

TRANSMISSION

Manual Transmission - Eaton 6-Speed (N8D) - Canyon, Colorado

SPECIFICATIONS

FASTENER SPECIFICATIONS

Application	Specification	
	Metric	English
M/Trans Control Lever Housing Bolt/Screw (Qty: 4)	18 N.m	13 lb ft
Park/Neutral Position and Backup Lamp Switch Assembly	17 N.m	13 lb ft
Reverse Gear Nut	244 N.m	180 lb ft
Shift Control Housing Plug (Qty: 2)	13 N.m	115 lb in
Shift Fork Bolt (Qty: 2)	23 N.m	17 lb ft
Speed Sensor Bolt - 2WD	12 N.m	106 lb in
Shift Shaft Detent Plug	13 N.m	115 lb in
Transmission Bolt/Screw (Qty: 2) (Shift Interlock Plate to Transmission Rear Case Assembly)	12 N.m	106 lb in
Transmission Case Bolt/Screw (Qty: 3) (Clutch Housing to Transmission Intermediate Case Assembly)	23 N.m	17 lb ft
Transmission Case Bolt/Screw (Qty: 10) (Transmission Intermediate Case Assembly to Clutch Housing)	23 N.m	17 lb ft
Transmission Case Bolt/Screw (Qty: 12) (Transmission Rear Case Assembly to Transmission Intermediate Case Assembly)	23 N.m	17 lb ft
Transmission to Engine Fastener	50 N.m	37 lb ft
Transmission Extension Nut	177 N.m	131 lb ft
Transmission Oil Drain Plug	44 N.m	32 lb ft
Transmission Oil Fill Plug	44 N.m	32 lb ft
Transmission Rear Case Bolt/Screw	23 N.m	17 lb ft

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Application	Type of Material	GM Part Number	
		United States	Canada
All Fasteners	Threadlocker	12345382	10953489
Automatic Transmission Fluid	DEXRON®VI	88861037	19264717
Plugs	Sealant	19332211	10953488

APPROXIMATE FLUID CAPACITIES

Application	Specification	
	Metric	English
Transmission Fluid Capacity	3.0 liters	3.17 quarts
When filled, fluid level should be at the bottom of the fluid check plug hole.		

SPECIFICATIONS	Specification	
	Metric	English
	Application	Specification
Application	Metric	English
Counter Gear Rear Bearing Shim Measurement	0.175-0.225 mm	0.0069-0.0089 in
Mainshaft Bearing Shim Measurement	0.175-0.225 mm	0.0069-0.0089 in

SCHEMATIC WIRING DIAGRAMS

MANUAL TRANSMISSION WIRING SCHEMATICS

N8D

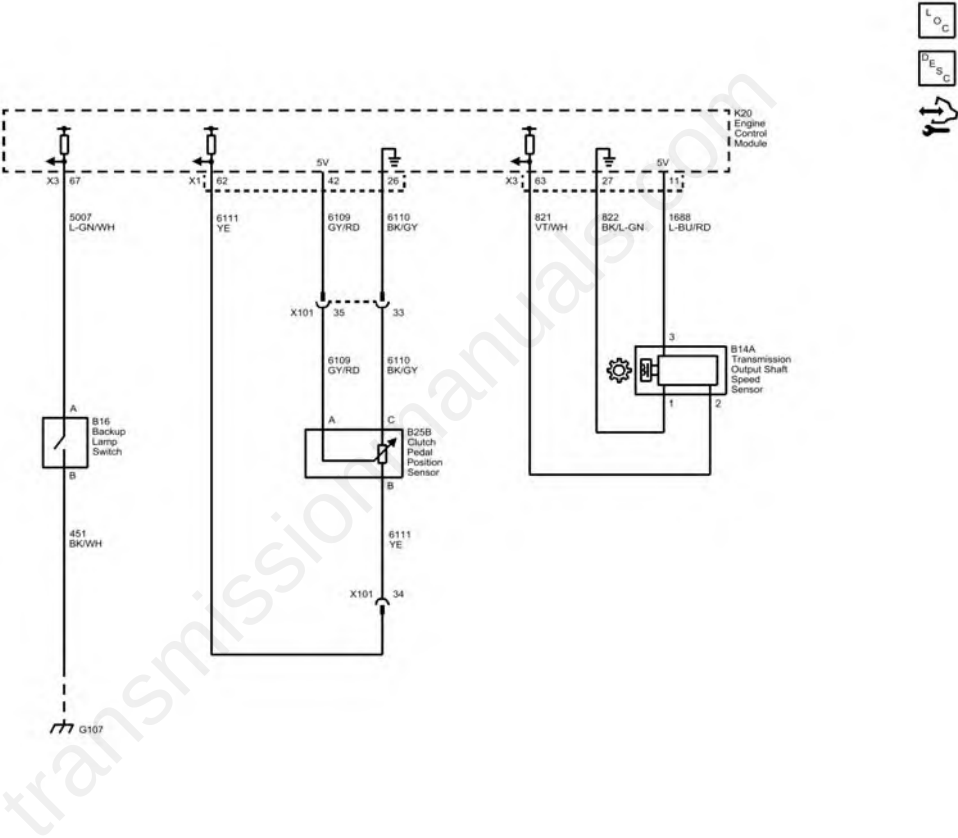


Fig. 1: N8D
Courtesy of GENERAL MOTORS COMPANY

COMPONENT LOCATOR

DISASSEMBLED VIEWS

Case and Associated Parts

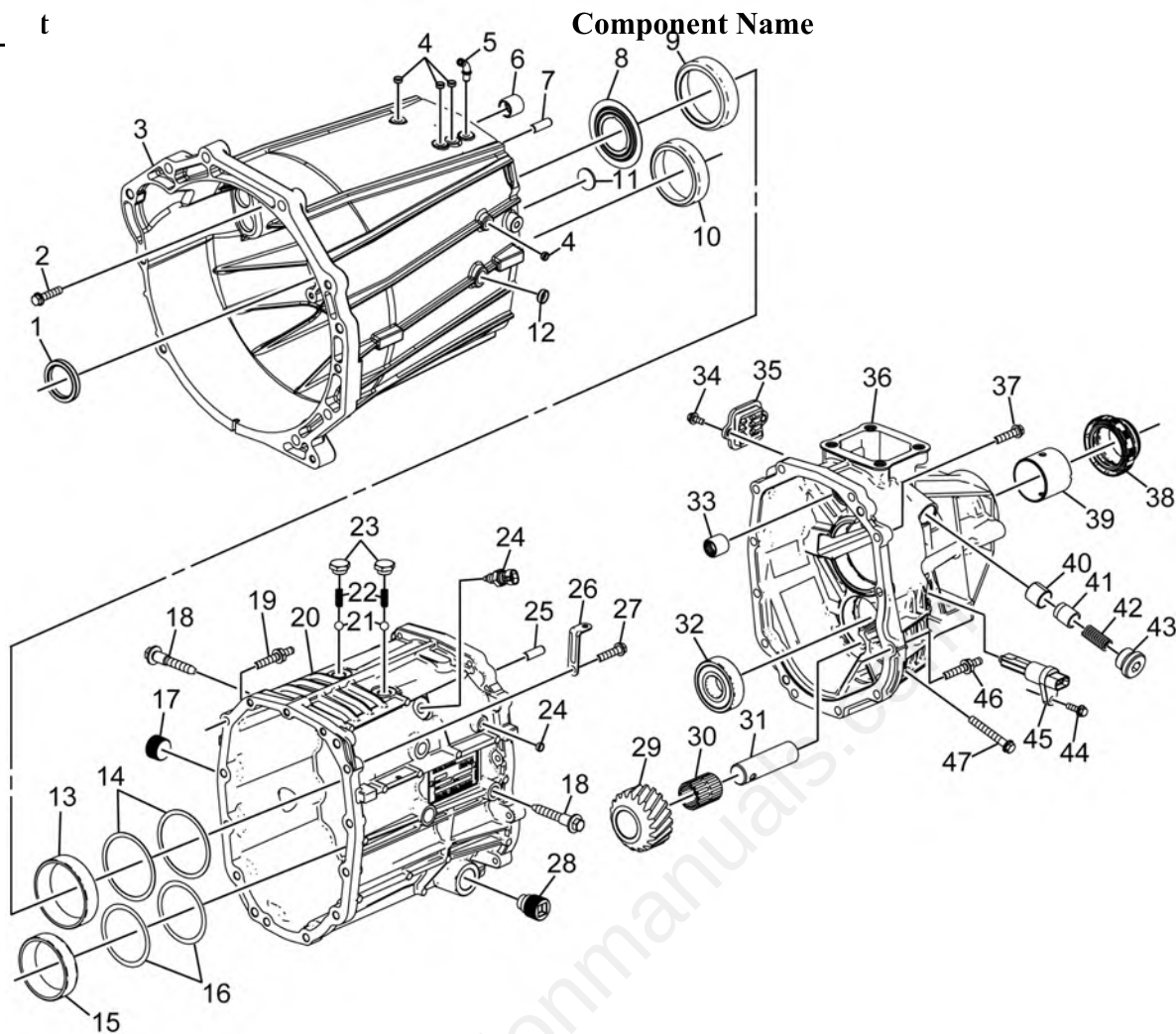


Fig. 2: Case and Associated Parts

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Input Shaft Seal
2	Transmission Case Bolt/Screw (Qty: 3)
3	Clutch Housing
4	Transmission Vent Hole Plug (Qty: 4)
5	Transmission Vent Hose
6	Transmission Bushing - Shift Shaft
7	Transmission Locating Pin (Qty: 2)
8	Input Shaft Bearing Oil Baffle
9	Input Shaft Bearing Cup
10	Counter Gear Bearing Cup
11	Clutch Housing Hole Plug
12	Transmission Case Plug
13	Main Shaft Bearing Cup
14	Main Shaft Bearing Shim (Qty: As Required)
15	Counter Gear Rear Bearing Cup
16	Counter Gear Rear Bearing Shim (Qty: As Required)

t	Component Name
17	Transmission Oil Fill Plug
18	Shift Fork Bolt (Qty: 2)
19	Transmission Case Stud (Qty: 2)
20	Transmission Intermediate Case Assembly
21	Shift Shaft Detent Ball (Qty: 2)
22	Shift Shaft Detent Ball Spring (Qty: 2)
23	Shift Control Housing Plug (Qty: 2)
24	Park/Neutral Position and Backup Lamp Switch
25	Transmission Intermediate Case Locating Pin (Qty: 2)
26	Transmission Wiring Harness Bracket (Qty: 2)
27	Transmission Case Bolt/Screw (Qty: 8)
28	Transmission Oil Drain Plug
29	Reverse Idler Gear
30	Reverse Idler Gear Thrust Bearing
31	Reverse Idler Gear Shaft
32	Reverse Gear Thrust Bearing
33	Transmission Bushing - Shift Shaft
34	Transmission Bolt/Screw - 2WD (Qty: 2)
35	Shift Interlock Plate - 2WD
36	Transmission Rear Case Assembly - 2WD
37	Transmission Case Bolt/Screw (Qty: 10)
38	Output Shaft Seal
39	Output Shaft Bushing
40	Shift Shaft Detent
41	Shift Shaft Detent Cam
42	Shift Shaft Detent Spring
43	Shift Shaft Detent Plug
44	Speed Sensor Bolt - 2WD
45	Speed Sensor - 2WD
46	Transmission Rear Case Stud (Qty: 2)
47	Transmission Rear Case Bolt/Screw

Input and Main Shaft Components

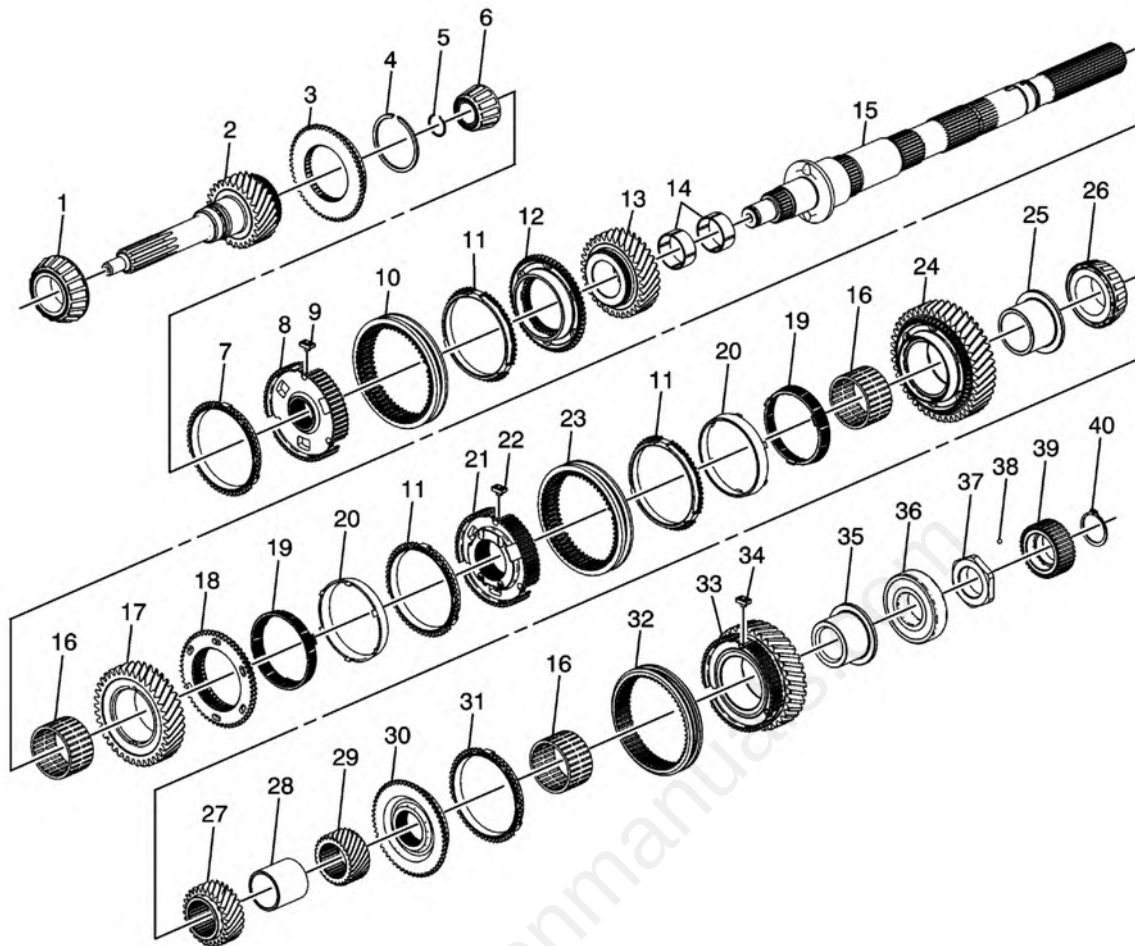


Fig. 3: Input and Main Shaft Components

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Input Shaft Bearing Cone Assembly
2	Input Shaft
3	4th Gear Synchronizer Cone
4	3rd and 4th Gear Synchronizer Retaining Ring
5	Retaining Ring - Main Shaft Front Bearing
6	Main Shaft Front Bearing Cone Assembly
7	4th Gear Blocking Ring Assembly (Synchronizer Ring)
8	3rd and 4th Gear Synchronizer Hub
9	3rd and 4th Gear Synchronizer Insert
10	3rd and 4th Gear Synchronizer Sleeve
11	1st, 2nd, and 3rd Gear Outer Blocking Ring (Qty: 3)
12	3rd Gear Synchronizer Cone
13	3rd Gear - Main Shaft
14	3rd Gear Bearing Assembly (Qty: 2)
15	Main Shaft - 2WD
16	2nd Gear Bearing Assembly (Qty: 3)
17	2nd Gear

t	Component Name
18	2nd Gear Synchronizer Cone
19	1st and 2nd Gear Inner Blocking Ring (Qty: 2)
20	1st and 2nd Gear Intermediate Blocking Ring (Qty: 2)
21	1st and 2nd Gear Synchronizer Hub
22	1st and 2nd Gear Synchronizer Insert
23	1st and 2nd Gear Synchronizer Sleeve
24	1st Gear
25	1st Gear Bushing
26	Main Shaft Bearing Cone Assembly
27	5th Gear
28	6th Gear Needle Bearing
29	6th Gear - Counter Shaft
30	Reverse Gear Synchronizer Cone
31	Reverse Gear Blocking Ring Assembly
32	Reverse Gear Synchronizer Sleeve
33	Reverse Gear Synchronizer Hub Assembly
34	Reverse Gear Synchronizer Insert Assembly
35	Reverse Gear Bearing Bushing
36	Bearing Assembly - Main Shaft
37	Nut - Main Shaft
38	Speedometer Drive Gear Locating Ball - 2WD
39	Vehicle Speed Sensor Rotor - 2WD
40	Main Shaft Retaining Ring - Speed Sensor Rotor - 2WD

Counter Gear Shaft Components

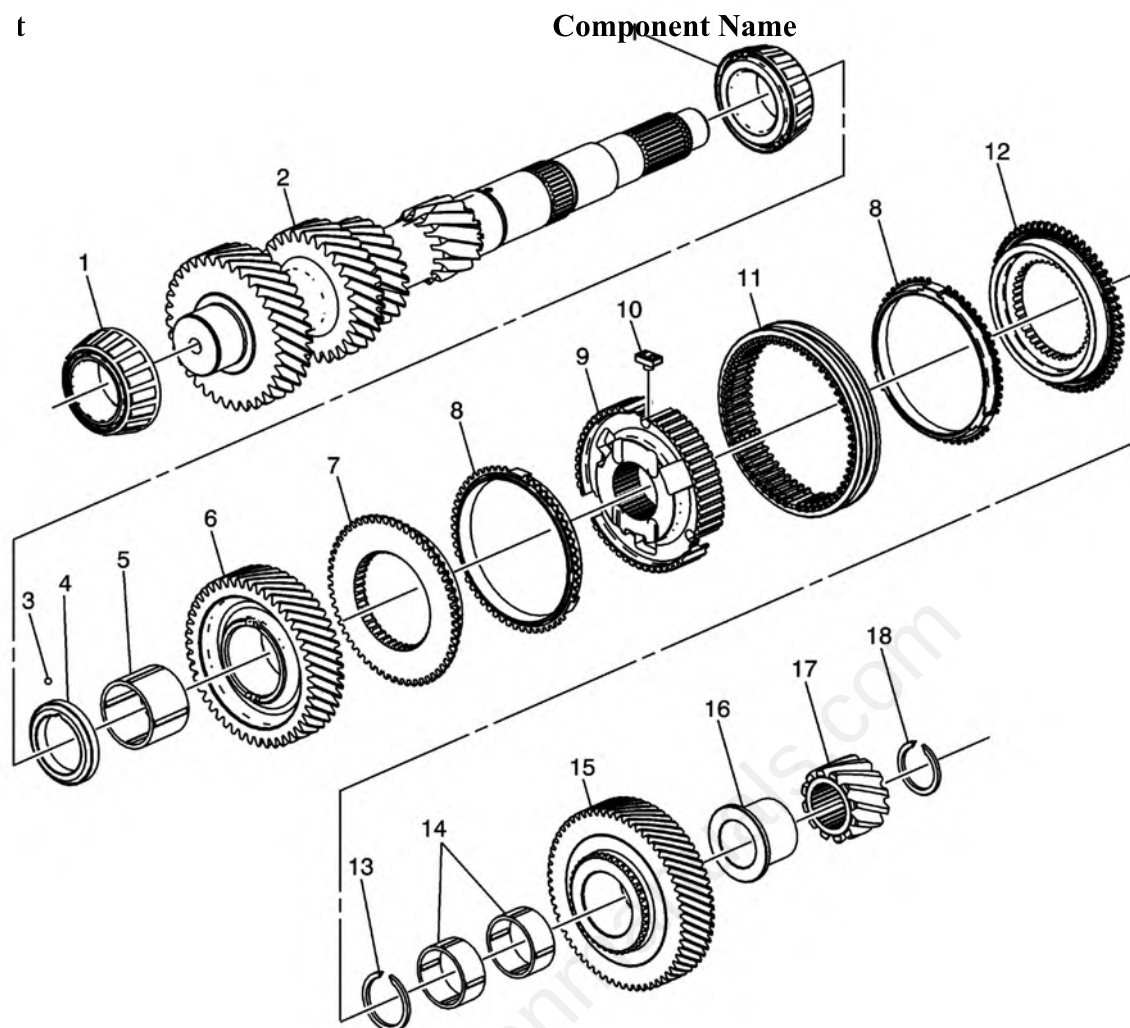


Fig. 4: Counter Gear Shaft Components

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Counter Gear Bearing Cone Assembly (Qty: 2)
2	Counter Gear Shaft
3	5th Gear Thrust Washer Locating Ball
4	Counter Gear Thrust Washer
5	5th Gear Needle Bearing Assembly
6	5th Counter Gear
7	5th Gear Synchronizer Cone
8	5th Gear Blocking Ring Assembly (Qty: 2)
9	5th and 6th Gear Synchronizer Hub
10	5th and 6th Gear Synchronizer Insert Assembly
11	5th and 6th Gear Synchronizer Sleeve
12	6th Gear Synchronizer Cone
13	5th and 6th Gear Synchronizer Hub Retaining Ring
14	6th Gear Needle Bearing Assembly (Qty: 2)
15	6th Counter Gear
16	6th Gear Bearing Spacer
17	Reverse Gear Assembly

t	Component Name
18	Reverse Gear Retaining Ring

Shift Forks and Shafts

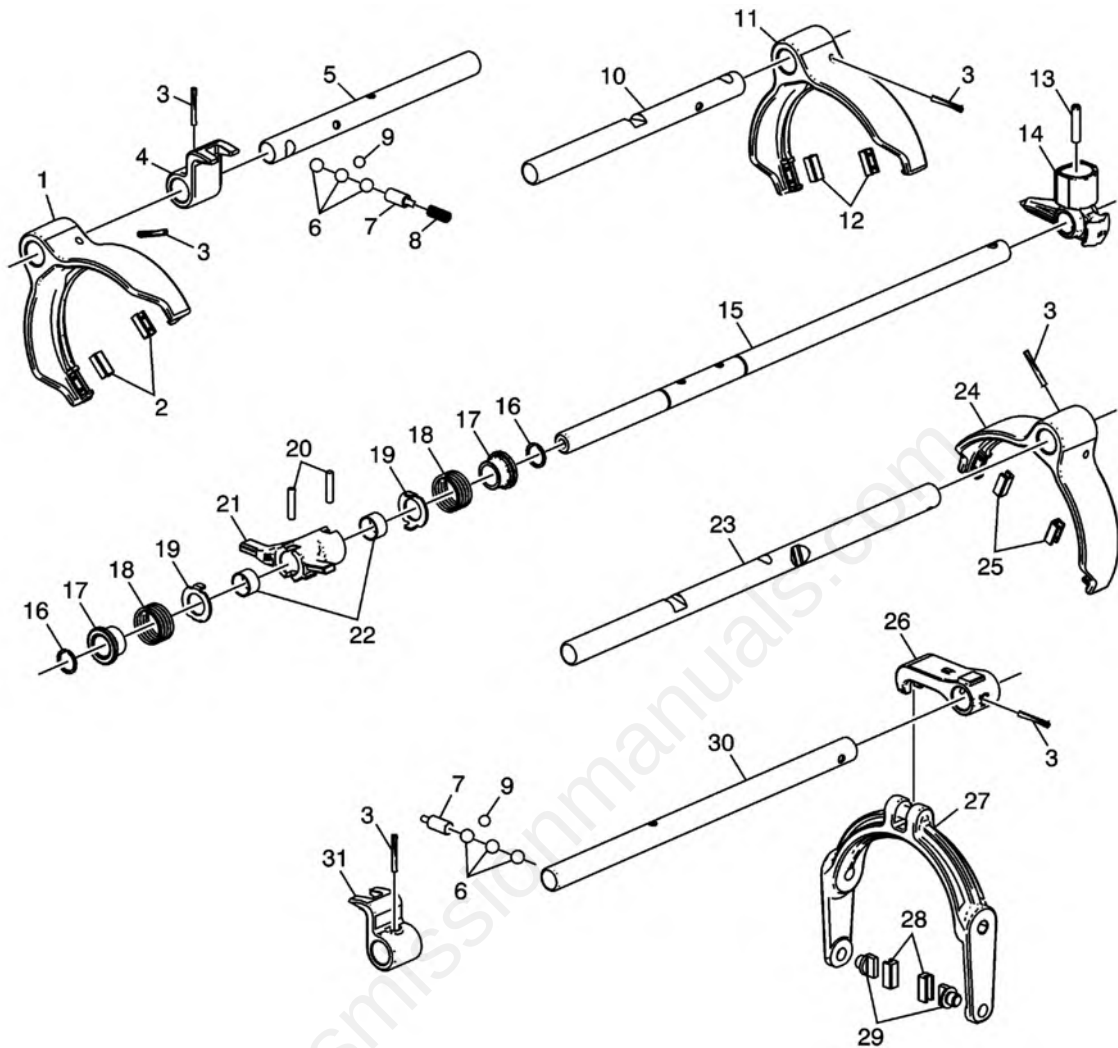


Fig. 5: Shift Forks and Shafts

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	3rd and 4th Shift Fork Assembly
2	3rd and 4th Shift Fork Insert (Qty: 2)
3	Spring Pin (Qty: 6)
4	3rd and 4th Shift Block
5	3rd and 4th Shift Shaft (Rail)
6	Shift Rail Interlock Ball - 9.5 mm (Qty: 6)
7	3rd and 4th Interlock Pin (Qty: 2)
8	Reverse Shift Rail Detent Spring
9	Shift Detent Ball - 8.0 mm (Qty: 2)
10	1st and 2nd Shift Rail
11	1st and 2nd Shift Fork Assembly
12	1st and 2nd Shift Fork Insert
13	Spring Pin Assembly

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
15	Shift Rail			
16	Shift Rail Retainer Ring (Qty: 2)			
17	Spring Support (Qty: 2)			
18	Control Lever Spring (Qty: 2)			
19	Thrust Washer (Qty: 2)			
20	Shift Rail Block Pin (Qty: 2)			
21	Shift Rail Block			
22	Shift Rail Bushing (Qty: 2)			
23	Reverse Shift Rail			
24	Reverse Shift Fork Assembly			
25	Reverse Shift Fork Insert (Qty: 2)			
26	5th and 6th Shift Lever			
27	5th and 6th Shift Fork Assembly			
28	5th and 6th Shift Fork Bushing (Qty: 2)			
29	5th and 6th Shift Fork Insert (Qty: 2)			
30	5th and 6th Shift Rail			
31	5th and 6th Shift Counter Block			

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC P0502 OR P0503: VEHICLE SPEED SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P0502

Vehicle Speed Sensor Circuit Low Voltage

DTC P0503

Vehicle Speed Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0502, P0503, P0651	P0502, P0503	P0502, P0503, P0651	P0502, P0503
Signal	P0502, P0503	P0502, P0503	P0502, P0503	P0502, P0503
Low Reference	-	P0502, P0503	-	-

Circuit/System Description

eed sensor (VSS) is a three wire hall effect sensor mounted on the left rear of the transmission case. The VSS pickup magnet aligns with a target wheel on the output shaft of the transmission. The output signal to the engine control module (ECM) is a square wave shaped signal. The frequency of the VSS signal will increase with an increase in vehicle speed. The ECM supplies a 5 volt circuit, a signal circuit, and a low reference or ground circuit to the VSS.

Conditions for Running the DTC

P0502

- DTC P0503 is not set.
- The accelerator pedal position is more than 8%.
- The engine is running.
- The system voltage is 9-32 V.
- The engine speed is 1, 500-6, 500 RPM.
- Engine torque is greater than 54 N.m (40 lb ft).

P0503

- The system voltage is 9-32 V.
- The engine speed is 200-7, 500 RPM.
- The transmission output shaft speed is at least 292 RPM for 5 s.
- The transmission output shaft speed change is less than 124 RPM for 5 s.

Conditions for Setting the DTC

P0502

The transmission output shaft speed is 60 RPM or less for 4.5 s.

P0503

The transmission output shaft speed drops 350 RPM in less than 3 s.

Action Taken When the DTC Sets

P0502 and P0503 are Type B DTCs.

Conditions for Clearing the DTC

P0502 and P0503 are Type B DTCs.

Diagnostic Aids

- Remove and inspect the B115 Vehicle Speed Sensor for metal debris on the output shaft facing end of the sensor.
- Inspect the transmission output shaft target wheel teeth for damage.
- Visually inspect the B115 Vehicle Speed Sensor for cracks or damage.
- Ensure the B115 Vehicle Speed Sensor is not loose and is properly torqued to the transmission.
- When a speed sensor fault is present, the scan tool Output Shaft Speed Sensor parameter may show a defaulted processed speed, based on another source such as Antilock Brake System (ABS) wheel speed. Use of this parameter is not recommended for fault diagnosis.

Reference Information

Manual Transmission Schematics

Connector End View Reference

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

Description and Operation

Manual Transmission Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

J-35616 GM-Approved Terminal Test Kit

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

Circuit/System Verification

1. Ignition ON.
2. Verify DTC P0651 is not set
 - **If DTC P0651 is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
 - **If DTC P0651 is not set**
3. Raise the vehicle off the ground.
4. Support the rear axle assembly so the propeller shaft is at the normal drive line angle.
5. Start and idle the engine.
6. Place the transmission in second gear and release the clutch pedal.
7. Verify the scan tool Vehicle Speed Sensor parameter increases as the drive wheel speed increases.
 - **If the Vehicle Speed Sensor parameter does not increase with wheel speed**

Refer to Circuit/System Testing below.

- **If the Vehicle Speed Sensor parameter does increase with wheel speed**

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

9. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set**

10. All OK.

Circuit/System Testing

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

1. Ignition OFF and all vehicle systems OFF. Disconnect the B115 Vehicle Speed Sensor harness connector at the sensor. It may take up to 2 min for all vehicle systems to power down.

2. Test for less than 10 Ω between the low reference circuit terminal 1 and ground.

- **If 10 Ω or greater**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.

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

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

- **If less than 10 Ω**

3. Ignition ON.

4. Test for 4.8-5.2 volts between 5 volt reference circuit terminal 3 and ground.

- **If less than 4.8 V**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.

2. Test for infinite resistance between the 5 V reference circuit and ground.

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

3. Test for less than 2 Ω in the 5 V reference circuit end to end.

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

- **If greater than 5.2 V**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.

2. Test for less than 1 V between the 5 V reference circuit and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the K20 Engine Control Module.

- **If between 4.8-5.2 V**

5. Ignition ON.

6. Test for 11 V or greater between the signal circuit terminal 2 and ground.

- **If less than 11 V**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.

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

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

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

- If less than 2 Ω , replace the K20 Engine Control Module.

- If 11 V or greater

7. Replace the B115 Vehicle Speed Sensor.

Repair Instructions

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

- [Vehicle Speed Sensor Replacement](#).
- [Control Module References](#) for ECM replacement, programming and setup.

DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P0806

Clutch Pedal Position (CPP) Sensor Performance

DTC P0807

Clutch Pedal Position (CPP) Sensor Circuit Low Voltage

DTC P0808

Clutch Pedal Position (CPP) Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0651, P0807	P0807	P0651, P0808	-
Signal	P0807	P0807	P0808	P0806
Low Reference	-	P0808	-	-

Typical Scan Tool Data

CPP Sensor Voltage

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON. CPP Sensor Voltage Parameter Normal Range: 1 V with clutch pedal applied to 4 V when clutch pedal is released.			
5 V Reference	0 V	0 V	5 V
Signal	0 V	0 V	5 V
Low Reference	-	5 V	-

Percentage	Circuit	Short to Ground	Open	Short to Voltage
	Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON. CPP Sensor Percent Parameter Normal Range: 0% with clutch pedal released to 100% when clutch pedal is applied.				
5 V Reference		100%	100%	0%
Signal		100%	100%	0%
Low Reference		-	0%	-

Circuit/System Description

The clutch pedal position (CPP) sensor is a three wire sensor, connected to a 5 V reference circuit, a low reference circuit, and a signal circuit. The engine control module supplies 5 V to the CPP sensor, and also provides a sensor ground path on the low reference circuit. The CPP sensor sends a voltage signal to the ECM on the signal circuit. The voltage on the signal circuit will vary from a voltage near 4 V when the clutch pedal is released, to a voltage near 1 V when the clutch pedal is applied.

Conditions for Running the DTC

P0806

- DTC P0335, P0336, P0502, P0503, P0807, or P0808 is not set.
- The vehicle speed is greater than 8 kmh (5 mph).
- The ignition is ON.

P0807 and P0808

- DTC P0651 is not set.
- The system voltage is more than 9 V.
- The ignition is ON.

Conditions for Setting the DTC

P0806

The CPP sensor is stuck in range.

P0807

The CPP sensor voltage is less than 0.2 V for more than 1 s.

P0808

The CPP sensor voltage is more than 4.8 V for more than 1 s.

Action Taken When the DTC Sets

DTC P0806 - P0808 are Type A DTCs.

Conditions for Clearing the DTC

DTC P0806 - P0808 are Type A DTCs.

Reference Information

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Manual Transmission Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Manual Transmission Description and Operation

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

K20 Engine Control Module: Scan Tool Information (LCV or LFX) K20 Engine Control Module: Scan Tool Information (LKH or LWN) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTC P0651 is not set
 - **If DTC P0651 is set**
Refer to Diagnostic Trouble Code (DTC) List - Vehicle .
 - **If DTC P0651 is not set**
3. Verify the scan tool CPP Sensor percent parameter varies from 0% when the clutch pedal is released, to 100% when the clutch pedal is in the apply position.
 - **If the percentage does not vary from 0% to 100%**
Refer to Circuit/System Testing.
 - **If the percentage varies from 0% to 100%**
4. Operate the vehicle within the conditions for running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **If the DTC does not set**
5. All OK.

Circuit/System Testing

OFF, disconnect the harness connector of the B25B Clutch Pedal Position Sensor.

2. Test for less than 5 Ω between the low reference circuit terminal C and ground:

- **If 5 Ω or greater**

1. Disconnect the X1 harness connector at the K20 Engine Control Module.

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

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

- **If less than 5 Ω**

3. Ignition ON.

4. Test for 4.8-5.2 V between the 5 V reference circuit terminal A and ground:

- **If less than 4.8 V**

1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module.

2. Test for infinite resistance between the 5 V reference circuit and ground.

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

3. Test for less than 2 Ω in the 5 V reference circuit end to end.

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

- **If greater than 5.2 V**

1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module.

2. Test for less than 1 V between the 5 V reference circuit and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the K20 Engine Control Module.

- **If between 4.8-5.2 V**

5. Verify the scan tool CPP Sensor voltage parameter is less than 0.1 V.

- **If 0.1 V or greater**

1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module, Ignition ON.

2. Test for less than 1 V between the signal circuit terminal B and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the K20 Engine Control Module.

- **If less than 0.1 V**

6. Install a 3 A fused jumper wire between the signal circuit terminal B and the 5 V reference circuit terminal C.

7. Verify the scan tool CPP Sensor voltage parameter is greater than 4.9 V.

- **If 4.9 V or less**

1. Ignition OFF, remove the jumper wire, disconnect the X1 harness connector at the K20 Engine Control Module.

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

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

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

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

- **If greater than 4.9 V**

replace the B25B Clutch Pedal Position Sensor.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector of the B25B Clutch Pedal Position Sensor.
2. Measure the resistance between the signal terminal B and the low reference terminal C at the B25B Clutch Pedal Position Sensor. Depress the clutch pedal through the entire range. The resistance should vary from low to high and vice versa without any spikes or dropouts.

- **If the resistance is erratic with spikes or dropouts**

Replace the B25B Clutch Pedal Position Sensor.

- **If the resistance is not erratic without spikes or dropouts**

3. All OK.

Repair Instructions

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

- [Clutch Pedal Position Sensor Replacement](#)
- [Control Module References](#) for ECM replacement, programming and setup.

DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED

Diagnostic Instructions

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

DTC Descriptor

DTC P080A

Clutch Pedal Position (CPP) Not Learned

Circuit/System Description

The clutch pedal position (CPP) is a 3-wire sensor, connected to a 5 V reference circuit, a low reference circuit, and a signal circuit. The engine control module supplies 5 V to the CPP sensor, and also provides a sensor ground path on the low reference circuit. The CPP sensor sends a voltage signal to the ECM on the signal circuit. The voltage on the signal circuit will vary from a voltage near 4 V when the clutch pedal is released to a voltage near 1 V when the clutch pedal is applied.

Conditions for Running the DTC

Ignition is ON.

Conditions for Setting the DTC

CPP sensor learned apply position not learned.

Action Taken When the DTC Sets

pe A DTC.

Conditions for Clearing the DTC

P080A is a Type A DTC.

Reference Information

Schematic Reference

Manual Transmission Schematics

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

K20 Engine Control Module: Scan Tool Information (LCV or LFX) K20 Engine Control Module: Scan Tool Information (LKH or LWN)

Circuit/System Verification

1. Ignition ON.
2. Verify DTC P0651, P0806, P0807, or P0808 is not set.
 - **If DTC P0651, P0806, P0807, or P0808 is set**
Refer to Diagnostic Trouble Code (DTC) List - Vehicle .
 - **If DTC P0651, P0806, P0807, or P0808 is not set**
3. Perform the clutch pedal position sensor learn procedure.
 - **If the clutch pedal position sensor learn was not successful**
Refer to Circuit/System Testing.
 - **If the clutch pedal position sensor learn was successful**
4. Ignition ON.
5. Verify DTC P080A ran and passed this ignition cycle. Operate the vehicle within the conditions for running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.

the scan tool indicates DTC P080A failed

Refer to Circuit/System Testing.

- **If the scan tool indicates DTC P080A ran and passed this ignition cycle**

6. All OK.

Circuit/System Testing

1. Verify the clutch pedal is not loose and is properly torqued. Refer to [Clutch Pedal Replacement](#) .

- **If a condition is found with the clutch pedal**

Repair or replace as necessary.

- **If no condition is found with the clutch pedal**

2. Replace the K20 Engine Control Module.

Repair Instructions

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

- [Clutch Pedal Position Sensor Learn](#)
- [Control Module References](#) for replacement, programming and setup.

CLUTCH PEDAL POSITION SENSOR LEARN

NOTE: The clutch pedal position (CPP) sensor learn procedure is required when the following service procedures have been performed regardless of whether DTC P080A is set:

- An engine control module (ECM) replacement
- A CPP sensor replacement
- Any repairs which affect the CPP sensor relationship

1. Perform each step listed below:

- Set parking brake
- Block drive wheels

NOTE: For vehicles equipped with the push button ignition switch, ensure the power mode is RUN.

2. Engine OFF, with the ignition ON.

3. Verify no other DTCs are set, except DTC P080A.

- **If other DTCs are set**

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

- **If no other DTCs are set**

4. Using a scan tool, select Clutch Pedal Position Sensor Learn.

NOTE: The CPP sensor learn procedure cannot be performed more than once per ignition cycle.

press and hold the clutch pedal and select Continue.

6. Select Learn.

- **If the scan tool CPP Learn Status is Unsuccessful - Sensor Detected Movement**

Verify vehicle is stopped with the parking brake set, and repeat the procedure.

- **If the scan tool CPP Learn Status is Unsuccessful - Sensor Low Voltage or Unsuccessful - Sensor High Voltage**

Refer to [DTC P0806-P0808](#).

- **If the scan tool CPP Learn Status is Not Learned**

Refer to [DTC P080A](#).

- **If the scan tool CPP Learn Status is Complete or Performed Successfully**

7. Verify DTC P080A ran and passed this ignition cycle.

- **If the scan tool indicates DTC P080A failed or did not run this ignition**

Refer to [DTC P080A](#).

- **If the scan tool indicates DTC P080A ran and passed this ignition cycle**

8. Turn OFF the ignition for 30 seconds after the learn procedure has successfully completed in order to store the CPP sensor variation values in ECM history.

SYMPTOMS - MANUAL TRANSMISSION

Strategy Based Diagnostics

Review the system operations in order to familiarize yourself with the system functions. Refer to [Manual Transmission 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 transmission for the correct fluid level.
- Inspect the manual transmission for fluid leaks.
- Inspect the manual transmission for broken or loose transmission 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 Jumps Out of Gear](#)
- [Transmission Locked in One Gear](#)

• **Transmission Fluid Leak Diagnosis**

TRANSMISSION SHIFTS HARD

Diagnostic Aids

An intermittent hard shift may be caused after installation of a new clutch actuator. With a new clutch actuator, the annular seal may not be in the forward position and not allow full clutch release. With a self adjusting clutch, the clutch may be between adjustments and not allow full clutch release. This might be felt by a low clutch pedal load. After several applications, the clutch may adjust properly to give the proper pedal feel.

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 shafts. You should be able to feel the detent plungers operating when coming out of a gear and when going into a gear.

5

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

6

The transmission uses a transmission fluid that allows proper synchronizer operation. The incorrect fluid may cause hard shifting from varnish build up, or from not enough lubrication for proper synchronizer operation. Only use the proper transmission fluid.

Step	Action	Yes	No
DEFINITION: The transmission does not shift smoothly or without difficulty from one gear to the other.			
1	Did you review the Symptoms - Manual Transmission operations and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Inspect the clutch system for proper operation. Refer to Clutch System Description and Operation . Did you find or repair the condition?	Go to Step 11	Go to Step 3

	Action	Yes	No
3	1. Perform a static shift test on the transmission. 2. Test for the following conditions: • Blockage preventing full shift lever movement • Excessive movement in the shift lever • Binding in the shift lever • Detent plungers or shift shafts binding • Shift linkage binding • Shift linkage proper adjustment Are you able to shift into all gears?	Go to Step 7	Go to Step 4
4	Remove the shift control shift closeout boot and foam isolator. Refer to Transmission Control Lever Boot Replacement. Inspect for the following: • Loose mounting • Foreign debris • Interference to foam isolator Did you find and repair the condition?	Go to Step 11	Go to Step 5
5	1. Perform a dynamic shift test on the transmission. 2. Test for the following conditions: • Detent plungers or shift shafts binding • Synchronizer sleeve binding • Gear clash into only one gear • Gear clash into all gears Did the transmission shift hard into all gears?	Go to Step 6	Go to Step 10
6	Inspect the transmission for the correct fluid level and the correct type of transmission fluid. Refer to Transmission Fluid Level Inspection, and Approximate Fluid Capacities. Is the transmission at the correct level and proper fluid being used?	Go to Step 8	Go to Step 7
7	Drain and fill the transmission with the correct type fluid. Refer to Transmission Fluid Drain and Fill. Did you find and repair the condition?	Go to Step 11	Go to Step 8
8	1. Remove the transmission. Refer to Transmission Replacement. 2. Inspect the clutch pressure plate and/or clutch driven plate. Is the clutch pressure plate and/or clutch driven plate worn or faulty?	Go to Step 9	Go to Step 10

	Action	Yes	No
9	Replace the clutch assembly. Refer to Clutch Assembly Replacement . Did you find and repair the condition?	Go to Step 11	Go to Step 10
10	1. Disassemble the transmission. Refer to Transmission Disassemble. 2. Inspect the transmission for the following faulty components in the gear that is hard to shift or clashing: • Excessive synchronizers blocking ring to gear clearance • Synchronizer hub external splines worn or damaged • Excessive axial clearance in the speed gear • Main shaft to speed gear bearing or journal worn • Shift shaft and the internal shift control lever components for wear or damage 3. Replace worn or damaged components as necessary. Did you find and repair the condition?	Go to Step 10	Go to Diagnostic Aids
11	Operate the system in order to verify the repair. Did you correct the condition?	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 release of the clutch. If the clutch reserve is not correct, the main shaft gears may be turning, causing the gear to clash.

5

This step inspects for the proper transmission fluid. The proper 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 feels. Also, while shifting from one gear to another, feel for binding in the shift shafts. 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.

Action	Yes	No
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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. Press the clutch pedal and move the shift lever to engage that gear again. If the transmission shifts back into the gear without clashing, the clutch is releasing correctly and the synchronizer is operating. If clashing occurs, test another gear. If all gears clash, the clutch is not releasing correctly.

Step	Action	Yes	No
DEFINITION: Noise from the transmission 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 transmission condition if the noise is only happens in one gear.			
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 transmission 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 . Does the clutch operate properly?	Go to Step 5	Go to Step 4
4	Repair the clutch system. Refer to Symptoms - Clutch . Did you find and repair the condition?	Go to Step 11	Go to Step 5
5	Inspect for the correct transmission fluid level and for the correct fluid. Refer to Transmission Fluid Drain and Fill . Is the transmission fluid level correct and at the correct level?	Go to Step 7	Go to Step 6
6	Fill the transmission to the correct level or change the fluid if it is the incorrect type. Does the transmission still have gear clash?	Go to Step 7	Go to Step 11
7	1. Perform a static shift test on the transmission. 2. Test for the following conditions: • Blockage preventing full shift lever movement • Excessive movement in the shift lever • Binding in the shift lever • Detent plungers or shift shafts binding • Shift linkage binding • Shift linkage proper adjustment Did the transmission shift smoothly into the gear that is clashing?	Go to Step 9	Go to Step 8

	Action	Yes	No
8	1. Remove the shift lever. 2. Inspect for damaged or worn components. Refer to Transmission Control Lever Replacement . Did you find and repair the condition?	Go to Step 11	Go to Step 9
9	1. Perform a dynamic shift test on the transmission. 2. Test for the following conditions: • Detent plungers or shift shafts binding • Synchronizer sleeve binding • Gear clashing in more than the suspected gear Is the transmission hard to shift into all gears?	Go to Transmission Shifts Hard	Go to Step 10
10	1. Disassemble the transmission. Refer to Transmission Disassemble . 2. Inspect the following transmission components for the suspect gear that is clashing: • Excessive synchronizer blocking ring to gear clearance • Synchronizer sleeve to hub lash or rock excessive • Excessive axial clearance in the speed gear • Main shaft to speed gear bearing or journal worn • Shift fork worn or damaged • Internal shift control worn or damaged • Main shaft bearing worn or damaged • Input gear bearing or pilot bearing worn Did you find and repair the condition?	Go to Step 11	Go to Diagnostic Aids
11	Operate the system and verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION NOISY

Diagnostic Aids

If the transmission is in neutral with the engine operating, and a whirling noise - a neutral gear rattle is heard outside the vehicle, the sound is a normal condition.

Test Description

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

8	inspects for the correct transmission fluid level. If the transmission fluid level is excessively low, damage may have occurred to the transmission components.	Yes	No
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7

This step inspects for the correct type of transmission fluid. If the incorrect fluid was used, there may have been an overheating condition. Overheating may cause damage to the transmission components.

9

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

13

This step tests to determine if clutch components are making the noise. Press 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 transmission component is faulty.

Step	Action	Yes	No
DEFINITION: The transmission is making a noise. The noise may be a whine or a growl caused by faulty bearings or gears. The noise may also be caused from a faulty component causing a vibration noise.			
1	Did you review the Symptoms - Manual Transmission operations and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Is the noise present while in neutral, with the engine operating?	Go to Diagnostic Aids	Go to Step 3
3	Is the noise present in all gears?	Go to Step 5	Go to Step 4
4	Is the noise present in just one gear?	Go to Step 15	Go to Step 5
5	Inspect the transmission fluid level. Refer to Transmission Fluid Level Inspection . Is the fluid level correct?	Go to Step 7	Go to Step 6
6	Add transmission fluid. Refer to Transmission Fluid Drain and Fill . Did you find and repair the condition?	Go to Step 16	Go to Step 7
7	Inspect the transmission for the correct fluid type. Refer to Approximate Fluid Capacities . Is the transmission fluid the correct type?	Go to Step 9	Go to Step 8
8	Drain and fill the transmission with the correct type of fluid. Refer to Transmission Fluid Drain and Fill . Did you find and repair the condition?	Go to Step 16	Go to Step 9
9	Inspect the shift tower boot. Is the closeout boot loose or damaged?	Go to Step 10	Go to Step 11
10	Position and tighten the shift tower boot to specifications. Refer to Transmission Control Lever Boot Replacement . Did you find and repair the condition?	Go to Step 16	Go to Step 11
11	Inspect for loose transmission mounting bolts. Are there any loose transmission mounting bolts?	Go to Step 12	Go to Step 15
12	Replace and tighten the transmission mounting bolts. Refer to Fastener Specifications . Is the noise still present?	Go to Step 13	Go to Step 16

	Action	Yes	No
13	With the engine operating, press the clutch pedal. Is the noise still present?	Go to Step 14	Go to Step 15
14	1. Remove the clutch. Refer to Clutch Assembly Replacement. 2. Inspect the following components for being the cause of the noise: • The release bearing • The pilot bearing • The dual mass flywheel, if equipped • 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 16	Go to Step 15
15	1. Remove the transmission. Refer to Transmission Replacement. 2. Disassemble the transmission. Refer to one of the following: Transmission Disassemble. Use the information in the Cleaning and Inspection section to determine if any of the transmission components are faulty. Did you find and repair the condition?	Go to Step 16	-
16	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 transmission 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 transmission 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 transmission 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 transmission internal shift components.

5

Static 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, 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 transmission or engine mounts. Loose mounts may cause a shock on the transmission allowing for gear disengagement.

7

This step inspects for the misalignment of the engine to transmission. Misalignment may put a bind on the input shaft, allowing for the input shaft or the main shaft 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.

Step	Action	Yes	No
DEFINITION: Gear disengagement occurs during acceleration or deceleration.			
1	Did you review the Symptoms - Manual Transmission operations and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	1. Perform a static shift test. 2. Test for the following conditions: • Blockage preventing full shift lever movement • Excessive movement in the shift lever • Detent plungers engaging in the shift shafts • Synchronizer pressure pieces on the synchronizer sleeves • Shift linkage binding • Shift linkage proper adjustment		
	Did the transmission shift completely into all gears?	Go to Step 5	Go to Step 3
3	1. Remove the shift control shift closeout boot and foam isolator. Refer to Transmission Control Lever Boot Replacement . 2. Inspect for the following: • Loose mounting • Foreign debris • Interference to foam isolator		
	Did you find and repair the condition?	Go to Step 10	Go to Step 4

	Action	Yes	No
4	1. Perform a dynamic shift test on the transmission. 2. Test for the following conditions: • Synchronizer sleeve engagement to the speed gear selector teeth • Detent plungers engaging in the shift shafts Did the transmission shift completely into all gears?	Go to Step 5	Go to Step 8
5	Inspect the engine and/or transmission mounts. Refer to Transmission Mount Inspection Transmission Mount Inspection, and Engine Mount Inspection , (2.5L LVN or 2.8L LWH) or Engine Mount Inspection 2.8L, 3.0L, 3.2L or 3.6L. Did you find and repair the condition?	Go to Step 10	Go to Step 6
6	Inspect the clutch housing for loose bolts or misalignment. Are there any loose bolts or misalignment?	Go to Step 9	Go to Step 8
7	Tighten any loose housing bolts and/or align the housing. Refer to Clutch Assembly Replacement . Did you find and repair the condition?	Go to Step 10	Go to Step 8
8	1. Remove the transmission. Refer to Transmission Replacement. 2. Remove the clutch assembly. Refer to Clutch Assembly Replacement . 3. Inspect the pilot bearing for being faulty. 4. Inspect the input shaft for excessive wear at the pilot bearing. Did you find and repair the condition?	Go to Step 10	Go to Step 9
9	1. Disassemble the transmission. Refer to Transmission Disassemble. 2. Inspect the following components for wear or damage: • The shift shafts • The detent plungers and springs • The shift forks • The synchronizer sleeve and speed gear selector teeth • The main shaft to input shaft bearing and journals • The speed gear bearings and journals • The speed gear axial clearance • The main shaft center and rear bearings • The shift guide plate Did you find and repair the condition?	Go to Step 10	Go to Diagnostic Aids

	Action	Yes	No
10	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 transmission 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 test is to confirm that the clutch is not slipping. During certain conditions, the clutch may slip and feel as though the transmission 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 shafts moving freely, the detent plungers operating when coming out of a gear and going into the next gear, and for 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. Press the clutch pedal and move the shift lever to engage that gear again, to ensure full travel of the shift components.

