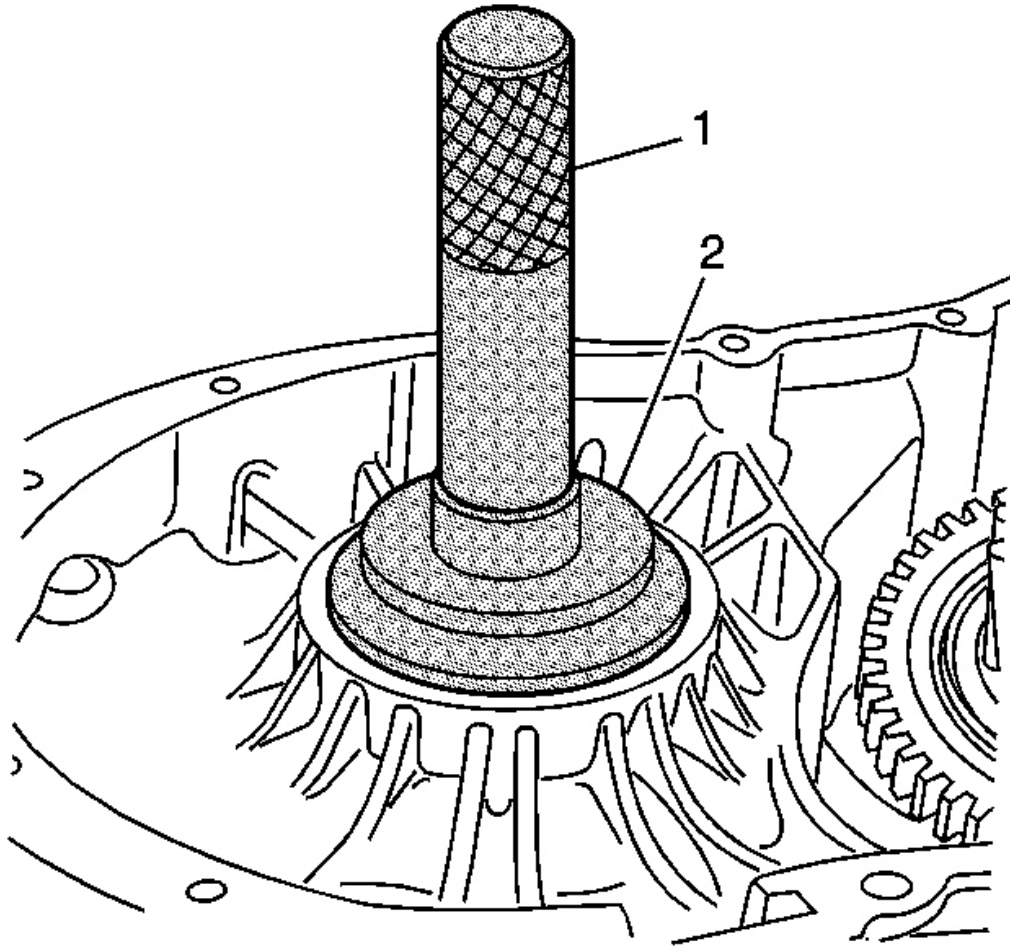


Fig. 273: Differential Bearing Race, J 44381 & J 7079-2
Courtesy of GENERAL MOTORS CORP.

9. Make sure the left differential bearing race is fully seated into the transaxle case using the **J 7079-2** (1) and the **J 44385** (2). See Special Tools and Equipment .

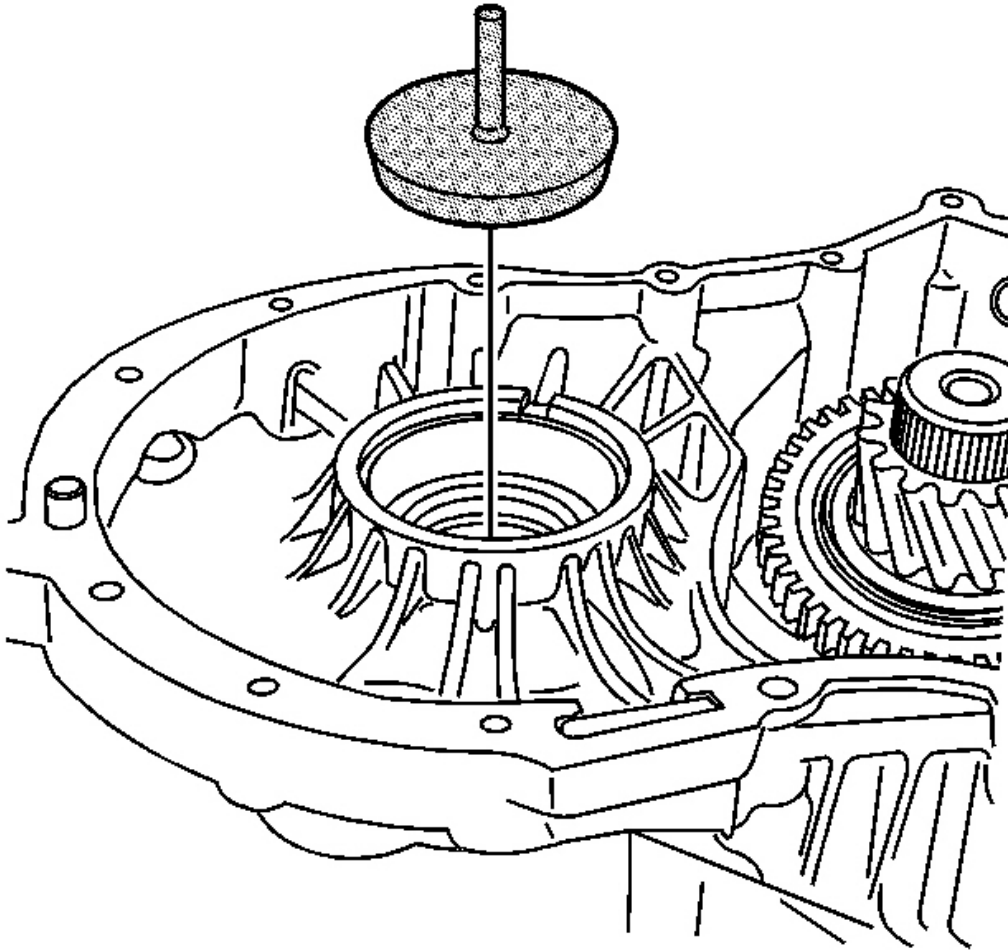


Fig. 274: Left Differential Side Bearing Race & J 44388-2
Courtesy of GENERAL MOTORS CORP.

10. Install the J 44388-2 into the left differential side bearing race. Ensure that the J 44388-2 is fully seated into the left differential side bearing race.

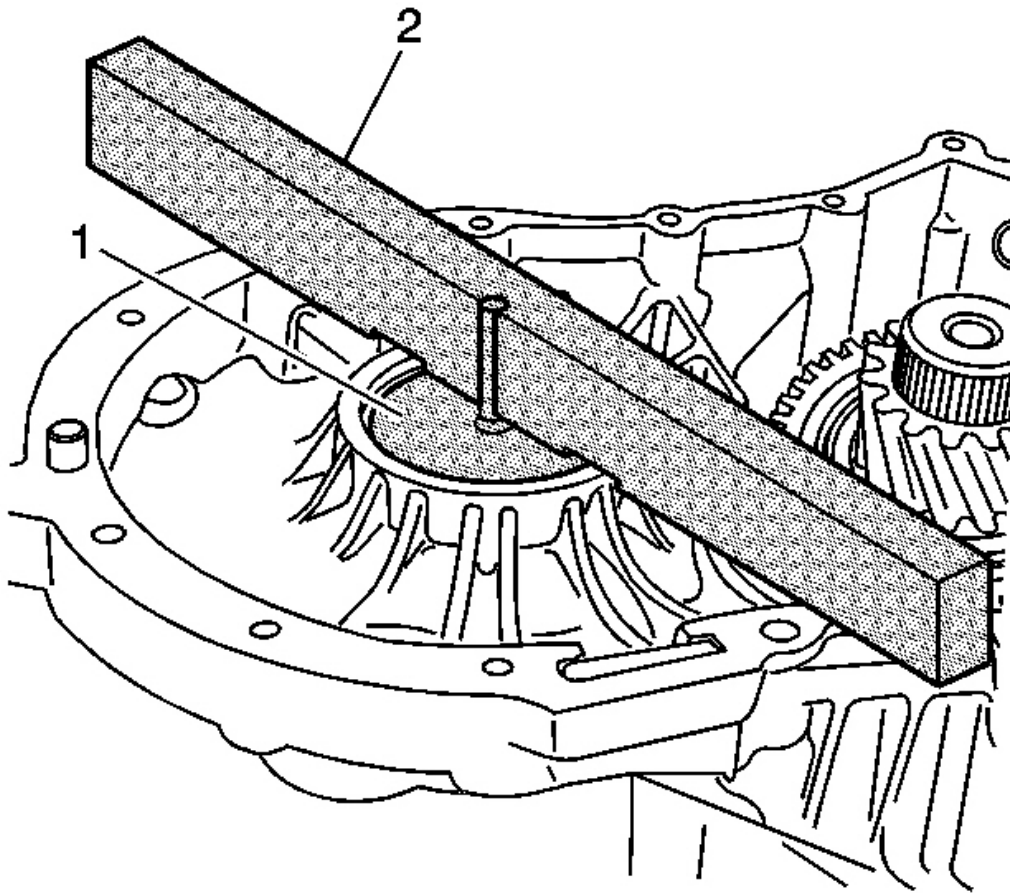


Fig. 275: Gage Rod, J 44388-1 & J 44388-2
Courtesy of GENERAL MOTORS CORP.

11. Remove the gage rod from the J 44388-1 (2).
12. Place the bar of the J 44388-1 (2) onto the gage rod of the J 44388-2 (1).
13. Tighten the thumbscrew on the J 44388-1 (2) to retain the J 44388-2 (1) gage rod.

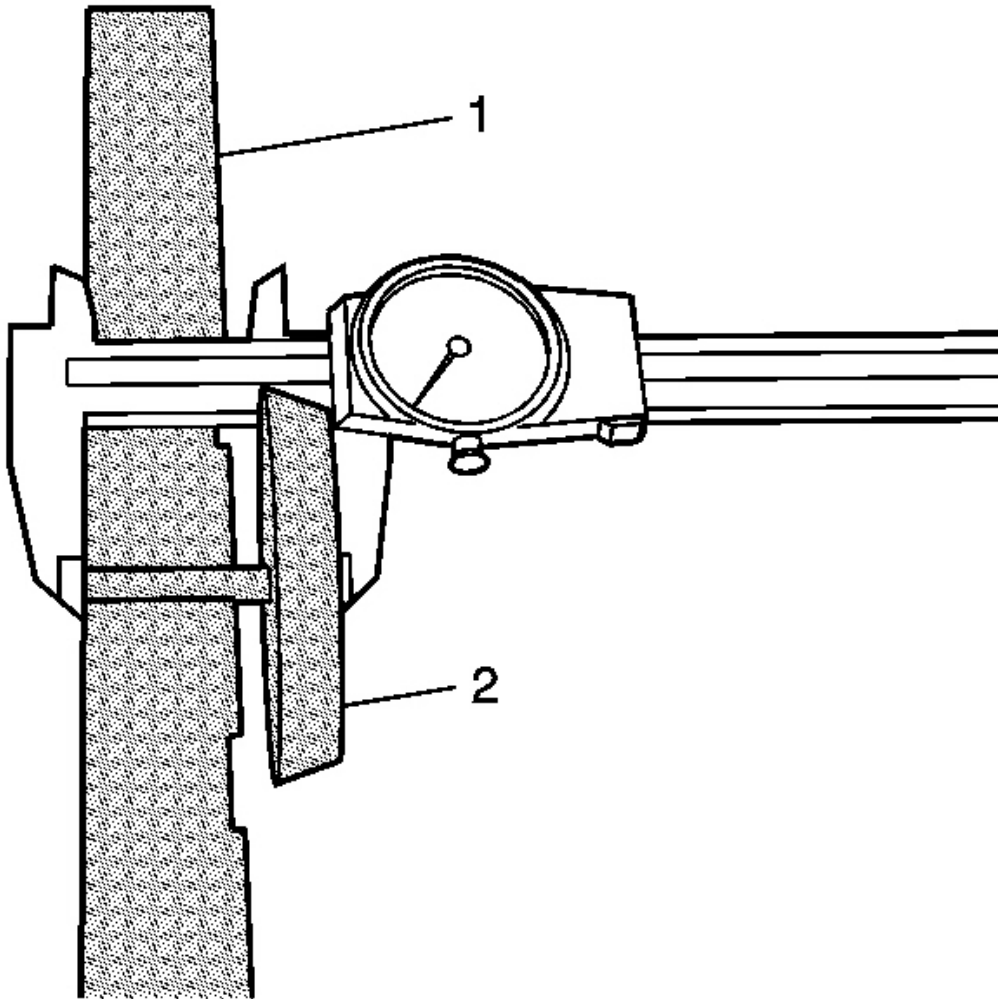


Fig. 276: Measuring Overall Height Of J 44388-1 & J 44388-2
Courtesy of GENERAL MOTORS CORP.

14. Measure the overall height of the J 44388-1 (1) and J 44388-2 (2) (measurement B).

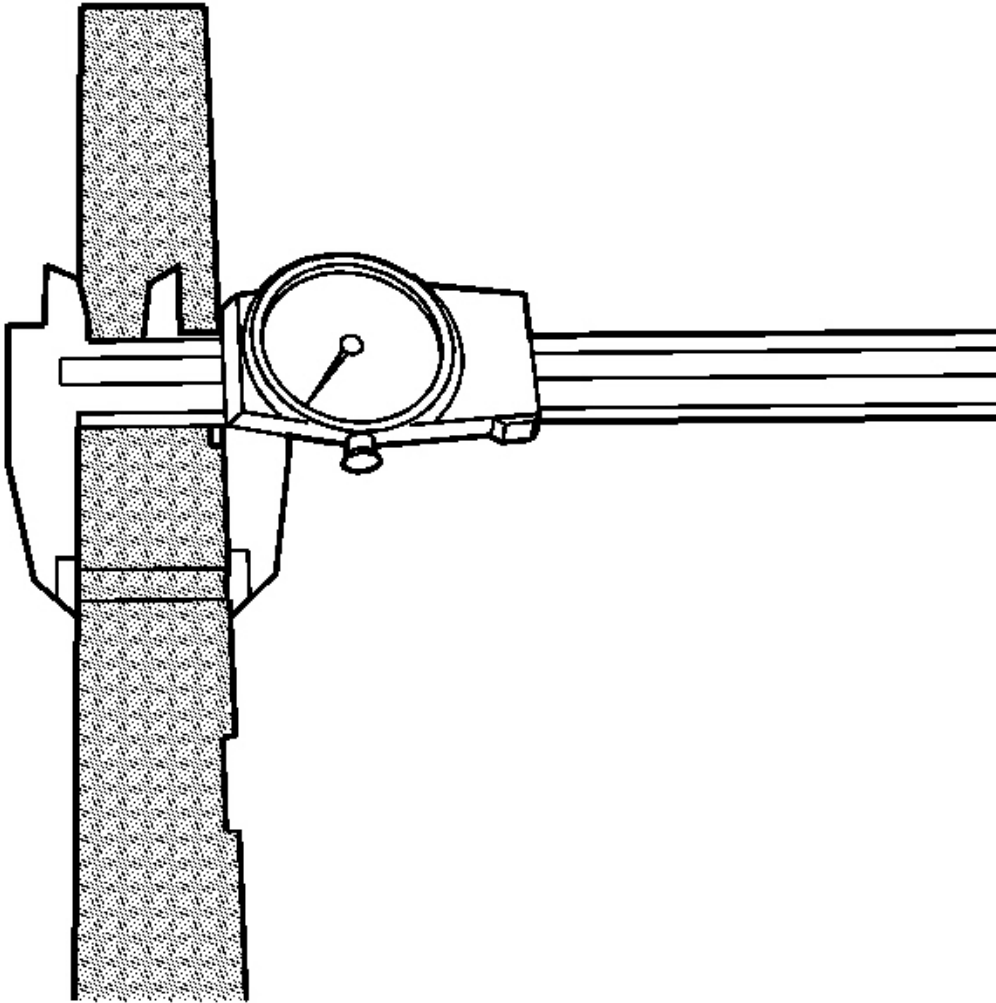


Fig. 277: Measuring Height Of J 44388-1
Courtesy of GENERAL MOTORS CORP.

15. Measure the height of just the J 44388-1 (measurement C).
16. Subtract the height of the J 44388-1 (measurement C) from the overall height of the J 44388-1 and J 44388-2 (measurement B) and record (measurement D).

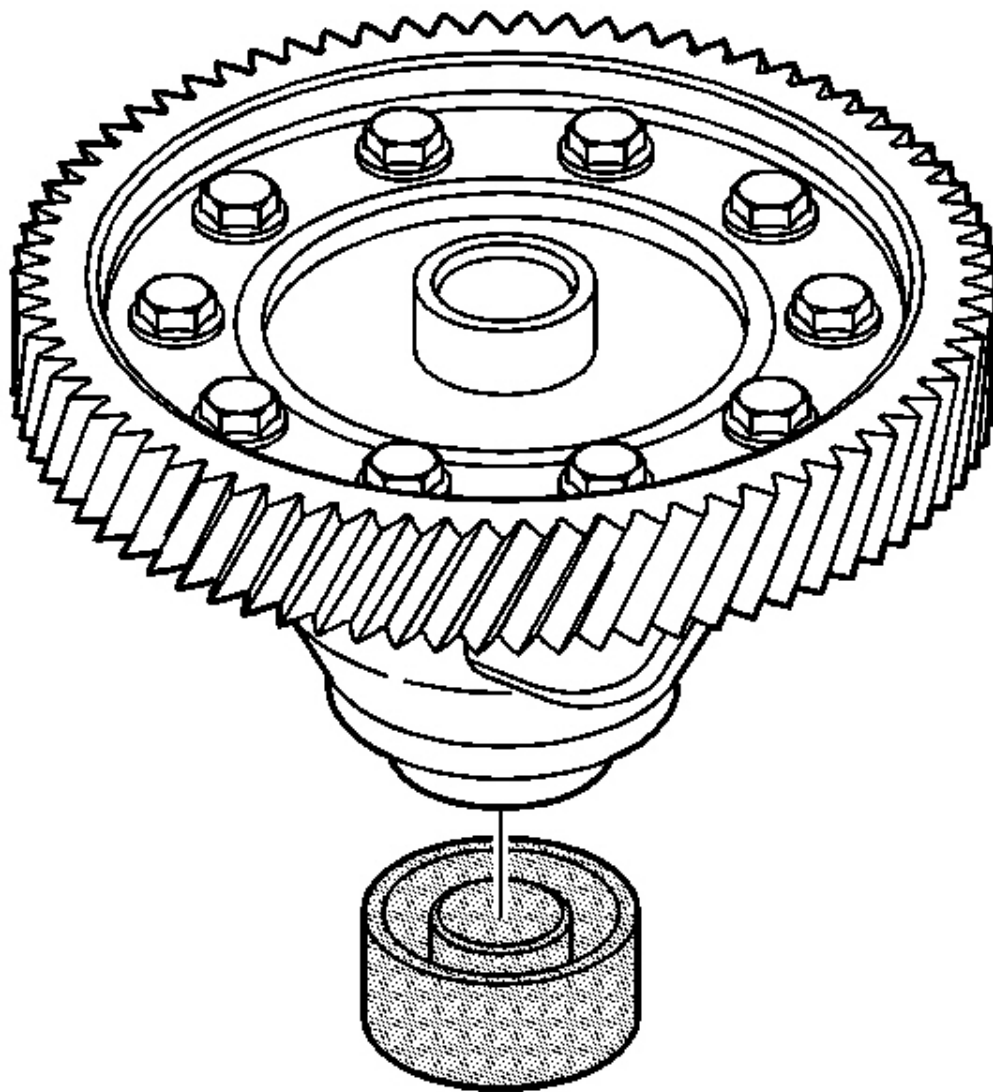


Fig. 278: Differential Assembly & J 44388-4
Courtesy of GENERAL MOTORS CORP.

17. Place the differential assembly onto the J 44388-4 to provide a steady measuring surface.

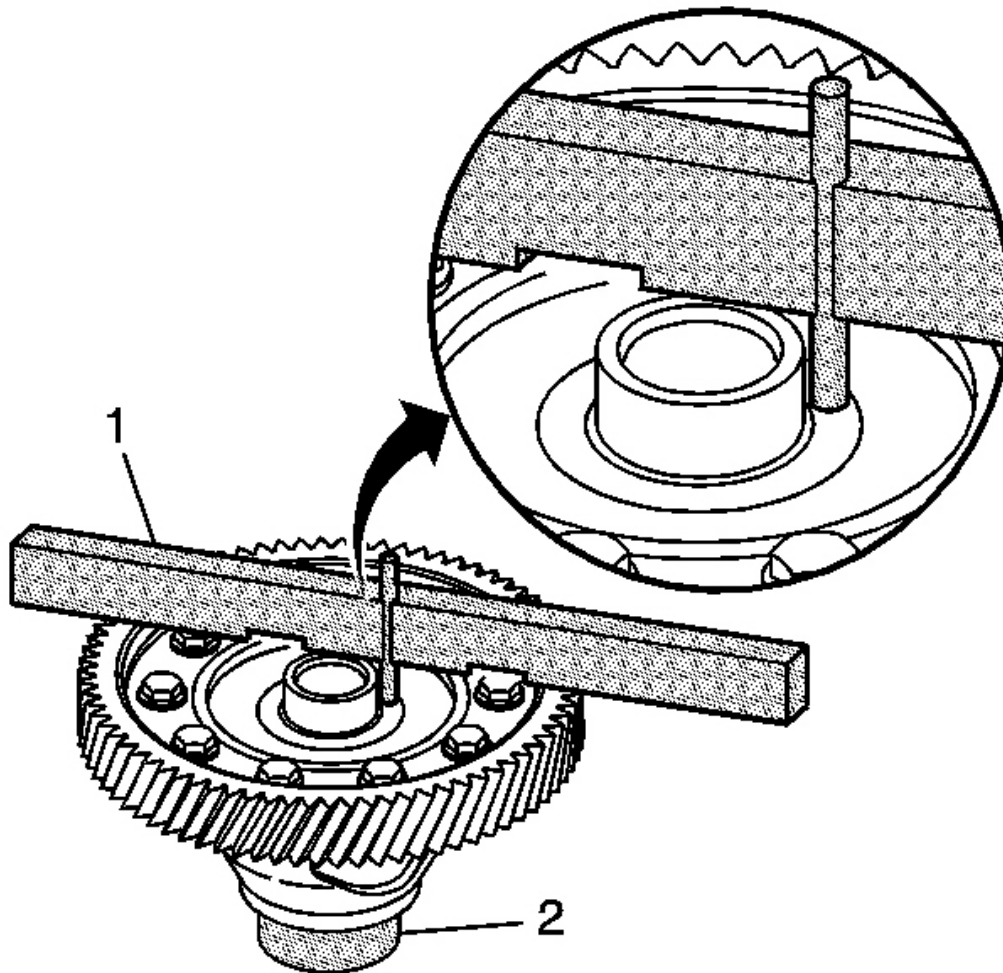


Fig. 279: Left Differential Side Bearing Shim, Gage Rod & J 44388-1
Courtesy of GENERAL MOTORS CORP.

18. Install the rod back into the J 44388-1 (1).
19. Place the J 44388-1 (1) across the face of the ring gear.
20. Center the gage rod of the J 44388-1 (1) over the land for the left differential side bearing shim.
21. With the gage rod of the J 44388-1 (1) fully seated on the shim land for the left differential side bearing shim, tighten the thumbscrew on the J 44388-1 (1).

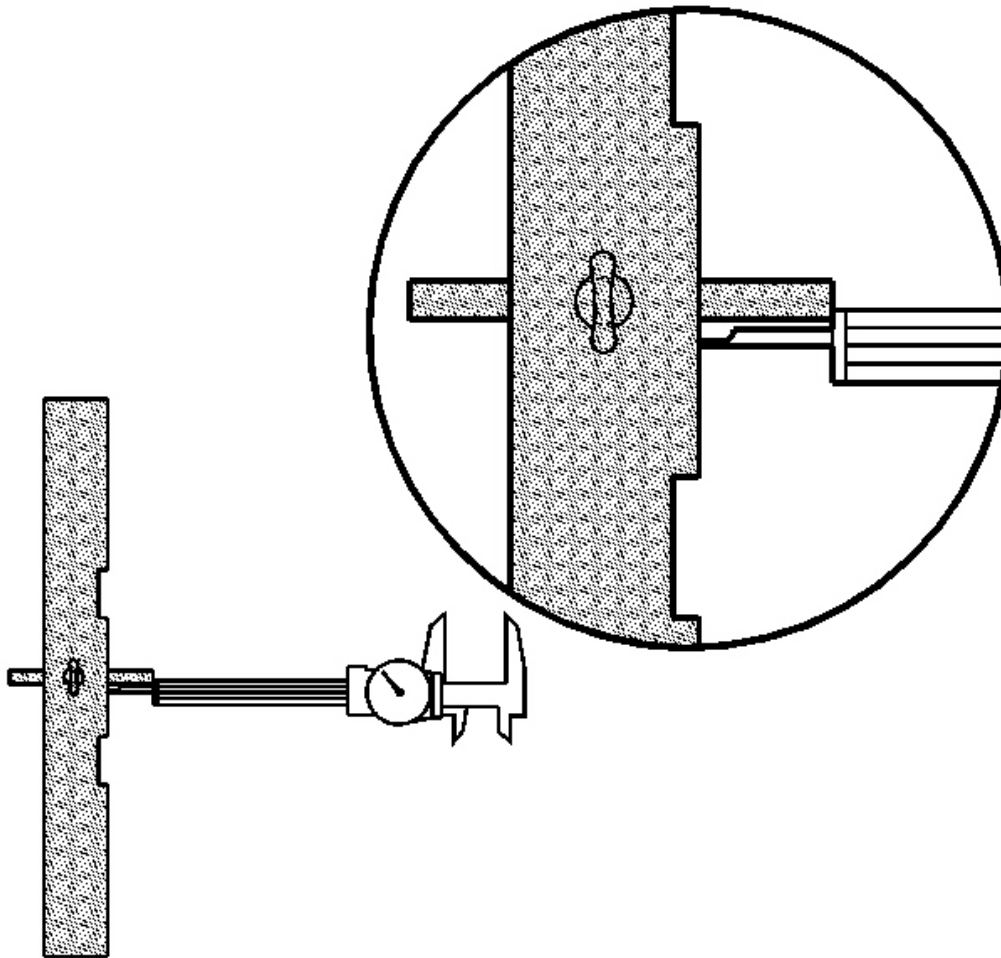


Fig. 280: Measuring The Length Of Gage Rod Protruding & Gage Bar
Courtesy of GENERAL MOTORS CORP.

22. Measure and record the length of the gage rod protruding from the J 44388-1 (measurement E).

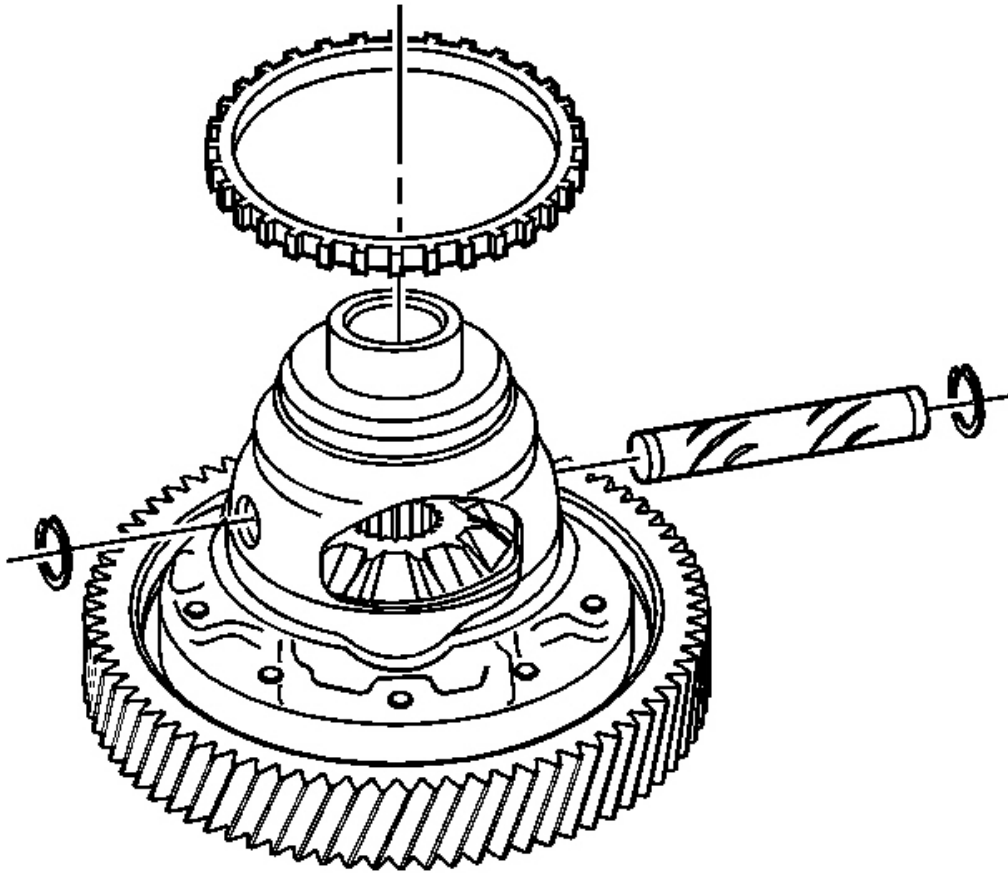


Fig. 281: Differential Pinion Shaft & Retaining Rings
Courtesy of GENERAL MOTORS CORP.

23. Remove the vehicle speed sensor (VSS) ring.

IMPORTANT: Both retaining rings must be removed from the pinion shaft to ensure proper removal of the differential pinion shaft.

24. Remove and discard both the differential pinion shaft retaining rings and remove the differential pinion shaft.

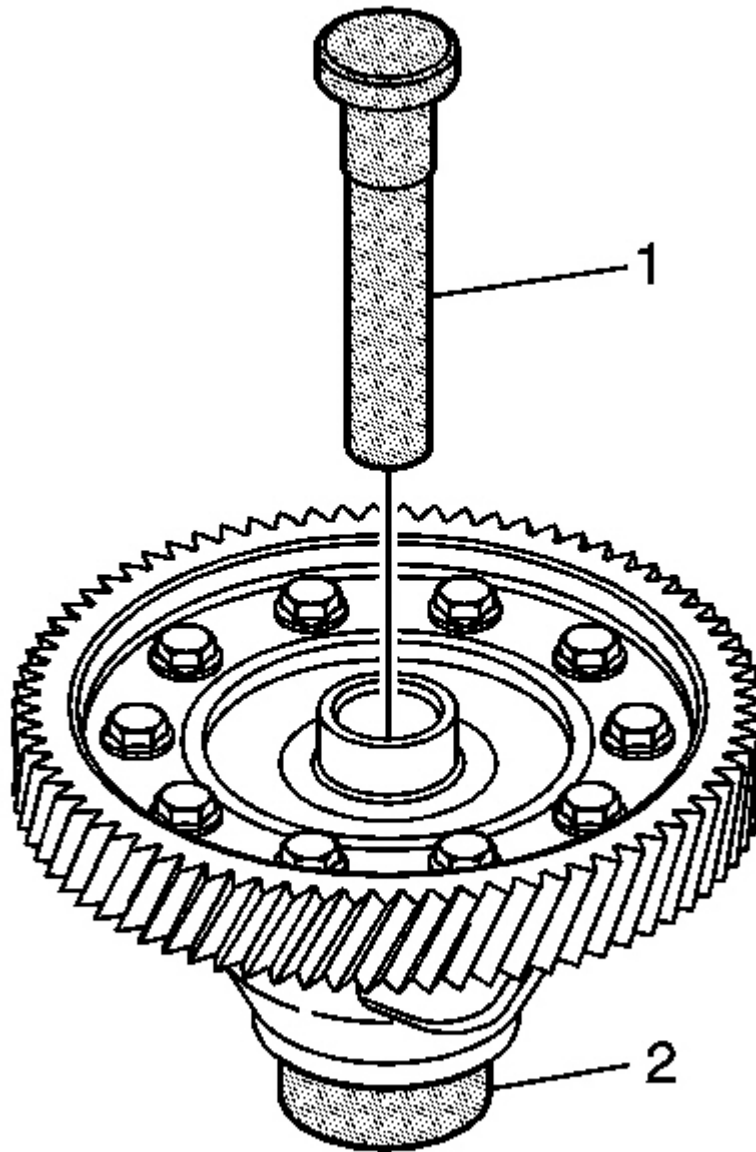


Fig. 282: Center Of Differential & J 44388-3
Courtesy of GENERAL MOTORS CORP.

25. Insert the J 44388-3 (1) through the center of the differential until it rests firmly on the J 44388-4 (2).

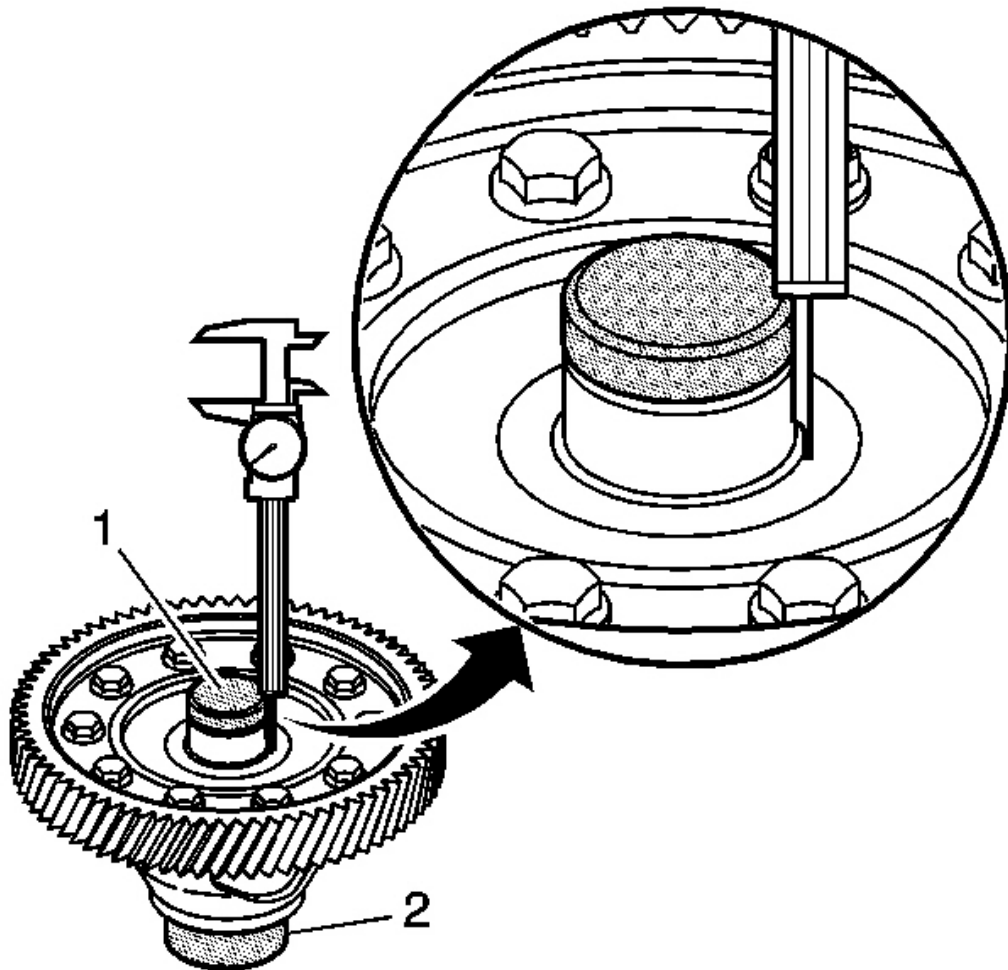


Fig. 283: Right Differential Side Bearing Shim & J 44388-3
Courtesy of GENERAL MOTORS CORP.

26. The distance from the top surface of the J 44388-3 (1) to the land of the right differential side bearing shim is measured and recorded (measurement F).
27. Subtract measurement F from 127 mm (5 in) (measurement G).

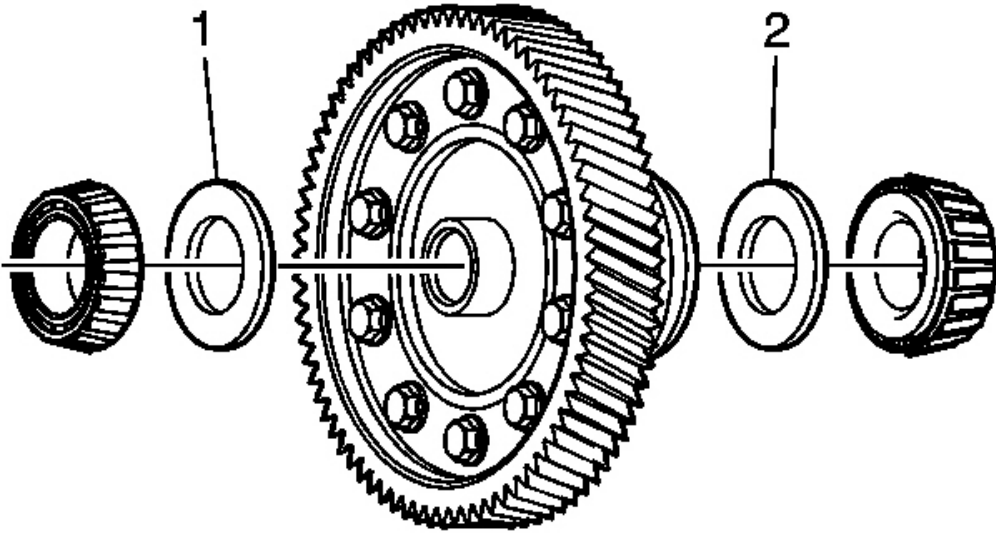


Fig. 284: Left/Right Differential Side Shim
Courtesy of GENERAL MOTORS CORP.

28. To obtain shim size for left differential side shim (1) use the following formula:

$$\text{Shim (1)} = E - A + D - 19.036 \text{ mm (0.749 in).}$$

29. To obtain shim size for right differential side shim (2) use the following formula:

$$\text{Shim (2)} = 94.65 \text{ mm (3.726 in)} - G - \text{shim (1).}$$

DESCRIPTION AND OPERATION

TRANSMISSION SYSTEM DESCRIPTION AND OPERATION

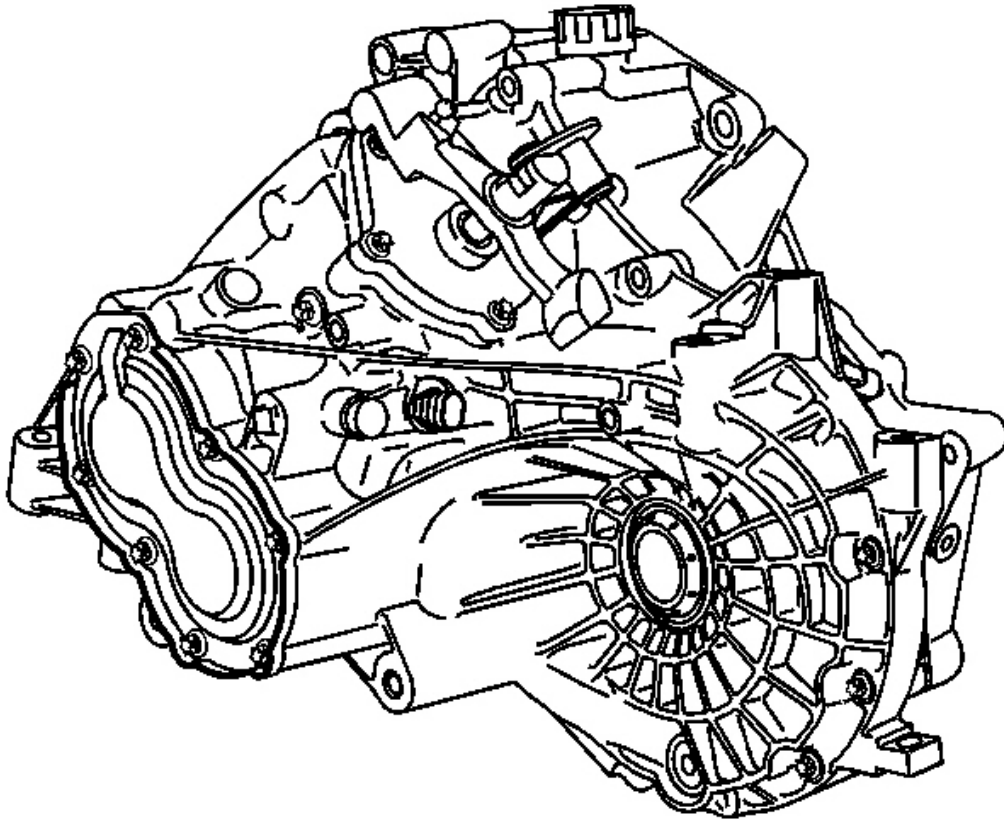


Fig. 285: Transmission System Description And Operation
Courtesy of GENERAL MOTORS CORP.

The MG3 Getrag is a 5 speed manual transmission assembly.

IMPORTANT: Use only DEXRON(R)III Automatic Transmission Lubricant for this manual transmission assembly. Other lubricants or additives may affect the shift performance.

The MG3 Getrag manual transmission has the following features:

- First and second gear double coned synchronizer
- Third, fourth, and fifth gear single coned synchronizer
- Reverse synchronized
- Three shaft design consisting of an input shaft, output shaft, and intermediate shaft
- Reverse inhibit feature

- One piece clutch actuator - no bleed screw
- Transmission venting system is part of the fill cap
- First gear ratio is 3.58
- Second gear ratio is 2.02
- Third gear ratio is 1.35
- Fourth gear ratio is 0.98
- Fifth gear ratio is 0.69
- Reverse gear ratio is 3.31
- Final drive ratio is 3.94
- Vehicle speed sensor (VSS)

The manual transmission shift cables must be adjusted for proper shifter performance.

Lubrication Flow

A common sump supplies oil for the manual transaxle. When the manual transaxle is operating normally, the differential assembly splashes oil from the sump, to provide lubrication. The splashed oil is collected in an oil trough. The oil travels down the trough at the case end and lubricates the input and output shafts. The counter shaft is lubricated from the clutch housing end through splashed oil from the differential assembly.

Power Flow

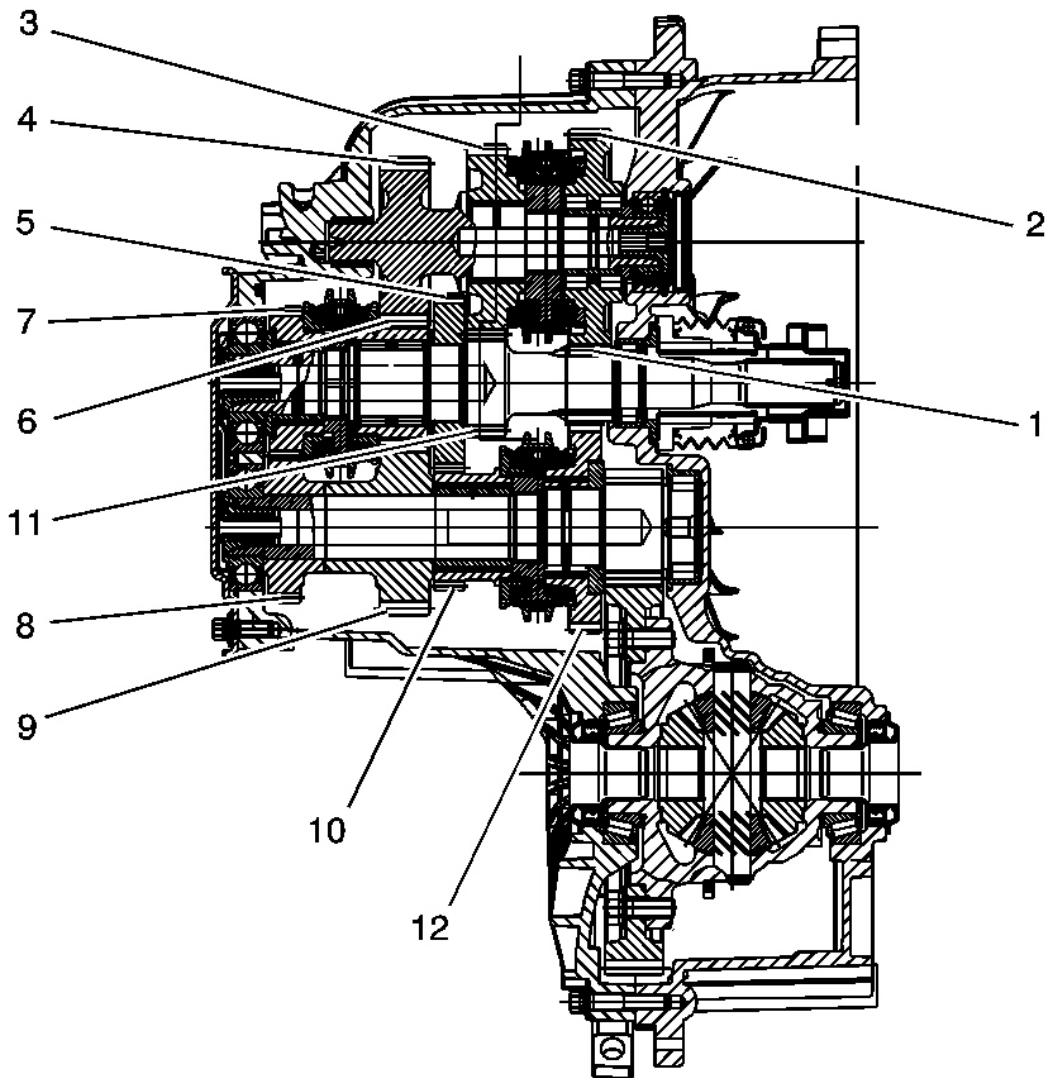


Fig. 286: Power Flow
 Courtesy of GENERAL MOTORS CORP.

Neutral

In neutral, with engine running and clutch engaged, the input shaft turns. With 1st/2nd, 3rd/4th and 5th/Reverse synchronizers in a neutral position, power does not flow to the output shaft.

1st Gear

In 1st gear range, the 3rd/4th and 5th/Reverse synchronizers are in neutral and the 1st/2nd synchronizer sleeve is moved toward the 1st gear blocking ring and 1st gear on the counter shaft (2). Because the

1st/2nd synchronizer hub is splined to the counter shaft, torque is transmitted from the input shaft 1st gear (1) through the counter shaft 1st gear (2), the synchronizer sleeve and hub, counter shaft 3rd gear (4), output shaft 3rd gear (9), and into the differential, final drive, assembly.

2nd Gear

In 2nd gear range, the 3rd/4th and 5th/Reverse synchronizers are in neutral and the 1st/2nd synchronizer sleeve is moved toward the 2nd gear blocking ring and 2nd gear on the counter shaft (3). Because the 1st/2nd synchronizer hub is splined to the counter shaft, torque is transmitted from the input shaft 2nd gear (11) through the counter shaft 2nd gear (3), the synchronizer sleeve and hub, counter shaft 3rd gear (4), output shaft 3rd gear (9), and into the differential, final drive, assembly.

3rd Gear

In 3rd gear range, the 1st/2nd and 5th/Reverse synchronizers are in neutral, and the 3rd/4th synchronizer sleeve is moved toward the 3rd gear blocking ring and 3rd gear on the input shaft (6). Because the 3rd/4th synchronizer hub is splined to the input shaft, torque is transmitted from the input shaft through the synchronizer hub and sleeve, 3rd drive gear (6), 3rd driven gear (9), the output shaft, and into the differential, final drive, assembly.

4th Gear

In 4th gear range, the 1st/2nd and 5th/Reverse synchronizers are in neutral and the 3rd/4th synchronizer sleeve is moved toward the 4th gear blocking ring and 4th gear on the input shaft (7). Because the 3rd/4th synchronizer hub is splined to the input shaft, torque is transmitted from the input shaft through the synchronizer hub and sleeve, 4th drive gear (7), 4th driven gear (8), the output shaft, and into the differential, final drive, assembly.

5th Gear

In 5th gear range, the 1st/2nd and 3rd/4th synchronizers are in neutral and the 5th/Reverse synchronizer sleeve is moved toward the 5th gear blocking ring and 5th gear on the output shaft (10). Because the 5th/Reverse synchronizer hub is splined to the output shaft, torque is transmitted from the input shaft through the 5th drive gear (5), 5th driven gear (10), the synchronizer sleeve and hub, the output shaft, and into the differential, final drive, assembly.


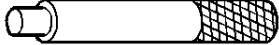
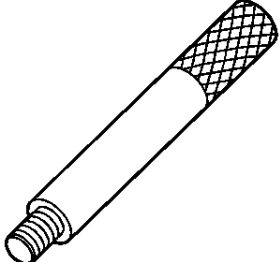
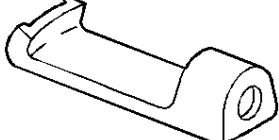
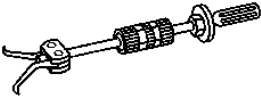
Reverse

In reverse range, the 1st/2nd and 3rd/4th synchronizers are in neutral, and the 5th/Reverse synchronizer sleeve is moved toward the reverse gear blocking ring and the reverse gear on the output shaft (12). Because the 5th/Reverse synchronizer hub is splined to the output shaft, torque is transmitted from the input shaft through the input shaft 1st drive gear (1), counter shaft 1st gear (2), freewheeling as a reverse idler, reverse driven gear (12), the synchronizer sleeve and hub, the output shaft, and into the differential, final drive, assembly.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Special Tools

Illustration	Tool Number/Description
	J 6125-B Slide Hammer
	J 7079-2 Universal Driver Handle - Non-threaded
	J 8092 Universal Driver Handle - 3/4 in - 10
	J 23129 Seal Remover
	J 23907 Slide Hammer with Bearing Adapter
	J 24433

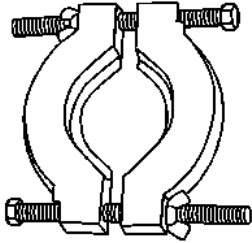
Press Tube



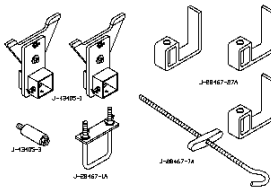
J 36346
Fascia Retainer Remover



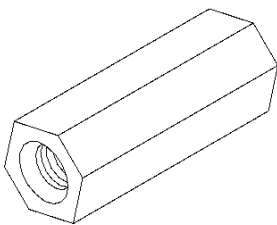
J 36513
Gear and Bearing Separator Plate

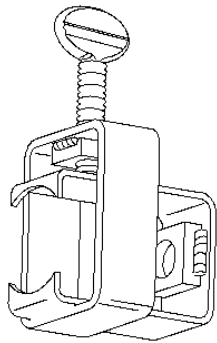


J 43405
Engine Support Fixture Adapter

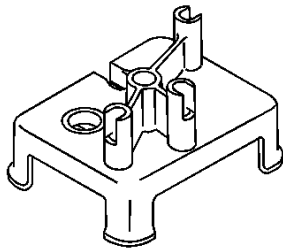


J 44015
Steering Linkage Installer

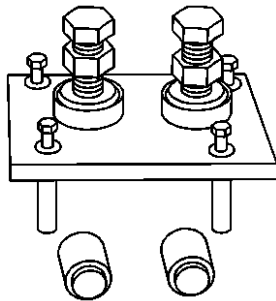




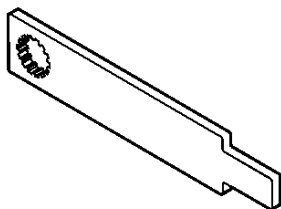
J 44017
Stub Shaft Assembly Remover



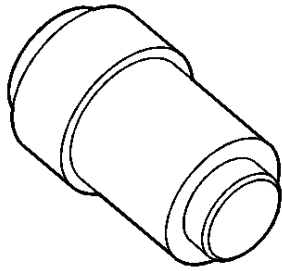
J 44375
Assembly Pallet



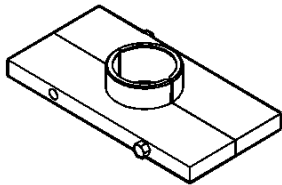
J 44376
Bearing Pusher/Puller



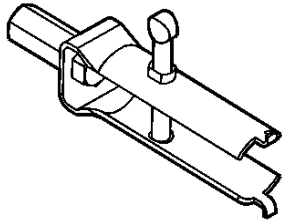
J 44377
Input Shaft Anti-Rotation Tool



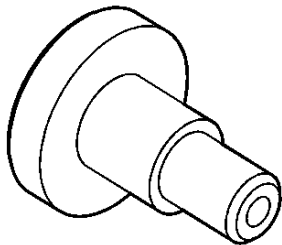
J 44378
Press Adapter - all shafts



J 44379
Differential Bearing Puller Plate



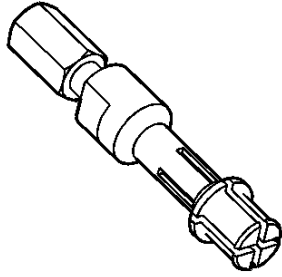
J 44380
Differential Bearing Race Puller



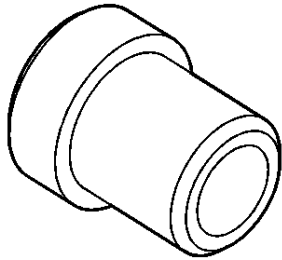
J 44381
Shifter Bearing/Input and Output Bearing Remover

J 44382

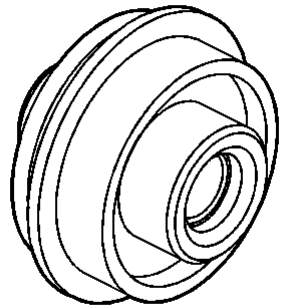
Countershaft Needle Bearing Puller



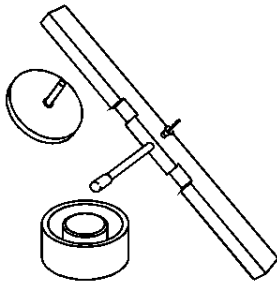
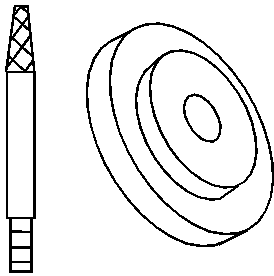
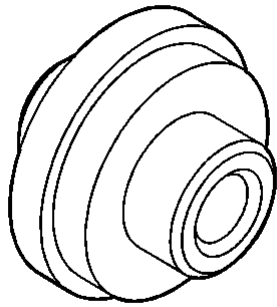
J 44383
Countershaft Bearing Installer - to case



J 44385
Differential Bearing Race and Seal Installer



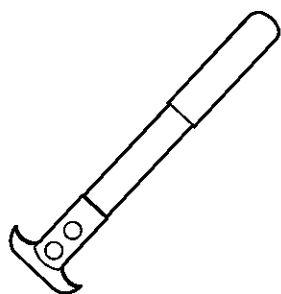
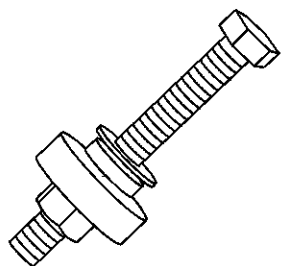
J 44386
Input/Output Bearing Installer



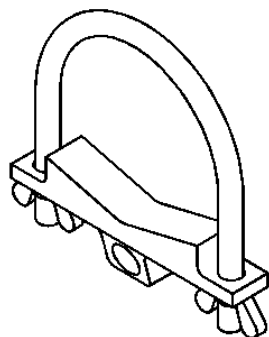
J 44387
Output Shaft Bearing Sleeve Installer and Pin

J 44388
Final End Checking Fixture

J 44389
Countershaft Bearing Installer

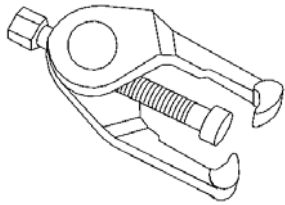
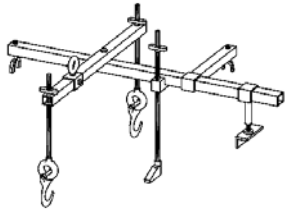


J 45000
Seal Remover

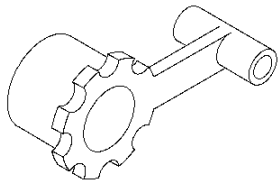


J 45341
Rear Wheel Drive Shaft Removal Tool

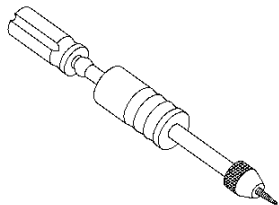
SA9105E
Engine Support Fixture - 3 Bar



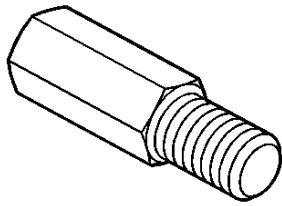
SA91100C
Tie Rod Separator



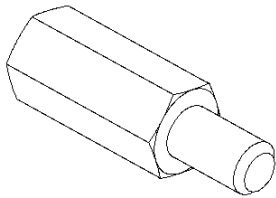
SA91112T
Axle Seal Protector



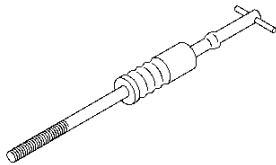
SA9133T
Axle Seal Puller



SA9133T-1
Axle Seal Puller Adapter



SA9133T-2
Axle Seal Puller Adapter



SA9173G
Slide Hammer

2004 TRANSMISSION

Manual Transmission - Overhaul - Getrag 5 Speed

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Drain Plugs	38 N.m	28 lb ft
Intermediate Shaft Bolt	95 N.m	70 lb ft
Rear Cover Bolts	25 N.m	18 lb ft
Reverse Lockout Bolt	6 N.m	53 lb in
Reverse Switch	18 N.m	13 lb ft
Ring Gear	90 N.m	66 lb ft
Shaft Bolts	110 N.m	81 lb ft
Shifter Guide Bolt	25 N.m	18 lb ft
Shifter Retaining Bolts	25 N.m	18 lb ft
Speed Sensor	12 N.m	106 lb in
Transmission Housing Bolts	27 N.m	20 lb ft

SEALERS, ADHESIVES, AND LUBRICANTS

Sealers, Adhesives, and Lubricants

Application	Type of Material	GM Part Number	
		United States	Canada
Case Halves	Sealant	12378516	88900757
Differential Ring Gear Bolt	Threadlocker	12345493	10953488
Drain Plugs	Sealant	12346004	10953480
Input Shaft Bolt	Threadlocker	12345493	10953488
Intermediate Shaft Bolt	Threadlocker	12345493	10953488
Output Shaft Bolt	Threadlocker	12345493	10953488
Rear Cover	Sealant	12346286	10953472
Reverse Lockout Lever	Threadlocker	12345382	10953489
Reverse Switch	Sealant	12346004	10953480
Shifter Cover	Sealant	12378516	88900757
Transmission Fluid	DEXRON III	12346143	10952622

LUBRICATION SPECIFICATIONS

Lubrication Specifications

Application	Specification	
	Metric	English
DEXRON(R)III	1.7 liters	1.8 quarts

SHIM SIZE SPECIFICATIONS

Shim Size Specifications

Shim Thickness	
Metric	English
0.5 mm	0.0197 in
0.55 mm	0.0217 in
0.6 mm	0.0236 in
0.65 mm	0.0256 in
0.7 mm	0.0276 in
0.75 mm	0.0295 in
0.8 mm	0.0315 in
0.85 mm	0.0335 in
0.9 mm	0.0354 in
0.95 mm	0.0374 in
1.00 mm	0.0394 in
1.05 mm	0.0413 in
1.1 mm	0.0433 in
1.15 mm	0.0453 in
1.2 mm	0.0473 in
1.25 mm	0.0493 in
1.3 mm	0.0512 in
1.35 mm	0.0531 in

COMPONENT LOCATOR

TRANSMISSION COMPONENT LOCATION

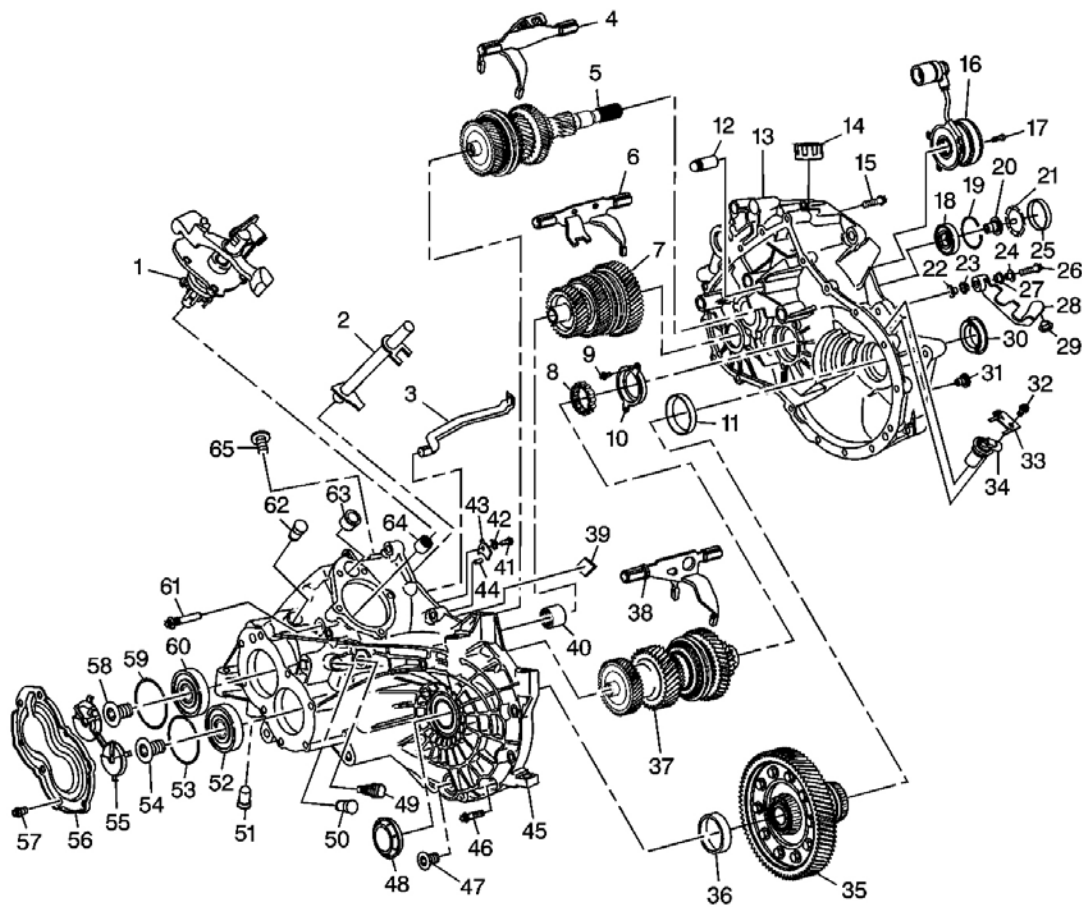


Fig. 1: Transmission Case Component Locations
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 1

Callout	Component Name
1	Shifter
2	Shift Rod
3	Oil Tube
4	3rd/4th Gear Shift Fork
5	Input Shaft Assembly
6	1st/2nd Gear Shift Fork
7	Intermediate Shaft Assembly
8	Output Shaft Roller Bearing
9	Output Shaft Bearing Race Bolt
10	Output Shaft Bearing Race
11	Clutch Housing Differential Bearing Race
12	Shifter Detent

13	Clutch Housing
14	Fill Cap
15	Clutch Housing to Transaxle Case Bolt
16	Actuator
17	Actuator Bolt
18	Intermediate Shaft Roller Bearing
19	Intermediate Shaft Bearing Snap Ring
20	Intermediate Shaft Bolt
21	Oil Guide
22	Shift Cable Bracket Spacer
23	Shift Cable Bracket Isolators
24	Shift Cable Bracket Spacer
25	Intermediate Shaft Seal
26	Shift Cable Bracket Bolt
27	Shift Cable Bracket Isolators
28	Shift Cable Bracket
29	Shift Cable Bracket Isolators
30	Clutch Housing Differential Output Shaft Seal
31	Lubricant Check Plug
32	Vehicle Speed Sensor Bolt
33	Vehicle Speed Sensor Retaining Bracket
34	Vehicle Speed Sensor
35	Differential Assembly
36	Transaxle Case Differential Bearing Race
37	Output Shaft Assembly
38	5th/Reverse Gear Shift Fork
39	Magnet
40	Intermediate Shaft Needle Bearing
41	Bolt, if equipped
42	Spring, if equipped
43	Lever, if equipped
44	Alignment Pin
45	Transaxle Case
46	Transaxle Case to Clutch Housing Bolt
47	Lubricant Drain Plug
48	Transaxle Case Differential Output Shaft Seal
49	Reverse Lamp Switch
50	Shift Shaft Detents
51	Shift Shaft Detents
52	Bearing
53	Output Shaft Bearing Snap Ring

54	Output Shaft Bolt
55	Oil Guide
56	Rear Cover
57	Rear Cover Bolts
58	Input Shaft Bolt
59	Input Shaft Bearing Snap Ring
60	Bearing
61	Shifter Guide Bolt
62	Shift Shaft Detents
63	Shift Rod Bushing
64	Shifter Bearing
65	Fill Plug

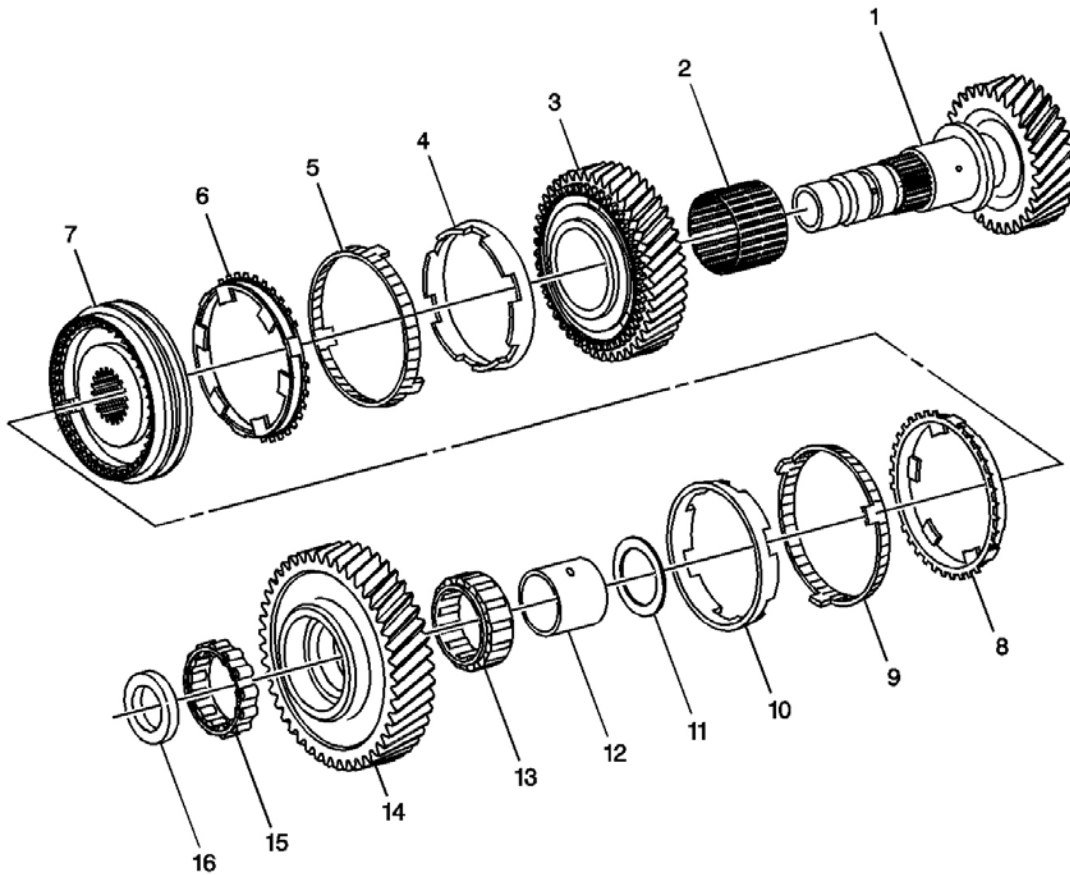


Fig. 2: Intermediate Shaft Components Location
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 2

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Callout	Component Name
1	Intermediate Shaft
2	Caged Needle Bearings
3	2nd Gear
4	2nd Gear Inner Cone
5	2nd Gear Blocking Ring
6	2nd Gear Outer Cone
7	1st/2nd Synchronizer Assembly
8	1st Gear Outer Cone
9	1st Gear Blocking Ring
10	1st Gear Inner Cone
11	Thrust Washer
12	Bearing Collar
13	Roller Bearing
14	1st Gear
15	Roller Bearing
16	Thrust Washer

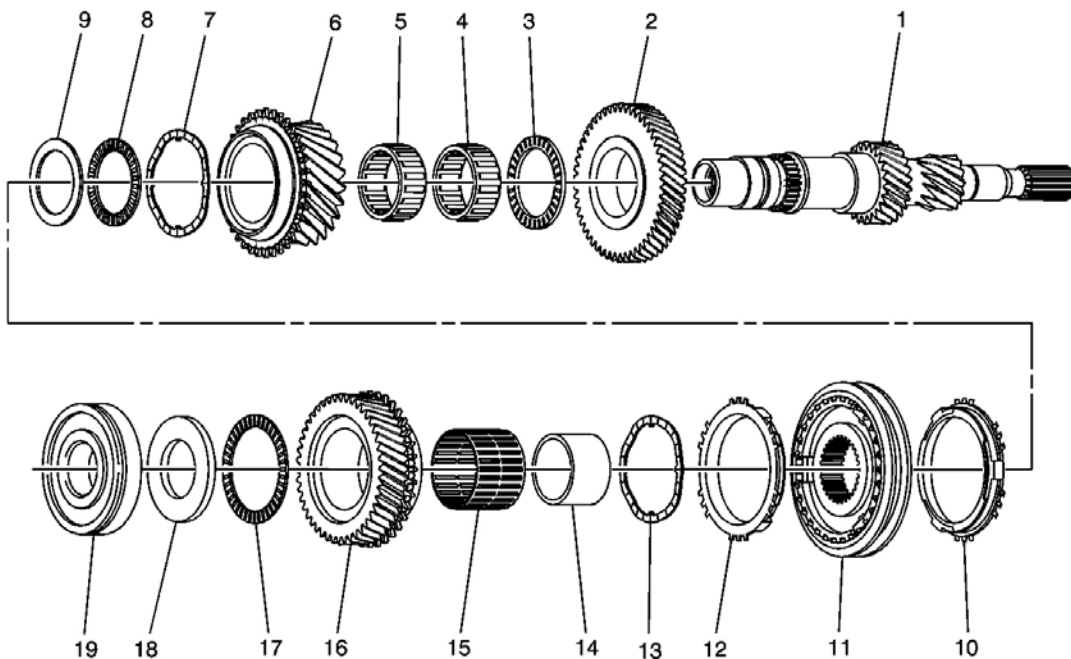


Fig. 3: Input Shaft Components Location
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 3

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Callout	Component Name
1	Input Shaft
2	5th Drive Gear
3	Thrust Bearing
4	Caged Needle Bearing
5	Caged Needle Bearing
6	3rd Drive Gear
7	Wavy Washer
8	Thrust Bearing
9	Thrust Washer
10	3rd Gear Blocking Ring
11	3rd/4th Synchronizer Assembly
12	4th Gear Blocking Ring
13	Wavy Washer
14	Bearing Collar
15	Caged Needle Bearing
16	4th Drive Gear
17	Thrust Bearing
18	Thrust Washer
19	Input Shaft Bearing

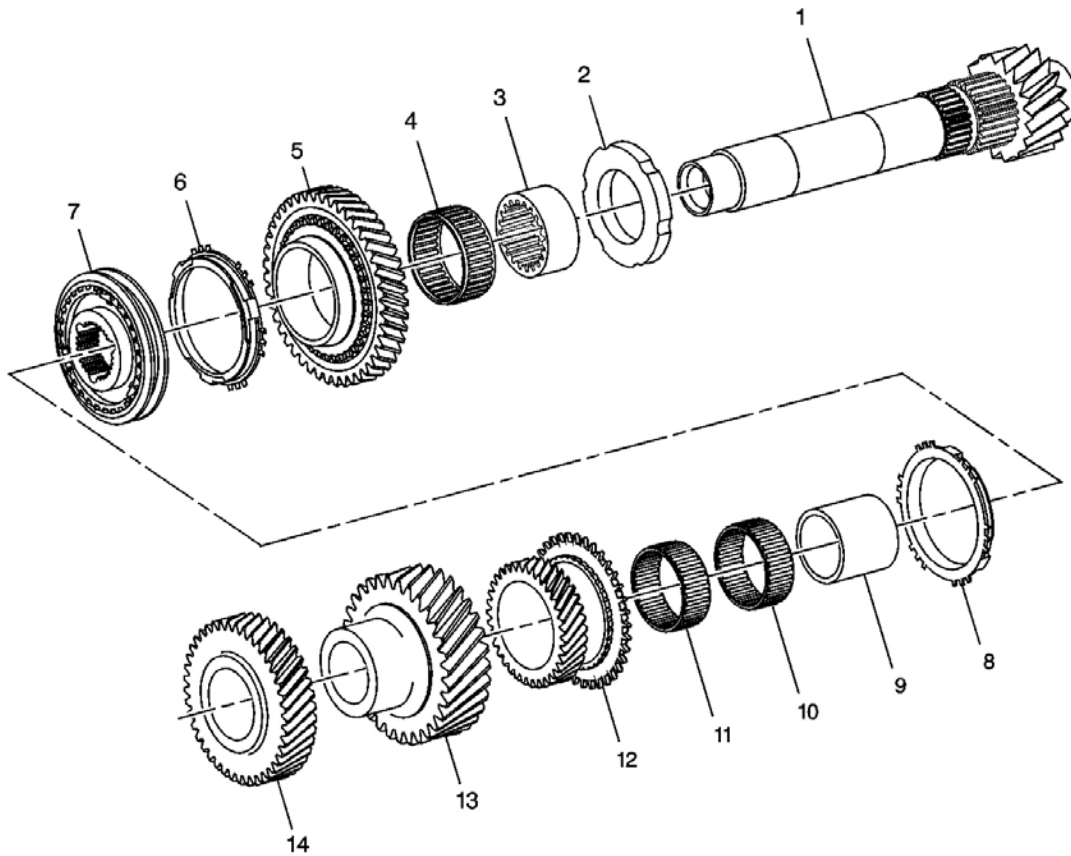


Fig. 4: Output Shaft Components Location
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
1	Output Shaft
2	Thrust Washer
3	Bearing Collar
4	Caged Needle Bearing
5	Reverse Gear
6	Reverse Blocking Ring
7	5th/Reverse Synchronizer Assembly
8	5th Gear Blocking Ring
9	Bearing Collar
10	Caged Needle Bearing
11	Caged Needle Bearing
12	5th Driven Gear
13	3rd Driven Gear

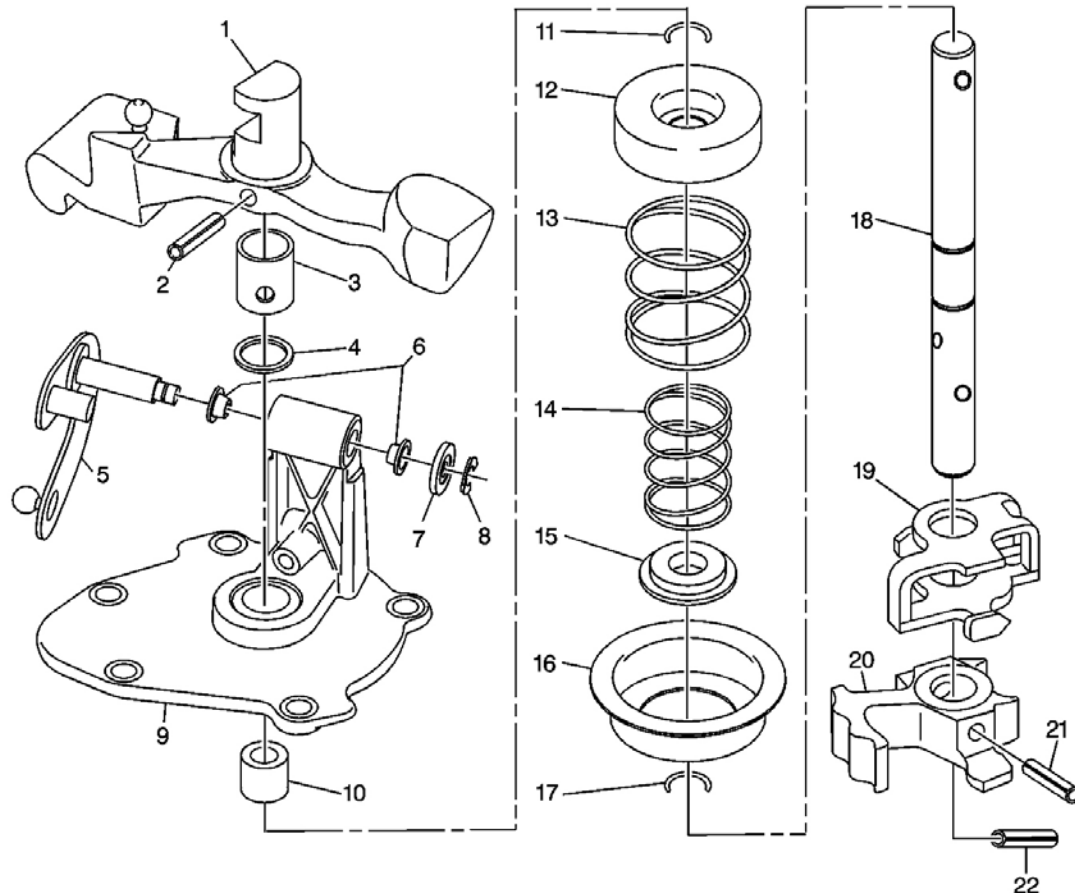


Fig. 5: Shifter Components Location
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Shift Lever
2	Roll Pin
3	Cover Bushing
4	Seal
5	Select Lever
6	Bushing
7	Washer
8	Retainer
9	Shift Cover
10	Bushing

11	Retainer
12	Outer Spring Seat
13	Outer Spring
14	Inner Spring
15	Inner Spring Seat
16	End Cap
17	Retainer
18	Shift Shaft </td
19	Outer Control Lever
20	Inner Control Lever
21	Roll Pin
22	Reverse Inhibit Roll Pin

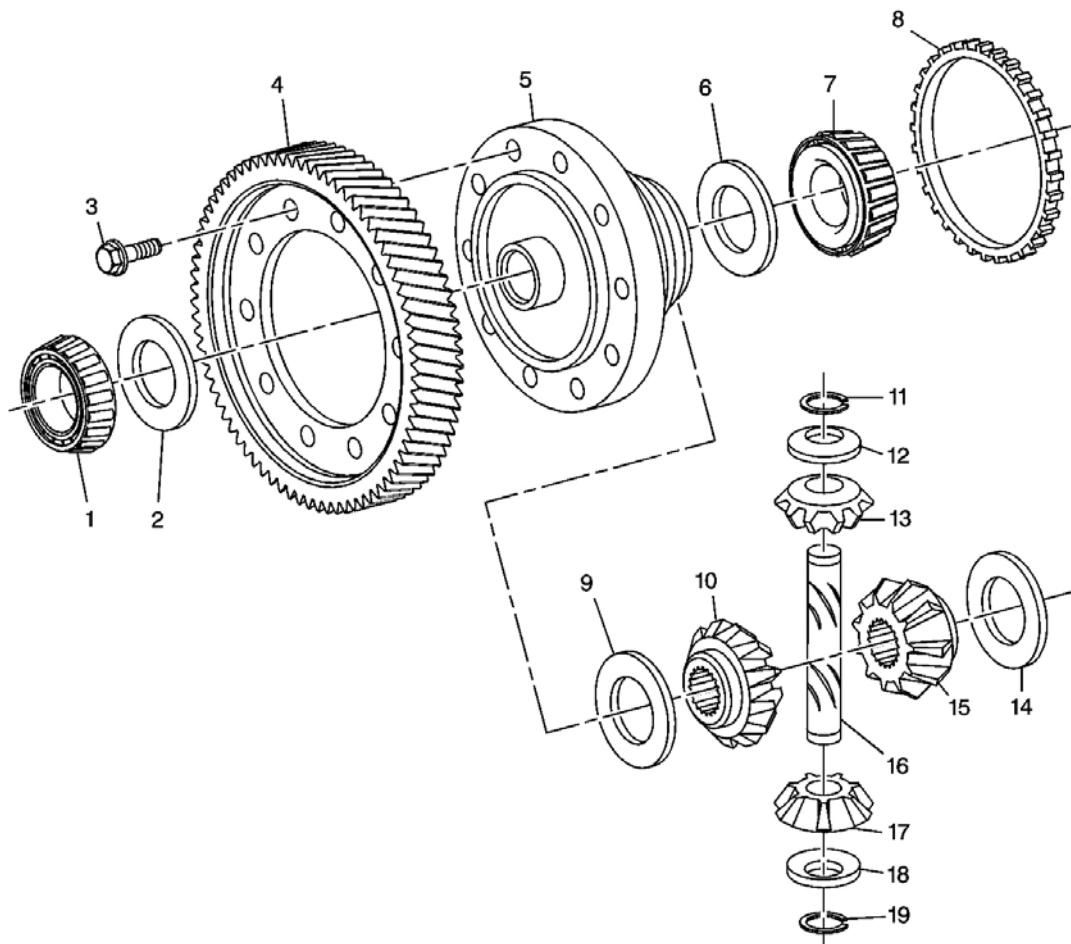


Fig. 6: Differential Components Location
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
1	Left Differential Side Bearing
2	Left Differential Shim
3	Differential Ring Gear Bolts
4	Differential Ring Gear
5	Differential Case
6	Right Differential Shim
7	Right Differential Side Bearing
8	Vehicle Speed Sensor (VSS) Ring
9	Side Gear Thrust Washer
10	Side Gear
11	Pinion Shaft Snap Ring
12	Pinion Gear Thrust Washer
13	Pinion Gear
14	Side Gear Thrust Washer
15	Side Gear
16	Pinion Shaft
17	Pinion Gear
18	Pinion Gear Thrust Washer
19	Pinion Shaft Snap Ring

REPAIR INSTRUCTIONS

TRANSAXLE CASE DISASSEMBLE

Tools Required

- **J 7079-2** Universal Driver Handle - Non-Threaded. See **Special Tools and Equipment** .
- **J 8092** Universal Driver Handle - 3/4 in - 10. See **Special Tools and Equipment** .
- **J 23907** Slide Hammer with Bearing Adapter. See **Special Tools and Equipment** .
- **J 44375** Assembly Pallet. See **Special Tools and Equipment** .
- **J 44376** Bearing Pusher/Puller. See **Special Tools and Equipment** .
- **J 44377** Input Shaft Anti-Rotation Tool. See **Special Tools and Equipment** .
- **J 44380** Differential Bearing Race Puller. See **Special Tools and Equipment** .
- **J 44381** Shifter Bearing/Input and Output Bearing Remover. See **Special Tools and Equipment** .
- **J 44382** Countershaft Needle Bearing Puller. See **Special Tools and Equipment** .
- **J 44385** Differential Bearing Race and Seal Installer. See **Special Tools and Equipment** .