Step	Action	Yes	No
DEFINITION: The shift lever will not move into a particular gear position, or when in a gear position, power is not delivered through the transmission.			
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 . Is the clutch operating properly?	Go to Step 2	Go to Clutch Assembly Replacement

	Action	Yes	No
3	1. Perform a static shift test on the transmission. 2. Test for the following conditions: • Blockage preventing full shift lever movement • Excessive movement in the shift lever • Binding in the shift lever • Detent plungers or shift shafts binding • Synchronizer sleeve moving on the hub and pressure pieces • Shift linkage binding • Shift linkage proper adjustment Were you able to shift into the gear position with the concern?	Go to Step 5	Go to Step 4
4	1. Remove the shift control shift closeout boot and foam isolator. Refer to Transmission Control Lever Boot Replacement. 2. Inspect for the following: • Loose mounting • Foreign debris • Interference to foam isolator Did you find and repair the condition?	Go to Step 8	Go to Step 5
5	1. Perform a dynamic shift test on the transmission. 2. Test for the following conditions: • Detent plungers or shift shafts binding • Synchronizer sleeve binding • Synchronizer sleeve engaging on the speed gear selector teeth Were you able to shift into the gear position with the concern?	Go to Step 7	Go to Step 6
6	1. Remove the transmission. Refer to Transmission Replacement. 2. Disassemble the transmission. Refer to Transmission Disassemble. 3. Inspect the following transmission internal components for wear or damage: • The shift forks • The internal shift control lever Did you find and repair the condition?	Go to Step 8	Go to Step 7

	Action	Yes	No
7	1. Remove the transmission. Refer to Transmission Replacement. 2. Disassemble the transmission. Refer to Transmission Disassemble. 3. Inspect the following transmission internal components for wear or damage: • The synchronizer sleeve selector teeth • The speed gear selector teeth • The speed gear axial clearance for being excessive • The speed gear to main shaft bearings and journals • The counter gear shaft for being broken • The main shaft for being broken • The counter shaft gear for being stripped • The main shaft gear for being stripped Did you find and repair the condition?	Go to Step 8	Go to Diagnostic Aids
8	Operate the system in order to verify the repair. Did you correct the condition?	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 transmission fluid. The transmission fluid is used to ensure proper synchronizer operation, and for sufficient lubrication. Improper fluid may cause the synchronizers to stick or cause overheating of the transmission components.

4

A static shift test is performed by shifting into all gears with the engine not operating. By confirming that the transmission 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 properly functioning.

Step	Action	Yes	No
DEFINITION: The transmission cannot be shifted out of a gear or the vehicle will not move because the transmission is locked.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission

r	Action	Yes	No
2	Inspect for the correct type of transmission fluid. Refer to Approximate Fluid Capacities . Is the correct type of transmission fluid being used?	Go to Step 6	Go to Step 5
3	Drain and fill the transmission with the correct type of fluid. Refer to Transmission Fluid Drain and Fill . Did you find and repair the condition?	Go to Step 9	Go to Step 6
4	1. Perform a static shift test on the transmission. 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. Refer to Transmission Control Lever Replacement . 2. Inspect for worn or faulty components. Did you find and repair the conditions?	Go to Step 9	Go to Step 6
6	1. Perform a dynamic shift test on the transmission. 2. Test for being able to shift in and out of the gear with the concern. Were you able to shift the transmission correctly?	Go to Step 7	Go to Step 8
7	1. Remove the transmission. Refer to Transmission Replacement . 2. Inspect the clutch system for the clutch not releasing properly. Refer to Clutch System Description and Operation . Did you find and repair the condition?	Go to Step 9	Go to Step 8
8	1. Disassemble the transmission. Refer to Transmission Disassemble . 2. Inspect the following transmission internal components for wear or damage: • The shift shaft • The internal shift control lever • The synchronizer components for being broken or faulty • The speed gears for being seized to the main shaft • The shift turret rail Did you find and repair the conditions?	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 CLUNK ON ACCELERATION OR DECELERATION

Action	Yes	No
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All manual transmissions have gear play that might cause a clunk. If the transmission is suspected of causing the clunk, compare it with a similar vehicle. An internal clunk in the transmission 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 transmission.

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 , (2.5L LVN or 2.8L LVC LWH) or Engine Mount Inspection (2.8L, 3.0L, 3.2L or 3.6L). Did you find and repair the condition?	Go to Step 7	Go to Step 3
3	Inspect the transmission 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 transmission to engine fasteners for being loose or missing. Refer to Fastener 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 - Vehicle . Did you find and repair the condition?	Go to Step 7	Go to Step 6
6	1. Remove the transmission. Refer to Transmission Replacement. 2. Disassemble the transmission. Refer to Transmission Disassemble. 3. Inspect the following transmission components that maybe causing the clunk: • Faulty main shaft bearings • Faulty counter gear shaft bearings • Worn speed gear teeth • Worn counter gear shaft gear teeth • Worn synchronizer sleeve to hub • Worn thrust washers and thrust surfaces on the speed gears or main shaft Did you find and repair the condition?	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

ION FLUID LEAK DIAGNOSIS**Action****Yes****No****Diagnostic Aids**

Using the incorrect type of transmission fluid may affect the sealing ability of the seals. Ensure the use of the correct type of transmission fluid. The incorrect type of sealer may not be compatible with the transmission fluid or may not have the correct characteristics for sealing the affected components. Ensure the use of the correct type of sealers.

Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).

Test Description

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

5

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

Step	Action	Yes	No
DEFINITION: Visible sign of the transmission fluid leaking from the transmission.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	1. Inspect for the transmission fluid level higher than the recommended level. Refer to Transmission Fluid Drain and Fill . 2. Adjust the transmission level if incorrect. Was the transmission fluid level too high?	Go to Step 19	Go to Step 3
3	Inspect the transmission vent for a blockage. Is the transmission vent blocked?	Go to Step 4	Go to Step 5
4	Repair or replace the transmission vent. Did you find and repair the condition?	Go to Step 19	Go to Step 5
5	Verify the location of the leak. 1. Clean the transmission assembly. 2. Operate the vehicle for 24 km (15 mi), or until normal operating temperatures are reached. 3. Visual inspect or use the powder method or dye and black light method to locate the leak. Is the leak occurring at the drain or fill plug?	Go to Step 6	Go to Step 7
6	Replace the drain or fill plug. Refer to Transmission Fluid Drain and Fill . Did you find and repair the condition?	Go to Step 19	Go to Diagnostic Aids
7	Is the leak at the transmission output shaft seal?	Go to Step 8	Go to Step 9

	Action	Yes	No
8	Remove the output shaft seal and inspect for the following. Refer to Output Shaft Seal Replacement. • Damaged or worn seal • Damaged seal bore • Improper installation • Cracks in the component • Propeller shaft yoke sealing surface is scratched, nicked, damaged, or worn • Loose or worn bearing causing excessive seal wear • Yoke flange nut loose Did you find and repair the condition?	Go to Step 19	Go to Diagnostic Aids
9	Is the leak at the front of the transmission?	Go to Step 10	Go to Step 12
10	1. Inspect for the leak at the input shaft seal. 2. Inspect for the following if the input shaft seal is leaking: • 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 Output Shaft Seal Replacement. Did you find and repair the condition?	Go to Step 19	Go to Step 11
11	1. Inspect the case for cracks or porosity. 2. Replace the transmission front case half if it is faulty. Refer to Transmission Disassemble. Did you find and repair the condition?	Go to Step 19	Go to Diagnostic Aids
12	Is the leak at the backup light switch?	Go to Step 13	Go to Step 15
13	1. Remove the backup light switch. Refer to Backup Lamp Switch Replacement. 2. Inspect for the following: • Cross threaded or damaged threads • Insufficient sealant • Leaking switch, sensor or solenoid • Improper installation Did you find and repair the condition?	Go to Step 19	Go to Step 1

	Action	Yes	No
14	1. Remove the shift shaft detent sleeve. Refer to the applicable procedure: • Transmission Disassemble • Transmission Assemble 2. Inspect for the following: • Cross threaded or damaged threads • Insufficient sealant • Cracked sleeve or case • Improper installation Did you find and repair the condition?	Go to Step 19	Go to Step 1
15	Is the leak at the sealing flanges of the transmission case?	Go to Step 16	Go to Step 17
16	1. Remove the transmission. Refer to Transmission Replacement. 2. Disassemble the transmission. Refer to Transmission Disassemble. 3. Inspect the sealing surfaces. Refer to the applicable procedure: • Clutch Housing Cleaning and Inspection • Rear Case Cleaning and Inspection Did you find and repair the condition?	Go to Step 19	Go to Step 17
17	Is the leak coming from a crack or porosity in the transmission case?	Go to Step 18	Go to Diagnostic Aids
18	1. Remove the transmission. Refer to Transmission Replacement. 2. Disassemble the transmission. Refer to Transmission Disassemble. 3. Replace the faulty case. Refer to Transmission Assemble Did you find and repair the condition?	Go to Step 19	Go to Diagnostic Aids
19	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

REPAIR INSTRUCTIONS - ON VEHICLE

TRANSMISSION CONTROL LEVER BOOT REPLACEMENT

Removal Procedure

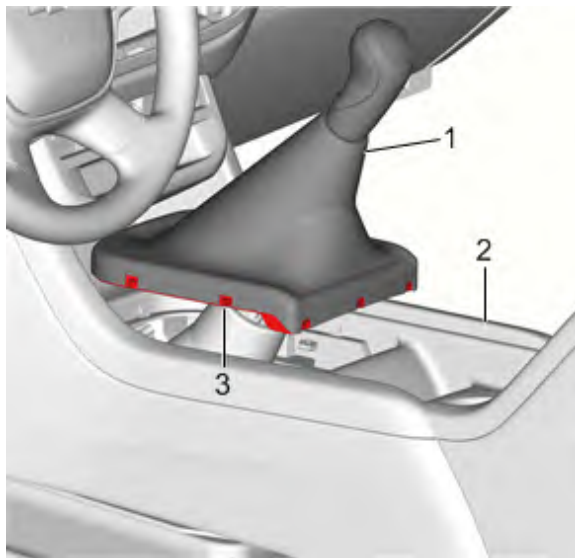
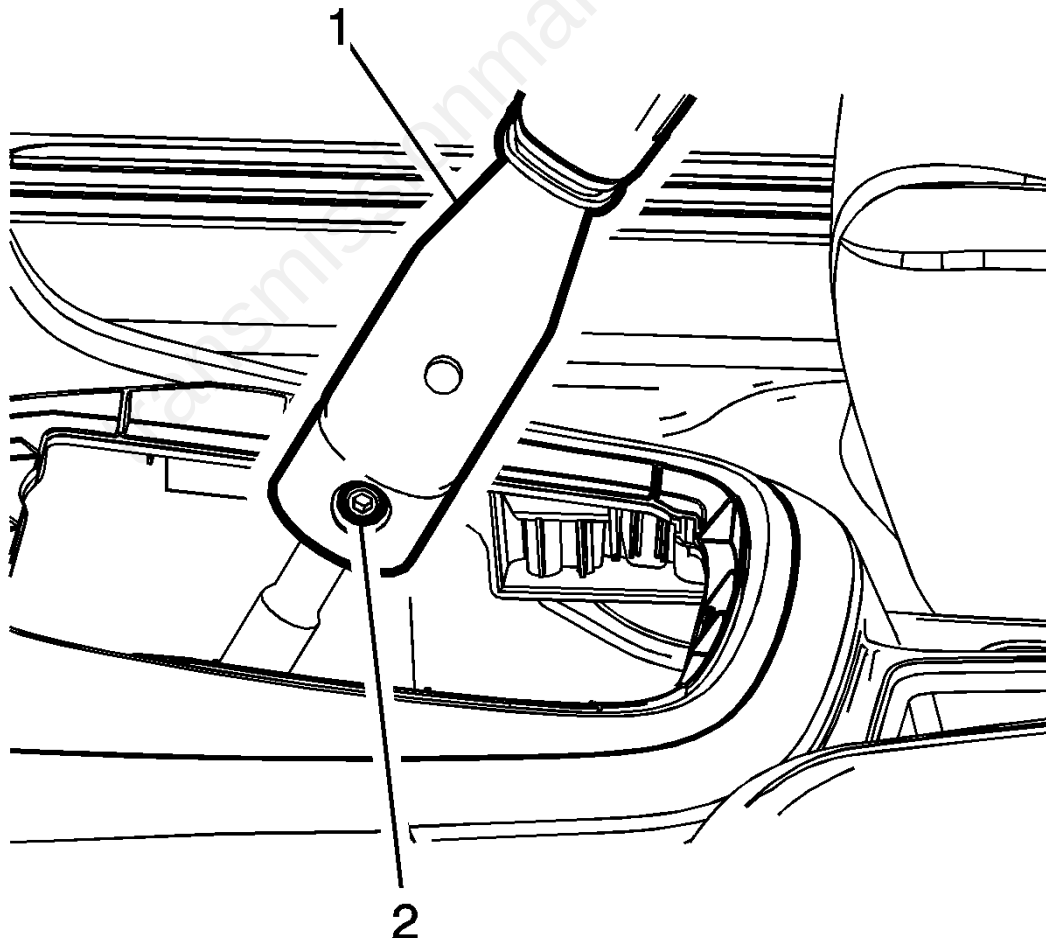


Fig. 6: Boot And Boot Retainers

Courtesy of GENERAL MOTORS COMPANY

1. Using a flat-bladed trim tool, carefully release the four retaining tabs on each side of the boot (1) in order to disengage the boot retainers (3) from the floor console (2).
2. Pull the boot upward to access the control lever set screw.



Set Screw And Shift Lever

Courtesy of GENERAL MOTORS COMPANY

3. Remove the set screw (2) from the shift lever (1).
4. Remove the shift lever assembly from the transmission control lever.
5. Remove the shift lever boot from the control lever.

Installation Procedure

1. Install the shift lever boot to the control lever.

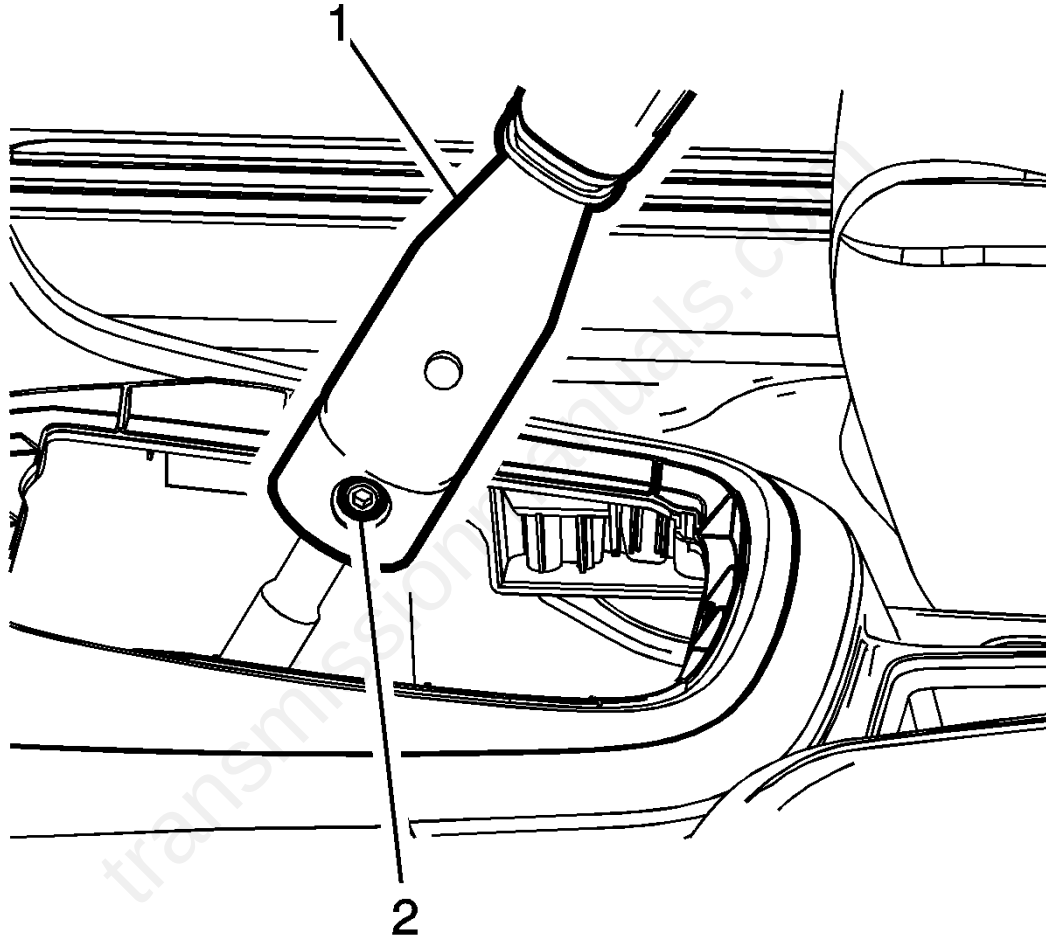


Fig. 8: Set Screw And Shift Lever

Courtesy of GENERAL MOTORS COMPANY

2. Install the control lever and boot assembly to the transmission control lever, aligning the set screw (2) threaded hole with the flat on the transmission control lever.
3. Apply threadlock to the shift lever set screw threads. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).

CAUTION: Refer to [Fastener Caution](#) .

4. Install the shift lever set screw and tighten to 9 N.m (80 lb in).

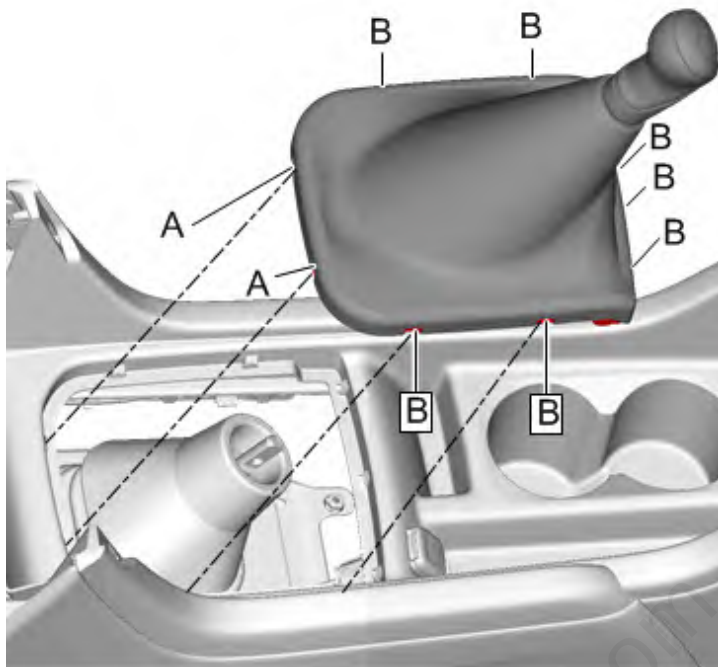


Fig. 9: Control Assembly Retainers

Courtesy of GENERAL MOTORS COMPANY

5. Position boot into console by engaging control assembly retainers (A) front into hole of console first and push downward to secure, then roll the rear side of boot frame down to engage control assembly retainers (B) and push downward to secure.

TRANSMISSION CONTROL LEVER REPLACEMENT

Removal Procedure

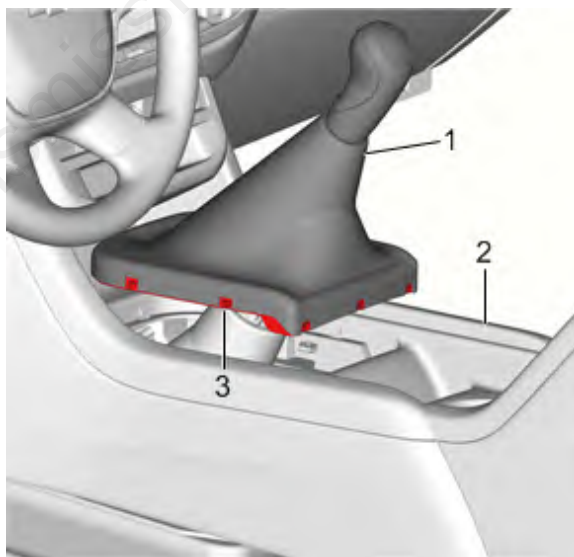


Fig. 10: Boot And Boot Retainers

Courtesy of GENERAL MOTORS COMPANY

1. Using a flat-bladed trim tool, carefully release the retaining tabs on each side of the boot (1) in order to disengage the boot retainers (3) from the floor console (2).
2. Pull the boot upward to access the control lever set screw.

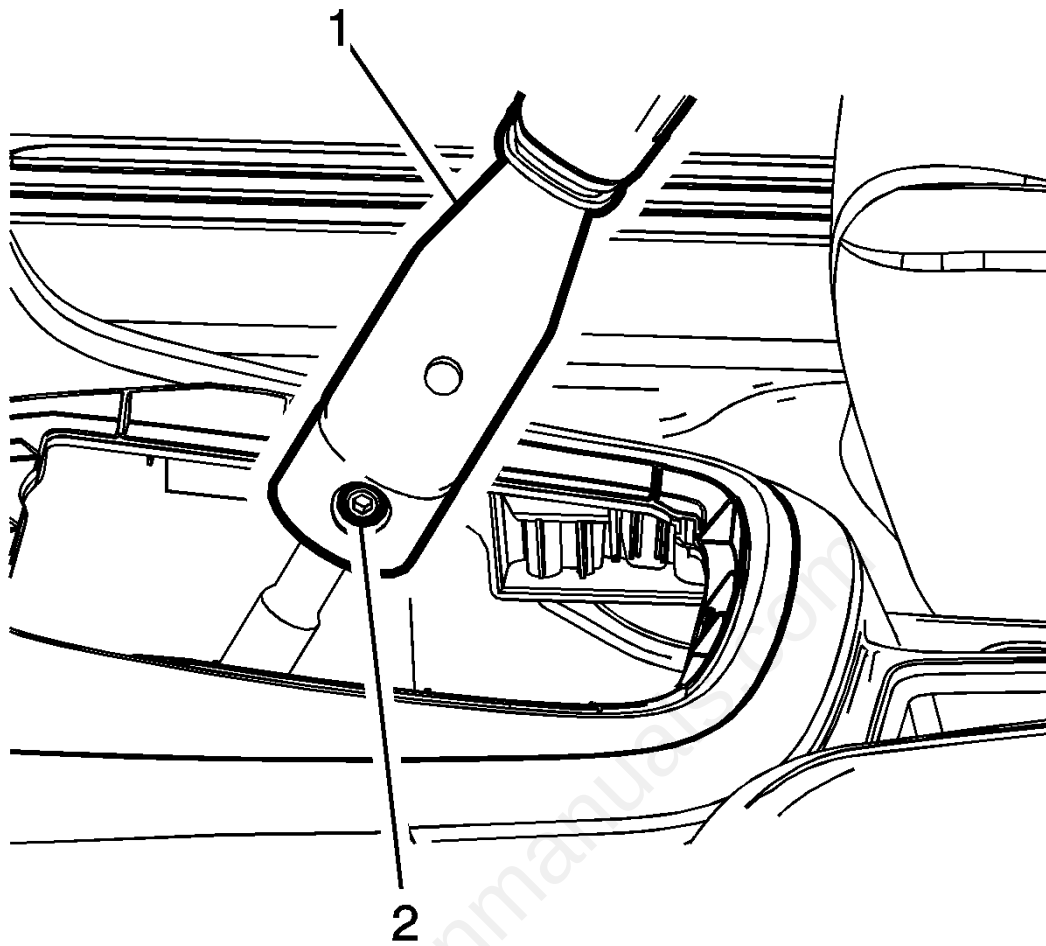


Fig. 11: Set Screw And Shift Lever

Courtesy of GENERAL MOTORS COMPANY

3. Remove the set screw (2) from the shift lever (1).
4. Remove the shift lever assembly from the transmission control lever.
5. If necessary, remove the shift lever boot from the control lever.

Installation Procedure

1. If removed, install the shift lever boot to the control lever.

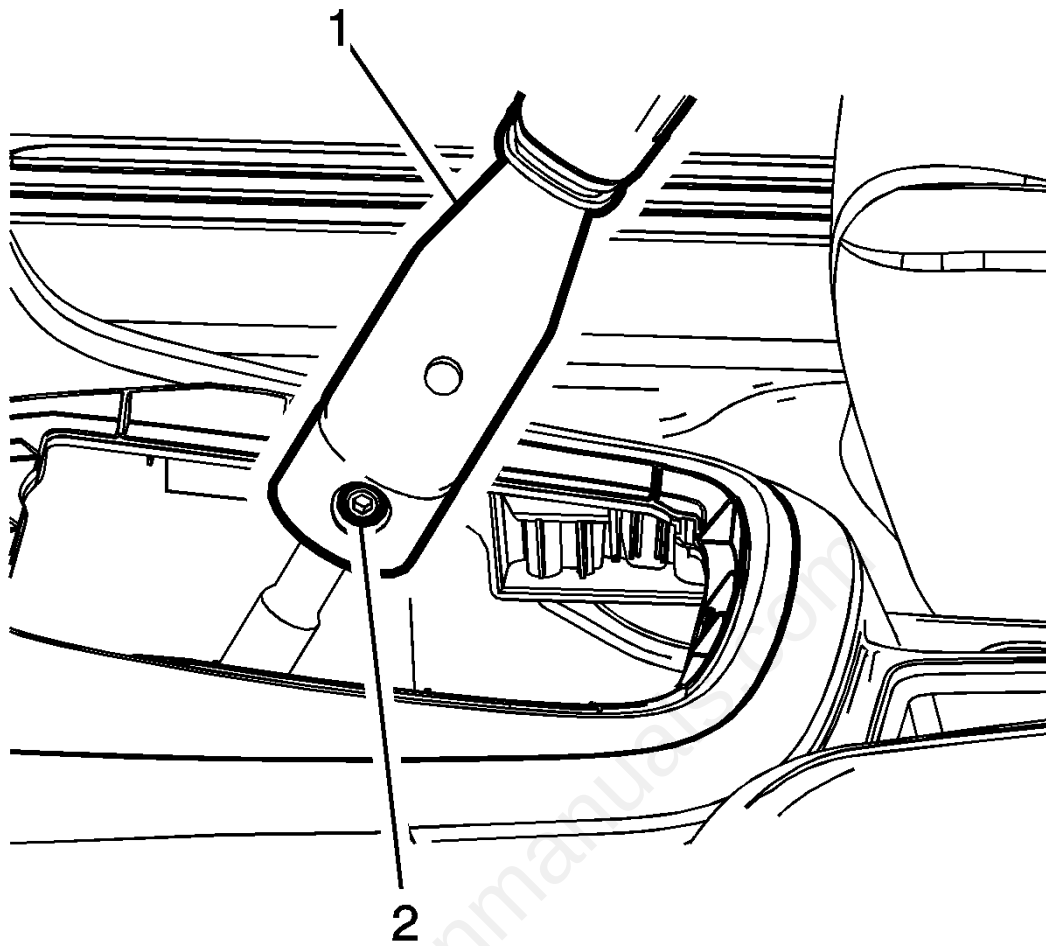


Fig. 12: Set Screw And Shift Lever

Courtesy of GENERAL MOTORS COMPANY

2. Install the control lever and boot assembly to the transmission control lever, aligning the set screw (2) threaded hole with the flat on the transmission control lever.
3. Apply threadlock to the shift lever set screw threads. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).

CAUTION: Refer to [Fastener Caution](#) .

4. Install the shift lever set screw and tighten to 9 N.m (80 lb in).

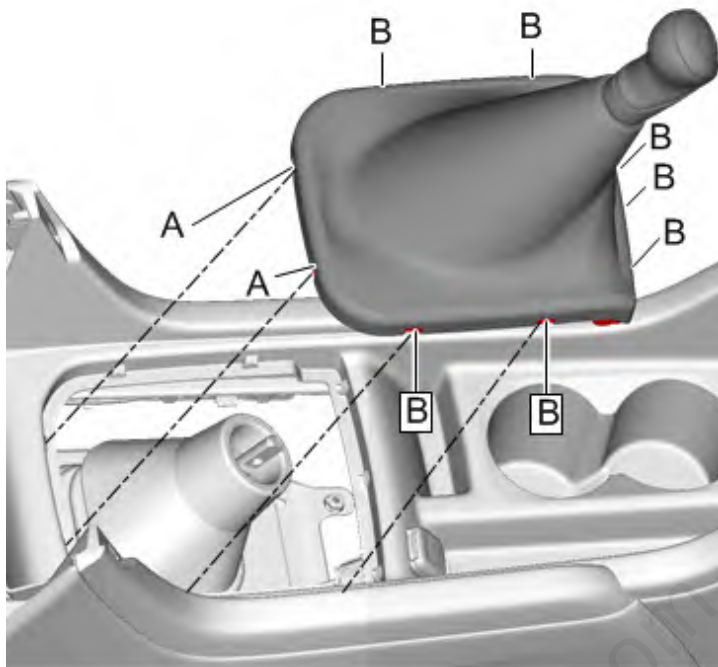


Fig. 13: Control Assembly Retainers
 Courtesy of GENERAL MOTORS COMPANY

5. Position boot into console by engaging control assembly retainers (A) front into hole of console first and push downward to secure, then roll the rear side of boot frame down to engage control assembly retainers (B) and push downward to secure.

TRANSMISSION FLUID LEVEL INSPECTION

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Clean away all dirt and debris from the transmission fluid fill plug area.

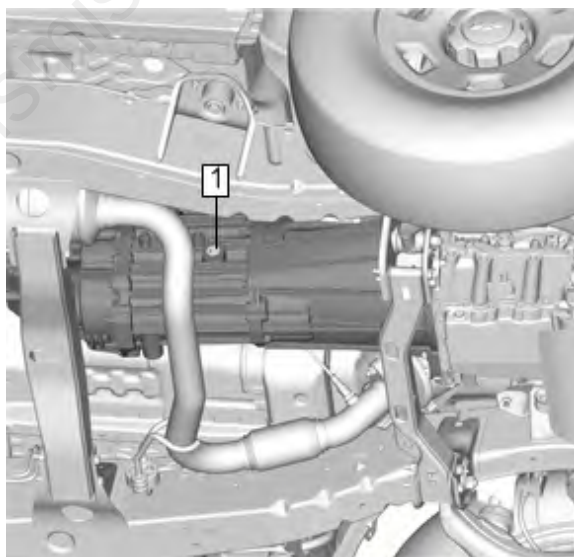


Fig. 14: Transmission Fluid Fill Plug
 Courtesy of GENERAL MOTORS COMPANY

3. Remove the transmission fluid fill plug (1).

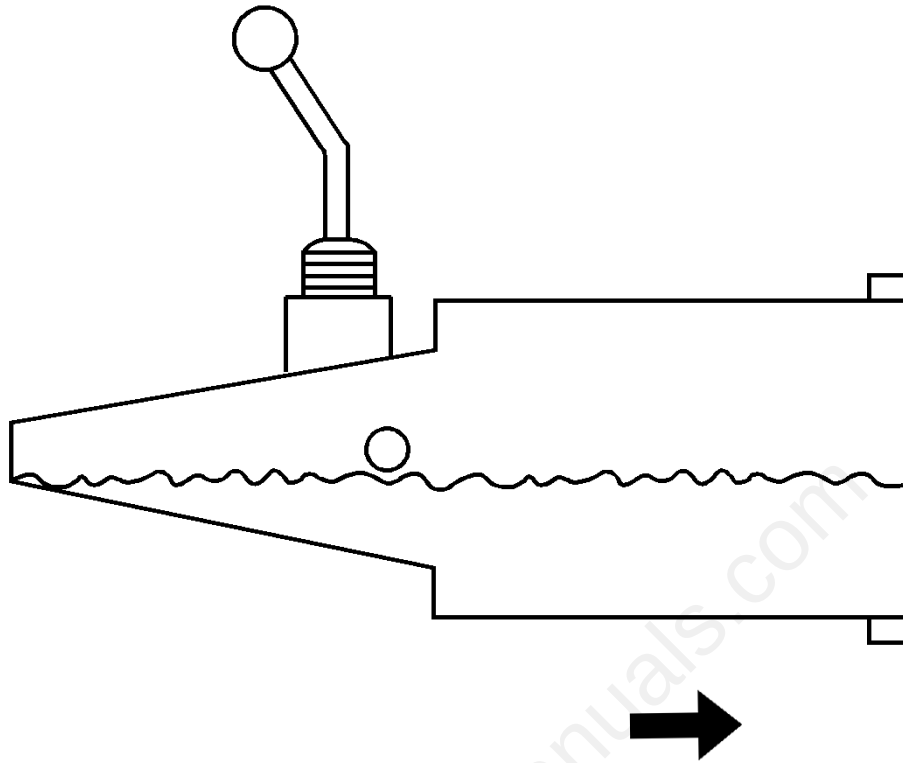


Fig. 15: Filling Transmission To Just Below Bottom Of Fill Plug Hole

Courtesy of GENERAL MOTORS COMPANY

4. Fill the transmission to just below the bottom of the fill plug hole with the recommended fluid. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).

CAUTION: Refer to [Component Fastener Tightening Caution](#) .

5. Install the transmission fluid fill plug and tighten to 44 N.m (32 lb ft).
6. Lower the vehicle.

TRANSMISSION MOUNT INSPECTION

1. Raise the transmission/transaxle in order to remove the weight from the transmission/transaxle mount and create slight tension in the rubber.
2. Observe the transmission/transaxle mount while raising the transmission/transaxle. Replace the transmission/transaxle mount if the transmission/transaxle mount exhibits any of the following conditions:

NOTE: Black paint on the rubber will crack with time, this does no constitute a failure.

- The hard rubber surface is covered with heat check cracks.
- The rubber is separated from the metal plate of the transmission/transaxle mount.

ie rubber is split through the center of the transmission/transaxle mount.

3. If there is movement between the metal plate of the transmission/transaxle mount and its attaching points, lower the transmission/transaxle on the transmission/transaxle mount. Tighten the bolts or nuts attaching the transmission/transaxle mount to the frame or transmission/transaxle mount bracket.

TRANSMISSION MOUNT INSPECTION

1. Raise the transmission/transaxle in order to remove the weight from the transmission/transaxle mount and create slight tension in the rubber.
2. Observe the transmission/transaxle mount while raising the transmission/transaxle. Replace the transmission/transaxle mount if the transmission/transaxle mount exhibits any of the following conditions:

NOTE: Black paint on the rubber will crack with time, this does no constitute a failure.

- The hard rubber surface is covered with heat check cracks.
 - The rubber is separated from the metal plate of the transmission/transaxle mount.
 - The rubber is split through the center of the transmission/transaxle mount.
3. If there is movement between the metal plate of the transmission/transaxle mount and its attaching points, lower the transmission/transaxle on the transmission/transaxle mount. Tighten the bolts or nuts attaching the transmission/transaxle mount to the frame or transmission/transaxle mount bracket.

TRANSMISSION REAR MOUNT REPLACEMENT

Removal Procedure

1. Remove the crossmember. Refer to [Transmission Support Crossmember Replacement \(4WD\)](#) [Transmission Support Crossmember Replacement \(2WD\)](#) .

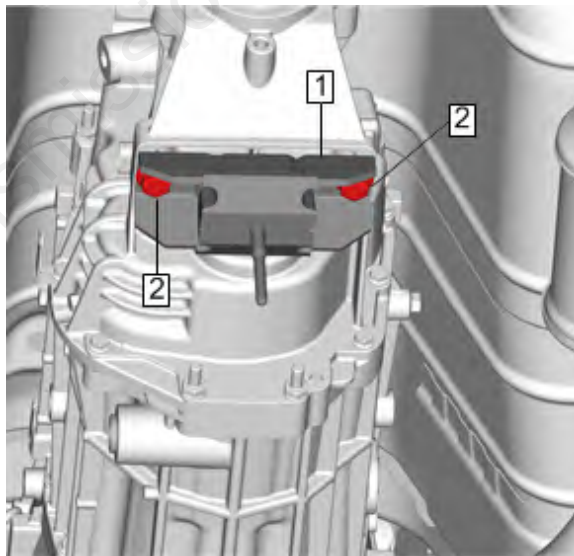


Fig. 16: Transmission Mount Bolts

Courtesy of GENERAL MOTORS COMPANY

2. Remove the transmission mount bolts (2).
3. Remove the transmission mount (1) from the transmission.

Installation Procedure

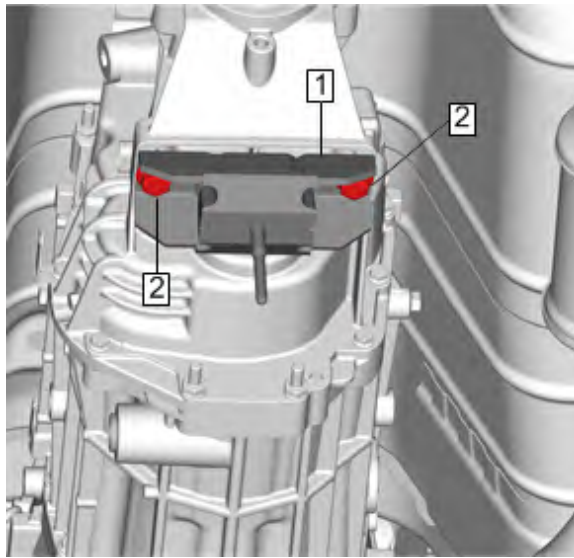


Fig. 17: Transmission Mount Bolts

Courtesy of GENERAL MOTORS COMPANY

1. Install the transmission mount (1) to the transmission.

CAUTION: Refer to [Fastener Caution](#) .

2. Install the bolts (2) and tighten to 58 N.m (42 lb ft).
3. Install the crossmember. Refer to [Transmission Support Crossmember Replacement \(4WD\)](#) [Transmission Support Crossmember Replacement \(2WD\)](#) .

OUTPUT SHAFT SEAL REPLACEMENT

Special Tools

DT-47928 Rear Seal Installer

EN-70006832 Rear Bearing Seal Puller

EN-680770 Universal Sliding Mallet

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

Removal Procedure

1. Remove the propeller shaft. Refer to [Propeller Shaft Replacement \(with MYB\)](#) [Propeller Shaft Replacement \(with N8D\)](#) .

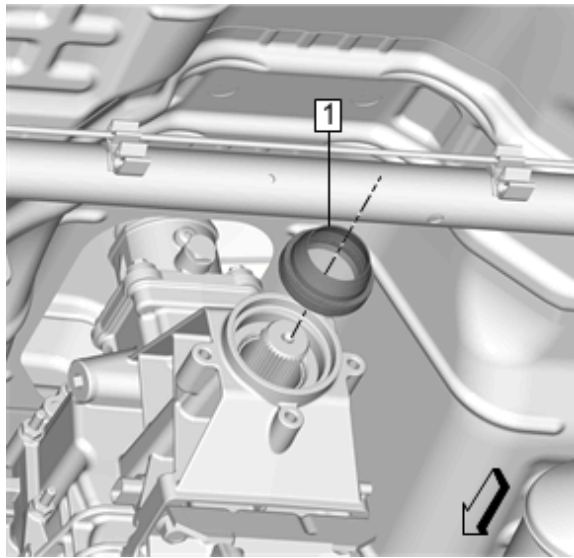


Fig. 18: Output Shaft Seal

Courtesy of GENERAL MOTORS COMPANY

2. Using EN-700068 with EN-680770 or a suitable equivalent, remove the output shaft seal (1) from the transmission housing, then DISCARD the seal.

Installation Procedure

1. Coat the NEW seal lip with the recommended fluid.

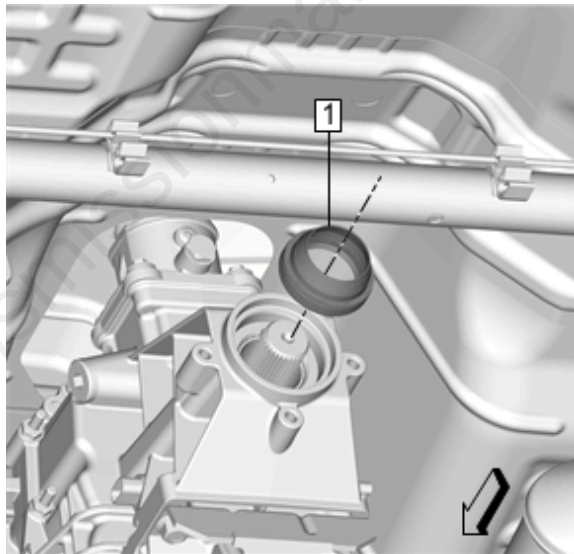


Fig. 19: Output Shaft Seal

Courtesy of GENERAL MOTORS COMPANY

2. Using the **DT-47928** installer and a hammer, install the NEW output shaft seal (1).
3. Check the transmission fluid level. Add if necessary. Refer to **Transmission Fluid Level Inspection**.
4. Install the rear propeller shaft. Refer to **Propeller Shaft Replacement (with MYB) Propeller Shaft Replacement (with N8D)**.

BACKUP LAMP SWITCH REPLACEMENT

Removal Procedure

d support the vehicle. [Lifting and Jacking the Vehicle](#)

2. Remove the electrical connector from the backup switch.

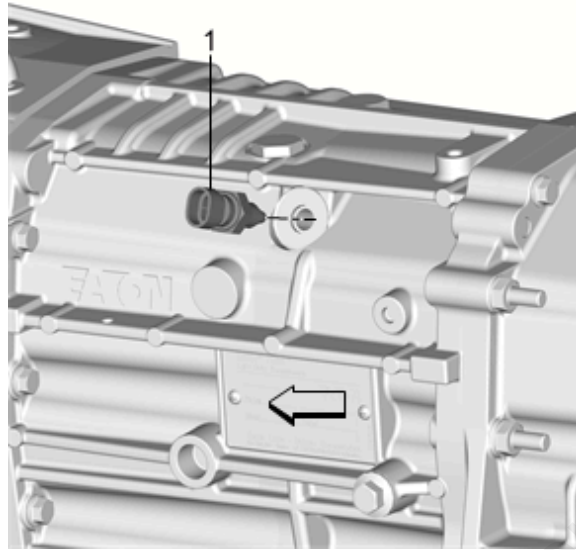


Fig. 20: Backup Switch

Courtesy of GENERAL MOTORS COMPANY

3. Remove the backup switch (1) from the transmission.

Installation Procedure

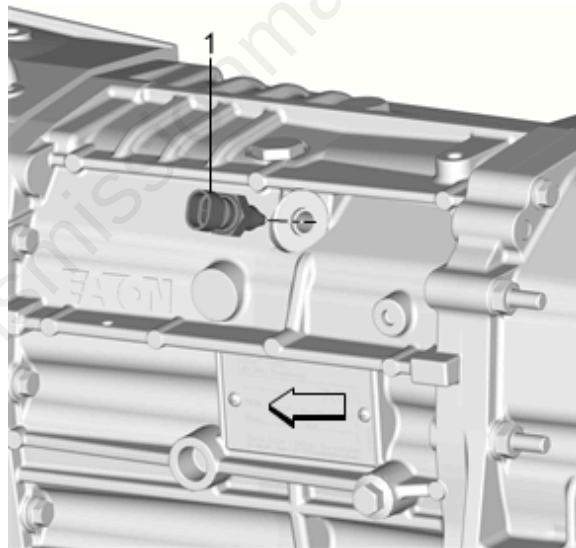


Fig. 21: Backup Switch

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Component Fastener Tightening Caution](#) .

1. Install the backup switch (1) to the transmission and tighten to 17 N.m (13 lb ft).
2. Install the electrical connector to the backup switch.
3. Lower the vehicle. [Lifting and Jacking the Vehicle](#)

VEHICLE SPEED SENSOR REPLACEMENT

Removal Procedure

d support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .

2. Remove the electrical connector from the speed sensor.

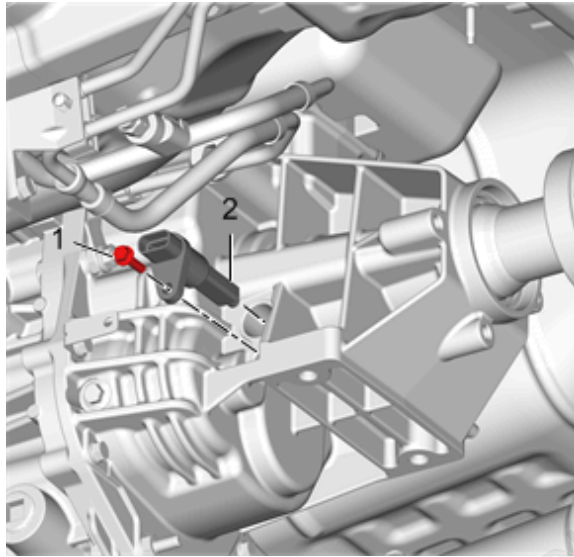


Fig. 22: Speed Sensor Retaining Fastener And Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

3. Remove the speed sensor retaining fastener (1).
4. Remove the speed sensor (2) from the transmission case.

Installation Procedure

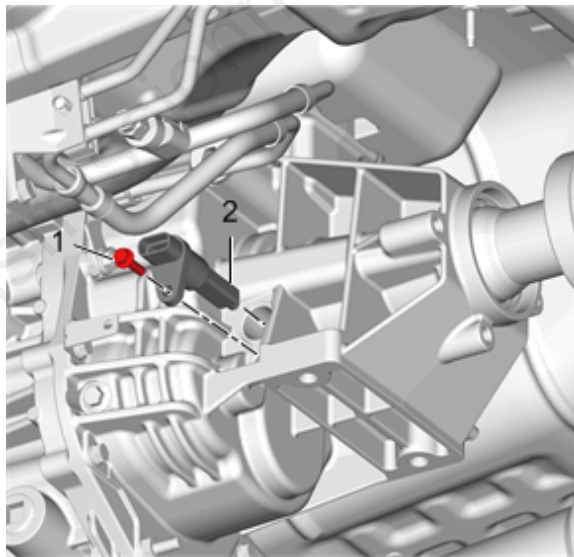


Fig. 23: Speed Sensor Retaining Fastener And Speed Sensor
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#) .

1. Install the new speed sensor (2) into the transmission case. Tighten the speed sensor fastener (1) to 12 N.m (106 lb in).
2. Install the electrical connector to the speed sensor.
3. Lower the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .

ION FLUID DRAIN AND FILL

Draining Procedure

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Clean away all dirt and debris from the transmission fluid drain plug area.
3. Position an appropriate container under the transmission.

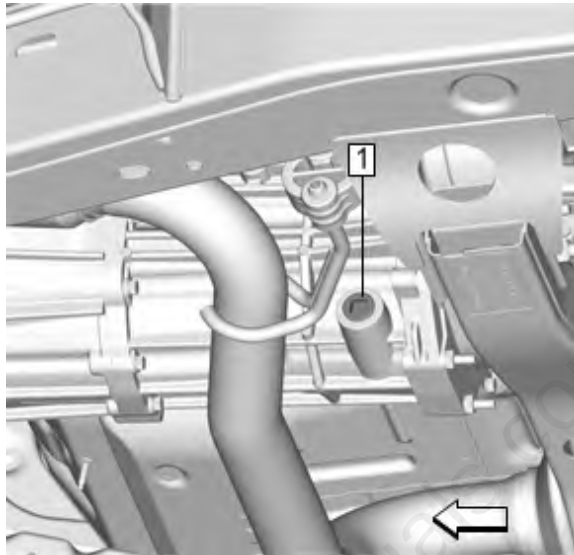


Fig. 24: Transmission Fluid Drain Plug

Courtesy of GENERAL MOTORS COMPANY

4. Remove the transmission fluid drain plug (1).

Allow the transmission fluid to drain into the container.

CAUTION: Refer to [Component Fastener Tightening Caution](#) .

5. Install the transmission fluid drain plug and tighten to 44 N.m (32 lb ft).
6. Remove the container used to catch the used transmission fluid from under the vehicle.

Filling Procedure

1. Clean away all dirt and debris from the transmission fluid fill plug area.

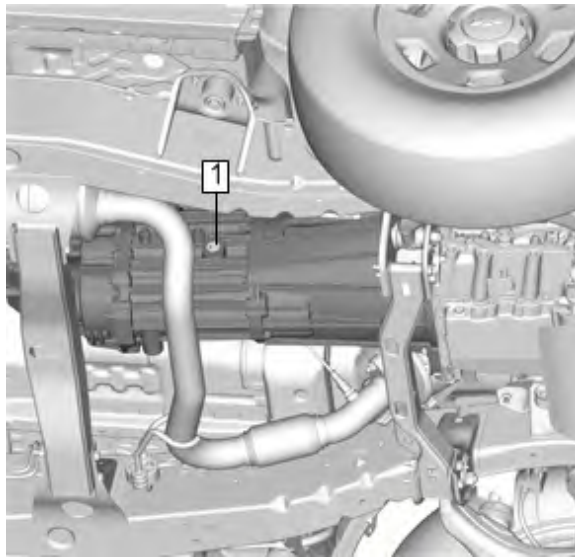


Fig. 25: Transmission Fluid Fill Plug

Courtesy of GENERAL MOTORS COMPANY

2. Remove the transmission fluid fill plug (1).

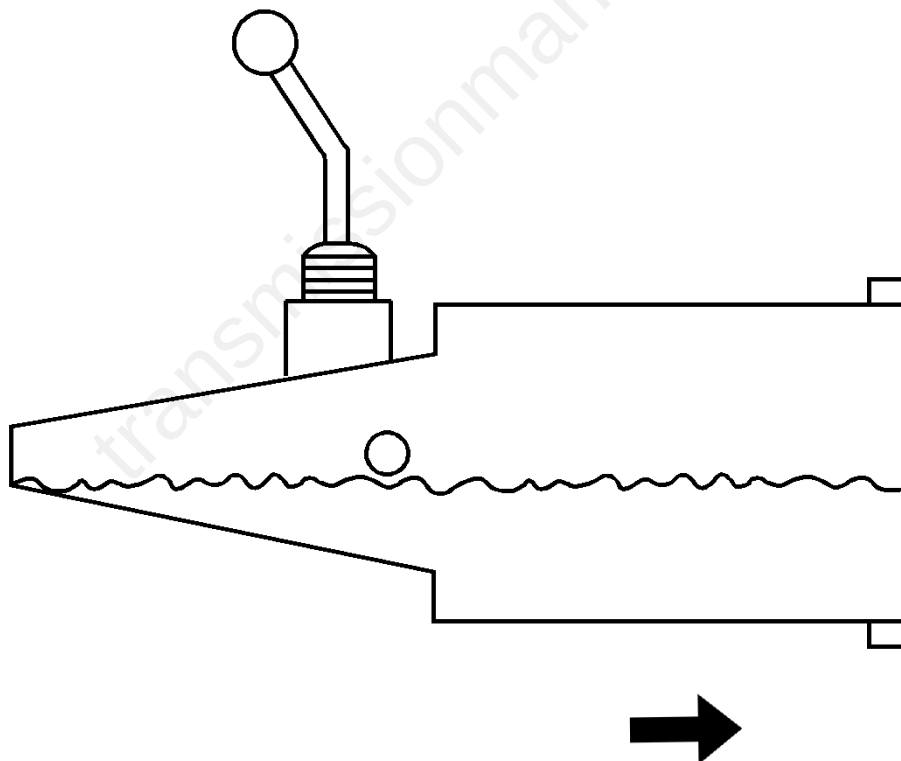


Fig. 26: Filling Transmission To Just Below Bottom Of Fill Plug Hole

Courtesy of GENERAL MOTORS COMPANY

transmission to just below the bottom of the fill plug hole with the recommended fluid. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).