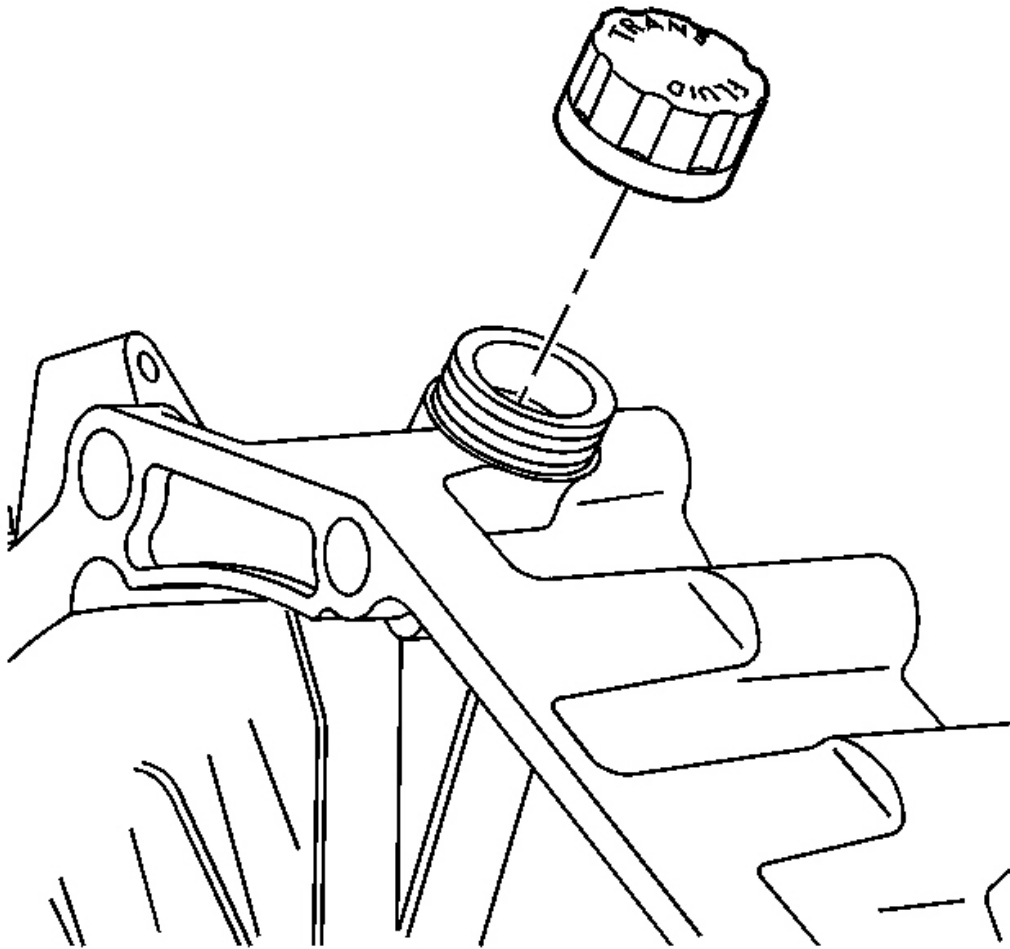


Fig. 7: View Of Transmission Filler Cap
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission filler cap.

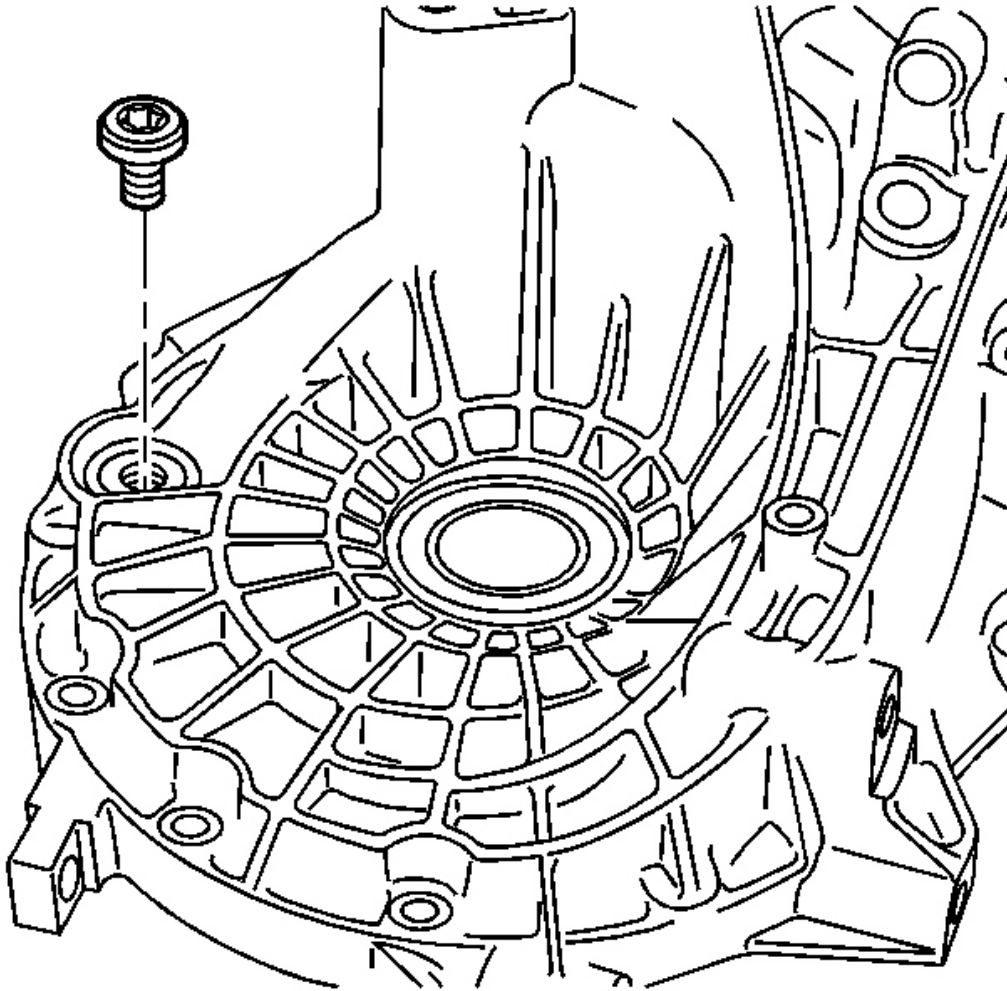


Fig. 8: View Of Transmission Drain Plug
Courtesy of GENERAL MOTORS CORP.

2. Remove the transmission drain plug and drain the fluid.

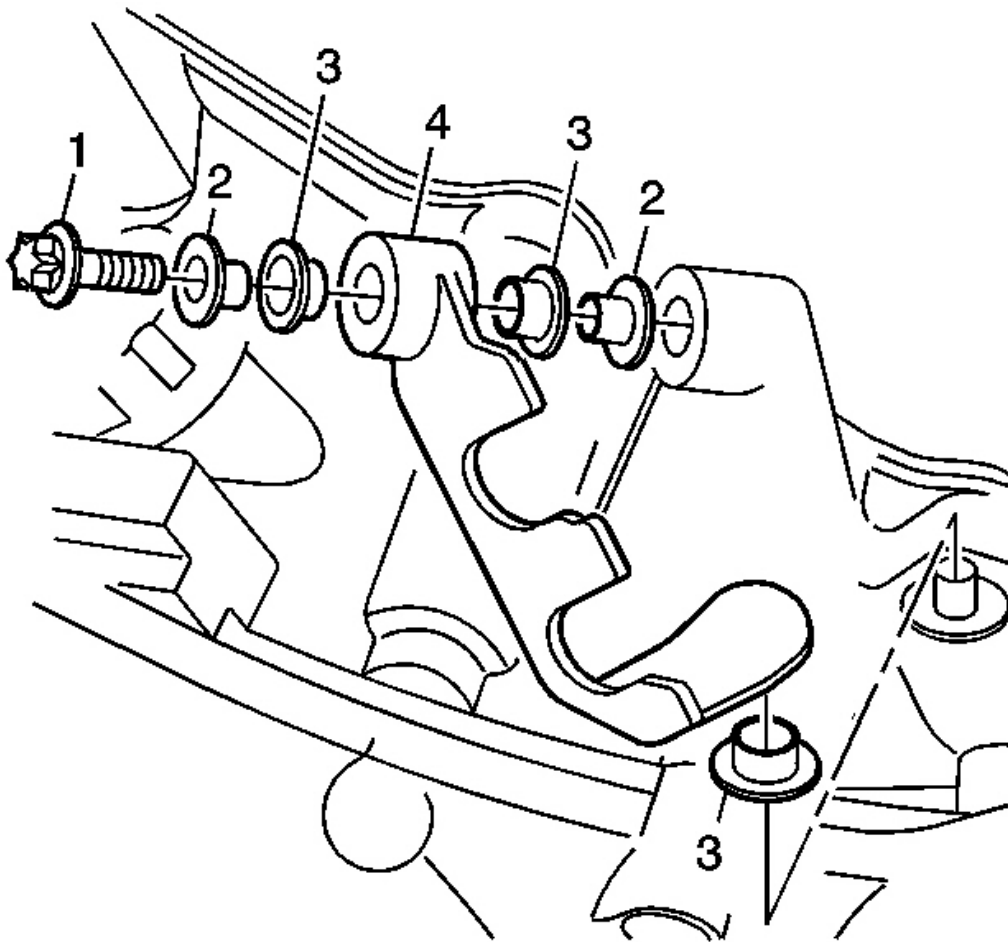


Fig. 9: View Of Shift Cable Bracket Assembly
Courtesy of GENERAL MOTORS CORP.

3. Remove the shift cable bracket (4), the spacers (2), the isolators (3) and the bolt (1).

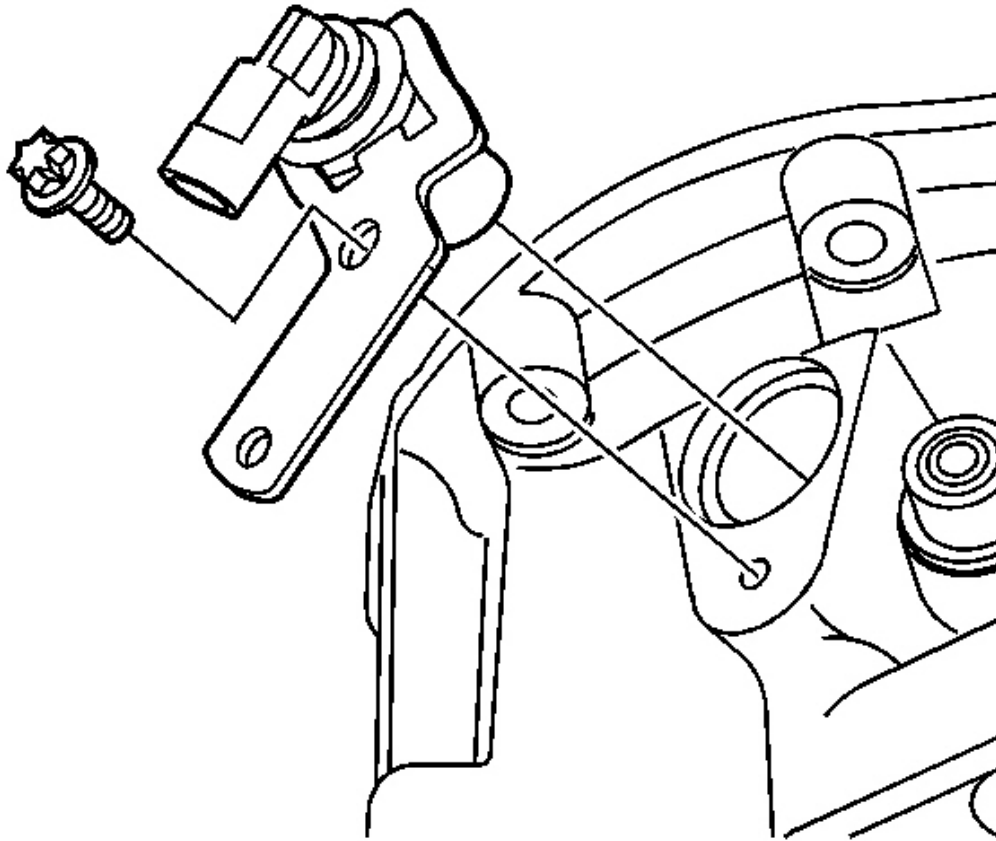


Fig. 10: View Of VSS
Courtesy of GENERAL MOTORS CORP.

4. Remove the vehicle speed sensor and bolt.

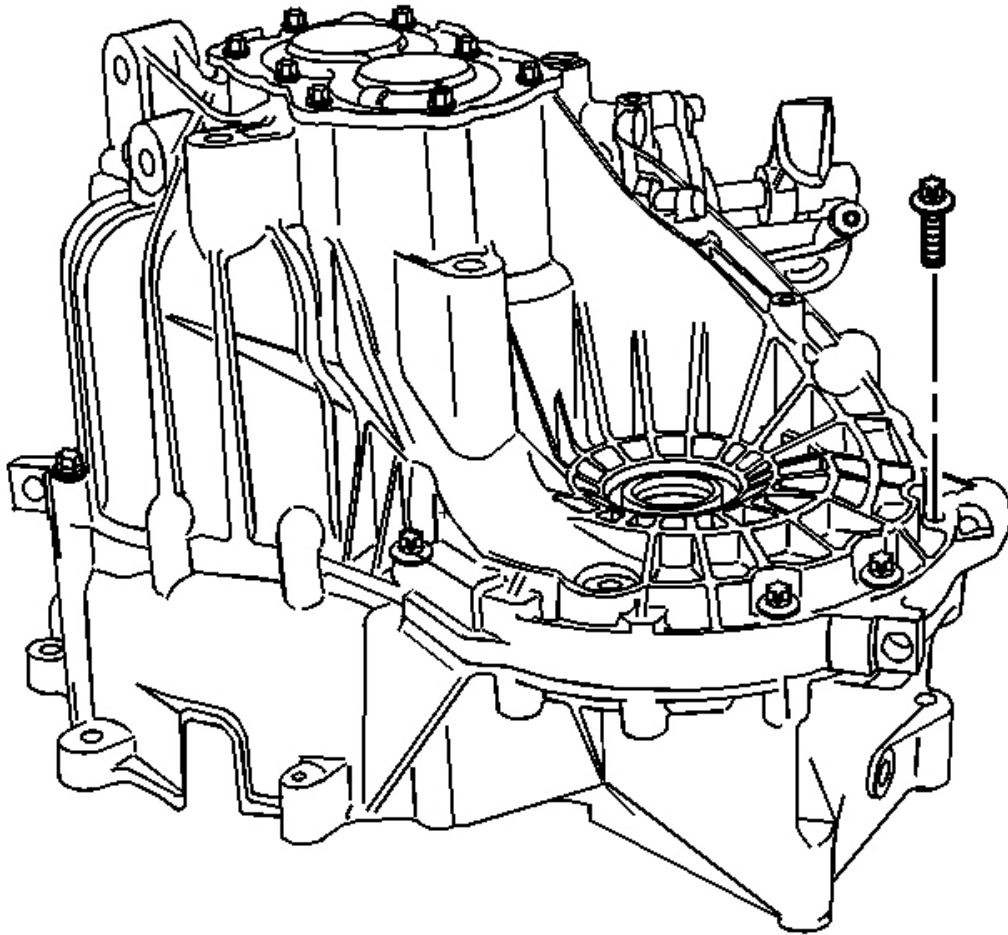


Fig. 11: View Of Transaxle Case Side Of Housing Bolt
Courtesy of GENERAL MOTORS CORP.

5. Position the transmission, with the transaxle case side facing up, on a bench.
6. Remove the seven bolts from the transaxle case side of the housing.
7. Turn the transmission over.

NOTE: Puncture the seal in the center to prevent damage to the transmission.

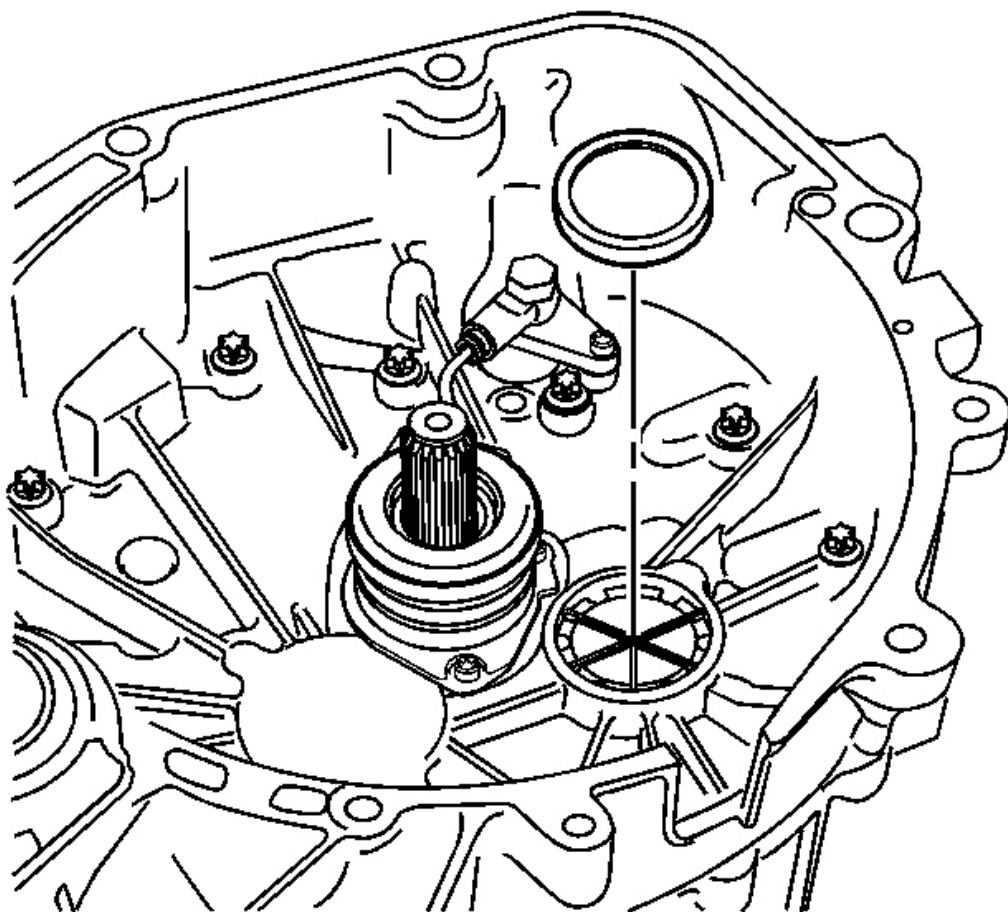


Fig. 12: Identifying Intermediate Shaft Seal
Courtesy of GENERAL MOTORS CORP.

8. Remove the intermediate shaft seal using a suitable tool. Discard the seal.

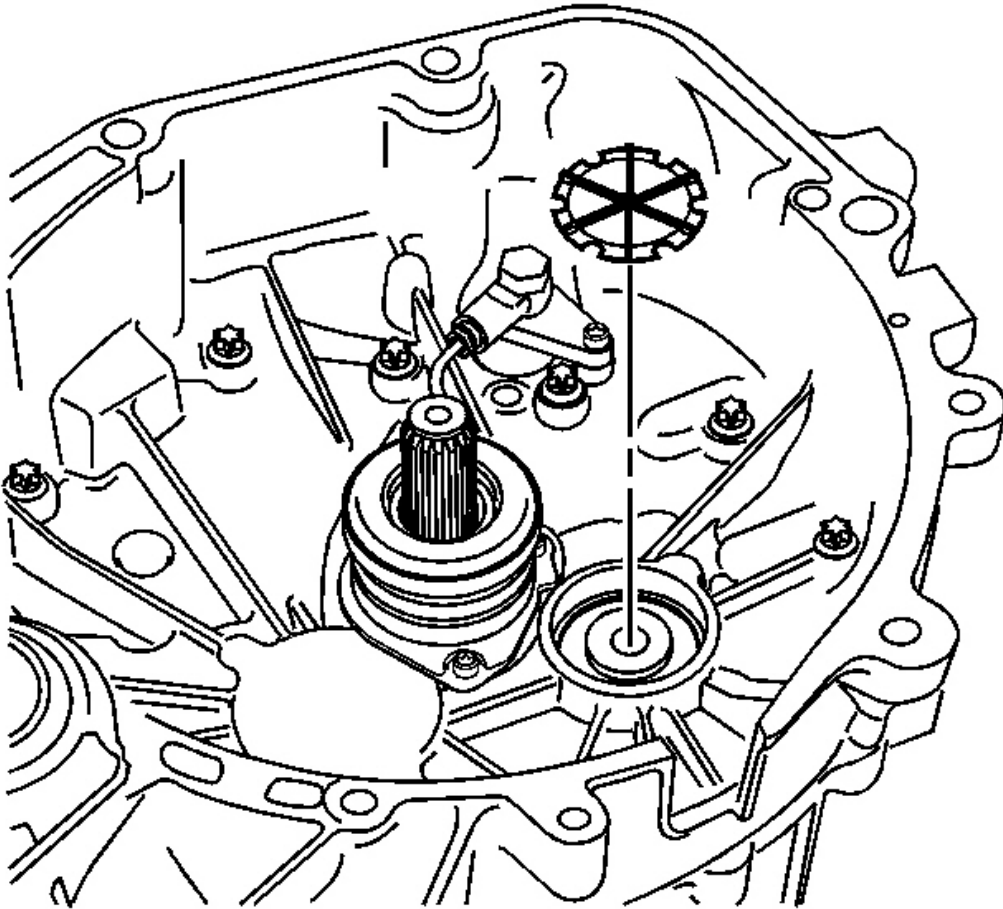


Fig. 13: Identifying Plastic Oil Guide
Courtesy of GENERAL MOTORS CORP.

9. Remove the plastic oil guide from the intermediate shaft using a suitable tool. Discard the oil guide.

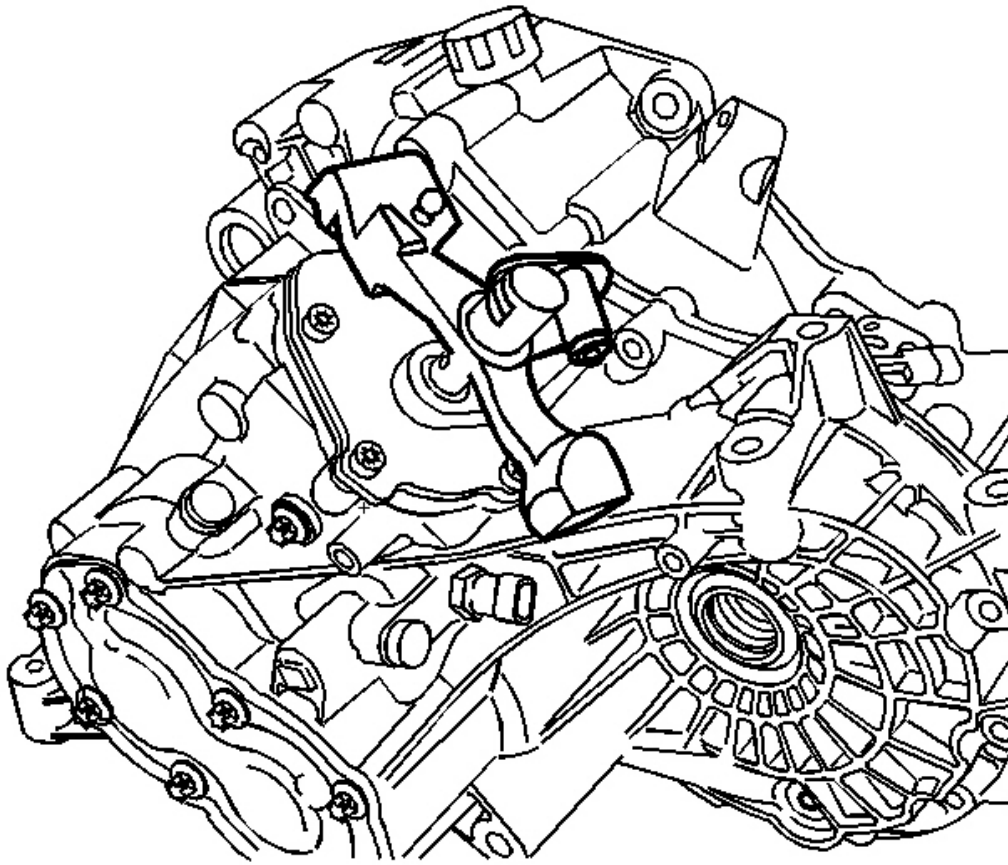


Fig. 14: Locating Shifter
Courtesy of GENERAL MOTORS CORP.

10. Turn the transmission so the shifter is on top.
11. Shift the transmission into any gear.
12. Hold the input shaft with **J 44377** .
13. Remove the bolt from the intermediate shaft.

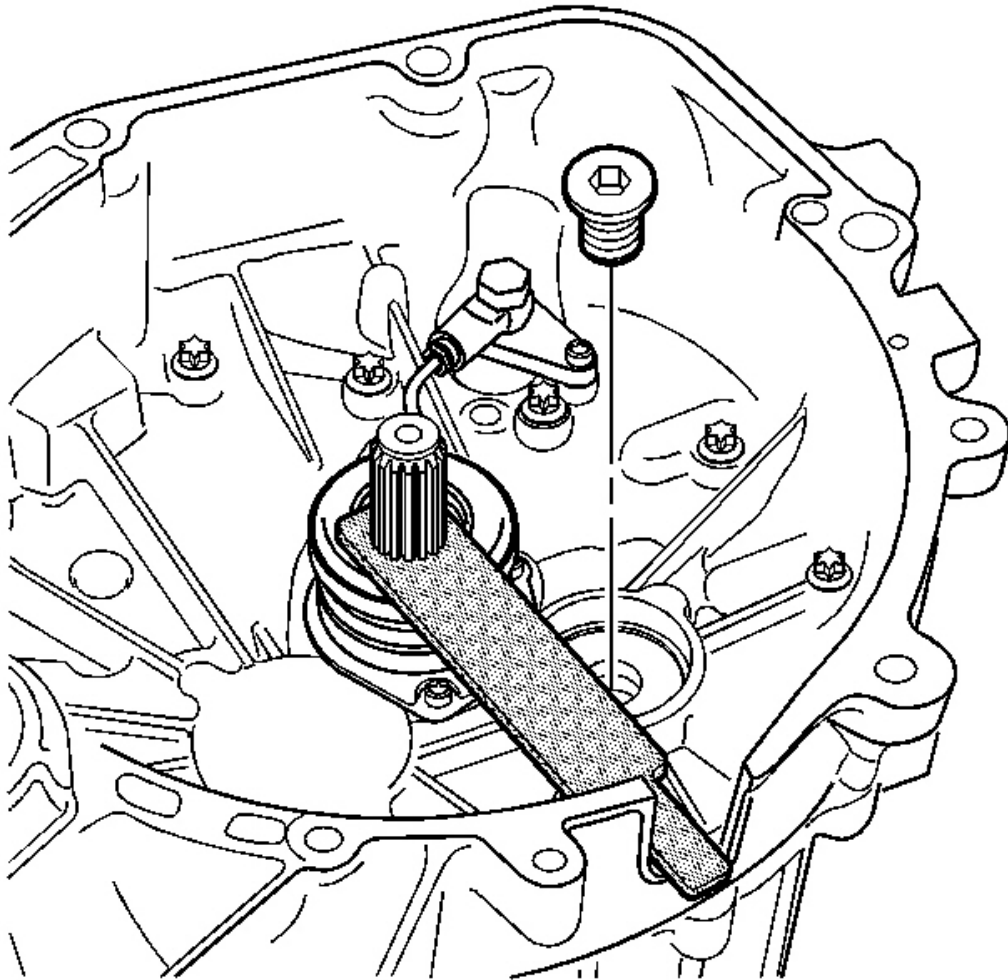


Fig. 15: View Of Intermediate Shaft Bolt
Courtesy of GENERAL MOTORS CORP.

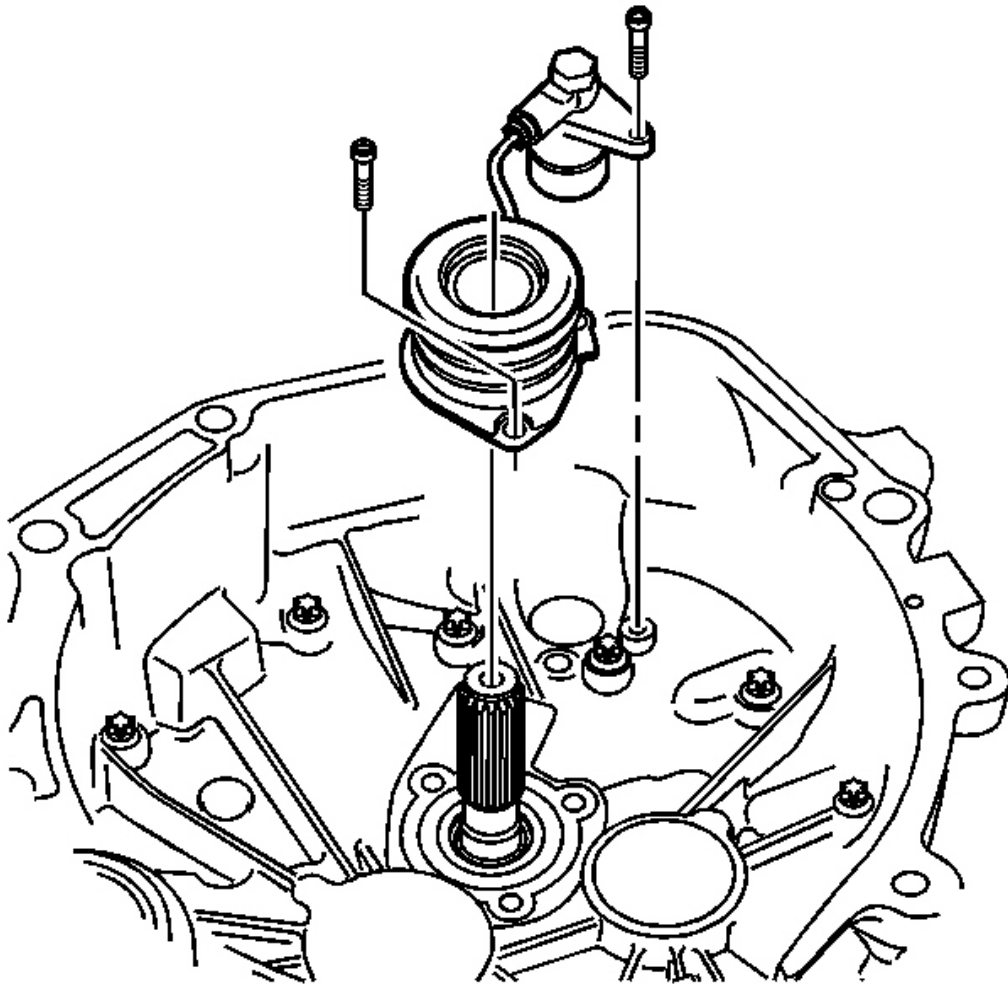


Fig. 16: View Of Actuator And Tube
Courtesy of GENERAL MOTORS CORP.

14. Remove the actuator and tube bolts.
15. Remove the actuator and tube.
16. Inspect the input shaft seal for cuts, nicks, and damage. If damaged, replace the actuator.
17. Shift the transmission into neutral.
18. Remove the shifter guide bolt.

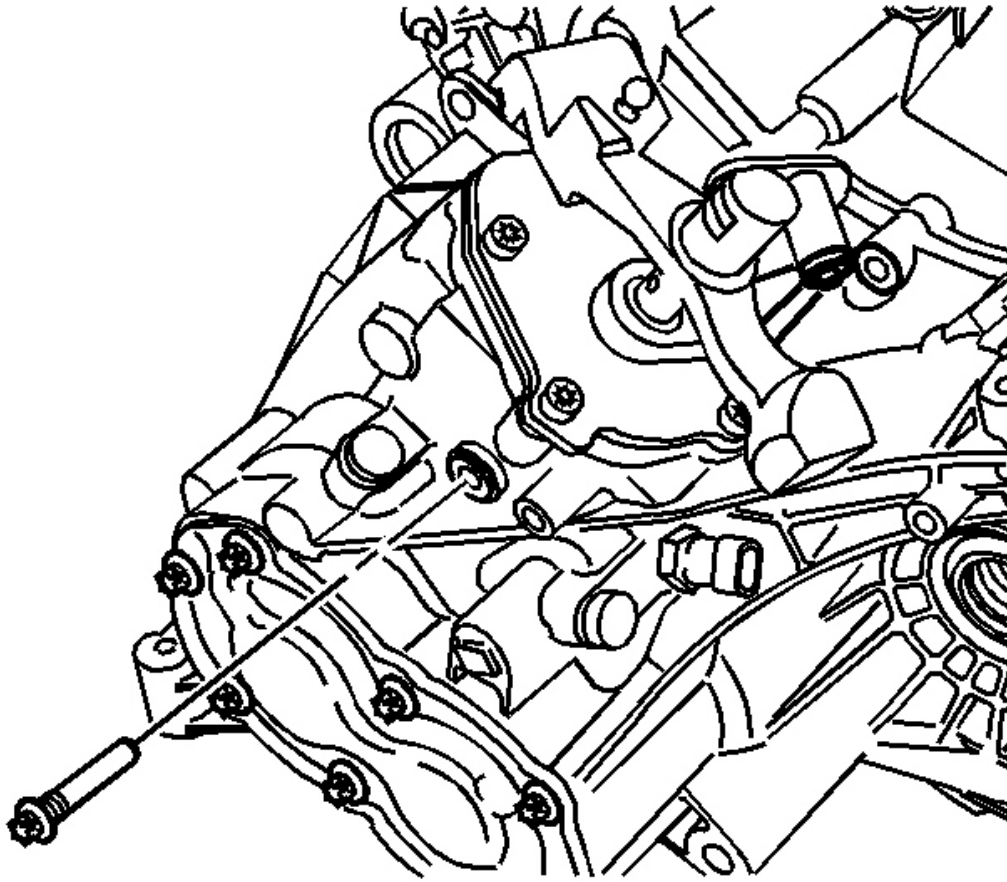


Fig. 17: View Of Shifter Guide Bolt
Courtesy of GENERAL MOTORS CORP.

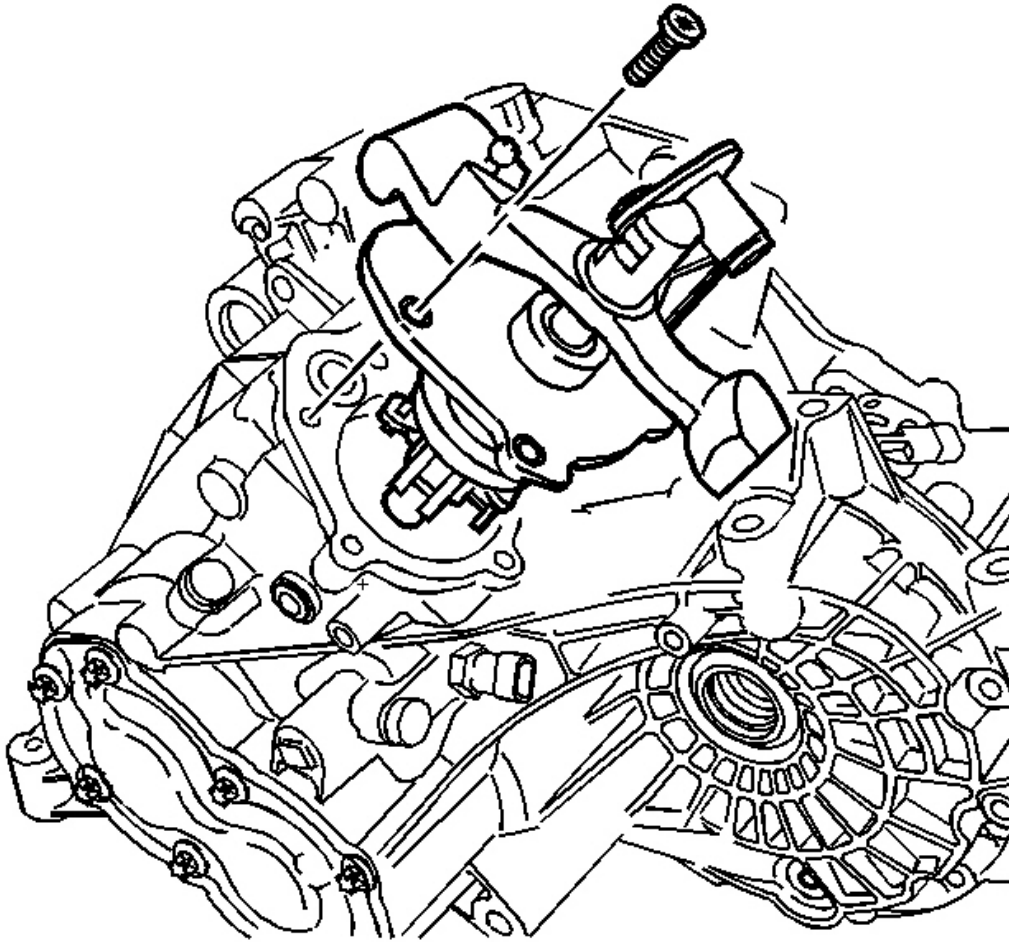


Fig. 18: View Of Shifter Assembly
Courtesy of GENERAL MOTORS CORP.

19. Remove the five shifter retaining bolts.
20. Remove the shifter.

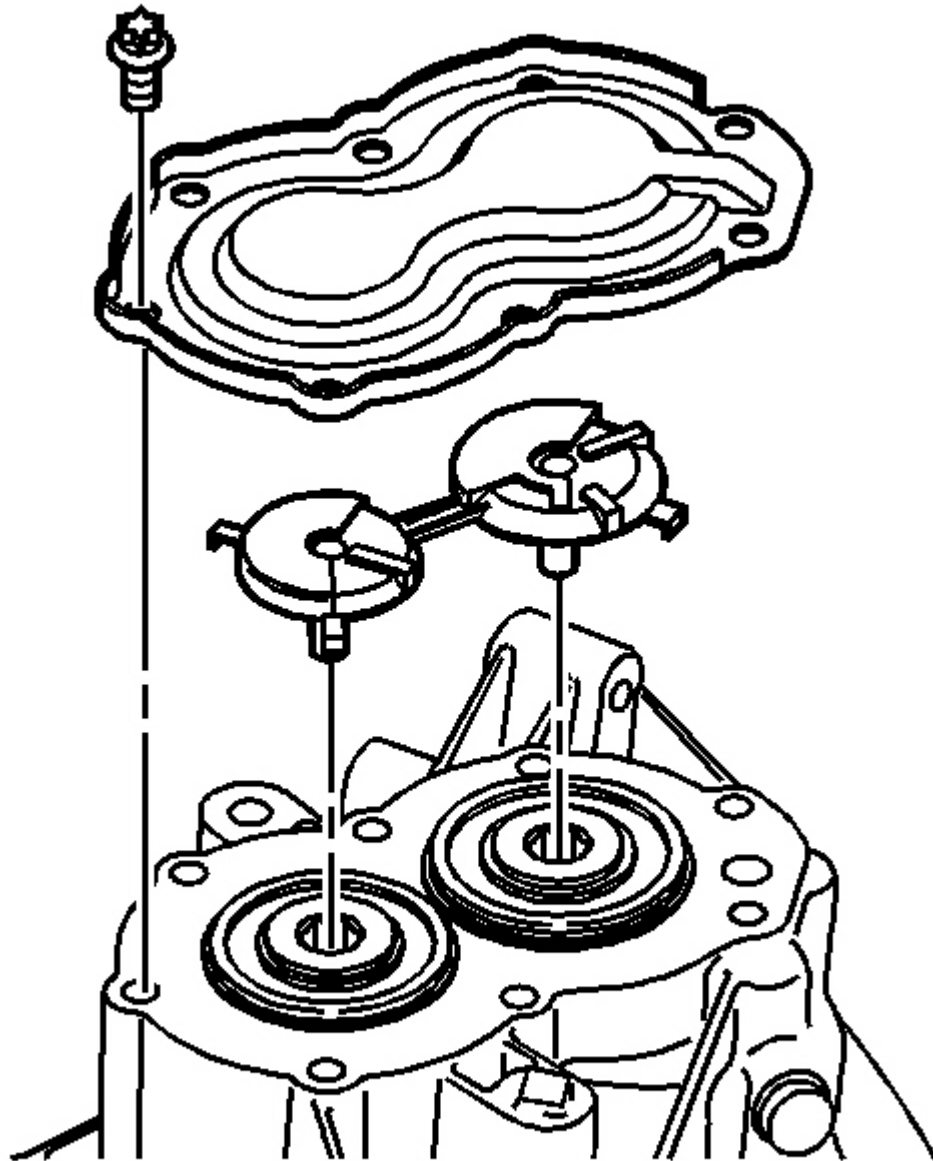


Fig. 19: View Of Rear Cover
Courtesy of GENERAL MOTORS CORP.

21. Remove the rear cover bolts.
22. Remove the rear cover.
23. Remove the oil guide.

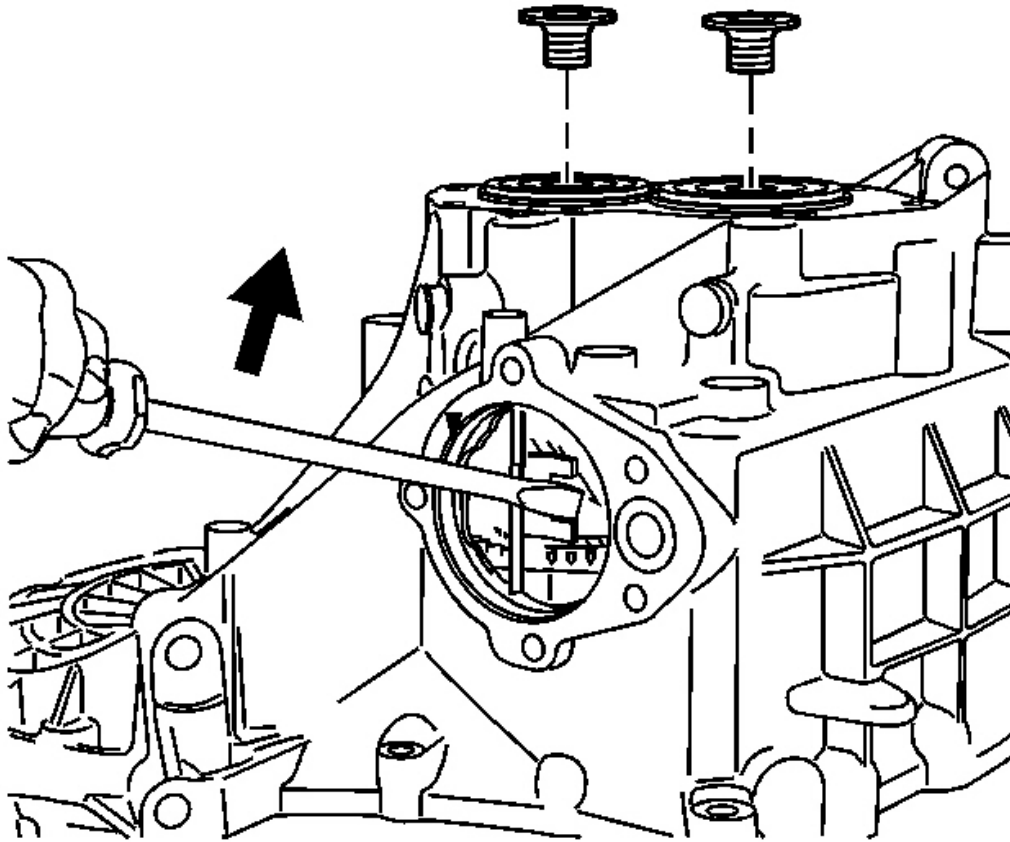


Fig. 20: Shifting Transmission Into 4th And 5th Gear Using A Screwdriver
Courtesy of GENERAL MOTORS CORP.

24. Shift the transmission into 4th and 5th gear using a screwdriver in an upward direction.
25. Remove the two shaft bolts while holding the transmission into 4th and 5th gear with a screwdriver in an upward direction.

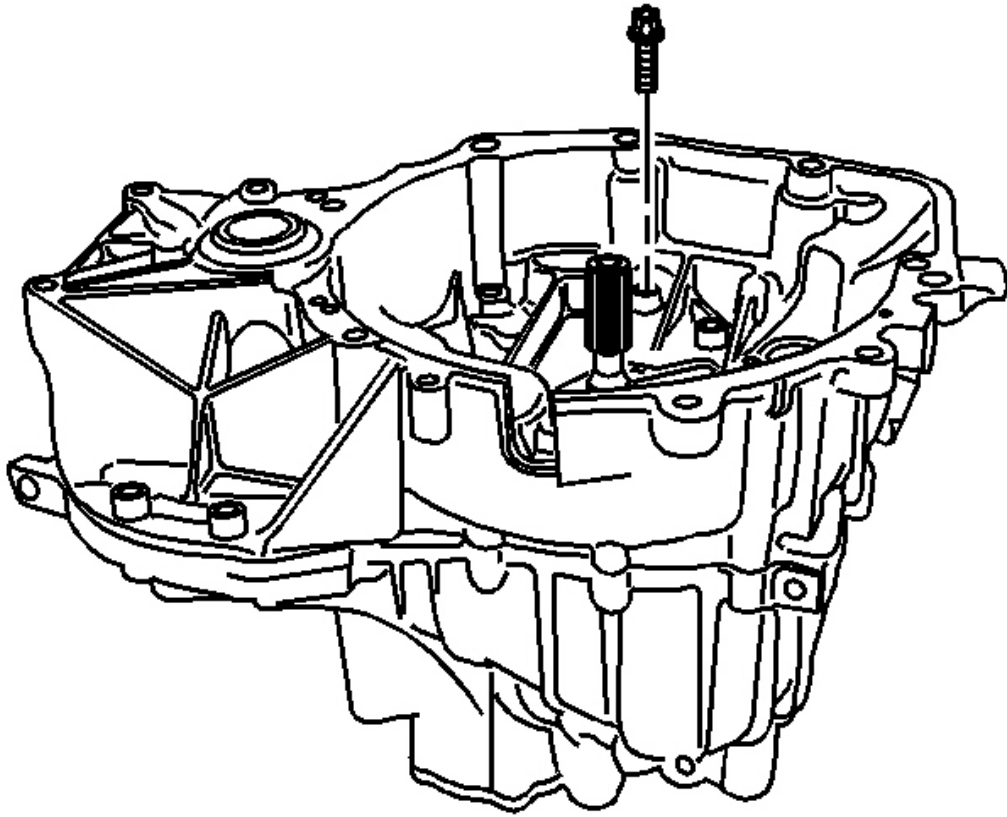


Fig. 21: View Of Clutch Housing Side Transmission Housing Bolt
Courtesy of GENERAL MOTORS CORP.

26. Turn the transmission over and remove the remainder of the transmission housing bolts from the clutch housing side.

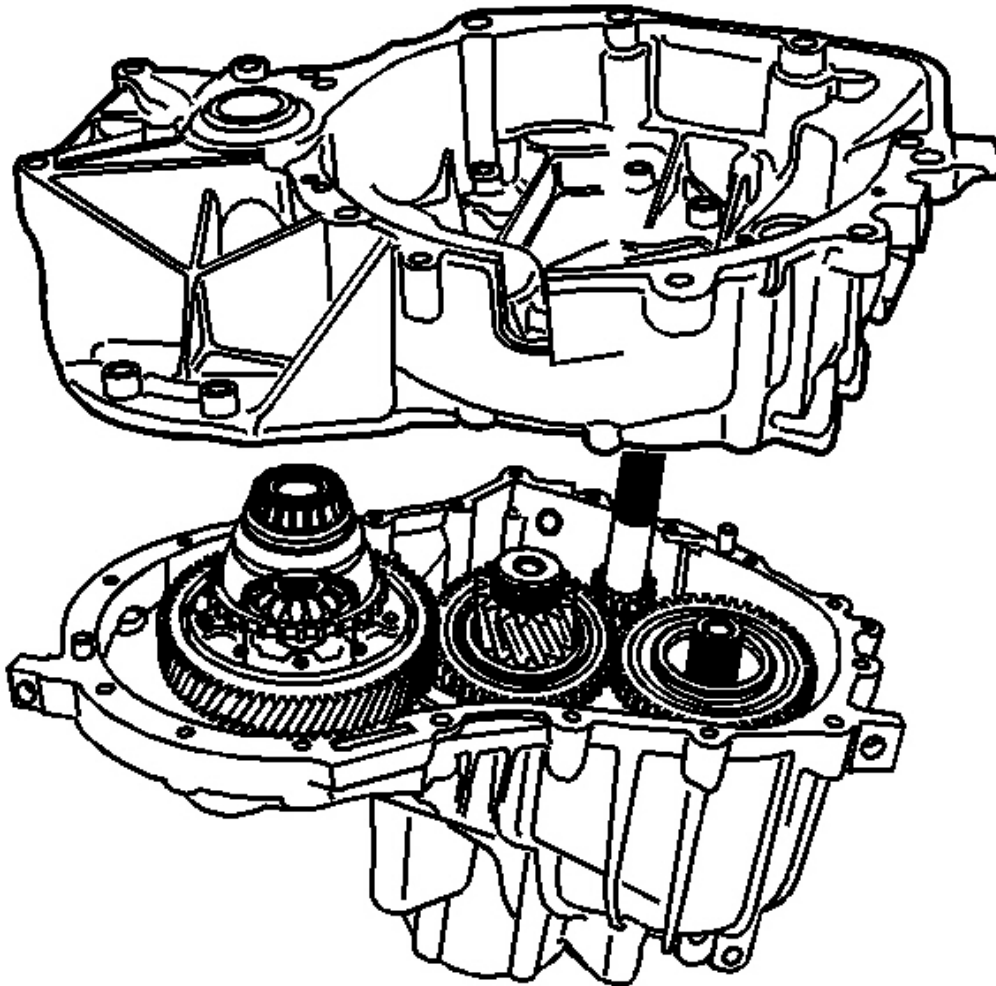


Fig. 22: View Of Clutch Housing & Transaxle Case
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: In line with the intermediate shaft, use two suitable tools to assist in the case separation.

27. Remove the clutch housing from the transaxle case.

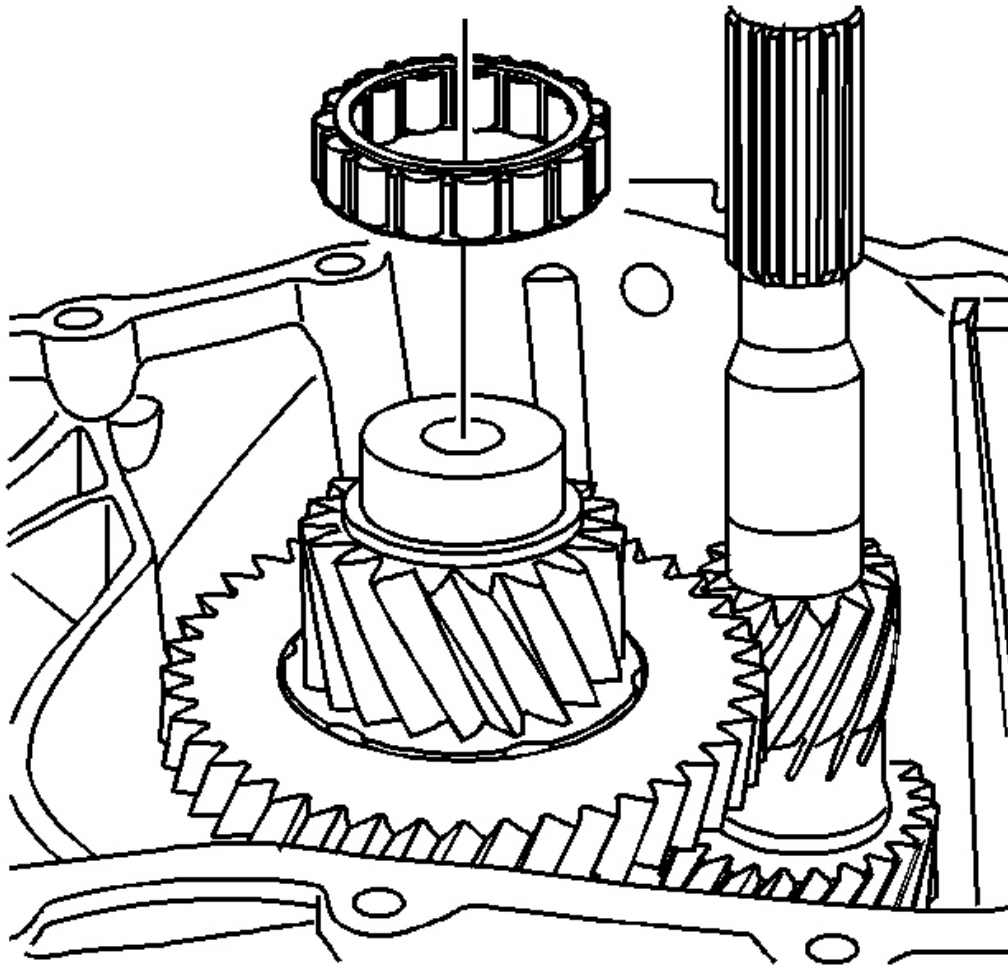


Fig. 23: View Of Roller Bearing
Courtesy of GENERAL MOTORS CORP.

28. Remove the roller bearing from the output shaft.

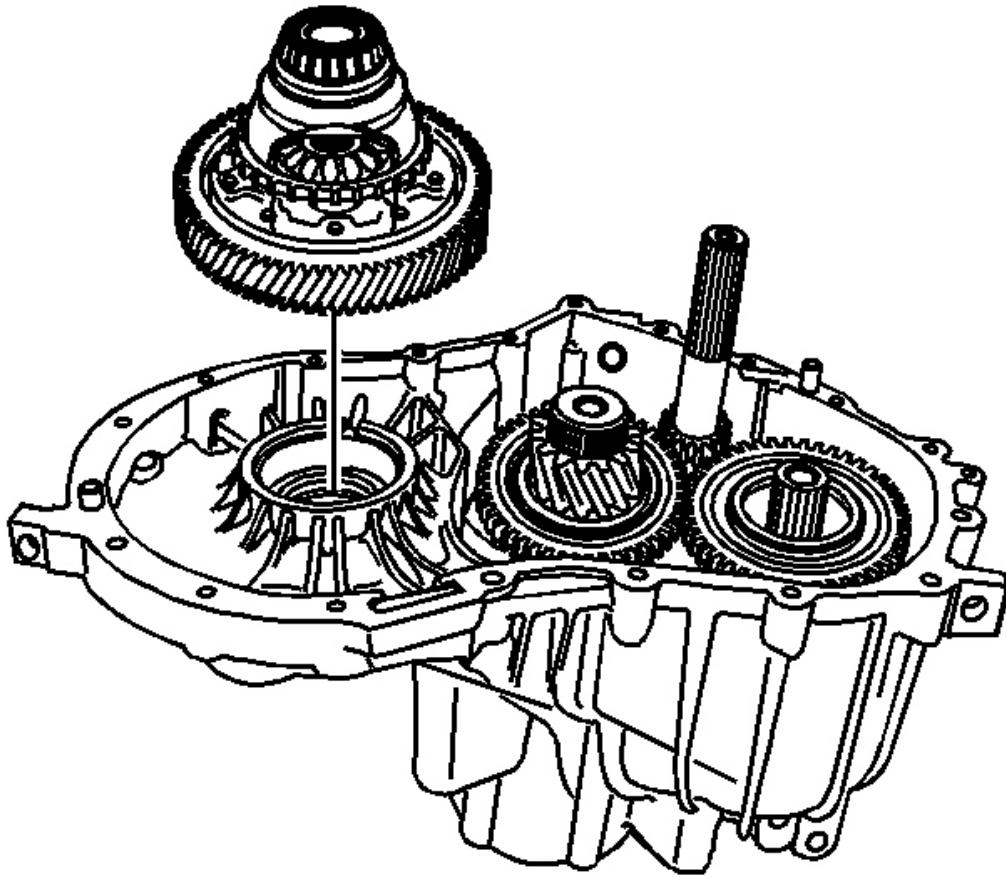


Fig. 24: View Of Differential
Courtesy of GENERAL MOTORS CORP.

29. Remove the differential from the transaxle case.

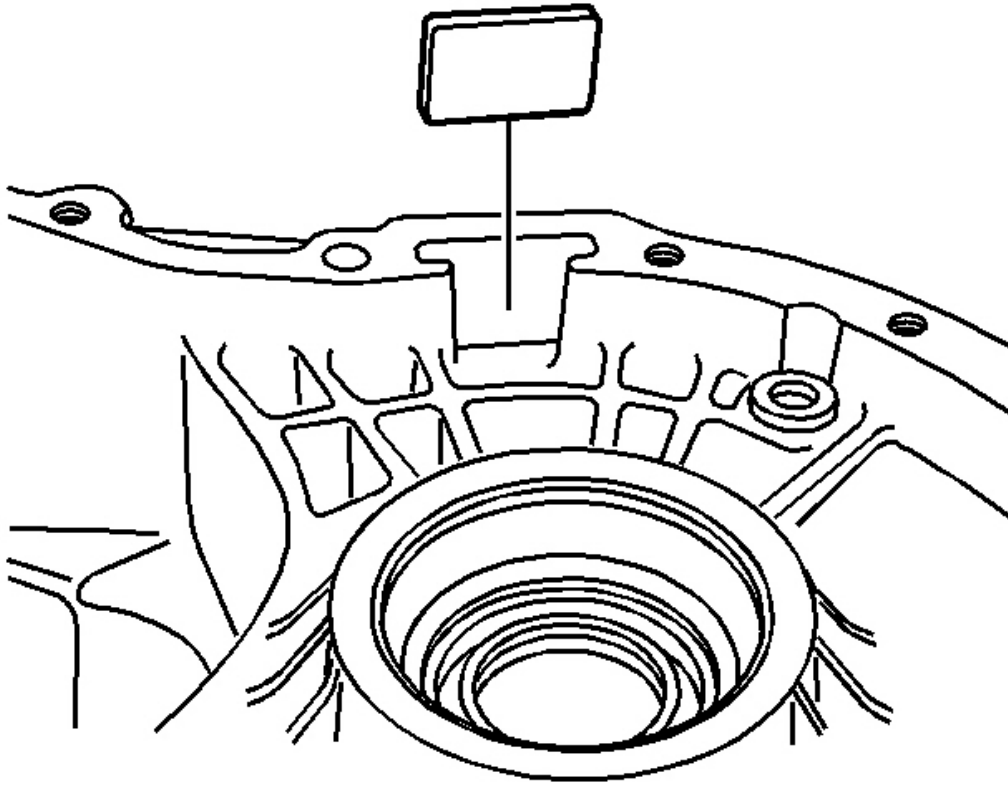


Fig. 25: View Of Transaxle Magnet
Courtesy of GENERAL MOTORS CORP.

30. Remove the magnet from the transaxle case.

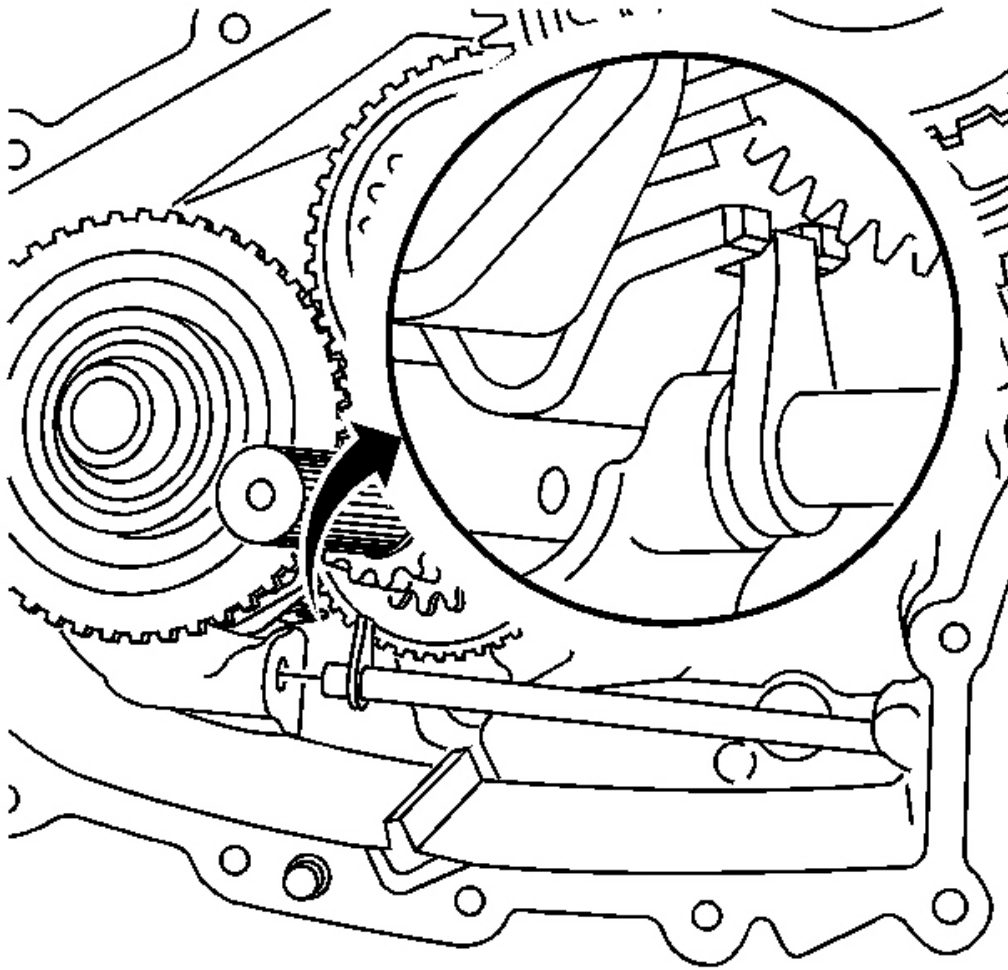


Fig. 26: View Of Shift Fork
Courtesy of GENERAL MOTORS CORP.

31. Slide outward and unhook the shift rod from the shift fork.

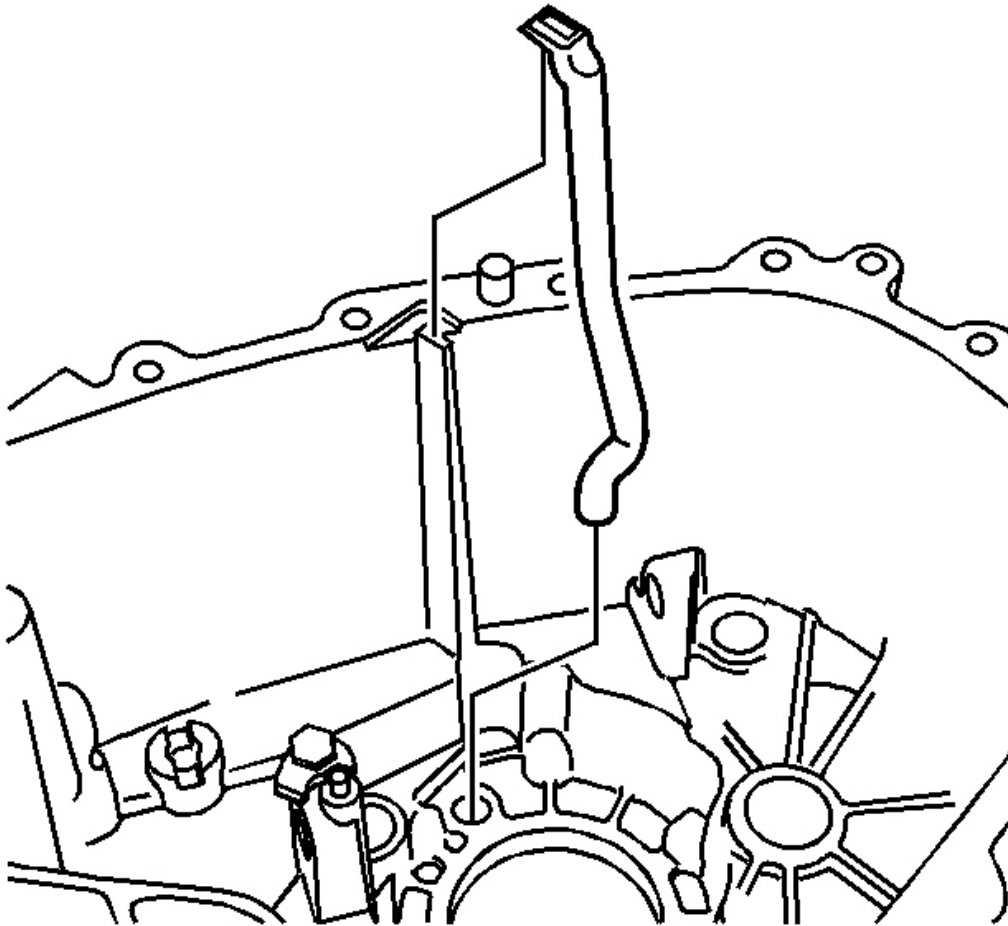


Fig. 27: View Of Oil Tube
Courtesy of GENERAL MOTORS CORP.

32. Remove the oil tube from the transaxle case.

IMPORTANT: Ensure all of the shafts are in the proper slots on the holding fixture.

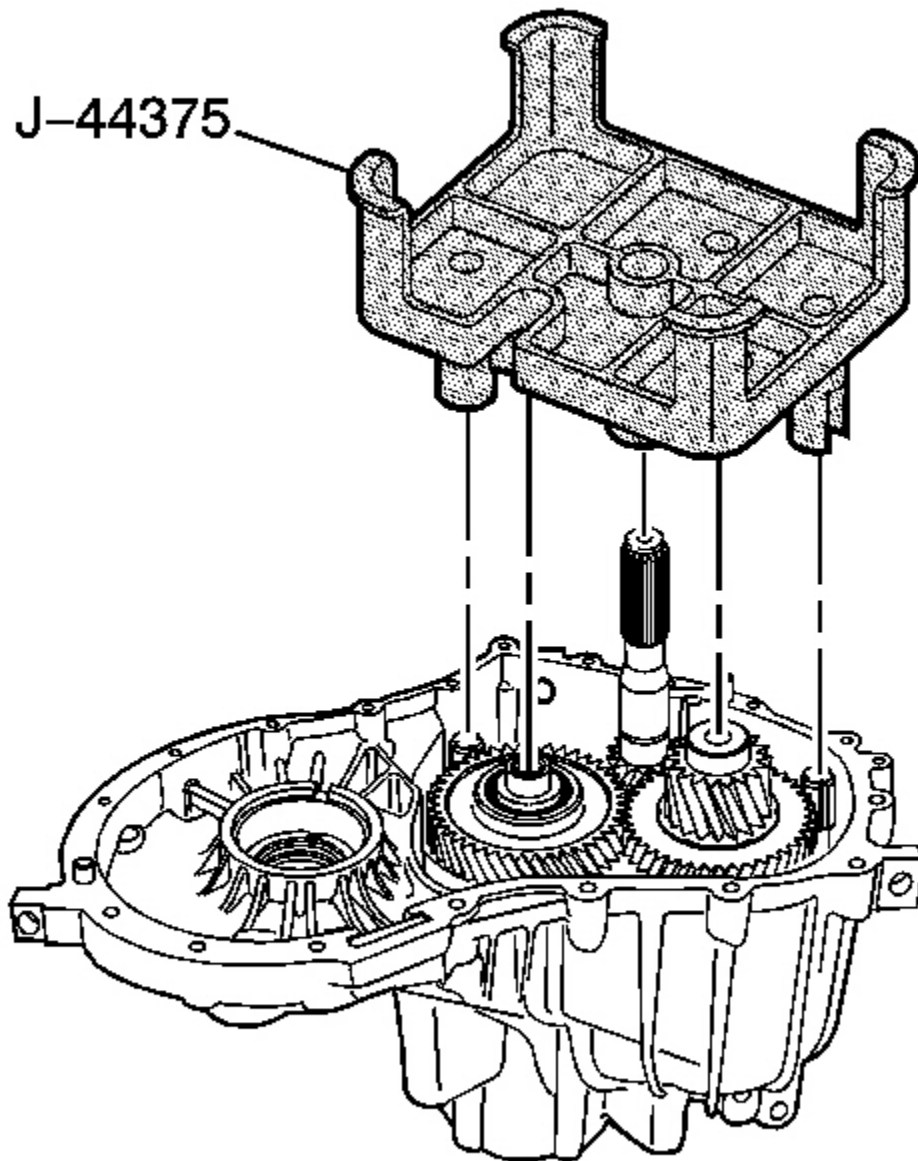


Fig. 28: Identifying J 44375
Courtesy of GENERAL MOTORS CORP.

33. Install the **J 44375** onto the gear shafts and the shift forks.

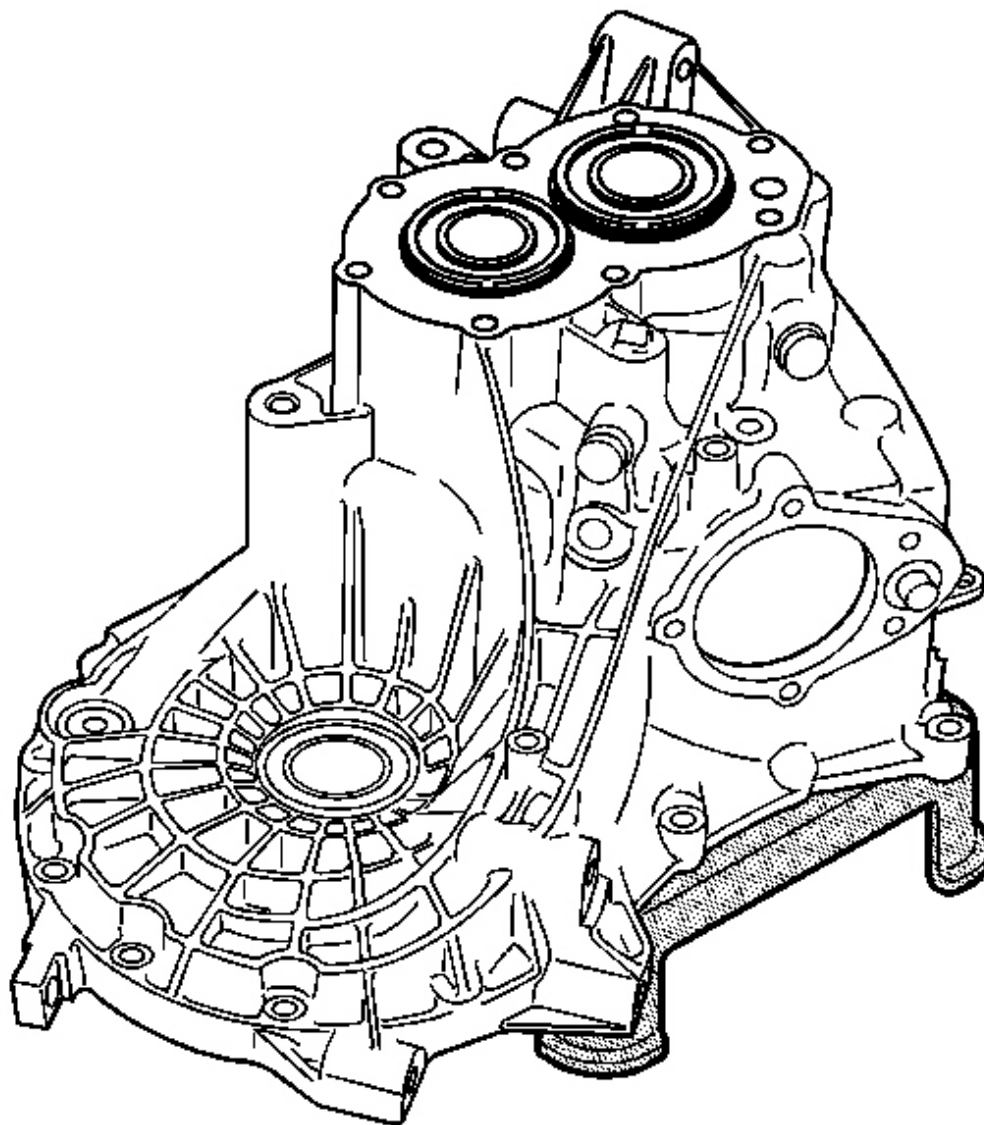


Fig. 29: Turning Transaxle Case On Onto J 44375
Courtesy of GENERAL MOTORS CORP.

34. Turn the transaxle case over on the J 44375 .

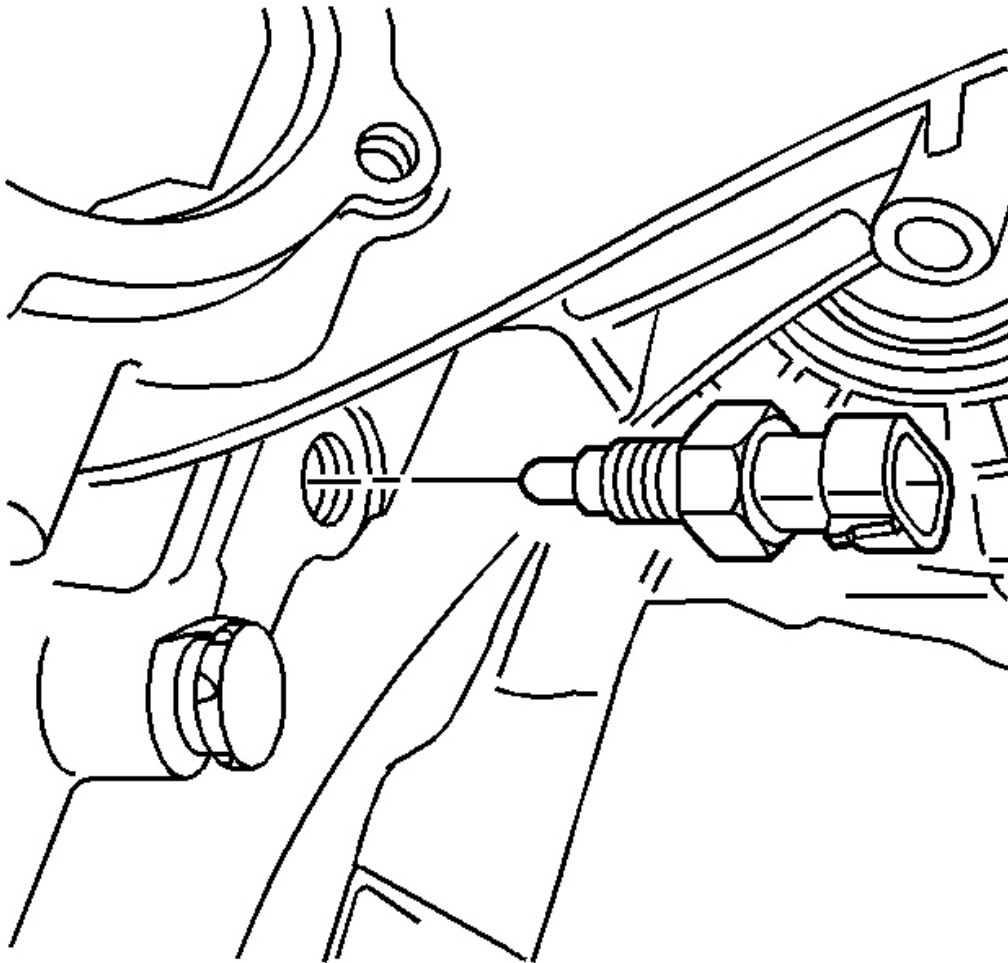


Fig. 30: View Of Reverse Lamp Switch
Courtesy of GENERAL MOTORS CORP.

35. Remove the reverse lamp switch.

IMPORTANT: Alternate the tightening of the jack screws on the J 44376 to ensure proper removal of the transaxle case.

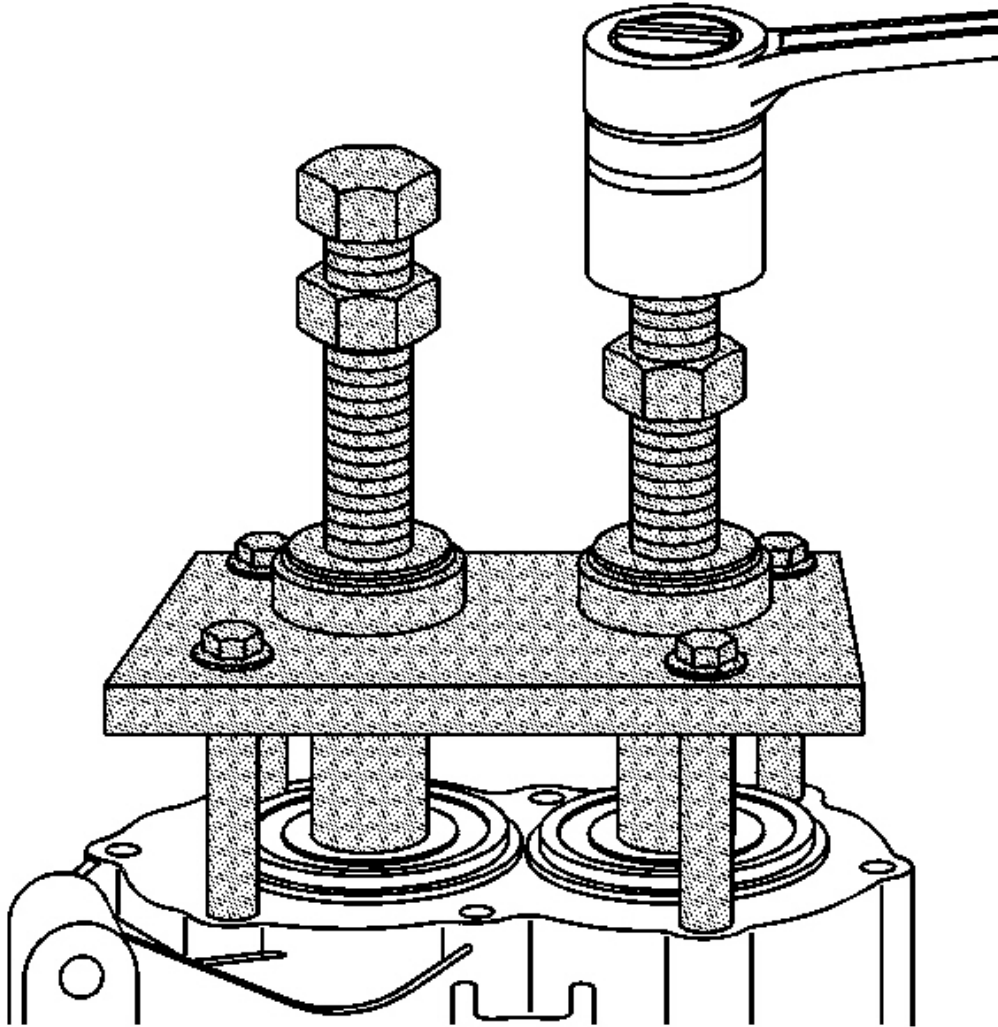


Fig. 31: Removing Transaxle Case From Shafts Using J 44376-1, J 44376-2, And J 44376-3
Courtesy of GENERAL MOTORS CORP.

36. Remove the transaxle case from the shafts using the J 44376-1, J 44376-2, and J 44376-3.

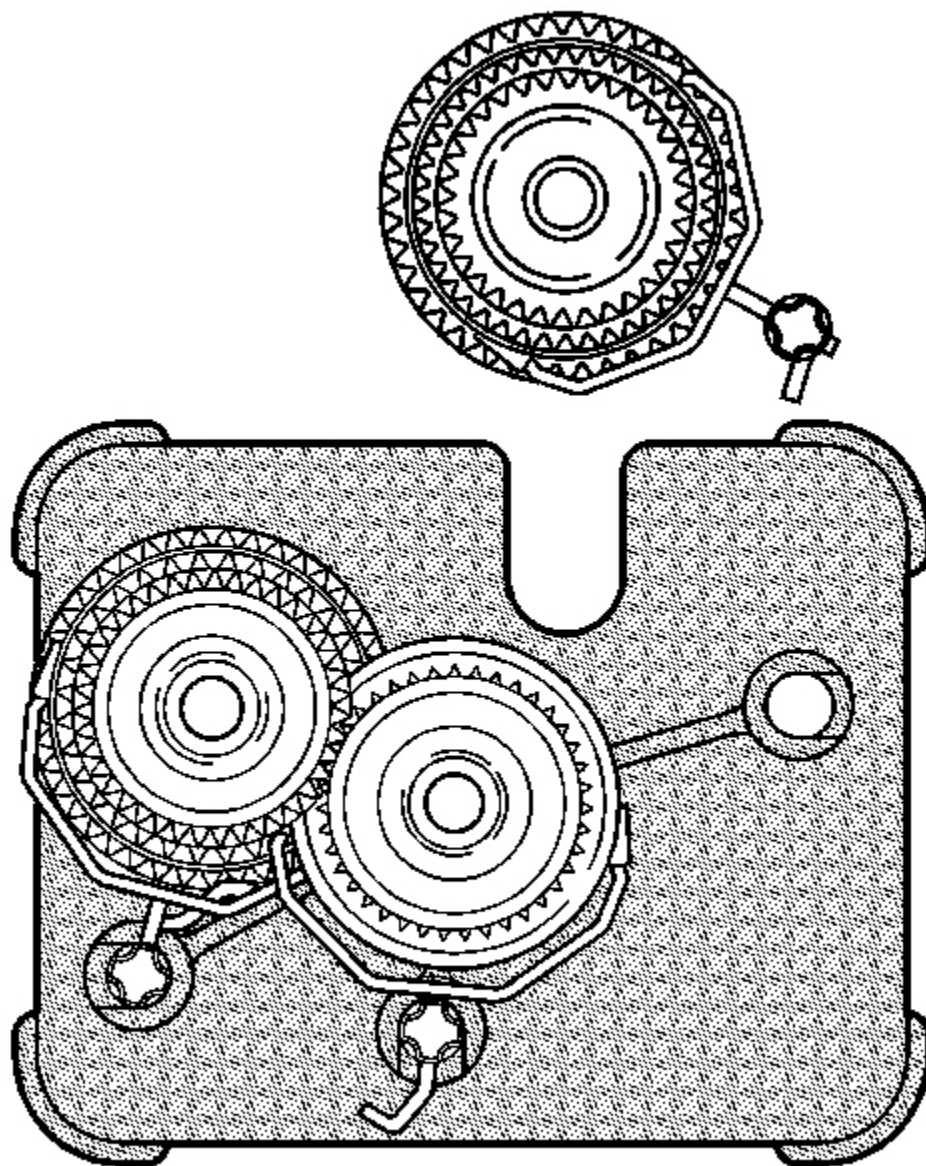


Fig. 32: View Of Intermediate Shaft & Shift Fork
Courtesy of GENERAL MOTORS CORP.

37. Remove the intermediate shaft and shift fork from the input shaft, the output shaft, and the **J 44375** .

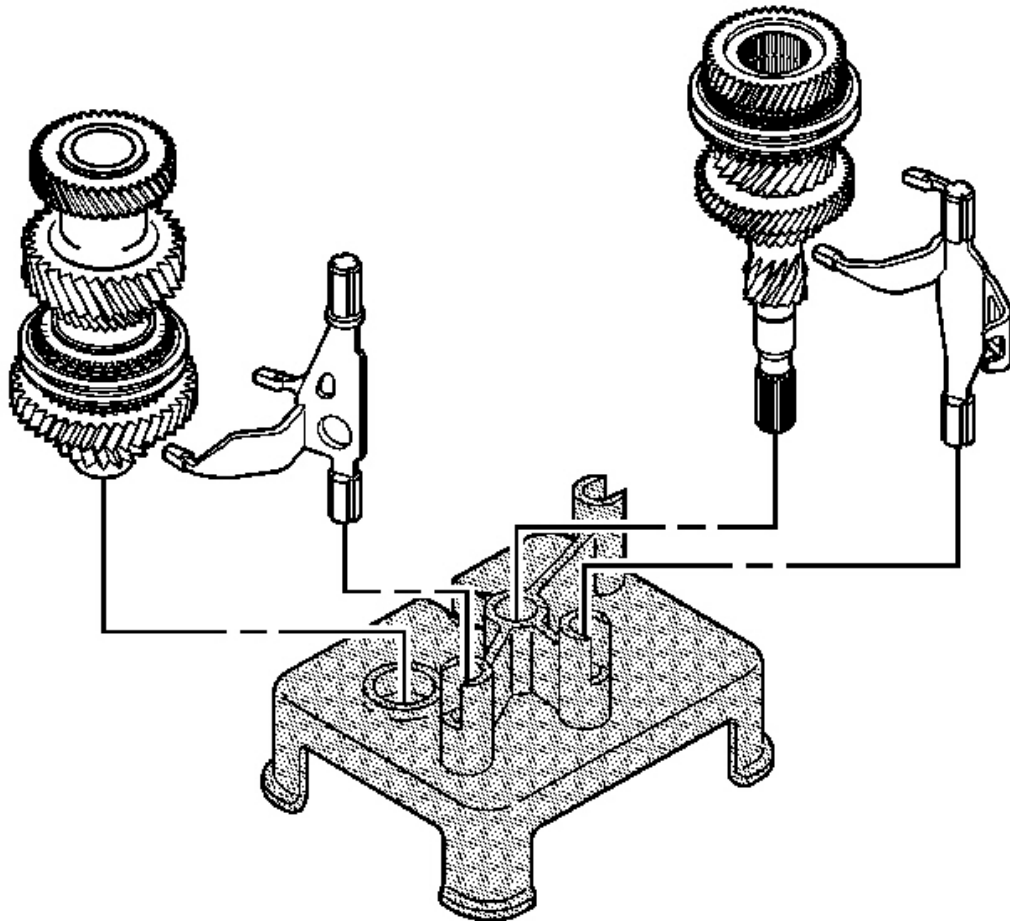


Fig. 33: View Of Gear Assemblies & Shift Forks
Courtesy of GENERAL MOTORS CORP.

38. Remove the remaining gear assemblies from the holding fixtures.
39. Remove the shift forks from the gear assemblies.

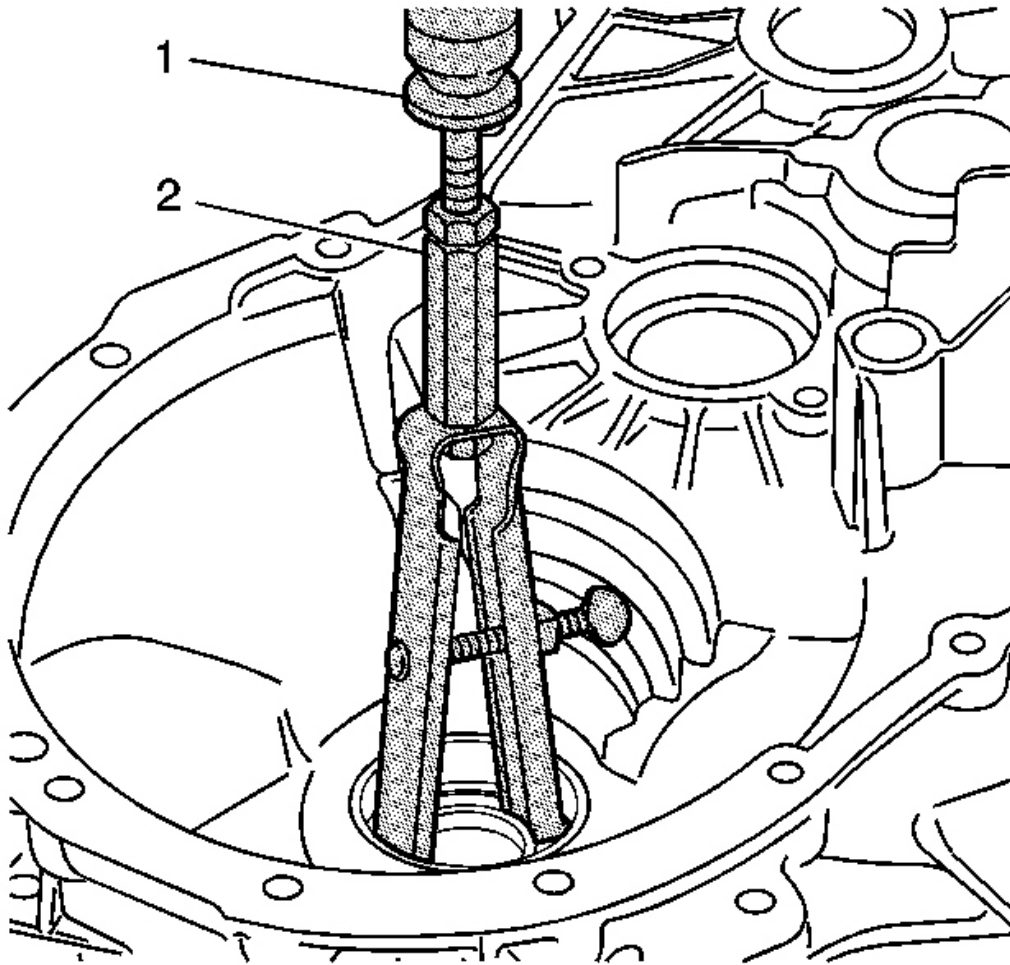


Fig. 34: Removing Differential Bearing Outer Race From Clutch Housing Using J 44380 & J 23907
Courtesy of GENERAL MOTORS CORP.

40. Using the **J 44380** (2) and the **J 23907** (1), remove the differential bearing outer race from the clutch housing. Discard the race.

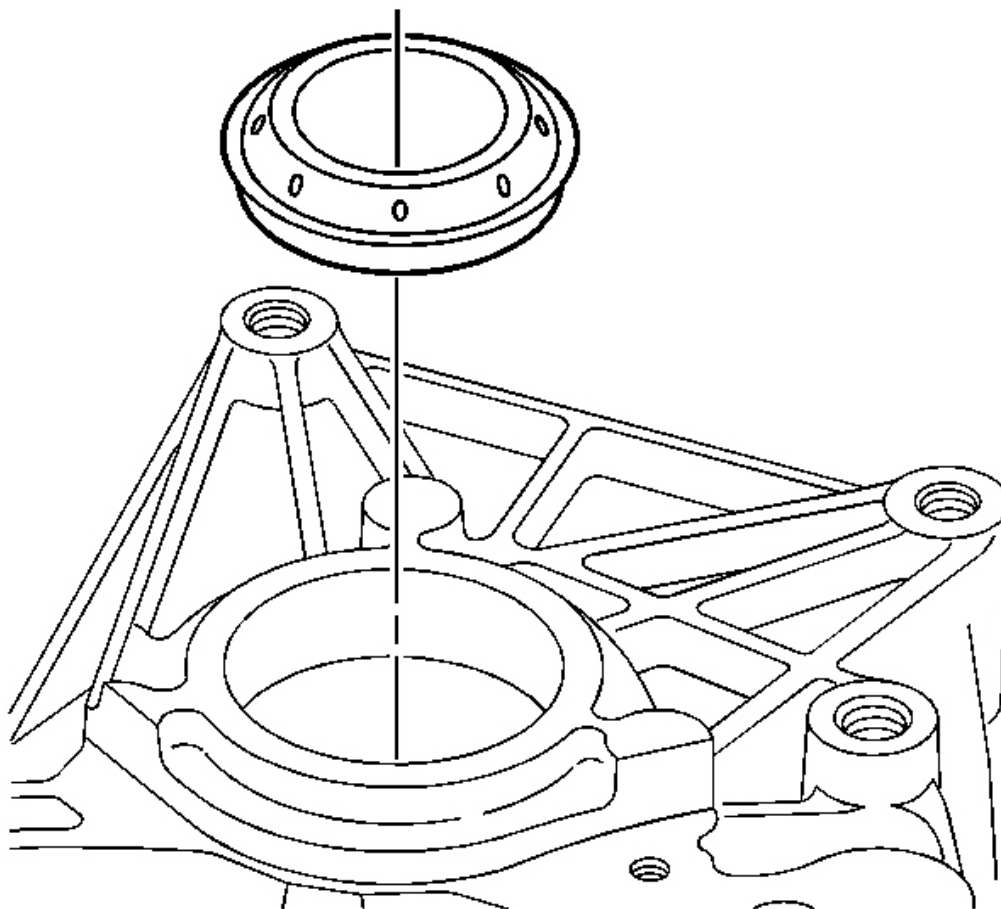


Fig. 35: View Of Differential Output Shaft Seal
Courtesy of GENERAL MOTORS CORP.

41. Remove the differential output shaft seal from the clutch housing. Discard the seal.

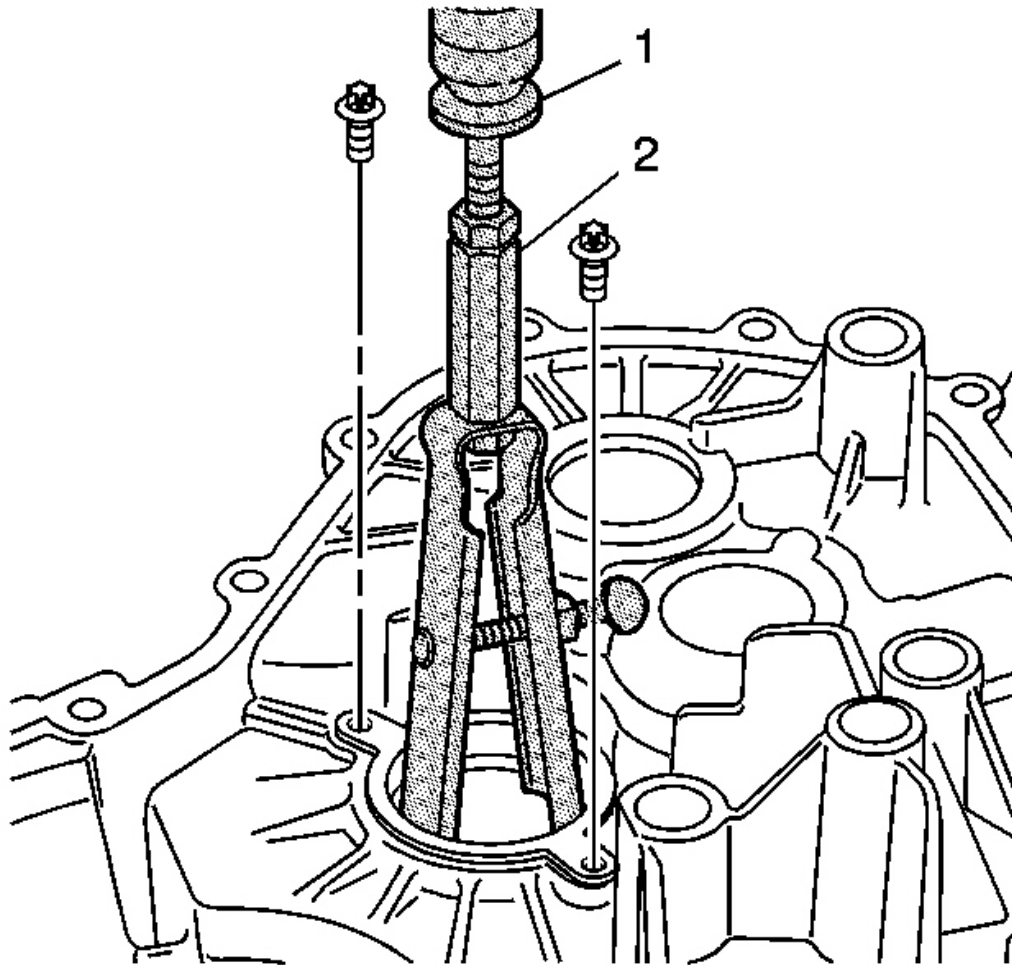


Fig. 36: Removing Output Shaft Bearing Race And Bolts From The Clutch Housing Using The J 23907 And The J 44380

Courtesy of GENERAL MOTORS CORP.

42. Remove the output shaft bearing race and bolts from the clutch housing using the **J 23907** (1) and the **J 44380** (2).

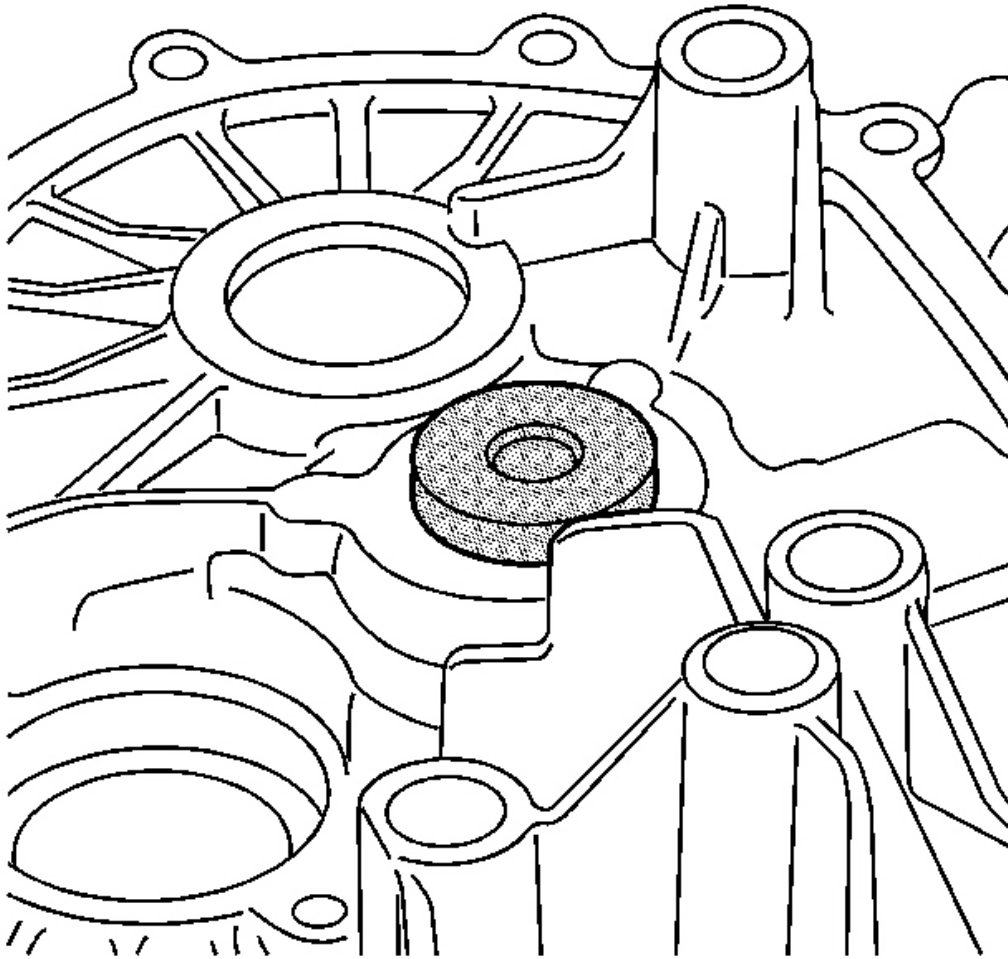


Fig. 37: Locating Input Shaft Bearing
Courtesy of GENERAL MOTORS CORP.

43. Remove the input shaft bearing from the clutch housing using the **J 44381** and **J 7079-2** .
44. Remove the snap ring from the counter shaft bearing.
45. Remove the counter shaft bearing from the clutch housing using the **J 44381** (2) and the **J 7079-2** (1).

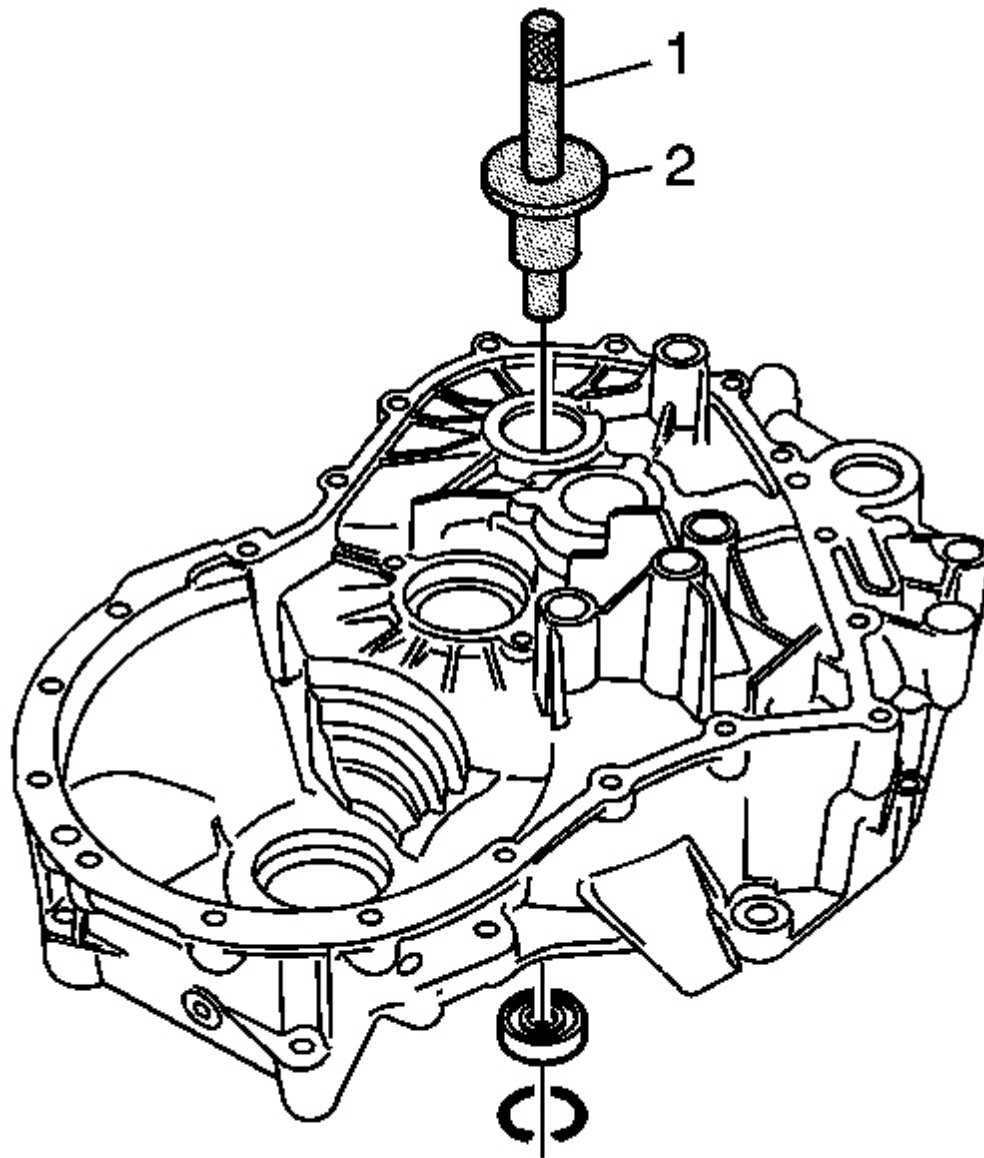


Fig. 38: Removing Counter Shaft Bearing & Shaft Ring Using The J 44381 And J 7079-2
Courtesy of GENERAL MOTORS CORP.

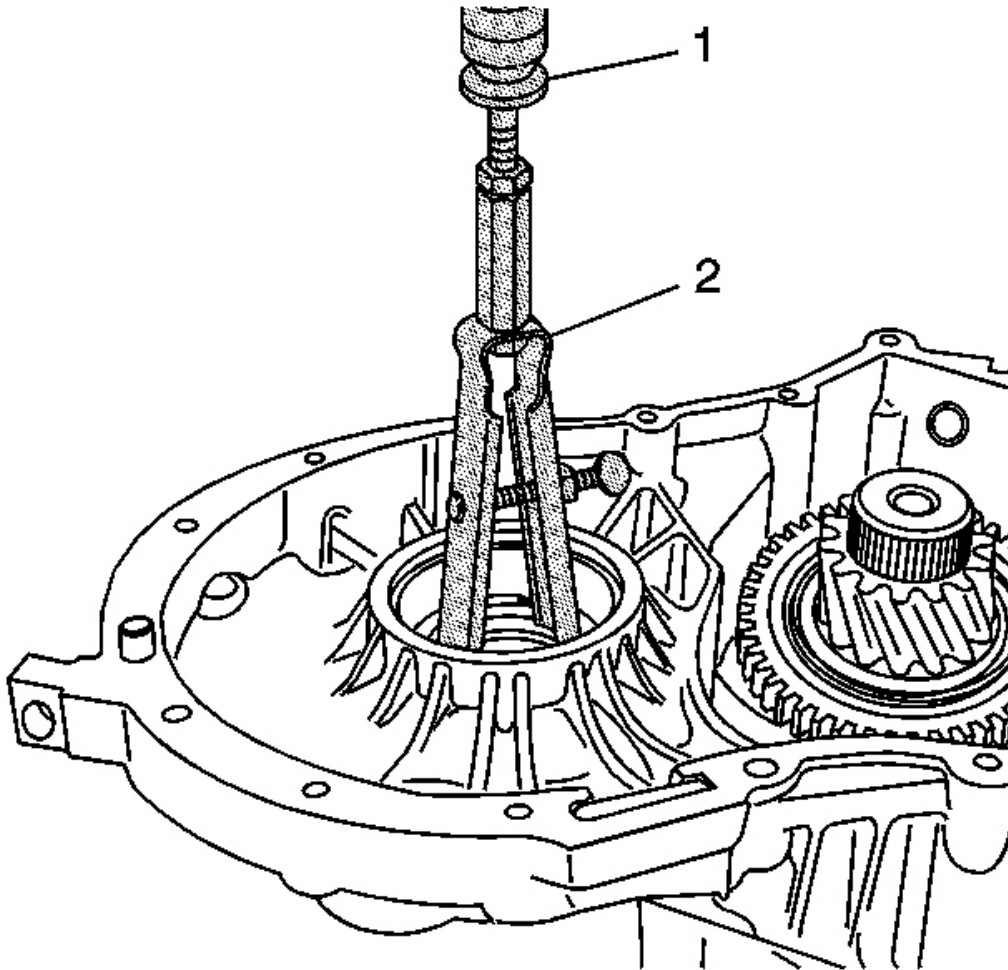


Fig. 39: Removing Differential Bearing Outer Race Using The J 44380 And J 23907
Courtesy of GENERAL MOTORS CORP.

46. Remove the differential bearing outer race from the transmission housing using the **J 44380** (2) and the **J 23907** (1). Discard the race.

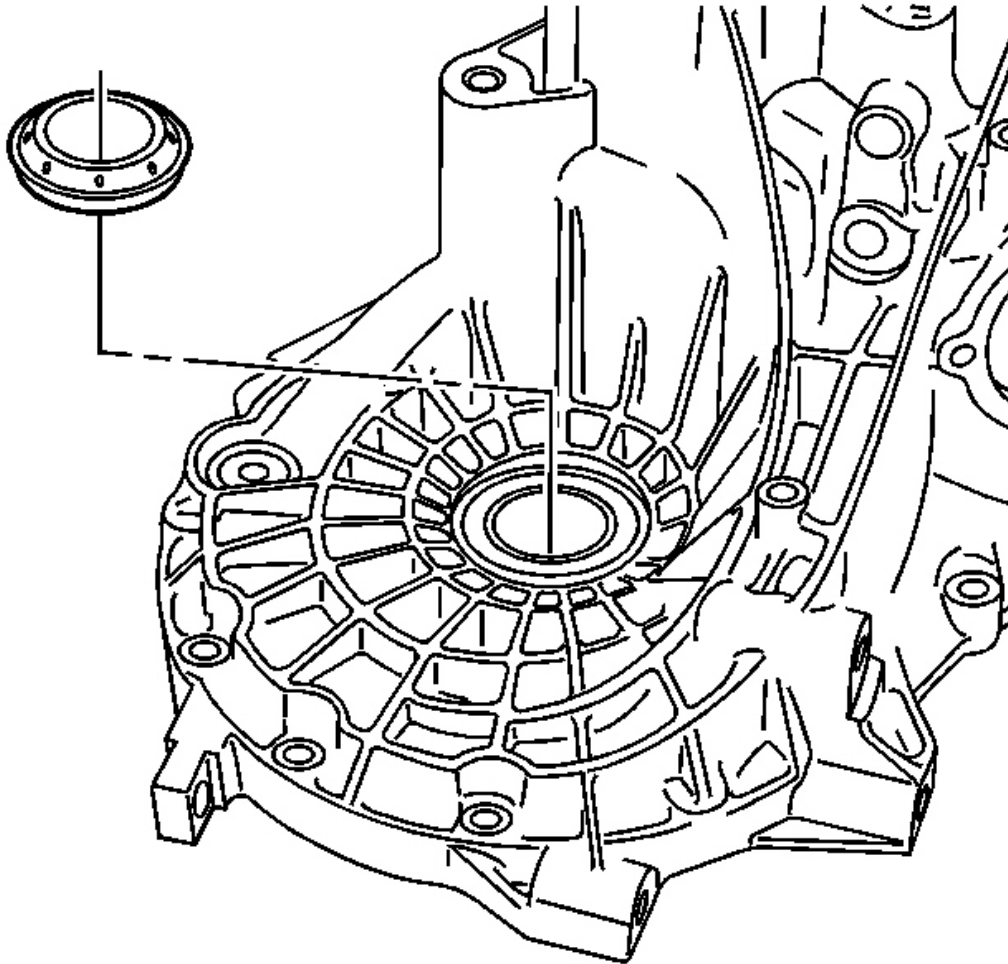


Fig. 40: View Of Differential Output Shaft Seal
Courtesy of GENERAL MOTORS CORP.

47. Remove the differential output shaft seal from the transmission housing. Discard the seal.

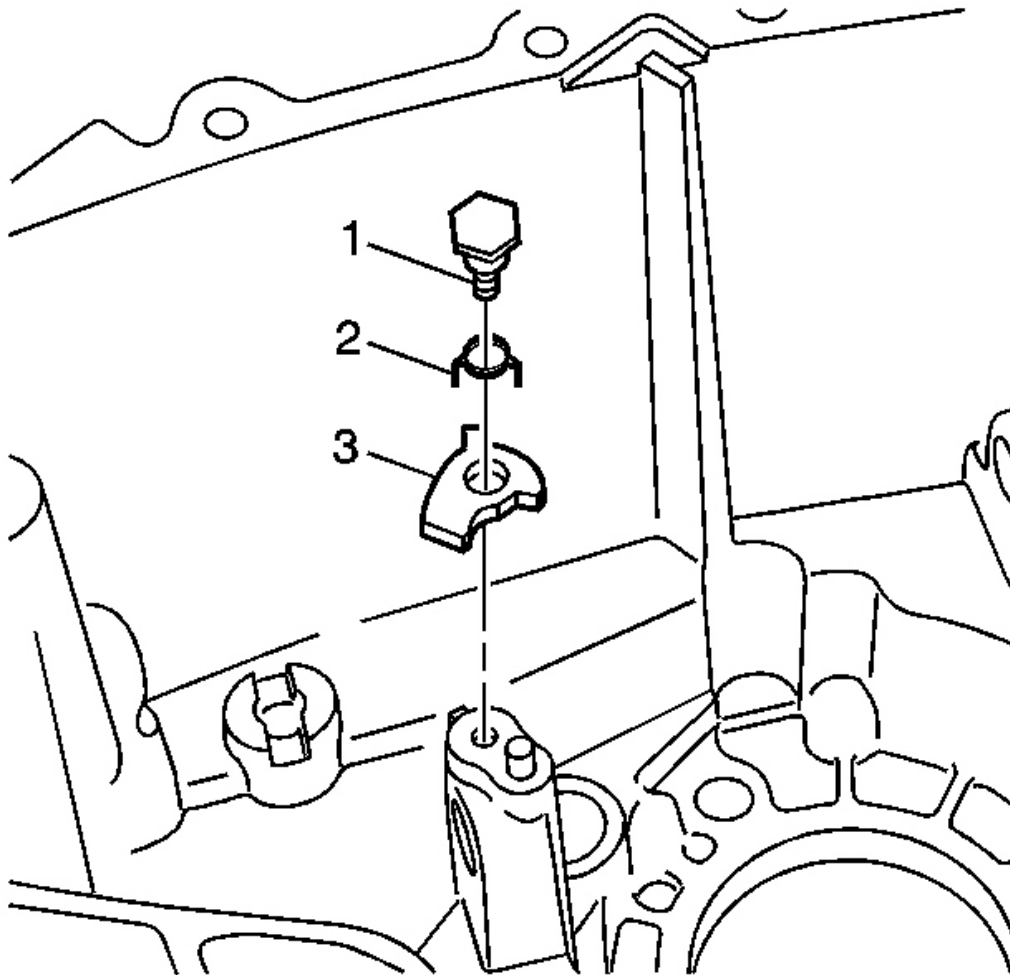


Fig. 41: View Of Transmission Housing Bolt, Spring & Lever
Courtesy of GENERAL MOTORS CORP.

48. Remove the bolt (1), lever (3) and spring (2) from the transmission housing, if equipped.

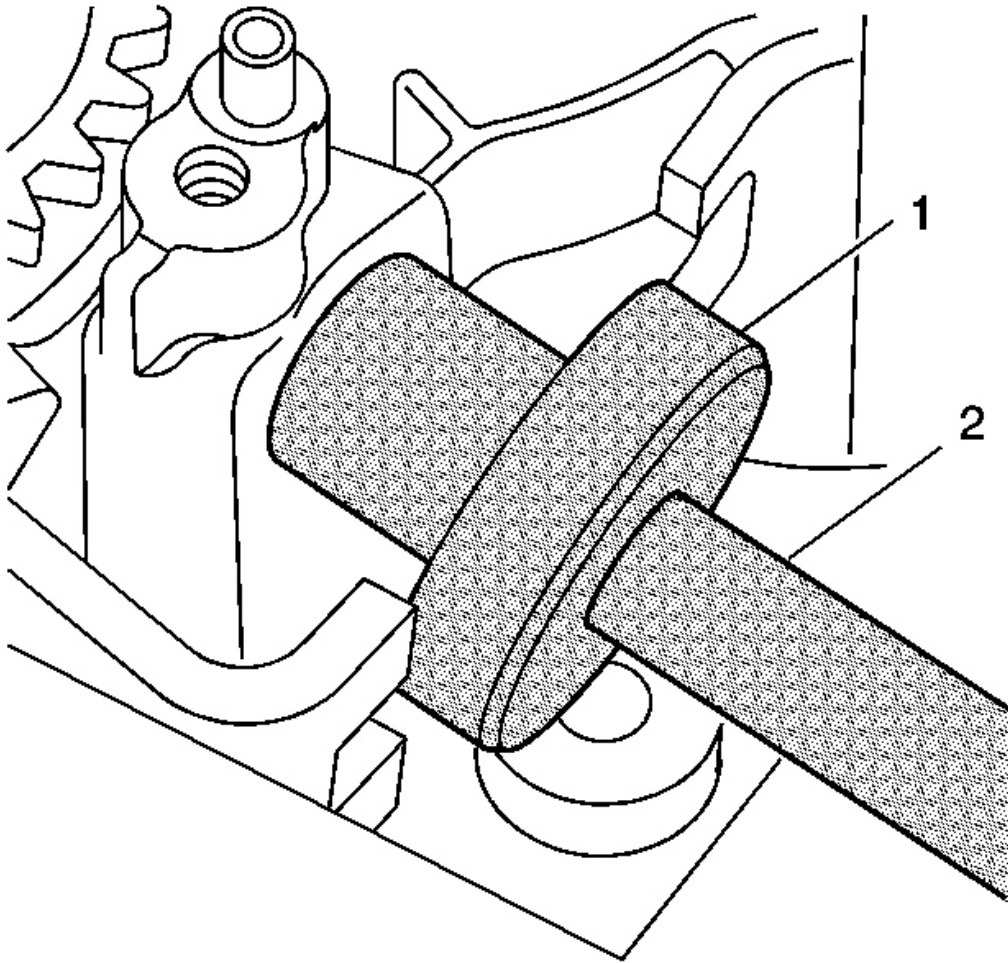


Fig. 42: Removing Shifter Bearing From The Transmission Housing Using J 44381 & J 8092
Courtesy of GENERAL MOTORS CORP.

49. Remove the shifter bearing from the transmission housing using the **J 44381** (1) and the **J 7079-2** (2).

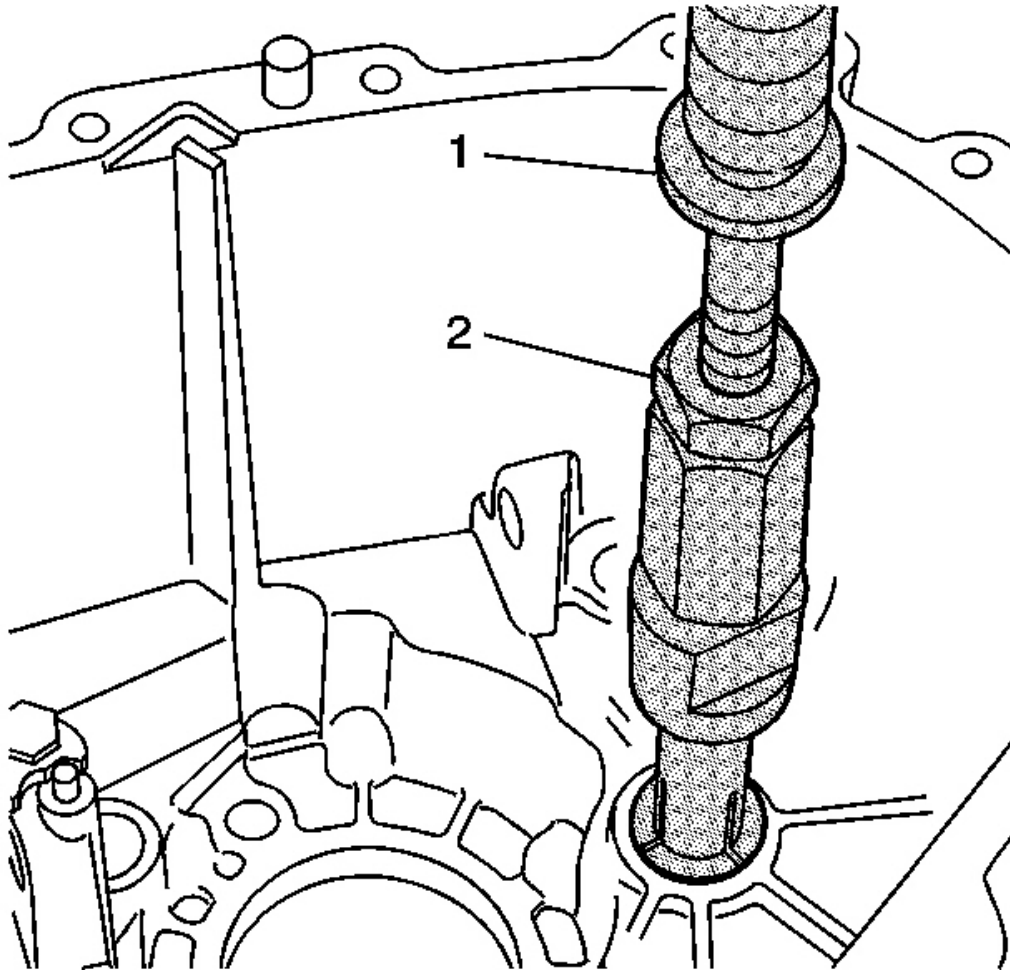


Fig. 43: Removing Intermediate Shaft Needle Bearing From The Transmission Housing Using The J 44382 And The J 23907

Courtesy of GENERAL MOTORS CORP.

50. Remove the intermediate shaft needle bearing from the transmission housing using the **J 44382** (2) and the **J 23907** (1).

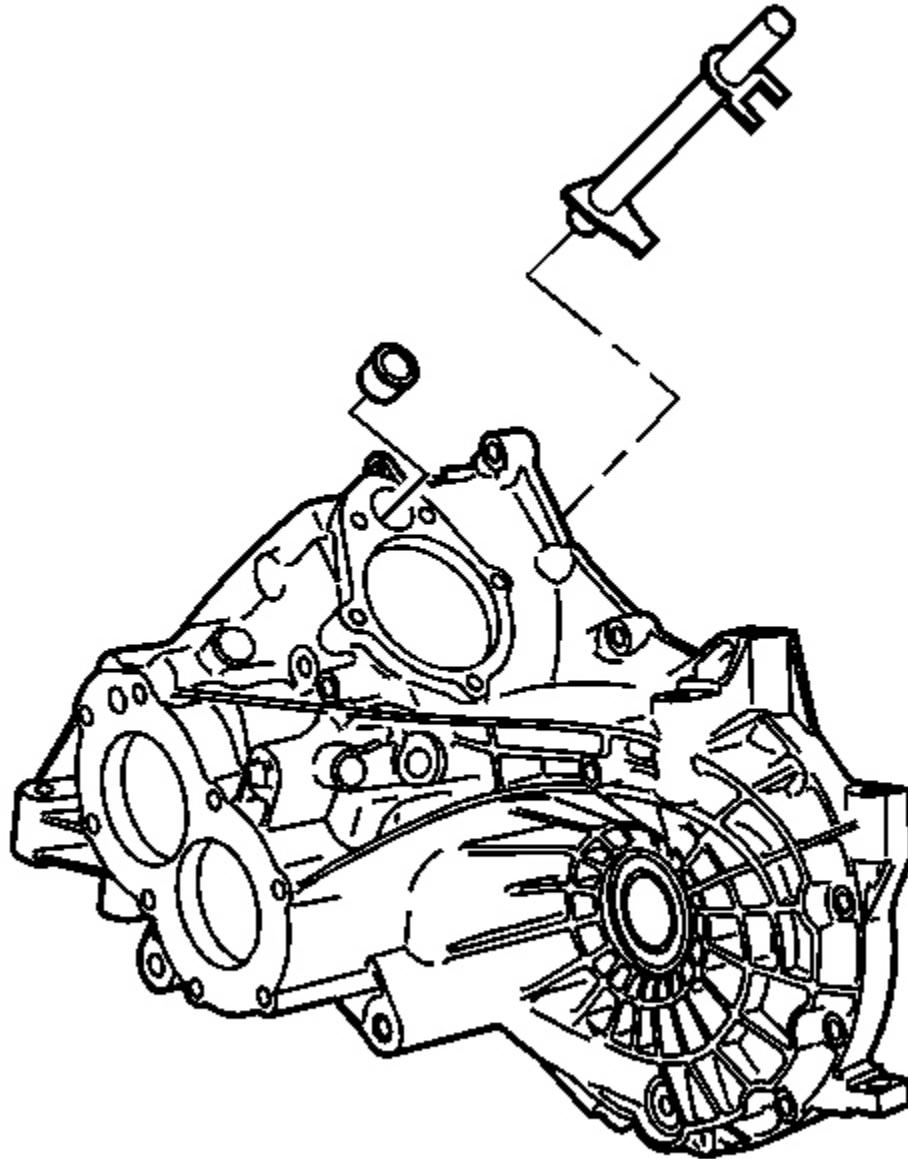


Fig. 44: View Of Shift Rod & Bushing
Courtesy of GENERAL MOTORS CORP.

51. Remove the shift rod bushing and the shift rod from the transmission housing.
52. Remove the snap ring and the input shaft bearing from the transmission housing using the **J 44385** (2) and the **J 8092** (1). Discard the snap ring.

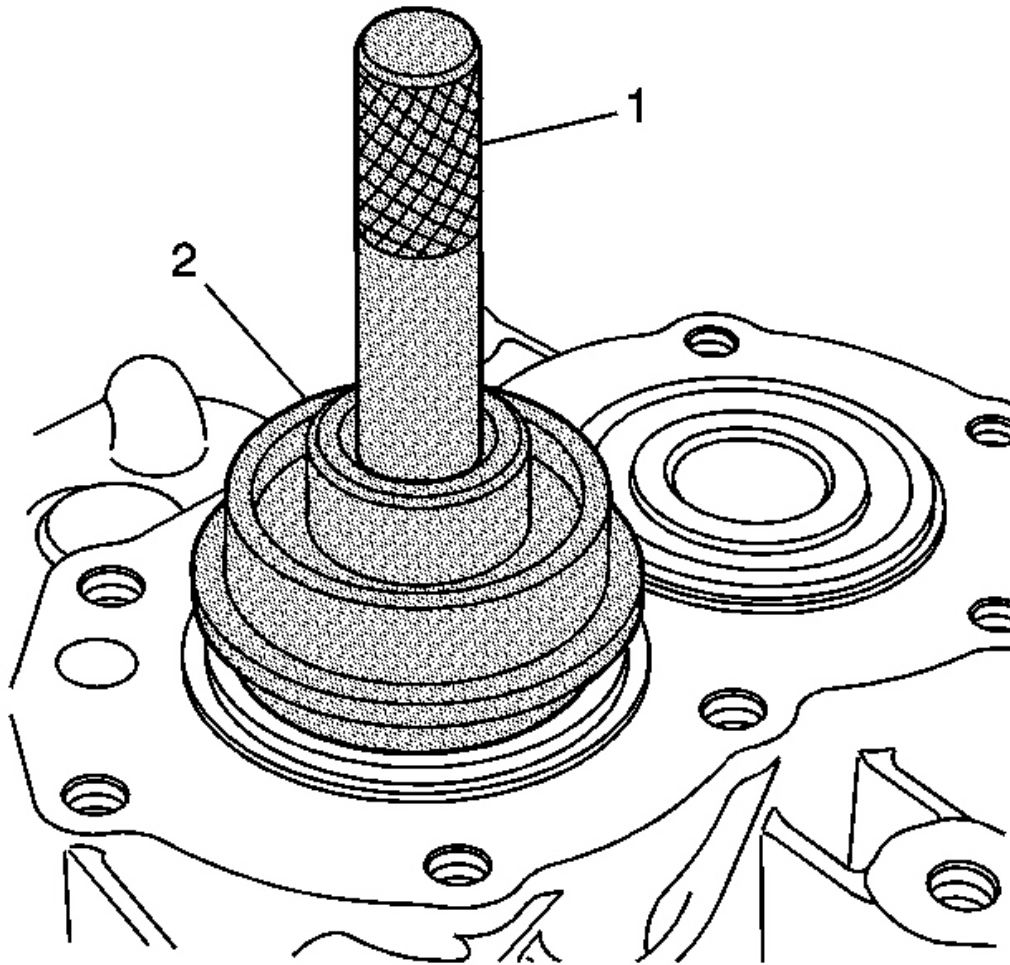


Fig. 45: Removing Snap Ring And Input Shaft Bearing From Transmission Housing Using J 44385 & J 8092

Courtesy of GENERAL MOTORS CORP.

53. Remove the snap ring and the output shaft bearing from the transmission housing using the **J 44385** (2) and the **J 8092** (1). Discard the snap ring.

INTERMEDIATE SHAFT DISASSEMBLE

Tools Required

- **J 36513** Gear and Bearing Separator Plate. See **Special Tools and Equipment** .
- **J 44383** Countershaft Bearing Installer. See **Special Tools and Equipment** .

1. Press off the 1st gear assembly and the 2nd gear assembly as a unit, from the intermediate shaft using the **J 36513** (1), the **J 44383** (2) and a hydraulic press.

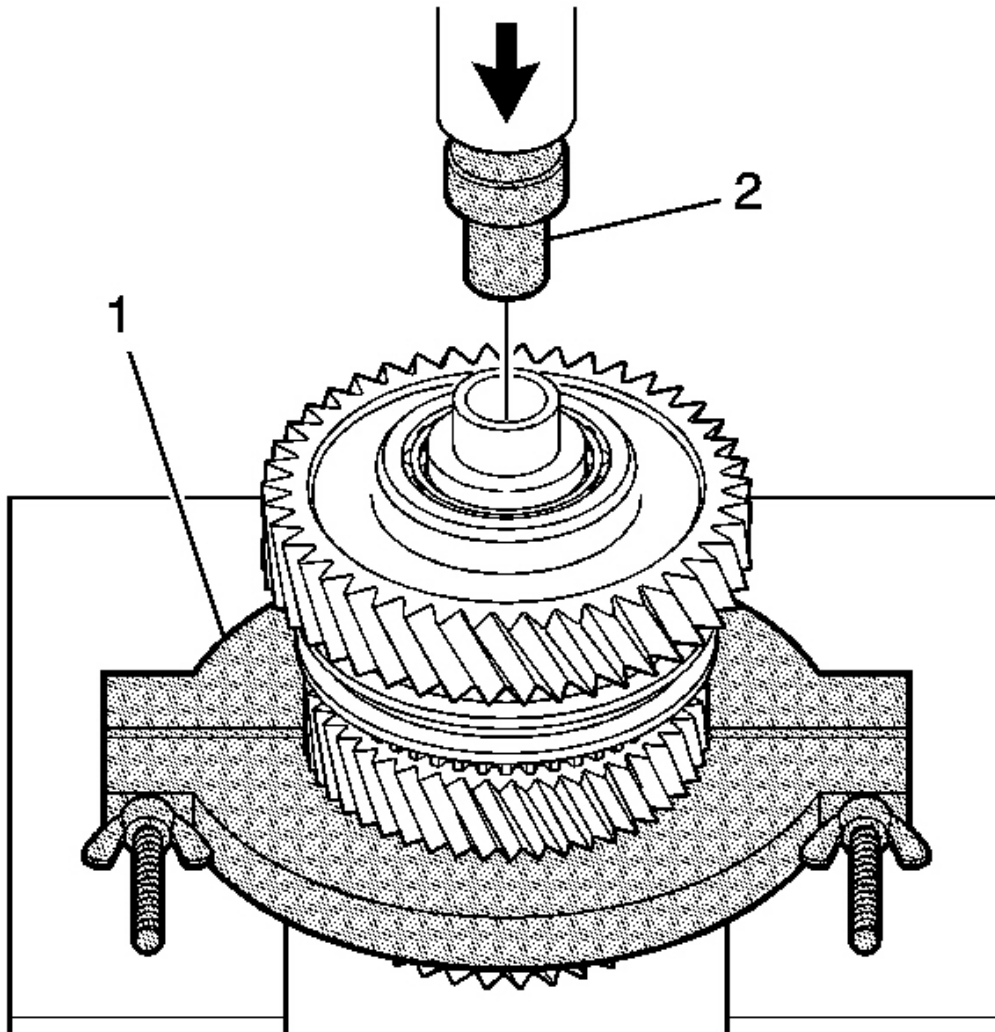


Fig. 46: Pressing Off 1st & 2nd Gear Assemblies
Courtesy of GENERAL MOTORS CORP.

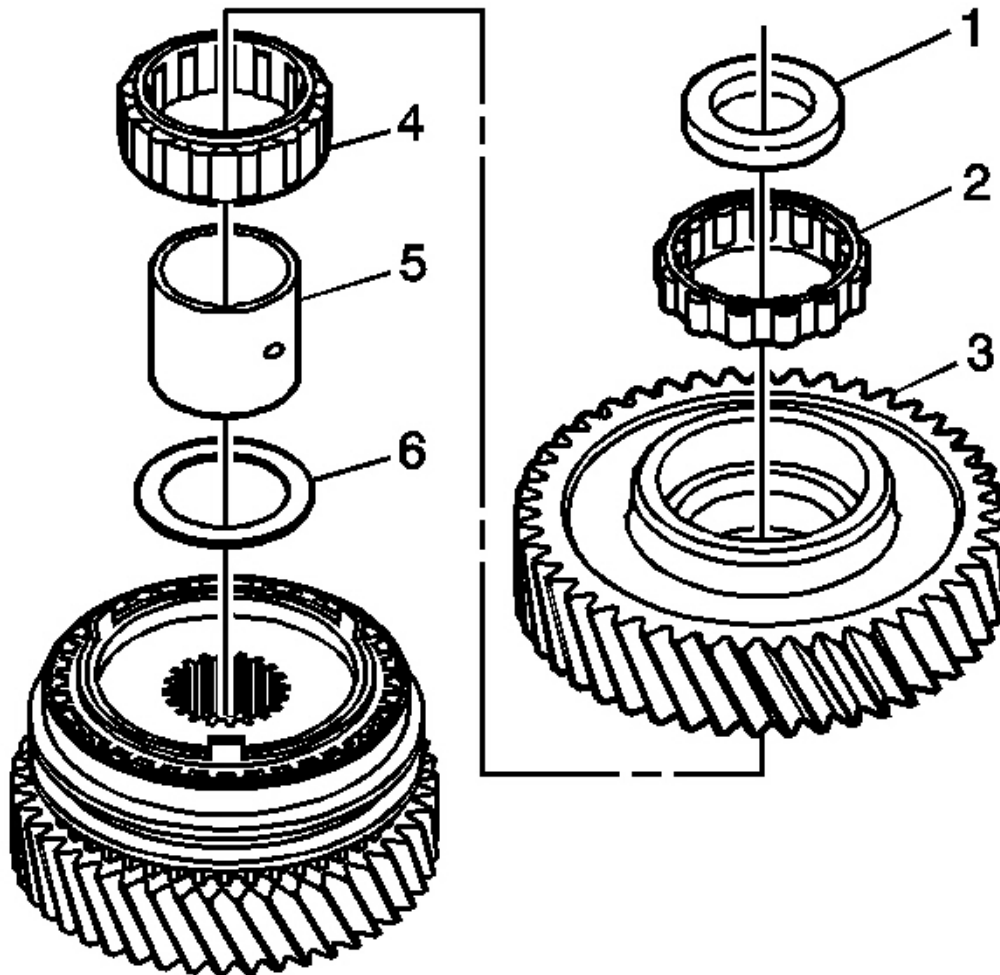


Fig. 47: Exploded View Of 1st And 2nd Gear Assemblies
Courtesy of GENERAL MOTORS CORP.

2. Put the 1st gear assembly and the 2nd gear assembly, as a unit, on the bench.
3. Remove the thrust washer (1).
4. Remove the roller bearing (2).
5. Remove the 1st gear (3).
6. Remove the roller bearing (4).
7. Remove the bearing collar (5).
8. Remove the thrust washer (6).

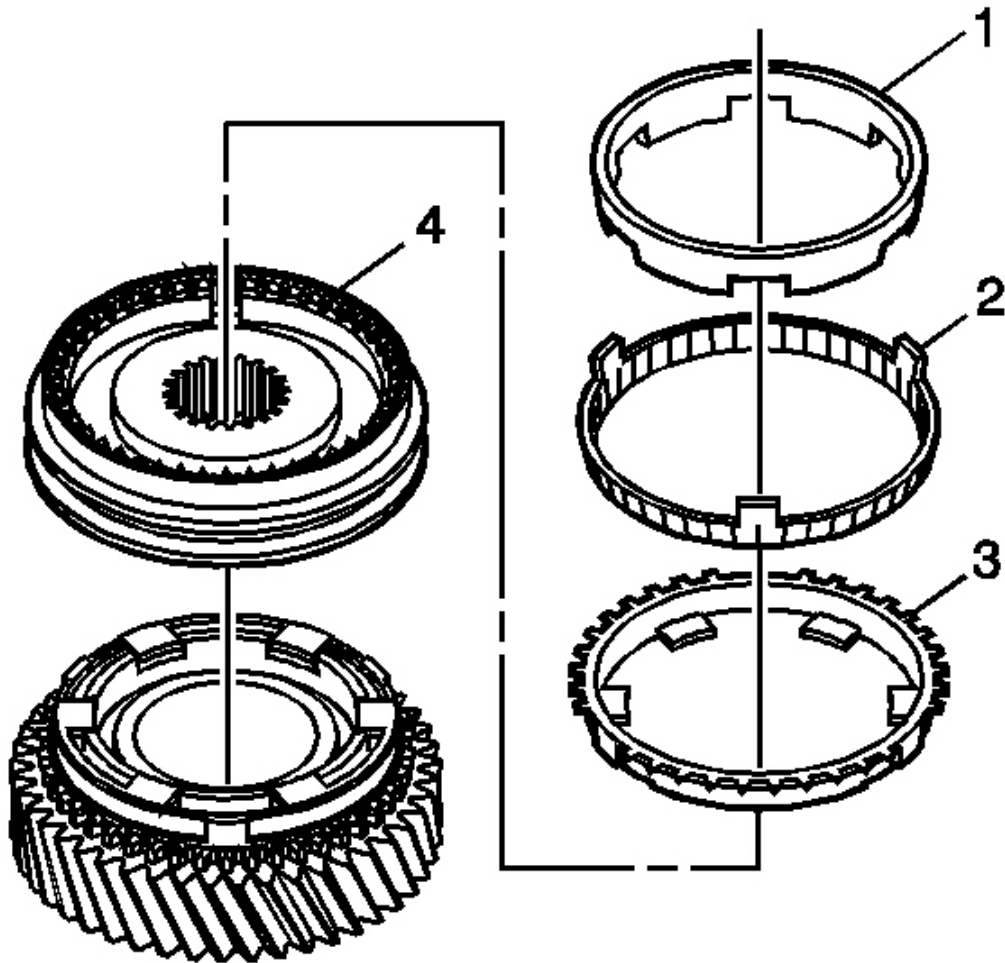


Fig. 48: Exploded View Of 1st Gear Assembly
Courtesy of GENERAL MOTORS CORP.

9. Remove the 1st gear inner cone (1).
10. Remove the 1st gear blocking ring (2).
11. Remove the 1st gear outer cone (3).
12. Remove the 1st/2nd synchronizer assembly (4).