4. Install the transmission fluid fill plug and tighten to 44 N.m (32 lb ft).
5. Lower the vehicle.

TRANSMISSION VENT TUBE REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).

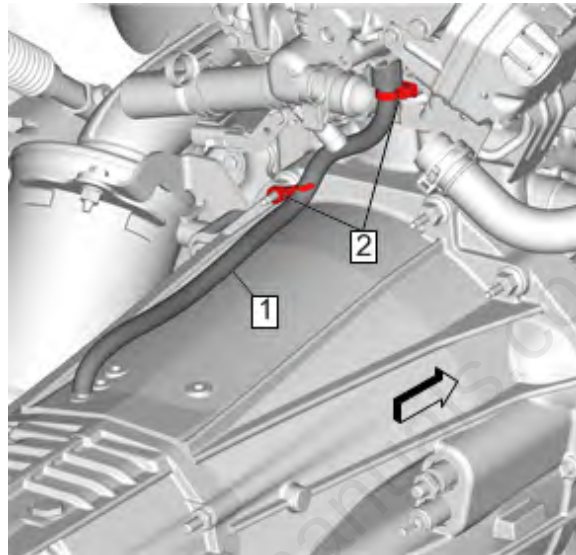


Fig. 27: Transmission Vent Hose Assembly

Courtesy of GENERAL MOTORS COMPANY

NOTE: Coolant hose removed for clarity.

2. Disconnect the transmission vent hose assembly (1) from the engine compartment bracket (2) and transmission.
3. Disconnect the transmission vent hose assembly (1) from the transmission.
4. Remove the transmission vent hose assembly (1) from the vehicle.

Installation Procedure

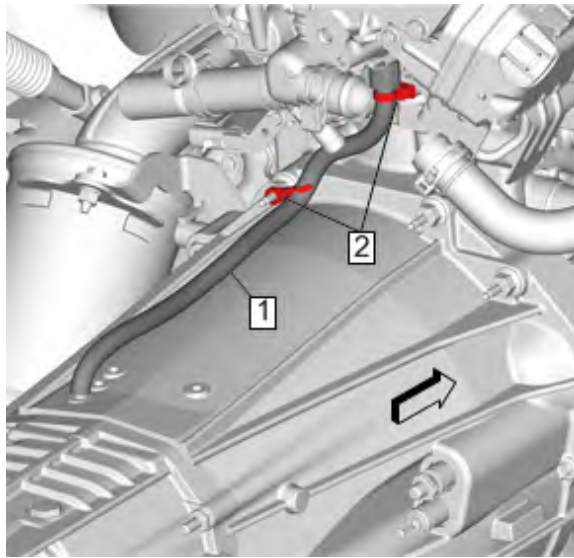


Fig. 28: Transmission Vent Hose Assembly

Courtesy of GENERAL MOTORS COMPANY

NOTE: Ensure the vent hoses are free of kinks and routed clear of sharp objects.

1. Connect the transmission vent hose assembly (1) to the engine compartment bracket (2) and transmission.
2. Connect the transmission vent hose assembly (1) to the transmission.
3. Lower the vehicle.

TRANSMISSION REPLACEMENT

Removal Procedure

1. Disconnect the negative battery cable. Refer to [Battery Negative Cable Disconnection and Connection](#) .
2. Remove the transmission control lever. Refer to [Transmission Control Lever Replacement](#).
3. Remove the front exhaust pipe. Refer to [Exhaust Pipe Replacement \(LCV\) Exhaust Pipe Replacement](#) .
4. On 4 wheel drive vehicles, remove the transfer case. Refer to [Transfer Case Assembly Replacement](#) , for the NQ7 or [Transfer Case Assembly Replacement](#) for the NQ6 transfer case.
5. On 2 wheel drive vehicles, remove the propeller shaft. Refer to [Propeller Shaft Replacement \(with MYB\) Propeller Shaft Replacement \(with N8D\)](#) .
6. Support the transmission with a transmission jack.

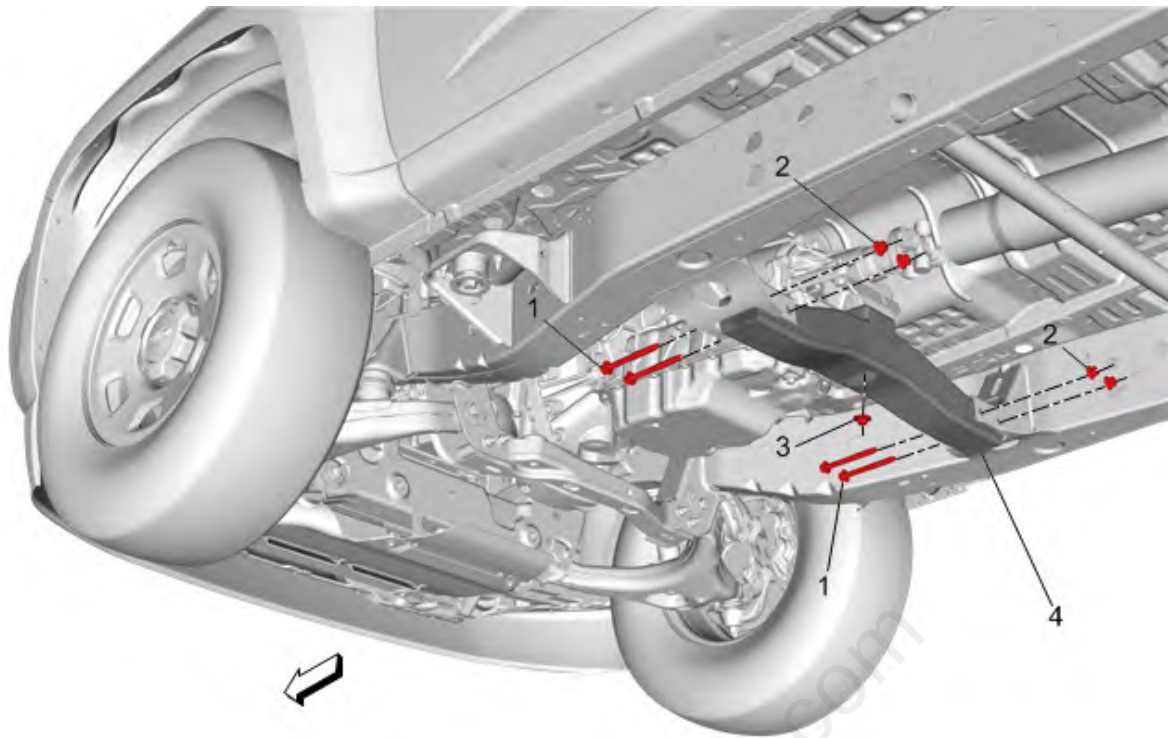


Fig. 29: Transmission Support Crossmember (2WD)
 Courtesy of GENERAL MOTORS COMPANY

7. Remove the transmission crossmember (2). Refer to [Transmission Support Crossmember Replacement \(4WD\)](#) [Transmission Support Crossmember Replacement \(2WD\)](#) .

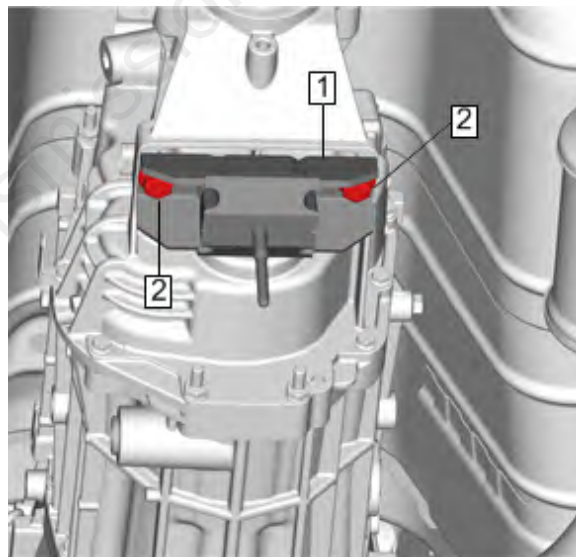


Fig. 30: Transmission Mount Bolts
 Courtesy of GENERAL MOTORS COMPANY

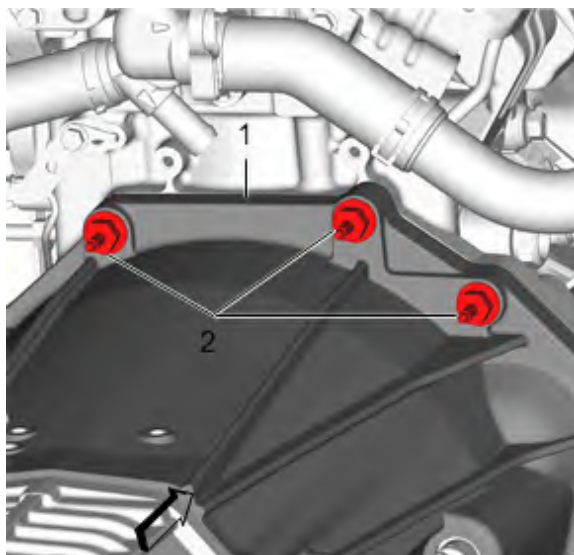
8. Remove the transmission mount (1). Refer to [Transmission Rear Mount Replacement](#).



Fig. 31: Retaining Clip And Cluth Actuator

Courtesy of GENERAL MOTORS COMPANY

9. Remove the retaining clip (2) from the clutch actuator (1).
10. Disconnect the rear actuator pipe (3) from the front clutch actuator (1).
11. Remove the transmission vent tube, if equipped. Refer to [Transmission Vent Tube Replacement](#).
12. Disconnect the transmission electrical connector as required.
13. Reposition the wire harnesses away from the transmission.
14. Remove the nuts and brackets securing the fuel and evaporative emission line bundle from the transmission. Refer to [Fuel Feed Pipe Replacement \(At Tank\)](#), [Fuel Feed Pipe Replacement \(At Engine\)](#) , and [Fuel Tank Filler Pipe Replacement](#) .
15. Place a drain pan under the vehicle.
16. Disconnect the fuel feed line and evaporative emission lines at the fuel tank area and cap the lines to prevent contamination and fuel loss.
17. Remove the upper retaining bracket for the fuel feed and evaporative emission lines.
18. Remove the air conditioning evaporator and blower module drain hose from the transmission clutch housing.
19. Lower the transmission to gain access to the top and sides of the transmission.



3 Upper Fasteners

Courtesy of GENERAL MOTORS COMPANY

20. Remove the 3 upper fasteners (2) securing the transmission to the engine.

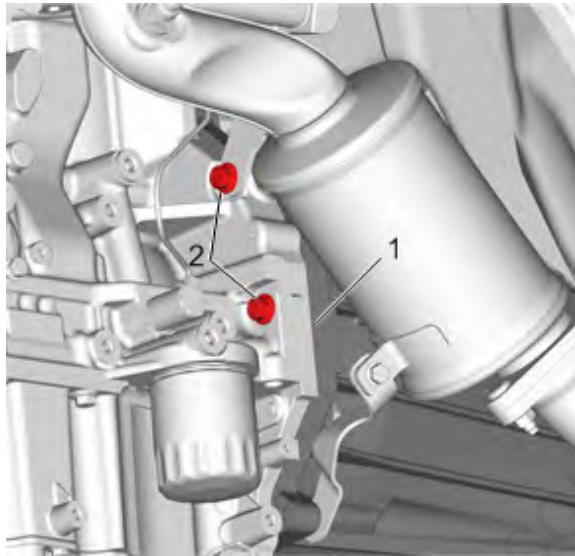


Fig. 33: 2 Lower Left Fasteners

Courtesy of GENERAL MOTORS COMPANY

21. Remove the 2 lower left fasteners (2) securing the transmission to the engine.

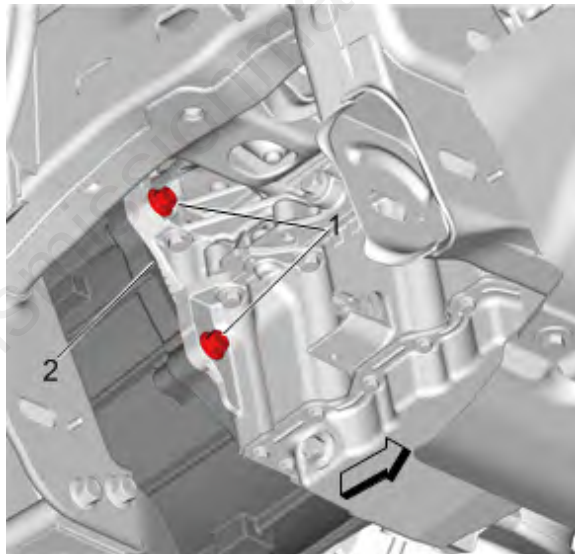


Fig. 34: 2 Lower Right Fasteners

Courtesy of GENERAL MOTORS COMPANY

22. Remove the 2 lower right fasteners (1) securing the transmission to the engine.

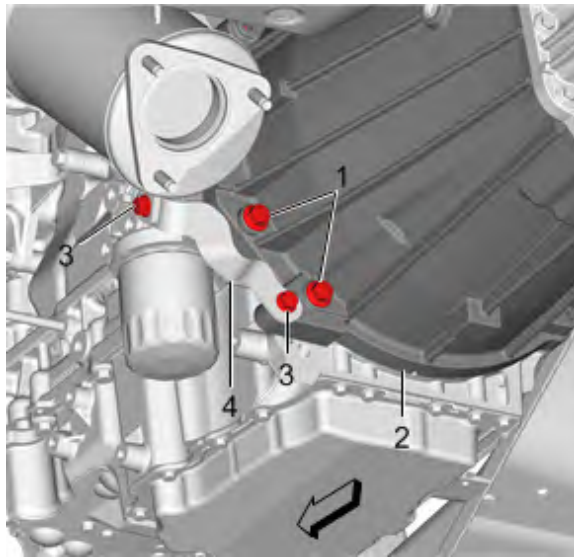


Fig. 35: Catalytic Converter Brace

Courtesy of GENERAL MOTORS COMPANY

23. Remove the catalytic converter brace (4) from the vehicle.
24. Lower the transmission enough to access the shift tower.
25. Reposition the foam block upward to access the shift tower fasteners.

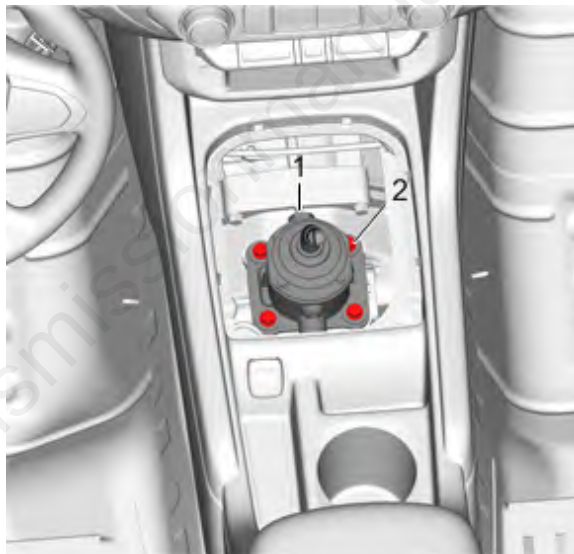


Fig. 36: Four Transmission Shift Tower

Courtesy of GENERAL MOTORS COMPANY

26. Remove the four transmission shift tower (2) fasteners, then the transmission shift tower (1) from the transmission.

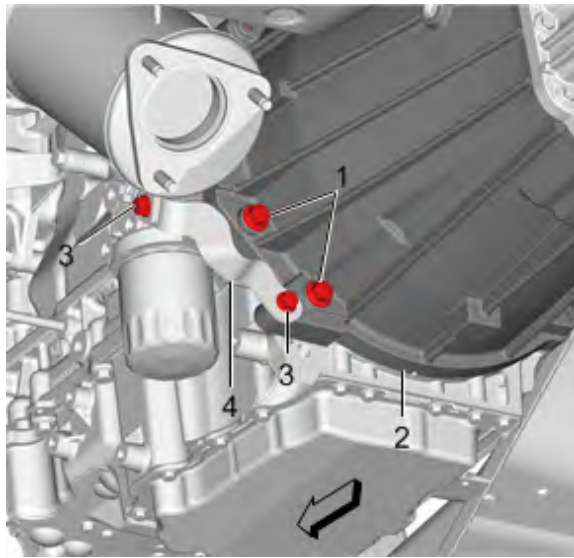


Fig. 37: Catalytic Converter Brace

Courtesy of GENERAL MOTORS COMPANY

27. Remove the 2 lower fasteners (1) securing the transmission to the engine.
28. Pull the transmission straight back.

Installation Procedure

WARNING: Use care when cleaning the clutch hub. The clutch hub may have sharp edges and can cause personal injury if contact is made. Wear protective gloves to avoid personal injury.

1. Clean the clutch hub and the input shaft from any debris and contaminants with a lint-free towel.

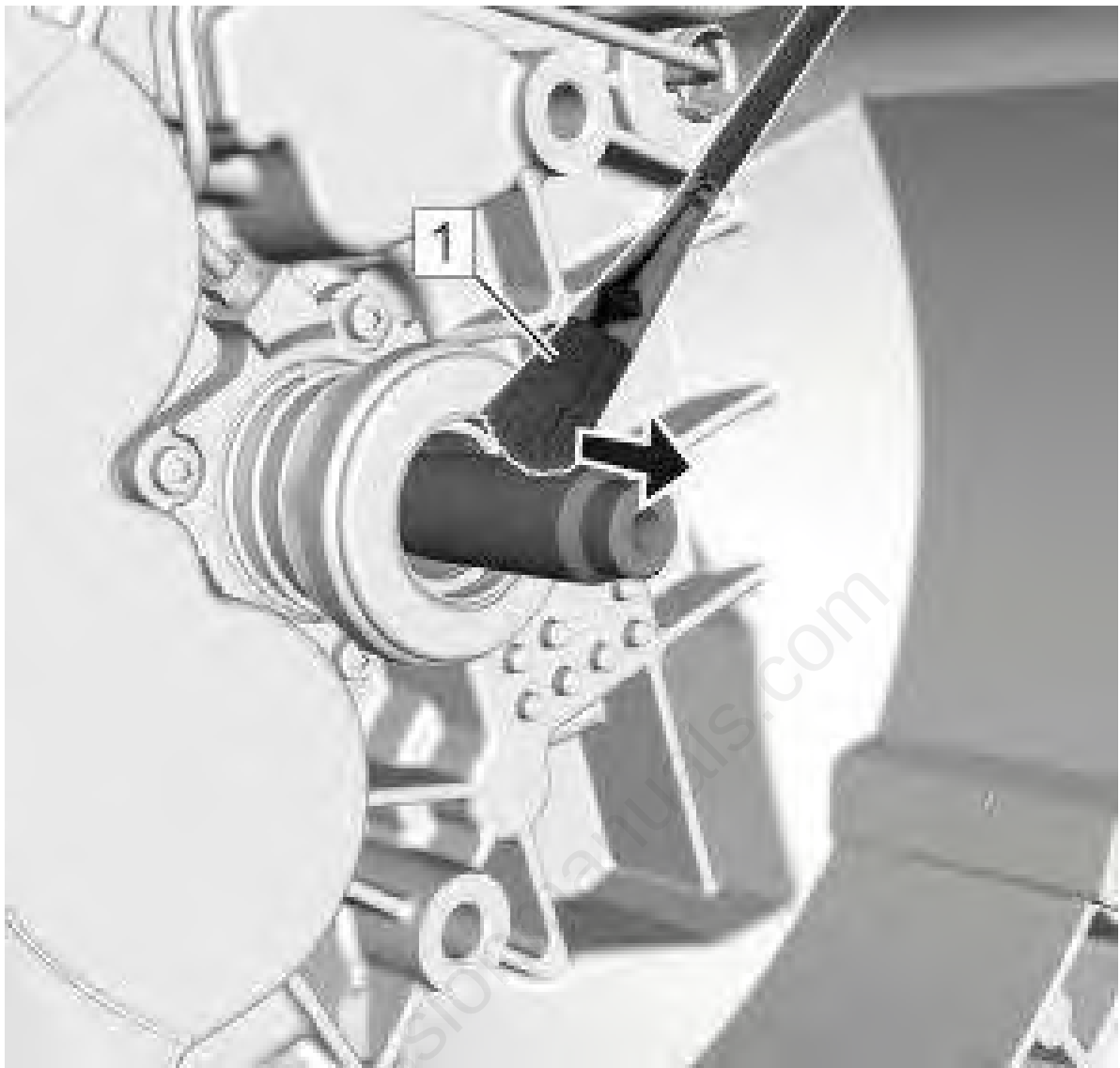


Fig. 38: Using Flat Brush To Apply Light Coating Of Multi-Purpose Grease
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Applying too much or the wrong type of grease on the transmission input shaft may cause damage, clutch slippage or failure. Always apply the correct type of grease. Never apply more grease than is necessary to coat the transmission input shaft with a very thin film of grease.

2. Use a clean flat brush (1) to apply very light coating of multi-purpose grease to input shaft until the metal is only shiny. No visible clumps of grease are permissible regardless of size. Smear away from the transmission in direction of the shown arrow.

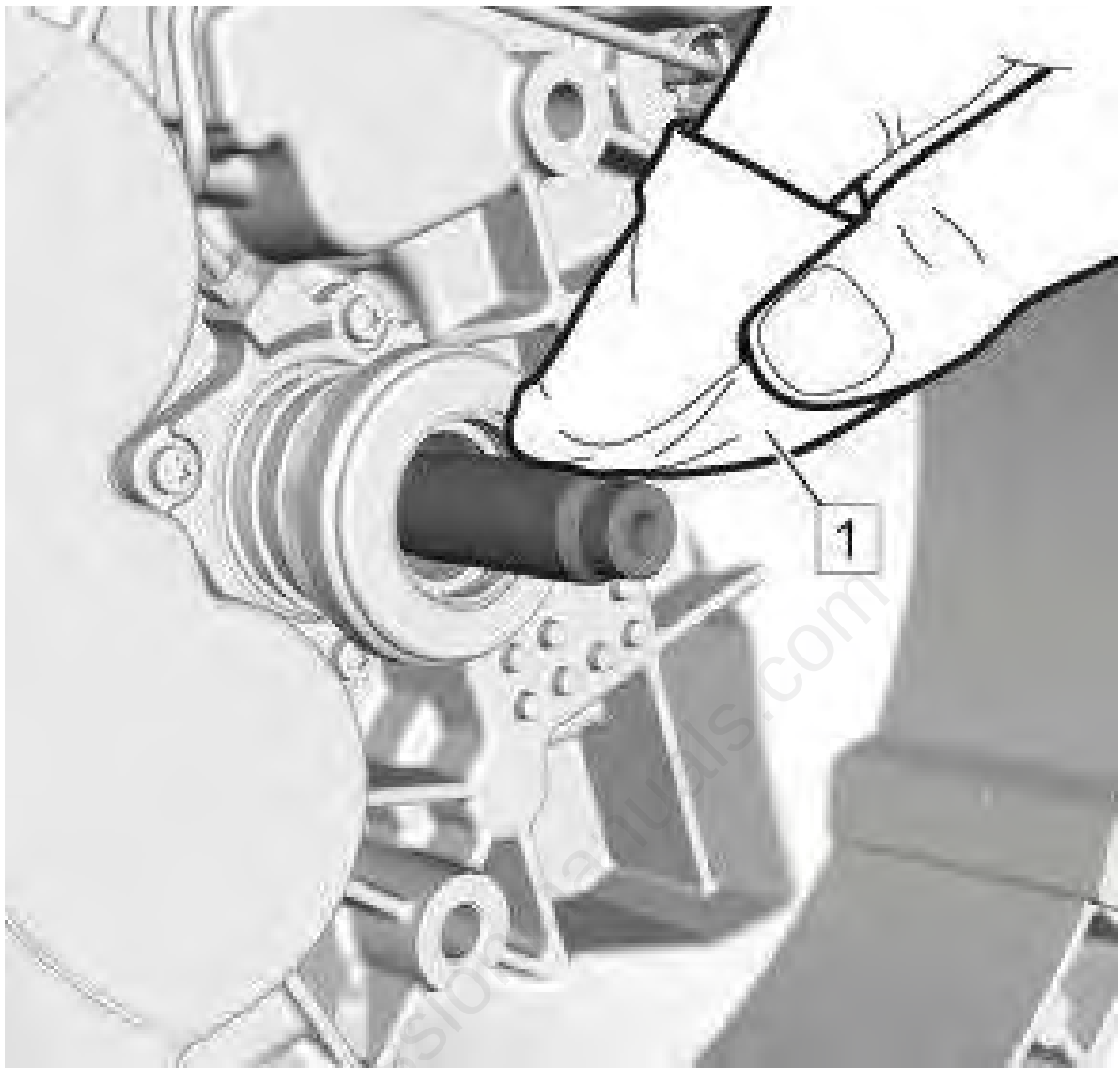


Fig. 39: Cleaning Lead Surface Of Input Shaft With Lint-Free Towel

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Ensure that no grease remains on the lead surface of the transmission input shaft. Clean the lead surface of the transmission input shaft prior to the assembly of the transmission to the engine. Failure to maintain a clean surface may cause clutch slippage or failure.

3. Clean the entire lead surface of the input shaft with a NEW, lint-free towel (1).
4. Raise the transmission into place.
5. Slide the transmission straight onto the locating pins.

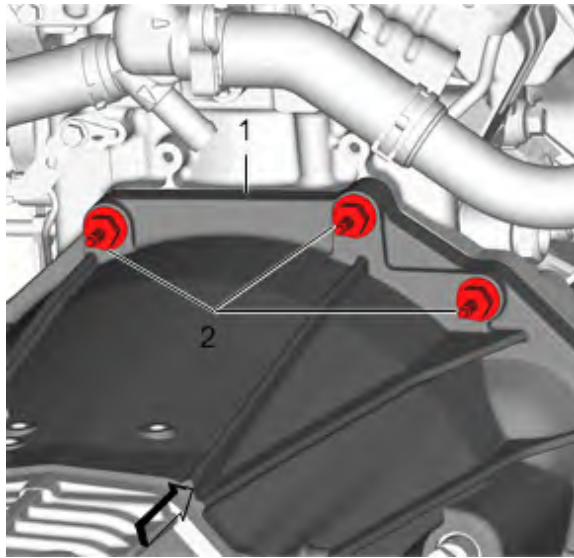


Fig. 40: 3 Upper Fasteners

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#) .

6. Install the 3 upper fasteners (2) securing the transmission to the engine and tighten to 50 N.m (37 lb ft).

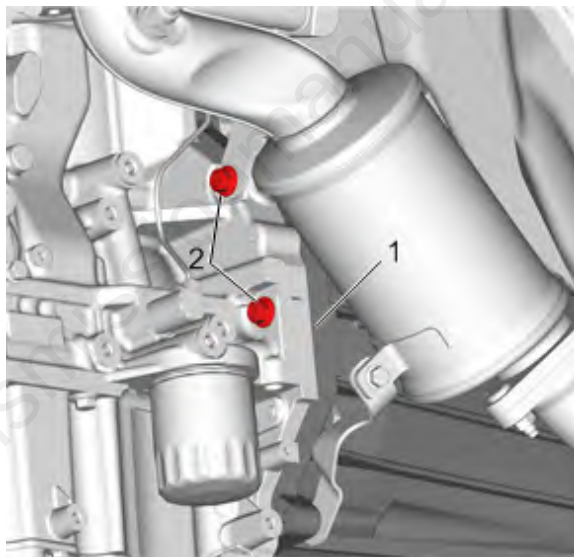


Fig. 41: 2 Lower Left Fasteners

Courtesy of GENERAL MOTORS COMPANY

7. Install the 2 lower left fasteners (2) securing the transmission to the engine and tighten to 50 N.m (37 lb ft).

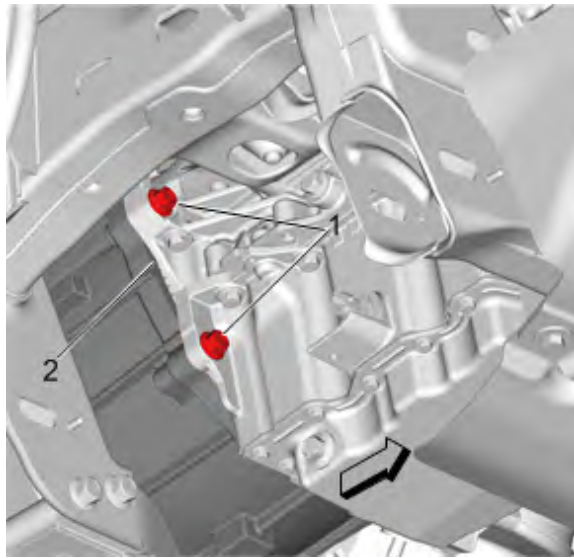


Fig. 42: 2 Lower Right Fasteners

Courtesy of GENERAL MOTORS COMPANY

8. Install the 2 lower right fasteners (1) securing the transmission to the engine and tighten to 50 N.m (37 lb ft).

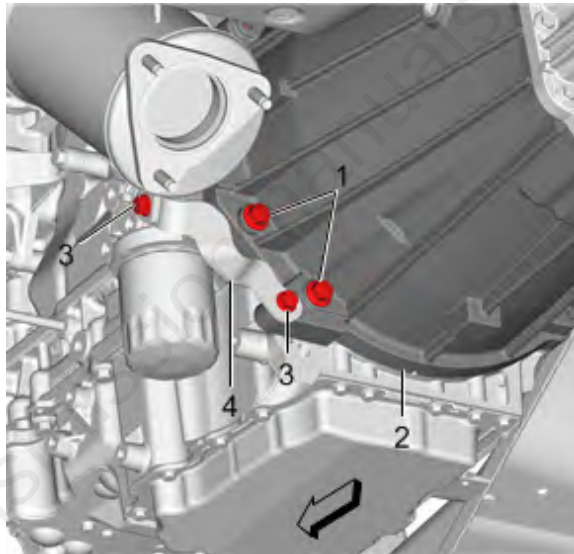


Fig. 43: Catalytic Converter Brace

Courtesy of GENERAL MOTORS COMPANY

9. Install the 2 lower fasteners (1) securing the transmission to the engine and tighten to 50 N.m (37 lb ft).
10. Install the catalytic converter brace (4) to the vehicle.
11. Install the catalytic converter brace fasteners (2) and tighten to 18 N.m (13 lb ft).

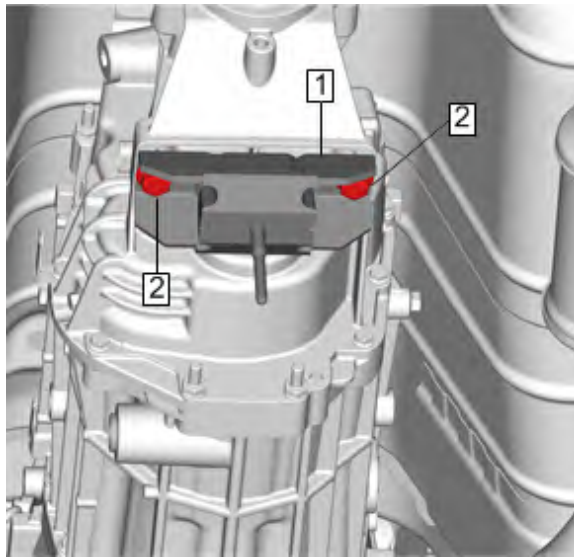


Fig. 44: Transmission Mount Bolts

Courtesy of GENERAL MOTORS COMPANY

12. Install the transmission mount (1). Refer to [Transmission Rear Mount Replacement](#).

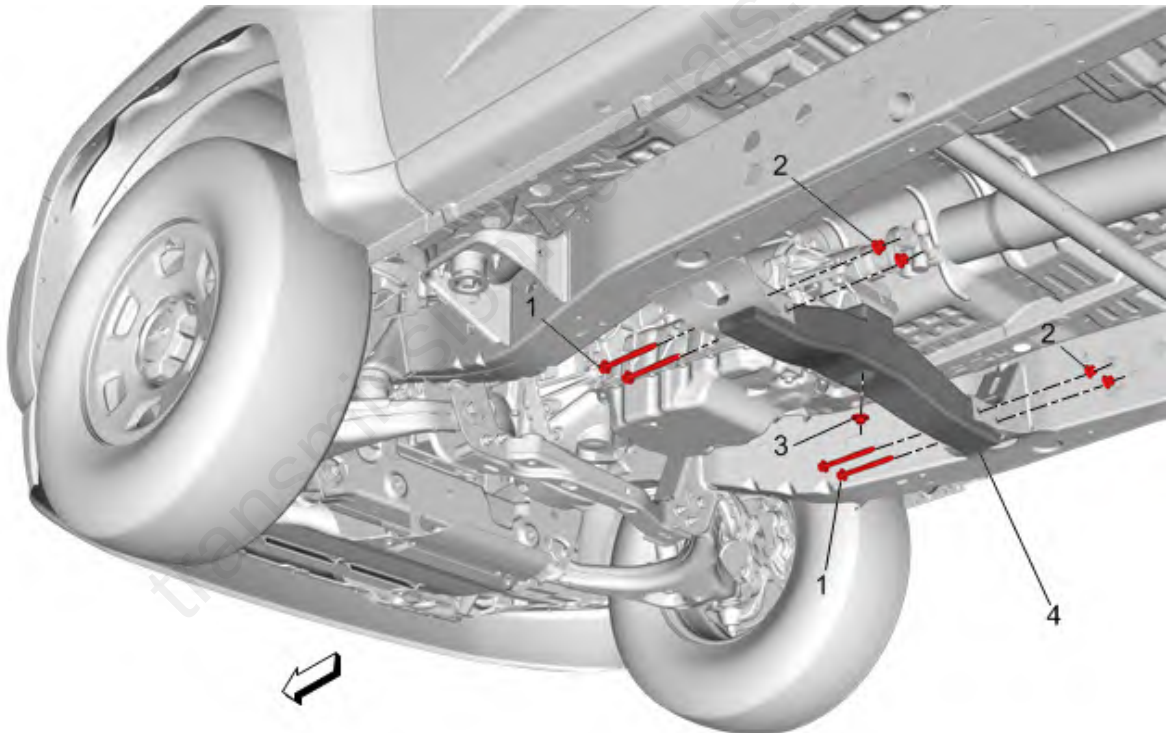


Fig. 45: Transmission Support Crossmember (2WD)

Courtesy of GENERAL MOTORS COMPANY

13. Install the transmission crossmember (2). Refer to [Transmission Support Crossmember Replacement \(4WD\)](#) [Transmission Support Crossmember Replacement \(2WD\)](#).
14. Install the air conditioning evaporator and blower module drain hose to the transmission clutch housing.
15. Install the wire harness to the transmission.
16. Install the upper retaining bracket for the fuel feed and evaporative emission lines.

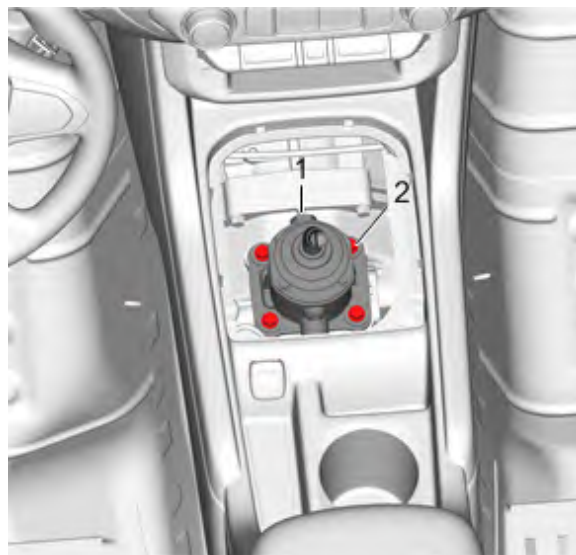
ie nuts and brackets securing the fuel and evaporative emission line bundle to the transmission. Refer to [Fuel Feed Pipe Replacement \(At Tank\)](#), [Fuel Feed Pipe Replacement \(At Engine\)](#), and [Fuel Tank Filler Pipe Replacement](#).

18. Connect the transmission electrical connectors to the transmission.



Fig. 46: Retaining Clip And Cluth Actuator
Courtesy of GENERAL MOTORS COMPANY

19. Connect the rear actuator pipe (3) to the front clutch actuator (1).
20. Install the retaining clip (2) to the clutch actuator (1).
21. Install the transmission vent tube, if equipped. Refer to [Transmission Vent Tube Replacement](#).
22. Remove the transmission jack.
23. On 4 wheel drive vehicles, install the transfer case. Refer to [Transfer Case Assembly Replacement](#), for the NQ7 or [Transfer Case Assembly Replacement](#) for the NQ6 transfer case.
24. On 2 wheel drive vehicles, install the propeller shaft. Refer to [Propeller Shaft Replacement \(with MYB\)](#) [Propeller Shaft Replacement \(with N8D\)](#).
25. Install the front exhaust pipe. Refer to [Exhaust Pipe Replacement \(LCV\)](#) [Exhaust Pipe Replacement](#).
26. Lower the vehicle.



27. Install the transmission shift tower (1) and fasteners (2) and tighten to 18 N.m (13 lb ft).
28. Install the foam block.
29. Install the transmission control lever. Refer to [Transmission Control Lever Replacement](#).
30. Connect the negative battery cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
31. Bleed the hydraulic clutch system. Refer to [Hydraulic Clutch System Bleeding](#).

REPAIR INSTRUCTIONS - OFF VEHICLE

TRANSMISSION DISASSEMBLE

Drain Fluids and Mount to Holding Fixture

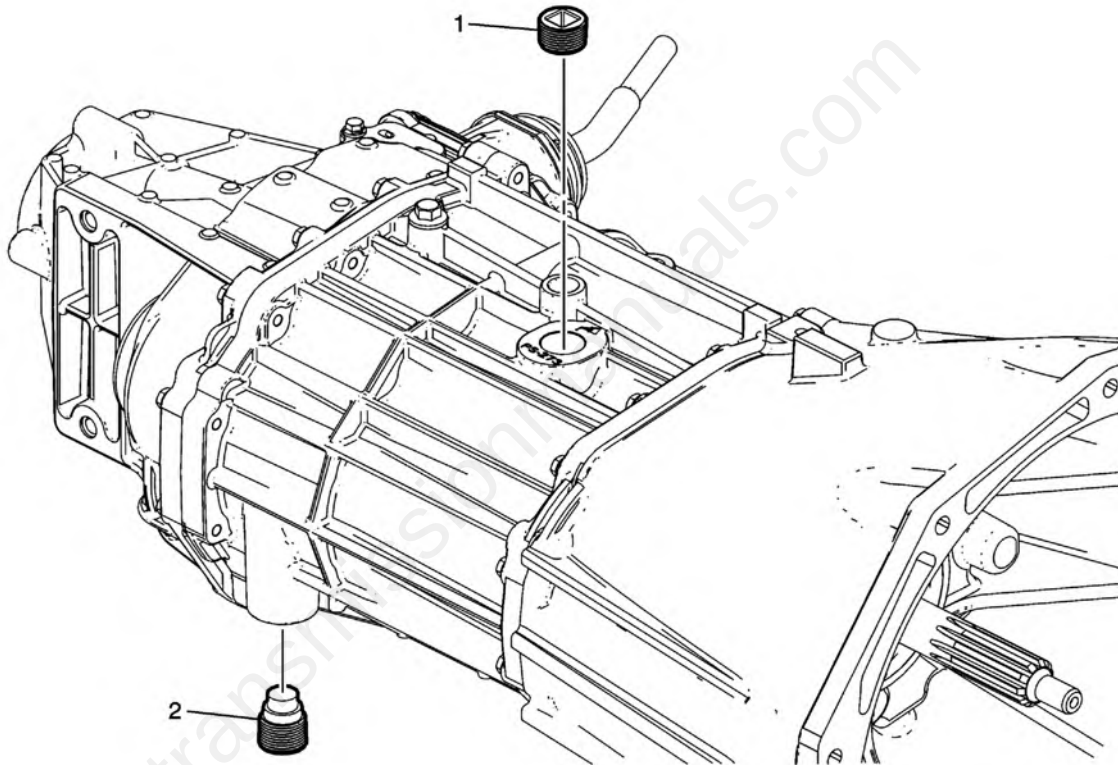


Fig. 48: Drain and Fill Plug

Courtesy of GENERAL MOTORS COMPANY

Drain Fluids and Mount to Holding Fixture

Callout	Component Name
1	Transmission Oil Fill Plug
2	Transmission Oil Drain Plug

Rear Case and Shift Control Lever Housing Assembly Removal

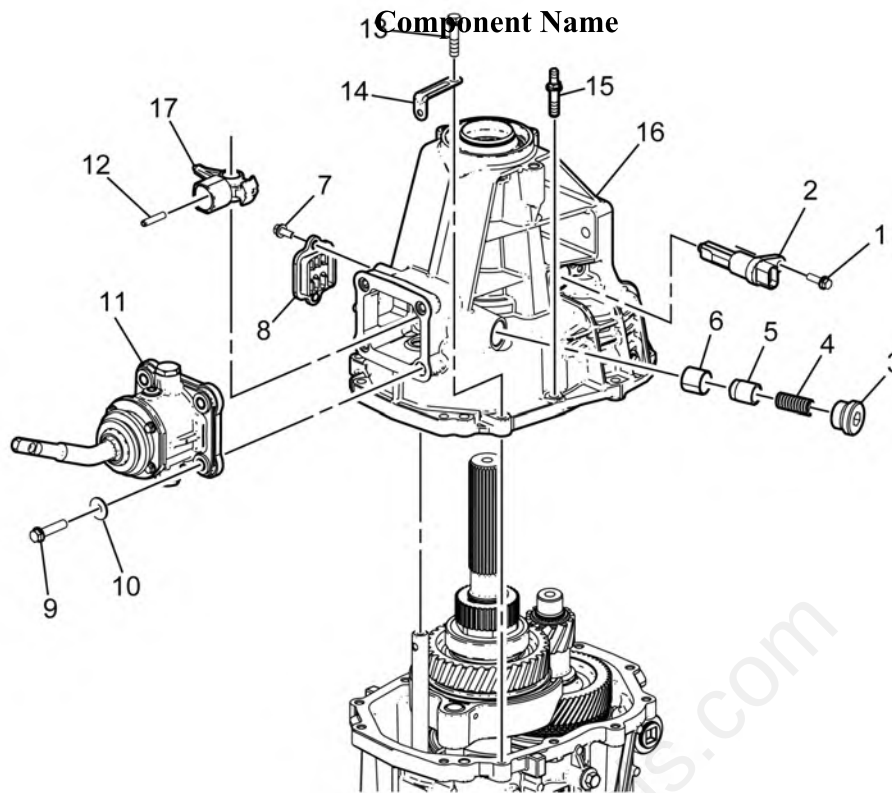


Fig. 49: Rear Case and Shift Control Lever Housing Assembly
 Courtesy of GENERAL MOTORS COMPANY

Rear Case and Shift Control Lever Housing Assembly Removal

Callout	Component Name
Preliminary Procedure Place shift control lever in 1st gear before you begin.	
1	Speed Sensor Bolt
2	Vehicle Speed Sensor
3	Shift Shaft Detent Plug
4	Shift Shaft Detent Spring
5	Shift Shaft Detent Cam
6	Shift Shaft Detent
7	Transmission Bolt/Screw (Qty: 2)
8	Shift Interlock Plate
9	M/Trans Control Lever Housing Bolt/Screw (Qty: 4)
10	M/Trans Control Lever Housing Washer (Qty: 4)
11	M/Trans Control Lever Housing
12	Shift Shaft Detent Pin
13	Transmission Case Bolt/Screw (Qty: 12)
14	Transmission Wiring Harness Bracket
15	Transmission Case Stud (Qty: 2)
16	Transmission Rear Case Assembly - 2WD NOTE: The reverse gear thrust bearing assembly may have been removed with the transmission rear case assembly.

Component Name	
17	Shift Shaft Detent Lever

Vehicle Speed Sensor Rotor and Reverse Gear Nut Removal

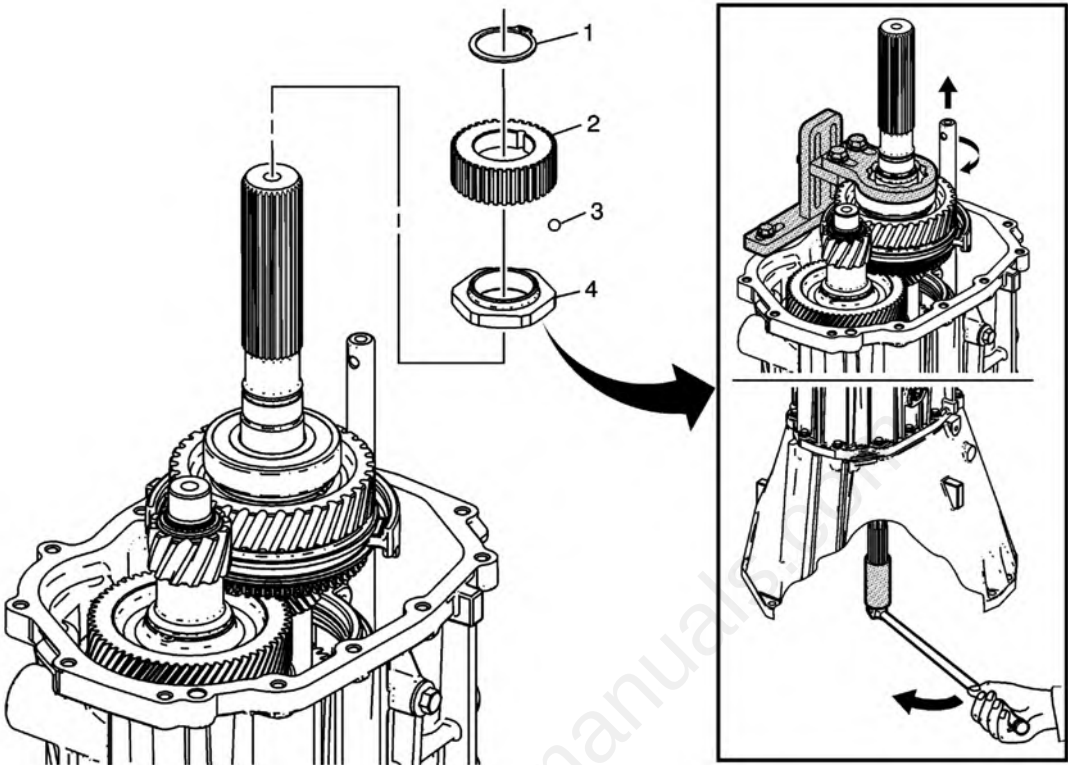


Fig. 50: Vehicle Speed Sensor Rotor and Reverse Gear Nut
Courtesy of GENERAL MOTORS COMPANY

Vehicle Speed Sensor Rotor and Reverse Gear Nut Removal

Callout	Component Name
1	Main Shaft Retaining Ring - Speed Sensor Rotor - 2WD
2	Vehicle Speed Sensor Rotor - 2WD
3	Speedometer Drive Gear Locating Ball
4	Reverse Gear Nut
	Procedure 1. Attach DT-51327 54 mm special wrench with adjustable base to the intermediate case. 2. Place the transmission in first gear by rotating the shift shaft clockwise and towards the rear of the transmission. 3. Using DT 50859 input shaft spline socket rotate the input shaft clockwise to loosen the reverse gear nut. Special Tools • DT-51327 54 mm Special Wrench with Adjustable Base • DT-50859 Input Shaft Spline Socket For equivalent regional tools, refer to Special Tools.