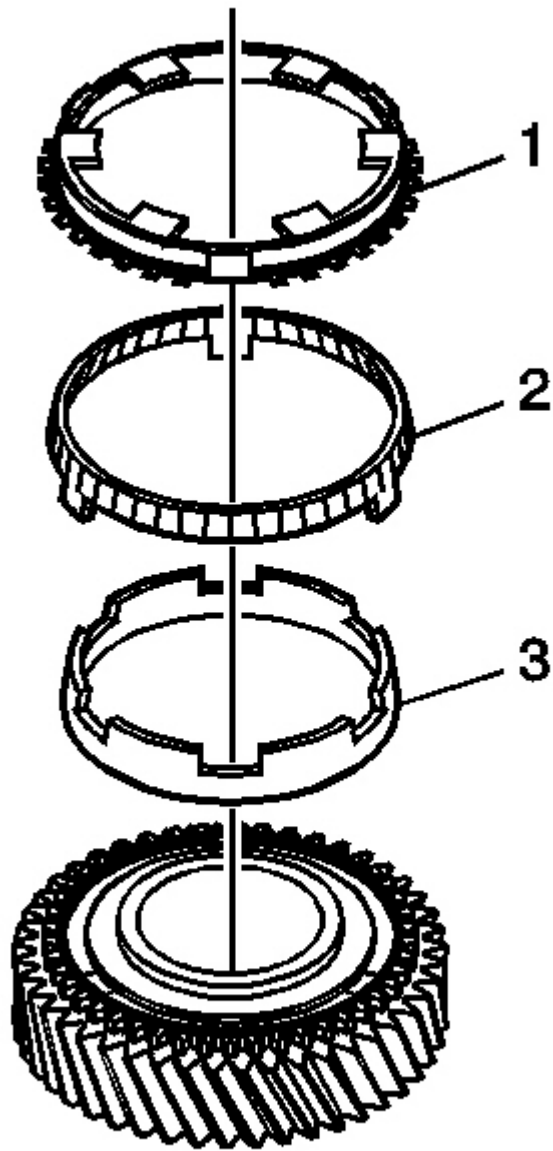


Fig. 49: Exploded View Of 2nd Gear Assembly
Courtesy of GENERAL MOTORS CORP.

13. Remove the 2nd gear outer cone (1).
14. Remove the 2nd gear blocking ring (2).
15. Remove the 2nd gear inner cone (3).

16. Remove the 2nd gear.

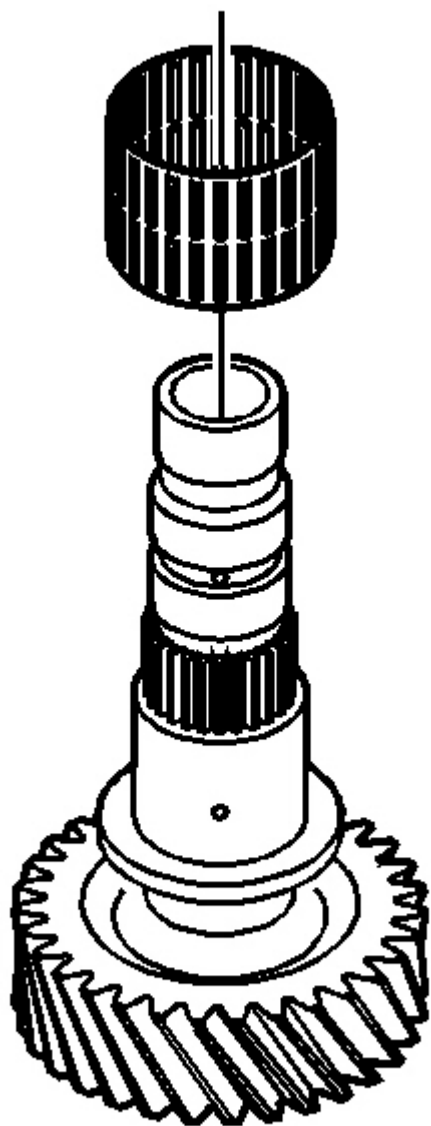


Fig. 50: Removing Caged Needle Bearings
Courtesy of GENERAL MOTORS CORP.

17. Remove the caged needle bearings from the intermediate shaft.

INPUT SHAFT DISASSEMBLE

Tools Required

- **J 36513** Gear and Bearing Separator Plate. See Special Tools and Equipment .
- **J 44378** Press Adapter (all shafts). See Special Tools and Equipment .

1. Remove the thrust washer (1).

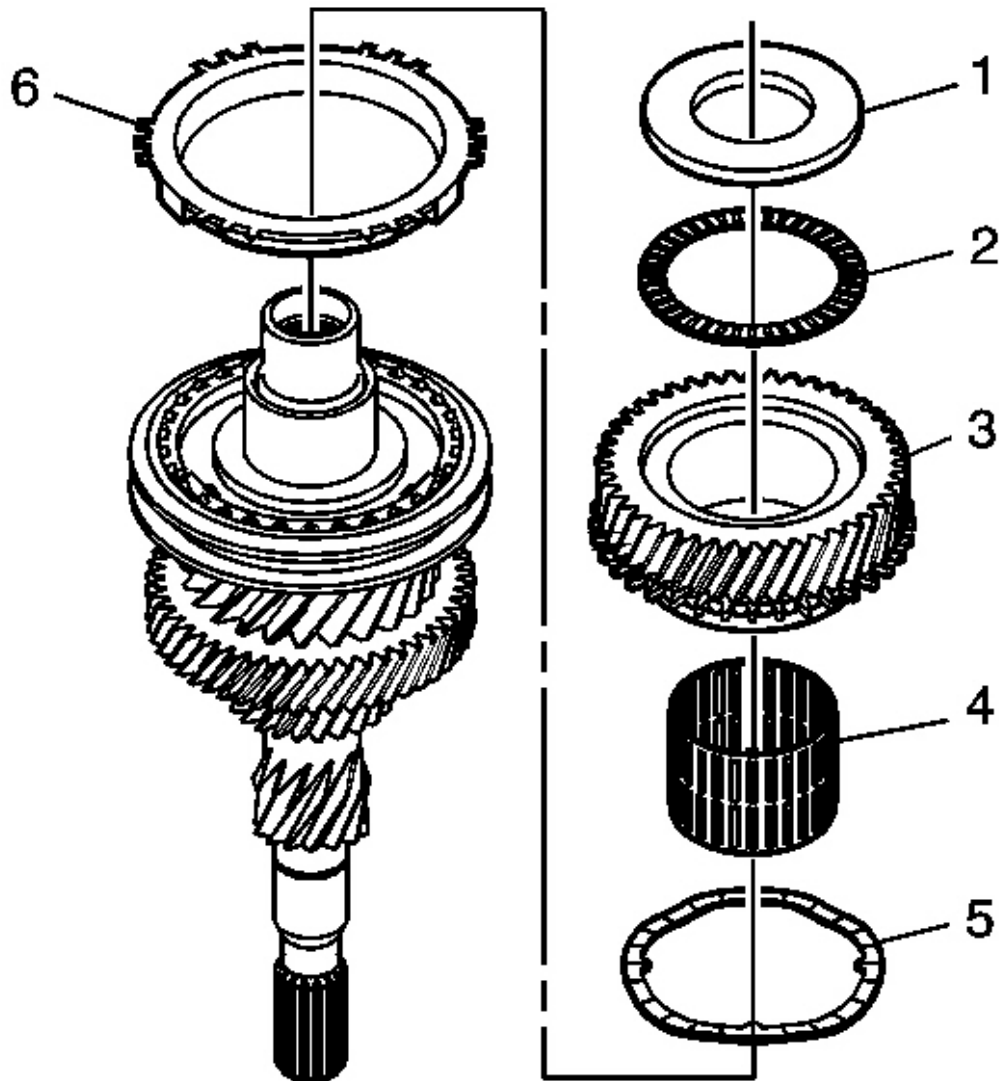


Fig. 51: Exploded View Of Input Shaft
Courtesy of GENERAL MOTORS CORP.

2. Remove the thrust bearing (2).
3. Remove the 4th gear (3).
4. Remove the caged needle bearing (4).
5. Remove the wavy washer (5).
6. Remove the 4th gear blocking ring (6).

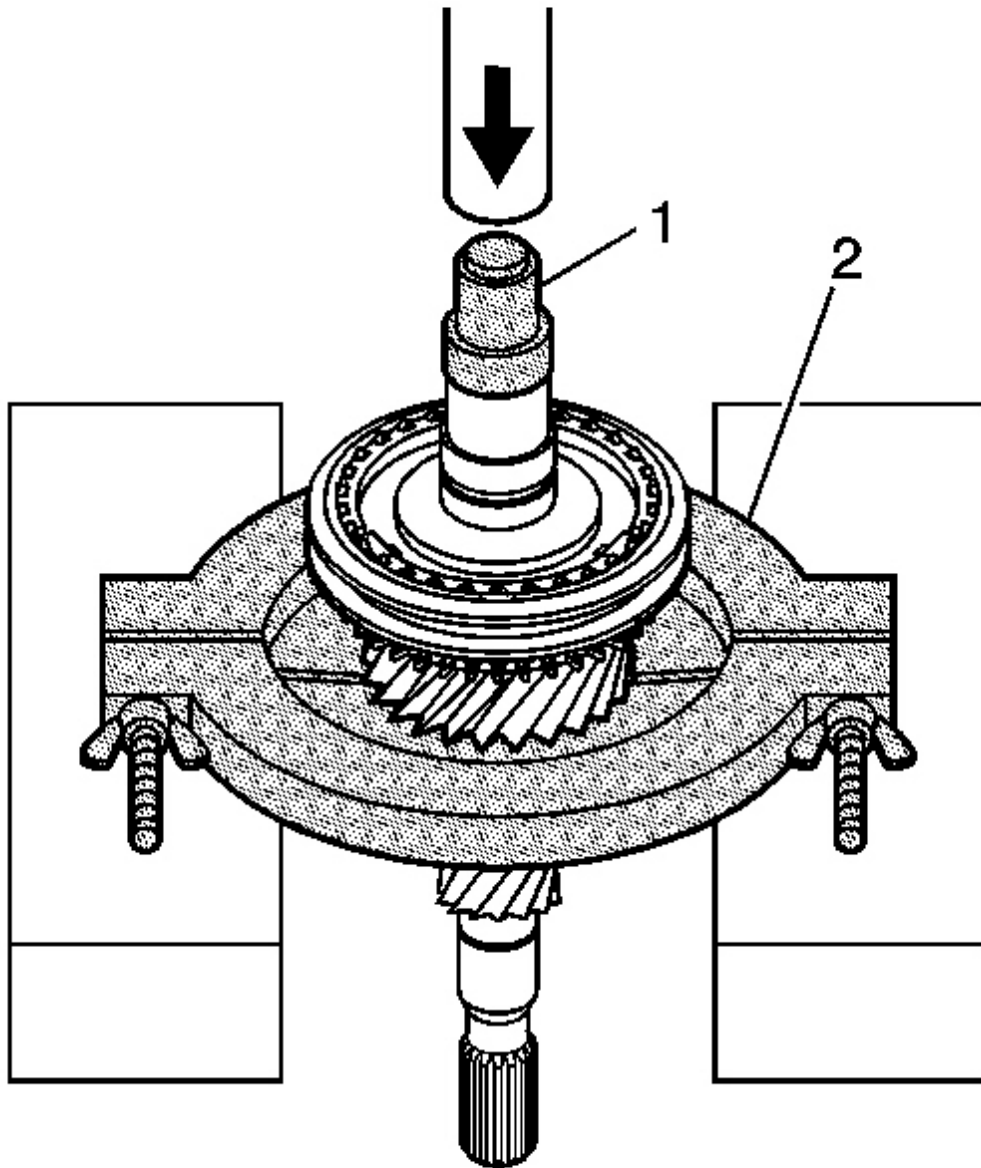


Fig. 52: Removing Bearing Collar & 3rd/4th Synchronizer
Courtesy of GENERAL MOTORS CORP.

7. Remove the bearing collar and the 3rd/4th synchronizer from the input shaft using the **J 36513** (2) under the 3rd speed gear, the **J 44378** (1), and a hydraulic press.

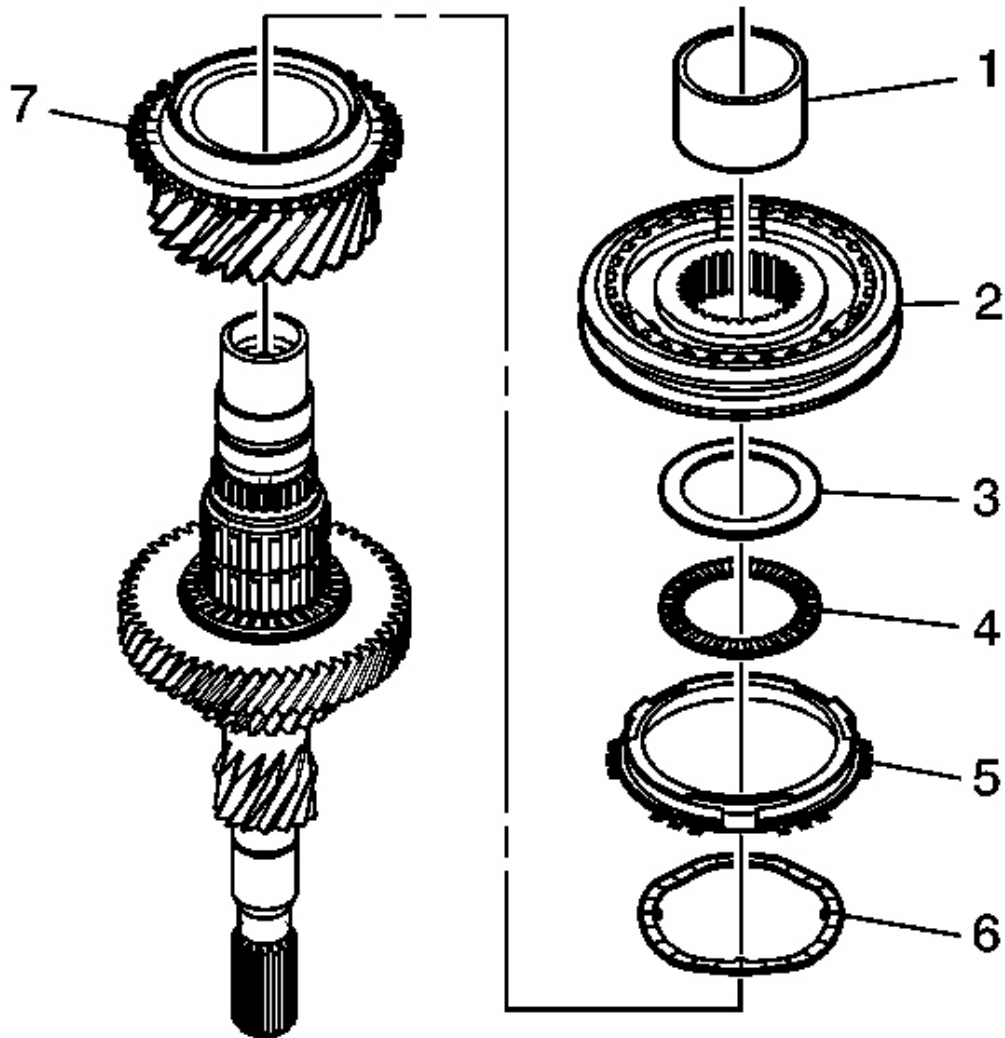


Fig. 53: Exploded View Of 3rd Gear Assembly
Courtesy of GENERAL MOTORS CORP.

8. Remove the following components as an assembly:

1. The bearing collar (1)
2. The 3rd/4th synchronizer assembly (2)
3. The thrust washer (3)
4. The thrust bearing (4)
5. The 3rd gear blocking ring (5)

6. The wavy washer (6)
7. The 3rd gear (7)

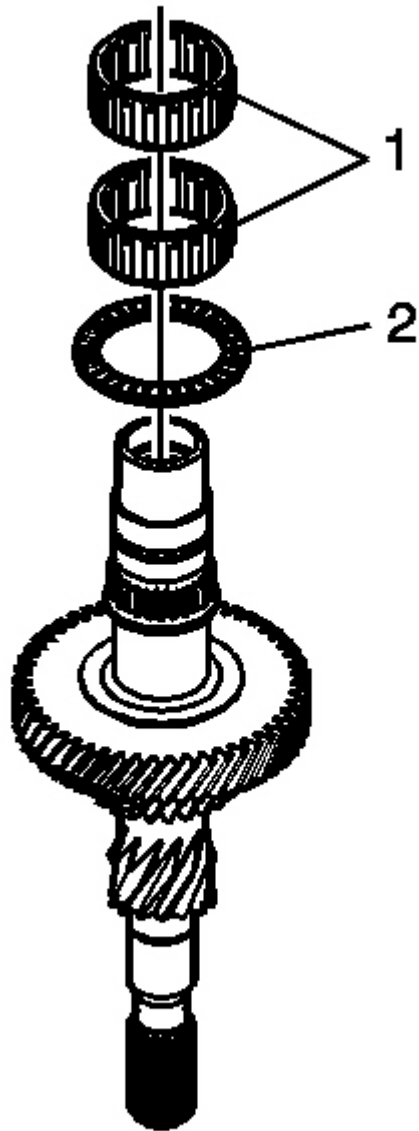


Fig. 54: View Of Caged Needle Bearing & Thrust Bearing
Courtesy of GENERAL MOTORS CORP.

9. Remove the caged needle bearing (1).

10. Remove the caged needle bearing (1).
11. Remove the thrust bearing (2).

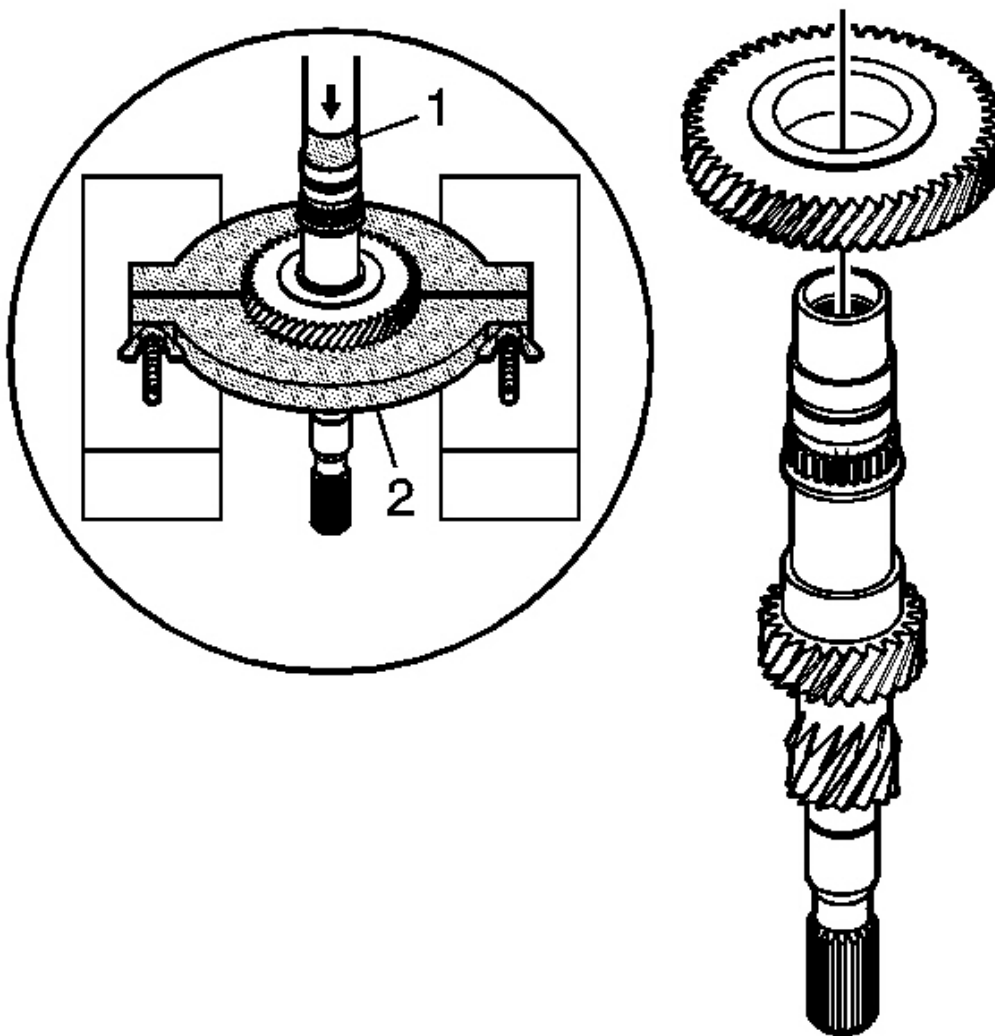


Fig. 55: Pressing Off 5th Gear
Courtesy of GENERAL MOTORS CORP.

12. Press off 5th gear using the J 44378 (1), the J 36513 (2) and a hydraulic press.

OUTPUT SHAFT DISASSEMBLE

Tools Required

- **J 36513** Gear and Bearing Separator Plate. See Special Tools and Equipment .
- **J 44378** Press Adapter (all shafts). See Special Tools and Equipment .

IMPORTANT: The 4th driven gear is a very tight press.

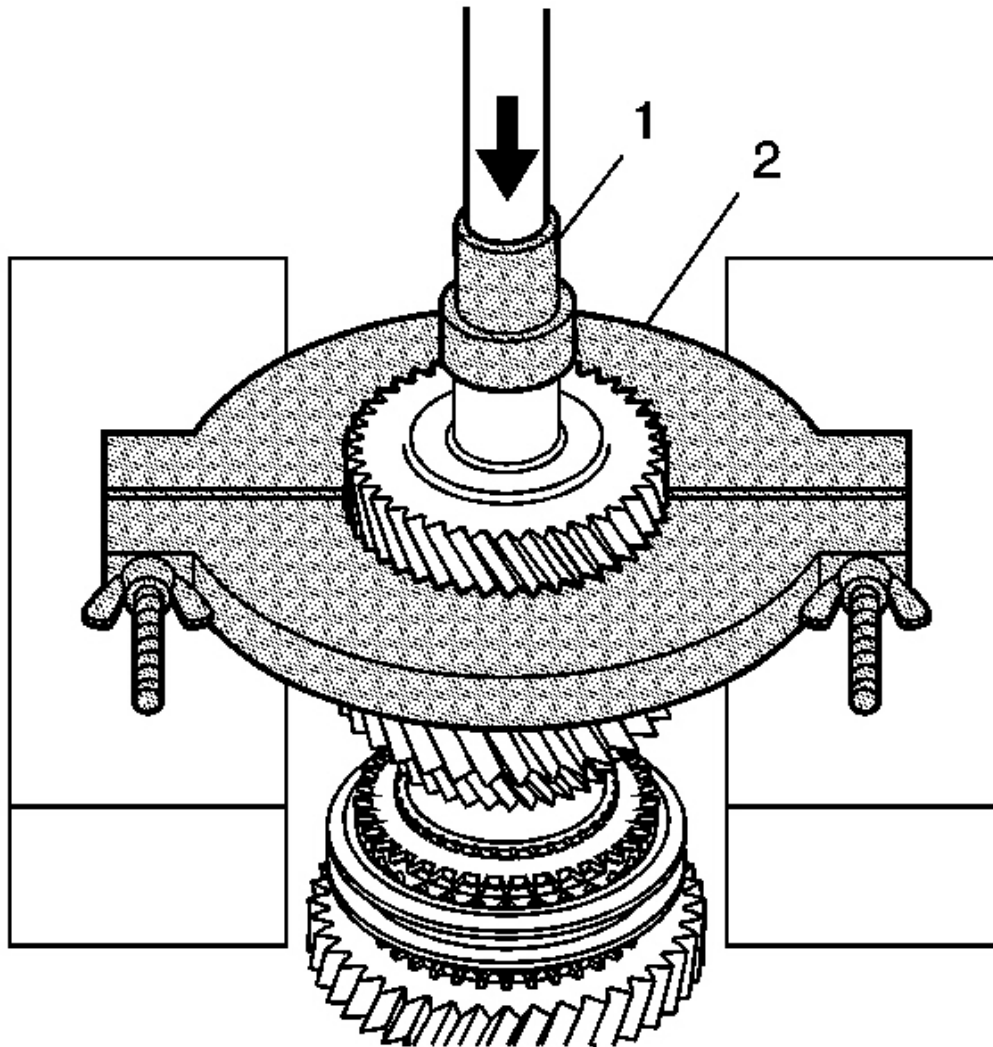


Fig. 56: Pressing Off 4th Driven Gear
Courtesy of GENERAL MOTORS CORP.

1. Press off the 4th driven gear using the **J 36513** (2) and the **J 44378** (1).

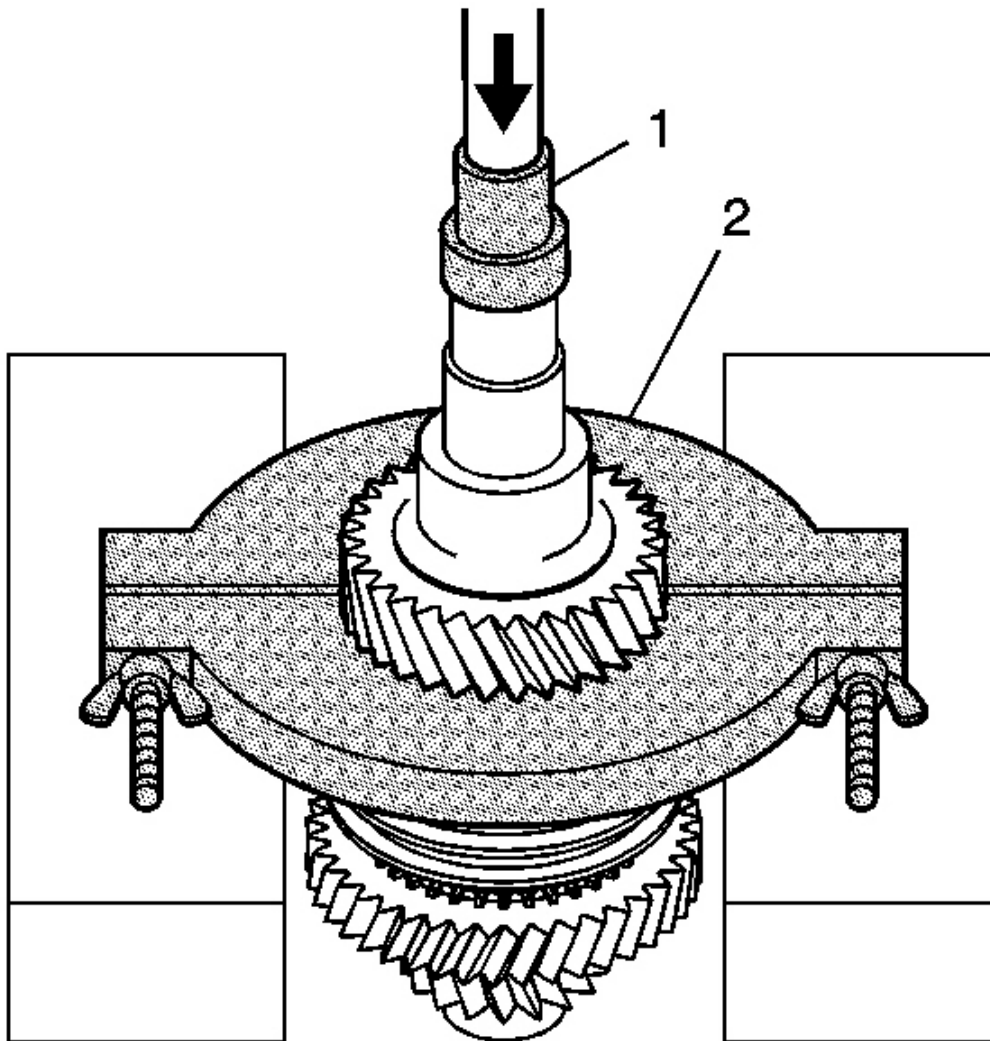


Fig. 57: Removing 3rd Driven Gear
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The 3rd driven gear is a very tight press.

2. Remove the 3rd driven gear using the **J 36513** (2) and the **J 44378** (1).

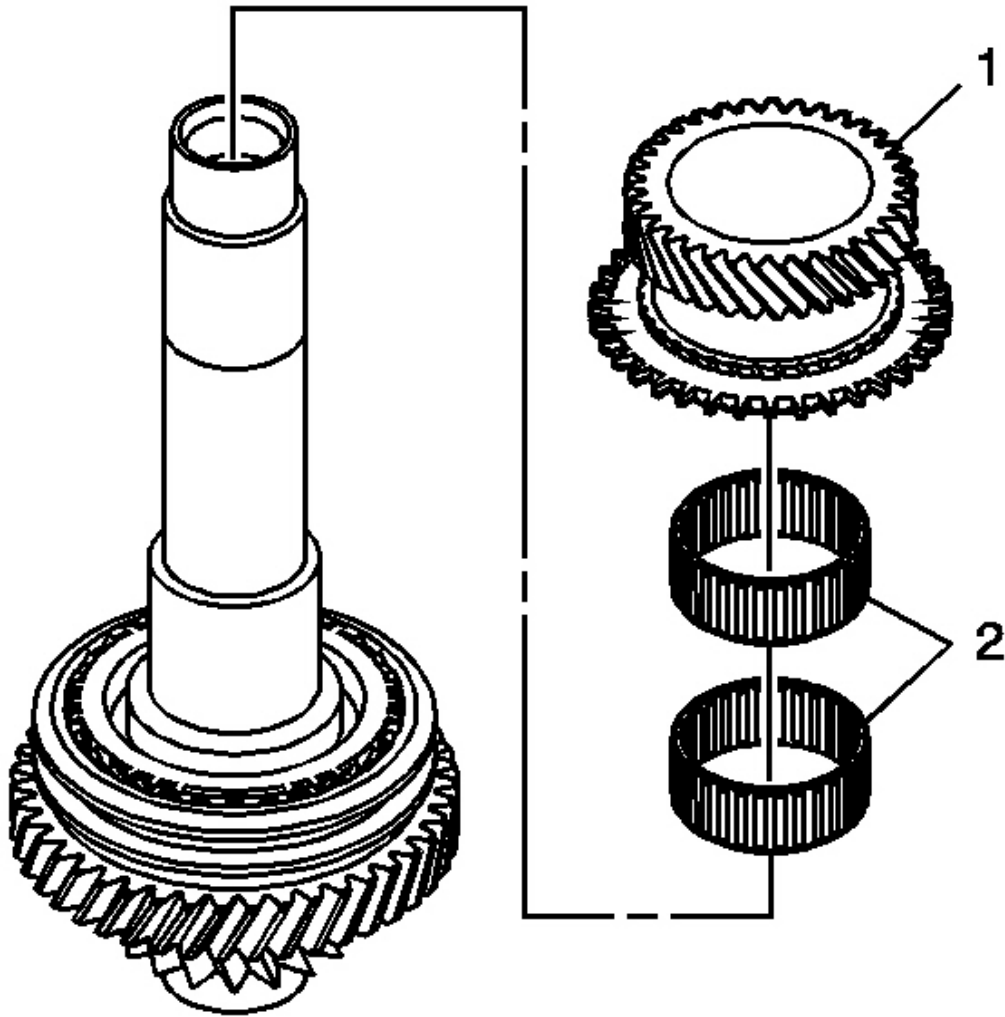


Fig. 58: View Of 5th Gear & Caged Needle Bearings
Courtesy of GENERAL MOTORS CORP.

3. Remove the 5th gear (1) and the two caged needle bearings (2).

IMPORTANT: Do not contact the thrust washer under the reverse gear.

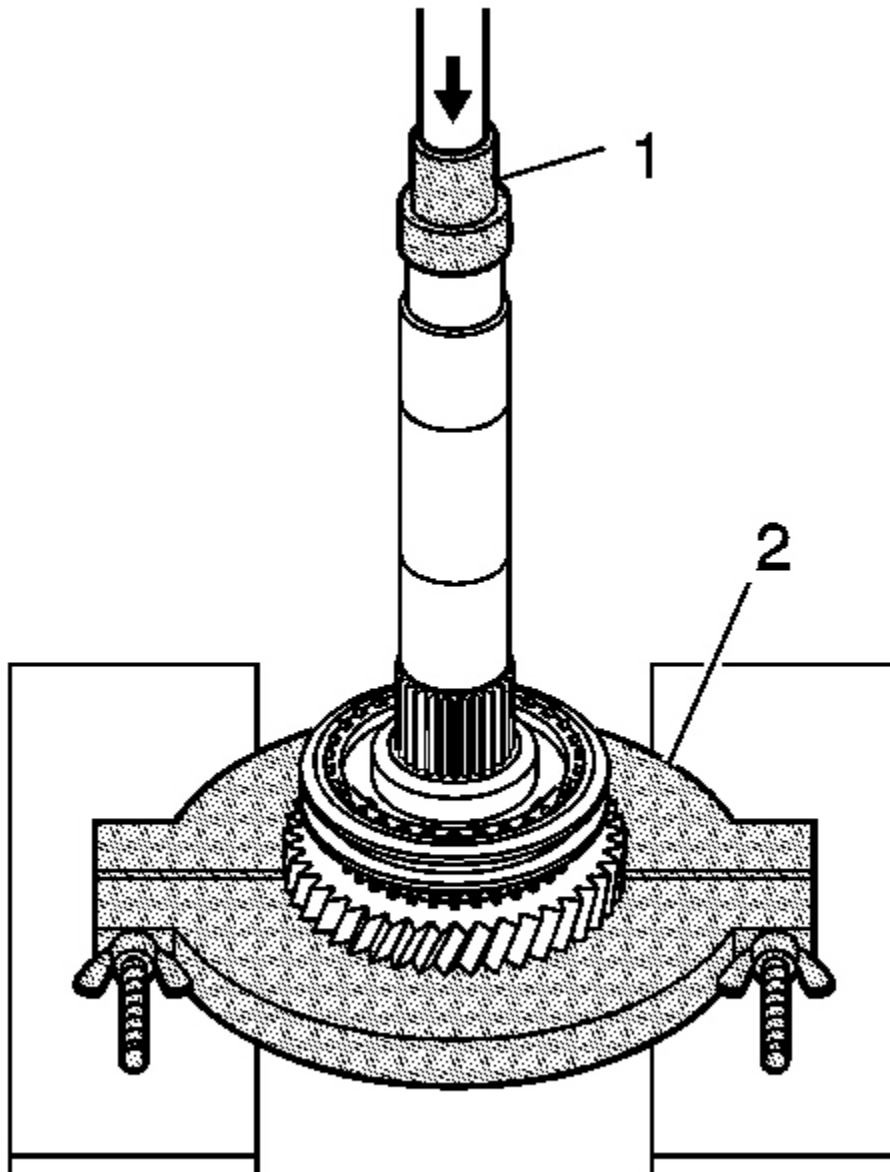


Fig. 59: Removing Bearing Collar Using Press
Courtesy of GENERAL MOTORS CORP.

4. Remove the bearing collar using the J 36513 (2), under the reverse gear, the J 44378 (1), and a hydraulic press.

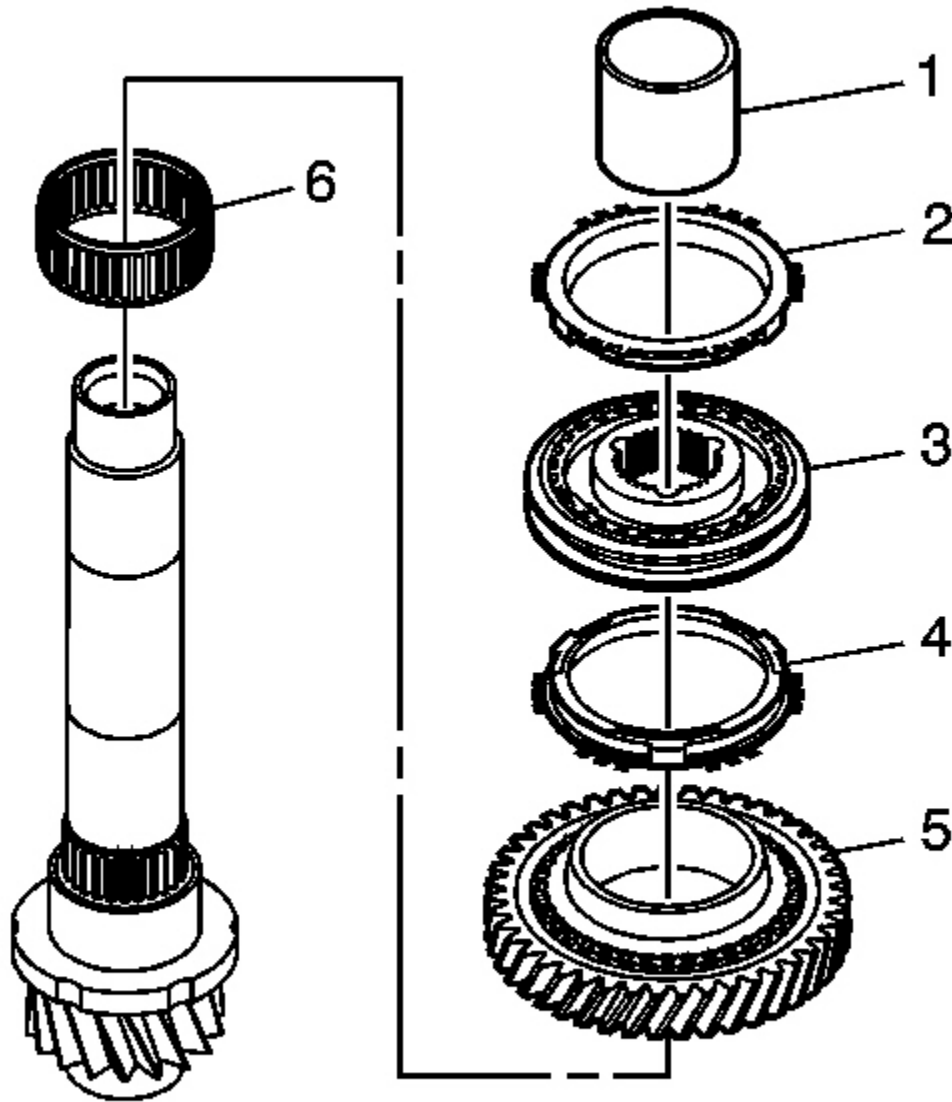


Fig. 60: Exploded View Of Reverse Gear Assembly
Courtesy of GENERAL MOTORS CORP.

5. Remove the following components as an assembly:
 1. The bearing collar (1)
 2. The 5th gear blocking ring (2)
 3. The 5th/Reverse synchronizer assembly (3)

4. The reverse blocking ring (4)
5. The reverse gear (5)
6. The caged needle bearing (6)

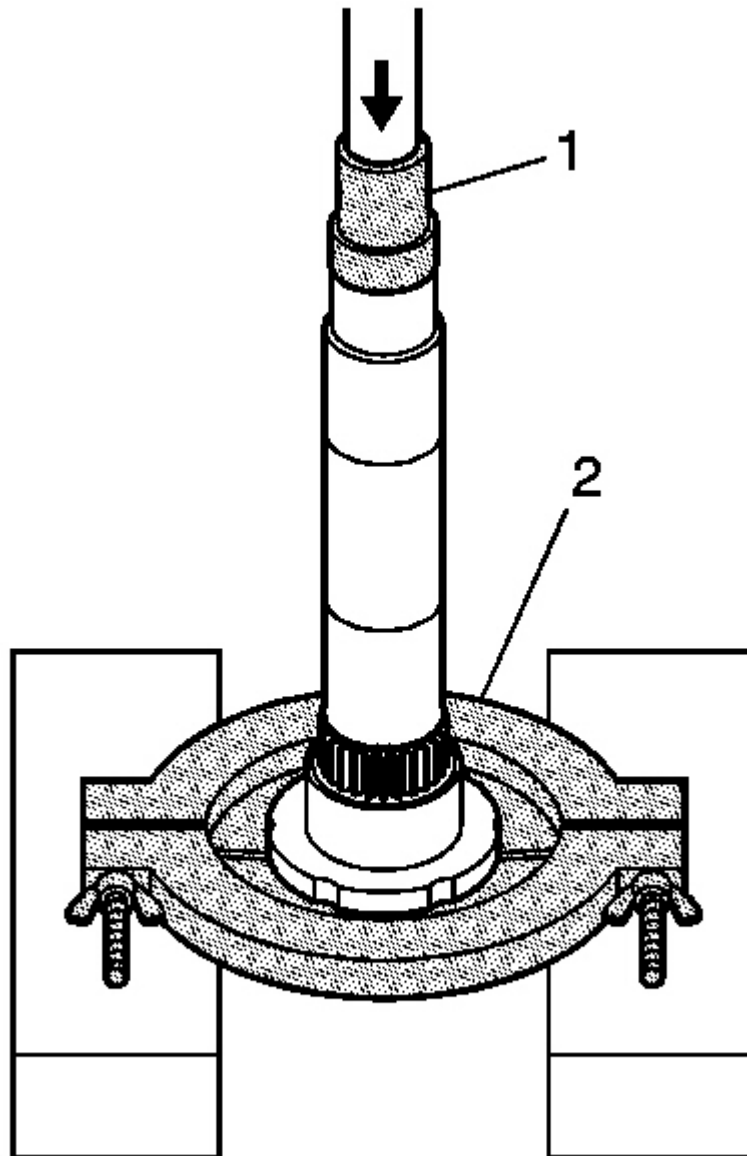


Fig. 61: Removing Collar & Thrust Washer
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the J 36513 is not making contact with the pinion gear before pressing off the collar and thrust washer.

6. Remove the collar and the thrust washer using the **J 44378** (1), the **J 36513** (2), and a hydraulic press.

DIFFERENTIAL CASE DISASSEMBLE

Tools Required

- **J 44379** Differential Bearing Puller Plate. See **Special Tools and Equipment** .
- **J 44381** Shifter Bearing/Input and Output Bearing Remover. See **Special Tools and Equipment** .

1. Remove the ten differential ring gear bolts from the differential case. Discard the bolts.

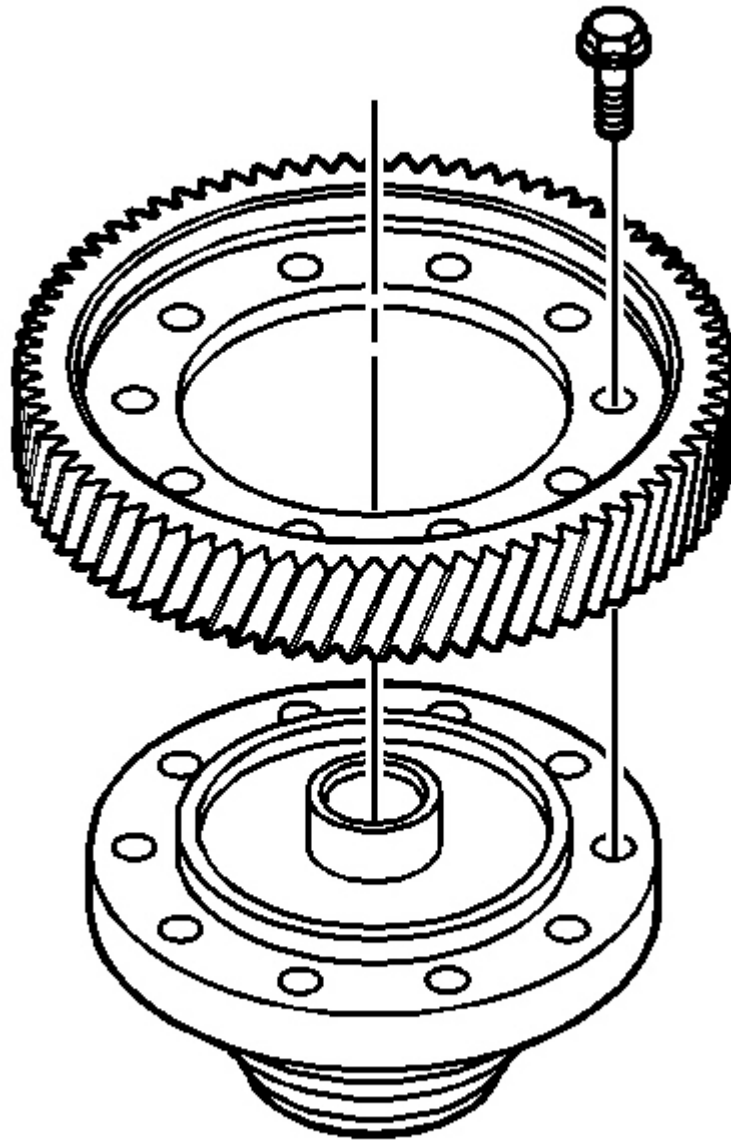


Fig. 62: View Of Differential Gear
Courtesy of GENERAL MOTORS CORP.

2. Remove the differential ring gear from the differential case.

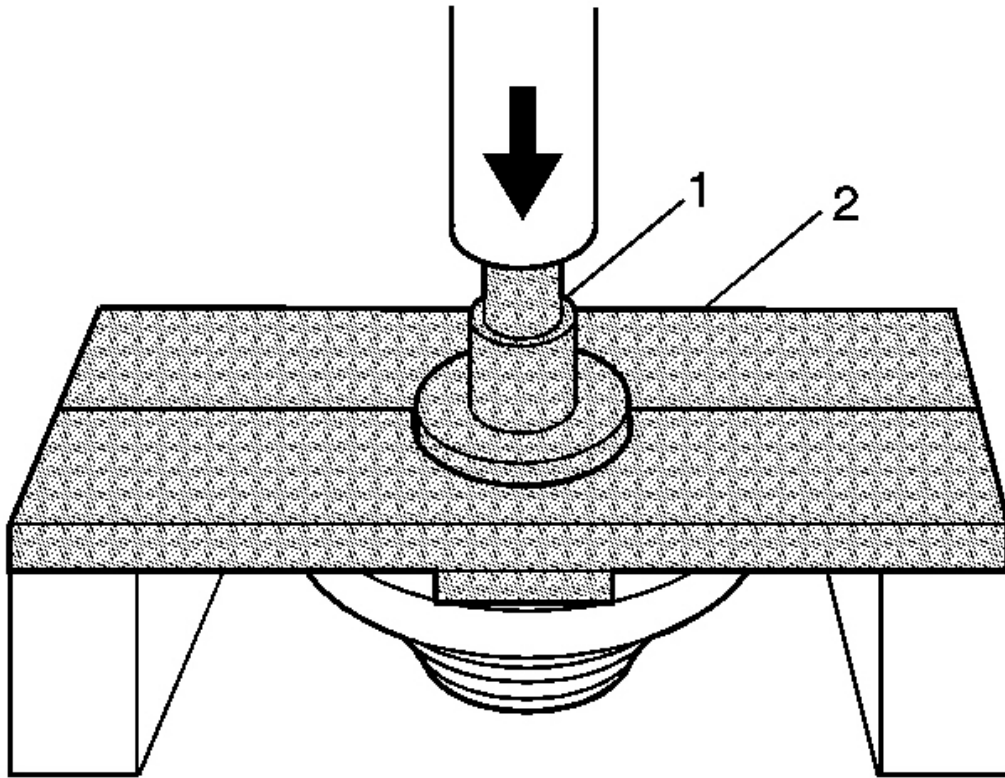


Fig. 63: Removing Left Differential Side Bearing
Courtesy of GENERAL MOTORS CORP.

3. Remove the left differential side bearing using the **J 44379** (2), the **J 44381** (1), and a hydraulic press. Discard the bearing.

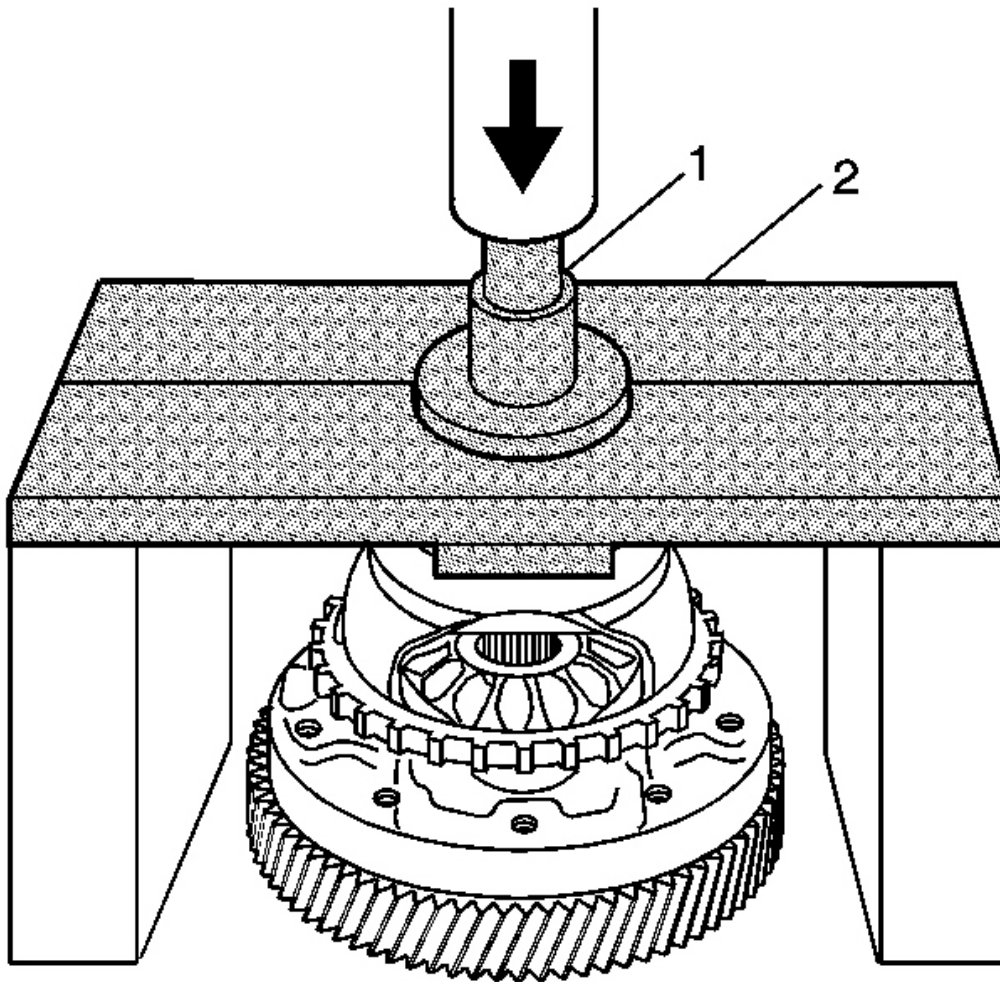


Fig. 64: Removing Right Differential Side Bearing
Courtesy of GENERAL MOTORS CORP.

4. Remove the right differential side bearing from the differential case using the **J 44379** (2), the **J 44381** (1), and a hydraulic press. Discard the bearing.

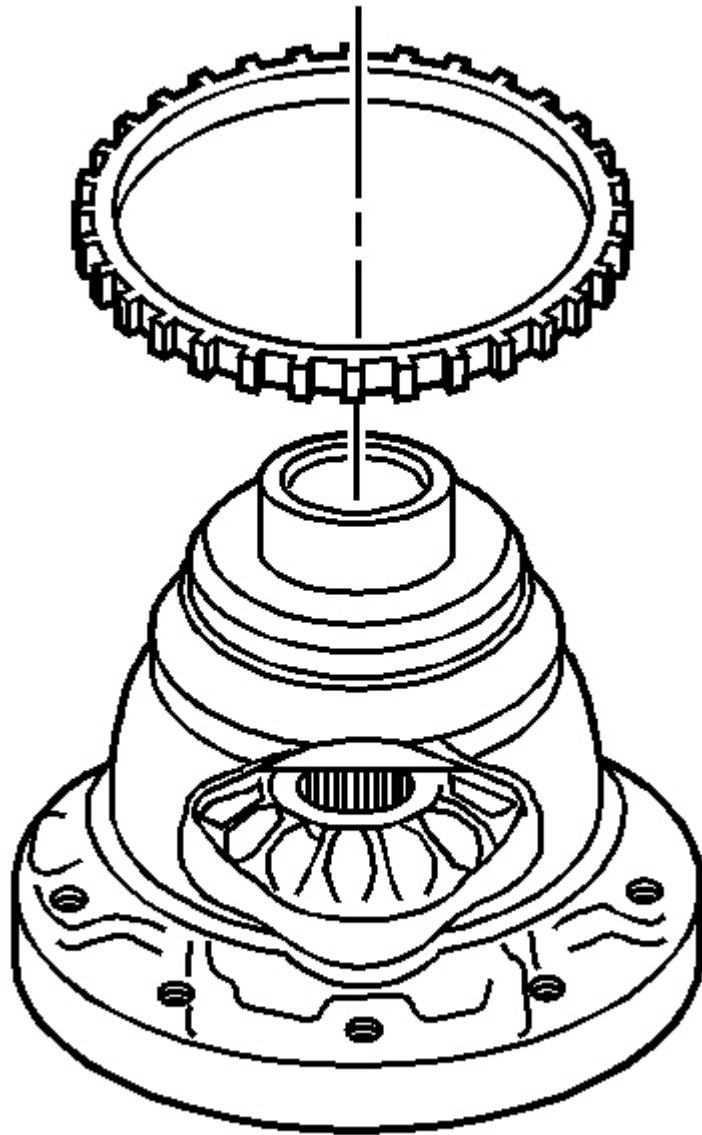


Fig. 65: View Of VSS Ring
Courtesy of GENERAL MOTORS CORP.

5. Remove the vehicle speed sensor (VSS) ring.

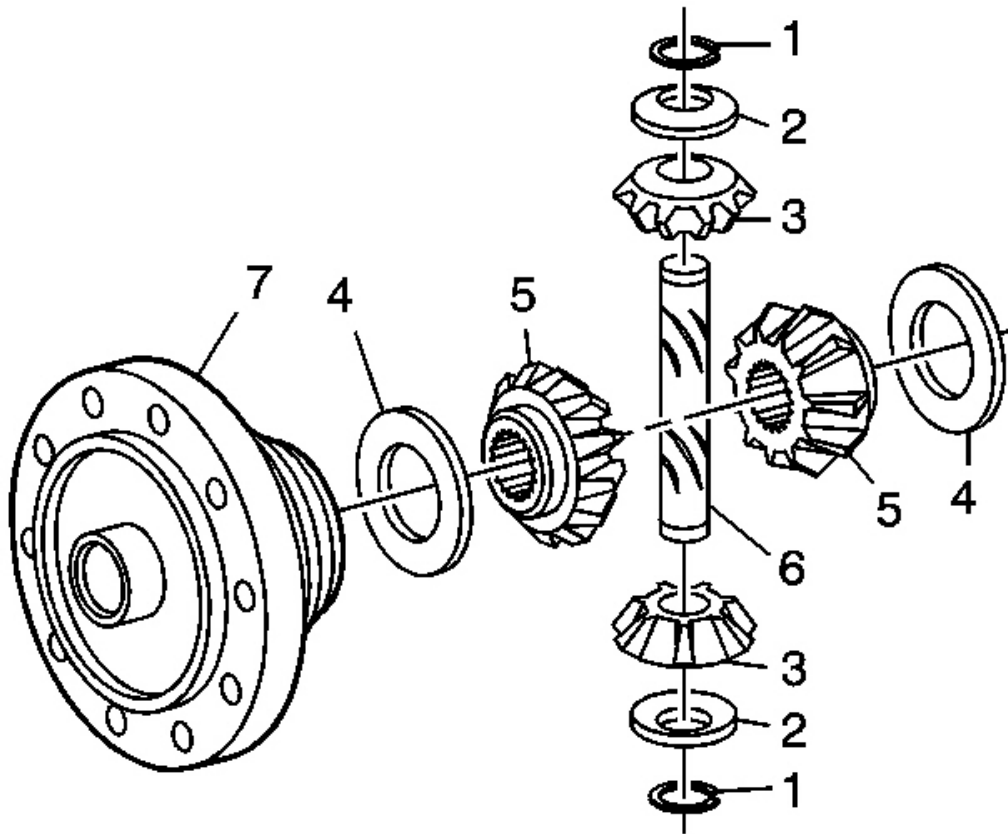


Fig. 66: Exploded View Of Pinion Assembly
 Courtesy of GENERAL MOTORS CORP.

6. Remove the following parts from the differential case (7):

- The snap rings (1)

Discard the snap rings.

- The pinion shaft (6)
- The pinion gears (3)
- The pinion gear thrust washers (2)
- The side gears (5)
- The side gear thrust washers (4)

IMPORTANT: Observe the orientation of the roll pin (4) before removal.

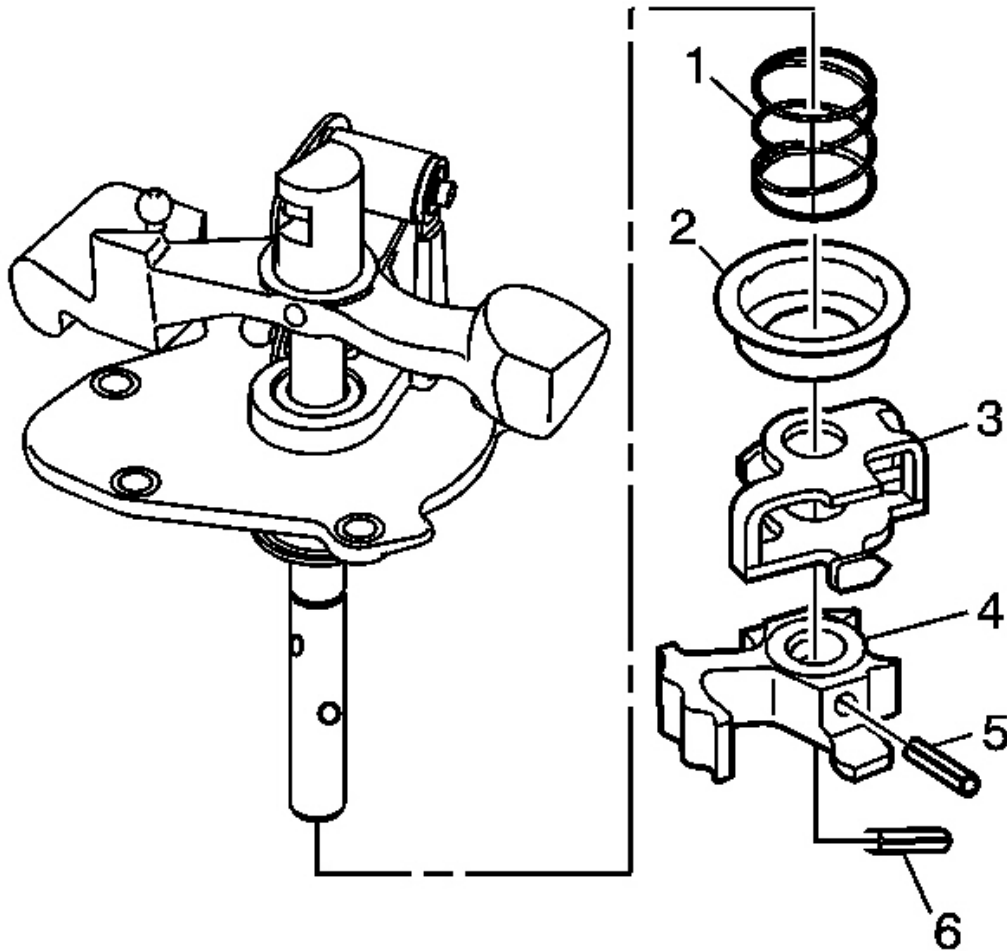


Fig. 67: View Of Shifter Roll Pins & Control Levers
Courtesy of GENERAL MOTORS CORP.

1. Remove the reverse inhibit roll pin (6). Discard the inhibit roll pin.
2. Remove the roll pin (5). Discard the roll pin.
3. Remove the outer control lever (3).
4. Remove the inner control lever (4).
5. Remove the end cap (2).
6. Remove the outer spring (1).

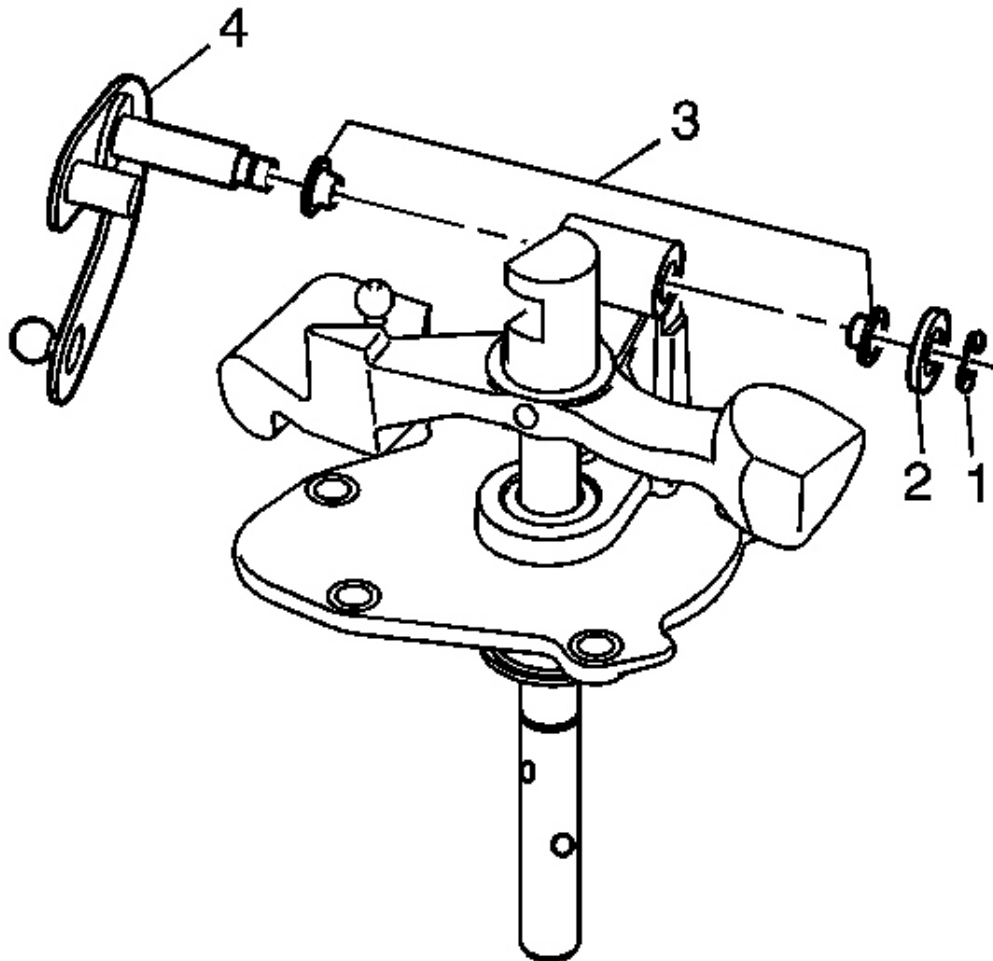


Fig. 68: View Of Select Lever & Components
Courtesy of GENERAL MOTORS CORP.

7. Remove the retainer (1).
8. Remove the washer (2).
9. Remove the select lever (4).
10. Inspect the bushings (3). Do not remove.

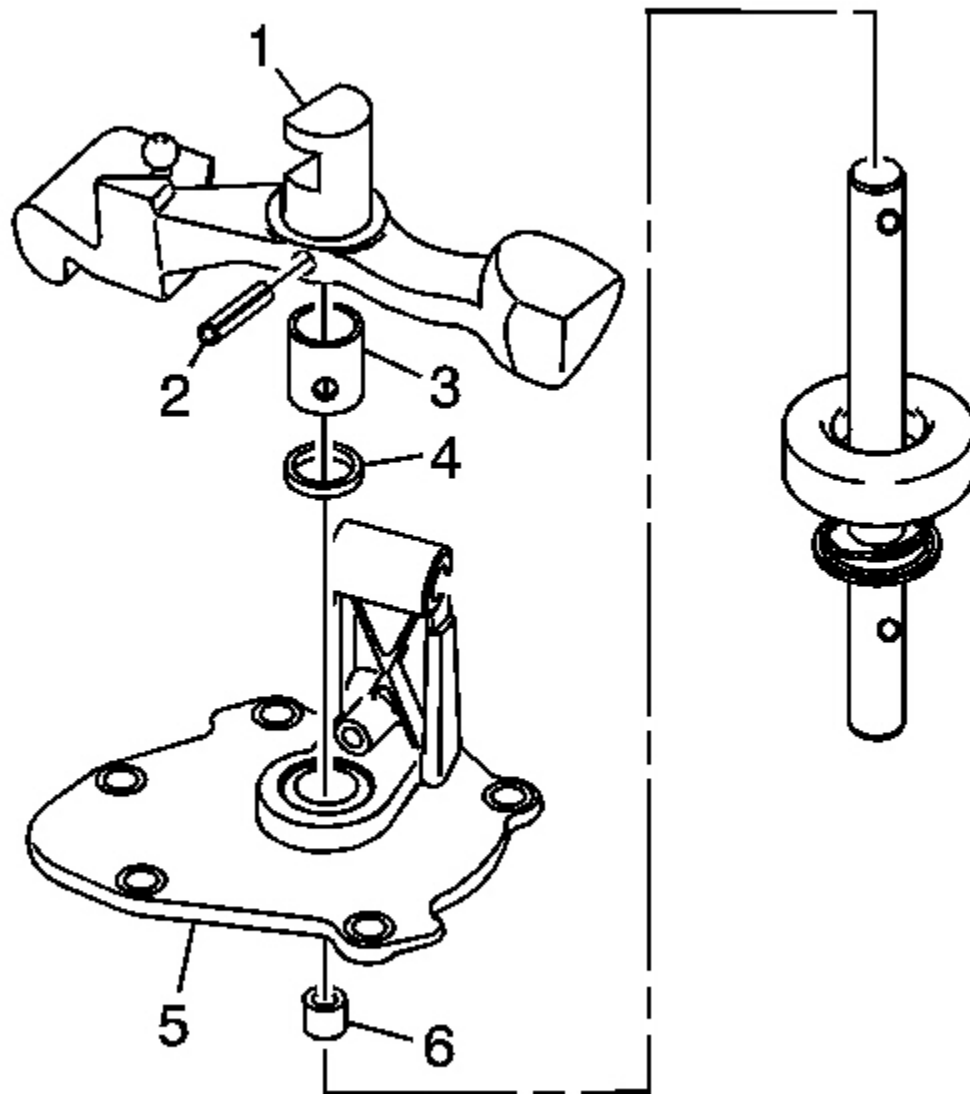


Fig. 69: View Of Shifter Shift Lever, Roll Pin, Bushing, Seals, Cover & Bearing
Courtesy of GENERAL MOTORS CORP.

11. Remove the roll pin (2). Discard the roll pin.
12. Remove the shift lever (1).
13. Remove the shift cover (5).
14. Inspect the shift cover bushing (3). Do not remove.

15. Inspect the seals (4). Do not remove.
16. Inspect the bearing (6). Do not remove.

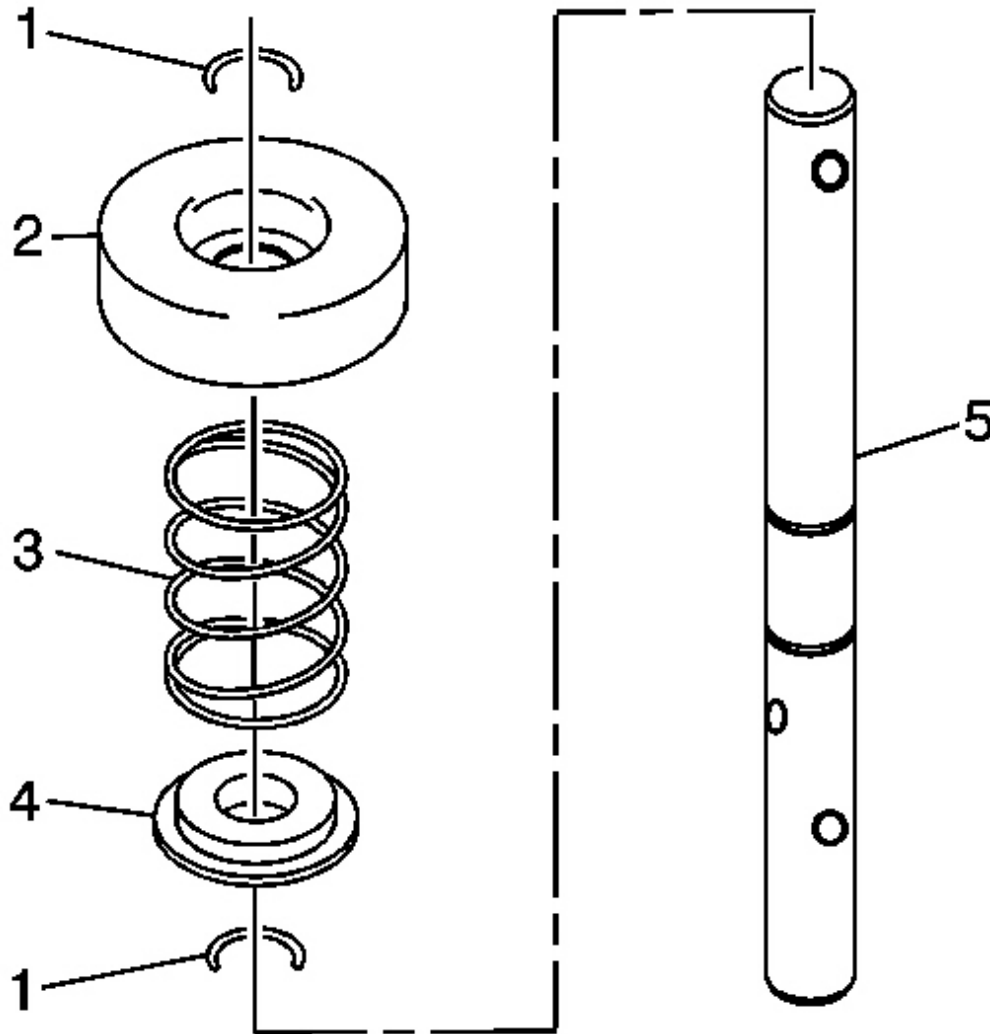


Fig. 70: Exploded View Of Shift Rod Assembly
Courtesy of GENERAL MOTORS CORP.

17. Remove the retainers (1). Discard the retainers.
18. Remove the outer spring seat (2).
19. Remove the inner spring (3).

20. Remove the inner spring seat (4) from the shift rod (5).

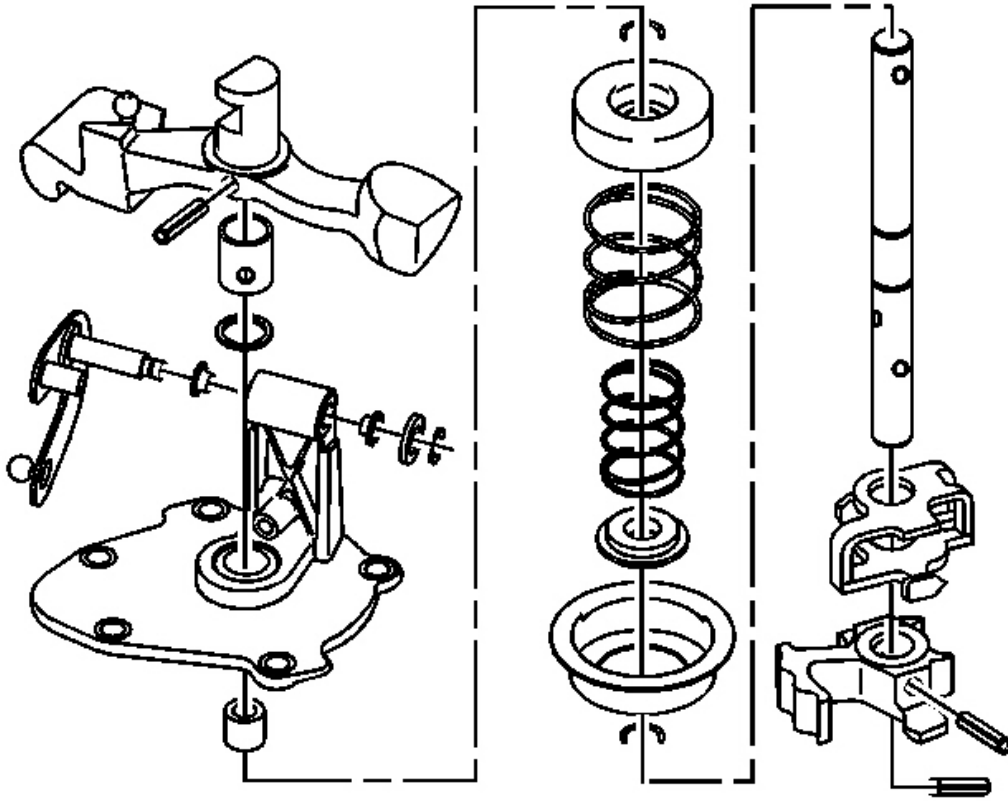


Fig. 71: Exploded View Of Shifter Assembly
Courtesy of GENERAL MOTORS CORP.

21. Clean all components in a suitable solution.
22. Inspect all components for wear or damage.
23. If any components have wear or damage, replace the shifter.

CLUTCH AND DIFFERENTIAL HOUSING CLEANING AND INSPECTION

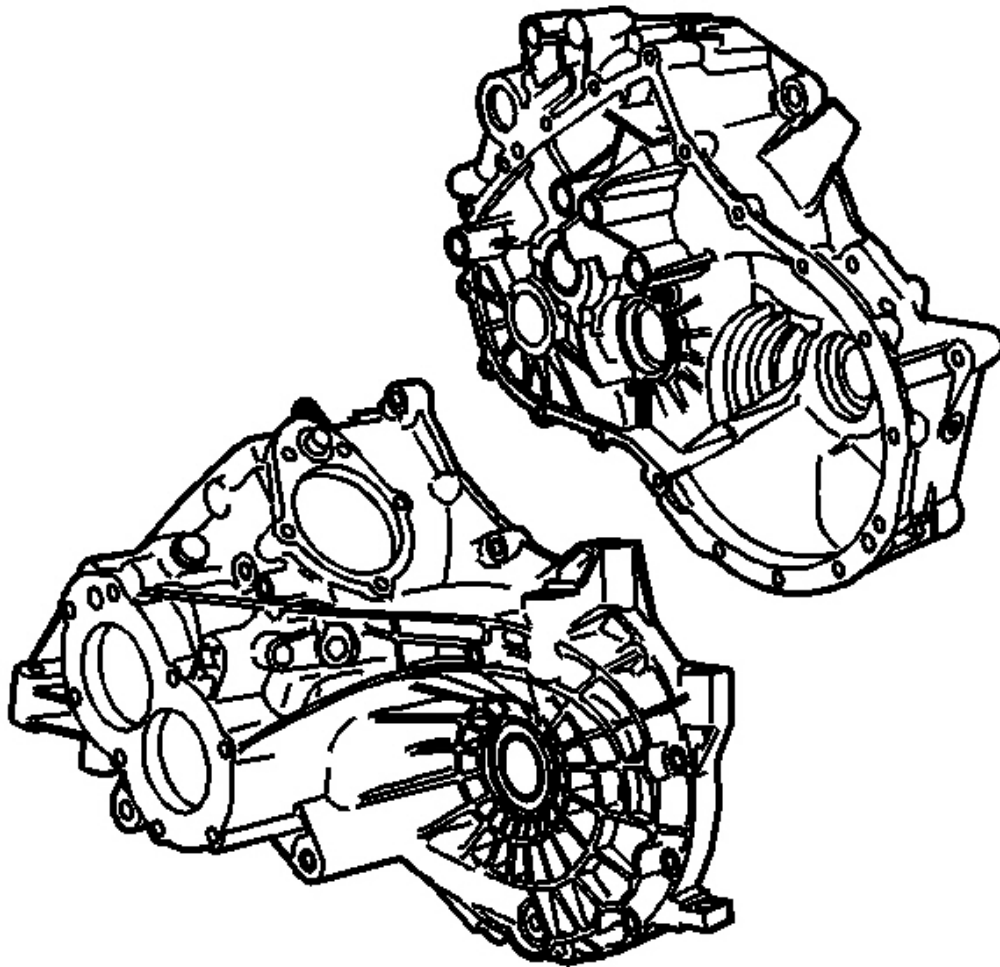


Fig. 72: View Of Clutch & Differential Housing
Courtesy of GENERAL MOTORS CORP.