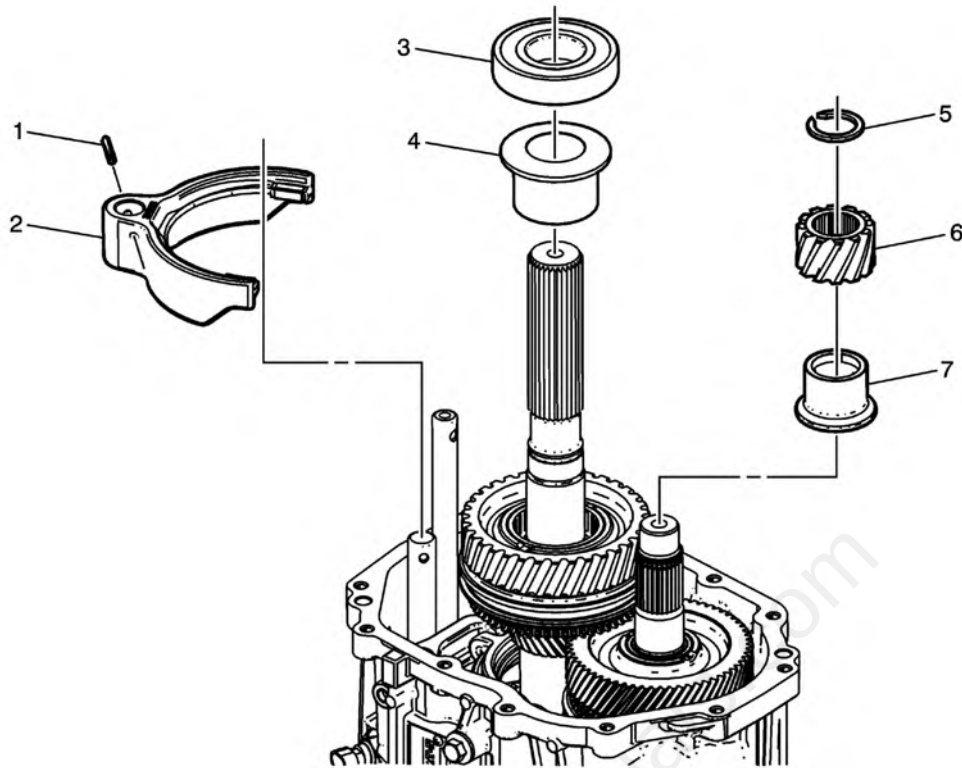


Fig. 51: Reverse Gear Assembly and Reverse Shift Fork Assembly

Courtesy of GENERAL MOTORS COMPANY

Reverse Gear Assembly and Reverse Shift Fork Assembly Removal

Callout	Component Name
1	Reverse Interlock Shift Detent Pin
2	Reverse Shift Fork
3	Reverse Gear Bearing
4	Reverse Gear Bearing Bushing
5	Input Shaft Bearing Retaining Ring
6	Reverse Gear Assembly
7	6th Gear Bearing Spacer

Reverse Gear Synchronizer Assembly Removal

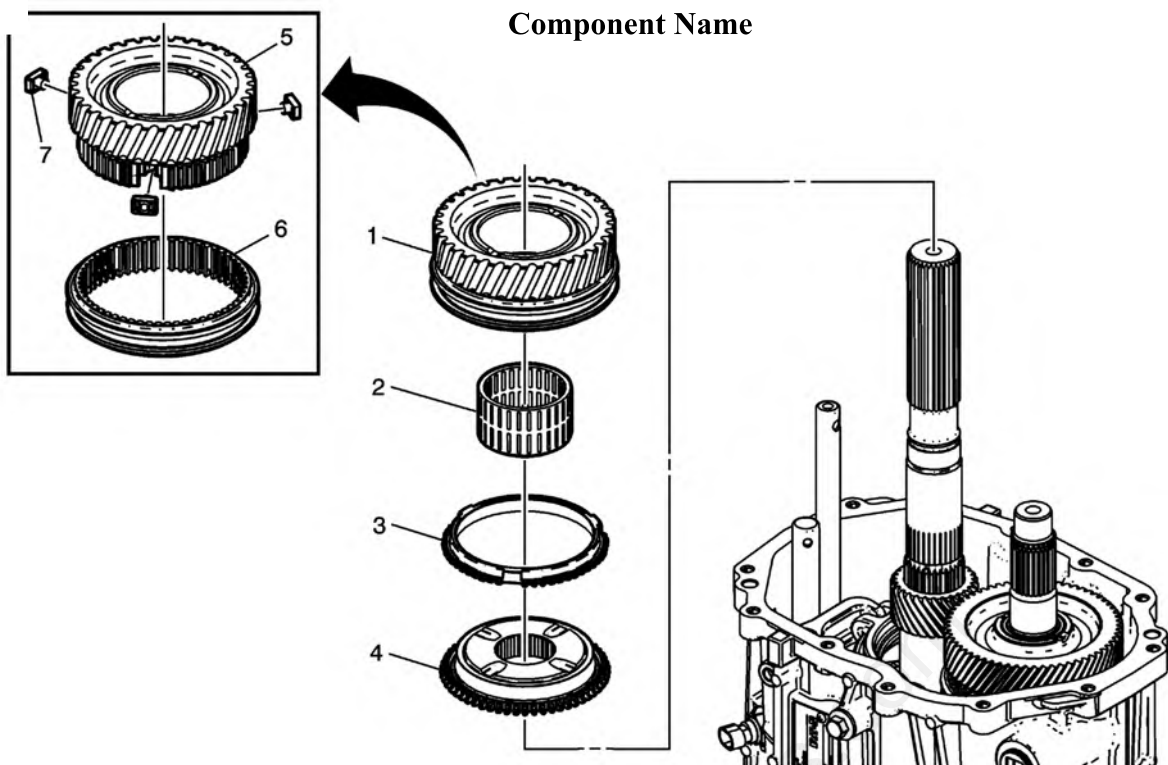


Fig. 52: Reverse Gear Synchronizer Assembly
 Courtesy of GENERAL MOTORS COMPANY

Reverse Gear Synchronizer Assembly Removal

Callout	Component Name
1	Reverse Gear Synchronizer
2	2nd Gear Bearing
3	Reverse Gear Blocking Ring
4	Reverse Gear Synchronizer Cone
5	Reverse Gear Synchronizer Hub
6	Reverse Gear Synchronizer Sleeve
7	Reverse Gear Synchronizer Insert (Qty: 3)

6th Gear and 6th Counter Gear Removal

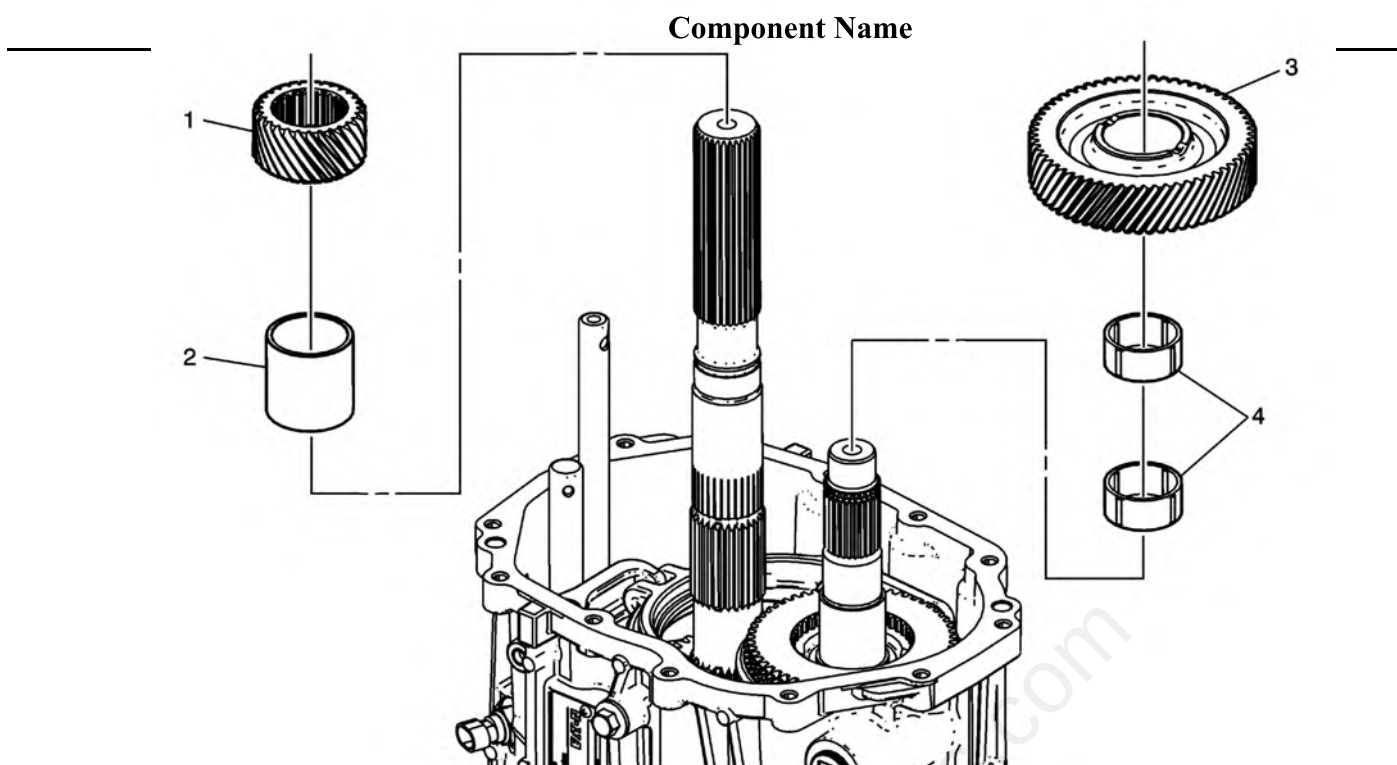


Fig. 53: 6th Gear and 6th Counter Gear

Courtesy of GENERAL MOTORS COMPANY

6th Gear and 6th Counter Gear Removal

Callout	Component Name
1	6th Gear
2	6th Gear Bushing
3	6th Counter Gear
4	6th Gear Bearing (Qty: 2)

5th and 6th Shift Fork Removal

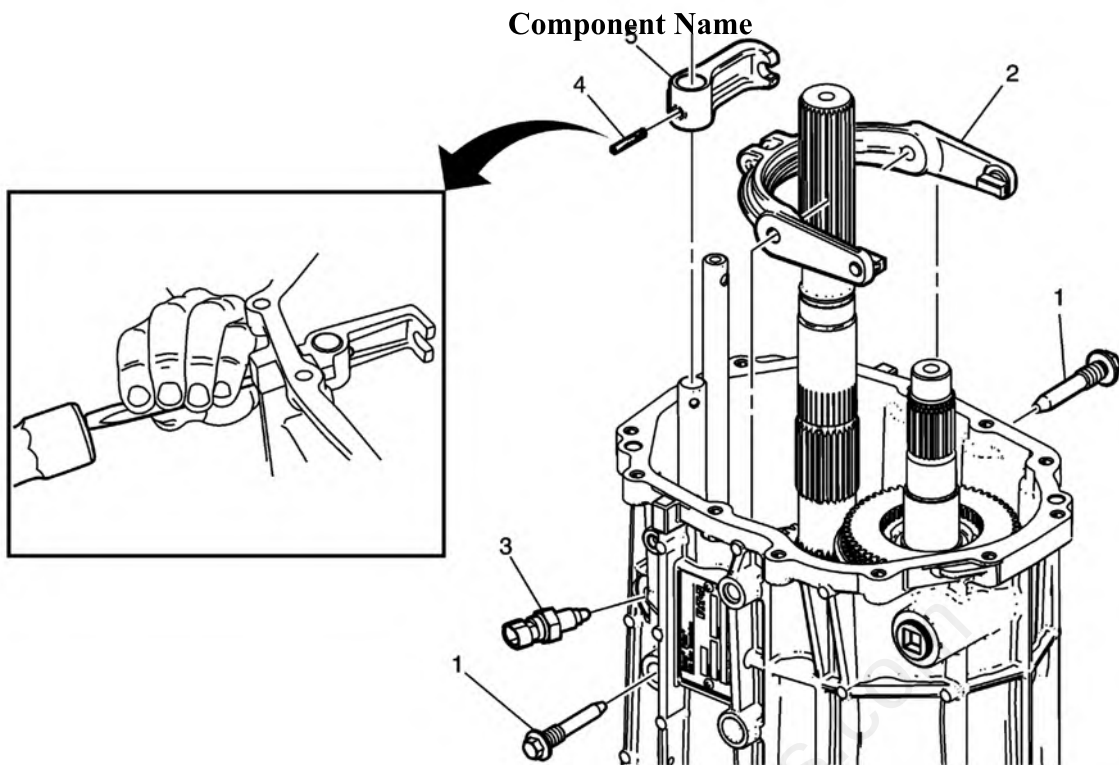


Fig. 54: 5th and 6th Shift Fork

Courtesy of GENERAL MOTORS COMPANY

5th and 6th Shift Fork Removal

Callout	Component Name
1	Shift Fork Bolt (Qty: 2)
2	5th and 6th Shift Fork Assembly
3	Park/Neutral Position and Backup Lamp Switch
4	Reverse Interlock Shift Detent Pin
5	5th and 6th Shift Lever

5th Gear and 5th Counter Gear Removal

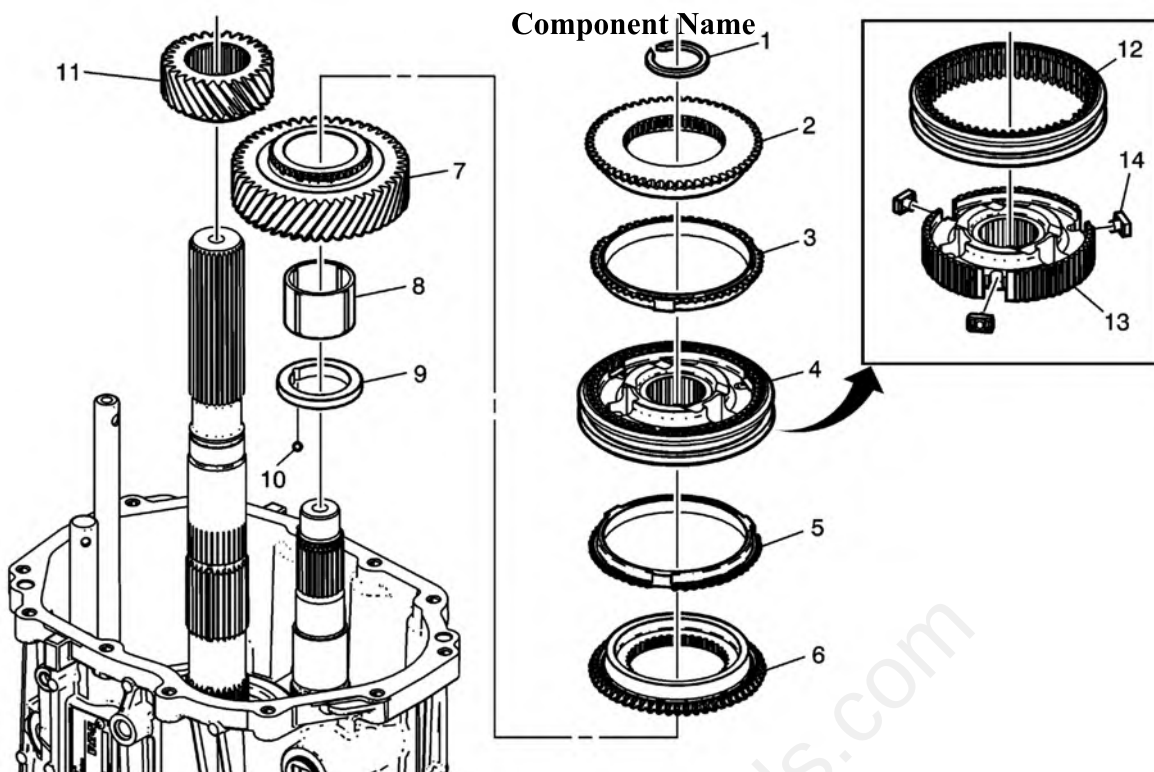


Fig. 55: 5th Gear and 5th Counter Gear
Courtesy of GENERAL MOTORS COMPANY

5th Gear and 5th Counter Gear Removal

Callout	Component Name
1	5th and 6th Gear Synchronizer Retaining Ring
2	6th Gear Synchronizer Cone
3	5th Gear Blocking Ring
4	5th and 6th Gear Synchronizer
5	5th Gear Blocking Ring
6	5th Gear Synchronizer Cone
7	5th Counter Gear
8	Counter Gear Bearing
9	Counter Gear Washer
10	5th Gear Thrust Washer Locating Ball
11	5th Gear
12	5th and 6th Gear Synchronizer Sleeve
13	5th and 6th Gear Synchronizer Hub
14	5th and 6th Gear Synchronizer Insert (Qty: 3)

Intermediate Case Removal

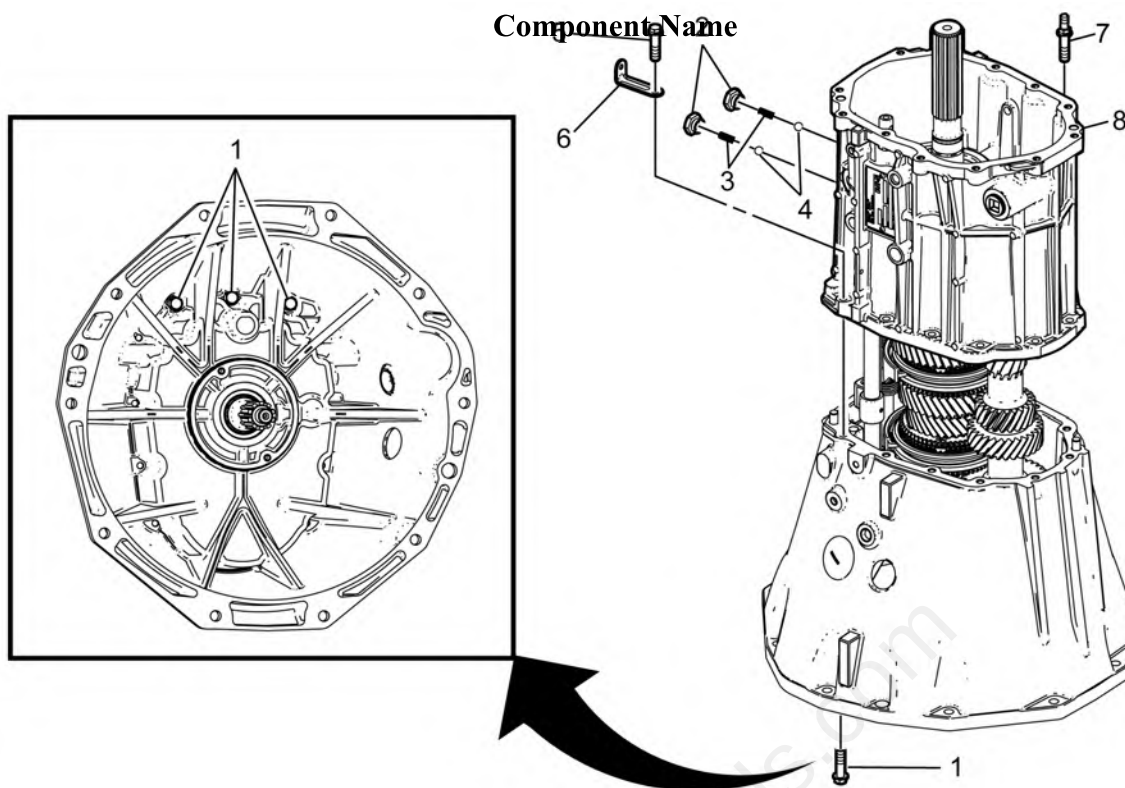


Fig. 56: Intermediate Case

Courtesy of GENERAL MOTORS COMPANY

Intermediate Case Removal

Callout	Component Name
1	Transmission Case Bolt/Screw (Qty: 3)
2	Shift Control Housing Plug (Qty: 2)
3	Shift Detent Ball Spring (Qty: 2)
4	Shift Shaft Detent Ball (Qty: 2)
5	Transmission Case Bolt/Screw (Qty: 8)
6	Transmission Wiring Harness Bracket
7	Transmission Case Stud (Qty: 2)
8	Transmission Intermediate Case

Shift Shafts and Forks Removal

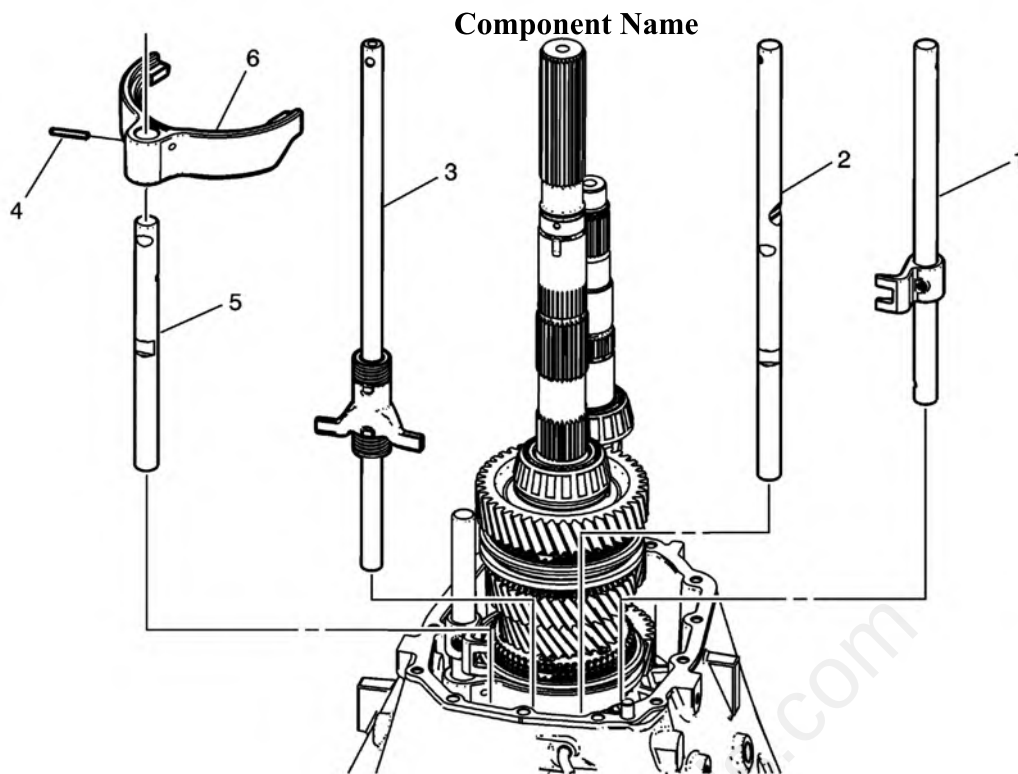


Fig. 57: Shift Shafts and Forks

Courtesy of GENERAL MOTORS COMPANY

Shift Shafts and Forks Removal

Callout	Component Name
1	5th and 6th Shift Shaft Assembly
2	Reverse Shift Shaft
3	Shift Shaft Assembly
4	Reverse Interlock Shift Detent Pin
5	1st and 2nd Shift Shaft
6	1st and 2nd Shift Fork Assembly

Main Shaft, Input Shaft and Counter Gear Shaft Removal

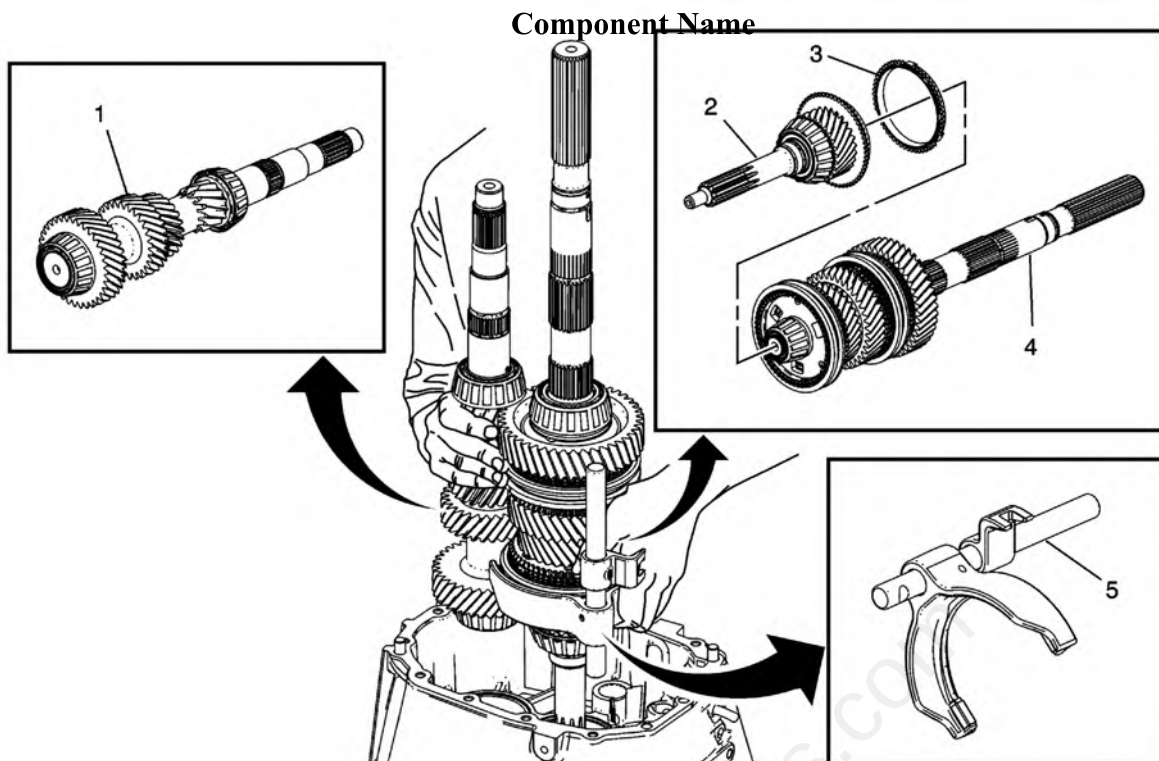


Fig. 58: Main Shaft, Input Shaft and Counter Gear Shaft

Courtesy of GENERAL MOTORS COMPANY

Main Shaft, Input Shaft and Counter Gear Shaft Removal

Callout	Component Name
Preliminary Procedure	
All the following components must be removed at the same time.	
1	Counter Gear Shaft Assembly
2	Input Shaft Assembly
3	4th Gear Blocking Ring Assembly
4	Main Shaft Assembly
5	3rd and 4th Shift Shaft and Fork Assembly
	NOTE: Be careful when removing the yoke bars. Interlock balls may drop into the bar bores. Keep close watch on the interlock balls when disassembling and assembling the transmission.

MAIN SHAFT DISASSEMBLE

Main Shaft Disassemble (1 of 2)

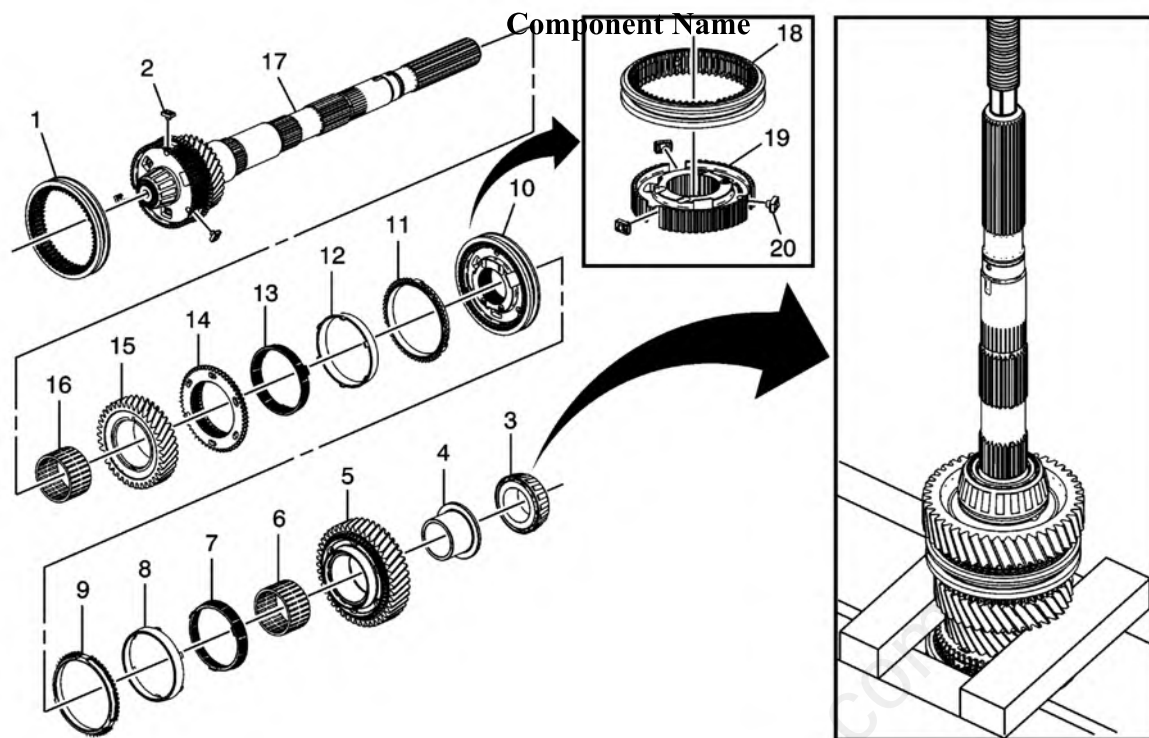


Fig. 59: Main Shaft Disassemble (1 of 2)

Courtesy of GENERAL MOTORS COMPANY

Main Shaft Disassemble (1 of 2)

Callout	Component Name
1	3rd and 4th Gear Synchronizer Sleeve NOTE: Inserts may come out with the sleeve.
2	3rd and 4th Gear Synchronizer Insert (Qty: 3)
3	Main Shaft Bearing Cone Assembly
4	1st Gear Bushing
5	1st Gear
6	2nd Gear Bearing Assembly
7	3rd Gear Inner Blocking Ring
8	3rd Gear Intermediate Blocking Ring
9	3rd Gear Outer Blocking Ring
10	1st and 2nd Gear Synchronizer Assembly NOTE: Try to keep the sleeve and hub together to avoid losing inserts.
11	3rd Gear Outer Blocking Ring
12	3rd Gear Intermediate Blocking Ring
13	3rd Gear Inner Blocking Ring
14	2nd Gear Synchronizer Cone
15	2nd Gear

Component Name	
16	2nd Gear Bearing Assembly
17	Main Shaft Assembly
18	1st and 2nd Gear Synchronizer Sleeve
19	1st and 2nd Gear Synchronizer Hub
20	1st and 2nd Gear Synchronizer Insert (Qty: 3)

Main Shaft Disassemble (2 of 2)

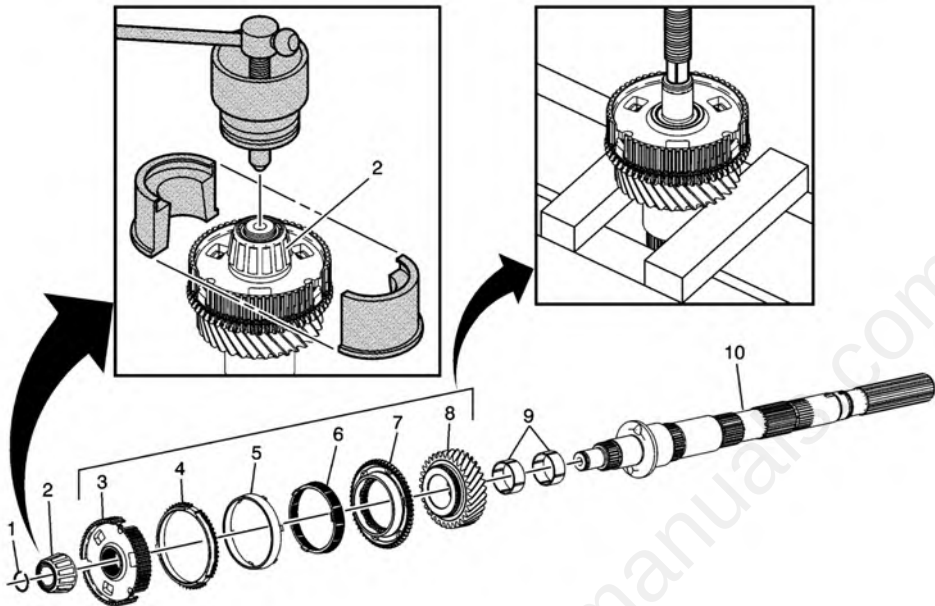


Fig. 60: Main Shaft Disassemble (2 of 2)
 Courtesy of GENERAL MOTORS COMPANY

Main Shaft Disassemble (2 of 2)

Callout	Component Name
1	3rd and 4th Gear Synchronizer Retaining Ring
2	Main Shaft Front Bearing Cone Assembly Special Tools • DT 19207148 Main Shaft Bearing Puller • DT 30207889 Puller - Main Shaft Conical Bearing For equivalent regional tools, refer to Special Tools .
3	3rd and 4th Gear Synchronizer Hub
4	3rd Gear Outer Blocking Ring
5	3rd Gear Intermediate Blocking Ring
6	3rd Gear Inner Blocking Ring
7	3rd Gear Synchronizer Cone
8	3rd Gear
9	3rd Gear Bearing Assembly (Qty: 2)

Component Name	
10	Main Shaft - 2WD NOTE: Use the same tools and procedure for the 4WD models.

INPUT SHAFT DISASSEMBLE

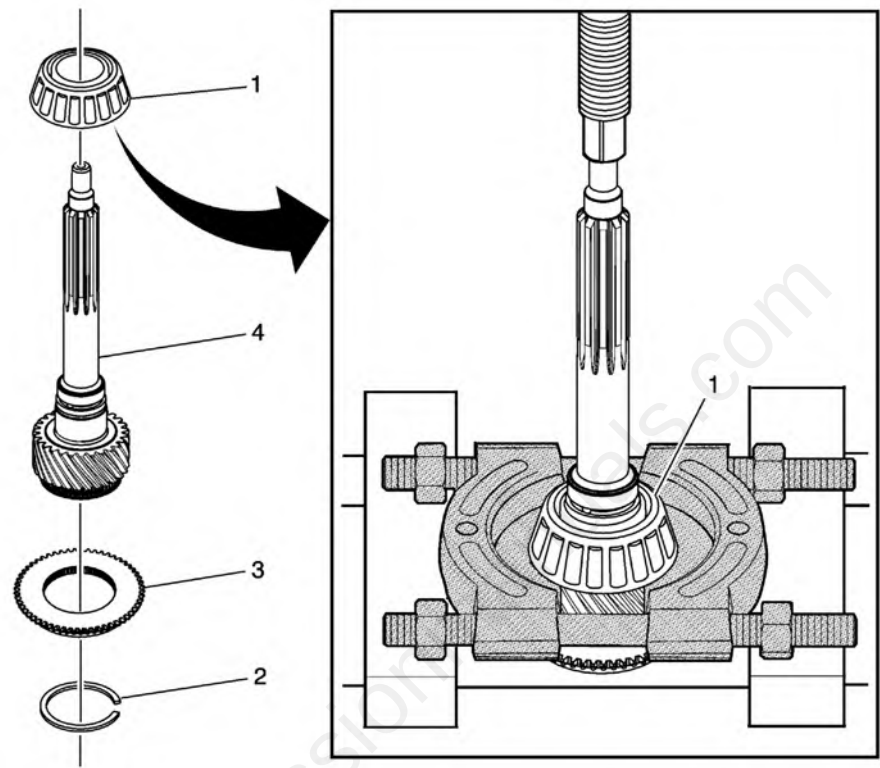


Fig. 61: Input Shaft Disassemble
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Input Shaft Bearing Cone Assembly Special Tools DT 22912-B Split Plate Bearing Puller For equivalent regional tools, refer to Special Tools.
2	3rd and 4th Gear Synchronizer Retaining Ring
3	4th Gear Synchronizer Cone
4	Input Shaft

COUNTER GEAR SHAFT DISASSEMBLE

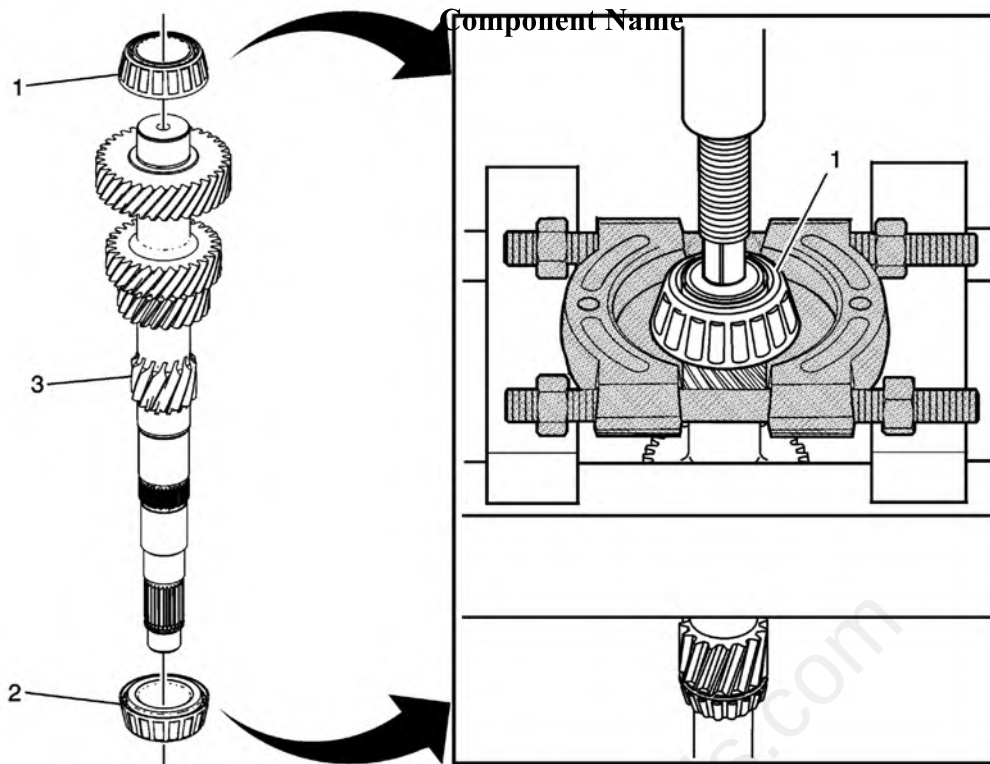


Fig. 62: Counter Gear Shaft Disassemble
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Counter Gear Bearing Cone Assembly Special Tools DT 22912-B Split Plate Bearing Puller For equivalent regional tools, refer to Special Tools.
2	Counter Gear Rear Bearing Cone Assembly Special Tools DT 22912-B Split Plate Bearing Puller For equivalent regional tools, refer to Special Tools.
3	Counter Gear Shaft

SYNCHRONIZERS DISASSEMBLE

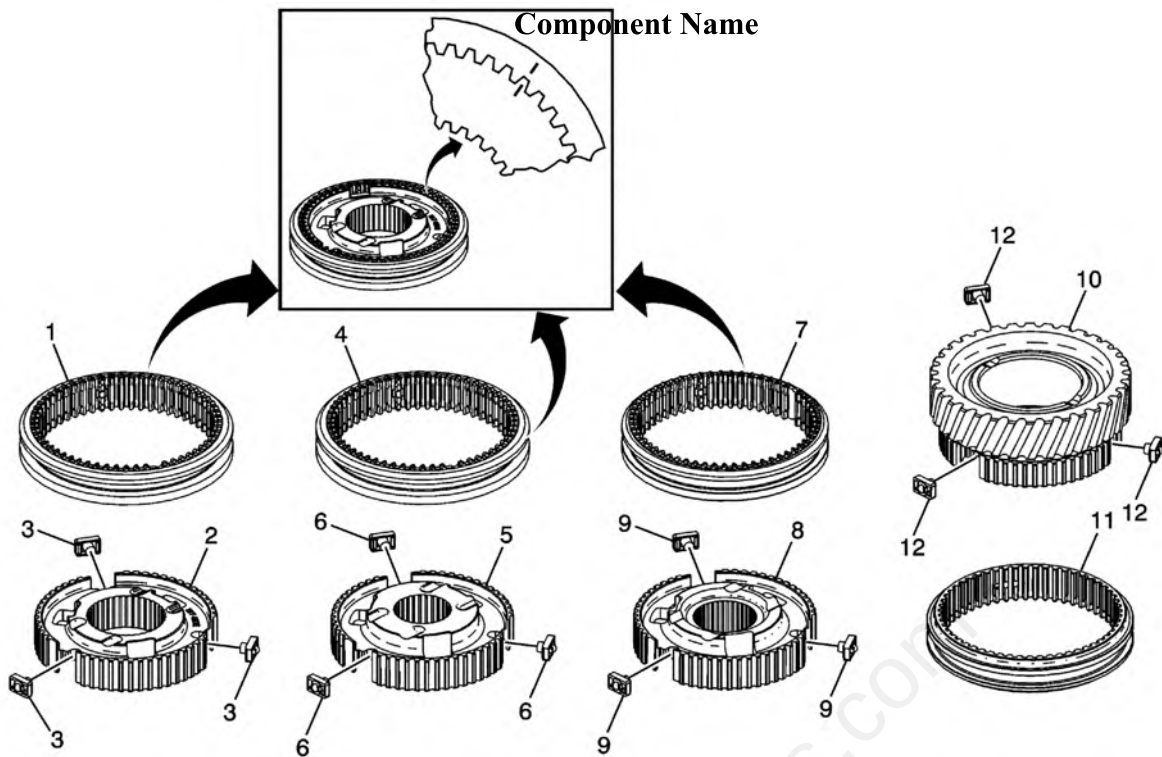


Fig. 63: Synchronizers Disassemble

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures	
1. Synchronizer components are not interchangeable. Keep all the synchronizer components separate. The synchronizer hubs and the sliding sleeves are a selected assembly. Keep the hubs and the sliding sleeves together as originally assembled. 2. Mark on the synchronizer hub and on the sleeve. This will help you to reinstall the parts in the same position. 3. If you are servicing this transmission for a shifting concern such as clash, hop out of gear, or block-out in a particular gear, the following hardware must be replaced as a set for the gear in question. Adjoining gears do not need to be serviced unless necessary: • Main gear in question - for example 1st, 2nd • Synchronizer Assembly • Blocker Ring Assembly • Shift Fork Inserts	
1	1st and 2nd Gear Synchronizer Sleeve
2	1st and 2nd Gear Synchronizer Hub
3	1st and 2nd Gear Synchronizer Insert (Qty: 3)
4	3rd and 4th Gear Synchronizer Sleeve
5	3rd and 4th Gear Synchronizer Hub
6	3rd and 4th Gear Synchronizer Insert (Qty: 3)
7	5th and 6th Gear Synchronizer Sleeve
8	5th and 6th Gear Synchronizer Hub
9	5th and 6th Gear Synchronizer Insert Assembly (Qty: 3)

Preliminary Procedures

1. When you service the synchronizers, retain them in the order that they are removed. Mark the parts to ensure the correct position for inspection and assembly.
2. Clean all the synchronizer parts in a suitable solvent. Air dry all the synchronizer parts.
3. Inspect the synchronizer parts for the following conditions:
 - Burrs
 - Cracks
 - Hicks
 - Chamfer for excessive wear
 - Free movement for the clutching sleeves on their hubs
 - Worn or damaged clutch teeth
 - Distorted teeth
 - Warping
 - Worn grooves
 - Wear on external splines
4. When repairing synchronizer assemblies, do not replace a single part only. Always replace the assembly. If it would be necessary to replace one synchronizer ring, always replace the synchronizer ring set.
5. Correct the cause, such as, but not limited to the following conditions:
 - Engine related vibrations
 - Driving at a low speed in a high gear
 - Defective vibration damper or crankshaft

1	2nd Gear Synchronizer Cone
2	3rd Gear Inner Blocking Ring (Qty: 2)
3	3rd Gear Intermediate Blocking Ring (Qty: 2)
4	3rd Gear Outer Blocking Ring (Qty: 2)
5	1st and 2nd Gear Synchronizer Insert (Qty: 3)
6	1st and 2nd Gear Synchronizer Hub
7	1st and 2nd Gear Synchronizer Sleeve
8	1st Gear (1st Gear Synchronizer Cone)

3rd and 4th Gear Synchronizer Components

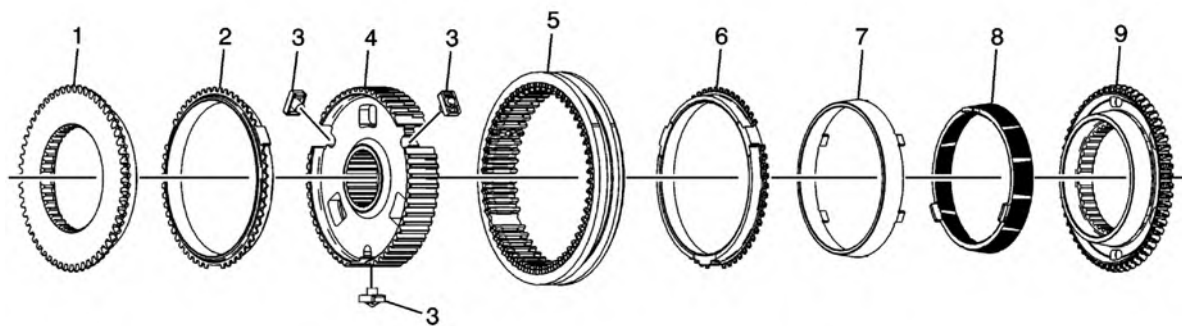


Fig. 65: 3rd and 4th Gear Synchronizer Components
Courtesy of GENERAL MOTORS COMPANY

3rd and 4th Gear Synchronizer Components

Callout	Component Name

Preliminary Procedures

1. When you service the synchronizers, retain them in the order that they are removed. Mark the parts to ensure the correct position for inspection and assembly.
2. Clean all the synchronizer parts in a suitable solvent. Air dry all the synchronizer parts.
3. Inspect the synchronizer parts for the following conditions:
 - Burrs
 - Cracks
 - Hicks
 - Chamfer for excessive wear
 - Free movement for the clutching sleeves on their hubs
 - Worn or damaged clutch teeth
 - Distorted teeth
 - Warping
 - Worn grooves
 - Wear on external splines
4. When repairing synchronizer assemblies, do not replace a single part only. Always replace the assembly. If it would be necessary to replace one synchronizer ring, always replace the synchronizer ring set.
5. Correct the cause, such as, but not limited to the following conditions:
 - Engine related vibrations
 - Driving at a low speed in a high gear
 - Defective vibration damper or crankshaft

1	4th Gear Synchronizer Cone
2	4th Gear Blocking Ring Assembly
3	3rd and 4th Gear Synchronizer Insert (Qty: 3)
4	3rd and 4th Gear Synchronizer Hub
5	3rd and 4th Gear Synchronizer Sleeve
6	3rd Gear Outer Blocking Ring
7	3rd Gear Intermediate Blocking Ring
8	3rd Gear Inner Blocking Ring
9	3rd Gear Synchronizer Cone

5th and 6th Gear Synchronizer Components

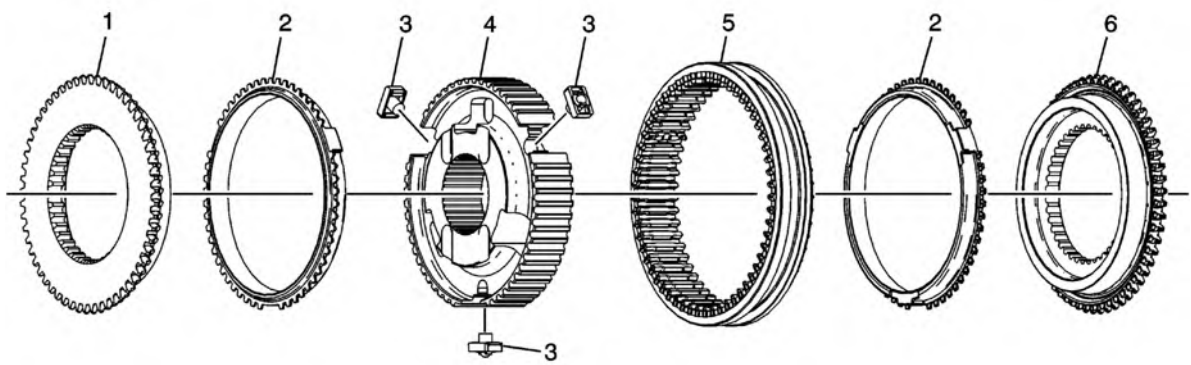


Fig. 66: 5th and 6th Gear Synchronizer Components
Courtesy of GENERAL MOTORS COMPANY

5th and 6th Gear Synchronizer Components

Callout	Component Name

Preliminary Procedures

1. When you service the synchronizers, retain them in the order that they are removed. Mark the parts to ensure the correct position for inspection and assembly.
2. Clean all the synchronizer parts in a suitable solvent. Air dry all the synchronizer parts.
3. Inspect the synchronizer parts for the following conditions:
 - Burrs
 - Cracks
 - Hicks
 - Chamfer for excessive wear
 - Free movement for the clutching sleeves on their hubs
 - Worn or damaged clutch teeth
 - Distorted teeth
 - Warping
 - Worn grooves
 - Wear on external splines
4. When repairing synchronizer assemblies, do not replace a single part only. Always replace the assembly. If it would be necessary to replace one synchronizer ring, always replace the synchronizer ring set.
5. Correct the cause, such as, but not limited to the following conditions:
 - Engine related vibrations
 - Driving at a low speed in a high gear
 - Defective vibration damper or crankshaft

1	5th Gear Synchronizer Cone
2	5th Gear Blocking Ring Assembly (Qty: 2)
3	5th and 6th Gear Synchronizer Insert Assembly (Qty: 3)
4	5th and 6th Gear Synchronizer Hub
5	5th and 6th Gear Synchronizer Sleeve
6	6th Gear Synchronizer Cone

Reverse Gear Synchronizer Components

Preliminary Procedures

1. When you service the synchronizers, retain them in the order that they are removed. Mark the parts to ensure the correct position for inspection and assembly.
2. Clean all the synchronizer parts in a suitable solvent. Air dry all the synchronizer parts.
3. Inspect the synchronizer parts for the following conditions:
 - Burrs
 - Cracks
 - Hicks
 - Chamfer for excessive wear
 - Free movement for the clutching sleeves on their hubs
 - Worn or damaged clutch teeth
 - Distorted teeth
 - Warping
 - Worn grooves
 - Wear on external splines
4. When repairing synchronizer assemblies, do not replace a single part only. Always replace the assembly. If it would be necessary to replace one synchronizer ring, always replace the synchronizer ring set.
5. Correct the cause, such as, but not limited to the following conditions:
 - Engine related vibrations
 - Driving at a low speed in a high gear
 - Defective vibration damper or crankshaft

1	Reverse Gear Synchronizer Cone
2	Reverse Gear Blocking Ring Assembly
3	Reverse Gear Synchronizer Sleeve
4	Reverse Gear Synchronizer Insert Assembly (Qty: 3)
5	Reverse Gear Synchronizer Hub Assembly

SYNCHRONIZERS ASSEMBLE

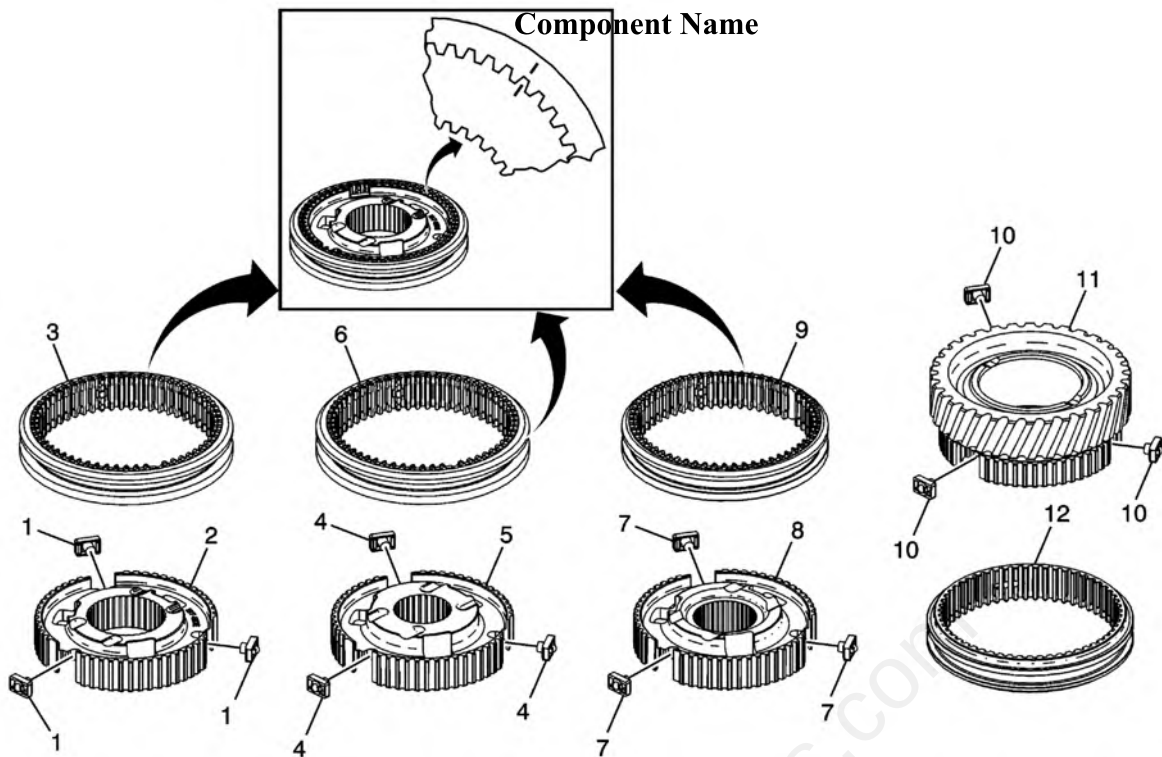


Fig. 68: Synchronizers Assemble

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Synchronizer components are not interchangeable. Keep all the synchronizer components separate. The synchronizer hubs and the sliding sleeves are a selected assembly. Keep the hubs and the sliding sleeves together as originally assembled. 2. Match up the marks on the synchronizer hub and on the sleeve. This will help you to reinstall the parts in the same position. 3. When repairing synchronizer assemblies, do not replace a single part only. Always replace the assembly. If it would be necessary to replace one synchronizer ring, always replace the synchronizer ring set. 4. Grooves on the inside splines of sleeves should match the grooves for the inserts on the hubs.	
1	1st and 2nd Gear Synchronizer Insert (Qty: 3)
2	1st and 2nd Gear Synchronizer Hub NOTE: Hub should be facing up as shown above.
3	1st and 2nd Gear Synchronizer Sleeve NOTE: Assemble with chamfer side up.
4	3rd and 4th Gear Synchronizer Insert (Qty: 3)

Component Name	
5	3rd and 4th Gear Synchronizer Hub NOTE: Hub should be facing up as shown above.
6	3rd and 4th Gear Synchronizer Sleeve NOTE: Assemble with chamfer side up.
7	5th and 6th Gear Synchronizer Insert Assembly (Qty: 3)
8	5th and 6th Gear Synchronizer Hub NOTE: Hub should be facing up as shown above.
9	5th and 6th Gear Synchronizer Sleeve NOTE: Assemble with chamfer side up.
10	Reverse Gear Synchronizer Insert Assembly (Qty: 3)
11	Reverse Gear Synchronizer Hub Assembly NOTE: Hub should be facing up as shown above.
12	Reverse Gear Synchronizer Sleeve NOTE: Assemble with chamfer side up.

COUNTER GEAR SHAFT ASSEMBLE

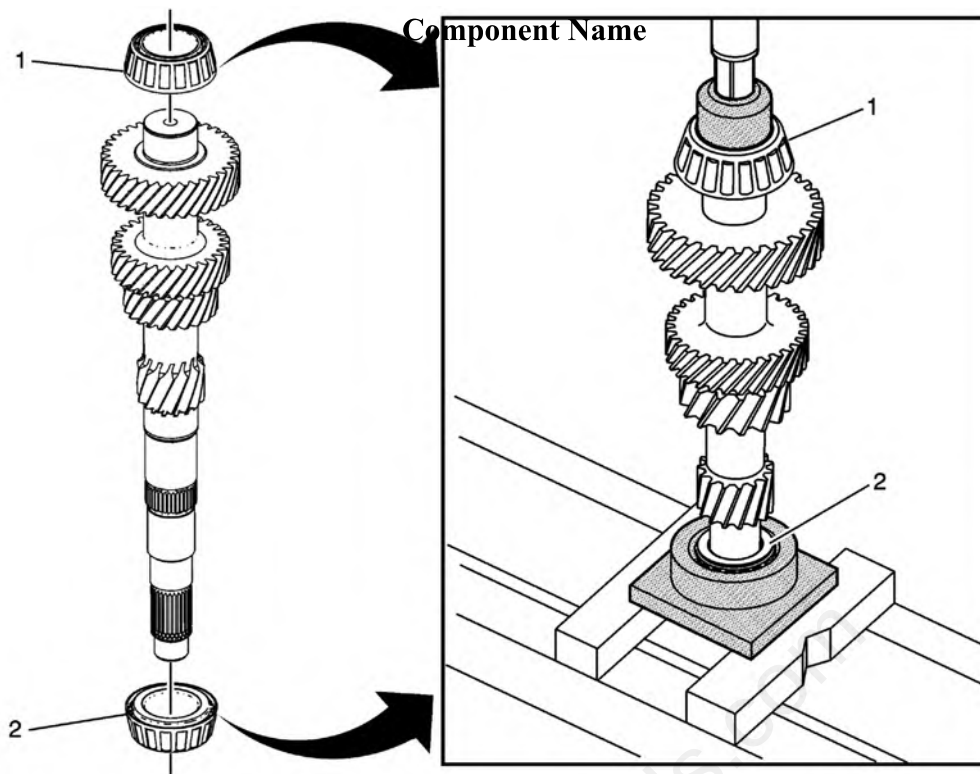


Fig. 69: Counter Gear Shaft Assemble

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Counter Gear Bearing Cone Assembly Procedure 1. Using DT 50857 countershaft bearing cone installer, place the counter gear shaft in the press, using the inner races of those two bearings as a base. 2. Press both bearings until they rest against the shaft stops. Special Tools DT 50857 Countershaft Bearing Cone Installer For equivalent regional tools, refer to Special Tools.
2	Counter Gear Rear Bearing Cone Assembly

INPUT SHAFT ASSEMBLE

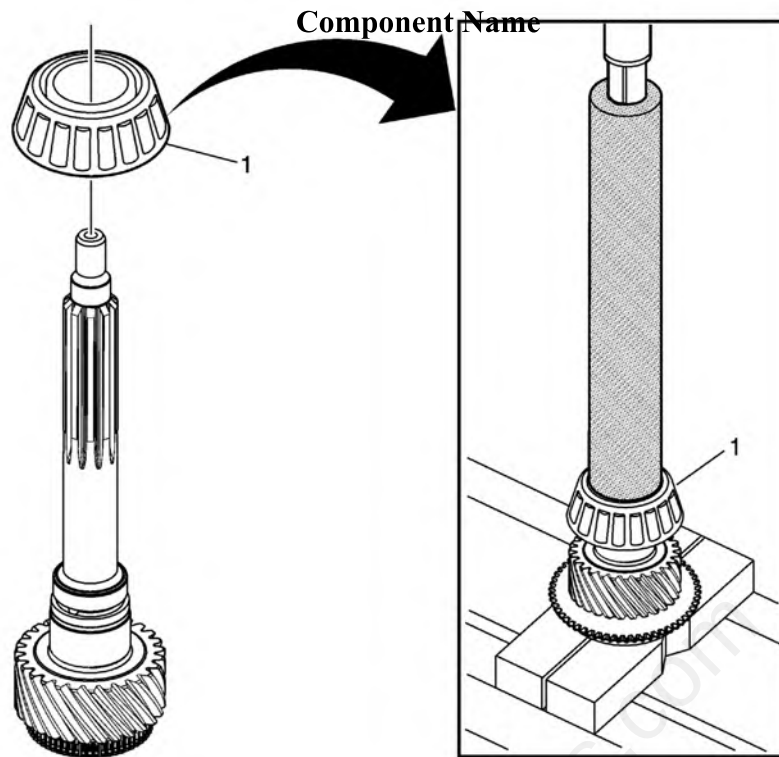


Fig. 70: Input Shaft Assemble

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Input Shaft Bearing Cone Assembly Procedure 1. With the synchronizer side down, place the input shaft on a base. Be careful not to damage the synchronizer cone. 2. Using the bearing inner race as a base, press the bearing assembly using DT 50861 bearing cone installer, until the race shoulder rests against the shaft face. Special Tools DT 50861 Bearing Cone Installer For equivalent regional tools, refer to Special Tools.

MAIN SHAFT ASSEMBLE

1st and 2nd Gear Installation

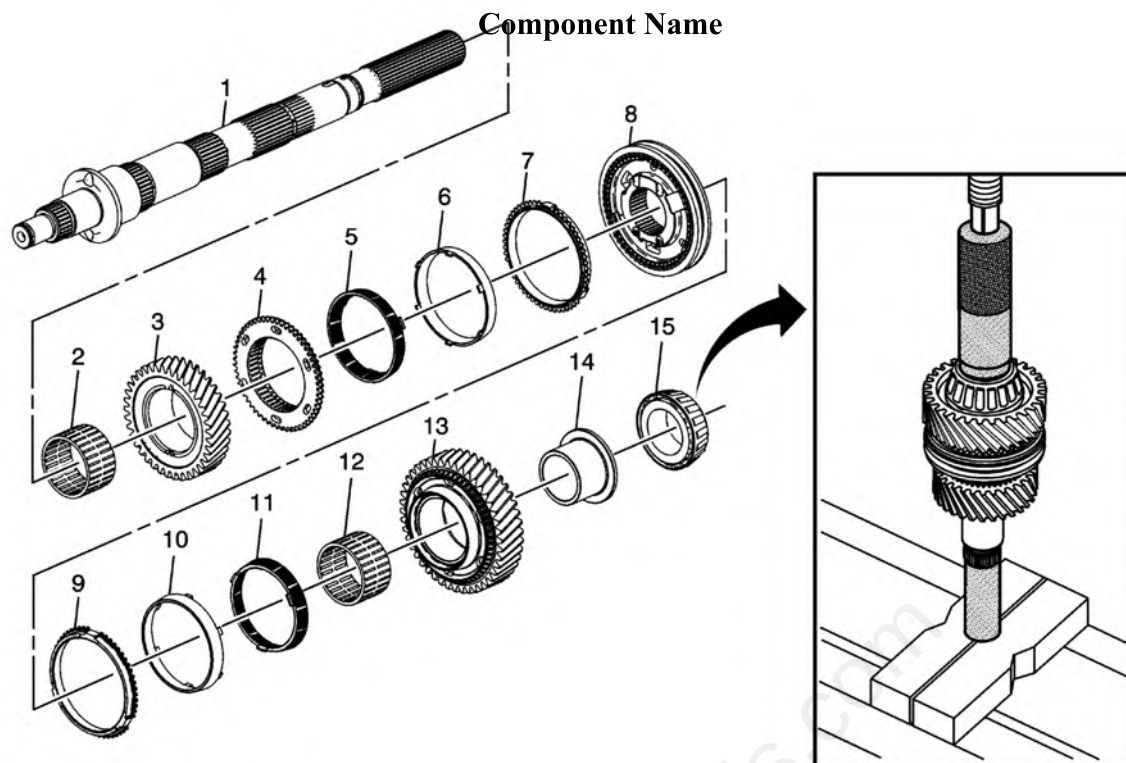


Fig. 71: 1st and 2nd Gear

Courtesy of GENERAL MOTORS COMPANY

1st and 2nd Gear Installation

Callout	Component Name
1	Main Shaft - 2WD
2	2nd Gear Bearing Assembly
3	2nd Gear
4	2nd Gear Synchronizer Cone
5	3rd Gear Inner Blocking Ring
6	3rd Gear Intermediate Blocking Ring
7	3rd Gear Outer Blocking Ring
8	1st and 2nd Gear Synchronizer Assembly NOTE: Make sure chamfer on sleeve is facing up.
9	3rd Gear Outer Blocking Ring
10	3rd Gear Intermediate Blocking Ring
11	3rd Gear Inner Blocking Ring
12	1st Gear Bearing Assembly
13	1st Gear
14	1st Gear Bushing

Component Name	
15	Main Shaft Bearing Cone Assembly NOTE: Verify the pressing procedure was successful: Disengage the synchronizer and position it between the 3rd and 4th speed gears. In this condition, the gears should run free. Special Tools • DT 50860 Bearing Cone Installer • DT 50861 Bearing Cone Installer For equivalent regional tools, refer to Special Tools.

3rd Gear Installation

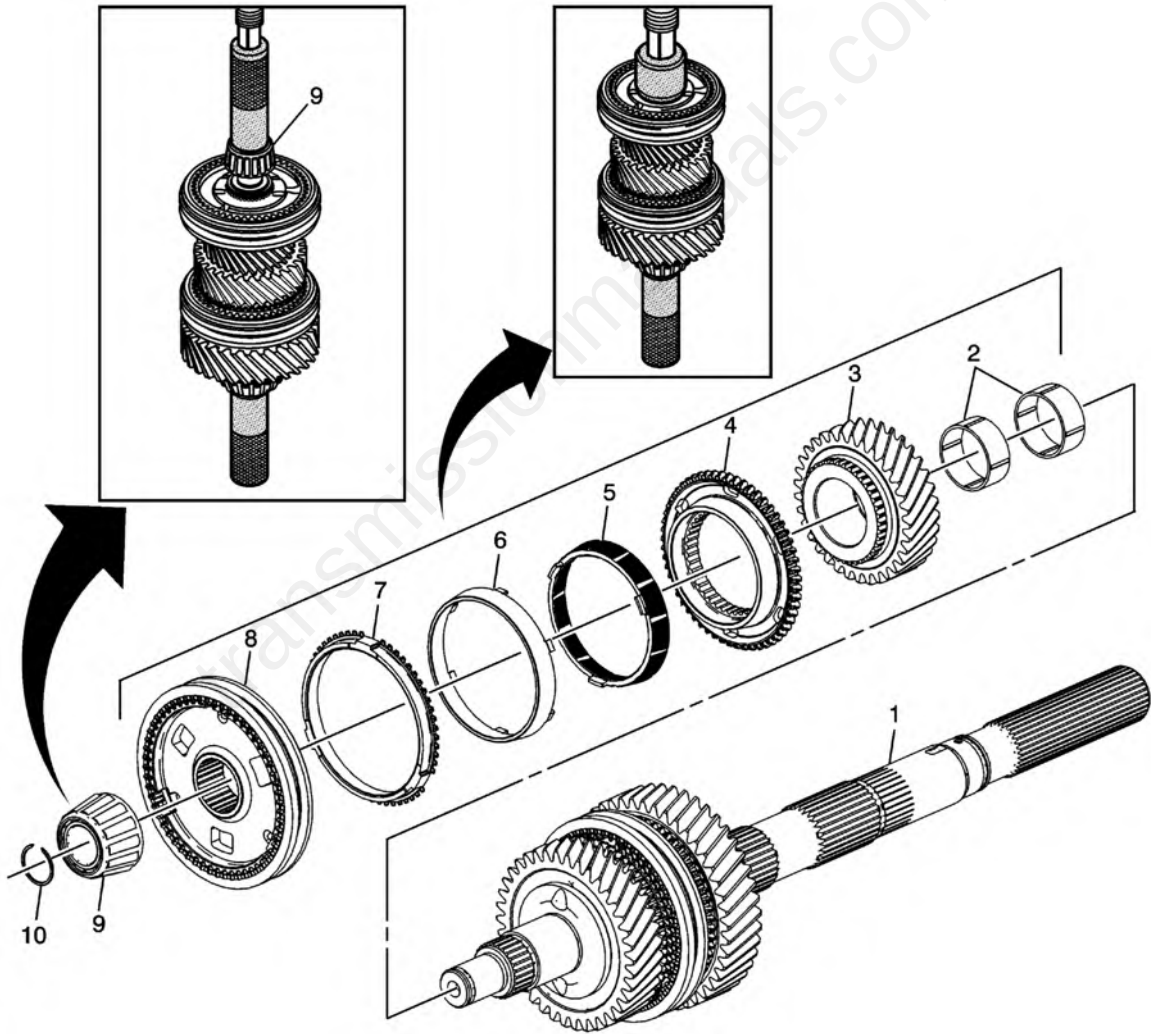


Fig. 72: 3rd Gear
Courtesy of GENERAL MOTORS COMPANY

3rd Gear Installation

Callout	Component Name
1	Main Shaft Assembly - 2WD

3rd Gear Bearing Assembly (Qty: 2) Component Name	
3	3rd Gear
4	3rd Gear Synchronizer Cone
5	3rd Gear Inner Blocking Ring
6	3rd Gear Intermediate Blocking Ring
7	3rd Gear Outer Blocking Ring
8	3rd and 4th Gear Synchronizer Assembly Procedure 1. Install synchronizer chamfer side down. 2. Make sure to align the inserts over blocking ring tabs 3. Using DT 47928-1 rear seal installer Special Tools DT 47928-1 Rear Seal Installer For equivalent regional tools, refer to Special Tools.
9	Main Shaft Front Bearing Cone Assembly NOTE: Verify the pressing procedure was successful: Disengage the synchronizer and position it between the 3rd and 4th speed gears. In this condition, the gears should run free. Special Tools • DT 50860 Bearing Cone Installer • DT 50861 Bearing Cone Installer For equivalent regional tools, refer to Special Tools.
10	3rd and 4th Gear Synchronizer Retaining Ring

SHIFT SHAFT AND SHIFT FORK CLEANING AND INSPECTION

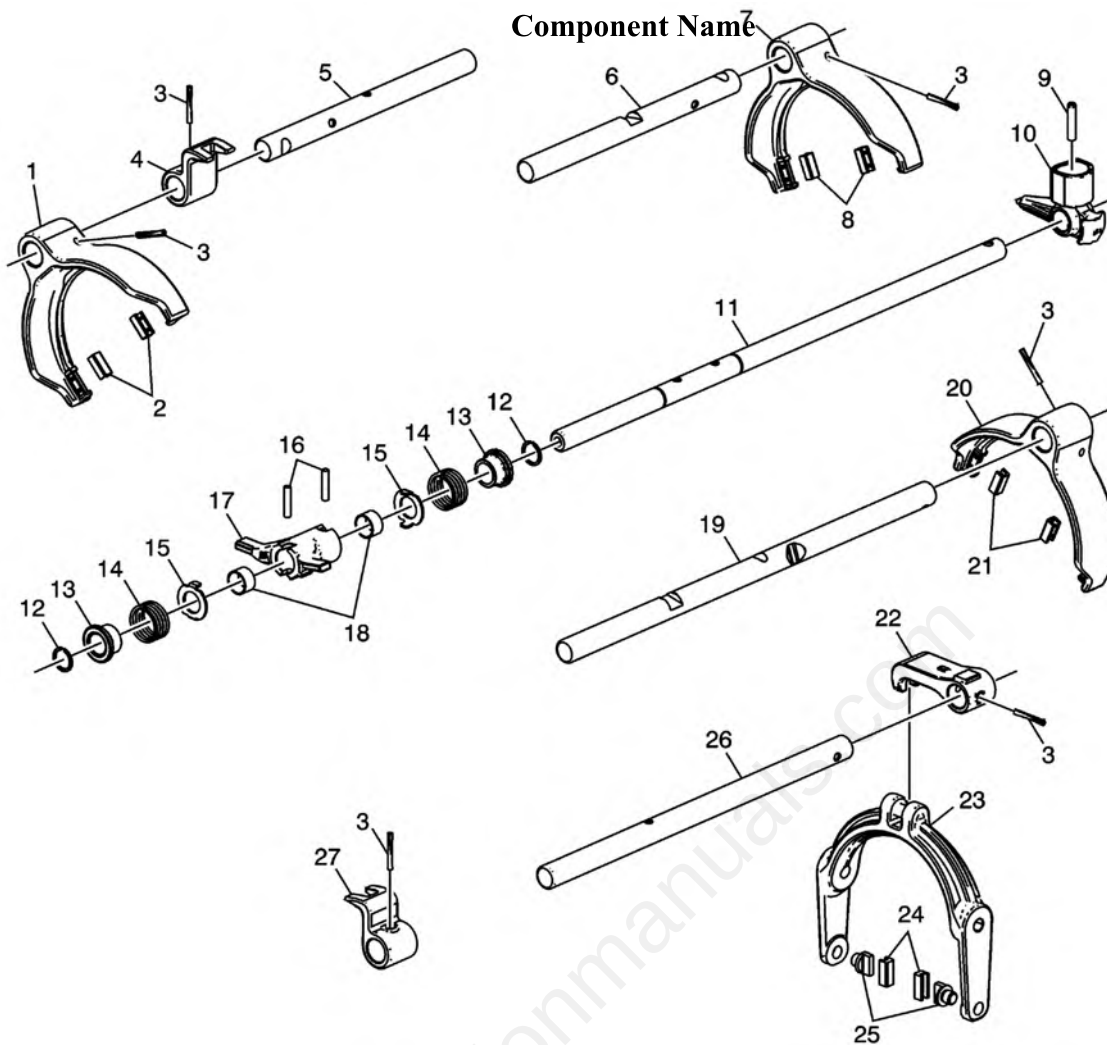


Fig. 73: Shift Shaft and Shift Fork
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	3rd and 4th Shift Fork Assembly
2	3rd and 4th Shift Fork Insert (Qty: 2)
3	Reverse Interlock Shift Detent Pin (Qty: 6)
4	3rd and 4th Shift Block
5	3rd and 4th Shift Shaft
6	1st and 2nd Shift Shaft
7	1st and 2nd Shift Fork Assembly
8	1st and 2nd Shift Fork Insert (Qty: 2)
9	Shift Shaft Detent Pin Assembly
10	Shift Shaft Detent Lever
11	Shift Shaft
12	Shift Shaft Retainer Ring (Qty: 2)
13	Center Support (Qty: 2)
14	Shift Control Lever Shaft Spring (Qty: 2)
15	Trans Washer (Qty: 2)
16	Shift Shaft Block Pin (Qty: 2)
17	Shift Shaft Block

Component Name	
18	Shift Shaft Bushing (Qty: 2)
19	Reverse Shift Shaft
20	Reverse Shift Fork Assembly
21	Reverse Shift Fork Insert (Qty: 2)
22	5th and 6th Shift Lever
23	5th and 6th Shift Fork Assembly
24	5th and 6th Shift Fork Bushing (Qty: 2)
25	5th and 6th Shift Fork Insert (Qty: 2)
26	5th and 6th Shift Shaft
27	5th and 6th Shift Counter Block

CLUTCH HOUSING CLEANING AND INSPECTION

Clutch Housing Assembly

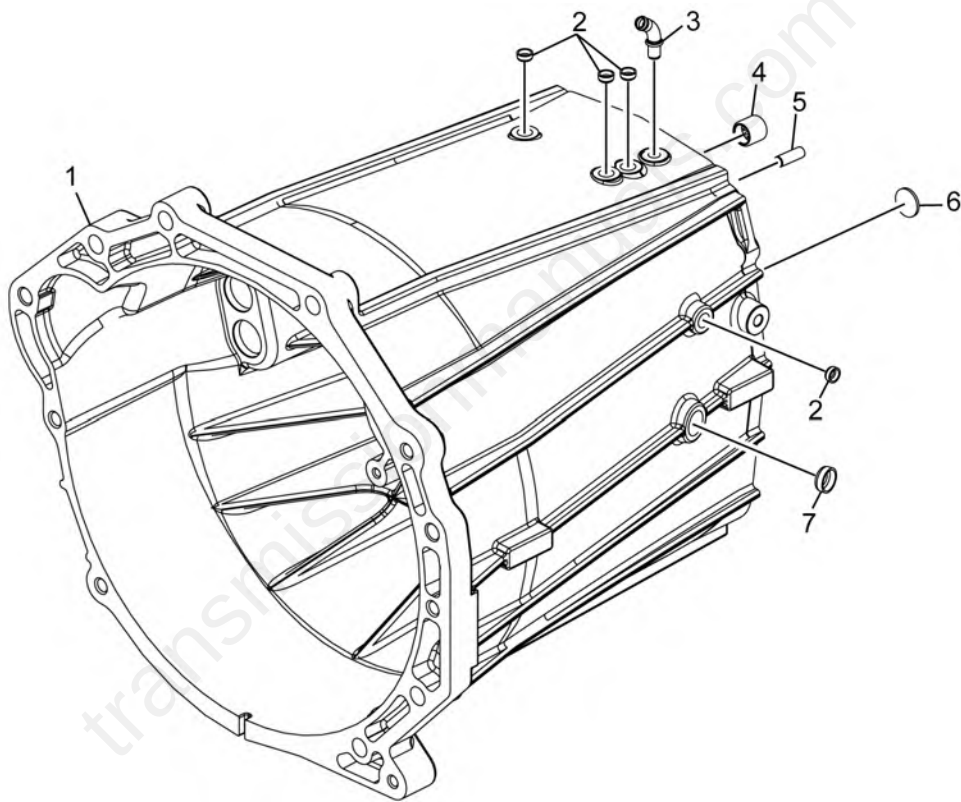


Fig. 74: Clutch Housing

Courtesy of GENERAL MOTORS COMPANY

Clutch Housing Assembly

Callout	Component Name
Preliminary Procedure WARNING: Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals. Clean the clutch housing (1) parts with a suitable solvent. Air dry all the parts.	

Component Name	
1	Clutch Housing Procedure 1. Inspect the clutch housing for the following conditions: • Cracks Replace the clutch housing part if cracks are found. • Scratches • Burrs • Nicked mounting surfaces • Damaged sealing surfaces • Damaged bearing bores 2. Inspect the machined mating surfaces for flatness. Check the mating surfaces with a straight edge. 3. Use a fine mill file to dress minor scratches or burrs. 4. If scratches, or grooves, or scoring, cannot be removed by hand with a soft stone or crocus cloth, replace the component.
2	Transmission Vent Hole Plug (Qty: 4) Procedure Part must be install flush to surface of housing with sealant, refer to Approximate Fluid Capacities. NOTE: Not serviceable separately, comes in Kit which will required assembly.
3	Transmission Vent Hose NOTE: Part is interference fit, must face the front of vehicle.
4	Transmission Bushing - Shift Shaft Procedure Inspect the bushing for excessive wear. Replace worn bushings.
5	Transmission Locating Pin (Qty: 2) NOTE: Part is interference fit, not serviceable separately, comes in kit.
6	Clutch Housing Hole Plug Procedure Part must be install flush to surface of housing with sealant, refer to Approximate Fluid Capacities. NOTE: Not serviceable separately, comes in Kit which will required assembly.

Component Name	
7	Transmission Case Plug Procedure Part must be install flush to surface of housing with sealant, refer to Approximate Fluid Capacities. NOTE: Not serviceable separately, comes in Kit which will required assembly.

Shift Shaft Interlocking Balls and Pins Cleaning and Inspection

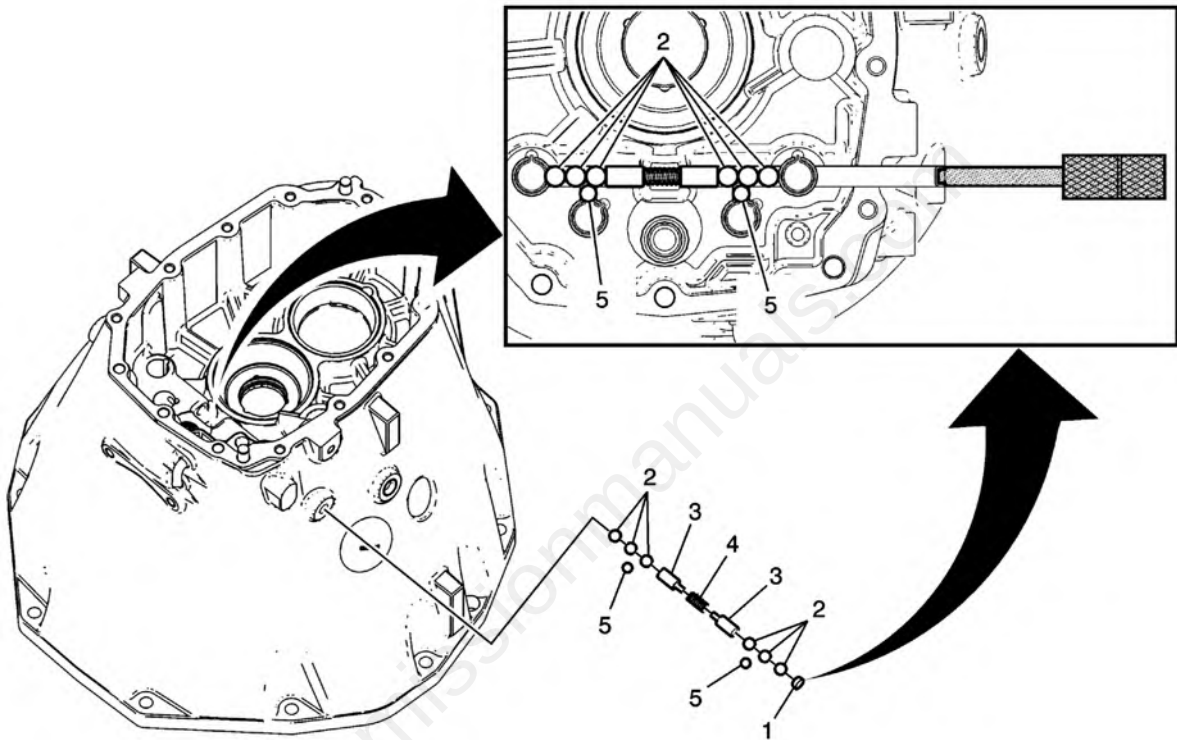


Fig. 75: Shift Shaft Interlocking Balls and Pins

Courtesy of GENERAL MOTORS COMPANY

Shift Shaft Interlocking Balls and Pins Cleaning and Inspection

Callout	Component Name
1	Transmission Vent Hole Plug NOTE: When installing use a NEW plug. Special Tools DT 50851 Front Housing Expansion Plug Installer For equivalent regional tools, refer to Special Tools.

Component Name	
2	Shift Shaft Interlock Ball - 9.5 mm (Qty: 6) NOTE: • Three balls - 9.5 mm align with the 3rd and 4th shift shaft bore, and three balls - 9.5 mm align with the 5th and 6th shift shaft bore. • Be careful when removing the shift shafts. Interlock balls may drop into the shift shaft bores. Keep a close watch on the interlock balls and their locations when disassembling and assembling. • Use the appropriate lubricant to hold balls in their bores in the proper location.
3	3rd and 4th Shift Shaft Pin (Qty: 2) Procedure 1. Push the 3rd and 4th shift shaft pins and reverse shift shaft detent spring to the opposite side in order to force the shift shaft interlock balls to drop from their bores. 2. Displace the 3rd and 4th shift shaft pins and reverse shift shaft detent spring towards the removed plug hole and remove the parts through the housing hole.
4	Reverse Shift Shaft Detent Spring (Qty: 1)
5	Shift Shaft Interlock Ball - 8.0 mm (Qty: 2) NOTE: • One ball is located in the 1st and 2nd shift shaft bore, and the other ball is located in the reverse shift shaft bore. The larger balls will not install into the smallest interlock bore. • Be careful when removing the shift shafts. Interlock balls may drop into the shift shaft bores. Keep a close watch on the interlock balls and their locations when disassembling and assembling. • Use the appropriate lubricant to hold balls in their bores in the proper location.

INPUT SHAFT AND COUNTER GEAR SHAFT BEARING RACE REMOVAL

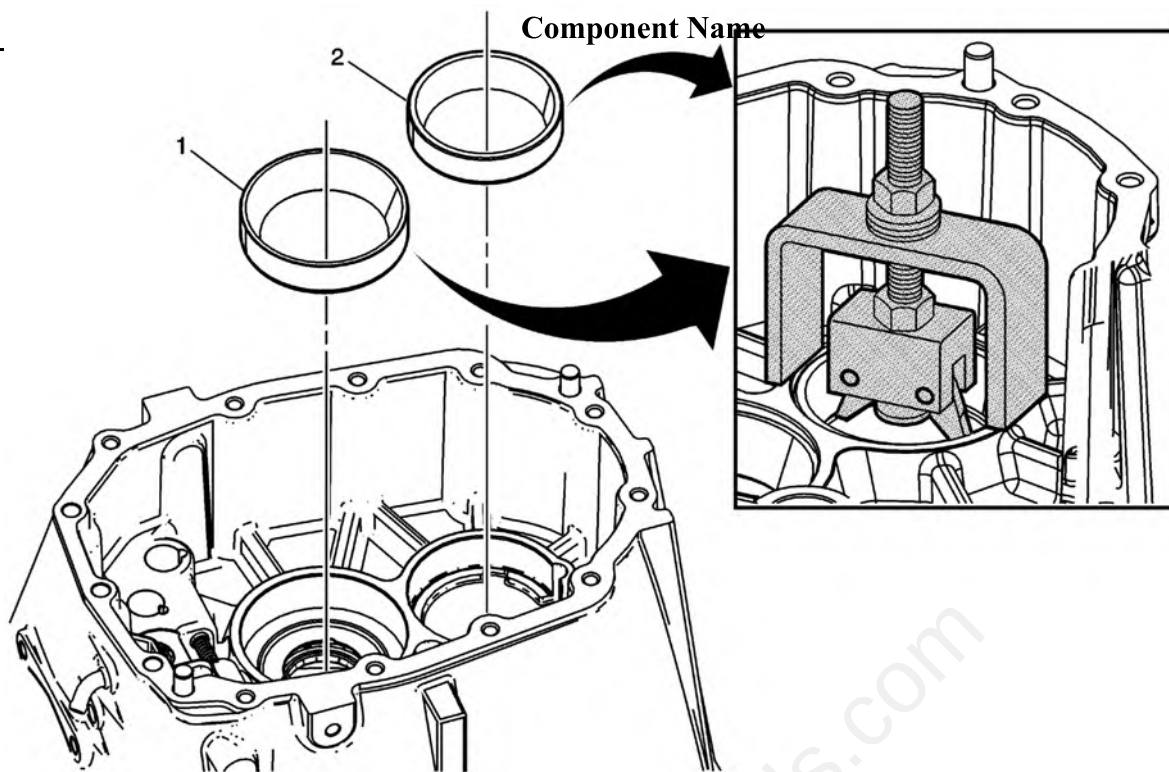


Fig. 76: Input Shaft and Counter Gear Shaft Bearing Race

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Input Shaft Bearing Race Special Tools DT 50862 Front Housing Bearing Race Puller For equivalent regional tools, refer to Special Tools.
2	Counter Gear Bearing Race Special Tools DT 50862 Front Housing Bearing Race Puller For equivalent regional tools, refer to Special Tools.

INPUT SHAFT AND COUNTER GEAR SHAFT BEARING RACE INSTALLATION

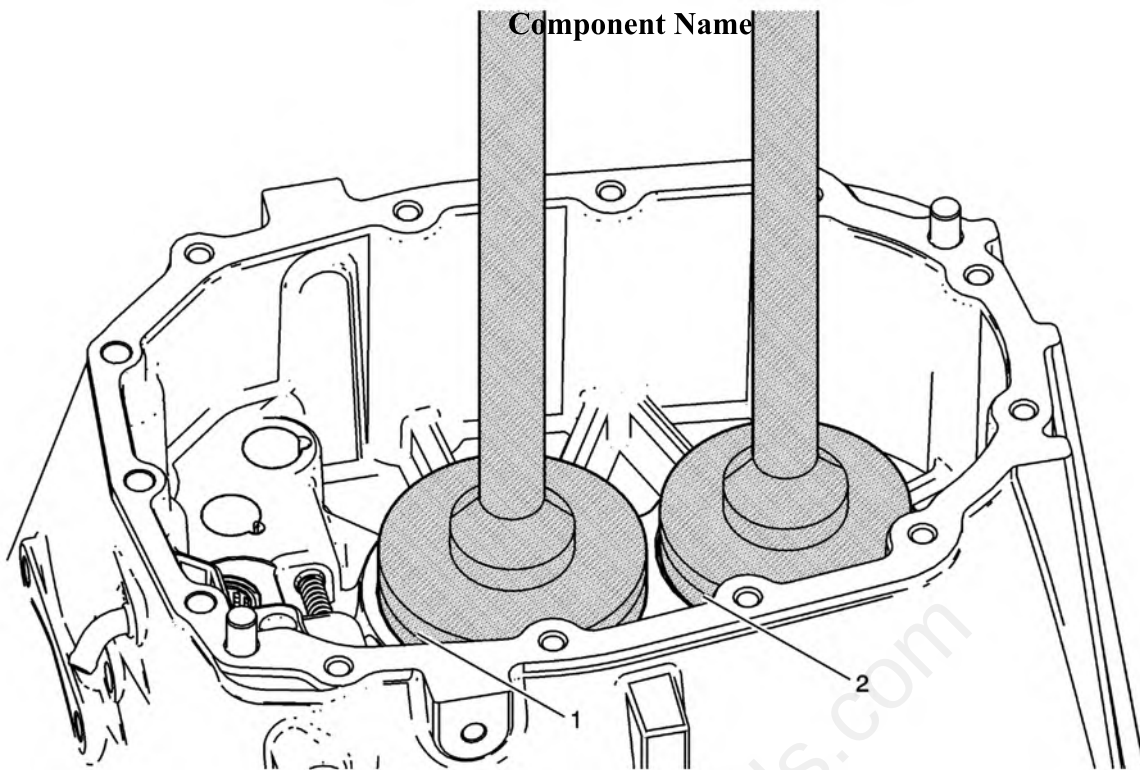


Fig. 77: Input Shaft and Counter Gear Shaft Bearing Race
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Prior to installing the bearing races, carefully clean bearing race and bore.	
1	Input Shaft Bearing Race Special Tools • DT 50850 Driver Handle • DT 50852 Front Housing Bearing Race Installer For equivalent regional tools, refer to Special Tools.
2	Counter Gear Bearing Race Special Tools • DT 50850 Driver Handle • DT 50856 Countershaft Bearing Race Installer For equivalent regional tools, refer to Special Tools.

TRANSMISSION SHIFT SHAFT BUSHING REPLACEMENT

Clutch Housing

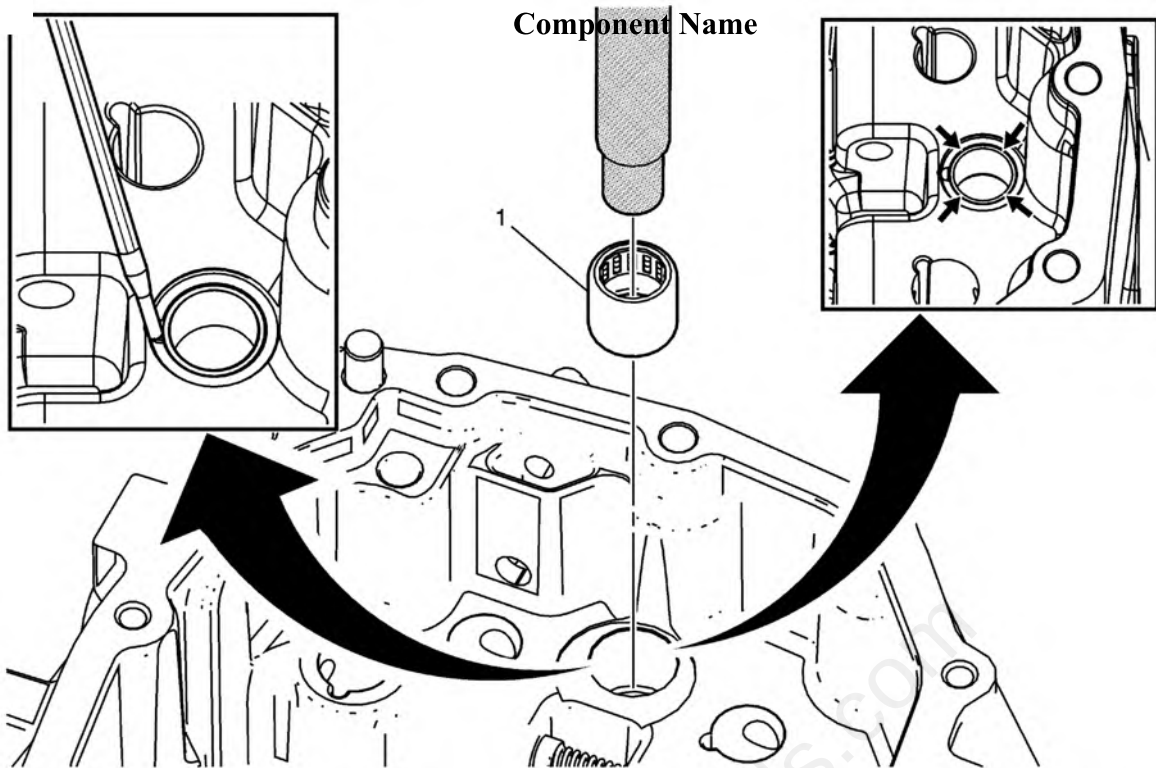


Fig. 78: Clutch Housing

Courtesy of GENERAL MOTORS COMPANY

Clutch Housing

Callout	Component Name
1	Transmission Bushing - Shift Shaft CAUTION: When locking the bushing be careful not to damage the bushing itself. Procedure 1. To remove, punch and deform the bushing as shown. Use pliers to pull the bushing out from the bushing bore. 2. To install, use a punch and stake the bushing by punching the housing material in four positions around the bushing bore. 3. Apply a thin coating of recommended grease to the bushing inner diameter. Special Tools DT 50849 Permaglide Bushing Installer For equivalent regional tools, refer to Special Tools.

Rear Case Housing

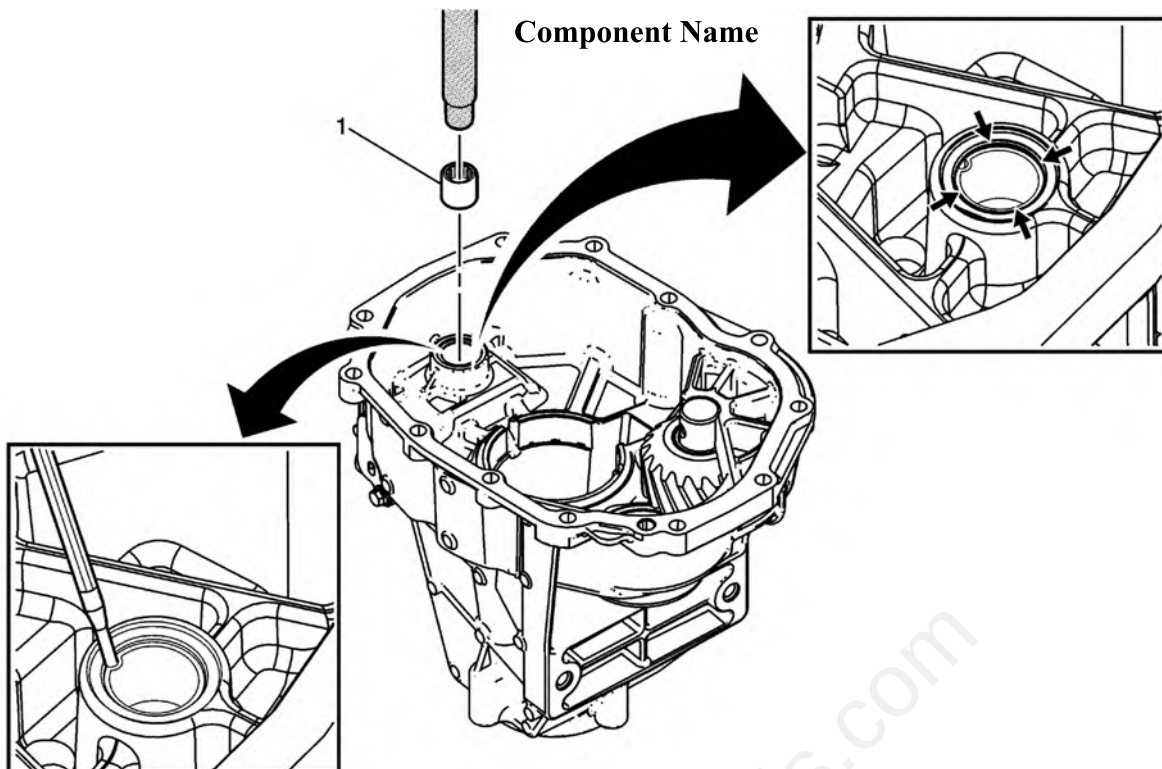


Fig. 79: Rear Case Housing

Courtesy of GENERAL MOTORS COMPANY

Rear Case Housing

Callout	Component Name
1	Transmission Bushing - Shift Shaft CAUTION: When staking the bushing be careful not to damage the bushing itself. Procedure 1. To remove, punch and deform the bushing as shown. Use pliers to pull the bushing out from the bushing bore. 2. To install, use a punch and stake the bushing by punching the housing material in four positions around the bushing bore. 3. Apply a thin coating of recommended grease to the bushing inner diameter. Special Tools DT 50849 Permaglide Bushing Installer For equivalent regional tools, refer to Special Tools.

INPUT SHAFT SEAL REPLACEMENT

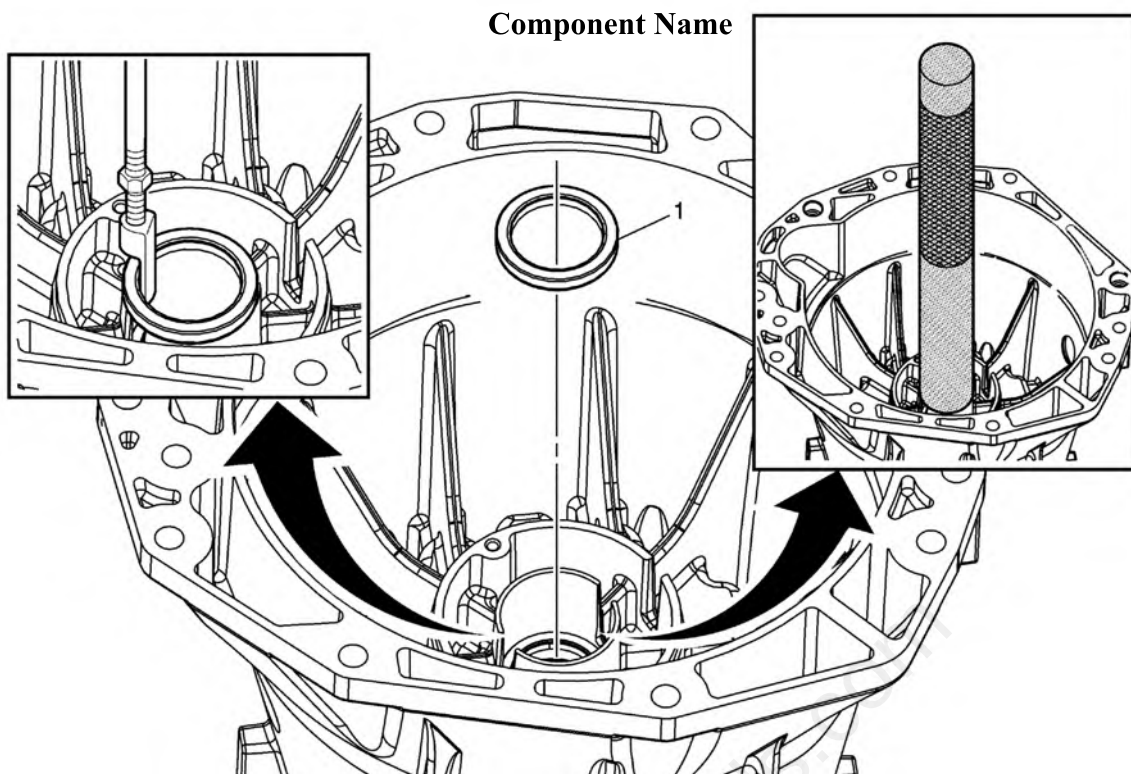


Fig. 80: Input Shaft Seal

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Input Shaft Seal NOTE: 1. To remove use appropriate pry tool. 2. Install using J-22828 installer Special Tools J-22828 Installer For equivalent regional tools, refer to Special Tools.

TRANSMISSION INTERMEDIATE CASE CLEANING AND INSPECTION

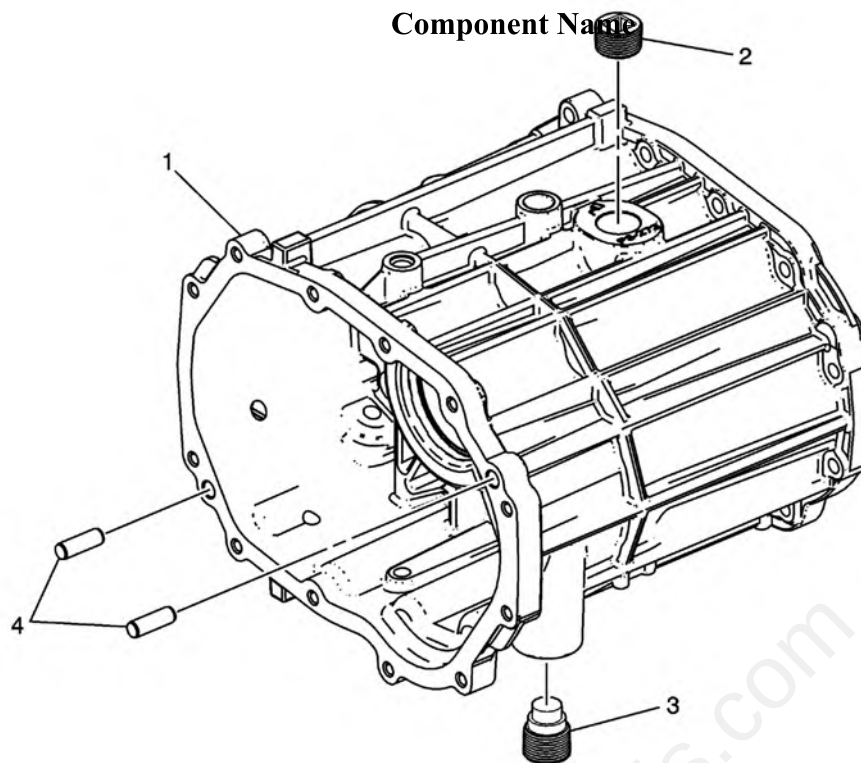


Fig. 81: Transmission Intermediate Case
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure WARNING: Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals. Clean the intermediate case (1) parts with a suitable solvent. Air dry all the parts.	