Inspect the clutch housing and the differential housing for the following:

- Cracks
- Porosity
- Damaged mating surface
- Stripped bolt threads
- Distortion

Replace any part that exhibits any of these conditions.

GEARS CLEANING AND INSPECTION

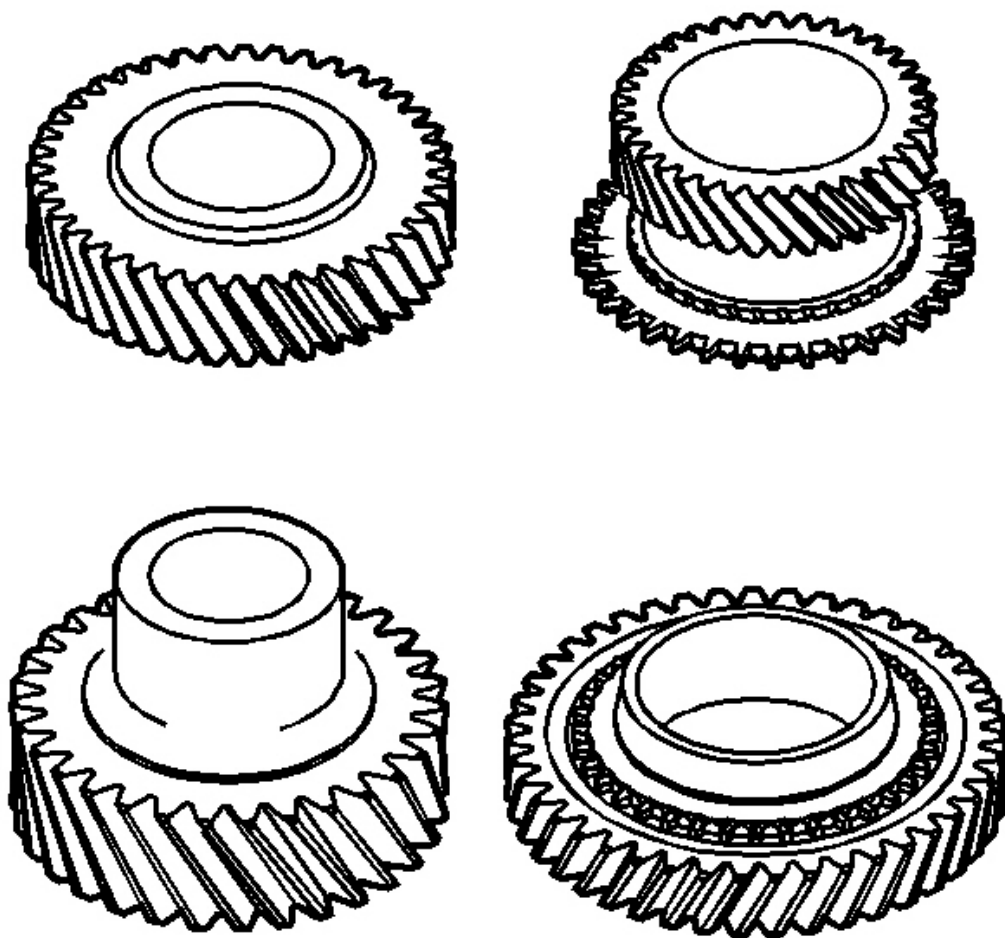


Fig. 73: View Of Gears

Courtesy of **GENERAL MOTORS CORP.**

Inspect the gear teeth and the gear splines for excessive wear or damage. Remove minor nicks or scratches with an oil stone. Replace worn or damaged gears.

THRUST WASHER AND BEARING CLEANING AND INSPECT

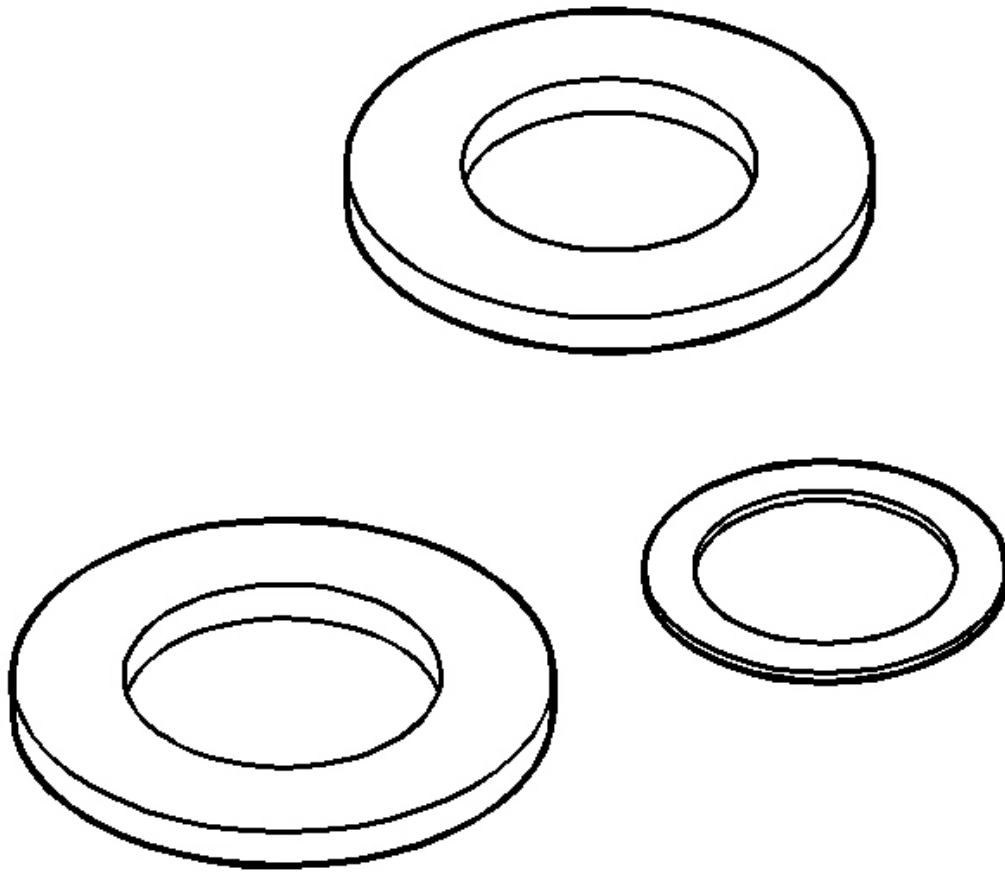


Fig. 74: View Of Thrust Washers
Courtesy of GENERAL MOTORS CORP.

1. Inspect the thrust washer for wear or damage.

Replace worn or damaged thrust washers.

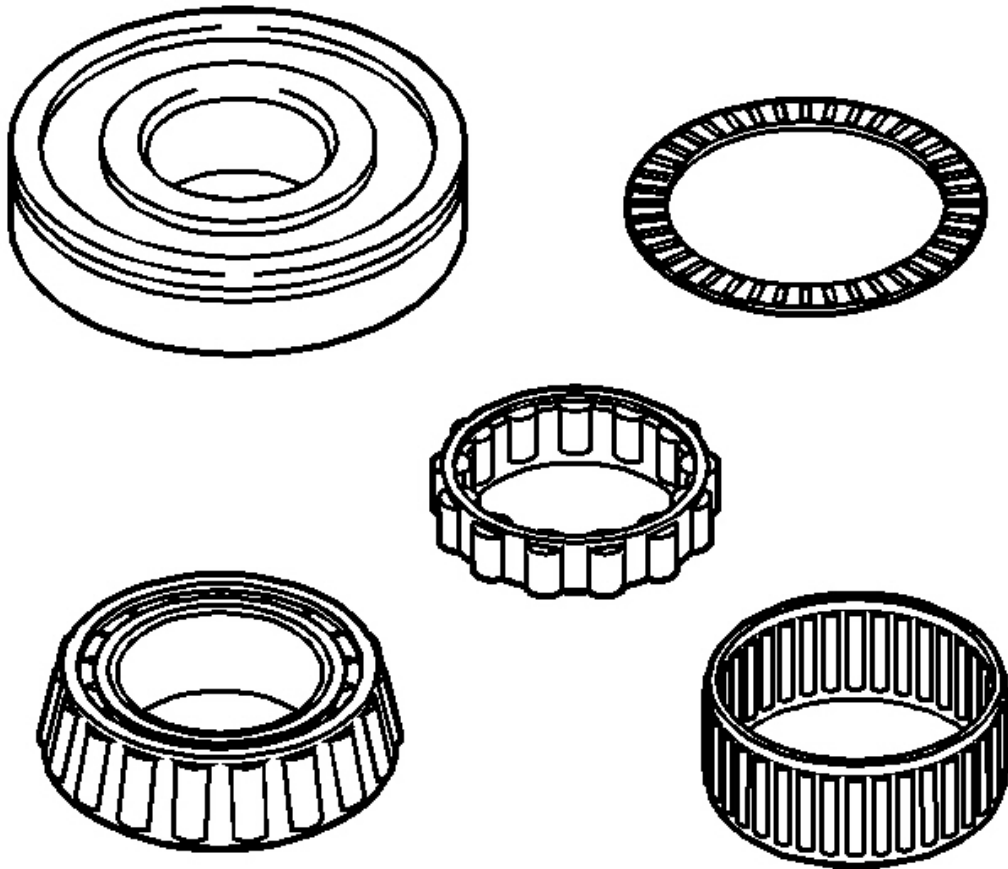


Fig. 75: View Of Bearings
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not allow the bearings to spin. Turn the bearings slowly by hand. Spinning bearings may cause damage to the rollers.

2. Inspect the condition of all thrust bearings, input shaft bearing, and output shaft bearing.

Wash the bearings thoroughly in a cleaning solvent. Apply compressed air to the bearings. Lubricate the bearings with light oil. Check the bearings for roughness by slowly turning the race by hand.

SYNCHRONIZERS CLEANING AND INSPECTION

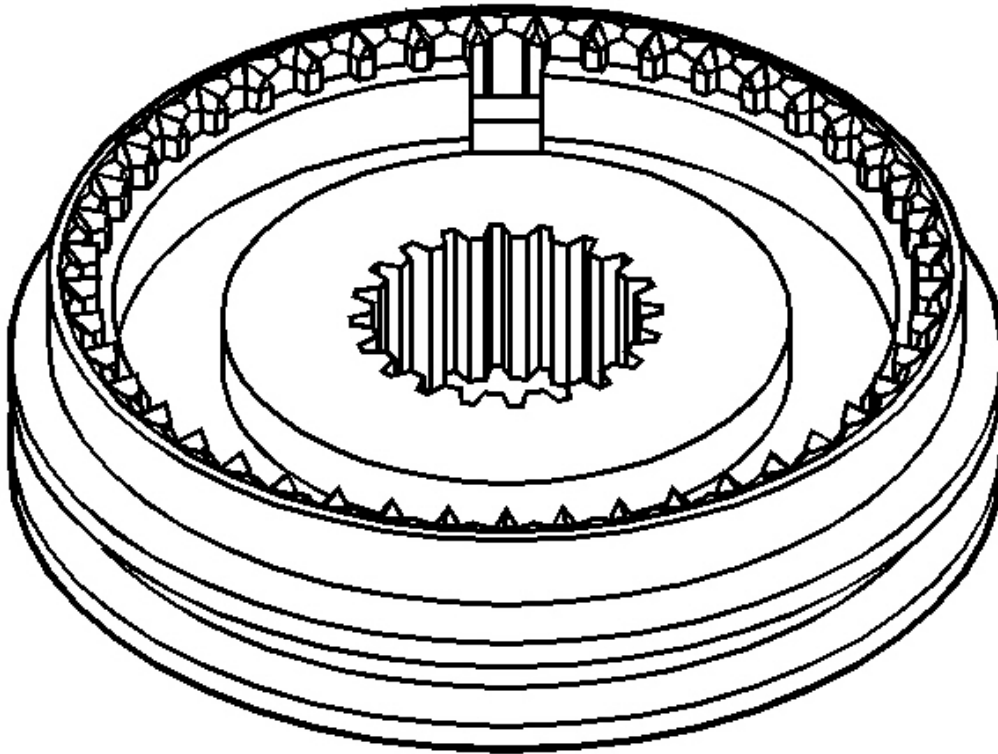


Fig. 76: View Of Synchronizer
Courtesy of GENERAL MOTORS CORP.

1. Clean the synchronizer with clean solvent.
2. Air dry the components.
3. Inspect the synchronizer teeth for the following conditions:
 - Wear
 - Scuffing
 - Nicks
 - Burrs
 - Breaking
4. Inspect the keys or the springs for the following:
 - Wear
 - Cracks
 - Distortion

If any of the following conditions exist, replace synchronizer.

SHIFT FORK CLEANING AND INSPECTION

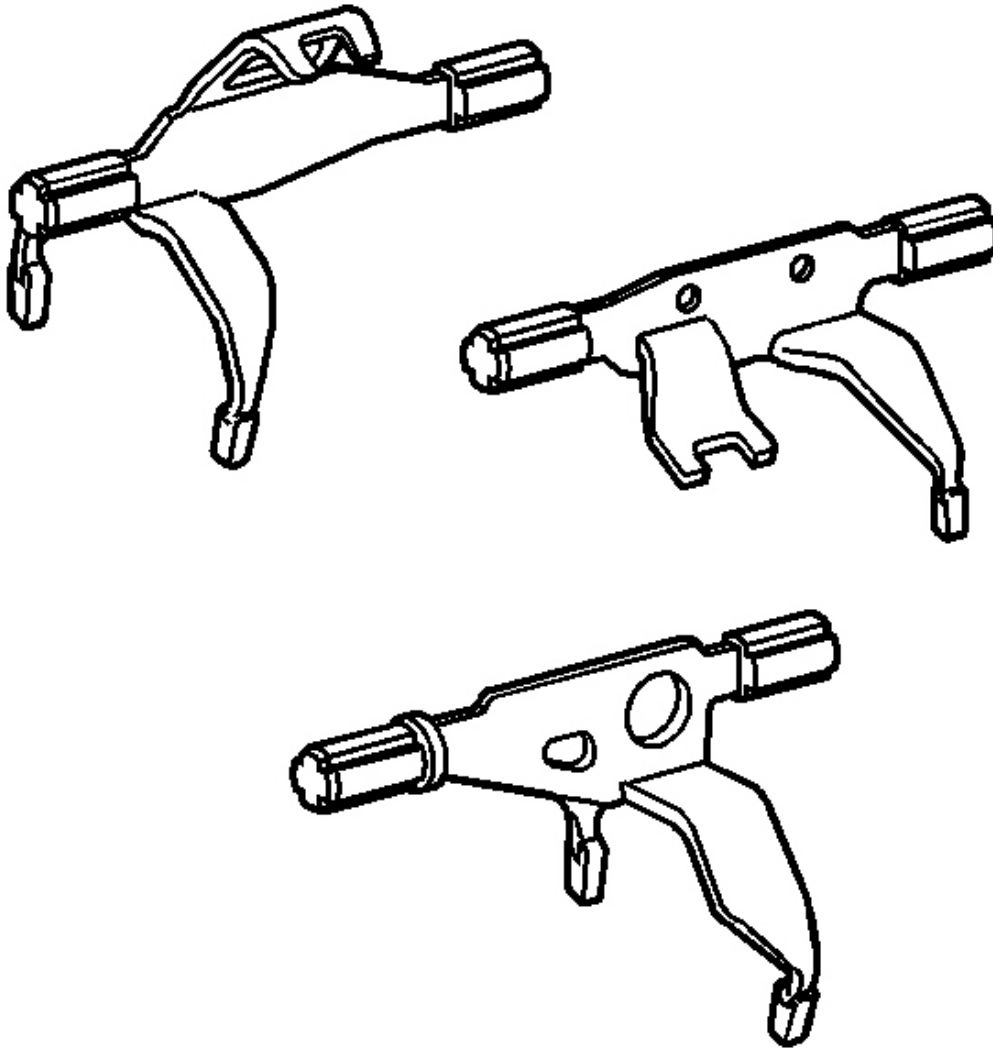


Fig. 77: View Of Shift Forks
Courtesy of GENERAL MOTORS CORP.

Inspect the shift forks, shafts and the rubber end for wear or damage.

Replace any part that is worn or damaged.

SHIFTER ASSEMBLE

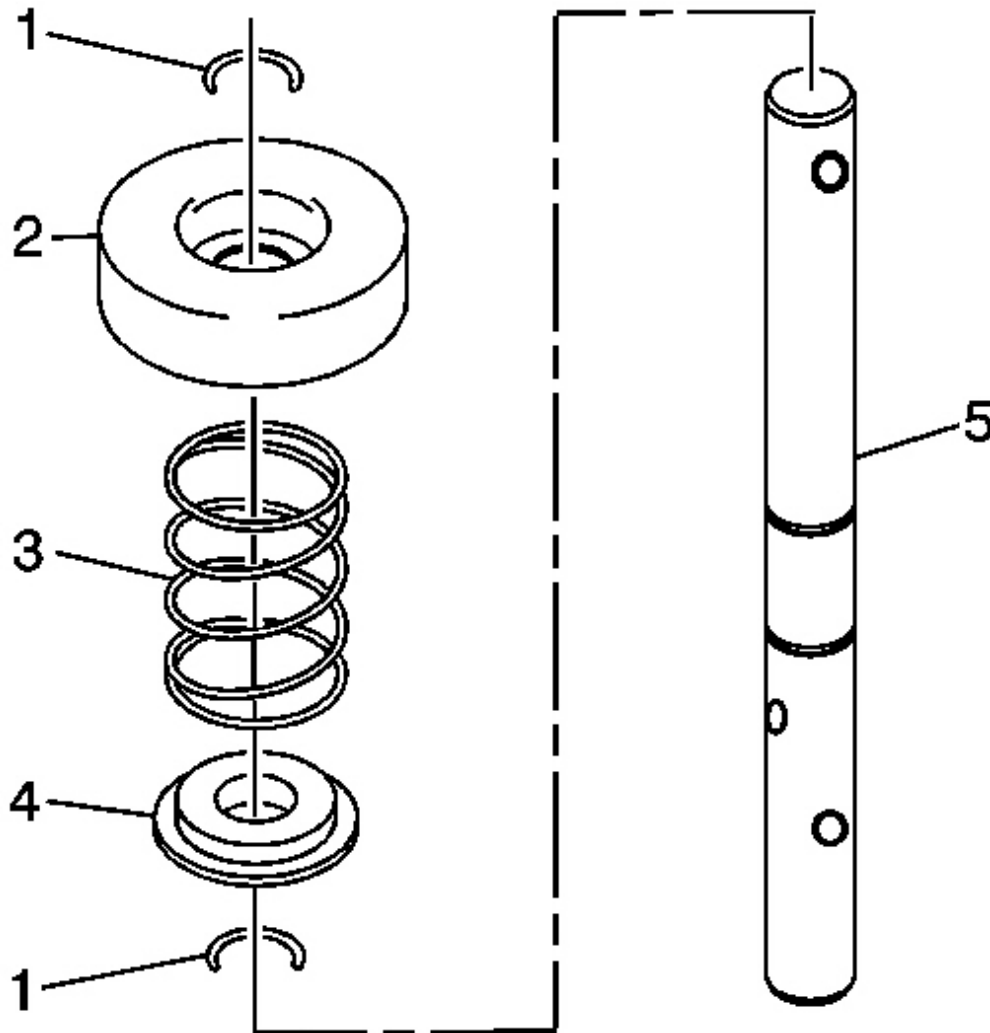


Fig. 78: Exploded View Of Shift Rod Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the inner spring seat (4) onto the shift rod (5).
2. Install the inner spring (3).
3. Install the outer spring seat (2).
4. Install NEW retainers (1).

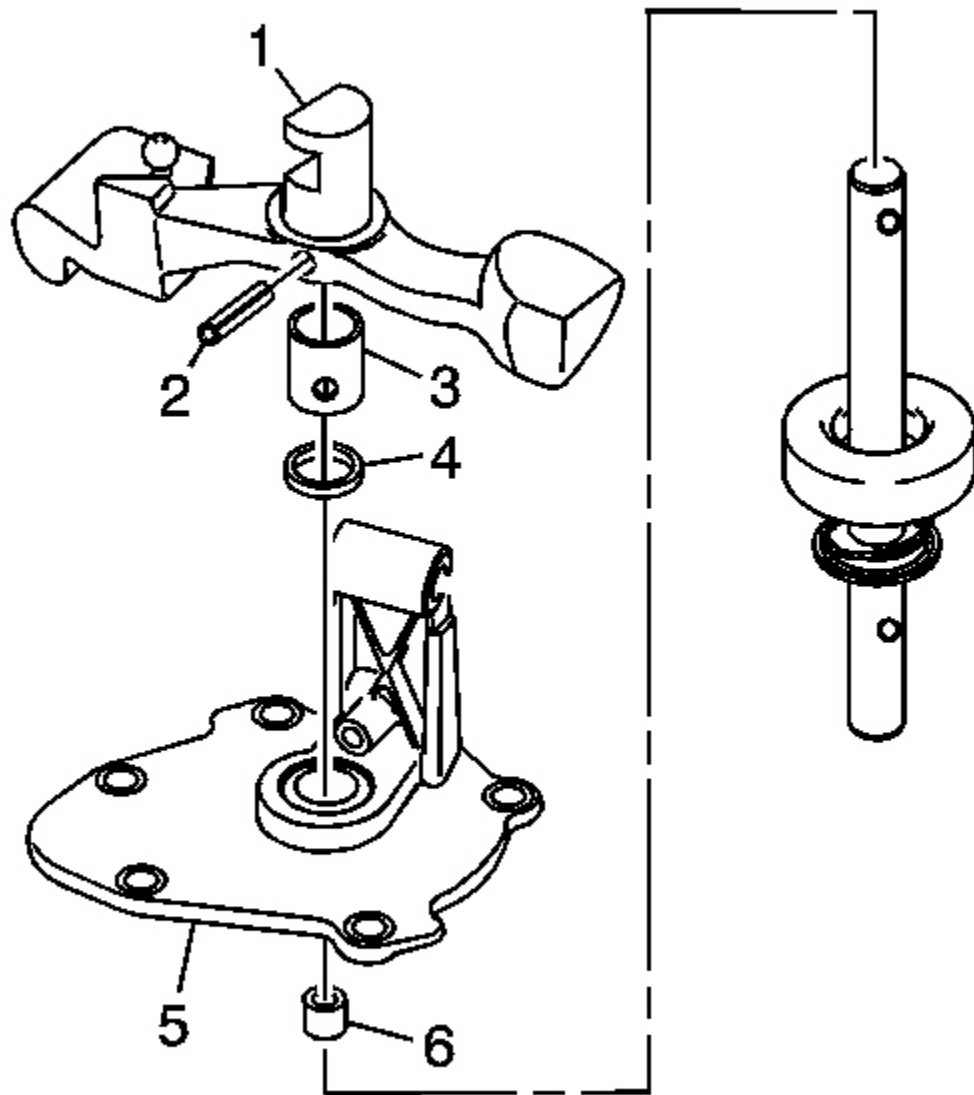


Fig. 79: View Of Shifter Shift Lever, Roll Pin, Bushing, Seals, Cover & Bearing
Courtesy of GENERAL MOTORS CORP.

5. Install the shift cover (5).
6. Install the shift cover bushing (3), if removed.
7. Install the shift lever (1).
8. Install a new roll pin (2).

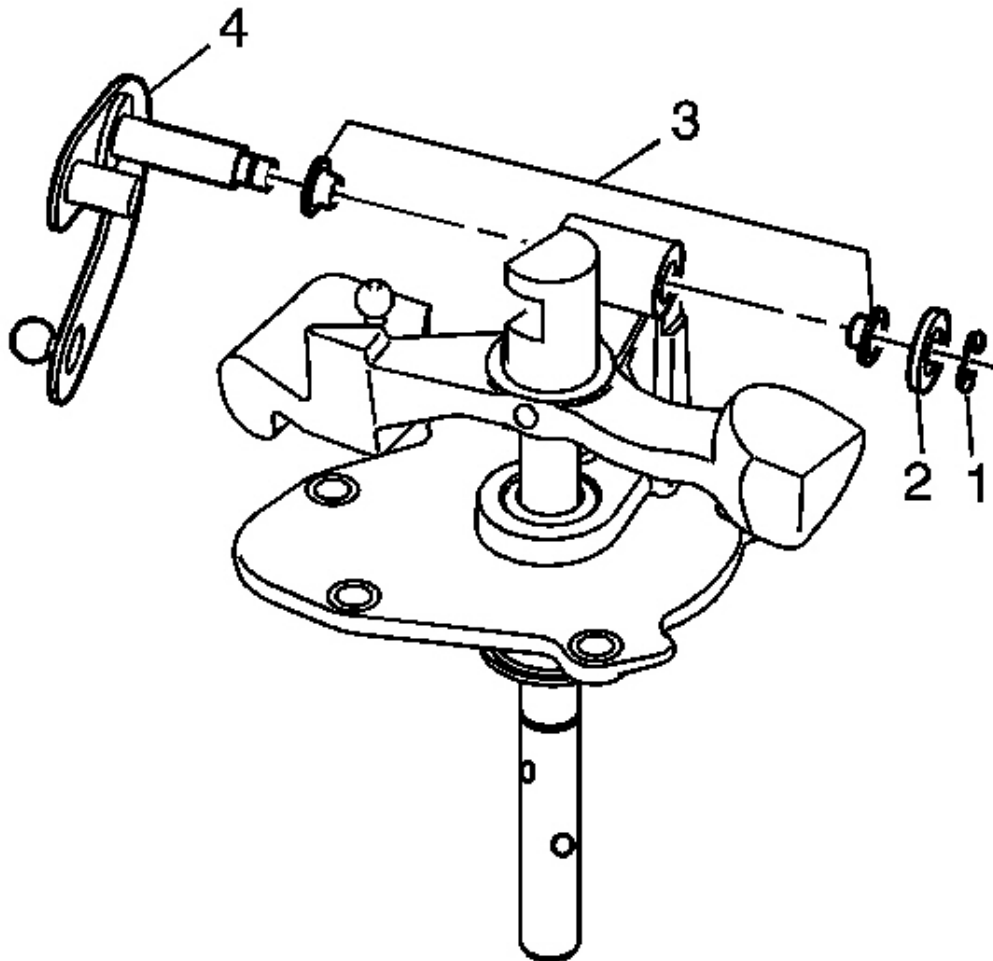


Fig. 80: View Of Select Lever & Components
Courtesy of GENERAL MOTORS CORP.

9. Install the select lever (4).
10. Install the washer (2).
11. Install the retainer (1).

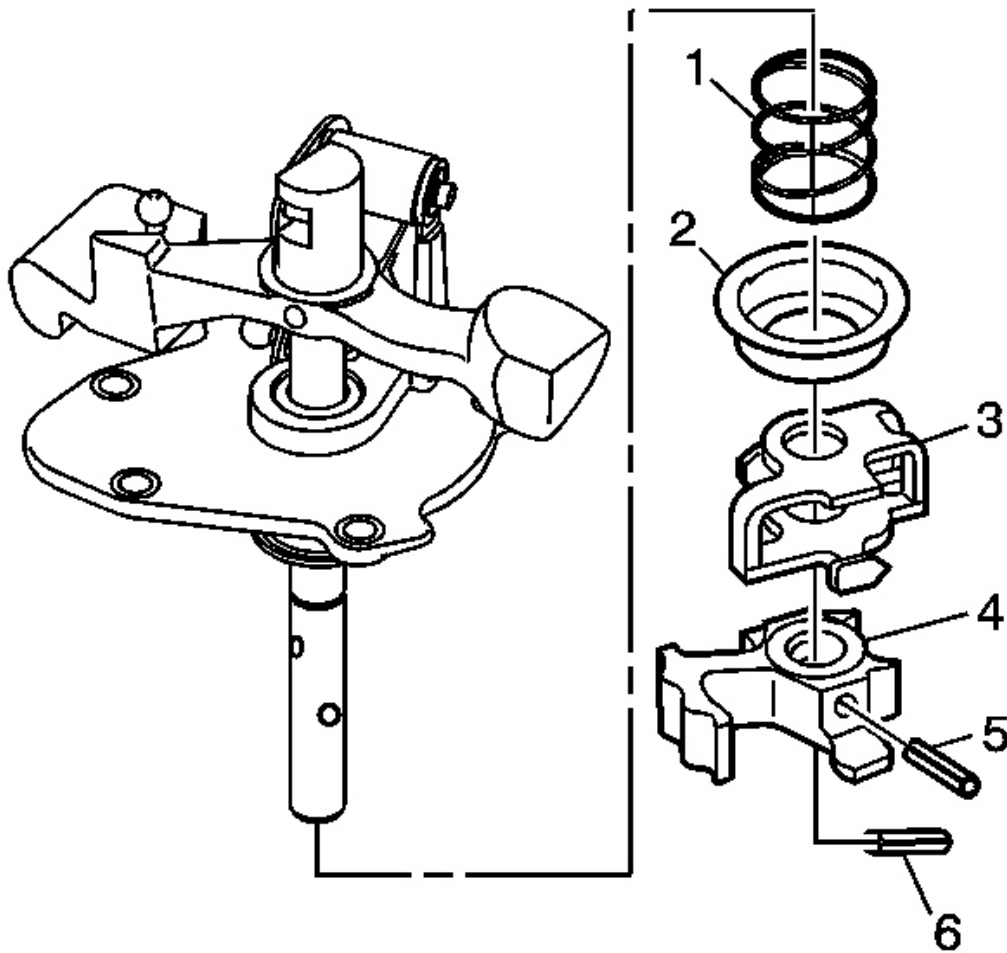


Fig. 81: View Of Shifter Roll Pins & Control Levers
Courtesy of GENERAL MOTORS CORP.

12. Install the outer spring (1).
13. Install the end cap (2).
14. Install the inner control lever (4) into the outer control lever (3).
15. Install the control levers onto the shaft.

IMPORTANT: Properly support the inner control lever (4) when installing the roll pin. Do not support the inner control lever (4) with the outer control lever (3).

16. Install a new roll pin (5).

IMPORTANT: Install the reverse lockout inhibit roll pin 1/3 to 1/4 way into the shaft. The pin must activate the reverse inhibit lever.

17. Install a new reverse lockout inhibit roll pin (6).

INTERMEDIATE SHAFT ASSEMBLE

Tools Required

J 24433 Press Tube. See **Special Tools and Equipment** .

Assembly Procedure

IMPORTANT: Lubricate all components with transmission fluid before installation.

1. Install the caged needle bearing (5).
2. Install the 2nd gear (4).

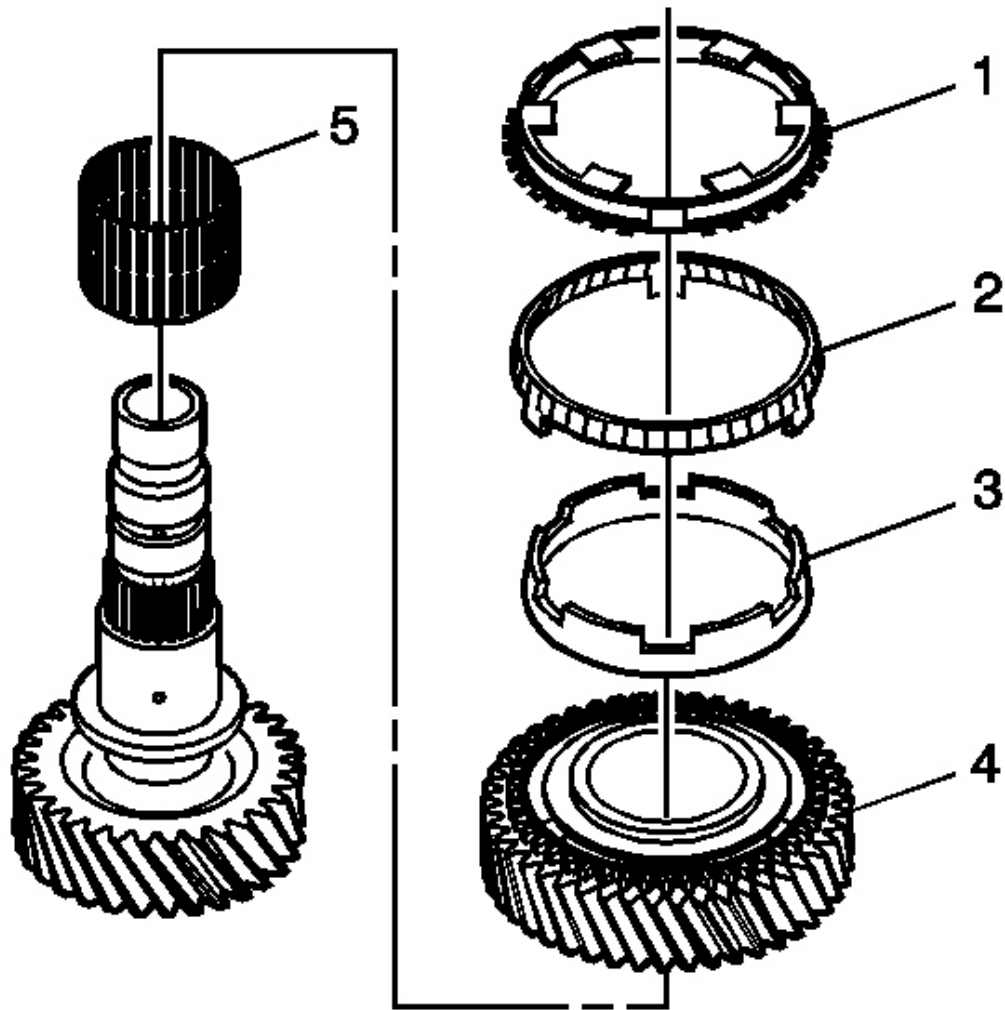


Fig. 82: Exploded View Of 2nd Gear Assembly
 Courtesy of GENERAL MOTORS CORP.

3. Install the 2nd gear inner cone (3).
4. Install the 2nd gear blocking ring (2).
5. Install the 2nd gear outer cone (1).

IMPORTANT:

- Make sure to properly align the synchronizer to the gear and notches in the blocking ring.
- Observe the orientation of the synchronizer. The shoulder of the

synchronizer faces 1st gear.

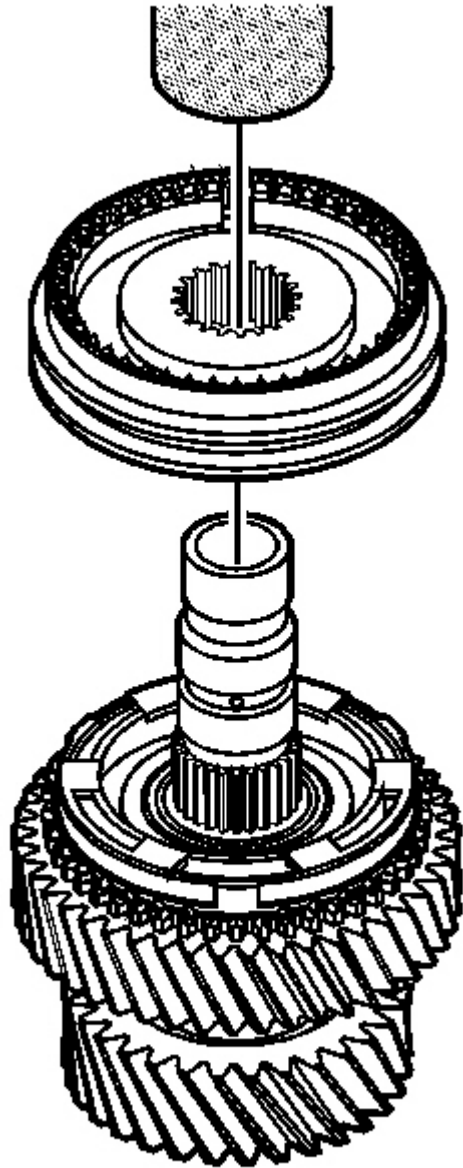


Fig. 83: Installing 1st/2nd Gear Synchronizer
Courtesy of GENERAL MOTORS CORP.

6. Install the 1st/2nd synchronizer using **J 24433** and a hydraulic press.

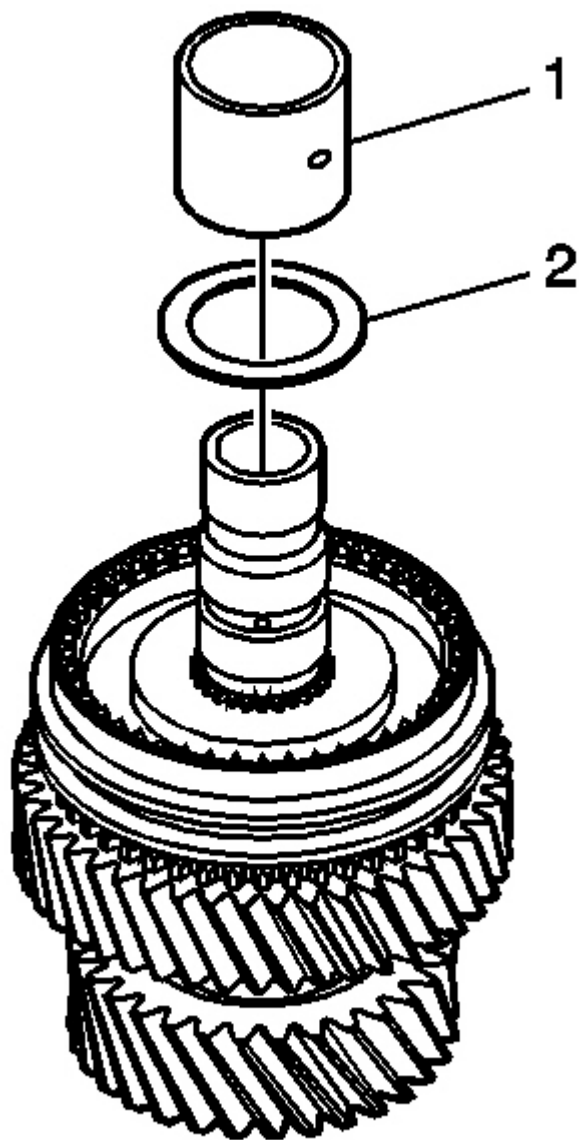


Fig. 84: Installing Thrust Washer & Bearing Collar
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Install the bearing collar oil hole 180 degrees from shaft oil hole.

7. Install the thrust washer (2) and the bearing collar (1) using an appropriate tool and a hydraulic press.

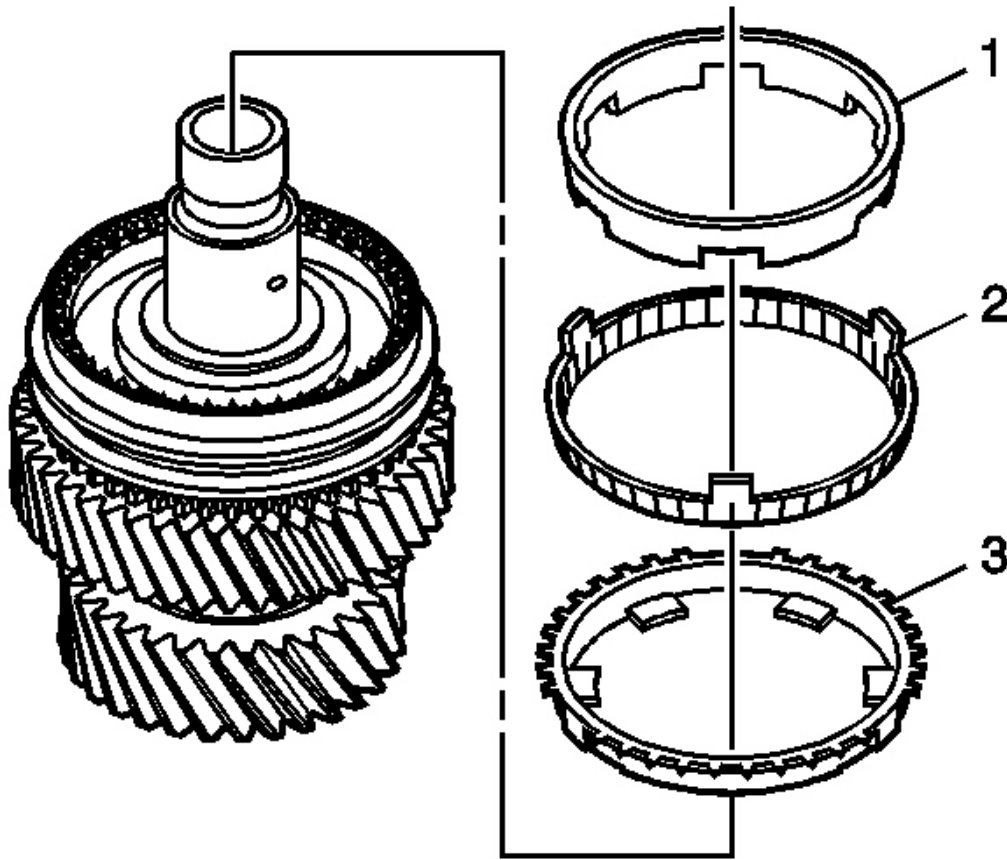


Fig. 85: View Of 1st Gear Cones & Blocking Ring
Courtesy of GENERAL MOTORS CORP.

8. Install the 1st gear outer cone (3).
9. Install the 1st gear blocking ring (2).
10. Install the 1st gear inner cone (1).

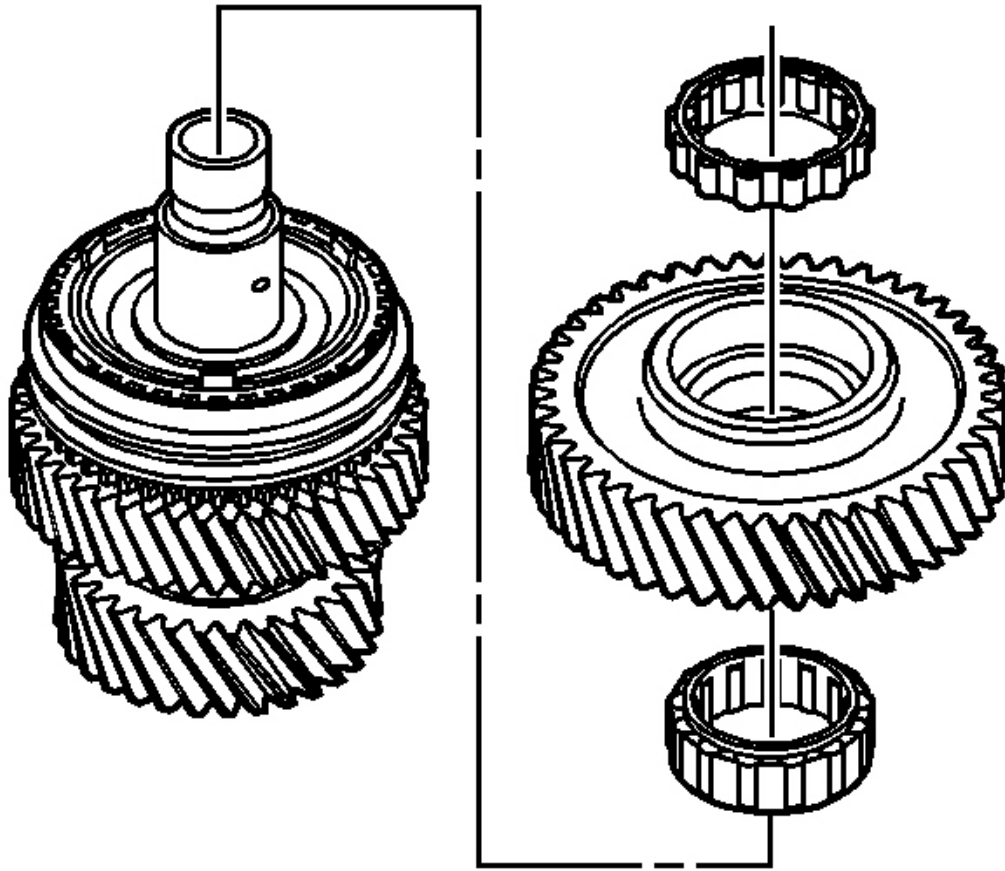


Fig. 86: Installing 1st Gear
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The steps in both roller bearings must fall into the 1st gear.

11. Install the roller bearing.
12. Install the 1st gear.
13. Install the roller bearing.

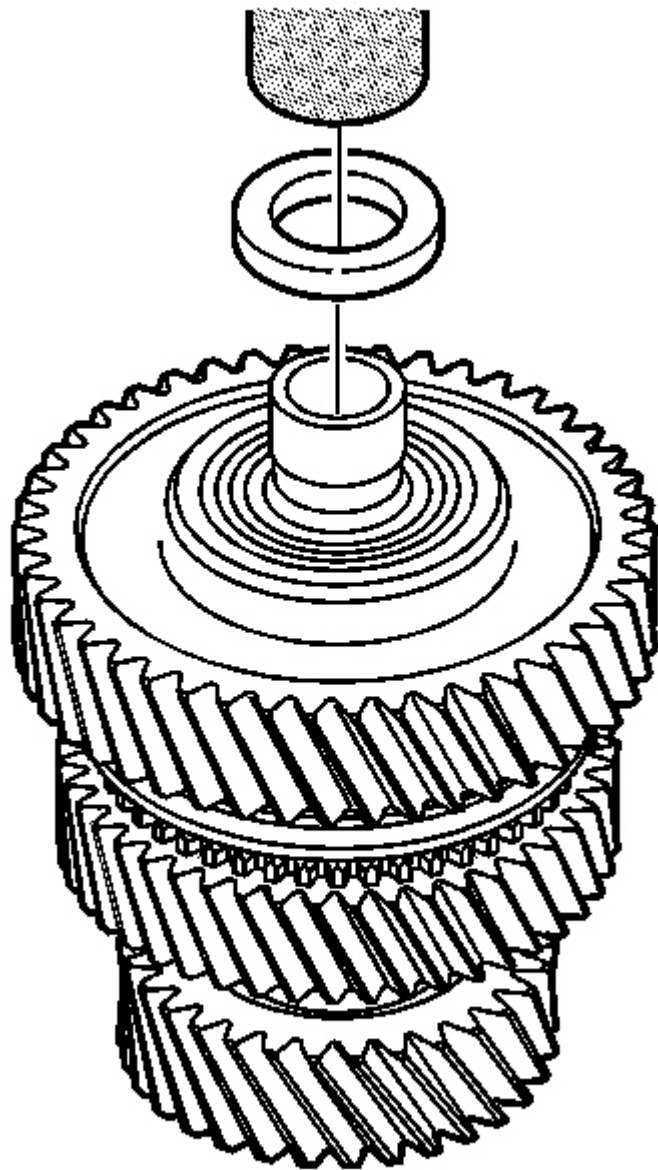


Fig. 87: Installing Thrust Washer
Courtesy of GENERAL MOTORS CORP.

14. Install the thrust washer using J 24433 and a hydraulic press.

INPUT SHAFT ASSEMBLE

Tools Required

J 24433 Press Tube. See **Special Tools and Equipment** .

Assembly Procedure

IMPORTANT:

- **Lubricate all components with transmission fluid before installation.**
- **The machined surface faces the needle thrust bearing.**

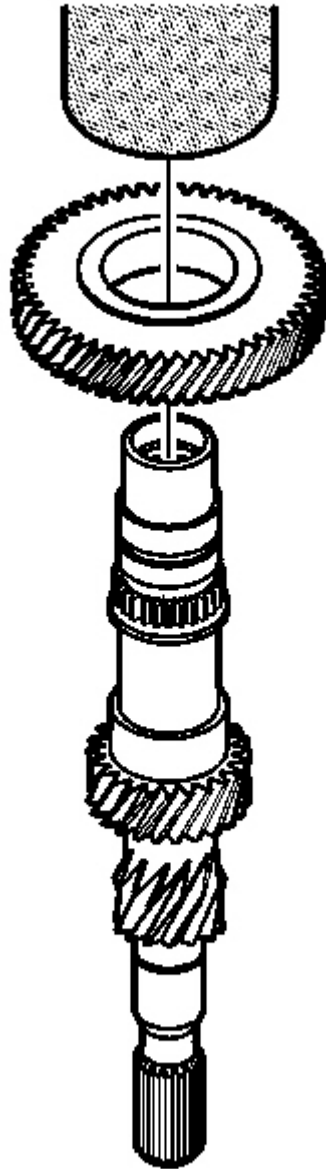


Fig. 88: Installing 5th Gear Using J 24433
Courtesy of GENERAL MOTORS CORP.

1. Install the 5th gear using **J 24433** and a hydraulic press.

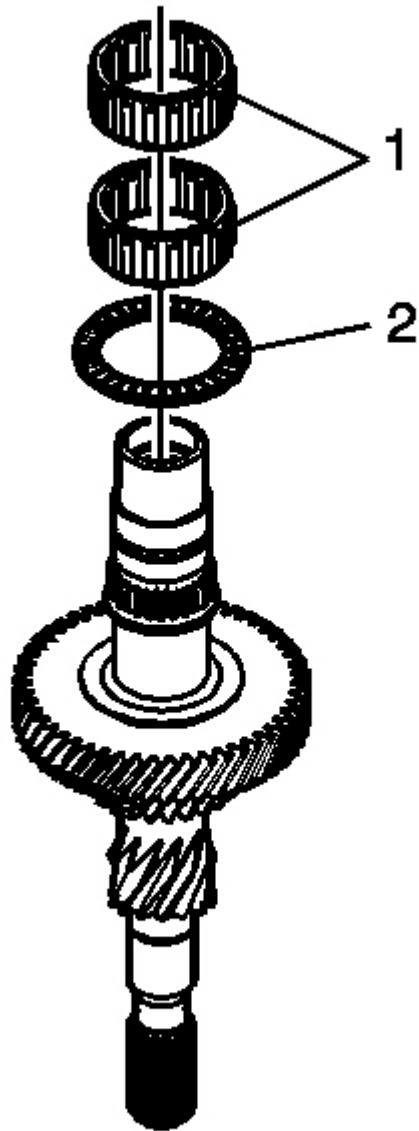


Fig. 89: View Of Caged Needle Bearing & Thrust Bearing
Courtesy of GENERAL MOTORS CORP.

2. Install the thrust bearing (2).
3. Install the two caged needle bearings (1).

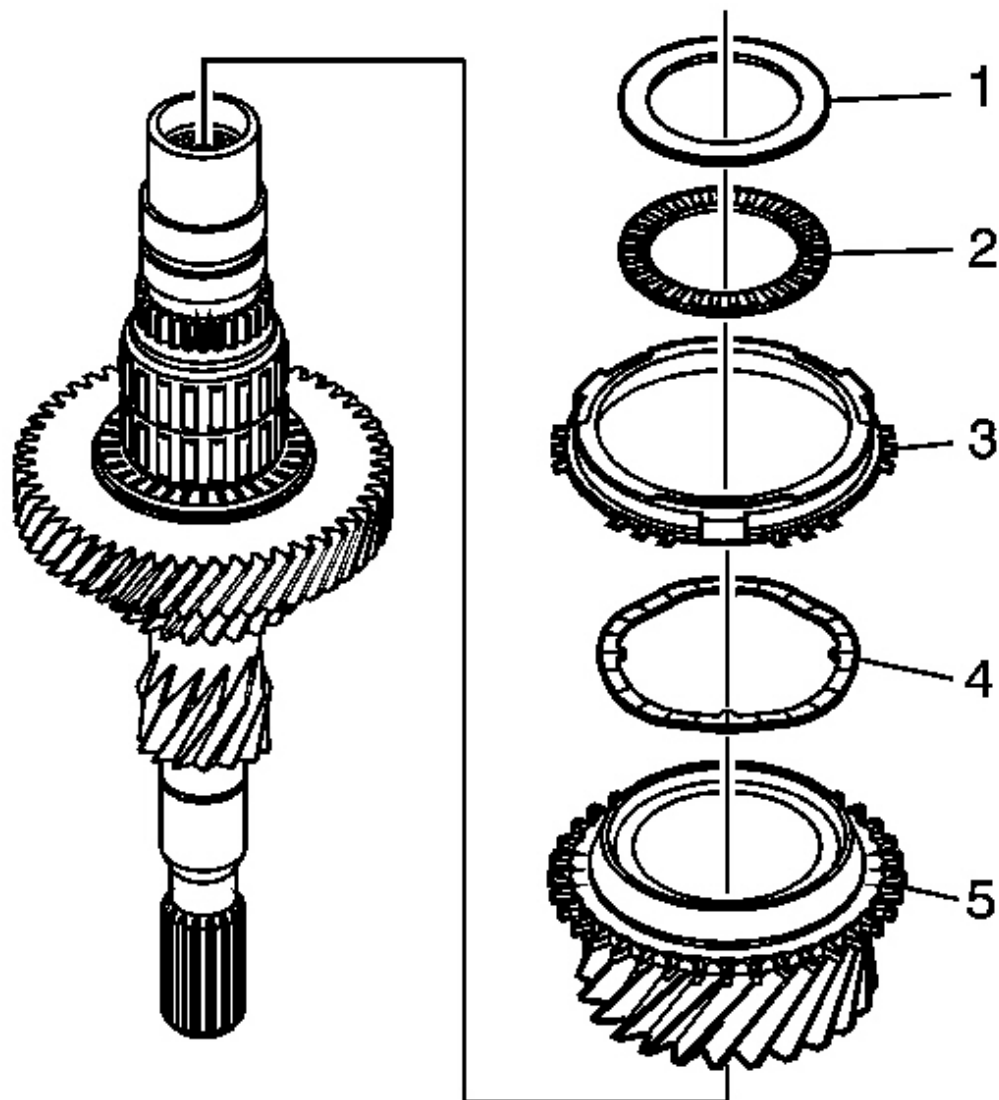


Fig. 90: Exploded View Of Input Shaft Assembly
Courtesy of GENERAL MOTORS CORP.

4. Install the 3rd gear (5).
5. Install the wavy washer (4).
6. Install the 3rd gear blocking ring (3).
7. Install the thrust bearing (2).

IMPORTANT: Use a NEW thrust washer.

8. Install a new thrust washer (1).

IMPORTANT:

- **The machined surface of the synchronizer faces the thrust washer.**
- **Make sure to align the slots in the synchronizer with the gear blocking ring tabs.**

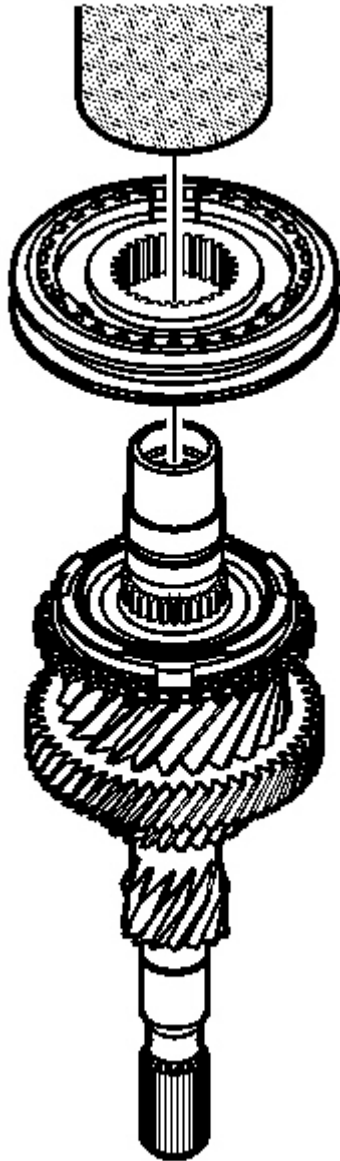


Fig. 91: Installing 3rd/4th Gear Synchronizer Assembly
Courtesy of GENERAL MOTORS CORP.

9. Install the 3rd/4th synchronizer using the **J 24433** and a hydraulic press.

IMPORTANT: Make sure the oil hole on the bearing collar is 90 degrees from the oil hole

in the shaft.

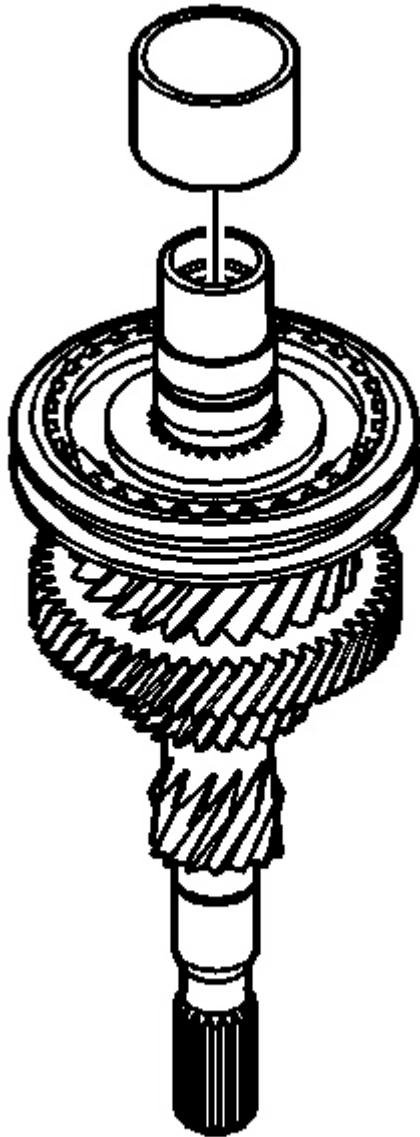


Fig. 92: View Of Bearing Collar
Courtesy of GENERAL MOTORS CORP.

10. Install the bearing collar using an appropriate tool and a hydraulic press.

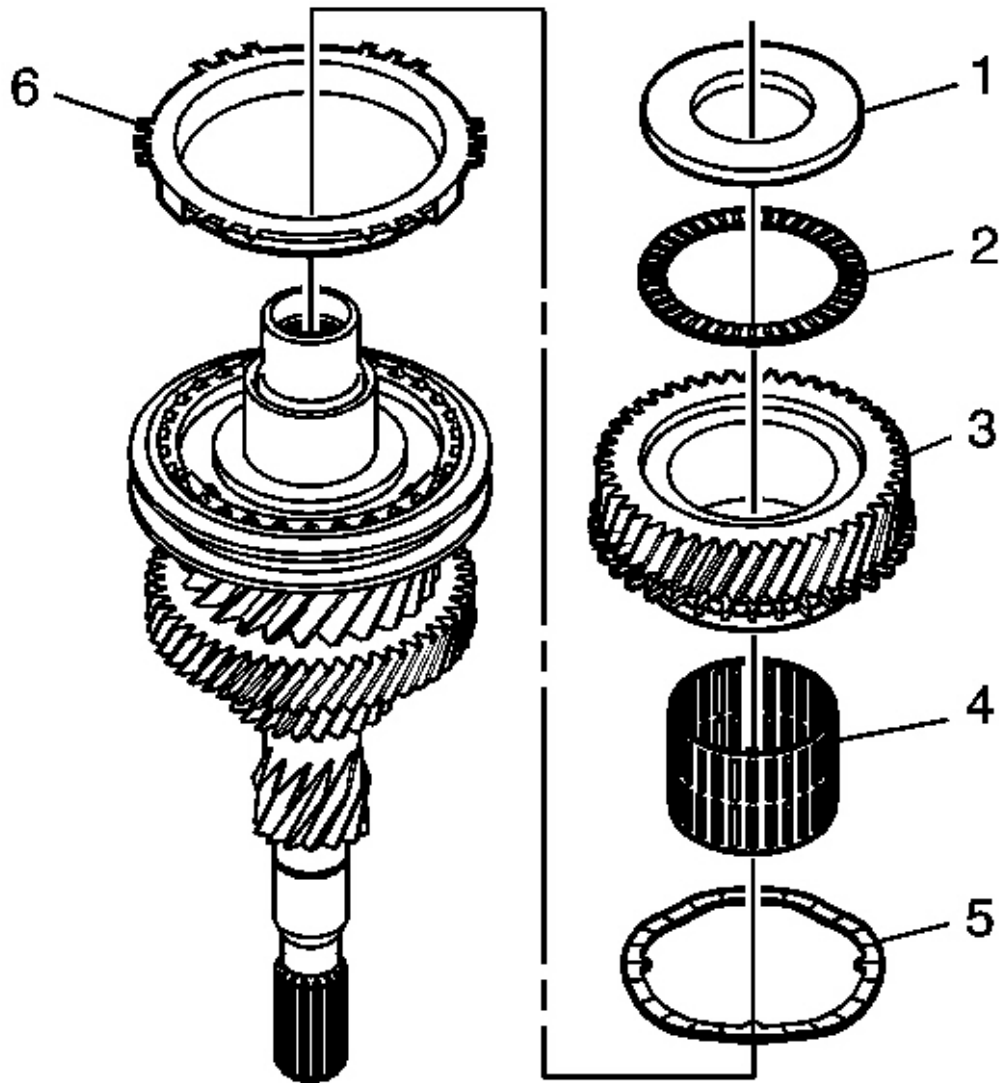


Fig. 93: Exploded View Of Input Shaft
Courtesy of GENERAL MOTORS CORP.

11. Install the 4th gear blocking ring (6).
12. Install the wavy washer (5).
13. Install the caged needle bearing (4).
14. Install the 4th gear (3).

IMPORTANT: The pocketed side of the thrust bearing (2) faces the thrust washer.

15. Install the thrust bearing (2).
16. Install the thrust washer (1).

OUTPUT SHAFT ASSEMBLE

Tools Required

J 24433 Press Tube. See **Special Tools and Equipment** .

Assembly Procedure

IMPORTANT:

- Lubricate all components in transmission fluid before installation.
- Make sure the oil hole in the collar is 90 degrees from the oil hole in the output shaft.

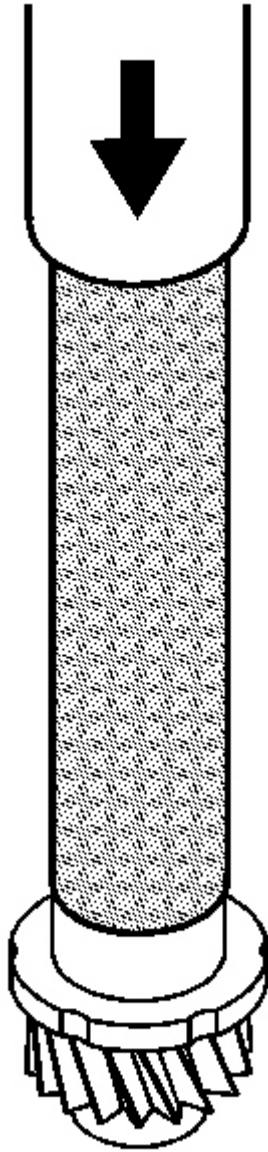


Fig. 94: Identifying J 24433
Courtesy of GENERAL MOTORS CORP.

1. Install the thrust washer using the **J 24433** and a hydraulic press.
2. Install the collar using the **J 24433** and a hydraulic press.

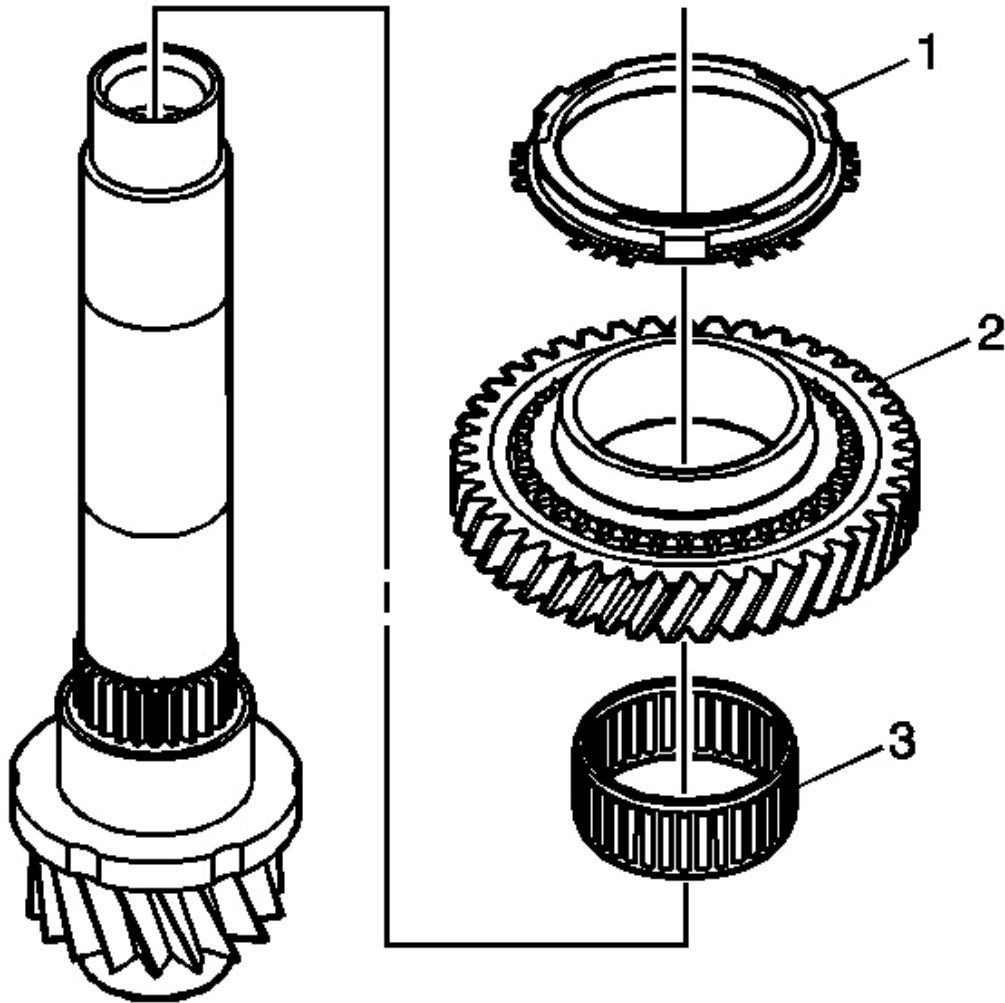


Fig. 95: Installing Reverse Gear, Reverse Gear Blocking Ring And Caged Needle Bearings
Courtesy of GENERAL MOTORS CORP.

3. Install the caged needle bearings (3).
4. Install the reverse gear (2).
5. Install the reverse gear blocking ring (1).

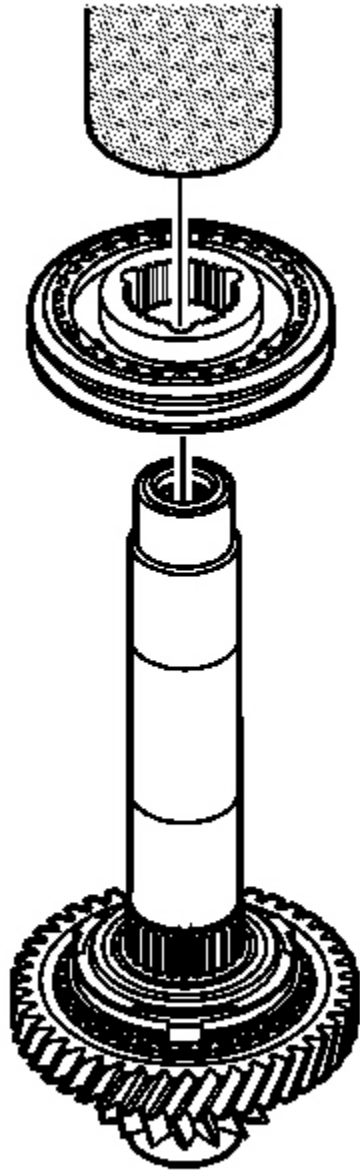


Fig. 96: Installing 5th/Reverse Synchronizer
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- The raised center hub of the 5th/Reverse synchronizer assembly faces the 5th gear.

- Line up the blocking ring tabs and the hub keyways while pressing.

6. Install the 5th/Reverse synchronizer using the **J 24433** and a hydraulic press.

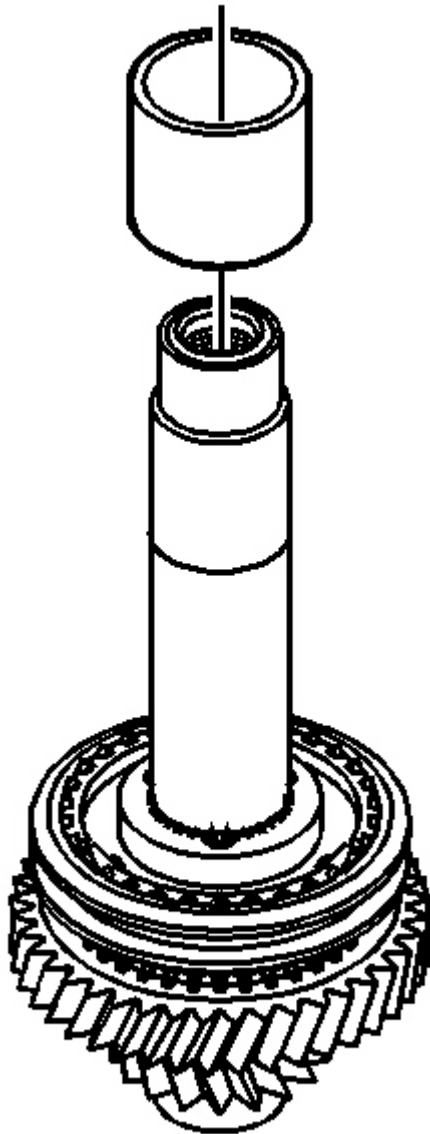


Fig. 97: Installing Bearing Collar
Courtesy of GENERAL MOTORS CORP.

7. Install the bearing collar using an appropriate tool and a hydraulic press.

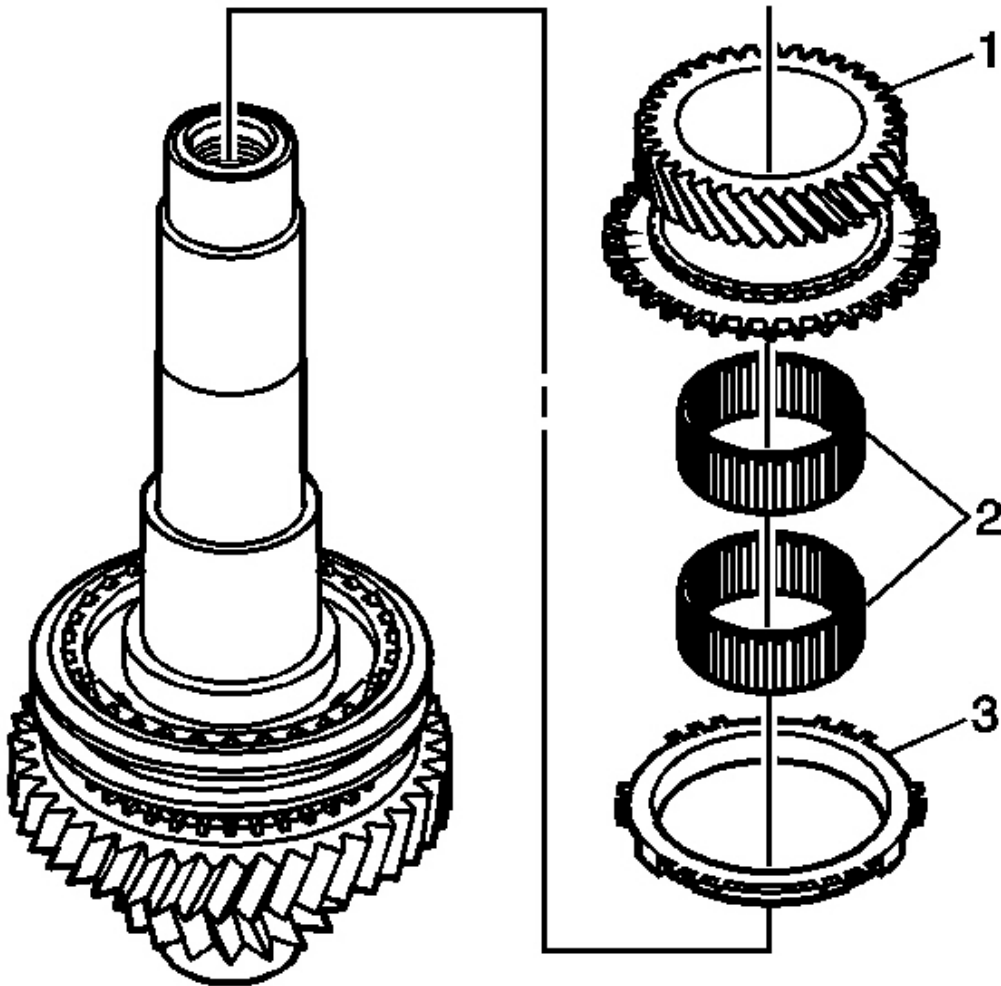


Fig. 98: Installing 5th Gear, Caged Needle Bearings And 5Th Gear Blocking Ring
Courtesy of GENERAL MOTORS CORP.