Component Name	
1	Intermediate Case 1. Inspect the intermediate case for the following conditions: • Cracks Replace the intermediate case if cracks are found. • Scratches • Burrs • Nicked mounting surfaces • Damaged sealing surfaces • Damaged bearing bores 2. Inspect the machined mating surfaces for flatness. Check the mating surfaces with a straight edge. 3. Use a fine mill file to dress minor scratches or burrs. 4. If scratches, or grooves or scoring cannot be removed by hand with a soft stone or crocus cloth, replace the component.
2	Transmission Oil Fill Plug
3	Transmission Oil Drain Plug
4	Transmission Intermediate Case Locating Pin (Qty: 2)

MAIN SHAFT BEARING RACE AND COUNTER GEAR BEARING RACE REMOVAL

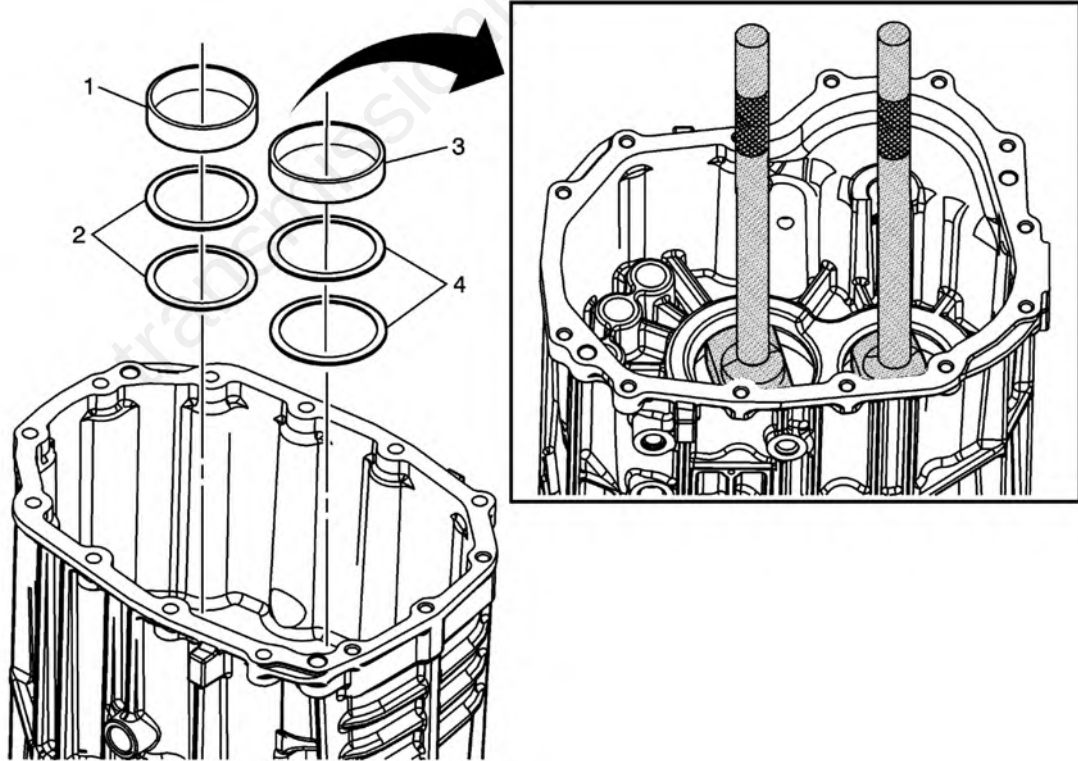


Fig. 82: Main Shaft Bearing Race and Counter Gear Bearing Race
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Component Name	
1	Counter Gear Rear Bearing Race Special Tools • DT 50850 Driver Handle • DT 50854 Countershaft Bearing Race Puller For equivalent regional tools, refer to Special Tools .
2	Counter Gear Bearing Shim (Qty: 2)
3	Mainshaft Bearing Race Special Tools • DT 50850 Driver Handle • DT 50853 Mainshaft Bearing Race Puller For equivalent regional tools, refer to Special Tools .
4	Mainshaft Bearing Shim (Qty: 2)

TRANSMISSION REAR CASE DISASSEMBLE

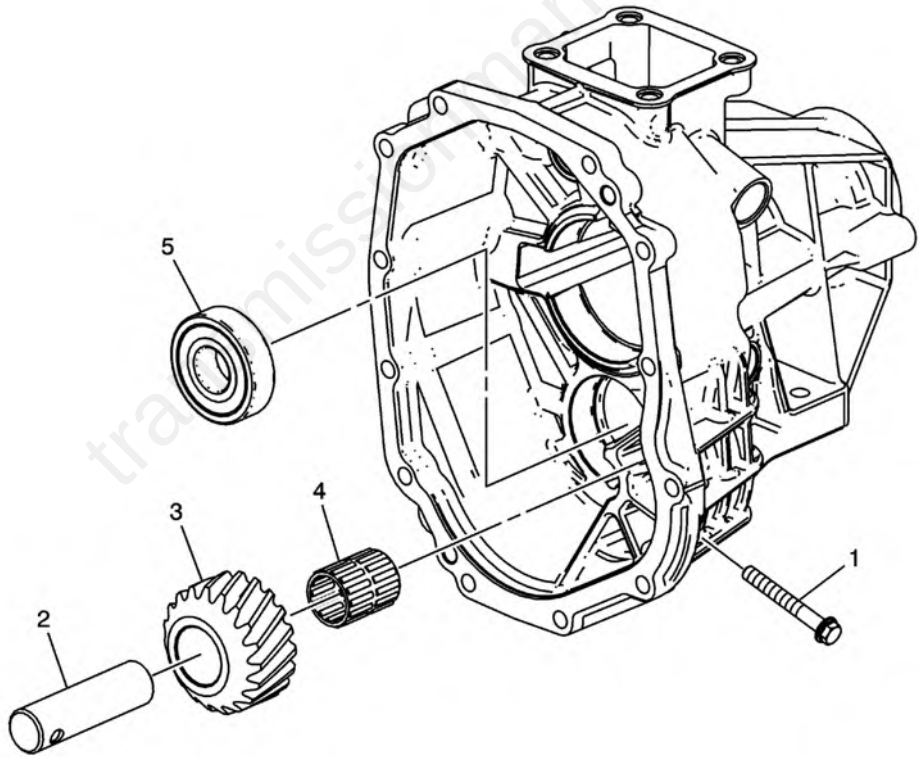


Fig. 83: Transmission Rear Case
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Transmission Rear Case Bolt/Screw (Qty: 1)
2	Reverse Idler Gear Shaft
3	Reverse Idler Gear

Component Name	
4	Reverse Idler Gear Thrust Bearing Assembly
5	Reverse Gear Thrust Bearing Assembly

REAR CASE CLEANING AND INSPECTION

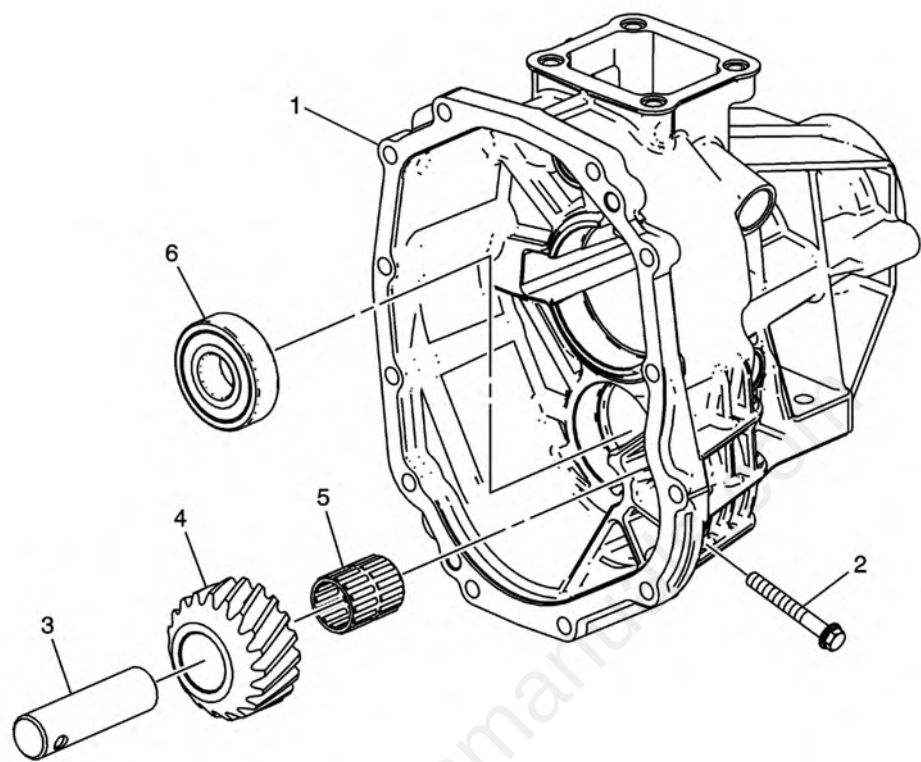
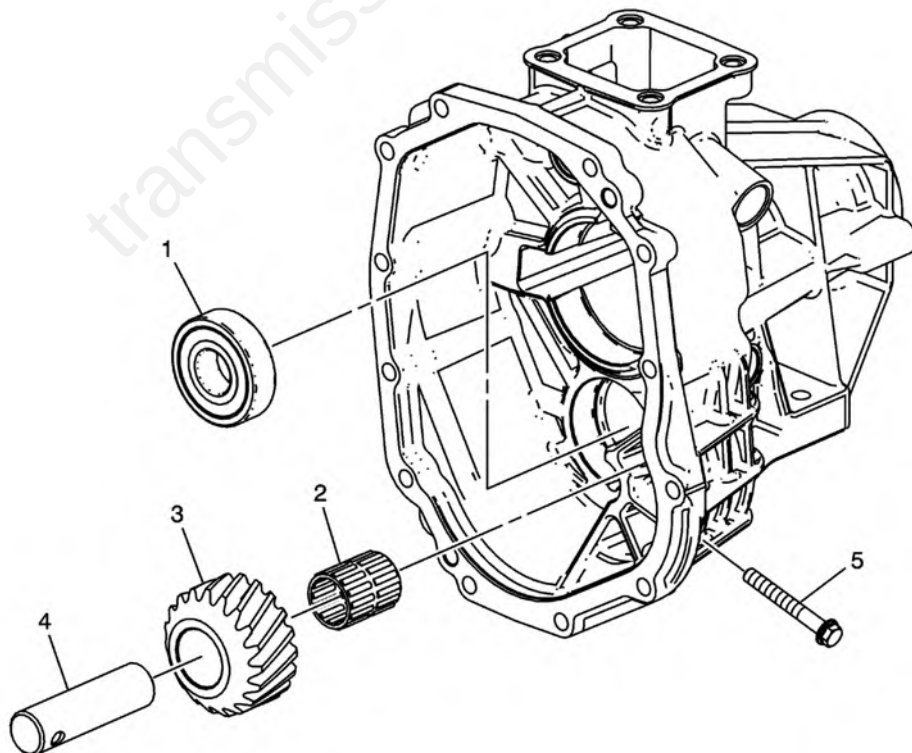


Fig. 84: Rear Case
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure WARNING: Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals. Clean the transmission rear case assembly (1) with a suitable solvent. Air dry all the parts.	
Empty space for additional callouts	

Component Name	
1	Transmission Rear Case Assembly - Inspect the rear case for the following conditions: - Cracks Replace the rear case if cracks are found. - Scratches - Burrs - Nicked mounting surfaces - Damaged sealing surfaces - Damaged bearing bores - Inspect the machined mating surfaces for flatness. Check the mating surfaces with a straight edge. - Inspect the bushing for excessive wear. Replace worn bushings. - Use a fine mill file to dress minor scratches or burrs. - If scratches, or grooves or scoring cannot be removed by hand with a soft stone or crocus cloth, replace the component.
2	Transmission Rear Case Bolt/Screw (Qty: 1)
3	Reverse Idler Gear Shaft
4	Reverse Idler Gear
5	Reverse Idler Gear Thrust Bearing Assembly
6	Reverse Gear Thrust Bearing Assembly

TRANSMISSION REAR CASE ASSEMBLE



Callout	Component Name
1	Reverse Gear Thrust Bearing Assembly
2	Reverse Idler Gear Thrust Bearing Assembly
3	Reverse Idler Gear
4	Reverse Idler Gear Shaft
5	Transmission Rear Case Bolt/Screw (Qty: 1) CAUTION: Refer to Fastener Caution . Tighten 22.5 N.m (16.6 lb ft)

OUTPUT SHAFT SEAL REMOVAL

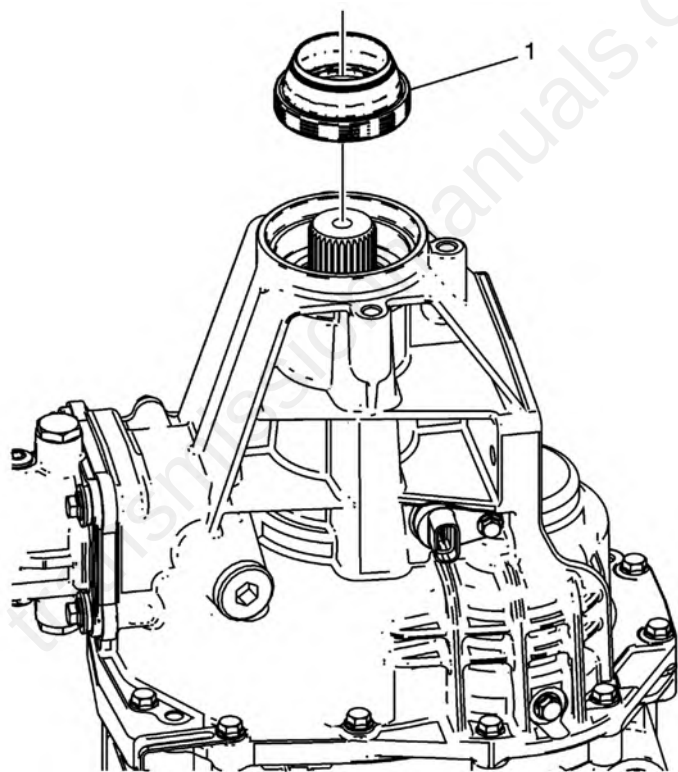


Fig. 86: Output Shaft Seal
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Output Shaft Seal NOTE: Using EN-70006832 with EN-680770 or suitable tools, remove the oil seal and discard. The seal is not reusable.

Shim Measurement

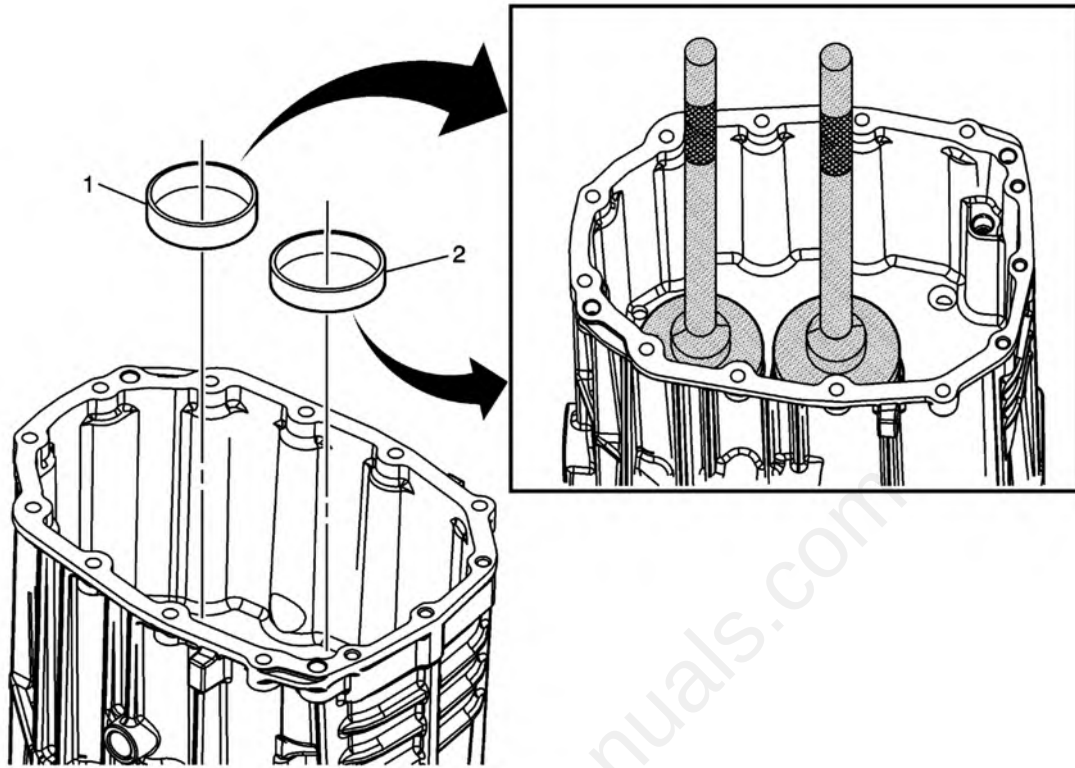


Fig. 87: Shim Measurement

Courtesy of GENERAL MOTORS COMPANY

Shim Measurement

Callout	Component Name
Preliminary Procedure Do not install the shims - only the bearing races.	
1	Main Shaft Bearing Race Special Tools • DT 50850 Driver Handle • DT 50855 Main Shaft Bearing Race Installer For equivalent regional tools, refer to Special Tools .
2	Counter Gear Rear Bearing Race Special Tools • DT 50850 Driver Handle • DT 50855 Main Shaft Bearing Race Installer For equivalent regional tools, refer to Special Tools .

Install Main Shaft and Counter Gear Shaft Assemblies

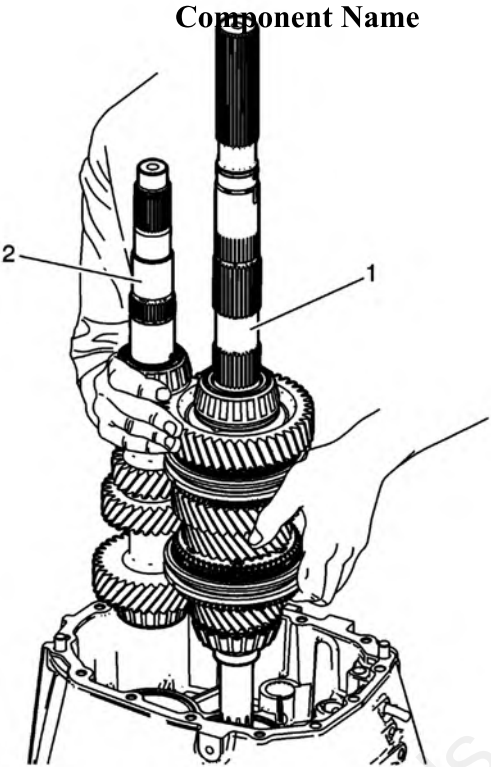


Fig. 88: Install Main Shaft and Counter Gear Shaft Assemblies
Courtesy of GENERAL MOTORS COMPANY

Install Main Shaft and Counter Gear Shaft Assemblies

Callout	Component Name
Preliminary Procedure Install the main shaft and counter gear shaft assemblies as one unit.	
1	Main Shaft Assembly
2	Counter Gear Shaft Assembly

Intermediate Case Installation

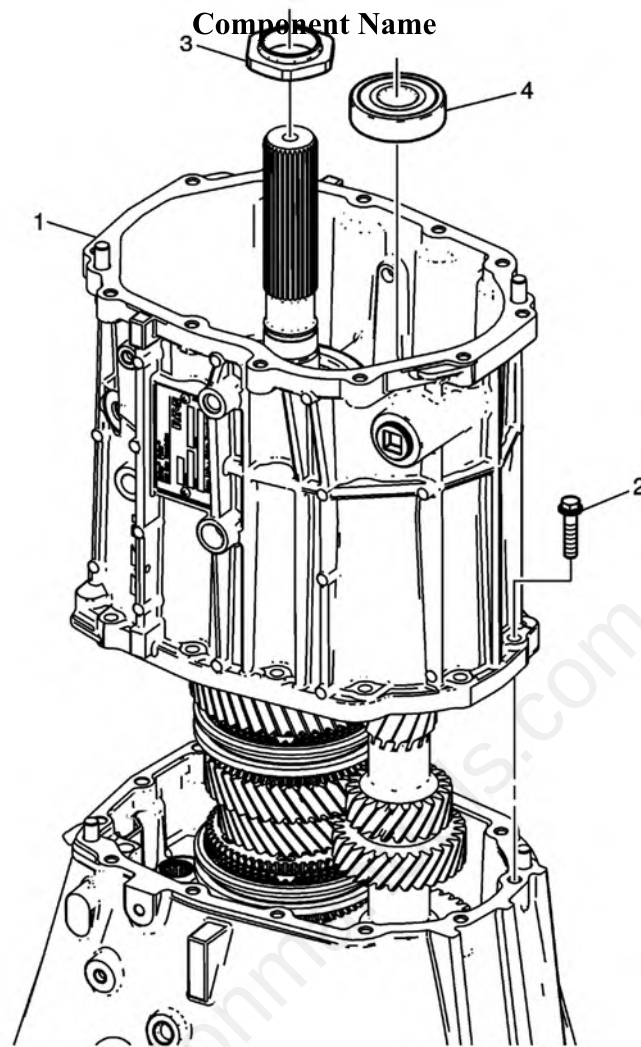


Fig. 89: Intermediate Case

Courtesy of GENERAL MOTORS COMPANY

Intermediate Case Installation

Callout	Component Name
1	Transmission Intermediate Case Assembly
2	Transmission Case Bolt/Screw (Qty: 10) CAUTION: Refer to Fastener Caution . Tighten 22.5 N.m (16.6 lb ft)
3	Reverse Gear Nut Procedure Only install the nut onto the shaft 2 or 3 threads.
4	Reverse Gear Thrust Bearing Assembly

Measure End Play to Determine Correct Shim

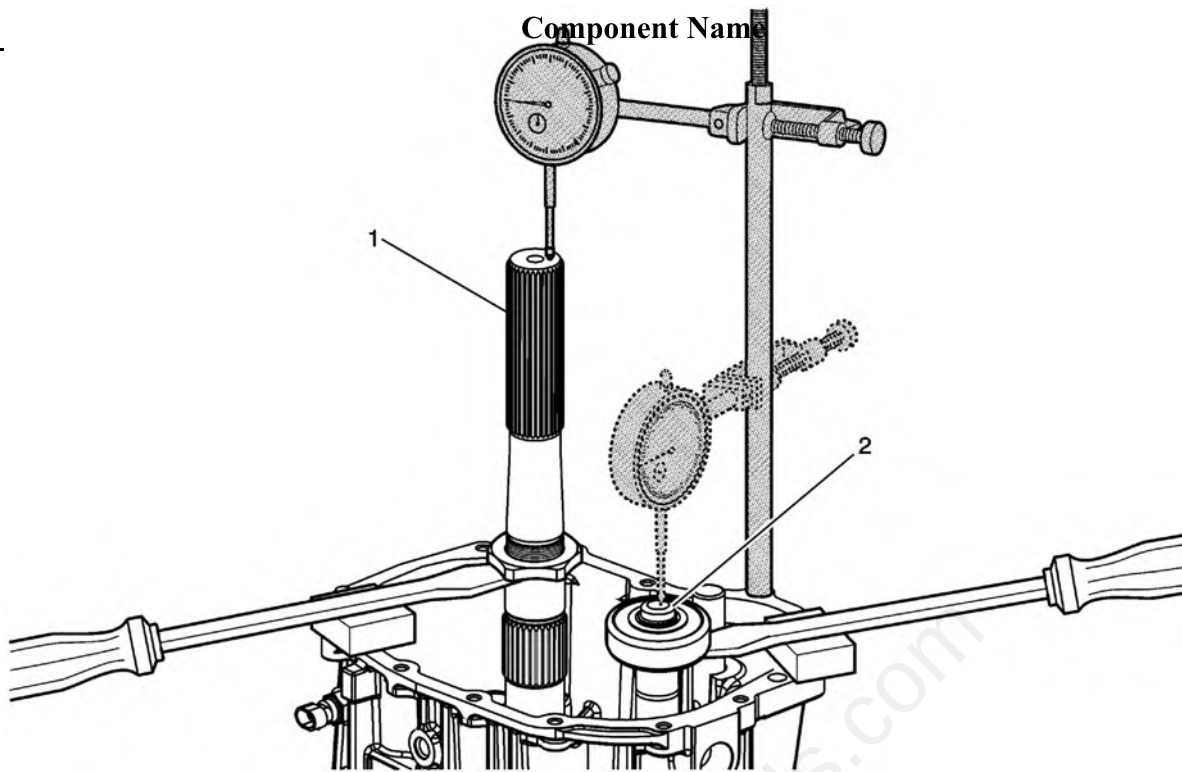


Fig. 90: Measure End Play to Determine Correct Shim

Courtesy of GENERAL MOTORS COMPANY

Measure End Play to Determine Correct Shim

Callout	Component Name
Preliminary Procedure Rotate the main shaft and counter gear shaft several times in both directions to ensure the bearings are seated into the bearing races.	
1	Main Shaft Procedure 1. Set up GE 8001 dial indicator with GE 25025-B post and guide set, and zero out on top of the main shaft. 2. Place a block of wood between the case and a pry bar. 3. Pry straight up on the reverse gear nut and record the measurement. Select appropriate shims to achieve the following specification. Specification 0.060 mm-0.110 mm (0.002-0.004 in) Special Tools • GE 25025-B Dial Indicator Post and Guide Pin Set • GE 8001 Dial Indicator For equivalent regional tools, refer to Special Tools .

Component Name

Counter Gear Shaft

Procedure

1. Set up **GE 8001** dial indicator with **GE 25025-B** post and guide set, and zero out on top of the main shaft.
2. Place a block of wood between the case and a pry bar.
3. Pry straight up on the reverse gear thrust bearing assembly and record the measurement. Select appropriate shims to achieve the following specification.

Specification

0.060 mm-0.110 mm (0.002-0.004 in)

4. Remove the main shaft, counter gear shaft and transmission intermediate case assembly.
5. Install the specified shims. Refer to [Main Shaft Bearing Race and Counter Gear Bearing Race Installation](#).

Special Tools

- **GE 25025-B** Dial Indicator Post and Guide Pin Set
- **GE 8001** Dial Indicator

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

MAIN SHAFT BEARING RACE AND COUNTER GEAR BEARING RACE INSTALLATION

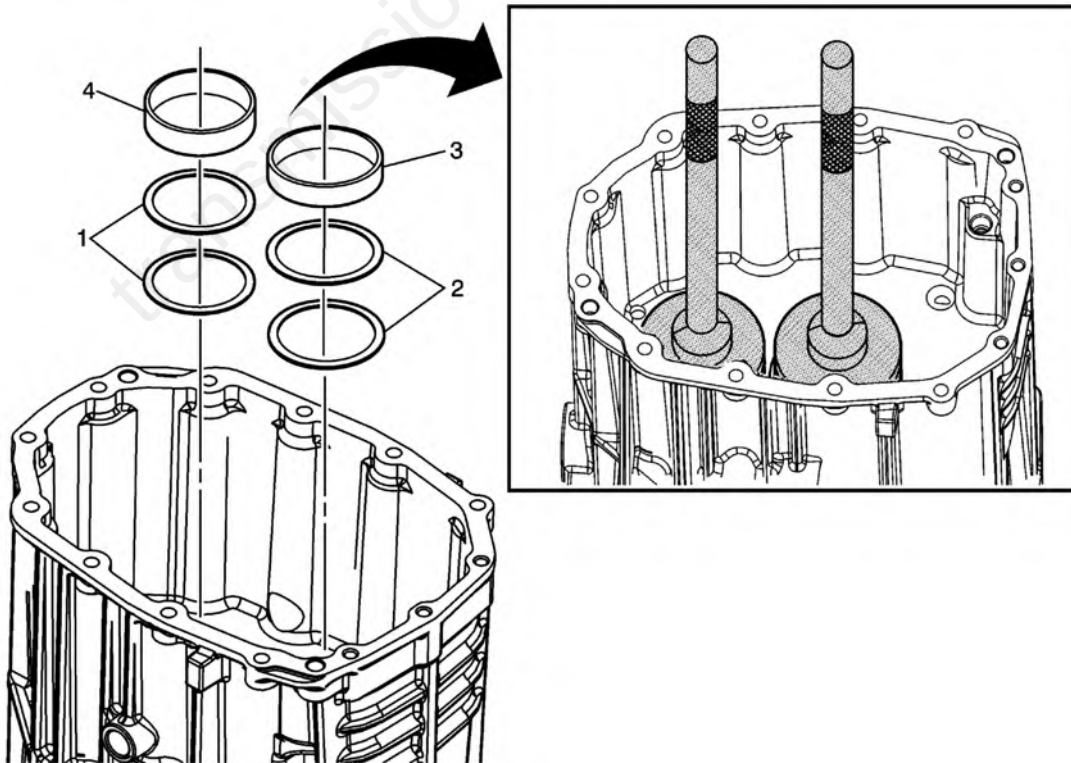


Fig. 91: Main Shaft Bearing Race and Counter Gear Bearing Race
Courtesy of GENERAL MOTORS COMPANY

Component Name	
Preliminary Procedures 1. Prior to installing the bearing race, carefully clean both bearing bore and race. 2. Prior to installing bearing shims perform the Main Shaft Bearing Shim and Counter Gear Bearing Shim Measurement procedure to determine correct shim.	
1	Counter Gear Bearing Shim (Qty: 2) NOTE: Prior to installing bearing shims perform the Main Shaft Bearing Shim and Counter Gear Bearing Shim Measurement procedure to determine correct shim.
2	Main Shaft Bearing Shim (Qty: 2) NOTE: Prior to installing bearing shims perform the Main Shaft Bearing Shim and Counter Gear Bearing Shim Measurement procedure to determine correct shim.
3	Main Shaft Bearing Race Procedure Install the bearing race without any shim before adjusting the transmission end play. Special Tools • DT 50850 Driver Handle • DT 50855 Mainshaft Bearing Race Installer For equivalent regional tools, refer to Special Tools
4	Counter Gear Rear Bearing Race Procedure Install the bearing race without any shim before adjusting the transmission end play. Special Tools • DT 50850 Driver Handle • DT 50856 Countershaft Bearing Race Installer For equivalent regional tools, refer to Special Tools

TRANSMISSION ASSEMBLE

Main Shaft, Input Shaft and Counter Gear Shaft Installation

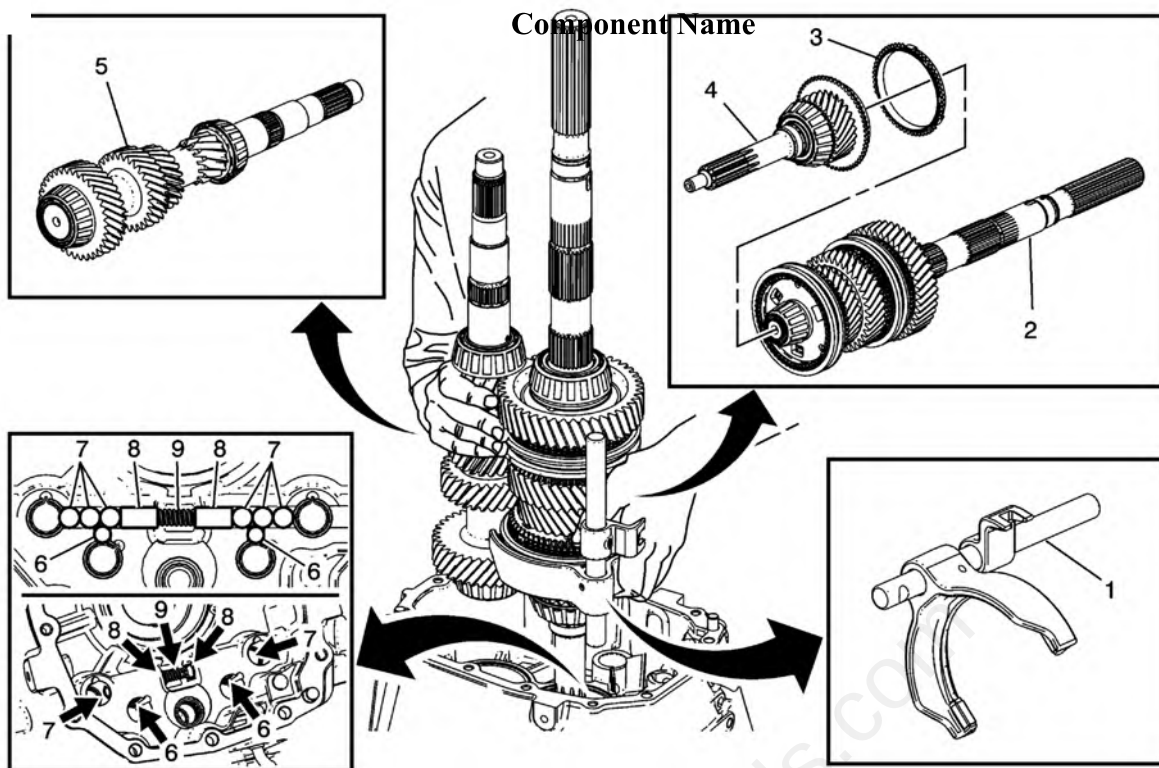


Fig. 92: Main Shaft, Input Shaft and Counter Gear Shaft

Courtesy of GENERAL MOTORS COMPANY

Main Shaft, Input Shaft and Counter Gear Shaft Installation

Callout	Component Name
Preliminary Procedure	
All the following components must be installed at the same time.	
1	3rd and 4th Shift Shaft and Fork Assembly
2	Main Shaft Assembly
3	4th Gear Blocking Ring Assembly
4	Input Shaft Assembly
5	Counter Gear Shaft Assembly
6	Shift Detent Balls - 8.0 mm (Qty: 2) NOTE: • One 8.0 mm ball is located on the 1st and 2nd shift shaft bore. • One 8.0 mm ball is located on the reverse shift shaft bore. • Use the appropriate lubricant to hold ball in the proper location.
7	Shift Shaft Interlock Balls - 9.5 mm (Qty: 6) NOTE: • See locations of the six 9.5 mm balls shown above. • Use the appropriate lubricant to hold ball in the proper location.

Component Name	
8	3rd and 4th Shift Shaft Pin (Qty: 2)
9	Reverse Shift Shaft Detent Spring

Shift Shafts and Forks Installation

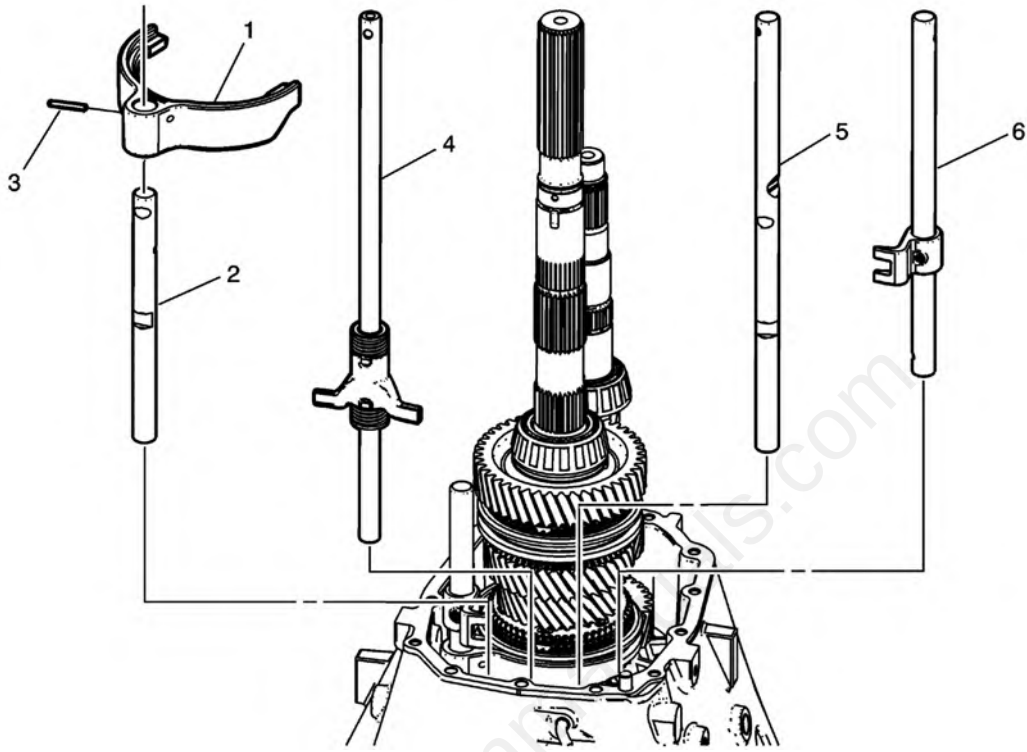


Fig. 93: Shift Shafts and Forks

Courtesy of GENERAL MOTORS COMPANY

Shift Shafts and Forks Installation

Callout	Component Name
1	1st and 2nd Shift Fork Assembly
2	1st and 2nd Shift Shaft
3	Reverse Interlock Shift Detent Pin
4	Shift Shaft Assembly
5	Reverse Shift Shaft
6	5th and 6th Shift Shaft Assembly

Intermediate Case Installation

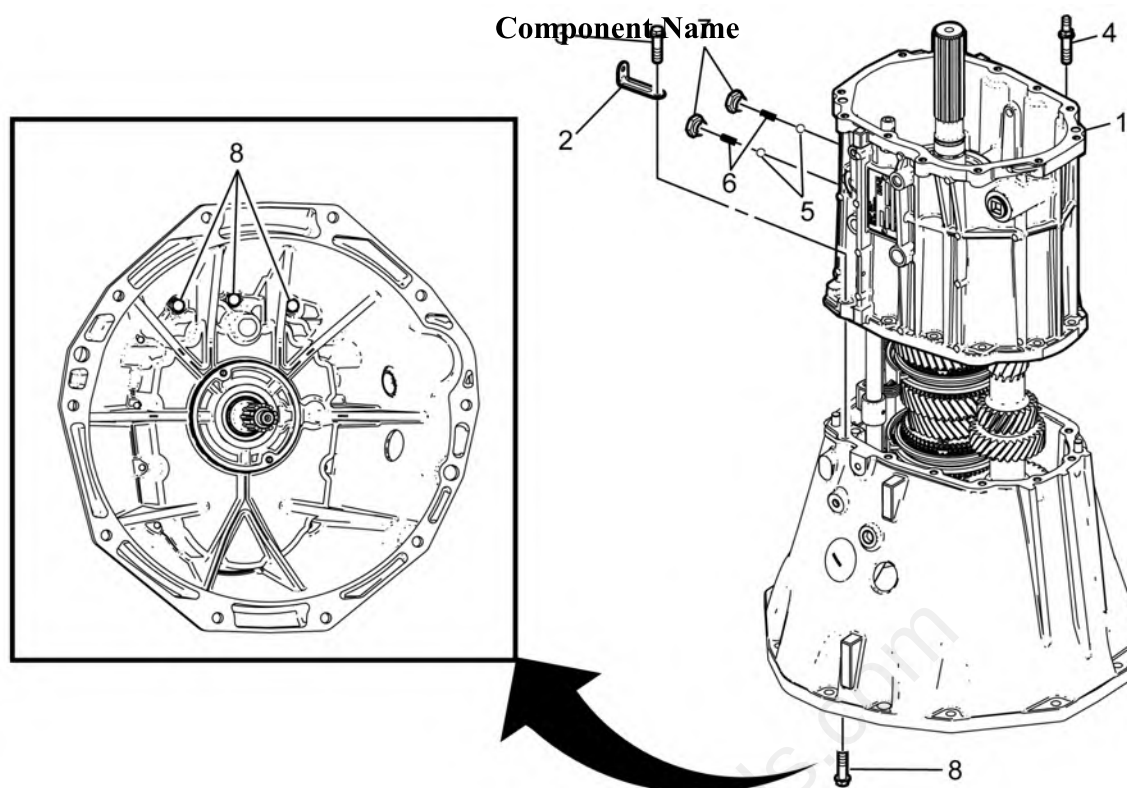


Fig. 94: Intermediate Case

Courtesy of GENERAL MOTORS COMPANY

Intermediate Case Installation

Callout	Component Name
1	Transmission Intermediate Case Assembly
2	Transmission Wiring Harness Bracket Assembly
3	Transmission Case Bolt/Screw (Qty: 8) CAUTION: Refer to Fastener Caution . Tighten 23 N.m (17 lb ft)
4	Transmission Case Stud (Qty: 2) Tighten 23 N.m (17 lb ft)
5	Shift Shaft Detent Ball (Qty: 2)
6	Shift Detent Ball Spring (Qty: 2)
7	Shift Control Housing Plug (Qty: 2) CAUTION: Refer to Component Fastener Tightening Caution . Tighten 13 N.m (115 lb in)

Component Name	
8	Transmission Case Bolt/Screw (Qty: 3) Tighten 23 N.m (17 lb ft)

5th Gear and 5th Counter Gear Installation

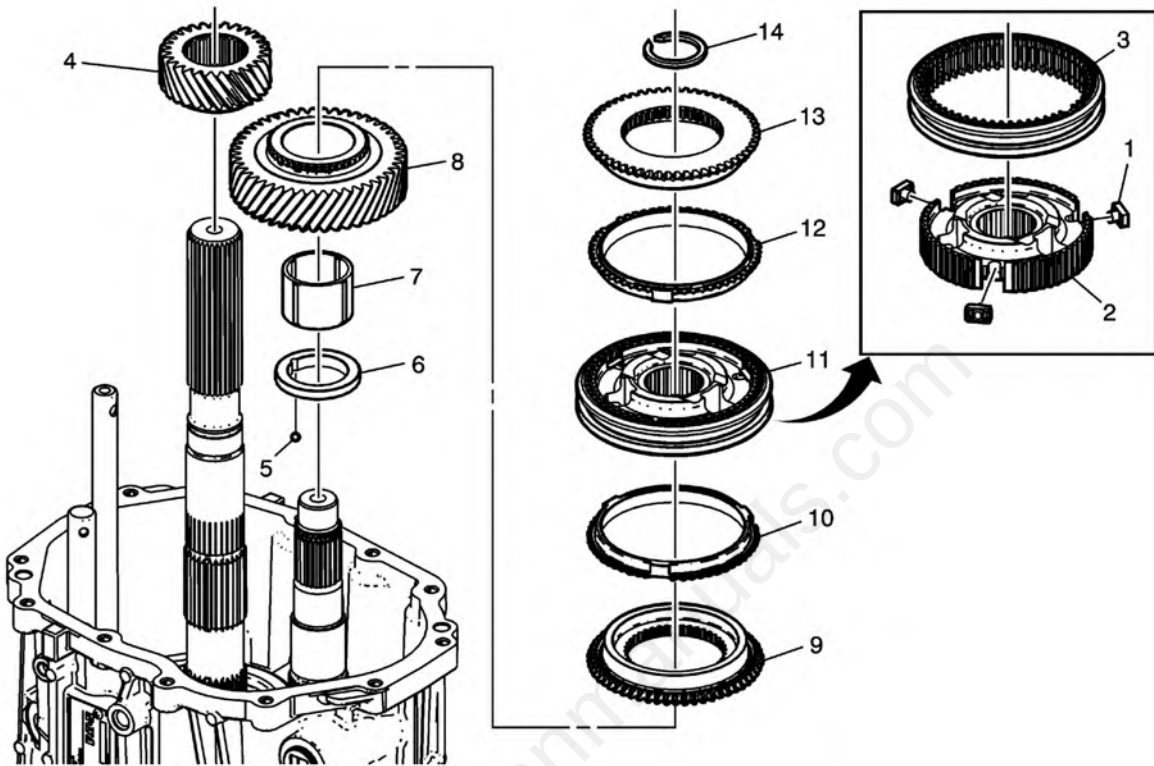


Fig. 95: 5th Gear and 5th Counter Gear
Courtesy of GENERAL MOTORS COMPANY

5th Gear and 5th Counter Gear Installation

Callout	Component Name
1	5th and 6th Gear Synchronizer Insert Assembly (Qty: 3)
2	5th and 6th Gear Synchronizer Hub
3	5th and 6th Gear Synchronizer Sleeve
4	5th Gear
5	5th Gear Thrust Washer Locating Ball
6	Counter Gear Washer
7	Counter Gear Bearing Assembly
8	5th Counter Gear
9	5th Gear Synchronizer Cone
10	5th Gear Blocking Ring Assembly
11	5th and 6th Gear Synchronizer Assembly
12	5th Gear Blocking Ring Assembly
13	6th Gear Synchronizer Cone
14	5th and 6th Gear Synchronizer Retaining Ring

5th and 6th Shift Fork Installation

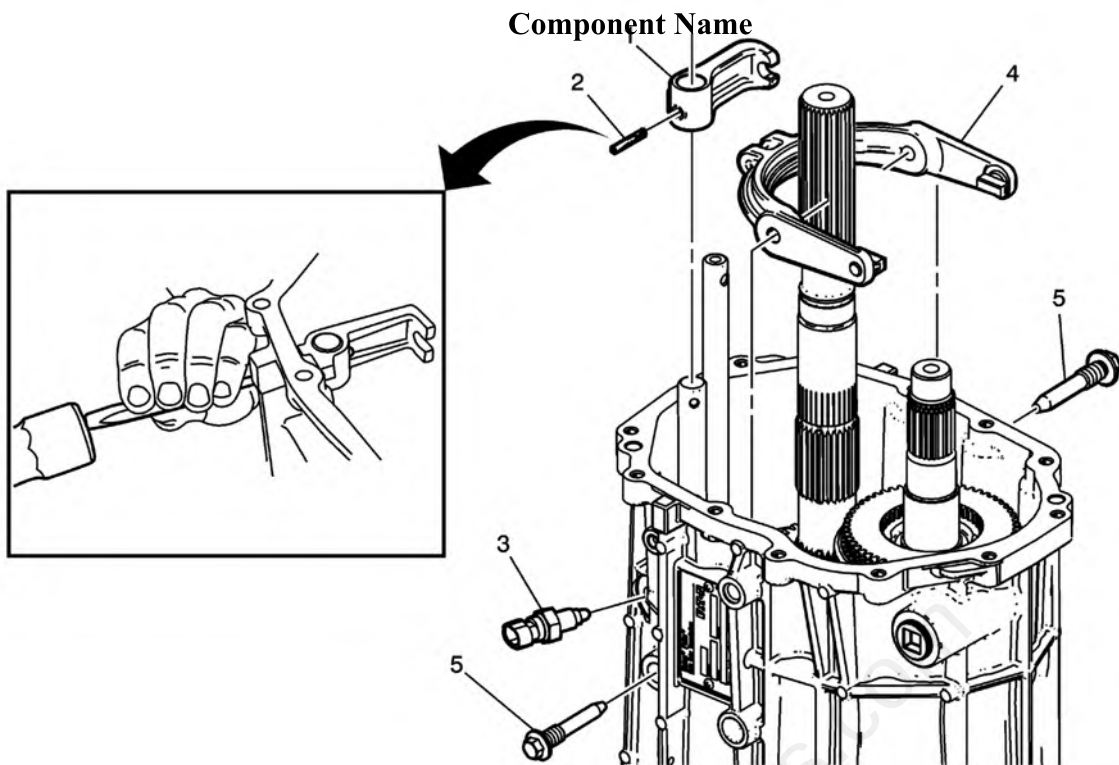


Fig. 96: 5th and 6th Shift Fork

Courtesy of GENERAL MOTORS COMPANY

5th and 6th Shift Fork Installation

Callout	Component Name
1	5th and 6th Shift Lever
2	Reverse Interlock Shift Detent Pin NOTE: Use a punch to install.
3	Park/Neutral Position and Backup Lamp Switch Assembly CAUTION: Refer to Component Fastener Tightening Caution . Tighten 17 N.m (12.5 lb ft)
4	5th and 6th Shift Fork Assembly
5	Shift Fork Bolt (Qty: 2) CAUTION: Refer to Fastener Caution . Tighten 22.5 N.m (16.6 lb ft)

6th Gear and 6th Counter Gear Installation

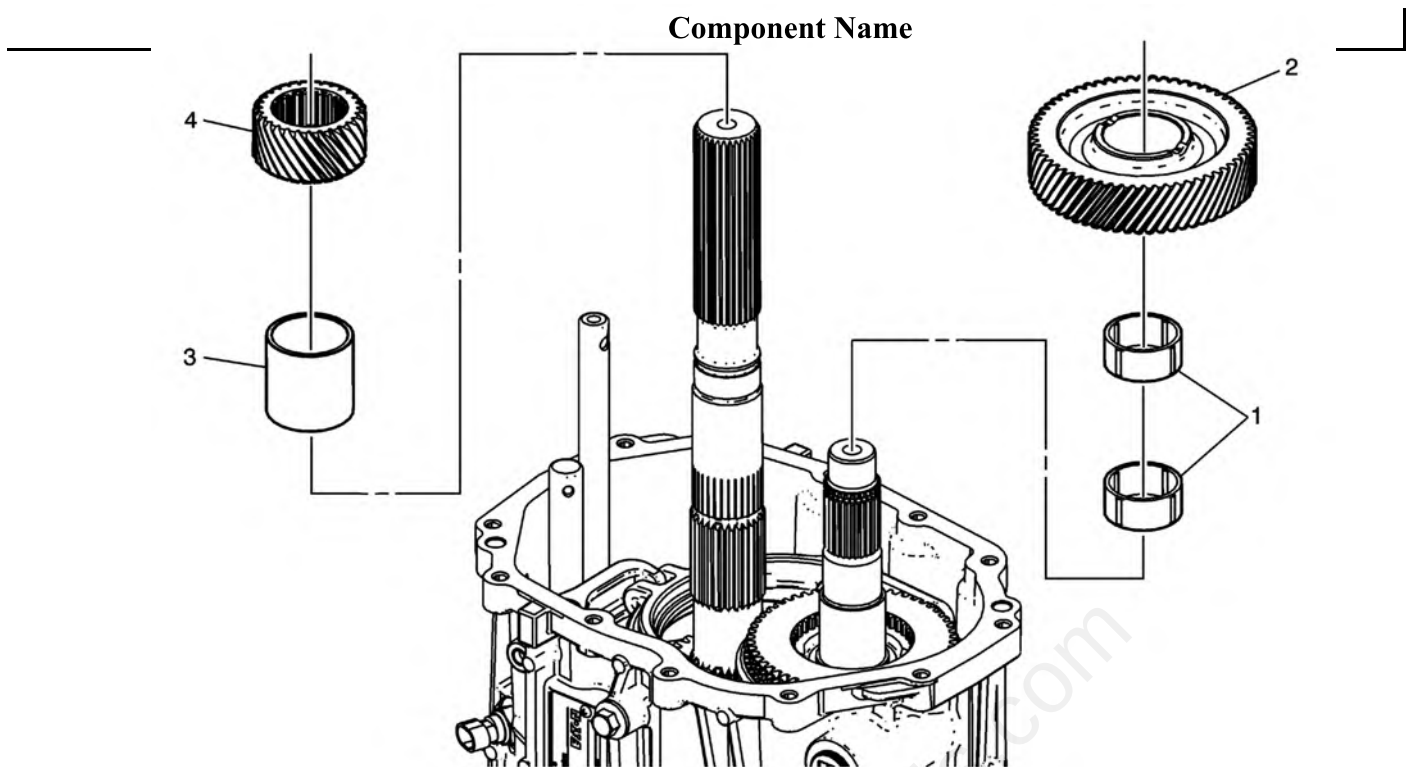


Fig. 97: 6th Gear and 6th Counter Gear
 Courtesy of GENERAL MOTORS COMPANY

6th Gear and 6th Counter Gear Installation

Callout	Component Name
1	6th Gear Bearing Assembly (Qty: 2)
2	6th Counter Gear
3	6th Gear Bushing
4	6th Gear

Reverse Gear Synchronizer Assembly Installation

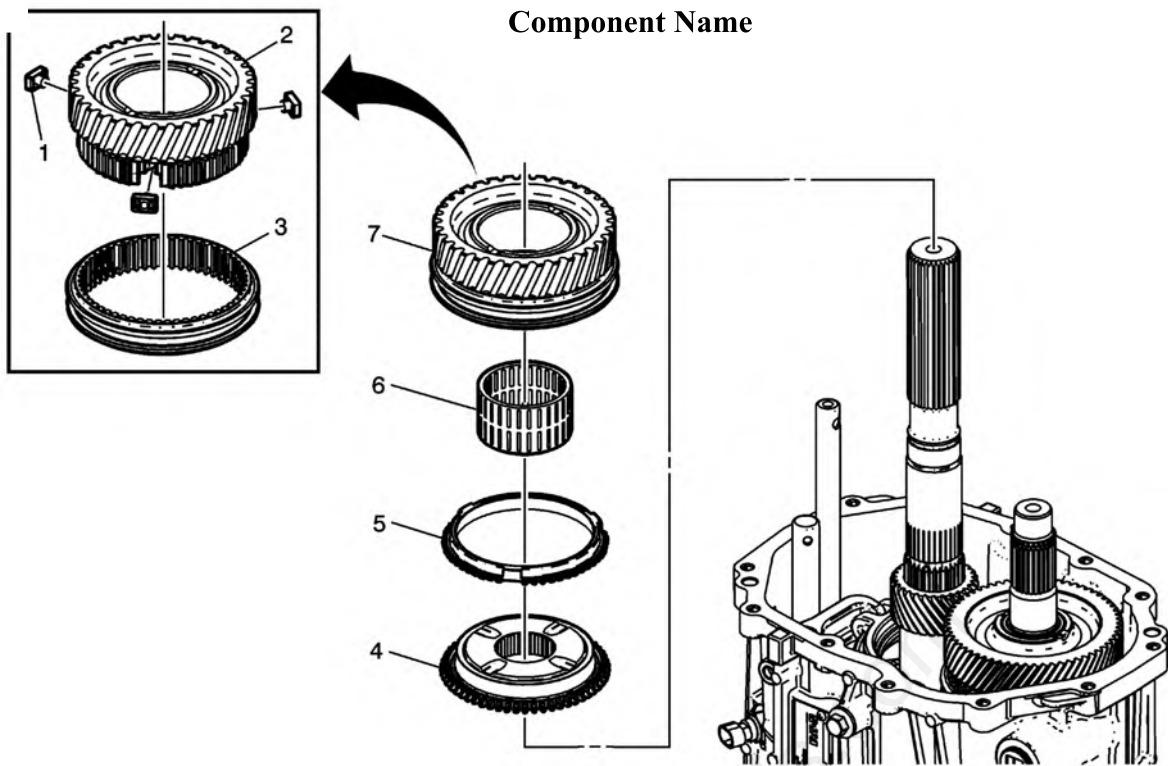


Fig. 98: Reverse Gear Synchronizer Assembly
 Courtesy of GENERAL MOTORS COMPANY

Reverse Gear Synchronizer Assembly Installation

Callout	Component Name
1	Reverse Gear Synchronizer Insert Assembly (Qty: 3)
2	Reverse Gear Synchronizer Sleeve
3	Reverse Gear Synchronizer Hub
4	Reverse Gear Synchronizer Cone
5	Reverse Gear Blocking Ring
6	2nd Gear Bearing
7	Reverse Gear Synchronizer Assembly

Reverse Gear Assembly and Reverse Shift Fork Assembly Installation

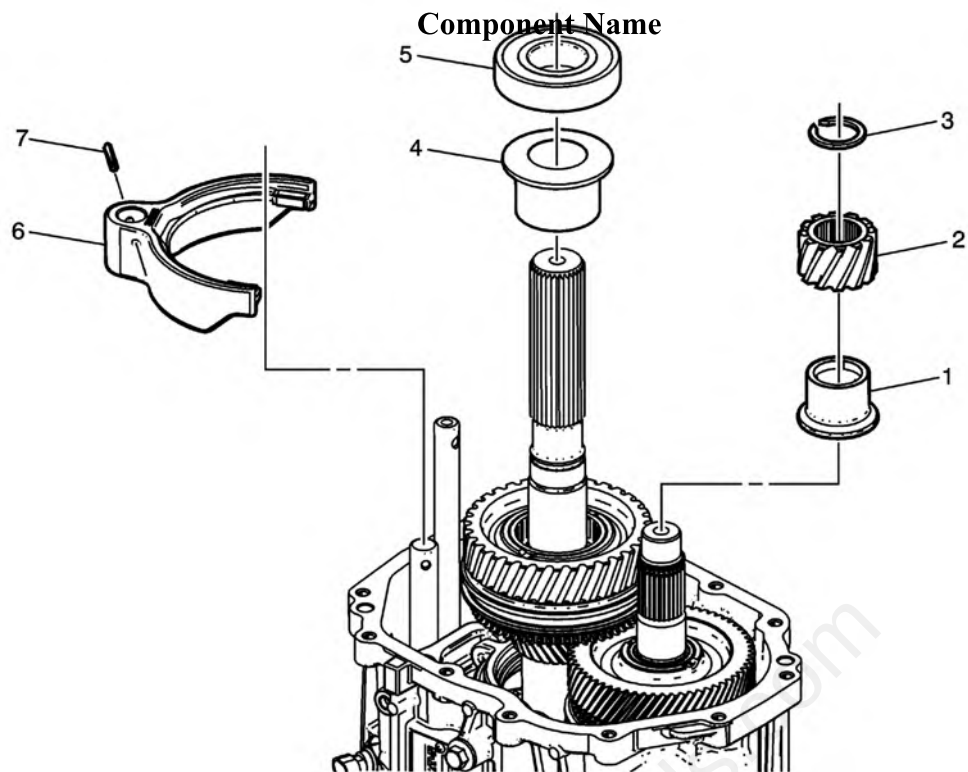


Fig. 99: Reverse Gear Assembly and Reverse Shift Fork Assembly

Courtesy of GENERAL MOTORS COMPANY

Reverse Gear Assembly and Reverse Shift Fork Assembly Installation

Callout	Component Name
1	6th Gear Bearing Spacer
2	Reverse Gear
3	Input Shaft Bearing Retaining Ring
4	Reverse Gear Bearing Bushing
5	Reverse Gear Bearing
6	Reverse Shift Fork
7	Reverse Interlock Shift Detent Pin
	NOTE: Use a punch to install.

Vehicle Speed Sensor Rotor and Reverse Gear Nut Installation

Component Name	
1	Reverse Gear Nut Procedure 1. Attach DT-51327 54 mm special wrench with adjustable base to the intermediate case assembly. 2. Place the transmission in first gear by rotating the shift shaft clockwise and towards the rear of the transmission. 3. Using DT-50859 input shaft spline socket rotate the input shaft counterclockwise to tighten the reverse gear nut to the correct specification. CAUTION: Refer to Fastener Caution . Specification 243.5 N.m (179.6 lb ft) 4. Use a punch to peen the reverse gear nut to the machine groove on the output shaft. Special Tools • DT-50859 Input Shaft Spline Socket • DT-51327 54 mm Special Wrench with Adjustable Base For equivalent regional tools, refer to Special Tools.
2	Speedometer Drive Gear Locating Ball
3	Vehicle Speed Sensor Rotor - 2WD
4	Main Shaft Retaining Ring - Speed Sensor Rotor - 2WD

Rear Case and Shift Control Lever Housing Assembly Installation

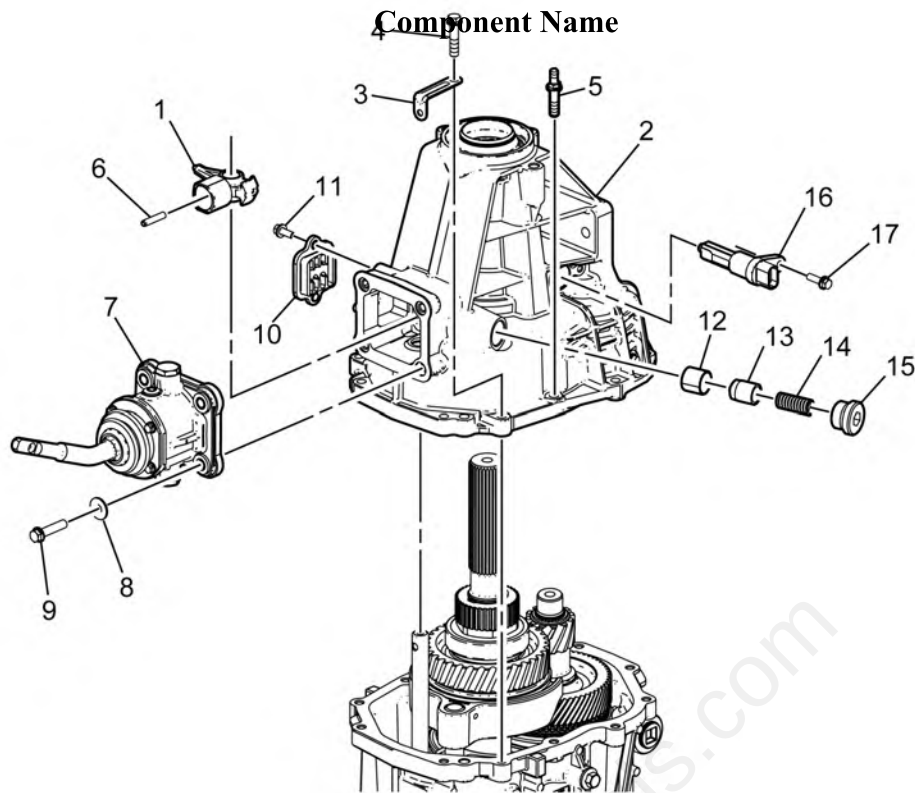


Fig. 101: Rear Case and Shift Control Lever Housing Assembly
 Courtesy of GENERAL MOTORS COMPANY

Rear Case and Shift Control Lever Housing Assembly Installation

Callout	Component Name
1	Shift Shaft Detent Lever
2	Transmission Rear Case Assembly - 2WD
3	Transmission Wiring Harness Bracket
4	Transmission Case Bolt/Screw (Qty: 12) CAUTION: Refer to Fastener Caution . Tighten 23 N.m (17 lb ft)
5	Transmission Case Stud (Qty: 2) Tighten 23 N.m (17 lb ft)
6	Shift Shaft Detent Pin
7	M/Trans Control Lever Housing
8	M/Trans Control Lever Housing Washer (Qty: 4)
9	M/Trans Control Lever Housing Bolt/Screw (Qty: 4) Tighten 18 N.m (13.28 lb ft)
10	Shift Interlock Plate
11	Transmission Bolt/Screw (Qty: 2) Tighten 12 N.m (106 lb in)

Component Name	
12	Shift Shaft Detent
13	Shift Shaft Detent Cam
14	Shift Shaft Detent Spring
15	Shift Shaft Detent Plug CAUTION: Refer to Component Fastener Tightening Caution . Tighten 13 N.m (115 lb in)
16	Speed Sensor
17	Speed Sensor Bolt Tighten 12 N.m (106 lb in)

Drain and Fill Plug Installation

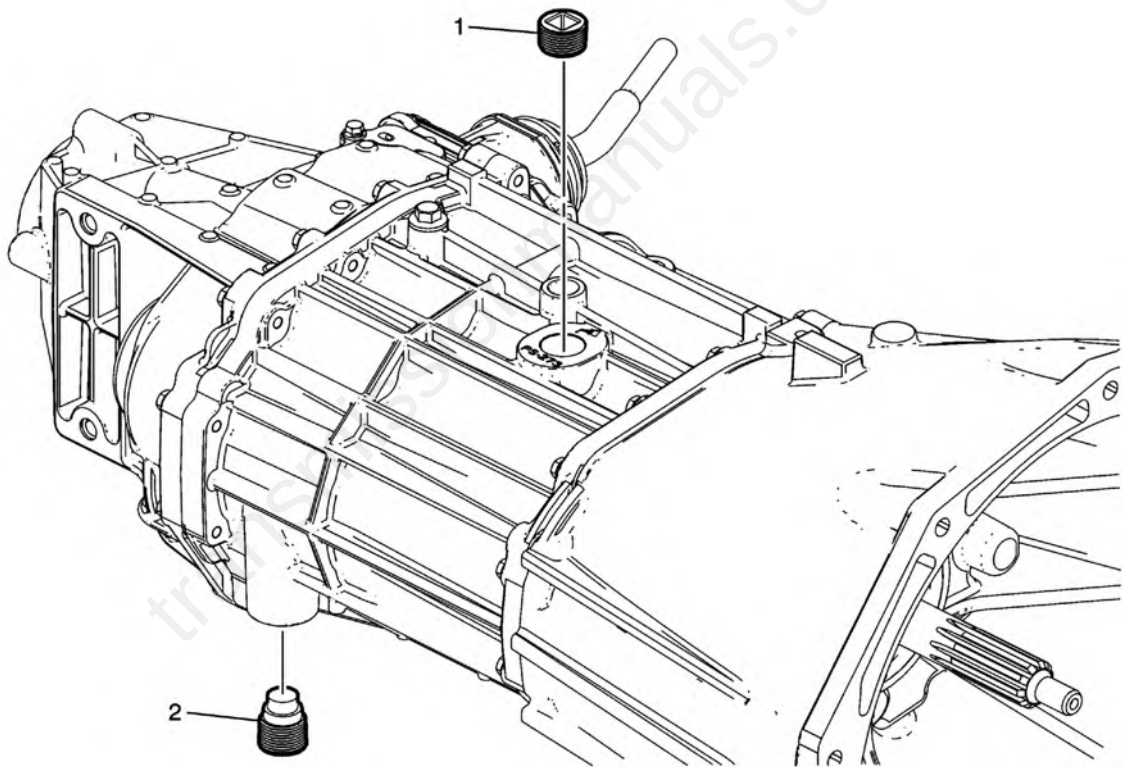


Fig. 102: Drain and Fill Plug
Courtesy of GENERAL MOTORS COMPANY

Drain and Fill Plug Installation

Callout	Component Name

Component Name	
1	Transmission Oil Fill Plug CAUTION: Refer to Component Fastener Tightening Caution . Tighten 44 N.m (32 lb ft)
2	Transmission Oil Drain Plug Tighten 44 N.m (32 lb ft)

OUTPUT SHAFT SEAL INSTALLATION

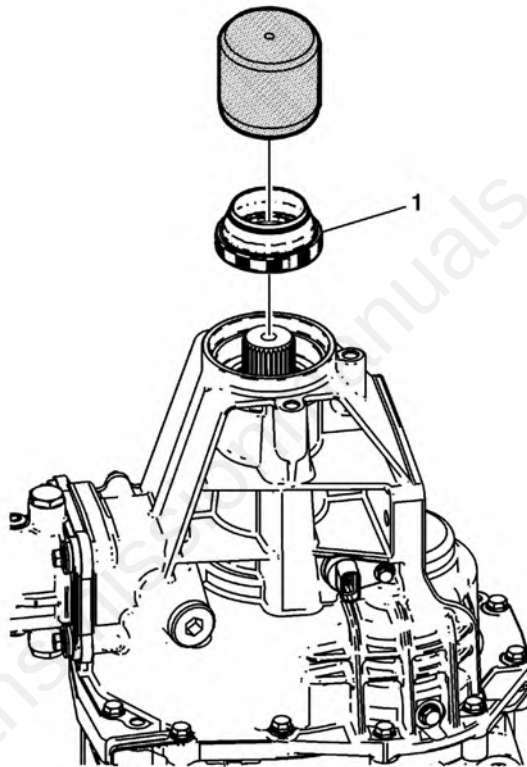


Fig. 103: Output Shaft Seal

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Output Shaft Seal - 2WD Procedure 1. Replace with NEW oil seal. 2. Using DT 47928-1 rear seal installer, install the seal. Special Tools DT 47928-1 Rear Seal Installer For equivalent regional tools, refer to Special Tools .

TRANSMISSION IDENTIFICATION INFORMATION

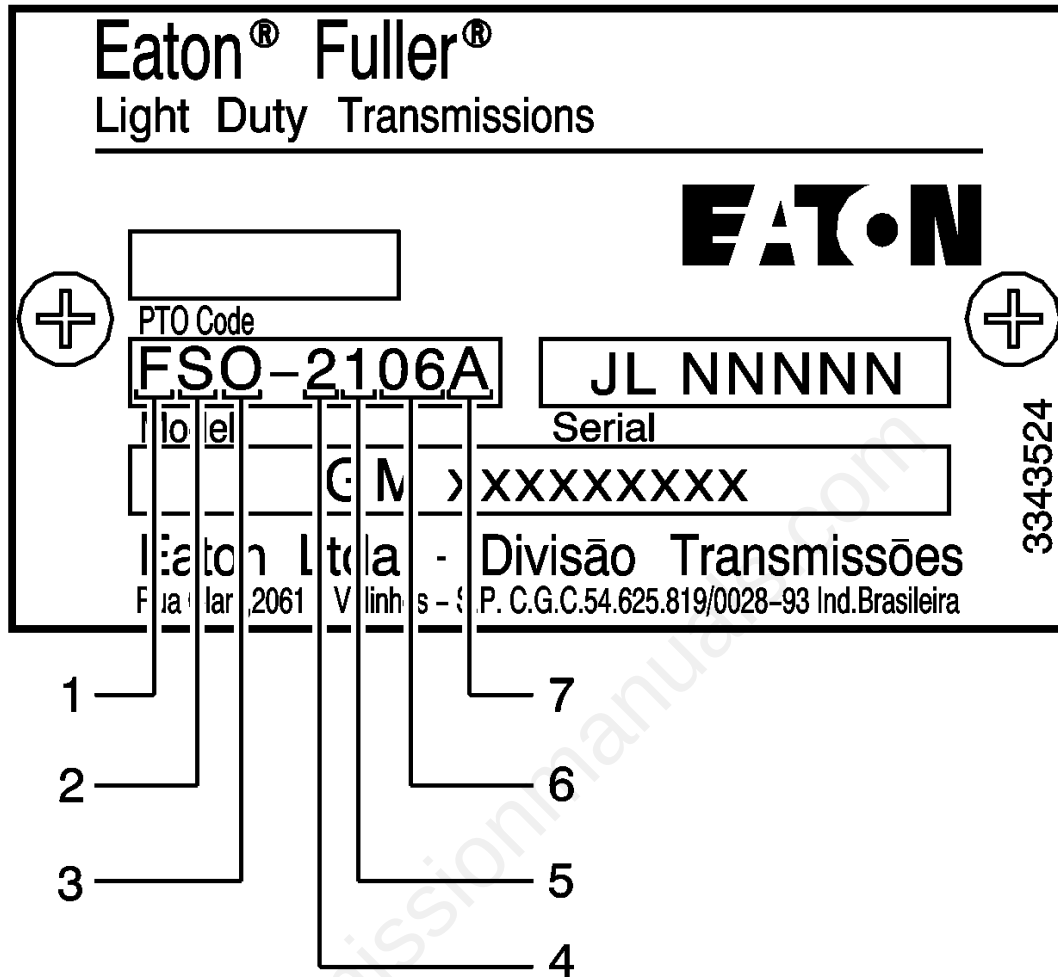


Fig. 104: Transmission Identification

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Eaton Fuller
2	Synchronized
3	Overdrive
4	Nominal Torque (x 100 lb ft)
5	Design Level
6	Forward Speeds
7	Gear Ration

MANUAL TRANSMISSION DESCRIPTION AND OPERATION

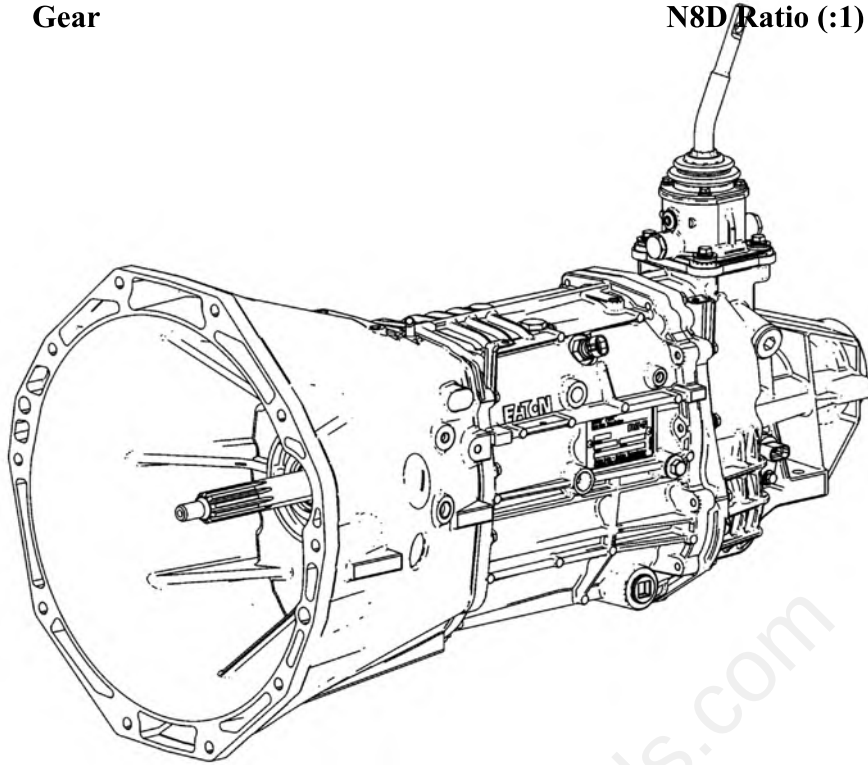


Fig. 105: Manual Transmission

Courtesy of GENERAL MOTORS COMPANY

Manual transmissions are identified by the number of forward gears and the measured distance between the centerline of the output shaft and the counter gear.

The 6-speed manual transmissions RPO's: MA2 and N8D incorporate the following features:

- An aluminum case
- Fully synchronized gearing with an enhanced synchronizer cone arrangement:
 - Dual-cone: FIRST, SECOND
 - Single-cone: THIRD, FOURTH, FIFTH, SIXTH, REVERSE
- An internal shift rail mechanism
- A direct transmission shift control mounted rearward of the transmission
- Tapered roller and sealed ball bearings supporting the main shaft and counter gear shaft
- Caged roller bearings under all speed gears

These features combine to yield a rugged, reliable system capable of handling input torques of 270 N.m (200 lb ft).

The gear ratios are as follows:

Gear	N8D Ratio (:1)
FIRST	4.473
SECOND	2.458
THIRD	1.472
FOURTH	1
FIFTH	0.848
SIXTH	0.725
REVERSE	4.032

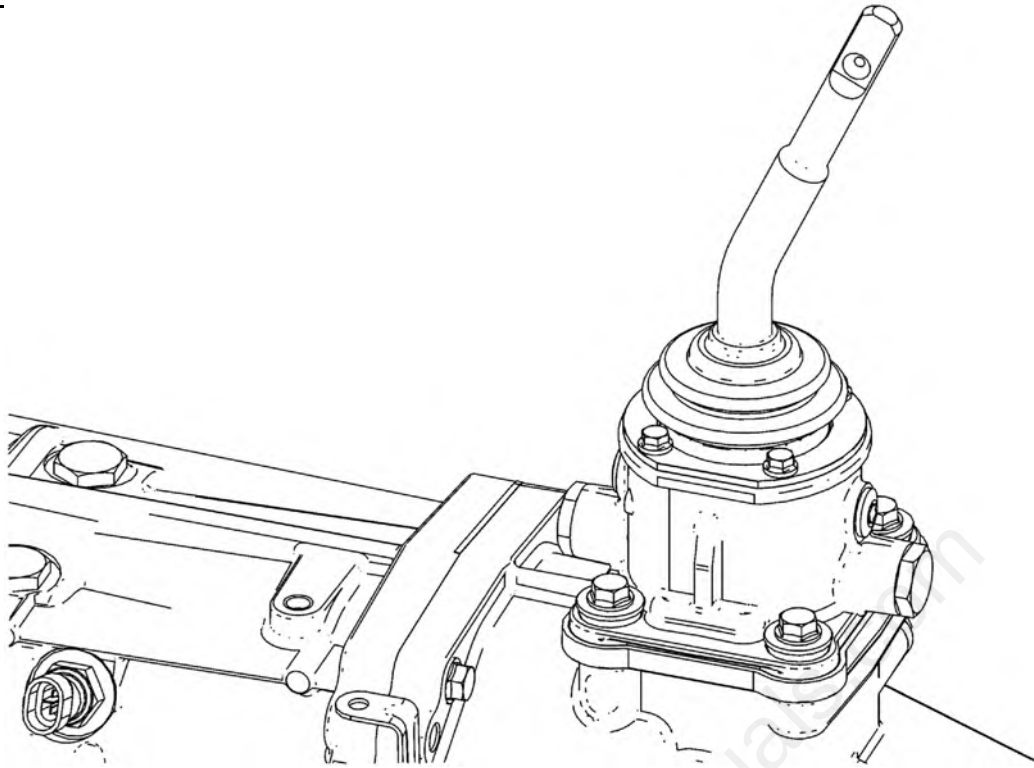


Fig. 106: Shift Control Assembly

Courtesy of GENERAL MOTORS COMPANY

The shift control lever assembly is mounted to the rear case with a rubber isolation gasket. The cockpit of the vehicle is isolated from the driveline through the use of a shift control closeout boot which seals off the shift control and the driveline tunnel shift control opening.

Reverse Lockout

This transmission is equipped with a lock-out mechanism, which prohibits mis-shift from fifth gear or sixth gear to reverse gear.

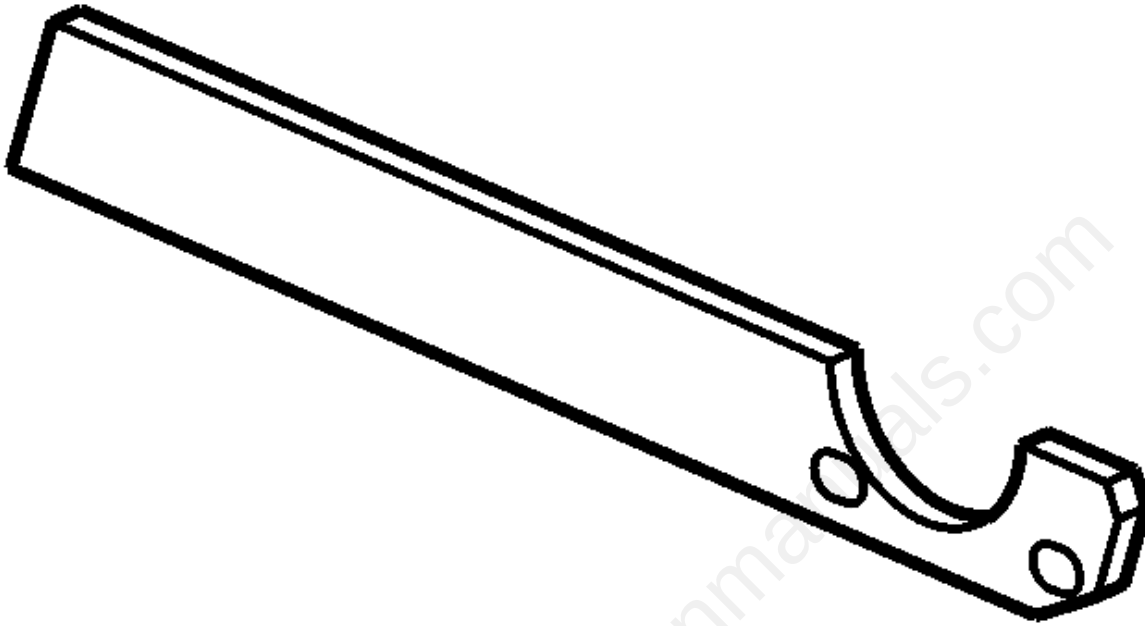
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/Description

Illustration

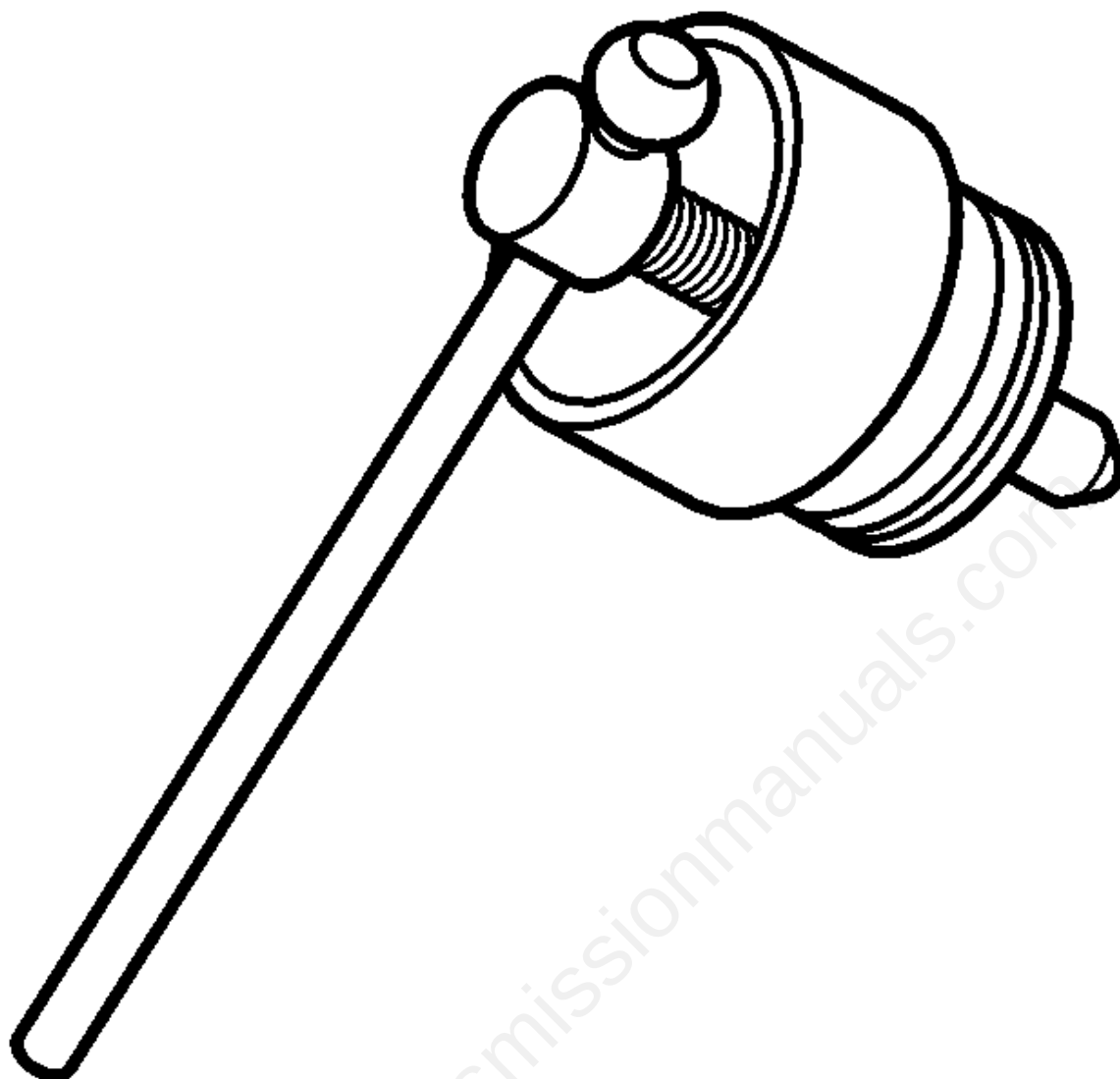
**Tool
Number/Description**



CH-50393
Wheel Hub Holding
Tool

Illustration

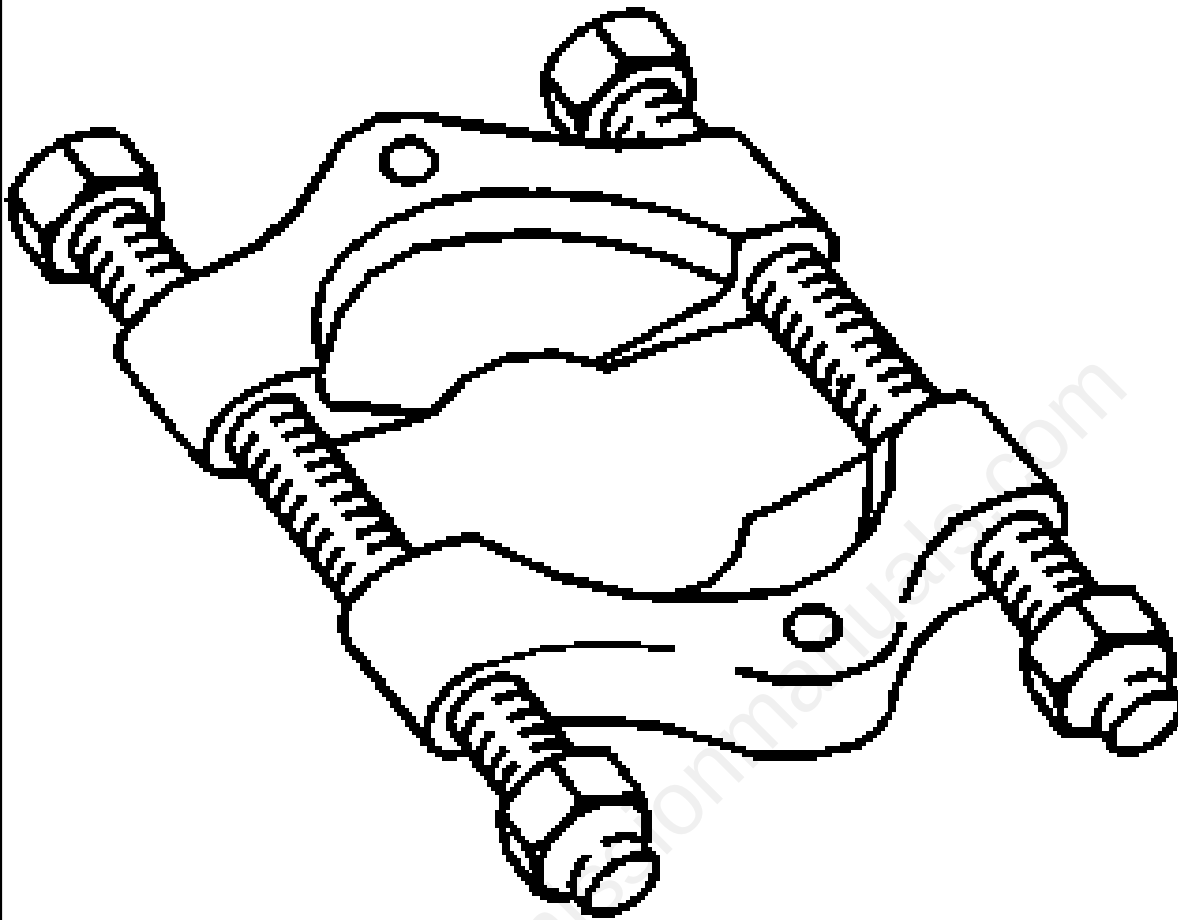
**Tool
Number/Description**



DT-19207148
1-9207148
Main Shaft Bearing
Puller

Illustration

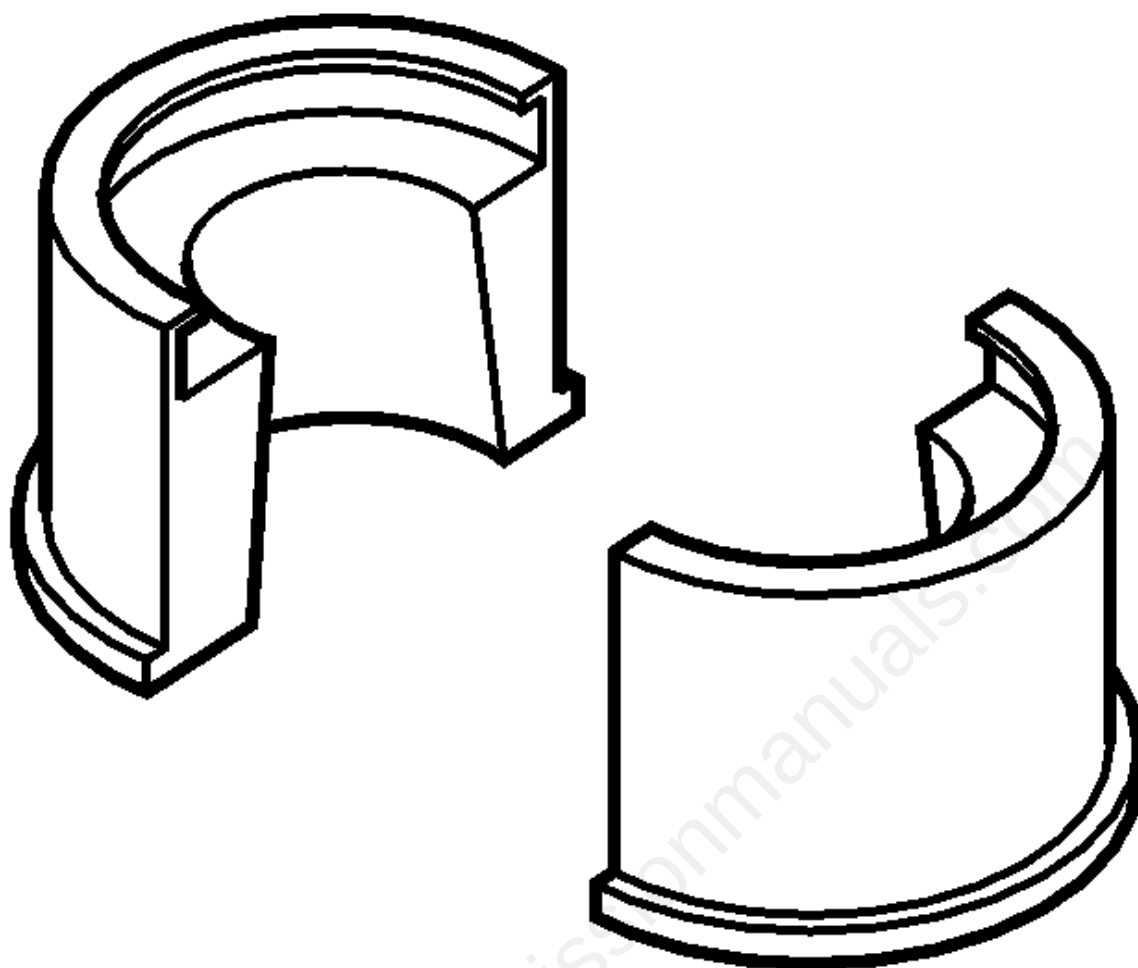
Tool
Number/Description



DT-22912-B
J-22912-B
DT-69604356
Split Plate Bearing
Puller

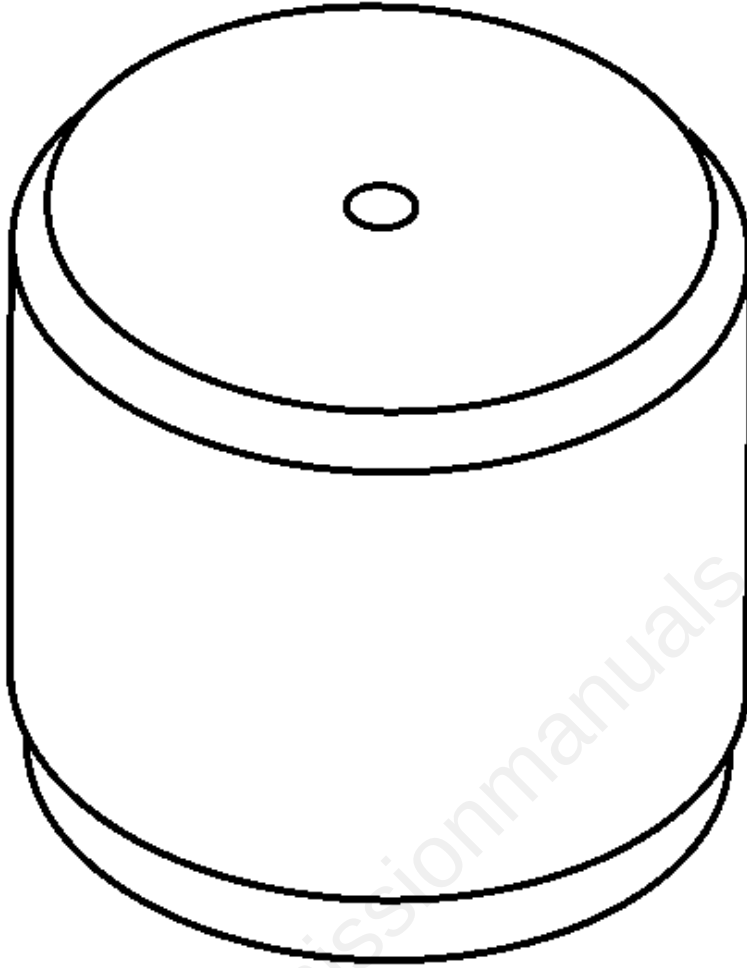
Illustration

**Tool
Number/Description**



DT-30207889
3-0207889
Puller - Main Shaft
Conical Bearing

Illustration



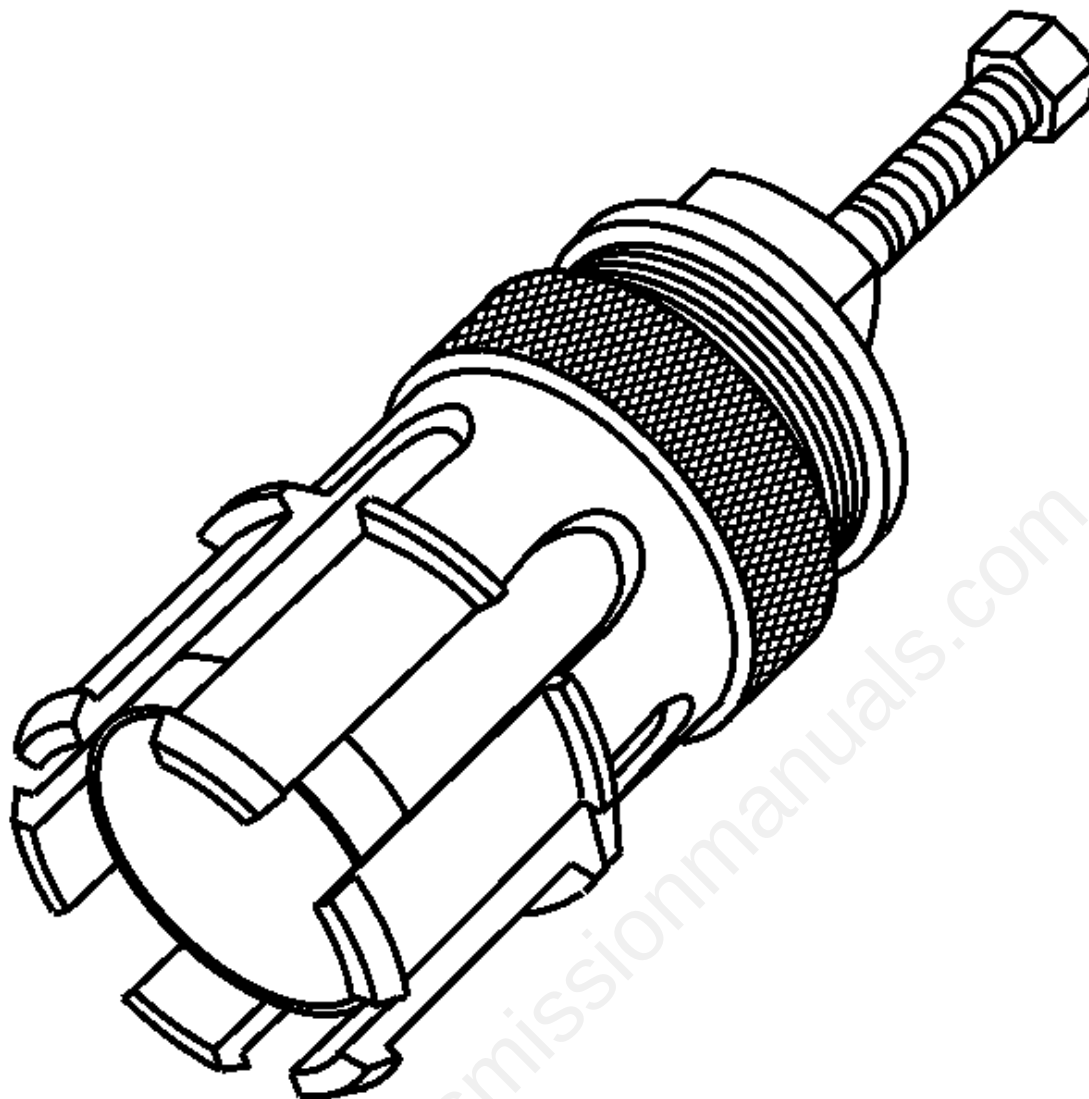
**Tool
Number/Description**

DT-47928-1
Rear Seal Installer

Illustration	Tool Number/Description
 The illustration shows two long, blue cylindrical shafts positioned diagonally. To the left of the shafts are two blue circular washers. To the right of the shafts are two blue hexagonal nuts. A faint watermark 'transmissionmanuals.com' is visible across the image.	DT-50315 Puller Hardware Kit