8. Install the 5th gear blocking ring (3).
9. Install the two caged needle bearings (2).
10. Install the 5th gear (1).

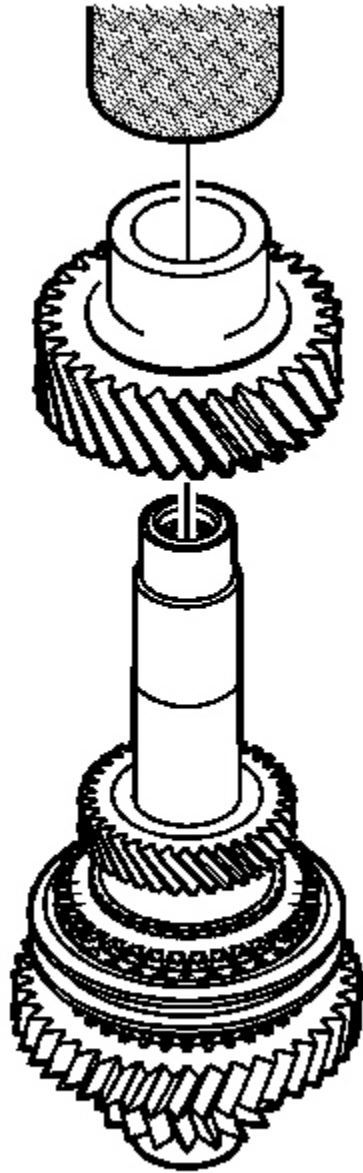


Fig. 99: Installing 3rd Gear
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The 3rd gear will install very tight. Ensure that the mating surfaces are clean.

11. Install the 3rd gear using the **J 24433** and a hydraulic press.

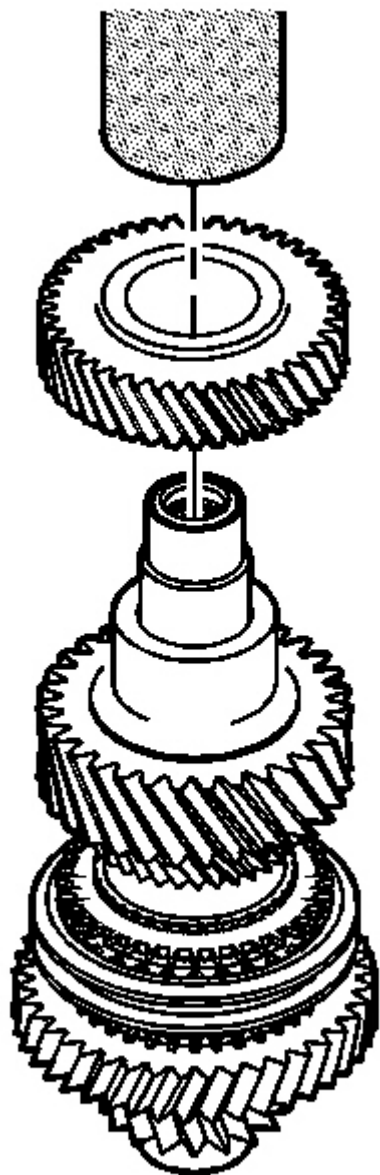


Fig. 100: Installing 4th Gear
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The 4th gear will install very tight. Ensure that the mating surfaces are clean.

12. Install the 4th gear using the **J 24433** and a hydraulic press.

DIFFERENTIAL CASE ASSEMBLE

Tools Required

- **J 7079-2** Universal Driver Handle - Non-threaded. See **Special Tools and Equipment** .
- **J 44386** Input/Output Bearing Installer. See **Special Tools and Equipment** .

1. Clean all parts in a suitable solution before assembling.

IMPORTANT:

- Refer to **Shimming Procedures** before assembling the differential case.
- Lubricate the bearing inner and outer race surface before assembly.

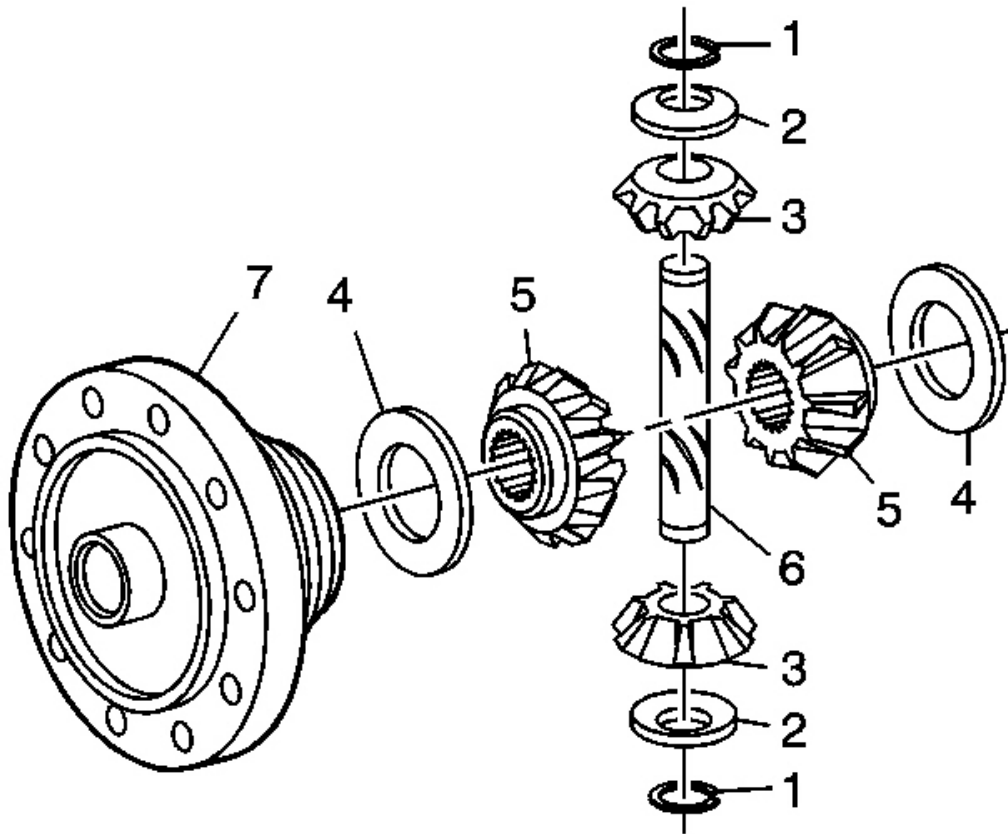


Fig. 101: Exploded View Of Pinion Assembly
Courtesy of GENERAL MOTORS CORP.

2. Install the following parts into the differential case (7):
 - The pinion gears (3)
 - The pinion gear thrust washers (2)
 - The side gears (5)
 - The side gear thrust washers (4)
 - The pinion shaft (6)
 - NEW snap rings (1)

IMPORTANT: Apply even pressure to the vehicle speed sensor (VSS) ring during installation.

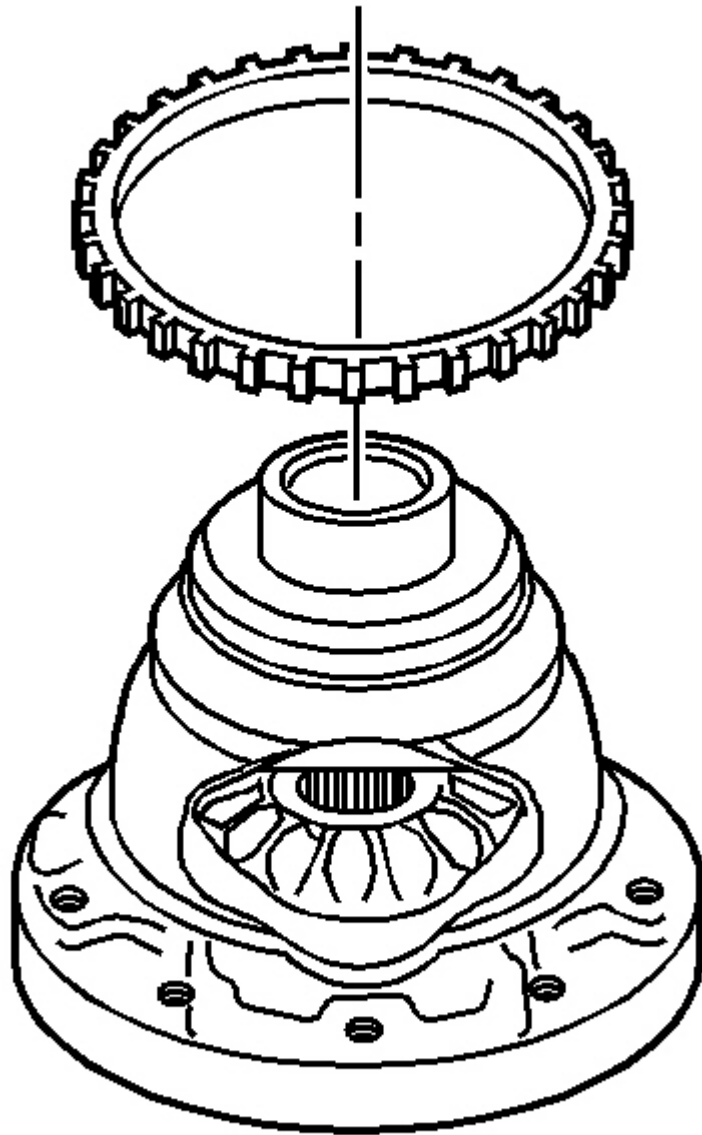


Fig. 102: View Of VSS Ring
Courtesy of GENERAL MOTORS CORP.

3. Install the vehicle speed sensor (VSS) ring onto the differential case.

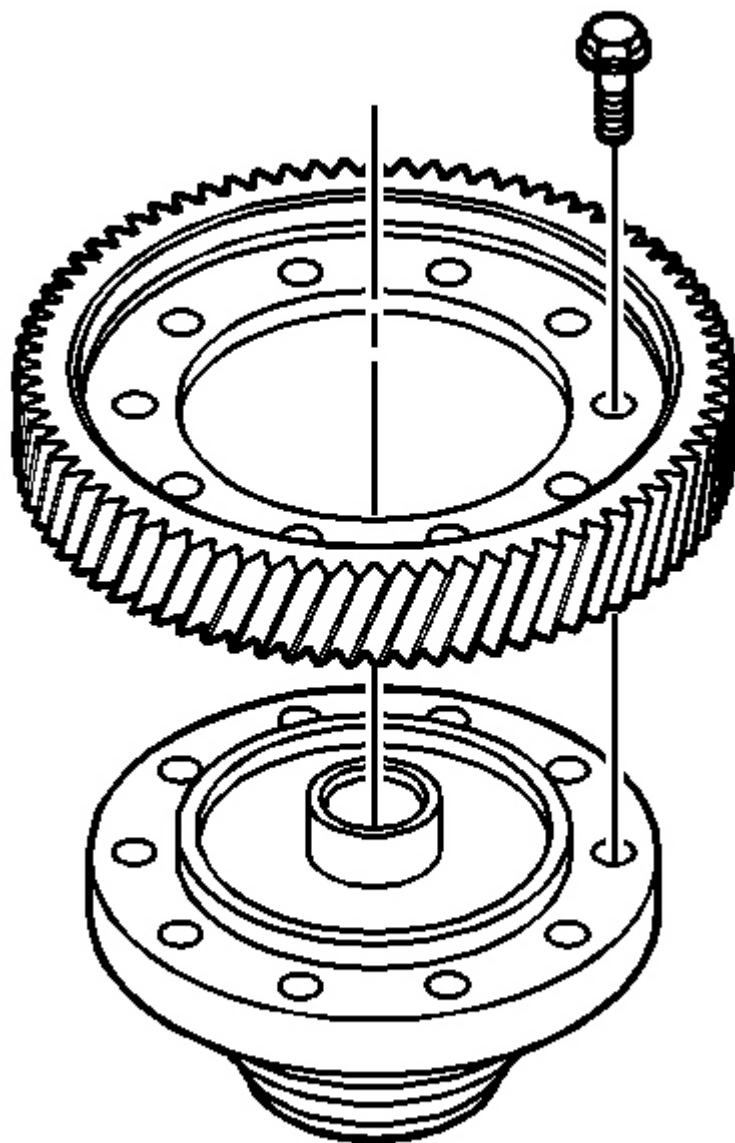


Fig. 103: View Of Differential Gear
Courtesy of GENERAL MOTORS CORP.

4. Apply GM P/N 12345493 (Canadian P/N 10953488) or equivalent to the differential ring gear bolts.

IMPORTANT: The machined surface on the differential ring gear faces the differential case.

5. Install the differential ring gear onto the differential case.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the ten NEW differential ring gear bolts.

Tighten: Tighten the differential ring gear bolts to 95 N.m (68 lb ft).

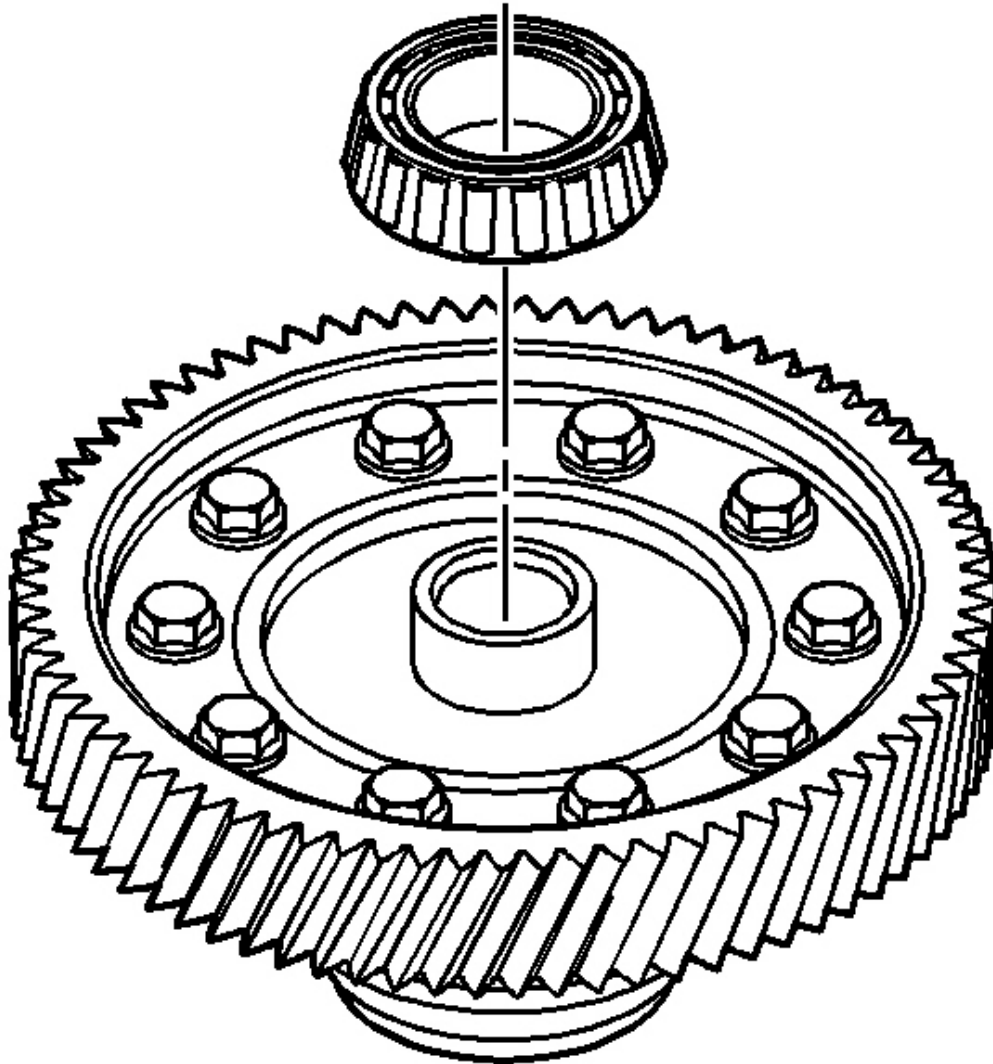


Fig. 104: Installing Left Differential Side Bearing & Shim

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Refer to Shimming Procedures before installing the left differential side bearing.

7. Install a NEW left differential side bearing and shim onto the differential case using the **J 44386** and the **J 7079-2** .

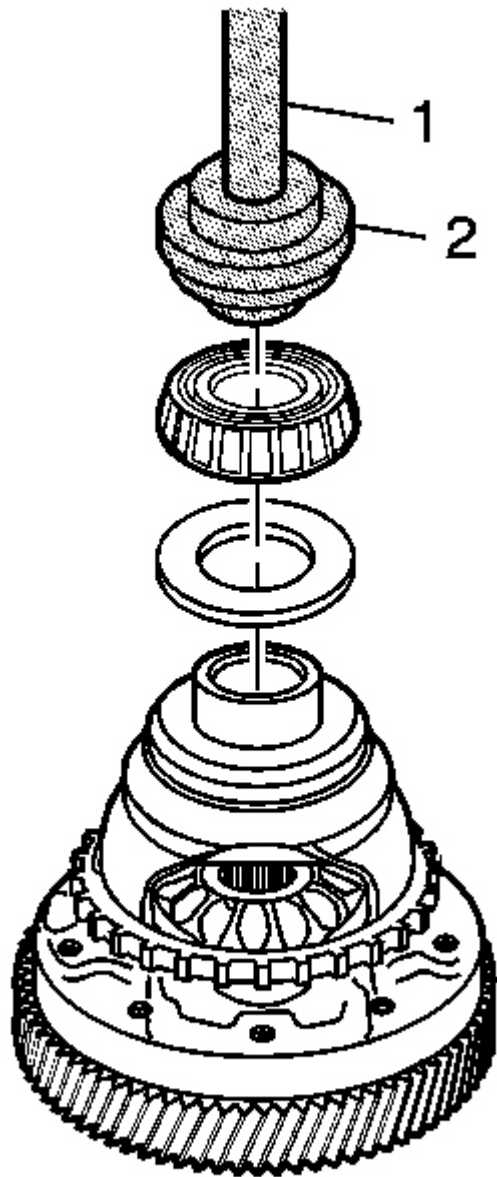


Fig. 105: Installing Right Differential Side Bearing & Shim
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Refer to Shimming Procedures before installing the right differential side bearing.

8. Install a NEW right differential side bearing and shim onto the differential case using the **J 44386** (2) and the **J 7079-2** (1).

TRANSAXLE CASE ASSEMBLY

Tools Required

- **J 7079-2** Universal Driver Handle - Non-Threaded. See **Special Tools and Equipment** .
- **J 8092** Universal Driver Handle - 3/4 in - 10. See **Special Tools and Equipment** .
- **J 44375** Assembly Pallet. See **Special Tools and Equipment** .
- **J 44376** Bearing Pusher/Puller. See **Special Tools and Equipment** .
- **J 44377** Input Shaft Anti-Rotation Tool. See **Special Tools and Equipment** .
- **J 44381** Shifter Bearing/Input and Output Bearing Remover. See **Special Tools and Equipment** .
- **J 44383** Countershaft Bearing Installer. See **Special Tools and Equipment** .
- **J 44385** Differential Bearing Race and Seal Installer. See **Special Tools and Equipment** .
- **J 44387** Output Shaft Bearing Sleeve Installer and Pin. See **Special Tools and Equipment** .
- **J 44389** Countershaft Bearing Installer. See **Special Tools and Equipment** .

1. Install the shift rod and bushing.

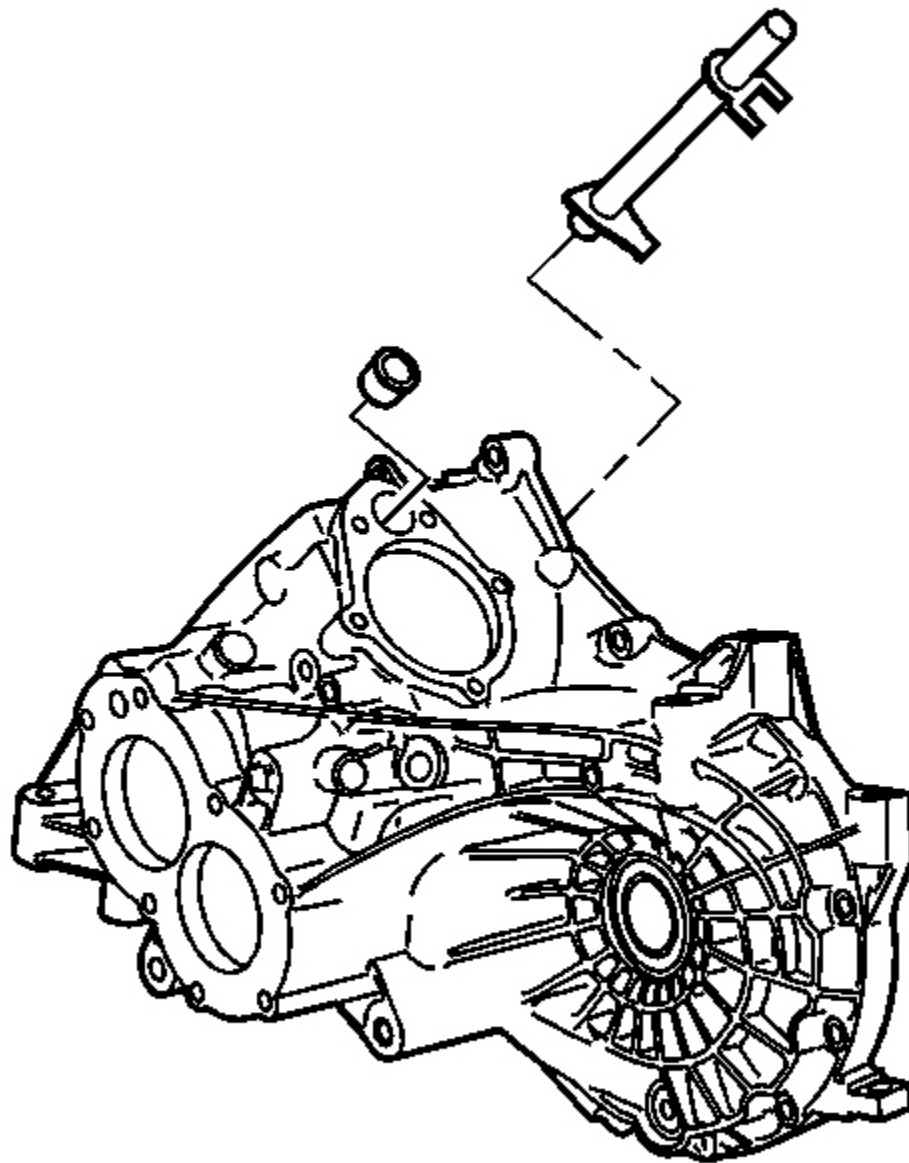


Fig. 106: View Of Shift Rod & Bushing
Courtesy of GENERAL MOTORS CORP.

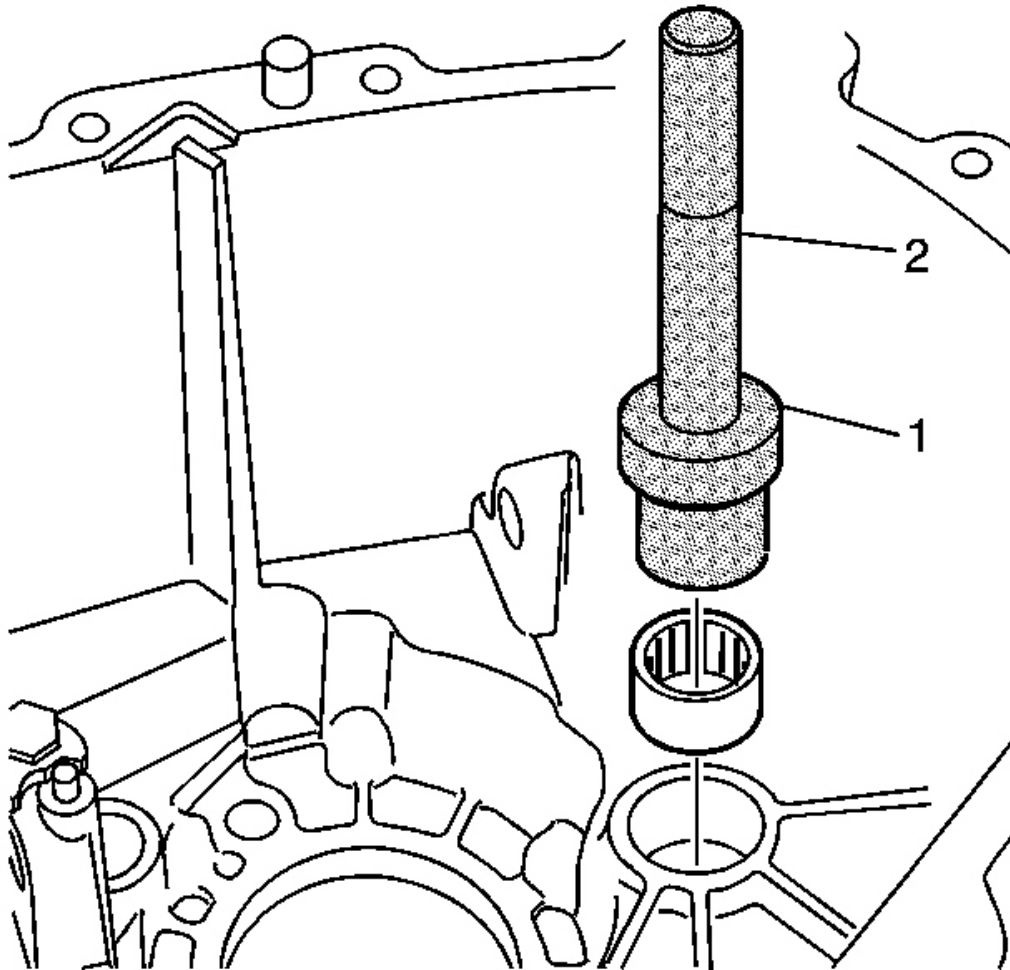


Fig. 107: Installing Intermediate Shaft Needle Bearing
Courtesy of GENERAL MOTORS CORP.

2. Install the intermediate shaft needle bearing to the transmission housing using the **J 44383** (1) and the **J 8092** (2).

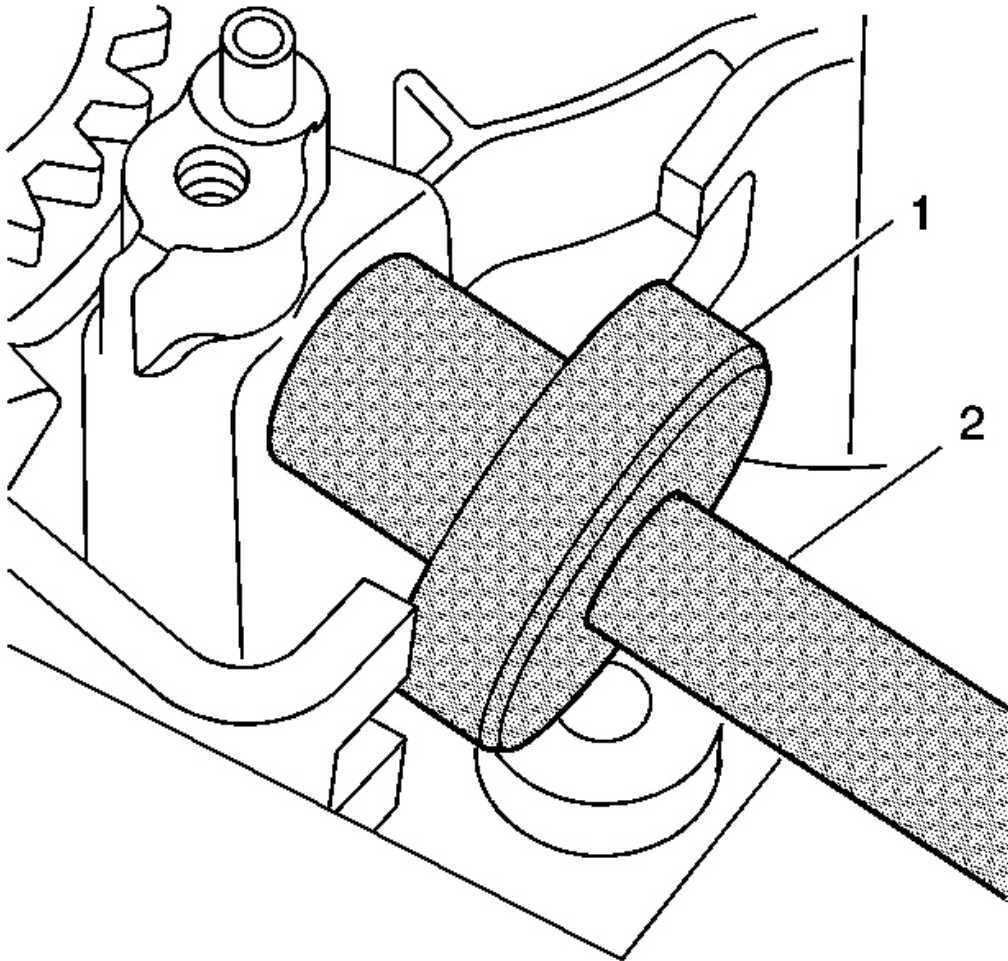


Fig. 108: Installing New Shifter Shaft Bearing Using J 44381 & J 8092
Courtesy of GENERAL MOTORS CORP.

3. Install a new shifter shaft bearing flush with the casting in the transmission housing, using the **J 44381** (1) and the **J 8092** (2).

IMPORTANT: Do not over apply the threadlocker to the bolt threads.

4. Apply GM P/N United States 12345382, GM P/N Canada 10953489 to the reverse lockout lever bolt threads.

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT: The spring (2) fingers must be positioned on either side of the lever (3).

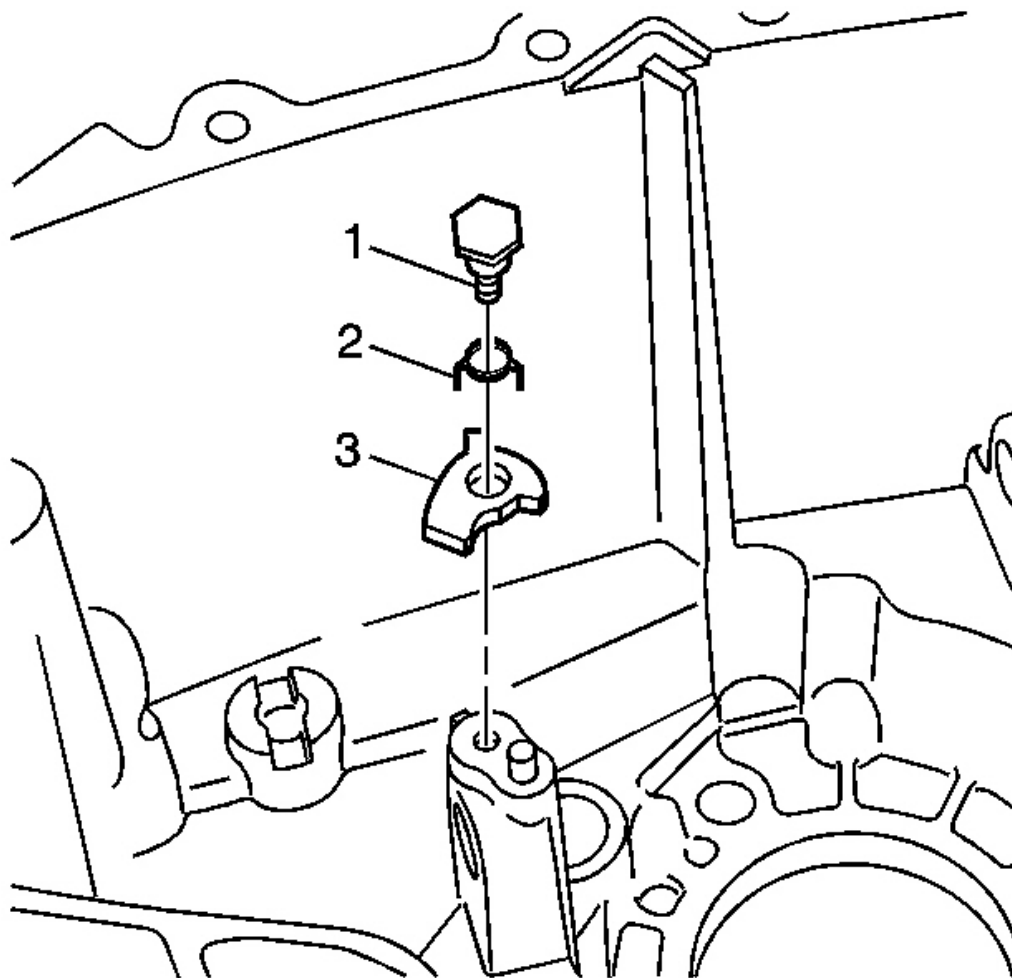


Fig. 109: View Of Transmission Housing Bolt, Spring & Reverse Lockout Lever
Courtesy of GENERAL MOTORS CORP.

5. Install the reverse lockout lever (3), spring (2), and the bolt (1) to the transmission housing, if equipped.

Tighten: Tighten the bolt to 6 N.m (53 lb in).

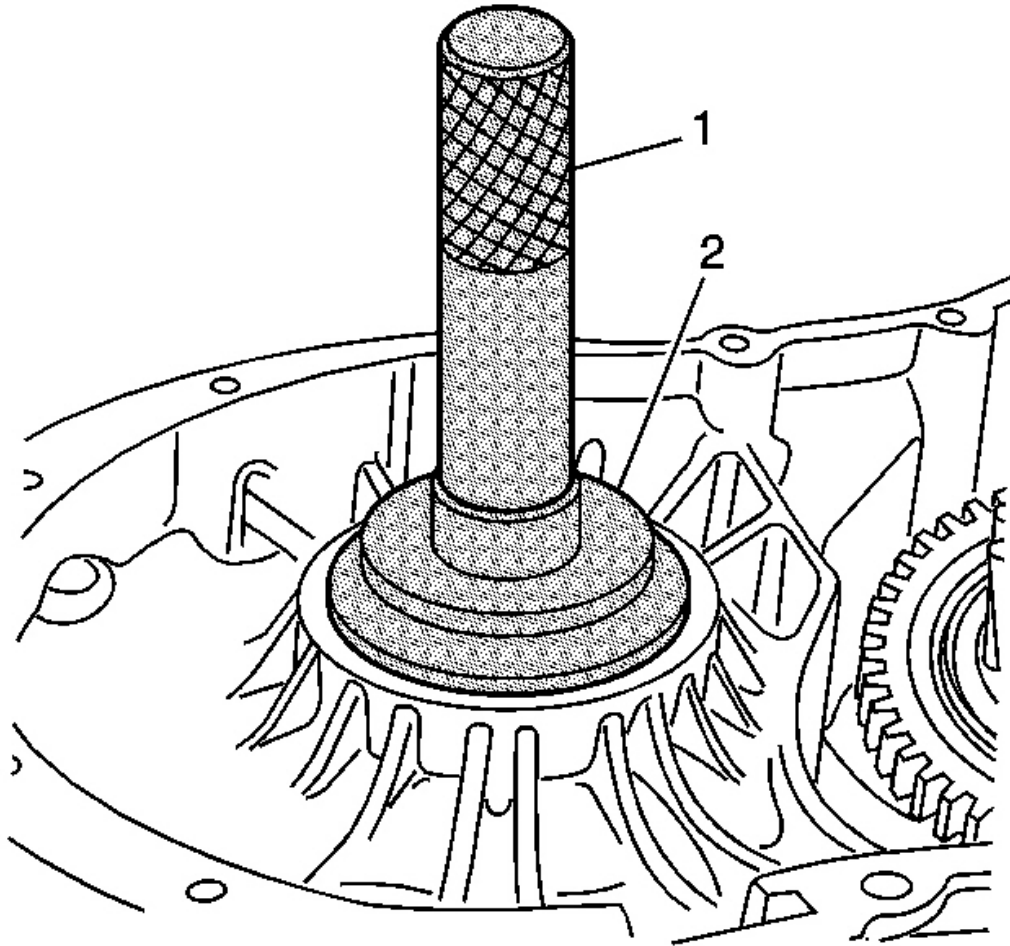


Fig. 110: Installing Differential Race
Courtesy of GENERAL MOTORS CORP.

6. Install a new differential bearing race to the transmission housing using the **J 44385** (2) and the **J 7079-2** (1).

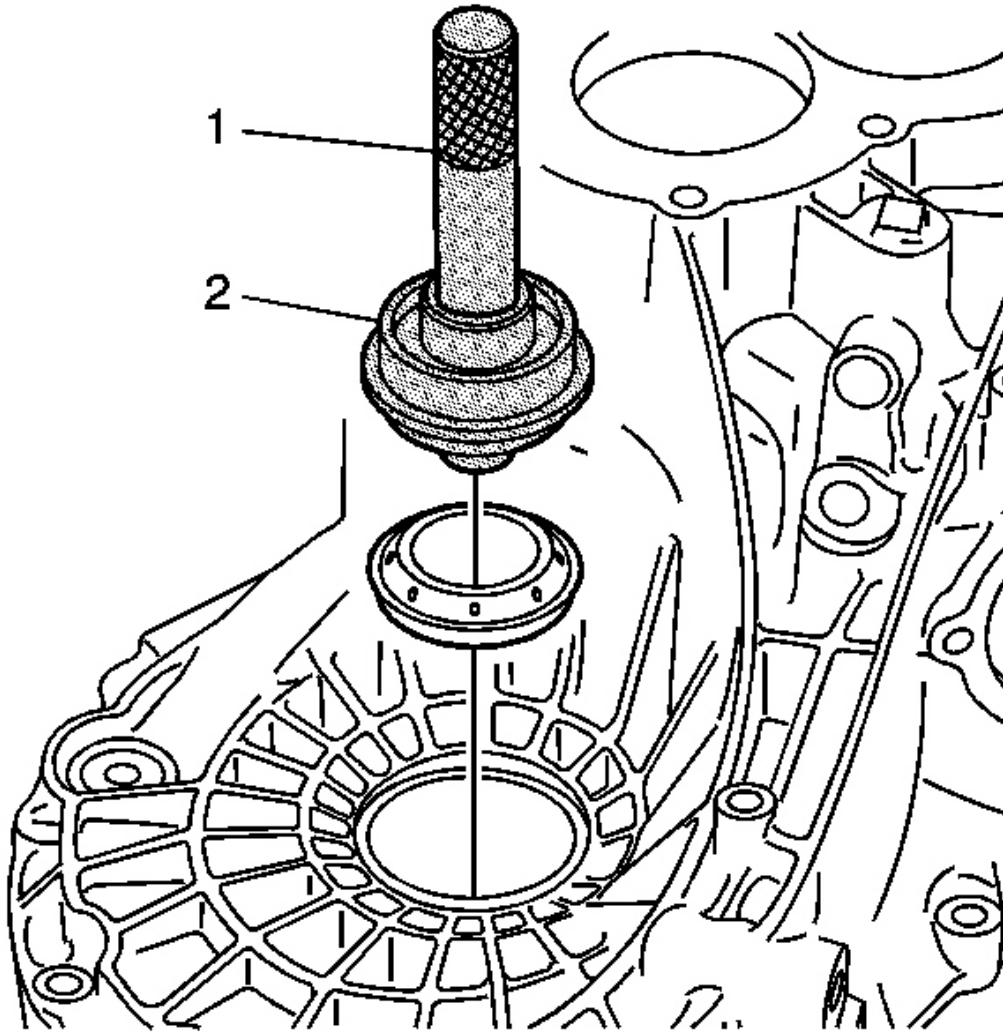


Fig. 111: Installing Differential Bearing Race Seal
Courtesy of GENERAL MOTORS CORP.

7. Install a new differential side bearing race seal to the transmission housing using the **J 44385** (2) and the **J 7079-2** (1).

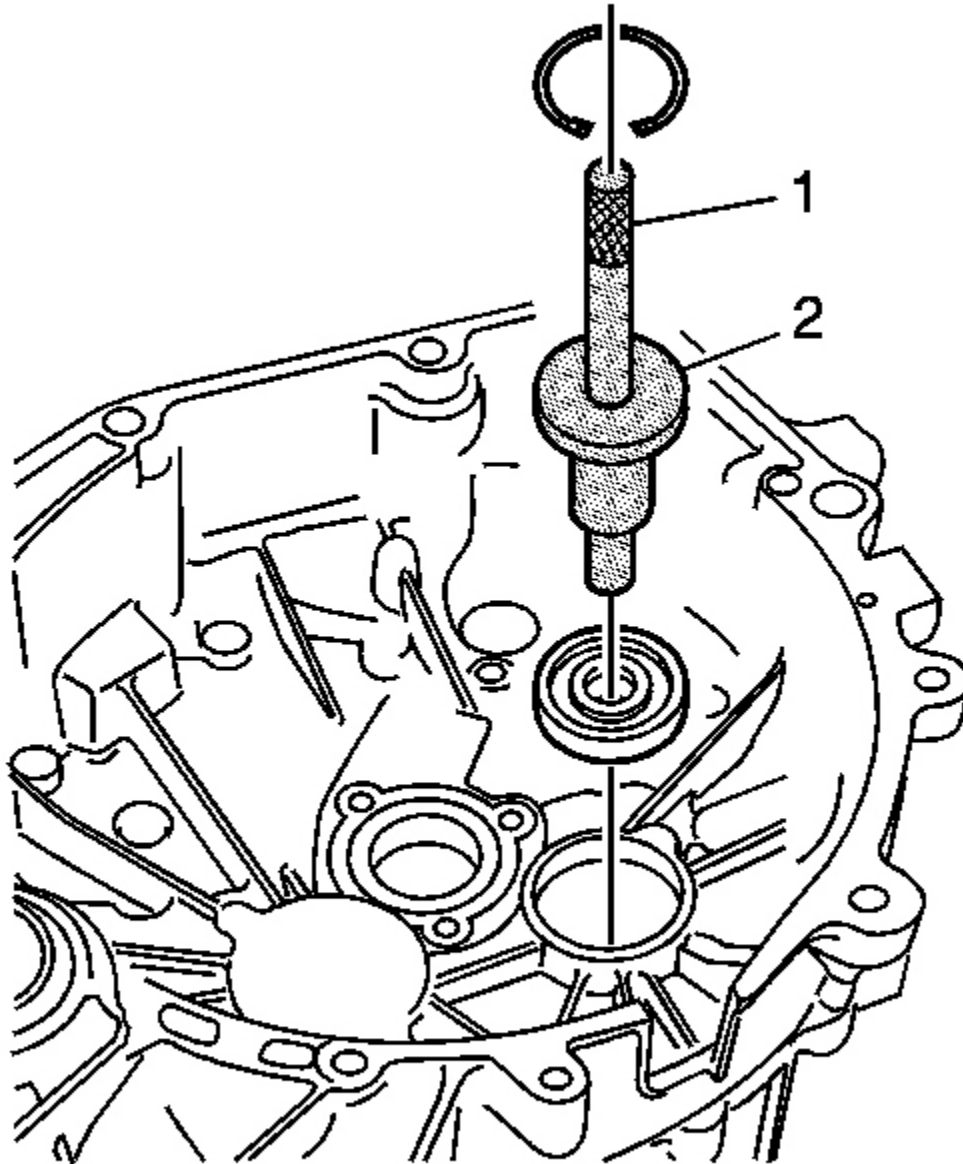


Fig. 112: Installing Countershaft Bearing To Clutch Housing
Courtesy of GENERAL MOTORS CORP.

8. Install the countershaft bearing to the clutch housing using the J 44381 (1) and the J 7079-2 (2).
9. Install a new snap ring.

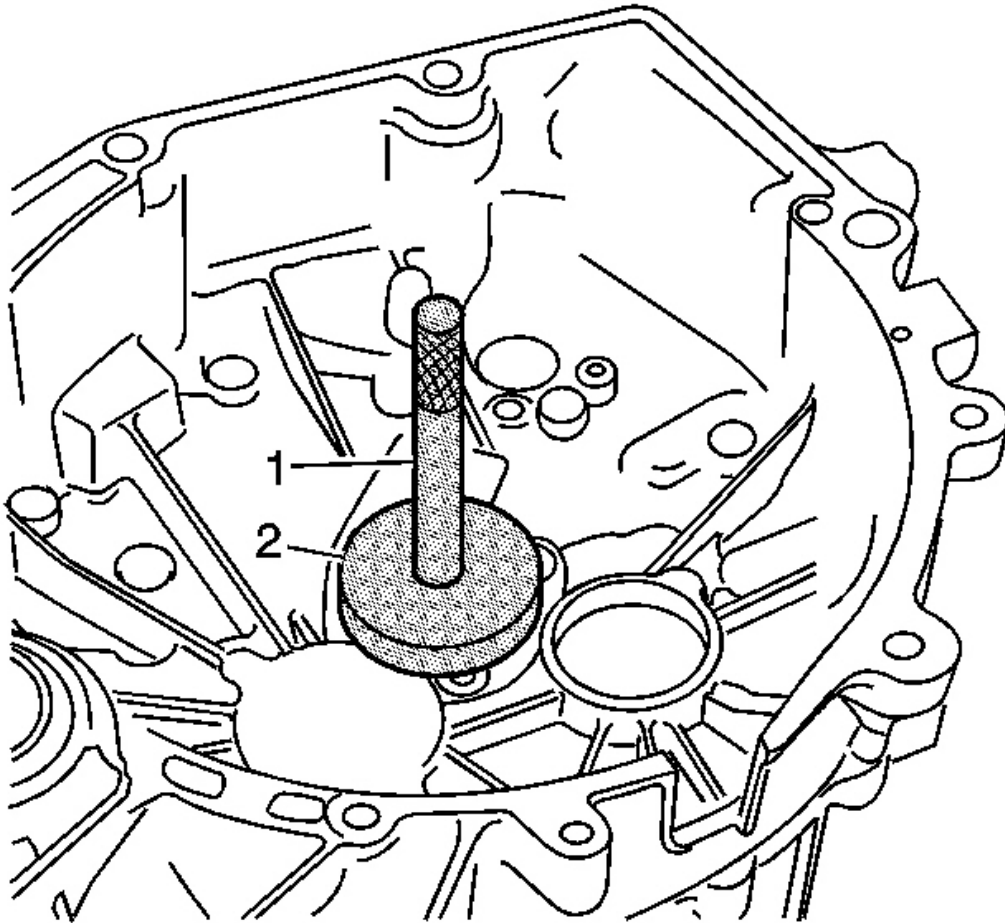


Fig. 113: Installing Input Shaft Bearing
Courtesy of GENERAL MOTORS CORP.

10. Install the input shaft bearing to the clutch housing using the **J 44381** (2) and the **J 7079-2** (1).

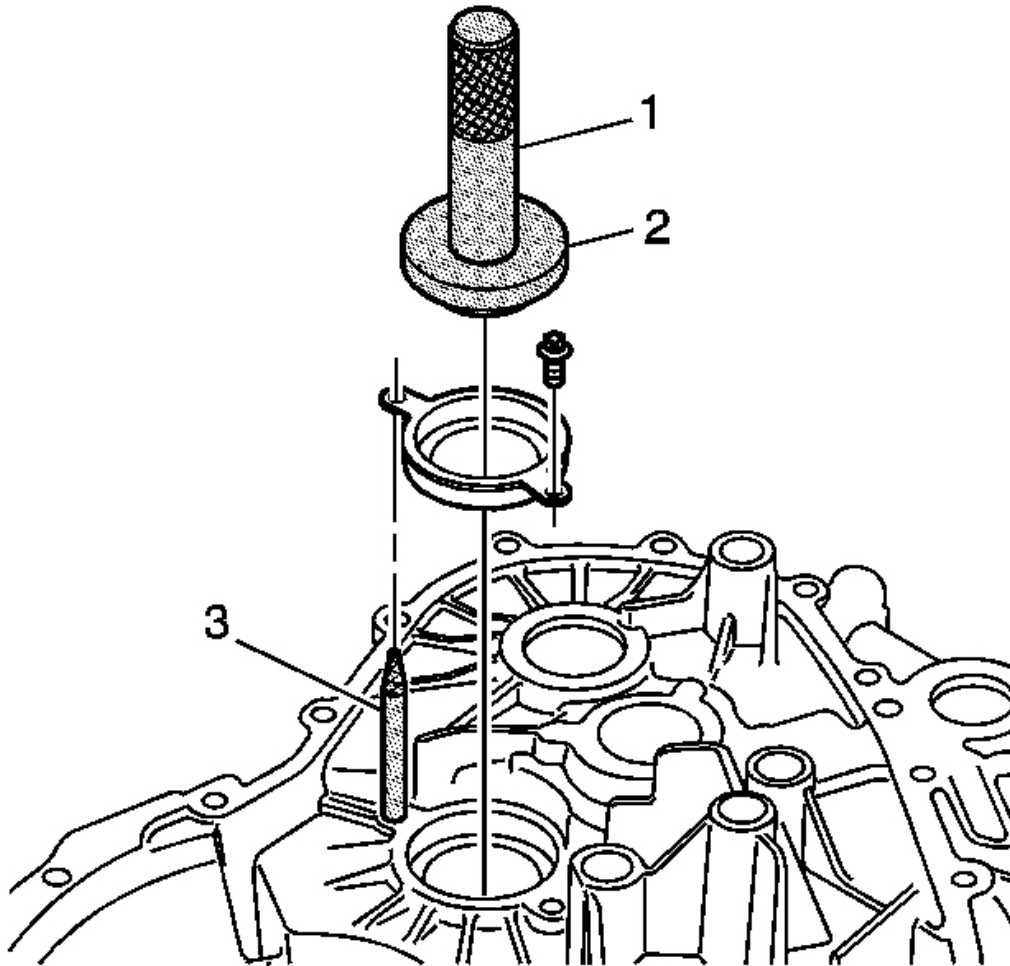


Fig. 114: Installing Output Shaft Bearing Race
Courtesy of GENERAL MOTORS CORP.

11. Install the output shaft bearing race and bolts using the J 44387-1 (2), J 44387-2 (3), and the **J 7079-2** (1).

Tighten: Tighten the output shaft bearing bolts to 10 N.m (89 lb in).

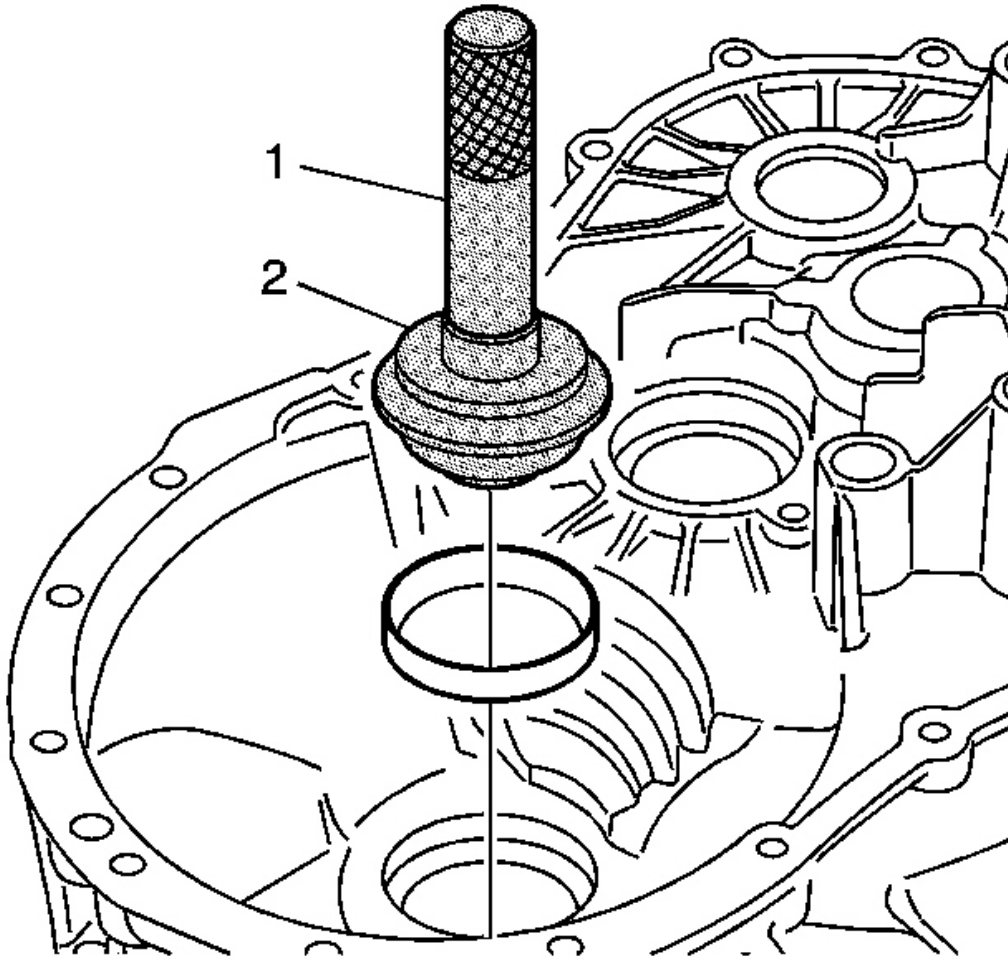


Fig. 115: Installing Differential Bearing Race To Clutch Housing
Courtesy of GENERAL MOTORS CORP.

12. Install a new differential bearing race to the clutch housing using the J 44385 (2) and the J 7079-2 (1).

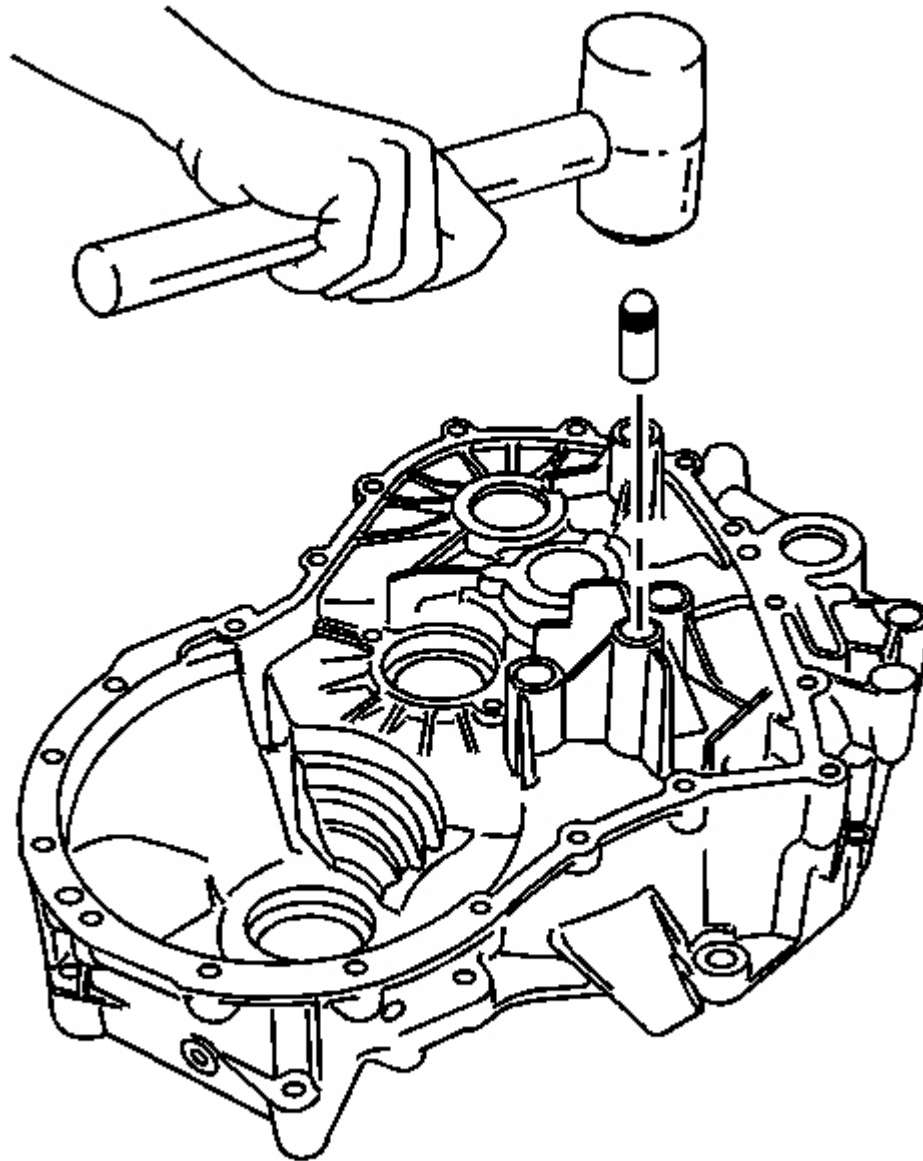


Fig. 116: Installing Shifter Detent
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If either the case or shifter detent is damaged, it may be necessary to install a new shifter detent and/or case.

13. Install the shifter detent into the case if necessary.

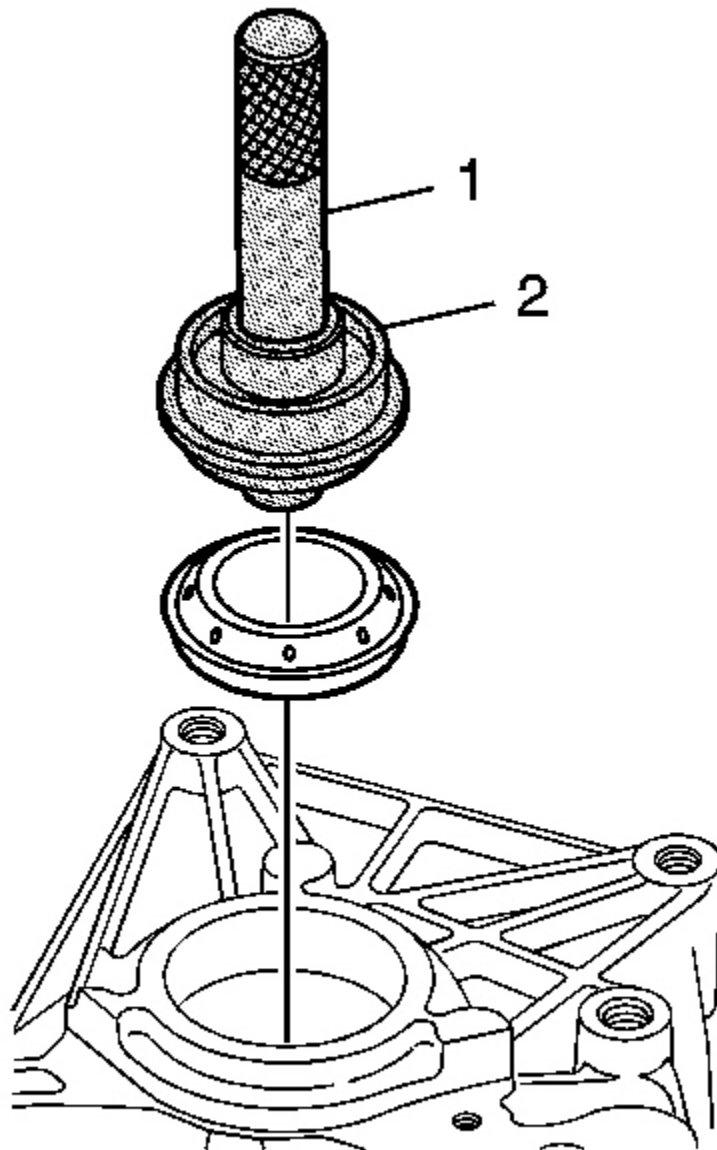


Fig. 117: Installing Differential Output Shaft Seal To Clutch Housing
Courtesy of GENERAL MOTORS CORP.

14. Install a new differential output shaft seal to the clutch housing using the **J 44385** (2) and the **J 8092** (1).

15. Install the snap rings to the input shaft and output shaft bearings.
16. Install the input shaft and output shaft bearings into the transmission housing using the **J 44385** (2) and the **J 7079-2** (1).

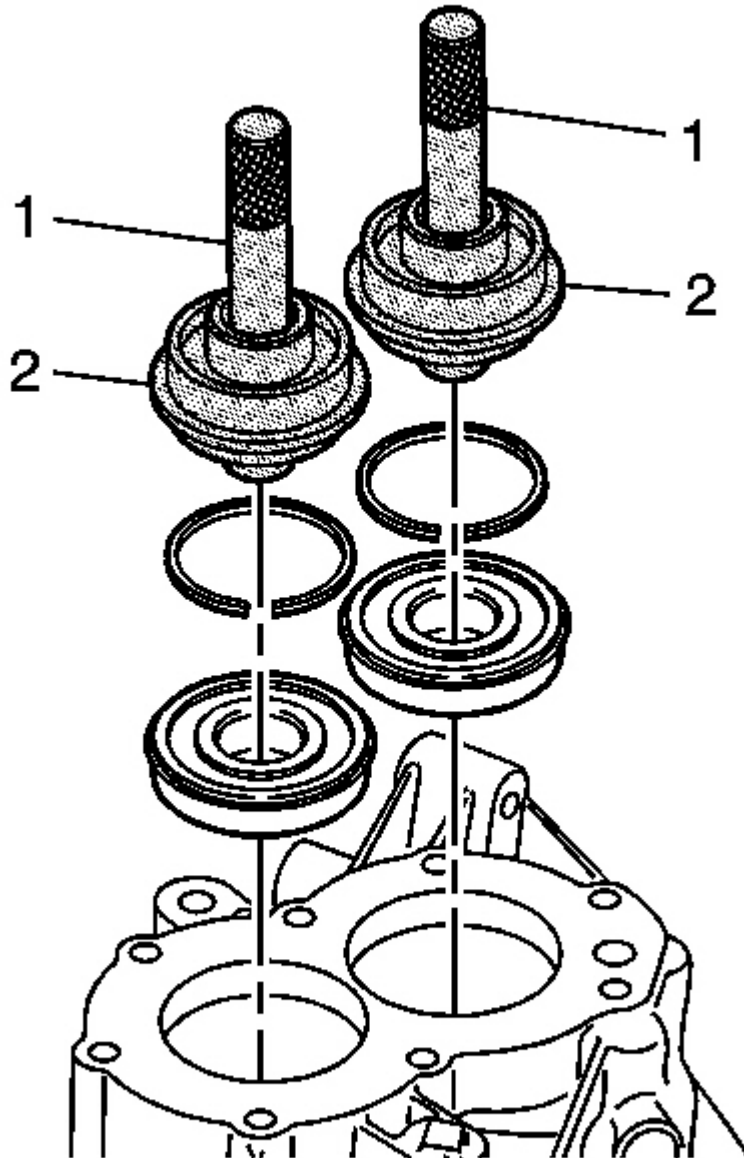


Fig. 118: Installing Input & Output Shaft Bearings
Courtesy of GENERAL MOTORS CORP.

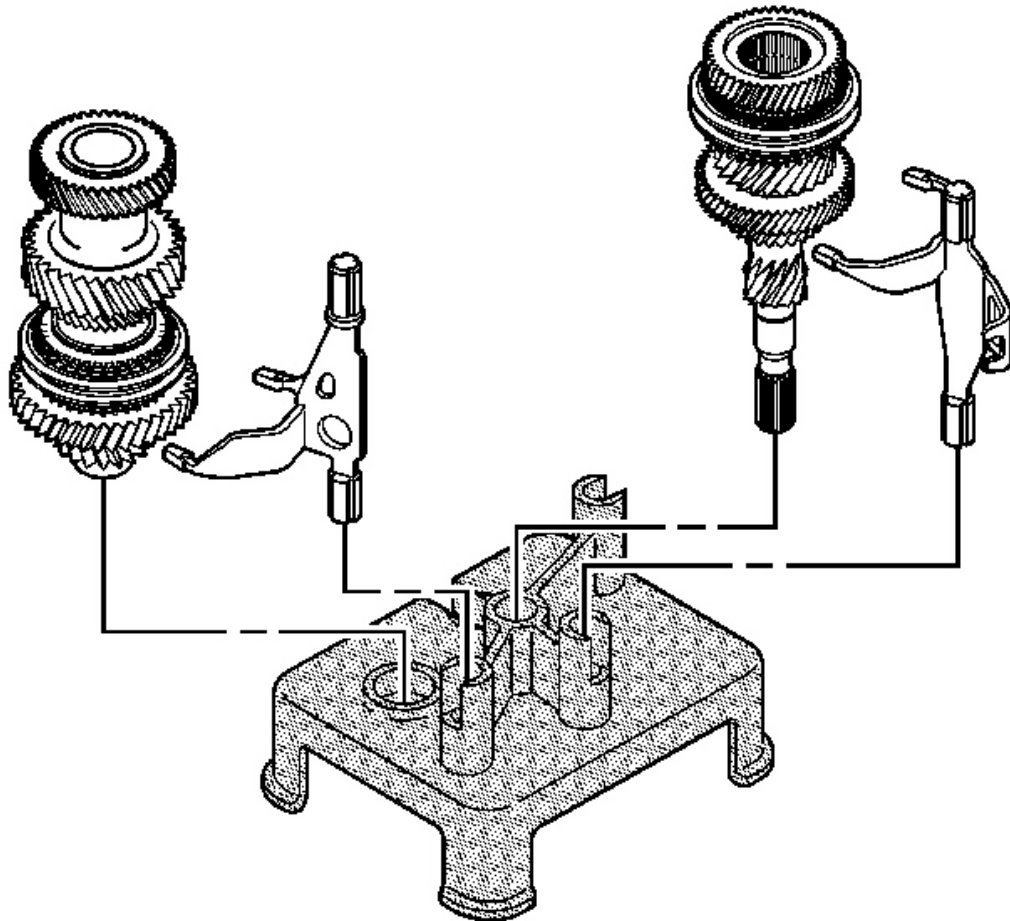


Fig. 119: View Of Gear Assemblies & Shift Forks
Courtesy of GENERAL MOTORS CORP.

17. Install the shift forks and the input shaft and output shaft onto the **J 44375** .

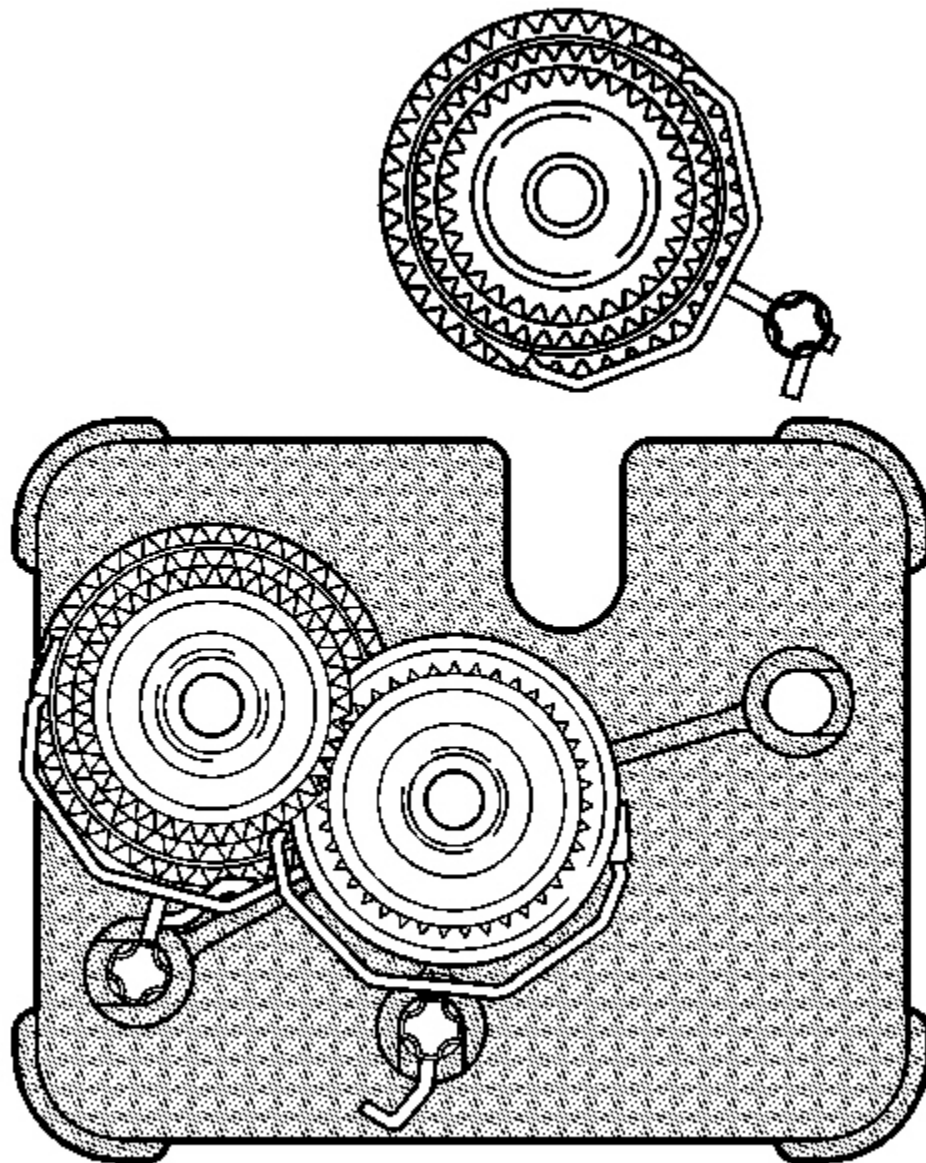


Fig. 120: View Of Countershaft, Input Shaft, Intermediate Shaft & Shift Fork
Courtesy of GENERAL MOTORS CORP.

18. Install the countershaft and the shift fork onto the **J 44375** .
19. Rotate the shaft to verify all gears are properly meshing.

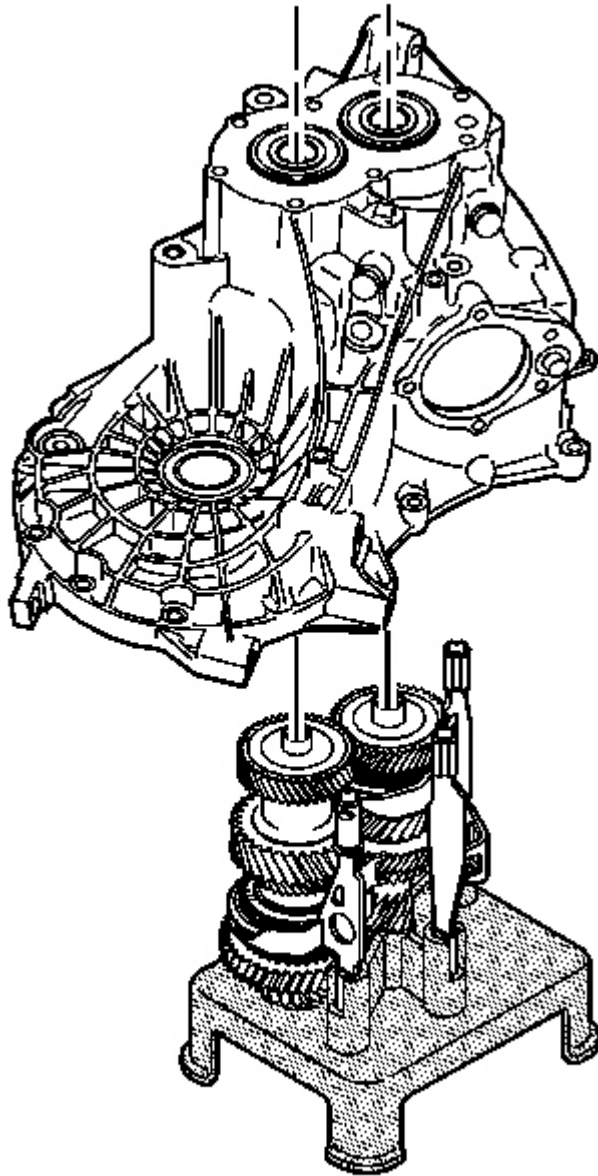


Fig. 121: Installing Housing & Shafts
Courtesy of GENERAL MOTORS CORP.

20. Install the housing onto the shift forks and the shafts on to the **J 44375** . Line up the shift forks and the shafts with the housing.

IMPORTANT: Install the transaxle case to the shafts evenly using the J 44376 .

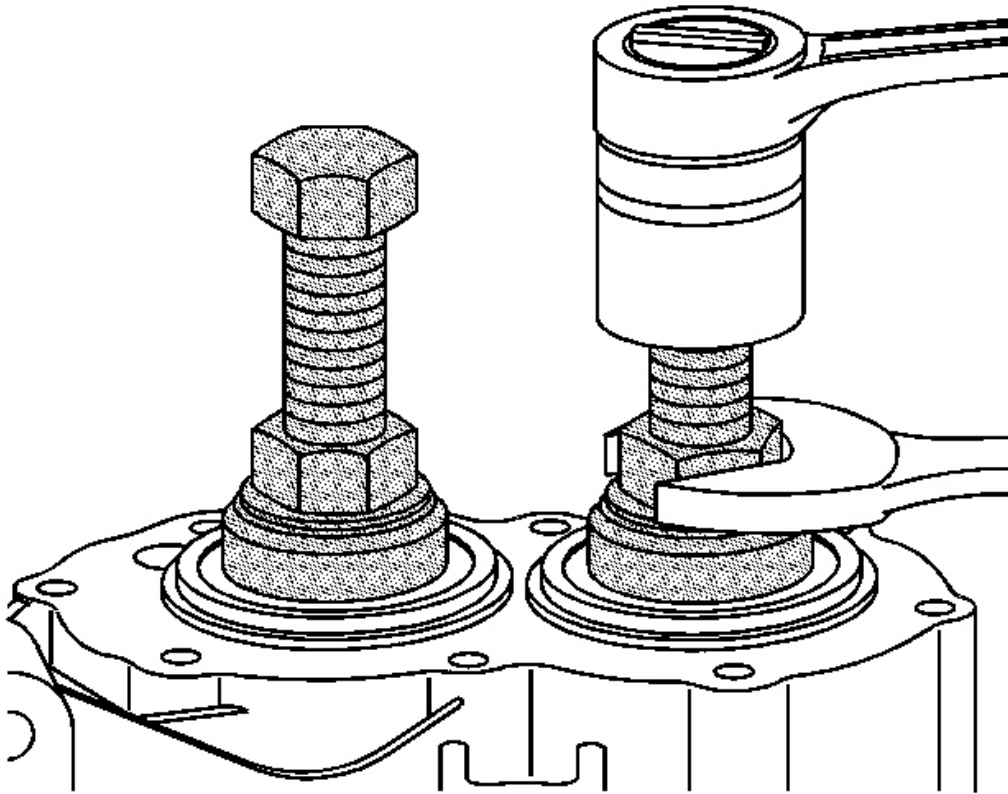


Fig. 122: Installing Transaxle Case Using The J 44376
Courtesy of GENERAL MOTORS CORP.

21. Install the transaxle case to the shafts using the **J 44376** .

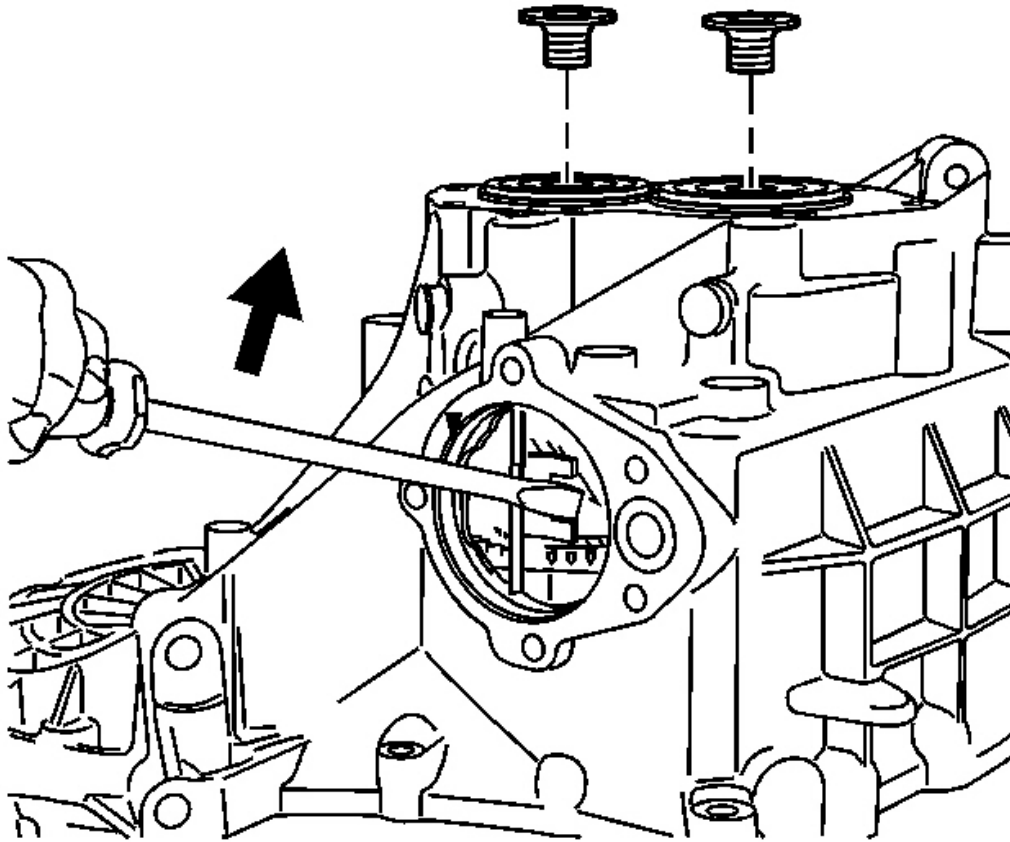


Fig. 123: Shifting Transmission Into 4th And 5th Gear Using A Screwdriver
Courtesy of GENERAL MOTORS CORP.

22. Shift the transmission into 4th and 5th gear using a screwdriver in an upward direction.
23. Apply GM P/N United States 12345493, GM P/N Canada 10953488 to the input and output shaft bolts.
24. Install NEW input and output shaft bolts while holding the transmission into 4th and 5th gear in an upward direction.

Tighten: Tighten the shaft bolts to 110 N.m (81 lb ft).

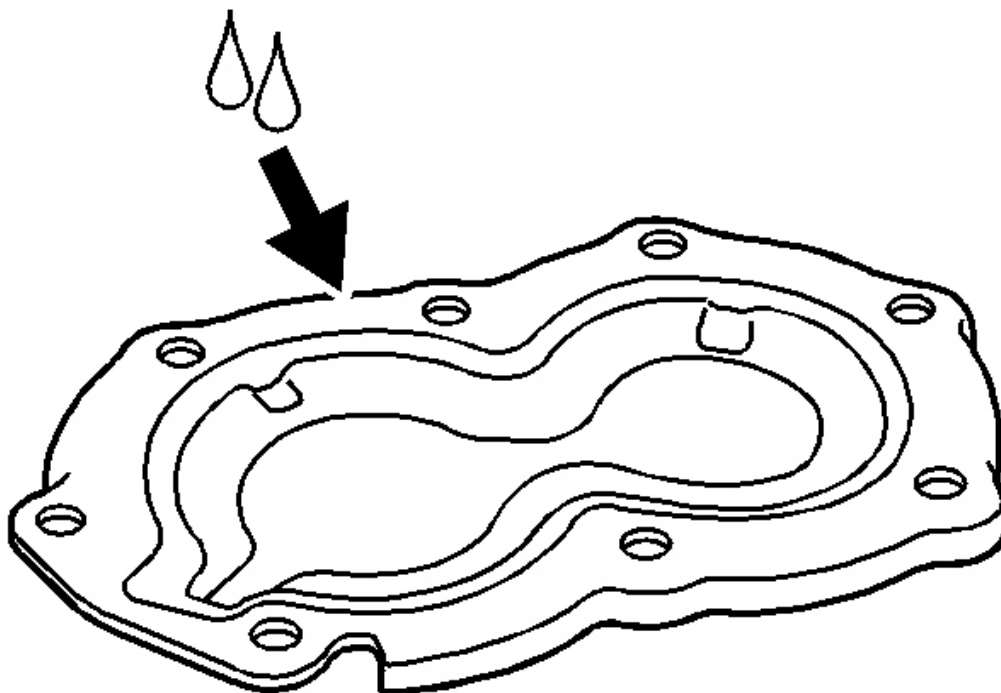


Fig. 124: Installing Sealant To Rear Cover
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If shimming is required, refer to Shimming Procedures before installing the cover.

25. Install sealant GM P/N United States 12346286, GM P/N Canada 10953472 to the rear cover.

IMPORTANT: The oil guide only installs in one direction. Ensure the oil guide is completely seated in the gear shafts.

26. Install the oil guide.
27. Install the rear cover.

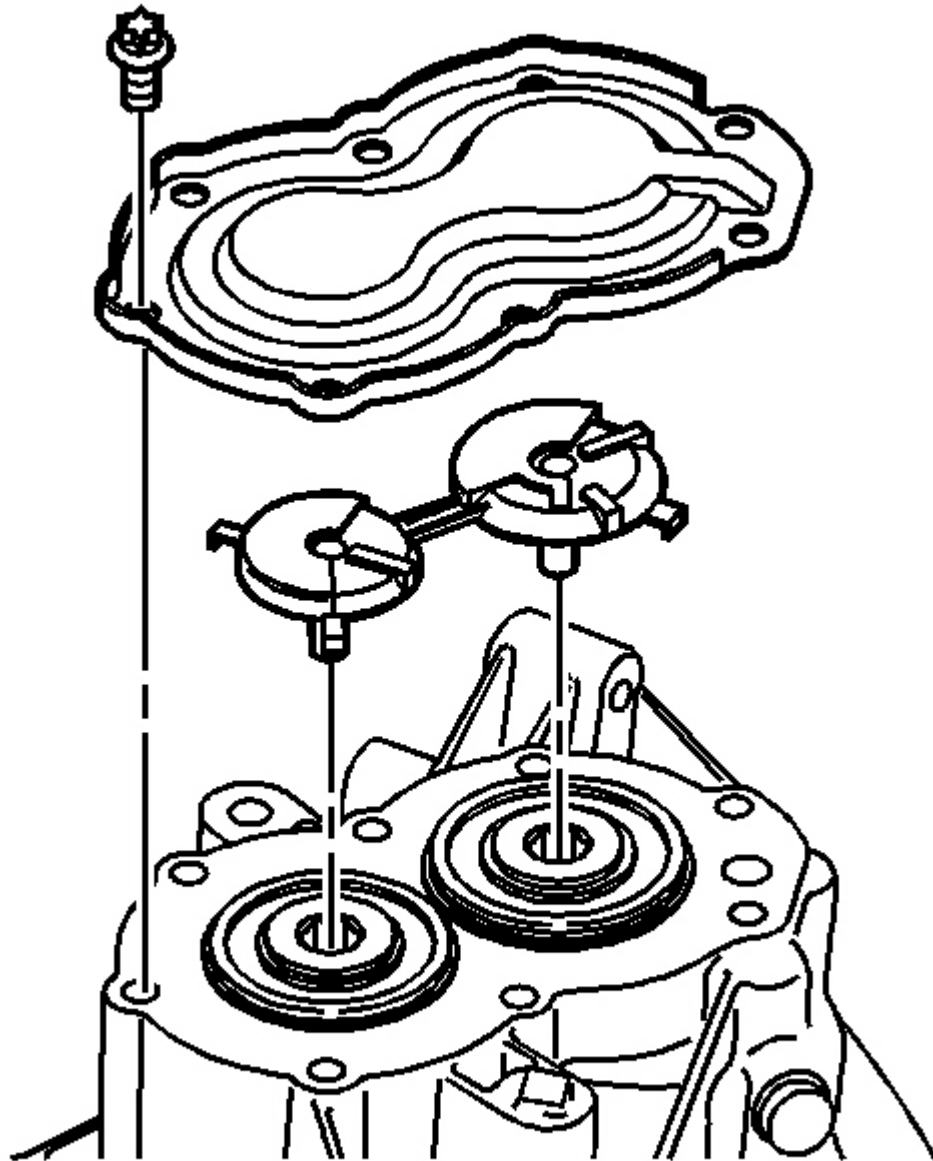


Fig. 125: View Of Rear Cover
Courtesy of GENERAL MOTORS CORP.

28. Install the rear cover bolt.

Tighten: Tighten the rear cover bolt to 25 N.m (18 lb ft).

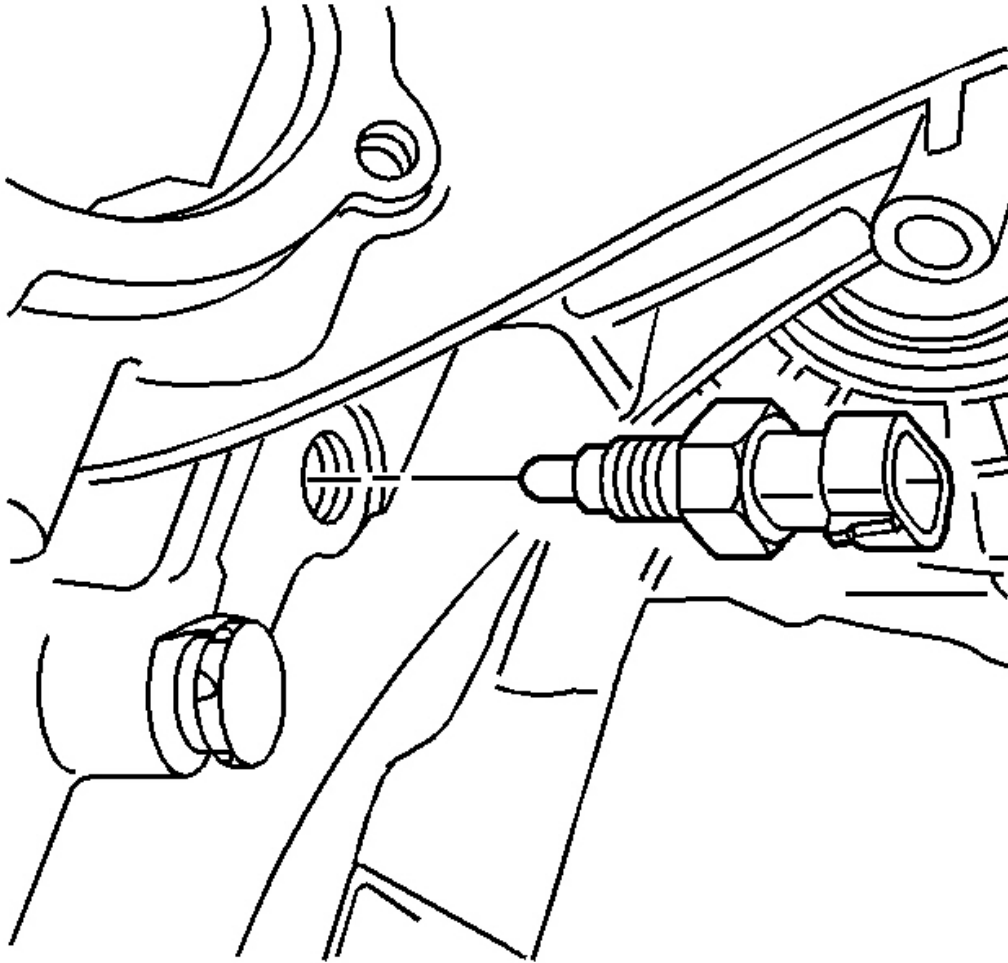


Fig. 126: View Of Backup Lamp Switch
Courtesy of GENERAL MOTORS CORP.

29. Apply sealant GM P/N United States 12346004, GM P/N Canada 10953480 to the backup lamp switch.
30. Install the backup lamp switch into the transaxle case.

Tighten: Tighten the backup lamp switch to 18 N.m (13 lb ft).

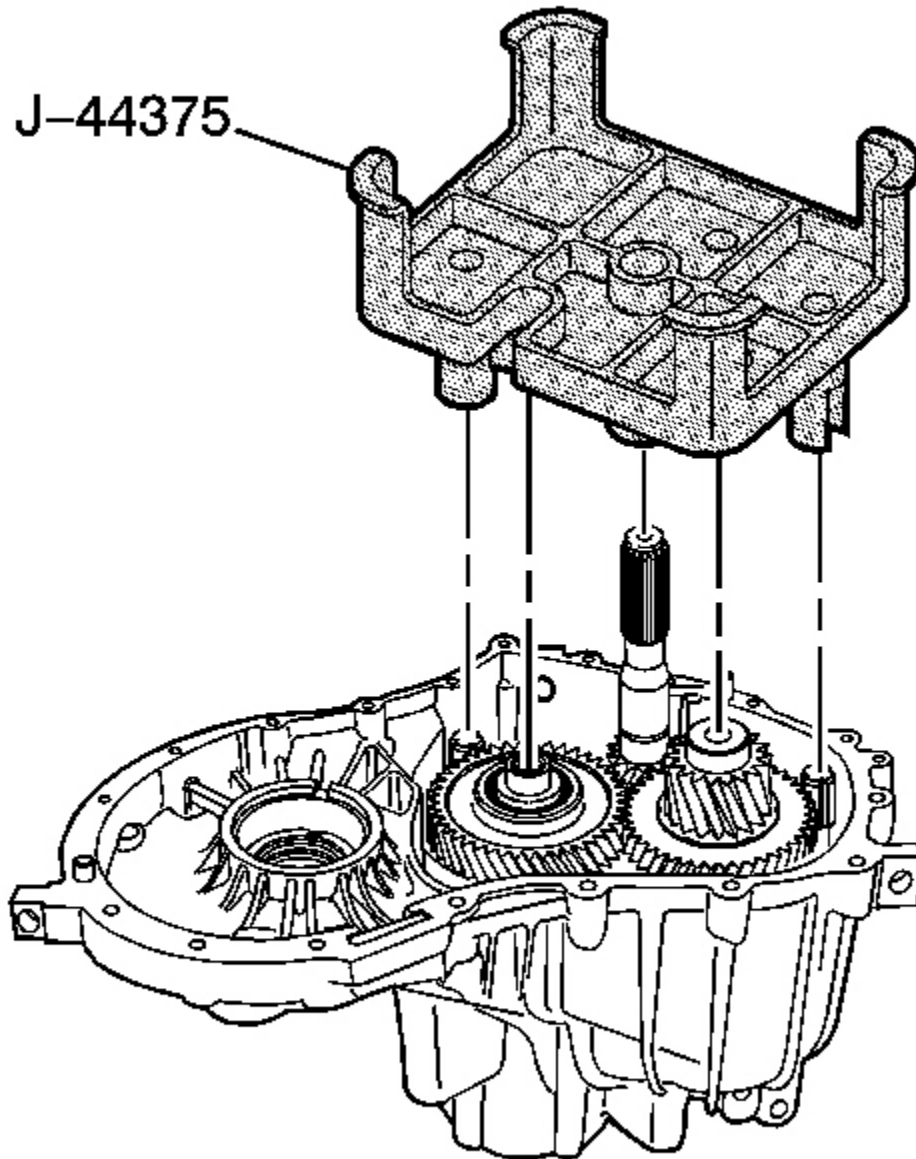


Fig. 127: Identifying J 44375
Courtesy of GENERAL MOTORS CORP.

31. Turn the transaxle case and the **J 44375** over on the table.
32. Remove the **J 44375** from the gear shafts and the shift forks.

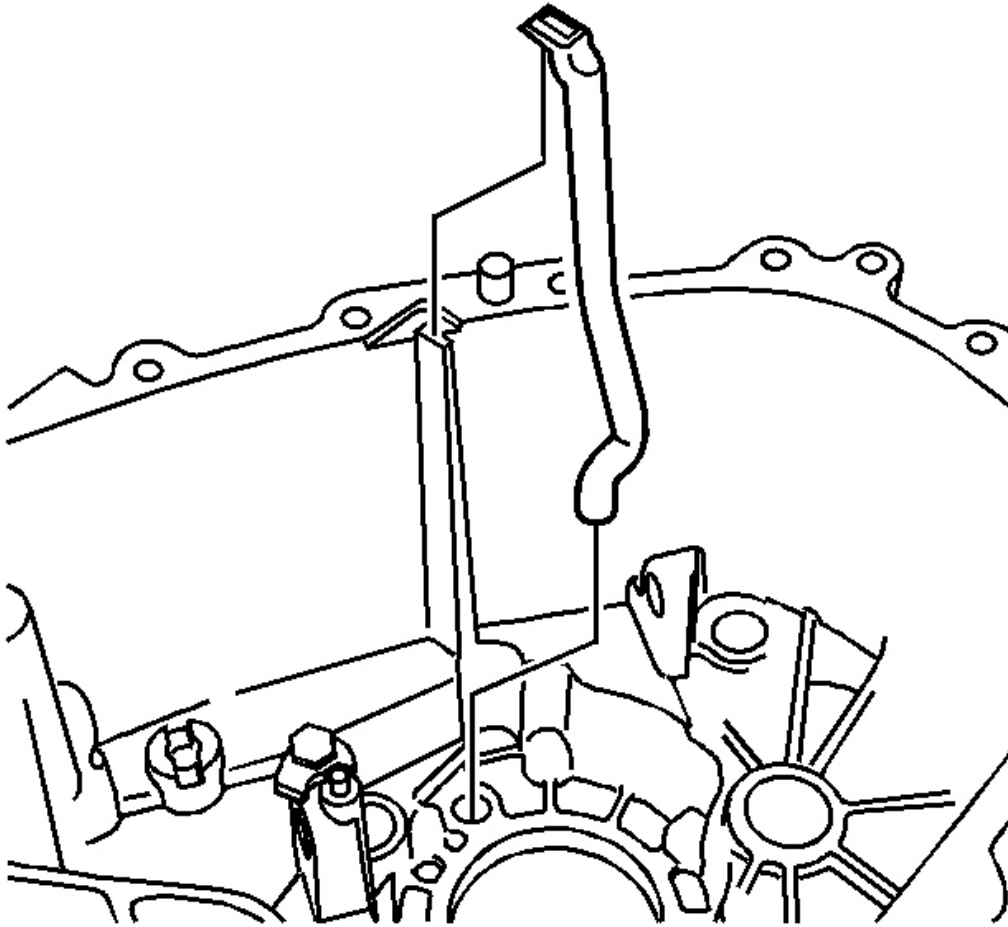


Fig. 128: View Of Oil Tube
Courtesy of GENERAL MOTORS CORP.

33. Install the oil tube into the transaxle case.

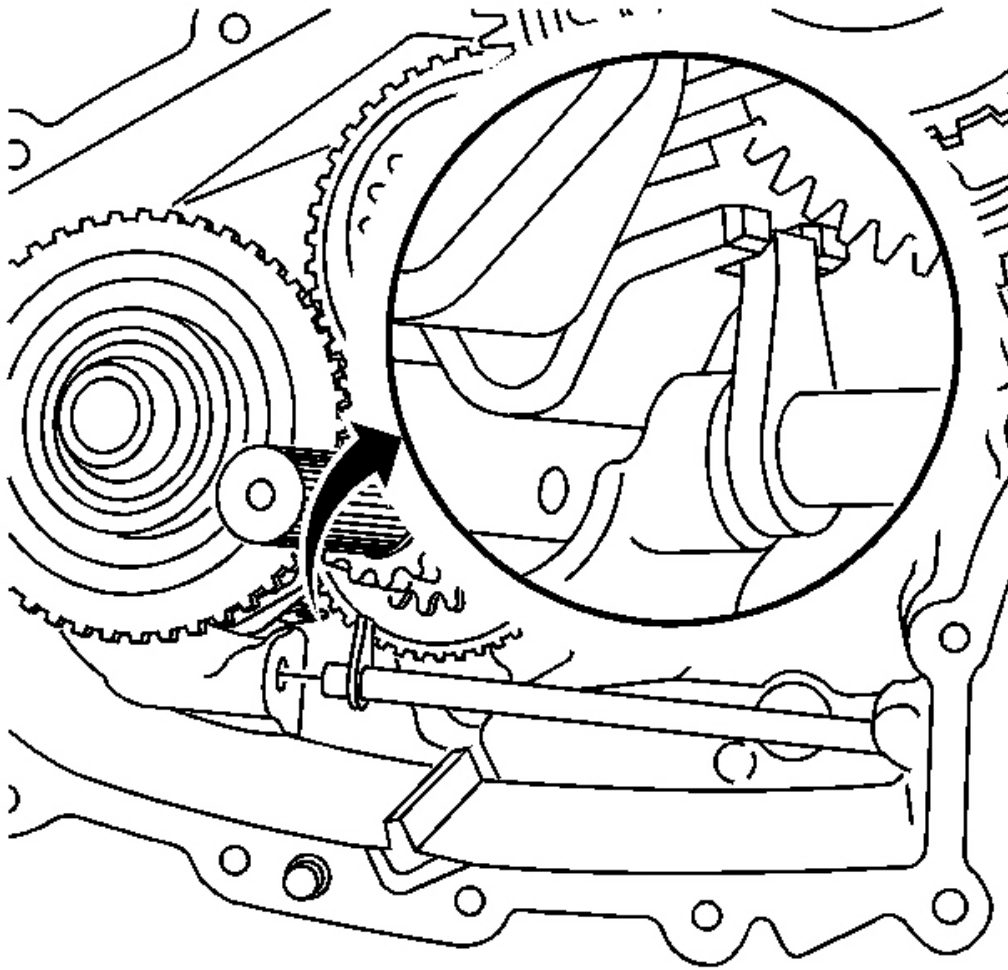


Fig. 129: View Of Shift Fork
Courtesy of GENERAL MOTORS CORP.

34. Install the shift rod to the shift fork.

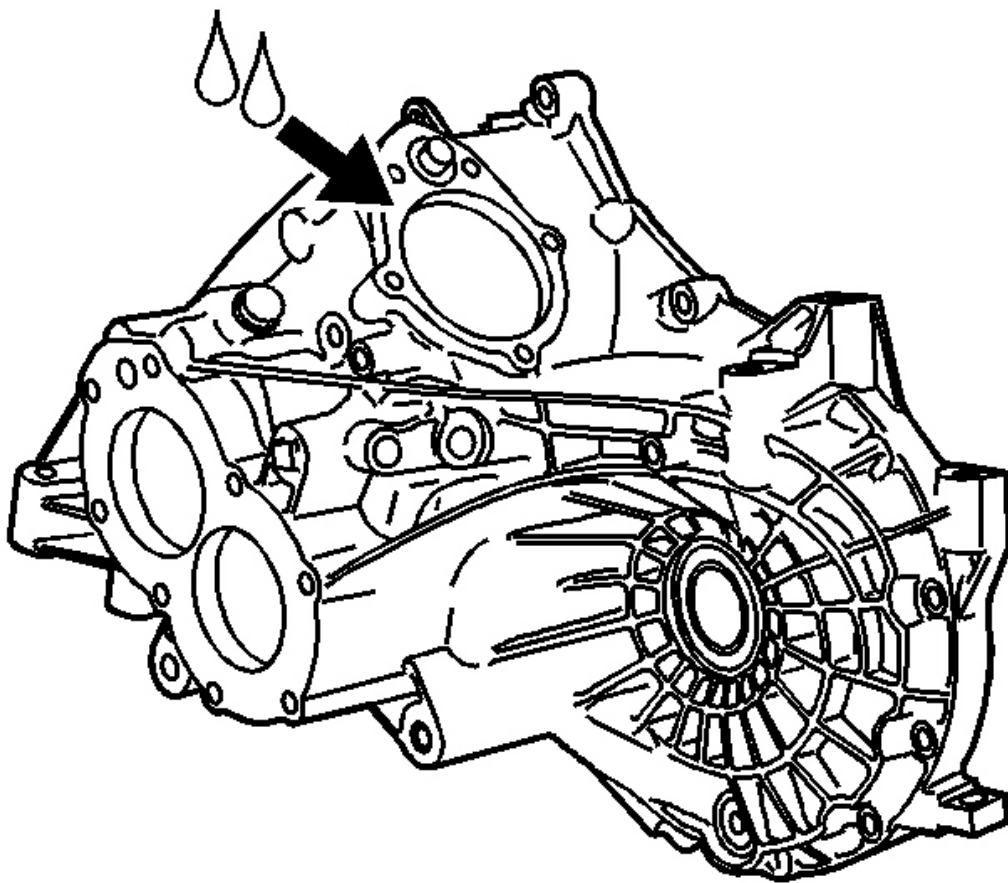


Fig. 130: Applying Sealer To Transaxle Case-To-Shifter Cover Mating Surface
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use only the approved sealer for the transaxle case to shifter cover mating surface.

35. Apply sealer GM P/N United States 12378516, GM P/N Canada 88900757 to the transaxle case to shifter cover mating surface.

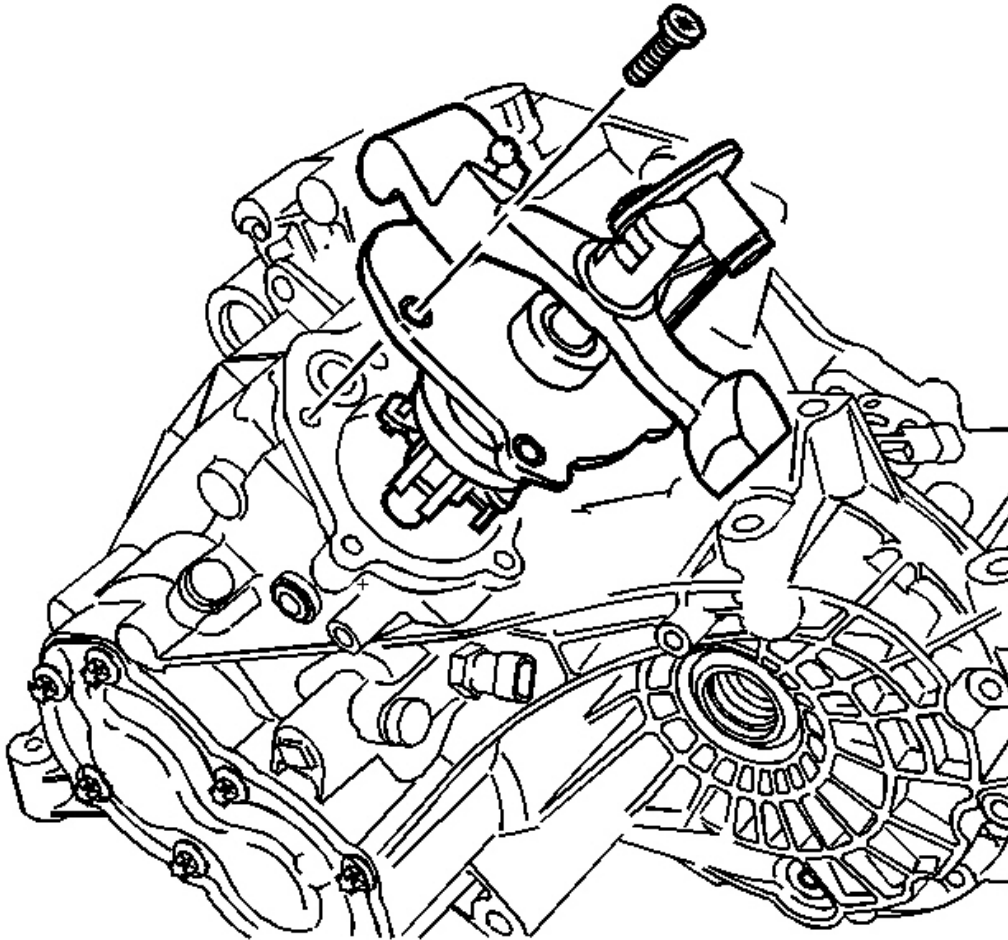


Fig. 131: View Of Shifter Assembly
Courtesy of GENERAL MOTORS CORP.

36. Install the shifter and the shifter retaining bolts.

Tighten: Tighten the shifter retaining bolts to 25 N.m (18 lb ft).

Install all possible shifter bolts with the shifter in the neutral position. Install the last shifter bolt in gear and then shift the transmission back into neutral.

37. Shift the transmission into neutral.
38. Apply GM P/N United States 12346004, GM P/N Canada 10953480 to the shifter guide bolt.

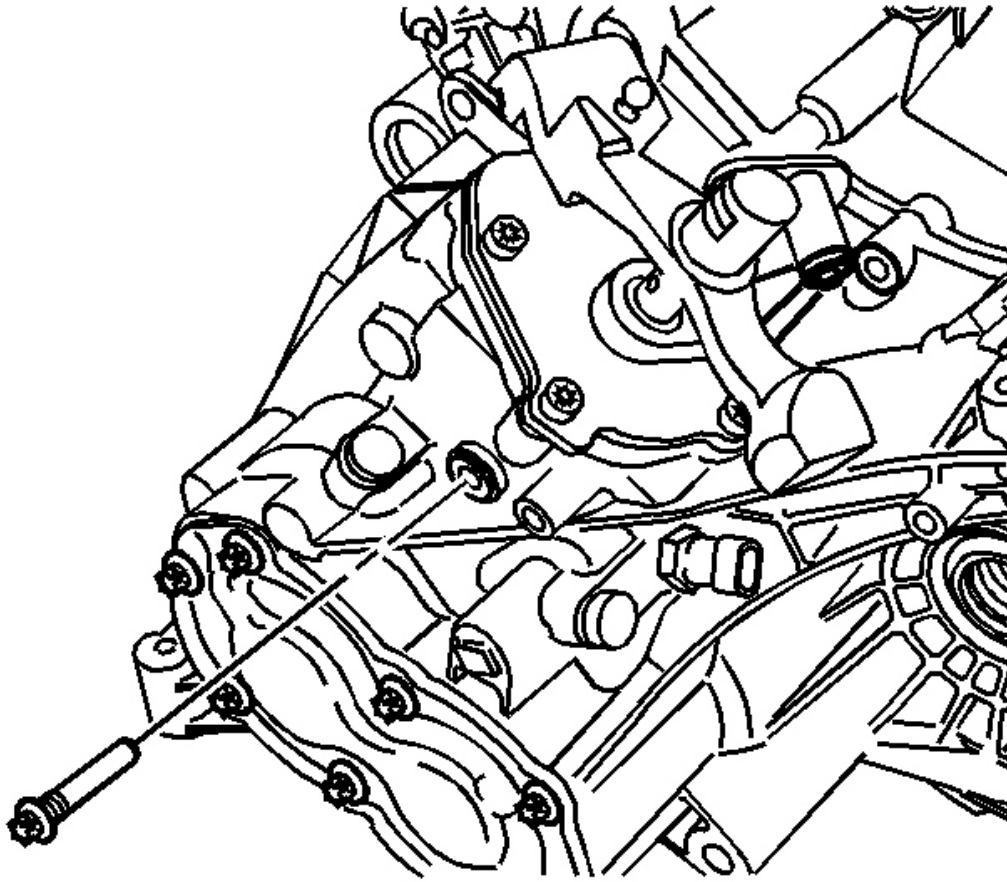


Fig. 132: View Of Shifter Guide Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Hand start and tighten the shifter guide bolt to avoid damaging the shift lever.

39. Install the shifter guide bolt.

Tighten: Tighten the shifter guide bolt to 25 N.m (18 lb ft).

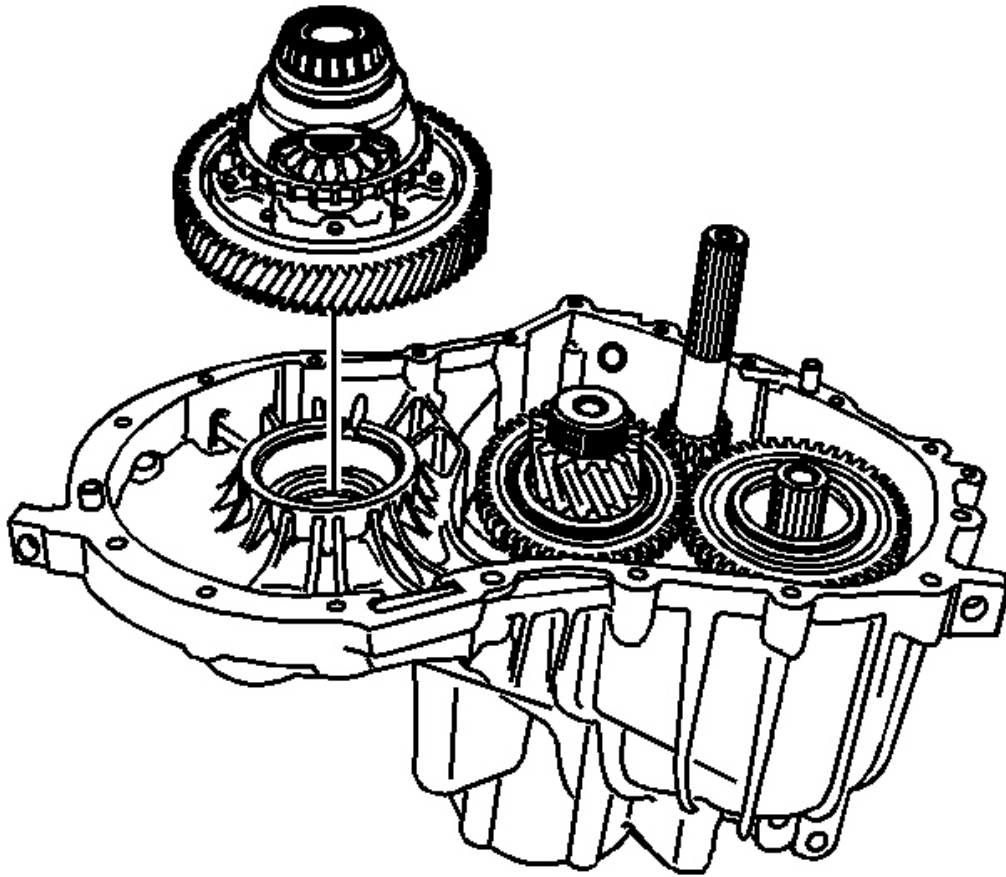


Fig. 133: View Of Differential
Courtesy of GENERAL MOTORS CORP.

40. Install the differential into the transaxle case.

IMPORTANT: The step in the roller bearing faces opposite of the pinion gear.

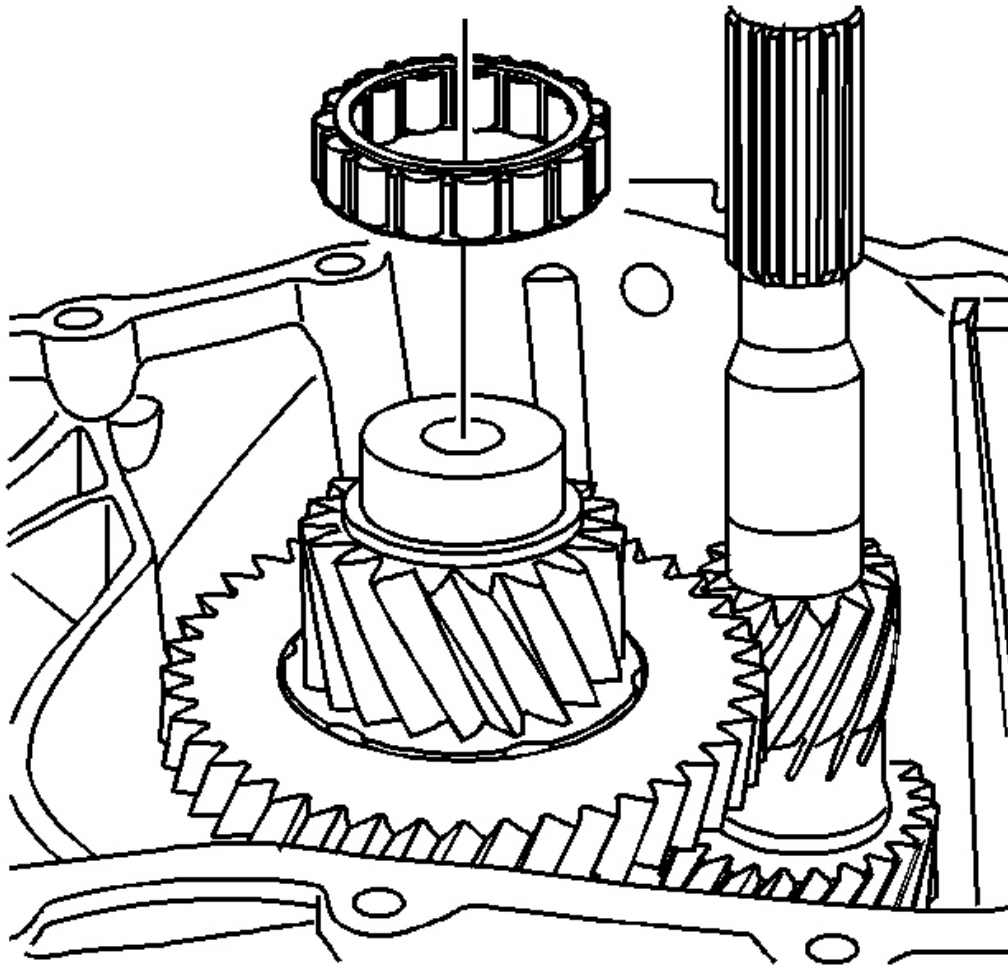


Fig. 134: View Of Roller Bearing
Courtesy of GENERAL MOTORS CORP.

41. Install the roller bearing onto the output shaft.

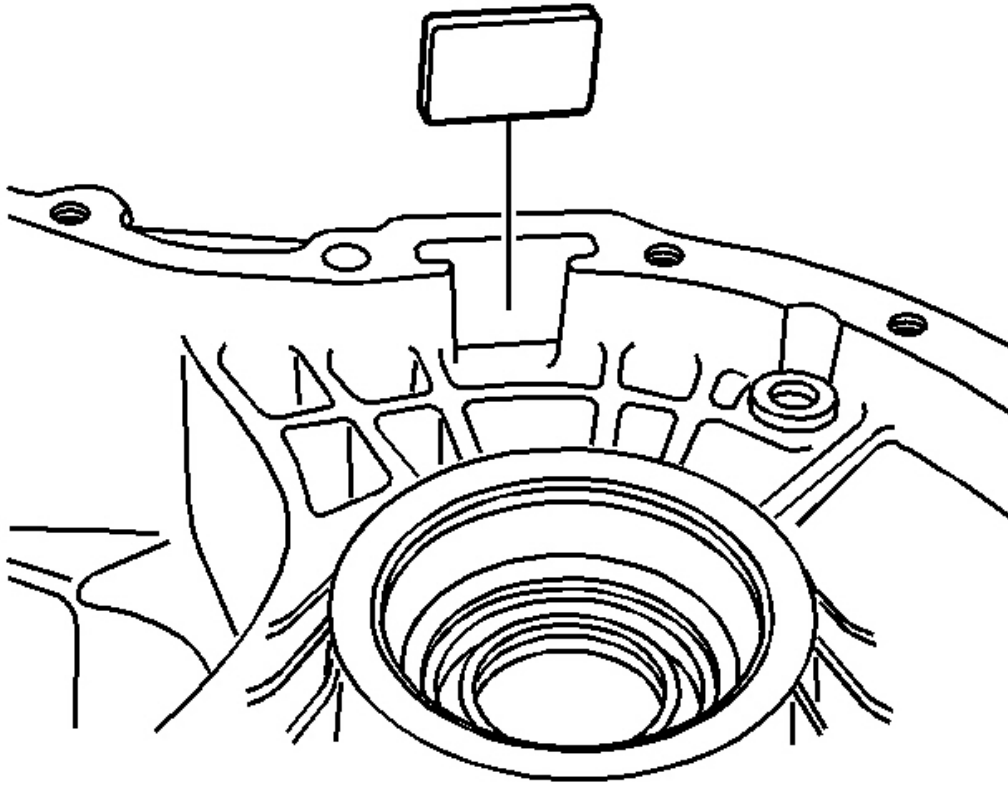


Fig. 135: View Of Transaxle Magnet
Courtesy of GENERAL MOTORS CORP.

42. Install the magnet into the transaxle case.

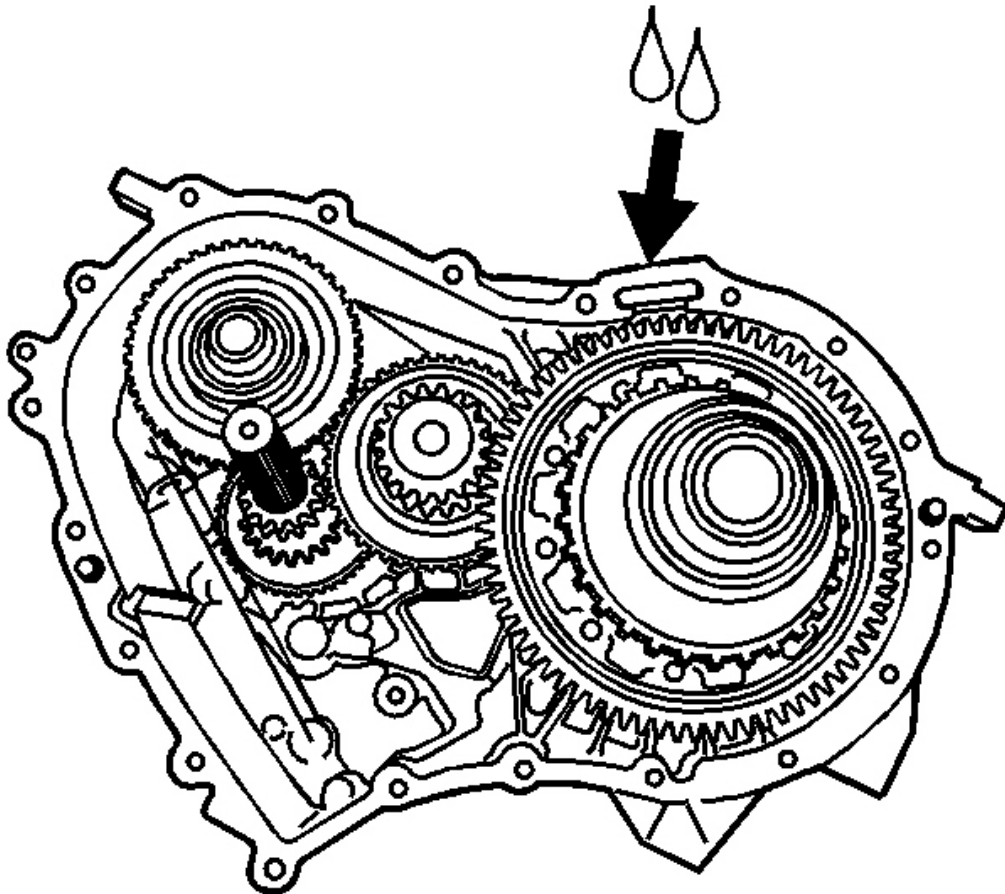


Fig. 136: Applying Sealant To Transaxle Case-To-Clutch Housing Mating Surface
Courtesy of GENERAL MOTORS CORP.

43. Apply sealant GM P/N United States 12378516, GM P/N Canada 88900757 to the transaxle case to clutch housing mating surface.

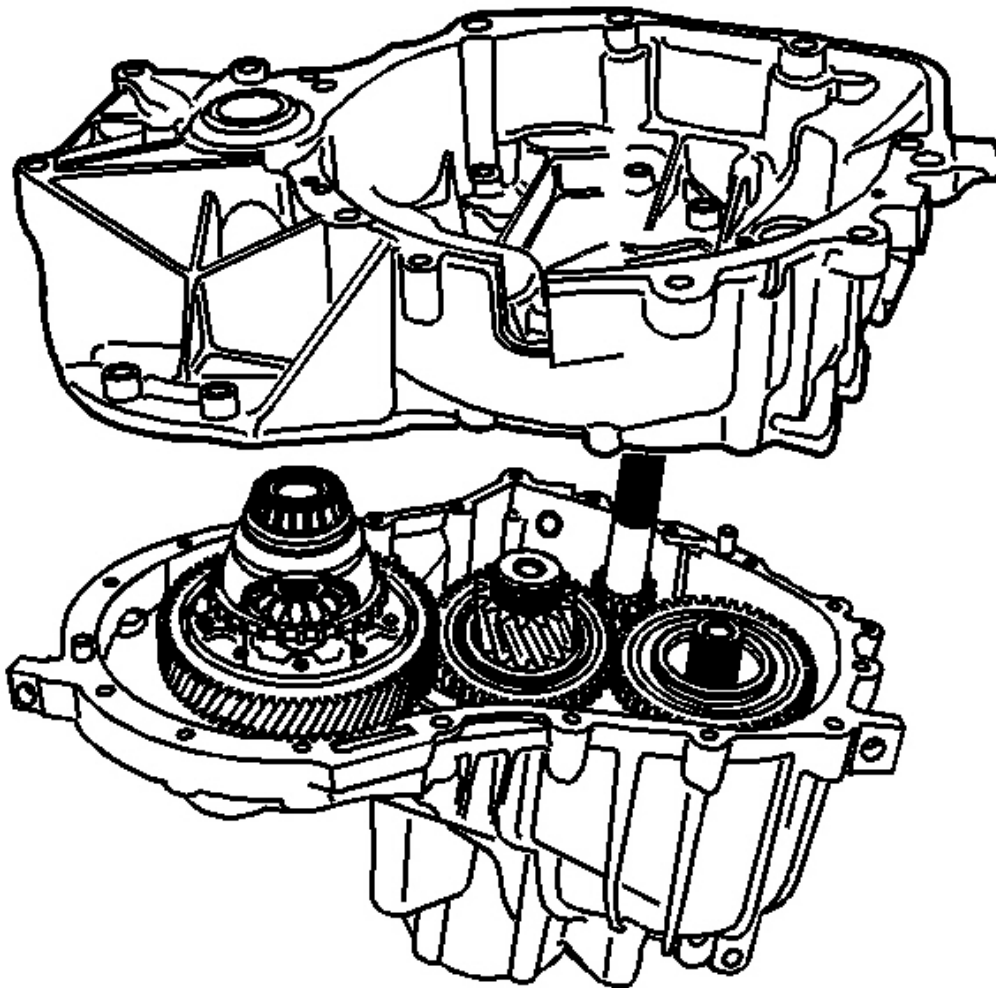


Fig. 137: View Of Clutch Housing & Transaxle Case
Courtesy of GENERAL MOTORS CORP.

44. Install the clutch housing to the transaxle case.

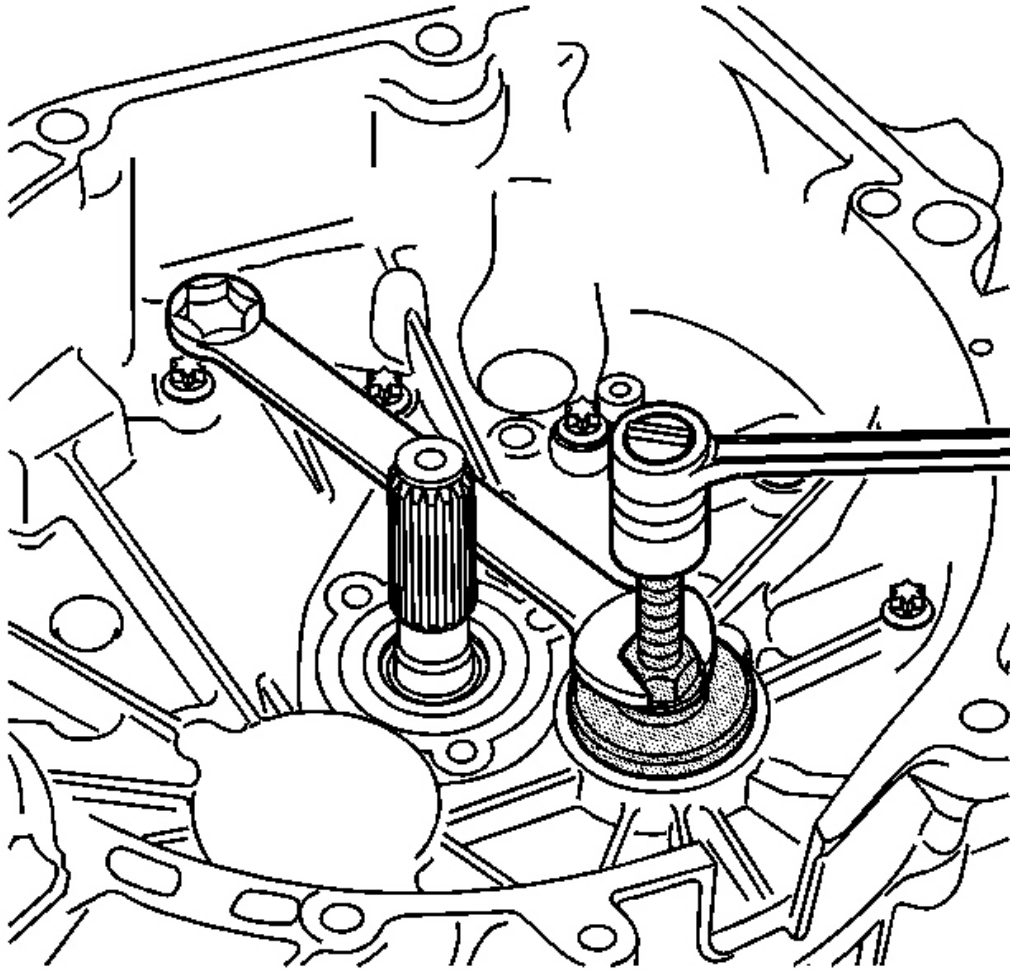


Fig. 138: Installing Countershaft Into Clutch Housing Bearing
Courtesy of GENERAL MOTORS CORP.

45. Install the countershaft into the clutch housing bearing using the J 44389 .

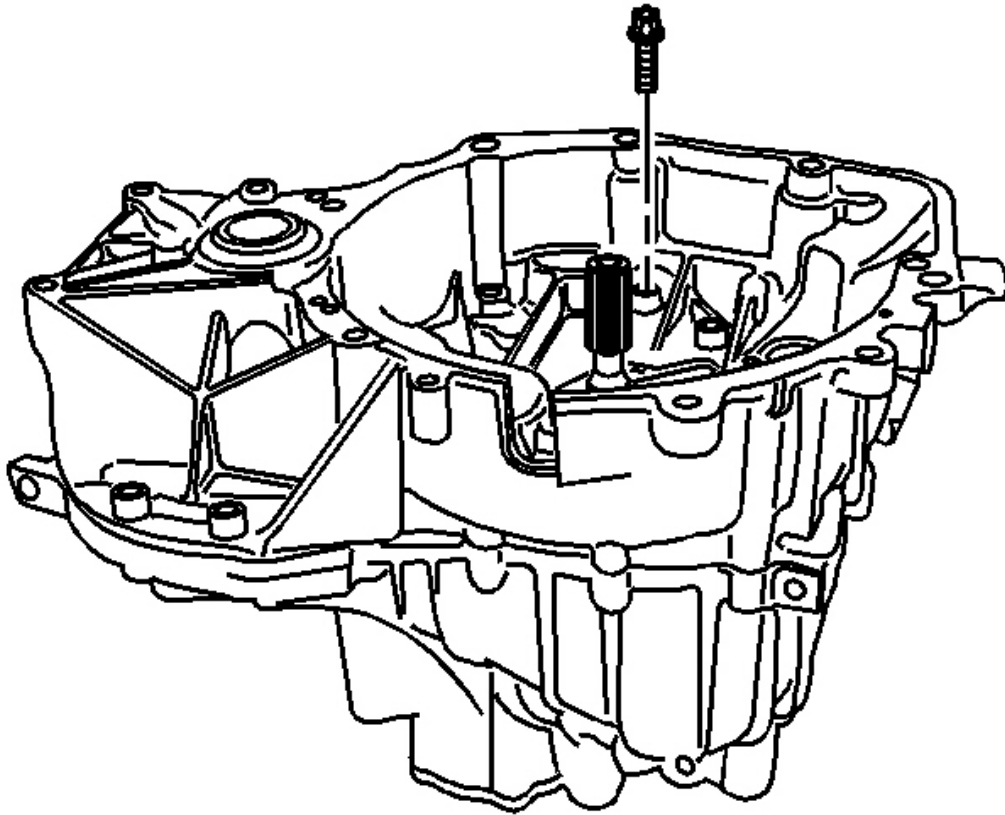


Fig. 139: View Of Clutch Housing Side Transmission Housing Bolt
Courtesy of GENERAL MOTORS CORP.

46. Install the clutch housing to transaxle case bolts.

Tighten: Tighten the housing bolts to 27 N.m (20 lb ft).

47. Turn the transmission over.

48. Install the transaxle case to clutch housing bolts.

Tighten: Tighten the housing bolts to 27 N.m (20 lb ft).

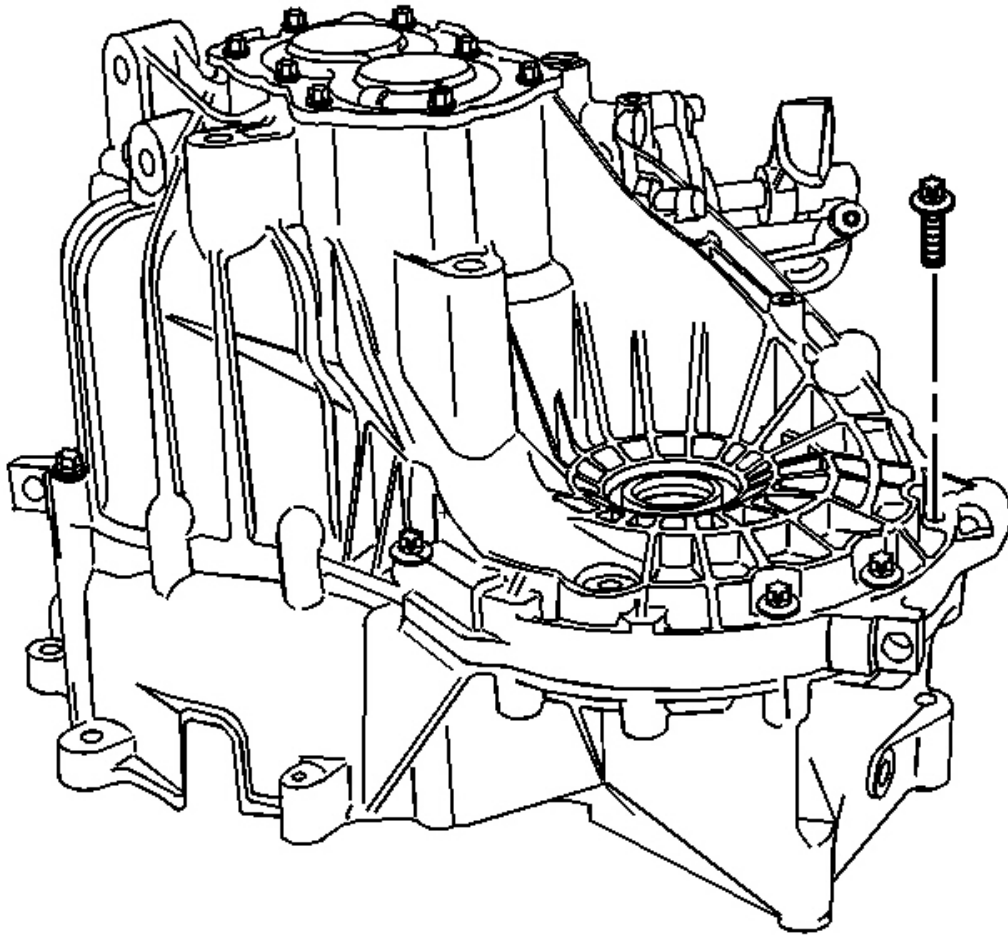


Fig. 140: View Of Transaxle Case Side Of Housing Bolt
Courtesy of GENERAL MOTORS CORP.

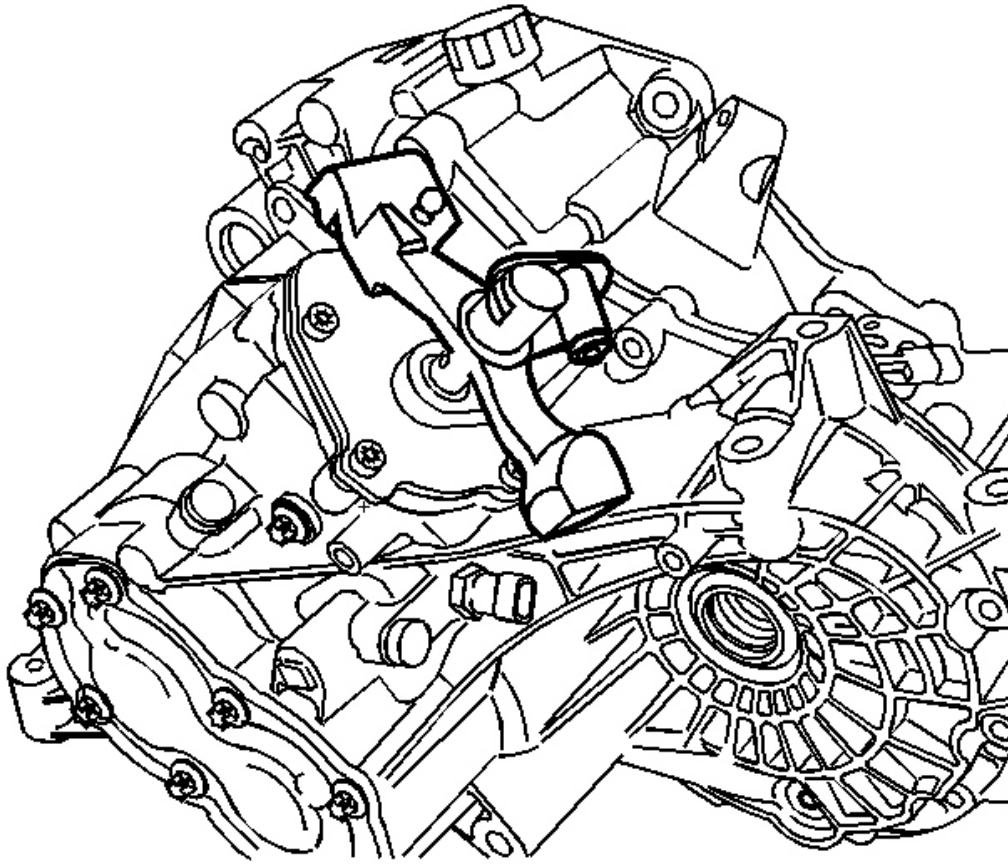


Fig. 141: Locating Shifter
Courtesy of GENERAL MOTORS CORP.

49. Turn the transmission so the shifter is on top.
50. Shift the transmission into any gear.

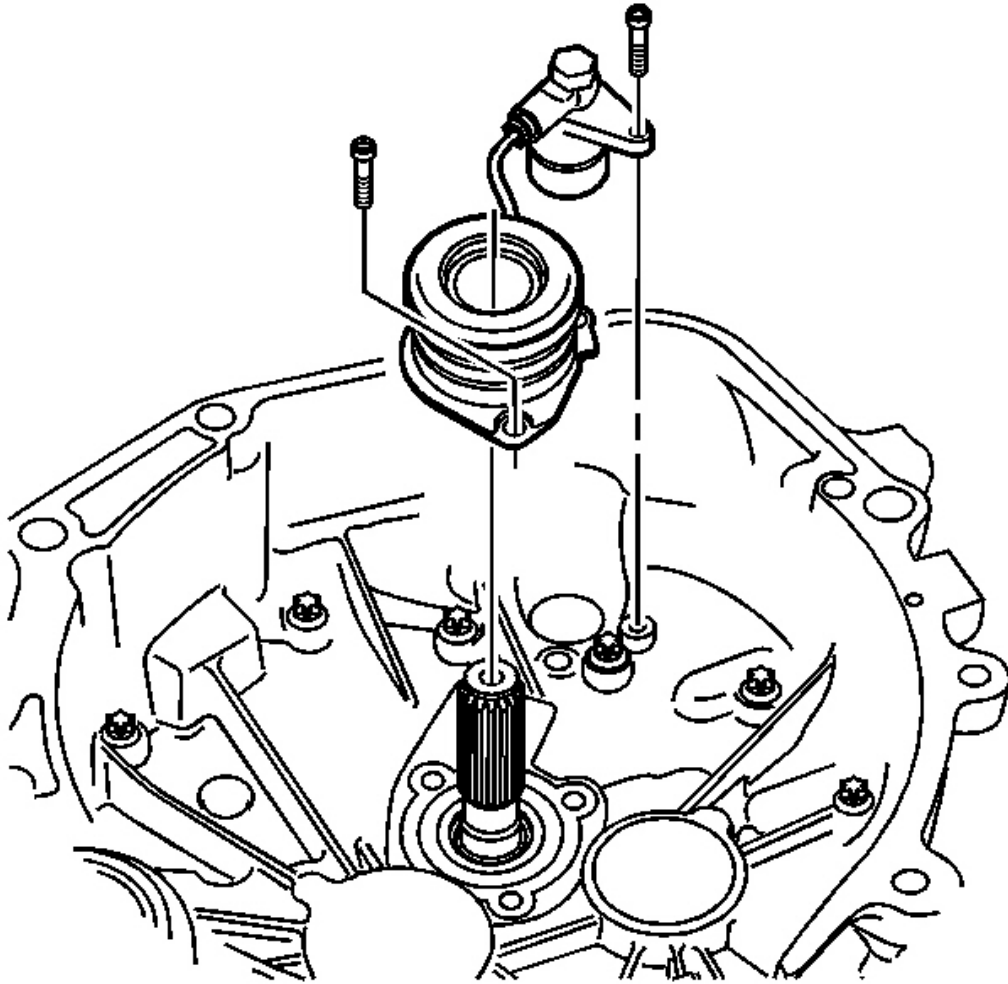


Fig. 142: View Of Actuator And Tube
Courtesy of GENERAL MOTORS CORP.

51. Install the actuator and tube.
52. Install the actuator and tube bolts.

Tighten: Tighten the tube bolts to 10 N.m (89 lb in).

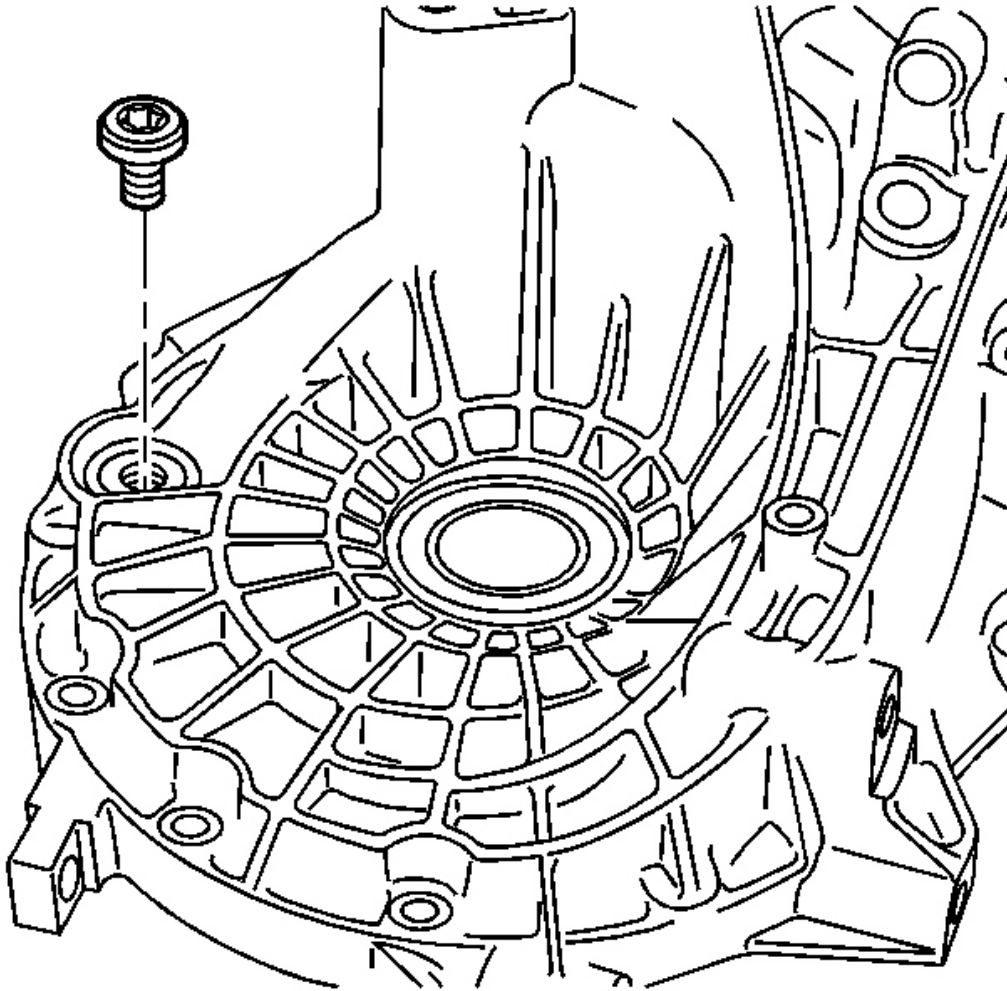


Fig. 143: View Of Transmission Drain Plug
Courtesy of GENERAL MOTORS CORP.

53. Apply GM P/N United States 12346004, GM P/N Canada 10953480 to the transmission drain plug.
54. Install the transmission drain plug.

Tighten: Tighten the transmission drain plug to 38 N.m (28 lb ft).

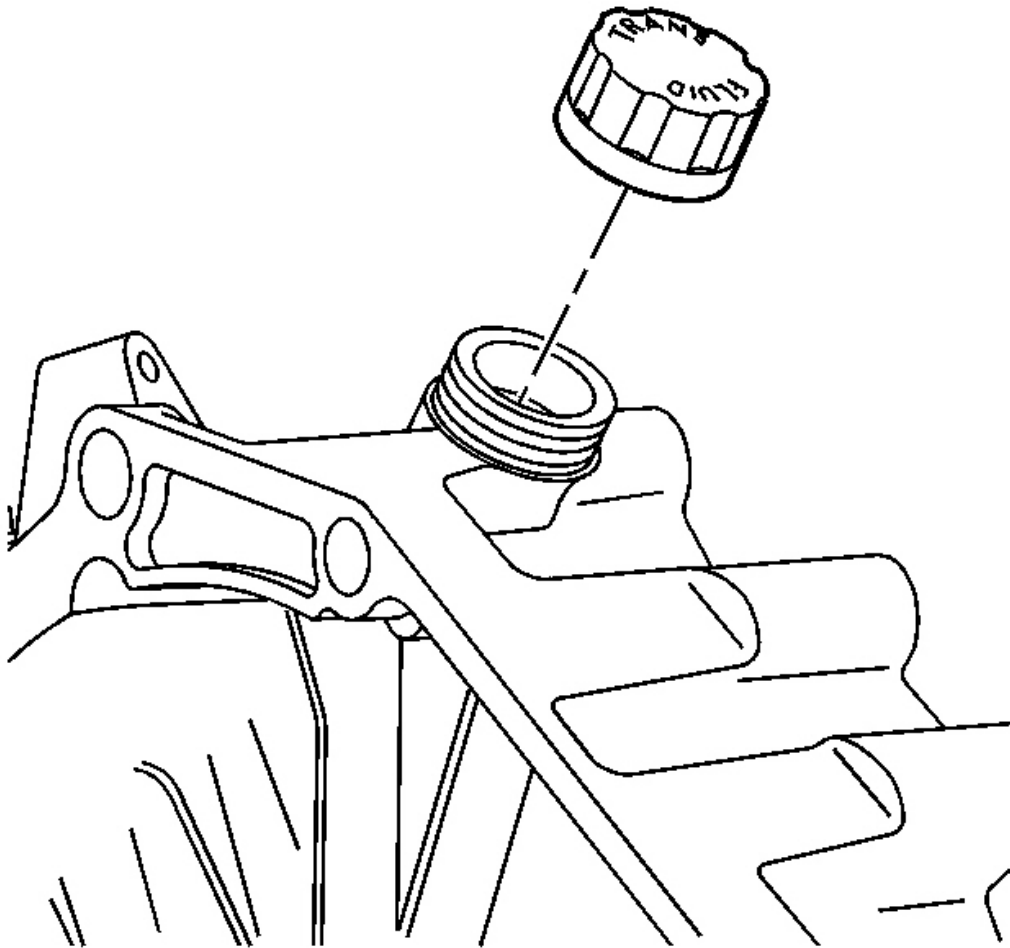


Fig. 144: View Of Transmission Filler Cap
Courtesy of GENERAL MOTORS CORP.

55. Install the transmission fill cap.
56. Hold the input shaft with the **J 44377** .
57. Apply GM P/N United States 12345493, GM P/N Canada 10953488 to the intermediate shaft bolt.
58. Install the bolt in the intermediate shaft.

Tighten: Tighten the intermediate shaft bolts to 95 N.m (70 lb ft).

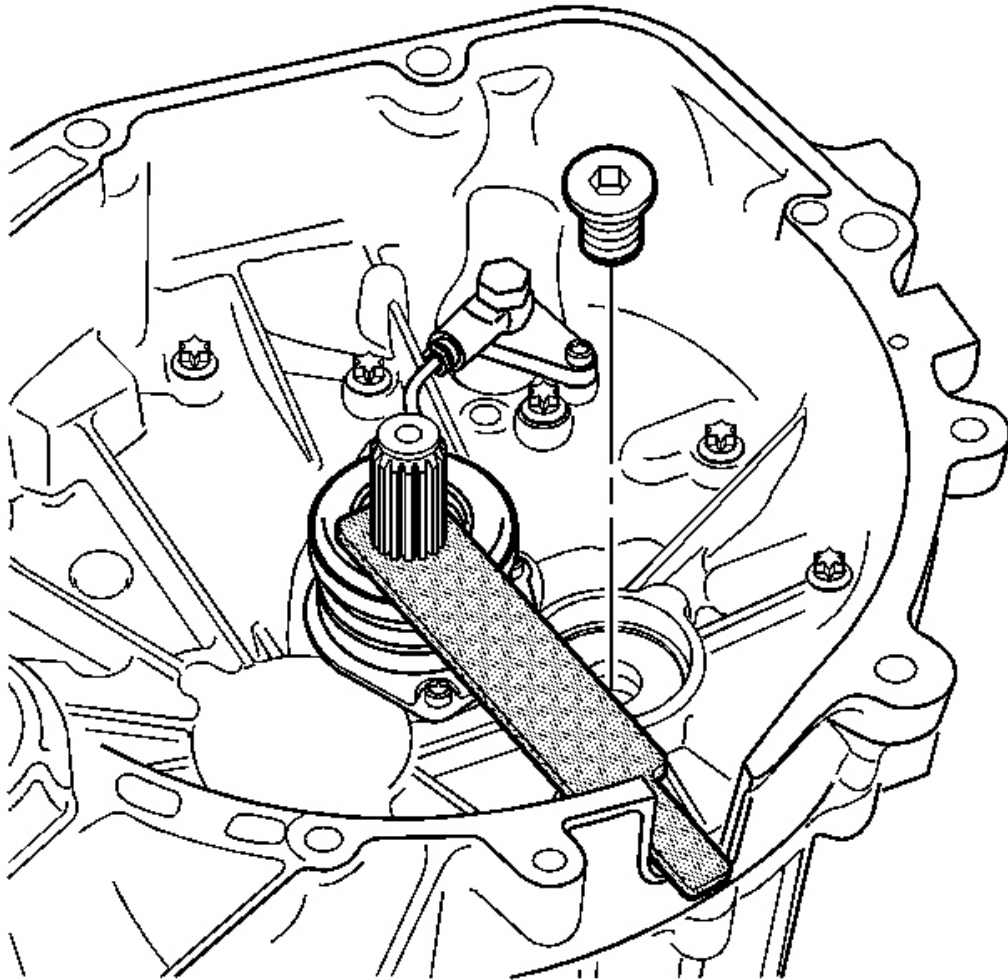


Fig. 145: View Of Intermediate Shaft Bolt
Courtesy of GENERAL MOTORS CORP.