Illustration

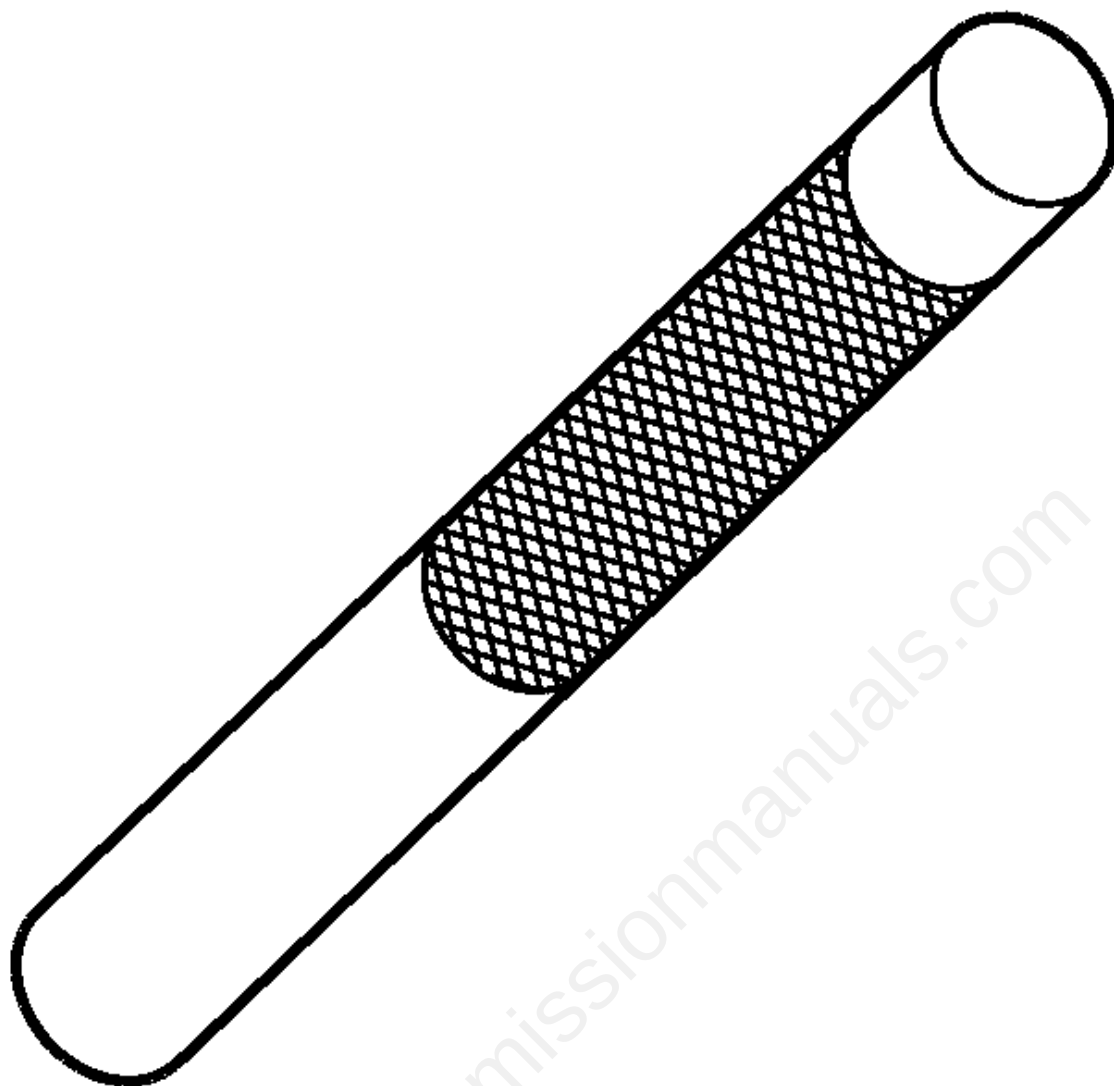
Tool
Number/Description



DT-50575
Extension Housing
Bushings
Remover/Installer

Illustration

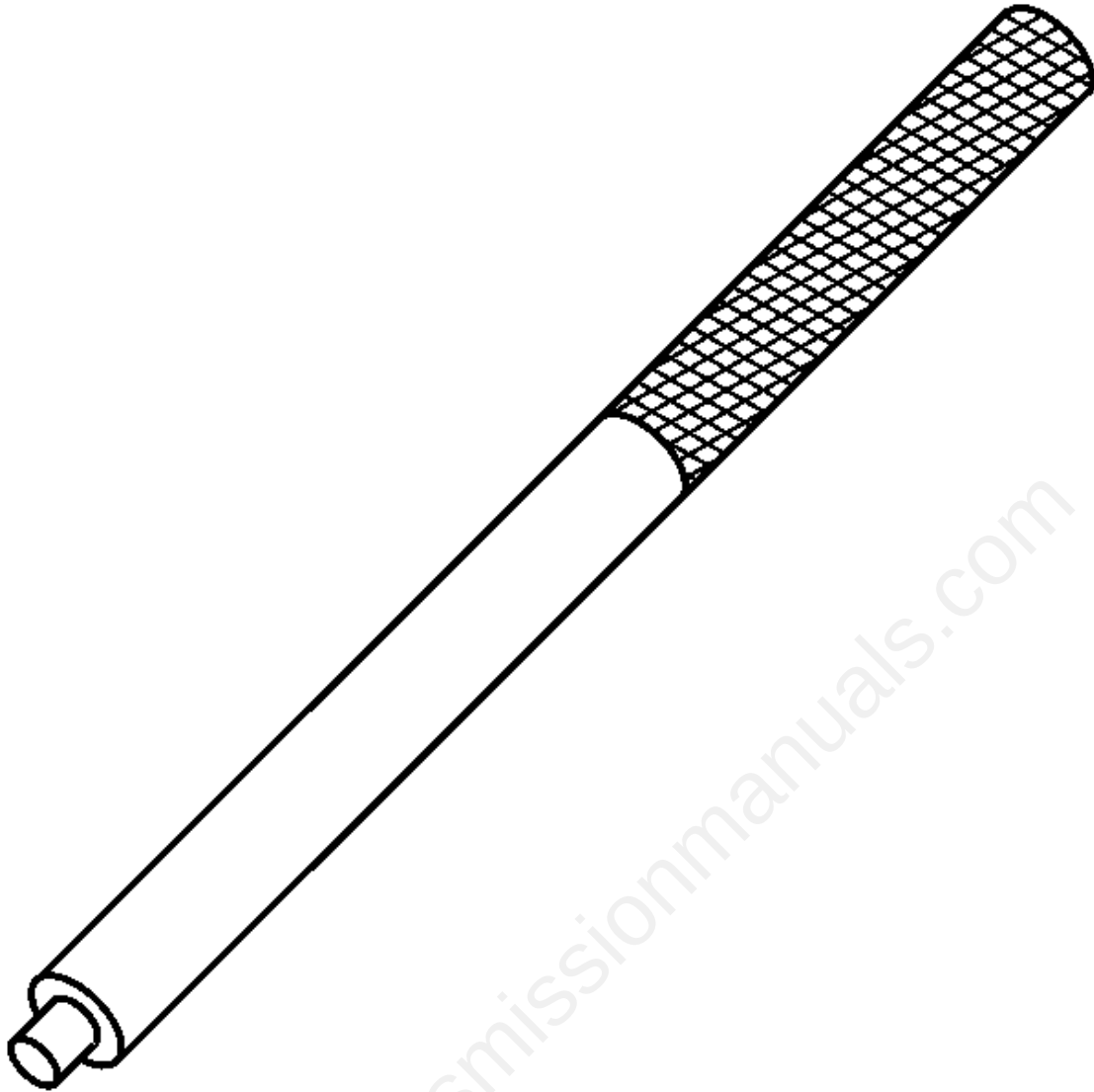
**Tool
Number/Description**



DT-50848
J-22828
3-0207944
Input Shaft Bearing
Cone Installer

Illustration

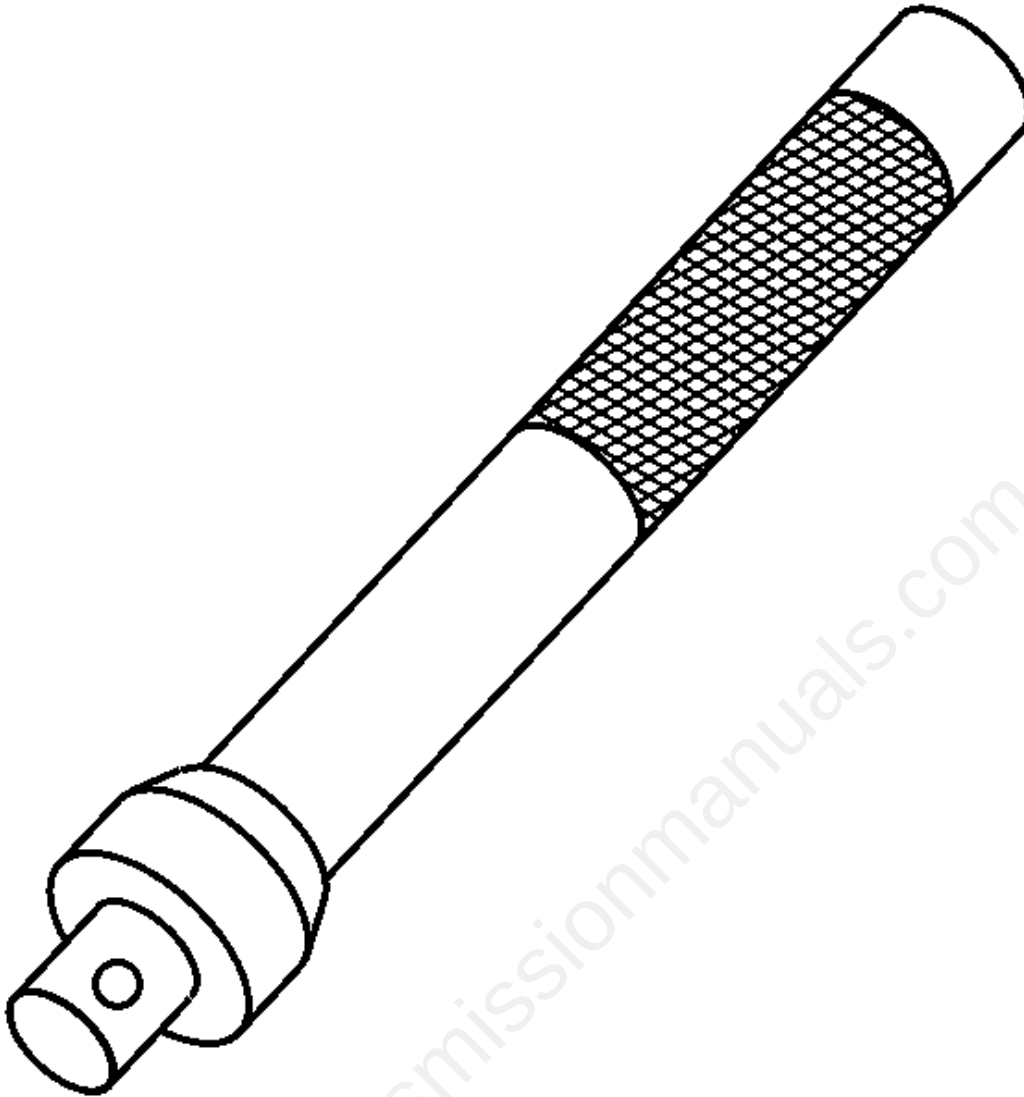
**Tool
Number/Description**



DT-50849
3-0207891
Permaglide Bushing
Installer

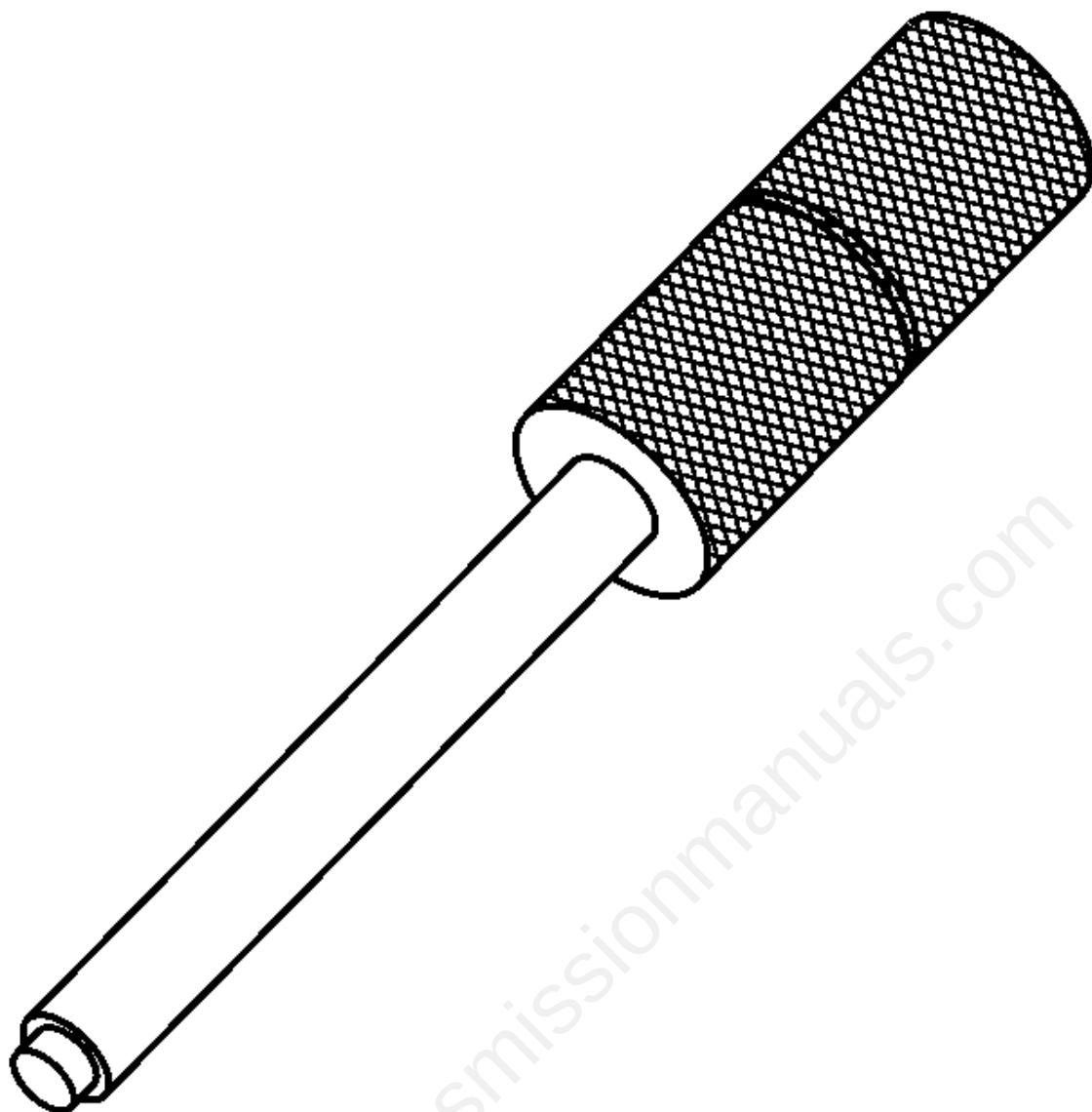
Illustration

**Tool
Number/Description**



DT-50850
M-840911-A
Driver Handle

Illustration

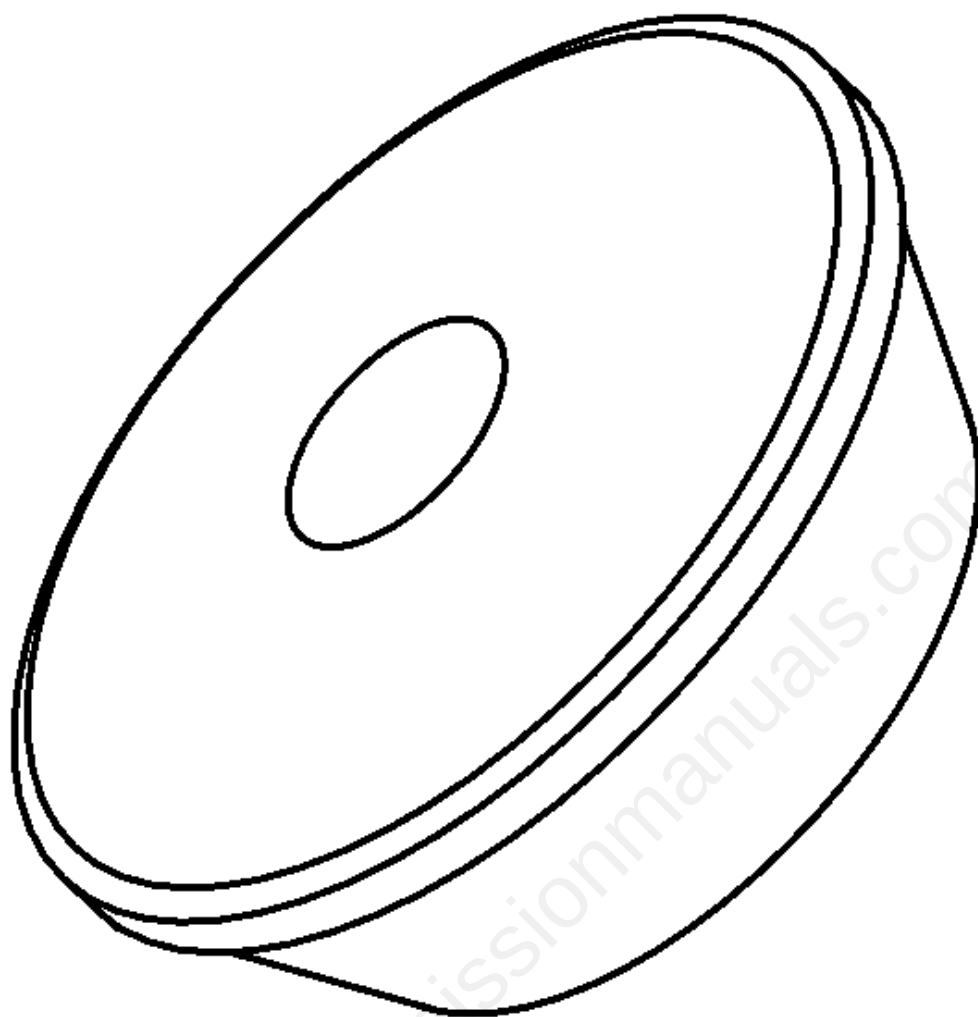


**Tool
Number/Description**

DT-50851
Front Housing
Expansion Plug
Installer

Illustration

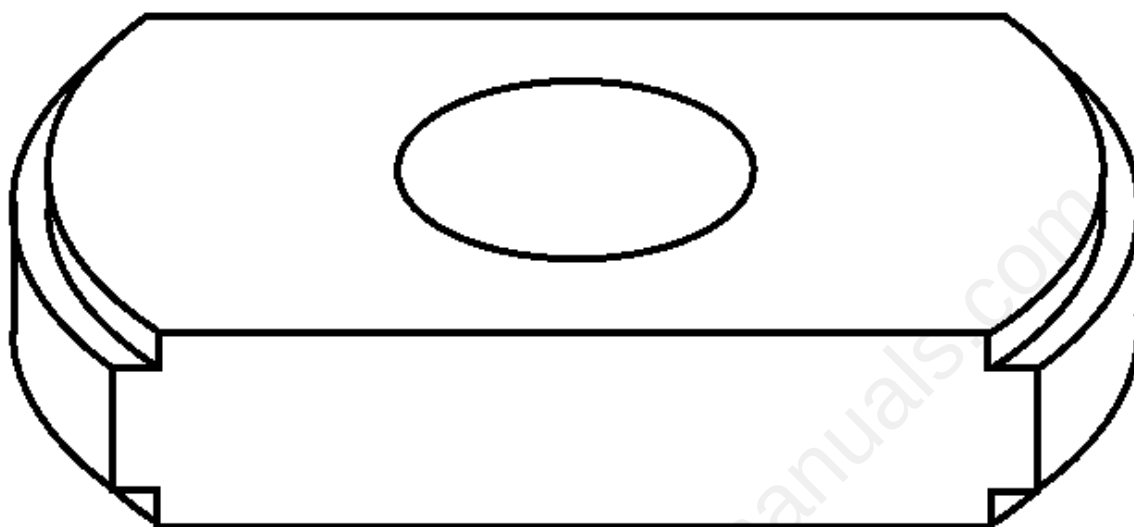
**Tool
Number/Description**



DT-50852
Front Housing
Bearing Race
Installer

Illustration

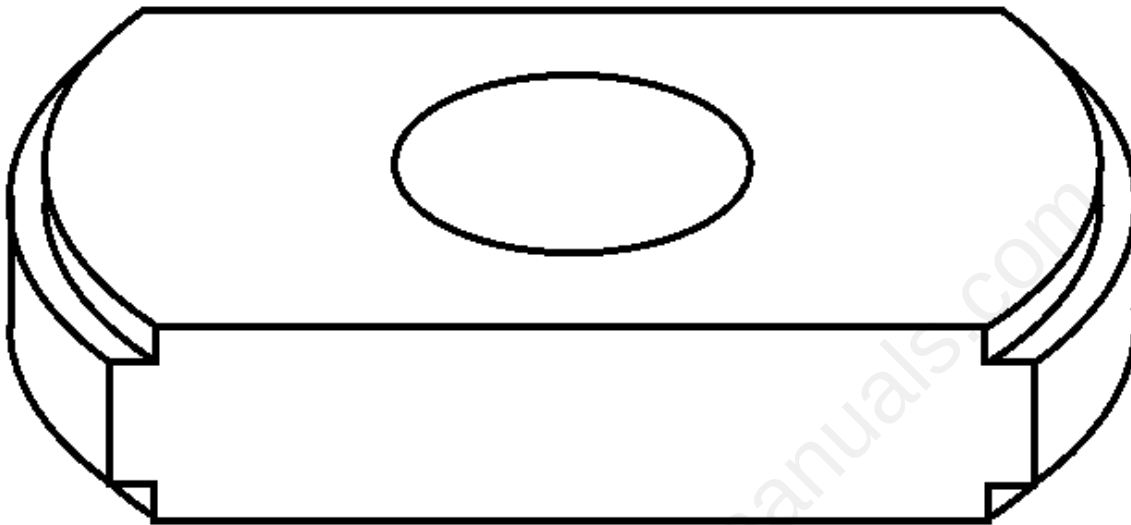
**Tool
Number/Description**



DT-50853
Mainshaft Bearing
Race Puller

Illustration

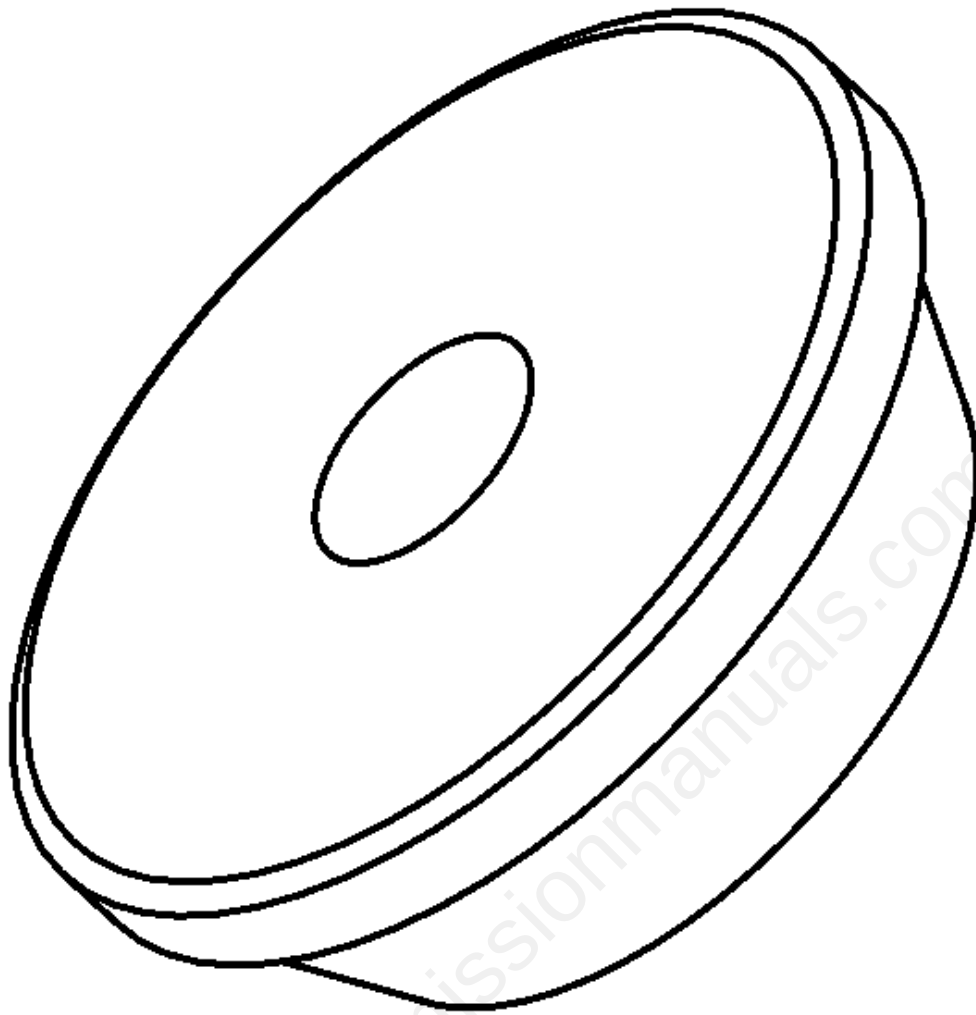
**Tool
Number/Description**



DT-50854
Countershaft Bearing
Race Puller

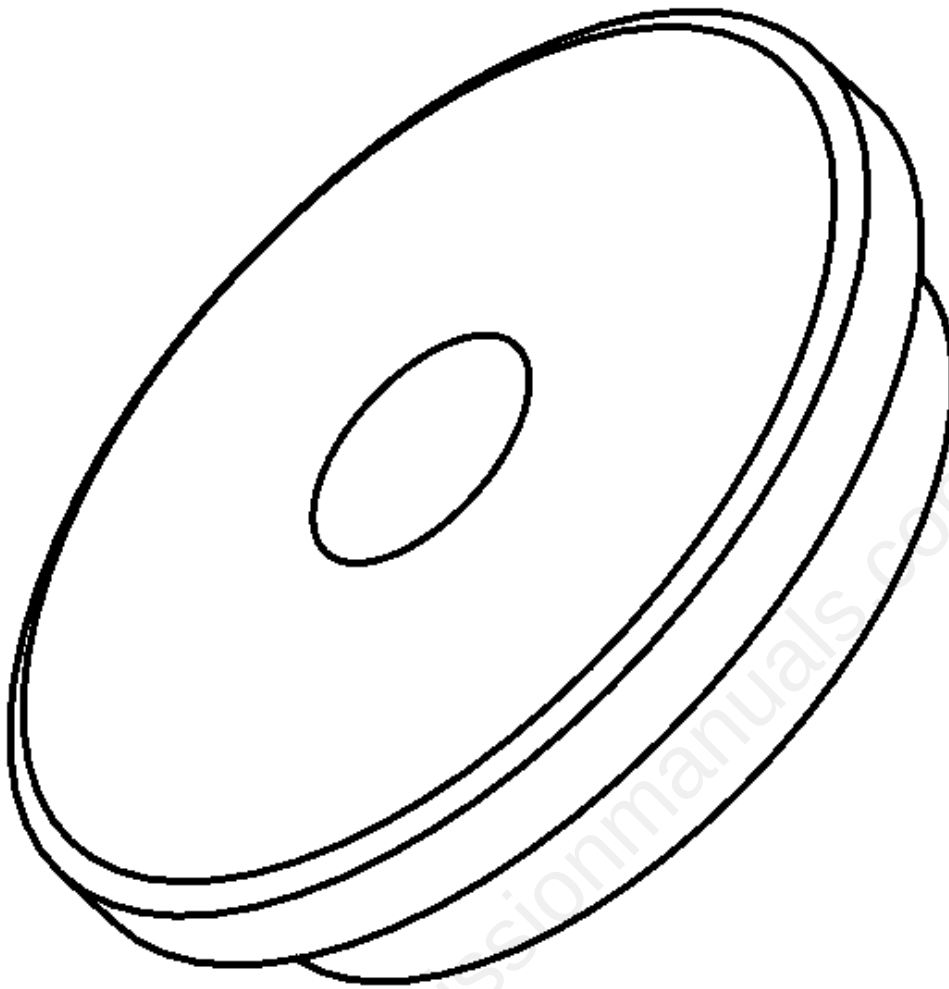
Illustration

**Tool
Number/Description**



DT-50855
3-0207887
Mainshaft Bearing
Race Installer

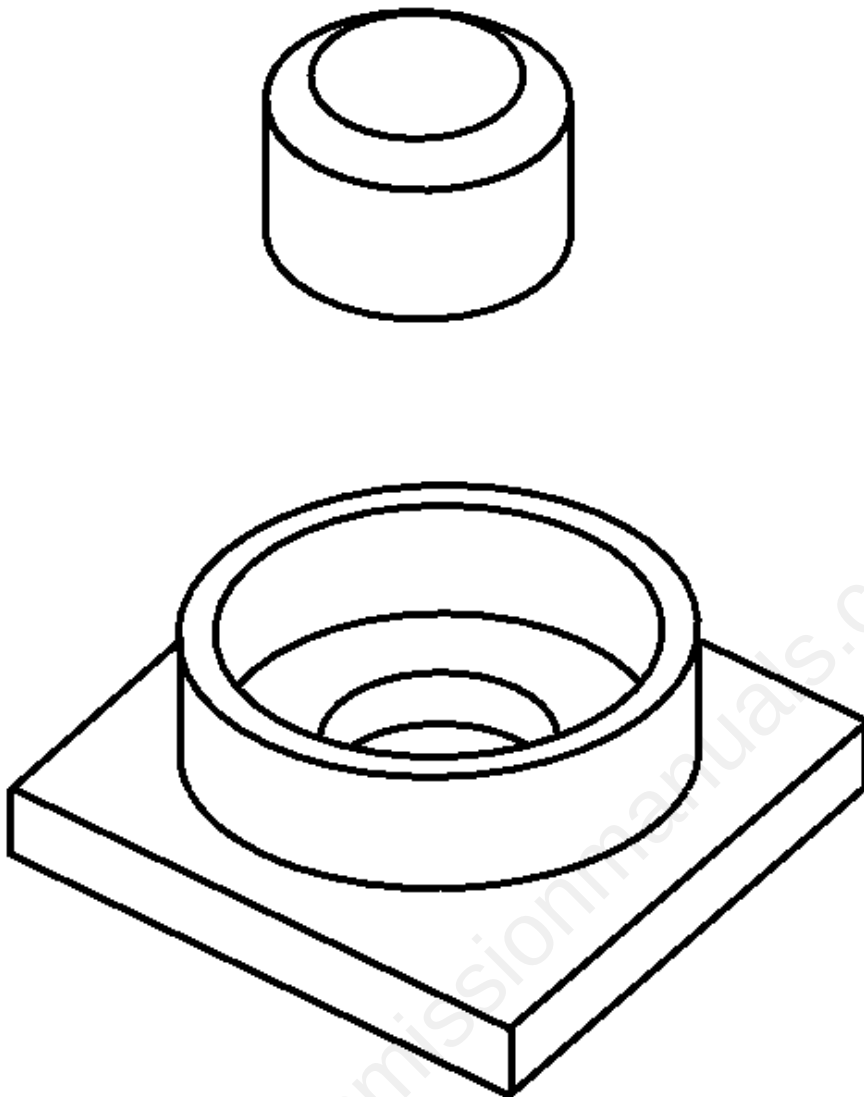
Illustration



**Tool
Number/Description**

DT-50856
3-0207886
Countershaft Bearing
Race Installer

Illustration

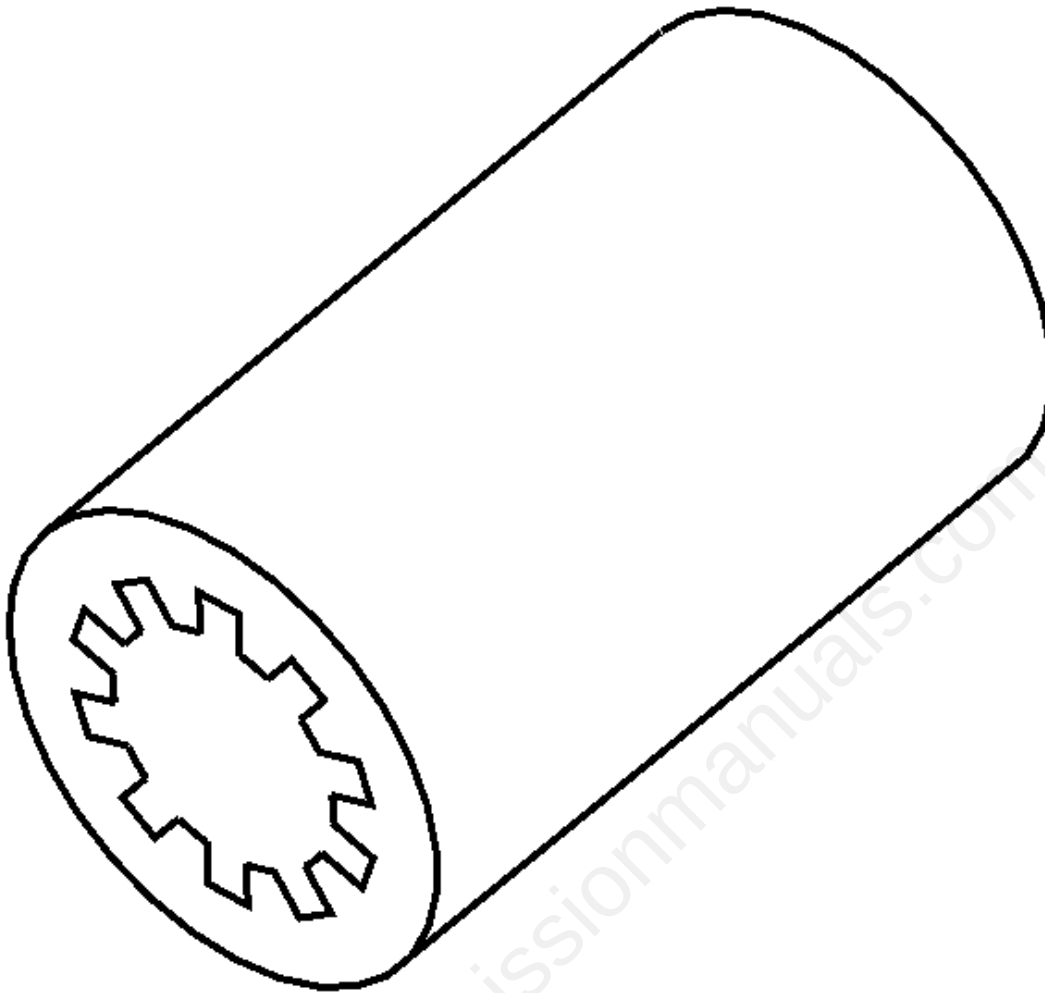


**Tool
Number/Description**

DT-50857
Countershaft Bearing
Cone Installer

Illustration

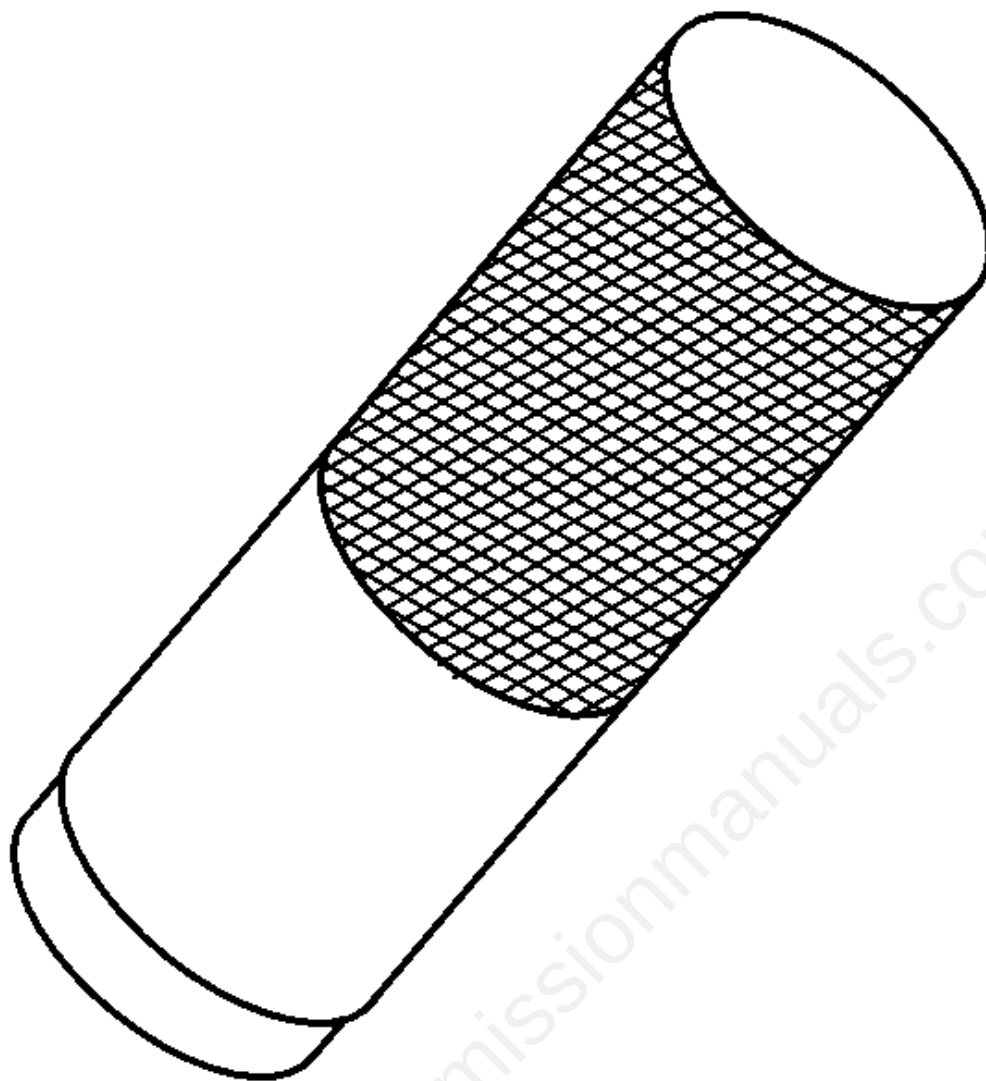
**Tool
Number/Description**



DT-50859
Input Shaft Spline
Socket

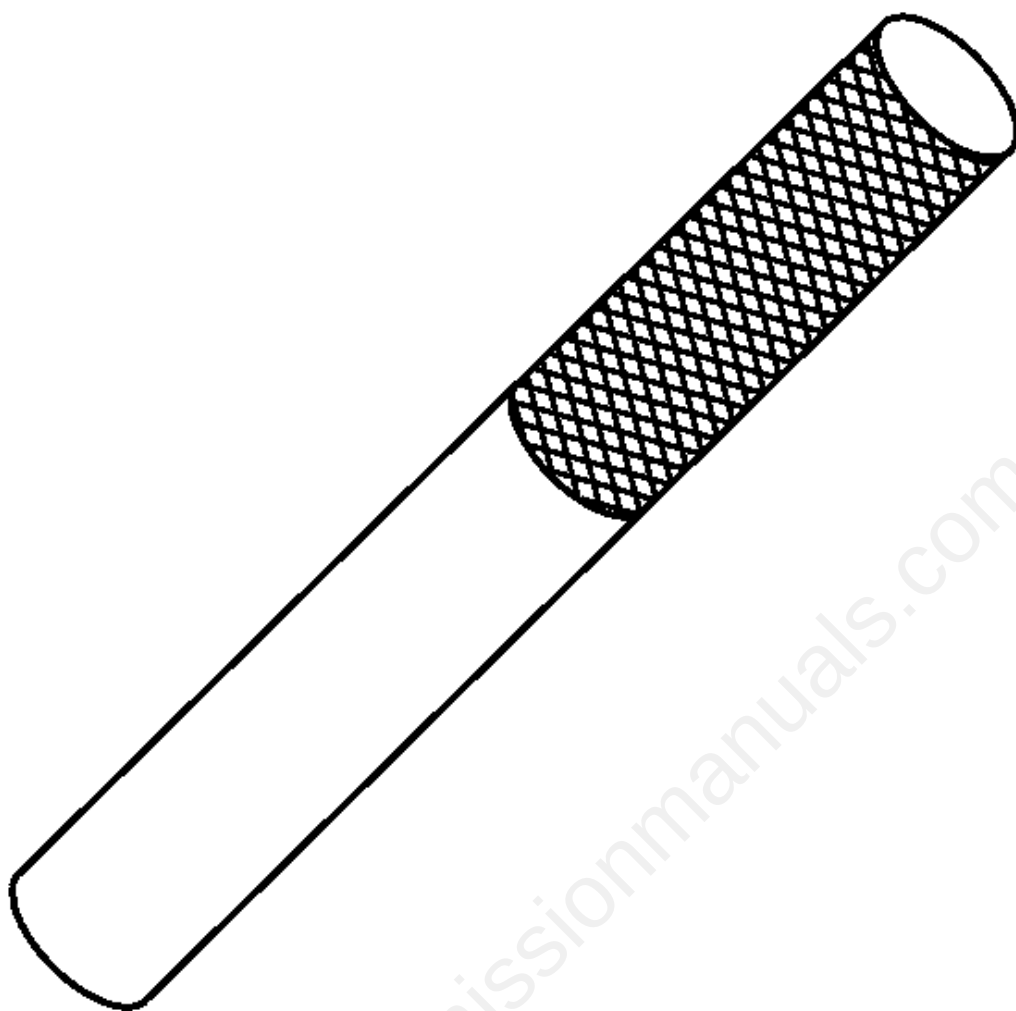
Illustration

**Tool
Number/Description**



DT-50860
Bearing Cone
Installer

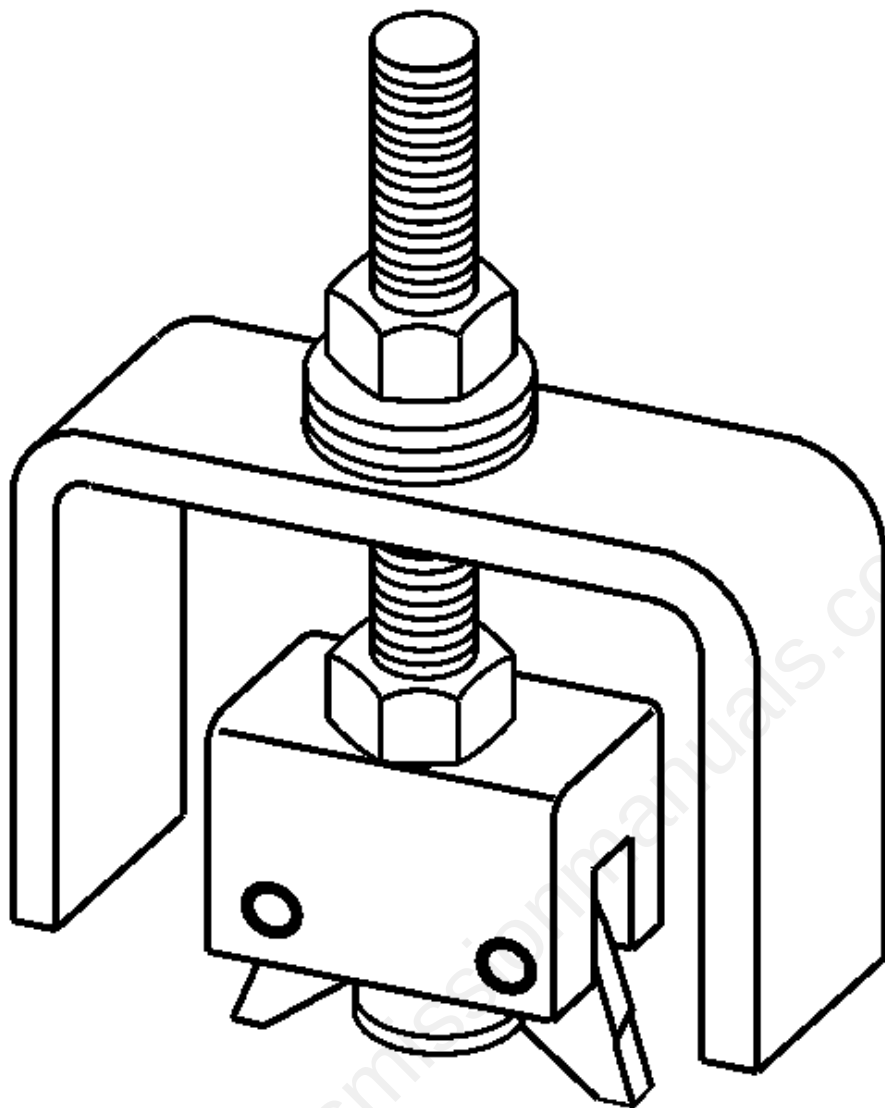
Illustration



**Tool
Number/Description**

DT-50861
3-0207944
Bearing Cone
Installer

Illustration



Tool
Number/Description

DT-50862
T-9907690
Front Housing
Bearing Race Puller

Illustration

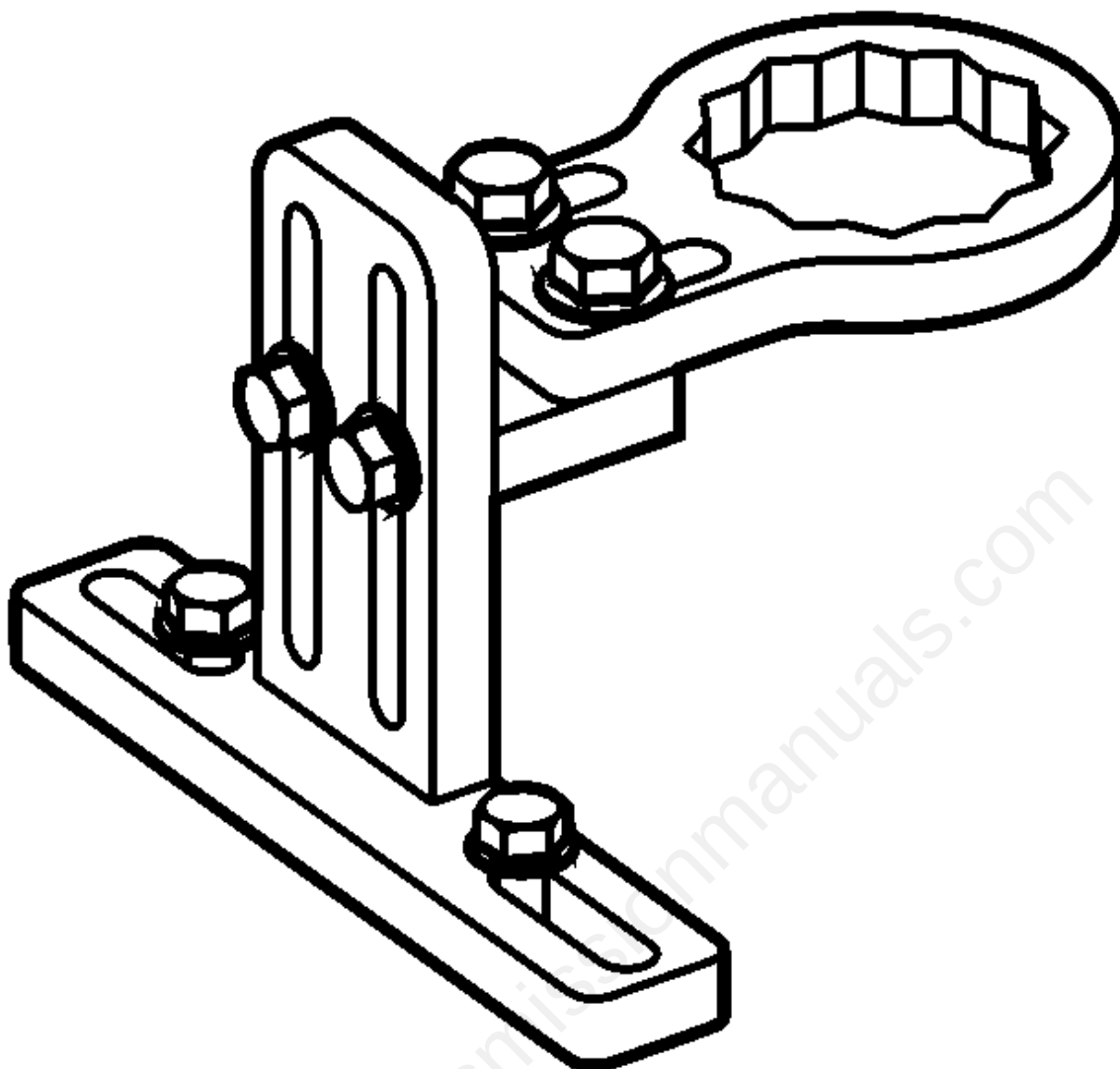
**Tool
Number/Description**



DT-51693
Trans Inner Nut
Holding Tool

Illustration

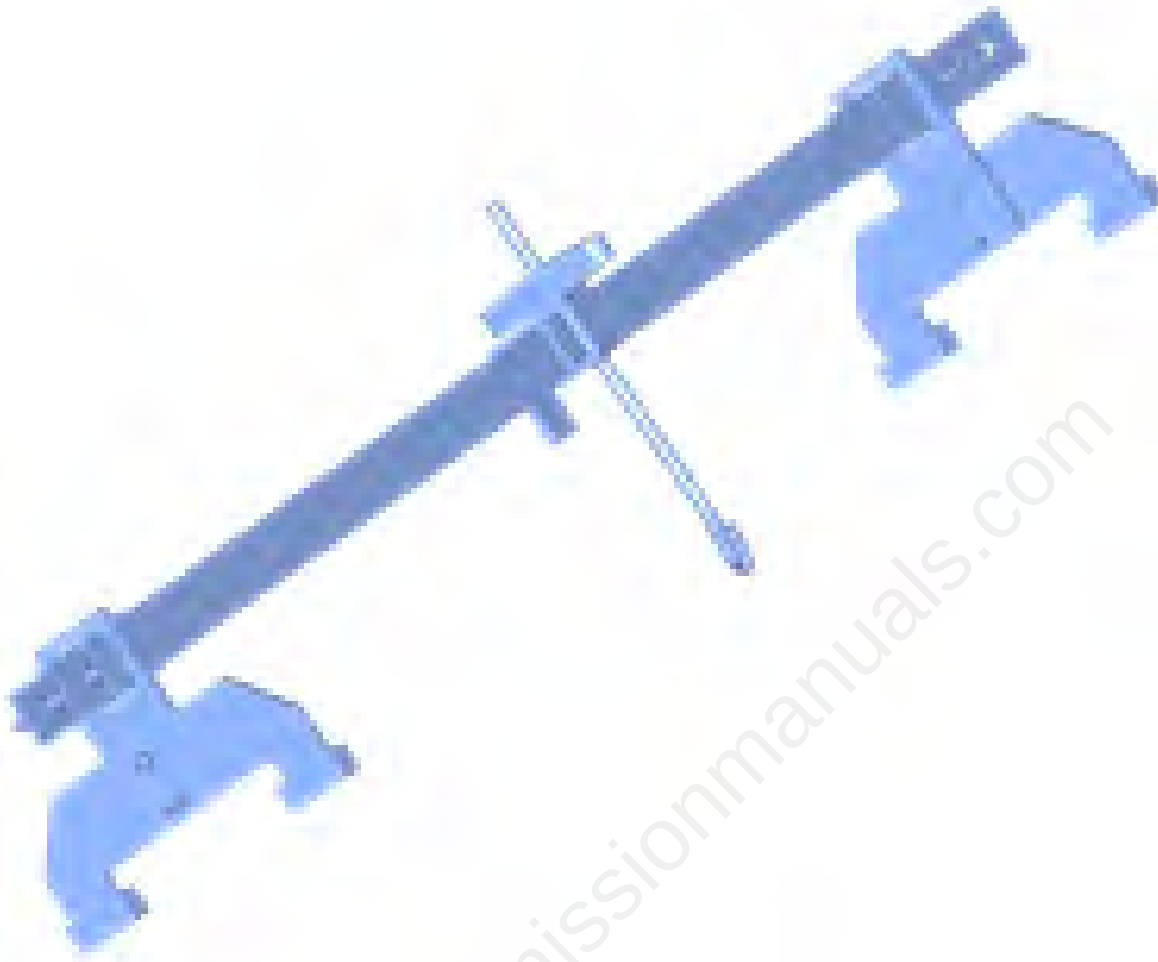
Tool
Number/Description



DT-51327
54 mm Special
Wrench w/
Adjustable Base

Illustration

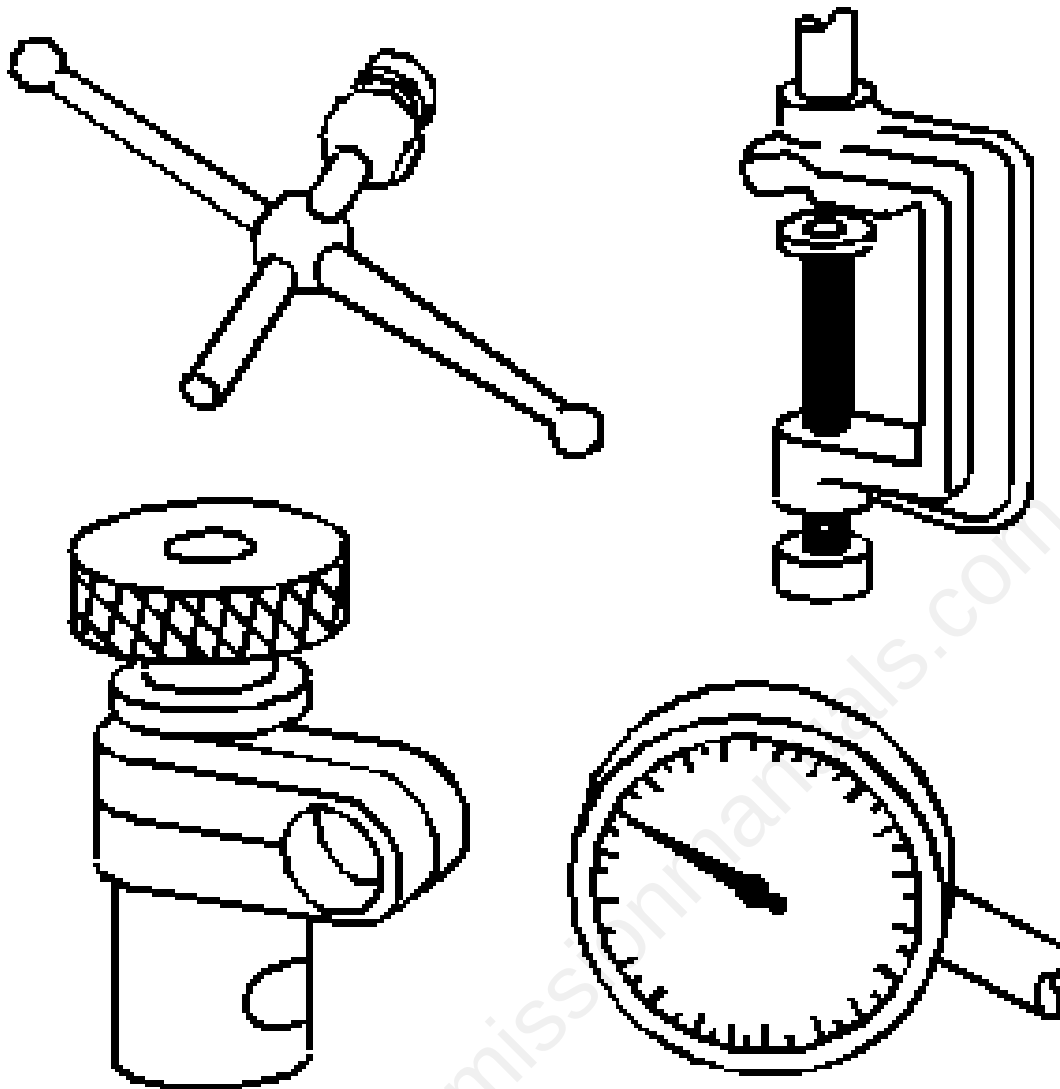
**Tool
Number/Description**



EN-28467-700
EN-47649
X-0206951
Engine Bridge Tool

Illustration

Tool
Number/Description



GE-8001
J-8001
Dial Indicator Set

Illustration

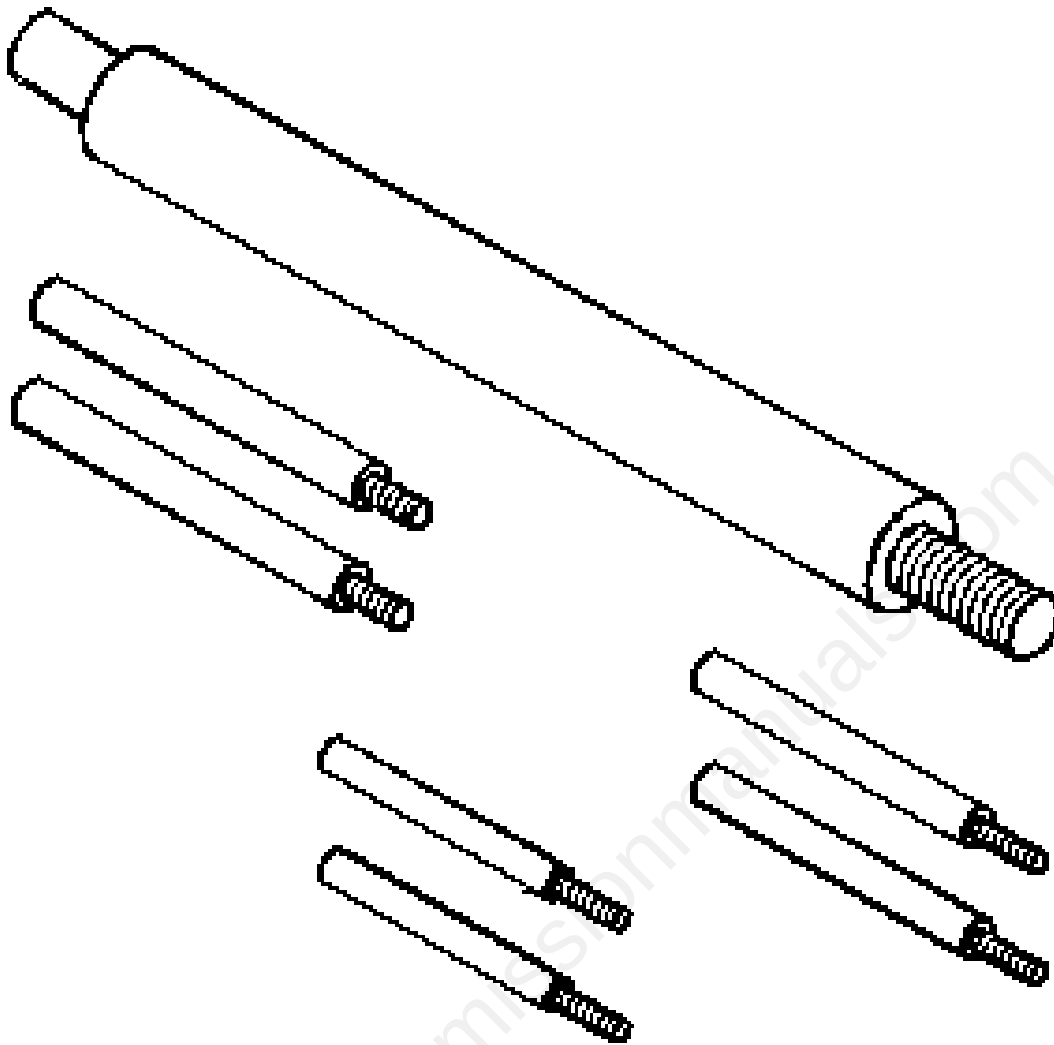
**Tool
Number/Description**



GE-8433-1
J-8433-1
Puller Bar

Illustration

**Tool
Number/Description**



GE-25025-B
DT-25025-B
J-25025-B
Dial Indicator Post
and Guide Pin Set