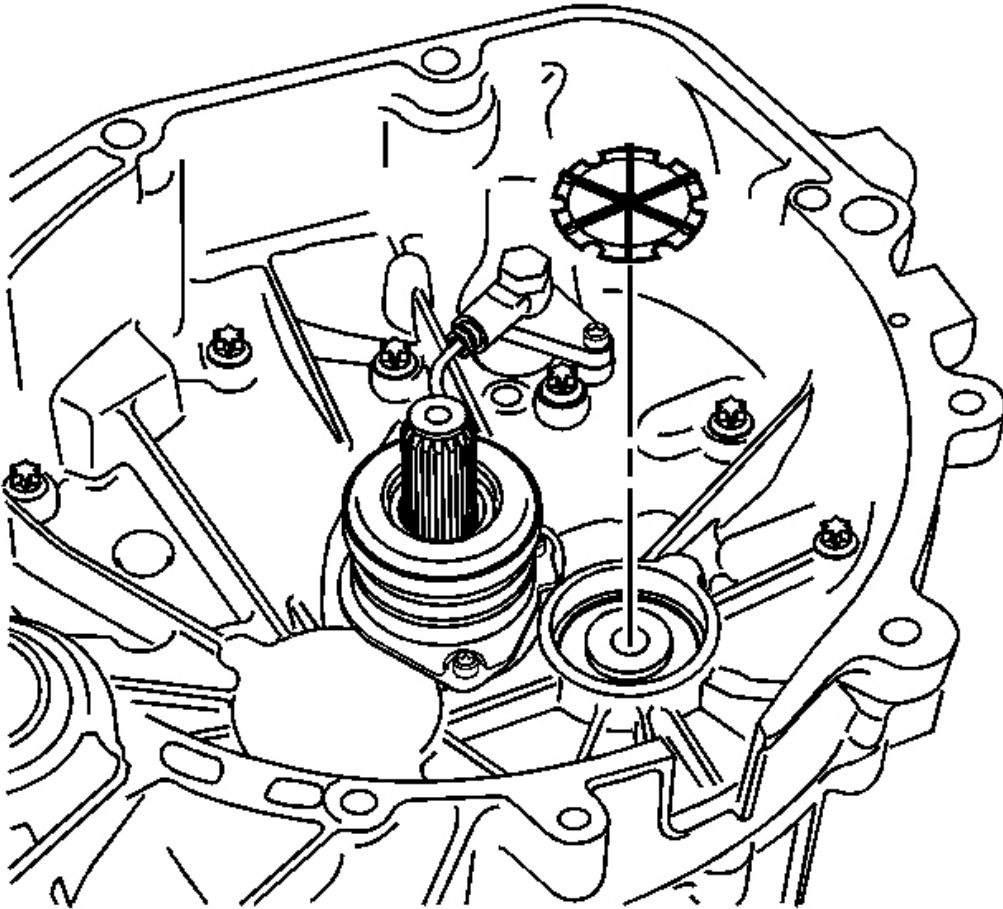


Fig. 146: Identifying Plastic Oil Guide
Courtesy of GENERAL MOTORS CORP.

59. Install a new plastic oil guide into the intermediate shaft.

IMPORTANT: Ensure not to press the sealing cap past the bottom of the chamfer.

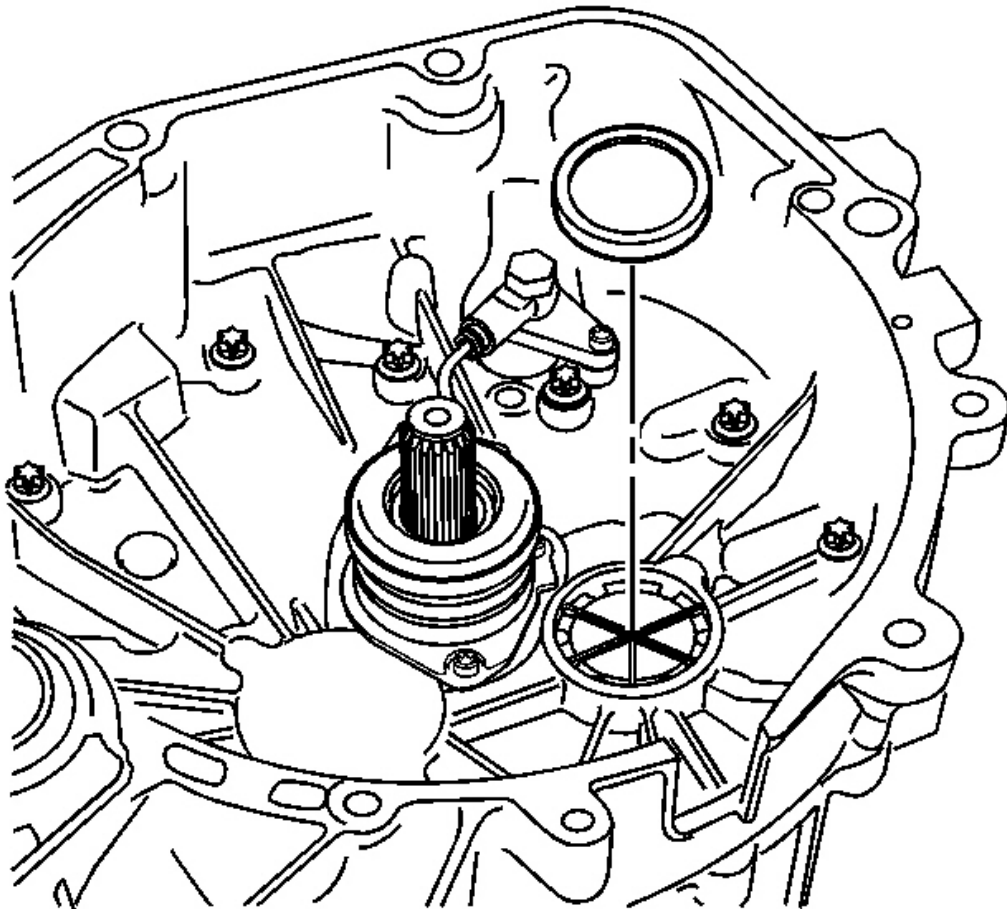


Fig. 147: Identifying Intermediate Shaft Seal
Courtesy of GENERAL MOTORS CORP.

60. Install a new intermediate shaft sealing cap.
61. Apply GM P/N United States 12345382, GM P/N Canada 10953489 to the vehicle speed sensor bolt.
62. Install the vehicle speed sensor, seal, and bolt.

Tighten: Tighten the bolt to 12 N.m (8 lb ft).

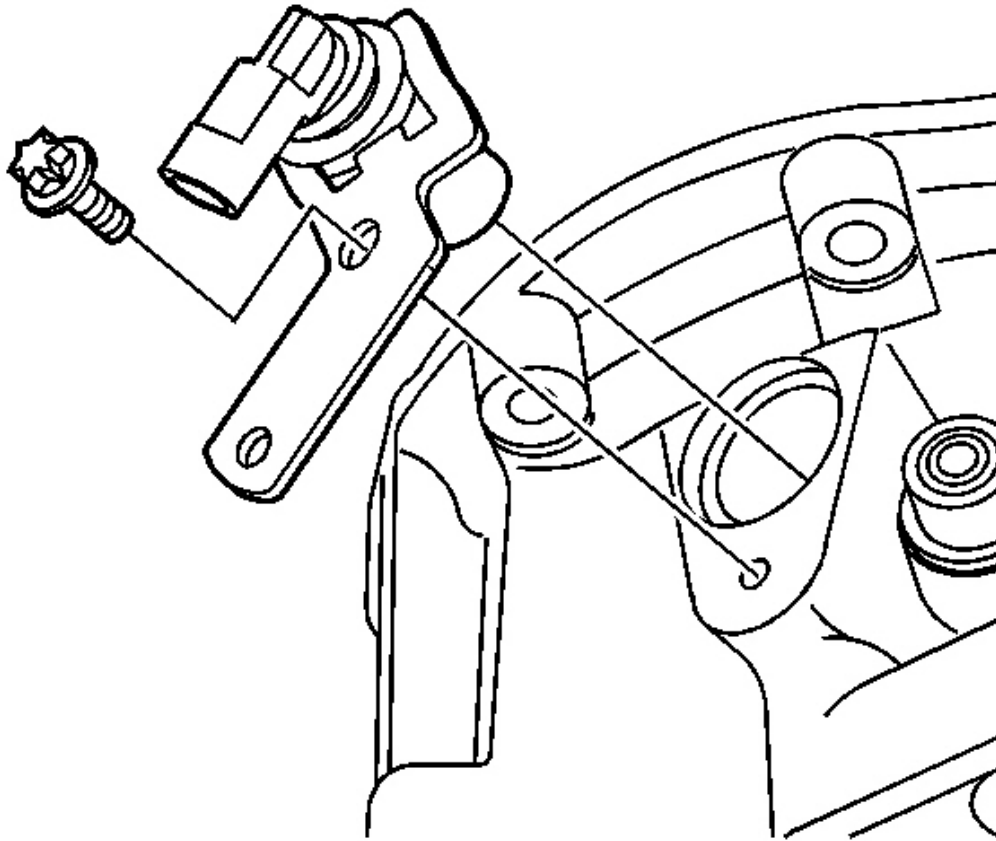


Fig. 148: View Of VSS
Courtesy of GENERAL MOTORS CORP.

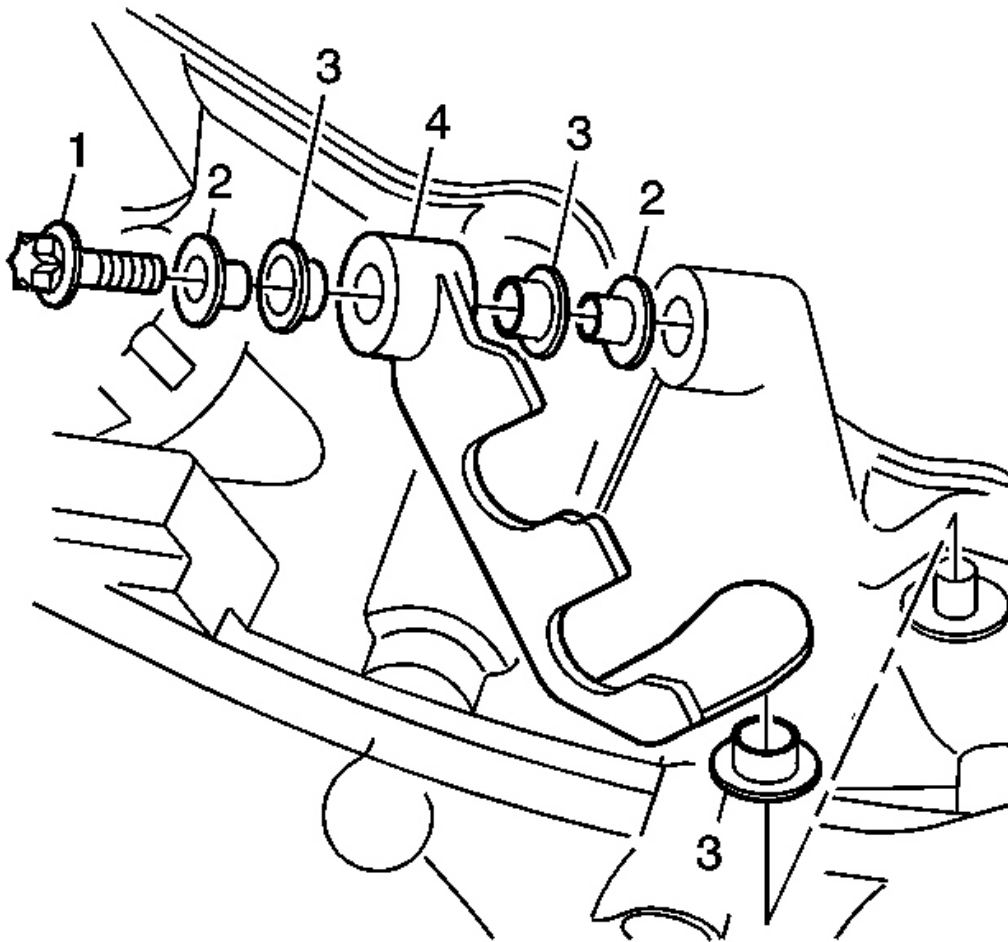


Fig. 149: View Of Shift Cable Bracket Assembly
Courtesy of GENERAL MOTORS CORP.

63. Install the shift cable bracket (4), the isolators (3), the spacers (2) and the bolt (1).

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

SHIMMING PROCEDURES

Tools Required

- **J 7079-2** Universal Driver Handle - Non-Threaded. See **Special Tools and Equipment** .
- **J 44385** Differential Bearing Race and Seal Installer. See **Special Tools and Equipment** .

- **J 44388** Final End Checking Fixture. See Special Tools and Equipment .

IMPORTANT: Remove all of the old shims before performing the Shimming Procedures.

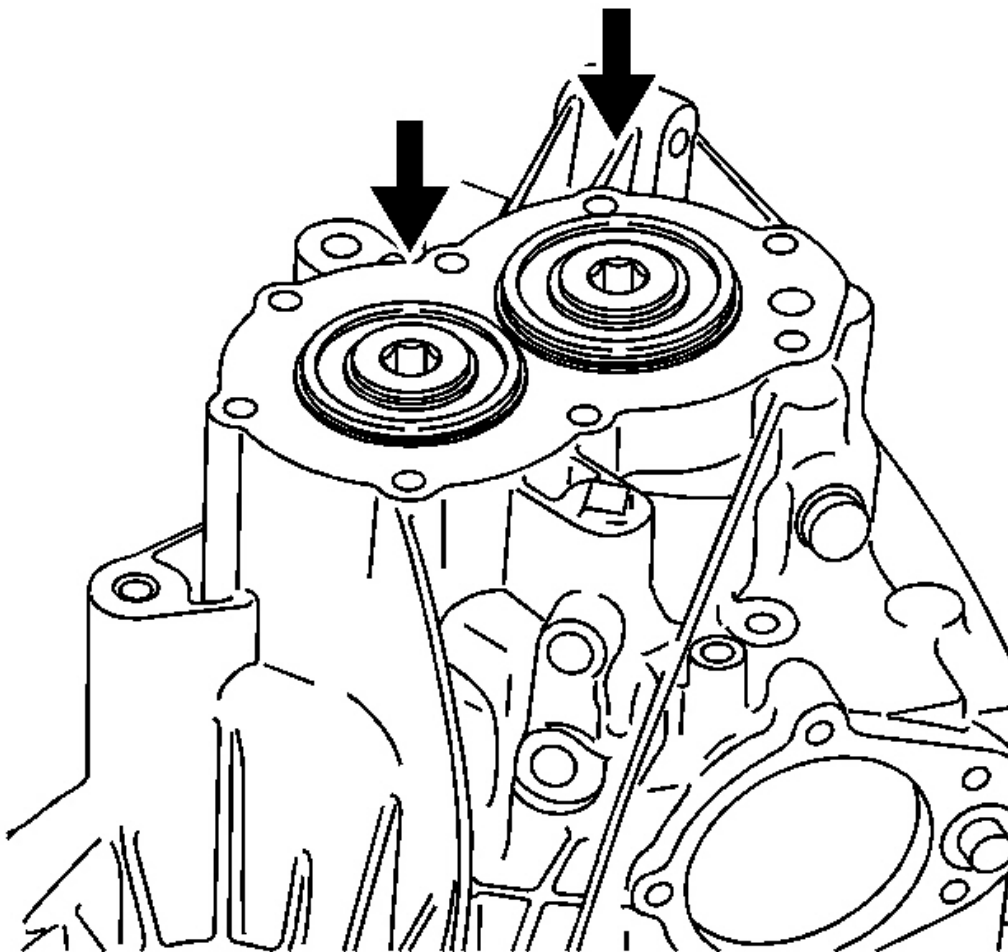


Fig. 150: Inspecting Bearings
Courtesy of GENERAL MOTORS CORP.

1. Make sure the bearings are fully seated in the case.
2. Position the transaxle on a bench so that the bearings are resting on a flat surface.
3. Using a rubber mallet, tap lightly on the case mating surface to ensure the bearings are fully seated.

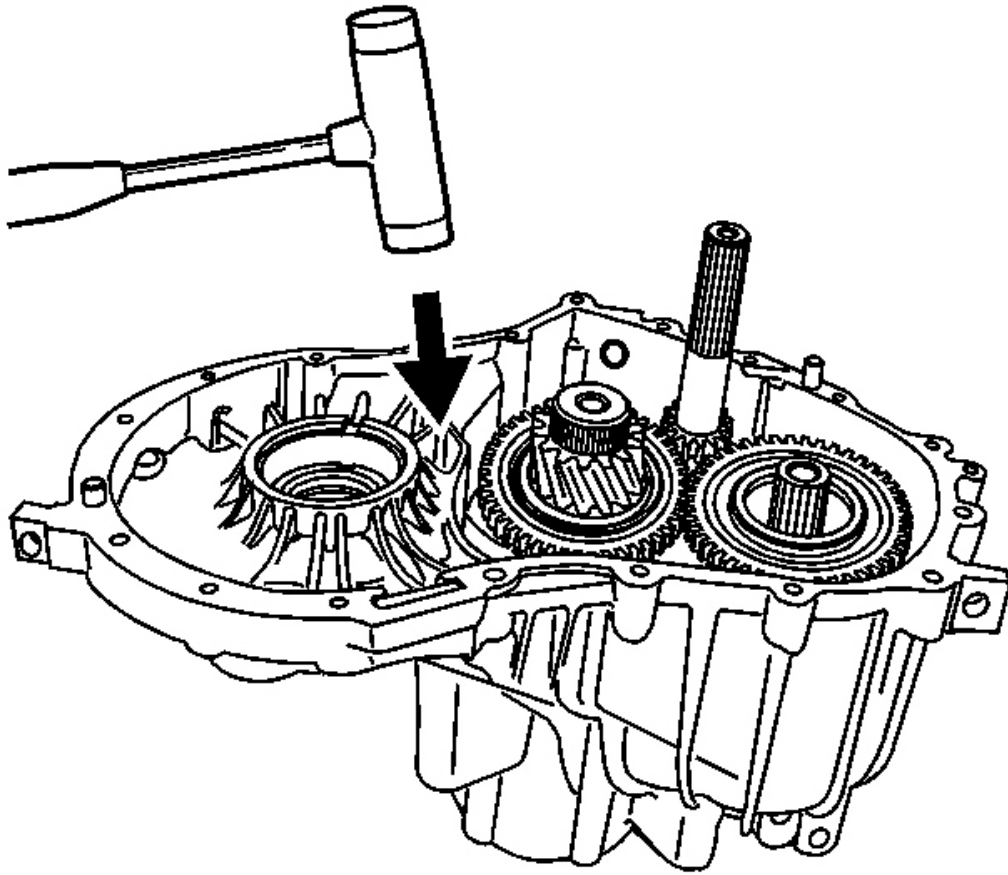


Fig. 151: Ensuring Bearing Are Correctly Seated
Courtesy of GENERAL MOTORS CORP.

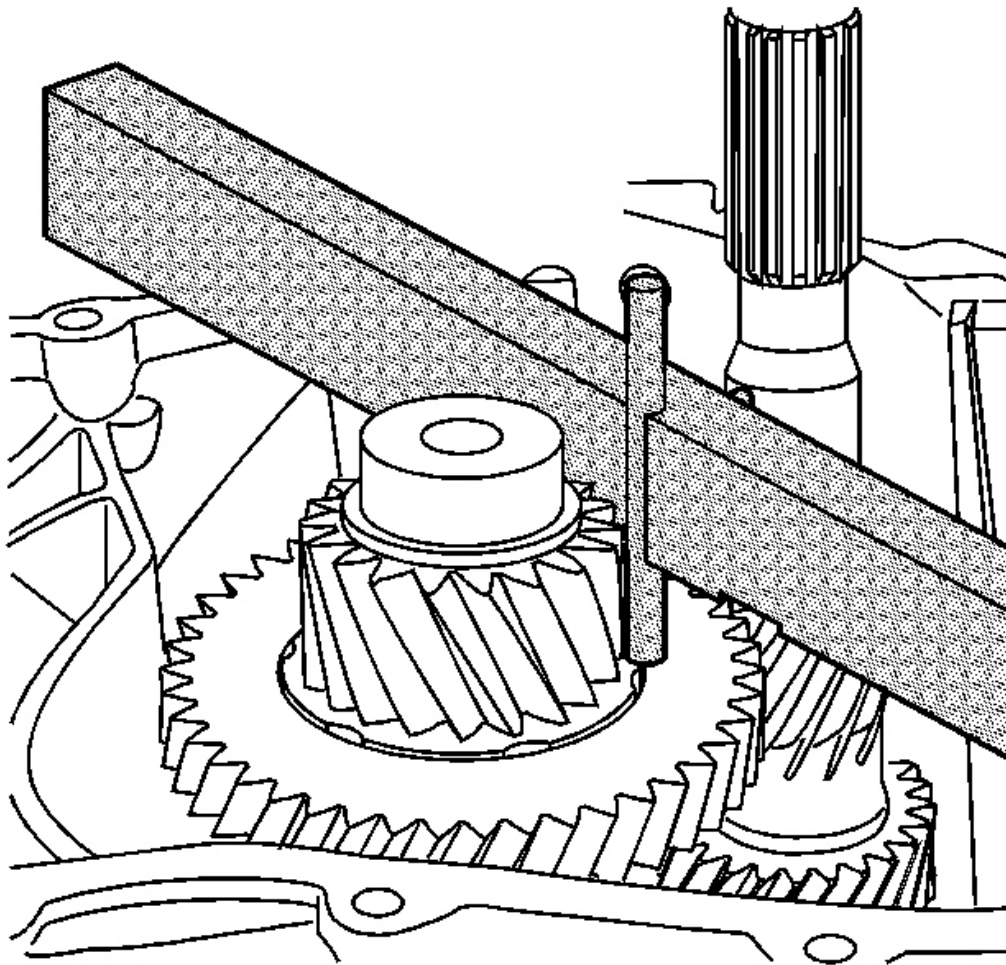


Fig. 152: Measuring Distance Of Transaxle Case Parting Surface To Output Shaft Gear Thrust Washer Surface Using J 44388-1
Courtesy of GENERAL MOTORS CORP.

4. Measure the distance of the transaxle case parting surface to the output shaft gear thrust washer surface using the J 44388-1.
5. Place the J 44388-1 on the case parting surface.
6. Extend the gage rod on the J 44388-1 until it is bottomed on the output shaft gear thrust washer.
7. Tighten the thumbscrew on the J 44388-1 to retain the gage rod.

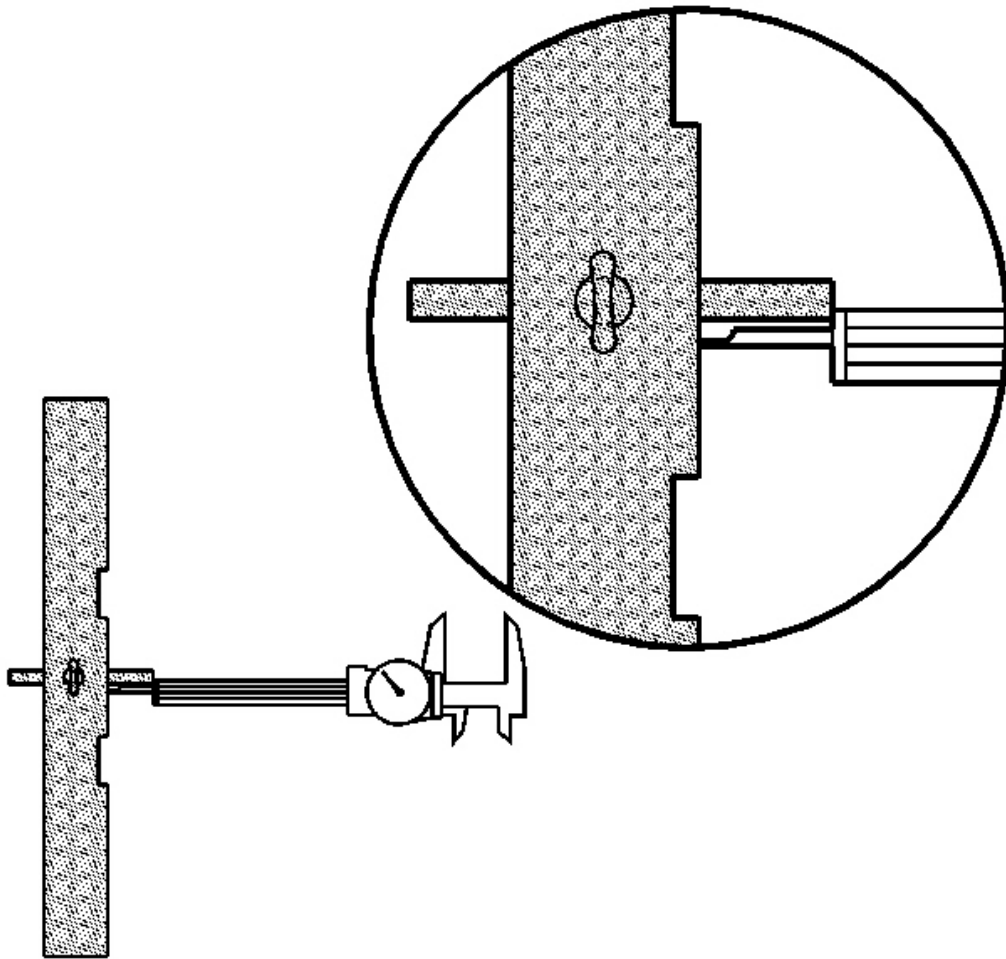


Fig. 153: Measuring Length Of Gage Rod Protruding From Gage Bar
Courtesy of GENERAL MOTORS CORP.

8. Measure and record the length of the gage rod protruding from the gage bar (measurement A).

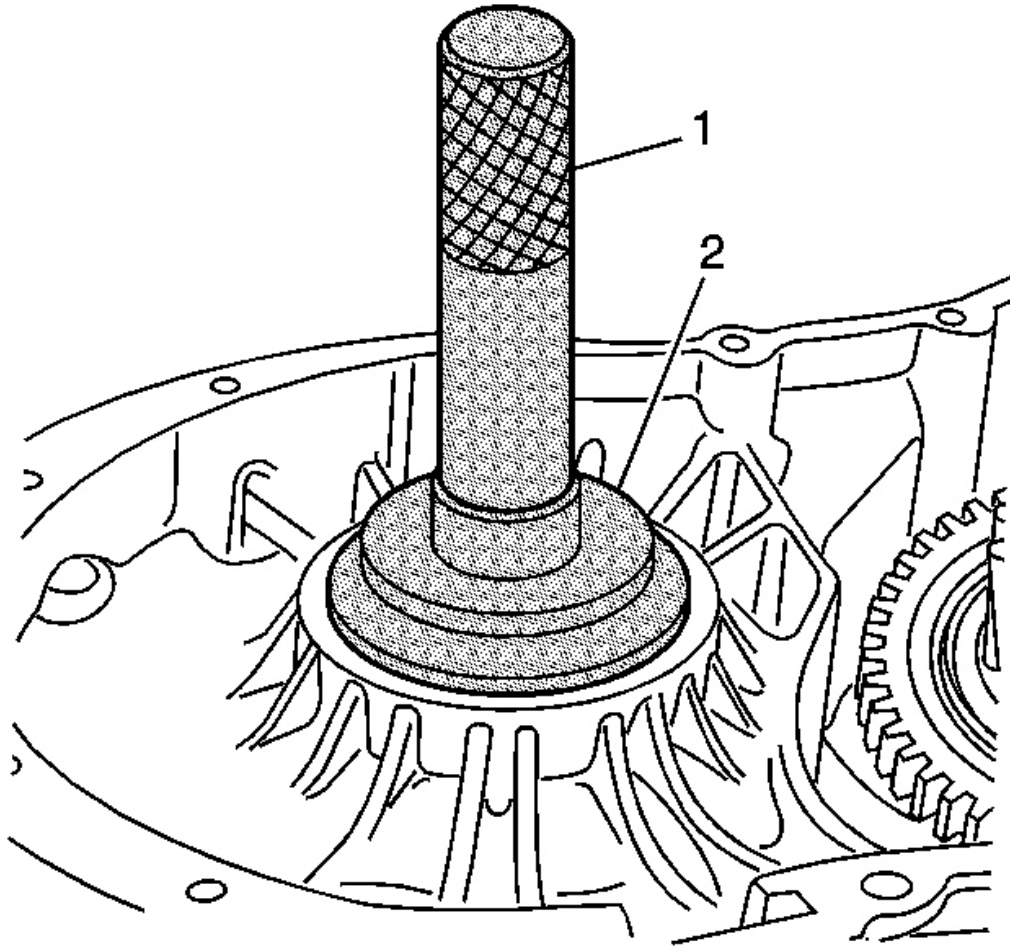


Fig. 154: Installing Left Differential Bearing Race
Courtesy of GENERAL MOTORS CORP.

9. Make sure the left differential bearing race is fully seated into the transaxle case using the **J 7079-2** (1) and the **J 44385** (2).

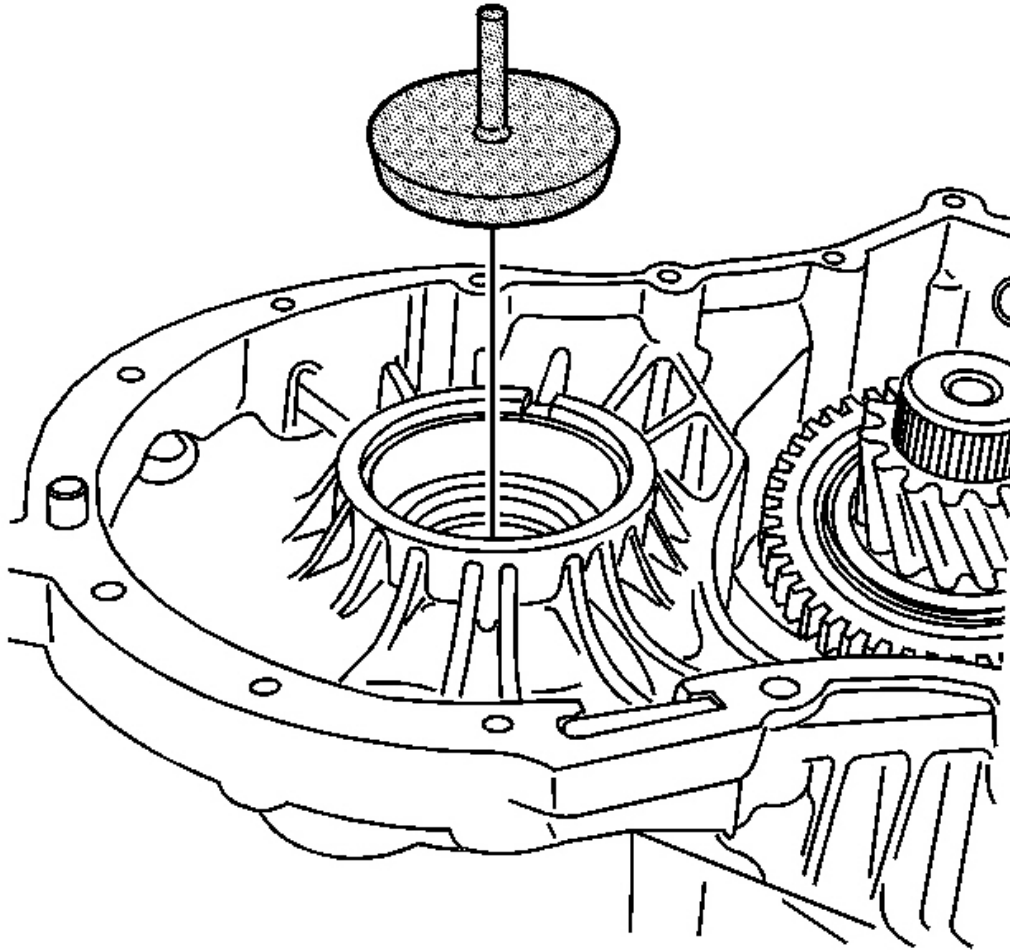


Fig. 155: Installing J 44388-2 Into The Left Differential Side Bearing Race
Courtesy of GENERAL MOTORS CORP.

10. Install the J 44388-2 into the left differential side bearing race. Ensure that the J 44388-2 is fully seated into the left differential side bearing race.
11. Remove the gage rod from the J 44388-1 (2).
12. Place the bar of the J 44388-1 (2) onto the gage rod of the J 44388-2 (1).

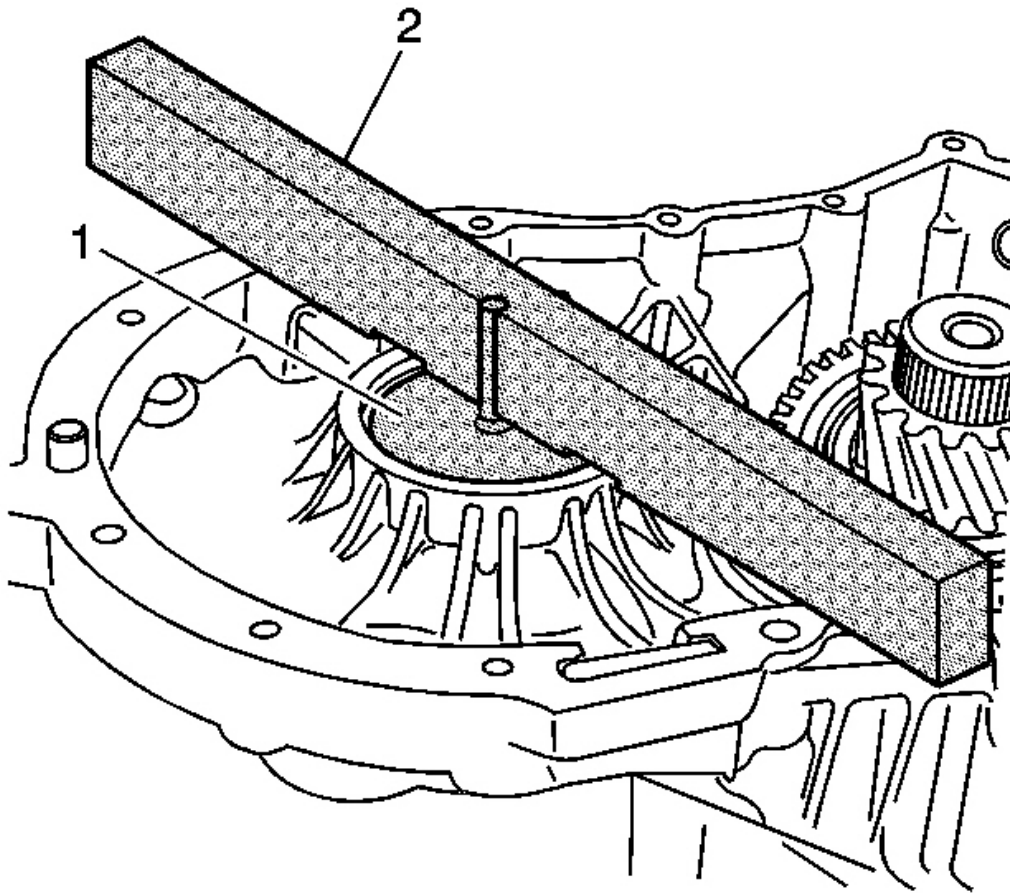


Fig. 156: Identifying J 44388-2 & J 44388-1
Courtesy of GENERAL MOTORS CORP.

13. Tighten the thumbscrew on the J 44388-1 (2) to retain the J 44388-2 (1) gage rod.

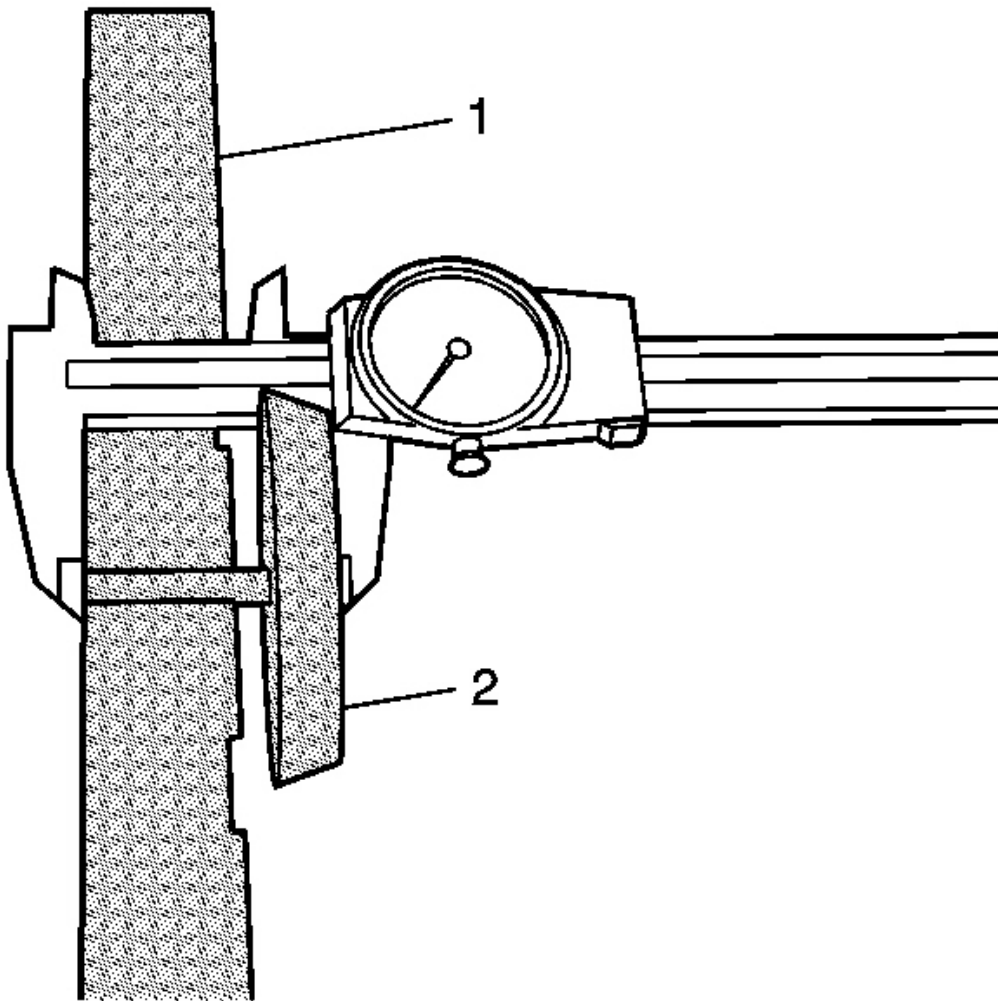


Fig. 157: Measuring Height Of J 44388-1 & J 44388-2
Courtesy of GENERAL MOTORS CORP.

14. Measure the overall height of the J 44388-1 (1) and J 44388-2 (2) (measurement B).

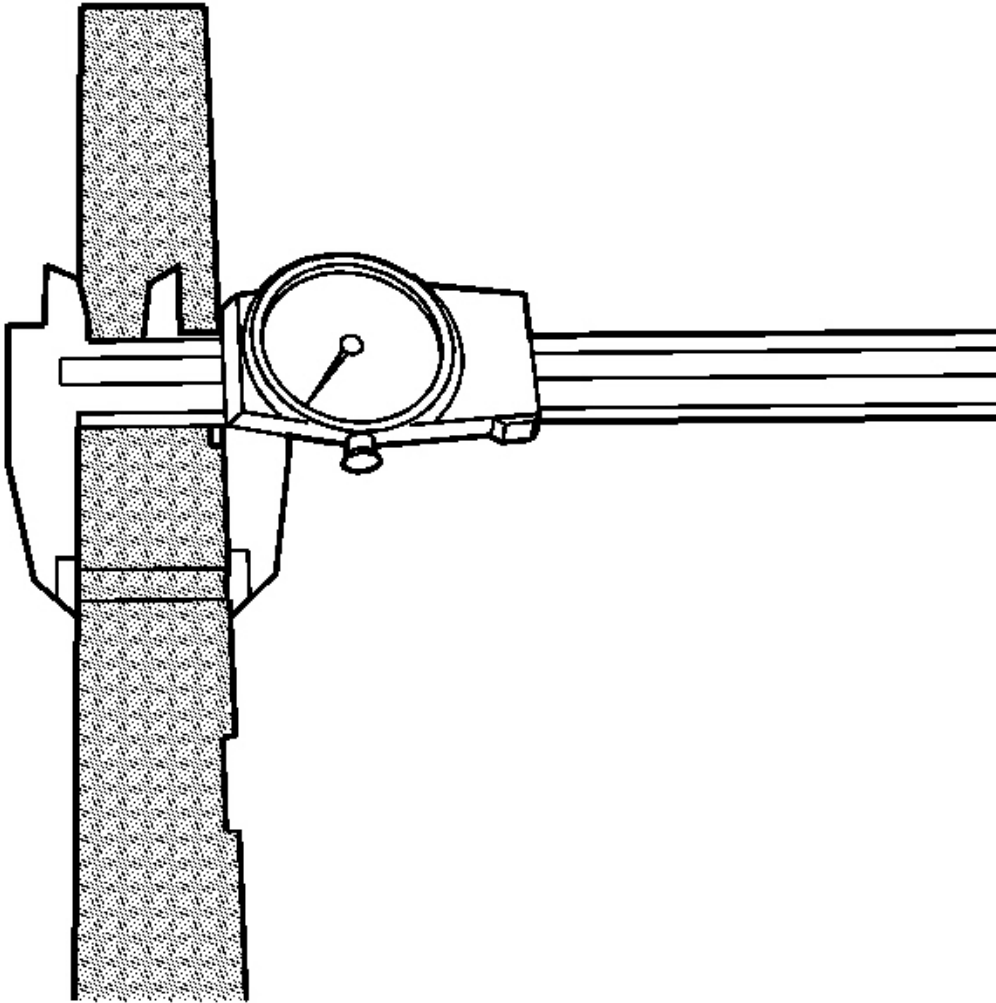


Fig. 158: Measuring Height Of J 44388-1
Courtesy of GENERAL MOTORS CORP.

15. Measure the height of just the J 44388-1 (measurement C).
16. Subtract the height of the J 44388-1 (measurement C) from the overall height of the J 44388-1 and J 44388-2 (measurement B) and record (measurement D).

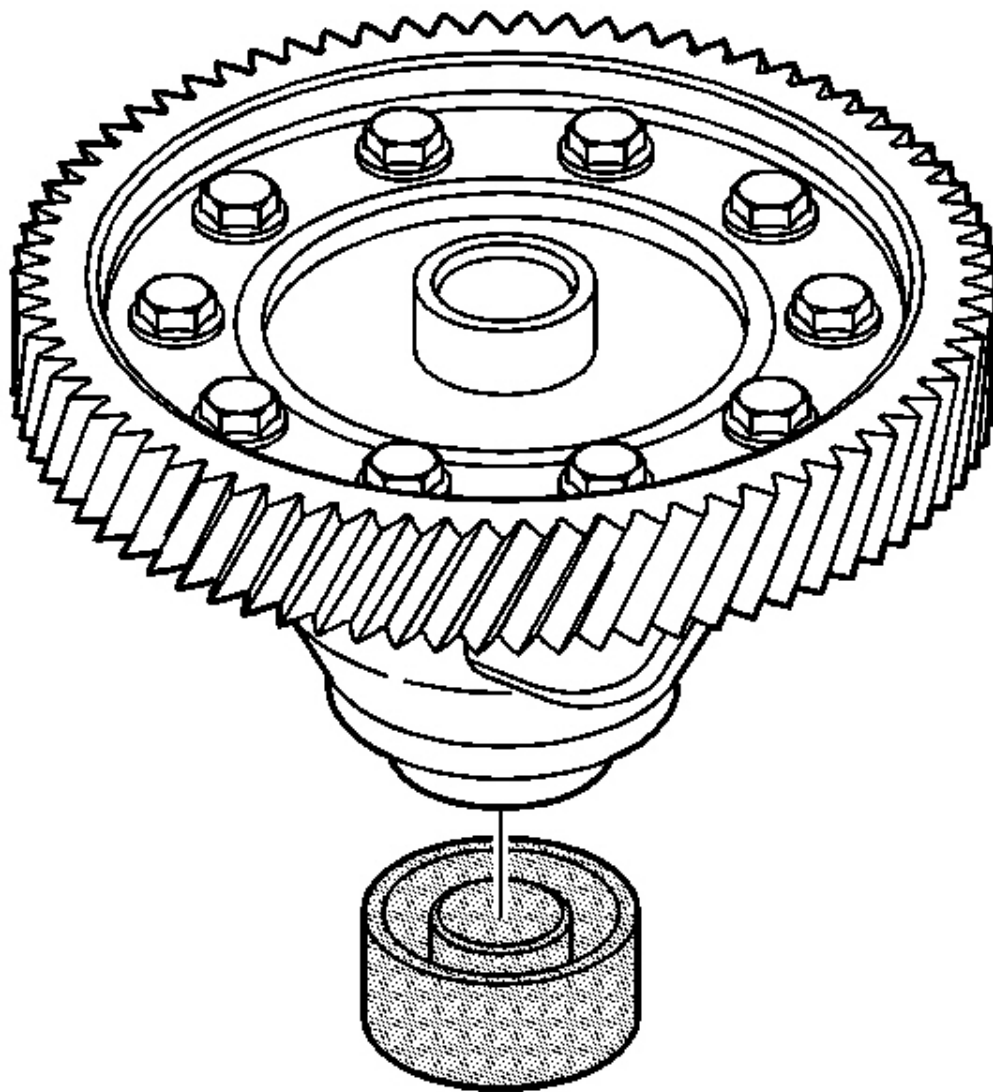


Fig. 159: Placing Differential Assembly Onto J 44388-4
Courtesy of GENERAL MOTORS CORP.

17. Place the differential assembly onto the J 44388-4 to provide a steady measuring surface.

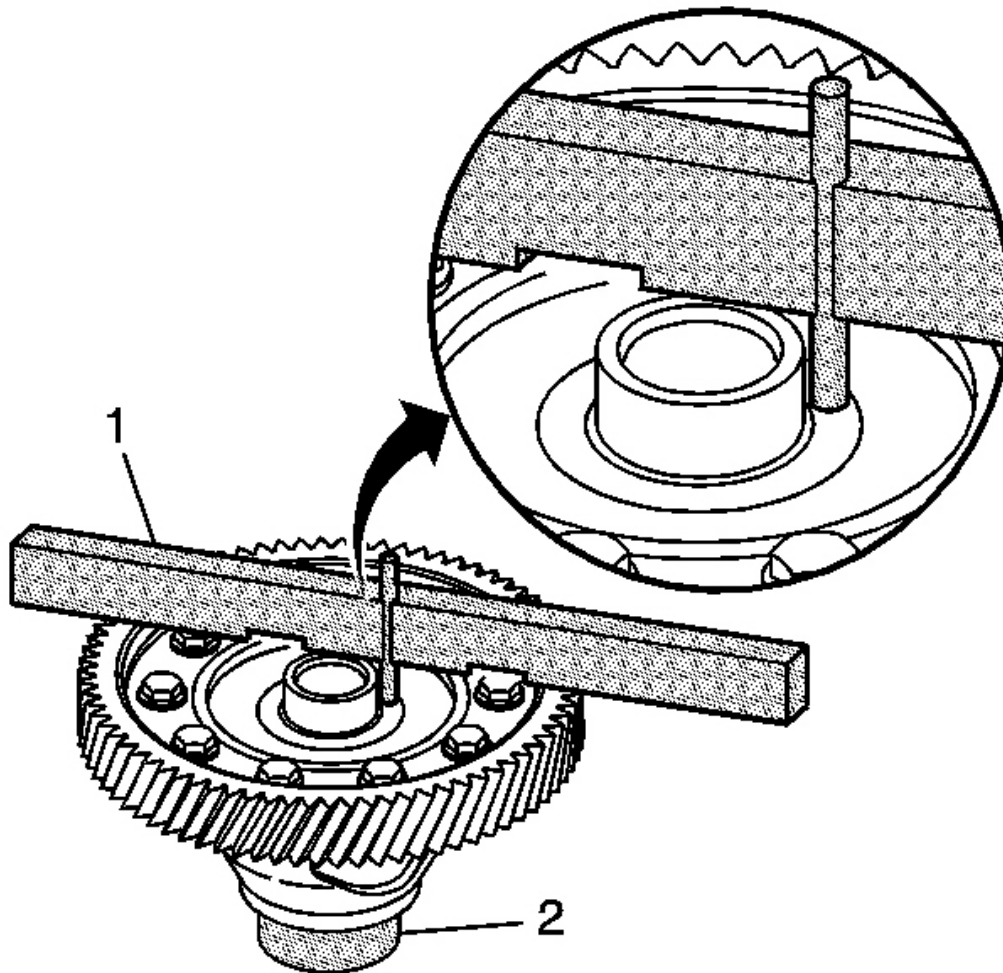


Fig. 160: Installing J 44388-1 To Differential Assembly
Courtesy of GENERAL MOTORS CORP.

18. Install the rod back into the J 44388-1 (1).
19. Place the J 44388-1 (1) across the face of the ring gear.
20. Center the gage rod of the J 44388-1 (1) over the land for the left differential side bearing shim.
21. With the gage rod of the J 44388-1 (1) fully seated on the shim land for the left differential side bearing shim, tighten the thumbscrew on the J 44388-1 (1).

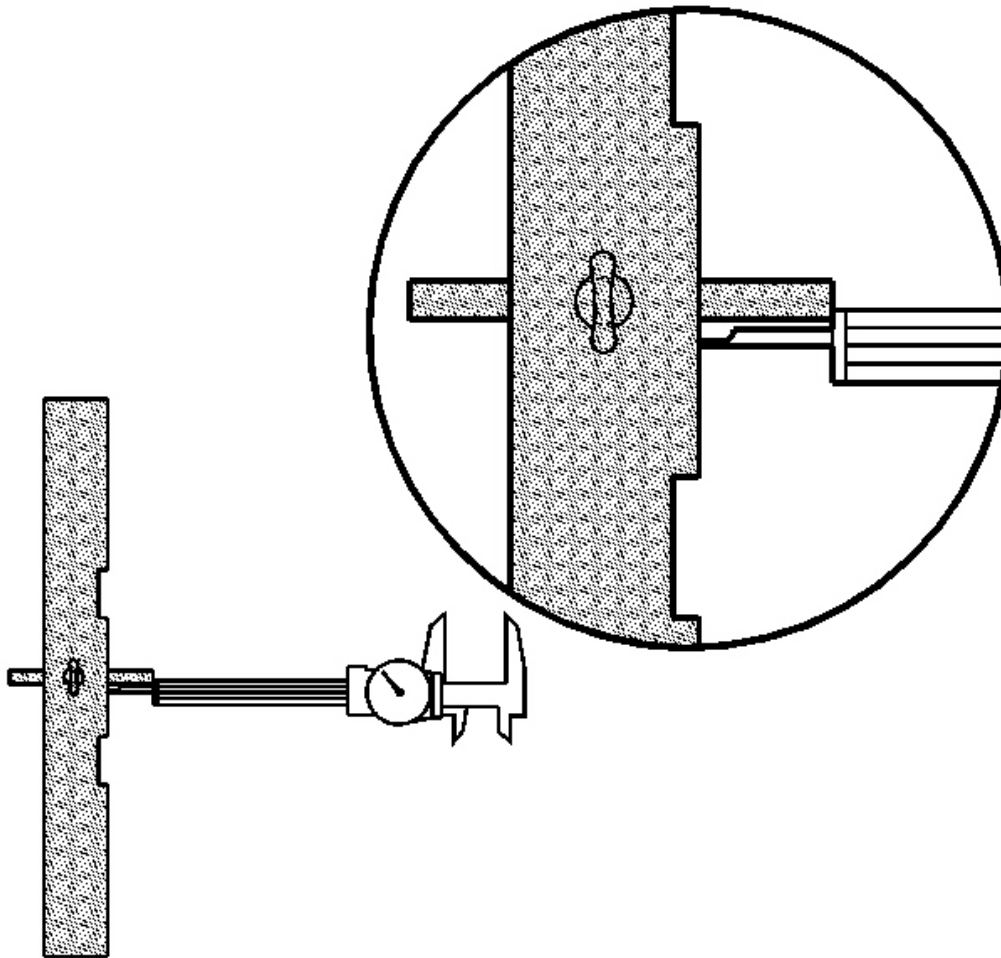


Fig. 161: Measuring Length Of Gage Rod Protruding From Gage Bar
Courtesy of GENERAL MOTORS CORP.

22. Measure and record the length of the gage rod protruding from the J 44388-1 (measurement E).

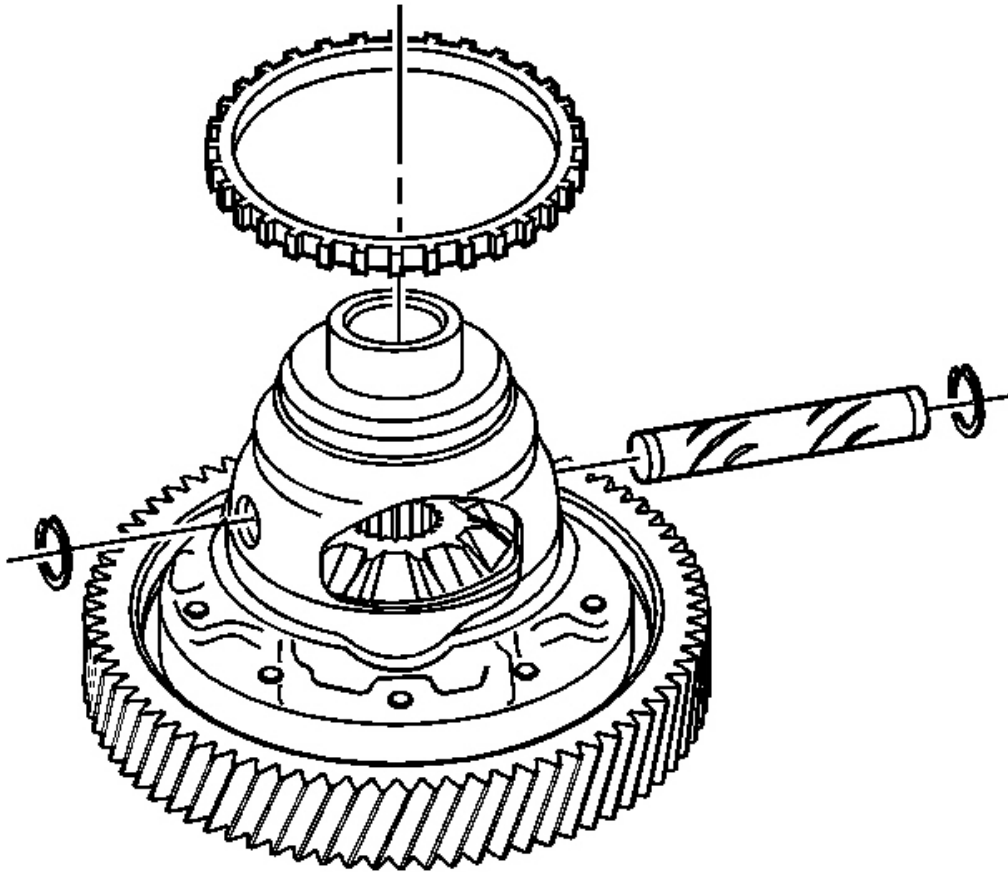


Fig. 162: Removing VSS Ring And Differential Pinion Shaft
Courtesy of GENERAL MOTORS CORP.

23. Remove the vehicle speed sensor (VSS) ring.

IMPORTANT: Both retaining rings must be removed from the pinion shaft to ensure proper removal of the differential pinion shaft.

24. Remove and discard both the differential pinion shaft retaining rings and remove the differential pinion shaft.

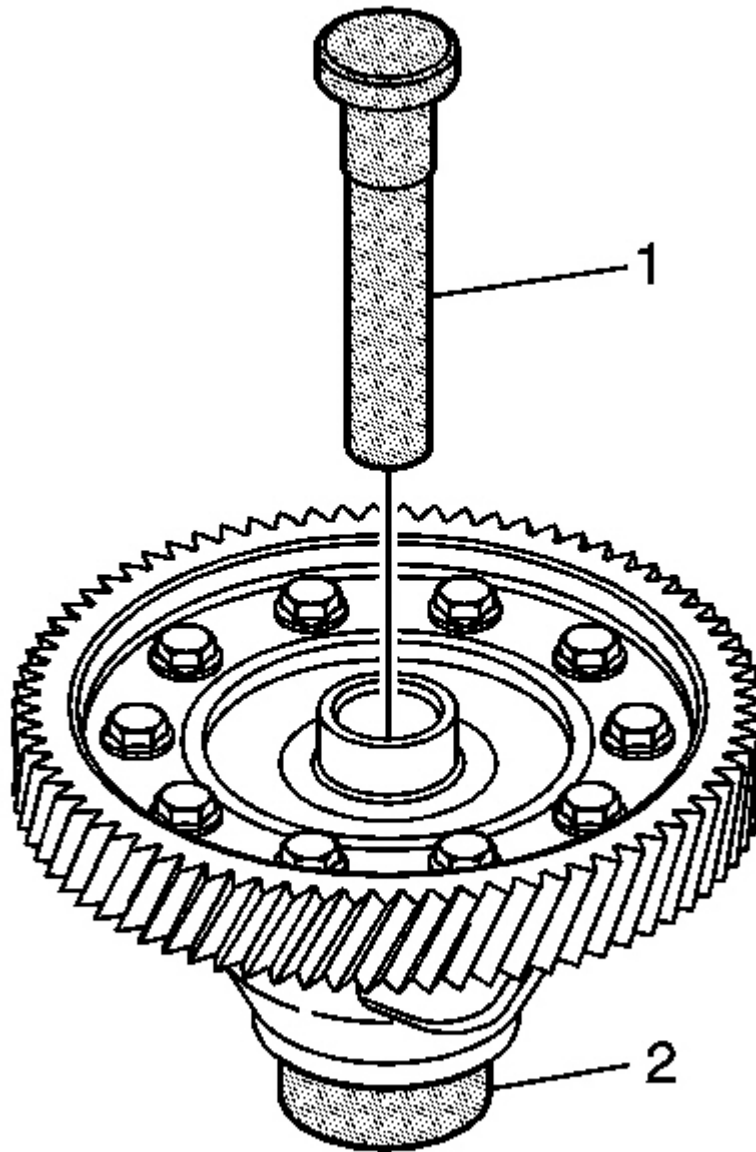


Fig. 163: Installing J 44388-3 & J 44388-4 Into Center Of Differential
Courtesy of GENERAL MOTORS CORP.

25. Insert the J 44388-3 (1) through the center of the differential until it rests firmly on the J 44388-4 (2).

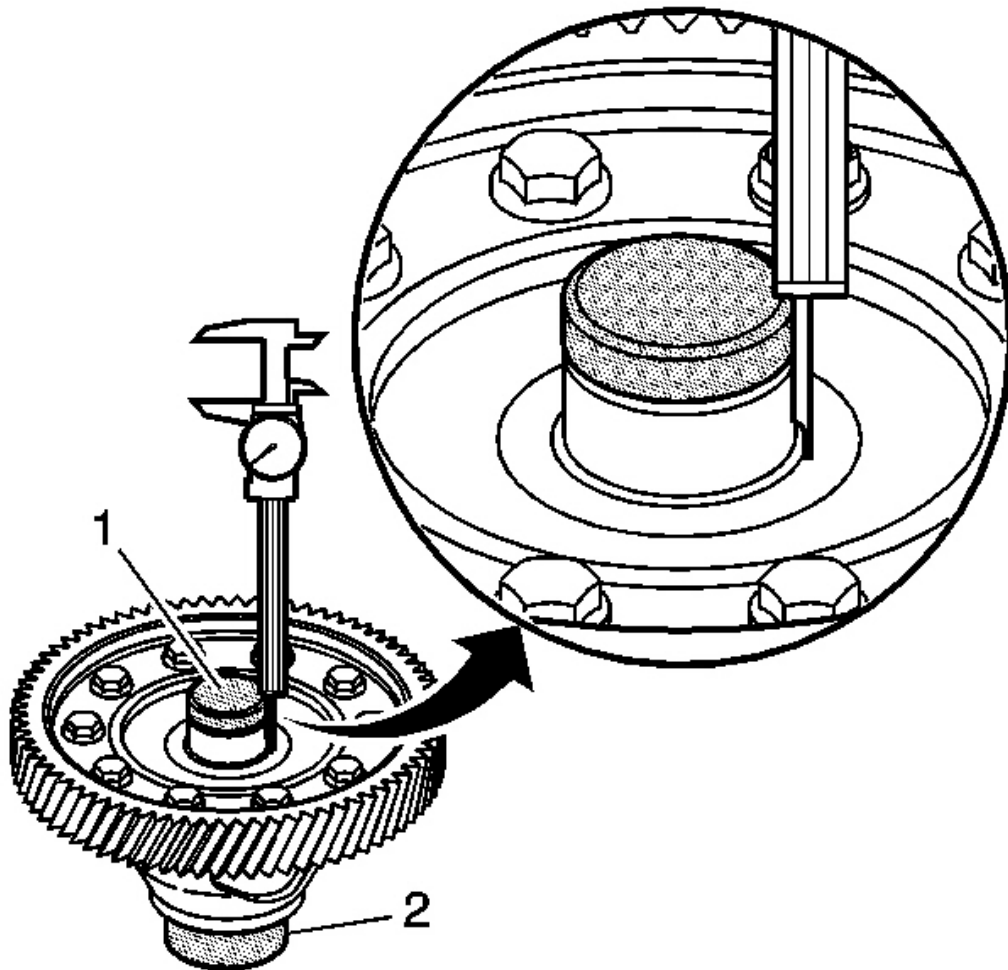


Fig. 164: Measuring From Top Surface Of Right Differential Side Bearing Shim To J 44388-3
Courtesy of GENERAL MOTORS CORP.

26. The distance from the top surface of the J 44388-3 (1) to the land of the right differential side bearing shim is measured and recorded (measurement F).
27. Subtract measurement F from 127 mm (5 in) (measurement G).

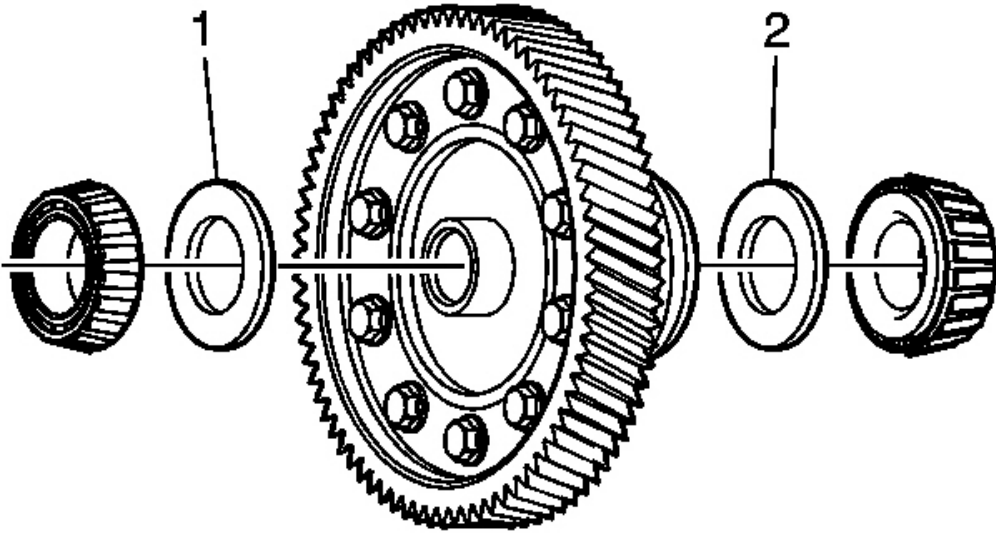


Fig. 165: Identifying Left And Right Differential Side Shims
Courtesy of GENERAL MOTORS CORP.

28. To obtain shim size for left differential side shim (1) use the following formula:

$$\text{Shim (1)} = E - A + D - 19.036 \text{ mm (0.749 in).}$$

29. To obtain shim size for right differential side shim (2) use the following formula:

$$\text{Shim (2)} = 94.65 \text{ mm (3.726 in)} - G - \text{shim (1).}$$

DESCRIPTION AND OPERATION

TRANSMISSION SYSTEM DESCRIPTION AND OPERATION

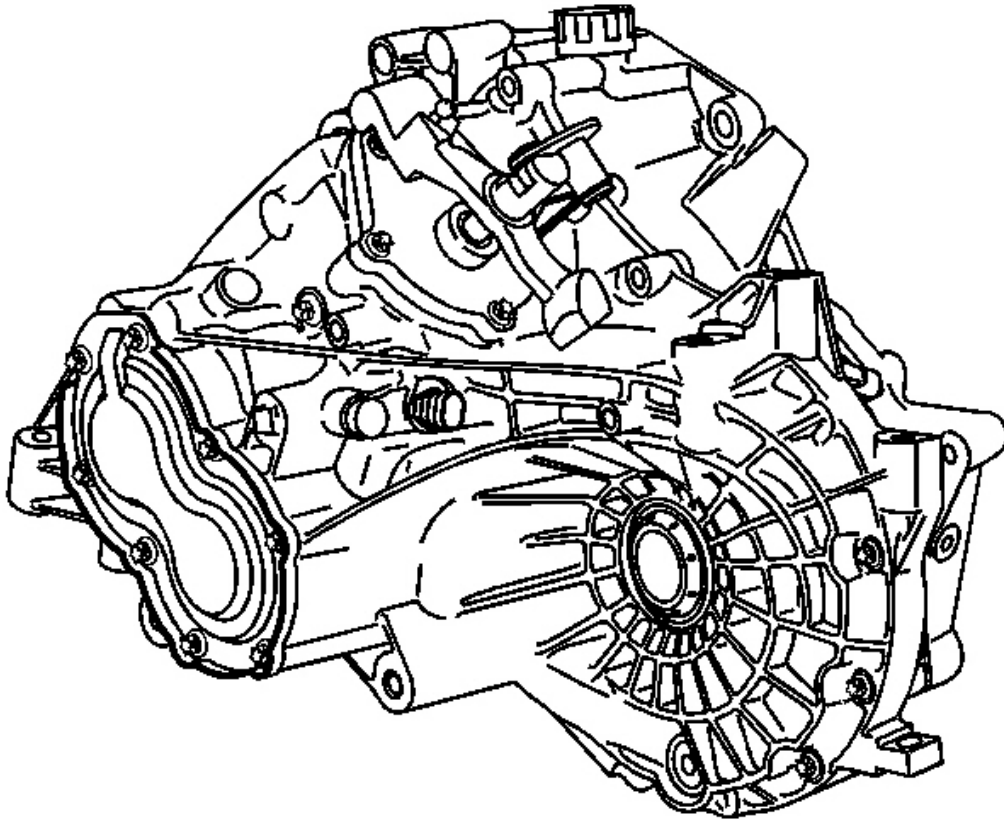


Fig. 166: Getrag 5 Speed Manual Transmission
Courtesy of GENERAL MOTORS CORP.

The Getrag 5 Speed is a 5 speed manual transmission assembly.

IMPORTANT: Use only DEXRON(R)III Automatic Transmission Lubricant for this manual transmission assembly. Other lubricants or additives may affect the shift performance.

The Getrag 5 Speed manual transmission has the following features:

- First and second gear double coned synchronizer
- Third, fourth, and fifth gear single coned synchronizer
- Reverse synchronized
- Three shaft design consisting of an input shaft, output shaft, and intermediate shaft
- Reverse inhibit feature

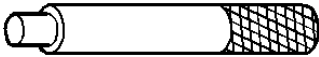
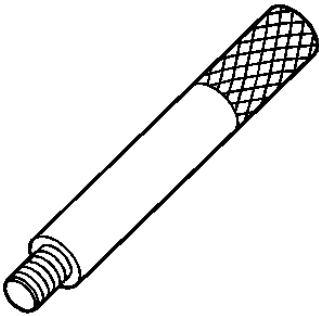
- One piece clutch actuator - no bleed screw
- Transmission venting system is part of the fill cap
- First gear ratio is 3.58
- Second gear ratio is 2.02
- Third gear ratio is 1.35
- Fourth gear ratio is 0.98
- Fifth gear ratio is 0.69
- Reverse gear ratio is 3.31
- Final drive ratio is 3.94
- Vehicle speed sensor (VSS)

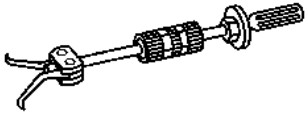
The manual transmission shift cables must be adjusted for proper shifter performance.

SPECIAL TOOLS AND EQUIPMENT

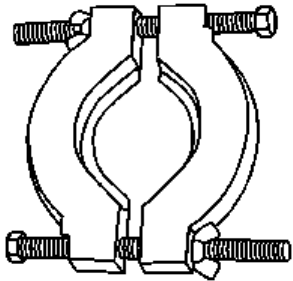
SPECIAL TOOLS

Special Tools

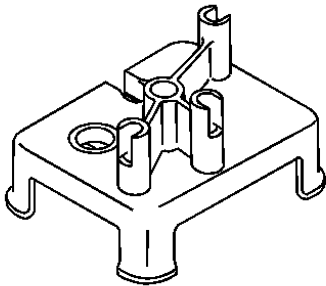
Illustration	Tool Number/Description
	<p>J 7079-2 Universal Driver Handle - Non-threaded</p>
	<p>J 8092 Universal Driver Handle - 3/4 in - 10</p>
	<p>J 23907 Slide Hammer with Bearing Adapter</p>



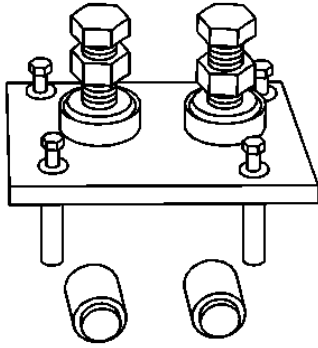
J 24433
Press Tube



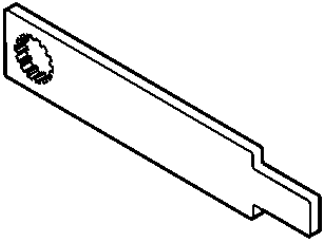
J 36513
Gear and Bearing Separator Plate



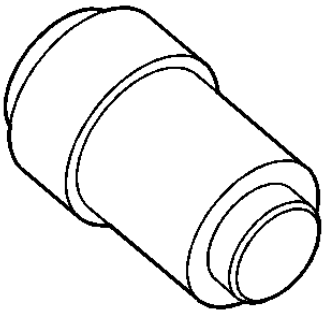
J 44375
Assembly Pallet



J 44376
Bearing Pusher/Puller

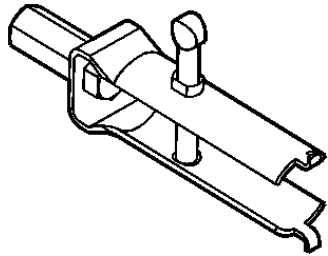
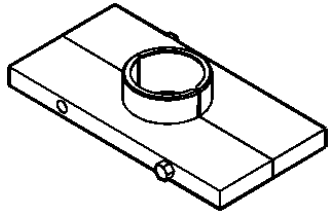


J 44377
Input Shaft Anti-Rotation Tool

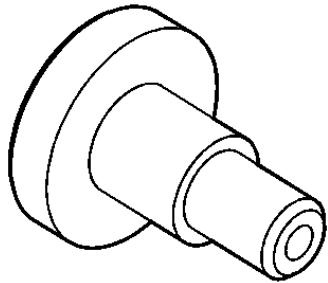


J 44378
Press Adapter - all shafts

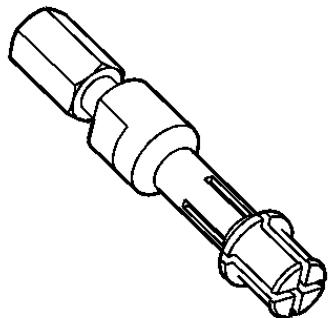
J 44379
Differential Bearing Puller Plate



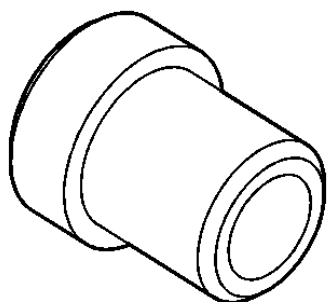
J 44380
Differential Bearing Race Puller



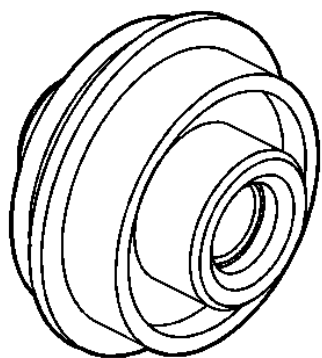
J 44381
Shifter Bearing/Input and Output Bearing Remover



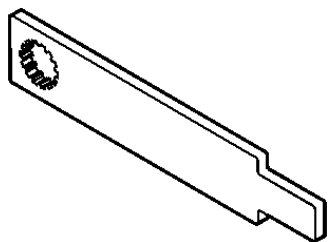
J 44382
Countershaft Needle Bearing Puller



J 44383
Countershaft Bearing Installer - to case

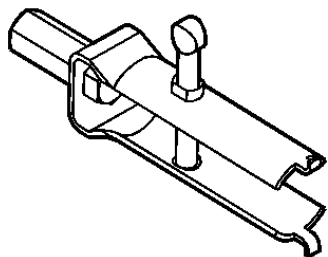
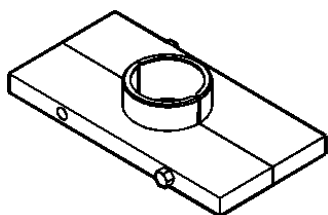
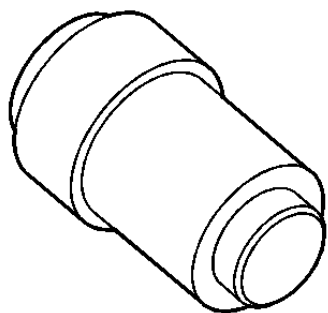


J 44385
Differential Bearing Race and Seal Installer



J 44386
Input/Output Bearing Installer

J 44387
Output Shaft Bearing Sleeve Installer and Pin



J 44388
Final End Checking Fixture

J 44389
Countershaft Bearing Installer